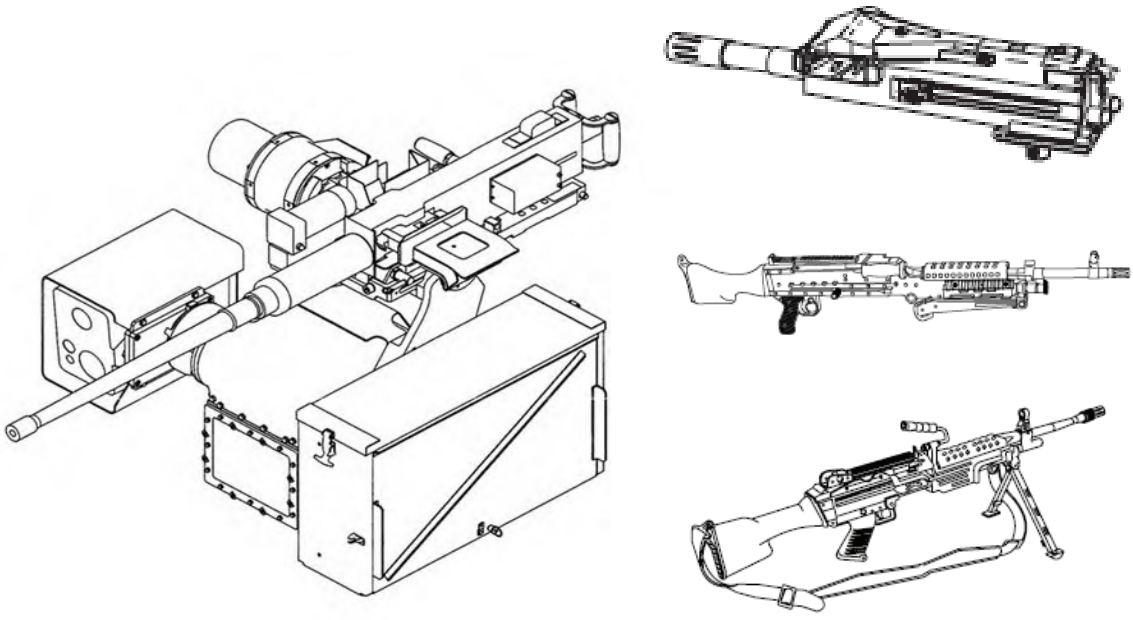
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TECHNICAL MANUAL

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)
PN 21677-0100
NSN 1090-01-525-5049
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OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101; COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

WARNING SUMMARY

General

For first aid data, see FM 4-25.11, First Aid, Headquarters, Department of the Army, December 2002 (Change 1, 15 July 2004)

Ensure no power is applied while performing the **BEFORE** and **AFTER** PMCS operating procedures on the system unless instructed to do so.

Wear appropriate eye protection when cleaning the system or its parts. Failure to do so may result in personal injury.

Do not expose the eyes, directly or indirectly, to the rangefinder's laser beam in the sensor unit.

Observe all warnings, cautions, and notes in this manual; they can save your life.

Know, understand, and practice all safety requirements, including wearing appropriate safety devices (e.g., safety goggles and hearing protection as needed) and operating equipment safely.

Set the CROWS main power switch to the OFF position and ensure that all system motion has stopped during an intervention to avoid any unexpected movement of the mount because it can rotate 360° with an azimuth rotational speed of 80°/second. As an added precaution, secure the CROWS mount using the azimuth lock to hold its movement. Failure to do so may result in personal injury and equipment damage.

Follow proper safety procedures when connecting CROWS cables to a power source. Failure to do so may result in personal injury.

The laser/optical radiation associated with the laser rangefinder (LRF) has been classified as a Class 1 laser device and is considered eye safe. Avoid exposing the eyes, directly or indirectly, to the laser beam of the rangefinder in the sensor unit. Failure to do so may result in personal injury.

Wear eye protection when applying safety wire. Failure to do so may result in personal injury.

Wear eye protection when performing thread-locking procedures.

Wear latex gloves during threadlock removal and application. Exposure of compounds to skin may result in an allergic reaction.

Ensure that the work station/area is well-ventilated as solvent fumes can cause headaches and dizziness. Do not mix solvents.

Use two personnel during installation/removal of the weapon and cradle. Failure to do so may result in personal injury or equipment damage.

Ensure system power is OFF when connecting or disconnecting cables.

Do not select an incorrect vehicle. An incorrect vehicle selection will cause malfunction of equipment and possible injury to personnel.

Ensure the boresight tool has been removed from the weapon. Leaving the boresight kit in the weapon may result in personal injury.

Warning Summary - Cont

General - Cont

Follow all safety warnings and cautions during interconnection procedures. Failure to do so may result in personal injury or equipment damage.

The system should be taken out of the TRP mode before the hatch is opened.

The ammo hanger assembly is connected to the ammo yoke arm by the bolts attaching the yoke arm to the mount. Support both the ammo hanger and ammo yoke arm during stowing procedures and when returning the yoke arm to its standard operating position. Failure to do so may result in personal injury and equipment damage.

Use two personnel during procedures on the elevation yoke arm. Failure to do so may result in personal injury.

Be extremely careful not to expose the eyes, directly or indirectly, to the laser beam of the rangefinder in the sensor unit. Failure to do so may result in personal injury.

Ensure input voltage is at the correct level. An overvoltage condition when power is applied may make the mount move and spin rapidly, which could result in personal injury and equipment malfunction or damage. Do not stand within muzzle length of the system when applying power.

Ensure input voltage is at the correct level. An overvoltage condition when power is applied may make the mount move and spin rapidly, which could result in personal injury and equipment malfunction or damage. Do not stand within muzzle length of the system when applying power.

Once power is applied, the system is fully functional and the mount and/or cradle with weapon could move. Ensure that the weapon mount is cleared, any cleared rounds are secured, and the weapon cannot move during this procedure. Ensure that all personnel are clear of any possible weapon movements. Do not stand under the barrel.

Power should be shut off and all system motion stopped before approaching the station closer than muzzle length. Failure to do so may result in personal injury.

Expendable/Durable Materials

Cleaning solvents are FLAMMABLE and TOXIC. Keep cleaning solvents away from open flames and use only in a well-ventilated area. Use rubber gloves to protect the skin when cleaning system parts with solvent. Failure to do so may result in personal injury.

Do not use ethyl alcohol near an open flame or a source of sparks. Use ethyl alcohol only in a well-ventilated area to prevent undue exposure to vapors. If accidental skin contact occurs, wash the exposed area immediately with soap and water. Failure to follow these instructions may result in personal injury.

Use appropriate eye protection when lubricating and cleaning the system or its parts.

Use only authorized materials during these procedures.

Do not use isopropyl alcohol near heat, an open flame, or a source of sparks. Use isopropyl alcohol only in a well-ventilated area to prevent undue exposure; avoid breathing vapors. Avoid contact with eyes. If accidental contact occurs, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately. Avoid contact with skin and clothing. If accidental contact occurs, wash the exposed area immediately with soap and water. Failure to do so may result in personal injury.

Warning Summary - Cont

Expendable/Durable Materials - Cont

Do not use acetone near heat, an open flame, or a source of sparks. Use acetone only in a well-ventilated area to prevent undue exposure; avoid breathing vapors. Avoid contact with eyes. If accidental contact occurs, immediately flush eyes with plenty of lukewarm water for at least 15 minutes. Get medical attention immediately. Avoid contact with skin and clothing. If accidental contact occurs, wash the exposed area immediately with soap and water. Failure to follow these instructions may result in personal injury.

Weapons

After completing the following procedures, a round will be in the chamber, the trigger switch will be armed and the weapon will be ready to fire.

Follow all stated warnings and cautions when handling the weapons. Ensure that the weapon is cleared and any cleared rounds are secured before performing any procedures, unless specifically directed to load the weapon. (For instructions on clearing and loading the M2 weapon, refer to WP 0018; for the Mk19 weapon, refer to WP 0019; for the M240B weapon, refer to WP 0020 and for the M249 weapon, refer to WP 0021.)

Follow all stated safety warnings and cautions when handling the weapons, including loading or unloading. Failure to do so may result in personal injury or damage to the equipment.

Use two personnel during installation of the weapon and adapter kit components onto the cradle. Failure to do so may result in personal injury or damage to equipment.

Ensure the weapon is cleared and any cleared rounds are secured in accordance with the applicable weapon technical manual before performing any procedures, unless specifically directed to load the weapon. For instructions on clearing and loading the weapons, refer to WP 0018 (M2); WP 0019 (Mk19); WP 0020 (M240B); and WP 0021 (M249).

Weapons must be cleared and any cleared rounds secured prior to and during boresighting activity (i.e., no rounds should be loaded or chambered while boresighting the CROWS).

Personnel will not be positioned in front of the weapon barrel. Doing so may result in personal injury.

Use two personnel during installation/removal of the cradle and the weapon and when moving the gun. Failure to do so may result in personal injury or equipment damage.

During boresighting, ensure that the weapon is cleared and any cleared rounds are secured IAW the applicable weapon TM. Refer to WP 0035, References, for a listing of weapon TMs. Failure to do so may result in personal injury.

Due to differences in weapon dispersion, Custom No-Fire Zones must be re-defined every time a new weapon type is installed, even if they are the same Custom No-Fire Zone(s) as previously defined. Failure to follow this warning may result in personal injury.

Live ammunition is used during the zeroing process. Follow all safety warnings and cautions. Failure to do so may result in personal injury.

A round will be chambered after the following step.

A round will be chambered after completion of the following charging sequence.

After completing the following procedure, the trigger switch will be disarmed, but the weapon will have a round on the bolt face.

Warning Summary - Cont

Weapons - Cont

During the following procedure, the trigger switch on the control grip will be disarmed, but the weapon will have a round in the chamber.

The gun defaults to continuous fire mode. Safety interlocks will not function. Only firing is inhibited.

The gun defaults to continuous fire mode. Safety interlocks will not function. Motion control is active.

The gun defaults to continuous fire mode. Safety interlocks will not function. Both firing and weapon movement are inhibited.

If ammunition is not properly placed in the weapon feed tray, a round could be prematurely chambered during the first charging sequence.

When working on the weapon, the field operator should work alone except when removing/ installing the weapon. Failure to do so may result in personal injury.

When a weapon is installed on CROWS, maintenance personnel should work alone except when removing or installing the weapon on the mount. Failure to use two persons when moving the gun may result in personal injury or damage to the equipment.

The CROWS weapon operator may start a procedure only after having received a clear signal from the maintenance personnel that the weapon is no longer being worked on. After the CROWS operator has completed a procedure, he must give a clear signal to the maintenance personnel to indicate that it is safe to continue working on the weapon.

Ensure that the mount is secured and cannot move during this procedure. Secure the CROWS mount using the azimuth lock to restrict its movement. Once power is applied, the CROWS system is fully functional. Follow all safety warnings and cautions. Failure to do so may result in personal injury and equipment damage

Wait at least 15 minutes after the system has been turned off before working on the weapon. This time-period ensures that the weapon has cooled down sufficiently. For additional information, refer to TM 9-1005-213-10, M2 HB Operator's Manual; TM 9-1010-230-10, Operator’s Manual for the Mk19 40 mm Grenade Machine Gun; TM 9-1005-313-10, Operator’s Manual for the M240 7.62 mm Machine Gun. Failure to follow this instruction may result in inadvertent discharge of the ammunition due to “cook-off” or personal injury.

Use two personnel during installation/removal of the cradle and the weapon (M2, Mk19, M240, or M249). Failure to do so may result in personal injury or equipment damage.

Never remove the backplate assembly from any weapon until the chamber has been cleared and any cleared rounds have been secured. Stand to one side of the weapon when removing the backplate.

Do not attempt to charge the M2 weapon without the backplate assembled to the weapon.

Ensure the breech bolt is in the forward position IAW TM 9-1005-213-10, Operator’s Manual for the M2 HB .50-Cal Machine Gun; TM 9-1010-230-10, Operator’s Manual for the Mk19 40 mm Grenade Machine Gun; TM 9-1005-313-10, Operator’s Manual for the M240 7.62 mm Machine Gun.

Ensure headspace is adjusted properly.

Warning Summary - Cont

Weapons - Cont

If a ballistic computer inputs erroneous data (i.e., range too long or range too short), an incorrect ballistic solution may occur. This situation could result in an incorrect aimpoint with rounds impacting outside the intended target area.

Ensure that the operator is not looking in the boresight scope before performing the next step. The weapon and sensor may move slightly as they are aligning themselves. Failure to follow these instructions may result in personal injury.

During these procedures live ammunition will be handled. Follow all safety warnings and cautions.

If ammunition is not properly placed in the weapon feed way, a round could be prematurely chambered during the first charging sequence.

Ensure that the weapon is cleared and any cleared rounds are secured before performing any procedures, unless specifically directed to load the weapon. (For instructions on clearing and loading the M2 HB, refer to WP 0018; for the Mk19 weapon, refer to WP 0019; for the M240B weapon, refer to WP 0020 and for the M249 weapon, refer to WP 0021.)

Ensure that the M2 HB 50-cal/Mk19 40 mm/M240 7.62 mm/M249 5.56 mm ammunition is loaded in accordance with the technical manuals listed in WP 0035, References, as well as mission requirements (e.g., “half-load” or “full load”).

Under no circumstances should the safety be engaged with the bolt in the forward position.

Ensure the weapon has cooled before handling. For additional information, refer to TM 9-1005-213-10, Operator’s Manual for the M2 HB .50-Cal Machine Gun; TM 9-1010-230-10, Operator’s Manual for the Mk19 40 mm Grenade Machine Gun; TM 9-1005-313-10, Operator’s Manual for the M240 7.62 mm Machine Gun.

Do not chamber a round until instructed to do so. After completing the following procedure, the M2/Mk19/M240/M249 will be live and ready to fire. Follow all safety warnings and cautions. Failure to follow this instruction may result in personal injury or damage to the equipment.

Electronic "SAFEing" does not prohibit manual firing. Manual weapon controls are still functional.

In case of immediate action for stoppages (for example, jam, feeding, during ammo can insert switch) or malfunctions (weapon-related breaks, etc.), follow standard procedures in TM 9-1005-213-10, Operator’s Manual for the M2 HB .50-Cal Machine Gun; TM 9-1010-230-10, Operator’s Manual for the Mk19 40 mm Grenade Machine Gun; TM 9-1005-313-10, Operator’s Manual for the M240 7.62 mm Machine Gun, and other related manuals listed in WP 0035, References.

During the following procedure, the trigger switch on the joystick will be disarmed, but the weapon could have a round in the chamber.

Hatch 1 is open. Only firing is inhibited. The gun defaults to continuous fire mode. Safety interlocks will not function.

Hatch 2 is open. Both firing and motion are inhibited. The gun defaults to continuous fire mode. Safety interlocks will not function.

Hatch interlocks have been overridden with Safety Over-Ride switch. The gun defaults to continuous fire mode. Safety interlocks and no-fire zones will not function. Motion control is active.

Warning Summary - Cont

Weapons - Cont

No-fire zones, burst mode, single-burst mode, and safety interlocks will not function.

The gun defaults to continuous fire mode. Safety interlocks and no-fire zones will not function. Motion control is active. “Commander Inhibit” is overridden.

The gun defaults to continuous fire mode. Safety interlocks and no-fire zones will not function. Motion control is active.

Depending on the weapon (M2, Mk19, M240, or M249) being loaded and fired, and the step in the process, the trigger switch may be disarmed while a round is on the bolt face (e.g., when ceasing fire), as shown in the following warnings. Follow the specific warnings in each weapon’s Loading and Firing work package, referring to WP 0018 (M2); WP 0019 (Mk19); WP 0020 (M240B); and WP 0021 (M249).

If weapon is engaged with erroneous data, an incorrect ballistic solution may occur, which could result in friendly fire.

During the procedure, the trigger switch on the control grip will be disarmed, but the weapon could have a round in the chamber. Follow all safety warnings and cautions. Failure to do so may result in personal injury.

After completing the following procedure, the weapon (M2 HB .50-cal, Mk19, M240, or M249) will be live and ready to fire. Follow all warnings and safety precautions. Failure to do so may result in personal injury.

After completing the following procedures, the trigger switch will be armed and the weapon ready to fire. Follow all warnings and normal safety precautions. Failure to do so may result in personal injury.

After completing step 10, never exceed 4 full counterclockwise (CCW) turns of the solenoid cap. Failure to do so may result in uncommanded weapon fire. Follow all safety warnings and cautions. Failure to do so may result in personal injury and equipment damage.

Range Safety

Comply with all local range safety procedures and precautions, including hearing protection.

Override Switches

The Safety Over-Ride Switch should be used in combat conditions only. Use of the Safety Over-Ride Switch will cause No-Fire zones, burst mode, single-burst mode, and safety interlocks to become non-functional. Injury or death to personnel and damage to equipment could result from using the Safety Over-Ride Switch in non-combat situations and certain combat situations.

The Safety Over-Ride Switch will also restart weapon movement after it has been stopped because GWS BIT error. Incorrect/improper use of this switch could lead to injury or death to personnel and damage to equipment.

Warning Summary - Cont

Weapons - Cont

Ammunition Can Safety

Use two personnel to remove the ammo can from the ammo hanger because, when the pins holding the ammo can to the ammo hanger are disconnected, the ammo can is no longer attached to the ammo hanger and, if the ammo can is loaded with ammunition, it is very heavy. Failure to follow this instruction may result in personal injury or equipment damage.

Use two personnel to lift the ammo can if the can is filled with ammunition. Failure to follow this instruction may result in personal injury or equipment damage.

If ammunition remains in the ammo can, use two personnel to remove the can from the ammo hanger assembly. Failure to do so may result in personal injury.

Ensure that the weapon is empty (all ammunition has cleared the feed tray and any cleared rounds are secured) before swapping out the ammo can insert. Failure to do so may result in personal injury.

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM, REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

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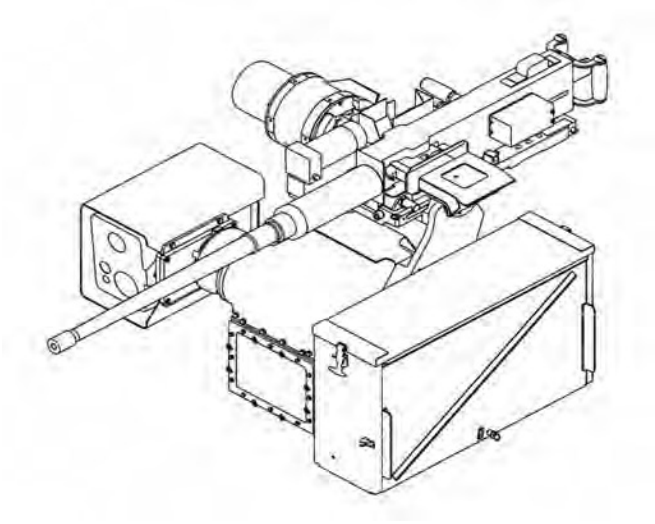
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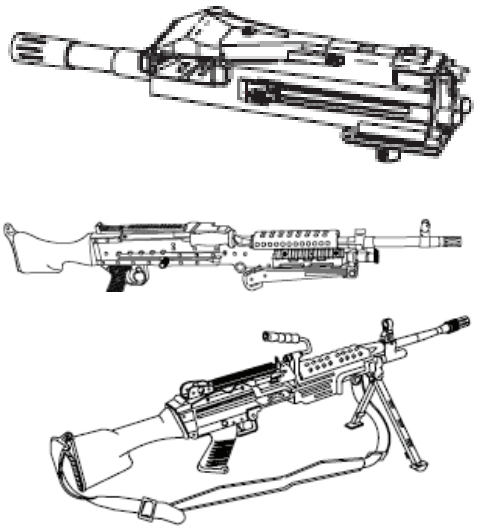
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OPERATOR's MANUAL

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PN 21677-0100
NSN 1090-01-525-5049
(EIC: 4EM)





*Supersedes TM 9-1090-218-10 dated 01 September 2005.

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HOW TO USE THIS MANUAL

This manual covers operating instructions for the Common Remotely Operated Weapon Station (CROWS).

Take a few minutes to look through this manual. You will find that this manual is easy for you to read and use. Each chapter and work package is set up to lead you through step by step instructions.

Before starting any inspection or operating procedures, read How to Use this Manual; Chapter 1 – CROWS General Information, Equipment Description and Data, and Theory of Operation and Operational Overview; Chapter 2 – CROWS Operator Instructions; Chapter 3 – CROWS Troubleshooting; Chapter 4 – CROWS Preventive Maintenance Checks and Services (PMCS) Maintenance Instructions; Chapter 5 – CROWS Maintenance Instructions; and Chapter 6 – CROWS Supporting Information.

General

To use the technical manuals efficiently, you need to know the following items:

- All references in the manual are to work packages or to another manual.
- Whenever the male gender is mentioned (e.g., crewman, repairman) in the manual, it also pertains to females.
- Procedures apply to all weapons unless otherwise noted.
- Each work package is headed by an initial setup. This setup outlines what is needed as well as certain conditions that must be met before starting the task.

WHAT'S IN THE MANUAL - FRONT TO BACK

Warnings, Cautions, and Notes

WARNING SUMMARY

General

For first aid data, see FM 4-25.11, First Aid, Headquarters, Department of the Army, December 2002 (Change 1, 15 July 2004)

Follow all safety warnings and cautions. Failure to follow these instructions may result in personal injury or equipment damage.

Ensure no power is applied while performing the **BEFORE** and **AFTER** PMCS operating procedures on the system unless instructed to do so.

A **WARNING** precedes the text of any procedure involving a clear danger to the person doing that procedure.

A **CAUTION** precedes the text of any procedure involving a clear risk of damage to the equipment.

A **NOTE** highlights essential procedures, conditions, or statements that follow.

WHAT'S IN THE MANUAL - FRONT TO BACK - Cont

Front Matter

TABLE OF CONTENTS lists the chapters, work packages, figures, tables, and indexes in this manual.

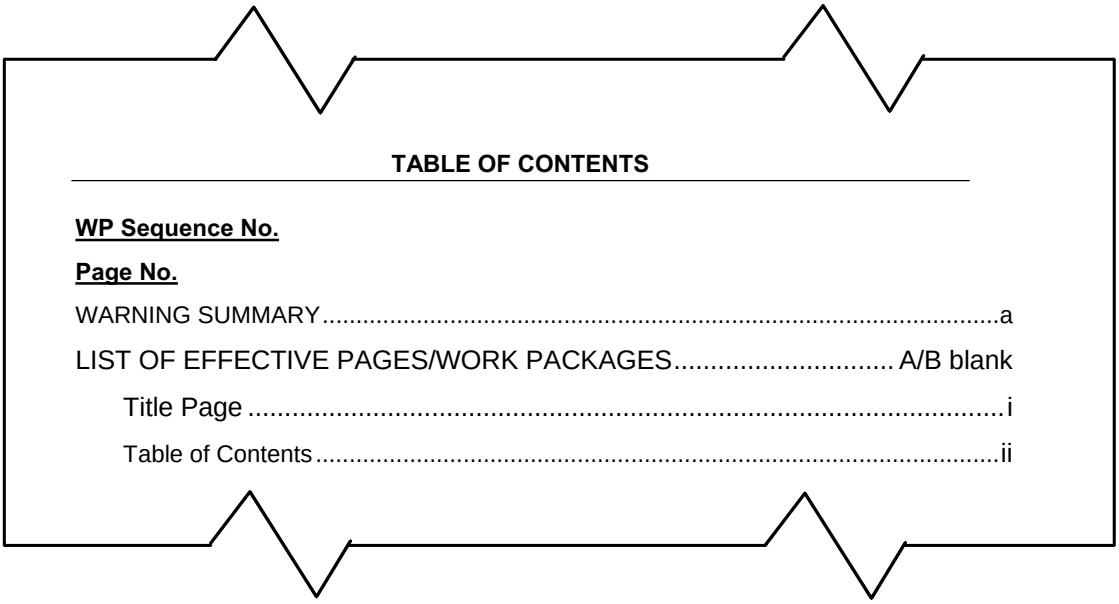


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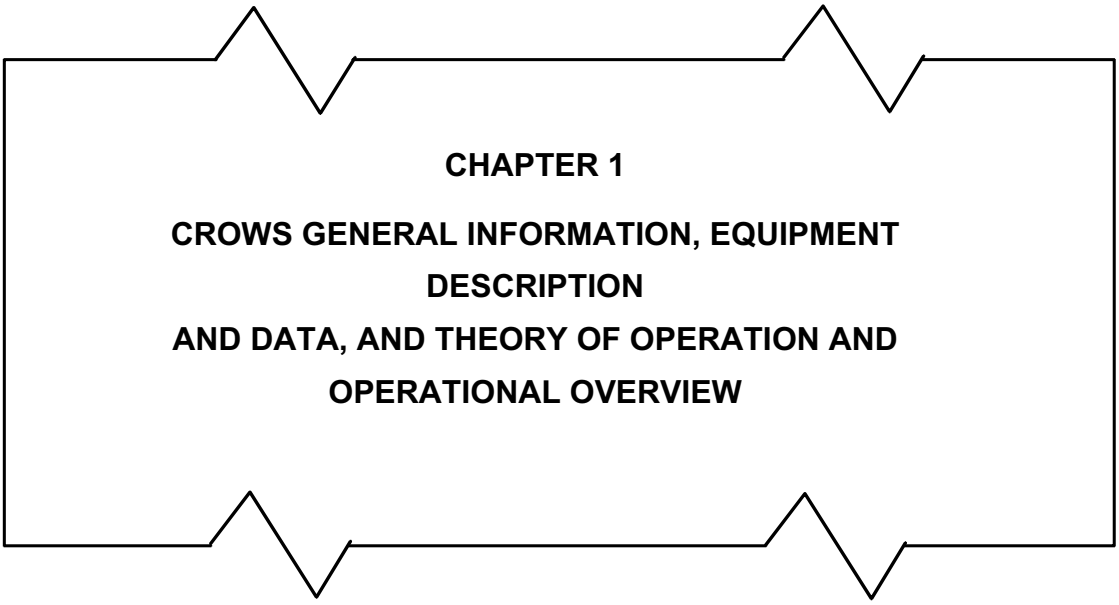
WP Sequence No.

Page No.

WARNING SUMMARY ..... a
LIST OF EFFECTIVE PAGES/WORK PACKAGES ..... A/B blank
Title Page i
Table of Contents ii

Chapter Divisions

CHAPTER 1 covers general information and gives a quick review of major components and features of the CROWS system.



CHAPTER 1

CROWS GENERAL INFORMATION, EQUIPMENT DESCRIPTION AND DATA, AND THEORY OF OPERATION AND OPERATIONAL OVERVIEW

CHAPTER 2 covers operator instructions for the CROWS system, including description and use of operator controls and indicators; interconnections; and operation under usual and unusual conditions.

CHAPTER 2

CROWS

OPERATOR INSTRUCTIONS

CHAPTER 3 contains troubleshooting procedures for weapons as well as a troubleshooting index.

CHAPTER 3

CROWS

TROUBLESHOOTING

WHAT'S IN THE MANUAL - FRONT TO BACK - Cont

Chapter Divisions - Cont

CHAPTER 4 contains a preventive maintenance checks and services (PMCS) introduction, the PMCS procecedures, and a before operational check.

CHAPTER 4
CROWS
PREVENTIVE MAINTENANCE CHECKS AND SERVICES
(PMCS) MAINTENANCE INSTRUCTIONS

CHAPTER 5 contains maintenance instructions for cleaning, lubricating, safety wiring, and thread locking. In addition, it contains the instructions for the preparation for storage, handling, and shipping of the CROWS system.

CHAPTER 5
CROWS
MAINTENANCE INSTRUCTIONS

CHAPTER 6 contains supporting information such as publication references; a list of the components of the CROWS system and the basic issue items for the system; a listing of other authorized items for use in conjuction with the system; a list of expendable/durable supplies and materials used with the CROWS system, and a glossary which contains the general abbreviations, acronyms, and terms found in the manual (Table 1) plus the abbreviations that appear on the display unit screen (Table 2).

CHAPTER 6

CROWS

SUPPORTING INFORMATION

Rear Matter

The Glossary contains three tables: general abbreviations and terms used in this manual; abbreviations that appear on the display unit screen; and units of measure.

The Index contains an alphabetical listing of important information and gives a reference to where this information can be found. Usually each subject is presented in more than one way to make the information easier to find.

INDEX

This work package contains a listing of major subjects in alphabetical order, cross-referenced to work package (or page number where appropriate).

A

AAL ..... WP 0035

Accessing Location Pages to Select from Possible 200 TRPs ..... WP 0015

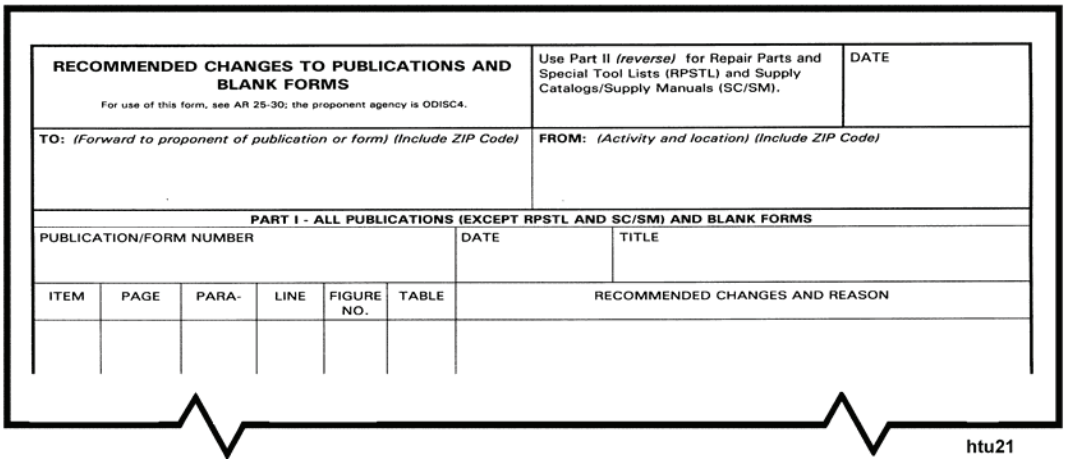
Adapter Kit and Weapon Installation (M2) ..... WP 0007

Adapter Kit and Weapon Installation (Mk19) ..... WP 0009

WHAT'S IN THE MANUAL - FRONT TO BACK - Cont

Rear Matter

DA Form 2028 is used to recommend changes to publications and blank forms.



RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is ODISC4.						Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
TO: *(Forward to proponent of publication or form) (Include ZIP Code)*						**FROM:** *(Activity and location) (Include ZIP Code)*	
PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS							
PUBLICATION/FORM NUMBER						DATE	TITLE
ITEM	PAGE	PARA-	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON	

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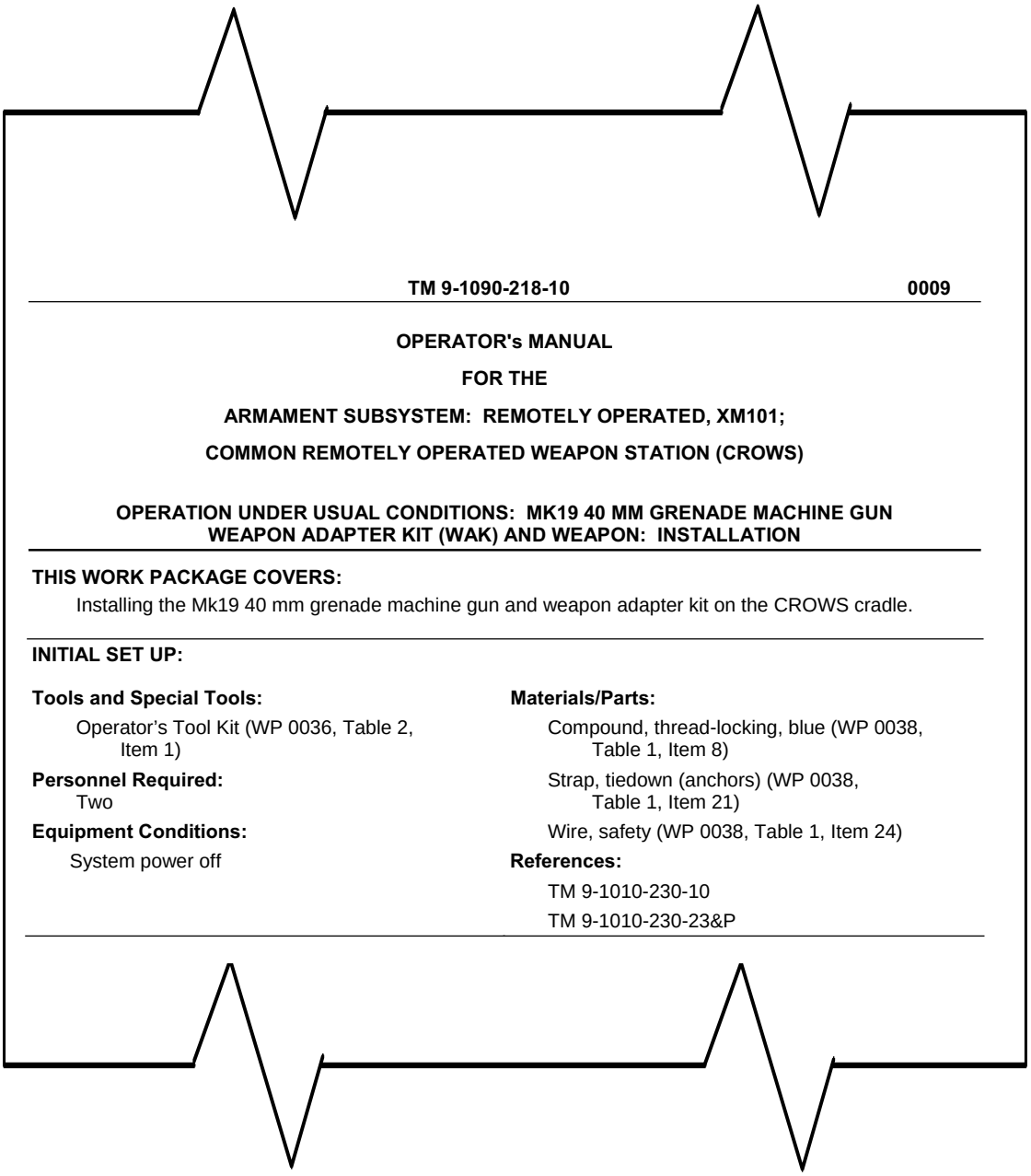
How To Find A Work Package

The Index contains a listing of work packages in alphabetical order by name and number. Once you have located the work package number, turn to that work package. Or go to the table of contents for a listing of work packages in the order that they occur in the manual.

In this manual, work package numbers are listed at the top right hand corner of each page.

Beginning a Work Package

When you find the work package you are going to work on, read the top half of the first page. See the example on the next page with its legend (following).



1

TM 9-1090-218-10 0009

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER USUAL CONDITIONS: MK19 40 MM GRENADE MACHINE GUN WEAPON ADAPTER KIT (WAK) AND WEAPON: INSTALLATION

THIS WORK PACKAGE COVERS:

Installing the Mk19 40 mm grenade machine gun and weapon adapter kit on the CROWS cradle.

2

INITIAL SET UP:

Tools and Special Tools:

Operator's Tool Kit (WP 0036, Table 2, Item 1)

3

Personnel Required:

Two

4

Equipment Conditions:

System power off

5

Materials/Parts:

Compound, thread-locking, blue (WP 0038, Table 1, Item 8)

Strap, tiedown (anchors) (WP 0038, Table 1, Item 21)

Wire, safety (WP 0038, Table 1, Item 24)

References:

TM 9-1010-230-10

TM 9-1010-230-23&P

6

Legend (to example above)

1. Title. This is the number and name of the work package.
2. Description. This describes the overall actions you will perform.
3. Tools and Special Tools. These are the tools and equipment you will need to complete the work. Tools found in the tool kit, shop sets or shelters are not listed separately.
4. Personnel Required. This tells you the number of personnel needed to perform the required task.
5. Equipment Conditions. This describes the condition the equipment must be in before you start the task. If other conditions within the work package are needed for a particular procedure, the conditions for that procedure are noted prior to the steps to be performed.
6. Materials/Parts. These are the consumable materials you will need to do the task. Consumable materials are listed in Expendable and Durable Materials (WP 0038).

WHAT'S IN THE MANUAL - FRONT TO BACK - Cont

Using the Work Package Steps

Read through the work package's illustrated instructions step by step. As you proceed through each step, remember that it is important to do each step in the order given.

Using the Troubleshooting Index (WP 0024)

A malfunction is discovered in one of two ways: during normal operation; or during normal maintenance such as inspection, alignment, PMCS, or other scheduled testing. The symptoms of the malfunction may be common or unusual, but identification of fault symptoms is the first step in the troubleshooting process.

Entry into the troubleshooting process is based on observed fault systems. It is important that you identify the fault symptoms as accurately as possible and then use the troubleshooting index (for screen messages) or the fault system index (for observed faults) as an aid to identify the item that needs repair or replacement.

The troubleshooting index and fault system index describe the more common fault symptoms that you may encounter, specifies the action to be taken, and references the places where these actions can be found.

References

References within a work package refer to another work package in the same manual. A step in one work package may be a complete task somewhere else.

The tools needed to do the referenced work will be listed in that work package.

Cleaning and Inspection

Clean and inspect steps are found in WP 0029, Cleaning. Use these steps to clean and inspect any part being removed, repaired, or installed. Special cleaning will be covered in the task step. Below is a step that requires general cleaning.

Example:

3. Perform general cleaning IAW WP 0029.

Comments on Work Packages

The following comments apply to all work packages.

1. Consumable materials are listed under Materials.
2. Removed components must be cleaned, inspected, and reinstalled if found to be serviceable.
3. Cleaning and inspection must be done according to Chapter 5, CROWS Maintenance Instructions.
4. A new component must be installed if inspection indicates a removed component to be defective.
5. Defective components must be discarded or sent to the next higher maintenance level for repair.

Now you are ready to use this manual.

END OF FRONT MATTER

CHAPTER 1

CROWS GENERAL INFORMATION, EQUIPMENT DESCRIPTION AND DATA, AND THEORY OF OPERATION AND OPERATIONAL OVERVIEW

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

GENERAL INFORMATION

This work package contains general information and equipment description/data for the Common Remotely Operated Weapon Station (CROWS).

WP CONTENTS

Section/Subsection	Page
Scope	1
Type of Manual	1
Purpose of Equipment	1
Maintenance Forms, Records, and Reports	2
Reporting Equipment Improvement Recommendations (EIRs)	2
Corrosion Prevention and Control (CPC)	2
Hand Receipt (HR) Manuals	2
Destruction of Material to Prevent Enemy Use	2
Applicable Documents	2
CROWS Overview	3
Preparation for Storage or Shipment	4
List of Abbreviations/Acronyms	4

SCOPE

Type of Manual

Operator Manual

Purpose of Equipment

CROWS provides under-armor crew protection and self-defense as a gunner-operated system to remotely aim and fire a variety of crew-served weapons. It is used as the weapon mount for primary or secondary armament on a suite of combat vehicles and operates from the host vehicle's system power. CROWS offers remote firing from inside a vehicle or from the Command and Control Center using a control grip (joystick), and a display unit (DU); remotely located, usually inside the vehicle.

For the purposes of this manual, CROWS is considered to be accessible.

MAINTENANCE FORMS, RECORDS, AND REPORTS

Reporting Equipment Improvement Recommendations (EIRs)

If your equipment needs improvement, let us know. You, as the user, are the best person to tell us what you don't like about your equipment and what you think could improve it. Send us an equipment improvement recommendation (EIR) – your suggestions about an item's design or performance. Just fill out an SF Form 368 (Product Quality Deficiency Report), DA Form 2404 (Equipment Inspection and Maintenance Worksheet), or DA Form 5988-E (Equipment Inspection and Maintenance Worksheet (EGA) - Electronic), and mail documentation to TACOM Life Cycle Management Command, Tank-automotive & Armament Command-Rock Island, ATTN: AMSTA-LC-LPIT, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. We'll send you a reply and, in the meantime, know that we appreciate your efforts.

Corrosion Prevention and Control (CPC)

Corrosion prevention and control (CPC) of material are continuing concerns. Report any corrosion problems with this item so that they can be fixed and improvements can be made to prevent future problems. Although corrosion is typically associated with rusting of metals, it can also include deterioration of other materials such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of these materials may be a corrosion problem.

If you suspect a corrosion problem, use the SF Form 368, DA Form 2404, or DA Form 5988-E to identify possible issues. Use of key words such as "corrosion," "rust," "deterioration," or "cracking" will ensure that the information is identified as a CPC problem. Submit the form to Commander, Armament Research, Development and Engineering Center, ATTN: AMSRD-AAR-QEP-C/Customer Feedback Center, 1 Rock Island Arsenal, Rock Island, IL 61299-7300.

Hand Receipt (HR) Manuals

This manual has a companion document with a TM number followed by "-HR" (Hand Receipt). TM 9-1090-218-10-HR consists of preprinted hand receipts that list end item related equipment (i.e., COEI, BII, and AAL) that must be accounted for. As an aid to property accountability, additional HR manuals may be requisitioned through normal publication channels.

DESTRUCTION OF MATERIAL TO PREVENT ENEMY USE

For specific procedures and materials, should destruction of the CROWS be required, refer to TM 750-244-7, Procedures for Destruction of Equipment in Federal Supply Classifications 1000, 1005, 1010, 1015, 1020, 1025, 1030, 1055, 1090 and 1095 to Prevent Enemy Use.

Should the CROWS be in danger of being overrun, remove or cut the joystick cable and remove or cut the electronic module unit (EMU) cable.

LIST OF ABBREVIATIONS

For lists of general abbreviations and terms, on-screen abbreviations and definitions, and symbols and units of measure, refer to the Glossary.

APPLICABLE DOCUMENTS

NOTE

Refer to WP 0035, References, for additional information on supporting documents.

The following documents form part of this manual to the extent specified herein.

TM 9-1005-213-10, M2 HB .50-Cal Machine Gun Operator's Manual
TM 9-1010-230-10, Mk19 Grenade Machine Gun Operator's Manual
TM 9-1005-313-10, M240 7.62 mm Machine Gun Operator's Manual
TM 9-1005-201-10, M249 5.56 mm Machine Gun Operator's Manual

CROWS OVERVIEW

CROWS supports a range of weapons including the M2 HB .50-cal machine gun, the Mk19 40 mm grenade machine gun, the M240B 7.62 mm machine gun, and the M249 5.56 mm machine gun, as shown in Figures 1 through 4.

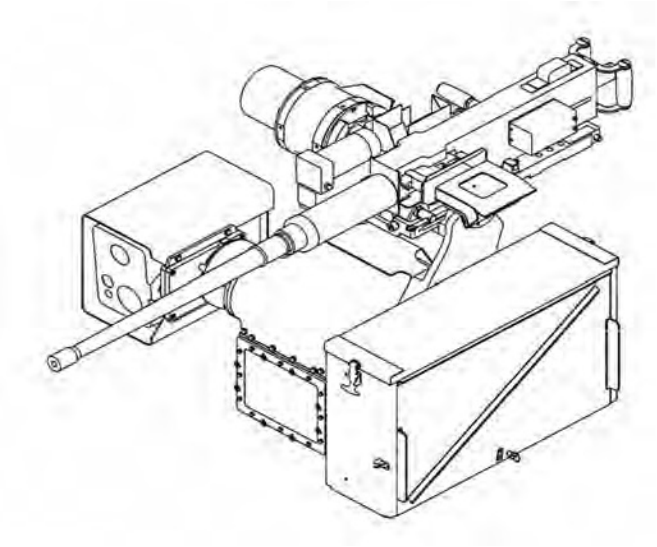


Figure 1. CROWS Configuration with M2 HB .50-cal Machine Gun.

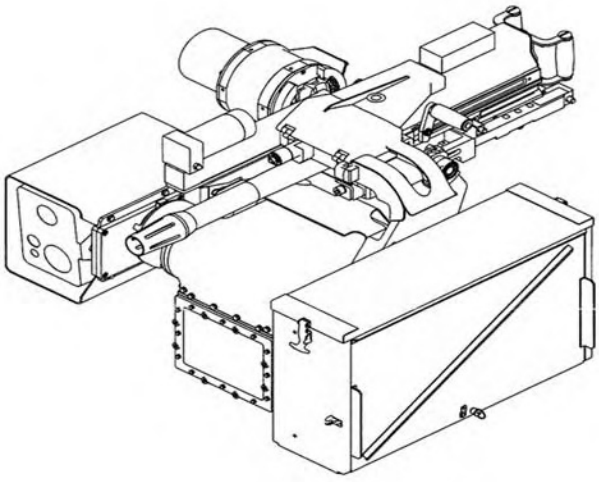


Figure 2. CROWS Configuration with Mk19 40 mm Grenade Machine Gun.

CROWS OVERVIEW - Cont



Figure 3. CROWS Configuration with M240B 7.62 mm Machine Gun.



Figure 4. CROWS Configuration with M249 5.56 mm Machine Gun.

PREPARATION FOR STORAGE OR SHIPMENT

For instructions on preparation for storage or shipment, refer to WP 0033.

LIST OF ABBREVIATIONS/ACRONYMS

For a listing of abbreviations, acronyms, and terms (including those found on the DU screen), refer to the Glossary.

END OF WORK PACKAGE

OPERATOR's MANUAL
FOR THE
ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

EQUIPMENT DESCRIPTION AND DATA

This work package contains detailed equipment descriptions and data for the Common Remotely Operated Weapon Station (CROWS).

WP CONTENTS

Section/Subsection	Page
System Overview	1
Equipment Characteristics, Capabilities, and Features	2
Location and Description of Major Components	5
CROWS Weapon Mount	5
Serial Number and Identification Labels	6
Cradles and Weapon Adapter Kits (WAKs)	6
Ammo Can	10
Sensor Group	11
Control Group	12
Equipment Data	14

SYSTEM OVERVIEW

CROWS provides under-armor crew protection and self-defense, and is used as a gunner-operated weapon mount for primary or secondary armament on a suite of combat vehicles. CROWS offers remote firing from inside a vehicle. System components include:

- A two-axis stabilized CROWS mount with azimuth, elevation, and sight drives
- Weapon interface, consisting of a variety of cradles and weapon adapter kits (WAKs) that support a range of weapons and ammunition
- An ammunition can able to feed a variety of weapons
- A viewing and sighting unit, called the Sensor Group, with a sensor unit, cable, sunshade, and interface/adapter plates (drive and sight) that attach it to the sight drive
- A control and display system for weapon charging and fire-control called a Control Group, composed of an Electronic Module Unit (EMU), Switch Panel Unit (SPU), Interface Control Unit (ICU), hand control (joystick), and a display unit (DU); remotely located, usually inside the vehicle
- Cable assemblies interconnecting the subsystems
- Ballistic armor (mission-dependent)

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

The CROWS consists of the components listed in Table 1, which includes the ROI part number, official nomenclature, and common name. Hereinafter, the common name will be used for convenience in this manual. Subassemblies are indented under their next higher assembly.

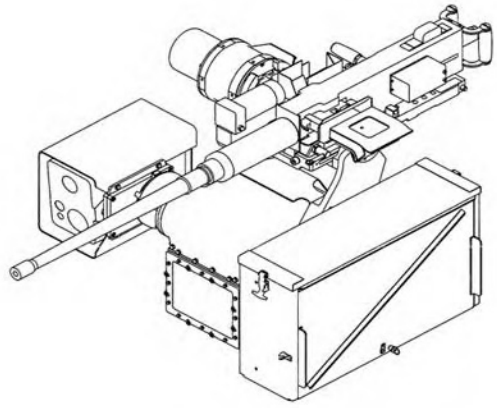
Table 1. CROWS Components and Nomenclature.

ROI Part Number	Nomenclature	Common Name
21677-0100	Common Remotely Operated Weapon Station, consisting of:	CROWS
21677-0200-1	. Weapon Mount Assembly, Resilient	Mount, CROWS Mount, Weapon Mount
21677-1000	. . Pedestal Gun Mount	Pedestal Mount
21677-0505	. . Ammunition Bracket Adapter	Ammo Hanger
21677-2000	. . Yoke Arm Assembly – Elevation	Elevation Yoke Arm
21677-2500	. . Arm Assembly, Weapon Mounting	Ammo Yoke Arm
21677-3700	. . Cable Assembly, Power, Electrical	Weapon Elevation Cable
21677-2600	. Gun Mount	Cradle (Heavy)
21677-2614	. . Pin, Forward – M2/Mk19	Forward Pin
21677-3100	. Gun Mounting Adapter	M2 HB Weapon Adapter Kit (WAK), Adapter Kit
21677-3702	. . Cable Assembly, Electrical	M2 Weapon-Mount Cable
21677-3200	. Gun Mounting Adapter	Mk19 WAK, Adapter Kit
21677-3703	. . Cable Assembly, Electrical	Mk19 Weapon-Mount Cable
21677-3400-1	. Gun Mounting Adapter	M240/M249 WAK, Adapter Kit
21677-3705	. . Cable Assembly, Electrical	M240/M249 Weapon-Mount Cable
21677-0500	. Ammunition Can Assembly	Ammo Can
21677-4500	. Sensor Group	Sensor Group
ASY06077	. . Sensor Unit	Sensor
21677-3706	. . Cable Assembly, Electrical	Mount-Sensor Unit Cable
21677-5500	. Control Group	Control Group
ASY05820	. . Electronic Module Unit	EMU
ASY05821	. . Panel Control, Electronic	Switch Panel Unit (SPU)
ASY05822	. . Interface Control Unit	ICU
ASY05823	. . Grip Assembly, Controller, Weapon	Joystick
ASY05843	. . Display Unit	DU, display
21677-3713	. . Cable Assembly, Electrical – Power	Vehicle Power Cable
21677-3714	. . Cable Assembly, Electrical –	ICU-SPU Cable

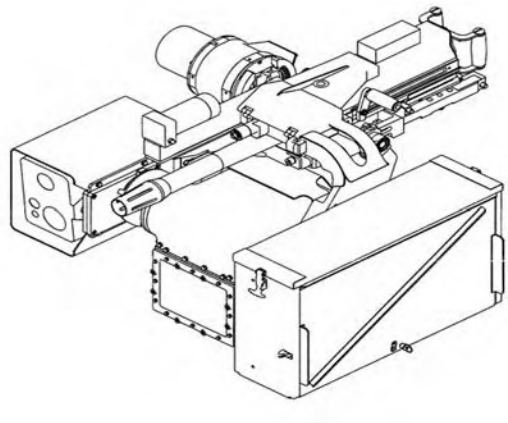
Table 1. CROWS Components and Nomenclature – Cont.

ROI Part Number	Nomenclature	Common Name
21677-3715	. . Cable Assembly, Electrical –	ICU-DU Cable
21677-3716	. . Cable Assembly, Electrical –	ICU-EMU Cable
21677-3720	. . Cable Assembly, Electrical –	Hatch Interlock Cable
21677-3730	. . Cable Assembly, Electrical –	Mount-Bulkhead Cable
21677-3731	. . Cable Assembly, Electrical –	Bulkhead-ICU Cable
21677-0700	. Ballistic Protection Kit (Mission-Dependent)	Ballistic Armor, BPA
n/a	Reticle	Aimpoint (i.e., ballistic aimpoint, laser aimpoint)

CROWS, shown in Figure 1, supports a range of weapons including the M2 HB .50-cal machine gun, the Mk19 40 mm grenade machine gun, the M240B 7.62 mm machine gun, and the M249 5.56 mm machine gun.



View A, CROWS with M2 HB .50-cal Machine Gun



View B, CROWS with Mk19 40 mm Grenade Machine Gun

Figure 1. Common Remotely Operated Weapon Station (CROWS) Configurations (Sheet 1 of 2).

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES - Cont



View C, CROWS with M240B 7.62 mm Machine Gun



View D, CROWS with M249 5.56 mm Machine Gun

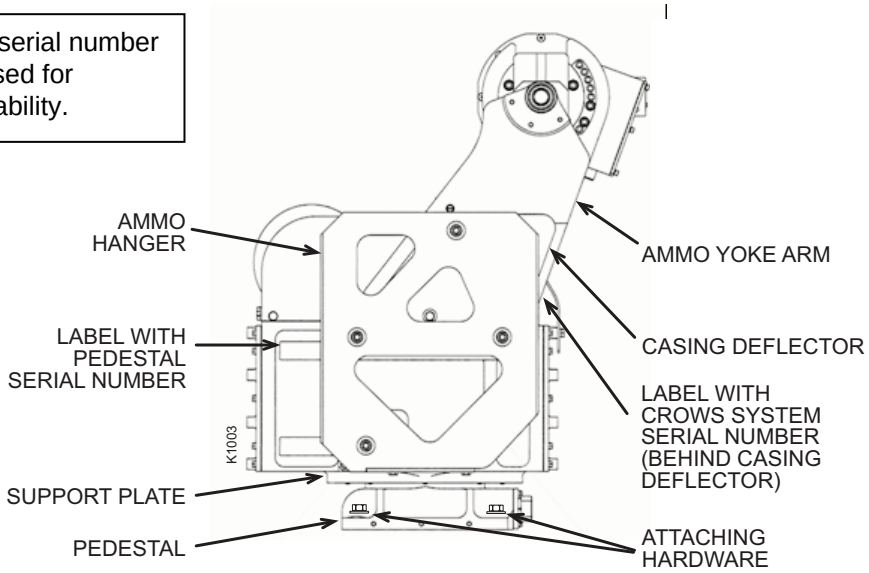
Figure 1. Common Remotely Operated Weapon Station (CROWS) Configurations (Sheet 2 of 2).

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

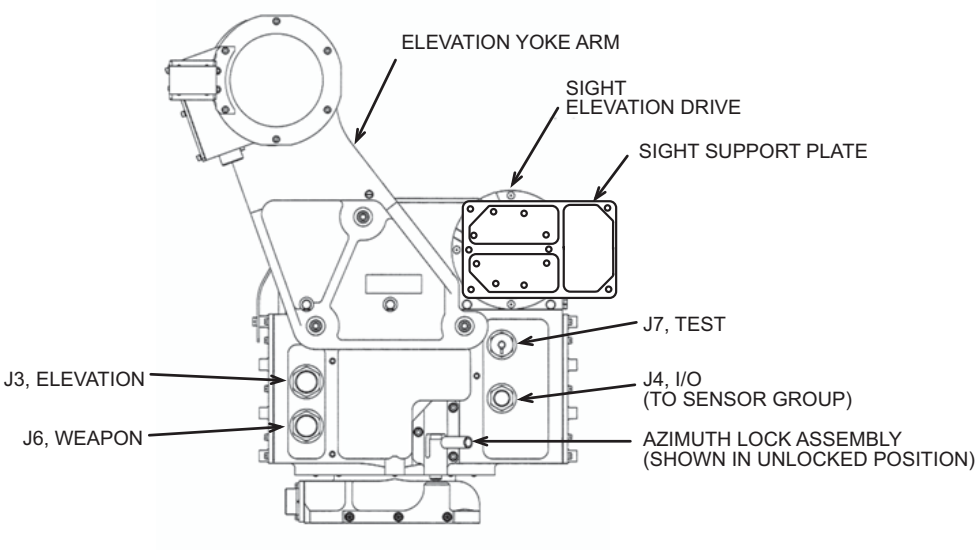
CROWS Weapon Mount

The CROWS weapon mount, shown in Figure 2, is a remotely controlled, two-axis stabilized weapons mount. The mount is capable of continuous 360° of azimuth rotation and -20° to +60° of elevation movement. Using the adapter kits, the mount can be configured with a variety of weapons such as the M2 HB machine gun, Mk19 grenade machine gun, the M240B machine gun, and M249 machine gun.

Note: Pedestal serial number is the number used for system accountability.



Ammo Yoke Arm Side



Elevation Yoke Arm Side

Figure 2. CROWS Weapon Mount.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Cont

Serial Number Identification Labels

The serial number is the number used for system accountability. There are two serial number labels on the pedestal mount. One label is for the pedestal mount itself (Figure 3, item 1); the other serial number label is for the CROWS system (Figure 3, item 2). Both serial numbers should match. If they do not match, contact your next higher level of maintenance.

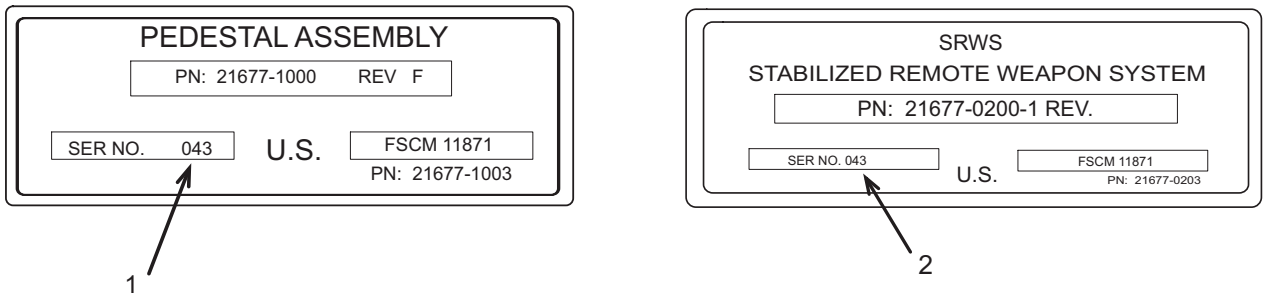


Figure 3. Labels for CROWS Serial Number Identification.

Cradles and Weapon Adapter Kits (WAKs)

The cradle provides a platform for a variety of weapons and, together with specific adapter kits for each weapon, allows each weapon to be positioned and operated remotely. Figure 4 shows the M2/Mk19 cradle.

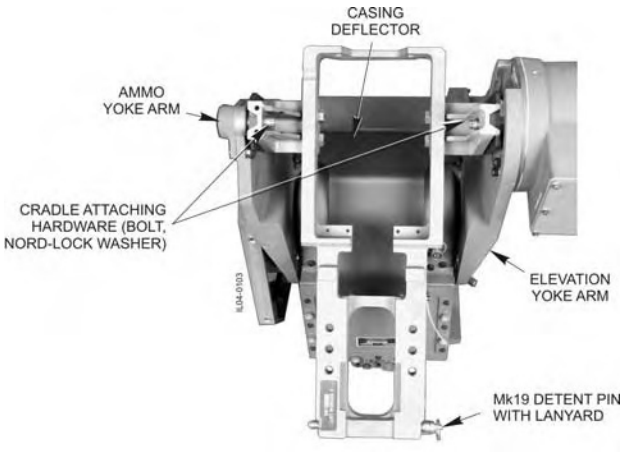


Figure 4. Cradle Assembly for M2 and Mk19.

Figure 5 shows the M2 HB .50-cal machine gun and adapter kit configuration.

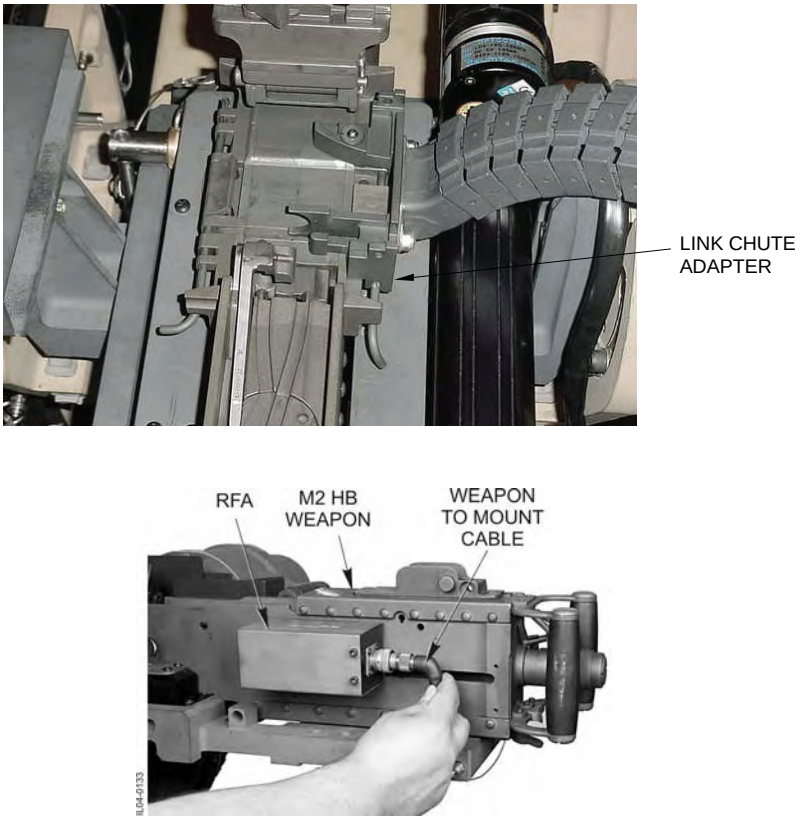


Figure 5. M2 and Adapter Kit (Right-Hand View and Left-Hand, Rear View).

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Cont

Cradles and Weapon Adapter Kits (WAKs) - Cont

Figure 6 shows the Mk19 grenade machine gun and adapter kit configuration.

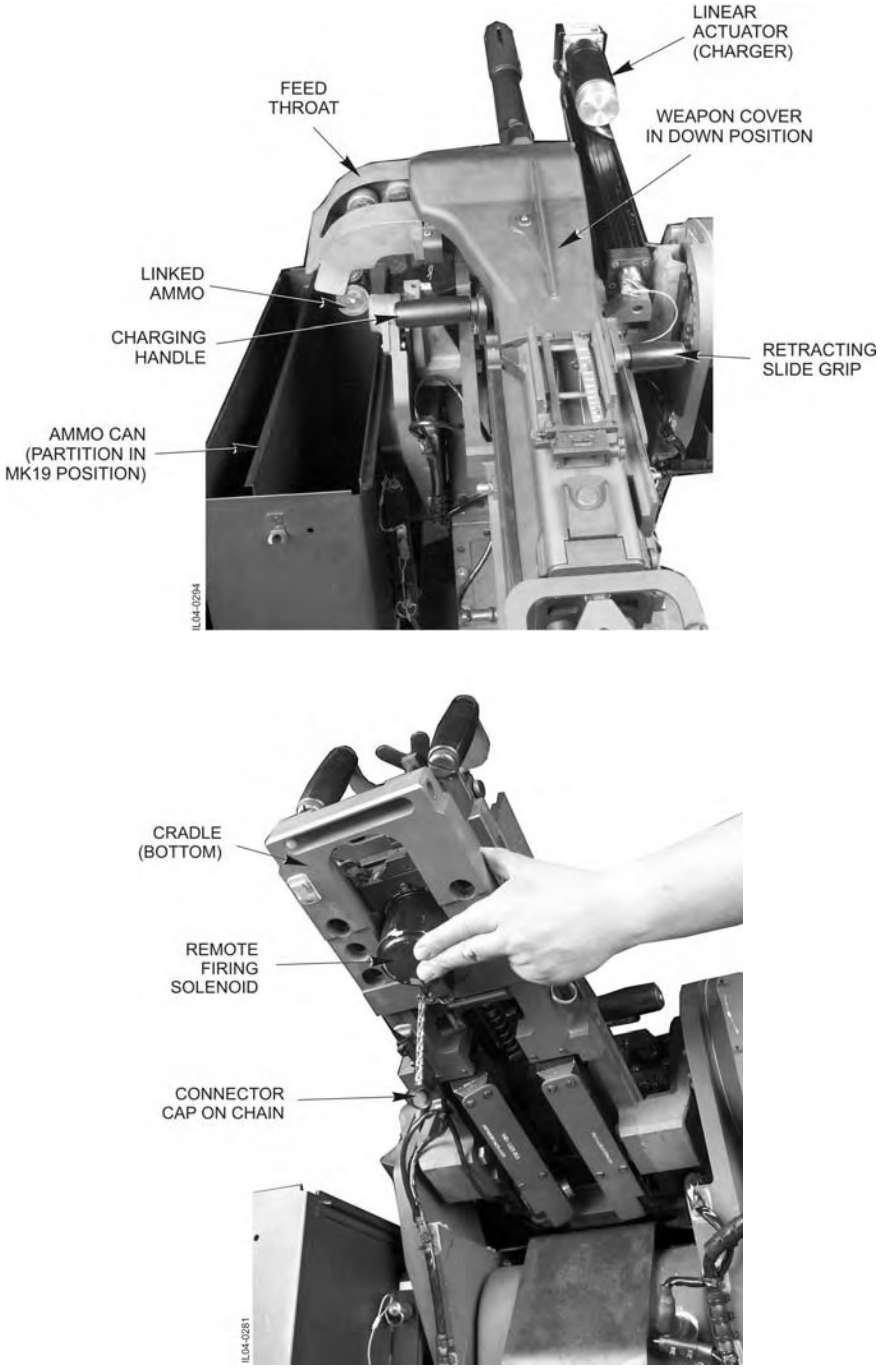


Figure 6. Mk19 and Adapter Kit Mounted on the CROWS Cradle (Top View and Bottom View).

The cradle, shown in Figure 7, provides a platform for the M240B and M249 machine guns and allows each weapon to be positioned and operated remotely. Figures 8 and 9 show the M240/M249 WAK with weapons installed. The cradle is provided with two different rounds counter modules, one for the M240B and an adapter-counter combination for the M249.



Figure 7. Cradle for M240/M249 WAK.



Figure 8. M240B on M240/M249 Cradle.

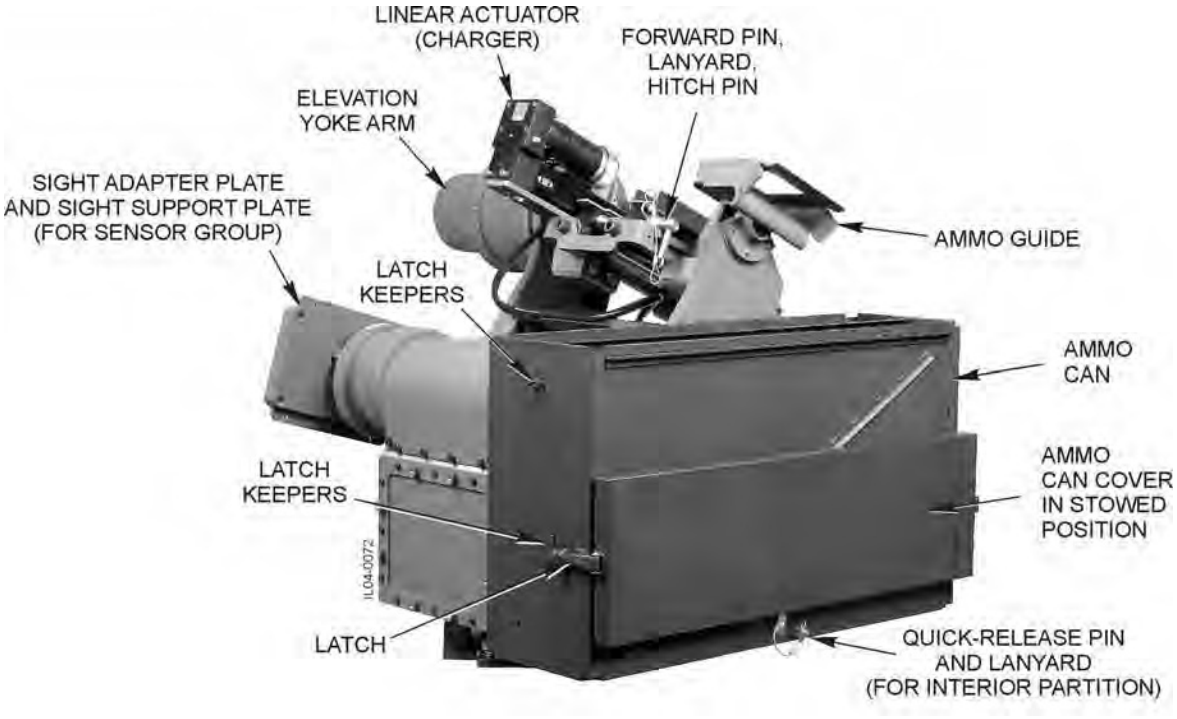


Figure 9. M249 on M240/M249 Cradle.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Cont

Ammo Can

The ammo can, shown in Figure 10, attaches to the ammo hanger on the pedestal and holds the linked ammunition as it feeds into the weapon with an internal partition inside the ammo can positioned specifically for the type of ammunition being used. The cover may be positioned on top of the ammo can or stowed on the side during weapon firing.



Cover Stowed on Side



Cover in Top Position

Figure 10. Ammo Can.

Sensor Group

The Sensor Group consists of a sensor unit, shown in Figure 11, sunshade, cable, sight support plate, and a sight adapter plate. The senor unit consists of the following items:

- A day sensor (daylight video camera)
- A thermal sensor (thermal imager or night sensor)
- An eyesafe laser rangefinder (ELRF)
- Supporting electronics, including an input/output multiplexer assembly
- Environmental sensors, including a temperature pressure sensor
- Cant and elevation sensor
- Optical windows providing access to the thermal sensor, ELRF transmitter and receiver, and day sensor

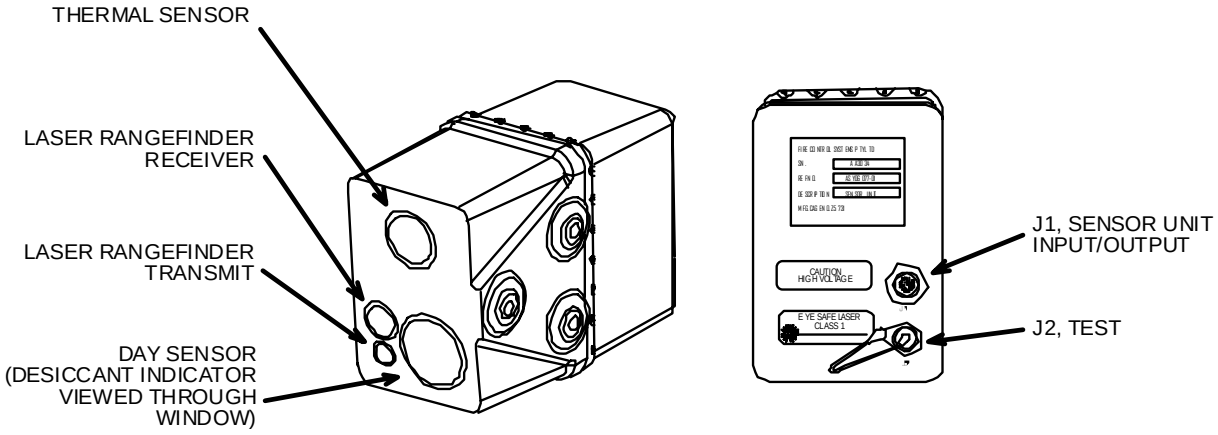


Figure 11. Sensor Unit.

The daylight video camera consists of a 1/3 format charge-coupled device (CCD) and an f/7, 27X continuous zoom lens. The thermal imager has a 320x256 InSb-cooled array matched to an f/4, 50 mm/150 mm dual field of view (FOV) lens.

While the platform is stationary, the laser rangefinder is able to establish the distance to vehicle-size targets (2.3 x 2.3 m) greater than 4,000 m within ± 10 m, given unencumbered visibility and target reflectance of 0.25.

The SU provides target acquisition and engagement at ranges well beyond those typical for the range of weapons used with CROWS. This extended imaging capability enables CROWS to perform low-profile surveillance with the ability to identify a threat in ample time to engage.

The Sensor Group is furnished with a fully integrated fire control system that provides ballistic correction. The ballistic computer takes into account the weapon, ammunition, target range, vehicle cant and elevation, and environmental factors to provide a corrected aimpoint to the CROWS operator.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Cont

Control Group

The Control Group is the gunner interface and consists of a DU, interface control unit (ICU), electronic module unit (EMU), switch panel unit (SPU), hand controller (joystick), and interface cable assemblies. The system control module may be combined in a single unit or separated as needed.

Figure 12 shows the Control Group components (considered to be part of the Vehicle Integration Kit [VIK] for installation purposes only).

NOTE

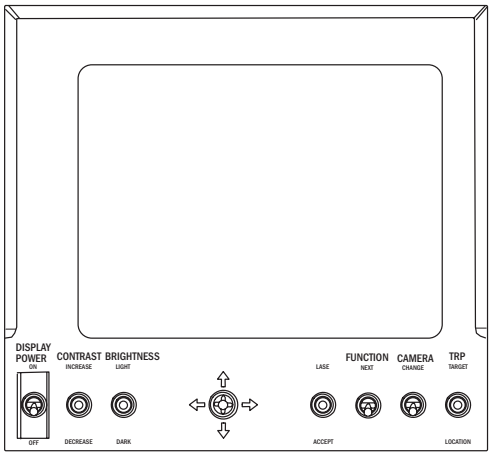
Safety overrides depend on configuration of the components in the vehicle integration kit (VIK).

The Control Group provides full remote control of the weapon system via on-screen menus presented on the DU and by the switches on the SPU and joystick. These separate components are located inside the vehicle and are arranged to optimize the user interface.

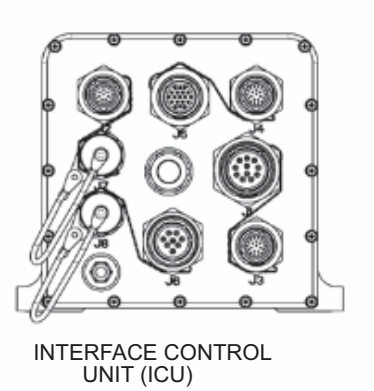
- **Display Unit.** The DU projects camera images and overlay data from the ballistics computer. The 12.1-inch flat-panel diagonal screen, built into a ruggedized enclosure, has a resolution of 800 x 600 lines, with embedded brightness and contrast controls. The DU provides the operator with access to an array of controls, including display power and specific user interface switches to control the SU and CROWS functions.
- **Interface Control Unit.** The ICU provides the electronic interface to the DU, SPU, joystick, and vehicle hatches. It also contains the weapon-control electronics as well as the power distribution and line filtering for the other Control Group assemblies and the rest of the CROWS components.
- **Electronics Module Unit.** The EMU contains the main electronics processors, power management, and sensor-support electronics to control CROWS. The processors include an embedded computer and digital video system.

  The EMU controls the sensors within the Sensor Group via a serial interface and performs ballistic aimpoint computation for the operator based on the weapon and ammunition in use, range to target, and environmental conditions detected. The EMU also creates overlay text and symbols shown on the DU to the operator.
- **Switch Panel Unit.** The SPU is a small enclosure with several switches, which provide operator access to an array of controls, including the Main Power, Safety Override, weapon Safe/Arm, weapon Charge switches, and the smoke grenade launcher (SGL) fire switch.
- **Joystick.** The CROWS operator uses a non-displacement, thumb-activated, force-sensitive joystick to move the mount, zoom the cameras, laze targets, accept the fire solution, and fire the weapon.

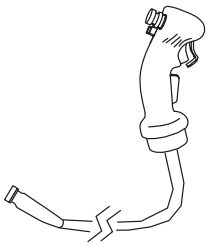
  The joystick incorporates two function-selector switches, a switch for stabilization ON/OFF, a Deadman switch, and a trigger with a guard. It provides two ranges of speed in elevation and traverse, with the lower speed range for target tracking and the higher speed range for rapid slewing. Rigidly mounted in the host vehicle, the joystick accommodates right- or left-handed operation and is removable for hand-held use.
- **Interconnection Cable Assemblies.** These cables include all of the external cables used to connect the Sensor Group and Control Group components together, the mount to the Sensor Group and Control Group, and CROWS to power from the vehicle's battery.



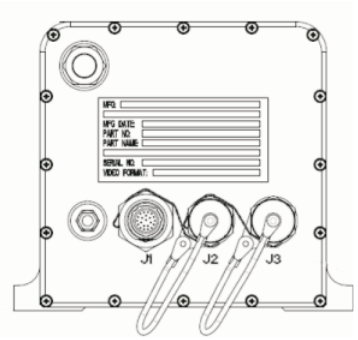
DISPLAY UNIT



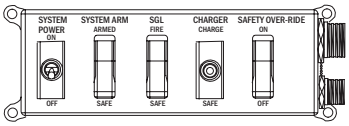
INTERFACE CONTROL UNIT (ICU)



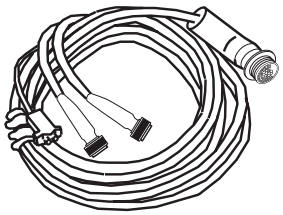
JOYSTICK



ELECTRONIC MODULE UNIT (EMU)



SWITCH PANEL UNIT (SPU)



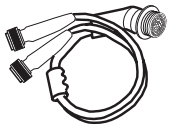
BULKHEAD-ICU CABLE (21677-3731)



ICU-DISPLAY UNIT CABLE (21677-3715)



VEHICLE POWER CABLE (21677-3713)



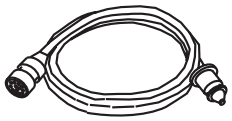
MOUNT-BULKHEAD CABLE (21677-3730)



ICU-EMU CABLE (21677-3716)



ICU-SPU CABLE (21677-3714)



HATCH INTERLOCK CABLE (21677-3720)

Figure 12. Control Group.

EQUIPMENT DATA

The CROWS specifications are listed in Table 2.

Table 2. Key CROWS Specifications.

Subject	Specification
CROWS Mount	
Overall Dimensions (Standard, with Ballistic Protection Kit installed):	
Depth	635 mm (25 inches)
Width	762 mm (30 inches)
Height	711 mm (28 inches)
Overall Dimensions (Standard, without Ballistic Protection Kit installed):	
Depth	635 mm (25 inches)
Width	762 mm (30 inches)
Height	711 mm (28 inches)
Overall Dimensions (Stowed):	
Depth	864 mm (34 inches)
Width	711 mm (28 inches)
Height	533 mm (21 inches)
Weight (Mount Only):	142 kg (313 lb)
Total with M2 HB Configuration	206.3 kg (454.8 lb) (No ammunition, no armor)
Total with Mk19 Configuration	207.2 kg (456.7 lb) (No ammunition, no armor)
Total with M240B Configuration	175.6 kg (387.25 lb) (No ammunition, no armor)
Total with M249 Configuration	180.0 kg (396.9 lb) (No ammunition, no armor)
Power Requirements	24 Vdc, 4 A nominal, 30 A peak
Azimuth Operation	Continuous 360° operation
Maximum Azimuth Speed	80°/second
Elevation Operation	+60° to -20°
Maximum Elevation Speed	60°/second
Motion Control	Stabilized in azimuth and elevation to eliminate effects of vehicle motion on the payload
Tracking and Slewing	Continuously variable
Elevation	<1 to >800 mil/second
Traverse	<1 to >1400 mil/second
Pointing Accuracy	±0.5 mil
Ammunition Can Capacity (Rounds)	M2 = 500 rounds Mk19 = 96 rounds M240B = 1200 rounds M249 = 1400 rounds
Sensor Group	
Overall Dimensions:	
Length	356 mm (14 inches)
Width	235 mm (9 inches)

Table 2. Key CROWS Specifications – Cont.

Subject	Specification
Sensor Group - Continued	
Height	182 mm (7 inches)
Weight	12 kg (26 lb)
Power requirements	24 Vdc, 4 A (nominal)
Day Camera:	
Field of View Zoom	Scaleable from <1.1° to >25° (nominally 27X)
Magnification Zoom	Scaleable from .6X to >15X (750 mm viewing distance)
Focal Length	256.5 to 9.5 mm (nominal)
Illumination Level	1 to 125,000 lx
Night (Thermal) Camera:	
Fields of View (Digital/Optical) (±.5°)	11° (Optical), 5.5° (Digital), 3.6° (Optical), 1.8° (Digital)
Magnification	4.25X, 1.4X (750 mm viewing distance)
Effective Focal length	150, 50 mm (nominal)
Laser Rangefinder:	
Eye Safe	Class I (AS 2211:1996/97), 1.54 μm
Range and Accuracy (2.3 x 2.3-m target)	Up to 5,000 m
Range Accuracy	±10 m (±33 ft)
Range Resolution	+5 m (+16.5 ft)
Lase Rate	6/minute
Power	24 Vdc nominal
Radiant Energy	8 mJ
Wavelength	1.54 μm
Control Group	
Display Unit: (DU)	
Technology	Thin film transistor (TFT)
Depth	55 mm (2.1 inches)
Width	333 mm (13 inches)
Height	285 mm (11.1 inches)
Weight	4.5 kg (9.9 lb)
Viewing Area	307 mm (12.1 inches diagonal)
Format	800 x 600 lines
Standards	PAL and NTSC compatible (video formats)
Power requirements	24 Vdc, 1 A nominal
Control Grip:	Non-displacement force
Command Qualifier/Output Enable	Yes

END OF WORK PACKAGE

OPERATOR's MANUAL
FOR THE
ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

THEORY OF OPERATION AND OPERATIONAL OVERVIEW

This work package presents the theory of operation and an overview of CROWS operation.

WP CONTENTS

Section/Subsection	Page
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Surveillance	1
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Target Engagement	1
System Interface	2
Weapon Firing	2
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Sector Scan	2
No-Fire Zones	2
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Fire Control Solution	2
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Target Acquisition	2
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THEORY OF OPERATION

Surveillance

The day and night imaging systems, along with the motion control system, can be used to acquire imagery supporting both offensive and defensive missions.

Target Acquisition

The CROWS provides target acquisition (detection, recognition, and identification) capability during the day or night in all specified environmental conditions.

Target Engagement

The CROWS enables the operator to effectively engage a target once the target has been detected and identified.

THEORY OF OPERATION - Cont

System Interface

The CROWS configuration does not interfere with the operator's access to the installed weapon when required for maintenance or immediate action drills.

Weapon Firing

The CROWS allows the fitted weapon to be fired remotely, enables the operator to monitor and control the weapon's ammunition usage, and provides a selectable burst and fully automatic firing capability.

Weapon Charging

The CROWS enables the operator to remotely charge the weapon from the SPU or manually charge the weapon at the mount.

Target Reference Points

The Target Reference Point (TRP) mode allows the operator to assign target points and store up to 200 target points in memory for rapid recall, scan between stored target points and adjust the rate of scan between points.

Sector Scan

The CROWS provides the capability to designate two end points for an automatic sector scan. The system automatically and continuously moves the center of the field of view (FOV) back and forth between these points in a raster scan pattern, stepping in elevation by the sensor field of view.

No-Fire Zones

The CROWS provides a minimum of 20 azimuth no fire zones which are selectable and programmable at installation, to prevent firing at safety-sensitive vehicle components, and for training and range safety. No fire zones may be programmed at any time.

OVERVIEW OF SYSTEM OPERATION

Fire-Control Solution

The CROWS provides a fire-control solution based on range-to-target, line-of-sight inclination, vehicle cant, air pressure, and temperature for each combination of installed weapon and ammunition. The fire-control solution, which produces super-elevation and azimuth displacement (projectile drift) signals, is used to re-orient the weapon and ballistic aimpoint while allowing the gunner to maintain visual contact with the target.

Set-Up

When an authorized weapon is first installed, the operator uses the menu system to boresight the CROWS weapon and to select an appropriate type of weapon ammunition. This configuration information is subsequently used by the system to position graphical data to the FOV selected by the operator.

Target Acquisition

The target scene is acquired through the sensor unit, with the image shown on the display unit (DU) panel. The operator uses the CROWS zoom function when a target is identified or if an area of interest needs to be investigated in more detail.

Laser Alignment for Target Engagement

The operator aligns the laser aimpoint reticle on the target and fires the laser by pressing up on the DU LASE switch, or by pressing Left on the Joystick LEFT toggle switch on the control grip. The ballistic computer assembly (BCA) then calculates the ballistic solution for the engagement and generates a corrected ballistic aimpoint on the screen. The operator accepts the ballistic solution by pressing down on the DU ACCEPT switch, or by pressing Right on the Joystick LEFT toggle switch. The system overlays the ballistic aimpoint to the position of the laser aimpoint and elevates the weapon for the correct ballistic solution.

Stabilization

Stabilization (STAB) keeps the weapon relatively on target when the host platform is in motion. It uses a 2-axis, closed loop gyro feedback network. The stabilization network will compensate for vehicle azimuth and elevation movements in order to keep the weapon on the target. The stabilization switch (STAB) on the joystick shall be turned off (pressed Left) when the weapon mount is stationary and also during performance of weapon boresighting procedures.

Crows Signal Flow

Figure 1 illustrates the CROWS signal flow.

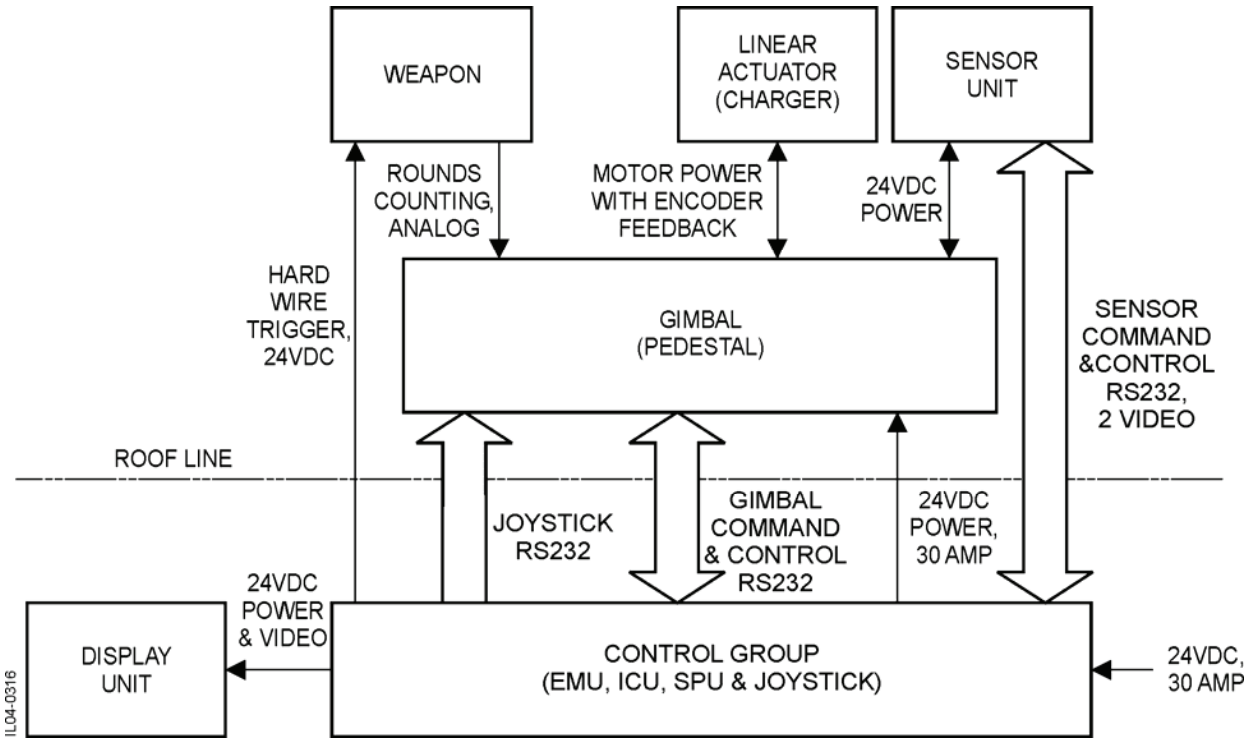


Figure 1. CROWS Signal Flow Diagram.

SAFETY OVER-RIDE SWITCH

WARNING

Incorrect or improper use of the Safety Over-Ride switch could cause personal injury or death, and damage to equipment in non-combat situations and certain combat situations. Failure to follow this warning may result in personal injury or death and equipment damage.

The Safety Over-Ride Switch shall be used only in emergency situations as determined by the Commander. The Safety Over-Ride Switch should be used in combat conditions only. Positioning of the Safety Over-Ride Switch from the Default OFF position to the ON position will cause No-Fire zones, burst mode, single-burst mode, and safety interlocks to become non-functional. The Safety Over-Ride Switch in the ON position will also restart weapon movement after it has been stopped because of GWS BIT error.

No-Fire Zones

The factory preset overridable No-Fire Zones can be overridden by turning the Safety Over-Ride Switch to the ON position. To re-enable the factory preset overridable No-Fire Zones, turn the Safety Over-Ride Switch to the OFF position.

Factory Default No-Fire Zones and Factory Overridable No-Fire Zones are configuration-controlled zones that are preloaded by the system software. Factory preset default zones are always active; while Factory overridable zones are active when the Safety Over-Ride switch on the SPU is in the OFF position.

The operator may define custom no-fire zones at any time. A combination of up to 20 factory preset and custom zones may be defined. This menu selection allows the operator to select factory preset and factory custom no-fire zones by selecting default, or allows the operator to choose all three zones by selecting Custom No-Fire Zones.

Motion Inhibits

Factory Default Motion Inhibits and Factory Overridable Motion Inhibits are configuration-controlled zones that are preloaded by the system software. Factory Default Motion Inhibits are always active, while Factory Overridable Motion Inhibits are active when the Safety Over-Ride Switch on the SPU is in the OFF position.

END OF WORK PACKAGE

CHAPTER 2

CROWS

OPERATOR INSTRUCTIONS

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS

This work package describes the use of the CROWS Controls Group switches.

WP CONTENTS

Section/Subsection	Page
Control Switches: Display Unit (DU) and Switch Panel Unit (SPU)	2
Joystick Control, Switches, and Trigger Guard	4
Use of Joystick Toggle Switches	6
Redundant Functions: Joystick and DU	9
Joystick-Only Functions	10
DU-Only Functions	10
SPU FUNCTIONS	11
Adjustment of the Screen Graphics and Image Brightness and Contrast	11
Screen Graphics Color Selection	11
Light Discipline Mode (Low Brightness)	12

NOTE

Understanding and committing to memory the use of the switches will assist you in the performance of procedural steps. Read, comprehend, and memorize the use of these controls and indicators.

CONTROL SWITCHES: DISPLAY UNIT (DU) AND SWITCH PANEL UNIT (SPU)

The CROWS Control Group that have switches/controls consists of the DU, SPU, and the Joystick.

Figure 1 shows the DU.

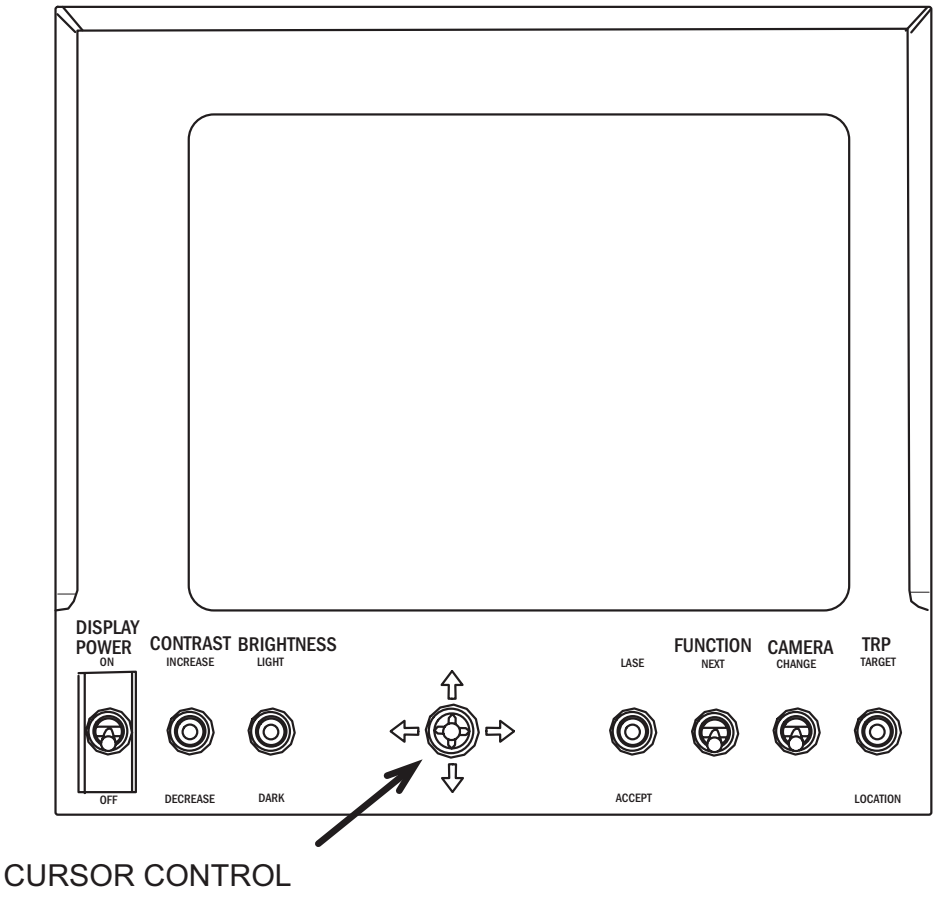


Figure 1. CROWS Display Unit (DU).

Figure 2 shows the SPU.

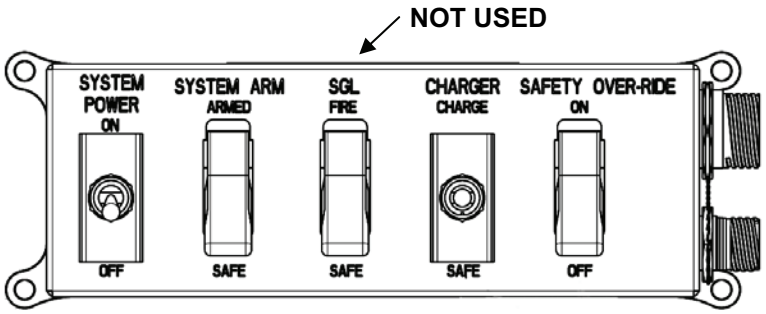


Figure 2. Switch Panel Unit (SPU).

NOTE

Except for the POWER switches, all switches on the DU and SPU are momentary switches.

Table 1 describes the functions of the DU and the SPU switches.

Table 1. DU Controls and SPU Switches.

Control/Switches	Function
Display Unit (DU)	
POWER	DU POWER ON/OFF Switch.
CONTRAST	Controls the variable contrast of the DU screen. **NOTE:** Holding the switch UP or DOWN allows a gradual increase or decrease in contrast.
BRIGHTNESS	Controls the variable brightness of the DU screen. **NOTE:** Holding the switch UP or DOWN allows a gradual increase or decrease in brightness.
(Not Labeled) 	Referred to as CURSOR CONTROL. Used to navigate through the variety of menu options. Also used for zoom, focus, and brightness.
LASE ACCEPT	LASE position fires the laser rangefinder. ACCEPT position accepts a calculated firing solution or accepts a Function menu or sub-menu selection.
FUNCTION	Pressing UP on the Function switch to the NEXT position navigates the system through menu options. Also used to navigate through boresight procedures.
CAMERA	Pressing UP on the CAMERA switch to the CHANGE position alternates use of the day camera to thermal camera, or thermal camera to day camera.
TRP	Pressing UP on the target reference points (TRP) switch to the TARGET position displays on screen the TRP menu options for assignment and storage of programmed TRPs. Pressing DOWN on the TRP switch to the LOCATION position displays on screen the Choose Location screen of saved TRPs and allows for additional TRPs to be added to stored memory.

CONTROL SWITCHES: DISPLAY UNIT (DU) AND SWITCH PANEL UNIT (SPU) - Cont

Table 1. DU Controls and SPU Switches - Cont.	
Control/Switches	**Function**
SPU	
POWER	SPU POWER ON/OFF Switch.
SYSTEM ARM	Routes weapon firing solenoid power from the trigger switch to the weapon firing solenoid. The SAFE position prevents the system from firing the weapon. The ARMED position enables the system to fire the weapon.
SGL	NOT USED.
CHARGER	The CHARGE position electrically drives the weapon bolt to the rear position for charging, then to the forward position to load the weapon. The charging and load functions each take approximately 6 seconds. The SAFE position drives the weapon bolt to the rear and holds it there.
SAFETY OVER-RIDE	The OFF position enables the Safety circuit. The ON position overrides the safety circuit.

JOYSTICK CONTROL, SWITCHES, AND TRIGGER GUARD

CAUTION

Ensure that the joystick is handled properly. Improper handling includes but is not limited to dropping, excessive force and/or pressure applied to joystick switches. Do not drop the Joystick. Damage may occur to the joystick switches causing a fault/error message and lack of weapon mount movement. Whenever the joystick is not in use, ensure the joystick is secured in its retaining cup by turning the joystick counterclockwise inside the joystick cup until the joystick firmly locks into place. Failure to follow this instruction may result in equipment or cable damage and system inoperability.

Figure 3 illustrates the Joystick with Table 2 listing its functions.

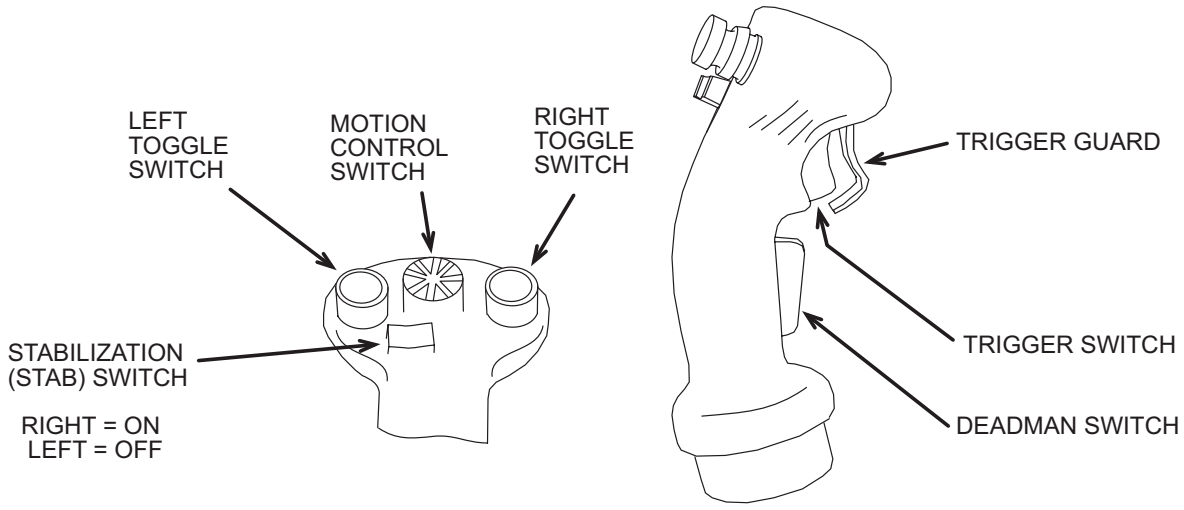


Figure 3. Joystick.

Table 2 describes the functions of the Joystick control switches.

Table 2. Joystick Switch Functions.

Control Switches	Function
FRONT VIEW	
LEFT Toggle Switch (four-way thumb switch)	
Functional Mode Controls:	
Menu Mode	When in the Menu Mode Function, pressing in the UP or DOWN direction on the Joystick Left toggle switch enables the CURSOR on the DU screen to navigate up or down for selection of menu and sub-menu options. Pressing LEFT returns to the Engagement Screen. Pressing RIGHT accepts. See Figure 4.
Rg/Brt/Accpt Mode	When in the Rg/Brt/Accpt Mode Function, pressing UP or DOWN on the Joystick Left toggle switch adjusts Range. Pressing RIGHT substitutes for pressing DOWN on the ACCEPT switch on the DU. Pressing LEFT substitutes for pressing UP on the LASE switch on the DU. See Figure 5.
Zm/Fc and Zm/Fc/P Modes	When in either the Zm/Fc or Zm/Fc/P Modes Function, pressing UP or DOWN on the Joystick Left toggle switch adjusts camera zoom. Pressing RIGHT substitutes for pressing DOWN on the ACCEPT switch and to toggle the polarity (P) of the Thermal Camera Laser Aimpoint between “white hot” and “black hot”. Pressing LEFT substitutes for pressing UP on the LASE switch on the DU. See Figure 6.
RIGHT Toggle Switch (four-way thumb switch)	
Functional Mode Controls:	
Menu Mode	When in the Menu Mode Function, pressing in the LEFT or RIGHT direction on the Joystick Right switch enables the CURSOR on the DU screen to navigate for selection of menu and sub-menu options. Pressing UP alternates use of the day camera to thermal camera, or thermal camera to day camera. Pressing DOWN navigates the system through menu options and is also used to navigate through boresight procedures. See Figure 4.
Rg/Brt/Accpt Mode	When in the Rg/Brt/Accpt Mode Function, pressing LEFT or RIGHT on the Joystick Right Switch adjusts the variable brightness of the DU screen. Pressing UP substitutes for pressing UP on the Camera Change switch on the DU. Pressing DOWN substitutes for pressing UP on the Function switch on the DU. See Figure 5.
Zm/Fc (day camera) and Zm/Fc/P (thermal camera) Modes	When in either the Zm/Fc or Zm/Fc/P Modes Function, pressing LEFT or RIGHT on the Joystick Right Switch adjusts the variable camera focus. Pressing UP substitutes for pressing UP on the Camera Change switch on the DU. Pressing DOWN substitutes for pressing UP on the Function switch on the DU. See Figure 6.

JOYSTICK CONTROL, SWITCHES, AND TRIGGER GUARD - Cont

Table 2. Joystick Switch Functions - Cont.

Control Switches	Function
MOTION CONTROL Switch (360 degrees rotational)	Controls movement of the weapon mount. Will not move unless the Deadman Switch is depressed at the same time.
STABILIZATION (STAB) Switch	Toggles stabilization ON/OFF. Press the STAB switch LEFT to turn the Weapon Mount Stabilization function OFF; press the STAB switch RIGHT to turn the Weapon Mount Stabilization function ON. Verification of stabilization positioning of ON or OFF is shown in the top center of the Engagement Mode screen. Refer to WP 0015, Figure 8.
SIDE VIEW	
Deadman Switch	When depressed, allows the weapon mount to move as guided by the force placed on the MOTION CONTROL switch.
Trigger Guard	Covers the trigger switch, ensuring the weapon is not accidentally fired. The weapon cannot be fired without first lifting the trigger guard.
Trigger Switch	When depressed, actuates the weapon firing solenoid and fires the weapon.

Use of Joystick Toggle Switches

The preferred method of operation of the CROWS is by using the joystick. Figures 4 through 6 reflect the functional use of the left and right toggle switches on the joystick. The functions indicated while in the three functional modes (Menu, Rg/Brt/Accpt, and Zm/Fc or Zm/Fc/P) are redundant functions of the DU switches.

Procedures in this CROWS manual will make reference to the two joystick toggle switches, except where the use of the DU switches is mandatory. Reference to the two joystick toggle switches will be stated by first referring to the left or right toggle switch, then stating the direction in which to press the toggle switch. See the following examples (refer to Figures 4 through 6 and Tables 3 through 5).

1. While in the Menu Functional Mode:

   a. To move the DU screen CURSOR up or down: LEFT toggle UP or LEFT toggle DOWN.

   b. To move the DU screen CURSOR left or right: RIGHT toggle LEFT or RIGHT toggle RIGHT.

2. While in the Rg/Brt/Accpt Functional Mode:
    a. To increase the RANGE: LEFT toggle UP
    b. To decrease the RANGE: LEFT toggle DOWN.
    c. Changes in BRIGHTNESS: RIGHT toggle LEFT or RIGHT toggle RIGHT.
3. While in the Zm/Fc (Day Camera) or Zm/Fc/P (Thermal Camera) Functional Mode:
    a. To ZOOM IN the FOV: LEFT toggle UP.
    b. To ZOOM OUT the FOV: LEFT toggle DOWN.
    c. To change the camera FOCUS: RIGHT toggle LEFT or RIGHT toggle RIGHT.
4. Common functions in all modes:
    a. To LASE: LEFT toggle LEFT.
    b. To ACCEPT: LEFT toggle RIGHT.
    c. To change camera selection: RIGHT toggle UP.
    d. To change functional modes: RIGHT toggle DOWN.

JOYSTICK CONTROL, SWITCHES, AND TRIGGER GUARD - Cont

Use of Joystick Toggle Switches

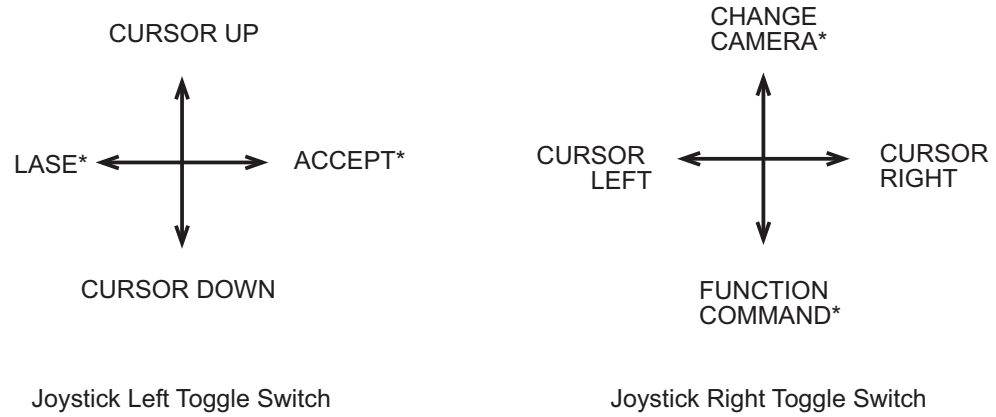


Figure 4. Functional Use of Joystick Toggle in Menu Mode.

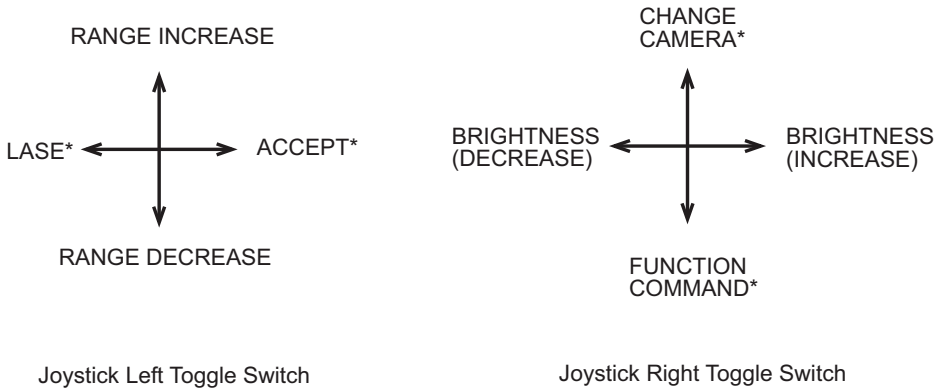


Figure 5. Functional Use of Joystick Toggle in Rg/Brt/Accpt Mode.

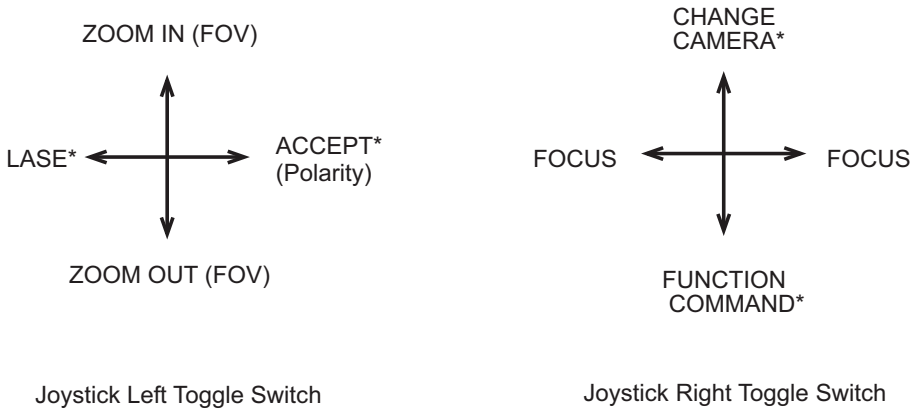


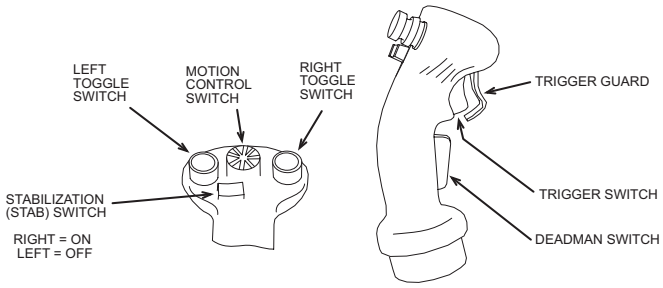
Figure 6. Functional Use of Joystick Toggle in Zm/Fc (Day Camera) and Zm/Fc/P (Thermal Camera) Modes.

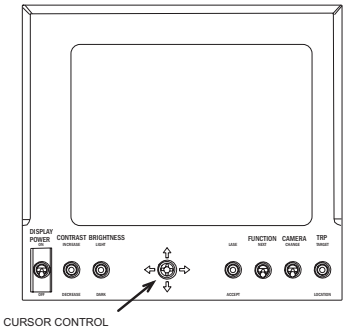
* Functions that remain the same in all modes.

REDUNDANT FUNCTIONS: JOYSTICK AND DU

Most of the CROWS menu functions can be performed with the switches either on the DU or on the joystick, including CURSOR CONTROL, LASE/ACCEPT, FUNCTION, and CAMERA CHANGE. See Table 3.

Table 3. CROWS Joystick and DU Redundant Functions.





FUNCTION	MODE	JOYSTICK ACTION	DU ACTION
Cursor Control	Menu	Press LEFT toggle UP/DOWN Press RIGHT toggle RIGHT/LEFT	Press CURSOR CONTROL switch UP/DOWN/LEFT/RIGHT
Move to previous screen	Menu	Press RIGHT toggle LEFT	Press CURSOR CONTROL switch LEFT
LASE	All	Press LEFT toggle LEFT	Press LASE switch UP
ACCEPT	All	Press LEFT toggle RIGHT	Press ACCEPT switch DOWN
Function	All	Press RIGHT toggle DOWN	Press FUNCTION switch UP
Camera Change	All	Press RIGHT toggle UP	Press CAMERA CHANGE switch UP
Range Increase	Rg/Brt/Accpt	Press LEFT toggle UP	Press CURSOR CONTROL switch UP
Range Decrease	Rg/Brt/Accpt	Press LEFT toggle DOWN	Press CURSOR CONTROL switch DOWN
Brightness Increase	Rg/Brt/Accpt	Press RIGHT toggle RIGHT	Press BRIGHTNESS switch UP (LIGHT) or CURSOR CONTROL switch RIGHT
Brightness Decrease	Rg/Brt/Accpt	Press RIGHT toggle LEFT	Press BRIGHTNESS switch DOWN (DARK) or CURSOR CONTROL switch LEFT
Zoom In (FOV)	Zm/Fc	Press LEFT toggle UP	Press CURSOR CONTROL switch UP
Zoom Out (FOV)	Zm/Fc	Press LEFT toggle DOWN	Press CURSOR CONTROL switch DOWN
Focus	Zm/Fc	Press RIGHT toggle LEFT or RIGHT	Press CURSOR CONTROL switch LEFT and RIGHT
Polarity Change	Zm/Fc/P (thermal)	Press LEFT toggle RIGHT	Press ACCEPT switch DOWN

REDUNDANT FUNCTIONS: JOYSTICK AND DU - Cont

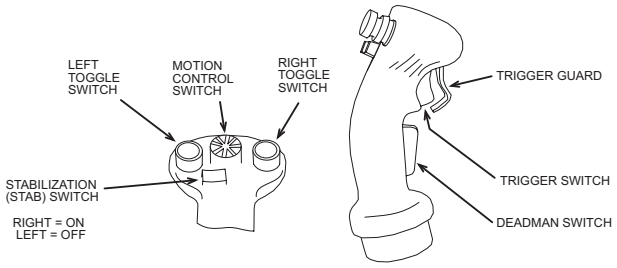
Exceptions to this redundant-function capability are listed below in Table 4, CROWS Joystick Only Functions, and Table 5, CROWS DU Only Functions.

Joystick-Only Functions

NOTE

Press the STAB switch LEFT to turn the Weapon Mount Stabilization function OFF. Press the STAB switch RIGHT to turn the Weapon Mount Stabilization function ON.

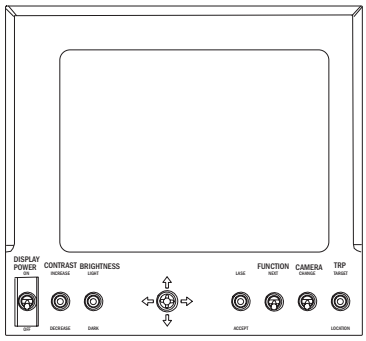
Table 4. CROWS Joystick Only Functions.



FUNCTION	JOYSTICK ACTION
Stabilization ON/OFF	Toggle STAB switch **LEFT** (off) or **RIGHT** (on)
Deadman Switch	Depress to use motion control
Motion Control	Depress deadman switch and use thumb to move system UP/DOWN/LEFT/RIGHT
Trigger	Flip up trigger guard and depress trigger which will fire the weapon

DU-Only Functions

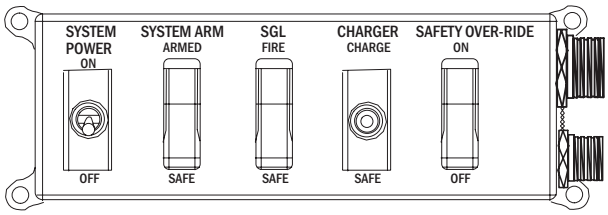
Table 5. CROWS DU Only Functions.



FUNCTION	DU ACTION
Display Power	Press UP to turn ON Press DOWN to turn OFF
Target Reference Point (TRP)	Press TRP switch UP to store TRPs Press TRP switch DOWN to locate TRPs

SPU FUNCTIONS

Table 6. CROWS SPU Functions.



FUNCTION	SPU ACTION
SYSTEM POWER	Press to ON to turn ON Press to OFF to turn OFF
SYSTEM ARM	Press to ARMED to ARM weapon Press to SAFE to SAFE weapon
SGL	NOT USED
CHARGER	Press to CHARGE to charge the weapon Press to SAFE to place weapon in safe mode
SAFETY OVER-RIDE	Press to ON to enable override of system Press to OFF to disable override of system

ADJUSTMENT OF THE SCREEN GRAPHICS AND IMAGE BRIGHTNESS AND CONTRAST

The operator can change the brightness, contrast and color of the screen graphics via use of DU and/or joystick Brightness/Contrast controls and menu selections for color. Image brightness may be adjusted using the sensor brightness control on the DU and / or Joystick.

Screen Graphics Color Selection

NOTE

For information on selecting screen graphics colors, refer to WP 0015 in the Configure Menu/Color Menu section.

The screen graphics color pallet includes nine selections for screen graphics. The operator should select the color that best displays the screen graphics. For example, if the scene image is predominantly forest green, screen graphics should be a contrasting color, i.e., white or red. Another example may be a scene that is predominately desert sand or snow.

The screen graphics may best be displayed when black, blue, or green is selected. The laser reticle and ballistic aim point color may be separately selected to either red or white by the operator. Brightness and contrast of the screen graphics may be adjusted by use of the “BRIGHTNESS” and “CONTRAST” switches on the DU and/or joystick. It is recommended that the operator try varying screen graphics color and brightness/contrast combinations to select one most suitable for the mission and personal visual needs.

ADJUSTMENT OF THE SCREEN GRAPHICS AND IMAGE BRIGHTNESS AND CONTRAST - Cont

Light Discipline Mode (Low Brightness)

NOTE

Do not use night vision equipment while operating the CROWS. In the Light Discipline Mode, it is not necessary to wear night vision equipment. The entire DU screen can be seen, text is legible, and the target is recognizable without night vision equipment.

Light discipline mode decreases the brightness of the DU. All DU controls and Menu color selection functions remain the same.

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

INTERCONNECTION (CONNECTORS AND CABLES)

THIS WORK PACKAGE COVERS:

Setup and procedures for interconnecting CROWS connectors and cables.

INITIAL SET UP:

Tools and Special Tools

Operator's Tool Kit (WP 0036, Table 2, Item 1)

Materials/Parts

Strap, tiedown (anchors) (WP 0038, Table 1, Item 21)

Personnel Required

One

References

WP 0002
WP 0024
WP 0036
WP 0038

Equipment Conditions

System power off

WP CONTENTS

Section/Subsection	Page
CROWS Interconnection	2
CROWS Signal Flow	4
Connectors and Cables	4
Control Group Components	5
Sensor Unit	9
Connectors	10

NOTE

Should any malfunction occur, refer to WP 0024, Troubleshooting Index.

CROWS INTERCONNECTION

Figure 1 is an interconnect diagram detailing CROWS connectors and cables both inside the vehicle (below roof line) and on top of the vehicle (above the roof line). The linear actuator and remote firing mechanism (left side of drawing) will vary depending on the weapon type selected (e.g., M2, Mk19, M240B, or M249).

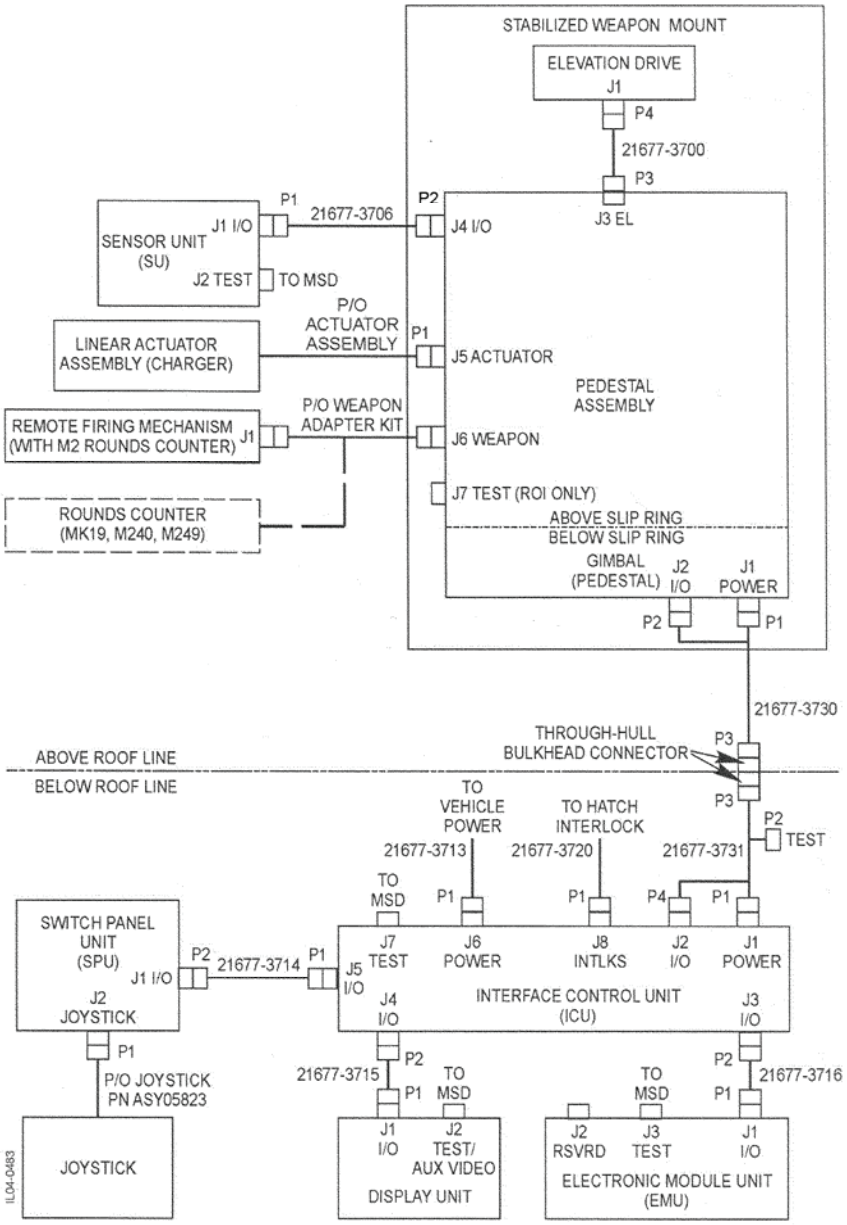


Figure 1. Interconnect Diagram of Connectors and Cables.

Table 1 presents the interconnect details listing connectors with corresponding pins, signals, etc.

CAUTION

When the ICU-Display Unit (DU) cable (P/N 21677-3715) is installed and secured, ensure that the radius of any bend measures at least 5 inches. Failure to follow this instruction may result in equipment damage and system inoperability.

Table 1. CROWS Interconnections.

Cable PN	From	To	Additional Information
21677-3731	ICU J1	Bulkhead	Power to Gimbal J1
21677-3731	ICU J2	Bulkhead	I/O to Gimbal J2
21677-3715	ICU J4	Display J1	
21677-3716	ICU J3	EMU J1	
21677-3714	ICU J5	SPU J1	
21677-3713	ICU J6	Vehicle Power	
--	ICU J7	--	Test
21677-3720	ICU J8	Hatch Interlock	Part of Vehicle Integration Kit (VIK)
Cable P/O Joystick, ASY05823	Joystick	SPU J2	
21677-3730	Mount J1	Bulkhead	Power to Gimbal J1
21677-3730	Mount J2	Bulkhead	I/O to Gimbal J2
21677-3700	Mount J3	Elevation Drive J1	
21677-3706	Mount J4	Sensor Unit J1	
Cable (part of Linear Actuator Charger)	Mount J5	Charger J1	Varies per weapon
21677-3702	Mount J6	Remove Firing Assembly (RFA)	M2 Mount-Weapon Cable
21677-3703	Mount J6	Remote Firing Solenoid and Rounds Counter (Ogive Plunger)	Mk19 Mount-Weapon Cable
21677-3705	Mount J6	Remote Firing Solenoid and Rounds Counters	M240/M249 Mount-Weapon Cable
	Mount J7		Test

CROWS SIGNAL FLOW

Figure 2 illustrates the CROWS signal flow.

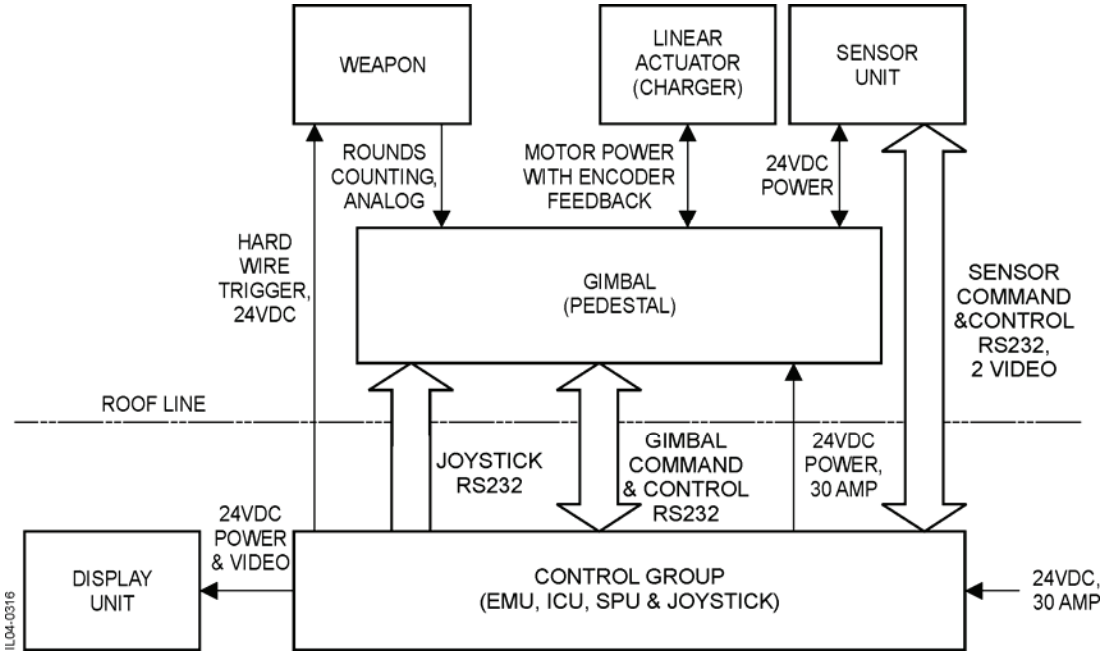


Figure 2. CROWS Signal Flow Diagram.

WARNING

Follow all stated warnings and cautions. Failure to do so may result in personal injury or equipment damage.

CONNECTORS AND CABLES

Perform the following procedure to connect the cables and connectors for the weapon and weapon adapter kit (WAK).

CAUTION

Ensure system power is off when connecting or disconnecting cables.

Do not attach connectors when system power is on.

Ensure proper alignment of connector keyways prior to installing cables. Failure to do so may result in damage to the electrical pins and other equipment.

When the ICU-DU cable (P/N 21677-3715) is installed and secured, ensure that the radius of any bend measures at least 5 inches. Failure to follow this instruction may result in equipment damage and system inoperability.

Cover connectors with the appropriate connector cap attached to the cable assembly if not connected to a mating connector.

1. Ensure system power is OFF.

2. Attach cables to connectors, as shown in Figure 1, with signal flow as detailed in Figure 2.

3. When all connections have been completed, ensure all cables are tied down**,** with appropriate service loops as necessary. Figures 3 through 21 illustrate the component connectors and their locations.

4. Move the cradle through the full range of vertical motion and the mount through 360° (full) rotation to ensure that there are no points where the cables “pinch” or “bind” in normal operation, especially the linear actuator cable and the cables to the remote firing mechanisms.

END OF TASK

Control Group Components

NOTE

For additional information on CROWS components/assemblies, refer to WP 0002.

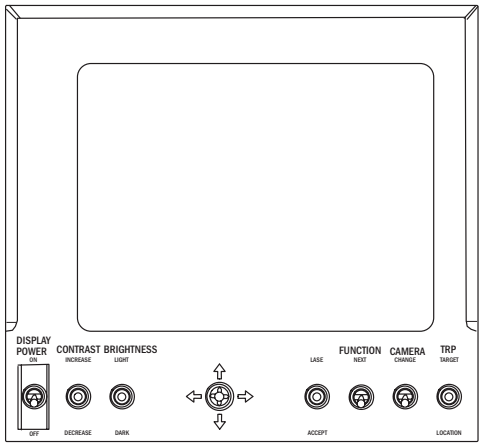
The Control Group consists of the components listed in Table 2 and shown in Figure 3.

Table 2. CROWS Control Group Components and Nomenclature.

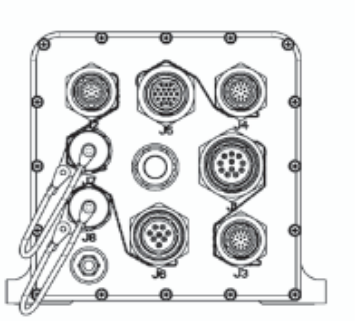
Part Number (CAGEC 11871)	**Common Name**
21677-5500	Control Group
ASY05820	. EMU
ASY 05821	. SPU
ASY 05822	. ICU
ASY 05823	. Joystick
ASY 05843	. DU, Display
21677-3713	. Vehicle Power Cable
21677-3714	. ICU-SPU Cable
21677-3715	. ICU-DU Cable
21677-3716	. ICU-EMU Cable
21677-3720	. Hatch Interlock Cable, Part of the VIK
21677-3730	. Mount-Bulkhead Cable
21677-3731	. Bulkhead-ICU Cable

CONNECTORS AND CABLES - Cont

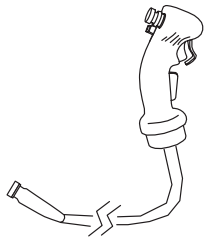
Control Group Components – Cont



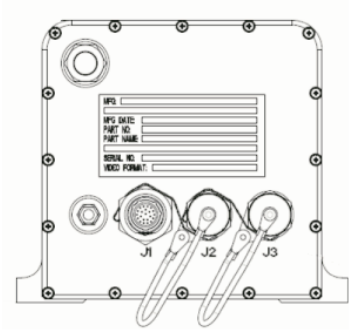
DISPLAY UNIT



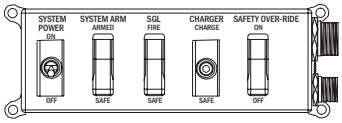
INTERFACE CONTROL UNIT (ICU)



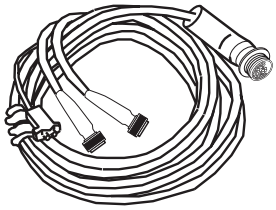
JOYSTICK



ELECTRONIC MODULE UNIT (EMU)



SWITCH PANEL UNIT (SPU)



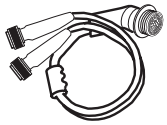
BULKHEAD-ICU CABLE (21677-3731)



ICU-DISPLAY UNIT CABLE (21677-3715)



VEHICLE POWER CABLE (21677-3713)



MOUNT-BULKHEAD CABLE (21677-3730)



ICU-EMU CABLE (21677-3716)



ICU-SPU CABLE (21677-3714)



HATCH INTERLOCK CABLE (21677-3720)

Figure 3. Control Group.

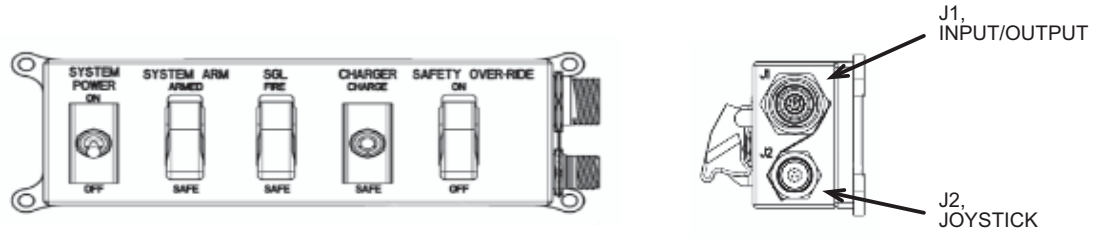


Figure 4. SPU Connectors.

CAUTION

Do not touch the purge ports. Failure to follow this instruction may result in equipment damage.

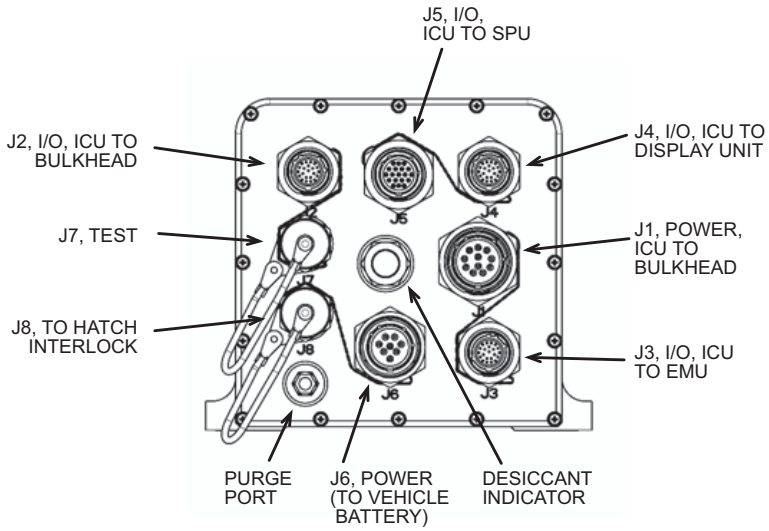


Figure 5. ICU Connectors.

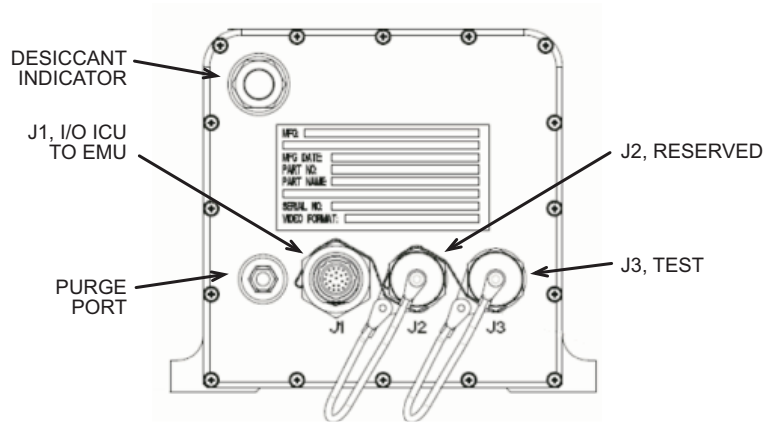
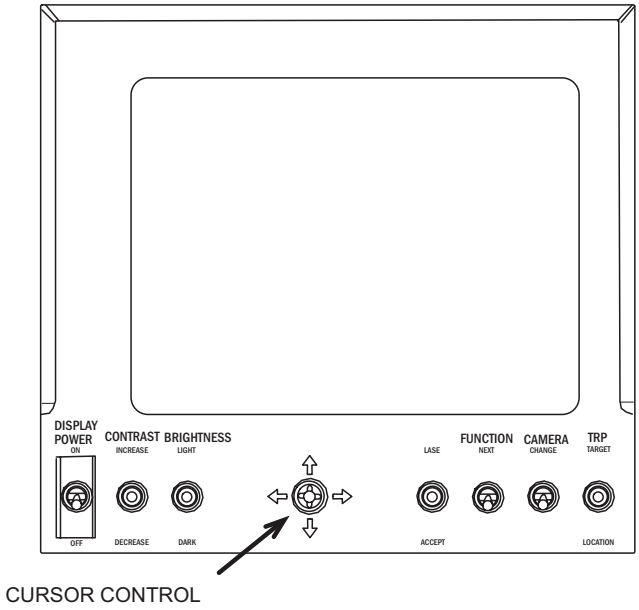


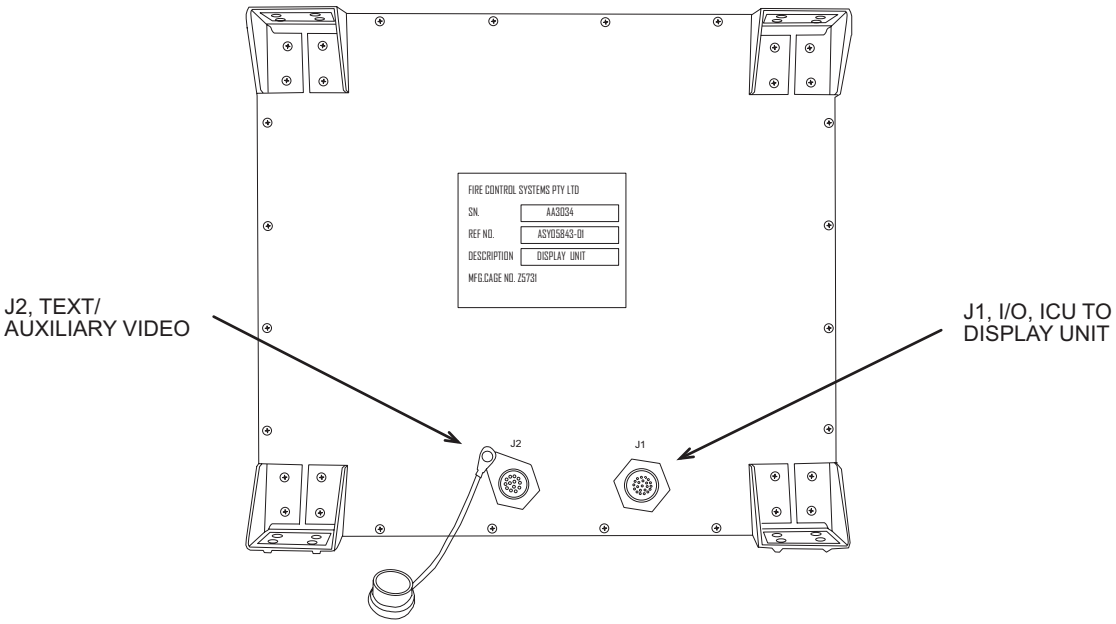
Figure 6. EMU Connectors.

CONNECTORS AND CABLES - Cont

Control Group Components - Cont



Front View

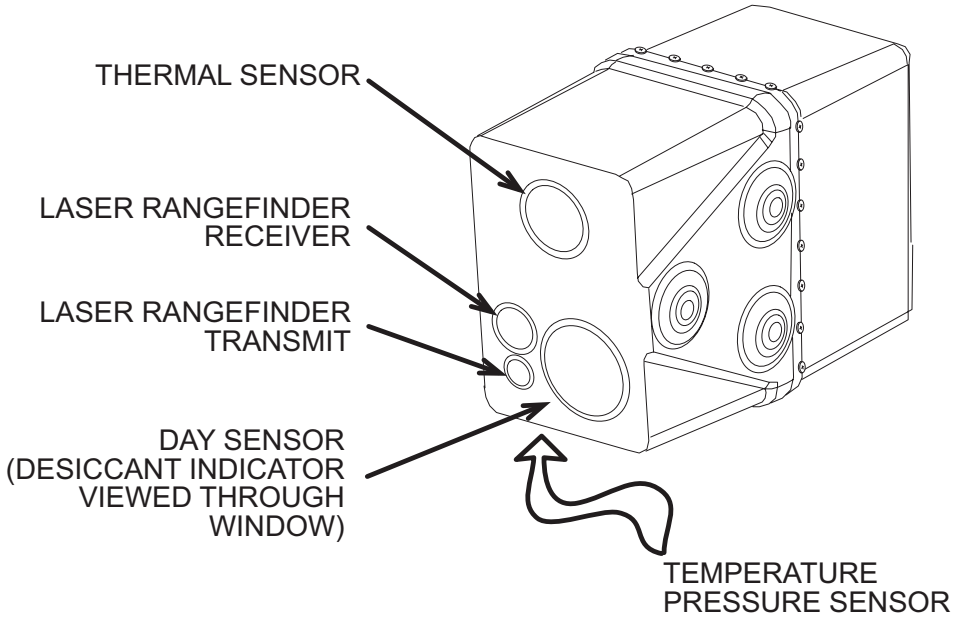


Rear View

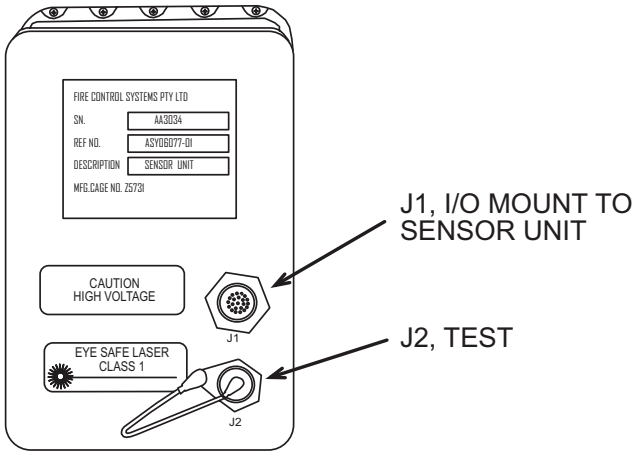
Figure 7. DU Connectors.

Sensor Unit

Figure 8 shows the sensor unit including connectors.



Front and Side View



Rear View

Figure 8. Sensor Unit (Front and Rear View).

CONNECTORS AND CABLES - Cont

Connectors

Figure 9 shows the mount connectors for I/O and Power, while Figure 10 shows the weapon, elevation, test, and I/O connectors for the pedestal mount.

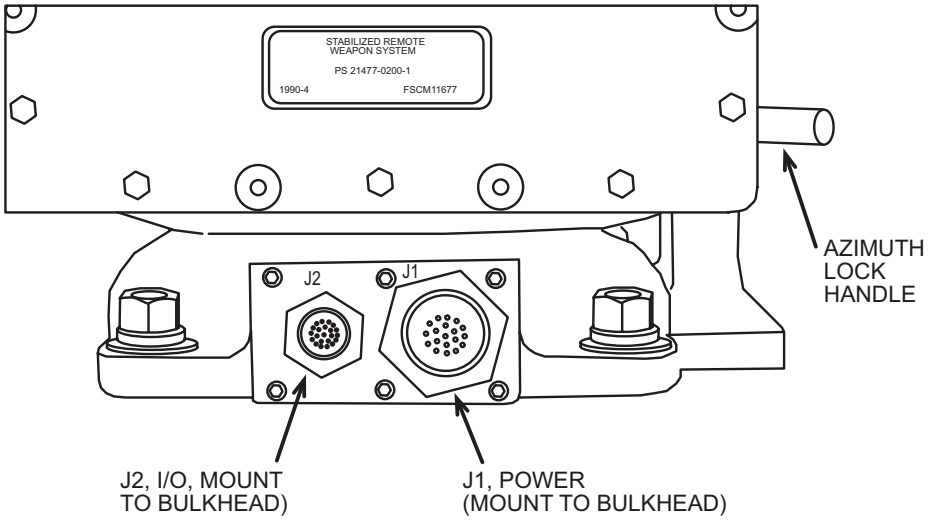


Figure 9. I/O and Power Connectors (Pedestal Mount).

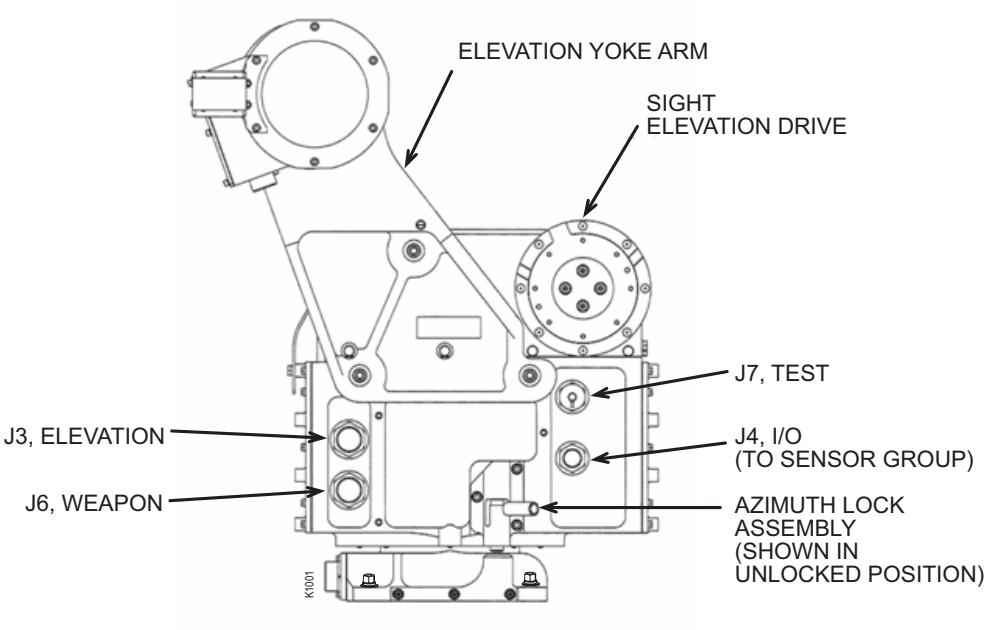


Figure 10. Weapon, I/O, Test, and Elevation Connectors (Pedestal Mount).

Figure 11 shows the elevation drive and actuator connectors.

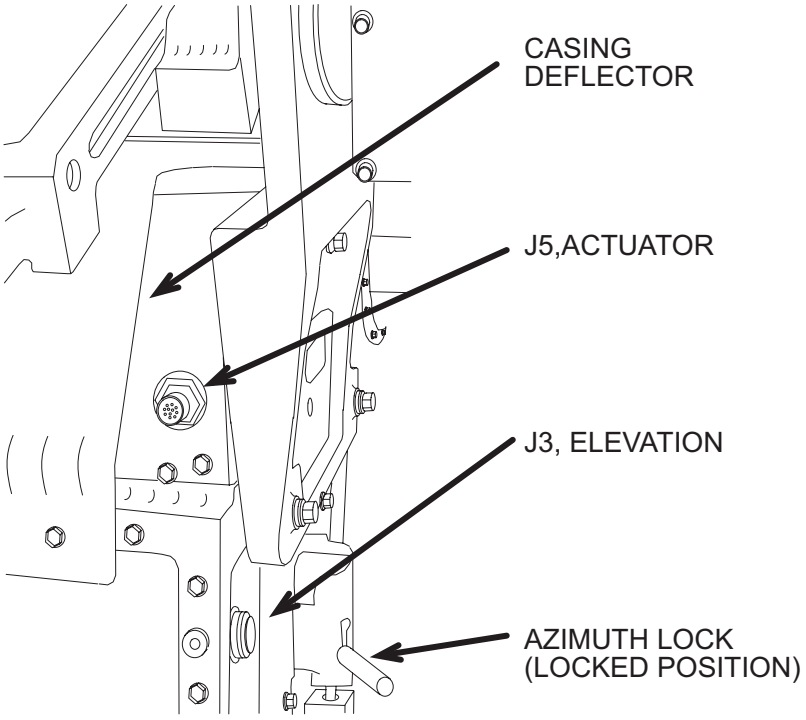
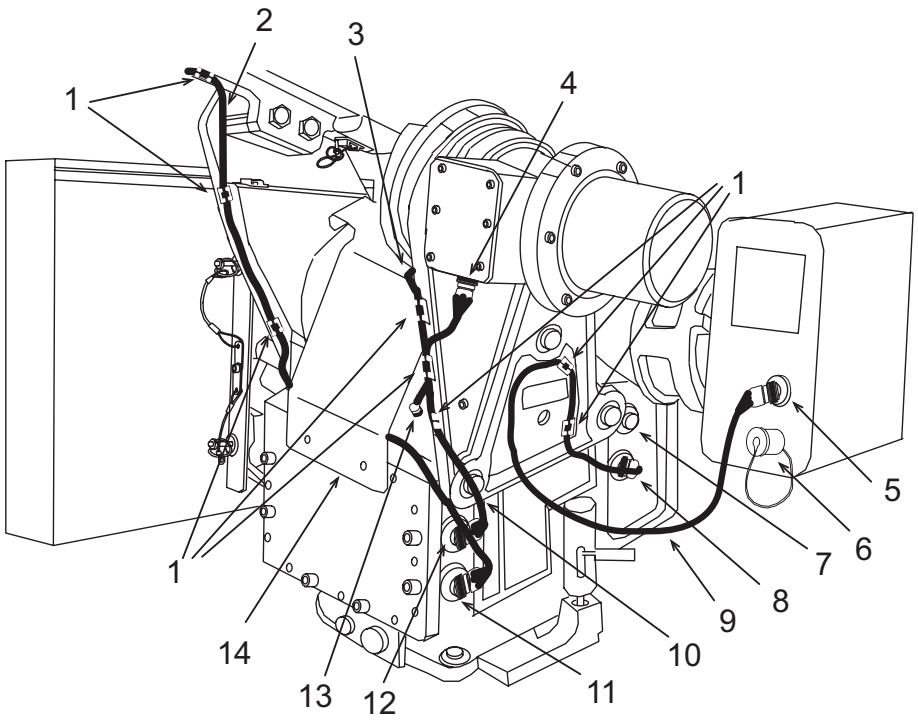


Figure 11. Elevation Drive and Actuator Connectors and Cables.

CONNECTORS AND CABLES - Cont

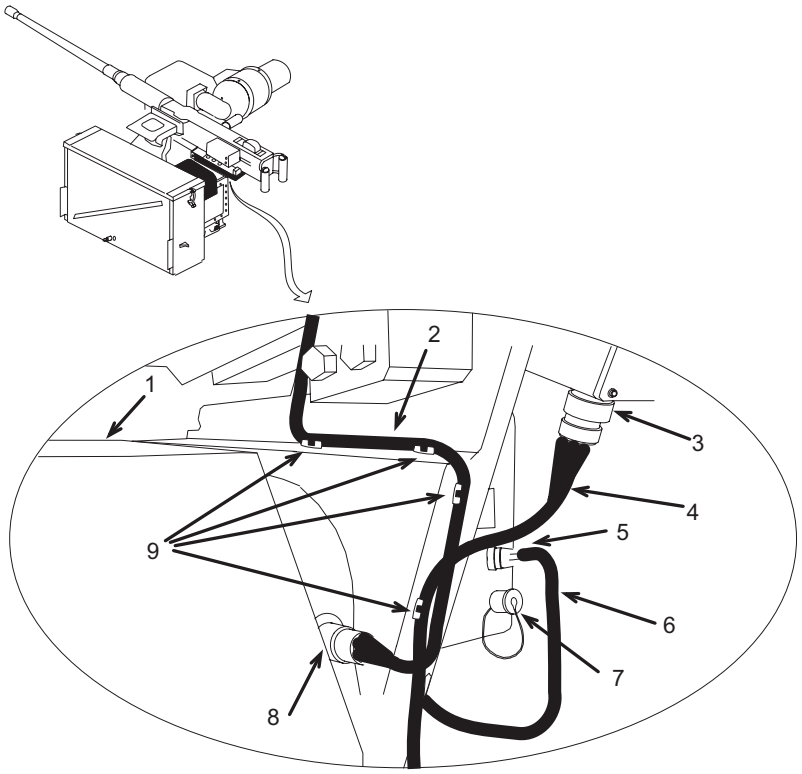
Connectors - Cont

Figures 12 and 13 show cables positioned and tied down throughout the entire mount.



Legend:	
1. Cable Anchors	9. Mount-Sensor Unit Cable
2. Weapon-Mount Cable	10. Mount-Elevation Drive Cable
3. Mount-Linear Actuator Cable	11. J6, Weapon, Mount
4. J1, Elevation Drive	12. J3, Elevation, Mount
5. J1, Sensor Unit	13. J5, Actuator, Mount
6. J2, Test, Sensor Unit	14. Casing Deflector
7. J7, Test, Mount	
8. J4, Input/Output, Mount	

Figure 12. Threading Cables Under the Cradle and Behind the Casing Deflector.



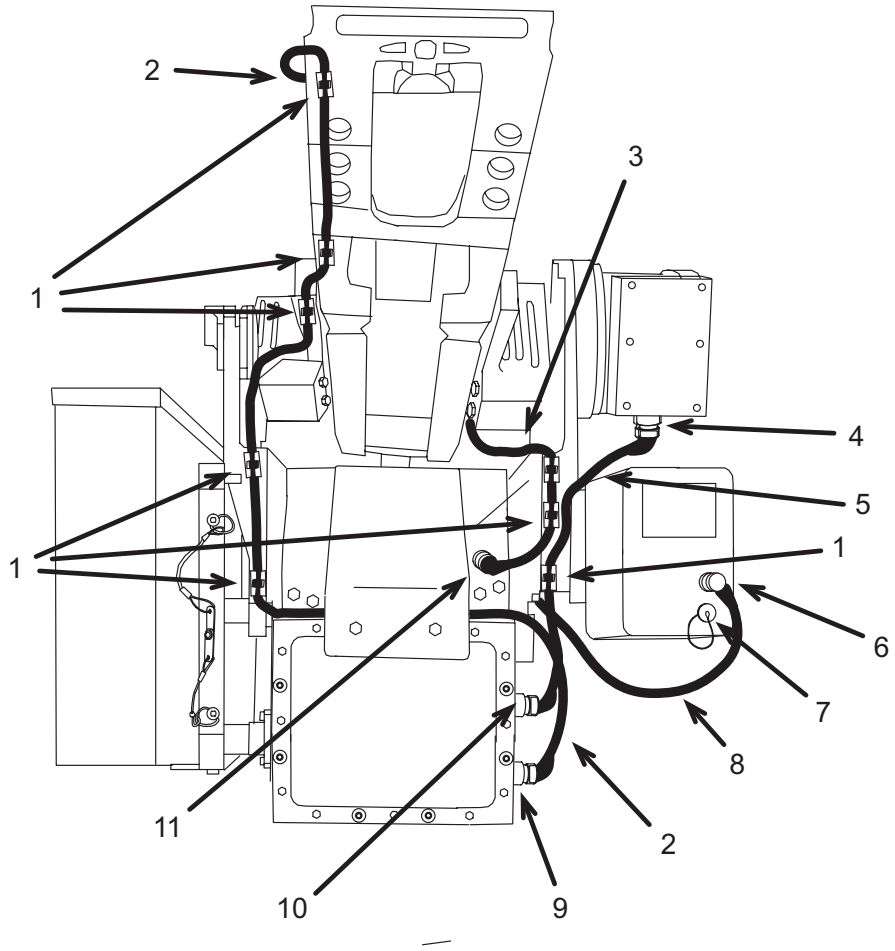
Legend:
1. Casing Deflector
2. Mount-Linear Actuator Cable
3. J1, Elevation Drive
4. Mount-Elevation Drive Cable
5. J1, Sensor Unit
6. Mount-Sensor Unit Cable
7. J2, Test, Sensor Unit
8. J5, Actuator, Mount
9. Cable Anchors

Figure 13. Cables Threaded Under Cradle and Tied Down.

CONNECTORS AND CABLES - Cont

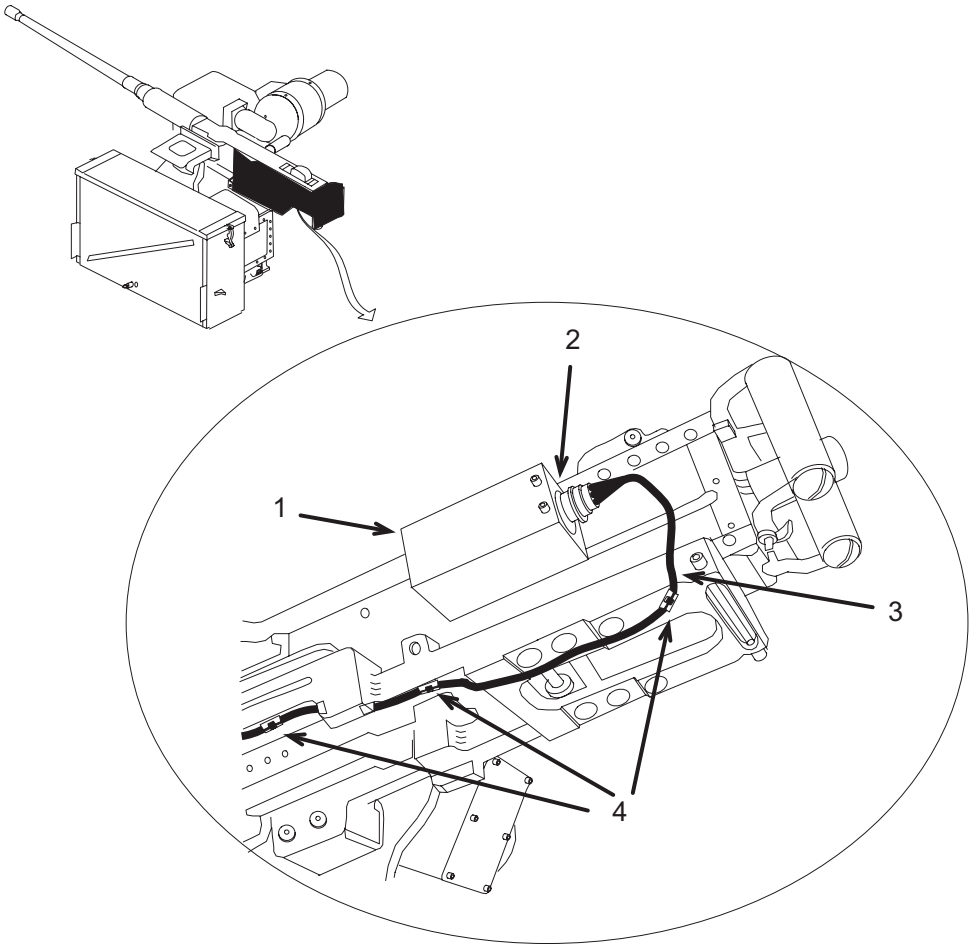
Connectors - Cont

Figures 14 through 16 show the M2 cables threaded, positioned, and tied down.



Legend:	
1. Cable Anchors	7. J2, Test, Sensor Unit
2. Weapon-Mount Cable	8. Mount-Sensor Unit Cable
3. Mount-Linear Actuator Cable	9. J6, Weapon, Mount
4. J1, Elevation Drive	10. J3, Elevation, Mount
5. Mount-Elevation Drive Cable	11. J5, Actuator, Mount
6. J1, Sensor Unit	

Figure 14. M2 Actuator Cable.

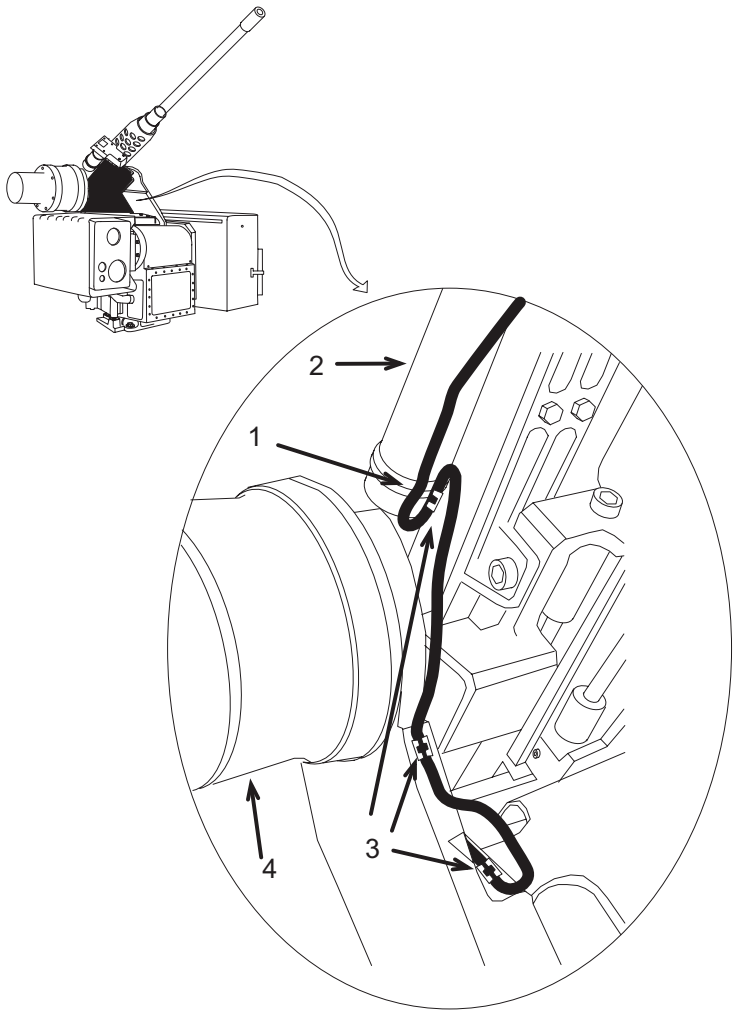


Legend:
1. Remote Firing Assembly (RFA)
2. J1, RFA
3. Weapon-Mount Cable
4. Cable Anchors

Figure 15. M2 Weapon-Mount Cable with Cables Positioned and Tied Down Under the Cradle.

CONNECTORS AND CABLES - Cont

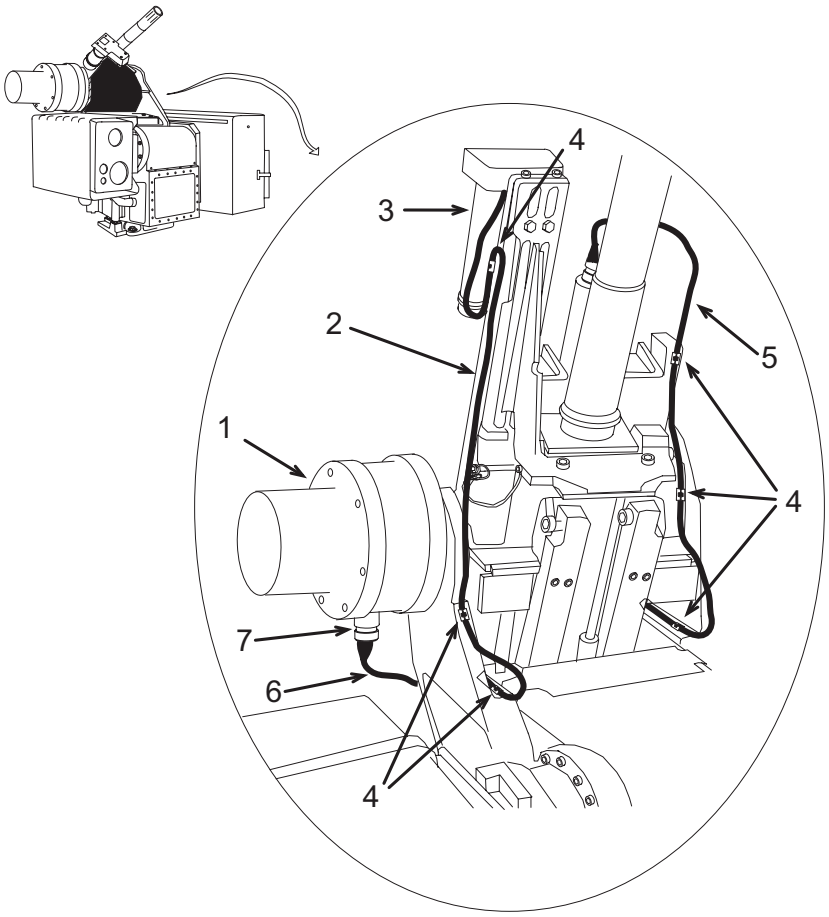
Connectors - Cont



Legend:
1. Mount-Linear Actuator (Charger) Cable
2. Linear Actuator (Charger)
3. Cable Anchors
4. Elevation Drive

Figure 16. Linear Actuator (Charger) Cable Threaded and Tied Down to Prevent Pinching or Binding.

Figures 17 through 19 show the cables connected, positioned, and tied down for the Mk19.

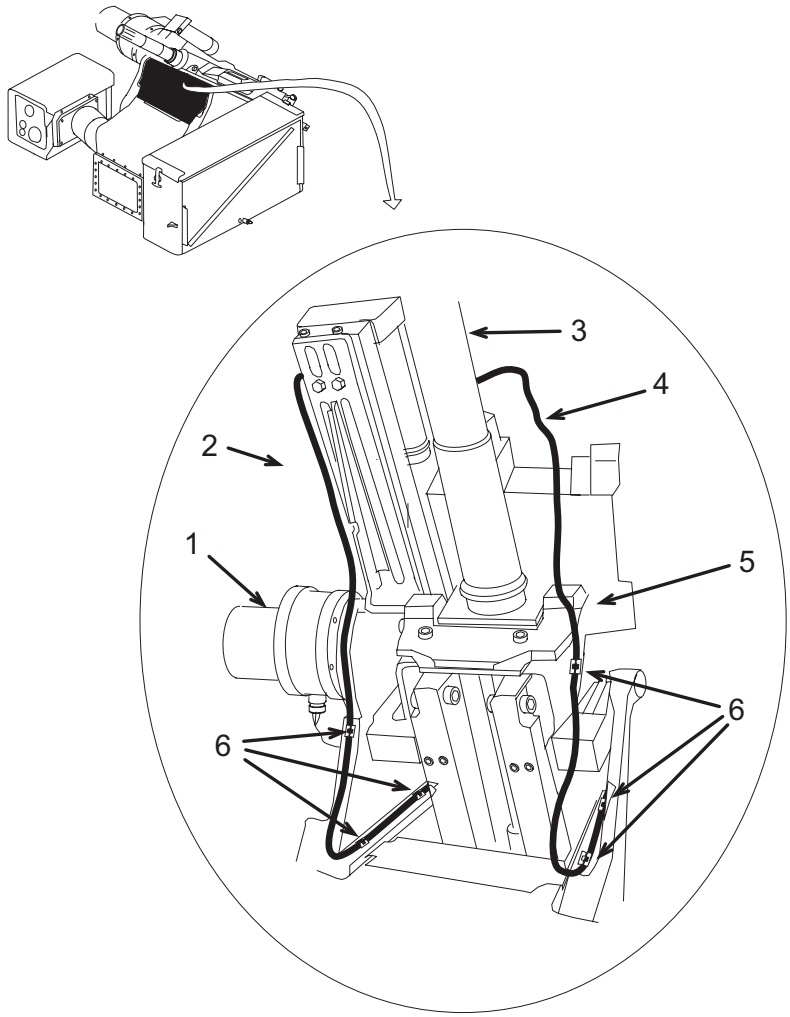


Legend:
1. Elevation Drive
2. Mount-Linear Actuator (Charger) Cable
3. Linear Actuator (Charger)
4. Cable Anchors
5. Weapon-Mount Cable (from Rounds Counter
6. Elevation Drive Cable
7. J1, Elevation Drive

Figure 17. Mk19 with Weapon Elevated; Cables Shown as Threaded and Tied Down.

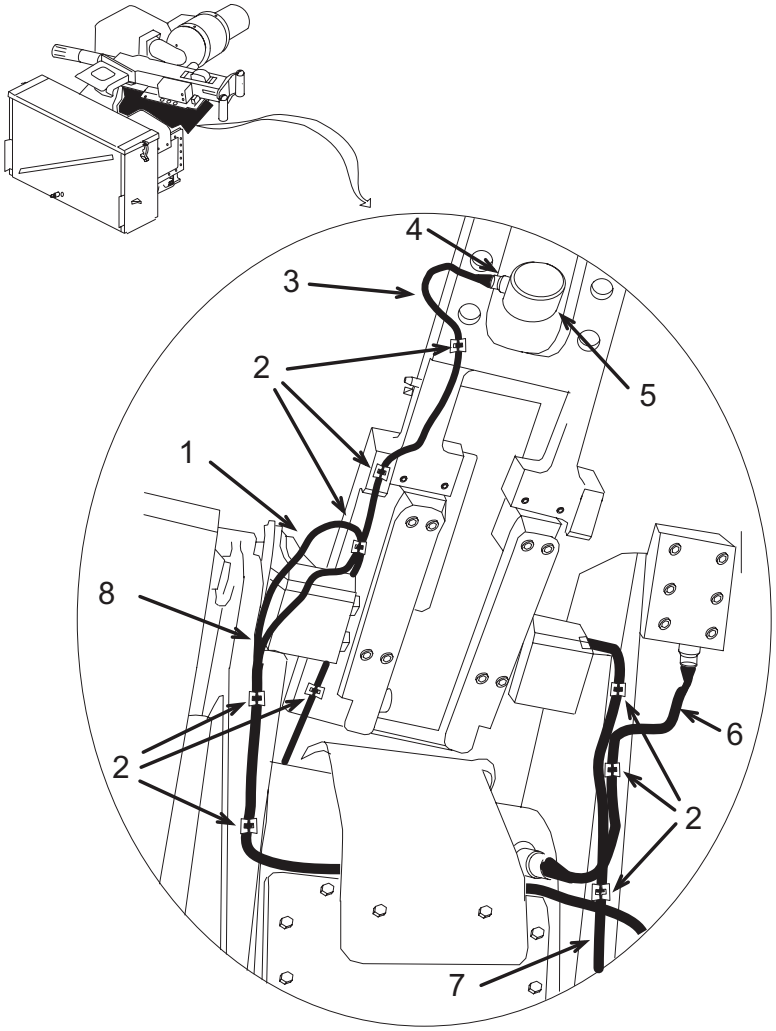
CONNECTORS AND CABLES - Cont

Connectors - Cont



Legend:
1. Elevation Drive
2. Mount-Linear Actuator (Charger) Cable
3. Weapon
4. Weapon-Mount Cable (from Rounds Counter
5. Cradle
6. Cable Anchors

Figure 18. Mk19 - Both Linear Actuator (Charger) and Weapon-Mount Cables in Place.



Legend:
1. Weapon-Mount Cable (after split) to Rounds Counter
2. Cable Anchors
3. Weapon-Mount Cable (after split) to Remote Firing Solenoid
4. J1, Remote Firing Solenoid
5. Remote Firing Solenoid
6. Mount-Sensor Unit Cable
7. Mount-Linear Actuator (Charger) Cable
8. Weapon-Mount Cable (before split, threaded under casing deflector)

Figure 19. Mk19 - Weapon-Mount Cable Set-up for Connection to the Mk19 Remote Firing Solenoid.

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER USUAL CONDITIONS - GENERAL INFORMATION, AMMUNITION CAN, AND AZIMUTH LOCK

THIS WORK PACKAGE COVERS:

An overview of locking/unlocking procedures for the azimuth lock assembly.

INITIAL SET UP:

Tools and Special Tools

N/A

Personnel Required

One

Equipment Conditions

N/A

References

WP 0012
WP 0014
WP 0018
WP 0019
WP 0020
WP 0021
WP 0035
TM 9-1005-201-10
TM 9-1005-213-10
TM 9-1005-313-10
TM 9-1010-230-10

Materials/Parts

N/A

WP CONTENTS

Section/Subsection	Page
Considerations Before and During Assembly/Disassembly	2
Azimuth Lock Assembly	2
General	2
Operation	3
Ammo Can Configuration	4
Configuring Ammo Can for M240/M249 WAK from M2/Mk19 Version	4
Configuring Ammo Can for M2/Mk19 WAK from M240/M249 Version	6
Ammo Can: Installation	7
Overview	7
Mounting the Ammo Can to the Ammo Hanger	9
Ammo Can Cover: Attaching, Removing, Stowing, and Storing	13
Ammo Can: Removal	14

CONSIDERATIONS BEFORE AND DURING ASSEMBLY/DISASSEMBLY

The following general procedures are recommended to reduce maintenance time and prevent accidental damage to the equipment.

- Follow all safety regulations, warnings, cautions, and notes.
- Ensure vehicle is positioned on level ground.
- Ensure the system is powered down and the weapon is cleared for safe maintenance performance.
- Refer to the appropriate weapon operation and maintenance manuals, as well as related CROWS manuals, detailed in WP 0035, References.
- Examine equipment carefully to determine cause of failure before removing defective or broken parts.
- Disassemble equipment only to the point necessary to perform required maintenance.
- Before disconnecting any electrical parts, ensure parts are tagged for identification.
- Note orientation of all parts before removal.
- Ensure that the radius of any bends in the ICU-Display Unit (DU) cable (P/N 21677-3715) measures at least 5 inches.

AZIMUTH LOCK ASSEMBLY

General

Depending on the position of the handle, the azimuth lock either allows or prevents movement of the pedestal mount. During certain procedures, the azimuth lock handle will need to be unlocked in order to gain access to areas of the CROWS mount.

Operation

Perform the following procedures to lock/unlock the azimuth lock, referring to Figure 1.

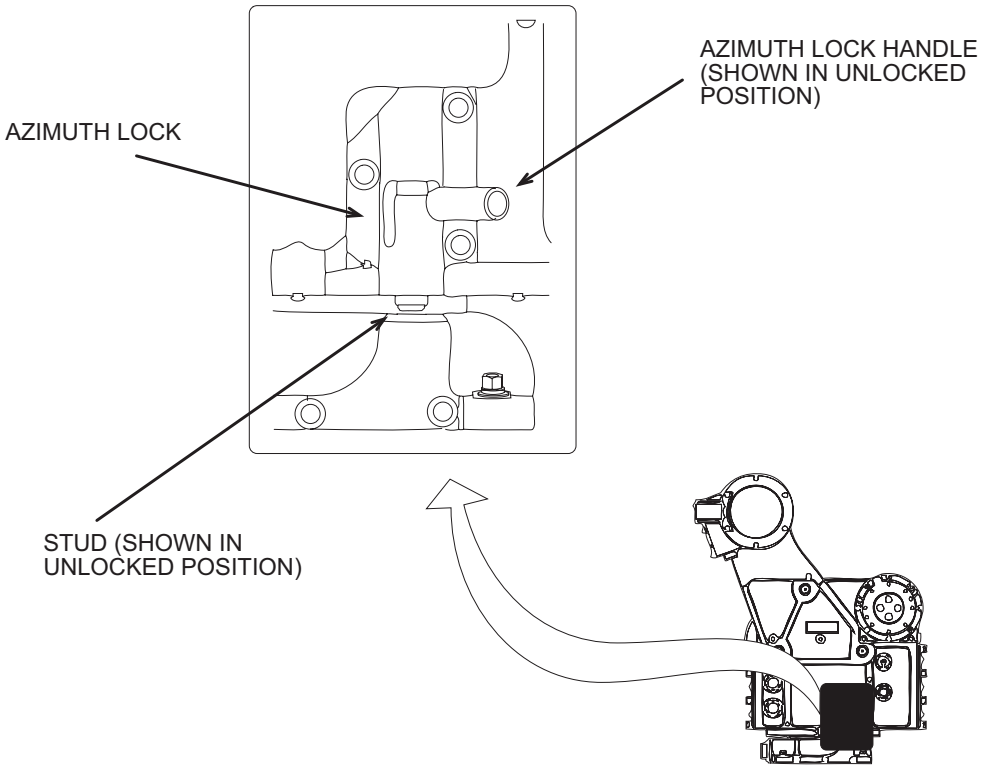


Figure 1. Azimuth Lock Assembly.

1. To unlock the azimuth lock (allowing the pedestal mount to move):

    a. Move the spring-loaded azimuth lock handle up, over to the right, and down until it seats in the unlocked position.

    b. Verify that the pedestal mount moves freely (horizontal rotation).

2. To lock the azimuth lock (preventing movement of the pedestal mount):

    a. Move the spring-loaded azimuth lock handle up, over to the left, and down until it seats in the locked position.

3. Verify that the pedestal mount does not move.

END OF TASK

AMMO CAN CONFIGURATION

Configuring Ammo Can for M240/M249 WAK from M2/Mk19 Version

Equipment Conditions. The ammo can must be empty, with the standard cover removed from the top of the ammo can and stowed on the front of the ammo can, the M2/Mk19 partition removed from the ammo can, and the quick release pin secured in the can. Refer to Ammo Can: Installation section of this work package.

Perform the following procedures to convert the ammo can assembly from the M2/Mk19 configuration to the M240/M249 configuration.

NOTE

The long bolts extend through the ammo can and the ammo can divider (Figure 2).

1. Ensure that the M2/Mk19 partition is in the M2 position, referring to Figure 2.

2. Remove the quick release pin holding the partition in place, referring to Figure 2.

CAUTION

Ensure the M240/M249 partition is installed securely into the Mk19 set of rails and that the chamber divider faces toward the mounting bracket on the ammo can. Failure to follow this instruction may result in serious equipment damage or equipment inoperability.

3. Insert the M240/M249 partition into the Mk19 set of rails with the chamber divider facing towards the mounting bracket on the ammo can.

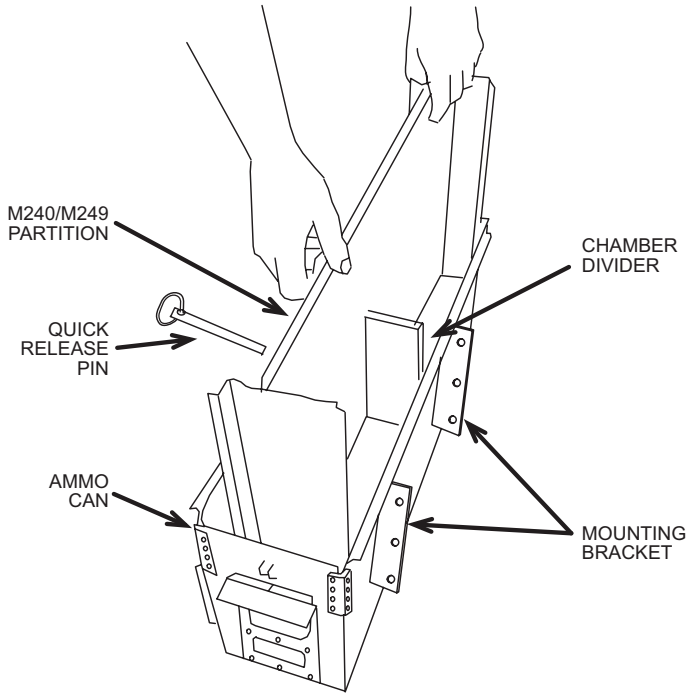


Figure 2. M240/M249 Partition for Ammo Can, with Chamber Divider Facing Mounting Bracket.

4. Insert and secure the quick release pin holding the partitions in place, referring to Figure 2.

5. Position the top cover assembly on the ammo can, with the chute adapter (part of top cover) toward the front of the ammo can, as shown in Figure 3.

6. Install the top cover assembly on the can and secure with the latches at each end.

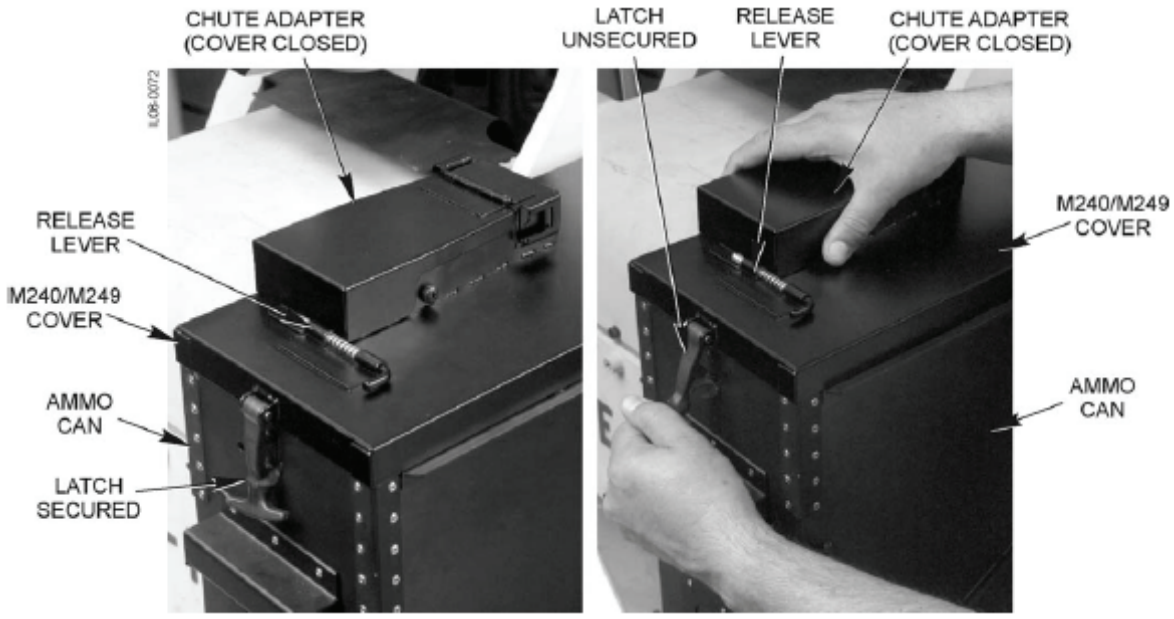


Figure 3. Top Cover Assembly in Place and Secured on the Ammo Can.

END OF TASK

AMMO CAN CONFIGURATION - Cont

Configuring Ammo Can for M2/Mk19 WAK from M240/M249 Version

Equipment Conditions. The ammo can is equipped with M240/M249 components and mounted to the weapon mount; refer to Configuring Ammo Can for M240/M249 WAK from M2/Mk19 Version section of this work package. All ammunition is removed from the feed chute assembly and the feed chute assembly is disconnected from the top cover assembly; refer to the Disconnecting Ammo Can from Weapon section of this work package.

Perform the following procedure to convert the ammo can from the M240/M249 to the M2/Mk19 configuration.

1. Lift the latches from the latch keepers on each end of the ammo can and remove the top cover assembly. Place on a flat, stable work surface.

2. Remove the quick release pin holding the partition in place, referring to Figure 4.

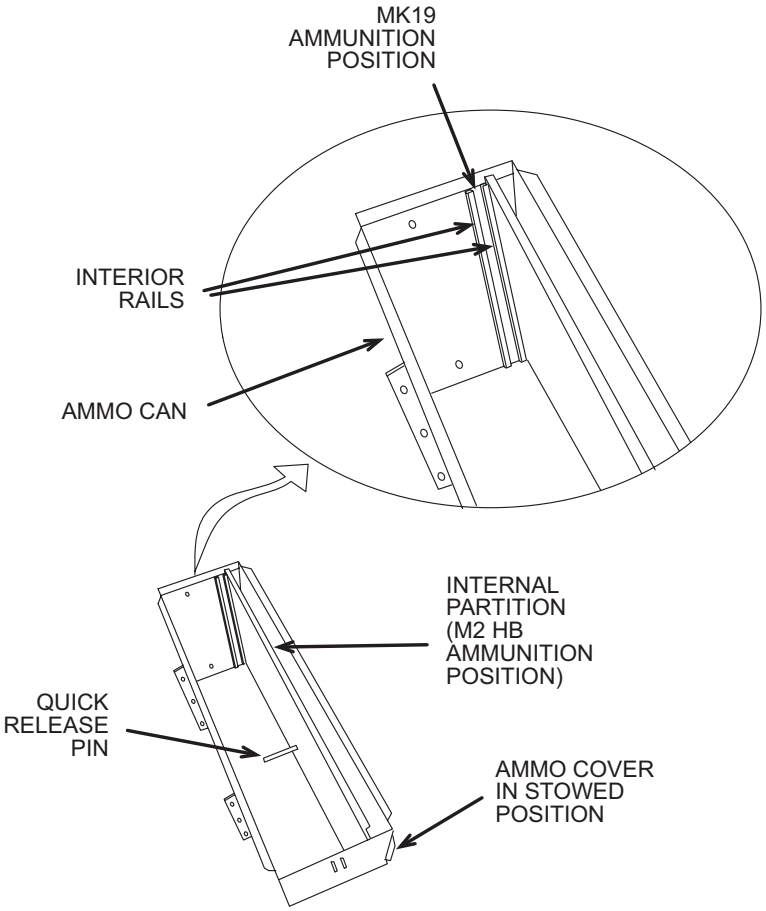


Figure 4. Location Description of M2/Mk19 Version of Ammo Can.

3. Remove the M240/M249 partition from the Mk19 set of rails, referring to Figure 2. Place on a flat, stable work surface.

4. Install the partition in the M2 or Mk19 position in accordance with mission requirements, and then secure with the quick-release pin, referring to Figure 4.

END OF TASK

AMMO CAN: INSTALLATION

Overview

This section describes the procedures for attaching the ammo can assembly to the ammo hanger assembly on the mount and for positioning and securing the ammo can cover and internal partitions.

NOTE

See WP 0018 for instructions on loading and firing the M2 HB .50-Cal Machine Gun, WP 0019 for the Mk19, WP 0020 for the M240B, and WP 0021 for the M249.

For additional information on the M2 weapon, refer to TM 9-1005-213-10, Operator's Manual for the M2 HB .50-Cal Machine Gun; for the Mk19, refer to TM 9-1010-230-10; for the M240B, refer to TM 9-1005-313-10; and for the M249, refer to TM 9-1005-201-10.

The ammo can, as detailed in Table 1 and shown in Figure 4, consists of a container with a removable external cover and a moveable internal partition that guides ammunition belts for a variety of weapons. The ammo can attaches to an ammo hanger assembly attached to the mount. See Figure 5 and Figure 6.

NOTE

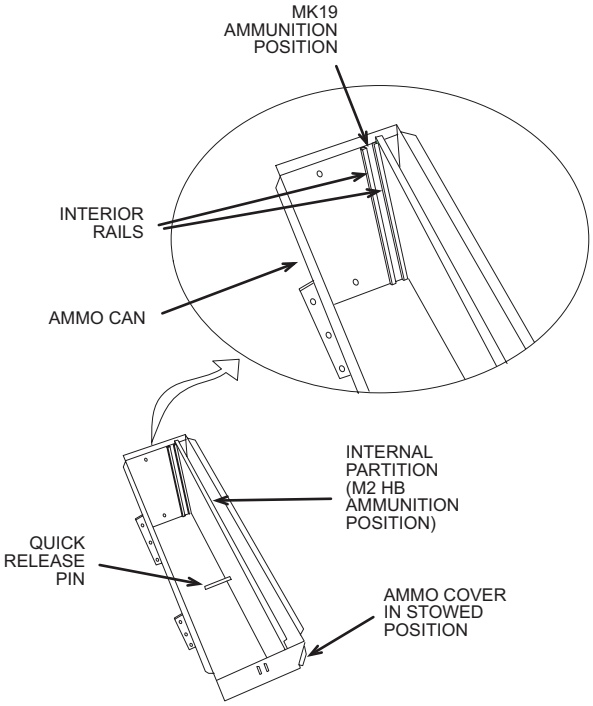
Quantities are assumed to be 1 each unless otherwise specified.

Table 1. Ammunition Can: Standard Components, M2/Mk19 Components, and M240/M249 Component.

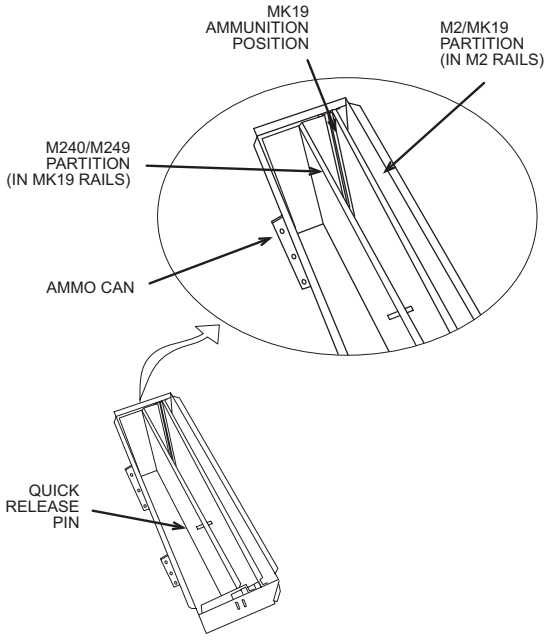
PN	Nomenclature	Common Name
Standard Configuration		
21677-0500	Ammunition Can	Ammo Can
21677-0525	. Cover, Weldment	Standard Cover
92384A063	. Pin, Quick Release	Partition Pin with Lanyard
30345T21	. Wire Rope Assembly	Lanyard
79NTM-82	Nut-Hex, Self-Locking, Hexagon	Hex nut
92384A056	. Pin, Quick Release	Ammo Can Attaching Pin with Lanyard (Qty. 4)
MS24693-C49	Screw, Machine, Flat CSK Head, 100 Degree	Flat Screw,
21677-0516	. Ammunition Can Weldment	Container
21677-0536	. Partition Weldment	Internal Partition

AMMO CAN: INSTALLATION - Cont

Mounting the Ammo Can to the Ammo Hanger



M2/MK19 Version of the Ammo Can



M240/M249 Version of the Ammo Can

Figure 5. Ammo Can Configurations with Standard Cover Stowed.

Perform the following procedure to mount the ammo can to the ammo hanger.

WARNING

Use two personnel to lift the ammo can if the can is filled with ammunition. Failure to follow this instruction may result in personal injury or equipment damage.

NOTE

The ammo can holds ammunition for the following weapons in specific component configurations:

M2 .50-cal machine gun or the Mk19 automatic grenade machine gun, with the internal partition positioned differently for each type and the standard ammo can cover

M240B 7.62 mm machine gun and the M249 5.56 mm machine gun, with an internal ammo divider, four inserts, and a top cover assembly

The ammo can may be installed on the ammo hanger with or without ammunition. Use two personnel to install the ammo can if the can is filled with ammunition.

1. Ensure that the ammo can is configured properly for the specified weapon: M2, Mk19, M240B, or M249, as shown in Figure 5.

2. Ensure the ammo hanger is in position on the mount, as shown in Figure 6 and Figure 7.

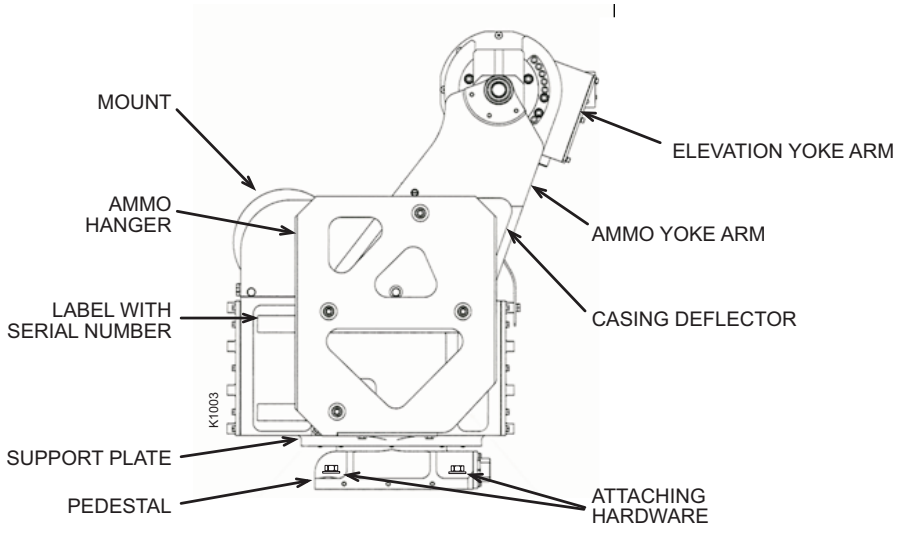


Figure 6. Ammo Hanger Assembly.

3. Rest the bottom of the ammo can on the ammo hanger support plate, referring to Figure 6.

AMMO CAN: INSTALLATION - Cont

Mounting the Ammo Can to the Ammo Hanger - Cont

4. Align the interface bracket holes (two on each side, four total) with the mounting bracket holes and insert the four quick release pins, referring to Figure 7.

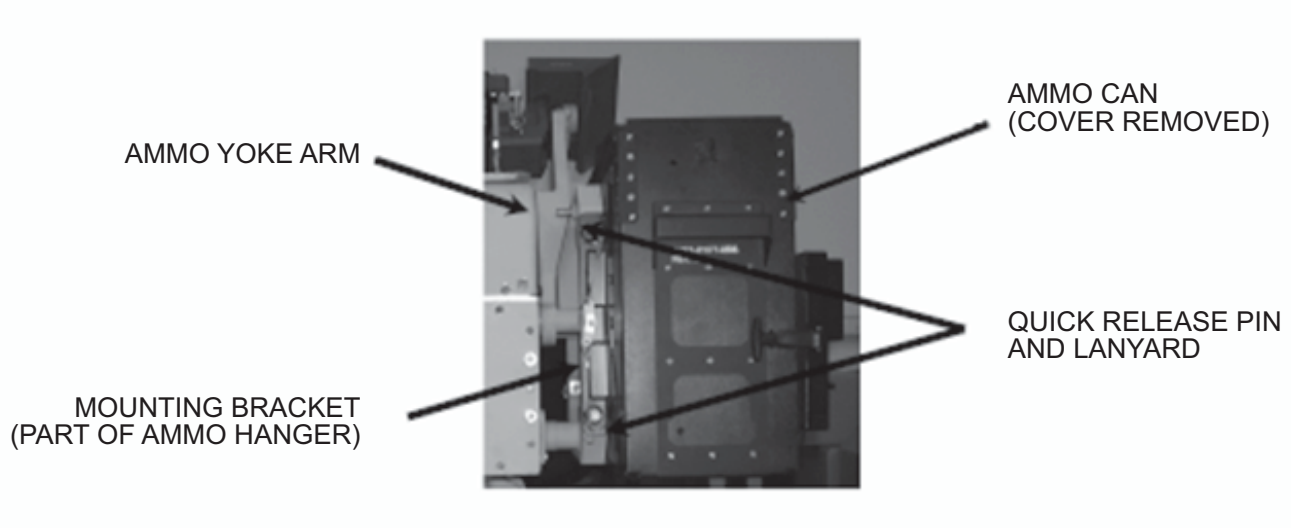


Figure 7. Ammo Can Mounted to Ammo Hanger.

5. Push the button at the end of each ammo can quick-release pin and lanyard, and insert them in to their full depth, as shown in Figure 8.

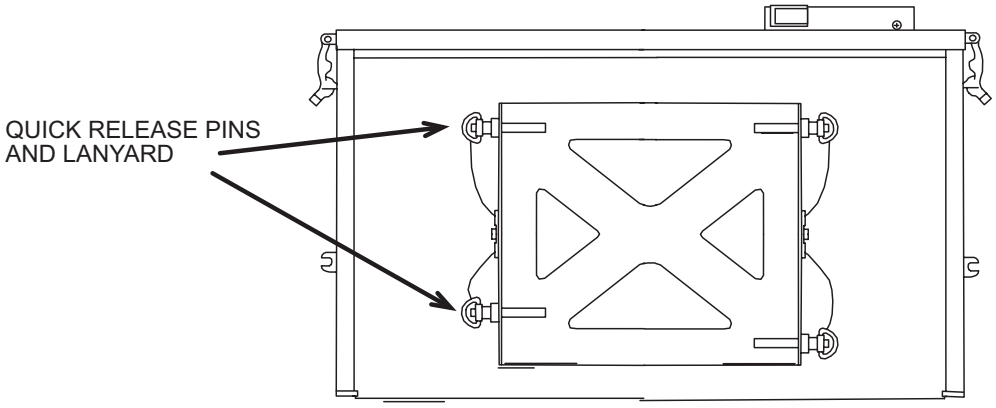


Figure 8. Pins Inserted into Ammo Can Showing Proper Position (Full Depth).

END OF TASK

AMMO CAN COVER: ATTACHING, REMOVING, STOWING, AND STORING

NOTE

The ammo can standard cover must be removed and placed in stowed position or stored off the CROWS for the ammunition to be loaded and used when using the M2 or Mk19 weapons.

1. To attach the cover, carefully place the cover onto the ammo can and secure it by inserting the latches into latch keepers on the sides (one each per side) as shown in Figure 8.

2. To remove the cover, release the two latches and lift the cover off the container, referring to Figure 9.

3. To stow the cover, place the cover onto the two stowed cover supports on the front of the ammo can, as shown in Figure 9. Secure the cover by placing the latches into the latch keepers (one per side).

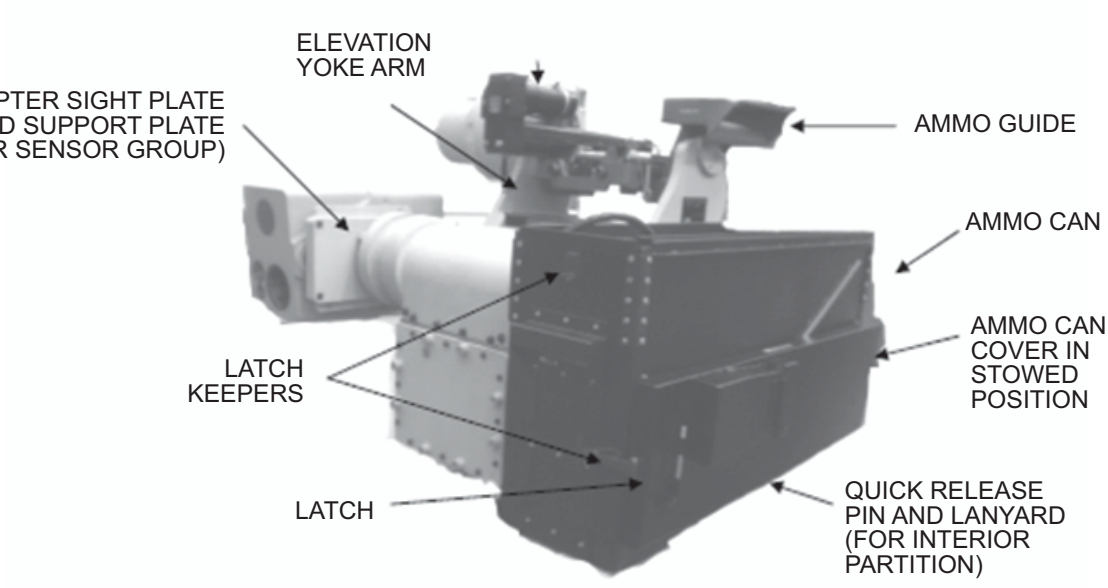


Figure 9. Ammo Can With Standard Cover In Stowed Position.

4. Store the ammo can with the partition inserted into the set of rails for the Mk19 ammunition and secured with the partition pin, making sure that the cover is secured to the top of the can.

END OF TASK

AMMO CAN: REMOVAL

This section describes the procedures for removing the ammo can assembly from the ammo hanger assembly on the mount.

The ammo can, as detailed in Table 1 and shown in Figure 4, consists of a container with a removable external cover and a moveable internal partition that guides ammunition belts for a variety of weapons. The ammo can attaches to an ammo hanger assembly attached to the mount.

Perform the following procedure to remove the ammo can from the ammo hanger.

Equipment Condition. M240/M249: Ensure that the ammo feed chute has been removed from the top cover assembly, referring to WP 0012 and WP 0014, Disconnection of Ammo Feed Chute from the Weapon and the Ammo Can section.

WARNING

Use two personnel to lift the ammo can if the can is filled with ammunition. Failure to follow this instruction may result in personal injury and equipment damage.

NOTE

The ammo can holds ammunition for the following weapons in specific component configurations:

M2 .50-cal machine gun or the Mk19 automatic grenade machine gun, with the internal partition positioned differently for each type and the standard ammo can cover.

M240B 7.62 mm machine gun and the M249 5.56 mm machine gun, with an internal ammo divider, four inserts, and a top cover assembly.

1. If needed, release the latches securing the top cover assembly from the latch keepers on each end of the ammo can and remove the top cover assembly, referring to Figure 10.

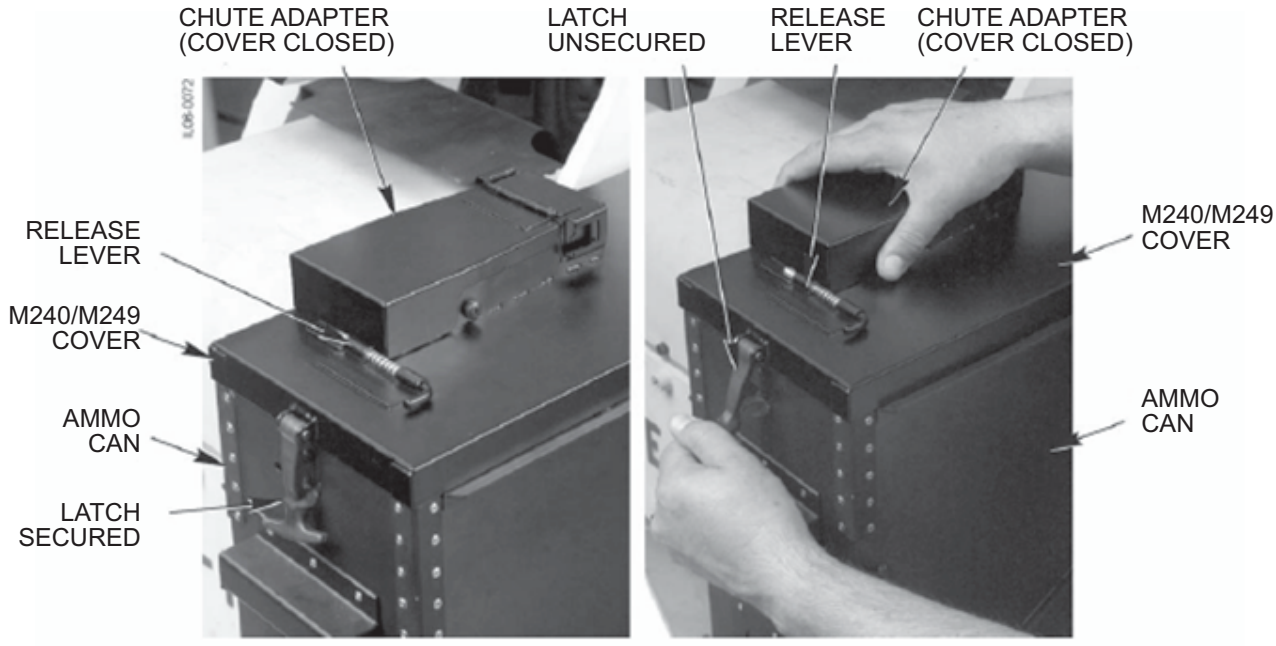


Figure 10. Top Cover Assembly on Ammo Can.

WARNING

Use two personnel to remove the ammo can from the ammo hanger because, when the pins holding the ammo can to the ammo hanger are disconnected, the ammo can is no longer attached to the ammo hanger and, if the ammo can is loaded with ammunition, it is very heavy. Failure to follow this instruction may result in personal injury or equipment damage.

2. Push the button at the end of the four quick-release pins and lanyards securing the ammo can to the ammo hanger, and remove the pins, referring to Figure 11.

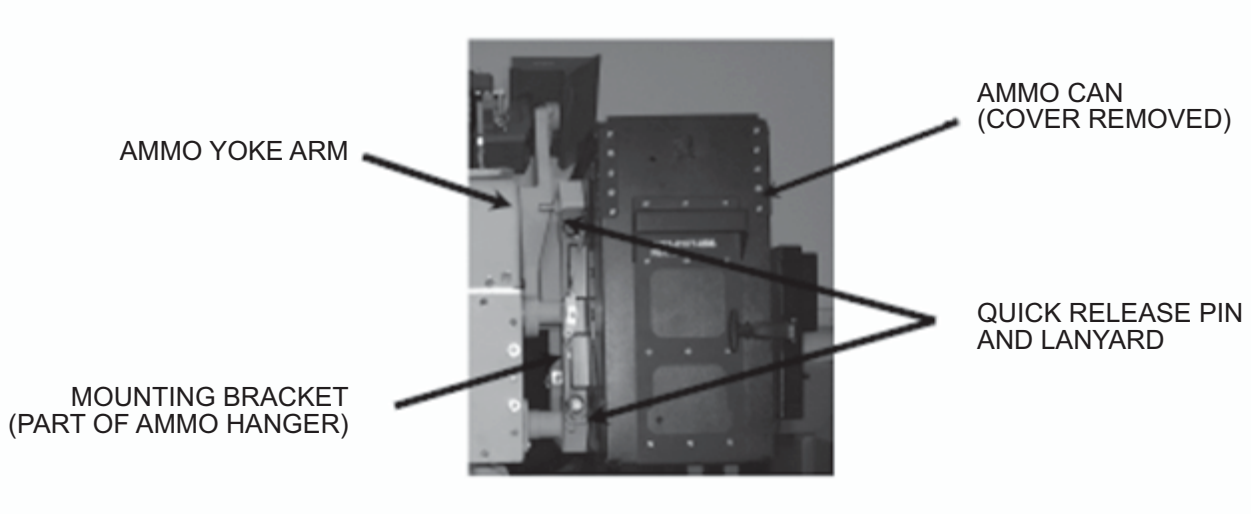


Figure 11. Pins Securing Ammo Can to Ammo Hanger.

WARNING

If any ammunition remains in the ammo can, use two personnel to remove the ammo can from the bracket. Failure to do so may result in personal injury.

NOTE

Store the ammo can with the ammo can divider, ammo can inserts, and partition pin in place, making sure that the top cover assembly is secured to the top of the can.

3. Lift the can from the ammo hanger mounting bracket and store in accordance with mission requirements.

END OF TASK

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER USUAL CONDITIONS - M2 HB .50-CAL MACHINE GUN WEAPON ADAPTER KIT (WAK) AND WEAPON: INSTALLATION

THIS WORK PACKAGE COVERS:

Installing the M2 HB .50-Cal Machine Gun and WAK on the cradle in the CROWS.

INITIAL SET UP:

Tools and Special Tools

Operator's Tool Kit (WP 0036, Table 2, Item 1)

References

WP 0004	WP 0018	WP 0028
WP 0005	WP 0023	WP 0029
WP 0006	WP 0024	WP 0030
WP 0012	WP 0025	WP 0031
WP 0014	WP 0026	WP 0032
WP 0015	WP 0027	WP 0035
TM 9-1005-213-10		**WP 0036**
TM 9-1005-213-23&P		**WP 0038**

Materials/Parts

Compound, thread-locking, blue (WP 0038, Table 1, Item 8)

Compound, thread-locking, red (WP 0038, Table 1, Item 9)

Compound, thread-locking, black (WP 0038, Table 1, Item 10)

Marker (WP 0038, Table 1, Item 18)

Strap, tiedown (anchors) (WP 0038, Table 1, Item 21)

Wire, safety (WP 0038, Table 1, Item 24)

Personnel Required

Two

Equipment Conditions

System power off

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CAUTION

Use two personnel during installation/removal of the cradle and M2 HB .50-cal machine gun. Failure to do so may result in personal injury or equipment damage.

NOTE

Should any weapon malfunction occur, refer to WP 0023, Troubleshooting – Weapon Interface Malfunctions.

Some steps within the assembly procedures are easier with two personnel.

To ensure CROWS components/assemblies are ready for operation, refer to WP 0027, Before Operational Check.

For information on performing preventive maintenance, cleaning, or lubrication on the M2 adapter kit, refer to WP 0025 through WP 0030. For additional information about expendable and durable materials, refer to WP 0038.

For lists of specific weapon operation and maintenance manuals, refer to WP 0035, References.

M2 HB .50-CAL WAK OVERVIEW

Installation of the M2 on the CROWS mount requires configuring the weapon with assemblies from the M2 WAK and installing the kit plus weapon onto CROWS cradle assembly, as detailed in the remainder of this work package.

CONSIDERATIONS BEFORE AND DURING ASSEMBLY

The following general procedures are recommended to reduce maintenance time and prevent accidental damage to the equipment.

- Follow all safety regulations, warnings, cautions, and notes.
- Ensure vehicle is positioned on level ground.
- Ensure the system is powered down, the weapon is cleared, and any cleared rounds are removed.
- Ensure that the radius of any bends in the ICU-Display Unit (DU) cable (P/N 21677-3715) measures at least 5 inches.
- Before disconnecting any electrical or mechanical parts, ensure parts are tagged for identification.
- Refer to the appropriate weapon operation and maintenance manuals, as well as related CROWS manuals, detailed in WP 0035, References.

PREPARATION FOR INSTALLATION OF THE WAK AND WEAPON

Follow the steps in Table 1 to prepare the CROWS and WAK for installation.

Table 1. Determination of Status.

Task	Next Step
1. Verify that the casing deflector is in its proper position.	If not, return CROWS to unit maintenance for installation. If yes, proceed to the next step.
2. If required, verify that the ballistic armor is properly installed.	If not, return CROWS to unit maintenance for installation. If yes, proceed to the next step.
3. Verify that the azimuth lock handle is in the unlocked position: pedestal mount should move freely.	If not, refer to WP 0006, Azimuth Lock Assembly section. If yes, proceed to the next step.
4. Verify sear slide is attached to sear assembly.	If not, return CROWS to unit maintenance for installation. If yes, proceed to the next step.
5. Inspect the M2 WAK, IAW Table 2 and Figure 1.	If any loose or missing hardware, return CROWS to unit maintenance for missing parts. If all items present and ready, proceed to the next step.
6. Verify M2/Mk19 cradle secured to mount.	If the M240/M249 cradle is in position on the mount, refer to WP 0012 or WP 0014 for removal instructions. If the cradle is not installed, proceed to Cradle Installation section of this work package. If yes, proceed to the next step.
7. Verify attenuators installed and in proper position.	If not, proceed to Installation of Attenuators section of this work package. If yes, proceed to the next step.
8. Verify ammunition can is installed and in the M2/Mk19 configuration.	If not, go to WP 0006, Configuring Ammo Can for M2/Mk19 WAKs from M240/M249 Version section and then Ammunition Can: Installation section. If yes, proceed to the next step.
9. Verify adapter kit and weapon are assembled and ready for operation.	If not, proceed to the WAK and Weapon Installation section of this work package. If yes, proceed to WP 0027, Before Operational Check.

PREPARATION FOR INSTALLATION OF THE WAK AND WEAPON - Cont

M2 WAK Components

Table 2 details the major components of the M2 WAK, which are illustrated in Figure 1.

NOTE

Quantities are assumed to be 1 each unless otherwise specified.

Table 2. M2 HB WAK Components (PN 21677-3100).

Item Number	PN	Nomenclature	Common Name
1	21677-3107	. Chute Assembly, Ammunition	Link Chute Assembly
2	21483-2609	. Screw, Shoulder	Linear Actuator (Charger) Bolt (qty. 2)
3	21677-3170	. Linear Actuator Assembly	Linear Actuator (Charger) Assembly
4	21677-3160	. Sear	Sear Assembly with Sear Slide
5	21677-3134	. Guide, Cartridge, Ammunition	Ammo Guide
6	21677-3164	. Extension, Retracting Slide	Retracting Slide Extension
7	21677-3130	. Guide, Cartridge, Ammunition	Block Guide Assembly
8	21677-3175-2	. Pin, Shoulder, Headless	Breech Bolt Pin Long
9	21677-3175-1	. Pin, Shoulder, Headless	Breech Bolt Pin Short
10	21483-3166	. Nut, Self Locking Hexagon	Locking Long Nut
11	21677-3172	. Pin, Shoulder, Headed	Left-Hand Securing Bolt
12	21677-3171	. Pin, Shoulder, Headed	Right-Hand Securing Bolt
13	21677-3702	. Cable Assembly, Power, Electrical	Weapon-Mount Cable
14	21483-3145	. Feeder, Ammunition, Machine Gun	Feed Throat
15	21677-3165	. End Rod, Threaded	Rod End
16	21677-3150	. Remote Firing Assembly	RFA
17	21677-2614	. Pin Assembly, Mounting	Forward Pin with Lanyard and Hitch Pin
18	21677-3030	. Link Chute Clamp	Link Chute Bracket

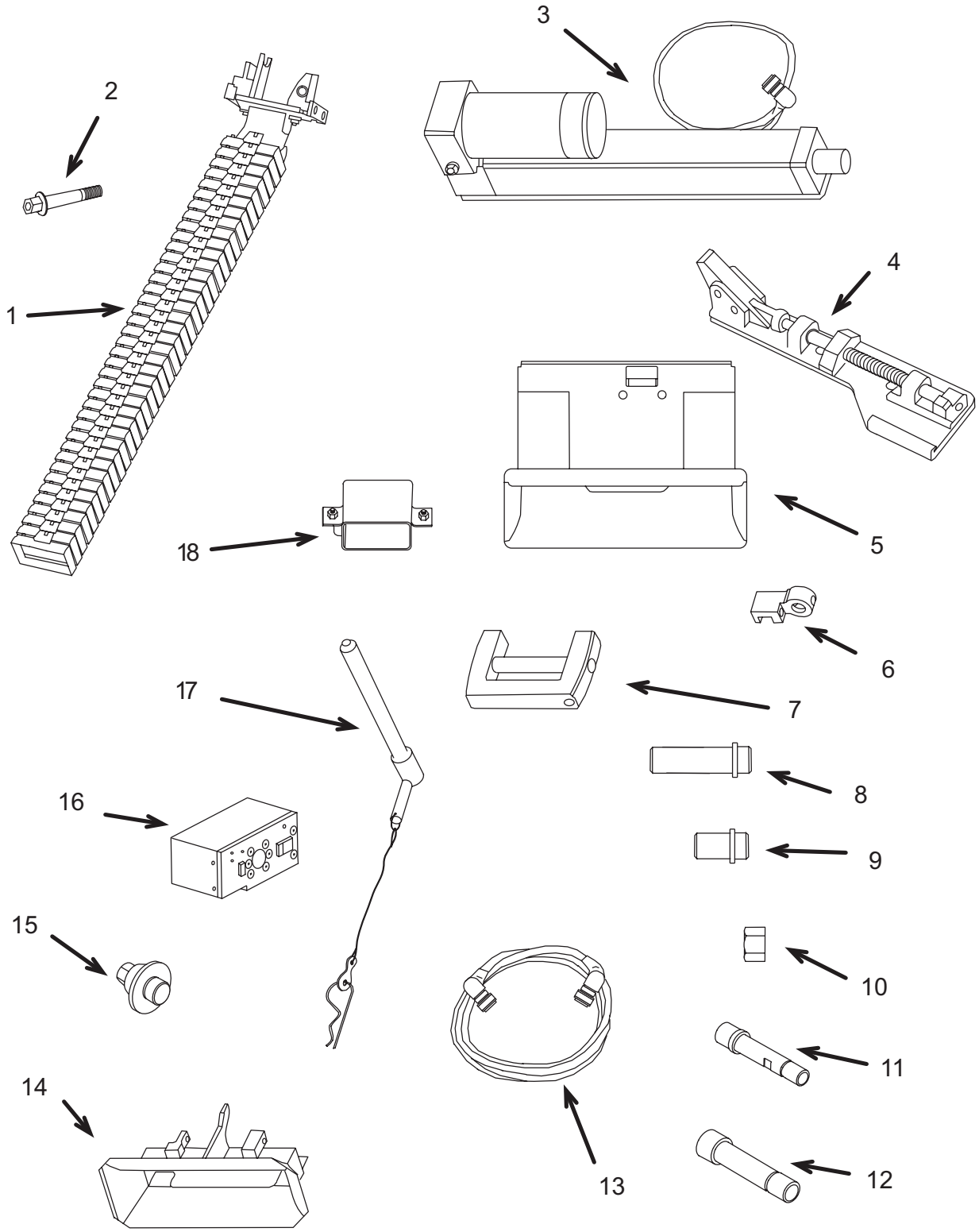


Figure 1. M2 HB WAK Components.

PREPARATION FOR INSTALLATION OF THE WAK AND WEAPON - Cont

Cradle Installation

Overview

Table 3 lists the components of the cradle assembly, as well as related items of the CROWS mount.

NOTE

Quantities are assumed to be 1 each unless otherwise specified.

Each Nord-lock washer is a set of two washers. Ensure that the washer set is positioned so that the serrated edges face outward in both directions.

Table 3. Cradle and Related Items.

PN	Nomenclature	Common Name
21677-2600	Gun Mount	M2/Mk19 Cradle (Heavy)
BLC8R60N	. Pin, Detent	Detent Pin with Lanyard
21483-3146-5	. Wire Rope Assembly, Single Leg	Lanyard
MS21250-06016	. Bolt, Shear	Bolt
NL3/8SS	. Washer, Lock	Nord-lock washers (Attaching Hardware -- Qty: 2 bolts and 2 Nord-lock washers)
MS16995-35B	. Socket Head Cap Screw	Attaching Hardware

Figure 2 shows the basic cradle (heavy) before being installed onto the CROWS mount.

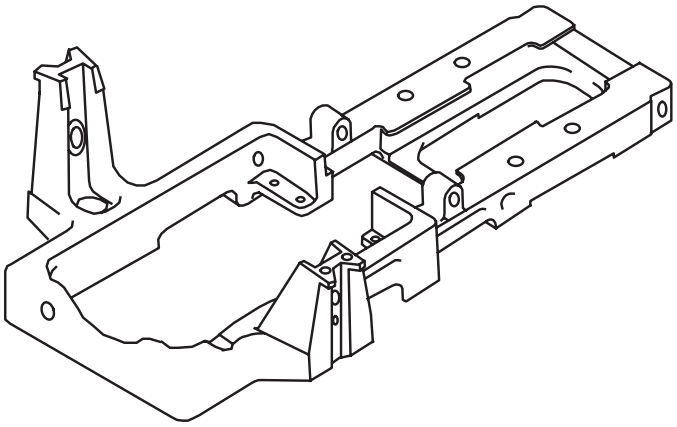


Figure 2. Cradle (Heavy).

Cradle Installation

WARNING

Follow all stated warnings and cautions when handling the weapons. Failure to do so may result in personal injury or equipment damage.

Use two personnel during installation/removal of the cradle and M2 HB .50-cal machine gun. Failure to do so may result in personal injury or equipment damage.

1. Ensure CROWS system power is OFF.

2. Ensure the azimuth lock is in the locked position (referring to WP 0006, Azimuth Lock Assembly section). The pedestal mount should not be able to move.

NOTE

If M240/M249 cradle is attached to the mount, refer to WP 0012 or WP 0014 for removal procedures.

Ensure proper orientation of the cradle in relation to the mount.

3. Slide the cradle pivot arms into the slots of the ammo yoke arm and elevation yoke arm, aligning the holes in the pivot arms with holes in the yoke arms, as shown in Figure 3.

NOTE

Each Nord-lock washer is a set of two washers. Ensure that the washer set is positioned so that the serrated edges face outward in both directions.

Ensure both weapon cradle bolts and Nord-lock washers are loosely installed. When securing the cradle bolts, completely tighten the drive axle cradle bolt first and then the dead axle cradle bolt. Following this procedure will ensure proper cradle alignment and prevents dead axle interference.

4. Insert attaching hardware (one tension bolt and one Nord-lock washer set per side) into the holes on the cradle pivot arms and the yoke arms, as shown in Figure 3.

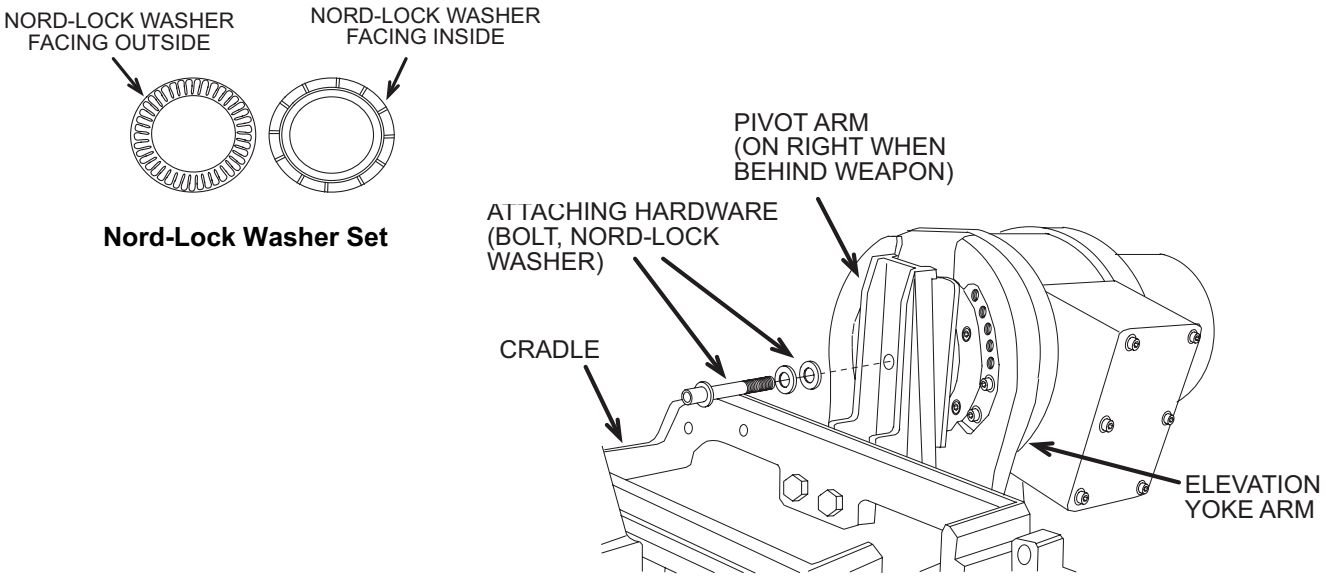


Figure 3. Attaching Hardware Being Positioned for Insertion into the Cradle.

PREPARATION FOR INSTALLATION OF THE WAK AND WEAPON - Cont

Cradle Installation - Cont

Cradle Installation – Cont

5. Tighten the attaching hardware to 65 ± 15 ft-lbs with a torque wrench, to secure the cradle to the mount, as shown in Figure 4.

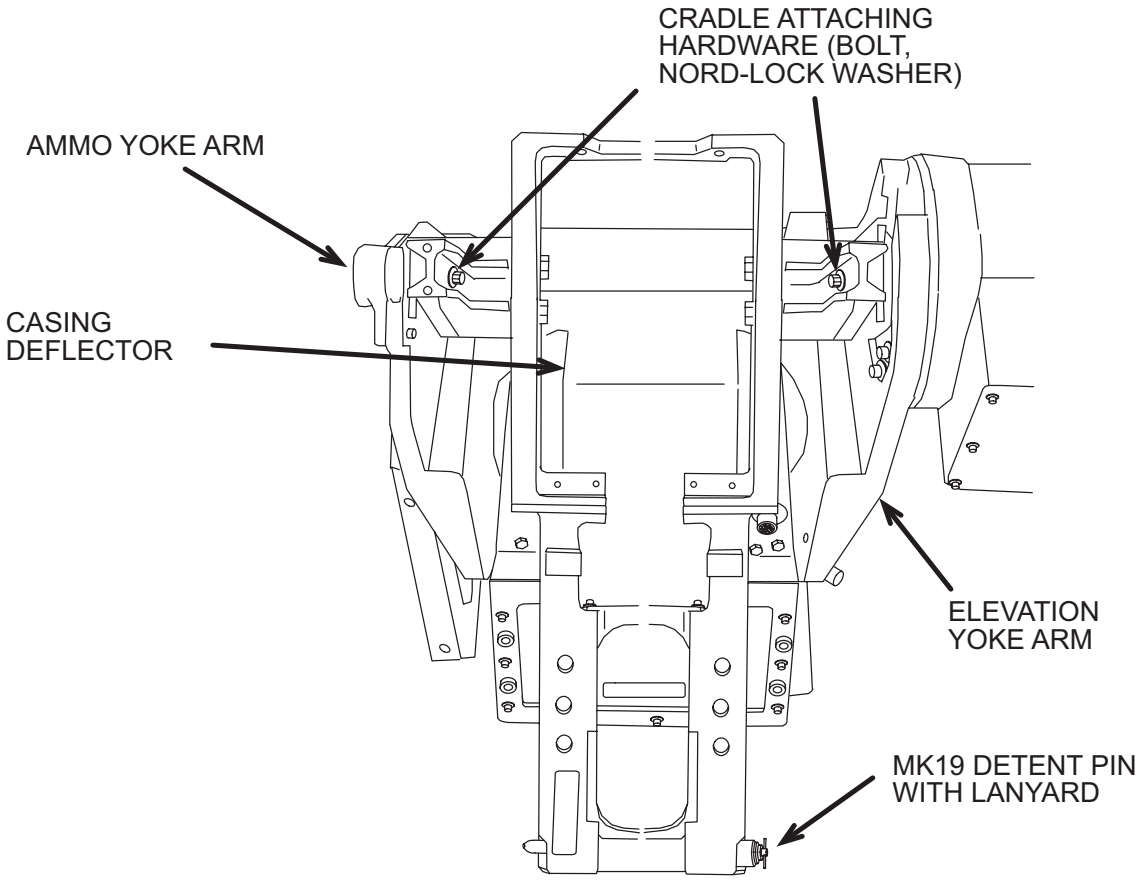


Figure 4. Cradle Installed on the Mount.

END OF TASK

Attenuator Positioning

For the M2, the attenuators must be in the up position (see Figure 8). If the attenuators are in the down position, perform the following procedure to reposition the attenuators.

1. Ensure CROWS system power is OFF.

2. Remove the hitch pin from the brass bushings in the forward pin, as shown in Figure 5.

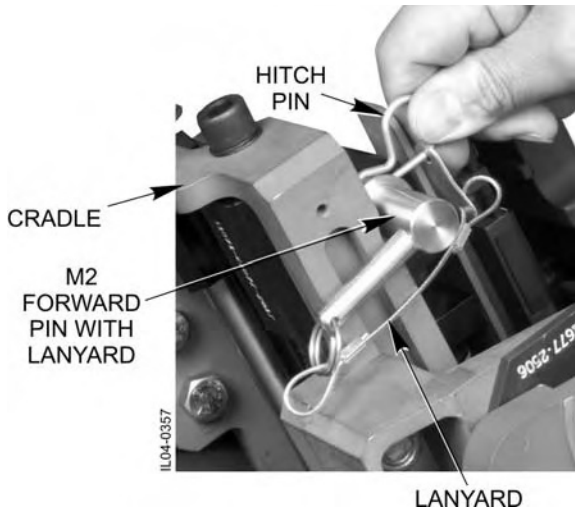


Figure 5. Removing Hitch Pin from Forward Pin.

3. Place your thumb on the bottom of the attenuators, rotating the assemblies toward the center of the cradle and up until the attenuators are 180° from previous position, as shown in Figure 6.

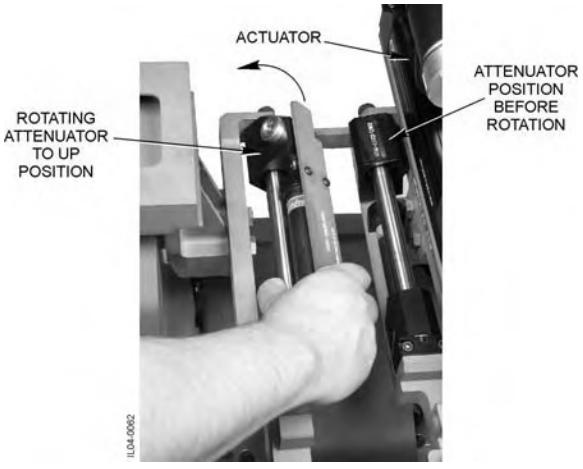


Figure 6. Attenuator Being Rotated from Down to Up Position.

4. Ensure both attenuators are even and insert the forward pin through both attenuators.

5. Turn the forward pin handle to the down position and insert the hitch pin into the brass bushing in the handle to secure the forward pin, as shown in Figure 5.

END OF TASK

WAK AND WEAPON INSTALLATION

Perform the following procedures to mount the M2 weapon and adapter kit to the cradle.

WARNING

Follow all stated warnings and cautions when handling the weapons. Ensure that the weapon is cleared and any cleared rounds are secured before performing any procedures, unless specifically directed to load the weapon. (For instructions on clearing and loading the M2 weapon, refer to WP 0018.)

Use two personnel during installation of the cradle and M2 HB .50-cal machine gun.

Failure to follow these instructions may result in personal injury or equipment damage.

NOTE

Ensure the azimuth lock is in the locked position. (For azimuth lock procedures, refer to WP 0006, Azimuth Lock Assembly section.)

For details on handling or disassembling the M2 weapon, refer to WP 0035, References, for information on the M2 technical manuals.

Sear Assembly with Sear Slide Installation

Perform the following procedure to install the sear assembly with sear slide onto the cradle.

1. Ensure CROWS system power is OFF.

2. Position the sear assembly with sear slide on the right-hand side of the cradle (facing) so that the two location pins on the base of the sear assembly are aligned with the holes on the cradle, as shown in Figure 7.

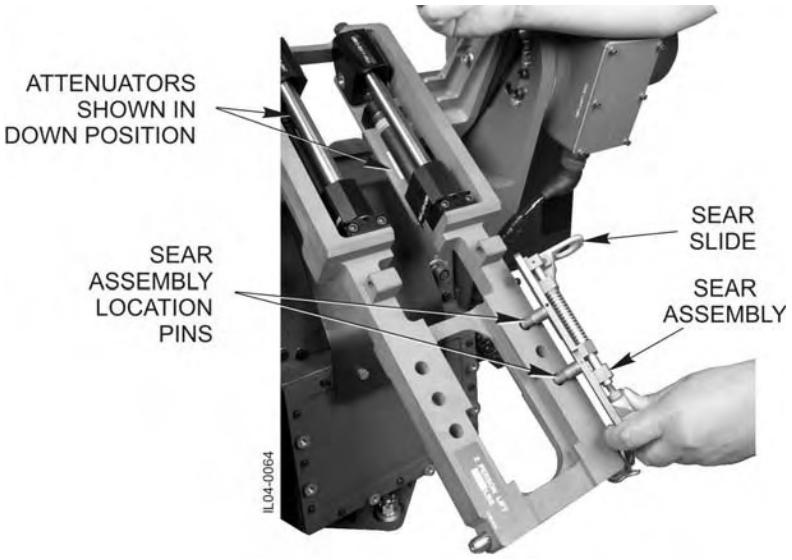


Figure 7. Positioning of Sear Assembly with Sear Slide on Cradle.

CAUTION

Ensure that the attaching hardware for the sear assembly is recessed into the cradle (underside) to prevent damage to personnel or the equipment.

3. Using 5/16-in hex head wrench, tighten the attaching hardware to secure the sear assembly to the cradle, as shown in Figures 8 and 9.

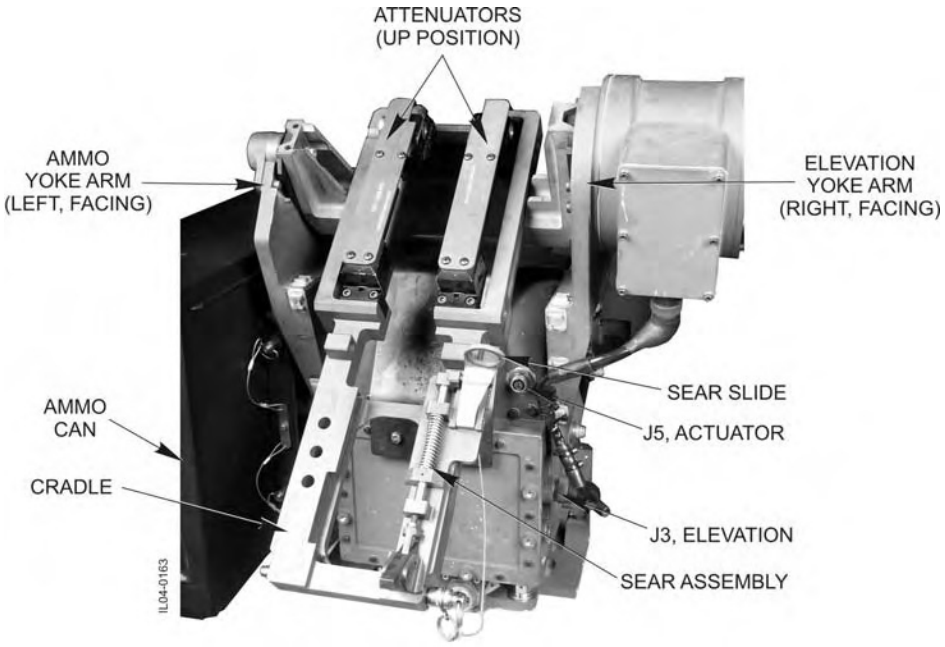


Figure 8. Sear Assembly with Sear Slide in Position.

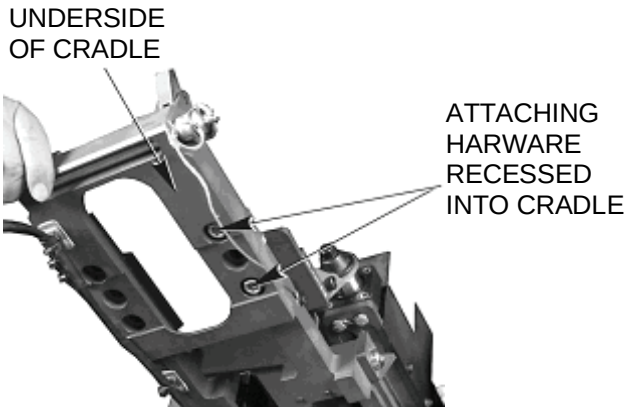


Figure 9. Sear Assembly from Underside of Cradle Showing Attaching Hardware Properly Recessed.

END OF TASK

WAK AND WEAPON INSTALLATION - Cont

Linear Actuator (Charger) Assembly Installation

NOTE

The rod end and the mounting plate do not have to be removed when the linear actuator (charger) assembly is returned to unit maintenance.

Perform the following procedure to attach the mounting plate to the linear actuator (charger) assembly and to install the linear actuator (charger) assembly to the cradle.

NOTE

For additional information on thread locking, refer to WP 0032, Thread-Locking Procedures.

1. Ensure CROWS system power is OFF.

WARNING

Wear latex gloves during threadlock removal and application. Exposure of compounds to skin may result in an allergic reaction.

2. Apply thread-locking compound to the threads, then insert and the four cap screws and flat washers to secure the actuator mounting plate to the actuator, referring to Figure 10. Tighten the cap screws to 88 in-lb ± 12 in-lbs, using a torque wrench.

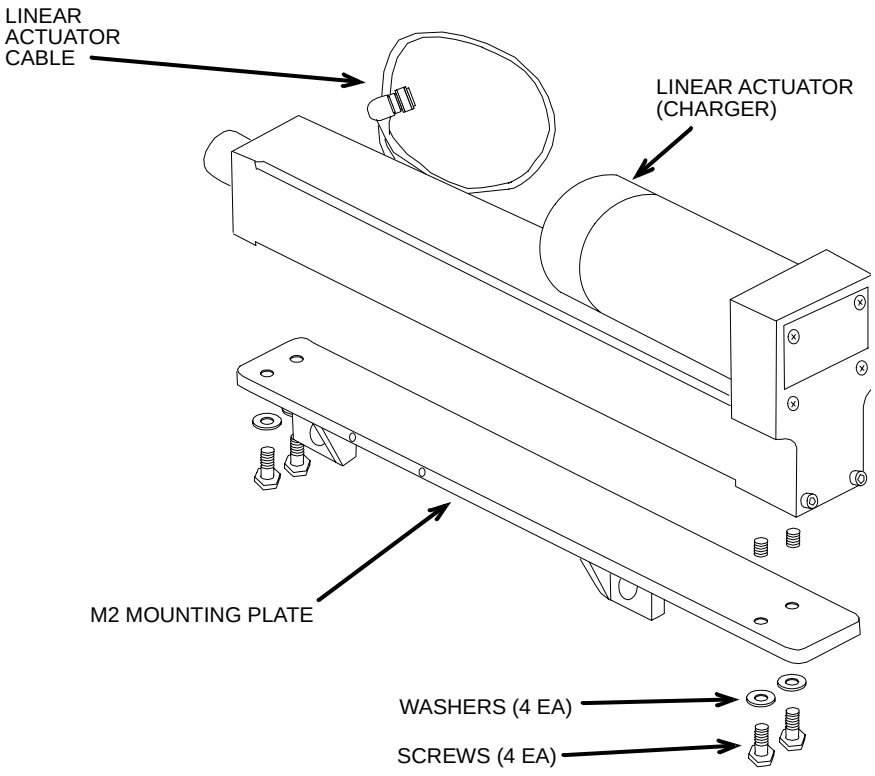


Figure 10. Linear Actuator (Charger) and Mounting Plate.

NOTE

For additional information, refer to WP 0031, Safety Wire Procedures.

3. Secure the four cap screws to the bottom of the mounting plate with safety wire, as shown in Figure 11. Figure 12 shows the assembled linear actuator (charger).

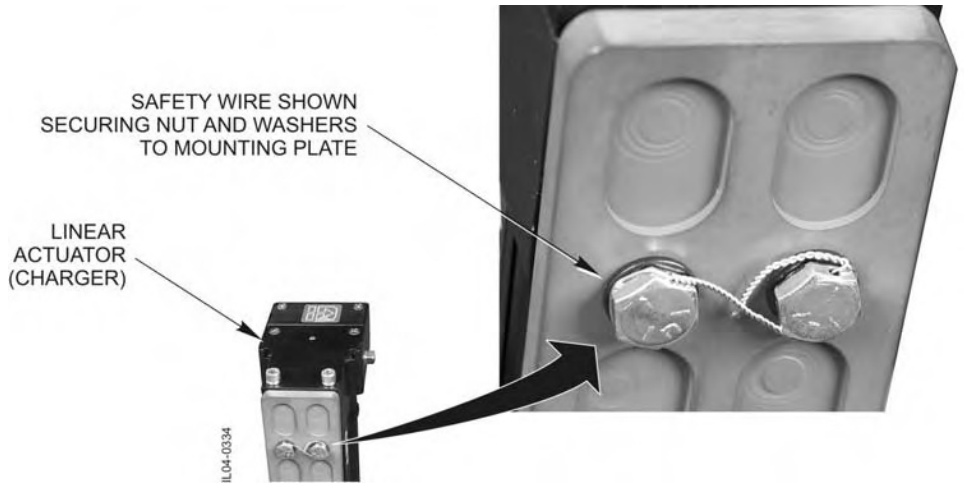


Figure 11. Linear Actuator (Charger) Mounting Plate with Safety Wire.

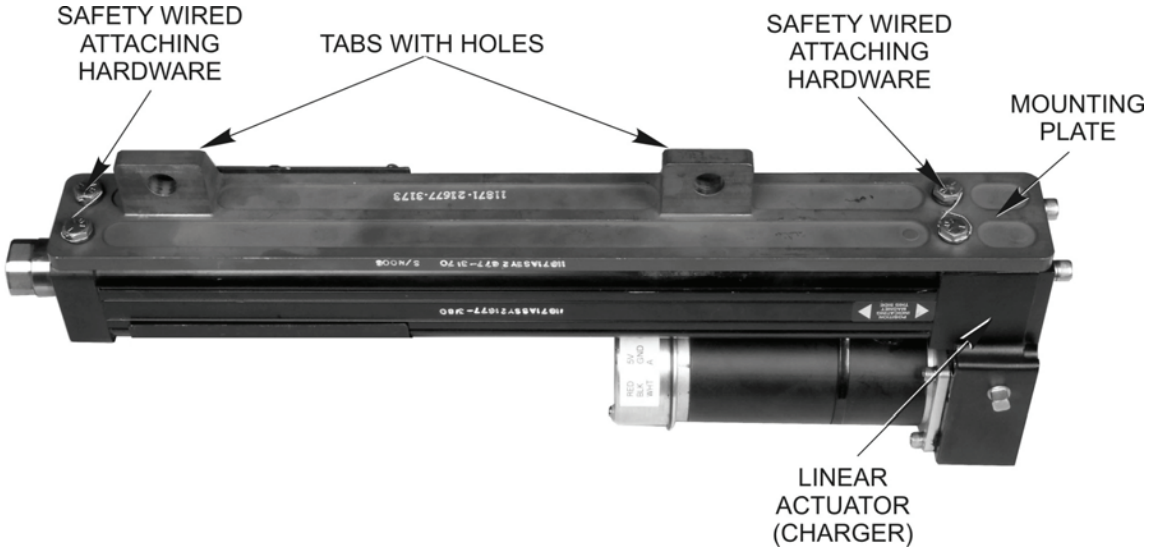


Figure 12. Linear Actuator (Charger) Mounting Plate Safety Wired and Thread Locked.

4. Position the linear actuator (charger) assembly above the right-hand side of the cradle permitting the linear actuator (charger) assembly to rest on the cradle.

WAK AND WEAPON INSTALLATION - Cont

Linear Actuator (Charger) Assembly Installation - Cont

5. Thread the linear actuator (charger) cable under the cradle and past the casing deflector for later connection to the mount, as shown in Figure 13.

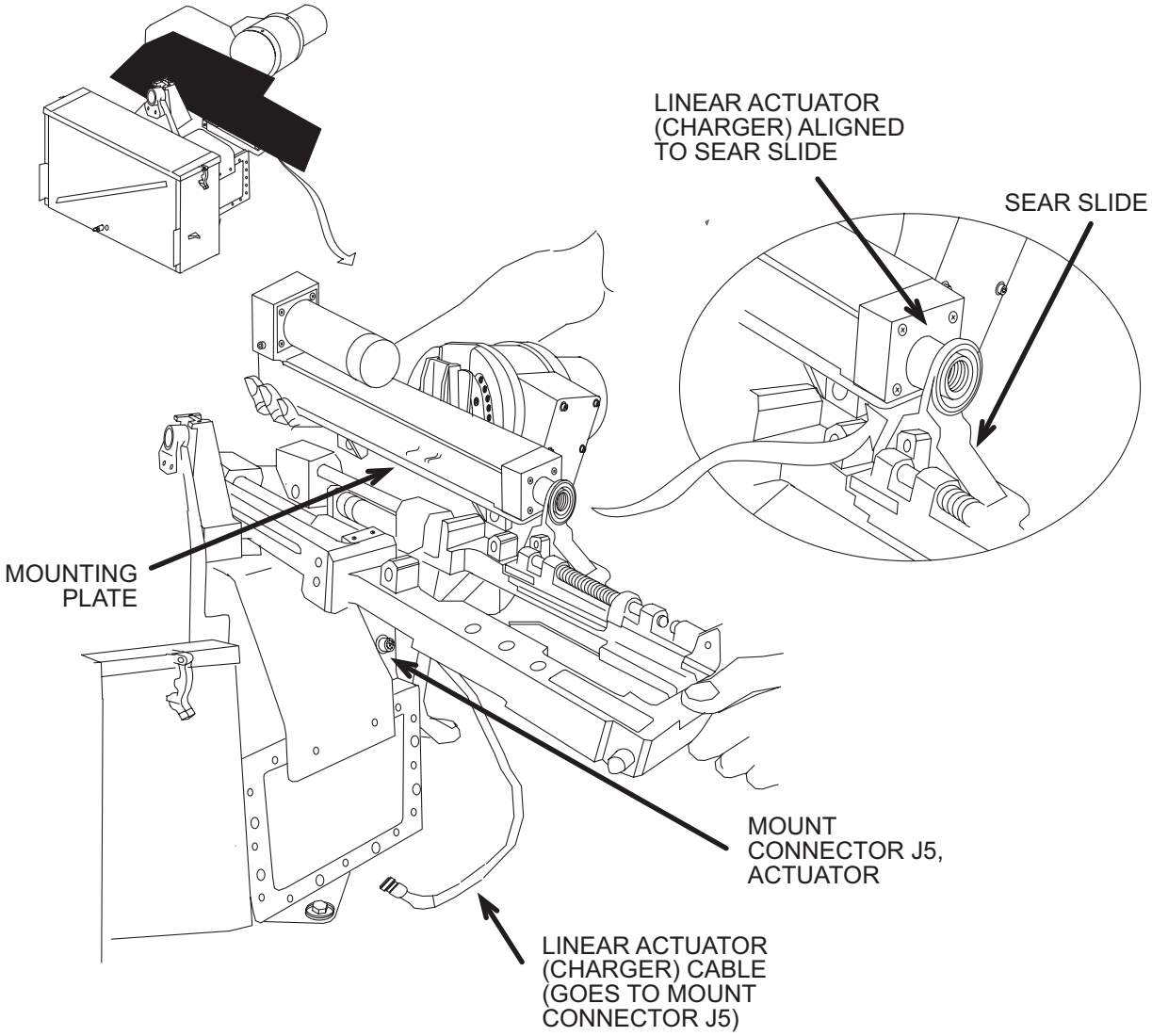


Figure 13. Linear Actuator (Charger) Installation (Shown from Ammo Yoke Arm Side).

6. Carefully align the actuator rod with the sear slide, as shown in Figures 13 and 14.

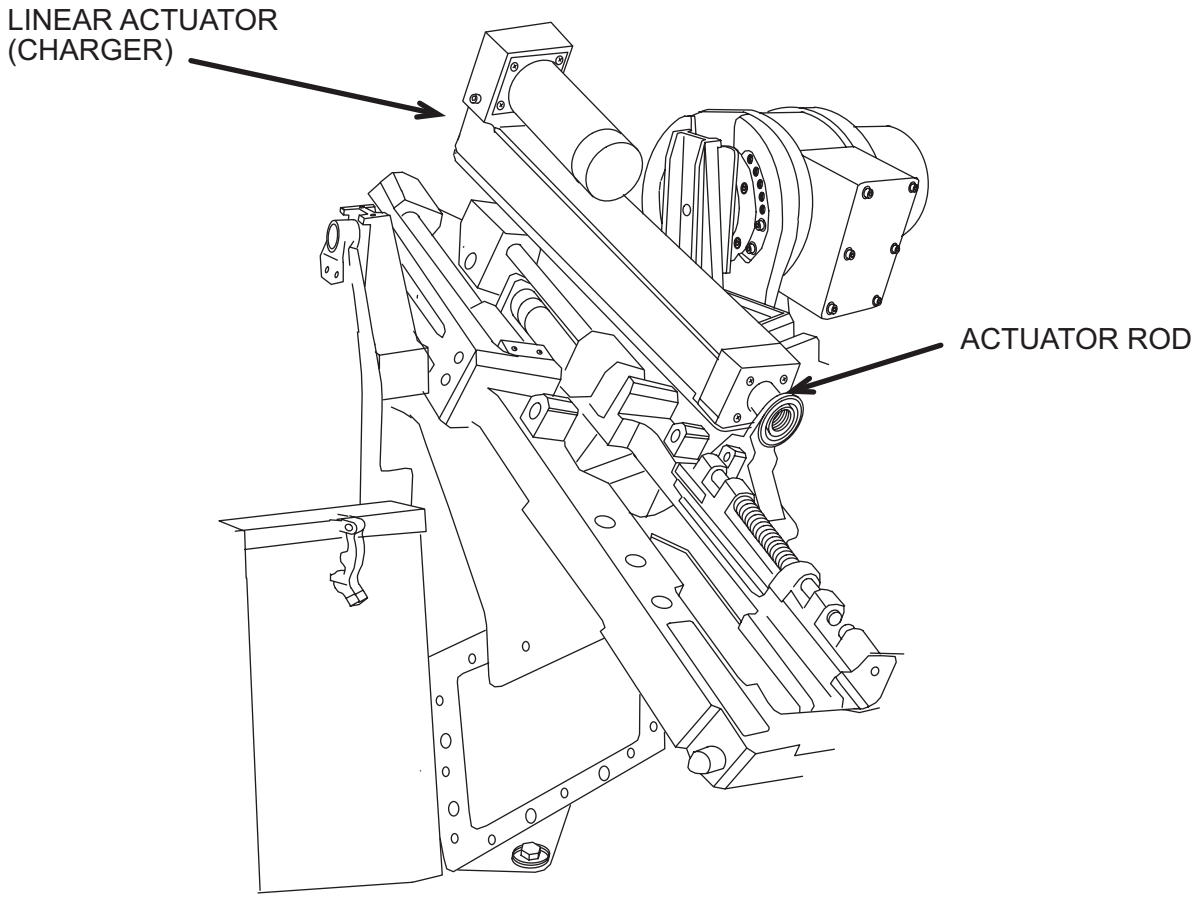


Figure 14. Actuator (Charger) Aligned with Sear Slide.

WAK AND WEAPON INSTALLATION - Cont

Linear Actuator (Charger) Assembly Installation - Cont

NOTE

The operator may need to gently push the sear assembly with sear slide slightly toward the linear actuator (charger) to ensure proper alignment and positioning for installation of the rod end.

Ensure that the rod end is installed on the rear side of the sear slide. The sear slide should be between the rod end and the linear actuator (charger) shaft.

7. Slide the actuator rod through the sear slide and ensure the linear actuator (charger) mounting plate is resting on the cradle. Attach the rod end to the actuator rod, as shown in Figure 15.

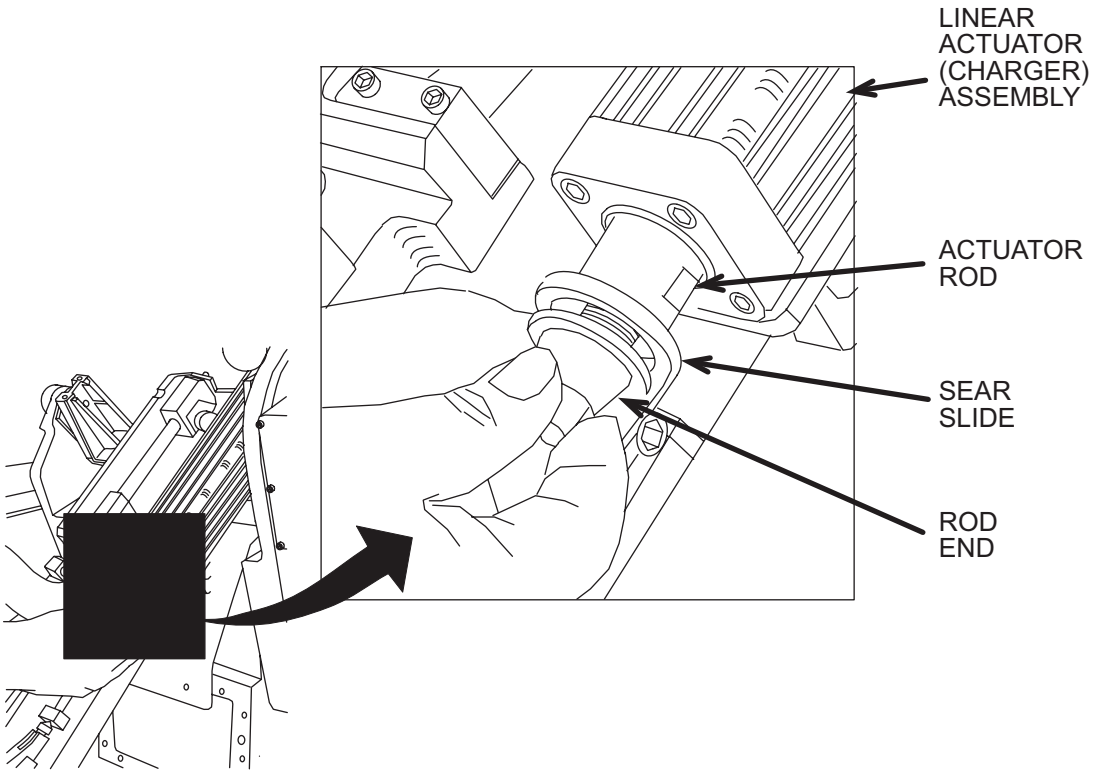


Figure 15. Attaching Rod End to Actuator (Charger) Shaft through Sear Slide.

CAUTION

When installing/removing the rod end, do not allow the actuator rod to move. Keep the actuator rod stationary. Failure to do so may result in equipment damage

8. Carefully tighten the rod end snugly using an adjustable wrench and a 1/2-inch wrench, as shown in Figures 16 and 17.

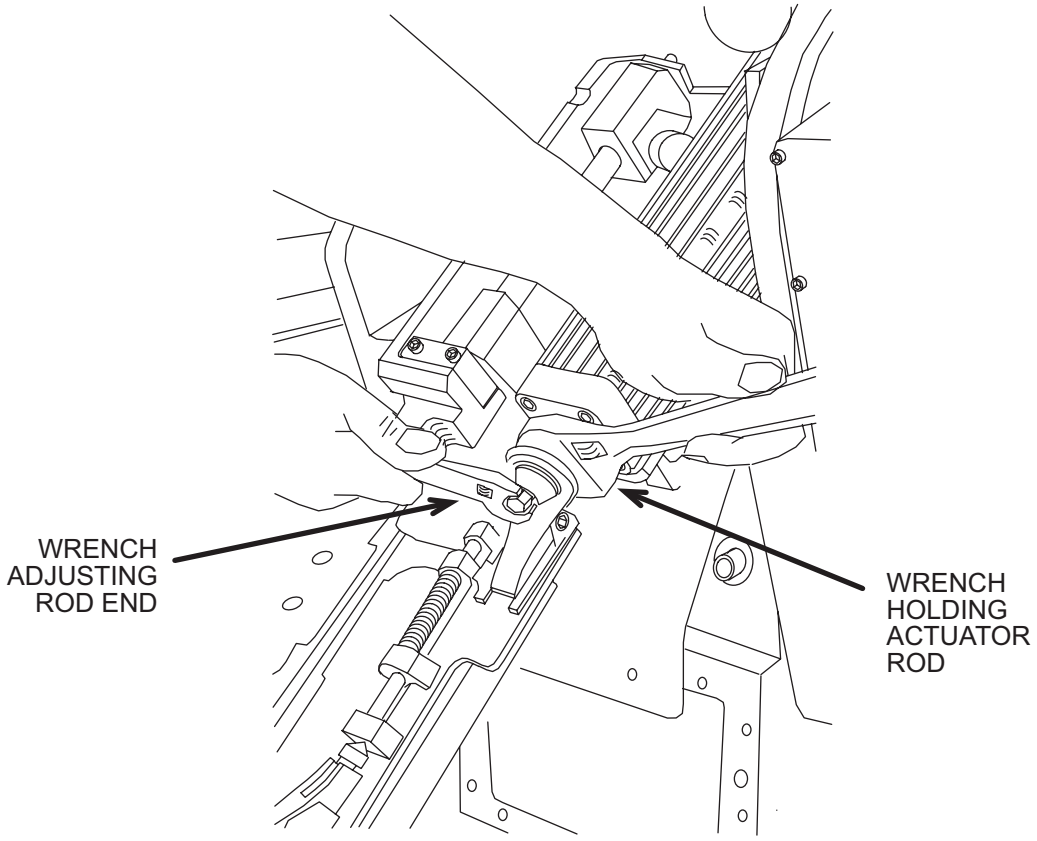


Figure 16. Tightening the Rod End.

WAK AND WEAPON INSTALLATION - Cont

Linear Actuator (Charger) Assembly Installation - Cont

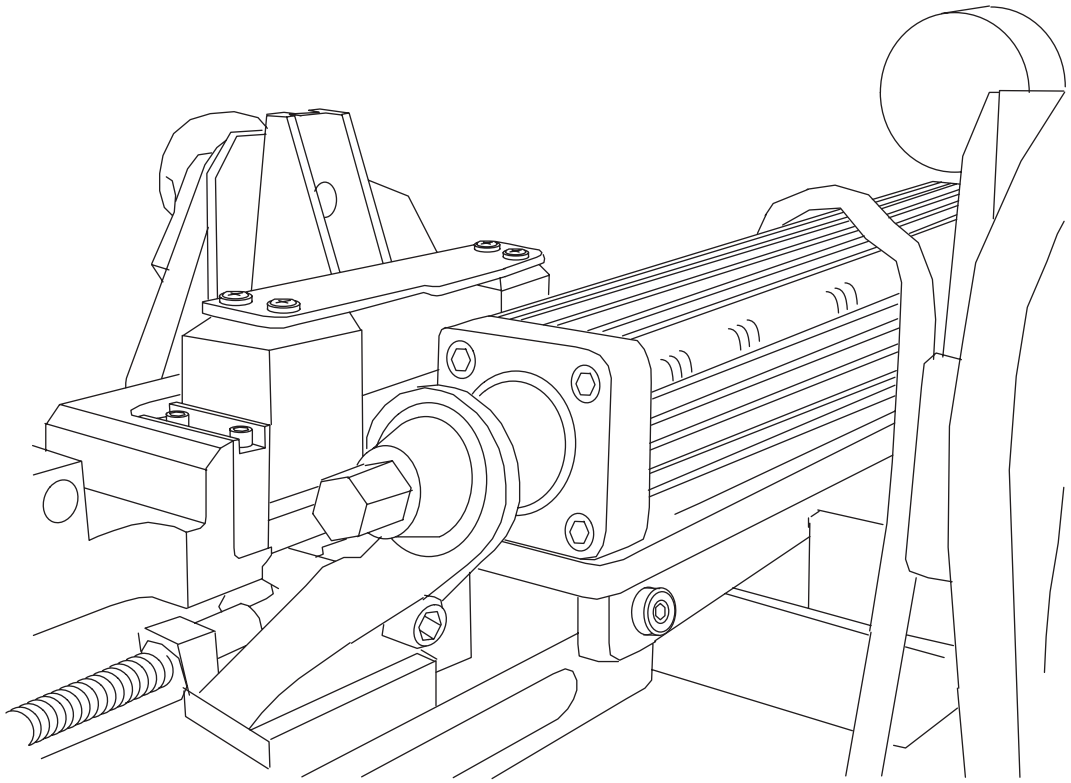


Figure 17. Rod End Installed on Linear Actuator (Charger) Assembly.

9. Align the holes in the tabs on the linear actuator (charger) mounting plate with the holes on the cradle.

10. Insert and tighten both bolts attaching the linear actuator (charger) to the cradle, using a 1/4-inch hex head wrench, as shown in Figures 18 and 19.

NOTE

For additional information on safety wire procedures, refer to WP 0031.

11. Once the bolts are tightened, safety wire the bolts to the mounting plate, referring to Figures 18 and 19.

    a. Once the bolts are in place, insert one leg of a piece of safety wire through the bolt and wrap the other leg around the outer rim of the bolt. Using twisting pliers, twist the wires together on the outside of the bolt.

    b. Insert one leg of the wire through the hole in the flange on the cradle and wrap the other leg of the wire on the outside of the flange.

    c. Connect and twist the wire on the other side of the flange from the bolt. Finish off the connection with a pigtail, trimming any excess wire with the wire cutters.

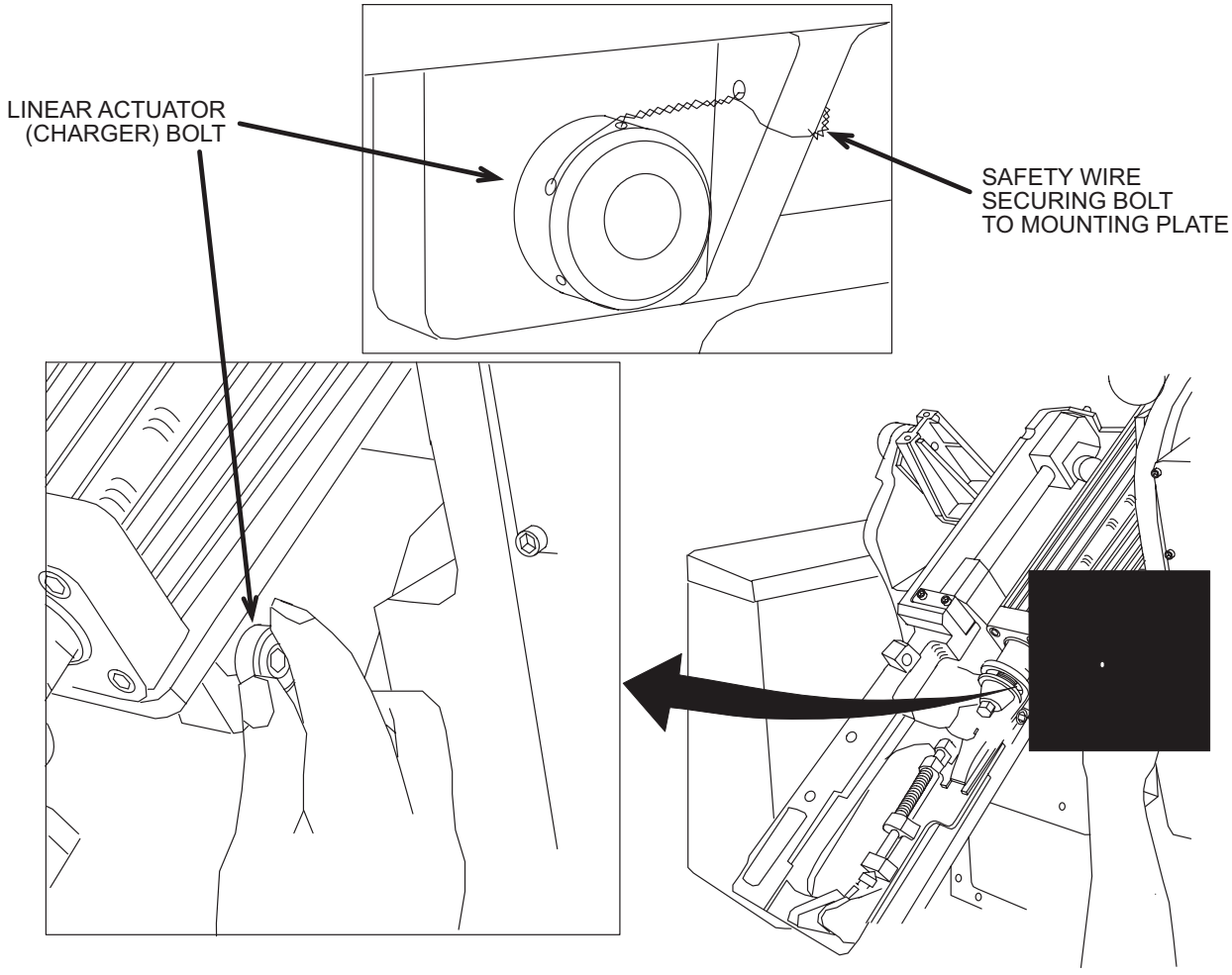


Figure 18. Bolt Securing Linear Actuator (Charger) to the Cradle (by Sear Slide).

WAK AND WEAPON INSTALLATION - Cont

Linear Actuator (Charger) Assembly Installation - Cont

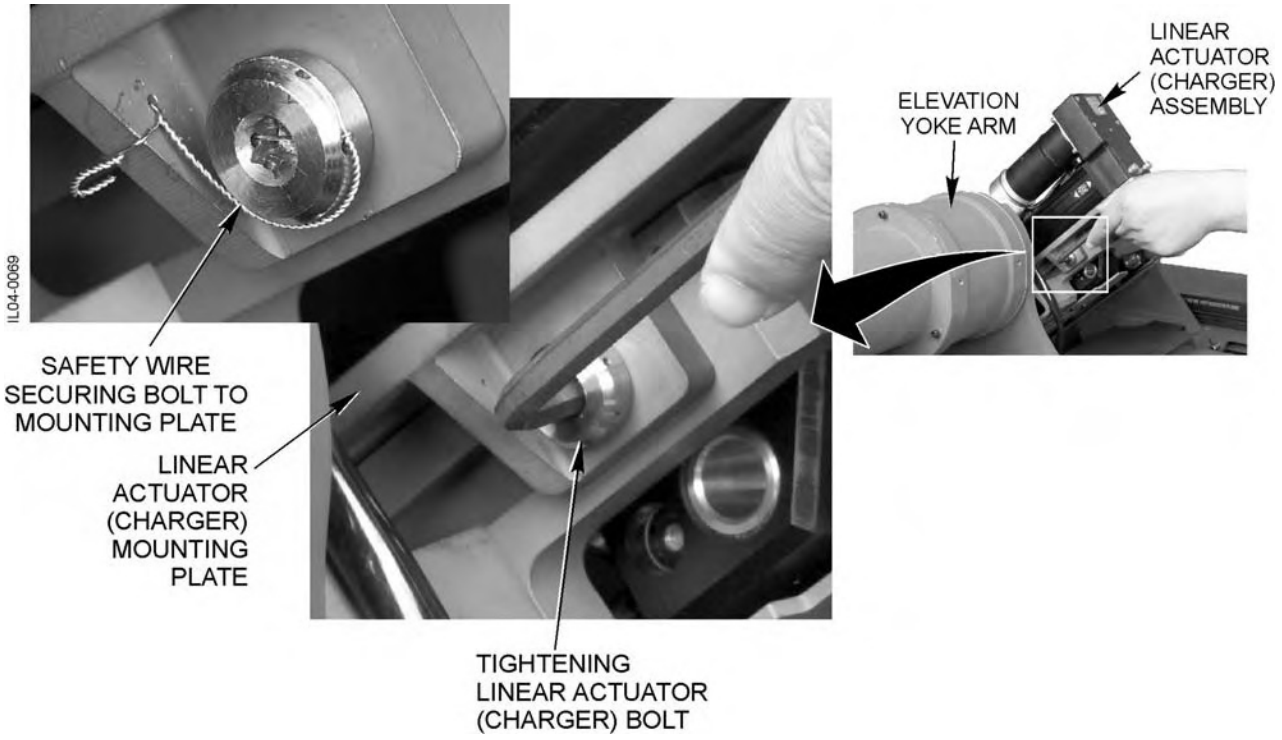


Figure 19. Bolt Securing Linear Actuator (Charger) to the Cradle at Far End of Cradle.

12. Ensure smooth action of the sear assembly by pushing and releasing the breech bolt lever, as demonstrated in Figure 20.

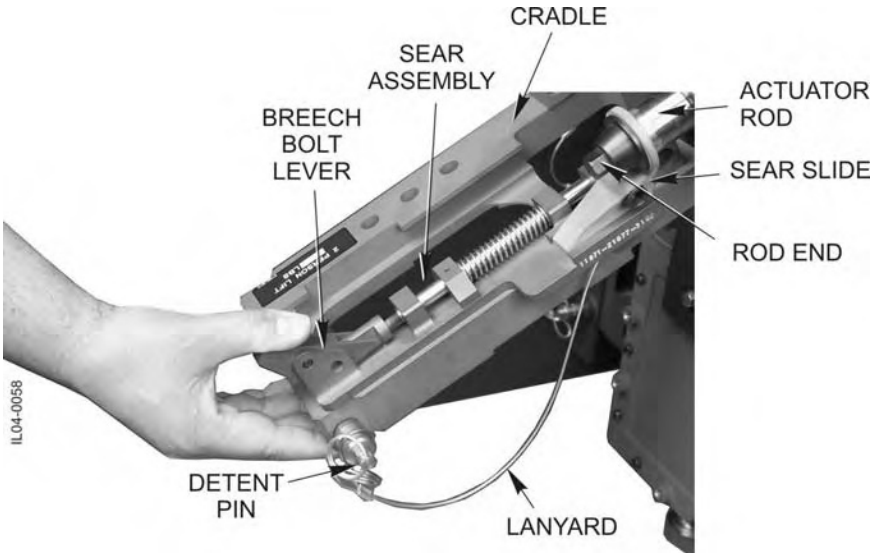


Figure 20. Checking the Performance of the Breech Bolt Pin Sear.

END OF TASK

Ammo Guide Installation

NOTE

For additional information about the ammo can, refer to the Ammo Can sections of WP 0006.

Perform the following procedures to attach the ammo guide to the pivot arm and ammo yoke arm.

NOTE

Each Nord-lock washer is a set of two washers.

1. Ensure CROWS system power is OFF.

2. Remove the bolt and Nord-lock washer set securing the pivot arm to the ammo yoke arm, using 7/16-inch socket wrench, as shown in Figure 21. Retain the attaching hardware for use in step 4.



Figure 21. Pivot Arm on Ammo Yoke Arm (Left Side).

WAK AND WEAPON INSTALLATION - Cont

Ammo Guide Installation - Cont

3. Align the pins and the ammo guide bracket with the holes on the pivot arm, as shown in Figure 22. Position the ammo guide and insert the bracket into the pivot arm.

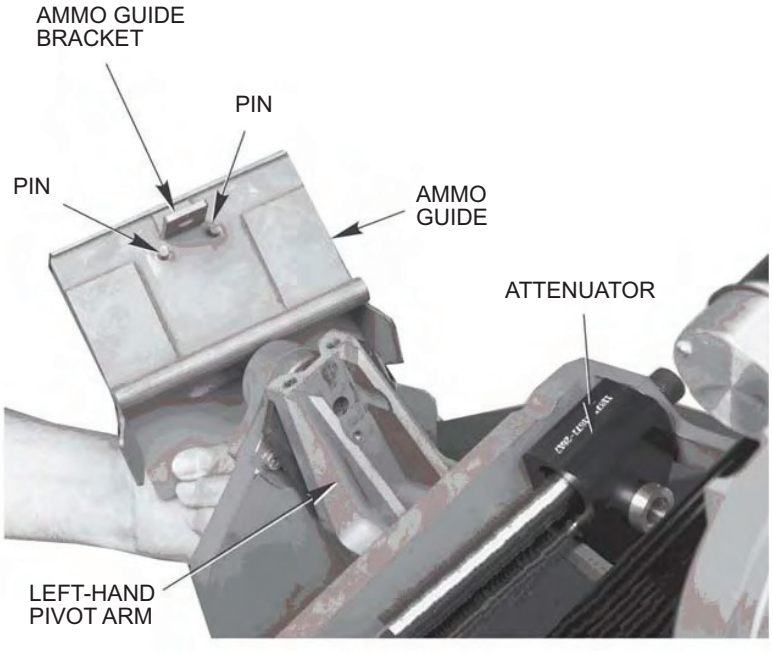


Figure 22. Positioning Ammo Guide onto the Right-Hand Pivot Arm.

NOTE

Each Nord-lock washer is a set of two washers. Ensure that the washer set is positioned so that the serrated edges face outward in both directions.

4. After inserting the ammo guide into the pivot arm, insert and tighten the bolt and Nord-lock washer set using the 7/16-inch socket wrench, as shown in Figure 23.

5. After inserting the ammo guide into the pivot arm, insert and tighten the bolt and lock washer to 65 +/-05 ft-lb using a torque wrench, as shown in Figure 23.

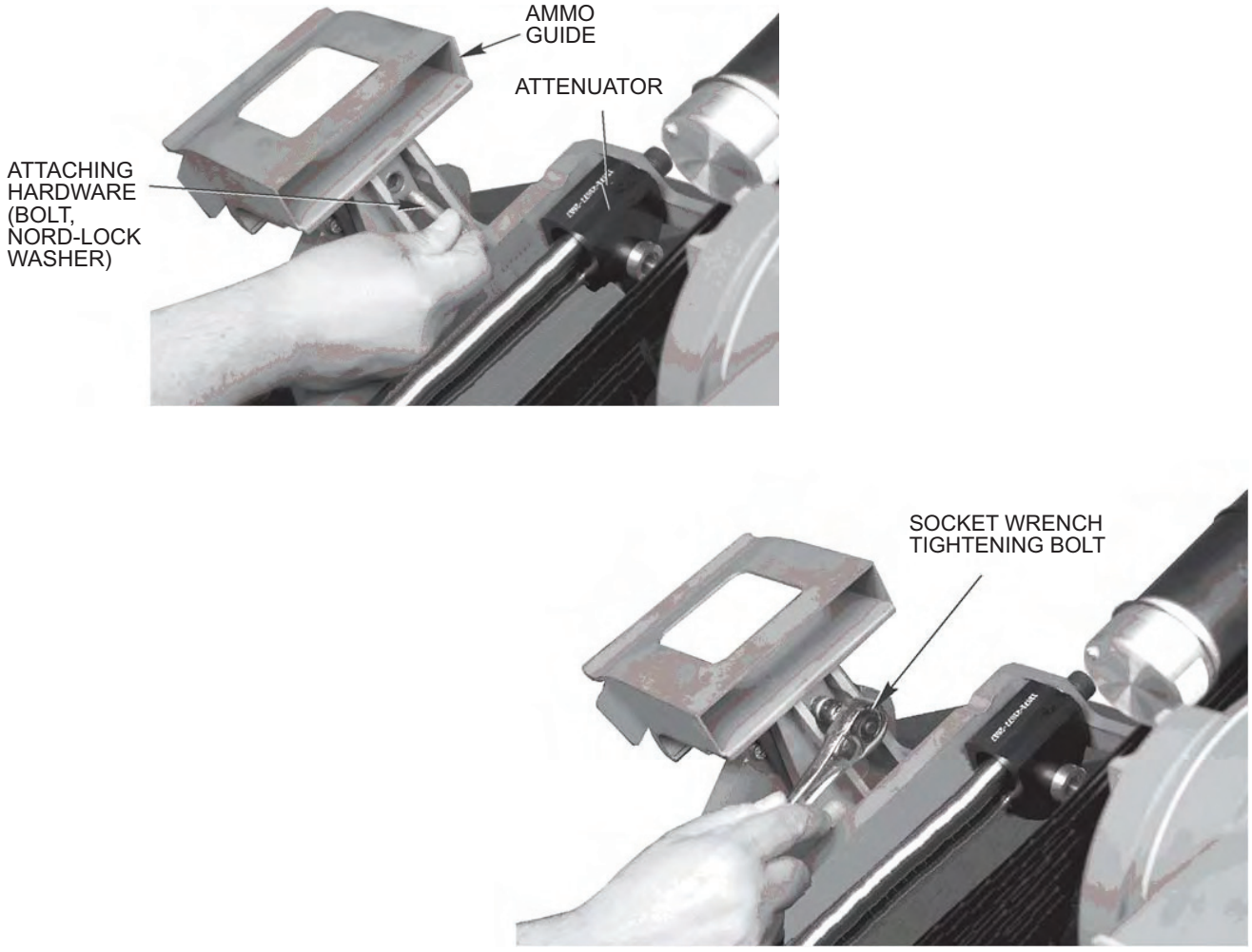


Figure 23. Inserting and Securing Attaching Hardware.

WAK AND WEAPON INSTALLATION - Cont

Ammo Guide Installation - Cont

6. Ensure the cradle is prepared, as shown in Figure 24, including the attenuators, sear assembly with sear slide, and ammo guide, before installation of the weapon and remaining adapter kit items.

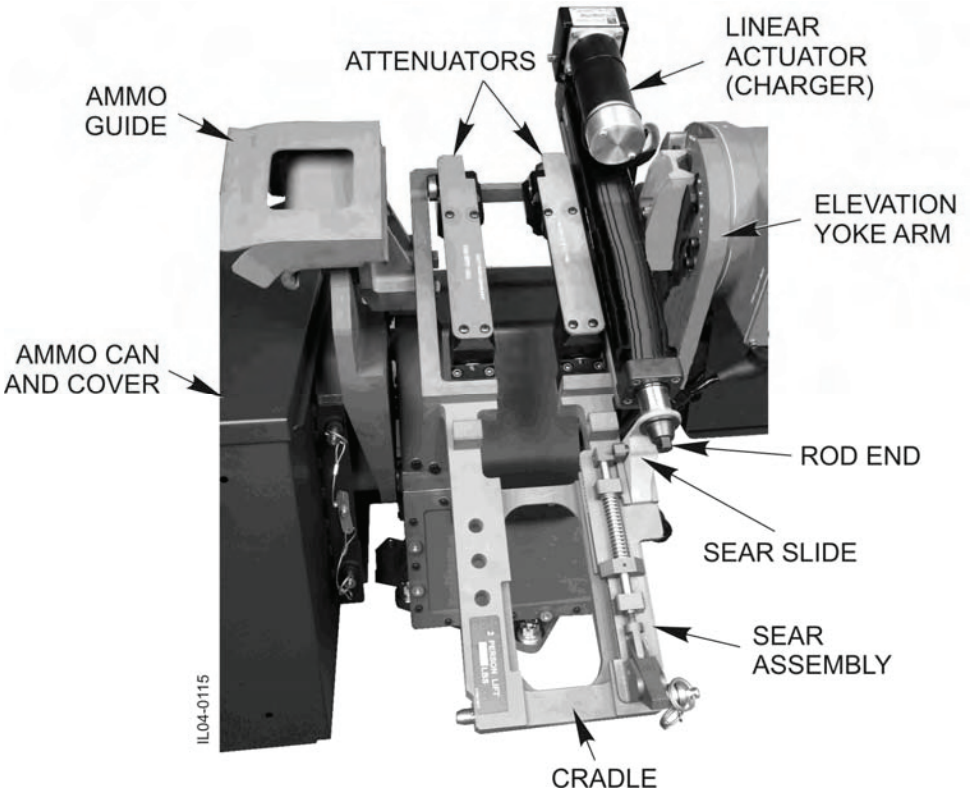


Figure 24. Initial M2 Adapter Kit Items in Place.

END OF TASK

Block Guide Assembly Installation

Perform the following procedure to install the block guide assembly on the M2 weapon.

WARNING

Follow all stated warnings and cautions when handling the weapons. Ensure that the weapon is cleared and any cleared rounds are secured before performing any procedures, unless specifically directed to load the weapon. (For instructions on clearing and loading the M2 weapon, refer to WP 0018.)

Use two personnel during installation of the cradle and M2 HB .50-cal machine gun.

Failure to follow these instructions may result in personal injury or equipment damage.

NOTE

The block guide assembly is installed on the bottom rear of the weapon, near the backplate.

Use of a straight shank, flat tip screwdriver (step 1) prevents the setscrew from being stripped out.

1. Loosen the setscrew, using the 1/4-inch, straight shank, flat tip screwdriver, and remove the pin from the block guide assembly, as shown in Figure 25.

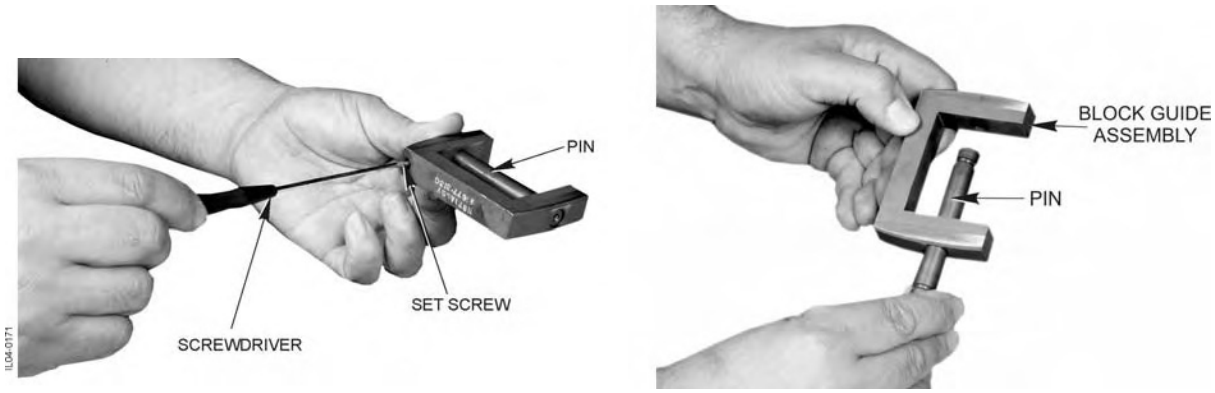


Figure 25. Block Guide Prepared for Installation on the Weapon.

2. Align the block guide to the bottom set of holes at the rear of the weapon with the open end of the block guide facing the barrel, as shown in Figure 26. Once the assembly is seated properly, secure it to the weapon by reinserting the block guide pin until it is flush on both sides.

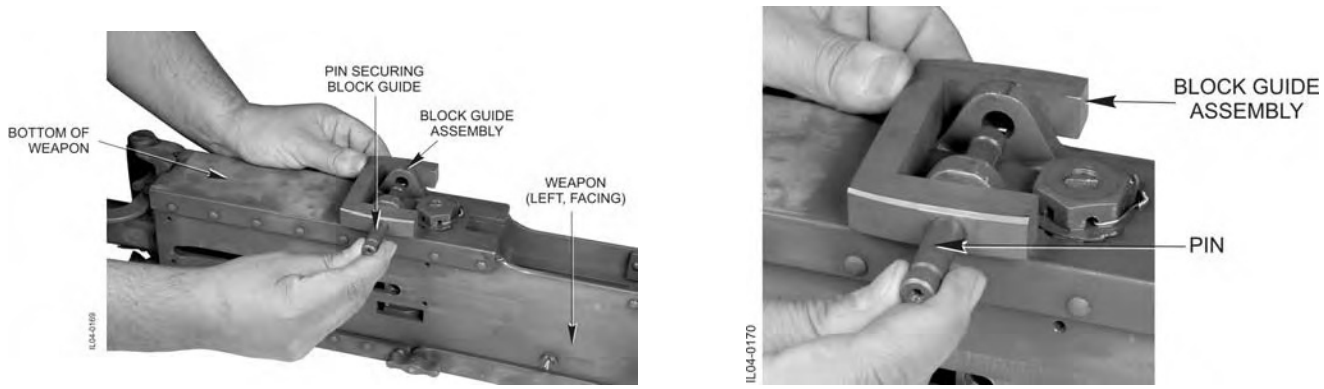


Figure 26. Block Guide Positioned and Attached to M2.

WAK AND WEAPON INSTALLATION - Cont

Block Guide Assembly Installation - Cont

3. Complete securing the block guide assembly to the weapon by tightening the setscrew using the 1/4-inch flat tip screwdriver as shown in Figure 27. Verify pin is secure.

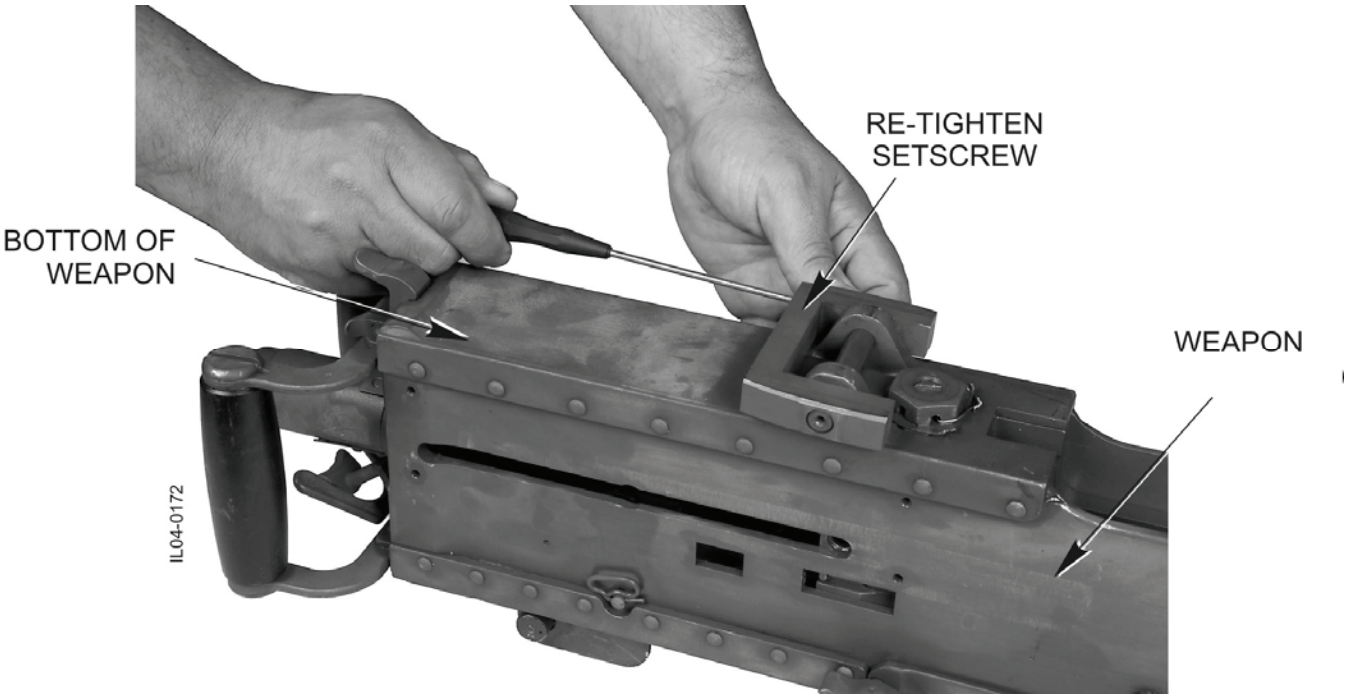


Figure 27. Setscrew Securing Block Guide Assembly to Weapon.

END OF TASK

Feed Throat Assembly Installation

Perform the following procedures to install the feed throat assembly onto the weapon.

NOTE

Use two personnel during this procedure to prevent the feed throat pawl springs from falling out when the weapon retaining pin is removed.

For weapon operation and maintenance, refer to TM 9-1005-213-10, Operator's Manual for the M2 HB .50-Cal Machine Gun, and TM 9-1005-213-23&P, Unit and Direct Support Maintenance Manual for the M2 HB .50-Cal Machine Gun, including Repair Parts and Special Tools List, listed in WP 0035, References.

1. Lift the weapon cover.

2. If present, remove any securing hardware (for example, cotter pin, safety wire, hitch pin) from the left-hand belt-holding pawl pin.

3. Press down the belt-holding pawl springs and remove the left-hand belt-holding pawl pin from the weapon (left side, facing).

4. While still holding down the belt-holding pawl springs, position the feed throat assembly on the weapon's left-hand side (facing), as shown in Figure 28.

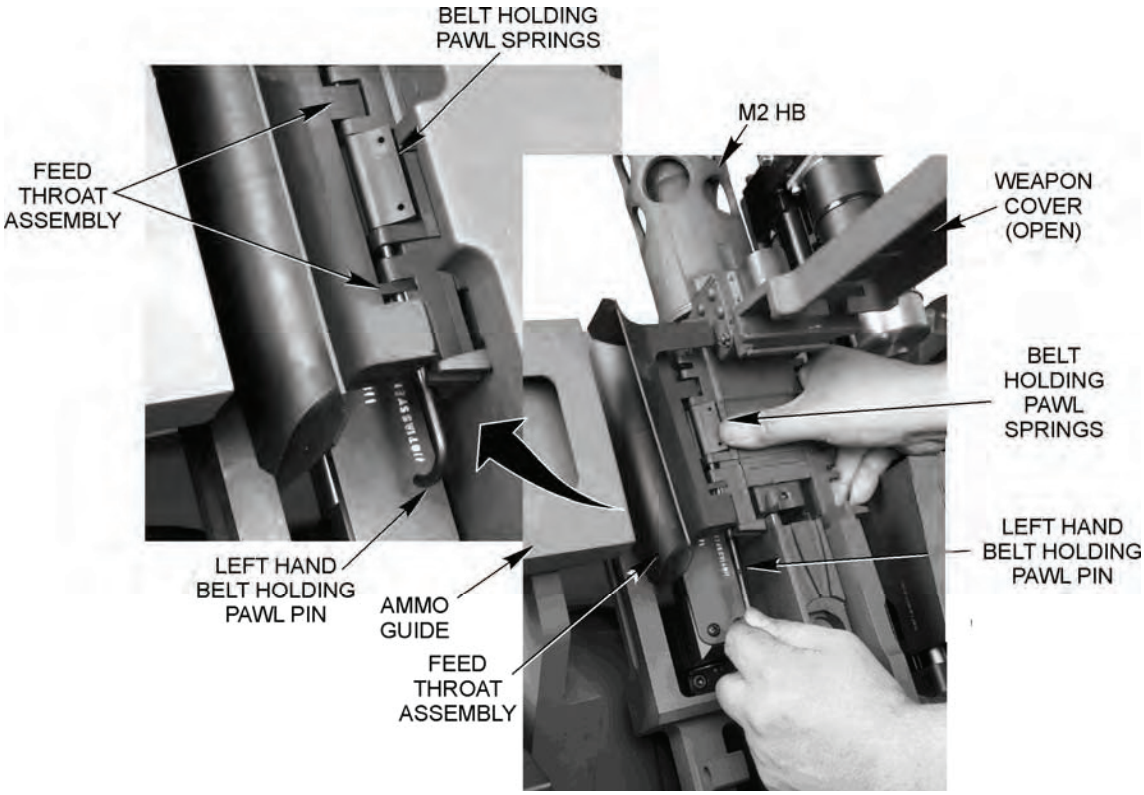


Figure 28. Weapon and Feed Throat Assembly.

5. Secure the feed throat assembly to the weapon by pushing the left-hand belt-holding pawl pin through the weapon alignment holes and the feed throat, referring to Figure 28.

6. Replace the securing hardware removed in step 2.

7. Close the weapon cover.

END OF TASK

WAK AND WEAPON INSTALLATION - Cont

Breech Bolt Pins and Weapon Charging Mechanism Installation

Perform the following procedures to install both breech bolt pins (short and long) and the retracting slide extension onto the weapon.

WARNING

Never remove the backplate assembly from any weapon until the chamber has been cleared and any cleared rounds are secured. Stand to one side of the weapon when removing the backplate.

Do not attempt to charge the M2 weapon without the backplate assembled to the weapon.

Ensure the breech bolt is in the forward position IAW TM 9-1005-213-10, Operator's Manual for the M2 HB .50-Cal Machine Gun.

Failure to follow these warnings may result in personal injury or equipment damage.

1. Ensure that the chamber has been cleared, any cleared rounds are secured, and the breech bolt is in the forward position by lifting the weapon cover.

2. Remove the backplate assembly by simultaneously pulling the latch lock, lifting the latch, and sliding the backplate up and off the weapon, as shown in Figures 29 through 31.

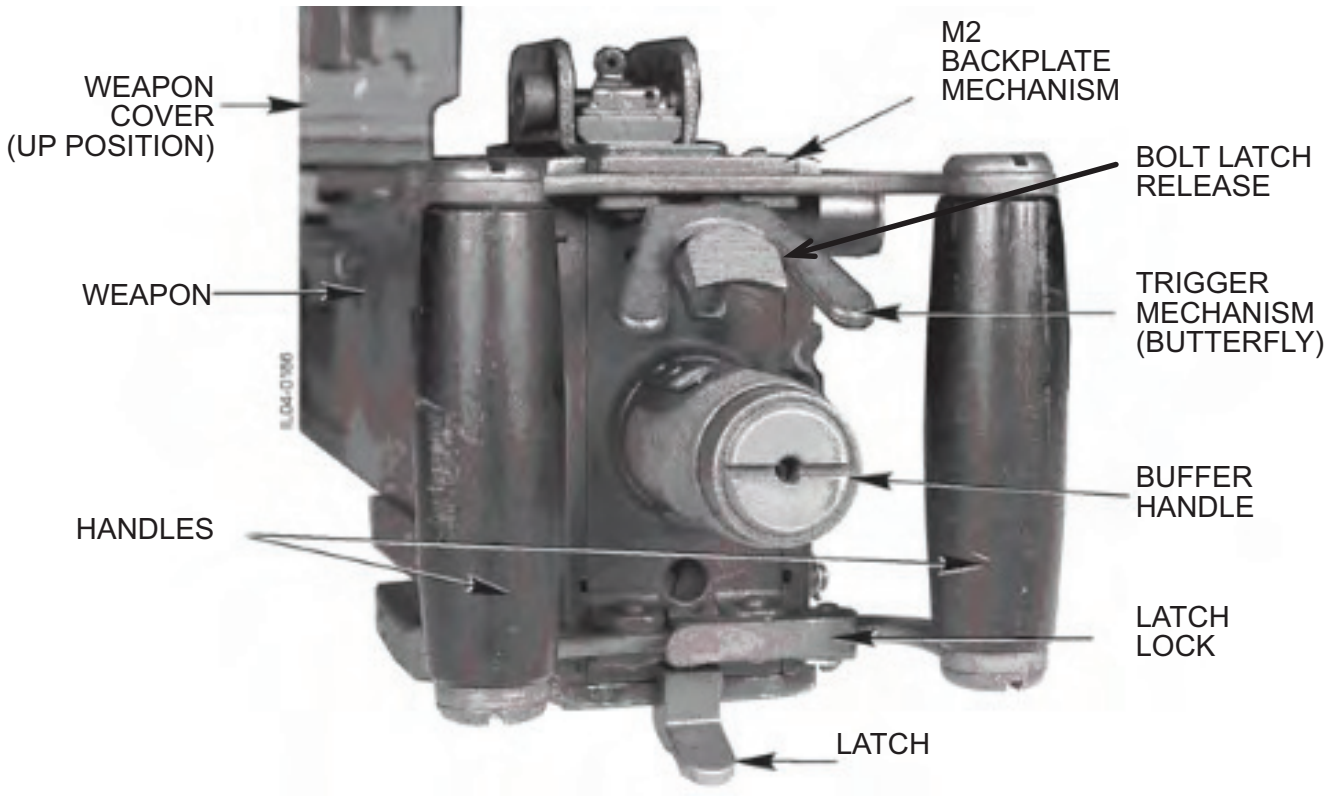


Figure 29. Backplate Assembly.

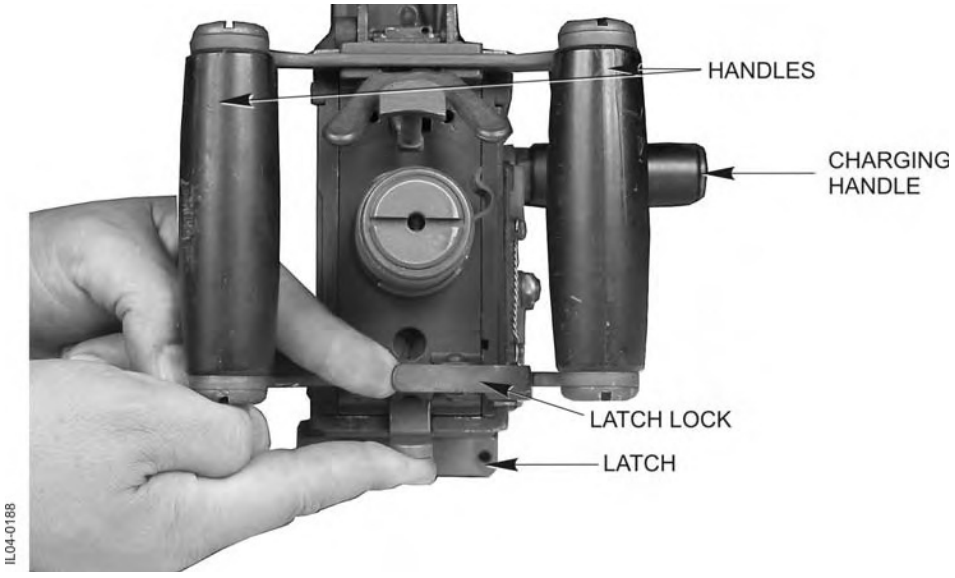


Figure 30. Latch and Latch Lock Releasing Backplate.

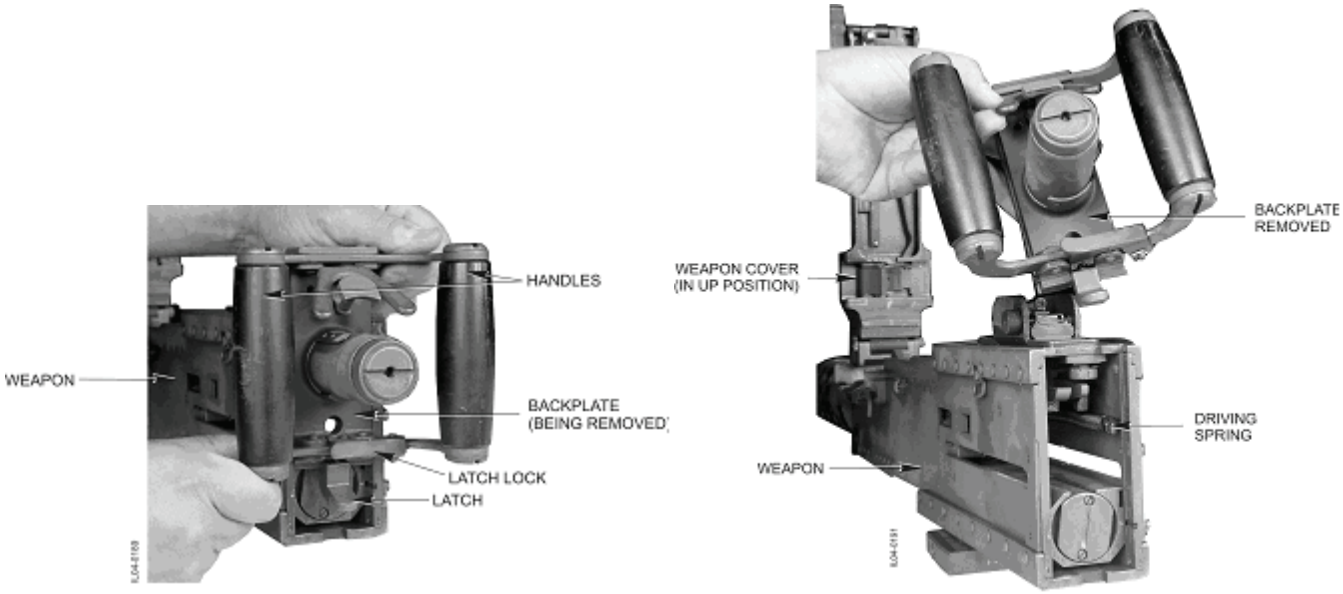


Figure 31. Lifting Backplate Off of M2.

WAK AND WEAPON INSTALLATION - Cont

Breech Bolt Pins and Weapon Charging Mechanism Installation - Cont

CAUTION

Do not stand behind the weapon while releasing the driving spring.

3. Disengage the driving spring from its detent hole as shown in Figures 32 through 34. (This action will release the charging handle so that it can be pulled back to insert the breech bolt pins.)

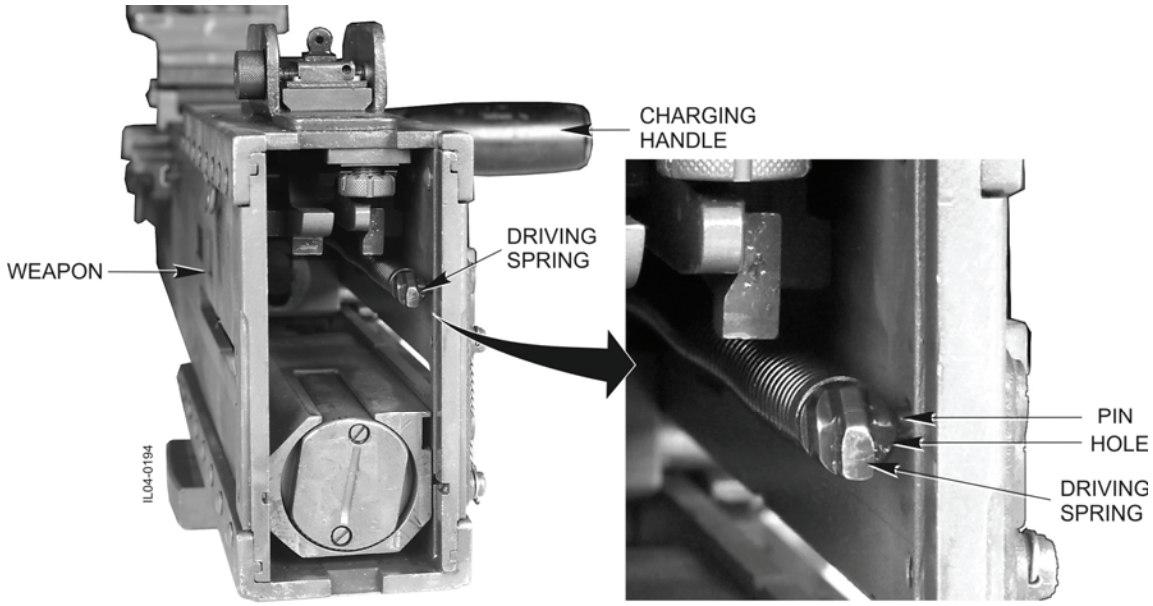


Figure 32. View Inside M2 Showing Driving Spring, Pin, and Retaining Hole.

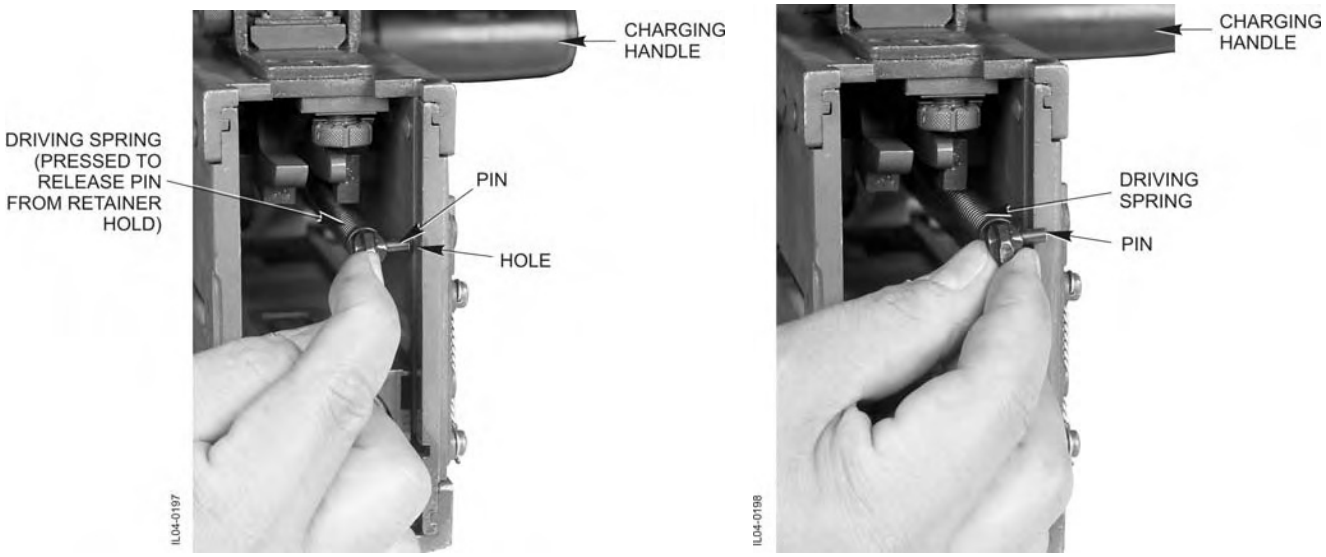


Figure 33. Pin Released from Retaining Hole.

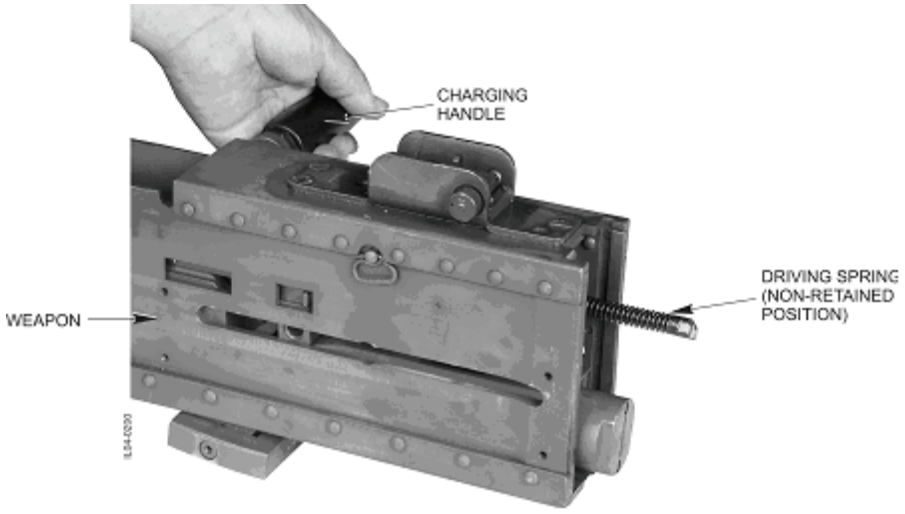


Figure 34. Driving Spring Released.

NOTE

Be sure that the short side of the breech bolt pin short faces out.

4. While moving the charging handle to the rear of the weapon (refer to Figure 34), install the breech bolt pin short on the left-hand side of the weapon, as shown in Figure 35. Return the charging handle to the forward position.

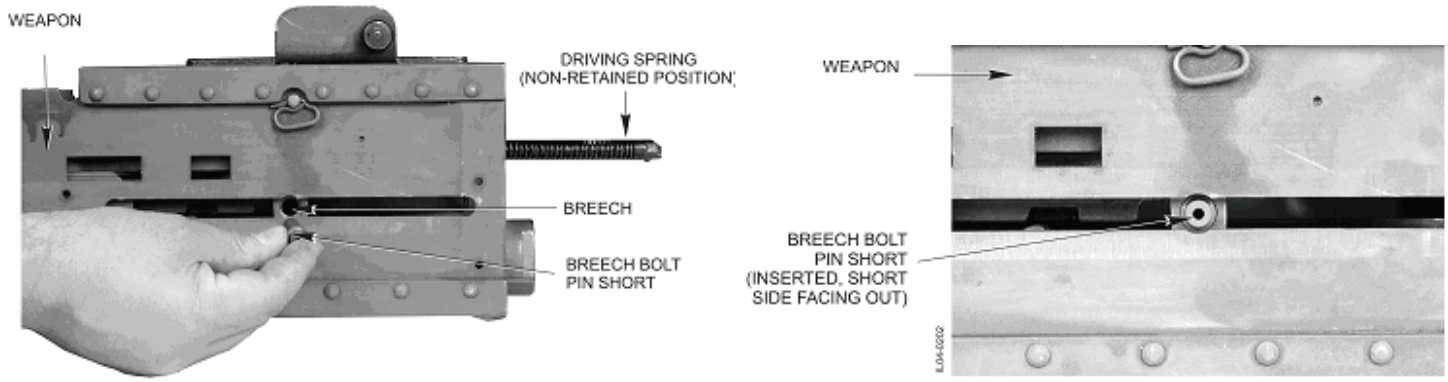


Figure 35. Breech Bolt Pin Short Inserted.

WAK AND WEAPON INSTALLATION - Cont

Breech Bolt Pins and Weapon Charging Mechanism Installation - Cont

NOTE

Be sure that the long side of the breech bolt pin long faces out.

5. Remove the original pin on the right-hand side (facing) of the weapon and replace it with breech bolt pin long, as shown in Figures 36 through 38. Retain the original pin in adapter kit box until weapon is restored to its original configuration.

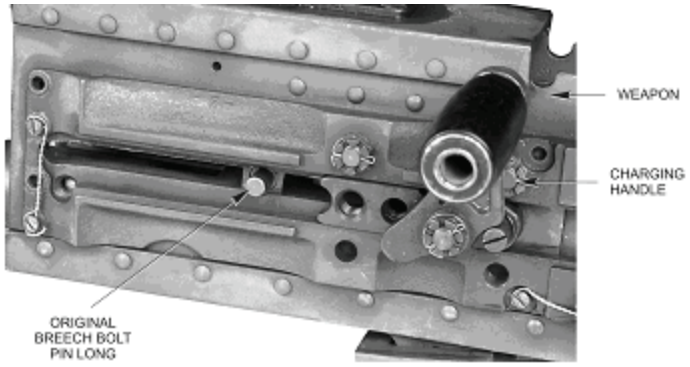


Figure 36. Original Breech Bolt with Charging Handle in Forward Position.

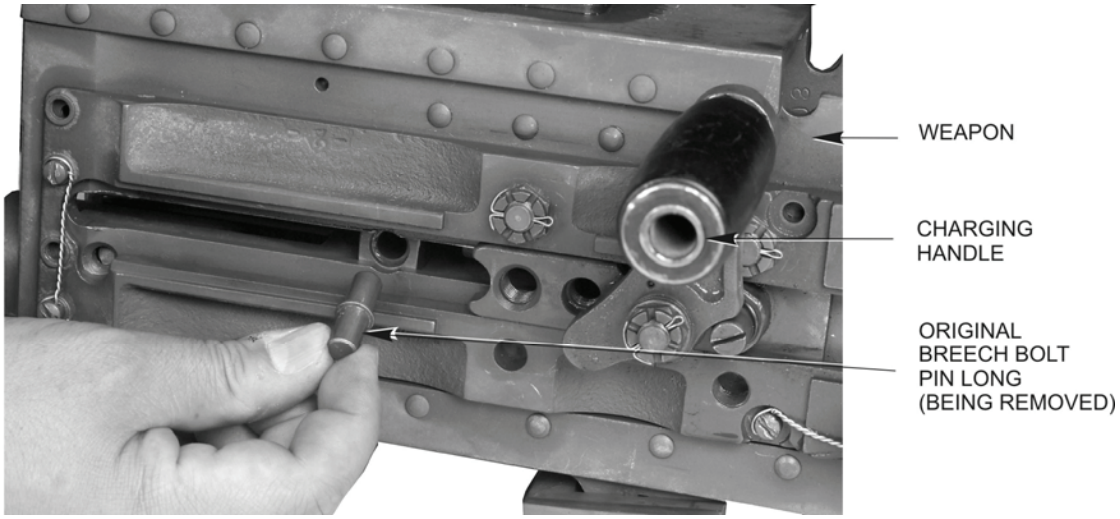


Figure 37. Original Breech Bolt Pin Long Being Removed.

6. Proceed to Retracting Slide Extension and Securing Bolts Installation section.

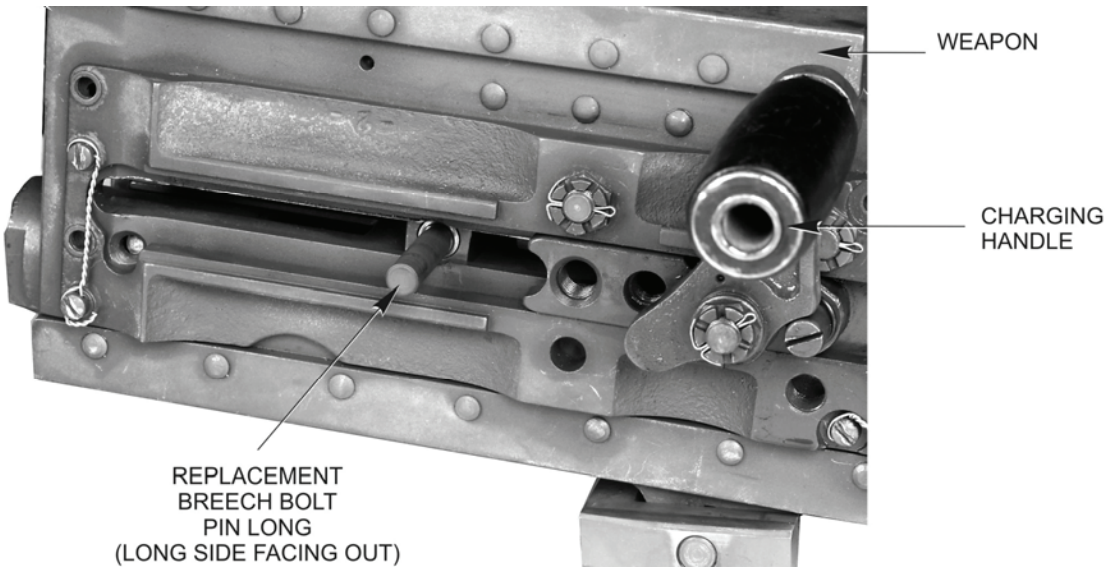


Figure 38. Replacement Breech Bolt Pin Long In Position.

END OF TASK

Retracting Slide Extension and Securing Bolts Installation

Perform the following procedure to install the retracting slide extension on the weapon.

1. Perform the Breech Bolt Pins and Weapon Charging Mechanism Installation (previous section).

2. Install and tighten the left-hand securing bolt onto the weapon using a 9 mm combination wrench, as shown in Figures 39 and 40.

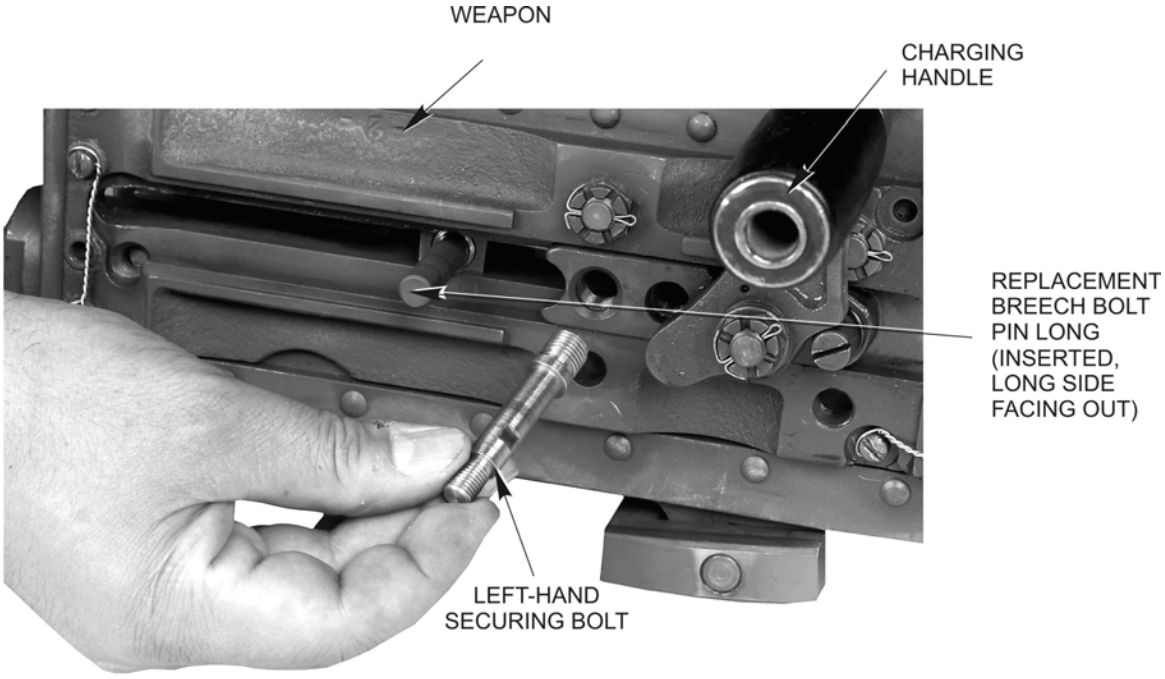


Figure 39. Left-Hand Securing Bolt in Position.

WAK AND WEAPON INSTALLATION - Cont

Retracting Slide Extension and Securing Bolts Installation - Cont

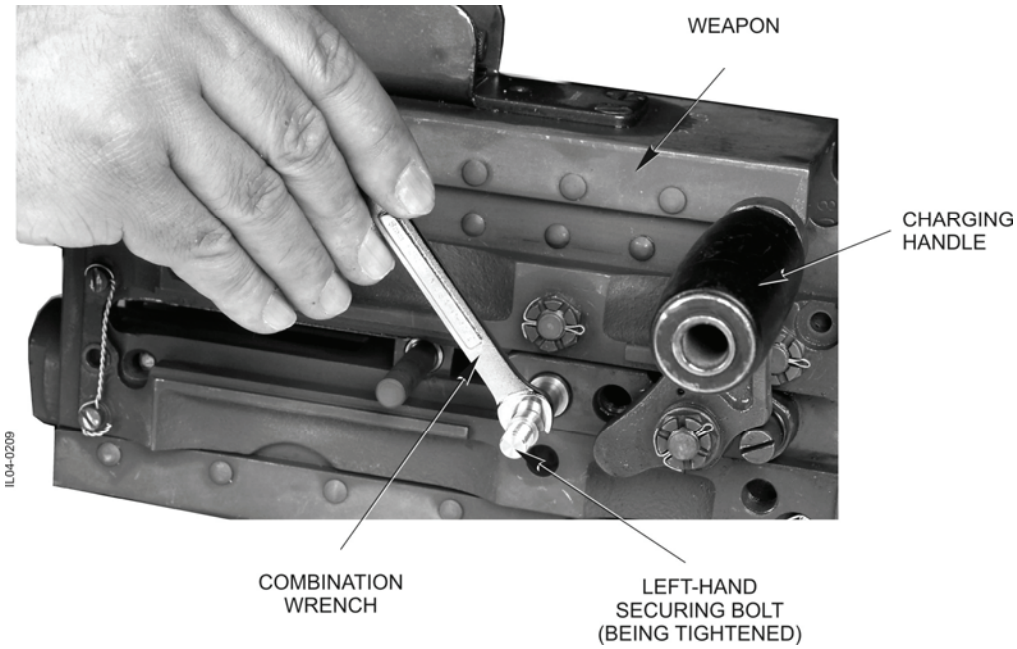


Figure 40. Left-Hand Securing Bolt Inserted and Tightened.

3. Position the countersunk hole of the retracting slide extension over the left-hand securing bolt, as shown in Figure 41.

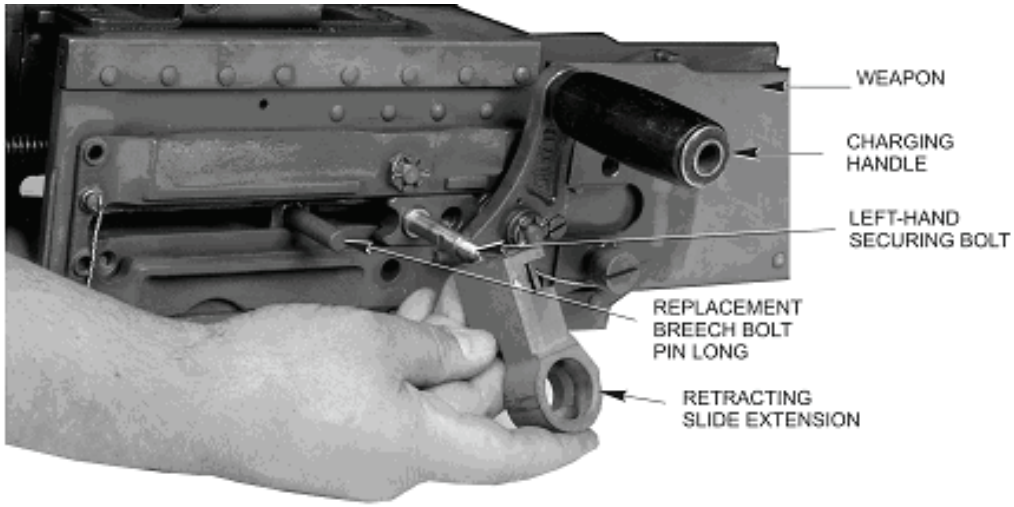


Figure 41. Retracting Slide Extension Positioned.

4. Once the retracting slide extension is fully seated, rotate the extension (clockwise) until it locks into the charging handle, as shown in Figures 42 and 43.

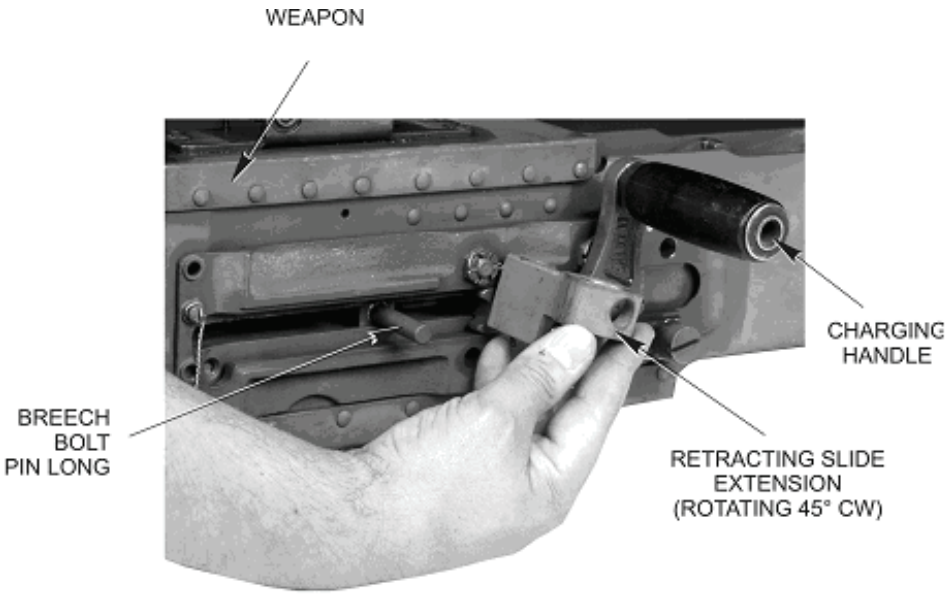


Figure 42. Retracting Slide Extension Being Rotated.

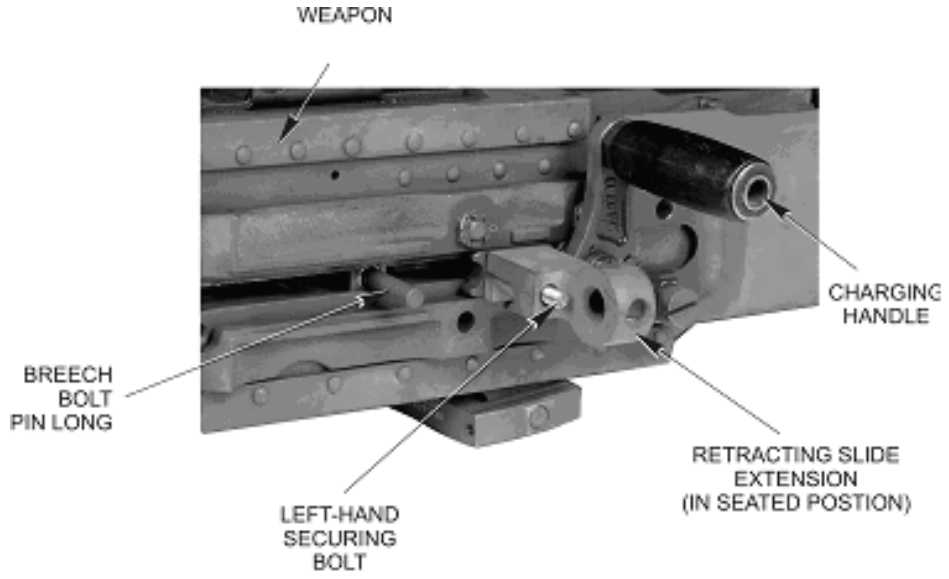


Figure 43. Retracting Slide Extension in Position.

WAK AND WEAPON INSTALLATION - Cont

Retracting Slide Extension and Securing Bolts Installation - Cont

5. Once the retracting slide extension is in position, install the right-hand securing bolt through the hole on the end of the retracting slide extension, as shown in Figure 44. Using a 5/16-inch hex head wrench, tighten the right-hand securing bolt.

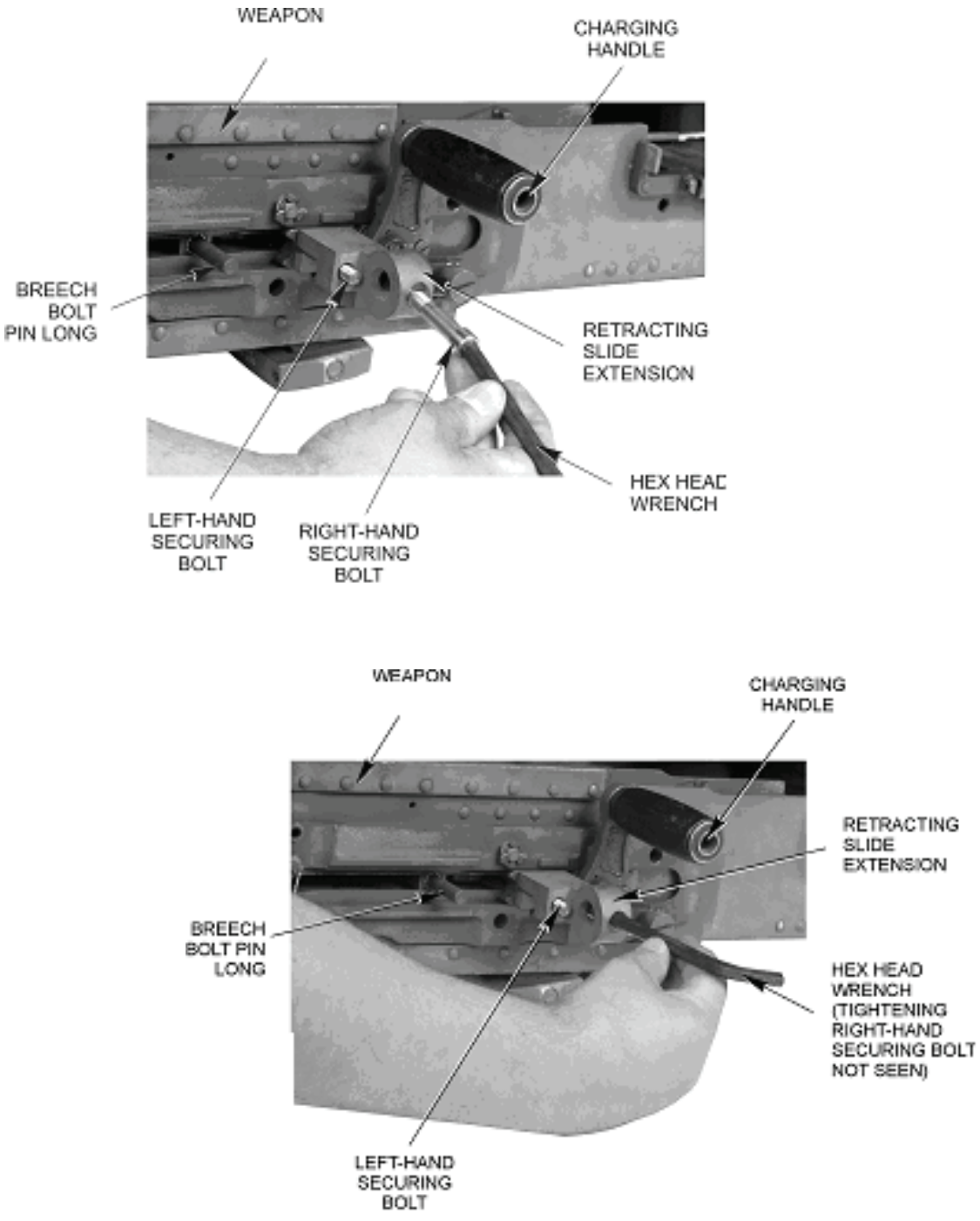


Figure 44. Right-Hand Securing Bolt Positioned and Secured Into Extension.

6. Attach the locking long nut to the left-hand securing bolt using a 12 mm combination wrench, as shown in Figure 45.

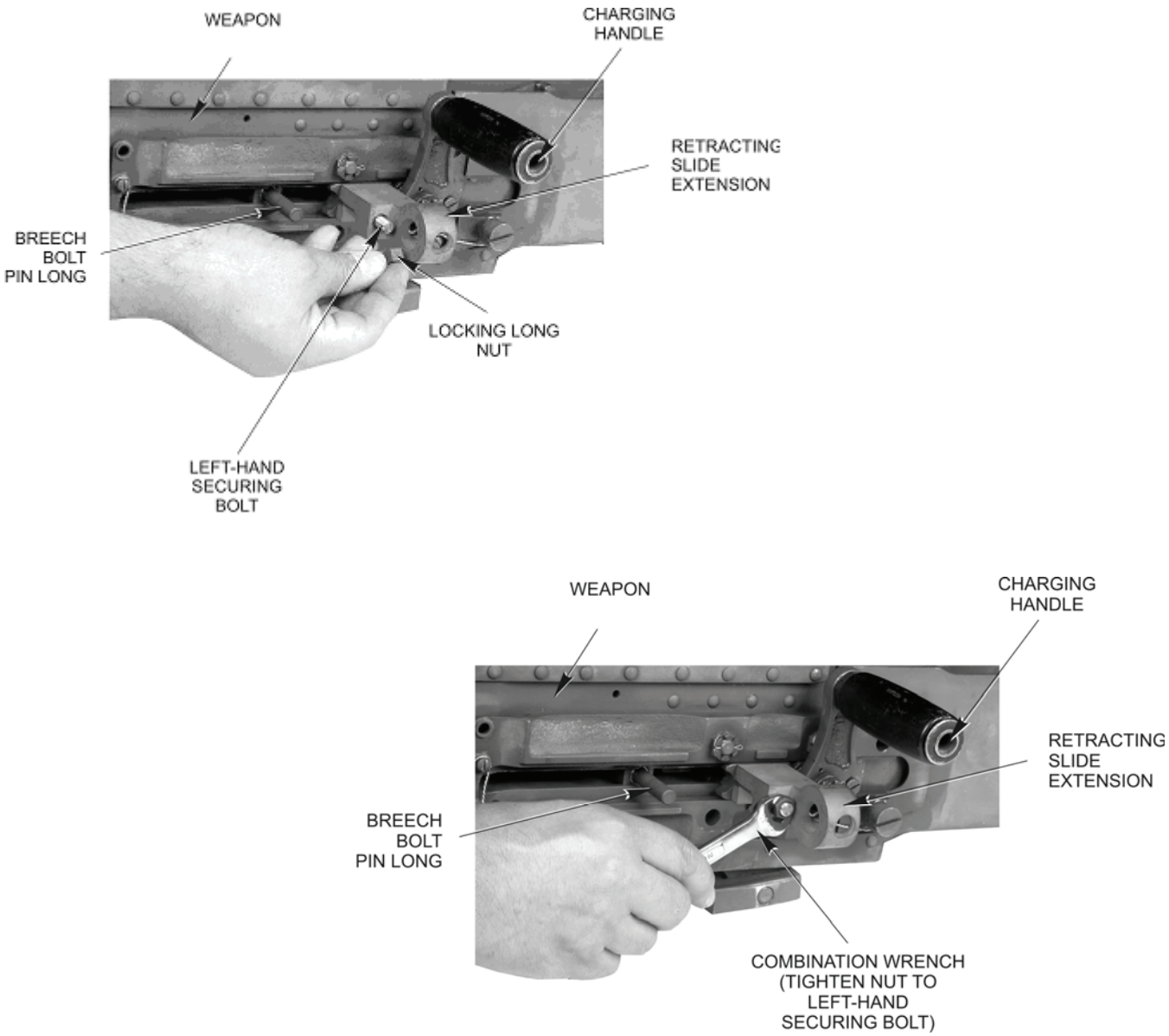


Figure 45. Securing Left-Hand Securing Bolt with Long Locking Nut.

WAK AND WEAPON INSTALLATION - Cont

Retracting Slide Extension and Securing Bolts Installation - Cont

WARNING

Do not attempt to charge the M2 weapon without the backplate assembled to the weapon.

Ensure the breech bolt is in the forward position IAW TM 9-1005-213-10, Operator's Manual for the M2 HB .50-Cal Machine Gun.

Failure to follow these warnings may result in personal injury or equipment damage.

NOTE

Refer to Breech Bolt Pins and Weapon Charging Mechanism Installation section of this work package for additional information on the backplate assembly.

7. Reposition the weapon driving spring into its retaining hole, as shown in Figure 46.

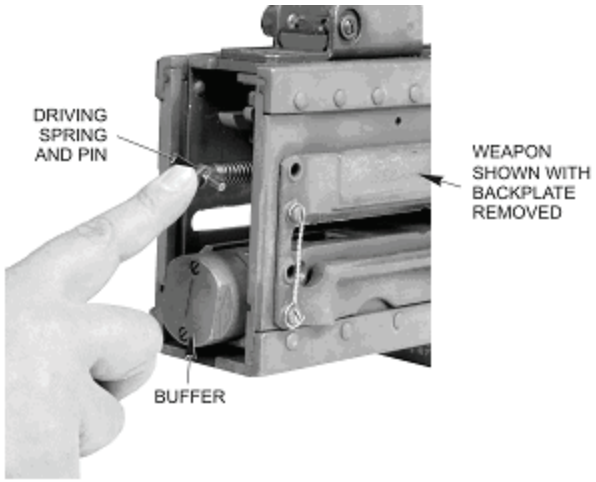


Figure 46. Pushing Driving Spring and Pin Into Weapon to Secure in Retaining Hole.

8. Reposition buffer into weapon, moving the charging handle until the buffer slides into position, as shown in Figure 47.

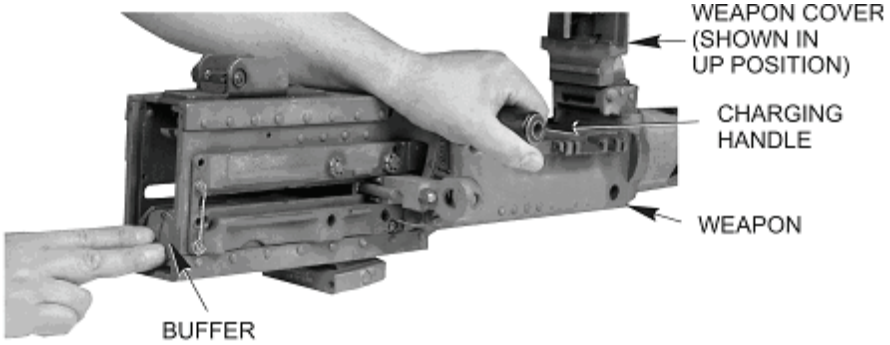


Figure 47. Buffer Repositioned in Weapon Using Charging Handle.

9. Replace the backplate assembly by simultaneously pulling the latch lock, lifting the latch, and sliding the backplate down onto the weapon, as shown in Figures 48 through 50.
10. Close the weapon cover.

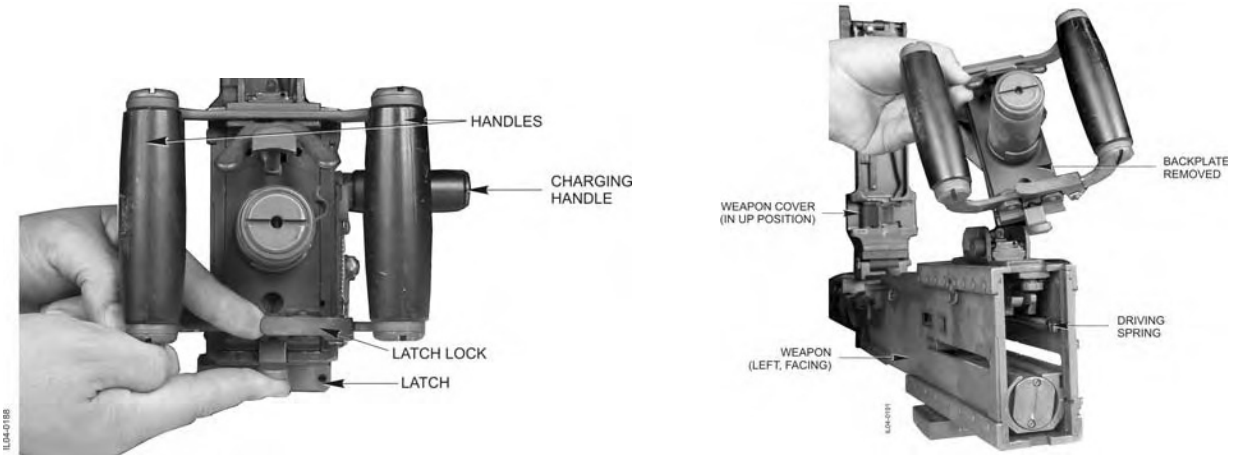


Figure 48. Latch and Latch Lock Lifted to Position Backplate Assembly.

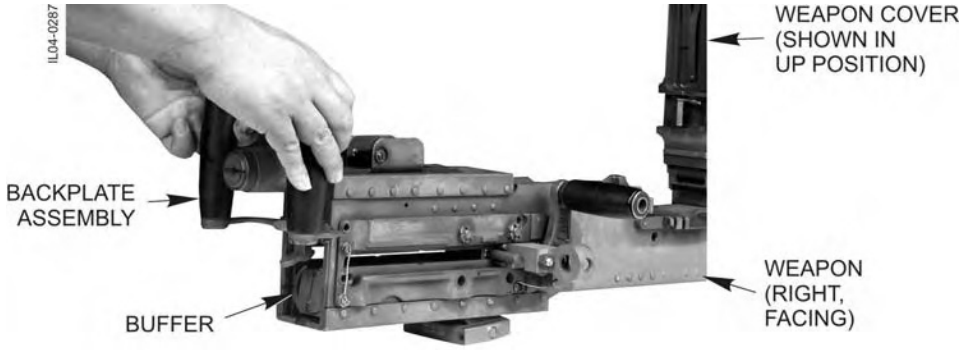


Figure 49. Sliding Backplate Assembly onto Weapon.

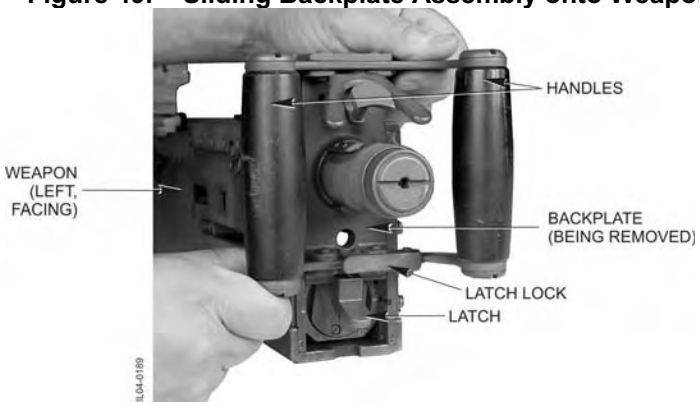


Figure 50. Backplate Assembly Positioned.

END OF TASK

WAK AND WEAPON INSTALLATION - Cont

Remote Firing Assembly (RFA) Installation

Perform the following procedures to install the RFA on the left side (facing) of the weapon.

1. Remove the safety wiring, if needed, and the two screws from the RFA using a 5/32-inch hex head wrench, as shown in Figure 51.

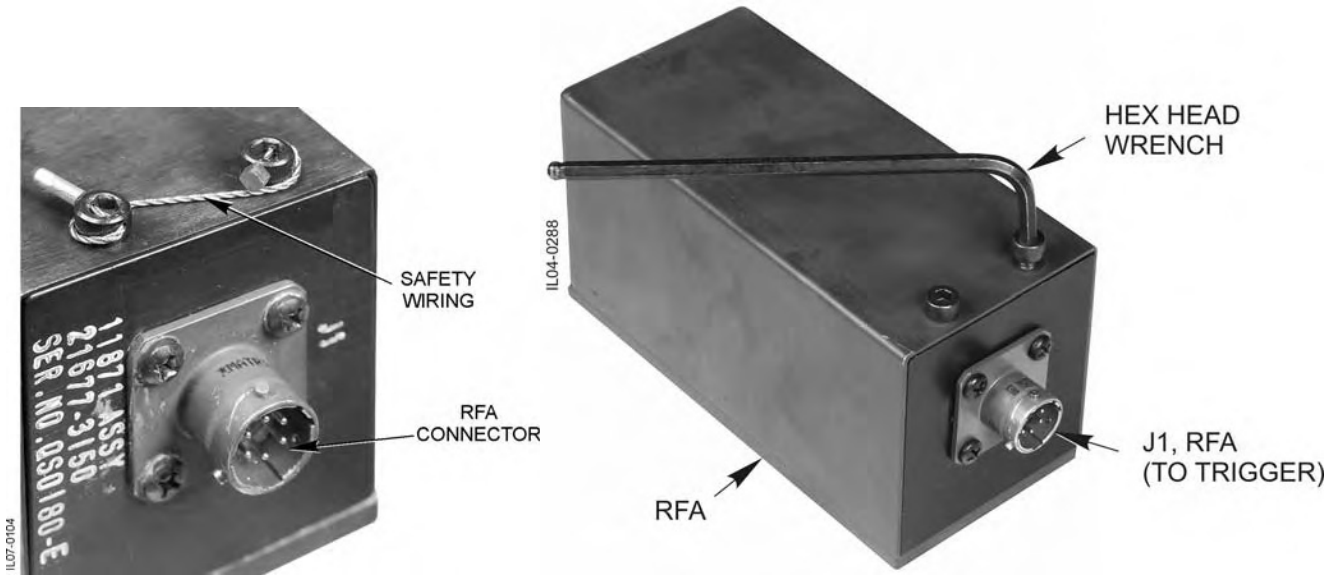


Figure 51. RFA with Cover (Shown with and without Safety Wiring.

NOTE

The interior of the RFA may vary depending on configuration.

2. Slide the cover off the RFA, as shown in Figure 52.

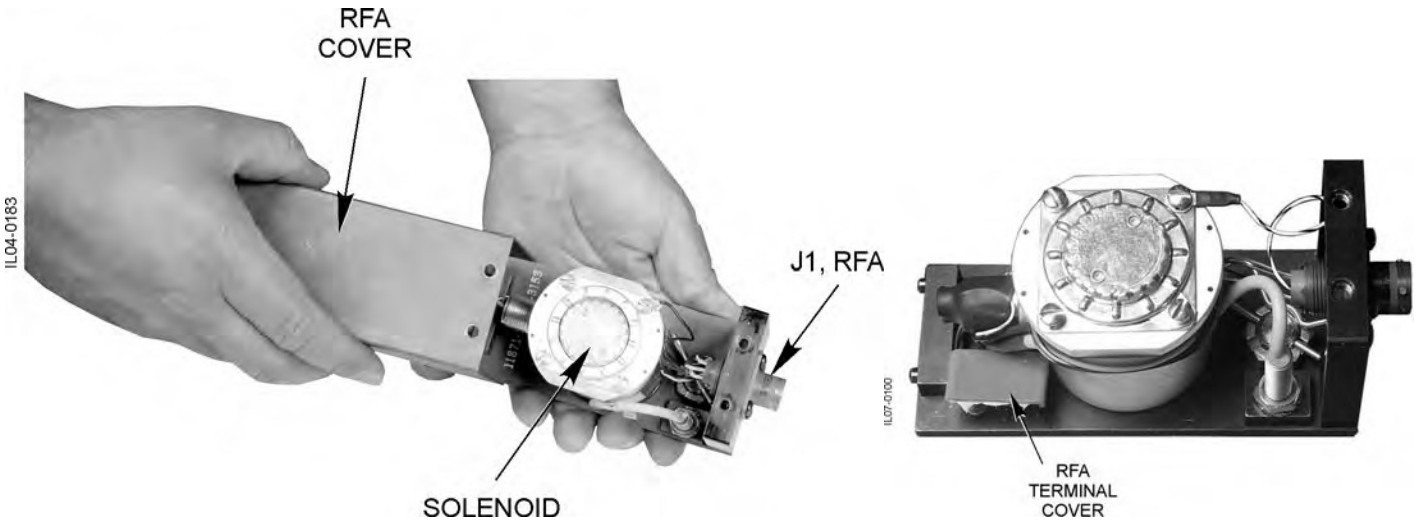


Figure 52. RFA Cover Removed.

CAUTION

Do not damage exposed wires during installation of the RFA. Failure to do so may result in equipment damage.

3. Using the needle-nose pliers, remove the hitch pin. Then, using the 19 mm combination wrench, loosen the castellated nut, as shown in Figure 53.

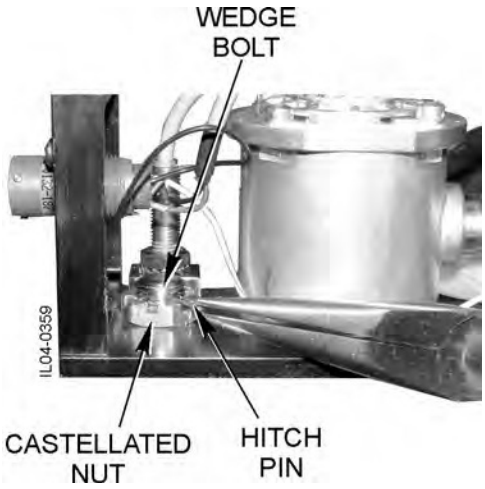


Figure 53. Removing Hitch Pin and Loosening Castellated Nut.

4. With connector J1 facing to the rear of the weapon, insert the RFA wedge bolt into the wedge slot on the weapon, as shown in Figure 54.

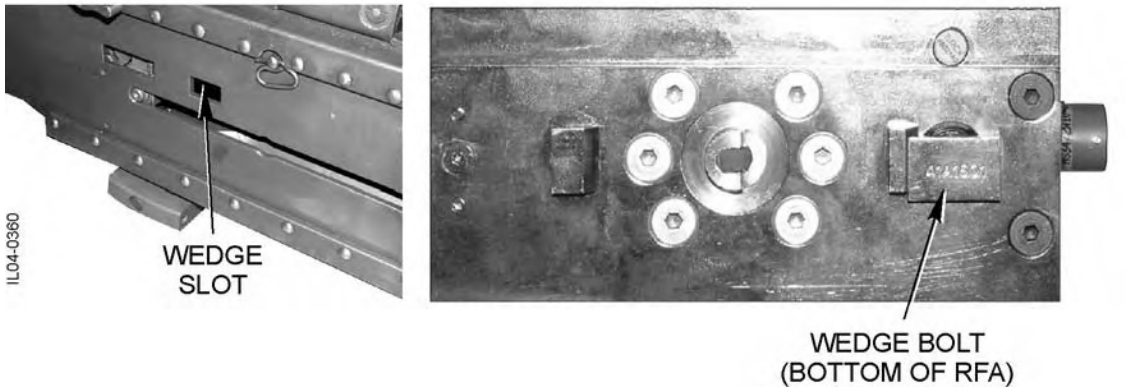


Figure 54. Wedge Inserted into Wedge Slot.

WAK AND WEAPON INSTALLATION - Cont

Remote Firing Assembly (RFA) Installation - Cont

5. Using the 19 mm combination wrench, tighten the castellated nut. Insert the hitch pin to secure its position, referring to Figure 55.

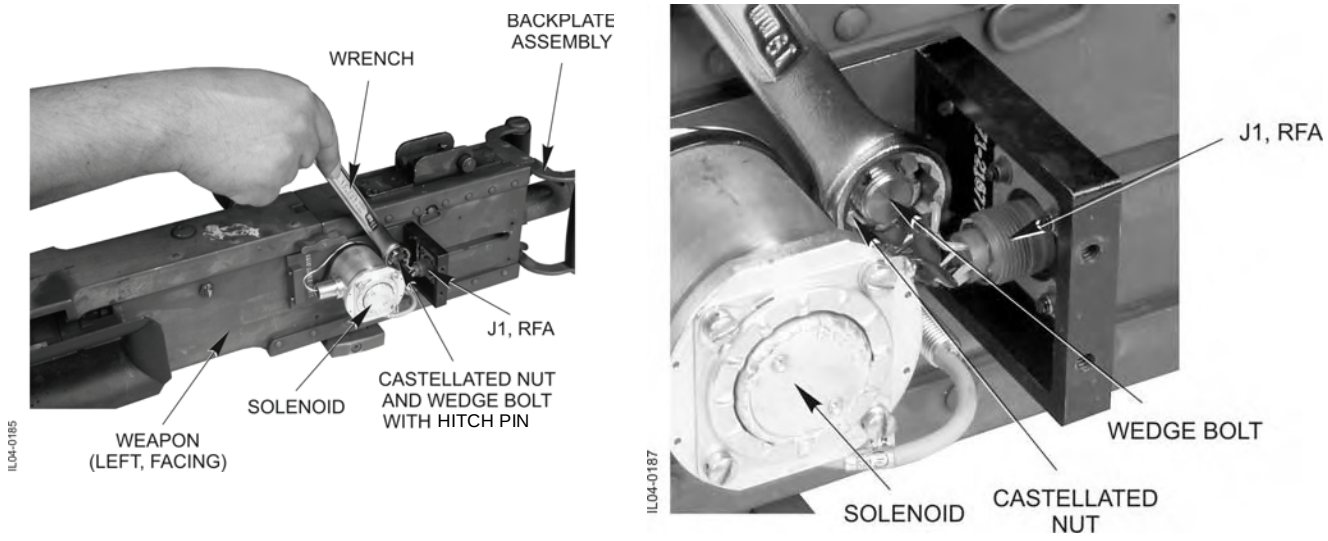


Figure 55. Castellated Nut Adjustment.

6. Reinstall the RFA cover, referring to Figures 51 and 52.

END OF TASK

Link Chute Adapter Assembly Installation

Perform the following procedure to attach the link chute adapter to the M2 weapon.

NOTE

For additional information, refer to TM 9-1005-213-10, Operator's Manual for M2 HB .50-Cal Machine Gun.

1. Ensure CROWS system power is OFF.

2. With the weapon cover up, remove the hitch pin from the right-hand belt-holding pawl pin, then remove the right-hand belt-holding pawl pin on the right-hand side of the weapon (facing), as shown in Figure 56.

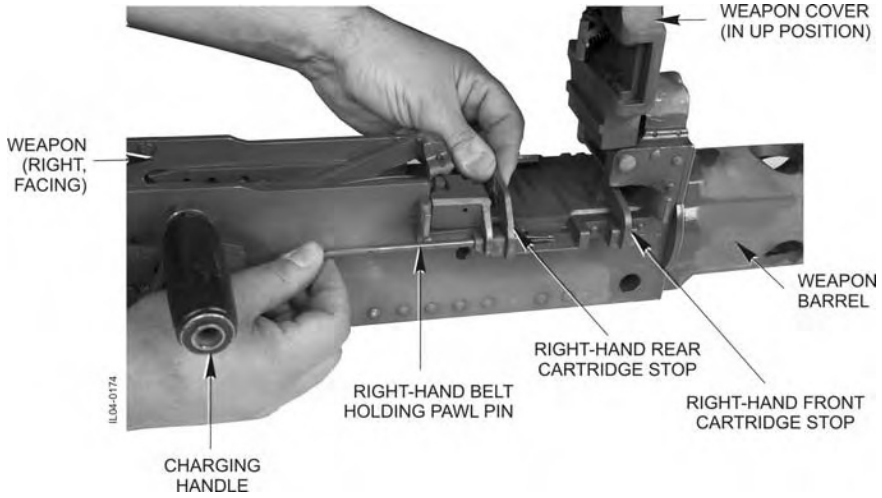


Figure 56. Weapon Pin for Link Chute Adapter (Removed from Mount for Clarity).

3. Remove the front cartridge stop from the weapon, as shown in Figure 57. Retain the original front cartridge stop in adapter kit box until weapon is restored to its original configuration.

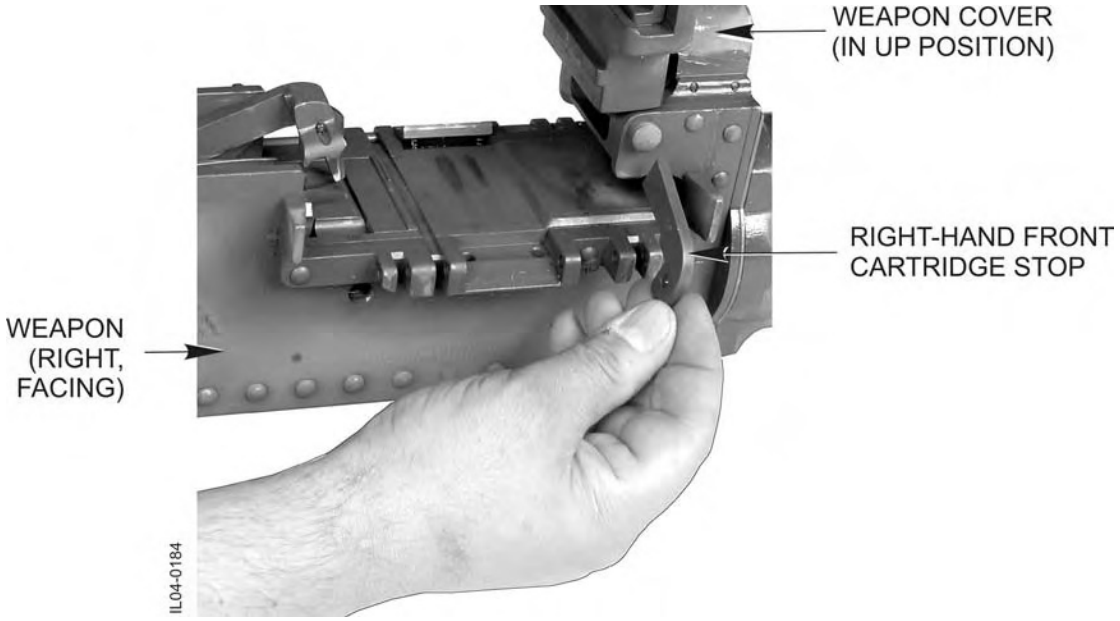


Figure 57. Removal of Front Cartridge Stop.

WAK AND WEAPON INSTALLATION - Cont

Link Chute Adapter Assembly Installation - Cont

4. Remove the rear cartridge stop from the weapon, as shown in Figures 58 and 59. Retain the original rear cartridge stop in adapter kit box until weapon is restored to its original configuration.

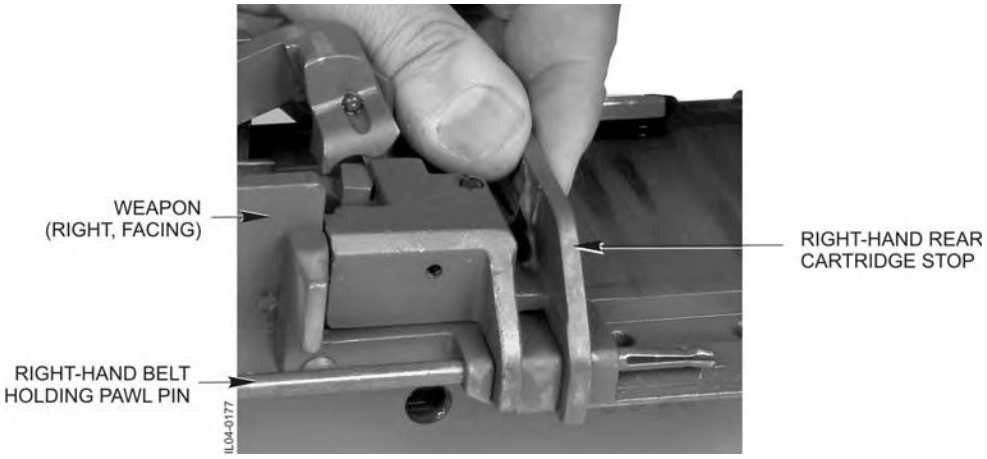


Figure 58. Lifting Rear Cartridge Stop from Weapon.

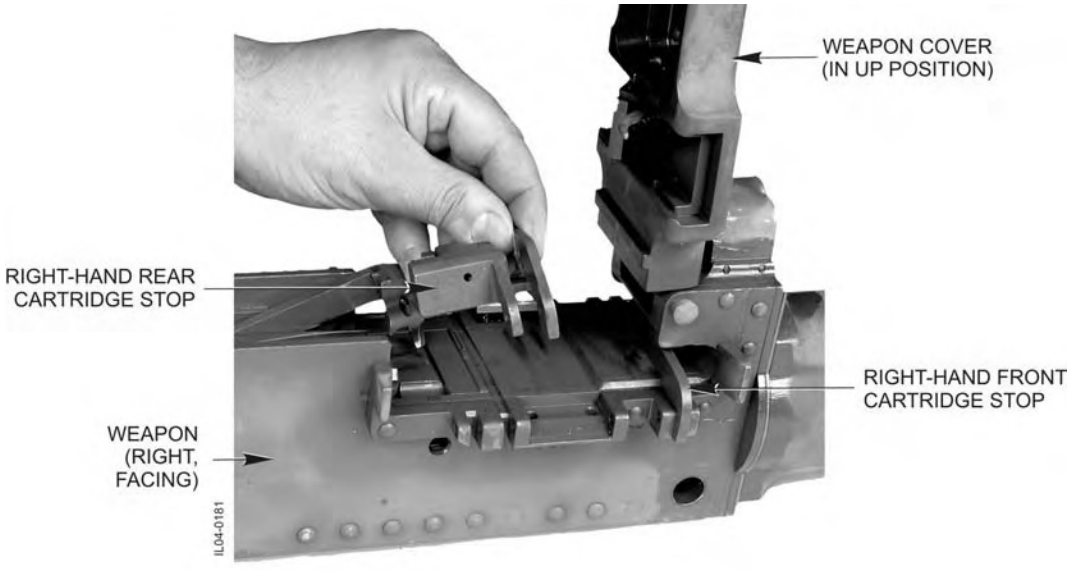


Figure 59. Removal of Rear Cartridge Stop.

5. Position the link chute adapter onto the right-hand side of the weapon, as shown in Figure 60, and secure the adapter to the weapon by fully inserting the right-hand belt-holding pawl pin removed in step 2.
6. Ensure that the link chute assembly with link chute clamp are inserted into the link chute bracket, referring to Figure 60.
7. Close the weapon cover.

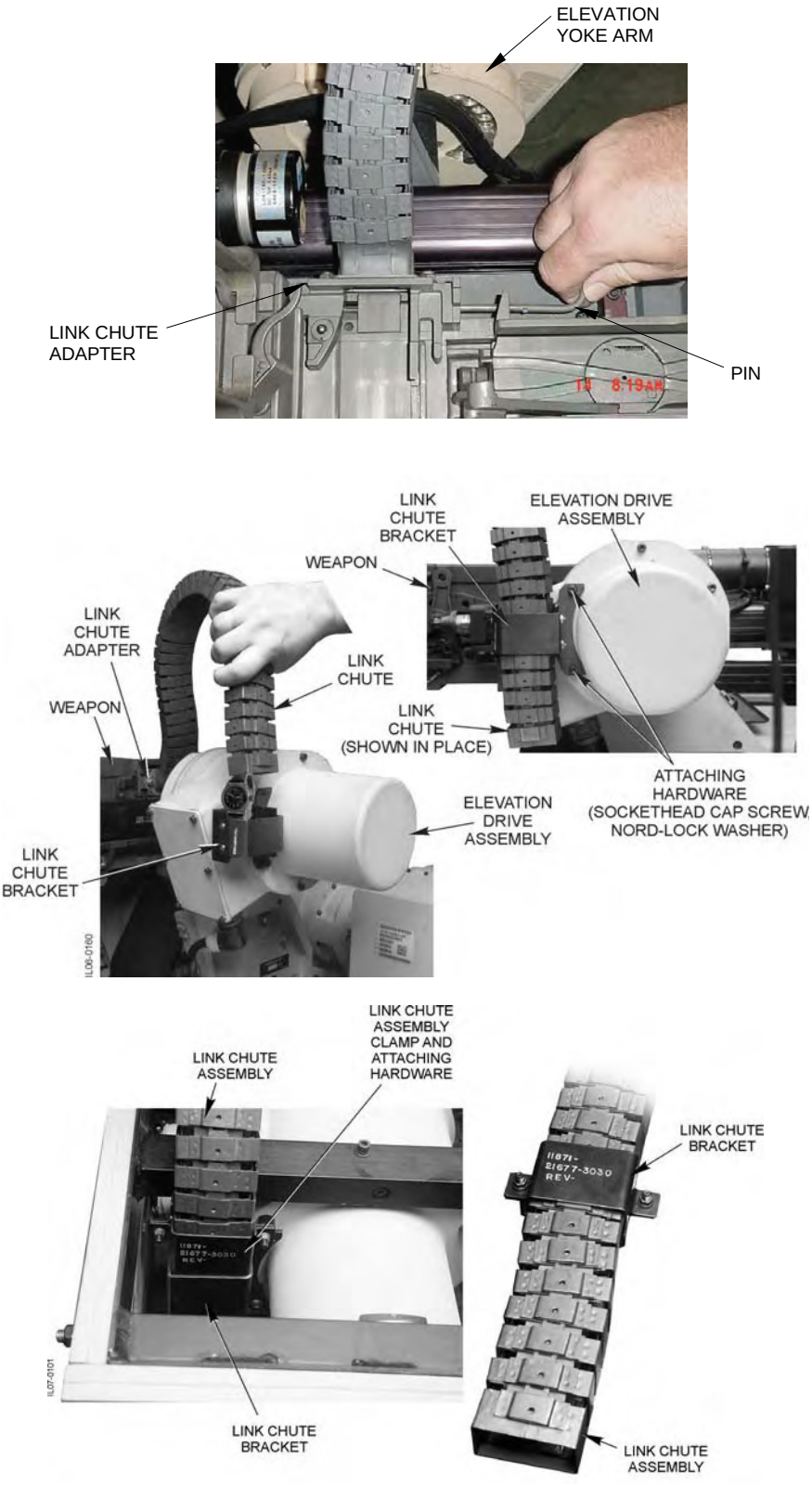


Figure 60. Link Chute Adapter Aligned with Weapon; Link Chute Assembly Secured in Bracket.

END OF TASK

WAK AND WEAPON INSTALLATION - Cont

Attaching the Weapon to the Cradle

Perform the following procedure to mount the M2 HB .50-cal machine gun to the cradle.

WARNING

Ensure that weapon has been cleared and any cleared rounds are secured before performing any procedures unless specifically directed to load the weapon. For information on loading and firing the weapon, refer to WP 0018. Failure to follow these instructions may result in personal injury.

CAUTION

When attaching the weapon to the cradle, use care not to damage the RFA if the cover is off.

Failure to follow these instructions may result in equipment damage or system inoperability.

NOTE

Ensure the azimuth lock is in the locked position. For additional information on the azimuth lock, refer to WP 0006, Azimuth Lock Assembly section.

1. Ensure CROWS system power is OFF.
2. Ensure the weapon cover is closed.
3. Manually elevate the cradle.
4. Remove the forward pin from the brass bushing of the left (facing) attenuator, as shown in Figure 61.

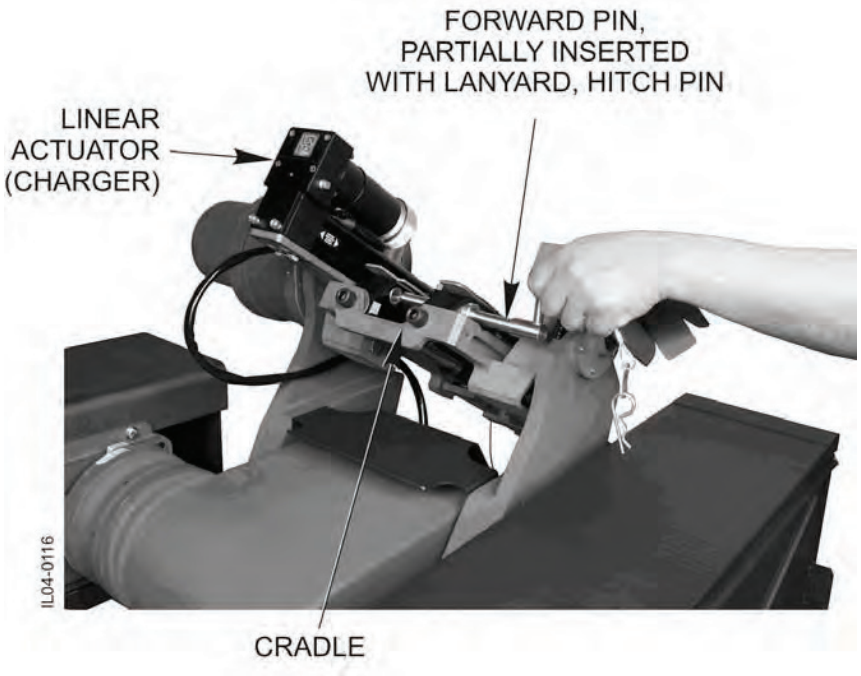


Figure 61. Insertion of Pin into Left Attenuator.

WARNING

Use two personnel during installation of the weapon and adapter kit components onto the cradle. Failure to do so may result in personal injury or damage to equipment.

NOTE

Refer to the Block Guide Assembly section of this work package for additional information.

For details on handling or disassembling the M2 weapon, refer to WP 0035, References, for information on the M2 technical manuals.

The following procedure may be performed with or without the barrel installed.

5. Lay the M2 weapon onto the cradle, ensuring that the block guide assembly on the bottom rear of the weapon slides into the block guide channel, as shown in Figure 62.

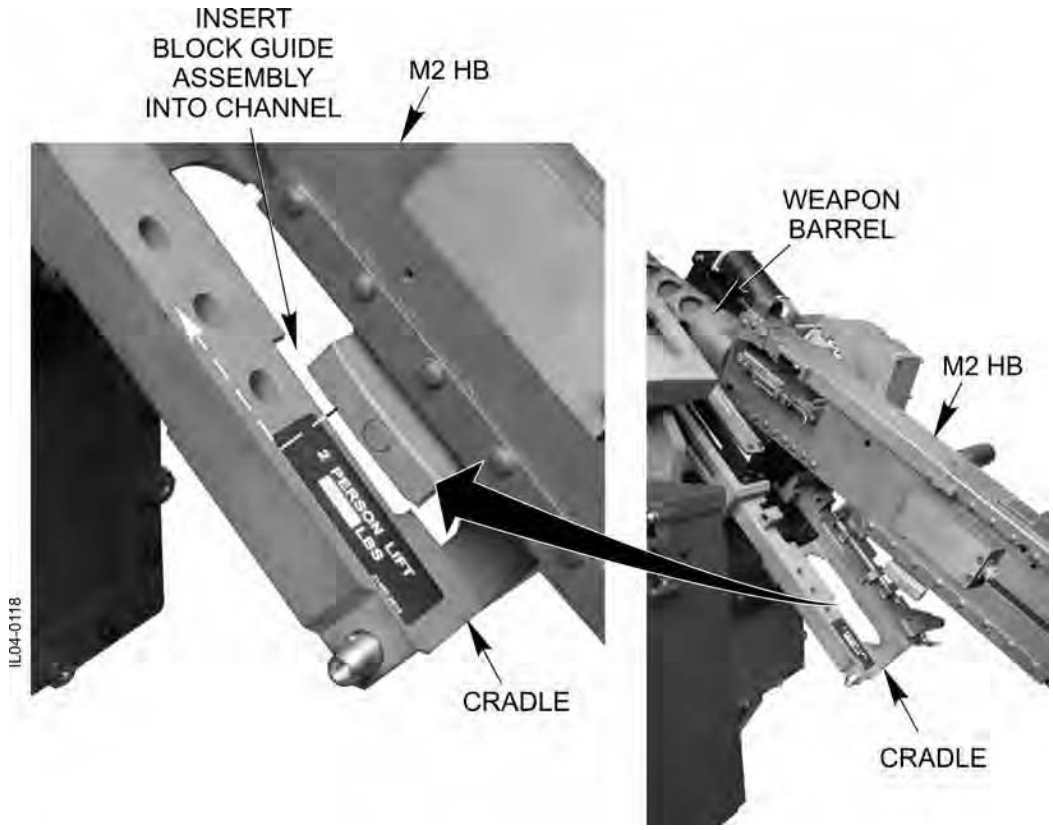


Figure 62. Positioning Weapon onto Cradle.

WAK AND WEAPON INSTALLATION - Cont

Attaching the Weapon to the Cradle - Cont

6. Slide the weapon forward on the cradle until it is fully seated, as shown in Figure 63.

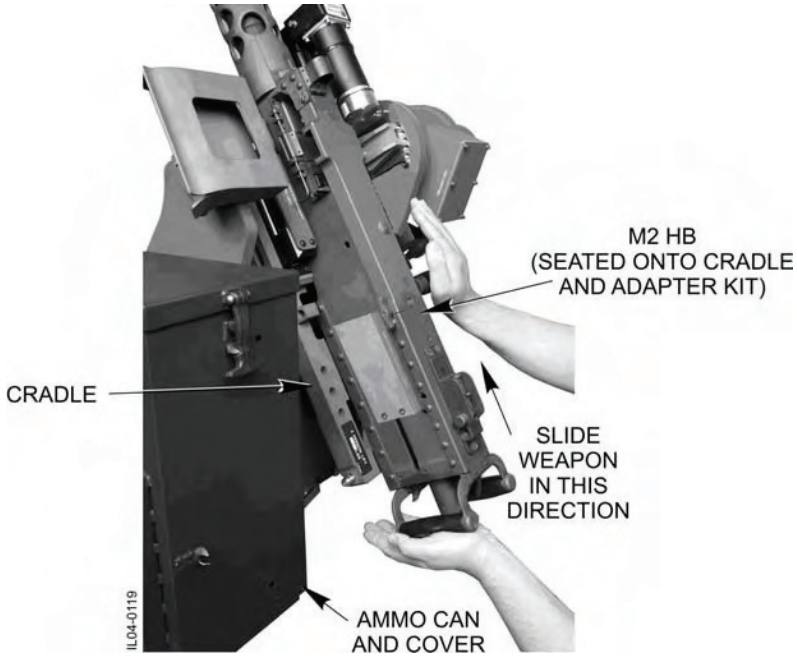


Figure 63. Insertion of Weapon onto CROWS Cradle.

7. After ensuring that the weapon is properly seated, insert the forward pin fully through both sides of the attenuators and gun, as shown in Figure 64.

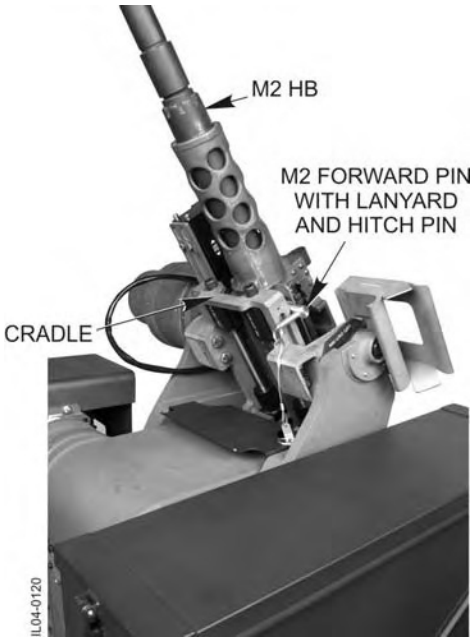


Figure 64. Weapon in Position with Pin Partially Inserted.

8. Turn the forward pin handle to the down position and insert the hitch pin into the brass bushing in the handle to secure the forward pin, as shown in Figure 65.
9. Install barrel (if not installed). For installation instructions, go to the Adjusting Mechanical Headspace section of this work package.

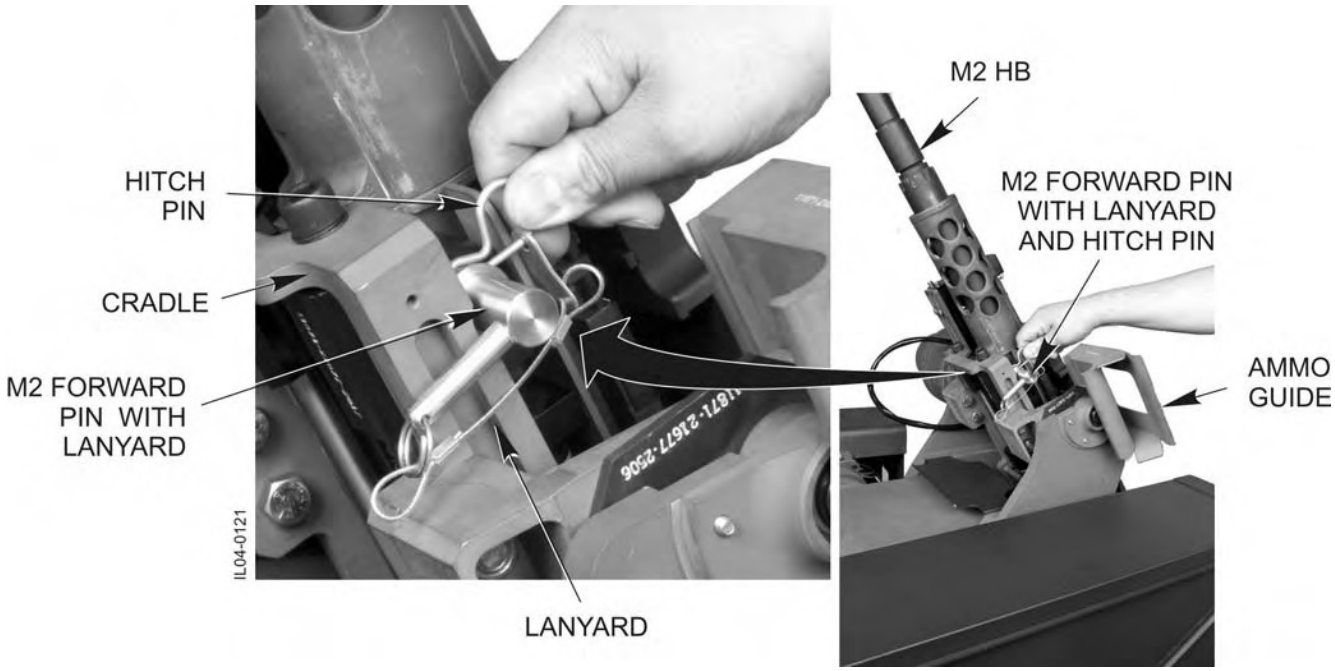


Figure 65. Securing Weapon with M2 Forward Pin.

END OF TASK

WAK AND WEAPON INSTALLATION - Cont

Adjusting Mechanical Headspace

WARNING

Never remove the backplate assembly from any weapon until the chamber has been cleared and any cleared rounds have been secured. Stand to one side of the weapon when removing the backplate.

Do not attempt to charge the M2 weapon without the backplate assembled to the weapon.

Ensure the breech bolt is in the forward position IAW TM 9-1005-213-10, Operator's Manual for the M2 HB .50-Cal Machine Gun.

Ensure headspace is adjusted properly.

Failure to follow these instructions may result in personal injury and equipment malfunction or damage.

NOTE

Headspace and timing should be checked and adjusted before firing a weapon, after assembling a weapon, and after replacing the barrel.

Perform the headspace verification and adjustment for the M2 IAW the instructions listed in TM 9-1005-213-10, Operator's Manual for the M2 HB .50-Cal Machine Gun.

Checking Mechanical Headspace

Use the following procedure to check mechanical headspace as follows:

NOTE

For additional information on the azimuth lock, refer to WP 0006, Azimuth Lock Assembly section.

1. Ensure CROWS system power is OFF.
2. Move the azimuth lock to the locked position. The pedestal mount should not move.
3. Open the weapon cover.
4. Perform steps 11 and 12 in Mechanically Adjust the Weapon Headspace subsection of this work package.
   a. If steps 11 and 12 can be performed correctly, proceed to the Checking and Adjusting Mechanical Timing section of this work package.
   b. If steps 11 and 12 cannot be performed correctly, proceed to the following procedure to adjust mechanical headspace.

END OF TASK

Mechanically Adjusting the Weapon Headspace

Perform the following procedure to mechanically adjust the weapon headspace.

1. Ensure CROWS system power is OFF.
2. With the weapon and adapter kit mounted to the cradle, open the weapon cover.

NOTE

The small loop of a .50-cal link between the trunnion lock and the barrel extension can be used to hold the barrel back 3/8 inch.

3. With the charging handle, pull the bolt back about 3/8-inch.
4. While holding the bolt in this position, screw the barrel fully into barrel extension, as shown in Figure 66.

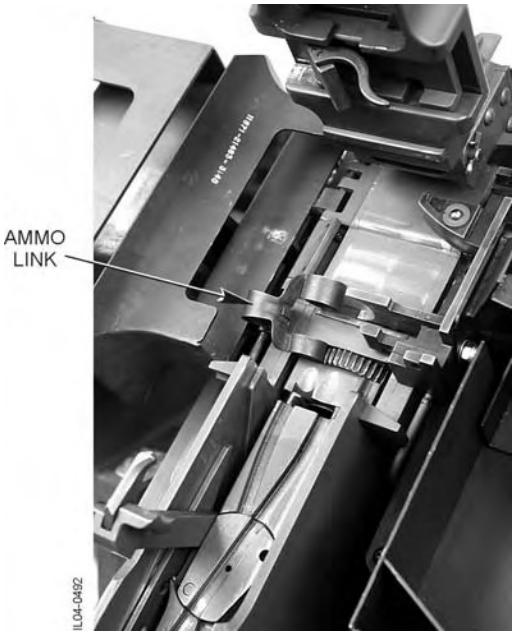


Figure 66. M2 .50-Cal Link Positioned Between Trunnion Lock and Barrel Extension.

5. After barrel is fully inserted, unscrew barrel 2 notches (clicks).
6. Release the charging handle, or remove the .50-cal link if one is used, and allow the barrel to slide forward.
7. Using the charging handle, pull the bolt fully to the rear to charge the weapon (if not charged).
8. While holding the handle, slowly return the bolt to the forward position.
9. Raise the extractor out of the way for better visibility.

WAK AND WEAPON INSTALLATION - Cont

Adjusting Mechanical Headspace - Cont

Mechanically Adjusting the Weapon Headspace - Cont

10. Pull back on the charging handle no more than 1/16 inch to remove the slack between the bolt and the barrel extension.

11. Timing gauges are shown in Figure 67. Insert the NO GO end of gauge into the T-slot between the face of the bolt and the end of the barrel, as shown in Figure 68. The gauge should not fit.



Figure 67. Timing Gauges: GO / NO GO and FIRE / NO FIRE.

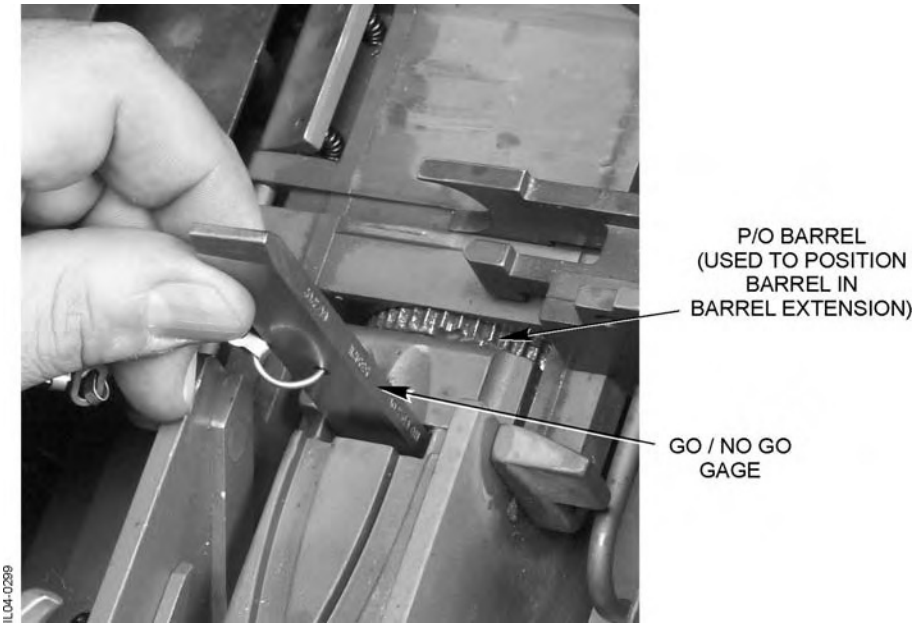


Figure 68. Insertion of NO GO Gauge for Headspace Adjustment.

12. Insert the GO end of the gauge into the slot. The gauge should fit all the way up to the center ring of the gauge.

NOTE

Do not unscrew barrel more than 7 total clicks. If more than 7 clicks are required to insert the headspace gauge, the barrel must be replaced.

For additional information on the M2 technical manuals, refer to WP 0035, References.

13. If the GO end fits and the NO GO end does not fit, the headspace is correct. Proceed to Checking and Adjusting Timing section of this work package (immediately following).
    a. If the GO end of gauge does not fit, then the headspace is too tight. Perform the following procedure to loosen the headspace, then repeat steps 11 through 13 (above).
        (1) With charging handle, pull bolt back about 3/8 inch.
        (2) Unscrew the barrel one click.
        (3) Remove slack between the bolt and the barrel extension (no more than 1/16 inch).
        (4) Recheck headspace by repeating steps 11 and 12 (above).
    b. If the NO GO end of gauge enters into the T-slot, then the headspace is too loose. Perform the following procedure to loosen the headspace, then repeat steps 11 through 13 (above).
        (1) With the charging handle, pull the bolt back about 3/8-inch.
        (2) Screw in the barrel one click.
        (3) Remove slack between the bolt and the barrel extension (no more than 1/16 inch).
        (4) Recheck headspace by repeating steps 11 and 12 (above).

NOTE

Do not unscrew barrel more than 7 total clicks. If more than 7 clicks are required to insert the headspace gauge, the barrel must be replaced.

For additional information on M2 technical manuals, refer to WP 0035, References.

    c. If more than 7 clicks are required to insert the headspace gauge, and the headspace is still too loose, replace the barrel, as detailed in TM 9-1005-213-10, Operator's Manual for the M2 HB .50-Cal Machine Gun.

END OF TASK

WAK AND WEAPON INSTALLATION - Cont

Checking and Adjusting Mechanical Timing

WARNING

Ensure headspace is adjusted properly.

Do not attempt to charge the M2 weapon without the backplate assembled to the weapon.

Ensure the breech bolt is in the forward position IAW TM 9-1005-213-10, Operator's Manual for the M2 HB .50-Cal Machine Gun.

Failure to follow these instructions may result in personal injury and equipment malfunction or damage.

NOTE

Headspace and timing should be checked and adjusted before firing a weapon, after assembling a weapon, and after replacing the barrel.

Perform the timing procedures for the M2 IAW the instructions listed in TM 9-1005-213-10, Operator's Manual for the M2 HB .50-Cal Machine Gun.

Mechanical Timing Check

Perform the following procedure to mechanically check the timing.

1. Ensure CROWS system power is OFF.
2. Ensure proper headspace before adjusting timing. Refer to Mechanically Adjust the Weapon Headspace subsection of this work package (immediately preceding).
3. With the charging handle, pull the bolt all the way back and charge the weapon.
4. Return the bolt to the forward position.

5. Pull the bolt back far enough to insert the NO FIRE gauge between the barrel extension and trunnion block, as shown in Figure 69.

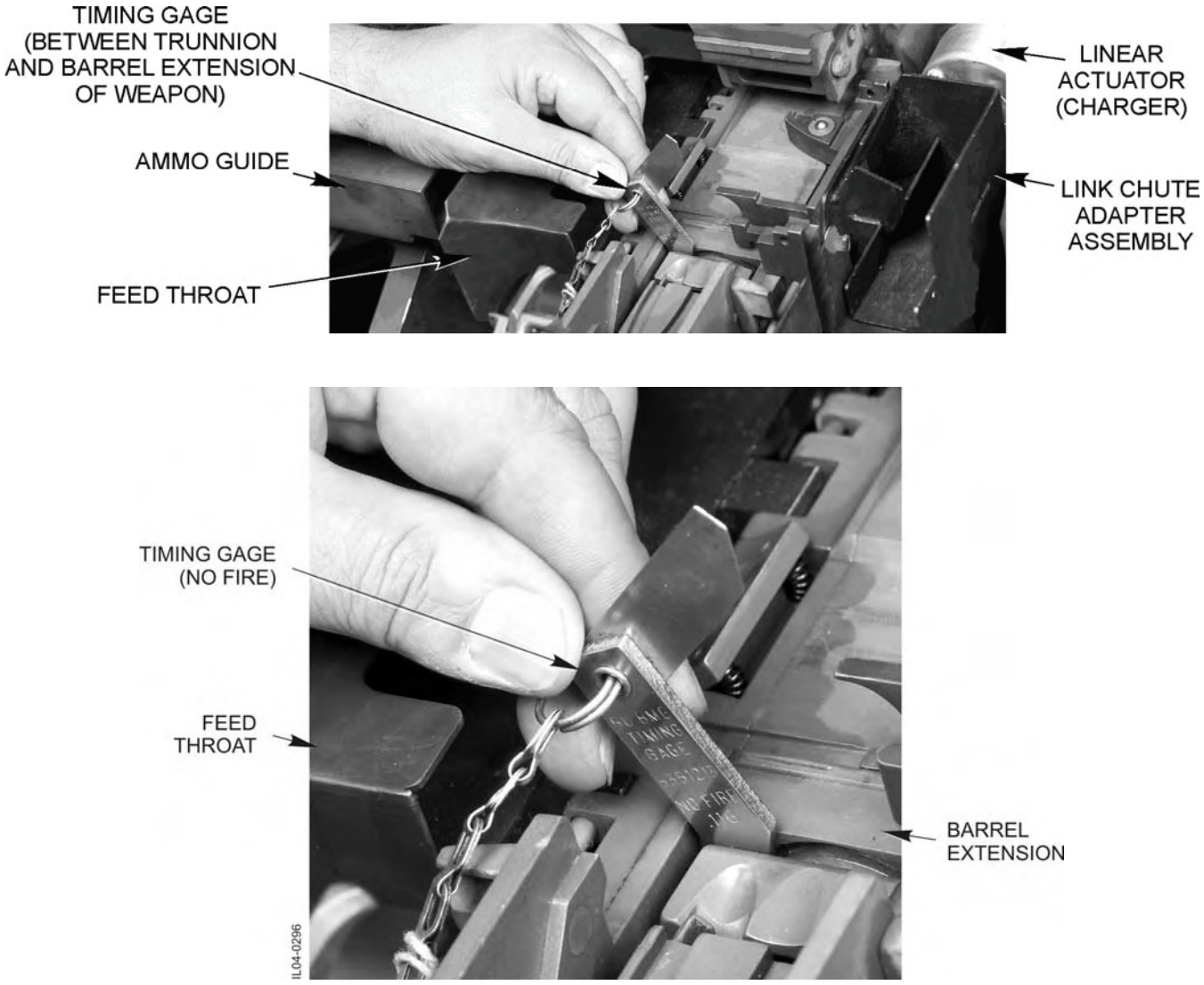


Figure 69. NO FIRE Gauge Inserted During Mechanical Timing Check.

6. Insert the beveled edge of the gauge against the barrel notches and slowly release the charging handle.
7. Press the trigger; weapon should not fire. If weapon fires, refer to Mechanical Timing Adjustment subsection in this work package (immediately following).

WAK AND WEAPON INSTALLATION - Cont

Checking and Adjusting Mechanical Timing - Cont

Mechanical Timing Check - Cont

8. Pull the bolt back far enough to remove the NO FIRE gauge, then insert the FIRE gauge and slowly release the charging handle, as shown in Figure 70.

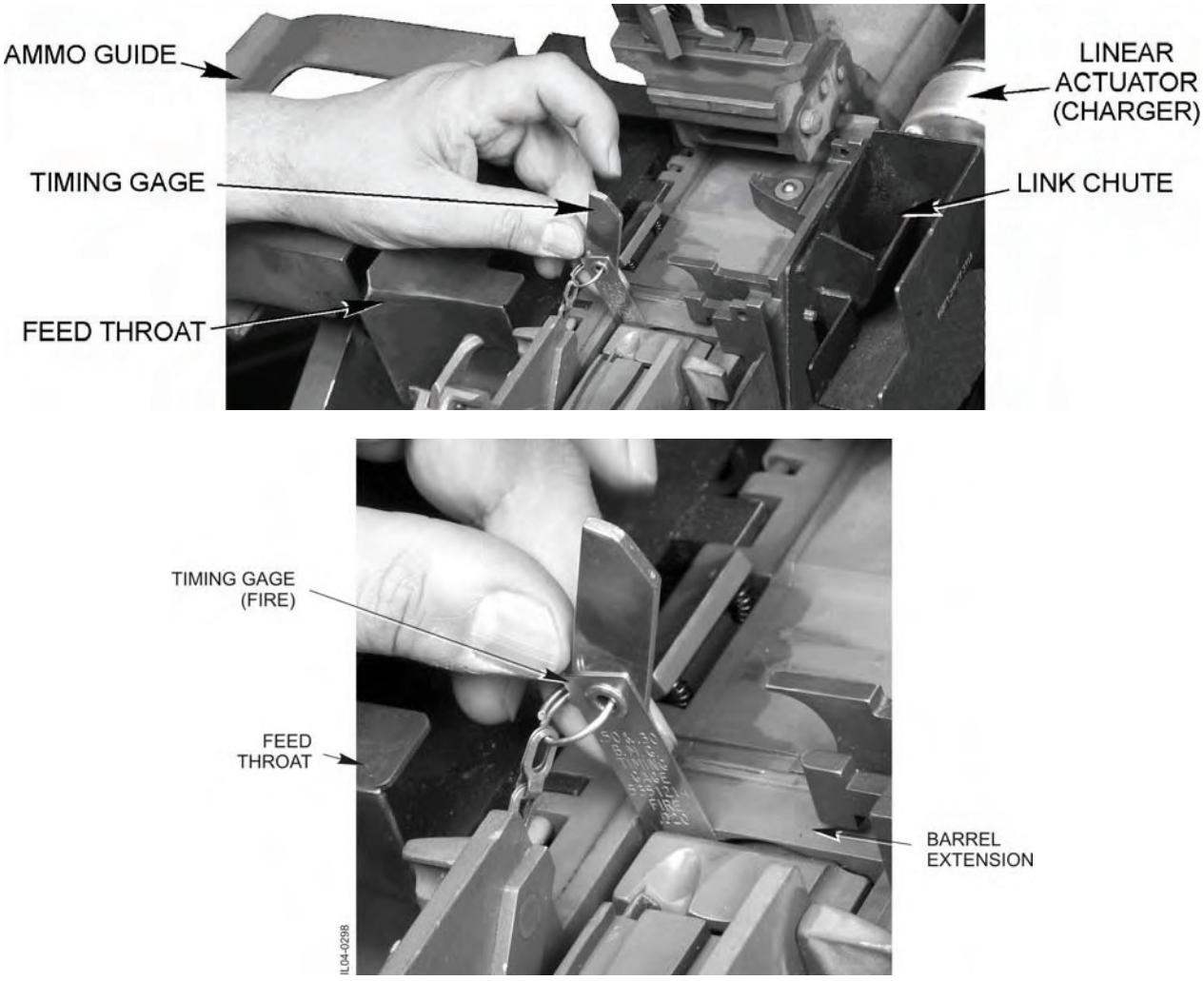


Figure 70. Insertion of FIRE Gauge During Manual Timing Check.

NOTE

Once the timing has been verified, the headspace should be rechecked and, if necessary, readjusted to conform to the specifications as listed in TM 9-1005-213-10, Operator's Manual for the M2 HB .50-Cal Machine Gun.

9. Press the trigger. The weapon should fire.
   a. If the weapon fires, the Mechanical Timing Check is complete. Proceed to Checking and Adjusting RFA Timing section of this work package.
   b. If weapon does not fire, refer to Mechanical Timing Adjustment subsection in this work package (immediately following).

END OF TASK

Mechanical Timing Adjustment

Perform the following procedure if the weapon fires with NO FIRE gauge installed or the weapon does not fire with the FIRE gauge installed.

WARNING

Never remove the backplate assembly from any weapon until the chamber has been cleared and any cleared rounds have been secured. Stand to one side of the weapon when removing the backplate.

Do not attempt to charge the M2 weapon without the backplate assembled to the weapon.

Ensure the breech bolt is in the forward position IAW TM 9-1005-213-10, Operator's Manual for the M2 HB .50-Cal Machine Gun.

Ensure headspace is adjusted properly.

Failure to follow these instructions may result in personal injury and equipment malfunction or damage.

1. Ensure CROWS system power is OFF.
2. Pull the bolt all the way back to charge the weapon.
3. Return the bolt to the forward position.
4. Pull the bolt back far enough to insert the FIRE gauge and slowly release the charging handle.
5. Ensure the bolt is in the forward position before removing backplate.
6. Remove backplate by releasing the backplate latches and sliding backplate upwards. (Refer to Breech Bolt Pins and Weapon Charging Mechanism Installation section of this work package for additional information.)
7. Turn the timing nut all the way down to the left, as shown in Figure 71.
8. Reinstall the backplate.
9. Push DOWN on the trigger mechanism (see Figure 29). The weapon should NOT fire. If weapon does fire, replace the weapon.
10. Remove backplate.
11. Turn the timing adjustment nut one click to the right. Replace the backplate and press on the trigger mechanism (see Figure 29). Repeat this step until the weapon fires.
12. After weapon fires, turn the timing nut two more clicks to the right. Mechanical timing is now set.
13. Remove the FIRE gauge.
14. Verify the mechanical timing by performing the procedure in the Mechanical Timing Check subsection of this work package (immediately preceding this section). Repeat steps 3-11.

WAK AND WEAPON INSTALLATION - Cont

Checking and Adjusting Mechanical Timing - Cont

Mechanical Timing Adjustment - Cont

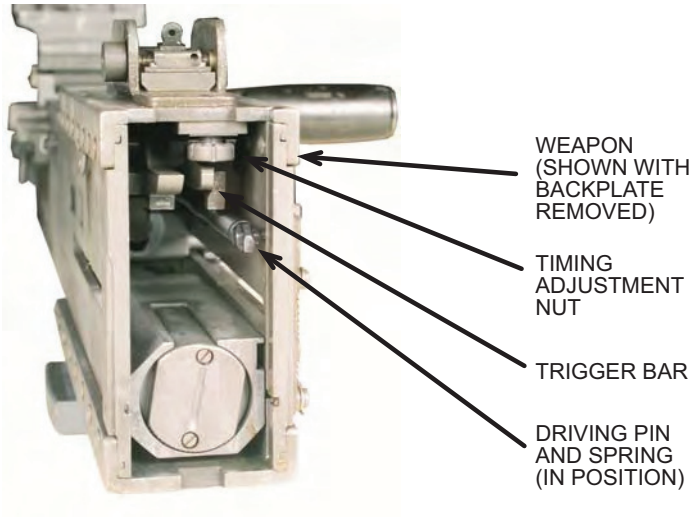


Figure 71. Timing Nut Positioned.

15. Set the weapon for automatic firing.
    a. Press the latch release, as shown in Figure 72, all the way down.
    b. While holding the latch release down, rotate the rear buffer handle left until the automatic fire latch secures the latch release. This positions the trigger for automatic firing.

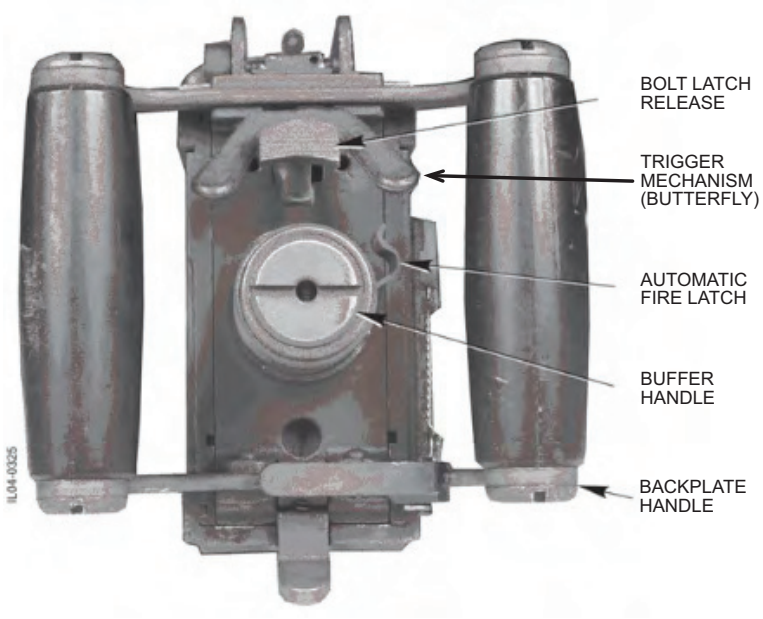


Figure 72. Adjusting the Rear Buffer Handle.

END OF TASK

Connecting Actuator and Weapon Cables

Perform the following procedure to connect the cables and connectors for the M2 weapon and adapter kit.

WARNING

Follow all safety warnings and cautions during interconnection procedures. Failure to do so may result in personal injury or equipment damage.

CAUTION

Ensure proper alignment of connector keyways prior to installing cables. Failure to do so may result in damage to the electrical pins and other equipment.

Cover connectors with the appropriate connector cap attached to the cable assembly if not connected to a mating connector.

When the ICU-Display Unit (DU) cable (P/N 21677-3715) is installed and secured, ensure that the radius of any bend measures at least 5 inches. Failure to follow this instruction may result in equipment damage and system inoperability.

Ensure system power is OFF before connecting or disconnecting cables.

Failure to follow these instructions may result in equipment damage and system inoperability.

NOTE

For additional information on CROWS cables and connectors, refer to WP 0005, Interconnection (Connectors and Cables).

1. Ensure CROWS system power is OFF.
2. Ensure all cables above roof line are connected IAW Figure 73, M2 Above Vehicle Interconnect Diagram. For all cables, see WP 0005, Figure 1.
3. Connect the actuator cable from the linear actuator (charger) to connector, J5 on the pedestal mount, as shown in Figures 74 and 75.
4. Connect the weapon-mount cable to connectors J1 of the RFA and J6 on the pedestal mount, routing it under the casing deflector, as shown in Figures 76 and 77.
5. When all connections have been completed, ensure all cables are tied down properly with appropriate service loops as necessary, as shown in Figures 74 through 77.

NOTE

For additional information on the azimuth lock, refer to WP 0006, Azimuth Lock Assembly section.

6. Move azimuth lock to unlocked position. The pedestal mount should move freely.
7. Move the cradle through its full range of vertical motion, the mount through 360° (full) rotation, and the sensor unit up and down to ensure that there are no points where the cables “pinch” or “bind” in normal operation, especially the actuator cable and the weapon-mount cable. Refer to Figures 74 through 77.

WAK AND WEAPON INSTALLATION - Cont

Connecting Actuator and Weapon Cables - Cont

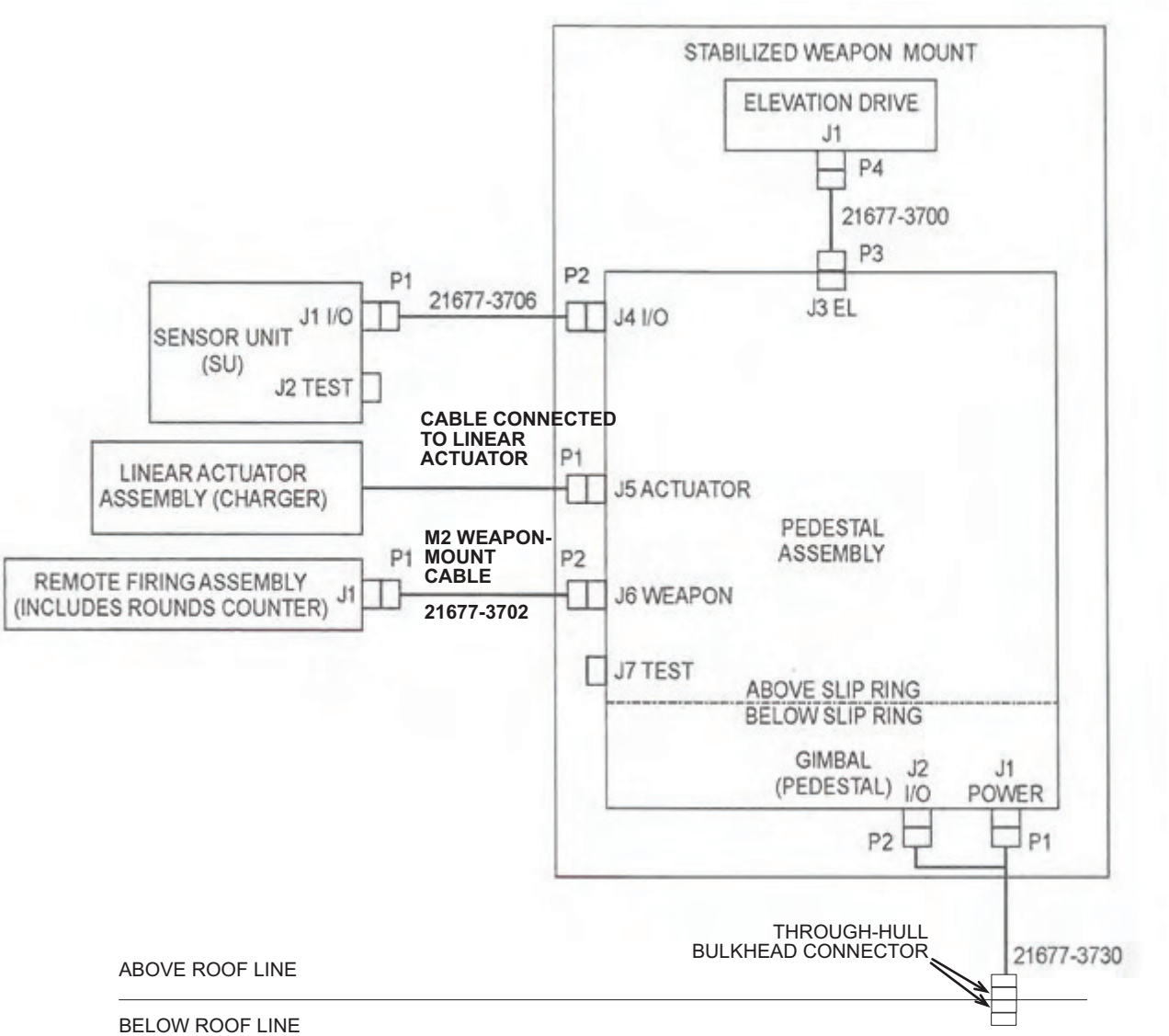
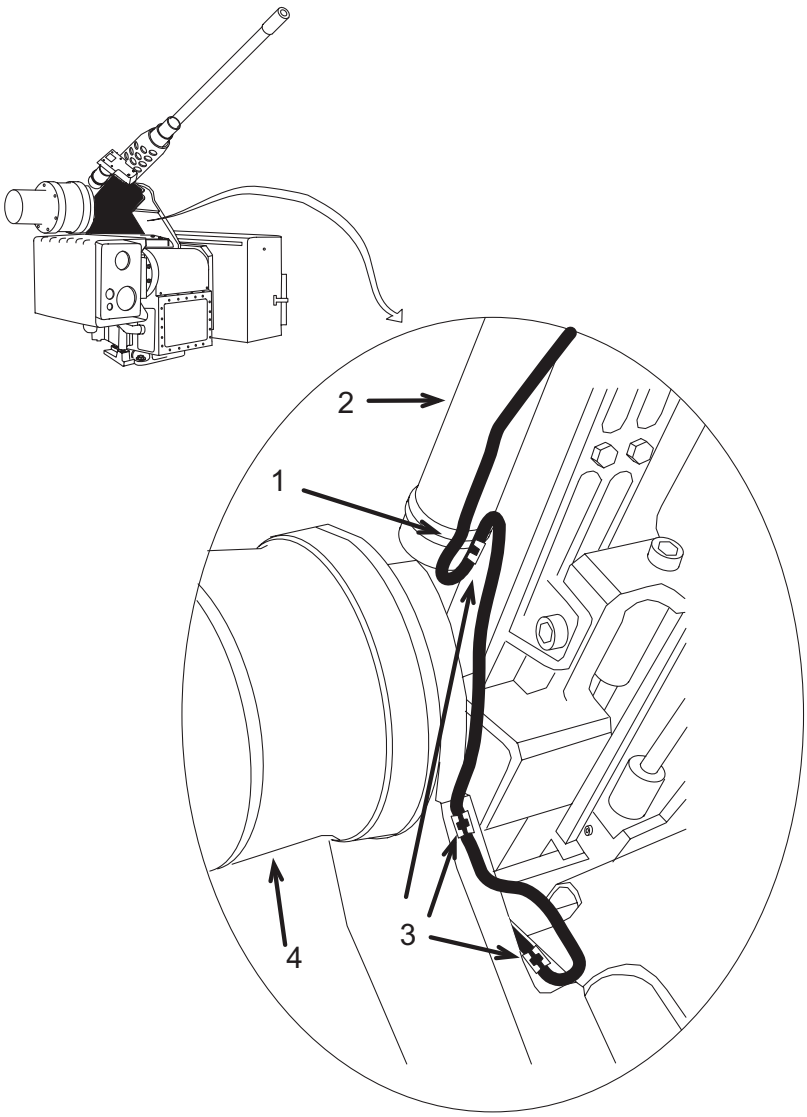


Figure 73. M2 Above Vehicle Interconnect Diagram.

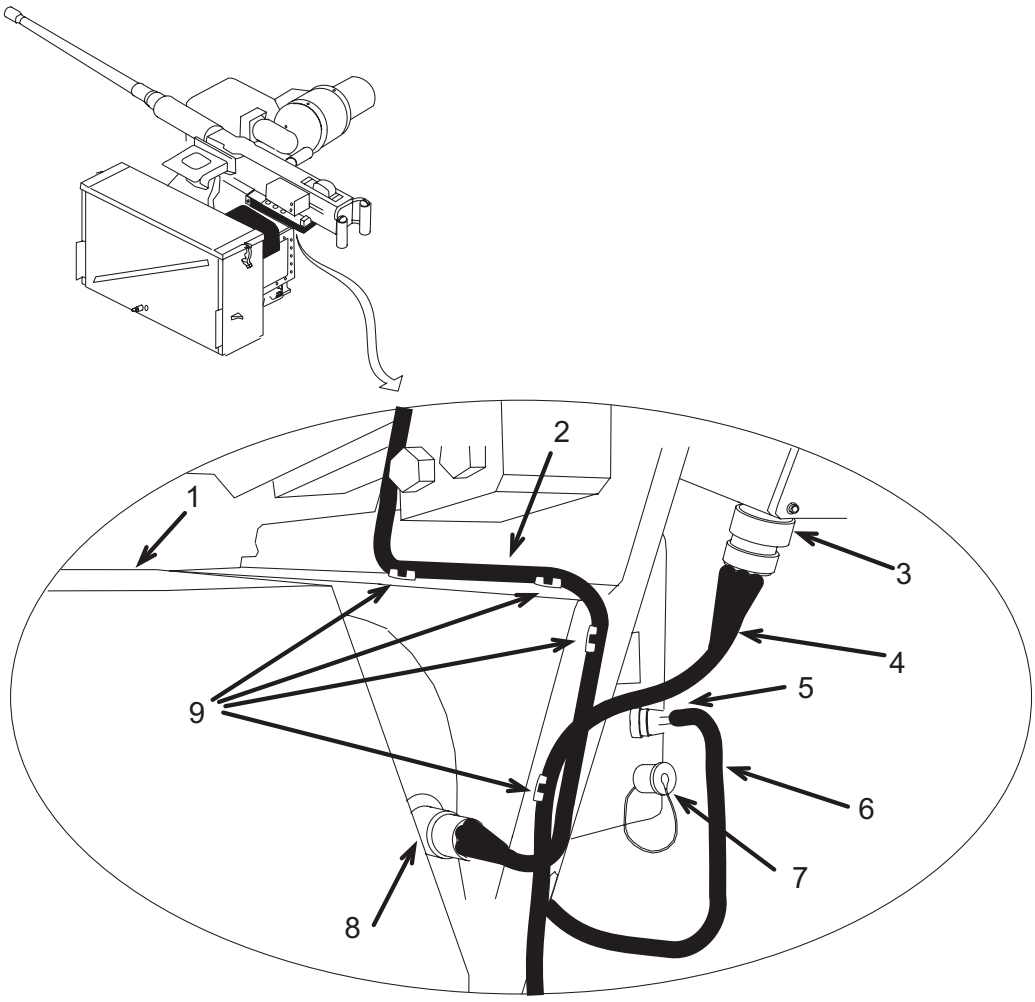


Legend:
1. Mount-Linear Actuator (Charger) Cable
2. Linear Actuator (Charger)
3. Cable Anchors
4. Elevation Drive

Figure 74. Linear Actuator Cable from Elevation Yoke Arm (shown without Ballistic Protection Armor).

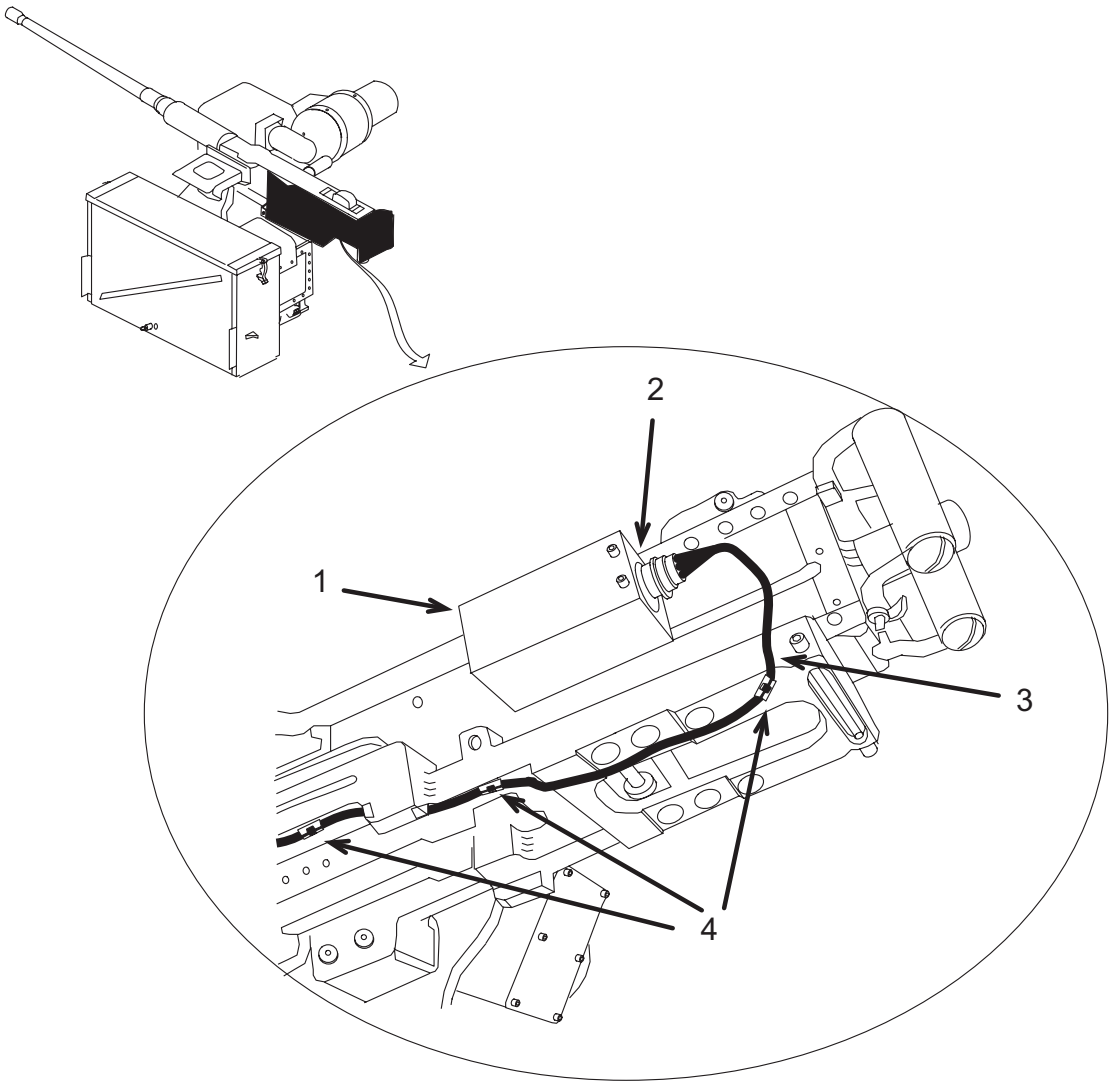
WAK AND WEAPON INSTALLATION - Cont

Connecting Actuator and Weapon Cables - Cont



Legend:
1. Casing Deflector
2. Mount-Linear Actuator (Charger) Cable
3. J1, Elevation Drive
4. Mount-Elevation Drive Cable
5. J1, Sensor Unit
6. Mount-Sensor Unit Cable
7. J2, Test, Sensor Unit
8. J5, Actuator, Mount
9. Cable Anchors

Figure 75. Charger Cable Connected to Connector J5, Actuator.

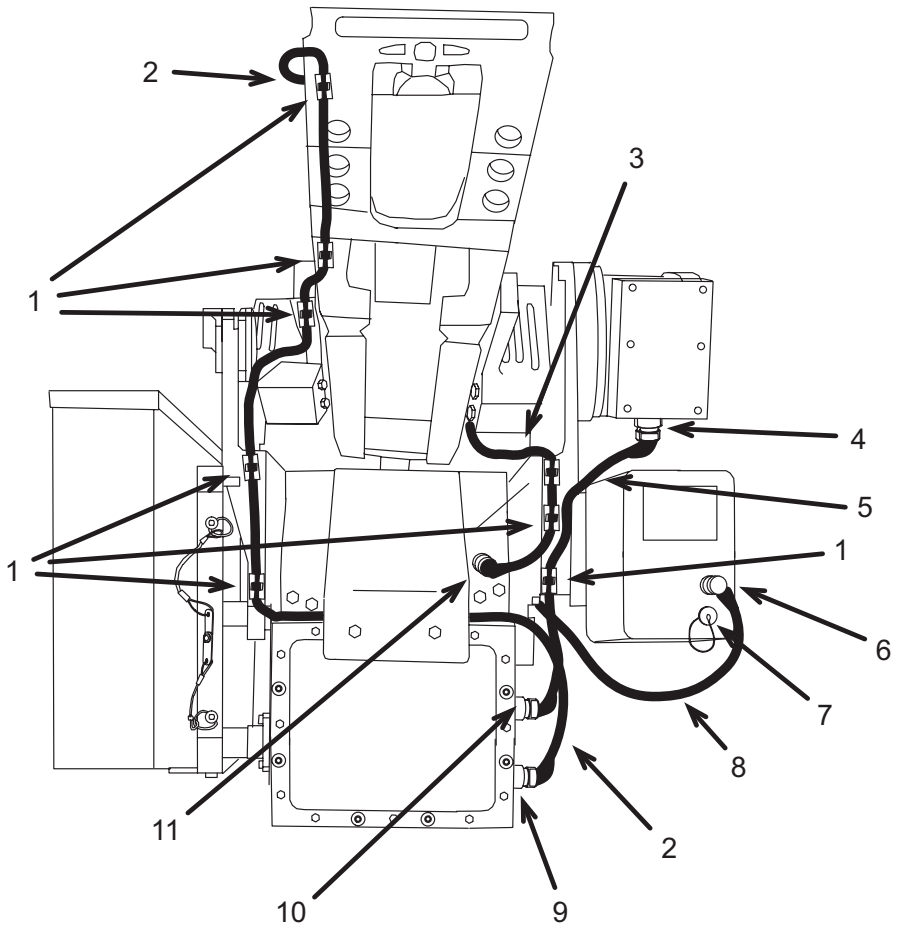


Legend:
1. Remote Firing Assembly (RFA)
2. J1, RFA
3. Weapon-Mount Cable
4. Cable Anchors

Figure 76. M2 Weapon-Mount Cable Connected to RFA Connector J1.

WAK AND WEAPON INSTALLATION - Cont

Connecting Actuator and Weapon Cables - Cont



Legend:	
1. Cable Anchors	7. J2, Test, Sensor Unit
2. Weapon-Mount Cable	8. Mount-Sensor Unit Cable
3. Mount-Linear Actuator (Charger) Cable	9. J6, Weapon, Mount
4. J1, Elevation Drive	10. J3, Elevation, Mount
5. Mount-Elevation Drive Cable	11. J5, Actuator, Mount
6. J1, Sensor Unit	

Figure 77. Setting Up Cable Anchors to Prevent Pinching or Binding (shown without Ballistic Protection Armor).

END OF TASK

Applying Power to the System

WARNING

Ensure input voltage is at the correct level. An overvoltage condition when power is applied may make the mount move and spin rapidly, which could result in personal injury and equipment malfunction or damage. Do not stand within muzzle length of the system when applying power.

Once power is applied, the system is fully functional and the mount and/or cradle with weapon could move. Ensure that the weapon mount is cleared and any cleared rounds are secured. Ensure that all personnel are clear of any possible weapon movements. Do not stand under the barrel.

Follow all safety warnings and cautions. Failure to do so may result in personal injury and equipment damage.

NOTE

For additional information on interconnection, cables and connectors, refer to WP 0005.

For additional information on controls and indicators of the system once power is applied, refer to WP 0004.

For additional information on the CROWS Menu System, refer to WP 0015.

For additional information on the M2 interconnection, refer to the Connection of Actuator and Weapon Cables section of this work package.

Perform the following procedure to apply power to the system and verify interconnection of cables and connectors.

NOTE

For additional information on the azimuth lock, refer to WP 0006, Azimuth Lock Assembly section.

1. Ensure CROWS system power is OFF.
2. Ensure azimuth lock is in the unlocked position. The pedestal mount should move freely.

NOTE

For additional information on the CROWS Menu system, refer to WP 0015.

3. Apply power to CROWS by turning the main power switch on the SPU to ON.

WAK AND WEAPON INSTALLATION - Cont

Applying Power to the System - Cont

4. Verify system status by ensuring the system built-in test (BIT) status report shows on the DU, as shown in Figure 78.
   a. If message does not appear, refer to WP 0027, Before Operational Check.
   b. If fault message appears, refer to WP 0024, Troubleshooting Index.

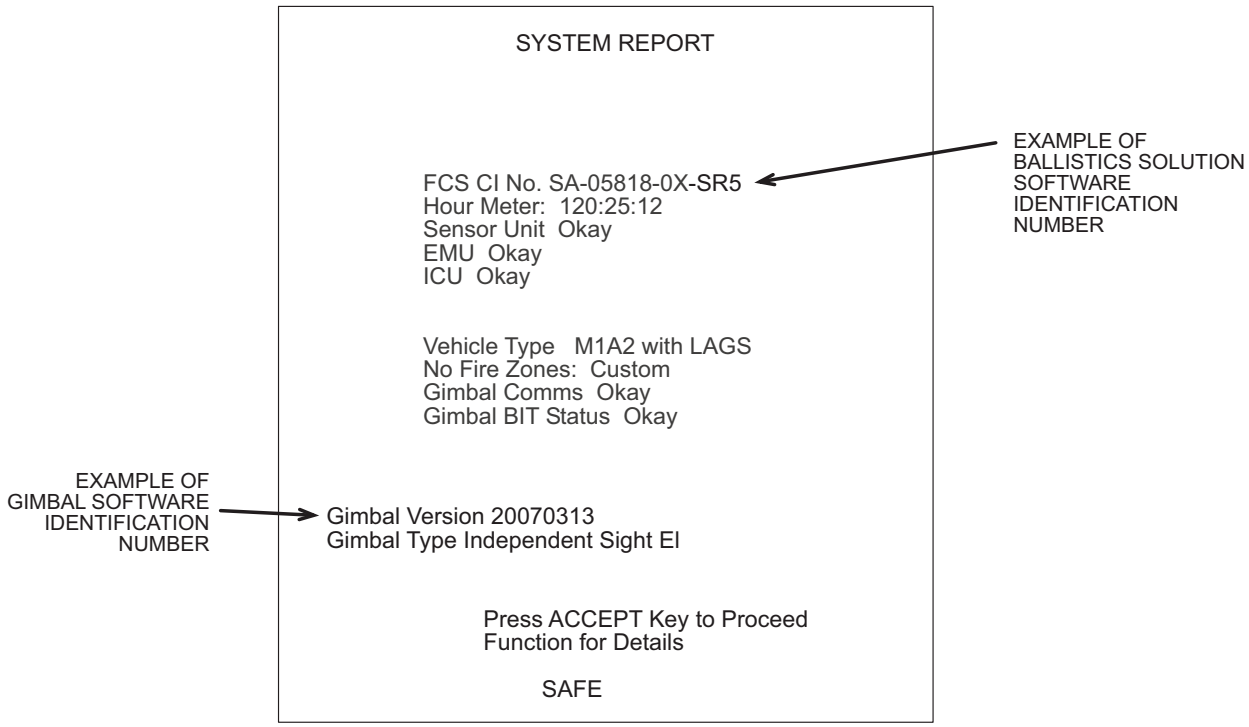


Figure 78. Example of System BIT System Report.

5. Press LASE (LEFT toggle LEFT) placing the system in Engagement mode. Verify system status by ensuring that the default screen appears, as shown in Figure 79.
   a. If message does not appear, refer to WP 0027, Before Operational Check.
   b. If fault message appears, refer to WP 0024, Troubleshooting Index.

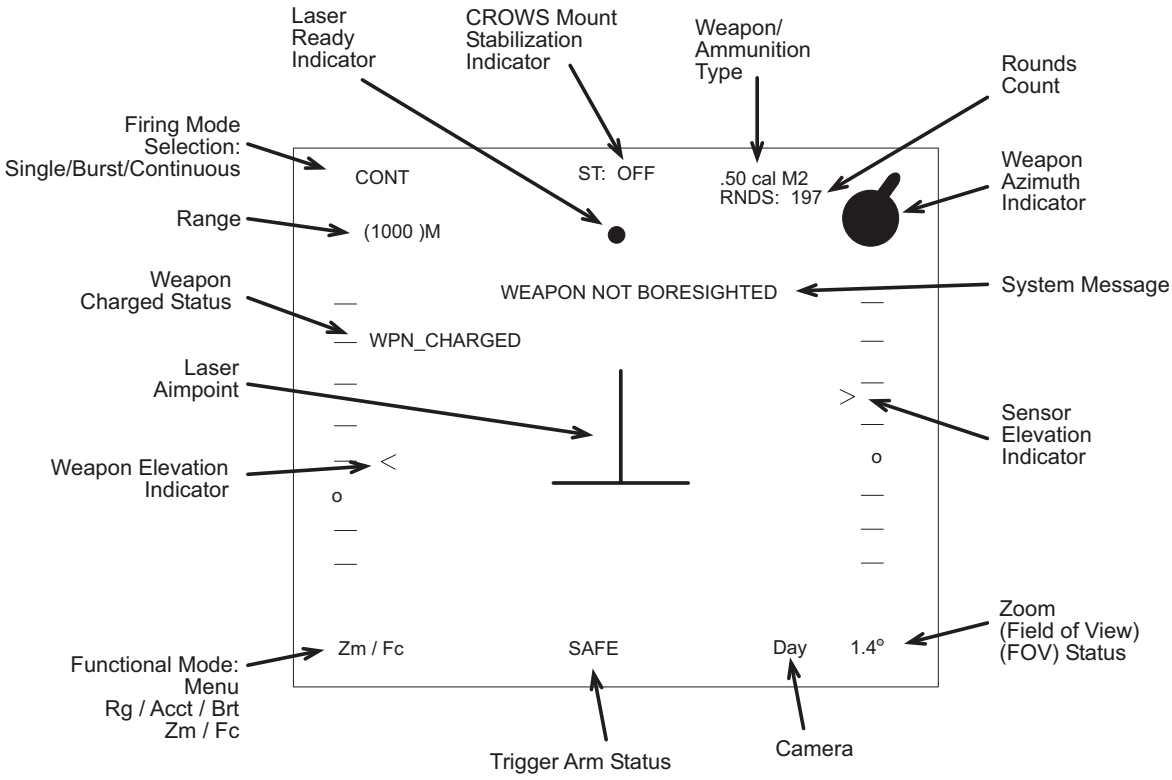


Figure 79. Example of M2 Engagement Mode Screen.

END OF TASK

WAK AND WEAPON INSTALLATION - Cont

Checking and Adjusting RFA Timing

The RFA timing adjustment procedure in this section usually will not need to be redone if the adjusted RFA stays connected to the specific weapon. Steps 1 through 5 in the following procedure will check or verify the RFA timing, while steps 6 and on will be used for adjustment if necessary. The timing procedures should be performed each time the RFA is installed on a weapon.

Perform the following procedures to check and adjust the RFA.

WARNING

Once power is applied, the system is fully functional. Ensure that the weapon mount is cleared, any cleared rounds are secured, and that the weapon cannot move during this procedure. Do not stand under the barrel. Follow all safety warnings and cautions. Failure to do so may result in personal injury and equipment damage.

NOTE

For detailed instructions on charging the weapon, refer to WP 0018, Loading and Firing the M2 HB .50-Cal Machine Gun.

For additional information on the RFA, refer to the RFA Installation section of this work package.

1. Ensure M2 HB mechanical headspace and timing checks have been performed, referring to the Adjusting Mechanical Headspace and Checking and Adjusting Mechanical Timing sections of this work package.

NOTE

For additional information on the azimuth lock, refer to WP 0006, Azimuth Lock Assembly section.

2. Ensure the azimuth lock is in the locked position. The pedestal mount should not move.
3. On the SPU, position the CHARGER switch to the CHARGE position to charge the weapon to the rear, and allow the bolt to return to the forward position. Insert the “FIRE” portion of the timing gauge between the trunnion and the barrel extension in the weapon.
   a. On the SPU, place the SYSTEM ARM switch in ARMED position and press the trigger switch on the joystick once.
   b. If weapon fires, proceed to step 4.
   c. If weapon does not fire, proceed to step 7.
4. Remove FIRE portion of the timing gauge, and charge the weapon.
5. Insert the “NO FIRE” portion of the timing gauge between the trunnion and the barrel extension in the weapon.
   a. Press the trigger switch on joystick 3 times. If weapon fires, proceed to step 7.
   b. If weapon does not fire, the RFA timing is correct.
   c. On the SPU, place the SYSTEM ARM switch in the SAFE position.
6. Remove NO FIRE portion of the timing gauge.
   a. Repeat step 3 to verify RFA timing.
   b. Proceed to step 17 to safety wire the solenoid.
7. If installed, remove the RFA cover, referring to Figures 51 and 52.

NOTE

For additional information about safety wire procedures, refer to WP 0031.

8. Remove the safety wire, if installed, and loosen the two screws that hold the tabs in place on top of the solenoid approximately two turns using a 1/4-inch flat tip screwdriver, as shown in Figure 80.

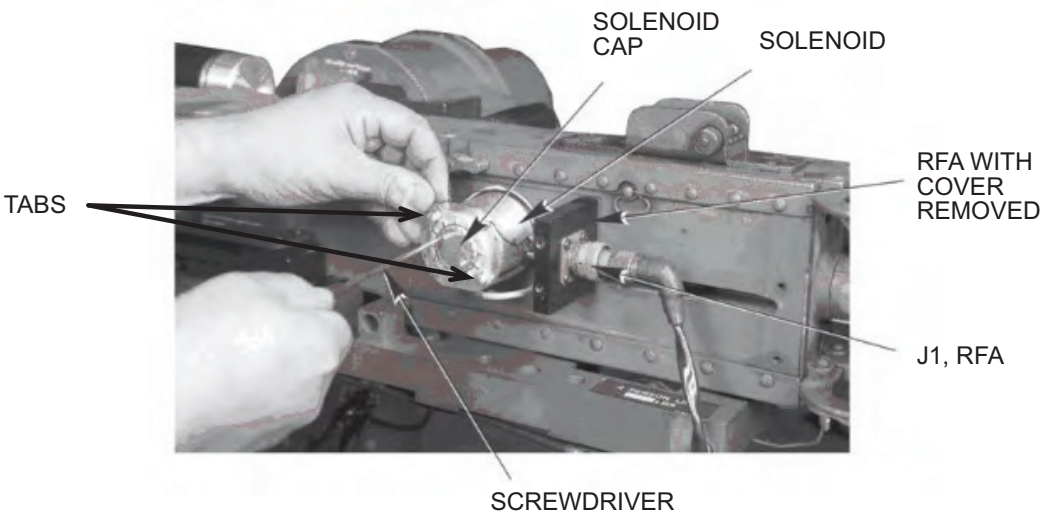


Figure 80. Loosening the Solenoid Prior to Adjustment.

NOTE

The plunger behind the solenoid cap is held in position by the plunger tabs through a slot in the retaining plate. To ensure proper adjustment and operation, make sure that the plunger tabs are properly placed between the plunger and the solenoid cap. See Figures 81, 82, and 83.

9. Rotate the two plunger tabs (that hold the retaining plate in place) out of the retaining ring slots, as shown in Figure 84.

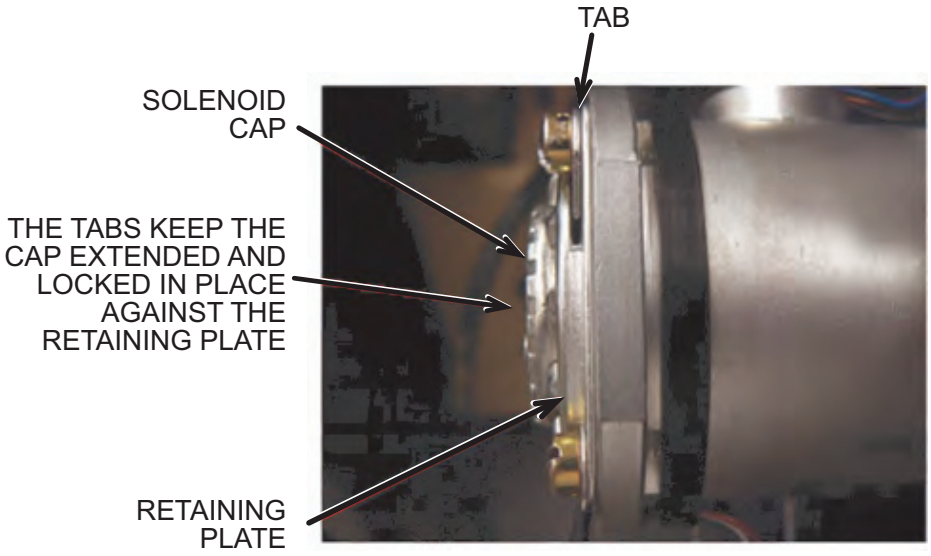


Figure 81. Properly Placed Tabs.

WAK AND WEAPON INSTALLATION - Cont

Checking and Adjusting RFA Timing - Cont

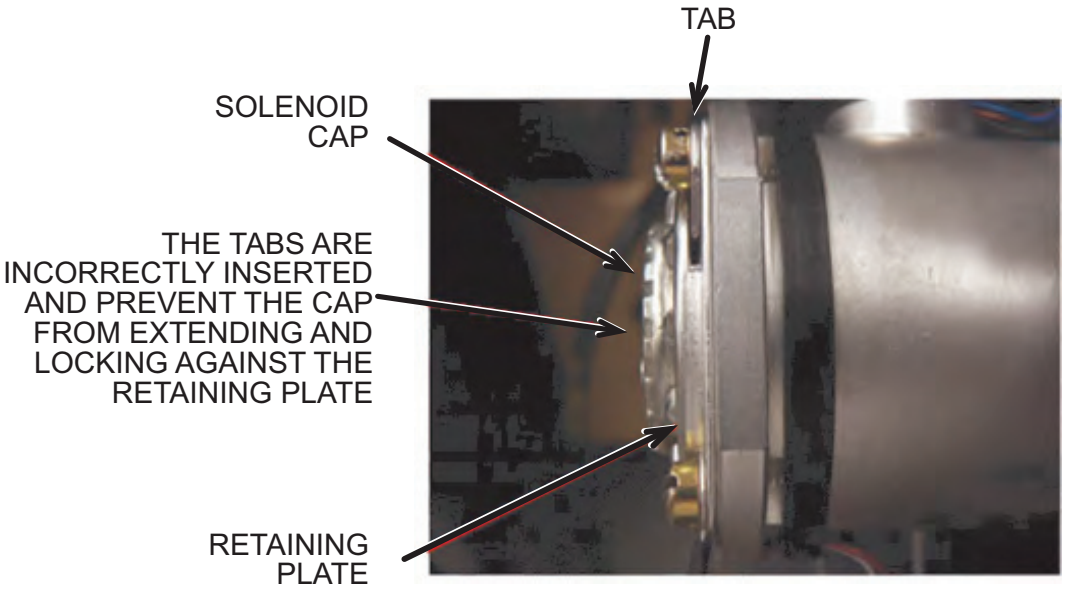


Figure 82. Incorrect Placement of Tabs.

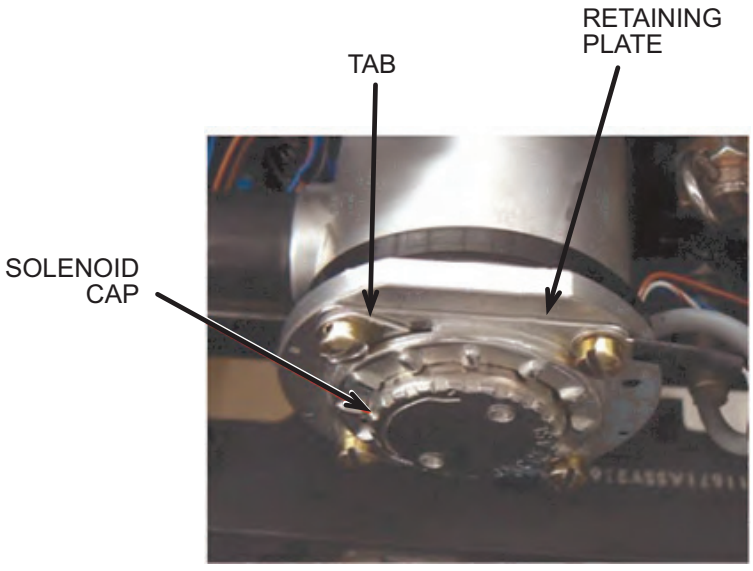


Figure 83. RFA Solenoid.

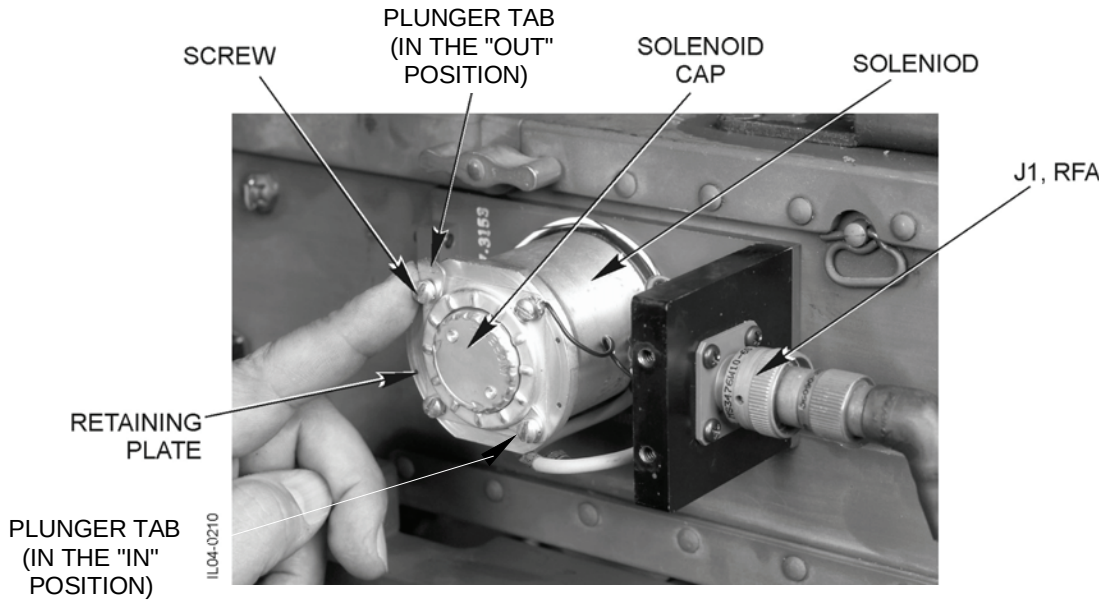


Figure 84. With Screw Loosened, Plunger Tabs Can Be Moved and the Solenoid Cap Used to Adjust the Plunger.

WARNING

After completing step 10, never exceed 4 full counterclockwise (CCW) turns of the solenoid cap. Failure to do so may result in uncommanded weapon fire. Follow all safety warnings and cautions. Failure to do so may result in personal injury and equipment damage.

NOTE

The arrow and the words “INCREASE” on the solenoid cap are not used for this procedure.

10. Press in the cap on the solenoid while simultaneously rotating it clockwise (CW), as shown in Figure 85, until it cannot be rotated any further. (This action retracts the plunger inside the solenoid.)

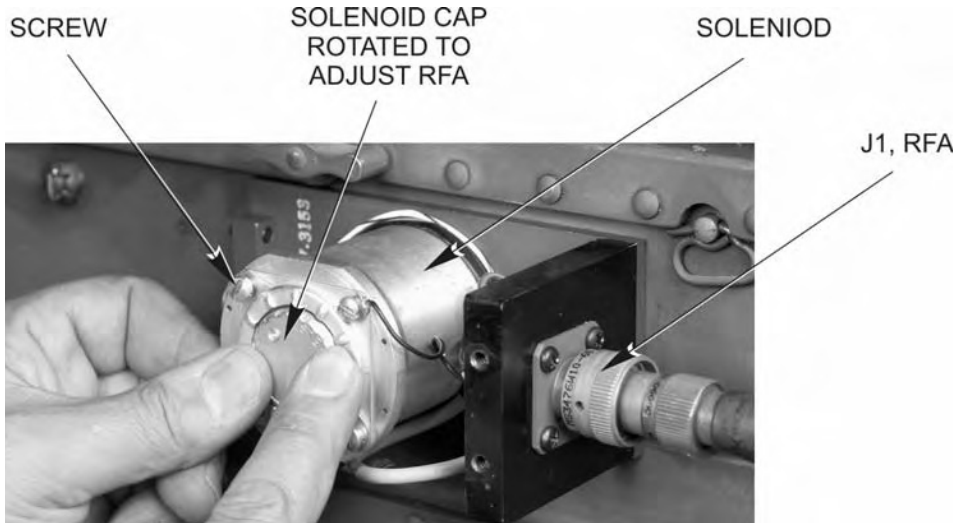


Figure 85. Pressing In and Rotating Solenoid Cap.

WAK AND WEAPON INSTALLATION - Cont

Checking and Adjusting RFA Timing - Cont

NOTE

For detailed instructions on charging the weapon, refer to WP 0018, Loading and Firing M2 HB .50-Cal Machine Gun.

11. Perform an adjustment check, as follows.
    a. Press in the solenoid cap and rotate it CCW 1/4 turn. Release the solenoid cap.
    b. Lightly tighten the four screws on top of the solenoid (if not tight).
    c. On the SPU, position the CHARGER switch to the CHARGE position to charge the weapon (if not charged).
    d. Insert the FIRE portion of the timing gauge between the trunnion and the barrel extension in the weapon.
    e. On the SPU, place the SYSTEM ARM switch in the ARMED position, then press the trigger switch on the joystick.
    f. Verify that the firing pin was released and the weapon fired by visually inspecting the front of the breech bolt to detect whether the firing pin tip is protruding from the front of the bolt face.
    g. If the firing pin was not released and the weapon did not fire, continue to repeat the adjustment check (step 11a) until the firing pin is actuated. If the firing pin never actuates, the probable cause is an RFA failure; contact your next higher level of maintenance.
12. Once the firing pin is actuated, rotate the solenoid cap one additional 1/4 turn CCW. (When the RFA timing is correct, this will be the final solenoid adjustment.)
    a. Remove the FIRE portion of the timing gauge and, on the SPU, position the CHARGER switch to the CHARGE position to charge the weapon.
    b. Insert the NO FIRE portion of the timing gauge between the trunnion and the barrel extension in the weapon.
    c. Press the trigger switch on the joystick three times and verify that the firing pin was not released by visually inspecting the front of the breech bolt.
    d. Remove the NO-FIRE portion of the timing gauge.
    e. If the firing pin was released, repeat step 11.
13. Insert the FIRE portion of the timing gauge between the trunnion and the barrel extension in the weapon.
    a. Press the trigger switch on the joystick and verify that the firing pin was released and the weapon fired by visually inspecting the front of the breech bolt to detect whether the firing pin tip is protruding from the front of the bolt face.
    b. Remove the FIRE portion of the timing gauge.
    c. If the firing pin was not released, repeat step 11.
    d. On the SPU, place the SYSTEM ARM switch to the SAFE position.

NOTE

The plunger behind the solenoid cap is held in position by the plunger tabs through a slot in the retaining plate. To ensure proper adjustment and operation, make sure that the plunger tabs are properly placed between the plunger and the solenoid cap. Once tabs are in place and screws tightened, the solenoid cap should not be able to be rotated. If cap rotates, then the tabs are not properly placed. Refer to Figures 81, 82, and 83 for examples of correct and incorrect placement of tabs.)

14. Reposition the corner plunger tabs inward, securing the timing ring and retaining plate around the solenoid cap, as shown in Figure 84.
15. Repeat steps 12b through 12e and step 13 two times to ensure the RFA timing adjustment is correct and reliable.
16. Securely tighten the screws on top of the solenoid using a 1/4-inch flat tip screwdriver, as shown in Figure 80.
17. On the SPU, place the SYSTEM ARM switch to the SAFE position.
18. Open the weapon cover and visually ensure the plunger is not extended beyond the inner wall of the receiver. If the plunger extends beyond the inner wall of the receiver repeat steps 10 through 17. If the plunger continues to extend after one repeat of steps 10 through 17, halt the procedure and contact higher maintenance.
19. Apply safety wire to the solenoid, as shown in Figures 86 and 87, using wire-twisting pliers.

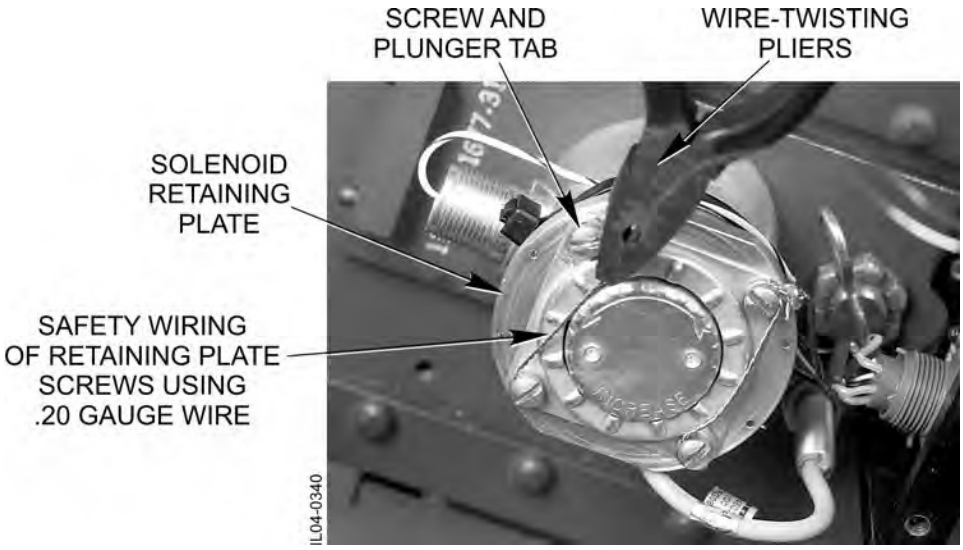


Figure 86. Safety Wiring the Screws Holding the Solenoid Retaining Plate.

WAK AND WEAPON INSTALLATION - Cont

Checking and Adjusting RFA Timing - Cont

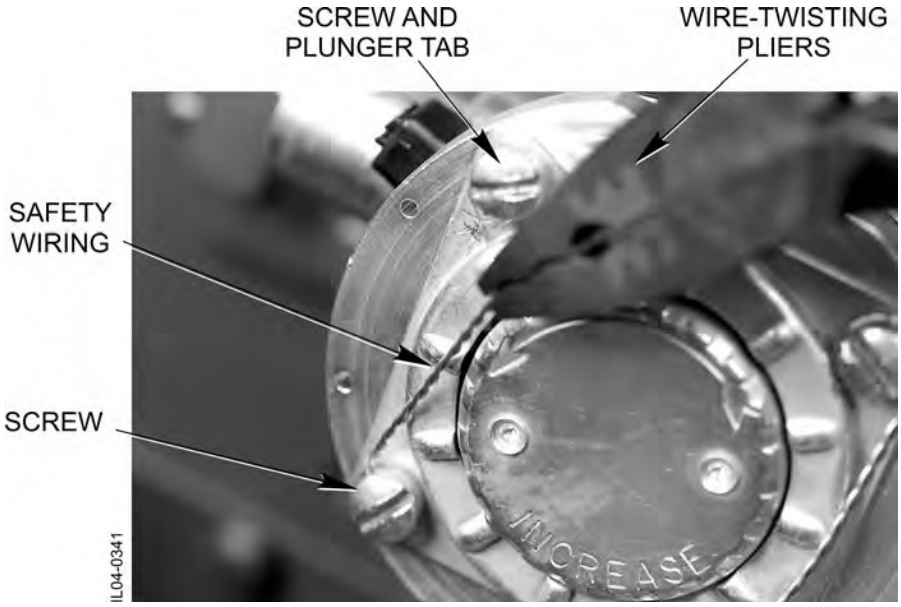


Figure 87. Safety Wire Used to Secure Retaining Plate Screws.

20. Reinstall the RFA cover by sliding forward over the two alignment pins on the rear of the RFA, as shown in Figure 88. Insert and tighten the two screws securing the cover, using a 5/32-inch hex head wrench.

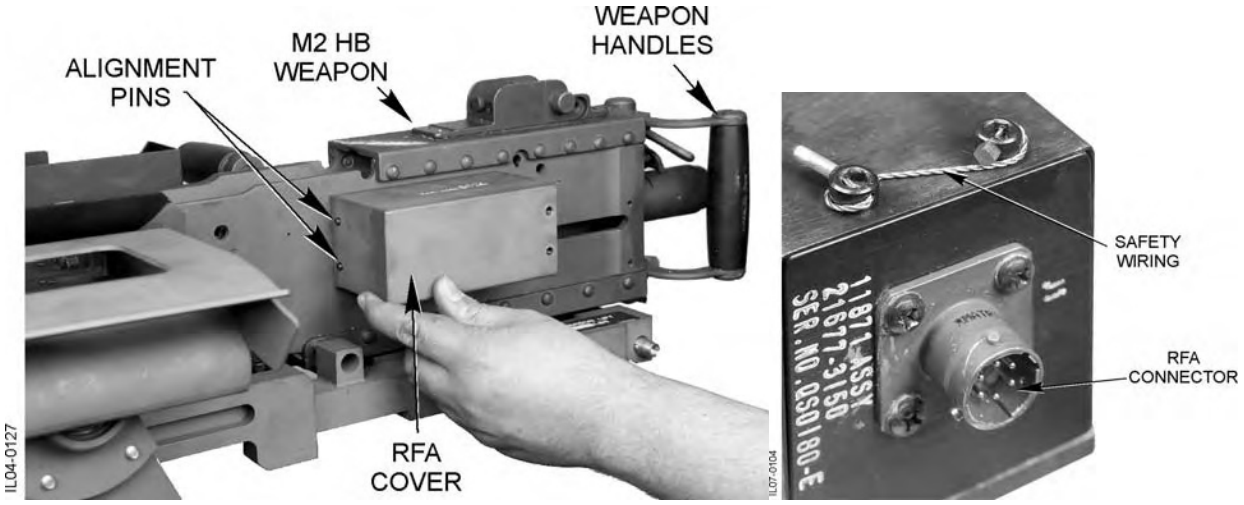


Figure 88. RFA Cover Reinstalled.

21. Set the weapon for automatic firing.
    a. Press the bolt latch release, shown in Figure 72, all the way down.
    b. While holding the latch release down, rotate the rear buffer handle left until the automatic fire latch secures the latch release. This positions the trigger for automatic firing.
    c. Attach cables to appropriate cable connectors and secure to cable anchors. See WP 0005, Interconnection (Connectors and Cables).
    d. Proceed to WP 0027, Table 1, Before Operational Check.

END OF TASK

Checking and Adjusting the M2 Rounds Counter

Equipment Conditions: The cradle is installed on the weapon mount with weapon. Weapon-mount cable should be disconnected from the RFA rounds counter; refer to the Connecting Actuator and Weapon Cables section of this work package.

NOTE

The check and adjustment of the RFA rounds counter sensor is required if the RFA is removed and reinstalled on the weapon. A periodic check is required as directed by PMCS, WP 0026.

Two mechanics are recommended for checking or adjusting the rounds sensor.

The narrow (tapered) blade thickness gage is required for this check and adjustment due to the width of the M2 Machine Gun charging slot.

Checking the M2 Rounds Counter

To check the RFA rounds sensor adjustment, proceed as follows:

1. Remove the spade grip handles. See Figure 89.

WARNING

Ensure that the M2 Machine Gun chamber is empty IAW TM 9-1005-213-10.

Lift the M2 cover and ensure that the breech bolt is in the forward position. Refer to TM 9-1005-213-10.

Stand to the side of the weapon when removing the spade grip and back plate.

2. At the rear of the M2 Machine Gun lift the lock (2), pull out the latch (3), and remove the spade grip by moving up.

WAK AND WEAPON INSTALLATION - Cont

Checking and Adjusting the M2 Rounds Counter - Cont

Checking the M2 Rounds Counter - Cont

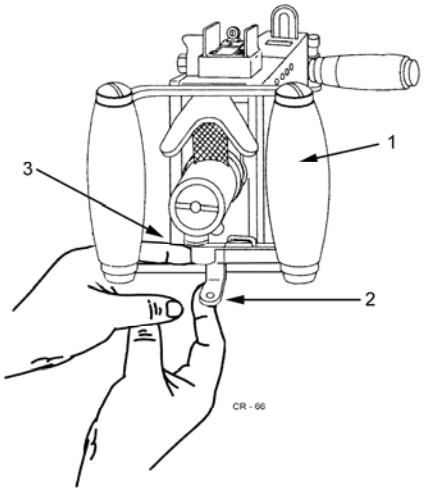


Figure 89. Removing the Spade Grip.

3. Release the drive spring. At the rear of the weapon (1) push the drive spring forward, then to the left (2) and move the spring and rod rearward to release pressure. See Figure 90.

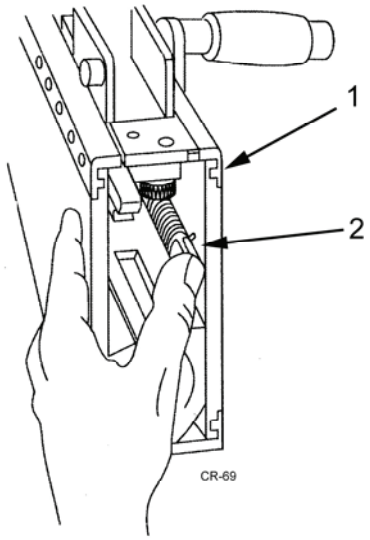


Figure 90. Releasing Drive Spring and Rod.

4. On the right side of the weapon (1), locate the sensor (yellow circle) (2) by looking through the weapon charging slot. See Figure 91.

5. Locate the long charging pin on the right side (3).

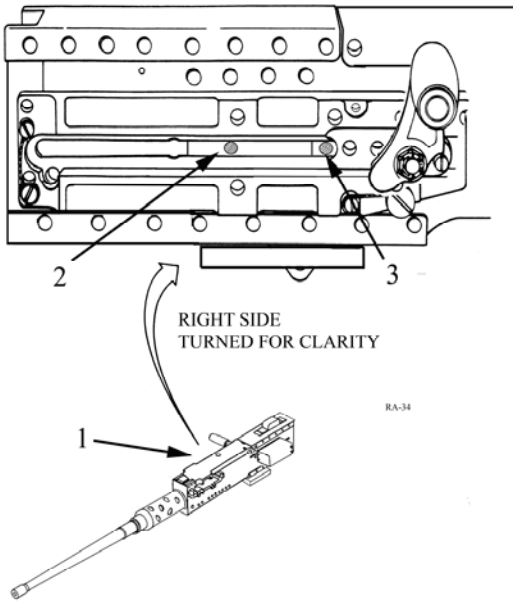


Figure 91. Locating the Rounds Counter Sensor.

WAK AND WEAPON INSTALLATION - Cont

Checking and Adjusting the M2 Rounds Counter - Cont

Checking the M2 Rounds Counter - Cont

NOTE

The long (3) and short bolt breech pins are installed in the weapon bolt assembly directly across from each other in the same bore. Aligning one aligns the other.

Some parts assembled to the weapon have been left off of the drawing for clarity.

6. Look through the right side weapon charging slot into the weapon and see the yellow rounds sensor (2) on the inside of the outer weapon. Mark (1) directly over the sensor position (2). See Figure 92.

7. Slowly move the charging handle (4) rearward until the long bolt breech pin (3) is directly under the mark (1). Since the long bolt breech pin at position (1) is directly across from the short bolt breech pin (hidden by bolt) the short bolt breech pin is now aligned with the rounds sensor (2).

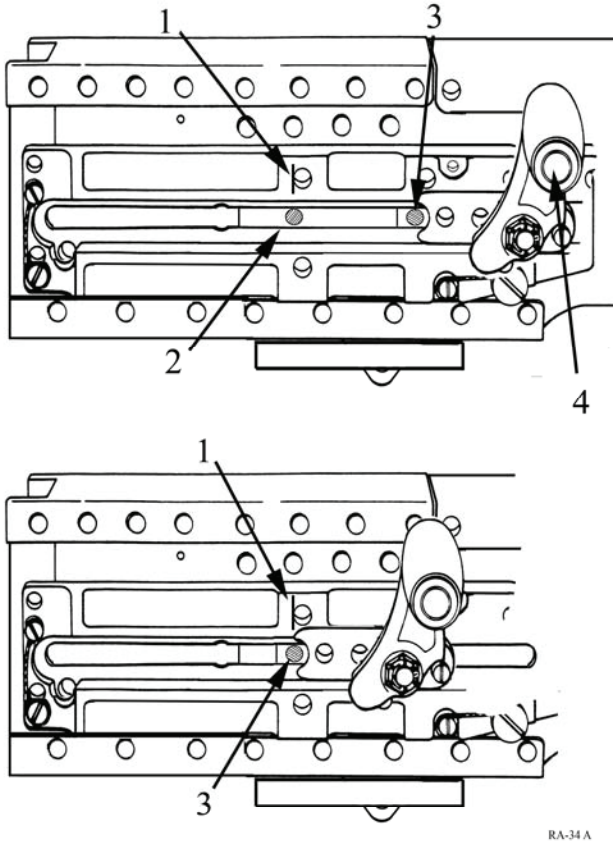


Figure 92. Aligning the Breech Bolt Pins with the Rounds Sensor.

NOTE

The alignment set at step 7 must be held to allow completion of the following measurement.

8. Measure the sensor and short pin clearance as follows. See Figure 93.

   a. On the left side of the weapon at the charging slot at the rear of the RFA (1), insert the feeler gage (2) set at .020.

   b. Slide the feeler gage 1 inch down the slot (3). The feeler must go the full 1 inch of travel to confirm the "go" setting between the sensor and the short charging pin.

   c. Reset the feeler gage using two blades, .015 and .016, to equal the .031, "NO GO" condition and insert in the slot (1). The combination equaling .031 must not go in the 1 inch of travel.

   d. If the above checks are not correct, go to Adjusting the M2 Rounds Counter section.

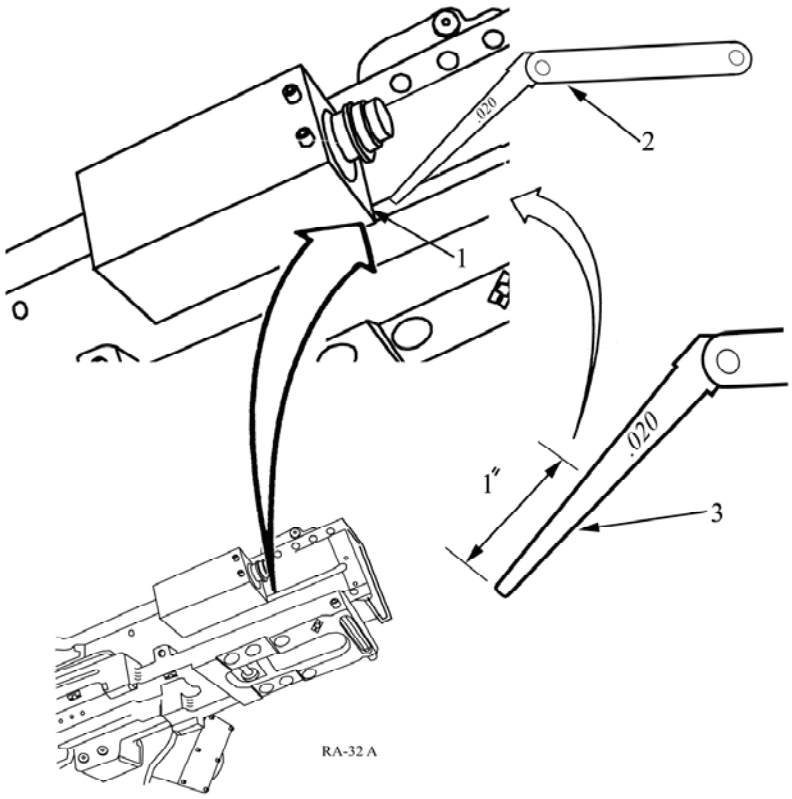


Figure 93. Checking Sensor Pin Clearance.

WAK AND WEAPON INSTALLATION - Cont

Checking and Adjusting the M2 Rounds Counter - Cont

Checking the M2 Rounds Counter - Cont

9. At the rear of the weapon (1) push the drive spring and rod (2) in to the normal position and move the rod right to latch in position. Move M2 bolt assembly forward. See Figure 94.

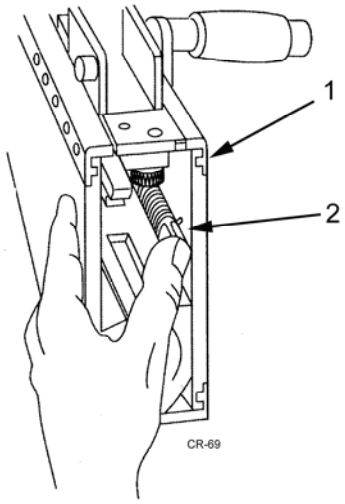


Figure 94. Positioning and Latching the Drive Spring and Rod.

10. On the weapon (1), install the spade grip and back plate (2) by lining with slot (3) and sliding down from the top until the latch (4) clicks in position and the latch lock (5) engages the latch. See Figure 95.

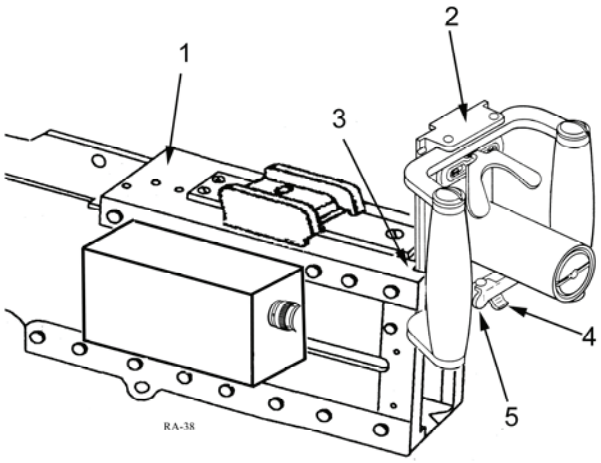


Figure 95. Installing Spade Grip and Back Plate.

END OF TASK

Adjusting the M2 Rounds Counter

Adjust the rounds counter sensor as follows:

1. Remove the RFA from the weapon as follows. See Figure 96.
    a. Cut safety wire (if wired) and remove socket cap screws (1) and slide off cover (2).
    b. Remove retaining pin (3) and take off nut (4).
    c. Pull the RFA from the weapon and remove bolt (6).

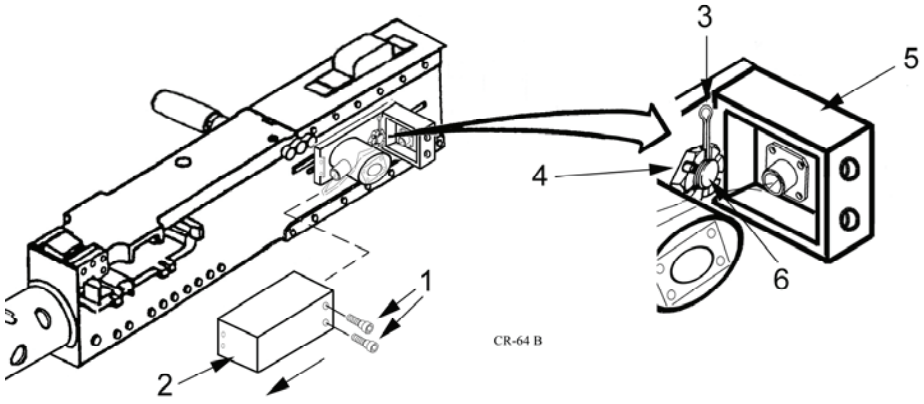


Figure 96. Removing the RFA.

WAK AND WEAPON INSTALLATION - Cont

Checking and Adjusting the M2 Rounds Counter - Cont

Adjusting the M2 Rounds Counter - Cont

CAUTION

Turning the sensor is limited to 1/2 turn only. Further turning will damage the wiring solder contacts. A 1/2 turn provides an adjustment of 0.020 inches which should provide sufficient adjustment.

2. Place the edge of the machinist scale over the sensor (5) and check for flatness with the RFA surface using feeler gage blade .0015 (4). See Figure 97.

3. Loosen nut (2) and turn the sensor (3) until the sensor and the RFA surface are flush (5). The 0.0015 feeler blade will not slide under the scale at any point including the sensor (5).

4. Holding the sensor (3) in position, tighten nut (2). Recheck with the 0.0015 feeler blade to make certain the sensor did not slip.

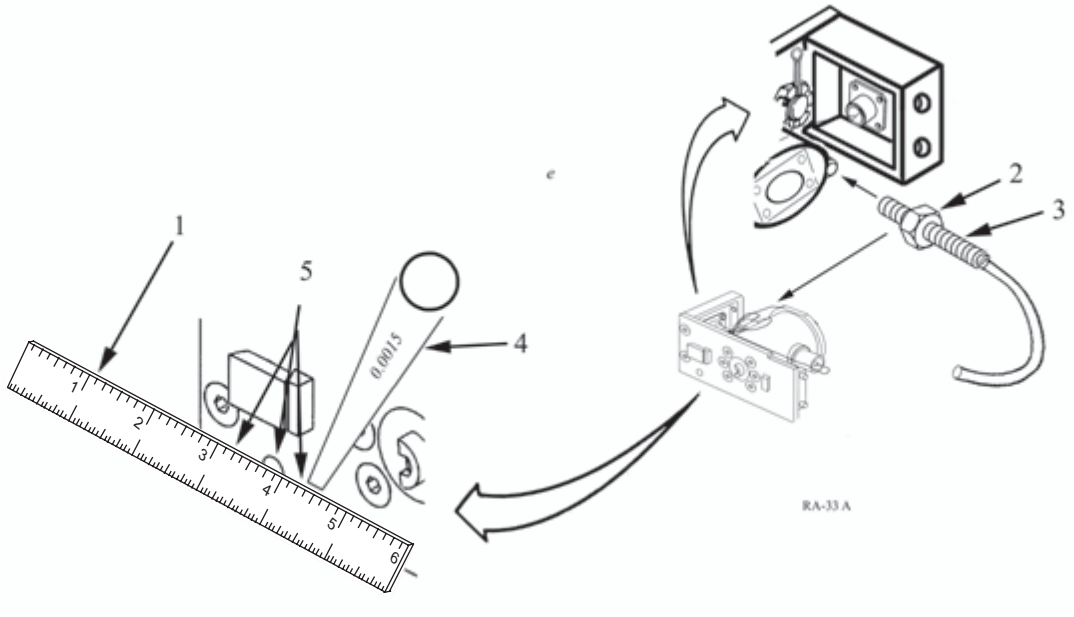


Figure 97. Resetting the Sensor Starting Adjustment.

5. Install the RFA on the weapon as follows. See Figure 98.

   a. Place bolt (2) in the RFA (1) and install on the weapon.

   b. Tighten nut (3) finger tight, then tighten until the RFA (1) is firm against the weapon. Do not install the retaining pin (4) or the cover at this time.

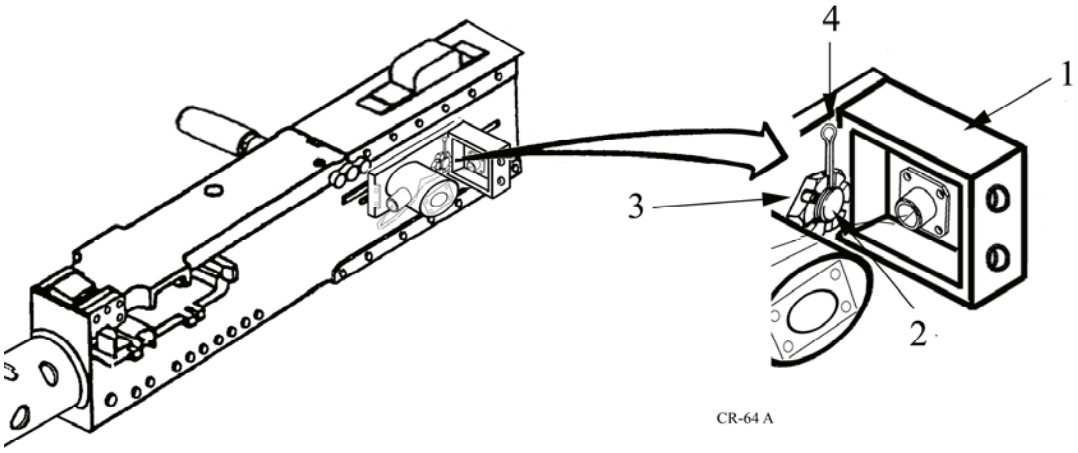


Figure 98. Installing the RFA.

WAK AND WEAPON INSTALLATION - Cont

Checking and Adjusting the M2 Rounds Counter - Cont

Adjusting the M2 Rounds Counter - Cont

6. Move the charging handle (1) until the short charging pin (2) is at the edge of the RFA. See Figure 99.

7. Use the feeler gage (3) to measure the gap between the RFA and the pin (2). Record the result.

NOTE

A presumed result of 0.035 inches for step 7 will be used to simulate setting the rounds sensor.

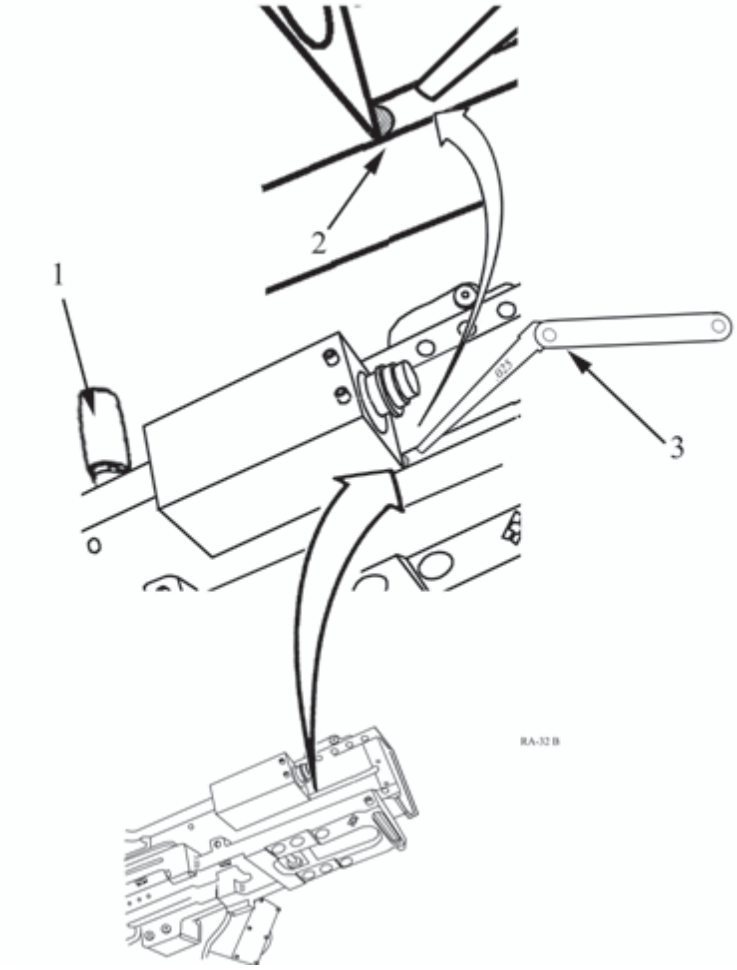


Figure 99. Locating Static Dimension of the Short Charging Pin.

8. Remove nut (2) and pull the RFA (1) off of the weapon. See Figure 100.

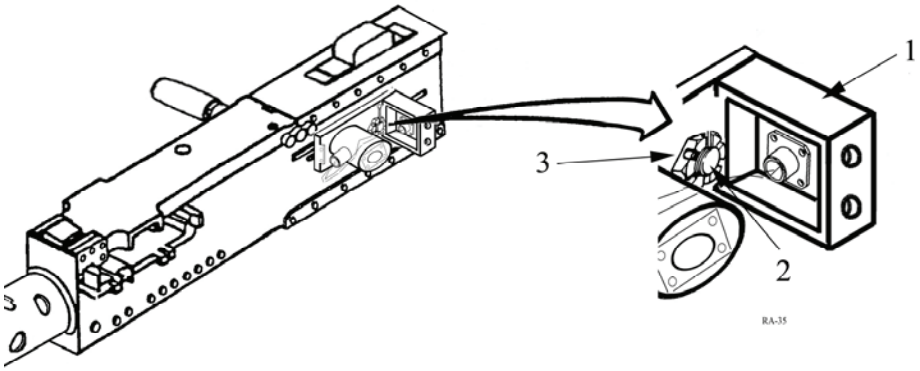


Figure 100. Removing the RFA.

CAUTION

Adjusting the sensor is limited to a maximum of 1/2 turn to avoid damaging the soldered wires. If a 1/2 turn does not provide enough adjustment, the RFA must be turned in to higher level maintenance to untangle and re-solder the wires.

NOTE

The sensor will move 0.010 inches for a 1/4 turn. Assuming a result of 0.035 inches for the feeler gage measurement at step 7, the sensor must be adjusted 1/4 turn CW to reduce the gap with the short charging pin to the nominal setting of 0.025 inches.

9. Mark a line on the top (12 o'clock position) of the sensor cable (1) to establish the starting position. See Figure 101.

10. Loosen nut (2) and turn the sensor CW until the mark is at 90 degrees (3 o'clock position).

11. While still holding the sensor at the 90 degree (3 o'clock) position, tighten the nut.

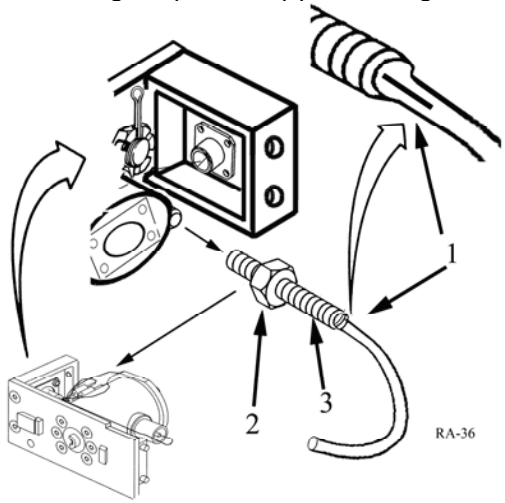


Figure 101. Adjusting the Rounds Sensor.

WAK AND WEAPON INSTALLATION - Cont

Checking and Adjusting the M2 Rounds Counter - Cont

Adjusting the M2 Rounds Counter - Cont

12. Install the RFA as follows. See Figure 102:
    a. Install bolt (2) in the weapon slot and RFA (1).
    b. Install nut (3) until the RFA is in full contact with the weapon.
    c. Tighten nut (3) to the next retaining pin hole and install the retaining pin (4).

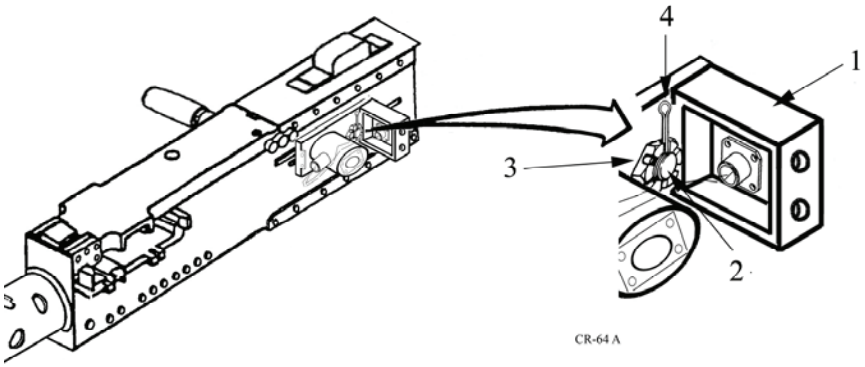


Figure 102. Installing the RFA.

13. Repeat the Checking the M2 Rounds Counter procedure to confirm the rounds sensor adjustment.
    a. If results are not as specified, repeat the adjustment process from step 1.
    b. If results are correct, proceed to step 14.
14. Install the cover (1) and cap screws (2). See Figure 103.

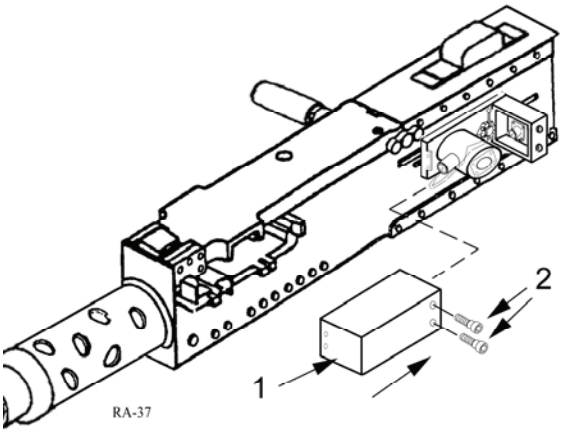


Figure 103. Installing the Cover on the RFA.

END OF TASK

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER USUAL CONDITIONS - M2 HB .50-CAL MACHINE GUN WEAPON ADAPTER KIT (WAK) AND WEAPON: REMOVAL

THIS WORK PACKAGE COVERS:

Removing the M2 HB .50-Cal Machine Gun and WAK and cradle from the CROWS.

INITIAL SET UP:

Tools and Special Tools

Operator's Tool Kit (WP 0036, Table 2, Item 1)

Materials/Parts

Pin, hitch, lock (WP 0038, Table 1, Item 20)

Personnel Required

Two

Equipment Conditions

System power off

References

WP 0005	WP 0010	WP 0031
WP 0006	WP 0012	WP 0032
WP 0007	WP 0014	WP 0034
WP 0008	WP 0018	WP 0035
TM 9-1005-213-10		WP 0036
TM 9-1005-213-23&P		WP 0038

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- Removal of Remote Firing Assembly (RFA) 15
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- Removal of Block Guide Assembly 30
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- Removal of Sear Assembly with Sear Slide 39

Cradle Removal 40

CAUTION

Use two personnel during removal of the cradle and M2 HB .50-cal machine gun. Failure to do so may result in personal injury or equipment damage.

CONSIDERATIONS BEFORE AND DURING DISASSEMBLY

The following general procedures are recommended to reduce maintenance time and prevent accidental damage to the equipment.

- Follow all safety regulations, warnings, cautions, and notes.
- Ensure vehicle is positioned on level ground.
- Ensure the system is powered down, the weapon is cleared, and any cleared rounds are removed.
- Refer to the appropriate weapon operation and maintenance manuals, as well as related CROWS manuals, detailed in WP 0035, References.
- Examine equipment carefully to determine cause of failure before removing defective or broken parts.
- Disassemble equipment only to the point necessary to perform required maintenance.
- Before disconnecting any electrical parts, ensure parts are tagged for identification.
- Note orientation of all parts before removal.

TURN IN OF M2 HB .50-CAL MACHINE GUN FROM CROWS CONFIGURATION

Refer to WP 0034 for instructions on how to remove CROWS parts from the weapon prior to turning in the weapon.

M2 WAK COMPONENTS

Table 1 details the major components of the M2 WAK, which are illustrated in Figure 1.

NOTE

Quantities are assumed to be 1 each unless otherwise specified.

Table 1. M2 HB WAK Components (PN 21677-3100).

Item Number	PN	Nomenclature	Common Name
1	21677-3107	. Chute Assembly, Ammunition	Link Chute Assembly
2	21483-2609	. Screw, Shoulder	Linear Actuator (Charger) Bolt (qty. 2)
3	21677-3170	. Linear Actuator Assembly	Linear Actuator (Charger) Assembly
4	21677-3160	. Sear	Sear Assembly with Sear Slide
5	21677-3164	. Extension, Retracting Slide	Retracting Slide Extension
6	21677-3134	. Guide, Cartridge, Ammunition	Ammo Guide
7	21677-3130	. Guide, Cartridge, Ammunition	Block Guide Assembly
8	21677-3175-2	. Pin, Shoulder, Headless	Breech Bolt Pin Long
9	21677-3175-1	. Pin, Shoulder, Headless	Breech Bolt Pin Short
10	21483-3166	. Nut, Self Locking Hexagon	Locking Long Nut
11	21677-3172	. Pin, Shoulder, Headed	Left-Hand Securing Bolt
12	21677-3171	. Pin, Shoulder, Headed	Right-Hand Securing Bolt
13	21677-3702	. Cable Assembly, Power, Electrical	Weapon to Mount Cable
14	21483-3145	. Feeder, Ammunition, Machine Gun	Feed Throat
15	21677-3165	. End Rod, Threaded	Rod End
16	21677-3150	. Remote Firing Assembly	RFA
17	21677-2614	. Pin Assembly, Mounting	Forward Pin with Lanyard and Hitch Pin
18	21677-3030	. Link Chute Clamp	Link Chute Clamp

M2 WAK COMPONENTS - Cont

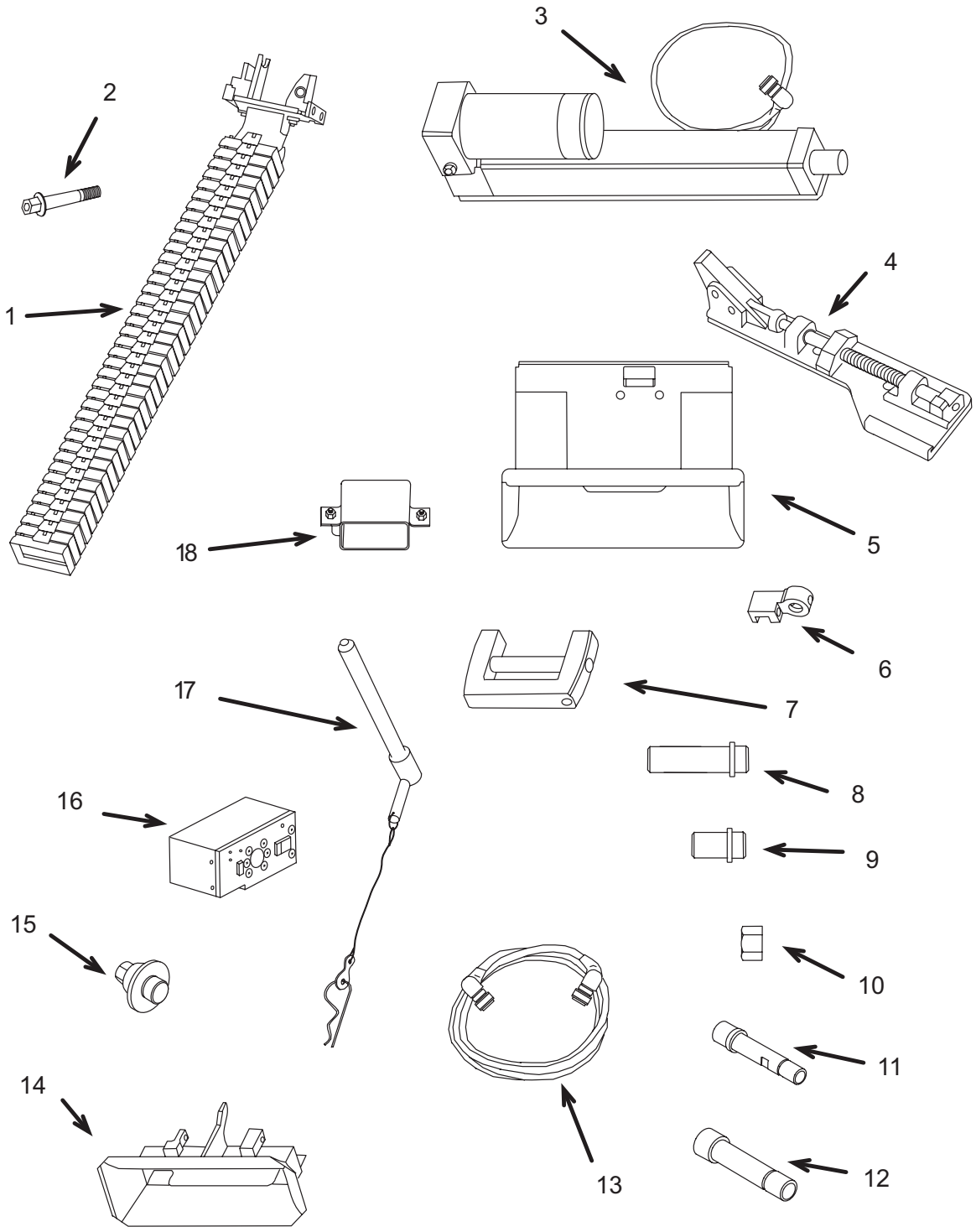


Figure 1. M2 HB WAK Components.

REMOVAL OF M2 HB WEAPON AND WAK COMPONENTS

Perform the following procedures to remove the M2 CROWS weapon and WAK items.

WARNING

Follow all stated warnings and cautions when handling the weapons.

Ensure that the weapon is cleared and any cleared rounds are secured before performing any procedures, unless specifically directed to load the weapon. (For instructions on clearing and loading the M2, refer to WP 0018.)

Ensure the weapon has cooled before handling. For additional information, refer to TM 9-1005-213-10, Operator's Manual for the M2 HB .50-Cal Machine Gun.

Use two personnel during installation/removal of the cradle and M2 gun.

Failure to follow these instructions may result in personal injury or equipment damage.

NOTE

Ensure the azimuth lock assembly is in the locked position for the following procedures. (For azimuth lock procedures, refer to WP 0006, Azimuth Lock Assembly section.)

For details on handling or disassembling the M2 weapon, refer to WP 0035, References, or WP 0034, Preparation for Weapon Turn-In.

To prepare the CROWS cradle for other configurations, the following items from the M2 WAK will need to be removed, as detailed in the remainder of this section:

- Cable Connections: Actuator to Pedestal and RFA to weapon cables
- Link Chute Adapter
- Weapon
- Remote Firing Assembly (RFA)
- Breech Bolt Pins and Weapon Charging Mechanism
- Retracting Slide Extension and Securing Bolts
- Feed Throat Assembly
- Block Guide Assembly
- Ammo Guide
- Linear Actuator
- Sear Assembly with Sear Slide

REMOVAL OF M2 HB WEAPON AND WAK COMPONENTS - Cont

Removal of Cable Connections: Mount-Linear Actuator (Charger) and Weapon-Mount Cable

WARNING

Follow all safety warnings and cautions during interconnection procedures. Failure to do so may result in personal injury or equipment damage.

CAUTION

Install connector caps as cables are being detached from the solenoid, adapter-counter, and other connectors.

Ensure CROWS system power is OFF when connecting or disconnecting cables.

Failure to do so may result in equipment damage or system inoperability.

NOTE

For additional information on CROWS cables and connectors, refer to WP 0005, Interconnection (Connectors and Cables).

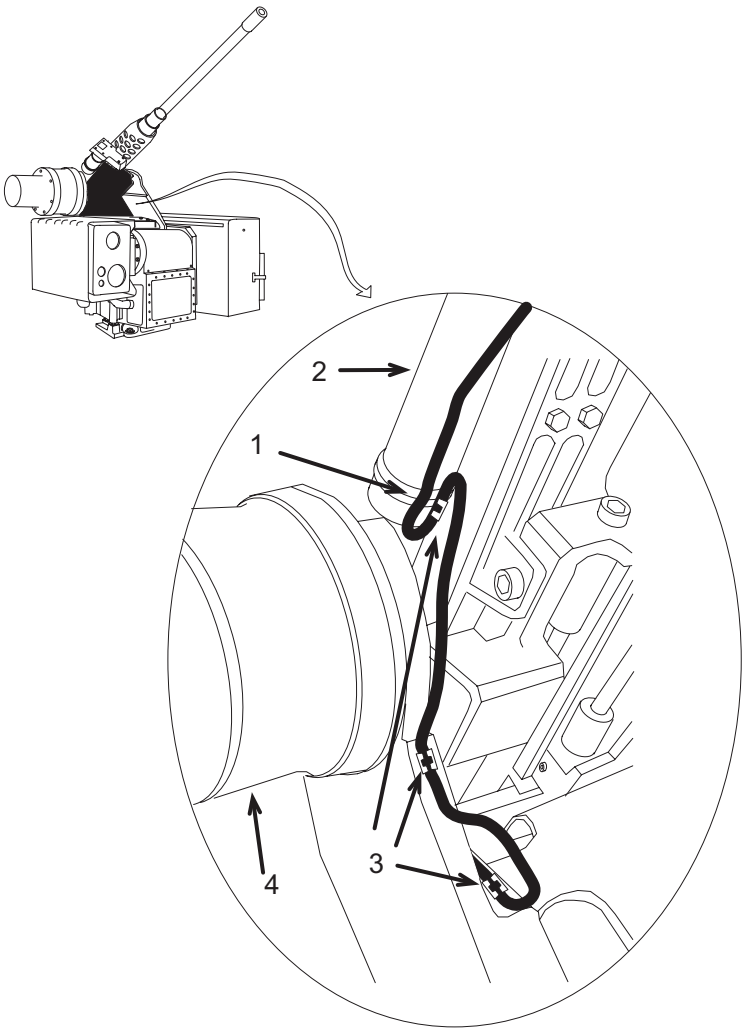
Ensure the azimuth lock assembly is in the locked position for the following procedure. (For azimuth lock procedures, refer to WP 0006, Azimuth Lock Assembly section.)

Some steps within the disassembly procedures require two personnel.

Perform the following procedure to disconnect the M2 cables.

1. Turn all POWER switches to OFF position.

2. Cut the cable ties holding the cable to the cable anchors for the mount-linear actuator (charger) and weapon-mount cables, referring to Figures 2 through 5.



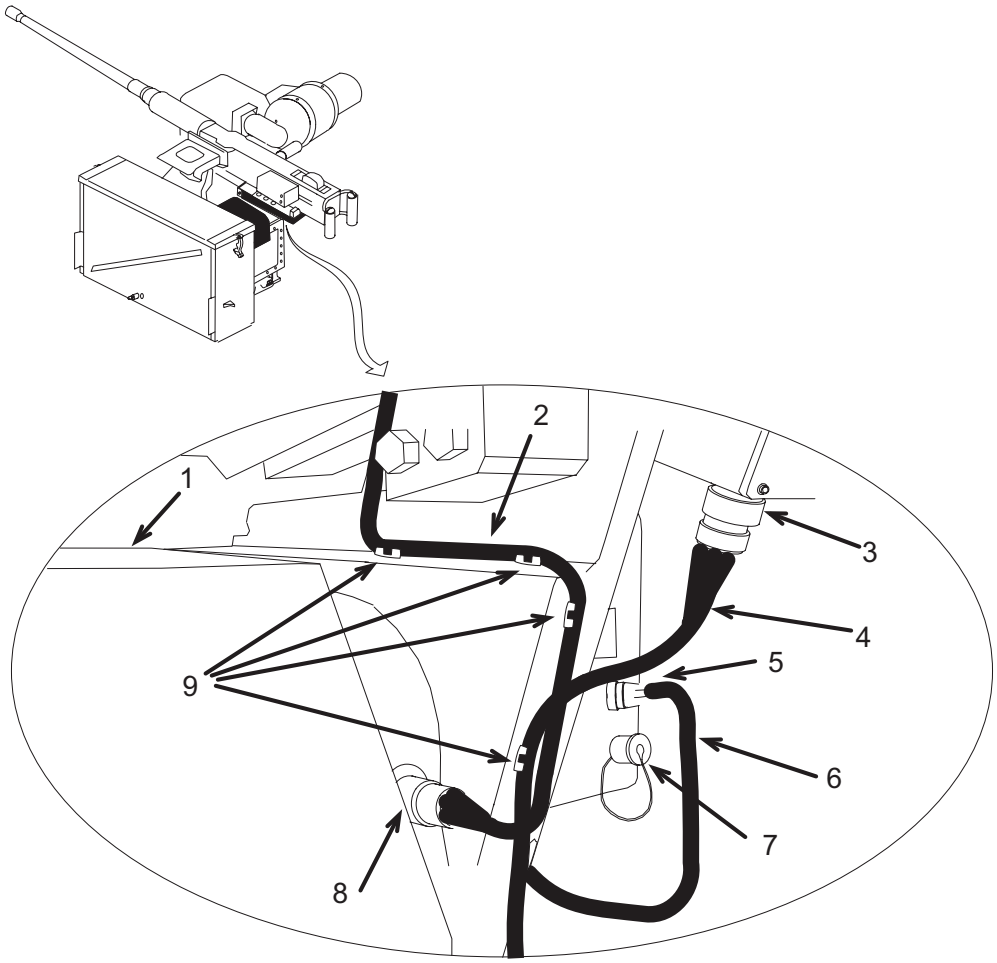
Legend:
1. Mount-Linear Actuator (Charger) Cable
2. Linear Actuator (Charger)
3. Cable Anchors
4. Elevation Drive

Figure 2. Mount-Linear Actuator (Charger) Cable Seen from Elevation Yoke Arm.

REMOVAL OF M2 HB WEAPON AND WAK COMPONENTS - Cont

Removal of Cable Connections: Mount-Linear Actuator (Charger) and Weapon-Mount Cable - Cont

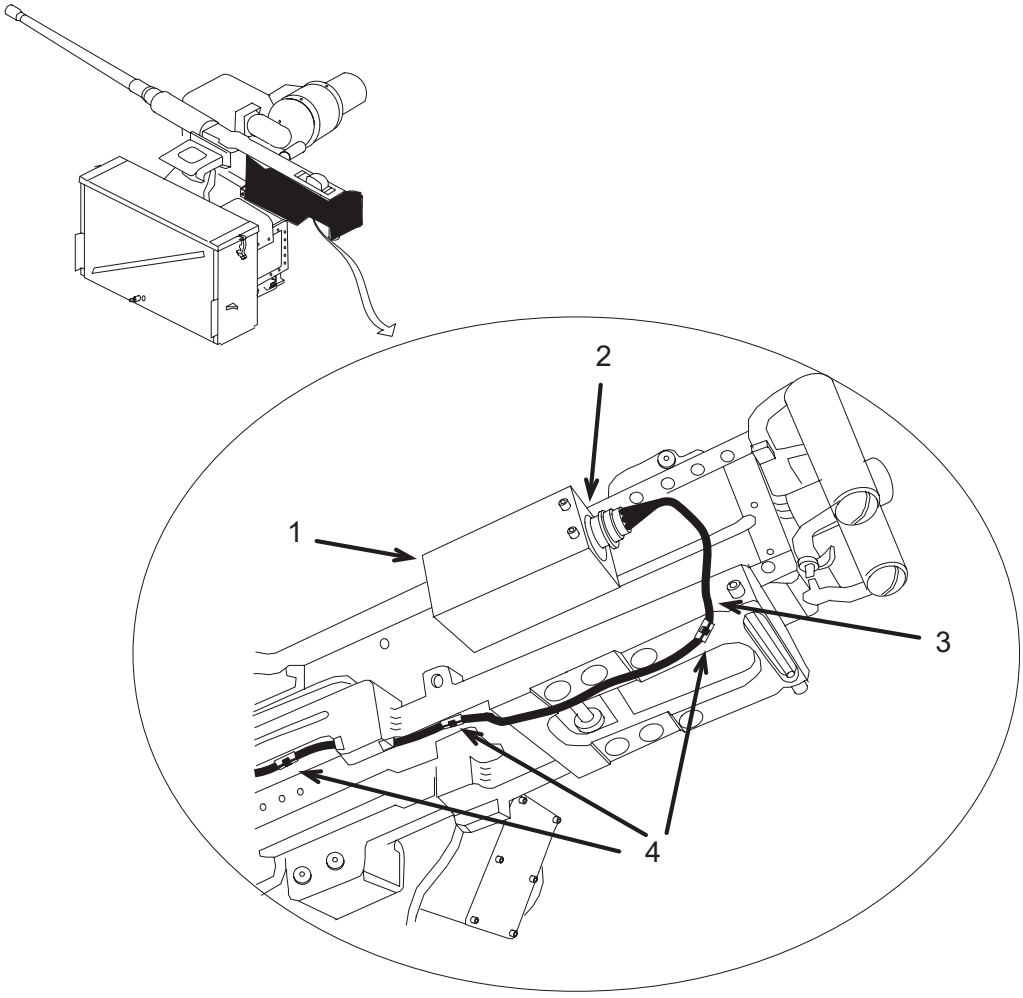
3. Disconnect the mount-linear actuator (charger) cable (2) from connector, J5 (8), on the pedestal, as shown in Figure 3.



Legend:
1. Casing Deflector
2. Mount-Linear Actuator (Charger) Cable
3. J1, Elevation Drive
4. Mount-Elevation Drive Cable
5. J1, Sensor Unit
6. Mount-Sensor Unit Cable
7. J2, Test, Sensor Unit
8. J5, Actuator, Mount
9. Cable Anchors

Figure 3. Mount-Linear Actuator (Charger) Cable Connected to Connector J5, Actuator.

4. Disconnect the weapon-mount cable (Figure 7, item 3) from connector, J1 (Figure 7, item 2) and connector J6, Weapon (Figure 8, item 9).

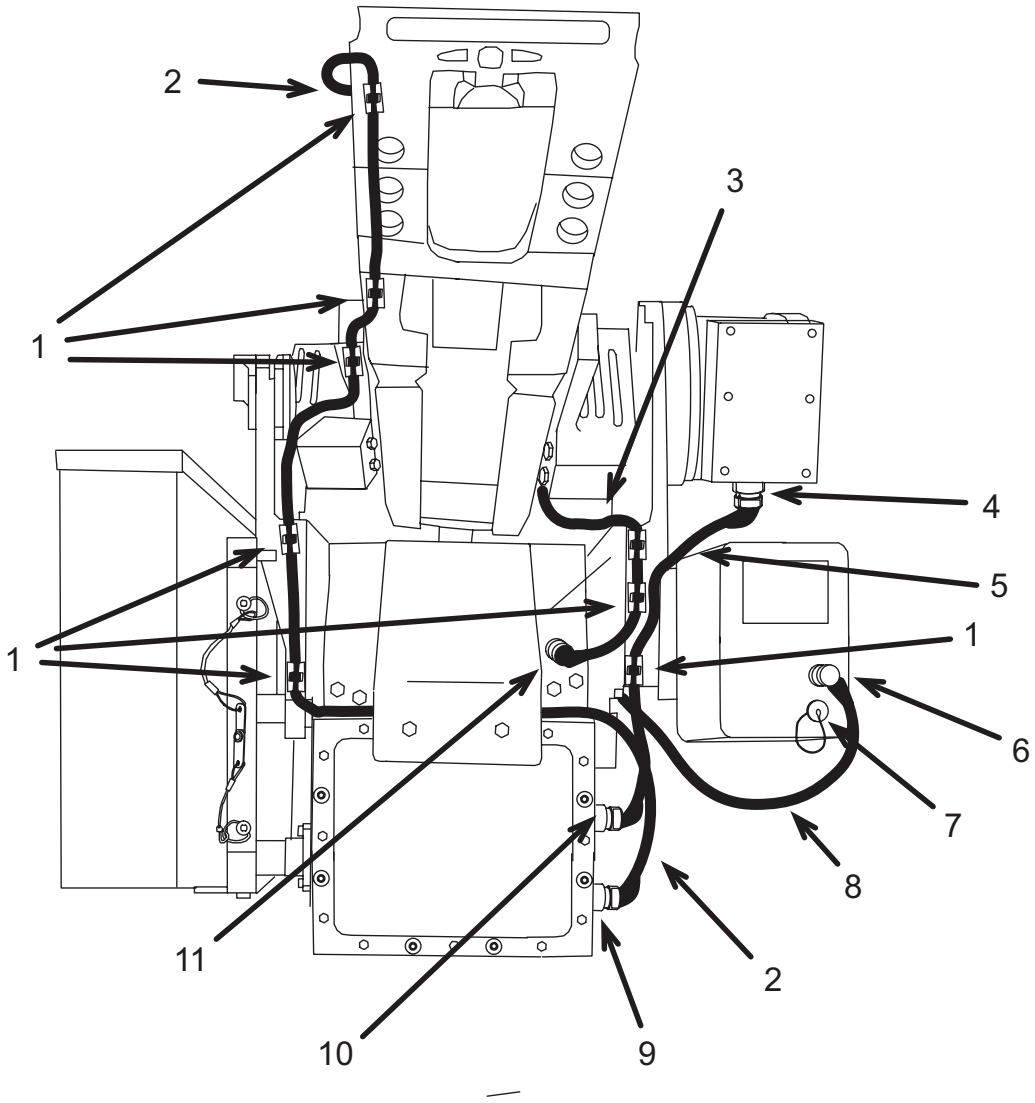


Legend:
1. Remote Firing Assembly (RFA)
2. J1, RFA
3. Weapon-Mount Cable
4. Cable Anchors

Figure 4. RFA Connector J1 with Cables Tied Down.

REMOVAL OF M2 HB WEAPON AND WAK COMPONENTS - Cont

Removal of Cable Connections: Mount-Linear Actuator (Charger) and Weapon-Mount Cable - Cont



Legend:	
1. Cable Anchors	7. J2, Test, Sensor Unit
2. Weapon-Mount Cable	8. Mount-Sensor Unit Cable
3. Mount-Linear Actuator (Charger) Cable	9. J6, Weapon, Mount
4. J1, Elevation Drive	10. J3, Elevation, Mount
5. Mount-Elevation Drive Cable	11. J5, Actuator, Mount
6. J1, Sensor Unit	

Figure 5. CROWS Cable Anchor Positions.

END OF TASK

Removal of M2 HB .50-Cal Machine Gun from Cradle

Perform the following procedure to remove the M2 HB .50-cal machine gun from the cradle.

WARNING

Follow all safety warnings and cautions during interconnection procedures. Failure to do so may result in personal injury or equipment damage.

NOTE

Ensure the azimuth lock assembly is in the locked position for the following procedure. (For azimuth lock procedures, refer to WP 0006, Azimuth Lock Assembly section.)

1. Ensure CROWS system power is OFF.
2. Ensure weapon is cleared and any cleared rounds are secured IAW applicable TM.
3. Manually elevate the cradle.
4. Remove the hitch pin from the brass bushing in the handle, as shown in Figure 6, and turn the forward pin handle to the up position.

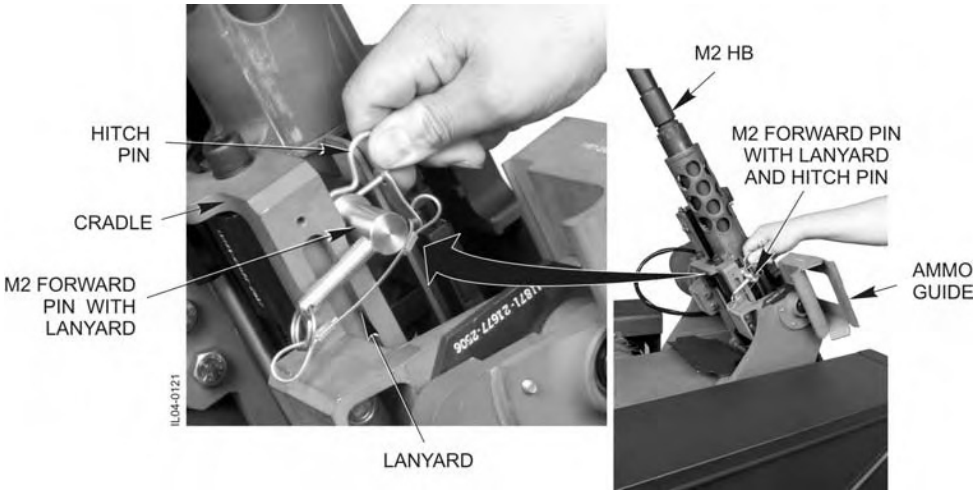


Figure 6. Releasing M2 Forward Pin Holding Weapon.

REMOVAL OF M2 WEAPON AND WAK COMPONENTS - Cont

Removal of M2 HB .50-Cal Machine Gun from Cradle - Cont

5. Remove the forward pin from the attenuators and gun.

6. Remove the weapon as follows, referring to Figures 7 and 8:

   a. Slide the gun forward slightly until the block guide assembly on the bottom rear of the weapon clears the block guide channel.

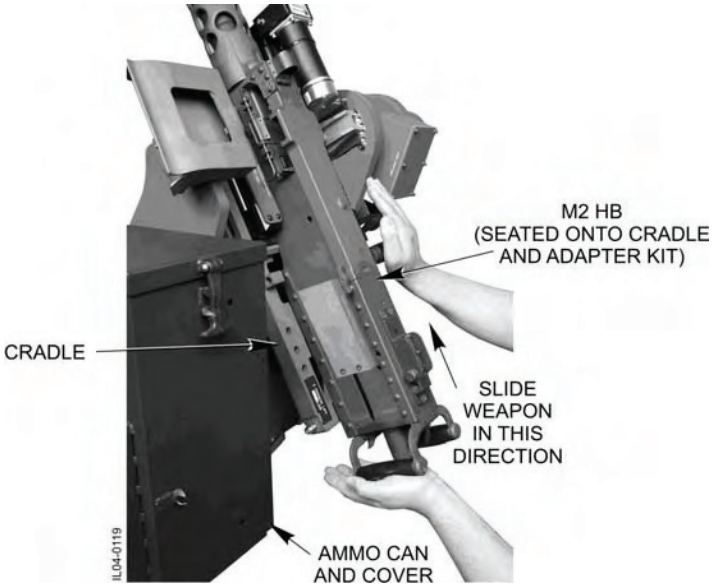


Figure 7. Sliding Weapon Forward On Cradle.

   b. Lift the gun, with adapter kit items, off of the cradle and place it on a secure surface.

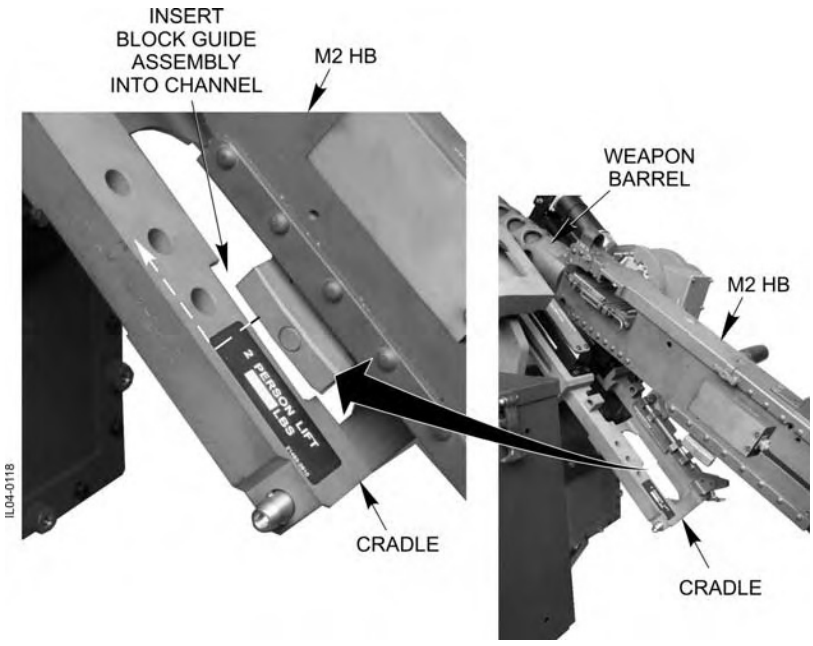


Figure 8. Removing Weapon from Cradle.

END OF TASK

Removal of Link Chute Adapter

NOTE

Ensure the azimuth lock assembly is in the locked position for the following procedure. (For azimuth lock procedures, refer to WP 0006, Azimuth Lock Assembly section.)

Perform the following procedure to remove the link chute adapter from the M2 weapon.

1. Ensure CROWS system power is OFF.
2. Open the weapon cover and remove the right hand belt-holding pawl pin holding the link chute adapter to the weapon, as shown in Figure 9.

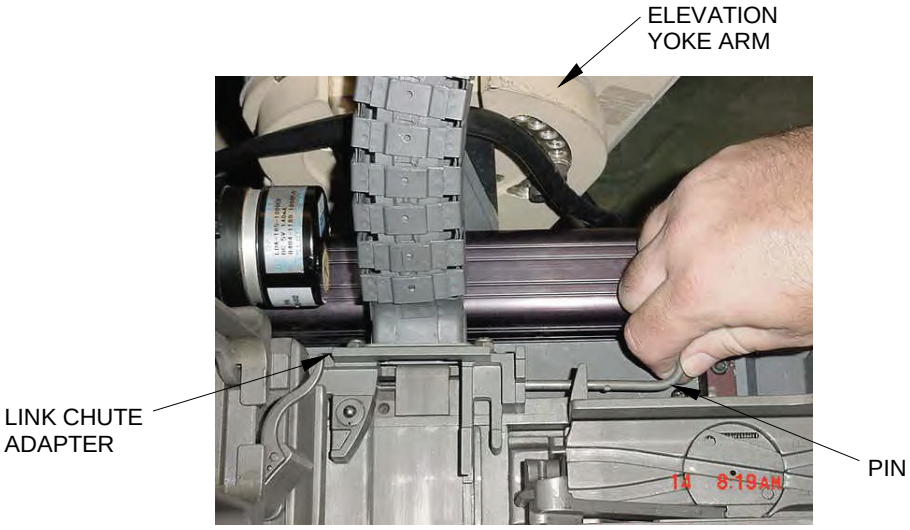


Figure 9. Link Chute Adapter Assembly Secured to Weapon.

3. Remove the link chute adapter.
4. Insert the front cartridge stop into the weapon, as shown in Figure 10.

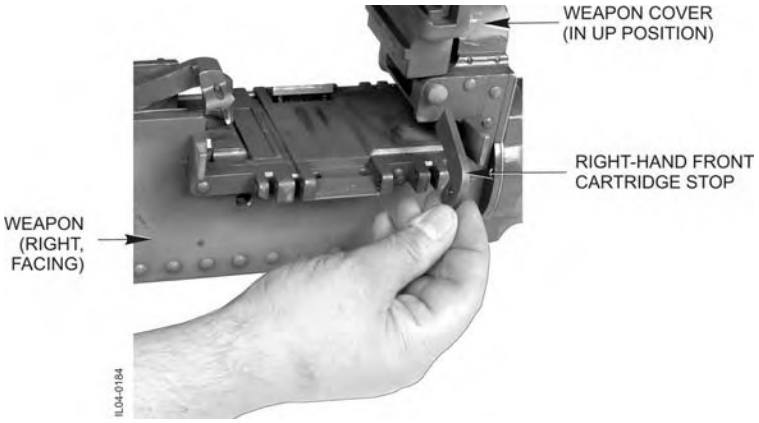


Figure 10. Insertion of Front Cartridge Stop.

REMOVAL OF M2 WEAPON AND WAK COMPONENTS - Cont

Removal of Link Chute Adapter - Cont

5. Insert the rear cartridge stop into the weapon, as shown in Figures 11 and 12.

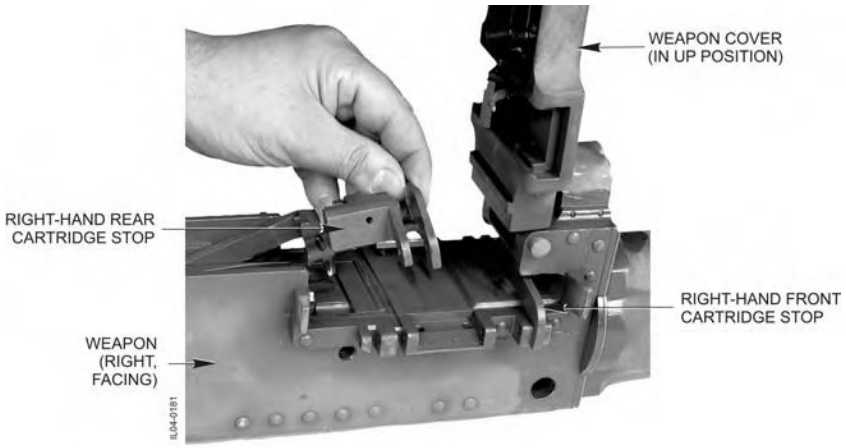


Figure 11. Positioning of Rear Cartridge Stop.

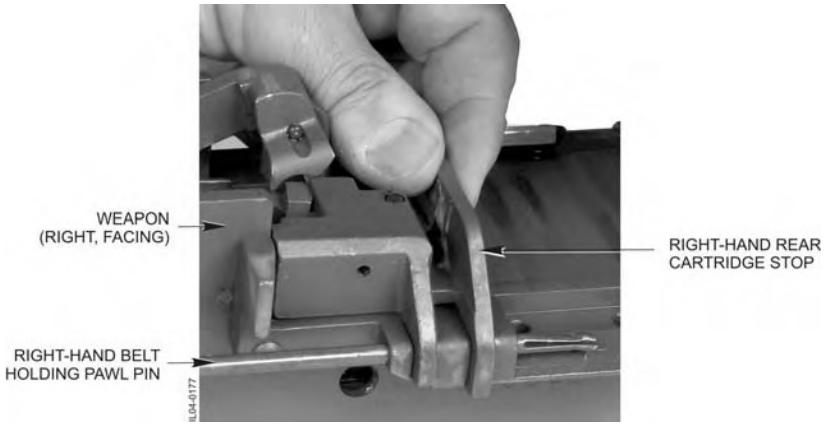


Figure 12. Inserting Rear Cartridge Stop into Weapon.

6. Insert the retaining pin into the cartridge stops, as shown in Figure 13, and close the weapon cover.

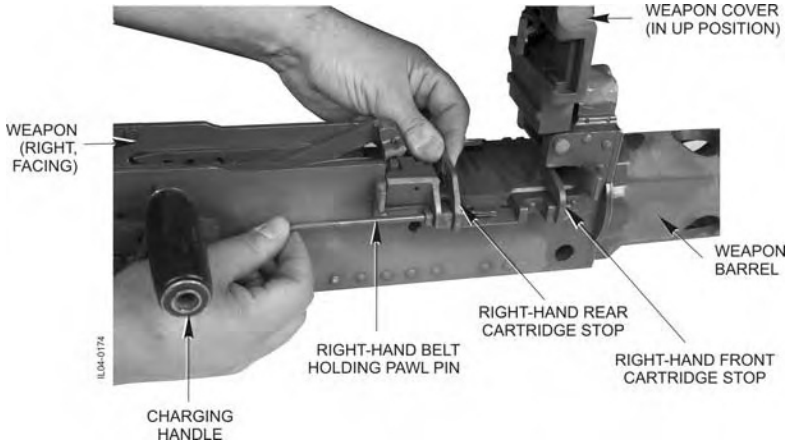


Figure 13. Retaining Pin Being Inserted into Rear and Front Cartridge Stops.

END OF TASK

Removal of Remote Firing Assembly (RFA)

Perform the following procedures to remove the RFA from the left side (facing) of the weapon.

1. Remove the two screws from the cover of the remote firing assembly using a 5/32-inch hex head wrench, as shown in Figure 14. Slide the cover off of the RFA.

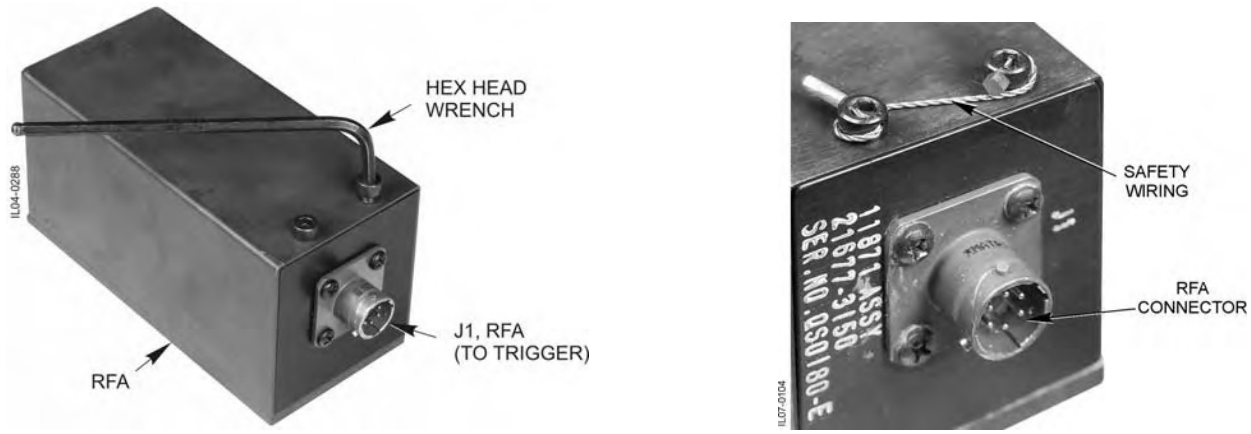


Figure 14. RFA with Cover.

2. Using needle-nose pliers, remove the hitch pin. Then, using a 19 mm combination wrench, loosen the castellated nut, as shown in Figure 15.

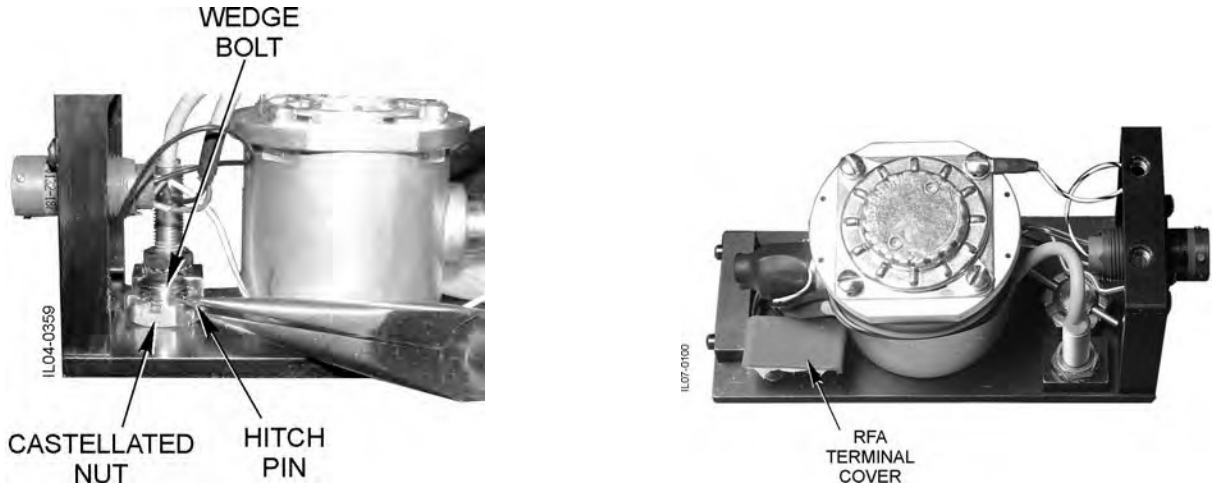


Figure 15. Removing Hitch Pin and Loosening Castellated Nut.

REMOVAL OF M2 WEAPON AND WAK COMPONENTS - Cont

Removal of Remote Firing Assembly (RFA) - Cont

3. Remove the RFA wedge bolt from the wedge slot on the weapon, as shown in Figure 16.

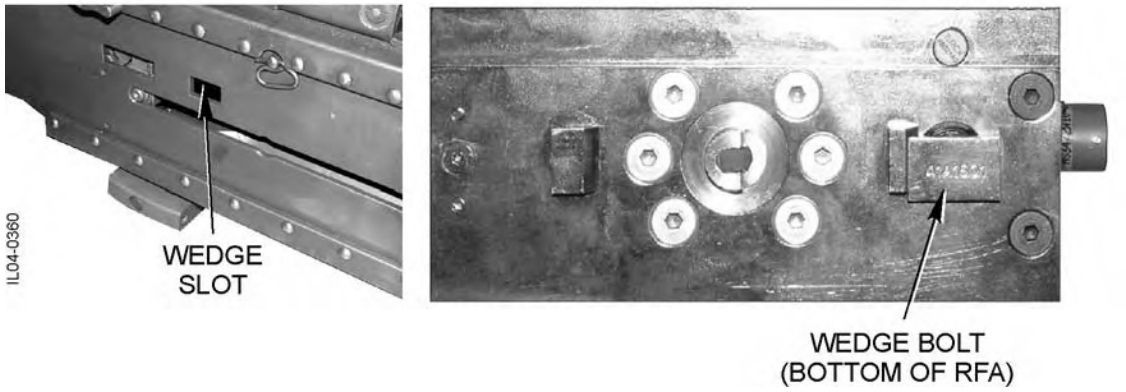


Figure 16. Wedge Inserted into Wedge Slot.

NOTE

If hitch pin is missing or damaged, replace as needed (see WP 0038, Table 1, Item 20).

4. Insert the hitch pin into the castellated nut, referring to Figure 15.

5. Reinstall the cover as follows, as shown in Figure 17.

   a. Slide the RFA cover forward over the two alignment pins on the rear of the RFA.

   b. Insert and tighten the two screws using a 5/32-inch hex head wrench, referring to Figure 14.

NOTE

For additional information on safety wiring, refer to WP 0031.

   c. Secure the screws with safety wire.

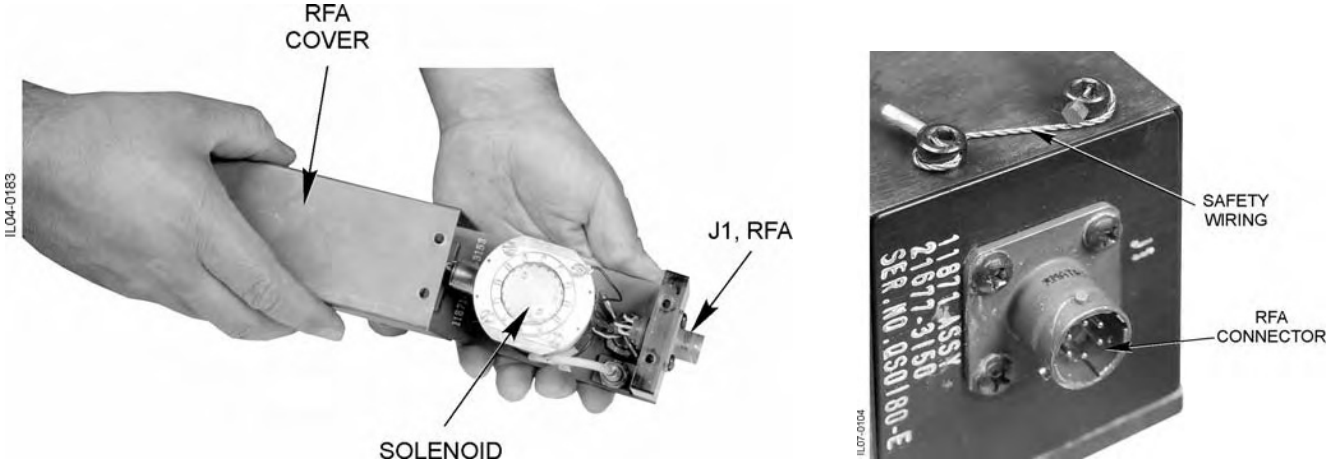


Figure 17. RFA Cover Sliding onto Assembly.

END OF TASK

Removal and Replacement of Breech Bolt Pins and Weapon Charging Mechanism

Perform the following procedure to remove the weapon charging mechanism and replace the original breech bolt pins in the weapon.

WARNING

Never remove the backplate assembly from any weapon until the chamber has been cleared and any cleared rounds have been secured. Stand to one side of the weapon when removing the backplate.

Ensure the breech bolt is in the forward position IAW TM 9-1005-213-10, Operator's Manual for the M2 HB .50-Cal Machine Gun.

Failure to follow these warnings may result in personal injury or equipment damage.

NOTE

Be sure that the long side of the breech bolt pin long faces out.

1. Ensure that the chamber has been cleared, any cleared rounds have been secured, and the breech bolt is in the forward position by lifting the weapon cover.
2. Depress bolt latch release and ensure automatic fire latch on buffer handle is disengaged by rotating latch clockwise.
3. Remove the backplate assembly by simultaneously pulling the latch lock, lifting the latch, and sliding the backplate up and off the weapon, as shown in Figures 18 and 19.

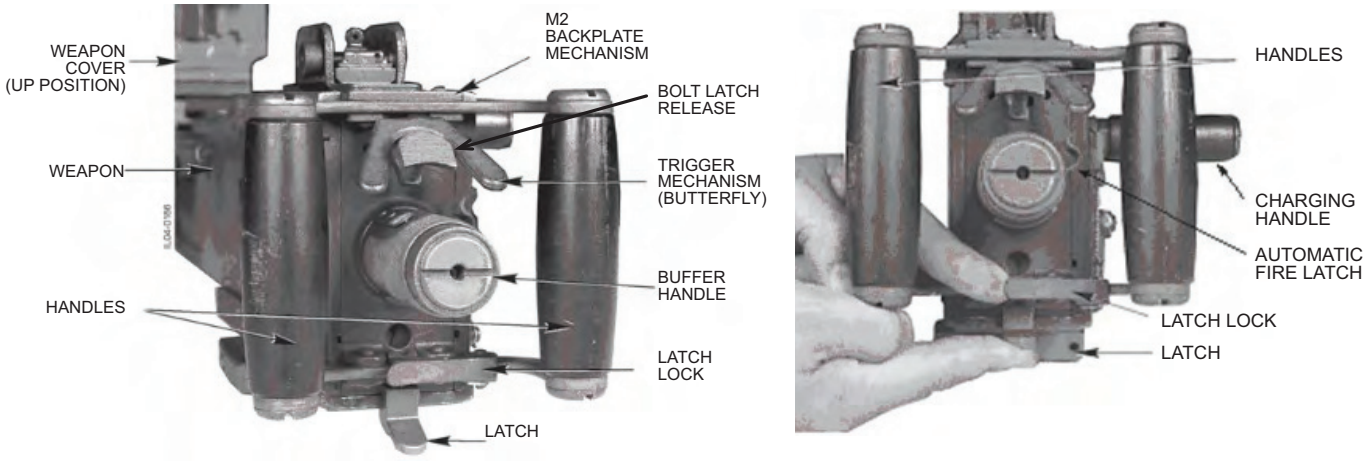


Figure 18. Backplate Assembly Removal.

REMOVAL OF M2 WEAPON AND WAK COMPONENTS - Cont

Removal and Replacement of Breech Bolt Pins and Weapon Charging Mechanism - Cont

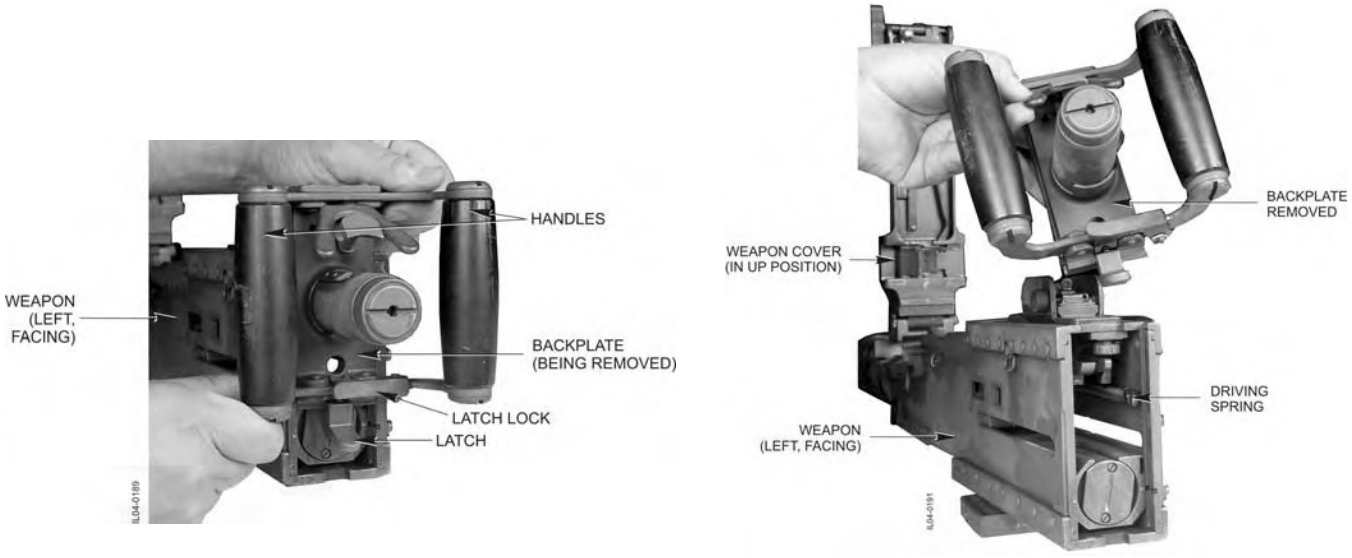


Figure 19. Lifting Backplate Off of M2.

CAUTION

Do not stand behind the weapon while releasing the driving spring.

4. Disengage the driving spring from its detent hole as shown in Figures 20 through 22. (This action will release the charging handle so that it can be pulled back to insert the original breech bolt pin.)

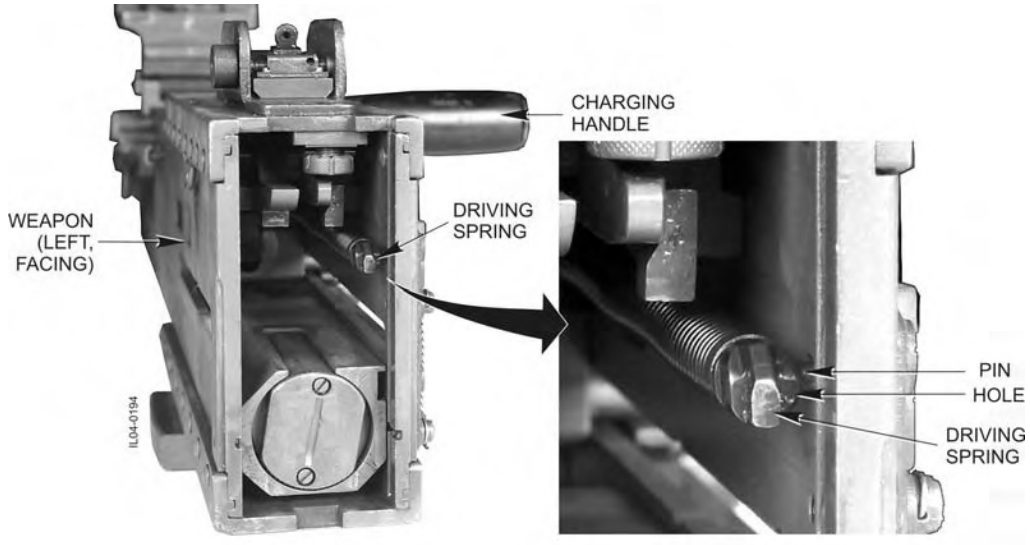


Figure 20. View Inside M2 Showing Driving Spring, Pin, and Retaining Hole.

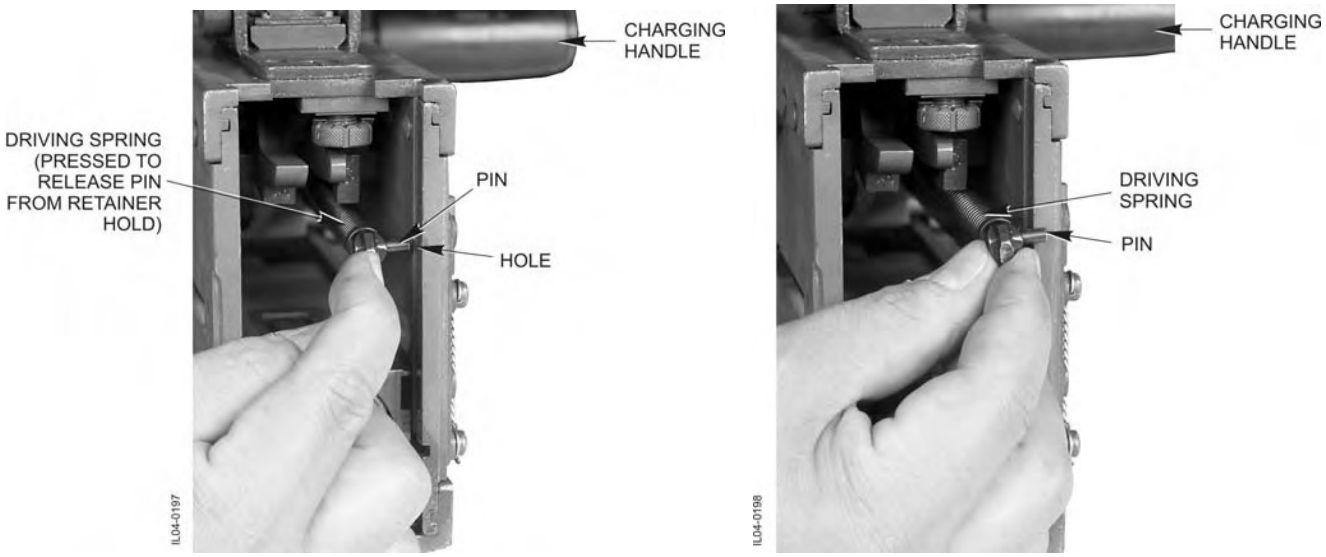


Figure 21. Pin Released from Retaining Hole.

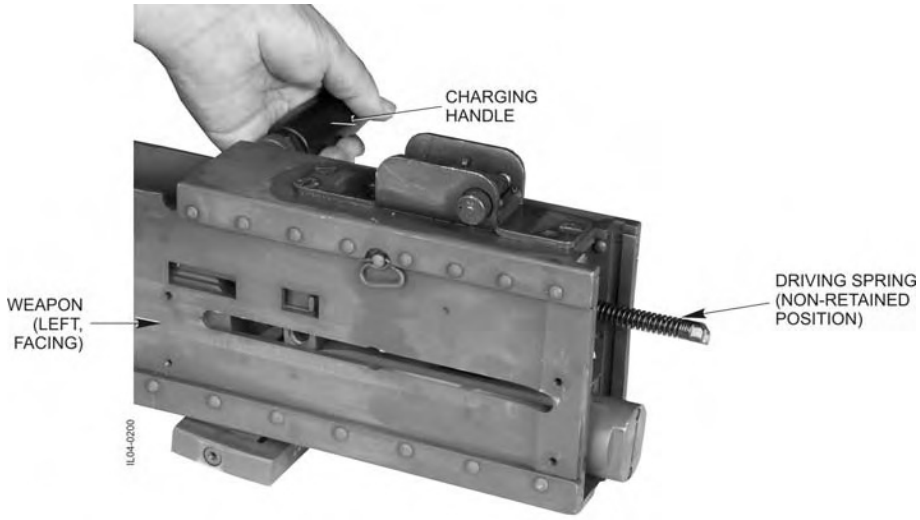


Figure 22. Moving Charging Handle (Driving Spring Released).

REMOVAL OF M2 WEAPON AND WAK COMPONENTS - Cont

Removal and Replacement of Breech Bolt Pins and Weapon Charging Mechanism - Cont

5. Remove the replacement pin on the right-hand side (facing) of the weapon and replace it with original breech bolt pin, as shown in Figures 23 and 24. Retain the replacement pin in adapter kit box until weapon is restored to its CROWS configuration.

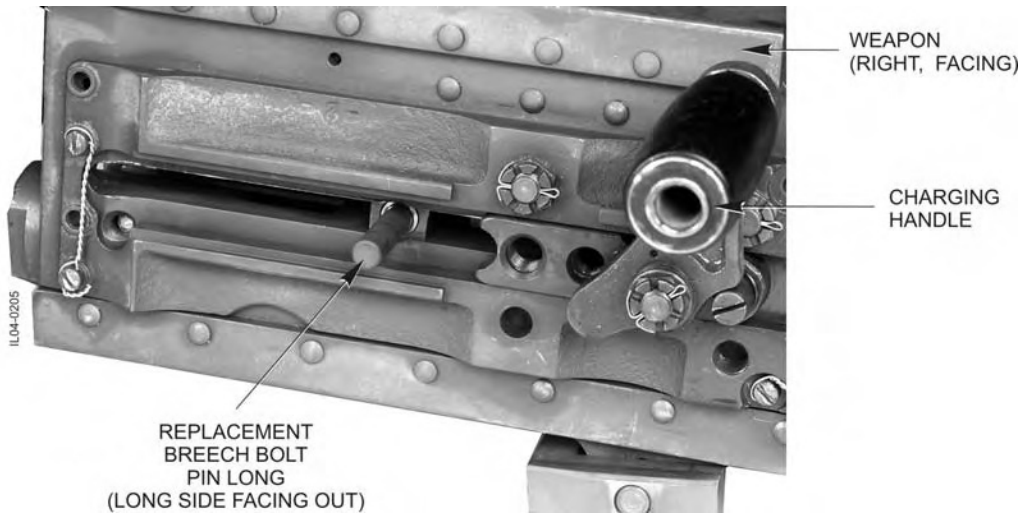


Figure 23. Replacement Breech Bolt Pin Long In Position.



Figure 24. Original Breech Bolt Pin Long Being Inserted.

NOTE

Be sure that the short side of the breech bolt pin short faces out.

6. While moving the charging handle to the rear of the weapon, referring to Figure 22, remove the breech bolt pin short on the left-hand (facing) side of the weapon, as shown in Figure 25. Return the charging handle to the forward position. Retain the replacement pin in adapter kit box until weapon is restored to its CROWS configuration.

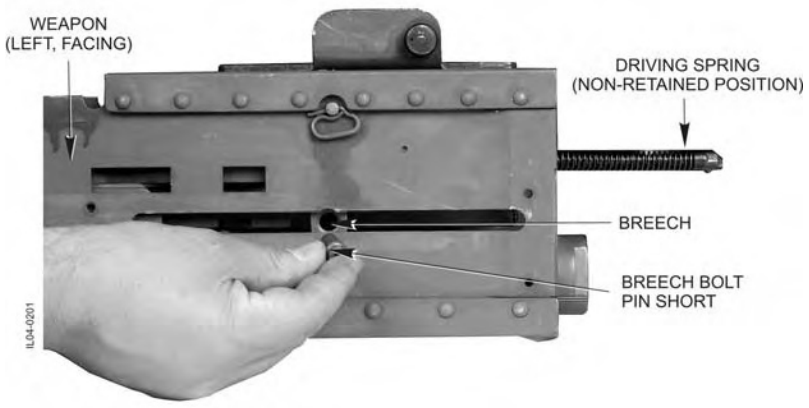


Figure 25. Breech Bolt Pin Short Removed.

END OF TASK

REMOVAL OF M2 WEAPON AND WAK COMPONENTS - Cont

Removal of Retracting Slide Extension and Securing Bolts

Perform the following procedure to remove the retracting slide extension from the weapon and replace the securing bolts.

1. Remove the locking long nut from the left-hand securing bolt using a 12 mm combination wrench, as shown in Figure 26.

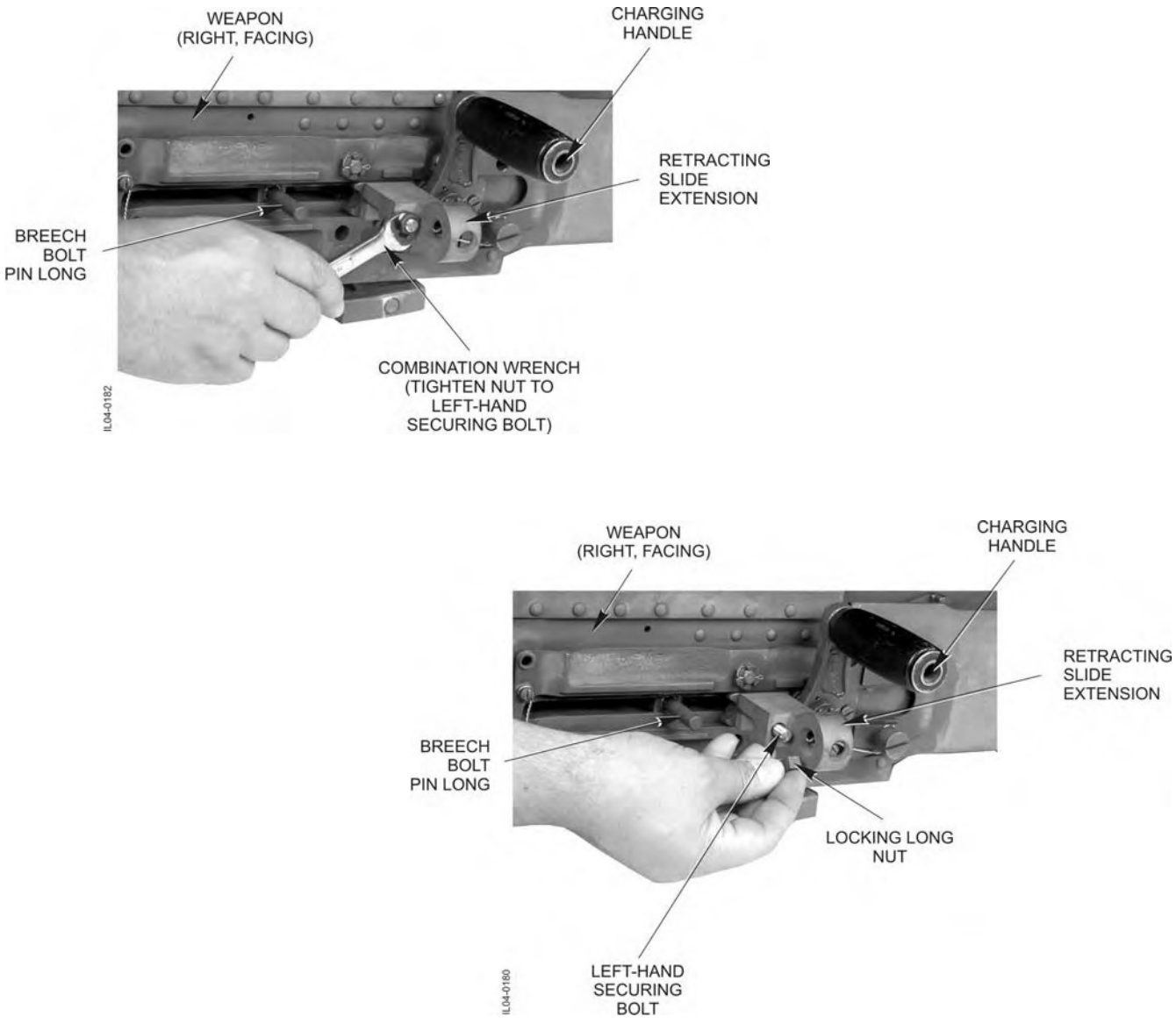


Figure 26. Removing Left-Hand Securing Bolt with Long Locking Nut.

2. Loosen and remove the right-hand securing bolt from the hole on the end of the retracting slide extension, using a 5/16-inch hex head wrench, as shown in Figure 27.

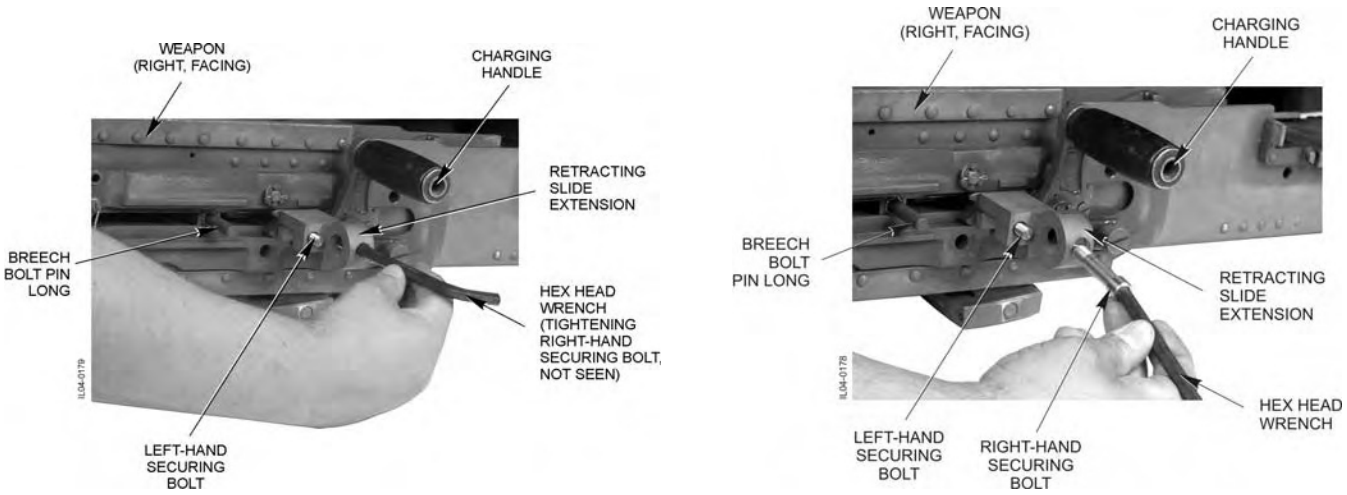


Figure 27. Right-Hand Securing Bolt Being Removed from Extension.

3. Rotate the extension (counterclockwise) until it separates from the charging handle, as shown in Figures 28 through 30.

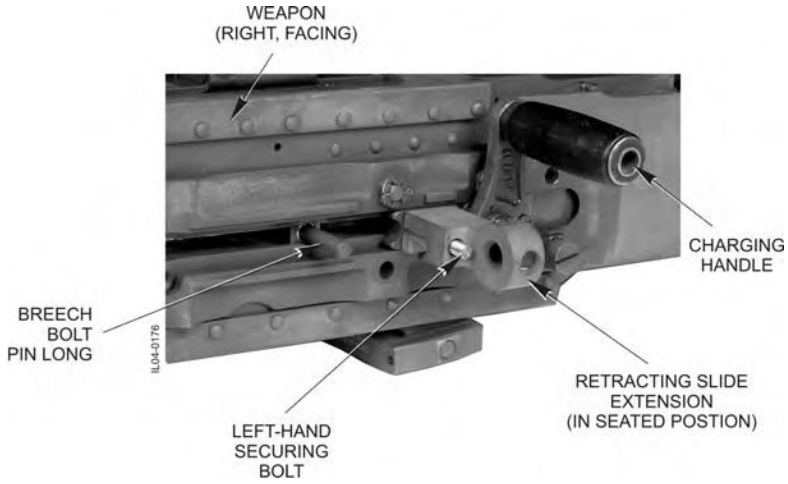


Figure 28. Retracting Slide Extension.

REMOVAL OF M2 WEAPON AND WAK COMPONENTS - Cont

Removal of Retracting Slide Extension and Securing Bolts - Cont

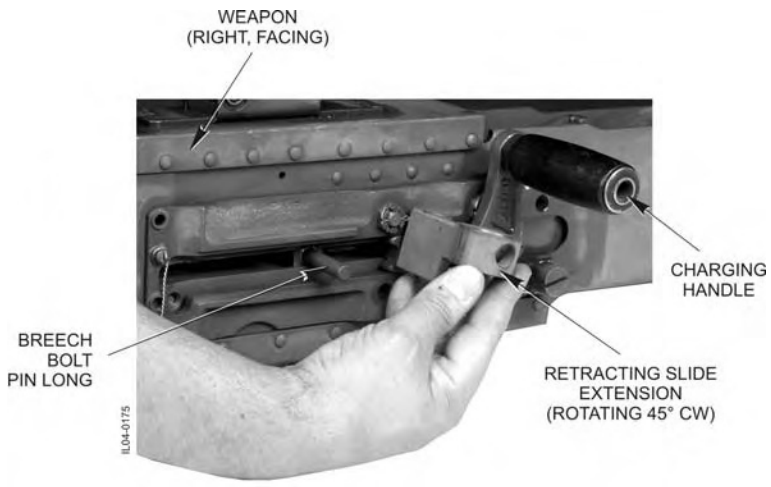


Figure 29. Retracting Slide Extension Being Rotated.

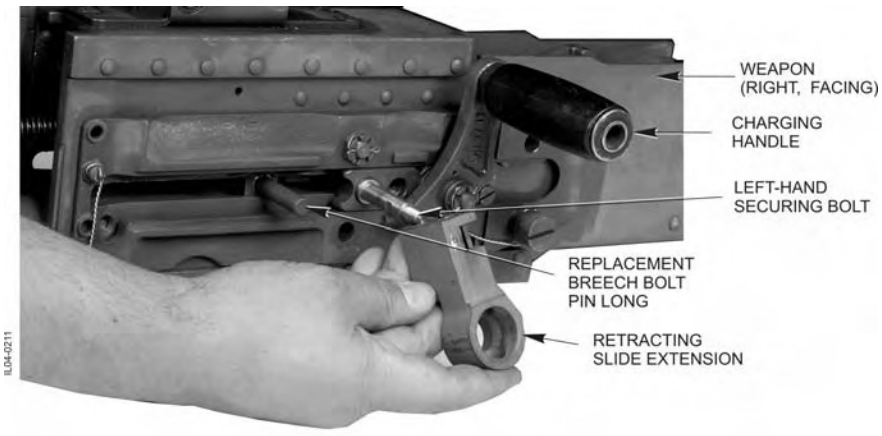


Figure 30. Retracting Slide Extension Being Removed.

4. Remove the left-hand securing bolt onto the weapon using a 9 mm combination wrench, as shown in Figures 31 and 32.

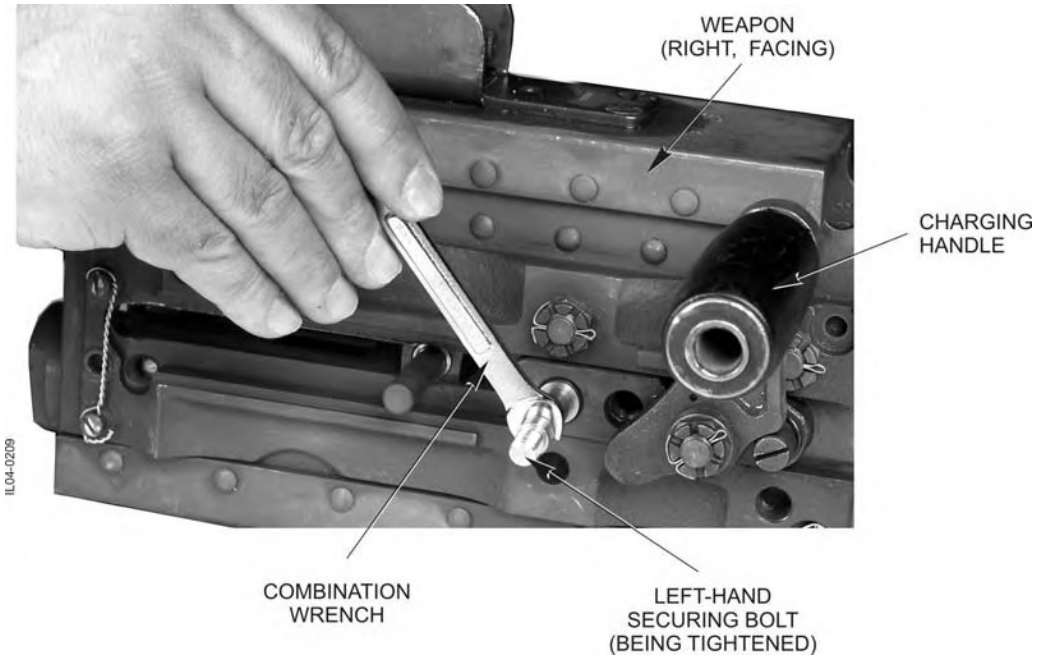


Figure 31. Left-Hand Securing Bolt Being Removed.

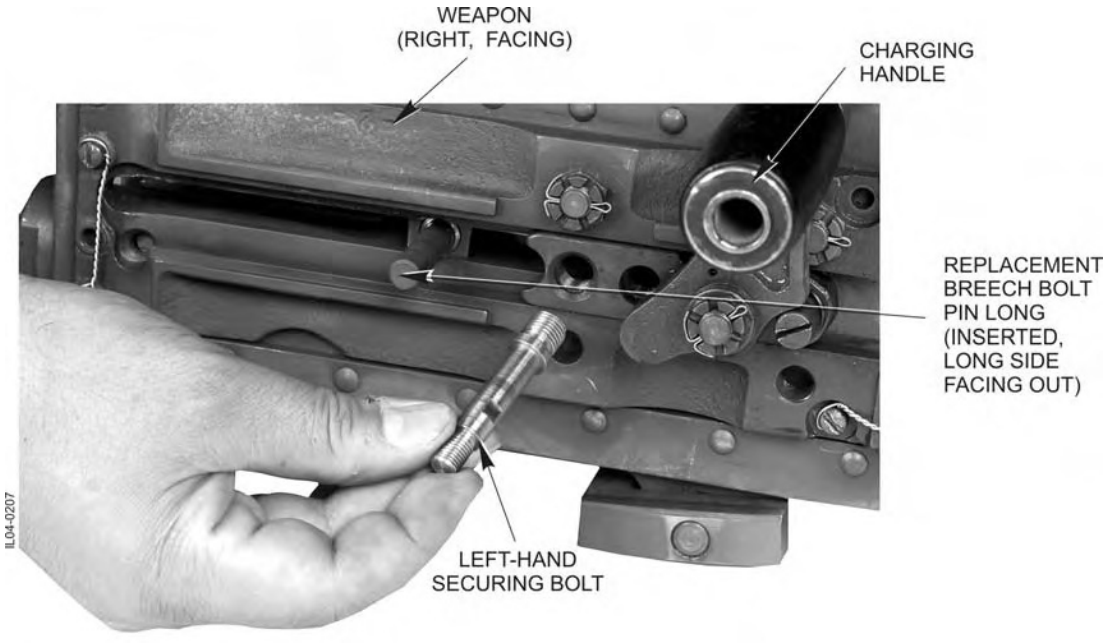


Figure 32. Left-Hand Securing Bolt Removed.

REMOVAL OF M2 WEAPON AND WAK COMPONENTS - Cont

Removal of Retracting Slide Extension and Securing Bolts - Cont

WARNING

Do not attempt to charge the M2 weapon without the backplate assembled to the weapon.

Ensure the breech bolt is in the forward position IAW TM 9-1005-213-10, Operator's Manual for the M2 HB .50-Cal Machine Gun.

Failure to follow these warnings may result in personal injury or equipment damage.

NOTE

Refer to Breech Bolt Pins and Weapon Charging Mechanism Installation section of WP 0007 for additional information on the backplate assembly.

5. Reposition the weapon driving spring into its retaining hole, as shown in Figure 33.

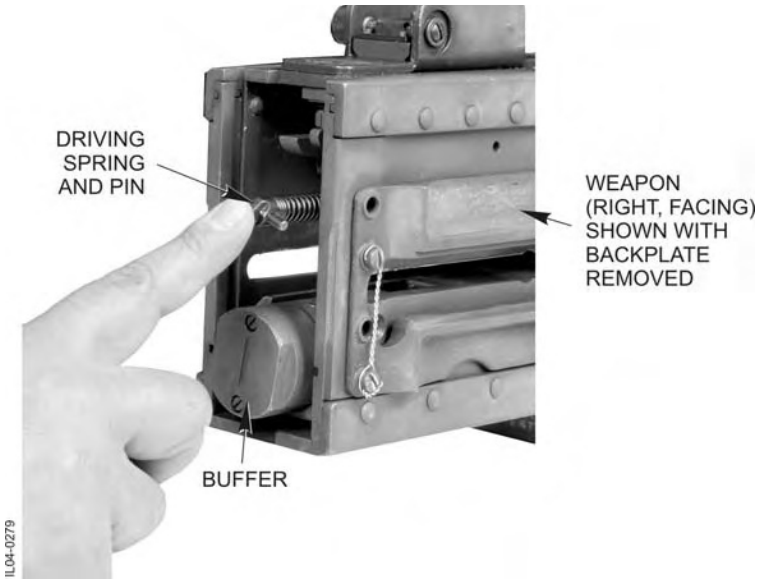


Figure 33. Pushing Driving Spring and Pin Into Weapon to Secure in Retaining Hole.

6. Reposition buffer into weapon, moving the charging handle until the buffer is correctly positioned, as shown in Figure 34.

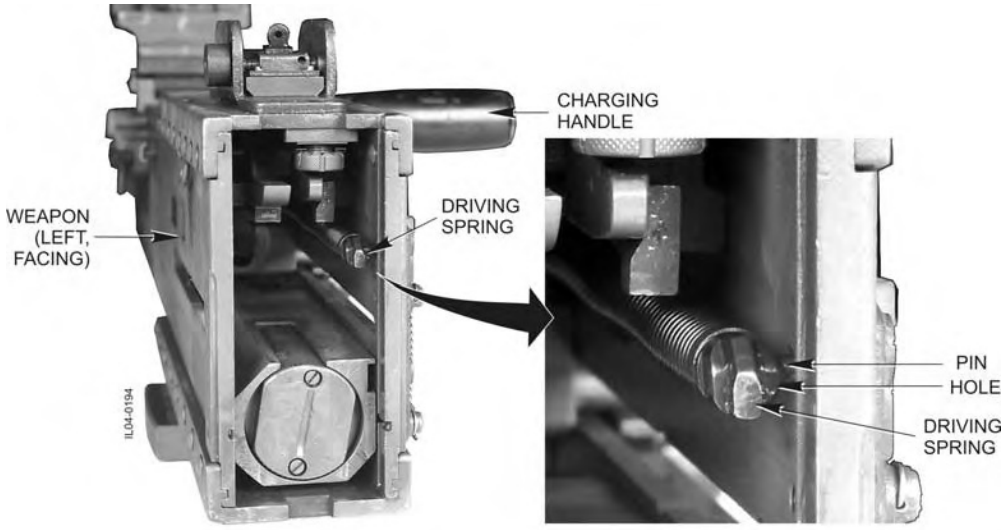


Figure 34. Buffer Repositioned in Weapon Using Charging Handle.

7. Replace the backplate assembly by simultaneously pulling the latch lock, lifting the latch, and sliding the backplate down onto the weapon, as shown in Figures 35 through 37.

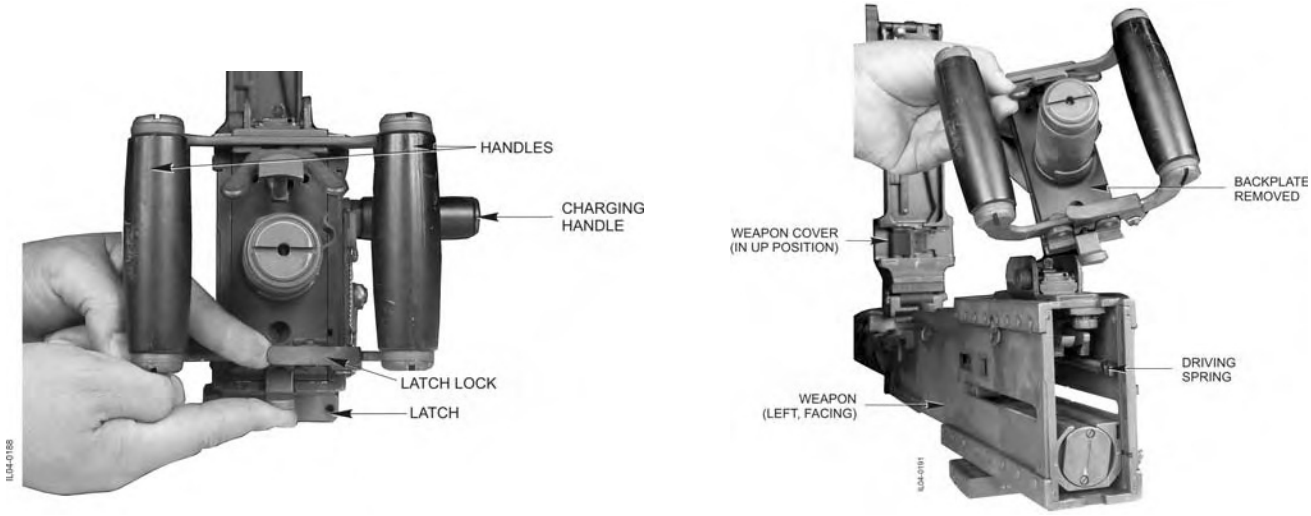


Figure 35. Latch and Latch Lock Lifted to Position Backplate Assembly.

REMOVAL OF M2 WEAPON AND WAK COMPONENTS - Cont

Removal of Retracting Slide Extension and Securing Bolts - Cont

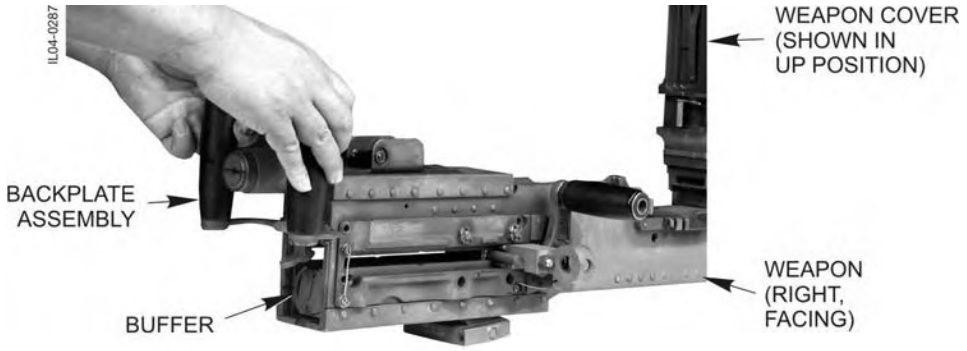


Figure 36. Sliding Backplate Assembly onto Weapon.

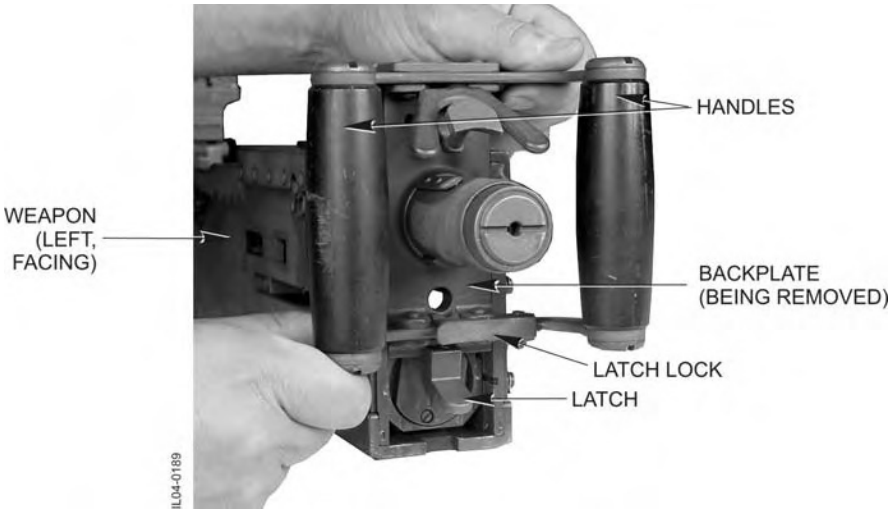


Figure 37. Backplate Assembly Positioned.

END OF TASK

Removal of Feed Throat Assembly

Perform the following procedure to remove the feed throat assembly from the weapon.

NOTE

Use two personnel during this procedure to prevent the feed throat pawl springs from falling out when the weapon retaining pin is removed.

For weapon operation and maintenance, refer to TM 9-1005-213-10, Operator's Manual for the M2 HB .50-Cal Machine Gun, and TM 9-1005-213-23&P, Unit and Direct Support Maintenance Manual for the M2 HB .50-Cal Machine Gun, including Repair Parts and Special Tools List, listed in WP 0035, References.

1. Lift the weapon cover.
2. Remove the left-hand belt-holding pawl pin from the weapon alignment holes and the feed throat, referring to Figure 38.

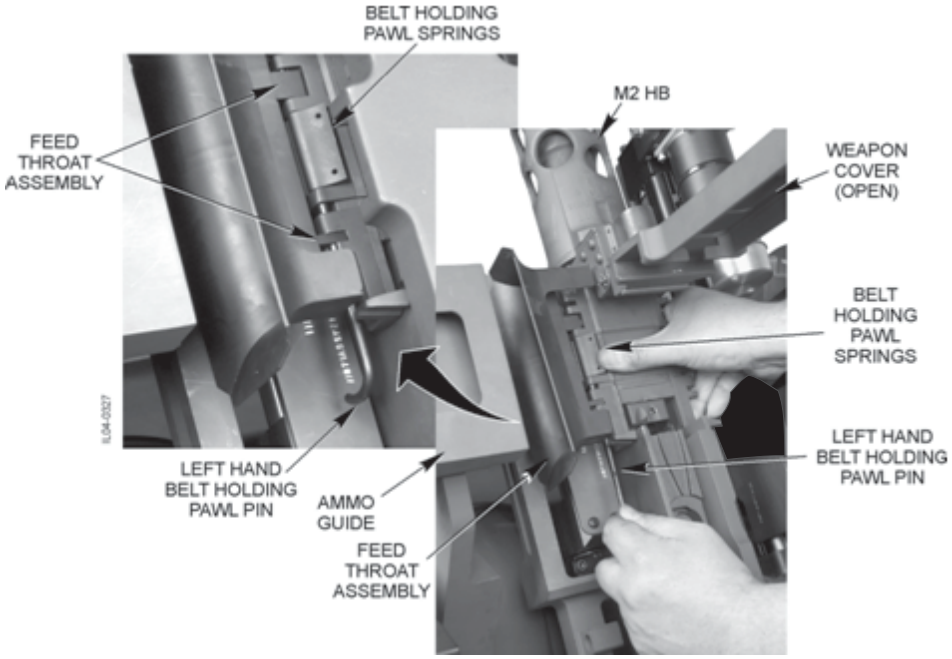


Figure 38. Weapon and Feed Throat Assembly.

3. Remove the feed throat.
4. Press down the belt-holding pawl springs and insert the left-hand belt-holding pawl pin into the weapon (left side, facing).
5. Reconnect any securing hardware (for example, retaining pin, safety wire, hitch pin).
6. Close the weapon cover.

END OF TASK

REMOVAL OF M2 WEAPON AND WAK COMPONENTS - Cont

Removal of Block Guide Assembly

Perform the following procedure to remove the block guide assembly from the weapon.

WARNING

Follow all stated warnings and cautions when handling the weapons. Ensure that the weapon is cleared and any cleared rounds are secured before performing any procedures, unless specifically directed to load the weapon. (For instructions on clearing and loading the M2 weapon, refer to WP 0018.)

Use two personnel during installation/removal of the cradle and M2 HB .50-cal machine gun.

Failure to follow these instructions may result in personal injury or equipment damage.

NOTE

The block guide assembly is installed on the bottom rear of the weapon, near the backplate.

1. Loosen the setscrew holding the block guide assembly onto the weapon using a 1/4-inch flat tip screwdriver as shown in Figure 39.



Figure 39. Setscrew Securing Block Guide Assembly to Weapon.

2. Remove the block guide pin, as shown in Figure 40, and then remove the block guide.

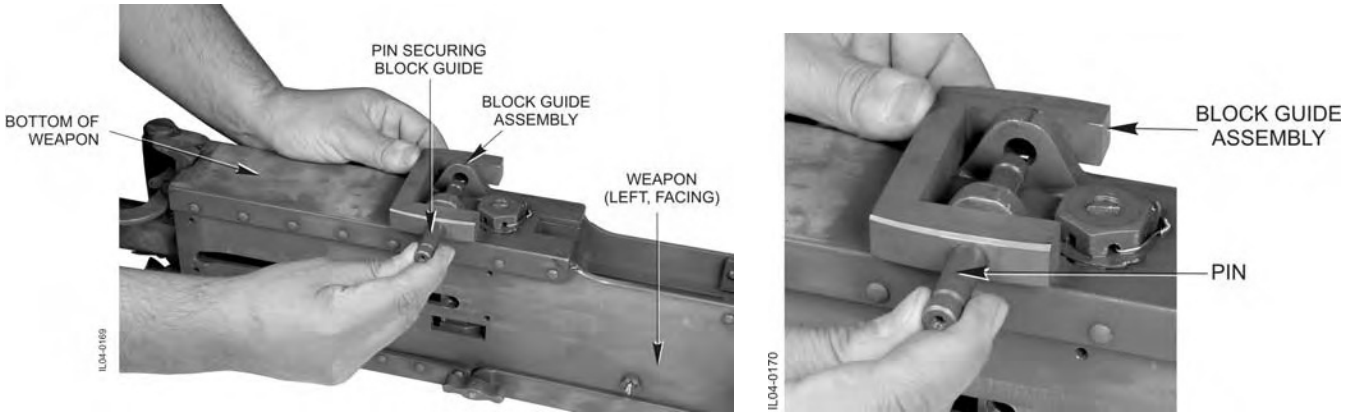


Figure 40. Block Guide Positioned and Attached to M2.

3. Reinsert the pin into the block guide assembly and tighten the setscrew using a 1/4-inch flat tip screwdriver, as shown in Figure 41.

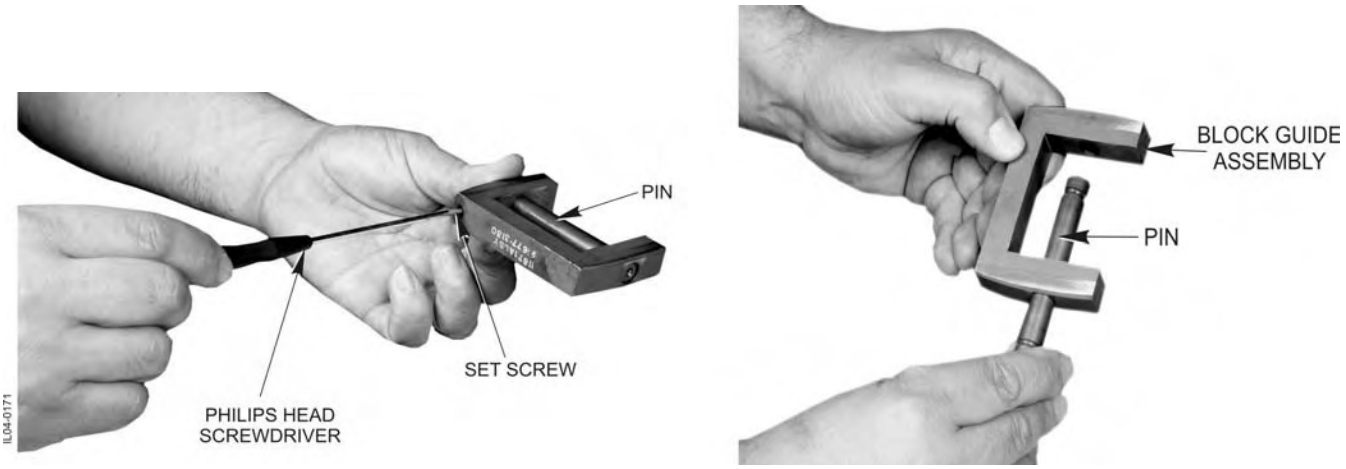


Figure 41. Block Guide Reassembled.

END OF TASK

REMOVAL OF M2 WEAPON AND WAK COMPONENTS - Cont

Removal of Ammo Guide

Perform the following procedures to remove the ammo guide from the ammo yoke arm.

1. Remove the bolt and Nord-lock washer set securing the ammo guide to the pivot arm (left, facing) and ammo yoke arm using a 7/16-inch socket wrench, as shown in Figures 42 and 43.

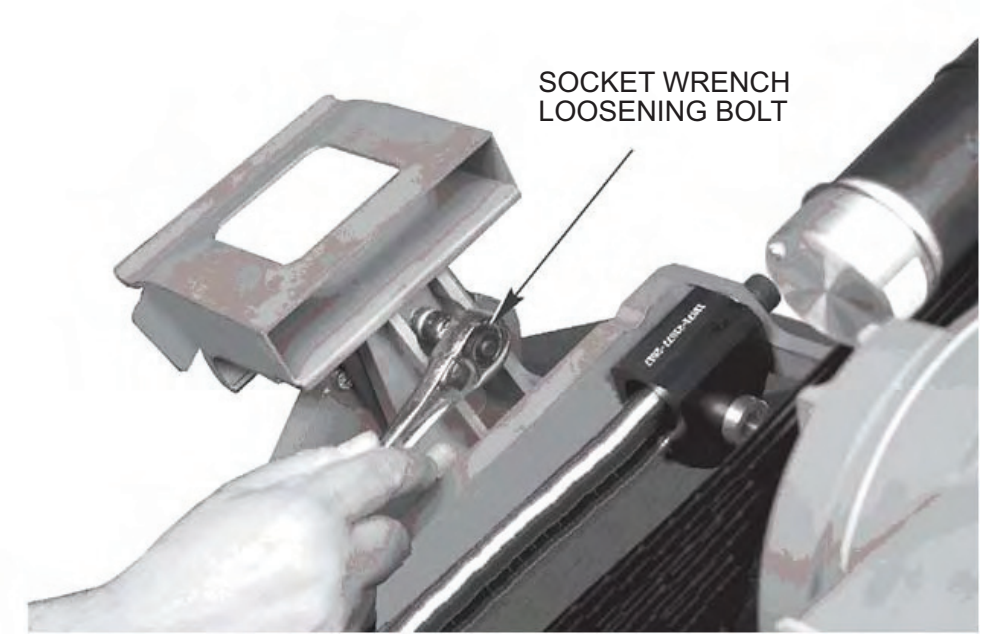


Figure 42. Loosening Attaching Hardware in Top Hole.

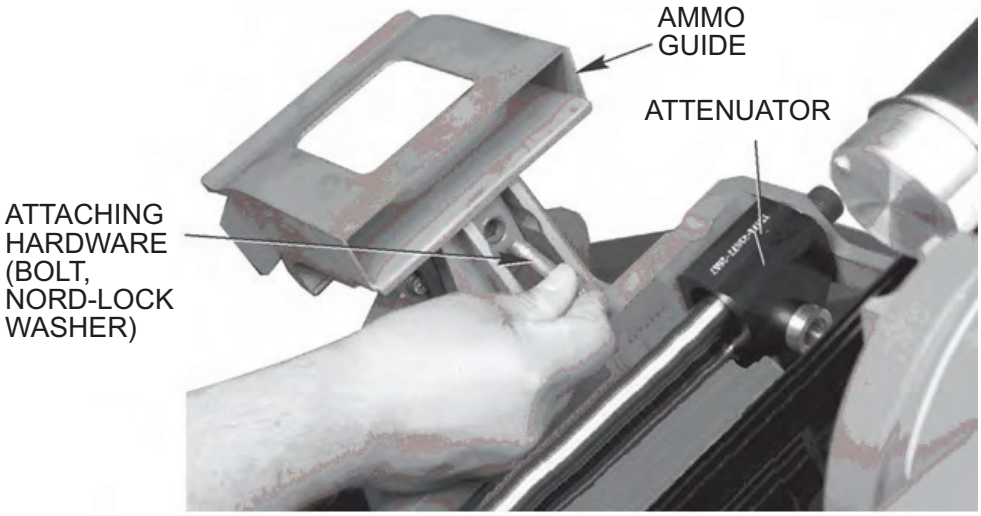


Figure 43. Removing Attaching Hardware.

2. Remove the ammo guide, lifting up the assembly from the pivot arm, as shown in Figure 44.

3. Reinsert attaching hardware through the pivot arm and ammo yoke arm, and tighten using a 7/16-inch socket wrench.

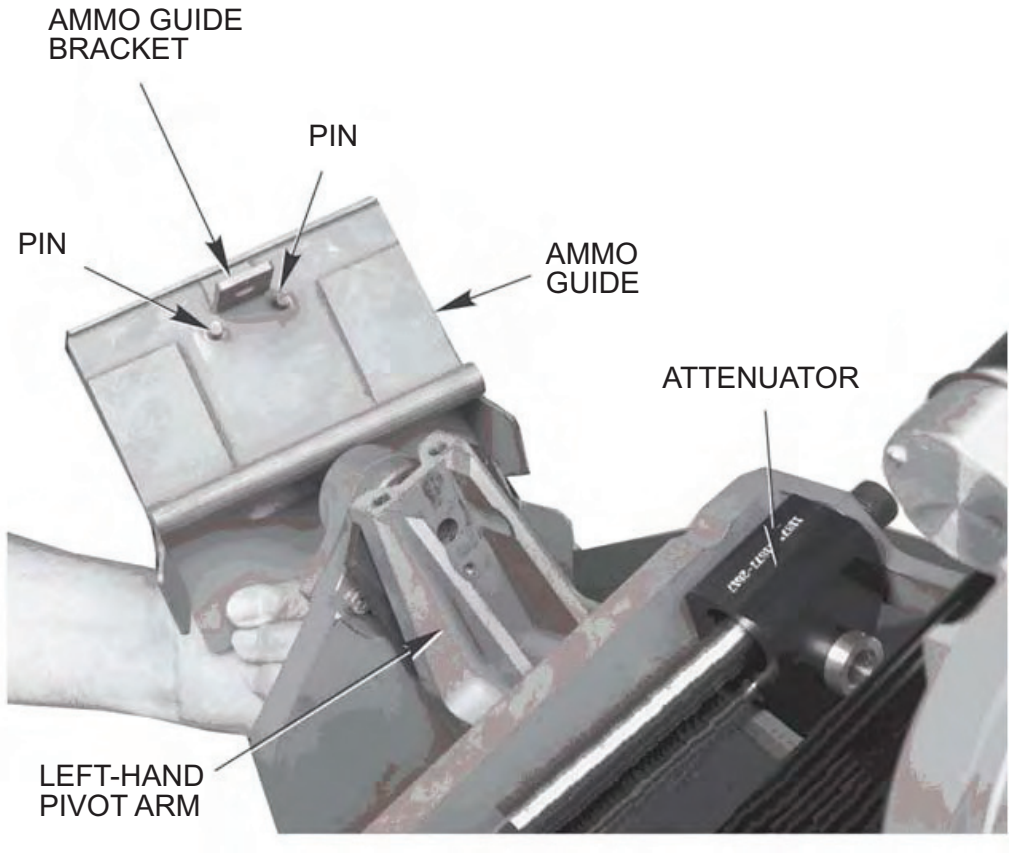


Figure 44. Removing Ammo Guide from Pivot Arm.

END OF TASK

REMOVAL OF M2 WEAPON AND WAK COMPONENTS - Cont

Removal of the Linear Actuator (Charger) Assembly

Perform the following procedure to remove the linear actuator (charger) assembly from the cradle and the mounting plate from the linear actuator (charger) assembly.

1. Ensure CROWS system power is OFF.

NOTE

For additional information on safety wire procedures, refer to WP 0031.

2. Using wire cutters, remove the safety wire from both bolts that secure the linear actuator (charger) to the cradle.

3. With a 1/4-inch hex head wrench, loosen and remove the bolts, as shown in Figures 45 and 46. Safely dispose of the wire.

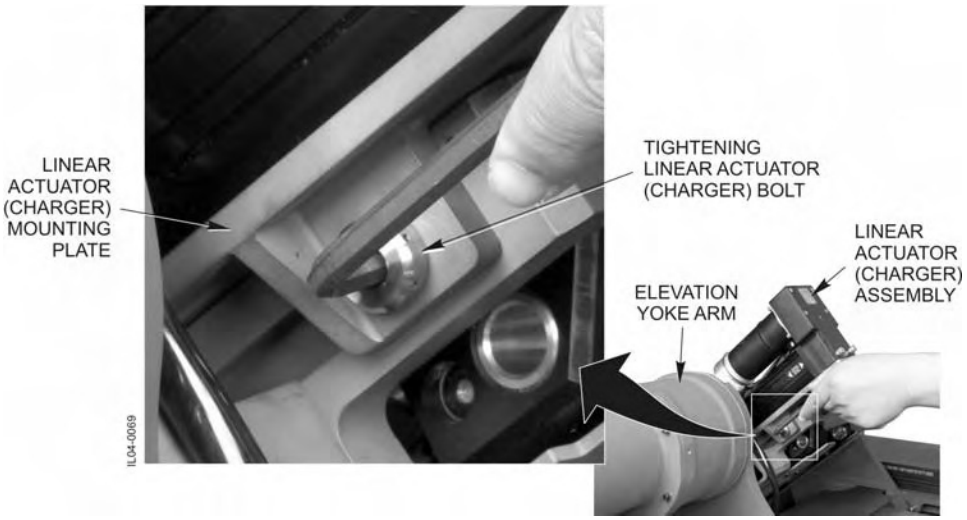


Figure 45. Linear Actuator (Charger) Bolt Being Loosened Prior to Removal (At Far End of Cradle).

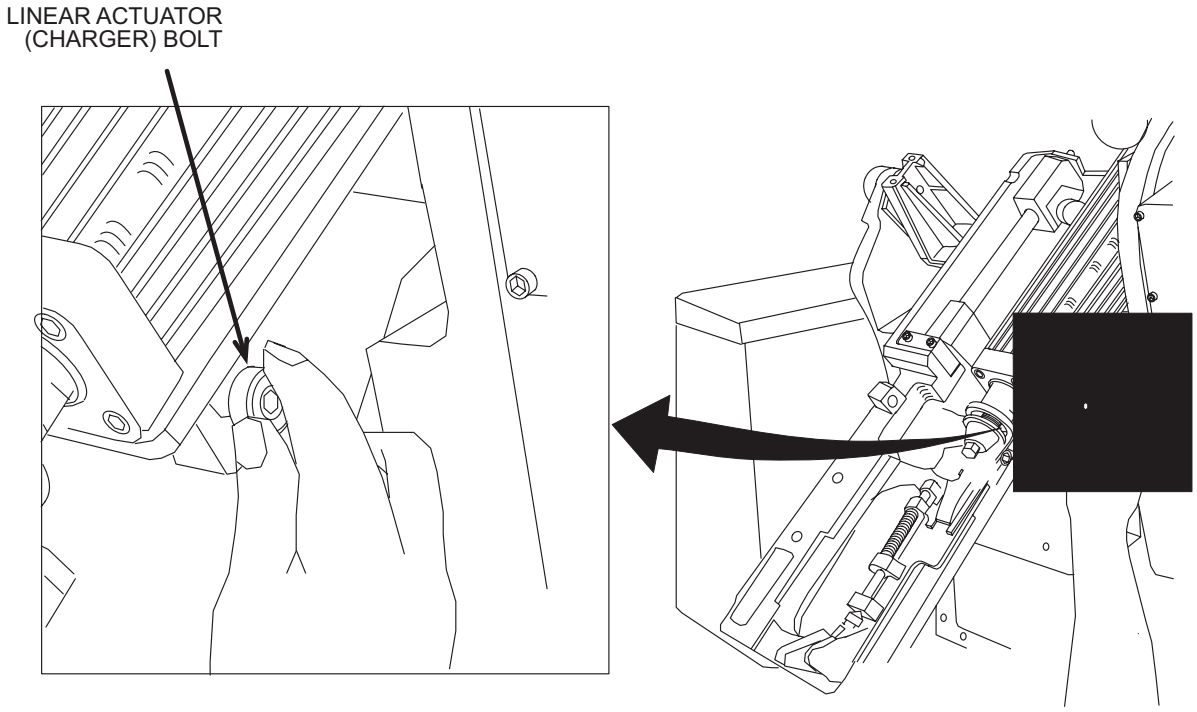


Figure 46. Linear Actuator (Charger) Bolt Being Loosened Prior to Removal (By Sear Assembly).

REMOVAL OF M2 WEAPON AND WAK COMPONENTS - Cont

Removal of the Linear Actuator (Charger) Assembly - Cont

CAUTION

When removing the rod end, do not allow the actuator rod to move. Keep the actuator rod stationary. Failure to do so may result in equipment damage

4. Carefully loosen and remove the rod end from the actuator extension rod, using an adjustable wrench and a 1/2-inch wrench, as shown in Figures 47 and 48.

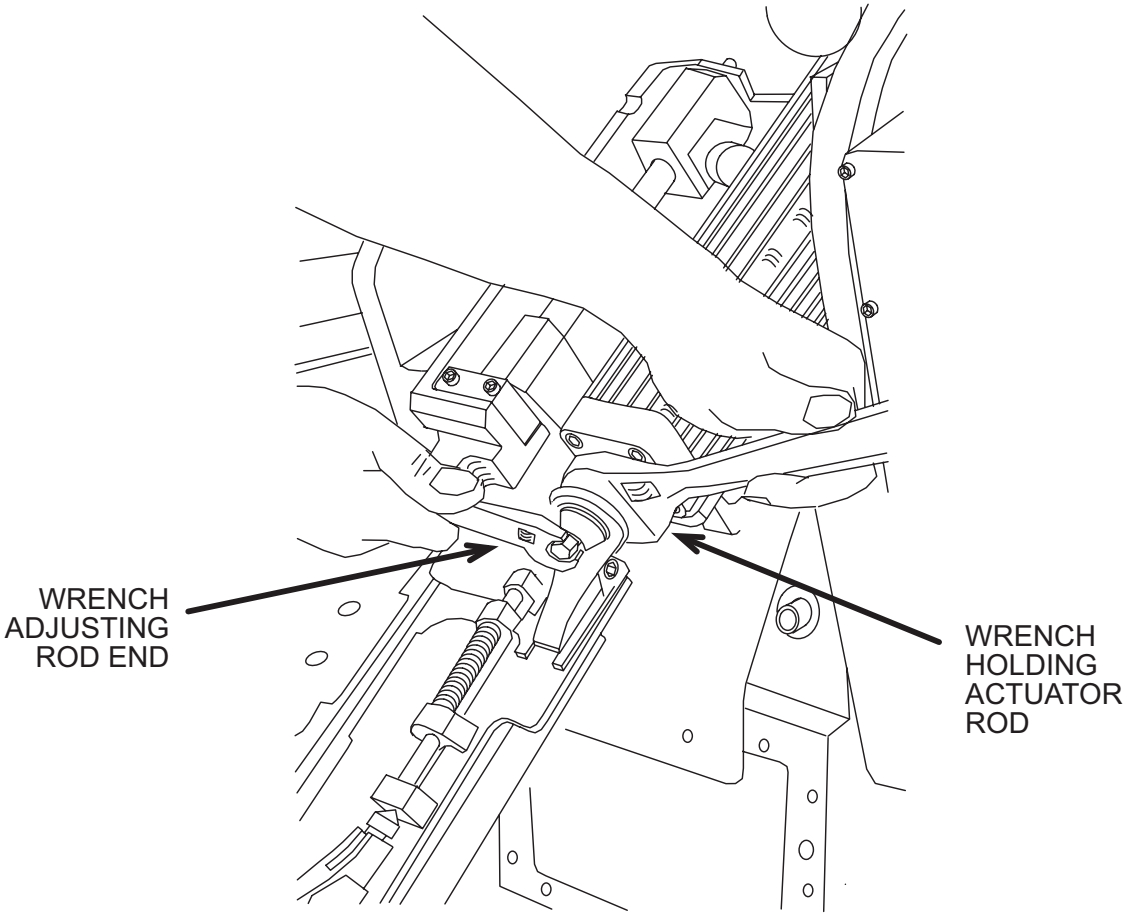


Figure 47. Loosening the Rod End.

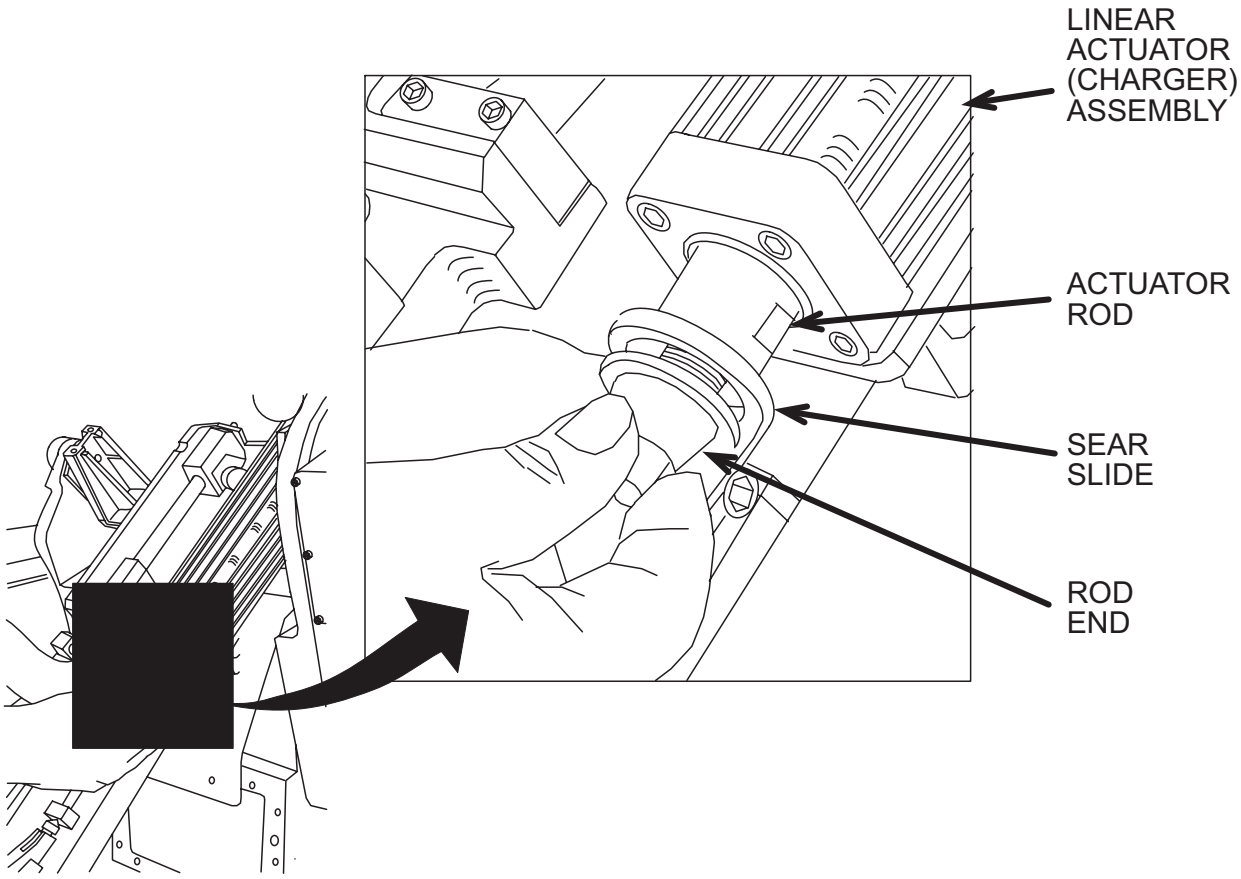


Figure 48. Removing Rod End from Actuator (Charger) Shaft through Sear Slide.

5. Verify that any cable anchors holding the linear actuator (charger) cable in place under the cradle have been removed.

6. Disconnect the linear actuator cable from mount connector, J5.

REMOVAL OF M2 WEAPON AND WAK COMPONENTS - Cont

Removal of the Linear Actuator (Charger) Assembly - Cont

7. Carefully slide the linear actuator (charger) away from the sear assembly with sear slide and lift it off of the cradle.

NOTE

For additional information, refer to WP 0031, Safety Wire Procedures.

8. Using wire cutters, remove the safety wire securing the four cap screws to the bottom of the mounting plate, as shown in Figure 49. Safely dispose of the wire.

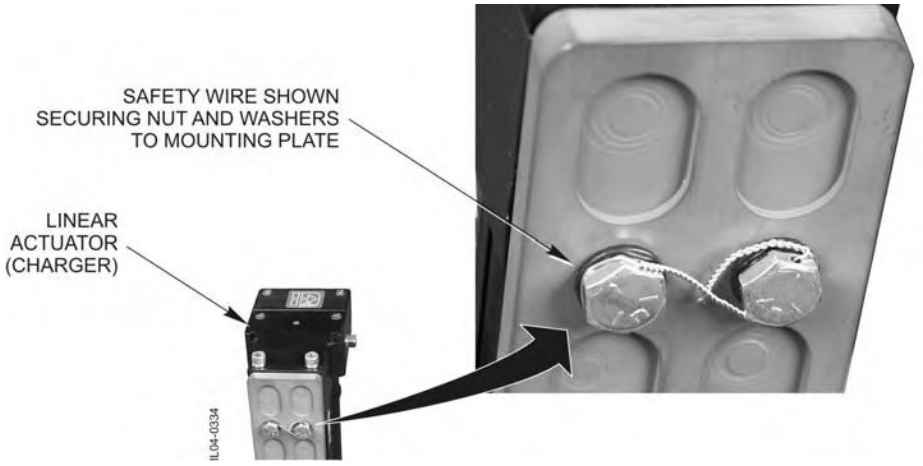


Figure 49. Linear Actuator (Charger) Mounting Plate with Safety Wire.

NOTE

For additional information on thread-locking procedures, refer to WP 0032.

9. Remove the thread-locking compound from the bolts securing the mounting plate to the linear actuator (charger).

10. Remove the four cap screws and flat washers securing the actuator mounting plate to the actuator, using a 7/16-inch socket wrench, referring to Figure 50.

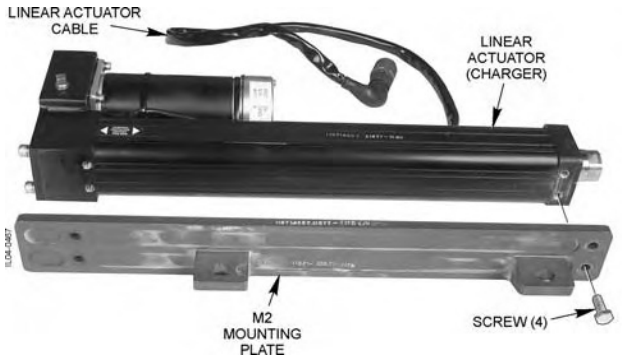


Figure 50. Linear Actuator (Charger) and Mounting Plate.

END OF TASK

Removal of Sear Assembly with Sear Slide

Perform the following procedure to remove the sear assembly with sear slide from the cradle.

NOTE

The attaching hardware for the sear assembly is recessed into the underside of the cradle.

1. Ensure CROWS system power is OFF.

2. Remove the attaching hardware (two nuts and two lock washers) holding the sear assembly to the cradle, as shown in Figure 51, using a 5/16-inch hex head wrench.

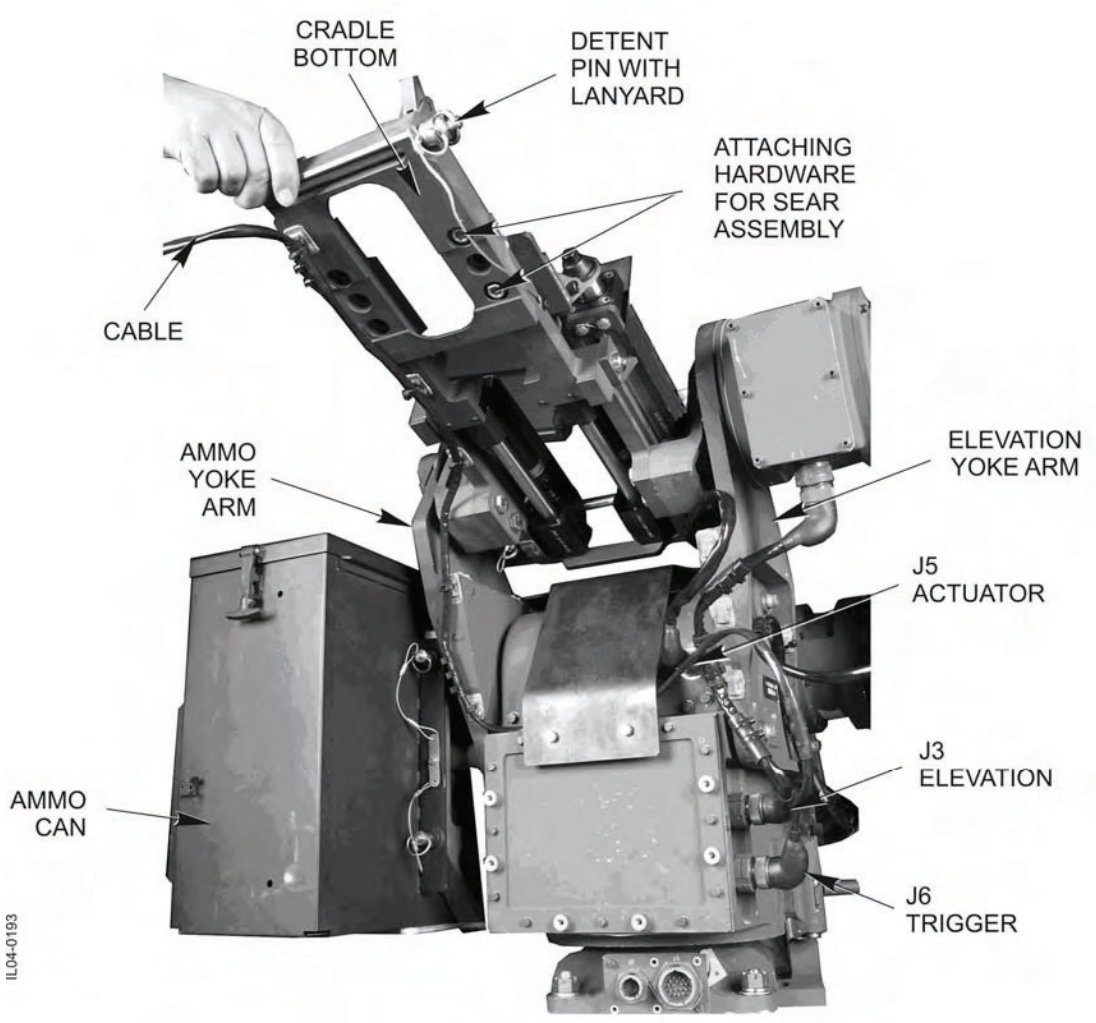


Figure 51. View from Underside of Cradle Showing Recessed Attaching Hardware and Pin and Lanyard.

REMOVAL OF M2 WEAPON AND WAK COMPONENTS - Cont

Removal of Sear Assembly with Sear Slide - Cont

3. Carefully lift the sear assembly with sear slide off of the cradle, ensuring the location pins clear the cradle when the assembly is lifted, as shown in Figure 52.

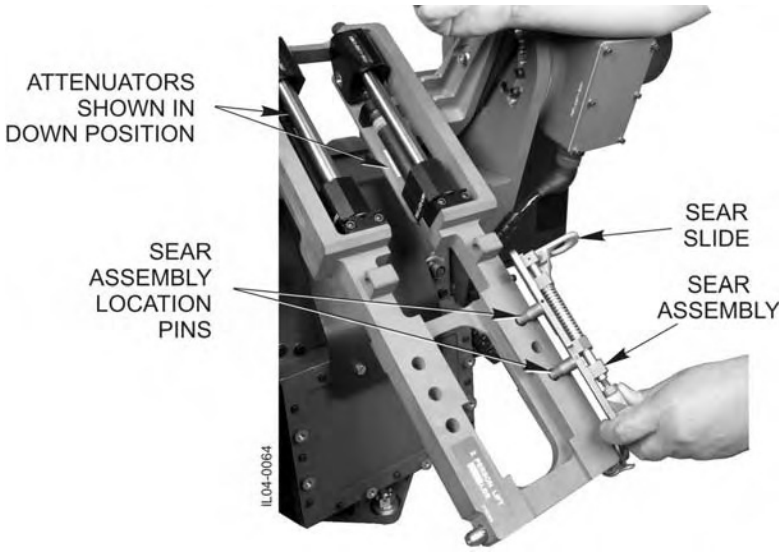


Figure 52. Removal of Sear Assembly with Sear Slide from Cradle.

END OF TASK

CRADLE REMOVAL

Table 2 lists the components of the cradle assembly, as well as related items of the CROWS mount.

Table 2. Cradle and Related Items.

PN	Nomenclature	Common Name
21677-2600	Gun Mount	M2/Mk19 Cradle (Heavy)
BLC8R60N 21483-3146-5	. Pin, Detent . Wire Rope Assembly, Single Leg	Detent Pin with Lanyard Lanyard
MS21250-06016 NL3/8SS	. Bolt, Shear . Washer, Lock	Bolt Nord-lock washers (Attaching Hardware -- Qty: 2 bolts and 2 Nord-lock washers)
MS16995-35B	. Socket Head Cap Screw	Attaching Hardware

Figure 53 shows the basic cradle before being installed onto the CROWS mount.

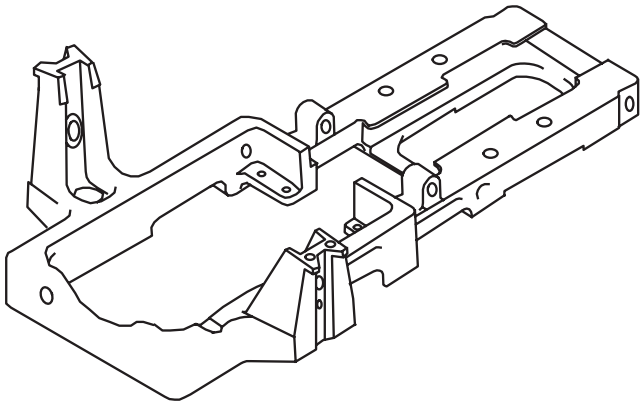


Figure 53. Cradle (Heavy).

Equipment Condition: WAK removed (see Removal of Weapon and WAK Components section in applicable work package: WP 0008, WP 0010, WP 0012, or WP 0014).

Perform the following procedures to remove the cradle from the CROWS mount.

WARNING

Follow all warnings and cautions when handling the weapons. Failure to do so may result in personal injury or equipment damage.

Use two personnel during removal of the cradle and M2 HB .50-cal machine gun. Failure to do so may result in personal injury or equipment damage.

1. Ensure CROWS system power is OFF.
2. Ensure the azimuth lock is in the locked position (referring to WP 0006, Azimuth Lock Assembly section). The pedestal should not be able to move.

CRADLE REMOVAL - Cont

NOTE

Each Nord-lock washer is a set of two washers.

3. Loosen and remove attaching hardware (one tension bolt and one Nord-lock washer set) from the elevation and ammo yoke arms, using a 7/16-inch socket wrench, referring to Figure 54.

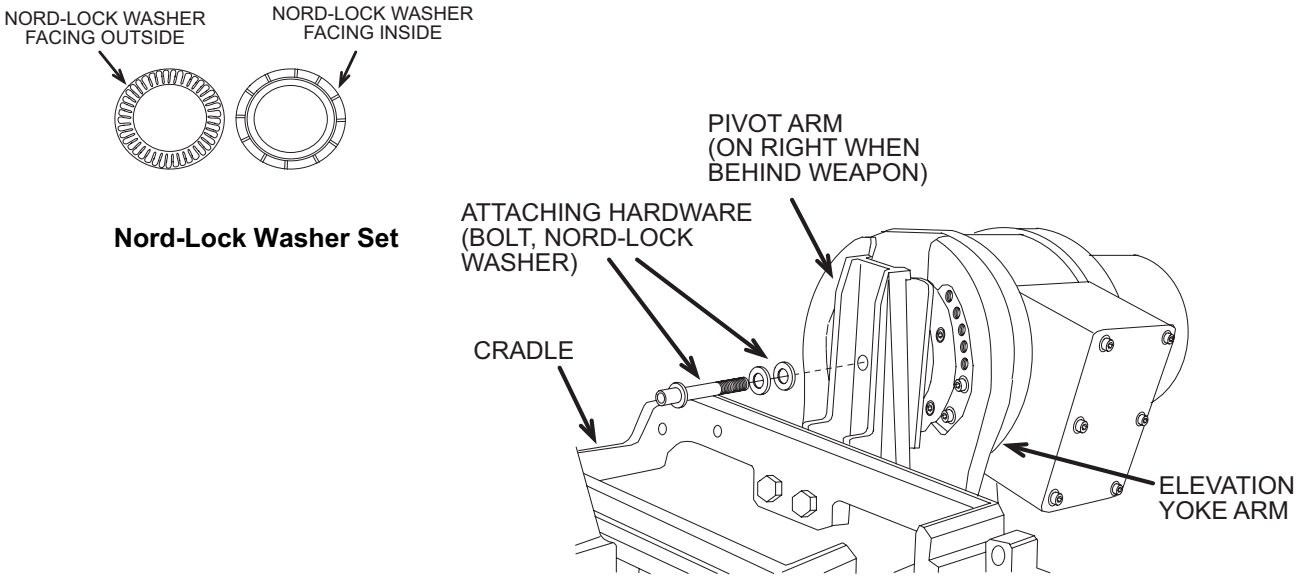


Figure 54. Attaching Hardware as Removed from the Cradle.

4. Lift the cradle from the yoke arms.

END OF TASK

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER USUAL CONDITIONS - MK19 40 MM GRENADE MACHINE GUN WEAPON ADAPTER KIT (WAK) AND WEAPON: INSTALLATION

THIS WORK PACKAGE COVERS:

Installing the Mk19 40 mm grenade machine gun and WAK on the CROWS cradle.

INITIAL SET UP:

Tools and Special Tools

Operator's Tool Kit (WP 0036, Table 2, Item 1)

References

WP 0002	WP 0015	WP 0028
WP 0004	WP 0019	WP 0029
WP 0005	WP 0023	WP 0030
WP 0006	WP 0024	WP 0031
WP 0010	WP 0025	WP 0032
WP 0012	WP 0026	WP 0035
WP 0014	WP 0027	WP 0036
TM 9-1010-230-10		WP 0038

Materials/Parts

Compound, thread-locking, blue (WP 0038, Table 1, Item 8)

Compound, thread-locking, red (WP 0038, Table 1, Item 9)

Compound, thread-locking, black (WP 0038, Table 1, Item 10)

Strap, tiedown (anchors) (WP 0038, Table 1, Item 21)

Wire, safety (WP 0038, Table 1, Item 24)

Personnel Required

Two

Equipment Conditions

System power off

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- Mk19 WAK 4
- Cradle Installation 6
  - Overview 6
  - Cradle Installation 7
- Attenuator Positioning 9

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Installation of End Rod Assembly 33
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CAUTION

Use two personnel during installation of the cradle and Mk19 grenade machine gun. Failure to do so may result in personal injury or equipment damage.

NOTE

Should any weapon malfunction occur, refer to WP 0023, Troubleshooting – Weapon Interface Malfunctions.

Some steps within the assembly procedures are easier with two personnel.

To ensure CROWS components/assemblies are ready for operation, refer to WP 0027, Before Operational Check.

For information on performing preventive maintenance, cleaning, or lubrication on the Mk19 adapter kit, refer to WP 0025 through WP 0030. For additional information about expendable and durable materials, refer to WP 0038.

For lists of specific weapon operation and maintenance manuals, refer to WP 0035, References.

MK19 WAK OVERVIEW

Installation of the Mk19 on the CROWS mount requires configuring the weapon with assemblies from the Mk19 WAK and installing the kit plus weapon onto CROWS cradle assembly.

CONSIDERATIONS BEFORE AND DURING ASSEMBLY

The following general procedures are recommended to reduce maintenance time and prevent accidental damage to the equipment.

- Follow all safety regulations, warnings, cautions, and notes.
- Ensure vehicle is positioned on level ground.
- Ensure the system is powered down, the weapon is cleared, and any cleared rounds are removed.
- Ensure that the radius of any bends in the ICU-Display Unit (DU) cable (P/N 21677-3715) measures at least 5 inches.
- Before disconnecting any electrical or mechanical parts, ensure parts are tagged for identification.
- Refer to the appropriate weapon operation and maintenance manuals, as well as related CROWS manuals, detailed in WP 0035, References.

PREPARATION FOR INSTALLATION OF THE WAK AND WEAPON

Follow the steps in Table 1 to prepare the CROWS and WAK for installation.

Table 1. Determination of Status.

Task	Next Step
1. Verify that the casing deflector is in its proper position.	If not, return CROWS to unit maintenance for installation. If yes, proceed to the next step.
2. If required, verify that the ballistic armor is properly installed.	If not, return CROWS to unit maintenance for installation. If yes, proceed to the next step.
3. Verify that the azimuth lock handle is in the unlocked position: pedestal mount should move freely.	If not, refer to WP 0006, Azimuth Lock Assembly section. If yes, proceed to the next step.
4. Inspect the Mk19 WAK, IAW Table 2 and Figure 1.	If any loose or missing hardware, return CROWS to unit maintenance for missing parts. If all items present and ready, proceed to the next step.
5. Verify M2/Mk19 cradle secured to mount.	If the M240/M249 cradle is in position on the mount, refer to WP 0012 or WP 0014 for removal instructions. If the cradle is not installed, proceed to Cradle Installation section of this work package. If yes, proceed to the next step.
6. If present, verify attenuators are in proper (down) position. **NOTE** The Mk19 WAK and weapon can be used with or without the attenuator assemblies.	If not, proceed to Attenuator Installation or Attenuator Positioning sections of this work package. If yes, proceed to the next step.
7. Verify ammunition can is installed and in the M2/Mk19 configuration.	If not, go to WP 0006, Configuring Ammo Can for M2/Mk19 WAKs from M240/M249 Version section and then Ammunition Can: Installation section. If yes, proceed to the next step
8. Verify adapter kit and weapon are assembled and ready for operation.	If not, proceed to the WAK and Weapon Installation section of this work package. If yes, proceed to WP 0027, Before Operational Check.

PREPARATION FOR INSTALLATION OF THE WAK AND WEAPON - Cont

Mk19 WAK

Table 2 details the major components of the Mk19 WAK, which are illustrated in Figure 1.

NOTE

Quantities are assumed to be 1 each unless otherwise specified.

Table 2. Mk19 WAK Components (PN 21677-3200).

Item Number	PN	Nomenclature	Common Name
1	21677-3205	Linear Actuator Assembly	Linear Actuator (Charger) Assembly
2	21677-3215	Bracket, Mounting	Front Bracket Assembly
3	21677-3220	Cap, Linear Actuating	End Rod Assembly
4	L5416	Solenoid, Electrical	Remote Firing Solenoid
5	21677-3228	Feeder, Ammunition, Machine Gun	Feed Throat
6	92391A034	Pin, Cotter	Feed Throat Hitch Pin
7	21677-3207	Block, Ejector, Cartridge	Rounds Counter Block
8	92390A165	Pin, Straight, Headed	Feed Throat Clevis Pin
9	21677-3225	Switch, Sensitive	Ogive Plunger Assembly with Rounds Counter
10	21677-3240	Charger, Gun	Remote Charger
11	21677-3703	Cable Assembly, Power, Electrical	Mk19 Weapon-Mount Cable

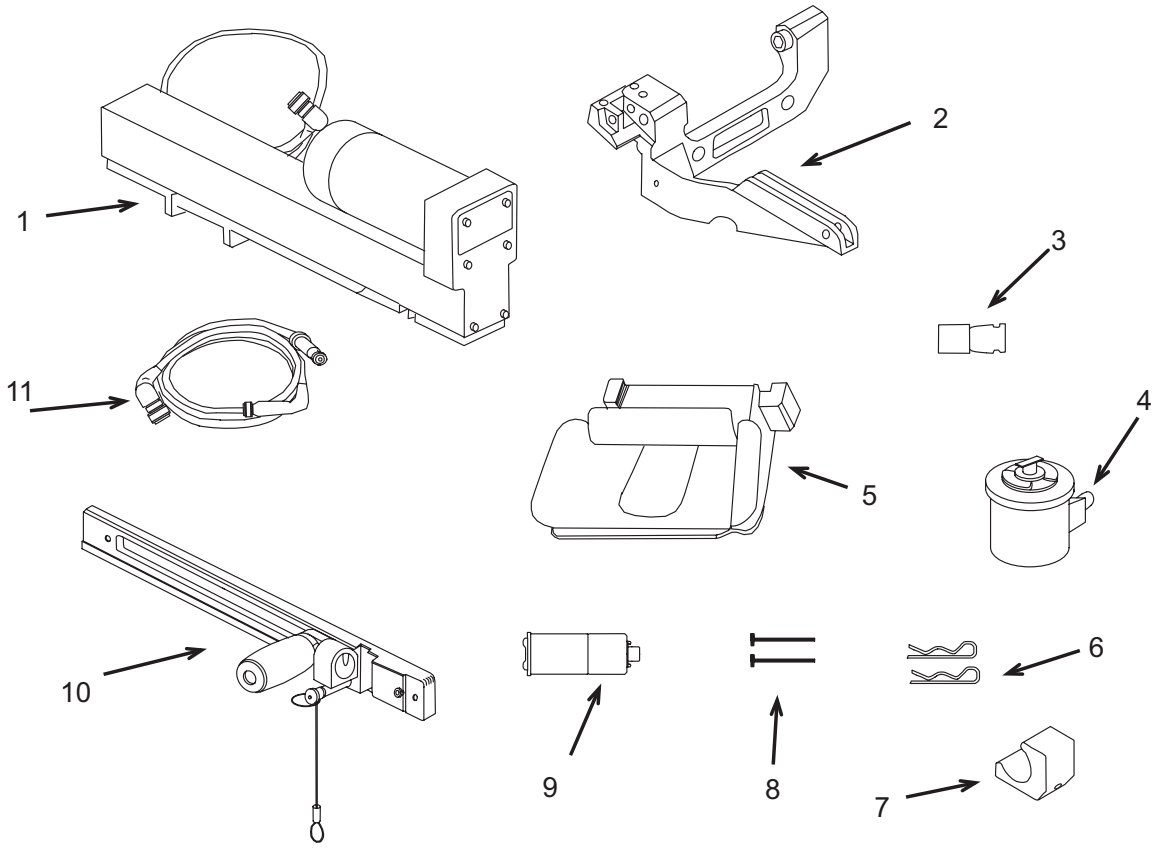


Figure 1. Mk19 WAK Components.

PREPARATION FOR INSTALLATION OF THE WAK AND WEAPON - Cont

Cradle Installation

Overview

Table 3 lists the components of the cradle assembly, as well as related items of the CROWS mount.

NOTE

Quantities are assumed to be 1 each unless otherwise specified.

Each Nord-lock washer is a set of two washers. Ensure that the washer set is positioned so that the serrated edges face outward in both directions.

Table 3. Cradle and Related Items.

PN	Nomenclature	Common Name
21677-2600	Gun Mount	M2/Mk19 Cradle (Heavy)
BLC8R60N 21483-3146-5	. Pin, Detent . Wire Rope Assembly, Single Leg	Detent Pin with Lanyard Lanyard
MS21250-06016 NL3/8SS	. Bolt, Shear . Washer, Lock	Bolt Nord-lock washers (Attaching Hardware -- Qty: 2 bolts and 2 Nord-lock washers)
MS16995-35B	. Socket Head Cap Screw	Attaching Hardware

Figure 2 shows the basic cradle before being installed onto the CROWS mount.

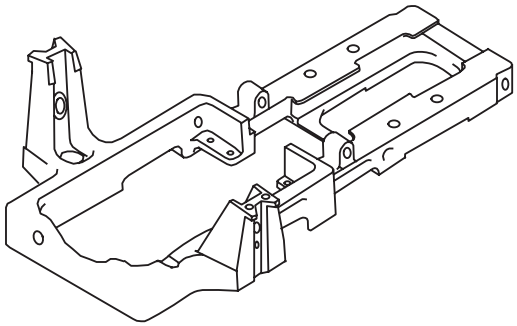


Figure 2. Cradle (Heavy).

Cradle Installation

WARNING

Follow all stated warnings and cautions when handling the weapons. Failure to do so may result in personal injury or equipment damage.

Use two personnel during installation of the cradle and Mk19 weapon. Failure to do so may result in personal injury or equipment damage.

1. Ensure CROWS system power is OFF.
2. Ensure the azimuth lock is in the locked position (referring to WP 0006, Azimuth Lock Assembly section). The pedestal mount should not be able to move.

NOTE

If M240/M249 cradle is attached to the mount, refer to WP 0012 or WP 0014 for removal procedures.

Ensure proper orientation of the cradle in relation to the mount.

3. Slide the cradle pivot arms into the slots of the ammo yoke arm and elevation yoke arm, aligning the holes in the pivot arms with holes in the yoke arms, as shown in Figure 3.

NOTE

Each Nord-lock washer is a set of two washers. Ensure that the washer set is positioned so that the serrated edges face outward in both directions.

Ensure both weapon cradle bolts and Nord-lock washers are loosely installed. When securing the cradle bolts, completely tighten the drive axle cradle bolt first and then the dead axle cradle bolt. Following this procedure will ensure proper cradle alignment and prevents dead axle interference.

4. Insert attaching hardware (one tension bolt and one Nord-lock washer set per side) into the holes on the cradle pivot arms and the yoke arms, as shown in Figure 3.

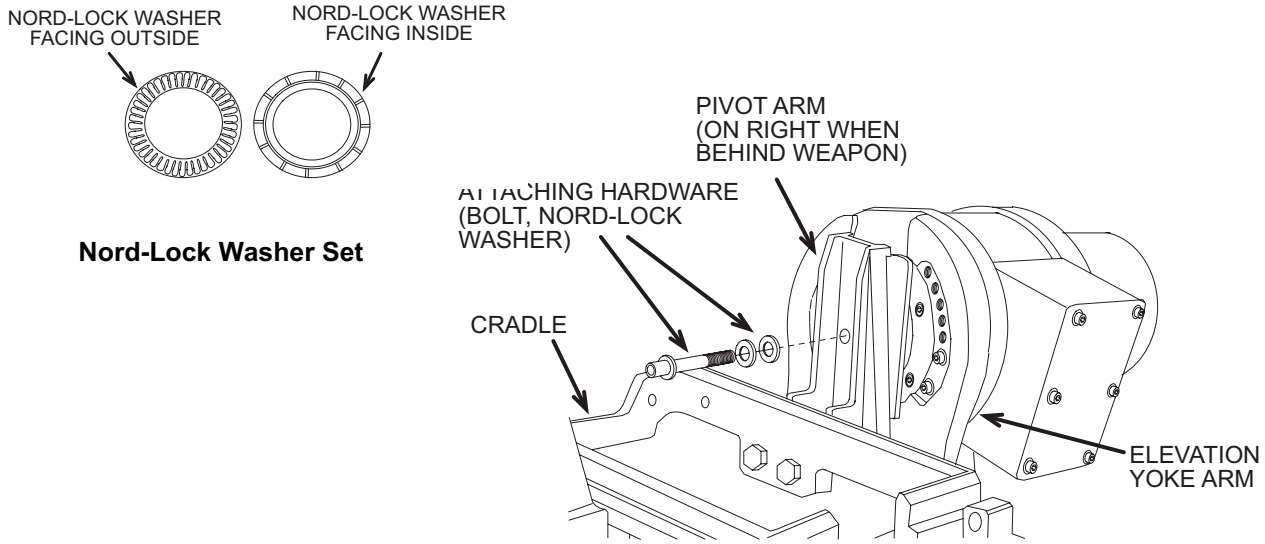


Figure 3. Attaching Hardware Being Positioned for Insertion into the Cradle.

PREPARATION FOR INSTALLATION OF THE WAK AND WEAPON - Cont

Cradle Installation - Cont

Cradle Installation - Cont

NOTE

Tighten the bolt on the side of the elevation yoke arm first, then tighten the bolt on the side of the ammo yoke arm.

5. Tighten the attaching hardware to 65 +/15 ft-lb with a torque wrench, to secure the cradle to the mount, as shown in Figure 4.

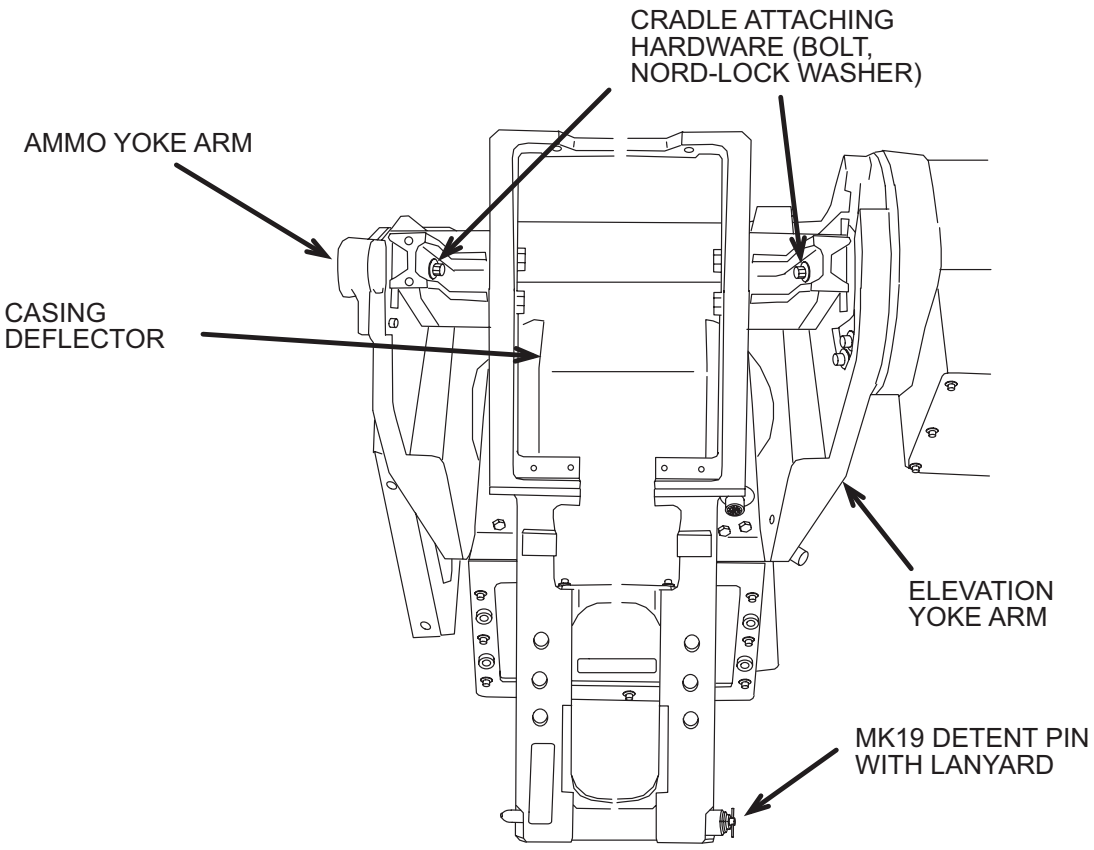


Figure 4. Cradle Installed on the Mount.

END OF TASK

Attenuator Positioning

For the Mk19, if the attenuators are installed, they must be in the down position, as shown in Figure 5. If the attenuators are in the up position, perform the following procedure to reposition the attenuators.

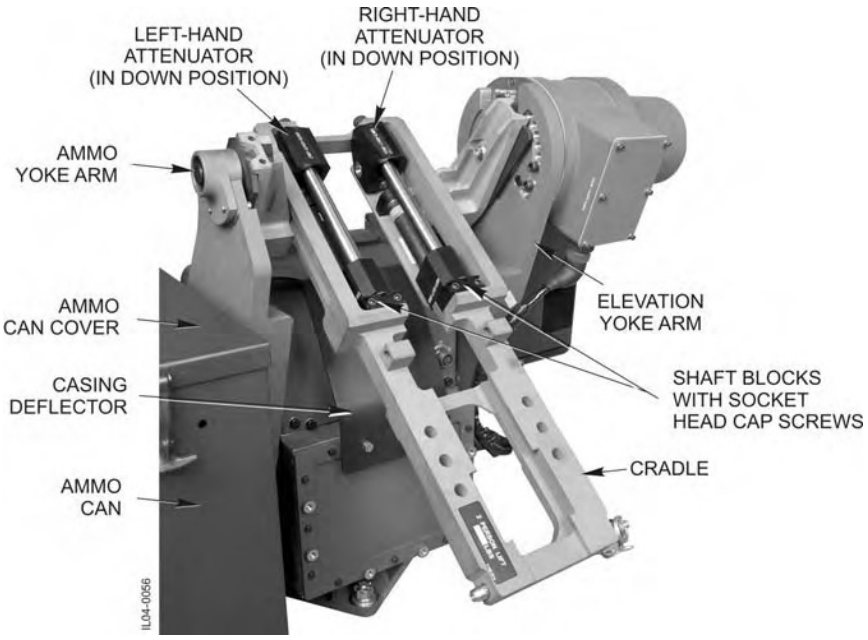


Figure 5. Attenuators Installed in Down Position.

1. Ensure CROWS system power is OFF.

2. If installed, remove the hitch pin from the brass bushings in the forward pin, then remove the forward pin, as shown in Figure 6. (Retain pins for later use.)

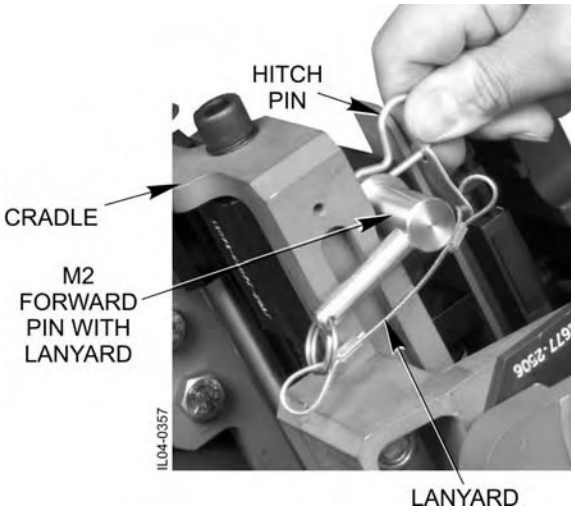


Figure 6. Removing Hitch Pin from Forward Pin.

PREPARATION FOR INSTALLATION OF THE WAK AND WEAPON - Cont

Attenuator Positioning - Cont

3. Place your thumb on the top of the attenuators, rotating the assemblies toward the center of the cradle and down until the attenuators are 180° from previous position, as shown in Figure 7.

4. Ensure both attenuators are level and even.

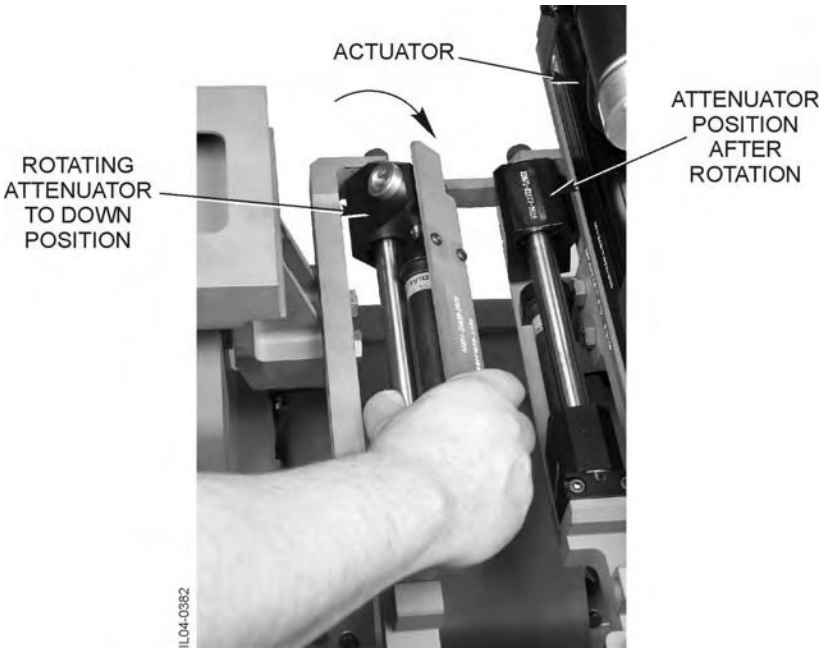


Figure 7. Attenuator Being Rotated from Up to Down Position.

END OF TASK

WAK AND WEAPON INSTALLATION

Perform the following procedures to mount the Mk19 weapon and adapter kit to the cradle.

WARNING

Follow all stated warnings and cautions when handling the weapons.

Ensure that the weapon is cleared and any cleared rounds are secured before performing any procedures, unless specifically directed to load the weapon. (For instructions on clearing and loading the Mk19 weapon, refer to WP 0019.)

Use two personnel during installation/removal of the cradle and Mk19 grenade gun.

Failure to follow these instructions may result in personal injury or equipment damage.

NOTE

Ensure the azimuth lock assembly is in the locked position for the procedure to be performed. (For azimuth lock procedures, refer to WP 0006, Azimuth Lock Assembly section.)

For details on handling or disassembling the Mk19 weapon, refer to TM 9-1010-230-10, Operator's Manual for Machine Gun, 40 mm, Mk19.

Front Bracket Assembly Installation

Perform the following procedures to attach the front bracket assembly to the cradle.

1. Ensure CROWS system power is OFF.
2. Remove the two front cap screws and lock washer, referring to Figure 8.

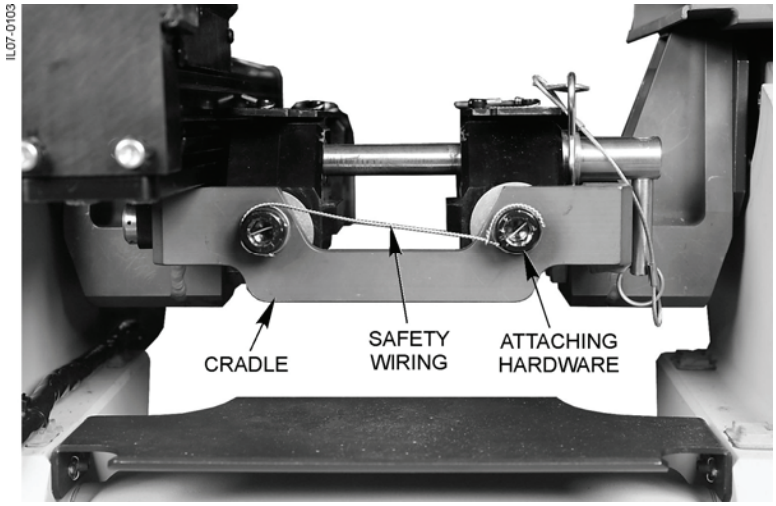


Figure 8. Attenuator Attaching Hardware Being Tightened.

WAK AND WEAPON INSTALLATION - Cont

Front Bracket Assembly Installation - Cont

NOTE

The front bracket assembly and the actuator bracket need to be held in alignment while the attaching hardware is being inserted and tightened.

3. Position the front bracket assembly (Figure 9) on the outside edge of the cradle, as shown in Figure 10, aligning holes in the bracket with holes in the cradle.



Figure 9. Front Bracket Assembly.

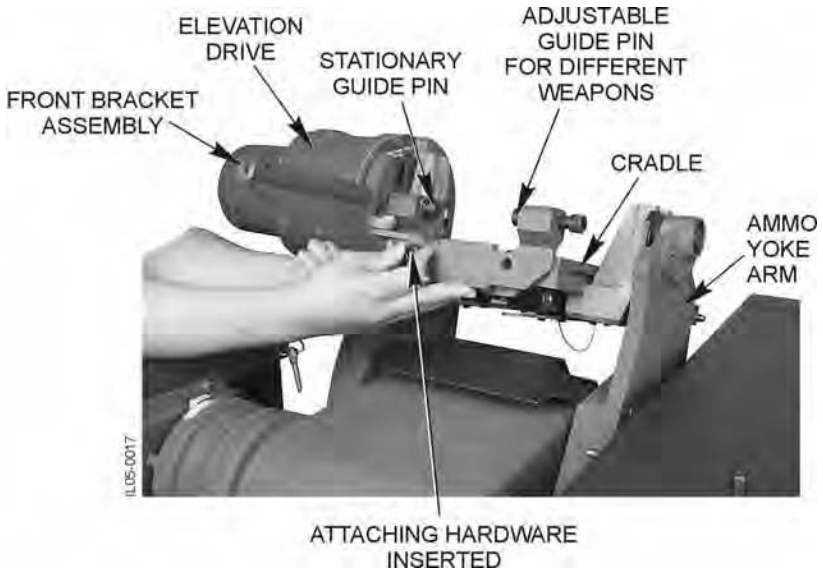


Figure 10. Front Bracket Assembly being Moved into Position for Installation.

4. Insert the socket head cap screws, lock washers, and washers through the front bracket assembly, add the nuts, and tighten, using a 3/8-inch hex head wrench, to secure the front bracket assembly to the cradle, as shown in Figure 11.

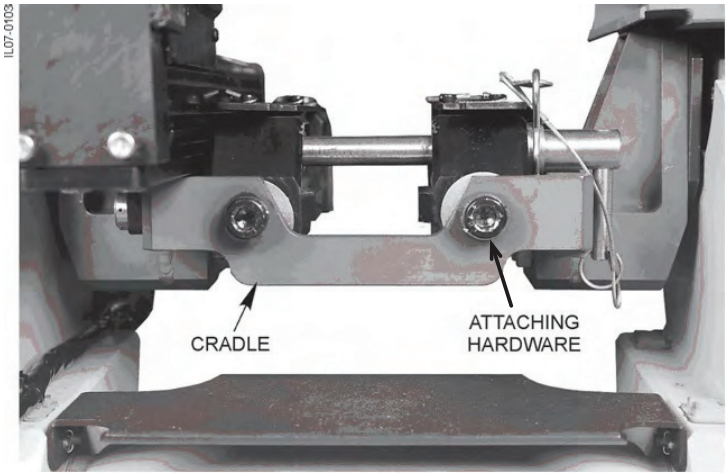


Figure 11. Bracket Hardware Tightened onto Cradle.

NOTE

For additional information on safety wiring, refer to WP 0031.

The cradle, when used with the Mk19 weapon and WAK, can be equipped with or without attenuators.

5. Once the attaching hardware is tightened, secure the socket head cap screws with safety wire, referring to Figure 8.

END OF TASK

WAK AND WEAPON INSTALLATION - Cont

Linear Actuator (Charger) Assembly with Mounting Plate Installation

NOTE

The end rod assembly and the mounting plate do not have to be removed when the linear actuator (charger) assembly is returned to unit maintenance.

Perform the following procedure to attach the mounting plate to the linear actuator (charger) and to install the linear actuator (charger) assembly to the cradle.

1. Ensure CROWS system power is OFF.

2. Ensure the front bracket assembly is in position and secured, as shown in Figure 12.

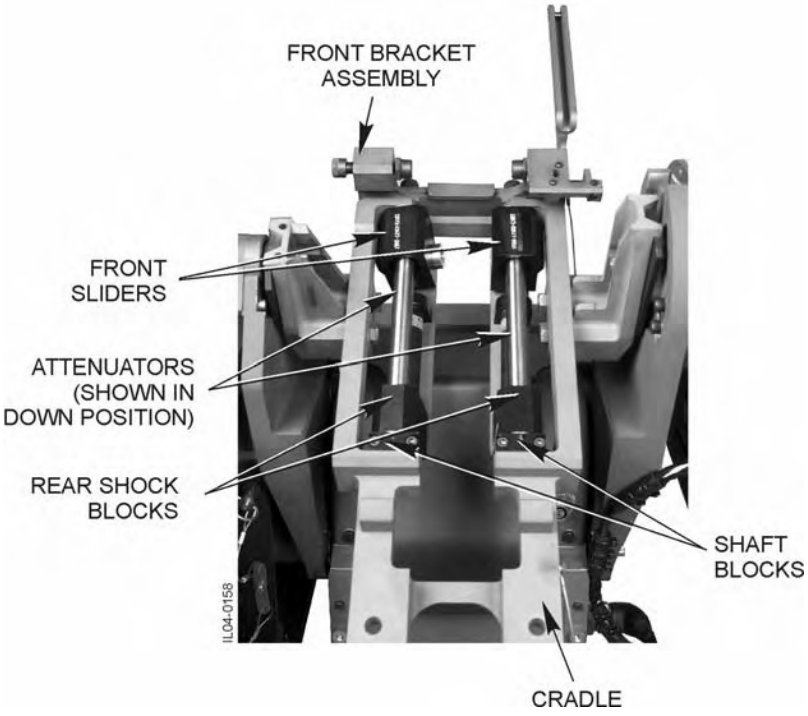


Figure 12. Cradle with Brackets in Position for Linear Actuator.

NOTE

For Thread-Locking Procedures, refer to WP 0032.

3. Apply thread-locking compound to the threads, then insert and tighten the four cap screws and flat washers securing the actuator mounting plate to the actuator to 88 in-lb ± 12 in-lbs, using a torque wrench, referring to Figure 13.

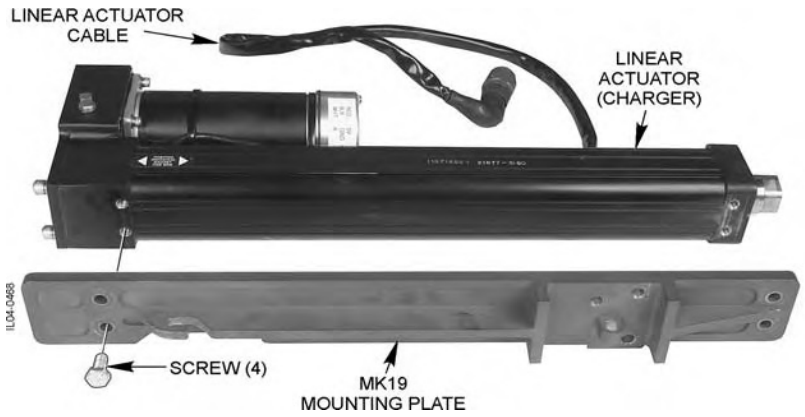


Figure 13. Linear Actuator (Charger) and Mounting Plate.

NOTE

For Safety Wire Procedures, refer to WP 0031.

4. Secure the four cap screws to the bottom of the mounting plate with safety wire, as shown in Figure 14. Figure 15 shows a fully assembled Linear Actuator (Charger).

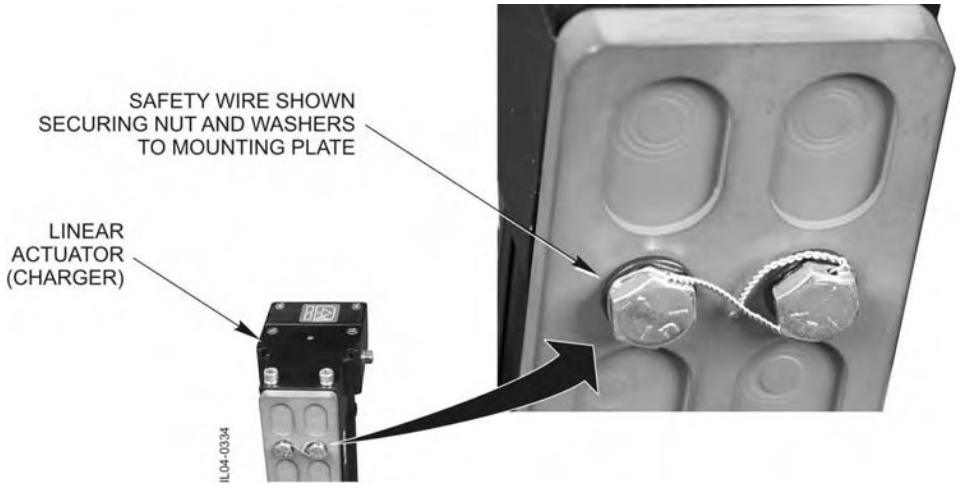


Figure 14. Linear Actuator (Charger) Mounting Plate with Safety Wire.

WAK AND WEAPON INSTALLATION - Cont

Linear Actuator (Charger) Assembly with Mounting Plate Installation - Cont

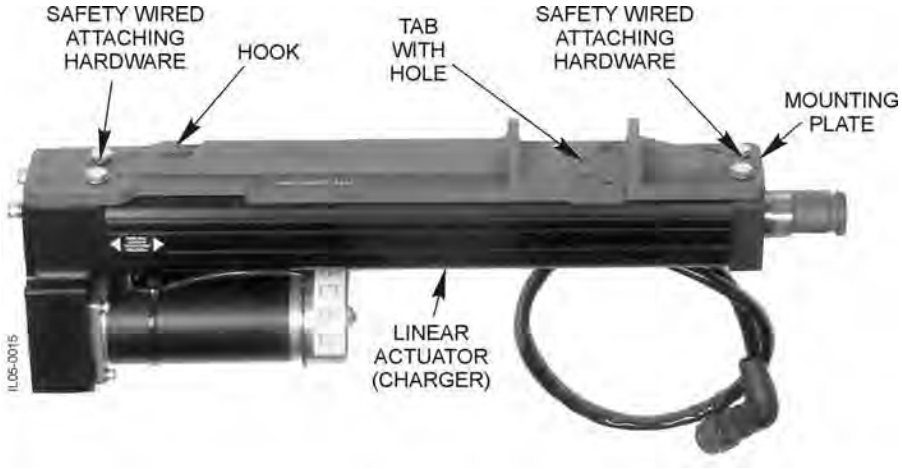


Figure 15. Linear Actuator (Charger) Mounting Plate Safety Wired and Thread-Locked.

5. Position the linear actuator (charger) assembly so that the hook in the actuator mounting plate is aligned with the dowel pin in the front bracket assembly, as shown in Figure 16.

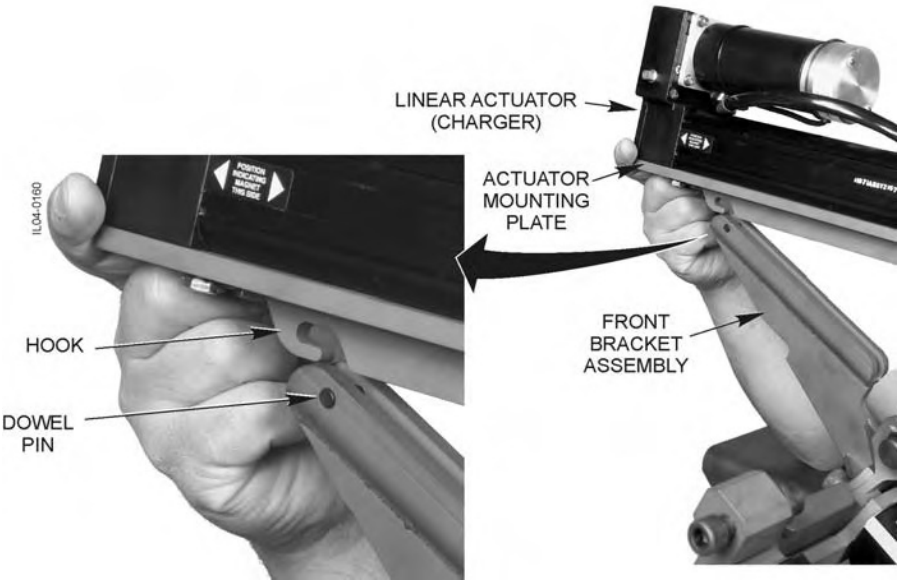


Figure 16. Positioning Actuator on Front Bracket Assembly.

6. Slide the linear actuator into the front bracket assembly until the hook is positioned against the pin.

7. Lower the remainder of the linear actuator onto the front bracket assembly pin and cradle, as shown in Figures 17 and 18. Ensure the holes on the actuator line up with holes in the front bracket assembly.

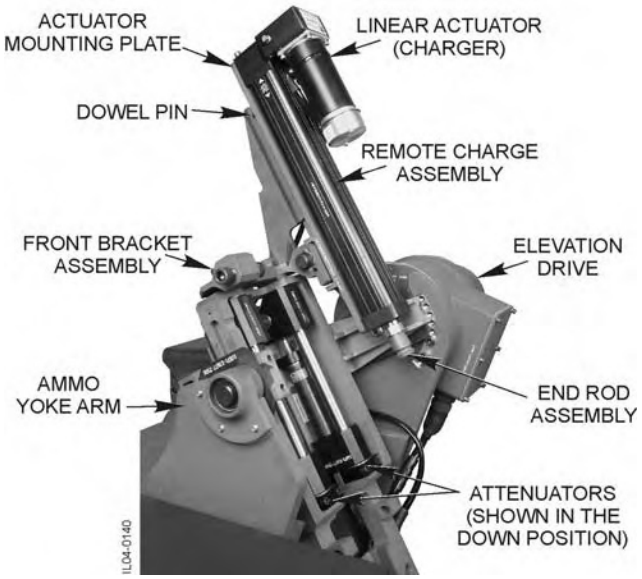


Figure 17. Linear Actuator (Charger) in Position on Bracket and Cradle.

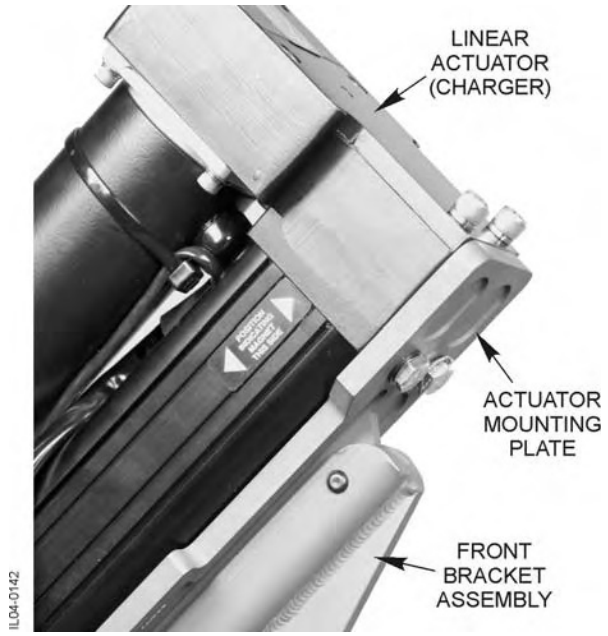


Figure 18. Linear Actuator (Charger) in Position (View from Elevation Yoke Arm Side).

WAK AND WEAPON INSTALLATION - Cont

Linear Actuator (Charger) Assembly with Mounting Plate Installation - Cont

8. Insert the ball lock pin (with lanyard) into the elevation drive side of the linear actuator, as shown in Figure 19, pushing the center button until the pin is fully engaged. This holds the linear actuator in place.

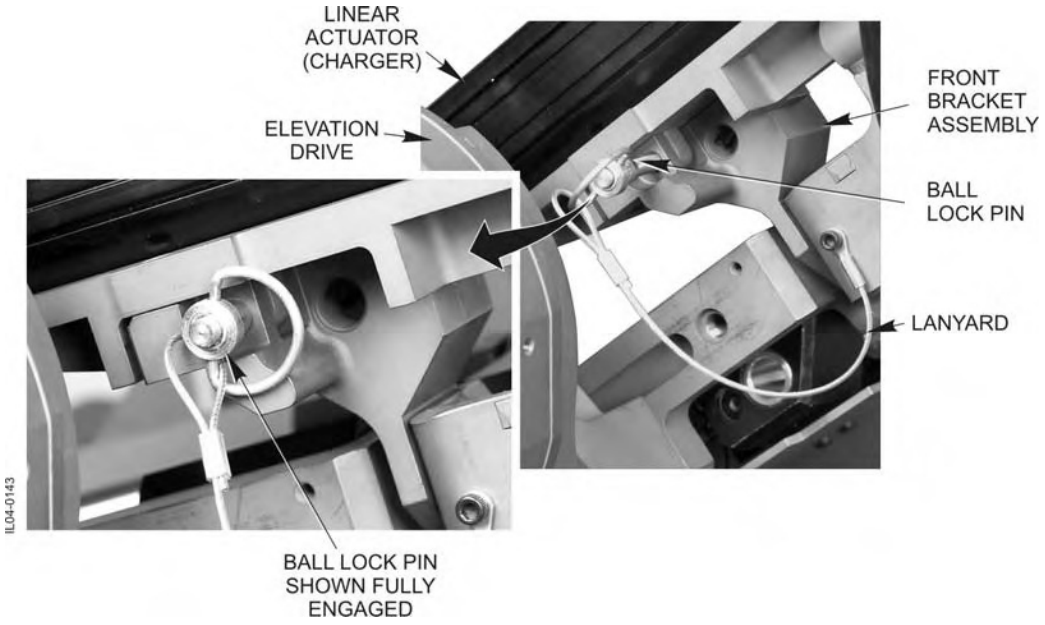


Figure 19. Installation of the Ball Lock Pin into the Linear Actuator.

NOTE

The linear actuator (charger) cable will be connected and secured by cable anchors in a later step (see the Connectors and Cables section of this work package).

9. Ensure the cable from the linear actuator (charger) is routed on the right-hand side, under the cradle, as shown in Figure 20.

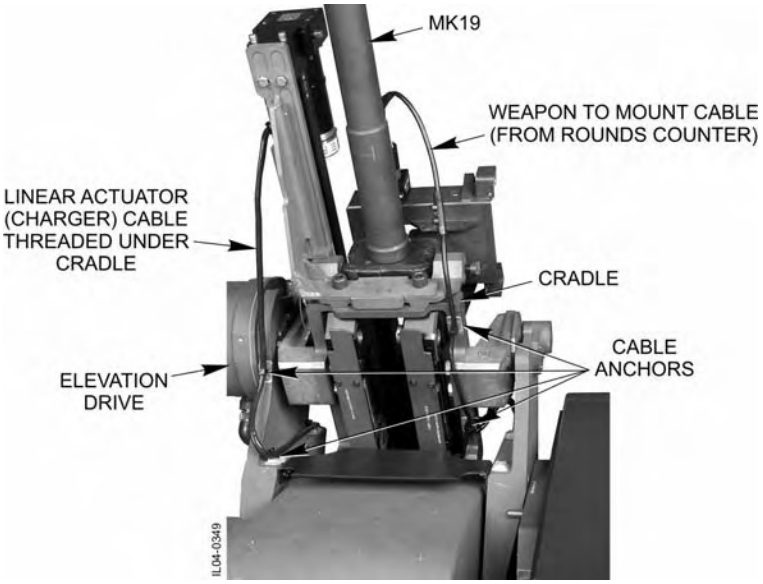


Figure 20. Linear Actuator and Remote Charger Assemblies in Place (Viewed from under Cradle).

END OF TASK

Remote Charger Assembly Installation

Perform the following procedures to prepare the remote charger assembly for installation on the weapon.

1. Ensure CROWS system power is OFF.

2. Remove the original charger assembly and replace it with the remote charger assembly on the right-hand side of the weapon.

   a. Lift the weapon cover.

   b. Pull the left charging handle back enough to expose the front of the weapon bolt at the top of the weapon.

   c. Begin pulling the release pin, as shown in Figures 21 and 22.

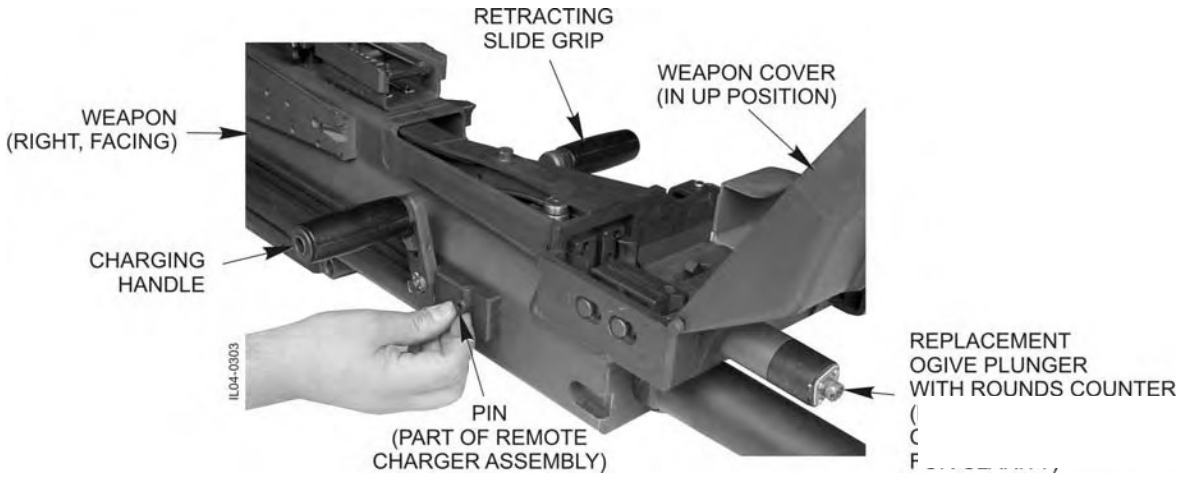


Figure 21. Mk19 and Remote Charger.

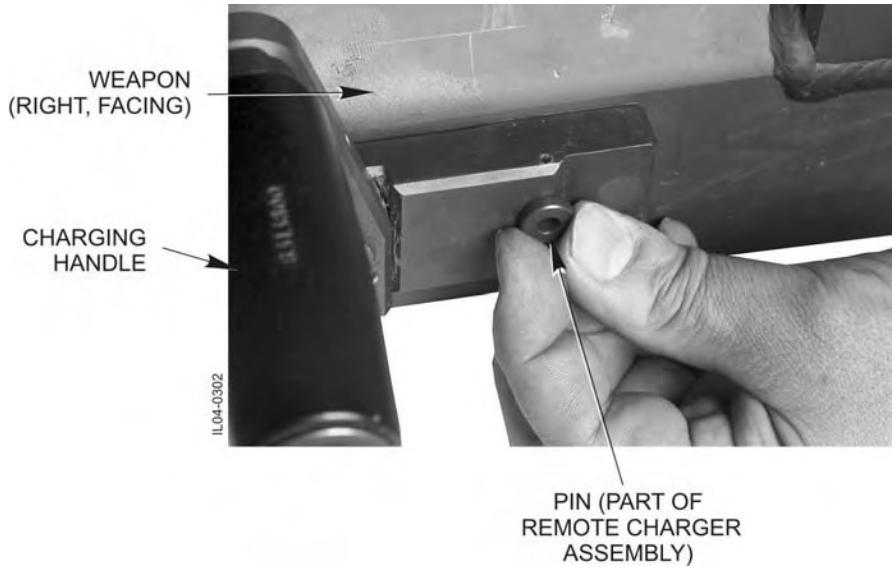


Figure 22. Release Pin Being Removed.

WAK AND WEAPON INSTALLATION - Cont

Remote Charger Assembly Installation - Cont

d. Continue to pull the left charging handle until the release pin is released, as shown in Figure 23.

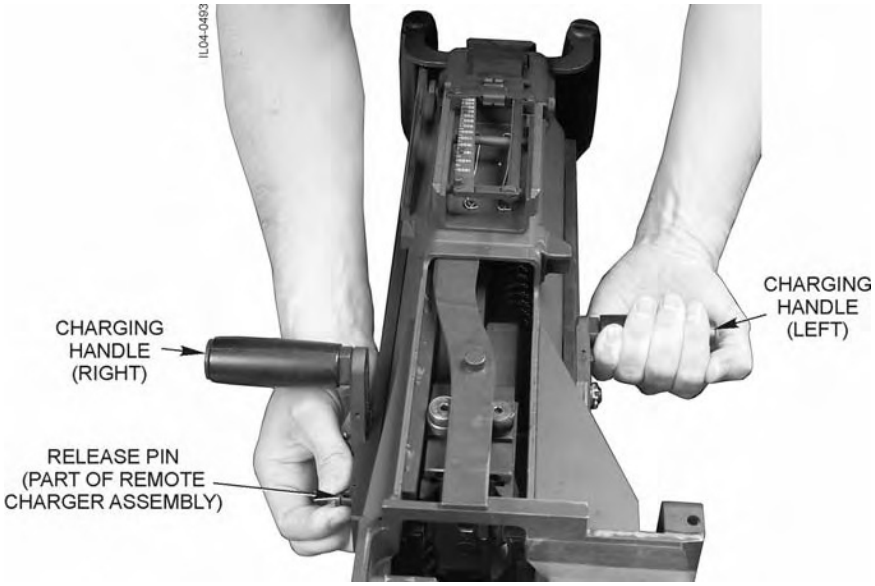


Figure 23. Charging Handle Release Pin Being Released.

e. Release the release pin.

f. Slide the charging handle to the rear, approximately 1 inch.

NOTE

Remove the right-hand charging handle and stow in Mk19 adapter kit box, retaining for when weapon is returned to its original configuration.

g. Remove the charging handle IAW Mk19 grenade machine gun operation manual.

h. Slide the replacement remote charger assembly into the slot, as shown in Figure 24. If needed, use the other hand to push the charging handle until the remote charger assembly snaps into place.



Figure 24. Replacement Remote Charger Assembly Positioned.

i. Move the charging handle (on the right) and verify that the weapon bolt moves. (This action verifies that the remote charger is installed properly.)

j. Install the ball lock pin into the slide extension assembly, referring to Figure 25.

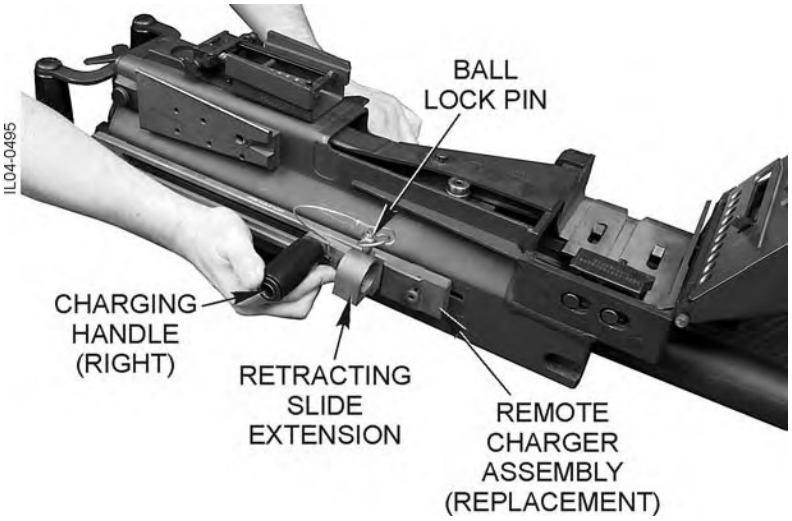


Figure 25. Replacement Remote Charger Assembly Installed.

END OF TASK

WAK AND WEAPON INSTALLATION - Cont

Ogive Plunger Assembly and Rounds Counter with Locking Rounds Counter Block Installation

Perform the following procedures to install the replacement ogive plunger assembly with rounds counter and the locking rounds counter block.

Equipment Condition. Original feed throat removed (see WP 0010).

1. Open the weapon cover.

2. Ensure the original feed throat and attaching hardware have been removed.

3. Remove the ogive plunger alignment guide assembly by inserting a screwdriver to release the flat leaf spring holding the plate in place, as shown in Figure 26.

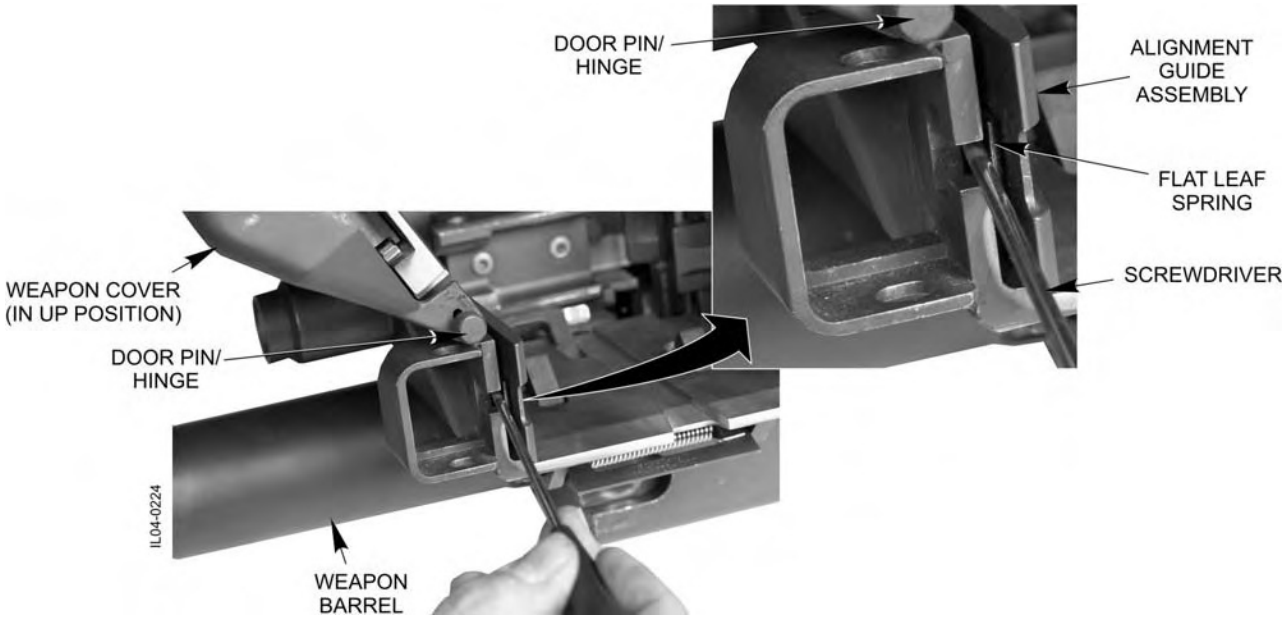


Figure 26. Loosening Flat Leaf Spring Holding Ogive Plunger Assembly in Place.

4. Release the flat leaf spring of the weapon's alignment guide assembly, as shown in Figure 27. Remove the alignment guide assembly to access the original ogive plunger.

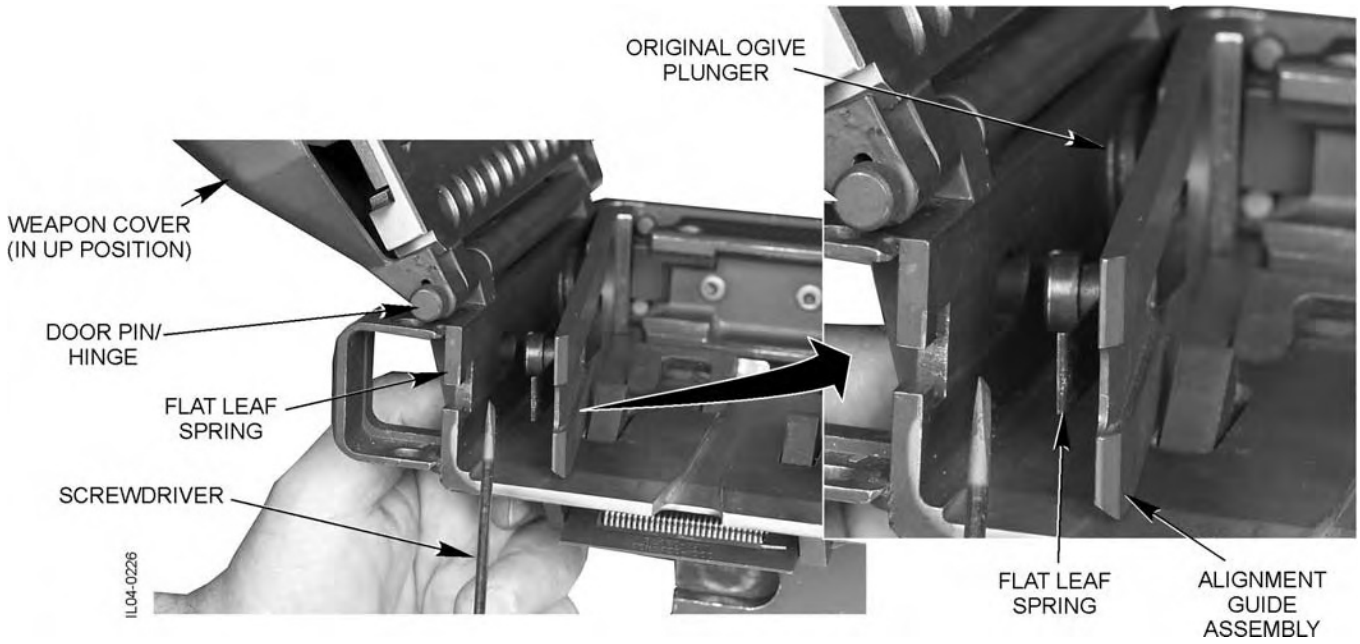


Figure 27. Moving the Flat Leaf Spring and Ogive Plunger Alignment Guide.

5. Carefully loosen and remove the original ogive plunger.

6. Insert the replacement ogive plunger assembly with rounds counter into the hole for the ogive, as shown in Figures 28 and 29.

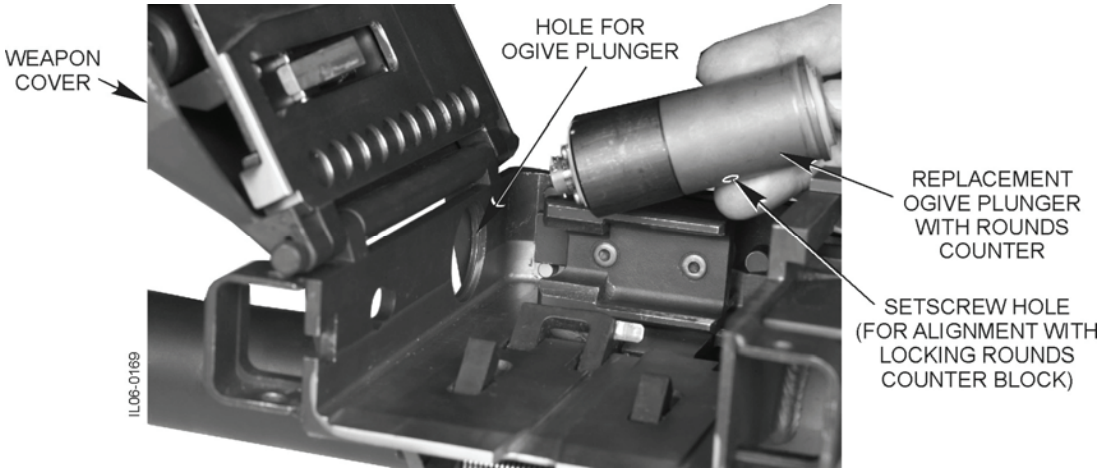


Figure 28. Insertion of Replacement Ogive Plunger with Rounds Counter.

WAK AND WEAPON INSTALLATION - Cont

Ogive Plunger Assembly and Rounds Counter with Locking Rounds Counter Block Installation - Cont

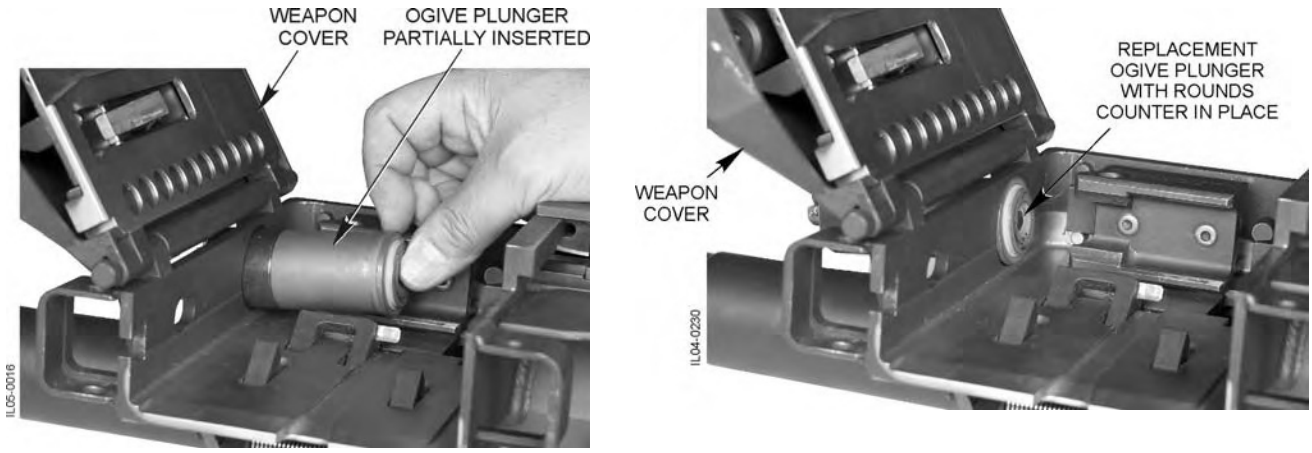


Figure 29. Replacement Ogive with Rounds Counter Being Inserted (Left) and Fully Seated (Right).

7. Reposition the alignment guide assembly, as shown in Figure 30.



Figure 30. Alignment Guide Assembly Positioned over Replacement Ogive.

8. Carefully snap the alignment guide assembly into position, ensuring the flat leaf spring is securely seated, as shown in Figure 31.

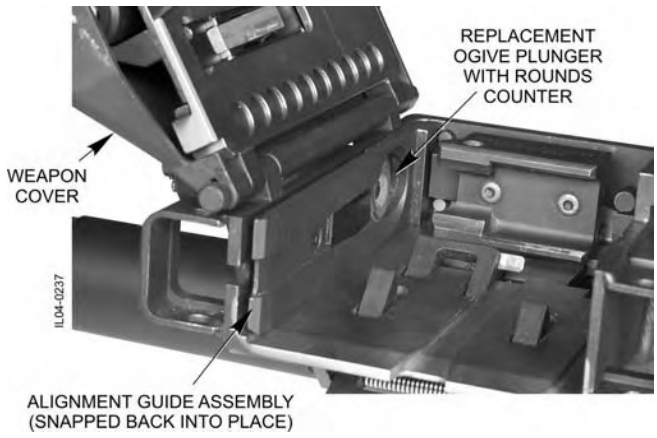


Figure 31. Replacement Ogive Plunger with Rounds Counter.

CAUTION

Ensure alignment of the ogive plunger to the locking rounds counter block and the weapon cable to the weapon barrel to ensure that the weapon cable does not touch the weapon barrel and that the cable operates properly. Failure to follow this instruction may result in cable damage.

NOTE

For additional information about weapon cables, refer to the Connectors and Cables section of this work package.

9. With the weapon cover closed, ensure that the ogive plunger is rotated so the setscrew hole is visible, as shown in Figure 32. This alignment ensures proper orientation of the ogive plunger, locking rounds counter block, and the weapon cable (when attached) so that the weapon cable does not touch the weapon barrel.

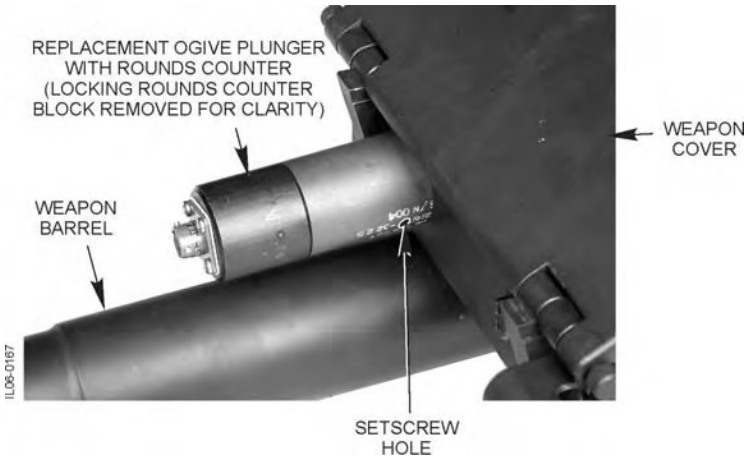


Figure 32. Replacement Ogive Plunger with Rounds Counter in Position with Weapon Cover Closed.

10. Position the locking rounds counter block onto the ogive plunger, aligning the block's setscrew with the ogive's setscrew hole, as shown in Figure 33.

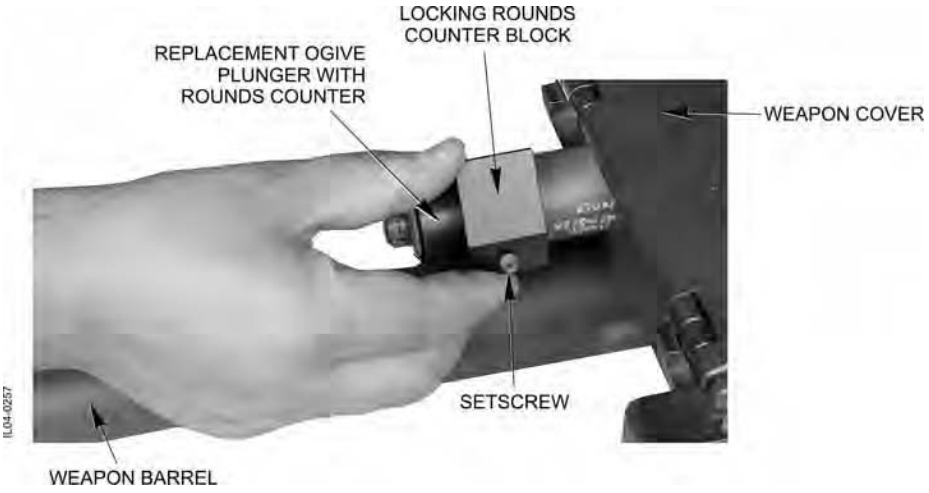


Figure 33. Locking Rounds Counter Block Being Positioned.

WAK AND WEAPON INSTALLATION - Cont

Ogive Plunger Assembly and Rounds Counter with Locking Rounds Counter Block Installation - Cont

11. Slide the locking rounds counter block until it touches the weapon cover, ensuring that the setscrew is aligned with the setscrew hole, as shown in Figure 34.

12. Using a 1/8-inch hex head wrench, tighten the setscrew to secure the locking rounds counter block to the replacement ogive plunger, as shown in Figure 34. The ogive plunger is in position and ready for the weapon cable.

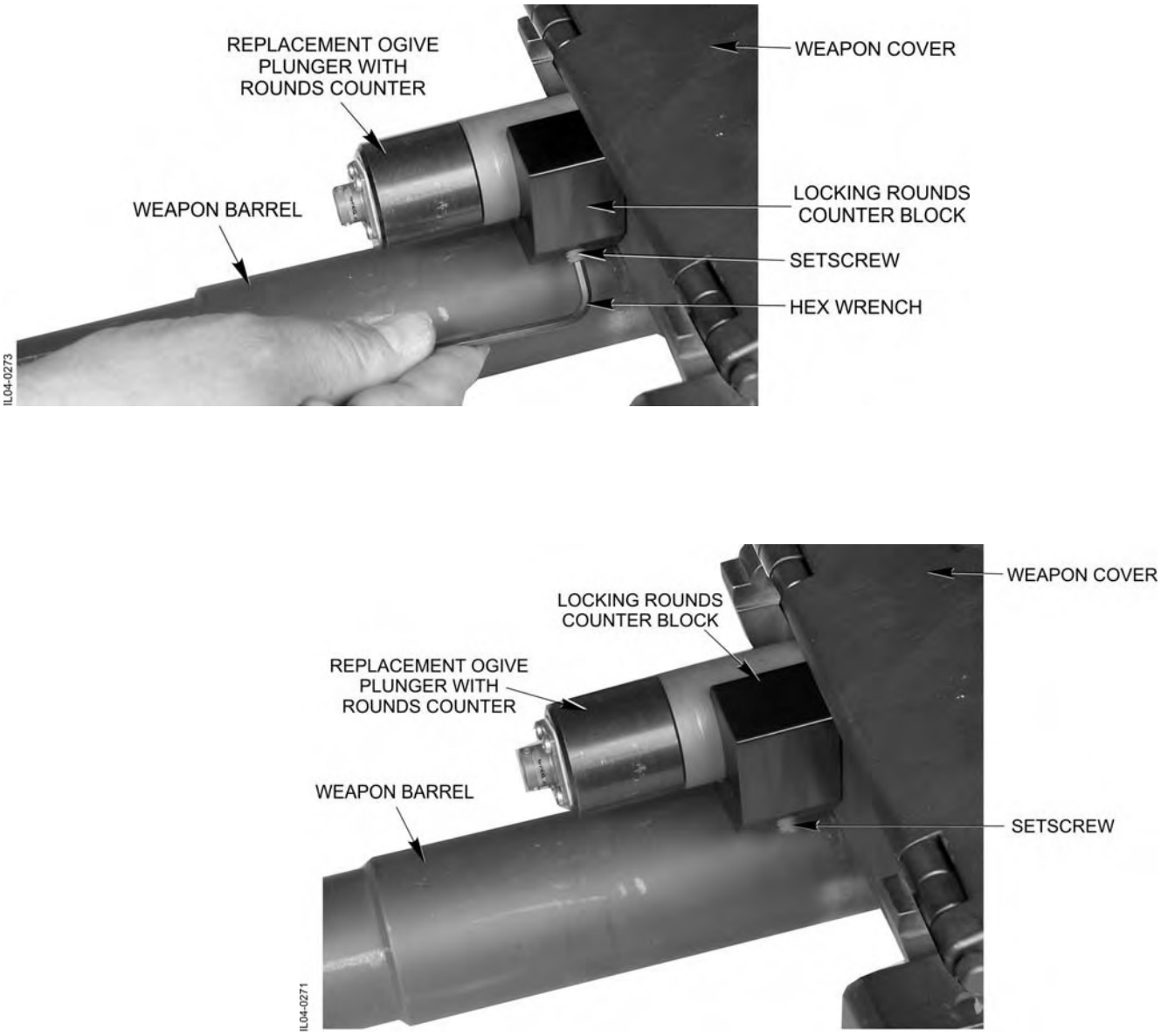


Figure 34. Setscrew Inserted and Tightened, Securing the Replacement Ogive Plunger with Rounds Counter.

END OF TASK

Feed Throat Assembly Installation

Equipment Condition. Original feed throat removed (see WP 0010).

Perform the following procedure to install the replacement feed throat assembly on the weapon.

1. Open the weapon cover.

NOTE

Remove weapon cover if you have difficulty inserting the hitch pins (see WP 0010).

2. Install replacement feed throat, as shown in Figure 35, ensuring the assembly is seated properly.
3. Insert the forward feed throat clevis pin from the bottom up and secure with hitch pin.
4. Insert the rear feed throat clevis pin from the top down and secure with hitch pin.

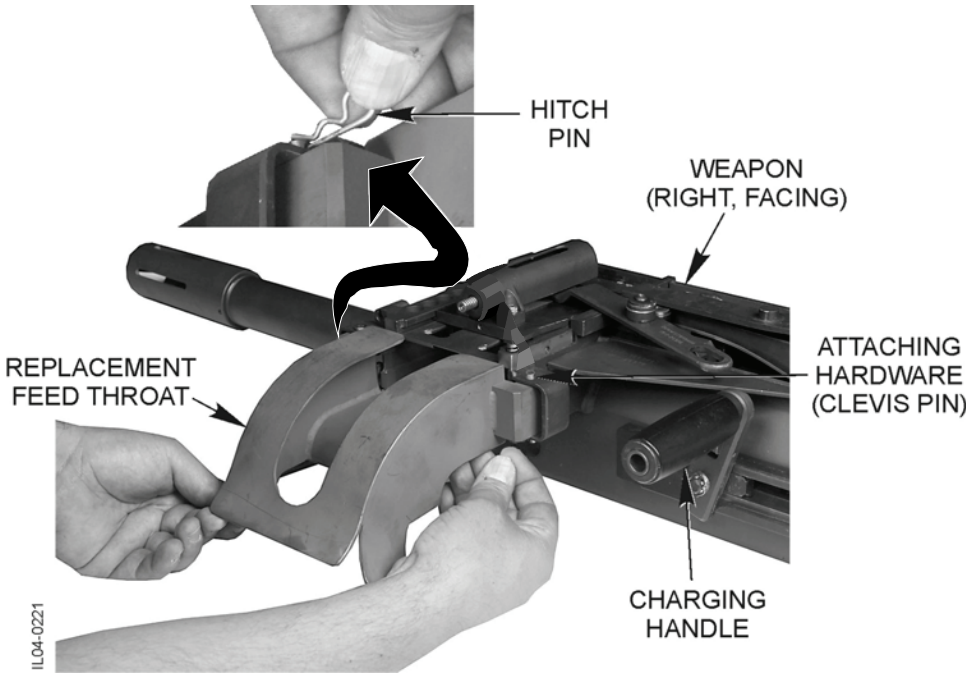


Figure 35. Replacement Feed Throat Secured.

WAK AND WEAPON INSTALLATION - Cont

Feed Throat Assembly Installation - Cont

5. If removed, reinstall the weapon cover and insert the door pins, referring to Figure 36.

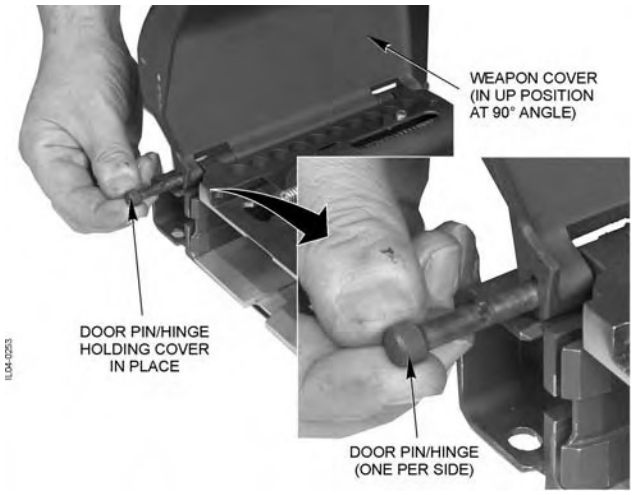


Figure 36. Inserting Pin for Weapon Cover Hinge.

6. Position secondary drive lever in position and re-secure the snap ring to weapon cover, as shown in Figure 37.

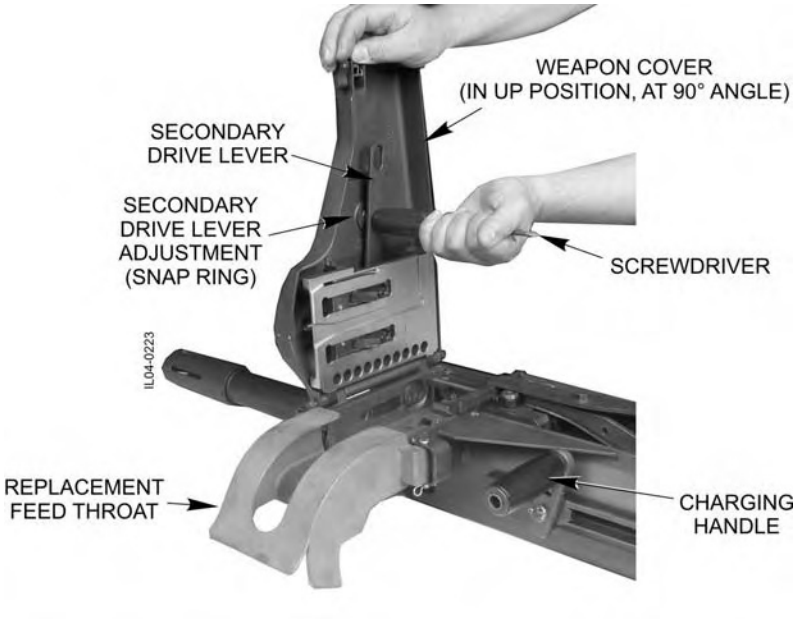


Figure 37. Reassembly of Weapon Cover with Replacement Feed Throat.

END OF TASK

Weapon and Detent Pin Installation

Perform the following procedures to mount and secure the Mk19 with adapter kit components to the cradle.

WARNING

Ensure weapon is cleared and any cleared rounds are secured before performing any procedures unless specifically directed to load the weapon. For instructions on loading and firing the weapon, refer to WP 0019 and WP 0035. Failure to do so may result in personal injury or equipment damage.

NOTE

Refer to TM 9-1010-230-10, Operator's Manual for the Mk19 40 mm Grenade Machine Gun.

1. Remove sear cover from the bottom of the weapon, as follows.
   a. Turn the weapon upside down and place on sturdy surface.
   b. Place weapon SAFE/FIRE switch to FIRE.
   c. Press down on sear cover detent and rotate 90°.
   d. Remove cover.
   e. Place weapon SAFE/FIRE switch to SAFE.
2. Slide the weapon into the cradle, aligning the slots on the front of the weapon with the Mk19 guide pins on the front bracket assembly, shown in Figure 38.

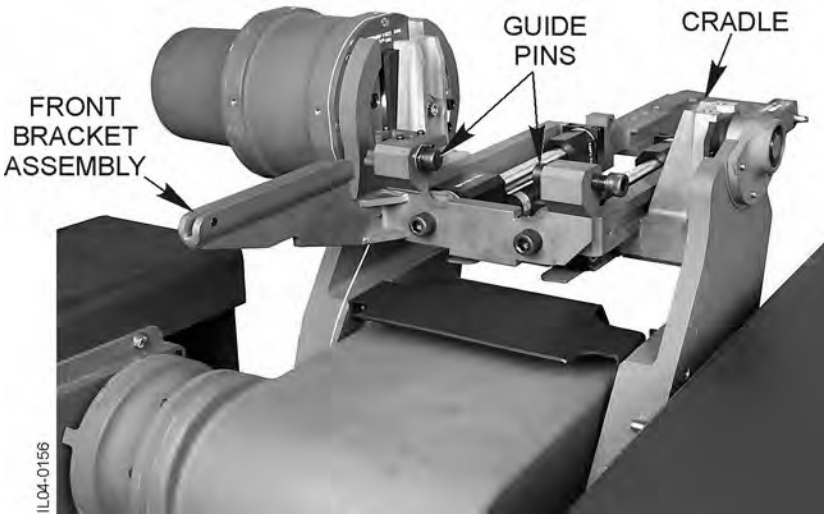


Figure 38. Cradle Ready for Mk19 Installation (Linear Actuator [Charger] Removed for Clarity).

WAK AND WEAPON INSTALLATION - Cont

Weapon and Detent Pin Installation - Cont

3. Remove the detent pin from its stowage area on the rear of the cradle and slide it into the holes provided on the cradle and through the weapon, as shown in Figure 39.

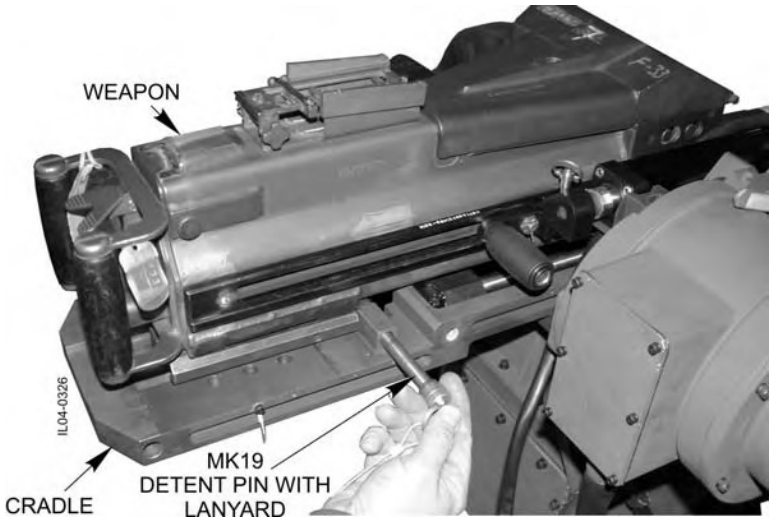


Figure 39. Detent Pin Securing Mk19 to Cradle.

4. Remove bolt on side of front bracket assembly (see Figure 40). Tighten guide pin on the ammo can side to remove “play.” Return bolt to side of front bracket assembly and re-tighten.

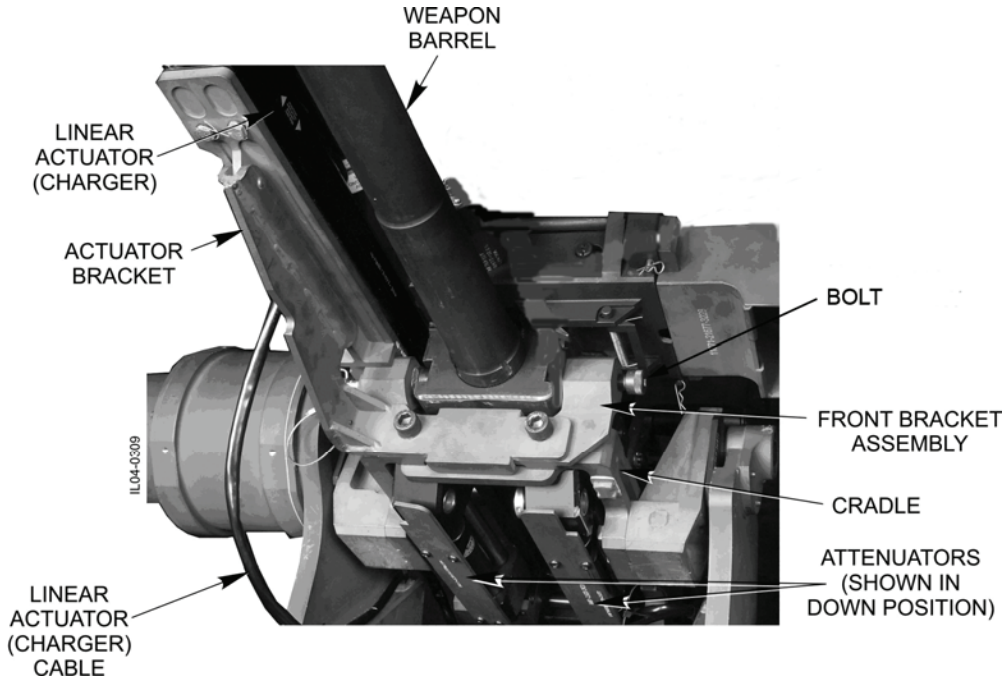


Figure 40. Guide Pin Securing Mk19 to Cradle.

END OF TASK

Connection of Linear Actuator (Charger) to Remote Charger Assembly

Perform the following procedures to connect the linear actuator (charger) to the remote charger assembly.

NOTE

Refer to WP 0002, Equipment Description and Data, for information on the Control Group components.

Refer to WP 0015, Menu System, for procedures on using the CROWS menus to operate the system.

Refer to WP 0019, Loading and Firing the Mk19 40 mm Grenade Machine Gun, for procedures on proper use and operation of the CROWS with Mk19.

1. Ensure the remote charger assembly and linear actuator (charger) are in position on the weapon and cradle, respectively.

2. Remove the ball lock pin from the remote charger assembly, as shown in Figure 41.

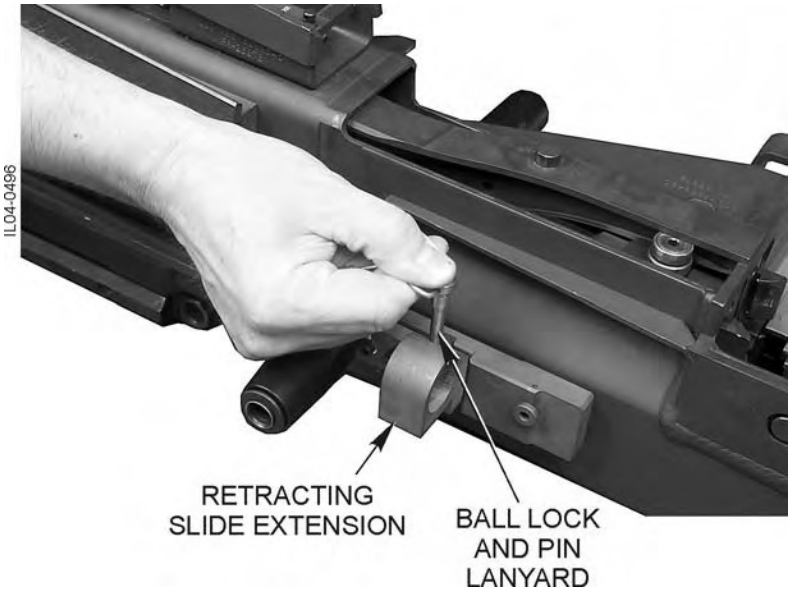


Figure 41. Ball Lock Pin on Remote Charger Assembly.

WAK AND WEAPON INSTALLATION - Cont

Connection of Linear Actuator (Charger) to Remote Charger Assembly - Cont

3. Pull back on the spring-loaded end rod until end rod is fully inserted into retracting slide extension, as shown in Figure 42.

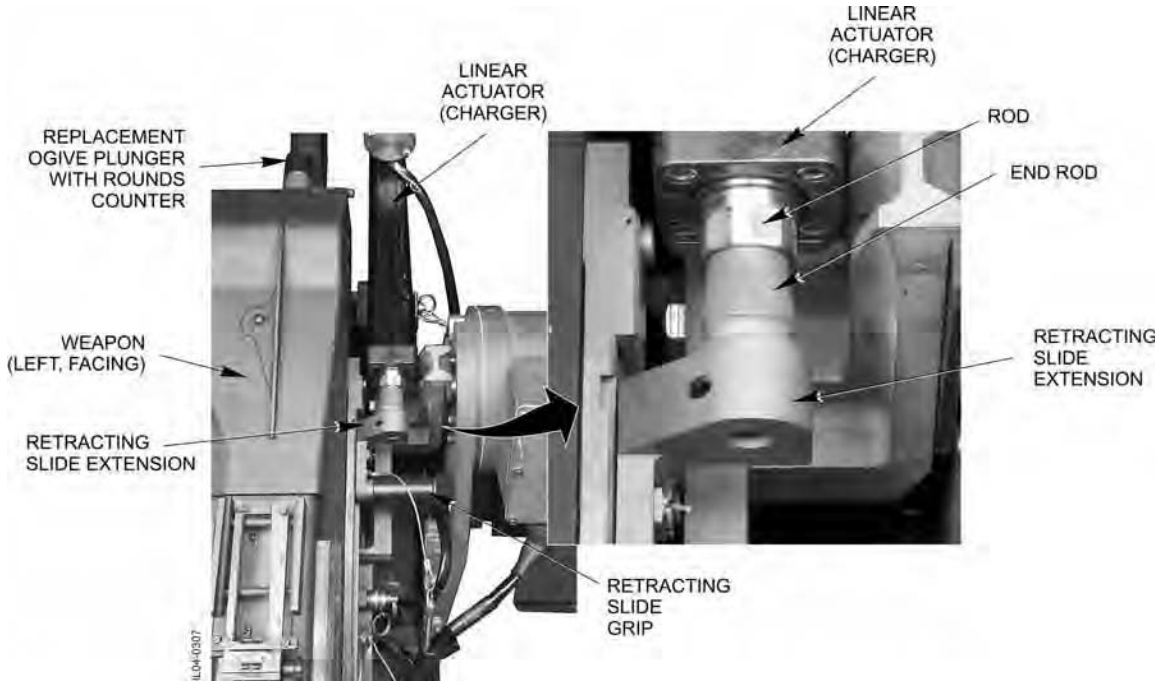


Figure 42. Remote Charger and Linear Actuator in Position.

4. Insert the ball lock pin into remote charger assembly to maintain component positions, as shown in Figure 43.

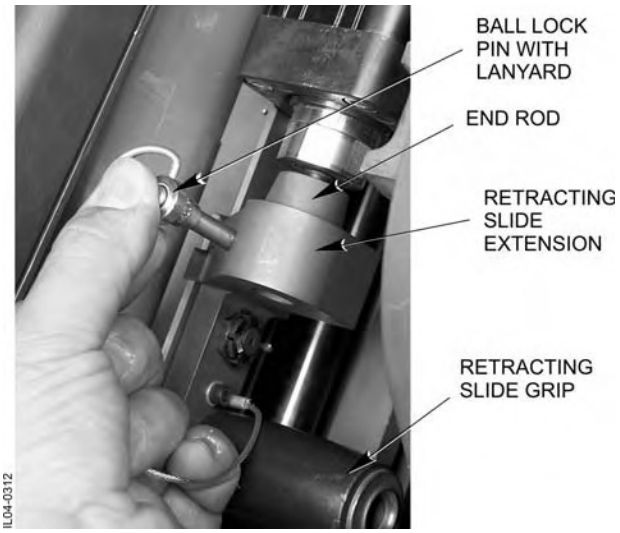


Figure 43. Ball Lock Inserted to Hold Position.

END OF TASK

Installation of End Rod Assembly

Perform the following procedures to install the end rod assembly on the linear actuator (charger).

CAUTION

When installing the end rod assembly or components, do not allow the actuator rod to move. Keep the actuator rod stationary. Failure to do so may result in equipment damage.

1. With the linear actuator (charger) on a stable work surface, secure the actuator rod with a wrench to ensure that the actuator rod does not move, referring to Figure 44.

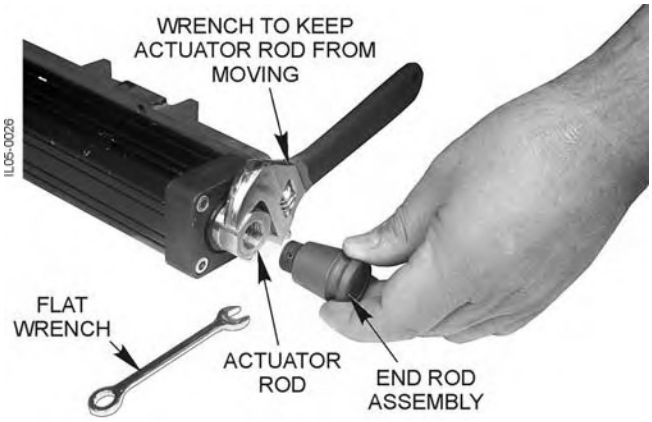


Figure 44. End Rod Assembly Separated from Linear Actuator (Charger) Assembly.

NOTE

For Thread-Locking Procedures, refer to WP 0032.

2. Apply thread-locking compound to the threaded bushing of the end rod assembly.
3. Insert and secure the threaded bushing into the actuator rod.

WAK AND WEAPON INSTALLATION - Cont

Installation of End Rod Assembly - Cont

CAUTION

When installing the end rod assembly or components, do not allow the actuator rod to move. Keep the actuator rod stationary. Failure to do so may result in equipment damage.

NOTE

Pulling the spring-loaded end rod assembly while keeping the linear actuator (charger) assembly in place may be easier with two personnel.

4. While keeping the actuator rod stationary with the wrench, pull the spring-loaded end rod assembly away from the linear actuator (charger) assembly to reveal the two flat spots on the end rod stud, referring to Figure 45.

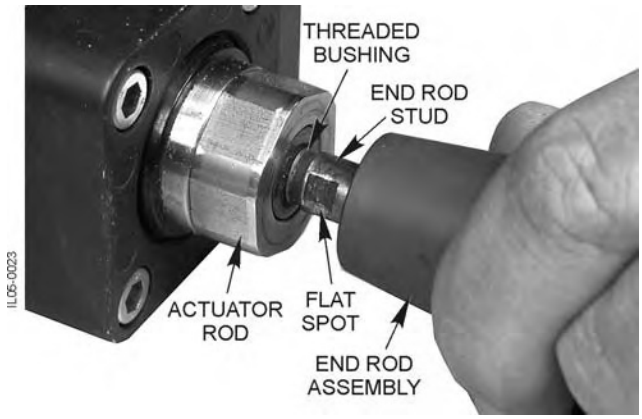


Figure 45. End Rod Assembly Pulled Away from Linear Actuator (Charger) Assembly (Wrench Removed for Clarity).

5. Using the wrench to secure the actuator rod, insert the 5/16-inch flat wrench onto the two flat spots on the end rod stud, referring to Figure 46.

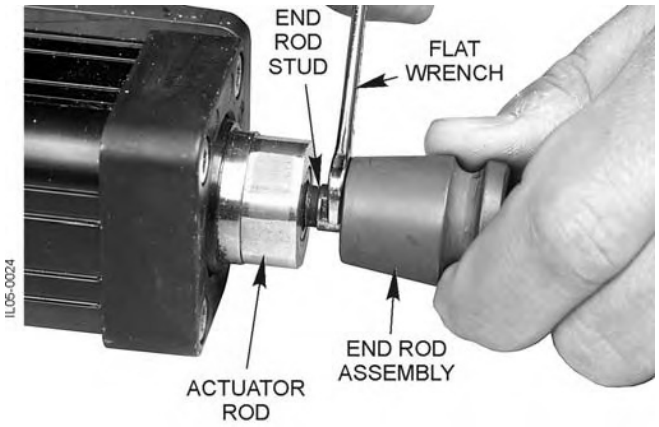


Figure 46. Flat Wrench Positioned on the End Rod Stud (Other Wrench Removed for Clarity).

6. Using both wrenches (steps 4 and 5), tighten the end rod assembly, referring to Figure 47.

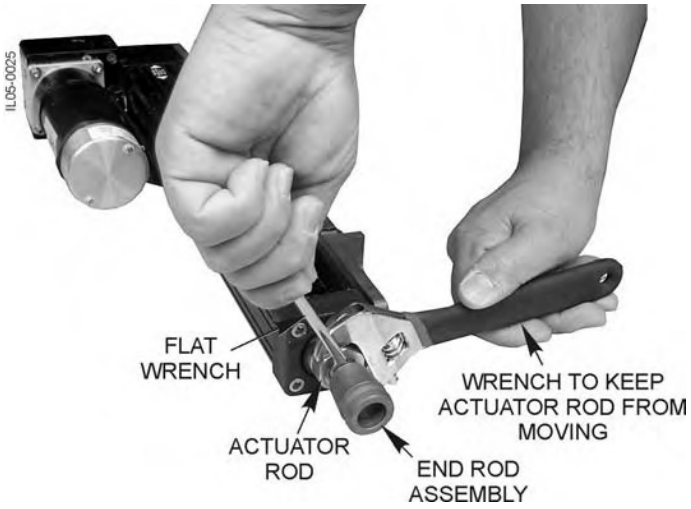


Figure 47. Both Wrenches in Place.

7. Figure 48 shows the End Rod Assembly installed onto the Linear Actuator (Charger) Assembly with Mounting Plate.

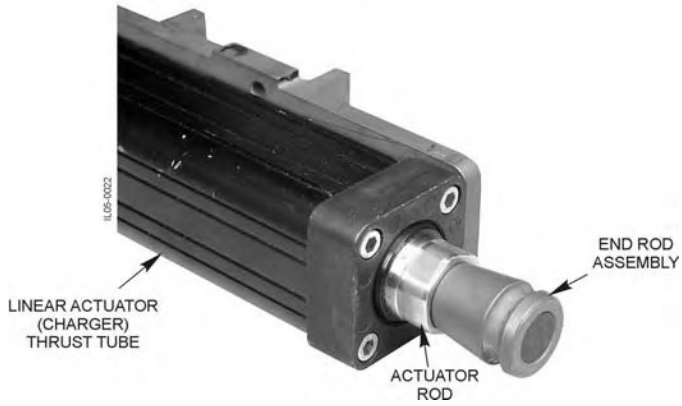


Figure 48. End Rod Assembly on Linear Actuator (Charger) Assembly.

END OF TASK

WAK AND WEAPON INSTALLATION - Cont

Remote Firing Solenoid Installation

Perform the following procedures to install the remote firing solenoid on the weapon.

1. Ensure CROWS system power is OFF.

2. Ensure the Mk19 and WAK components are in place, as shown in Figure 49.

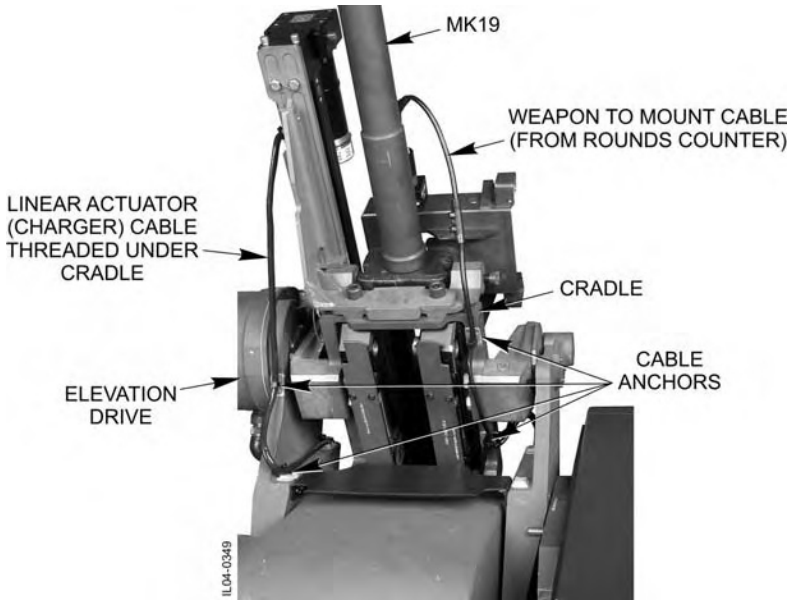


Figure 49. View of Cradle with Mk19 and Adapter Kit (from Bottom).

3. Place the weapon mechanical SAFE/FIRE switch on FIRE.

4. Insert the remote firing solenoid onto the bottom rear of the weapon with the connector facing front toward the barrel, as shown in Figure 50.

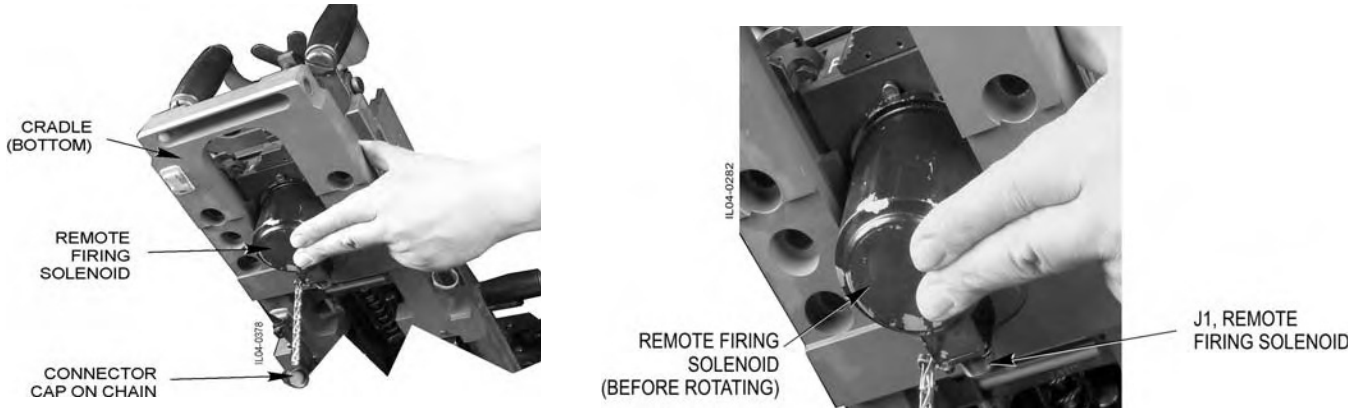


Figure 50. Remote Firing Solenoid Positioned.

5. Rotate the solenoid 90° to the left until it snaps into place. The connector will be facing the left side of weapon, as shown in Figure 51.

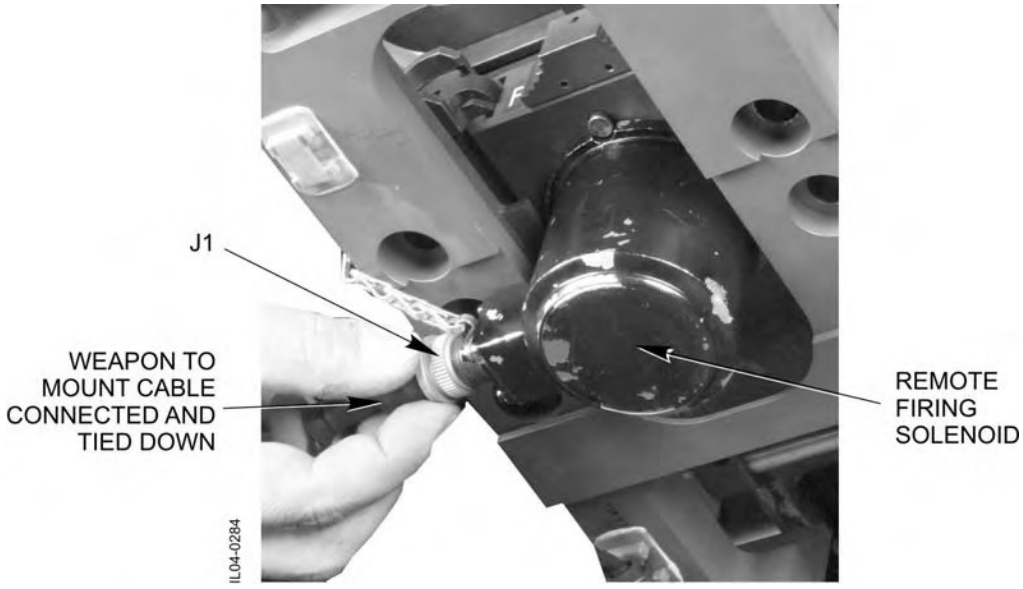


Figure 51. Remote Firing Solenoid Rotated to Operating Position.

6. Place the weapon mechanical SAFE/FIRE switch on SAFE.

7. Figure 52 shows the Mk19 weapon and adapter kit fully installed on the CROWS mount.

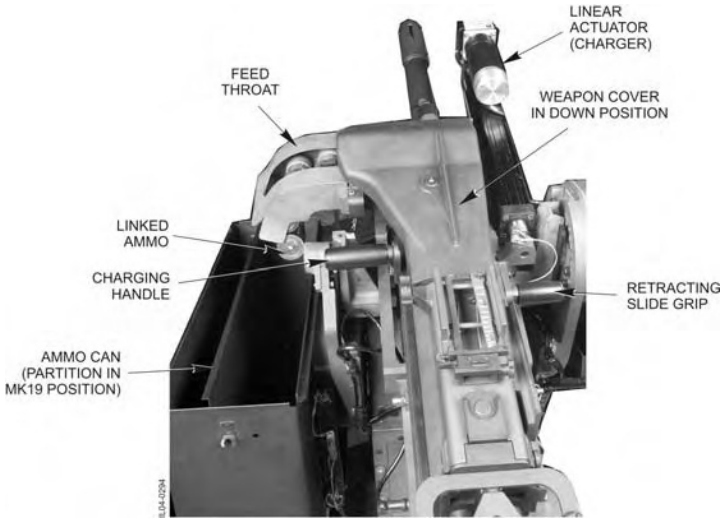


Figure 52. Fully Installed Mk19 Weapon and Adapter Kit.

END OF TASK

Connectors and Cables

WARNING

Follow all safety warnings and cautions during interconnection procedures. Failure to do so may result in personal injury or equipment damage.

CAUTION

Ensure proper alignment of connector keyways prior to installing cables.

Cover connectors with the appropriate connector cap attached to the cable assembly if not connected to a mating connector.

When the ICU-DU cable (P/N 21677-3715) is installed and secured, ensure that the radius of any bend measures at least 5 inches.

Ensure system power is OFF when connecting or disconnecting cables.

Failure to follow the above instructions may result in equipment damage, damage to the electrical pins, and system inoperability.

NOTE

For additional information on CROWS cables and connectors, refer to WP 0005, Interconnection (Connectors and Cables).

Perform the following procedure to connect the cables and connectors for the Mk19 weapon and adapter kit.

1. Ensure CROWS system power is OFF.
2. Ensure all cables above roof line are connected IAW Figure 53, Mk19 Above Vehicle Interconnect Diagram. For all cables, see WP 0005, Figure 1.
3. Connect the actuator cable from the linear actuator (charger) to connector, J5 on the pedestal mount, as shown in Figures 54 and 55.
4. Connect the weapon-mount cable to connectors J1 of the remote firing solenoid, J1 of the rounds counter, and J6, Weapon, on the pedestal mount, as shown in Figures 54, 56, and 57.
5. When all connections have been completed, ensure all cables are tied down properly with appropriate service loops as necessary, as shown in Figures 54 and 55.

NOTE

For azimuth lock procedures, refer to WP 0006, Azimuth Lock Assembly section.

6. Ensure azimuth lock is in unlocked position. The pedestal mount should move freely.
7. Move the cradle through its full range of vertical motion, the mount through 360° (full) rotation, and the sensor unit up and down to ensure that there are no points where the cables “pinch” or “bind” in normal operation, especially the actuator cable and the weapon-mount cable. Refer to Figures 54 through 56.

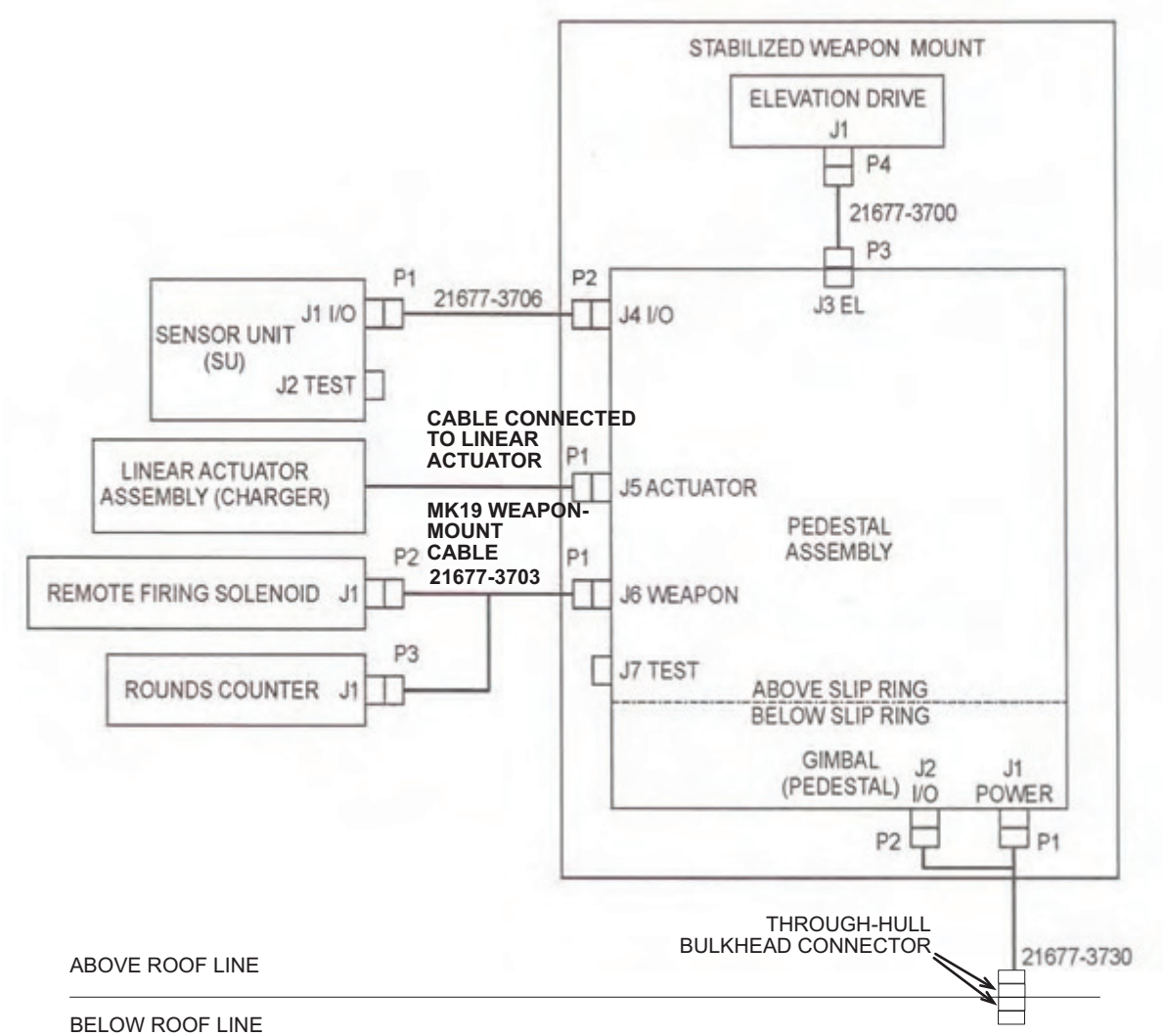
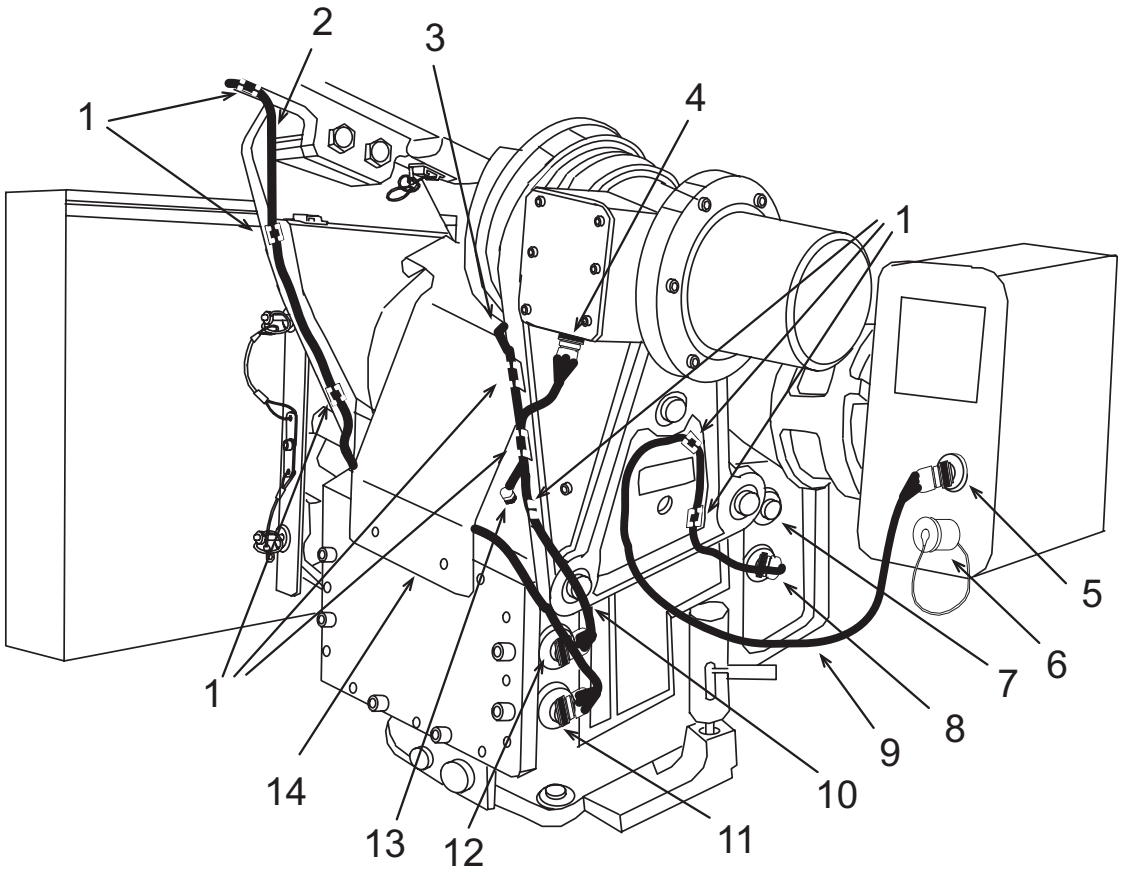


Figure 53. Mk19 Above Vehicle Interconnect Diagram.

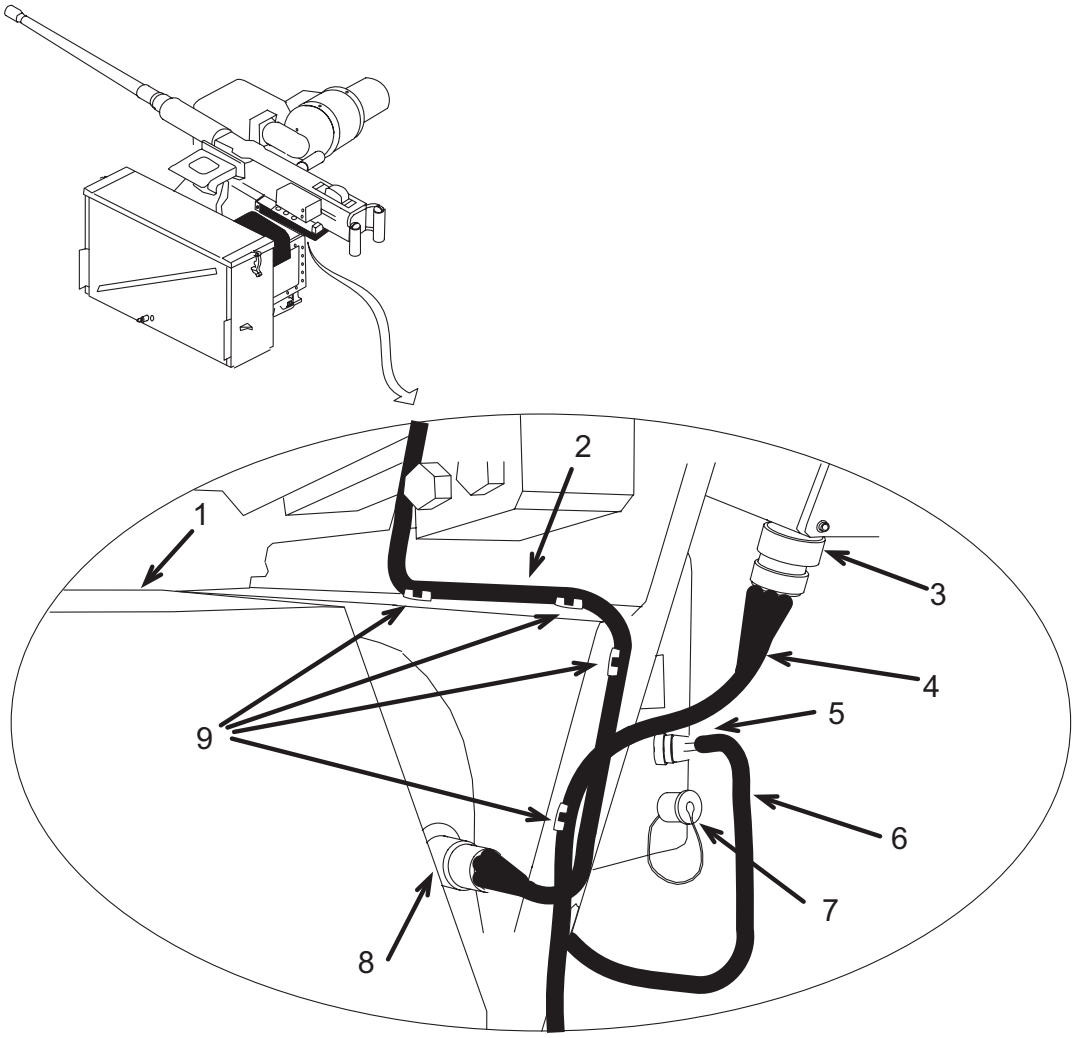
WAK AND WEAPON INSTALLATION - Cont

Connectors and Cables - Cont



Legend:	
1. Cable Anchors	9. Mount-Sensor Unit Cable
2. Weapon-Mount Cable	10. Mount-Elevation Drive Cable
3. Mount-Linear Actuator (Charger) Cable	11. J6, Weapon, Mount
4. J1, Elevation Drive	12. J3, Elevation, Mount
5. J1, Sensor Unit	13. J5, Actuator, Mount
6. J2, Test, Sensor Unit	14. Casing Deflector
7. J7, Test, Mount	
8. J4, Input/Oputput, Mount	

Figure 54. Mount Connectors and Cables (J3, J1, and J5) with Weapon-Mount Cable Threaded Behind Casing Deflector.

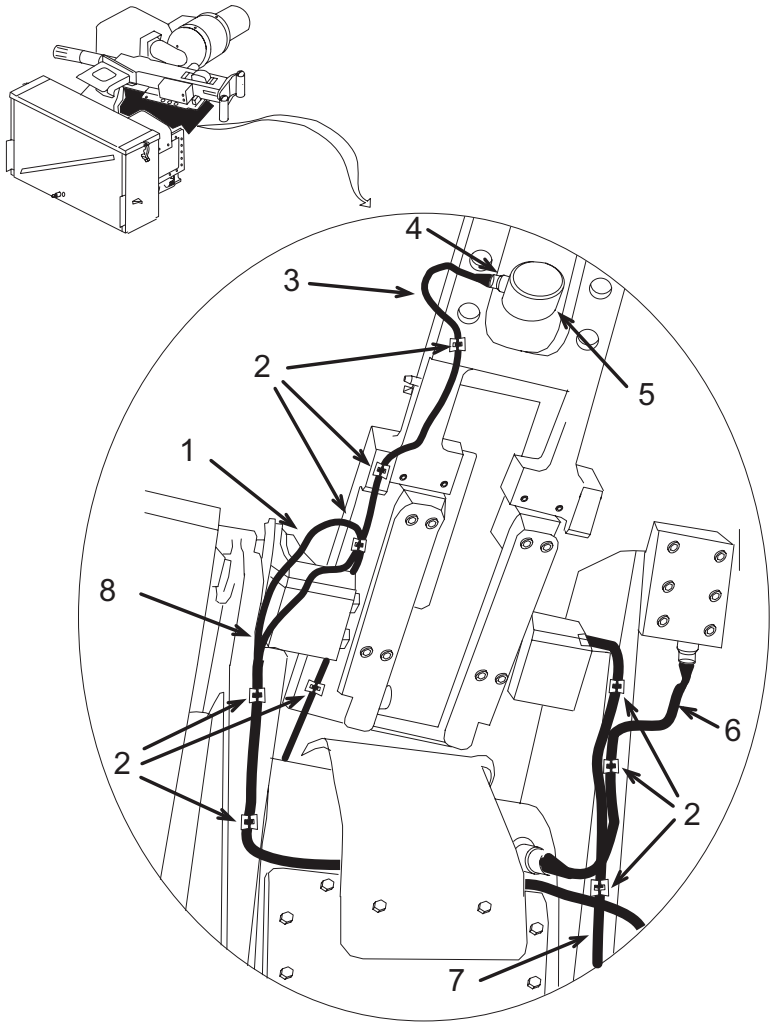


Legend:
1. Casing Deflector
2. Mount-Linear Actuator (Charger) Cable
3. J1, Elevation Drive
4. Mount-Elevation Drive Cable
5. J1, Sensor Unit
6. Mount-Sensor Unit Cable
7. J2, Test, Sensor Unit
8. J5, Actuator, Mount
9. Cable Anchors

Figure 55. Actuator Cable and Connector.

WAK AND WEAPON INSTALLATION - Cont

Connectors and Cables - Cont



Legend:
1. Weapon-Mount Cable (after split) to Rounds Counter
2. Cable Anchors
3. Weapon-Mount Cable (after split) to Remote Firing Solenoid
4. J1, Remote Firing Solenoid
5. Remote Firing Solenoid
6. Mount-Sensor Unit Cable
7. Mount-Linear Actuator (Charger) Cable
8. Weapon-Mount Cable (before split, threaded under casing deflector)

Figure 56. Remote Firing Solenoid Cable and Connector (Trigger to Solenoid).

8. With the largest Ogive keyway positioned at the 3:00 position (as viewed from the barrel side, referring to Figure 31) and secured by the alignment guide assembly, connect the cable, as shown in Figure 60.

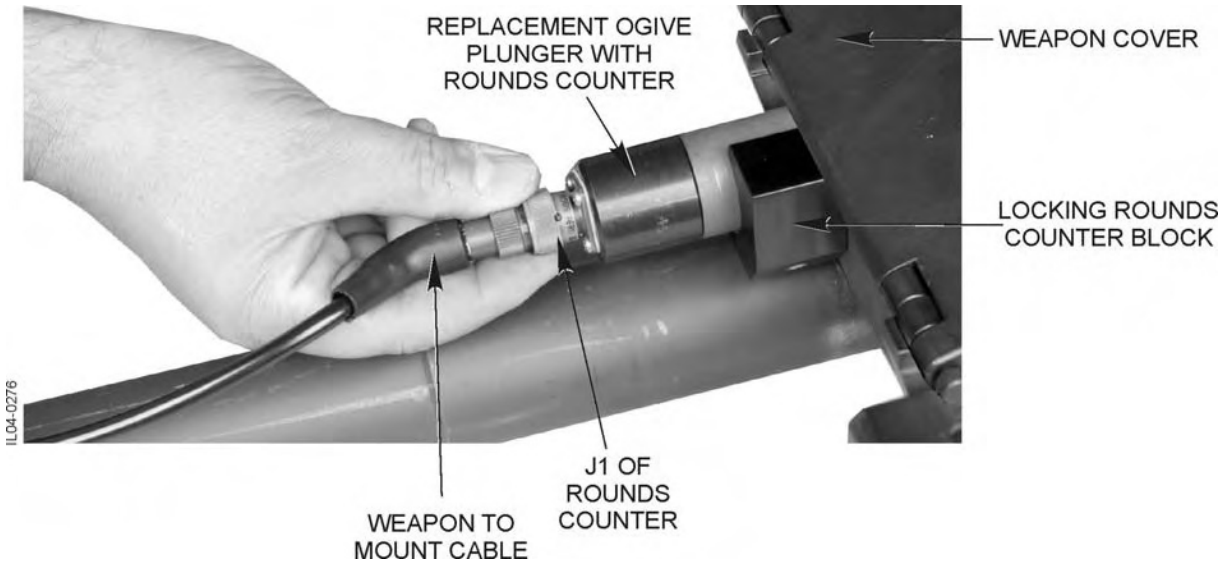


Figure 57. Ogive Plunger with Rounds Counter to Weapon-Mount Cable.

END OF TASK

WAK AND WEAPON INSTALLATION - Cont

Applying Power to the System

WARNING

Ensure input voltage is at the correct level. An overvoltage condition when power is applied may make the mount move and spin rapidly, which could result in personal injury and equipment malfunction or damage. Do not stand within muzzle length of the system when applying power.

Once power is applied, the system is fully functional and the mount and/or cradle with weapon could move. Ensure that the weapon mount is cleared and any cleared rounds are secured. Ensure that all personnel are clear of any possible weapon movements. Do not stand under the barrel.

Follow all safety warnings and cautions. Failure to do so may result in personal injury and equipment damage.

NOTE

For additional information on interconnection, cables and connectors, refer to WP 0005.

For additional information on controls and indicators of the system once power is applied, refer to WP 0004.

For additional information on the CROWS Menu System, refer to WP 0015.

For additional information on the Mk19 interconnection, refer to the Connectors and Cables section of this work package.

Perform the following procedure to apply power to the system and verify interconnection of cables and connectors.

NOTE

For additional information on the azimuth lock, refer to WP 0006, Azimuth Lock Assembly section.

1. Ensure CROWS system power is OFF.
2. Ensure azimuth lock is in unlocked position. The pedestal mount should move freely.

NOTE

For additional information on the CROWS Menu system, refer to WP 0015.

3. Apply power to CROWS by turning the main power switch on the SPU to ON.

4. Verify system status by ensuring the system built-in test (BIT) status report shows on the DU, as shown in Figure 58.

   a. If message does not appear, refer to WP 0027, Before Operational Check.

   b. If fault message appears, refer to WP 0024, Troubleshooting Index.

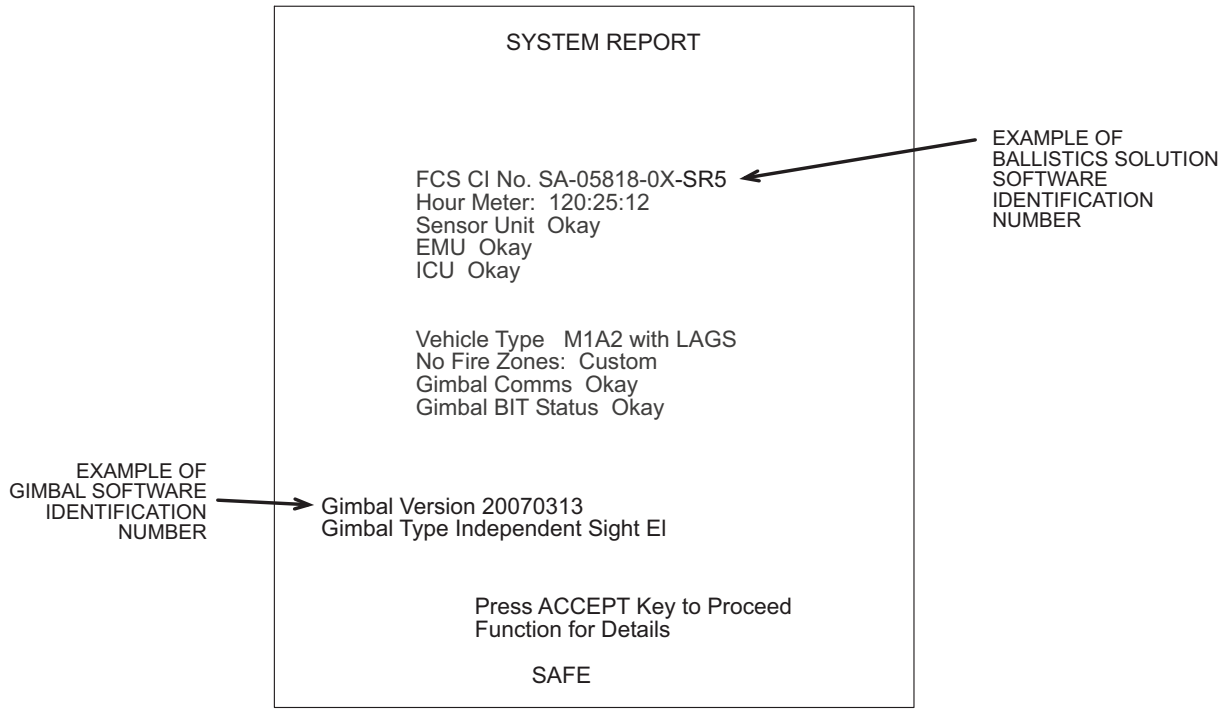


Figure 58. Example of System BIT System Report.

WAK AND WEAPON INSTALLATION - Cont

Applying Power to the System - Cont

5. Press LASE (LEFT toggle LEFT) placing the system in Engagement mode. Verify system status by ensuring that the default screen appears, as shown in Figure 59.

   a. If message does not appear, refer to WP 0027, Before Operational Check.

   b. If fault message appears, refer to WP 0024, Troubleshooting Index.

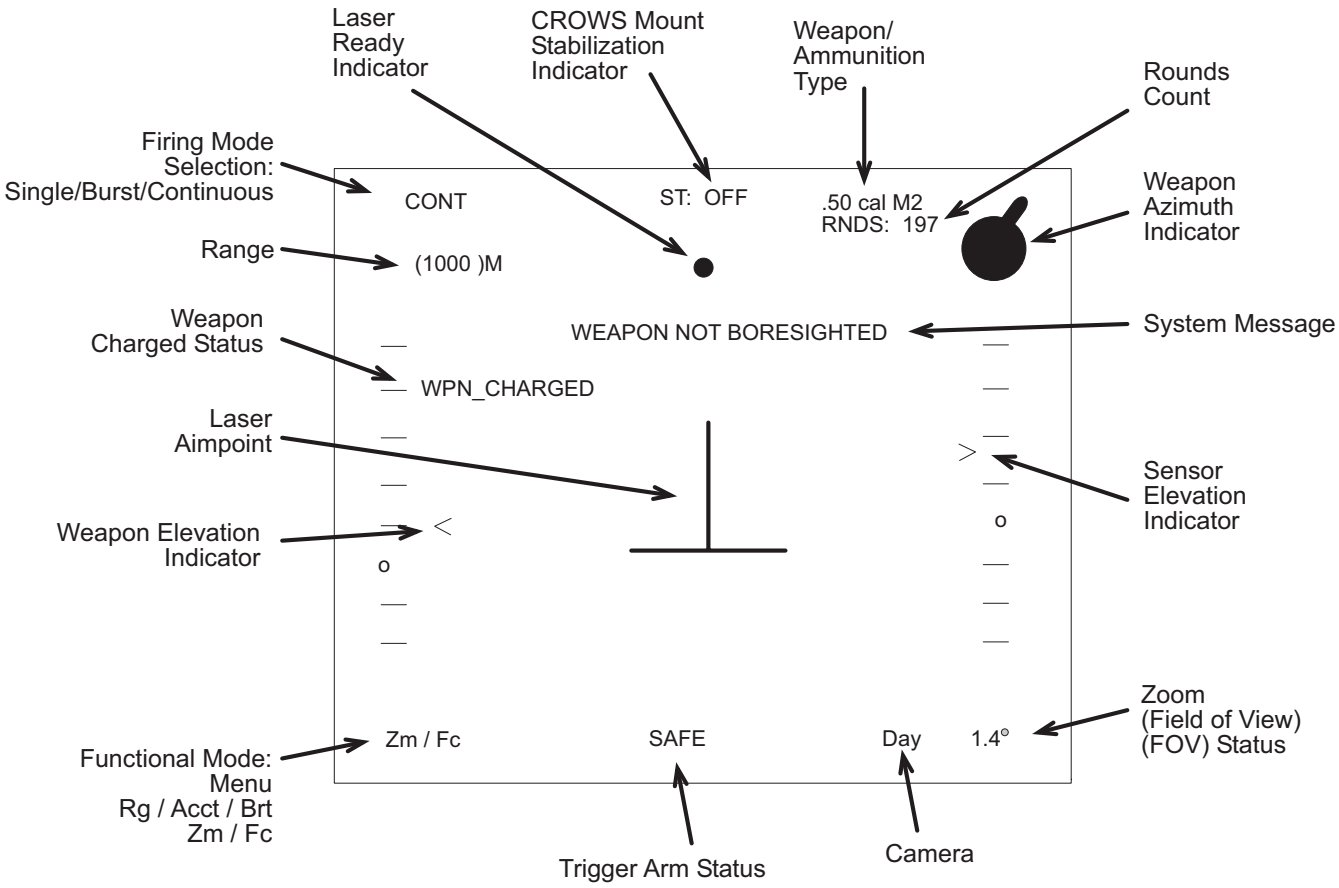


Figure 59. Example of Mk19 Engagement Mode Screen.

END OF TASK

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER USUAL CONDITIONS - MK19 40 MM GRENADE MACHINE GUN WEAPON ADAPTER KIT (WAK) AND WEAPON: REMOVAL

THIS WORK PACKAGE COVERS:

Removing the Mk19 40 mm grenade machine gun and WAK and cradle from the CROWS.

INITIAL SET UP:

Tools and Special Tools

Operator's Tool Kit (WP 0036, Table 2, Item 1)

Materials/Parts

N/A

References

WP 0004
WP 0006
WP 0008
WP 0010
WP 0012
WP 0014
WP 0019
WP 0031
WP 0032
WP 0034
WP 0035
WP 0036
TM 9-1010-230-10

Personnel Required

Two

Equipment Conditions

System power off

WP CONTENTS

Section/Subsection **Page**

Considerations Before and During Disassembly 2
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Removal of Replacement Feed Throat and Reinstallation of Original Feed Throat 19
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Disassembly of Linear Actuator (Charger) Assembly 24
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Removal of Front Bracket Assembly 28
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CAUTION

Use two personnel during installation/removal of the cradle and Mk19 grenade machine gun. Failure to do so may result in personal injury or equipment damage.

NOTE

Some steps within the disassembly/assembly procedures are easier with two personnel.

CONSIDERATIONS BEFORE AND DURING DISASSEMBLY

The following general procedures are recommended to reduce maintenance time and prevent accidental damage to the equipment.

- Follow all safety regulations, warnings, cautions, and notes.
- Ensure vehicle is positioned on level ground.
- Ensure the system is powered down, the weapon is cleared, and any cleared rounds are removed.
- Refer to the appropriate weapon operation and maintenance manuals, as well as related CROWS manuals, detailed in WP 0035, References.
- Examine equipment carefully to determine cause of failure before removing defective or broken parts.
- Disassemble equipment only to the point necessary to perform required maintenance.
- Before disconnecting any electrical parts, ensure parts are tagged for identification.
- Note orientation of all parts before removal.

TURN-IN OF MK19 40 MM GRENADE MACHINE GUN WEAPON FROM CROWS CONFIGURATION

Refer to WP 0034 for instructions on how to remove CROWS parts from the weapon prior to turning in the weapon.

MK19 WAK COMPONENTS

Table 1 details the major components of the Mk19 WAK, which are illustrated in Figure 1.

NOTE

Quantities are assumed to be 1 each unless otherwise specified.

Table 1. Mk19 WAK Components (PN 21677-3200).

Item Number	PN	Nomenclature	Common Name
1	21677-3205	Linear Actuator Assembly	Linear Actuator (Charger) Assembly
2	21677-3215	Bracket, Mounting	Front Bracket Assembly
3	21677-3220	Cap, Linear Actuating	End Rod Assembly
4	L5416	Solenoid, Electrical	Remote Firing Solenoid
5	21677-3228	Feeder, Ammunition, Machine Gun	Feed Throat
6	92391A034	Pin, Cotter	Feed Throat Hitch Pin
7	21677-3207	Block, Ejector, Cartridge	Rounds Counter Block
8	92390A165	Pin, Straight, Headed	Feed Throat Clevis Pin
9	21677-3225	Switch, Sensitive	Ogive Plunger Assembly with Rounds Counter
10	21677-3240	Charger, Gun	Remote Charger
11	21677-3703	Cable Assembly, Power, Electrical	Mk19 Weapon-Mount Cable

MK19 WAK COMPONENTS - Cont

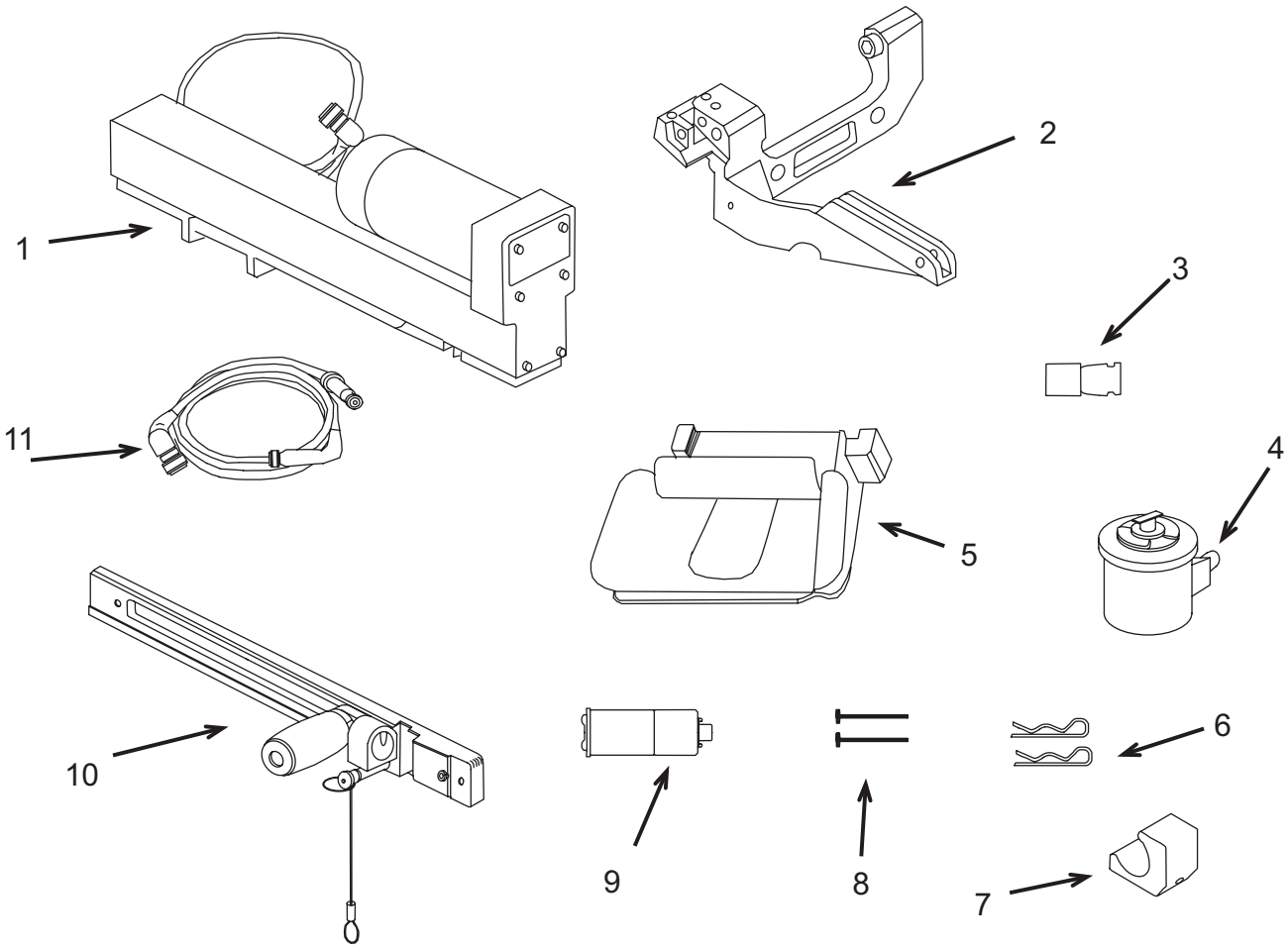


Figure 1. Mk19 WAK Components.

REMOVAL OF MK19 WEAPON AND WAK COMPONENTS

Perform the following procedures to remove the Mk19 WAK items, if installed.

WARNING

Follow all stated warnings and cautions when handling the weapons.

Ensure that the weapon is cleared and any cleared rounds are secured before performing any procedures, unless specifically directed to load the weapon. (For instructions on clearing and loading the Mk19, refer to WP 0019.)

Ensure the weapon has cooled before handling. For additional information, refer to TM 9-1010-230-10, Operator's Manual for the Mk19 40 mm Grenade Machine Gun.

Use two personnel during removal of the cradle and Mk19 grenade gun.

Failure to follow these instructions may result in personal injury or equipment damage.

NOTE

Ensure the azimuth lock assembly is in the locked position for the procedure to be performed. (For azimuth lock procedures, refer to WP 0006, Azimuth Lock Assembly section.)

For details on handling or disassembling the Mk19 weapon, refer to WP 0035, References, for information on the Mk19 technical manuals.

To prepare the CROWS cradle for other configurations, the following items from the Mk19 WAK will need to be removed, as detailed in the remainder of this section:

- Cable connections: Mount-Linear Actuator (Charger) and Weapon-Mount (remote firing solenoid and rounds counter) Cables
- Remote Firing Solenoid
- Mk19 Weapon and Detent Pin
- Remote Charger Assembly
- Feed Throat
- Ogive Plunger Assembly with Rounds Counter and Locking Rounds Counter Block
- Linear Actuator (Charger) Assembly with Mounting Plate
- Front Bracket Assembly

REMOVAL OF MK19 WEAPON AND WAK COMPONENTS - Cont

Removal of Cable Connections: Mount-Linear Actuator (Charger) and Weapon-Mount (Remote Firing Solenoid and Rounds Counter) Cables

WARNING

Use two personnel during removal of the cradle and Mk19 machine gun.

Follow all safety warnings and cautions during interconnection procedures.

Failure to do so may result in personal injury or equipment damage.

CAUTION

Install connector caps as cables are being detached from the solenoid, adapter-counter, and other connectors.

Ensure CROWS system power is OFF when connecting or disconnecting cables.

Failure to do so may result in equipment damage or system inoperability.

NOTE

For additional information on CROWS cables and connectors, refer to WP 0005, Interconnection (Connectors and Cables).

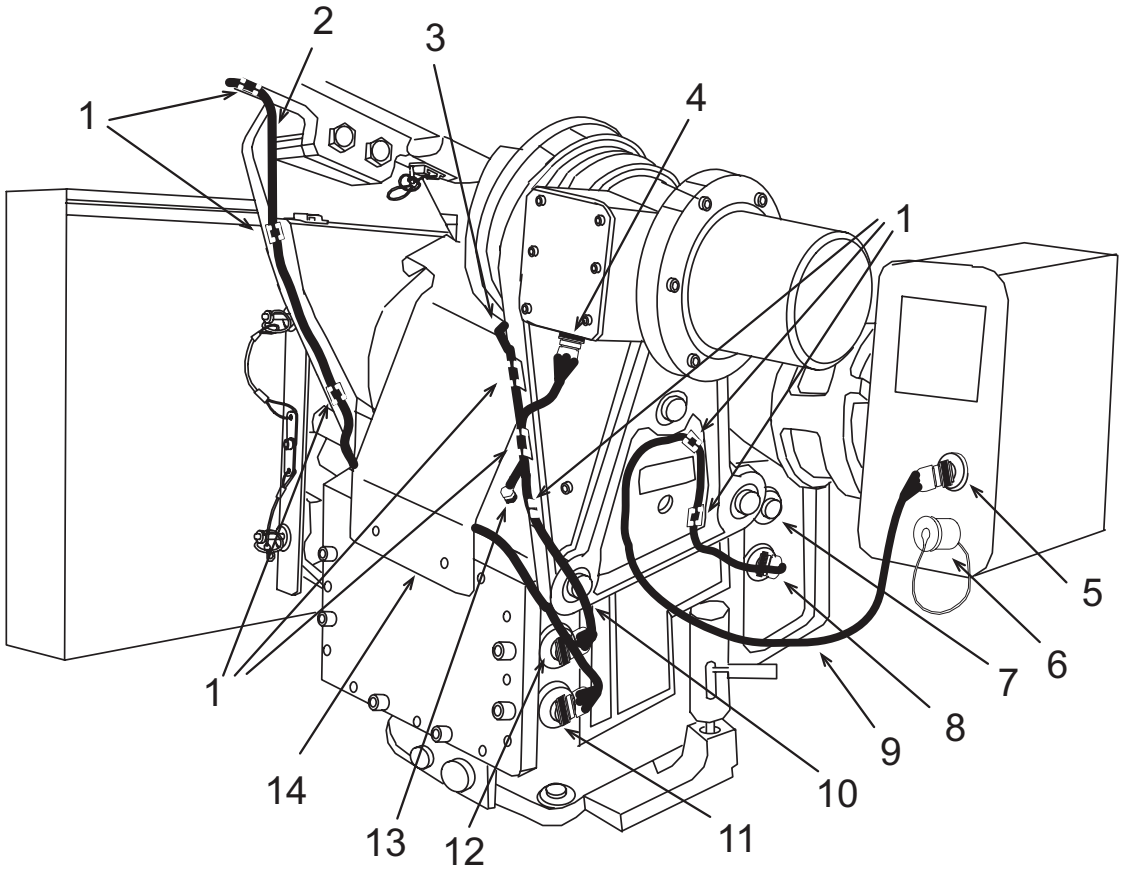
Ensure the azimuth lock assembly is in the locked position for the following procedure. (For azimuth lock procedures, refer to WP 0006, Azimuth Lock Assembly section.)

Some steps within the disassembly procedures require two personnel.

Perform the following procedure to disconnect the Mk19 cables.

1. Turn all POWER switches to OFF position.

2. Cut the cable ties holding the cable to the cable anchors for the linear actuator (charger) and weapon-mount cables, referring to Figures 2 through 5.



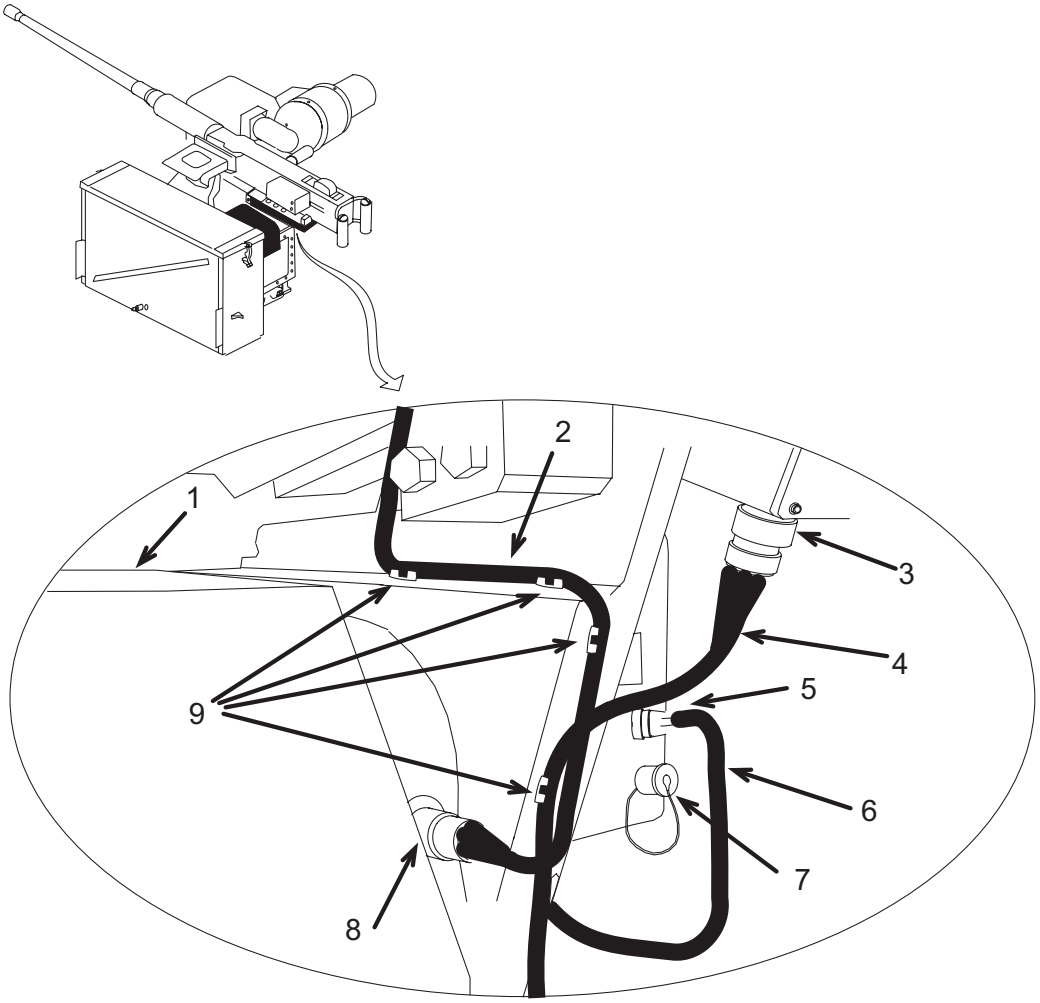
Legend:	
1. Cable Anchors	9. Mount-Sensor Unit Cable
2. Weapon-Mount Cable	10. Mount-Elevation Drive Cable
3. Mount-Linear Actuator Cable	11. J6, Weapon, Mount
4. J1, Elevation Drive	12. J3, Elevation, Mount
5. J1, Sensor Unit	13. J5, Actuator, Mount
6. J2, Test, Sensor Unit	14. Casing Deflector
7. J7, Test, Mount	
8. J4, Input/Oputput, Mount	

Figure 2. Mount Connectors and Cables, J3, J1, and J5 with Cable (Weapon-Mount) Threaded Behind Casing Deflector.

REMOVAL OF MK19 WEAPON AND WAK COMPONENTS - Cont

Removal of Cable Connections: Mount-Linear Actuator (Charger) and Weapon-Mount (Remote Firing Solenoid and Rounds Counter) Cables - Cont

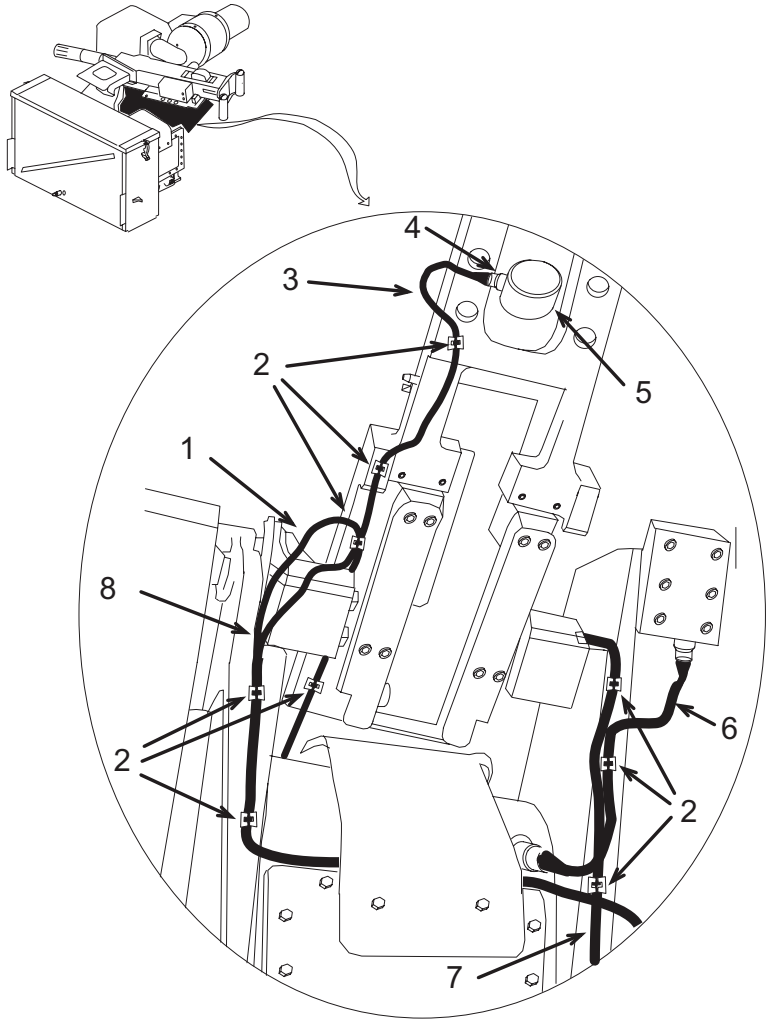
3. Disconnect the linear actuator (charger) cable from connector, J5 on the pedestal mount, as shown in Figures 2 and 3.



Legend:
1. Casing Deflector
2. Mount-Linear Actuator (Charger) Cable
3. J1, Elevation Drive
4. Mount-Elevation Drive Cable
5. J1, Sensor Unit
6. Mount-Sensor Unit Cable
7. J2, Test, Sensor Unit
8. J5, Actuator, Mount
9. Cable Anchors

Figure 3. Actuator Cable and Connector.

4. Disconnect the weapon-mount cables from connectors, J1 on both the remote firing solenoid and the rounds counter, and connector J6, Weapon, as shown in Figures 4 and 5.



Legend:
1. Weapon-Mount Cable (after split) to Rounds Counter
2. Cable Anchors
3. Weapon-Mount Cable (after split) to Remote Firing Solenoid
4. J1, Remote Firing Solenoid
5. Remote Firing Solenoid
6. Mount-Sensor Unit Cable
7. Mount-Linear Actuator (Charger) Cable
8. Weapon-Mount Cable (before split, threaded under casing deflector)

Figure 4. Remote Firing Solenoid Cable and Connector (Weapon-Solenoid).

REMOVAL OF MK19 WEAPON AND WAK COMPONENTS - Cont

Removal of Cable Connections: Mount-Linear Actuator (Charger) and Weapon-Mount (Remote Firing Solenoid and Rounds Counter) Cables - Cont

5. With the ogive positioned so that the largest keyway is at the 3:00 position (as viewed from the barrel of the weapon) and secured by the alignment guide assembly, disconnect the cable, as shown in Figure 5.

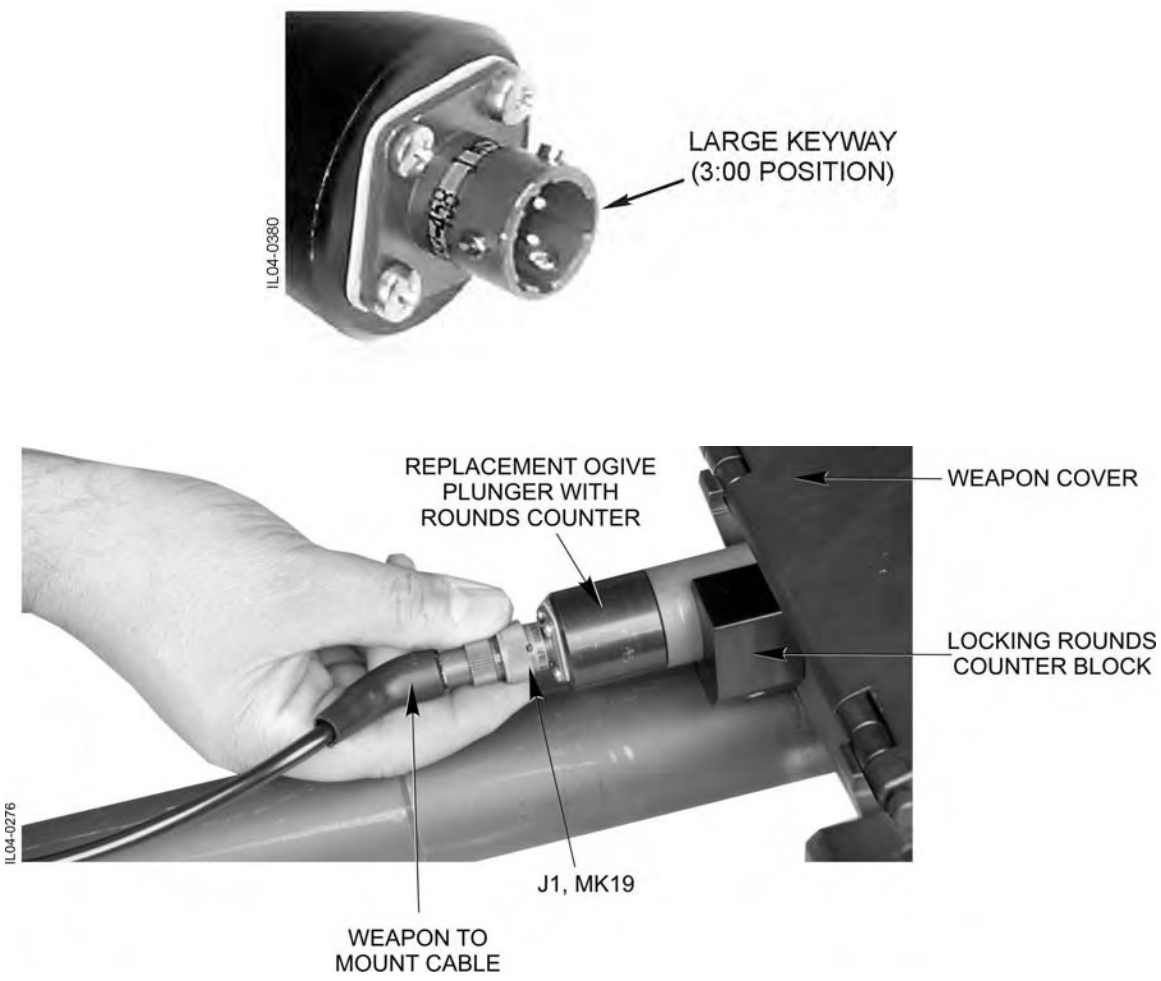


Figure 5. Ogive Plunger with Rounds Counter Connection to MK19 Weapon-Mount Cable.

END OF TASK

Removal of Remote Firing Solenoid

Perform the following procedure to remove the remote firing solenoid.

1. Ensure weapon-mount cable (from rounds counter and remote firing solenoid) has been disconnected.
2. Place mechanical SAFE/FIRE switch to FIRE.
3. Rotate remote firing solenoid to the right until the connector is facing toward the barrel, as shown in Figure 6.

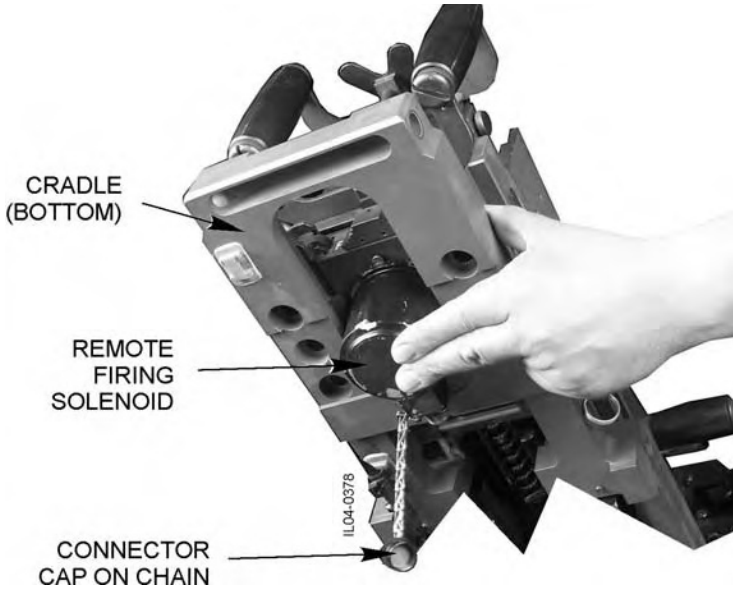


Figure 6. Remote Firing Solenoid Positioned.

4. Remove the remote firing solenoid and secure the connector cap to the connector.
5. Place mechanical SAFE/FIRE switch to SAFE.

END OF TASK

REMOVAL OF MK19 WEAPON AND WAK COMPONENTS - Cont

Removal of Mk19 Weapon and Detent Pin

Perform the following procedure to remove the detent pin and weapon.

WARNING

Follow all safety warnings and cautions during interconnection procedures. Failure to do so may result in personal injury or equipment damage.

NOTE

Ensure the azimuth lock assembly is in the locked position for the following procedure. (For azimuth lock procedures, refer to WP 0006, Azimuth Lock Assembly section.)

1. Ensure CROWS system power is OFF.
2. Ensure weapon is cleared and any cleared rounds are secured IAW applicable TM.
3. Remove ball lock pin and lanyard from retracting slide extension, referring to Figure 7.

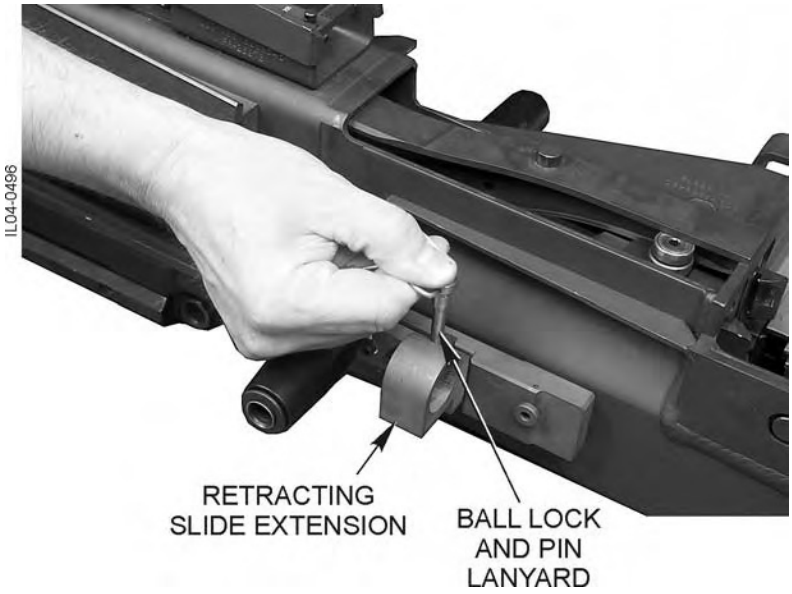


Figure 7. Removing Ball Lock Pin and Lanyard.

4. Remove the detent pin from the cradle and weapon, as shown in Figure 8.

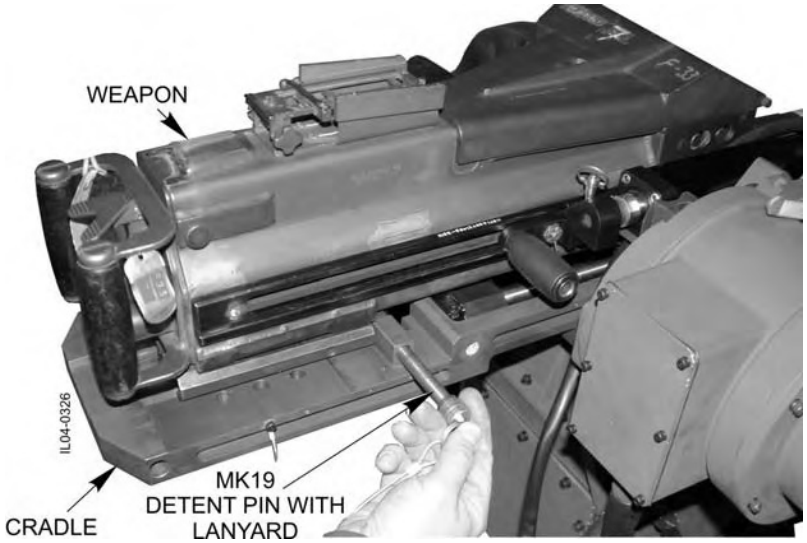


Figure 8. Detent Pin Securing Mk19 to Cradle.

5. Slide the weapon from the cradle.

NOTE

Refer to TM 9-1010-230-10, Operator's Manual for the Mk19 40 mm Grenade Machine Gun.

6. Reinstall the sear cover onto the bottom of the weapon, as follows.

   a. Turn the weapon upside down and place on sturdy surface.

   b. Place weapon SAFE/FIRE switch to FIRE.

   c. Replace sear cover detent, push down and rotate 90°.

   d. Place weapon SAFE/FIRE switch to SAFE.

END OF TASK

REMOVAL OF MK19 WEAPON AND WAK COMPONENTS - Cont

Removal of Remote Charger Assembly

Perform the following procedure to install the original charging handle.

1. Ensure the ball lock pin is removed from the slide extension assembly, referring to Figure 9.

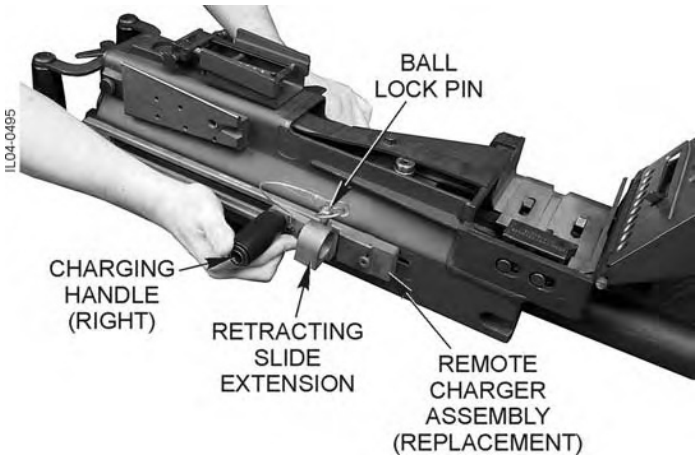




Figure 9. Removal of Remote Charger Assembly.

2. Pull the release pin on the remote charger assembly (right), as shown in Figure 9.

3. Slide the replacement remote charger assembly out of the slot.

NOTE

Retrieve original right-hand charging handle from Mk19 adapter kit box.

4. Insert and slide the original charging handle to the rear of the weapon, approximately 1 inch.

5. Release the release pin.

6. With the left hand, pull back the charging handle until the release pin is properly seated, as shown in Figure 10.

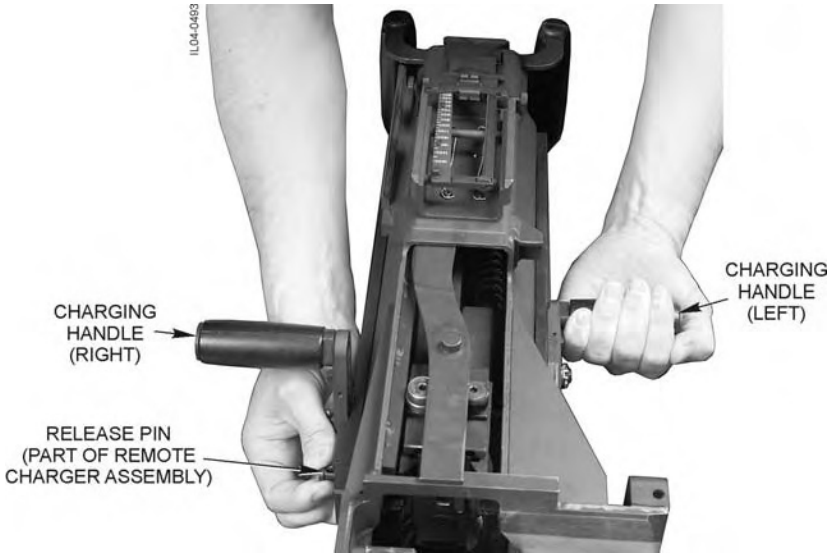


Figure 10. Releasing Charging Handle Release Pin.

END OF TASK

REMOVAL OF MK19 WEAPON AND WAK COMPONENTS - Cont

Removal of Weapon Cover

Perform the following procedure to remove the Mk19 weapon cover.

1. Lift the weapon cover and hold at a 90° angle with respect to the weapon.

2. Push in the snap ring (part of the secondary drive lever adjustment) on the outside of the weapon cover to release the secondary drive lever, as shown in Figures 11 and 12. Hold the secondary drive plate as it separates from the weapon cover.

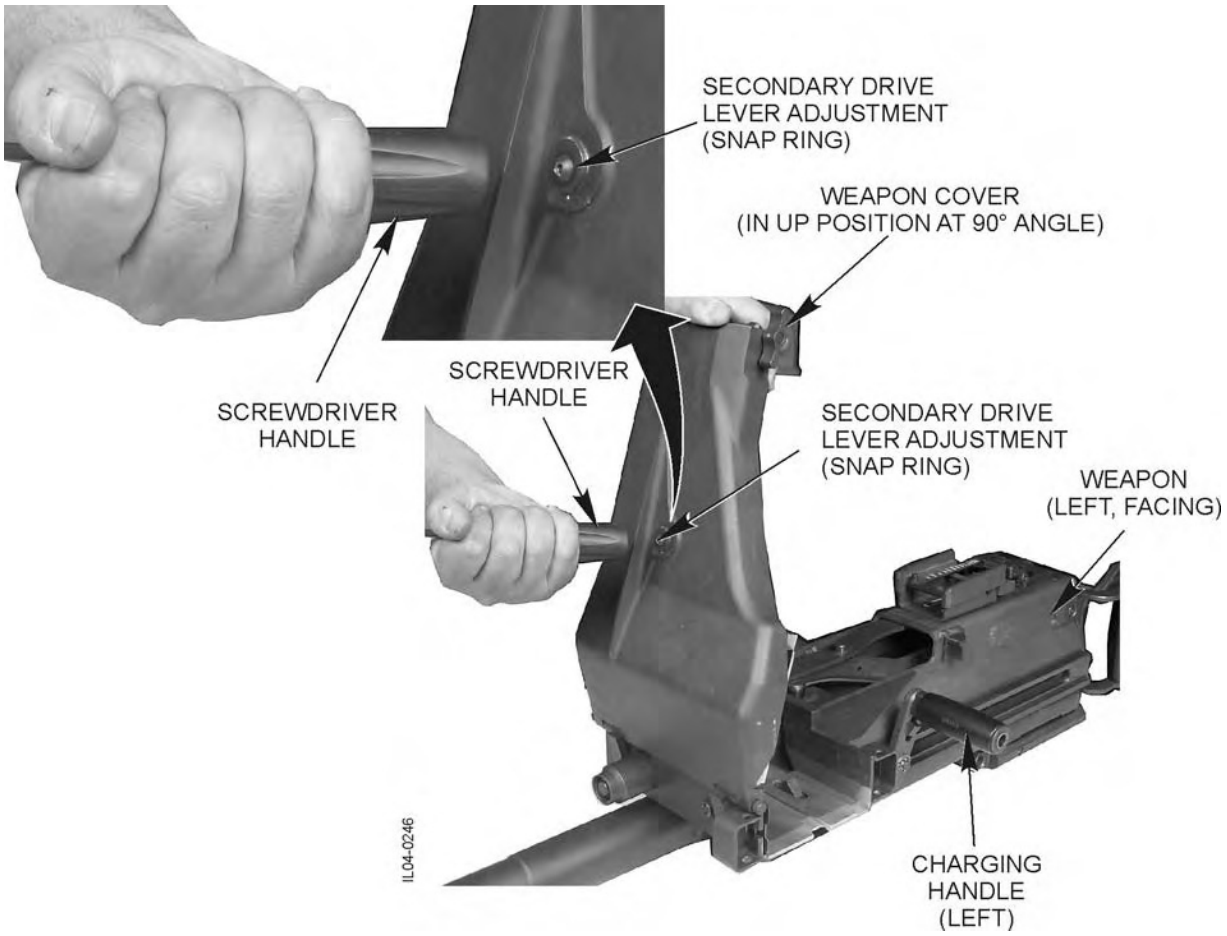


Figure 11. Releasing the Secondary Drive Lever.

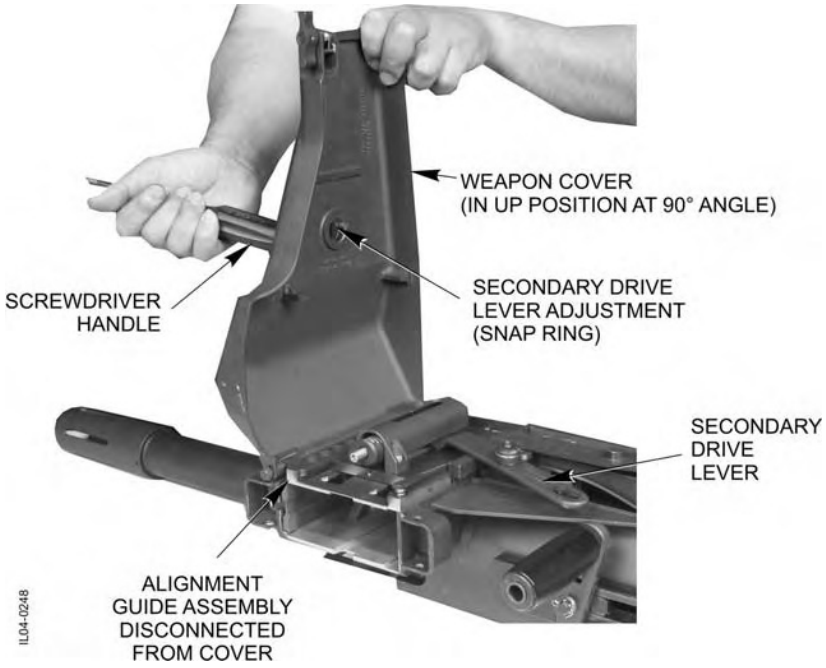


Figure 12. Releasing Secondary Drive Lever (Alternate View).

3. Remove the two pins providing the hinge for the weapon cover door, as shown in Figure 13.

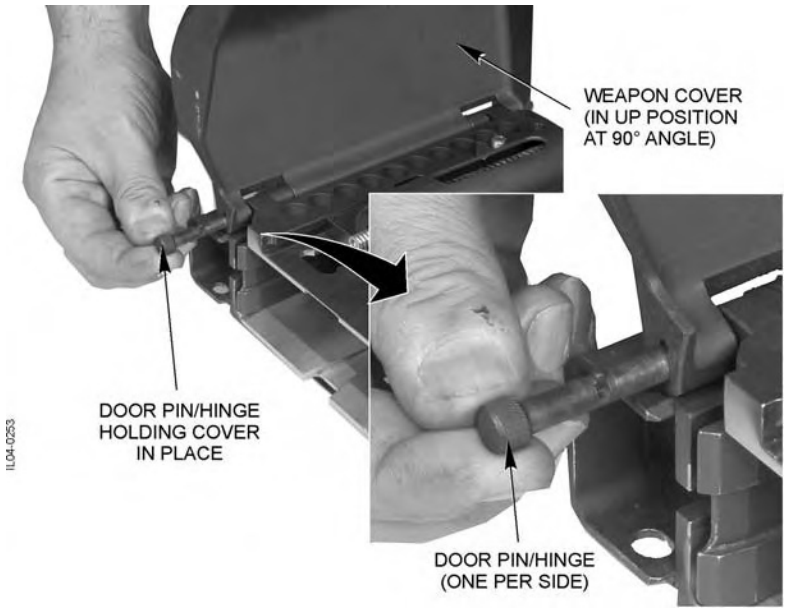


Figure 13. Removing Pin.

REMOVAL OF MK19 WEAPON AND WAK COMPONENTS - Cont

Removal of Weapon Cover - Cont

4. Remove the weapon cover, as shown in Figure 14. Retain in the adapter kit box for later use.



Figure 14. Weapon Cover Removed.

END OF TASK

Removal of Original Feed Throat

Perform the following procedure to remove the original feed throat, as shown in Figure 15.

1. Pull out the two feed throat pins and two clevis pins holding the original feed throat to the weapon.

2. Squeeze the pawls on both sides and lift out the original feed throat. Retain feed throat and attaching hardware in adapter kit box until weapon is returned to its original configuration.

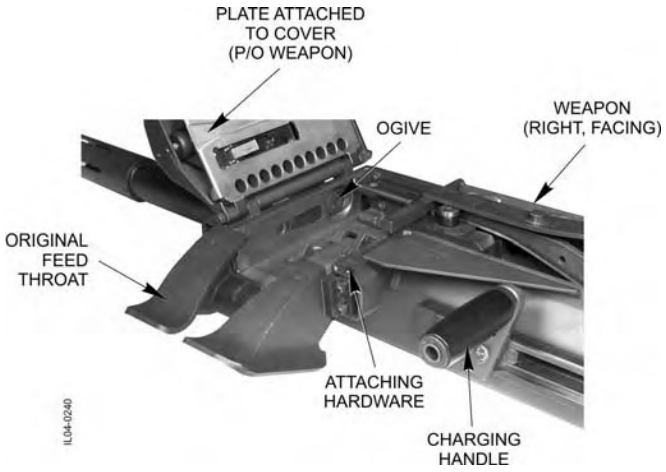


Figure 15. Original Feed Throat with Attaching Hardware.

END OF TASK

Removal of Replacement Feed Throat and Reinstallation of Original Feed Throat

Perform the following procedure to remove the replacement feed throat and install the original feed throat assembly.

1. Lift the weapon cover.

2. Remove the two hitch pins holding the two clevis pins, as shown in Figure 16. Remove the pins and then remove the replacement feed throat.

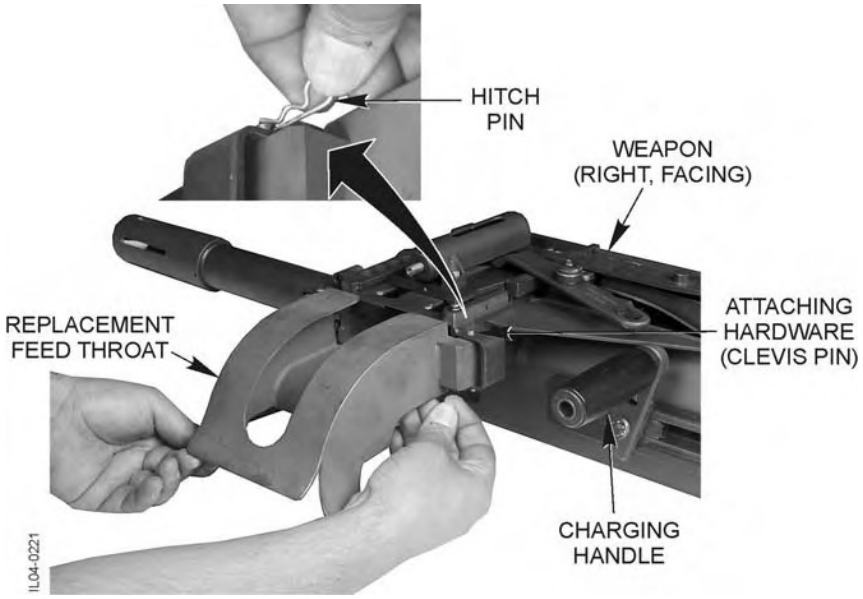


Figure 16. Replacement Feed Throat Removed (Weapon Cover Removed for Clarity).

3. Squeeze the pawls on both sides of the original feed throat, then insert the feed throat until properly seated, as shown in Figure 17.

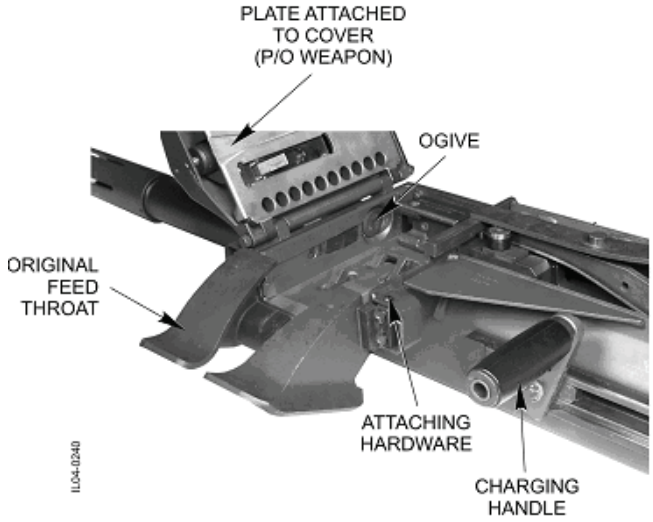


Figure 17. Original Feed Throat Installed.

END OF TASK

REMOVAL OF MK19 WEAPON AND WAK COMPONENTS - Cont

Removal of Replacement Ogive Plunger Assembly and Rounds Counter with Locking Rounds Counter Block and Reinstallation of Original Ogive Plunger

Perform the following procedure to remove the replacement ogive plunger assembly, rounds counter, and locking rounds counter block, and reinstall the original ogive plunger.

1. Remove the locking rounds counter block from the replacement ogive plunger with rounds counter using a 1/8-inch hex head wrench, as shown in Figure 18.

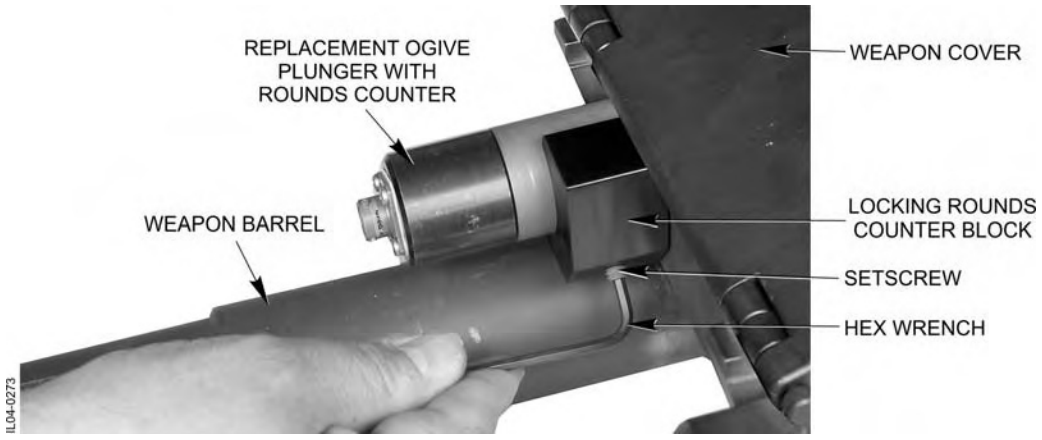


Figure 18. Setscrew Removed from Rounds Counter.

2. Remove the ogive plunger alignment guide assembly by inserting a screwdriver to release the flat leaf spring, as shown in Figures 19 and 20, and pull the alignment guide assembly from the weapon.

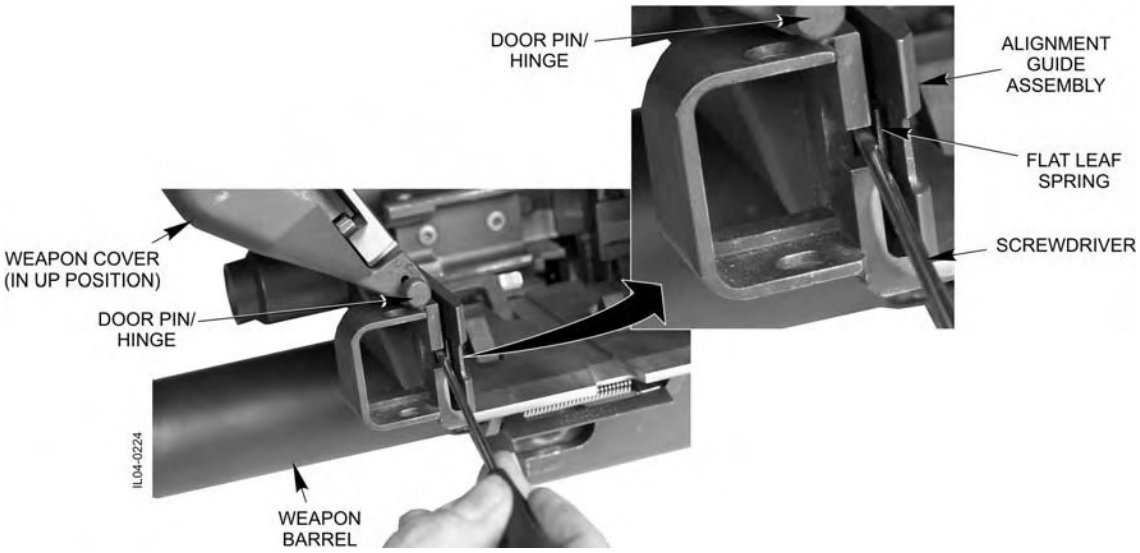


Figure 19. Loosening Flat Leaf Spring Holding Ogive Plunger Assembly in Place.

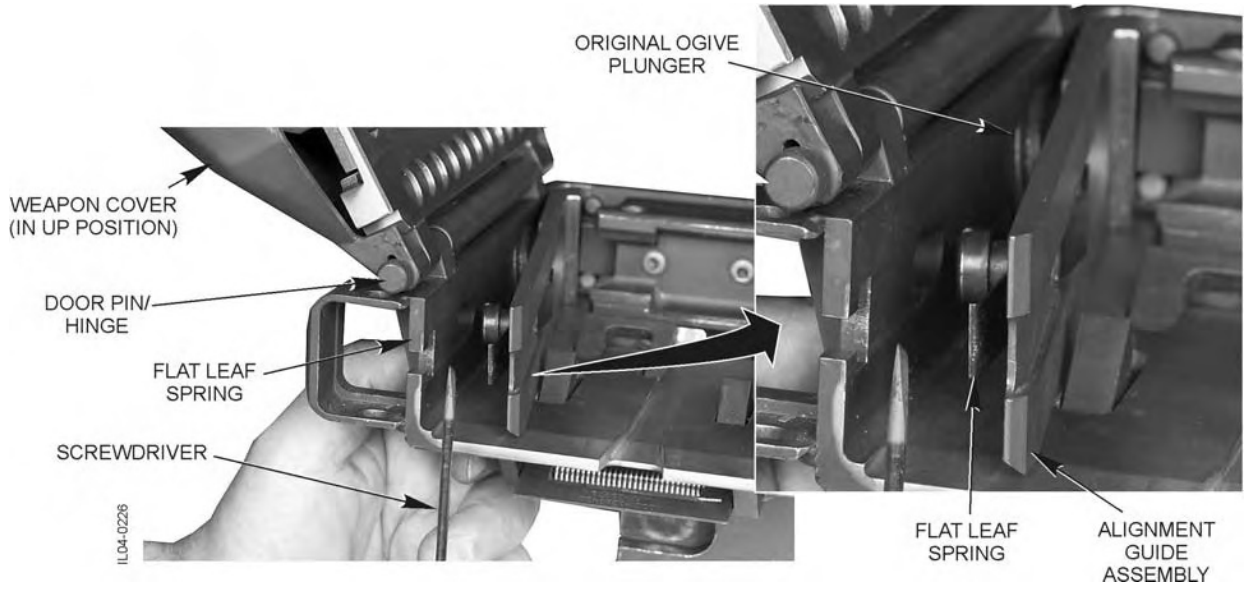


Figure 20. Moving the Alignment Guide Assembly with Flat Leaf Spring.

3. With the alignment guide assembly removed, carefully loosen and remove the replacement ogive plunger with rounds counter, as shown in Figure 21.

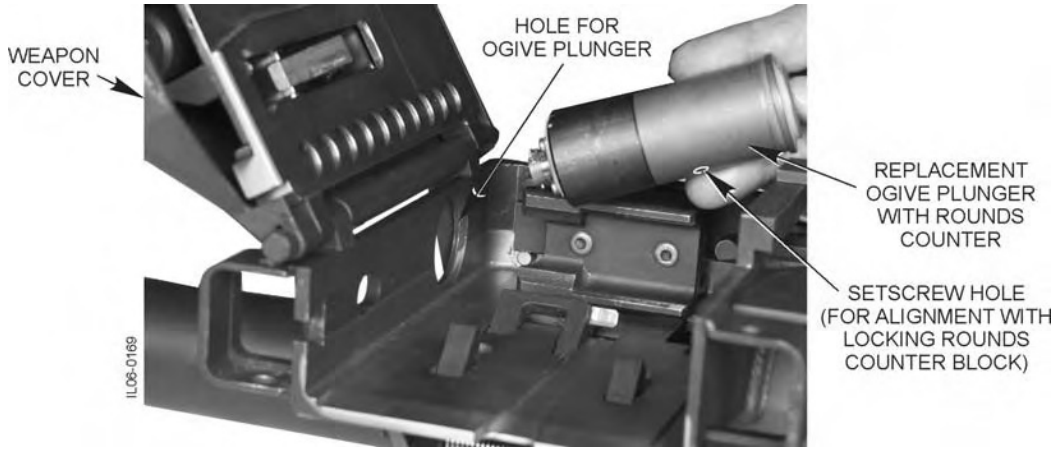


Figure 21. Removal of Replacement Ogive Plunger with Rounds Counter.

4. Insert the original ogive plunger assembly into its hole.

REMOVAL OF MK19 WEAPON AND WAK COMPONENTS - Cont

Removal of Replacement Ogive Plunger Assembly and Rounds Counter with Locking Rounds Counter Block and Reinstallation of Original Ogive Plunger - Cont

5. Replace the flat leaf spring and alignment guide assembly, as shown in Figure 22.

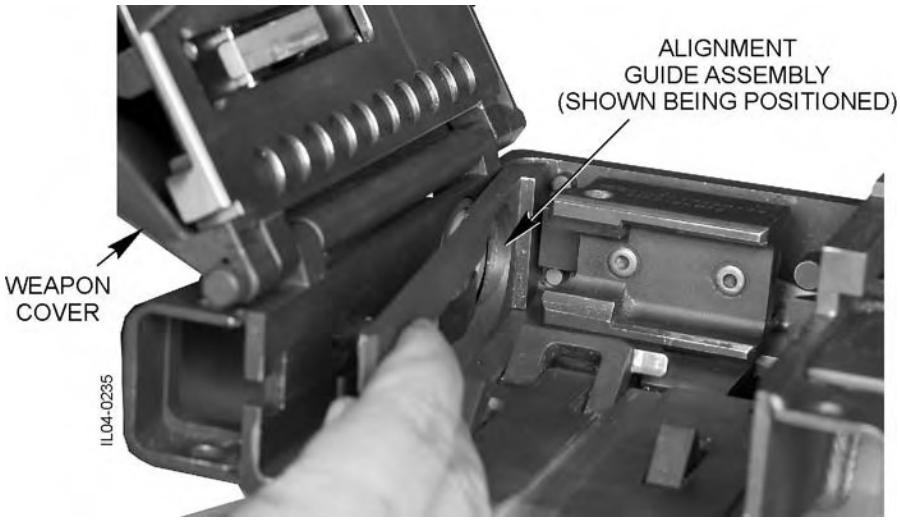


Figure 22. Alignment Guide Assembly Being Positioned over the Original Ogive Plunger.

END OF TASK

Removal of Linear Actuator (Charger) Assembly with Mounting Plate

Perform the following procedures to remove the linear actuator (charger) from the cradle.

1. Push the center button of the ball lock pin (with lanyard) until the pin is fully disengaged from the elevation drive side of the linear actuator, as shown in Figure 23.

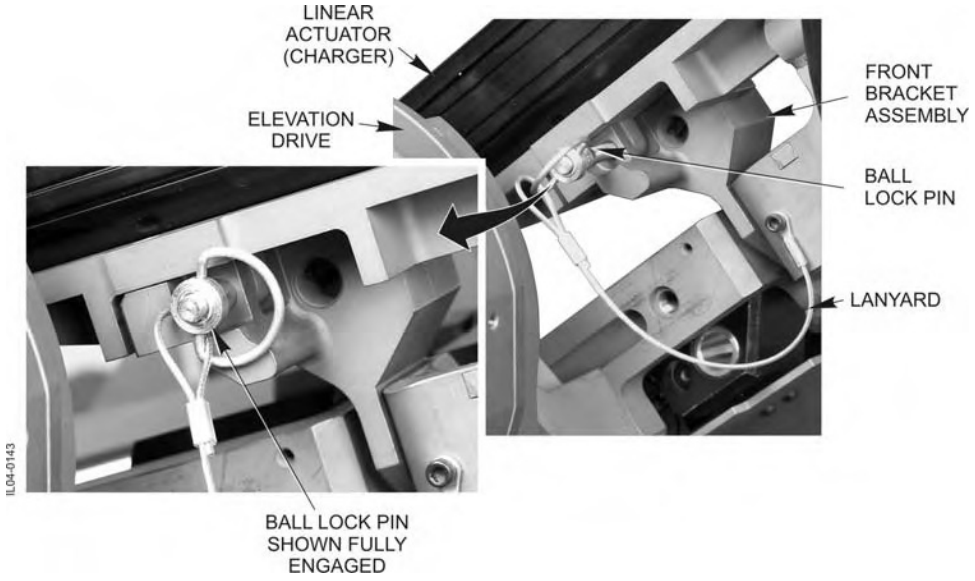


Figure 23. Installation of the Ball Lock Pin into the Linear Actuator.

2. Remove the attaching hardware securing the linear actuator to the actuator bracket, front bracket assembly pin, and cradle, as shown in Figure 24.

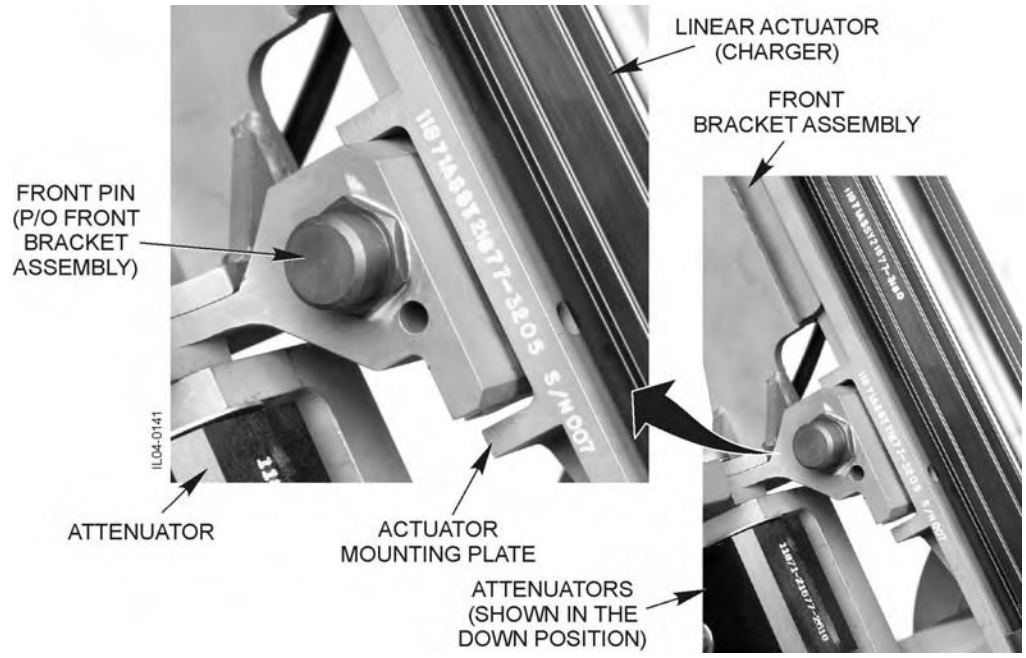


Figure 24. Linear Actuator Secured to Front Bracket Assembly.

3. Lift the linear actuator from the actuator bracket and hook from the pin, Figure 25.

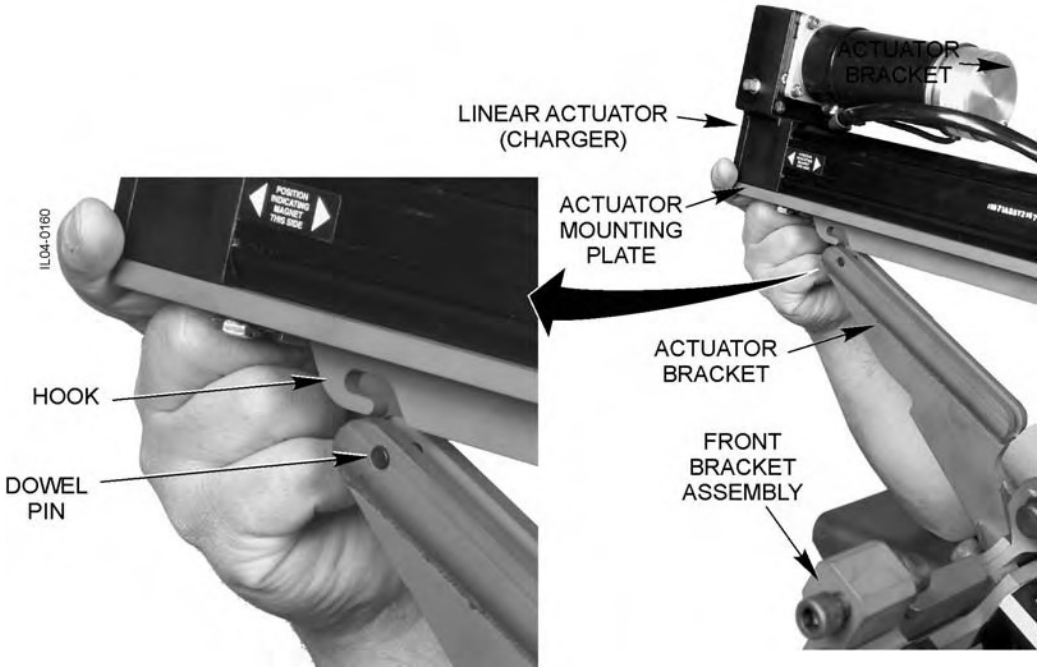


Figure 25. Removing Actuator from Actuator Bracket.

END OF TASK

REMOVAL OF MK19 WEAPON AND WAK COMPONENTS - Cont

Disassembly of Linear Actuator (Charger) Assembly

NOTE

For Safety Wire Procedures, refer to WP 0031.

1. Using wire cutters, remove the safety wire securing the four cap screws to the bottom of the mounting plate, as shown in Figure 26. Safely dispose of the wire.

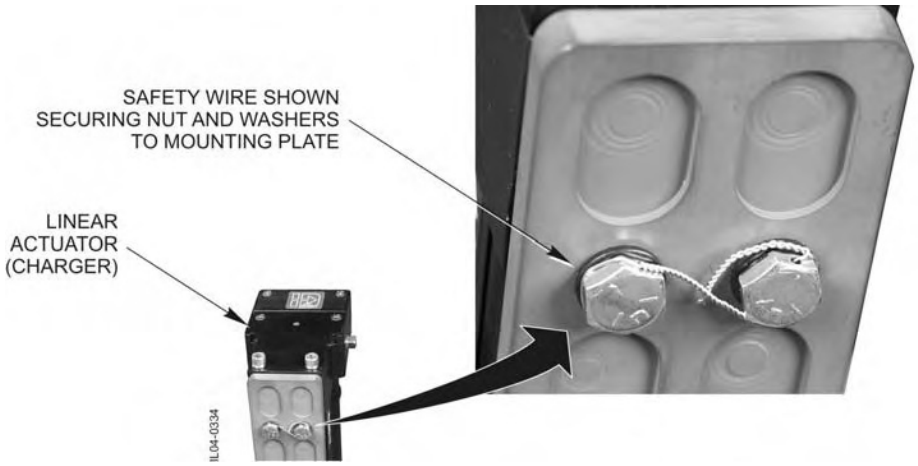


Figure 26. Linear Actuator (Charger) Mounting Plate with Safety Wire.

NOTE

For Thread-Locking Procedures, refer to WP 0032.

2. Remove the thread-locking compound from the bolts securing the mounting plate to the linear actuator (charger).

3. Remove the four cap screws and flat washers securing the actuator mounting plate to the actuator, using a 7/16-inch socket wrench, referring to Figure 27.

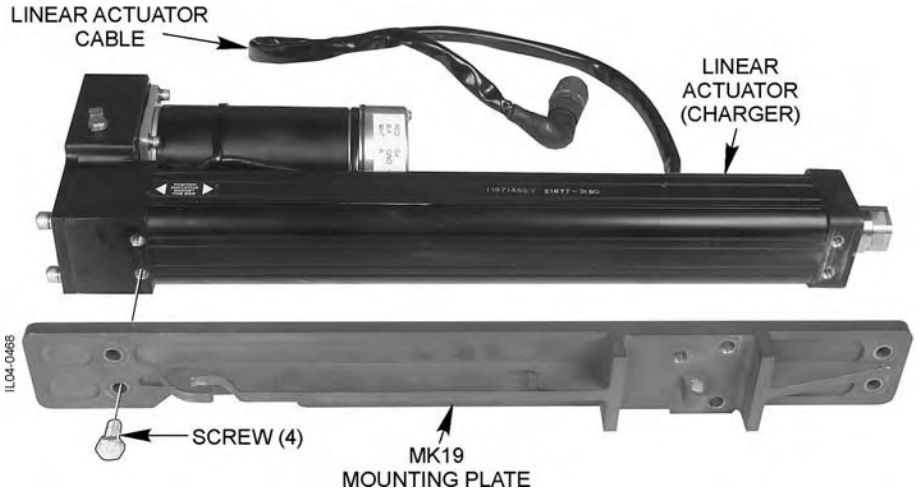


Figure 27. Linear Actuator (Charger) and Mounting Plate.

END OF TASK

Removal of End Rod Assembly

NOTE

The end rod assembly and the mounting plate do not have to be removed when the linear actuator (charger) assembly is returned to unit maintenance.

Perform the following procedures to remove the end rod assembly from the linear actuator (charger).

1. Ensure that the linear actuator (charger) assembly is removed from the cradle and placed on a stable work surface, referring to the Removal of Linear Actuator (Charger) Assembly with Mounting Plate section of this work package (previous section). Refer to Figure 28.

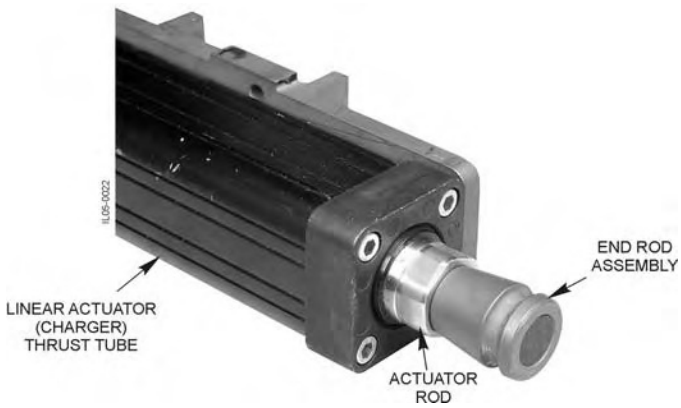


Figure 28. End Rod Assembly on Linear Actuator (Charger) Assembly.

NOTE

Pulling the spring-loaded end rod assembly while keeping the linear actuator (charger) assembly in place may be easier with two personnel.

2. Pull the spring-loaded end rod assembly away from the linear actuator (charger) assembly to reveal the two flat spots on the end rod stud, as shown in Figure 29.

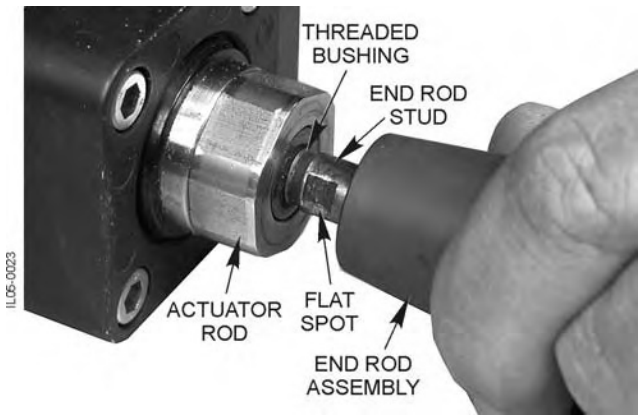


Figure 29. End Rod Assembly Pulled Away from Linear Actuator (Charger) Assembly.

REMOVAL OF MK19 WEAPON AND WAK COMPONENTS - Cont

Removal of End Rod Assembly - Cont

3. Insert a 5/16-inch flat wrench onto the two flat spots on the stud, as shown in Figure 30.

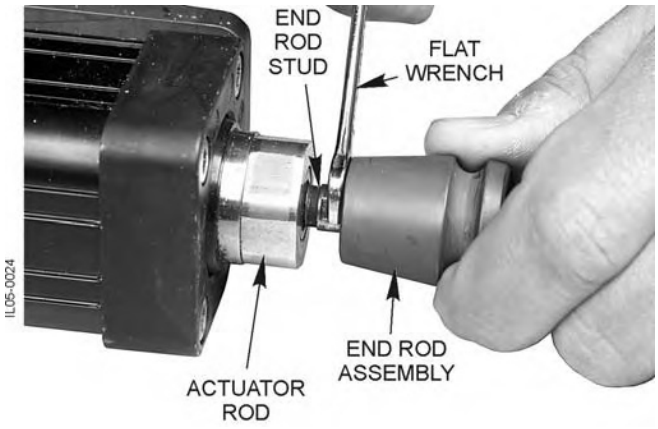


Figure 30. Flat Wrench Positioned on the End Rod Stud.

NOTE

For additional information on thread-locking procedures, refer to WP 0032.

4. If needed, remove the thread-locking compound from the threaded bushing securing the end rod assembly to the actuator rod, referring to Figure 29.

CAUTION

When removing the end rod assembly or components, do not allow the actuator rod to move. Keep the actuator rod stationary. Failure to do so may result in equipment damage.

5. Secure the actuator rod with a wrench to ensure that the actuator rod does not move, as shown in Figure 31.

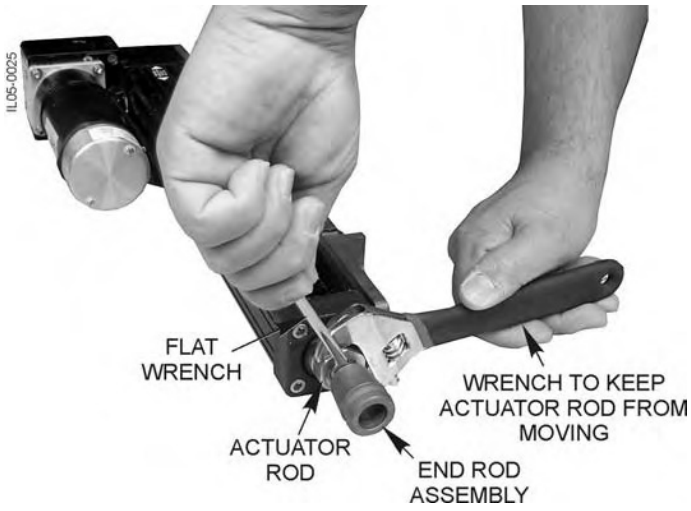


Figure 31. Both Wrenches in Place.

CAUTION

When removing the end rod assembly or components, do not allow the actuator rod to move. Keep the actuator rod stationary. Failure to do so may result in equipment damage.

6. While keeping the actuator rod stationary, carefully remove the end rod assembly, as shown in Figure 32. Retain end rod assembly for later use.

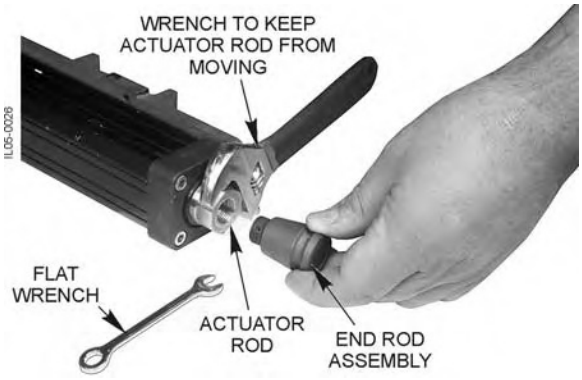


Figure 32. End Rod Assembly Separated from Linear Actuator (Charger) Assembly.

END OF TASK

REMOVAL OF MK19 WEAPON AND WAK COMPONENTS - Cont

Removal of Front Bracket Assembly

Perform the following procedure to remove the front bracket assembly.

NOTE

Some steps in this procedure are more easily performed with two personnel.

The cradle, when used with the Mk19 weapon and WAK, can be equipped with or without attenuators. Replace attaching hardware if the attenuators are installed.

For Safety Wire Procedures, refer to WP 0031.

1. Using wire cutters, remove the safety wire securing the socket head cap screws, referring to Figure 33.
2. Remove the attaching hardware (socket head cap screw, lock washer, washer, and nut) with 3/16-inch hex head wrench, as shown in Figure 33.

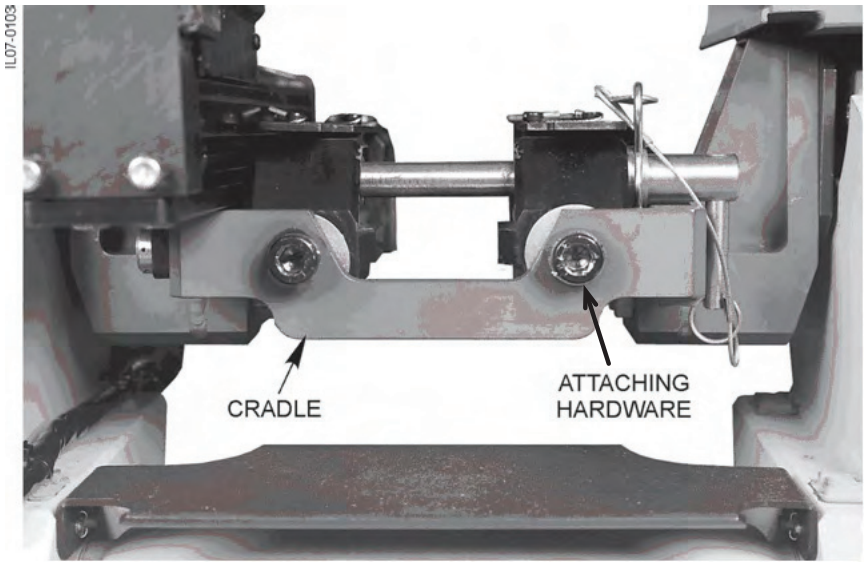


Figure 33. Bracket Hardware to be Removed.

3. Remove the front bracket assembly, as shown in Figure 34.

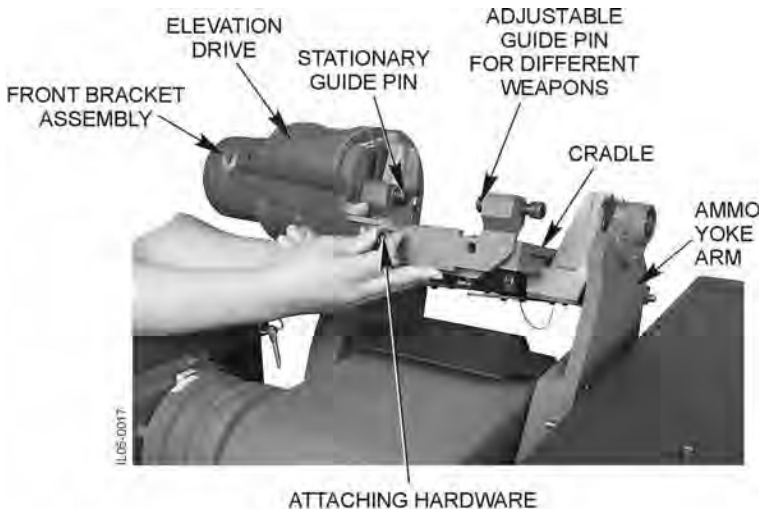


Figure 34. Front Bracket Assembly Being Removed from Cradle.

NOTE

For Safety Wire Procedures, refer to WP 0031.

4. Insert two socket head cap screws and lock washers through the cradle into the attenuator shafts. Tighten the screws to 28 +/-3 ft-lb using a torque wrench. Secure the screws with safety wiring, referring to Figure 35.

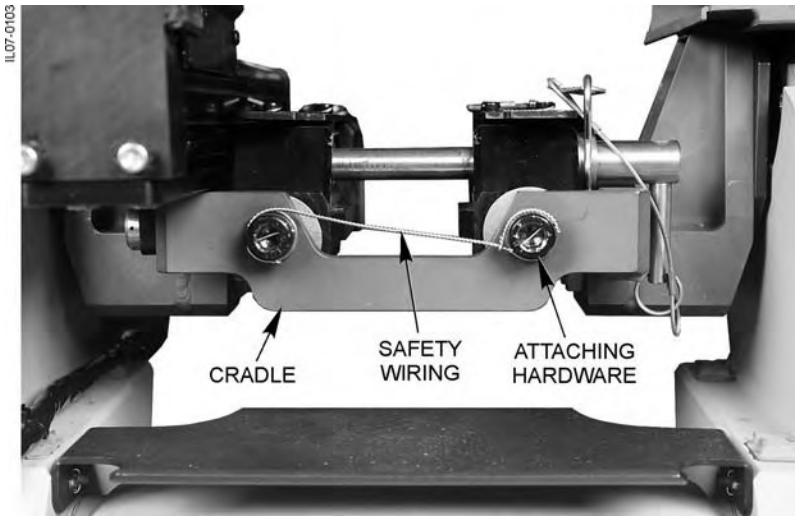


Figure 35. Cradle Installed and Secured with Attaching Hardware and Safety Wire.

END OF TASK

CRADLE REMOVAL

Table 2 lists the components of the cradle assembly, as well as related items of the CROWS mount.

Table 2. Cradle and Related Items.

PN	Nomenclature	Common Name
21677-2600	Gun Mount	M2/Mk19 Cradle (Heavy)
BLC8R60N 21483-3146-5	. Pin, Detent . Wire Rope Assembly, Single Leg	Detent Pin with Lanyard Lanyard
MS21250-06016 NL3/8SS	. Bolt, Shear . Washer, Lock	Bolt Nord-lock washers (Attaching Hardware -- Qty: 2 bolts and 2 Nord-lock washers)
MS16995-35B	. Socket Head Cap Screw	Attaching Hardware

Figure 36 shows the basic cradle before being installed onto the CROWS mount.

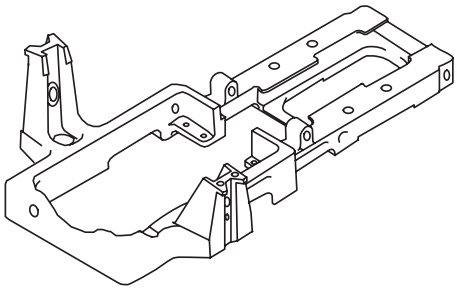


Figure 36. Cradle (Heavy).

Equipment Condition. WAK removed (see Removal of Weapon and WAK Components section in applicable work package: WP 0008, WP 0010, WP 0012, or WP 0014).

Perform the following procedures to remove the cradle from the CROWS mount.

WARNING

Follow all warnings and cautions when handling the weapons.

Use two personnel during installation/removal of the cradle and Mk19 grenade gun.

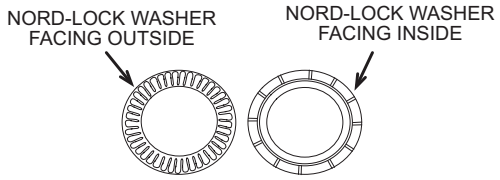
Failure to follow these instructions may result in personal injury or equipment damage.

1. Ensure CROWS system power is OFF.
2. Ensure the azimuth lock is in the locked position (referring to WP 0006, Azimuth Lock Assembly section). The pedestal mount should not be able to move.

NOTE

Each Nord-lock washer is a set of two washers.

3. Loosen and remove attaching hardware (one tension bolt and one Nord-lock washer set) from the elevation and ammo yoke arms, using a 7/16-inch, 12-point socket wrench, as shown in Figure 37.



Nord-Lock Washer Set

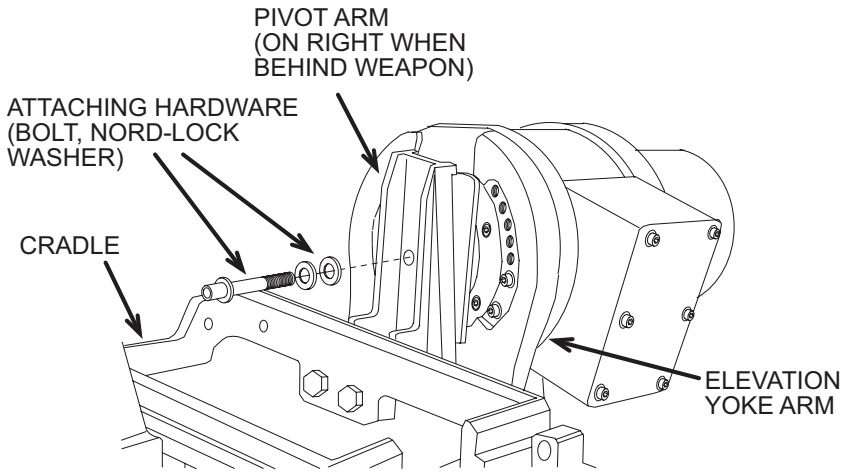


Figure 37. Attaching Hardware as Removed from the Cradle.

4. Lift cradle from yoke arms.

END OF TASK

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER USUAL CONDITIONS - M240B 7.62 MM LIGHT MACHINE GUN WEAPON ADAPTER KIT (WAK) AND WEAPON: INSTALLATION

THIS WORK PACKAGE COVERS:

Installing the M240/M249 weapon adapter kit (WAK) and the M240B Light Machine Gun on the cradle in the CROWS.

This work package is not included at this time.

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER USUAL CONDITIONS - M240B 7.62-MM MACHINE GUN WEAPON ADAPTER KIT (WAK) AND WEAPON: REMOVAL

THIS WORK PACKAGE COVERS:

Removing the M240B 7.62-mm Machine Gun and weapon adapter kit and cradle from the CROWS.

This work package is not included at this time.

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER USUAL CONDITIONS - M249 5.56 MM LIGHT MACHINE GUN WEAPON ADAPTER KIT (WAK) AND WEAPON: INSTALLATION

THIS WORK PACKAGE COVERS:

Installing the M240/M249 weapon adapter kit (WAK) and the M249 Light Machine Gun on the cradle in the CROWS.

This work package is not included at this time.

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER USUAL CONDITIONS - M249 5.56-MM MACHINE GUN WEAPON ADAPTER KIT (WAK) AND WEAPON: REMOVAL

THIS WORK PACKAGE COVERS:

Removing the M249 5.56-mm Machine Gun and weapon adapter kit and cradle from the CROWS.

This work package is not included at this time.

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER USUAL CONDITIONS - MENU SYSTEM

THIS WORK PACKAGE COVERS:

An overview of the menu system, detailing each menu's function and performance.

INITIAL SET UP:

Tools and Special Tools:

N/A

Personnel Required:

One

Equipment Conditions:

CROWS Set Up and Operational

Materials/Parts:

N/A

References:

WP 0004, WP 0016, WP 0017, WP 0018, WP 0019, WP 0020, WP 0021, WP 0022, WP 0023, WP 0024, DA Form 2404, DA Form 5988-E

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CONTROL GROUP

The Menu System is managed and configured by the Control Group using three CROWS components for remote operation. The three components are the Display Unit (DU), Figure 1; the Switch Panel Unit (SPU), Figure 2; and the Joystick, Figure 3.

NOTE

See WP 0004, for a description and use of the switches on the components making up the CROWS Control Group. Understanding and committing to memory the use of the switches will assist you in the performance of procedural steps. Read, comprehend, and memorize the use of these controls and indicators.

Use the Joystick as the primary control instrument with the DU and the SPU as backup, except for performing TRP procedures.

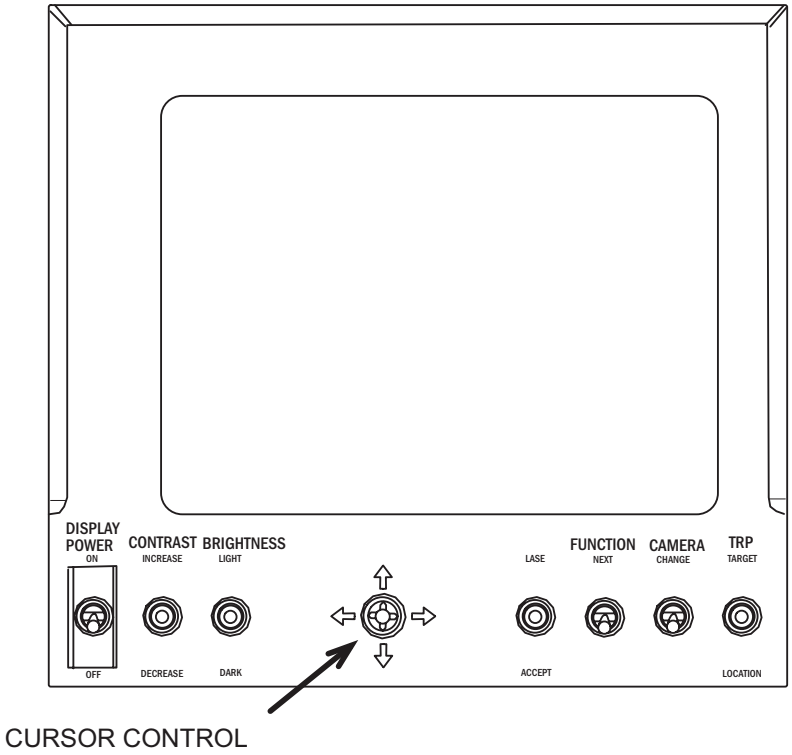


Figure 1. CROWS Display Unit (DU).

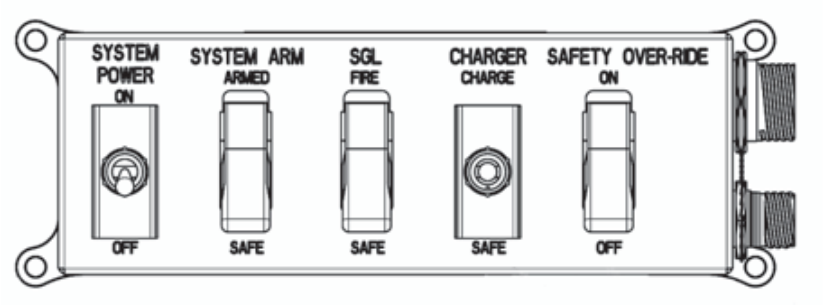


Figure 2. Switch Panel Unit (SPU).

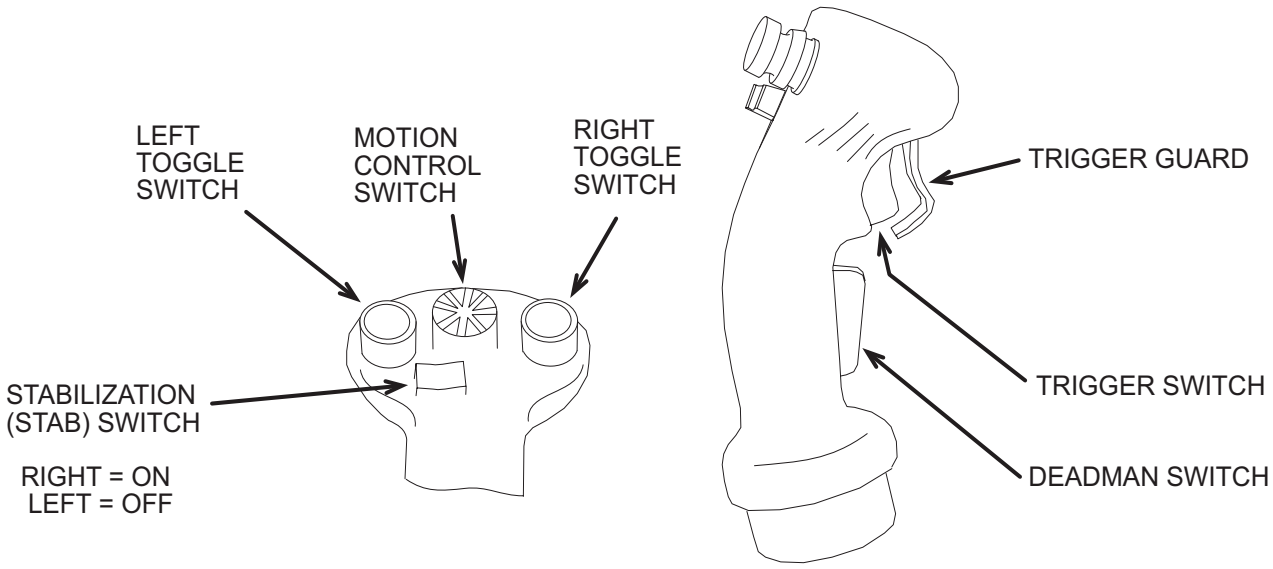


Figure 3. Joystick.

Menu System Overview

The Control Group provides full remote control of the CROWS via on-screen menus presented on the DU using the operational switches located on the DU, the SPU, and the Joystick.

A flat-panel, liquid crystal DU, housed in a ruggedized enclosure, projects camera images and overlay data from the ballistics computer.

The CROWS operator uses a non-displacement, force-sensitive, joystick-style control grip for mount azimuth and elevation positioning, operation of the ballistics computer, and firing the weapon. The joystick provides two ranges of speed in elevation and traverse – the lower speed range for target tracking and the higher speed range for rapid slewing. The joystick accommodates right- or left handed operation and may be dismounted from its stationary holding fixture for hand-held use.

CONTROL GROUP - Cont

Operational Overview

CAUTION

Do not touch any system controls after applying power to the CROWS system until the System Report is displayed. A blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any of the switches on the Control Group. Failure to follow this instruction may result in equipment malfunction or failure.

After powering up the CROWS system, the DU screen displays a Power-ON system built-in test (BIT) system status report, as shown in Figure 4.

NOTE

In the System Report screen, installed operating software identification is shown for the Ballistic Solution and the Gimbal software. Installed software identification for the weapon and ammunition used in ballistic computation is shown in the top right corner of the Weapon Menu. See figure 13. Installed software identification for the vehicle parameter file is shown in the top right corner of the Vehicle Type Menu. See figure 125.

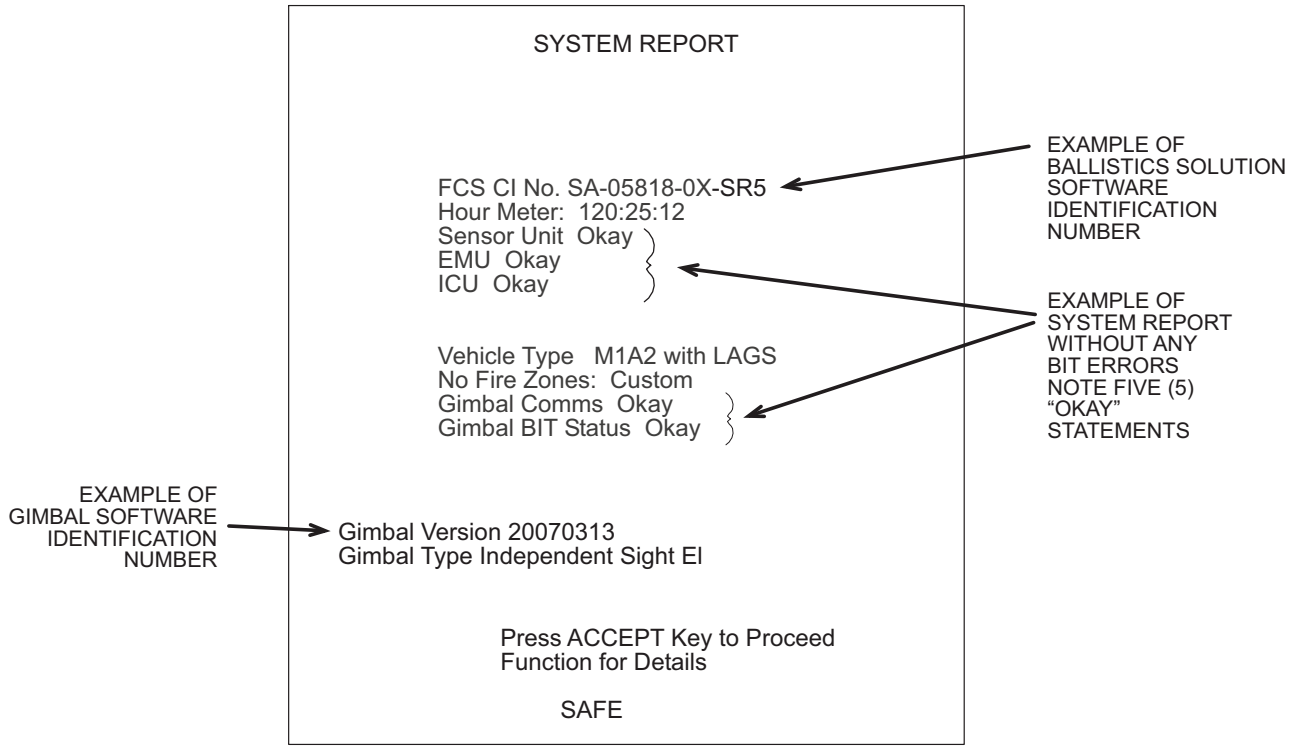


Figure 4. Example of System BIT System Report.

If any BIT failures are detected, the failure message(s) are listed on the System Report screen. See example at Figure 5.

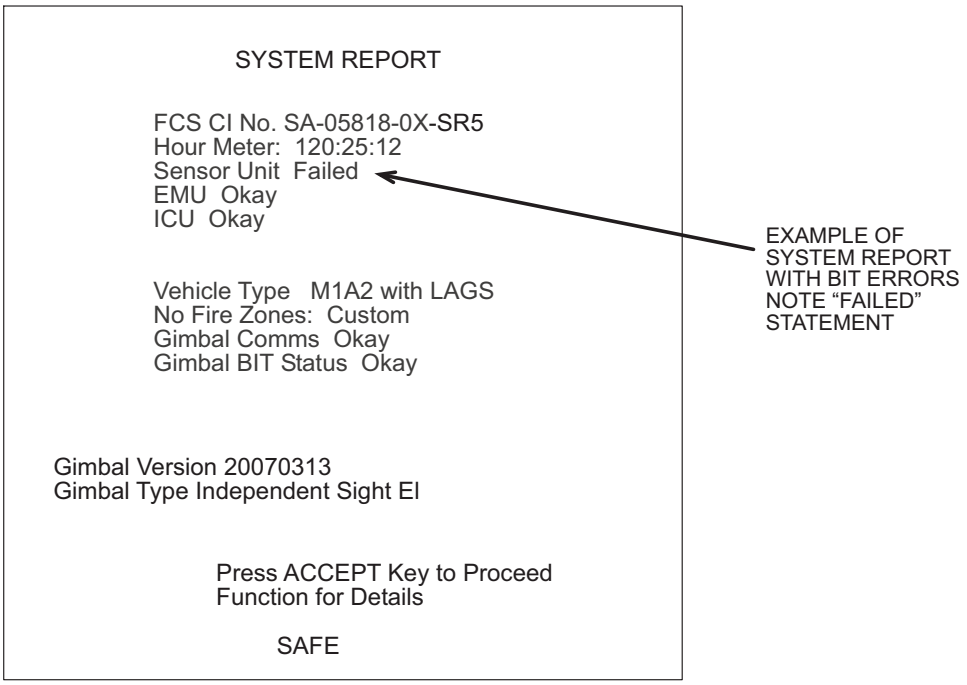


Figure 5. Example of System BIT System Report with Error Message.

NOTE

Only failed subsystems will be listed. See Figure 7 for an example of a failed subsystems report if no systems have failed.

Press FUNCTION (RIGHT toggle DOWN) to view a detailed description of a BIT fault/failure. See example at Figure 6. If BIT failures appear, proceed to Chapter 3, CROWS Troubleshooting, WPs 0023 and 0024.

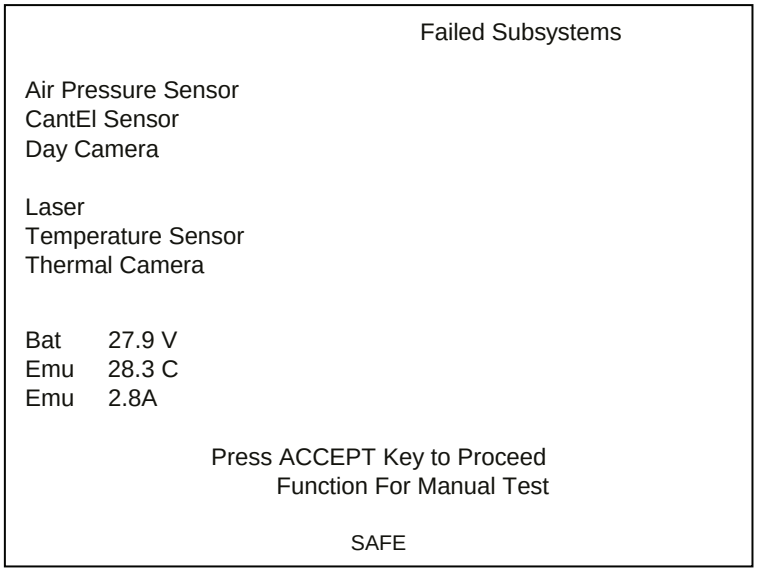


Figure 6. Example of Subsystem Failure Screen.

CONTROL GROUP - Cont

Operational Overview - Cont

Figure 7 illustrates an example of a failed subsystems report if no systems have failed.

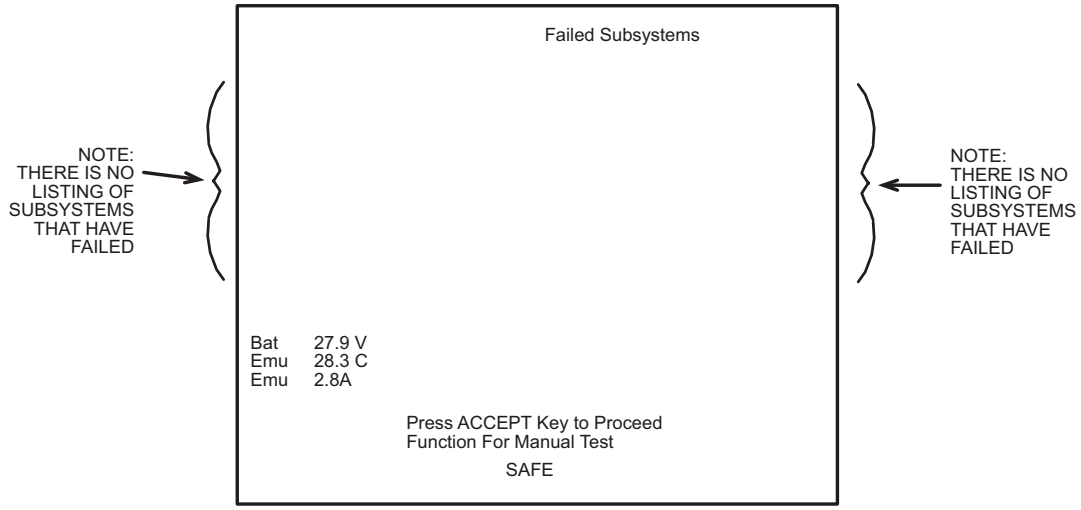


Figure 7. Example of a Subsystem Failure Screen without Failures.

WARNING

Before opening the vehicle hatch, ensure the laser aimpoint is displayed. Do not range step or enter a manual range, while the hatch is open, unless the Safety Over-Ride switch on the SPU is in the OFF position (enabled). The ballistic solution may be affected.

NOTE

If "GWS BIT ERROR – FIRING INHIBITED" message appears on the DU, attempt to reset by toggling (moving the switch back and forth) the SAFETY OVER-RIDE switch on the SPU from any current setting OFF or ON. For example: ON-OFF-ON or OFF-ON-OFF. If fault message still appears, refer to WP 0024, Troubleshooting Index, Table 1, General Fault Messages, for the “GWS BIT ERROR – FIRING INHIBITED” message.

Record and report subsystem failure information as shown on the Failed Subsystem Report screen on DA Form 2404, Equipment Inspection and Maintenance Worksheet, or DA Form 5988-E, Equipment Inspection Maintenance Worksheet (EGA) - Electronic.

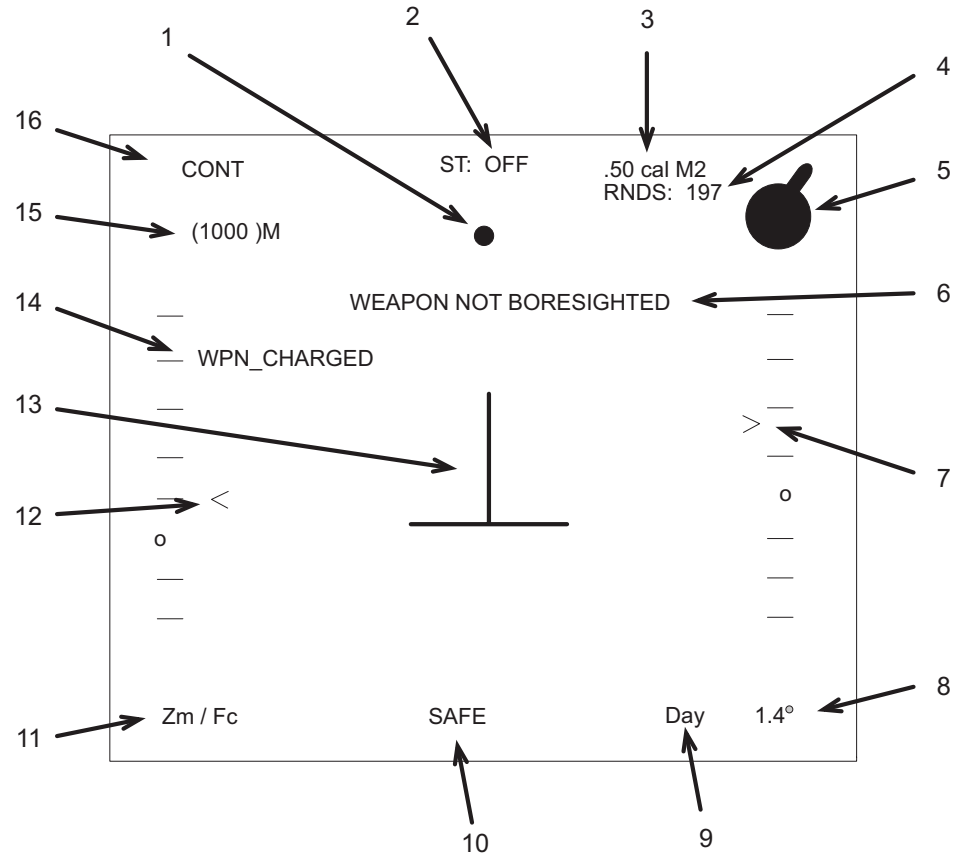
After the operator presses the ACCEPT switch twice (LEFT toggle RIGHT), the system is placed in the CROWS primary Engagement mode of operation. Figure 8 shows an example of the Engagement mode screen in the Zm/Fc function mode.

NOTE

The Range to target is displayed (refer to Figure 8).

If the First / Last Range option is enabled, a First / Last Range to target may be displayed (refer to Figure 9).

A "Rainbow" screen (showing large vertical bars of varying colors) will appear if thermal camera mode is accessed before the sensor is ready for operation. If this occurs, wait until the sensor is ready for operation. The rainbow screen will disappear. WP 0022, Operation Under Unusual Conditions, Operating In Extreme Temperature Conditions section, defines the maximum time required to reach operational readiness.



1. Laser Ready Indicator.
2. CROWS Mount Stabilization Indicator: Shows whether the STAB switch is on or off.
3. Weapon and Ammunition in use.
4. Rounds Count: Shows number of remaining rounds.
5. Weapon Azimuth Indicator: Example showing weapon is pointed to the 1 o'clock azimuth position in relation to front of vehicle.
6. System Message: Will show messages, if any, to which the operator must pay attention.
7. Sensor Elevation Indicator: Example showing sensor elevation (vertical) angle positioning in relation to the horizontal.
8. Zoom (Field of View) (FOV) Status: Shows current FOV status.
9. Camera: Shows whether system is in Day or Thermal camera mode.
10. Trigger Arm Status: Shows whether system weapon is Armed (ready to fire) or in a Safed mode.
11. Functional Mode: Shows Menu, Rg / Acct / Brt, or Zm / Fc
12. Weapon Elevation Indicator: Example showing weapon elevation (vertical) angle positioning in relation to the horizontal.
13. Laser Aimpoint: Laser Range Finder symbol used to aim and acquire target range. After accepting the range, the symbol changes to the Ballistic Aimpoint symbol shown in figure 9.
14. Weapon Charged Status: Shows whether the weapon has been remotely charged.
15. Range: Shows range to target. May show First and Last Range, if First/Last Range option is enabled and if multiple target ranges are returned.
16. Firing Mode Selection: Shows how weapon will fire -- in Single, Burst, or Continuous mode.

Figure 8. Example of Engagement Mode Screen.

CONTROL GROUP - Cont

Light Discipline Mode (Low Brightness)

Perform the following procedure to put the DU in Light Discipline Mode. All DU controls and Menu color selection functions remain the same.

NOTE

Do not use night vision equipment while operating the CROWS. In the Light Discipline Mode, it is not necessary to wear night vision equipment. The entire DU screen can be seen, text is legible, and the target is recognizable without night vision equipment.

1. Hold the BRIGHTNESS switch down to the DARK position until a momentary flash appears on the DU. Release BRIGHTNESS switch.

2. Press DOWN on the BRIGHTNESS switch to further readjust brightness of screen, as needed.

END OF TASK

Return to Normal Brightness Mode

Perform the following procedure to return the DU to Normal Brightness Mode. All DU controls and Menu color selection functions remain the same.

1. On the DU, press the BRIGHTNESS switch UP to the LIGHT position. A momentary flash appears on the DU. Release BRIGHTNESS switch.

2. Press the BRIGHTNESS switch UP to the LIGHT position until normal brightness is achieved.

END OF TASK

Functional Mode(s)

NOTE

For additional information on CROWS controls and indicators, refer to WP 0004.

CROWS functional modes are shown in Table 1. These functional modes are accessed and changed while on the Engagement Mode screen using the FUNCTION Switch on the DU or the joystick RIGHT toggle DOWN. The selected Functional Mode will be shown in the lower left corner of the Engagement Mode Screen as shown in Figure 8.

Table 1. CROWS Functional Modes.

Functional Mode	Sub-Mode	Description
Menu	n/a	The CURSOR is used to navigate through the menus to set up or change system configuration parameters. Navigate the menus by: • Press ACCEPT (LEFT toggle RIGHT) to accept an option or select a sub-menu. • Press the joystick RIGHT toggle LEFT or DU CURSOR CONTROL switch LEFT to return to the previous menu.
Zm/Fc	Laser Aimpoint (Day)	Default when the laser aimpoint is displayed in Engagement mode. • Press the joystick LEFT toggle UP or DU CURSOR CONTROL switch UP to zoom (Zm) the camera in (narrow the field of view (FOV)). Press the joystick LEFT toggle DOWN or DU CURSOR CONTROL switch DOWN to zoom (Zm) the camera out (widen the FOV). • Press the Press the joystick RIGHT toggle LEFT or DU CURSOR CONTROL switch LEFT to focus (Fc) the camera in (close). Press the joystick RIGHT toggle RIGHT or DU CURSOR CONTROL switch RIGHT to focus (Fc) the camera out (long).
Zm/Fc/P	Laser Aimpoint (Thermal)	When the thermal camera is activated, the ACCEPT switch is used as a toggle to change the polarity (P) between "white hot" and "black hot."
Ballistic Aimpoint Rg/Brt/Accpt		Default when the ballistic aimpoint is displayed in Engagement mode. • Press the joystick LEFT toggle UP or DU CURSOR CONTROL switch UP to increase the manual range (Rg) to the target input for the ballistic computation. Press the joystick LEFT toggle DOWN or DU CURSOR CONTROL switch DOWN to decrease the manual range (Rg) to the target input for the ballistic computation. • Press the joystick RIGHT toggle LEFT / RIGHT or DU CURSOR CONTROL switch LEFT / RIGHT to change the camera brightness (Brt) by changing the electronic iris set-point. • Press ACCEPT (LEFT toggle RIGHT) to accept a calculated firing solution.

BALLISTIC AIMPOINT PRODUCTION

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power off and do not touch any switches. Failure to do so may result in equipment malfunction or failure.

NOTE

A ballistic aimpoint will be produced whenever a ballistic solution is accepted and saved to memory. Ensure verification of the weapon boresighting procedures have been performed.

The system produces a ballistic aimpoint after the operator selects the target, establishes the range to target (laser or manually input) and accepts the ballistic solution.

CROWS application software uses the weapon/ammunition data, target range, and sensor data to compute the weapon aimpoint correction and then displays the ballistic aimpoint, replacing the laser aimpoint on the DU.

BALLISTIC AIMPOINT PRODUCTION - Cont

Example of Sequence for Engagement of a Target

NOTE

Unless otherwise stated, the procedures performed below use the switches on the joystick.

The ballistic aimpoint replaces the laser aimpoint and is represented by the symbol, ^. Refer to Figure 9.

If the FIRST / LAST RANGE option is enabled, a First / Last Range to target may be displayed if multiple target ranges are returned. Refer to Figure 9.

Perform the following procedure to engage a target.

1. Position the laser aimpoint on a designated target, using the joystick MOTION CONTROL switch while simultaneously depressing the DEADMAN switch.

2. Press LASE (LEFT toggle LEFT) to compute ballistics. The Rg / Brt / Accpt screen is selected and, as shown in Figure 9. The ballistics aimpoint and the target range will appear on the DU screen.

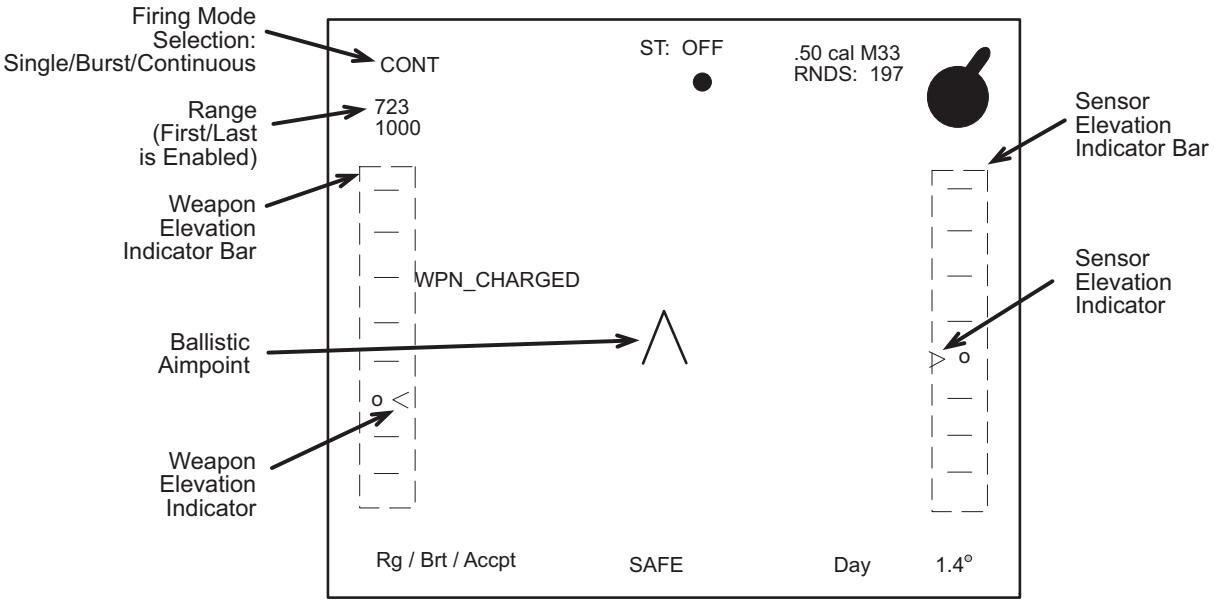


Figure 9. Example of Rg / Brt / Accpt Screen with Ballistic Aimpoint Displayed.

NOTE

Auto Accept Solutions is an option found in the Configure/Engagement/Rules of Engagement Menu. If the AUTO ACCEPT option is enabled (ON), proceed to step 4.

3. If Auto Accept Solutions has not been enabled (OFF), press ACCEPT (LEFT toggle RIGHT) to accept the ballistic solution. The ballistic aimpoint is adjusted for the designated target.

4. Ensure the ballistic aimpoint is on the target. If the ballistic aimpoint is not on target, repeat steps 1 through 3. If the ballistic aimpoint is on target, proceed to step 5.

NOTE

Refer to WP 0018 for instructions on firing and loading the M2 weapon; WP 0019 for instructions on firing and loading the Mk19 weapon; WP 0020 for instructions on firing and loading the M240B weapon; or WP 0021 for instructions on firing and loading the M249 weapon.

If the correct status is not displayed on the screen, refer to WP 0024, Troubleshooting Index, to identify and resolve the issue.

5. Position the SYSTEM ARM switch on the SPU to the ARMED position. Observe the result on the DU screen. The SAFE status shown at the bottom of the screen should change to ARMED. Refer to Figure 9.
6. Engage the target by lifting the joystick trigger guard, then pressing the Trigger switch to fire the weapon. Release joystick trigger switch when firing is complete.
7. When engagement is over, position the SYSTEM ARM switch on the SPU to the SAFE position.
8. Press LASE (LEFT toggle LEFT) to display the laser aimpoint (Engagement Menu).

END OF TASK

PREPARATION MENU

The Preparation Menu allows the operator to set up and modify CROWS data and options, customizing the system for specific operational or training mission scenarios.

To Access the Preparation Menu

1. Access the Menu mode by pressing FUNCTION (RIGHT toggle DOWN) on the DU. Menu will display in the lower left corner. See Figure 10.
2. Ensure the CURSOR is positioned to the Preparation Menu entry point designated by P, shown in the upper left of the screen in Figure 10. If it is not, press RIGHT toggle RIGHT until CURSOR is positioned to P.

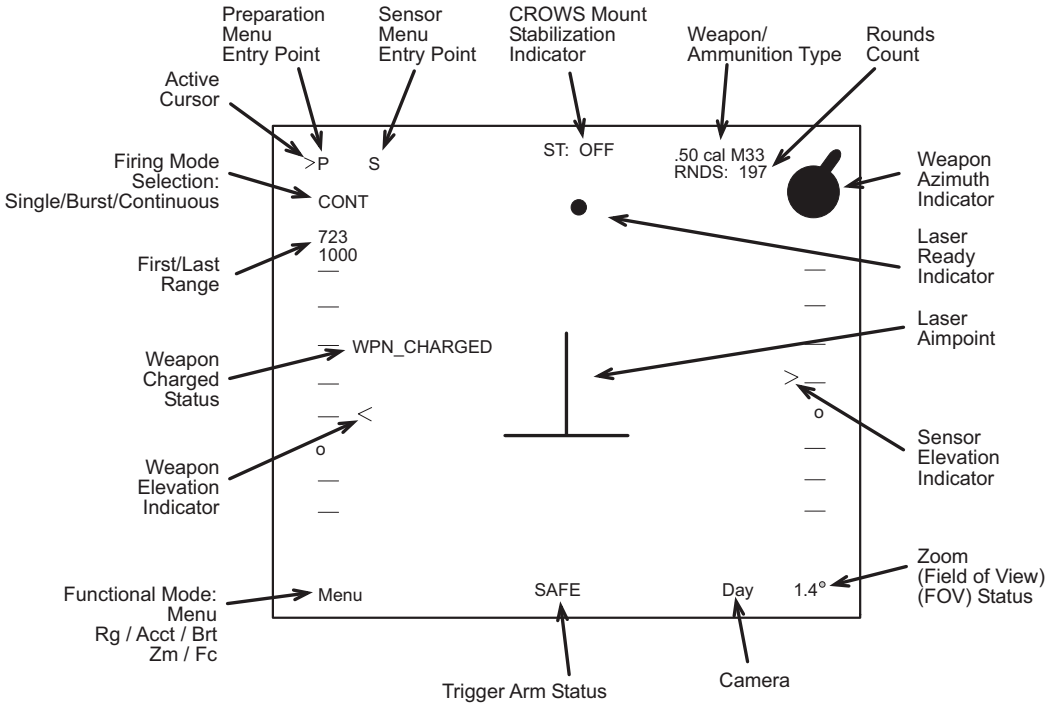


Figure 10. Example of Menu Mode Screen.

PREPARATION MENU - Cont

To Access the Preparation Menu - Cont

3. Press ACCEPT (LEFT toggle RIGHT). The Preparation Menu, Figure 11, appears, enabling the operator to select from the following available menu options for establishing system operable parameters.

    - Ammunition (choose the appropriate ammunition type for weapon installed).
    - Boresight (refer to WP 0016 to boresight the installed weapon).
    - Zero (refer to WP 0017 to zero the installed weapon).
    - Surveillance.
    - Sector Scan Setup.
    - Sector Scan Enable.
    - No-Fire Zones.
    - Motion Inhibits.
    - Configure other specific system parameters.
    - Test.

NOTE

Trigger Arm Status, Camera, and Zoom (FOV) Status are examples of what may appear on all screens.

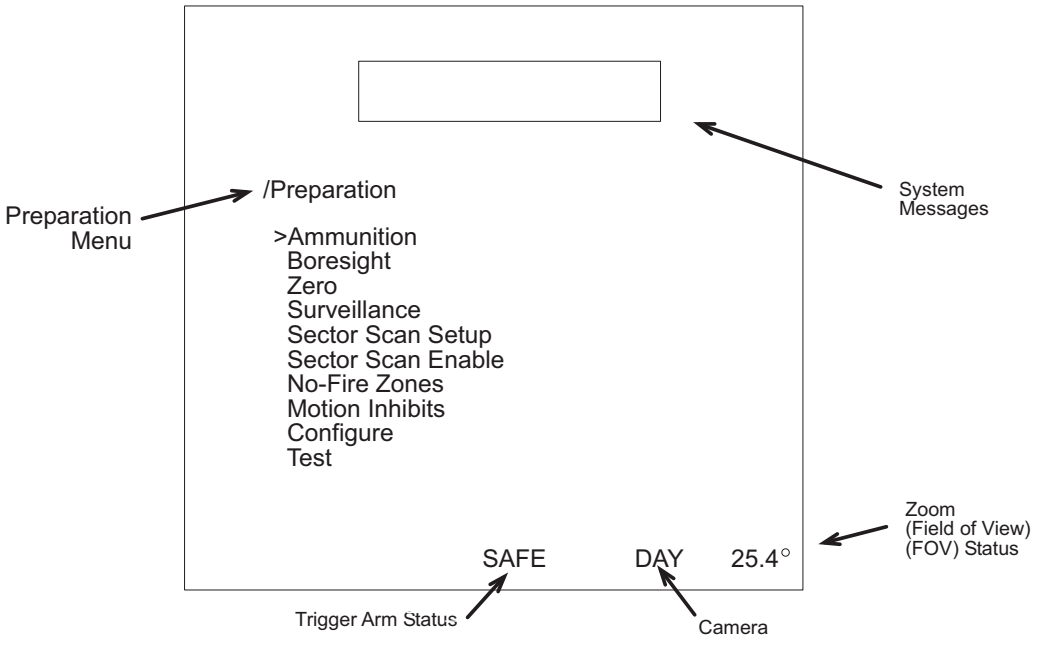


Figure 11. Preparation Menu Display.

END OF TASK

Additional Preparation Menu Options

NOTE

See WP 0004, for a description and use of the switches on the components making up the CROWS Control Group. Understanding and committing to memory the use of the switches will assist you in the performance of procedural steps. Read, comprehend, and memorize the use of these controls and indicators as they may not be stated in all instances where their action is required so as to reduce the repetitive nature of the steps.

The CROWS software automatically selects and positions the CURSOR on the first (top) option. The operator may select a different option by pressing the joystick LEFT toggle DOWN or DOWN on the CURSOR CONTROL switch on the DU.

Within the Preparation Menu and sub-menus, the operator may “escape” from a menu and return to the next higher previous menu by pressing the joystick RIGHT toggle LEFT or the DU CURSOR CONTROL switch once to the LEFT.

WARNING

The Laser may fire while using the “quick exit” method below. Ensure that no personnel are standing in front of the laser. Failure to follow these instructions may result in serious personal injury.

For a quick exit from any level within the Preparation Menu back to the Engagement Mode screen (Figure 8), press LASE (LEFT toggle LEFT).

Rounds Counting

NOTE

Refer to WP 0018 for instructions on firing and loading the M2 weapon; WP 0019 for instructions on firing and loading the Mk19 weapon; WP 0020 for instructions on firing and loading the M240B weapon; or WP 0021 for instructions on firing and loading the M249 weapon.

Counting rounds is accomplished by a proximity switch that monitors either gun bolt or ammunition motion, depending on which weapon adapter kit (WAK) is being used. Rounds counting provides a DU screen indication of the number of rounds remaining.

The rounds counter allows operators to establish the number of rounds loaded at the time of ammunition loading. This rounds count will allow the operator to determine the approximate time to reload the ammunition can. If used properly, an operator can reload ammunition at a point when there are enough rounds left to allow a quick connect of a new ammo belt onto the existing belt.

OPERATOR DATA ENTRY

Throughout the Preparation Menu section, various options are shown on the DU allowing the operator to enter specific data and to alter or override selected parameter or sensor settings. This data is subsequently used in the ballistic computation performed by the ballistic computer assembly (BCA).

Common types of data to be entered include:

- Rounds count
- Range
- Sector scan rate
- Sensor, such as cross-wind (CW), range wind (RW), temperature (Te), pressure (Pr), and cant/elevation (Cant/El)

OPERATOR DATA ENTRY - Cont

This section describes the procedures the operator performs to enter specific data into the system. Table 2 describes what appears on the screen.

Table 2. Data Entry Definitions.

Term	Definition
Numeric value	Series of numbers representing system data (e.g., distance or temperature).
Alphanumeric parameters	Represents operational functions (e.g., the selected ammunition or sensor settings).
Left-most digit	Default selection for modification when selecting and activating a numeric value to be changed.
Underlined digit	Number selected for modification.

Data Entry Procedure Description

The date entry procedure is applicable to all procedures where numeric values may need to be changed. Refer to Table 3 for an example of data entry and modification. References back to this procedure will be made where applicable.

When an option is activated (by pressing the ACCEPT switch), a numeric or alphanumeric value appears that represents the current configuration for that menu option.

During editing of a numeric or alphanumeric value, no other menu function can be used.

Pressing the joystick LEFT toggle UP / DOWN or RIGHT toggle LEFT / RIGHT or the DU CURSOR CONTROL switch will modify the highlighted (underlined) number only.

When a numeric value is displayed, the joystick LEFT toggle UP / DOWN or RIGHT toggle LEFT / RIGHT or the DU CURSOR CONTROL switch is used to modify the displayed number:

Press the joystick LEFT toggle UP or DU CURSOR CONTROL switch UP to increase the value or joystick LEFT toggle DOWN or DU CURSOR CONTROL switch DOWN to decrease the value by 1 each time the switch is pressed.

Press the joystick RIGHT toggle LEFT / RIGHT or DU CURSOR CONTROL switch LEFT / RIGHT to move to the next digit to be modified.

> Before pressing ACCEPT (LEFT toggle RIGHT) to confirm the changes, the LASE (LEFT toggle LEFT) may be pressed to cancel the editing process and return to the Engagement mode, restoring the number to its previous value. For example, referring to the example in Table 3, if, after setting the value to 0900, and before confirming by pressing ACCEPT (LEFT toggle RIGHT), the operator pressed LASE (LEFT toggle LEFT), the value would return to 1024 and the system would return to the Engagement mode screen.

When all the required digits have been modified, press the ACCEPT (LEFT toggle RIGHT) to confirm the modification and store the new data value. The change in the number takes effect immediately, and the system returns to the menu.

END OF TASK

Example of Modifying A Numeric Value

Table 3 shows each step of the editing sequence as the operator changes a numeric value from 1024 to 0900. Note the underlined digits in the Numeric Value column (also bolded for the manual only).

Table 3. Sample Procedure and Results of Editing Sequence.

Original Numeric Value	Joystick Procedural Step	DU Procedural Step	Resulting Numeric Value	Action
>**1**024	Original number. Pressing ACCEPT (LEFT toggle RIGHT) selects value and highlights and underlines first digit			
>**1**024	LEFT toggle DOWN	Cursor Control DOWN	>**0**024	Reduces 1 to 0
>**0**024	RIGHT toggle RIGHT	Cursor Control RIGHT	>0**0**24	Moves to second digit to be modified
>0**0**24	LEFT toggle DOWN	Cursor Control DOWN	>0**9**24	Increases 0 to 9
>0**9**24	RIGHT toggle RIGHT	Cursor Control RIGHT	>09**2**4	Moves to third digit to be modified
>09**2**4	LEFT toggle DOWN (twice)	Cursor Control DOWN (twice)	>09**0**4	Reduces 2 to 0
>09**0**4	RIGHT toggle RIGHT	Cursor Control RIGHT	>090**4**	Moves to fourth digit to be modified
>090**4**	LEFT toggle DOWN (4 times)	Cursor Control DOWN (4 times)	**>**090**0**	Reduces 4 to 0
>090**0**	LEFT toggle RIGHT	ACCEPT switch DOWN	**>**0900	Confirms modification

AMMUNITION SELECTION

The following procedure enables the operator to configure the system for ammunition types to be used in the ballistics solution

Perform the following procedures to select an ammunition type.

1. From the Engagement screen, press FUNCTION (RIGHT toggle DOWN) until you are in the Menu mode. See Figure 10.

2. Ensure the CURSOR is positioned on the Preparation Menu entry point designated by P, in the upper left of the screen. See Figure 10.

AMMUNITION SELECTION - Cont

3. Press ACCEPT (LEFT toggle RIGHT). This will take you to the Preparation Menu, as shown in Figure 12.

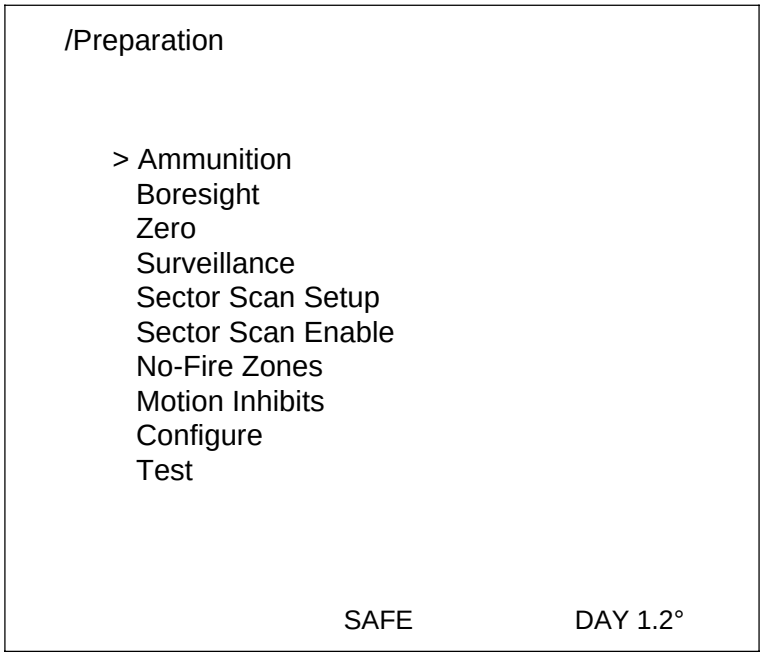


Figure 12. Preparation Menu with Ammunition Option Selected.

4. Ensure the CURSOR is positioned onto the AMMUNITION option.

NOTE

The CROWS is configured to accept more than one weapon. When ACCEPT (LEFT toggle RIGHT) is pressed, a menu appears listing the different weapons available for making an ammunition selection. The underlined entry shows which weapon represents the weapon installed in the WAK due to the appropriate cable connection. An asterisk (*) next to a weapon option indicates that ammunition for that weapon option has been selected. See Figure 13. The asterisk(s) (*) will remain until removed.

5. Press ACCEPT (LEFT toggle RIGHT). Figure 13 appears showing available weapons for ammunition selection.

NOTE

Do not select ATK .50, M230LF, or XM312. The underlined option indicates the weapon being recognized by CROWS.

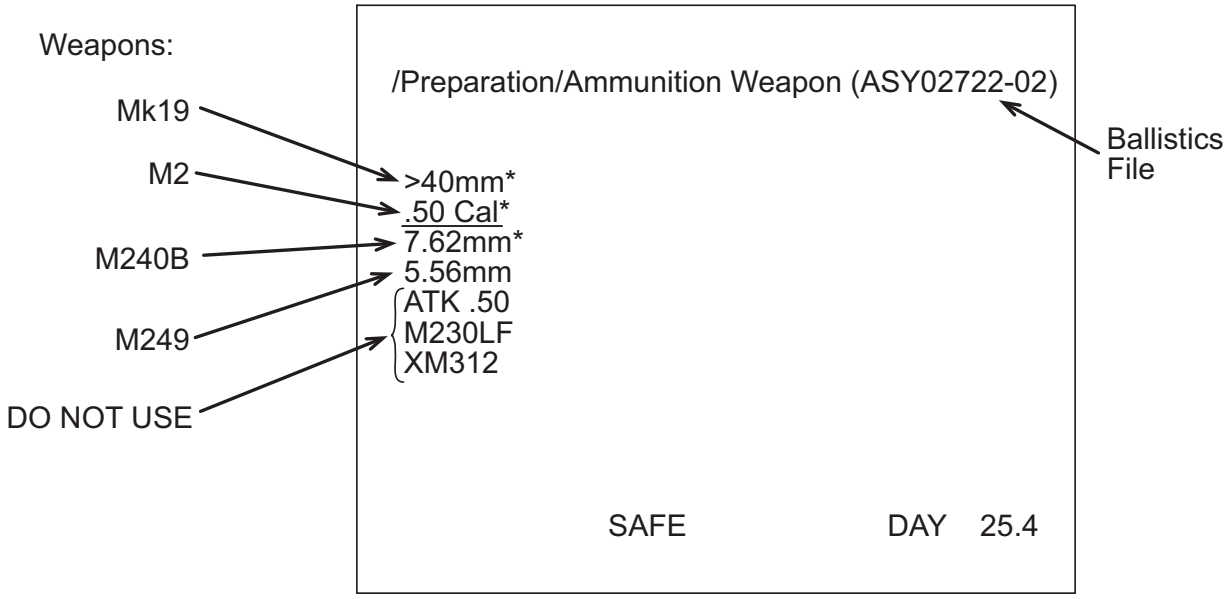


Figure 13. Weapon Menu.

6. Position the CURSOR onto the desired weapon from the category selected.

AMMUNITION SELECTION - Cont

7. Press ACCEPT (LEFT toggle RIGHT), bringing up the list of available ammunition for the selected weapon, as shown in Figure 14.

NOTE

For information describing the various ammunition options, refer to Table 4.

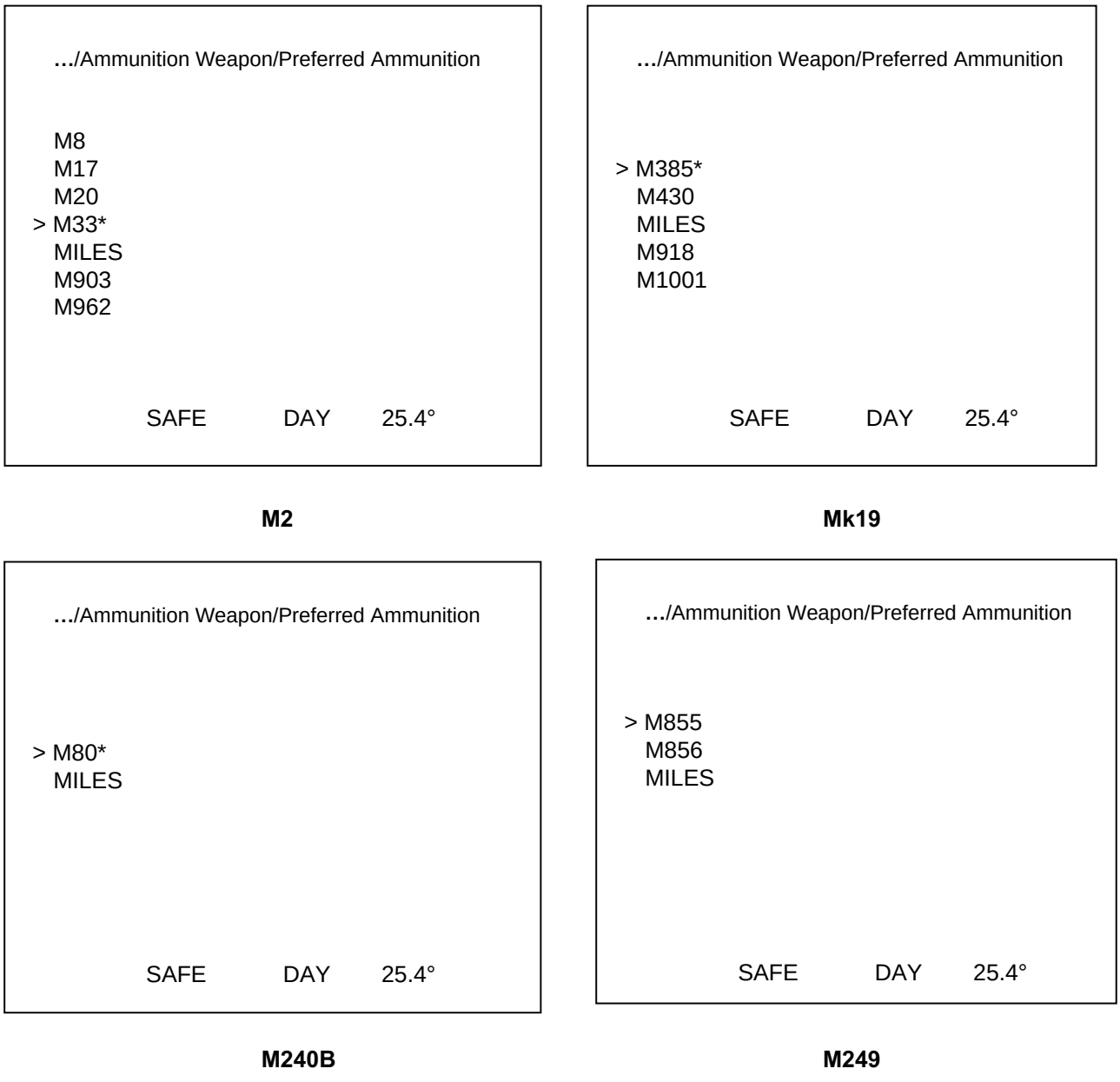


Figure 14. Available Ammunition for the M2, Mk19, M240B, and M249 Weapons.

8. Position the CURSOR onto the specific ammunition from the selected category. See Table 4 for a description of the various types of ammunition available to use.

NOTE

Once the ammunition type is selected and accepted in the following step, an asterisk (*) will be displayed next to the ammunition type. A blue, horizontal status bar appears on the screen, indicating the ammunition type is being saved into memory for ballistics computations. While this status bar is displayed, do not turn power OFF and do not touch any of the switches. Failure to follow these instructions may result in equipment malfunction or failure.

To remove an ammunition from being selected, place the cursor next to the option with the asterisk (*) and re-select it. The asterisk (*) will disappear.

9. Verify that the appropriate ammunition type is selected, then press the ACCEPT (LEFT toggle RIGHT).

10. Press LASE (LEFT toggle LEFT) to return to the Engagement screen.

Table 4. Ammunition Descriptions.

Weapon Type	Caliber	Ammunition Type	Description	Remarks
M2 HB, Machine Gun	.50 Cal	M8	Cartridge, Caliber .50, Ball, Armor Piercing Incendiary	The cartridge combines the functions of the M2 armor piercing bullet and the incendiary bullet, and is used against flammable targets and light-armored or unarmored targets, concrete shelters, and similar bullet-resisting targets.
		M17	Cartridge, Caliber .50, Tracer, M17	The cartridge tracer is intended to permit visible observation of the bullets in-flight path or trajectory to the point of impact.
		M20	Cartridge, Caliber .50, Armor Piercing Incendiary-Tracer, M20	The cartridge combines the functions of the armor piercing and the incendiary bullet, and is used against flammable targets and light-armored or unarmored targets, concrete shelters, and similar bullet-resisting targets. This tracer is dim at near ranges, but increases to bright as it moves further from the gun.
		M33	Cartridge, Caliber .50, Ball, M33	The cartridge is intended for use against personnel or unarmored targets. Generally use for qualification and practice.
		MILES	N/A	Used in setting Elevation and Boresight of CROWS unit.
		M903	Cartridge, Caliber .50, Saboted Light Armor Penetrator (SLAP), M903	The SLAP is used against light armored targets and Armored Attack Helicopters (AAHs) at ranges greater than those of other .50 cal ammunition.
		M962	Cartridge, Caliber .50, Saboted Light Armor Penetrator-Tracer (SLAP-T), M962	Used against light armor vehicles and aircraft with the additional tracer feature. This round is also for use in M1-series Abrams Tank gunnery training using a sub-caliber insert.

AMMUNITION SELECTION - Cont

Table 4. Ammunition Descriptions - Cont.

Weapon Type	Caliber	Ammunition Type	Description	Remarks
Mk19 Grenade Machine Gun	40 mm	M385	M385 / M918 40mm, practice	The M385 is an inert round with a propellant charge. The M385 practice rounds are joined with either M16A1 OR M16A2 links, B490. They are packed the same as the HE rounds, in wooden boxes, 50 rounds to a box. The M918 is a flash-bang round with a propellant charge.
		M430	M430 High-Explosive, Dual-Purpose (HEDP)	The HEDP M430 cartridge, joined with M16A2 links, is the standard round for the MK 19. The impact-type round penetrates 2 inches of steel armor at 0-degree obliquity and inflicts personnel casualties in the target area. This round is packed in an M548 ammunition container (48 rounds, linked, in each container). It is olive drab with a yellow ogive and yellow markings. It has a PIBD, M549 fuze, and Comp B filler. It arms between 18 to 30 meters and has a casualty radius of 15 meters.
		MILES	N/A	Used in setting Elevation and Boresight of CROWS unit.
		M918	M922/M922A1 40mm Dummy Rounds	These rounds are totally inert and are used to check gun functioning and to train gun crews. They are issued only to armorers. The M922 dummy cartridges are joined with M16A2 links. Each MK 19 is allowed one 10-round belt (DODAC B472), which is packed in an M2A1 metal box. These inert cartridges are used to check weapon function and for crew training.
		M1001	40mm Canister Round	The 40mm canister cartridge provides a short range anti-personnel capability from muzzle to a maximum effective range of 100 meters for the Mk19 MOD3 Grenade Machine Gun (GMG). The cartridge is used by combat, combat support and combat service support organizations as a force multiplier against ground troops in exposed positions, in extremely rugged terrain, dense vegetation, military operations in urban terrain (MOUT), and other tactical scenarios where the present MK-19 family of 40mm ammunition is limited. The cartridge will be in use Army wide.

Table 4. Ammunition Descriptions - Cont.

Weapon Type	Caliber	Ammunition Type	Description	Remarks
M240B Machine Gun	7.62 mm	M80	Cartridge, 7.62mm, Ball, M80	For use against light materials and personnel, and for range training.
		MILES	N/A	Used in setting Elevation and Boresight of CROWS unit.
M249 Machine Gun	5.56 mm	M855	Cartridge, 5.56mm, Ball, M855 or Cartridge, 5.56mm, Ball, M855, Lead Free	The cartridge has a 62-grain, gilded metal-jacketed, lead alloy core bullet with a steel penetrator. The M855 "lead free" ball cartridge has a bullet with a conical steel insert and a tungsten composite core in a copper alloy jacket. The cartridge is intended for use against personnel and unarmored targets. This is a training standard item used in both training and combat.
		M856	Cartridge, 5.56mm, Tracer, M856	The tracer is intended to permit visible observation of the bullet's in-flight path or trajectory to the point of impact. This is a training standard item used in both training and combat. The M856 tracer cartridge has characteristics similar to the M196 tracer with a slightly longer tracer burnout distance. The M856 is ballistically matched to the M855 ball cartridge. The tracer bullet delivers a visible red light signature through its trajectory. The M856 does not have a steel penetrator.
		MILES	N/A	Used in setting Elevation and Boresight of CROWS unit.

END OF TASK

SURVEILLANCE

The Surveillance mode removes all overlays from the screen, except for azimuth indicator, sight elevation indicator, weapon safe status, camera, FOV, and sensor indicators. In this mode the weapon is super-elevated to a passive (non-aggressive) position.

Perform the following procedure to enter the Surveillance Mode.

1. From the Engagement screen (Figure 8), press FUNCTION (RIGHT toggle DOWN) until you are in the Menu mode. The Menu status is shown in the lower left of the screen. See Figure 8.

2. Ensure the CURSOR is positioned on the Preparation Menu entry point designated by P, in the upper left of the screen. See Figure 10.

3. Press ACCEPT (LEFT toggle RIGHT). This will take you to the Preparation Menu.

4. Position the CURSOR onto the SURVEILLANCE option.

NOTE

Pressing ACCEPT (LEFT toggle RIGHT) in the following step positions the weapon to maximum elevation (Passive Mode). The sensor sight remains in its current position.

5. Press ACCEPT (LEFT toggle RIGHT). A view of the landscape will appear on the screen, see example at Figure 15.

NOTE

The MOTION CONTROL switch will move the mount in all directions and the camera selected (day or thermal) will function normally.

6. Depress DEADMAN switch and use the MOTION CONTROL switch to conduct surveillance.

7. Press LASE (LEFT toggle LEFT) to return to Engagement screen. This returns the weapon to the Aggressive Mode.

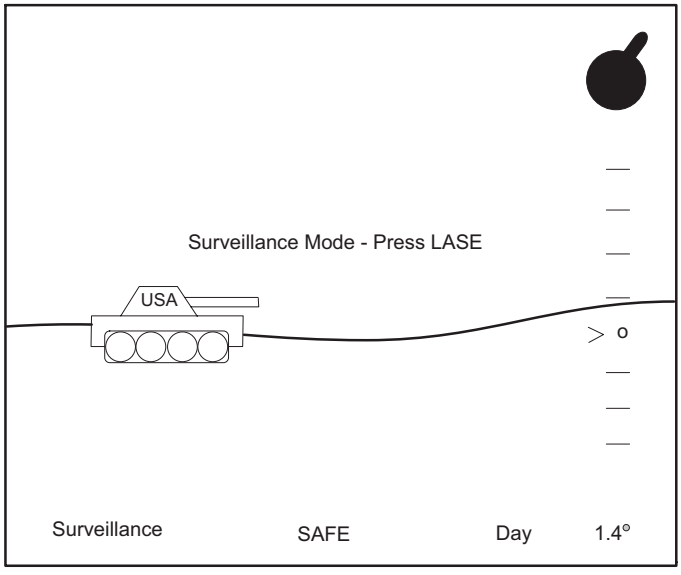


Figure 15. Example of Viewing in Surveillance Mode.

END OF TASK

SECTOR SCAN SETUP

NOTE

Instructions given in this section are based on using the joystick unless otherwise directed.

Perform the following procedure to set up automatic sector scans of desired zones.

1. From the Engagement screen (Figure 8), press FUNCTION (RIGHT toggle DOWN) until you are in the Menu mode. See Figure 8. The Menu status is shown in the lower left of the screen.

2. Ensure the CURSOR is positioned on the Preparation Menu entry point designated by P, in the upper left of the screen. See Figure 10.

3. Press ACCEPT (LEFT toggle RIGHT). This will take you to the Preparation Menu.

4. Position the CURSOR on the SECTOR SCAN SETUP option. See Figure 16.

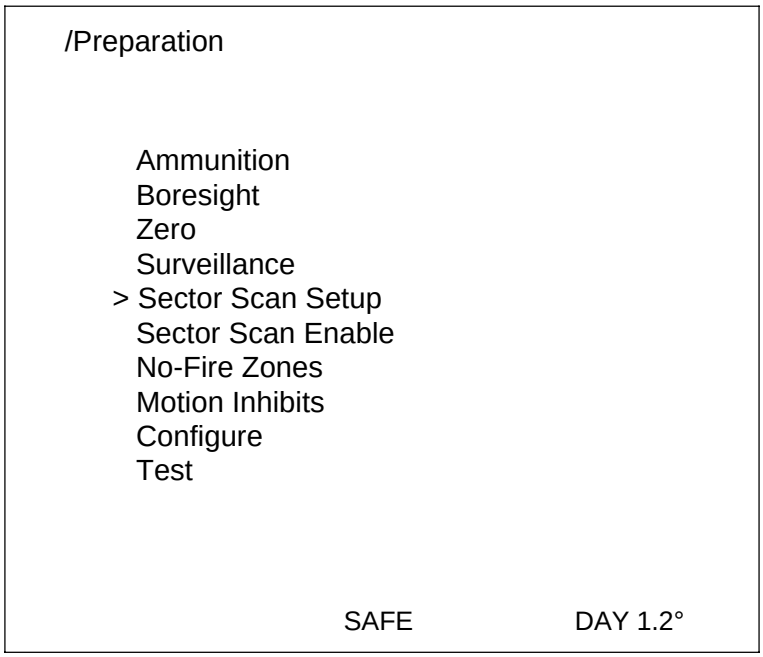


Figure 16. Preparation Menu with Sector Scan Setup Option Selected.

SECTOR SCAN SETUP - Cont

5. Press ACCEPT (LEFT toggle RIGHT), bringing up the Automatic Sector Scan screen shown in Figure 17.

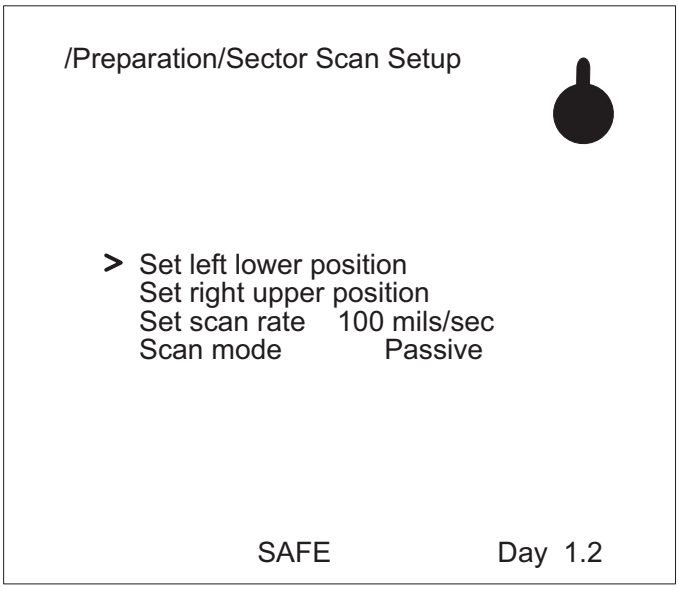


Figure 17. Automatic Sector Scan Setup Menu with Set Left Lower Position Option Selected.

6. To select a starting LOWER LEFT Sector Scan position, depress the DEADMAN switch and use the MOTION CONTROL switch (see Figure 18) to move the desired LOWER LEFT Sector Scan position to the approximate center of the DU screen.

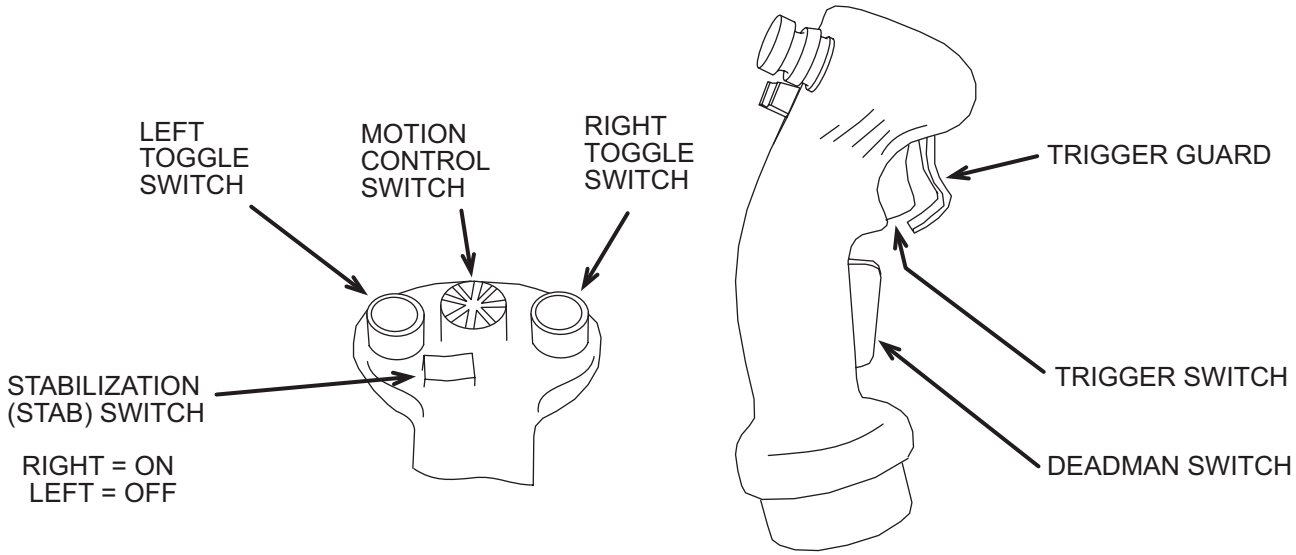


Figure 18. Joystick – Motion Control Switch.

7. Press ACCEPT (LEFT toggle RIGHT). Ensure an asterisk (*) appears at the end of SET LEFT LOWER POSITION line. See Figure 19.

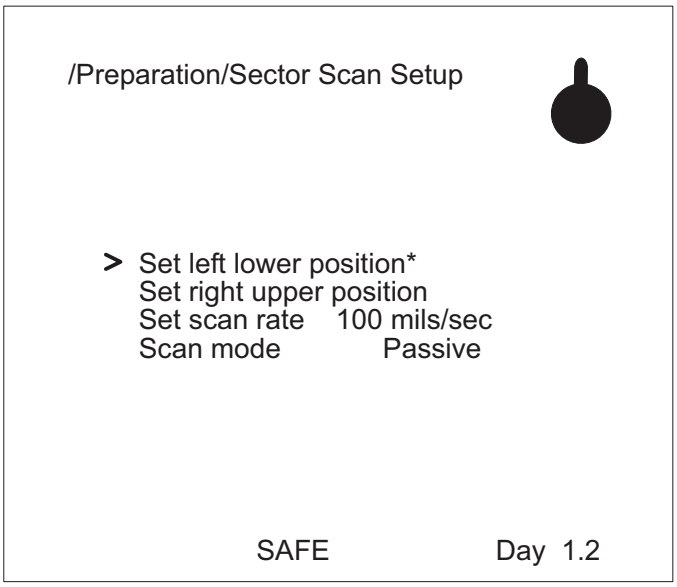


Figure 19. Automatic Sector Scan Setup Menu, with Asterisk at End of Set Left Lower Position.

8. Position the CURSOR on the SET RIGHT UPPER POSITION option using the CURSOR CONTROL switch. See Figure 20.

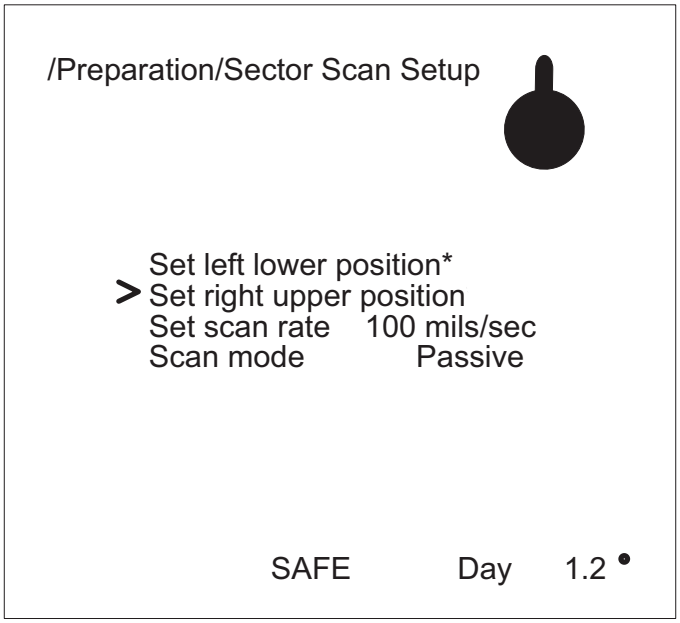


Figure 20. Automatic Sector Scan Setup Menu, Set Right Upper Position.

9. To finish selection of the sector scanning area, depress the DEADMAN switch and use the MOTION CONTROL switch (see Figure 18) to move the camera shot of the desired UPPER RIGHT Sector Scan position to the approximate center of the screen.

SECTOR SCAN SETUP - Cont

10. Press ACCEPT (LEFT toggle RIGHT). Ensure an asterisk (*) appears at the end of the SET RIGHT UPPER POSITION line. See Figure 21.

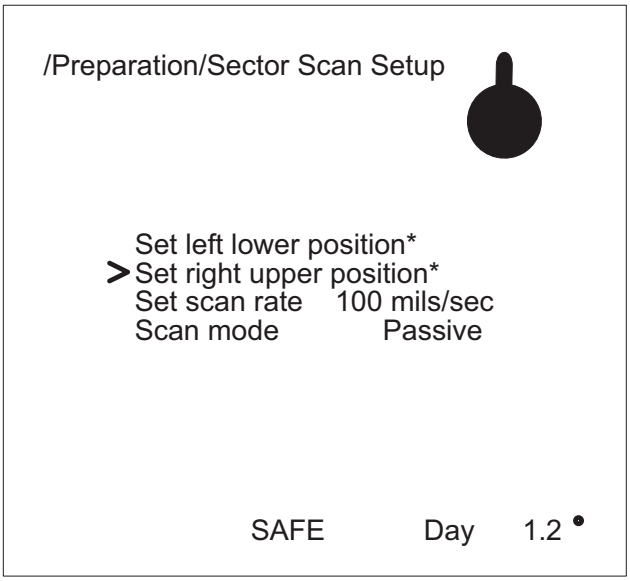


Figure 21. Automatic Sector Scan Setup Menu, with Asterisk on Set Right Upper Position.

11. To change the scan rate from default rate of 100 mils/sec:

    a. Position CURSOR on the SET SCAN RATE option using the CURSOR CONTROL switch. See Figure 22.

    b. Press ACCEPT (LEFT toggle RIGHT).

    c. Change scan rate as required. Refer to Operator Data Entry section, Tables 2 and 3.

    d. Press ACCEPT (LEFT toggle RIGHT).

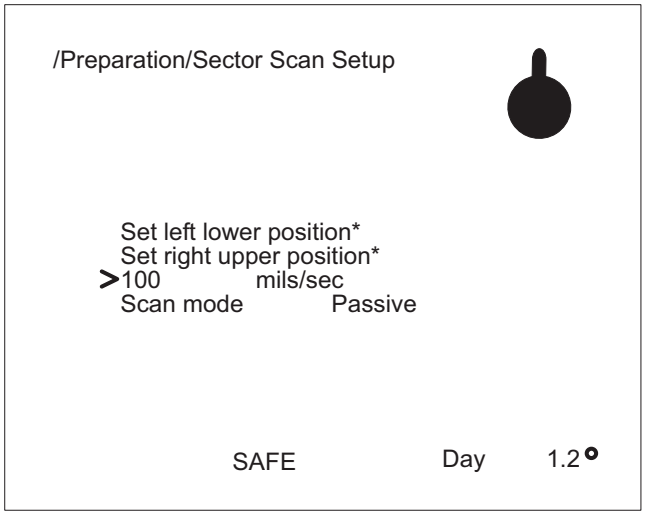


Figure 22. Automatic Sector Scan Setup Menu, Setting Scan Rate.

Changing Scan Mode

Perform the following procedure to change the scan mode.

NOTE

This procedure is password protected. You must enable "Allow Changes" in the Sector Scanning section. See Configure/Engagement/Rules of Engagement Menu.

1. Perform steps 1 through 5 in the Sector Scan Setup section.
2. Position the CURSOR on the SCAN MODE option. See Figure 23.
3. Press ACCEPT (LEFT toggle RIGHT) to toggle between Aggressive and Passive.

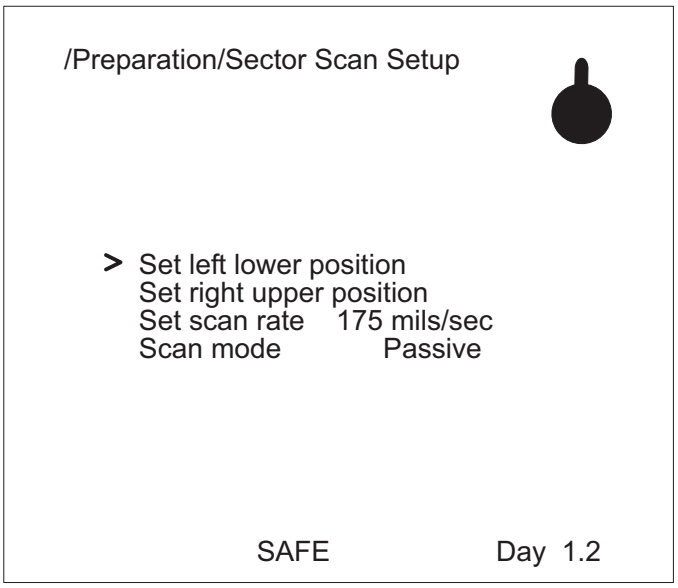


Figure 23. Automatic Sector Scan Setup Menu, Scan Mode Option Selected.

END OF TASK

Sector Scan Enable

Enabling Sector Scan

Perform the following procedure to enable the sector scan mode.

1. From the Engagement screen (Figure 8), press FUNCTION (RIGHT toggle DOWN) until you are in the Menu mode. See Figure 8. The Menu status is shown in the lower left of the screen.
2. Ensure the CURSOR is positioned on the Preparation Menu entry point designated by P, in the upper left of the screen. See Figure 10.
3. Press ACCEPT (LEFT toggle RIGHT). This will take you to the Preparation Menu.

SECTOR SCAN SETUP - Cont

Sector Scan Enable - Cont

Enabling Sector Scan - Cont

4. Position the CURSOR on the SECTOR SCAN ENABLE option. See Figure 24.

5. Press ACCEPT (LEFT toggle RIGHT) to enable sector scan. The Engagement Mode screen will be displayed. See Figure 8.

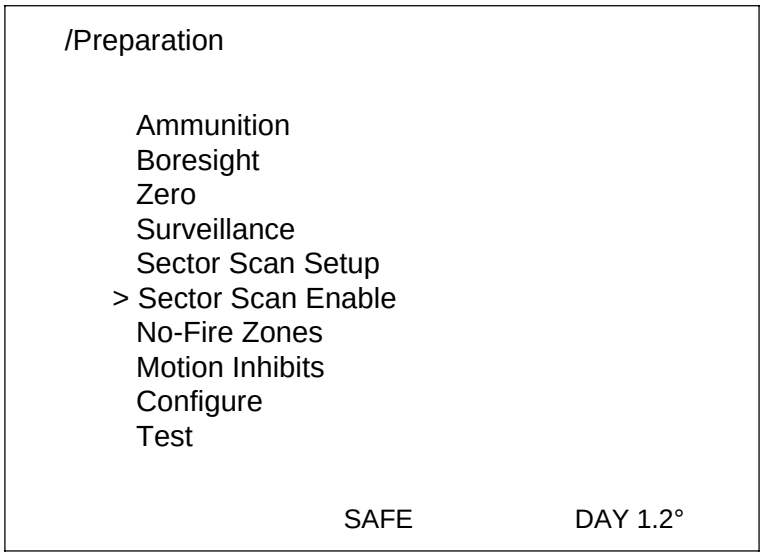


Figure 24. Preparation Menu with Sector Scan Enable Option Selected.

END OF TASK

Disabling Sector Scan

Perform the following procedure to disable the sector scan mode.

1. Press DEADMAN switch on joystick. See Figure 18.

2. Sector Scan can also be disabled by pressing LASE (LEFT toggle LEFT). See Figure 25.

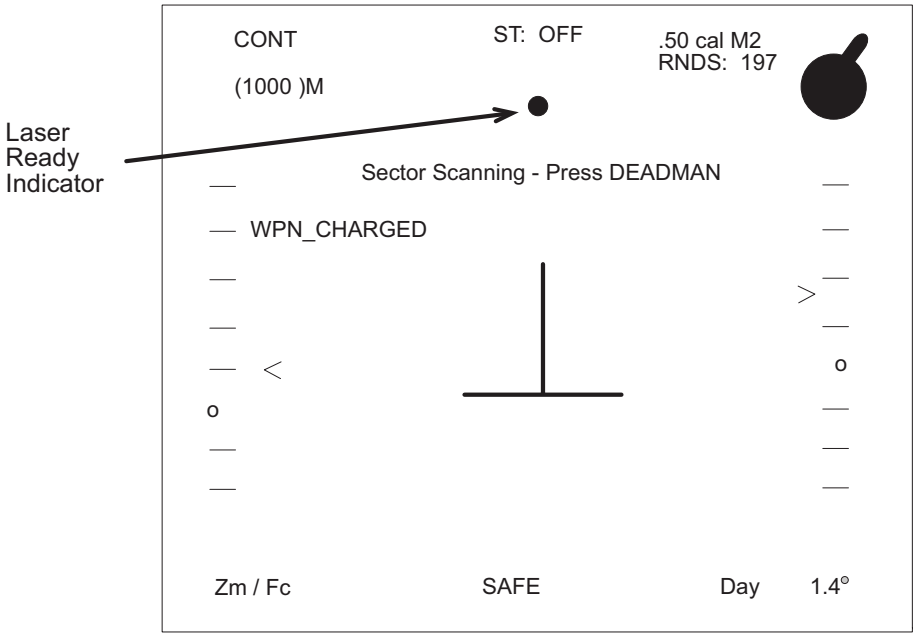


Figure 25. Disabling Sector Scan.

END OF TASK

NO-FIRE ZONES MODE

Description of No-Fire Zones

No-Fire Zones are used to disable firing in specified areas about the vehicle on which the CROWS is installed and for areas specified and defined by the operator. If the weapon is aimed at one of these No-Fire Zones, the trigger will be disabled.

No-Fire Zones are sectors with respect to the vehicle. No-Fire Zones intended to protect certain areas or objects external to the vehicle (objects not normally attached to the vehicle) may be rendered useless once the vehicle moves. The No-Fire Zone will still be present, but it may no longer cover the intended area or object.

The CROWS contains the following different types of No-Fire Zones:

Factory Preset No-Fire Zones:
- Factory Preset Default No-Fire Zones
- Factory Preset Overridable No-Fire Zones

Custom No-Fire Zones

The Factory Preset Default No-Fire zones and the Factory Preset Overridable No-Fire zones are referred to as Factory Preset No-Fire zones. It is important to understand each of the No-Fire Zones, combinations of the No-Fire zones, and the effect in use of the Safety Over-Ride switch on the No-Fire zones.

NO-FIRE ZONES MODE - Cont

Description of No-Fire Zones - Cont

CAUTION

The SAFETY OVER-RIDE switch on the SPU is used ONLY in emergency situations as ordered by the Commander. The Factory Preset Overridable No-Fire Zones and the Custom No-Fire zones can be overridden by positioning the SAFETY OVER-RIDE switch to the ON position. Refer to WP 0022, Emergency Use of Safety Over-Ride Switch section, and to WP 0024, Troubleshooting Index. Positioning the SAFETY OVER-RIDE switch to the ON position has no effect on the Factory Preset Default No-Fire Zones. Failure to follow these instructions may cause equipment damage.

Any attempt to add additional Custom No-Fire zones will reset (DELETE) all previously defined Custom No-Fire zones. Failure to follow this CAUTION will result in loss of previously defined Custom No-Fire zones.

The total combination of Factory Preset Overridable No-Fire Zones and Custom No-Fire zones cannot exceed 20.

Power cycling the CROWS system retains the previous No-Fire zones selected and accepted.

Factory Preset No-Fire Zones

Factory Preset zones are configured for predefined vehicle configurations on which the CROWS is installed, which enables the specific Factory Preset zones for the vehicle. These Factory Preset zones cannot be changed by the operator. Factory Preset zones consist of the Factory Preset Default No-Fire zones and the Factory Preset Overridable No-Fire zones. These zones are defined as follows:

Factory Preset Default No-Fire Zones -- Always active for the selected vehicle configuration.

Factory Preset Overridable No-Fire Zones --Active for the selected vehicle configuration only when the SAFETY OVER-RIDE switch on the Switch Panel Unit (SPU) is in the OFF position. The Factory Preset Overridable No-Fire Zones may be disabled by positioning the SAFETY OVER-RIDE switch to the ON position.

Custom No-Fire Zones

Custom No-Fire Zones may be defined by the operator at any time. All Custom No-Fire zones must be defined and accepted (SAVED TO MEMORY) during the same setting.

Display No-Fire Zones Options

Perform the following procedures to display the No-Fire Zones options.

WARNING

When defining Custom No-Fire Zones, the Stabilization (STAB) switch on the Joystick must be in the OFF position. Failure to follow this instruction may result in serious personal injury or equipment damage.

1. Press LEFT on the STAB switch to ensure it is in the OFF position.
2. From the Engagement screen (Figure 8), press FUNCTION (RIGHT toggle DOWN) until you are in the Menu mode. See Figure 8. Menu is shown in the lower left of the screen.
3. Ensure the CURSOR is positioned on the Preparation Menu entry point designated by P, shown in the upper left of the screen. See Figure 10.
4. Press ACCEPT (LEFT toggle RIGHT). This will take you to the Preparation Menu.
5. Position the CURSOR onto the NO-FIRE ZONES option, as shown in Figure 26.

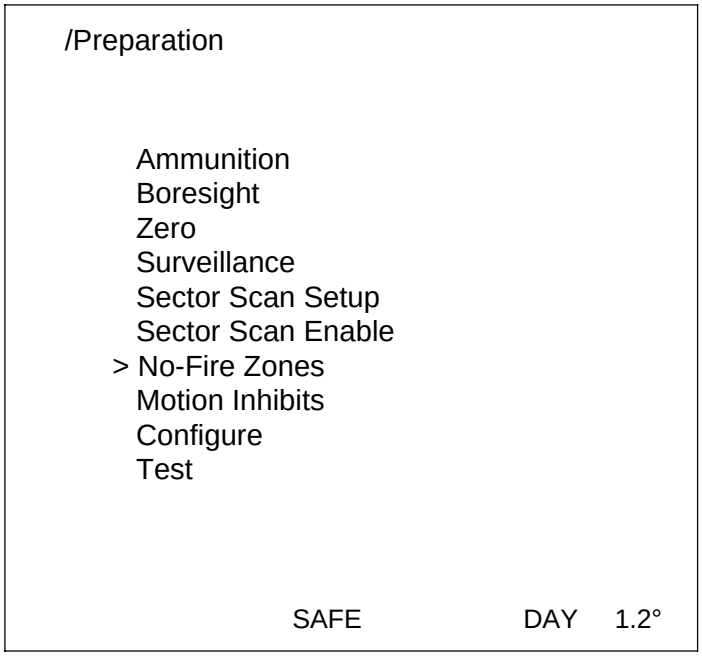


Figure 26. Preparation Menu with No-Fire Zones Option Selected.

NO-FIRE ZONES MODE - Cont

Display No-Fire Zones Options - Cont

6. Press ACCEPT (LEFT toggle RIGHT) to display the No-Fire Zone Selection Menu. See Figure 27.

NOTE

There are three options listed in the No-Fire Zones Options Selection Menu shown in Figure 27.

(1) Selecting the USE FACTORY PRESET ZONES option activates Factory Preset Default zones and Factory Preset Overridable zones. Custom No-Fire zones are inactive.

(2) Selecting the USE CUSTOM ZONES option activates all three types of zones: Factory Preset Default zones, Factory Preset Overridable zones, and Custom No-Fire zones.

(3) Selecting the DEFINE CUSTOM NO-FIRE ZONES option will advance to the Define Custom No-Fire Zones Screen where Custom No-Fire zones can be defined, reset (DELETED), or verified, or all zones can be displayed.

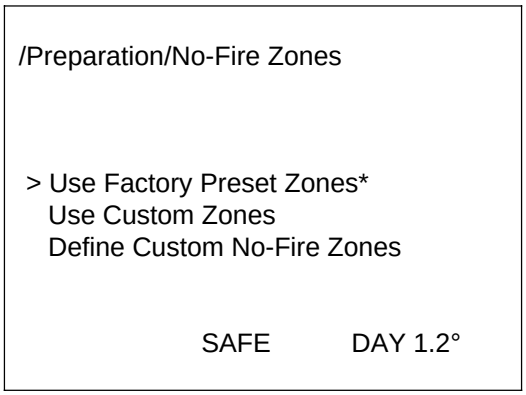


Figure 27. No-Fire Zones Options Selection Menu.

NOTE

The asterisk (*) located in the No-Fire Zones Options Selection Menu shows whether the USE FACTORY PRESET ZONES option or the USE CUSTOM ZONES option is currently selected and active. See Table 5.

Placing the CURSOR next to either the USE FACTORY PRESET ZONES option or the USE CUSTOM ZONES option and pressing ACCEPT (LEFT toggle RIGHT) repositions the asterisk and determines which option is currently selected. The selected No-Fire Zones Option accepted, as indicated by the asterisk (*), will remain as the selected No-Fire Zones Option after a system power cycle.

When the asterisk (*) is positioned next to the USE FACTORY PRESET ZONES option, Factory Preset Default zones and Factory Preset Overridable zones are active. Operator defined Custom No-Fire Zones are inactive.

When the asterisk (*) is positioned next to USE CUSTOM ZONES, all three types of zones: Factory Preset Default zones, Factory Preset Overridable zones, and Operator defined Custom No-Fire zones are active.

NOTE

When the SAFETY OVER-RIDE switch is ON, the SAFETY OVER-RIDE switch will override, but not delete, Factory Preset Overridable zones and operator defined Custom No-Fire zones. When the SAFETY OVER-RIDE switch is ON, only Factory Preset Default zones are active.

Table 5 is a matrix of active and inactive No-Fire Zones depending on selection and acceptance of the USE FACTORY PRESET ZONES***** option or the USE CUSTOM ZONES* option when the SAFETY OVER-RIDE switch is ON, or when the SAFETY OVER-RIDE switch is OFF. The letter “X” in the Active Zones columns indicates which zones are active in the specified configuration.

Table 5. SAFETY OVER-RIDE Switch Position Affect On No-Fire Zones.

Configuration		Active Zones		
SAFETY OVER-RIDE Switch	No-Fire Zones Option Selected	Factory Preset No-Fire		Custom No-Fire
		Default	Overridable	
OFF	Use Custom Zones*	X	X	X
OFF	Use Factory Preset Zones*	X	X	
ON	Use Custom Zones*	X		
ON	Use Factory Preset Zones*	X		

END OF TASK

Display No-Fire Zones Settings

Perform the following procedures to set the No-Fire Zones.

1. Perform the steps in the Display No-Fire Zones Options procedure.

2. Position the CURSOR on the USE CUSTOM ZONES option.

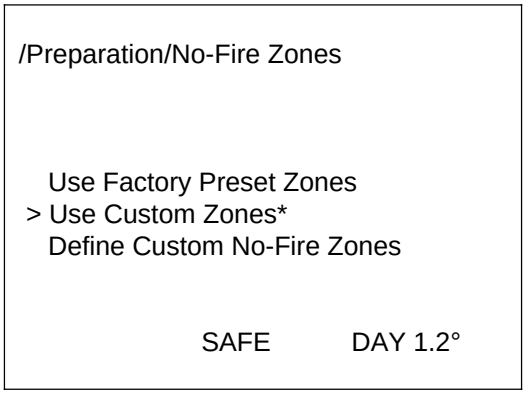


Figure 28. No-Fire Zones Selection Menu with Use Custom Zones Option Selected.

NO-FIRE ZONES MODE - Cont

Display No-Fire Zones Settings - Cont

3. Press ACCEPT (LEFT toggle RIGHT). An asterisk (*) will appear at the end of the Use Custom Zones line. See Figure 28. This enables Factory Preset Default No-Fire zones, Factory Preset Overridable No-Fire zones, and Operator defined Custom No-Fire zones.

NOTE

The USE CUSTOM ZONES option must be enabled to allow Custom No-Fire zones to be displayed. To disable Custom No-Fire Zones, see the Disabling Custom No-Fire Zones section.

4. Position the CURSOR onto the DEFINE CUSTOM NO-FIRE ZONES option. See Figure 29.

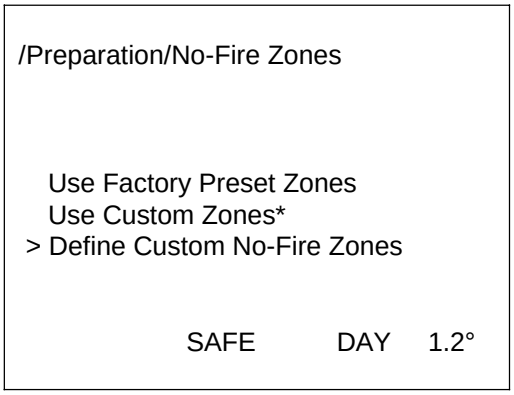


Figure 29. No-Fire Zones Selection Menu with Define Custom No-Fire Zones Selected.

5. Press ACCEPT (LEFT toggle RIGHT) to display the Define Custom No-Fire Zones screen shown in Figure 30. All three No-Fire Zones settings are displayed.

NOTE

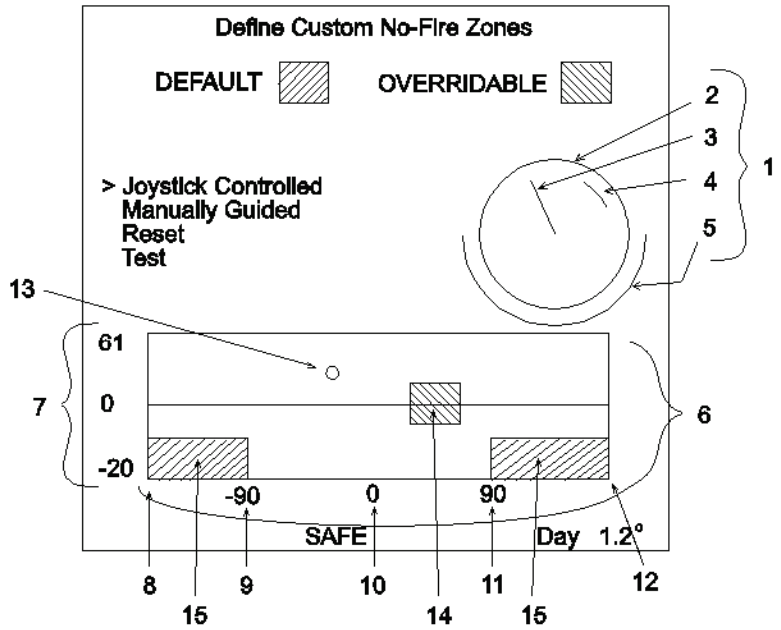
The Define Custom No-Fire Zones screen displays the current No-Fire Zone status. Default zones displayed are orange with right diagonal slashes and overridable zones displayed are red with left diagonal slashes. Default zones are the Factory Preset Default zones. Overridable zones include both the Factory Preset Overridable zones and any operator-assigned Custom No-Fire zones (when enabled).

Figure 30 is an explanation of the symbols found on the Define Custom No-Fire Zones screen.

6. Press LASE (LEFT toggle LEFT) to exit to the Engagement Menu.

NOTE

If Custom No-Fire Zones are not required, see the Disabling Custom No-Fire Zones section.



Legend:

1. AZIMUTH INDICATOR: Shows direction weapon is pointing and No-Fires Zones (NFZs) in the 360° azimuth path of weapon.
2. Circle that represents the 360° azimuth path of weapon.
3. In this example, weapon is pointing to the left at -30° (11 o'clock).
4. Overridable NFZs are shown inside of the 360° azimuth path of weapon. This example shows an overridable NFZ at 30° to 60° azimuth to the front right of weapon system between 1 o'clock and 2 o'clock. See item 14.
5. Factory Preset Default NFZs are shown outside of the 360° azimuth path of weapon. This example shows a factory preset default NFZ in back of weapon system between 3 o'clock and 9 o'clock. Reference item 15.
6. TWO-DIMENSIONAL (2-D) INDICATOR: Shows direction weapon is pointing and NFZs within the elevation limits (-20° to 61°) of weapon and within the 360° azimuth path of weapon.
7. ELEVATION SCALE: Scale showing elevation limits (-20° to 61°) on the 2-D INDICATOR.
8. -180° in azimuth -- Equivalent to directly behind weapon system (6 o'clock). This azimuth direction is equivalent to item 12 because the 2-D INDICATOR wraps around at this azimuth.
9. -90° in azimuth -- Equivalent to directly over the left side of weapon system (9 o'clock).
10. 0° in azimuth -- Equivalent to directly in front of weapon system (12 o'clock)
11. 90° in azimuth -- Equivalent to the directly over the right side of weapon system (3 o'clock)
12. 180° in azimuth – Equivalent to directly behind weapon system (6 o'clock). This azimuth direction is equivalent to item 8 because the 2-D INDICATOR wraps around at this azimuth.
13. DIRECTION OF WEAPON BARREL: The circle shows the direction in both elevation and azimuth that the weapon barrel is pointing. This example shows the weapon pointing to the left at -30° (11 o'clock) and elevated 30°.
14. Shows an example of an overridable NFZ at 30° to 60° azimuth to the front right of weapon system between 1 o'clock and 2 o'clock with an elevation of 20° to -5°. Reference item 4.
15. Shows an example of a Factory Preset Default NFZ from 3 o'clock to 9 o'clock, and an elevation below the weapon of -10° to -20°. This NFZ wraps around in azimuth at item 12 to item 8. Reference item 5.

Figure 30. No-Fire Zones Graphics Description.

END OF TASK

NO-FIRE ZONES MODE - Cont

Define Custom No-Fire Zones

Basic Setup

There are four methods for defining Custom No-Fire Zones. The method required depends on what weapon is installed on CROWS and the ranges of the objects to be protected by the Custom No-Fire Zones.

The four methods are:

Joystick Controlled Method – Used for all weapons except the Mk19 (40 mm) when defining Custom No-Fire Zones at ranges greater than 25 meters.

Mk19 (40 mm) Joystick Controlled Method – Used only for the Mk19 (40 mm) when defining Custom No-Fire Zones at ranges greater than 25 meters.

Manually Guided Method – Used for all weapons except the Mk19 (40 mm) when defining Custom No-Fire Zones at ranges of 25 meters or less.

Mk19 (40 mm) Manually Guided Method – Used only for the Mk19 (40 mm) when defining Custom No-Fire Zones at ranges of 25 meters or less.

WARNING

Use only the Manually Guided Method (or the Mk19 (40 mm) Manually Guided Method when a Mk19 is installed) when defining Custom No-Fire Zones at ranges of 25 meters or less.

Take into account weapon dispersion when establishing Custom No-Fire Zones by leaving a buffer around the desired area to be protected.

Failure to follow these instructions may result in serious personal injury and/or equipment damage.

Both the Manually Guided Method and the Mk19 (40 mm) Manually Guided Method are required because of the parallax created from the line of sight (LOS) of the weapon and the LOS of the sensor unit (parallax being the displacement of an object as seen from two different points that are not on a parallel line with the object). Use the Joystick Controlled Method and the Mk19 (40 mm) Joystick Controlled Method for ranges beyond 25 meters.

CAUTION

Previous operator defined Custom No-Fire Zones will be reset (DELETED) after acceptance of the following procedures.

Performing the following procedures to set up operator defined Custom No-Fire Zones restricts the ability of the weapon to fire into the desired CROWS Custom No-Fire Zones. After setup is complete, proceed to either the Manually Guided Method subsection for ranges of 25 meters or less, or the Joystick Controlled Method for ranges beyond 25 meters. In order to set Custom No-Fire Zones for a mixture of ranges both closer than and beyond 25 meters, first perform the Manually Guided Method, then the Joystick Controlled Method. Do not accept the settings until after all Custom No-Fire zones are defined.

If the weapon installed is a Mk19, proceed to either the Mk19 (40 mm) Manually Guided Method section for ranges of 25 meters or less, or the Mk19 (40 mm) Joystick Controlled Method for ranges beyond 25 meters. In order to set Custom No-Fire Zones for a mixture of ranges both closer than and beyond 25 meters, first perform the Mk19 (40 mm) Manually Guided Method, then the Mk19 (40 mm) Joystick Controlled Method. Do not accept the settings until after all Custom No-Fire zones are defined.

WARNING

When defining Custom No-Fire Zones, the Stabilization (STAB) switch on the joystick must be in the OFF position. Failure to follow this instruction may result in serious personal injury or equipment damage.

1. Press LEFT on the STAB switch to ensure it is in the OFF position.

2. From the Engagement screen (Figure 8), press FUNCTION (RIGHT toggle DOWN) until the Zm/Fc mode is shown in the lower left portion of the screen.

WARNING

Due to differences in weapon dispersion, Custom No-Fire Zones must be redefined every time a new weapon type is installed, even if they are the same Custom No-Fire Zone(s) as previously defined. Failure to follow this warning may result in personal injury.

NOTE

The value selected from Table 6 is based on the weapon installed in the CROWS system. The value selected is based on the camera setting (daylight or thermal) used at the time the Custom No-Fire Zones are defined. Use the daylight camera when any light is available. Use the thermal camera only when no light is available.

For fine adjustment of FOV, use the DU CURSOR CONTROL switch.

3. Set the Field of View shown in the lower right portion of the display screen to the appropriate Field of View value for the weapon listed in Table 6, by zooming in (LEFT toggle UP) or zooming out (LEFT toggle DOWN) until the desired weapon FOV is achieved.

NOTE

Situational awareness may be reduced or limited due to the FOV change required while defining Custom No-Fire Zones.

4. RIGHT toggle LEFT/RIGHT to adjust FOCUS. Choose a midpoint between desired No Fire Zones.

Table 6. Field of View (FOV) Selection Table.

Weapon	Daylight Camera FOV	Thermal Camera FOV
M2 (.50 cal)	2.8°	3.6°
Mk19 (40 mm)	9.0°	10.8°
M240B (7.62 mm)	2.5°	3.6°
M249 (5.56 mm)	2.5°	3.6°

5. Press FUNCTION (RIGHT toggle DOWN) until the Menu mode is shown in the lower left portion of the screen.

6. Ensure the CURSOR is positioned on the Preparation Menu entry point designated by P in the upper left of the screen. See Figure 10.

7. Press ACCEPT (LEFT toggle RIGHT). This will take you to the Preparation Menu.

NO-FIRE ZONES MODE - Cont

Define Custom No-Fire Zones

Basic Setup - Cont

8. Position the CURSOR onto the NO-FIRE ZONES option, as shown in Figure 31.

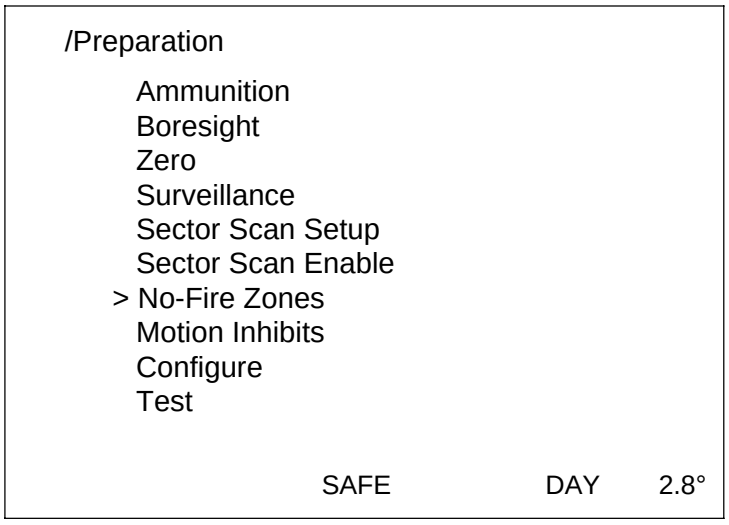


Figure 31. Preparation Menu with No-Fire Zones Option Selected.

9. Press ACCEPT (LEFT toggle RIGHT), bringing up the No-Fire Zones Selection Menu shown in Figure 32.

NOTE

The asterisk (*) shown in the No-Fire Zone Selection Menu can be positioned either next to USE FACTORY PRESET ZONES or USE CUSTOM ZONES. When positioned next to USE FACTORY PRESET ZONES, Custom No-Fire Zones are inactive. When positioned next to USE CUSTOM ZONES, Custom No-Fire Zones are active. The status of both types of Factory Preset No-Fire Zones (Default and Overridable) is not affected by the asterisk position. See Table 5.



Figure 32. No-Fire Zones Options Selection Menu.

10. Position the CURSOR onto the USE CUSTOM ZONES option. See Figure 33.



Figure 33. No-Fire Zones Selection Menu with Use Custom Zones Selected.

11. Press ACCEPT (LEFT toggle RIGHT). An asterisk (*) appears at the end of the USE CUSTOM ZONES option indicating Custom No-Fire Zones are enabled.

NOTE

Use Custom Zones must be enabled to allow Custom No-Fire Zones to be defined.

12. Position the CURSOR on the DEFINE CUSTOM NO-FIRE ZONES option, as shown in Figure 34.

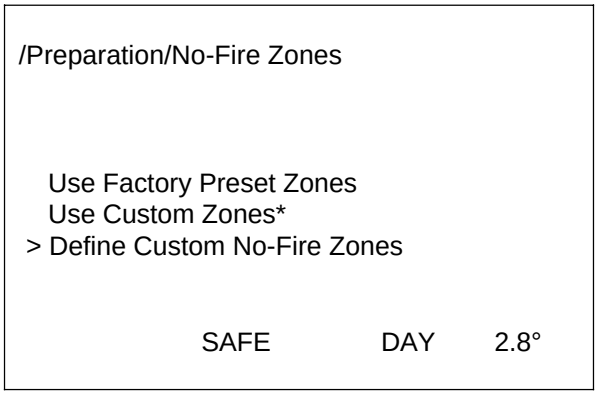


Figure 34. No-Fire Zones Selection Menu with Define Custom No-Fire Zones Selected.

NO-FIRE ZONES MODE - Cont

Define Custom No-Fire Zones - Cont

Basic Setup - Cont

NOTE

Factory Preset Default No-Fire Zones and Factory Preset Overridable No-Fire Zones are not shown in Figures 35 through 77 for clarity.

13. Press ACCEPT (LEFT toggle RIGHT) to display the Define Custom No-Fire Zones screen as shown in Figure 35.

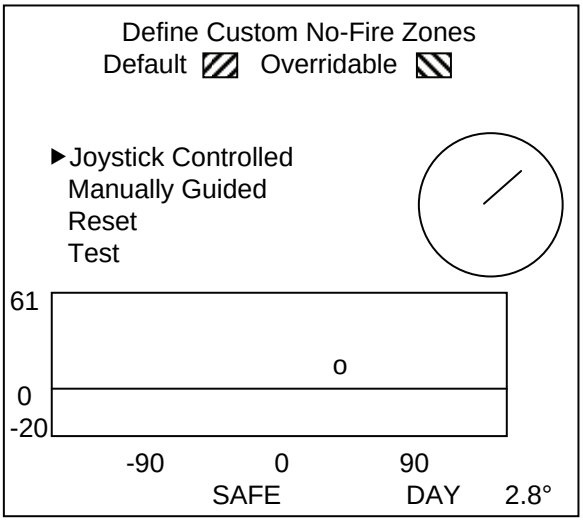


Figure 35. Define Custom No-Fire Zones Menu Screen.

NOTE

In order to set Custom No-Fire Zones for a mixture of ranges both closer than and beyond 25 meters, first perform the Manually Guided Method, then the Joystick Controlled Method. Do not accept the settings until after all Custom No-Fire zones are defined.

If the weapon installed is the Mk19, first perform the Mk19 (40 mm) Manually Guided Method, then the Mk19 (40 mm) Joystick Controlled Method. Do not accept the settings until after all Custom No-Fire zones are defined.

14. Depending on the range of the Custom No-Fire Zone to be defined, proceed to either the Manually Guided Method for ranges of 25 meters or less or the Joystick Controlled Method for ranges beyond 25 meters. If the weapon installed is the Mk19 (40 mm), proceed to either the Mk19 (40 mm) Manually Guided Method for ranges of 25 meters or less or the Mk19 (40 mm) Joystick Controlled Method for ranges beyond 25 meters.

END OF TASK

Joystick Controlled Method

WARNING

The Joystick Controlled Method is used for establishing Custom No-Fire Zones at ranges beyond 25 meters from the CROWS for all weapons except the Mk19 (40 mm) weapon. Use only the Manually Guided Method when defining Custom No-Fire Zones at ranges of 25 meters or less.

Do not use the following Joystick Controlled Method section when a Mk19 (40 mm) weapon is installed on the CROWS. Proceed to the Mk19 (40 mm) Joystick Controlled Method section for the procedures to define Custom No-Fire Zones at ranges beyond 25 meters with a Mk19 (40 mm) weapon installed. Proceed to the Mk19 (40 mm) Manually Guided Method section for the procedures to define Custom No-Fire Zones at ranges of 25 meters or less with a Mk19 (40 mm) weapon installed.

Ensure weapon is evacuated of rounds and chamber is cleared IAW the applicable weapon TM prior to performing this procedure. Remove and secure any rounds that have been cleared.

Dispersion of weapon rounds firing must be considered when defining a Custom No-Fire Zone. Ensure a buffer allowing for weapon rounds firing dispersion is provided.

For any Custom No-Fire Zones established at the upper limit of weapon elevation (61º) and/or at the lower limit of weapon elevation (-20º depression), caution must be applied when firing near the upper limit of weapon elevation (61º) and/or near the lower limit of weapon elevation (-20º depression). It is possible that the Custom No-Fire Zone may be disabled at each of these extremes.

Failure to follow these instructions may result in serious personal injury and/or equipment damage.

CAUTION

All Custom No-Fire Zones previously defined and accepted will be reset (DELETED) after acceptance of the following procedures.

NOTE

DU screen image may be out of focus.

Perform the following procedures to define Custom No-Fire Zones for ranges beyond 25 meters.

1. Ensure that CROWS is not currently configured with a Mk19 (40 mm) weapon installed. If the CROWS has a Mk19 (40 mm) weapon installed, proceed to the Mk19 (40 mm) Joystick Controlled Method section.

NO-FIRE ZONES MODE - Cont

Define Custom No-Fire Zones - Cont

Joystick Controlled Method - Cont

2. Ensure Define Custom No-Fire Zones Basic Setup procedure has been performed.

3. Ensure the CURSOR is positioned on the JOYSTICK CONTROLLED option, as shown in Figure 36.

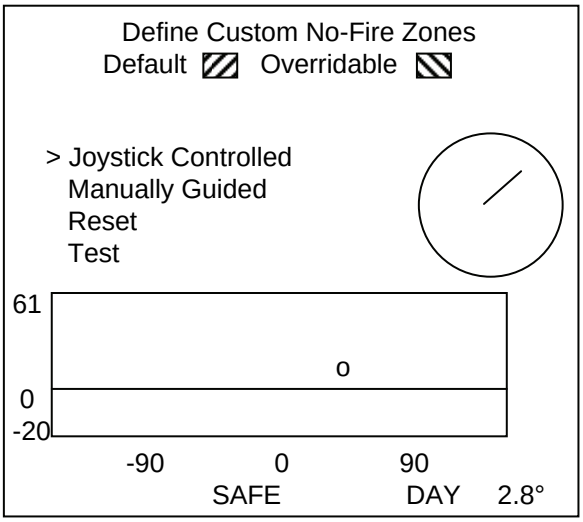


Figure 36. Define Custom No-Fire Zones Screen with Joystick Controlled Selected.

4. Press ACCEPT (LEFT toggle RIGHT). The Define Custom No-Fire Zones screen appears. See Figure 37.

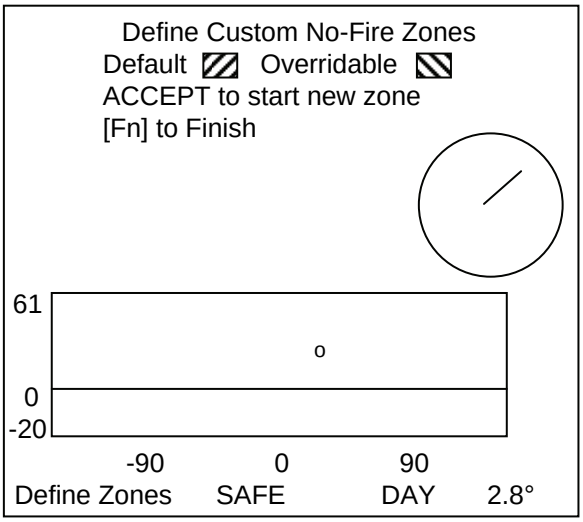


Figure 37. Define Custom No-Fire Zones Screen Prior to Joystick Definition.

5. Using the MOTION CONTROL switch while simultaneously depressing the DEADMAN switch, rotate the weapon mount so that the point that defines the LOWER LEFT corner of the required two-dimensional Custom No-Fire Zone appears in the TOP RIGHT corner of the DU screen as shown by the “Initial Position of Screen” in Figure 38.

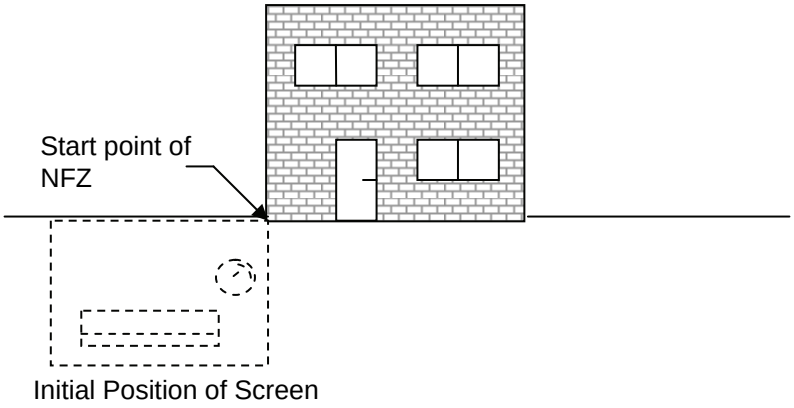


Figure 38. DU Position While Setting No-Fire Zone (NFZ) Around Building.

6. Press ACCEPT (LEFT toggle RIGHT) to start the zone setting. Figure 39 appears.

NOTE

In Figure 39, [Fn] refers to the FUNCTION switch on the DU or joystick RIGHT toggle DOWN.

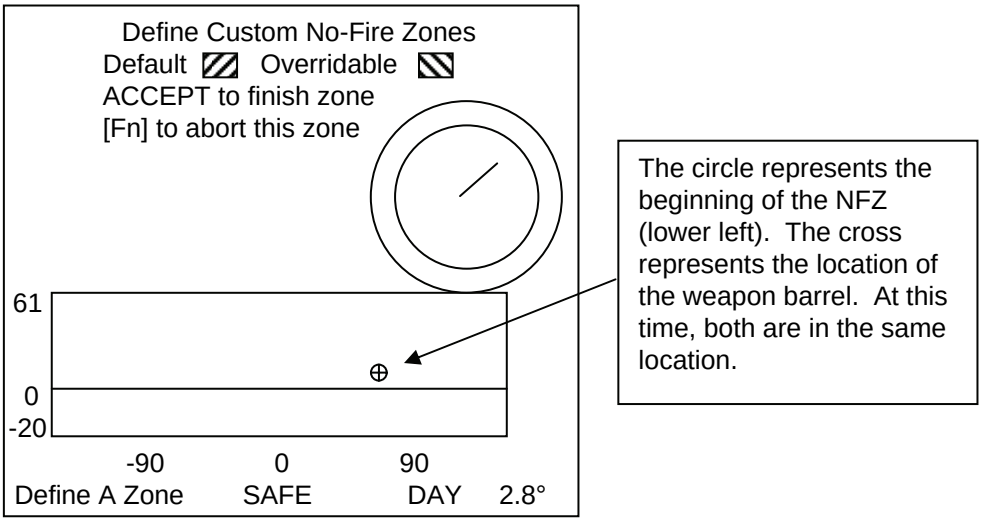


Figure 39. Define Custom No-Fire Zones Screen After Initial Definition.

NO-FIRE ZONES MODE - Cont

Define Custom No-Fire Zones - Cont

Joystick Controlled Method - Cont

7. Using the MOTION CONTROL switch while simultaneously depressing the DEADMAN switch, elevate and rotate the weapon mount CLOCKWISE so that the point which defines the UPPER RIGHT corner of the required two-dimensional Custom No-Fire Zone appears in the LOWER LEFT corner of the DU screen as shown by the “Final Position of Screen” in Figure 40.

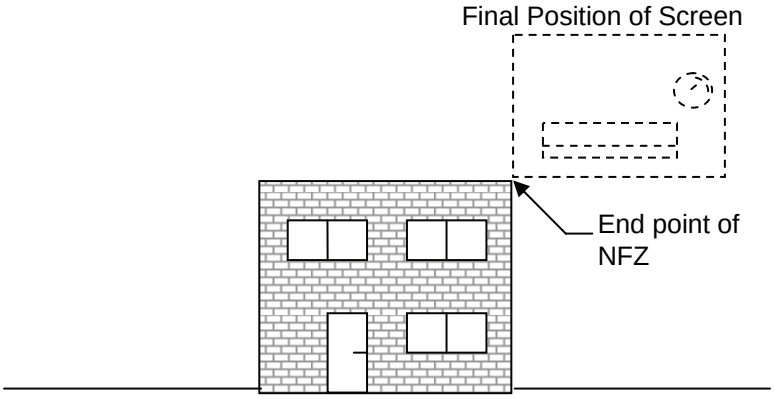


Figure 40. Second DU Position While Setting No-Fire Zone (NFZ) Around Building.

NOTE

A Custom No-Fire Zone is displayed and resized due to the mount movement. See Figure 41.

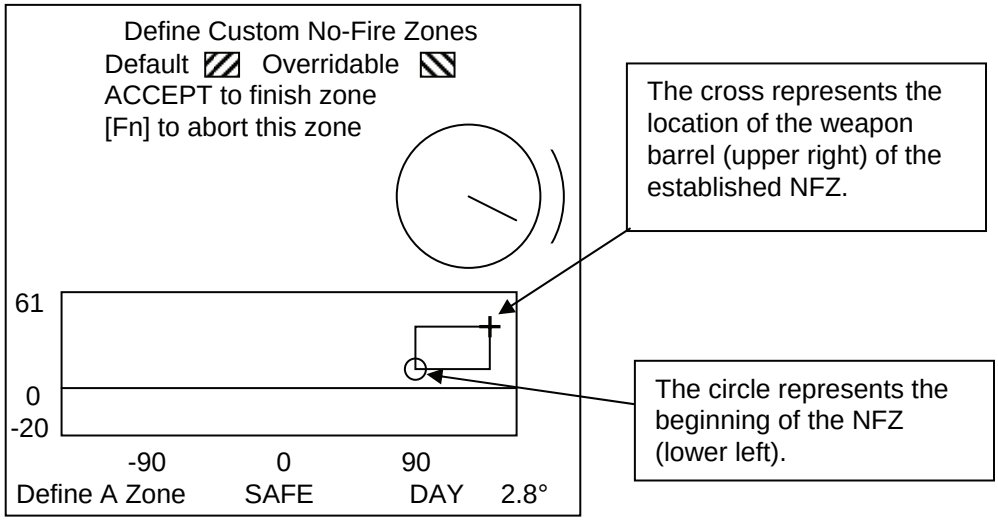


Figure 41. Define Custom No-Fire Zones Screen Before Zone Definition Completed.

NOTE

A correct No-Fire Zone is displayed as a box with two defining corners (Lower Left and Upper Right) as shown in Figure 41. Incorrect No-Fire Zones are shown in Figures 42 through 44.

8. If the No-Fire Zone appears to incorrectly cover elevation parameter from top to bottom as shown in Figure 42, slightly elevate the weapon barrel until the zone appears correctly between the Lower Left corner and the Upper Right corner of the Custom No-Fire zone defined.

   a. If the No-Fire Zone appears to incorrectly cover the elevation parameter from top to bottom as shown in Figure 42, slightly ELEVATE the weapon barrel until the zone appears correctly between the Lower Left corner and the Upper Right corner of the Custom No-Fire Zone defined.

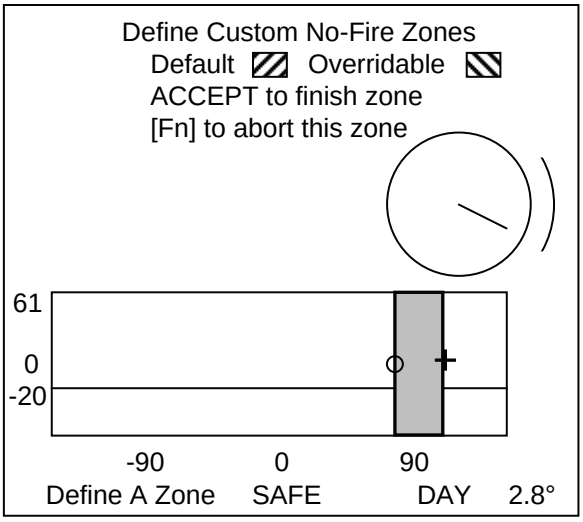


Figure 42. Incorrectly Defined Zone in Elevation.

   b. If the No-Fire Zone appears to incorrectly cover the azimuth parameter from left to right as shown in Figure 42, slightly rotate the weapon barrel CLOCKWISE until the zone appears correctly between the Lower Left corner and the Upper Right corner of the Custom No-Fire zone defined.

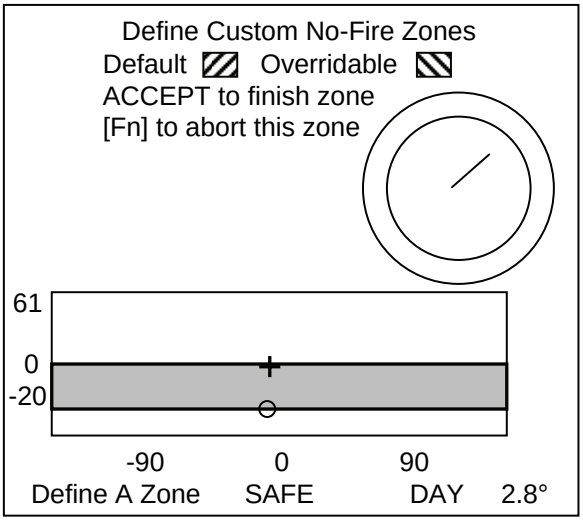


Figure 43. Incorrectly Defined Zone in Azimuth.

NO-FIRE ZONES MODE - Cont

Define Custom No-Fire Zones - Cont

Joystick Controlled Method - Cont

c. If the No-Fire Zone appears to incorrectly cover the elevation parameter from top to bottom AND the azimuth parameter from left to right as shown in Figure 44, slightly ELEVATE the weapon barrel until the zone displayed appears correctly in elevation (will look similar to Figure 43). Then slightly rotate the weapon barrel CLOCKWISE until the zone appears correctly between the Lower Left corner and the Upper Right corner of the Custom No-Fire zone defined.

d. When the Custom No-Fire Zone is displayed correctly, as shown in Figure 45, proceed to step 9.

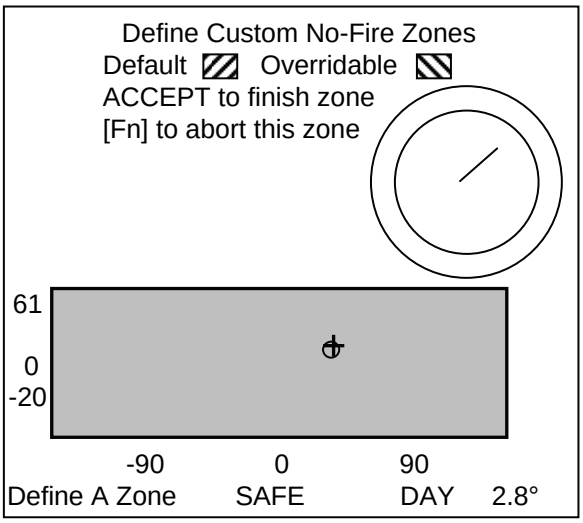


Figure 44. Incorrectly Defined Zone in Both Elevation and Azimuth.

9. Press ACCEPT (LEFT toggle RIGHT) to finish setting the Custom No-Fire Zone. See Figure 45.

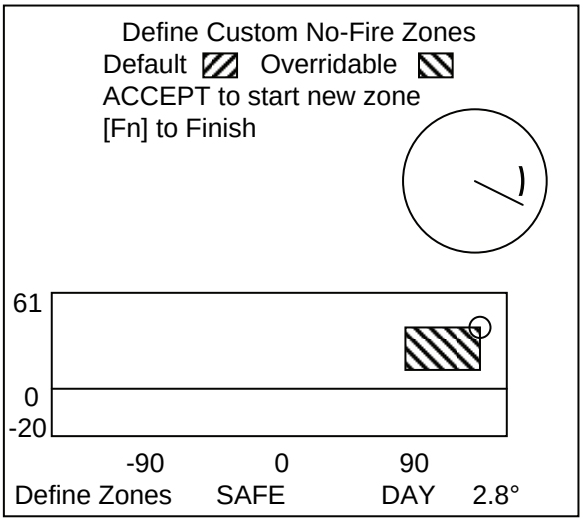


Figure 45. Define Custom No-Fire Zones Screen After Zone is Correctly Defined.

10. Repeat steps 5 through 9 to set up to a maximum of 20 Custom zones, as required. The total combination of Factory Preset Overridable zones and Custom No-Fire Zones cannot exceed 20.

NOTE

All Custom No-Fire Zones created by the CROWS operator must be defined sequentially during the same setting before acceptance.

11. Press FUNCTION (RIGHT toggle DOWN) to finish defining all Custom No-Fire Zone(s) established. The ACCEPT/REJECT screen appears. See Figure 46.

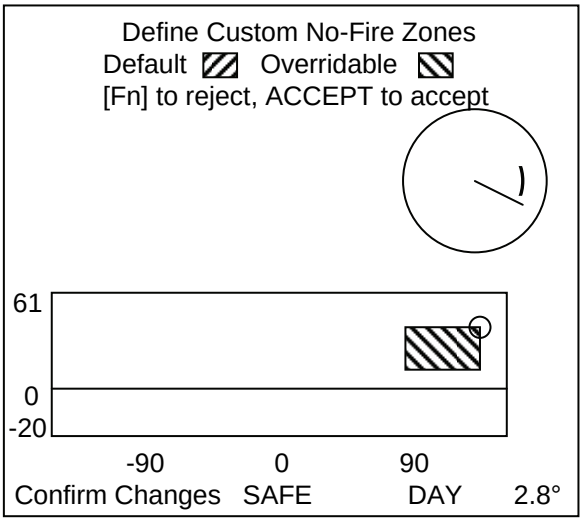


Figure 46. Accept/Reject of No-Fire Zones Screen.

NO-FIRE ZONES MODE - Cont

Define Custom No-Fire Zones - Cont

Joystick Controlled Method - Cont

12. Perform one of the following options:

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any switches. Failure to follow these instructions may result in equipment malfunction or failure.

NOTE

Custom No-Fire Zones which have been previously defined and accepted will be reset (DELETED) after acceptance in the following option step.

a. Press ACCEPT (LEFT toggle RIGHT) to accept the defined Custom No-Fire Zone(s). Figure 47 appears showing all Custom No-Fire Zones established.

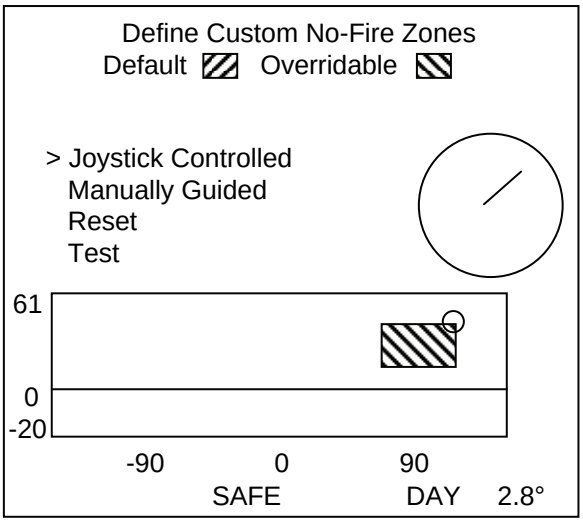


Figure 47. Accepted No-Fire Zones Screen.

b. Press FUNCTION (RIGHT toggle DOWN) to reject (DELETE) all of the Custom No-Fire Zone(s) just established. All previously defined and accepted Custom No-Fire Zones will remain.

13. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

Mk19 (40 mm) Joystick Controlled Method

WARNING

The Mk19 (40 mm) Joystick Controlled Method is used for establishing Custom No-Fire Zones at ranges beyond 25 meters from the CROWS with a Mk19 (40 mm) weapon installed. Proceed to the Mk19 (40 mm) Manually Guided Method section for the procedures to define Custom No-Fire Zones at ranges of 25 meters or less with a Mk19 (40 mm) weapon installed.

Ensure weapon is evacuated of rounds and chamber is cleared IAW the applicable weapon TM prior to performing this procedure. Remove and secure any rounds that have been cleared.

Dispersion of weapon rounds firing must be considered when defining a Custom No-Fire Zone. The Mk 19 grenade has a larger dispersion to consider than other normal weapon rounds. Ensure a sufficient buffer allowing for weapon rounds firing dispersion is provided to ensure the protected zone is not affected by the effective kill radius of the grenade.

After establishing Custom No-Fire Zones for the Mk 19 weapon, caution must be applied when firing near the upper limit of weapon elevation (61º) and near the lower limit of weapon elevation (-20º depression). It is possible that the Custom No-Fire Zone may be disabled at each of these extremes.

Failure to follow these instructions may result in serious personal injury and/or equipment damage.

CAUTION

All Custom No-Fire Zones previously defined and accepted will be reset (DELETED) after acceptance of the following procedures.

NOTE

DU screen image may be out of focus.

Perform the following procedures to define Custom No-Fire Zones for ranges beyond 25 meters when the CROWS has a Mk19 (40 mm) weapon installed.

1. Ensure that CROWS is currently configured with a Mk19 (40 mm) weapon installed.
2. Ensure Define Custom No-Fire Zones Basic Setup procedure has been performed.
3. Ensure the CURSOR is positioned on the JOYSTICK CONTROLLED option, as shown in Figure 36.
4. Press ACCEPT (LEFT toggle RIGHT). The Define Custom No-Fire Zones screen appears. See Figure 37.

NO-FIRE ZONES MODE - Cont

Define Custom No-Fire Zones - Cont

Mk19 (40 mm) Joystick Controlled Method - Cont

5. Using the MOTION CONTROL switch while simultaneously depressing the DEADMAN switch, rotate the weapon mount so that the RIGHT side of the DU Screen is aligned with the LEFT edge of the required Custom No-Fire Zone. See the “Initial Position of Screen” in Figure 48.

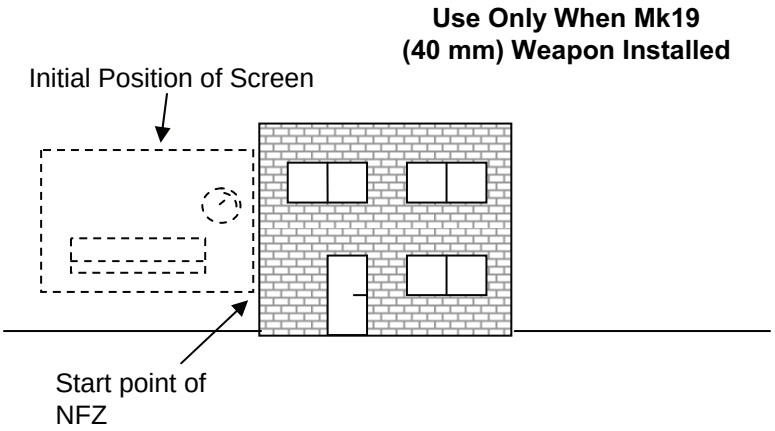


Figure 48. DU Position While Setting Left Side of No-Fire Zone (NFZ) Around Building with Mk19 (40 mm) Installed.

6. Press ACCEPT (LEFT toggle RIGHT) to start the zone setting. Figure 39 appears.

7. Using the MOTION CONTROL switch while simultaneously depressing the DEADMAN switch, rotate the weapon mount HORIZONTALLY CLOCKWISE so that the LEFT side of the DU Screen is aligned with the RIGHT edge of the required two-dimensional Custom No-Fire Zone. See the “Final Position of Screen” in Figure 49.

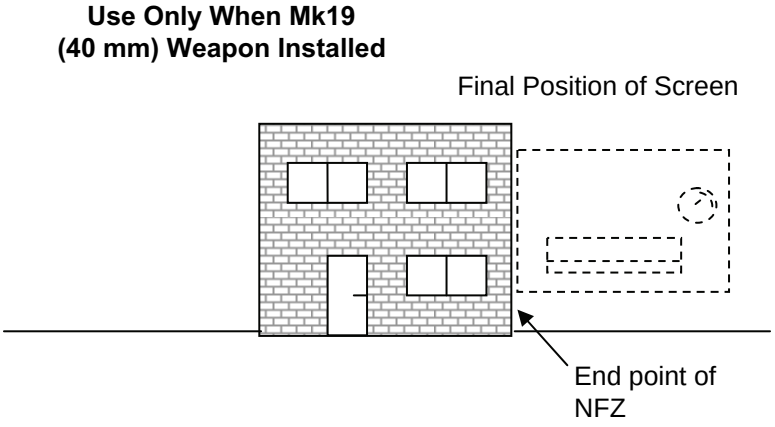


Figure 49. DU Position While Setting Right Side of No-Fire Zone (NFZ) Around Building with Mk19 (40 mm) Installed.

NOTE

A Custom No-Fire Zone is displayed and resized due to the mount movement and should appear as shown in Figure 50.

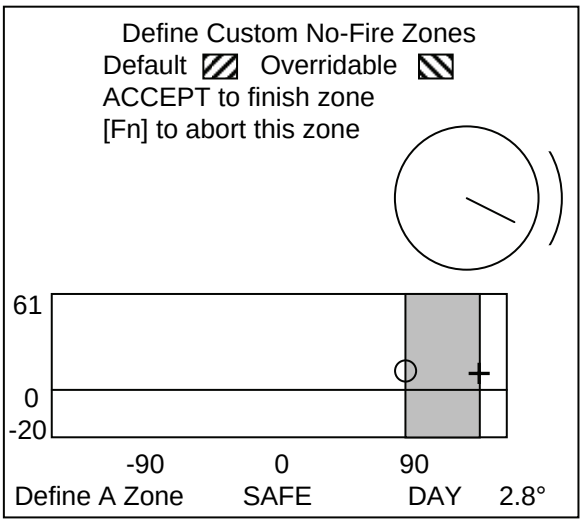


Figure 50. Define Custom No-Fire Zones Screen Before Zone Definition Completed.

NOTE

The Mk19 (40 mm) Joystick Controlled Method is meant to define a Custom No-Fire Zone that inhibits firing from -20° to 61° elevation at particular azimuths. See example in Figure 50. When moving the weapon mount from the left side to the right side in step 7, if movement of the weapon mount is not performed exactly HORIZONTAL, the zone displayed in Figure 50 may not be correct in covering the total -20º to 61º elevation. Either a gap may appear between the upper and lower limits as shown in Figure 51 or a strip may appear as shown in Figure 52.

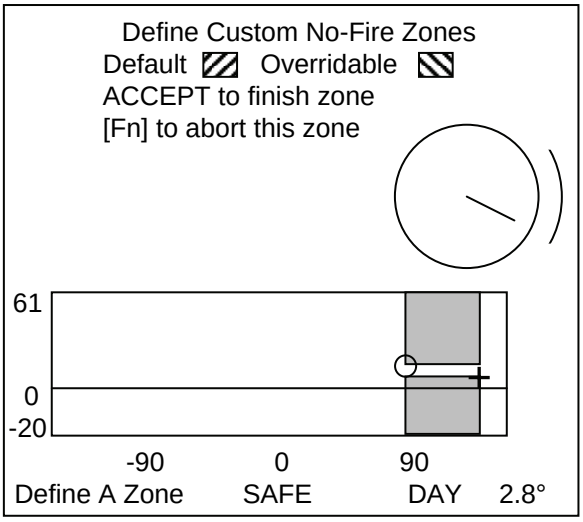


Figure 51. Incorrect Custom No-Fire Zone with Gap.

NO-FIRE ZONES MODE - Cont

Define Custom No-Fire Zones - Cont

Mk19 (40 mm) Joystick Controlled Method - Cont

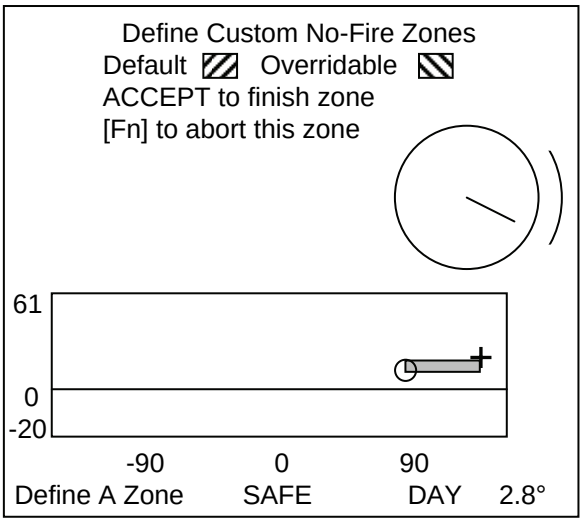


Figure 52. Incorrect Custom No-Fire Zone with Strip.

8. Perform one of the following options:

    a. If a gap or strip appears between -20º to 61º elevation, repeat step 7 until no gap or strip appears. The corrected Custom No-Fire Zone must extend from -20° to 61° in elevation without a gap.

    b. If the no-fire zone is displayed correctly, proceed to step 9.

9. Press ACCEPT (LEFT toggle RIGHT) to finish setting the Custom No-Fire Zone. See Figure 53.

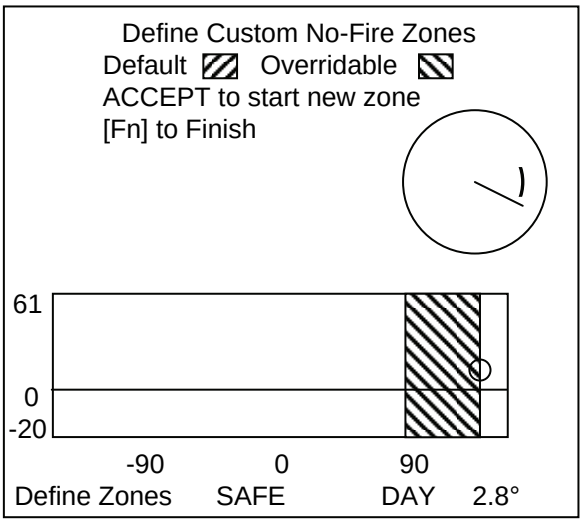


Figure 53. Define Custom No-Fire Zones Screen After Zone Defined.

10. Repeat steps 5 through 9 to set up to a maximum of 20 Custom zones, as required. The total combination of Factory Preset Overridable zones and Custom No-Fire Zones cannot exceed 20.

NOTE

All Custom No-Fire Zones created by the CROWS operator must be defined sequentially during the same setting before acceptance.

11. Press FUNCTION (RIGHT toggle DOWN) to finish defining all Custom No-Fire Zone(s) established. The ACCEPT/REJECT screen appears. See Figure 54.

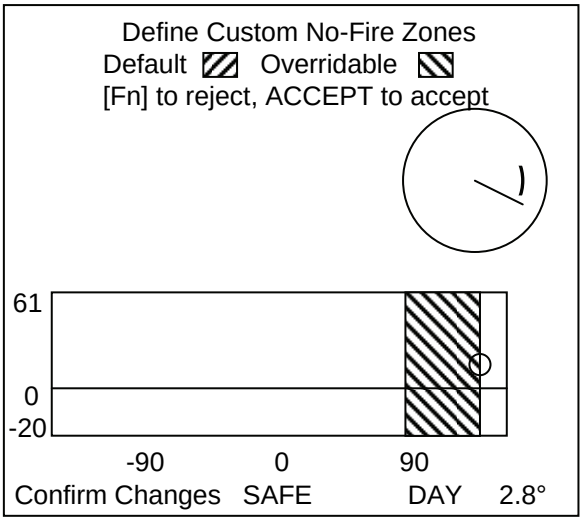


Figure 54. Accept/Reject of No-Fire Zones Screen.

NO-FIRE ZONES MODE - Cont

Define Custom No-Fire Zones - Cont

Mk19 (40 mm) Joystick Controlled Method - Cont

12. Perform one of the following options:

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any switches. Failure to follow these instructions may result in equipment malfunction or failure.

NOTE

Custom No-Fire Zones, which have been previously defined and accepted, will be reset (DELETED) after acceptance in the following option step.

a. Press ACCEPT (LEFT toggle RIGHT) to accept the defined Custom No-Fire Zone(s). Figure 55 appears showing all Custom No-Fire Zones established.

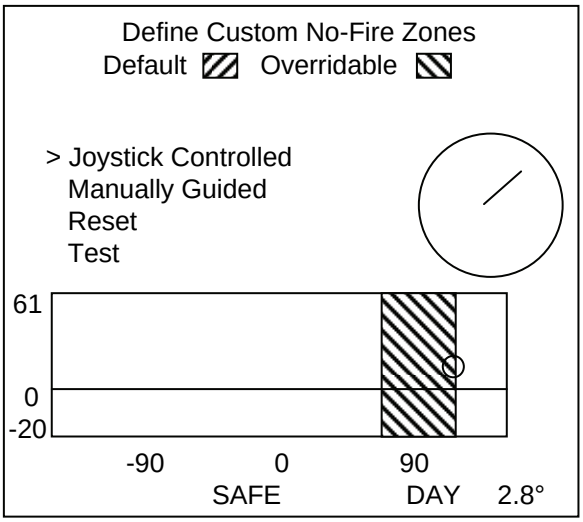


Figure 55. Accepted No-Fire Zones Screen.

b. Press FUNCTION (RIGHT toggle DOWN) to reject (DELETE) all of the Custom No-Fire Zone(s) just established. All previously defined and accepted Custom No-Fire Zones will remain.

13. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

Manually Guided Method

The Manually Guided Method is used for establishing Custom No-Fire Zones for all weapons, except the Mk19 (40 mm) weapon, at ranges of 25 meters or less from the CROWS, or for equipment attached to the vehicle. Use the Mk19 (40 mm) Manually Guided Method for ranges of 25 meters or less from the CROWS, or for equipment attached to the vehicle, if the Mk19 (40 mm) weapon is installed on the CROWS.

The Manually Guided Method is required because of the parallax created from the line of sight (LOS) of the weapon and the LOS of the sensor unit (parallax being the displacement of an object as seen from two different points that are not on a parallel line with the object). Use the Joystick Controlled Method for ranges beyond 25 meters for all weapons except the Mk19 (40 mm) weapon. Use the Mk19 (40 mm) Joystick Controlled Method for ranges beyond 25 meters when the Mk19 (40 mm) weapon is installed.

WARNING

Use only the Manually Guided Method when defining Custom No-Fire Zones at ranges of 25 meters or less. Do not use the Manually Guided Method when the Mk19 (40 mm) weapon is installed. Proceed to the Mk19 (40 mm) Manually Guided Method section for the procedures to define Custom No-Fire Zones for ranges of 25 meters or less with a Mk19 (40 mm) weapon installed.

Ensure weapon is evacuated of rounds and chamber is cleared IAW the applicable weapon TM prior to performing this procedure. Remove and secure any rounds that have been cleared.

Dispersion of weapon rounds firing must be considered when defining a Custom No-Fire Zone. Ensure a buffer allowing for weapon rounds firing dispersion is provided.

For any Custom No-Fire Zones established at the upper limit of weapon elevation (61º) and/or at the lower limit of weapon elevation (-20º depression), caution must be applied when firing near the upper limit of weapon elevation (61º) and/or near the lower limit of weapon elevation (-20º depression). It is possible that the Custom No-Fire Zone may be disabled at each of these extremes.

Failure to follow these instructions may result in serious personal injury and/or equipment damage.

CAUTION

All Custom No-Fire Zones previously defined and accepted will be reset (DELETED) after acceptance of the following procedures.

The Manually Guided Method requires two personnel and good communication between the two in setting Custom No-Fire Zones:

CROWS Operator
CROWS Mount Guide

The CROWS Operator is stationed at the Control Group. The CROWS Mount Guide is stationed at the CROWS Mount while maintaining voice communications with the CROWS Operator.

NO-FIRE ZONES MODE - Cont

Define Custom No-Fire Zones - Cont

Manually Guided Method - Cont

Perform the following procedures to define Custom No-Fire Zones for ranges of 25 meters or less.

1. Ensure that CROWS is not currently configured with a Mk19 (40 mm) weapon installed. If the CROWS has a Mk19 (40 mm) weapon installed, proceed to the Mk19 (40 mm) Manually Guided Method section.
2. CROWS Operator: Ensure the Define Custom No-Fire Zones Basic Setup procedure has been performed.
3. CROWS Operator: Position the CURSOR on the MANUALLY GUIDED option as shown in Figure 56.

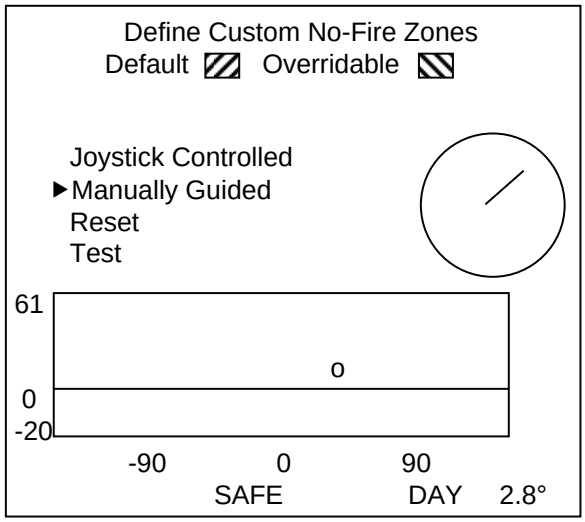


Figure 56. Define Custom No-Fire Zones Screen with Manually Guided Selected.

4. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT). The Define Custom No-Fire Zones screen appears, as shown in Figure 57.

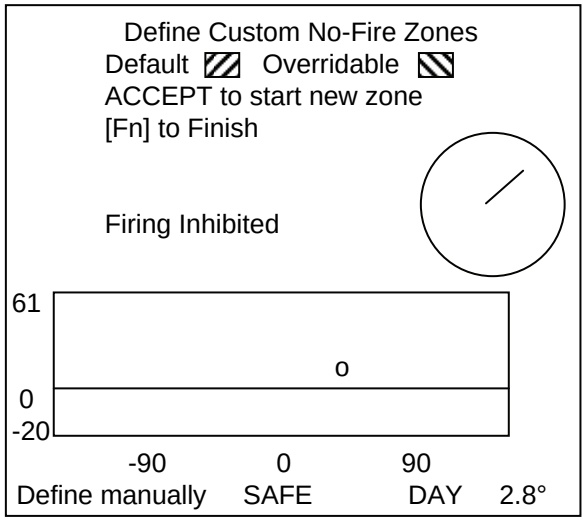


Figure 57. Define Custom No-Fire Zones Screen Prior to Manual Definition.

NOTE

See WP 0036, Table 2, Basic Issue Items (BII), for component parts of the CROWS Boresight Alignment Kit.

5. CROWS Mount Guide: Insert the appropriate Boresight Alignment weapon mandrel and boresight telescope into the weapon barrel bore so that the boresight telescope is positioned vertically (12 o'clock).

NOTE

Do not disturb the position of the weapon barrel and mandrel during rotation of the boresight telescope. Avoid loosening of the mandrel inserted into the weapon barrel by carefully rotating the boresight telescope counterclockwise (CCW).

6. CROWS Mount Guide: See Figure 58 to determine direction of rotation. Rotate the boresight telescope CCW from the vertical position 45°. The image seen through the boresight telescope is now rotated 45° with respect to the boresighting crosshair (see Figure 59).

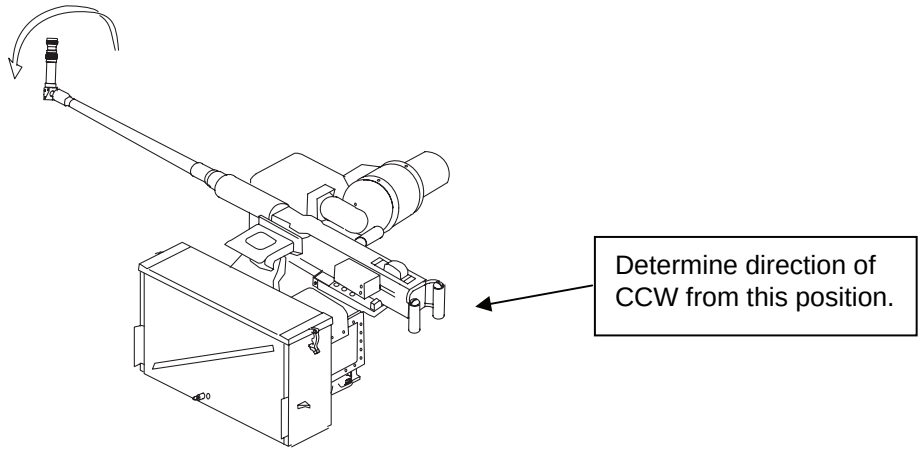


Figure 58. Determination of CCW Rotation of Boresight Telescope in Relation to Weapon Mounted on CROWS.

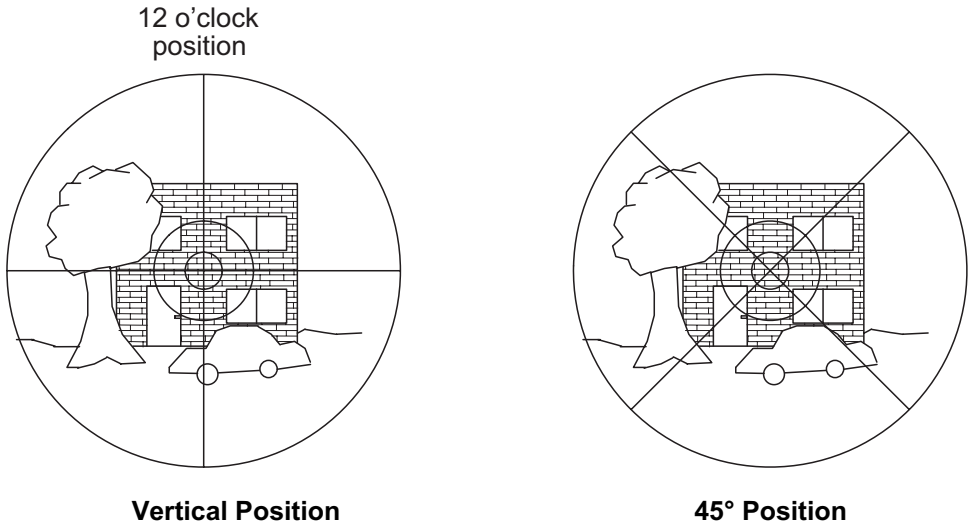


Figure 59. Example of Boresighting Crosshair and Image Before and After Rotating 45°.

NO-FIRE ZONES MODE - Cont

Define Custom No-Fire Zones - Cont

Manually Guided Method - Cont

NOTE

In the following procedures, the CROWS Mount Guide must continuously look through the boresight telescope while moving the weapon to verify where the weapon is pointing when setting no-fire zones at ranges of 25 meters or less. The CROWS Mount Guide must not let go of the weapon barrel during establishment of the Lower Left parameter and selection of the Upper Right parameter of the Custom No-Fire Zone.

The CROWS Mount Guide must ensure that the boresight telescope maintains its 45° angle when moving the weapon barrel. If it loses its 45° angle during the movement, carefully rotate the boresight telescope counterclockwise until it retains its original 45° angle.

7. CROWS Mount Guide: Move the weapon barrel so that the Upper-Right Point where the cross-hair intersects the Borescope Boundary (see Figure 60) is on the LOWER LEFT corner of the required two-dimensional Custom No-Fire Zone (see Figure 61). Once the desired start point is achieved, hold the weapon barrel stationary and notify the CROWS Operator to perform step 8.

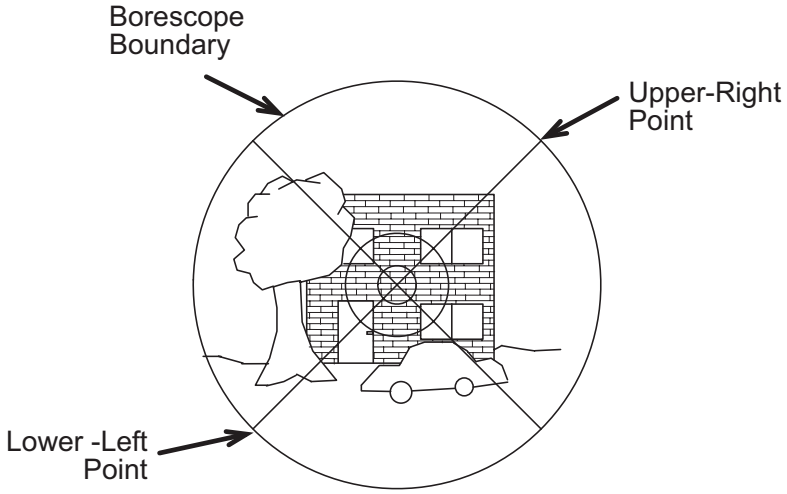


Figure 60. Points to Use While Manually Defining No-Fire Zones with a Boresight Telescope.

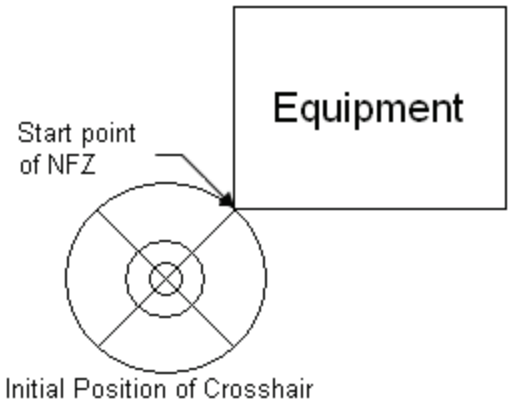


Figure 61. Example of Manually Defining the Start Point of a No-Fire Zone with a Boresight Telescope.

8. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT) to start the zone setting, bringing up the screen in Figure 62.

NOTE

In Figure 62, [Fn] refers to the FUNCTION switch on the DU or joystick RIGHT toggle DOWN.

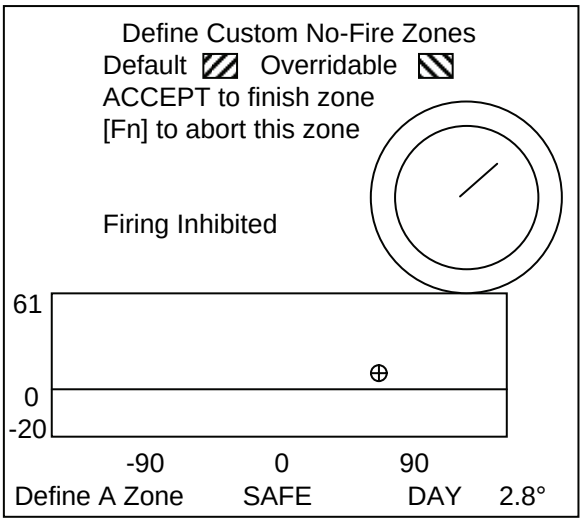


Figure 62. Define Custom No-Fire Zones Screen After Initial Definition.

NO-FIRE ZONES MODE - Cont

Define Custom No-Fire Zones - Cont

Manually Guided Method - Cont

NOTE

The CROWS Mount Guide must ensure that the boresight telescope maintains its 45° angle when moving the weapon barrel. If it loses its 45° angle during the movement, carefully rotate the boresight telescope counterclockwise until it retains its original 45° angle.

9. CROWS Mount Guide: Elevate and rotate the weapon barrel CLOCKWISE so that the Lower-Left Point where the cross-hair intersects the Borescope Boundary (see Figure 60) is on the UPPER RIGHT corner of the required two-dimensional Custom No-Fire Zone (see Figure 63). Once the desired end point is achieved, hold the weapon barrel stationary and notify the CROWS Operator to perform step 10.

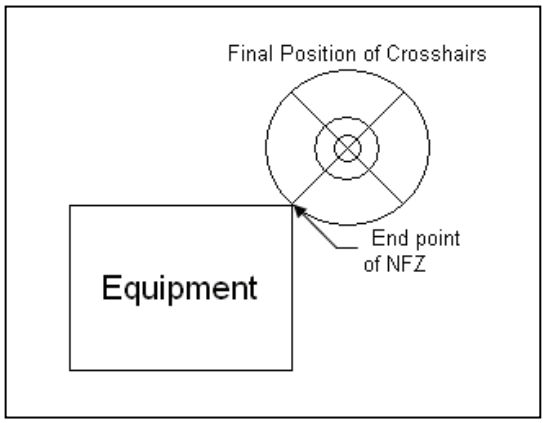


Figure 63. Example of Manually Defining the End Point of a No-Fire Zone with a Boresight Telescope.

NOTE

A Custom No-Fire Zone is displayed and resized due to the mount movement. See Figure 64.

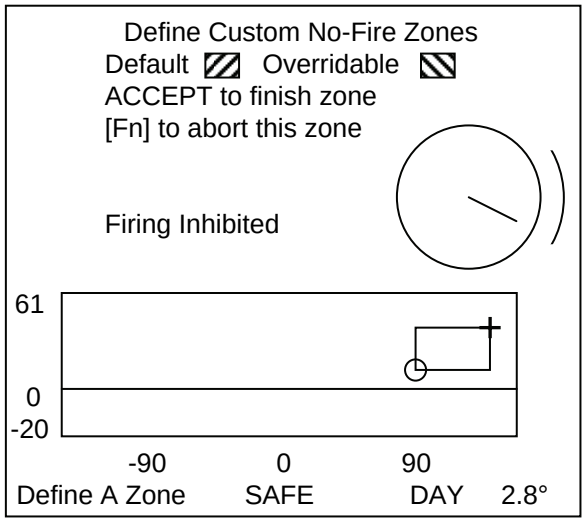


Figure 64. Define Custom No-Fire Zones Screen Before Zone Definition Completed.

NOTE

A correct No-Fire Zone is displayed as a box with two defining corners (Lower Left and Upper Right) as shown in Figure 64. Incorrect No-Fire Zones are shown in Figures 42 through 44.

10. If the No-Fire Zone is not displayed correctly, perform one of the following three procedures. If the No-Fire Zone is correctly displayed, proceed to step 11.
    a. CROWS Operator: If the zone displayed appears to incorrectly cover elevation parameter from top to bottom as shown in Figure 42, direct the CROWS Mount Guide to slightly elevate the weapon barrel until the zone displayed appears correctly between the Lower Left corner and the Upper Right corner of the Custom No-Fire zone defined. When corners are correctly defined, direct the CROWS Mount Guide to immediately stop moving the weapon barrel.

    b. CROWS Operator: If the zone displayed appears to incorrectly cover azimuth parameter from left to right as shown in Figure 43, direct the CROWS Mount Guide to slightly rotate the weapon barrel CLOCKWISE until the zone displayed appears correctly between the Lower Left corner and the Upper Right corner of the Custom No-Fire zone defined. When corners are correctly defined, direct the CROWS Mount Guide to immediately stop moving the weapon barrel.

    c. CROWS Operator: If the zone displayed appears to incorrectly cover elevation parameter from top to bottom AND azimuth parameter from left to right as shown in Figure 44, direct the CROWS Mount Guide to slightly elevate the weapon barrel until the zone displayed appears correctly in elevation (will look similar to Figure 43). When elevation parameter is correctly defined, direct the CROWS Mount Guide to immediately stop elevating the weapon barrel. Then direct the CROWS Mount Guide to slightly rotate the weapon barrel CLOCKWISE until the zone displayed appears correctly between the Lower Left corner and the Upper Right corner of the Custom No-Fire zone defined. When corners are correctly defined, direct the CROWS Mount Guide to immediately stop moving the weapon barrel.

    d. When No-Fire Zone is displayed correctly, proceed to step 11.

11. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT) to finish setting the Custom No-Fire Zone. Direct the CROWS Mount Guide to release the weapon barrel. See Figure 65.

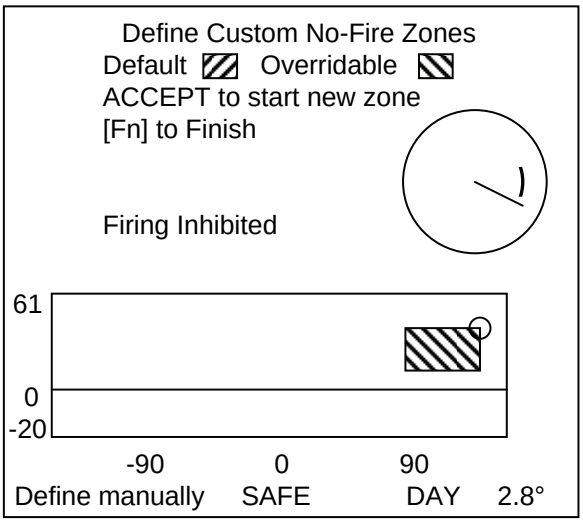


Figure 65. Define Custom No-Fire Zones Screen After Zone Defined.

NO-FIRE ZONES MODE - Cont

Define Custom No-Fire Zones - Cont

Manually Guided Method - Cont

12. Repeat steps 7 through 11 to set up to a maximum of 20 Custom Zones, as required. The total combination of Factory Preset Overridable zones and Custom No-Fire zones cannot exceed 20.

13. CROWS Mount Guide: Remove the Boresight Alignment weapon mandrel and telescope from the weapon barrel.

14. CROWS Operator: Direct the CROWS Mount Guide to step away from the CROWS system to a safe distance.

NOTE

All Custom No-Fire zones created by the CROWS operator must be defined sequentially during the same setting before acceptance.

15. To set up additional Custom No-fire Zones at distances greater than 25 meters, proceed to step 5 of the Joystick Controlled Method section.

16. CROWS Operator: Press FUNCTION (RIGHT toggle DOWN) to finish defining all Custom No-Fire Zone(s) established. The ACCEPT/REJECT screen appears. See Figure 46.

17. Perform one of the following optional steps:

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any switches. Failure to follow these instructions may result in equipment malfunction or failure.

NOTE

Custom No-Fire Zones which have been previously defined and accepted, will be reset (DELETED) after acceptance in the following option step.

a. Press ACCEPT (LEFT toggle RIGHT) to accept the defined Custom No-Fire Zone(s) for ranges 25 meters or less. Figure 47 appears showing all Custom No-Fire Zones established.

b. Press FUNCTION (RIGHT toggle DOWN) to reject (DELETE) all of the Custom No-Fire Zone(s) just established. All previously defined and accepted Custom No-Fire Zones will remain.

18. CROWS Operator: Press LASE (LEFT toggle LEFT) to return to the Engagement Mode screen.

END OF TASK

Mk19 (40mm) Manually Guided Method

The Mk19 (40mm) Manually Guided Method is required because of the parallax created from the line of sight (LOS) of the weapon and the LOS of the sensor unit (parallax being the displacement of an object as seen from two different points that are not on a parallel line with the object). Use the Mk19 (40mm) Joystick Controlled Method for ranges beyond 25 meters.

WARNING

The Mk19 (40 mm) Manually Guided Method is used for establishing Custom No-Fire Zones at ranges of 25 meters or less from the CROWS with a Mk19 (40 mm) weapon installed. Proceed to the Mk19 (40 mm) Joystick Controlled Method section for the procedures to define Custom No-Fire Zones at ranges beyond 25 meters with a Mk19 (40 mm) weapon installed.

Ensure weapon is evacuated of rounds and chamber is cleared IAW the applicable weapon TM prior to performing this procedure. Remove and secure any rounds that have been cleared.

Dispersion of weapon rounds firing must be considered when defining a Custom No-Fire Zone. The Mk 19 grenade has a larger dispersion to consider than other normal weapon rounds. Ensure a sufficient buffer allowing for weapon rounds firing dispersion is provided to ensure the protected zone is not affected by the effective kill radius of the grenade.

After establishing Custom No-Fire Zones for the Mk 19 weapon, caution must be applied when firing near the upper limit of weapon elevation (61º) and near the lower limit of weapon elevation (-20º depression). It is possible that the Custom No-Fire Zone may be disabled at each of these extremes.

Failure to follow these instructions may result in serious personal injury and/or equipment damage.

CAUTION

All Custom No-Fire Zones previously defined and accepted will be reset (DELETED) after acceptance of the following procedures.

The Mk19 (40mm) Manually Guided Method requires two personnel and good communication between the two in setting Custom No-Fire Zones:

CROWS Operator
CROWS Mount Guide

The CROWS Operator is stationed at the Control Group. The CROWS Mount Guide is stationed at the CROWS Mount while maintaining voice communications with the CROWS Operator.

Perform the following procedures to define Custom No-Fire Zones for ranges of 25 meters or less when the CROWS has a Mk19 (40mm) weapon installed.

1. Ensure that CROWS is currently configured with a Mk19 (40 mm) weapon installed.
2. CROWS Operator: Ensure the Define Custom No-Fire Zones Basic Setup procedure has been performed.
3. CROWS Operator: Position the CURSOR on the MANUALLY GUIDED option as shown in Figure 56.
4. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT). The Define Custom No-Fire Zones screen appears, as shown in Figure 57.

NO-FIRE ZONES MODE - Cont

Define Custom No-Fire Zones - Cont

Mk19 (40mm) Manually Guided Method - Cont

NOTE

See WP 0036, Table 2, Basic Issue Items (BII), for component parts of the CROWS Boresight Alignment Kit.

5. CROWS Mount Guide: Insert the appropriate Boresight Alignment weapon mandrel and boresight telescope into the weapon barrel bore so that the boresight telescope is positioned vertically (12 o'clock). See Figure 66 for an example.

NOTE

Do not disturb the position of the weapon barrel and mandrel during rotation of the boresight telescope. Avoid loosening of the mandrel inserted into the weapon barrel by carefully rotating the boresight telescope counterclockwise (CCW). See Figure 67 to determine direction of rotation.

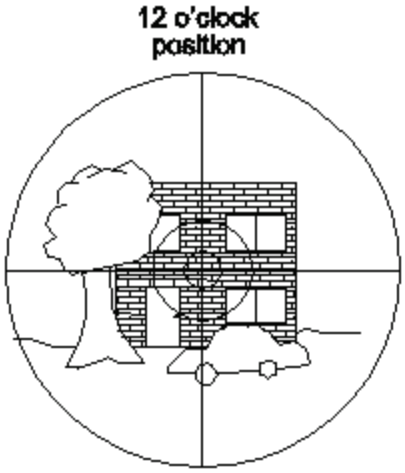


Figure 66. Example of Boresighting Crosshair at 12 o'clock Orientation.

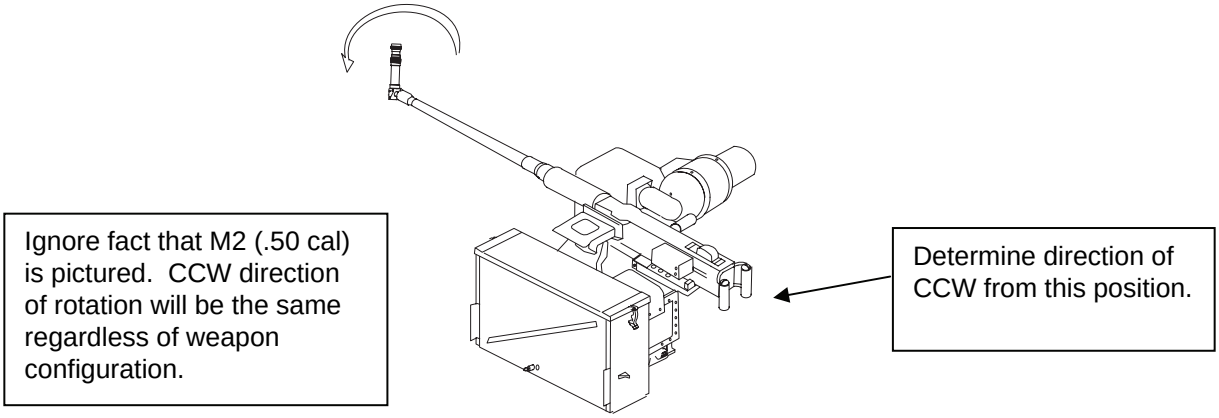


Figure 67. Determination of CCW Rotation of Boresight Telescope in Relation to Weapon Mounted on CROWS.

NOTE

In the following procedures, the CROWS Mount Guide must continuously look through the boresight telescope while moving the weapon to verify where the weapon is pointing when setting no-fire zones at ranges of 25 meters or less. The CROWS Mount Guide must not let go of the weapon barrel during establishment of the Left parameter and selection of the Right parameter of the Custom No-Fire Zone.

The CROWS Mount Guide must ensure that the boresight telescope maintains its 12 o'clock orientation when moving the weapon barrel. If it loses its 12 o'clock orientation during the movement, carefully rotate the boresight telescope counterclockwise until it retains its original 12 o'clock orientation.

6. CROWS Mount Guide: Move the weapon barrel so that the RIGHT Point where the cross-hair intersects the Borescope Boundary (see Figure 68) is on the LEFT edge of the required two-dimensional Custom No-Fire Zone (see Figure 69). Once the desired start point is achieved, hold the weapon barrel stationary and notify the CROWS Operator to perform step 7.

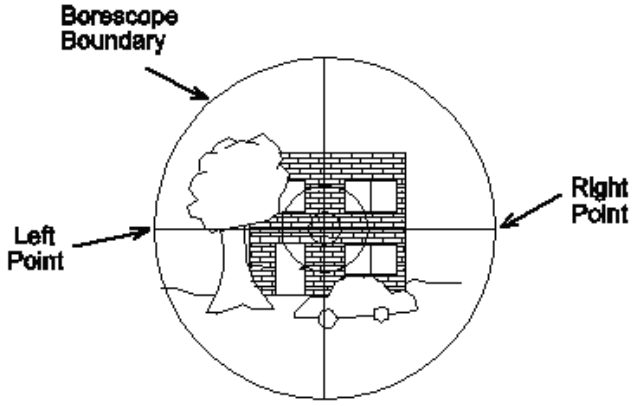


Figure 68. Points to Use While Manually Defining No-Fire Zones with a Boresight Telescope when Mk19 (40mm) Is Installed.

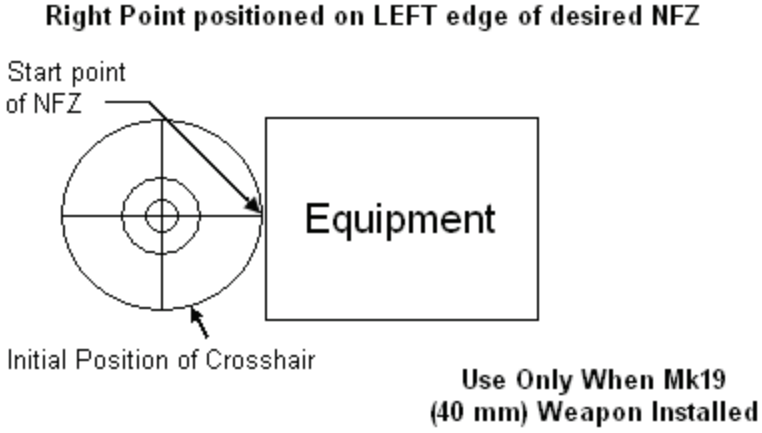


Figure 69. Example of Manually Defining the Start Point of a No-Fire Zone with a Boresight Telescope for when Mk19 (40 mm) Is Installed.

NO-FIRE ZONES MODE - Cont

Define Custom No-Fire Zones - Cont

Mk19 (40mm) Manually Guided Method - Cont

7. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT) to start the zone setting, bringing up the screen in Figure 62.

NOTE

The CROWS Mount Guide must ensure that the boresight telescope maintains its 12 o'clock orientation when moving the weapon barrel. If it loses its 12 o'clock orientation during the movement, carefully rotate the boresight telescope counterclockwise until it retains its original 12 o'clock orientation.

8. CROWS Mount Guide: Rotate the weapon barrel HORIZONTALLY CLOCKWISE so that the LEFT Point where the cross-hair intersects the Borescope Boundary (see Figure 68) is on the RIGHT edge of the required two-dimensional Custom No-Fire Zone (see Figure 70). Once the desired end point is achieved, hold the weapon barrel stationary and notify the CROWS Operator to perform step 9.

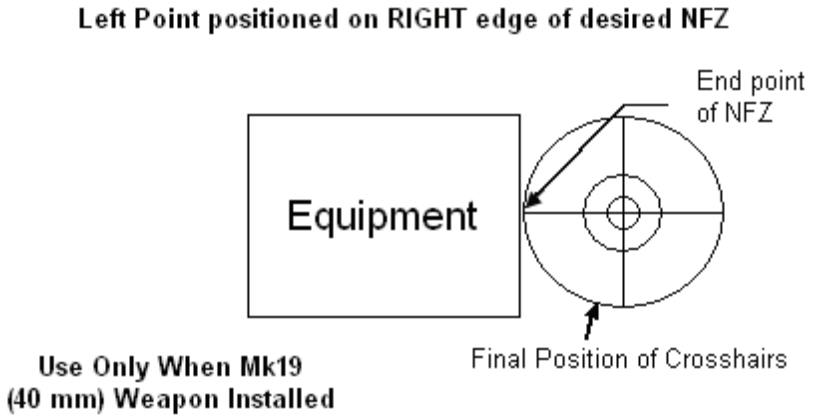


Figure 70. Example of Manually Defining the End Point of a No-Fire Zone with a Boresight Telescope for when Mk19 (40 mm) Is Installed.

NOTE

A Custom No-Fire Zone is displayed and resized due to the mount movement and should appear as shown in Figure 71.

The Mk19 (40 mm) Manually Guided Method is meant to define a Custom No-Fire Zone that inhibits firing from -20° to 61° elevation at particular azimuths. See example in Figure 71. When moving the weapon mount from the left side to the right side in step 8, if movement of the weapon mount is not performed exactly HORIZONTAL, the zone displayed in Figure 71 may not be correct in covering the total -20º to 61º elevation. Either a gap may appear between the upper and lower limits as shown in Figure 51 or a strip may appear as shown in Figure 52.

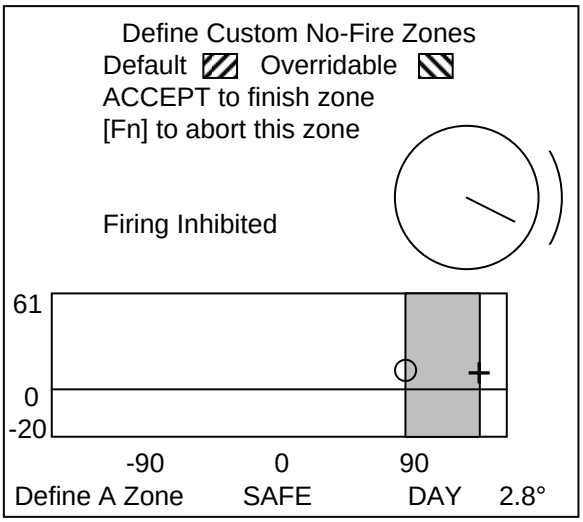


Figure 71. Define Custom No-Fire Zones Screen Before Zone Definition Completed.

9. CROWS Operator: Perform one of the following options:

   a. Should a gap or strip appear between -20° to 61° elevation, repeat step 8 until no gap or strip appears. This will require communication directing the CROWS Mount Guide to aim the mount at an elevation such that no gap or strip appears.

   b. If the no-fire zone is displayed correctly, proceed to step 10.

NO-FIRE ZONES MODE - Cont

Define Custom No-Fire Zones - Cont

Mk19 (40mm) Manually Guided Method - Cont

10. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT) to finish setting the Custom No-Fire Zone. Direct the CROWS Mount Guide to release the weapon barrel. See Figure 72.

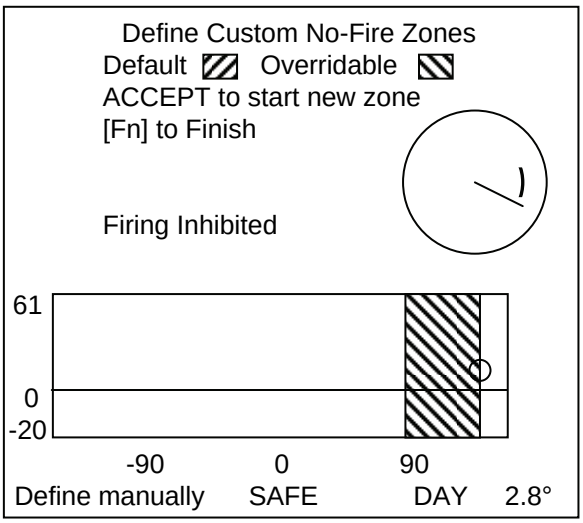


Figure 72. Define Custom No-Fire Zones Screen After Zone Defined.

11. Repeat steps 6 through 10 to set up to a maximum of 20 Custom Zones, as required. The total combination of Factory Preset Overridable zones and Custom No-Fire zones cannot exceed 20.

12. CROWS Mount Guide: Remove the Boresight Alignment weapon mandrel and telescope from the weapon barrel.

13. CROWS Operator: Direct the CROWS Mount Guide to step away from the CROWS system to a safe distance.

NOTE

All Custom No-Fire zones created by the CROWS operator must be defined sequentially during the same setting before acceptance.

14. To set up additional Custom No-Fire Zones at distances greater than 25 meters, proceed to step 5 of the Mk19 (40 mm) Joystick Controlled Method section.

15. CROWS Operator: Press FUNCTION (RIGHT toggle DOWN) to finish defining all Custom No-Fire Zone(s) established. The ACCEPT/REJECT screen appears. See Figure 54.

16. Perform one of the following optional steps:

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any switches. Failure to follow these instructions may result in equipment malfunction or failure.

NOTE

Custom No-Fire Zones, which have been previously defined and accepted, will be reset (DELETED) after acceptance in the following option step.

a. Press ACCEPT (LEFT toggle RIGHT) to accept the defined Custom No-Fire Zone(s) for ranges 25 meters or less. Figure 55 appears showing all Custom No-Fire Zones established.

b. Press FUNCTION (RIGHT toggle DOWN) to reject (DELETE) all of the Custom No-Fire Zone(s) just established. All previously defined and accepted Custom No-Fire Zones would remain.

17. CROWS Operator: Press LASE (LEFT toggle LEFT) to return to the Engagement Mode screen.

END OF TASK

Enabling Custom No-Fire Zones

Perform the following procedure to enable Custom No-Fire Zones. All three No-Fire Zones (Factory Preset Default zones, Factory Preset Overridable zones, and Custom No-Fire zones) will be active after performing this procedure.

1. Perform the steps in the Display No-Fire Zones Options procedure.

2. Position the CURSOR onto the USE CUSTOM ZONES option, as shown in Figure 33.

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any switches. Failure to follow these instructions may result in equipment malfunction or failure.

3. Press ACCEPT (LEFT toggle RIGHT) to activate Custom No-Fire Zones. The asterisk (*) next to the USE CUSTOM ZONES option indicates that Custom No-Fire Zones are active.

4. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

NO-FIRE ZONES MODE - Cont

Disabling Custom No-Fire Zones

Perform the following procedure to disable Custom No-Fire Zones. Only Factory Preset Default zones and Factory Preset Overridable zones will be active after performing this procedure.

WARNING

Disabling Operator defined Custom No-Fire Zones will leave only Factory Preset No-Fire Zones and Factory Preset Overridable zones active. Disabling Custom No-Fire Zones should only be performed when no Custom No-Fire Zones are required. Failure to follow this Warning may result in serious personal injury and/or equipment damage.

1. Perform the steps in the Display No-Fire Zones Options procedure.

2. Position the CURSOR to the USE FACTORY PRESET ZONES option, as shown in Figure 32.

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any switches. Failure to follow these instructions may result in equipment malfunction or failure.

3. Press ACCEPT (LEFT toggle RIGHT) to disable Custom No-Fire Zones. The asterisk (*) next to the USE FACTORY PRESET ZONES option indicates that Custom No-Fire Zones are disabled.

4. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

NOTE

If the DEFINE CUSTOM NO-FIRE ZONES option is selected while Custom No-Fire zones are disabled, the Define Custom No-Fire Zones screen appears. The message “Custom Fire Inhibit Zones Disabled” appearing on this screen indicates that Custom No-Fire zones are disabled. See Figure 73.

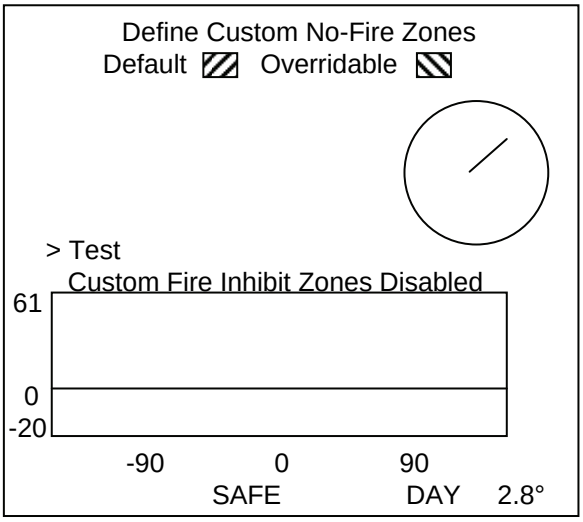


Figure 73. Define Custom No-Fire Zones Screen When Custom No-Fire Zones is Disabled.

END OF TASK

Verification of Custom No-Fire Zones

Perform the following procedure to verify that the Operator-defined Custom No-Fire Zones are accurate and complete. Starting with the leftmost Custom No-Fire Zone, verify all Custom No-Fire Zones from left to right so that no Custom zones are accidentally skipped and left unverified.

NOTE

The verification procedures are the same for all sides of a Custom No-Fire Zone, except for the starting point. Should there be overlapping Custom No-Fire Zones, as shown in Figures 74 and 75, all four edges (sides) of a Custom No-Fire Zone need to be verified, unless one of the edges is completely overlapped by another Custom No-Fire Zone. In the example shown in Figure 74, only three sides of the rightmost zone require verification.

This may require positioning the circular CURSOR in a starting position other than in the proximity of the center of the zone.

See Figure 74 for an example of positioning to start the verification of the leftmost zone's right edge. The verification procedures are the same for all sides of a No-Fire Zone requiring verification except for the starting point.

All four edges (sides) of a Custom No-Fire Zone need to be verified, unless one of the edges is completely overlapped by another Custom No-Fire Zone. See Figure 74. Only three sides of the rightmost zone will require verification.

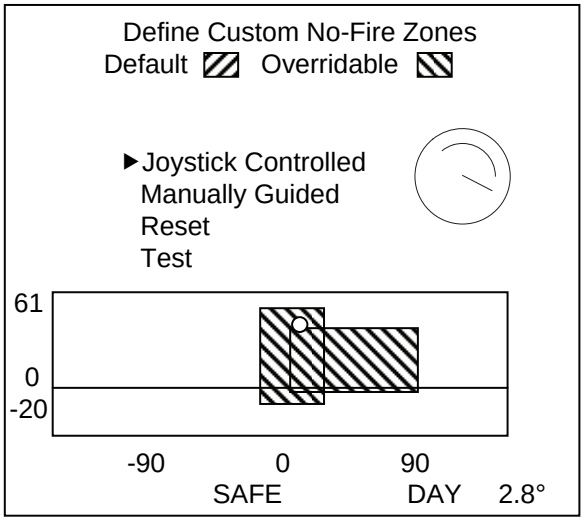


Figure 74. Example of Overlapping Custom No-Fire Zones and the Need to Verify Only Three Edges of the Right Custom Zone.

NO-FIRE ZONES MODE - Cont

Verification of Custom No-Fire Zones - Cont

NOTE

The example in Figure 75 shows the leftmost Custom No-Fire Zone and a rightmost Custom No-Fire Zone. Each of the four sides of the overlapping zones requires verification.

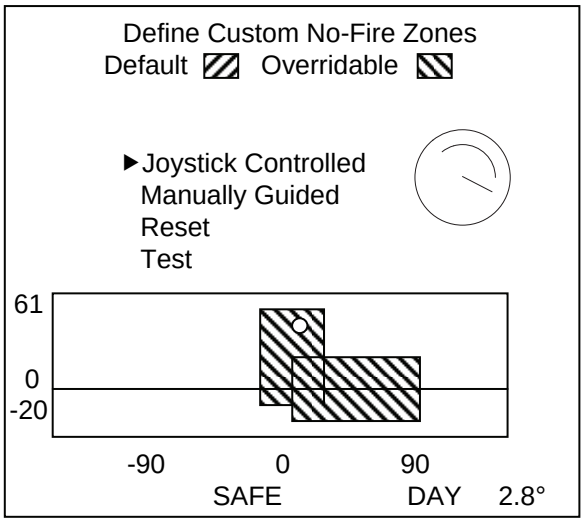


Figure 75. Example of Overlapping Custom No-Fire Zones and the Need to Verify all Four Edges of the Right Custom Zone.

NOTE

During Verification of Custom No-Fire Zones, if a procedural step cannot be verified as stated, restart the verification of the particular edge/no-fire zone combination in question.

If the Custom No-Fire Zone edge/no-fire zone combination can be verified as stated in the second attempt, continue with the verification procedures.

If the Custom No-Fire Zone edge/no-fire zone combination once again fails to be verified, then the Custom No-Fire Zone in question was incorrectly defined. Go back to the Defining Custom No-Fire Zones section and redefine all Custom No-Fire Zones.

1. Press LEFT on the STAB switch to ensure it is in the OFF position.
2. Perform steps 5 through 13 of the Define Custom No-Fire Zones Basic Setup procedure. Figure 76 is an example of all No-Fire Zones including Operator Defined Custom No-Fire Zones.
3. Ensure Custom No-Fire Zones have been established.

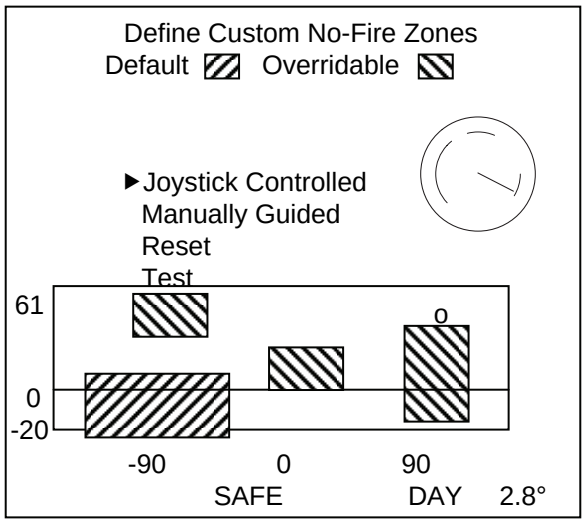


Figure 76. Example of All No-Fire Zones Including Operator Defined Custom No-Fire Zones.

WARNING

Moving the circular CURSOR onto the center point of the NFZ means you are pointing a weapon at a NFZ. Ensure that no personnel are standing near the weapon. The pedestal mount will rotate.

NOTE

The Define Custom No-Fire Zones screen displays the current No-Fire Zone status. Default zones displayed are orange with right diagonal slashes and Overridable zones displayed are red with left diagonal slashes. Default zones are the Factory Preset Default zones. Overridable zones include both the Factory Preset Overridable zones and operator assigned Custom No-Fire Zones (when enabled).

4. Position the circular CURSOR (representing the barrel of the weapon) approximately in the center of the Custom No-Fire Zone being verified as shown in Figure 77. Depress the DEADMAN switch and use the MOTION CONTROL switch to move the circular CURSOR.

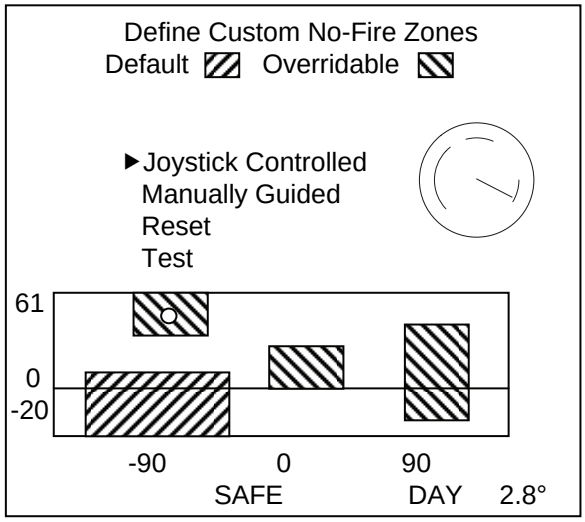


Figure 77. Example of Circular Cursor Centered on Leftmost Custom No-Fire Zone.

NO-FIRE ZONES MODE - Cont

Verification of Custom No-Fire Zones - Cont

5. Press LASE (LEFT toggle LEFT) to exit to the Engagement Mode screen.

NOTE

Situational awareness can be reacquired by zooming out (LEFT toggle DOWN) until the desired weapon FOV is achieved and refocus.

6. Ensure Laser Aimpoint is positioned on a solid surface of the object being protected by the NFZ. See Figure 78.

   a. If Laser Aimpoint is not aimed at a solid surface of the NFZ, proceed to step 7.

   b. If Laser Aimpoint is aimed at a solid surface of the NFZ, proceed to step 8.

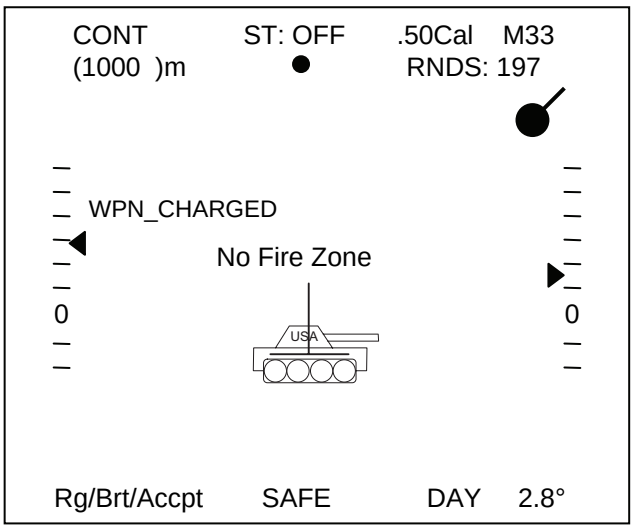


Figure 78. Engagement Mode Screen with Laser Aimpoint Displayed on Solid NFZ Surface.

7. Move laser aimpoint to a solid surface within the NFZ.

8. Press LASE (LEFT toggle LEFT) to acquire the Ballistic Aimpoint. See Figure 79.

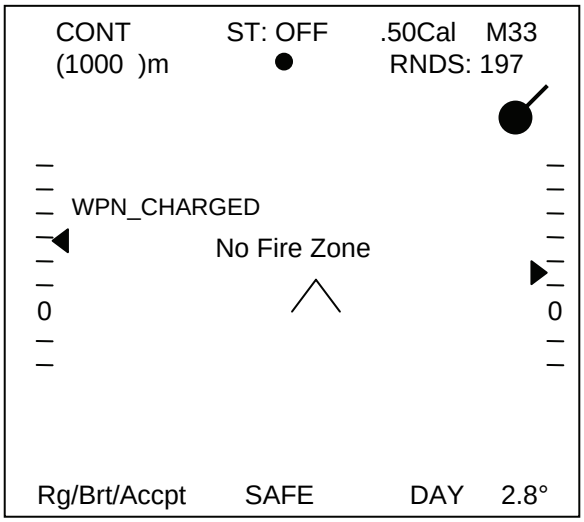


Figure 79. Engagement Mode Screen with Ballistic Aimpoint Displayed.

9. Verify that the text “No Fire Zone” appears on the DU screen.

NOTE

In the following step, do not move the circular CURSOR (weapon) any further when the text “No Fire Zone” momentarily disappears.

10. Using the MOTION CONTROL switch with DEADMAN switch depressed, slowly move the mount towards the edge being verified (CLOCKWISE, COUNTERCLOCKWISE, UP, or DOWN) until the text “No Fire Zone” momentarily disappears. Do not move the mount any further.

NO-FIRE ZONES MODE - Cont

Verification of Custom No-Fire Zones - Cont

NOTE

In Figure 80, the desired Custom No-Fire Zone is meant to cover the tank displayed. Observe that the Ballistic Aimpoint is located to the left of the tank.

11. Verify the leftmost parameter of the Custom No-Fire Zone by looking at the view displayed on the DU screen. The Ballistic Aimpoint should be outside of the edge of the desired Custom No-Fire Zone being verified (LEFT, RIGHT, ABOVE, or BELOW). See Figure 80.

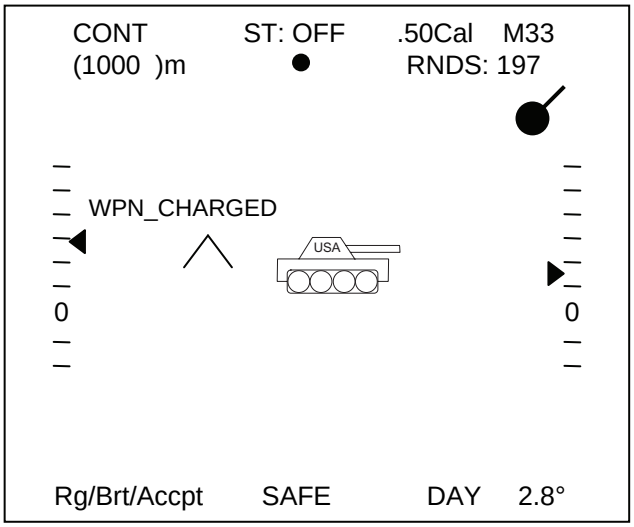


Figure 80. Example Showing the Ballistic Aimpoint Outside and to the Left of the Area of the Desired Custom No-Fire Zone.

12. Repeat steps 5 through 13 of the Defined Custom No-Fire Zones Basic Setup procedure to return to the Define Custom No-Fire Zones Menu screen.

13. Verify that the circular CURSOR is located just outside of, or on the edge of, the current Custom No-Fire Zone's edge being verified (LEFT, RIGHT, TOP, and BOTTOM) as shown in Figure 81.

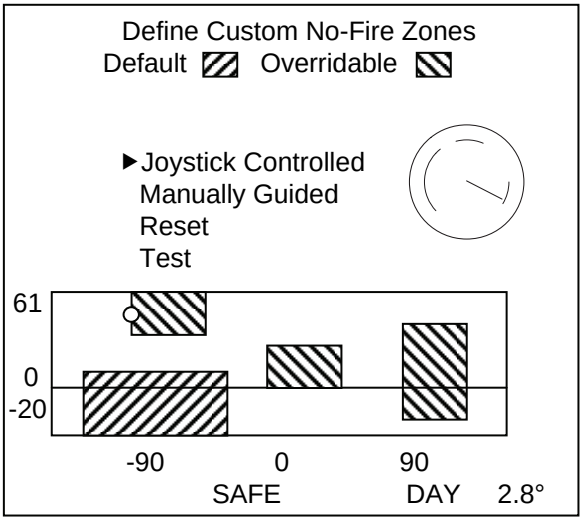


Figure 81. Example with Circular Cursor on Left Edge of Leftmost Custom No-Fire Zone.

14. Repeat steps 4 through 13 for the remaining three sides of the current No-Fire Zone.

15. Repeat steps 4 through 14 for all remaining Custom No-Fire Zones to ensure all Custom No-Fire Zones are verified.

16. After verifying the physical rectangular parameters of all Custom No-Fire zones, press LASE (LEFT toggle LEFT) to exit to the Engagement Mode screen.

END OF TASK

NO-FIRE ZONES MODE - Cont

Resetting Custom No-Fire Zones

Perform the following procedure to reset (DELETE) current Operator defined Custom No-Fire Zones.

CAUTION

This procedure will reset (DELETE) all previously defined Custom No-Fire Zones leaving no Custom No-Fire Zones defined.

1. Press LEFT on the STAB switch to ensure it is in the OFF position.
2. Perform steps 5 through 13 of the Define Custom No-Fire Zones Basic Setup procedure**.** The Define Custom No-Fire Zones Screen displayed will be similar to Figure 76.
3. Position the CURSOR to the RESET option. See Figure 82.

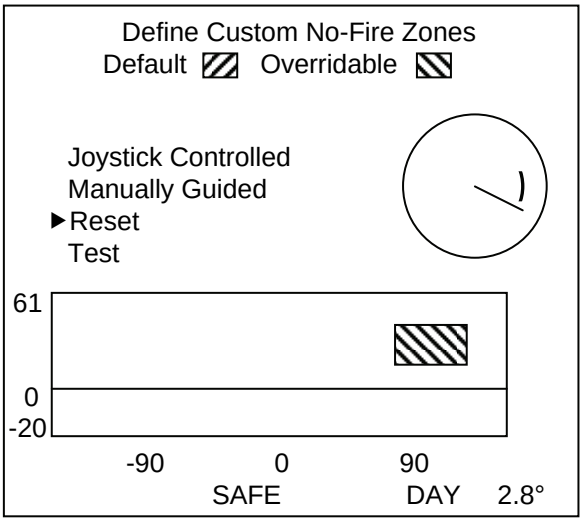


Figure 82. Define Custom No-Fire Zones Screen with Reset Option Selected.

4. Press ACCEPT (LEFT toggle RIGHT). Figure 83 appears.

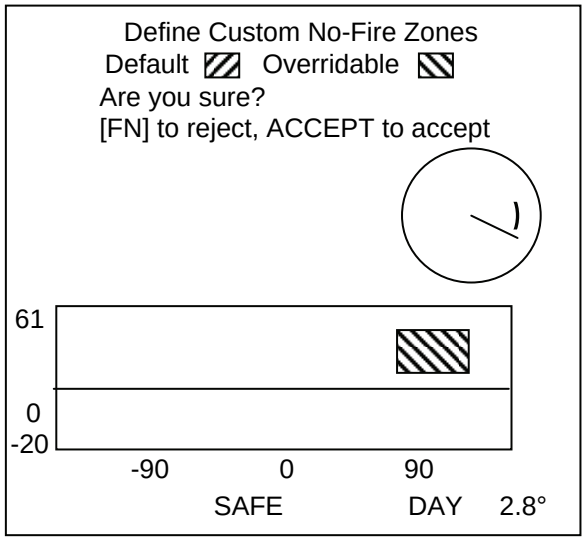


Figure 83. Accept/Reject Reset Option.

5. Perform one of the following options:

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any switches. Failure to follow these instructions may result in equipment malfunction or failure.

   a. Press ACCEPT (LEFT toggle RIGHT) to reset (DELETE) all Custom No-Fire Zones defined.

   b. Press FUNCTION (RIGHT toggle DOWN) to reject resetting (DELETING) Custom No-Fire Zones.

6. Press the LASE (LEFT toggle LEFT) to exit to the Engagement Menu.

END OF TASK

Software Test of Custom No-Fire Zones

1. Press LEFT on the STAB switch to ensure it is in the OFF position.

NOTE

This test is not for field use.

2. Perform steps 5 through 13 in the Define Custom No-Fire Zones Basic Setup procedure.

WARNING

Software verification of Custom No-Fire Zones testing will take approximately 30 seconds. During the test, the system is not operational.

3. Position the CURSOR onto the TEST option. See Figure 84.

NO-FIRE ZONES MODE - Cont

Software Test of Custom No-Fire Zones - Cont

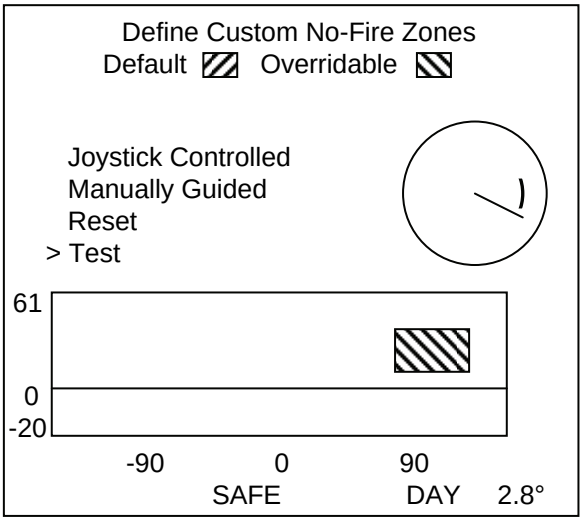


Figure 84. Define Custom No-Fire Zones Menu Screen with Test Option Selected.

4. Press ACCEPT (LEFT toggle RIGHT). The Define Custom No-Fire Zones screen appears. See Figure 85.

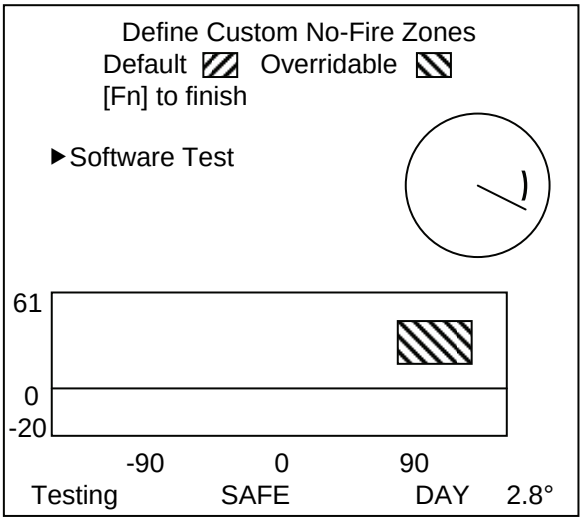


Figure 85. No-Fire Zones Software Test Screen.

5. Ensure the CURSOR is positioned on SOFTWARE TEST, as shown in Figure 85.

6. Press ACCEPT (LEFT toggle RIGHT) to select the SOFTWARE TEST option. The screen in Figure 86 initially appears.

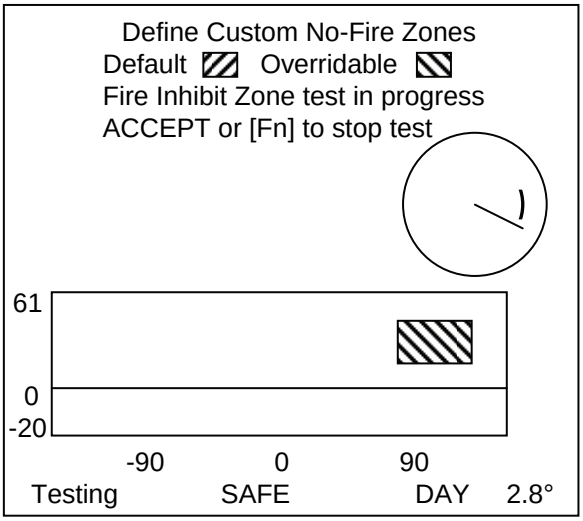


Figure 86. No-Fire Zones Software Test-In-Progress Screen.

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any switches. Failure to follow these instructions may result in equipment malfunction or failure.

NOTE

During testing, green lines will progressively appear increasing from left to right to show that testing is progressing. A total of eight green lines will appear. Testing will take approximately 30 seconds.

When the message “Fire Inhibit Zone test complete” is displayed in Figure 87, ignore “Testing” in the lower left corner of the screen.

7. Testing will proceed until all eight green lines are shown, the blue bar disappears, and the message “Fire Inhibit Zone test in progress” is replaced by the message “Fire Inhibit Zone test complete”. See Figure 87.

NO-FIRE ZONES MODE - Cont

Software Test of Custom No-Fire Zones - Cont

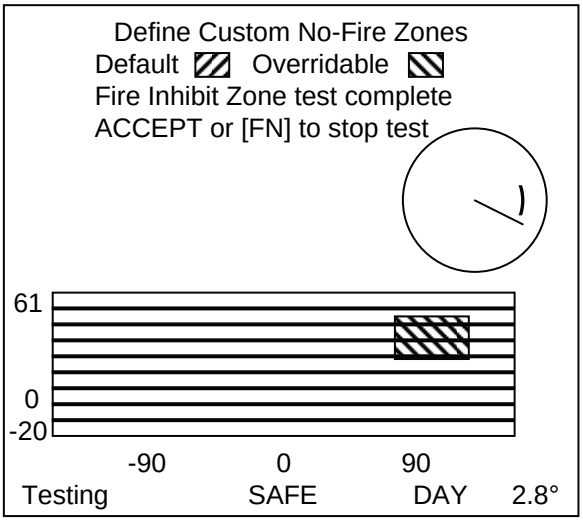


Figure 87. No-Fire Zones Software-Test-Complete Screen.

8. Verify that each of the eight green horizontal lines turns red when intersecting an Overridable zone (Factory Preset Overridable Zones and Custom No-Fire Zones) or when intersecting a Default Zone (Factory Preset Default Zones).

9. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

MOTION INHIBITS

Factory Preset Default Motion Inhibits and Overridable Motion Inhibits are configuration controlled settings contained in the CROWS system software. Factory Default Motion Inhibits are always active. Factory Overridable Motion Inhibits are active when the Safety Over-Ride Switch on the SPU is in the OFF position.

CAUTION

The SAFETY OVER-RIDE switch on the SPU is used ONLY in emergency situations in accordance with local SOP and as directed by the Commander. Overriding motion inhibits may cause equipment damage.

The Factory Preset Overridable Motion Inhibits can be overridden by turning the SAFETY OVER-RIDE switch to the ON position. To ensure the Factory Preset Overridable Motion Inhibits are enabled, position the SAFETY OVER-RIDE switch to the OFF position. Refer to WP 0022, Emergency Use of Safety Over-Ride Switch section, and to WP 0024, Troubleshooting Index.

Display Motion Inhibits Settings

Perform the following procedures to display the Motion Inhibit settings.

1. Ensure STAB is OFF by depressing LEFT on the Joystick STAB Switch.

2. From the Engagement screen (Figure 8), press FUNCTION (RIGHT toggle DOWN) until you are in the Menu mode. Refer to Figure 8. The Menu status will appear in the lower left of the screen.

3. Ensure the CURSOR is positioned onto the Preparation Menu entry point designated by P in the upper left of the screen. Refer to Figure 10.

4. Press ACCEPT (LEFT toggle RIGHT). This will take you to the Preparation Menu, as shown in Figure 88.

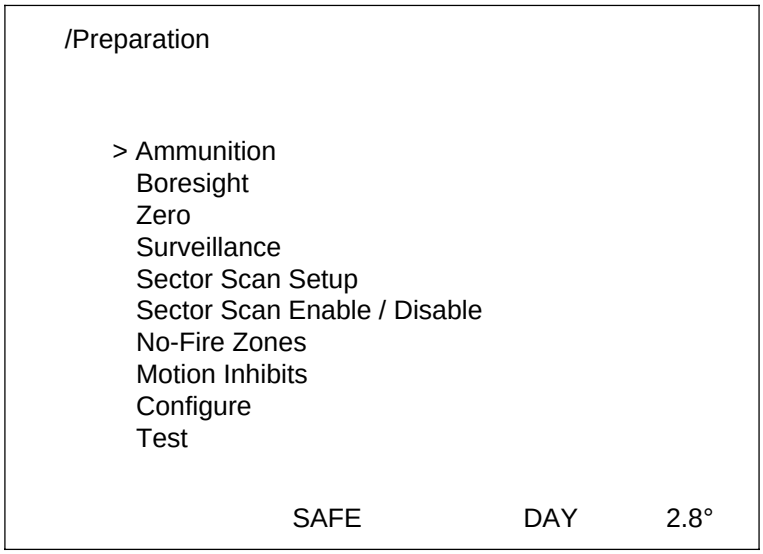


Figure 88. Preparation Menu.

5. Position the CURSOR onto the MOTION INHIBITS option, as shown in Figure 89.

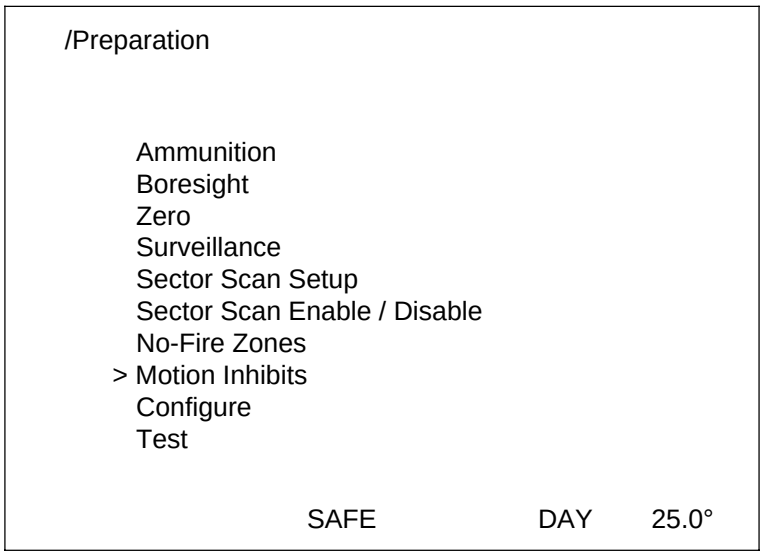


Figure 89. Preparation Menu with Motion Inhibits Option Selected.

MOTION INHIBITS

Display Motion Inhibits Settings

6. Press ACCEPT (LEFT toggle RIGHT), which brings up the Motion Inhibits screen shown in Figure 90.

NOTE

The screen will show a key explaining that Factory DEFAULT zones are orange with right diagonal slashes and Factory OVERRIDABLE zones are red with left diagonal slashes.

This example shows the factory-set Motion Inhibits for the M1A2 Tank with Lags. Factory Preset OVERRIDABLE Motion Inhibits are displayed only if they are assigned to the host vehicle.

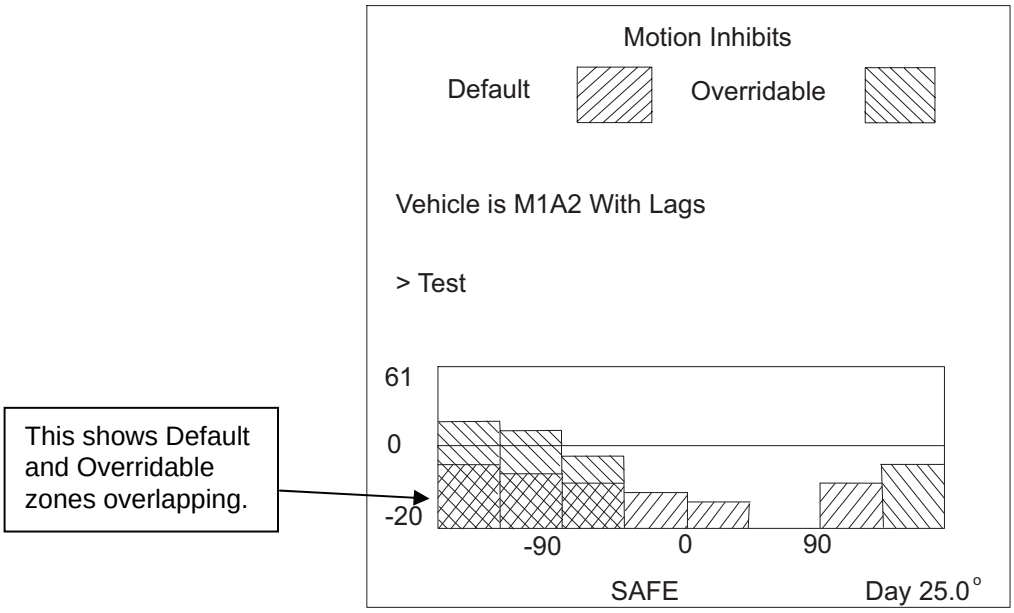


Figure 90. Motion Inhibits Screen.

NOTE

Do not start testing if vehicle does not have any motion inhibit zones set.

7. Test the MOTION INHIBITS ZONES as follows:

   a. Ensure correct vehicle is displayed. See Figure 90.

WARNING

Ensure all personnel are clear of weapon and follow all safety precautions. During testing of Motion Inhibit Zones, the weapon mount will move. Failure to follow this warning may result in serious personal injury or equipment damage.

NOTE

During test, a plus sign, + , traces the upper left corner of each Motion Inhibits Zone Reference Point as shown in Figure 91. The upper left corner of each vertical box is the Reference Point for the top of that individual zone.

Reference Point = +

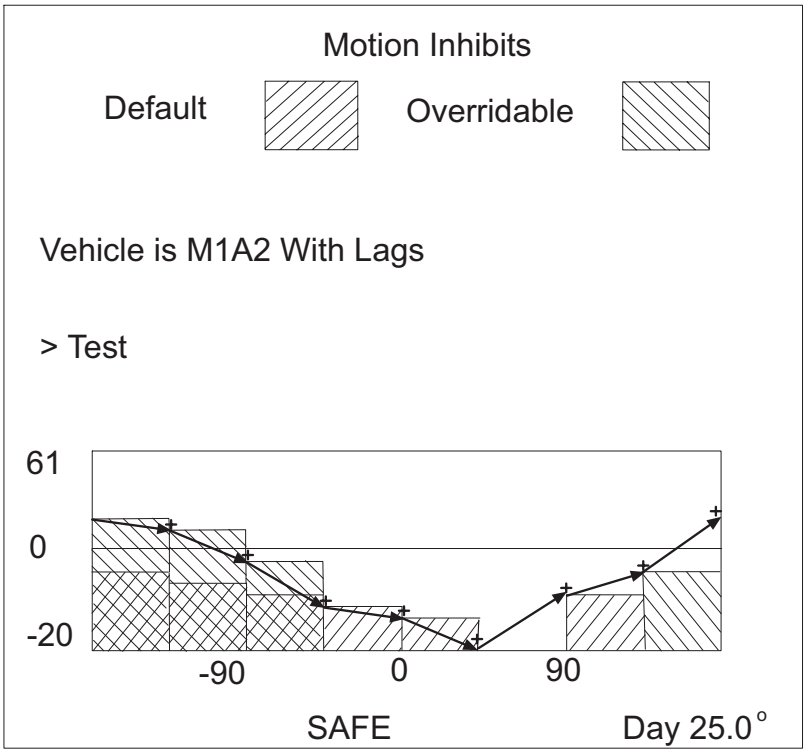


Figure 91. Trace of Reference Points During Motion Inhibits Test.

MOTION INHIBITS - Cont

Display Motion Inhibits Settings - Cont

b. Press ACCEPT (LEFT toggle RIGHT) to begin test. The Motion Inhibits Test In Progress Screen appears. See Figure 92.

NOTE

The weapon moves over Motion Inhibits Reference Points when ascending and through Motion Inhibits Reference Points when descending. .

c. Verify that Motion Inhibits Zones are set correctly. If not correct, see WP 0024, Troubleshooting Index.

d. If correct, press ACCEPT (LEFT toggle RIGHT) or press FUNCTION (RIGHT toggle DOWN) to end test. See Figure 92.

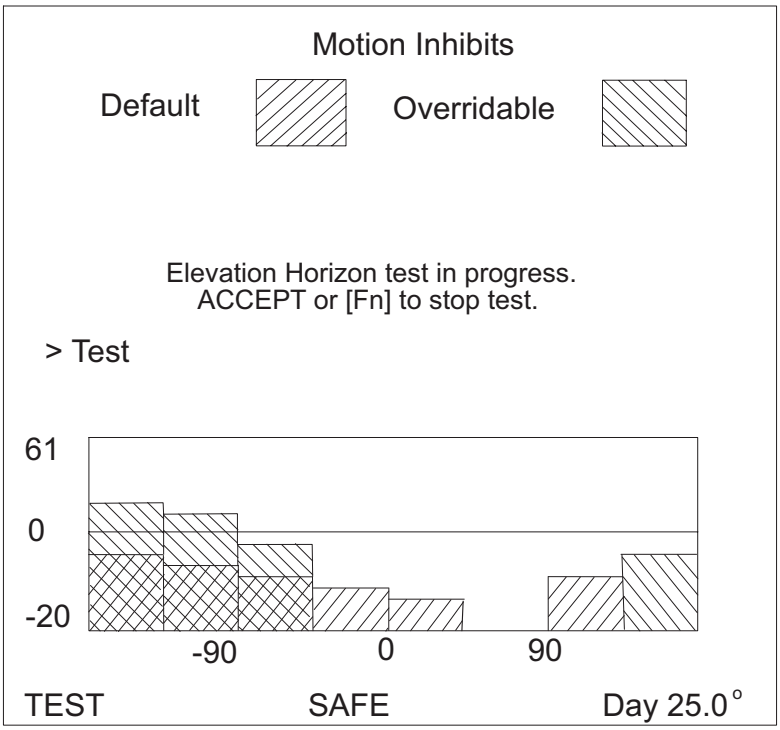


Figure 92. Motion Inhibits Test In Progress Screen.

8. Press LASE (LEFT toggle LEFT) to return to the Engagement screen.

END OF TASK

CONFIGURE MENU

Overview

The Configure Menu provides the operator with options to set-up the system in response to several conditions. To get to the Configure Menu, follow the below procedure:

1. From the Engagement screen (Figure 8), press FUNCTION (RIGHT toggle DOWN) until you are in the Menu mode. See Figure 8. The Menu mode is shown in the lower left of the screen.

2. Ensure the CURSOR is positioned on the Preparation Menu entry point designated by P in the upper left of the screen. See Figure 10.

3. Press ACCEPT (LEFT toggle RIGHT). This will take you to the Preparation Menu.

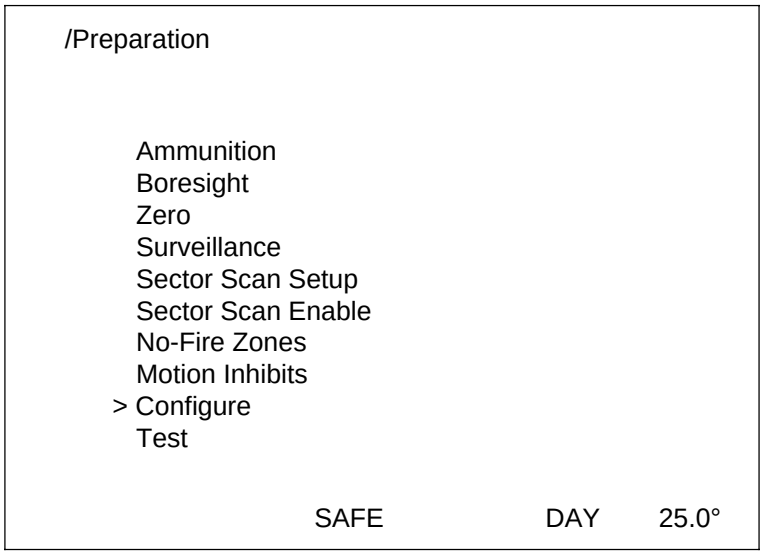


Figure 93. Preparation Menu.

4. Position the CURSOR onto the CONFIGURE option, as shown in Figure 93.

CONFIGURE MENU - Cont

Overview - Cont

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any switches. Failure to follow these instructions may result in equipment malfunction or failure.

5. Press ACCEPT (LEFT toggle RIGHT). This will take you to the Configure Menu as shown in Figure 94.

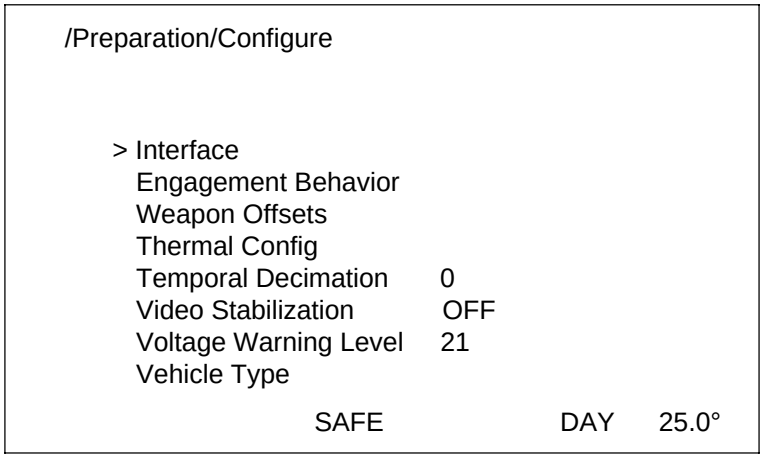


Figure 94. Configure Menu with Interface Option Selected.

END OF TASK

Interface

Selecting INTERFACE will give the operator the ability to configure the options shown in Figure 95.

1. To get to the Configuration Menu INTERFACE option, follow the instructions in the Configure Menu Options section.

2. Ensure the CURSOR is positioned on the INTERFACE option.

3. Press ACCEPT (LEFT toggle RIGHT). The Configure Interface screen, Figure 95, appears.

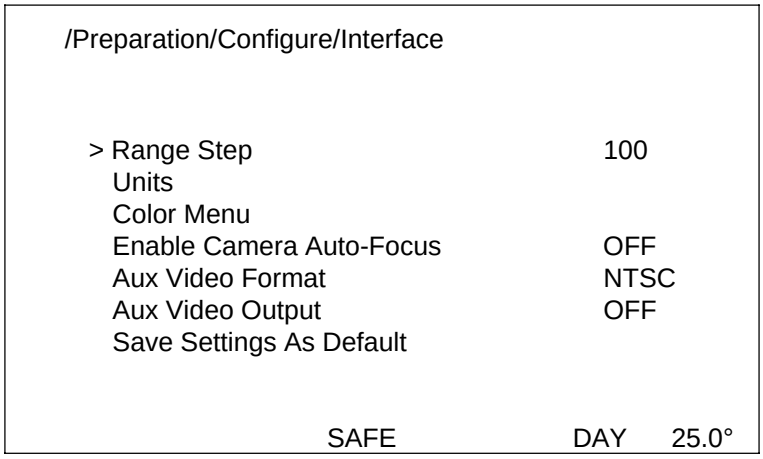


Figure 95. Configure Interface Menu with Range Step Option Selected.

END OF TASK

Range Step

WARNING

Before opening the vehicle hatch, ensure the laser aimpoint is displayed. Do not range step or enter a manual range while the hatch is open, unless the Safety Over-Ride switch on the SPU is in the OFF position (enabled). The ballistic solution may be affected.

When a ballistic aimpoint is displayed in the Rg / Brt / Accpt screen (either from lasing a target or from manual input), the displayed range can be increased or decreased using the CURSOR CONTROL switch or by pressing LEFT toggle UP / DOWN on the joystick.

NOTE

Range is always calculated in meters (SI) regardless of what unit of measure is chosen for display purposes. The amount of variation in range step ballistic increments is a Factory Preset Default of 100 meters, but can be changed using the RANGE STEP option found in the Interface Menu (Figure 95).

The Range Step value is not stored between Power-ON cycles. Range step values default to the last saved default setting at Power ON. Any other Range Step value must be reset every time unless the SAVE SETTINGS AS DEFAULT option is selected. For additional information, refer to the Sensing Interface Settings as Default section of this work package.

Perform the following procedures to modify the Range Step value.

1. Position CURSOR on Configure Interface Menu RANGE STEP option. See Figure 95.
2. Press ACCEPT (LEFT toggle RIGHT).

NOTE

Activation of the RANGE STEP option presents the operator with the current RANGE STEP value. Refer to the Operator Data Entry section of this work package to modify the existing RANGE STEP setting to the new value.

3. Change Range Step value, as required. Refer to Operator Data Entry section Tables 2 and 3.
4. When the new value has been set, press ACCEPT (LEFT toggle RIGHT) to confirm the new setting.

END OF TASK

CONFIGURE MENU - Cont

Interface - Cont

Units

Selecting the Configure Interface UNITS option, Figure 96, allows the operator to change settings.

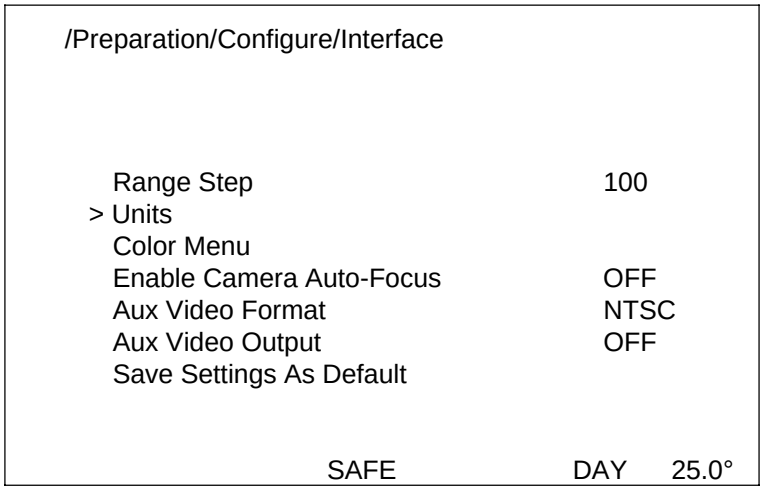


Figure 96. Interface Menu with Units Option Selected.

Perform the following procedures to modify the values of the Interface Units. Repeat the procedure to change additional UNITS of measure.

1. Position the CURSOR on the Configuration Interface Menu UNITS option. See Figure 96.

2. Press ACCEPT (LEFT toggle RIGHT). The menu for selecting different Units settings appears, as shown in Figure 97.

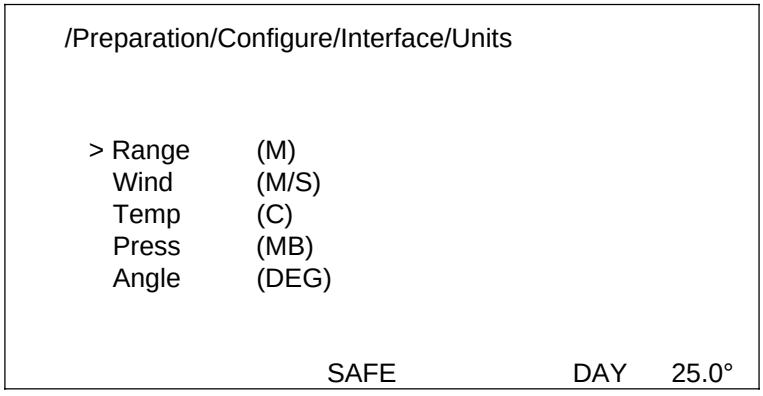


Figure 97. Units Menu for Selecting Options and Values.

NOTE

Table 7 lists the Units Categories and available Units of Measure options.

3. Position the CURSOR on the desired UNITS category, shown in Table 7.

NOTE

Range step is always calculated in meters (SI) regardless of what unit of measure is chosen for display purposes.

Table 7. Available Units of Measure.

Categories	Options for Unit of Measure
Range	M, mi, yd, nm, ft, km
Wind	M/s, mph, ft/s, km/hr, kn
Temperature	C, F, K
Pressure	Mb, mmHg, Atm, inHg, Kpa
Angle	Mils, Rads, Deg°

4. Press ACCEPT (LEFT toggle RIGHT) until the desired unit of measurement is selected.
5. Repeat steps 3 and 4 for each Category requiring change.
6. Press RIGHT toggle LEFT to return to the Interface Menu.

END OF TASK

CONFIGURE MENU - **Cont**

Interface - Cont

Color Menu - Everything Else Color/Laser Reticle Color/Aimpoint Color

Perform the following procedures to modify the various color options.

1. Position the CURSOR on the Configure Interface Menu COLOR MENU option. See Figure 98.

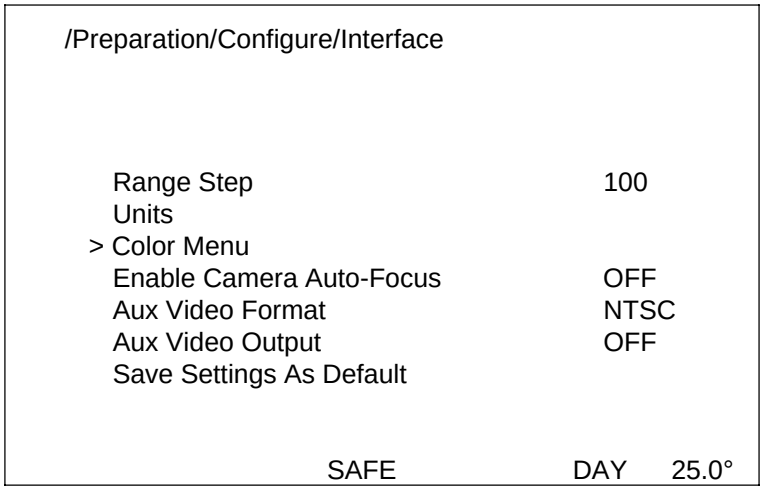


Figure 98. Interface Menu with Color Menu Option Selected.

2. Press ACCEPT (LEFT toggle RIGHT), bringing up the COLOR MENU as shown in Figure 99.

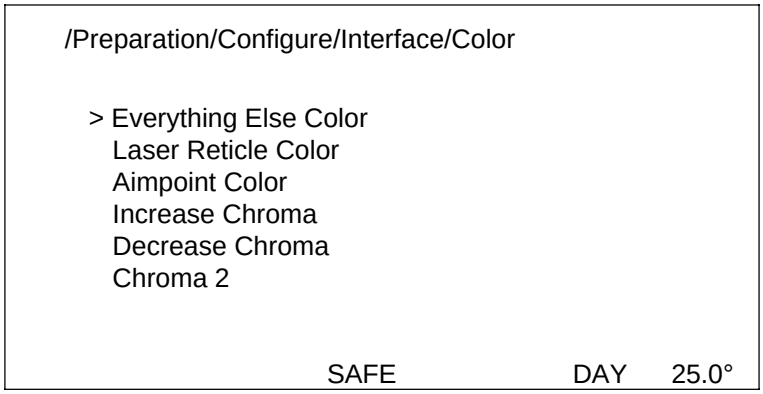


Figure 99. Color Menu with Everything Else Color Option Selected.

NOTE

Selecting the EVERYTHING ELSE COLOR option allows the operator to adjust screen text and symbology colors except Laser Aimpoint and Ballistic Aimpoint color. Selecting the LASER RETICLE COLOR option allows the operator to adjust laser aimpoint colors. Selecting the AIMPOINT COLOR option allows the operator to adjust ballistic aimpoint colors.

3. Position the CURSOR on the EVERYTHING ELSE COLOR option. See Figure 99.

4. Press ACCEPT (LEFT toggle RIGHT).

NOTE

The following procedural steps 5 through 11 may be performed for Color Menu options EVERYTHING ELSE COLOR, LASER RETICLE COLOR (Laser Aimpoint), and AIMPOINT COLOR (Ballistic Aimpoint).

5. As required, position the CURSOR onto the color to be selected. See Figure 100.

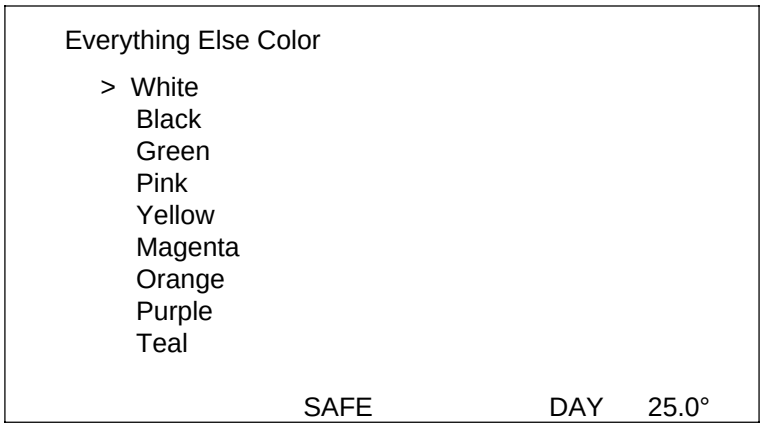


Figure 100. Color Menu Selections.

6. Press ACCEPT (LEFT toggle RIGHT).

7. Press RIGHT toggle LEFT to return to the Interface Menu.

END OF TASK

CONFIGURE MENU - Cont

Interface - Cont

Color Menu - Increase Chroma/Decrease Chroma

NOTE

Increasing or decreasing the Chroma adjusts a green or purple hue, which may be observed in the color video of the day camera. This adjustment does not affect the Thermal camera.

Perform the following procedures to increase or decrease chroma.

1. To increase the CHROMA level, perform the following steps.

   a. Position the CURSOR to INCREASE CHROMA, referring to Figure 101.

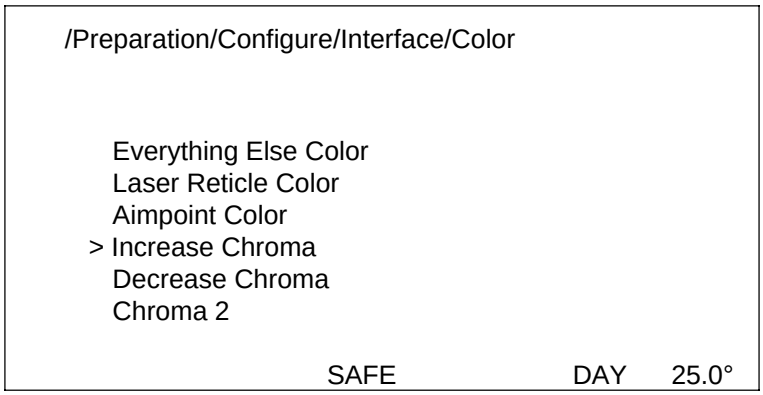


Figure 101. Color Menu with Increase Chroma Option Selected.

   b. Press ACCEPT (LEFT toggle RIGHT) and verify that the CHROMA increases by 1. Repeat as needed.

2. To decrease the CHROMA level, perform the following steps.

   a. Position the CURSOR to DECREASE CHROMA, referring to Figure 102.

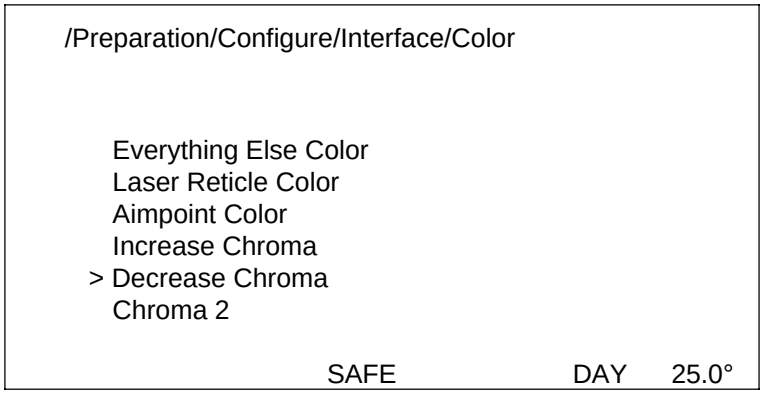


Figure 102. Color Menu with Decrease Chroma Option Selected.

   b. Press ACCEPT (LEFT toggle RIGHT) and verify that the CHROMA decreases by 1. Repeat as needed.

3. Press RIGHT toggle LEFT to return to the Interface Menu, or press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

Enable Camera Auto-Focus

NOTE

Auto-focus performs best on stationary objects with medium-to-high contrast.

Perform the following procedures to enable/disable camera auto-focusing.

1. Position the CURSOR on the Configure Interface Menu ENABLE CAMERA AUTO-FOCUS option. See Figure 103.

2. Press ACCEPT (LEFT toggle RIGHT) to toggle between ON and OFF to enable (ON) or disable (OFF) camera auto-focus.

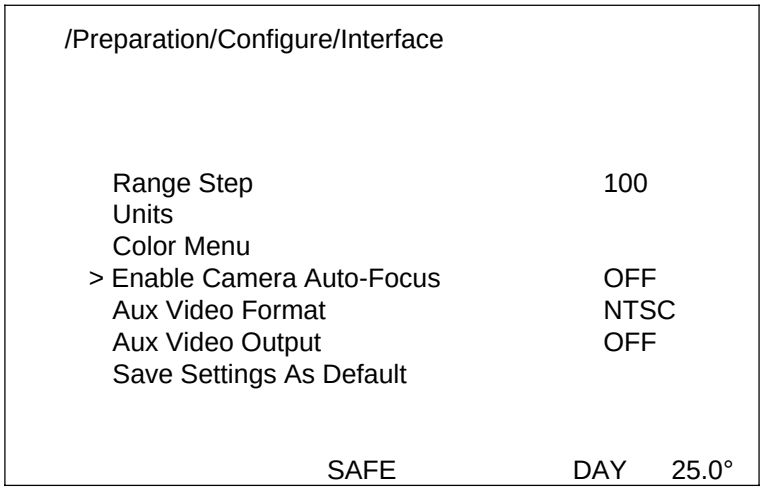


Figure 103. Interface Menu with Enable Camera Auto-Focus Option Selected.

3. Press RIGHT toggle LEFT to return to the Interface Menu or press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

CONFIGURE MENU - Cont

Interface - Cont

Aux Video Format

Perform the following procedures to change the format of the Aux Video.

1. Position the CURSOR on the Configure Interface Menu onto the AUX VIDEO FORMAT option. See Figure 104.

NOTE

Unless directed otherwise by the Commander for mission requirements, the Aux Video Format shall remain in the NTSC format.

2. Press ACCEPT (LEFT toggle RIGHT) to toggle between the NTSC video format and PAL video format. Leave this option in the NTSC format.

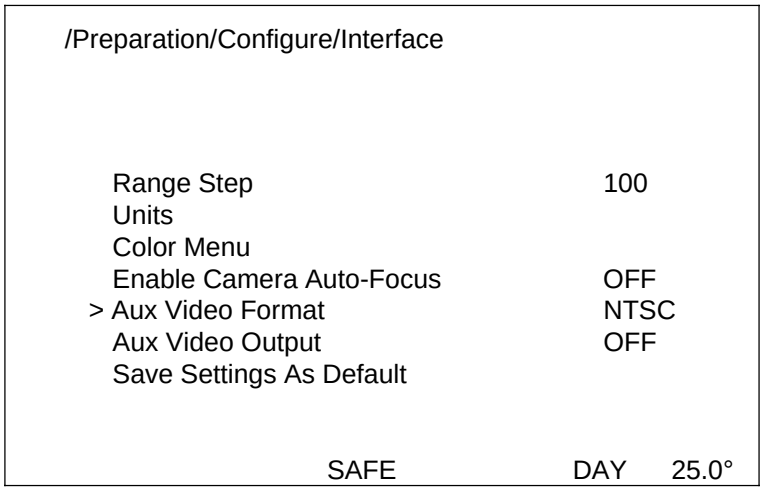


Figure 104. Interface Menu with Aux Video Format Option Selected.

3. Press RIGHT toggle LEFT to return to the Interface Menu or press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

Aux Video Output

Perform the following procedures to allow aux video output. This will allow you to hook up an auxiliary video unit.

1. Position the CURSOR on the Configure Interface Menu onto the AUX VIDEO OUTPUT option. See Figure 105.

2. Press ACCEPT (LEFT toggle RIGHT) to toggle between ON and OFF to enable (ON) or disable (OFF) Aux Video Output.

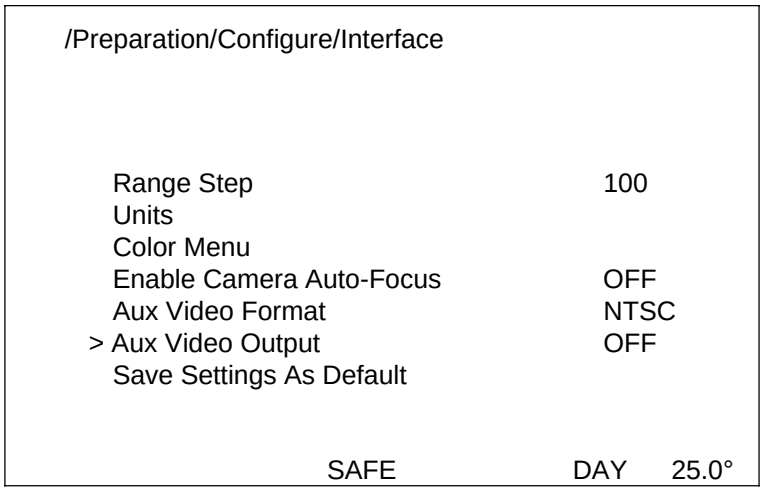


Figure 105. Interface Menu with Aux Video Output Option Selected.

3. Press RIGHT toggle LEFT to return to the Interface Menu or press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

NOTE

The CROWS is to be powered off before connecting an auxiliary video unit.

END OF TASK

CONFIGURE MENU - Cont

Interface - Cont

Save Settings as Default

NOTE

Selecting the SAVE SETTINGS AS DEFAULT option in the Preparation/Configure/Interface menu allows the operator to set and save custom values for a variety of functions. The settings are saved and are not affected by a system power cycle (i.e., when the system power is turned OFF and then ON). Table 8 lists the Functions for which settings are saved as default values.

Table 8. Configure Menu Interface Settings Saved when "Save Settings as Default" Option is Selected.

FUNCTION	FUNCTION
Range Step	Angle Unit
Temperature Unit	Pressure Unit
Pressure Unit	Aimpoint Color
Angle Unit	Enable Camera Auto-Focus

Perform the following procedures to save the custom value settings.

1. Position the CURSOR on the Configure Interface Menu SAVE SETTINGS AS DEFAULT option. See Figure 106.
2. Press ACCEPT (LEFT toggle RIGHT) to save current settings.

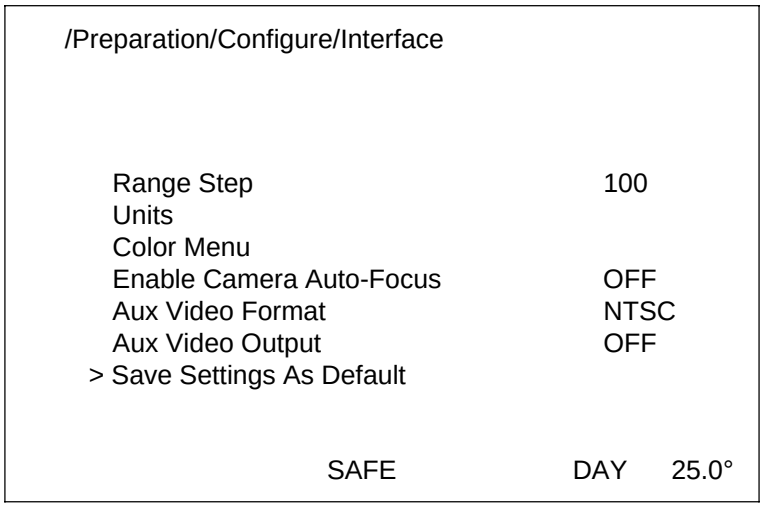


Figure 106. Interface Menu with Save Settings as Default Option Selected.

3. Press RIGHT toggle LEFT to return to the Interface Menu or press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

Engagement Behavior

Perform the following procedures to configure the way targets are acquired and engaged.

1. Position the CURSOR onto the Configure Menu ENGAGEMENT BEHAVIOR option. See Figure 107.

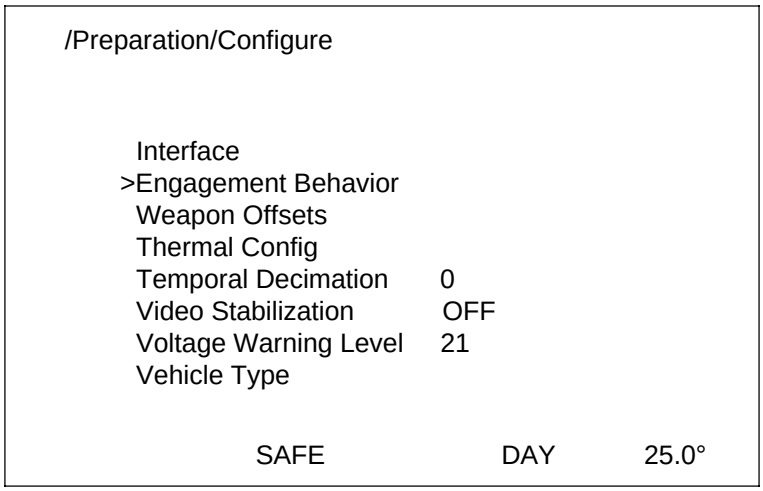


Figure 107. Configure Menu with Engagement Behavior Option Selected.

2. Press ACCEPT (LEFT toggle RIGHT) to display the options in the Engagement Behavior Menu, as shown in Figure 108.

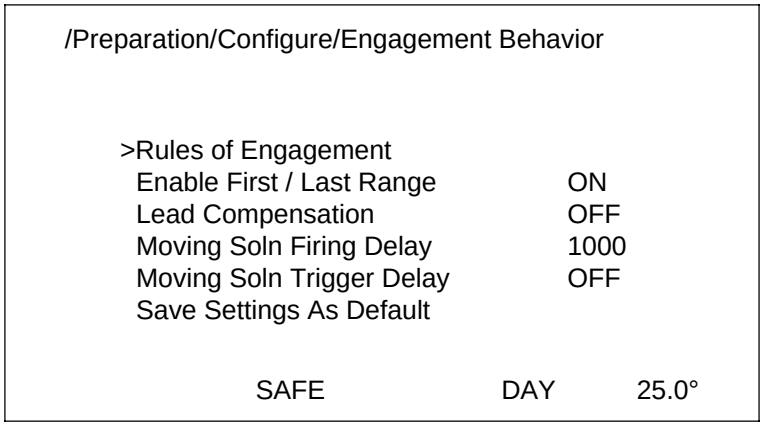


Figure 108. Engagement Behavior Menu.

END OF TASK

CONFIGURE MENU - Cont

Engagement Behavior - Cont

Rules of Engagement

Perform the following procedures to configure the way targets are acquired and engaged.

1. Position CURSOR onto the Engagement Behavior RULES OF ENGAGEMENT option. See Figure 108.

2. Press ACCEPT (LEFT toggle RIGHT) to display the options for Rules of Engagement, as shown in Figure 109.

NOTE

The asterisk (*) indicates that the "Allow Changes" lines cannot be accessed or changed.

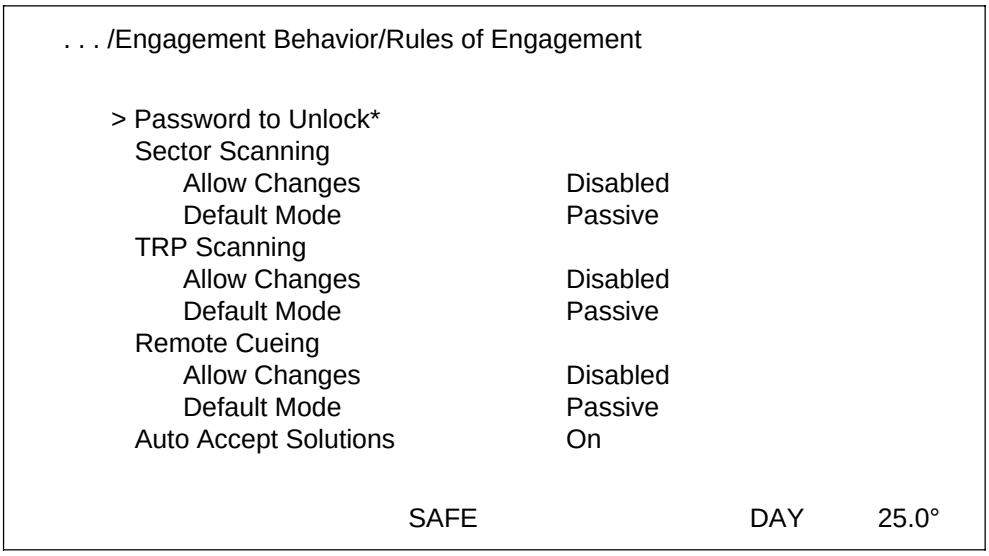


Figure 109. Rules of Engagement Menu.

END OF TASK

Rules of Engagement - Password to Unlock

NOTE

To change Sector Scanning, TRP Scanning, and Remote Cueing from Passive to Aggressive, a password is required to Unlock settings for changes. Refer to the next higher level of command for password.

Password to UnLock in the Rules of Engagement allows the user to toggle between the Allow Changes DISABLED and ENABLED.

1. Ensure the CURSOR is positioned on the Engagement Behavior, Rules of Engagement Menu, PASSWORD TO UNLOCK option.

2. Press ACCEPT (LEFT toggle RIGHT). A keyboard screen appears. See Figure 110.

	°	1	2	3	4	5	6	7	8	9	0	-	=	Backspace	
			Q	W	E	R	T	Y	U	I	O	P	[	]	\
	A	S	D	F	G	H	J	K	L	;	'	Enter			
	Z	X	C	V	B	N	M	,	.	/					
							Space								

Figure 110. Keyboard for Password Input.

3. Position CURSOR onto first character (letter, number, or symbol) of password. See Figure 111 for Joystick input.

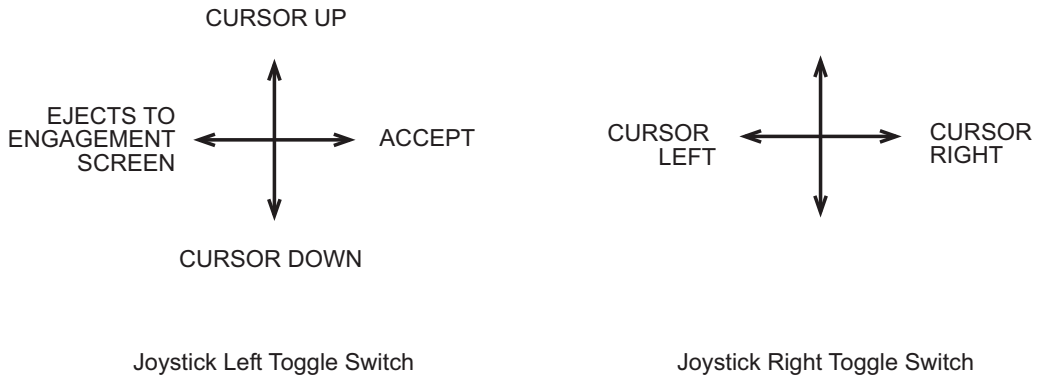


Figure 111. Joystick Switches for Password Input.

4. Press ACCEPT (LEFT toggle RIGHT). An asterisk (*) will appear.
5. Repeat steps 3 and 4 for each remaining character of password.
6. Highlight "Enter."
7. Press ACCEPT (LEFT toggle RIGHT).

CONFIGURE MENU - Cont

Engagement Behavior - Cont

Rules of Engagement - Password to Unlock - Cont

NOTE

After pressing ACCEPT, the password will be processed as shown in Figure 112. Access will be granted if the password was entered correctly. The text “Access Granted,” as shown in Figure 113, will appear only for an instant.

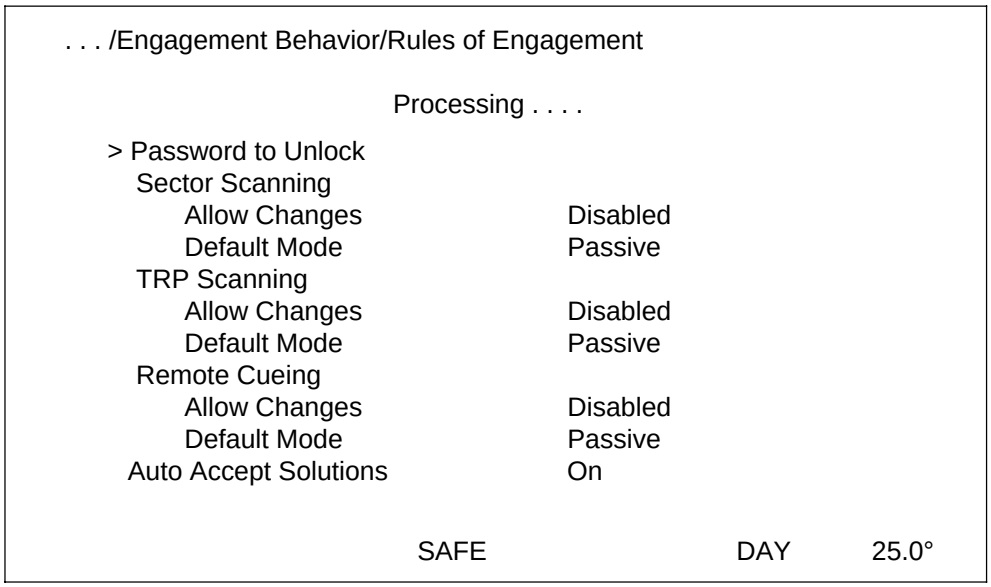


Figure 112. Rules of Engagement Menu while Processing the Password to Unlock.

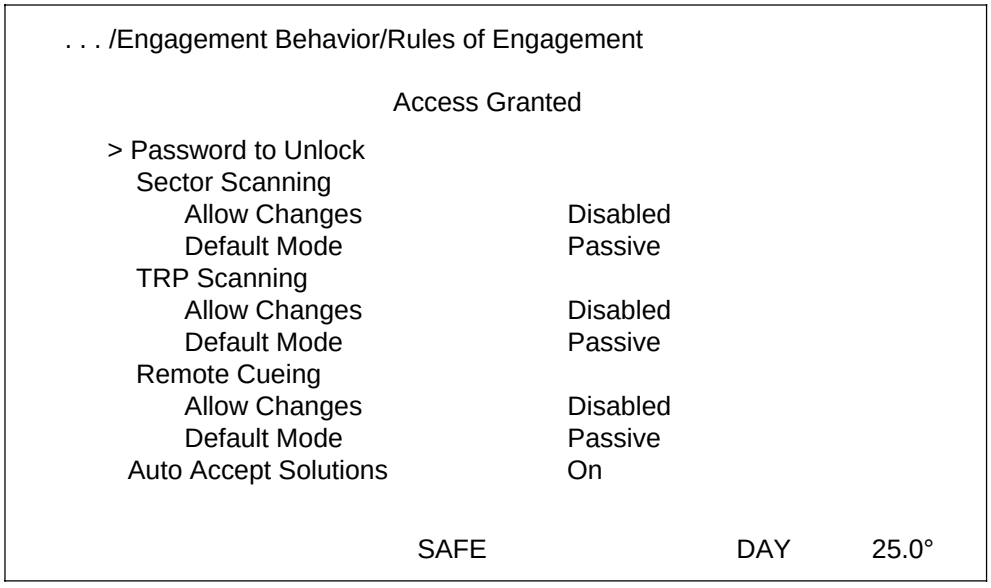


Figure 113. Rules of Engagement Menu After Access Granted.

END OF TASK

Rules of Engagement - Sector Scanning, TRP Scanning, and Remote Cueing

Perform the following to change the ALLOW CHANGES and DEFAULT MODE options of Sector Scanning, TRP Scanning, and Remote Cueing.

1. Position the CURSOR onto the Engagement Behavior, Rules of Engagement Menu, ALLOW CHANGES option under SECTOR SCANNING. See Figure 114.

NOTE

ALLOW CHANGES option must be Enabled before the DEFAULT MODE option can be changed from the default Passive mode to the Aggressive mode.

2. Press ACCEPT (LEFT toggle RIGHT) to toggle the ALLOW CHANGES option to read ENABLED.

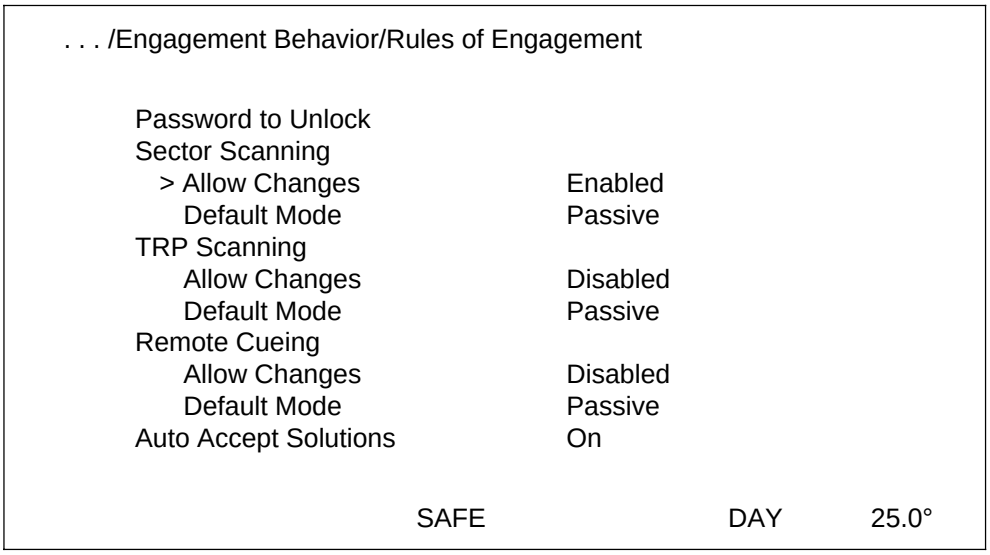


Figure 114. Rules of Engagement Menu for Enabling/Disabling Changes in Sector Scanning, TRP Scanning, or Remote Cueing.

3. Position the CURSOR onto the DEFAULT MODE option under SECTOR SCANNING.

CONFIGURE MENU - Cont

Engagement Behavior - Cont

Rules of Engagement - Sector Scanning, TRP Scanning, and Remote Cueing – Cont

NOTE

Selecting the PASSIVE DEFAULT MODE option allows the weapon to scan while elevated. Selecting the AGGRESSIVE DEFAULT MODE option allows the weapon to scan in synchronization with the sensor unit.

4. Press ACCEPT (LEFT toggle RIGHT) to toggle between the sector-scanning DEFAULT MODE options PASSIVE and AGGRESSIVE. See Figure 115.

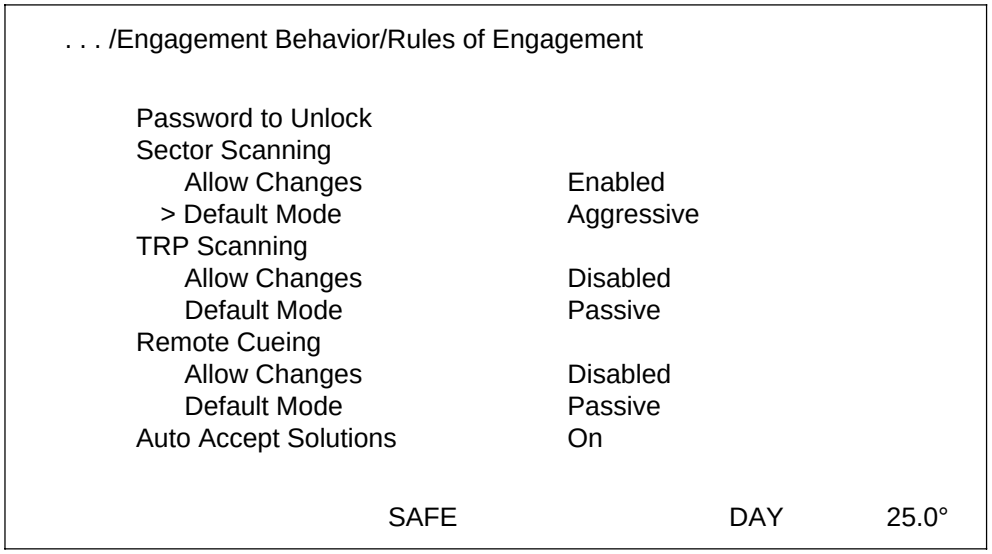


Figure 115. Rules of Engagement Menu for Changing the Sector Scanning Default Mode.

5. Repeat steps 1 through 4 for TRP Scanning and Remote Cueing, as required.

NOTE

Exiting the Rules of Engagement screen saves all changes, even through a power cycle. After exiting the screen, the "Allow Changes" lines may only be accessed or changed if Password to Unlock is re-entered.

To lock, LASE (LEFT toggle RIGHT) back to the Engagement screen. Upon return to the PASSWORD TO UNLOCK option, there will be an asterisk (*).

END OF TASK

Rules of Engagement - Auto Accept Solutions

NOTE

Enabling the AUTO ACCEPT SOLUTIONS feature is not password-protected. This option allows you to have the system automatically accept the ballistic solutions after lazing a target (ON/Enable). The OFF mode (Disable) requires operator acceptance of a ballistic solution after lazing a target.

Perform the following procedures to enable or disable the ballistics AUTO ACCEPT SOLUTIONS option.

1. Position the CURSOR onto the Engagement Behavior Rules of Engagement Menu AUTO ACCEPT SOLUTIONS option. See Figure 116.

2. Press ACCEPT (LEFT toggle RIGHT) to toggle between the ON and OFF modes. See Figure 116.

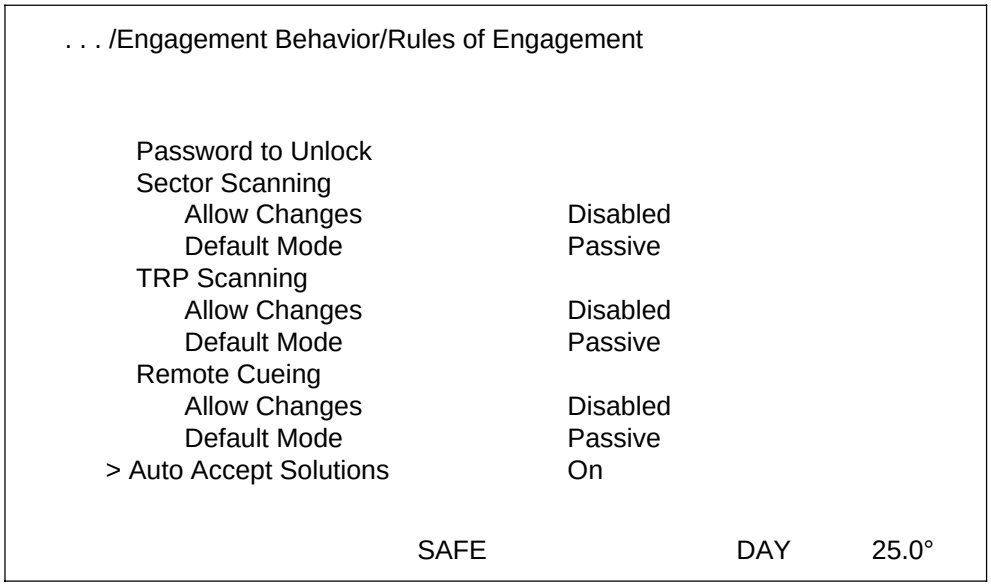


Figure 116. Rules of Engagement Menu with Auto-Accept Solutions Option Selected.

3. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

CONFIGURE MENU - Cont

Engagement Behavior - Cont

Enable First / Last Range

NOTE

The gunner will use the Last Range option in most combat situations. The LAST RANGE option will provide correct range to target if laser beam in FOV is stopped by target. Usually target is larger than the laser beam; therefore, laser beam will be reflected from target and last range will be correct range regardless of number of multiple returns from other obstructions. The last return will be correct over 90% of the time in a combat environment.

The First Range option should be used when there are no obstacles between ranging vehicle and intended target.

The First Range option can also be used for training targets such as panels or cloth-type silhouettes. These targets may get holes in them which will allow laser to pass through and produce multiple returns.

The First Range option can also be used for training targets that are situated above ground level. The laser beam can pass underneath them and produce multiple returns.

Perform the following procedures to change the LRF ENABLE FIRST / LAST RANGE option.

1. Position the CURSOR onto the Engagement Behavior Menu ENABLE FIRST / LAST RANGE option. See Figure 117.

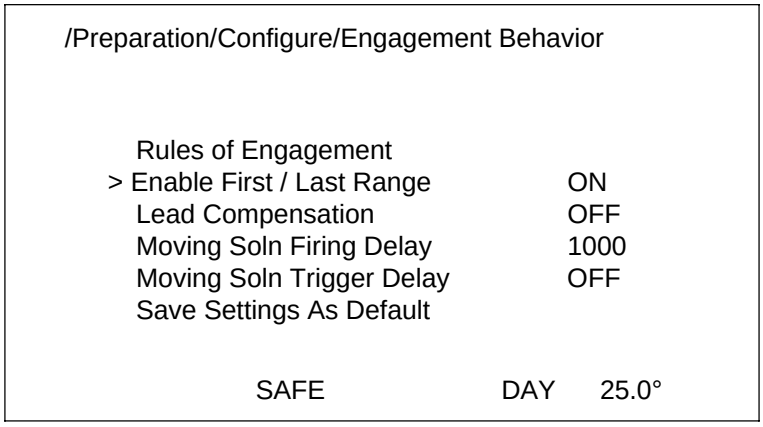


Figure 117. Engagement Behavior Menu with Enable First / Last Range Option Selected.

2. Press ACCEPT (LEFT toggle RIGHT) to toggle between the ENABLE FIRST / LAST RANGE option ON or OFF.

3. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

Lead Compensation - Overview

Lead Compensation provides the ability to engage moving targets or stationary targets when the CROWS host vehicle is moving. Effective Lead Compensation is dependent on Dynamic Tracking, which is a video automatic target tracking mode of operation currently **NOT IMPLEMENTED** in the CROWS.

Lead Compensation

As required, perform the following procedures to turn Lead Compensation OFF.

1. Position CURSOR onto the Engagement Behavior Menu, LEAD COMPENSATION option. See Figure 118.

2. Ensure Lead Compensation is OFF by pressing ACCEPT (LEFT toggle RIGHT) to toggle the LEAD COMPENSATION option to OFF.

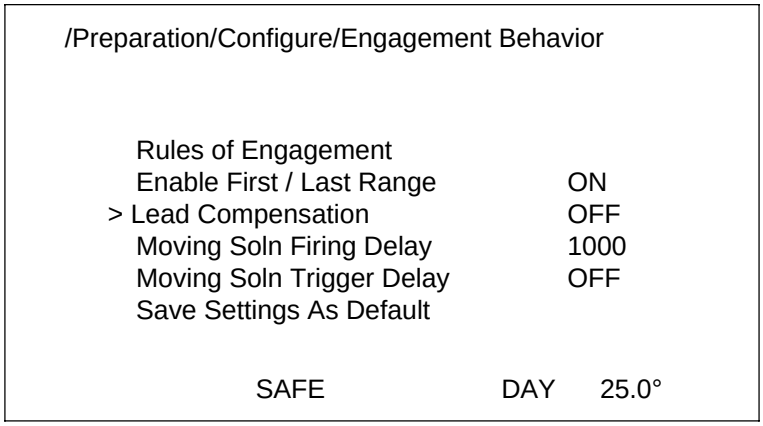


Figure 118. Engagement Behavior Menu with Lead Compensation Option Selected.

3. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

Using Lead Compensation

Perform the following procedures to enable and use Lead Compensation.

1. Position CURSOR onto the Engagement Behavior Menu, LEAD COMPENSATION option. See Figure 118.

2. Press ACCEPT (LEFT toggle RIGHT) to toggle the LEAD COMPENSATION option to ON.

CONFIGURE MENU - Cont

Engagement Behavior - Cont

Using Lead Compensation - Cont

3. Press LASE (LEFT toggle LEFT) to return to the Engagement mode screen. See Figure 8.

4. After the laser ready marker displays on the Engagement screen, position the laser aimpoint on a designated target and hold (do not release) the LASE switch (LEFT toggle LEFT) on the desired target. The laser aimpoint is replaced by the ballistic aimpoint. The laser ready marker will disappear.

5. Continue to hold the LASE switch while tracking the target until the laser ready marker reappears.

6. Release the LASE switch. The system will LASE again and the ballistic computer calculates an automatic lead compensation solution based on the track.

END OF TASK

Moving Solution Firing Delay

NOTE

The Moving Solution (Soln) Firing Delay is the time in milliseconds that the ballistic computer will hold the trigger relay open while tracking a target and calculating a ballistic solution. 1000 milliseconds are equal to 1 second. Effective Moving Solution Firing Delay is dependent on Lead Compensation being enabled, which in turn is dependent on Dynamic Tracking. Dynamic Tracking is a video automatic target tracking mode of operation currently **NOT IMPLEMENTED** in the CROWS.

As directed, perform the following procedures to increase or reduce the firing delay.

1. Position the CURSOR onto the Engagement Behavior Menu, MOVING SOLN FIRING DELAY option. See Figure 119.

NOTE

Do not change the Moving Soln Firing Delay unless directed to do so.

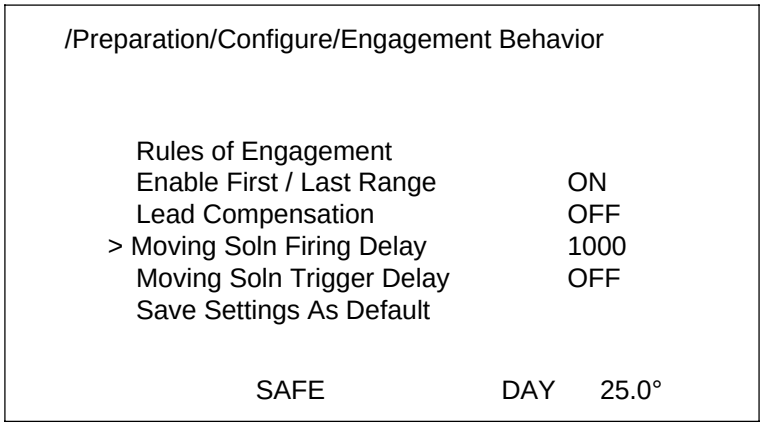


Figure 119. Engagement Behavior Menu with Moving Solution Firing Delay Option Selected.

2. Press ACCEPT (LEFT toggle RIGHT). The screen will show the current number of milliseconds set for the firing delay with the first digit underlined. See Figure 120.

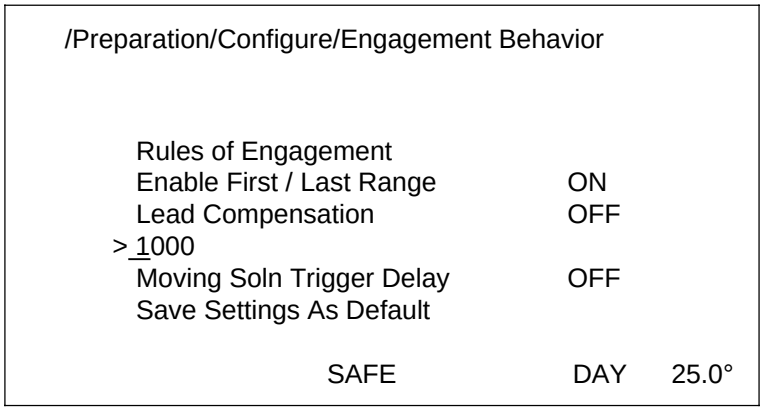


Figure 120. Engagement Behavior Menu for Increasing/Decreasing the Moving Solution Firing Delay.

NOTE

Pressing the CURSOR CONTROL switch will modify the highlighted (underlined) number only. For additional information about changing the numerical value to less than a 1-second firing delay, refer to the Operator Data Entry section, including Table 3, of this work package.

3. Refer to Operator Data Entry section, Tables 2 and 3, to change the number of milliseconds for the firing delay, as required.

4. Press ACCEPT (LEFT toggle RIGHT) to accept the new value.

5. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

Moving Solution Trigger Delay - Disable

NOTE

Ensure Moving Solution (Soln) Trigger Delay is OFF. Effective Moving Solution Trigger Delay is dependent on Lead Compensation being enabled, which in turn is dependent on Dynamic Tracking. Dynamic Tracking is a video automatic target tracking mode of operation currently NOT IMPLEMENTED in the CROWS.

Perform the following procedures to turn Moving Soln Trigger Delay OFF (Disable).

1. Position the CURSOR onto the Engagement Behavior Menu, MOVING SOLN TRIGGER DELAY option. See Figure 121.

CONFIGURE MENU - Cont

Engagement Behavior - Cont

Moving Solution Trigger Delay - Disable - Cont

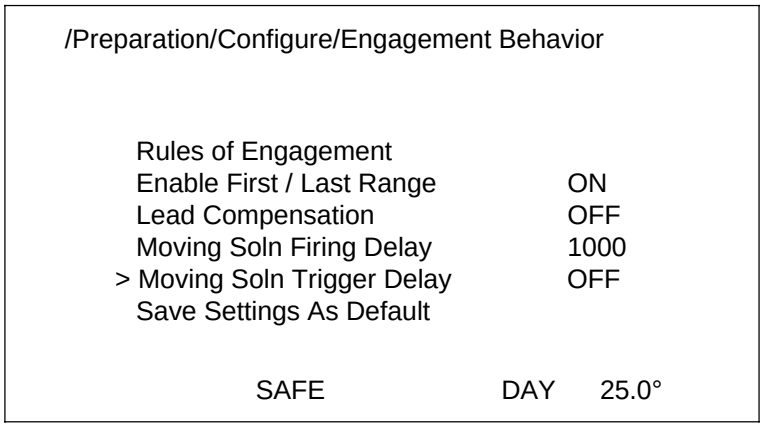


Figure 121. Engagement Behavior Menu with Moving Soln Trigger Delay Option Selected.

2. Press ACCEPT (LEFT toggle RIGHT) to toggle the MOVING SOLN TRIGGER DELAY option to OFF.

3. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

Moving Solution Trigger Delay - Enable

Perform the following procedures to enable and use the Moving Soln Trigger Delay.

1. Position CURSOR onto the Engagement Behavior Menu, MOVING SOLN TRIGGER DELAY option. See Figure 121.

2. Press ACCEPT (LEFT toggle RIGHT) to toggle the MOVING SOLN TRIGGER DELAY option to ON.

3. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

Save Settings as Default

NOTE

Selecting the SAVE SETTINGS AS DEFAULT option allows the operator to set and save values for a variety of functions, even when the settings are made after a system power cycle (i.e., when the system power is turned OFF and then ON). Table 9 lists the settings that are saved.

Table 9. Configure Menu Engagement Behavior Settings Saved when "Save Settings as Default" Option is Selected.

Function
Enable First/Last Range
Lead Compensation Setting
Moving Soln Firing Delay
Moving Soln Trigger Delay

Perform the following procedures to save the operator settings.

1. Position CURSOR on Engagement Behavior Menu SAVE SETTINGS AS DEFAULT option. See Figure 122.
2. Press ACCEPT (LEFT toggle RIGHT) to save current settings as default.

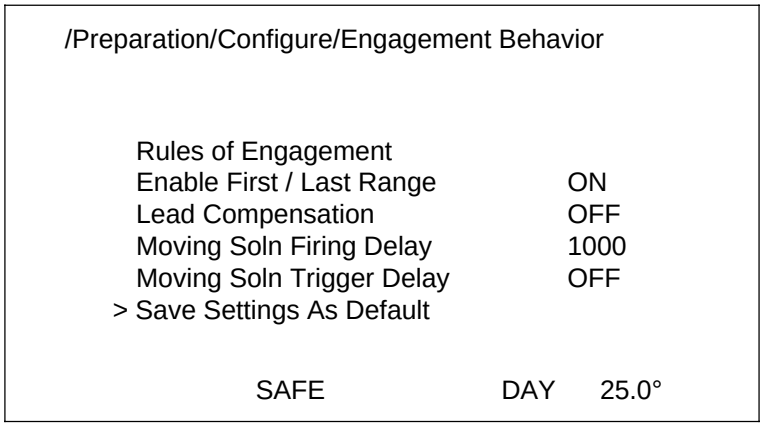


Figure 122. Engagement Behavior Menu for Saving Settings as Default.

3. Press RIGHT toggle LEFT to return to the Engagement Behavior Menu or press LASE (LEFT toggle LEFT) to return to the Engagement Menu

END OF TASK

CONFIGURE MENU - Cont

Weapon Offsets

Perform the following procedures to view boresight, zero, and other weapon-offset data.

1. Position the CURSOR on the Configure Menu WEAPON OFFSETS option. See Figure 123.

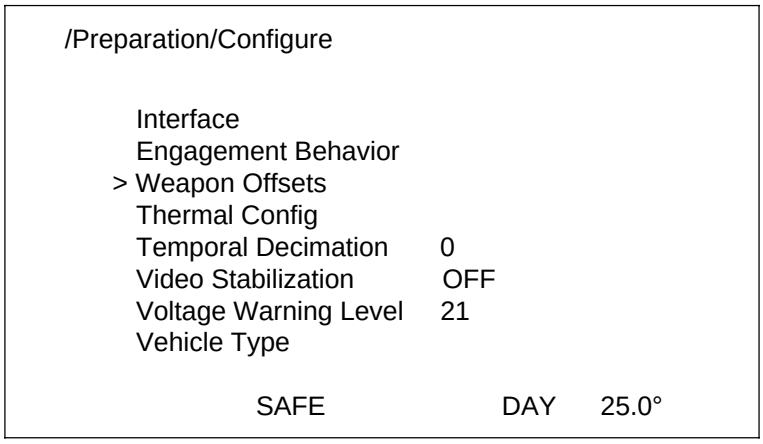


Figure 123. Configure Menu with Weapon Offsets Option Selected.

NOTE

The weapon offsets data can only be viewed for informational purposes. The X, Y and Z data is Factory Preset for each weapon type and cannot be changed by the operator or maintainer. The Boresight and Zero information may change after procedures are performed in accordance with WP 0016 Boresighting and WP 0017 Zeroing. The Weapon Offsets Last Soln (solution) for weapon azimuth and elevation change each time the ballistic computer performs a ballistic calculation.

2. Press ACCEPT (LEFT toggle RIGHT) to view the Weapon Offsets data. An example of weapon offset values is shown in Figure 124.

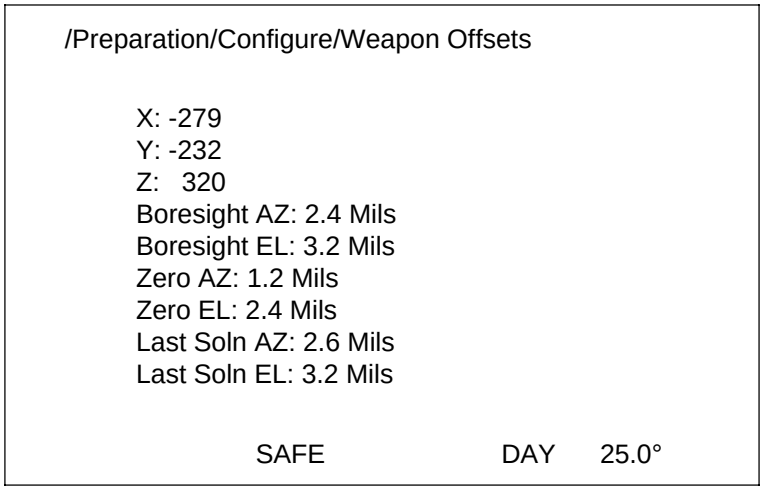


Figure 124. Weapon Offsets Menu with Example Data.

3. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

Thermal Config

Perform the following procedures to modify the thermal configuration options for the thermal sensor.

1. Position the CURSOR on the Configure Menu THERMAL CONFIG option, as shown in Figure 125.

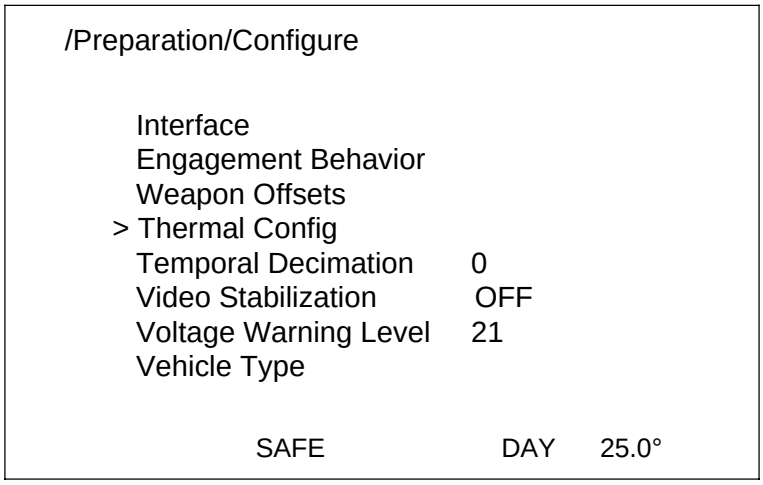


Figure 125. Configure Menu with Thermal Config Option Selected.

2. Press ACCEPT (LEFT toggle RIGHT) to display the Thermal Config options, as shown in Figure 126.

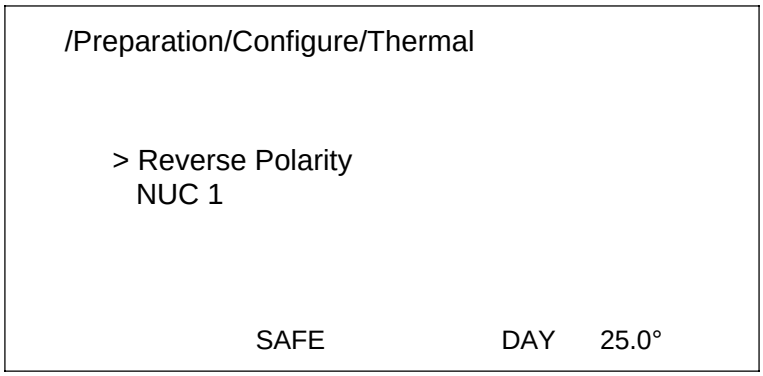


Figure 126. Thermal Config Menu with Reverse Polarity Option Selected.

3. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

CONFIGURE MENU - Cont

Thermal Config - Cont

Reverse Polarity

NOTE

Reverse polarity refers to the thermal sensor (thermal imager). Reverse polarity “White Hot” is the default setting for the thermal sensor polarity.

A "Rainbow" screen (showing large vertical bars of varying colors) will appear if thermal camera mode is accessed before the sensor is ready for operation. If this occurs, wait until the sensor is ready for operation. The rainbow screen will disappear. WP 0022, Operation Under Unusual Conditions, Operating In Extreme Temperature Conditions section, defines the maximum time required to reach operational readiness.

Perform the following procedures to reverse the polarity of the thermal sensor.

1. Perform the procedures in the Thermal Config section.
2. Press RIGHT toggle UP to change camera to THERMAL Camera.
3. Ensure the CURSOR is positioned on the Thermal Config Menu REVERSE POLARITY option. See Figure 126.
4. Press ACCEPT (LEFT toggle RIGHT).
5. Verify that the polarity indication changed from “white hot” to “black hot.”
6. As required, press ACCEPT (LEFT toggle RIGHT) to change from “black hot” to “white hot.”
7. Press RIGHT toggle UP to return to DAY camera.
8. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

NUC 1 Option

NOTE

Non-Uniformity Correction (NUC 1) refers to correction of thermal images that do not appear uniform. A uniform thermal image can be obtained using a uniform temperature object, such as a flat, one-color object, preferably solid black, held firmly against the thermal camera lens. Use extreme caution not to scratch the thermal lens. Ensure the lens cover object is large enough to cover the entire thermal lens. Another method to correct the thermal image is to point the sensor unit to a cloudless, clear sky (pointing away from the sun).

Perform the following procedure to enhance the uniformity appearance of a thermal image when the image is non-uniform.

NOTE

Attempt a NUC 1 correction only if absolutely necessary. If a NUC 1 correction is performed improperly, the thermal image may not be clear and distinct enough for mission use. Should the NUC 1 procedures result in a worse image, restarting the system should obtain the original thermal camera screen image.

If the NUC 1 procedures result in a better image, restarting the system could obtain the original non-uniform image and the corrective NUC 1 procedures will need to be performed again.

1. Perform the procedures in the Thermal Config section.

2. Position the CURSOR onto the Thermal Config Menu NUC 1 option. See Figure 127.

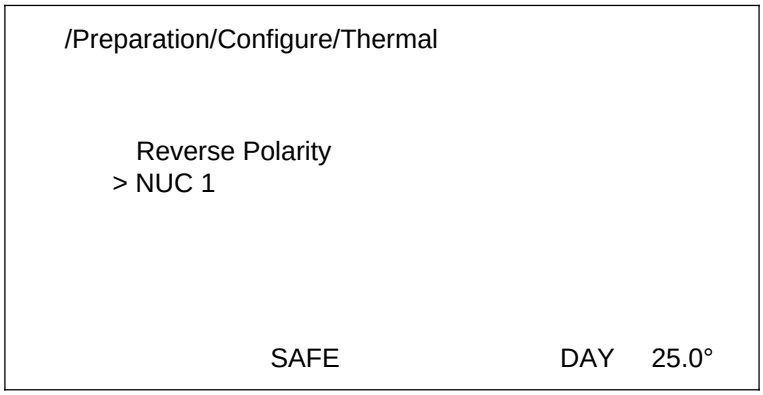


Figure 127. Thermal Config Menu with NUC 1 Option Selected.

3. Prepare the sensor for thermal image correction by covering the lens with a flat, solid, blue or black object or by using the MOTION CONTROL switch and DEADMAN switch on the Joystick to point the sensor at a clear, cloudless sky (pointing away from the sun).

CAUTION

In the following step, do not remove the object covering the sensor lens, nor reposition the sensor from its sky position for a minimum of 15 seconds. Failure to follow these instructions may result in equipment damage or system inoperability.

4. Press ACCEPT (LEFT toggle RIGHT).

5. After a minimum of 15 seconds, remove the object covering the sensor unit lens, if used, or, the sensor unit can be repositioned.

6. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

CONFIGURE MENU - Cont

Temporal Decimation

Temporal Decimation provides for adjustment of video image stability. Using a range of values from 0 (the default) to 9, the operator modifies the settings until the video image is adjusted for optimum stability under a wide range of conditions (e.g., weapon, environment, vehicle, vehicle load, etc.).

Perform the following procedure to adjust the video image stability temporal decimation.

1. Position the CURSOR on the Configure Menu TEMPORAL DECIMATION option. See Figure 128.

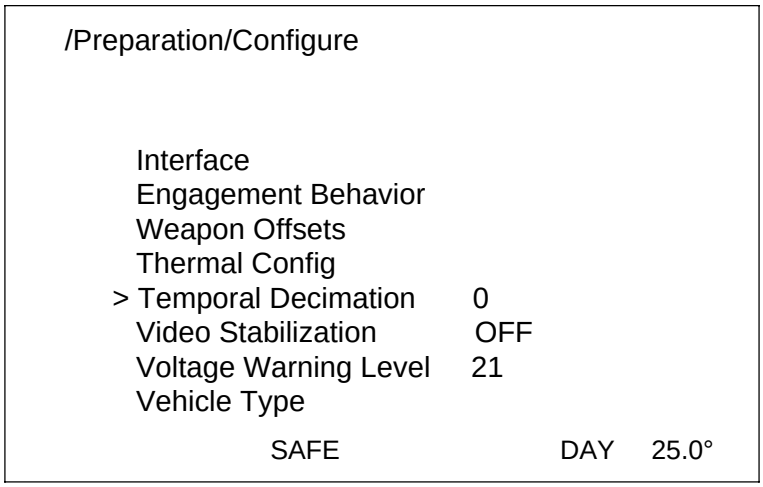


Figure 128. Configure Menu with Temporal Decimation Option Selected.

2. Press ACCEPT (LEFT toggle RIGHT) to display the Temporal Decimation value, as shown in Figure 129.

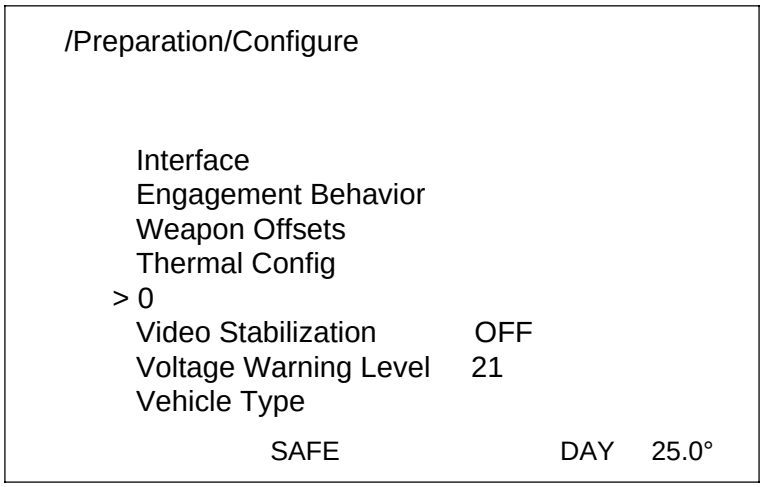


Figure 129. Temporal Decimation Increase/Decrease Option.

3. LEFT toggle UP/DOWN to increase or decrease the current setting.

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any switches. Failure to follow these instructions may result in equipment malfunction or failure.

4. Press ACCEPT (LEFT toggle RIGHT).

5. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

Video Stabilization

With the VIDEO STABILIZATION option enabled, video image clarity is improved while firing and when on the move.

Perform the following procedure to enable/disable Video Stabilization.

1. Position the CURSOR on the Configure Menu VIDEO STABILIZATION option. See Figure 130.

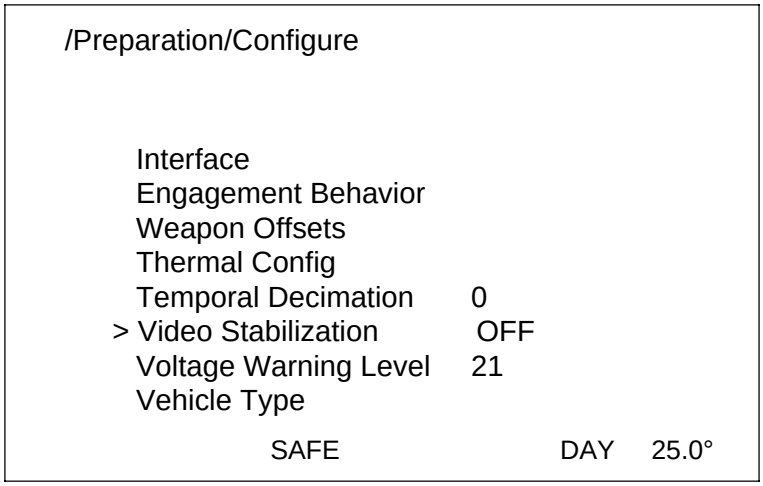


Figure 130. Configure Menu with Video Stabilization Option Selected.

2. Press ACCEPT (LEFT toggle RIGHT) to toggle OFF / ON as needed.

3. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

CONFIGURE MENU - Cont

Voltage Warning Level

The Voltage Warning Level is a safety feature that provides notification when the system is running low on power.

Perform the following procedure to change the Voltage Warning Level.

CAUTION

Do not lower the voltage warning level below 21. Failure to follow this instruction may result in equipment damage or system inoperability.

1. Position the CURSOR onto the Configure Menu VOLTAGE WARNING LEVEL option. See Figure 131.

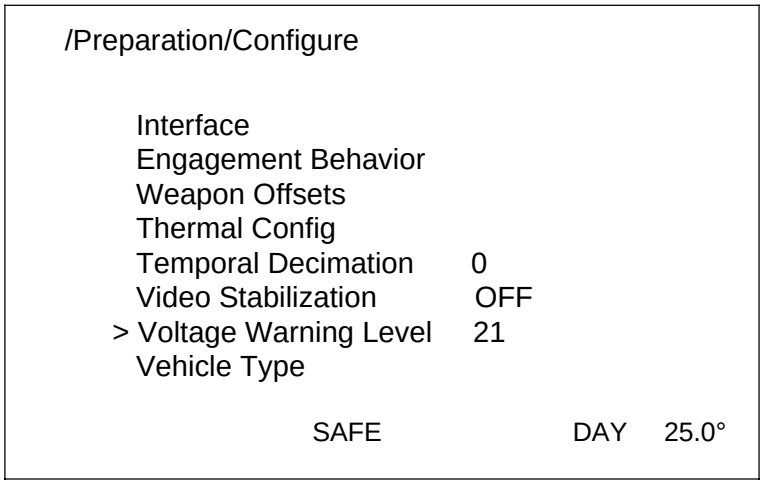


Figure 131. Configure Menu with Voltage Warning Level Option Selected.

2. Press ACCEPT (LEFT toggle RIGHT) to display the Voltage Warning Level value, as shown in Figure 132.

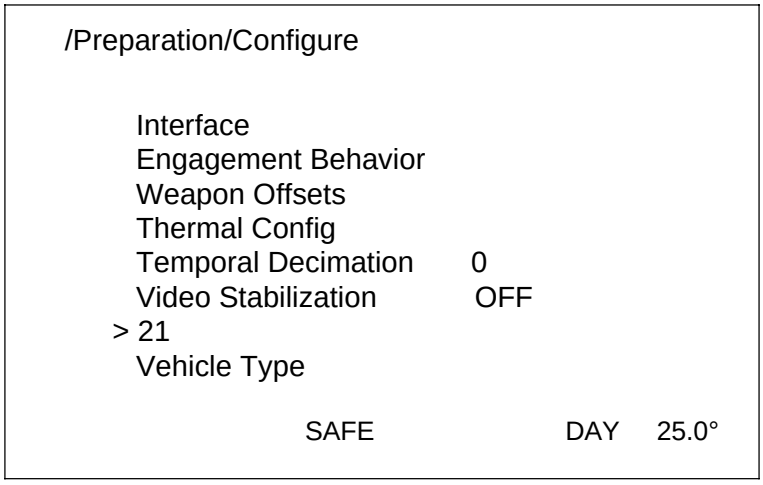


Figure 132. Voltage Warning Level Increase/Decrease Option.

3. Change Voltage Warning Level value, as required. Refer to Operator Data Entry section Tables 2 and 3.

4. Press ACCEPT (LEFT toggle RIGHT) to accept the new value.

5. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

Vehicle Type Menu Options

Selecting the VEHICLE TYPE option loads the system Factory Preset No-Fire Zones and Motion Inhibits specific for the vehicle on which the CROWS is installed. (Refer to the Description of No-Fire Zones section and the Motion Inhibits section.)

Perform the following steps to select the vehicle type on which the CROWS is installed.

1. Position the CURSOR onto the VEHICLE TYPE option. See Figure133.

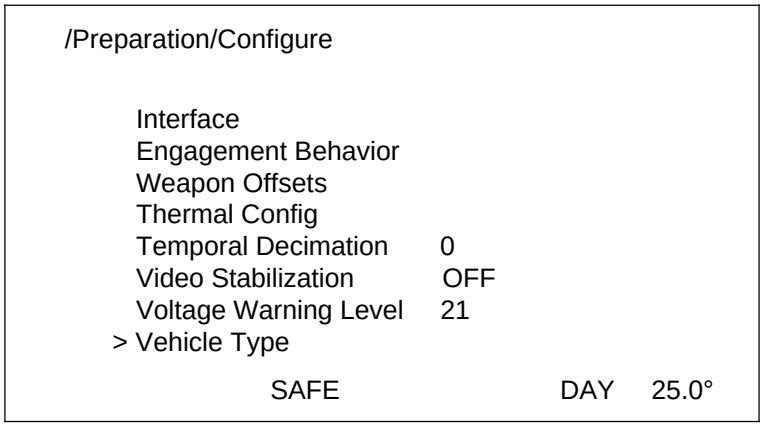


Figure 133. Configure Menu with Vehicle Type Option Selected.

2. Press ACCEPT (LEFT toggle RIGHT) to display all vehicles with programmed vehicle profile defaults. See Figure 134.

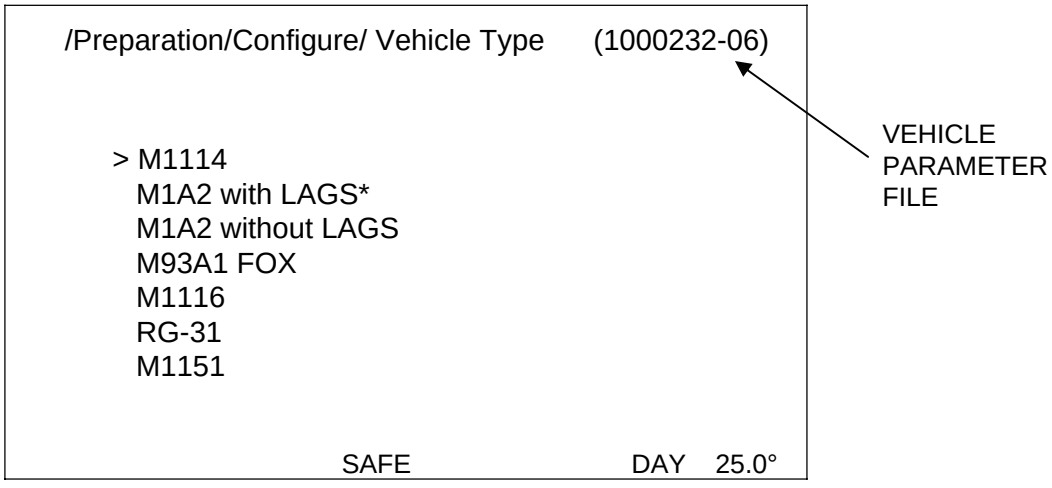


Figure 134. Vehicle Type Menu.

CONFIGURE MENU - Cont

Vehicle Type Menu Options - Cont

WARNING

Ensure the vehicle selected is the vehicle on which the CROWS is installed. Do not select an incorrect vehicle. An incorrect vehicle selection will cause malfunction of equipment and possible injury to personnel.

CAUTION

In Figure 134 the screen will display an asterisk (*) indicating the current selection of the vehicle on which the CROWS is installed. Ensure the correct vehicle on which your CROWS is installed shows an asterisk (*). Failure to follow this CAUTION will result in incorrect Factory Preset No-Fire Zones and incorrect Motion Inhibits.

3. Position the CURSOR onto the vehicle type on which your CROWS system is installed.

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any switches. Failure to follow these instructions may result in equipment malfunction or failure.

4. Press ACCEPT (LEFT toggle RIGHT).

5. Verify that asterisk (*) is on correct vehicle selection.

6. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

TEST MENU SELECTION

A BIT sequence is performed when TEST is selected from the Preparation Menu.

Perform the following procedures to run the BIT sequence test.

1. From the Engagement screen, press FUNCTION (RIGHT toggle DOWN) until you are in the Menu mode. Refer to Figure 8. The Menu mode is shown in the lower left of the screen.

2. Ensure the CURSOR is positioned on the Preparation Menu entry point designated by P in the upper left of the screen. See Figure 10.

3. Press ACCEPT (LEFT toggle RIGHT). This will take you to the Preparation Menu. See Figure 135.

4. Position the CURSOR onto the TEST option, as shown in Figure 135.

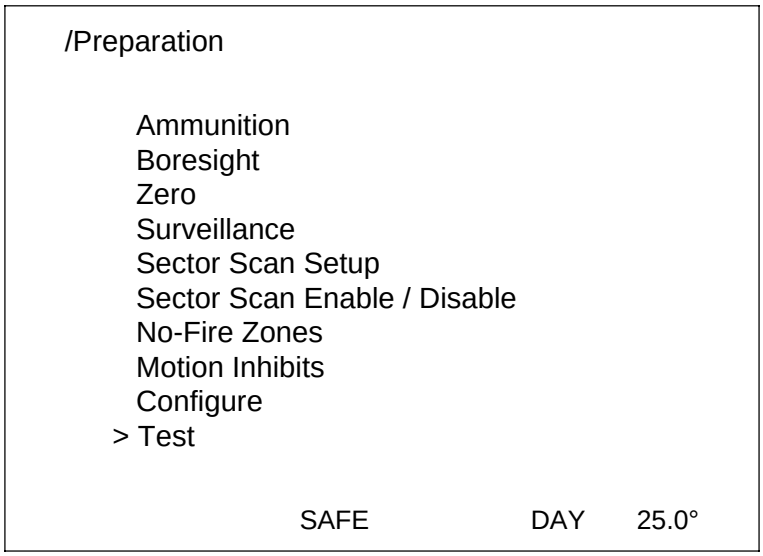


Figure 135. Preparation Menu with No-Fire Zones Option Selected.

5. Press ACCEPT (LEFT toggle RIGHT). CROWS will run the BIT sequence. A CROWS system report will be displayed. An example CROWS system BIT system status report is shown in Figure 136.

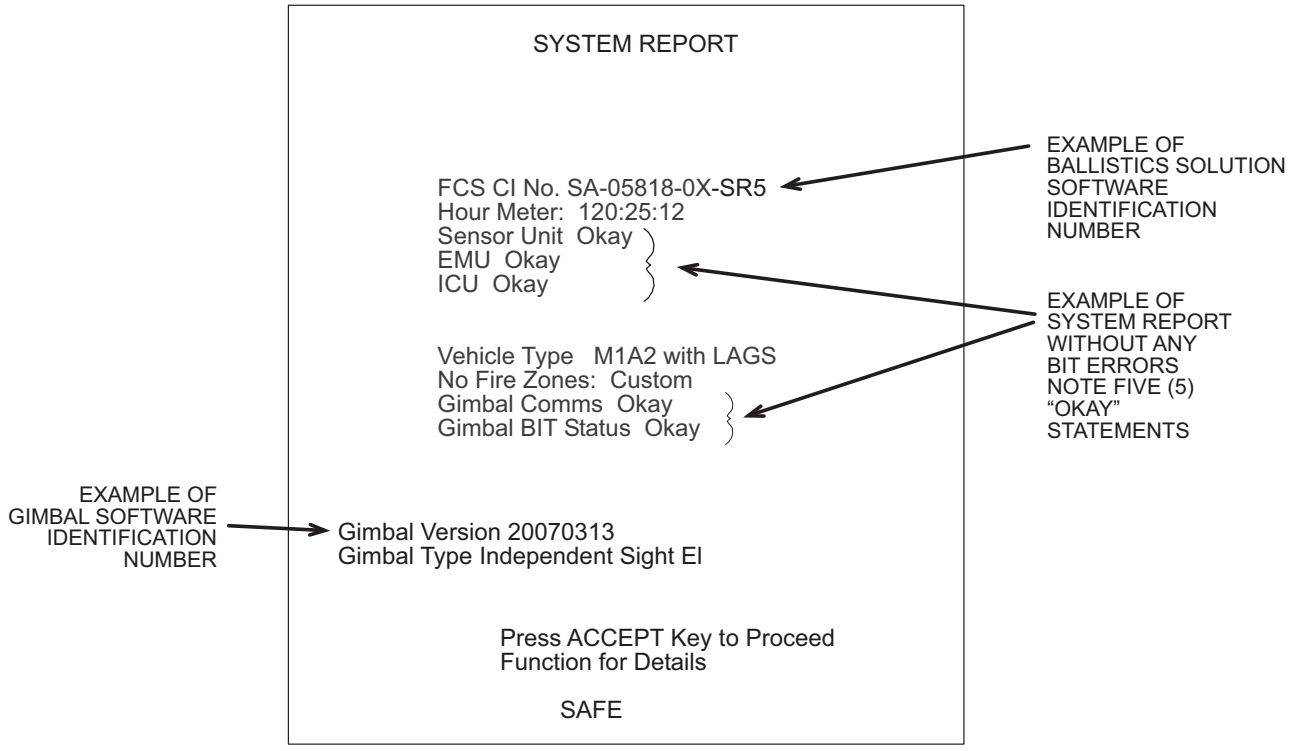


Figure 136. Example of System BIT System Report.

TEST MENU SELECTION - Cont

6. If any BIT failures are detected, the failure message(s) are listed on the System Report screen. See example at Figure 137.

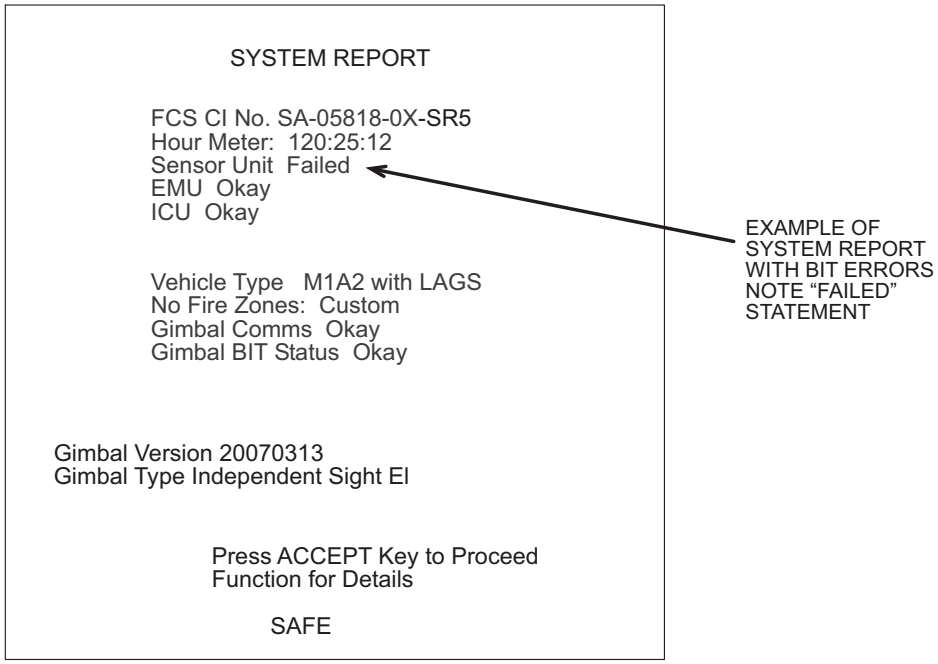


Figure 137. Example of System BIT System Report with Error Message.

NOTE

Only failed subsystems will be listed. See Figure 139 for an example of a failed subsystems report if no systems have failed.

7. Press FUNCTION (RIGHT toggle DOWN) to view a detailed description of a BIT fault/failure. See example at Figure 138. If BIT failures appear, see Chapter 3, CROWS Troubleshooting, WPs 0023 and 0024.

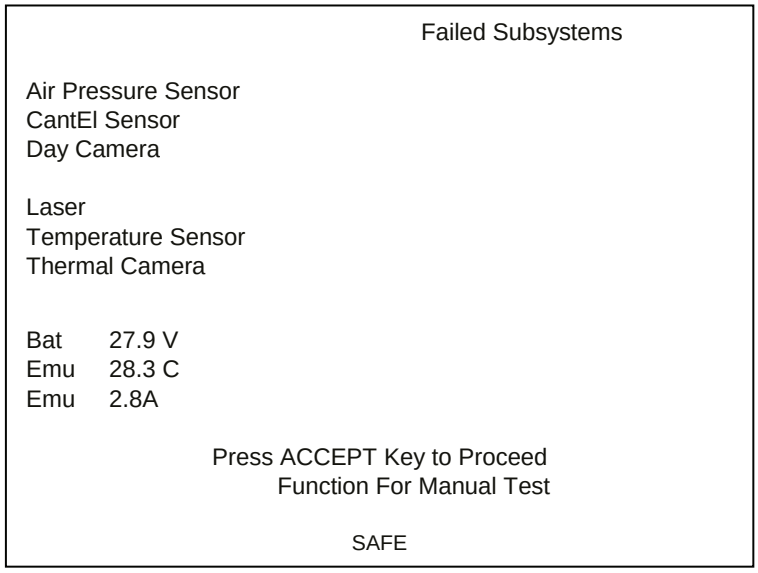


Figure 138. Example of a Subsystem Failure Screen.

8. Figure 139 illustrates an example of a failed subsystems report if no systems have failed.

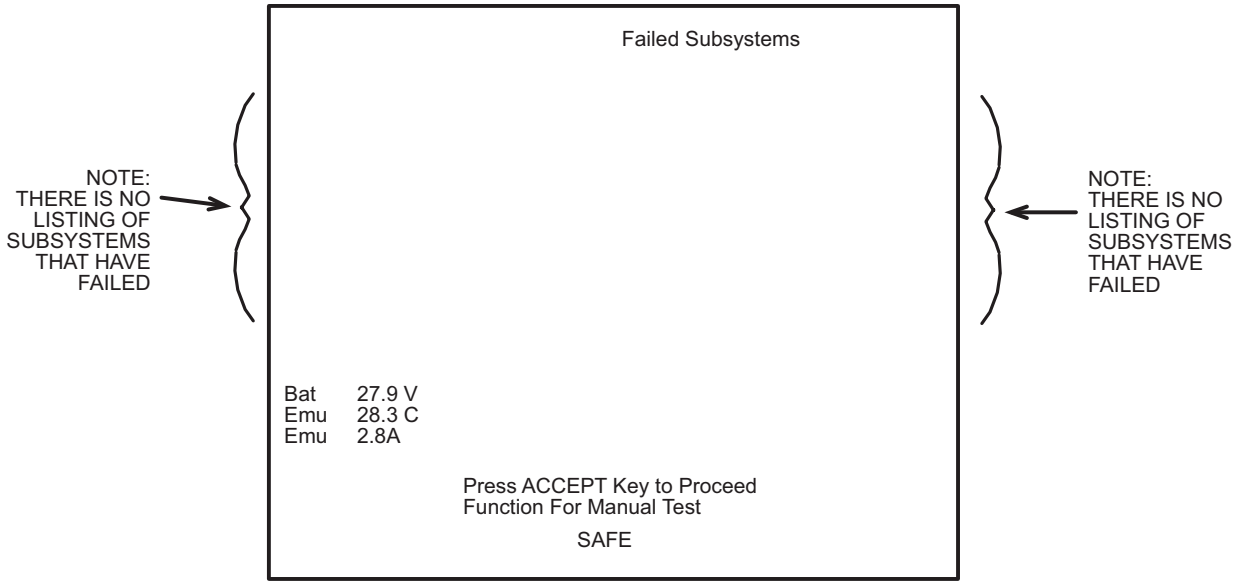


Figure 139. Example of a Subsystem Failure Screen without Failures.

9. Record and report subsystem failure information as shown on the Failed Subsystem Report screen on DA Form 2404, Equipment Inspection and Maintenance Worksheet, or DA Form 5988-E, Equipment Inspection Maintenance Worksheet (EGA) - Electronic.

10. Press ACCEPT (LEFT toggle RIGHT) to return to the Preparation Menu or press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

MODIFYING SENSOR INFORMATION

In addition to the changes that can be made to the CROWS operational parameters using options available in the Preparation Menu, the operator can modify CROWS Sensor data value information while in the Engagement mode and selecting the Sensor Menu. See Figure 10. The Sensor Menu is activated when the system is set to the Menu function mode, then selecting the S option (upper left corner next to P). No Sensor data values input by the operator are saved with a Reboot (Power OFF, then ON) of the CROWS system.

Sensor data values interact with each other in the calculation of a ballistic solution. Combinations of weapon, ammunition, and sensor data may produce a firing solution that will not allow the operator to shoot while keeping the target on the screen.

MODIFYING SENSOR INFORMATION - Cont

WARNING

The CROWS system software allows for data entry by the operator to the Sensor data values “outside” of the valid Sensor data limit values documented in Table 10. Ensure only valid Sensor data values are input within the data limit ranges for ballistic solution computations. Sensor data values interact with each other in the calculation of a ballistic solution. Combinations of weapon, ammunition, and sensor data may produce a firing solution that will not allow the operator to shoot while keeping the target on the screen.

When overriding Sensor data, it is important to review the data entry limits. It is the Operator’s responsibility to understand the limits established in Table 10 and ensure that only valid sensor data values are being input within the data limit ranges for ballistic solution computations.

Failure to follow these instructions will result in incorrect, invalid, or no ballistic computation solutions and may result in Friendly Fire.

NOTE

If information messages such as “EXCESSIVE RANGE” or “NO FIRING SOLUTION” or “AIMPOINT OFFSCREEN” are displayed on the Engagement Mode screen, sensor data values may require validation and change to ensure they do not exceed the data limits documented in Table 10. Informational screen messages and operators' actions are described in WP 0024.

Informational screen messages and operators' actions are described in WP 0024.

Table 10 lists specified default values.

Table 10. Specified Default Values.

Parameter	Valid Data Limits	Default Values
Range to Target	30 to 5000 m	1000-m
Cross Wind (CW)	± 15 m/s	0 m/s
Range Wind (RW)	± 15 m/s	0 m/s
Air Temperature (Te)	-45 to +60 °C	20 °C
Air Pressure (Pr)	500 to 1200 mb	1013 mb
Cant (Ca)	-900 to +900 mils	0 mil
Elevation (El)	-1500 to +1500 mils	0 mil

Default values consist of factory preset values within the valid data limits. Operator-set values are entered within the sensor menu window.

If the CROWS system receives invalid data from a sensor, including “outside” of valid data limits and malfunctioning sensors, the Factory Preset default values will be used for all calculations, including the ballistic computation solution. Parentheses “( )” will appear around Factory Preset default values used in the ballistic computation, such as shown for the CW and RW values. Brackets “[ ]” will appear around operator input overriding the sensor default values.

Perform the following procedures to access the Sensor Menu.

1. From the Engagement screen, press FUNCTION (RIGHT toggle DOWN) until you are in the Menu mode. See Figure 8. The Menu mode is shown in the lower left of the screen.

2. Position the CURSOR on the Sensor Menu entry point designated by S in the upper left of the screen. Refer to Figure 10.

3. Press ACCEPT (LEFT toggle RIGHT). This will take you to the Sensor Menu. See Figure 140.

NOTE

The Range-to-Target is displayed as a number in the upper left of the screen (e.g., “1000” in this example). Environmental, Cant, and Elevation sensor data values appear in the right-center portion of the screen, as shown in Figure 140.

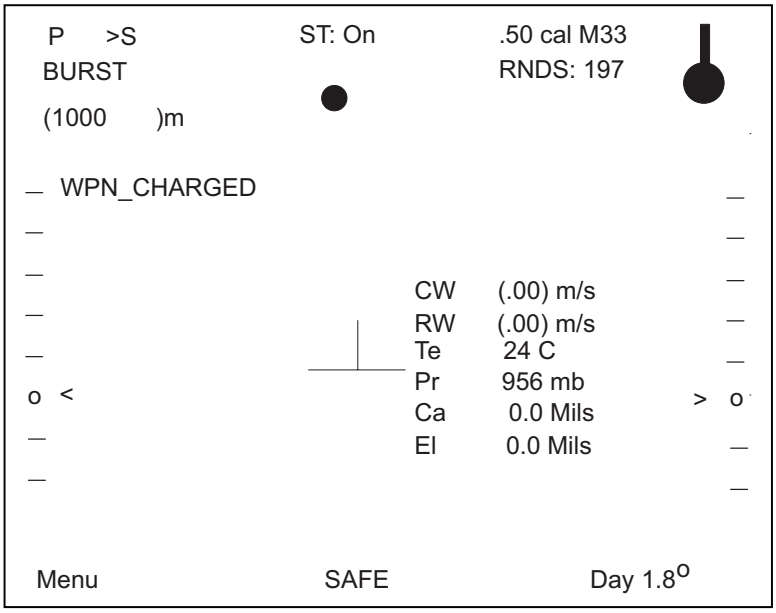


Figure 140. Sensor Menu.

4. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

MODIFYING SENSOR INFORMATION - Cont

Manual Input: Range to Target

WARNING

Before opening the vehicle hatch, ensure the laser aimpoint is displayed. Do not range step or enter a manual range while the hatch is open, unless the safety override is enabled. The ballistic solution may be affected.

The range to target value displayed in the upper left corner of the Engagement Mode screen provides the current range-to-target and is used in the ballistic computation performed by the ballistic computer assembly (BCA). The preset system default for the target range value is 1000 meters (1000-m). Target range data is updated when the laser rangefinder (LRF) is used to establish the range to a target. When conditions preclude the effective use of the LRF, the range to target value to be used for ballistic computation may be changed to a value within the range limits shown in Table 10.

Perform the following procedures to set a default range value in Engagement mode.

NOTE

Operator configured range data is not stored between power OFF/ON cycles. Valid range data inputs are between 30m and 5000m.

1. From the Engagement screen, press FUNCTION (RIGHT toggle DOWN) until you are in the Menu mode. See Figure 8. The Menu mode is shown in the lower left of the screen.

2. LEFT toggle DOWN to position the CURSOR onto the RANGE data line.

3. Press ACCEPT (LEFT toggle RIGHT).

NOTE

For the procedure to edit RANGE values, refer to the Operator Data Entry section of this work package and Tables 2 and 3.

4. Change the RANGE value as required.

5. Press ACCEPT (LEFT toggle RIGHT). The entry line will now say "Sensor" or "Override."

6. RIGHT toggle RIGHT until the CURSOR scrolls to OVERRIDE.

NOTE

Square brackets [ ] are always displayed around the input value indicating operator override data.

7. Press ACCEPT (LEFT toggle RIGHT) and the RANGE value will display in brackets "[ ]" to signify it is a value set by the operator. See Figure 141.

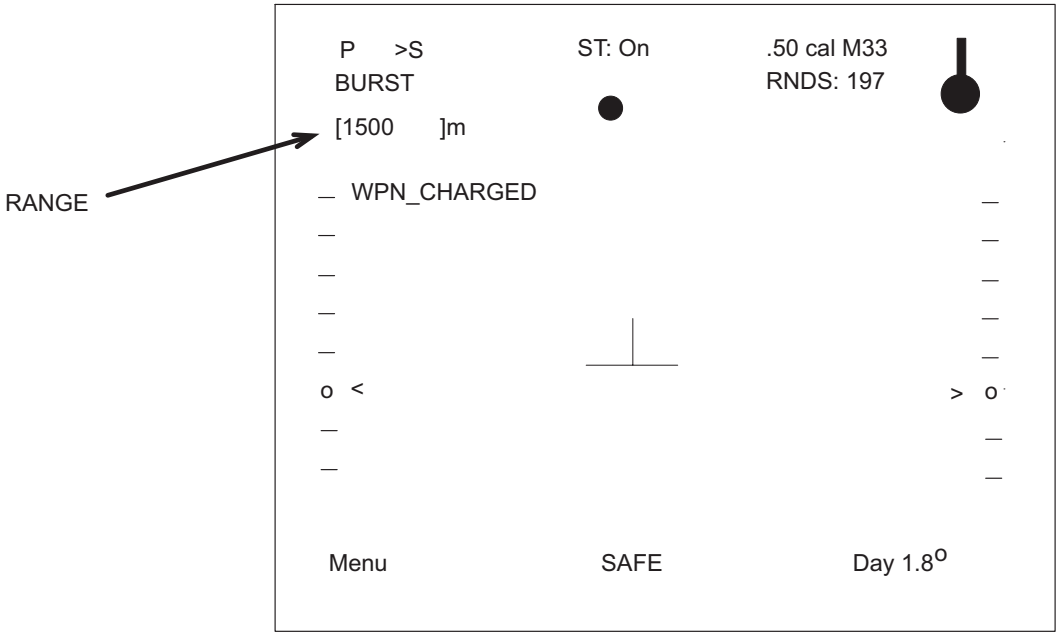


Figure 141. Example of Sensor Menu with an Operator Set Range Value.

8. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.

END OF TASK

MODIFYING SENSOR INFORMATION - Cont

Manual Input: Cross Wind (CW), Range Wind (RW), Air Temperature (Te), Air Pressure (Pr), Cant (Ca), and Elevation (El)

CW and RW

NOTE

Operator configured CW and RW data is not stored between system power OFF / ON cycles. Valid range data inputs are between -15m/s and 15m/s.

The CROWS system does not measure CW and RW. The factory preset default value for CW and RW data is loaded at power-ON. The default values appear in parentheses, "(00)."

The following value indicators are while facing down range toward the target area. A positive CW value indicates a wind blowing from left to right; a negative CW value indicates a wind blowing from right-to-left. A positive RW value indicates a tail wind and a negative RW value indicates a head wind. Valid CW and RW manual inputs are between -15 m/s and +15 m/s.

If CW and RW data is to be used in the CROWS ballistic computation, the information for these fields must be manually input by the operator. Square brackets "[ ]" are displayed around the input value indicating operator override of preset data. Wind direction is specified using positive and negative wind data. Positive values, including zero values, are not identified with a mathematical sign. Negative values are identified by a minus "-" sign.

Te and Pr

NOTE

Operator-configured data for the system sensor is not stored between Power OFF-ON cycles. Valid Te data inputs are between -45°C and +60°C. Valid Pr data inputs are between 500mb and 1200mb.

Sensor values for Te and Pr are, by default, data measured by sensors integral to the CROWS system. The system-measured temperature and pressure values may be changed by the operator if needed. Changing the temperature and pressure values enables the system to use the value input by the operator for the ballistic computation solution.

Ca and El

NOTE

If a Ca or El sensor malfunctions, data displayed may be erroneous and could result in incorrect data being included in the ballistic computation solution.

If a failure occurs, the preset default Ca and El sensor values can be overridden by the operator. The CROWS system software allows for data entry by the operator to the Sensor data values "outside" of the valid Sensor data limit values documented in Table 10.

Ensure only valid Sensor data values are input within the data limit ranges for ballistic solution computations.

Operator-configured data for the Ca and El sensors is not stored between Power OFF-ON cycles. Valid Ca manual inputs are between -900 mils and +900 mils. Valid El manual inputs are between -1500 mils and +1500 mils.

The Ca and El sensors are used to refine the ballistic computation solution. These sensors provide specific information related to the weapon's degree of axial tilt left or right (Ca) of the line of sight to the target, and target elevation angle (El).

WARNING

Input only valid sensor data values. Incorrect, invalid, or erroneous data may result in an incorrect ballistic solution. Failure to follow these instructions may result in Friendly Fire.

NOTE

To achieve a positive value, the operator presses the LEFT toggle UP (to change the numerals to above zero). To achieve a negative number, the operator presses the LEFT toggle DOWN to change the numerals to below zero.

Perform the following procedures to manually change CW data.

1. From the Engagement screen, press FUNCTION (RIGHT toggle DOWN) until you are in the Menu mode. See Figure 8. The Menu mode is shown in the lower left of the screen.

2. RIGHT toggle RIGHT to position the CURSOR onto the Sensor Menu entry point designated by S in the upper left of the screen. Refer to Figure 10.

3. Press ACCEPT (LEFT toggle RIGHT). The Sensor Menu, Figure 140, is displayed.

4. LEFT toggle DOWN until the CURSOR is positioned on the desire sensor value to be changed. See Figure 142.

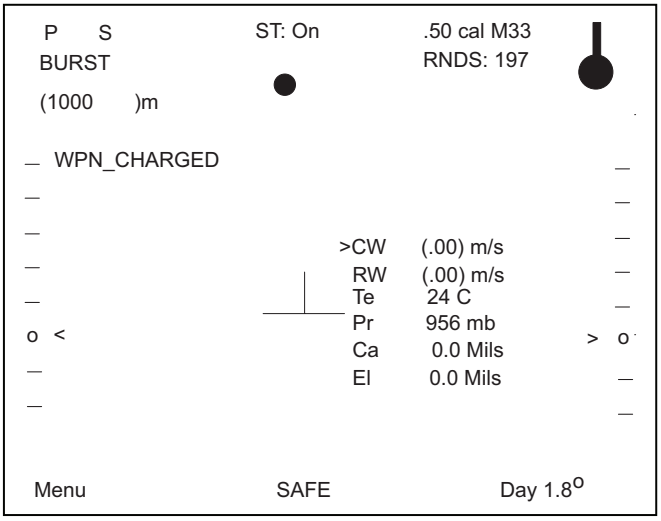


Figure 142. Example of Sensor Menu with CW Sensor Value Selected.

MODIFYING SENSOR INFORMATION - Cont

Manual Input: Cross Wind (CW), Range Wind (RW), Air Temperature (Te), Air Pressure (Pr), Cant (Ca), and Elevation (El) - Cont

5. Press ACCEPT (LEFT toggle RIGHT). See Figure 143.

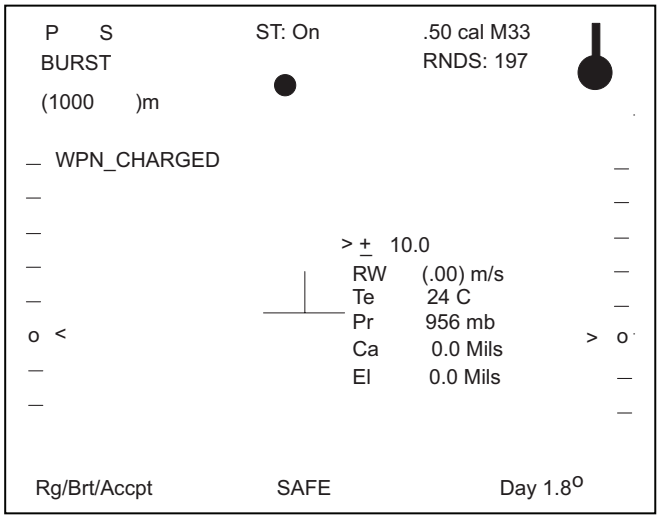


Figure 143. Example of Sensor Menu with CW Sensor Value Being Changed.

NOTE

Refer to the Operator Data Entry section of this work package for procedures to change values. See Tables 2 and 3.

6. As required, change the desired value (CW is shown in this example).

7. Press ACCEPT (LEFT toggle RIGHT). The entry line will now say "Sensor" or "Override."

8. RIGHT toggle RIGHT until the CURSOR scrolls to OVERRIDE. See Figure 144.

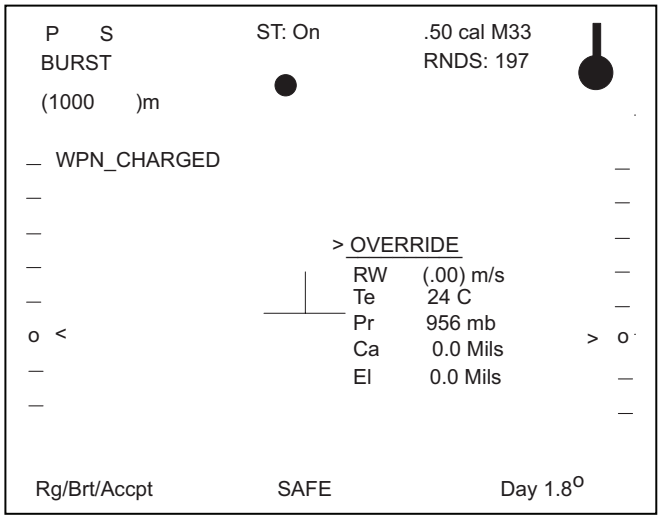


Figure 144. Example of Sensor Menu with CW Set to Override.

NOTE

Square brackets [ ] are displayed around the input value indicating operator override data.

9. Press ACCEPT (LEFT toggle RIGHT) and the desired value will display in brackets “[ ]” to signify it is a value set by the operator. See Figure 145.

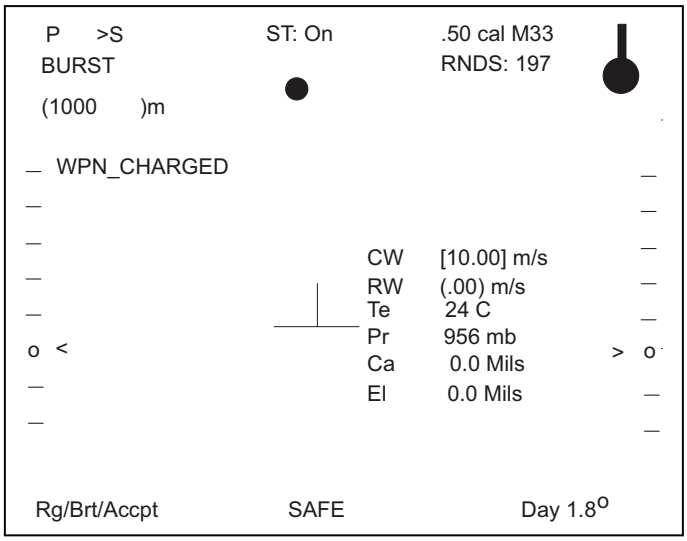


Figure 145. Example of Sensor Menu with CW Value Changed.

10. As required, repeat steps 4 through 9 for other sensor values to be changed.

11. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu, Rg/Brt/Accpt screen.

12. Press FUNCTION (RIGHT toggle DOWN) until in the Menu mode.

13. Position CURSOR onto "S."

14. Press ACCEPT (LEFT toggle RIGHT) to return to the Engagement Screen.

END OF TASK

Reverting Back to Sensor Value

NOTE

The CROWS system does not measure CW and RW. The factory preset default value for CW and RW data is loaded at power-ON. The default values appear in parentheses, “(00).”

Perform the following steps to change the sensor value back to the value that the CROWS senses.

1. Perform steps 1 through 5 in the Manual Input: Cross Wind, Range Wind, Air Temperature, Air Pressure, Cant, and Elevation section.

2. Press ACCEPT (LEFT toggle RIGHT). The entry line will now say "Sensor" or "Override."

MODIFYING SENSOR INFORMATION – Cont

Reverting Back to Sensor Value - Cont

3. RIGHT toggle RIGHT until the CURSOR scrolls to SENSOR. See Figure 146.

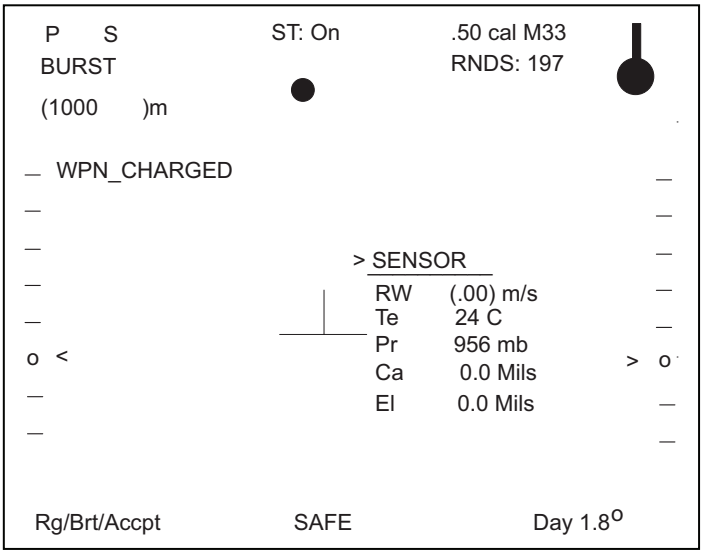


Figure 146. Example of Sensor Menu with CW Set to Sensor.

NOTE

Square brackets [ ] are displayed around the input value indicating operator override data. Parentheses "( )" signify a value sensed by CROWS.

4. Press ACCEPT (LEFT toggle RIGHT) and the sensor value will display in parentheses "( )" to signify it is a value sensed by CROWS. See Figure 147.

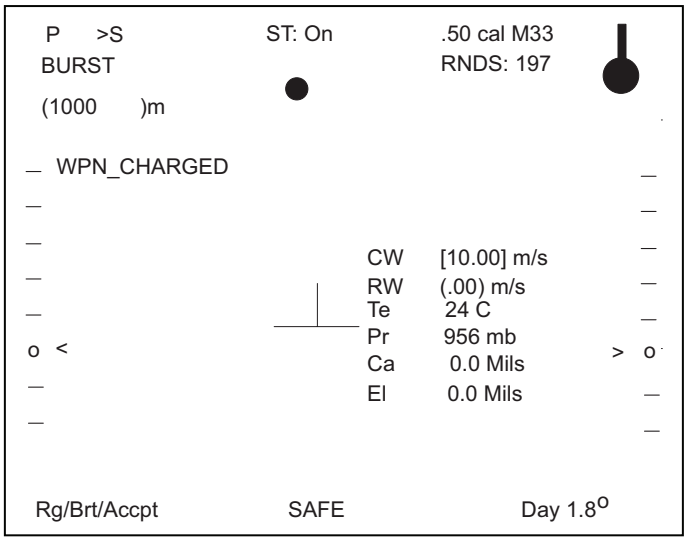


Figure 147. Example of Sensor Menu with CW Value Changed.

5. As required, repeat steps 1 through 4 for other sensor values to be sensed by CROWS.
6. Press LASE (LEFT toggle LEFT) to return to the Engagement Menu, Rg/Brt/Accpt screen.
7. Press FUNCTION (RIGHT toggle DOWN) until in the Menu mode.
8. Position CURSOR onto "S."
9. Press ACCEPT (LEFT toggle RIGHT) to return to the Engagement Screen.

END OF TASK

TARGET REFERENCE POINTS (TRP) MODE

The TRP Mode allows the operator to assign target points, store up to 200 target points in memory for rapid recall; scan between stored target points; and adjust the rate of scan between points.

CAUTION

Failure to follow this caution will cause the TRP scan positions to move off target. The TRP mode is designed to be used while the vehicle is stationary and not moving. Ensure the vehicle is not moving when scanning to assign and store Target Reference Points.

Preparatory Procedures

Perform the following procedures to assign and store Target References Points.

1. Ensure you are in the Engagement screen, Figure 8.
2. Press LEFT on the Joystick STABILIZATION (STAB) switch to toggle the Engagement screen STAB setting to OFF.

TARGET REFERENCE POINTS (TRP) MODE - Cont

Preparatory Procedures - Cont

3. On the DU, press UP on the TRP switch to the Target position to display the TRP screen. See Figure 148.

NOTE

The default LEARN POSITION option shown in the lower left corner of the screen in Figure 148 is automatically shown if the cursor is on a blank line and no TRP is assigned.

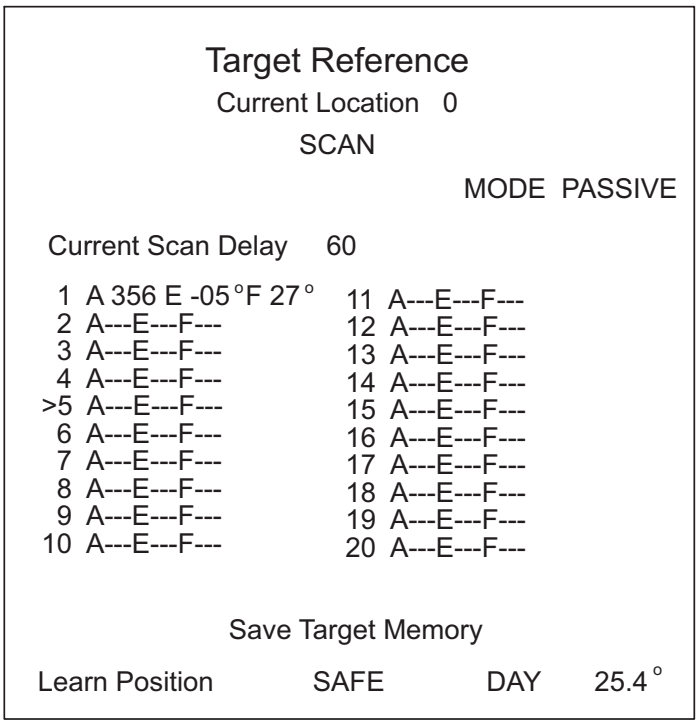


Figure 148. TRP Menu Showing a Single TRP "Location" Page and the Message Line.

There are four TRP Menu Options in the TRP Mode: Scan, Mode, Current Scan Delay, and Save Target Memory. See Figure 148. See Table 11 for a description of the TRP Menu Options. There are five TRP Mode Function Options: Learn Position (default), Go To, Delete, Edit Name, and Learn Last Target, which appear in the lower left corner of the TRP Menu screen.

Table 11. TRP Menu Options.

Option	Description	Refer to Subsection Procedures
SCAN	Enables scanning between selected target points in passive or aggressive modes	Scanning Between TRPs
MODE	Enables the operator to select passive (default) or aggressive scan mode. • Passive – scanning between target points with weapon in super-elevation position • Aggressive – scanning between target points with weapon in ready-to-fire position	Changing Scan Mode
CURRENT SCAN DELAY	Enables the operator to set the scan delay when scanning between TRP scan movements	Scanning Between TRPs
SAVE TARGET MEMORY	Enables the operator to save the TRPs to memory for later use.	Saving TRPs to Memory

TARGET REFERENCE POINTS (TRP) MODE - Cont

Preparatory Procedures - Cont

After a ballistic computation solution is accepted and the operator activates the “Learn Last Target” function option, see Table 12, a TRP will be displayed on a single line showing the scanned TRP with an A, E, F, and R. Each letter is followed by a number in the units of measurement specified. "A" stands for Azimuth, "E" stands for Elevation, "F" stands for Field of View (FOV), and "R" stands for Range.

Table 12. Function Options.

Option	Description	For Procedure, Refer to Subsection
LEARN POSITION (default)	Enables the system to “learn” the TRP locations that the operator wants to set for the operational cycle. It saves the bearing information (Azimuth, Elevation, FOV, and Range) so that the system moves to a specified position where the weapon is pointing.	TRP Mode: Assigning Target Reference Points
NOTE The following Function Options appear in the lower left corner of the TRP Menu when the cursor is positioned on a saved TRP line.		
GO TO	Allows the operator to “go to” a specific TRP which will move the weapon mount to a selected bearing. GO TO is the default command in the TRP Location Page; refer to Figure 150.	Moving Weapon Mount to A Single TRP Accessing Location Pages to Select from Possible 200 TRPs
DELETE	Allows the operator to delete individual, or all TRPs that have been set.	Deleting a TRP from the List Deleting All TRPs on a Single “Location” Page
EDIT NAME	Allows the operator to assign a name to a target; sub-functions include DISPLAY BEARING and DISPLAY NAME.	Editing Target Name Additional Target Name Options
NOTE The following Function Option appears in the lower left corner of the TRP Menu screen when the cursor is placed on a blank TRP line when a ballistic computation solution is accepted.		
LEARN LAST TARGET	Allows the operator to save last ballistic computation solution accepted (i.e., the last scanned target position acquired)	--

END OF TASK

Selecting a TRP Menu Option

Use the following procedure to select a TRP Menu Option.

1. Perform TRP Preparatory Procedures to display the Target Reference screen, Figure 148.
2. Position the CURSOR onto the desired TRP Menu option, as listed in Table 11.
3. Press ACCEPT (LEFT toggle RIGHT) to select the TRP Menu option. This takes you into the Surveillance Mode.
4. Press LASE (LEFT toggle LEFT) to return to Engagement screen.

END OF TASK

Changing Scan Mode

Use the following procedure to change between PASSIVE (default) and AGGRESSIVE mode for TRP scan.

The operator can change between PASSIVE and AGGRESSIVE modes only if the Rules of Engagement menu ALLOW CHANGES option has been ENABLED. See the Rules of Engagement section.

1. Perform TRP Preparatory Procedures to display the Target Reference screen, Figure 148.
2. Ensure the Rules of Engagement, TRP Scanning, ALLOW CHANGES has been ENABLED.
3. Position the CURSOR onto the MODE option line. See Figure 148.
4. Press ACCEPT (LEFT toggle RIGHT) to toggle between PASSIVE and AGGRESSIVE modes.
5. Press LASE (LEFT toggle LEFT) to return to Engagement screen.

END OF TASK

TARGET REFERENCE POINTS (TRP) MODE - Cont

Scanning Between TRPs

Perform the following procedure to scan between saved target reference points.

1. Perform TRP Preparatory Procedures to display the Target Reference screen, Figure 148.
2. Position the CURSOR onto the CURRENT SCAN DELAY line.
3. Press ACCEPT (LEFT toggle RIGHT).

NOTE

The unit of measure for the CURRENT SCAN DELAY rate is in seconds.

4. LEFT toggle UP/DOWN or RIGHT toggle LEFT/RIGHT to change the rate of scan, if necessary; the delay is in seconds.
5. Press ACCEPT (LEFT toggle RIGHT).
6. Position the CURSOR onto the SCAN line.
7. Press ACCEPT (LEFT toggle RIGHT). The system will start scanning between all target points. See Figure 149.

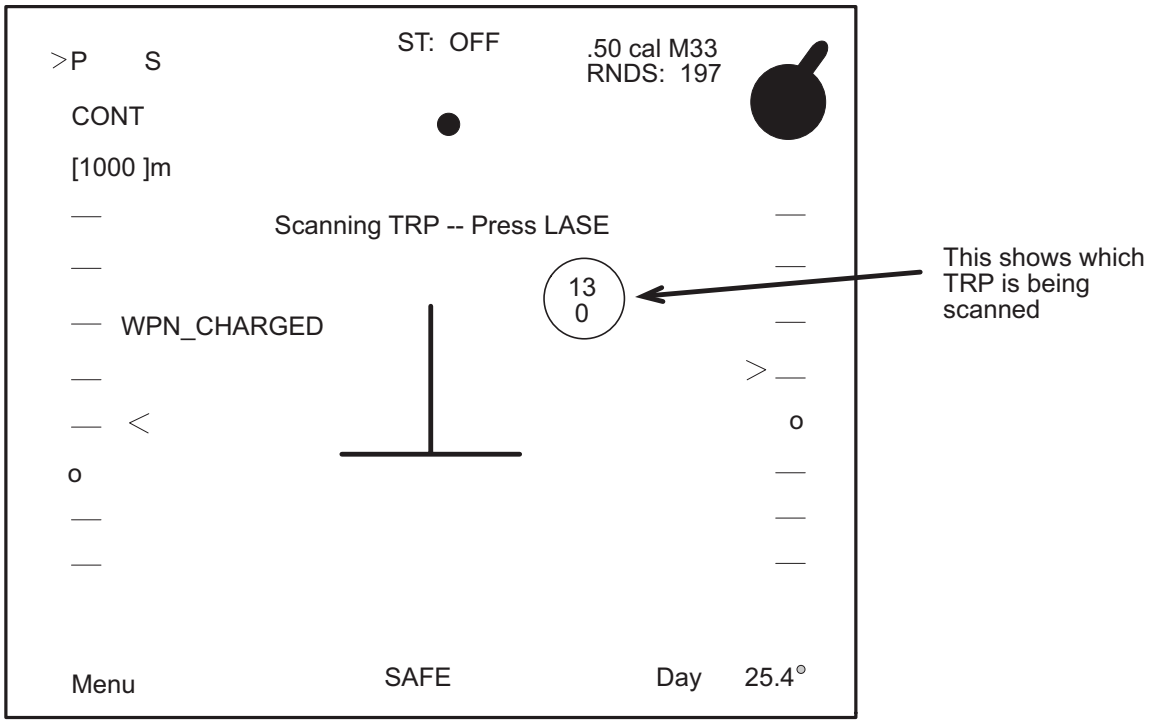


Figure 149. Scanning Between TRPs.

8. Press LASE (LEFT toggle LEFT) to return to Engagement screen.

END OF TASK

TRP Mode: Assigning Target Reference Points (TRPs)

Perform the following procedures to assign target points in TRP Mode.

1. From the Engagement Screen, put laser reticle on a target in desired FOV.
2. Press UP on the TRP switch to the TARGET position. Figure 148 is displayed.
3. Position the CURSOR on the TRP number line that you wish to select, referring to Figure 148.
4. Position the CURSOR onto a blank position line. The LEARN POSITION indicator appears in the lower left corner of the screen.
5. Press ACCEPT (LEFT toggle RIGHT). The positions A (azimuth), E (elevation), F (FOV), and R (range; if the ballistic solution is saved, i.e., range to target) appear on the selected line, indicating that the target point is now assigned.
6. Repeat steps 1 through 5 to store up to 20 TRPs of the allowable 200 TRPs on a single “Location” page.
7. To save the assigned TRP, refer to Saving TRPs to Memory.
8. Press LASE (LEFT toggle LEFT) to return to Engagement screen.

END OF TASK

Saving TRPs to Memory

Perform the following procedures to save TRPs over Power cycle.

1. Press DOWN on the TRP switch on the DU to the LOCATION or UP to the TARGET position.
2. Position the CURSOR onto SAVE TARGET MEMORY. See Figures 148 and 150.

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any switches. Failure to follow these instructions may result in equipment malfunction or failure.

3. Press ACCEPT (LEFT toggle RIGHT). A blue status bar will appear while saving to flash memory.

TARGET REFERENCE POINTS (TRP) MODE - Cont

Saving TRPs to Memory - Cont

4. The values of the table are saved. TRP locations that have been lased will have a Range Value (R) that will appear at the bottom of screen when the CURSOR is positioned on that line. See Figure 150.

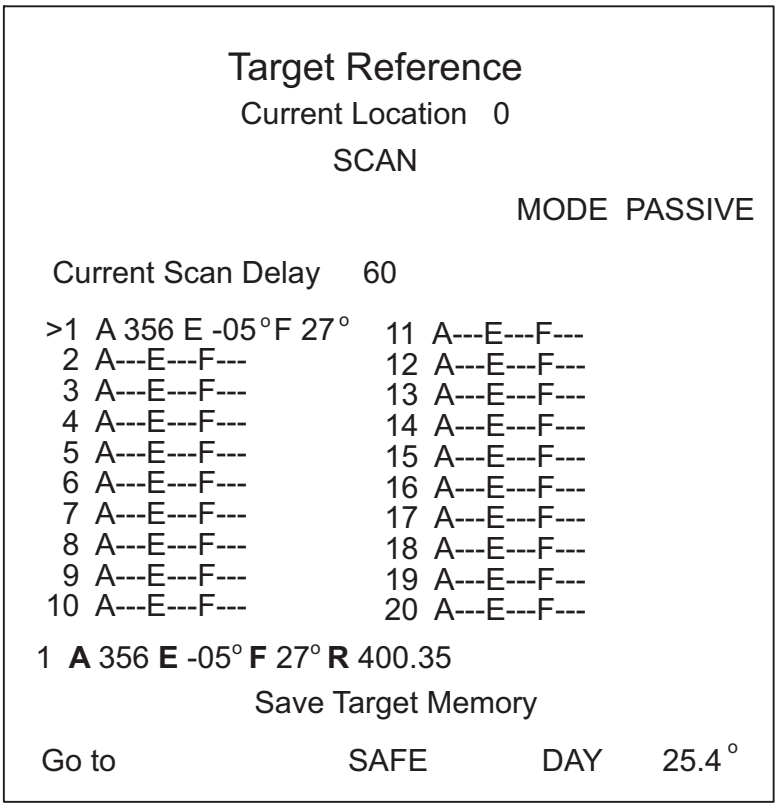


Figure 150. TRP Showing Lased Range Value.

5. Press LASE (LEFT toggle LEFT) to return to Engagement screen.

END OF TASK

Accessing Location Pages to Select from a Possible 200 TRPs

The Choose Location menu shows the “Current Location” page. See Figure 151.

Perform the following procedure to access location pages and select from among a possible 200 target points.

1. Press DOWN on the TRP switch to the LOCATION position. The screen in Figure 151 will appear.

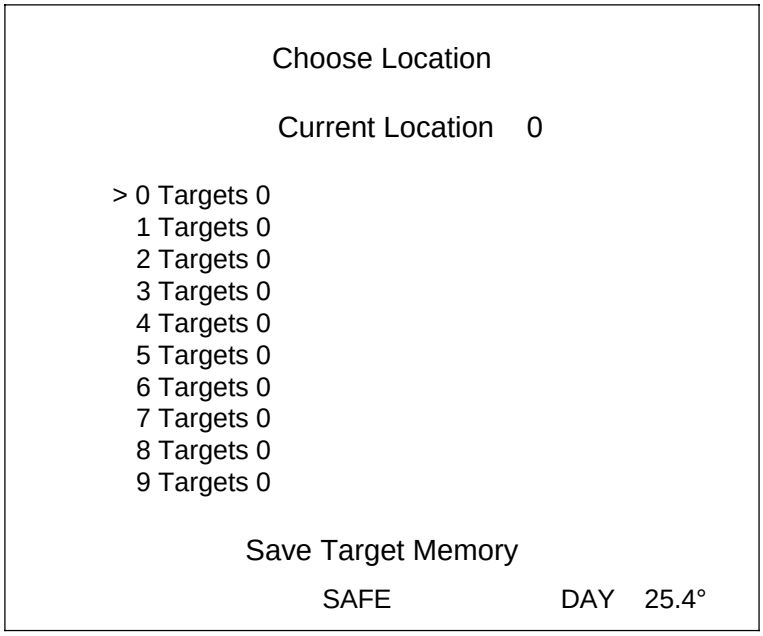


Figure 151. TRP Choose Location Screen.

2. Position the CURSOR onto the desired Location Page, selecting from pages 0 through 9.

TARGET REFERENCE POINTS (TRP) MODE - Cont

Accessing Location Pages to Select from a Possible 200 TRPs - Cont

3. Press FUNCTION (RIGHT toggle DOWN) until the GO TO Function option is displayed in the lower left of the screen. See Figure 152.

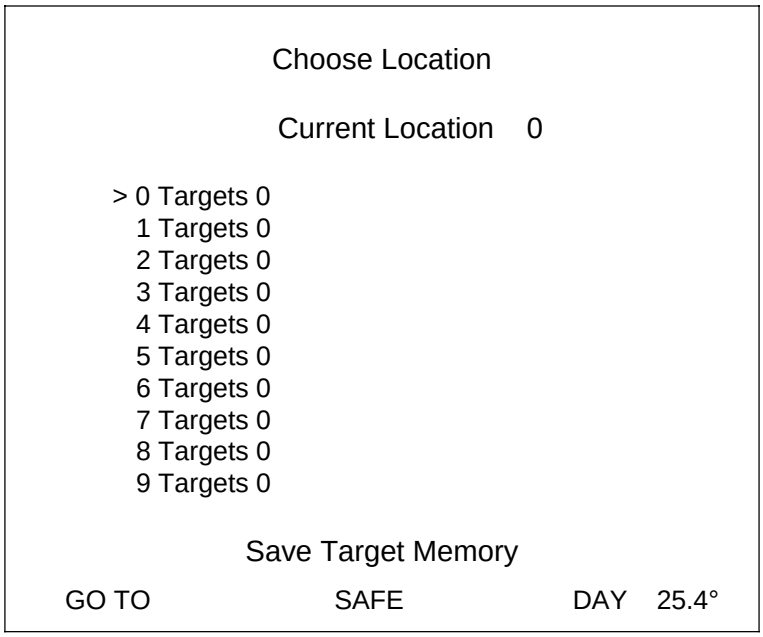


Figure 152. TRP Choose Location Screen With GO TO at Lower Left of Screen.

4. Press ACCEPT (LEFT toggle RIGHT). The number on the CURRENT LOCATION line will change to the number of the selected Location page.

5. Press UP on the TRP switch to the TARGET position returning to the TRP Choose Location screen, Figure 151.

NOTE

If the TRP you are searching for is not among the 20 points on the selected CURRENT LOCATION page, you will need to select another LOCATION page.

6. Repeat steps 2 through 5, as required, to locate the TRP.

7. Press LASE (LEFT toggle LEFT) to return to Engagement screen.

END OF TASK

Moving Weapon Mount to a Single TRP

Perform the following procedures to go to a single TRP.

1. Position the CURSOR onto a saved TRP until GO TO appears in the lower left corner of the screen.
2. Press ACCEPT (LEFT toggle RIGHT). The weapon mount will move to that stored TRP.
3. Press LASE (LEFT toggle LEFT) to return to Engagement screen.

END OF TASK

Deleting a TRP from the List

Perform the following procedures to delete a selected point from the list.

1. Position the CURSOR to the TRP you want to delete.
2. Press FUNCTION (RIGHT toggle DOWN) until DELETE shows in the lower left corner of the screen, referring to Figure 153.

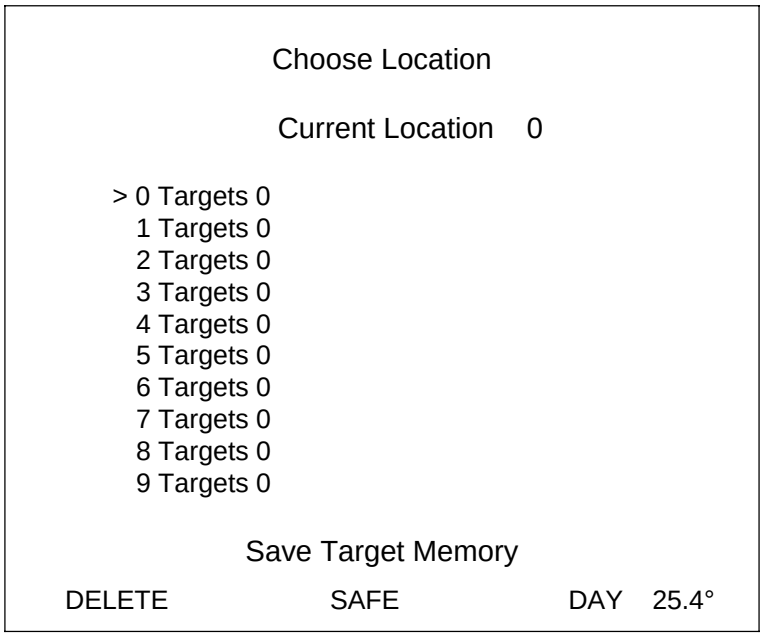


Figure 153. TRP Choose Location Screen With DELETE at Lower Left of Screen.

3. Press ACCEPT (LEFT toggle RIGHT). A message will appear on the screen “Are you sure?” to verify that the selected TRP is to be deleted.
4. Press ACCEPT (LEFT toggle RIGHT). The TRP will be deleted.
5. Press LASE (LEFT toggle LEFT) to return to Engagement screen.

END OF TASK

TARGET REFERENCE POINTS (TRP) MODE - Cont

Deleting All TRPs on a Single "Location" Page

Perform the following procedures to delete all of the target points on any individual "Location" page.

1. Press DOWN on the TRP switch to the LOCATION position.
2. Position the CURSOR on the "Location" page you want to delete.
3. Press FUNCTION (RIGHT toggle DOWN) until DELETE is displayed in the lower left of the screen. See Figure 153.
4. Press ACCEPT (LEFT toggle RIGHT). A message will appear on the screen "Are you sure?" to verify that the selected Location Page is to be deleted.
5. Press ACCEPT (LEFT toggle RIGHT). All of the target points on that page will be deleted.
6. Press LASE (LEFT toggle LEFT) to return to Engagement screen.

END OF TASK

Editing TRP Name

Perform the following procedure to edit the name of a selected target.

1. Press DOWN on the TRP switch on the DU to the LOCATION or UP to the TARGET position.
2. Position the CURSOR to a saved TRP.
3. Press FUNCTION (RIGHT toggle DOWN) as many times as needed to toggle to the EDIT NAME option.
4. Press ACCEPT (LEFT toggle RIGHT) to select the option. The keyboard in Figure 154 will appear as an overlay on the DU, enabling the operator to create or edit a name for the selected target.

	Target Name														
	°	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**0**	**-**	**=**	**Backspace**	
			Q	**W**	**E**	**R**	**T**	**Y**	**U**	**I**	**O**	**P**	**[**	**]**	****
	A	**S**	**D**	**F**	**G**	**H**	**J**	**K**	**L**	**;**	**'**	**Enter**			
	Z	**X**	**C**	**V**	**B**	**N**	**M**	**,**	**.**	**/**					
							Space								

Figure 154. Keyboard for Creating and Editing TRP Name.

NOTE

The characters that may be used for a target name are shown in the keyboard at Figure 154. As each character of the target name is selected, created, or modified, the character will appear in the box below the Target Name box.

Limit number of characters for each TRP name to 14 characters.

Select the Backspace key in the keyboard (i.e., move the cursor, highlight the character, then press ACCEPT (LEFT toggle RIGHT)) to change a character.

5. Perform the following procedure to change the target name.

   a. Position CURSOR onto first character (letter, number, or symbol) of the target name. See Figure 155 for Joystick input.

   b. Press ACCEPT (LEFT toggle RIGHT) to select the character. The character will appear in the Target Name box.

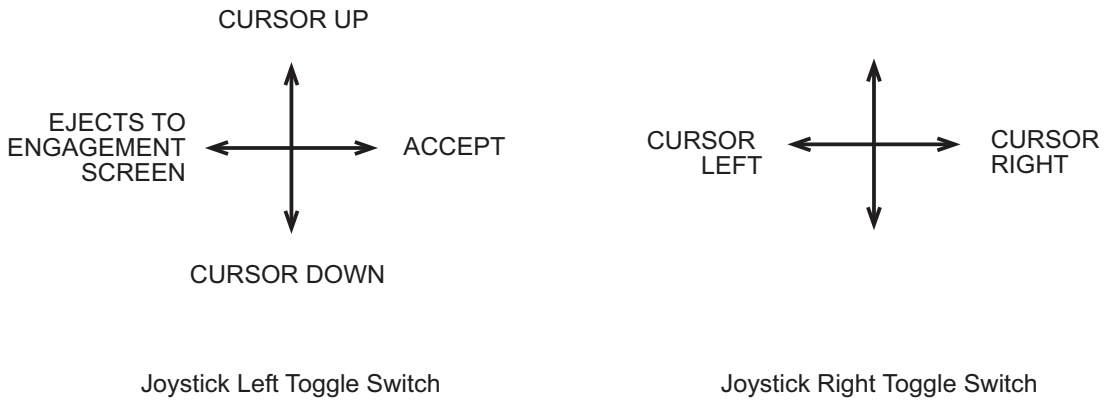


Figure 155. Joystick Switches for TRP Name Input.

   c. Repeat steps a and b for each character in the target name.

   d. When all changes have been made to the target name, highlight **Enter** from the keyboard.

   e. Press ACCEPT (LEFT toggle RIGHT).

   f. Once the screen updates, the new target name appears at the end of the selected line (in parenthesis). Verify the name. The procedure is complete.

   g. If the target name requires correction or change, repeat steps 1 through 5f.

END OF TASK

TARGET REFERENCE POINTS (TRP) MODE - Cont

Additional TRP Name Options

Perform the following procedures to check the bearing information for a renamed TRP line.

1. Select the renamed TRP line.
2. Press FUNCTION (RIGHT toggle DOWN) until the DISPLAY BEARING function is displayed in the lower left corner.
3. Press ACCEPT (LEFT toggle RIGHT) to display the azimuth, elevation, and FOV information for the selected (renamed) TRP line.
4. Validate the name of the TRP line.
    a. Press FUNCTION (RIGHT toggle DOWN) until the DISPLAY NAME function is displayed in the lower left corner.
    b. Press ACCEPT (LEFT toggle RIGHT) to display the renamed “new name” for the selected TRP line.

END OF TASK

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER USUAL CONDITIONS - BORESIGHTING

THIS WORK PACKAGE COVERS:

The process ensuring that the corrected aimpoint calculated by the Ballistic Computer Assembly (BCA) includes compensation for the boresight alignment of the weapon to the system.

INITIAL SET UP:

Tools and Special Tools

Operator's Tool Kit (WP 0036, Table 2, Item 1)

Boresight Alignment Kit (WP 0036, Table 2, Item 2)

Materials/Parts

N/A

Personnel Required

Two

References

WP 0004
WP 0006
WP 0015
WP 0017
WP 0026
WP 0035
WP 0036

Equipment Conditions

CROWS Set Up and Operational

Weapon installed

WP CONTENTS

Section/Subsection **Page**

Boresighting Overview....2
Preparation for Boresighting....3
System Boresight Procedure....10
Elevation Alignment....10
Electronic Alignment....15
Verification of Boresighting....23

NOTE

Refer to WP 0026, PMCS, to ensure that the CROWS components and assemblies are ready for operation.

See WP 0004, for a description and use of the switches on the components making up the CROWS Control Group. Understanding and committing to memory the use of the switches will assist you in the performance of procedural steps. Read, comprehend, and memorize the use of these controls and indicators.

BORESIGHTING OVERVIEW

WARNING

Do not expose the eyes, directly or indirectly, to the laser beam of the rangefinder in the sensor unit.

Ensure weapon is evacuated of rounds and chamber is cleared IAW the applicable weapon TM prior to and during boresighting. Remove and secure any rounds that have been cleared. Refer to WP 0035, References, for a listing of weapon TMs.

When the Boresight telescope and mandrel are installed in barrel of the weapon, eye damage could occur if the weapon is moved while the CROWS Mount Guide's eye is resting on the scope. Use caution when coordinating the movement of the weapon while boresighting the weapon.

Failure to follow above warnings may result in personal injury.

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any switches. Failure to follow these instructions may result in equipment malfunction or failure.

Boresighting is the process that ensures the corrected aimpoint calculated by the Ballistic Computer Assembly (BCA) includes compensation for the boresight alignment of the weapon to CROWS.

CROWS must be mechanically and electronically boresighted to the weapon. The elevation alignment verification process provides a check of the weapon alignment, and the electronic boresight procedures provides a fine alignment to the precision required for effective fire control.

System boresighting should be performed if any of the following parts of the system have been changed:

- Weapon
- Weapon barrel
- Cradle
- Weapon adapter kit (WAK)
- Electronics Modular Unit (EMU)
- Sensor Unit (SU)
- Elevation Drive
- Pedestal Mount
- Vehicle Integration Kit (VIK)

PREPARATION FOR BORESIGHTING

Perform the following procedures prior to boresighting the CROWS.

WARNING

Observe all warnings, cautions, and notes. Failure to do so may result in personal injury or damage to the equipment.

CAUTION

The boresight scope is an optical instrument, handle with care. Failure to do so may result in equipment damage.

NOTE

The Boresighting procedure requires two personnel and good communication between the two in boresighting the weapon.

- CROWS Operator
- CROWS Mount Guide

The CROWS Operator is stationed at the Control Group; the CROWS Mount Guide is stationed outside the host vehicle to perform procedures of the weapon while maintaining voice communications with the CROWS Operator.

1. Ensure that the vehicle is positioned so that it remains stable throughout the boresight process.

NOTE

For additional information on the azimuth drive, refer to WP 0006, Azimuth Lock Assembly section.

2. CROWS Mount Guide: Ensure the azimuth lock assembly is in unlocked position before applying power. To put the azimuth lock in the unlocked position, lift the handle up and to the right until the handle is fully seated and the pedestal mount moves freely. Figure 1 shows the azimuth lock in the unlocked position.

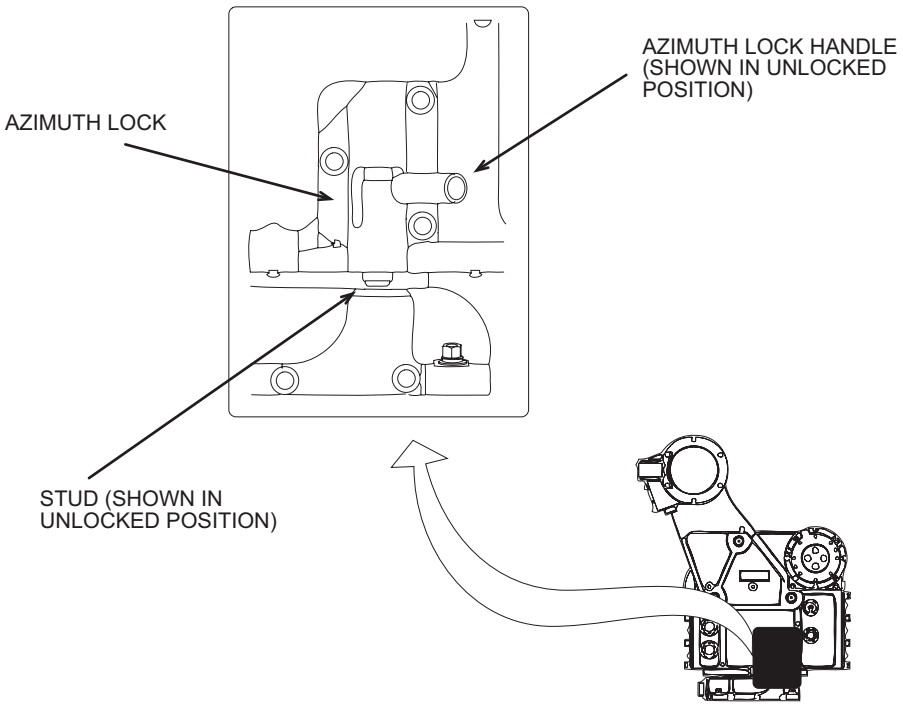


Figure 1. Azimuth Lock Assembly.

PREPARATION FOR BORESIGHTING - Cont

3. CROWS Operator: Ensure the POWER switch on the Display Unit (DU) is in the ON position. After system status screen is displayed, proceed to the engagement screen by pressing ACCEPT (LEFT toggle RIGHT).

NOTE

The Stabilization (STAB) switch on the Joystick is turned OFF when depressed LEFT and is turned ON when depressed RIGHT.

4. CROWS Operator: Ensure STAB is OFF.

5. Designate a target to be used for boresighting at approximately 300 to 500 m.

6. Perform the procedures in WP 0015, Menu System, for weapon and ammunition selection.

7. Select MILES ammunition.

8. Determine which kit you will be using. There are two boresight kits, MR1 and MR2. The differences between the two kits are explained below.

a. Boresight Kit - MR1.

Perform the following procedure to insert the boresight telescope and appropriate mandrel into the designated weapon barrel using the MR1 boresight kit.

CAUTION

The optical boresight telescope is fragile. Handle with care. Failure to do so may result in equipment damage.

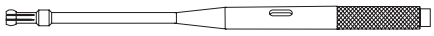
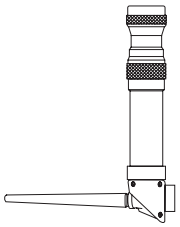
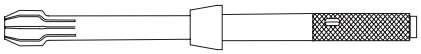
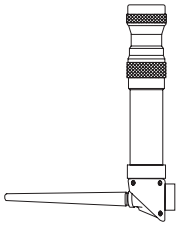
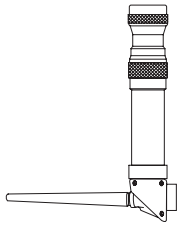
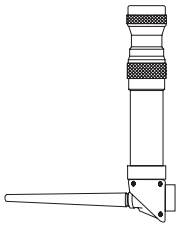
NOTE

The boresight alignment kit MR1 consists of an optical telescope and a mandrel specific to the inside diameter of the installed weapon. Each weapon uses a different set up configuration of mandrels and adapters. See Table 1, Boresight Alignment Kit –MR1. Each time the boresight alignment kit is used, perform the boresight telescope calibration verification.

(1) CROWS Mount Guide: Insert the boresight telescope into the appropriate weapon mandrel. See Table 1.

(2) CROWS Mount Guide: Insert the weapon mandrel into the weapon barrel (bore) so that the boresight telescope is aligned vertically.

Table 1. Boresight Kit -- MR1.

Weapon	Mandrel	Boresight Telescope
M2 HB .50 Cal Machine Gun		
Mk19 40 mm Grenade Machine Gun		
M240B 7.62 mm Machine Gun		
M249 5.56 mm Machine Gun		

PREPARATION FOR BORESIGHTING - Cont

b. Boresight Kit - MR2.

Perform the following procedures to insert the boresight telescope and appropriate mandrel into the designated weapon barrel. See Table 2.

CAUTION

The optical boresight telescope is fragile. Handle with care. Failure to do so may result in equipment damage.

NOTE

Each time the boresight alignment kit is used, perform the boresight telescope verification.

Each weapon uses a different set up configuration of mandrels and adapters. See Table 2.

Items in Table 2 are shown in the order that they must be in when inserted into the weapon's barrel.

(1) M2 HB .50 CAL MACHINE GUN.

(a) Screw the .50-cal mandrel (2) into the boresight adapter (3).

(b) Insert the .50-cal mandrel (2) into the weapon barrel (bore).

(c) Insert boresight telescope (4) into the boresight adapter (3) so that the boresight telescope is aligned vertically.

(2) MK19 40 MM GRENADE MACHINE GUN.

(a) Screw the 5.56 mm mandrel (2) into the boresight adapter (3).

(b) Insert the 5.56mm mandrel (2) into the 40 mm expansion mandrel (1).

(c) Insert the 40 mm expansion mandrel (1) into the weapon barrel (bore).

(d) Insert boresight telescope (4) into the boresight adapter (3) so that the boresight telescope is aligned vertically.

(3) M240B 7.62 MM MACHINE GUN.

(a) Screw the 7.62 mm mandrel (2) into the boresight adapter (3).

(b) Insert the 7.62 mm mandrel (2) into the weapon barrel (bore).

(c) Insert boresight telescope (4) into the boresight adapter (3) so that the boresight telescope is aligned vertically.

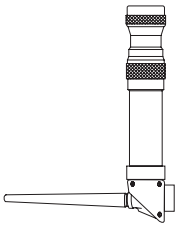
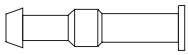
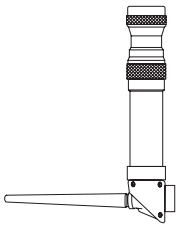
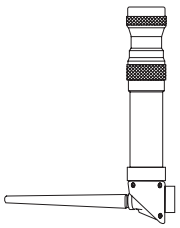
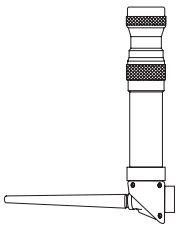
(4) M249 5.56 MM MACHINE GUN.

(a) Screw the 5.56 mm mandrel (2) into the boresight adapter (3).

(b) Insert the 5.56 mm mandrel (2) into the weapon barrel (bore).

(c) Insert boresight telescope (4) into the boresight adapter (3) so that the boresight telescope is aligned vertically.

Table 2. Boresight Kit -- MR2.

Weapon	Extension Mandrel (1)	Mandrel (2)	Adapter (3)	Boresight Telescope (4)
M2 HB .50 Cal Machine Gun	None			
Mk19 40 mm Grenade Machine Gun		(5.56 mm Mandrel) 		
M240B 7.62 mm Machine Gun	None			
M249 5.56 mm Machine Gun	None	(5.56 mm Mandrel) 		

PREPARATION FOR BORESIGHTING - Cont

NOTE

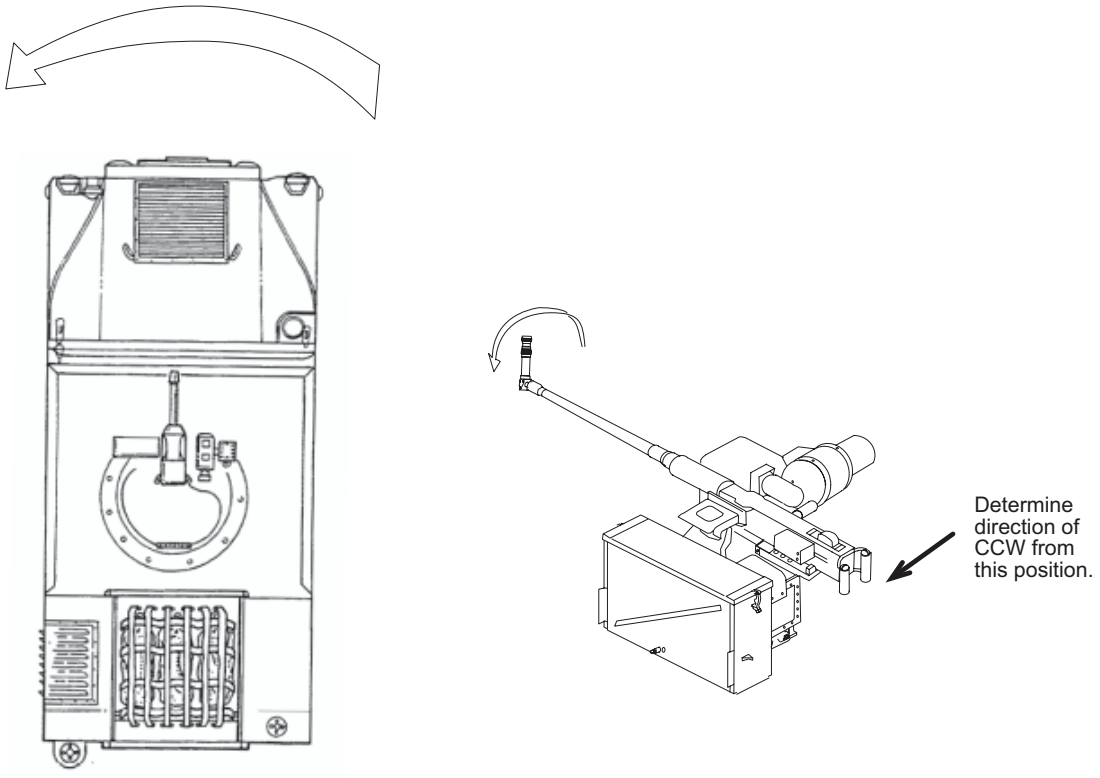
Perform the boresight telescope calibration verification procedures each time the boresight alignment kit is removed from a weapon and installed into the barrel of another weapon.

9. CROWS Mount Guide: Look down through the boresight telescope and align the cross-hairs to center on the boresight aimpoint selected in step 3 of the preceding Preparation for Boresighting procedure.

NOTE

Do not disturb the position of the weapon barrel and mandrel during rotation of the boresight telescope. Avoid rotation of the mandrel inserted into the weapon barrel by carefully rotating the boresight telescope counterclockwise (CCW).

10. CROWS Mount Guide: Rotate the boresight telescope CCW (see Figure 2) from the vertical position to 45°.



CCW in Relation to Vehicle Position **CCW in Relation to Weapon**

Figure 2. Determination of CCW from Vehicle Position.

11. CROWS Mount Guide: Look through the boresight telescope to verify that the cross-hairs remained centered on the boresight aimpoint within 1 mil or less (within inner circle of the boresight scope). See Figure 3.

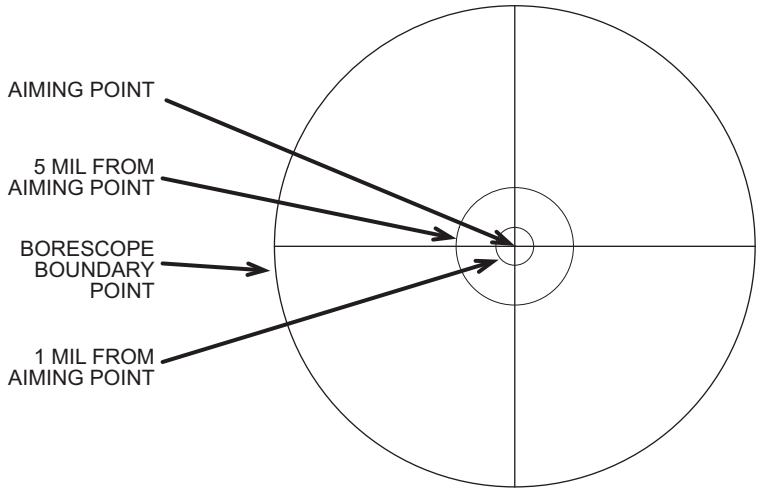


Figure 3. Boresighting Crosshair.

12. CROWS Mount Guide: Repeat steps 3 and 4 by rotating the boresight telescope counterclockwise from the 45° position to 90°.

    a. If the cross-hairs have maintained center on the boresight aimpoint, the boresight telescope calibration is verified and available for use.

    b. If the cross-hairs have not maintained center on the boresight aimpoint, the boresight telescope may need to be replaced or the mandrel may be bent or damaged.

    c. After reticle alignment, or replacement of the boresight telescope or the mandrel, repeat the boresight calibration verification steps 1 through 6.

13. Proceed to System Boresight Procedure, Elevation Alignment.

END OF TASK

SYSTEM BORESIGHT PROCEDURE

Elevation Alignment

1. Perform Preparation for Boresighting (see Preparation for Boresighting section).

2. CROWS Operator: Using the Joystick MOTION CONTROL switch and the LEFT toggle UP and DOWN for zoom functions, align the laser aimpoint on the designated boresight target and zoom to minimum FOV (1.0° to 1.2°).

3. CROWS Mount Guide: Ensure the boresight telescope is in the vertical position to the horizontal axis.

CAUTION

CROWS Mount Guide shall plant his feet securely and remain stationary during the following procedures. Do not allow any persons to lean on vehicle during the following procedures. Any movement of the vehicle at this time may cause the boresighting results to be skewed. Failure to follow these instructions may invalidate the boresighting solution.

NOTE

Do not be concerned where weapon is pointed at this time.

4. CROWS Operator: Using the MOTION CONTROL switch, align the horizontal bar of the laser aimpoint on the Engagement Mode screen on a target point at 300 to 500 meters.

5. CROWS Operator: Press FUNCTION (RIGHT toggle DOWN) until Menu appears in the left corner of the Engagement Mode screen.

6. CROWS Operator: Ensure that the cursor is positioned at the Preparation Menu entry point designated by P in the upper left of the screen.

7. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT). This will take you to the Preparation Menu.

8. CROWS Operator: Position cursor onto the CONFIGURE option, as shown in Figure 4.

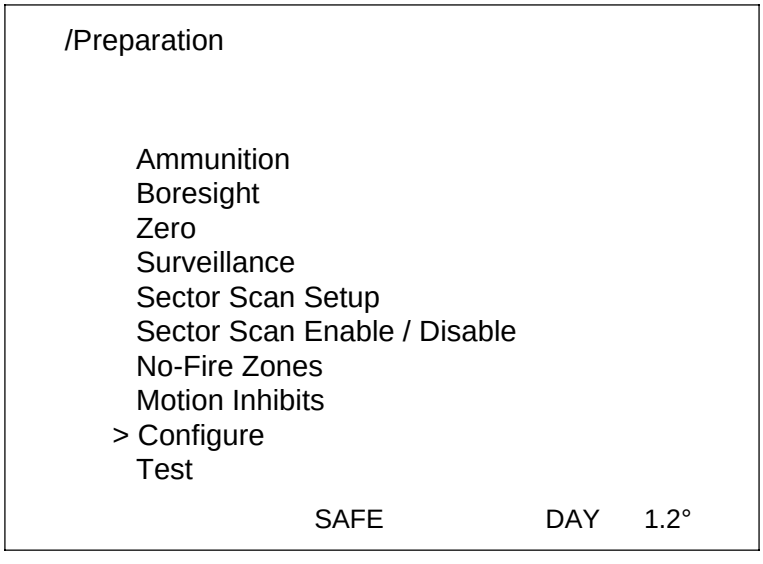


Figure 4. Preparation Menu with Configure Option Selected.

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any switches. Failure to follow these instructions may result in equipment malfunction or failure.

9. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT). This will take you to the Configure Menu as shown in Figure 5.

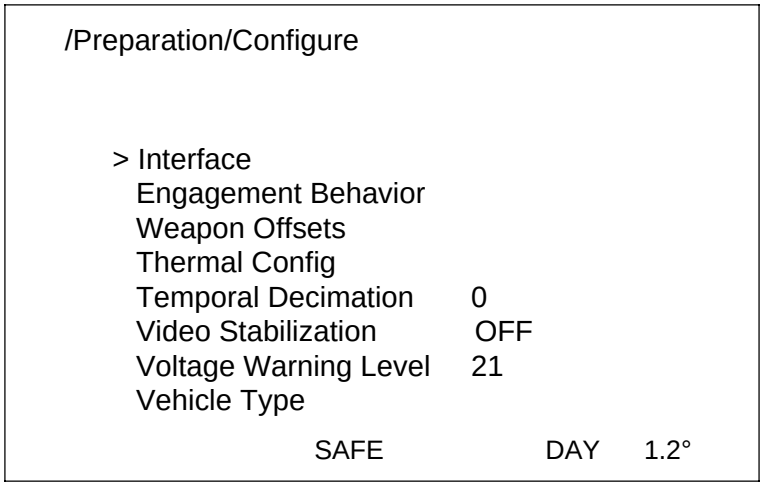


Figure 5. Configure Menu with Interface Option Selected.

10. CROWS Operator: In the CONFIGURE menu, press and HOLD the Joystick RIGHT toggle DOWN. Do not release holding the Joystick RIGHT toggle DOWN. The ADVANCED CONFIGURATION option will appear as shown in Figure 6.

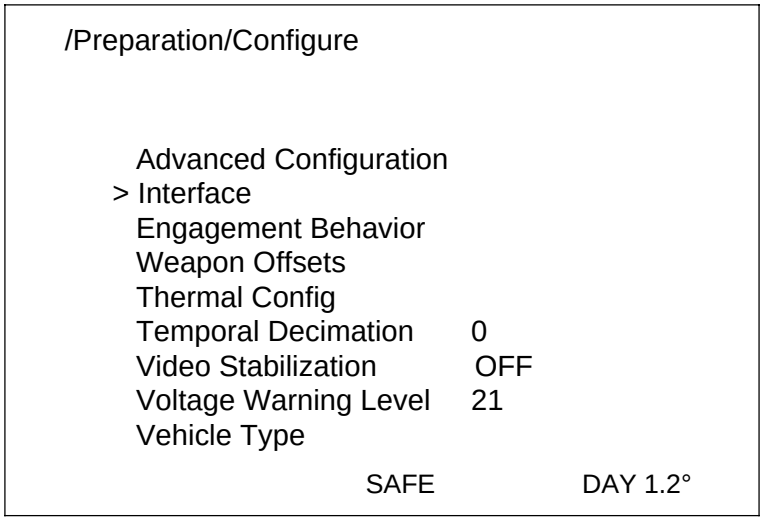


Figure 6. Configure Menu with Interface Option Selected and Advanced Configuration Showing.

SYSTEM BORESIGHT PROCEDURE - Cont

Elevation Alignment - Cont

11. CROWS Operator: While continuing to HOLD the Joystick RIGHT toggle DOWN, position cursor UP to the ADVANCED CONFIGURATION option, see Figure 7, and press ACCEPT (LEFT toggle RIGHT). The ADVANCED CONFIGURATION menu will appear. See Figure 8.

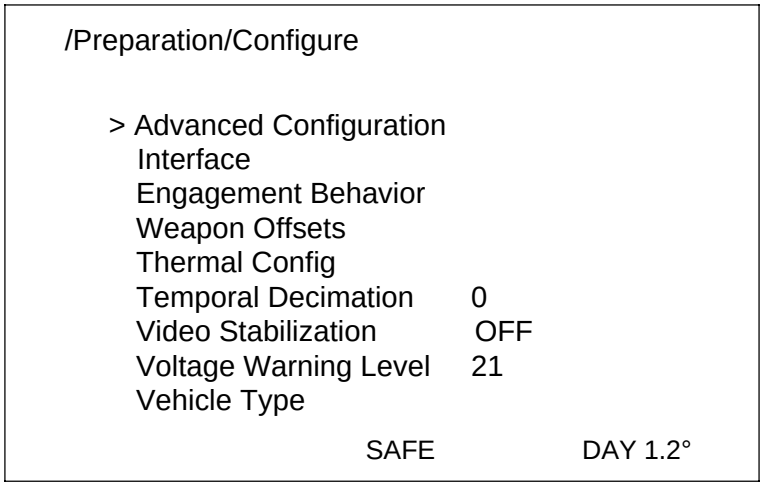


Figure 7. Configure Menu with Advanced Configuration Option Selected.

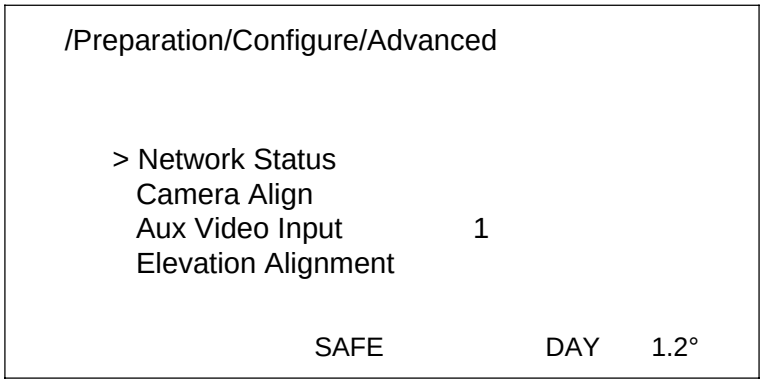


Figure 8. Advanced Configuration Menu.

12. CROWS Operator: Release the Joystick RIGHT toggle DOWN.

CAUTION

DO NOT select any option other than ELEVATION ALIGNMENT while in the ADVANCED CONFIGURATION menu. Selecting any other option may cause a system malfunction.

13. CROWS Operator: Position the CURSOR onto the ELEVATION ALIGNMENT option. See Figure 9.

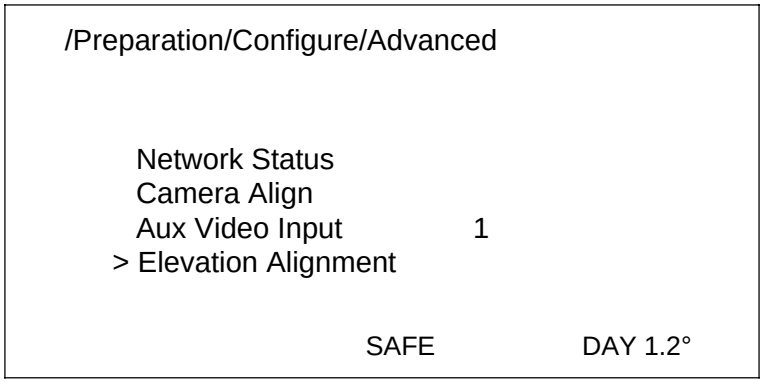


Figure 9. Advanced Configuration Menu with Elevation Alignment Option Selected.

WARNING

While maintaining alignment and just prior to the following step, the Mount Guide shall remove eye from physical contact with the boresight telescope. Acceptance of the alignment by the CROWS Operator in the following step may cause the Elevation Drive to slightly move the weapon. Failure to follow these instructions may result in personal injury.

14. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT). This will free the weapon elevation drive and allow manual movement of the weapon. An asterisk (*) will appear to the right of the ELEVATION ALIGNMENT option to verify the selection. See Figure 10.

NOTE

This is an elevation adjustment. Do not be concerned if the weapon and sensor are not aligned in azimuth.

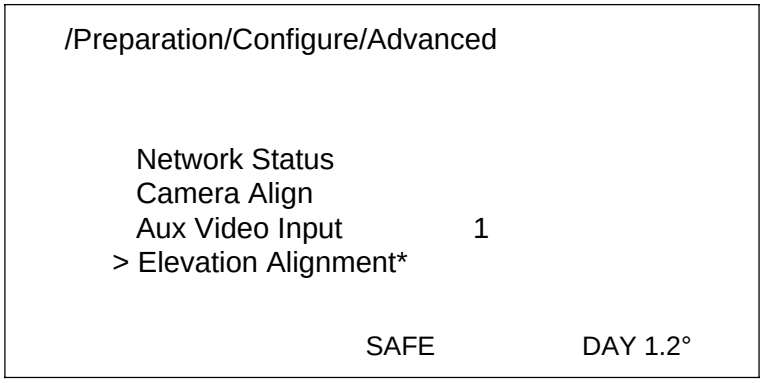


Figure 10. Advanced Configuration Menu with Asterisk on Elevation Alignment.

SYSTEM BORESIGHT PROCEDURE - Cont

Elevation Alignment - Cont

15. CROWS Mount Guide: Look through the boresight telescope to physically move the weapon barrel and align the boresight horizontal cross-hair to a horizontal reference line on the target 300 to 500 meters. Maintain horizontal alignment until directed to release the weapon barrel. Alert the CROWS Operator when aligned.

16. CROWS Operator: Direct the Mount Guide to remove eye from physical contact with the boresight telescope, then press ACCEPT (LEFT toggle RIGHT). This will reapply power to the weapon Elevation Drive.

17. CROWS Operator: Press LASE (LEFT toggle LEFT) to return to the Engagement Menu. The laser aimpoint will be visible on the DU screen.

18. CROWS Operator: Using the joystick MOTION CONTROL switch, move the mount elevation up and down, realigning the horizontal bar of the laser aimpoint on a horizontal reference line on the target point at 300 to 500 meter range.

19. CROWS Mount Guide: Look through the boresight telescope to verify that the target point of the boresight telescope is aligned within 5 mils or less with the horizontal bar of the laser aimpoint, as shown in Figure 11. The outer reticle circle of the boresight scope has a radius of 5 mils. If not aligned, repeat steps 5 through 18.

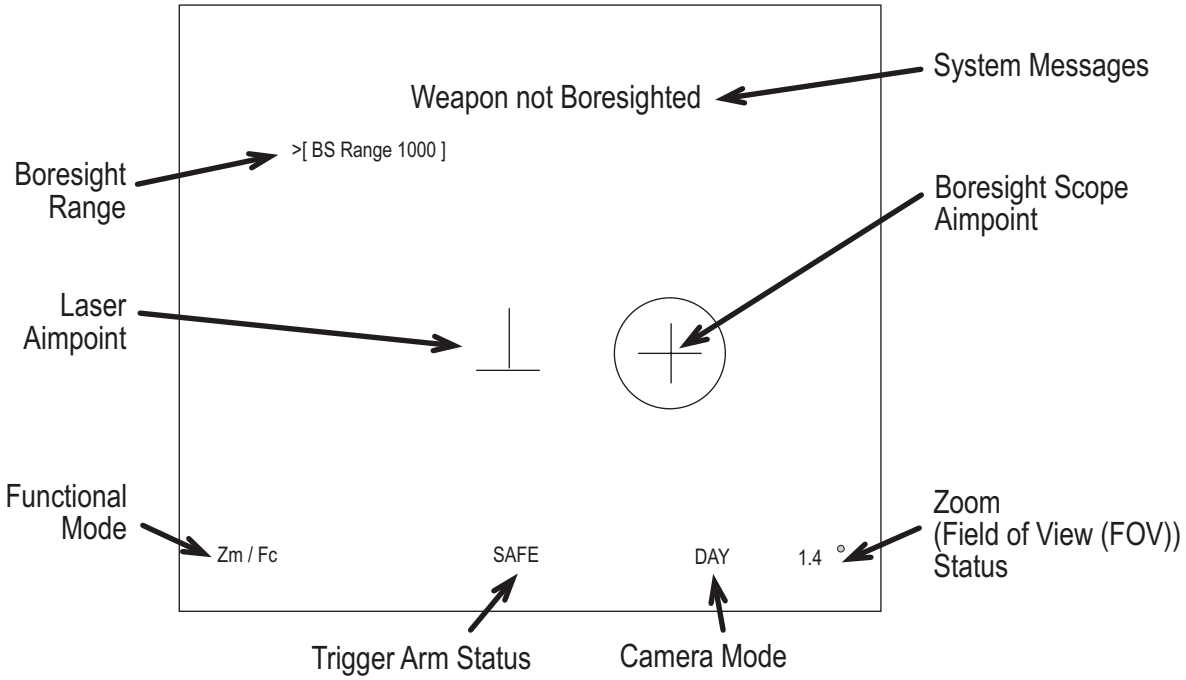


Figure 11. Elevation Alignment Graphical Overlay with Boresight Scope Aimpoint.

20. CROWS Mount Guide: Remove the boresight telescope and mandrel from the weapon barrel and proceed to the Electronic Alignment procedures.

END OF TASK

Electronic Alignment

NOTE

Two personnel are required to accurately boresight the weapon: The CROWS Operator for performing Control Group procedures and the CROWS Mount Guide for performing the boresight telescope procedures. Ensure communication is good between the two personnel.

Ensure that Elevation Alignment procedures have been performed. See previous task.

Perform the following procedures to set or clear boresight data.

NOTE

If the anticipated mission targets will be more than 1500 meters, the target point used in electronic boresighting must be 1500 to 1800 meters.

The “ADJUST” functional mode can only be accessed when the electronic boresight procedure is being carried out.

1. CROWS Operator: Ensure STAB is OFF by depressing the STAB Switch LEFT.

CAUTION

If boresight mandrel and telescope are left in barrel, damage may occur during the following steps.

2. CROWS Mount Guide: Remove the Boresight mandrel and telescope from the weapon barrel, if installed.

CAUTION

When pulling up the weapon barrel in the following step, DO NOT pull up so hard that it causes the system to go into a “GWS BIT fault”. Failure to follow this instruction could result in equipment damage or system inoperability.

3. CROWS Mount Guide: Firmly pull up on the barrel of the weapon three times. Do not pull up hard enough to cause the system to go into a “GWS BIT fault”.
4. CROWS Operator: If the system faults, press UP on the SAFETY OVER-RIDE switch ON and then OFF to reset the gimbal; then restart this procedure from step 1.
5. CROWS Operator: Charge the weapon by pressing UP on the CHARGE switch two times.
6. CROWS Operator: Press LEFT toggle UP to zoom in to minimum FOV.
7. CROWS Operator: Press FUNCTION (RIGHT toggle DOWN) until in the Menu mode.
8. CROWS Operator: Ensure the CURSOR is at the Preparation Menu entry point designated by P, shown on the upper left of the screen.
9. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT). This will take you to the Preparation Menu.

SYSTEM BORESIGHT PROCEDURE - Cont

Electronic Alignment - Cont

10. CROWS Operator: Position the CURSOR onto the BORESIGHT option, as shown in Figure 12.

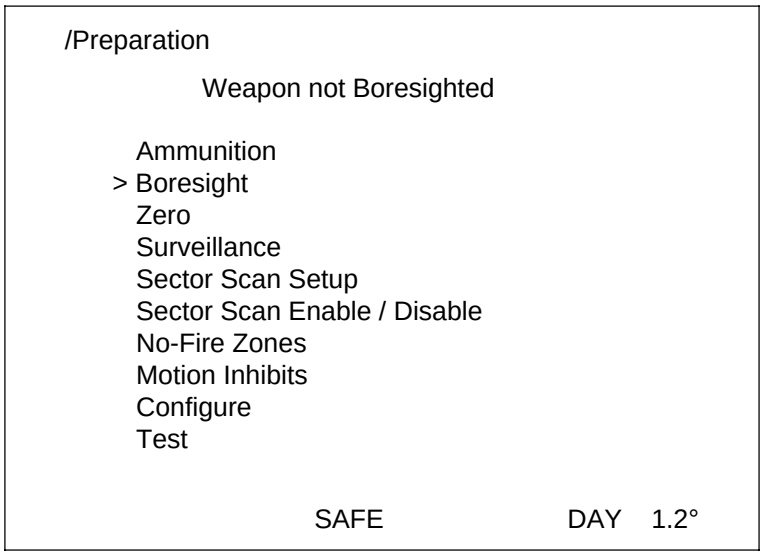


Figure 12. Preparation Menu with Boresight Option Selected.

NOTE

The CROWS is configured to accept more than one weapon. When ACCEPT (LEFT toggle RIGHT) is pressed, a menu appears listing the different weapons available for making an ammunition selection. The underlined entry shows which weapon represents the weapon installed in the WAK due to the appropriate cable connection. An asterisk (*) next to a weapon option indicates that ammunition for that weapon option has been selected. See Figure 13. The asterisk(s) (*) will remain until removed.

11. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT). Figure 13 appears showing available weapons for ammunition selection.

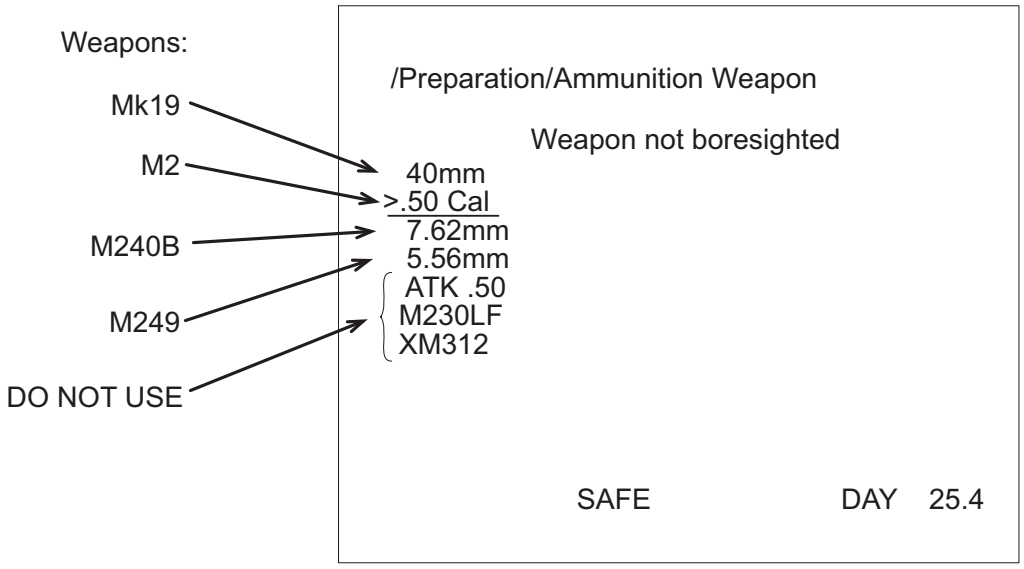


Figure 13. Weapon Menu.

12. CROWS Operator: Position CURSOR onto the appropriate weapon type (underlined) option, as shown in Figure 13.

SYSTEM BORESIGHT PROCEDURE - Cont

Electronic Alignment - Cont

13. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT). The Weapon Charged Menu appears, as shown in Figure 14.

NOTE

RIGHT toggle LEFT or RIGHT toggles between Clear and Set. See Figure 14.

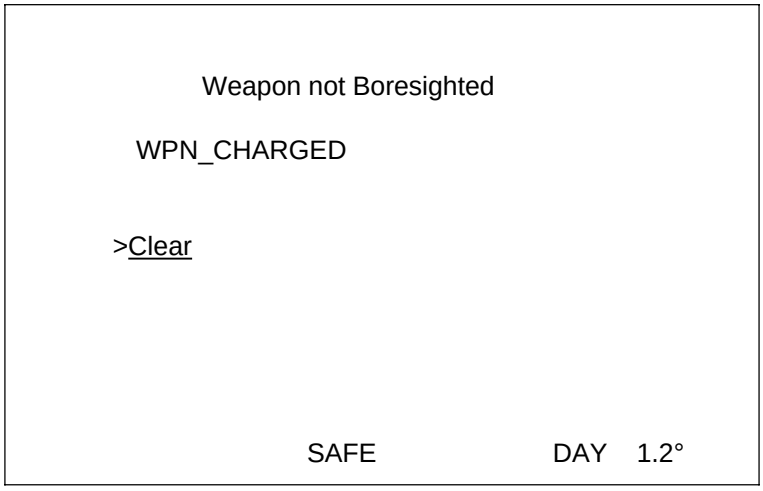


Figure 14. Weapon Charged with Clear Option Selected.

14. CROWS Operator: Ensure the CURSOR is positioned on the SET option. See Figure 15.

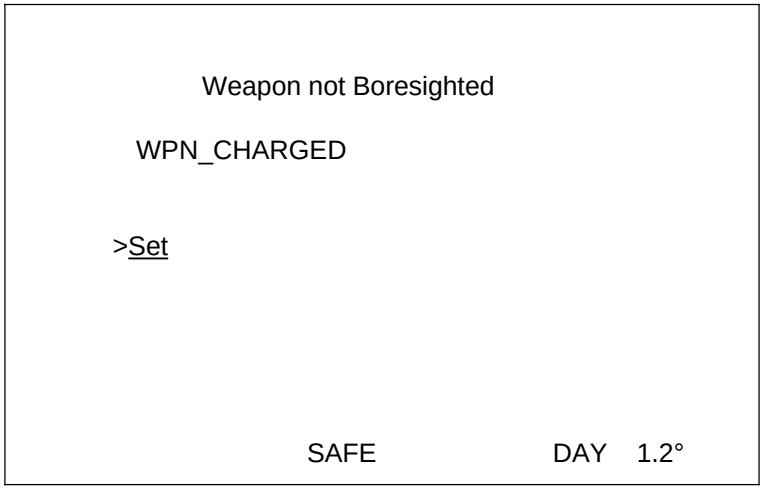


Figure 15. Weapon Charged with Set Option Selected.

15. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT). The boresight screen will appear, showing Zm / Fc in the lower left of the screen, as shown in Figure 16.

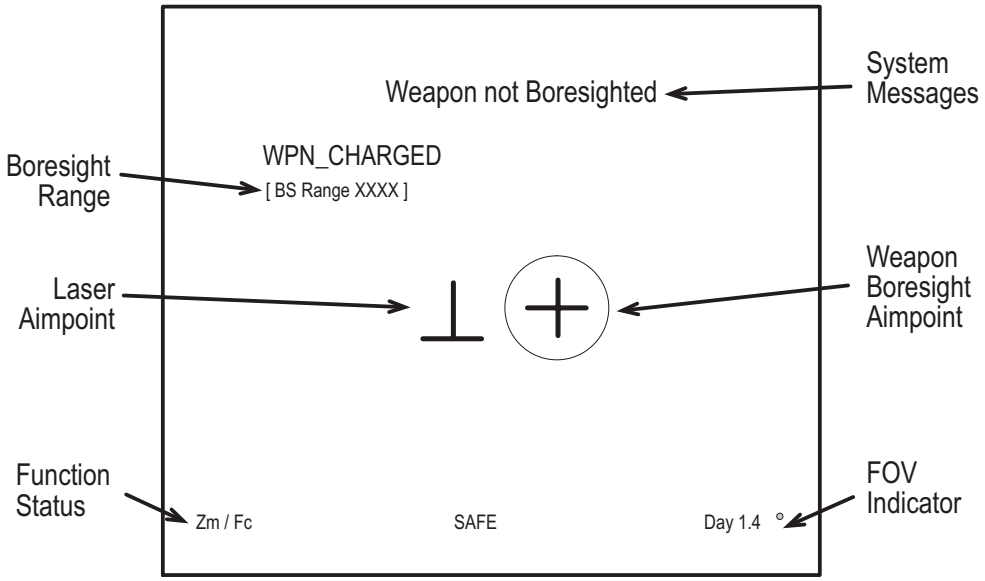


Figure 16. Boresight Zm / Fc Screen with Boresight Telescope Aimpoint.

NOTE

The position of the laser aimpoint is not important at this step of the procedure.

16. CROWS Mount Guide: Insert the Boresight mandrel and telescope into the weapon barrel.

17. CROWS Mount Guide: Look through the boresight telescope to verify that the target point of the boresight telescope is aligned within 1 mil or less (within inner circle of the boresight scope) of the horizontal bar of the laser aimpoint, as shown in Figure 11. If not aligned, repeat steps 7 through 17.

CAUTION

CROWS Mount Guide shall plant his feet securely and remain stationary during the following procedures. Do not allow any persons to lean on vehicle during the following procedures. Any movement of the vehicle at this time may cause the boresighting results to be skewed. Failure to follow these instructions may invalidate the boresighting solution.

18. CROWS Operator: Press RIGHT toggle LEFT or RIGHT to focus on the target.

SYSTEM BORESIGHT PROCEDURE - Cont

Electronic Alignment - Cont

19. CROWS Operator: Press FUNCTION (RIGHT toggle DOWN) once to select the Range mode. Range appears in the lower left of the screen, as shown in Figure 17.

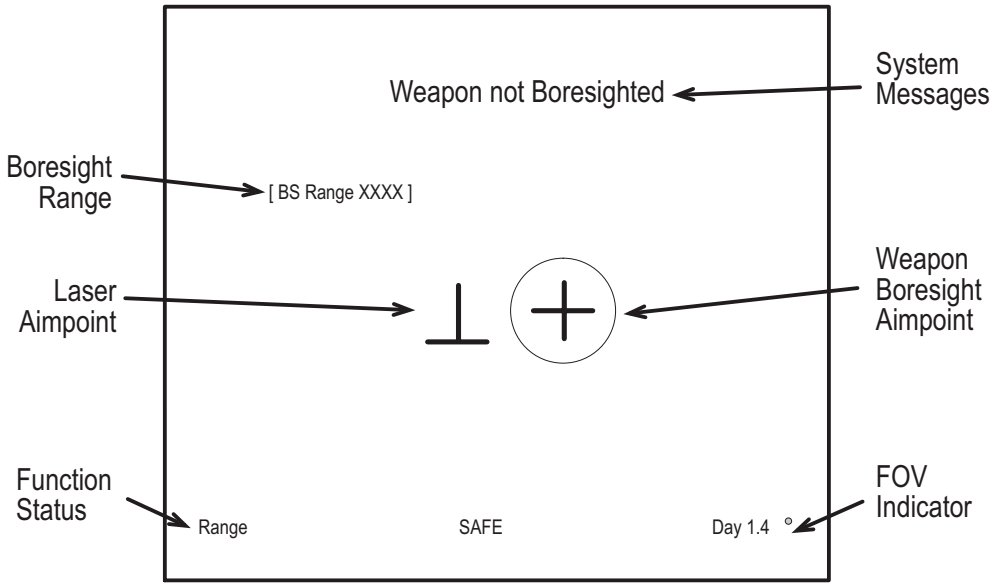


Figure 17. Boresight Range Screen.

NOTE

Do not use the joystick for the following steps.

20. CROWS Operator: If the Laser aimpoint is on the target, press UP on the DU LASE switch to determine target distance. Target range will appear on the display screen. If the Laser aimpoint is not on the target, perform the following procedure. Otherwise, proceed to step 22.

21. CROWS Operator: If you do not get a valid laser range, use the following procedure:

    a. Press DOWN on the DU ACCEPT switch.

    b. Manually insert the Range value. See WP 0015, Menu System, Table 10, Specified Default Values, and the Range Step section.

    c. Press DOWN on the DU ACCEPT switch again to select range.

22. CROWS Operator: Press UP on the DU FUNCTION switch once to select the ADJUST mode. ADJUST appears in the lower left of the screen, as shown in Figure 18.

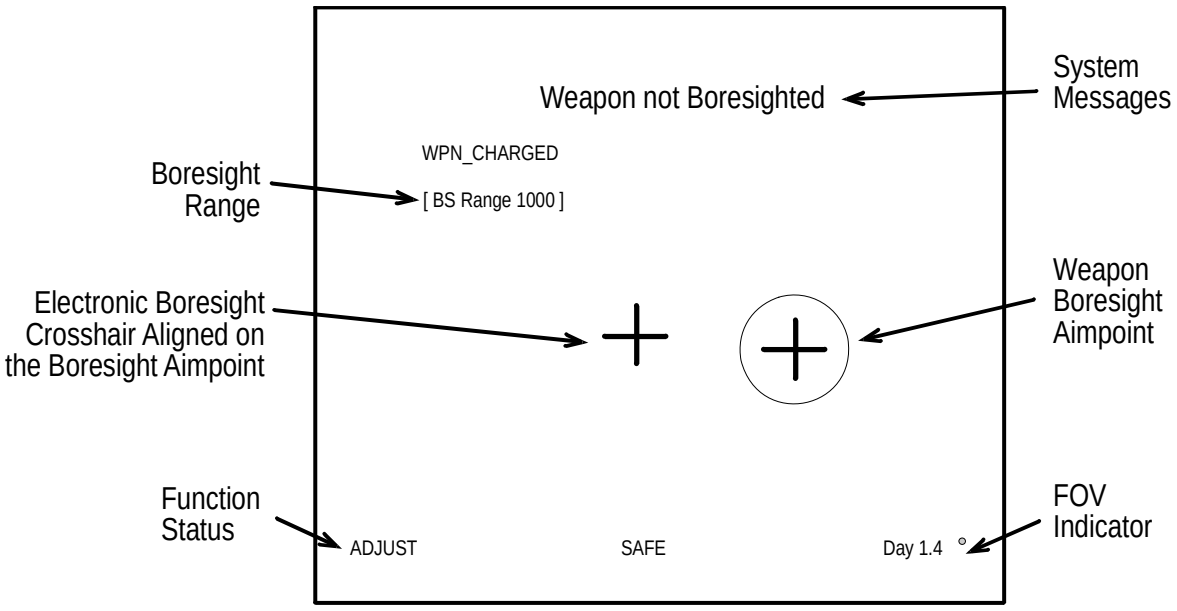


Figure 18. Boresight Adjustment Screen.

WARNING

Ensure weapon is evacuated of rounds and chamber is cleared IAW the applicable weapon TM prior to and during boresighting. Remove and secure any rounds that have been cleared. Refer to WP 0035, References, for a listing of weapon TMs.

NOTE

Use the joystick for the following step.

CROWS Mount Guide: Do not touch the barrel or the boresight telescope when looking at the target.

23. CROWS Operator: Using input from the CROWS Mount Guide, press the MOTION CONTROL toggle to directionally guide the weapon until the boresight telescope crosshair is centered on the target.

SYSTEM BORESIGHT PROCEDURE - Cont

Electronic Alignment - Cont

NOTE

Each time a CURSOR switch is pressed once in any direction, the electronic boresight crosshair is moved one pixel in the direction controlled by the switch.

Use the DU switches for the following steps.

24. CROWS Operator: Press the DU CURSOR CONTROL to align the electronic boresight crosshair with the original target, as shown in Figure 19. Ensure the boresight telescope remains on target.

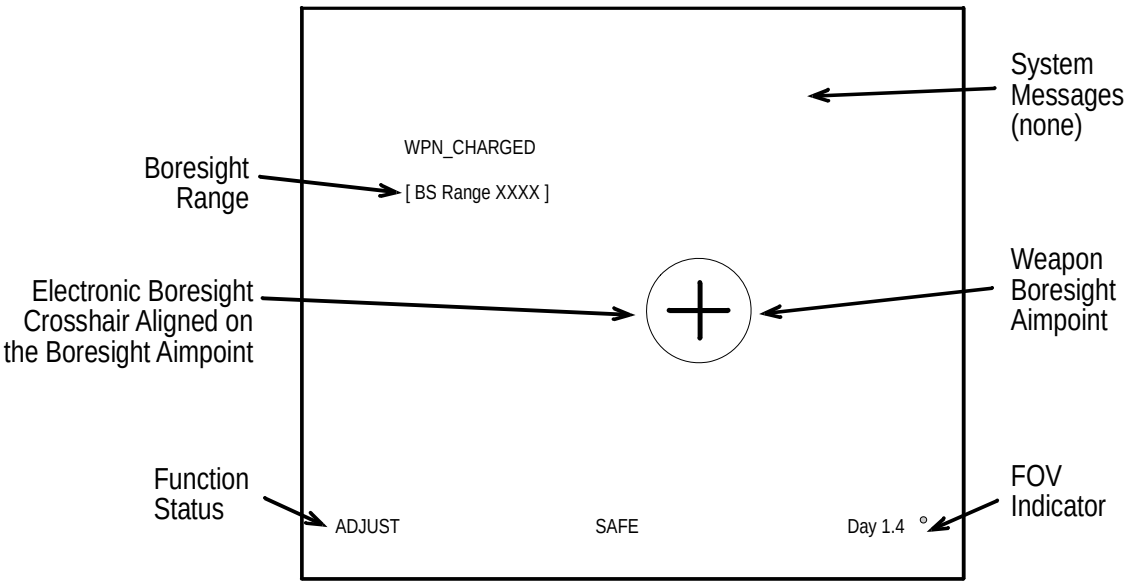


Figure 19. Boresight Process Complete.

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any switches. Failure to follow these instructions may result in equipment malfunction or failure.

25. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT) to save the boresight information.

26. CROWS Mount Guide: Remove the boresight mandrel and telescope from the weapon barrel, then proceed to Verification of Boresighting procedures.

27. Proceed to Verification Procedures.

END OF TASK

Verification of Boresighting

WARNING

Ensure weapon is evacuated of rounds and chamber is cleared IAW the applicable weapon TM prior to and during boresighting. Remove and secure any rounds that have been cleared. Refer to WP 0035, References, for a listing of weapon TMs.

NOTE

This section's example is based on verification of an M2 boresighting completed in the Electronic Alignment section of this work package.

1. CROWS Mount Guide: Ensure the boresight telescope and mandrel are not installed in the weapon barrel.
2. CROWS Operator: Press LASE (LEFT toggle LEFT) to return to the Engagement Menu.
3. CROWS Operator: Ensure STAB is OFF by depressing the STAB switch LEFT.

CAUTION

When pulling up the weapon barrel in the following step, DO NOT pull up so hard that it causes the system to go into a "GWS BIT fault." Failure to follow this instruction could result in equipment damage or system inoperability.

4. CROWS Mount Guide: Firmly pull up on the barrel of the weapon three times. Do not pull up hard enough to cause the system to go into a "GWS BIT fault".
5. CROWS Operator: If the system faults, press the SAFETY OVER-RIDE switch ON and then OFF to reset the gimbal; then restart this procedure from step 1.
6. CROWS Operator: Charge the weapon by pressing UP on the CHARGE switch two times.
7. CROWS Mount Guide: Install the boresight mandrel and telescope.
8. CROWS Operator: Press FUNCTION (RIGHT toggle DOWN) until in the Menu mode.
9. CROWS Operator: Ensure that the CURSOR is at the Preparation Menu entry point designated by P in the upper left corner of the screen.
10. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT). This will take you to the Preparation Menu.

SYSTEM BORESIGHT PROCEDURE - Cont

Verification of Boresighting - Cont

11. CROWS Operator: Ensure the CURSOR points to the AMMUNITION option, as shown in Figure 20.

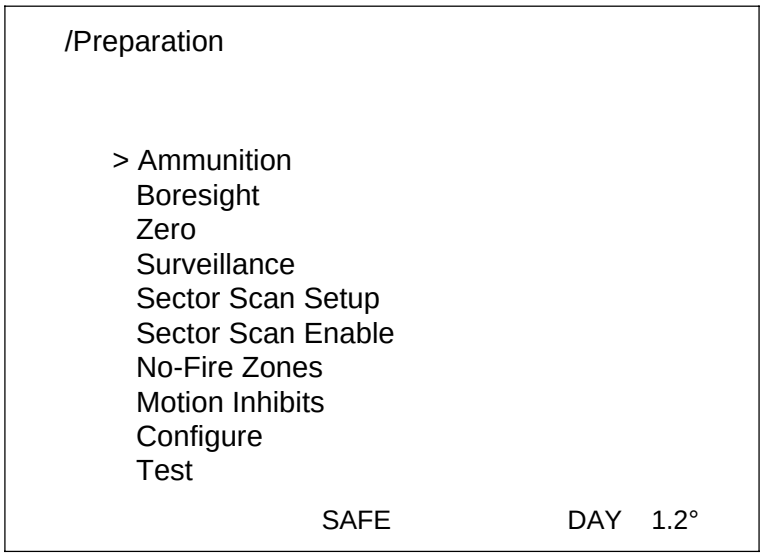


Figure 20. Preparation Menu with Ammunition Option Selected.

12. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT). The Ammunition Weapon Menu appears, as shown in Figure 21.

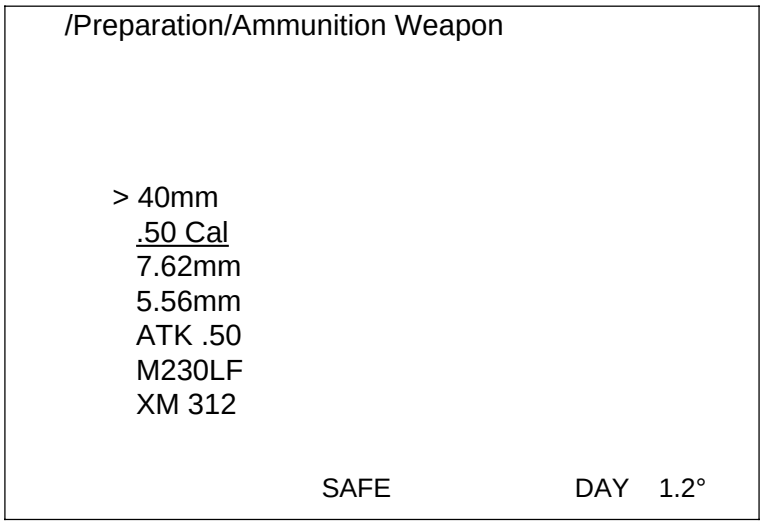


Figure 21. Weapon Menu.

13. CROWS Operator: Position the CURSOR to select the appropriate weapon type.

14. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT). The Available Ammunition Menu will appear.

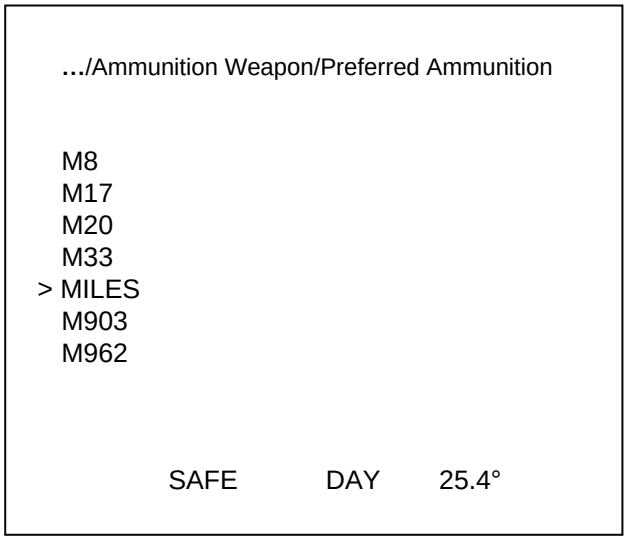


Figure 22. Available Ammunition for M2 Weapon.

15. CROWS Operator: Position the CURSOR to the MILES option. See Figure 22.

16. CROWS Operator: Press ACCEPT (LEFT toggle RIGHT). An asterisk (*) appears next to the MILES option. See Figure 23.

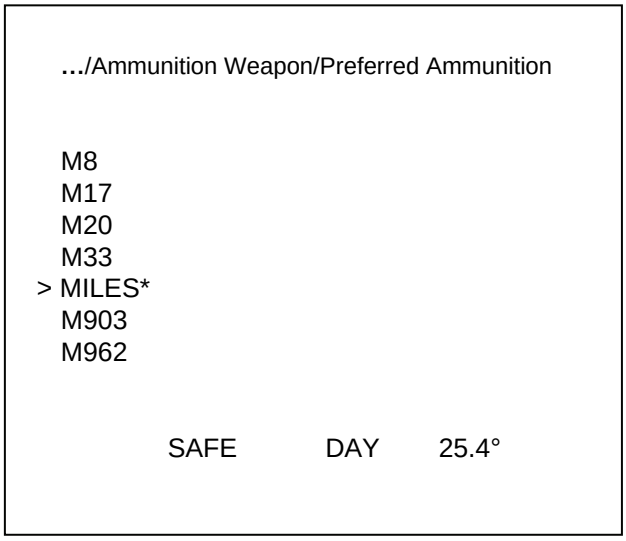


Figure 23. M2 Weapon MILES Ammunition Selected.

17. CROWS Operator: Press LASE (LEFT toggle LEFT) until the system is back at the Engagement menu.

SYSTEM BORESIGHT PROCEDURE - Cont

Verification of Boresighting - Cont

WARNING

Ensure all personnel are clear of weapon and follow all safety precautions. The weapon mount will move. Failure to follow this warning may result in serious personal injury or equipment damage.

18. CROWS Operator: Using Joystick MOTION CONTROL SWITCH, align the laser aimpoint on a target.

19. CROWS Operator: Press LASE (LEFT toggle LEFT).

NOTE

Auto Accept Solutions is an option found in WP 0015, Configure Menu section, Engagement Behavior subsection. If the Auto Accept option is enabled (ON), proceed to step 21.

20. If Auto-Accept is not enabled, press the ACCEPT switch to accept the fire control solution.

21. CROWS Operator: Align the ballistic aimpoint on the target.

22. CROWS Mount Guide: Look through the boresight telescope to verify it is on the same target as the ballistic aimpoint target within 1 mil or less (within inner circle of the boresight scope). If it is, the weapon boresighting is successful. Go to step 24.

23. If the weapon verification of boresighting is not successful, repeat the System Boresighting Procedure. If boresighting cannot be achieved after two tries, contact higher maintenance.

24. CROWS Mount Guide: Remove the boresight mandrel and telescope from the weapon barrel. See WP 0015, Ammunition Selection section.

25. CROWS Operator: Select the appropriate ammunition type to be used for mission.

NOTE

Once initial weapon boresighting is successfully completed, it is recommended the weapon zeroing procedure be performed immediately. See WP 0017, Zeroing.

END OF TASK

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER USUAL CONDITIONS - ZEROING

THIS WORK PACKAGE COVERS:

The operation and procedures of the zeroing process.

INITIAL SET UP:

Tools and Special Tools:

Operator's Tool Kit (WP 0036, Table 2, Item 1)

Materials/Parts:

Weapon and Ammunition

References:

WP 0015
WP 0016
WP 0018
WP 0019
WP 0020
WP 0021
WP 0023
WP 0024
WP 0026
WP 0027
WP 0036

Personnel Required:

Two

Equipment Conditions:

CROWS Set Up and Operational
Weapon installed

WP CONTENTS

Section/Subsection **Page**

Overview of Zeroing Process 1
Zeroing Procedure 2
Preparation Before Zeroing the System 2
Zeroing the System 3
Confirmation of Zeroing 9

NOTE

Refer to WP 0023, Troubleshooting – Weapon Interface Malfunctions, should any weapon malfunction occur.

OVERVIEW OF ZEROING PROCESS

Zeroing of the weapon is accomplished with the weapon installed in the applicable CROWS Weapon Adapter Kit (WAK) and while the vehicle is stationary. Zeroing is designed to compensate for all the factors in the system ballistic solution that affects weapon accuracy. These factors include weapon dynamics, CROWS/Vehicle mounting dynamics, and lot-to-lot ammunition variances.

OVERVIEW OF ZEROING PROCESS - Cont

NOTE

It is recommended that the weapon zeroing process be undertaken immediately after the weapon boresighting process to ensure the most accurate alignment. Should mission circumstances dictate, the CROWS system may be mission-operational after Boresighting is completed, although in a potentially degraded mode. For additional information, refer to WP 0016, Boresighting.

The laser aimpoint is represented by the symbol, ⊥.

The ballistic aimpoint is represented by the symbol, ^.

ZEROING PROCEDURE

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any switches.

Preparation Before Zeroing the System

WARNING

Live ammunition is used during the zeroing process. Follow all safety warnings and cautions. Failure to do so may result in personal injury.

NOTE

For additional information on weapon operation, refer to WP 0018, Loading and Firing the M2 HB .50-Cal Machine Gun; WP 0019, Loading and Firing the Mk19 (40 mm) Automatic Grenade Machine Gun; WP 0020, Loading and Firing the M240B (7.62 mm) Machine Gun; or WP 0021, Loading and Firing the M249 (5.56 mm) Machine Gun, and WP 0035, References.

Perform the following procedure before zeroing the system.

NOTE

For detailed instructions on setting range and aimpoint, refer to WP 0015, Menu System.

If it is determined that the current wind conditions will affect the ballistics of the rounds during firing, a wind correction is to be made in accordance with WP 0015, Table 10, Specified Default Values.

1. Ensure boresighting procedures in WP 0016 were performed immediately preceding these Zeroing preparation procedures.

2. Select a suitable target on the range, with the following criteria. Refer to WP 0016 Boresighting:

   - Range: If Electronic Boresighting was performed using a 1500 to 1800-m target point, zeroing should be performed using a 1500 to 1800-m target point. If Electronic Boresighting was performed using a 300 to 500-m target point, zeroing must be performed using a 300 to 500-m target point.
   - Targets: Readily identifiable targets and round impact points that can be used and marked throughout the procedure.

WARNING

Ensure the boresight tool has been removed from the weapon. Leaving the boresight kit in the weapon may result in personal injury.

3. Ensure the proper weapon and ammunition type is selected.

NOTE

Ensure wind speed units (m/s, mph, etc.) are consistent with source information. Refer to WP 0015, Table 10, Specified Default Values.

4. If the estimated cross or range winds exceed 3 miles per hour (1.3 meters per second) use the procedures in WP 0015 to enter an appropriate wind correction.

5. Load the weapon with at least 50 rounds of correct ammunition (25 rounds for the Mk 19).

END OF TASK

Zeroing the System

Perform the following procedures to zero the system:

1. Use the MOTION CONTROL switch to align the laser aimpoint on the designated target.

2. Press LASE (LEFT toggle LEFT). Target distance should appear in upper left of the screen and aimpoint will move off the target to indicate the ballistic solution.

NOTE

If auto accept has been enabled, proceed to step 4.

3. If auto accept has not been enabled, press ACCEPT (LEFT toggle RIGHT) to accept the ballistic solution.
4. If the aimpoint is not on target, use the MOTION CONTROL switch to align the ballistic aimpoint on the selected point of aim located in the center of mass of the target.
5. Charge the weapon by pressing the CHARGER switch on the SPU to the CHARGE position.

NOTE

The Stabilization (STAB) Switch on the Joystick is turned OFF when depressed LEFT and is turned ON when depressed RIGHT.

6. Turn STAB to ON by pressing the joystick STAB Switch RIGHT.

ZEROING PROCEDURE - Cont

Zeroing the System - Cont

7. Press the SYSTEM ARM switch on the SPU to the ARMED position. Verify that ARMED is displayed on the DU screen. See Figure 1.

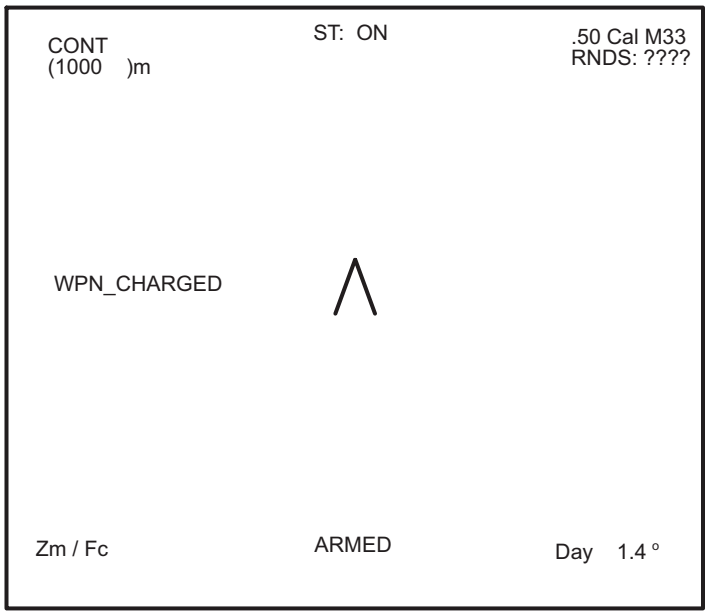


Figure 1. Charging the Weapon.

NOTE

Ensure the generated ballistic aimpoint is realigned on the point of aim at the start of each burst. If the ARMED status is not displayed on screen, refer to WP 0024, Troubleshooting Index; WP 0026, Preventive Maintenance Checks and Services (PMCS); or WP 0027, Before Operational Check, to identify and resolve the issue. If the problem is not resolved, send the CROWS system to the next higher level of maintenance.

8. Fire a burst of 10-12 rounds (M2, M240B, M249) or 5 rounds if MK-19 is installed. Repeat this procedure two more times.

9. Press the SYSTEM ARM switch on the SPU to the SAFE position. Verify that SAFE is displayed on the DU screen. See Figure 2.

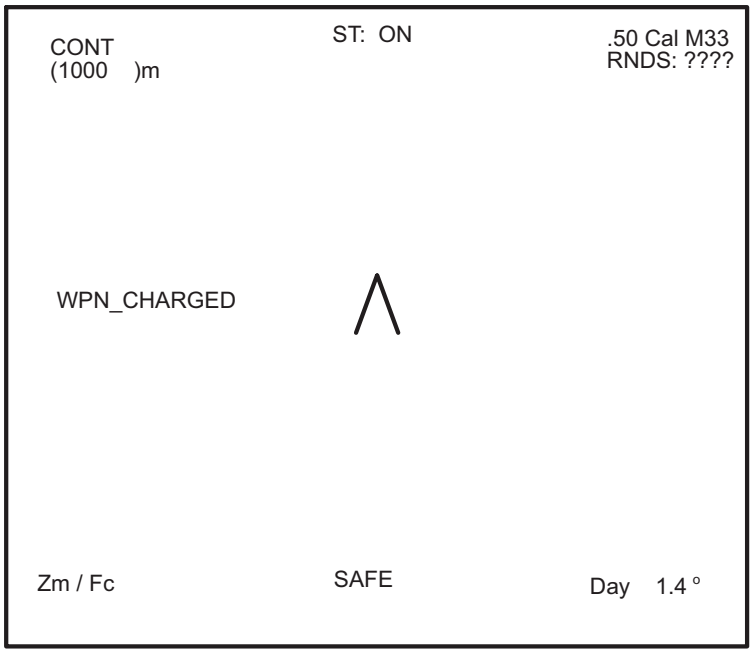


Figure 2. Weapon SAFED.

NOTE

If the SAFE status is not displayed on screen, refer to WP 0024, Troubleshooting Index; WP 0026, Preventive Maintenance Checks and Services (PMCS); or WP 0027, Before Operational Check, to identify and resolve the issue. If the problem is not resolved, send the CROWS system to the next higher level of maintenance.

10. Press the CHARGER switch on the SPU to the SAFE position.

11. Turn STAB OFF by pressing the STAB Switch on the Joystick LEFT.

NOTE

For proper procedures on clearing the weapon, refer to WP 0018, Loading and Firing the M2 HB .50-Cal Machine Gun; WP 0019, Loading and Firing the Mk19 (40 mm) Automatic Grenade Machine Gun; WP 0020, Loading and Firing the M240B (7.62 mm) Machine Gun; or WP 0021, Loading and Firing the M249 (5.56 mm) Machine Gun.

12. Unload and clear the weapon. Remove and secure any rounds that have been cleared.

13. Ensure the ballistic aimpoint remains on screen to complete the zeroing procedure.

ZEROING PROCEDURE - Cont

Zeroing the System - Cont

14. Observe the Burst Group round impacts on the target, determine the Mean Point of Impact (MPI) and clearly mark the MPI on the target. Figure 3 shows an example of an MPI calculation of Burst Group round impacts on the actual target.

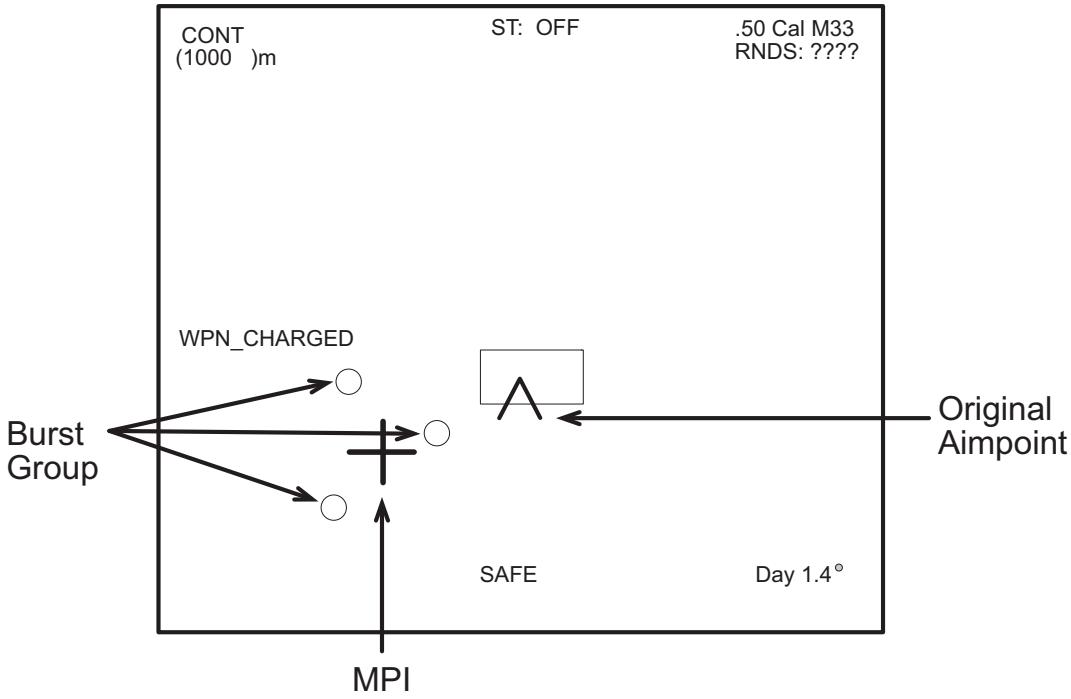


Figure 3. Mean Point Impact (MPI) Calculation at the Actual Target.

15. If the MPI is on the original aimpoint, Zeroing is complete. Proceed to the Confirmation of Zeroing section of this work package.

16. If the target does not show a complete Burst Group rounds impact for MPI calculation, perform the following alternate zeroing procedure.

    a. If the Burst Group round impact points are not on the target for MPI calculation, determine an estimated MPI.

    b. Use the MOTION CONTROL switch to move the ballistic aimpoint off the original aimpoint in the opposite direction from the estimated MPI. For example, if you determine the MPI is low-left by 2 meters, move the ballistic aimpoint high-right by 2 meters from the original aimpoint, as shown in Figure 4.

    c. Reload the weapon with at least 50 rounds of ammunition (25 rounds for the Mk 19).

    d. Repeat steps 1-15 and the alternate zeroing procedure steps a and b (step c, if necessary), until an MPI calculation can be obtained on the original aimpoint.

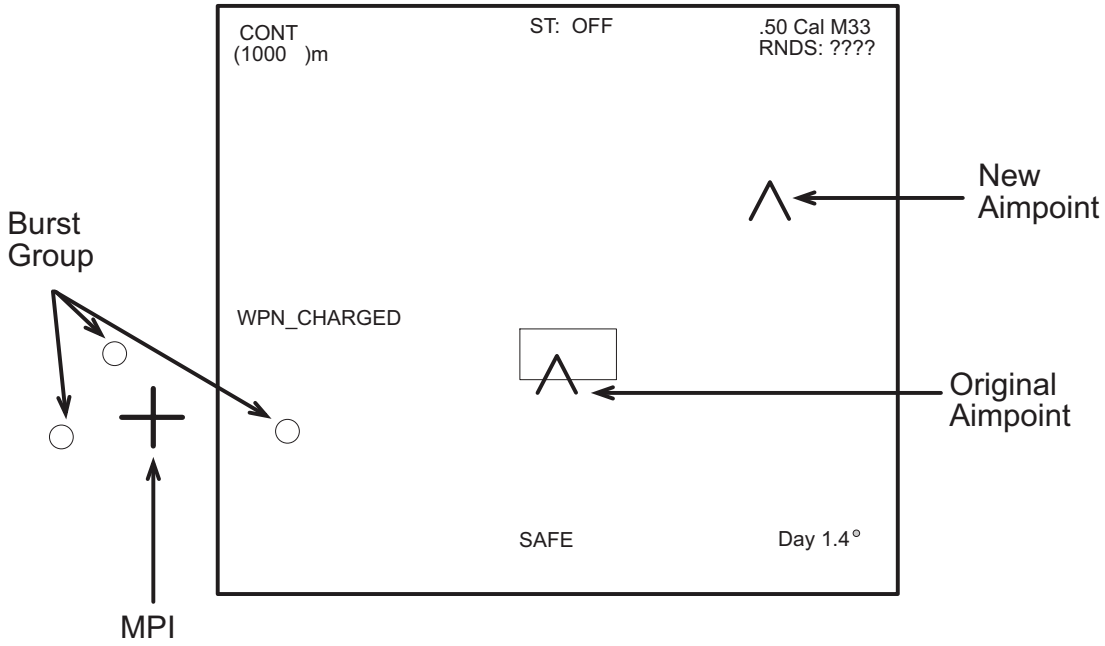


Figure 4. MPI Calculation with Alternate Zeroing Procedure Aimpoint and Burst-Group Location.

17. Press FUNCTION (RIGHT toggle DOWN) until the MENU mode is shown in the lower left of the Display Unit (DU) screen.

18. Ensure the cursor is on the P in the upper left of the screen.

19. Press ACCEPT (LEFT toggle RIGHT). This will take you to the Preparation menu.

20. Position the CURSOR to select the ZERO option.

21. Press ACCEPT (LEFT toggle RIGHT).

22. Position the CURSOR onto the proper weapon type and press ACCEPT (LEFT toggle RIGHT).

ZEROING PROCEDURE - Cont

Zeroing the System - Cont

23. Ensure the ballistic aimpoint is positioned on the original target.

NOTE

Do not use the Joystick and do not move the CROWS weapon with the MOTION CONTROL switch during the next step.

24. Press the DU CURSOR CONTROL switch in any direction to move the zeroing crosshair until it overlays the MPI, as shown in Figure 5.

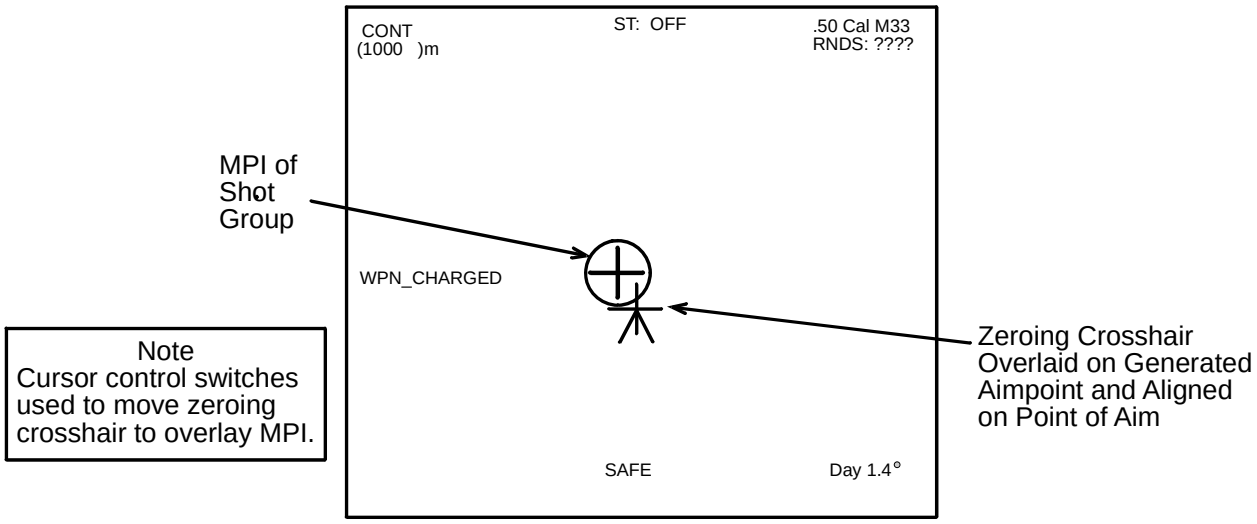


Figure 5. Zeroing Procedure.

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any switches.

25. Press DOWN on the DU ACCEPT switch to exit the Zeroing menu and save the zeroing offset. A blue horizontal status bar will be displayed while the system is saving the zeroing information. The system reverts to the Preparation menu.

26. Press LASE (LEFT toggle LEFT) to return to the Engagement screen.

27. Proceed to Confirmation of Zeroing section.

END OF TASK

Confirmation of Zeroing

Perform the following procedures to confirm the zero of the weapon:

WARNING

Live ammunition is used during the zeroing process. Follow all safety warnings and cautions. Failure to do may result in personal injury or equipment damage.

NOTE

Refer to WP 0018 for instructions on firing and loading the M2 HB .50-Cal Machine Gun; WP 0019 for instructions on firing and loading the Mk19 (40 mm) Automatic Grenade Machine Gun; WP 0020 for instructions on firing and loading the M240B (7.62 mm) Machine Gun; or WP 0021 for instructions on firing and loading the M249 (5.56 mm) Machine Gun.

1. Ensure the proper ammunition type is selected.
2. Load the weapon with 50 rounds of correct ammunition selected.
3. Select the same target used for zeroing with a readily identifiable point of aim located in the center of mass of the target.
4. Press LASE (LEFT toggle LEFT). Target distance appears in upper left of the screen and the aimpoint will move off target to indicate the ballistic solution.

NOTE

If auto accept has been enabled, proceed to step 6.

5. If auto accept is not enabled, press ACCEPT (LEFT toggle RIGHT).
6. Charge the weapon by pressing the CHARGER switch on the SPU to the CHARGE position.
7. Turn STAB ON by pressing the joystick STAB Switch RIGHT.
8. Press the SYSTEM ARM switch on the SPU to the ARMED position. Observe the result on the screen.

NOTE

If the ARMED status is not displayed on screen, refer to WP 0024, Troubleshooting Index; WP 0026, Preventive Maintenance Checks and Services (PMCS); or WP 0027, Before Operational Check, to identify and resolve the issue. If the problem is not resolved, send the CROWS system to the next higher level of maintenance.

9. If the ballistic aimpoint is not on the original target, use the CURSOR CONTROL switch to move the ballistics aimpoint on the original target.
10. Engage the target by firing three burst of 10 to 12 rounds at the target using the M2, M240B, or M249, or three bursts of 5 rounds using the Mk19. The rounds from each burst should form a group with an MPI scored on the targeted aimpoint.
11. Press the SYSTEM ARM switch on the SPU to the SAFE position.

ZEROING PROCEDURE - Cont

Confirmation of Zeroing - Cont

NOTE

If the SAFE status is not displayed on screen, refer to WP 0024, Troubleshooting Index; WP 0026, Preventive Maintenance Checks and Services (PMCS); or WP 0027, Before Operational Check, to identify and resolve the issue. If the problem is not resolved, send the CROWS system to the next higher level of maintenance.

12. Press the CHARGER switch on the SPU to the SAFE position.

NOTE

For proper procedures on clearing the weapon, refer to WP 0018, Loading and Firing the M2 HB .50-Cal Machine Gun; WP 0019, Loading and Firing the Mk19 (40 mm) Automatic Grenade Machine Gun; WP 0020, Loading and Firing the M240B (7.62 mm) Machine Gun; or WP 0021, Loading and Firing the M249 (5.56 mm) Machine Gun.

13. Unload and clear the weapon. Remove and secure any rounds that have been cleared.

14. Turn STAB OFF by pressing the joystick STAB Switch LEFT.

15. Ensure the ballistic aimpoint remains on screen to complete confirmation of the Zeroing Procedure.

16. Determine the MPI of the three bursts, and clearly mark the MPI on the target.

17. If the calculated MPI is on the original target aimpoint, Zeroing is confirmed complete.

18. If the calculated MPI is not on the original target aimpoint, repeat the zeroing procedure starting at step 17 of the Zeroing the System section, then reconfirm.

END OF TASK

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER USUAL CONDITIONS - LOADING AND FIRING THE M2 HB .50-CAL MACHINE GUN

THIS WORK PACKAGE COVERS:

The operation and procedures to load the ammunition can and weapon, fire the machine gun, and clear the weapon.

INITIAL SET UP:

Tools and Special Tools:

Operator's Tool Kit (WP 0036, Table 2, Item 1)

Boresight Alignment Kit (WP 0036, Table 2, Item 2)

.50-cal mandrel (M2)

Materials/Parts:

M2 HB .50-cal Automatic Machine Gun

M2 HB .50-cal Ammunition

Personnel Required:

Two

References:

WP 0004	WP 0015	WP 0026
WP 0005	WP 0016	WP 0027
WP 0006	WP 0017	WP 0035
WP 0007	WP 0023	WP 0036
WP 0008	WP 0024	

TM 9-1005-213-10

TM 9-1090-218-23&P

Equipment Conditions:

CROWS Set Up and Operational

Weapon installed

WP CONTENTS

Section/Subsection	Page
Preparing the System for Operation	2
Loading the Ammunition	2
Selecting the Ammunition	5
Charging the Weapon	9
Firing the Weapon	10
Cease-Firing the Weapon	11
Clearing the Weapon	11

NOTE

For additional information on the M2 weapon adapter kit (WAK) and related items, refer to WP 0007, M2 Installation or WP 0008, M2 Removal.

For additional information on the CROWS cables and connectors, refer to WP 0005, Interconnection (Connectors and Cables).

For additional information on CROWS controls and indicators, refer to WP 0004.

To ensure CROWS components/assemblies are ready for operation, refer to WP 0027, Before Operational Check.

Should any weapon malfunction occur, refer to WP 0023, Troubleshooting – Weapon Interface Malfunctions.

PREPARING THE SYSTEM FOR OPERATION

Inspect the system before loading the weapon to determine configuration and next-step procedures, as detailed in Table 1.

NOTE

For detailed procedures on preparing CROWS for operation, refer to WP 0026, Preventive Maintenance Checks and Services (PMCS), and WP 0027, Before Operational Check.

Table 1. Determination of M2 Status.

Inspect Component/Assembly	If Not, Next Step
Ensure the main POWER switch on the SPU is in ON position.	Move switch to ON position
Ensure the SYSTEM ARM switch on the SPU is in the SAFE position and that the safety cover is depressed.	Move switch to SAFE position. Depress safety cover.
Ensure the trigger switch on the control grip is not depressed.	Lift trigger guard and allow switch to move to neutral position.
Ensure the bolt latch release is depressed and locked in the depressed position with the buffer tube.	Depress the bolt latch release.
Ensure the ammo can is attached to the ammo hanger with the cover placed in the stow position and that the partition is in the correct position for the M2 ammunition.	Refer to WP 0007 and WP 0008 for detailed instructions on attaching the ammo can, placing the cover in the stow position, and partition placement.
Ensure (optional) ballistic protection is in place and properly secured.	Refer to TM 9-1090-218-23&P.

LOADING THE AMMUNITION

Perform the following procedures to load the ammunition.

WARNING

During these procedures live ammunition will be handled. Follow all safety warnings and cautions.

Ensure that the weapon is cleared, any cleared rounds are secured, and the weapon is in FIRE position before performing any procedures. Ensure that the M2 HB 50-cal ammunition is loaded in accordance with the technical manuals listed in WP 0035, References, as well as mission requirements (e.g., “half-load” or “full load”).

Under no circumstances should the safety be engaged with the bolt in the forward position.

Do not expose the eyes, directly or indirectly, to the rangefinder’s laser beam in the sensor unit.

Failure to follow these instructions may result in personal injury or damage to the equipment.

CAUTION

After completing the following procedures, linked ammunition is positioned in the weapon for loading, but a round is not in the chamber.

1. Ensure all preparatory steps have been completed, referring to Table 1 above.

2. Ensure the azimuth lock is in the locked position (referring to WP 0006, Azimuth Lock Assembly). The pedestal should not be able to move.

NOTE

Inserting the “single-loop” end of the ammunition belt into the container first allows the open slot to be placed into the weapon for proper operation.

3. Place the “single-loop” end of the ammunition belt into the ammo can, as shown in Figure 1. This procedure allows the double link to feed into the weapon properly.

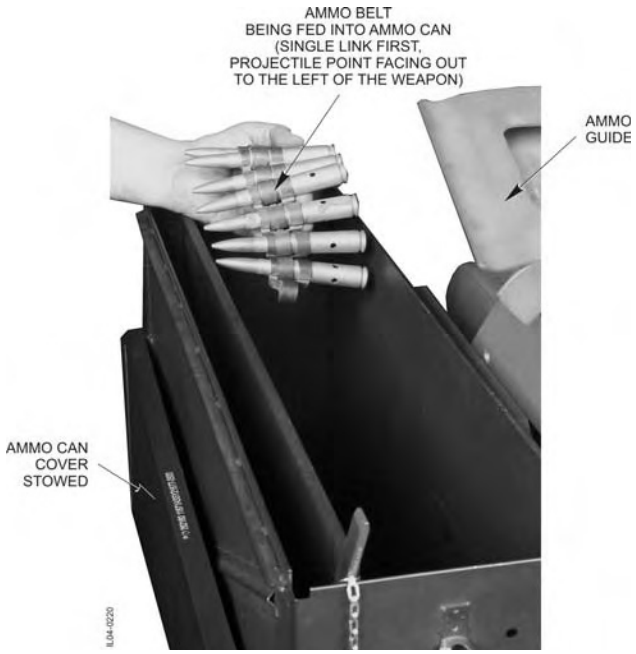


Figure 1. Ammo Can and Belt.

4. Carefully layer the ammo belt in the ammo can.

5. Open the top cover of the weapon and, grasping the linked ammunition belt, position it in the ammo guide. Insert the belt through the feed throat assembly and into the feed tray of the weapon, as shown in Figure 2.

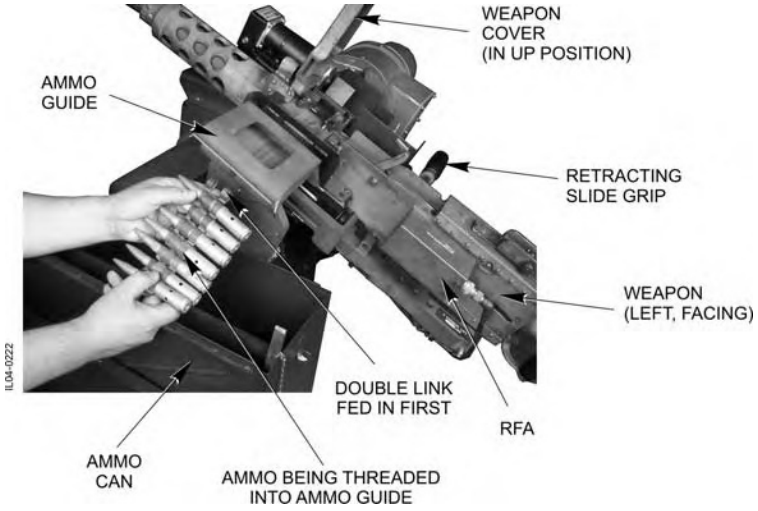


Figure 2. Loading Ammunition into the M2 HB Automatic Machine Gun.

LOADING THE AMMUNITION - Cont

6. Insert the double loop end of the belted ammunition into the feed way until the first cartridge is over and held by the belt-holding pawls, as shown in Figure 3.

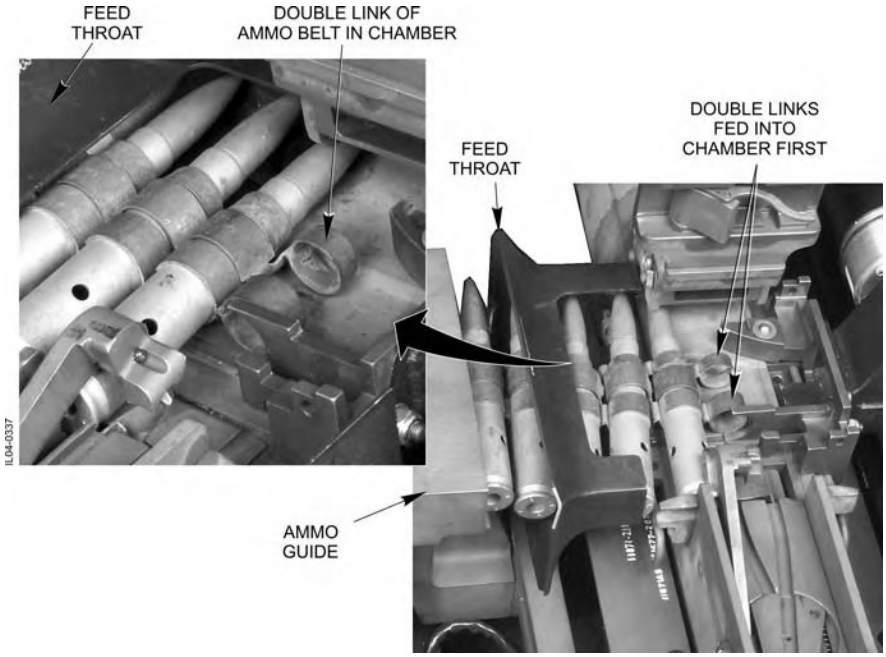


Figure 3. Feeding the Ammo Belt through the Ammo Guide and Into Weapon.

7. Hold the ammunition belt in place, then close and latch the weapon cover, referring to Figure 4.

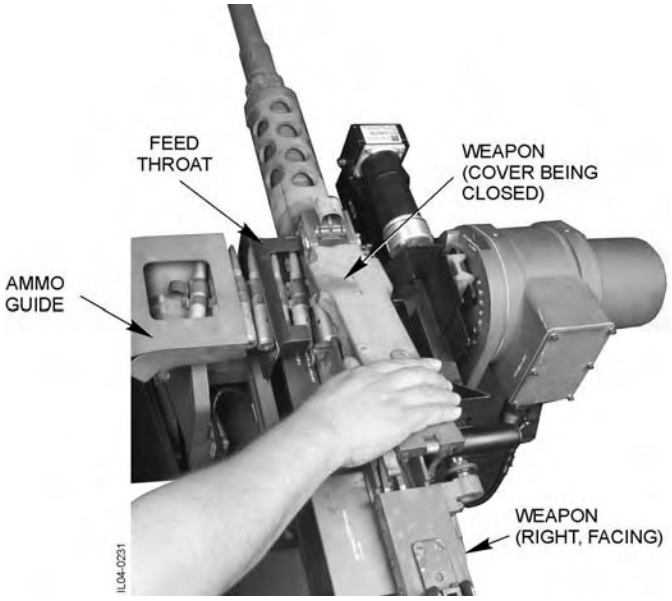


Figure 4. Weapon Cover Closed after Ammo Loaded.

END OF TASK

SELECTING THE AMMUNITION

Perform the following procedure to select the ammunition type/category for the M2.

NOTE

For detailed procedures and information on the CROWS menu system, refer to WP 0015.

1. Verify all systems have passed the Built-In Test (BIT), then press ACCEPT (LEFT toggle RIGHT). The main Engagement screen will be displayed as shown in Figure 5.

NOTE

The functional menu appears in the lower left corner of the screen.

The laser aimpoint is represented by the symbol, ⊥.

The ballistic aimpoint is represented by the symbol, ^.

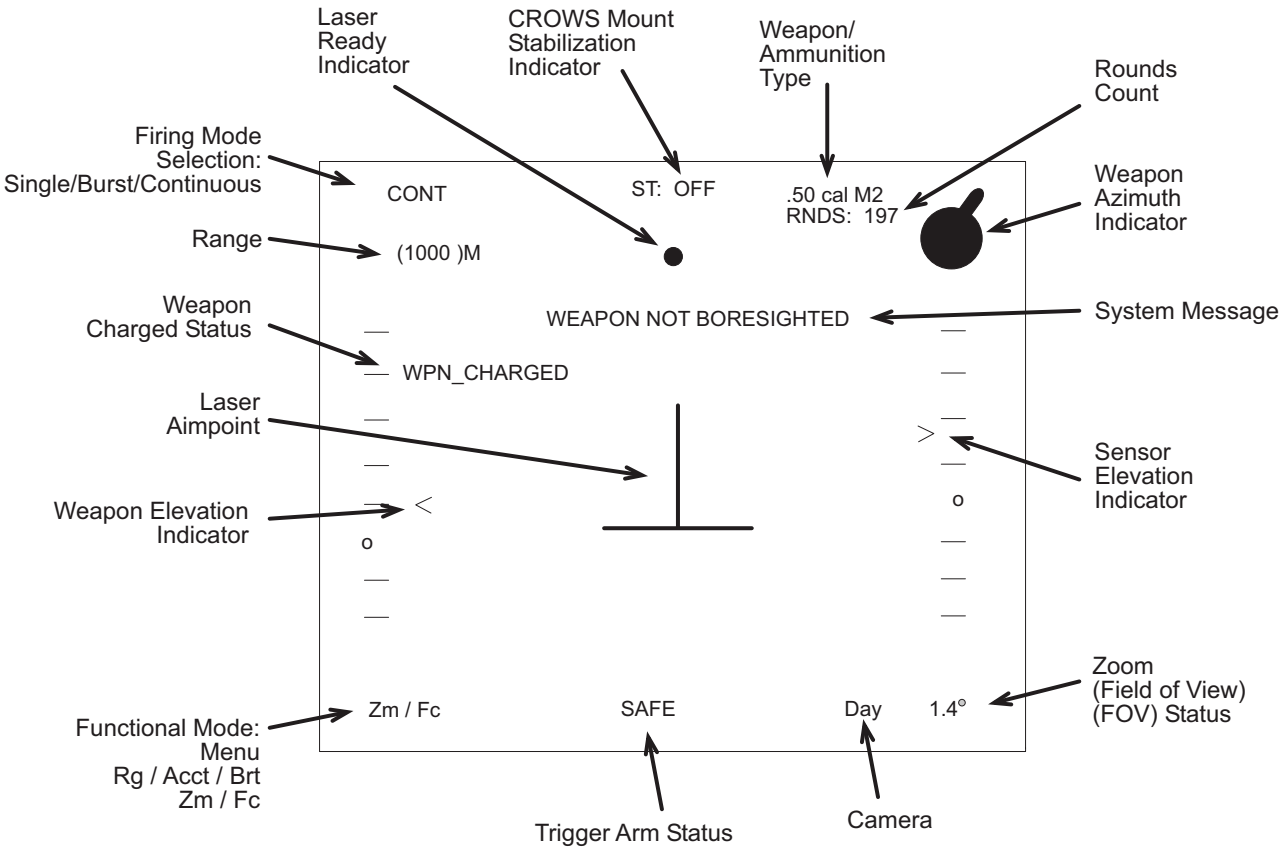


Figure 5. Example of M2 Engagement Mode Screen.

SELECTING THE AMMUNITION - Cont

2. From the Engagement screen (Figure 5), press FUNCTION (RIGHT toggle DOWN) to select the MENU mode, lower left corner of the screen, as shown in Figure 6.

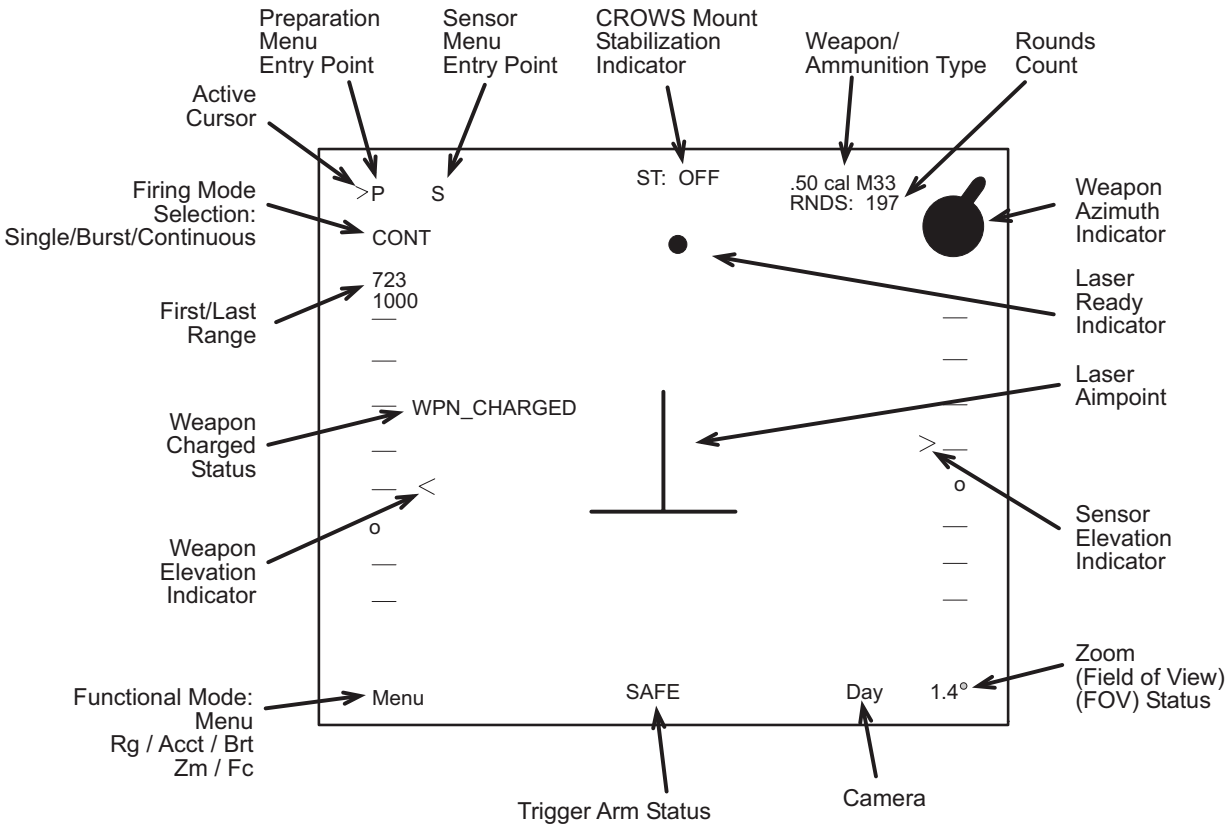


Figure 6. Example of M2 Engagement Screen Showing FUNCTION, Preparation Menu, and Other Options.

3. Ensure the cursor is at the Preparation menu entry point designated by a P, upper left of the screen.

4. Position CURSOR onto the Firing Mode Selection section of the screen, referring to Figure 6.

5. Press ACCEPT (LEFT toggle RIGHT).

6. Press RIGHT toggle RIGHT to scroll to the desired mode of firing (Single/Burst/Cont).

7. Press ACCEPT (LEFT toggle RIGHT).

8. Position the CURSOR onto the RNDS: section of screen (ROUNDS COUNT).

9. Press ACCEPT (LEFT toggle RIGHT).

10. Insert number of rounds loaded (LEFT toggle UP/DOWN=increase/decrease digit ; RIGHT toggle LEFT/RIGHT=move to previous/next digit;).

11. Press ACCEPT (LEFT toggle RIGHT).

12. Position the CURSOR back onto the Preparation menu entry point designated by a P, in the upper left of the screen.

13. Press ACCEPT (LEFT toggle RIGHT). The Preparation Menu appears, as shown in Figure 7.

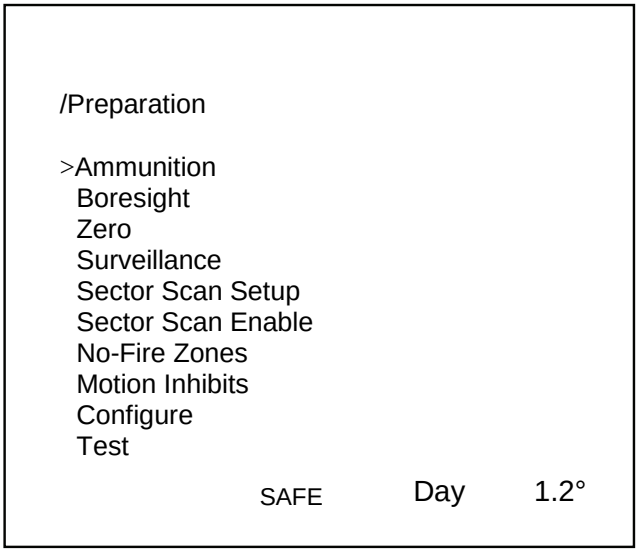


Figure 7. Preparation Menu with Ammunition Option Selected.

14. Ensure the CURSOR is positioned on the AMMUNITION option.

15. Press ACCEPT (LEFT toggle RIGHT). The Ammunition Weapon menu appears.

NOTE

The list that appears when the ACCEPT switch is pressed represents only those weapons and ammunitions with ballistic data currently contained in the system.

The underlined entry shows which weapon cable is connected.

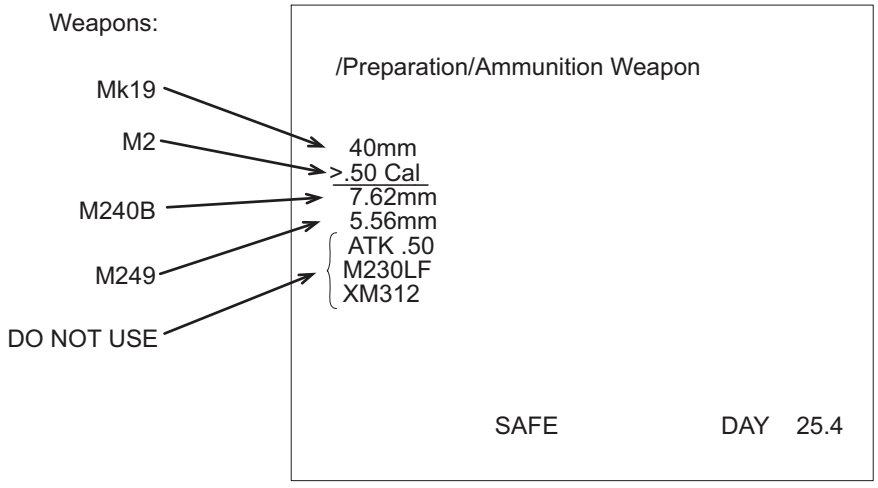


Figure 8. Ammunition Weapon Menu Selecting .50 Cal (M2 Machine Gun).

16. Position the CURSOR onto the desired ammunition. See Figure 8.

SELECTING THE AMMUNITION - Cont

17. Press ACCEPT (LEFT toggle RIGHT). The list of available ammunition for .50-cal weapon appears, as shown in Figure 9.

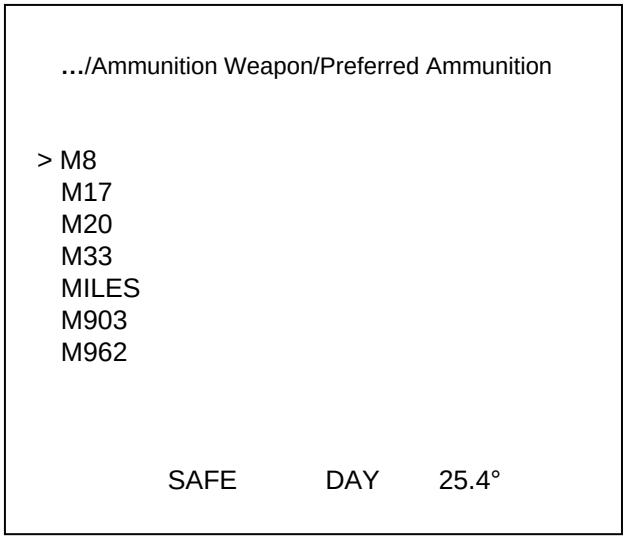


Figure 9. Available Ammunition for .50-Cal Weapon (M2 Machine Gun).

18. Position the CURSOR onto the desired ammunition type.

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, **do not turn power OFF** and **do not touch** any of the switches.

19. Press ACCEPT (LEFT toggle RIGHT). Once the ammunition type is selected an asterisk (*) will be displayed next to the ammunition type, and the words “LOADING BALLISTICS” will appear momentarily in the center section of the screen.

20. Press LASE (LEFT toggle LEFT) to return to the Engagement screen. See Figure 5.

21. Verify the ammunition selected appears in the top right of the screen.

END OF TASK

CHARGING THE WEAPON

WARNING

Do not chamber a round until instructed to do so. After completing the following procedure, the M2 HB will be live and ready to fire.

Ensure input voltage is at the correct level. An overvoltage condition when power is applied may make the mount move and spin rapidly, which could result in personal injury and equipment malfunction or damage. Do not stand within muzzle length of the system when applying power.

Once power is applied, the system is fully functional and the mount and/or cradle with weapon could move. Ensure that the weapon mount is cleared and any cleared rounds are secured. Ensure that all personnel are clear of any possible weapon movements. Do not stand under the barrel.

Follow all safety warnings and cautions. Failure to do so may result in personal injury and equipment damage.

NOTE

Refer to TM 9-1005-213-10, Operator's Manual for Machine Guns, Caliber .50; M2 Heavy Barrel, for specific instructions.

1. Ensure the azimuth lock is in the unlocked position (referring to WP 0006, Azimuth Lock Assembly). The pedestal should be able to move freely.

2. Orient the weapon to a safe position.

3. Ensure SYSTEM ARM switch is in SAFE position. After moving the switch, observe that SAFE is displayed on the screen. If the correct status is not present, refer to WP 0024, Troubleshooting Index; WP 0026, Preventive Maintenance Checks and Services (PMCS); or WP 0027, Before Operational Check, to identify and resolve the issue. If the problem is not resolved, send the CROWS system to the next higher level of maintenance.

WARNING

If ammunition is not properly placed in the weapon feed way, a round could be prematurely chambered during the first charging sequence.

Electronic “SAFEing” does not prohibit manual firing. Manual weapon controls are still functional.

A round will be chambered after completion of the following charging sequence.

4. Position the CHARGER switch on the SPU to the CHARGE position to index the bolt through the charging sequence.

WARNING

Use extreme care to not depress the TRIGGER switch until commanded to do so at this point in the procedure. Depending on how the ammunition is loaded into the .50-cal feed tray, the M2 weapon will fire a round if the TRIGGER switch is depressed at this time. Failure to follow this instruction may result in personal injury or damage to the equipment.

5. Lift the SYSTEM ARM switch guard on the SPU and set the switch to the ARMED position. After moving the switch, observe that ARMED is displayed on the screen. If the correct status is not present, refer to WP 0024, Troubleshooting Index; WP 0026, Preventive Maintenance Checks and Services (PMCS); or WP 0027, Before Operational Check, to identify and resolve the issue. If the problem is not resolved, send the CROWS system to the next higher level of maintenance.

CHARGING THE WEAPON - Cont

6. On the joystick, raise the trigger guard for access to the trigger switch.

7. Depress the TRIGGER switch to allow the bolt to be released and returned to the forward position.

8. Remove finger from the trigger, allowing the guard to return to the non-fire position.

WARNING

A round will be chambered after the following step.

9. On the SPU, set the CHARGER switch to the CHARGED position. A round is now chambered, and the weapon is ready to fire.

10. Put the SYSTEM ARMED switch to the SAFE position until ready to fire. After moving the switch, observe that SAFE is displayed on the screen. If the correct status is not present, refer to WP 0024, Troubleshooting Index; WP 0026, Preventive Maintenance Checks and Services (PMCS); or WP 0027, Before Operational Check, to identify and resolve the issue. If the problem is not resolved, send the CROWS system to the next higher level of maintenance.

END OF TASK

FIRING THE WEAPON

Perform the following procedures to fire the weapon:

WARNING

After completing the following procedures, the trigger switch will be armed and the weapon ready to fire.

Follow all safety warnings and cautions. Failure to do so may result in personal injury or equipment damage.

NOTE

Before beginning the firing procedure, ensure that boresighting and zeroing procedures (refer to WP 0016 and WP 0017) have been performed on the weapon. Should the weapon or weapon barrel be changed, boresighting and zeroing must be completed before firing.

1. On the SPU, lift the SYSTEM ARM switch guard and move the SYSTEM ARM switch to the ARMED position. After moving the switch to the ARMED position, observe that ARMED is displayed on the screen. If the correct status is not present, refer to WP 0024, Troubleshooting Index; WP 0026, Preventive Maintenance Checks and Services (PMCS); or WP 0027, Before Operational Check, to identify and resolve the issue. If the problem is not resolved, send the CROWS system to the next higher level of maintenance.

2. On the joystick, raise the trigger guard for access to the trigger switch.

3. Depress (squeeze) the trigger switch to fire the weapon.

END OF TASK

CEASE-FIRING THE WEAPON

Perform the following procedures to cease firing the weapon:

WARNING

After completing the following procedure, the trigger switch on the control grip will be disarmed, but the weapon could have a round in the chamber.

When the weapon mount is cleared, secure any cleared rounds.

Follow all safety warnings and cautions. Failure to do so may result in personal injury or equipment damage.

1. On the joystick, release the trigger switch.
2. Allow the trigger guard to fall back in place, preventing depression of the trigger switch.
3. On the SPU, move the SYSTEM ARM switch to the SAFE position. After moving the switch to the SAFE position, observe that SAFE is displayed on the screen. If the correct status is not present, refer to WP 0024, Troubleshooting Index; WP 0026, Preventive Maintenance Checks and Services (PMCS); or WP 0027, Before Operational Check, to identify and resolve the issue. If the problem is not resolved, send the CROWS system to the next higher level of maintenance.

END OF TASK

CLEARING THE WEAPON

Perform the following procedures to clear the weapon.

WARNING

During the following procedure, the trigger switch on the control grip will be disarmed, but the weapon will have a round in the chamber.

Electronic “SAFEing” does not prohibit manual firing. Manual weapon controls are still functional.

Follow all safety warnings and cautions. Failure to do so may result in personal injury or equipment damage.

1. Ensure the azimuth lock is in the locked position (referring to WP 0006, Azimuth Lock Assembly). The pedestal should not be able to move.
2. On the SPU, position the CHARGER switch to the CHARGED position, indexing the bolt through the charging sequence.

NOTE

For information on the weapon and clearing instructions, refer to TM 9-1005-213-10, Operator's Manual for Machine Guns, Caliber .50; M2 Heavy Barrel.

3. Open the top cover of the weapon and visually inspect the chamber. Remove all spent ammunition cases and links and clear the weapon IAW TM 9-1005-213-10.
4. Ensure the weapon is cleared, then close and latch the weapon cover.
5. Remove and secure any rounds that have been cleared.

END OF TASK

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER USUAL CONDITIONS - LOADING AND FIRING THE MK19 40 MM GRENADE MACHINE GUN

THIS WORK PACKAGE COVERS:

The operation and procedures to load the ammunition can and weapon, fire the machine gun, and clear the weapon.

INITIAL SET UP:

Tools and Special Tools

Operator's Tool Kit (WP 0036, Table 2, Item 1)

Boresight Alignment Kit (WP 0036, Table 2, Item 2)

.40 mm mandrel (Mk19)

Personnel Required

Two

Equipment Conditions

CROWS Set Up and Operational

Weapon installed

Materials/Parts

Mk19 Automatic Grenade Machine Gun

Mk19 Ammunition

References

WP 0004	WP 0010	WP 0023
WP 0005	WP 0015	WP 0024
WP 0006	WP 0016	WP 0026
WP 0009	WP 0017	WP 0027
TM 9-1010-230-10		WP 0035
TM 9-1090-218-23&P		WP 0036

WP CONTENTS

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Preparing System for Operation 2
Loading the Ammunition 2
Selecting the Ammunition 5
Charging the Weapon 10
Firing the Weapon 11
Cease-Firing the Weapon 11
Clearing the Weapon 12

NOTE

For additional information on the Mk19 weapon adapter kit (WAK) and related items, refer to WP 0009, Mk19 Installation or WP 0010, Mk19 Removal.

For additional information on the CROWS cables and connectors, refer to WP 0005, Interconnection (Connectors and Cables).

For additional information on CROWS controls and indicators, refer to WP 0004.

To ensure CROWS components/assemblies are ready for operation, refer to WP 0027, Before Operational Check.

Should any weapon malfunction occur, refer to WP 0023, Troubleshooting – Weapon Interface Malfunctions.

PREPARING SYSTEM FOR OPERATION

Inspect the system before loading the weapon to determine configuration and next-step procedures, as detailed in Table 1.

NOTE

For detailed procedures on preparing CROWS for operation, refer to WP 0026, Preventive Maintenance Checks and Services (PMCS), and WP 0027, Before Operational Check.

Table 1. Determination of Mk19 Status.

Inspect Component/Assembly	If Not, Next Step
Ensure the main POWER switch on the SPU is in ON position.	Move switch to ON position
Ensure the SYSTEM SAFE switch on the SPU is in the SAFE position and that the safety cover is depressed.	Move switch to SAFE position. Depress safety cover.
Ensure the trigger switch on the control grip is not depressed.	Lift finger and allow switch to move to neutral position.
Ensure the bolt latch release is depressed and locked in the depressed position with the buffer tube.	Depress the bolt latch release.
Ensure the ammo can is attached to the ammo hanger with the cover placed in the stow position and that the partition is in the correct position for the Mk19 ammunition.	Refer to WP 0009 and WP 0010 for detailed instructions on attaching the ammo can, placing the cover in the stow position, and partition placement.
Ensure (optional) ballistic armor is in place and properly secured.	Refer to TM 9-1090-218-23&P.

LOADING THE AMMUNITION

Perform the following procedures to load the ammunition.

WARNING

During these procedures, live ammunition will be handled. Follow all safety warnings and cautions.

Ensure that the weapon is cleared, any cleared rounds are secured, and the weapon is in FIRE position before performing any procedures. Ensure that the Mk19 40 mm ammunition is loaded in accordance with the technical manuals listed in WP 0035, References, as well as mission requirements (e.g., “half-load” or “full load”).

Under no circumstances should the safety be engaged with the bolt in the forward position.

Do not expose the eyes, directly or indirectly, to the rangefinder’s laser beam in the sensor unit.

Failure to follow these instructions may result in personal injury or equipment damage.

CAUTION

After completing the following procedures, linked ammunition is positioned in the weapon for loading, but a round is not in the chamber.

NOTE

Insert the cartridge end of the ammo belt into the feed throat first, with the projectile end placed into the ammo can first, allowing the correct link to be placed into the weapon for proper operation.

1. Ensure all preparatory steps have been completed as listed in Table 1 of this work package.

2. Ensure the azimuth lock is in the locked position (referring to WP 0006, Azimuth Lock Assembly). The pedestal should not be able to move.

3. Place the projectile end of the ammunition belt into the ammo can first, as shown in Figure 1.

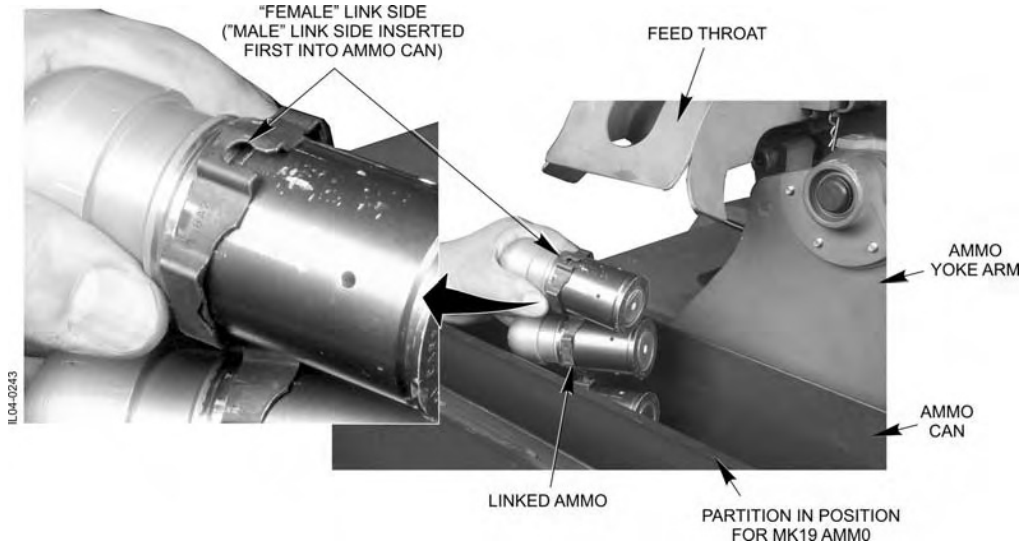


Figure 1. Ammo Can and Belt.

4. Carefully layer the ammo belt in the ammo can with the cartridge link out of the can first, as shown in Figure 2.

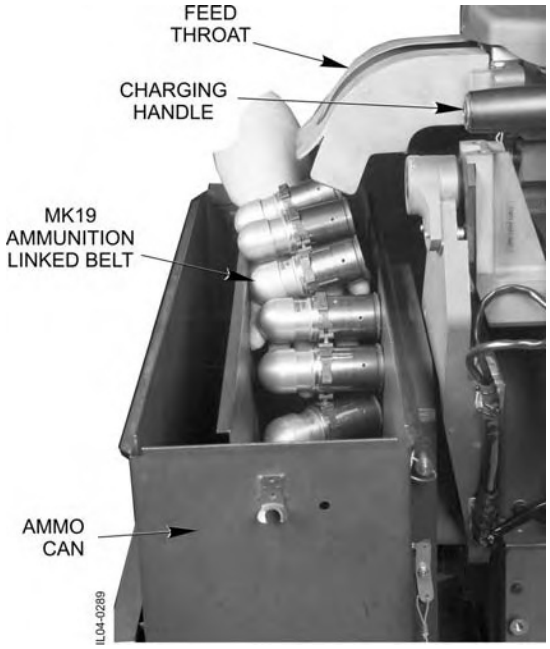


Figure 2. Linked Ammo Being Layered from Bottom to Top in Ammo Can.

LOADING THE AMMUNITION - Cont

5. Open the top cover of the weapon and, grasping the linked ammunition belt, insert it into the feed throat assembly and into the feed tray of the weapon, as shown in Figure 3.

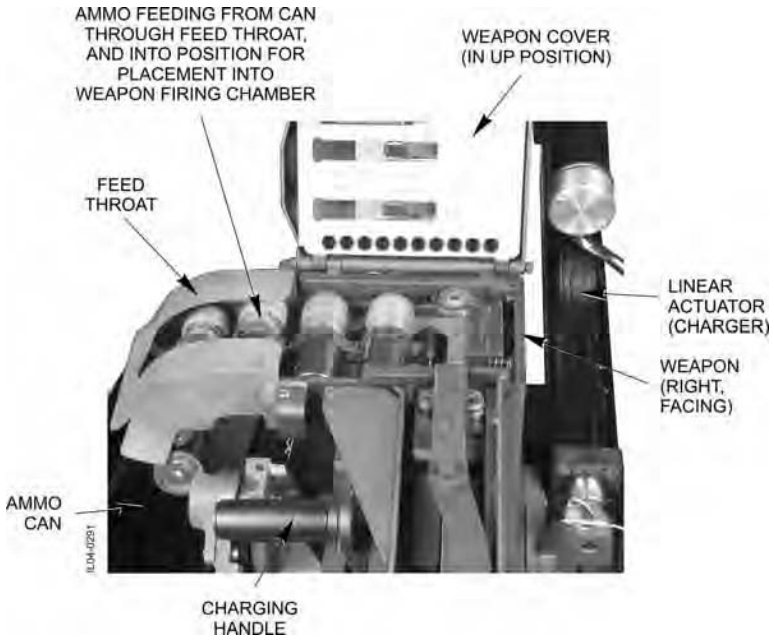


Figure 3. Ammo Being Loaded via Feed Throat into Weapon.

6. Once the ammunition has been threaded through the ammo guide and into the weapon, index the secondary drive lever to the right (facing), as shown in Figure 4.

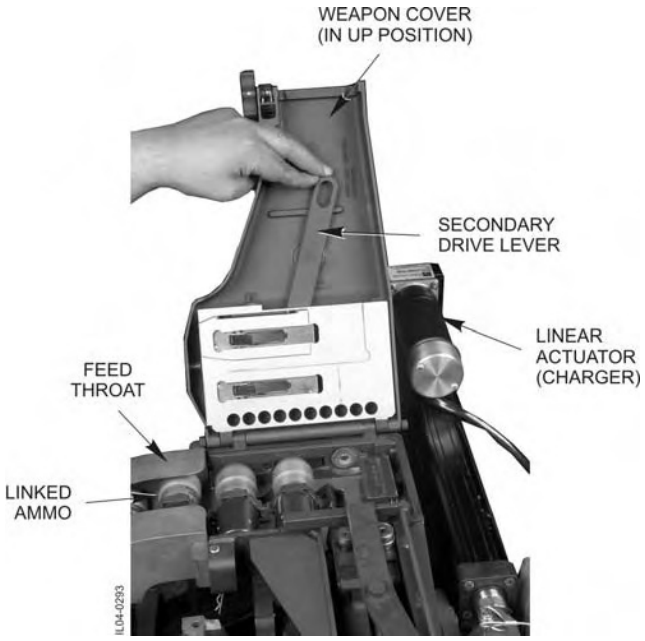


Figure 4. Ammo Loaded and Secondary Drive Lever Positioned.

7. Hold the ammunition belt in place, then close and latch the top cover. The weapon is loaded.

END OF TASK

SELECTING THE AMMUNITION

Perform the following procedure to select the ammunition type/category for the Mk19.

NOTE

For detailed procedures and information on the CROWS menu system, refer to WP 0015.

1. Verify all systems have passed the Built-In Test (BIT), then press ACCEPT (LEFT toggle RIGHT). The main Engagement screen will be displayed as shown in Figure 5.

NOTE

The functional menu appears in the lower left corner of the screen.

The laser aimpoint is represented by the symbol, ⊥.

The ballistic aimpoint is represented by the symbol, ^.

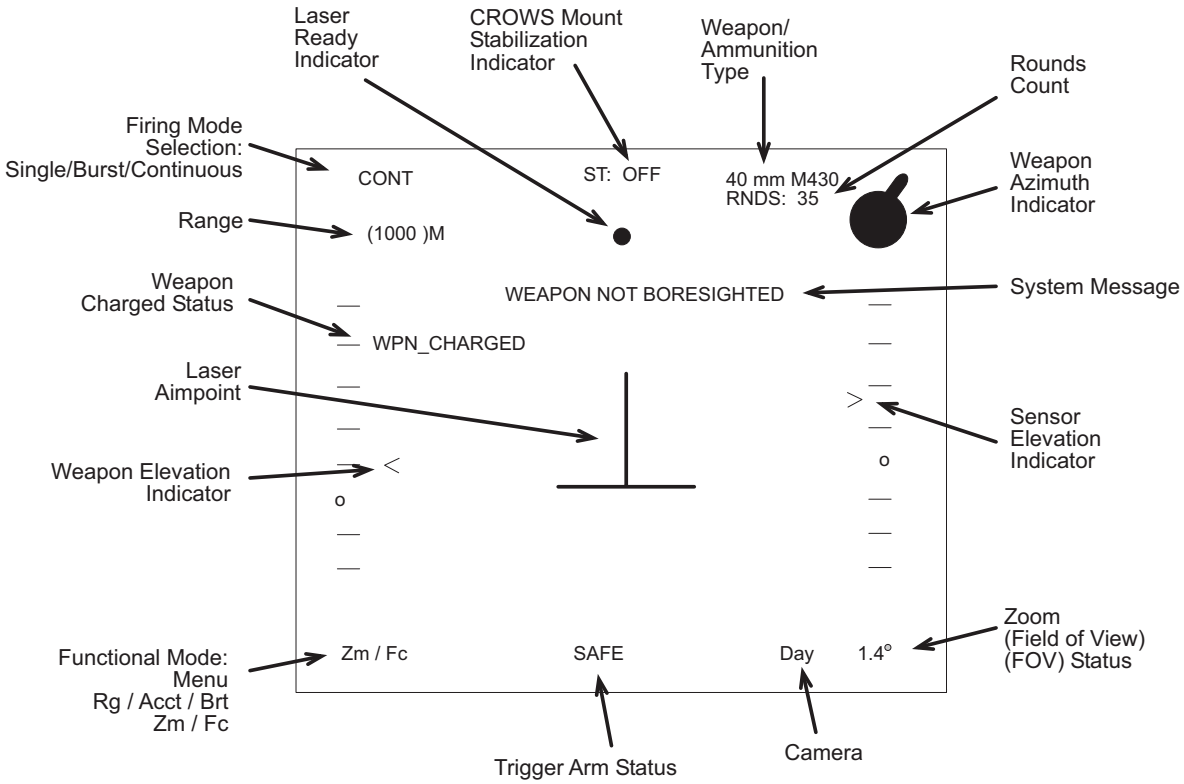


Figure 5. Example of Mk19 Engagement Mode Screen.

SELECTING THE AMMUNITION - Cont

2. From the Engagement screen (Figure 5), press FUNCTION (RIGHT toggle DOWN) to select the MENU state, lower left corner of the screen, as shown in Figure 6.

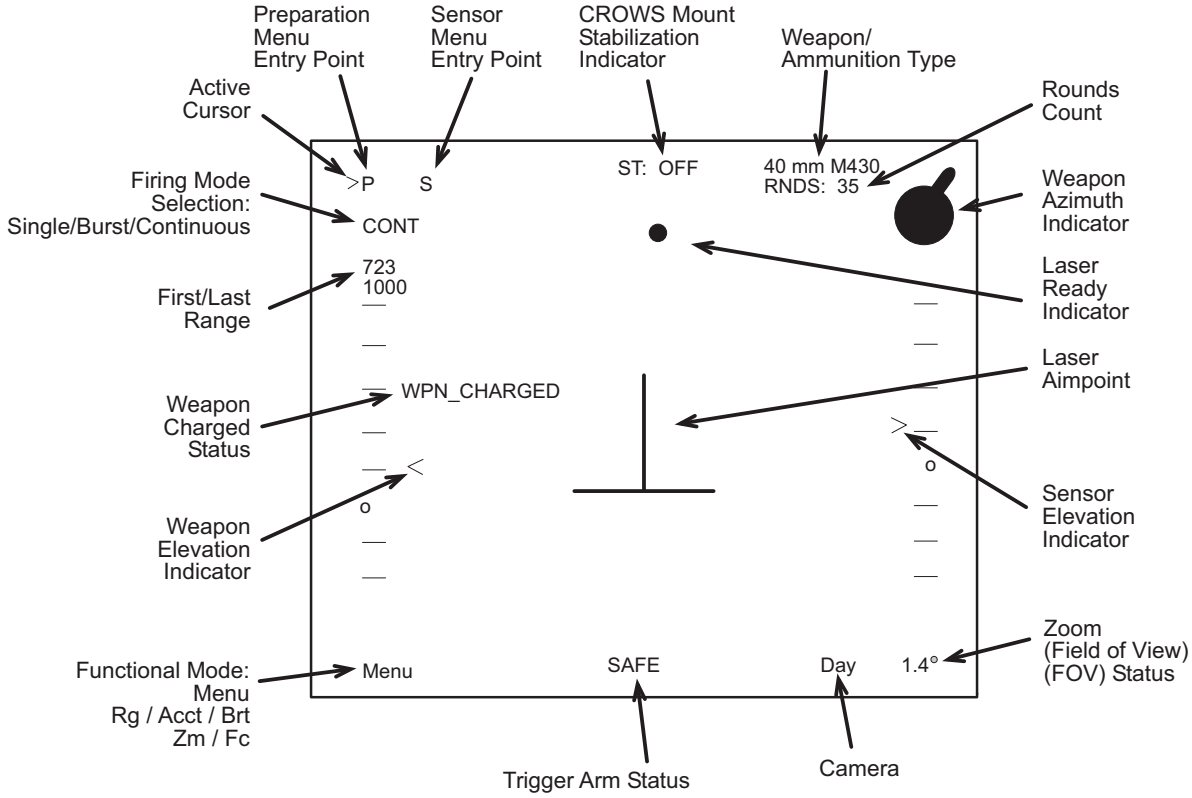


Figure 6. Example of Mk19 Engagement Screen Showing FUNCTION, Preparation Menu, and Other Options.

3. Ensure the cursor is at the Preparation menu entry point designated by a P, upper left of the screen.
4. Position the CURSOR onto the Firing Mode Selection section of the screen. See Figure 6.
5. Press ACCEPT (LEFT toggle RIGHT).
6. Press RIGHT toggle RIGHT to scroll to the desired mode of firing (Single/Burst/Cont).
7. Press ACCEPT (LEFT toggle RIGHT).
8. Position the CURSOR onto the RNDS: section of screen (ROUNDS COUNT).
9. Press ACCEPT (LEFT toggle RIGHT).
10. Insert number of rounds loaded (LEFT toggle UP/DOWN = increase/decrease digit; RIGHT toggle LEFT/RIGHT = move to previous/next digit.
11. Press ACCEPT (LEFT toggle RIGHT).

12. Position the CURSOR back to the Preparation menu entry point designated by a P, in the upper left of the screen.

13. Press ACCEPT (LEFT toggle RIGHT). The Preparation Menu appears, as shown in Figure 7.

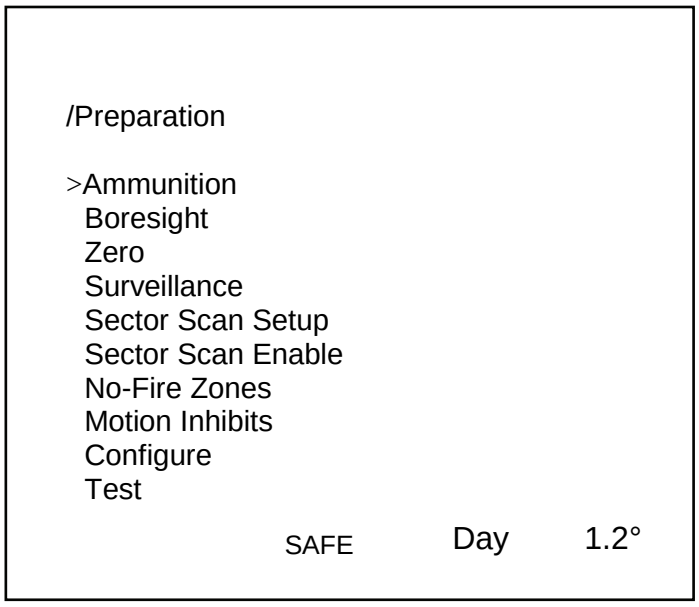


Figure 7. Preparation Menu with Ammunition Option Selected.

14. Ensure the CURSOR is positioned on the AMMUNITION option.

SELECTING THE AMMUNITION - Cont

15. Press ACCEPT (LEFT toggle RIGHT). The Ammunition Weapon menu appears.

NOTE

The list that appears when the ACCEPT switch is pressed represents only those weapons and ammunitions with ballistic data currently contained in the system.

The underlined entry shows which weapon cable is connected.

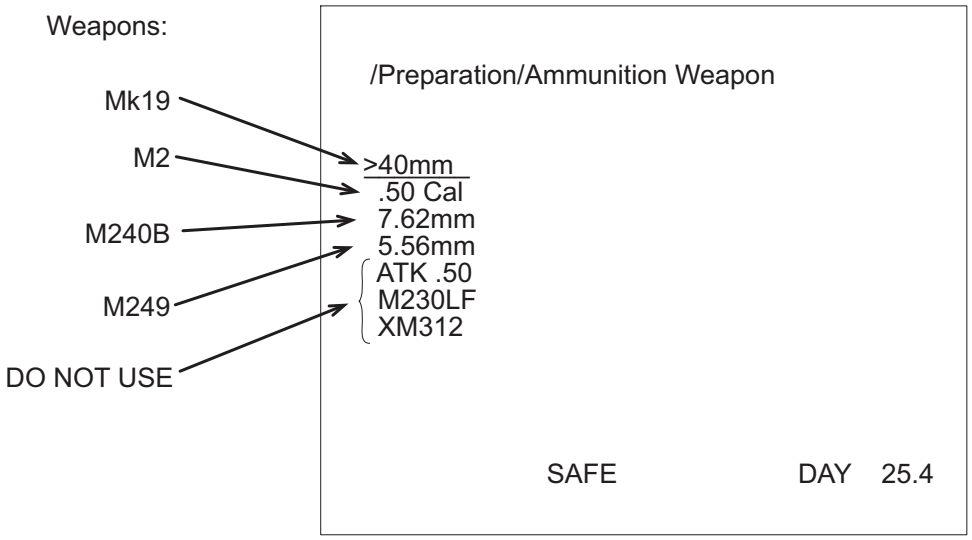


Figure 8. Ammunition Weapon Menu Selecting 40 mm (Mk19 Grenade Machine Gun)..

16. Position the CURSOR onto the desired ammunition. See Figure 8.

17. Press ACCEPT (LEFT toggle RIGHT). The list of available ammunition for a particular weapon appears, as shown in Figure 9.

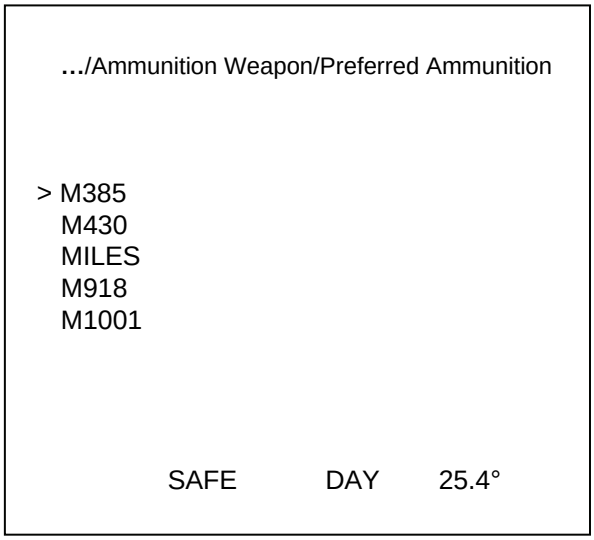


Figure 9. Available Ammunition for 40 mm Weapon.

18. Position the CURSOR onto the desired ammunition type.

CAUTION

When saving information into memory, a blue, horizontal status bar appears on the screen. While this status bar is displayed, do not turn power OFF and do not touch any of the switches.

19. Press ACCEPT (LEFT toggle RIGHT). Once the ammunition is selected, an asterisk (*) will be displayed next to the ammunition type and the words “LOADING BALLISTICS” will appear momentarily in the center section of the screen.

20. Press LASE (LEFT toggle LEFT) toeturn to the Engagement screen. See to Figure 5.

21. Verify the ammunition selected appears in the top right of the screen (WEAPON/AMMUNITION TYPE).

END OF TASK

CHARGING THE WEAPON

WARNING

Do not chamber a round until instructed to do so. After completing the following procedure, the Mk19 will be live and ready to fire.

Ensure input voltage is at the correct level. An overvoltage condition when power is applied may make the mount move and spin rapidly, which could result in personal injury and equipment malfunction or damage. Do not stand within muzzle length of the system when applying power.

Once power is applied, the system is fully functional and the mount and/or cradle with weapon could move. Ensure that the weapon mount is cleared and any cleared rounds are secured. Ensure that all personnel are clear of any possible weapon movements. Do not stand under the barrel.

Follow all safety warnings and cautions. Failure to do so may result in personal injury and equipment damage.

NOTE

Refer to TM 9-1010-230-10, Operator's Manual for Machine Gun, 40 mm, Mk19 Grenade.

1. Ensure the azimuth lock is in the unlocked position (referring to WP 0006, Azimuth Lock Assembly). The pedestal should be able to move freely.

2. Orient the weapon to a safe position and place the mechanical safe/fire switch to the FIRE position.

3. Ensure SYSTEM ARM switch is in SAFE position. After moving the switch, observe the result on the screen. If the correct status is not present, refer to WP 0024, Troubleshooting Index; WP 0026, Preventive Maintenance Checks and Services (PMCS); or WP 0027, Before Operational Check, to identify and resolve the issue. If the problem is not resolved, send the CROWS system to the next higher level of maintenance.

WARNING

If ammunition is not properly placed in the weapon feed way, a round could be prematurely chambered during first charging sequence.

4. On the SPU, position the CHARGER switch to the CHARGE position to index the bolt through the seared position. (The bolt will be seared to the rear without a live cartridge on the bolt face.)

5. Lift the SYSTEM ARM switch guard on the SPU and set the switch to the ARMED position. After moving the switch, observe the result on the screen. If the correct status is not present, refer to WP 0024, Troubleshooting Index; WP 0026, Preventive Maintenance Checks and Services (PMCS); or WP 0027, Before Operational Check, to identify and resolve the issue. If the problem is not resolved, send the CROWS system to the next higher level of maintenance.

6. On the joystick, raise the trigger guard for access to the trigger switch.

7. Depress the trigger switch allowing the bolt to be released and returned to the forward position.

WARNING

A round will be chambered after completion of the following charging sequence.

Electronic "SAFEing" does not prohibit manual firing. Manual weapon controls are still functional.

8. Position the CHARGER switch on the SPU to the CHARGE position. A round is now chambered, and the weapon is ready to fire.

9. Remove finger from trigger, allowing the trigger guard to fall back into position.

10. Put the SYSTEM ARMED switch to the SAFE position until ready to fire. After moving the switch, observe the result on the screen. If the correct status is not present, refer to WP 0024, Troubleshooting Index; WP 0026, Preventive Maintenance Checks and Services (PMCS); or WP 0027, Before Operational Check, to identify and resolve the issue. If the problem is not resolved, send the CROWS system to the next higher level of maintenance.

END OF TASK

FIRING THE WEAPON

Perform the following procedures to fire the weapon:

WARNING

After completing the following procedures, the trigger switch will be armed and the weapon ready to fire.

Follow all safety warnings and cautions. Failure to do so may result in personal injury or equipment damage.

NOTE

Before beginning the firing procedure, ensure that boresighting and zeroing procedures (refer to WP 0016 and WP 0017) have been performed on the weapon. Should the weapon or weapon barrel be changed, boresighting and zeroing must be completed before firing.

1. On the SPU, lift the SYSTEM ARM switch guard and set the SYSTEM ARM switch to the ARMED position. After moving the switch to the ARMED position, observe the result on the screen. If the correct status is not present, refer to WP 0024, Troubleshooting Index; WP 0026, Preventive Maintenance Checks and Services (PMCS); or WP 0027, Before Operational Check, to identify and resolve the issue. If the problem is not resolved, send the CROWS system to the next higher level of maintenance.

2. On the joystick, raise the trigger guard for access to the trigger switch.

3. Depress (squeeze) the trigger switch to fire the weapon.

END OF TASK

CEASE-FIRING THE WEAPON

Perform the following procedures to cease firing the weapon:

WARNING

After completing the following procedure, the trigger switch will be disarmed, but the weapon will have a round on the bolt face.

Electronic “SAFEing” does not prohibit manual firing. Manual weapon controls are still functional.

Follow all safety warnings and cautions. Failure to do so may result in personal injury or equipment damage.

1. On the joystick, release the trigger switch.

CEASE-FIRING THE WEAPON - Cont

2. Allow the trigger guard to fall back in place, preventing depression of the trigger switch.

3. On the SPU, set the SYSTEM ARM switch to the SAFE position. After moving the switch to the SAFE position, observe the result on the screen. If the correct status is not present, refer to WP 0024, Troubleshooting Index; WP 0026, Preventive Maintenance Checks and Services (PMCS); or WP 0027, Before Operational Check, to identify and resolve the issue. If the problem is not resolved, send the CROWS system to the next higher level of maintenance.

END OF TASK

CLEARING THE WEAPON

Perform the following procedures to clear the weapon.

WARNING

During the following procedure, the trigger switch on the control grip will be disarmed, but the weapon could have a round in the chamber.

Electronic “SAFEing” does not prohibit manual firing. Manual weapon controls are still functional.

When the weapon mount is cleared, secure any cleared rounds.

Follow all safety warnings and cautions. Failure to do so may result in personal injury or equipment damage.

1. Ensure the azimuth lock is in the locked position (referring to WP 0006, Azimuth Lock Assembly). The pedestal should not be able to move.

2. On the SPU, position the CHARGER switch to the SAFE position, indexing the bolt to the rearward position in the weapon.

NOTE

For information on the weapon and clearing instructions, refer to TM 9-1010-230-10, Operator’s Manual for Machine Gun, 40 mm, Mk19 Grenade.

3. Place mechanical safe/fire switch in the SAFE position.

4. Open the top cover of the weapon and visually inspect the chamber. Remove all ammunition spent cases and links and clear the weapon IAW TM 9-1010-230-10.

5. Ensure the weapon is cleared, then close and latch the top cover. Remove and secure any rounds that have been cleared.

6. Position the CHARGER switch on the SPU to the CHARGE position, retracting the charger mechanism to allow the bolt to travel forward once released.

7. Grasp the left-hand manual charging handle with the left hand and pull it to the rear of the weapon until the bolt is locked in the rear position, as shown in Figure 10.

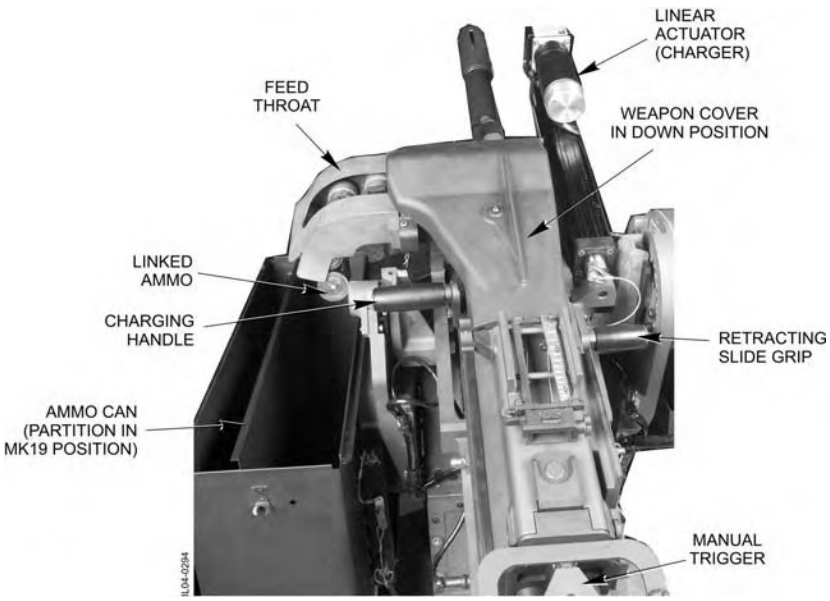


Figure 10. Mk19 Weapon with Adapter Kit on CROWS.

8. Place the mechanical safe/fire switch in the FIRE position.

9. While holding the charging handle with the left hand, use the right hand to depress the manual trigger on the rear of the weapon.

10. Allow the charging handle and bolt to return slowly to the forward position.

11. Place the mechanical safe/fire switch in the SAFE position.

12. Close and latch the weapon cover.

END OF TASK

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER USUAL CONDITIONS - LOADING AND FIRING THE M240B 7.62 MM LIGHT MACHINE GUN

THIS WORK PACKAGE COVERS:

Operations and procedures to load the ammunition can and weapon, fire the M240 light machine gun, and clear the weapon on the CROWS.

This work package is not included at this time.

END OF TASK

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER USUAL CONDITIONS - LOADING AND FIRING THE M249 5.56-MM LIGHT MACHINE GUN

THIS WORK PACKAGE COVERS:

Operations and procedures to load the ammunition can and weapon, fire the M249 machine gun, and clear the weapon on the CROWS.

This work package is not included at this time.

END OF WORK PACKAGE

OPERATOR's MANUAL
FOR THE
ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATION UNDER UNUSUAL CONDITIONS

THIS WORK PACKAGE COVERS:

The special considerations needed for operating the CROWS under unusual conditions.

INITIAL SET UP:

Tools and Special Tools

Operators Tool Kit (WP 0036, Table 2, Item 1)

References

WP 0015
WP 0023
WP 0027
AR 385-10
TM 9-1005-201-10
TM 9-1005-213-10
TM 9-1005-245-13&P
WP 0036
WP 0037
DA Pam 385-61
FM 3-5
TM 9-1005-313-10
TM 9-1010-230-10

Materials/Parts

Parts for emergency operation off vehicle:
M3 Tripod Gun Mount, NSN 1005-00-322-9716
WP 0037, Table 1, Item 2)
M64 Gun Mount Adapter, NSN 1010-01-179-7616
WP 0037, Table 1, Item 3)

Personnel Required

Mission Crew

Equipment Conditions

Variable as described

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NOTE

Should any weapon malfunctions occur, refer to WP 0023, Troubleshooting – Weapon Interface Malfunctions.

To ensure CROWS is ready for operation, refer to WP 0027, Before Operational Check.

UNUSUAL ENVIRONMENT/WEATHER

Operating In Degraded Environmental Conditions

CROWS is designed to be operational under the highly variable conditions of fog, rain, snow, dust, and blowing sand. Operational, sensor performance will be degraded by the reduced visibility caused by these conditions.

Perform the following procedures in degraded environmental conditions.

1. Should degraded visibility conditions be present, the operator should use the applicable camera (i.e., day camera or thermal imager) that provides the best image of the target on the display unit (DU).

NOTE

The eyesafe laser rangefinder (ELRF) uses a reflected pulse of light to determine range to target. Atmospheric conditions and target reflectance that hinder or prevent the transmission or ability to reflect light will result in the LRF not being able to provide a range to target.

Examples of atmospheric attenuation include rain, snow, fog, and smoke. Examples of poor target reflectance include a dark black target or a target angled sharply away from the line of sight.

A general rule of thumb is that if you cannot see the target or the target is heavily obscured, the ELRF cannot see it either.

If the ELRF does not get a return from the target, the TARGET NOT DETECTED message appears on the screen. If this situation occurs, refer to WP 0015, Menu System, Modifying Sensor Information section.

2. If the ELRF fails to return a correct range because of reduced visibility due to foggy, rainy, or other conditions, the operator should perform the following procedures.

   a. Lase an object (e.g., a building) near and at about the same range as the intended target to get a ballistic solution.

   b. Select a different target.

   c. Estimate and manually input the target range IAW WP 0015, Menu System, Modifying Sensor Information section.

END OF TASK

Operating In Extreme Temperature Conditions

CROWS is designed to operate in temperatures ranging from -25 to 140 °F (-32 to 60 °C). Should temperatures exceed this range, normal operating procedures are followed with the exception of an extended warm-up for the sensor unit.

Cold Start

At a cold start, in which a system that has been powered down at the following reference temperatures for an extended period of time (that is, longer than 1 hour), extended warm-up times may be required:

- For a cold start at -25 °F (-32 °C), a warm-up time of up to 30 minutes may be required for the sensor unit.
- For a cold start at 32 °F (0 °C), a warm-up time of up to 10 minutes may be required for the sensor unit.

Error Messages

An error message may occur during sub-zero temperatures. If you get either the "Gimbal BIT Status Failed" message or the "ICU Failed" message during sub-zero temperatures, leave the system powered up for 2-3 minutes.

Cool Down in Hot Conditions

For operation in temperatures exceeding 140 °F (60 °C), thermal system cool down may take up to 10 minutes.

OPERATING UNDER NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) CONTAMINATION CONDITIONS

CROWS is designed to be operational in NBC conditions with no changes to normal procedures.

After exposure to NBC contamination, perform decontamination procedures IAW DA PAM 385-61, Toxic Chemical Agent Safety Standards; AR 385-10, The Army Safety Program; FM 3-5, NBC Decontamination; and with local SOP. The CROWS must be decontaminated if contact with chemical agents or other toxic materials is suspected.

EMERGENCY USE OF SAFETY OVER-RIDE SWITCH

WARNING

The Safety Over-Ride Switch should be used in combat conditions only. Use of the Safety Over-Ride Switch will cause No-Fire zones, burst mode, single-burst mode, and safety interlocks to become non-functional. Injury or death to personnel and damage to equipment could result from using the Safety Over-Ride Switch in non-combat situations and certain combat situations. The Safety Over-Ride Switch will also restart weapon movement after it has been stopped because of GWS BIT error. Incorrect/improper use of this switch could lead to injury or death to personnel and damage to equipment.

CAUTION

The Safety Over-Ride Switch shall be used only in emergency situations as determined by the Commander. Damage to the equipment may occur.

No Fire Zones

The overridable factory preset zones can be overridden by turning the Safety Over-Ride Switch to the ON position. To re-enable the factory preset zones, turn the Safety Over-Ride Switch to the OFF position.

Factory Default No-Fire Zones and Factory Overridable No-Fire Zones are configuration-controlled zones that are preloaded onto the system. Factory preset zones are always active; while Factory overridable zones are active when the safety Over-Ride switch on the SPU is in the OFF position.

The operator may define custom zones at any time. A combination of up to 20 factory preset and custom zones may be defined. This menu selection allows the operator to select factory preset and factory custom zones by selecting default, or allows the operator to choose all three zones by selecting custom.

Motion Inhibits

Factory Default Motion Inhibits and Factory Overridable Motion Inhibits are configuration-controlled zones that are preloaded onto the system. Factory Default Motion Inhibits are always active, while Factory Overridable Motion Inhibits are active when the Safety Over-Ride Switch on the SPU is in the OFF position.

NOTE

For removal and operation of the weapon off the vehicle go to Emergency Operation if Vehicle is Disabled section of this work package.

EMERGENCY OPERATION IF CROWS SYSTEM FAILS

If an emergency situation occurs due to electrical/electronic malfunction where the CROWS system will not operate, the M2 .50 Caliber or the MK19 40 mm weapons can be operated by the hands-on method. The M240B or the M249 light machine guns must be removed from the cradle to operate; see EMERGENCY OPERATIONS IF VEHICLE IS DISABLED.

Hands-On Operation of the M2 or Mk19

1. Turn the DU and Switch Panel Unit (SPU) power switches to the OFF position. See Figure 1.

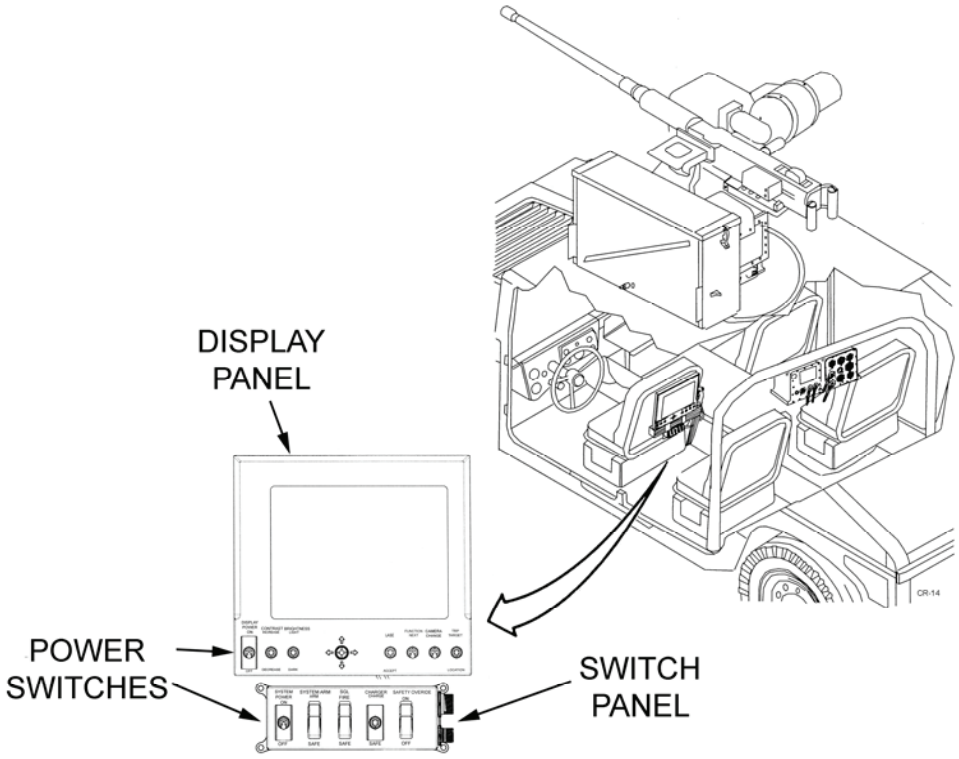


Figure 1. CROWS Power Switches.

EMERGENCY OPERATION IF CROWS SYSTEM FAILS - Cont

Hands-On Operation of the M2 or Mk19 - Cont

2. Go to subparagraph a for the M2 HB .50 cal machine gun; go to subparagraph b for the Mk19 40 mm grenade machine gun or sub paragraph c for the light machine guns.

    a. For the .50-cal, M2 HB .50 cal machine gun, proceed as follows:

        (1) The gunner must open the hatch and assume a position behind the weapon.

        (2) Manually charge the weapon with the cocking handle.

        (3) Point the weapon by hand and fire using the butterfly trigger.

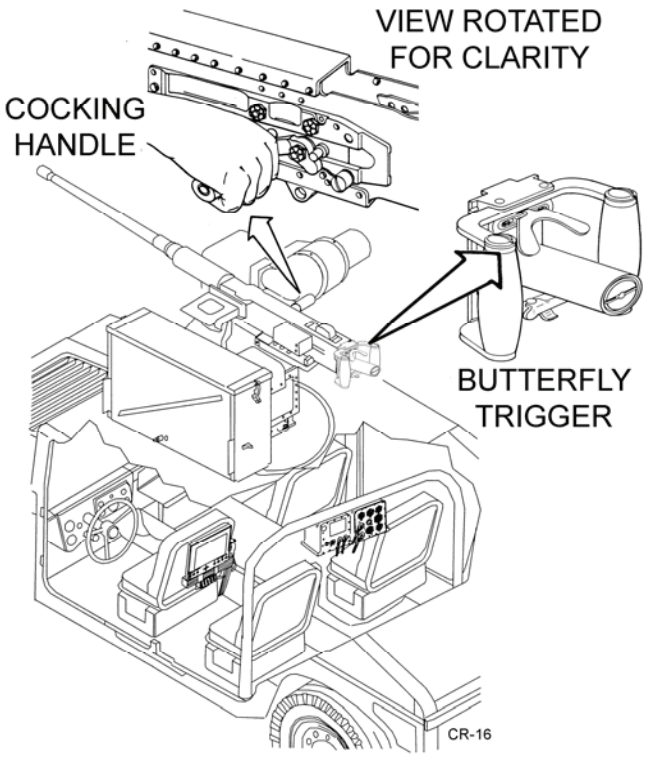


Figure 2. Manual Operation of the .50-Cal, M2 HB Machine Gun.

b. For 40 mm, Mk19 grenade machine gun, proceed as follows. See Figure 3.

(1) Open hatch and assume position behind the weapon.

(2) Remove the charger pin to free the charger for manual charging.

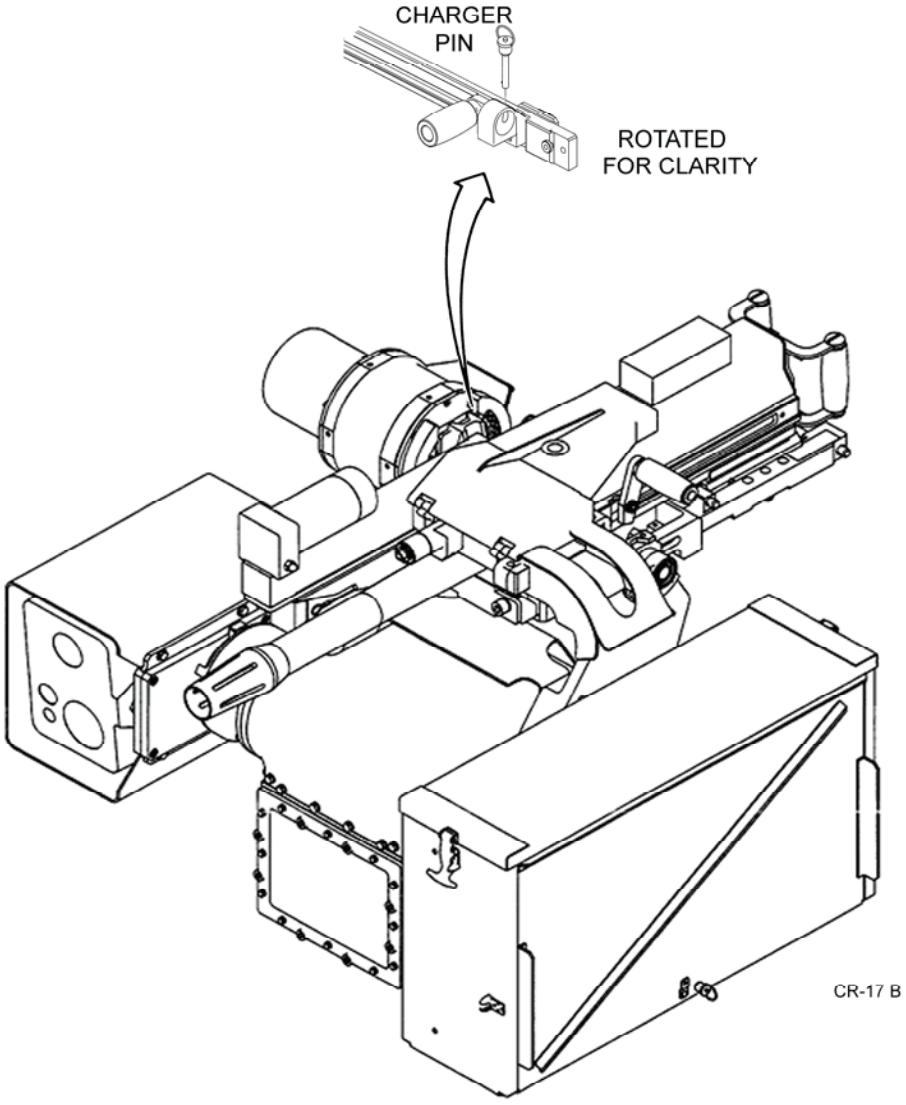


Figure 3. Removing Charger Pin.

EMERGENCY OPERATION IF CROWS SYSTEM FAILS - Cont

Hands-On Operation of the M2 or Mk19 - Cont

(3) Manually charge the weapon with the charging handles. See Figure 4.

(4) Point the weapon by hand and fire using the butterfly trigger.

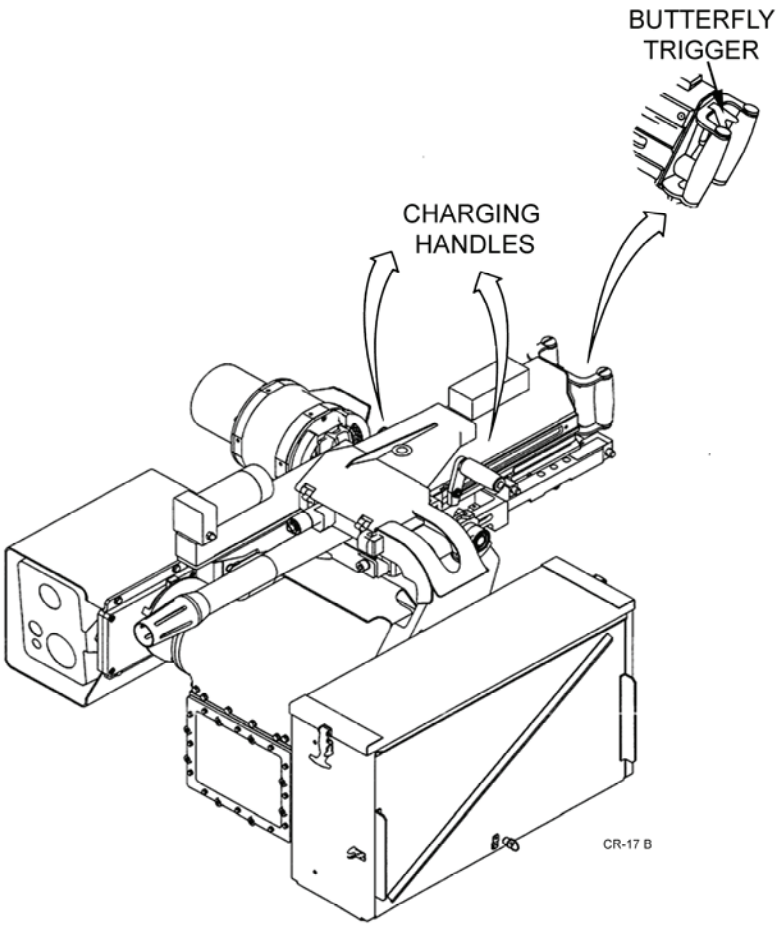


Figure 4. Charging the Mk19 for Operation.

END OF TASK

Hands-On Operation of the M240B or M249

Go to Removal of M240B or M249 in the Emergency Operation if Vehicle is Disabled section of this work package.

END OF TASK

EMERGENCY OPERATION IF VEHICLE IS DISABLED

WARNING

If power is on, the system is fully functional and the mount and/or cradle with weapon could move. Ensure that the weapon mount is cleared and any cleared rounds are secured. Ensure that all personnel are clear of any possible weapon movements. Do not stand under the barrel. Follow all safety warnings and cautions. Failure to do so may result in personal injury and equipment damage.

If an emergency situation occurs due to a malfunction of the vehicle, the CROWS will operate if the vehicle engine still runs or the battery is charged. If power is not available, the M2 50 Caliber or the MK 19 40 mm weapons can be operated by the hands-on method (see Emergency Operation if CROWS System Fails section above). The light machine guns must be separated from the cradle to be fired by hand see Removal of M 240B or M249, page 23 and 27.

Operation of the 50 caliber or 40 mm weapons away from the vehicle can be accomplished if an M3 Tripod is on board. Additional to the M3 Mount an M64 Mount is required for operation of the Mk19 Grenade Gun.

Removal of M2 HB .50 Caliber Machine Gun

1. Turn the DU and SPU power switches to the OFF position. See Figure 5.

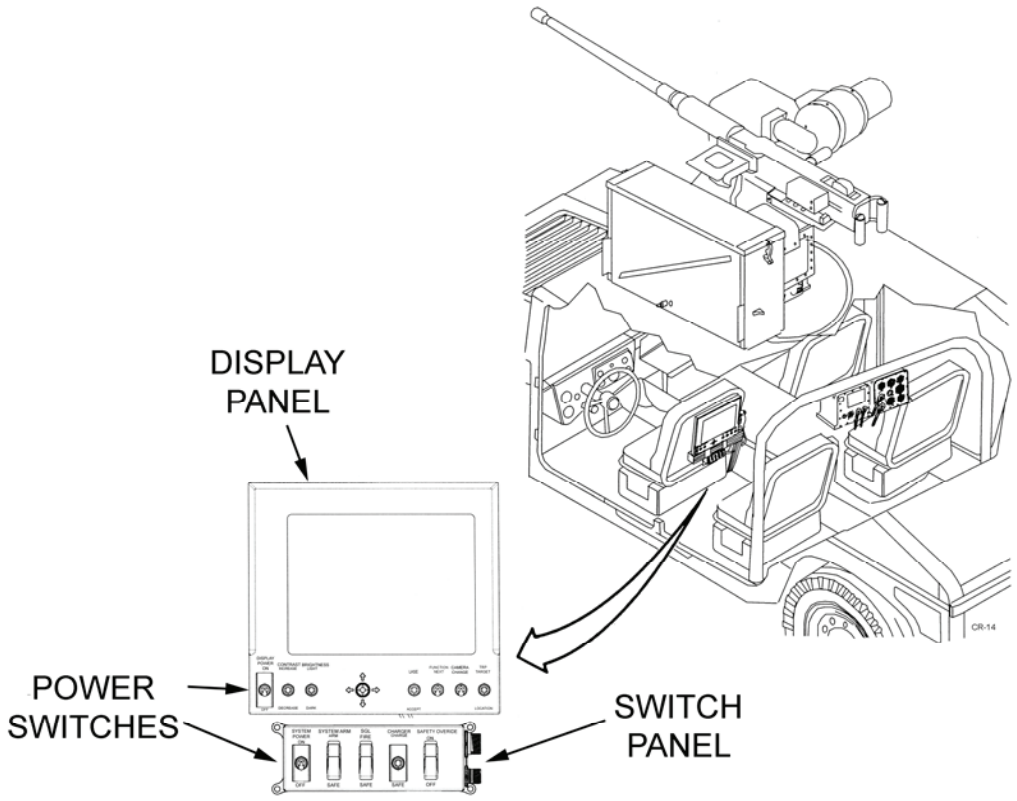


Figure 5. CROWS Power Switches.

EMERGENCY OPERATION IF VEHICLE IS DISABLED - Cont

Removal of M2 HB .50 Caliber Machine Gun - Cont

2. Place the azimuth lock in the locked position. See Figure 6.

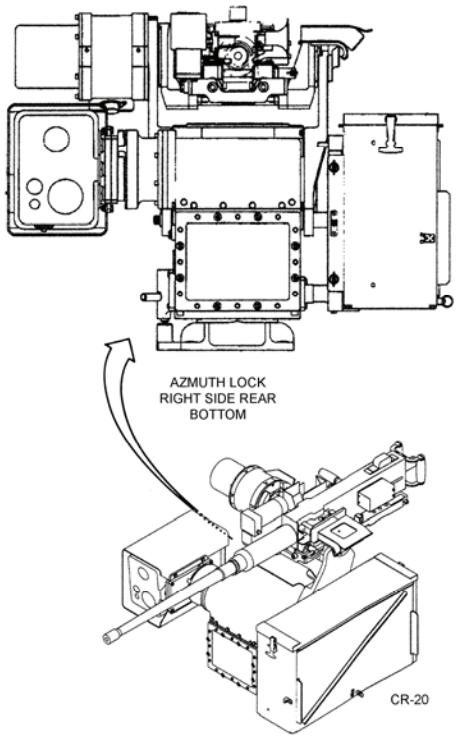


Figure 6. Locating the Azimuth Lock.

3. Disconnect the .50 cal connector from the Remote Firing Assembly (RFA). See Figure 7.

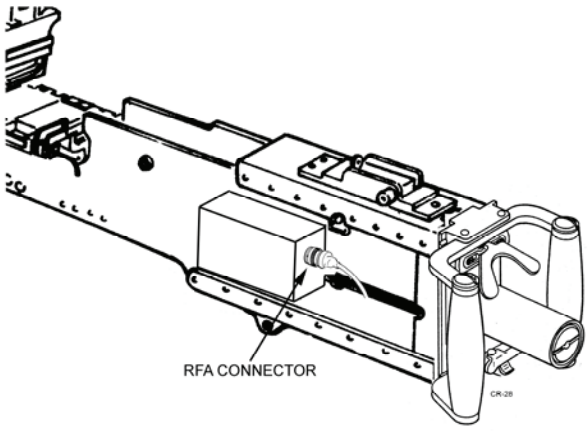


Figure 7. RFA Connector Removal.

4. Lift weapons cover, unhook the ammunition belt, and clear the weapon. Remove and secure any rounds that have been cleared.

5. Disconnect the Link Chute. Replace the pin which belongs with the weapon, See Figure 8.

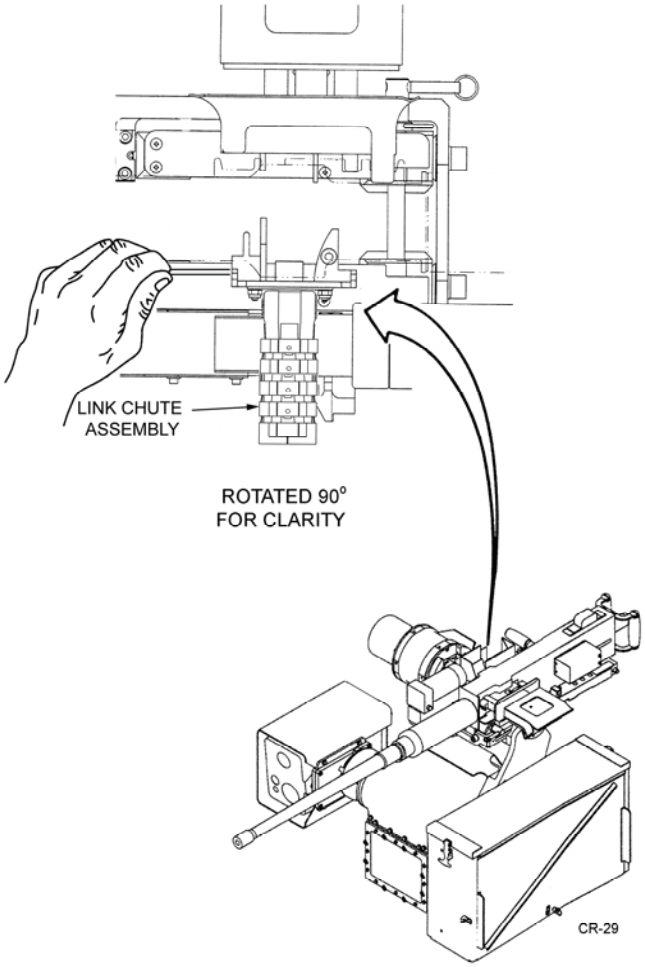


Figure 8. Disconnecting the Link Chute.

EMERGENCY OPERATION IF VEHICLE IS DISABLED - Cont

Removal of M2 HB .50 Caliber Machine Gun - Cont

6. Remove the forward weapon support pin. See Figure 9.
   a. Pull the hitch pin up and out.
   b. Turn the forward pin handle up and pull the pin out.

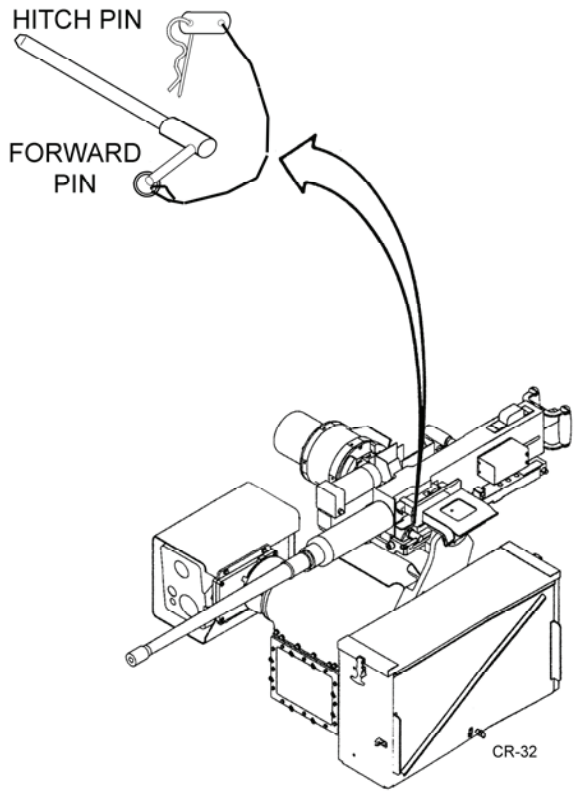


Figure 9. Removing Forward Weapon Support Pin.

NOTE

Two persons are required to remove the weapon from the cradle.

7. Remove the weapon as follows. See Figure 10.

   a. Slide the weapon forward until the block guide on the bottom rear of the weapon clears the block guide channel in the weapons cradle.

   b. Lift the weapon off of the cradle and remove from the vehicle.

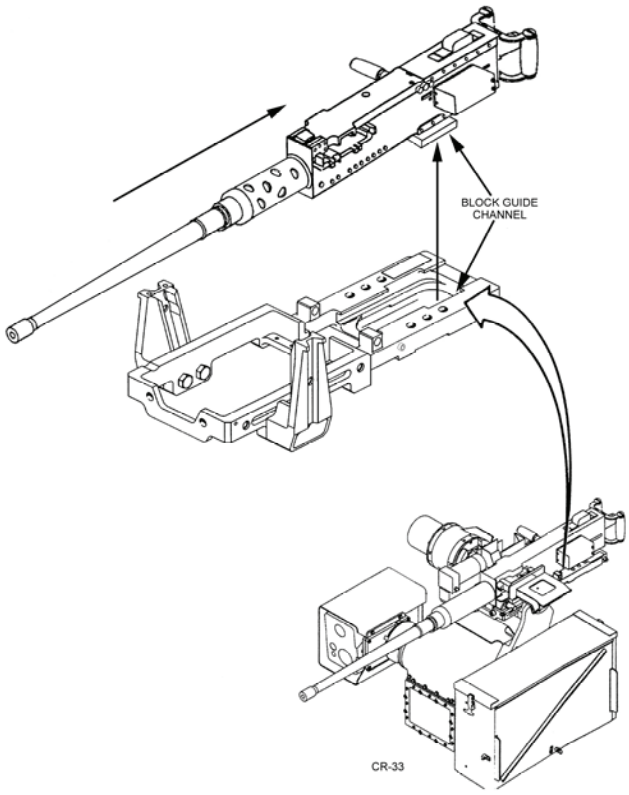


Figure 10. Removing Weapon from Cradle.

EMERGENCY OPERATION IF VEHICLE IS DISABLED - Cont

Removal of M2 HB .50 Caliber Machine Gun - Cont

8. Remove block guide from weapon. See Figure 11.

   Loosen set screw, slide the connecting pin out, and remove the block.

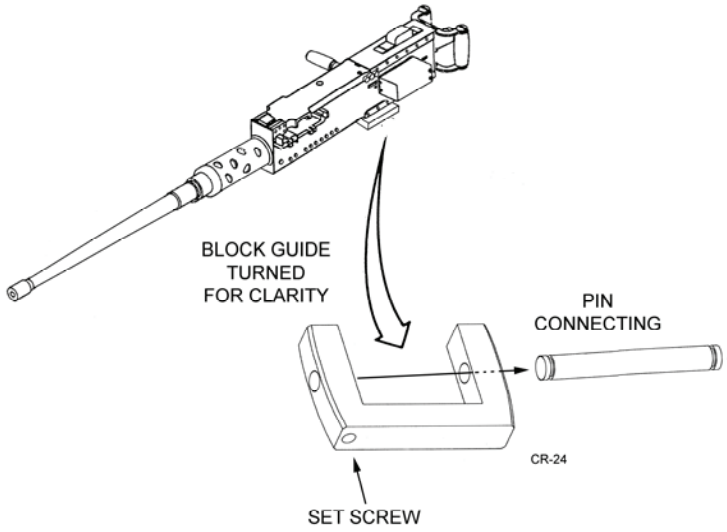


Figure 11. Removing Block Guide from the Weapon.

NOTE

The M2 Machine Gun can be mounted directly on the M3 mount or on the combination mount M64 and M3. M3 direct is non flexible. The combination M3/M64 provides a flexible weapon. The following steps illustrate a quick non flex mount. Refer to TM 9-1005-245-13&P for detailed mounting instructions.

9. Install the pintle from the M3 Gun Mount on the M2 HB machine gun. See Figure 12.

   a. Place the pintle on the forward end of the weapon and insert the bolt through the forward mounting hole.

   b. Install the castle nut finger tight then install cotter pin. Tighten to next cotter pin hole if holes do not line up. Bend ends of cotter pin.

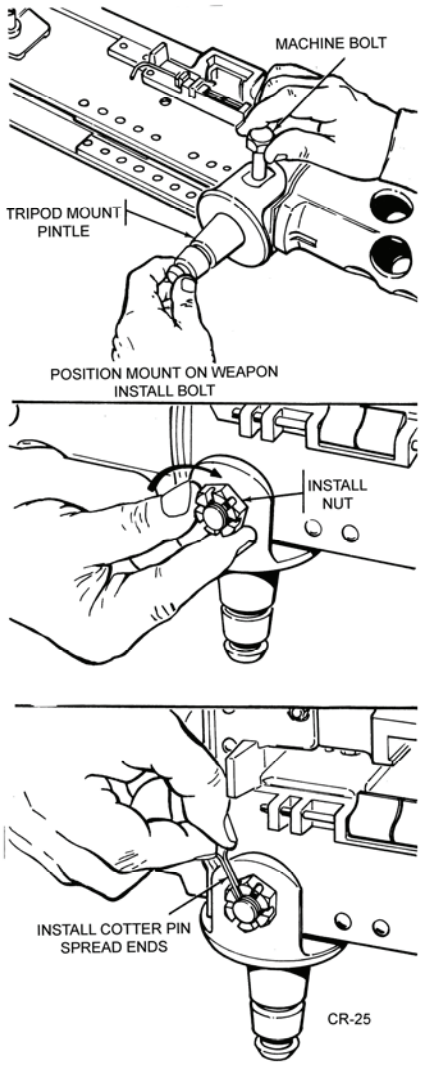


Figure 12. Installing the M3 Mount Pintle on the M2 HB Machine Gun.

EMERGENCY OPERATION IF VEHICLE IS DISABLED - Cont

Removal of M2 HB .50 Caliber Machine Gun - Cont

NOTE

Refer to TM 9-1005-213-10 to locate and position the M3 Mount and for operation of the M2 HB Machine Gun.

10. Install the M2 HB machine gun on the M3 Mount. See Figure 13.
    a. Locate the rear of the weapon and the front pintle and install the weapon on the mount.
    b. Install the rear locking pin and lock the front of the weapon with the pintle lock.

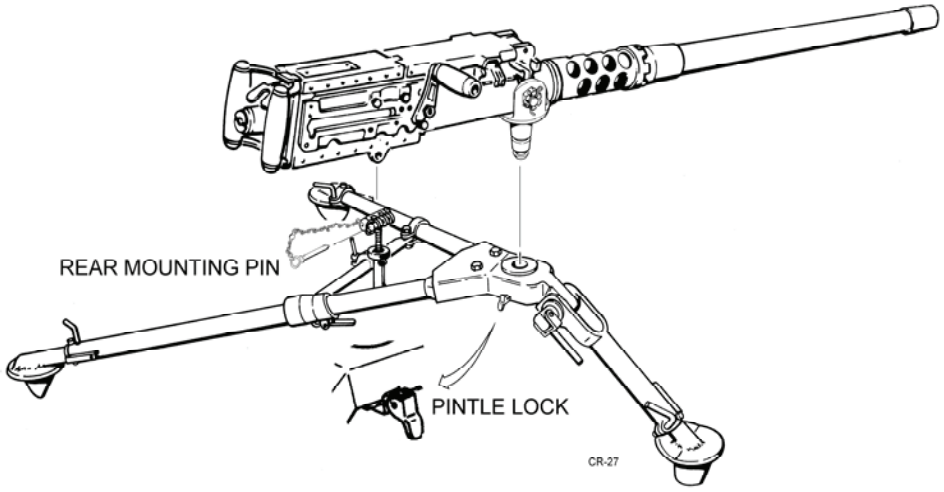


Figure 13. Mounting the Weapon on the M3.

11. Retrieve ammunition from vehicle and position with the weapon.

END OF TASK

Removal of Mk19 40 mm Grenade Machine Gun

1. Turn the DU and SPU power switches to the OFF position. See Figure 14.

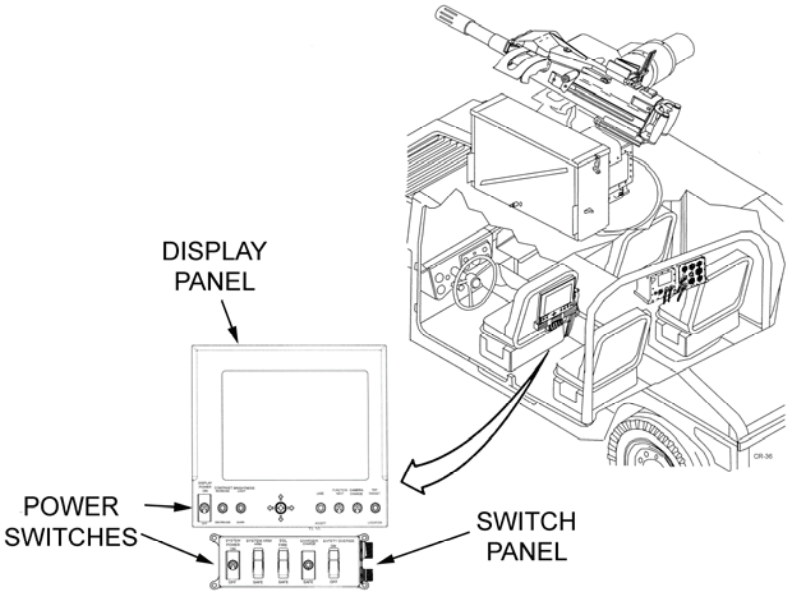


Figure 14. Power Switches Off.

2. Assume a position behind the weapon and place the azimuth lock in the lock position. See Figure 15.

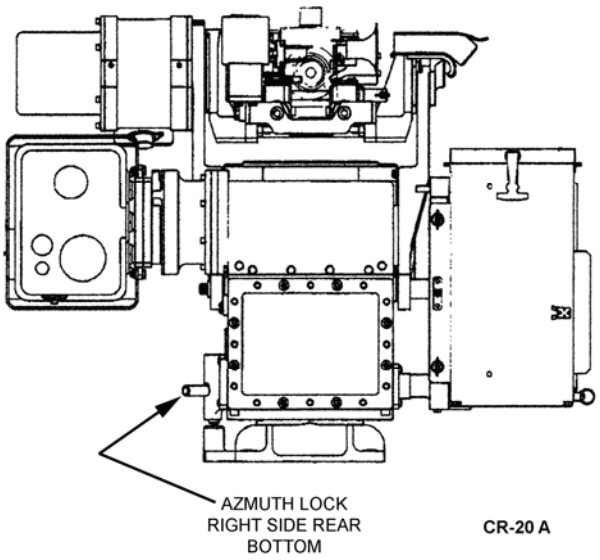


Figure 15. Azimuth Lock.

EMERGENCY OPERATION IF VEHICLE IS DISABLED - Cont

Removal of Mk19 40 mm Grenade Machine Gun - Cont

3. Refer to Figure 16 and proceed as follows:

   a. Remove the charger pin to free the charger for manual charging.

   b. Lift the weapon cover, disconnect the ammunition, and clear the weapon. Remove and secure any rounds that have been cleared.

   c. Place the Safe/Fire switch in the FIRE position by sliding the switch to the right.

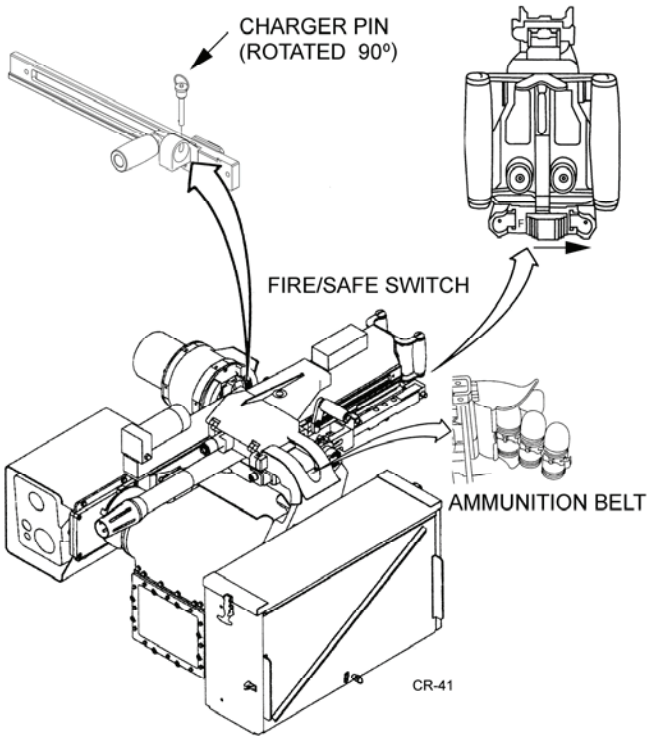


Figure 16. Removing Charger Pin, Disconnecting Ammo, and Switching to FIRE Position.

4. Remove solenoid electrical connector. Disconnect the electrical connector then turn the remote firing solenoid 90 degrees until the connector is toward the barrel and pull down to remove from the weapon. See Figure 17.

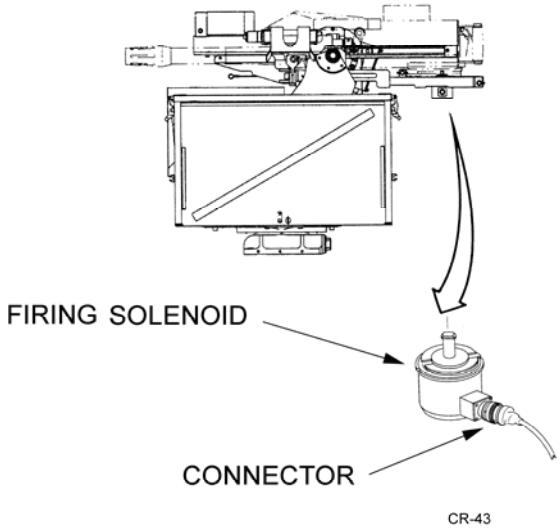


Figure 17. Removing Remote Firing Solenoid.

5. Disconnect the Ogive plunger harness. See Figure 18.

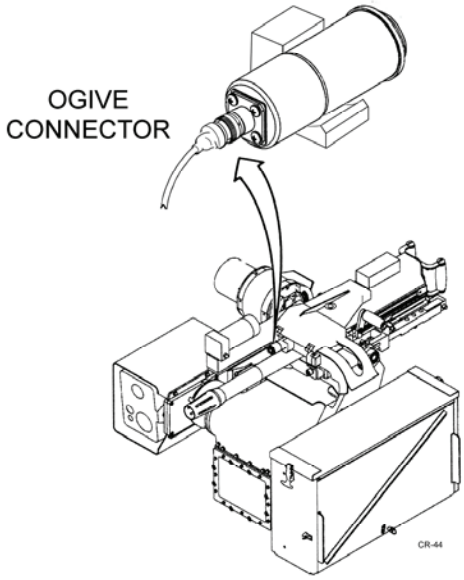


Figure 18. Disconnecting the Ogive Plunger and Rounds Counter Assembly.

EMERGENCY OPERATION IF VEHICLE IS DISABLED - Cont

Removal of Mk19 40 mm Grenade Machine Gun - Cont

6. Remove the aft quick release pin and lift the Mk19 out of the cradle. See Figure 19.

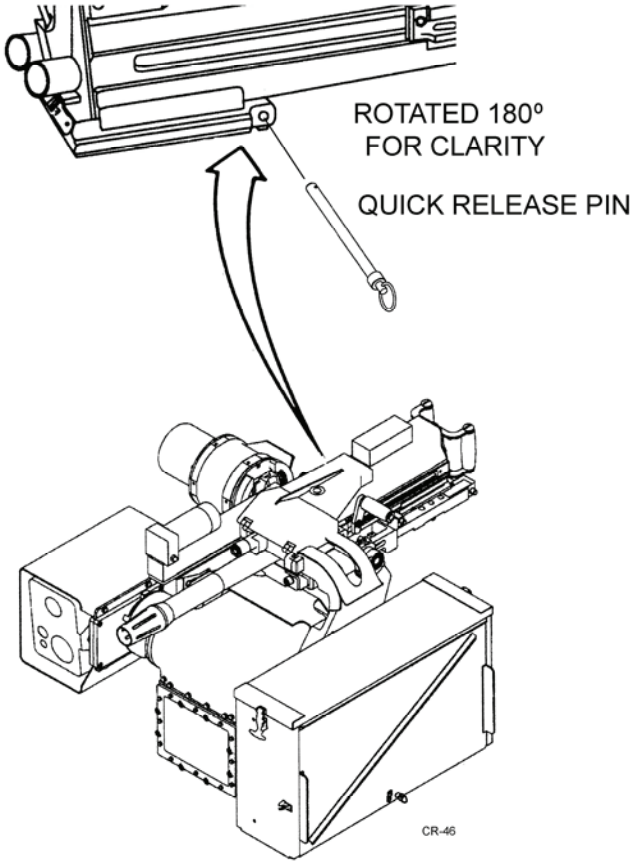


Figure 19. Removing Mk19 from Cradle.

NOTE

Refer to TM 9-1005-245-13&P for the M64/M3 Mount and TM 9-1010-230-10 for operation of the Mk19.

7. Install the Mk19 on the M64/M3 tripod assembly. See Figure 20.

   a. Place the MK64 lugs in the MK19 groves.

   b. Move the weapon forward to line up the rear holes and install the aft mount pin.

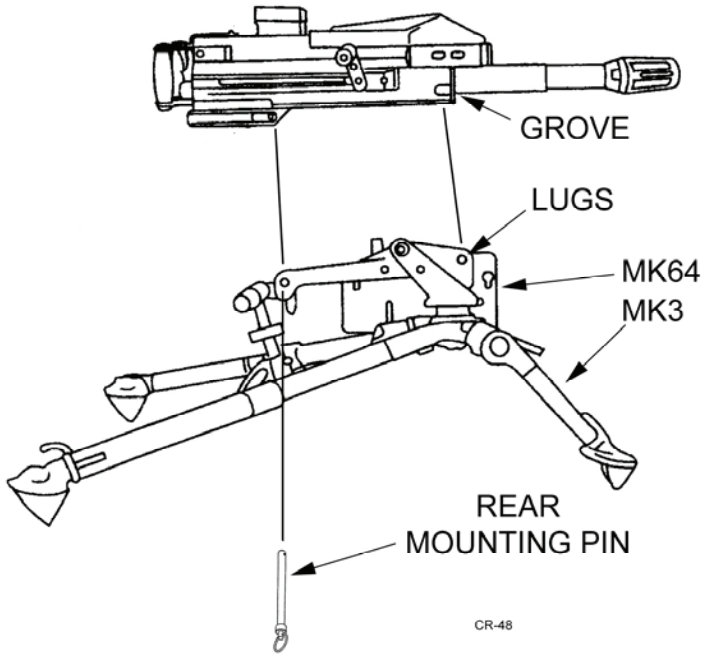


Figure 20. Installing Mk19 on M64/M3 Tripod Assembly.

   c. Retrieve ammunition from the vehicle and position with the weapon.

END OF TASK

EMERGENCY OPERATION IF VEHICLE IS DISABLED - Cont

Removal of M240B 7.62 mm Light Machine Gun

1. Turn the DU and SPU power switches to the OFF position. See Figure 21.

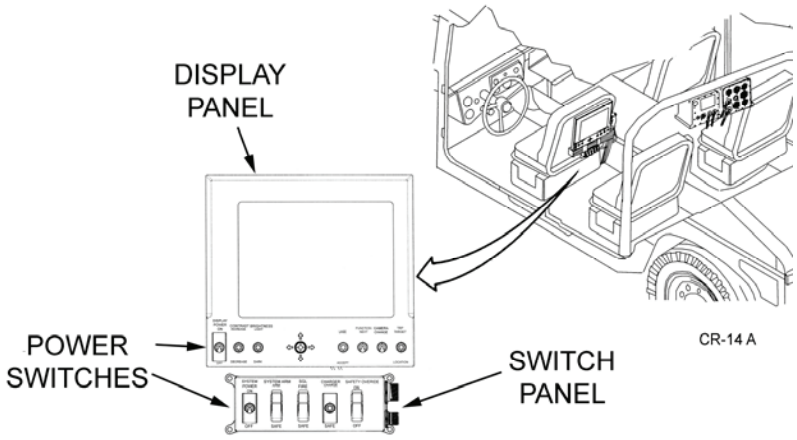


Figure 21. Turning Off Power Switches.

2. Assume a position behind the weapon and place the azimuth lock in the lock position. See Figure 22.

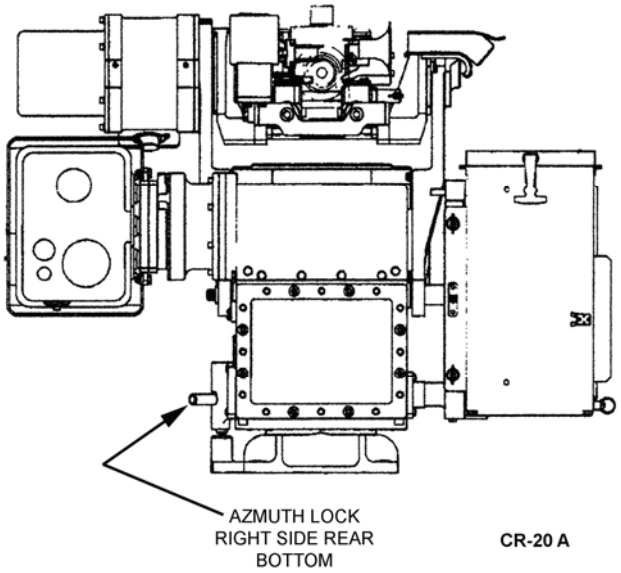


Figure 22. Azimuth Lock.

3. At point (1) on the weapon turn the charging handle bracket (3) down by removing pin (2), Figure 23.

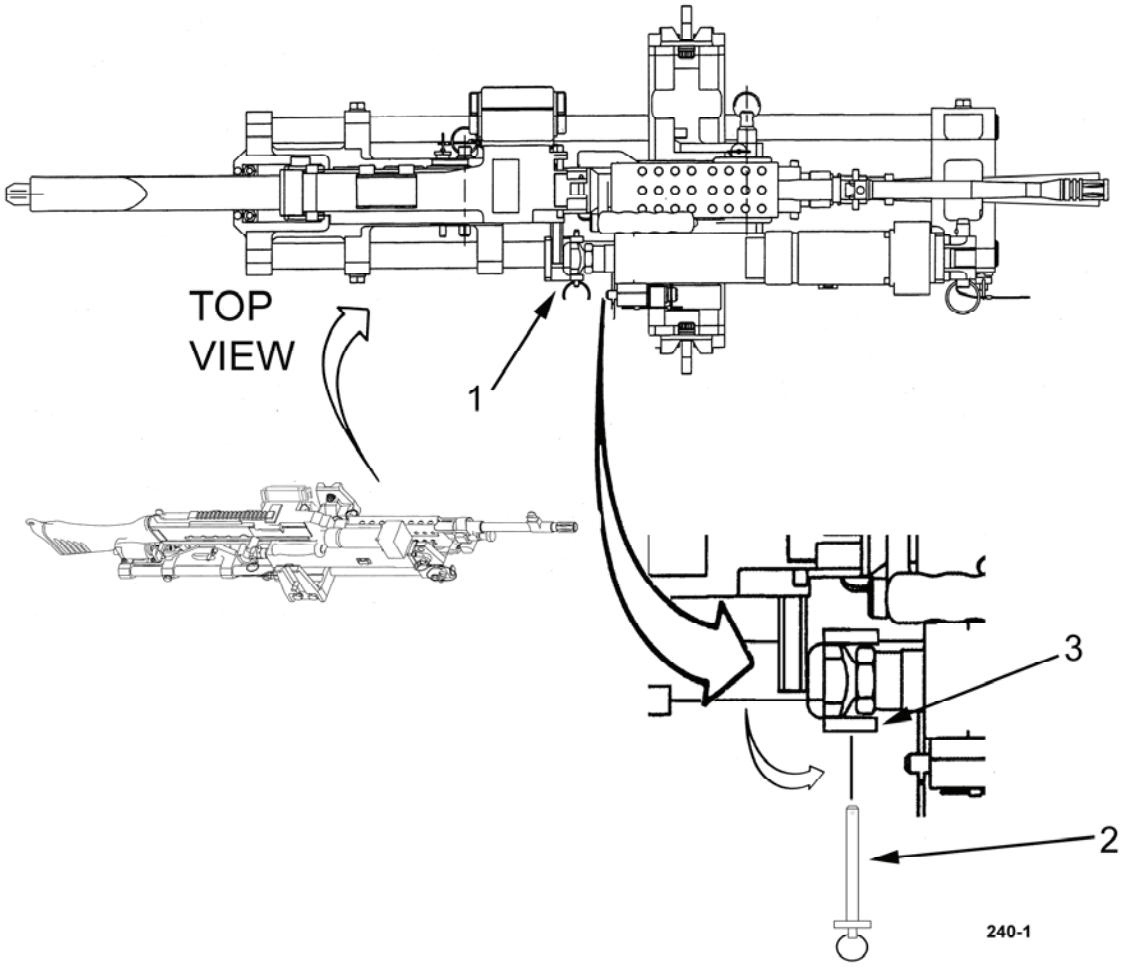


Figure 23. Turning the Charging Handle Bracket.

EMERGENCY OPERATION IF VEHICLE IS DISABLED - Cont

Removal of M240B 7.62 mm Light Machine Gun - Cont

4. Remove the chute (3), clear the weapon, then remove chute adapter (5). See Figure 24. Remove and secure any rounds that have been cleared.

   a. Push on the side ears (1) to loosen the chute (2).

   b. Disconnect the ammunition belt and remove the chute (2) from the weapon.

   c. Clear the weapon, ensure that any cleared rounds are secured, then remove the chute adapter by pushing up on the holding tab (3) and sliding the chute until the locking stud pin (4) will move to the hole. Pull the chute adapter (5) off of the weapon.

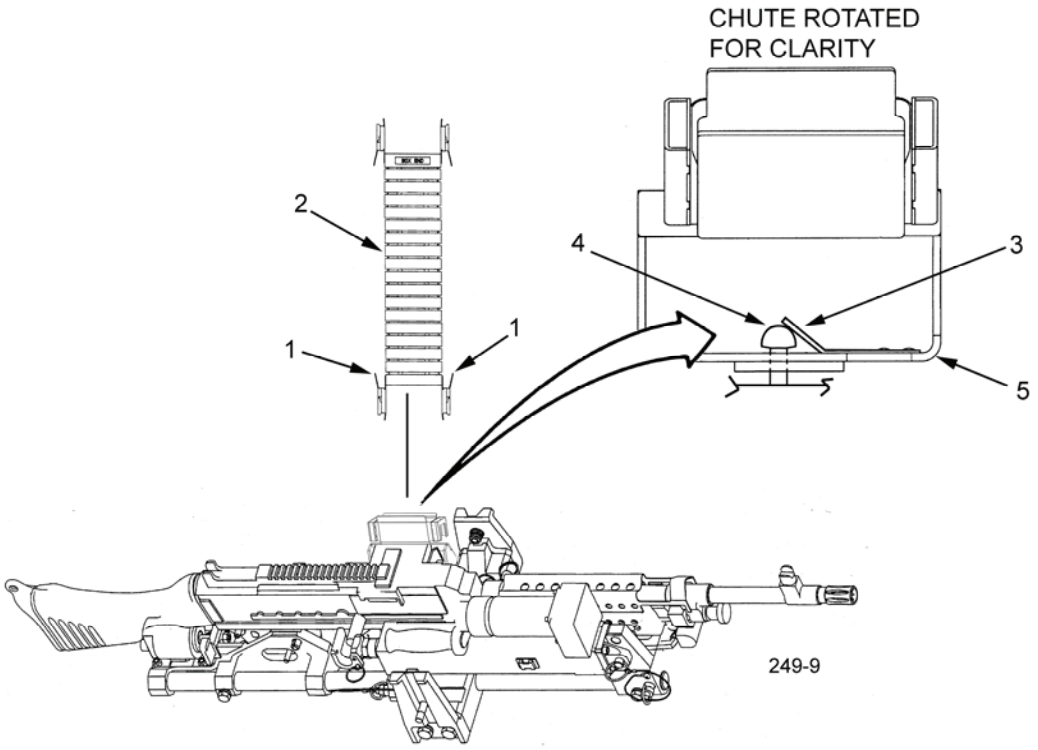


Figure 24. Clearing the Weapon and Removing Chute and Chute Adapter.

5. For removal of the weapon from the cradle refer to Figure 25 and proceed as follows:
   a. Remove hairpin (1) securing pin (3).
   b. Remove pins (2) and (3).
   c. Remove pin (4) securing pin (5) from underneath the cradle, then remove pin (5).
   d. Remove pin (6) that secures the weapon bipod.
   e. Lift the weapon (7) out of the cradle.

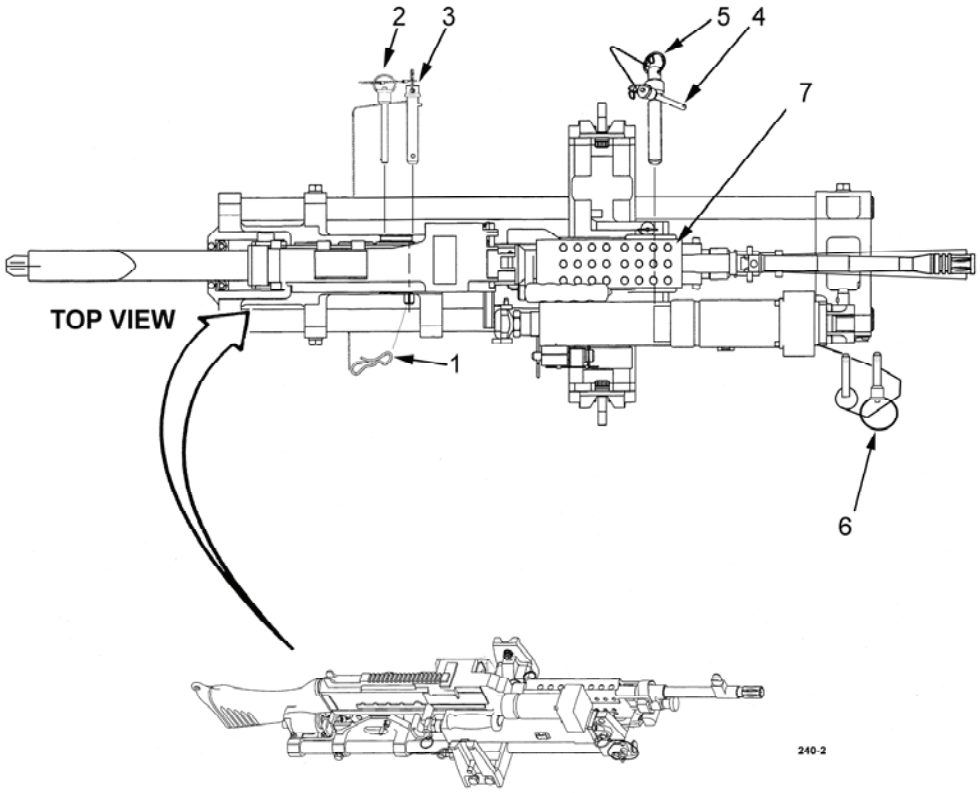


Figure 25. Removing M240B from Cradle.

EMERGENCY OPERATION IF VEHICLE IS DISABLED - Cont

Removal of M240B 7.62 mm Light Machine Gun - Cont

NOTE

The CROWS system ammo can, chute, and chute adapter may be used off the vehicle to support the M240B if application and/or emplacement can be improved.

6. Recover ammunition from the vehicle and refer to TM 9-1005-313-10 to set up and operate the M240B Machine Gun.

END OF TASK

Removal of M249 5.56 mm Light Machine Gun

1. Turn the DU and SPU power switches to the OFF position. See Figure 26.

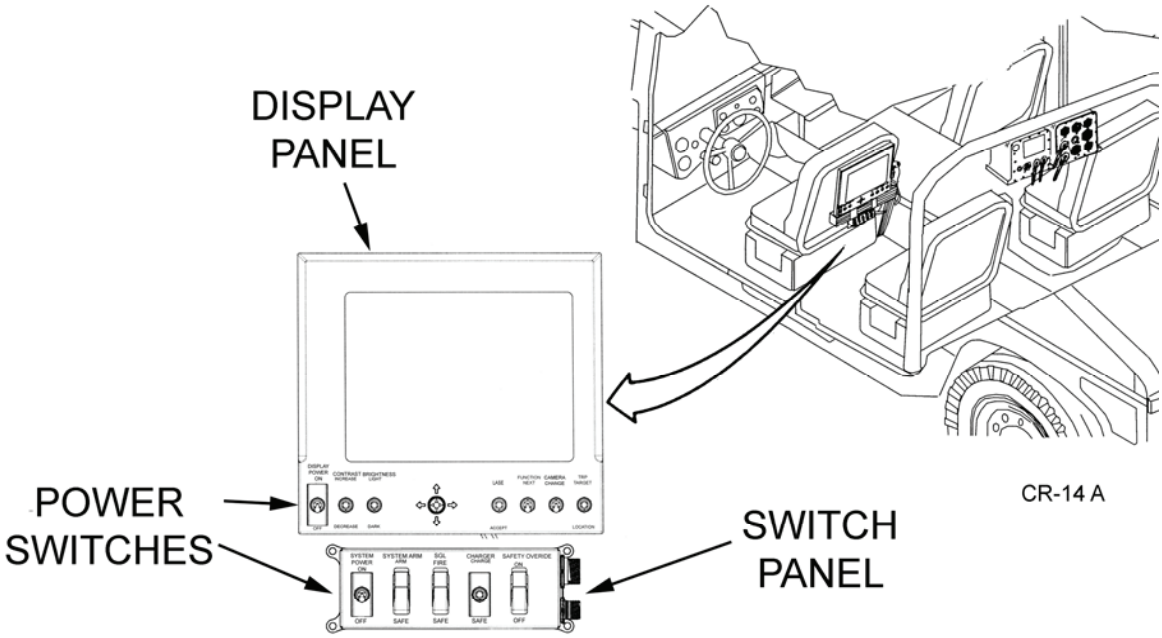


Figure 26. Turn Off Power Switches.

2. Assume a position behind the weapon and place the azimuth lock in the lock position, Figure 27.

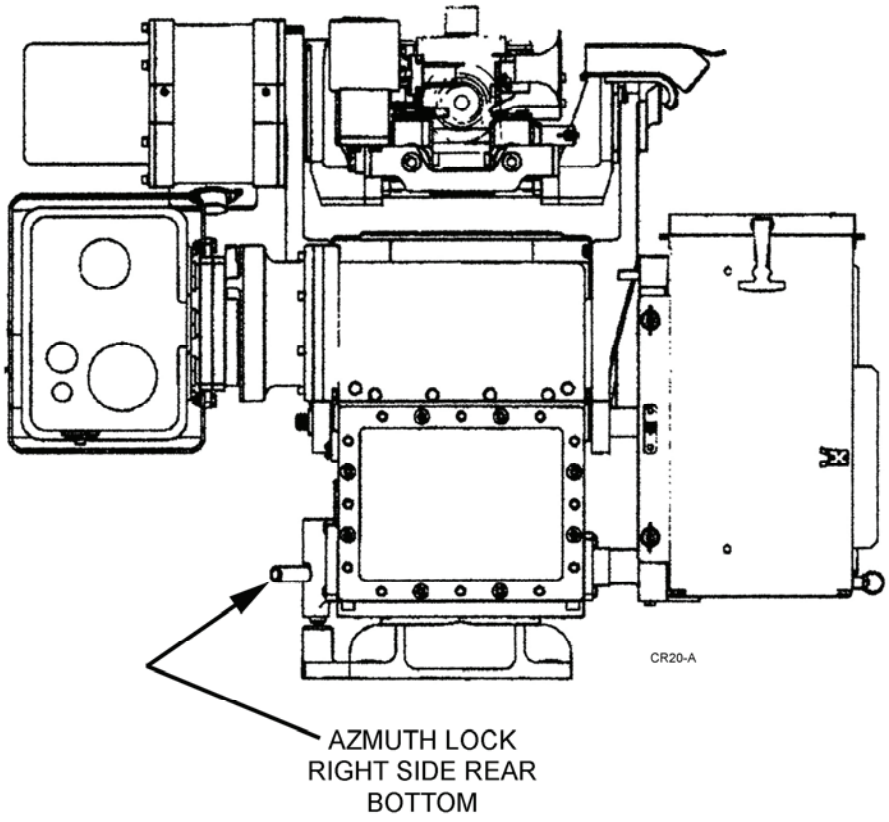


Figure 27. Azimuth Lock.

EMERGENCY OPERATION IF VEHICLE IS DISABLED - Cont

Removal of M249 5.56 mm Light Machine Gun - Cont

3. On the gun assembly at (1), free the charging handle by removing the pin (2) and turning the bracket (3) down, Figure 28.

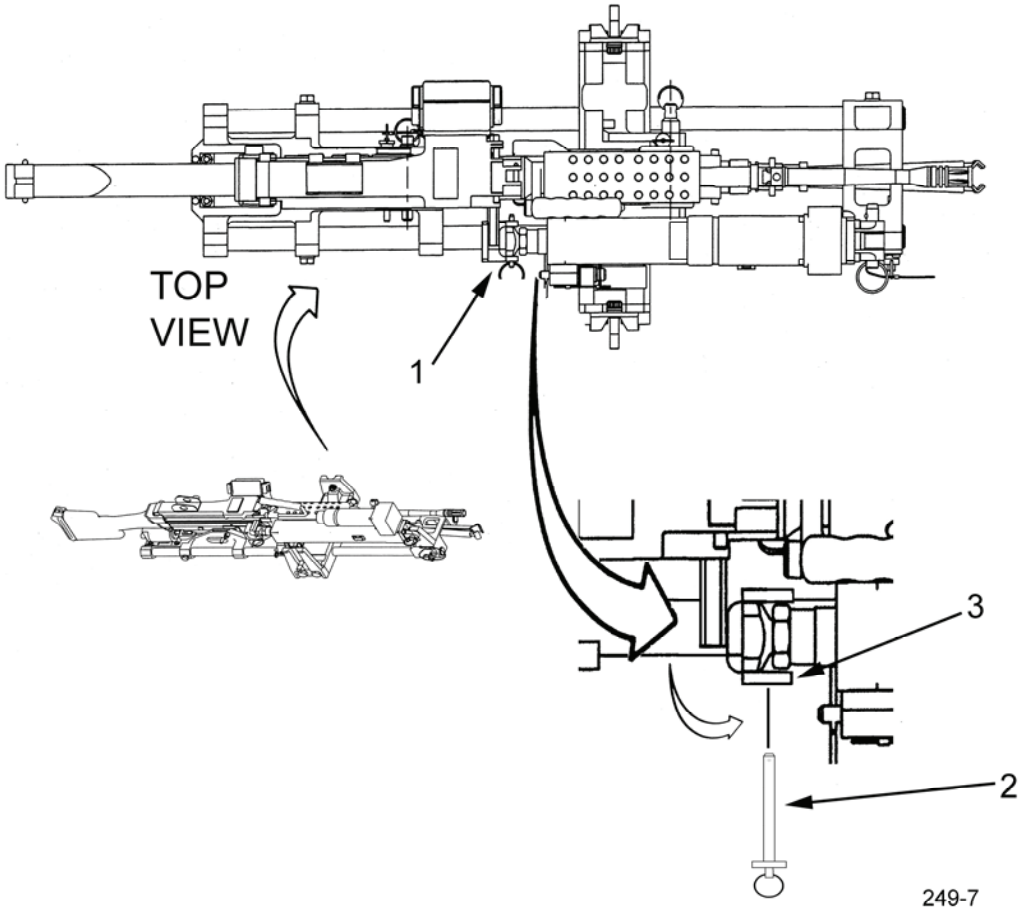


Figure 28. Moving the Charging Handle Bracket.

4. To clear the weapon and remove the chute (3), proceed as follows. See Figure 29.
   a. Push on the side ears (1) to loosen the chute (2).
   b. Disconnect the ammunition belt, remove the chute (2), and clear the weapon.
   c. Remove and secure any rounds that have been cleared.

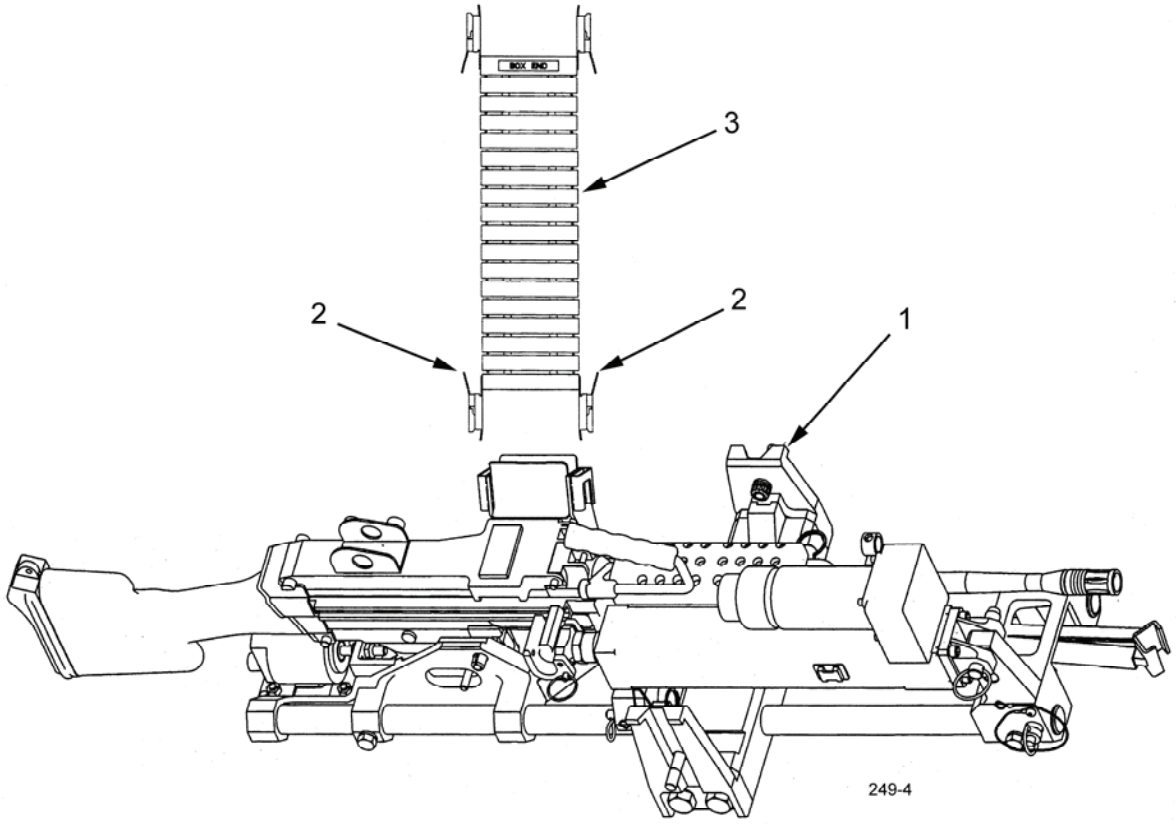


Figure 29. Removing Ammo Chute.

EMERGENCY OPERATION IF VEHICLE IS DISABLED - Cont

Removal of M249 5.56 mm Light Machine Gun - Cont

5. Remove the chute adapter (1) as follows: Disconnect connector (3), press locking tab (4), and lift the chute adapter (1) from the weapon (2). See Figure 30.

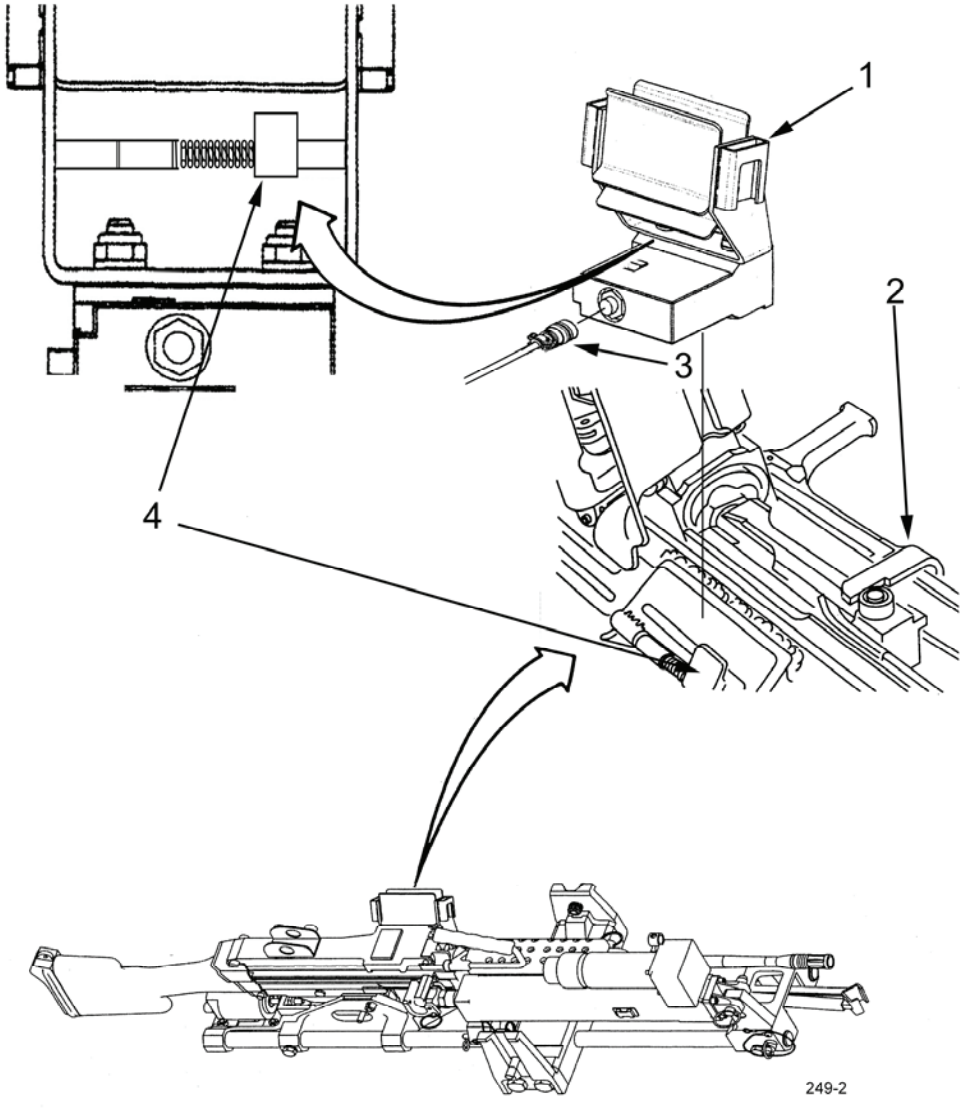


Figure 30. Removing Chute Adapter.

6. For removal of the weapon from the cradle, refer to Figure 31 and proceed as follows:
   a. Remove hairpin (1) securing pin (3).
   b. Remove pins (2) and (3).
   c. Remove pin (4) securing pin (5) from underneath the cradle then remove pin (5).
   d. Remove pin (6) that secures the weapon bipod.
   e. Left the weapon (7) out of the cradle.

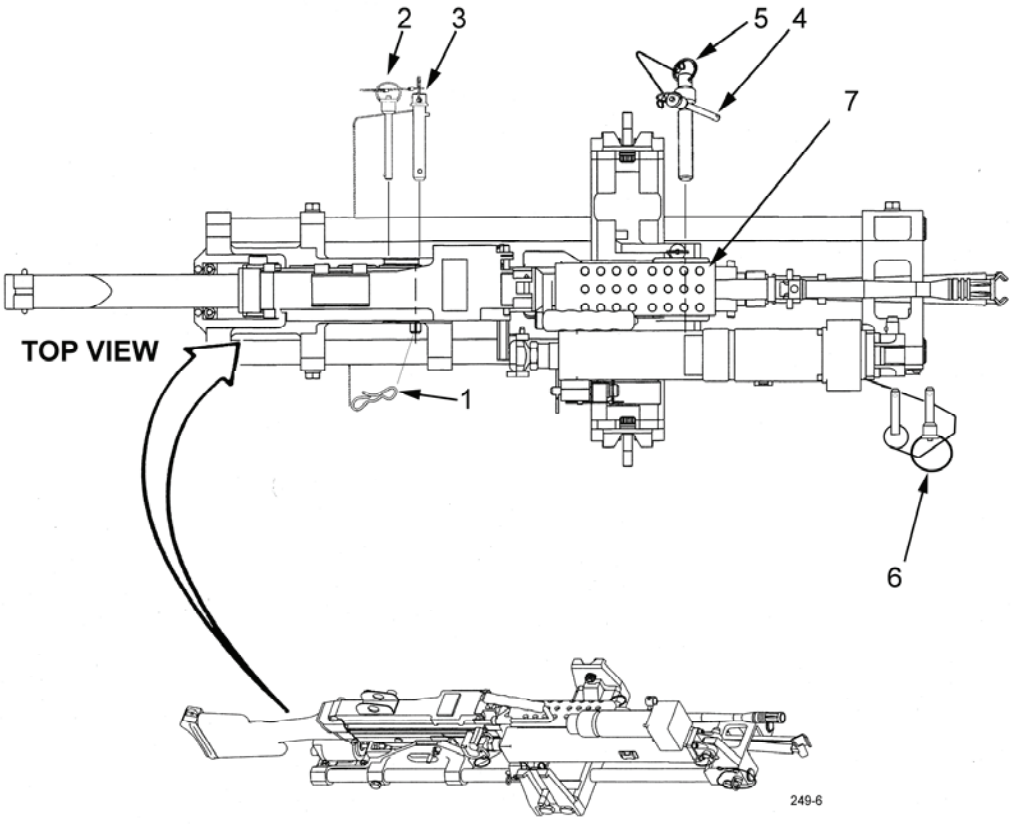


Figure 31. Removing Weapon from the Cradle.

NOTE

The CROWS system ammo can, chute, and chute adapter may be used off the vehicle to support the M249 if application and/or emplacement can be improved.

7. Recover ammunition from the vehicle and refer to TM 9-1005-201-10 to set up and operate the M249 Machine Gun.

END OF TASK

END OF WORK PACKAGE

CHAPTER 3

CROWS

TROUBLESHOOTING

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

TROUBLESHOOTING - WEAPON INTERFACE MALFUNCTIONS

This work package contains troubleshooting information for locating and correcting problems that may develop in the CROWS and its subassemblies.

WP CONTENTS

Section/Subsection	Page
General Procedures	1
Troubleshooting - Weapon Interface Malfunctions	1

GENERAL PROCEDURES

Use the following procedures when working on the CROWS system.

Table 1 is furnished as an aid in localizing weapon problems. It will show indications of improper weapon interface and the troubleshooting procedures to resolve performance issues.

TROUBLESHOOTING - WEAPON INTERFACE MALFUNCTIONS

NOTE

Refer to WP 0035, References, for vehicle and weapon operator and maintenance manuals.

To ensure cable connections are made as specified, refer to WP 0005 for the overall Interconnect Diagram (ICD), and to WP 0007, WP 0009, WP 0011 or WP 0013 for the ICD specifically applicable to the M2 HB, Mk19, or M240/M249 weapon adapter kits (WAKs), respectively.

Table 1 lists CROWS weapon malfunctions with possible reason for failure and the steps to take to restore performance or to return the unit to next higher maintenance.

TROUBLESHOOTING - WEAPON INTERFACE MALFUNCTIONS - Cont

CAUTION

Ensure system power is off when connecting and disconnecting cables

Ensure weapon is cleared and any cleared rounds are secured before performing any procedures unless specifically directed to load the weapon. For instructions on loading and firing the weapons, refer to WP 0018 (M2), WP 0019 (Mk19), WP 0020 (M240B), or WP 0021 (M249).

Failure to follow these instructions may result in equipment damage and system inoperability.

Table 1. Weapon Interface Malfunctions.

Malfunction	Symptom / Possible Cause	Operator Action
Ammunition does not feed	Weapon may be jammed	1. Clear weapon. Remove and secure any rounds that have been cleared. 2. Charge weapon. 3. If fault remains, send weapon to next higher maintenance.
M2 is too loose and moves too much in cradle	Forward pin of M2 is not fully inserted into the weapon	1. Reposition weapon. 2. Ensure forward pin is fully inserted into actuator bushing. 3. Ensure hitch pin is fully inserted. Verify that forward pin and weapon are secure.
Rounds counter does not decrement while firing	Rounds counting sensor has failed	1. Continue target engagement. 2. Ensure cables are connected. 3. M2 HB - Send RFA to next higher maintenance. 4. Mk19 - Send rounds counter assembly to next higher maintenance. 5. M240B - Send M240 rounds counter with rounds counting sensor to next higher maintenance. 6. M249 – Send M249 rounds counter with rounds counting sensor (P/O M249 adapter-counter) to next higher maintenance.
Weapon does not charge	Remote charging assemblies or weapon has malfunctioned	1. Reboot system and verify fault. 2. Manually charge the weapon. If it will not charge, send the weapon to next higher maintenance. 3. Send SWS to next higher maintenance.

Table 1. Weapon Interface Malfunctions - Cont.

Malfunction	Symptom / Possible Cause	Operator Action
Weapon does not fire	Weapon may be jammed Weapon may be malfunctioning Remote firing solenoids may be malfunctioning	1. Clear weapon. Remove and secure any rounds that have been cleared. 2. Electrically fire the system and listen for audible indication of solenoid actuating. – If solenoid is actuating, the weapon has malfunctioned. – If solenoid is not actuating, the solenoid or firing circuit has malfunctioned. 3. Manually fire the weapon. 4. M2 HB – Verify headspace and timing. Send weapon to next higher maintenance. – Send RFA to next higher maintenance. 5. Mk19 – Send weapon to next higher maintenance. – Send remote firing solenoid next higher maintenance. M240B – Send weapon to next higher maintenance. – Send remote firing solenoid to next higher maintenance. 6. M249 – Send weapon to next higher maintenance. – Send remote firing solenoid to next higher maintenance.
Weapon jammed	Links or ammunition may have jammed weapon or weapon has malfunctioned Round may be stuck in the chamber	1. Change barrel in accordance with applicable TM. 2. Verify mechanical headspace and timing. 3. Verify RFA timing (M2 only). 4. Verify boresight. 5. Charge weapon. 6. If fault remains, send weapon to next higher maintenance.

END OF WORK PACKAGE

OPERATOR's MANUAL
FOR THE
ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

TROUBLESHOOTING INDEX

This work package contains troubleshooting information for locating and correcting problems that may develop in the CROWS and its subassemblies.

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GENERAL PROCEDURES

NOTE

Before performing an Operator Action (column 3), refer to the procedures listed below.

Refer to WP 0035, References, for vehicle and weapon operator and maintenance manuals.

To ensure cable connections are made as specified, refer to WP 0005 for the overall Interconnect Diagram (ICD), and to WP 0007, WP 0009, WP 0011 or WP 0013 for the ICD specifically applicable to the M2 HB, Mk19, or M240/M249 weapon adapter kits (WAKs), respectively.

Use the following procedures when working on the CROWS system.

Tables 1 through 4 are furnished as an aid in localizing equipment problems. These tables list screen messages that you may find in the operation of the CROWS system. They contain actions to resolve performance issues, with directions given for referring problems to next higher maintenance.

- If an error message is displayed on the screen, refer to Tables 1 through 4 for a possible cause and operator action. Table 1 covers general faults, Table 2 lists the failed subsystem messages, Table 3 details systems report messages, and Table 4 describes informational messages.

Table 5 is a listing of problems and Table 6 is a listing of visual faults that you may encounter.

This manual cannot list all of the faults, malfunctions, symptoms, or possible causes, nor all tests, inspections, or corrective actions. If a malfunction is not listed or if the measures suggested do not restore normal operation, notify your next higher maintenance and return the CROWS system to the maintenance facility for further troubleshooting and repair.

GENERAL PROCEDURES - Cont

CAUTION

Ensure proper alignment of connector keyways prior to installing cables.

Cover connectors with the appropriate connector cap attached to the cable assembly if not connected to a mating connector.

Ensure system power is off when connecting and disconnecting cables

Ensure weapon is cleared and any cleared rounds are secured before performing any procedures unless specifically directed to load the weapon. For instructions on loading and firing the weapons, refer to WP 0018 (M2), WP 0019 (Mk19), WP 0020 (M240B), or WP 0021 (M249).

Failure to follow these instructions may result in equipment damage, system inoperability, or damage to the electrical pins and other equipment.

1. Ensure system is properly connected.

2. Perform a physical inspection of the system per WP 0026, Preventive Maintenance Checks and Services (PMCS).

3. Perform the Before Operational Check in WP 0027 before proceeding with troubleshooting.

4. Perform the procedures in the Operator Action column of the tables in sequential order.

TROUBLESHOOTING INDEX

Fault Messages

General Fault Messages

Table 1 lists general fault messages shown on the CROWS Display Unit (DU) screen and possible causes. Steps are given for resolution of performance issues or to return the CROWS system to next higher maintenance.

CAUTION

For specific gyro faults – in addition to the fault message shown on the screen – the STAB status message at the top of the screen will change. The change will read either STAB: EL OFF or STAB: AZ OFF depending on the fault (as detailed in the following table). As a result, when the fault message appears, the operator must also check the STAB status line. Failure to follow this instruction may result in system inoperability.

Table 1. General Fault Messages.

Message	Symptom / Possible Cause	Operator Action
"BALLISTIC FILE ERROR"	An error was detected in the ballistics file for the selected weapon and ammunition combination.	1. Switch to another ammunition for this weapon. 2. Reboot system and verify fault. 3. Return system to next higher maintenance.
"BATTERY LOW"	Battery output voltage is low.	1. Recharge vehicle battery by starting vehicle. 2. If vehicle battery is flat, use cables and another vehicle to jump-start your vehicle.
"BURST RELAY FAILED CLOSED"	The relay that controls the burst firing of the weapon and safety interrupts has failed short circuit.	**CAUTION** No-fire zones, burst mode, single-burst mode, and safety interlocks will not function. 1. Reboot system and verify fault. 2. Send system to next higher maintenance.

Table 1. General Fault Messages – Cont.

Message	Symptom / Possible Cause	Operator Action
"BURST RELAY FAILED OPEN"	The relay that controls the burst firing of the weapon and safety interrupts has failed in an open circuit.	1. Use SAFETY OVERRIDE switch to override burst control relay. **CAUTION** No-fire zones, burst mode, single-burst mode, and safety interlocks will not function. 2. Reboot system and verify fault. 3. Send system to next higher maintenance.
"CANTEL SENSOR FAILED"	Communication with the cant and elevation sensor is not operating properly.	1. Cant and Elevation measurement is not available. System operates with degraded ballistics performance. 2. Cant and Elevation may be manually entered for ballistic calculation if defaults do not suffice. 3. Reboot system and verify fault. 4. Send sensor unit to next higher maintenance.
"FIRING STATE UNKNOWN"	Communication with ICU is not operating properly and firing relay state is unknown.	1. Use Safety Over-Ride if firing is absolutely necessary. **CAUTION** No-fire zones, burst mode, single-burst mode, and safety interlocks will not function. 2. Reboot system and verify fault. 3. Send system to next higher maintenance.
NOTE If "GWS BIT ERROR – FIRING INHIBITED" message appears on the display screen, attempt to reset by toggling the SAFETY OVERRIDE switch on the SPU (moving the switch back and forth [OFF or ON] from any current setting, or cycling either ON-OFF-ON or OFF-ON-OFF). If fault still appears, refer to WP 0024, Troubleshooting Index, Table 1, General Fault Messages subsection, for the "GWS BIT ERROR – FIRING INHIBITED" message.		
"GWS BIT ERROR – FIRING INHIBITED"	The mount BIT has reported a failure and firing has been inhibited. System control may not function properly	**NOTE** Press the STAB switch LEFT for OFF; press RIGHT for ON. 1. Go to Failed Subsystems Screen (see WP 0015, Menu System, Control Group, Operational Overview subsection), to log exact failure. 2. Use SAFETY OVERRIDE switch to reset gimbal. 3. Reboot system and verify fault. 4. If fault continues, send system to next higher maintenance.
"LASER FAILED"	Communication with the Laser rangefinder is not operating properly. Rangefinder is not functioning.	1. Range must be manually entered for ballistic calculation. 2. Reboot system and verify fault. 3. If fault remains, enter a manual range to engage targets. 4. Send sensor unit to next higher maintenance.

TROUBLESHOOTING INDEX - Cont

Fault Messages - Cont

General Fault Messages – Cont

Table 1. General Fault Messages – Cont.

Message	Symptom / Possible Cause	Operator Action
“LASER NOT CHARGED”	The high voltage capacitor inside the laser rangefinder did not successfully charge and the laser will not range. Rangefinder is not functioning.	1. Range must be manually entered for ballistic calculation. 2. Reboot system and verify fault. 3. Allow laser rangefinder to cool for 15 minutes and retry. 4. If fault remains, enter a manual range to engage targets. 5. Return sensor unit to next higher maintenance.
“NO BALLISTIC SOLUTION INITIATE”	The mount does not change position when a range to the target is accepted.	1. Reboot system and verify fault. 2. If fault continues, send system to next higher maintenance.
"Off Target"		1. Need new valid ballistic solution. 2. LASE for a new ballistic solution.
“PRESSURE SENSOR FAILED”	Communication with the pressure sensor is not operating properly. Pressure measurement is not available.	1. Pressure must be entered manually if default does not suffice. 2. Reboot system and verify fault. 3. Return sensor unit to next higher maintenance.
“TEMPERATURE SENSOR FAILED”	Communication with the temperature sensor is not operating properly. Temperature measurement is not available.	1. Temperature must be entered manually if default does not suffice. 2. Reboot system and verify fault. 3. Return sensor unit to next higher maintenance.
“TRIGGER RELAY FAILED CLOSED”	Trigger will not function. The relay that controls the trigger of the weapon has failed short circuit.	1. Reboot system and verify fault. 2. Manually fire the weapon. 3. Return ICU to next higher maintenance.
“TRIGGER RELAY FAILED OPEN”	Trigger will not function. The relay that controls the trigger of the weapon has failed open circuit.	1. Reboot system and verify fault. 2. Manually fire the weapon. 3. Return ICU to next higher maintenance.
“TRP Fault”	Cannot set TRP positions	1. Reboot system and verify fault. 2. Send sensor unit to next higher maintenance.

Table 1. General Fault Messages – Cont.

Message	Symptom / Possible Cause	Operator Action
"TX NOT DETECTED"	Laser rangefinder did not transmit laser energy.	1. LASE on an alternate target to verify function of LRF. 2. If fault remains, reboot system and verify fault. 3. If fault still remains, target range must be manually entered for ballistic calculation. 4. Return sensor unit to next higher maintenance.
"WEAPON NOT BORESIGHTED"	The current weapon has not been boresighted or the boresight information has been cleared. The weapon may not be recognized by the system.	1. Boresight the system. 2. Inspect weapon cable for proper connection. 3. If target engagement imminent, continue engagement using the laser aim point adjusting laser aim point for round impact.

CAUTION

For specific gyro faults – in addition to the fault message shown on the screen – the STAB status message at the top of the screen will change. The change will read either STAB: EL OFF or STAB: AZ OFF depending on the fault (as detailed in the following table). As a result, when the fault message appears, the operator must also check the STAB status line. Failure to follow this instruction may result in system inoperability.

Failed Subsystem Messages

Table 2 lists messages related to failed subsystems with possible causes. Steps are given for resolution of performance issues or to return the CROWS system to next higher maintenance.

Table 2. Failed Subsystem Messages.

Message	Symptom / Possible Cause	Operator Action
"Air Pressure Sensor"	Communication with the pressure sensor is not operating properly. Pressure measurement is not available.	1. Reboot system. 2. If fault continues, pressure must be entered manually if default does not suffice. 3. Return sensor unit to next higher maintenance.
"Azimuth Drive"	The mount has detected an azimuth drive failure. System azimuth control may not function properly.	1. Go to Failed Subsystems Screen (see WP 0015, Menu System, Control Group, Operational Overview subsection), to log exact failure. 2. Use SAFETY OVERRIDE switch to reset gimbal. 3. Reboot system and verify fault. 4. If fault continues, send mount to next higher maintenance.
"Azimuth Resolver"	The mount has detected an azimuth resolver failure. System azimuth control may not function properly	1. Go to Failed Subsystems Screen (see WP 0015, Menu System, Control Group, Operational Overview subsection), to log exact failure. 2. Use SAFETY OVERRIDE switch to reset gimbal. 3. Reboot system and verify fault. 4. If fault continues, return mount to next higher maintenance.

TROUBLESHOOTING INDEX - Cont

Fault Messages - Cont

Failed Subsystem Messages – Cont

Table 2. Failed Subsystem Messages – Cont.

Message	Symptom / Possible Cause	Operator Action
NOTE On the Engagement screen, when an error occurs, the STAB STATUS message becomes AZ OFF. On the Failed Subsystems Screen, both AZ related items can be showing at the same time. If both the elevation and azimuth gyros fail, all four EL and AZ messages from the Symptom / Possible Cause column can be shown at the same time.		
"AZ Gyro Fail"	Az Gyro Offline Gimbal Elevation Gyro	1. Go to Failed Subsystems Screen (see WP 0015, Menu System, Control Group, Operational Overview subsection), to log exact failure. 2. Use SAFETY OVERRIDE switch to reset gimbal. 3. Reboot system and verify fault. 4. Send mount to next higher maintenance.
"Burst Relay Failed Closed"	The relay that controls the burst firing of the weapon and safety interrupts has failed short circuit.	**CAUTION** No-fire zones, burst mode, single-burst mode, and safety interlocks will not function. 1. Reboot system and verify fault. 2. Send ICU to next higher maintenance.
"Burst Relay Failed Open"	The relay that controls the burst firing of the weapon and safety interrupts has failed in an open circuit.	1. Use SAFETY OVERRIDE switch to override burst control relay. **CAUTION** No-fire zones, burst mode, single-burst mode, and safety interlocks will not function. 2. Reboot system and verify fault. 3. Send ICU to next higher maintenance.
"CantEl Sensor"	Communication with the cant and elevation sensor is not operating properly.	1. Cant and Elevation measurement is not available. System operates with degraded ballistics performance. 2. Cant and Elevation must be manually entered for ballistic calculation if defaults do not suffice. 3. Reboot system and verify fault. 4. Send sensor unit to next higher maintenance.
"Day Camera"	Day Camera has failed.	1. Use thermal camera. 2. Reboot system and verify fault. 3. Send sensor unit to next higher maintenance.

Table 2. Failed Subsystem Messages – Cont.

Message	Symptom / Possible Cause	Operator Action
NOTE On the Engagement screen, when an error occurs, the STAB STATUS message becomes EL OFF. On the Failed Subsystems Screen, both EL related items can be showing at the same time. If both the elevation and azimuth gyros fail, all four EL and AZ messages from the Symptom / Possible Cause column can be shown at the same time.		
"EL Gyro Fail"	Al Gyro Offline Gimbal Elevation Gyro	1. Go to Failed Subsystems Screen (see WP 0015, Menu System, Control Group, Operational Overview subsection), to log exact failure. 2. Use SAFETY OVERRIDE switch to reset gimbal. 3. Reboot system and verify fault. 4. Send mount to next higher maintenance.
"Firing State Unknown"	Communication with ICU is not operating properly and firing relay state is unknown.	1. Reboot system and verify fault. 2. Use Safety Over-Ride if target engagement is required. **CAUTION** No-fire zones, burst mode, single-burst mode, and safety interlocks will not function. 3. Manually fire the weapon. 4. Send EMU to next higher maintenance.
"Gimbal Azimuth Gyro"	The mount has detected an azimuth gyro failure. System azimuth control or stabilization may not function properly	1. Go to Failed Subsystems Screen (see WP 0015, Menu System, Control Group, Operational Overview subsection), to log exact failure. 2. Use SAFETY OVERRIDE switch to reset gimbal. 3. Reboot system and verify fault. 4. If fault continues, send mount to next higher maintenance.
"Gimbal Elevation Gyro"	The mount has detected an elevation gyro failure. System azimuth control or stabilization may not function properly.	1. Go to Failed Subsystems Screen (see WP 0015, Menu System, Control Group, Operational Overview subsection), to log exact failure. 2. Use SAFETY OVERRIDE switch to reset gimbal. 3. Reboot system and verify fault. 4. If fault continues, send mount to next higher maintenance.
"Gimbal Joystick Interface"	The joystick to mount communication interface has detected a problem. The mount may not function properly.	1. Reboot system and verify fault. 2. Manually fire the weapon. 3. If fault continues, send system to next higher maintenance.
"Laser"	The laser rangefinder has failed. Laser rangefinder may have overheated due to improper use.	1. Reboot system and verify fault. 2. Allow laser to cool for 15 minutes and retry. 3. If laser is still not working revert to manual range input. 4. If fault continues, send sensor unit to next higher maintenance.

TROUBLESHOOTING INDEX - Cont

Fault Messages - Cont

Failed Subsystem Messages – Cont

Table 2. Failed Subsystem Messages – Cont.

Message	Symptom / Possible Cause	Operator Action
“Sight Elevation Drive”	Mount has detected a sight elevation drive failure. SEM control may not function properly.	1. Go to Failed Subsystems Screen (see WP 0015, Menu System, Control Group, Operational Overview subsection), to log exact failure. 2. Use SAFETY OVERRIDE switch to reset gimbal. 3. Reboot system and verify fault. 4. If fault continues, return mount to next higher maintenance.
“Sight Elevation Resolver“	Mount has detected a sight elevation resolver failure. SEM control may not function properly	1. Go to Failed Subsystems Screen (see WP 0015, Menu System, Control Group, Operational Overview subsection), to log exact failure. 2. Use SAFETY OVERRIDE switch to reset gimbal. 3. Reboot system and verify fault. 4. If fault continues, return mount to next higher maintenance.
“Temperature Sensor“	Communication with the temperature sensor is not operating properly. Temperature measurement is not available.	1. Temperature must be entered manually if default does not suffice. 2. Return sensor unit to next higher maintenance.
“Thermal Camera”	Thermal camera has failed.	1. Use day camera. 2. Reboot system and verify fault. 3. Send sensor unit to next higher maintenance.
“Trigger Relay Fail Closed”	Trigger will not function. The relay that controls the trigger of the weapon has failed short circuit.	1. Manually fire the weapon. 2. Return ICU to next higher maintenance.
“Trigger Relay Fail Open”	Trigger will not function. The relay that controls the trigger of the weapon has failed open circuit.	1. Manually fire the weapon. 2. Return ICU to next higher maintenance.
“Video System”	The video system in the EMU has failed.	1. Reboot system and verify fault. 2. Send EMU to next higher maintenance.
“WAM configuration”	The WAM (Weapons and Ammunition Management) configuration setup has failed.	1. Reboot system and verify fault. 2. Send EMU to next higher maintenance.

Table 2. Failed Subsystem Messages – Cont.

Message	Symptom / Possible Cause	Operator Action
“Weapon Charger”	The mount has detected a failure of the remote charger.	1. Go to Failed Subsystems Screen (see WP 0015, Menu System, Control Group, Operational Overview subsection), to log exact failure. 2. Use SAFETY OVERRIDE switch to reset gimbal. 3. Reboot system and verify fault. 4. If fault continues, return mount to next higher maintenance.
“Weapon Elevation Drive”	The mount has detected an elevation drive failure. Elevation drive control may not function properly.	1. Go to Failed Subsystems Screen (See WP 0015, Menu System, Control Group, Operational Overview subsection), to log exact failure. 2. Use SAFETY OVERRIDE switch to reset gimbal. 3. Reboot system and verify fault. 4. If fault continues, return mount to next higher maintenance.
“Weapon Elevation Resolver”	The mount has detected an elevation resolver failure. Elevation drive control may not function properly.	1. Go to Failed Subsystems Screen (see WP 0015, Menu System, Control Group, Operational Overview subsection), to log exact failure. 2. Use SAFETY OVERRIDE switch to reset gimbal. 3. Reboot system and verify fault. 4. If fault continues, return mount to next higher maintenance.

TROUBLESHOOTING INDEX - Cont

Fault Messages - Cont

System Report Messages

Table 3 lists system report messages with possible causes. Steps are given for resolution of performance issues or to return the CROWS system to next higher maintenance.

CAUTION

For specific gyro faults – in addition to the fault message shown on the screen – the STAB status message at the top of the screen will change. The change will read either STAB: EL OFF or STAB: AZ OFF depending on the fault (as detailed in the following table). As a result, when the fault message appears, the operator must also check the STAB status line. Failure to follow this instruction may result in system inoperability.

Table 3. System Report Messages.

Message	Symptom / Possible Cause	Operator Action
"EMU Failed"	EMU has failed.	1. Go to Failed Subsystem Messages (Table 2) to log exact failure. 2. Reboot system and verify fault. 3. Send EMU to next higher maintenance.
"Gimbal BIT Status Failed"	The mount has detected a fault and may not function properly.	**NOTE** Sub-zero temperatures may require a 2-3 minute warm up period. If you get this message during sub-zero temperatures, leave the system powered up for 2-3 minutes. 1. Go to Failed Subsystems Screen (see WP 0015, Menu System, Control Group, Operational Overview subsection), to log exact failure. 2. Use SAFETY OVERRIDE switch to reset gimbal. 3. Reboot system and verify fault. 4. If fault continues, return mount to next higher maintenance.
"Gimbal BIT Status Unknown"	The mount is not connected or not communicating.	1. Go to Failed Subsystem Messages (Table 2) to log exact failure. 2. Verify cable connections. 3. Reboot system and verify fault. 4. If fault continues, return system to next higher maintenance.
"Gimbal Comms Failed"	The mount and ICU/EMU have detected a communication problem.	1. Go to Failed Subsystem Messages (Table 2) to log exact failure. 2. Reboot system and verify fault. 3. If fault continues, send system to next higher maintenance.

Table 3. System Report Messages - Cont.

Message	Symptom / Possible Cause	Operator Action
“ICU Failed”	The ICU has failed.	**NOTE** Sub-zero temperatures may require a 2-3 minute warm up period. If you get this message during sub-zero temperatures, leave the system powered up for 2-3 minutes. 1. Reboot system and verify fault. 2. If fault continues, send mount to next higher maintenance.
“No Fire Zones”	The EMU has failed to define a custom no-fire zone.	1. Go to Failed Subsystem Messages (Table 2) to log exact failure. 2. If unable to define fire zone, use default fire zone. 3. Send EMU to next higher maintenance.
“Sensor Unit Failed”	The sensor unit has failed.	1. Go to Failed Subsystem Messages (Table 2) to log exact failure. 2. Reboot system and verify fault. 3. If fault continues, send sensor unit to next higher maintenance.
“Sensor Unit Unknown”	The mount or Sensor Unit is not connected or not communicating.	1. Go to Failed Subsystem Messages (Table 2) to log exact failure. 2. Verify cable connections. 3. Reboot system and verify fault. 4. If fault continues, return system to next higher maintenance.
“TRIGGER HELD”	Trigger was held down during boot up and the system will not arm.	1. Release the trigger. 2. Reboot the system.

TROUBLESHOOTING INDEX - Cont

Informational Messages

Table 4 covers informational messages with possible causes where applicable. Steps are given for resolution of performance issues or to return the unit to next higher maintenance.

Table 4. Informational Messages.

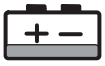
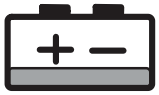
Message	Symptom / Possible Cause	Operator Action
"AIMPOINT OUT OF RANGE"	The ballistic calculation has exceeded the azimuth or elevation bounds of the DU.	1. Abort current target engagement until target is close enough. 2. Revert to manual range input.
NOTE A battery symbol (icon), with green voltage-level indicator, may appear on the display screen, as shown below. Follow the screen message instructions. For additional voltage-level icons, refer to the following messages in this table: "Battery Critically Low – Shutdown Now"; "Battery Critically Low – Start Vehicle"; and "Low Battery – Start Vehicle." 19.5V Level  20V Level  21V Level (default)  22V Level  23V Level  24V Level 		
"Battery Critically Low – Shutdown Now" A battery icon with a green 20V-level indicator is shown: 	The battery voltage is 20V.	1. Shut down CROWS. 2. Revert to manual firing.
"Battery Critically Low – Start Vehicle" A battery icon with a green 21V level indicator is shown: 	The battery voltage is at 21V.	1. Start the vehicle.

Table 4. Informational Messages - Cont.

Message	Symptom / Possible Cause	Operator Action
"End of Focus"	The focus limit for the selected camera has been reached.	1. Reset focus.
"End of Zoom"	The zoom limit for the selected camera has been reached.	1. Reset zoom.
"Excessive Range"	The detected range to the target is in excess of the capabilities of the selected weapon and ammunition combination.	1. Abort current target engagement until target is close enough.
NOTE A hatch-open symbol (icon) may appear on the display screen, as shown below. (See the **NOTE** in the Symptom / Possible Cause column regarding the number of hatches involved.) Follow the screen message instructions. For additional hatch-open icons, refer to the following messages in this table: "Hatch Open 1 - Firing Inhibited" and "Hatch Open 2 - Firing Inhibited." Hatch-open 1 icon:  Hatch-open 2 icon:  Hatches-open 1 and 2 icon: 		
"Hatch Open 1 - Firing Inhibited" (Message appears when a different hatch is opened; not currently in use for CROWS) A hatch-open 1 icon is shown: 	Hatch 1 is open. Only firing is inhibited. **NOTE** The number of hatches depends on the vehicle configuration.	1. Close hatch. 2. Use Safety Override switch. **WARNING** The gun defaults to continuous fire mode. Safety interlocks will not function. Only firing is inhibited.

TROUBLESHOOTING INDEX - Cont

Informational Messages - Cont

Table 4. Informational Messages - Cont.

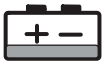
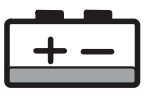
Message	Symptom / Possible Cause	Operator Action
"Hatch Open 2 - Firing Inhibited" (Message appears when the top hatch is open) A hatch-open 2 icon is shown:  **NOTE** For additional information on hatch-related icons, see NOTE above "Hatch Open 1 - Firing Inhibited" message.	Hatch 2 is open. Both firing and weapon movement are inhibited. **NOTE** The number of hatches depends on the vehicle configuration.	1. Close hatch. 2. Use Safety Override switch. **WARNING** The gun defaults to continuous fire mode. Safety interlocks will not function. Both firing and weapon movement are inhibited.
"LASER FIRING RATE EXCEEDED"	The safe laser firing rate of 6 ranges per minute has been exceeded.	1. Wait 1 minute before re-firing laser range finder.
NOTE A red battery symbol (icon), with green voltage-level indicator, may appear on the display screen, as shown below. Follow the screen message instructions. For additional voltage-level icons, refer to the following messages in this table: "Battery Critically Low – Shutdown Now"; "Battery Critically Low – Start Vehicle"; and "Low Battery – Start Vehicle." 19.5V Level  20V Level  21V Level (default)  22V Level  23V Level  24V Level 		
"Low Voltage – Start Vehicle" A battery icon with a green level indicator is shown: 	Message appears between user-preset voltage above 21V (if set) down to the default value (21V).	1. Start the vehicle.

Table 4. Informational Messages - Cont.

Message	Symptom / Possible Cause	Operator Action
“Motion Inhibit”	Message appears when the weapon barrel approaches the border of a motion-inhibit zone or when the ballistic solution would put the barrel into a motion-inhibit zone.	1. Move the weapon away from the motion-inhibit zone. 2. If motion inhibits are incorrect, notify next higher level of maintenance.
“No Firing Solution”	No ballistics solution was possible for the detected target.	1. Reattempt ballistics solution.
“No Target Detected”	No laser return was detected from the laser firing.	1. Reattempt ballistics solution. 2. Lase different target.
“Off Target”	The message appears when the weapon is out of position with the last ballistic solution.	1. Re-engage the target.
“Safety Override - ACTIVE”	Several items – including hatch interlocks, default custom no-fire zones and custom no-fire zones; motion inhibit zones, and burst control functioning – may have been overridden with the Safety Override switch on the SPU.	WARNING The gun defaults to continuous fire mode. Hatch interlocks, no-fire zones, motion-inhibit zones, and burst control will not function. Motion control is active. 1. No corrective action needed.
“Scanning TRP - press LASE”	The system is in TRP mode and pressing the LASE key will stop scanning the TRPs.	1. Press LASE key.
“Sector Scanning - press DEADMAN”	The system is currently in Sector Scanning mode and pressing the DEADMAN will stop Sector Scanning.	1. Press DEADMAN key.
“Thermal Camera Setting Up”	The thermal camera undergoes an initial setup when it is first selected, which is more time-consuming than subsequent selections.	1. Wait until message terminates before proceeding.

TROUBLESHOOTING INDEX - Cont

Fault System Index

Table 5 contains a listing of common faults to aid in locating equipment problems that may develop in the CROWS and its subassemblies. Steps are given for resolution of performance issues or to return the unit to next higher maintenance.

Table 5. Fault System Index.

Fault No.	Problem:	Action
1.	Ammunition type will not select properly.	Send CROWS system to next higher level of maintenance.
2.	Boresighting menus will not function properly.	Send CROWS system to next higher level of maintenance.
3.	Boresighting solution is not accurate.	1. Check boresight telescope and mandrel. Replace if defective. 2. Send CROWS system to next higher level of maintenance.
4.	Color settings will not change.	Send CROWS system to next higher level of maintenance.
5.	Continually getting GWS BIT errors.	Send CROWS system to next higher level of maintenance.
6.	DU does not turn on when power is applied for 1 minute, 15 seconds.	Send CROWS system to next higher level of maintenance.
7.	DU screen has graphics; system operates, but no video (screen is blue).	Send CROWS system to next higher level of maintenance.
8.	DU screen remains black after power up.	Send CROWS system to next higher level of maintenance.
9.	DU screen remains gray.	Send CROWS system to next higher level of maintenance.
10.	Elevation or azimuth drives do not move.	1. Ensure azimuth lock is unlocked. 2, Send CROWS system to next higher level of maintenance.
11.	"EMU Failed" or "EMU Unknown" screen message.	Send CROWS system to next higher level of maintenance.
12.	Focus will not adjust.	Send CROWS system to next higher level of maintenance.
13.	Field of View (FOV) will not adjust.	Send CROWS system to next higher level of maintenance.
14.	"Gimbal Comms Failed" screen message.	Send CROWS system to next higher level of maintenance.
15.	GWS BIT error occurs when going from Surveillance mode to normal operation (lase mode).	Send CROWS system to next higher level of maintenance.
16.	“Hatch Open 1 – Firing Inhibited” or “Hatch Open 2 – Firing Inhibited” message appears.	1. Ensure hatches are properly closed. 2. Send CROWS system to next higher level of maintenance.
17.	"ICU Failed" or "ICU Unknown" screen message.	Send CROWS system to next higher level of maintenance.
18.	Laser failure.	Send CROWS system to next higher level of maintenance.

Table 5. Fault System Index - Cont.

Fault No.	Problem:	Action
19.	Laser will not fire or return a range.	Send CROWS system to next higher level of maintenance.
20.	Linear actuator (charger) is driving, but the sear assembly is not being released (M2 only).	Send CROWS system to next higher level of maintenance.
21.	Linear actuator (charger) is not driving to the full rear position.	Send CROWS system to next higher level of maintenance.
22.	Linear (charger) actuator is not working.	Send CROWS system to next higher level of maintenance.
23.	Linear (charger) actuator is excessively noisy.	Send linear (charger) actuator to next higher level of maintenance.
24.	Mount moves uncommanded when system is powered up.	Send CROWS system to next higher level of maintenance.
25.	Mount shakes excessively when slewing.	Send CROWS system to next higher level of maintenance.
26.	Mount will not move to proper target point.	Send CROWS system to next higher level of maintenance.
27.	NO-FIRE ZONES are not working properly.	Send CROWS system to next higher level of maintenance.
28.	No focus on day or thermal camera.	Send CROWS system to next higher level of maintenance.
29.	No power.	Send CROWS system to next higher level of maintenance.
30.	Opening the hatch(es) did not “SAFE” the system.	Send CROWS system to next higher level of maintenance.
31.	Polarity of thermal camera will not change.	Send CROWS system to next higher level of maintenance.
32.	Precise movement of aimpoint is not possible (when zoomed in).	Send CROWS system to next higher level of maintenance.
33.	"Rainbow" screen appears when in Thermal cameral.	System is not warmed up enough for thermal camera. Wait until system is warmed up.
34.	Range step settings will not change.	Send CROWS system to next higher level of maintenance.
35.	Rounds count will not select properly.	Send CROWS system to next higher level of maintenance.
36.	SAFE/ARMED indications on screen are incorrect and do not correspond to switch positions on SPU.	Send CROWS system to next higher level of maintenance.
37.	SAFE-SAFE message appears in upper right-hand corner of screen (under weapon/ammunition type).	Send CROWS system to next higher level of maintenance.
38.	Safety Override is not overriding the hatch interlock.	Send CROWS system to next higher level of maintenance.
39.	Screen indicators are not following the movement of the mount.	Send CROWS system to next higher level of maintenance.

TROUBLESHOOTING INDEX - Cont

Fault System Index - Cont

Table 5. Fault System Index – Cont.

Fault No.	Problem:	Action
40	Screen is blue without video or graphics.	Send CROWS system to next higher level of maintenance.
41.	Selecting Display Switch does not put system into TRP menu.	Send CROWS system to next higher level of maintenance.
42.	Sensor settings will not change or are not accurate.	Send CROWS system to next higher level of maintenance.
43.	"Sensor Unit Failed" or "Sensor Unit Unknown" screen message.	Send CROWS system to next higher level of maintenance.
44.	System drifts in AZ after system power up.	Send CROWS system to next higher level of maintenance.
45.	System firing circuit is not working properly.	Send CROWS system to next higher level of maintenance.
46.	System will not go into sector scan.	Send CROWS system to next higher level of maintenance.
47.	Target points will not be accepted, stored, or deleted properly.	Send CROWS system to next higher level of maintenance.
48.	There is power to the screen, but no display.	Send CROWS system to next higher level of maintenance.
49.	Thermal cameral image is intermittent or flickers in high temperature.	Send CROWS system to next higher level of maintenance.
50.	Units settings will not change.	Send CROWS system to next higher level of maintenance.
51.	Weapon firing solenoid not working.	Send CROWS system to next higher level of maintenance.
52.	Weapon rounds counter not working.	1. Perform rounds count adjustment procedure for the appropriate weapon. 2. Send weapon rounds counter to next higher level of maintenance.
53.	Will not enter or function properly in surveillance mode.	Send CROWS system to next higher level of maintenance.
54	“WPN CHARGED” indicator on DU is not displaying properly.	Send CROWS system to next higher level of maintenance.

Malfunction Visual Fault Index

Table 6 contains a listing of common visual faults to aid in resolving equipment problems that may develop in the CROWS and its subassemblies. Steps are given for resolution of performance issues or to return the unit to next higher maintenance.

Table 6. Malfunction Visual Fault Index.

Visual Fault	Symptom / Possible Cause	Operator Action
Laser rangefinder does not function.	Loose cable Unusual weather	1. Check cables. 2. Re-fire laser. 3. Proceed to manual operation of the laser rangefinder IAW WP 0015, Menu System, Modifying Sensor Information section, Manual Input: Range to Target section.
No image from the day camera.	Sensor unit is not sending a day video signal	1. Switch to thermal camera and use thermal camera. 2. Reboot system and verify fault. 3. If not working, send sensor unit to next higher level of maintenance.
No image from the thermal camera.	Sensor unit is not sending a thermal video signal	1. Switch to day camera during day operations. 2. Reboot system and verify fault. 3. If not working, send sensor unit to next higher level of maintenance.
No image or graphic overlay on DU.	No video or graphics are being sent to the DU	1. Ensure cables are connected and DU power is ON. 2. Ensure nothing is covering camera lens. 3. Reboot system and verify fault. 4. If fault continues, return system to next higher level of maintenance.
No image on DU, but graphic overlay is present.	EMU is not generating video output	1. Switch from day camera to thermal or vice-versa. 2. If getting an image on the opposite camera, use opposite camera. 3. Check all cable connections. 4. Reboot system and verify fault. 5. If not working, send system to next higher level of maintenance.

TROUBLESHOOTING INDEX - Cont

Malfunction Visual Fault Index - Cont

Table 6. Malfunction Visual Fault Index- Cont.

Visual Fault	Symptom / Possible Cause	Operator Action
No response to joystick control switch controls.	Joystick switch commands are not being transmitted or received	1. Use control switches on DU. 2. If control switches on DU function properly, send joystick to next higher level of maintenance. 3. If control switches on DU function do not function properly, ensure cables are connected and reboot system and verify fault. 4. If fault continues, send ICU to next higher level of maintenance.
No response to joystick motion control for azimuth and elevation slewing of the mount.	Joystick control of mount movement has been lost	1. Manually fire the weapon. 2. Ensure cables are connected. 3. Reboot system and verify fault. 4. Set a range manually. 5. Accept ballistics solution. 6. If mount moves in azimuth and elevation, replace joystick. 7. If fault continues, send mount to next higher level of maintenance.
Sensor unit does not respond.	No image from the day and thermal camera Cannot measure range, temp, cant and elevation	1. Ensure cables are connected. 2. Reboot system and verify fault. 3. If not working, send sensor unit to next higher level of maintenance.
System does not initialize when power is applied.	No or low input power Improper cabling SPU has failed ICU has failed	1. Verify charged vehicle battery. 2. Ensure all cables are connected properly. 3. Reboot system and verify fault. 4. Send system to next higher level of maintenance.

END OF WORK PACKAGE

CHAPTER 4

CROWS

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

(PMCS) MAINTENANCE INSTRUCTIONS

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) INTRODUCTION

THIS WORK PACKAGE COVERS:

Introduction to Preventive Maintenance Checks and Services (PMCS) Procedures

WP CONTENTS

Section/Subsection	Page
Introduction	1
Designated Intervals	2
PMCS Column Description	2
General Procedures	2
Correct Assembly	4
Interconnection (Connectors and Cables)	4
Considerations Before and During PMCS	4
List of “Do Not” Items	4

INTRODUCTION

NOTE

Removal and replacement of a CROWS assembly/component is permitted if the operator/crew discovers an obvious problem during visual inspection and is directed to perform the task by higher level maintenance personnel.

Preventive maintenance consists of visual inspections for physical damage and cleanliness, and procedures to correct any faults found during those inspections. Preventive maintenance prolongs service and contributes to continued, uninterrupted operation of the CROWS and its components or related parts.

PMCS means systematic caring, inspecting, and servicing of the CROWS to keep it in good condition and to prevent breakdown. If the CROWS is found to be defective during any checks, remove the CROWS from service and make repairs. Pay attention to WARNING and CAUTION statements. A WARNING means someone could be hurt. A CAUTION means equipment could be damaged.

INTRODUCTION - Cont

Designated Intervals

NOTE

Designated PMCS intervals are performed under usual operating conditions. PMCS intervals must be performed more frequently when operating under unusual conditions.

Be sure to perform your PMCS each time the CROWS is to be used. Always do the PMCS in the same order, so it gets to be a habit. Once you have had some practice, you'll quickly spot anything wrong.

Do the BEFORE PMCS just before placing the CROWS system in operation.

Do the DURING PMCS while the CROWS is being used.

Do the AFTER PMCS immediately after completion of the CROWS mission.

Do the MONTHLY PMCS every month to ensure no damage has occurred to the CROWS during storage. Also do the BEFORE and AFTER PMCS at the same time.

Use DA Form 2404 or DA Form 5988-E (electronic) to record any discrepancies discovered while doing the PMCS and report malfunctions to unit maintenance at once.

PMCS COLUMN DESCRIPTION

The PMCS procedures are contained in WP 0026, Table 1. The procedures are arranged in logical sequence requiring a minimum amount of time and motion to complete them.

ITEM NO. column. Numbers in this column are for reference. When completing DA Form 2404 (or DA Form 5988-E (electronic)), include item number for check/service indicating a fault. Item numbers appear in the order that you must do the checks and services.

INTERVAL column. This column contains the designated interval when each check/service is to be performed.

ITEM TO BE INSPECTED column. This column identifies the items to be inspected.

PROCEDURE column. This column contains a brief description of the procedures by which checks or services are to be performed, as well as any information required to accomplish each check or service.

EQUIPMENT NOT READY/AVAILABLE IF column. This column contains a brief statement of condition (e.g., malfunction, shortage) that would cause covered equipment to be less than fully ready to perform its assigned mission.

GENERAL PROCEDURES

A permanent record of the services, repairs, and modifications made to this system must be recorded IAW Army SOP. Refer to DA Pam 750-8, The Army Maintenance Management System (TAMMS) Users Manual, for a list of the forms and records required and how to complete them.

WARNING

Follow all safety warnings and cautions. Failure to follow these instructions may result in personal injury or equipment damage.

CAUTION

Do not remove cable connections for routine inspections; but if the connection is loose or there is a suspected problem with a particular cable, remove and inspect at that time.

Ensure system power is off when connecting and disconnecting cables.

Ensure weapon is cleared and any cleared rounds are secured before performing any procedures unless specifically directed to load the weapon. For instructions on loading and firing the weapons, refer to WP 0018 (M2), WP 0019 (Mk19), WP 0020 (M240B), and WP 0021 (M249).

Failure to follow these instructions may result in equipment damage and system inoperability.

NOTE

Always keep cables clean and in serviceable condition if excessive taping to outer protection casing is required.

1. Visually inspect cable assemblies for any evidence of internal or external damage, as detailed below.
   - Ensure all identification (ID) tags are installed.
   - Ensure all back shell connectors are tight.
   - Check all connector pins and sockets for damage (for example, missing, bent, or loose pins).
   - Check for damaged threads on connectors.
2. Return items to unit maintenance for the following reasons:
   - Bent, broken, or missing pins or sockets.
   - Damaged threads on connector or backshell.
   - Inoperative or damaged cables.

NOTE

Dirt, grease, oil, and debris may cover up a serious problem. Clean as you check. For cleaning procedures, refer to WP 0029, Cleaning.

For information on consumable, expendable, and durable materials, refer to WP 0038.

Should any weapon malfunction occur, refer to WP 0023, Troubleshooting – Weapon Interface Malfunctions. For screen message problems, refer to WP 0024.

3. Check all bolts, nuts, and screws. If loose, bent, broken, or missing, either tighten or report conditions to unit maintenance.
4. Look for loose or chipped paint, and rust or cracks at welds. Remove rust and loose paint, and spot paint as required. Report all cracked weld(s) to unit maintenance immediately.

GENERAL PROCEDURES - Cont

5. Inspect electrical wires and connectors for cracked or broken insulation. Also look for bare wires and loose or broken connections. Tighten loose connections. Report other problems to unit maintenance.

6. Check data, caution, and warning plates for security and legibility.

7. If a system or subsystem is not able to perform the mission, equipment will be reported as “Not Fully Mission Capable.” Refer to DA Pam 750-8.

Correct Assembly

Check each component for installation as an assembly, in the right place, and with no missing parts.

Interconnection (Connectors and Cables)

For interconnection procedures (before applying power), refer to WP 0005.

Considerations Before and During PMCS

The following general procedures are recommended to reduce maintenance time and prevent accidental damage to the equipment.

- Follow all safety regulations, warnings, cautions, and notes.
- Ensure vehicle is positioned on level ground.
- Ensure the system is powered down, the weapon is cleared, and any cleared rounds are removed. Refer to the appropriate weapon operation and maintenance manuals, as well as related CROWS manuals, detailed in WP 0035, References.
- Examine equipment carefully to determine cause of failure before removing defective or broken parts.
- Disassemble equipment only to the point necessary to perform required maintenance.
- Before disconnecting any electrical parts, ensure parts are tagged for identification.
- When removing a connector, never pull the wires on the cable/wiring harness.
- Note orientation of all parts before removal.
- Retain hardware for later use.
- Use Basic Issue Items (WP 0036) specific to CROWS when performing Preventive Maintenance Checks and Services (PMCS). Wiping cloths are needed to remove dirt or grease.
- Ensure that the diameter of any bends in the ICU-Display Unit cable (P/N 21677-3715) measures at least 5 inches.

List of “Do Not” Items

The following list highlights important maintenance information related to all aspects of CROWS.

- Do not remove terminal lugs or wire markers (electrical parts) unless replacement is necessary.
- Do not remove parts before noting orientation, including witness marks when necessary, and tagging the items for later identification.
- Do not remove parts held in place by pins secured by thread-locking compound.
- Do not lock wire one connector to another unless absolutely necessary.
- Do not use lens tissue to clean optical surfaces.
- Do not use compressed air to clean optical surfaces because the glass may become scored or pitted.
- When saving information into memory using the Menu System, a blue, horizontal status bar appears on the display unit (DU) screen. While this status bar is displayed, do not turn power OFF and do not touch any of the switches.
- Do not position the ICU-Display Unit cable (P/N 21677-3715) so that it has a diameter of less than 5 inches on any bends when the cable is installed and secured.

END OF WORK PACKAGE

OPERATOR's MANUAL
FOR THE
ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

THIS WORK PACKAGE COVERS:

PMCS.

INITIAL SET UP:

Tools and Special Tools:

Operator's Tool Kit (WP 0036, Table 2, Item 1)

Personnel Required:

Two

Materials/Parts:

Cleaning compound, lens (WP 0038, Table 1, Item 6)
Cloth, cleaning, lint free (WP 0038, Table 1, Item 7)
Lubricant, grease (WP 0038, Table 1, Item 17)
Water, distilled (WP 0038, Table 1, Item 23)

Equipment Conditions:

CROWS Set Up and Operating

References:

WP 0006
WP 0027
WP 0029
WP 0036
WP 0038
TM 9-1005-201-10
TM 9-1005-213-10
TM 9-1005-313-10
TM 9-1010-230-10

WARNING

Once power is applied, the system is fully functional and the mount and/or cradle could move. Ensure that all personnel are clear of any possible mount movement. Follow all safety warnings and cautions. Failure to do so may result in personal injury and equipment damage.

PMCS LISTING

Table 1 presents a detailed listing of the specified Preventive Maintenance tasks based on the intervals designated for each component/assembly.

PMCS Listing - Cont

CAUTION

Ensure system power is off when connecting and disconnecting cables.

Ensure weapon is cleared and any cleared rounds are secured before performing any procedures unless specifically directed to load the weapon. For instructions on loading and firing the weapons, refer to WP 0018 (M2), WP 0019 (Mk19), WP 0020 (M240B), and WP 0021 (M249).

Failure to follow these instructions may result in equipment damage and system inoperability.

Table 1. Preventive Maintenance Checks and Services (PMCS).

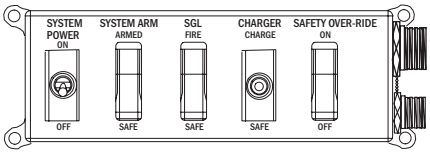
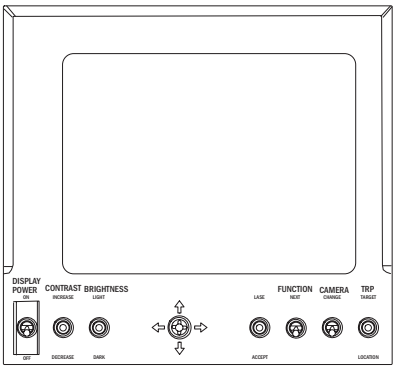
Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
			WARNING Ensure no power is applied while performing the **BEFORE** and **AFTER** PMCS operating procedures on the system unless instructed to do so.	
			CONTROL GROUP	
1	Before, During, and After	Switch Panel Unit (SPU) (Figure 1) a. POWER ON/OFF b. SYSTEM ARM / SAFE c. CHARGER / SAFE d. SAFETY OVERRIDE e. SGL FIRE/SAFE	**With power off** a. Inspect all switches for serviceability. b. Ensure safety wire is installed on connectors.  **Figure 1. SPU.**	a. Switches and/or switch guards are bent, broken, loose, missing, or inoperable. Momentary switches will not toggle. b. Safety wire is missing.

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
2	Before, During, and After	Display Unit (DU) (Figure 2) a. POWER ON/OFF b. CONTRAST INCREASE / DECREASE c. BRIGHTNESS LIGHT / DARK d. CURSOR KEYS e. LASE / ACCEPT f. FUNCTION NEXT g. CAMERA CHANGE h. TRP TARGET / LOCATION	a. Inspect all switches for serviceability. b. Ensure safety wire is installed on connectors. c. Inspect electrical cables and/or connectors that are loose or disconnected for pins that are bent, broken, or recessed. d. Inspect screen for damage.  **Figure 2. DU.**	a. Switches are broken, bent, loose, or missing. b. Safety wire not installed. c. Electrical cable and/or connector is loose or broken. Pins are bent, broken, or recessed. d. Panel glass is broken or cracked.

PMCS Listing – Cont

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

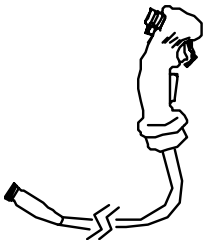
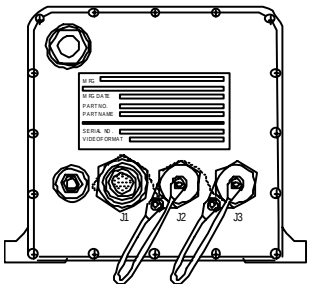
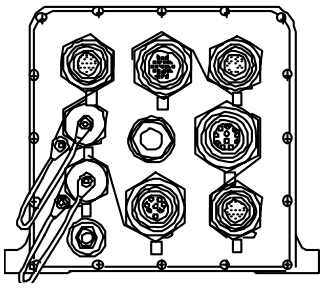
Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
3	Before, During, and After	Joystick -- Switches (Figure 3) a. MOTION CONTROL b. LEFT c. RIGHT d. STABILIZER (STAB) e. TRIGGER f. DEADMAN	a. Inspect all switches for serviceability. b. Inspect electrical cables and/or connectors that are loose or disconnected for pins that are bent, broken, or recessed. c. Inspect Trigger Guard for serviceability.  **Figure 3. Joystick.**	a. Switches are broken, bent, loose, or missing. b. Electrical cable and/or connector is loose or broken. Pins are bent, broken, or recessed. c. Safety guard on Trigger switch is missing, broken, or bent.
4	Before and After	Electronics Modular Unit (EMU) (Figure 4)	a. Verify proper installation in vehicle. b. Verify common hardware is not damaged and is properly installed. **NOTE** Vehicle's rear hatch may need to be opened to view desiccant indicator. c. Check that desiccant indicator is clear. d. Verify cables are connected. e. Ensure safety wire is installed on connectors.  **Figure 4. EMU.**	a. EMU improperly installed. b. One or more loose, missing, or damaged hardware items. Missing or stripped screws. c. Desiccant indicator is pink. d. Electrical cable and/or connector is loose or broken. e. Safety wire is missing.

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
5	Before and After	Interface Control Unit (ICU) (Figure 5)	**NOTE** Vehicle's rear hatch may need to be opened to view desiccant indicator. a. Verify proper installation in vehicle. b. Verify common hardware is not damaged and is properly installed. c. Check that desiccant indicator is clear. d. Verify cables are connected. e. Ensure safety wire is installed on connectors.  **Figure 5. ICU.**	a. ICU improperly installed. b. One or more loose, missing, or damaged hardware items. Missing or stripped screws. c. Desiccant indicator is pink. d. Electrical cable and/or connector is loose or broken. e. Safety wire is missing.

PMCS Listing – Cont

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
6	Before and After	Interconnect Cables (Figure 6) a. 21677-3700, Weapon Elevation Cable b. 21677-3706 Sensor Cable c. 21677-3713, Power Input - ICU Cable d. 21677-3714, ICU-Mount Cable e. 21677-3715, ICU -DU Cable f. 21677-3716, ICU -EMU Cable g. 21677-3720, Hatch Interlock Cable h. 21677-3730, Mount - Bulkhead Cable i. 21677-3731, Bulkhead-ICU Cable	**CAUTION** When the ICU-DU cable (P/N 21677-3715) is installed and secured, ensure that the radius of any bend measures at least 5 inches. Failure to follow this instruction may result in equipment damage and system inoperability. **NOTE** Do not disconnect any cable if it is properly connected. Threaded connectors will show a band of red if they are loose. Cable 21677-3720 is part of the Vehicle Integration Kit (VIK) (WP 0036, Table 2, Item 4).	
			a. Ensure all cables are present and identified.	a. Cables are missing. Identification tags are missing.
			b. Ensure all back shell connectors are tight.	b. Back shell connectors are loose.
			c. Ensure all cables are connected. Inspect any cables that are loose or disconnected for pins that are bent, broken, or recessed.	c. Electrical cable and/or connector is loose or broken. Pins are bent, broken, or recessed.
			d. Ensure safety wire is installed on connectors.	d. Safety wire is missing.
			e. Ensure cables are not dangling or in danger of being pinched.	e. Cables are dangling or pinched when the system is rotated.
			f. Ensure that the radius of any bends in the ICU-DU cable (P/N 21677-3715) measure at least 5 inches.	f. Cable is bent with less than a 5 inch radius.

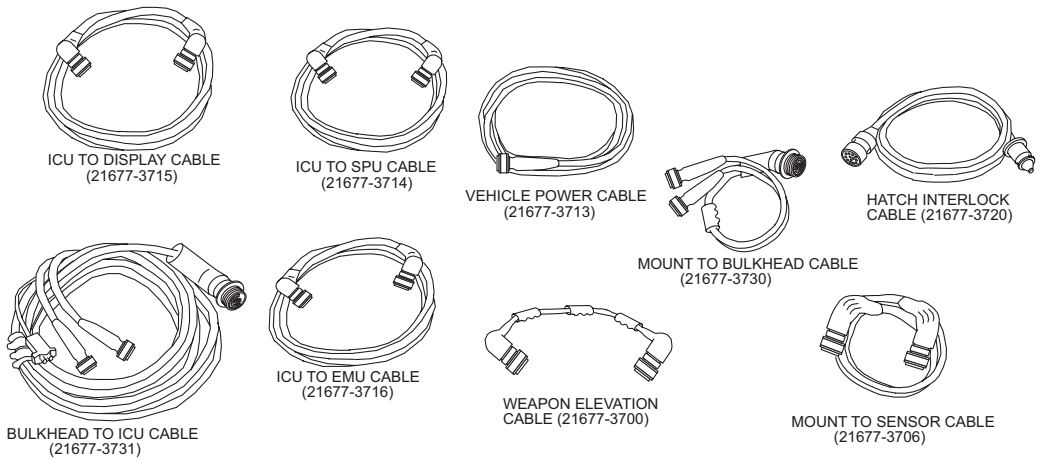
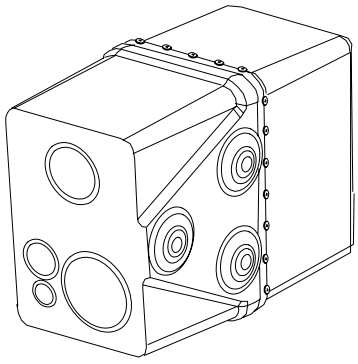


Figure 6. Interconnect Cables.

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
			SENSOR GROUP	
7	Before and After	Sensor Unit (Figure 7) a. Day sensor lens b. Thermal sensor lens c. Laser fire lens d. Laser return lens e. Sunshade	a. Verify proper installation on the mount. b. Verify common hardware is not damaged and is properly installed. c. Check and clean optical windows. d. Ensure sunshade is installed properly. **NOTE** Desiccant indicator is inside the sensor unit and can be seen through the day sensor window at approximately the 3 o'clock position. e. Check desiccant indicator for serviceability. f. Ensure safety wire is installed on connectors.  **Figure 7. Sensor Unit (Shown without Sunshade).**	a. Sensor unit is loose or not mounted correctly. b. One or more loose, missing, or damaged hardware items. Missing or stripped screws. c. Any one lens is cracked or is scratched to the point of visual impairment. d. Sunshade improperly installed. e. Desiccant indicator is at 50% or higher. f. Safety wire is missing.

PMCS Listing - Cont

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
			STABILIZED WEAPON MOUNT	
8	Before and After	Azimuth Lock and Base (Figure 8)	a. Ensure azimuth lock will lock and unlock smoothly. b. Verify common hardware is installed properly and not damaged.	a. Azimuth locking mechanism will not lock or unlock IAW WP 0006, Azimuth Lock Assembly b. One or more loose or missing hardware items.
9	Before and After	Casing Deflector (Figure 9)	a. Verify proper installation on the mount. b. Verify common hardware is not damaged and properly installed. c. Ensure bolts are tight.	a. Improperly installed on mount. b. Missing or stripped screws. c. Loose bolts.

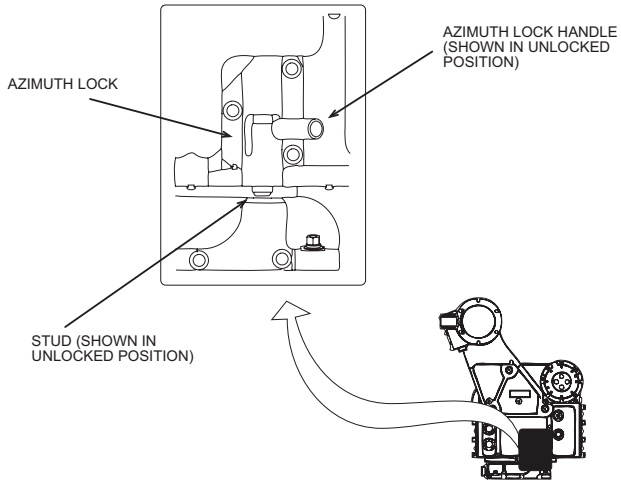


Figure 8. Azimuth Lock.

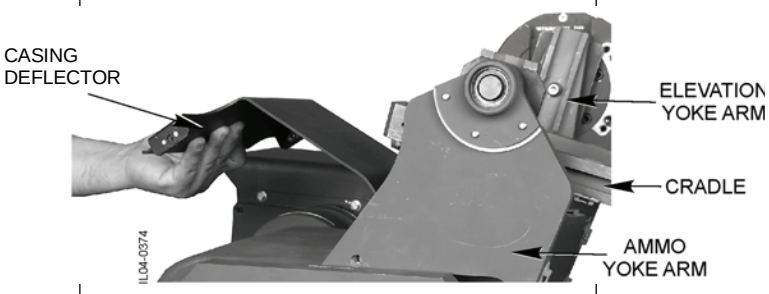
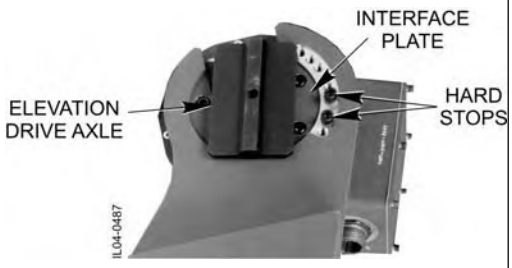


Figure 9. Casing Deflector.

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
10	Before and After	Elevation Yoke Arm a. Elevation Drive Assembly	a. Check for nicks, burrs. b. Check for loose and/or missing hardware. c. Check for loose connectors on elevation drive assembly. Inspect any cables and connectors that are loose or disconnected for pins that are bent, broken, or recessed. d. Verify proper installation on the mount. e. Ensure attaching bolts are installed and tight. f. Using the cradle, rotate elevation drive manually through full range of movement, listening for any unusual grinding noise and checking for excessive tightness or looseness in the assembly. g. Ensure the two “hard stops” (hex head screws) in the elevation drive are in the proper position, as shown in Figure 10.  **Figure 10. Elevation Drive “Hard Stops” Set at Proper Positions.**	a. Nicks and/or burrs present. b. One or more loose or missing hardware items. c. Cable and/or connector is loose or broken. Pins are bent, broken, or recessed. d. Improperly installed on mount. e. One or more loose, missing, or damaged hardware items. Missing or stripped screws. f. Elevation drive does not rotate smoothly, has a grinding noise, or is excessively loose. g. Elevation drive “hard stops” are improperly positioned.

PMCS Listing - Cont

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

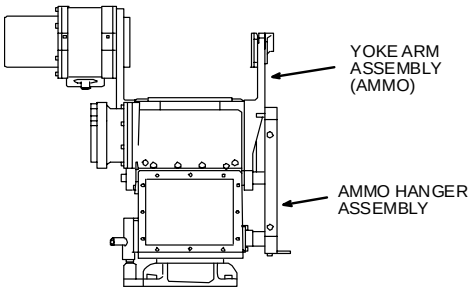
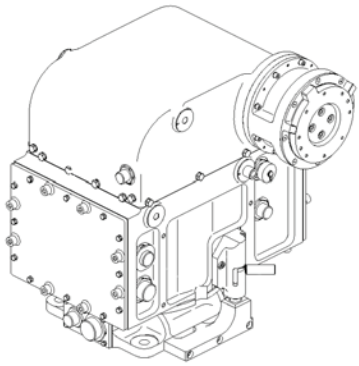
Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
11	Before and After	Ammo Yoke Arm	a. Check for nicks, burrs. b. Check for loose and/or missing hardware. Ensure bolts are tight. c. Verify proper installation on the mount.	a. Nicks or burrs are present. b. One or more loose, missing, or damaged hardware items. Missing or stripped screws. c. Improperly installed on the mount.
12	Before and After	Ammo Hanger Assembly (Figure 11)	a. Check for nicks, burrs. b. Check for loose and/or missing hardware. Ensure bolts are tight. c. Verify proper installation on mount.  **Figure 11. Ammo Yoke Arm Assembly and Ammo Hanger Assembly.**	a. Nicks or burrs are present. b. One or more loose, missing, or damaged hardware items. Missing or stripped screws. c. Improperly installed on the mount.

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
13	Before and After	Mount (Figure 12)	a. Check for nicks, burrs. b. Check for loose and/or missing hardware. Ensure attaching bolts are installed and tight. c. Verify proper installation on the vehicle. d. Ensure safety wire is installed on connectors. e. Manually rotate mount 360 degrees, listening for any unusual grinding noise and checking for excessive tightness or looseness in the assembly.  **Figure 12. CROWS Mount (for clarity, shown without Elevation Arm or Ammo Yoke Arm).**	a. Nicks or burrs are present. b. One or more loose, missing, or damaged hardware items. Missing or stripped screws. c. Improperly installed on the vehicle. d. Safety wire missing. e. Pedestal does not rotate smoothly, has an unusually grinding noise, or is excessively loose.
BALLISTIC PROTECTION KIT				
14	Before and After	Ballistic Protection Kit (Mission Dependent) (Sensor Group and mount only)	a. Check for proper installation and cleanliness of interior/exterior surfaces IAW WP 0029, Cleaning. b. Check for loose and/or missing hardware.	a. BPA improperly installed. b. One or more loose, missing, or damaged hardware items. Missing or stripped screws.

PMCS Listing - Cont

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

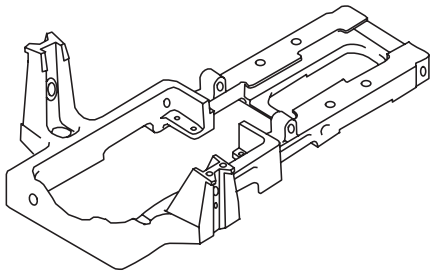
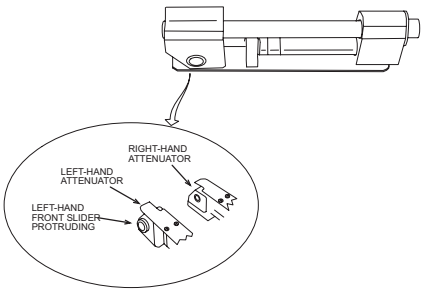
Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
			CRADLE ASSEMBLY	
15	Before and After	M2/Mk19 and M240/249 Cradle Assemblies (Figure 13) a. Pivot arm RH b. Pivot arm LH c. Forward attaching pin d. Rear detent pin e. Deflector (P/O of M240/M249 Cradle; for M240/M249 only).	a. Check for nicks, burrs and cracks. b. Check for loose and/or missing hardware. c. Verify proper installation on the mount. d. Check that pivot arms are tightly attached to the cradle. e. Ensure forward attaching pin and/or clevis pin are present. f. Ensure rear detent is present and will lock in place (Mk19 only). d. Inspect cradle for cracks or deformities. e. Inspect deflector for cracks and for attaching hardware.  **Figure 13. Cradle (M2/Mk19 Shown).**	a. Nicks or burrs are present. b. One or more loose, missing, or damaged hardware items. Missing or stripped screws. c. Improperly installed on the mount. d. Pivot arms are loose or have missing attaching hardware. e. Forward attaching pin and/or clevis pin missing. f. Rear detent missing or will not lock in place (Mk19 only). d. Cradle is cracked or broken. e. (M240/M249 cradle only) Deflector is cracked or attaching hardware is missing.

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
			M2 HB .50 CAL WEAPON ADAPTER KIT (WAK)	
16	Before and After	M2 HB WAK	a. Verify proper installation on the mount. b. Verify common hardware is not damaged and properly installed. c. Ensure forward pin is fully inserted into actuator bushing. d. Ensure hitch pin is fully inserted. e. Verify that forward pin and weapon are secure.	a. Not mounted properly, or is damaged. b. One or more loose, missing, or damaged hardware items. Missing or stripped screws. c. Forward pin will not fully insert into actuator bushing. d. Hitch pin is not fully inserted. e. Forward pin and weapon are not secured.
17	Before and After	Right-Hand Attenuator (Figure 14)	a. Check for nicks, burrs. b. Check for loose and/or missing hardware. Ensure bolts are tight. c. Ensure attenuator does not bind.	a. Nicks or burrs are present. b. One or more loose, bent, missing, or damaged hardware items. Missing or stripped screws. c. Attenuator binds.
18	Before and After	Left-Hand Attenuator (Figure 14)	a. Check for nicks, burrs. b. Check for loose and/or missing hardware. Ensure bolts are tight. c. Ensure attenuator does not bind.  **Figure 14. Right and Left Attenuators.**	a. Nicks or burrs are present. b. One or more loose, bent, missing, or damaged hardware items. Missing or stripped screws. c. Attenuator binds.

PMCS Listing - Cont

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

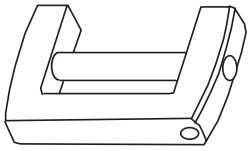
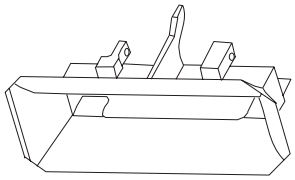
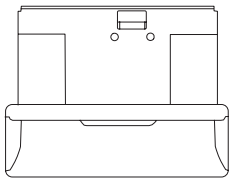
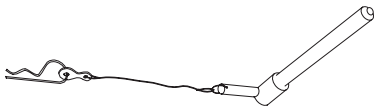
Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
19	Before and After	Block Guide Assembly (Figure 15)	a. Check for nicks, burrs. b. Check for loose and/or missing hardware. c. Verify that it will lock weapon in place.  **Figure 15. Block Guide Assembly.**	a. Nicks or burrs are present. b. One or more loose, bent, missing, or damaged hardware items. Missing or stripped screws. c. Will not lock the weapon in place.
20	Before and After	Feed Throat Assembly (Figure 16)	a. Check for nicks, burrs; welds for cracks. b. Check for loose and/or missing hardware.  **Figure 16. Feed Throat Assembly.**	a. Nicks or burrs are present. Welds have cracks. b. One or more loose, bent, missing, or damaged hardware items. Missing or stripped screws.

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
21	Before and After	Ammo Guide (Figure 17)	a. Check for nicks or burrs, or cracks in welds. b. Check for loose and/or missing hardware. c. Ensure operability.  **Figure 17. Ammo Guide.**	a. Nicks or burrs are present. Welds have cracks. b. One or more loose, bent, missing, or damaged hardware items. Missing or stripped screws. c. Will not guide ammunition through weapon.
22	Before and After	Forward Pin (Figure 18)	a. Inspect for serviceability.  **Figure 18. Forward Pin.**	a. Forward locking pin and/or hitch pin missing.

PMCS Listing - Cont

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

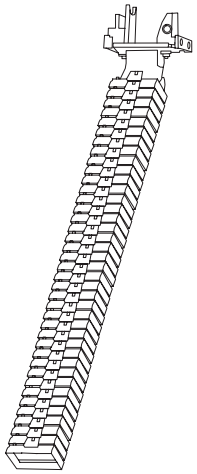
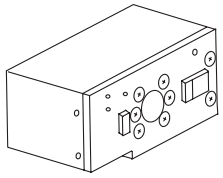
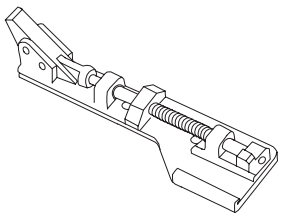
Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
23	Before and After	Link Chute Adapter Assembly (Figure 19)	a. Check for nicks, burrs. b. Check for loose and/or missing hardware. c. Ensure operability. 	a. Nicks or burrs are present. Welds have cracks. b. One or more loose, bent, missing, or damaged hardware items. Missing or stripped screws. c. Does not operate properly.

Figure 19. Link Chute Adapter Assembly.

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
24	Before and After	Remote Firing Assembly (RFA) (Figure 20)	a. Check for nicks, burrs. b. Check for loose and/or missing hardware. c. Inspect electrical cable for nicked, broken connectors, etc. d. Ensure operability. **NOTE** Ensure safety wire is installed on solenoid during the **MONTHLY** PMCS.  **Figure 20. RFA.**	a. Nicks or burrs are present. b. One or more loose, bent, missing, or damaged hardware items. Missing or stripped screws. c. Electrical cable and/or connector is loose or broken. One or more pins are bent, broken, or recessed on connector J1 of the RFA. d. Does not sense rounds depletion.
25	Before and After	Sear Assembly (Figure 21)	a. Check for nicks, burrs. b. Check for loose and/or missing hardware.  **Figure 21. Sear Assembly.**	a. Nicks or burrs are present. b. One or more loose, bent, missing, or damaged hardware items. Missing or stripped screws.

PMCS Listing – Cont

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

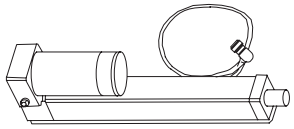
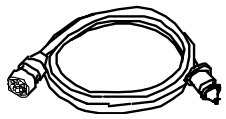
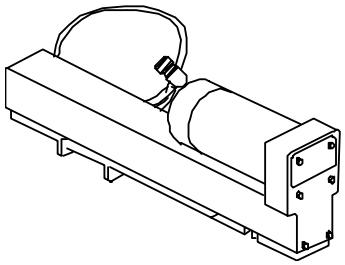
Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
26	Before and After	Linear Actuator (Charger) Assembly (Figure 22)	a. Check for nicks, burrs, and cleanliness of interior and exterior surfaces. b. Check for loose and/or missing hardware. Ensure bolts are tight. c. Ensure safety wire is installed on mounting bolts. d. Ensure cable is connected. Inspect any cables that are loose or disconnected for pins that are bent, broken, or recessed.  **Figure 22. M2 Linear Actuator (Charger) Assembly.**	a. Nicks or burrs are present. b. One or more loose, bent, missing, or damaged hardware items. Missing or stripped screws. c. Safety wire is missing. d. Electrical cable connector is loose or broken, or one or more pins are bent, broken, or recessed.
27	Before and After	M2 Weapon-Mount Cable, 21677-3702 (Figure 23)	**NOTE** Do not disconnect cable if it is properly connected.	
			a. Check for cracked or frayed insulation and nicks in shielding. b. All cable harnesses should be neatly and securely bundled and labeled. c. Check for bent, broken, loose or missing pins prior to installation.  **Figure 23. Weapon-Mount Cable 21677-3702.**	a. Cracked or frayed insulation; nicks in shielding. b. Harness improperly secured. c. Cable connector pins loose, broken, bent, broken, or recessed.

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
			MK19 WAK	
28	Before and After	Mk19 WAK	a. Verify proper installation on the mount. b. Verify common hardware is not damaged and is properly installed. c. Verify proper installation of the weapon mounted components.	a. Not mounted properly, or is damaged. b. One or more loose, missing, or damaged hardware items. Missing or stripped screws. c. All components mounted properly.
29	Before and After	Linear Actuator (Charger) (Figure 24)	a. Check for nicks, burrs, and cleanliness of interior and exterior surfaces. b. Check for loose and/or missing hardware. Ensure bolts are tight. c. Ensure safety wire is installed on mounting bolts. d. Ensure all cable is connected. Inspect any cables that are loose or disconnected for pins that are bent, broken, or recessed.  **Figure 24. Mk19 Linear Actuator (Charger).**	a. Nicks or burrs are present. b. One or more loose, bent, missing, or damaged hardware items. Missing or stripped screws. c. Safety wire is missing. d. Electrical cable connector is loose or broken, or one or more pins are bent, broken, or recessed.

PMCS Listing – Cont

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

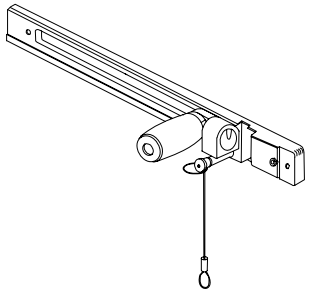
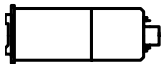
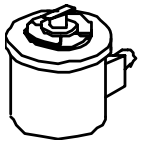
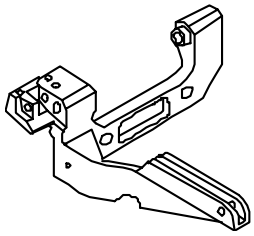
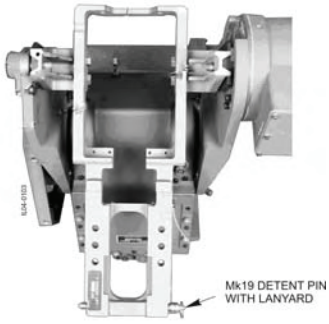
Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
30	Before and After	Remote Charger Assembly (Figure 25)	a. Check for nicks, burrs. b. Check for loose and/or missing hardware. c. Ensure operability.  **Figure 25. Remote Charger Assembly.**	a. Nicks or burrs are present. b. One or more loose, bent, missing, or damaged hardware items. Missing or stripped screws. c. Will not stay secured in weapon.
31	Before and After	Ogive Plunger with Rounds Counter and Locking Rounds Counter Block (Figure 26)	a. Check for nicks, burrs. b. Check for loose and/or missing hardware. c. Ensure operability.  **Figure 26. Ogive Plunger with Rounds Counter.**	a. Nicks or burrs are present. b. One or more loose, bent, missing, or damaged hardware items. Missing or stripped screws. c. Does not sense rounds depletion.
32	Before and After	Remote Firing Solenoid (Figure 27)	a. Check for nicks, burrs. b. Check connector, including pins on the connector, the cap, and the chain.  **Figure 27. Remote Firing Solenoid.**	a. Nicks or burrs are present. b. One or more pins are loose, bent, missing, damaged or recessed on the solenoid connector J1. Missing, bent or broken hardware.

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
33	Before and After	Front Bracket Assembly (Figure 28)	a. Check for nicks, burrs. b. Check for missing hardware. c. Ensure bolts are tight.  **Figure 28. Front Bracket Assembly.**	a. Nicks or burrs are present. b. Missing, bent or broken hardware. c. Loose bolts.
34	Before and After	Rear Locking Pin (Detent) (Figure 29)	a. Inspect for serviceability.  **Figure 29. Rear Detent Locking Pin.**	a. Rear detent missing or will not lock in place (Mk19 only).

PMCS Listing – Cont

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

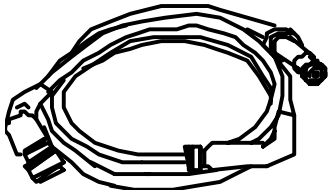
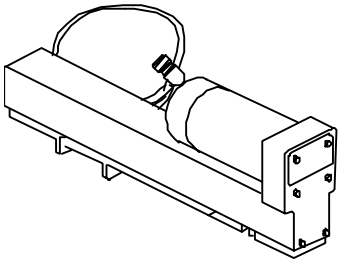
Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
35	Before and After	Mk19 Weapon-Mount Cable, (Figure 30)	**NOTE** Do not disconnect cable if it is properly connected.	
			a. Check for cracked or frayed insulation and nicks in shielding.	a. Cracked or frayed insulation; nicks in shielding.
			b. All cable harnesses should be neatly and securely bundled and labeled.	b. Harness improperly secured.
			c. Check for bent, broken, loose or missing pins or sockets.	c. Cable connector pins loose, broken, bent, broken, or recessed.
			 **Figure 30. Mk19 Weapon-Mount Cable, 21677-3703.**	
M240/M249 WAK				
36	Before and After	M240/M249 WAK	a. Verify proper installation on the mount.	a. Not mounted properly, or is damaged.
			b. Verify common hardware is not damaged and is properly installed.	b. One or more loose, missing, or damaged hardware items. Missing or stripped screws.
			c. Verify proper installation of the weapon mounted components.	c. All components mounted properly.

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
37	Before and After	Linear Actuator (Charger) (Figure 31)	a. Check for nicks, burrs, and cleanliness of interior and exterior surfaces. b. Check for loose and/or missing hardware. c. Ensure safety wire is installed on connectors and bolts. d. Ensure all cable is connected. Inspect any cables that are loose or disconnected for pins that are bent, broken, or recessed.  **Figure 31. M240/M249 Linear Actuator (Charger).**	a. Nicks or burrs are present. b. One or more loose, bent, missing, or damaged hardware items. Missing or stripped screws. c. Safety wire is missing. d. Electrical cable connector is loose or broken, or one or more pins are bent, broken, or recessed.

PMCS Listing - Cont

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

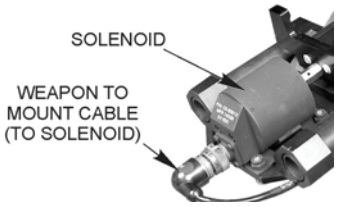
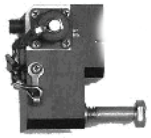
Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
38	Before and After	Remote Firing Solenoid (Figure 32)	a. Check for nicks, burrs. b. Check for loose and/or missing hardware. c. Inspect electrical cable for nicked, broken connectors, etc. d. Check connector.  **Figure 32. M240 Remote Firing Solenoid.**	a. Nicks or burrs are present. b. One or more loose, bent, missing, or damaged hardware items. Missing or stripped screws. c. Electrical cable and/or connector is loose, broken, or nicked. One or more pins are bent, broken, or recessed. d. Will not provide voltage to rounds.

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
39	Before and After	M240 Rounds Counter (Figure 33) a. Rounds Counting Sensor	a. Check for nicks, burrs. b. Inspect sensor for nicks, broken connectors, ability to be moved or positioned, etc. c. Check setscrew for nicks, proper threading, etc. d. Check connector J1. e. Check for loose and/or missing hardware. f. Check operability.  **Figure 33. M240 Rounds Counter.**	a. Nicks or burrs are present. b. Sensor is missing, will not move, or is damaged. c. Setscrew is missing, will not move or hold sensor in position, or is damaged. d. Connector is loose or broken. One or more pins are bent, broken, or recessed on the connector J1. e. Missing, bent, or broken hardware. f. Does not sense rounds depletion.

PMCS Listing - Cont

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
40	Before and After	M249 Adapter-Counter (Figure 34) a. Rounds Counter	a. Check for nicks, burrs. b. Inspect sensor for nicks, broken connectors, ability to be moved or positioned, etc. c. Check setscrew for nicks, proper threading, etc. d. Check for loose and/or missing hardware. e. Check connector J1. f. Check operability. 	a. Nicks or burrs are present. b. Sensor is missing, will not move, or is damaged. c. Setscrew is missing, will not move or hold sensor in position, or is damaged. d. Missing, bent or broken hardware. e. Connector is loose or broken. One or more pins are bent, broken, or recessed on the connector J1. f. Does not sense rounds depletion.

Figure 34. M249 Adapter-Counter.

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
41	Before and After	M240/M249 Weapon-Mount Cable, 21677-3705 (Figure 35)	**NOTE** Do not disconnect cable if it is properly connected. Only standard, not collapsible, M249 butt stocks are compatible with the M240/M249 WAK. a. Check for cracked or frayed insulation and nicks in shielding. b. All cable harnesses should be neatly and securely bundled and labeled. c. Check for bent, broken, loose or missing pins or sockets.  **Figure 35. M240/M249 Weapon-Mount Cable, 21677-3705.**	a. Cracked or frayed insulation; nicks in shielding. b. Harness improperly secured. c. Cable connector pins loose, broken, bent, broken, or recessed.

PMCS Listing - Cont

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

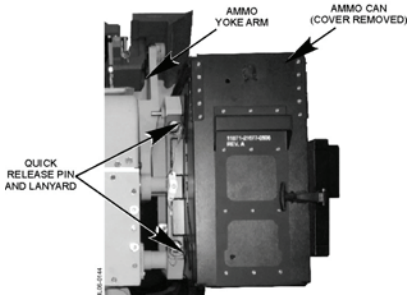
Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
			AMMO CAN	
42	Before and After	Ammo Can (Figure 36) a. Lid / cover b. Pins c. Partition d. Ammo feed chute assembly e. M240 chute adapter f. M249 adapter-counter **NOTE** Items e and f are part of the M240/ M249 WAK.	a. Verify proper installation on the ammo hanger. b. Verify common hardware is not damaged and is properly installed. c. Inspect welds for cracks. d. Check operability.  **Figure 36. Ammo Can.**	a. Ammo can is not properly installed. b. One or more items are inoperative, loose, bent, missing, or damaged. Missing or stripped screws. c. Welds have cracks. d. Ammo can is damaged to the point where ammunition cannot be stored or fed properly.
43	Before Only	CROWS	Perform the Before Operational Check, covered in WP 0027, Table 1, which details the instructions for an operational test with power applied to CROWS.	Before Operational Check not performed.
44	Before Only	Weapon	Conduct Verification of Borsighting Procedure (WP 0016).	Weapon not correctly boresighted after two tries.

Table 1. Preventive Maintenance Checks and Services (PMCS) – Cont.

Item No.	Interval	Item to be Inspected	Procedure	Equipment Not Ready/Available If
			WEAPONS	
45	Before and After	Weapon	a. Verify weapon lubrication per: • TM 9-1005-213-10, Operator's Manual for M2 HB .50-Cal Machine Gun • TM 9-1010-230-10, Operator's Manual for Mk19 Grenade Machine Gun • TM 9-1005-313-10, Operator's Manual for M240 (7.62 mm) Machine Gun • TM 9-1005-201-10, Operator's Manual for M249 (5.56 mm) Machine Gun b. Ensure headspace and timing are set IAW TM 9-1005-213-10, Operator's Manual for M2 HB .50-Cal. Machine Gun.	a. Weapon not lubricated correctly. b. Headspace and timing cannot be set correctly.
46	After Only	Weapon	a. Verify weapon has been downloaded and cleaned. b. Verify ammo has been downloaded.	a. Weapon not downloaded or cleaned. b. Ammo not downloaded.
47	Monthly		**NOTE** Linear actuators (chargers) that are exposed to temperatures exceeding 100 °F on a consistent basis, should be returned to higher maintenance every 30 days for inspection. If not exposed to these temperatures, return to higher maintenance for inspection on a 365-day interval. a. Repeat ALL steps in the BEFORE and AFTER checks of the PMCS to satisfy the monthly requirements completely. b. Install safety wire on solenoid.	a. Monthly PMCS not performed. b. Safety wire not installed on solenoid.

END OF TASK

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

BEFORE OPERATIONAL CHECK

THIS WORK PACKAGE COVERS:

An inspection of the CROWS system which shall be performed prior to each mission use if the CROWS System is powered down upon completion of a previous mission to ensure the CROWS system, optional Ballistic Armor, and selected weapon are operationally mission capable.

INITIAL SET UP:

Tools and Special Tools:

Operator's Tool Kit (WP 0036, Table 2, Item 1)

Equipment Conditions:

Vehicle power ON, CROWS system power OFF

Personnel Required:

Two

References:

WP 0007, WP 0008, WP 0009, WP 0010, WP 0011, WP 0012, WP 0013, WP 0014, WP 0015, WP 0016, WP 0023, WP 0024, WP 0025, WP 0026, WP 0028, WP 0035, WP 0036

WP CONTENTS

Section/Subsection **Page**

Operational Check 1

OPERATIONAL CHECK

WARNING

Ensure input voltage is at the correct level. An overvoltage condition when power is applied may make the mount move and spin rapidly. Do not stand within muzzle length of the system when applying power. Once power is applied, the system is fully functional and the mount and/or cradle with weapon could move. Ensure that the weapon mount is cleared and any cleared rounds are secured. Ensure that all personnel are clear of any possible weapon movements. Do not stand under the barrel. Follow all safety warnings and cautions. Failure to do so may result in personal injury and equipment damage.

NOTE

The operator performing the Operational Check shall be thoroughly familiar with procedures contained in WP 0015, Menu System, for operation under usual conditions prior to performing the Operational Check. There are no procedural steps for performing tasks provided, such as using the Control Group switches, switching to a different function, or selecting a menu option.

Before performing the procedures in this work package, review WP 0024, Troubleshooting Index ,Table 6, Malfunction Visual Fault Index.

Table 1 procedures are required to perform an operational mission readiness inspection of the CROWS system.

WARNING

Failure to follow all safety instructions in the performance of procedures may result in personal injury or death, or damage to equipment.

CAUTION

Ensure proper alignment of connector keyways when installing cable assemblies. Failure to do so may result in damage to the electrical pins and other equipment.

Cover connectors with the appropriate connector cap attached to the cable assembly if not connected to a mating connector.

NOTE

For preventive maintenance procedures, refer to WP 0025, Preventive Maintenance Checks and Services (PMCS) Introduction, and WP 0026, Preventive Maintenance Checks and Services (PMCS).

For detailed procedures in installing and removing the M2, Mk19, M240B, and the M249 weapons, refer to WP 0007 thru WP 0014.

For Menu System instructions, refer to WP 0015.

Successful completion of the Before Operational Check indicates CROWS operational integrity. In Table 1 below, Columns 2 and 3 work together; if indicated results (Column 3) cannot be verified after performing procedure (Column 2), refer to Operator Troubleshooting Action (Column 4 -- starting with step 1). If problems persist, send to next higher maintenance for further evaluation. If directed to "report" to next higher maintenance in the Operator Troubleshooting Action (Column 4), it is considered a partially-mission capable fault. If directed to "send" to next higher maintenance in Operator Troubleshooting Action (Column 4), do not continue to use the CROWS system.

For specific weapon operation and maintenance manuals, refer to WP 0035, References.

Only standard, not collapsible, butt stocks on the M249 are compatible with the M240/M249 Weapon Adapter Kit (WAK).

Table 1. Before Operational Check.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
NOTE Should any weapon malfunction occur, refer to WP 0023, Troubleshooting – Weapon Interface Malfunctions. Faults may be due to a loose connection; ensure all connectors are properly seated and tested before sending to next higher maintenance. "Equipment Not Ready/Available If" determinations constitute deadline criteria for the CROWS system.				
1. Ensure all PMCS "BEFORE" tasks have been performed.	1. Ensure all equipment is secure and serviceable according to TM. 2. Ensure azimuth travel lock is unlocked. 3. Ensure vehicle hatch is locked.	1. For procedures, refer to WP 0026, PMCS, Table 1. 2. Ensure weapon mount rotates 360 degrees in both horizontal axes. 3. Hatch is locked.	1. If equipment is determined to be unserviceable, report to next higher maintenance. 2. If the azimuth lock cannot be disengaged, send to next higher maintenance.	1. The azimuth lock cannot be disengaged.
2. System Power-Up.	1. Press "Power" switch on the display unit (DU) to ON. 2. Press "Power" switch on the SPU to ON.	1. Verify DU “Power” switch is ON. 2. Verify SPU “Power” switch is ON.	1. Verify charged vehicle battery. 2. Send to next higher maintenance if the DU does not power up or the main power switch does not turn system on.	1. System does not power up.

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
3. SYSTEM REPORT screen.	**CAUTION** Ensure the joystick is placed in the joystick holder and not touched during system power up. 1. Ensure joystick is in joystick holder. 2. System boots-up in approximately <120 seconds.	1. Verify joystick is in holder. 2. Verify a. Built In Test (BIT): "Sensor Unit Okay" "EMU Okay" "ICU Okay" "Vehicle Type **XXXX**" "No Fire Zones Custom" "Gimbal Comms Okay" "Gimbal BIT Status Okay" b. That vehicle type is correct.	1. Ensure all cables are connected properly. 2. If “failed” message appears on System Report screen, press function switch for detailed fault message and record information. a. Attempt to correct failure utilizing the system override control to correct error and then return override switch to the off position. b. If SENSOR FAILED message appears, determine if system is mission capable (for example, if only one camera is failed). Go to WP 0028, Operational Criteria. c. If vehicle type is incorrect, go to Preparation/Configure/Vehicle Menu to update selection. 3. Reboot system and verify fault.. 4. If fault continues, send system to next higher maintenance.	1. A fault continues to appear and cannot be corrected.

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
3. SYSTEM REPORT screen – Cont.	**NOTE** The default setting during power up for Stabilization is OFF. Press the STAB switch LEFT for OFF; press RIGHT for ON. 3. Ensure the vehicle is stationary and not moving. Press RIGHT on the joystick STAB switch to toggle stabilization ON. Do not touch any system controls for 30 seconds to allow the system to calculate and compensate for planetary drift.	3. Verify STAB switch setting reads ON in the following Task 4, Verify Engagement Mode Screen Symbology and Video Image).		

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
4. Verify Engagement Mode Screen Symbology and Video Image	1. Press the ACCEPT switch to proceed to the Engagement Mode screen.	1. Verify the following: a. STAB ON b. Symbology. c. Video image appears.	1. Ensure cables are connected and DU power is ON. 2. If "Weapon Not Boresighted" message appears after the Before Operational Check, perform WP 0016 Boresight Procedure. 3. Ensure nothing is covering camera lens. 4. Switch from day camera to thermal camera by pressing UP on the CAMERA CHANGE switch or vice-versa (after thermal camera has an approximate 6-minute cool down period). 5. If getting an image on the opposite camera, use opposite camera. 6. If " GWS BIT Error" message appears, press and release Safety Override Switch to reset GWS BIT circuit. 7. If fault continues, report system to next higher maintenance.	1. A fault continues to appear and cannot be corrected.

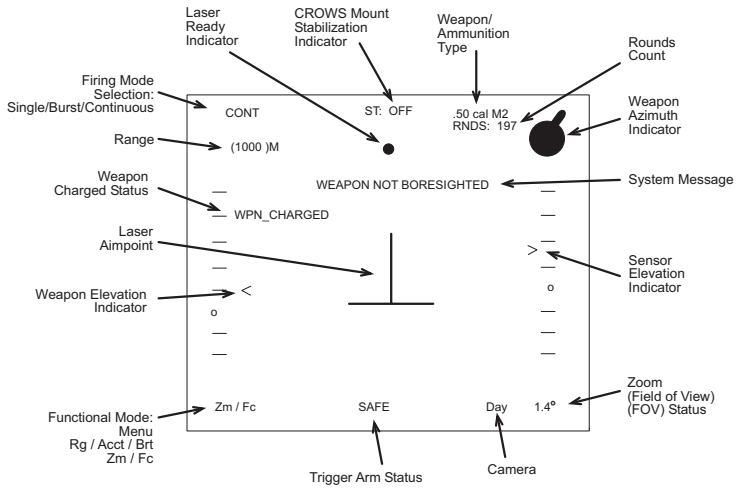


Figure 1. Engagement Mode Screen Showing Symbology and Video Image.

Table 1. Before Operational Check - Cont.				
Task	**Procedure or Reference**	**Verification**	**Operator Troubleshooting Action**	**Equipment Not Ready/Available If:**
4. Verify Engagement Mode Screen Symbology and Video Image - Cont			8. Reboot system and verify fault. 9. If fault continues, send system to next higher maintenance, unless it is determined that the mission can be accomplished with only one camera. See WP 0028, Operational Criteria.	

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
5. DU Brightness Contrast Function	**NOTE** Holding the BRIGHTNESS switch UP or DOWN allows for gradual adjustment to brightness. 1. On DU, switch the "BRIGHTNESS" switch between LIGHT and DARK. 2. Set brightness to a visual best brightness condition. **NOTE** Holding the CONTRAST switch UP or DOWN allows for gradual adjustment to contrast. 3. On DU, switch the "CONTRAST" switch between INCREASE and DECREASE. 4. Set contrast to a visual best contrast condition.	1. Observe the DU brightness change. 2. Set brightness. 3. Observe the DU contrast change. 4. Set contrast.	1. Determine if image is usable for mission. Go to WP 0028, Operational Criteria. 2. If fault continues, report system to next higher maintenance.	

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
6. Day Camera Automatic Exposure Control	**NOTE** The day camera is the default camera selected at power up. 1. Ensure DAY and FOV are displayed in lower right hand corner of DU screen. 2. Switch FUNCTION to "Rg / Brt/ Accpt.". 3. Set brightness to change in both the darker and lighter condition. 4. Set brightness to a visual best brightness condition.	1. DAY and FOV are displayed in lower right hand corner of DU screen. 2. Set to Rg / Brt / Accpt. 3. Observe an image change. 4. Set brightness.	1. Try to adjust brightness using control switches on joystick. 2. Try to adjust brightness using control switches on DU. 3. Determine if system is mission capable. Go to WP 0028, Operational Criteria. 4. If brightness does not adjust properly, reboot system and verify fault. 5. If fault continues, report system to next higher maintenance.	

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
7. Day Camera Zoom and Focus Control	1. Switch to Zm/Fc menu. 2. Set the day sensor to widest FOV. 3. Set the day sensor to narrowest FOV. 4. Set the focus to an out-of-focus condition. 5. Set focus to a visual best focus condition.	1. "Zm/Fc" is displayed in lower left corner of DU screen. 2. DU screen should indicate 26±1.0°, at widest FOV. 3. DU screen should indicate 1.2±0.0° at narrowest FOV. 4. Observe an image focus change. 5. Set focus.	1. Ensure cables are connected. 2. Try to adjust zoom using switches on DU and Joystick. 3. If one set of switches is working, determine if system is mission capable. Go to WP 0028, Operational Criteria. 4. Reboot system and verify fault. 5. If fault continues, report system to next higher maintenance. 6. Send to next higher maintenance if focus command does not clearly identify targets.	

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
8. Azimuth and Elevation Slewing Function	1. Set the day sensor to widest FOV. 2. Slew the system through 360° degrees of azimuth rotation in a clockwise and counter-clockwise direction. 3. Slew the elevation drive to the upper limit of travel and the lower limit of travel.	1. DU screen should indicate 27±0.0° at widest FOV. 2. Verify: Slewing motion Azimuth indicator displays the relative position of the weapon barrel to the front of the vehicle. 3. Verify: Elevation drive and sensor unit move weapon to a fully elevated 60 degree position and a fully lowered 20 degree position from the horizontal. Elevation and sensor unit indicators display the relative positions of the weapon barrel in elevation to the horizontal and the sensor unit.	1. Ensure cables are connected. 2. Ensure nothing is physically interfering with mount moving in all three axes. 3. If “GWS BIT ERROR” message appears, press and release Safety Override switch to reset “GWS BIT circuit.” 4. Reboot system and verify fault. 5. If mount is moving, but screen azimuth or elevation indicators are not following movement, send system to next higher maintenance. 6. If mount will not respond properly to joystick commands, send system to next higher maintenance.	1. Mount will not respond properly to joystick commands.

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
9. FOV Slewing Control Function	1. Set the CROWS to the narrowest FOV.	1. Verify ability to slowly and precisely move and position weapon aimpoint on a target.	1. If unable to move mount slowly and precisely, send system to next higher maintenance.	
10. Thermal Camera Zoom and Focus Control	1. Switch to the "THERMAL" sensor. 2. Switch to "Zm/Fc/P" on the function menu. 3. Set the thermal sensor to narrowest FOV. 4. Set the thermal sensor to widest FOV. 5. Set the thermal sensor to narrowest FOV. 6. Set the focus to an out-of-focus condition. 7. Set focus to a visual best focus condition.	1. Set to Thermal 2. Ensure "Zm/Fc/P" is displayed in lower left corner of DU screen. 3. DU should indicate (1.) 1.8±0.0°. (2.) 3.7±0.0°. (3.) 5.7±0.0°. (4.) 11±0.1°. 4. DU should indicate 11±0.1°. 5. DU should indicate 1.8±0.0°. 6. Observe an image focus change. 7. Set focus.	1. Ensure cables are connected. 2. Perform NUC 1 Option (WP 0015, in the Thermal Config section). 3. Ensure thermal sensor has had approximately 6 minutes to cool down. 4. Reboot system and verify fault. 5. If day camera is fully operational, determine if system is mission capable with only the day camera. 6. If fault continues, report system to next higher maintenance. 7. If FOV will not adjust to within limits, send to next higher maintenance.	1. FOV will not adjust to within limits.

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
11. Thermal Camera Polarity Control	1. Set function mode to “Zm / Fc / P." 2. Press the ACCEPT switch.	1. Set to "Zm / Fc / P." 2. Verify thermal polarity switches from Black Hot to White Hot (default).	1. Determine if system is mission capable. Go to WP 0028, Operational Criteria. 2. Reboot system and verify fault. 3. If fault remains report system to next higher maintenance.	
12. Surveillance Mode Function (Passive / Aggressive Modes)	1. Switch to "SURVEILLANCE" submenu, Passive Mode. 2. Rotate mount. Move zoom and focus sensor. 3. Press LASE switch.	1 Verify system is in passive surveillance mode (weapon fully elevated). 2. Verify ability to move mount and ability to zoom and focus sensor. 3. Surveillance mode is exited.	1. If “GWS BIT” fault message appears, press and release Safety Override switch. 2. Reboot system and verify fault. 3. Determine if system is mission capable. Go to WP 0028, Operational Criteria. 4. If fault remains, report system to next higher maintenance.	

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
13. Range Step Setup	1. Select "CONFIGURE" menu. 2. Switch to "INTERFACE" submenu. 3. Switch to "RANGE STEP" submenu. 4. Set range step increments per mission requirement.	1 Verify system is in CONFIGURE menu. 2. Verify INTERFACE menu. 3. Verify system is in range mode. 4. Range step increments are set.	1. Reboot system and verify fault. 2. If unable to set range step increments, determine if system is mission capable. 3. If fault remains report system to next higher maintenance.	
14. Units Setup	1. Select "CONFIGURE" menu. 2. Switch to "INTERFACE " submenu. 3. Switch to "UNITS" submenu. 4. Set measurement units per mission requirement.	1 Verify system is in CONFIGURE menu. 2. Verify INTERFACE menu. 3. Verify system is in UNITS mode. 4. Units measurement is set.	1. Reboot system and verify fault. 2. If unable to set UNIT measurements, determine if system is mission capable. 3. If fault remains, report system to next higher maintenance.	

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
15. Color Setup	1. Select "CONFIGURE" menu. 2. Switch to "INTERFACE " submenu. 3. Switch to "COLOR" menu. 4. Set colors per mission requirements for the following: -symbology -laser aim point -ballistics aim point.	1 Verify system is in CONFIGURE menu. 2. Verify INTERFACE menu. 3. Verify system is in COLOR mode. 4. Colors are set.	1. Reboot system and verify fault. 2. If unable to set Colors, determine if system is mission capable. 3. If fault remains, report system to next higher maintenance.	
16. Automatic Sector Scan Function	1. Switch to "SECTOR SCAN SETUP" submenu. 2. Set up sector scan limits and speed. 3. Switch to “SECTOR SCAN ENABLE.” 4. Depress “DEADMAN” switch to exit sector scanning.	1 Verify SECTOR SCAN SETUP submenu. 2. Sector scan limits and speed are set up. 3. Verify sector scanning is operating. 4. Verify sector scanning exits.	1. Reboot system and verify fault. 2. If “GWS BIT ERROR” message appears, press and release safety override switch. 3. If unable to set Sector Scan, determine if system is mission capable. 4. If fault remains, report system to next higher maintenance.	

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
17. Sensor Unit Menu	1. Switch to Main Menu screen. 2. Switch to the Sensor "S" screen. 3. Press Accept Switch. 4. Set Sensor values per mission requirements.	1. Verify Main Menu screen. 2. Verify Sensor screen displays. 3. Verify: "CW" (crosswind) displays ".00 m/s" "RW" (Range) displays ".00 m/s" "Te" (temp) displays ambient temperature. "Pr" displays barometric pressure. "Ca" displays Sensor cant position. "El" displays Sensor elevation position. 4. Sensor values are set per mission requirements.	1. Ensure cables are connected. 2. Reboot system and verify fault. 3. If Sensor menu indications are not accurate, send system to next higher maintenance.	

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
18. Firing Circuit Function	1. Verify trigger guard is in the DOWN position on the joystick. 2. Position the SYSTEM ARM switch to the "SAFE" position. 3. Lift trigger guard and press the trigger switch for approximately 1 second. FIRING SOLENOID SHOULD NOT ACTIVATE. 4. Position the SYSTEM ARM switch to the "ARMED" position. 5. Press the trigger switch for approximately 1 second. FIRING SOLENOID SHOULD ACTIVATE. 6. Close the trigger guard.	1 Trigger guard is down, preventing trigger from being depressed. 2. Verify "SAFE" indication is displayed on DU screen. 3. Verify the Remote Firing Adapter did not actuate when SYSTEM ARM switch is in SAFE position and trigger switch is pressed. 4. Verify "ARMED" indication is displayed on DU screen. 5. Verify Remote Firing Adapter actuated when SYSTEM ARM switch is in ARMED position and trigger is pressed. 6. Trigger guard is closed.	1. Ensure hatch is fully locked. 2. If Hatch is locked, verify hatch interlock switch is installed properly. 3. Verify Remote Firing Solenoid is installed on weapon properly. 4. Reboot system and verify fault. 5. If fault remains, send system to next higher maintenance. 6. Send to next higher maintenance if firing solenoid activates while in the SAFE position or does not activate while in the ARMED position.	1. Firing solenoid activates while in the safe position. 2. Firing solenoid does not activate while in the armed position.

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
19. Hatch Interlock Function	1. Ensure the SYSTEM ARM switch is in the "ARMED" position. 2. Open Hatch. 3. Lift trigger guard and press the trigger for approximately 1 second. 4. Close the trigger guard.	1. Verify ARMED message appears on DU screen. 2. Verify “Hatch Open – Firing Inhibited” message is displayed on DU screen when hatch is open. 3. Verify: "SAFE" indication is displayed on DU screen when Hatch is opened. Verfiy Remote Firing Solenoid DID NOT ACTUATE. 4. Trigger guard is closed.	1. If “ Hatch Open – Firing Inhibited” message does not appear when hatch is open, verify the following: -hatch interlock cable is installed properly. -Safety Override Switch is OFF. 2. If “SAFE” message does not appear when hatch is open, verify the following: -hatch interlock cable is installed properly. -Safety Override switch is OFF. 3. Reboot system and verify the fault. 4. If fault remains, send system to next higher maintenance.	

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
20. Safety Override Function	1. Lock Hatch. 2. Position the SYSTEM ARM switch to the "ARMED" position. 3. Open Hatch. 4. Position Safety Override switch in ON position.	1. Verify Hatch is locked. 2. Verify ARMED message appears on DU screen. 3. Verify: "Hatch Open – Firing Inhibited" is displayed on DU screen. "SAFE" indication is displayed on DU screen. 4. Verify "ARMED" indication appears on DU screen (i.e., system can only be armed by the Safety Over-Ride switch if the hatch is open).	1. Reboot system and verify fault. 2. If fault remains send system to next higher maintenance. 3. If opening the hatch does not activate Firing Inhibited, send to next higher maintenance.	1. Opening the hatch does not activate firing Inhibited.

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
21. No-Fire Zone Verification	1. Set a no-fire zone of approximately a 180 degree arc. 2. Position the barrel of the weapon within the NO-FIRE zone. 3. Set system “SAFE/ARMED" switch to the "ARMED" position. 4. Press the trigger for approximately 1 second. 5. Position the barrel of the weapon outside of the NO-FIRE ZONE. 6. Press the trigger for approximately 1 second.	1. No-fire zone set. 2. Barrel positioned within the no-fire zone. 3. Verify “SAFE “ indication appears on DU screen. 4. Verify the remote firing solenoid DID NOT ACTIVATE (system will not ARM or FIRE while barrel of weapon is inside ACTIVE NO-FIRE ZONE). 5. Verify: Barrel positioned outside the no-fire zone. Verify “ARMED“ indication appears on DU screen. 6. Verify the Remote Firing Solenoid activates (system will ARM and FIRE when barrel is moved out of an ACTIVE NO FIRE ZONE).	1. Reboot system and verify fault. **NOTE** Ensure the current weapon system is properly configured. 2. If still unable to set a NO FIRE ZONE, determine if system is mission capable. 3. If fault remains, send system to next higher maintenance.	

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
22. M2 Remote Charging	1. Check DU screen. 2. Press and release the "CHARGED/SAFE" switch to the "CHARGED" position. 3. Press and release the "CHARGED/SAFE" switch to the "SAFE" position. 4. Press and release the "CHARGED/SAFE" switch to the "CHARGED" position.	1. Verify “WPN-CHARGED” message appears on DU screen. 2. Observe: Linear actuator move toward the rear, stop at the rear end of travel and return to the forward position, actuating the sear assembly and releasing the weapon bolt. “WEAPON CHARGED” indication briefly disappears while the actuator is in the full rear position. 3. Verify the charger extends fully and remains extended. 4. Observe: Linear actuator move to the forward position actuating the sear assembly. "WEAPON CHARGED" indication is displayed on DU screen.	1. Reboot system and verify fault. **NOTE** Ensure the current weapon system is properly configured. 2. If charger does not extend or retract, replace charger. 3. If fault remains, send system to next higher maintenance. 4. Send to next higher maintenance if charger does not extend or retract; weapon does not charge; or if “WPN- CHARGED” message does not appear on DU screen.	1. Charger does not extend or retract. 2. Weapon does not charge. 3. “WPN- CHARGED” message does not appear on DU screen.

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
23. Mk19 Remote Charging	1. Check DU screen. 2. Press and release the "CHARGED/SAFE" switch to the "CHARGED" position. 3. Press and release the "CHARGED/SAFE" switch to the "SAFE" position. 4. Press and release the "CHARGED/SAFE" switch to the "CHARGED" position.	1. Verify “WPN-CHARGED” message appears on DU screen. 2. Observe: Linear actuator move toward the rear, stop at the rear end of travel, and return to the forward position, actuating the sear assembly and releasing the weapon bolt. “WEAPON CHARGED” indication briefly disappears while the actuator is in the full rear position. 3. Verify the charger extends fully and remains extended. 4. Observe: Linear actuator move to the forward position. "WEAPON CHARGED" indication is displayed on DU screen.	1. Reboot system and verify fault. **NOTE** Ensure the current weapon system is properly configured. 2. If charger does not extend or retract, replace charger. 3. If fault remains, send system to next higher maintenance. 4. Send to next higher maintenance if charger does not extend or retract; weapon does not charge; or if “WPN- CHARGED” message does not appear on DU screen.	1. Charger does not extend or retract. 2. Weapon does not charge. 3. “WPN- CHARGED” message does not appear on DU screen.

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
24. M240 Remote Charging	1. Verify "WEAPON CHARGED" is displayed on DU screen. 2. Press and release the "CHARGED/SAFE" switch to the "CHARGED" position. 3. Press and release the "CHARGED/SAFE" switch to the "SAFE" position. 4. Press and release the "CHARGED/SAFE" switch to the "CHARGED" position.	1. "WEAPON CHARGED" is displayed on DU screen. 2. Observe: Linear actuator move toward the rear, stop at the rear end of travel and return to the forward position. "WEAPON CHARGED" indication briefly disappears while the actuator is in the full rear position. 3. Observe: Linear actuator move toward the rear and stop at the rear end of travel. "WEAPON CHARGED" indication briefly disappears while the actuator is in the full rear position. 4. Observe: Linear actuator move to the forward position. "WEAPON CHARGED" indication is displayed on DU screen.	1. Reboot system and verify fault. **NOTE** Ensure the current weapon system is properly configured. 2. If charger does not extend or retract, replace charger. 3. If fault remains, send system to next higher maintenance. 4. Send to next higher maintenance if charger does not extend or retract; weapon does not charge; or if "WPN- CHARGED" message does not appear on DU screen.	1. Charger does not extend or retract. 2. Weapon does not charge. 3. "WPN- CHARGED" message does not appear on DU screen.

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
25. M249 Remote Charging	1. Verify "WEAPON CHARGED" is displayed on DU screen. 2. Press and release the "CHARGED/SAFE" switch to the "CHARGED" position. 3. Press and release the "CHARGED/SAFE" switch to the "SAFE" position. 4. Press and release the "CHARGED/SAFE" switch to the "CHARGED" position.	1. "WEAPON CHARGED" is displayed on DU screen. 2. Observe: Linear actuator move toward the rear, stop at the rear end of travel and return to the forward position. "WEAPON CHARGED" indication briefly disappears while the actuator is in the full rear position. 3. Observe: Linear actuator move toward the rear and stop at the rear end of travel. "WEAPON CHARGED" indication briefly disappears while the actuator is in the full rear position. 4. Observe: Linear actuator move to the forward position. "WEAPON CHARGED" indication is displayed on DU screen.	1. Reboot system and verify fault. **NOTE** Ensure the current weapon system is properly configured. Only standard, not collapsible, butt stocks on the M249 are compatible with the M240/M249 WAK. 2. If charger does not extend or retract, replace charger. 3. If fault remains, send system to next higher maintenance. 4. Send to next higher maintenance if charger does not extend or retract; weapon does not charge; or if "WPN- CHARGED" message does not appear on DU screen.	1. Charger does not extend or retract. 2. Weapon does not charge. 3. "WPN- CHARGED" message does not appear on DU screen.

Table 1. Before Operational Check - Cont.

Task	Procedure or Reference	Verification	Operator Troubleshooting Action	Equipment Not Ready/Available If:
26. Ammunition Type Setup	1. Switch to Ammunition Submenu. 2. Select appropriate weapon to be utilized. 3. Select appropriate ammunition for mission requirements.	1. Verify ammunition type appears on main engagement screen. 2. Correct weapon is selected. 3. Correct ammunition is selected.	1. Reboot system and verify the fault. 2. If fault remains, send system to next higher maintenance. 3. If correct ammunition or weapon will not select, send system to next higher maintenance.	1. Correct weapon will not select. 2. Correct ammunition will not select.
27. Round Counter Setup	1. Switch to main “MENU” screen. 2. Set rounds count to appropriate amount for mission requirement. 3. Set rounds count per mission requirement.	1. Verify main menu is on DU screen. 2. Verify the ability to set a rounds count to ensure the system is ready for ammunition loading. 3. Rounds count is set per mission requirement.	1. Reboot system and verify the fault. 2. If fault remains, send system to next higher maintenance. 3. If correct rounds count will not select, send system to next higher maintenance.	

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

OPERATIONAL CRITERIA

This work package contains criteria for determination of CROWS Mission Readiness. Criteria are presented to determine if the CROWS system status is Not-Mission-Capable (NMC) or Partially-Mission-Capable (PMC). The criteria is used for determining the status of the CROWS system only, and not the status of the vehicle or weapon.

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GENERAL

NOTE

See WP 0024, Troubleshooting Index, for an explanation of error message probable causes and operator actions to resolve and correct the error.

Table 1 is a listing of System Report error messages that may occur during initial startup, with their corresponding Failed Subsystem Report error messages.

Table 2 is a listing of Engagement screen General Fault error messages that may occur during operation of the CROWS, with their corresponding Failed Subsystem Report error messages.

Table 3 is a listing of functional problems that may occur while operating the CROWS.

If a CROWS system fault or functional check falls under Not Mission Capable (NMC), send the system to your next higher maintenance echelon. If a CROWS system fault or functional check falls under Partially Mission Capable (PMC), the Commander may make a mission readiness determination dependant on the current mission requirements.

Prior to making a mission readiness determination of NMC or PMC, ensure that::

1. Operator has completed PMCS IAW WP 0026.

2. Operator is in-process of performing, or has successfully performed, the Before Operational Check IAW WP 0027.

3. Operator has completed or has attempted to perform troubleshooting and resetting of the CROWS IAW WP 0023.

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Table 1. CROWS System Report and Failed Subsystem Report Error Messages.

SYSTEM REPORT	FAILED SUBSYSTEM REPORT	CROWS ERROR MESSAGES	NOTES	NMC	PMC
X		"Sensor Unit Unknown"		X	
X		"Sensor Unit Failed"	Mission dependent. If ALL below subsystems are reported as failed on Failed Subsystem Report, the Sensor Unit is Not Mission Capable (NMC): "Air Pressure Sensor", "CantEl", "Day Camera", "Laser", "Temperature Sensor" and "Thermal Camera" If both Day Camera AND Thermal Camera fail, Sensor Unit is NMC.	See Failed Subsystem Reports below	
	X	"Air Pressure Sensor"	Enter Air Pressure manually if it differs from the default value. Refer to WP 0015, Table 10.		X
	X	"CantEl Sensor"	Enter Cant manually if it differs from the default value. Refer to WP 0015, Table 10.		X
	X	"Day Camera"			X
	X	"Laser"	Enter Range to target manually if it differs from the default value. Refer to WP 0015, Table 10.		X
	X	"Temperature Sensor"	Enter Air Temperature manually if it differs from the default value. Refer to WP 0015, Table 10.		X
	X	"Thermal Camera"			X
X		"EMU Unknown"		X	

NOTE

Table 1. CROWS System Report and Failed Subsystem Report Error Messages - Cont.

SYSTEM REPORT	FAILED SUBSYSTEM REPORT	CROWS ERROR MESSAGES	NOTES	NMC	PMC
X		"EMU Failed"		See Failed Subsystem Reports below	
	X	"WAM* configuration"		X	
	X	"Video System"		X	
X		"ICU Unknown"		X	
X		"ICU Failed"		See Failed Subsystem Reports below	
	X	"Firing State Unknown"		X	
	X	"Trigger Relay Fail Closed"		X	
	X	"Trigger Relay Fail Open"		X	
	X	"Burst Relay Fail Closed"		X	
	X	"Burst Relay Fail Open"		X	
	X	"Gimbal Azimuth Gyro"	Mission dependent. Loss of stabilization.		X
	X	"Gimbal Elevation Gyro"	Mission dependent. Loss of stabilization.		X
X		"GIMBAL Comms Failed"		See Failed Subsystem Report below	
	X	"Gimbal Joystick Interface"		X	
X		"Gimbal BIT Status Unknown"		X	

* WAM = weapons and ammunition management.

Table 1. CROWS System Report and Failed Subsystem Report Error Messages - Cont.

SYSTEM REPORT	FAILED SUBSYSTEM REPORT	CROWS ERROR MESSAGES	NOTES	NMC	PMC
X		"Gimbal BIT Status Failed"		See Failed Subsystem Reports below	
	X	"Azimuth Drive"	NMC if fault cannot be cleared.	X	
	X	"Azimuth Resolver"	NMC if fault cannot be cleared.	X	
	X	"Sight Elevation Drive"	NMC if fault cannot be cleared.	X	
	X	"Sight Elevation Resolver"	NMC if fault cannot be cleared.	X	
	X	"Weapon Elevation Drive"	NMC if fault cannot be cleared.	X	
	X	"Weapon Elevation Resolver"	NMC if fault cannot be cleared.	X	
	X	"Weapon Charger"	NMC if fault cannot be cleared.	X	

Table 2. CROWS Engagement Screen General Fault and Failed Subsystem Report Error Messages.

GENEAL FAULT	FAILED SUBSYSTEM REPORT	CROWS ERROR MESSAGES	NOTES	NMC	PMC
X		"BALLISTIC FILE ERROR"		X	
X		"BURST RELAY FAILED CLOSED"		X	
X		"BURST RELAY FAILED OPEN"		X	
X		"CANTEL SENSOR FAILED"	Enter Cant manually if it differs from the default value. Refer to WP 0015, Table 10.		X
X		"EMU Unknown"		X	

Table 2. CROWS Engagement Screen General Fault and Failed Subsystem Report Error Messages – Cont.

GENEAL FAULT	FAILED SUBSYSTEM REPORT	CROWS ERROR MESSAGES	NOTES	NMC	PMC
X		"EMU Failed"		X	
X		"FIRING STATE UNKNOWN"		X	
X		"GWS BIT ERROR-FIRING INHIBITED"	NMC if fault cannot be cleared.	X	
X		"ICU Unknown"		X	
X		"ICU Failed"		X	
X		"LASER FAILED"	Enter Range to target manually if it differs from the default value. Refer to WP 0015, Table 10.		X
X		"NO BALLISTIC SOLUTION INITIATE"		X	
X		"NO FIRE ZONES"		X	
X		"SENSOR UNIT Unknown"		X	
X		"SENSOR UNIT Failed"	If ALL below subsystems are reported as failed on Failed Subsystem Report, the Sensor Unit is Not Mission Capable (NMC): "Air Pressure Sensor", "CantEl", "Day Camera", "Laser", "Temperature Sensor" and "Thermal Camera"	See Failed Subsystem Report below	
	X	"Air Pressure Sensor"	Enter Air Pressure manually if it differs from the default value. Refer to WP 0015, Table 10.		X
	X	"CantEl Sensor"	Enter Cant manually if it differs from the default value. Refer to WP 0015, Table 10.		X

Table 2. CROWS Engagement Screen General Fault and Failed Subsystem Report Error Messages – Cont.

GENEAL FAULT	FAILED SUBSYSTEM REPORT	CROWS ERROR MESSAGES	NOTES	NMC	PMC
	X	"Day Camera"	Both Day Camera AND Thermal Camera must fail for Sensor Unit to be declared NMC.		X
	X	"Laser" Failed	Enter Range to target manually if it differs from the default value. Refer to WP 0015, Table 10.		X
	X	"Temperature Sensor"	Enter Air Temperature manually if it differs from the default value. Refer to WP 0015, Table 10.		X
	X	"Thermal Camera"	Both Day Camera AND Thermal Camera must fail for Sensor Unit to be declared NMC.		X
X		"TEMPERATURE SENSOR FAILED"	Enter Air Temperature manually if it differs from the default value. Refer to WP 0015, Table 10.		X
X		"PRESSURE SENSOR FAILED"	Enter Air Pressure manually if it differs from the default value. Refer to WP 0015, Table 10.		X
X		"TRIGGER RELAY FAILED CLOSED"		X	
X		"TRIGGER RELAY FAILED OPEN"		X	
X		"TRP Fault"			X
X		"TX** NOT DETECTED"	Enter Range to target manually if it differs from the default value. Refer to WP 0015, Table 10.		X
X		"WEAPON NOT BORESIGHTED"	NMC if boresighting is attempted and cannot be accomplished.	X	

** TX = transmit.

NOTE

Press the STAB switch LEFT for OFF; press RIGHT for ON.

Table 3. CROWS Functional Operational Criteria.

CROWS FUNCTION	NMC	PMC
System does not power up or boot up	X	
Azimuth Travel Lock will not disengage	X	
Display unit does not turn on when power is applied for 1 minute, 30 sec	X	
No camera video on Display Unit	X	
No screen graphics on Display Unit	X	
Azimuth does not slew (left or right)	X	
Elevation does not slew (up or down)	X	
Sensor Unit does not slew up or down	X	
SAFE/ARM Function Failure - SAFE/ARMED indications on screen are incorrect and do not correspond to switch position on SPU	X	
Hatch Interlock Failure	X	
Opening the hatch(es) did not “SAFE” the system	X	
Safety Override is not overriding the hatch interlock		X
Correct Weapon Not Displayed	X	
Ammunition cannot be selected	X	
Weapon does not remotely charge	X	
Weapon does not fire due to malfunctioning remote firing solenoid	X	
Mount moves uncommanded when system is powered up	X	
Mount will not move to proper target aim point	X	
No Fire Zones do not inhibit firing	X	
Boresighting cannot be successfully performed	X	

Table 3. CROWS Functional Operational Criteria - Cont.

CROWS FUNCTION	NMC	PMC
Laser Range Finder does not function. Enter range to target manually if it differs from the default value. Refer to WP 0015, Table 10.		X
Loss of Rounds Counting		X
System will not go into TRP menu (mission dependent)		X
System will not go into surveillance mode (mission dependent)		X
System will not go into sector scan (mission dependent)		X
System will not switch to passive mode (mission dependent)		X
System will not switch to aggressive mode (mission dependent)		X
Azimuth FOG*** Failure – Stationary Platform (mission dependent)		X
Azimuth FOG*** Failure – Mobile Platform (STAB OFF)		X
Elevation FOG*** Failure -- Stationary Platform (mission dependent)		X
Elevation FOG*** Failure -- Mobile Platform (STAB OFF) (mission dependent)		X
Color settings will not change		X
Polarity of thermal camera will not change		X
Range step settings will not change		X

*** FOG = fiber optic gyro.

Table 3. CROWS Functional Operational Criteria - Cont.

CROWS FUNCTION	NMC	PMC
Units settings will not change		X
Joystick Failure	See Individual Switch Failure below	
Loss of Joystick Servo Control	X	
Loss of Joystick Deadman Switch	X	
Loss of Joystick Trigger Switch	X	
Loss of Joystick Left Switch (if Display Unit Cursor & Lase / Accept switch OK)		X
Loss of Joystick Right Switch (if Display Unit Cursor & Menu / Cam switch OK)		X
SPU Failure	See Individual Switch Failure below	
Loss of POWER Switch	X	
Loss of ARMED / SAFE Switch	X	
Loss of SGL Switch (currently not available)	N/A	N/A
Loss of Remote Charger Switch	X	
Loss of SAFETY OVERRIDE Switch	X	
Display Unit	See Individual Switch Failure below	
Loss of Contrast Switch (if loss results in unusable display on screen)	X	
Loss of Brightness Switch (if loss results in unusable display on screen)	X	
Loss of Cursor Switch (PMC if Joystick Camera / Menu & Lase / Accept switches OK)		X
Loss of Lase / Accept Switch (PMC if Joystick Lase / Accept switch OK)		X
Loss of Menu Switch (PMC if Joystick Menu switch OK)		X
Loss of Camera Select Switch (PMC if Joystick Camera switch OK)		X
Loss of TRP Switch (mission dependent)		X

Table 3. CROWS Functional Operational Criteria - Cont.

CROWS FUNCTION	NMC	PMC
Sensor Unit	See Individual Function Failure below	
Both Day Camera and Thermal Camera Fail	X	
Day Camera (see individual failure below):		
Loss of FOV zoom servo (use for determining serviceability of day camera)	X	
Loss of focus servo (use for determining serviceability of day camera)	X	
Loss of Automatic Exposure Control (AEC) servo (use for determining serviceability of day camera)	X	
Thermal Camera (see individual failure below):		
Loss of FOV zoom servo (use for determining serviceability of thermal camera)	X	
Loss of focus servo (use for determining serviceability of thermal camera)	X	
Loss of Automatic Gain Control (AGC) servo (use for determining serviceability of thermal camera)	X	
Laser Range Finder. Enter range to target manually if it differs from the default value. Refer to WP 0015, Table 10.		X
Temperature Sensor. Enter range to target manually if it differs from the default value. Refer to WP 0015, Table 10.		X
Pressure Sensor. Enter range to target manually if it differs from the default value. Refer to WP 0015, Table 10.		X
Cant Sensor. Enter range to target manually if it differs from the default value. Refer to WP 0015, Table 10.		X
Target Elevation (El) Sensor. Enter range to target manually if it differs from the default value. Refer to WP 0015, Table 10.		X

END OF TASK

END OF WORK PACKAGE

CHAPTER 5

CROWS

MAINTENANCE INSTRUCTIONS

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

CLEANING

THIS WORK PACKAGE COVERS:

Instructions on cleaning CROWS components/assemblies.

INITIAL SET UP:

Tools and Special Tools:

Operator's Tool Kit (WP 0036, Table 2, Item 1)

Personnel Required:

One

References:

WP 0025
WP 0026
WP 0035
WP 0036
WP 0038

Materials/Parts:

Alcohol, ethyl (WP 0038, Table 1, Item 2)
Alcohol, isopropyl (WP 0038, Table 1, Item 3)
Brush, artist's (WP 0038, Table 1, Item 5)
Cleaning compound, lens (WP 0038, Table 1, Item 6)
Cloth, cleaning, lint free (WP 0038, Table 1, Item 7)
Cotton, balls (WP 0038, Table 1, Item 11)
Detergent (WP 0038, Table 1, Item 12)
Dust remover, compressed air (WP 0038, Table 1, Item 13)
Gloves, plastic/latex (WP 0038, Table 1, Item 14)
Goggles, industrial (WP 0038, Table 1, Item 16)
Grease, lubricant (WP 0038, Table 1, Item 17)
Paper tissue, lens (WP 0038, Table 1, Item 19)
Water, distilled (WP 0038, Table 1, Item 23)

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Painted and Metallic Surfaces 2
Rubber Materials 2
Connectors 3
Optics 3
Display Unit (DU) 4
Linear Actuator (Charger) Extension Rod Procedures 4

NOTE

For procedures to clean CROWS components/assemblies, refer to WP 0025, PMCS Introduction and WP 0026, Preventive Maintenance Checks and Services (PMCS).

GENERAL CLEANING INSTRUCTIONS

WARNING

Wear appropriate eye protection when cleaning the system or its parts. Failure to do so may result in personal injury.

NOTE

Refer to specific operation and maintenance manuals for weapon-cleaning procedures, as listed in WP 0035, References.

Should damage be discovered during cleaning operations, refer to Unit Maintenance.

Painted and Metallic Surfaces

Clean painted and metallic surfaces as follows.

1. Remove dust and foreign matter with a dry, clean, lint-free cloth or brush.
2. Remove dust and foreign matter from inaccessible areas with low-pressure (3 to 5 PSI) compressed air or a dry cleaning brush.

WARNING

Do not use ethyl alcohol near an open flame or a source of sparks. Use ethyl alcohol in a well-ventilated area to prevent undue exposure to vapors. If accidental skin contact occurs, wash the exposed area immediately with detergent and water. Failure to follow these instructions may result in personal injury.

3. Remove contamination with a clean, lint-free cloth or lint-free cotton swab moistened, not saturated, with ethyl alcohol.

END OF TASK

Rubber Materials

1. Clean rubber parts with a lint-free cloth moistened, not saturated, with clean water.

END OF TASK

Connectors

Clean connectors as follows:

1. Remove dust and foreign matter with a nonmetallic brush or low-pressure (3 to 5 PSI) compressed air.

WARNING

Do not use ethyl alcohol near an open flame or a source of sparks. Use ethyl alcohol in a well-ventilated area to prevent undue exposure to vapors. If accidental skin contact occurs, wash the exposed area immediately with detergent and water. Failure to follow these instructions may result in personal injury.

2. Clean connector shell and threads with a clean, lint-free cloth moistened, not saturated, with ethyl alcohol.

END OF TASK

Optics

Clean optics as follows.

CAUTION

Use extreme care to avoid scoring or scratching glass surfaces. Use the materials listed below in the order given. Avoid fingerprints on optical surfaces.

Do not use compressed air to clean optical surfaces because the glass may become scored or pitted. Use only authorized materials during cleaning procedures. Do not use commercial cleaners on optics. Failure to follow these instructions may result in equipment damage.

1. Gently remove dust, loose soil, lint, and other foreign matter from optical parts with a clean, dry brush.

CAUTION

Always use clean, moistened cotton balls or swabs to clean optical elements. Once the cotton ball or swab is lifted from the surface, discard it. The build-up of dirt on the cotton ball or swab will damage the surface. Failure to follow these instructions may result in equipment damage.

2. Use the following procedure to clean optical surfaces with optical glass cleaner.
   a. Lightly moisten a cotton ball or folded lens tissue with optical glass cleaner.
   b. Dab the cotton ball or tissue gently over the glass surface, lightly coating the surface.
   c. Discard the cotton ball or tissue after lifting it from the element surface.
   d. Hold a lens tissue at an approximately 135° angle to the surface. Using one continuous motion, gently pull the tissue across the element surface in a “squeegee” fashion. Discard the tissue.
   e. Repeat steps a thru d as needed until the surface is completely dry and free of streaks.

END OF TASK

GENERAL CLEANING INSTRUCTIONS - Cont

Display Unit (DU)

Perform the following procedures to clean the DU.

WARNING

Do not use isopropyl alcohol near heat, an open flame, or a source of sparks. Use isopropyl alcohol in a well-ventilated area to prevent undue exposure; avoid breathing vapors. Avoid contact with eyes. If accidental contact occurs, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately. Avoid contact with skin and clothing. If accidental contact occurs, wash the exposed area immediately with detergent and water. Failure to follow these instructions may result in personal injury.

CAUTION

Abrasive cleaners should not be used to clean the DU screen. Avoid the use of chemical cleaning agents that might damage the plastics used in the display module. In particular, avoid chemicals that contain benzene, toluene, xylene, acetone, methylethylketone (MEK), or similar aggressive solvents.

1. Gently remove smudges, dirt, or foreign objects with a clean cloth dampened, not saturated, with clean water.
2. If step 1 does not completely clean the display, use a clean cloth dampened with a solution of 20% isopropyl alcohol and 80% clean water.

END OF TASK

Linear Actuator (Charger) Extension Rod Procedures

Perform the following procedures to clean the linear actuator (charger) rod (part of the adapter kits).

1. The only cleaning necessary is to wipe off the actuator rod, shown in Figure 1, with a clean, dry cloth.



Figure 1. Sample Actuator Rod from M240/M249 Weapon Adapter Kit (WAK).

END OF TASK

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

LUBRICATION

THIS WORK PACKAGE COVERS:

Lubrication maintenance procedures performed on the CROWS at the operator level.

INITIAL SET UP:

Tools and Special Tools:

Operator's Tool Kit (WP 0036, Table 2, Item 1)

Personnel Required:

One

References:

WP 0029
WP 0035
WP 0036
WP 0038

Materials/Parts:

Alcohol, isopropyl (WP 0038, Table 1, Item 3)
Cloth, cleaning, lint free (WP 0038, Table 1, Item 7)
Detergent (WP 0038, Table 1, Item 12)
Gloves, plastic/latex (WP 0038, Table 1, Item 14)
Goggles, industrial (WP 0038, Table 1, Item 16)
Grease, lubricant (WP 0038, Table 1, Item 17)
Water, distilled (WP 0038, Table 1, Item 23)

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General Lubrication Procedures 2
Attenuator Shaft Procedures 3
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LUBRICATION OVERVIEW

Selected components need to be lubricated on a quarterly basis or when the mount is reconfigured with a new weapon. Components include:

- Linear actuator extension rod (part of the weapon adapter kits (WAKs))
- Attenuator rods (part of M2 WAK)
- All detent, retaining, or holding pins in the cradle assembly, ammo can, and WAKs

NOTE

For a list of expendable or durable materials needed for this procedure, refer to WP 0038.

For general cleaning procedures, refer to WP 0029.

For lubrication procedures related to specific weapons, refer to the operation and maintenance manuals listed in WP 0035, References.

GENERAL LUBRICATION PROCEDURES

Use the following procedures to lubricate components.

WARNING

Follow all safety warnings and cautions.

Use appropriate eye protection when lubricating and cleaning the system or its parts.

Failure to do so may result in personal injury.Use only authorized materials during these procedures.

Do not use isopropyl alcohol near heat, an open flame, or a source of sparks. Use isopropyl alcohol in a well-ventilated area to prevent undue exposure; avoid breathing vapors. Avoid contact with eyes. If accidental contact occurs, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately. Avoid contact with skin and clothing. If accidental contact occurs, wash the exposed area immediately with soap and water.

Failure to follow these instructions may result in personal injury.

CAUTION

Do not lubricate any part of the linear actuator (charger), the rod end (part of the M2 WAK) or the end rod assembly (part of the Mk19 WAK). Failure to follow these instructions may result in equipment damage.

1. Clean the item with isopropyl alcohol and allow to dry.
2. Apply a thin film of lubricant, thoroughly coating the component.
3. Wipe any excess lubricant off of the component with a clean, lint-free cloth.

END OF TASK

Attenuator Shaft Procedures

NOTE

The left-hand and right-hand attenuators are different. The front slider bushing on the left-hand attenuator protrudes (see Figure 1).

Perform the following procedures to lubricate attenuator shafts (part of the M2/Mk19 cradle), as shown in Figure 1.

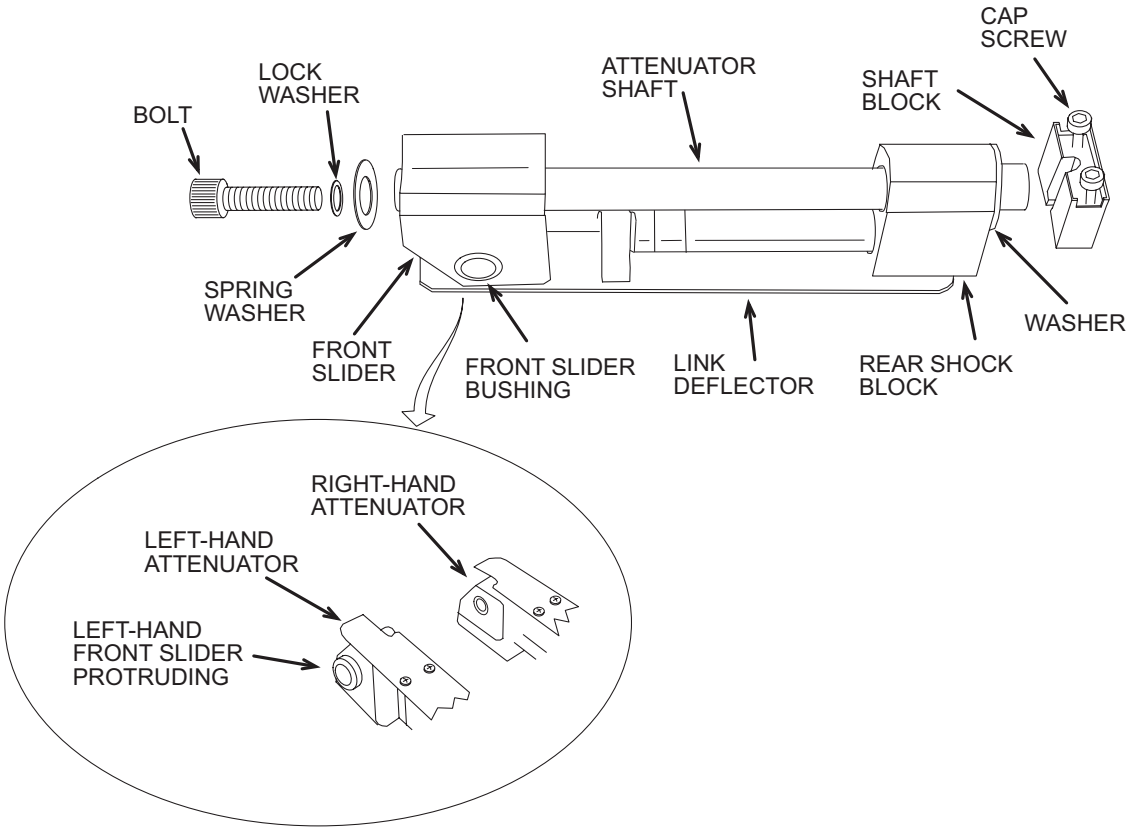


Figure 1. Right-Hand Attenuator Assembly with Attaching Hardware.

WARNING

Do not use isopropyl alcohol near heat, an open flame, or a source of sparks. Use isopropyl alcohol in a well-ventilated area to prevent undue exposure; avoid breathing vapors. Avoid contact with eyes. If accidental contact occurs, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately. Avoid contact with skin and clothing. If accidental contact occurs, wash the exposed area immediately with soap and water. Failure to follow these instructions may result in personal injury.

1. Clean the shaft with isopropyl alcohol and allow to dry.
2. Apply a thin film of lubricant, thoroughly coating the shaft.
3. Wipe any excess lubricant from the shaft with a clean, lint-free cloth.

END OF TASK

GENERAL LUBRICATION PROCEDURES - Cont

Pin Procedures

Perform the following procedures to lubricate all detent, retaining, quick-release, or holding pins in the cradle assembly, ammo can, and WAKs. Samples of some of the pins are shown in Figure 2.

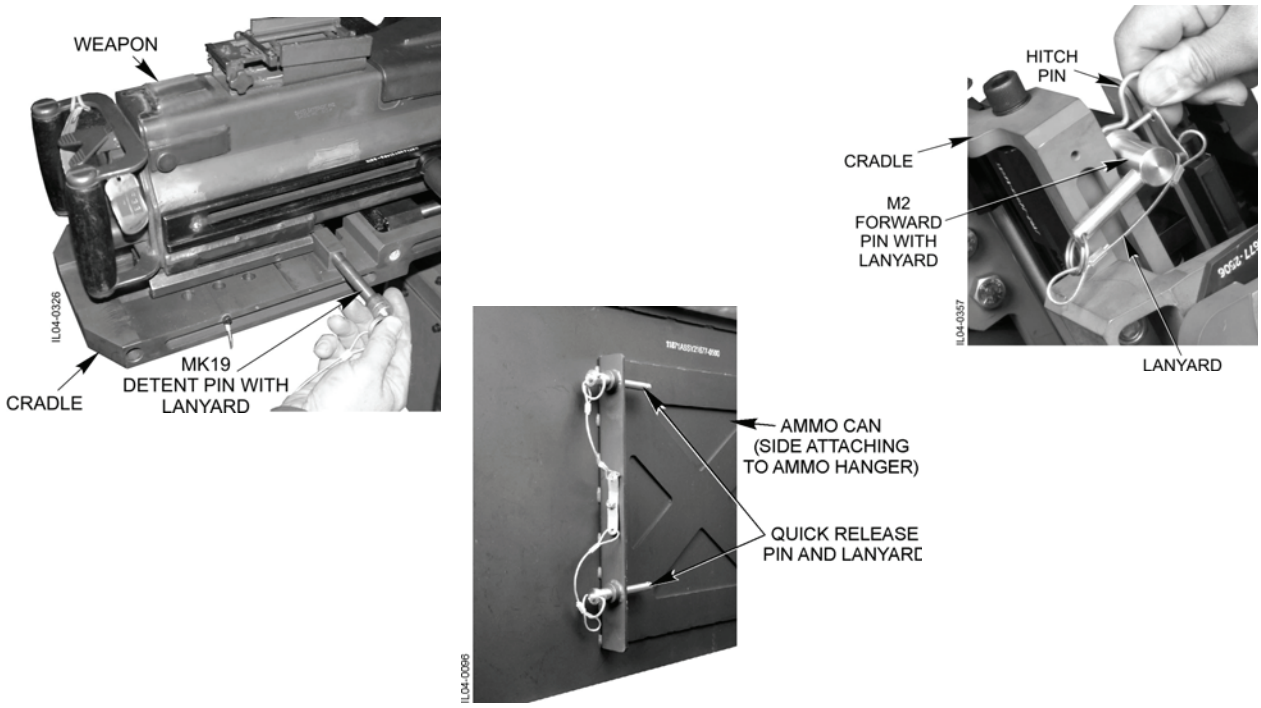


Figure 2. Examples of Pins and Locations.

WARNING

Do not use isopropyl alcohol near heat, an open flame, or a source of sparks. Use isopropyl alcohol in a well-ventilated area to prevent undue exposure; avoid breathing vapors. Avoid contact with eyes. If accidental contact occurs, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately. Avoid contact with skin and clothing. If accidental contact occurs, wash the exposed area immediately with soap and water. Failure to follow these instructions may result in personal injury.

1. Gently pull the pins out from their holding positions. For quick-release-type pins, push the center button to reveal the internal rod.
2. Clean the pins and internal rods with isopropyl alcohol and allow to dry.
3. Apply a thin film of lubricant, thoroughly coating the pins and internal rods.
4. Wipe any excess lubricant from the pins and rods with a clean, lint-free cloth.
5. Return the pins to their normal positions.

END OF TASK

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

SAFETY WIRE PROCEDURES

THIS WORK PACKAGE COVERS:

Items and instructions used to perform operator-level safety wire procedures.

INITIAL SET UP:

Tools and Special Tools:

Operator's Tool Kit (WP 0036, Table 2, Item 1)

Materials/Parts:

Wire, safety (WP 0038, Table 1, Item 24)

References:

WP 0036
WP 0038

Personnel Required:

One

Equipment Conditions:

System power off

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Wire Size	2
Wire-Twisting Practices and Criteria	2
Finishing Off with a Pigtail	3
Special Methods or Considerations	4
Methods for Multiple Fasteners, Closely Spaced	4
Single Wire Method	4
Examples of Safety Wiring CROWS Components/Parts	5

GENERAL REQUIREMENTS

WARNING

Wear eye protection when safety-wiring. Failure to do so may result in personal injury.

CAUTION

Use only new safety wire is for each application. Dispose of used wire and wire cuttings safely. Failure to follow these instructions may result in equipment damage.

NOTE

The terms “safety wire” and “lock wire” are used interchangeably in this procedure.

Wire Size

Use .020-inch diameter safety wire, on parts having the following characteristics:

- A nominal hole diameter of less than .045 inch.
- A nominal hole diameter between .045 and .062, with a spacing between parts of less than 2 inches.
- Closely spaced screws and bolts of 1/4-inch diameter and smaller.

Wire-Twisting Practices and Criteria

Ensure the following methods are used for properly twisting safety wire.

NOTE

Abrasions normally caused by commercially available wire-twisting pliers shall be acceptable.

1. Determine the direction – left-/right-hand or clockwise/counterclockwise – of the hardware to be safety-wired, ensuring the safety wire is threaded, twisted, and tied appropriately.

2. Safety-wire parts so that the safety wire is put in tension when the part starts to loosen.

   a. Always install and twist the lock-wire so that the loop around the head stays down and does not tend to come up over the bolt head and leave a slack loop.

   b. Exercise caution during the twisting operation to keep the wire tight without over-stressing it or allowing it to become nicked, kinked, or otherwise mutilated.

   c. Ensure that the safety wire does not touch adjacent parts or assemblies when that contact can cause damage or operational malfunction to those parts/assemblies, or to the safety wire.

NOTE

Standard safety-wire twists per inch is 14.

   d. Using a standard 14 twists per inch, twist the strands, keeping them tight, until the twisted part is just short of the nearest lock-wire hole in the next unit. The twisted portion shall be within 1/8 inch of the holes in each unit.

3. Ensure the following methods are used for electrical connectors using threaded coupling rings or for plugs using screws or rings to fasten the individual parts together:
   - Use only .020-inch diameter wire, making sure to follow all guidelines in this work package.
   - Safety-wire all electrical connectors individually.
   - Do not lock wire one connector to another unless absolutely necessary.
4. Use the double-twist method of lockwiring unless otherwise specified, as shown in Figures 1 and 2.

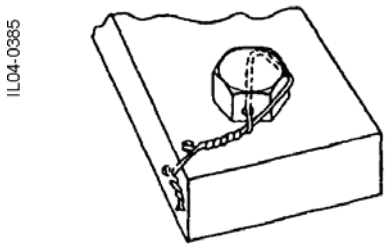


Figure 1. Single Fastener Application Using the Double-Twist Method.

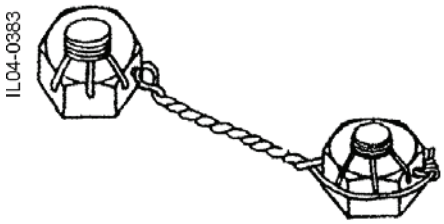


Figure 2. Castellated Nut on Undrilled Studs Using the Double-Twist Method.

END OF TASK

Finishing Off with a Pigtail

1. After wiring the last unit, make a pigtail of 1/4-inch to 1/2-inch (3 to 5 twists) at the end. Cut off excess wire.
2. Bend the pigtail in toward the part to prevent it from snagging other items and to prevent injury, as shown in Figure 3.

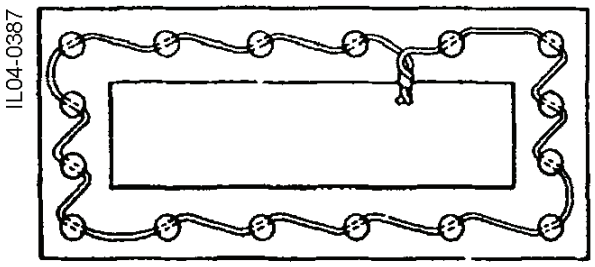


Figure 3. Small Screws in a Closely Spaced, Closed, Pattern with Pigtail Bent In.

SPECIAL METHODS OR CONSIDERATIONS

Methods for Multiple Fasteners, Closely Spaced

Ensure that, when multiple fasteners are safety-wired together, only 24-inch lengths of wire are used, maximum. This practice limits the number of fasteners that can be connected with one length of wire for improved safety and efficiency.

Figure 4 shows the double-twist method of connecting multiple fasteners. The example illustrates the standard practice of wrapping the safety wire through and around a multiple-hole fastener.

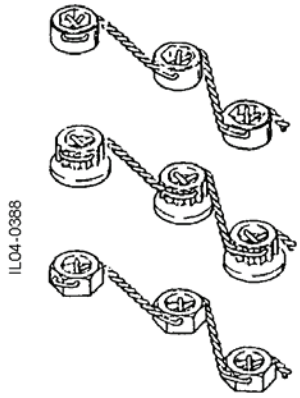


Figure 4. Standard Double-Twist Method – Multiple Holes.

Single-Wire Method

Figure 5 shows the single-wire method.

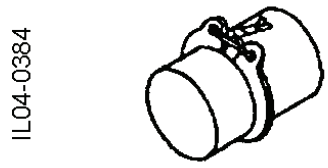


Figure 5. Securing Snap Ring Using the Single-Wire Method.

EXAMPLES OF SAFETY WIRING CROWS COMPONENTS/PARTS

Figure 6 illustrates safety wiring of the bolts securing the M2 linear actuator (charger) assembly to the cradle.

Note that the safety wire is threaded through the bolt, twisted for security, threaded both through and over the flange on the mounting plate, twisted again on the side of the flange away from the bolt, and then finished with a pigtail.

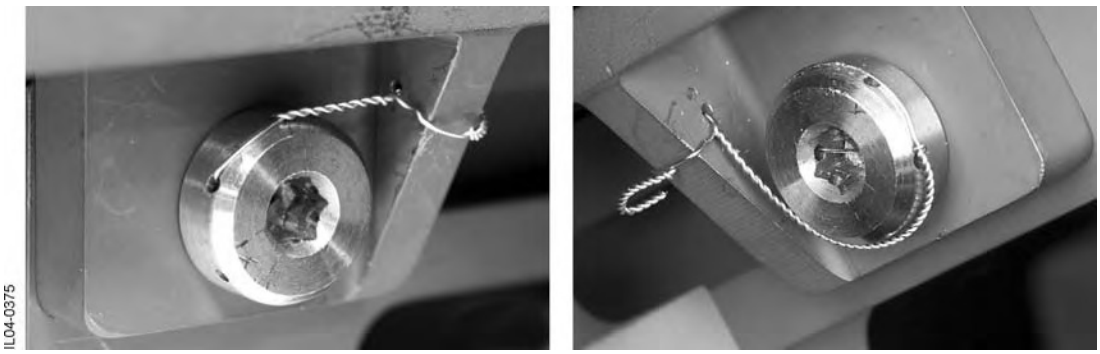


Figure 6. Bolts Safety Wired at Both Ends of the M2 Linear Actuator (Charger) Mounting Plate.

Figure 7 shows safety wiring of the screws on top of the solenoid in the remote firing assembly, using wire-twisting pliers.

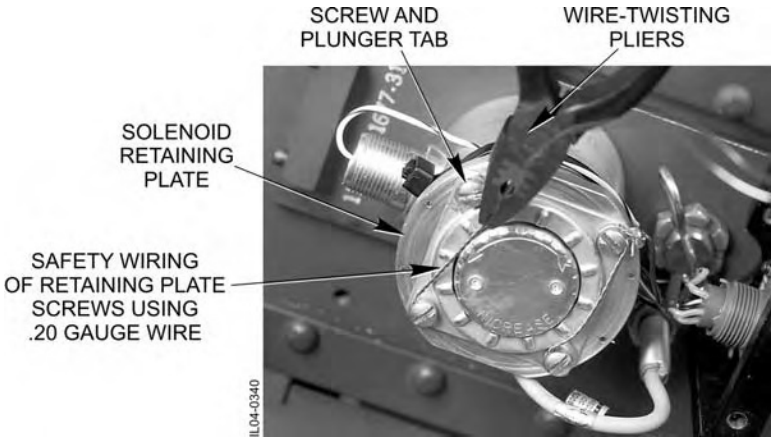


Figure 7. Screws on RFA Solenoid Being Safety Wired.

EXAMPLES OF SAFETY WIRING CROWS COMPONENTS/PARTS - Cont

Figure 8 shows the screws in the mounting plate of the linear actuator (charger) secured with safety wire.

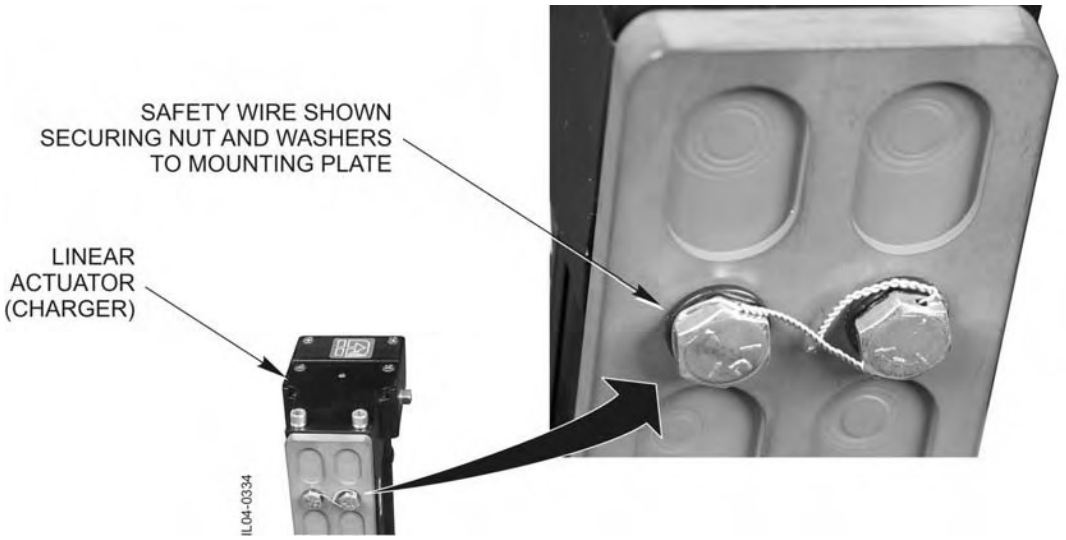


Figure 8. Linear Actuator (Charger) Mounting Plate Safety Wire Locations.

END OF WORK PACKAGE

OPERATOR's MANUAL
FOR THE
ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

THREAD-LOCKING PROCEDURES

THIS WORK PACKAGE COVERS:

Items and information to perform thread-locking procedures.

INITIAL SET UP:

Tools and Special Tools

Operator's Tool Kit (WP 0036, Table 2, Item 1)

Personnel Required

One

Equipment Conditions

System power off

References

WP 0029
WP 0036
WP 0038

Materials/Parts

Acetone (WP 0038, Table 1, Item 1)
Compound, thread-locking, blue (WP 0038, Table 1, Item 8)
Compound, thread-locking, red (WP 0038, Table 1, Item 9)
Compound, thread-locking, black (WP 0038, Table 1, Item 10)
Detergent (WP 0038, Table 1, Item 12)
Gloves, plastic/latex (WP 0038, Table 1, Item 14)
Goggles, industrial (WP 0038, Table 1, Item 16)
Water, distilled (WP 0038, Table 1, Item 23)

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Thread-Locking Retainers	3
Removal of Thread-Locked Parts	4

THREAD-LOCKING OVERVIEW

Thread-locking consists of securing, attaching or retaining parts with a type of cement applied to threads or exterior edges to prevent movement or loosening by vibration. (Thread locking may also be referred to as liquid staking.)

WARNING

Wear eye protection when performing thread-locking procedures.

Wear latex gloves during thread-locking removal and application. Exposure of compounds to skin may result in an allergic reaction.

Ensure that the work station/area is well-ventilated as solvent fumes can cause headaches and dizziness. Do not mix solvents.

Failure to follow these instructions may result in personal injury.

THREAD-LOCKING PROCEDURES

Thread-Locking Screws

NOTE

Ensure that all screw threads are free of oil before performing thread-locking procedures. Remove oil with a solvent and allow to dry.

Use a non-absorbent applicator such as a toothpick for application of thread-locking compound.

Use the following procedure to thread-lock screws.

1. Apply thread-locking compound to a few threads (the first few, if practical) of the screw immediately before final attachment. Use either the bottle spout or a toothpick to apply the compound.
2. In the case of adjusting screws, do not disturb the screw position, but apply the cement around the screw head.

END OF TASK

Use of Primer when Thread Locking

Table 1 shows drying and airing times for specific primers.

Table 1. Thread Locking Primer Use

Item	Time
WP 0038, Table 1, Item 10	Drying: 90 seconds (black-quick set)
WP 0038, Table 1, Items 8 and 9	Curing: 10 minutes to fix; 24 hours for full cure (blue-med strength; red-high strength)

CAUTION

Ensure proper primer and/or thread locking compound are being used prior to application. If needed, consult the applicable assembly method for further instructions. Failure to follow these instructions may result in equipment damage or inoperability.

NOTE

For further information on cleaning, refer to WP 0029.

Use the following procedure to use the primer.

1. Ensure the threaded surfaces are clean prior to applying primer or thread locking compound.
2. Apply primer to one of the mating surfaces and allow to dry for a minimum of 90 seconds.
3. Apply the appropriate thread locking compound to one side of the screw, covering approximately 1/3 of the length of the threads.
4. Insert the screw and tighten in accordance with the directions given.

END OF TASK

Thread-Locking Retainers

Use the following procedure to thread-lock threaded retainers.

1. Complete final attachment of the retainer.
2. Apply the thread-locking compound to the spanner wrench notches or holes.

END OF TASK

REMOVAL OF THREAD-LOCKED PARTS

Screws or nuts in various assemblies of the CROWS are thread-locked during assembly. When removing these parts, carefully scrape away thread-locking compound where accessible, but do not scrape threads to the extent that the part cannot be removed without damage.

Use the following procedure to loosen the thread-locking compound.

WARNING

Do not use acetone near heat, an open flame, or a source of sparks. Use acetone only in a well-ventilated area to prevent undue exposure; avoid breathing vapors. Avoid contact with eyes. If accidental contact occurs, immediately flush eyes with plenty of lukewarm water for at least 15 minutes. Seek medical attention immediately. Avoid contact with skin and clothing. If accidental contact occurs, wash the exposed area immediately with soap and water. Failure to follow these instructions may result in personal injury.

NOTE

During reassembly, apply the appropriate thread-locking compound to all parts from which thread-locking compound was removed during disassembly.

1. Note attaching hardware that has thread-locking compound applied for reference during reassembly.
2. Apply acetone to the threads.
3. Check to see if parts have loosened.
4. If needed, repeat step 2 until the part is loosened and able to be removed.
5. If screw will not loosen, send part to unit maintenance for removal.

END OF TASK

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

PREPARATION FOR CROWS STORAGE, HANDLING, AND SHIPPING

THIS WORK PACKAGE COVERS:

Procedures for preparing the CROWS for storage (especially stowing for special transport), handling, and shipping.

INITIAL SET UP:

Tools and Special Tools

Operator's Tool Kit (WP 0036, Table 2, Item 1)

Materials/Parts

N/A

References

WP 0006	WP 0010	WP 0013
WP 0007	WP 0011	WP 0014
WP 0008	WP 0012	WP 0036
WP 0009		

Personnel Required

One (63B)

Equipment Conditions

Cradle removed.

Ammo can removed.

Cables disconnected from the J3 and J6 connectors on the pedestal mount.

Two pieces of ballistic protection removed:

From between the J3 and J6 connector and the travel lock; and

The large piece on the J3/J6 connector end of the pedestal mount.

Weapon removed

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Stowing CROWS for Special Transport 2
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STOWING CROWS FOR SPECIAL TRANSPORT

CROWS components/assemblies are typically shipped in special containers. On occasion, however, the CROWS will be shipped in other ways (for example, in a height-restricted situation such as being transported on top of a vehicle in a C-130 aircraft), and will need to be put into the stow position.

CAUTION

When the ICU-Display Unit (DU) cable (P/N 21677-3715) is installed and secured, ensure that the radius of any bend measures at least 5 inches. Failure to follow this instruction may result in equipment damage and system inoperability.

NOTE

The remaining components of CROWS -- cradle, weapon adapter kits (WAKs), and Control Group – are packaged for standard shipment when the mount and Sensor Group are stowed for special transport.

Equipment Condition: Cradle removed. Ammo can removed. The cables disconnected from the J3 and J6 connectors on the pedestal mount. Two pieces of ballistic protection removed: from between the J3/J6 connector and the travel lock (see Figure 1) and the large piece on the J3/J6 connector end of the pedestal mount (see Figure 2).



Figure1. Removing Ballistic Protection between the J3/J6 Connectors and Travel Lock.

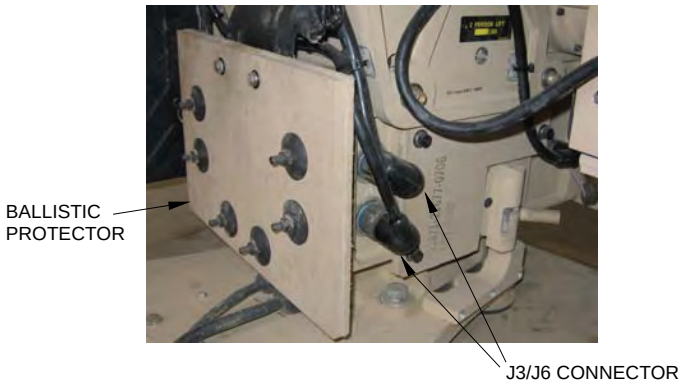


Figure 2. Removing Ballistic Protection from J3/J6 Side of Pedestal Mount.

Use the following procedure to stow the CROWS.

WARNING

Use two personnel during installation/removal of the weapon and cradle. Failure to do so may result in personal injury or equipment damage.

CAUTION

When the ICU-DU cable (P/N 21677-3715) is installed and secured, ensure that the radius of any bend measures at least 5 inches. Failure to follow this instruction may result in equipment damage and system inoperability.

NOTE

For additional information about the azimuth lock, refer to WP 0006.

For additional information about the M2 HB, Mk19, and M240/M249 WAKs and weapons, refer to WP 0007 thru WP 0014, and WP 0035, References.

1. Ensure azimuth lock assembly is in locked position.
2. If installed, remove the weapon, adapter kit, cables, cradle, and ammo can IAW the appropriate work package.

STOWING CROWS FOR SPECIAL TRANSPORT - Cont

3. Remove the bolts securing the casing deflector to the azimuth housing assembly, using a 7/16-inch, 12-point socket wrench, as shown in Figures 3 and 4.

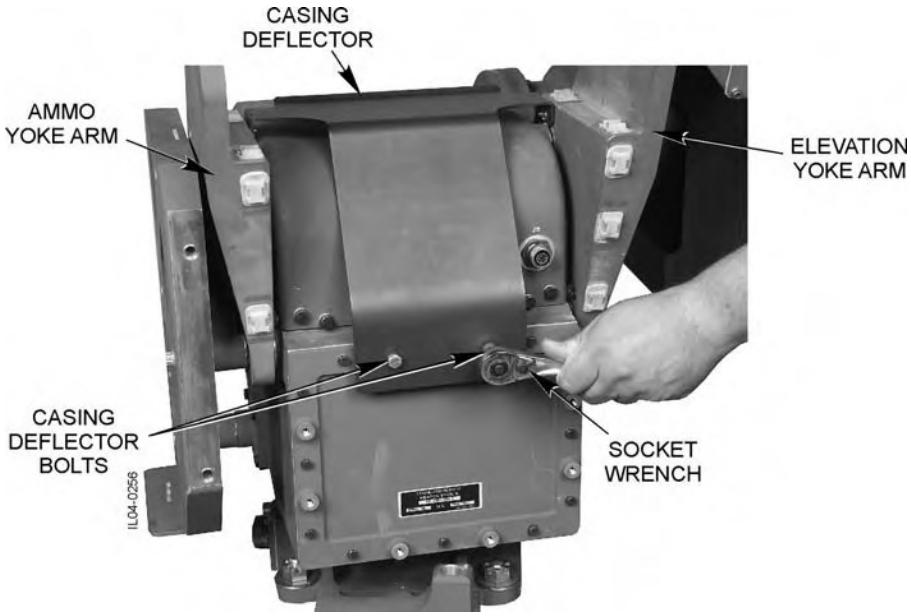


Figure 3. Removing Bolts Holding Casing Deflector.

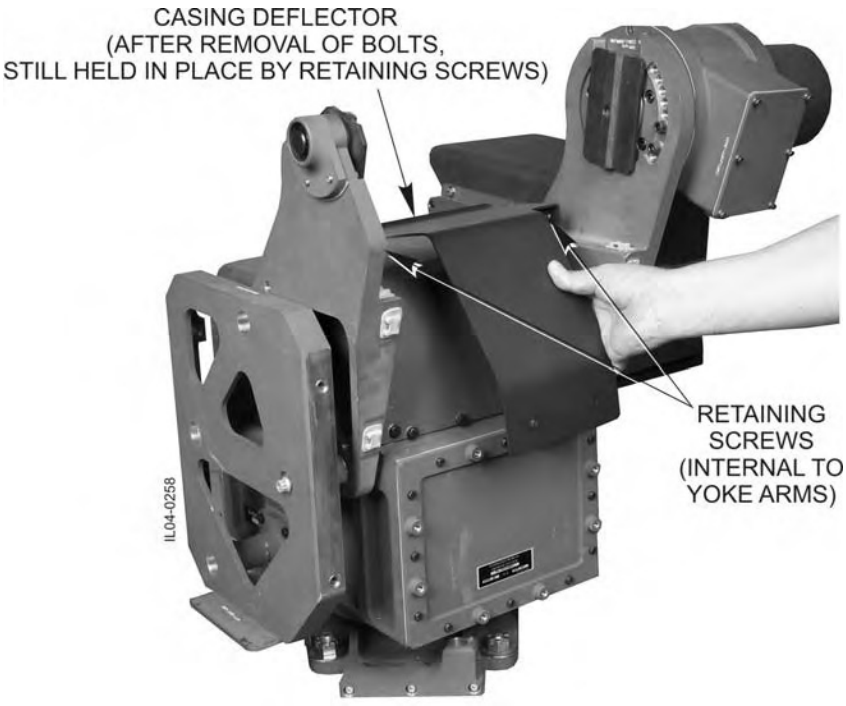
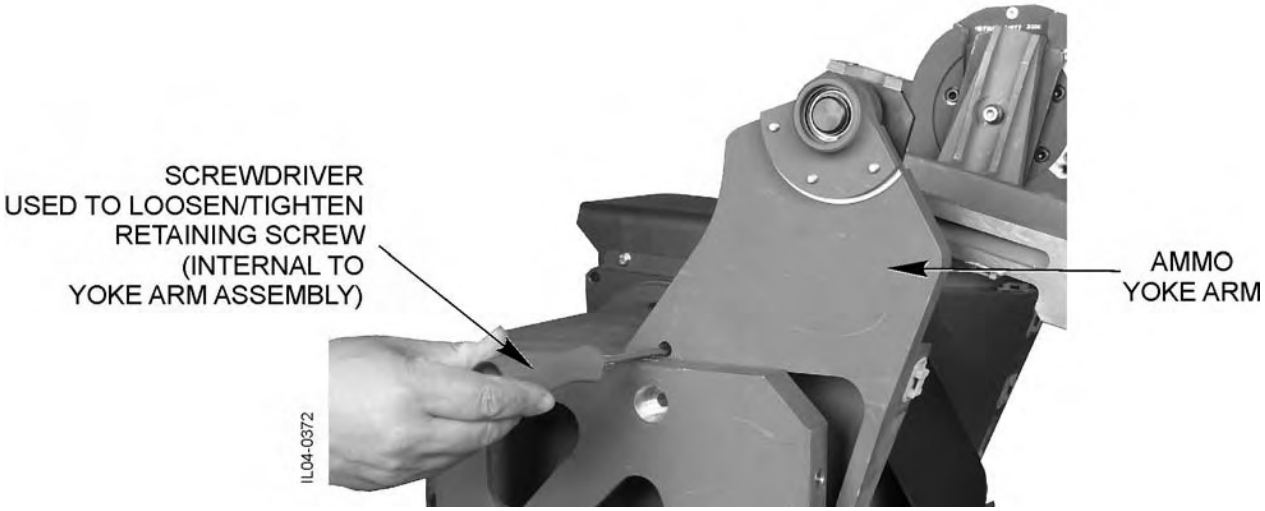
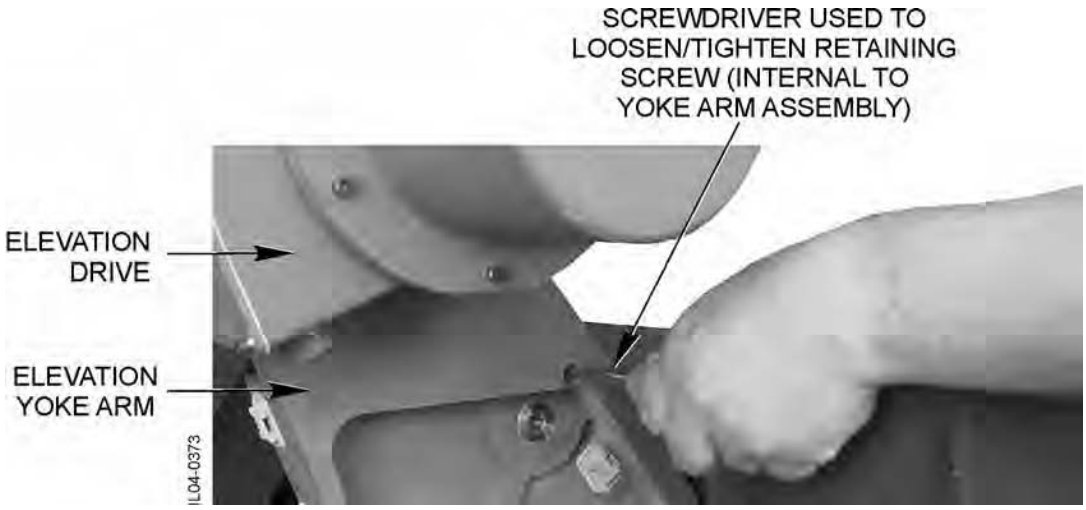


Figure 4. Casing Deflector Held By Retaining Screws Only.

4. Loosen the retaining screws holding the casing deflector to the yoke arms, using a 1/4-inch flat tip screwdriver, as shown in Figure 5.



Ammo Yoke Arm Side



Elevation Yoke Arm Side

Figure 5. Retaining Screws in Ammo Yoke Arm and Elevation Yoke Arm.

STOWING CROWS FOR SPECIAL TRANSPORT - Cont

5. Remove casing deflector from the mount, as shown in Figure 6.

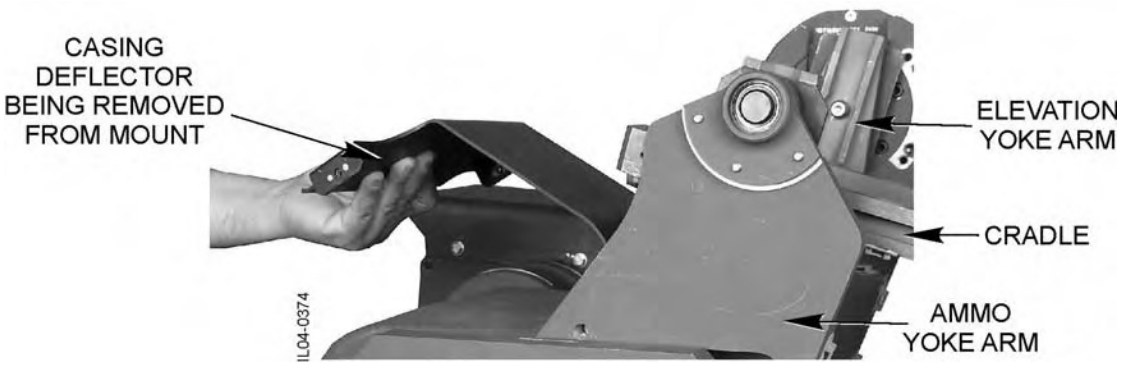


Figure 6. Removal of Casing Deflector.

WARNING

The ammo hanger assembly is connected to the ammo yoke arm by the bolts attaching the yoke arm to the mount. Support both the ammo hanger and ammo yoke arm during stowing procedures and when returning the yoke arm to its standard operating position. Failure to do so may result in personal injury and equipment damage.

CAUTION

Support each yoke arm during removal of bolts and rotation of the arm to the stowed position until the bolts are reinserted. Failure to follow these instructions may result in equipment damage.

6. Loosen and remove bolts from ammo yoke arm, leaving one bolt as the “pivot,” using a 7/16-inch, 12-point socket wrench, as shown in Figure 7. Retain the bolts for later use (step 8).

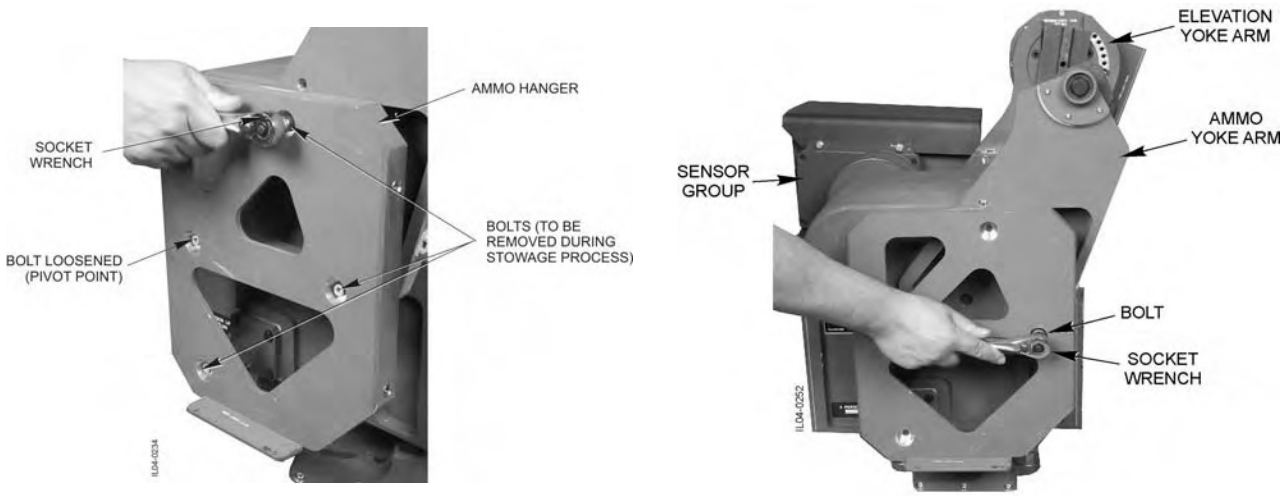


Figure 7. Removing Bolts for Rotation of Ammo Yoke Arm Leaving One “Pivot” Bolt.

7. Hold the ammo yoke arm and carefully rotate it back from the standard, upright position to the stowed position, as shown in Figures 8 and 9.

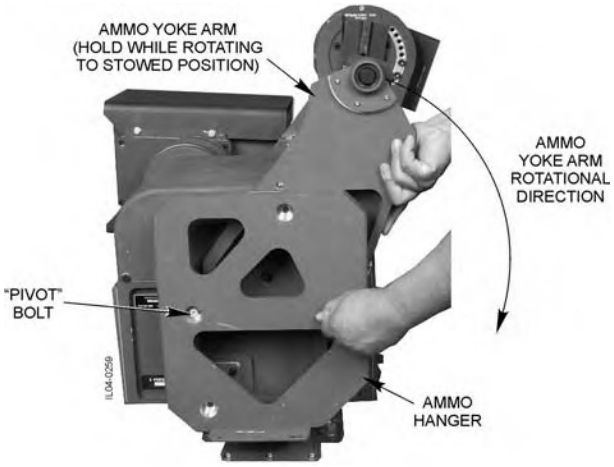


Figure 8. Ammo Yoke Arm in Upright Position Before Rotation.

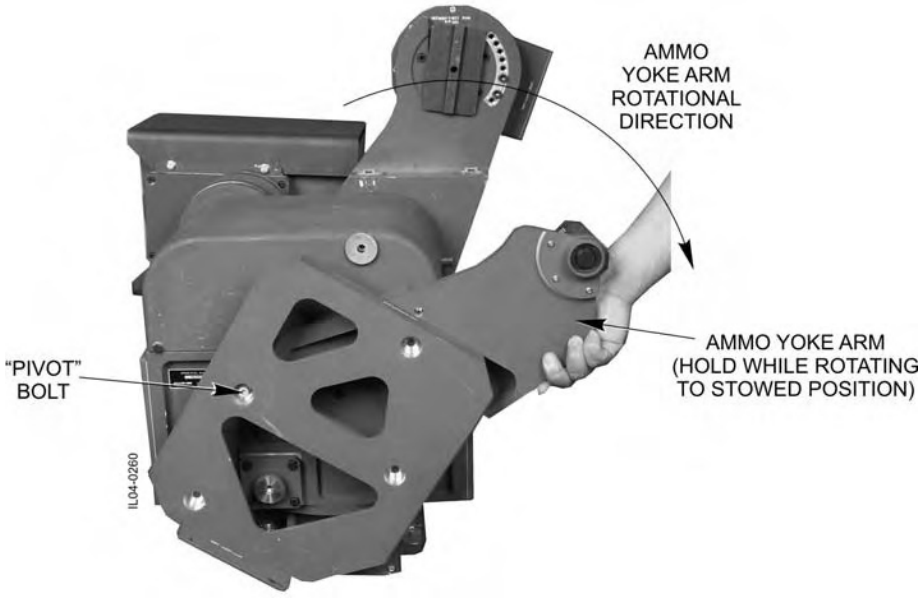


Figure 9. Ammo Yoke Arm During Rotation to Stowed Position.

STOWING CROWS FOR SPECIAL TRANSPORT - Cont

NOTE

During stowing only, the top and bottom holes (shown in Figure 10) are used to store two of the four bolts that secure the ammo yoke arm to the pedestal. The “pivot” bolt and the bolt on the right-hand (facing) hold the ammo yoke arm in position.

8. Once the ammo yoke arm is in the proper stow position, tighten the “pivot” bolt. Insert and tighten the two bolts for storage, as shown in Figure 10. Insert and tighten the “securing” bolt as shown in Figure 11.



Figure 10. Tightening “Pivot” Bolt Before Inserting and Tightening Remaining Bolts.

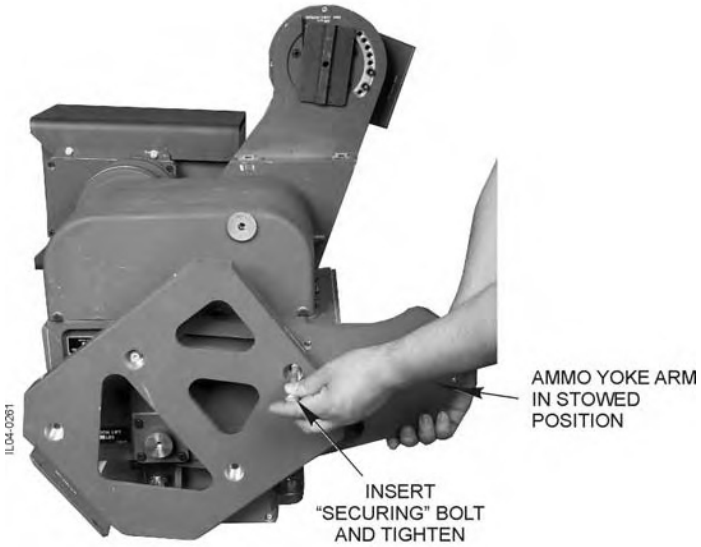


Figure 11. Securing Ammo Yoke Arm in Stow Position.

WARNING

Use two personnel during procedures on the elevation yoke arm. Failure to do so may result in personal injury.

CAUTION

Support the elevation yoke arm while the bolts are being loosened or removed, during rotation to stowed position, and until all the bolts are secured. Failure to follow these instructions may result in equipment damage.

Ensure cables have been removed from the J3 and J6 connectors on the pedestal mount.

9. Loosen the “pivot” bolt and remove the remaining bolts from elevation yoke arm, using a 7/16-inch socket wrench, as shown in Figure 12, retaining the bolts for later use (step 11). Support the elevation yoke arm during this and remaining steps until the arm is fully stowed and secured.

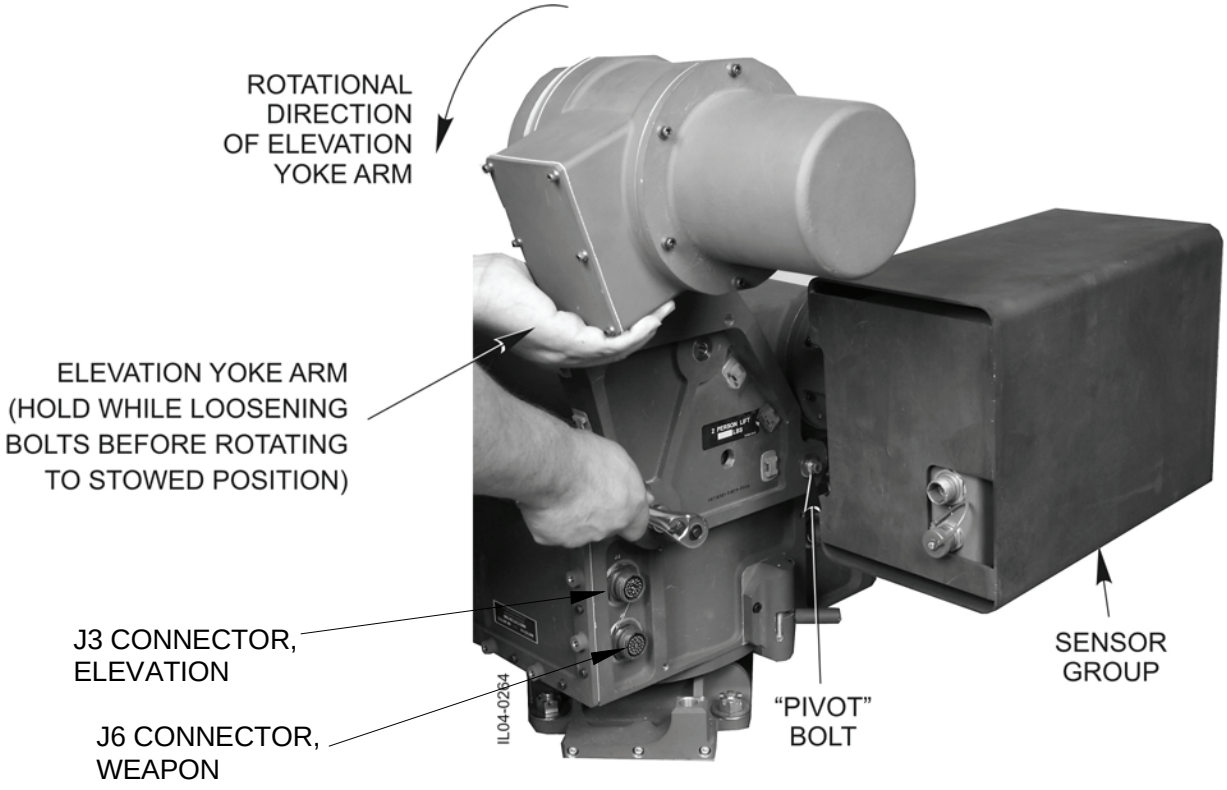


Figure 12. Loosening and Removing Bolts from Elevation Yoke Arm, Leaving One “Pivot” Bolt.

STOWING CROWS FOR SPECIAL TRANSPORT - Cont

10. Carefully rotate the elevation yoke arm back, as shown in Figure 13. Continue supporting the elevation yoke arm during this and remaining steps until the arm is fully stowed and secured.

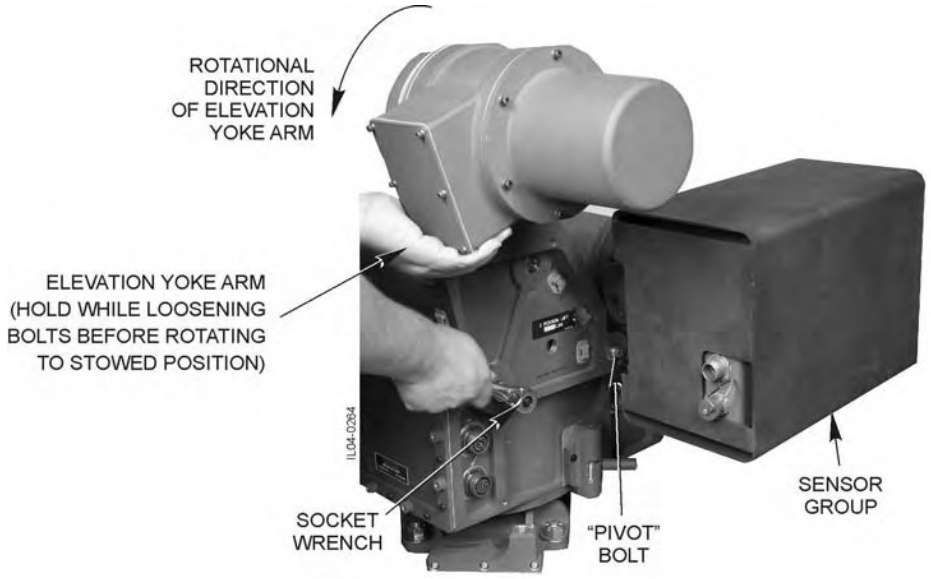


Figure 13. Elevation Yoke Arm Supported During Rotation to Stow Position.

11. Once the elevation yoke arm is in the proper stow position, tighten the “pivot” bolt, as shown in Figure 14. Insert and tighten the two remaining bolts.

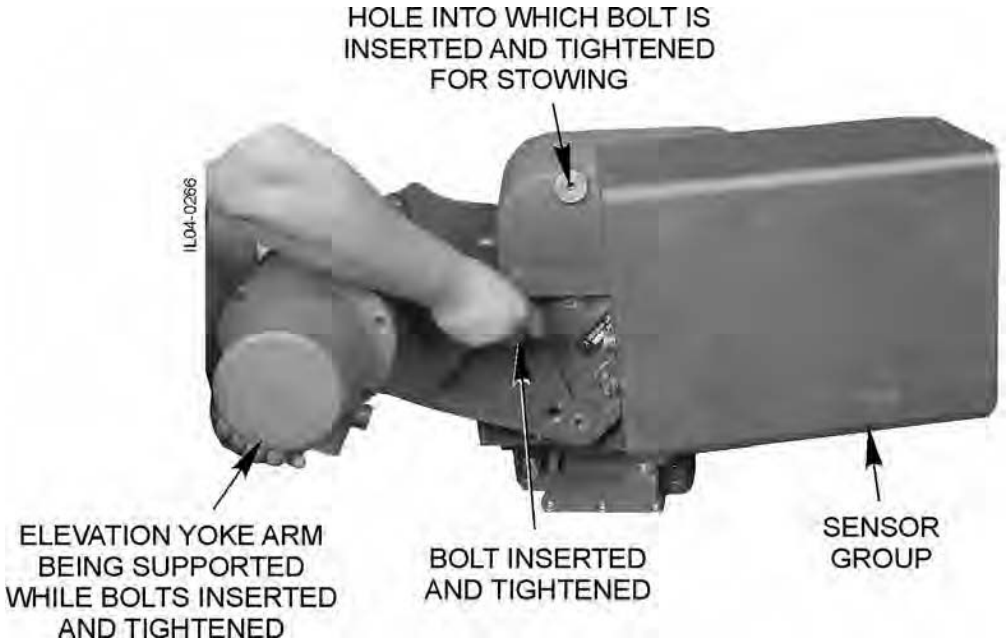


Figure 14. Securing Elevation Yoke Arm in Stow Position.

Figures 15 and 16 show the CROWS in the stowed position.

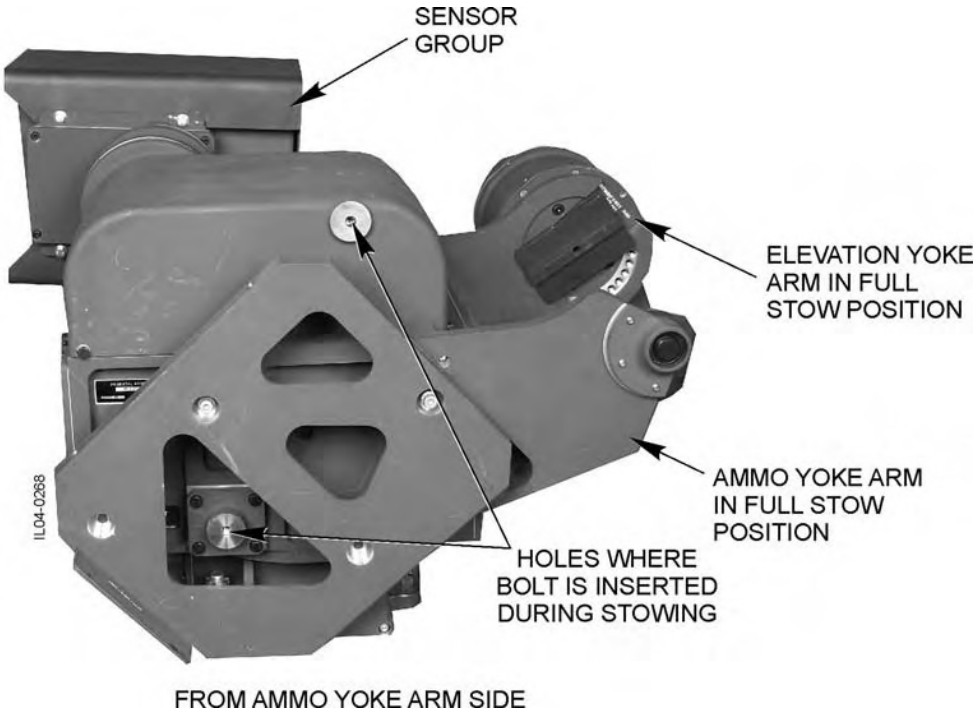


Figure 15. CROWS in Stow Position, Ammo Yoke Arm Side.

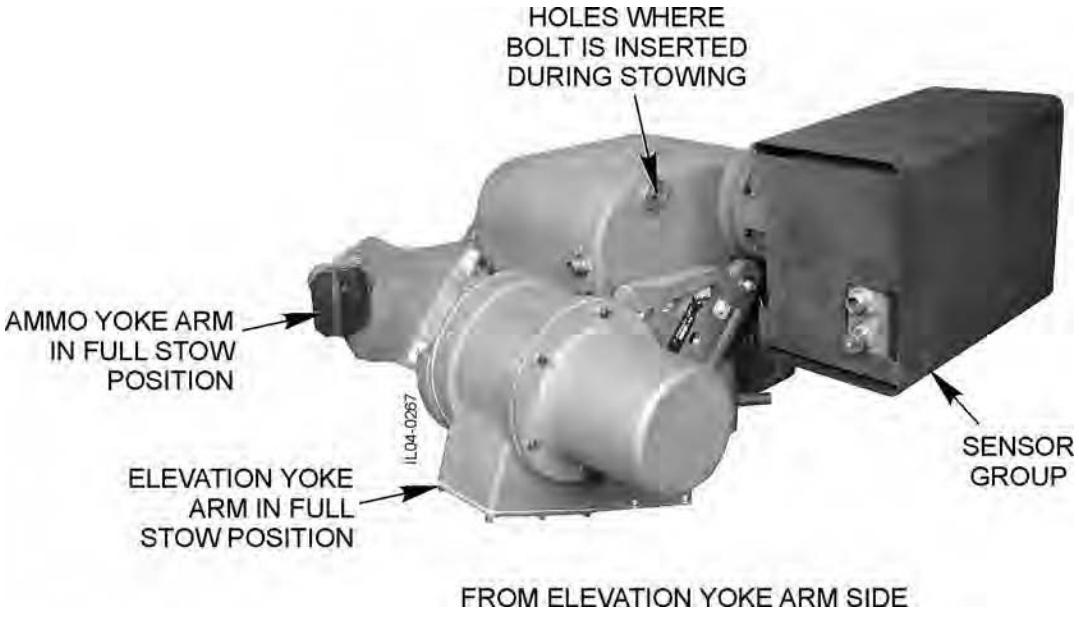


Figure 16. CROWS in Stow Position, Elevation Yoke Arm Side.

END OF TASK

RETURNING CROWS FROM STOWED TO STANDARD OPERATING POSITION

Use the following procedure to return the CROWS mount to the standard operating position.

CAUTION

Each yoke arm must be supported during removal of bolts and rotation of the arm to the stowed position until the bolts are reinserted. Failure to follow these instructions may result in equipment damage.

1. Reposition the elevation yoke arm, as follows, referring to Figures 12 thru 14:
   a. Loosen and remove the bolts on the yoke arm, using a 7/16-inch socket wrench, leaving one as the “pivot” bolt.
   b. Support the yoke arm and rotate it to the standard position.
   c. Insert and lightly tighten the bolts, using a 7/16-inch socket wrench.
2. Reposition the ammo yoke arm, as follows, referring to Figures 7 thru 11.
   a. Loosen and remove the bolts on the yoke arm, leaving one as the “pivot” bolt, using a 7/16-inch, 12-point socket wrench.
   b. Support the yoke arm and rotate it to the standard position.
   c. Insert and tighten the bolts, using a 7/16-inch, 12-point socket wrench.
3. Position the casing deflector between the yoke arms and tighten the internal retaining screws, using a 1/4-inch flat tip screwdriver, referring to Figures 3 and 4.
4. Tighten the elevation yoke arm bolts, using a 7/16-inch socket wrench.
5. Insert and tighten the bolts securing the casing deflector to the azimuth housing assembly, using a 7/16-inch, 12-point socket wrench, referring to Figures 3 and 4.

END OF TASK

CROWS SHORT TERM STORAGE

NOTE

Remove weapon before storing CROWS.

When the CROWS system will be inactive for short periods of time, protect the system and CROWS auxiliary equipment with the CROWS cover. See Figure 17.

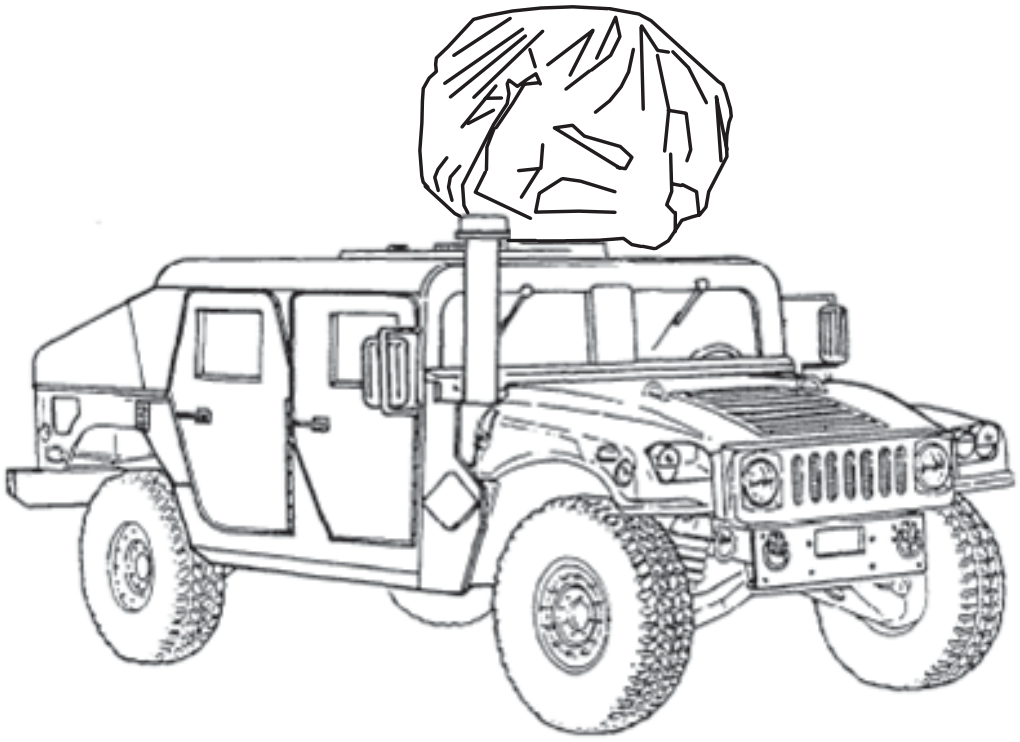


Figure 17. CROWS on Vehicle with Cover for Short Term Storage.

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

PREPARATION FOR WEAPON TURN-IN

THIS WORK PACKAGE COVERS:

Procedures for preparing the CROWS for storage (especially stowing for special transport), handling, and shipping.

INITIAL SET UP:

Tools and Special Tools

Operator's Tool Kit (WP 0036, Table 2, Item 1)

Equipment Conditions

Weapon removed

Materials/Parts

Bag, Textile (WP 0038, Table 1, item 4)

Tag, Shipping (WP 0038, Table 1, item 22

Personnel Required

One (63B)

References

WP 0008, WP 0010, WP 0012, WP 0014, WP 0036, WP 0038, TM 9-1005-201-10, TM 9-1005-213-10, TM 9-1005-313-10, TM 9-1010-230-10, AR 190-11, AR 710-2, AR 735-5

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HANDLING OF CROWS PARTS UPON TURN-IN OF M2 HB .50-CAL MACHINE GUN

NOTE

This section provides guidance to emphasize the specific CROWS parts attached to the M2 Machine Gun which must be removed and must remain with the CROWS when the M2 Machine Gun is turned in.

The procedures include guidance to replace, as applicable, with M2 standard parts. For complete procedures to remove/replace the M2 HB .50 Cal Machine Gun Weapon Adapter Kit (WAK), refer to WP 0008.

For general maintenance procedures, such as cleaning, lubrication, preventive maintenance, storage, and handling refer to the work packages in Chapter 5.

Identifying M2 CROWS Parts and M2 Machine Gun Standard Parts

Equipment Conditions: M2 HB .50 Caliber Machine Gun, removed from vehicle in shop on work bench.

The following CROWS parts assembled to the M2 Machine Gun must be removed from the gun prior to turning in the gun. See Table 1 and Figure 1.

Table 1. M2 WAK Components (PN 21677-3100) to be Removed from Weapon.

Item Number	NSN	PN	Cage Code	Nomenclature	QTY
1	1005-01-537-5438	21677-3111	11871	Chute Assembly, Ammunition	1
2	Pending	21677-3164	11871	Extension, Retracting Slide	1
3	1005-01-528-9357	21677-3130	11871	Guide, Cartridge, Ammunition	1
4	5315-01-529-1433	21677-3175-2	11871	Pin, Shoulder, Headless	1
5	5315-01-529-1436	21677-3175-1	11871	Pin, Shoulder, Headless	1
6	5310-01-528-9352	21483-3166	11871	Nut, Self Locking Hexagon	1
7	5315-01-529-1431	21677-3172	11871	Pin, Shoulder, Headed	1
8	5315-01-529-1432	21677-3171	11871	Pin, Shoulder, Headed	1
9	1005-01-528-9351	21483-3145	11871	Chute, Ammunition, Feed Throat	1
10	1010-01-530-1045	21677-3150	11871	Remote Firing Assembly	1

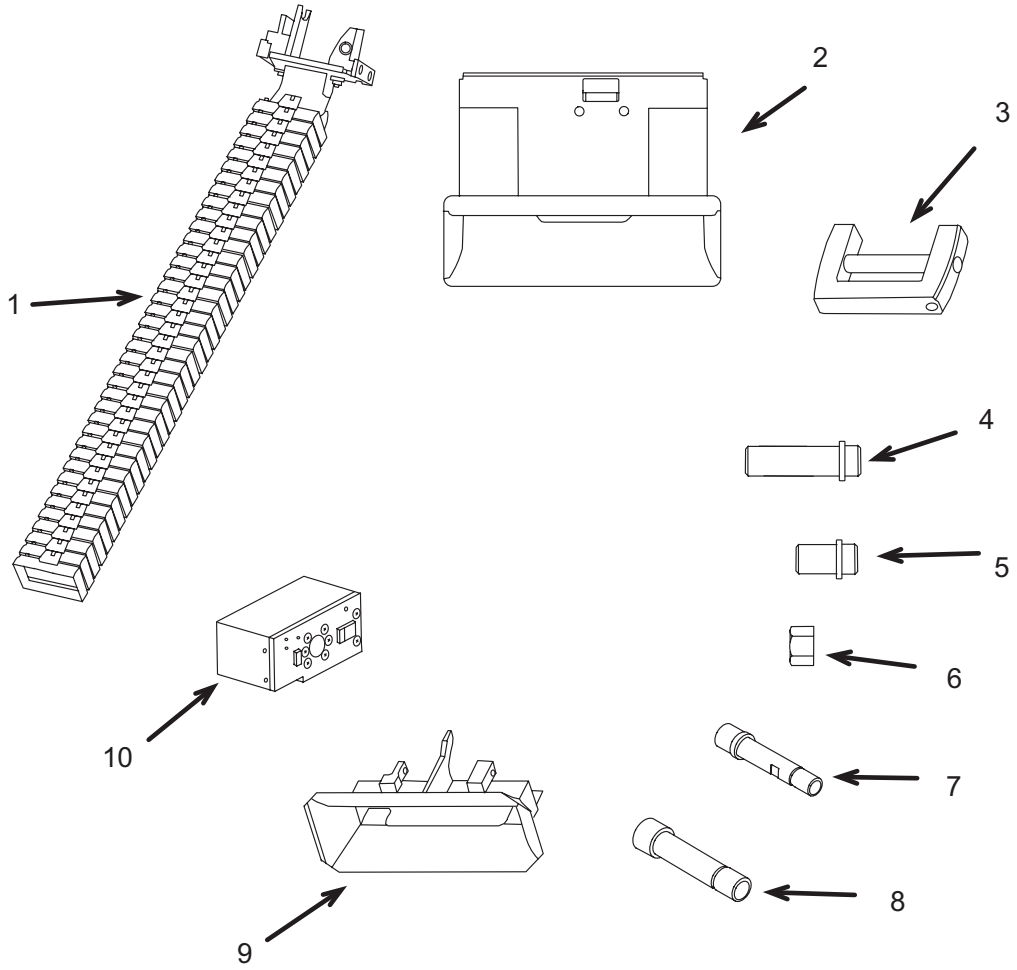


Figure 1. CROWS M2 Machine Gun WAK Parts to be Removed from Weapon.

HANDLING OF CROWS PARTS UPON TURN-IN OF M2 HB .50-CAL MACHINE GUN - Cont

Identifying M2 CROWS Parts and M2 Machine Gun Standard Parts - Cont

NOTE

The M2 Machine Gun standard parts are in the WAK box. If the parts are missing, requisition replacements for turn in of the M2 Machine Gun.

CROWS parts removed from the M2 Machine Gun are to be assembled onto the replacing gun or stored in the M2HB WAK box as applicable. Identify each part with a shipping tag and place small parts in textile bags.

The following M2 Machine Gun standard parts shall be reinstalled in the machine gun at turn in. See Table 2 and Figure 2.

Table 2. M2 Machine Gun Standard Parts.

Item	Nomenclature	Part Number	NSN	Qty
1	Pin, Shouldered, headless	5013424	5315-00-501- 3424	1
2	Stop, Front Cartridge	5013539	1005-00-501-3539	1
3	Stop, Rear Cartridge	5577409	1005-00-557-7409	1

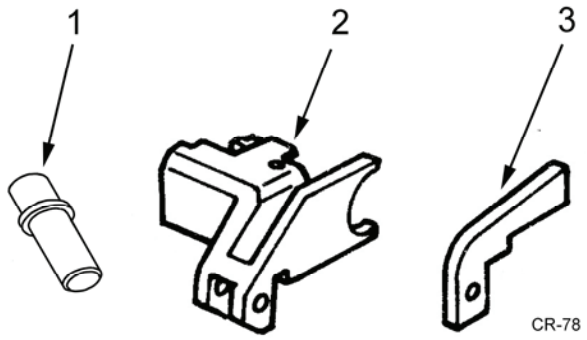


Figure 2. M2 Machine Gun Standard Parts.

Cleaning the M2 Machine Gun

Clean the M2 Machine Gun and attached CROWS components in accordance with TM 9-1005-213-10 and Chapter 5 of this manual.

END OF TASK

Disassembly and Removal of CROWS Parts

Remove CROWS parts from the M2 machine gun as follows:

NOTE

Reinstall pin (2) which is part of the gun.

1. Pull pin (2) and remove Link Chute (3) from the weapon (1), Figure 3.

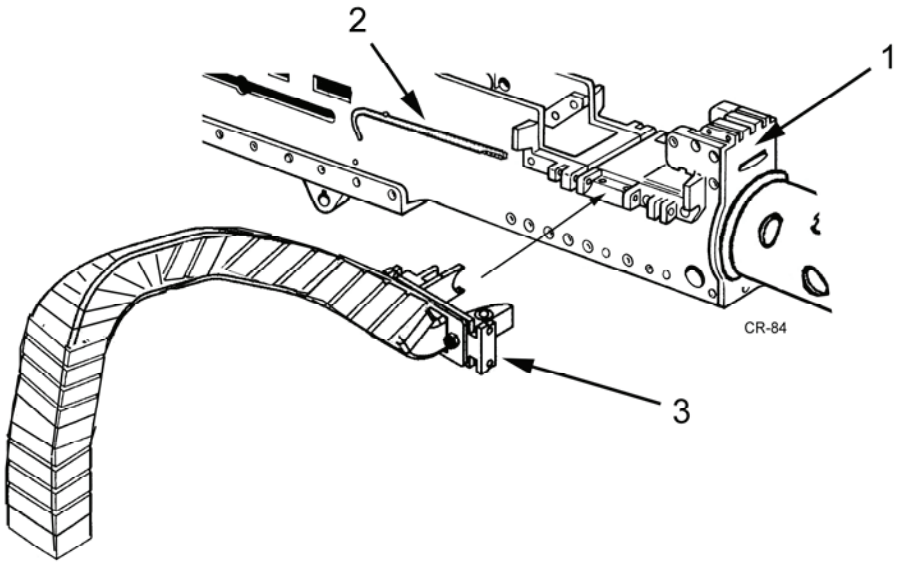


Figure 3. Removing Link Chute Assembly.

HANDLING OF CROWS PARTS UPON TURN-IN OF M2 HB .50-CAL MACHINE GUN - Cont

Disassembly and Removal of CROWS Parts - Cont

2. To remove the Remote Firing Assembly, proceed as follows. See Figure 4:

   a. Remove cap screws (1) and slide off cover (2).

   b. Remove cotter pin (3) and turn off castle nut (4).

   c. Pull the unit subassembly (5) from the weapon and remove special bolt (6).

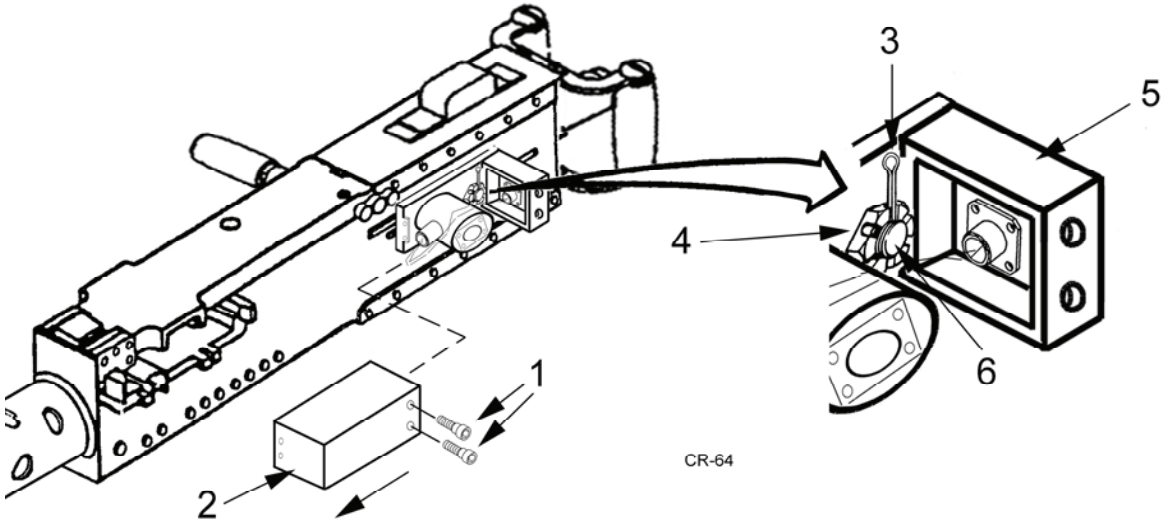


Figure 4. Removing the Remote Firing Assembly.

WARNING

Ensure that the M2 Machine Gun chamber is empty, IAW TM 9-1005-213-10.

Lift the M2 cover and ensure that the breech bolt is in the forward position, reference TM 9-1005-213-10.

Stand to the side of the weapon when removing the spade grip and back plate.

3. To remove Extension Retracting Slide, Breech Bolt Pin, Long, and install the standard breech bolt pin, proceed as follows:

   a. At the rear of the M2 Machine Gun lift the lock (2), pull out the latch (3) and remove the spade grip by moving it up. See Figure 5.

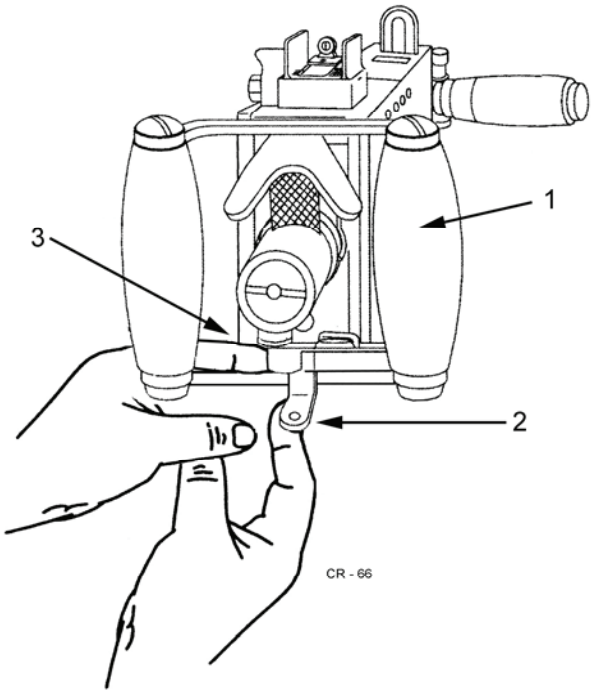


Figure 5. Removing the Spade Grip.

HANDLING OF CROWS PARTS UPON TURN-IN OF M2 HB .50-CAL MACHINE GUN - Cont

Disassembly and Removal of CROWS Parts - Cont

b. At the rear of the weapon (1) push the drive spring forward, to the left (2) and move the spring and rod rearward to release pressure. See Figure 6.

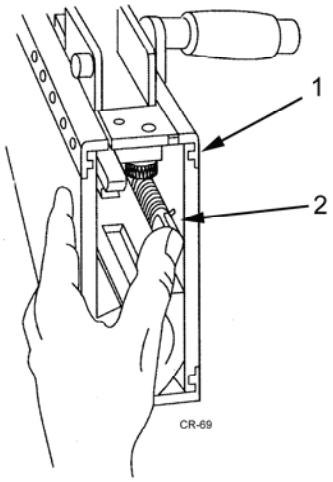


Figure 6. Releasing Drive Spring and Rod.

c. Align the breech bolt (1) until the breech bolt pin (3) aligns with the assembly hole (2) and screw out the pin. See Figure 7.

d. Install the standard breech bolt pin, NSN 5315-00-501-3424, at position (2).

e. Remove nut (4), bolt (5), and slide off the retracting slide extension (6).

f. Screw out and remove extension bolt (7).

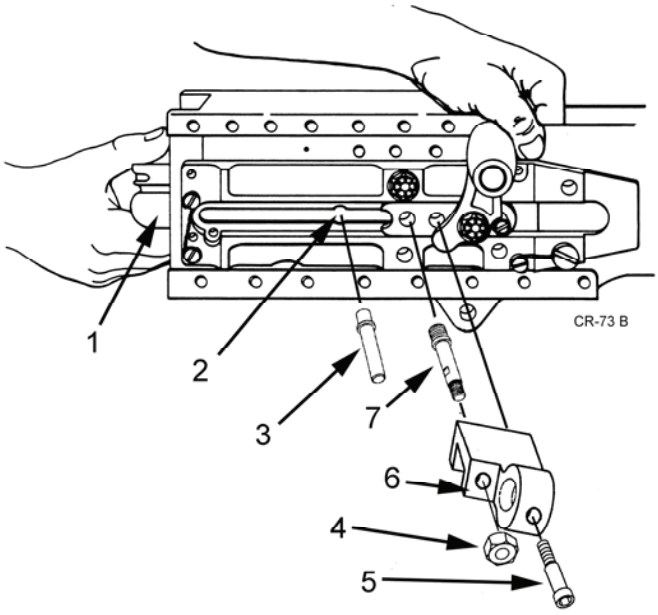


Figure 7. Removing Retracting Slide and Breech Bolt Pin.

4. To remove the Block Guide, proceed as follows. See Figure 8:

   a. On the weapon (1) loosen the set screw with screw driver (2) and screw out bolt (3).

   b. Lift the Block Guide (4) from the bottom of the weapon (5).

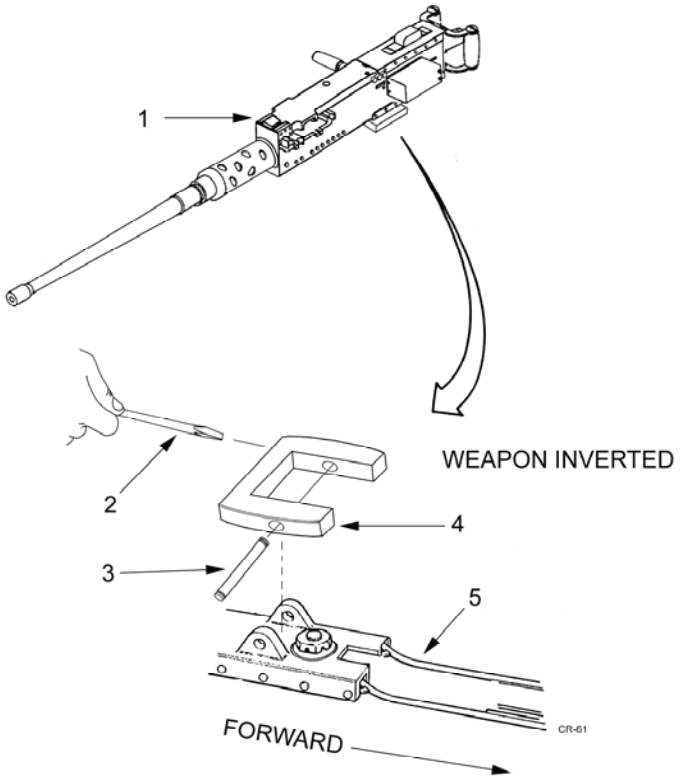


Figure 8. Removing Block Guide.

HANDLING OF CROWS PARTS UPON TURN-IN OF M2 HB .50-CAL MACHINE GUN - Cont

Disassembly and Removal of CROWS Parts - Cont

5. To remove the short breech pin, proceed as follows:

   On the left side of the weapon (1), align the breech bolt as shown in Disassembly and Removal of CROWS Parts section, step 3c, Figure 7, and remove the short breech pin (2). See Figure 9.

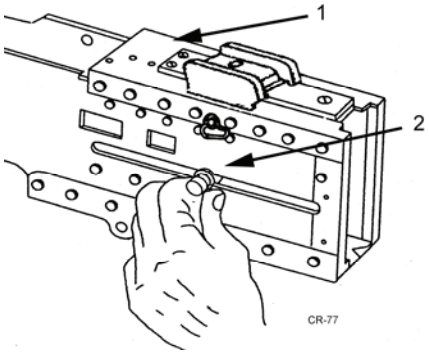


Figure 9. Removing Breech Pin Short.

6. Replace the spade grip and back plate, Figure 10, proceed as follows:

   a. At the rear of the weapon (1), push the drive spring and rod (2) in to the normal position and move the rod right to latch in position.

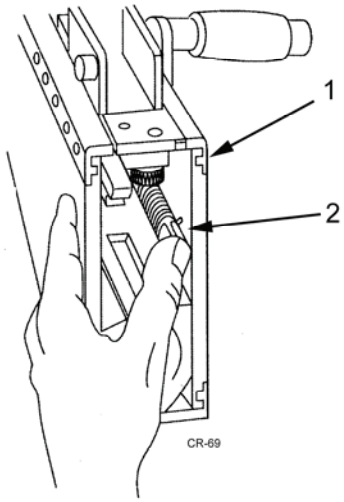


Figure 10. Positioning and Latching the Drive Spring and Rod.

b. On the weapon (1), install the spade grip and back plate (2) by lining with slot (3) and sliding down from the top until the latch (4) clicks in position and the latch lock (5) engages the latch, Figure 11.

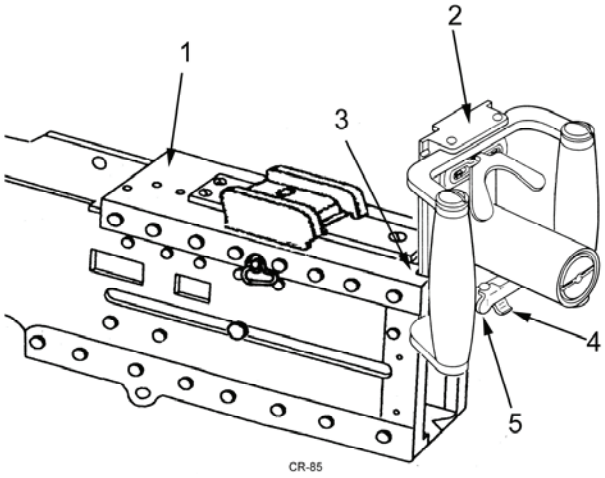


Figure 11. Installing Spade Grip and Back Plate.

NOTE

Put pin (2) back in the weapon; it is part of the gun.

7. To remove the Ammunition Feed Throat, proceed as follows. See Figure 12.

On the weapon (1), remove pin (2) and lift off Ammunition Feed Throat (3).

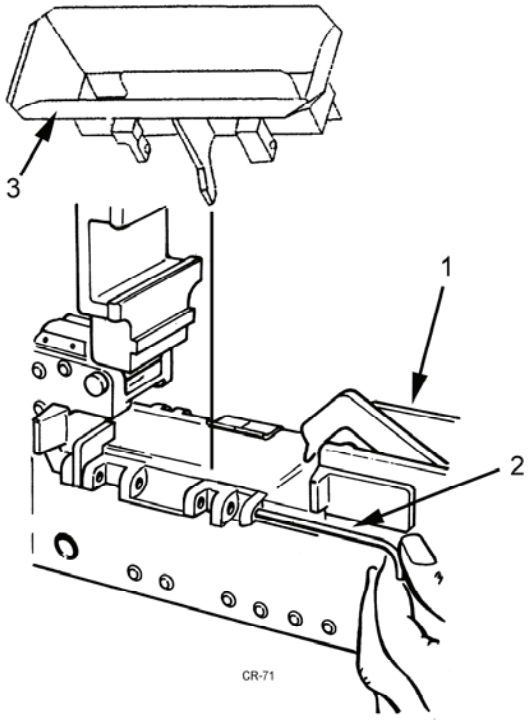


Figure 12. Removing Ammunition Feed Throat.

END OF TASK

HANDLING OF CROWS PARTS UPON TURN-IN OF M2 HB .50-CAL MACHINE GUN - Cont

Assembly of the M2 Machine Gun with Standard Parts

NOTE

The standard breech pin is installed in Disassembly and Removal of CROWS Parts section at step 3d.

On the M2 Machine Gun, install the forward cartridge stop (2), the rear cartridge stop (3), and secure with pin (4). See Figure 13.

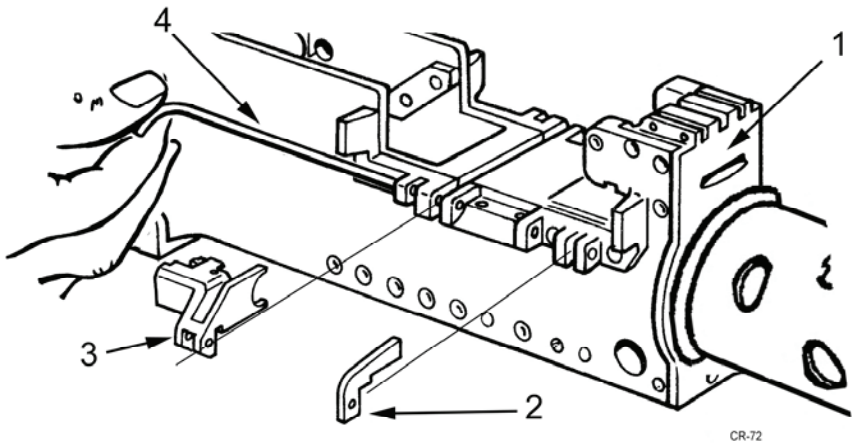


Figure 13. Installing Standard Cartridge Stops.

END OF TASK

Turn in of M2 Machine Gun

Repair/retain for future use or package and turn in IAW AR 710-2, AR 735-5 and TM 9-1005-213-10.

END OF TASK

HANDLING OF CROWS PARTS UPON TURN-IN OF MK19 40 MM GRENADE MACHINE GUN

NOTE

This section provides guidance to emphasize the specific crows parts attached to the Mk19 Grenade Machine Gun which must be removed and remain with the CROWS when the Mk19 is turned in.

The procedures include guidance to replace, as applicable, with Mk19 standard parts. For complete procedures to remove/replace the Mk19 40MM Grenade Machine Gun WAK, refer to WP 0010.

For general maintenance procedures, such as cleaning, lubrication, preventive maintenance, storage, and handling, refer to the work packages in Chapter 5 and the Mk19 operator's manual, TM 9-1010-230-10.

Identifying Mk19 CROWS Parts and Mk19 Grenade Machine Gun Standard Parts

Equipment Conditions: Mk19, 40mm, Grenade Machine Gun, removed from vehicle in shop on work bench.

The following CROWS parts assembled to the Mk19 Machine Gun must be removed from the gun prior to turning in the gun. See Table 3 and Figure 14.

Table 3. Mk19 WAK Components to be Removed from Weapon.

Item Number	NSN	PN	Cage Code	Nomenclature	Common Name	QTY
1	5930-01-530-9637	21677-3225	11871	Switch, Sensitive	Ogive Plunger Assembly	1
2	1005-01-529-0632	21677-3207	11871	Block, Ejector, Catridge	Block Locking – Rounds Counter	1
3	1005-01-528-9359	21677-3210	11871	Charger, Gun	Charger – Remote Assembly	1
4	5945-01-133-6985	3269501	10001	Solenoid, Electrical	Solenoid, Remote Firing	1
5	5315-01-518-3224	92390A165	71670	Pin, Straight, Headed	Pin, Clevis	2
6	5315-01-538-8427	92391A034	39428	Pin, Cotter	Pin, Hitch	2
7	1005-01-529-2306	21677-3228	11871	Feeder, Ammunition, Machine Gun	Chute, Feed Throat	1

HANDLING OF CROWS PARTS UPON TURN-IN OF MK19 40 MM GRENADE MACHINE GUN - Cont

Identifying Mk19 CROWS Parts and Mk19 Grenade Machine Gun Standard Parts - Cont

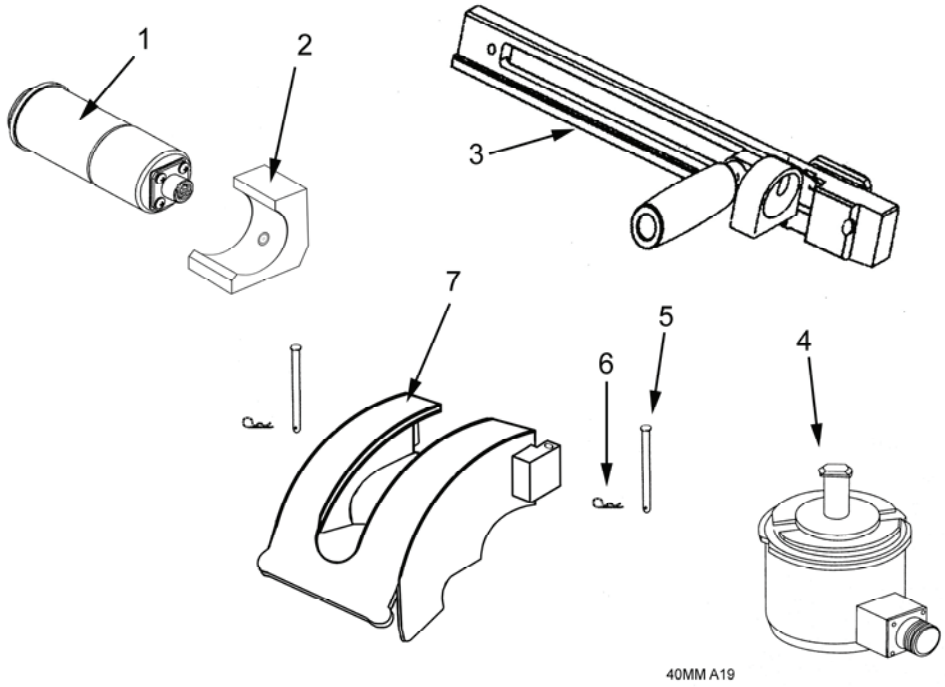


Figure 14. CROWS Mk19 Grenade Machine Gun WAK Parts to be Removed from Weapon.

NOTE

The MK19 Grenade Machine Gun standard parts are in the Mk19 WAK box. If the parts are missing, requisition replacements for turn in of the Mk19 Machine Gun.

CROWS parts removed from the Mk19 Machine Gun are to be assembled to the replacing gun or stored in the Mk19 WAK box as applicable. Identify each part, attach a shipping tag, and place small parts in textile bags.

Mk19 Machine Gun standard parts to be reinstalled in the machine gun at turn in are at Table 4 and Figure 15.

Table 4. Mk19 Grenade Machine Gun Standard Parts.

Item Number	NSN	PN	Cage Code	Nomenclature	Common Name	QTY
1	5340-01-129-1237	3269471	19200	Cap-Plug, Protective Dust	Cap, Sear Housing	1
2	1010-01-129-1233	3269408	19200	Loader, Gun	Charger, Gun, RH	1
3	1010-01-149-5468	5830095	19200	Feed Throat Assy	Chute, Feed Throat	1
4	1010-01-133-6977	3269405	10001	Ogive Plunger Assembly	Ogive Plunger Assembly	1

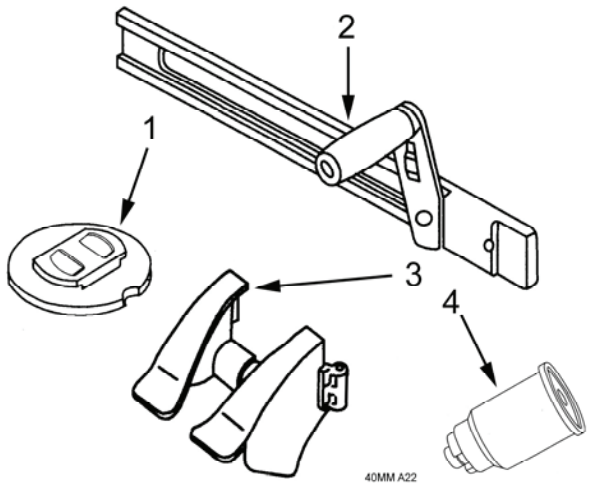


Figure 15. Mk19 Machine Gun Standard Parts.

Cleaning the MK19 Grenade Machine Gun

Clean the Mk19 Machine Gun and associated CROWS parts IAW TM 9-1010-230-10 and Chapter 5 of this manual.

END OF TASK

Disassembly and Removal of CROWS Parts

Remove CROWS parts from the Mk19 as follows:

NOTE

The Remote Firing Solenoid must be removed before the weapon can be taken off the cradle due to lack of clearance.

1. Place the Mk19 (1) Fire/Safe switch (2) in the FIRE position, Figure 16.

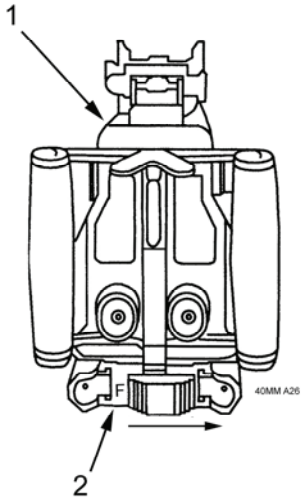


Figure 16. Fire/Safe Switch to the FIRE Position.

HANDLING OF CROWS PARTS UPON TURN-IN OF MK19 40 MM GRENADE MACHINE GUN - Cont

Disassembly and Removal of CROWS Parts - Cont

2. On the mounted machine gun (1), disconnect the remote cable connector (2). See Figure 17.

3. Turn the solenoid (3) until the connector (2) is facing forward toward the barrel of the weapon (1) and pull down to remove from the machine gun.

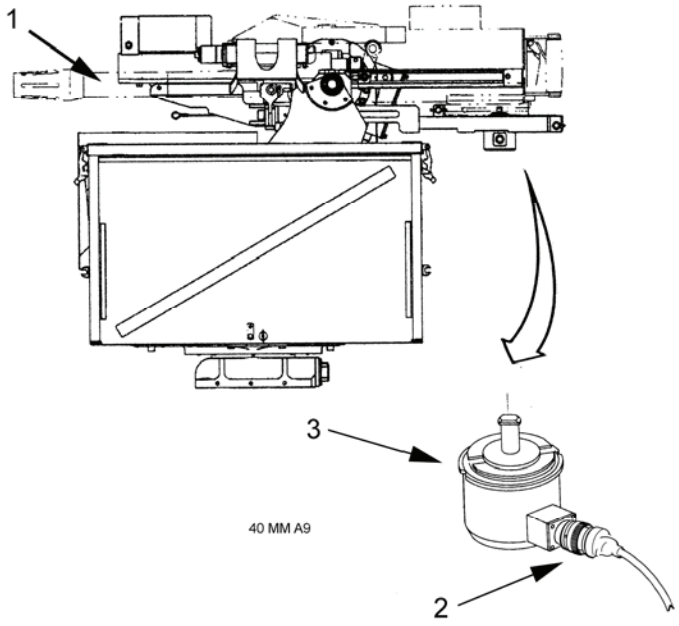


Figure 17. Removing the Remote Solenoid from the Weapon.

4. Place the Mk19 (1) Fire/Safe switch (2) in the SAFE position. See Figure 18.

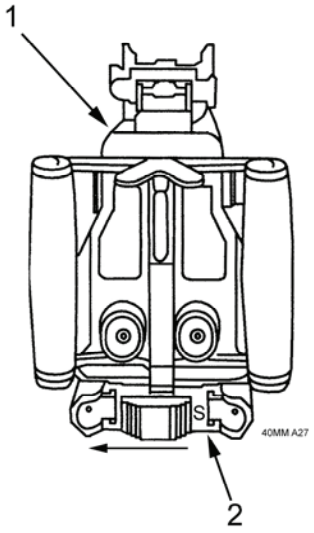


Figure 18. Fire/Safe Switch to the SAFE Position.

NOTE

Pin (4), forward, may be installed from the bottom.

5. To remove the Feed Throat Chute, proceed as follows. See Figure 19.

   On the gun assembly (1), remove two hair pins (5) and pull out the two pins (4) from the chute blocks at point (3) and separate the chute (2) from the weapon (1).

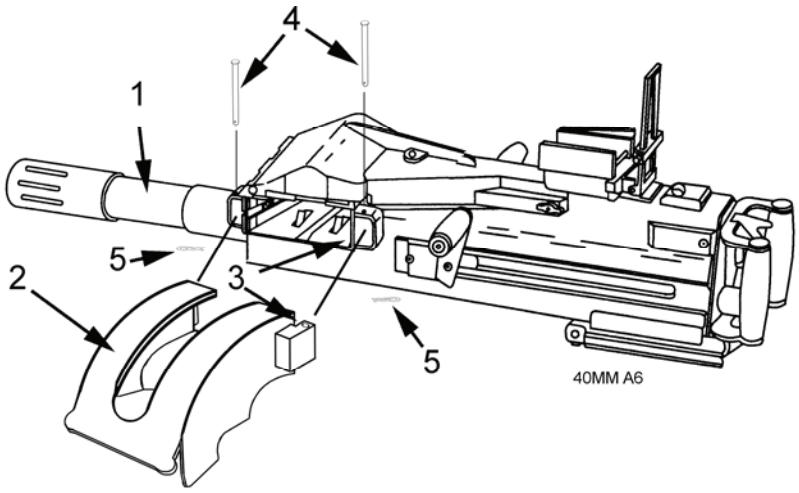


Figure 19. Removing the Feed Throat Chute.

NOTE

For the following sequence, hold pin (3) out with a screwdriver or needle nose pliers if necessary.

6. With the charging handle (2) forward, pull back slightly and pull or pry pin (3) out from the side of the weapon. Move the charger handle (2) slightly until the pin (3) pulls out fully. See Figure 20.

7. With the locking pin (3) pulled out and held (spring loaded), move the slider rearward to clear the forward and rear pins (4) from the locking slots (5) and pull out on the charger to remove from the machine gun.

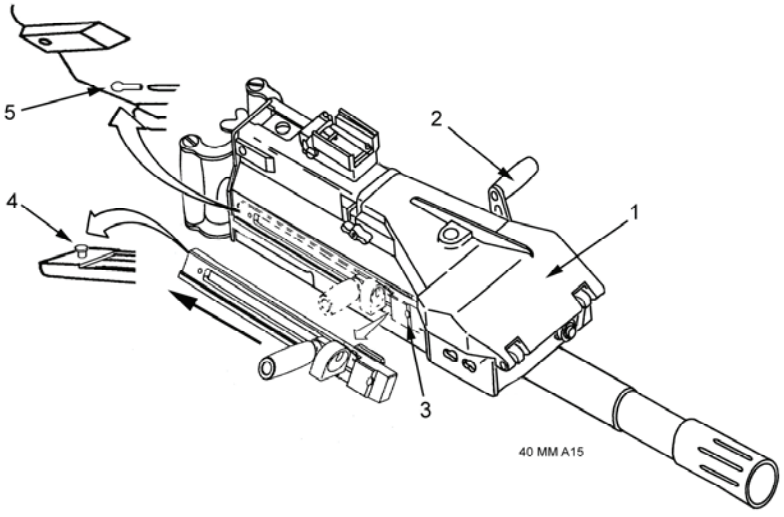


Figure 20. Removing Right Side CROWS Charger.

HANDLING OF CROWS PARTS UPON TURN-IN OF MK19 40 MM GRENADE MACHINE GUN - Cont

Disassembly and Removal of CROWS Parts - Cont

NOTE

The Ogive alignment guide (3) must be removed to take out the Ogive Rounds Counter.

8. Depress the locking tab (2) with a scribe or small screwdriver and pull out the Ogive locking plate (3). See Figure 21.

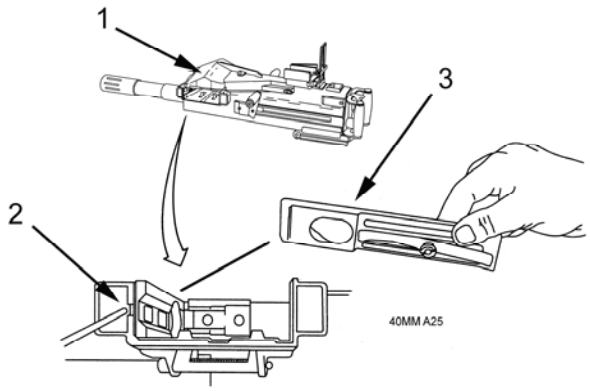


Figure 21. Removing the Ogive Guide.

9. Loosen set screw (2), slide off the locking block (3), and pull out the Ogive Rounds Counter (4). See Figure 22.

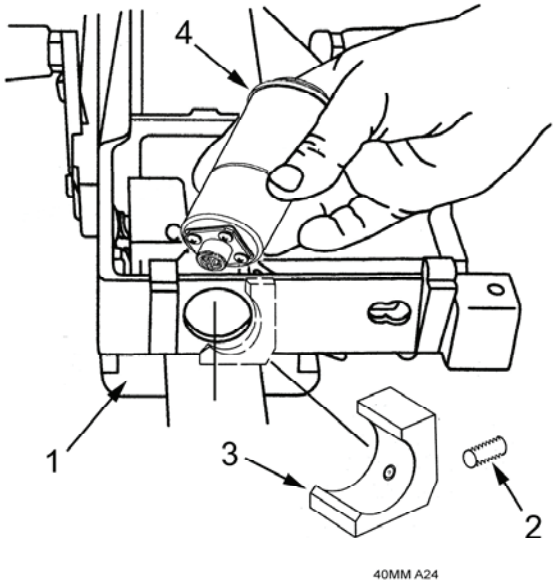


Figure 22. Removing the Ogive Rounds Counter.

END OF TASK

Assembly of the Mk19 Machine Gun with Standard Parts

NOTE

The following procedure assumes the Ogive Alignment Guide was removed in Disassembly and Removal of CROWS Parts section, step 8. Refer to Disassembly and Removal of CROWS Parts section, step 8, for removal if the guide is installed.

Install the Mk19 standard parts as follows:

1. Lift the cover (1) and plug in the Ogive Plunger (2) in hole (3). See Figure 23.

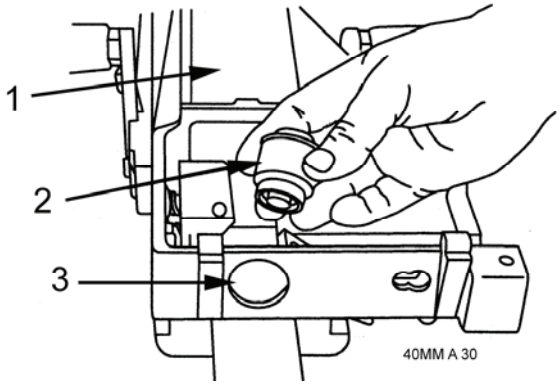


Figure 23. Installing the Ogive Plunger.

2. Install the Ogive Guide, Figure 24: On the gun (1), snap the guide (2) in the weapon (3).

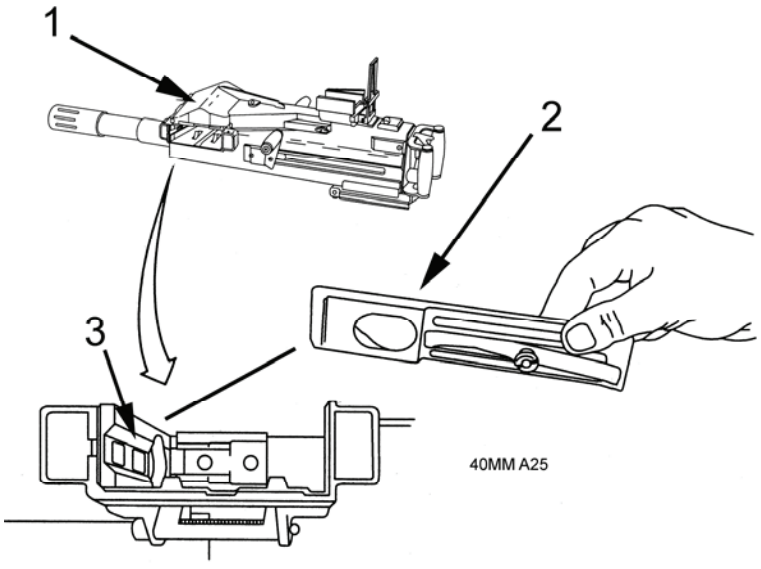


Figure 24. Installing the Ogive Guide.

HANDLING OF CROWS PARTS UPON TURN-IN OF MK19 40 MM GRENADE MACHINE GUN - Cont

Assembly of the Mk19 Machine Gun with Standard Parts - Cont

3. Install the Sear Housing Cap: On the under side of the weapon (1), place the cap (3) in the sear housing (2) and turn 90 degrees. See Figure 25.

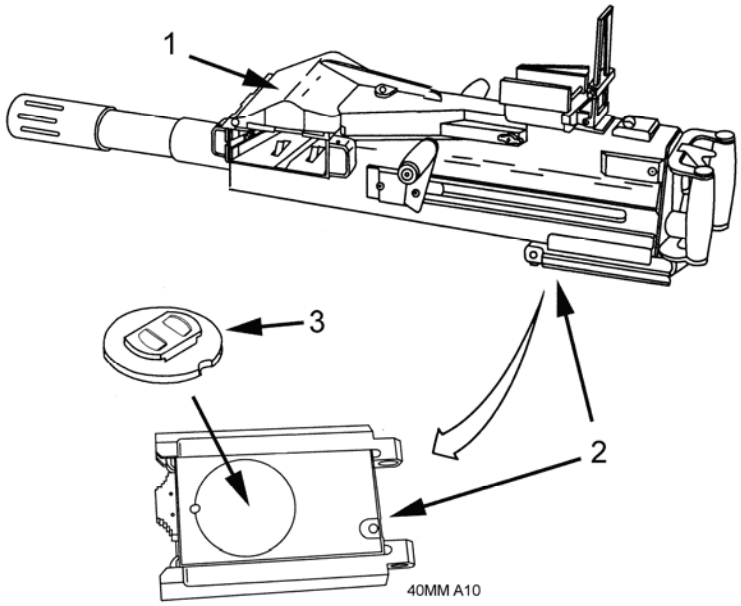


Figure 25. Installing the Sear Housing Cap.

4. Install the standard FEED Throat Chute: On the weapon (1), place the Feed Throat Chute (2) in position and squeeze the mounting ears (4) on each side to engage the chute entrance mounting holes (3). See Figure 26.

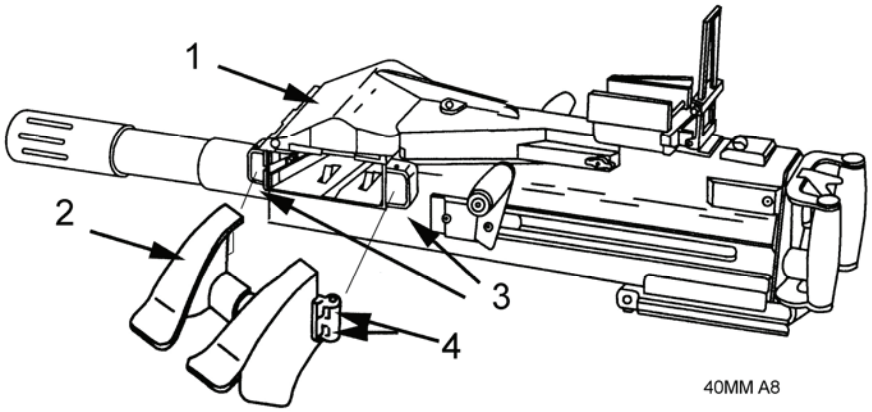


Figure 26. Installing the Standard Feed Throat.

5. Install the standard right side charger. See Figure 27.

   a. On the weapon (1), move the left charger handle (2) fully forward then rearward slowly until pins (4) front and rear will go into holes and locking slots (5) on both ends of the charger.

   b. Move the charger forward in the slots until spring loaded pin (3) snaps in place.

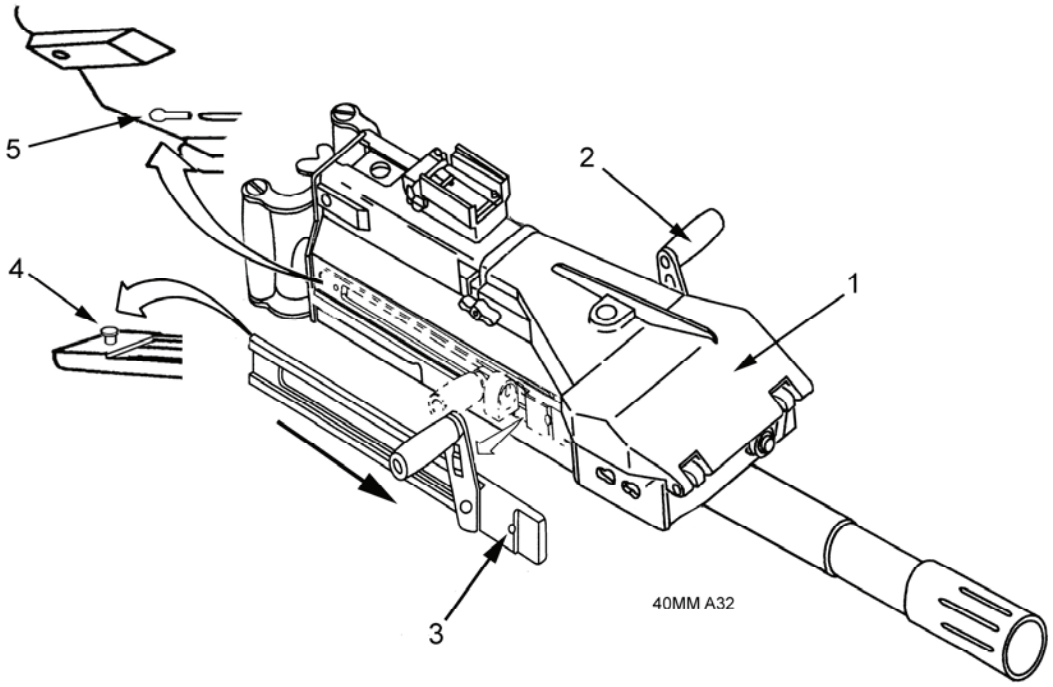


Figure 27. Installing the Standard Right Side Charger.

END OF TASK

Turn in of the Mk19 Grenade Machine Gun

Repair/retain for future use or package and turn in IAW AR 710-2, AR 735-5, and TM 9-1010-230-10.

END OF TASK

HANDLING OF CROWS PARTS UPON TURN-IN OF M240B 7.62 MM LIGHT MACHINE GUN

NOTE

This section provides guidance to emphasize the specific CROWS part(s) attached to the M240B Light Machine Gun which must be removed and must remain with the CROWS when the M240B Light Machine Gun is turned in.

For general maintenance procedures, such as cleaning, lubrication, preventive maintenance, storage, and handling refer to the work packages in Chapter 5 and the M240 Operator's Manual, TM 9-1005-313-10.

Identifying M240B CROWS Parts and M240B Light Machine Gun Standard Parts

Equipment Conditions: M240B 7.62 mm Light Machine Gun, removed from vehicle in shop on work bench.

NOTE

The M240B WAK parts are removed per WP 0012.

The following CROWS parts assembled to the M240B Light Machine Gun must be removed from the gun prior to turning in the gun. See Table 5 and Figure 28.

Table 5. M240B WAK Components (PN 21677-3400-1) to be Removed from Weapon.

Item Number	NSN	PN	Cage Code	Nomenclature	QTY
1	TBD	21677-3491	11871	Chute Adapter Assembly	1

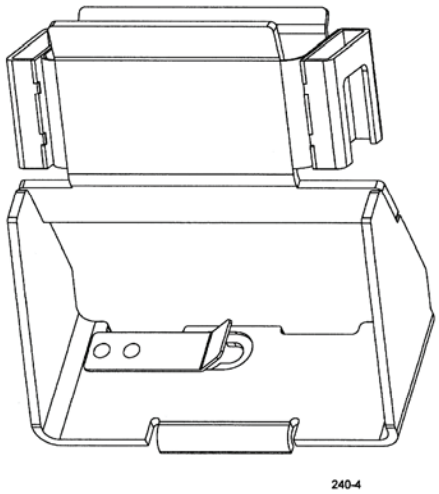


Figure 28. Chute Adapter Assembly.

NOTE

CROWS parts removed from the M240B Light Machine Gun are to be assembled onto the replacing gun or stored in the M240/M249 WAK box as applicable. Identify each part with a shipping tag and place small parts in textile bags.

Cleaning the M240B 7.62 mm Light Machine Gun

Clean the M240B 7.62 mm Light Machine Gun and attached CROWS components in accordance with TM 9-1005-313-10 and Chapter 5 of this manual.

Disassembly and Removal of CROWS Parts

To remove the chute adapter assembly, proceed as follows. See Figure 29.

1. Push tab (1) up to slide the chute until pin (2) is in line with the hole, then pull the chute (3) off the weapon.

2. Use a shipping tag to mark the Part Number and NSN of the chute and store the chute in the M240B WAK box for future use.

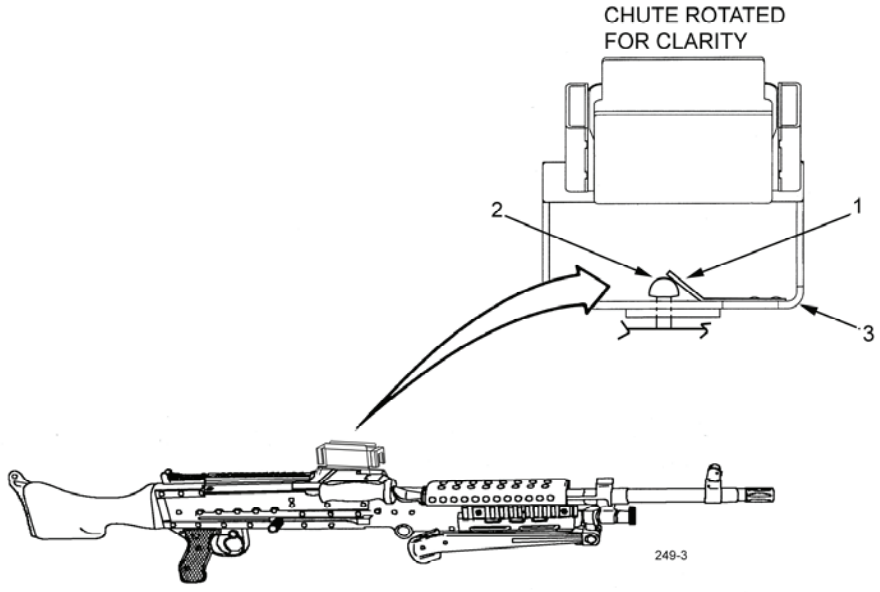


Figure 29. Removing the Chute Adapter.

END OF TASK

Assembly of the M240B Light Machine Gun with Standard Parts

There are no M240B Light Machine Gun standard parts to be reinstalled in the machine gun at turn in.

Turn in of M240B Light Machine Gun

Repair/retain for future use or package and turn in IAW AR 190-11, AR 710-2, AR 735-5 and TM 9-1005-313-10.

END OF TASK

HANDLING OF CROWS PARTS UPON TURN-IN OF M249 5.56 MM LIGHT MACHINE GUN

NOTE

This section provides guidance to emphasize the specific CROWS part(s) attached to the M249 Light Machine Gun which must be removed and must remain with the CROWS when the M249 Light Machine Gun is turned in.

For general maintenance procedures, such as cleaning, lubrication, preventive maintenance, storage, and handling refer to the work packages in Chapter 5, and the M249 Operator's Manual, TM 9-1005-201-10.

Identifying M249 CROWS Parts and M249 Light Machine Gun Standard Parts

Equipment Conditions: M249 5.56 mm Light Machine Gun, removed from vehicle in shop on work bench.

NOTE

The M249 WAK parts are removed per WP 0014.

The following CROWS parts assembled to the M249 Light Machine Gun must be removed from the gun prior to turning in the gun. See Table 6 and Figure 30.

Table 6. M249 WAK Components (PN 21677-3400-1) to be Removed from Weapon.

Item Number	NSN	PN	Cage Code	Nomenclature	QTY
1	TBD	21677-3430	11871	M249 Adapter-Counter	1

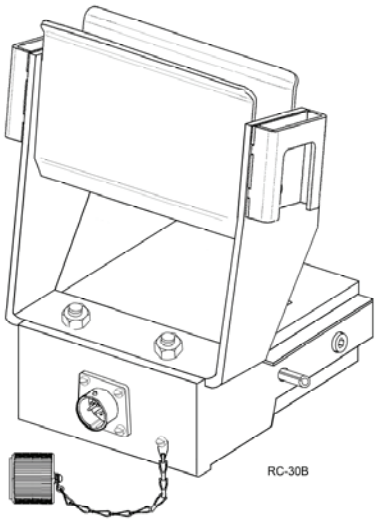


Figure 30. M249 Adapter Counter.

NOTE

CROWS parts removed from the M249 Light Machine Gun are to be assembled onto the replacing gun or stored in the M240/M249 WAK box as applicable. Identify each part with a shipping tag and place small parts in textile bags.

Cleaning the M249 5.56 mm Light Machine Gun

Clean the M249 5.56 mm Light Machine Gun and attached CROWS components in accordance with TM 9-1005-201-10 and Chapter 5 of this manual.

Disassembly and Removal of CROWS Parts

To remove the M249 Adapter-Counter, proceed as follows. See Figure 31.

1. On the chute adapter-counter (1), remove the counter harness (if attached) at (3).

2. On the weapon (2), push the release tab (4) and pull the chute adapter-counter (1) from the weapon (2). Identify with shipping tab and store with the CROWS M240/M249 WAK.

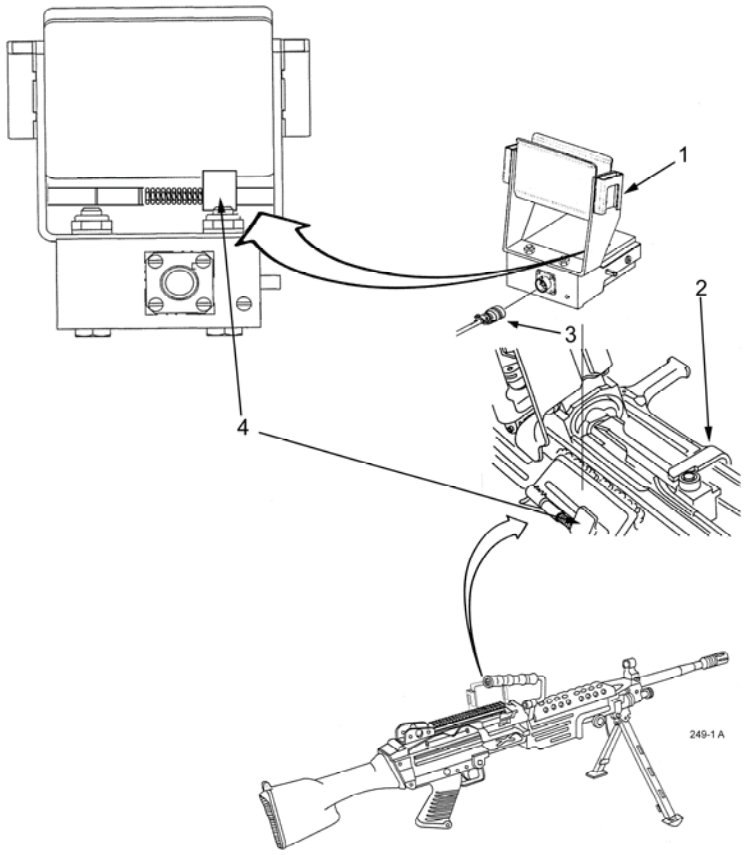


Figure 31. Removing the M249 Chute Adapter-Counter Assembly.

END OF TASK

HANDLING OF CROWS PARTS UPON TURN-IN OF M249 5.56 MM LIGHT MACHINE GUN

Assembly of the M249B Light Machine Gun with Standard Parts

There are no M249 Light Machine Gun standard parts to be reinstalled in the machine gun at turn in.

Turn in of M249 Light Machine Gun

Repair/retain for future use or package and turn in IAW AR 190-11, AR 710-2, AR 735-5 and TM 9-1005-201-10.

END OF TASK

END OF WORK PACKAGE

CHAPTER 6

CROWS

SUPPORTING INFORMATION

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

REFERENCES

This work package lists publications referenced in this manual.

REFERENCE LIST

PUBLICATION	TITLE/ADDITIONAL INFORMATION
DEPARTMENT OF ARMY PAMPHLETS AND FORMS	
DA Form 2028	Recommended Changes to Publications and Blank Forms
DA Form 2404	Equipment Inspection and Maintenance Worksheet
DA Form 2407	Maintenance Request
DA Form 5988-E	Equipment Inspection Maintenance Worksheet (EGA) - Electronic
SF 364	Report of Discrepancy (ROD)
SF 368	Product Quality Deficiency Report
DA PAM 385-61	Toxic Chemical Agent Safety Standards
DA PAM 385-64	Ammunition and Explosives Safety Standards
DA PAM 700-32	Packaging of Army Materiel
DA PAM 750-8	The Army Maintenance Management System (TAMMS) Users Manual
MILITARY HANDBOOKS, SPECIFICATIONS, AND STANDARDS	
MIL-HDBK-263B	Electrostatic Discharge Control Handbook for Protection of Electrical and Electronic Parts, Assemblies, and Equipment (Excluding Electrically Initiated Explosive Devices) (Metric)
MIL-HDBK-454B	General Guidelines for Electronic Equipment
MISCELLANEOUS PUBLICATIONS	
A-A-59199	Cleaning Compound, Optical Lens (Ready to Use)
CTA 8-100	Army Medical Department Expendable/Durable Items
CTA 50-970	Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items)
IPC-HDBK-001(1)	Handbook and Guide to Supplement J-STD-001
J-STD-001	Requirements for Soldered Electrical and Electronic Assemblies
NASM33540	Safety Wiring and Cotter Pinning
TB 43-0242	CARC Spot Painting
TB MED 524	Control of Hazards to Health from Laser Radiation
TG No. 144	Guidelines for Controlling Health Hazards in Painting Operations
RELATED PUBLICATIONS	
DOD 4160.21-M	Defense Materiel Disposition Manual

REFERENCE LIST – Cont.

PUBLICATION	TITLE/ADDITIONAL INFORMATION
TECHNICAL MANUALS	
TM 3-250	Storage, Shipment, Handling, and Disposal of Chemical Agents and Hazardous Chemicals
TM 9-1005-201-10	Operator's Manual for Machine Gun, 5.56MM, M249 w/Equip (NSN 1005-01-127-7510) (EIC: 4BG)
TM 9-1005-201-23&P	Unit and Direct Support Maintenance Manual (Including Repair Parts and Special Tools List) for Machine Gun, 5.56MM, M249 w/Equip (NSN 1005-01-127-7510) (EIC: 4BG)
TM 9-1005-213-10	Operator's Manual for Machine Guns, Caliber .50; M2, Heavy Barrel Flexible, W/E (1005-00-322-9715) (EIC: 4AG) M48 Turret Type (1005-00-957-3893) (EIC: 4BB) Soft Mount (1005-01-343-0747) (Navy) Fixed Type Right Hand Feed (1005-00-122-9339) (Navy) Fixed Type Left Hand Feed (1005-00-122-9368) (Navy)
TM 9-1005-213-23&P	Unit and Direct Support Maintenance Manual (Including Repair Parts and Special Tools List) For Machine Guns, Caliber .50: M2, Heavy Barrel Flexible, W/E (1005-00-322-9715) (EIC: 4AG) M48 Turret Type (1005-00-957-3893) (EIC: 4AB) Soft Mount (1005-01-343-0747) (Navy) Fixed Type Right Hand Feed (1005-00-122-9339) (Navy) Fixed Type Left Hand Feed (1005-00-122-9368) (Navy)
TM 9-1005-245-13&P	Operator's, Unit, and Direct Support Maintenance Manual with Repair Parts and Special Tools List (RPSTL) for Machine Gun Mounts and Combinations for Tactical/Armored Vehicles M122 Machine Gun Tripod Mount (NSN 1005-00-710-5599) (EIC:4EF) M122A1 Machine Gun Mount (1005-01-433-1617) M192 Machine Gun Tripod (1005-01-503-0141) M3 Machine Gun Tripod (1005-00-322-9716) (EIC: 4EA) M142 Machine Gun Mount (1005-00-704-6650) M197 Machine Gun Mount (1005-01-413-4098) Mk64 Machine Gun Mount Mod 5 (1010-01-180-9319); Mod 9 (1010-01-412-3159) Mk93 Mod 0 Machine Gun Mount (USMC 0nly) Mk93 Mod 2 Machine Gun Mount (1005-01-502-7547)
TM 9-1005-313-10	Operator's Manual for Machine Gun, 7.62MM, M240 (1005-01-025-8095); M240B (1005-01-412-3129); M240C (1005-01-085-4758); M240D (1005-01-418-6995); M240E1 (1005-01-252-4288); M240G (1005-01-359-2714); M240H (1005-01-518-2410); M240N (1005-01-493-1666)
TM 9-1005-313-23&P	Unit and Direct Support Maintenance (Including Repair Parts and Special Tools List) for M240 Series Machine Guns Machine Gun, 7.62MM, M240 (1005-01-025-8095); Machine Gun, 7.62MM. M240B (1005-01-412-3129); Machine Gun, 7.62MM, M240C (1005-01-085-4758); Machine Gun, 7.62MM, M240D (1005-01-418-6995); Machine Gun, 7.62MM, M240E1 (1005-01-252-4288); Machine Gun, 7.62MM, M240G (1005-01-359-2714); Machine Gun, 7.62MM, M240H (1005-01-518-2410); and Machine Gun, 7.62MM, M240N (1005-01-493-1666)
TM 9-1010-230-10	Operator's Manual for Machine Gun, 40MM, Mk19, MOD 3 (1010-01-126-9063) (EIC: 4AE)
TM 9-1010-230-23&P	Unit and Direct Support Maintenance Manual (Including Repair Parts and Special Tools List) for Machine Gun, 40MM, Mk19 MOD 3 (NSN 1010-01-126-9063) (EIC: 4AE) Machine Gun, Mk19, 40MM, Mk19 MOD 3, with Sight Bracket (NSN 1010-01-490-9697); Machine Gun, Mk19, 40MM, Upgunned Weapons Station (UPWS) (NSN 1010-01-362-6513)

REFERENCE LIST – Cont.

PUBLICATION	TITLE/ADDITIONAL INFORMATION
TECHNICAL MANUALS - Cont	
TM 9-2320-387-10	Operator's Manual for Truck, Utility: S250 Shelter Carrier, 4X4, M1113 (NSN 2320-01-412-0143) (EIC: B6B), Truck, Utility: Up-Armored Carrier, 4X4, M1114 (2320-01-413-3739) (EIC: B6C) Truck, Utility: Expanded Capacity, Armament Carrier, M1151 (2320-01-518-7330) (EIC: BA5); Truck, Utility: Expanded Capacity, Armament Carrier, IAP/Armor Ready, M1151A1 (2320-01-540-2038); Truck, Utility: Expanded Capacity, Enhanced, M1152 (2320-01-518-7332) (EIC: BA6); Truck, Utility: Expanded Capacity, Enhanced, IAP/Armor Ready, M1152A1 (2320-01-540-2007); Truck, Utility: Command and Control/General Purpose Vehicle, M1165 (2320-01-540-1993); Truck, Utility: Command and Control/General Purpose Vehicle, IAP/Armor Ready, M1165A1 (2320-01-540-2017)
TM 9-2320-387-24-1 and TM 9-2320-387-24-2	Unit, Direct Support, and General Support Maintenance for Truck, Utility: S250 Shelter Carrier, 4X4, M1113 (NSN 2320-01-412-0143) (EIC: B6B); Truck, Utility: Up-Armored Carrier, 4X4, M1114 (2320-01-413-3739) (EIC: B6C) Truck, Utility: Expanded Capacity, Armament Carrier, M1151 (2320-01-518-7330) (EIC: BA5); Truck, Utility: Expanded Capacity, Armament Carrier, IAP/Armor Ready, M1151A1 (2320-01-540-2038); Truck, Utility: Expanded Capacity, Enhanced, M1152 (2320-01-518-7332) (EIC: BA6); Truck, Utility: Expanded Capacity, Enhanced, IAP/Armor Ready, M1152A1 (2320-01-540-2007); Truck, Utility: Command and Control/General Purpose Vehicle, M1165 (2320-01-540-1993); Truck, Utility: Command and Control/General Purpose Vehicle, IAP/Armor Ready, M1165A1 (2320-01-540-2017)
TM 746-10	General Packaging Instructions for Field Units
TM 750-244-7	Procedures for Destruction of Equipment in Federal Supply Classifications 1000, 1005, 1010, 1015, 1020, 1025, 1030, 1055, 1090, and 1095 to Prevent Enemy Use
TECHNICAL MANUALS FOR CROWS	
TM 9-1090-218-23&P	Field Maintenance Manual (Including Repair Parts and Special Tools List) for Armament Subsystem: Remotely Operated, XM101; Common Remotely Operated Weapon Station (CROWS), PN 21677-0100, NSN 1090-01-525-5049
TM 9-1090-218-10-HR	Hand Receipt Covering Contents of Components of End Item (COEI), Basic Issue Items (BII), and Additional Authorization List (AAL) for Armament Subsystem: Remotely Operated, XM101; Common Remotely Operated Weapon Station (CROWS), PN 21677-0100, NSN 1090-01-525-5049
ARMY REGULATIONS	
AR 190-11	Physical Security of Arms, Ammunition, and Explosives
AR 385-10	The Army Safety Program
AR 710-2	Supply Policy Below the National Level
AR 735-5	Policies and Procedures for Property Accountability
FIELD MANUALS	
FM 3-11.5	Multi-Service Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Decontamination
FM 4-25.11	First Aid

END OF WORK PACKAGE

OPERATOR's MANUAL
FOR THE
ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

COMPONENT OF END ITEM (COEI) AND BASIC ISSUE ITEMS (BII)

Scope

This work package contains lists and procedures related to Component of End Item (COEI) and Basic Issue Items (BII) for CROWS.

General

The COEI list is for information purposes only and is not authority to requisition replacements. These items are part of the CROWS. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. COEI items are removed and separately packaged for transportation or shipment only when necessary. Illustrations are furnished to help you find and identify the items.

BIIs are required to place the CROWS in operation, operate it, and perform emergency repairs. Although shipped separately packaged, BIIs must be with the CROWS during operation and when it is transferred between property accounts. Listing these items is your authority to request/requisition them for replacement based on authorization of the end item by the TOE/MTOE. Illustrations are furnished to help you find and identify the items.

Explanation of Columns in the COEI List and BII List

Column (1) Illus Number. Gives you the number of the item illustrated.

Column (2) National Stock Number (NSN). Identifies the stock number of the item to be used for requisitioning purposes.

Column (3) Description, Part Number/(CAGEC). Identifies the Federal item name (in all capital letters) followed by a minimum description when needed. The stowage location of COEI and BII is also included in this column. The last line below the description is the part number and the Commercial and Government Entity Code (CAGEC) (in parentheses).

Column (4) Usable On Code. When applicable, gives you a code if the item you need is not the same for different models of equipment.

Column (5) U/I. Unit of Issue (U/I) indicates the physical measurement or count of the item as issued per the National Stock Number shown in column (2).

Column (6) Qty Rqr. Indicates the quantity required.

COMPONENTS OF END ITEM

Below are the major assemblies for the CROWS; for down parts, go to TM 9-1090-218-10-HR.

Table 1. Components of End Item (COEI).

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
1	5342-01-535-9166	Mount, Resiliant, Weapon Assembly 21677-0200-1			1
2	1010-01-530-1933	Gun Mount (Cradle Assembly – Heavy) 21677-2600			1
3	1005-01-529-3139	M2 HB Weapon Adapter Kit 21677-3100			1
4	1005-01-530-9636	Mk19 Weapon Adapter Kit 21677-3200			1
5		M240/M249 Weapon Adapter Kit 21677-3400-1 (11871)			1
6	8140-01-533-0816	Ammunition Can Assembly 21677-0500			1
7	5998-01-M98-0456	Sensor Group 21677-4500			1
8	5998-01-M98-0455	Control Group 21677-5500			1
9	2540-01-542-8092	Ballistic Protection Kit (Mission-Dependent) 21677-0600 (11871)			1
10	1010-01-542-8098	CROWS Cover * 21677-0400 (11871)			1

* Protects CROWS Auxiliary Equipment.

BASIC ISSUE ITEMS

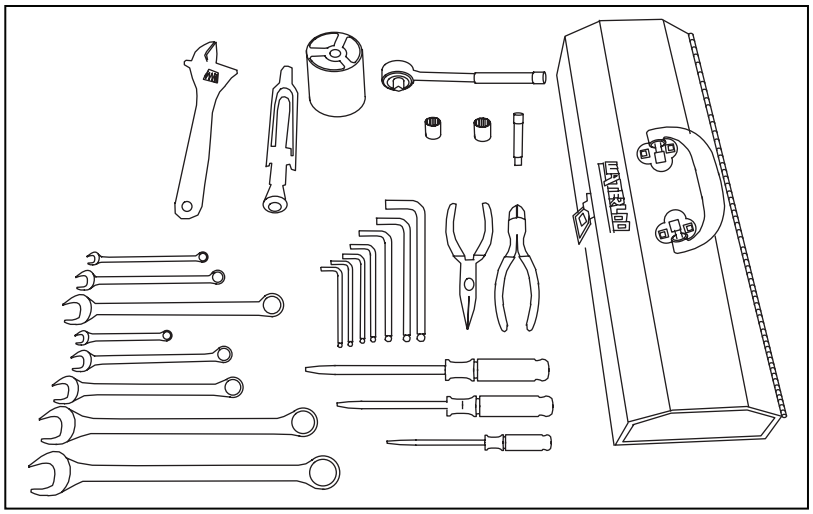


Table 2. Basic Issue Items (BII).

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
1	5180-01-542-3603	Operator's Tool Kit* DFP TRI-004 (19204) consisting of:		EA	1
	5140-00-329-4306	Pouch, Mechanic's Tools, or Tool Box 50J8016 (80049)		EA	1
	5120-00-240-5328	8-inch adjustable wrench B107.8 (05047)		EA	1
	5120-01-398-9351	8-mm combination wrench 9-42912 (53800)		EA	1
	5120-01-398-9355	12-mm combination wrench 9-42916 (53800)		EA	1
	5120-01-398-9361	19-mm combination wrench 9-42921 (53800)		EA	1
	5120-01-398-9291	5/16-inch combination wrench 9-44691 (53800)		EA	1
	5120-01-398-9221	1/2-inch combination wrench 9-44695 (53800)		EA	1
	5120-01-398-9218	5/8-inch combination wrench 9-44697 (53800)		EA	1
	5120-01-398-9322	7/8-inch flat combination wrench** 9-44703 (53800)		EA	1
	5120-01-398-9223	15/16-inch combination wrench 9-44704 (53800)		EA	1

* For an illustrated listing of each tool, go to TM 9-1090-218-10-HR.

**Tool locally modified for use with Mk19 guide pins, as detailed below:
Grind the head of the wrench to 3/16-inch thickness.

BASIC ISSUE ITEMS - Cont

BII Introduction - Cont

Table 2. Basic Issue Items (BII) - Cont.					
(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
	5120-00-189-2992	1/8-inch hex head wrench NC700-8 (35301)		EA	1
	5120-00-889-2163	9/64-inch hex head wrench 58A5A294-16 (10001)		EA	1
	5120-00-189-2991	5/32-inch hex head wrench L-5 (61452)		EA	1
	5120-00-189-2990	3/16-inch hex head wrench L-6 (61452)		EA	1
	5120-00-189-2988	1/4-inch hex head wrench L-8 (61452)		EA	1
	5120-00-189-2987	5/16-inch hex head wrench L-9 (61452)		EA	1
	5120-00-189-2986	3/8-inch hex head wrench L-10 (61452)		EA	1
	5120-00-010-7913	1/8-inch flat tip, 6-inch screwdriver CB964-5 (11728)		EA	1
	5120-00-010-7915	1/4-inch flat tip, 8-inch screwdriver CB416-6 (11728)		EA	1
	5120-00-033-9035	6-inch crosstip #2 screwdriver EX268P2 (05755)		EA	1
	5120-01-430-8332	6-inch needle nose pliers 25206 (08292)		EA	1
	5110-00-224-1532	6-inch diagonal cutters B107.11 (05047)		EA	1
	5120-00-305-2306	Wire-twisting pliers B107.18M (05047)		EA	1
	5120-01-445-1779	3/8-inch drive ratchet, socket 11924 (08292)		EA	1
	5120-01-430-7919	3/8-inch drive, 3-inch extension 11905 (08292)		EA	1
	5120-01-399-9573	Socket wrench, 7/16-inch, 12-point, 3/8 inch drive 5014 (1CV05)		EA	1
	5120-01-399-9535	Socket wrench, 9/16-inch, 12-point, 3/8 inch drive 5218 (1CV05)		EA	1
	9505-00-221-2650	0.020 inch Safety Wire ASTM A580 (81346)		EA	1

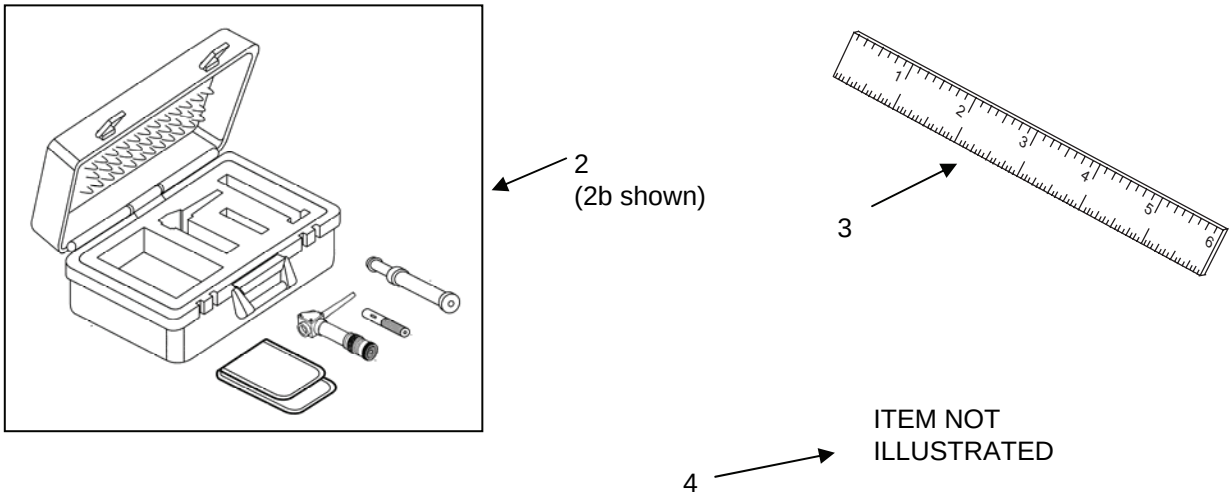


Table 2. Basic Issue Items (BII) - Cont.					
(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
2a		CROWS Boresight Alignment Kit MR1***: 11838942 (19200)		EA	1
	5975-01-491-2762	• Case, Standardized Components 1600 (65442)			
	4933-00-867-6607	• Optical Boresight Telescope 7799773 (19200)			
	4933-01-251-9703	• Test Adapter, .50-cal Mandrel (M2) 12561298 (19200)			
		• 40-mm Mandrel (Mk19) 1-1009 (1DBZ2)			
	4933-00-930-8951	• Boresight Adapter Assembly, 7.62-mm Mandrel (M240) 11686592 (19200)			
		• Weapon Boresighting Equipment, 5.56-mm Mandrel (M249) TBD (19200)			
		• Warning Tag			
		• Key			
		•			

***Recommend one Boresight Alignment Kit per squad equipped with one or more CROWS.

Table 2. Basic Issue Items (BII) - Cont.					
(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
2b	4933-01-M28-5246	CROWS Boresight System Alignment Kit MR2***: 11838947 (19200)		EA	1
		• Case, Instrument 13018331 (19200)			
	4933-00-867-6607	• Optical Boresight Telescope 7799773 (19200)			
		• Boresight Adapter 13014956 (19200)			
	3460-01-502-0575	• Expansion Mandrel, 40-mm (Mk19) LBS-121 (0B107)			
	5860-01-471-2091	• AN/PEM-1 Laser Borelight System LBS-300-A2 (0B107) see below for breakdown of laser system:			
	8105-01-523-6896	o Bag, Textile LBS-949-03 (0B107)			
	4933-01-518-6149	o Laser LBS-301-CAN (0B107)			
	4933-01-518-6150	o Test Adapter, .50-cal Mandrel (M2) LBS-076 (0B107)			
	4933-01-474-1265	o Boresight Adapter Assembly, 7.62-mm Mandrel (M240) LBS-071 (0B107)			
	4933-01-474-1114	o Weapon Boresighting Equipment, 5.56-mm Mandrel (M249) LBS-070 (0B107)			
	6135-00-985-7845 6135-01-333-6101	o Battery (AA Commercial) Alkaline Lithium			
3	5210-01-397-3011	Rule, Machinist's C604R-6 (57163)		EA	1
4a	2541-01-533-6903	VIK Kit (not shown) 6433029 (6W728)		EA	1
4b		VIK Kit (not shown) 13013100 (19200)		EA	1

***Recommend one Boresight Alignment Kit per squad equipped with one or more CROWS.

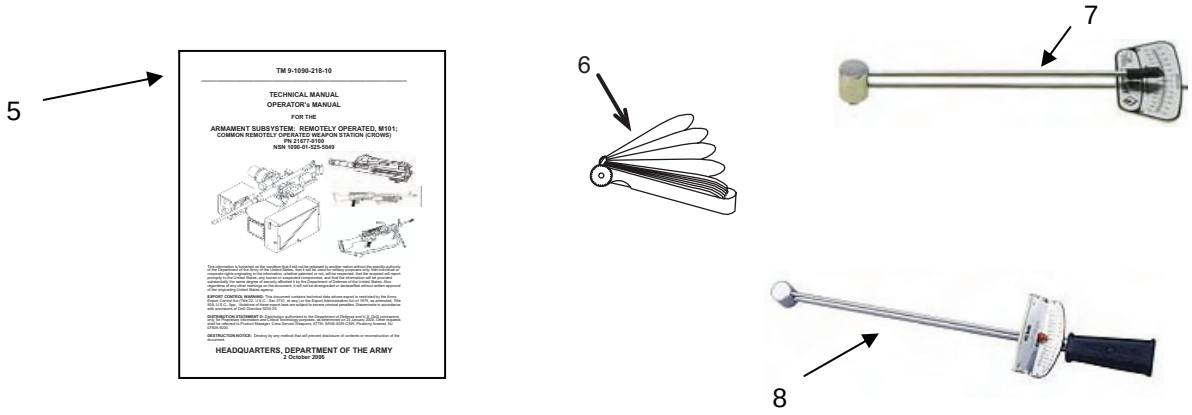


Table 2. Basic Issue Items (BII) - Cont.					
(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
5		Technical Manual: Operator's Manual for the Armament Subsystem: Remotely Operated, XM101 Common Remotely Operated Weapon Station (CROWS)		EA	1
6	5210-00-221-1999	Gage, Thickness 5026T (08871)		EA	1
7		Torque Wrench (0-60 in-lbs) 87004081 (0FR58)		EA	1
8		Torque Wrench (0-150 ft-lbs) 06632806 (0FR58)		EA	1

END OF WORK PACKAGE

OPERATOR's MANUAL
FOR THE
ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

ADDITIONAL AUTHORIZATION LIST (AAL)

Scope

This work package contains the Additional Authorization List (AAL) for CROWS.

General

The AAL identifies items that do not have to accompany the CROWS and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.

Explanation of Columns in the AAL

Column (1) Illus Number. Gives you the number of the item illustrated.

Column (2) National Stock Number (NSN). Identifies the stock number of the item to be used for requisitioning purposes.

Column (3) Description, Part Number/(CAGEC). Identifies the Federal item name (in all capital letters) followed by a minimum description when needed. The last line below the description is the part number and the Commercial and Government Entity Code (CAGEC) (in parentheses).

Column (4) Usable On Code. When applicable, gives you a code if the item you need is not the same for different models of equipment.

Column (5) U/I. Unit of Issue (U/I) indicates the physical measurement or count of the item as issued per the National Stock Number shown in column (1).

Column (6) Qty Recm. Indicates the quantity recommended."

ADDITIONAL AUTHORIZATION LIST (AAL)

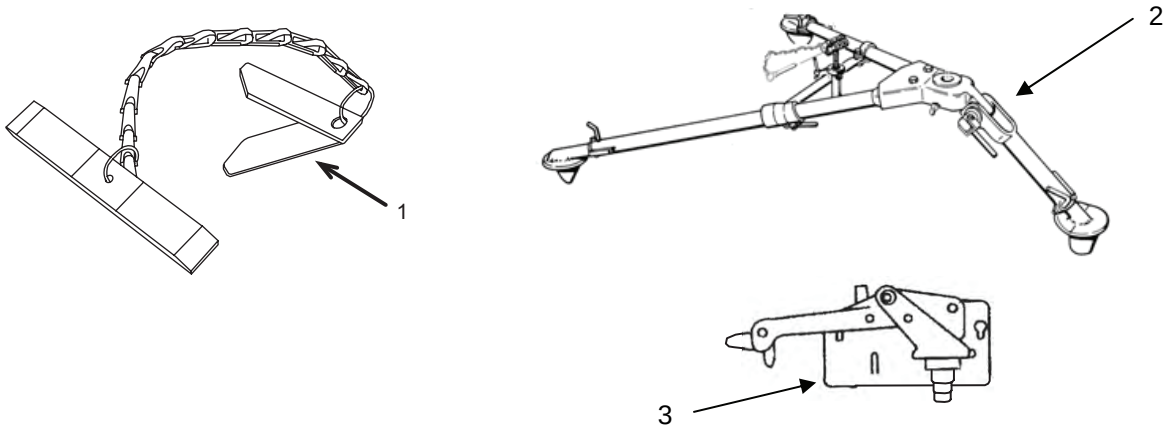


Table 1. Additional Authorization List (AAL).

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
1	5220-00-535-1217	M2 timing gages: GO/NO GO and FIRE/NO FIRE gages * 5351217 (19205)			1
2	1005-00-322-9716	M3 Tripod Gun Mount 8403398 (19204)			
3	1010-01-179-7616	M64 Gun Mount Adapter 5831469 (53711)			

* Normally fielded as part of weapon support structure; issued with M2 as BII.

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

EXPENDABLE AND DURABLE MATERIALS

This work package lists expendable and durable items that you will need to operate and maintain the CROWS.

INTRODUCTION

This list is for information only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items), CTA 50-909, Field and Garrison Furnishings and Equipment, or CTA 8-100, Army Medical Department Expendable/Durable Items.

EXPLANATION OF COLUMNS IN THE EXPENDABLE/DURABLE ITEMS LIST

Column (1) Item Number. This number is assigned to the entry in the list and is referenced in the narrative instructions to identify the item (e.g., “Use acetone (WP 0038, item 1)”).

Column (2) Level. This column includes the lowest level of maintenance that requires the listed item (C = Crew, O = Service, F = Field, H = Below Depot, D = Depot).

Column (3) National Stock Number (NSN). This is the NSN assigned to the item used when you requisition the item.

Column (4) Item, Description, Commercial and Government Entity Code (CAGEC), and Part Number (P/N). This column provides the other information you need to identify the item. The item description comes first, followed by the CAGEC (in parentheses) and the P/N.

Column (5) Unit of Issue (U/I). Indicates the physical measurement or count of the item such as gallon, dozen, gross, etc., as issued per the NSN shown in column (3).

EXPENDABLE AND DURABLE ITEMS LIST

Table 1 details the consumable, expendable, and durable materials required for operational procedures.

WARNING

Follow all safety precautions and procedures when handling these materials.

Read all appropriate Material Safety Data Sheets (MSDS).

Follow all instructions and local standard operating procedures (SOPs) concerning use, storage, and disposal of items deemed “hazardous materials.” For disposition of hazardous materials, contact your local hazardous material or safety office.

Do not use ethyl alcohol near an open flame or a source of sparks. Use ethyl alcohol only in a well-ventilated area to prevent undue exposure to vapors. If accidental skin contact occurs, wash the exposed area immediately with soap and water.

Do not use isopropyl alcohol near heat, an open flame, or a source of sparks. Use isopropyl alcohol only in a well-ventilated area to prevent undue exposure; avoid breathing vapors. Avoid contact with eyes. If accidental contact occurs, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately. Avoid contact with skin and clothing. If accidental contact occurs, wash the exposed area immediately with soap and water.

Do not use acetone near heat, an open flame, or a source of sparks. Use acetone only in a well-ventilated area to prevent undue exposure; avoid breathing vapors. Avoid contact with eyes. If accidental contact occurs, immediately flush eyes with plenty of lukewarm water for at least 15 minutes. Get medical attention immediately. Avoid contact with skin and clothing. If accidental contact occurs, wash the exposed area immediately with soap and water.

Failure to follow these instructions may result in personal injury or equipment damage.

Table 1. Expendable and Durable Materials.

(1) Item No.	(2) Level	(3) National Stock Number	(4) Item Name, Description, CAGEC, and Part Number	(5) U/I
1	O, F, S	6810-01-223-2739	Acetone (81345) ASTM-D-329-PT	BT
2	O, F, S	6810-01-106-2460	Alcohol, ethyl, denatured grade III, formula no. 3A (grade II, class B also acceptable) (81348) O-E-760	BT
3	O, F, S	6810-00-983-8551	Alcohol, isopropyl (81348) TT-I-735	CN
4	O	8105-00-063-5060	Bag, Textile (06214) 104N4X6IN	
5	O, F, S	8020-00-201-1870	Brush, artist's Nonmetallic (80244) 8020-00-201-1870	EA
6	O, F, S	6850-01-076-9656	Cleaning compound, optical lens; Type I or II Type I – 20% alcohol, 0.15% detergent (type I of MIL-D-167791), 79.9% clean water (preferably distilled) Type II – 57% alcohol, 0.15% detergent (type I of MIL-D-167791), 42.9% clean water (preferably distilled) (81349) MIL-C-43454C	BT

Table 1. Expendable and Durable Materials – Cont.

(1) Item No.	(2) Level	(3) National Stock Number	(4) Item Name, Description, CAGEC, and Part Number	(5) U/I
7	O, F, S	7920-00-044-9281	Cloth, cleaning, lint-free (58536) A-A-59323	BX
8	O, F, S	8030-01-014-5869	Compound, sealing/thread locking, blue-medium strength (50 cc bottle) (05972) 24231	BT
9	O, F, S	8030-00-148-9833	Compound, sealing/thread locking, red-high strength (ten 10-cc bottles per box) (05972) 27121	BX
10	O, F, S	8040-01-284-3984	Compound, sealing/thread locking, black-quick set (1 oz bottle) (05972) 38050	BT
11	O, F, S	6510-01-500-7929	Cotton balls (200 per pkg) (60180) 30-127	PG
12	O, F, S	7930-00-531-9716	Detergent, type I (5 gallon can) (81349) MIL-D-16791	CN
13	O, F, S	7930-01-398-2473	Dust remover, compressed air (1MB86) 105798-1 (one box contains 6 ea)	BX
14	O, F, S	8415-01-463-5934	Gloves, plastic/latex; non-talc (80244) 8415-01-463-5934	DZ
15	O, F, S	Size XS8, 8415-00-753-6550	Gloves, TAP, type II (81349) MIL-G-12223	PR
		Size S9, 8415-00-753-6551	Gloves, TAP, type II (81349) MIL-G-12223	PR
		Size M10, 8415-00-753-6552	Gloves, TAP, type II (81349) MIL-G-12223	PR
		Size L11, 8415-00-753-6553	Gloves, TAP, type II (81349) MIL-G-12223	PR
		Size XL12, 8415-00-753-6554	Gloves, TAP, type II (81349) MIL-G-12223	PR
16	O, F, S	4240-00-052-3776	Goggles, industrial (80204) ANSI Z87.1	PR
17	O, F, S	9150-01-378-0693	Grease, aircraft lubricant grade 1 (81349) MIL-PRF-81322,	CN
18	O, F	7520-00-043-3408	Marker, Tube Type (06383) PX-0	DZ
19	O, F, S	6640-01-474-0348	Paper tissue, lens (50 sheets per book/12 books per pkg) (1V571) RLC20205100	PG
20	O, F, S	5315-01-385-1540	Pin, Hitch, Lock (39428) 98335A061	EA
21	O, F, S	5975-01-476-0484	Strap, tiedown, electrical (also anchors) (1,000 in a bag) (06383) SST2S-MO	EA
22	O	8135-00-952-0672	Tag, Shipping (58536) A-A-900	HD
23	O, F, S	6810-00-107-1510	Water, distilled (5 gallon drum) (58536) A-A-59282	GL
24	O, F, S	9505-00-596-5101	Wire, safety, 0.020-inch diameter 302 stainless (81346) ASTM-580	SL

END OF WORK PACKAGE

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

GLOSSARY

This work package contains three tables: Table 1 lists general abbreviations and terms used in this Manual; Table 2 lists the abbreviations that appear on the display unit screen; and Table 3 lists units of measure.

Table 1 contains general abbreviations, including acronyms, and terms related to CROWS operation.

Table 1. General Abbreviations and Terms.

Term, Abbreviation (Acronym)	Definition
.50-cal	M2 HB .50-caliber automatic machine gun listed by ammunition
7.62 mm	M240 7.62 mm automatic machine gun listed by ammunition
5.56 mm	M249 5.56 mm automatic machine gun listed by ammunition
40 mm	Mk19 40 mm grenade machine gun listed by ammunition
A	SMR recoverability code
AAH	Armored Attack Helicopter
AAL	additional authorization list
AD	SMR source code
AEPS	Army Electronic Product Support
AF	SMR source code
AEC	automatic exposure control
AGC	automatic gain control
AH	SMR source code
Aimpoint	Related to laser aimpoint and ballistic aimpoint Laser aimpoint is represented by the following reticle or symbol, ⊥. Ballistic alignment is represented by the following reticle or symbol, ^.
AL	SMR source code
Alphanumeric parameters	For data entry (Menu System), alphanumeric parameters represent operational functions (e.g., the selected ammunition or sensor settings).
AO	SMR source code
ASS	automated sector scan
Auto Accept	Ballistic solution is automatically accepted. When disabled, the operator must manually accept the ballistic solution.
Az, AZ, Azimuth	horizontal movement or measurement
B	SMR maintenance code (fourth position)

Table 1. General Abbreviations and Terms – Cont.

Term, Abbreviation (Acronym)	Definition
Ballistic solution	After the operator aligns the laser aimpoint reticle on the target and fires the laser, the ballistic computer calculates a ballistic solution for the engagement and generates a corrected ballistic aimpoint on the screen. Once the operator accepts the ballistic solution, CROWS autolays the ballistic aimpoint to the position of the laser aimpoint and elevates the weapon for the correct ballistic solution. (Discussed further in WP 0003, Theory of Operation.)
BBA	backplane bus assembly
BCA	ballistic computer assembly
BII	basic issue items
BIT	built-in-test
Black hot	polarity option when using the thermal camera
Boresighting	Process ensuring that the corrected aimpoint calculated by the BCA includes compensation for the boresight alignment of the weapon to CROWS.
BPA	backplane assembly in EMU, contains SSEA, BCA, DVEA, PSA printer circuit cards
Brt	brightness
C	SMR maintenance code (third position)
Ca, CA	cant
CAGE	See Table 2 of this work package.
CAGE Code, CAGEC	commercial and Government entity code
CARC	chemical agent resistant coating (Governed by MIL-C-46168, MIL-C-53039, and MIL-DTL-64159)
CAUTION	Precedes the text of any procedure involving a clear risk of damage to the equipment.
CCA	circuit card assembly
CCD	charge coupled device
CCW	counterclockwise
CG	control group
Chroma	an adjustment to the shade of color
COEI	component(s) of end item
CPC	corrosion prevention and control
Cradle or Cradle Assembly	Equipment used to hold the applicable weapon and adapter kit.
CROWS	Common Remotely Operated Weapon System
CW	cross wind, clockwise

Table 1. General Abbreviations and Terms – Cont.

Term, Abbreviation (Acronym)	Definition
D	depot, as in depot-level maintenance also SMR maintenance code (third position and fourth position) also SMR recoverability code
DCM	day camera module
dispersion	the scattered pattern of hits from fired projectiles
DSP	digital signal processor
Display or DU	display unit Shows operational options via a Menu system, target-related data, and CROWS output.
DVEA	digital video electronics assembly
dynamic tracking	The ability to track a target while one or the other, or both, are in motion.
El, EL, elevation	vertical movement or measurement
EIR	equipment improvement recommendation
EMI	electromagnetic interference
EMP	electromagnetic pulse
EMU	electronics modular unit
ELRF	eyesafe laser rangefinder
ESD	electrostatic discharge
ETM	Electronic Technical Manual
F	SMR maintenance code (third position and fourth position) SMR recoverability code
FGC	functional group code
FOG	fiber optic gyro (azimuth and elevation)
FOV	field of view
FPD	flat panel display, see display unit
Gage or gauge	Terms used interchangeably. Related to the timing and firing GO/NO GO gages used in adjusting headspace (mechanical) and timing (electronic) for the M2 weapon.
Gimbal	Pedestal mount, SWM, or, basically, the CROWS without the cradle, adapter kit and weapon, Sensor Group, and Control Group.
GMG	grenade machine gun
GWS	gimballed weapon station

Table 1. General Abbreviations and Terms - Cont.

Term, Abbreviation (Acronym)	Definition
H	SMR maintenance code (third position and fourth position) SMR recoverability code
HB	heavy barrel; used with the M2 weapon
HCI	human-computer interface also hardness critical item
HDI	chemical compound in CARC; hexamethylene-1,6-diisocyanate
HEDP	high-explosive, dual-purpose
Hot, white or black	polarity options when using the thermal camera
IBA	improved body armor
ICD	interconnect diagram
ICS	interface cable set
ICU	interface control unit
InSb	indium antimony Indium is a soft, silver-colored, rare metallic element used in alloys, transistors, and electroplating. Antimony is a brittle, silver/white-colored metallic element used in alloys and electronics (also occurs in a non-metallic form).
IO	input/output
IOA	input output assembly
IPL	illustrated parts list
KB	SMR source code
KD	SMR source code
KF	SMR source code
L	SMR maintenance code (third position and fourth position) SMR recoverability code
LAN	local area network
LED	light emitting diode
Left-most digit	For data entry (Menu System), after selecting and activating a numeric value for modification, the left-most digit in that number is selected for modification by default and appears underlined on the display.
Lockwire, lock wire	see safety wire
LOS	line of sight
LRF	laser rangefinder
LRU	line replacement unit, equivalent to Field-level maintenance

Table 1. General Abbreviations and Terms – Cont.

Term, Abbreviation (Acronym)	Definition
M2, M2 HB, M2 HB .50-cal	M2 Heavy Barrel (HB) .50-caliber automatic machine gun listed by model and ammunition caliber
M240B, M240B 7.62 mm	M240B 7.62 mm automatic machine gun listed by model and ammunition caliber
M249, M249 5.56 mm	M249 5.56 mm automatic machine gun listed by model and ammunition caliber
MAC	Maintenance Allocation Chart, defines maintenance tasks to be performed on designated components/assemblies, those responsible for performing the tasks, and tools/equipment needed to complete the task.
MD	SMR source code
Menu System	System of computer-based operational options, shown on the display unit, used to operate the CROWS.
MF	SMR source code
MH	SMR source code
Mk19 Mk19 40 mm	Mk19 40 mm grenade machine gun listed by model and ammunition caliber
ML	SMR source code
MO	SMR source code
momentary switch	A switch that, no matter how long you hold it, only makes a connection for a short (momentary) length of time.
MOUT	military operations in urban terrain
MPI	mean point of impact
MSDS	Material Safety Data Sheet Contains information about components, usage, storage, safety issues/concerns, and disposal of materials.
NBC	nuclear, biological, and chemical Refers to contamination conditions.
NFOV	narrow field of view
NHA	next higher assembly
NMC	Not mission capable; the condition where the equipment is deadlined
NOTE	Highlights essential procedures, conditions or statements that follow.
NSN	national stock number
NTSC	National Television Standards Committee -- a form of video formatting
NUC	Non-uniformity correction, related to weapon offsets in the Menu system.

Table 1. General Abbreviations and Terms – Cont.

Term, Abbreviation (Acronym)	Definition
Numeric value	For data entry (Menu System), a numeric value is a series of numbers representing system data (e.g., distance or temperature).
NVD	night vision device
NVG	night vision goggles
O	SMR maintenance code (third position and fourth position) SMR recoverability code
OBIT	operational BIT
Out-of-limit data	Related to default values in the Menu system. Data outside of permitted ranges, one type of invalid data from a sensor.
P	pressure, see Pr also
PA	SMR source code
PAL	phase alteration line (German television system) – a form of video formatting
Parallax	The displacement of an object as seen from two different points that are not on a line with the object.
PB	SMR source code
PBIT	power-on BIT
PC	SMR source code
PCA	printed circuit assembly (synonymous with CCA)
PD	SMR source code
PE	SMR source code
PF	SMR source code
PG	SMR source code
PMC	Partially mission capable; the condition where the equipment deficiencies, but may still accomplish a mission (depending on the circumstances of the mission).
PMCS	preventive maintenance checks and services
PN or P/N	part number
P/O	part of
Polarity	See also “reverse polarity.” Refers to the thermal camera (thermal imager); options include “white hot” and “black hot.” Related to the Zm/Fc/Accpt functional state (Table 2).
PQDR	Product Quality Deficiency Report (SF Form 368)
Pr	pressure sensor
PSA	power supply assembly

Table 1. General Abbreviations and Terms - Cont.

Term, Abbreviation (Acronym)	Definition
PSI	pounds per square inch Pressure measurement related to compressed air and other items.
PWM	pulse-width modulated
Qty	quantity
RD	rounds
Redundant	System functions that can be performed in two ways. Examples of functions that can be performed using the switches on the display unit or the joystick buttons include: CURSOR CONTROL, LASE ACCEPT, FUNCTION, and CAMERA CHANGE.
Reticle	When related to aimpoint, it is the symbols that appear on the display unit for laser or ballistic aimpoint. When related to the view in the boresight tool, it is a grid of fine lines in the focus of an optical instrument, used for determining the scale or position of what is being looked at.
Reverse polarity	See also “polarity” Reverses polarity between “white hot” and “black hot” settings; “white hot” is the default.
RFA	remote firing assembly
RPSTL	Repair Parts and Special Tools List
RW	range wind
Safety wire	Material and method of securing attaching hardware and components/parts Refer to WP 0031
scan rate	The speed that the system/weapon mount moves.
SG	sensor group
SGL	smoke grenade launcher
SLAP	saboted light armor penetrator
SLAP-T	saboted light armor penetrator-tracer
Slew	To turn (something) on an axis; to rotate or pivot.
SMR	source, maintenance, and recoverability code SMR code for a part describes the manner of acquiring a part needed for maintenance, repair, or overhaul of an end item.
SPU	switch panel unit
SRU	shop replaceable unit, or equivalent to sustainment maintenance
SRWS	stabilized remote weapon station [original (prototype) name for CROWS]
SSEA	sensor support electronics assembly
SU	sensor unit
SVGA	super video graphics array (a computer display)
SWM	Stabilized Weapon Mount
Symbology	Text-and-graphics overlay generated by the EMU.

Table 1. General Abbreviations and Terms - Cont.

Term, Abbreviation (Acronym)	Definition
Te	temperature sensor
TFT	thin film transistor
TM	technical manual
TMDE	test measurement and diagnostic equipment
Toggle	To move a switch back and forth (i.e., OFF, ON, OFF, ON).
TP	Temperature pressure, as in the sensor unit's temperature pressure sensor.
TRP	target reference points
TX	transmit
VAK	vehicle adaptation kit (term not applicable to CROWS)
VIK	vehicle integration kit
WAK	weapon adapter kit
WAM	weapons and ammunition management
WARNING	Precedes the text of any procedure involving a clear danger to the person doing that procedure.
WFOV	wide field of view
White hot	Polarity option when using the thermal camera.
WP	work package
XA	SMR source code
AB	SMR source code
XC	SMR source code
XD	SMR source code
Z	SMR maintenance code (fourth position) SMR recoverability code
Zeroing	Results in the inclusion of a compensation factor in the system ballistic solution to offset for sources of dynamic vehicle and mount errors that may affect the weapon dispersion.

Table 2 lists abbreviations shown on the screen of the display unit, with a definition and description of each term.

Table 2. On-Screen Abbreviations and Definitions.

On-Screen Abbreviations	Definition and Description
A	**A**mmunition (toggle) A software toggle switch to quickly change between two types of ammunition without having to go through the Preparation menu.
Accpt	**Acc**e**pt** Used with Zm/Fc/Accpt When the thermal camera is activated, the ACCEPT switch is used as a toggle to change the polarity between white hot and black hot. Use with Rg/Brt/Accpt When the ballistic aimpoint is displayed (Engagement mode), the ACCEPT switch is used to accept and implement a calculated firing solution.
Adjust	**Adjust** A functional state only within the boresight process, **Adjust** enables the operator to change the boresight crosshair using the four-way thumb switches or the cursor keys.
BS Range	**B**ore**s**ight **Range** **BS Range** shows the range to target during the boresight process only.
Ca	**Ca**nt **Ca**, a submenu in the sensor window, is used to refine the ballistic solution in engagement mode. It provides specific information related to the weapon's degree of axial tilt left or right of the line observer-target.
CAE	**C**ant **a**nd **E**levation **CAE**, a submenu in the sensor window, is used to refine the ballistic solution in engagement mode. It provide specific information related to the weapon's degree of axial tilt left or right of the line observer-target, and target elevation angle.
CAGE	Options in the Preparation Menu mode for setting, changing, and storing mount positions (azimuth and elevation) for later recall.
CANTEL	**Cant** and **El**evation Related to the weapon's degree of axial tilt left or right of the observer-target and the target elevation angle.
CW	**C**ross **W**ind **CW**, a submenu in the Sensor window, permits the operator to manually enter wind data. A positive CW value indicates a wind blowing from left to right while a negative value indicates a right-to-left wind direction (facing down-range toward the target area).

Table 2. On-Screen Abbreviations and Definitions – Cont.

On-Screen Abbreviations	Definition and Description
Fc	Used with Zm/Fc/Accpt **Foc**us CURSOR CONTROL switch LEFT / RIGHT is used to focus (Fc) the camera in (close) or out (long).
FN	**F**unctio**n**; abbreviation for FUNCTION switch on the display
Menu	**Menu** A functional state, **Menu** allows the operator to move the cursor around the screen to various menus, using the four way thumb switch or the cursor keys.
P	**P**reparation (menu) When selected, **P** enters the first level of Preparation menus to prepare (i.e., setup or configure) the EFCS-T for use.
Pr	**Pr**essure. Pr, a submenu in the sensor window, is, by default, data measured by the CROWS integral sensors. Pressure values may be enabled or disabled and override values may be set for these sensors, if required. The Override process effectively isolates the sensor from the system and uses the override value input by the operator for the ballistic solution.
Rg/Brt/Accpt	**R**an**g**e / **Br**igh**t**ness / **Acc**e**pt** A functional state • **Rg** increases or decreases the range to target using the four-way thumb switches or the cursor keys. • **Brt** controls the set point of the camera electronic iris, using the four-way thumb switches or the cursor keys. • **Accpt** accepts and implements the ballistic solution.
RNDS	**R**ou**nds** **RNDS**, the rounds counter, tracks approximate number of remaining rounds.
RW	**R**ange **W**ind. Sub menu in Sensor Window. **RW**, a submenu in the Sensor window, permits the operator to manually enter wind data. Negative values indicate a head wind and positive values indicate a tail wind.
RX	Laser receiver
S	**S**ensor (display) When selected, **S** opens the sensor window and shows the reading/default value for all sensors.
ST or STAB	**St**abilization **ST** turns stabilization ON or OFF via a software toggle switch.

Table 2. On-Screen Abbreviations and Definitions – Cont.

On-Screen Abbreviations	Definition and Description
Te	**Te**mperature. **Te**, a submenu in the sensor window, is, by default, data measured by the CROWS integral sensors. Temperature values may be enabled or disabled and override values may be set for these sensors, if required. The Override process effectively isolates the sensor from the system and uses the override value input by the operator for the ballistic solution.
TX	Laser transmitter
WAM	Weapons and Ammunition Management
Zm	Use with Zm/Fc/Accpt **Z**oo**m** CURSOR CONTROL switch UP / DOWN is used to zoom (Zm) the camera in (narrow the field of view, FOV) or out (widen the FOV).
Zm/Fc/Accpt	**Z**oo**m** / **F**o**c**us A functional state. Default when the laser aimpoint is displayed in engagement mode. • **Zm** enables the operator to zoom in or out using the four-way thumb switches or the cursor keys. • **Fc** enables the operator to focus in or out, using the four-way thumb switches or the cursor keys. • **Accpt** enables the operator to change the polarity between white hot and black hot when the thermal camera is activated.

Table 3 lists units of measure used throughout the this manual.

Table 3. Symbols and Units of Measure.

Symbol or Unit of Measure	Definition and Description
°	Degree (measurement of angle or temperature), also deg
°/s or °/sec	Degrees per second (angle)
⊥	In the CROWS menu system, this symbol represents the laser aimpoint.
^	In the CROWS menu system, this symbol represents the ballistic aimpoint.
A, amp	ampere
Atm	standard atmosphere; a unit of pressure
C	Celcius
deg	degree (measurement of angle or temperature), also °
F	Fahrenheit
ft	feet
ft/s	feet per second
in	inches
inHg	inch of mercury; unit of atmospheric pressure
In-lb.	inch-pound; measurement of torque
J	Joule, standard unit of energy
K	Kelvin
kg	kilogram
km	kilometer
kmph, km/h	kilometers per hour
kn	knot (nautical mile per hour)
kpa	kilopascals; unit of atmospheric pressure
lb	pounds
lx	symbol for lux, the international standard (SI) unit of illumination, equal to one lumen per square meter
m	meter
μJ	microJoule
Mbar	millibar, unit of atmospheric pressure
mi	mile
mil	milliradian unit of angular measurement for artillery (a unit of angular distance equal to one thousandth of a radian)
mil	unit of measurement
mil/s	milliradians per second
min	minute
mJ	milliJoule

Table 3. Symbols and Units of Measure - Cont.

Symbol or Unit of Measure	Definition and Description
mm	millimeters
mmHg	millimeters of mercury; unit of atmospheric pressure
mph	miles per hour
m/s	meters per second
nm	nautical mile
rad	radian
s, sec	second
μm	micrometers
X	Unit of magnification
Vdc, VDC	Volts direct current
yd	yard

END OF WORK PACKAGE

OPERATOR's MANUAL
FOR THE
ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101;
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

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END OF WORK PACKAGE

By Order of the Secretary of the Army:

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

Official:



JOYCE E. MORROW
Administrative Assistant to the Secretary of the Army
0731201

Distribution:

To be distributed in accordance with the Initial Distribution Number (IDN) 401220 requirements for TM 9-1090-218-10.

OPERATOR's MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, XM101

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

DA FORM 2028

A sample form and three blank forms of DA Form 2028, Recommended Changes to Equipment Technical Publications, have been included should you have suggestions for ways to correct and improve this document. You may submit the form several ways:

- Through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is https://aeps.ria.army.mil. The DA Form 2028 is located under the Public Applications section in the AEPS Public Home Page. Fill out the form and click on SUBMIT.

  Using this form on AEPS will enable us to respond more quickly to your comments and better manage the DA Form 2028 program.

- By e-mail to ROCK-TACOM-TECH-PUBS@conus.army.mil.

- Via fax using DSN 793-0726 or the commercial fax number (309) 782-0726.

- By mailing a paper copy to TACOM Life Cycle Management Command, ATTN: AMSTA-LC-LMPP/ TECH PUBS, 1 Rock Island Arsenal, Rock Island, IL 61299-7630.

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is ODISC4.	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE Today's Date
TO: *(Forward to proponent of publication or form) (Include ZIP Code)* TACOM Life Cycle Management Command ATTN: AMSTA-LC-LMPP/ TECH PUBS 1 Rock Island Arsenal, Rock Island, IL 61299-7630	FROM: *(Activity and location) (Include ZIP Code)* Your military mailing address	

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 9-1090-218-10	30 November 2007	Armament Subsystem: Remotely Operated, XM101: Common Remotely Operated Weaton Station (CROWS)

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON *(Provide exact wording of recommended changes, if possible).*
1	XX	X	X	X	X	describe correction or suggested input.

SAMPLE

**Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Your name and grade or title	Your phone extension	Your signature

TO: (*Forward direct to addressee listed in publication)*	FROM: (*Activity and location) (Include ZIP Code)*	DATE
TACOM Life Cycle Management Command ATTN: AMSTA-LC-LPIT/ TECH PUBS 1 Rock Island Arsenal, Rock Island, IL 61299-7630	Your military mailing address	Today's Date

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE
TM 9-1090-218-01	30 November 2007	Armament Subsystem: Remotely Operated XM101 Common Remotely Operated Weapon Station (CROWS)

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

SAMPLE

PART III – REMARKS (*Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Your name and grade or title	Your phone number	Your signature

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THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meter = 0.3937 Inch
1 Decimeter = 10 Centimeters = 3.94 Inches
1 Meter = 10 Decimeters = 100 Centiimeters
= 1000 Millimeters = 39.37 Inches
1 Dekameter = 10 Meters = 32.8 Feet
1 Hectometer = 10 Dekameters = 328.08 Feet
1 Kilometer = 10 Hectometers = 1000 Meters
= 0.621 Mile = 3,280.8 Feet
Millimeters = Inches times 25.4
Inches = Millimeters divided by 25.4

WEIGHTS

1 Centigram = 10 Milligrams = 0.154 Grain
1 Decigram = 10 Centigrams = 1.543 Grains
1 Gram = 0.001 Kilogram = 10 Decigrams
= 1000 Milligrams = 0.035 Ounce
1 Dekagram = 10 Grams = 0.353 Ounce
1 Hectogram = 10 Dekagrams = 3.527 Ounces
1 Kilogram = 10 Hectograms = 1000 Grams = 2.205 Pounds
1 Quintal = 100 Kilograms = 220.46 Pounds
1 Metric Ton = 10 Quintals = 1000 Kilograms = 1.102 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liter = 0.034 Fluid Ounce
1 Centiliter = 10 Milliliters = 0.34 Fluid Ounce
1 Deciliter = 10 Centiliters = 3.38 Fluid Ounces
1 Liter = 10 Deciliters = 1000 Millileters = 33.82 Fluid Ounces
1 Dekaliter = 10 Liters = 2.64 Gallons
1 Hectoliter = 10 Dekaliters = 26.42 Gallons
1 Kiloliter = 10 Hectoliters = 264.18 Gallons

SQUARE MEASURE

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inch
1 Sq Decimeter = 100 Sq Centimeters = 15.5 Sq Inches
1 Sq Meter (Centare) = 100 Sq Decimeters
= 10,000 Sq Centimeters = 10.764 Sq Feet
1 Sq Dekameter (Are) = 100 Sq Meters = 1,076.4 Sq Feet
1 Sq Hectometer (Hectare) = 100 Sq Dekameters = 2.471 Acres
1 Sq Kilometer = 100 Sq Hectometers = 1,000,000 Sq Meters
= 0.386 Sq Mile

CUBIC MEASURE

1 Cu Centimeter = 1000 Cu Millimeters = 0.061 Cu Inch
1 Cu Decimeter = 1000 Cu Centimeters = 61.02 Cu Inches
1 Cu Meter = 1000 Cu Decimeters = 1,000,000 Cu Centimeters
= 35.31 Cu Feet

TEMPERATURE

5/9 (°F – 32°) = °C
9/5 (°C+ 32°) = °F
–35° Fahrenheit is equivalent to –37° Celsius
0° Fahrenheit is equivalent to –18° Celsius
32° Fahrenheit is equivalent to 0° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
100° Fahrenheit is equivalent to 38° Celsius
212° Fahrenheit is equivalent to 100° Celsius

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.452
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.574
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.350
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound–Feet	Newton–Meters	1.356
Pounds–Inches	Newton–Meters	0.11298
Pounds per Square Inch	Kilopascals	6.895
Ounce–Inches	Newton–Meters	0.007062
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609
Centimeters	Inches	0.394

TO CHANGE	TO	MULTIPLY BY
Meters	Feet	3.281
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton–Meters	Pound–Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.352
Kilometers per Hour	Miles per Hour	0.621
°Fahrenheit	°Celsius	°C = (°F –32)x5/9
°Celsius	°Fahrenheit	°F = (9/5x°C)+32

PIN: 082693-000