TM 9-1090-218-23&P

TECHNICAL MANUAL

UNIT AND DIRECT SUPPORT MAINTENANCE MANUAL
(INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST)

FOR

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;
COMMON REMOTELY OPERATED WEAPON STATION (CROWS),
PN 21677-0100
NSN 1090-01-525-5049



This information is furnished on the condition that it will not be released to another nation without the specific authority of the Department of the Army of the United States, that it will be used for military purposes only, that individual or corporate rights originating in the information, whether patented or not, will be respected, that the recipient will report promptly to the United States, any known or suspected compromise, and that the information will be provided substantially the same degree of security afforded it by the Department of Defense of the United States. Also regardless of any other markings on the document, it will not be downgraded or declassified without written approval of the originating United States agency.

EXPORT CONTROL WARNING: This Document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C., Sec 2751, et seq.) or the Export Administration Act of 1979 (Title 50, U.S.C., App. 2401 et seq.), as amended. Violations of these export laws are subject to severe criminal penalties. Disseminate in accordance with provisions of DoD Directive 5230.25.

DISTRIBUTION STATEMENT D: Distribution authorized to the Department of Defense and U.S. DoD contractors only, for Proprietary Information and Critical Technology purposes, as determined on 24 January 2005. Other requests shall be referred to Product Manager, Crew Served Weapons, ATTN: SFAE-SDR-CSW, Picatinny Arsenal, NJ 07806-5000.

DESTRUCTION NOTICE: Destroy by any method that will prevent disclosure of contents or reconstruction of the document.

HEADQUARTERS, DEPARTMENT OF THE ARMY

1 SEPTEMBER 2005

WARNING SUMMARY

General

Follow all safety warnings and cautions when handling equipment.

Before approaching the CROWS, ensure that power is off AND motion has stopped; then lock the azimuth lock.

Wear eye protection when safety-wiring. Failure to do so may result in personal injury.

Wear eye protection when performing thread-locking procedures.

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

Wear eye protection when performing desiccant inspection and replacement procedures.

Ensure that the gas source has stopped flowing before removing the hose from the valve core. Failure to follow these instructions may result in personal injury.

Before performing any maintenance on the CROWS, move the system to a designated maintenance area.

Set the CROWS main power switch to the OFF position and ensure that all system motion has completely stopped before performing 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.

Support each yoke arm during disassembly/assembly.

Use two personnel during assembly and disassembly [of the yoke arms].

Once the [ammo yoke arm] bolts are removed in step 2, you have two heavy items that are not connected to each other. Support both the ammo hanger and the ammo yoke arm during disassembly and assembly.

The ammo hanger assembly and the ammo yoke arm are heavy items that are not connected to each other. Support both the ammo hanger and the ammo yoke arm during disassembly and assembly.

The Sensor Group contains high voltage equipment. Follow all warnings and safety precautions.

The Sensor Group contains a laser. Although there are Eyesafe Laser labels, do not look into the laser. Handle with care.

Ensure that power is OFF and all system motion has stopped before installing any equipment. Failure to do so may result in personal injury and equipment damage.

WARNING SUMMARY – Cont.

General – Cont.

Use two personnel during removal/installation of the sight elevation drive assembly because the assembly is heavy and heavily weighted to one side. Handle the sight elevation drive assembly with care. Support the sight elevation drive assembly during disassembly/reassembly. Failure to follow these instructions may result in personal injury or equipment damage.

Use the hoist to lift and position CROWS on a stable work surface as needed to access the bottom of the pedestal. Verify that the azimuth lock handle is in the locked position and that all items are tightened before lifting and turning the system.

Verify that the azimuth lock handle is in the locked position and that all items tightened before lifting and turning the system.

Use extreme care during optics removal. Glass fragments have the potential to cause personal injury.

Proper switch orientation is critical to system operation. Ensure that the correct tagging and identifying methods are used. Failure to follow instructions may result in personal injury.

Follow all safety recommendations related to lifting or moving the CROWS. Use a hoist or forklift for maintenance and installation on or removal of the CROWS from the vehicle. Failure to follow these instructions may result in personal injury or equipment damage.

Use only authorized materials during these [lubrication] procedures.

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.

Stud is under spring tension. Removal of handle may cause spring to pop out, resulting in injury to personnel.

Expendable/Durable Materials

Follow all safety warnings and cautions. Use appropriate eye protection when cleaning the system or its parts. Wear latex gloves (or similar material) while using solvents to prevent an allergic reaction and fingerprint marks on surfaces.

Use only authorized materials during cleaning procedures.

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 soap and water.

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

WARNING SUMMARY – Cont.

Expendable/Durable Materials – Cont.

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. Wear eye protection. 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.

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.

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. Wear eye protection. 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.

Wear eye protection when performing corrosion-control procedures. Failure to do so may result in personal injury.

Solvents used in CARC and other paints are flammable. Never paint near open flames or where there are sparks, like welding or grinding. Never apply CARC to surfaces that will exceed 400°F (exhaust pipes, engine manifolds, etc.). Heating painted surfaces releases toxic gases, vapors, and metal fumes.

HDI, a component in CARC, is a potential sensitizer especially to asthmatics. Soldiers who are asthmatic should not apply CARC because a severe, life-threatening allergic reaction may occur.

Personnel must don chemical goggles, NBC gloves, and a hat, and must cover their arms to prevent skin contact with CARC.

Read all appropriate Material Safety Data Sheets (MSDS) for each paint/solvent used.

Nitrogen is an asphyxiant (i.e., decreases the concentration of oxygen in the air). Ensure the work area is well ventilated. Symptoms include headaches, dizziness, fainting, or in extreme concentrations, death.

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.

WARNING SUMMARY – Cont.

Weapons

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

Hatch 2 is open. The gun defaults to continuous fire mode. Safety interlocks will not function. Firing and weapon movement are inhibited.

Hatch interlocks have been overridden with Safety Override switch. The gun defaults to continuous fire mode. Safety interlocks will not function. Motion control is active.

LIST OF EFFECTIVE PAGES/WORK PACKAGES

INSERT LATEST CHANGED PAGES/WORK PACKAGES. DESTROY SUPERSEDED DATA.

NOTE: A vertical line in the outer margins of the page indicates the portion of the text affected by a change. Changes to illustrations are indicated by a miniature pointed hand. Changes to wiring diagrams are indicated by shaded areas.

Dates of issue for original and changed pages/work packages are:

Original Version 1 September 2005

TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER, INCLUDING THE INDEX, IS 24 AND TOTAL NUMBER OF WORK PACKAGES IS 66 PLUS INDEX, CONSISTING OF THE FOLLOWING ITEMS.

Page/WP No.	*Change No.	Page/WP No.	*Change No.	Page/WP No.	*Change No.
a-d	0	WP 0025 (2 pgs)	0	Ch 8, Title Page	
A-B	0	WP 0026 (2 pgs)	0	WP 0053 (3 pgs)	0
i-vii	0	WP 0027 (1 pg)	0	WP 0054 (6 pgs)	0
Ch 1, Title Page		WP 0028 (1 pg)	0	WP 0055 (14 pgs)	0
WP 0001 (5 pgs)	0	WP 0029 (1 pgs)	0	WP 0056 (4 pgs)	0
WP 0002 (15 pgs)	0	WP 0030 (64 pgs)	0	WP 0057 (3 pgs)	0
WP 0003 (2 pgs)	0	Ch 5, Title Page		WP 0058 (2 pgs)	0
Ch 2, Title Page		WP 0031 (0 pgs)	0	WP 0059 (27 pgs)	0
WP 0004 (8 pgs)	0	WP 0032 (0 pgs)	0	WP 0060 (64 pgs)	0
WP 0005 (6 pgs)	0	Ch 6, Title Page		WP 0061 (1 pg)	0
WP 0006 (8 pgs)	0	WP 0033 (0 pgs)	0	WP 0062 (1 pg)	0
WP 0007 (4 pgs)	0	WP 0034 (0 pgs)	0	WP 0063 (6 pgs)	0
WP 0008 (3 pgs)	0	WP 0035 (0 pgs)	0	WP 0064 (12 pgs)	0
WP 0009 (1 pg)	0	WP 0036 (0 pgs)	0	WP 0065 (1 pg)	0
WP 0010 (1 pg)	0	WP 0037 (0 pgs)	0	WP 0066 (10 pgs)	0
WP 0011 (1 pg)	0	WP 0038 (0 pgs)	0	Ch 9, Title Page	
Ch 3, Title Page		WP 0039 (0 pgs)	0	WP 0067 (7 pgs)	0
WP 0012 (5 pgs)	0	WP 0040 (0 pgs)	0	WP 0068 (3 pgs)	0
WP 0013 (60 pgs)	0	WP 0041 (0 pgs)	0	WP 0069 (3 pgs)	0
Ch 4, Title Page		WP 0042 (0 pgs)	0	WP 0070 (1 pg)	0
WP 0014 (6 pgs)	0	WP 0043 (0 pgs)	0	WP 0071 (3 pgs)	0
WP 0015 (1 pg)	0	WP 0044 (0 pgs)	0	WP 0072 (3 pgs)	0
WP 0016 (17 pgs)	0	WP 0045 (0 pgs)	0	WP 0073 (3 pgs)	0
WP 0017 (9 pgs)	0	WP 0046 (0 pgs)	0	WP 0074 (1 pg)	0
WP 0018 (1 pg)	0	WP 0047 (0 pgs)	0	WP 0075 (1 pg)	0
WP 0019 (4 pgs)	0	WP 0048 (0 pgs)	0	WP 0076 (4 pgs)	0
WP 0020 (13 pgs)	0	WP 0049 (0 pgs)	0	WP 0077 (3 pgs)	0
WP 0021 (1 pg)	0	WP 0050 (0 pgs)	0	WP 0078 (3 pgs)	0
WP 0022 (6 pgs)	0	WP 0051 (0 pgs)	0	WP 0079 (3 pgs)	0
WP 0023 (1 pg)	0	Ch 7, Title Page		WP 0080 (5 pgs)	0
WP 0024 (2 pgs)	0	WP 0052 (3 pgs)	0	WP 0081 (15 pgs)	0

*Zero in this column indicates an original page or work package.

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D.C.

TM 9-1090-218-23&P
1 September 2005

TECHNICAL MANUAL

UNIT AND DIRECT SUPPORT MAINTENANCE MANUAL
(INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST)

FOR

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101
COMMON REMOTELY OPERATED WEAPON STATION (CROWS),
PN 21677-0100
NSN 1090-01-525-5049



REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028 (Recommended Changes to Equipment Technical Publications), 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 the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or E-mail your letter or DA Form 2028 direct to: AMSTA-LC-LMIT / TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The email address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

DISTRIBUTION STATEMENT D: Distribution authorized to the Department of Defense and U.S. DoD contractors only, for Proprietary Information and Critical Technology purposes, as determined on 24 January 2005. Other requests shall be referred to Product Manager, Crew Served Weapons, ATTN: SFAE-SDR-CSW, Picatinny Arsenal, NJ 07806-5000.

DESTRUCTION NOTICE: Destroy by any method that will prevent disclosure of contents or reconstruction of the document.

i/ii blank

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

TABLE OF CONTENTS

WARNING SUMMARY ..... a

LIST OF EFFECTIVE PAGES/WORK PACKAGES ..... A/(B blank)

Title Page ..... i/(ii blank)

Table of Contents iii

HOW TO USE THIS MANUAL vi

CHAPTER 1, CROWS GENERAL INFORMATION, EQUIPMENT DESCRIPTION AND DATA, AND THEORY OF OPERATION

General Information ..... WP 0001

Equipment Description and Data ..... WP 0002

Theory of Operation and Operational Overview ..... WP 0003

CHAPTER 2, GENERAL MAINTENANCE INSTRUCTIONS

Cleaning Procedures ..... WP 0004

Lubrication Procedures ..... WP 0005

Safety-Wire Procedures ..... WP 0006

Thread-Locking Procedures ..... WP 0007

Corrosion Prevention and Control (CPC) Instructions ..... WP 0008

Desiccant Reactivation and Nitrogen-Purging Procedures (DS Only) ..... WP 0009

Electrostatic Discharge (ESD) Instructions (DS Only) ..... WP 0010

Soldering (DS Only) ..... WP 0011

CHAPTER 3, UNIT TROUBLESHOOTING PROCEDURES

Unit Maintenance Troubleshooting Procedures ..... WP 0012

Unit Maintenance Functional Testing and Troubleshooting ..... WP 0013

CHAPTER 4, UNIT MAINTENANCE INSTRUCTIONS

Unit Preventive Maintenance Checks and Services (PMCS) ..... WP 0014

Service Upon Receipt ..... WP 0015

Table of Contents – Cont.

CHAPTER 4, UNIT MAINTENANCE INSTRUCTIONS – Cont.

Unit Maintenance of CROWS Components:

Stabilized Weapon Mount (SWM) ..... WP 0016

Pedestal Gun Mount Assembly ..... WP 0017

Elevation Yoke Arm Assembly ..... WP 0018

Ammunition Yoke Arm Assembly ..... WP 0019

Sensor Group ..... WP 0020

Control Group ..... WP 0021

Interconnection (Connectors and Cables) ..... WP 0022

Ammunition Can Assembly ..... WP 0023

Cradle Assembly (M2/Mk19) ..... WP 0024

M2 HB Weapon Adapter Kit (WAK) ..... WP 0025

Mk19 Weapon Adapter Kit (WAK) ..... WP 0026

M240 Weapon Adapter Kit (WAK) ..... WP 0027

M249 Weapon Adapter Kit (WAK) ..... WP 0028

Additional Weapon Adapter Kit (WAK) ..... WP 0029

Ballistic Protection Kit ..... WP 0030

CHAPTER 5, DIRECT SUPPORT TROUBLESHOOTING PROCEDURES

Direct Support Maintenance Troubleshooting Procedures ..... WP 0031

Direct Support Functional Testing and Troubleshooting ..... WP 0032

CHAPTER 6, DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

Direct Support Maintenance of CROWS Components:

Stabilized Weapon Mount (SWM) ..... WP 0033

Pedestal Assembly ..... WP 0034

Elevation Yoke Arm and Elevation Drive Assembly ..... WP 0035

Ammunition Yoke Arm Assembly ..... WP 0036

Sensor Unit ..... WP 0037

Electronics Module Unit (EMU) ..... WP 0038

Switch Panel Unit (SPU) ..... WP 0039

Interface Control Unit (ICU) ..... WP 0040

Joystick ..... WP 0041

Display Unit ..... WP 0042

Table of Contents – Cont.

CHAPTER 6, DIRECT SUPPORT MAINTENANCE INSTRUCTIONS – Cont.

Interconnection (Connectors and Cables)..... WP 0043
Ammunition Can Assembly..... WP 0044
Cradle Assembly (M2/Mk19)..... WP 0045
M2 HB Weapon Adapter Kit (WAK)..... WP 0046
Mk19 Weapon Adapter Kit (WAK)..... WP 0047
M240 Weapon Adapter Kit (WAK)..... WP 0048
M249 Weapon Adapter Kit (WAK)..... WP 0049
Removal and Installation of Connectors and Seals..... WP 0050
Ballistic Protection Kit..... WP 0051

CHAPTER 7, AUXILIARY EQUIPMENT MAINTENANCE INFORMATION

Auxiliary Equipment Maintenance Information..... WP 0052

CHAPTER 8, SUPPORTING INFORMATION

References..... WP 0053
Introduction to the Maintenance Allocation Chart (MAC) for CROWS..... WP 0054
Maintenance Allocation Chart (MAC) for CROWS..... WP 0055
Expendable and Durable Items..... WP 0056
Tool Identification List..... WP 0057
Mandatory Replacement Parts/Spares..... WP 0058
Shipping, Handling, and Storage..... WP 0059
Vehicle Integration Kit - M1114 Up-Armored HMMWV..... WP 0060
Vehicle Integration Kit..... WP 0061
Illustrated List of Manufactured Items..... WP 0062
Torque Limits..... WP 0063
Glossary with Metric Conversion Chart..... WP 0064
Schematic Diagrams (DS Only)..... WP 0065
Wiring Diagrams..... WP 0066

CHAPTER 9, PARTS INFORMATION

RPSTL - Introduction..... WP 0067
Group 00 CROWS Repair Parts List..... WP 0068
Group 01 Stabilized Weapon Mount Assembly Repair Parts List..... WP 0069
Group 0101 Pedestal Gun Mount Assembly Repair Parts List..... WP 0070

Table of Contents – Cont.

Group 0104 Ammo Yoke Arm Assembly Repair Parts List ..... WP 0071
Group 02 Sensor Group Repair Parts List ..... WP 0072
Group 03 Control Group Repair Parts List ..... WP 0073
Group 05 Ammo Can Repair Parts List ..... WP 0074
Group 06 Cradle Assembly Repair Parts List ..... WP 0075
Group 07 M2 HB Weapon Adapter Kit Repair Parts List ..... WP 0076
Group 0702 M2 HB WAK -- Linear Actuator Assembly Repair Parts List ..... WP 0077
Group 08 Mk19 Weapon Adapter Kit Repair Parts List ..... WP 0078
Group 0802 Mk19 WAK -- Linear Actuator Assembly Repair Parts List ..... WP 0079
Group 10 Ballistic Protection Kit Repair Parts List ..... WP 0080
Group 11 Vehicle Integration Kit (VIK) Repair Parts List ..... WP 0081
National Stock Number Index ..... WP 0082
Part Number Index ..... WP 0083

INDEX I-1

DA Form 2028

HOW TO USE THIS MANUAL

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), it also pertains to females.
- Procedures apply to all models unless otherwise noted.

Indexes

This manual is organized to help you quickly find needed information and includes the following useful indexes.

- Table of Contents. A list of all chapters, work packages, and other material in the manual.
- Nomenclature Cross-Reference List. A table with part numbers, official nomenclature, and common names used in the manual (WP 0002).
- Work Package Overviews. Introductory sentences that summarize the information included in the work package.
- Index. An alphabetical listing of major topics/subjects cross-referenced to work packages or individual pages, located in the back of the manual.

Maintenance Procedures

Chapters 3 and 5 of this manual provide preventive maintenance information for the unit and direct support maintenance levels, respectively. Each work package has an initial set-up containing a list of the items needed to perform maintenance tasks.

Operator-level maintenance processes and materials are described in the CROWS Operator's Manual, TM 9-1090-218-10.

- Tools and Special Tools. Details tool kits and tools not found in the standard tool kit.
- Material/Parts. Describes expendable/durable and 100% replaceable parts. A part number or work package reference follows each item or part. If more than one part is needed, the quantity needed will follow the part number or reference.
- References. Lists other publications containing necessary information.

Warnings, Cautions, and Notes

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.

END OF WORK PACKAGE

CHAPTER 1

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

MAINTENANCE MANUAL
FOR THE
ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;
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 Reporting	2
Reporting Equipment Improvement Recommenations (EIRs)	2
Corrosion Prevention and Control (CPC)	2
Destruction of Materiel to Prevent Enemy Use	2
Preparation for Storage or Shipment	2
List of Abbreviations	2
Quality of Materiel	3
Safety, Care, and Handling	3
Electrostatic Discharge (ESD)	3
Applicable Documents	3
CROWS Overview	4

SCOPE

Type of Manual

Maintenance 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; remotely located, usually inside the vehicle.

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

MAINTENANCE FORMS, RECORDS, AND REPORTING

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 Electronic), and mail documentation to Commander, Tank-automotive & Armament Command-Rock Island, ATTN: AMSTA-LC-CIPWT, 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.

For additional information e-mail CROWS@mmcs.army.mil or phone (commercial) 732-532-2607, ext 6221/6242.

Corrosion Prevention and Control (CPC)

Corrosion prevention and control 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.

For additional information on CPC, refer to WP 0008.

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 SF Form 368 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.

DESTRUCTION OF MATERIEL 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 Electronic Material to Prevent Enemy Use.

Should the CROWS be in danger of being overrun, remove or cut the joystick cable and remove or cut the EMU cable.

PREPARATION FOR STORAGE OR SHIPMENT

For detailed instructions on preparation of the CROWS components/assemblies for storage, shipment, and handling, refer to WP 0059.

LIST OF ABBREVIATIONS

For lists of general abbreviations and terms, on-screen abbreviations and definitions, and symbols and units of measure, refer to WP 0064, Glossary.

QUALITY OF MATERIAL

Material used in for replacement, repair, or modification must meet the requirements of this manual or ETM. If quality of material requirements are not stated in this manual or ETM, the material must meet the requirements of the drawings, standards, specifications, or approved engineering change proposals applicable to the subject equipment.

SAFETY, CARE, AND HANDLING

The following general precautions and safety regulations shall be included as part of this program.

Electrostatic Discharge (ESD)

For compliance with ESD control standards for the protection of electronic parts, assemblies, and equipment refer to WP 0010 of this manual.

APPLICABLE DOCUMENTS

NOTE

Refer to WP 0053, 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 9-1005-213-23&P, M2 HB .50-Cal Machine Gun Maintenance Manual
- TM 9-1010-230-10, Mk19 Grenade Machine Gun Operator's Manual
- TM 9-1010-230-23&P, Mk19 Grenade Machine Gun Maintenance Manual
- TM 9-1005-313-10, M240 7.62-mm Machine Gun Operator's Manual
- TM 9-1005-313-23&P, M240 7.62-mm Machine Gun Maintenance Manual
- TM 9-1005-201-10, M249 5.56-mm Machine Gun Operator's Manual
- TM 9-1005-201-23&P, M249 5.56-mm Machine Gun Maintenance 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 M240 7.62-mm machine gun, and the M249 5.56-mm machine gun, as shown in Figures 1 thru 4.



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



Figure 2. CROWS Configuration with Mk19 Grenade Machine Gun



Figure 3. CROWS Configuration with M240 7.62-MM Machine Gun (Not fielded at time of print)



Figure 4. CROWS Configuration with M249 5.56-MM Machine Gun

(Not fielded at time of print)

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101'

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

EQUIPMENT DESCRIPTION AND DATA

This work package contains detailed equipment descriptions and data for 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
Cradles and Adapter Kits	6
Ammo Can	9
Sensor Group	10
Control Group	11
Equipment Data	13
Controls and Indicators	15
Menu System	15

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 or from the Command and Control Center. System components include:

- A two-axis stabilized CROWS mount with azimuth, elevation, and sight drives
- Weapon interface, consisting of a variety of cradles and adapter kits that support a range of weapons and ammunition
- An ammunition can that is 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; 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 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	. Stabilized Weapon Mount Assembly	CROWS Mount, Weapon Mount, Mount, or SWM
21677-1000	. . Pedestal Assembly	Pedestal
21677-0505	. . Ammunition Hanger Assembly	Ammo Hanger
21677-2000	. . Yoke Arm Assembly – Elevation	Elevation Yoke Arm
21677-2500	. . Yoke Arm Assembly – Ammo	Ammo Yoke Arm
21677-3700	. . Cable Assembly, Electrical – Weapon Elevation	Weapon Elevation Cable
21677-2600	. Cradle Assembly – Heavy	Cradle
21677-2614	. . Pin, Forward – M2/Mk19	Forward Pin
21677-3100	. M2 HB Weapon Adapter Kit	M2 or M2 HB Adapter Kit, WAK
21677-3702	. . Cable Assembly, Electrical – M2	M2 Weapon to Mount Cable
21677-3200	. Mk19 Weapon Adapter Kit	Mk19 Adapter Kit, WAK
21677-3703	. . Cable Assembly, Electrical – Mk19	Mk19 Weapon to Mount Cable
21677-3400	. M240/M249 Adapter Kit	M240/M249 Adapter Kit, WAK
21677-3505	. . Cable Assembly, Electrical – M240/M249	M240/M249 Weapon to 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 to Sensor Unit	Mount to Sensor Cable
21677-5500	. Control Group	Control Group
ASY05820	. . Electronic Module Unit	EMU
ASY05821	. . Switch Panel Unit	SPU
ASY05822	. . Interface Control Unit	ICU
ASY05823	. . Hand Control	Joystick
ASY05843	. . Display Unit	Display
21677-3713	. . Cable Assembly, Electrical – Power	Vehicle Power Cable
21677-3714	. . Cable Assembly, Electrical – ICU to SPU	ICU-SPU Cable
21677-3715	. . Cable Assembly, Electrical – ICU to Display	ICU-Display Cable

Table 1. CROWS Components and Nomenclature – Cont.

ROI Part Number	Nomenclature	Common Name
21677-3716	. . Cable Assembly, Electrical – ICU to EMU	ICU-EMU Cable
21677-3720	. . Cable Assembly, Electrical – Hatch Interlock	Hatch Interlock Cable
21677-3730	. . Cable Assembly, Electrical – Gimbal to Bulkhead	Gimbal-Bulkhead Cable
21677-3731	. . Cable Assembly, Electrical – Bulkhead to ICU	Bulkhead-ICU Cable
21677-0600	. Ballistic Protection Kit	Ballistic Armor, Armor

CROWS, shown in Figure 1 (Views A thru D), supports a range of weapons including the M2 HB .50-cal machine gun, the Mk19 40-mm grenade machine gun, the M240 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 Grenade Machine Gun

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



View C, CROWS with M240 7.62-MM Machine Gun

(Not fielded at time of print)



View D, CROWS with M249 5.56-MM Machine Gun

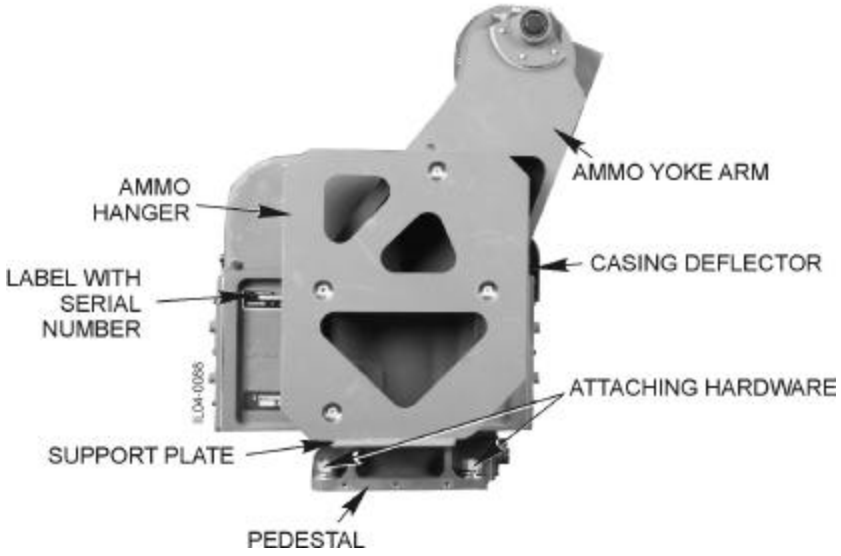
(Not fielded at time of print)

Figure 1. Common Remotely Operated Weapon Station (CROWS) Configurations – Cont.

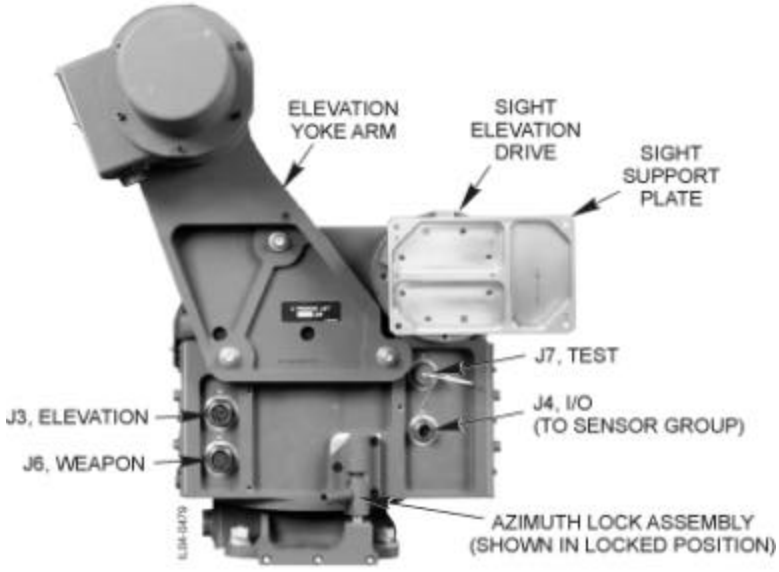
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

CROWS Weapon Mount

The 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 M240 machine gun, and the M249 machine gun.



Ammo Yoke Arm Side



Elevation Yoke Arm Side

Figure 2. CROWS Mount

Cradles and Adapter Kits

The CROWS cradles provide a platform for a variety of weapons and, together with specific adapter kits for each weapon, allow each weapon to be positioned and operated remotely. Figure 3 shows the M2/Mk19 cradle.

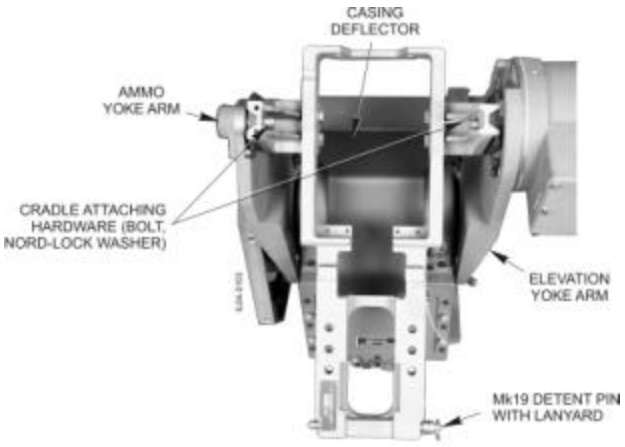


Figure 3. Cradle Assembly for M2 and Mk19

Figure 4 shows the M2 HB .50-cal machine gun and adapter kit configuration.

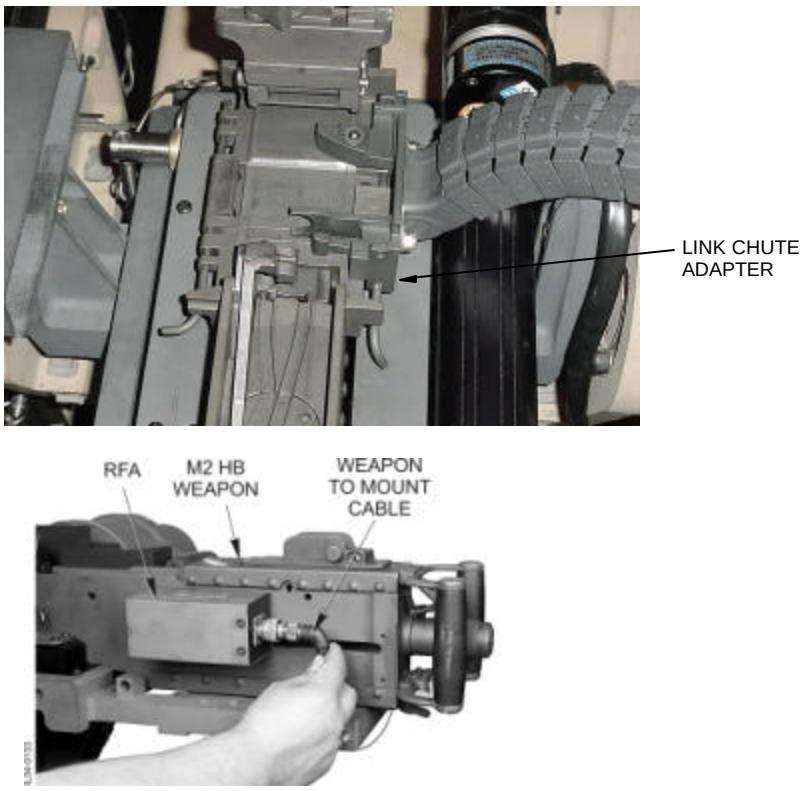


Figure 4. M2 and Adapter Kit (Top View and Left-Hand, Rear View)

Figure 5 shows the Mk19 grenade machine gun and adapter kit configuration.

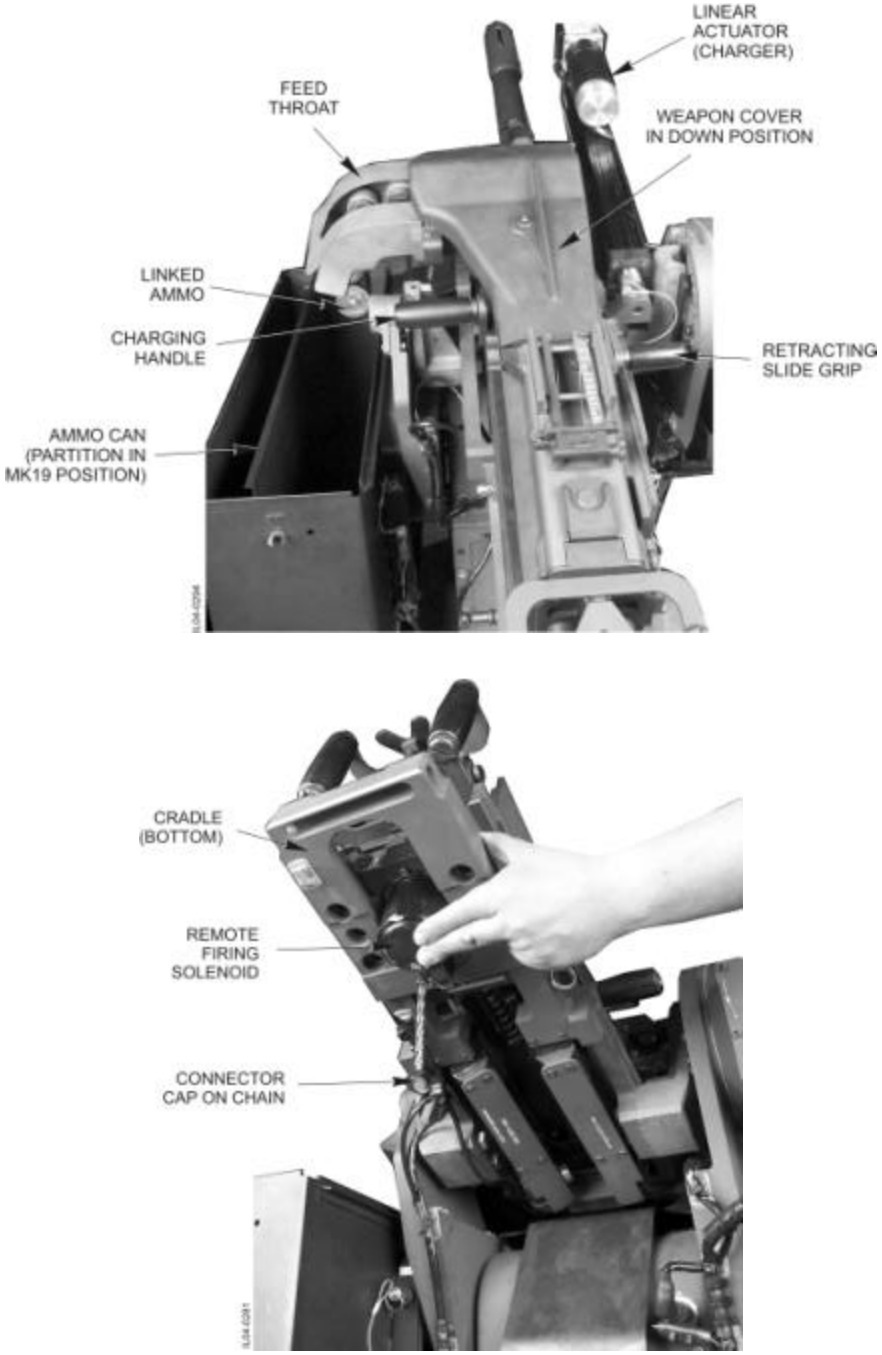


Figure 5. Mk19 and Adapter Kit Mounted on the CROWS Cradle (Top View and Bottom View)

The M240/M249 adapter kit, Figures 7 and 8, is supported by the M240/M249 cradle, Figure 6, which allows both weapons to be installed on the CROWS mount for remote operation and positioning.

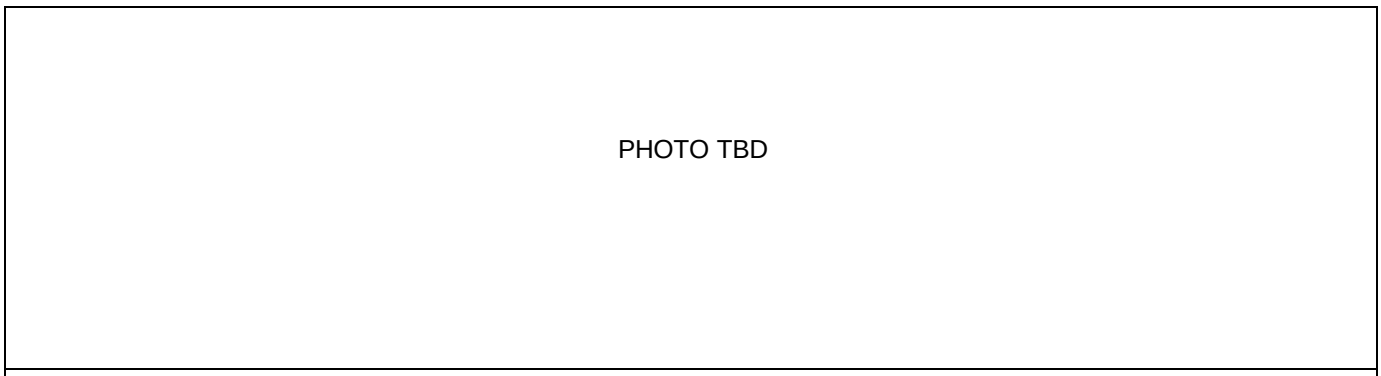


Figure 6. Cradle for M240/M249 Weapon Adapter Kit

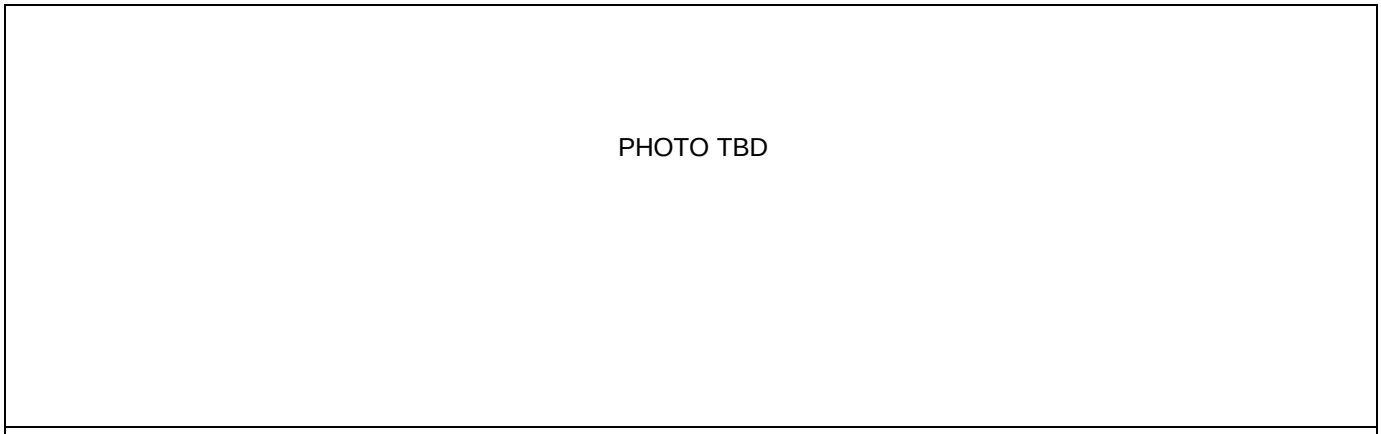


Figure 7. M240 on M240/M249 Cradle (Part of the Weapon Adapter Kit)

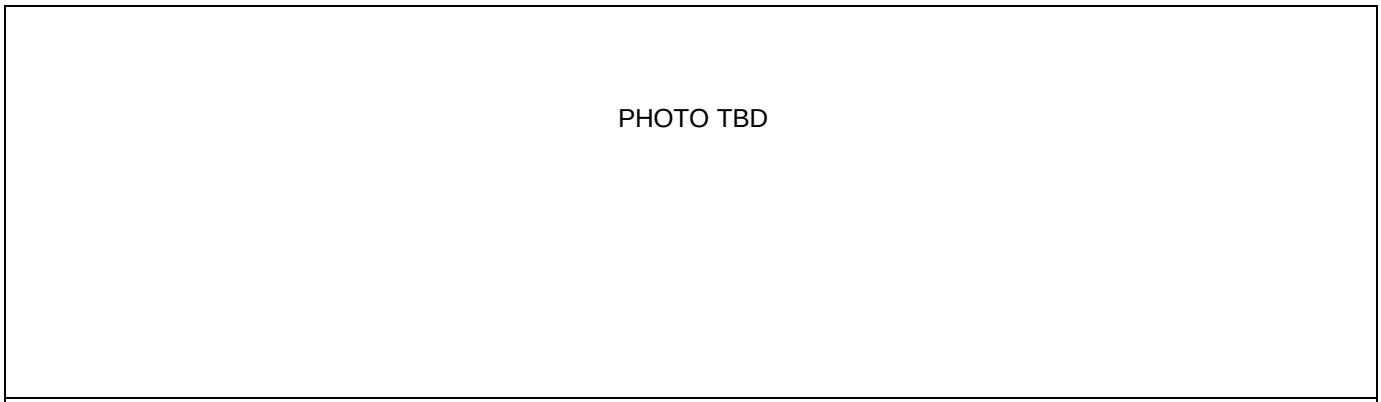
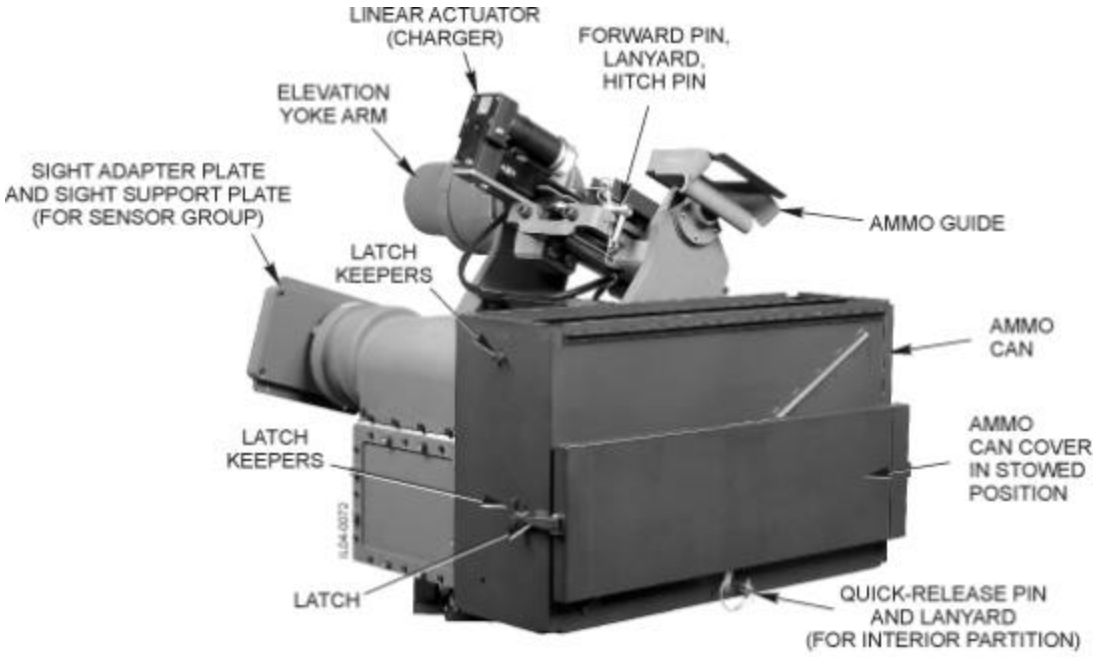


Figure 8. M249 on M240/M249 Adapter Kit (Part of the Weapon Adapter Kit)

Ammo Can

The ammo can, shown in Figure 9, 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 9. Ammo Can

Sensor Group

The Sensor Group consists of a sensor unit (SU), shown in Figure 10, a mount to sensor cable (see WP 0020, Figure 17), sunshade, sight support plate, and sight adapter plate (see WP 0020, Figure 5).

The sensor 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



Front View **Rear View**

Figure 10. 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 sensor unit 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.

Control Group

The Control Group is the gunner interface and consists of a display unit, 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 11 shows the Control Group components (considered as 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). For further information, refer to the VIK work package (WP 0060).

The Control Group provides full remote control of the weapon system via on-screen menus presented on the display 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 display unit projects camera images and overlay data from the ballistics computer. The 12.1-inch flat-panel diagonal display, built into a ruggedized enclosure, has a resolution of 800 x 600 lines, with embedded brightness and contrast controls. The display provides the operator with access to an array of controls, including display power and specific user interface switches to control the sensor unit and CROWS functions.
- **Interface Control Unit.** The ICU provides the electronic interface to the display, 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 FPD 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 weapon 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.



Figure 11. 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	686 mm (27 inches)
Width	711 mm (28 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 M240 Configuration	175.6 kg (387.25 lb) (No ammunition, no armor)
Total with M249 Configuration	180.0 kg (396.95 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 M240 = 192 rounds (design change pending) M249 = 225 rounds (design change pending)

Table 2. Key CROWS Specifications

Subject	Specification
Sensor Group	
Overall Dimensions:	
Length	356 mm (14 inches)
Width	235 mm (9 inches)
Height	182 mm (7 inches)
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) (±0.5°)	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:	
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
Joystick (Control Grip):	Non-displacement force
Command Qualifier/Output Enable	Yes

CONTROLS AND INDICATORS

For detailed information about the CROWS control mechanisms and indicator systems, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0015.

MENU SYSTEM

For detailed information about the CROWS menu system and display screens, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0017.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

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
Theory of Operation	1
Surveillance	1
Target Acquisition	1
Target Engagement	1
System Interface	1
Weapon Firing	2
Weapon Charging	2
Target Reference Points	2
Sector Scan	2
No-Fire Zones	2
Overview of System Operation	2
Fire-Control Solution	2
Set-Up	2
Target Acquisition	2
Laser Alignment for Target Engagement	2

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.

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 weapon 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 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 first installed, the operator uses the menu system to boresight the CROWS and to select the type of weapon and 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 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 using the LASE 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. Using the control grip, the operator selects the ENTER switch to accept the ballistic solution. The system autolays the ballistic aimpoint to the position of the laser aimpoint and elevates the weapon for the correct ballistic solution.

END OF WORK PACKAGE

CHAPTER 2

GENERAL MAINTENANCE INSTRUCTIONS

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

CLEANING PROCEDURES

This work package contains instructions on cleaning CROWS components/assemblies.

WP CONTENTS

Section/Subsection	Page
Initial Set Up	1
General Cleaning Instructions	2
Painted and Metallic Surfaces	2
Rubber Materials	2
Connectors	2
Linear Actuator (Charger) Rod	2
Optics	5
Display Unit	6
CROWS Cover	7

INITIAL SET UP

Refer to Table 1 for tools, special tools, personnel required, materials, and references needed to clean CROWS components and assemblies.

NOTE

For lists of tools, materials, and procedures to clean CROWS components/assemblies, refer to WP 0056, Expendable and Durable Materials, and WP 0055, Maintenance Allocation Chart, in this Maintenance Manual. Refer also to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0004, Preventive Maintenance Introduction; WP 0005, Preventive Maintenance Checks and Services; and WP 0027, COEI and BII.

Should any malfunctions occur, refer to WP 0012 and WP 0031, Unit Maintenance Troubleshooting and Direct Support Maintenance Troubleshooting, respectively.

Table 1. Initial Setup Information

Category	Item	Additional Information
Tools	N/A	
Special Tools	N/A	
Personnel Required	One	

Table 1. Initial Setup Information

Category	Item	Additional Information
Tools	N/A	
Materials/Parts	Alcohol, ethyl	WP 0056, Table 1, Item 2
	Alcohol, isopropyl	WP 0056, Table 1, Item 3
	Brush, artist's	WP 0056, Table 1, Item 5
	Cleaning compound, lens	WP 0056, Table 1, Item 7
	Cotton, balls	WP 0056, Table 1, Item 17
	Detergent	WP 0056, Table 1, Item 19
	Dust remover, compressed air	WP 0056, Table 1, Item 21
	Gloves, plastic/latex	WP 0056, Table 1, Item 22
	Goggles, industrial	WP 0056, Table 1, Item 24
	Grease, lubricant	WP 0056, Table 1, Item 26
	Paper tissue, lens	WP 0056, Table 1, Item 27
	Water, distilled	WP 0056, Table 1, Item 31
REFERENCES	TM 9-1090-218-10	CROWS Operator's Manual
	MIL-C-43454C	Cleaning Compound, Optical Lens

GENERAL CLEANING INSTRUCTIONS

WARNING

Follow all safety warnings and cautions. Use appropriate eye protection when cleaning the system or its parts. Wear latex gloves (or similar material) while using solvents to prevent an allergic reaction and fingerprint marks on surfaces.

Use only authorized materials during cleaning procedures.

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

NOTE

For weapon-cleaning procedures, refer to specific operation and maintenance manuals, as listed in WP 0053.

Should damage be discovered during cleaning operations, refer to WP 0008 for corrosion prevention and control (CPC) procedures.

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 nonmetallic brush.

2. Remove dust and foreign matter from inaccessible areas with a low-pressure (3 to 5 PSI) compressed air or nonmetallic 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 or equipment damage.

3. Remove contamination with a clean, lint-free cloth or lint-free cotton swab moistened, not saturated, with ethyl alcohol.

Rubber Materials

1. Clean rubber parts with a lint-free cloth moistened, not saturated, with clean water.

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 or equipment damage.

2. Clean connector shell and threads with a clean, lint-free cloth moistened, not saturated, with ethyl alcohol.

Linear Actuator (Charger) Rod

Clean the actuator rod (part of the weapon adapter kits [WAK]) as follows:

1. With the linear actuator (charger) in place and the system on, place the CHARGER switch on the SPU to the SAFE position. This action will extend the actuator rod, as shown in Figure 1.

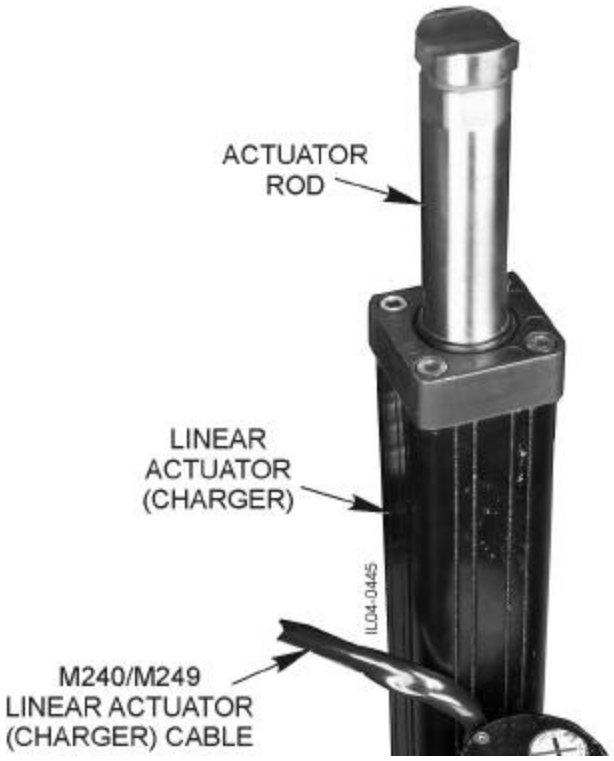


Figure 1. Sample Actuator Rod from M240/M249 WAK

2. Clean the rod by wiping it free of dirt, debris, or other foreign matter with a clean, lint-free cloth.

3. With the linear actuator (charger) in place and the system on, place the CHARGER switch on the SPU to the CHARGED position. This action will retract the actuator rod.

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 (camel's hair or sable hair).

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 through d as needed until the surface is completely dry and free of streaks.

Display Unit

Perform the following procedures to clean the display unit.

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 or equipment damage.

CAUTION

Abrasive cleaners should not be used to clean the screen. Avoid using chemical cleaning agents that might damage the plastics used in the display. 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.

CROWS Cover

NOTE

For additional information on the cover, refer to WP 0052, Auxiliary Equipment Information.

For additional information on corrosion prevention and control (CPC), refer to WP 0008.

When used properly the cover will absorb moisture, thus protecting critical objects from corrosion. Care of this cover is important to ensure long-term durability and effectiveness.

CAUTION

Because the material (i.e., black mesh) used on the interior of the CROWS cover has special desiccant-like properties, DO NOT EXPOSE the interior to water including but not limited to spray, immersion, or weather-related conditions. Exposure of the interior to water will alter the material, reducing or eliminating its ability to absorb moisture.

Use only authorized materials to clean the cover, as detailed in the following procedures. Use only isopropyl alcohol to clean the interior material.

Do not wash the interior layer with water or dry in a conventional dryer. Let the interior and exterior layers of the cover dry by evaporation only.

Store the cover in a protected dry area, ensuring that the interior material is protected from direct contact with rain or other sources of water.

Failure to follow these instructions may result in equipment damage.

Perform the following procedure to clean the interior of the cover (black mesh layer).

1. If needed, remove the cover from the vehicle.
2. Access the stain, turning the entire cover inside out, if needed.

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 or equipment damage.

3. Apply isopropyl alcohol to a cotton swab/ball or a clean, lint-free cloth, then rub it on the stain until the stain is removed.
4. Allow the cover to dry thoroughly by evaporation.

Perform the following procedure to clean the exterior of the cover.

1. If needed, remove the cover from the vehicle.

2. Prepare a solution of 1 part detergent and to 10 parts clean water, then apply it to the stain and rub until the stain is removed.

3. Rinse the area until it is free of detergent.

4. Allow the cover to dry thoroughly by evaporation.

Perform the following procedure to store the cover.

1. Once both the interior and exterior of the cover is completely dry, fold the cover so that the interior material cannot be seen.

2. Store the cover in a protected dry area, keeping it away from direct contact with rain or other sources of water.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

LUBRICATION PROCEDURES

This work package contains lubrication maintenance procedures performed on the CROWS.

WP CONTENTS

Section/Subsection	Page
Initial Set Up	1
Lubrication Overview	2
General Lubrication Procedures	2
Attenuator Shaft Procedures	3
Pin Procedures	4
Azimuth Lock Assembly (Stud and Spring) Procedures	5
Sear Assembly (Part of the M2 WAK) Procedures	6

INITIAL SET UP

Refer to Table 1 for tools, special tools, personnel required, materials, and references needed for CROWS lubrication procedures.

NOTE

Should any malfunction occur, refer to WP 0012 and WP 0031, Unit and Direct Support Maintenance Troubleshooting Procedures, respectively.

Table 1. Initial Setup Information

Category	Item	Additional Information
Tools	Operator's Tool Kit	
Special Tools	N/A	
Personnel Required	One	
Materials/Parts	Alcohol, isopropyl	WP 0056, Table 1, Item 3
	Cloth, cleaning, lint-free	WP 0056, Table 1, Item 8
	Goggles, industrial	WP 0056, Table 1, Item 24
	Grease, lubricant	WP 0056, Table 1, Item 26
References	N/A	

LUBRICATION OVERVIEW

Selected components need to be lubricated on a quarterly basis or when the mount is reconfigured with a new weapon. Components include:

- All detent, retaining, or holding pins in the cradle assembly, ammo can, and weapon adapter kits
- Azimuth lock assembly (stud and spring)
- Sear assembly (part of M2 weapon adapter kit)

NOTE

For a list of expendable or durable materials needed for this procedure, refer to WP 0056.

For specific cleaning procedures, refer to WP 0004.

For lubrication procedures related to specific weapons, refer to the operation and maintenance manuals listed in WP 0053, 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.

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.

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.

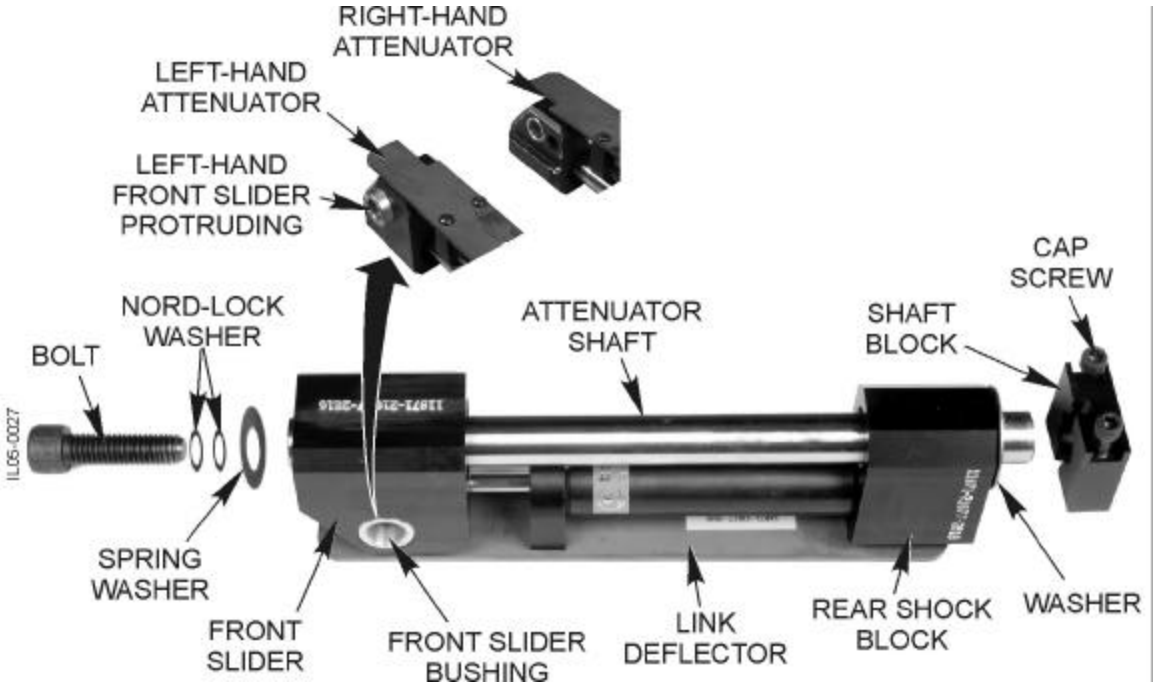


Figure 1. Right-Hand Attenuator Assembly with Attaching Hardware Also Shown is how the Left-Hand Attenuator Differs from the Right-Hand Attenuator

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.

Pin Procedures

Perform the following procedures to lubricate all detent, retaining, quick-release, or holding pins in the cradle assembly, ammo can, and weapon adapter kits. Samples of some of the pins are shown in Figure 2.

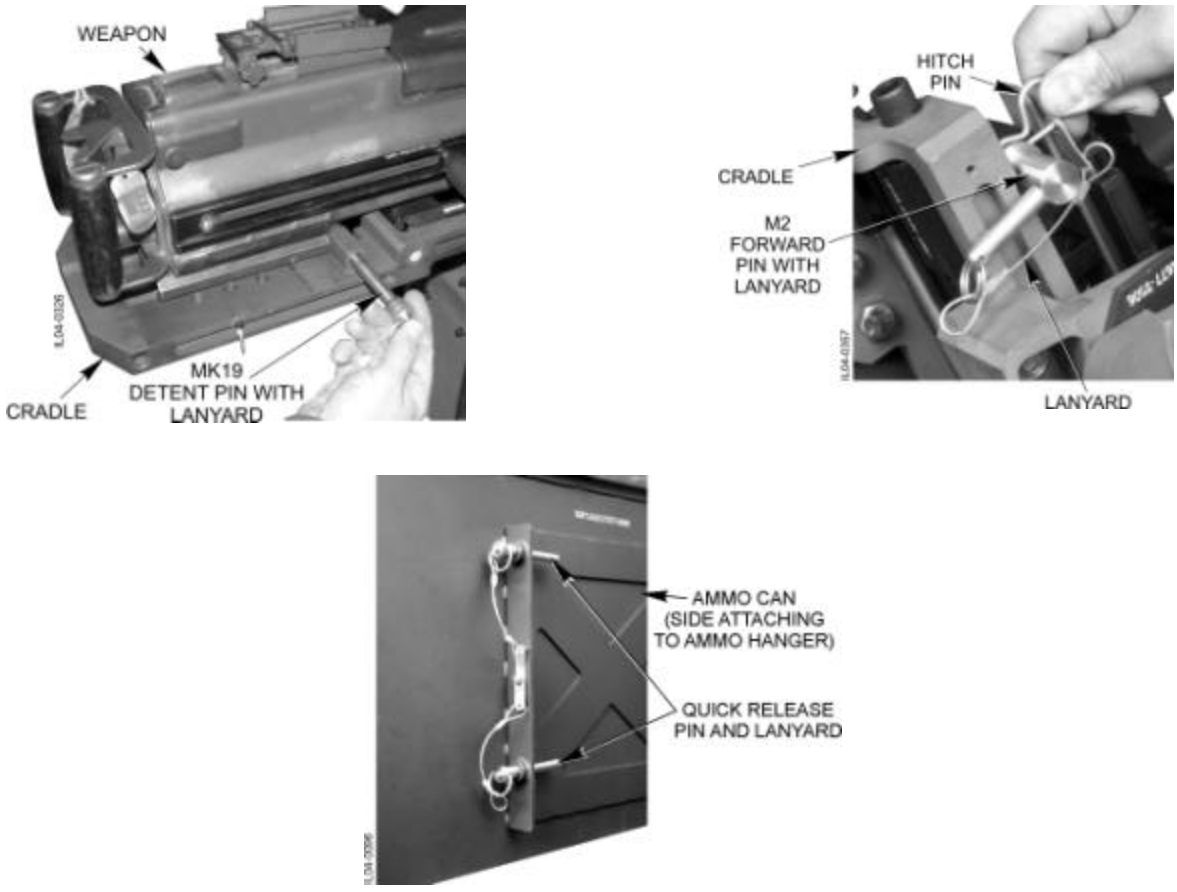


Figure 2. Examples of Pins and Locations

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.

Azimuth Lock Assembly (Stud and Spring) Procedures

Perform the following procedures to lubricate the azimuth lock assembly's stud and spring, as shown in Figure 3.

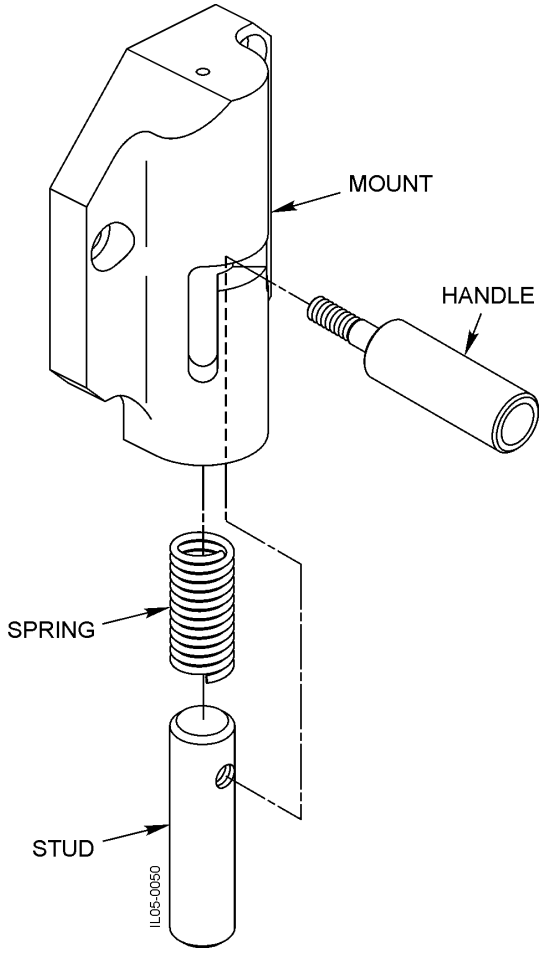


Figure 3. Azimuth Lock Assembly

NOTE

For instructions on disassembly/reassembly of the azimuth lock assembly, refer to WP 0017.

1. Clean the stud and spring with isopropyl alcohol, and allow to dry.
2. Apply a thin film of lubricant, thoroughly coating the stud and spring.
3. Wipe any excess lubricant off of the stud and spring with a clean, lint-free cloth.

Sear Assembly (Part of the M2 WAK) Procedures

CAUTION

Do not lubricate any part of the linear actuator (charger) or the rod end (part of the M2 WAK). Failure to follow these instructions may result in equipment damage.

Perform the following procedures to lubricate all moving parts in the sear assembly, as shown in Figure 4. These parts include the breech bolt lever, internal rods, and the spring.

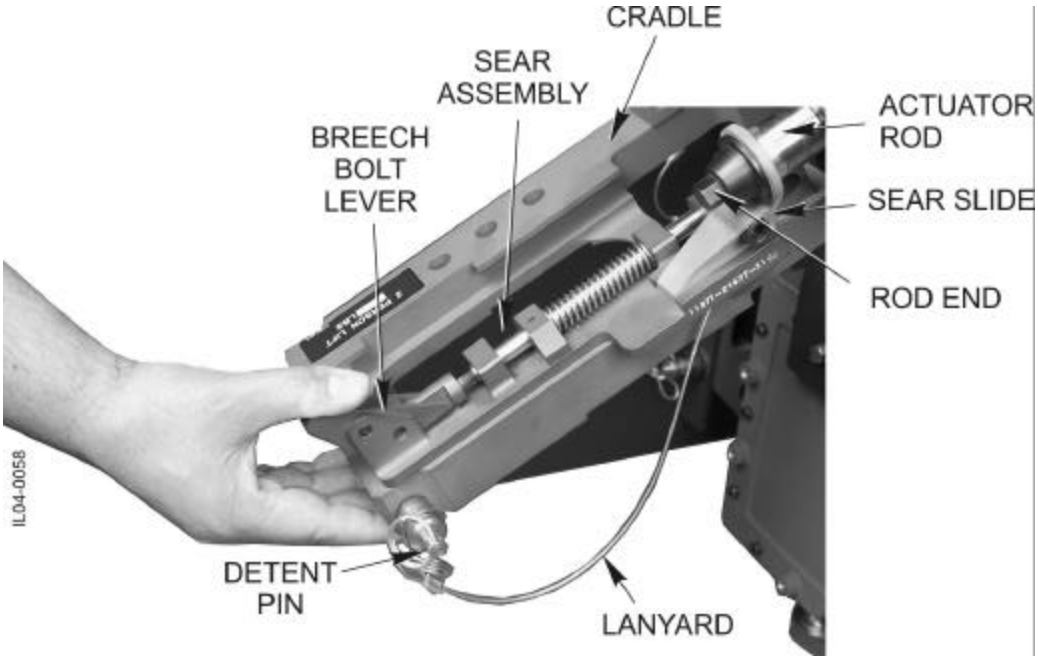


Figure 4. Sear Assembly Rods, Springs, and Breech Bolt Mechanism

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 items with isopropyl alcohol and allow to dry.
2. Apply a thin film of lubricant, thoroughly coating the parts.
3. Wipe any excess lubricant from the parts with a clean, lint-free cloth.
4. Return the parts to their normal positions.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

SAFETY-WIRE PROCEDURES

This work package contains the items used to perform maintenance-level safety-wire procedures.

WP CONTENTS

Section/Subsection	Page
Initial Set Up	1
General Requirements	2
Wire Size	2
Wire-Twisting Practices and Criteria	2
Finishing Off with a Pigtail	4
Special Methods or Considerations	4
Method for Multiple Fasteners, Closely Spaced	4
Single-Wire Method	5
Examples of Safety Wiring CROWS Components/Parts	5
Safety Wire Locations	8

INITIAL SET UP

Refer to Table 1 for tools, special tools, personnel required, materials, and references needed to perform safety-wire procedures.

NOTE

Should any malfunction occur, refer to WP 0012 and WP 0031, Unit and Direct Support Troubleshooting Procedures.

Table 1. Initial Setup Information

Category	Item	Additional Information
Tools	Operator's Tool Kit or	Pliers, Wire-twisting
	45G Shop Set	
Special Tools	N/A	
Personnel Required	One	
Materials/Parts	Goggles, industrial	WP 0056, Table 1, Item 24
	Safety Wire, 0.020 inch	WP 0056, Table 1, Item 32

Table 1. Initial Setup Information – Cont.

Category	Item	Additional Information
References	NASM 33540, Safety Wiring and Cotter Pinning	Military Standard covering general practices for safety wiring
	TM 9-1090-218-10	CROWS Operator's Manual

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

The 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 lock-wiring unless otherwise specified, as shown in Figures 1 and 2.

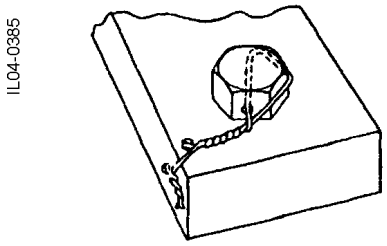


Figure 1. Single Fastener Application Using the Double-Twist Method.

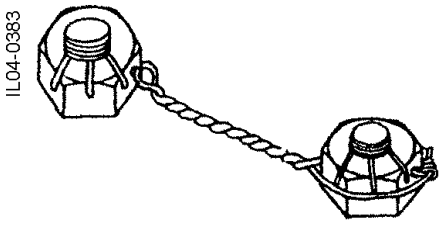


Figure 2. Castellated Nut on Undrilled Studs Using the Double-Twist Method

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.

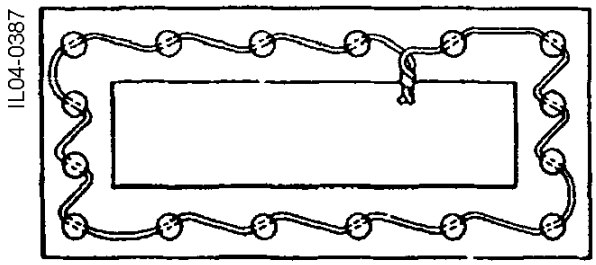


Figure 3. Small Screws in a Closely Spaced, Closed, Pattern with Pigtail Bent In

SPECIAL METHODS OR CONSIDERATIONS

Method 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, using the standard practice of wrapping the safety wire through and around each multiple-hole fastener.

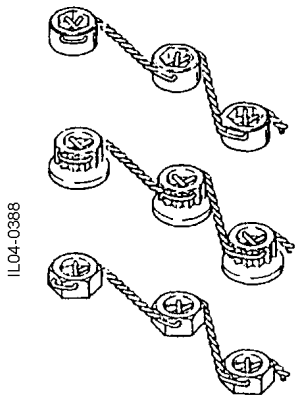


Figure 4. Standard Double-Twist Method – Multiple Holes

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 that secure the M2 linear actuator (charger) assembly to the cradle. (For information on this procedure, refer to CROWS Operator's Manual, TM 9-1090-218-10, WP 0009.)

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.

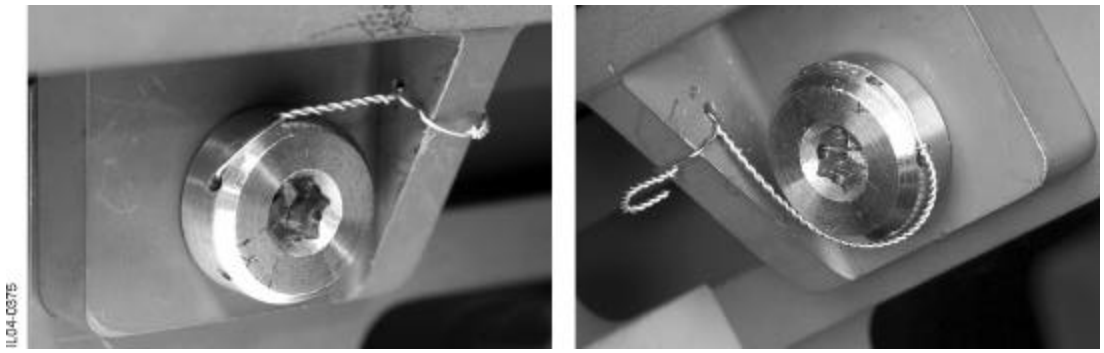


Figure 6. Bolts Safety-Wired at Both Ends of the M2 Linear Actuator (Charger) Mounting Plate

Figure 7 shows safety wiring of the screws on top of the solenoid in the remote firing assembly, using wire-twisting pliers. (Refer to CROWS Operator's Manual, TM 9-1090-218-10, WP 0009.)

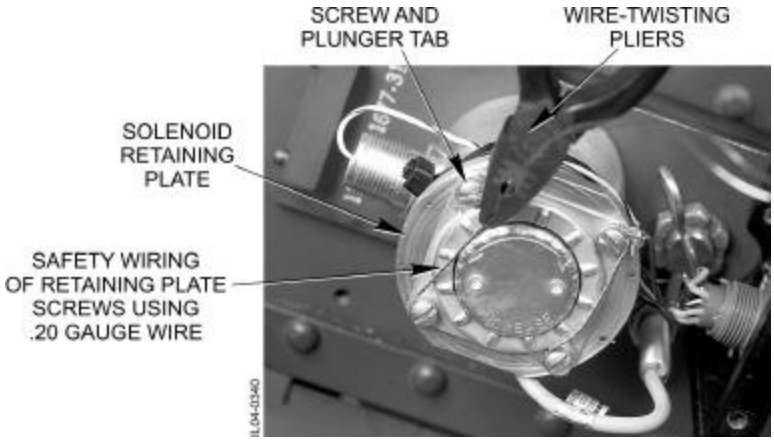


Figure 7. Screws on RFA Solenoid Being Safety-Wired

Figure 8 shows safety wire securing the sensor unit's temperature pressure sensor assembly to a fillister screw.

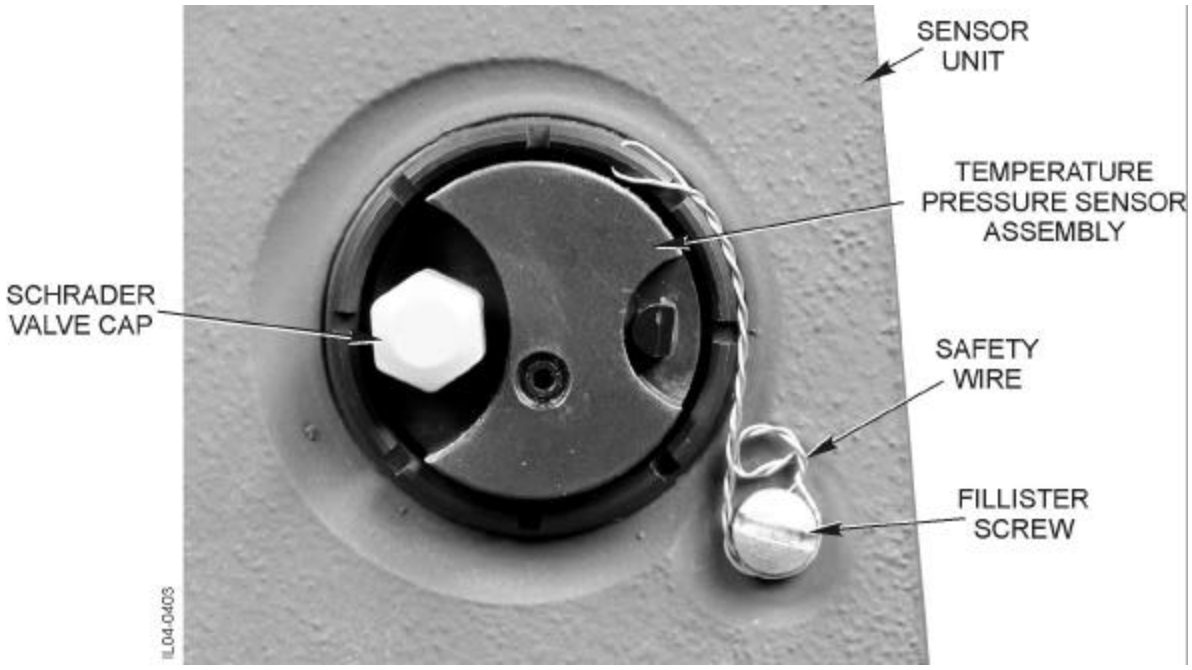


Figure 8. Temperature Pressure Sensor Safety Wired to Fillister Screw

Figure 9 shows the sensor unit connectors secured with safety wire.

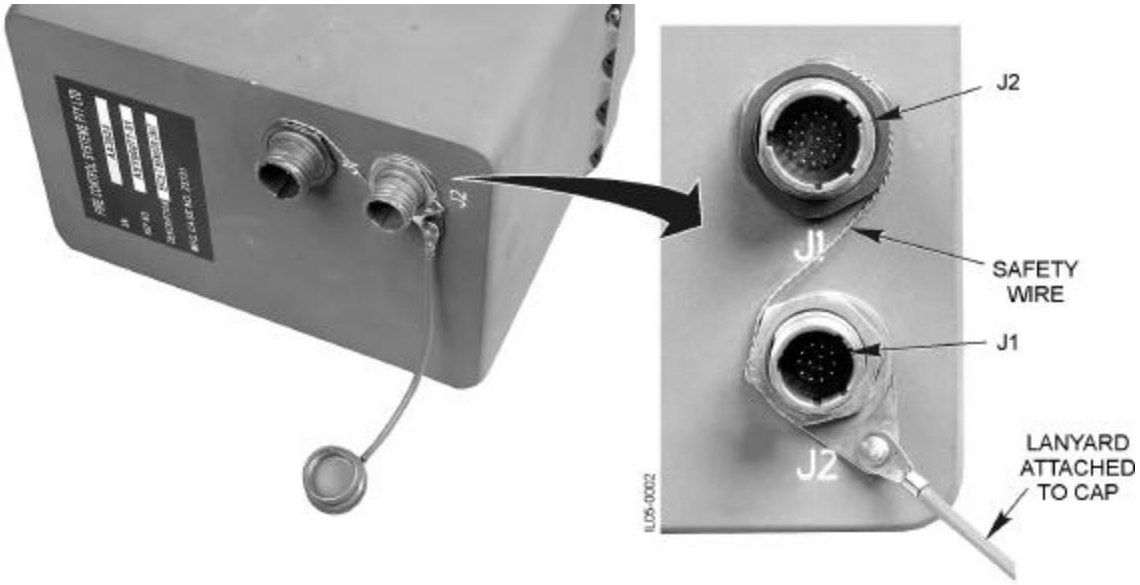


Figure 9. Sensor Unit Connectors

Figure 10 shows the screws in the mounting plate of the linear actuator (charger) secured with safety wire.

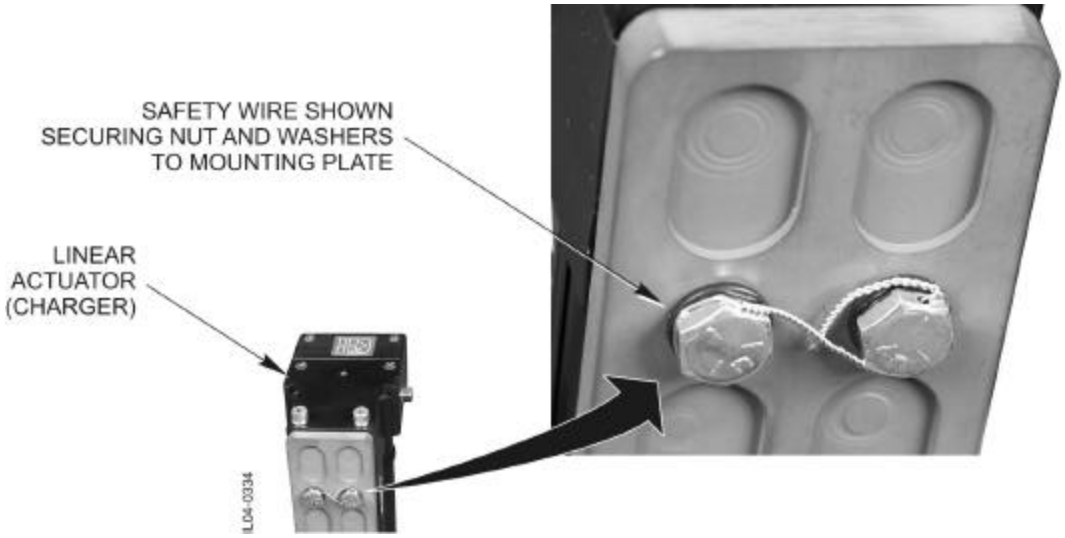


Figure 10. Safety-Wire Location on the Linear Actuator (Charger) Mounting Plate

Figure 11 shows two of the four safety-wire locations, securing the backplane bus assembly (BBA) to the sensor electronics module assembly (SEMA) standoffs in the EMU (DS only).

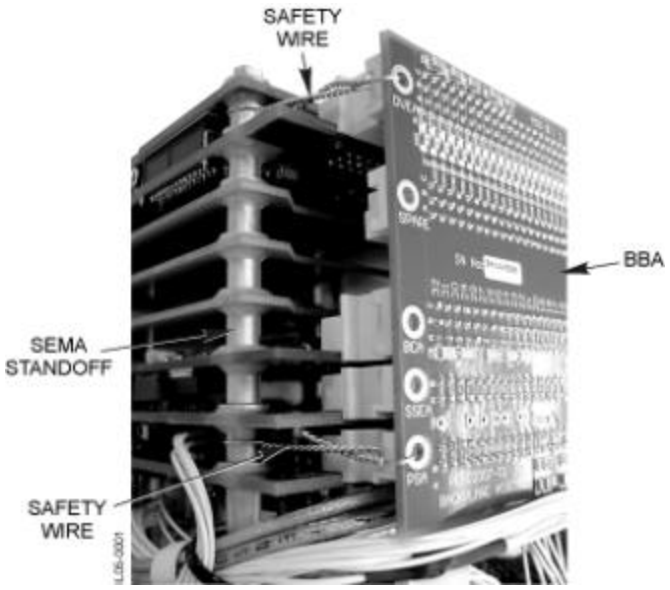


Figure 11. SEMA Standoffs Safety-Wired to BBA

SAFETY WIRE LOCATIONS

Table 2 lists the locations where safety wiring is required.

Table 2. Safety-Wire Locations

Component	Location
Pedestal	J1 to J2; J4 to J7; J3 to J6; J1 to a screw (elevation drive assembly; and J5 to a screw (sight elevation drive assembly)
M2 WAK	Screws securing linear actuator (charger) mounting plate; and bolts securing linear actuator (charger) to cradle
Mk19 WAK	Screws securing linear actuator (charger) mounting plate
M240/M249 WAK	TBD
Sensor Unit	J1 to J2; and temperature pressure sensor to fillister head screw
ICU	J2 to J5; J4 to J1; J3 to J6; and J7 to J8
SPU	J1 to J2
EMU	J1 to J2 to J3; and BBA to SEMA standoffs
Display Unit	J1 to J2

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

THREAD-LOCKING PROCEDURES

This work package contains the items and information to perform thread-locking procedures.

WP CONTENTS

Section/Subsection	Page
Initial Set-Up	1
Thread-Locking Overview	2
Removal of Thread Locked Parts	2
Thread-Locking Procedures	3
Thread-Locking Screws	3
Thread-Locking Retainers	3
Thread-Locking Azimuth Lock Handle	4

INITIAL SET-UP

Refer to Table 1 for tools, materials, and references needed to perform thread-locking procedures.

NOTE

Should any malfunction occur, refer to WP 0012 and WP 0031, Unit and Direct Support Maintenance Troubleshooting Procedures, respectively.

Table 1. Initial Setup Information

Category	Item	Additional Information
Tools	N/A	
Special Tools	N/A	
Personnel Required	One	
Materials/Parts	Acetone	WP 0056, Table 1, Item 1
	Compound, thread-locking	WP 0056, Table 1, Item 16
	Goggles, industrial	WP 0056, Table 1, Item 24
References	N/A	

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.

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. Wear eye protection. 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. Record the location(s) of attaching hardware that has thread-locking compound applied for reference during reassembly.
2. Apply acetone to the threads to remove thread-locking compound.
3. Check to see if parts have loosened.
4. If needed, repeat step 2 until the part is loosened and able to be removed.

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 a 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.

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.

Thread-Locking Azimuth Lock Handle

Perform the following procedures to thread lock the azimuth lock handle to the stud, as shown in Figure 1.

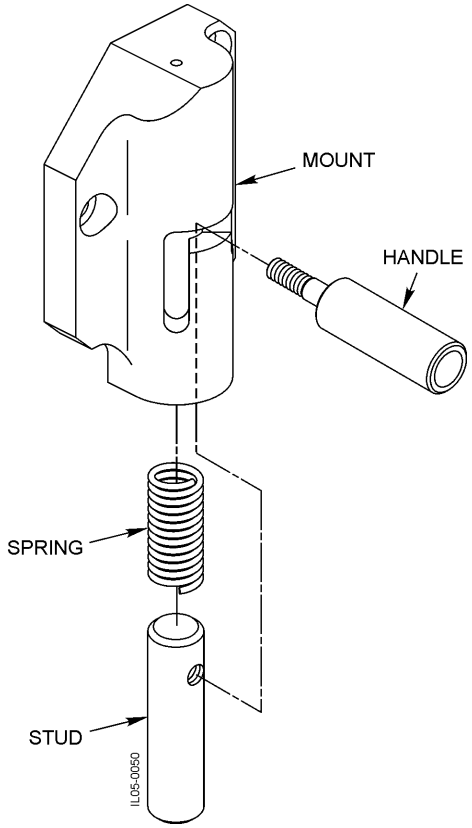


Figure 1. Azimuth Lock Assembly

NOTE

For instructions on disassembly/reassembly of the azimuth lock assembly, refer to WP 0017.

1. Apply thread-lock compound to the threads of the handle.
2. Insert the handle into the stud and tighten.
3. Wipe off any excess compound.
4. Ensure the azimuth lock handle can be moved easily into the locked and unlocked positions.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

CORROSION PREVENTION AND CONTROL (CPC) INSTRUCTIONS

This work package discusses maintenance-level procedures for corrosion prevention and control (CPC).

WP CONTENTS

Section/Subsection	Page
Initial Set Up	1
Corrosion Prevention and Control Overview	2
Reporting Corrosion Issues	2
Corrective Action Procedures	2
Chemical Agent Resistant Coating (CARC)	3
Purpose	3
General	3
Controls	3

INITIAL SET UP

Refer to Table 1 for tools, special tools, personnel required, materials, and references needed to perform CPC procedures.

NOTE

Should any malfunction occur, refer to WP 0012 or WP 0031, Unit and Direct Support Maintenance Troubleshooting Procedures, respectively.

For applicable expendable or durable materials, refer to WP 0056.

Table 1. Initial Setup Information

Category	Item	Additional Information
Tools	DS Shop Set	WP 0055, Table 2, Item 6
Special Tools	N/A	
Personnel Required	One	
Materials/Parts	Brush, paint	WP 0056, Table 1, Item 6
	Coating, polyurethane	WP 0056, Table 1, Items 9 thru 14
	Compound, corrosion preventive	WP 0056, Table 1, Item 15
References	TB 43-0242	CARC Spot Painting
	TG No. 144	Guidelines for Controlling Health Hazards in Painting Operations

CORROSION PREVENTION AND CONTROL OVERVIEW

Corrosion prevention and control (CPC) of material are continuing concerns. 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.

Reporting Corrosion Issues

You should report any corrosion problems with CROWS and its assemblies/components so that the items can be fixed and improvements can be made to prevent future problems.

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 SF Form 368 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.

CORRECTIVE ACTION PROCEDURES

Use the following procedures to inspect and repair components, maintenance significant items (e.g., nuts, bolts, screws, and seals), tools/special tools, test equipment, and auxiliary equipment that may become corroded.

WARNING

Wear eye protection when performing corrosion-control procedures. Failure to do so may result in personal injury.

1. Perform physical inspection of susceptible items, identifying corrosion on replaceable parts by noting unusual cracking, softening, swelling, or breaking.

NOTE

For additional information about the azimuth lock, refer to WP 0013 Unit Maintenance Functional Testing and Troubleshooting.

2. If needed, ensure the azimuth lock is in the locked position.
3. Treat corroded item as indicated.
    a. Apply Chemical Agent Resistant Coating (CARC), referring to the Chemical Agent Resistant Coating section (following) of this work package.
    b. Apply corrosion prevention compound for waterproofing and corrosion prevention on small areas of dry film lubrication and tetrafluoroethylene-coated surfaces that have been damaged down to bare metal (i.e., scratches, scrapes, etc.).

CHEMICAL AGENT RESISTANT COATING (CARC)

Purpose

This section provides guidance for safe spot or touch-up painting using CARC paint.

General

WARNING

Solvents used in CARC and other paints are flammable. Never paint near open flames or where there are sparks, like welding or grinding. Never apply CARC to surfaces that will exceed 400°F (exhaust pipes, engine manifolds, etc.). Heating painted surfaces releases toxic gases, vapors, and metal fumes.

HDI, a component in CARC, is a potential sensitizer especially to asthmatics. Soldiers who are asthmatic should not apply CARC because a severe, life-threatening allergic reaction may occur.

Personnel must don goggles, NBC gloves, and a hat, and must cover their arms to prevent skin contact with CARC.

Read all appropriate Material Safety Data Sheets (MSDS) for each paint/solvent used.

Failure to follow these instructions may result in personal injury.

NOTE

Unit-level painting is limited to touch-up or spot painting using a brush or roller.

As stipulated in TB 43-0242, CARC Spot Painting, dated 1 January 1991, units are not allowed to completely repaint vehicles or spray paint any portion. Moreover, TG No. 144, Guidelines for Controlling Health Hazards in Painting Operations, states that touch-up painting is done to prevent corrosion, not for purely cosmetic reasons. If the paint is marred, but not deep enough to see bare metal, you do not need to paint. Units are only authorized to use single-component CARC paint.

WP 0056, Table 1, Items 9-15 contain NSNs for single component CARC. Make sure you read the MSDS for each paint/solvent used. If the existing paint requires surface preparation, manual "wet" sanding is the recommended method (old paint may contain lead or chromates). "Wet" sanding eliminates the need for respiratory protection.

Controls

Chemical overexposures do not occur when applying CARC outdoors using a brush or roller. ~~Respiratory protection is not required for outdoor brush or roller painting~~, but if Commanders desire respiratory protection, the individual protective mask may be used. This applies only for operations performed outdoors involving one quart of CARC per person, per day.

DOL Repair Activity Division accomplishes all other painting operations (i.e., using more than one quart per person per day, spray-painting, painting in areas with restricted airflow [e.g., inside/under vehicles]).

Treat any leftover paint as hazardous waste. Contact the post DPW Hazardous Waste (Compliance) Office for disposal instructions.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

DESICCANT REACTIVATION AND NITROGEN-PURGING PROCEDURES (DS ONLY)

This work package is not included at this time. All Direct Support (DS) and depot maintenance tasks are being handled by contractor support personnel.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

ELECTROSTATIC DISCHARGE (ESD) INSTRUCTIONS (DS ONLY)

This work package is not included at this time. All Direct Support (DS) and depot maintenance tasks are being handled by contractor support personnel.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

SOLDERING (DS ONLY)

This work package is not included at this time. All Direct Support (DS) and depot maintenance tasks are being handled by contractor support personnel.

END OF WORK PACKAGE

CHAPTER 3

UNIT TROUBLESHOOTING PROCEDURES

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT MAINTENANCE TROUBLESHOOTING PROCEDURES

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**

Initial Set Up 1

Troubleshooting Messages Overview 2

Troubleshooting Reference 2

INITIAL SET UP

Refer to Table 1 for tools, special tools, materials, and references needed for troubleshooting the CROWS system.

NOTE

For complete lists of items, procedures, and inspection points/processes needed to operate, maintain, and repair the CROWS, refer to CROWS Operator's Manual, TM 9-1090-218-10, WP 0004, Preventive Maintenance Introduction; WP 0005, Preventive Maintenance Checks and Services; WP 0027, COEI and BII; and WP 0029, Expendable/Durable Materials.

For lists of maintenance tasks/assignments, tools and test equipment, and special instructions for CROWS, refer to WP 0054, Introduction to MAC, and WP 0055, MAC.

Table 1. Initial Setup Information

Category	Item	Additional Information
Tools	Operator's Tool Kit	WP 0055, Table 2, Item 1
	GMTK	WP 0055, Table 2, Item 8
Special Tools	N/A	
Personnel Required	One	63B
Materials/Parts	N/A	
References	TM 9-1090-218-10	CROWS Operator's Manual

TROUBLESHOOTING MESSAGES OVERVIEW

This work package contains a detailed listing of the screen messages that can appear during CROWS operation. Most of the messages relate to system or component problems, but supplemental information is also included.

Once the cause of a failure has been determined, refer to WP 0013, Unit Maintenance Functional Testing and Troubleshooting, to diagnose and resolve performance issues.

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 direct support maintenance and return the item(s) to the maintenance facility for further troubleshooting and repair.

NOTE

For additional information about weapon manuals, refer to WP 0053.

For additional information about the Vehicle Integration Kit (VIK), refer to WP 0060.

To ensure cable connections are made as specified, refer to WP 0013 for the CROWS Interconnect Diagram (ICD) covering various weapon adapter kit configurations.

1. Ensure system is properly connected.

2. Perform a physical inspection of the system per CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services.

NOTE

If problems are encountered during Pre-Mission Operational Checkout (CROWS Operator's Manual, TM 9-1090-218-10, WP 0016), go to WP 0013, Unit Maintenance Functional Testing and Troubleshooting, Table 5.

3. Perform the Pre-Mission Operational Checkout in CROWS Operator's Manual, TM 9-1090-218-10, WP 0016.

4. Before returning any line replaceable unit (LRU) to direct support (DS) maintenance, ensure appropriate cables are verified fully functional IAW WP 0013, Unit Maintenance Functional Testing and Troubleshooting, Table 5.

Troubleshooting Reference

NOTE

For a listing of malfunctions or visual faults, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0026, Table 2.

For unit functional testing and troubleshooting procedures, refer to WP 0013, Table 5.

Table 2 is furnished as an aid in locating equipment problems and then listing common faults, malfunctions, symptoms, or possible causes that you may find in the maintenance and operation of the CROWS system or its components.

Table 2. Message Index

Message	Explanation
"AIMPOINT OUT OF RANGE"	The ballistic calculation has exceeded the azimuth or elevation bounds of the display unit.
"Air Pressure Sensor"	Communication with the pressure sensor is not operating properly. Pressure measurement is not available.
"Azimuth Drive"	The SWM has detected an azimuth drive failure. System azimuth control may not function properly.
"Azimuth Resolver"	The SWM has detected an azimuth resolver failure. System azimuth control may not function properly
"BALLISTIC FILE ERROR"	An error was detected in the ballistics file for the selected weapon and ammunition combination.
"BATTERY LOW"	Battery output voltage is low.
"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.
"Burst Relay Failed Open"	The relay that controls the burst firing of the weapon and safety interrupts has failed in an open circuit. **CAUTION** No-fire zones, burst mode, single-burst mode, and safety interlocks will not function.
"CantEl Sensor"	Communication with the cant and elevation sensor is not operating properly.
"CANTEL SENSOR FAILED"	Cant and elevation sensor has failed.
"Day Camera"	Day camera has failed.
"EMU Failed"	EMU has failed.
"End of Focus"	The focus limit for the selected camera has been reached.
"End of Zoom"	The zoom limit for the selected camera has been reached.
"Excessive Range"	The detected range to the target is in excess of the capabilities of the selected weapon and ammunition combination.
"Firing State Unknown"	Communication with the ICU is not operating properly and firing relay state is unknown. **CAUTION** No-fire zones, burst mode, single-burst mode, and safety interlocks will not function.
"Gimbal Azimuth Gyro"	The SWM has detected an azimuth gyro failure. System azimuth control or stabilization may not function properly.
"GWS BIT ERROR – FIRING INHIBITED"	The SWM BIT has reported a failure and firing has been inhibited. System control may not function properly.
"Gimbal BIT Status Failed"	The SWM has detected a fault and may not function properly.
"Gimbal BIT Status Unknown"	The SWM is not connected or not communicating.

Table 2. Message Index – Cont.

Message	Explanation
"Gimbal Comms Failed"	The SWM and ICU/EMU have detected a communication problem.
"Gimbal Elevation Gyro"	The SWM has detected an elevation gyro failure. System azimuth control or stabilization may not function properly.
"Gimbal Joystick Interface"	The joystick to SWM communication interface has detected a problem. The SWM may not function properly.
"Hatch Open 1 - Firing Inhibited"	Hatch 1 is open. Firing only is inhibited. **WARNING** The gun defaults to continuous fire mode. Safety interlocks will not function. Firing only is inhibited.
"Hatch Open 2 - Firing Inhibited"	Hatch 2 is open. Firing and weapon movement are inhibited. **WARNING** The gun defaults to continuous fire mode. Safety interlocks will not function. Firing and weapon movement are inhibited
"ICU Failed"	The ICU has failed.
"Laser"	Communication with the laser rangefinder is not operating properly.
"LASER FAILED"	Laser has failed.
"LASER FIRING RATE EXCEEDED"	The safe laser firing rate of 6 ranges per minute has been exceeded. Laser rangefinder may have overheated due to improper use.
"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.
"NO BALLISTIC SOLUTION INITIATE"	The SWM does not change position when a range to the target is accepted.
"No Fire Zones"	The EMU has failed to define a custom no-fire zone.
"No Firing Solution"	No ballistics solution was possible for the detected target.
"No Target Detected"	No laser return was detected from the laser firing.
"Pressure Sensor"	Communication with pressure sensor is not operating properly. Pressure measurement is not available.
"PRESSURE SENSOR FAILED"	Pressure sensor has failed.
"Safety Override - ACTIVE"	Hatch interlocks have been overridden with Safety Override switch. **WARNING** The gun defaults to continuous fire mode. Safety interlocks will not function. Motion control is active.
"Scanning TRP - press LASE"	The system is in TRP mode and pressing the LASE switch will stop scanning the TRPs.
"Sector Scanning - press DEADMAN"	The system is currently in Sector Scanning mode and pressing the Deadman will stop Sector Scanning.
"Sensor Unit Failed"	The sensor unit has failed.

Table 2. Message Index – Cont.

Message	Explanation
"Sensor Unit Unknown"	The SWM or Sensor Unit is not connected or not communicating.
"Sight Elevation Drive"	SWM has detected a sight elevation drive failure. Sight elevation drive may not function properly.
"Sight Elevation Resolver"	SWM has detected a sight elevation resolver failure. Sight elevation drive may not function properly.
"Temperature Sensor"	Communication with the temperature sensor is not operating properly. Temperature measurement is not available.
"TEMPERATURE SENSOR FAILED"	Temperature sensor has failed.
"Thermal Camera"	Thermal camera has failed.
"Thermal Camera Setting Up"	The thermal camera undergoes an initial setup when it is first selected, which is more time-consuming than subsequent selections.
"TRIGGER HELD"	Trigger was held down during boot-up and the system will not arm.
"Trigger Relay Failed Closed"	Trigger will not function. The relay that controls the trigger of the weapon has failed short circuit.
"Trigger Relay Failed Open"	Trigger will not function. The relay that controls the trigger of the weapon has failed open circuit.
"TRP Fault"	Cannot set TRP positions.
"TX NOT DETECTED"	Laser rangefinder did not transmit laser energy.
"Video System"	The video system in the EMU has failed.
"WAM configuration"	The WAM (Weapons and Ammunition Management) configuration setup has failed.
"Weapon Charger"	The SWM has detected a failure of the remote charger.
"Weapon Elevation Drive"	The SWM has detected an elevation drive failure. Elevation drive control may not function properly
"Weapon Elevation Resolver"	The SWM has detected an elevation resolver failure. Elevation drive control may not function properly.
"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.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT MAINTENANCE FUNCTIONAL TESTING AND TROUBLESHOOTING

This work package contains a system-level inspection checklist to ensure that the CROWS mount, Sensor Group, and Control Group are ready for operation.

WP CONTENTS

Section/Subsection **Page**

Initial Set-Up 2
Unit Maintenance Functional Testing and Troubleshooting Overview 2
General Procedures - Cables 3
Unit Maintenance Functional Testing and Troubleshooting Set-Up 3
Azimuth Lock Assembly 3
Interconnection of CROWS Components 5
CROWS Interconnect Diagram 5
Connectors and Cables 5
CROWS Signal Flow Diagram 8
Control Group Components 8
Sensor Unit 13
Connectors 14
Unit Maintenance Functional Testing and Troubleshooting 21
Explanation of Columns in Table 5, Unit Maintenance Functional Testing and Troubleshooting 21
Sample of Engagement Mode Screen 43
Diagnostic Test Procedures Set-Up 44
Azimuth Lock Assembly 44
Test Set (Computer) Set-Up 44
Diagnostic Test Procedures 45
Explanation of Columns in Table 6, Diagnostic Test Procedures 45
Test Set (Computer) Diagnostic Log Test Readout 47

INITIAL SET-UP

Refer to Table 1 for tools, special tools, personnel required, materials, and references needed during unit maintenance functional testing and troubleshooting of the CROWS.

NOTE

For additional information on troubleshooting or malfunctions, refer to WP 0012, Unit Maintenance Troubleshooting.

Table 1. Initial Setup Information

Category	Item	Additional Information
Tools	Unit Tool Kit	WP 0055, Table 2, Item 4
	GMTK	WP 0055, Table 2, Item 8
Special Tools	Test Set, Electronic Systems	WP 0057, Item 7
	Cable Assembly, Bulkhead to ICU - Test	WP 0057, Item 8
	Cable Assembly, Diagnostic Cable	WP 0057, Item 9
Personnel Required	Two	
Materials/Parts	N/A	
References	TM 9-1090-218-10	CROWS Operator's Manual

UNIT MAINTENANCE FUNCTIONAL TESTING AND TROUBLESHOOTING OVERVIEW

At the unit maintenance level, functional testing and troubleshooting focuses on verifying the operator/crew diagnosis and performing the appropriate maintenance tasks.

The standard tasks to be completed for Unit Maintenance include Inspect, Test, Service, Remove, Repair, Install, and Replace. Remove and Replace activities include preparation, removal, and replacement of LRUs, and forwarding items with a job order to the next higher maintenance as needed.

General Procedures – Cables

Use the following procedure when working with cables/wiring harnesses.

CAUTION

When removing a connector, never pull the wires on the cable/wiring harness. Failure to follow this instruction may result in equipment damage.

NOTE

Ensure all connectors are properly seated and tested before further disassembly. The fault may lie in a loose connection.

1. Carefully remove the cable/wiring harness from the connector.
2. Inspect the connectors.
   a. If the connectors are not damaged and the cable attachment to the connector is secure, proceed with step 3.
   b. If the connectors are damaged, proceed with repair or replace activities as detailed in WP 0022, Interconnection Cables, then repeat this procedure from step 1.
3. Reinstall/reconnect the item and retest to see if the same fault occurs.
4. Continue with the steps in Table 5.

UNIT MAINTENANCE FUNCTIONAL TESTING AND TROUBLESHOOTING SET-UP

Azimuth Lock Assembly

CAUTION

Do not rotate the pedestal unless the azimuth lock handle is in the unlocked position. Failure to do so may result in equipment damage.

~~Overview~~

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

Table 2 details the components/assemblies of the azimuth lock assembly.

Table 2. Azimuth Lock Assembly and Base Components/Assemblies

PN	Name	Nomenclature
21677-1035	Azimuth Lock Assembly	Azimuth Lock
21677-1037	. Handle, Azimuth Lock	Azimuth Lock Handle
21439-1033	. Stud, Azimuth Lock	
21677-1036	. Mount, Azimuth Lock	
LC-027H-8S	. Spring	

~~Operation~~

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

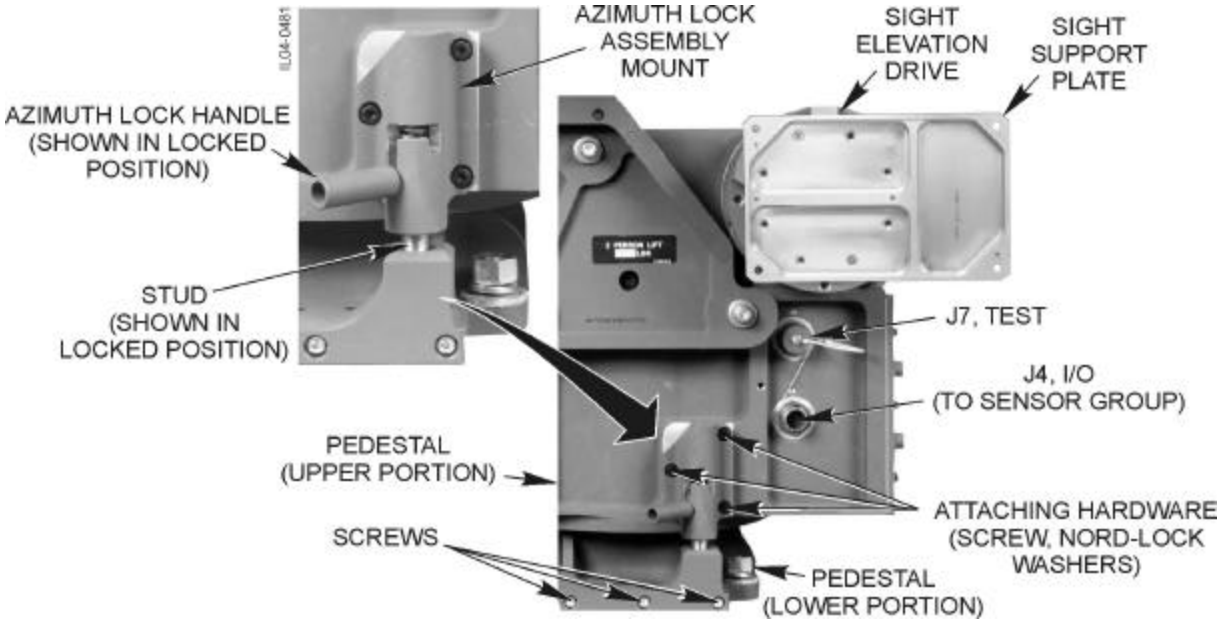


Figure 1. Azimuth Lock Assembly

1. Perform the following procedure to unlock the azimuth lock, allowing the pedestal 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 moves freely (horizontal rotation).

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

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

   b. Verify that the pedestal does not move.

INTERCONNECTION OF CROWS COMPONENTS

CROWS Interconnect Diagram

NOTE

Test Set (Computer) and cable are used for diagnostics (sensor unit, EMU, ICU, and display unit).

Figure 2 details CROWS connectors and cables both inside the vehicle (below roof line) and on top of the vehicle (above the roof line). The linear actuator, remote firing mechanism, and round counting assembly (left side of drawing) will vary depending on the weapon type selected (e.g., M2 HB, Mk19, M240, or M249).

Connectors and Cables

Perform the following procedure to connect the cables and connectors for the weapon and weapon 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

Prior to operation, ensure that all connectors are properly connected or covered (if not in use). Failure to do so may result in equipment damage.

1. Attach cables to connectors, as shown in Figure 2 and Table 3, with system signal flow detailed in Figure 3.
2. When all connections have been completed, ensure all cables are tied down**,** with appropriate service loops as necessary. Figures 4 thru 24 illustrate the component connectors and their locations.
3. 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.

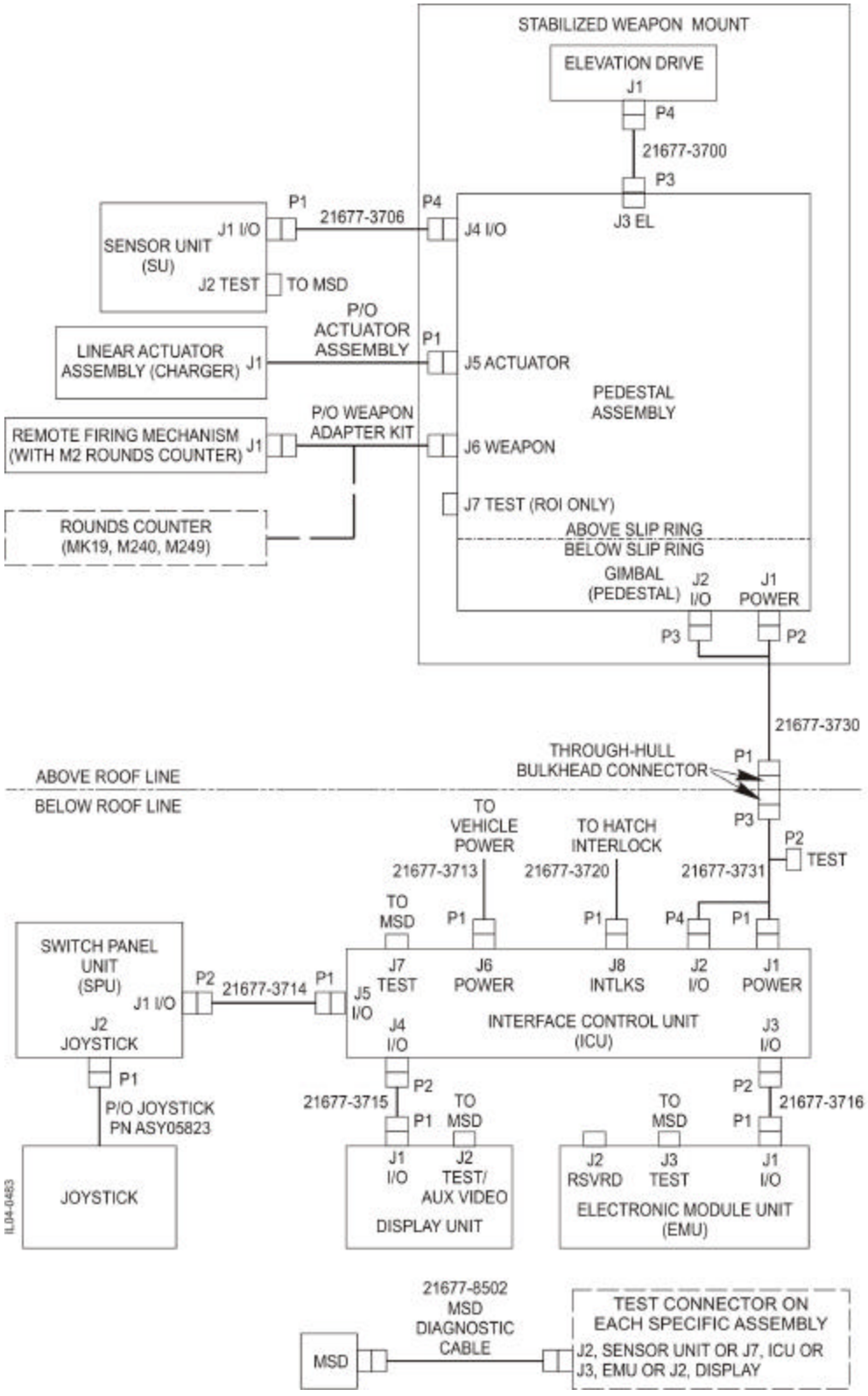


Figure 2. Interconnect Diagram of Connectors and Cables

Table 3 presents the interconnect details listing connectors with corresponding pins, signals, etc.

Table 3. 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
21577-3730	Mount J2	Bulkhead	I/O to Gimbal J2
21677-3700	Mount J3	Elevation Drive J1	
21677-3706	Mount J4	Sensor Unit J1	
Cable P/O Charger	Mount J5	Charger J1	Varies per weapon
21677-3702	Mount J6	RFA	M2 Mount to Weapon
21677-3703	Mount J6	Remote Firing Solenoid and Rounds Counter	Mk19 Mount to Weapon
21677-3705	Mount J6	Remote Firing Solenoid and Rounds Counter	M240/M249 Mount to Weapon
--	Mount J7		Test

CROWS Signal Flow Diagram

Figure 3 illustrates the CROWS signal flow.

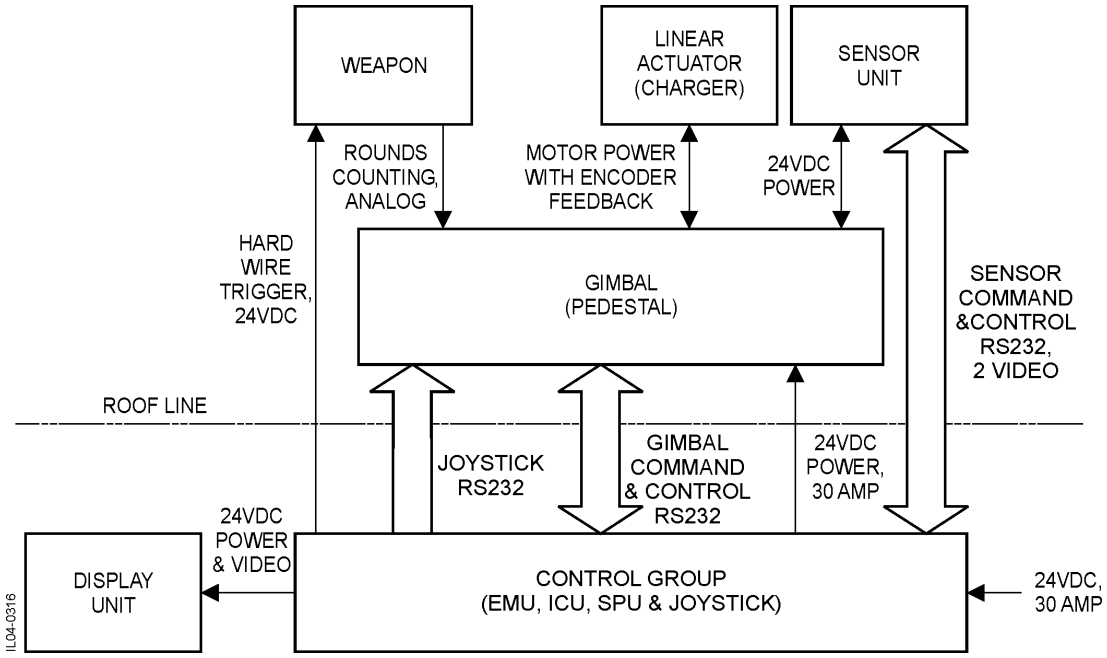


Figure 3. CROWS Signal Flow Diagram

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 4 and shown in Figures 4 thru 8.

Table 4. Control Group Components and Nomenclature

ROI Part Number	Common Name
21677-5500	Control Group
ASY05820	. EMU
ASY05821	. SPU
ASY05822	. ICU
ASY05823	. Joystick
ASY05843	. Display Unit
21677-3713	. Vehicle Power Cable
21677-3714	. ICU-SPU Cable
21677-3715	. ICU-Display Cable
21677-3716	. ICU-EMU Cable
21677-3720	. Hatch Interlock Cable
21677-3730	. Gimbal-Bulkhead Cable
21677-3731	. Bulkhead-ICU Cable

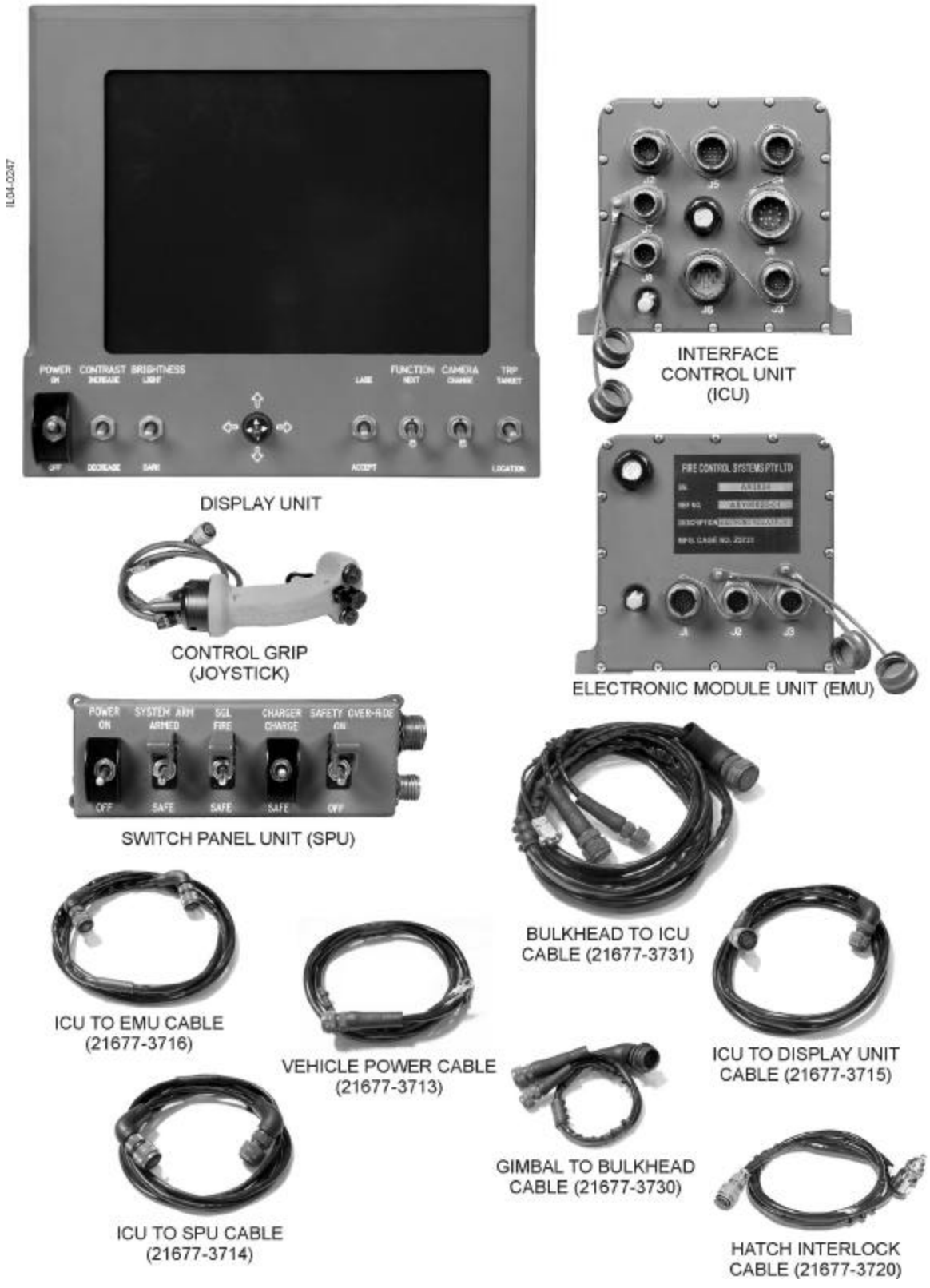


Figure 4. Control Group

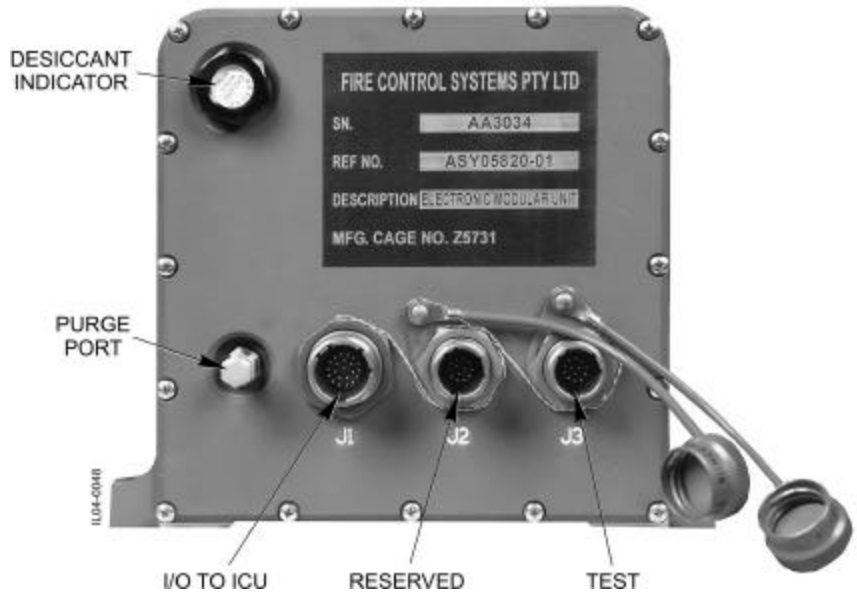


Figure 5. EMU Connectors



Figure 6. SPU Connectors

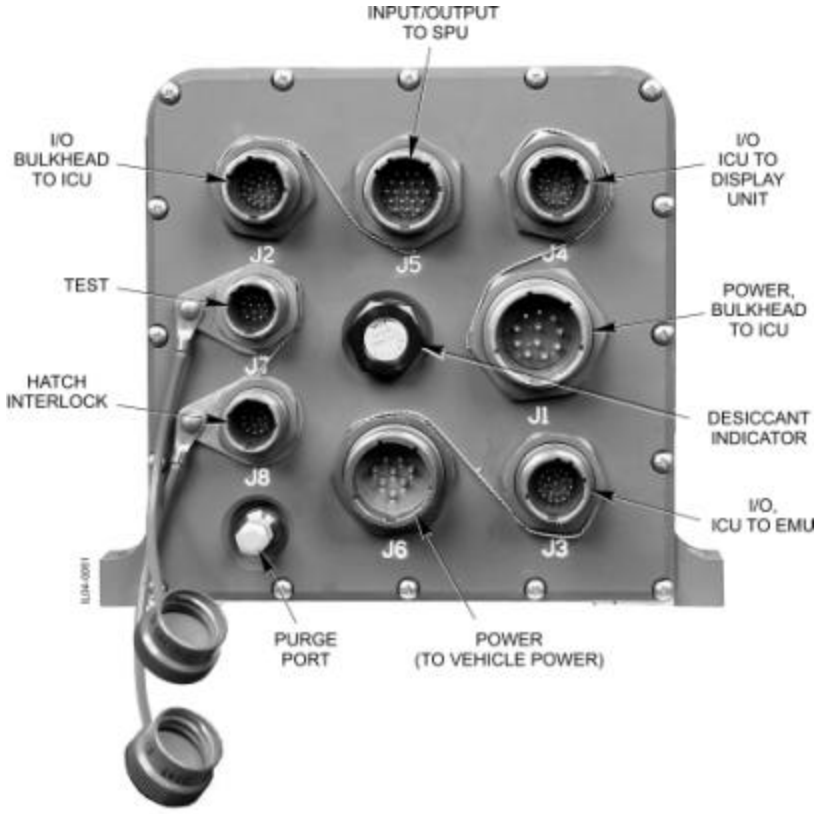


Figure 7. ICU Connectors

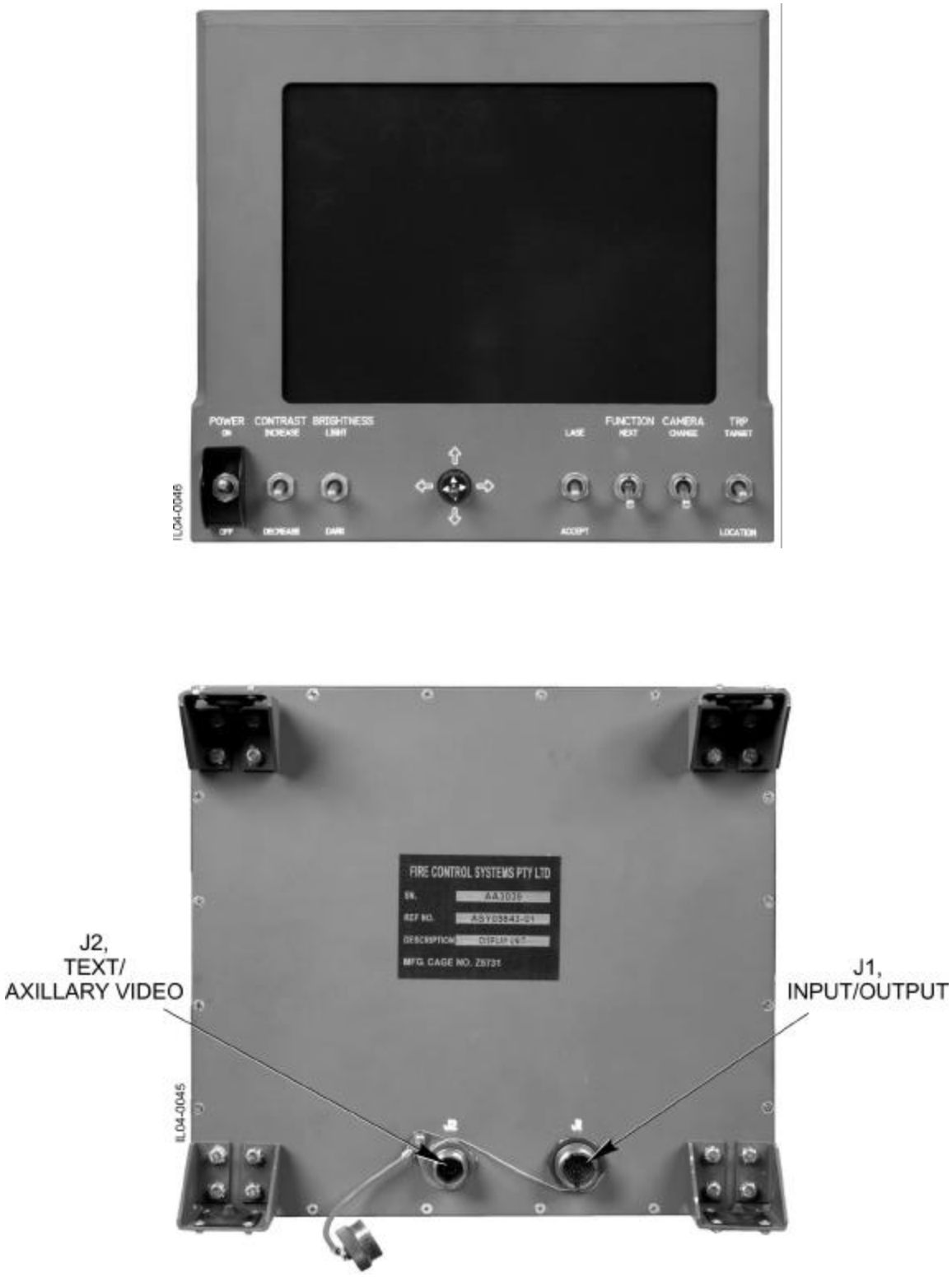


Figure 8. Display Connectors

Sensor Unit

Figure 9 shows the sensor unit including connectors.



Figure 9. Sensor Unit (Front and Rear View)

Connectors

Figure 10 shows the mount connectors for input/output (I/O) and Power, while Figure 11 shows the weapon, elevation, test, and I/O connectors for the pedestal.

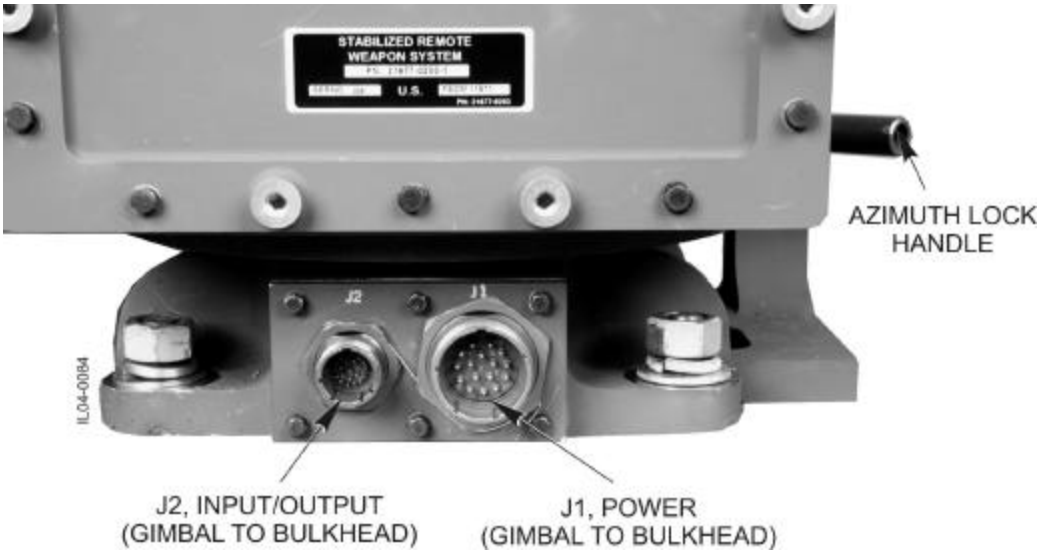


Figure 10. I/O and Power Connectors (Mount/Pedestal)

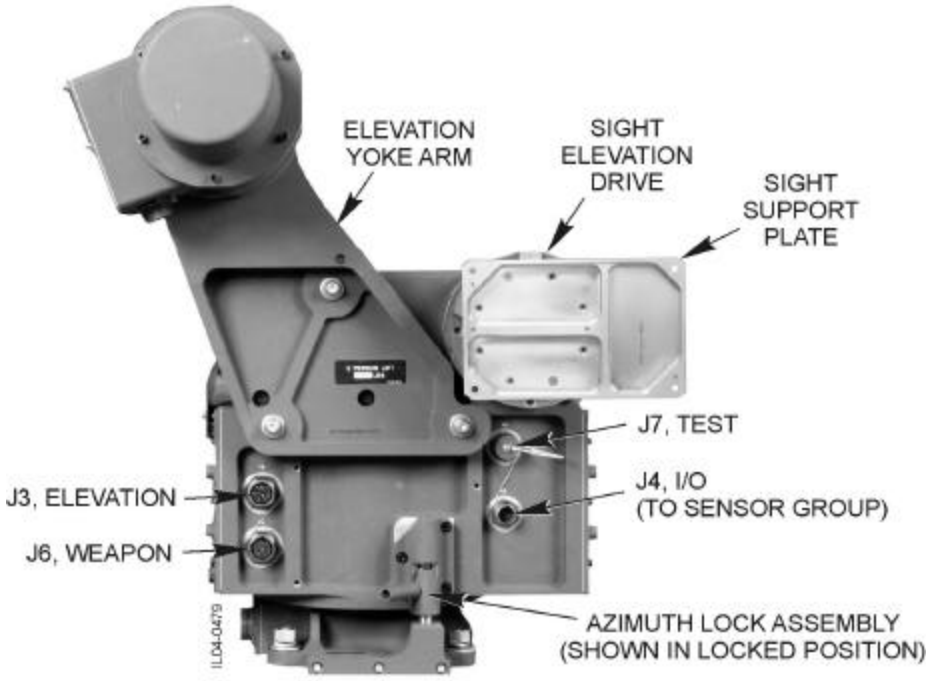


Figure 11. Weapon, Actuator, Test, and Elevation Connectors

Figure 12 shows the elevation drive and actuator connectors.

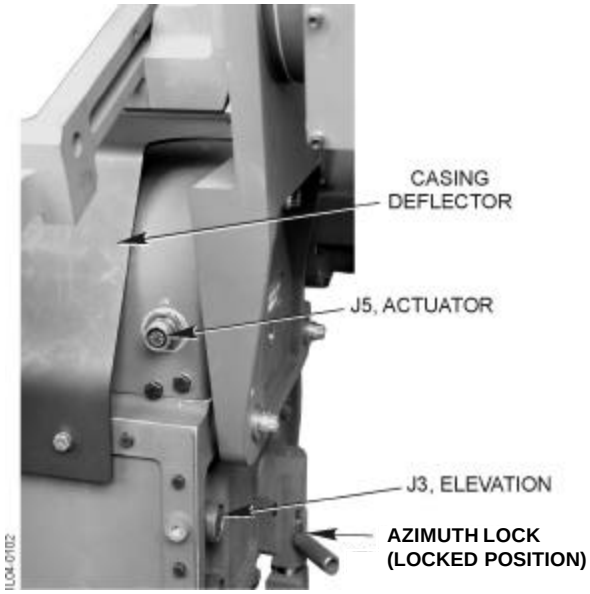


Figure 12. Elevation Drive Connectors and Cables

Figures 13 and 14 show cables positioned and tied down throughout the entire mount.

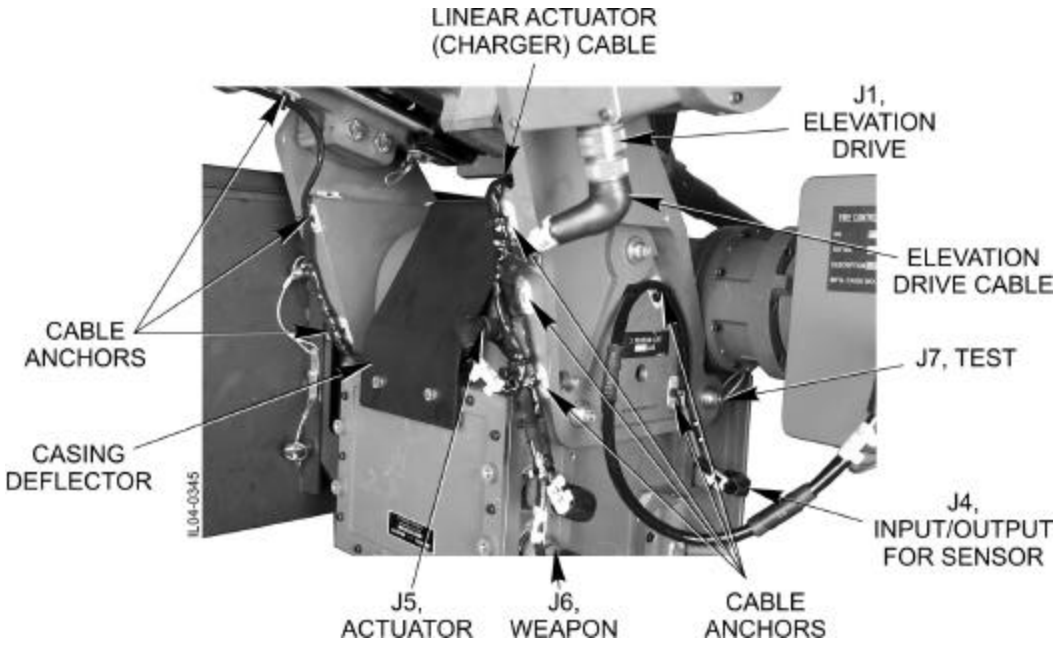


Figure 13. Threading Cables Under the Cradle and Behind the Casing Deflector

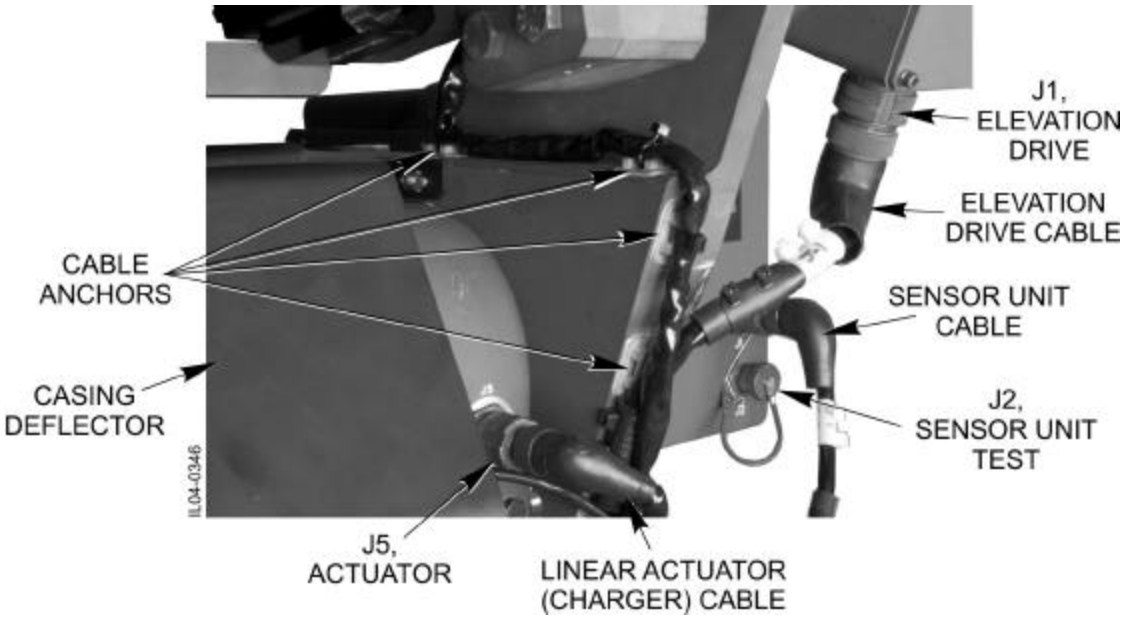


Figure 14. Cables Threaded Under the Cradle and Tied Down

Figures 15 thru 17 show the M2 cables threaded, positioned, and tied down.

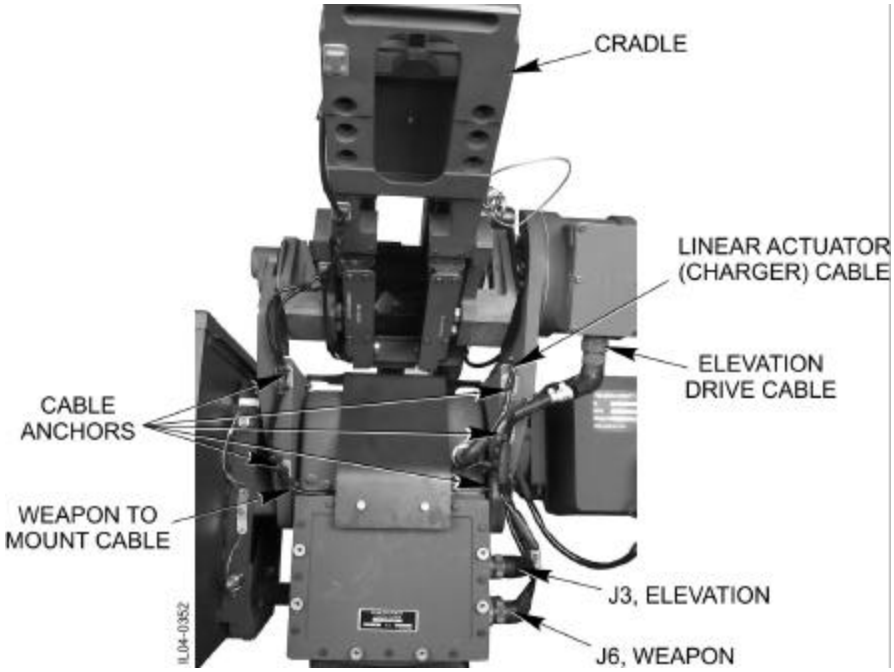


Figure 15. M2 Actuator Cable

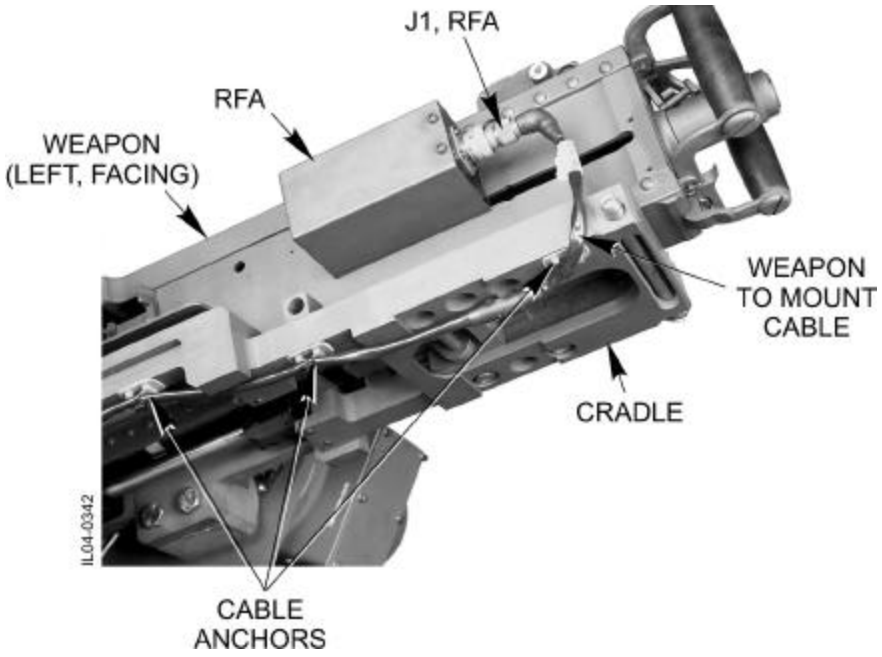


Figure 16. M2 Weapon to Mount Cable with Cables Positioned and Tied Down Under the Cradle for M2 Weapon to Mount Cradle

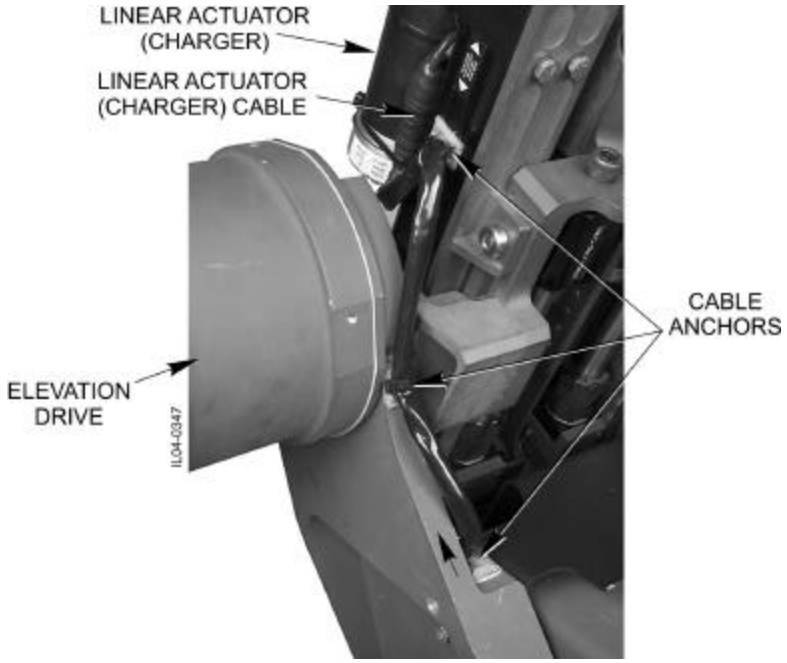


Figure 17. Linear Actuator (Charger) Cable Threaded and Tied Down to Prevent Pinching or Binding

Figures 18 thru 20 show the cables connected, positioned, and tied down for the Mk19.

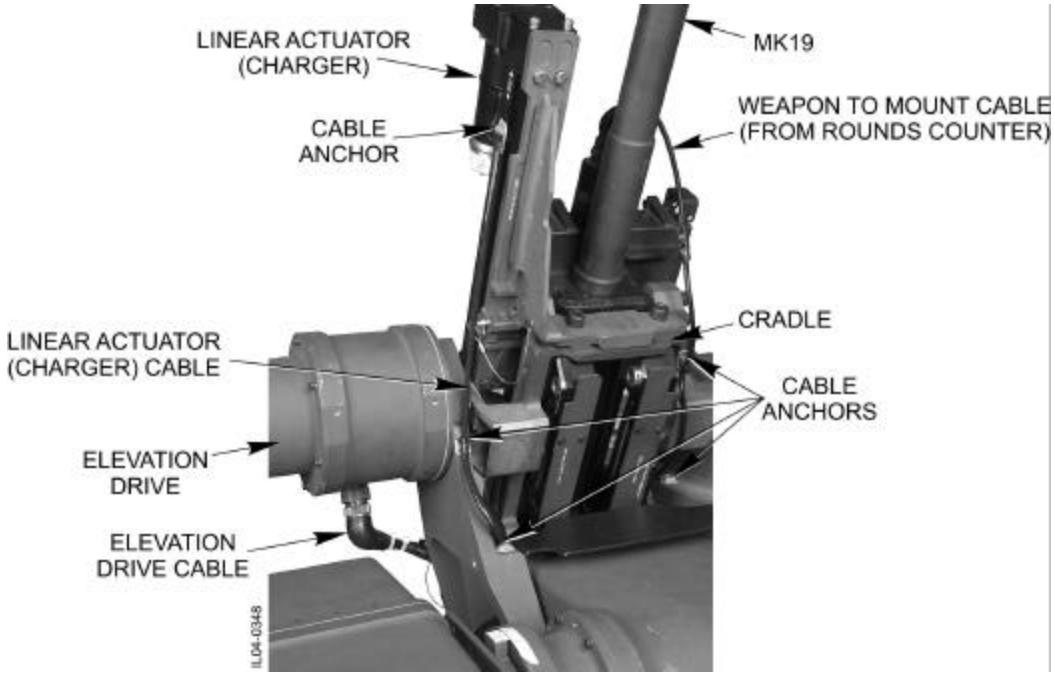


Figure 18. With Weapon Elevated, Cables Shown as Threaded and Tied Down

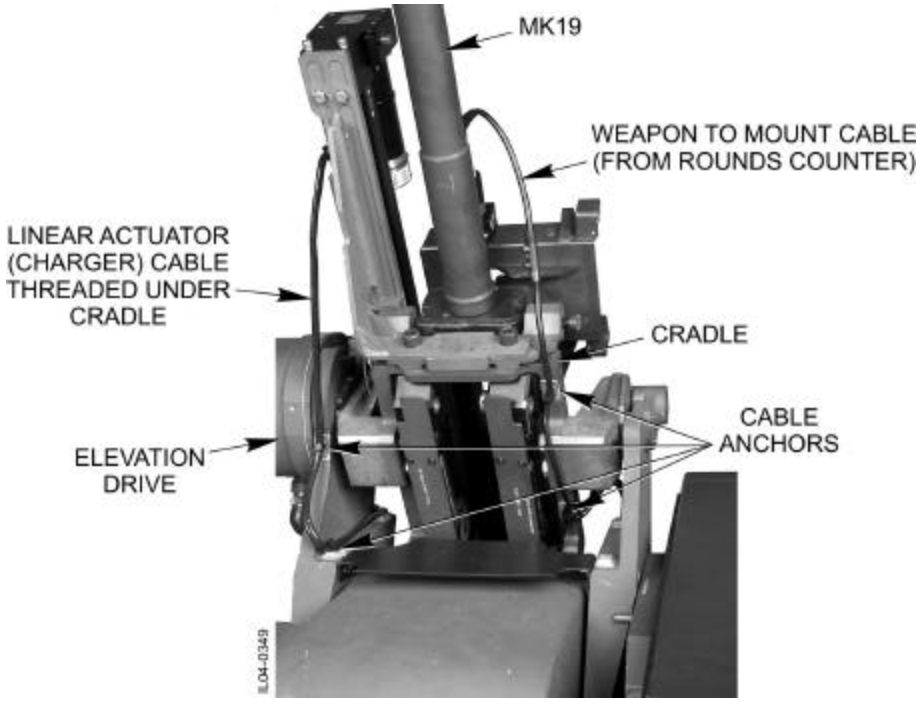


Figure 19. Both Linear Actuator (Charger) and Weapon to Mount Cables in Place

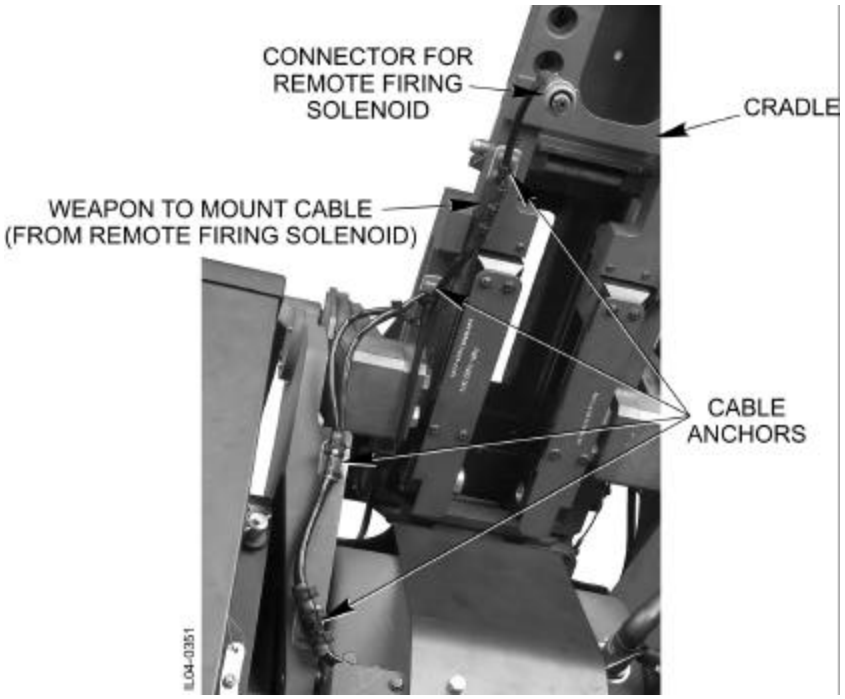


Figure 20. Weapon to Mount Cable Set-up for Connection to the Mk19 Remote Firing Solenoid

Figure 21 thru 23 show the cable connections for the M240 and M249 weapon adapter kits.

PHOTO TBD

Figure 21. Weapon to Mount Cable Set-up for Connection to the M240/M249 Remote Firing Solenoid

PHOTO TBD

Figure 22. Weapon to Mount Cable Set-up for Connection to the M240 Rounds Counter

PHOTO TBD

Figure 23. Weapon to Mount Cable Set-up for Connection to the M249 Rounds Counter

UNIT MAINTENANCE FUNCTIONAL TESTING AND TROUBLESHOOTING

Table 5 presents a list of functional tests.

Explanation of Columns in Table 5, Unit Maintenance Functional Testing and Troubleshooting

Column (1) Task. This column lists key CROWS performance functions or components/assemblies to be inspected, tested, and repaired/replaced.

Column (2) Procedure or Reference. This column detail procedures to be performed together with references supporting the steps.

Column (3) Possible Screen Messages. This column includes messages that may appear on the display unit screen. Refer to WP 0012 for an alphabetical list of all messages with a description of possible symptoms and causes.

Column (4) Troubleshooting. This column specifies troubleshooting symptoms or causes.

Column (5) Unit Maintenance Action. This column specifies steps to be taken at each step of fault isolation.

The steps in Column 4, Troubleshooting, directly relate to the unit maintenance actions of Column 5.

NOTE

When using the screen messages on the display unit, refer to the following list of terms and their equivalents as needed.

Day camera: daylight video camera or day sensor

Night camera: thermal sensor, thermal imager, or night sensor

Laser rangefinder: eyesafe laser rangefinder or ELRF

Cant EL: cant and elevation sensor

Gimbal: mount, SWM, stabilized weapon mount, or (on occasion) pedestal

WARNING

Follow all safety warnings and cautions when handling equipment.

Set the CROWS main power switch to the OFF position and ensure that all system motion has completely stopped before performing 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.

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

NOTE

When a fault is determined, record the information on DA Form 2404 or DA Form 5988-E and submit the form to the next higher maintenance.

For preventive maintenance (PM) information, refer to CROWS Operator's Manual, TM 9-1090-218-10, WP 0004, Preventive Maintenance Overview, and WP 0005, Preventive Maintenance Checks and Services.

For additional information, refer to WP 0012, Unit Maintenance Troubleshooting Procedures.

For specific weapon operation and maintenance manuals, refer to WP 0053, References.

For replacement of Control Group components, including external cables, refer to the Vehicle Integration Kit (VIK), WP 0060.

For replacement of Sensor Group components, refer to WP 0020.

For item details, refer to WP 0065, Schematic Diagrams, or WP 0066, Wiring Diagrams.

Perform unit maintenance tasks in the order listed in Table 5.

Table 5 presents the functional testing and troubleshooting tasks for unit-level maintenance. Table 6 is a diagnostic test procedure to be performed with the Test Set, Electronic Systems (using the Cable Assembly, Bulkhead to ICU - Test and the Cable Assembly, Diagnostic Cable) to assist in defining the defective LRU.

Table 5. Unit Maintenance Functional Testing and Troubleshooting

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
1 Ensure all external cables are connected.	Refer to Figure 2, Interconnect Diagram		Visually inspect connectors for bent, broken, or damaged pins, and damaged sockets.	

WARNING

Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.

CAUTION

In the tasks in this table, the step “Test cables” refers to the following procedure. Failure to follow this procedure may result in equipment damage.

1. Perform a continuity check on cables suspected to be deficient.
2. Test the cable(s) individually for continuity in the order listed.
3. Check the system after each replacement.

NOTE

Refer to Table 3 for a listing of the cables and their part numbers (PNs). Refer to Figure 2 for the CROWS Interconnect Diagram.

Test LRUs in the order listed by performing the diagnostic test procedures in Table 6 for the specific LRU.

If you do not have a weapon installed, the remote firing mechanism (RFA for M2 or solenoid for the MK19, M240, and M249) may be connected to the appropriate weapon to mount cable so that testing and troubleshooting can proceed. (Col 5)

The steps in Column 4, Troubleshooting, directly relate to the steps in Column 5, Unit Maintenance Action. If the Unit Maintenance Action does not correct the CROWS deficiency, contact your local Field Service Representative (FSR) or Logistics Assistance Representative (LAR).

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
2 System Power-up and Power-on BIT	1. Ensure azimuth (travel) lock is unlocked. Actuate POWER switch (SPU) to ON and verify display unit POWER switch is ON. After system boot-up, observe the system report screen for following results: • Verify "Sensor Unit Okay" • Verify "EMU Okay" • Verify "ICU Okay" • Verify "Vehicle Type M1114" • Verify "No Fire Zones Default" • Verify "Gimbal Comms Okay" • Verify "Gimbal BIT Status Okay"	BATTERY LOW EMU FAULTS -Video System SENSOR FAULTS -Pressure Sensor -Cant El Sensor -Temp Sensor -Laser -Day Camera -Thermal Camera MOUNT FAULTS -Azimuth Drive -Azimuth Resolver -Gimbal Azimuth Gyro -Gimbal Elevation Resolver -Sight Elevation Drive -Sight Elevation Resolver -Weapon Elevation Drive -Weapon Elevation Resolver	1. Reboot system if there is a FAILED or UNKNOWN indication on the screen. A. If fail remains, press Function switch for detailed fault description. 2. Display unit does not turn on when power is applied for 1 minute, 15 seconds. (List continued next page)	1. Test Control Group component, sensor unit, or mount, according to detailed fault description. A. If resolver fails or gyro fail send mount to the next higher maintenance. 2. Perform these steps. A. Ensure display unit power switch is on ON. B. Verify vehicle battery is charged. C. Test cables: 21677-3715 21677-3714 21677-3713 D. Test SPU. E. Test ICU. F. Test display unit. (List continued next page)

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
2 – Cont. System Power-up and Power-on BIT			3. After 1 minute, 15 second boot-up period, display unit background is blue (i.e., no video), but text is visible on display unit. 4. After 1 minute, 15 second boot up period, screen is all blue (i.e., no video, no text). 5. System drifts in AZ after power up.	3. Perform these steps. A. Test cables: 21677-3706 21677-3731 21677-3730 B. Test sensor unit. 4. Perform these steps. A. Test cables: 21677-3715 21677-3716 B. Test EMU. 5. Perform these steps: A. Test EMU B. Send to next higher maintenance level.

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
3 Verify Engagement Screen Symbology	1. Proceed to Engagement Screen and verify the following symbology. • Stabilization Status • Laser Ready Marker • Weapon Type • Ammunition Type • Rounds Counter • Mount Azimuth Indicator • Sight Elevation Indicator • Camera and FOV (field of view) • Trigger Arm Status • Laser Aim Point • Function Menu • Filter Indicator Day Camera • Weapon Charged Status • Weapon Elevation Indicator • Range • Burst Control	Hatch Open 1 – Firing Inhibited Hatch Open 2 – Firing Inhibited	1. Screen symbols are not in accordance with Figure 24. 2. SAFE-SAFE message appears in upper right-hand corner of screen. (Weapon/ammunition type, Figure 24). 3. "Hatch Open 1 – Firing Inhibited" or "Hatch Open 2 – Firing Inhibited" message appears.	1. Perform these steps. A. Test cable 21677-3716. B. Test EMU. 2. Test appropriate weapon to mount cable. 3. Perform these steps: A. Ensure hatch(es) closed properly. B. Test cable: 21677-3720

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
4 Display Unit Brightness Contrast Function	1. On display unit, alternately switch the "BRIGHTNESS" switch between "BRT" and "DRK". 2. Observe the display unit brightness change. 3. On display unit, alternately switch the "CONTRAST" switch between "INC" and "DEC". 4. Observe the display unit contrast change.		1. Display unit brightness or contrast will not change.	1. Test display unit.
5 Day Camera Automatic Exposure Control	1. Switch function to “Rg / Brt / Accpt”. 2. Set brightness to change in both the darker and lighter condition. 3. Observe image change.	DAY CAMERA	1. Brightness will not adjust. A. Try using switches on display unit and on joystick to verify all switches are working.	1. Perform these steps. A. If the display unit switches work, test the joystick. B. If the joystick switches work, test the display unit. C. Test EMU. D. Test sensor unit.

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
6 Day Camera Zoom and Focus Control	1. Switch to DAY SENSOR and switch to "Zm/FC" on the function menu. 2. Set the day sensor to widest FOV. Display should indicate 26° +/- 2.0°. 3. Set the day sensor to narrowest FOV. Display should indicate 1.2° +/- 0.4°. 4. Set the focus to an out-of-focus condition. 5. Observe an image focus change. 6. Reset focus.	END OF ZOOM END OF FOCUS	1. FOV or Focus will not adjust. A. Try using switches on display unit and on joystick to verify all switches are working.	1. Perform these steps. A. If the display unit switches work, test the joystick. B. If the joystick switches work, test the display unit. C. Test sensor unit. D. Test EMU E. Test ICU.

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
7 Azimuth and Elevation Slewing Function	1. Set the day sensor to widest FOV. 2. Slew the system through 360° of rotation in a clockwise and a counter-clockwise direction. 3. Verify azimuth indicator displays and follows the relative position of the weapon barrel. 4. Slew the elevation drive to the upper limit of travel and the lower limit of travel. 5. Verify that the elevation drive and sight elevation drive move to a fully elevated position and a fully depressed position. 6. Verify that the elevation drive and sight elevation drive indicators display and follow the relative positions of the weapon barrel and the sight elevation drive.	GWS BIT ERROR- FIRING INHIBITED AZIMUTH DRIVE AZIMUTH RESOLVER GIMBAL AZIMUTH GYRO GIMBAL ELEVATION GYRO GIMBAL JOYSTICK INTERFACE SIGHT ELEVATION DRIVE SIGHT ELEVATION RESOLVER WEAPON ELEVATION RESOLVER WEAPON ELEVATION DRIVE	1. Elevation or azimuth drives do not move. 2. Screen indicators are not following the movement of the mount.	1. Perform these steps. A. Test joystick. B. Test ICU. C. Test cables: 21677-3730 21677-3731 21677-3714 21677-3716 D. Test EMU. 2. Perform these steps. A. Test cables: 21677-3730 21677-3731 21677-3714 21677-3716 B. Test EMU.

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
8 FOV Slewing Control Function	1. Set the CROWS to the narrowest FOV. 2. Verify ability to precisely control motion by positioning the “LASER AIMPOINT” on a target.		1. Precise movement of aimpoint is not possible	1. Perform these steps. A. Test joystick. B. Test EMU.
9 Thermal Camera Zoom or 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. Display should indicate 1.8° +/- .4°. 4. Set the thermal sensor to widest FOV. Display should indicate 11° +/- 1.0°. 5. Set the thermal sensor to narrowest FOV. 6. Set the focus to an out-of-focus condition. 7. Observe an image focus change. 8. Reset focus.	THERMAL CAMERA	1. FOV or Focus will not adjust.	1. Perform these steps. A. Test sensor unit. B. Test EMU. C. Test ICU.

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
10 Thermal Camera Polarity Control	1. Set the “POLARITY” to white hot and black hot. 2. Verify change.		1. Polarity will not change.	1. Perform these steps. A. Test sensor unit. B. Test EMU.
11 SURVEIL-LANCE Mode Function	1. Put in "SURVEILLANCE" mode. 2. Verify capability to enter and exit surveillance mode. 3. Verify sensor unit is operational. 4. Verify mount will still move in azimuth. 5. Verify sensor unit will still move in elevation.		1. Will not enter or function properly in surveillance mode.	1. Send to next higher maintenance level.
12 RANGE STEP Setup	1. Switch to "RANGE STEP" submenu. 2. Set range step positions per mission requirements.		1. Range step settings will not change.	1. Test EMU.
13 UNITS Setup	1. Switch to "UNITS" submenu. 2. Set units per mission requirements.		1. Units settings will not change.	1. Test EMU.

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
14 COLOR Setup	1. Switch to "COLOR" submenu. 2. Set symbology, laser aimpoint, and ballistics aimpoint display colors per mission requirements.		1. Color settings will not change.	1. Test EMU.
15 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. Verify sector scanning is operating. 5. Depress “DEADMAN” switch to exit sector scanning.		1. System will not go into sector scan.	1. Perform these steps. A. Test EMU.

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
16 Sensor Display and Function	1. Switch to the Sensor display menu. 2. Verify the cross-wind indicator "CW" displays "0.0 m/s". 3. Verify range indicator "RW" displays "0.0 m/s". 4. Verify temperature indicator "Te" displays ambient temperature. 5. Verify absolute pressure indicator "Pr" displays barometric pressure. 6. Verify cant sensor indicator "Ca" displays the cant position. 7. Verify elevation sensor indicator "El" displays the elevation position. 8. Set sensor menu per mission requirements.		1. Sensor settings will not change or are not accurate.	1. Perform these steps. A. Test sensor unit. B. Test EMU.

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
17 Target Reference Point (TRP) Verification	1. Establish two TRPs. 2. Ensure the system slews to each TRP properly.	TRP FAULT	1. Selecting Display Switch does not put system into TRP menu. 2. Target points will not be accepted, stored, or deleted properly. 3. Mount will not move to proper target point.	Perform these steps. A. Test display unit. B. Test EMU.

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
18 Firing Circuit Function **NOTE** A remote firing mechanism is required. "Mechanism" refers to both the M2 remote firing assembly and the remote firing solenoid for the MK19, M240, and M249.	1. Plug weapon to mount cable into appropriate remote firing mechanism. 2. Set "SYSTEM SAFE/ARMED" switch in the "SAFE" position. 3. Verify "SAFE" indication is displayed. 4. Actuate the trigger. 5. Verify the firing mechanism did not actuate. 6. Set the "SYSTEM SAFE/ARMED" switch in the "ARMED" position. 7. Verify "ARMED" indication is displayed. 8. Actuate the trigger. 9. Verify the firing mechanism did actuate. 10. Set "SYSTEM SAFE/ARMED" switch in the "SAFE" position.	BURST RELAY FAILED CLOSED BURST RELAY FAILED OPEN FIRING STATE UNKNOWN TRIGGER RELAY FAILED CLOSED TRIGGER RELAY FAILED OPEN	1. System firing circuit is not working properly. 2. SAFE/ARMED indications on screen are incorrect and do not correspond to switch positions on SPU.	1. Perform these steps. A. Test remote firing mechanism B. Test joystick. C. Test ICU. D. Test SPU. E. Test EMU. 2. Perform these steps. A. Test SPU. B. Test ICU. C. Test EMU.

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
19 Hatch Interlock Function	1. Open hatch. Verify “Hatch Open 1 – Firing Inhibited” is displayed. Set the "SYSTEM SAFE/ARMED" switch to the "ARMED" position. Verify "SAFE" indication is displayed (because hatch is open). Actuate the trigger. Verify the remote firing mechanism did not actuate.	BURST RELAY FAILED CLOSED BURST RELAY FAILED OPEN FIRING STATE UNKNOWN TRIGGER RELAY FAILED CLOSED TRIGGER RELAY FAILED OPEN	1. Opening the hatch(es) did not “SAFE” the system.	1. Perform these steps. A. Test cable, 21677-3720. B. Test ICU.

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
20 Safety Override Function	1. Verify hatch open. Verify “Hatch Open 1-Firing Inhibited” message is displayed. Set the "SYSTEM SAFE/ARMED" switch to the "ARMED" position. Verify the “SAFE” indication is displayed. Set the "SAFETY OVERRIDE" switch to the "ON" position Verify “SAFETY OVERRIDE” and "ARMED” message displayed. Actuate trigger. Verify the remote firing mechanism did actuate. (List continued next page)	BURST RELAY FAILED CLOSED BURST RELAY FAILED OPEN FIRING STATE UNKNOWN TRIGGER RELAY FAILED CLOSED TRIGGER RELAY FAILED OPEN	1. Safety Override is not overriding the hatch interlock.	1. Perform these steps. A. Test SPU. B. Test ICU.

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
20 – Cont. Safety Override Function	2. Set the "SAFETY OVERRIDE" switch to "OFF" position. 3. Verify “SAFETY OVERRIDE” is not displayed. 4. Verify “Hatch Open 1 – Firing Inhibited” is displayed. 5. Verify "SAFE" indication is displayed. 6. Close hatch.			

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
21 No-Fire Zone Verification	1. Set no-fire zone of approximately an 180° arc. 2. Position system within no-fire zone. 3. Verify "NO FIRE ZONE" indication is displayed. 4. Set "SYSTEM SAFE/ARMED" switch to the "ARMED" position. 5. Verify "SAFE" indication is displayed. 6. Actuate the trigger. 7. Verify remote firing mechanism did not actuate. 8. Position system outside the no-fire zone. 9. Verify "ARMED" indication is displayed. 10. Actuate the trigger. 11. Verify the remote firing mechanism actuated. 12. Set "SYSTEM SAFE/ARMED" switch to the "SAFE" position.	BURST RELAY FAILED CLOSED BURST RELAY FAILED OPEN FIRING STATE UNKNOWN TRIGGER RELAY FAILED CLOSED TRIGGER RELAY FAILED OPEN	1. No-fire zones are not working properly.	1. Perform these steps. A. Test EMU.

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
22 Remote Charging	1. Verify the "WPN CHARGED" is displayed. Push and release the "CHARGED/SAFE" switch to "CHARGED" position. Observe the linear actuator (charger) move toward the rear, stop at the full rear end of travel, and return to the forward position. Verify "WPN CHARGED" indication momentarily goes away when linear actuator (charger) is in the full rear position. Push and release the "CHARGED/SAFE" switch to the "SAFE" position. (List continued next page)	WEAPON CHARGER	1. Linear actuator (charger) will not move. 2. Linear actuator (charger) is not driving to the full rear position. 3. "WPN CHARGED" indicator on display unit is not displaying properly. (List continued next page)	1. Perform these steps. A. Test linear actuator (charger). B. Test SPU. C. Test cables: 21677-3730 21677-3731 21677-3714 D. Test ICU. 2. Test linear actuator (charger). 3. Perform these steps. A. Test linear actuator (charger) (List continued next page)

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
22 – Cont. Remote Charging	Observe the linear actuator (charger) move toward the rear and stop at the aft end of travel. Observe "WPN CHARGED" indication is not displayed while actuator is secured in the full aft position. Push and release the "CHARGED/SAFE" switch to the "CHARGED" position. Observe linear actuator (charger) move to forward position. Observe "WPN CHARGED" indication is displayed.		4. Linear actuator (charger) is driving, but the sear assembly is not being released (M2 only).	4. Perform these steps (M2 only). A. Lubricate sear assembly with sear slide. B. Test sear assembly with sear slide.
23 Ammunition Type Setup	1. Set Ammunition Type. Switch to Engagement screen and verify ammunition type retention.		1. Ammunition type will not select properly.	1. Test EMU.
24 Rounds Counter Setup	1. Set rounds counter. Verify rounds count retention.		1. Rounds count will not select properly.	1. Test EMU.

Table 5. Unit Maintenance Functional Testing and Troubleshooting – Cont.

(1) Task	(2) Procedure or Reference	(3) Possible Screen Messages	(4) Troubleshooting	(5) Unit Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.				
25 Boresight the system **NOTE** A weapon with a properly installed and functioning weapon adapter kit (WAK) is required for this task.	For procedures and additional information, refer to CROWS Operator Manual, TM 9-1090-218-10, WP 0018, Boresighting and WP 0019, Zeroing.	BALLISTICS FILE ERROR NO BALLISTICS SOLUTION INITIATE LASER FAILED LASER NOT CHARGED TX NOT DETECTED WAM CONFIGURATION	1. Boresighting menus will not function properly. 2. Laser will not fire or return a range. 3. Boresighting solution is not accurate.	1. Perform these steps. A. Verify boresight procedure has been accomplished properly. B. Test EMU. C. Test ICU. 2. Perform these steps. A. Test sensor unit. B. Test EMU. 3. Perform these steps. A. Test EMU. B. Test sensor unit.

Sample of Engagement Mode Screen

A typical operational screen (Zm / Fc main default screen) is shown in Figure 24.

NOTE

The functional menu appears in the lower left corner of the screen.

The laser aimpoint is represented by the symbol, ⊥.

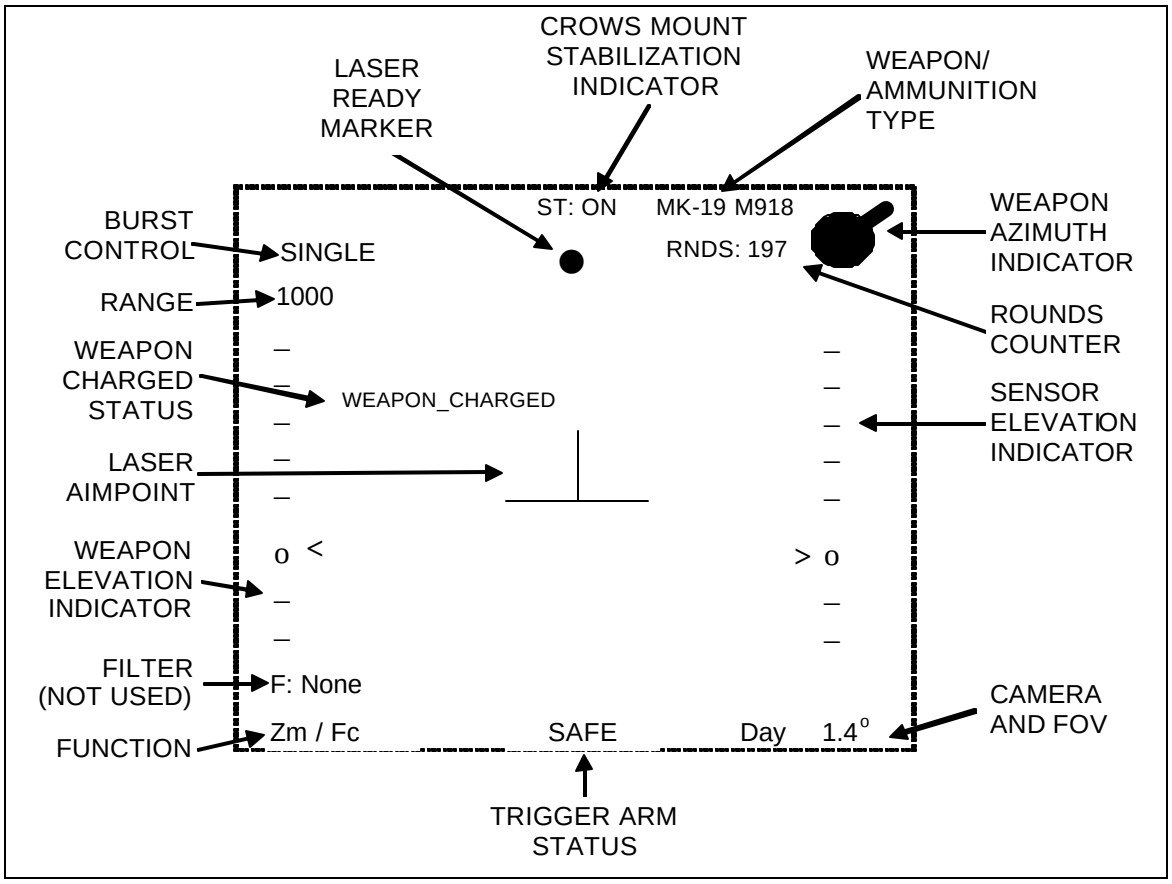


Figure 24. Typical Engagement Mode Screen

DIAGNOSTIC TEST PROCEDURES SET-UP

Azimuth Lock Assembly

For information on locking and unlocking the azimuth lock, refer to WP 0013 00.

WARNING

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

CAUTION

Prior to operation, ensure that all connectors are properly connected or covered (if not in use). Failure to do so may result in equipment damage.

See Figures 2 and 25 of this work package for Test Set (Computer) and diagnostic cable set-up.

Test Set (Computer) Set-Up

Use the following procedure to set-up the Test Set (Computer) and diagnostic cable, as shown in Figure 2.

1. Connect the diagnostic cable to the test port on the item to be tested (sensor unit, EMU, ICU, or display).
2. Connect the nine-pin serial connector on the diagnostic cable to the serial port of the Test Set (Computer).
3. Turn on the Test Set (Computer).
4. Double click on the Terra Term Pro icon to open the software.
5. In the New Connection dialog box, select the Serial Port option. Next, select the COM port number that matches the COM port into which you are plugged. Press OK.

NOTE

Because the COM port number varies per computer set-up, COM VT items appear with the phrase "~~No.~~" Whenever "COM ~~No.~~ VT" appears, verify that the COM port number matches the port into which you are plugged.

6. The COM ~~No.~~ VT dialog box will then appear. Verify that the COM port number on the dialog box matches the port into which you are plugged.
7. Create a log to track maintenance actions and send information to depot, if necessary.
   a. Go to the File menu.
   b. Select Log from the pull-down menu.

c. Name the new log and save it in the designated folder.

d. In the Terra Term Log dialog box, select Open to start the log.

e. Verify the Terra Term Log icon is displayed on the control bar.

If possible, the EMU Level 2 Test (Table 6, Task 7) should be running continuously.

8. You are now ready to view the diagnostic log for the sensor unit, ICU, or display, as well as the EMU Level #1 test. The COM ~~No.~~ VT dialog box is showing.

If you need to perform the EMU Level #2 test, use the following procedure.

NOTE

When the system is powered on, the diagnostic input from the item being tested should be displayed on the screen.

f. When performing EMU Level #2 test, choose the control bar, then select the Set-Up option.

g. Scroll down and select the Serial Port option, opening up the Serial Port Set-Up dialog box.

h. Verify the following six settings:

- ~~Port~~ equals port number currently plugged into
- ~~Baud~~ rate equals ~~115200~~
- ~~Data~~ equals ~~8-bit~~
- ~~Parity~~ equals ~~none~~
- ~~Stop~~ equals ~~1 bit~~
- ~~Flow control~~ equals ~~none~~

i. Press OK. You are now ready to view the diagnostic log for the EMU Level #2.

9. Turn CROWS on; wait 30 seconds for system boot-up.

DIAGNOSTIC TEST PROCEDURES

Table 6 presents a list of diagnostic tests together with data output from the Test Set (Computer), when applicable.

Explanation of Columns in Table 6, Diagnostic Test Procedures

Column (1) Task. This column lists key CROWS performance functions or components/assemblies to be inspected, tested, and repaired/replaced.

Column (2) Problem. This column details possible problem together with references supporting the steps.

Column (3) Procedure. This column specifies diagnostic action.

Column (4) Maintenance Action. This column specifies what to look for in the diagnostic printout.

WARNING

Follow all safety warnings and cautions when handling equipment.

Set the CROWS main power switch to the OFF position and ensure that all system motion has completely stopped before performing 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.

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

NOTE

When a fault is determined, record the information on DA Form 2404 or DA Form 5988-E and submit the form to THE NEXT HIGHER maintenance.

For preventive maintenance (PM) information, refer to CROWS Operator's Manual, TM 9-1090-218-10, WP 0004, Preventive Maintenance Overview, and WP 0005, Preventive Maintenance Checks and Services.

For additional information, refer to WP 0012, Unit Maintenance Troubleshooting Procedures.

For specific weapon operation and maintenance manuals, refer to WP 0053, References.

For replacement of Control Group components, including external cables, refer to the Vehicle Integration Kit (VIK), WP 0060.

For replacement of Sensor Group components, refer to WP 0020.

For item details, refer to WP 0065, Schematic Diagrams, or WP 0066, Wiring Diagrams.

Test Set (Computer) Diagnostic Log Test Readout

Tests performed on the sensor unit, EMU, ICU, and display use the Test Set (Computer) and diagnostic cable set-up; see Table 1 and Figures 2 and 25.



J7, Back Side of ICU



J3, Back Side of EMU



J2, Back Side of Display Unit



J2, Back Side of Sensor Unit

Figure 25. Location of Test Connections

In Table 6, any task performed that uses the Test Set (Computer) and diagnostic cable includes a **Diagnostic Log Test Readout** showing the messages that should appear on screen during testing. A **Descriptions and Procedures** column is also included that provides additional information and instructions.

NOTE

When using the screen messages on the display, refer to the following list of terms and their equivalents as needed.

Day camera: daylight video camera or day sensor

Night camera: thermal sensor, thermal imager, or night sensor

Laser rangefinder: eyesafe laser rangefinder or ELRF

Cant EL: cant and elevation sensor

Gimbal: mount, SWM, stabilized weapon mount, or (on occasion) pedestal

NOTE

The tasks in Table 6 do not need to be performed sequentially.

Table 6. Diagnostic Test Procedures

(1) Task	(2) Problem	(3) Procedure	(4) Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage. **CAUTION** In the tasks in this table, the step "test cables" refers to the following procedure. Failure to follow this procedure may result in equipment damage. 1. Test the cable(s) individually in the order listed. 2. Check the system after each replacement: **NOTE** Refer to Table 3 for a listing of the cables and their part numbers (PNs). Test items in the order listed. Visually inspect all components before booting up the CROWS system for testing.			
1 Cable Test	Refer to Figure 2, Interconnect Diagram A cable has failed according to Table 5, Unit Maintenance Functional Testing and Troubleshooting.	1. Inspect connectors for damage. 2. Perform testing per Table 5, Unit Maintenance Functional Testing and Troubleshooting, to verify the fault.	1. If connector damage was noted, repair or replace the connector or cable, per WP 0022. Send defective cable to next higher maintenance. 2. Perform a continuity check from pin to pin on the cable.

Table 6. Diagnostic Test Procedures – Cont.

(1) Task	(2) Problem	(3) Procedure	(4) Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.			
2 SPU Test	SPU has failed according to Table 5, Unit Maintenance Functional Testing and Troubleshooting.	1. Disconnect joystick and ICU from SPU and perform continuity check as indicated below, to verify fault.	1. If defective, send to next higher maintenance

From Connector	Pin:	To Connector	Pin:		Switch / Position	Reading C= Continuity NC=No Continuity
P1 (J1)	D	P1 (J1)	A		All Off	NC
P1 (J1)	D	P1 (J1)	B		All Off	NC
P1 (J1)	D	P1 (J1)	C		All Off	NC
P1 (J1)	D	P1 (J1)	A		Power On	C
P1 (J1)	D	P1 (J1)	B		Power On	C
P1 (J1)	D	P1 (J1)	C		Power On	C
P1 (J1)	D	P1 (J1)	V		Charger Safe	C
P1 (J1)	D	P1 (J1)	P		Charger Safe	NC
P1 (J1)	D	P1 (J1)	U		Safe Override	C
P1 (J1)	D	P1 (J1)	G		SGL Fire	NC
P1 (J1)	D	P1 (J1)	F		SGL Fire	NC
P1 (J1)	D	P1 (J1)	E		SGL Fire	NC
P1 (J1)	D	P1 (J1)	G		System Arm	C
P1 (J1)	D	P1 (J1)	F			C
P1 (J1)	D	P1 (J1)	E			C
P1 (J2)	H	P2 (J2)	1			C
P1 (J2)	J	P2 (J2)	2			C
P1 (J2)	K	P2 (J2)	3			C
P1 (J2)	L	P2 (J2)	4			C
P1 (J2)	M	P2 (J2)	8			C
P1 (J2)	N	P2 (J2)	7			C
P1 (J2)	S	P2 (J2)	9			C
P1 (J2)	R	P2 (J2)	10			

Table 6. Diagnostic Test Procedures – Cont.

(1) Task	(2) Problem	(3) Procedure	(4) Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.			
3 ICU and Joystick Test	ICU or joystick has failed according to Table 5, Unit Maintenance Functional Testing and Troubleshooting.	1. Turn power off. 2. Connect the Test Set (Computer) and diagnostic cable to the ICU and turn power on to view the diagnostic log.	1. If no **Diagnostic Log Test Readout** appears after the Test Set (Computer) is connected, check the circuit breaker and re-set if needed. Then re-run the test. 2. If the **Diagnostic Log Test Readout** shows an error, send to next higher maintenance.

NOTE

The information in the **Diagnostic Log Test Readout** column is a partial readout log as it appears on the display. The **Descriptions and Procedures** column provides additional information and the steps that need to be performed.

Diagnostic Log Test Readout – Task 3	Descriptions and Procedures – Task 3
	ICU Log @ 9600 baud
EOS FCS ICU 06692-01	Interface Control Unit diagnostics file Sign-on message. If the message does not appear, replace ICU.
Reading Joystick…….....Reading.. Joystick OK	If “Joystick OK” message does not appear, replace the joystick, referring to WP 0041 00.

Table 6. Diagnostic Test Procedures – Cont.

(1) Task	(2) Problem	(3) Procedure	(4) Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.			
4 Display Unit Test	Display unit has failed according to Table 5, Unit Maintenance Functional Testing and Troubleshooting.	1. Turn power off. 2. Connect the Test Set (Computer) and diagnostic cable to the display unit and turn power on to view the diagnostic log.	1. If no **Diagnostic Log Test Readout** appears after the Test Set (Computer) is connected, send display unit to next higher maintenance. 2. If diagnostic log appears, but the display is not lit, send display unit to next higher maintenance.

NOTE

The information in the **Diagnostic Log Test Readout** column is a partial readout log as it appears on the display. The **Descriptions and Procedures** column provides additional information and the steps that need to be performed.

Diagnostic Log Test Readout – Task 4	Descriptions and Procedures – Task 4
	Display Unit Log @ 9600 baud Display Unit Diagnostics messages
`Hello World`	Initial sign-on message. If message does not appear, send to next higher maintenance.
`Keypad UART`	Keypad UART configured
`Running RAM` `MMU Config`	Firmware Image executing from RAM
`MMU On` `LCD Config`	Memory Management Unit running
`LCD Enabled.`	Liquid Crystal Display (LCD) running. If display stops running before this message appears, send to next higher maintenance.
`NTSC`	Video format detected
`FPGAResync…. NTSC`	Video image resynchronisation required. If this message continuously appears or no picture is displayed, send to next higher maintenance.
`FPGA`	

Table 6. Diagnostic Test Procedures – Cont.

(1) Task	(2) Problem	(3) Procedure	(4) Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.			
5 Sensor Unit Test	Sensor unit has failed according to Table 5, Unit Maintenance Functional Testing and Troubleshooting.	1. Turn power off. 2. Connect the Test Set (Computer) and diagnostic cable to the sensor and turn power on to view the diagnostic port output.	1. If no **Diagnostic Log Test Readout** appears after the Test Set (Computer) is connected, send to next higher maintenance.

NOTE

The information in the **Diagnostic Log Test Readout** column is a partial readout log as it appears on the display. The **Descriptions and Procedures** column provides additional information and the steps that need to be performed.

Diagnostic Log Test Readout – Task 5	Descriptions and Procedures – Task 5
	Sensor Unit Log @ 9600 baud
`EOS FCS IOA 03346-05`	Input/output multiplex assembly starting. If this message does not appear, send to next higher maintenance.
`Volts (x1V) : 23 Curr (x.1A) : 00 Temp (C) : 39`	Status of power to sensor unit
`Starting FCS…`	Status of sensor unit. If failure message appears and readings are suspected to be erroneous, send to next higher maintenance.
`EOS FCS MUX PCA06020-01`	MUX starting. If this message does not appear, send to next higher maintenance.

`CDE VERSION: 07384-02`
`MUX: Powering Up Sensors`
`01`
`02`
`03`
`04`
`05`
`MUX: Sensors Powered Up`
	Starting sensors inside the sensor unit.

`MUX: Ready`	MUX operating
`Q07384-02`	*Report version*
`I` *`I`* *`I`*	Two pages of communication follows. If no communication occurs, send to next higher maintenance.

Table 6. Diagnostic Test Procedures – Cont.

(1) Task	(2) Problem	(3) Procedure	(4) Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.			
6 EMU Test Level 1	EMU has failed according to Table 5, Unit Maintenance Functional Testing and Troubleshooting.	1. Turn power off. 2. Connect the Test Set (Computer) and diagnostic cable to the EMU and turn power on to view the diagnostic port output.	1. If no **Diagnostic Log Test Readout** appears after the Test Set (Computer) is connected, send to next higher maintenance.

NOTE

The information in the **Diagnostic Log Test Readout** column is a partial readout log as it appears on the display. The **Descriptions and Procedures** column provides additional information and the steps that need to be performed.

Diagnostic Log Test Readout – Task 6	Descriptions and Procedures – Task 6
	EMU Log @ 9600 baud
`EOS FCS IOA 03346-04`	Sign-on message. If this message does not appear, send to next higher maintenance.
`Volts (x1V) : 28 Curr (x.1A) : 00 Temp (C) : 35` `Starting FCS…`	If failure message appears and the readings are suspected to be erroneous, send to next higher maintenance.

Table 6. Diagnostic Test Procedures – Cont.

(1) Task	(2) Problem	(3) Procedure	(4) Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.			
7 EMU Test Level 2	EMU has failed according to Table 5, Unit Maintenance Functional Testing and Troubleshooting.	1. Turn power off. 2. Connect the Test Set (Computer) and diagnostic cable to the EMU and set Serial Port Speed at 115200. Turn power on to view the diagnostic port output.	1. If no **Diagnostic Log Test Readout** appears after the Test Set (Computer) is connected, send to next higher maintenance.

NOTE

The information in the **Diagnostic Log Test Readout** column is a partial readout log as it appears on the display. The **Descriptions and Procedures** column provides additional information and the steps that need to be performed.

Diagnostic Log Test Readout – Task 7	Descriptions and Procedures – Task 7
	EMU LOG 2 @ 115200 baud
`FCS Second Stage Bootloader $Revision: 1.23 $`	If this message is not present, send to next higher maintenance.
	Several pages of text.

`18/11/2004 14:29:47.778 Event *** About to init C2 Service ***`
`18/11/2004 14:29:47.791 Event *** C2 Service Init complete ***`
`18/11/2004 14:29:47.795 Event >>>>>>>>>>>>> INIT COMPLETE <<<<<<<<<<<<<`
	If above message is not present, send to next higher maintenance.

Table 6. Diagnostic Test Procedures – Cont.

(1) Task	(2) Problem	(3) Procedure	(4) Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.			
8 Mount / Gimbal Test GIMBAL COMMS FAULT	The mount/gimbal has a communication fault within the pedestal / gimbal according to Table 5, Unit Maintenance Functional Testing and Troubleshooting.	1. Perform testing in Table 5, Unit Maintenance Functional Testing and Troubleshooting, to verify fault. 2. Review Detailed Fault description to isolate the Faulted component. 3. "GIMBAL COMMS FAULT" screen message.	1. If there is no power to any of the drives, send to next higher maintenance. 2. Remove the following items to prepare the mount for return to next higher maintenance. A. Sensor unit (WP 0020 00) B. Cradle (M2/Mk19) (WP 0024 00). C. Ammo can (CROWS Operator's Manual, TM 9-1090-218-10, (WP 0009 thru WP 0012) D. All cables (WP 0022 00, WP 0016 00, WP 0020 00, WP 0021 00)

Table 6. Diagnostic Test Procedures – Cont.

(1) Task	(2) Problem	(3) Procedure	(4) Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.			
9 Mount / Gimbal Test Weapon Elevation Drive Resolver Fault	The mount/gimbal has a weapon elevation drive fault according to Table 5, Unit Maintenance Functional Testing and Troubleshooting.	1. Perform testing in Table 5, Unit Maintenance Functional Testing and Troubleshooting, to verify fault. 2. Review Detailed Fault description to isolate the Faulted component. 3. "WEAPON EL DRIVE FAULT" screen message.	1. Return to next higher maintenance. 2. Remove the following items to prepare the mount for return to next higher maintenance. A. Sensor unit (WP 0020 00) B. Cradle (M2/Mk19) (WP 0024 00). C. Ammo can (CROWS Operator's Manual, TM 9-1090-218-10, (WP 0009 thru WP 0012) D. All cables (WP 0022 00, WP 0016 00, WP 0020 00, WP 0021 00)

Table 6. Diagnostic Test Procedures – Cont.

(1) Task	(2) Problem	(3) Procedure	(4) Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.			
10 Mount / Gimbal Test Sight Elevation Drive Assembly Fault	The mount/gimbal has a sight elevation drive fault according to Table 5, Unit Maintenance Functional Testing and Troubleshooting.	1. Perform testing in Table 5, Unit Maintenance Functional Testing and Troubleshooting, to verify fault. 2. Review Detailed Fault description to isolate the Faulted component. 3. "SIGHT EL DRIVE FAULT" screen message.	1. Return to next higher maintenance. 2. Remove the following items to prepare the mount for return to next higher maintenance. A. Sensor unit (WP 0020 00) B. Cradle (M2/Mk19) (WP 0024 00). C. Ammo can (CROWS Operator's Manual, TM 9-1090-218-10, (WP 0009 thru WP 0012) D. All cables (WP 0022 00, WP 0016 00, WP 0020 00, WP 0021 00)

Table 6. Diagnostic Test Procedures – Cont.

(1) Task	(2) Problem	(3) Procedure	(4) Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.			
11 Mount / Gimbal Test Azimuth Drive Fault	The mount/gimbal has an azimuth drive fault according to Table 5, Unit Maintenance Functional Testing and Troubleshooting.	1. Perform testing in Table 5, Unit Maintenance Functional Testing and Troubleshooting, to verify fault. 2. Review Detailed Fault description to isolate the Faulted component. 3. "AZIMUTH DRIVE FAULT" screen message.	1. Return to next higher maintenance. 2. Remove the following items to prepare the mount for return to next higher maintenance. A. Sensor unit (WP 0020 00) B. Cradle (M2/Mk19) (WP 0024 00). C. Ammo can (CROWS Operator's Manual, TM 9-1090-218-10, (WP 0009 thru WP 0012) D. All cables (WP 0022 00, WP 0016 00, WP 0020 00, WP 0021 00)

Table 6. Diagnostic Test Procedures – Cont.

(1) Task	(2) Problem	(3) Procedure	(4) Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.			
12 Mount / Gimbal Test Linear Actuator (Charger) Test	The mount/gimbal has a linear actuator (charger) fault according to Table 5, Unit Maintenance Functional Testing and Troubleshooting, but the fault is due to something other than the linear actuator (charger).	1. Perform testing in Table 5, Unit Maintenance Functional Testing and Troubleshooting, to verify fault. 2. Review Detailed Fault description to isolate the Faulted component. 3. "CHARGER FAULT" screen message.	1. Return to next higher maintenance. 2. Remove the following items to prepare the mount for return to next higher maintenance. A. Sensor unit (WP 0020 00) B. Cradle (M2/Mk19) (WP 0024 00). C. Ammo can (CROWS Operator's Manual, TM 9-1090-218-10, (WP 0009 thru WP 0012) D. All cables (WP 0022 00, WP 0016 00, WP 0020 00, WP 0021 00)

Table 6. Diagnostic Test Procedures – Cont.

(1) Task	(2) Problem	(3) Procedure	(4) Maintenance Action
WARNING Ensure that power is OFF before installing any equipment. Failure to do so may result in personal injury and equipment damage.			
13 Mount / Gimbal Test Gyro Test	The mount/gimbal has a fiber optic gyro (FOG) fault according to Table 5, Unit Maintenance Functional Testing and Troubleshooting.	1. Perform testing in Table 5, Unit Maintenance Functional Testing and Troubleshooting, to verify fault. 2. Review Detailed Fault description to isolate the Faulted component. 3. "GIMBAL AZIMUTH GYRO" or "GIMBAL ELEVATION GYRO" screen messages.	1. Return to next higher maintenance. 2. Remove the following items to prepare the mount for return to next higher maintenance. A. Sensor unit (WP 0020 00) B. Cradle (M2/Mk19) (WP 0024 00). C. Ammo can (CROWS Operator's Manual, TM 9-1090-218-10, (WP 0009 thru WP 0012) D. All cables (WP 0022 00, WP 0016 00, WP 0020 00, WP 0021 00)

END OF WORK PACKAGE

CHAPTER 4

UNIT MAINTENANCE

INSTRUCTIONS

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

This work package contains preventive maintenance checks and service procedures performed on CROWS at the unit and direct support maintenance level.

WP CONTENTS

Section/Subsection	Page
Initial Set Up	2
General Maintenance Information	3
Preventive Maintenance Overview	3
Inspection - Cables/Wiring Harneses	3
Considerations Before and During Disassembly	4
List of "Do Not" Items	4
Preventive Maintenance Checks and Services (PMCS)	5
General Procedures	5
Designated Intervals	5
Trouble Spots	5
Not Ready/Available	6
Correct Assembly or Stowing	6

INITIAL SET UP

Refer to Table 1 for tools/special tools, materials, and references needed to perform preventive maintenance on CROWS components/assemblies.

NOTE

For additional information on expendable and durable materials, refer to WP 0056.

Should any malfunction occur, refer to WP 0012, Unit Maintenance Troubleshooting Procedures.

Table 1. Initial Setup Information

Category	Item	Additional Information
Tools	Unit Tool Kit	WP 0055, Table 2, Item 4
	GMTK	WP 0055, Table 2, Item 8
Special Tools	N/A	
Personnel Required	Two	63B
Materials/Parts	Alcohol, ethyl	WP 0056, Table 1, Item 2
	Alcohol, isopropyl	WP 0056, Table 1, Item 3
	Brush, artist's	WP 0056, Table 1, Item 5
	Cleaning compound, lens	WP 0056, Table 1, Item 7
	Cloth, cleaning, lint-free	WP 0056, Table 1, Item 8
	Cotton, balls	WP 0056, Table 1, Item 17
	Detergent	WP 0056, Table 1, Item 19
	Dust remover, compressed air	WP 0056, Table 1, Item 21
	Grease, lubricant	WP 0056, Table 1, Item 26
	Water, distilled	WP 0056, Table 1, Item 31
References	TM 9-1090-218-10	CROWS Operator's Manual
	DA PAM 738-750	The Army Maintenance Management System (TAMMS) Users Manual

GENERAL MAINTENANCE INFORMATION

A permanent record of the services, repairs, and modifications made to this system must be recorded in accordance with ARMY SOP. Refer to DA PAM 738-750, The Army Maintenance Management System (TAMMS) Users Manual, for a list of the forms and records required and how to complete them.

PREVENTIVE MAINTENANCE OVERVIEW

NOTE

Removal and replacement of a CROWS assembly/component is permitted if the operator/crew discovers a problem after obvious visual inspection or are directed to perform the task by unit or direct support maintenance personnel.

For unit-level general maintenance procedures, such as cleaning, lubrication, safety-wiring, thread-locking, and corrosion prevention and control (CPC), refer to the work packages in Chapter, 2, General Maintenance.

Preventive maintenance consists of visual inspections for physical damage and cleanliness, and procedures to correct any faults found after those inspections. Preventive maintenance prolongs service and contributes to continued, uninterrupted operation of CROWS and its components or related parts.

Inspection – Cables/Wiring Harnesses

NOTE

Always keep cables clean and in serviceable condition. Should a tear or cut be discovered, tape the area in accordance with standard Army procedures.

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 direct support (DS) maintenance for the following reasons:
   - Bent, broken, or missing pins or sockets.
   - Damaged threads on connector or back shell.
3. If necessary to replace, send cables directly to depot.

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 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 0053, 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.
- For information on mandatory replacement parts – including spring (tension) washers, star washers and Nord-lock washers – that need to be replaced whenever components are disassembled, as well as parts that can be reused unless damaged – including seals and gaskets – refer to WP 0058.
- Inspect Maintenance Significant Items (MSI) required for operation of the CROWS but that do not require disassembly, including attaching hardware (e.g., screws, nuts, bolts, spacers) and switches/buttons.

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 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 screen. While this status bar is displayed, **do not turn power OFF** and **do not touch** any of the switches.

PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

WARNING

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

General Procedures

1. For troubleshooting malfunctions, refer to WP 0012, Unit Troubleshooting Procedures.
2. Use DA Form 2404 or DA Form 5988-E (electronic) and report malfunctions to DS maintenance at once.
3. Use CROWS Operator's Manual, TM 9-1090-218-10, WP 0027, Basic Issue Items, specific to CROWS when performing PMCS.
4. Refer to appropriate TMs for PMCS requirements on weapon systems being used, as listed in WP 0053, References.

Designated Intervals

Designated PMCS intervals are performed under usual operating conditions. PMCS intervals must be performed more frequently when operating under unusual conditions.

In general, return the linear actuators (chargers) -- part of the weapon adapter kits – to DS maintenance for inspection on a 365-day interval. Linear actuators (chargers) that are exposed to temperatures exceeding 100°F on a consistent basis should be returned to DS maintenance every 30 days for inspection. For DS-level maintenance for the linear actuators (chargers), refer to the following work packages: WP 0046, M2; WP 0047, Mk19; WP 0048, M240; and WP 0049, M249.

Trouble Spots

NOTE

Dirt, grease, oil, and debris may cover up a serious problem. Clean as you check. For cleaning procedures, refer to WP 0004, Cleaning.

1. Check all bolts, nuts, and screws. If loose, bent, broken, or missing, either tighten or report conditions to unit maintenance.
2. 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.
3. Ensure connectors are tightly connected to specific LRU. Inspect electrical wires and connectors for cracked or broken insulation. Also look for bare wires and loose or broken connections. Report other problems to DS maintenance.
4. Check data, caution, and warning plates for security and legibility.

Not Ready/Available

If a system or subsystem is not able to perform the mission, equipment will be reported as “Not Ready/Available.” Refer to DA PAM 738-750.

Correct Assembly or Stowing

Check each component for installation as an assembly, ensuring that it is in the right place with no missing parts.

NOTE

For weapon procedures, refer to the specific weapon operation and maintenance manuals as listed in WP 0053, References.

For additional information about PMCS, refer to CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services.

If the CROWS is in extended storage on a vehicle, perform PMCS on a monthly basis.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

SERVICE UPON RECEIPT

SERVICE UPON RECEIPT OF MATERIEL

For inspections to be performed on incoming items and before release of an item to operator/crew, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services.

NOTE

Refer to WP 0002, Equipment Description and Data, Table 1, CROWS Components and Nomenclature, for a list of assemblies/components shipped as the CROWS.

For instructions on unpacking and checking equipment, refer to WP 0059.

For mounting/installation of the CROWS onto a vehicle, including the Control Group with cables, refer to WP 0060 for the Vehicle Integration Kit (VIK).

STANDARD PROCEDURES

Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on SF 361, Transportation Discrepancy Report.

NOTE

For a list of assemblies/components shipped as the CROWS, refer to WP 0002, Equipment Description and Data, in Table 1, CROWS Components and Nomenclature.

1. Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with applicable service instructions (e.g., for Army instructions, see DA PAM 738-750) in SF 368, Product Quality Deficiency Report.

2. Check to see whether the equipment has been modified and report all such modifications. Refer to the CROWS Operator's Manual, TM 9-1090-218-10, and the Repair Parts and Special Tools List (RPSTL), Chapter 9, of this manual.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT MAINTENANCE: STABILIZED WEAPON MOUNT (SWM)

This work package contains information about performing unit-level maintenance tasks on the stabilized weapon mount (SWM), including inspection, testing, repair, disassembly, reassembly, adjustment, and retest.

WP CONTENTS

Section/Subsection	Page
Initial Set Up	2
Maintenance Overview	3
Inspect	4
Test	4
Repair	5
Disassembly of the SWM	5
Considerations Before and During Disassembly	5
Removal of the Weapon Elevation Cable	6
Removal of the Casing Deflector	7
Removal of the Ammo Yoke Arm and Ammo Hanger Assembly	10
Removal of the Elevation Yoke Arm Assembly	11
Reassembly of the SWM	13
Installation of the Elevation Yoke Arm Assembly	13
Installation of the Ammo Yoke Arm Assembly and Ammo Hanger Assembly	13
Installation of the Casing Deflector	15
Installation of the Weapon Elevation Cable	17
Adjustment	17
Retest after Reassembly	17

INITIAL SET UP

Refer to Table 1 for tools, special tools, personnel required, materials, and references needed to inspect, test, remove, repair, and replace the SWM.

NOTE

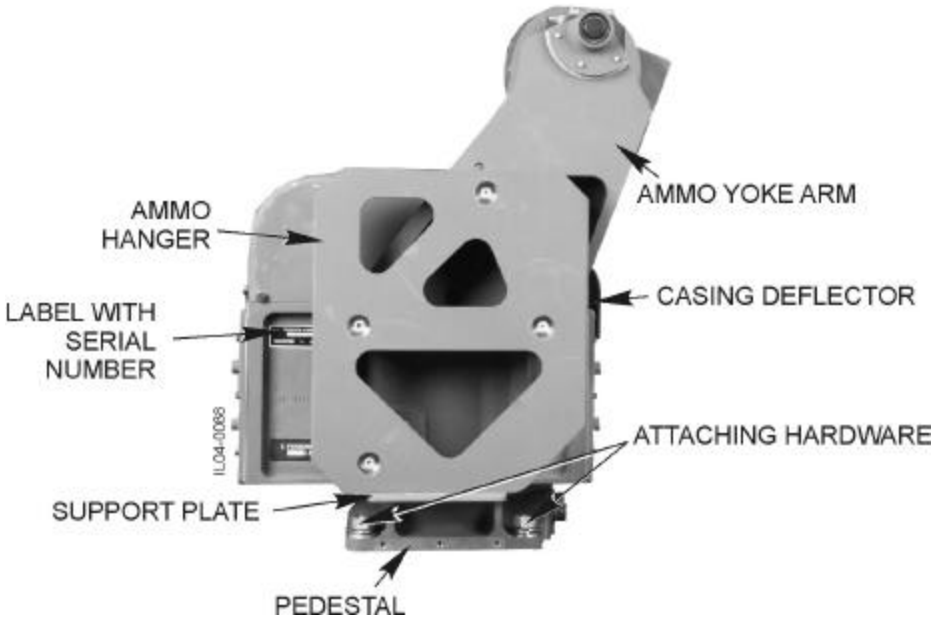
Should a malfunction occur, refer to WP 0012, Unit Maintenance Troubleshooting Procedures.

Table 1. Initial Setup Information

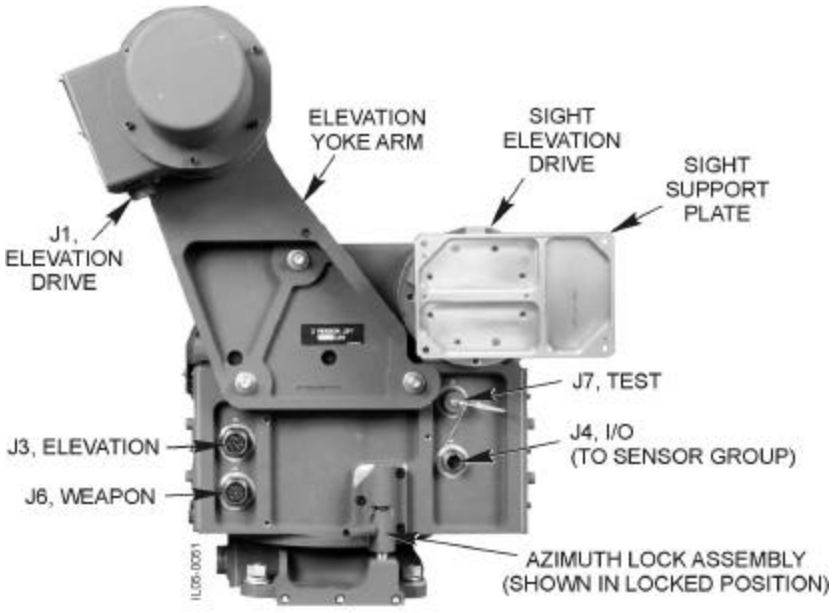
Category	Item	Additional Information
Tools	Unit Tool Kit	WP 0055, Table 2, Item 4
	GMTK	WP 0055, Table 2, Item 8
Special Tools	N/A	
Personnel Required	Two	63B
Materials/Parts	N/A	
References	TM 9-1090-218-10	CROWS Operator's Manual

MAINTENANCE OVERVIEW

These instructions cover the inspection, test, removal, repair, and replacement of the SWM, shown in Figure 1.



Mount – Ammo Yoke Arm Side



Mount – Elevation Yoke Arm Side

Figure 1. CROWS SWM

NOTE

For unit-level general maintenance procedures, such as cleaning, lubrication, safety-wiring, thread-locking, and corrosion prevention and control (CPC), refer to the work packages in Chapter, 2, General Maintenance.

The standard tasks to be completed for Unit Maintenance include Inspect, Test, Remove, Repair, and Replace. Remove and Replace activities include preparation, removal, and replacement of LRUs, and forwarding items with a job order to direct support (DS) maintenance as needed.

The Unit Maintenance tasks listed above are to be performed on the SWM components in Table 2.

NOTE

For removal of weapon adapter kits, refer to CROWS Operator's Manual, TM 9-1090-218-10, in WP 0009, M2; WP 0010, Mk19; WP 0011, M240; and WP 0012, M249.

For removal of the cradles, refer to CROWS Operator's Manual, TM 9-1090-218-10, in WP 0009 or WP 0010 for the M2/Mk19 cradle; and in WP 0011 or WP 0012 for M240/M249 cradle.

For removal of ballistic protection kit (armor) components, refer to WP 0030 of this manual.

For removal of Sensor Group components, refer to WP 0020 of this manual.

For removal of the interconnection cables (part of the Control Group), refer to WP 0022 or the Vehicle Integration Kit (VIK), WP 0060, of this manual.

Table 2. SWM Components

Description
Plate, Identification
Pedestal Assembly
Cable Assembly, Weapon Elevation
Casing Deflector
Yoke Arm Assembly – Ammo
Ammo Hanger Assembly
Yoke Arm Assembly – Elevation

INSPECT

Perform a visual inspection in accordance with CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services.

TEST

1. Connect the SWM to an available, fully functional Sensor Group and Control Group.
2. Perform testing IAW WP 0013, Unit Maintenance Functional Testing and Troubleshooting.

REPAIR

Repair of the SWM is accomplished by removal and replacement of the components listed in Table 2 that have been determined to be defective.

DISASSEMBLY OF THE SWM

Perform the following procedures to disassemble the SWM.

NOTE

When lifting the mount using a hoist or other lifting device, refer to the strap procedures in the VIK, WP 0060.

Equipment Conditions. The following components, with related work packages listed, need to be removed.

The mount is removed from the vehicle and detached from the Control Group components, including interconnection cables; refer to WP 0060 thru WP 0063 of this manual.

Sensor Group, including mount to sensor cable, is detached from mount; refer to WP 0020 of this manual.

The weapon, weapon adapter kit (WAK), cradle, and ammo can are removed; refer to CROWS Operator's Manual, TM 9-1090-218-10: WP 0009, M2; WP 0010, Mk19; WP 0011, M240; and WP 0012, M249.

CAUTION

Ensure that all hex head wrenches are fully inserted into the bolts to avoid stripping socket heads.

Ensure that painted surfaces are not damaged. For additional information, refer to WP 0008, Corrosion Prevention and Control (CPC) Instructions.

Failure to follow these instructions may result in equipment damage.

NOTE

Disassemble only to the extent necessary to determine defective condition and accomplish essential repairs necessary to produce a serviceable end item.

Refer to ID plate for serial number and other information.

Retain assemblies, components, and parts for later use or examination.

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 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 0053, 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.
- For information on mandatory replacement parts – including spring (tension) washers, star washers and Nord-lock washer sets – that need to be replaced whenever components are disassembled, as well as parts that can be reused unless damaged – including seals and gaskets – refer to WP 0058.
- Inspect Maintenance Significant Items (MSI) required for operation of the CROWS but that do not require disassembly, including attaching hardware (e.g., screws, nuts, bolts, spacers) and switches/buttons.

Removal of the Weapon Elevation Cable

Use the following procedures to remove the weapon elevation cable from the mount.

NOTE

For additional information about the azimuth lock, refer to WP 0013.

1. Ensure azimuth lock is in the locked position, referring to Figure 1.

NOTE

Refer to WP 0022 for further instructions about the cable assembly.

2. After removing cable ties, disconnect the weapon elevation cable from connector J1, elevation drive, and J3, elevation. Refer to the bottom illustration in Figure 1 for the location of these connectors.

Removal of the Casing Deflector

Use the following procedures to remove the casing deflector from the mount.

NOTE

For additional information about the azimuth lock, refer to WP 0013.

1. Ensure azimuth lock is in the locked position.

NOTE

Each Nord-lock washer is a set of two washers (Figure 2).

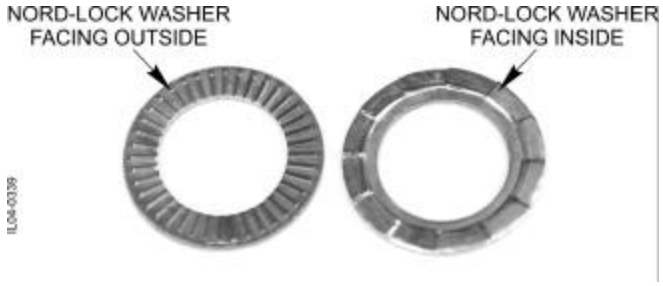


Figure 2. Nord-Lock Washer Set

2. Remove the two bolts and Nord-lock washer sets securing the casing deflector to the azimuth housing assembly of the pedestal, using a 7/16-inch socket wrench, as shown in Figure 3. The casing deflector will still be held in place by retaining screws in the yoke arms.

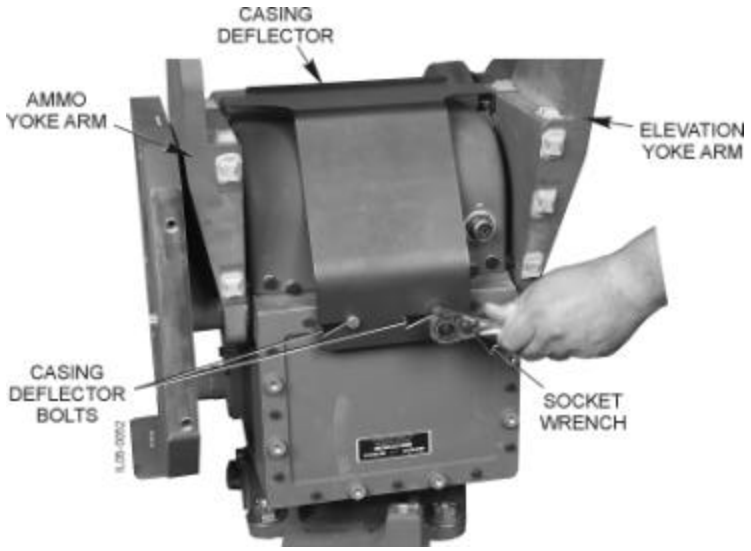


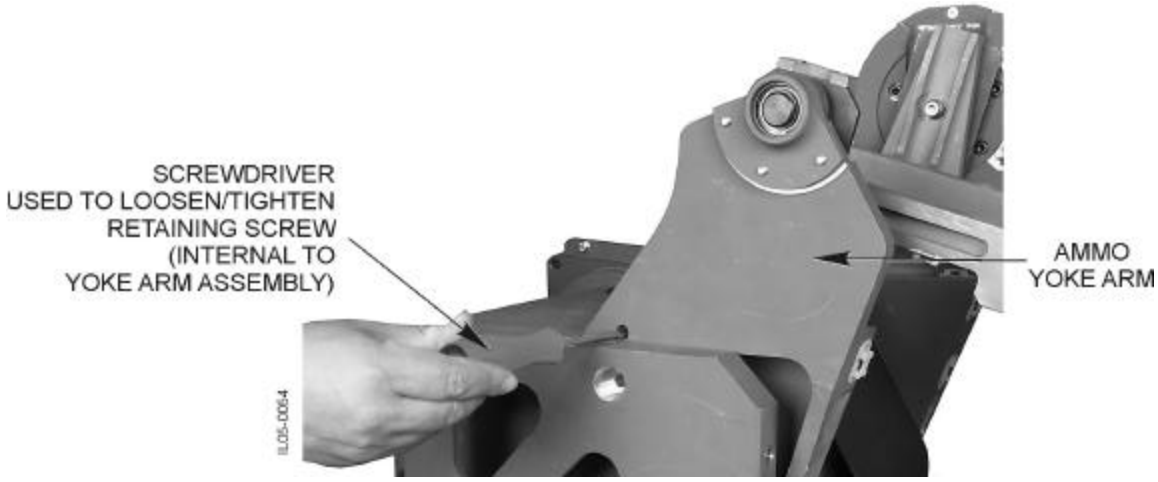
Figure 3. Removing Attaching Hardware Holding Casing Deflector

NOTE

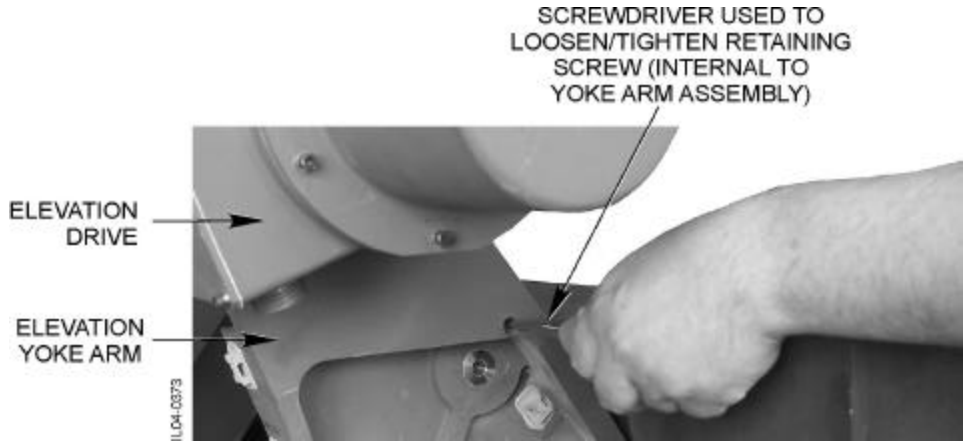
Retaining (or captive) screws remain internally in the yoke arms and are not removed.

If necessary, reach under the casing deflector and push the retaining screw into the yoke arm until the casing deflector can be removed.

3. Loosen the retaining (captive) screws in the yoke arms that hold the casing deflector to the yoke arms, using a 1/4-inch flat screwdriver, referring to Figures 4 and 5. If necessary, reach under the casing deflector and push the retaining screw into the yoke arm until the casing deflector can be removed.



Ammo Yoke Arm Side



Elevation Yoke Arm Side

Figure 4. Retaining Screws in Ammo Yoke Arm and Elevation Yoke Arm

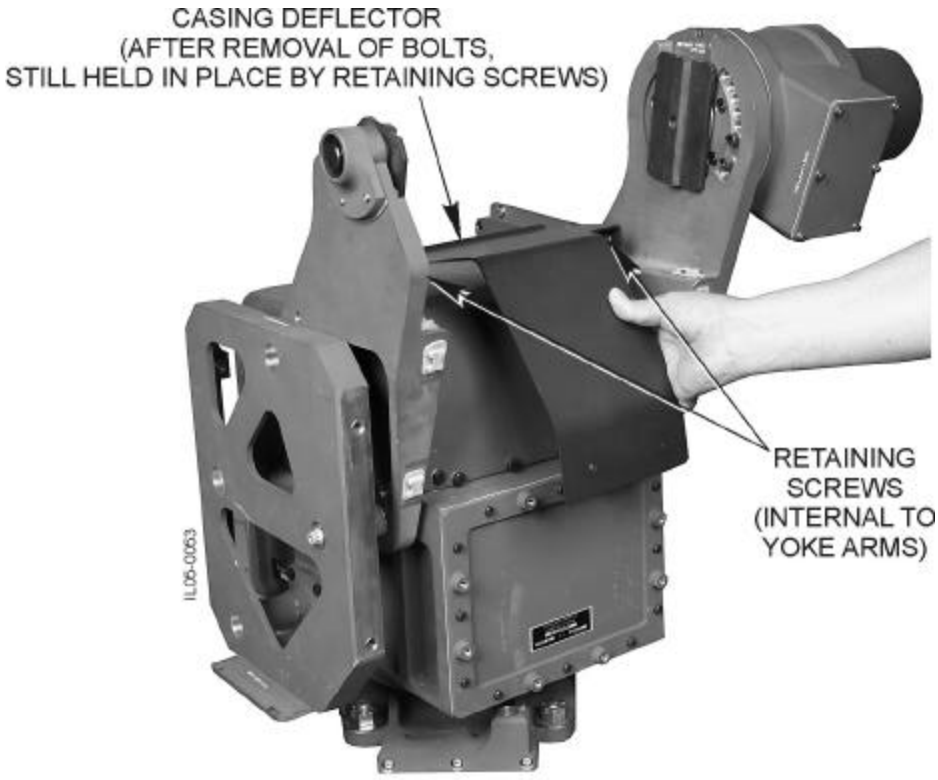


Figure 5. Casing Deflector Held By Retaining Screws Only

4. Remove the casing deflector from the pedestal, as shown in Figure 6.



Figure 6. Removal of Casing Deflector

Removal of the Ammo Yoke Arm Assembly and Ammo Hanger Assembly

Use the following procedure to remove the ammo yoke arm assembly, with ammo hanger, from the mount.

WARNING

Support each yoke arm during disassembly/assembly.

Use two personnel during assembly and disassembly.

Once the bolts are removed in step 2, you have two heavy items that are not connected to each other. Support both the ammo hanger and the ammo yoke arm during disassembly and assembly.

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

NOTE

For additional information about the azimuth lock, refer to WP 0013.

1. Ensure azimuth lock is in the locked position.

NOTE

Remove the top bolt last.

2. Loosen and remove three steel tension bolts, one steel tension (short) bolt, and four Nord-lock washer sets securing the ammo hanger assembly to the ammo yoke arm and the ammo yoke arm to the pedestal, using a 7/16-inch socket wrench, as shown in Figure 7.

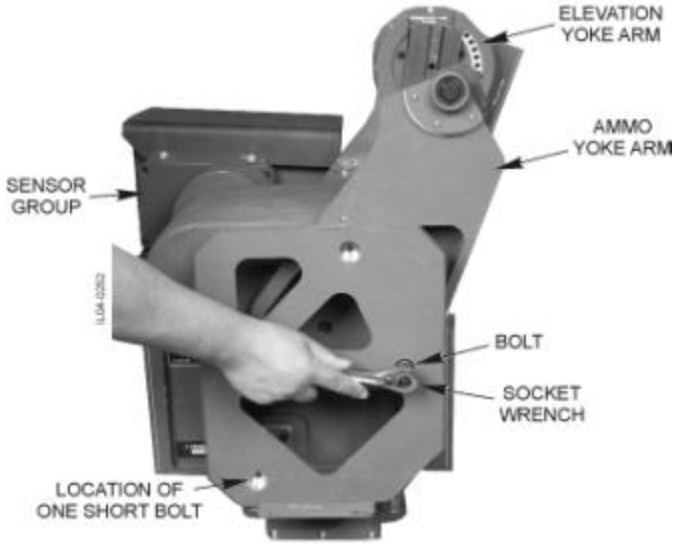


Figure 7. Removing Bolts from Ammo Hanger and Ammo Yoke Arm

3. Using the second person, remove the ammo hanger assembly and set on a stable work surface.

NOTE

For further ammo yoke arm disassembly instructions, refer to WP 0019.

4. Remove the ammo yoke arm from the mount and set on a stable work surface.
5. Retain the hardware for later use.

Removal of the Elevation Yoke Arm Assembly

Use the following procedures to remove the elevation yoke arm assembly from the mount.

WARNING

Support each yoke arm during disassembly/assembly.

Use two personnel during removal/installation of the elevation yoke arm assembly because it is very heavy.

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

NOTE

For additional information about the azimuth lock, refer to WP 0013.

1. Ensure azimuth lock is in the locked position.
2. Loosen and remove three steel tension bolts, Nord-lock washer sets, and thick washers securing the elevation yoke arm, as shown in Figure 8, using a 7/16-inch socket wrench. Retain the hardware for later use.

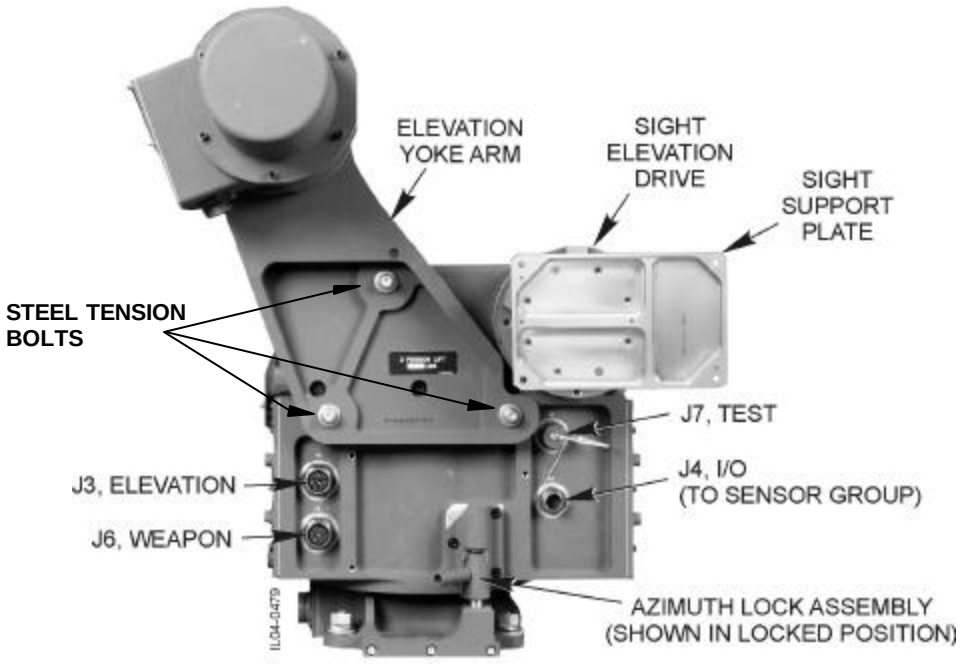
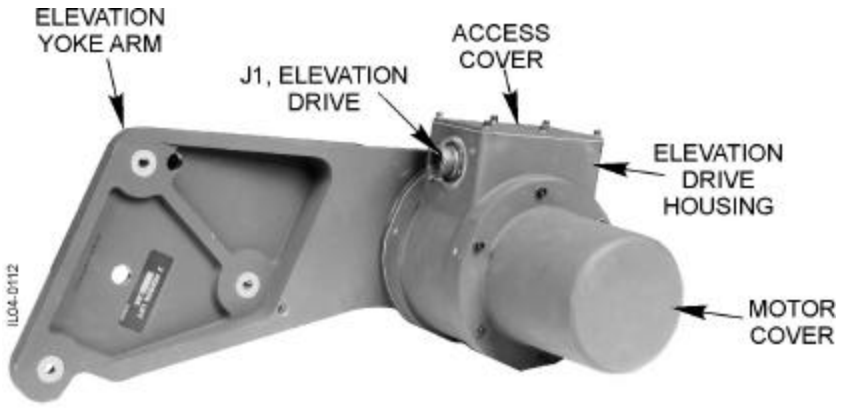


Figure 8. Elevation Yoke Arm and Three Securing Bolts

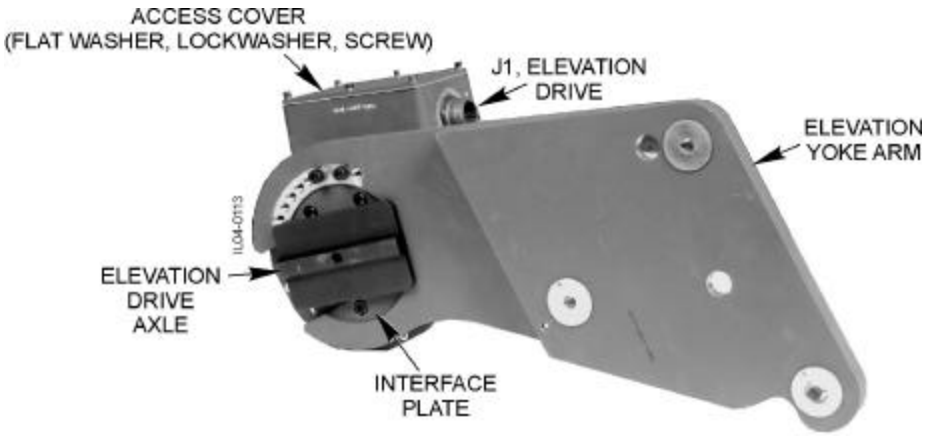
NOTE

Refer to WP 0018 for further instructions about the elevation yoke arm.

3. Carefully remove the elevation yoke arm, as shown in Figure 9, and place it on a stable work surface.



Side Away from the Cradle



Side Facing the Cradle

Figure 9. Elevation Yoke Arm Removed

NOTE

For further instructions about the pedestal assembly, refer to WP 0017.

4. The pedestal assembly remains. Refer to WP 0017 for further disassembly instructions.

REASSEMBLY OF THE SWM

Perform the following procedures to reassemble the SWM.

Installation of the Elevation Yoke Arm Assembly

Use the following procedures to install the elevation yoke arm assembly on the mount, referring to Figure 9.

CAUTION

Support each yoke arm during disassembly/assembly.

Use two personnel during removal/installation of the elevation yoke arm assembly because it is very heavy.

Failure to follow these instructions may result in equipment damage.

NOTE

For additional information about the azimuth lock, refer to WP 0013.

1. Ensure azimuth lock is in the locked position.
2. Carefully position the elevation yoke arm, as shown in Figure 8, to the pedestal.
3. Insert and tighten three steel tension bolts, Nord-lock washer sets, and thick washers to secure the elevation yoke arm to the mount, as shown in Figure 8, using a 7/16-inch socket wrench. Torque to 81.6 ± 3 in. lb.

Installation of the Ammo Yoke Arm and Ammo Hanger Assembly

Use the following procedure to install the ammo yoke arm assembly, with ammo hanger assembly, to the mount, referring to Figure 10.

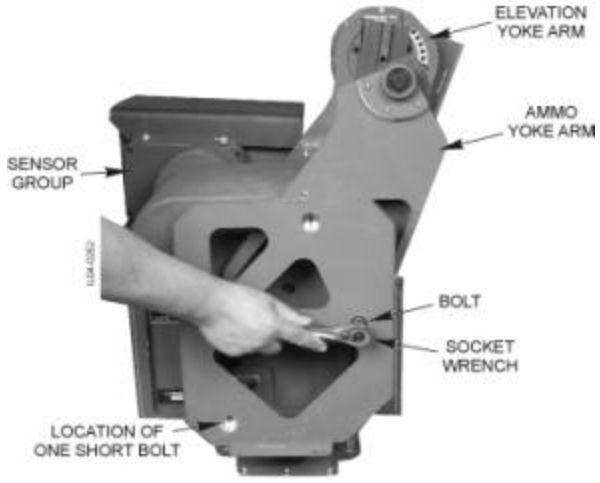


Figure 10. Attaching Bolts for Ammo Hanger and Ammo Yoke Arm

WARNING

Support each yoke arm during disassembly/assembly.

Use two personnel during assembly and disassembly.

The ammo hanger assembly and the ammo yoke arm are heavy items that are not connected to each other. Support both the ammo hanger and the ammo yoke arm during disassembly and assembly.

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

NOTE

For additional information about the azimuth lock, refer to WP 0013.

1. Ensure azimuth lock is in the locked position.
2. Position the ammo yoke arm to the pedestal.
3. Using the second person, position the ammo hanger assembly onto the ammo yoke arm.

NOTE

Secure the top bolt first.

4. Insert the top bolt and Nord-lock washer set, and tighten.
5. Insert and tighten the two remaining steel tension bolts, one steel tension (short) bolt, and three Nord-lock washer sets to secure the ammo hanger assembly to the ammo yoke arm and the ammo yoke arm to the pedestal, using a 7/16-inch socket wrench, as shown in Figure 10. Torque to 81.6 $\pm$ 3 in. lb.

Installation of the Casing Deflector

Use the following procedures to install the casing deflector onto the mount.

NOTE

For additional information about the azimuth lock, refer to WP 0013.

1. Ensure azimuth lock is in the locked position.
2. Position the casing deflector to the pedestal, as shown in Figure 11.



Figure 11. Installation of Casing Deflector

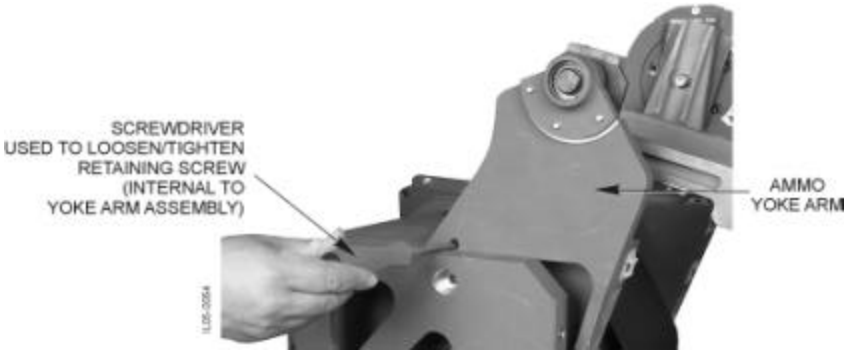
3. Loosen the three bolts holding the elevation yoke arm to the pedestal until the casing deflector is properly positioned, referring to Figure 8.

NOTE

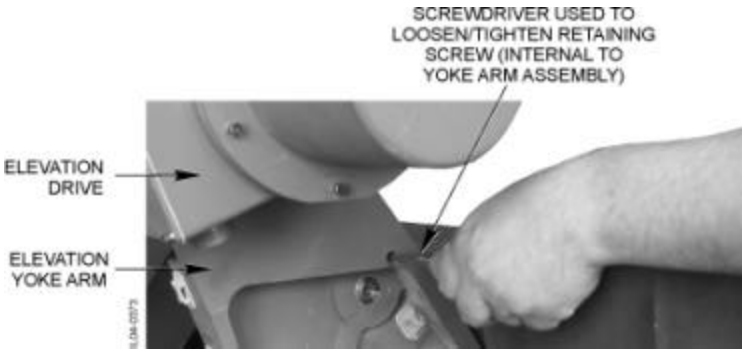
Retaining (or captive) screws remain internally in the yoke arms and are not removed.

4. Partially thread the retaining screws that hold the casing deflector into each yoke arm.
5. Tighten the three bolts holding the elevation yoke arm to the pedestal. Torque to 81.6 $\pm$ 3 in. lb.

6. Finish tightening the retaining screws in the yoke arms, using a 1/4-inch flat screwdriver, shown in Figure 12.



Ammo Yoke Arm Side



Elevation Yoke Arm Side

Figure 12. Retaining Screws in Ammo Yoke Arm and Elevation Yoke Arm

7. Insert and tighten the two bolts and Nord-lock washer sets securing the casing deflector to the azimuth housing assembly of the pedestal, using a 7/16-inch socket wrench, as shown in Figure 13. Torque to 26.4 ± 2 in. lb.

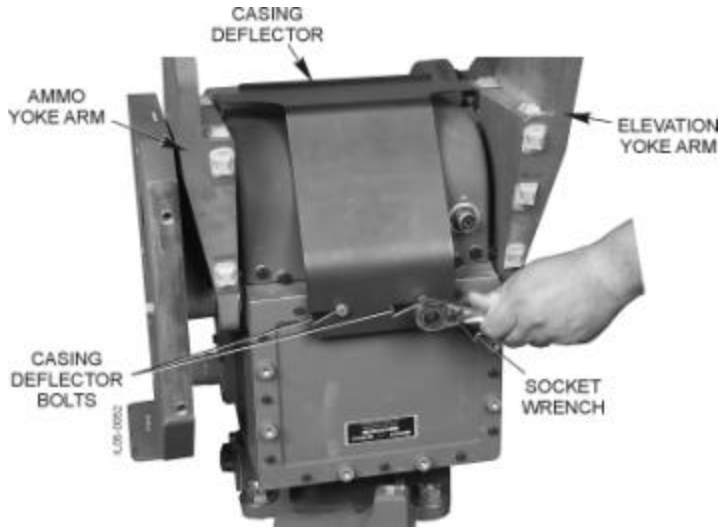


Figure 13. Casing Deflector in Position on the Mount

Installation of the Weapon Elevation Cable

Use the following procedures to reconnect the weapon elevation cable.

NOTE

Refer to WP 0022 for further instructions about cable assembly.

For additional information about the azimuth lock, refer to WP 0013.

1. Ensure azimuth lock is in the locked position, referring to Figure 1.
2. Connect the weapon elevation cable assembly to connector J1, elevation drive, and J3, elevation (pedestal). Refer to the bottom illustration in Figure 1 for the location of these connectors.

ADJUSTMENT

No adjustments are needed for the stabilized weapon mount.

RETEST AFTER REASSEMBLY

Retest the SWM to verify that it performs as specified.

1. Perform a visual inspection IAW the CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services.
2. Test the component/part in accordance with WP 0013, Unit Maintenance Functional Testing and Troubleshooting.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT MAINTENANCE: PEDESTAL GUN MOUNT ASSEMBLY

This work package contains information about performing unit-level maintenance tasks on the pedestal assembly, including inspection, testing, repair, disassembly, reassembly, adjustment, and retest.

WP CONTENTS

Section/Subsection	Page
Initial Set Up	2
Maintenance Overview	3
Inspect	4
Test	4
Repair	4
Disassembly of the Pedestal	5
Consideration Before and During Disassembly	5
Removal of the Azimuth Lock Assembly and the Azimuth Lock Base	5
Reassembly of the Pedestal	8
Installation of the Azimuth Lock Assembly and the Azimuth Lock Base	8
Adjustment	9
Test After Reassembly	9

INITIAL SET UP

Refer to Table 1 for tools, special tools, personnel required, materials, and references needed to inspect, test, remove, repair, and replace the pedestal assembly.

NOTE

Should a malfunction occur, refer to WP 0012, Unit Maintenance Troubleshooting Procedures.

Table 1. Initial Setup Information

Category	Item	Additional Information
Tools	Unit Tool Kit	WP 0055, Table 2, Item 4
	GMTK	WP 0055, Table 2, Item 8
Special Tools	N/A	
Personnel Required	Two	63B
Materials/Parts	Alcohol, isopropyl	WP 0056, Table 1, Item 3
	Cloth, cleaning, lint-free	WP 0056, Table 1, Item 8
	Compound, thread locking	WP 0056, Table 1, Item 16
	Grease, lubricant	WP 0056, Table 1, Item 26
References	TM 9-1090-218-10	CROWS Operator's Manual

MAINTENANCE OVERVIEW

The instructions in this work package cover the inspection, test, removal, and replacement of components/parts of the pedestal assembly, shown in Figures 1 and 2.

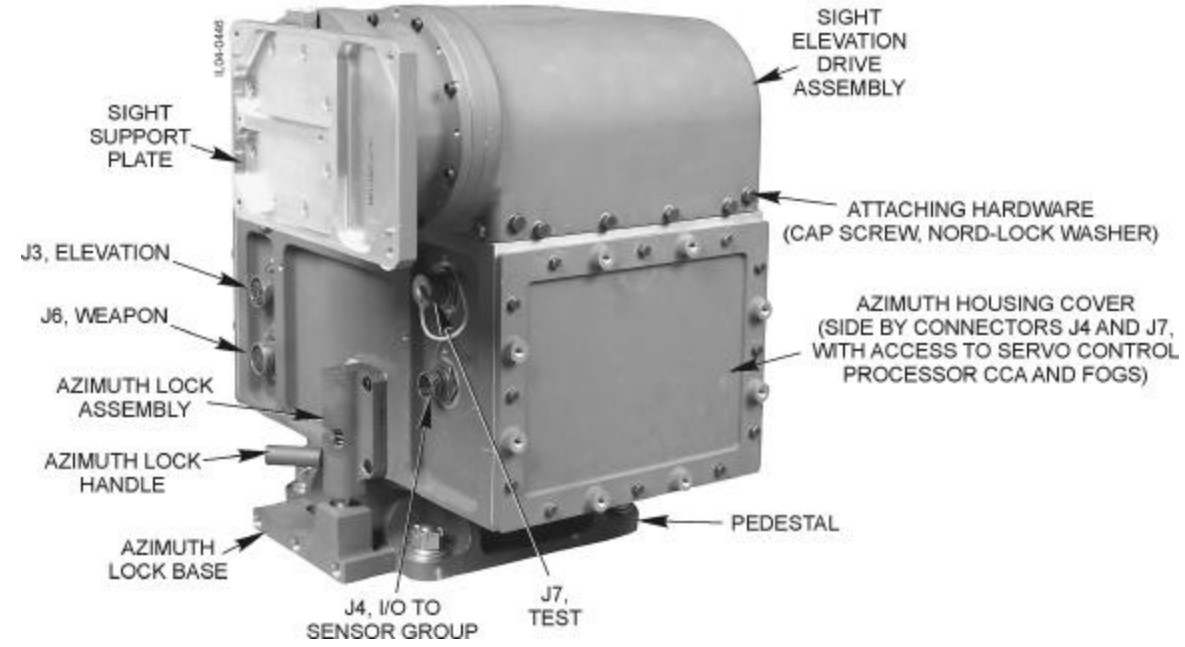


Figure 1. Pedestal – Elevation Yoke Arm Side

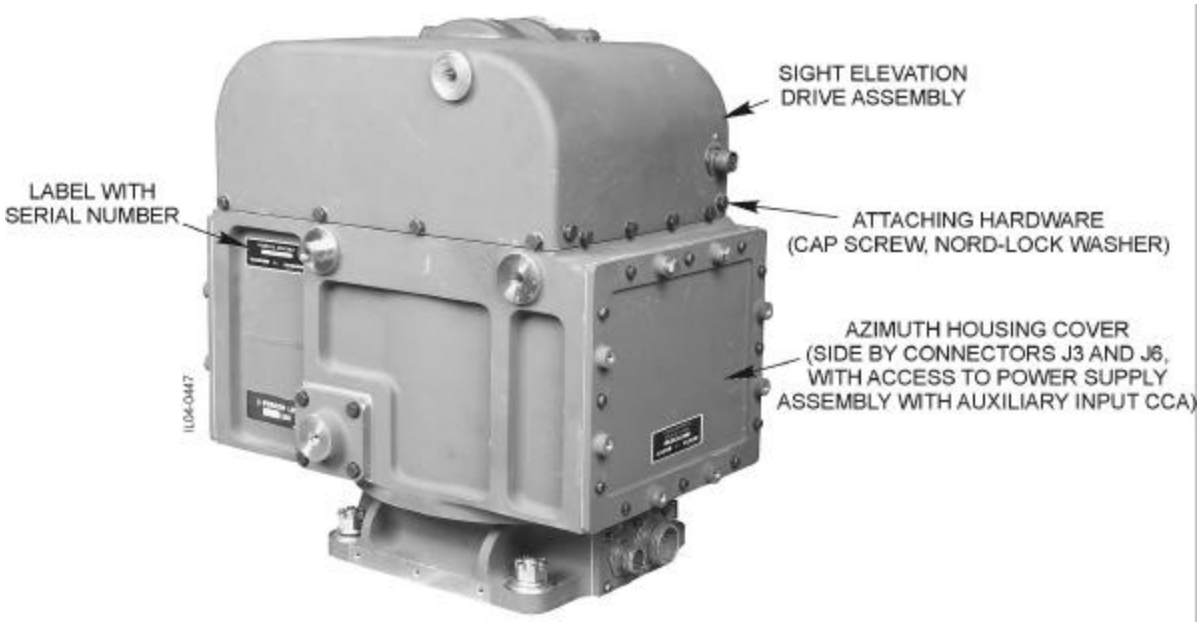


Figure 2. Pedestal – Ammo Yoke Arm Side

NOTE

For unit-level general maintenance procedures, such as cleaning, lubrication, safety-wiring, thread-locking, and corrosion prevention and control (CPC), refer to the work packages in Chapter, 2, General Maintenance.

The standard tasks to be completed for Unit Maintenance include Inspect, Test, Remove, Repair, and Replace. Remove and Replace activities include preparation, removal, and replacement of LRUs, and forwarding items with a job order to direct support (DS) maintenance as needed.

CAUTION

When removing environmental or electromagnetic interference (EMI) seals, including cover gaskets, do not damage any machined surfaces. For repair instructions, refer to WP 0008, Corrosion Prevention and Control (CPC) Instructions.

The Unit Maintenance tasks listed above are to be performed on the pedestal assembly components in Table 2.

Table 2. Pedestal Components

Description
Azimuth Lock Assembly
Azimuth Lock Base

INSPECT

Perform a visual inspection IAW CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services.

TEST

1. Install the pedestal onto an available, fully functioning CROWS.
2. Perform testing in accordance with WP 0013, Unit Maintenance Functional Testing and Troubleshooting.
3. Ensure the pedestal moves freely when the azimuth lock is in the unlocked position and that the pedestal does not move when the azimuth lock is in the locked position.

REPAIR

Repair of the pedestal is accomplished by removal and replacement of the components listed in Table 2 that have been determined to be defective.

DISASSEMBLY OF THE PEDESTAL

CAUTION

Ensure that all hex head wrenches are fully inserted into the bolts to avoid stripping socket heads.

Ensure that painted surfaces are not damaged. For additional information, refer to WP 0008, Corrosion Prevention and Control (CPC) Instructions.

Failure to follow these instructions may result in equipment damage.

NOTE

Disassemble only to the extent necessary to determine defective condition and accomplish essential repairs necessary to produce a serviceable end item.

Retain assemblies, components, and parts for later use or examination.

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 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 0053, 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.
- For information on mandatory replacement parts – including spring (tension) washers, star washers and Nord-lock washer sets – that need to be replaced whenever components are disassembled, as well as parts that can be reused unless damaged – including seals and gaskets – refer to WP 0058.
- Inspect Maintenance Significant Items (MSI) required for operation of the CROWS but that do not require disassembly, including attaching hardware (e.g., screws, nuts, bolts, spacers) and switches/buttons.

Removal of the Azimuth Lock Assembly and the Azimuth Lock Base

There is no disassembly at the Unit level, except for the removal of the azimuth lock assembly and the azimuth lock base.

Perform the following procedures to remove the azimuth lock assembly and the azimuth lock base of the pedestal assembly, shown in Figure 3.

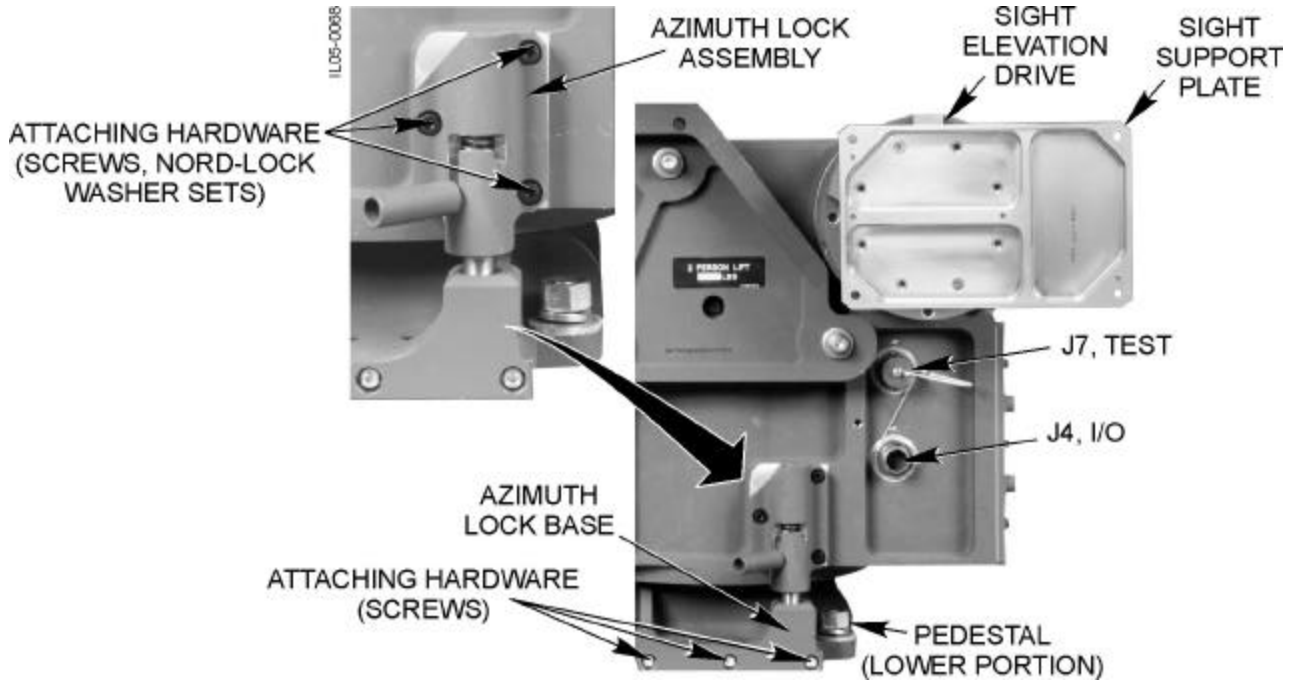


Figure 3. Azimuth Lock Assembly and Azimuth Lock Base

NOTE

For additional information about the azimuth lock, refer to WP 0013.

1. Ensure the azimuth lock handle is in the unlocked position. The pedestal should move freely.
2. Rotate the pedestal top until the azimuth lock assembly and azimuth lock base are not aligned.
3. Remove the three screws and Nord-lock washer sets securing the azimuth lock assembly to the pedestal (upper portion), using a 3/16-inch hex head wrench.
4. Detach the azimuth lock assembly from the pedestal (upper portion).
5. Remove the three screws and Nord-lock washer sets holding the azimuth lock base to the pedestal (lower portion), using a 3/16-inch screwdriver.

NOTE

For thread-locking information, refer to WP 0007.

6. Remove thread-lock compound from the handle, referring to WP 0007 and Figure 4.

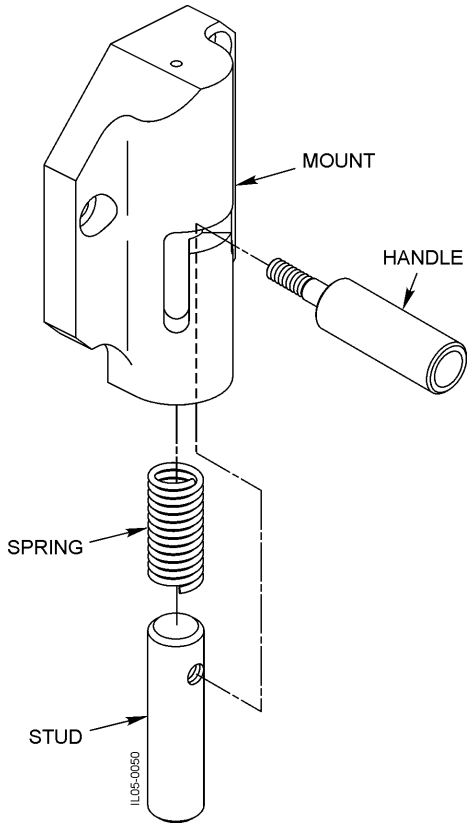


Figure 4. Azimuth Lock Assembly – Exploded View

WARNING

Stud is under spring tension. Removal of handle may cause spring to pop out, resulting in injury to personnel.

7. Place azimuth lock assembly so stud is on a solid object.
8. Slowly unscrew the handle from the stud, referring to Figure 4.
9. Remove the spring from the stud.

REASSEMBLY OF THE PEDESTAL

Installation of the Azimuth Lock Assembly and the Azimuth Lock Base

Perform the following procedures to install the azimuth lock assembly and the azimuth lock base of the pedestal assembly.

WARNING

Follow all safety warnings and cautions.

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 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.

NOTE

For additional information on lubrication, refer to WP 0005, Lubrication.

1. Lubricate the stud and spring as follows, referring to WP 0005.
   a. Clean the stud and spring with isopropyl alcohol, and allow to dry.
   b. Apply a thin film of lubricant, thoroughly coating the stud and spring.
   c. Wipe any excess lubricant off of the stud and spring with a clean, lint-free cloth.
2. Position the spring with the stud and insert into the mount, referring to Figure 4.
3. Align the handle to the stud, referring to Figure 4.

NOTE

For thread-locking information, refer to WP 0007.

4. Apply thread-lock compound to the handle's threads.
5. Screw the handle into the stud, referring to Figure 4.
6. Position the azimuth lock assembly onto the pedestal (upper portion), referring to Figure 3.
7. Insert and tighten the three screws and Nord-lock washer sets securing the azimuth lock assembly to the pedestal, using a 3/16-inch hex head wrench. Torque to 62 ± 3 in. lb.

8. Insert and loosely tighten the three screws and Nord-lock washer sets securing the azimuth lock base to the pedestal (lower portion), using a 1/8-inch screwdriver.

9. Rotate the pedestal top until the azimuth lock assembly and azimuth lock base are aligned, referring to Figure 3. Position the azimuth lock handle in the locked position to verify alignment.

10. Once the azimuth lock assembly and azimuth lock base are properly aligned, tighten the three screws on the azimuth lock base, using a 1/8-inch screwdriver. Torque to 62 ± 3 in. lb

ADJUSTMENT

None needed for the azimuth lock assembly or azimuth lock base.

TEST AFTER REASSEMBLY

Retest the pedestal assembly to verify that it performs as specified.

1. Perform a visual inspection IAW CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services.

2. Ensure the pedestal moves freely when the azimuth lock is in the unlocked position and that the pedestal does not move when the azimuth lock is in the locked position.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT MAINTENANCE: ELEVATION YOKE ARM ASSEMBLY

This work package contains information about unit maintenance of the elevation yoke arm assembly.

MAINTENANCE OVERVIEW

NOTE

For unit-level general maintenance procedures, such as cleaning, lubrication, safety-wiring, thread-locking, and corrosion prevention and control (CPC), refer to the work packages in Chapter, 2, General Maintenance.

The standard tasks to be completed for Unit Maintenance include Inspect, Remove, and Replace. Remove and Replace activities include preparation, removal, and replacement of LRUs, and forwarding items with a job order to direct support (DS) maintenance as needed.

Inspect Maintenance Significant Items (MSI) required for operation of the CROWS but that do not require disassembly, including attaching hardware (e.g., screws, nuts, bolts, spacers) and switches/buttons.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT MAINTENANCE: AMMUNITION YOKE ARM ASSEMBLY

This work package contains information about performing unit-level maintenance tasks on the ammo yoke arm, including inspection, repair, disassembly, reassembly, adjust, and retest.

WP CONTENTS

Section/Subsection	Page
Initial Set-Up	1
Maintenance Overview	2
Inspect	3
Repair	3
Disassembly of the Ammo Yoke Arm	3
Considerations Before and During Disassembly	3
Removal of the Dead Axle Housing	4
Reassembly of the Ammo Yoke Arm	4
Installation of the Dead Axle Housing	4
Adjust	4
Retest After Reassembly	4

INITIAL SET-UP

Refer to Table 1 for tools, special tools, materials, and references needed to inspect, test, and remove and replace the ammo yoke arm.

NOTE

Should a malfunction occur, refer to WP 0012, Unit Maintenance Troubleshooting Procedures.

Table 1. Initial Setup Information

Category	Item	Additional Information
Tools	Unit Tool Kit	WP 0055, Table 2, Item 4
	GMTK	WP 0055, Table 2, Item 8
Special Tools	N/A	
Personnel Required	One	63B
Materials/Parts	N/A	
References	TM 9-1090-218-10	CROWS Operator's Manual

MAINTENANCE OVERVIEW

The instructions in this work package cover the inspection, removal, and replacement of components/parts of the ammo yoke arm, shown in Figure 1.

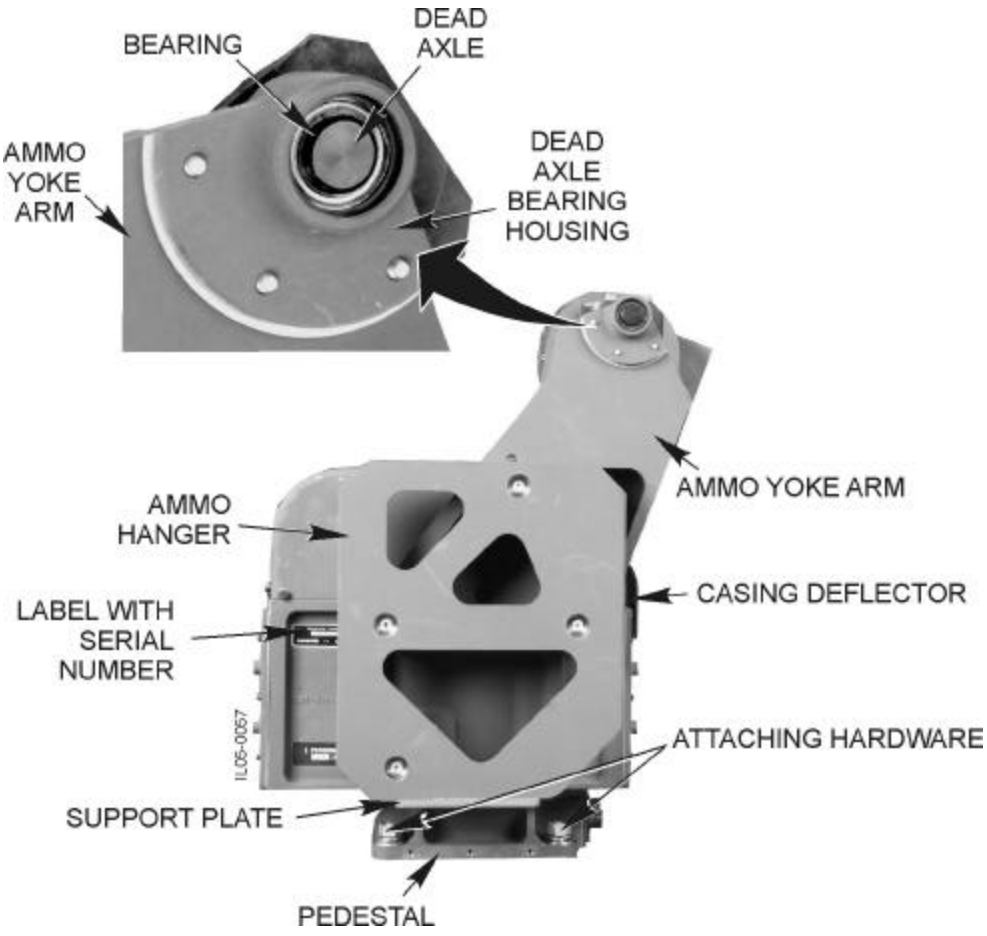


Figure 1. Ammo Yoke Arm

NOTE

For unit-level general maintenance procedures, such as cleaning, lubrication, safety-wiring, thread-locking, and corrosion prevention and control (CPC), refer to the work packages in Chapter, 2, General Maintenance.

The standard tasks to be completed for Unit Maintenance include Inspect, Remove, and Replace. Remove and Replace activities include preparation, removal, and replacement of LRUs, and forwarding items with a job order to direct support (DS) maintenance as needed.

CAUTION

When removing environmental or electromagnetic interference (EMI) seals, including cover gaskets, do not damage any machined surfaces. For repair instructions, refer to WP 0008, Corrosion Prevention and Control (CPC) Instructions.

The Unit Maintenance tasks listed above are to be performed on the ammo yoke arm component in Table 2.

Table 2. Ammo Yoke Arm Components

Description
Housing, Dead Axle
Bearing
Axle, Dead
Arm, Yoke

INSPECT

Perform a visual inspection IAW CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services.

REPAIR

Repair of the ammo yoke arm is accomplished by removal and replacement of the components listed in Table 2 that have been determined to be defective.

DISASSEMBLY OF THE AMMO YOKE ARM

CAUTION

Ensure that all hex head wrenches are fully inserted into the bolts to avoid stripping socket heads.

Ensure that painted surfaces are not damaged. For additional information, refer to WP 0008, Corrosion Prevention and Control (CPC) Instructions.

Failure to follow these instructions may result in 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 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 0053, 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.
- For information on mandatory replacement parts – including spring (tension) washers, star washers and Nord-lock washer sets – that need to be replaced whenever components are disassembled, as well as parts that can be reused unless damaged – including seals and gaskets – refer to WP 0058.
- Inspect Maintenance Significant Items (MSI) that are required for operation of the CROWS but that do not require disassembly, including attaching hardware (e.g., screws, nuts, bolts, spacers) and switches/buttons.

Removal of the Dead Axle Housing

Equipment Conditions. The ammo yoke arm is attached to the pedestal; refer to WP 0016. The pedestal assembly is secured to a stable work surface; refer to the Vehicle Integration Kit (VIK), WP 0060, of this manual.

Perform the following procedures to remove the dead axle housing from the ammo yoke arm, referring to Figure 1.

1. Remove three screws and Nord-lock washer sets to release the dead axle housing, using a 5/32-inch hex head wrench.
2. Remove the dead axle housing from the yoke arm. The dead axle and the bearing are released upon removal of the dead axle housing.

REASSEMBLY OF THE AMMO YOKE ARM

Installation of the Dead Axle Housing

Equipment Conditions. The ammo yoke arm is attached to the pedestal; refer to WP 0016. The pedestal assembly is secured to a stable work surface; refer to the Vehicle Integration Kit (VIK), WP 0060, of this manual.

Perform the following procedures to install the dead axle housing onto the ammo yoke arm, referring to Figure 1.

1. Position the bearing, the dead axle, and the dead axle housing in alignment with the ammo yoke arm.
2. Insert and tighten three screws and Nord-lock washer sets to secure the dead axle housing, using a 5/32-inch hex head wrench.

ADJUST

No adjustment is required for the ammo yoke arm.

RETEST AFTER REASSEMBLY

Retest the ammo yoke arm assembly to verify that it performs as specified.

1. Perform a visual inspection IAW the CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services.
2. Test the ammo yoke arm IAW WP 0013, Unit Maintenance Functional Testing and Troubleshooting.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT MAINTENANCE: SENSOR GROUP

This work package contains information about performing unit-level maintenance tasks on the Sensor Group, including inspection, testing, repair, disassembly, reassembly, adjustment, and retest.

WP CONTENTS

Section/Subsection	Page
Initial Set Up	1
Maintenance Overview	2
Inspect	3
Humidity Indicator Strip	3
Test	3
Repair	3
Disassembly of the Sensor Group	4
Considerations Before and After Disassembly	4
Reassembly of Sensor Group	9
Adjustment	13
Retest After Reassembly	13

INITIAL SET UP

Refer to Table 1 for tools, special tools, materials, and references needed to inspect, test, and remove and replace the Sensor Group.

NOTE

Should a malfunction occur, refer to WP 0012, Unit Maintenance Troubleshooting Procedures.

Table 1. Initial Setup Information

Category	Item	Additional Information
Tools	Unit Tool Kit	WP 0055, Table 2, Item 4
	GMTK	WP 0055, Table 2, Item 8
Special Tools	N/A	
Personnel Required	Two	63B
Materials/Parts	N/A	
References	TM 9-1090-218-10	CROWS Operator's Manual

MAINTENANCE OVERVIEW

The instructions in this work package cover the inspection, test, repair, disassembly, reassembly, adjustment, and retest of the components/parts of the Sensor Group, shown in Figure 1.

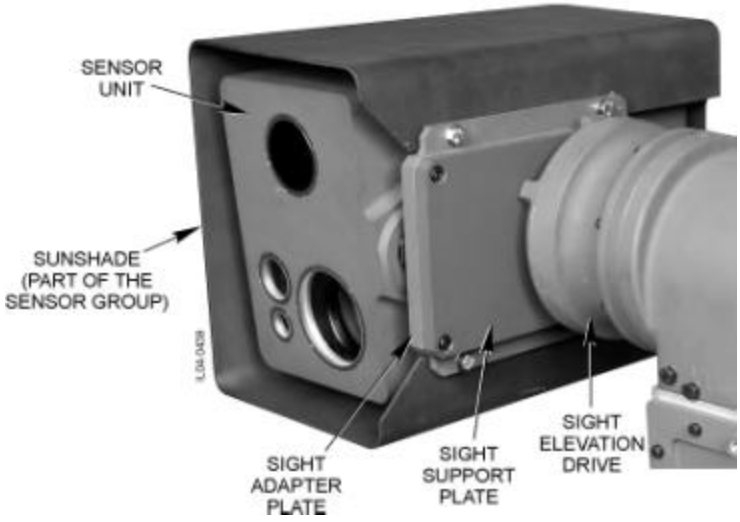


Figure 1. Sensor Group (Attached to Mount)

NOTE

For unit-level general maintenance procedures, such as cleaning, lubrication, safety-wiring, thread-locking, and corrosion prevention and control (CPC), refer to the work packages in Chapter, 2, General Maintenance.

The standard tasks to be completed for Unit Maintenance include Inspect, Test, Remove, and Replace. Remove and Replace activities include preparation, removal, and replacement of LRUs, and forwarding items with a job order to direct support (DS) maintenance as needed.

CAUTION

When removing environmental or electromagnetic interference (EMI) seals, including cover gaskets, do not damage any machined surfaces. For repair instructions, refer to WP 0008, Corrosion Prevention and Control (CPC) Instructions.

The Sensor Group subassemblies to be handled by Unit Maintenance are listed in Table 2.

Table 2. Sensor Group Components

Description
Mount to Sensor Cable
Plate, Adapter - Sight
Sensor Unit
Support Plate - Sight
Sunshade Assembly

INSPECT

Perform a visual inspection IAW CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services.

Humidity Indicator Strip

The optimum condition for the humidity indicator strip in the sensor unit is a reading of 50% or less with the strip appearing blue, referring to Figure 2. As long as the humidity indicator strip shows less than 80% and no condensation appears on the day sensor window or any other of the SU lenses/optical window, the unit is safe to operate and typical PMCS should be followed.

Should the humidity indicator strip show 80% or become totally pink, or should condensation appear on any of the optical windows or lenses, immediately return the sensor unit to DS maintenance.

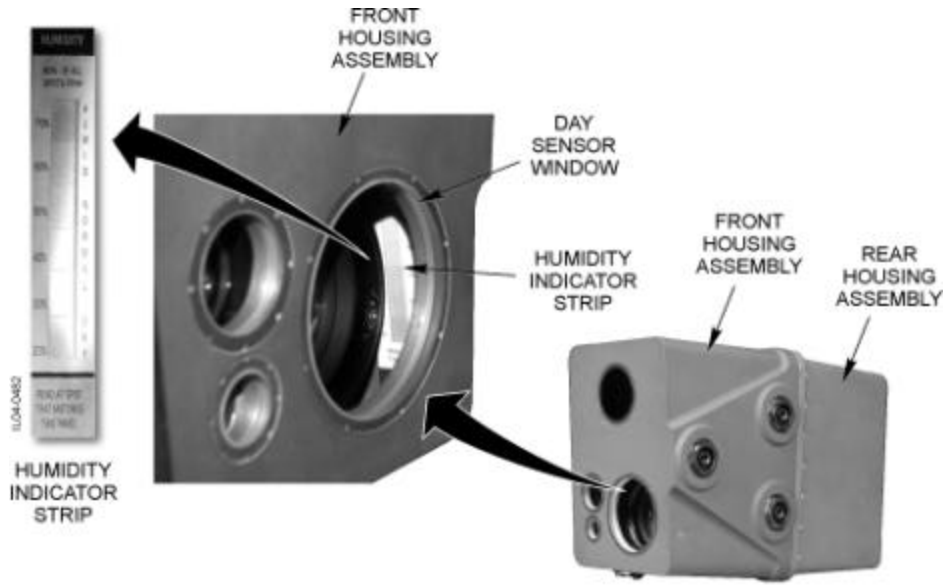


Figure 2. Viewing the Humidity Indicator through the Day Sensor Window

TEST

Install the Sensor Group onto an available, fully functioning CROWS, and perform testing in accordance with WP 0013, Unit Maintenance Functional Testing and Troubleshooting.

REPAIR

Repair of the sensor group is accomplished by removal and replacement of the components listed in Table 2 that have been determined to be defective.

DISASSEMBLY OF THE SENSOR GROUP

WARNING

The Sensor Group contains high voltage equipment. Follow all warnings and safety precautions.

The Sensor Group contains a laser. Although there are Eyesafe Laser labels, do not look into the laser. Handle with care.

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

CAUTION

The Sensor Unit contains optical elements. Although they are packaged in a rugged housing, handle with care. Do NOT touch the lenses.

Use two personnel during the following removal and disassembly procedures.

Ensure that all hex head wrenches are fully inserted into the bolts to avoid stripping socket heads.

Ensure that painted surfaces are not damaged. For additional information, refer to WP 0008, Corrosion Prevention and Control (CPC) Instructions.

Failure to follow these instructions may result in equipment damage.

NOTE

Disassemble only to the extent necessary to determine defective condition and accomplish essential repairs necessary to produce a serviceable end item.

Retain assemblies, components, and parts for later use or examination.

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 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 0053, 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.

- For information on mandatory replacement parts – including spring (tension) washers, star washers and Nord-lock washer sets – that need to be replaced whenever components are disassembled, as well as parts that can be reused unless damaged – including seals and gaskets – refer to WP 0058.
- Inspect Maintenance Significant Items (MSI) required for operation of the CROWS but that do not require disassembly, including attaching hardware (e.g., screws, nuts, bolts, spacers) and switches/buttons.

Equipment Conditions. The azimuth lock assembly and azimuth base must be installed; refer to WP 0017. Cable ties securing the mount- to sensor cable must be removed; refer to WP 0013.

Perform the following procedures to remove the Sensor Group.

NOTE

For additional information about the azimuth lock, refer to WP 0013.

1. Ensure the azimuth lock is in the locked position.
2. Disconnect the mount to sensor cable from connector J1 at the rear of the sensor unit, and from connector J4 on the pedestal as shown in Figures 3 and 4.



Front View **Rear View**

Figure 3. Sensor Unit (Shown Detached from Sensor Group for Clarity)

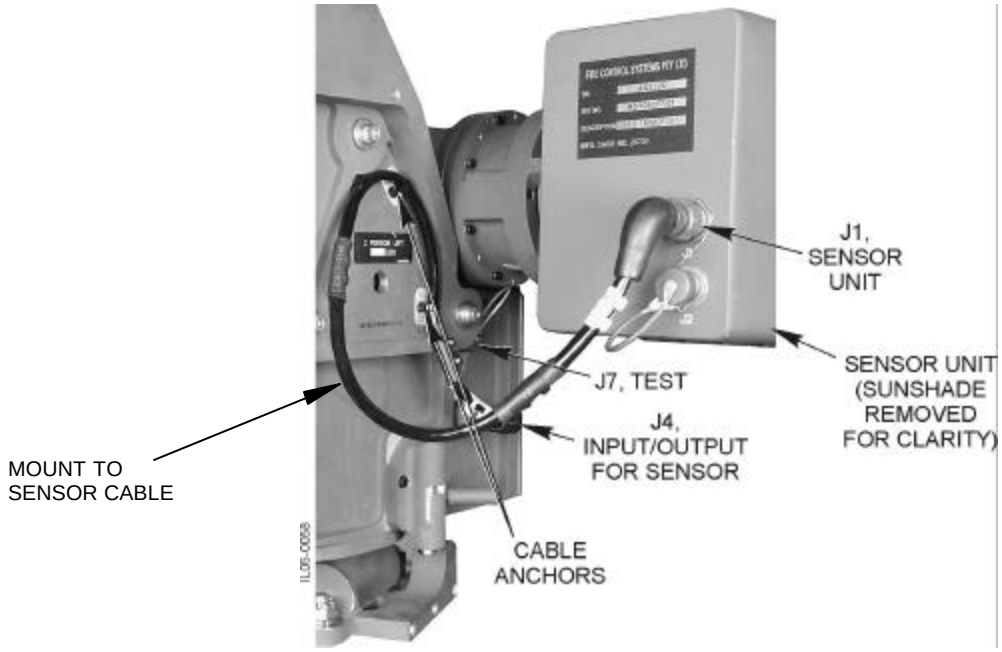


Figure 4. Mount to Sensor Cable with Connection to J4, Input/Output for Sensor (on the Pedestal) and J1, Sensor (on the Sensor Unit)

NOTE

One person should support the sunshade during disassembly.

3. Remove the four screws and flat washers securing the sunshade to the sensor unit using a 7/16-inch wrench.

4. Carefully slide the sunshade off of the mounted sensor unit, as shown in Figure 5. Place sunshade on a stable work surface.

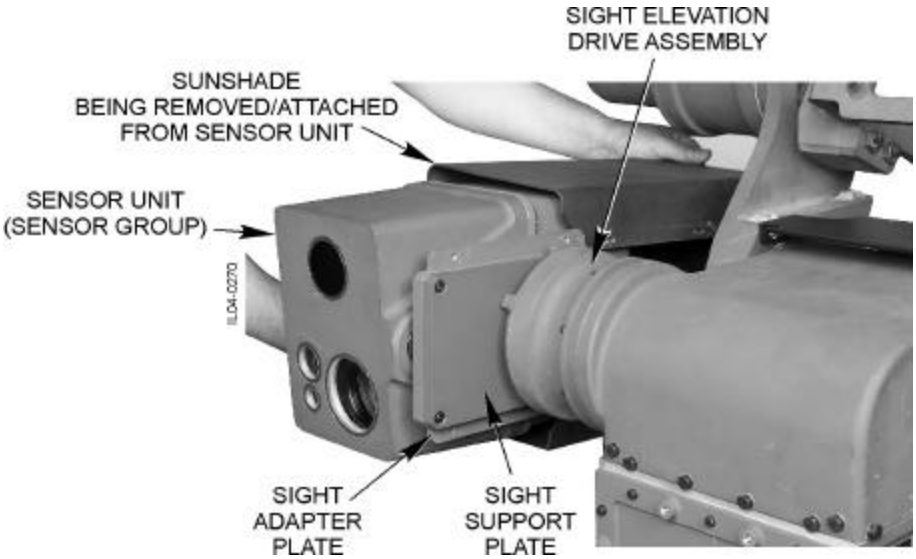


Figure 5. Sunshade Being Removed from Sensor Unit

CAUTION

Use two personnel during the following removal and disassembly procedures, one to hold the sensor unit and one to remove the hardware. Failure to follow these procedures may result in equipment damage.

5. While one person holds the sensor unit in position, the second person removes the four screws and Nord-lock washer sets securing the sight adapter plate to the sight support plate, using a 3/16-inch hex head wrench, as shown in Figure 6.

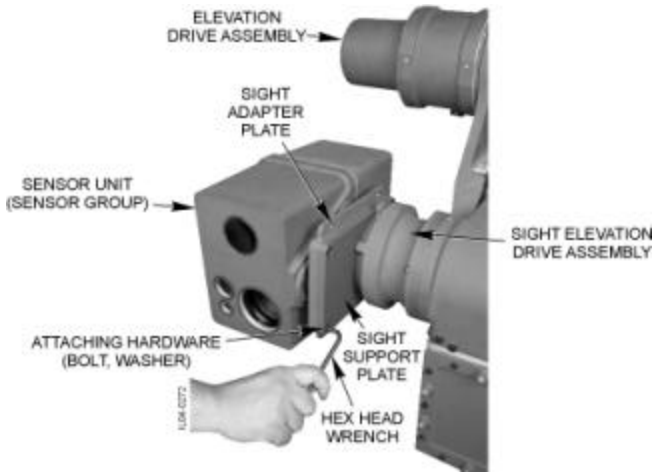


Figure 6. Removing Attaching Hardware Securing Sensor Unit to Mount

CAUTION

Ensure the sensor unit is placed on a soft mat on a stable work surface on its side as in Figure 8. Handle the lenses with care. Failure to do so may result in equipment damage.

NOTE

Removal of the sight support plate is handled at DS maintenance.

6. Carefully separate the sensor unit, with sight adapter plate attached, from the sight support plate, as shown in Figure 7. Place the sensor unit on a soft mat on a stable work surface on its side as in Figure 8.

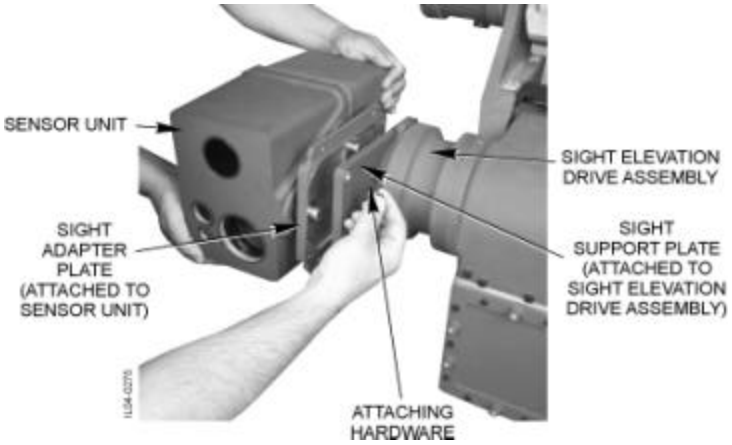


Figure 7. Detaching the Sensor Unit from the Mount

7. Remove the three screws and Nord-lock washer sets holding the sight adapter plate to the sensor unit, using a 5/16-inch hex head wrench, as shown in Figure 8. Retain hardware for later use.

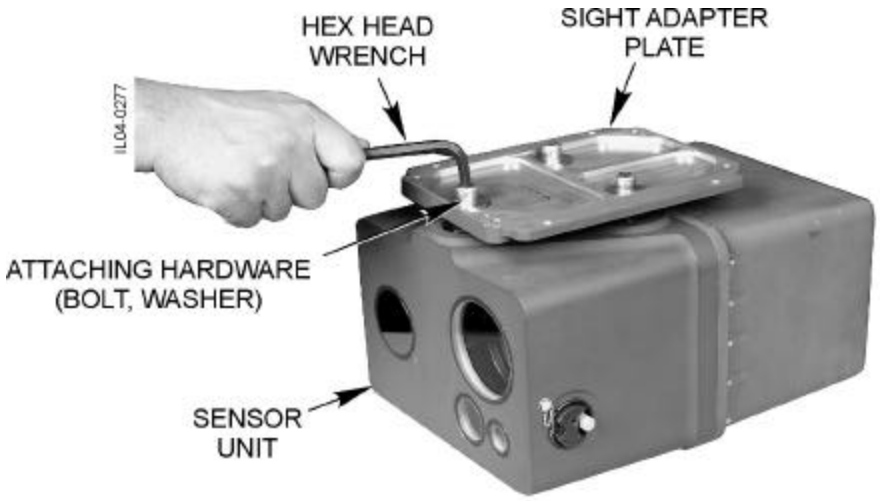


Figure 8. Removing the Sight Adapter Plate

CAUTION

Do not remove any of the three front housing assembly feet (Figure 9).

8. Remove the sight adapter plate from the sensor unit, as shown in Figure 9.

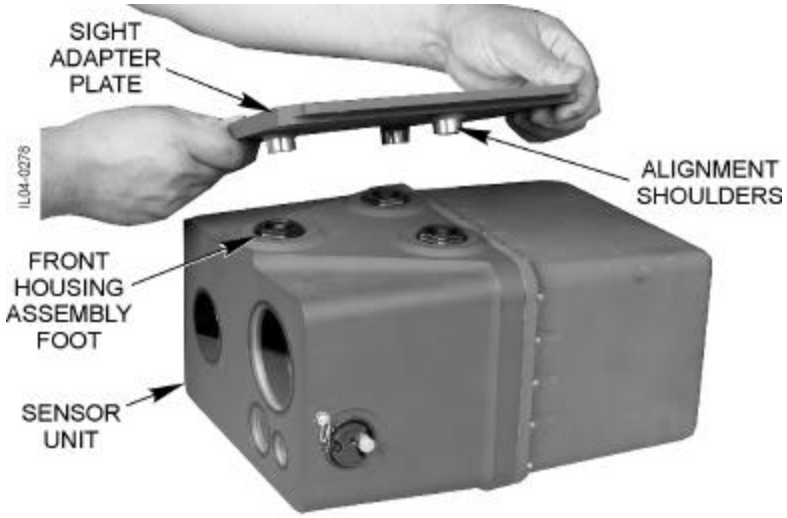


Figure 9. Sensor Unit with Sight Adapter Plate Removed

REASSEMBLY OF SENSOR GROUP

Perform the following procedures to install the Sensor Group.

WARNING

The Sensor Group contains high voltage equipment. Follow all warnings and safety precautions.

The Sensor Group contains a laser. Although there are Eyesafe Laser labels, do not look into the laser. Handle with care.

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

CAUTION

The Sensor Unit contains optical elements. Although they are packaged in a rugged housing, handle with care. Do NOT touch the lenses.

Use two personnel during the following removal and disassembly procedures.

Ensure that all hex head wrenches are fully inserted into the bolts to avoid stripping socket heads.

Ensure that painted surfaces are not damaged. For additional information, refer to WP 0008, Corrosion Prevention and Control (CPC) Instructions.

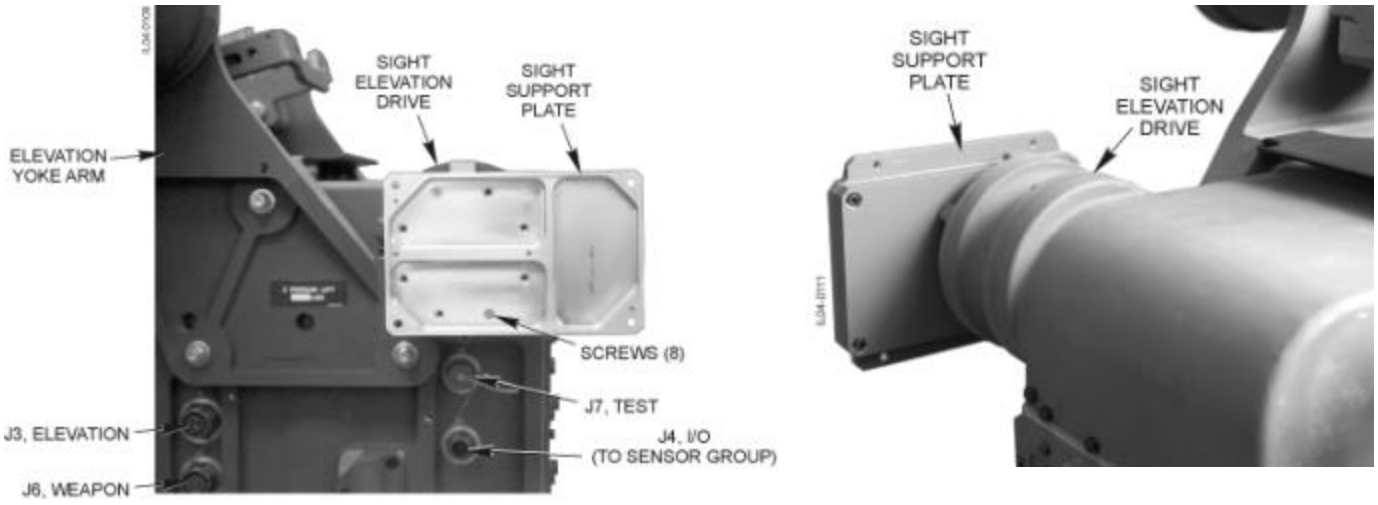
Failure to follow these instructions may result in equipment damage.

NOTE

For additional information about the azimuth lock, refer to WP 0013.

1. Ensure the azimuth lock is in the locked position.

2. If sight support plate is not attached to the sight elevation drive, as shown in Figure 10, send to DS.



View from Sensor Group Side **View from Ammo Yoke Arm Side**

Figure 10. Sight Support Plate Attached to Sight Elevation Drive

CAUTION

Do not move or modify the three front housing assembly feet (Figure 11).

3. Align the three alignment shoulders of the sight adapter plate with the three front housing assembly feet on the sensor unit, as shown in Figure 11.

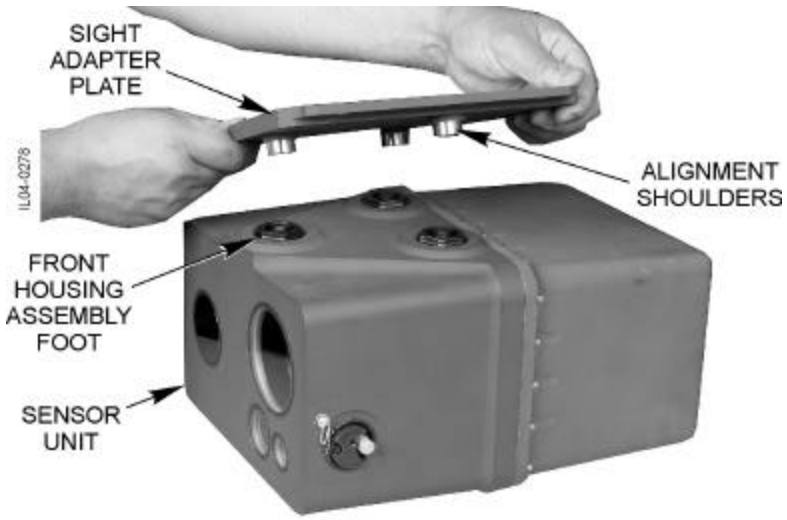


Figure 11. Sight Adapter Plate Aligned with Sensor Unit

4. Insert and tighten the three screws and Nord-lock washer sets holding the sight adapter plate to the sensor unit, using a 5/16-inch hex head wrench, as shown in Figure 12. Torque to 28 ± 1 ft. lb.

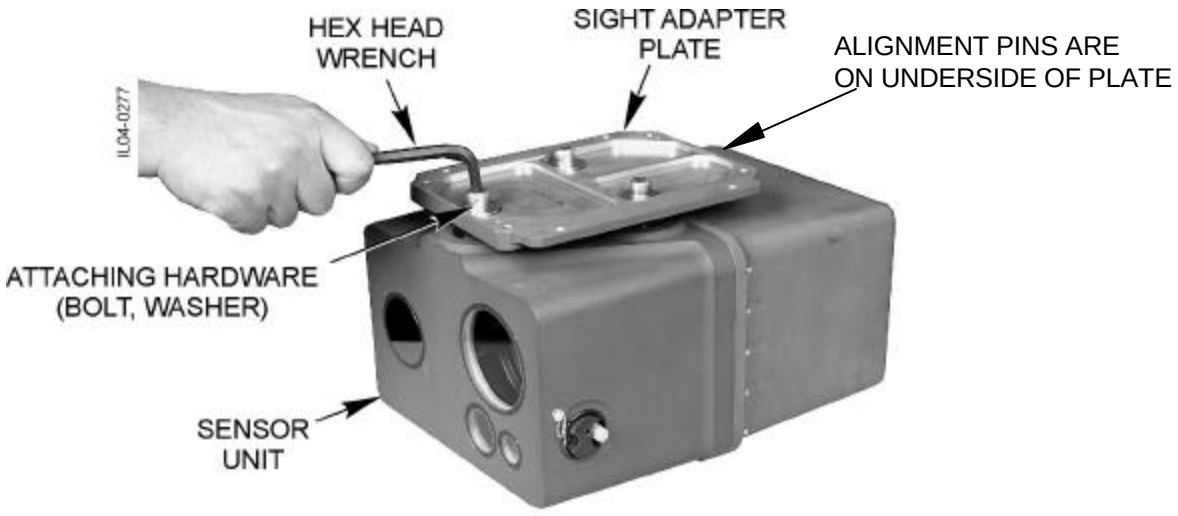


Figure 12. Installing the Sight Adapter Plate

CAUTION

Two personnel are required to lift and hold the sensor unit during disassembly/assembly. Failure to do so may result in equipment damage.

NOTE

Two alignment pins on the sight adapter plate provide proper positioning with the sight support plate. Inspect the pins before connecting the plates together (step 5).

5. Inspect the two pins on the sight adapter plate before attaching the sensor unit with sight adapter plate to the sight support plate, referring to Figure 12.

6. Position the sensor unit, with sight adapter plate attached, in alignment with the sight support plate, as shown in Figure 13.

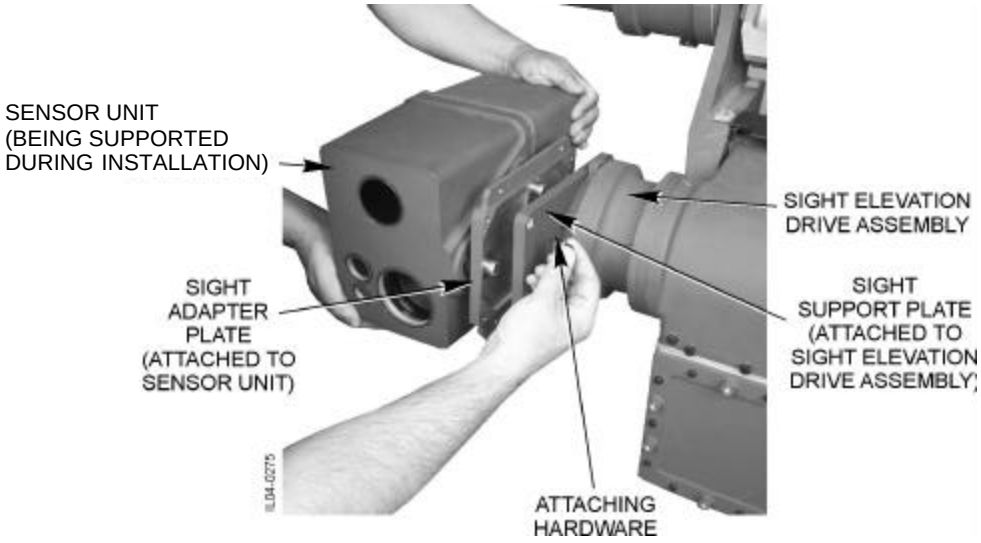


Figure 13. Attaching the Sensor Unit and Sight Adapter Plate to the Sight Support Plate

7. While one person holds the sensor unit in position, the second person inserts and tightens the four screws and Nord-lock washer sets securing the sight adapter plate to the sight support plate, using a 3/16-inch hex head wrench, as shown in Figure 13. Torque to 140 ± 10 in. lb.

8. Carefully slide the sunshade over the mounted sensor unit, as shown in Figure 14.

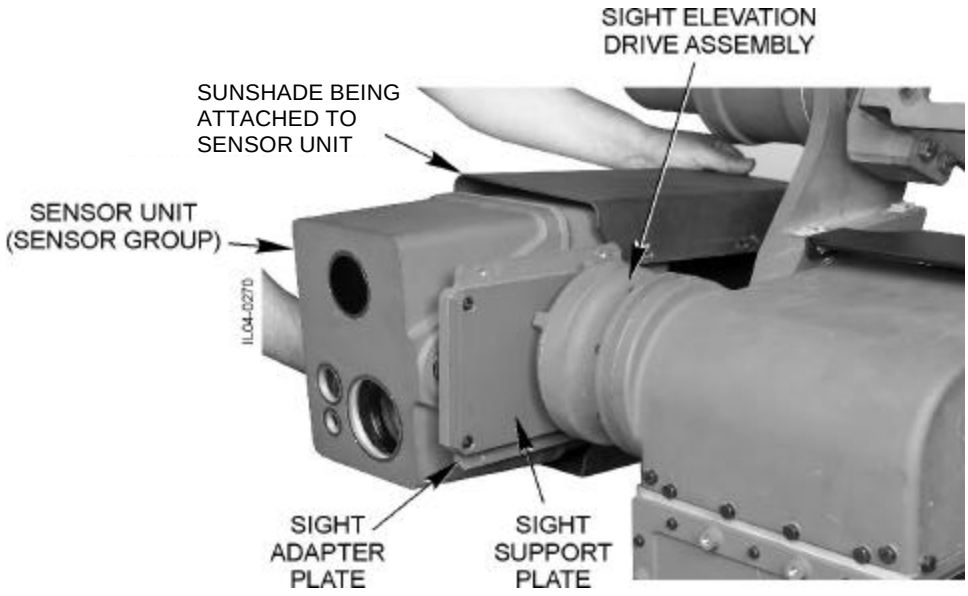


Figure 14. Sunshade Installation onto Sensor Unit

9. Insert and tighten the four screws and flat washers securing the sunshade to the sensor unit using a 7/16-inch wrench.

10. Connect the mount to sensor cable to connector J1 at the rear of the sensor unit and to connector J4 on the pedestal, referring to Figure 15.

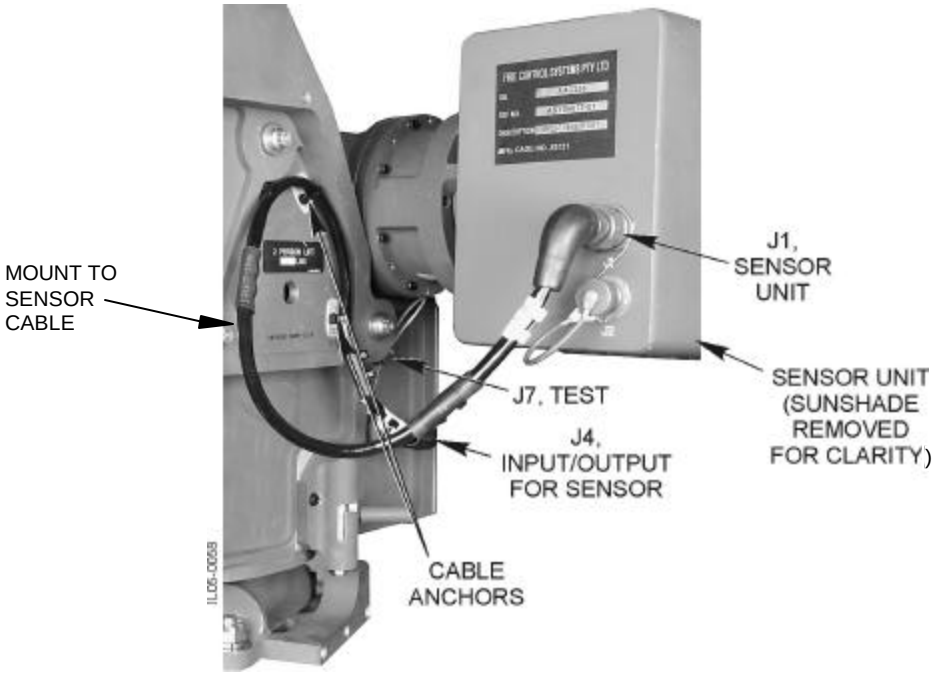


Figure 15. Mount to Sensor Cable with Connection to J4, Input/Output for Sensor (on the Pedestal) and J1, Sensor (on the Sensor Unit)

ADJUSTMENT

No adjustment of the Sensor Group is required.

RETEST AFTER REASSEMBLY

Retest the Sensor Group to verify that it performs as specified.

1. Perform a visual inspection IAW CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services.

2. Test the Sensor Group IAW WP 0013, Unit Maintenance Functional Testing and Troubleshooting.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT MAINTENANCE: CONTROL GROUP

This work package contains information about performing unit-level maintenance tasks on the Control Group.

MAINTENANCE OVERVIEW

NOTE

For unit-level general maintenance procedures, such as cleaning, lubrication, safety-wiring, thread-locking, and corrosion prevention and control (CPC), refer to the work packages in Chapter, 2, General Maintenance.

For additional information on the interconnection cables, refer to WP 0022.

For installation/removal of individual Control Group components, including the cables, refer to the Vehicle Integration Kit (VIK), WP 0060.

The standard tasks to be completed for Unit Maintenance include Inspect, Test, Service, Remove, and Replace. Remove and Replace activities include preparation, removal, and replacement of LRUs, and forwarding items with a job order to direct support (DS) maintenance as needed.

Inspect Maintenance Significant Items (MSI) required for operation of the CROWS but that do not require disassembly, including attaching hardware (e.g., screws, nuts, bolts, spacers) and switches/buttons.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT MAINTENANCE: INTERCONNECTION (CONNECTORS AND CABLES)

This work package contains information about performing unit-level maintenance tasks on the CROWS cables – both those in the Control Group, as well as the other external cables -- including inspection, testing, repair, removal, installation, adjustment, and retest.

WP CONTENTS

Section/Subsection	Page
Initial Set-Up	1
Maintenance Overview	2
Inspection	3
General Cable Inspection Procedures	3
Test	4
Repair	4
Removal of Interconnection Cables	4
Considerations Before and During Disassembly	5
Installation of Cables	6
Adjustment	6
Retest After Reassembly	6

INITIAL SET-UP

Refer to Table 1 for tools, special tools, personnel required, materials, and references needed to inspect, test, and remove and replace the interconnection cables.

NOTE

Should a malfunction occur, refer to WP 0013, Unit Maintenance Troubleshooting Procedures.

Table 1. Initial Setup Information

Category	Item	Additional Information
Tools	Operator's Tool Kit	WP 0055, Table 2, Item 1
	Unit Tool Kit	WP 0055, Table 2, Item 4
Special Tools	N/A	
Personnel Required	One	63B
Materials/Parts	N/A	
References	TM 9-1090-218-10	CROWS Operator's Manual

CAUTION

Prior to attaching or removing cables, ensure that power is turned off.

MAINTENANCE OVERVIEW

The instructions in this work package cover the inspection, test, removal, and replacement of the cables shown in Figure 1 and listed in Table 2.

NOTE

For unit-level general maintenance procedures, such as cleaning, lubrication, safety-wiring, thread-locking, and corrosion prevention and control (CPC), refer to the work packages in Chapter, 2, General Maintenance.

The standard tasks to be completed for Unit Maintenance include Inspect, Test, Remove, and Replace. Remove and Replace activities include preparation, removal, and replacement, and forwarding items with a job order to direct support (DS) maintenance as needed.

CAUTION

When removing environmental or electromagnetic interference (EMI) seals, including cover gaskets, do not damage any machined surfaces. For repair instructions, refer to WP 0008, Corrosion Prevention and Control (CPC) Instructions.

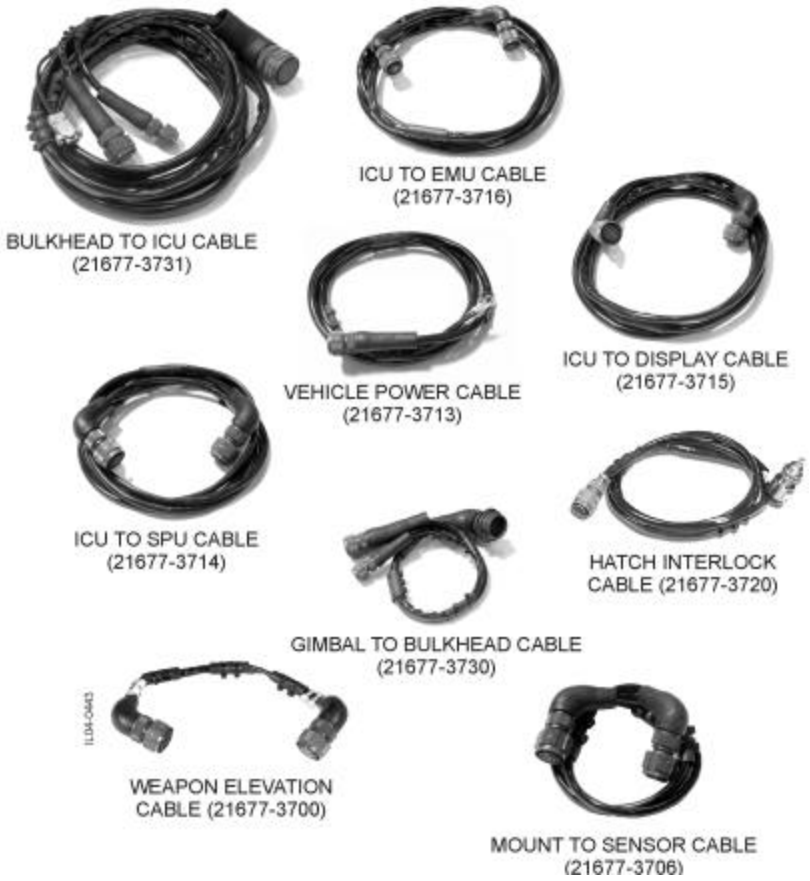


Figure 1. CROWS Cables

Table 2. CROWS Cables

Cable Assembly, Electrical – Weapon Elevation
Cable Assembly, Electrical – Mount to Sensor
Cable Assembly, Electrical – Vehicle Power
Cable Assembly, Electrical – ICU to SPU
Cable Assembly, Electrical – ICU to Display
Cable Assembly, Electrical – ICU to EMU
Cable Assembly, Electrical – Hatch Interlock
Cable Assembly, Electrical – Gimbal to Bulkhead
Cable Assembly, Electrical – Bulkhead to ICU

INSPECTION

Perform a visual inspection IAW CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services. In addition, use the following general instructions.

General Cable Inspection Procedures

NOTE

Always keep cables clean and in serviceable condition. Should a tear or cut be discovered, tape the area IAW standard Army procedures.

1. Visually inspect cable assemblies for any evidence of external damage, as listed below:

   - Ensure all identification (ID) tags are installed
   - Ensure all back shell connectors are tight
   - Check for damaged threads on connectors
   - Visually inspect connectors to ensure that all pins and sockets are not damaged (for example, missing, bent, or loose pins) and that all pins and sockets are properly aligned and seated, referring to Figure 2.



PIN CONNECTOR (PINS IN GOOD CONDITION) SOCKET CONNECTOR (SOCKETS IN GOOD CONDITION)

Figure 2. Connector Examples

2. Send items to DS maintenance if the following conditions are met:

   - Bent, broken, or missing pins or sockets
   - Damaged threads on connector or backshell
   - Inoperative or damaged cables

TEST

Install the cable onto an available, fully functioning CROWS, and perform testing IAW WP 0013, Unit Maintenance Functional Testing and Troubleshooting.

REPAIR

Repair of a cable is accomplished by removal and replacement of the components listed in Table 2 that have been determined to be defective.

REMOVAL OF INTERCONNECTION CABLES

CAUTION

Ensure that painted surfaces are not damaged. For additional information, refer to WP 0008, Corrosion Prevention and Control (CPC) Instructions. Failure to follow these instructions may result in equipment damage.

NOTE

Disassemble only to the extent necessary to determine defective condition and accomplish essential repairs necessary to produce a serviceable end item.

Retain assemblies, components, and parts for later use or examination.

For procedures to remove and replace the cable assemblies in Table 3, refer to the appropriate Vehicle Integration Kit (VIK), WP 0060 thru WP 0063.

Table 3. Interconnection Cables

Vehicle Power
ICU to SPU
ICU to Display
ICU to EMU
Hatch Interlock
Gimbal to Bulkhead
Bulkhead to ICU

For procedures to remove and replace the cable assemblies in Table 4, refer to the work package listed.

Table 4. CROWS Cables

Cable Assembly	Related WP
Weapon Elevation	WP 0016
Mount to Sensor	WP 0020
M2 WAK	WP 0025
Mk19 WAK	WP 0026
M240 WAK	WP 0027
M249 WAK	WP 0028

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 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 0053, 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.
- For information on mandatory replacement parts – including spring (tension) washers, star washers and Nord-lock washers – that need to be replaced whenever components are disassembled, as well as parts that can be reused unless damaged – including seals and gaskets – refer to WP 0058.
- Inspect Maintenance Significant Items (MSI) required for operation of the CROWS but that do not require disassembly, including attaching hardware (e.g., screws, nuts, bolts, spacers) and switches/buttons.

Equipment Condition. The cable ties must be removed from the cables and the cables disconnected from their respective components; refer to WP 0013, as well as WPs 0016, 0017, 0020, 0021, 0025, 0026, 0027, and 0028 of this manual.

Perform the following procedures when removing the cables.

1. Perform inspection and testing as detailed above.
2. If a problem is found, replace the faulty cable with a fully functional cable.
3. Replace the faulty cable at DS.

INSTALLATION OF CABLES

Referring to Tables 3 and 4, perform the following procedures to install the cables.

1. Inspect new or returned cable as detailed in the Inspection section of this work package.
2. Return the cable to its operating position.

ADJUSTMENT

No adjustment is needed for the cables.

TEST AFTER INSTALLATION

Test the CROWS to verify that it performs as specified.

1. Perform a visual inspection IAW CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services.
2. Test the CROWS IAW WP 0013, Unit Maintenance Functional Testing and Troubleshooting.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT MAINTENANCE: AMMUNITION CAN ASSEMBLY

This work package contains information about performing unit-level maintenance tasks on the ammo can.

WARNING

Ensure ammo can is empty prior to performing any maintenance tasks. Failure to do so may result in personal injury.

MAINTENANCE OVERVIEW

NOTE

For unit-level general maintenance procedures, such as cleaning, lubrication, safety-wiring, thread-locking, and corrosion prevention and control (CPC), refer to the work packages in Chapter, 2, General Maintenance.

There are no standard tasks to be completed at the Unit Maintenance level.

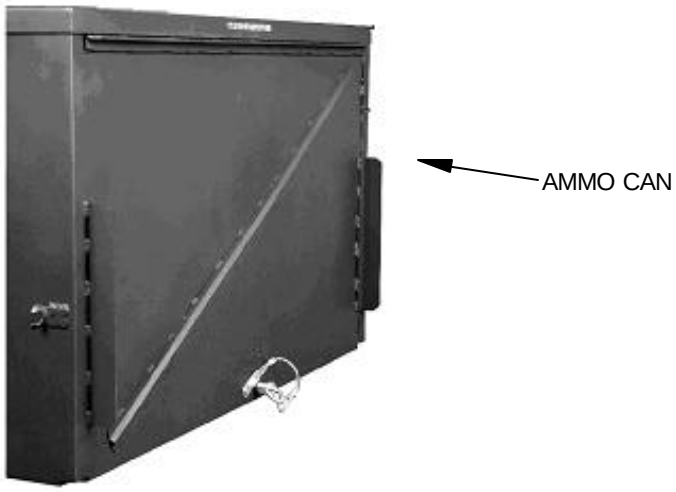


Figure 1. Ammo Can Assembly

NOTE

For procedures to remove and replace the ammo can, refer to the CROWS Operator's Manual, TM 9-1090-218-10, weapon installation work packages, WP 0009 thru WP 0012, referring to the section entitled Ammunition Can Installation and Removal.

For inspection, refer to CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT MAINTENANCE: CRADLE ASSEMBLY (M2/MK19)

This work package contains information about performing unit-level maintenance tasks on the M2/Mk19 cradle.

MAINTENANCE OVERVIEW

NOTE

For unit-level general maintenance procedures, such as cleaning, lubrication, safety-wiring, thread-locking, and corrosion prevention and control (CPC), refer to the work packages in Chapter, 2, General Maintenance.

The standard tasks to be completed for Unit Maintenance include Inspect and Service.

Inspect Maintenance Significant Items (MSI) required for operation of the CROWS but that do not require disassembly, including attaching hardware (e.g., screws, nuts, bolts, spacers) and switches/buttons.

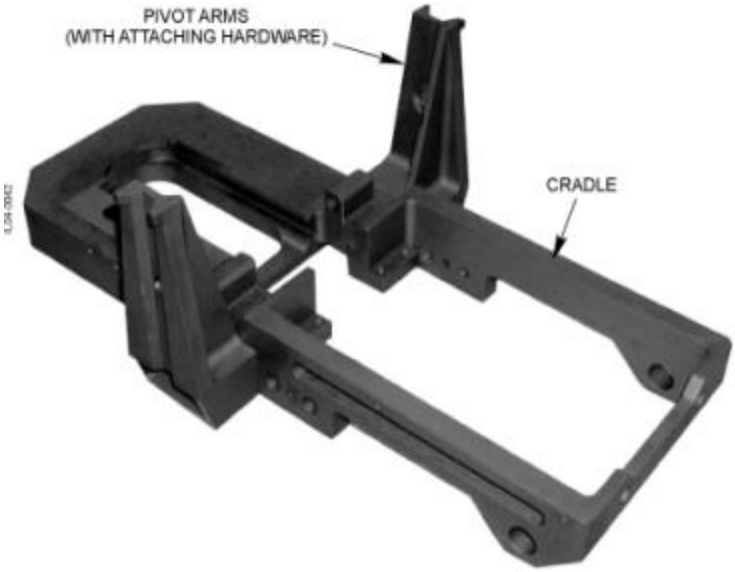


Figure 1. Heavy Cradle with Pivot Arms

NOTE

For procedures to remove and replace the M2/Mk19 cradle, refer to the CROWS Operator's Manual, TM 9-1090-218-10, weapon installation work packages, WP 0009 and WP 0010, referring to the section entitled Cradle Installation and Removal.

For inspection, refer to CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services.

The unit maintenance tasks listed above are to be performed on the cradle components in Table 1.

Table 1. M2/Mk19 Cradle Components

Description
Screw, Cap, Hex
Washer, Lock-Spring
Nut, Locking
Pivot Arm, RH CROWS
Pivot Arm, LH CROWS
Screw, Cap, Socket Head (see step 1 below)
Pin, Detent
Lanyard
Label, 2 Person Lift
Cradle, Heavy

NOTE

For information on thread-locking, refer to WP 0007.

For information on the M2/Mk19 cradle, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0009 or WP 0010.

For information on the attenuators, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0009.

1. If needed, remove/apply thread-lock compound to the screw holding the detent pin lanyard to the cradle.

END OF WORK PACKAGE

MAINTENANCE MANUAL
FOR THE
ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT MAINTENANCE: M2 HB WEAPON ADAPTER KIT (WAK)

This work package contains information about performing unit maintenance on the M2 WAK.

MAINTENANCE OVERVIEW

NOTE

For unit-level general maintenance procedures, such as cleaning, lubrication, safety wiring, thread locking, and corrosion prevention and control (CPC), refer to the work packages in Chapter, 2, General Maintenance.

The standard tasks to be completed for Unit Maintenance include Inspect, Test, Service, and Repair.

CAUTION

When removing environmental or electromagnetic interference (EMI) seals, including cover gaskets, do not damage any machined surfaces. For repair instructions, refer to WP 0008 00, Corrosion Prevention and Control (CPC) Instructions.

Inspect Maintenance Significant Items (MSI) required for operation of the CROWS but that do not require disassembly, including attaching hardware (e.g., screws, nuts, bolts, spacers) and switches/buttons.

NOTE

For procedures to remove/replace and adjust the M2 HB .50 cal machine gun WAK, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0009.

For inspection, refer to CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services.

For testing, refer to WP 0013, Unit Maintenance Functional Testing and Troubleshooting, of this manual.

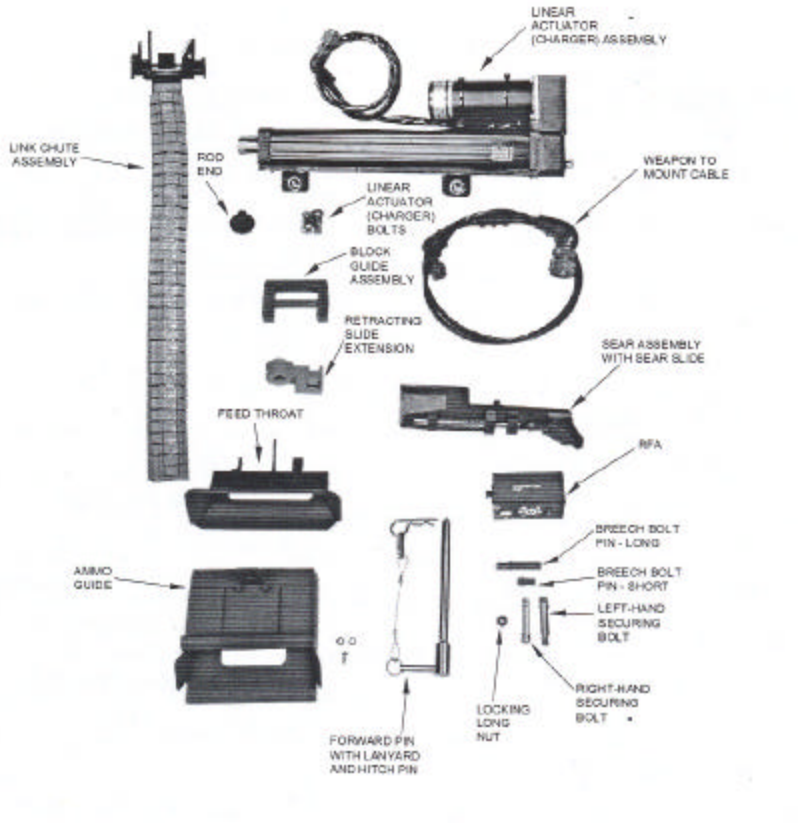


Figure 1. M2 HB Weapon Adapter Kit (WAK)

The unit maintenance tasks listed above are to be performed on the M2 WAK components listed in Table 1.

Table 1. M2 WAK Components

Description	Description
M2 Weapon to Mount Cable Assembly (Electrical-M2)	Extension, Retracting Slide
Sear Assembly with Sear Slide	Bolts, Securing, RH and LH
Linear Actuator Assembly with End Rod	Nut, Locking - Long
Bolt, Pivot Arm	Pins, Breech Bolt (Short and Long)
Pin, Forward - M2/Mk19	Remote Firing Assembly
Ammo Guide	Feed Throat Assembly
Block Guide Assembly	Link Chute Adapter Assembly

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT MAINTENANCE: MK19 WEAPON ADAPTER KIT (WAK)

This work package contains information about performing unit maintenance tasks on the Mk19 WAK.

MAINTENANCE OVERVIEW

NOTE

For unit-level general maintenance procedures, such as cleaning, lubrication, safety-wiring, thread-locking, and corrosion prevention and control (CPC), refer to the work packages in Chapter, 2, General Maintenance.

The standard tasks to be completed for Unit Maintenance include Inspect, Test, Service, and Repair.

CAUTION

When removing environmental or electromagnetic interference (EMI) seals, including cover gaskets, do not damage any machined surfaces. For repair instructions, refer to WP 0008, Corrosion Prevention and Control (CPC) Instructions.

Inspect Maintenance Significant Items (MSI) required for operation of the CROWS but that do not require disassembly, including attaching hardware (e.g., screws, nuts, bolts, spacers) and switches/buttons.



Figure 1. Mk19 Weapon Adapter Kit Main Components

NOTE

For procedures to remove/replace and adjust the Mk19 WAK, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0010.

For inspection, refer to CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services.

For testing, refer to WP 0013, Unit Maintenance Functional Testing and Troubleshooting, of this manual.

The unit maintenance tasks listed above are to be performed on the Mk19 WAK components listed in Table 1.

NOTE

The Mk19 weapon to mount cable and linear actuator (charger) assembly are serviced at DS maintenance.

The linear actuator (charger), ogive plunger assembly, remote charging assembly, front bracket assembly, and remote firing solenoid are dispositioned at depot.

Table 1. Mk19 WAK Components

Description	Description
Mk19 Weapon to Mount Cable	Ogive Plunger Assembly with Locking Rounds Counter Block
Linear Actuator (Charger) Assembly with End Rod Assembly	Feed Throat
Front Bracket Assembly (see step 1 below)	Remote Charging Assembly with Ball Lock Pin (see step 2 below)
Solenoid, Remote Firing	

NOTE

For information on thread-locking, refer to WP 0007.

For information on the Mk19 WAK components, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0010.

1. If needed, remove/apply thread-lock compound to the front pin without the cap screw, located on the side of the front bracket assembly nearest the Sensor Group during disassembly/assembly. Thread-locking the side that is never adjusted ensures that the pin never falls out and enables the other side to be adjusted for the individual weapon.

2. If needed, remove/apply thread-lock compound to the retracting slide grip, socket head cap screw, and nut during disassembly/assembly.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT MAINTENANCE: M240 WEAPON ADAPTER KIT (WAK)

This work package contains information about performing unit-level maintenance tasks on the M240 WAK, including inspection, testing, removal of defective items, and installation/reassembly.

WORK IN PROCESS

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT MAINTENANCE: M249 WEAPON ADAPTER KIT (WAK)

This work package contains information about performing unit-level maintenance tasks on the M249 WAK, including inspection, testing, removal of defective items, and installation/reassembly.

WORK IN PROCESS

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT MAINTENANCE: ADDITIONAL WEAPON ADAPTER KIT (WAK)

This work package intentionally left blank.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

UNIT MAINTENANCE: BALLISTIC PROTECTION KIT

This work package contains information about installing the mission-dependent ballistic protection kit (armor) on the CROWS.

WP CONTENTS

Section/Subsection	Page
Initial Set Up	2
Maintenance Overview	2
Repair	4
Installation of the Armor	7
Installation Overview: Differences Between the M2 and Mk19 WAKs and the M240/M249 WAKs	7
Installation of Rear Panel	8
Installation of Side Panel	13
Installation of Front Panel	15
Installation of the Elevation Drive Ballistic Protection Assembly (BPA)	18
Installation of Ammo Can BPA	25
Installation of Sight BPA	32
Removal of Armor	42
Consideration Before and During Assembly	42
Removal of the Front Panel	43
Removal of the Side Panel	45
Removal of the Rear Panel	46
Removal of the Elevation Drive BPA	49
Removal of Ammo Can BPA	55
Removal of Sight BPA	59
Removal of Sight Side Panel	61
Adjust	64
Test	64

INITIAL SET-UP

Refer to Table 1 for tools, special tools, personnel required, materials, and references needed to inspect, test, and remove and replace the armor.

NOTE

Should a malfunction occur, refer to WP 0012, Unit Maintenance Troubleshooting Procedures.

Table 1. Initial Setup Information

Category	Item	Additional Information
Tools	Operator's Tool Kit	WP 0055, Table 2, Item 1
	Unit Tool Kit	WP 0055, Table 2, Item 8
Special Tools	N/A	
Personnel Required	Two	63B
Materials/Parts	Compound, thread locking	WP 0056, Table 1, Item 16
References	TM 9-1090-218-10	CROWS Operator's Manual

MAINTENANCE OVERVIEW

These instructions cover the inspection, repair, removal, replacement, and test of the armor components. Table 2 lists the armor components, with nomenclature, part numbers, and hardware needed.

NOTE

For unit-level general maintenance procedures, such as cleaning, lubrication, safety-wiring, thread-locking, and corrosion prevention and control (CPC), refer to the work packages in Chapter, 2, General Maintenance.

The standard steps to be completed for Unit Maintenance include Inspect, Remove, Install, and Replace. Remove and Replace activities include preparation, removal, and replacement, and forwarding items with a job order to direct support (DS) maintenance as needed.

The Unit Maintenance tasks listed above are to be performed on the armor components in Table 2.

NOTE

For additional information about the ballistics shade weldment, part of the Sensor Group, refer to WP 0020 of this manual.

For additional information on the ammo can, refer to the CROWS Operator Manual, TM 9-1090-218-10, WP 0009 for the M2 machine gun; WP 0010 for the Mk19 grenade gun; WP 0011 for the M240 machine gun; or WP 0012 for the M249 machine gun.

Table 2. Ballistic Armor

Description	Common Name	PN	Hardware Required	
			PN	Name
Ballistic Panel -- Front	Front Panel	21677-0705	21677-0708 21677-1060-011	standoff washer, flat
			21677-1060-011 21677-1060-014 21677-1060-013	washer, flat washer, lock nut, hex
Ballistic Panel -- Side	Side Panel	21677-0706	21677-1060-011 21677-1060-014 21677-0712	washer, flat washer, lock bolt
Ballistic Panel -- Rear	Rear Panel	21677-0707	21677-0708 21677-1060-011	standoff washer, flat
			21677-1060-011 21677-1060-014 21677-1060-013	washer, flat washer, lock nut, hex
			21677-1060-010	washer, thick
			21677-1060-011 21677-1060-012	washer, flat screw
Elevation Drive Ballistic Panel Assembly:	Elevation Drive BPA	21677-0715	NAS1149C0363R MS35338-138 MS16996-10	washer, flat washer, lock screw
			NAS1149C0363R MS35338-138 MS16996-14	washer, flat washer, lock screw
Weldment, Ballistic Panel, Housing	Elevation Drive Housing	21677-0716	21677-1060-011 21677-1060-014 21677-1060-013	washer, flat washer, lock nut, hex
Ballistic Panel, Front – Elevation Drive	Elevation Drive Front Panel	21677-0723	21677-1060-011 21677-1060-014 21677-1060-013	washer, flat washer, lock nut, hex
			21677-1060-011 92245A587	washer, flat screw
Ballistic Panel, Rear – Elevation Drive	Elevation Drive Rear Panel	21677-0724	21677-1060-011 21677-1060-014 21677-1060-013	washer, flat washer, lock nut, hex
			21677-1060-011 92245A587	washer, flat screw
Ballistic Panel, End – Elevation Drive	Elevation Drive End Panel	21677-0725	21677-1060-011 21677-1060-014 21677-1060-013	washer, flat washer, lock nut, hex
			21677-1060-011 92245A587	washer, flat screw

Table 2. Ballistic Armor - Cont

Description	Common Name	PN	Hardware Required	
			PN	Name
Ammo Can Ballistic Panel Assembly:	Ammo Can BPA	21677-0727		
	Ammo Can Partition, consisting of:			
Ballistic Partition Panel (ceramic)	Ammo Can Panel	21677-0728	92356A544	bolt, carriage
			21677-1060-015 21677-1060-016 21677-1060-017	washer, flat washer, lock nut
Partition (metal)	Ballistic Partition	21677-0729		
Ballistic Panel – End	Ammo Can End Panel	21677-0730	21677-1060-015 91286A113	washer, flat screw hex hd cap 1/4-20x1.25)
			21677-1060-015 21677-1060-016 21677-1060-017	washer, flat washer, lock nut, hex
Sight Ballistic Protection Assembly:	Sight BPA	21677-0713		
Ballistic Panel, End – Sight	Sight End Panel	21677-0709	21677-1060-011 21677-1060-014 21677-1060-013	washer, flat washer, lock nut, hex
			21677-1060-011 92245A587	washer, flat screw
Ballistic Panel, Rear – Sight	Sight Rear Panel	21677-0710	21677-1060-011 21677-1060-014 21677-1060-013	washer, flat washer, lock nut, hex
			92356A587	bolt, carriage
Ballistic Panel, Side – Sight	Sight Side Panel	21677-0711	21677-1060-011 21677-1060-014 21677-1060-013	washer, flat washer, lock nut, hex
			21677-1060-011 92245A587	washer, flat screw
Ballistic Sunshade Weldment	Sunshade	21677-0735		

REPAIR

Repair of the armor is accomplished by removal and replacement of the components listed in Table 2 that have been determined to be defective.

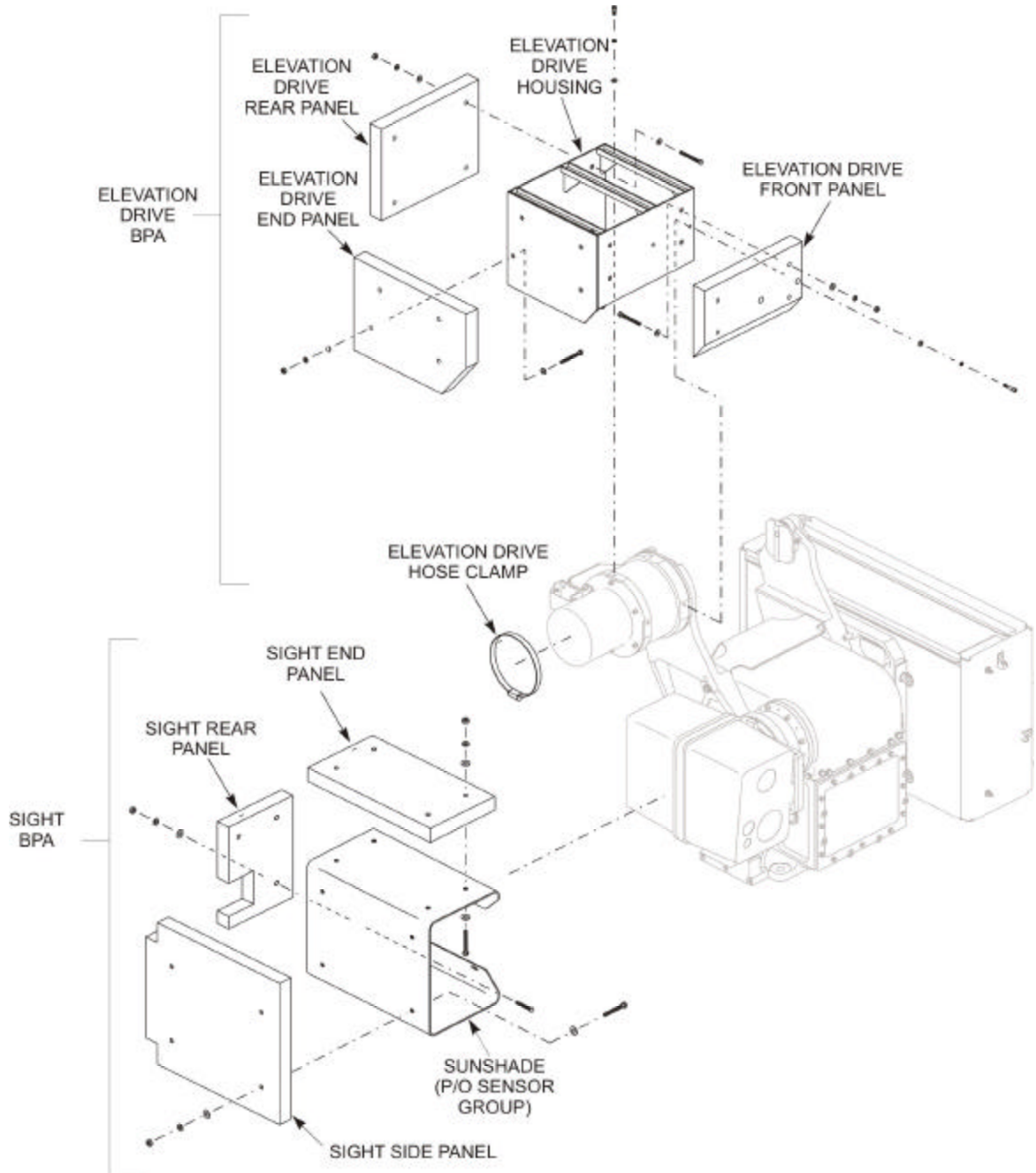


Figure 1. Locations of Elevation Drive and Sight Ballistic Protection Armor

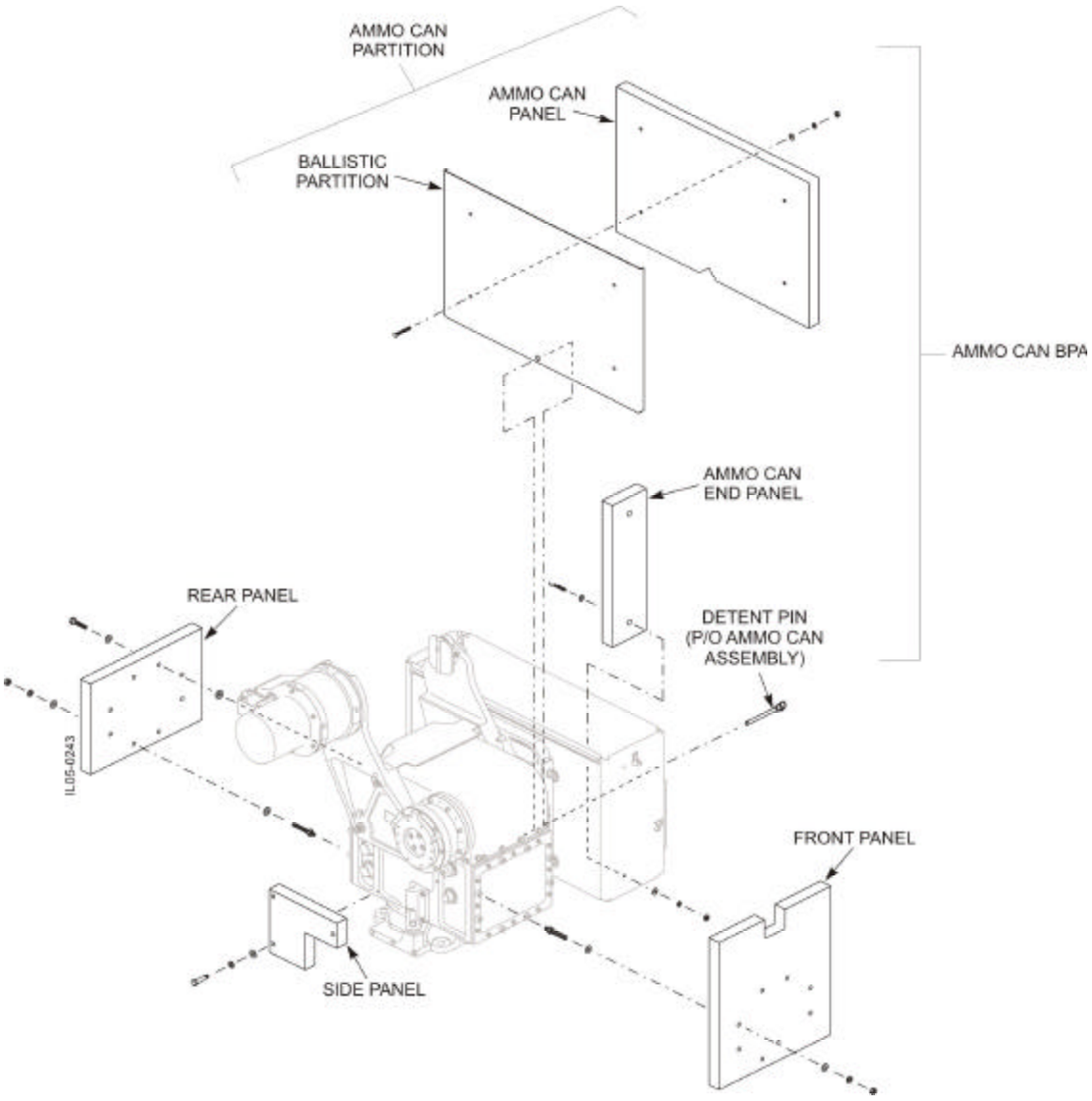


Figure 2. Locations of Ammo Can and Mount Ballistic Protection Armor

INSTALLATION OF THE ARMOR

See Figures 1 and 2 for an overview of the locations of the

Installation Overview: Differences between the M2 and Mk19 WAKs and the M240/M249 WAKs

NOTE

For additional information about the ammo can, refer to the Installation of Ammo Can BPA section of this work package.

For additional information about the M240/M249 WAK, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0011, M240; and WP 0012, M249.

Installation of the armor components listed in Table 2 is the same for the M2/Mk19 weapon adapter kits (WAKs) and the M240/M249 WAKs, with the following exception related to the ammo-can configuration: when using the M240/M249 WAK, the ammo can end panels are used, but the ammo can partition (the ammo can panel plus the ballistic partition) is not used. Remove the M2/Mk19 ammo can partition (armor version) and retain for late use.

Equipment Conditions:

NOTE

CROWS armor components may be installed with the stabilized weapon mount (SWM) and Control Group items (including the interconnection cables) installed on the vehicle; refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0014, for interconnection instructions, and the Vehicle Integration Kit (VIK), WP 0060, of this manual.

CROWS armor components may be installed with the weapon, weapon adapter kit (WAK), and cradle in place; refer to the CROWS Operator's Manual, TM 9-1090-218-10: WP 0009, M2; WP 0010, Mk19; WP 0011, M240; and WP 0012, M249.

Stabilized weapon mount (SWM) is attached to a flat, stable work surface; refer to the VIK, WP 0060, of this manual.

The ammo can may be installed on the mount; refer to CROWS Operator's Manual, TM 9-1090-218-10: WP 0009, M2; WP 0010, Mk19; WP 0011, M240; and WP 0012, M249.

Sensor unit, with sight support plate and sight adapter plate, are installed on the mount; the sunshade and mount to sensor cable are detached from the sensor unit. Refer to WP 0020 of this manual.

CAUTION

Ensure that painted surfaces are not damaged. For additional information, refer to WP 0008, Corrosion Prevention and Control (CPC) Instructions.
Ensure all attaching hardware is tightened evenly.
Failure to follow these instructions may result in equipment damage.

NOTE

Retain assemblies, components, and parts for later use or examination.
For additional information about the azimuth lock, refer to WP 0013.

1. If needed, ensure the azimuth lock is in the locked position when installing the armor components.

Installation of Rear Panel

Use the following procedures to install the rear panel.

Equipment Conditions: Refer to Installation of the Armor / Equipment Conditions section of this work package.

CAUTION

Each panel is labeled on one side with the part number. The textured side of the panel faces the inside and the smooth side faces outward. Disregard instructions printed on panel if instructed to install any other way.

Read and follow all instructions. Failure to follow these instructions may result in equipment damage.

NOTE

Each Nord-lock washer is a set of two washers (Figure 3).

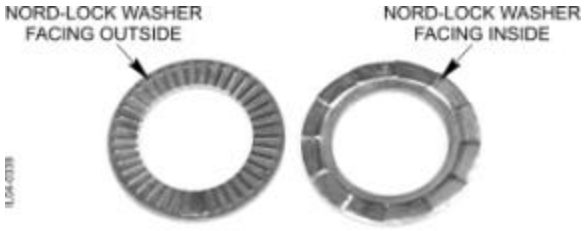


Figure 3. Nord-Lock Washer Set

NOTE

For additional information about the casing deflector, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0008, Preparation for Storage and Handling.

2. Using a 7/16-inch wrench, remove the two hex head screws and Nord-lock washer sets securing the casing deflector to the azimuth housing assembly of the pedestal, as shown in Figure 4. (The casing deflector will still be held in place by retaining screws in the yoke arms.) Retain attaching hardware for use if the armor is removed.

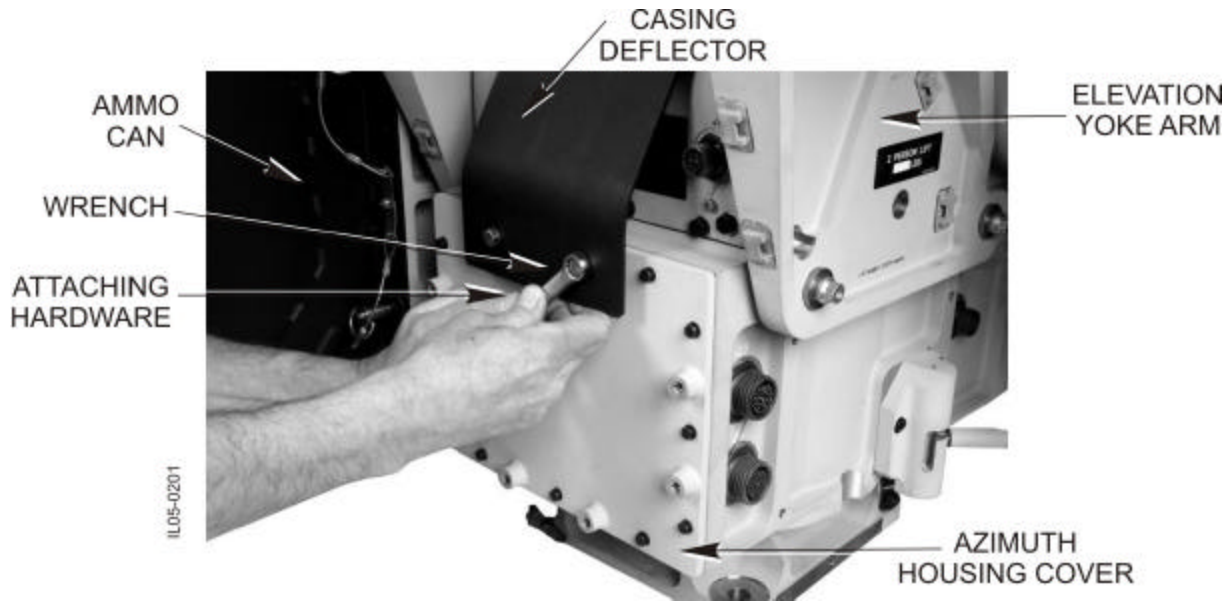


Figure 4. Casing Deflector and Attaching Hardware

NOTE

For additional information about applying thread-locking compound, refer to WP 0007.

Refer to Table 2 for guidance on hardware information.

3. Apply thread-locking compound to the 1/4-inch diameter threaded portion of the standoffs only, just before step 4 (following).

4. Insert the six standoffs into the bottom six shouldered holes in the azimuth housing cover, referring to Figure 5. Using a 1/2-inch wrench, tighten the standoffs.

5. Add a washer to each standoff, as shown in Figure 5.

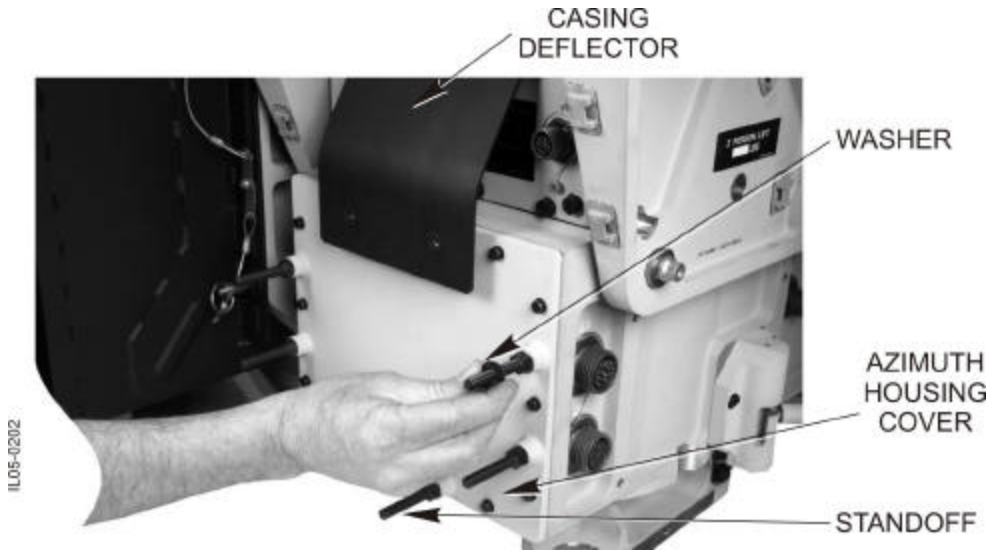


Figure 5. Standoffs with Flat Washers on Azimuth Housing Cover

NOTE

When installing the rear panel, observe the distance between each edge and the drilled holes. Place the rear panel with the smaller distance upwards.

6. Guide the rear panel over the standoffs and the casing deflector until it fits snuggly against the azimuth housing cover, as shown in Figure 6.

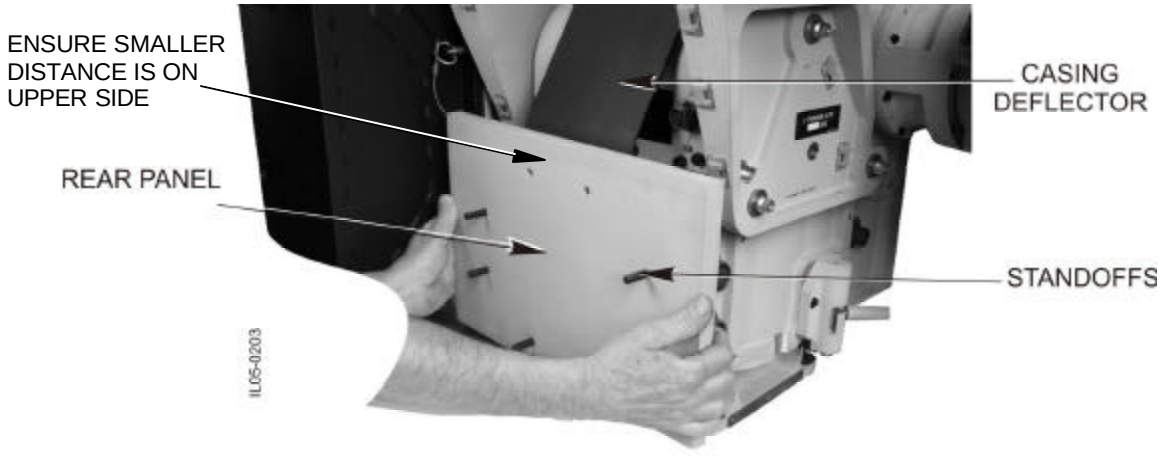


Figure 6. Rear Panel and Standoffs

NOTE

Use two personnel to align and secure the rear panel and attaching hardware to the casing deflector.

7. Position the two extra-thick washers between the casing deflector and the rear panel. While one person pushes on the top of the casing deflector, as shown in Figure 7, the second person aligns the holes in the rear panel, the extra-thick washers and the casing deflector.

NOTE

The assembly sequence for step 8 (below) is, from the outside of the rear panel and into the azimuth housing cover: a hex head bolt through a flat washer located on the outside of the panel, the rear panel, an extra-thick washer located between the panel and the casing deflector, and the casing deflector itself.

8. Once aligned, insert the two 1/4-inch-diameter hex head cap screws through the flat washers located on the outside of the rear panel, the two extra-thick washers between the panel and the casing deflector, and the deflector, and into the azimuth housing cover, referring to Figure 7.

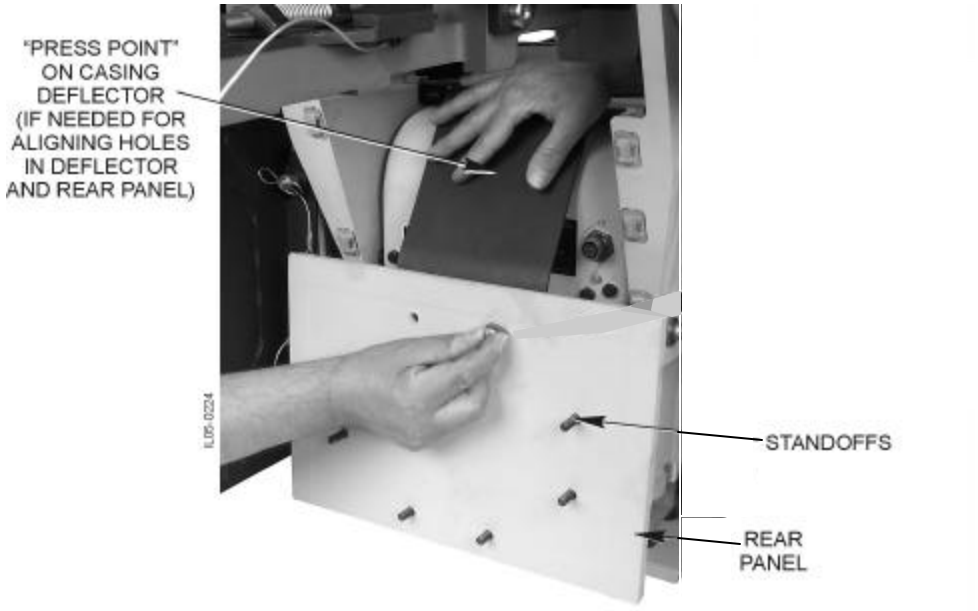


Figure 7. Aligning and Securing Rear Panel, Attaching Hardware and Casing Deflector

9. Tighten the two hex head cap screws (loosely) using a 7/16-inch wrench, as shown in Figure 8.

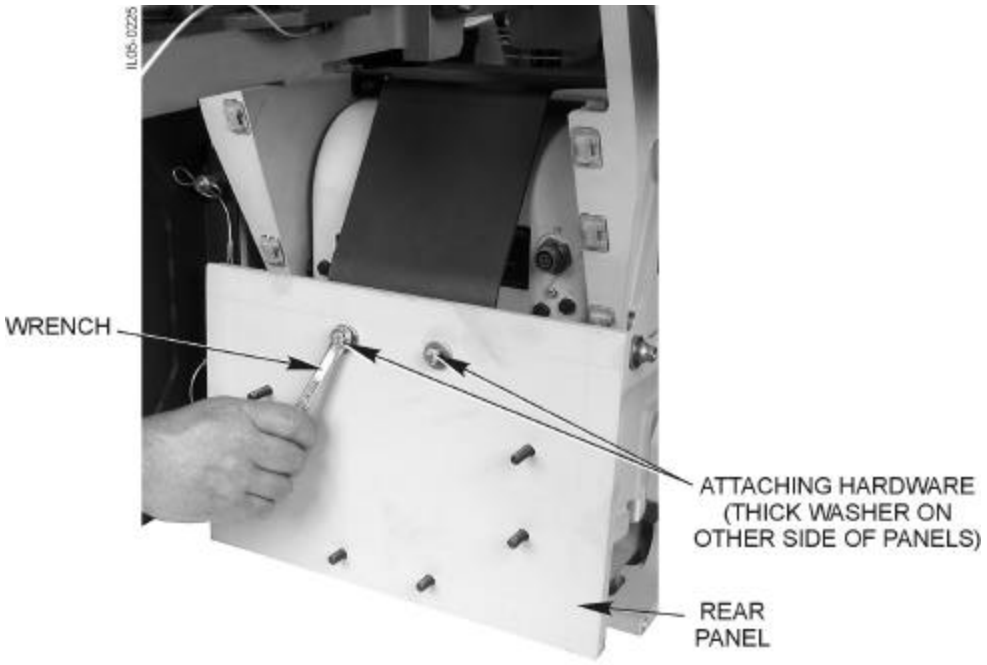


Figure 8. Tightening Attaching Hardware for Casing Deflector

10. Insert a flat washer, lock washer, and nut over each of the six standoffs, as shown in Figure 9, and tighten (loosely), using a 1/2-inch wrench.

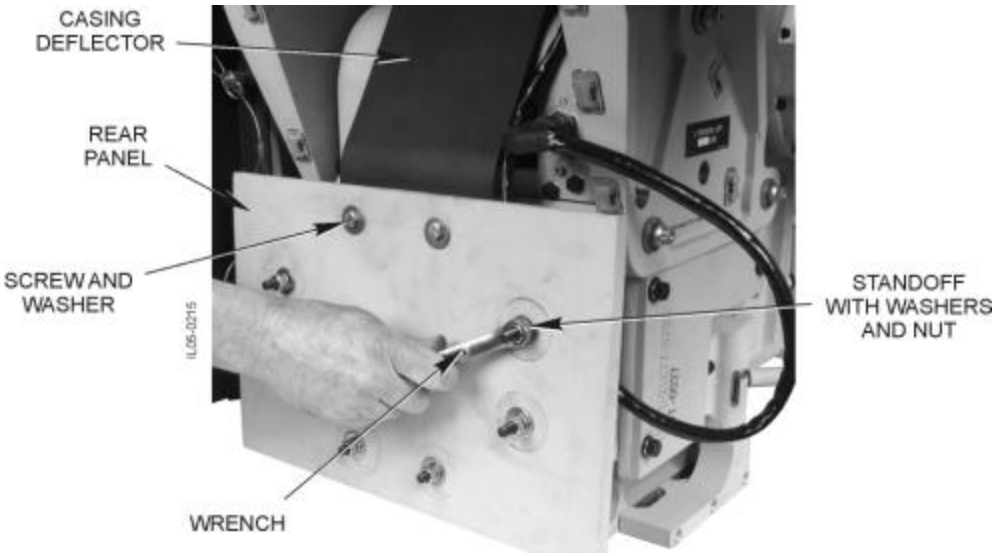


Figure 9. Attaching Hardware Securing the Rear Panel

CAUTION

Ensure all attaching hardware is tightened evenly. Failure to follow these instructions may result in equipment damage.

11. Tighten all of the nuts and screws securing the panel and casing deflector.

12. Once all the attaching hardware is in place, verify that the rear panel does not move. If needed, retighten the nuts and screws.

CAUTION

Ensure that all cables are routed and secured properly to prevent them from becoming tangled in the armor's attaching hardware. Failure to follow these instructions may result in equipment damage.

For additional information on cable installation, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0009, M2; WP 0010, Mk19; WP 0011, M240; and WP 0012, M249; and WP 0014, Interconnection. For information on the interconnection cables, refer to the VIK, WP 0060, of this manual.

13. Verify that all cables are properly routed and secured.

Installation of Side Panel

Use the following procedures to install the side panel.

Equipment Conditions: Refer to Installation of the Armor / Equipment Conditions section of this work package.

CAUTION

Each panel is labeled on one side with the part number. The textured side of the panel faces the inside and the smooth side faces outward. Disregard instructions printed on panel if instructed to install any other way.
NOTE

Refer to Table 2 for guidance on hardware information.

1. Position the side panel on the pedestal just beneath the elevation yoke arm to the left (facing) and above the azimuth lock assembly, referring to Figure 10.

2. Insert the three bolts through the flat washers and lock washers and into the pedestal, referring to Figure 10.

CAUTION

Ensure all attaching hardware is tightened evenly. Failure to follow these instructions may result in equipment damage.

3. Using a 1/2-inch wrench, tighten the bolts, as shown in Figure 10.

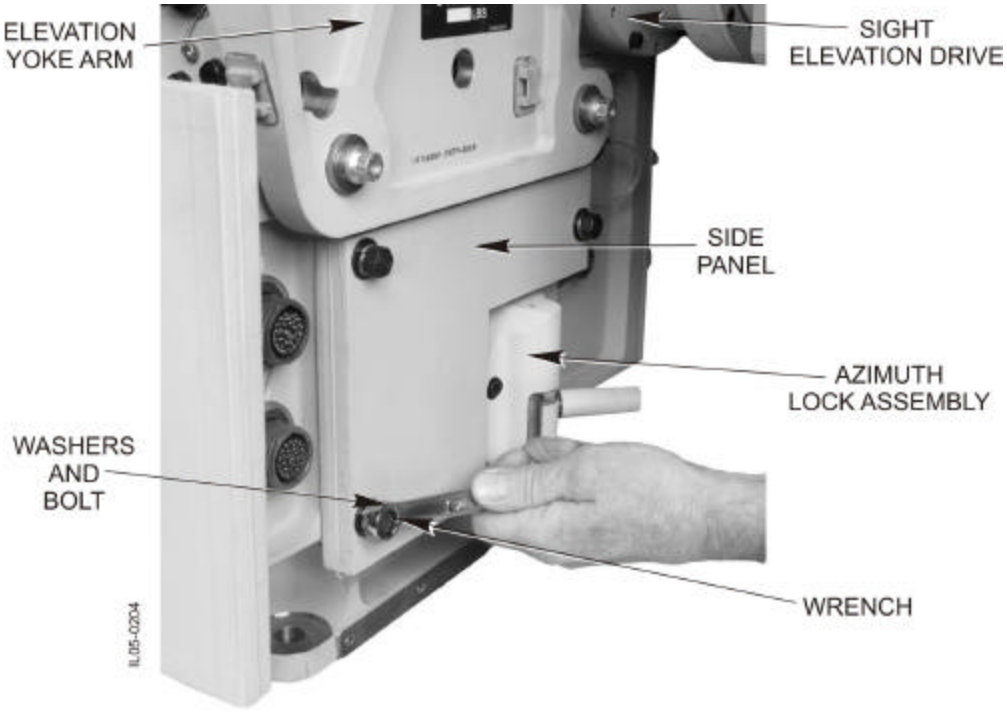


Figure 10. Side Panel with Attaching Hardware

4. Once all the attaching hardware is in place, verify that the side panel does not move. If needed, retighten the bolts.

CAUTION

Ensure that all cables are routed and secured properly to prevent them from becoming tangled in the armor's attaching hardware. Failure to follow these instructions may result in equipment damage.

For additional information on cable installation, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0009, M2; WP 0010, Mk19; WP 0011, M240; and WP 0012, M249; and WP 0014, Interconnection. For information on the interconnection cables, refer to the VIK, WP 0060, of this manual.

5. Verify that all cables are properly routed and secured.

Installation of the Front Panel

Use the following procedures to install the front panel.

Equipment Conditions: Refer to Installation of the Armor / Equipment Conditions section of this work package.

CAUTION

Each panel is labeled on one side with the part number. The textured side of the panel faces the inside and the smooth side faces outward. Disregard instructions printed on panel if instructed to install any other way.

NOTE

For additional information about applying thread-locking compound, refer to WP 0007.

Refer to Table 2 for guidance on hardware information.

1. Apply thread-locking compound to the 1/4-inch diameter threaded portion of the standoffs only, just before step 2 (following).
2. Insert eight standoffs into the holes in the azimuth housing cover and, using a 1/2-inch wrench, tighten the standoffs, referring to Figure 11.
3. Add a washer to each standoff, as shown in Figure 11.

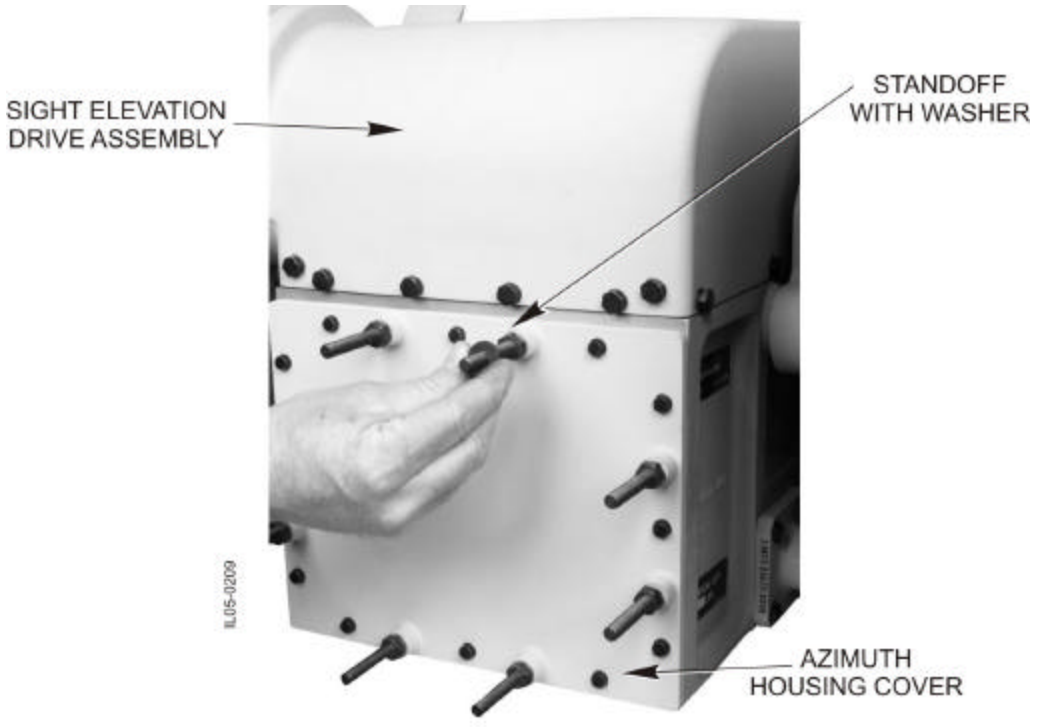


Figure 11. Standoffs in Place with Washer Added

NOTE

Ensure the square notch in the front panel faces up (Figure 12).

4. Guide the front panel over the standoffs until it fits snuggly against the azimuth housing cover, as shown in Figure 12.



Figure 12. Front Panel Positioned over Standoffs and Washers

5. Insert a flat washer, lock washer and nut over each of the eight standoffs, referring to Figure 13. Tighten (loosely), using a 1/2-inch wrench.

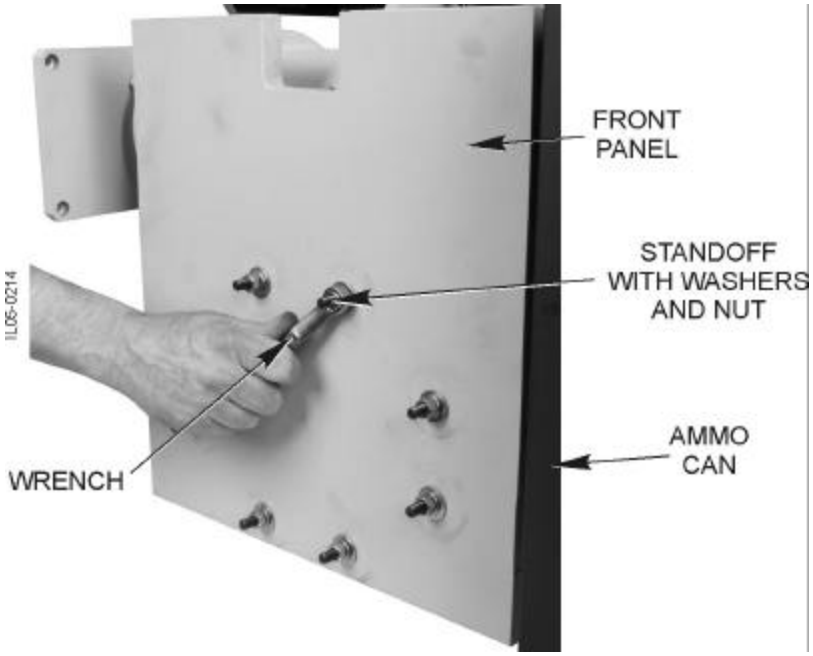


Figure 13. Front Panel with Attaching Hardware

CAUTION

Ensure all attaching hardware is tightened evenly. Failure to follow these instructions may result in equipment damage.

6. Tighten the nuts, using a 1/2-inch wrench.

7. Once all the attaching hardware is in place, verify that the front panel does not move. If needed, retighten the nuts.

CAUTION

Ensure that all cables are routed and secured properly to prevent them from becoming tangled in the armor's attaching hardware. Failure to follow these instructions may result in equipment damage.

For additional information on cable installation, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0009, M2; WP 0010, Mk19; WP 0011, M240; and WP 0012, M249; and WP 0014, Interconnection. For information on the interconnection cables, refer to the VIK, WP 0060, of this manual.

8. Verify that all cables are properly routed and secured.

Installation of the Elevation Drive Ballistic Protection Assembly (BPA)

Use the following procedures to install the elevation drive BPA (elevation drive housing with panels attached).

Equipment Conditions: Refer to Installation of the Armor / Equipment Conditions section of this work package.

CAUTION

Each panel is labeled on one side with the part number. The textured side of the panel faces the inside and the smooth side faces outward. Disregard instructions printed on panel if instructed to install any other way.

NOTE

Refer to Table 2 for guidance on hardware information.

1. Place the elevation drive housing on a flat, stable work surface, with the support side facing down, as shown in Figure 14.

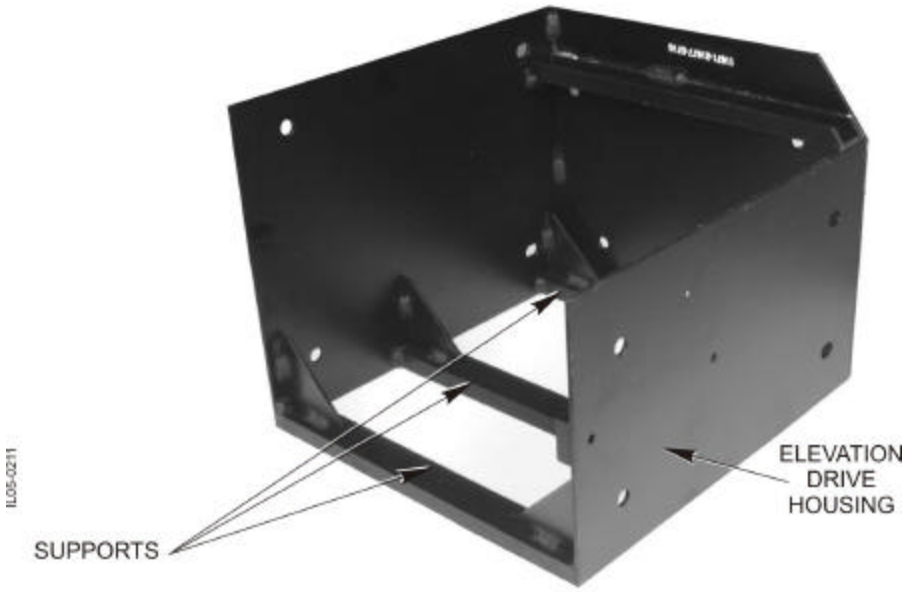


Figure 14. Elevation Drive Housing

~~Installation of Elevation Drive End Panel~~

Perform the following procedure to install the elevation drive end panel.

Equipment Conditions: Refer to Installation of the Armor / Equipment Conditions section of this work package.

NOTE

Align the angled corner on the elevation drive end panel with the angled corner on the elevation drive housing (Figure 15).

1. Position the elevation drive end panel to the elevation drive housing, referring to Figure 15.

NOTE

The assembly sequence in step 2 (below), for the elevation drive end panel and attaching hardware is (from outside the housing): hex head cap screw, flat washer, elevation drive end panel, elevation drive housing, flat washer, lock washer, and hex nut.

2. From outside the elevation drive housing, insert four hex head cap screws and flat washers through the housing end panel, then through the housing and into four flat washers and lock washers. Then install and finger tighten the four hex nuts.

CAUTION

Ensure all attaching hardware is tightened evenly. Failure to follow these instructions may result in equipment damage.

3. Tighten the hex nuts using a 1/2-inch wrench and a 1/2-inch adjustable wrench as the stabilizing wrench, as shown in Figure 15.

4. Once all the attaching hardware is in place, verify that the panel does not move. If needed, retighten the nuts.

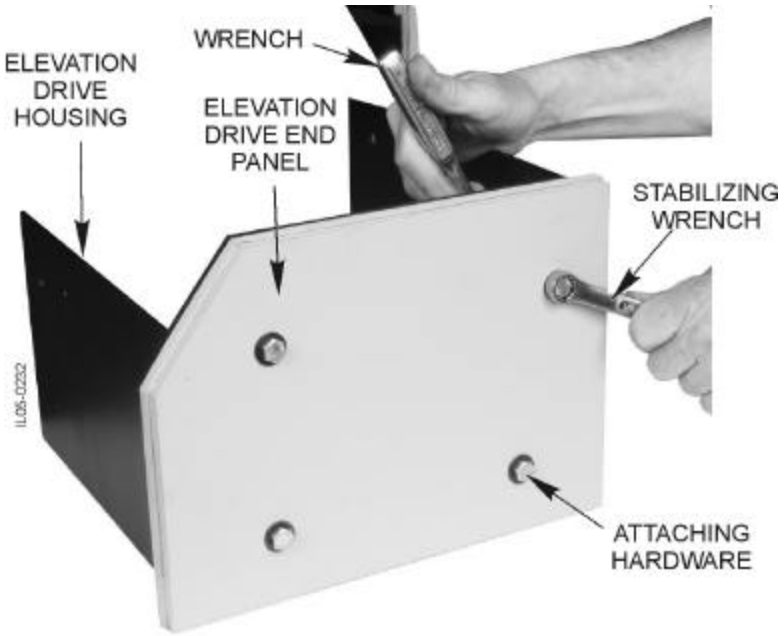


Figure 15. Elevation Drive End Panel

Installation of Elevation Drive Front Panel

Perform the following procedure to install the elevation drive front panel.

Eq**uipment Conditions:** Refer to Installation of the Armor / Equipment Conditions section of this work package.

1. Position the elevation drive front panel to the elevation drive housing, referring to Figure 16.

NOTE

The assembly sequence in step 2 (below) for the elevation drive front panel and attaching hardware is (from outside the housing): hex head cap screw, flat washer, elevation drive front panel, elevation drive housing, flat washer, lock washer, and hex nut.

2. From outside the elevation drive housing, insert four hex head cap screws and flat washers through the front panel and housing and into four flat washers and lock washers. Then install and finger tighten the four hex nuts.

CAUTION

Ensure all attaching hardware is tightened evenly. Failure to follow these instructions may result in equipment damage.

3. Tighten using a 1/2-inch wrench and a 1/2-inch adjustable wrench as the stabilizing wrench, as shown in Figure 16.

4. Once all the attaching hardware is in place, verify that the panel does not move. If needed, retighten the nuts.

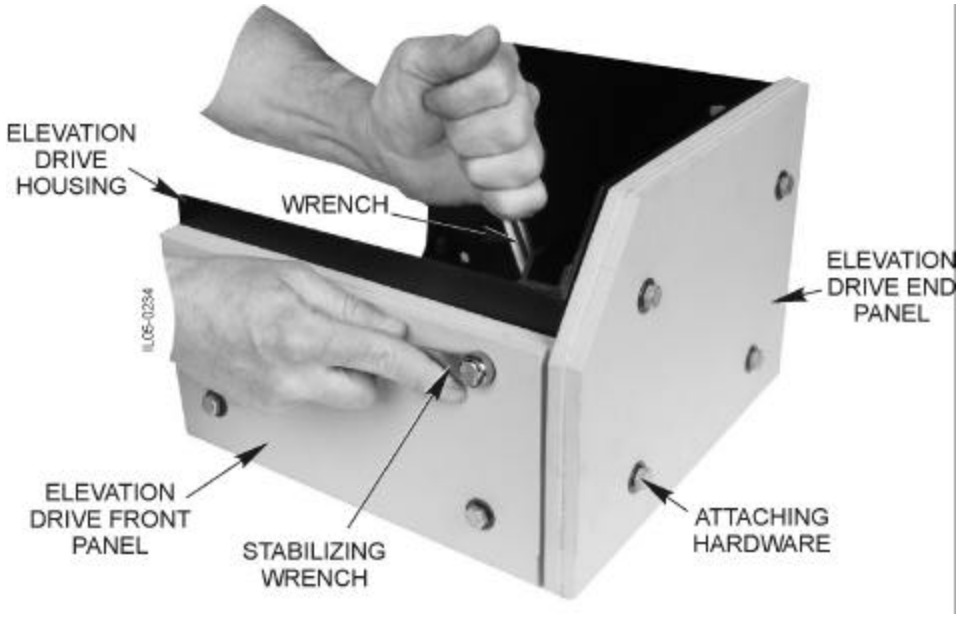


Figure 16. Elevation Drive Front Panel

Installation of Elevation Drive Rear Panel

Perform the following procedure to install the elevation drive rear panel.

Equipment Conditions: Refer to Installation of the Armor / Equipment Conditions section of this work package.

NOTE

For proper alignment of the elevation drive rear panel, make sure that the bottom of the elevation drive rear panel is even (flush) with the support side of the elevation drive housing and that the screw holes in the panel line up with the screw holes on the housing (Figure 17).

If the elevation drive rear panel is not properly positioned, the bottom of the panel will not line up evenly with the support side of the elevation drive housing.

1. Place the elevation drive housing on a flat, stable work surface, with the support side down, referring to Figure 17, then align the elevation drive rear panel to the elevation drive housing.

NOTE

The assembly sequence in step 2 (below) for the elevation drive rear panel and attaching hardware is (from outside the housing): hex head cap screw, flat washer, elevation drive rear panel, elevation drive housing, flat washer, lock washer, and hex nut.

2. From outside the elevation drive housing, insert four hex head cap screws and flat washers through the rear panel and housing and into four flat washers and lock washers. Then install and finger tighten the four hex nuts.

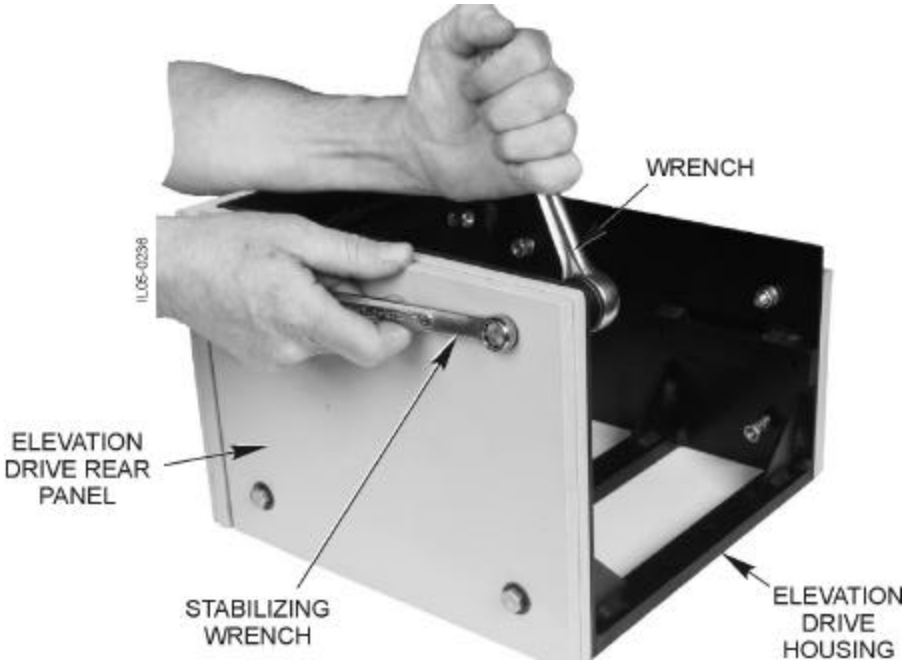


Figure 17. Elevation Drive Rear Panel

CAUTION

Ensure all attaching hardware is tightened evenly. Failure to follow these instructions may result in equipment damage.

3. Tighten using a 1/2-inch wrench and a 1/2-inch adjustable wrench as the stabilizing wrench, as shown in Figure 17.

4. Once all the attaching hardware is in place, verify that the panel does not move. If needed, retighten the nuts.

~~Installation of Elevation Drive BPA on Elevation Drive Assembly~~

NOTE

Use two personnel to install the elevation drive BPA.

Perform the following procedure to attach the elevation drive BPA (elevation drive housing with ballistic panels installed) to the elevation drive.

Equipment Conditions: Refer to Installation of the Armor / Equipment Conditions section of this work package.

1. Slide the hose clamp over the elevation drive assembly's motor cover, as shown in Figure 18.

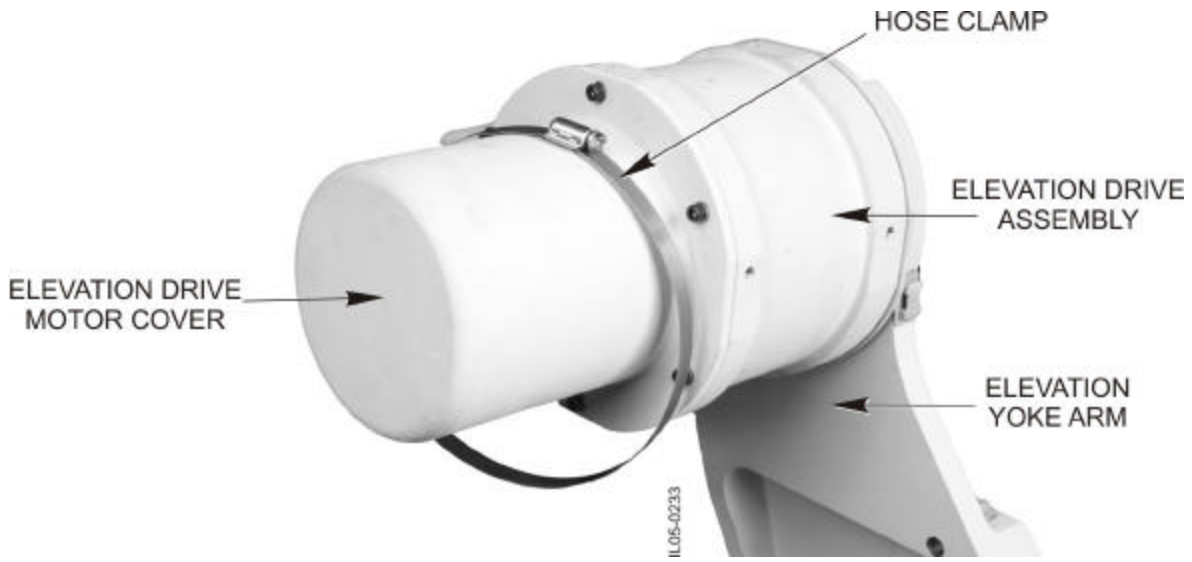


Figure 18. Hose Clamp on Elevation Drive's Motor Cover

2. Position the elevation drive BPA under and around the elevation drive motor cover, referring to Figure 19.

NOTE

For additional information about applying thread-locking compound, refer to WP 0007.

3. While one person holds the elevation drive BPA, the second person applies thread-locking compound to the socket head cap screws just before step 4 (following).

NOTE

Insert hardware into front panel first.

4. While one person continues to hold the elevation drive BPA, the other person inserts a socket head cap screw, lock washer, and flat washer into each of the two holes on the elevation drive front panel, as shown in Figure 19.

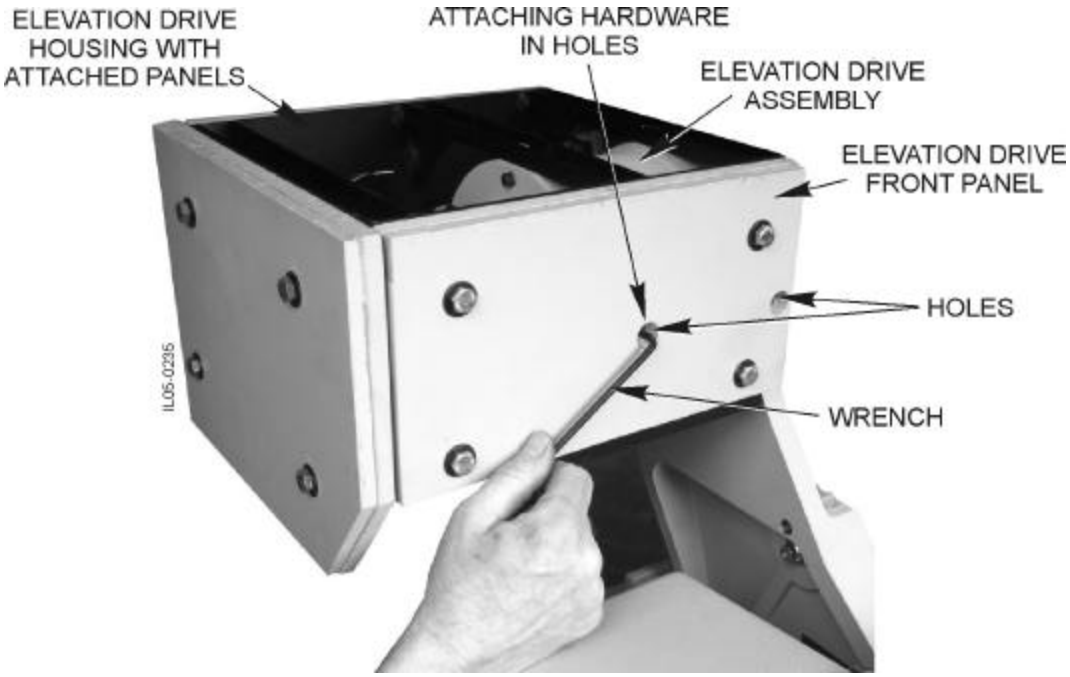


Figure 19. Elevation Drive BPA Positioned and Secured around Elevation Drive Assembly

5. Tighten the screws (loosely), using a 4-mm hex wrench, as shown in Figure 19.

NOTE

For additional information about applying thread-locking compound, refer to WP 0007.

6. While one person continues to hold the elevation drive BPA, the second person applies thread-locking compound to the screws just before step 7 (following).

7. Insert one screw, flat washer and lock washer into each of two supports (one by the elevation drive end panel and one in the center) on the elevation drive housing, as shown in Figure 20.

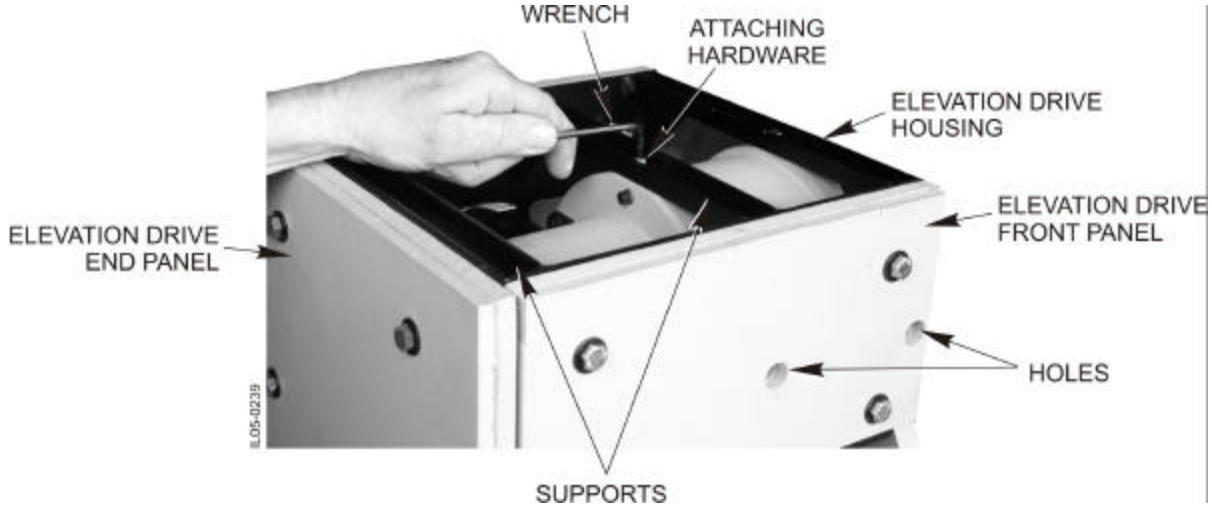


Figure 20. Securing Elevation Drive Housing Supports

8. Tighten the screws (loosely) using a 4-mm hex wrench, referring to Figure 20.

9. Position the hose clamp over the mounting tab on the elevation drive housing.

10. Using a flat screwdriver, tighten the screw on the clamp until the clamp cannot move, as shown in Figure 21. Ensure that any extra length of the clamp material is tucked into the side of the elevation drive housing.

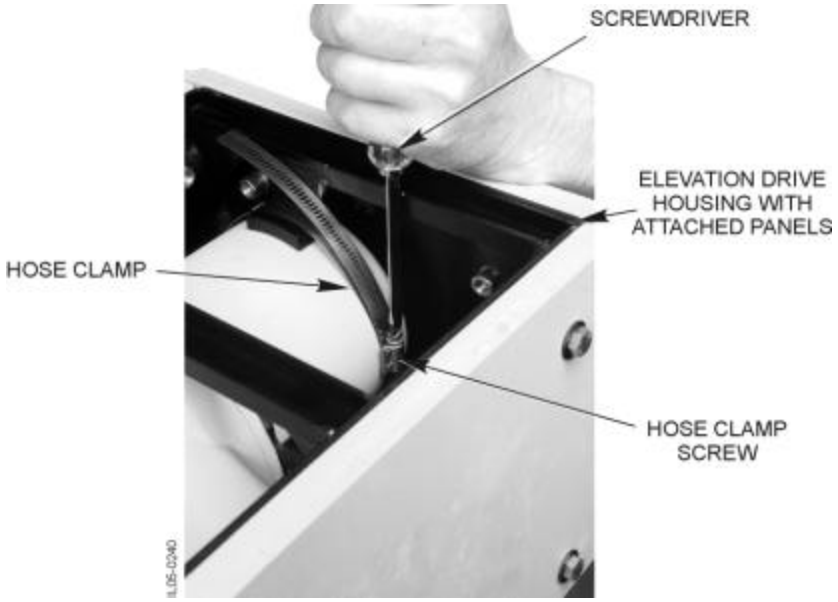


Figure 21. Hose Clamp Securing Elevation Drive Housing to Motor Cover

CAUTION

Ensure all attaching hardware is tightened evenly. Failure to follow these instructions may result in equipment damage.

11. Tighten the screws attaching the elevation drive BPA to the two supports using a 4-mm hex wrench, referring to Figure 20.

12. Tighten the two screws in the holes on the elevation drive front panel, as shown in Figure 20.

13. Once all the attaching hardware is in place, verify that the panels and elevation drive housing do not move. If needed, retighten the appropriate hardware.

CAUTION

Ensure that all cables are routed and secured properly to prevent them from becoming tangled in the armor's attaching hardware. Failure to follow these instructions may result in equipment damage.

For additional information on cable installation, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0009, M2; WP 0010, Mk19; WP 0011, M240; and WP 0012, M249; and WP 0014, Interconnection. For information on the interconnection cables, refer to the VIK, WP 0060, of this manual.

14. Verify that all cables are properly routed and secured.

Installation of Ammo Can BPA

Perform the following procedures to install the ammo can BPA, which consists of the ammo can partition (the ammo can panel [ceramic] attached to the ballistic panel [metal]) and the ammo can end panels.

Equipment Conditions: Refer to Installation of the Armor / Equipment Conditions section of this work package.

CAUTION

Each panel is labeled on one side with the part number. The textured side of the panel faces the inside and the smooth side faces outward. Disregard instructions printed on panel if instructed to install any other way.

Read and follow all instructions. Failure to follow these instructions may result in equipment damage.

NOTE

Each Nord-lock washer is a set of two washers (Figure 3).

~~Ammo Can Armor Components: M240/M249 WAK Only~~

Installation of the ammo can armor components for the M240/M249 WAKs consists of installing the ammo can end panels only.

Equipment Conditions: Refer to Installation of the Armor / Equipment Conditions section of this work package.

NOTE

The ammo can partition (the ammo can panel plus the ballistic partition) used with the M2 and Mk19 WAKs is not used with the M240/M249 WAKs. For additional information on the ammo can partition, refer to the Assembly and Installation of Ammo Can Partition – M2 and Mk19 WAKs section of this work package.

For additional information on the ammo can end panels, refer to the Installation of the Ammo Can End Panels – All WAKs section of this work package.

Perform the following procedure to prepare the ammo can (armor version) for use with the M240/M249 WAKs.

1. If needed, remove the M2/Mk19 ammo can partition (armor version) or the partition (original version) and retain for later use.

2. Install the ammo can end panels as detailed in the Installation of the Ammo Can End Panels – All WAKs section of this work package.

~~Installation of Ammo Can End Panels – All WAKs~~

Perform the following procedures to install the ammo can end panels.

Equipment Conditions: Refer to Installation of the Armor / Equipment Conditions section of this work package.

CAUTION

Each panel is labeled on one side with the part number (the textured side that faces the interior of the ammo can). Ensure that the smooth side of the panel touches the interior of the ammo can (and faces the outside). Read and follow all instructions. Failure to follow these instructions may result in equipment damage.

NOTE

The following procedure may be performed with the ammo can installed on the mount or separated from the mount. If the ammo can is removed from the mount, ensure that it is placed on a flat, stable work surface.

The following procedure may be performed with the M2/Mk19 ammo can partition installed or removed from the ammo can. The M2/Mk19 partition or ammo can partition must be removed to operate the M240/M249 WAKs.

For additional information on the ammo can, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0009 for the M2 machine gun; WP 0010 for the Mk19 grenade gun; WP 0011 for the M240 machine gun; or WP 0012 for the M249 machine gun.

3. Following the instructions on the ammo can end panel, position the end panel against an end wall of the ammo can and align the holes top and bottom with the holes on the ammo can, referring to Figure 22.

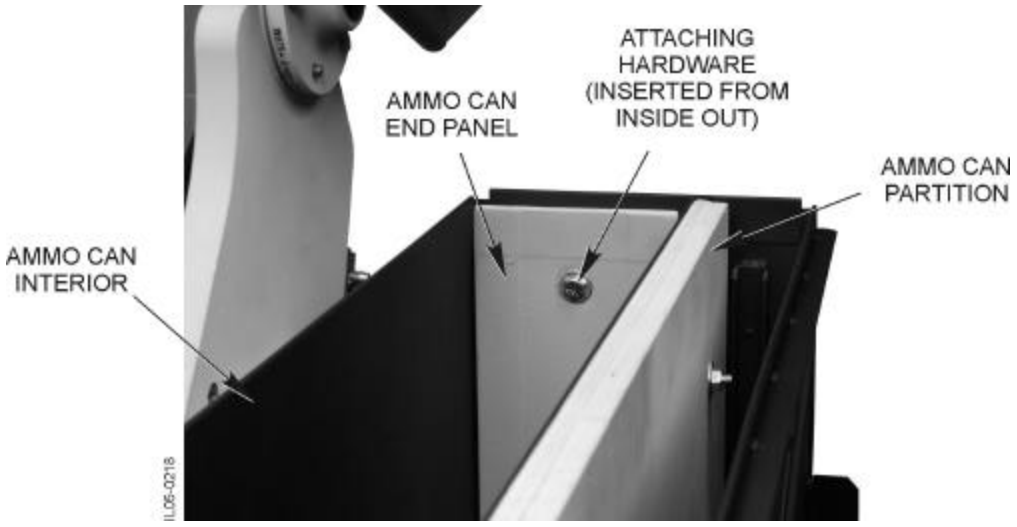
NOTE

The instructions for attaching the end panels apply to either of the end panels.
The assembly sequence in step 2 (below) for the ammo can end panel and attaching hardware is (from inside the ammo can): hex head cap screw, flat washer, ammo can end panel, ammo can, flat washer, lock washer, and hex nut.

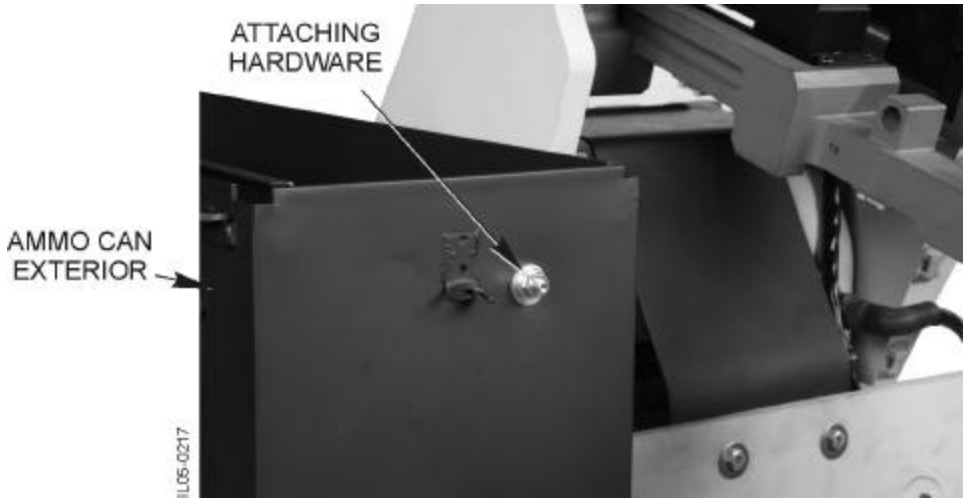
4. From inside the ammo can, insert two hex head cap screws and flat washers through the end panel and ammo can wall and into two flat washers and lock washers. Then install and loosely tighten the two hex nuts, referring to Figure 22.

NOTE

The ammo can partition is used only with the M2 and Mk19 WAKs. The ammo can partition must be removed when the M240/M249 WAKs are being used.



Interior View



Exterior View

Figure 22. End Panel for the Ammo Can – Interior and Exterior Views

CAUTION

Ensure all attaching hardware is tightened evenly. Failure to follow these instructions may result in equipment damage.

5. Tighten the two hex nuts using a 1/2-inch wrench and a 1/2-inch adjustable wrench as the stabilizing wrench, as shown in Figure 23.

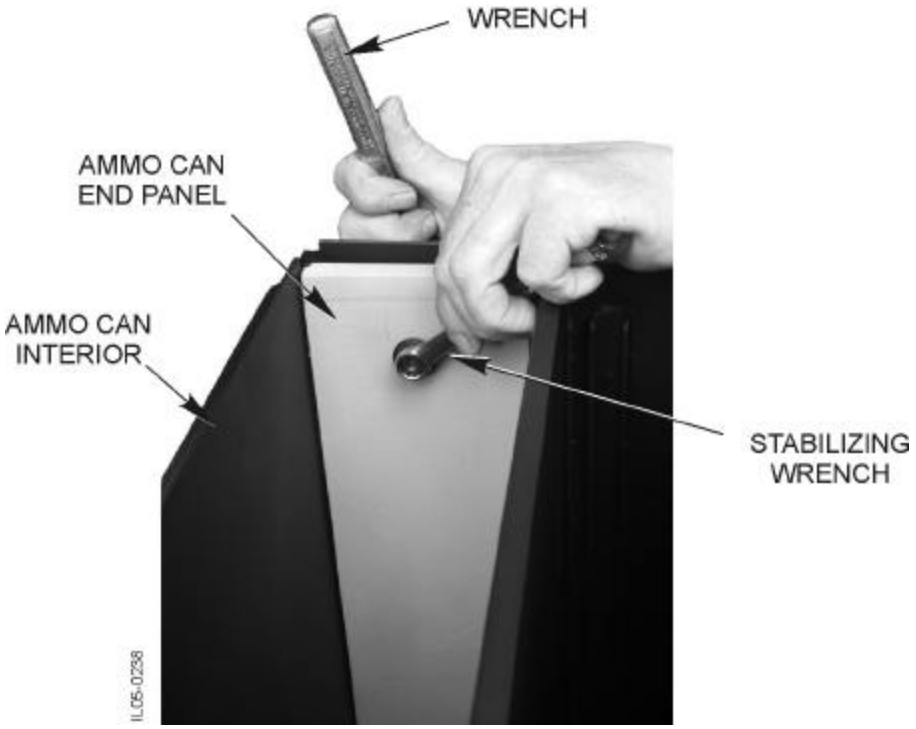


Figure 23. Ammo Can End Panel Secured

6. Once all the attaching hardware is in place, verify that the panel does not move. If needed, retighten the screws and nuts.

7. Repeat steps 1 thru 6 (above) for the other end panel.

Assembly and Installation of Ammo Can Partition – M2 and Mk19 WAKs

NOTE

The following procedure for the ammo can partition applies to the M2 and Mk19 weapon adapter kits (WAKs) only.

For information on the M240/M249 WAK armor, refer to the Ammo Can Armor Components – M240/M249 WAK Only section of this work package.

Perform the following procedures to assemble the ammo can panel (ceramic) to the ballistic partition (metal), and install the resulting ammo can partition.

Equipment Conditions: Refer to Installation of the Armor / Equipment Conditions section of this work package.

NOTE

The following procedure can be performed with the ammo can installed on the mount or separated from the mount. If the ammo can is removed from the mount, ensure that it is placed on a flat, stable work surface.

The following procedure can be performed with the ammo can end panels installed or removed.

For additional information on the ammo can, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0009 for the M2 machine gun; WP 0010 for the Mk19 grenade gun; WP 0011 for the M240 machine gun; or WP 0012 for the M249 machine gun.

For additional information on the ammo can end panels, refer to the Installation of Ammo Can End Panels – All WAKs section of this work package.

1. Ensure that the ammo can cover is removed from the ammo can and properly stowed.

NOTE

Should the ammo can partition or its components need to be replaced, refer to the Removal and Disassembly of Ammo Can Partition section of this work package.

2. Remove the detent pin securing the partition (original version) in the can.

3. Remove the partition (original version) from the ammo can and retain for later use.

4. Place the ballistic partition (metal) on a flat, stable work surface with the lip side facing up, referring to Figure 24.

5. Insert four carriage bolts through the ballistic partition from underneath, as shown in Figure 24.

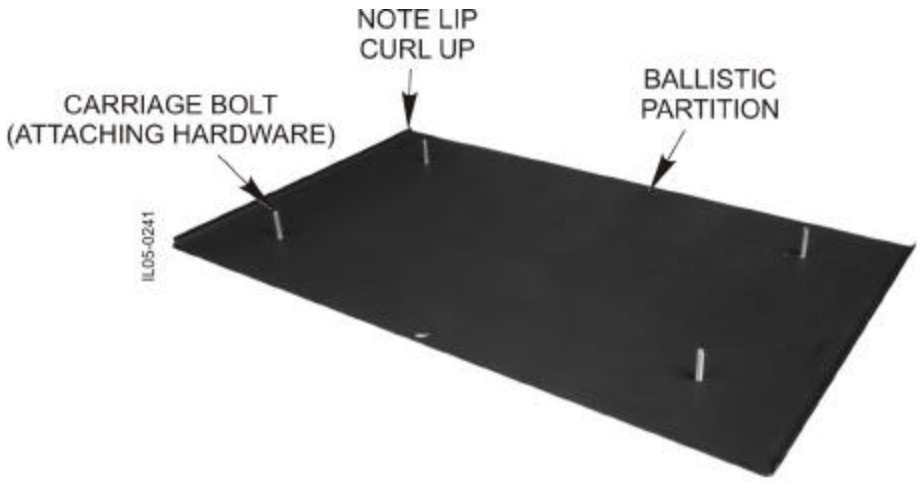


Figure 24. Ballistic Partition, Lip-Side Up with Bolts Inserted

NOTE

Ensure that the notch on the ammo can panel faces down when installing it on the ballistic partition, allowing insertion of the detent pin through the ammo can partition once it is in place.

6. Following the instructions on the ammo can panel, align and install the ammo can panel (textured side down) over the carriage bolts on the ballistic partition, referring to Figure 25.

7. Insert four flat washers, lock washers, and nuts onto the four carriage bolts, referring to Figure 25.

CAUTION

Ensure all attaching hardware is tightened evenly. Failure to follow these instructions may result in equipment damage.

8. Tighten the four nuts using a 7/16-inch wrench, as shown in Figure 25.

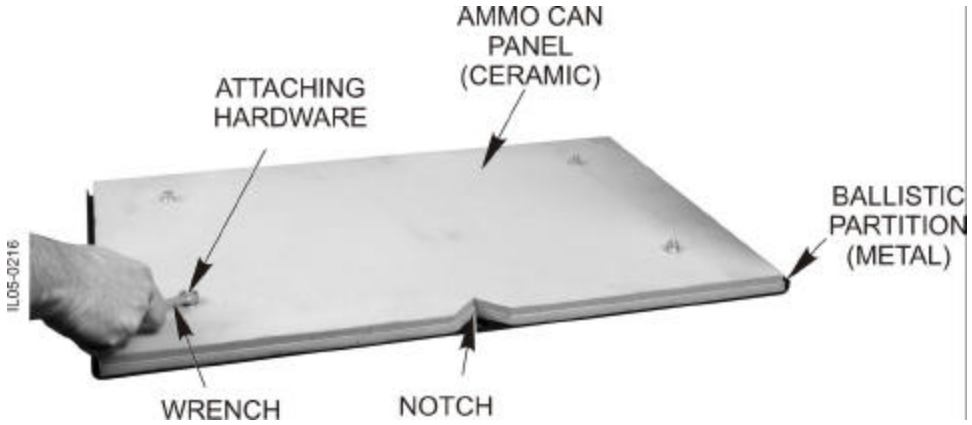


Figure 25. Ammo Can Partition (Ammo Can Panel with Ballistic Partition)

9. Once all the attaching hardware is in place, verify that the panel does not move. If needed, retighten the screws.

NOTE

Ensure that the notch on the panel faces down when installing the ammo can partition into the ammo can.

For additional information on the ammo can, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0009 for the M2 machine gun; WP 0010 for the Mk19 grenade gun; WP 0011 for the M240 machine gun; or WP 0012 for the M249 machine gun.

10. Insert the ammo can partition into the appropriate set of rails in the ammo can with the nuts facing away from the mount, referring to Figure 22.

11. Insert the detent pin through the ammo can wall and the ammo can partition until the pin is seated firmly.

CAUTION

Ensure that all cables are routed and secured properly to prevent them from becoming tangled in the armor's attaching hardware. Failure to follow these instructions may result in equipment damage.

For additional information on cable installation, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0009, M2; WP 0010, Mk19; WP 0011, M240; and WP 0012, M249; and WP 0014, Interconnection. For information on the interconnection cables, refer to the VIK, WP 0060, of this manual.

12. Verify that all cables are properly routed and secured.

Installation of Sight BPA

Use the following procedure to install the sight BPA (panels attached to the sunshade).

Equipment Conditions: Refer to Installation of the Armor / Equipment Conditions section of this work package. In addition:

Mount to sensor cable is detached from the sensor unit, referring to WP 0020.

Sunshade is removed from the Sensor Group, referring to WP 0020.

CAUTION

Each panel is labeled on one side with the part number. The textured side of the panel faces the inside and the smooth side faces outward. Disregard instructions printed on panel if instructed to install any other way.
NOTE

Refer to Table 2 for guidance on hardware information.

1. Place the sunshade on a flat, stable work surface, as shown in Figure 26.



Figure 26. Sunshade for Sensor Unit

Installation of the Sight Side Panel

Perform the following procedure to install the sight side panel onto the sunshade.

Equipment Conditions: Refer to Installation of the Armor / Equipment Conditions section of this work package.

NOTE

Ensure that the notches on the sight side panel face the rear of the sunshade (Figure 27).

1. Place the sight side panel on the sunshade with the notches facing the rear of the sunshade, as shown in Figure 27.

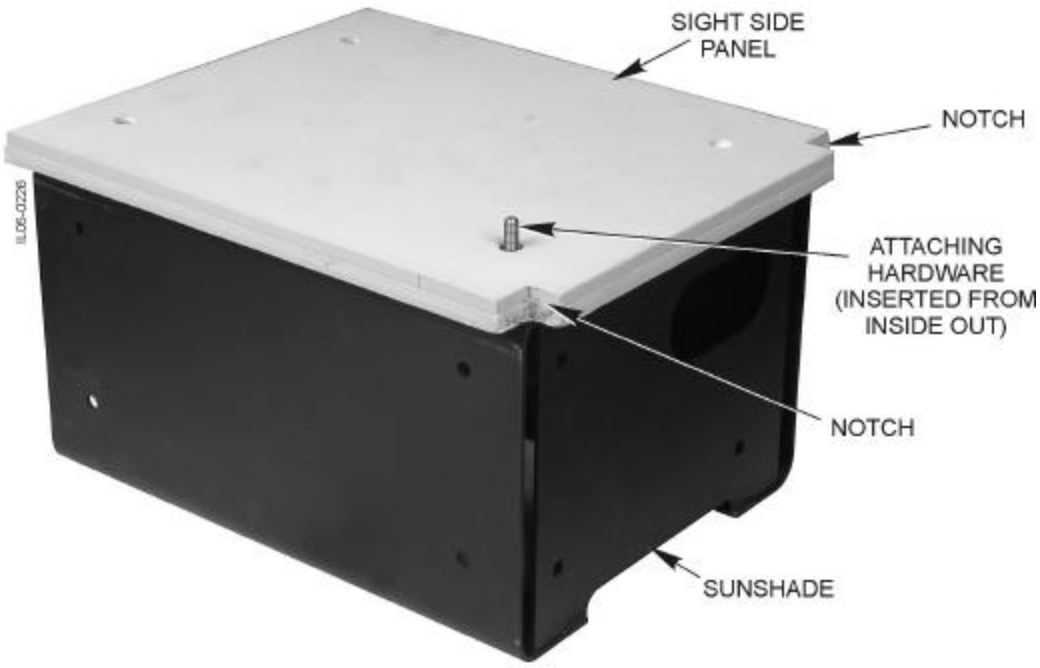


Figure 27. Sight Side Panel Positioned on Sunshade With Attaching Hardware

NOTE

The assembly sequence for step 2 (below), attaching the sight side panel to the sunshade, is as follows (from inside the sunshade): hex head cap screw, flat washer, sunshade, sight side panel, flat washer, lock washer, and hex nut.

2. From inside the sunshade, insert four hex head cap screws and flat washers through the sunshade and sight side panel and into four flat washers and lock washers. Then install and loosely tighten four hex nuts, as shown in Figures 27 and 28.

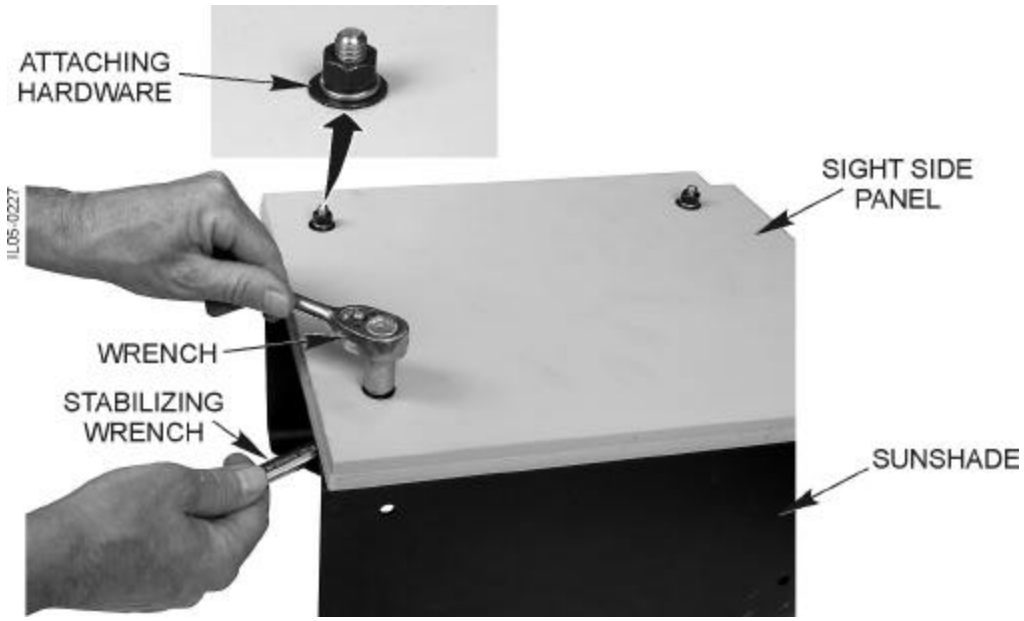


Figure 28. Sight Side Panel

CAUTION

Ensure all attaching hardware is tightened evenly. Failure to follow these instructions may result in equipment damage.

3. Tighten the four hex nuts using a 1/2-inch wrench and a 1/2-inch adjustable stabilizing wrench, as shown in Figure 28.

4. Once all the attaching hardware is in place, verify that the panel does not move. If needed, retighten the nuts, referring to Figure 28.

Installation of the Sight End Panel

Perform the following procedure to install the sight end panel on the sunshade.

Equipment Conditions: Refer to Installation of the Armor / Equipment Conditions section of this work package.

NOTE

The installation instructions are the same for the two sight end panels.

1. Turn the sunshade on its side and position the sight end panel onto the sunshade, referring to Figure 29.

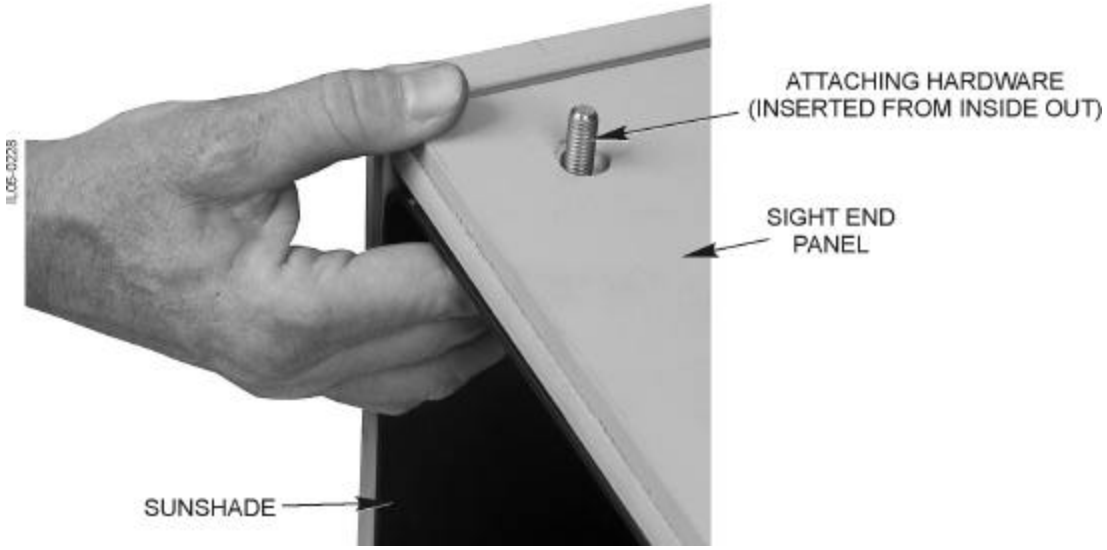


Figure 29. Sight End Panel

NOTE

The assembly sequence for step 2 (below), attaching the sight end panels to the sunshade, is as follows (from inside the sunshade): hex head cap screw, flat washer, sunshade, sight side panel, flat washer, lock washer, and hex nut.

2. From inside the sunshade, insert four hex head cap screws and flat washers through the sunshade and sight end panel and into four flat washers and lock washers. Then install and loosely tighten four hex nuts, referring to Figures 29 and 30.

CAUTION

Ensure all attaching hardware is tightened evenly. Failure to follow these instructions may result in equipment damage.

3. Tighten the hex nuts using a 1/2-inch wrench and a 1/2-inch wrench or socket stabilizing wrench, as shown in Figure 30.

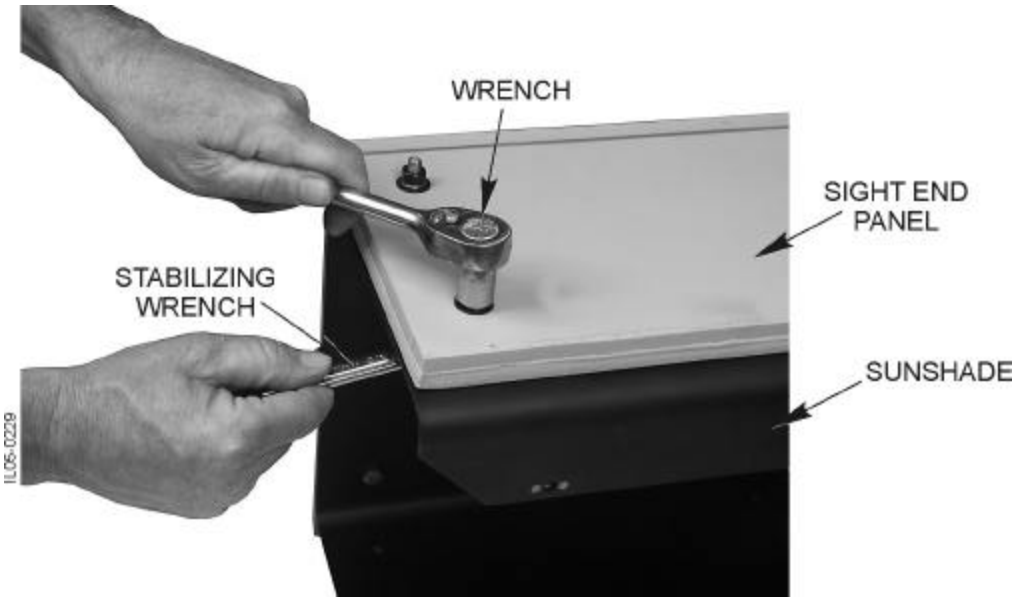


Figure 30. Sight End Panel

4. Once all the attaching hardware is in place, verify that the panel does not move. If needed, retighten the screws.

5. Repeat steps 1 thru 4 (above) for the other sight end panel.

Installation of the Sight Rear Panel

Perform the following procedure to install the sight rear panel on the sunshade.

Equipment Conditions: Refer to Installation of the Armor / Equipment Conditions section of this work package.

1. Place the sunshade with the sight side panel facing down, as shown in Figure 31.



Figure 31. Sunshade with Sight Side Panel Down to Attach the Sight Rear Panel

2. Position the sight rear panel on the rear of the sunshade with the cutout portion aligned with the opening for the connectors, referring to Figure 32.

NOTE

The assembly sequence for step 3 (below), attaching the sight rear panel to the sunshade, is as follows (from inside the sunshade): carriage bolts, flat washer, sunshade, sight rear panel, flat washer, lock washer, and hex nut.

3. From inside the sunshade, insert the three carriage bolts through the sunshade and sight rear panel and through the three flat washers and lock washers. Then install the three hex nuts, referring to Figure 32.

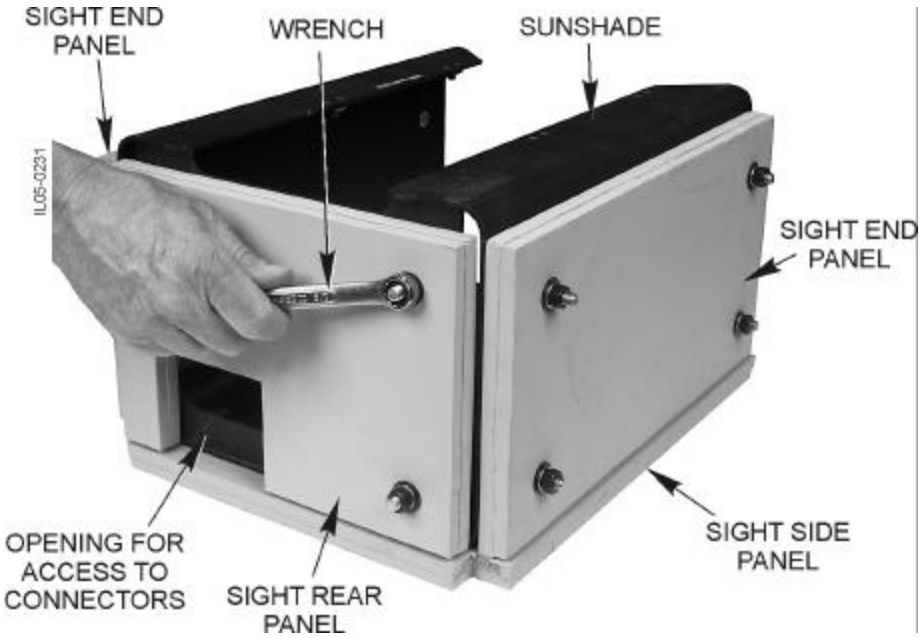


Figure 32. Sight Rear Panel with Attaching Hardware – Fix callout – side rear

CAUTION

Ensure all attaching hardware is tightened evenly. Failure to follow these instructions may result in equipment damage.

4. Tighten the nuts using a 7/16-inch wrench, as shown in Figure 32.

5. Once all the attaching hardware is in place, verify that none of the panels move. If needed, retighten the screws and bolts.

Installation of the Sight BPA on the Sensor Unit

Perform the following procedure to install the sight BPA (sunshade with armor attached) onto the sensor unit.

Equipment Conditions: Refer to Installation of the Armor / Equipment Conditions section of this work package.

CAUTION

Use two personnel to install the sight BPA onto the sensor unit. Failure to do so may result in equipment damage.

NOTE

For additional information on the Sensor Group, refer to WP 0020 of this manual.

1. Ensure that the sensor unit with sight adapter plate is properly installed onto the sight support plate, as detailed in WP 0020 of this manual.

2. While one person is holding the sight BPA, the second person tilts and holds the sensor unit at an approximately 20° to 30° angle, as shown in Figure 33.

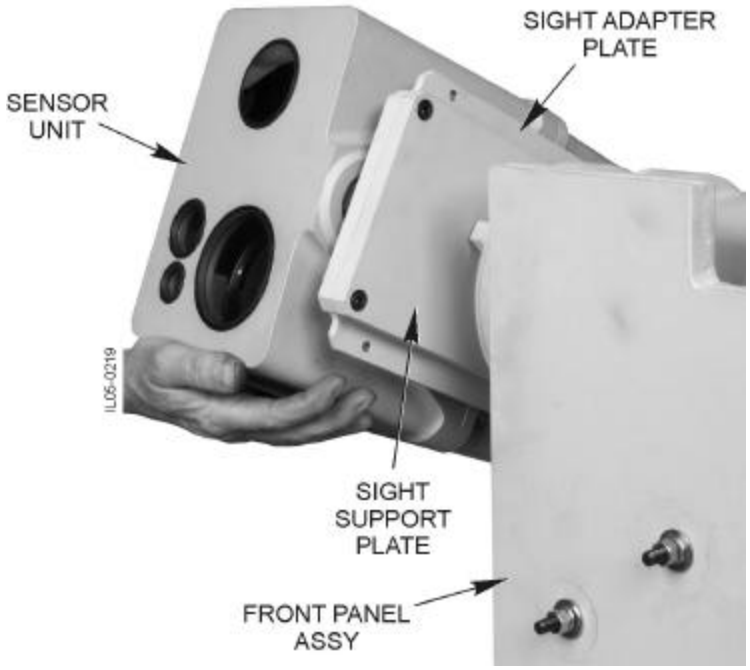


Figure 33. Sensor Unit Positioned for Installation of Sight BPA

3. While one person holds the sensor unit in place, the second person carefully slides the sight BPA over the sensor unit, as shown in Figure 34.

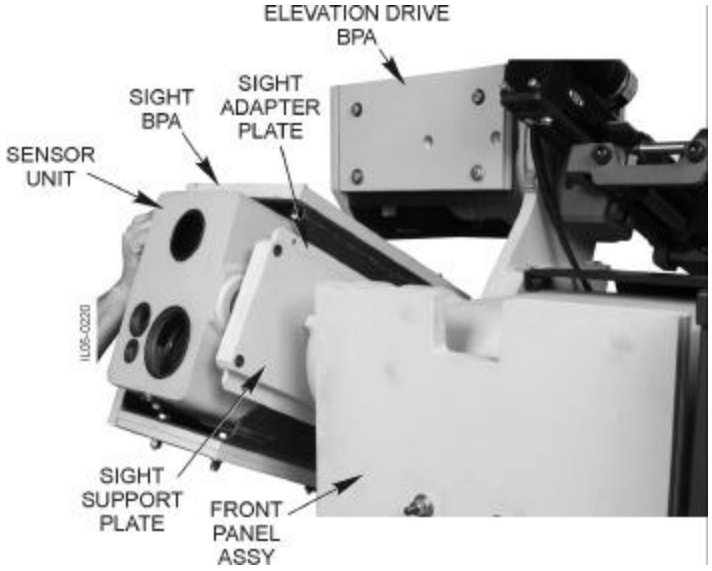


Figure 34. Sight BPA Sliding onto the Sensor Unit

4. While one person holds the sight BPA in position, the second person inserts and tightens the four screws and flat washers securing the sight BPA to the sensor unit, as shown in Figure 35, using a 7/16-inch wrench.

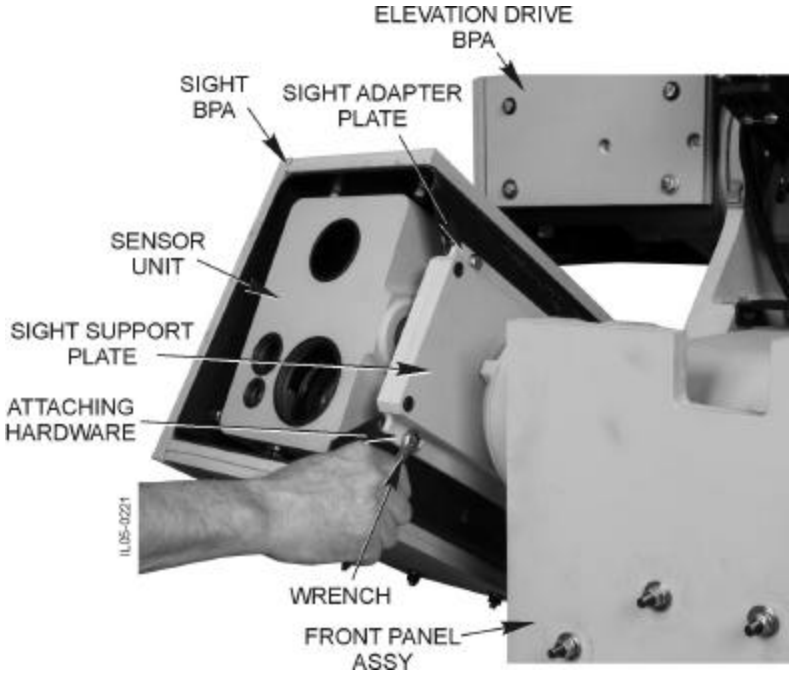


Figure 35. Securing Sight BPA to the Sight Adapter Plate

5. Connect the mount to sensor cable through the open area on the sight rear panel to connector J1, and to connector J4 on the pedestal, referring to Figures 36 and 37.

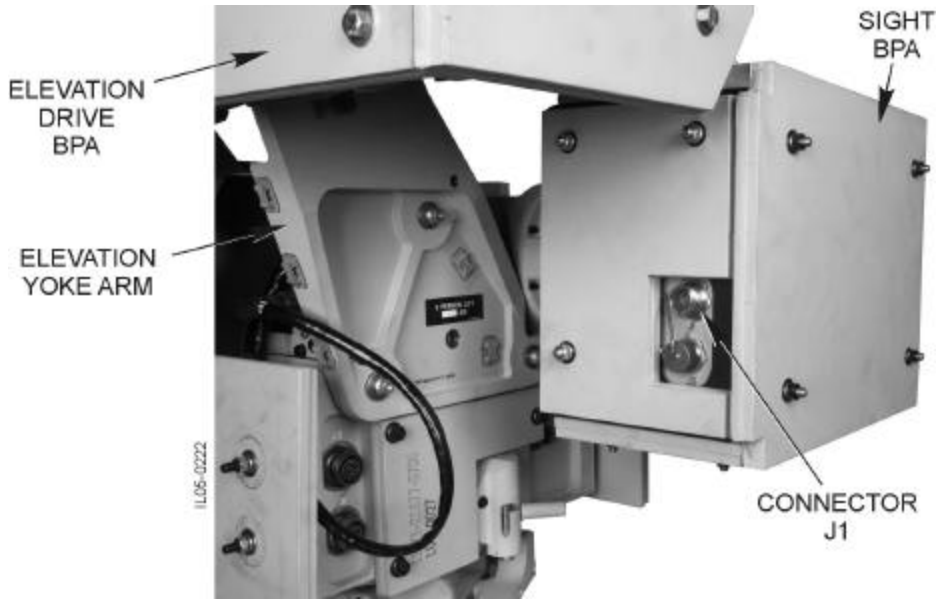


Figure 36. Sight BPA (Rear View)

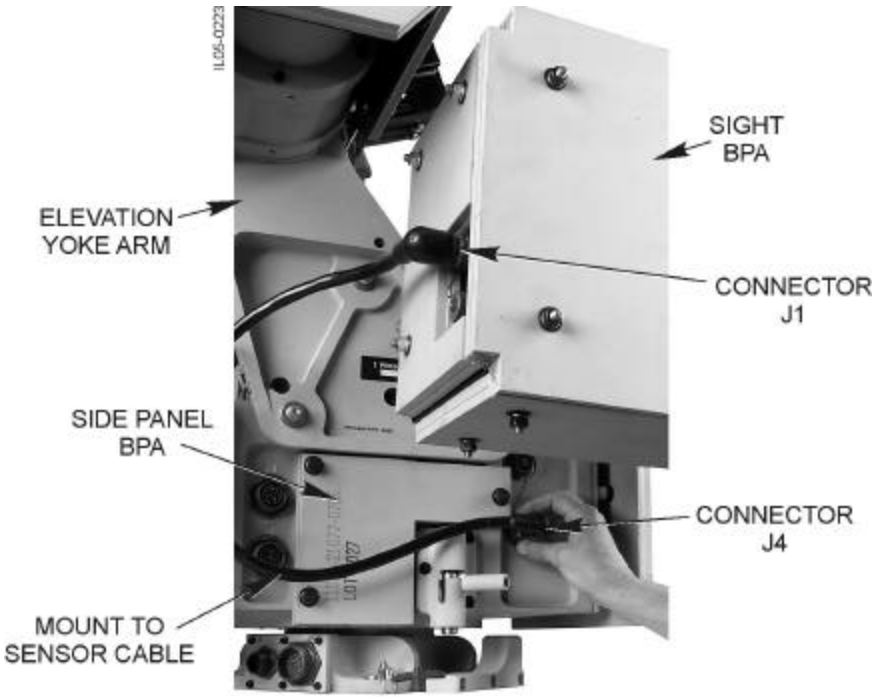


Figure 37. Sight BPA (Side View) Showing Mount to Sensor Cable in Place

CAUTION

Ensure all attaching hardware is tightened evenly. Failure to follow these instructions may result in equipment damage.

6. Once all the attaching hardware is in place, verify that none of the panels move. If needed, retighten the screws and bolts.

CAUTION

Ensure that all cables are routed and secured properly to prevent them from becoming tangled in the armor's attaching hardware. Failure to follow these instructions may result in equipment damage.

For additional information on cable installation, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0009, M2; WP 0010, Mk19; WP 0011, M240; and WP 0012, M249; and WP 0014, Interconnection. For information on the interconnection cables, refer to the VIK, WP 0060, of this manual.

7. Verify that all cables are properly routed and secured.

REMOVAL OF ARMOR

Use the following procedures to remove the armor components.

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 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 0053, 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.

- For information on mandatory replacement parts – including spring (tension) washers, star washers and Nord-lock washer sets – that need to be replaced whenever components are disassembled, as well as parts that can be reused unless damaged – including seals and gaskets – refer to WP 0058.

Inspect Maintenance Significant Items (MSI) required for operation of the CROWS but that do not require disassembly, including attaching hardware (e.g., screws, nuts, bolts, spacers) and switches/buttons.

NOTE

Disassemble only to the extent necessary to determine defective condition and accomplish essential repairs necessary to produce a serviceable end item.
Retain assemblies, components, and parts for later use or examination.
For additional information about the azimuth lock, refer to WP 0013.

1. If needed, ensure the azimuth lock is in the locked position when removing the armor.

Removal of the Front Panel

Use the following procedures to remove the front panel.

NOTE

Retain all hardware and components/assemblies for later use.

1. Using a 1/2-inch wrench, loosen and remove the eight nuts, referring to Figure 38.

2. Remove the eight flat washers and lock washers from the outside of the panel, referring to Figure 38.

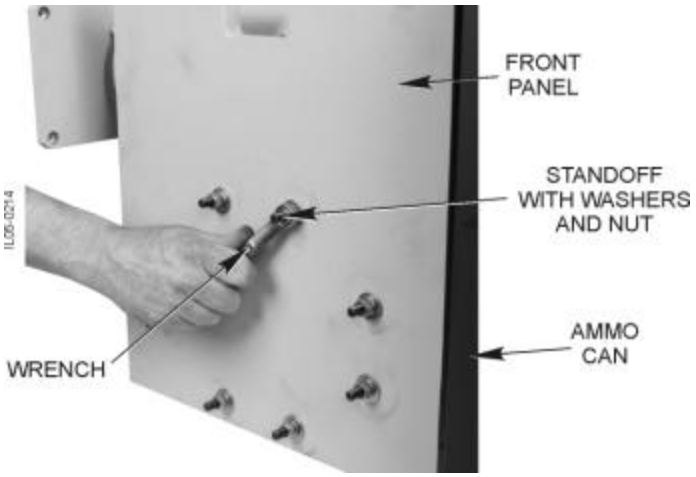


Figure 38. Front Panel with Attaching Hardware

3. Carefully remove the front panel from the standoffs, as shown in Figure 39, and place on a flat, stable work surface.



Figure 39. Front Panel Positioned over Standoffs

4. Remove the eight flat washers from the standoffs, as shown in Figure 40.

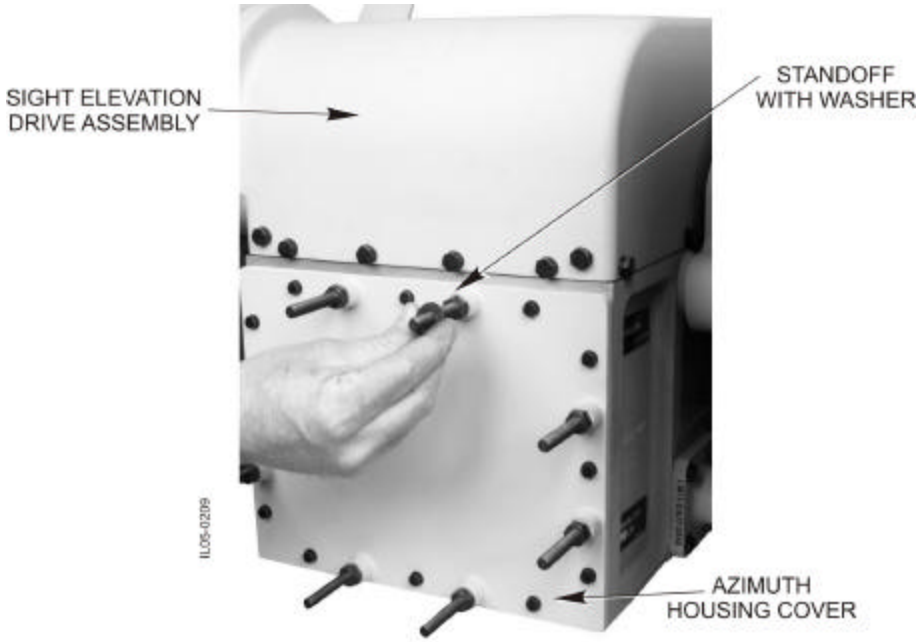


Figure 40. Front Panel with Standoffs and Washers

NOTE

For additional information about applying thread-locking compound, refer to WP 0007.

5. If needed, remove thread-locking compound from the standoffs.

6. Using a 1/2-inch wrench, remove the eight standoffs from the azimuth housing cover, referring to Figure 40.

Removal of the Side Panel

Use the following procedures to remove the side panel.

NOTE

Retain all hardware and components/assemblies for later use.

1. Using a 1/2-inch wrench, loosen and then remove the bolts, as shown in Figure 41.

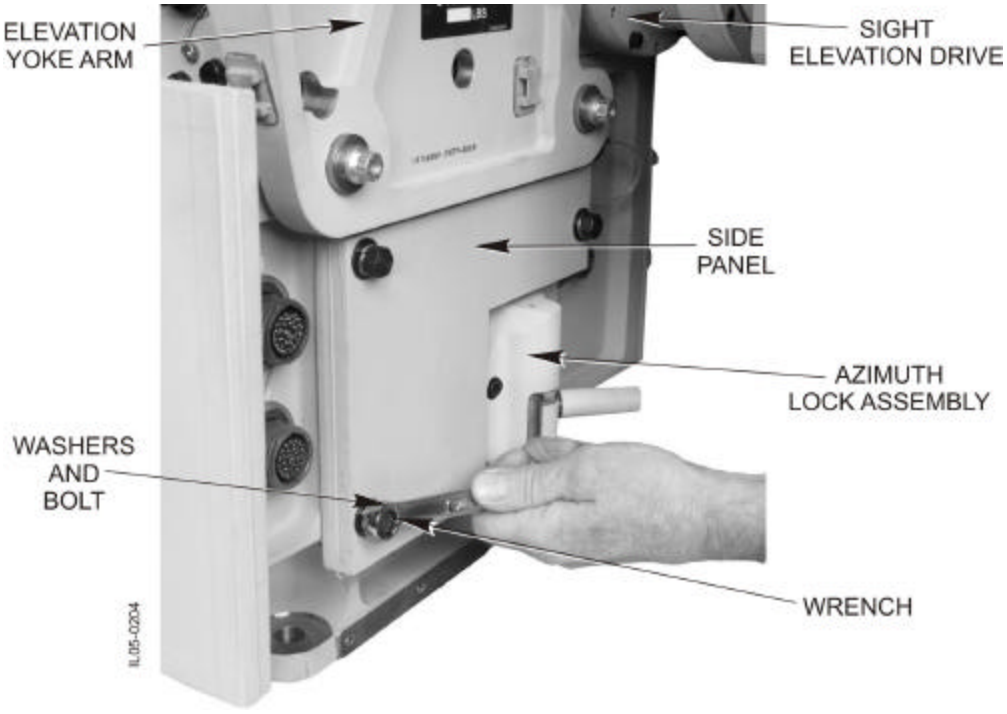


Figure 41. Side Panel

2. Remove the three flat washers and lock washers.
3. Remove the side panel, referring to Figure 41, placing it on a flat, stable work surface.

Removal of the Rear Panel

Use the following procedures to remove the rear panel.

NOTE

Retain all hardware and components/assemblies for later use.

1. Using a 1/2-inch wrench, remove the six nuts, flat washers, and lock washers from the six standoffs, as shown in Figure 42.

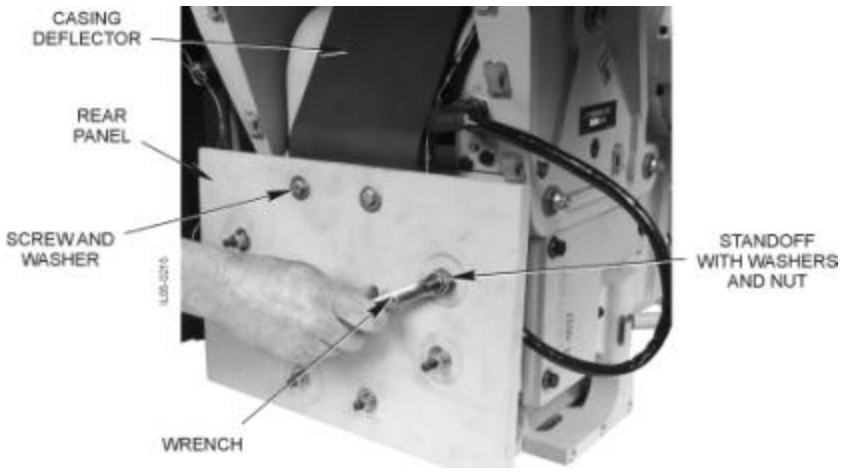


Figure 42. Attaching Hardware Securing Rear Panel

2. Using a 7/16-inch wrench, loosen and remove the two hex head cap screws, together with the two flat washers and extra-thick washers securing the panel to the casing deflector, as shown in Figure 43.

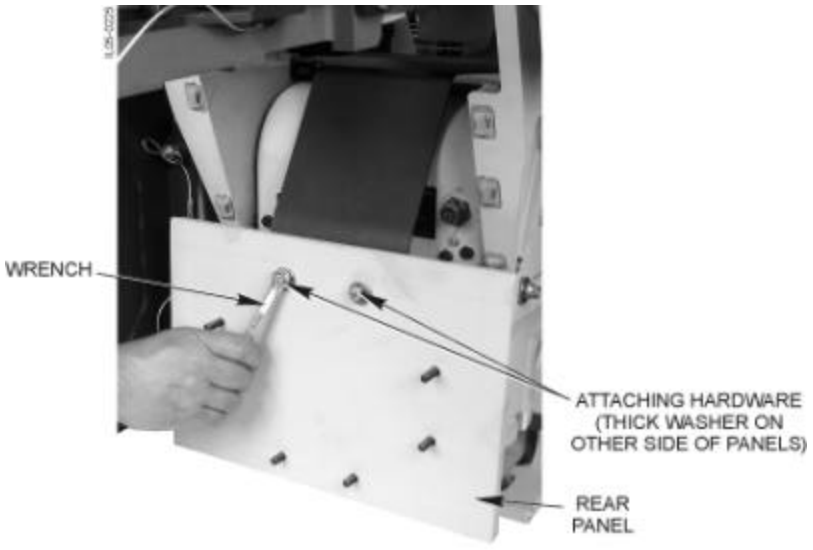


Figure 43. Removing Attaching Hardware for Casing Deflector

3. Carefully remove the rear panel from the standoffs and the casing deflector, as shown in Figure 44. Place on a flat, stable work surface.

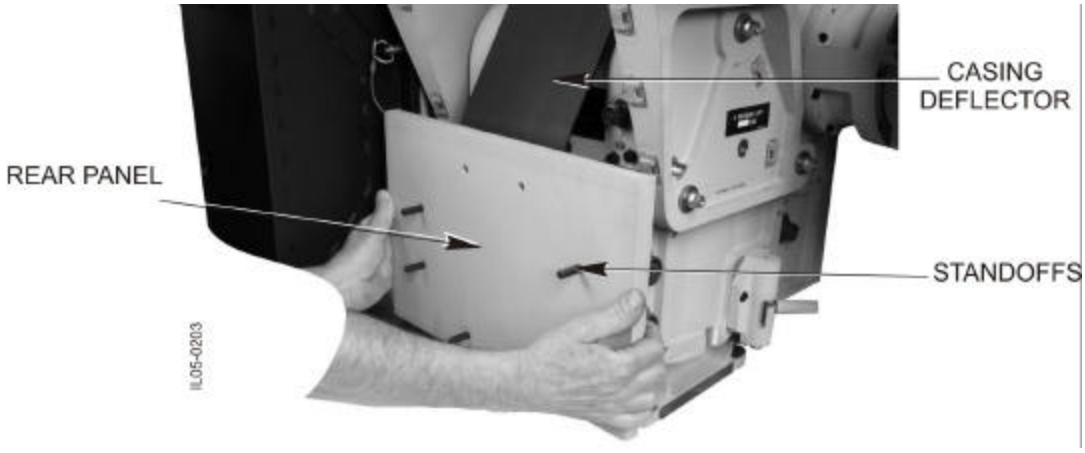


Figure 44. Rear Panel and Standoffs

4. Remove the six flat washers from the standoffs as shown in Figure 45.

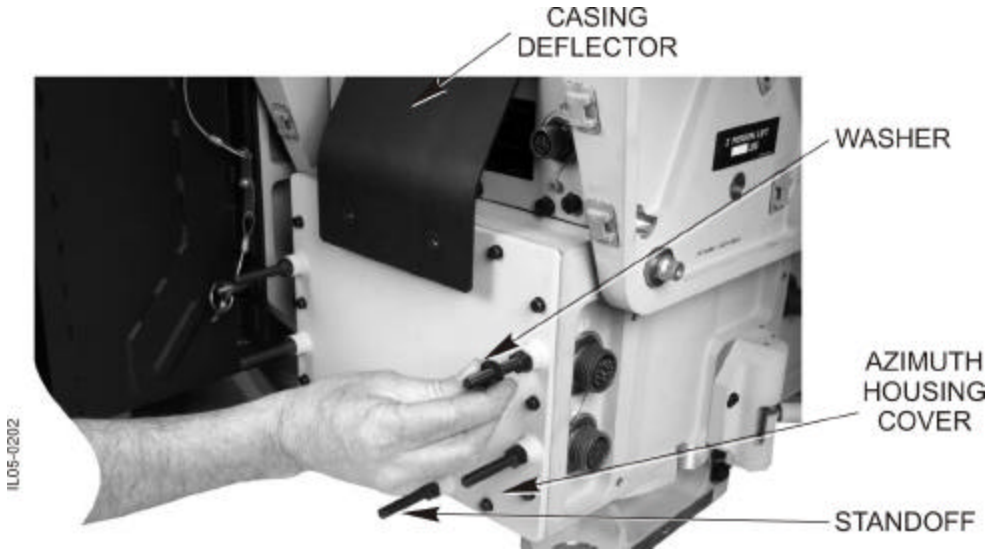


Figure 45. Standoffs in Azimuth Housing Cover

NOTE

For additional information about applying thread-locking compound, refer to WP 0007.

5. If needed, remove thread-locking compound from the standoffs.

6. Using a 1/2-inch wrench, remove the six standoffs from the bottom six shouldered holes in the azimuth housing cover, referring to Figure 45.

NOTE

Each Nord-lock washer is a set of two washers (Figure 46).



Figure 46. Nord-Lock Washer Set

7. Using a 7/16-inch wrench, insert and tighten two hex head screws and Nord-lock washer sets to secure the casing deflector to the azimuth housing assembly of the pedestal (non-armor configuration), as shown in Figure 47.

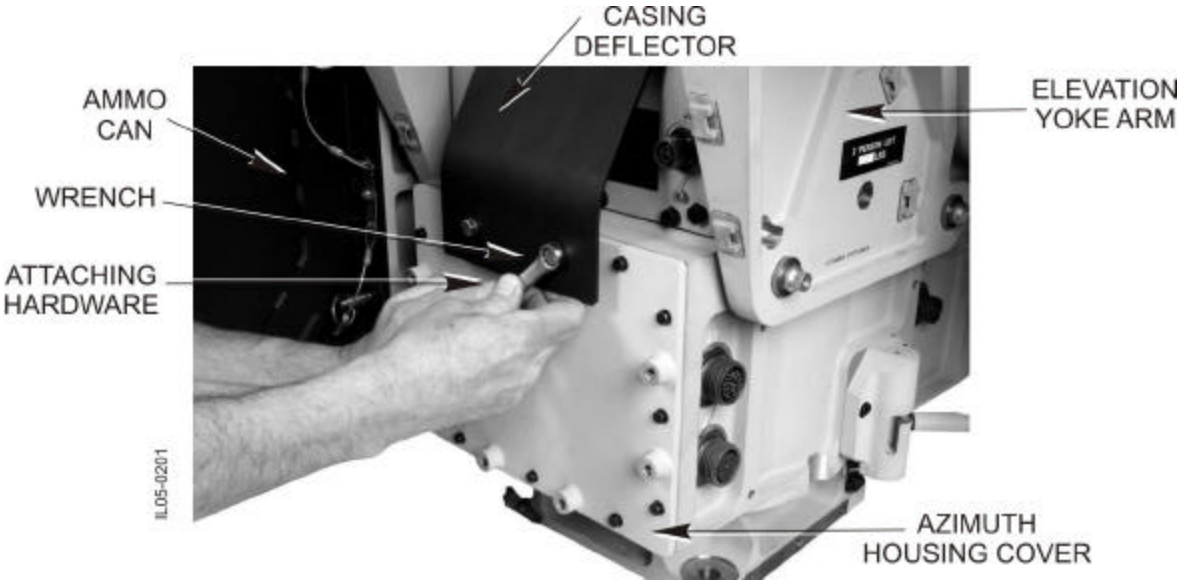


Figure 47. Casing Deflector and Attaching Hardware (Non-Armor Configurations)

Removal of the Elevation Drive BPA

Use the following procedures to remove the elevation drive BPA (elevation drive housing with panels attached and securing hardware).

1. Using a flat screwdriver, loosen the screw on the hose clamp just until the clamp moves freely and can be moved off of the mounting tab, as shown in Figure 48.

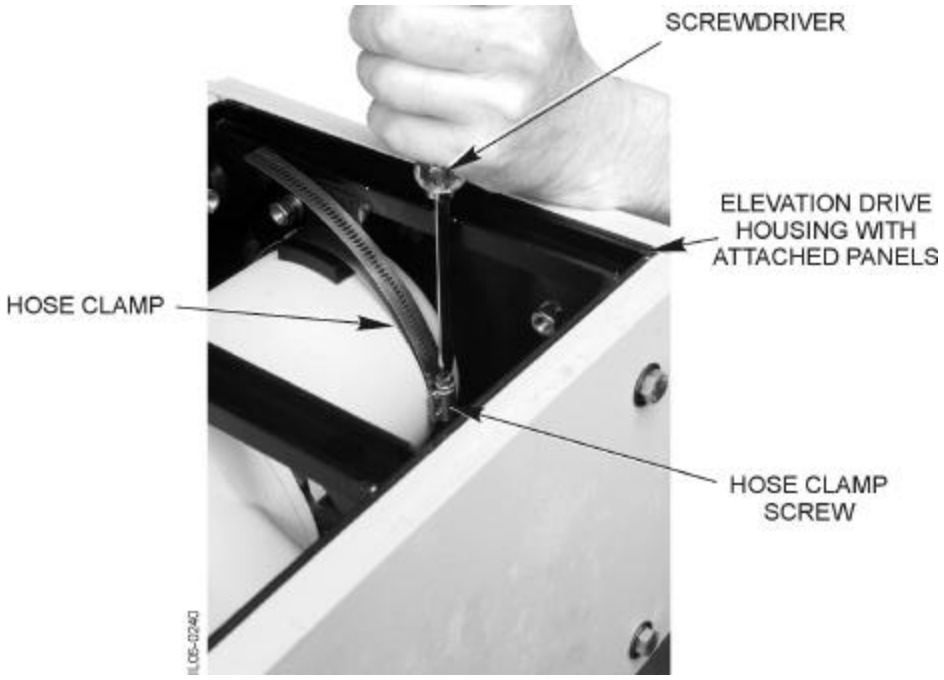


Figure 48. Hose Clamp Securing Elevation Drive BPA Housing to Motor Cover

CAUTION

Use two personnel for removal of the elevation drive BPA. Failure to do so may result in equipment damage.

2. Using a 4-mm hex wrench, and referring to Figure 49, loosen and remove the screw, flat washer, and lock washer from each of two supports (one by the elevation drive end panel and one in the center) on the elevation drive housing.

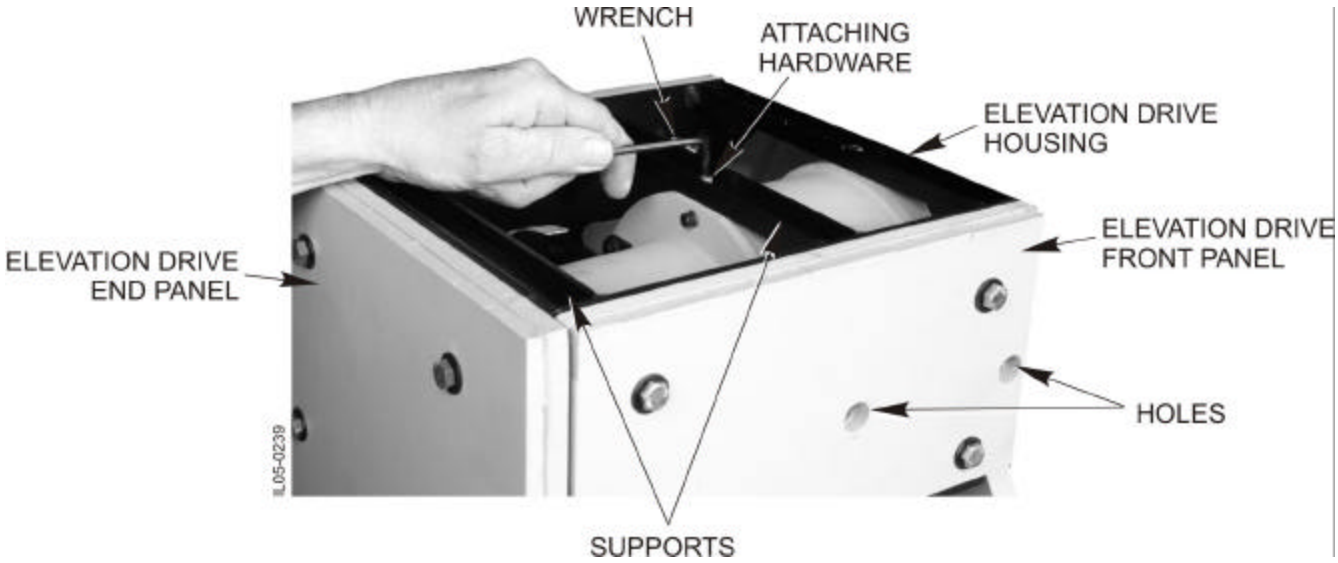


Figure 49. Loosening Elevation Drive Housing Supports

NOTE

For additional information about applying thread-locking compound, refer to WP 0007.

3. If needed, remove thread-locking compound from the screws just before step 4 (following).

4. While one person holds the elevation drive BPA, the other person loosens and removes a socket head cap screw, flat washer and lock washer from each of the two holes on the elevation drive front panel, using a 4-mm hex wrench, as shown in Figure 50.

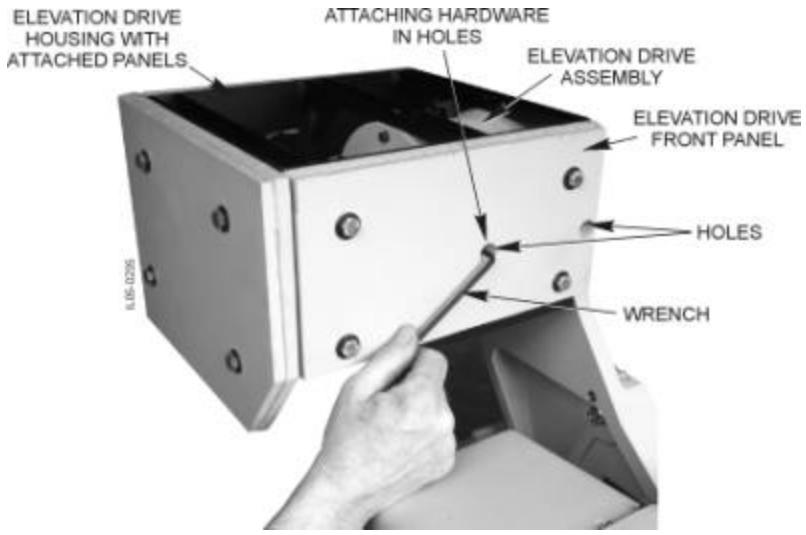


Figure 50. Elevation Drive BPA Positioned around Elevation Drive Assembly

5. Remove the elevation drive BPA from under and around the elevation drive motor cover, referring to Figure 50, and place on a flat, stable work surface.

6. Remove the hose clamp from the elevation drive assembly's motor cover, as shown in Figure 51, and retain for later use.

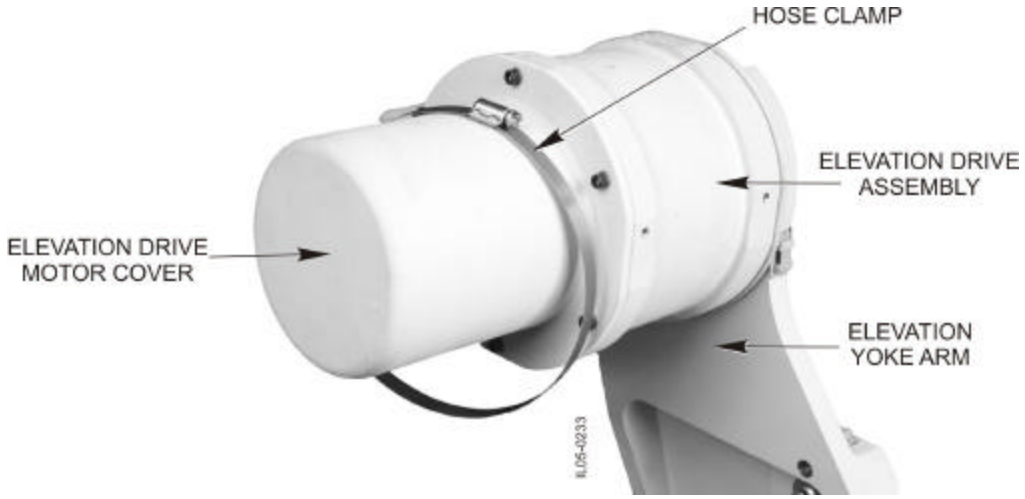


Figure 51. Hose Clamp on Elevation Drive's Motor Cover

Removal of Elevation Drive End Panel

Perform the following procedure to remove the elevation drive end panel.

1. Using a 1/2-inch wrench and a 1/2-inch adjustable wrench as the stabilizing wrench, loosen and remove the four hex head cap screws, flat washers located inside of the housing, flat washers located outside the housing, lock washers, and hex nuts from the elevation drive housing and end panel, as shown in Figure 52.

2. Remove the elevation drive end panel from the elevation drive housing, referring to Figure 52, and place on a flat, stable work surface.

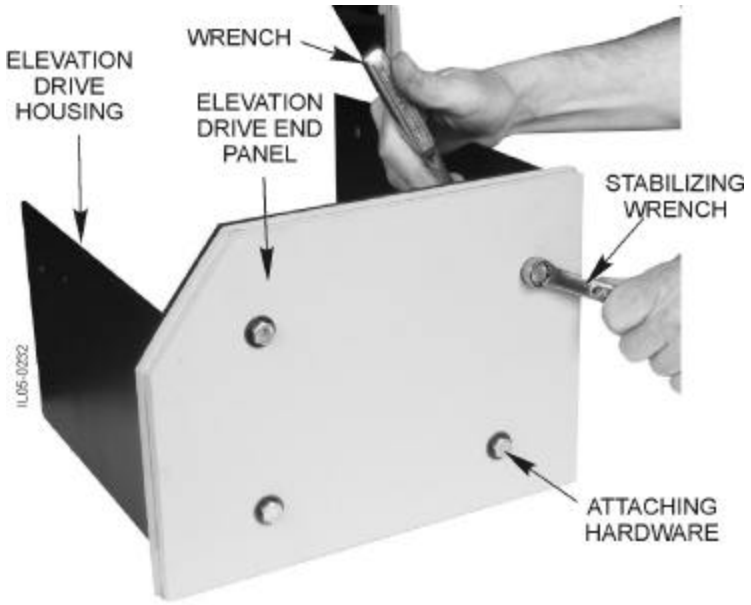


Figure 52. Elevation Drive End Panel

Removal of Elevation Drive Front Panel

Perform the following procedure to remove the elevation drive front panel.

1. Using a 1/2-inch wrench and a 1/2-inch adjustable wrench as the stabilizing wrench, remove the four hex head cap screws, flat washers located inside of the housing, flat washers located outside the housing, lock washers, and hex nuts from the elevation drive housing and front panel, as shown in Figure 53.

2. Remove the elevation drive front panel from the elevation drive housing, referring to Figure 53, and place on a flat, stable work surface.

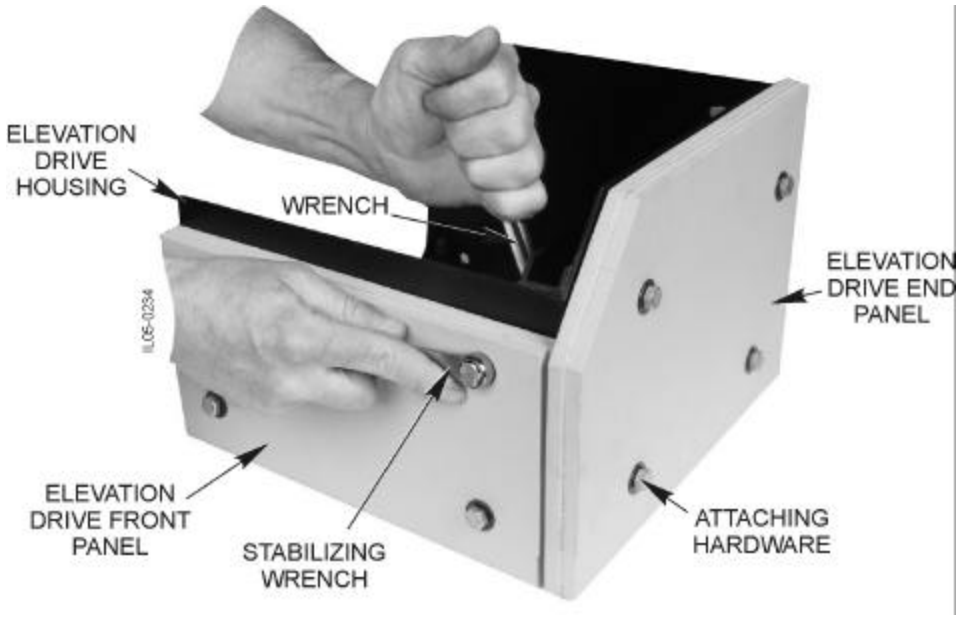


Figure 53. Elevation Drive Front Panel

Removal of Elevation Drive Rear Panel

Perform the following procedure to remove the elevation drive rear panel.

1. Using a 1/2-inch wrench and a 1/2-inch adjustable wrench as the stabilizing wrench, as shown in Figure 54, remove four hex head cap screws, flat washers located inside of the housing, flat washers located outside the housing, lock washers, and hex nuts from the elevation drive housing and rear panel.
2. Remove the elevation drive rear panel from the elevation drive housing, referring to Figure 54, and place on a flat, stable work surface.

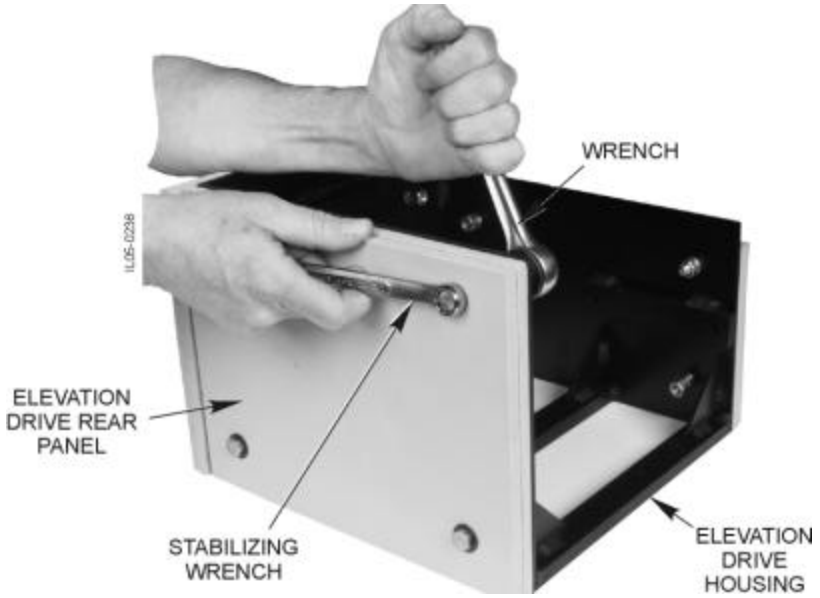


Figure 54. Elevation Drive Rear Panel

Elevation Drive Housing

1. If needed, once all of the elevation drive panels have been removed, place the elevation drive housing on a flat, stable work surface, with the support side facing down, as shown in Figure 55.

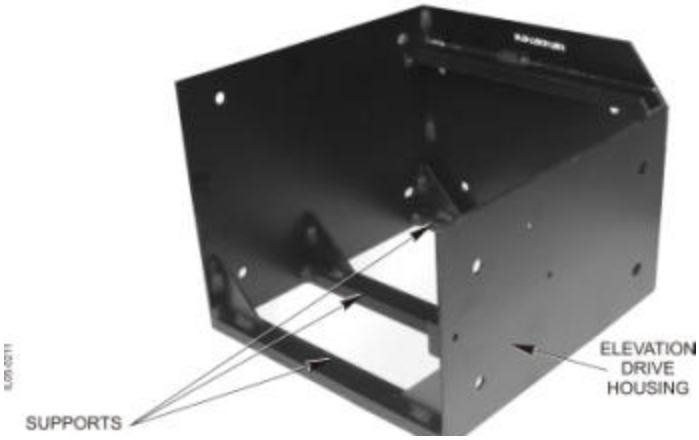


Figure 55. Elevation Drive Housing

Removal of Ammo Can BPA

Perform the following procedures to remove the ammo can BPA, which consists of the ammo can partition (the ammo can panel [ceramic] attached to the ballistic panel [metal]) and the ammo can end panels.

~~Ammo Can Armor Components – M240/M249 WAK Only~~

Removal of the ammo can armor components from the M240/M249 WAKs consists of removing the ammo can end panels. Perform the following procedure to remove the ammo can end panels from the ammo can used for the M240/M249 WAKs.

1. Remove the end panels, referring to the Removal of the Ammo Can End Panels – All WAKs section of this work package.

~~Removal of Ammo Can End Panels – All WAKs~~

Perform the following procedures to remove the ammo can end panels.

NOTE

The following procedure may be performed with the ammo can installed on the mount or separated from the mount. If separated from the mount, ensure the ammo can is placed on a flat, stable work surface. For additional information on the ammo can, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0009 for the M2 machine gun; WP 0010 for the Mk19 grenade gun; WP 0011 for the M240 machine gun; or WP 0012 for the M249 machine gun.
The instructions for removing the ammo can end panels apply to either of the end panels.

1. Using a 1/2-inch wrench and a 1/2-inch adjustable wrench as the stabilizing wrench, as shown in Figure 56, loosen and remove the two flat washers inside the ammo can, flat washers outside the ammo can, lock washers, and hex nuts.

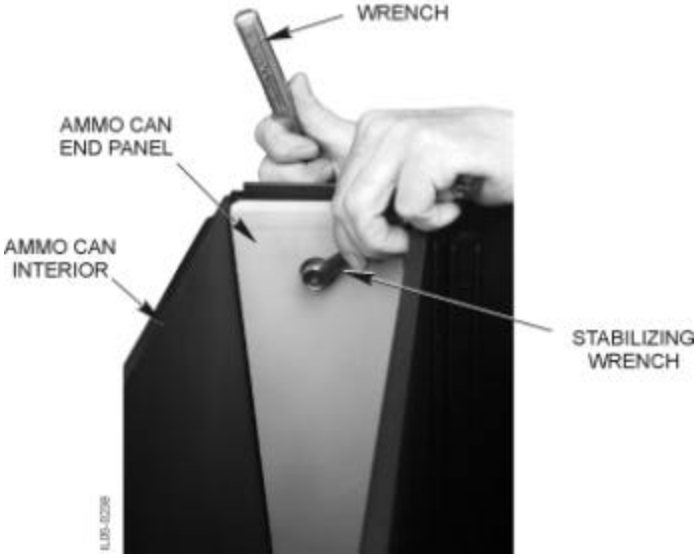


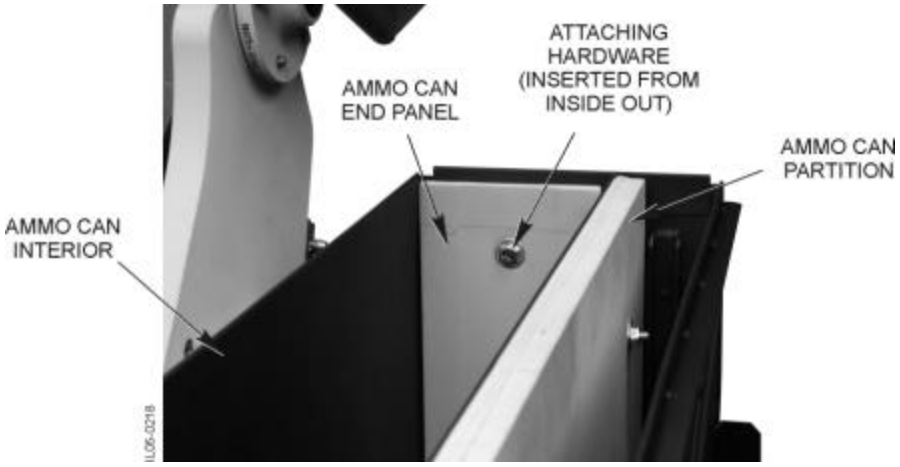
Figure 56. Ammo Can End Panel Secured

2. Remove the ammo can end panel, referring to Figure 57.

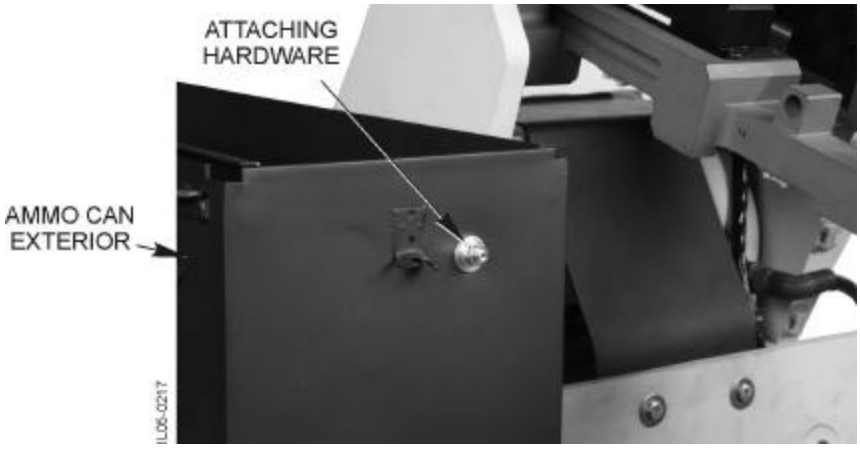
3. Repeat steps 1 and 2 (above) for the other end panel.

NOTE

The ammo can partition is used only with the M2 and Mk19 WAKs. The ammo can partition must be removed when the M240/M249 WAKs are being used.



Interior View



Exterior View

Figure 57. End Panel for the Ammo Can – Interior and Exterior Views

Removal and Disassembly of Ammo Can Partition – M2 and Mk19 WAKs

NOTE

The following procedure for the ammo can partition applies to the M2 and Mk19 weapon adapter kits (WAKs) only.

For information on the M240/M249 WAK armor, refer to the Ammo Can Armor Components – M240/M249 WAK Only section of this work package.

Perform the following procedures to remove and disassemble the ammo can partition (ammo can panel [ceramic] and ballistic partition [metal]).

NOTE

The following procedure can be performed with the ammo can installed on the mount or separated from the mount. If removed from the mount, ensure that the ammo can is placed on a flat, stable work surface.

The following procedure can be performed with the ammo can end panels installed or removed. For additional information on the ammo can, refer to the CROWS Operator's Manual, TM 9-1090-218-10, WP 0009 for the M2 machine gun; WP 0010 for the Mk19 grenade gun; WP 0011 for the M240 machine gun; or WP 0012 for the M249 machine gun.

For additional information on the ammo can end panels, refer to the Removal of Ammo Can End Panels – All WAKs section of this work package.

1. Ensure that the ammo can cover is removed from the ammo can and properly stowed.

2. Remove the detent pin securing the ammo can partition (armor version) in the can.

3. Remove the ammo can partition from the ammo can and place on a flat, stable work surface ceramic side up, referring to Figure 57 and 58.

4. Using a 7/16-inch wrench, loosen and then remove the four bolts, flat washers, lock washers and nuts, as shown in Figures 58 and 59.

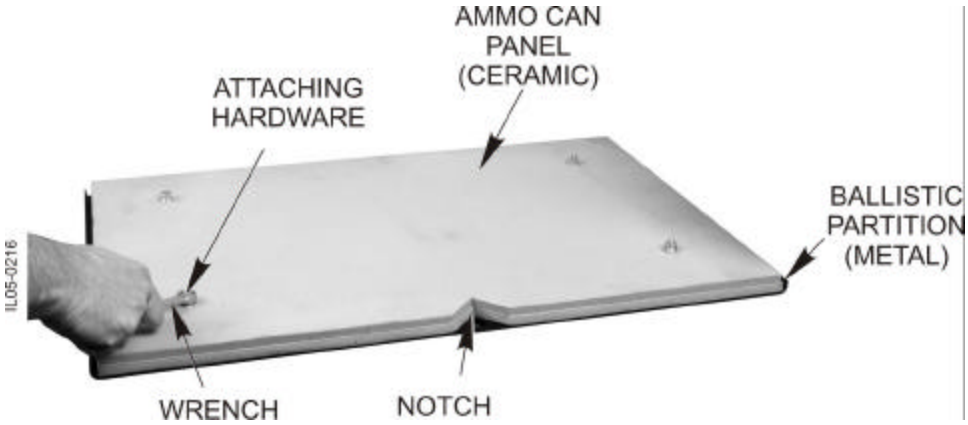


Figure 58. Ammo Can Partition (Ammo Can Panel and Ballistic Partition)

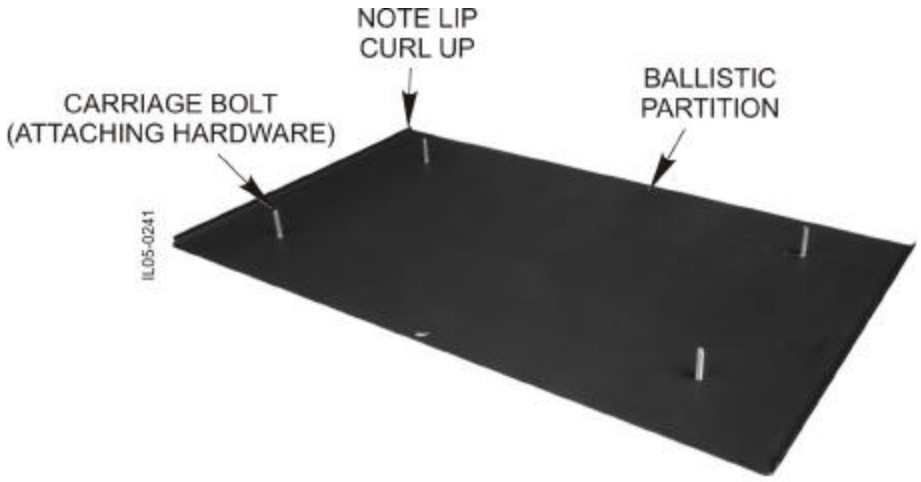


Figure 59. Ballistic Partition Panel with Bolts

5. Remove the ammo can panel (ceramic) and place on a flat, stable work surface.

6. Retain the ammo can panel and ballistic partition (metal) for later use.

Removal of Sight BPA

Use the following procedure to remove the sight BPA (sunshade with panels attached) from the sensor unit and the panels from the sight BPA.

~~Removal of the Sight BPA from the Sensor Unit~~

Perform the following procedure to remove the sight BPA from the sensor unit.

1. Disconnect the mount to sensor cable from connector J1 via the open area on the sight rear panel, and from connector J4 on the pedestal, referring to Figures 60 and 61.

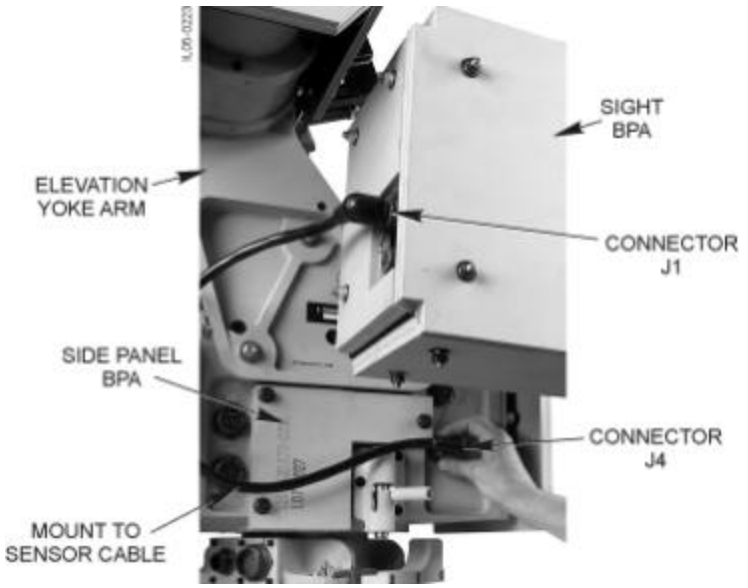


Figure 60. Sight BPA (Side View) Showing Mount to Sensor Cable in Place

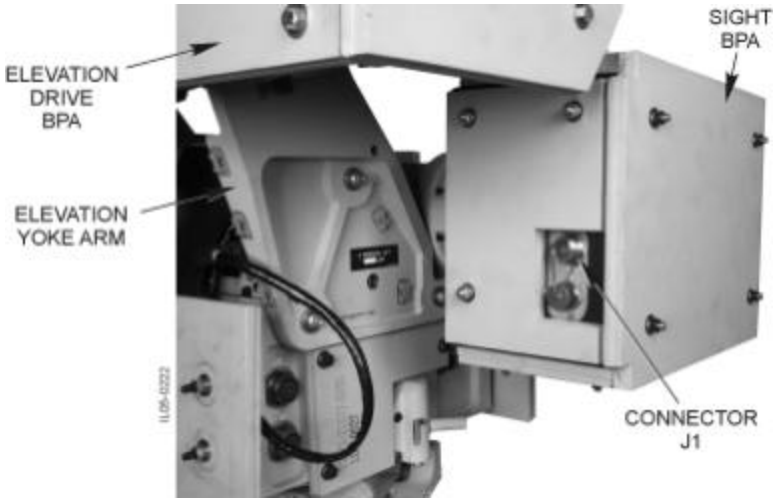


Figure 61. Sight BPA (Rear View)

CAUTION

Use two personnel to remove the sight BPA from the sensor unit.

NOTE

For additional information on the Sensor Group, refer to WP 0020 of this manual.

2. While one person holds the sight BPA in position, the second person uses a 7/16-inch wrench to loosen and remove the four screws and flat washers securing the sight BPA to the sensor unit, as shown in Figure 62.

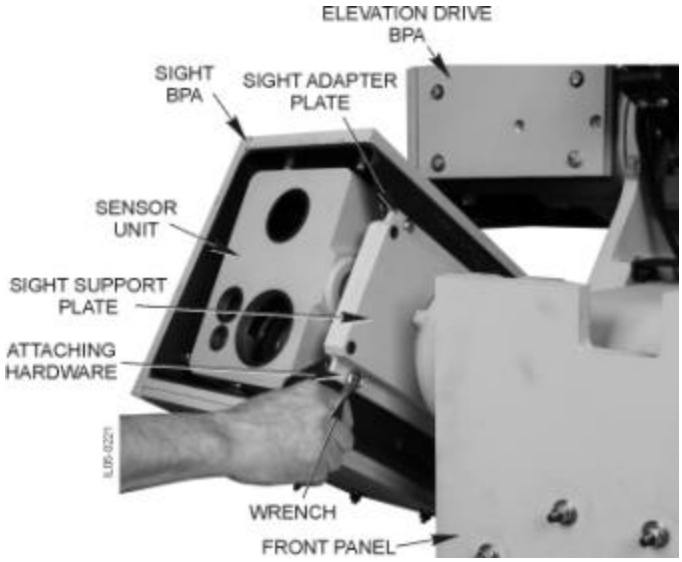


Figure 62. Removing Sight BPA from the Sensor Unit

3. While one person holds the sensor unit in place, the second person carefully slides the sight BPA off of the mounted sensor unit, as shown in Figure 63, and places it on a flat, stable work surface.

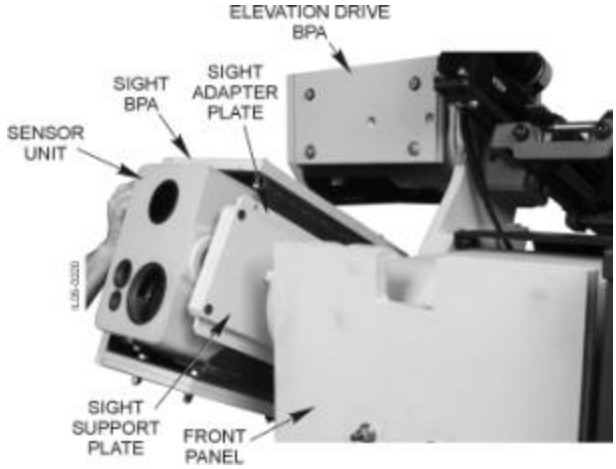


Figure 63. Sight BPA Sliding off of the Sensor Unit

Removal of the Sight Side Panel

Perform the following procedure to remove the sight side panel from the sunshade.

1. Ensure that the sunshade is placed on a flat, stable work surface and the sight side panel is on top.

2. Using a 1/2-inch wrench and a 1/2-inch adjustable stabilizing wrench, as shown in Figure 64, loosen and remove the four cap screws, flat washers inside the sunshade, flat washers outside the sunshade and panel, the lock washers, and the hex nuts.

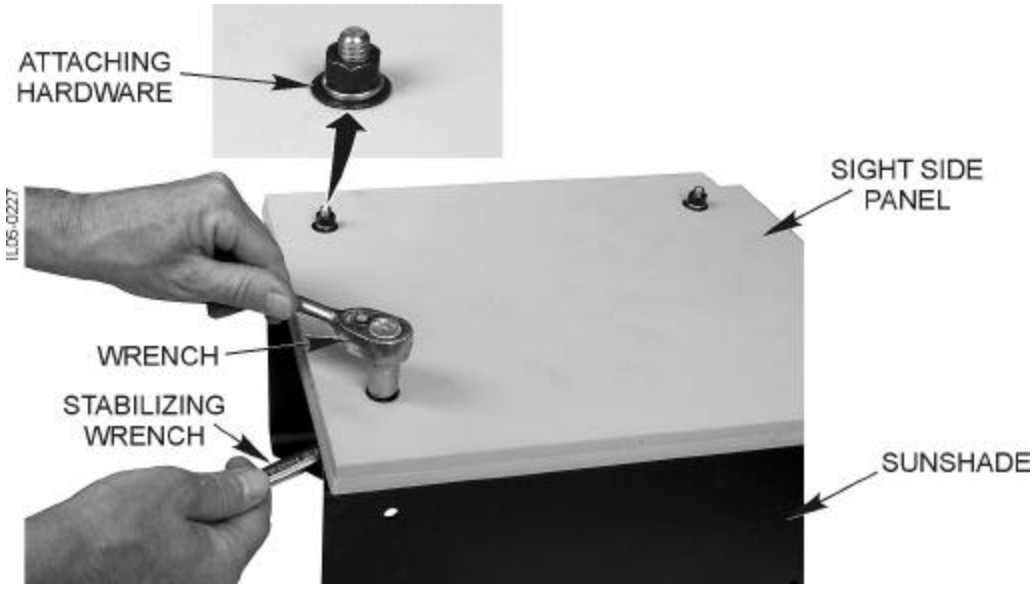


Figure 64. Sight Side Panel

3. Remove the sight side panel from the sunshade and place on a flat, stable work surface.

4. Retain the panel and hardware for later use.

Removal of the Sight End Panel

Perform the following procedure to remove the sight end panel from the sunshade.

NOTE

The procedure for removing the sight end panel applies to either of the sight end panels.

1. Ensure that the sunshade is placed on a flat, stable work surface and the sight end panel is on top.

2. Using a 1/2-inch wrench and a 1/2-inch wrench or socket stabilizing wrench, as shown in Figure 65, loosen and then remove the four hex head cap screws, flat washers from inside the sunshade, flat washers on the outside of the sunshade and panel, lock washers, and hex nuts.

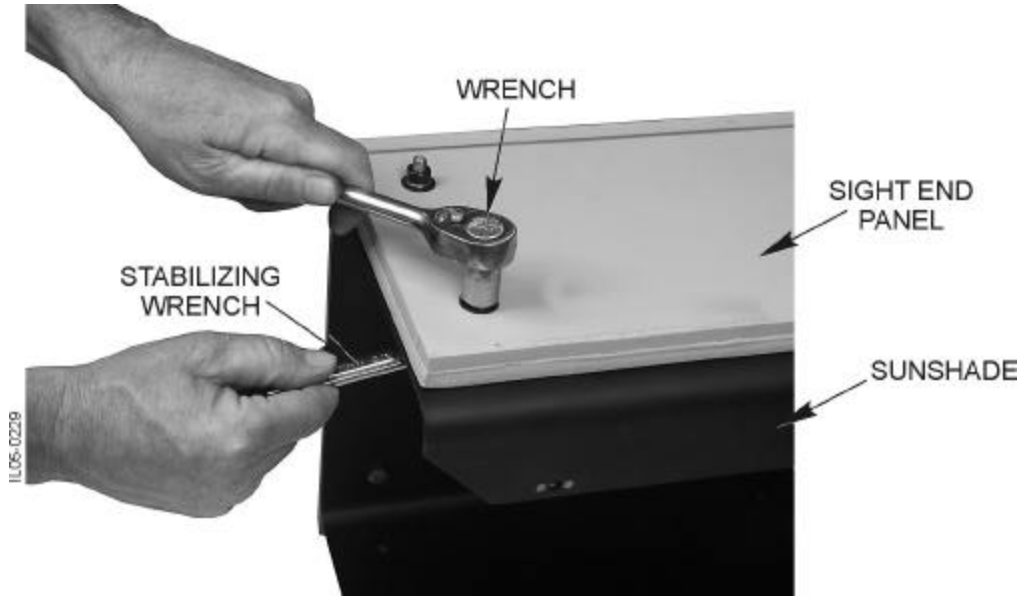


Figure 65. Sight End Panel

3. Remove the sight end panel from the sunshade and place on a flat, stable work surface.

4. Retain the panel and hardware for later use.

5. If needed, repeat steps 1 thru 4 (above) for the other sight end panel.

Removal of the Sight Rear Panel

Perform the following procedure to remove the sight rear panel from the sunshade.

1. Ensure that the sunshade is placed on a flat, stable work surface, referring to Figure 66.

2. Using a 1/2-inch wrench and a 1/2-inch wrench or socket stabilizing wrench, as shown in Figure 66, loosen and then remove the four cap screws, flat washers from inside the sunshade, flat washers on the outside of the sunshade and panel, lock washers, and hex nuts.

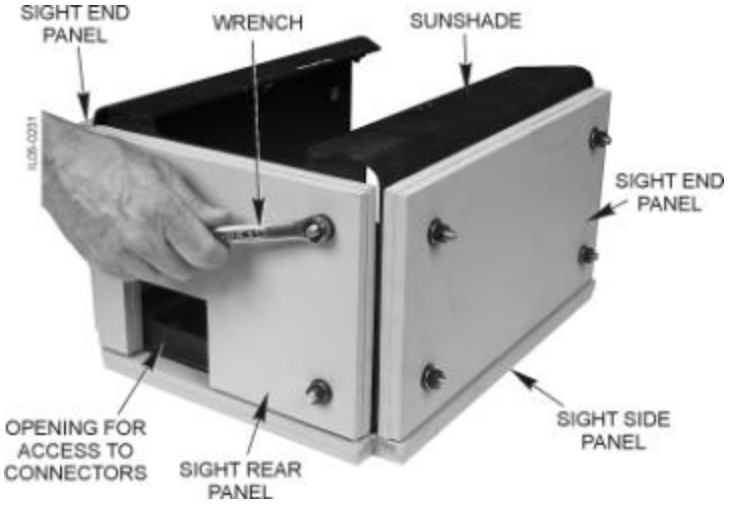


Figure 66. Sight Rear Panel with Attaching Hardware

3. Remove the sight rear panel from the sunshade and place on a flat, stable work surface.

4. Retain the panel and hardware for later use.

Sunshade

1. After removal of all BPA, sunshade will be as shown in Figure 67.



Figure 67. Sunshade

ADJUST

No adjustments are required for the armor.

TEST AFTER ASSEMBLY

1. Perform a visual inspection IAW the CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services.

END OF WORK PACKAGE

CHAPTER 5

DIRECT SUPPORT

TROUBLESHOOTING PROCEDURES

NOTE

The following work packages that comprise Chapter 5 are not included at this time. All Direct Support (DS) and depot maintenance tasks are being handled by contractor support personnel.

WP 0031, Direct Support Maintenance Troubleshooting Procedures

WP 0032, Direct Support Functional Testing and Troubleshooting

CHAPTER 6

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

NOTE

The following work packages that comprise Chapter 6 are not included at this time. All Direct Support (DS) and depot maintenance tasks are being handled by contractor support personnel.

WP 0033, Stabilized Weapon Mount (SWM) Assembly

WP 0034, Pedestal Assembly

WP 0035, Elevation Yoke Arm and Elevation Drive Assembly

WP 0036, Ammunition Yoke Arm Assembly

WP 0037, Sensor Unit

WP 0038, Electronics Module Unit (EMU)

WP 0039, Switch Panel Unit (SPU)

WP 0040, Interface Control Unit (ICU)

WP 0041, Joystick

WP 0042, Display Unit

WP 0043, Interconnection (Connectors and Cables)

WP 0044, Ammunition Can Assembly

WP 0045, Cradle Assembly (M2/Mk19)

WP 0046, M2 HB Weapon Adapter Kit (WAK)

WP 0047, Mk19 Weapon Adapter Kit (WAK)

WP 0048, M240 Weapon Adapter Kit (WAK)

WP 0049, M249 Weapon Adapter Kit (WAK)

WP 0050, Removal and Installation of Connectors and Seals

WP 0051, Ballistic Protection Kit

CHAPTER 7

AUXILIARY EQUIPMENT

MAINTENANCE INFORMATION

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

AUXILIARY EQUIPMENT MAINTENANCE INFORMATION

This work package presents auxiliary equipment necessary to operate and maintain CROWS.

WP CONTENTS

Section/Subsection	Page
Introduction	1
Explanation of Columns in the Auxiliary Equipment List	1
Auxiliary Equipment List	2
Care of Auxiliary Equipment	3
Cover	3
Spider Mount	3

INTRODUCTION

Explanation of Columns in the Auxiliary Equipment List

Column (1) Item Number. This number is assigned to the entry in the list and is referenced in the initial setup to identify the item (e.g., “Boresight, item 1, WP 0052”).

Column (2) Item Name. This column lists the item by noun nomenclature and other descriptive features (e.g., “Spider Mount”).

Column (3) National Stock Number. This is the National Stock Number (NSN) assigned to the item; use it to requisition the item.

Column (4) Part Number/CAGEC. Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity) which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items. The manufacturer’s Commercial and Government Entity Code (CAGEC) is also included.

Column (5) Reference. This column identifies the authorizing supply catalog, RPSTL, or illustrated parts list (IPL) for items listed in this work package.

AUXILIARY EQUIPMENT LIST

Table 1 lists the auxiliary equipment associated with CROWS, while Figures 1 thru 3 illustrate the items.

Table 1. Auxiliary Equipment List

(1) Item No.	(2) Item Name	(3) National Stock Number	(4) Part Number / CAGEC	(5) Reference
1	Cover, Travel (Figure 2) (Common Name: CROWS Cover)		21677-0400/11871	WP 0052 and WP 0057 of this manual
2	Structure, CROWS Support (Figure 3) (Common Name: Spider Mount)		0998-0200/11871	WP 0052 and WP 0057 of this manual

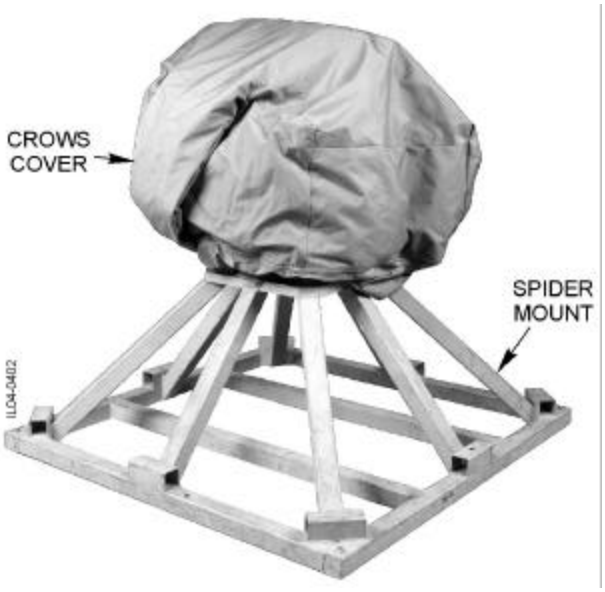


Figure 1. CROWS Cover Over CROWS on the Spider Mount

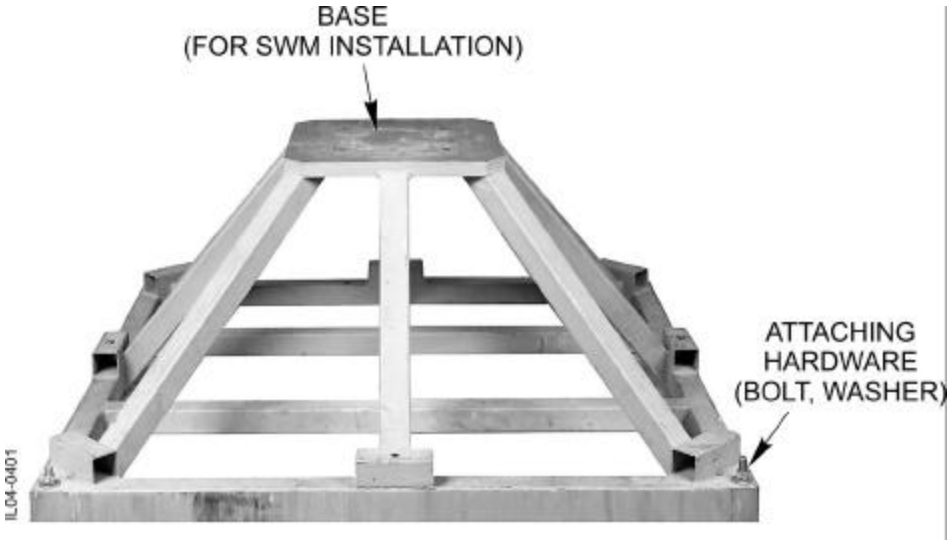


Figure 2. Spider Mount

CARE OF AUXILIARY EQUIPMENT

Cover

Clean and store the cover IAW the procedures in WP 0004, Cleaning Procedures.

Spider Mount

Clean the spider mount with detergent and water (see WP 0056, Table 1, Items 19 and 30), and then allow to dry.

NOTE

For additional information on Corrosion Prevention and Control (CPC), refer to WP 0008.

Inspect the spider mount for damage. Should damage to the surface be discovered, follow the CPC procedures in WP 0008.

END OF WORK PACKAGE

CHAPTER 8

SUPPORTING INFORMATION

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101

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 Form 361	Transportation Discrepancy Report
SF Form 364	Report of Discrepancy (ROD)
SF Form 368	Product Quality Deficiency Report (NSN 7540-00-133-5541)
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-454A	General Guidelines for Electronic Equipment
MIL-STD-1686C	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies, and Equipment (Excluding Electrically Initiated Explosive Devices)
MIL-STD-2000A	Standard Requirements for Soldered Electrical and Electronic Assemblies

REFERENCE LIST – CONT.

PUBLICATION	TITLE/ADDITIONAL INFORMATION
ARMY REGULATIONS	
AR 190-11	Physical Security of Arms, Ammunition, and Explosives
AR 385-61	Army Chemical Agents Safety Program
FIELD MANUALS	
FM 4-25.11	First Aid
FM 3-5	NBC Decontamination
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, 5.56-MM, 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, 5.56-MM, 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 (NSN 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 (NSN 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 9-1005-313-10	Operator's Manual for Machine Gun, 7.62-MM, M240 (NSN 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	Technical Manual Unit and Direct Support Maintenance (Including Repair Parts and Special Tools List) for M240 Series Machine Guns Machine Gun, 7.62-MM, M240 (NSN 1005-01-025-8095); Machine Gun, 7.62-MM. M240B (1005-01-412-3129); Machine Gun, 7.62-MM, M240C (1005-01-085-4758); Machine Gun, 7.62-MM, M240D (1005-01-418-6995); Machine Gun, 7.62-MM, M240E1 (1005-01-252-4288); Machine Gun, 7.62-MM, M240G (1005-01-359-2714); Machine Gun, 7.62-MM, M240H (1005-01-518-2410); and Machine Gun, 7.62-MM, M240N (1005-01-493-1666)

REFERENCE LIST – CONT.

PUBLICATION	TITLE/ADDITIONAL INFORMATION
TECHNICAL MANUALS – Cont.	
TM 9-1010-230-10	Operator's Manual for Machine Gun, 40-MM, Mk19, MOD 3 (NSN 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, 40-MM, Mk19 MOD 3 (NSN 1010-01-126-9063) (EIC: 4AE) and Machine Gun, Mk19, 40-MM, Upgunned Weapons Station (UPWS) (1010-01-362-6513)
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)
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)
TM 746-10	General Packaging Instructions for Field Units
TM 750-116	General Procedures for Purging and Charging of Fire Control Instruments
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 9-1090-218-10	Operator's Manual for Armament Subsystem: Remotely Operated, M101; Common Remotely Operated Weapon Station (CROWS), Part Number 21677-0100, NSN 1090-01-525-5049
MISCELLANEOUS PUBLICATIONS	
A-A-59199	Cleaning Compound, Optical Lens
CTA 8-100	Army Medical Department Expendable/Durable Items
CTA 50-970	Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items)
DOD 4160.21-M	Defense Materiel Disposition Manual
IPC-HDBK-001	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	Occupational and Environmental Health: Control of Hazards to Health from Laser Radiation
TG No. 144	Guidelines for Controlling Health Hazards in Painting Operations

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

INTRODUCTION TO THE MAINTENANCE ALLOCATION CHART (MAC) FOR CROWS

This work package provides a general explanation of all maintenance and repair functions authorized at the various maintenance levels under the standard Army Maintenance System concept. The MAC is described in WP 0055, Table 1; with tools, special tools, and test equipment requirements covered in Table 2; and supplemental instructions and explanatory notes listed in Table 3 of that work package.

WP CONTENTS

Section/Subsection **Page**

The Army Maintenance Concept 1

Maintenance Functions 2

Explanation of Columns in the MAC 3

Maintenance Concept Structure 4

Explanation of Columns in the Tools and Test Equipment Requirements 6

Explanation of Columns in the Remarks Section 6

THE ARMY MAINTENANCE CONCEPT

This introduction provides a general explanation of all maintenance and repair functions authorized at various maintenance levels under the standard Army Maintenance System concept.

MAC, detailed in WP 0055, Table 1, designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component shall be consistent with the capacities and capabilities of the designated maintenance levels, which are shown on the MAC in column (4) as:

- Field
    - Operator
    - Unit
    - Direct Support (on-system)
- Sustainment (STMT)
    - Direct Support (off-system)
    - Depot

The tools and test equipment requirements, WP 0055, Table 2, lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from the MAC.

The remarks information, WP 0055, Table 3, contains supplemental instructions and explanatory notes for a particular maintenance function.

MAINTENANCE FUNCTIONS

Maintenance functions are limited to and defined as follows.

1. **Inspect.** To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel). This includes scheduled inspection and gagings and evaluation of cannon tubes.

2. **Test.** To verify the serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards on a scheduled basis (i.e., load testing of lift devices and hydrostatic testing of pressure hoses).

3. **Service.** To perform operations required periodically to keep an item in proper operating condition, (e.g., to clean [including decontaminate, when required], to preserve, to drain, to paint, or to replenish fuels, lubricants, chemical fluids, or gases). This includes scheduled exercising and purging of recoil mechanisms.

4. **Adjust.** To maintain or regulate, within prescribed limits, by bringing into proper position, or by setting the operating characteristics to specified parameters.

5. **Align**. To adjust specified variable elements of an item to bring about optimum or desired performance.

6. **Calibrate**. To determine and cause corrections to be made or to be adjusted on instruments of test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

7. **Remove / Install.** To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of equipment or a system.

8. **Replace.** To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and assigned maintenance level is shown as the third position of the Source, Maintenance and Recoverability (SMC) code.

NOTE

The following definitions are applicable to the "repair" maintenance function (item 9):

Services – Inspect, test, service, adjust, align, calibrate and/or replace.

Fault location/troubleshooting – The process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or Unit Under Test (UUT).

Disassembly/assembly – The step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned an SMR code for the level of maintenance under consideration (i.e., identified as maintenance significant).

Actions – Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

9. **Repair.** To apply maintenance services, including fault location/troubleshooting, removal/installation, disassembly/assembly procedures, and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

10. **Overhaul**. To complete that maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like-new condition.

11. **Rebuild**. To perform services/actions necessary for the restoration of unserviceable equipment to a like-new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operations includes the act of returning to zero those age measurements (e.g., hours/miles) considered in classifying Army equipment/components.

EXPLANATION OF COLUMNS IN THE MAC

Refer to WP 0055, Table 1.

Column (1) – Group Number, lists the Functional Group Code (FGC) numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the Next Higher Assembly (NHA).

Column (2) – Component/Assembly, contains the item names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

Column (3) – Maintenance Function, lists the functions to be performed on the item listed in column (2). (For a detailed explanation of those functions, refer to “Maintenance Functions” outlined above.)

- Operator (-10 Level)
- Unit (-20 Level)
- Direct Support (-30 Level)

Maintenance Concept Structure

In Table 1, the two-level maintenance concept is used. This two-level concept includes the following structure.

- FIELD, tasks performed out in the field, includes Operator (-10), Unit (-20), and Direct Support (-30) maintenance activities.

  Field maintenance is on-system maintenance and is mainly replacement of defective parts and preventive maintenance. Field maintenance returns repaired equipment to the soldier. It covers crew, unit, and selected DS maintenance tasks. Some "off-system" maintenance can be done at field level if, based on task analysis, it is simple to complete or it is critical to mission readiness.

- SUSTAINMENT, tasks performed in a shop environment, including DS (-30) maintenance activities.

  Sustainment is off-system maintenance and is mainly repair of defective equipment/parts. Sustainment maintenance returns repaired equipment/parts to the supply system. It covers selected DS tasks, GS, and Depot maintenance.

- DS/GS tasks must be analyzed to determine whether they will be done at field or Sustainment level.

Column (4) – Maintenance Level, specifies each level of maintenance authorized to perform each function listed in column (3), by indicating work time required (expressed as manhours in whole hours or decimals) in the appropriate subcolumn. This work time figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance levels, appropriate work time figures are to be shown for each level.

The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC. The symbol designations for the various maintenance levels are as follows:

C Operator or crew maintenance

O Unit maintenance

F Direct support (DS) maintenance

L Specialized repair activity (SRA)

H General support (GS) maintenance

D Depot maintenance

Use the information in Table 1 to calculate hours for maintenance tasks.

Table 1. Conversion Calculation

Minutes	Hour
6	0.1
12	0.2
18	0.3
24	0.4
30	0.5
36	0.6
42	0.7
48	0.8
54	0.9
60	1.0

NOTE

The “L” maintenance level is not included in column (4) of the MAC. Functions to this level of maintenance are identified by a work time figure in the “H” column of column (4), and an associated reference code is used in the REMARKS column (6). This code is keyed to the remarks and the SRA complete repair application is explained there.

Column (5) – Tools and Test Equipment Reference Code, specifies, by code, those common tool sets (not individual tools) that are common Test Measurement and Diagnostic Equipment (TMDE), and special tools, special TMDE and special support equipment required to perform the designated function. Codes are keyed to the entries in the tools and equipment table (WP 0055, Table 2).

Column (6) – Remarks Code, when applicable, contains a letter code, in alphabetical order, which is keyed to the remarks table entries (WP 0055, Table 3).

NOTE

For illustrations of components/assemblies, refer to WPs

EXPLANATION OF COLUMNS IN THE TOOLS AND TEST EQUIPMENT REQUIREMENTS

Column (1) – Tool or Test Equipment Code, correlates with a code used in column (5) of WP 0055 Table 1, Maintenance Allocation Chart for CROWS (21677-0100).

Column (2) – Maintenance Level, lists the lowest level of maintenance authorized to use the tool or test equipment.

Column (3) – Nomenclature, names or identifies the tool or test equipment.

Column (4) – National Stock Number (NSN), lists the NSN for the tool or test equipment.

Column (5) – Tool Number, records the manufacturer's part number, model number, or type number.

EXPLANATION OF COLUMNS IN THE REMARKS SECTION

Column (1) – Remarks Code, cross-references to the code in column (6) of WP 0055 Table 1, Maintenance Allocation Chart for CROWS (21677-0100).

Column (2) – Remarks, lists information pertinent to the maintenance function being performed as indicated in the MAC.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

MAINTENANCE ALLOCATION CHART (MAC) FOR CROWS

This work package provides a general explanation of all maintenance and repair functions authorized at the various maintenance levels under the standard Army Maintenance System concept.

WP CONTENTS

Section/Subsection **Page**

Maintenance Allocation Chart (MAC) 1

Tools and Test Equipment Requirements 13

Explanation of Columns in the Remarks Section 14

MAINTENANCE ALLOCATION CHART (MAC)

NOTE

For an explanation of the columns of each MAC table, as well as additional information about the Army Maintenance Concept, refer to WP 0054, Introduction to the Maintenance Allocation Chart (MAC) for CROWS.

Operator adjustments include elevation alignment, boresighting, and zeroing. Refer to the CROWS Operator's Manual, TM 9-1090-218-10.

Table 1 contains the MAC for CROWS.

Table 1. MAC

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level: Field Operator (-10)	(4) Maintenance Level: Field Unit (-20) (LRU)	(4) Maintenance Level: STMT DS (-30) (SRU)	(5) Tools and Equipment	(6) Remarks
00	CROWS	Inspect Test Service Remove Install Adjust	0.4 0.2	0.2 0.2	0.2 0.2	1, 2, 3, 4	A, B, E
01	Stabilized Weapon Mount	Inspect Test Service Remove Repair Install Replace	0.1 0.2 0.1	0.1 0.1 0.3 0.4 0.5	0.1 0.2 0.1 1.0 1.0	1, 4	A, B, E
0101	Pedestal Assembly	Inspect Test Service Remove Repair Install Replace	0.1 0.1	0.1 0.1 0.3 0.2 0.3	0.1 0.3 0.1 0.5	1, 4	A, B, E
010101	Power Supply Assembly	Inspect Test Service Remove Repair Install Replace			0.1 0.2 0.2 0.2		E
010102	Sight Elevation Drive Assembly	Inspect Test Service Remove Repair Install Replace	0.1	0.1	0.1 0.2 0.1 0.1 0.4 0.1	1, 4	E

Table 1. MAC – Cont.

(1)	(2)	(3)	(4) Maintenance Level:			(5)	(6)
			Field		STMT		
Group Number	Component/ Assembly	Maintenance Function	Operator (-10)	Unit (-20) (LRU)	DS (-30) (SRU)	Tools and Equipment	Remarks
010103	Azimuth Power Amp Assembly	Inspect Test Service Remove Repair Install			0.1 0.2 0.1 0.2 0.3		E
0102	Cable Assembly – Weapon Elevation (21677-3700)	Inspect Test Service Remove Repair Install Replace	0.1	0.1 0.2 0.1 0.1	0.1 0.2 0.2 0.1	1, 4	E, F
0103	Elevation Yoke Arm Assembly	Inspect Test Service Remove Repair Install Replace	0.1	0.1 0.2 0.2		1, 4	B, E
010301	Elevation Drive Assembly (Weapon Elevation PWM Power Amp CCA)	Inspect Test Service Remove Repair Install			0.1 0.1 0.2 0.2		E
0104	Ammo Yoke Arm Assembly	Inspect Test Service Remove Repair Install Replace	0.1	0.1 0.3 0.3	0.1 0.1 0.3	1, 4	B, E
02	Sensor Group (sunshade, sight adapter plate, sight support plate, sensor unit) (Mount to Sensor Cable listed under Group 0401)	Inspect Test Service Remove Repair Install Replace	0.1 0.1	0.1 0.2 0.2 0.2	0.1 0.2 0.3 0.2	1, 4	E

Table 1. MAC – Cont.

(1)	(2)	(3)	(4) Maintenance Level:			(5)	(6)
			Field		STMT		
Group Number	Component/ Assembly	Maintenance Function	Operator (-10)	Unit (-20) (LRU)	DS (-30) (SRU)	Tools and Equipment	Remarks
0201	Sensor Unit	Inspect Test Service Remove Repair Install Replace	0.1 0.1	0.1 0.2 0.2 0.2	0.1 0.2 0.3 1.0 0.2	1, 4	E
020101	Optical Sensor Assembly	Inspect Test Service Remove Repair Install			0.1 0.3 0.2 0.3 1.0 0.7		E
020102	Temperature and Pressure Sensor Assembly	Inspect Test Service Remove Repair Install			0.1 0.3 0.1 0.1 0.3		E
020103	Input/Output Multiplex Assembly	Inspect Test Service Remove Repair Install			0.1 0.1 0.2 0.5 0.2		E
03	Control Group	Inspect Test Service Remove Repair Install Replace	0.1	0.1 0.2 0.2 0.1 0.1	0.1 0.2 0.3 0.5 1.0	1, 4	A, E, G
0301	Electronics Module Unit (EMU)	Inspect Test Service Remove Repair Install Replace	0.1	0.1 0.2 0.2 0.2	0.1 0.3 0.1 1.3 0.2	1, 4	A, E, G

Table 1. MAC – Cont.

(1)	(2)	(3)	(4) Maintenance Level:			(5)	(6)
			Field		STMT		
Group Number	Component/ Assembly	Maintenance Function	Operator (-10)	Unit (-20) (LRU)	DS (-30) (SRU)	Tools and Equipment	Remarks
030101	EM Support Cap Assembly	Inspect Test Service Remove Repair Install Replace			0.1 0.3 0.1 0.2 0.4 0.2		E
03010101	Sensor Electronics Module Assembly	Inspect Test Service Remove Repair Install Replace			0.1 0.3 0.1 0.3 1.5 1.0		E
0301010101	Digital Video Electronics Assembly	Inspect Test Service Remove Repair Install Replace			0.1 0.3 0.1 0.1 1.0 0.1		E
0302	Switch Panel Unit (SPU)	Inspect Test Service Remove Repair Install Replace	0.1	0.1 0.2 0.2	0.1 0.2 0.1 0.6 0.2	1, 4	A, E, G
0303	Interface Control Unit (ICU)	Inspect Test Service Remove Repair Install Replace	0.1	0.1 0.2 0.2 0.2	0.1 0.3 0.1 1.5 0.2	1, 4	A, E, G
030301	ICU Support Cap Assembly	Inspect Test Service Remove Repair Install Replace			0.1 0.3 0.1 0.2 1.5 0.4		E

Table 1. MAC – Cont.

(1)	(2)	(3)	(4) Maintenance Level:			(5)	(6)
			Field		STMT		
Group Number	Component/ Assembly	Maintenance Function	Operator (-10)	Unit (-20) (LRU)	DS (-30) (SRU)	Tools and Equipment	Remarks
03030101	ICU Power Assembly	Inspect Test Service Remove Repair Install Replace			0.1 0.3 0.1 0.4 0.2		E
0303010101	ICU Power Filter Board	Inspect Test Service Remove Repair Install Replace			0.1 0.3 0.1 0.3 0.5 0.2		E
0304	Joystick (Control Grip)	Inspect Test Service Remove Repair Install Replace	0.1	0.1 0.1 0.1	0.1 0.3 0.1 0.6 0.1 	1, 4	A, E, G
0305	Display Unit (FPD)	Inspect Test Service Remove Repair Install Replace	0.1	0.1 0.2 0.2	0.1 0.3 0.2 0.2 	1, 4	A, E, G
030501	FPD and LCD Interface Electronics Assembly	Inspect Test Service Remove Repair Install Replace		 0.3	0.1 0.3 0.1 0.5 0.5 0.8 	4	E
04	Cable Assemblies	Inspect Test Service Remove Repair Install Replace	0.1	0.1 0.2 0.1 0.1	0.1 0.2 0.2 0.1 	1, 4	F

Table 1. MAC – Cont.

(1)	(2)	(3)	(4) Maintenance Level:			(5)	(6)
			Field		STMT		
Group Number	Component/ Assembly	Maintenance Function	Operator (-10)	Unit (-20) (LRU)	DS (-30) (SRU)	Tools and Equipment	Remarks
0401	Electrical – Mount to Sensor (21677-3706)						E, F
0402	Cable Assembly, Electrical – Power (21677-3713)						A, E, F, G
0403	Cable, Assembly, Electrical – ICU to SPU (21677-3714)						A, E, F, G
0404	Cable Assembly, Electrical – ICU to Display (21677-3715)						A, E, F, G
0405	Cable Assembly, Electrical – ICU to EMU (21677-3716)						A, E, F, G
0406	Cable Assembly, Electrical – Hatch Interlock (21677-3720)						A, E, F, G
0407	Cable Assembly, Electrical – Gimbal to Bulkhead (21677-3730)						A, E, F, G
0408	Cable Assembly, Electrical – Bulkhead to ICU (21677-3731)						A, E, F, G

Table 1. MAC – Cont.

(1)	(2)	(3)	(4) Maintenance Level:			(5)	(6)
			Field		STMT		
Group Number	Component/ Assembly	Maintenance Function	Operator (-10)	Unit (-20) (LRU)	DS (-30) (SRU)	Tools and Equipment	Remarks
05	Ammo Can Assembly	Inspect	0.1			1, 4	E
		Test					
		Service	0.1				
		Remove	0.1				
		Repair					
		Install	0.1				
		Replace	0.1				
06	Cradle Assembly	Inspect	0.1	0.1	0.1	1, 4	E
		Test					
		Service	0.1	0.1	0.1		
		Remove	0.2				
		Repair			0.2		
		Install	0.2				
		Replace	0.3				
0601	Attenuator Assembly – Right Hand	Inspect	0.1	0.1	0.1	1, 4	E
		Test					
		Service			0.1		
		Remove			0.3		
		Repair					
		Install			0.3		
		Replace					
0602	Attenuator Assembly - Left Hand	Inspect	0.1	0.1	0.1	1, 4	E
		Test					
		Service			0.1		
		Remove			0.3		
		Repair					
		Install			0.3		
		Replace					
07	M2 HB Weapon Adapter Kit	Inspect	0.2	0.2	0.2	1, 2, 3, 4	C, D, E
		Test	0.2	0.2	0.2		
		Service	0.1	0.1	0.1		
		Remove	0.4				
		Repair		0.3			
		Install	0.5				
		Replace	1.0				

Table 1. MAC – Cont.

(1)	(2)	(3)	(4) Maintenance Level:			(5)	(6)
			Field		STMT		
Group Number	Component/ Assembly	Maintenance Function	Operator (-10)	Unit (-20) (LRU)	DS (-30) (SRU)	Tools and Equipment	Remarks
0701	Cable Assembly, Electrical – M2 (21677-3702)	Inspect Test Service Remove Repair Install Replace	0.1	0.1 0.2 0.1 0.2	0.1 0.2 0.1 0.1 	1, 4	E, F
0702	Linear Actuator (Charger) Assembly (Cable)	Inspect Test Service Remove Repair Install Replace	0.1	0.1 0.2 0.2 0.2	0.1 0.2 0.1 0.1 	1, 4	E, F
0703	Remote Firing Assembly	Inspect Test Service Remove Repair Install Replace Adjust	0.1 0.1 0.2 0.2 0.3 0.2	0.1 0.2 0.2 	0.1 0.2 0.1 	1, 4	E
0704	Block Guide Assembly (Setscrew)	Inspect Test Service Remove Repair Install Replace	0.1 0.1 0.1 0.2	0.1 0.1 	0.1 0.1 	1, 4	E
0705	Sear Assembly (with Sear Slide)	Inspect Test Service Remove Repair Install Replace	0.1 0.1 0.2 0.2 0.3	0.1 0.2 	0.1 	1, 4	E

Table 1. MAC – Cont.

(1)	(2)	(3)	(4) Maintenance Level:			(5)	(6)
			Field		STMT		
Group Number	Component/ Assembly	Maintenance Function	Operator (-10)	Unit (-20) (LRU)	DS (-30) (SRU)	Tools and Equipment	Remarks
08	MK19 Weapon Adapter Kit	Inspect	0.2	0.2	0.2	1, 2, 3, 4	C, E
		Test	0.2	0.2	0.2		
		Service	0.1	0.1	0.1		
		Remove	0.4				
		Repair		0.3			
		Install	0.5				
		Replace	1.0				
0801	Cable Assembly, Electrical – Mk19 (21677-3703)	Inspect	0.1	0.1	0.1	1, 4	E, F
		Test		0.2	0.2		
		Service			0.1		
		Remove		0.1			
		Repair					
		Install		0.1			
		Replace	0.1				
0802	Linear Actuator (Charger) Assembly (Cable)	Inspect	0.1	0.1	0.1	1, 4	E, F
		Test		0.2	0.2		
		Service			0.1		
		Remove	0.2				
		Repair					
		Install		0.2			
		Replace	0.2				
0803	Remote Charger Assembly	Inspect	0.1	0.1	0.1	1, 4	E
		Test		0.2	0.2		
		Service	0.1		0.1		
		Remove	0.2				
		Repair		0.2			
		Install		0.2			
		Replace	0.3				
0804	Ogive	Inspect	0.1	0.1	0.1	1, 4	E
		Test		0.2	0.2		
		Service	0.1		0.1		
		Remove	0.2		0.2		
		Repair		0.2			
		Install	0.2				
		Replace	0.3				

Table 1. MAC – Cont.

(1)	(2)	(3)	(4) Maintenance Level:			(5)	(6)
			Field		STMT		
Group Number	Component/ Assembly	Maintenance Function	Operator (-10)	Unit (-20) (LRU)	DS (-30) (SRU)	Tools and Equipment	Remarks
09 Work in process	M240/M249 Weapon Adapter Kit	Inspect	0.1	0.1	0.1		
		Test		0.2			
		Service	0.1				
		Remove	0.3	0.3	0.3		
		Repair			0.3		
		Install	0.3	0.3	0.3		
		Replace	0.7				
0901 Work in process	Cable Assembly, Electrical – M240/M249 (21677-3705)	Inspect	0.1	0.1	0.1		
		Test		0.2	0.2		
		Service			0.1		
		Remove	0.1	0.1	0.1		
		Repair					
		Install	0.1	0.1	0.1		
		Replace					
0902 Work in process	M240/M249 Cradle	Inspect	0.1	0.1	0.1		
		Test					
		Service		0.1	0.1		
		Remove	0.3	0.3	0.3		
		Repair			0.5		
		Install	0.3	0.3	0.3		
		Replace	0.7				
090201 Work in process	Linear Actuator (Charger) and Bracket Assembly (Cable)	Inspect	0.1	0.1	0.1		
		Test		0.2	0.2		
		Service	0.1		0.1		
		Remove	0.2	0.2	0.2		
		Repair					
		Install	0.2	0.2	0.2		
		Replace	0.3				
090202 Work in process	Rounds Counter – M240	Inspect	0.1	0.1	0.1		
		Test		0.2	0.2		
		Service			0.1		
		Remove	0.3	0.3	0.3		
		Repair			0.3		
		Install	0.3	0.3	0.3		
		Replace	0.5				

Table 1. MAC – Cont.

(1)	(2)	(3)	(4) Maintenance Level:			(5)	(6)
			Field		STMT		
Group Number	Component/ Assembly	Maintenance Function	Operator (-10)	Unit (-20) (LRU)	DS (-30) (SRU)	Tools and Equipment	Remarks
090203 Work in process	Rounds Counter – M249	Inspect	0.1	0.1	0.1		
		Test		0.2	0.2		
		Service	0.1	0.1	0.1		
		Remove	0.2	0.2	0.2		
		Repair			0.2		
		Install	0.2	0.2	0.2		
		Replace	0.3	0.3			
10	Ballistic Protection Kit	Inspect	0.1	0.1	0.1	1, 8	
		Test					
		Service			0.1		
		Remove		0.6			
		Repair					
		Install		0.6			
		Replace		1.2			
11	Vehicle Integration Kit	Inspect	0.1	0.1		1, 5, 6, 7	A
		Test					
		Service					
		Remove		0.6			
		Repair					
		Install		0.6			
		Replace		1.2			

TOOLS AND TEST EQUIPMENT REQUIREMENTS

NOTE

For further details on tools and special tools, refer to WP 0057, Tool Identification List.

Table 2 lists the tools, special tools, and test equipment required for unit and DS maintenance functions as referenced in the MAC.

Table 2. Tool and Test Equipment Requirements for CROWS

(1) Tool or Test Equipment Reference Code	(2) Maintenance Level	(3) Nomenclature	(4) National Stock Number	(5) Tool Number
1	Operator	Operator's Tool Kit	N/A	Commercial
2	Operator	CROWS Boresight Alignment Kit		
3	Operator	M2 Headspace and Timing Gages	4933-00-535-1217	(19205) 5351217
4	Unit	Tool Kit, Small Arms Repairman (45B)	5180-00-357-7770	SC 5180-95-A07
5	Unit	Riveter Kit, Blind	5180-01-201-4978	(64878) D-100-MIL-1
6	Unit	45G Tool Kit, Electronic System (Fire Control)	5180-01-168-0487	SC 5180-95-B29
7	Unit	45K Tool Kit, Artillery and Turret Mechanic (Armament)	5180-00-357-7727	SC 5180-95-A12
8	Unit	General Mechanic's Automotive (GMTK)	5180-01-454-3787	SC 5180-95-B47

EXPLANATION OF COLUMNS IN THE REMARKS SECTION

The remarks information, Table 3, contains supplemental instructions and explanatory notes for a particular maintenance function.

Column (1) – Reference Code cross-references to column (6) of Table 1, Maintenance Allocation Chart..

Column (2) – Remarks, lists information pertinent to the maintenance function being performed.

Table 3. Remarks

Reference Code	Remarks
A	See Vehicle Integration Kit (VIK), WP 0060
B	Operator authorized for stowing procedures; refer to Operator Manual, WP 0008.
C	Boresight Alignment Kit Recommend minimum of one kit per squad equipped with one or more CROWS
D	M2 Timing Gages Fielded as part of weapon support structure
E	Technical Manuals for the Armament Subsystem: Remotely Operated, M101 TM 9-1090-218-10 and TM 9-1090-218-23&P.
F	Check cables for condition of pins and connectors and perform continuity check.
G	Installation/Removal is part of the vehicle integration kit.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

EXPENDABLE AND DURABLE ITEMS

This work package contains the expendable and durable items that you will need to operate and maintain the CROWS at the unit and direct support maintenance levels.

INTRODUCTION

Scope

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), 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 brake fluid (item 5, WP 0098).”)

Column (2) Level. This column includes the lowest level of maintenance that requires the listed item (C= Operator/Crew).

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.

Column (5) Unit of Issue (U/I). Indicates the physical measurement or count of the item 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 maintenance 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	Unit, DS	6810-01-223-2739	Acetone (81345) ASTM-D-329-PT	BT
2	Unit, DS	6810-01-106-2460	Alcohol, ethyl, denatured Grade III, formula no. 3A (grade II, class B also acceptable) (81348) O-E-760	BT
3	Unit, DS	6810-00-983-8551	Alcohol, isopropyl (81348) TT-I-735	CN

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
4	Unit, DS	6530-01-460-1109	Bottle, spray (16 fluid oz) (07TA6) B7548-60	EA
5	Unit, DS	8020-00-201-1870	Brush, artist's Nonmetallic (80244) 8020-00-201-1870	EA
6	Unit, DS	8020-00-242-7266	Brush, paint Medium grade, hog hair (58536) A-A-3192	EA
7	Unit, DS	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
8	Unit, DS	7920-00-044-9281	Cloth, cleaning, lint-free (58536) A-A-59323	BX
9	Unit, DS	8010-01-246-0717	Coating, polyurethane (conforms to MIL-C-53039) African green/color number 34031 (81349) M53039-001Q-34031	QT
10	Unit, DS	8010-01-229-7540	Coating, polyurethane (conforms to MIL-C-53039) Black/color number 37030 (for 3-color camouflage system) (81349) M53039-001Q-37030	QT
11	Unit, DS	8010-01-229-7543	Coating, polyurethane (conforms to MIL-C-53039) Brown/color number 30051 (for 3-color camouflage system) (81349) M53039-001Q-30051	QT
12	Unit, DS	8010-01-229-7546	Coating, polyurethane (conforms to MIL-C-53039) Green/color number 34094 (for 3-color camouflage system) (81349) M53039-001Q-34094	QT
13	Unit, DS	8010-01-234-2934	Coating, polyurethane (conforms to MIL-C-53039) Sand/color number 33303 (81349) M53039-001Q-33303	QT
14	Unit, DS	8010-01-276-3638	Coating, polyurethane (conforms to MIL-C-53039) Tan 686/color number 33446 (81349) P/N M53039-001Q-33446	QT
15	Unit, DS	8030-00-118-0666	Compound, corrosion preventive (conforms to MIL-C-16173D) (66724) LPS3	KT
16	Unit, DS	8030-01-088-8140	Compound, sealing/thread locking (ten 10-cc bottles per box) type II, grade M (81349) MIL-S-46163	BX
17	Unit, DS	6510-01-500-7929	Cotton balls (200 per pkg) (60180) 30-127	PG

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
18	Unit, DS	6640-01-468-3557	Dessicant, silica (59590) 1194B	
19	Unit, DS	7930-00-531-9716	Detergent, type I (5 gallon can) (81349) MIL-D-16791	CN
20	Unit	5133-00-833-4635	Drill bit, 17/32 inch (0.5312 inch) (92061) T-105	EA
21	Unit, DS	7930-01-398-2473	Dust remover, compressed air (1MB86) 105798-1 (one box contains 6 ea)	BX
22	Unit, DS	8415-01-463-5934	Gloves, plastic/latex; non-talc (80244) 8415-01-463-5934	DZ
23	Unit, DS	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
24	Unit, DS	4240-00-052-3776	Goggles, industrial (80204) ANSI Z87.1	PR
25	Unit, DS	9150-01-443-9397	Grease, general purpose Synthetic-base, lithium-complex EP grease; NLGI grade 2 (77988) SHC 220	EA
26	Unit, DS	9150-01-378-0693	Grease, aircraft lubricant (81349) MIL-PRF-81322, grade 1	CN
27	Unit, DS	6640-01-474-0348	Paper tissue, lens (50 sheets per book/12 books per pkg) (1V571) RLC20205100	PG
28	Unit, DS	6850-01-159-4844	Silicone compound (7X677) 12346193	TU
29	Unit, DS	5975-01-476-0484	Strap, tiedown, electrical (also anchors) (1,000 in a bag) (06383) SST2S-MO	EA
30	Unit Ds	7510-00-266-6710	Tape, pressure sensitive (masking) (81346) ASTM D-6123	RO
31	Unit, DS	6810-00-107-1510	Water, distilled (5 gallon drum) (58536) A-A-59282	GL
32	Unit, DS	9505-00-596-5101	Wire, safety, 0.020-inch diameter 302 stainless (81346) ASTM-580	SL

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

TOOL IDENTIFICATION LIST

This work package lists all common tools and supplements and special tools/fixtures needed to maintain CROWS.

WP CONTENTS

Section/Subsection **Page**

Introduction....1

Tool/Special Tool List....2

INTRODUCTION

Explanation of Columns in the Tool Identification List

Column (1) Item Number. This number is assigned to the entry in the list and is referenced in the initial setup to identify the item (e.g., “Operator’s Tool Kit, WP 0055, Table 2, Item 1”).

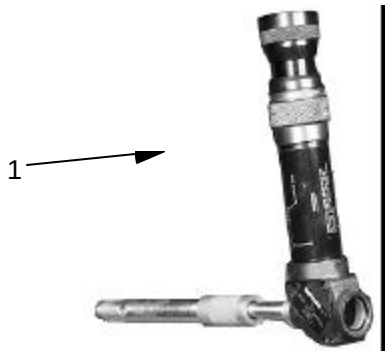
Column (2) Item Name. This column lists the item by noun nomenclature and other descriptive features (e.g., “Tool Kit, Small Arms Repairman”).

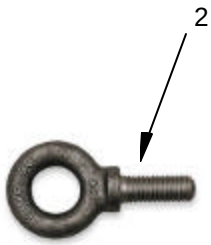
Column (3) National Stock Number. This is the National Stock Number (NSN) assigned to the item; use it to requisition the item.

Column (4) Part Number/CAGEC. Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity) which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items. The manufacturer’s Commercial and Government Entity Code (CAGEC) is also included.

Column (5) Reference. This column identifies the authorizing supply catalog, RPSTL, or illustrated parts list (IPL) for items listed in this work package.

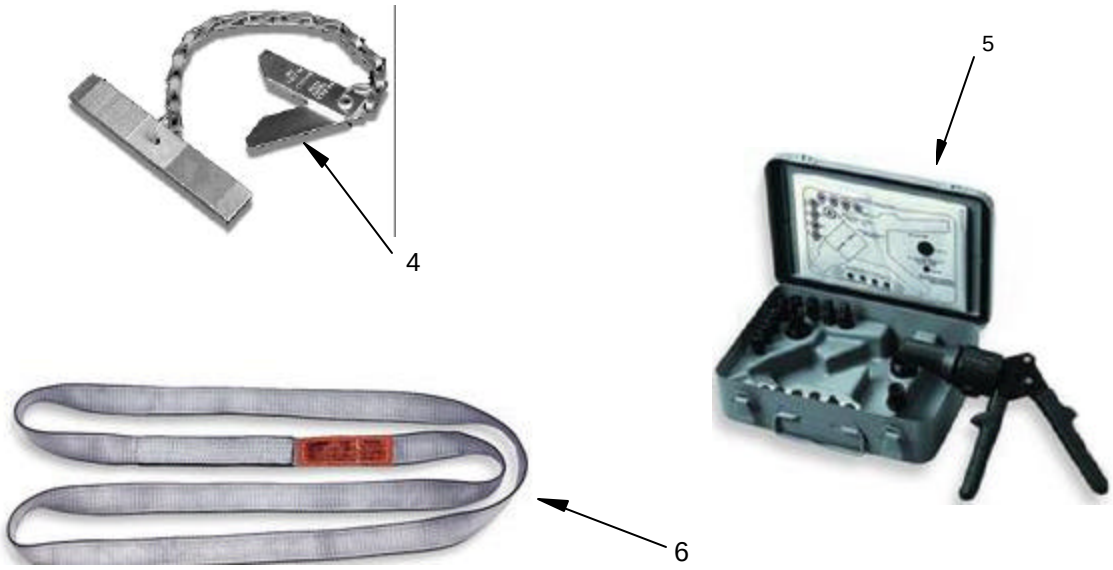
TOOL/SPECIAL TOOL LIST







(1) Item Number	(2) Item Name	(3) National Stock Number	(4) CAGEC / Part Number	(5) U/M
1	CROWS boresight alignment kit			
	• Case	TBD		
	• Boresight Telescope (Figure 1)	4933-00-867-6607	7799773	EA
	• Mandrel			
	➢ .50-cal (M2)	4933-01-251-9703	12561298	EA
	➢ 40-mm (Mk19)	TBD		
	➢ 7.62-mm (M240)	4933-00-930-8951	11686592	EA
	➢ 5.56-mm (M249)	TBD		
			NOTE AAL: One Boresight Alignment Kit per squad equipped with one or more CROWS	
2	Eyebolt (9/16")		(71747) 2G702	EA
3	Hoist, chain	3950-00-292-9881	(81349) MILH904	EA



(1) Item Number	(2) Item Name	(3) National Stock Number	(4) CAGEC / Part Number	(5) U/M
4	M2 headspace and timing gages: GO/NO GO and FIRE/NO FIRE gages	4933-00-535-1217	(19205) 5351217 **NOTE** Normally fielded as part of weapon support structure Available at DS maintenance; issued with M2 as BII	EA
5	Riveter Kit, Blind	5180-01-201-4978	(64878) D-100-MIL-1	KT
6	Sling	3940-01-333-6263	(23755) EE1-201X8	EA

(1) Item Number	(2) Item Name	(3) National Stock Number	(4) CAGEC / Part Number	(5) U/M
7	Test Set, Electronic Systems Laptop Computer, Hardened and Field-Ready for Diagnostics	6625-01-493-8984	(18876) 13580881	
8	Cable Assembly, Bulkhead to ICU - Test 300-inch length, Maintenance Aid		(11871) 21677-8501	
9	Cable Assembly, Diagnostic Cable From Control Group diagnostic port, Maintenance Aid		(11871) 21677-8502	

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

MANDATORY REPLACEMENT PARTS/SPARES

This work package lists items that are replaced routinely during maintenance activities even if they have not failed, as well as those items that should be replaced if damaged or worn.

WP CONTENTS

Section/Subsection **Page**

Mandatory Replacement Parts....1

Parts to be Replaced if Damaged or Worn....2

MANDATORY REPLACEMENT PARTS

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.

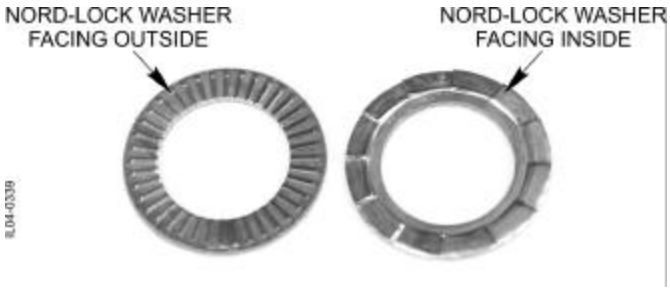


Figure 1. Nord-Lock Washer Set

Replace the following items each time they are accessed, regardless of observable condition:

- Spring (tension) washers
- Star washers
- Nord-lock and other lock-ring washers

PARTS TO BE REPLACED IF DAMAGED OR WORN

The items in Table 1 may be reused, but must be replaced if damage or excessive wear is noted. Damage includes, but is not limited to, the conditions listed in Table 1.

Table 1. Items and Damage Descriptions

Item and Location(s)	Conditions
Seals and gaskets Locations include: • Weapon elevation drive assembly access panel • Sight elevation drive assembly • Azimuth housing covers • Sensor unit • EMU • ICU • SPU • Display	Unable to make good seal, including • Scratched • Stretched • Cut • Twisted • Compressed • Worn out
Aluminum tape in the sensor unit	Unable to maintain attachment, including curled corners, bubbles in the tape, or portions of the tape peeling off

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

SHIPPING, HANDLING, AND STORING

This work package contains procedures for shipping, handling, and storing CROWS.

WP CONTENTS

Section/Subsection	Page
Initial Set Up	2
General Shipping and Handling Procedures	2
Overview	2
Packing/Unpacking	3
Inspection	3
Lifting and Moving the CROWS Mount	3
Mounting the CROWS and Components	4
Shipping CROWS	5
Shipping Container for the Mount - Packing Instructions	5
Shipping Container for the Mount - Unpacking Instructions	10
Control Group and Sensor Unit Shipping Containers - Overview	11
Armor Shipping and Handling	17
Overview	17
Inspection	18
Unpacking the Armor	18
Packing the Armor	22
Final Preparation for Shipping CROWS Armor	27
Depot Maintenance Instructions	27
Preparation for Storage and Handling	27
Long Term Storage	27

INITIAL SET-UP

Refer to Table 1 for tools, special tools, personnel required, materials, and references needed to prepare the CROWS for shipping, storage and handling.

NOTE

Should any malfunctions occur, refer to WP 0012 and WP 0031, Unit Maintenance Troubleshooting and Direct Support Maintenance Troubleshooting, respectively.

Table 1. Initial Setup Information

Category	Item	Additional Information
Tools	Operator's Tool Kit	WP 0055, Table 2, Item 1
	Unit Tool Kit	WP 0055, Table 2, Item 4
Special Tools	Hoist	WP 0057, Item 3
	Sling	WP 0057, Item 6
Personnel Required	Two	
Materials/Parts	Dessicant, silica	WP 0056, Table 1, Item 18
	Tape, masking	WP 0056, Table 1, Item 30
References	TM 9-1090-218-10	CROWS Operator's Manual
	DA Pam 700-32	Packaging of Army Materiel

GENERAL SHIPPING AND HANDLING PROCEDURES

Use the following procedures to prepare, handle, and ship CROWS components and assemblies.

Overview

NOTE

For additional information on shipping containers and procedures for packing/unpacking, refer to the Shipping CROWS section of this work package.

Depot will provide properly labeled, reusable shipping containers that may be used to return components/parts.

Government items will be packaged IAW standard Army procedures, including reusable containers.

Ship items to other facilities using Army-approved packaging and procedures.

CAUTION

Ensure a package of desiccant is included in any container when shipping electronic parts or devices. Failure to follow this instruction may result in equipment damage.

NOTE

Refer to WP 0010 for instructions on proper electrostatic discharge (ESD) procedures.

The CROWS components can be packed in a variety of ways depending on contract requirements (e.g., number and type of weapon adapter kits being sent, whether the shipment is for standard equipment or spares, etc.). If no contract requirements are specified, the program manager may determine the configuration.

Packing/Unpacking

NOTE

For additional information on shipping containers, refer to the Shipping CROWS section of this work package.

The CROWS system is transported in shipping containers containing the CROWS mount, cradle, weapon adapter kits (WAKs), and cables.

The Sensor Group/Unit and Control Group components may be supplied in custom-manufactured, lightweight, impact-absorbing carrying cases that are waterproof, dustproof, and secured by lockable quick-release catches.

Inspection

NOTE

For a list of CROWS assemblies and parts, refer to WP 0002, Table 1, CROWS Components and Nomenclature.

After unpacking, thoroughly inspect all equipment IAW the instructions given in the CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services (PMCS).

Lifting and Moving the CROWS Mount

WARNING

Follow all safety recommendations related to lifting or moving the CROWS. Use a hoist or forklift for maintenance and installation on or removal of the CROWS from the vehicle. Failure to follow these instructions may result in personal injury or equipment damage.

NOTE

When lifting the mount using a hoist or other lifting device, refer to the strap procedures in WP 0060.

For shipping procedures, refer to the Shipping CROWS section of this work package.

Disconnect the cables listed in Table 2 before using the strap procedures detailed in WP 0060.

Table 2. External Cables to be Removed

Part Number	Cable Name
21677-3700	Weapon Elevation Cable
21677-3702	M2 Weapon to Mount Cable
21677-3703	Mk19 Weapon to Mount Cable
21677-3705	M240/M249 Weapon to Mount Cable
21677-3706	Mount to Sensor Cable
21677-3730	Gimbal-Bulkhead Cable
21677-3731	Bulkhead-ICU Cable

If connected, the linear actuator (charger) assembly cable may remain connected.

The external cables used inside the vehicle, listed in Table 3, are not part of the strapping procedure.

Table 3. External Cables Not Part of the Strapping Procedure

Part Number	Cable Name
21677-3713	Vehicle Power Cable
21677-3714	ICU-SPU Cable
21677-3715	ICU-Display Cable
21677-3716	ICU-EMU Cable
21677-3720	Hatch Interlock Cable

Mounting the CROWS and Components

NOTE

When lifting the mount using a hoist or other lifting device, refer to the strap procedures in WP 0060.

The stabilized weapon mount (SWM) is installed onto the vehicle IAW the WP 0060.

The Control Group, Table 4, is installed IAW WP 0060.

Table 4. Control Group Components

Part Number	Cable Name
21677-5500	Control Group
ASY05820	. EMU
ASY05821	. SPU
ASY05822	. ICU
ASY05823	. Joystick
ASY05843	. Display Unit
21677-3713	. Vehicle Power Cable
21677-3714	. ICU-SPU Cable
21677-3715	. ICU-Display Cable
21677-3716	. ICU-EMU Cable
21677-3720	. Hatch Interlock Cable
21677-3730	. Gimbal-Bulkhead Cable
21677-3731	. Bulkhead-ICU Cable
21677-3731	. Bulkhead-ICU Cable

SHIPPING CROWS

Shipping Container for the Mount – Packing Instructions

The following procedures describe typical configurations and preparations for shipping the CROWS mount and related equipment.

Equipment Condition: The following list (and related procedures) is representative of a typical M2 configuration.

NOTE

The sensor unit may also be placed into a different shipping container without the other Sensor Group components. Refer to the Control Group and Sensor Group Shipping Containers section of this work package.

The following items are installed on the mount:

The Sensor Group with protective wrap over the optical elements; refer to WP 0020 of this manual.

The cradle (M2/Mk19); refer to CROWS Operator's Manual, TM 9-1090-218-10, WP 0009.

Selected M2 WAK components, including attenuators (up position), the M2 forward pin, the linear actuator (charger) assembly with cable connected to J6, Weapon, sear assembly, and the ammo guide; refer to CROWS Operator's Manual, TM 9-1090-218-10, WP 0009.

The ammo can; refer to CROWS Operator's Manual, TM 9-1090-218-10, WP 0009.

The following items are included in the shipping crate:

Documentation, including the Operator and Maintenance Manuals, as specified by contract requirements.

Box 1, containing the remaining components of the M2 WAK, including weapon to mount cable.

Box 2, containing the Mk19 WAK components, including weapon to mount cable.

Box 3, containing the external cables, as listed in Table 5.

Table 5. Box 3: External Cables for CROWS

Part Number	Cable Name
21677-3700	Weapon Elevation Cable
21677-3706	Mount to Sensor Cable
21677-3713	Vehicle Power Cable
21677-3714	ICU-SPU Cable
21677-3715	ICU-Display Cable
21677-3716	ICU-EMU Cable
21677-3720	Hatch Interlock Cable
21677-3730	Gimbal-Bulkhead Cable
21677-3731	Bulkhead-ICU Cable

Optional configurations include separate boxes that may contain:

All of the M2 WAK components, including weapon to mount cable.

The cradle (M2/Mk19).

The M240/M249 WAK components, including weapon to mount cable and the cradle.

Perform the following procedures to prepare the CROWS mount for shipping.

1. Perform a visual inspection of the exterior of the shipping crate, referring to Figure 1, to ensure that all parts are present and in good condition, and that the crate is marked as required by the contract.
2. Remove the twelve screws securing the crate top to the base, referring to Figure 1. Retain for later use.



Figure 1. Crate with Base and Top Secured

NOTE

Do not remove the hardware attaching the baseplate to the crate (Figure 2).

3. Inspect the interior of the crate to ensure that the all parts are present and in good condition, including the hardware attaching the baseplate to the crate, referring to Figures 1 and 2.

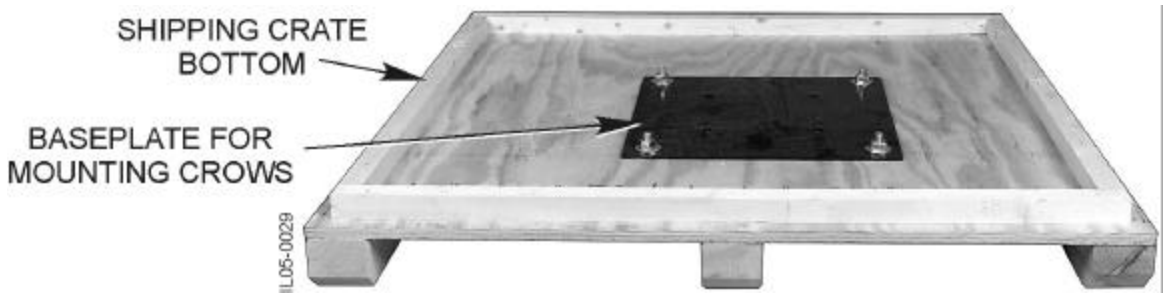


Figure 2. Interior of Crate with Baseplate

NOTE

For additional information about moving and securing the mount, including placement of straps in the mount when using a hoist and appropriate attaching hardware, refer to WP 0060 of this manual.

4. Using a hoist or other lifting device, place the holes on the bottom of the pedestal in alignment with the holes in the baseplate, as shown in Figure 3.

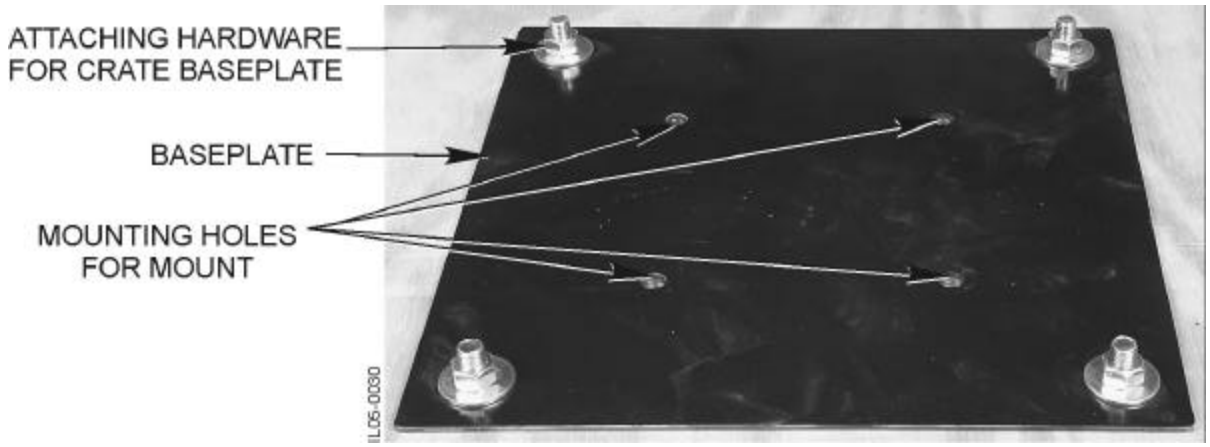


Figure 3. Baseplate with Mounting Holes and Attaching Hardware

NOTE

For additional information about moving and securing the mount, including placement of straps in the mount when using a hoist and appropriate attaching hardware, refer to WP 0060 of this manual.

5. Once the mount is aligned properly, insert and tighten the four screws and washers securing the mount to the base, referring to Figure 4.

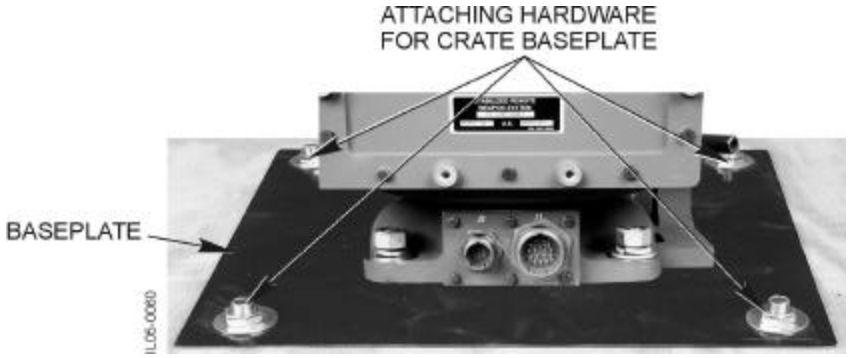


Figure 4. CROWS Aligned and Attached to Shipping Crate

NOTE

Do not the stack the boxes in the CROWS shipping crate more than two boxes high, otherwise the top will not fit properly.

6. Place Boxes 1 thru 3 (containing the rest of the M2 WAK, the Mk19 WAK, and the external cables) around the mount as shown in Figures 5 and 6.

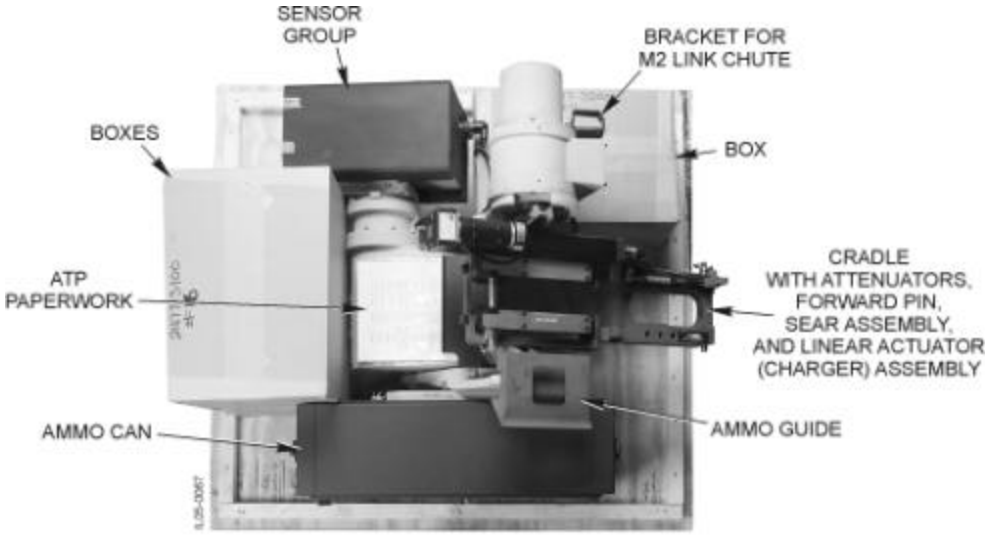


Figure 5. Top View of the Mount, Related Components, and Boxes 1 thru 3 – Positioned Around the Mount for a Typical M2 Configuration

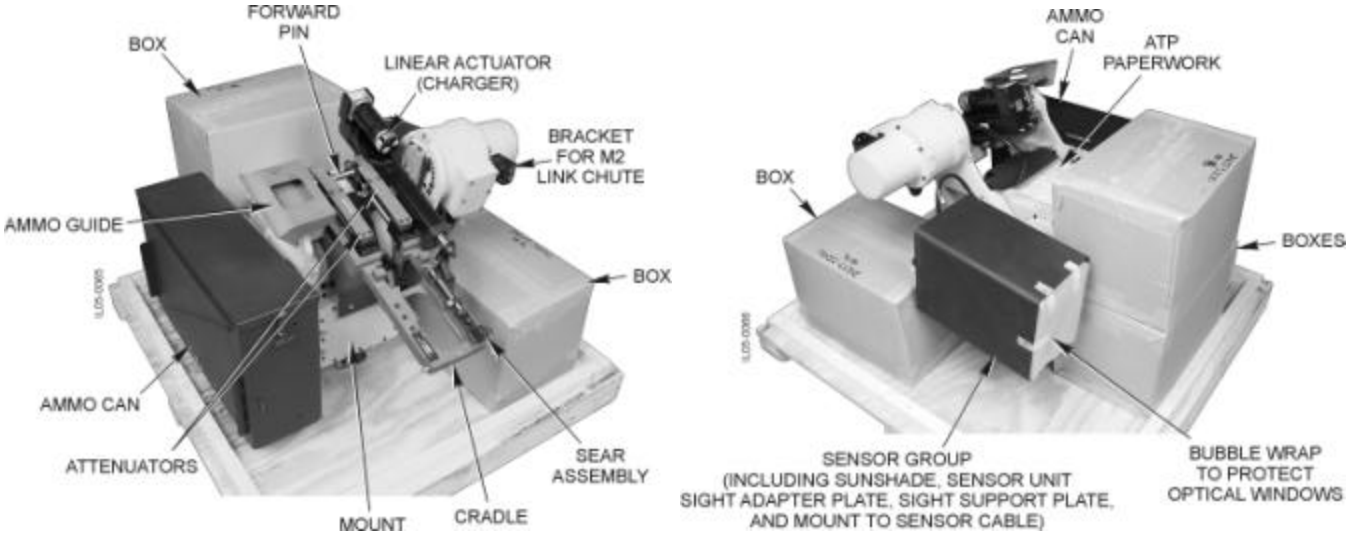


Figure 6. Side Views of the Mount, Related Components, and Boxes 1 thru 3 – Positioned Around the Mount for a Typical M2 Configuration

CAUTION

Ensure a package of desiccant is included in any container when shipping electronic parts or devices. Failure to follow this instruction may result in equipment damage.

NOTE

Refer to WP 0010 for instructions on proper electrostatic discharge (ESD) procedures.

7. Ensure that a package of desiccant is included in the shipping crate.
8. Ensure that appropriate paperwork and documentation are enclosed with the crate.
9. When the items are in position, carefully place the crate top on the base, referring to Figure 1.
10. Insert and tighten the twelve screws securing the top to the base, referring to Figure 1.

Shipping Container for the Mount – Unpacking Instructions

Perform the following procedures to prepare the CROWS mount for unpacking.

1. Perform a visual inspection of the exterior of the shipping crate, referring to Figure 1, to ensure that all parts are present and in good condition, and that the crate is marked as required by the contract.
2. Remove the twelve screws securing the crate top to the base, referring to Figure 1. Retain for later use.

NOTE

Do not remove the hardware attaching the baseplate to the crate (Fig 2).

3. Ensure that appropriate paperwork is enclosed with the crate.
4. Remove Boxes 1 thru 3 (M2 WAK, Mk19 WAK, and external cables) from around the mount as shown in Figures 5 and 6.

NOTE

For additional information about moving and securing the mount, including placement of straps in the mount when using a hoist and appropriate attaching hardware, refer to WP 0060 of this manual.

5. Remove the four screws and washers securing the mount to the base, referring to Figure 4.

NOTE

For additional information about moving and securing the mount, including placement of straps in the mount when using a hoist and appropriate attaching hardware, refer to WP 0060 of this manual.

Do not remove the hardware attaching the baseplate to the crate (Fig 2).

6. Using a hoist or other lifting device, lift the mount from the baseplate and position as directed.
7. Verify that all items are present and in good condition.
8. Carefully place the crate top on the base, then insert and tighten the twelve screws securing the top to the base, referring to Figure 1. Store for future use.

Control Group and Sensor Unit Shipping Containers – Overview

Shipping of the sensor unit and Control Group components can be handled in various configurations. The two standard options are presented in this procedure:

Option One uses a single large container for all of the items.

Option Two uses two mid-sized containers.

Equipment Conditions – Both Options: The sensor unit is removed from the mount and the mount to sensor cable is disconnected; refer to WP 0020 of this manual. The Control Group components including the interconnection cables, as listed in Table 4, are detached from the mount and the vehicle; refer to WP 0060.

Perform the following procedures to prepare the sensor unit and Control Group components for shipping.

1. Perform a visual inspection of the exterior of all shipping containers to ensure that all parts are present and in good condition, referring to Figure 7.



Figure 7. Sample of Mid-Sized Container

2. Ensure that all containers are marked as required by the contract.

CAUTION

Ensure a package of desiccant is included in any container when shipping electronic parts or devices. Failure to follow this instruction may result in equipment damage.

NOTE

Refer to WP 0010 for instructions on proper electrostatic discharge (ESD) procedures.

3. Ensure that a package of desiccant is included in each container.

Option One: Single Large Container – Packing Instructions

Perform the following procedures to prepare the sensor unit and Control Group components for shipping.

1. Insert the components in the bottom layer, as shown in Figure 8.

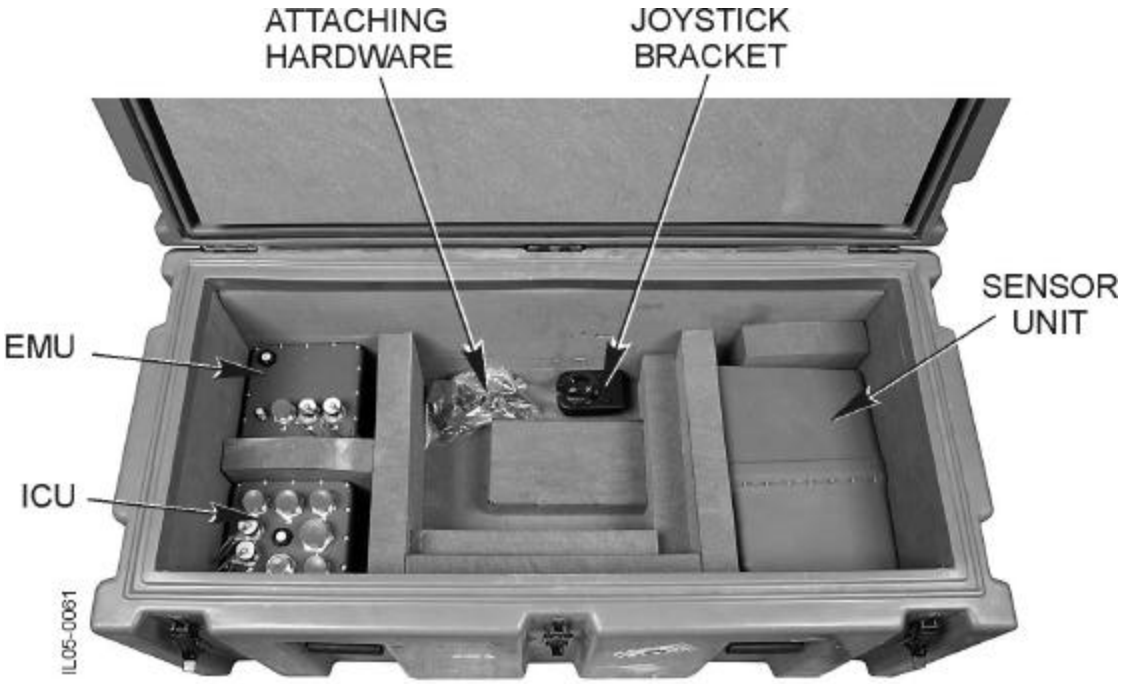


Figure 8. Large Shipping Container – Bottom Layer Packed with Components

2. Insert the display into the center of the middle layer and add a protective foam layer, as shown in Figure 9.

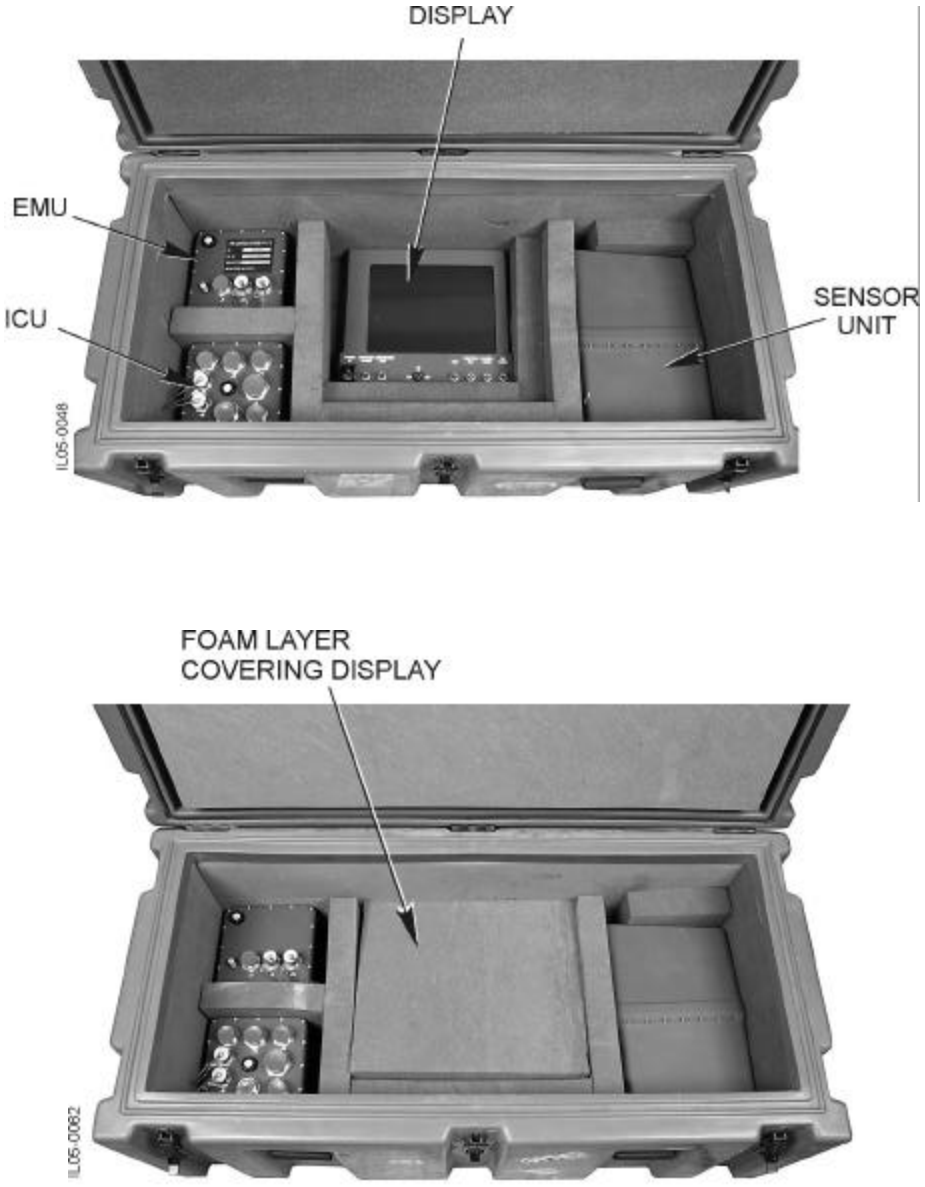


Figure 9. Larger Shipping Container Middle Layer Packed with Display and Protective Foam Layer

3. Place the joystick and SPU onto the center foam layer, as shown in Figure 10.

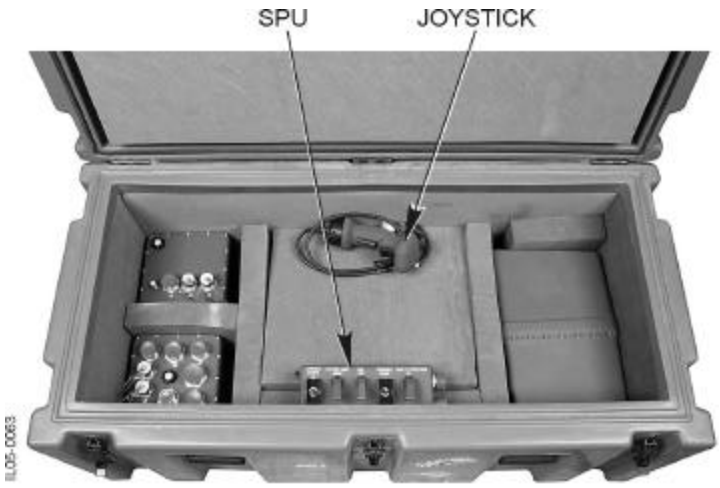


Figure 10. Larger Shipping Container with Joystick and SPU on Center Foam Layer

4. Place the top layer of foam on the components, as shown in Figure 11, with the underside cutouts positioned over the joystick and SPU.

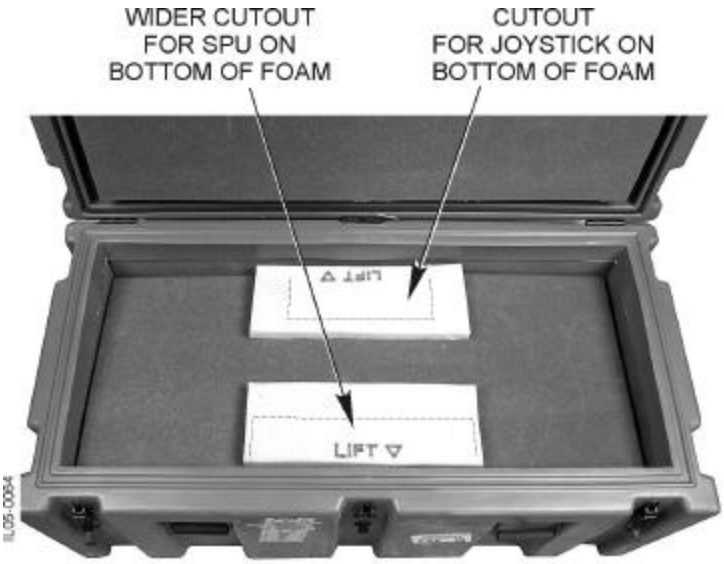


Figure 11. Larger Shipping Container Top Layer of Foam with Cut-Outs on Underside for Joystick and SPU

5. Ensure that appropriate paperwork is enclosed with the container.
6. Close and secure the container lid, using the external latches, referring to Figure 7.

Option One: Single Large Container – Unpacking Instructions

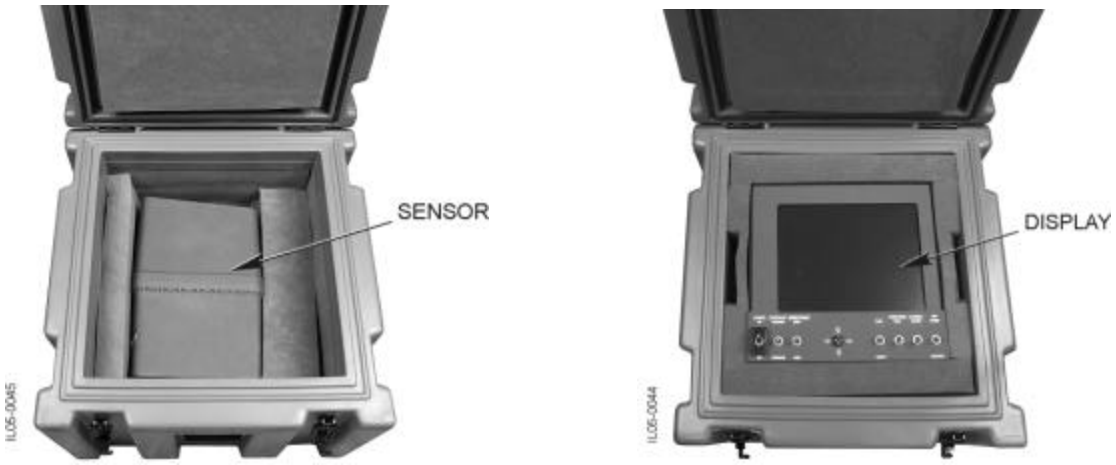
Perform the following procedures to prepare the Control Group and Sensor Group for unpacking.

1. Perform a visual inspection of the exterior of the shipping crate, referring to Figure 7, to ensure that all parts are present and in good condition, and that the crate is marked as required by the contract.
2. Ensure that appropriate paperwork is enclosed with the crate.
3. Remove the components, referring to Figures 11 thru 8 (in that order).
4. Verify that all items are present and in good condition.
5. Carefully close the empty crate and store for future use.

Option Two: Two Mid-Sized Containers – Packing Instructions

Perform the following procedures to prepare the Control Group and Sensor Group for shipping.

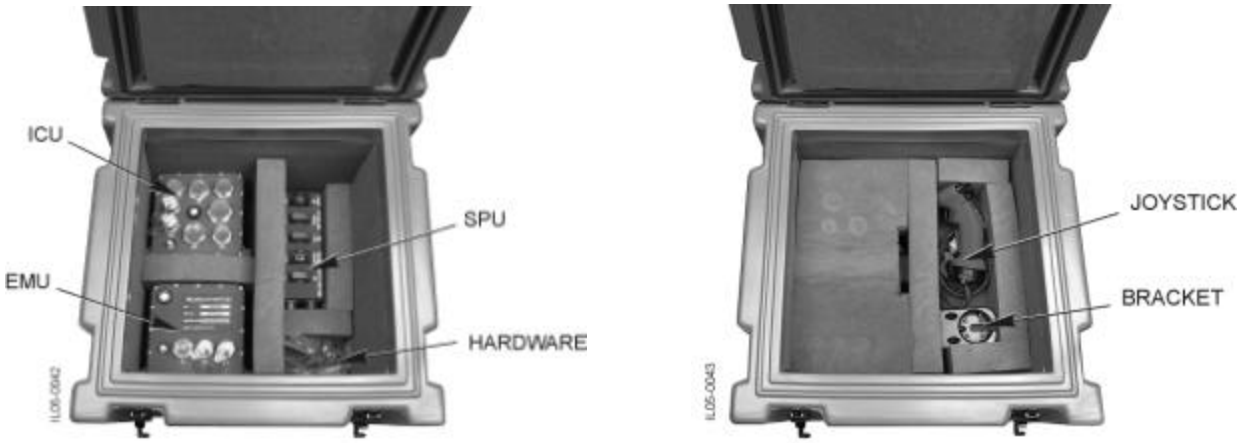
1. Insert the components in the bottom and top layers of the first container, as shown in Figure 12.



Bottom Layer **Top Layer**

Figure 12. First Container with Both Layers Packed with Components

2. Insert the components in the bottom and top layers of the second container, as shown in Figure 13.



Bottom Layer **Top Layer**

Figure 13. Second Container with Both Layers Packed with Components

3. Ensure that appropriate paperwork is enclosed with the container.
4. Close and secure the container lids, using the external latches, referring to Figure 7.

Option Two: Two Mid-Sized Containers – Unpacking Instructions

Perform the following procedures to prepare the Control Group and Sensor Group for unpacking.

1. Perform a visual inspection of the exterior of the shipping containers, referring to Figure 7, to ensure that all parts are present and in good condition, and that the crate is marked as required by the contract.
2. Ensure that appropriate paperwork is enclosed with the crate.
3. Remove the components, referring to Figures 12 and 13.
4. Verify that all items are present and in good condition.
5. Carefully close the empty crate and store for future use.

ARMOR SHIPPING AND HANDLING

Use the following procedures to prepare, handle, and ship the armor components.

Table 6. Ballistic Armor

Description	Common Name	Part Number
Ballistic Panel -- Front	Front Panel	21677-0705
Ballistic Panel -- Side	Side Panel	21677-0706
Ballistic Panel -- Rear	Rear Panel	21677-0707
Elevation Drive Ballistic Panel Assembly:	Elevation Drive BPA	21677-0715
Weldment, Ballistic Panel, Housing	Elevation Drive Housing	21677-0716
Ballistic Panel, Front – Elevation Drive	Elevation Drive Front Panel	21677-0723
Ballistic Panel, Rear – Elevation Drive	Elevation Drive Rear Panel	21677-0724
Ballistic Panel, End – Elevation Drive	Elevation Drive End Panel	21677-0725
Ammo Can Ballistic Panel Assembly:	Ammo Can BPA	21677-0728
	Ammo Can Partition, consisting of:	--
Ballistic Partition Panel (ceramic)	Ammo Can Panel	21677-0728
Partition (metal)	Ballistic Partition	21677-0729
Ballistic Panel – End	Ammo Can End Panel	21677-0730
Sight Ballistic Protection Assembly:	Sight BPA	21677-0713
Ballistic Panel, End – Sight	Sight End Panel	21677-0709
Ballistic Panel, Rear – Sight	Sight Rear Panel	21677-0710
Ballistic Panel, Side – Sight	Sight Side Panel	21677-0711
Ballistic Sunshade Weldment	Sunshade	21677-0735

Overview

The armor components listed in Table 6, together with attaching hardware, are shipped in a special crate, as shown in Figure 14.



Figure 14. Crate for Shipping and Storing CROWS Armor

1. Perform a visual inspection of the exterior of the shipping crate, referring to Figure 14, to ensure that all parts are present and in good condition, and that the crate is marked as required by the contract.
2. Using a crosstip no. 2 screwdriver, remove the twelve screws securing the crate top to the base, referring to Figure 14. Retain hardware for later use.
3. Ensure that appropriate paperwork is enclosed with the crate.

Inspection

NOTE

For a list of armor components, refer to Table 6.

The ballistics shade weldment (sunshade) is part of the Sensor Group. For additional information, refer to WP 0020 of this manual.

For additional information on the ammo can, refer to CROWS Operator's Manual, TM 9-1090-218-10, WP 0009 for the M2 machine gun; WP 0010 for the Mk19 grenade gun; WP 0011 for the M240 machine gun; or WP 0012 for the M249 machine gun.

For additional information on inspection related to preventive maintenance, refer to CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services (PMCS).

1. After unpacking, thoroughly inspect all equipment IAW the instructions given in the CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services (PMCS).
2. Verify that all items are present and in good condition, referring to Table 6.

Unpacking the Armor

Use the following procedure to unpack the armor components.

1. Remove the bagged attaching hardware, sunshade, and elevation drive housing from the top level of the crate's interior, shown in Figure 15. Place items on a flat, stable work surface.

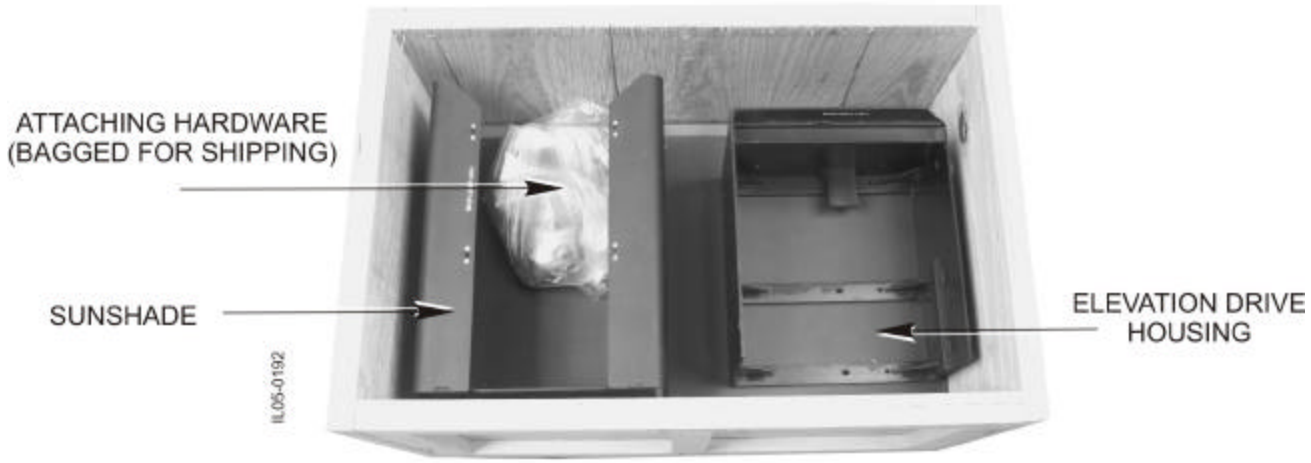


Figure 15. Top Level of Crate Interior (Wrapping Materials Removed for Clarity)

2. Remove the ballistic partition, shown in Figure 16, from the next level of the crate. Place the panel, lip side up, on a flat, stable work surface.

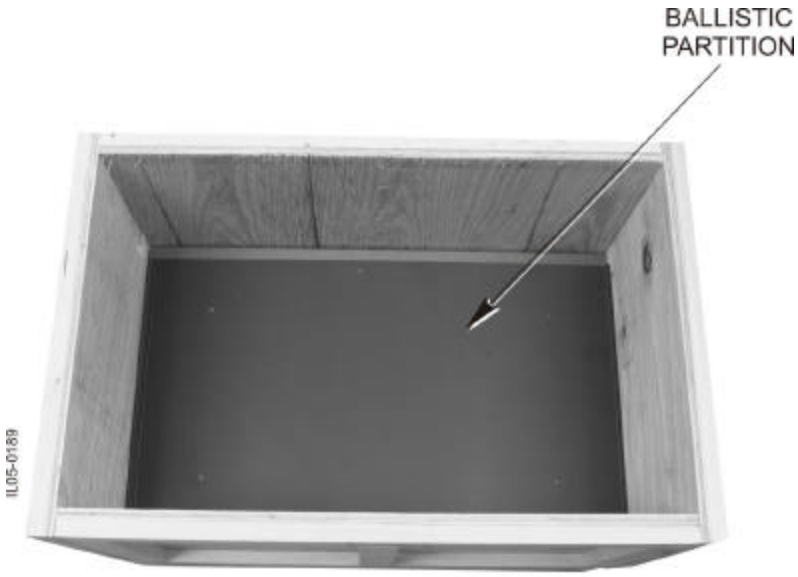


Figure 16. Ballistic Partition
(Wrapping Materials Removed for Clarity)

3. Remove the pressboard, shown in Figure 17, which separates the metal panels from the ceramic panels. Retain for later use.

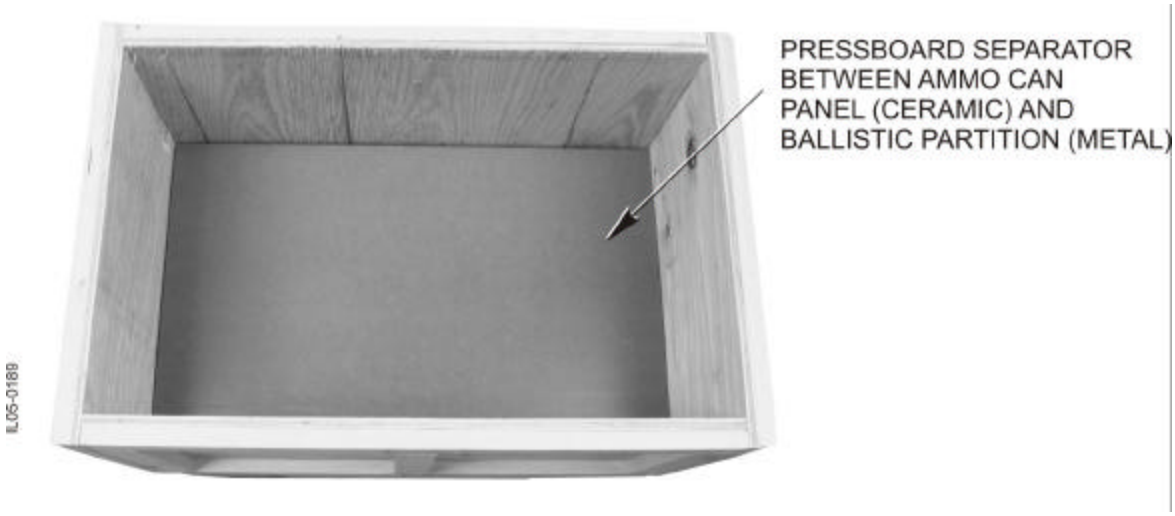


Figure 17. Pressboard Separator between
Ammo Can Partition Components

4. Remove the elevation drive end panel, side panel, and sight rear panel, shown in Figure 18. Place items on a flat, stable work surface.

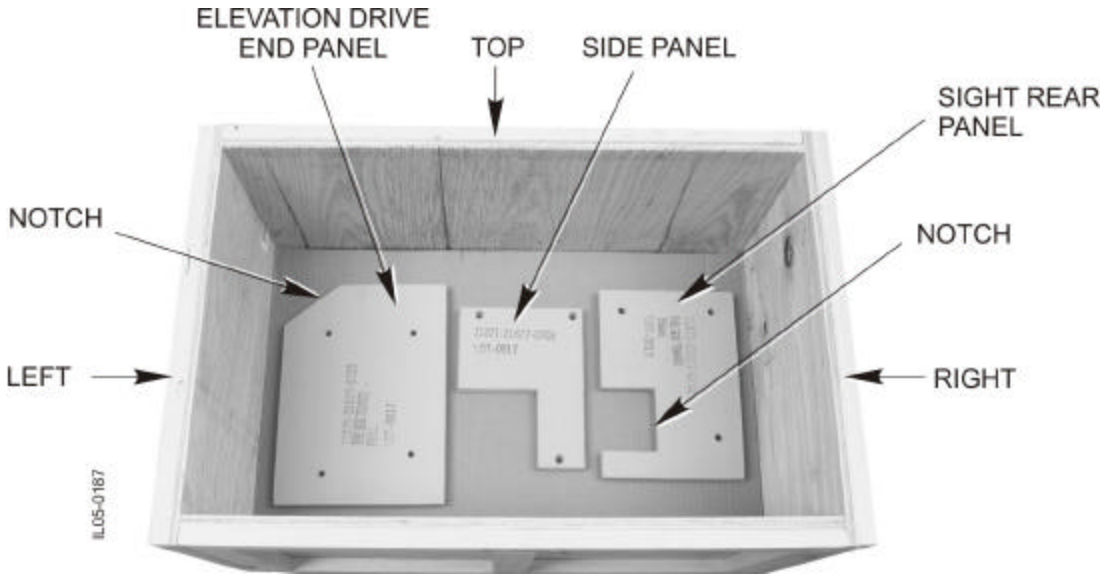


Figure 18. Elevation Drive End Panel, Side Panel, and Sight Rear Panel in Next Level of Crate

5. Remove the two sight end panels and two ammo can end panels, shown in Figure 19, and cardboard separator. Place items on a flat, stable work surface.

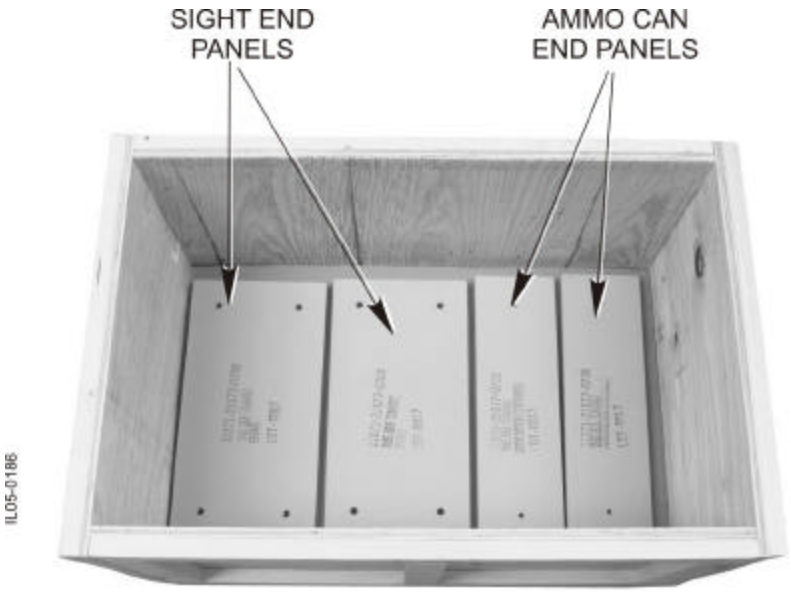


Figure 19. Sight End Panels and Ammo Can End Panels in Next Level of Crate

6. Remove the sight side panel, elevation drive front panel, and elevation drive rear panel, shown in Figure 20, and cardboard separator. Place items on a flat, stable work surface.

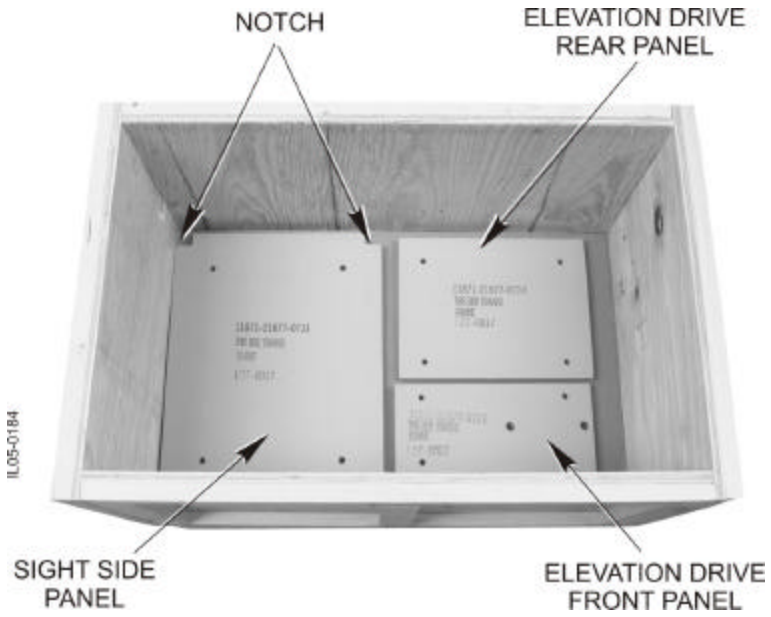


Figure 20. Sight Side Panel, Elevation Drive Front Panel, and Elevation Drive Rear Panel in Next Level of Crate

7. Remove the front panel and rear panel, shown in Figure 21, and cardboard separator. Place items on a flat, stable work surface.

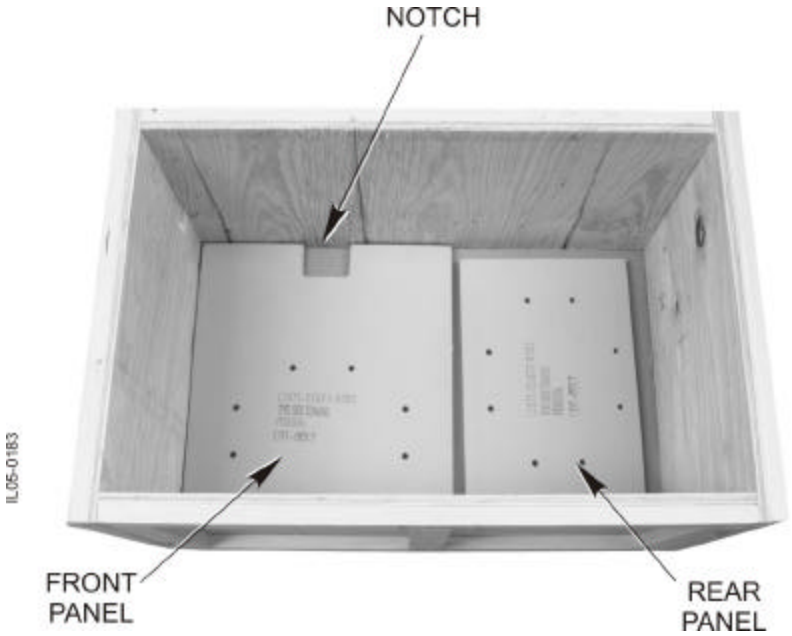


Figure 21. Front Panel and Rear Panel in Next Level of Crate

8. Remove the ammo can panel, shown in Figure 22. Place item on a flat, stable work surface.

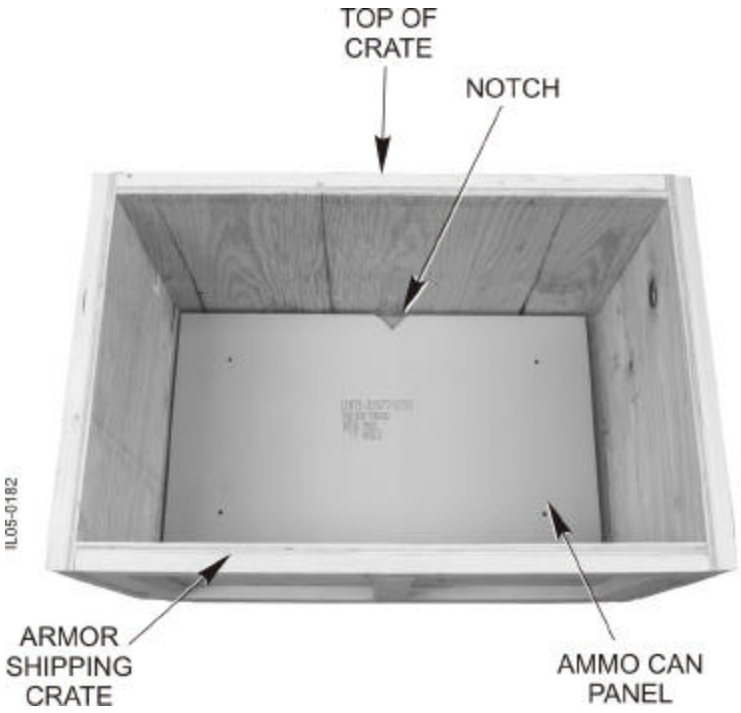


Figure 22. Ammo Can Partition in Bottom of Crate

Packing the Armor

Use the following procedure to pack the armor components.

1. Place the shipping crate, referring to Figure 14, on a flat, stable work surface.
2. If the cover is attached, use a crosstip no. 2 screwdriver to remove the twelve screws securing the cover to the crate, referring to Figure 14.

3. Place the ammo can panel, shown in Figure 23, into the crate ensuring that the notch faces to the top of the crate. Place the cardboard separator over the partition.

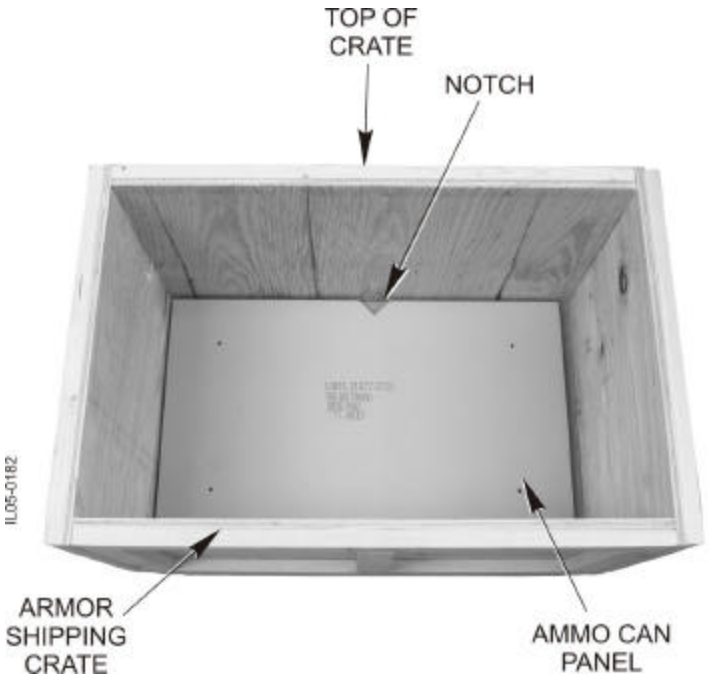


Figure 23. Ammo Can Partition in Next Level of Crate

4. Place the front panel and rear panel, shown in Figure 24, into the crate ensuring that the notch faces to the top of the crate. Place the cardboard separator over the items.

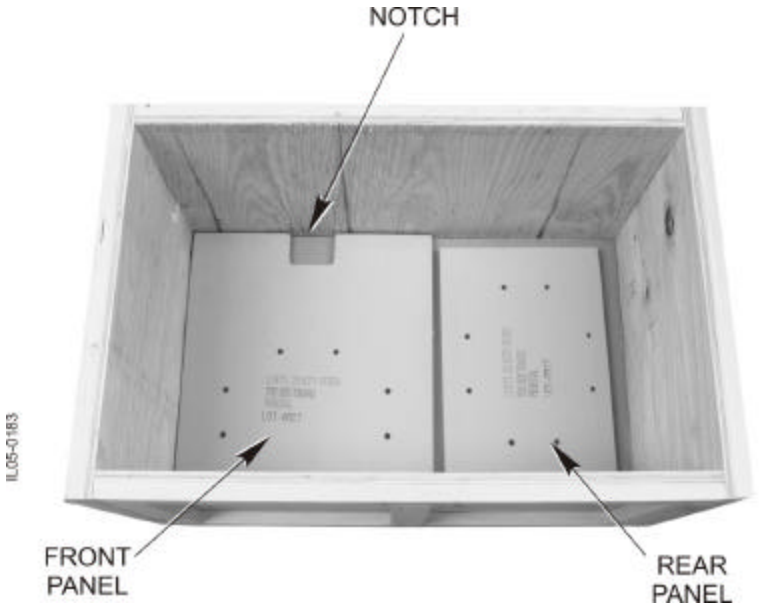


Figure 24. Front Panel and Rear Panel in Next Level of Crate

5. Place the sight side panel, elevation drive front panel, and elevation drive rear panel, shown in Figure 25, into the crate ensuring that the notches face to the top of the crate. Place the cardboard separator over the items.

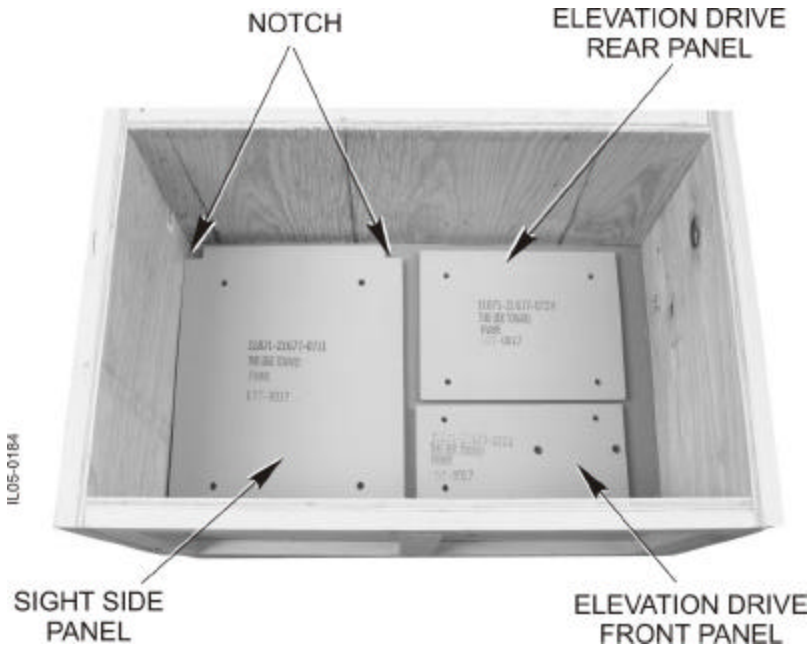


Figure 25. Sight Side Panel, Elevation Drive Front Panel, and Elevation Drive Rear Panel in Next Level of Crate

6. Place the two sight end panels and two ammo can end panels, shown in Figure 26, into the crate. Place the cardboard separator over the items.

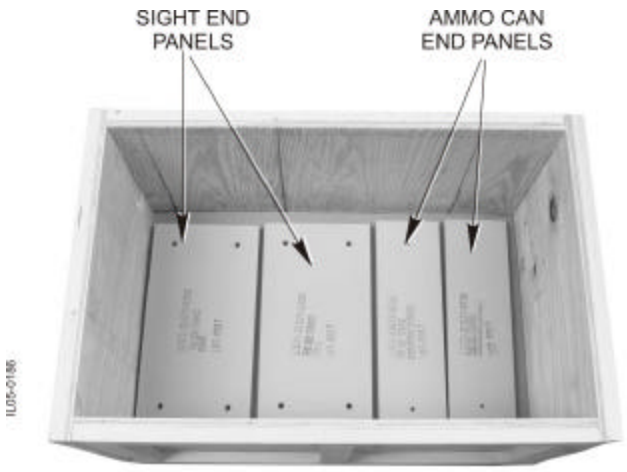


Figure 26. Sight End Panels and Ammo Can End Panels in Next Level of Crate

7. Place the elevation drive end panel, side panel, and sight rear panel, shown in Figure 27, into the crate ensuring that the notch on the elevation drive end panel faces to the top of the crate, the long side of the side panel is on the right-hand side, and large notch in the sight rear panel faces left.

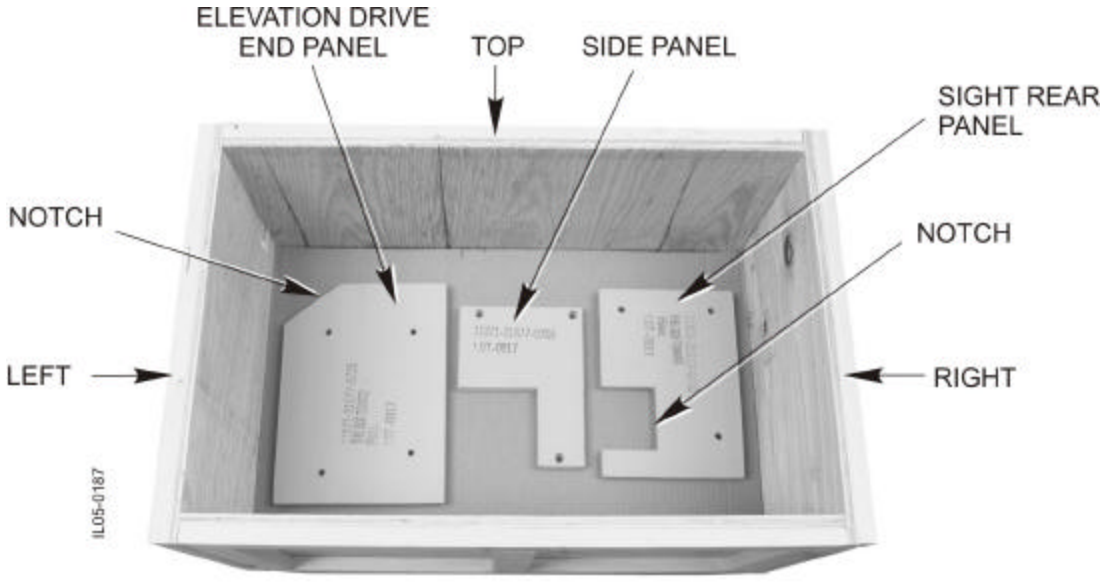


Figure 27. Elevation Drive End Panel, Side Panel, and Sight Rear Panel in Next Level of Crate

8. Place the pressboard separator, shown in Figure 28, over the items.

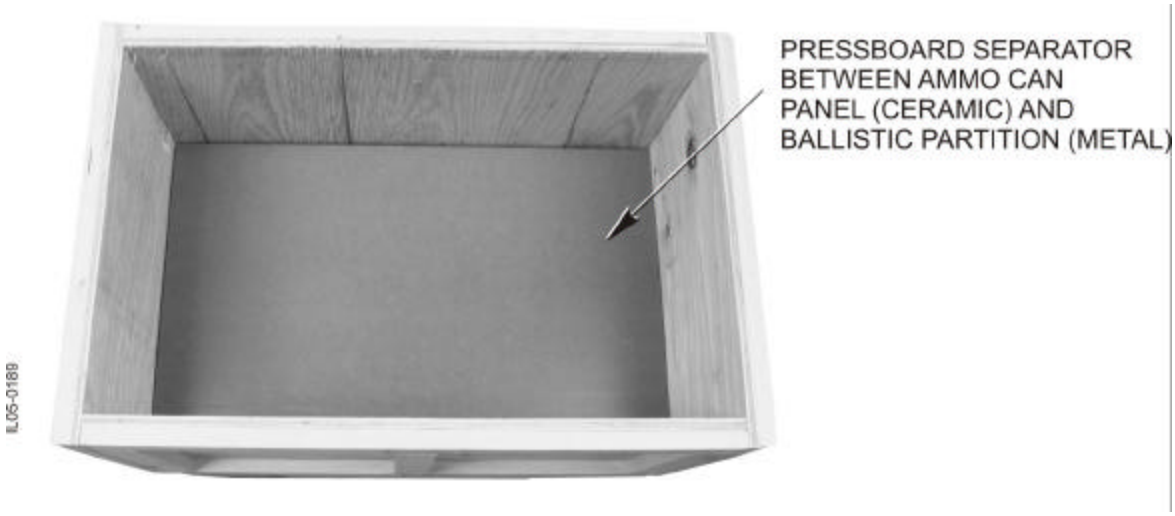


Figure 28. Pressboard Separator between Ammo Can Partition Components

9. Ensure that the ballistic partition is properly packaged, then place the ballistic partition, shown in Figure 29, into the next level of the crate. Ensure that the lip side faces up.

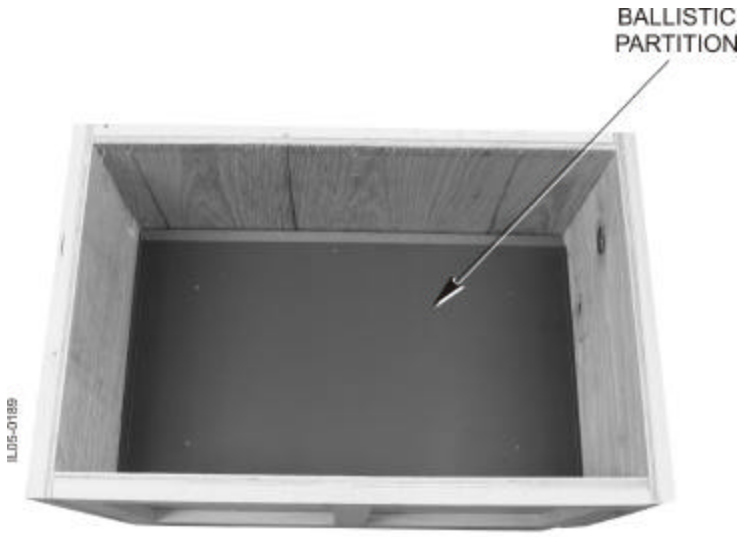


Figure 29. Ballistic Partition
(Wrapping Materials Removed for Clarity)

10. Ensure that the attaching hardware, sunshade, and elevation drive housing are properly packaged.
11. Place the sunshade with the opening facing up and the elevation drive housing with the support side facing down into the top level of the crate's interior, as shown in Figure 30.

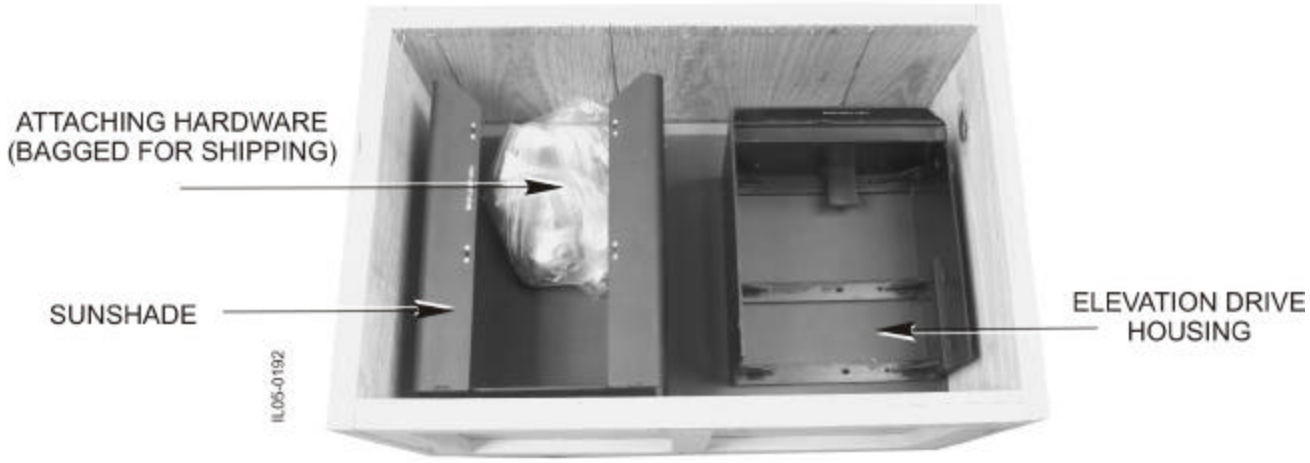


Figure 30. Top Level of Crate Interior
(Wrapping Materials Removed for Clarity)

12. Place the bagged attaching hardware and packing list into the sunshade, referring to Figure 30.
13. Position the cover on the crate, then insert and tighten the twelve screws securing the cover to the crate, using a crosstip no. 2 screwdriver, referring to Figure 14.

Final Preparation for Shipping CROWS Armor

Once the armor has been packed, referring to the Packing the Armor section of the work package, perform the following procedures to prepare the crate containing CROWS armor for shipping.

NOTE

For additional information on securing the crate cover, refer to the Packing Armor section of this work package.

1. Ensure the cover is securely fastened to the crate, referring to Figure 14 and step 13 (above) of the Packing the Armor section of this work package.
2. Perform a visual inspection of the exterior of the shipping crate, referring to Figure 14, to ensure that all parts are present and in good condition, and that the crate is marked as required.

DEPOT MAINTENANCE INSTRUCTIONS

Send items to depot maintenance in Army-approved packaging, using the following address:

Recon/Optical, Inc.
22292 North Pepper Road, Unit B
Barrington, IL USA 60010
ATTN: CROWS Depot
(847) 235-3670

PREPARATION FOR STORAGE AND HANDLING

For information on stowing the CROWS for special transport and returning the CROWS to its standard operating position, refer to CROWS Operator's Manual, TM 9-1090-218-10, WP 0008.

Long-Term Storage

Should the CROWS be in extended storage on a vehicle, perform a monthly PMCS as detailed in the CROWS Operator's Manual, TM 9-1090-218-10, WP 0005, Preventive Maintenance Checks and Services (PMCS).

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

VEHICLE INTEGRATION KIT (VIK) FOR THE M1114 UP-ARMORED HMMWV

This work package contains installation procedures for the Vehicle Integration Kit for the CROWS on the M1114 Up-Armored HMMWV.

WP CONTENTS

Section/Subsection	Page
Initial Set Up	1
First Time Install	3
Removing Turret Bearing and Turret Components	3
Display Unit Base Bracket	11
Installation	13
Installing Non-Rotating Turret Spacer Ring and Associated Components	13
Installing Plate Assembly	20
Installing Electronic Module Unit (EMU)	21
Installing Interface Control Unit (ICU)	21
Installing Hatch Interlock Switch	22
Installing Display Unit Base Bracket	23
Assembling Display Unit Support Arm Assembly	24
Installing Display Unit Support Arm Assembly onto Display Unit Base Bracket	26
Installing the Display Unit Upright Mounting Brackets	27
Installing Joystick Bracket	28
Installing Joystick Holder	28
Installing Joystick	28
Installing the Display Unit	29
Installing Switch Panel Unit (SPU) Adapter Bars and SPU - Alternative 1	30
Installing Switch Panel Unit (SPU) Adapter Bracket and SPU - Alternative 2	32
Installing Switch Panel Unit (SPU) Adapter Bars and SPU - Alternative 3	34
Installing End Cap into Display Unit Support Arm Assembly	36
Installing CROWS Weapon Mount onto Vehicle	37
Installing Cables	39
Removing CROWS Weapon Mount	42
Removing Power Cable from Vehicle	43
Removing CROWS Weapon Mount from Vehicle	44
Removing End Cap from Display Unit Support Arm Assembly	47
Removing Switch Panel Unit (SPU) and SPU Adapter Bars- Alternative 1	48
Removing Switch Panel Unit (SPU) and SPU Adapter Bracket- Alternative 2	50
Removing Switch Panel Unit (SPU) and SPU Adapter Bars- Alternative 3	52
Removing Display Unit	54
Removing Display Unit Upright Mounting Brackets	55

WP CONTENTS

Section/Subsection **Page**

Removing Joystick....56
Removing Joystick Holder....56
Removing Joystick Bracket....57
Removing Display Unit Support Arm Assembly from Display Unit Base Bracket....58
Removing Display Unit Base Bracket....59
Removing Hatch Interlock Switch....60
Removing the EMU from Plate Assembly....61
Removing the ICU from Plate Assembly....61
Removing Plate Assembly....62
Removing Batwing....63
Removing Access Hole Cover and Nut Ring From Turret....64
Removing CROWS Non-Rotating Turret Spacer Ring....64

INITIAL SETUP

Table 1. Initial Setup Information

Category	Item	Additional Information
Tools	Operator's Tool Kit	WP 0055, Table 2, Item 1
	Tool Kit, Electronic System, Fire Control, 45G	WP 0055, Table 2, Item 6
	Tool Kit, Artillery and Turret Mechanic (Armament), 45K	WP 0055, Table 2, Item 7
Special Tools	AVK Insert Installation Tool	WP 0057, Item 5
Personnel Required	Two	63B
Materials/Parts	Compound, thread locking	WP 0056, Table 1, Item 16
	Silicone compound	WP 0056, Table 1, Item 28
Equipment conditions	All HMMWV unit equipment removed	
	Front passenger seat removed.	TM 9-2320-387-24-1/2
	Vehicle battery disconnected.	TM 9-2320-387-24-1/2
References	TM 9-2320-387-24-1/2	

NOTE

This section provides unit level maintenance instructions for the installation of the Vehicle Integration Kit. Inspect all parts prior to installation for completeness and serviceability.

FIRST-TIME INSTALL

Removing Turret Bearing and Turret Components

Equipment Condition: Driver's rifle support removed. Gunner's protection kit (turret mounted on top of roof) removed. Turn buckle removed. Turret crank removed. Refer to TM 9-2320-387-24-1/2.

Perform the following procedure to remove the turret bearing and turret components.

1. Remove thirty-six hex head cap screws (2), thirty-six flat washers (3), and thirty-six two-piece rubber isolation bushings (4) from underside of bearing. See Figure 1.

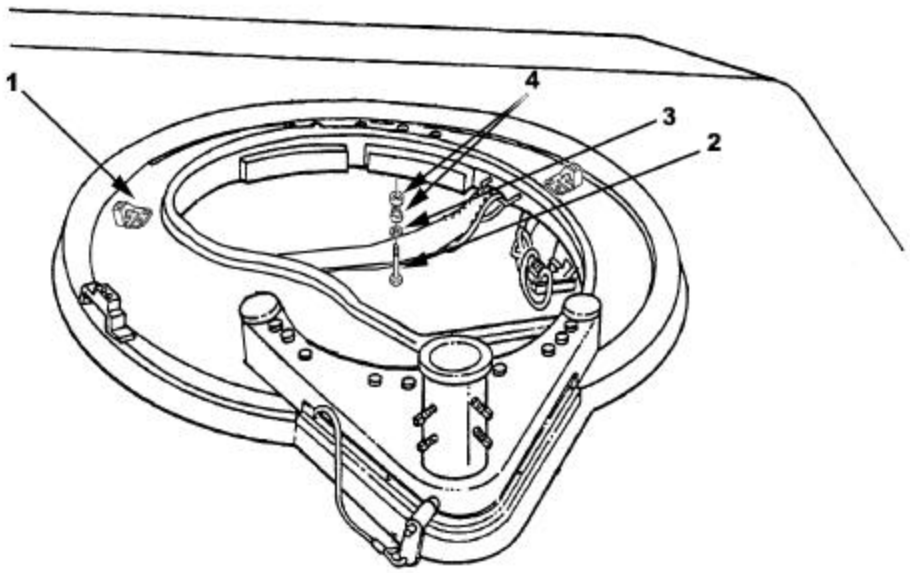


Figure 1. Removal of Turret Bearing Mounting Hardware

WARNING

The bearing with the pintle weapon mount and armor cover is very heavy; use an overhead hoist or other suitable means to remove. Use the gunner's sling (attached to turret) as a lift point. Ensure that turret lock is not engaged.

NOTE

Prior to removing bearing, note hole alignment (i.e., draw a chalk line) to assist in alignment when replacing spacer.

2. Lift complete turret assembly (1,2), and place it on a stable surface. See Figure 2.

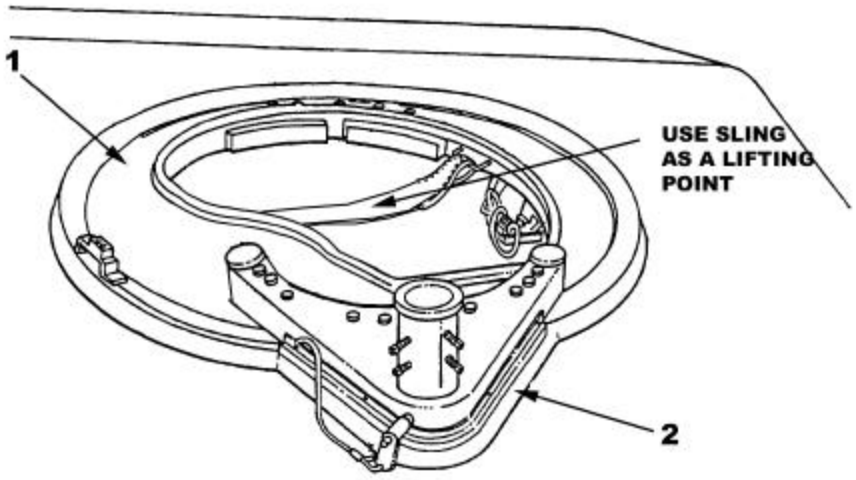


Figure 2. Bearing with Pintle Weapon Mount

NOTE

If hatch was removed with gunner's protection kit proceed to step 4.

3. Remove hatch assembly (1) by removing five hex head cap screws (2,3), ten washers (4), and five hex locking nuts (5). See Figure 3.

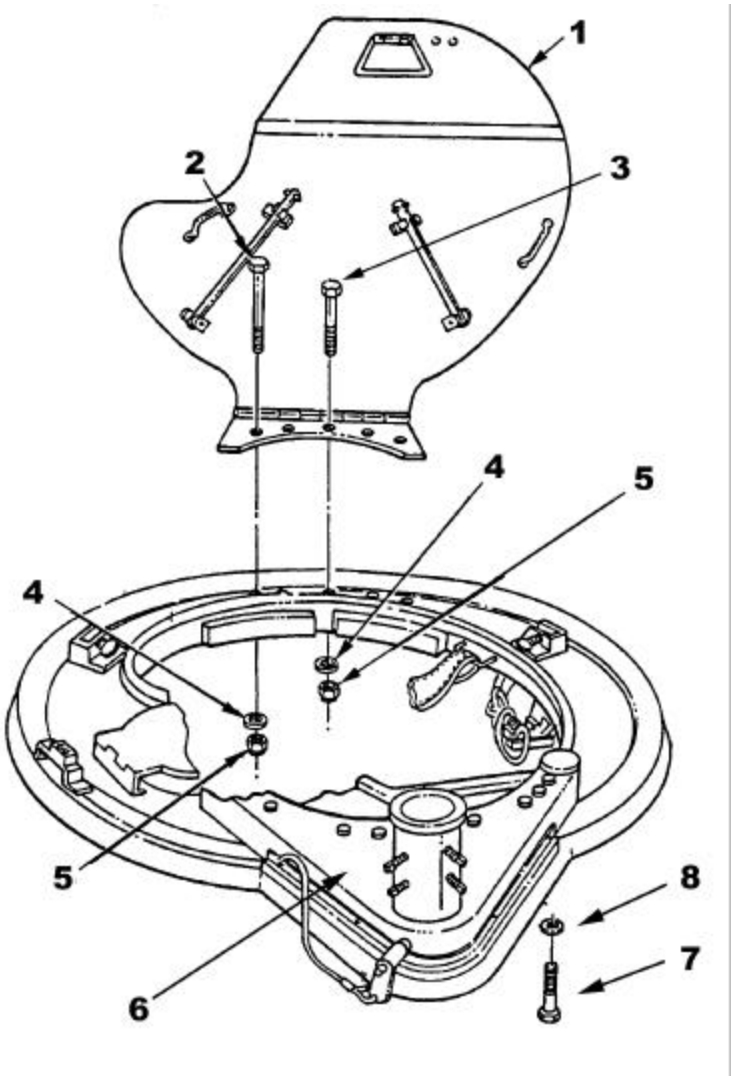


Figure 3. Hatch and Pintle Weapon Mount Removed from Turret

4. Remove pintle weapon mount (6) by removing thirteen hex head cap screws (7) and flat washers (8). See Figure 3.

5. Remove two pivot base assemblies (9) by removing four flat head countersink screws (10) per Figure 4.

6. Remove two hex head cap screws (one on each side)(11) from turret armor (12).

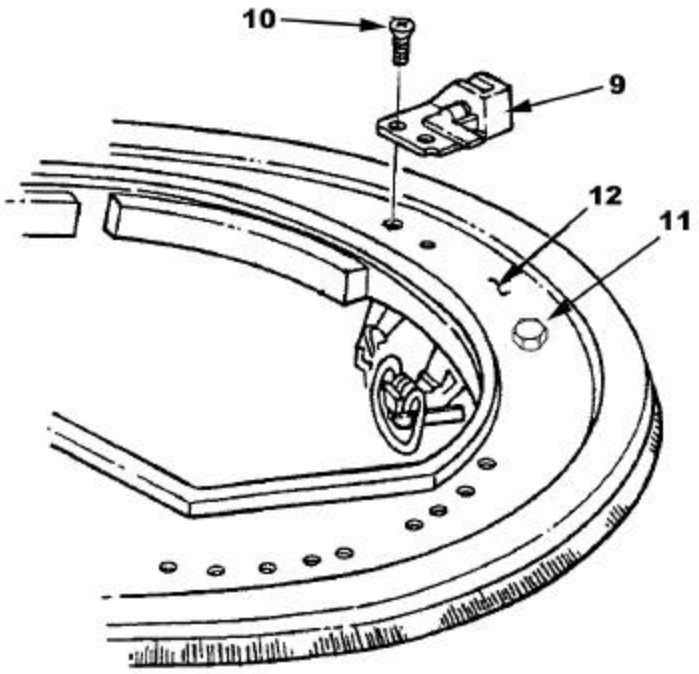


Figure 4. Removal of Pivot Base Assembly

7. Remove six hex head cap screws (10) and flat washers (11). Remove two hex head cap screws (12), four flat washers (13), and two hex locking nuts (14). Remove access hole cover (15) with gasket (16) and nut ring (17). See Figure 5.

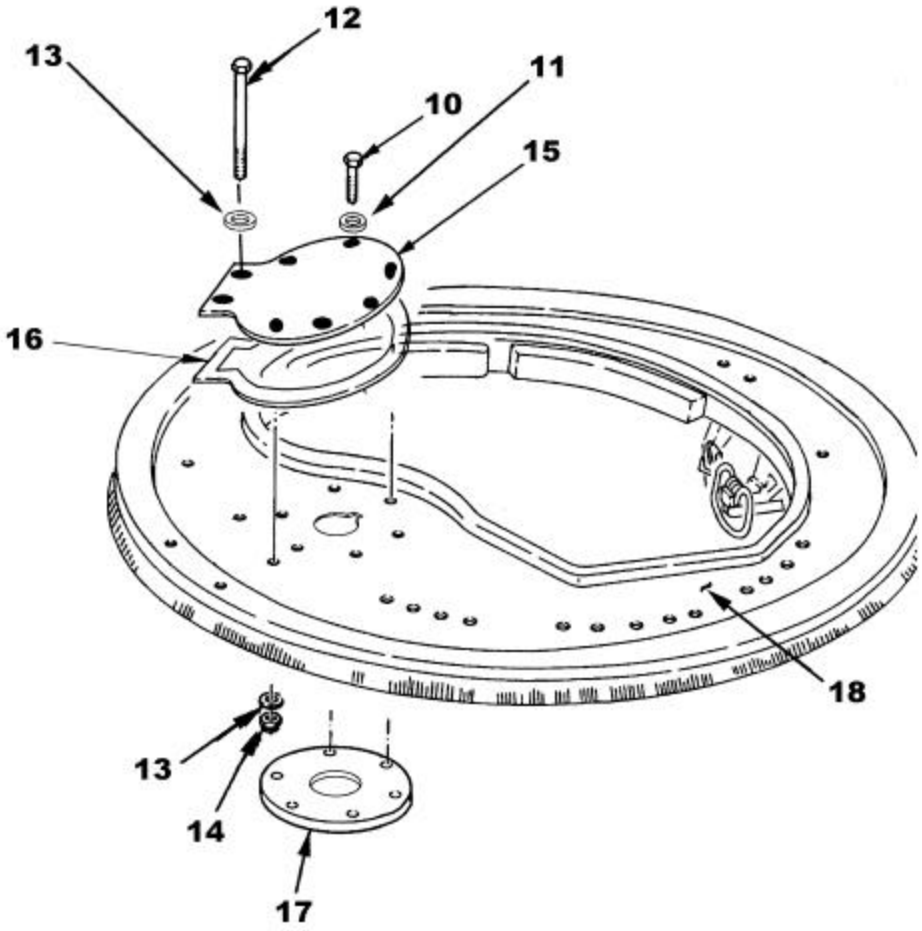


Figure 5. Removal of Access Hole Cover and Nut Ring

8. Remove turret armor cover (18) from bearing (19). See Figure 5.

9. Remove latch assembly (1), by removing hex head cap screw (2). See Figure 6.

NOTE

To increase latch tension, flat washers may be added between bottom of turret armor and latch assembly.

Perform step a for turret armor, cover-mounted latch assemblies.

Go to section entitled Installing Hatch Interlock Switch for turret bearing-mounted latch assemblies.

a. Remove one hex head cap screw (2), latch assembly (1), and clamp spacer (3) from turret armor (4).

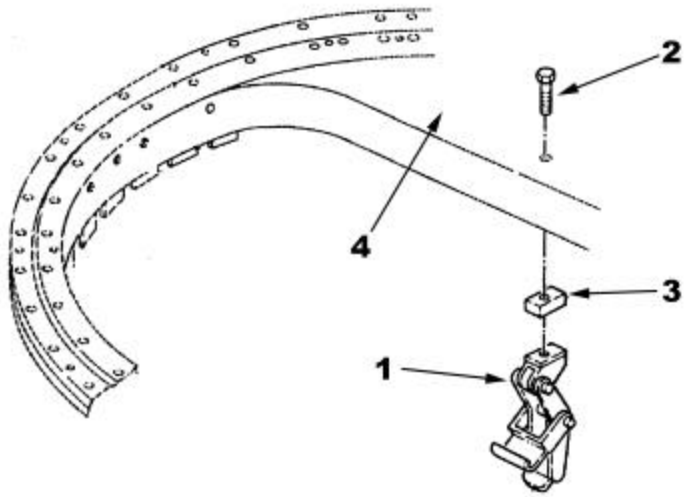


Figure 6. Removal of Latch Assembly

10. Remove two backrest pads and spacer plates (1) by removing two hex head cap screws (2) and flat washers (3). See Figure 7.

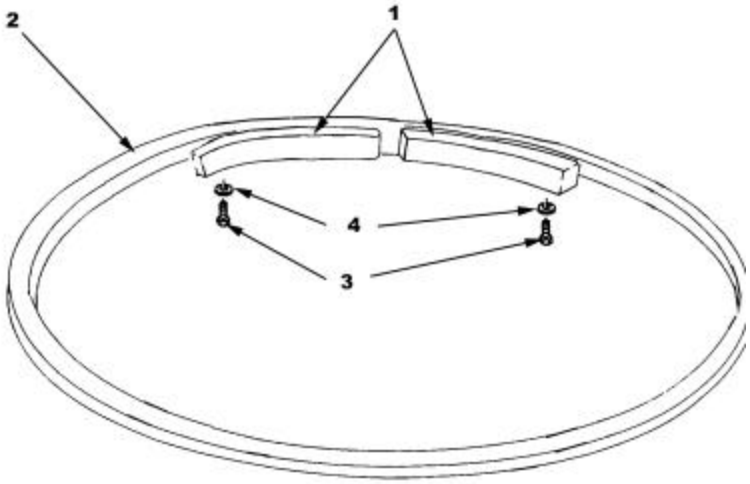


Figure 7. Backrest Removal

11. Using two personnel, rotate non-rotating turret spacer ring upside down.

12. Remove turret brake assembly (1) by removing two bolts (2) and washers (3). See Figure 8.

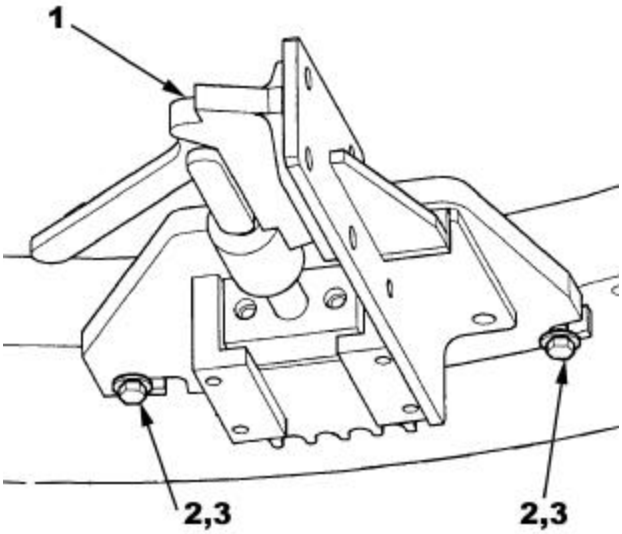


Figure 8. Turret Brake Assembly Removal

13. Remove gunner sling bracket (4) and spacer (5) by removing one hex head cap screw (6) and flat washer (7). See Figure 9.

14. Remove bracket with gunner's sling (8) and spacer plate (9) by removing one hex head cap screw (10) and flat washer (11).

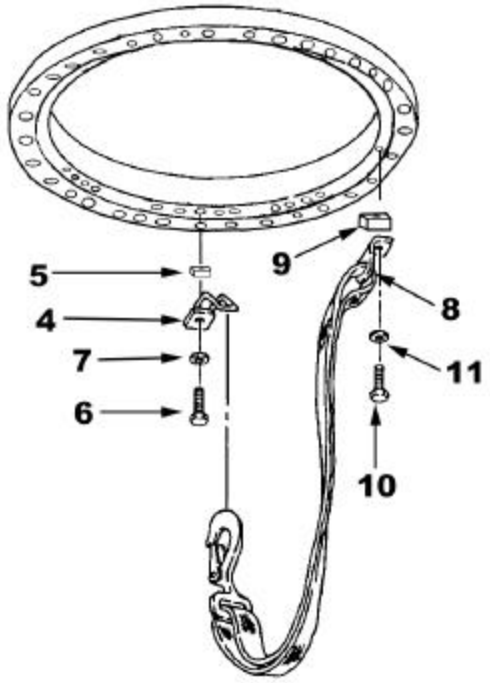


Figure 9. Removal of Gunner's Sling

Display Unit Base Bracket

Equipment Condition: Weapon mount bracket removed from tunnel next to driver's seat.

Perform the following procedure to drill the holes necessary to install the display unit base bracket.

NOTE

Prior to installing display unit base bracket ensure that three holes are marked and drilled for AVK inserts and nutplate. It may be necessary to trim the heatshield on the right side of the driver's seat to accommodate the placement of the bracket and tunnel spacer shim.

1. Position display unit base bracket (1) on top of thick 3-hole display unit base bracket spacer (2) and tunnel spacer shim (3) so that bracket (1) is flush along the front edge of the front seat support beam (4) and 2 inches in from the edge of the tunnel cover (5). See Figure 10.

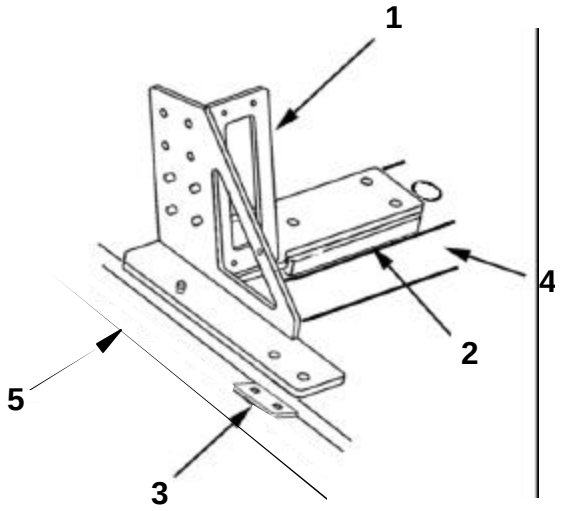


Figure 10. Display Unit Base Bracket

2. Mark five holes with a hammer and punch (three holes (6) on seat support beam (4) behind driver's seat and two forward holes (7) on tunnel cover (5)). See Figure 11.

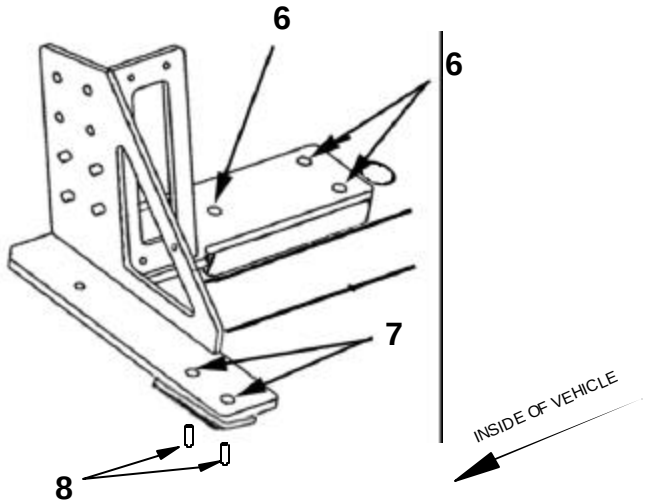


Figure 11. Five Holes for Display Unit Base Bracket

NOTE

Driver's seat many need to be adjusted forward to allow room for the drill.

3. Drill five holes using a 17/32-inch drill bit.

NOTE

Prior to installing AVK inserts and mounting bolts, ensure that all five holes in the display unit base bracket align with holes in tunnel and seat support beam. Shim may need to be trimmed to fit on tunnel and allow for metal tubing that may be present.

Two persons may be required to perform the next step.

4. Insert two AVK inserts (8) into the two forward drilled holes (7) on the tunnel. Use the AVK insert installation tool to expand inserts (8) by squeezing two handles together. This will secure the insert to the vehicle.

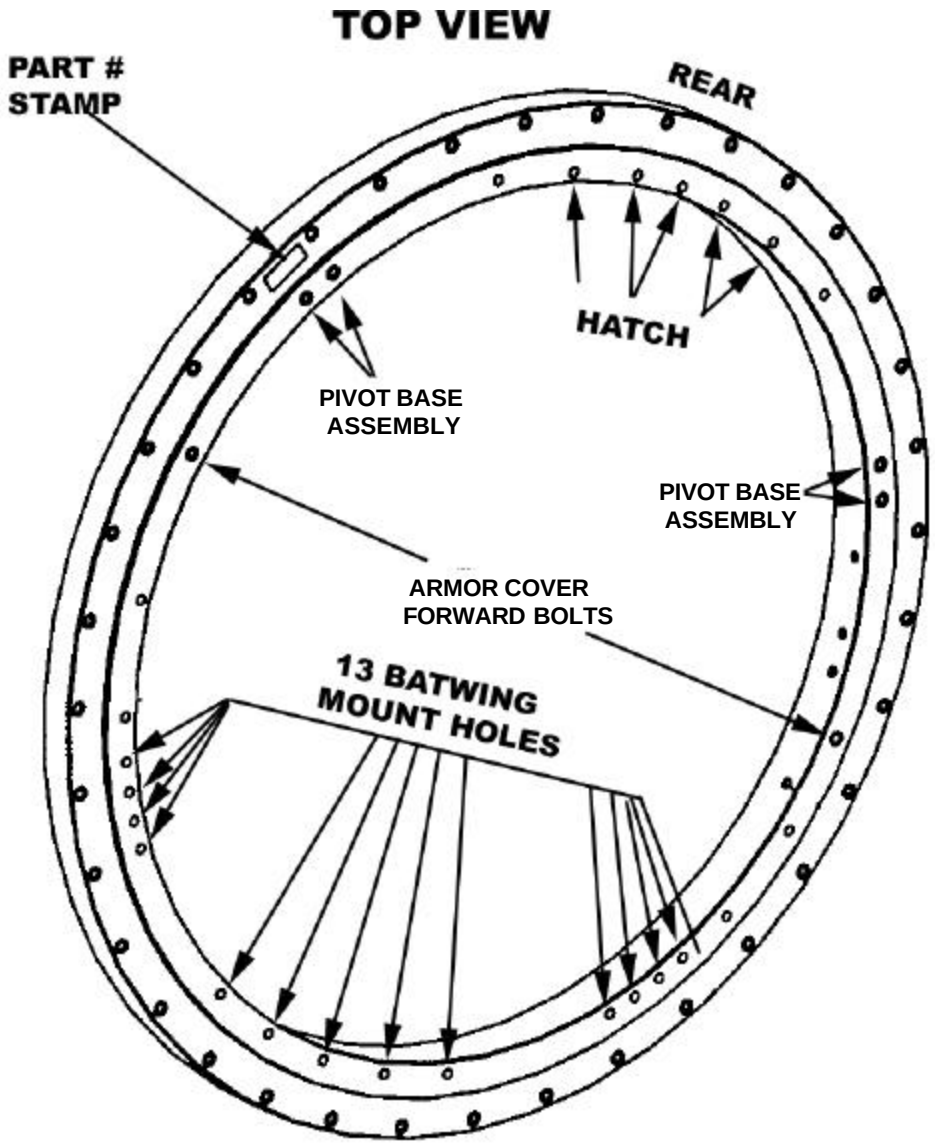
INSTALLATION

Installing Non-Rotating Turret Spacer Ring and Associated Components

Perform the following procedure to install the non-rotating turret spacer ring and associated components.

NOTE

See Figure 12 below to orient the non-rotating spacer ring.



NOTE: To further verify orientation of non-rotating turret spacer, the threaded ends of the inserts for the pivot base assembly and the forward armor bolts are to the top of the non-rotating turret spacer ring.

Figure 12. Non-Rotating TurretSpacer Ring

NOTE

Turn non-rotating turret spacer ring (1) with top-side down to install backrests and gunners sling.

1. Install two backrest pads (2) onto non-rotating turret spacer ring (1) by installing bolt (3) and washer (4) in last mounting hole adjacent to five hatch-mounting holes through backrest (2) and backrest spacer plate (5). Secure to underside of non-rotating turret spacer ring (1). Do not completely tighten bolts (3). Repeat for other backrest pad. See Figure 13.

2. Install gunner sling bracket (6) on left side of non-rotating turret spacer ring (1) with bolt (7) and washer (8). Tighten bolt (7).

3. Install webbing strap and bracket (9) on right side of non-rotating turret spacer ring (1) with bolt (7) and washer (8). Tighten bolt (7).

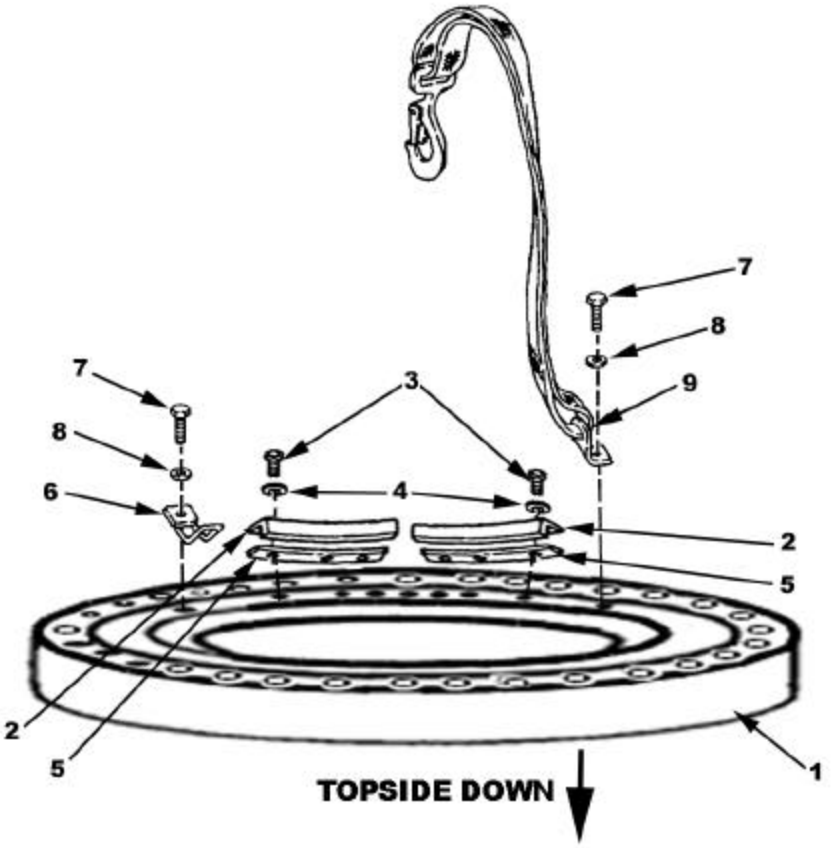


Figure 13. Off Vehicle Installation of Components Onto Non-Rotating Turret Spacer Ring (Upside Down View)

4. Using two personnel rotate spacer ring (1), so that top side is up.

NOTE

Apply thread-locking compound to threads of all bolts and screws.

5. Install turret armor cover (1) over non-rotating turret spacer ring (2) and position so that holes in turret armor cover (1) align with holes in non-rotating turret spacer ring (2) to accommodate vehicular bracket (batwing) (3). Install two hex head cap screws (4) to secure turret armor cover (1). Do not tighten. See Figure 14.

WARNING

The vehicular bracket (batwing) is extremely heavy. Use at least two personnel to lift and position bracket on top of non-rotating turret spacer ring.

6. Install vehicular bracket (batwing) (3) and spacer (5) onto turret armor cover (1) and non-rotating turret spacer ring (2) by installing thirteen bolts (6), washers (7), and nuts (8). Tighten all bolts (6,4) and torque bolts to 125 ft lbs.

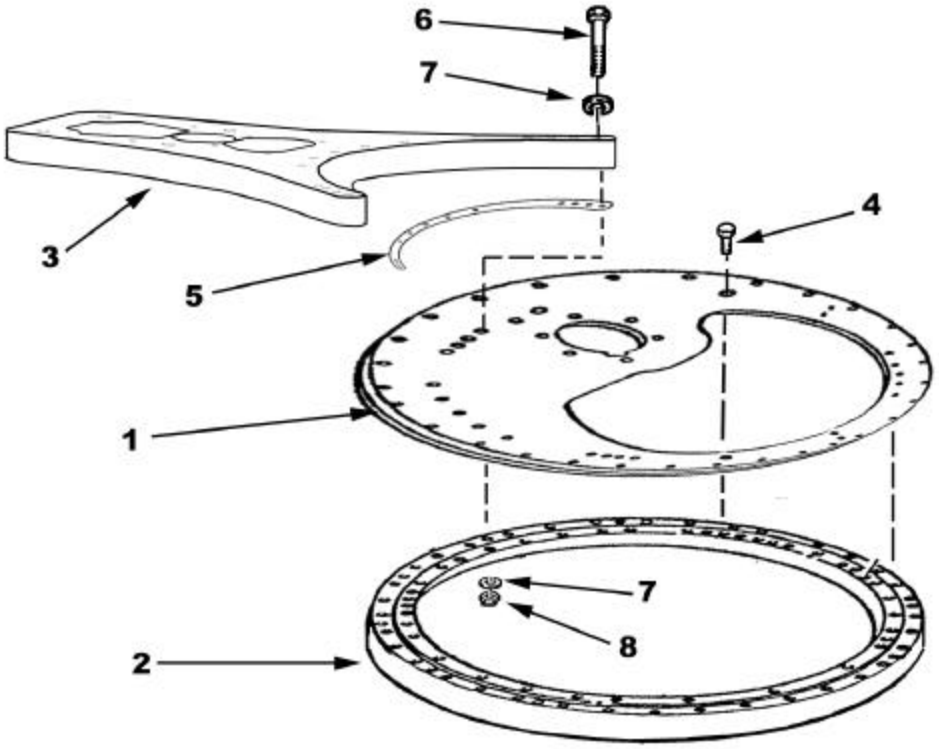


Figure 14. Installation of Vehicular Bracket (Batwing) and Armor Cover onto Non-Rotating Turret Spacer Ring (Backrests and Sling removed for clarity)

7. Install two pivot base assemblies (1) by installing two each flat head countersink screws (2) through the pivot base assembly (1) and secure pivot base assembly to turret armor (3) and non-rotating turret spacer ring. See Figure 15.

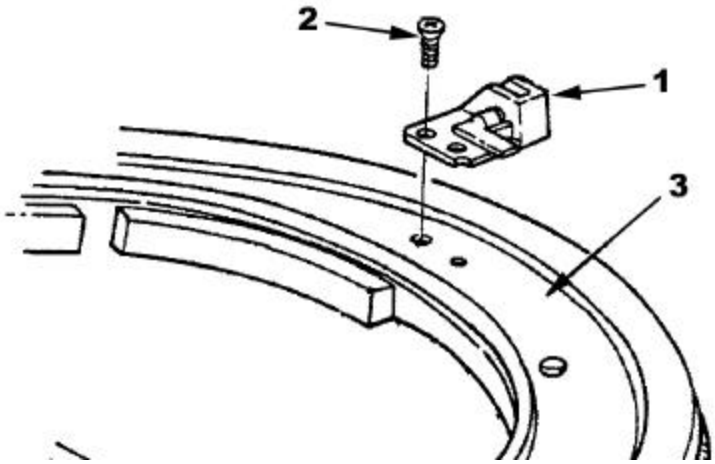


Figure 15. Installation of Pivot Base Assembly

8. Install hatch assembly (1) by installing four 3.75 in hex head cap screws (2) and one 3.00 in hex head cap screw (into center hole) (3), five flat washers, and five nuts. Ensure four hex head cap screws (2) go through the remaining two holes of each backrest pad and backrest spacer plate. Tighten all nine cap screws (including backrest pad underside cap screws). See Figure 16.

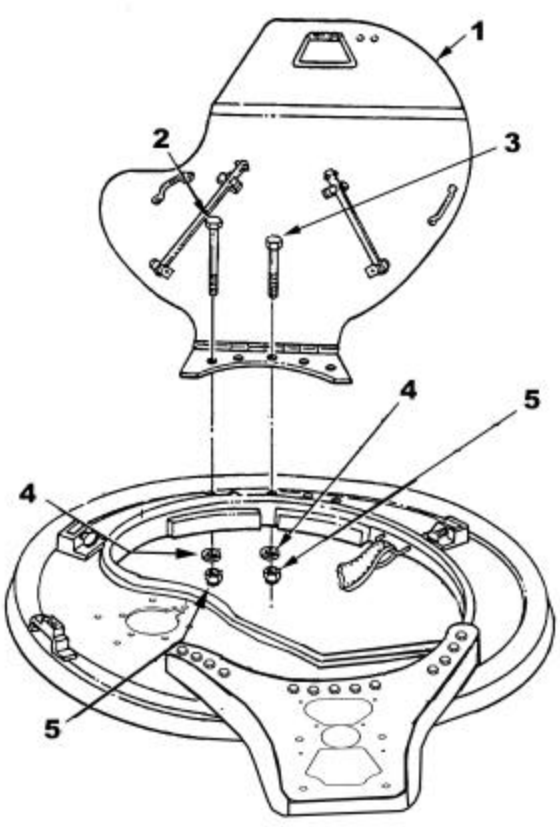


Figure 16. Installation of Hatch Assembly

9. Install roof bulkhead connector cover (1), two gaskets (2), and nut ring (3) by installing six hex head cap screws (4) and flat washers (5) to secure nut ring (3). Then install two hex head cap screws (6), four flat washers (7), and two hex locking nuts (8) to secure roof bulkhead connector cover to roof. See Figure 17.

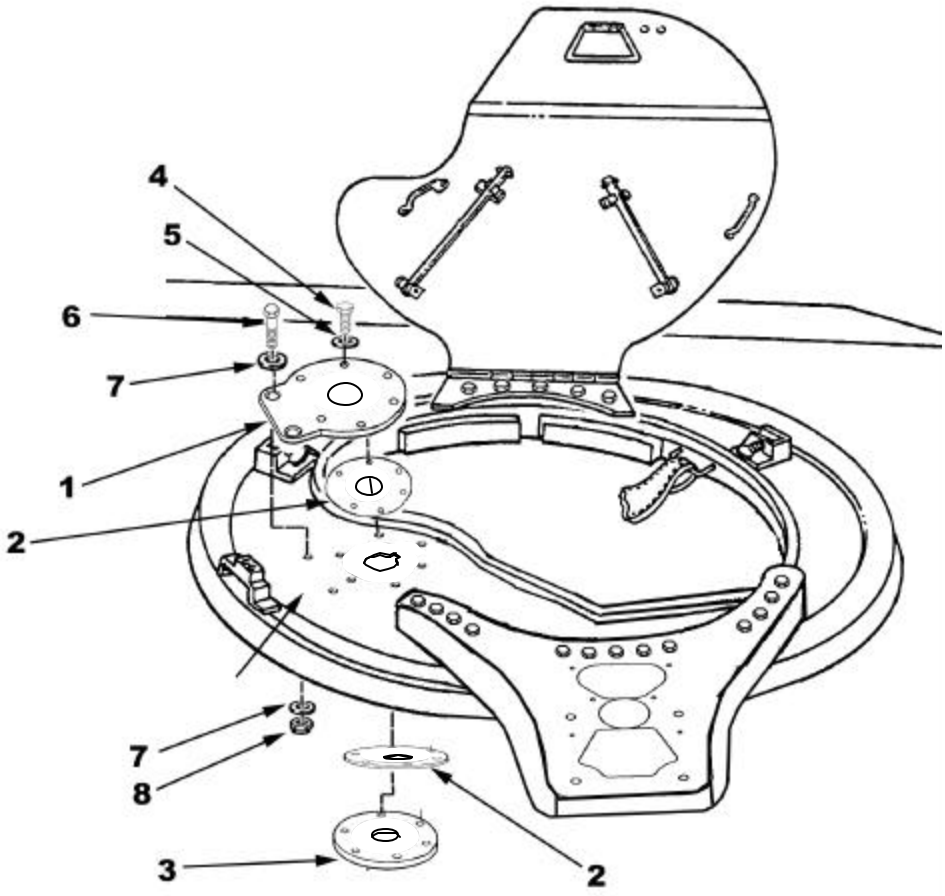


Figure 17. Installation of Roof Bulkhead Connector Cover

10. Install latch assembly (1). See Figure 18.

NOTE

Perform steps a and b for turret armor-mounted latch assemblies.

Go to section entitled Installing Hatch Interlock Switch for turret bearing-mounted latch assemblies and hatch interlock switch.

a. Apply silicone compound around mount hole prior to installing cap screw (2).

b. Install clamp spacer (3) and latch assembly (1) on turret armor (4) with cap screw (3). Tighten screw (3).

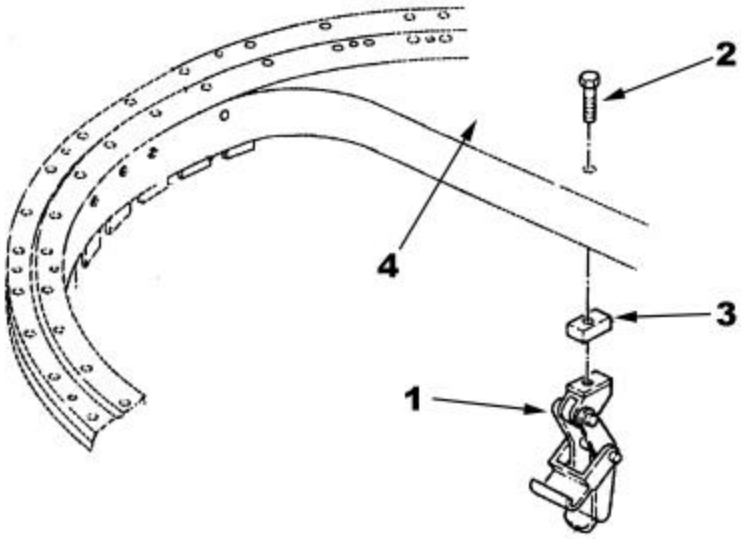


Figure 18. Installation of Latch Assembly

WARNING

The non-rotating turret spacer ring with the vehicular bracket (batwing) and armor cover is very heavy. When possible use an overhead hoist or other suitable means to install. Use eyebolt and sling as lift points per Figure 19 below.

NOTE

To assist in aligning the mount holes, insert two bolts into opposite sides of the non-rotating turret spacer ring. Remove bolts once spacer is properly aligned to roof.

11. Position non-rotating turret spacer ring (1) onto turret assembly (2) and align so that holes in non-rotating turret spacer ring (1) align with holes in turret assembly (2) and make a chalk mark. Install thirty-six hex head cap screws (3), thirty-six flat washers (4), and thirty-six 2-piece rubber isolation bushings (5) to secure non-rotating turret spacer ring (1) to turret assembly (2). Torque thirty-six bolts to 37 ft lbs.

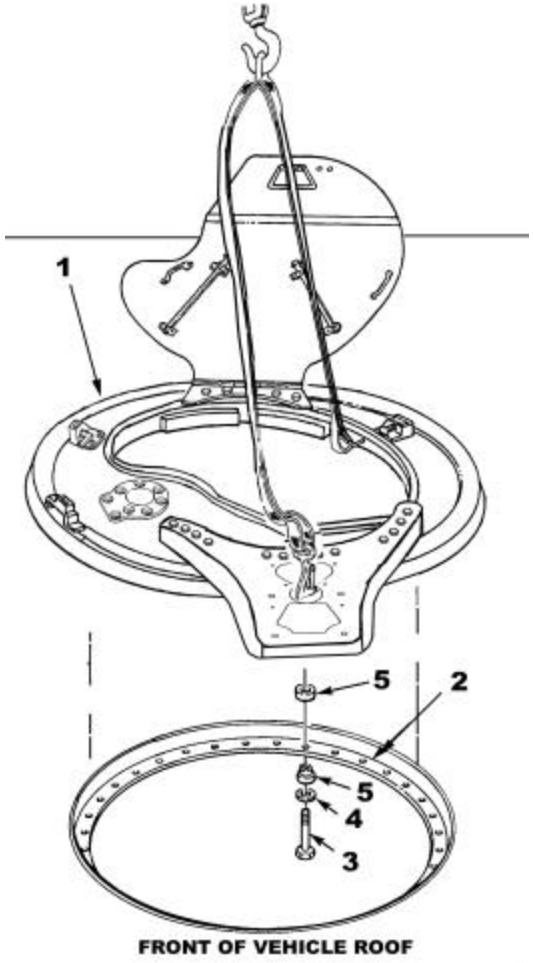


Figure 19. Lifting Non-Rotating Turret Spacer Ring with Vehicular Bracket (Batwing) and Turret Armor Cover

Installing Plate Assembly

Perform the following procedure to install the plate assembly. See Figure 20.

1. Remove four nuts (1), and four washers (2) (two from roof mounting studs (3), and two from the center hatch mounting bolts (4). Inspect studs for damage. If damaged, replace with new studs.

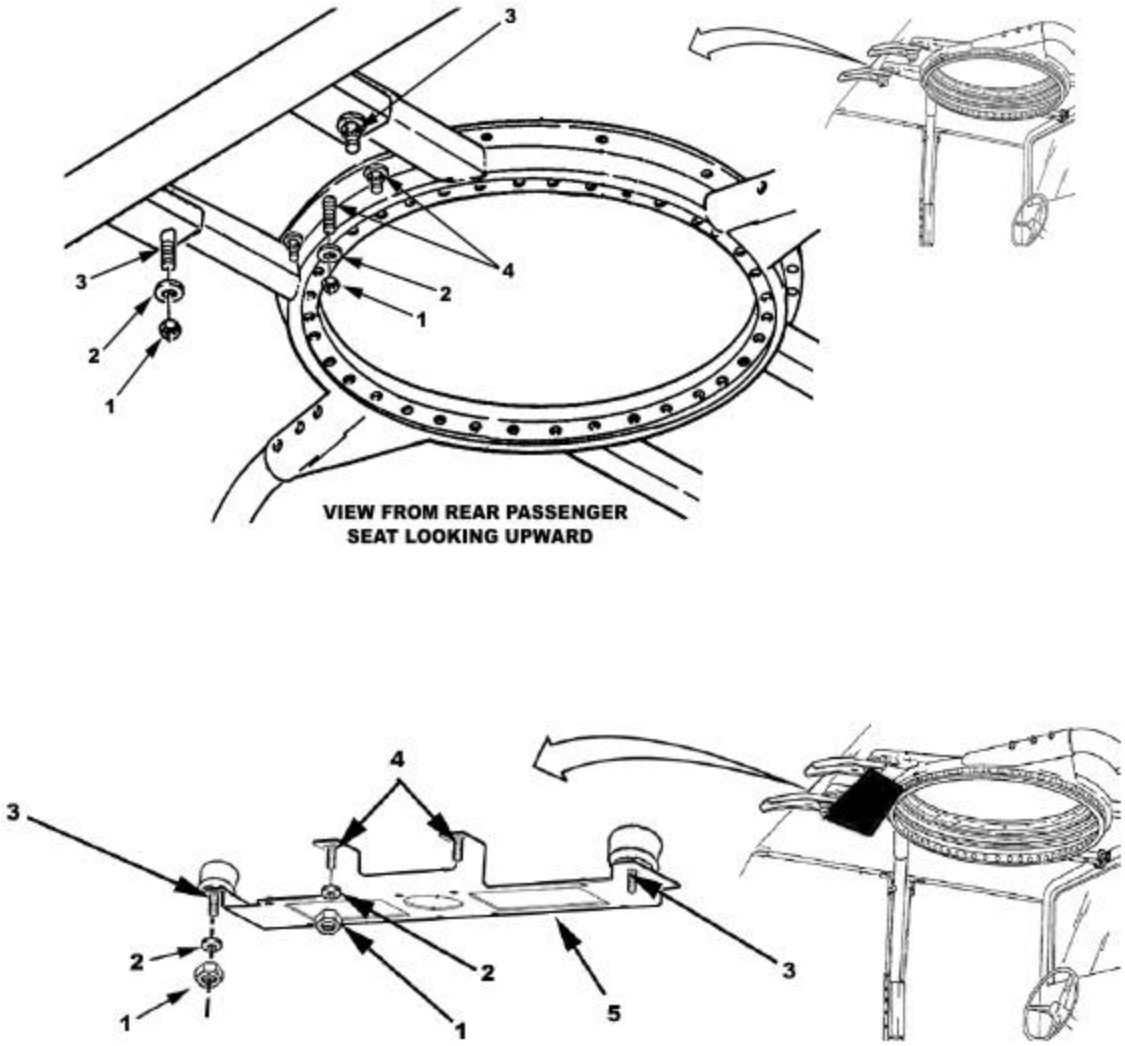


Figure 20. Installation of EMU/ICU Mounting Plate Assembly

2. Align center holes of the plate assembly (5) with the two center hatch bolts (4), and push plate assembly (5) upward to slide over the two roof mounting studs (3) and two hatch mounting bolts (4).

3. Secure plate assembly (5) with four washers (2), two new locknuts (1) for hatch mounting bolts (4), and new previously removed locknuts (1) for roof mounting studs (3). Tighten nuts (1).

Installing Electronic Module Unit (EMU)

Perform the following procedure to install the EMU. See Figure 21.

NOTE

Mount the EMU is so that the connectors are to the rear to avoid damage to control boxes and cables.

1. Align EMU (1) with holes on RH side of plate assembly (3) looking to the rear. Secure EMU (1) with four 4mm hex screws (4) and lock washers (5). Tighten screws.

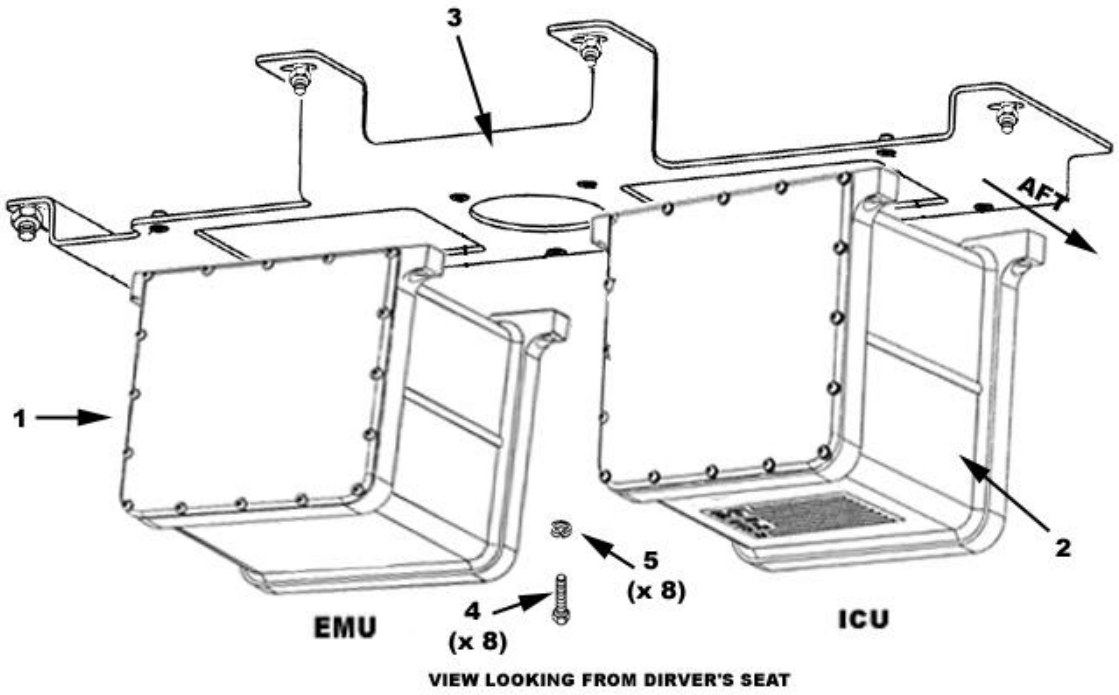


Figure 21. Installation of EMU and ICU

Installing Interface Control Unit (ICU)

Perform the following procedure to install the ICU. See Figure 21.

NOTE

Mount the ICU is so that the connectors are to the rear to avoid damage to control boxes and cables.

1. Align ICU (2) with holes on LH side of plate assembly (3) looking to the rear. Secure ICU (2) with four 4mm hex screws (4) and lock washers (5). Tighten screws.

Installing Hatch Interlock Switch

Perform the following procedure to install the hatch interlock switch. See Figure 22.

1. Remove bolt (1) and remove RH hatch lock (2) and spacer block (3) if installed.

2. Install hatch lock (2), bracket (4), and spacer block (3) and secure to turret ring with bolt (1).

3. Align keyway in hatch interlock switch (5) with notch in bracket (4). Install hatch interlock switch (5) through base of bracket (4) towards the hatch opening, and secure switch with top nut (6). The lower nut (7) is used to adjust the height of the hatch interlock switch (5) to the contact of the hatch. Ensure that hatch lock (2), when engaged, pushes the plunger (8) of the hatch interlock switch (5) down. This can be verified once system is powered up, by a hatch open message that appears on the display unit when the hatch is opened.

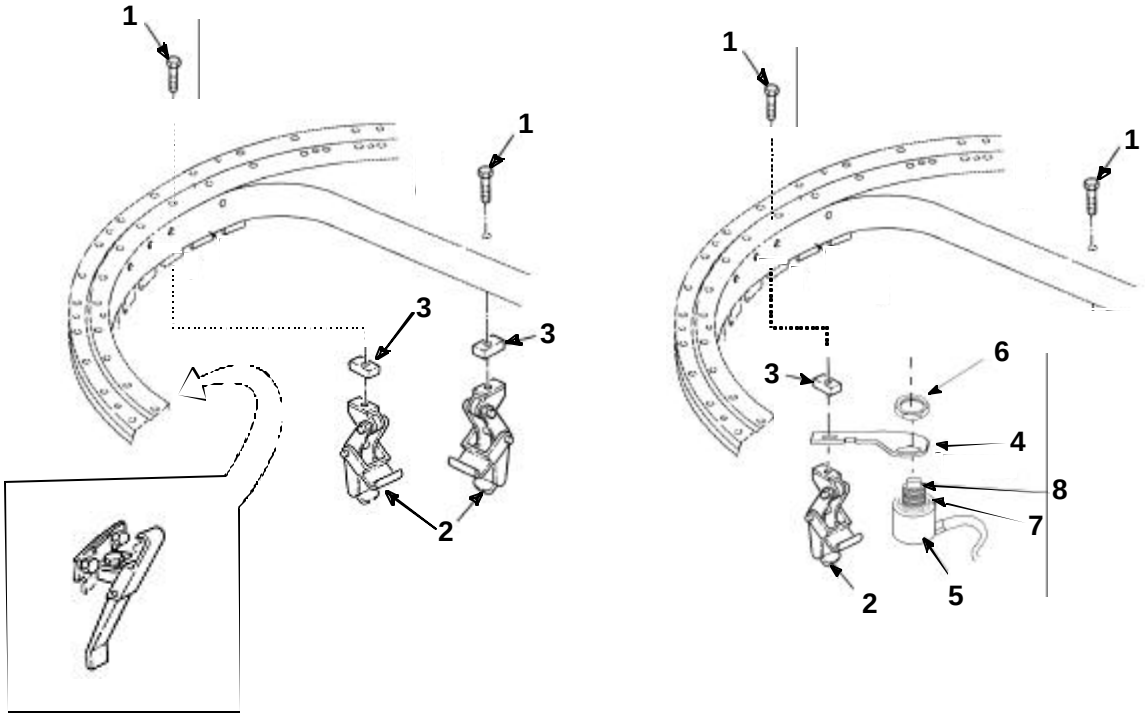


Figure 22. Installing Hatch Interlock Switch

Installing Display Unit Base Bracket

Equipment Condition: Five 17/32" holes drilled (two into the tunnel next to the driver's seat and three in the seat support beam behind the driver's seat). Two AVK inserts installed into the two holes on the tunnel. (See Pre-Installation (First Time Install) -- Display Unit Base Bracket.)

Perform the following procedure to install the display unit base bracket.

1. Insert shims (1) into two countersunk bolt holes. See Figure 23.

2. Align tunnel spacer shim (2) and 3-hole display unit base bracket spacer (3) with the mounting holes on the tunnel (next to driver's seat) (4) and seat support beam (behind driver's seat) (5). Place display unit base bracket (6) over spacers (2,3). Insert bolts (7) and washers (8) in tunnel AVK inserts. Insert bolts (9,10) and washers (11,12) into seat support beam (5). Do not tighten bolts at this time.

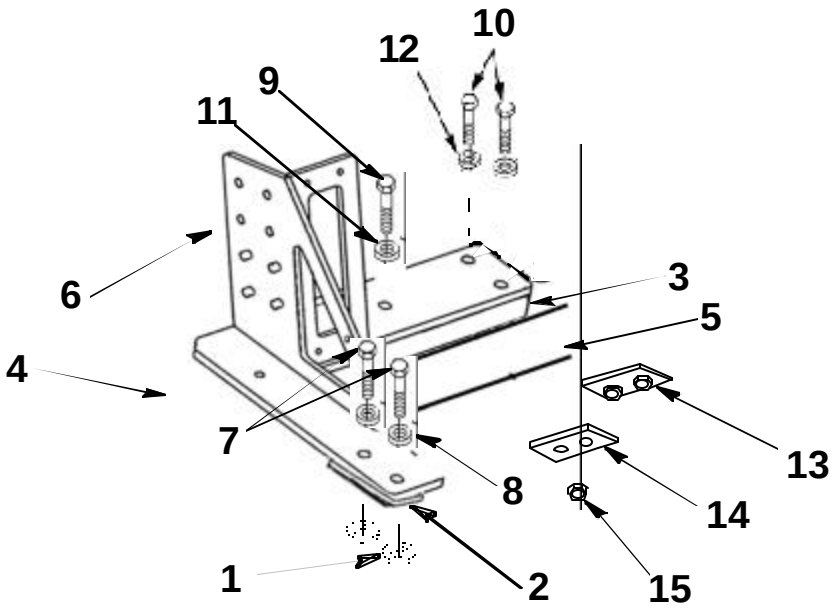


Figure 23. Display Unit Base Bracket (As Viewed from Front Passenger Seat)

NOTE

To access underside of seat support beam, you may need to remove access panel cover.

3. Align 2-hole nut plate (13) with two outermost mounting holes on underside of seat support beam (5), the 3-hole display unit base bracket spacer (3), and the display unit base bracket (4). Install two bolts (10) and washers (12). Do not tighten bolts at this time.

4. Align one hole of the 2-hole plate (14) and nut (15) with the innermost mounting hole on underside of seat support beam (5), the 3-hole display unit base bracket spacer (3), and the display unit base bracket (4). Install bolt (9) and washer (11).

5. Tighten all bolts.

Assembling Display Unit Support Arm Assembly

Perform the following procedure to assemble the display unit support arm assembly.

NOTE

Assemble the vertical and horizontal support arms prior to installing them onto the base bracket assembly.

When installing T-nuts, ensure that the flat edge faces outward in the channel and the curved edge faces inward.

1. On a flat surface, position the vertical support arm (1) so that the long side of the taper at the base is facing upwards. Position the horizontal support arm (2) to align with the outer upper edge of the vertical support arm (1). See Figure 24.

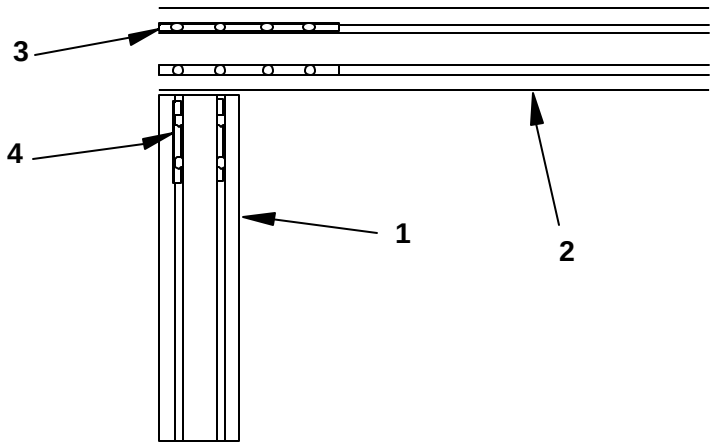


Figure 24. Assembling Vertical and Horizontal Support Arms

2. Insert two 4-hole T-nuts (3) into the front grooves of the horizontal support arm (2) and two 2-hole T-nuts (4) into the front grooves of the vertical support arm (1).

3. Position and secure the joining plate (5) onto the vertical support arm (1) and horizontal support arm (2) by using the twelve bolts (6), washers (7), and lock washers (8). See Figure 25.

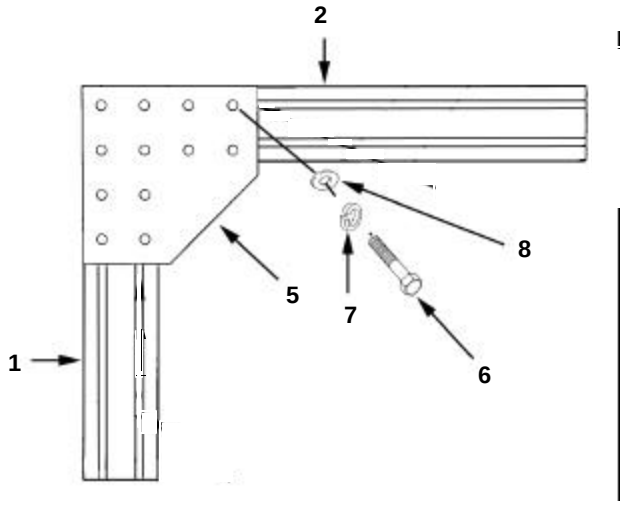


Figure 25. Installing Joining Plate to Display Unit Support Arm Assembly

4. Flip over.

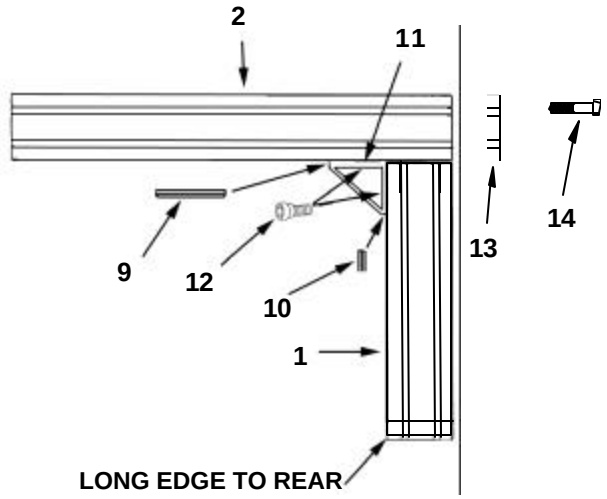


Figure 26. Installing Gusset onto Display Unit Support Arm Assembly

NOTE

The two top-mounting holes on the side of the gusset are not used; the two single hole T-nuts align with the two lower holes in the gusset.

5. Insert two 2-hole T-nuts (9) into underside grooves of horizontal support arm (2) (one T-nut in each groove) and two 1-hole T-nuts with grommet (10) on left side grooves of vertical support arm (1) (one T-nut in each groove). See Figure 26.

6. Install support gusset (11) in the "V" of the horizontal support arm (2) and the vertical support arm (1). Secure support gusset (11) with six screws (12).

7. Secure joystick plate (13) onto right side of horizontal support arm (2) with four bolts (14).

Installing Display Unit Support Arm Assembly onto Display Unit Base Bracket

Perform the following procedure to install the display unit support arm assembly.

NOTE

There are two brackets for the switch panel unit (SPU). Placement of T-nuts is dependant on which bracket will be used. See Installing Switch Panel Unit (SPU) and SPU Adapter Bars - Alternative 1, 2, or 3 later in this work package.

Prior to installing the display unit support arm assembly, ensure that the T-nuts are installed into the appropriate channels as follows (all directions are when directly facing the display unit support arm assembly):

Alternative 1:
RIGHT side of vertical support arm -- two 4-hole T-nuts (1)
REAR side of vertical support arm -- four 1-hole T-nuts (2)
FRONT of vertical support arm -- two each 1-hole T-nuts (3) (item 7)

Alternatives 2 and 3:
RIGHT side of vertical support arm -- two 4-hole T-nuts (1)
REAR side of vertical support arm -- four 1-hole T-nuts (2)

Ensure that flat side of T-nuts are facing the outside of the channels.

1. Ensure T-nuts (1,2,3 as applicable) are inserted into grooves of display unit support arm assembly as stated above.

2. Align display unit support arm assembly (4) upright so that long side of vertical support arm is toward front of vehicle (display unit support arm assembly will be leaning toward back seat). See Figure 27.

3. Attach display unit support arm assembly (4) to display unit base bracket (5) by securing eight bolts (6), lock washers (7), and washers (8) into the two 4-hole T nuts (1) on right side of vertical support arm. See Figure 27.

4. Secure back side of display unit support arm assembly (4) to display unit base bracket (5) by inserting four bolts (9), lock washers (10), and washers (11) into four 10-32 T-nuts (3).

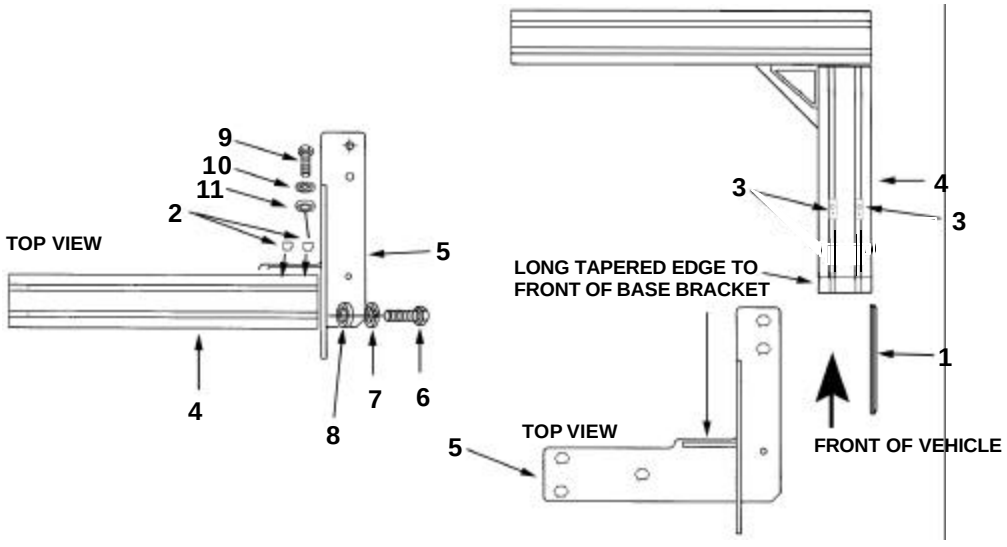


Figure 27. Installing Display Unit Support Arm Assembly

Installing the Display Unit Upright Mounting Brackets

Perform the following procedure to install the display unit upright mounting brackets.

NOTE

Space display unit upright mounting brackets so that the display unit will be centered in front of the operator when installed.

1. Secure left (1) and right (2) display unit upright mounting brackets on top of horizontal support arm (3) by installing four 5/16–18 2-hole T-nuts (4) in upper tracks of horizontal support arm (3). Secure upright mounting brackets (1,2) to horizontal support arm (3) with eight bolts (5), lock washers (6), and washers (7). See Figure 28.

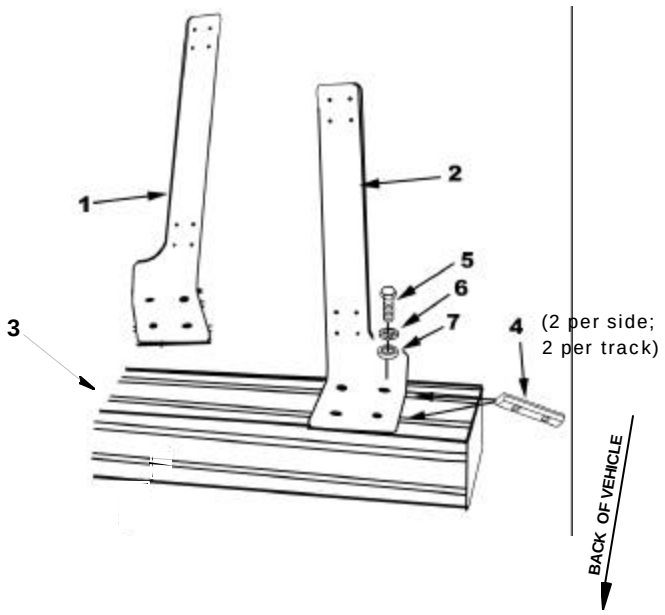


Figure 28. Installing Display Unit Upright Mounting Brackets

Installing Joystick Bracket

Perform the following procedure to install the joystick bracket.

1. Align joystick bracket (1) with joystick plate (2) on the horizontal support arm (3) and secure with three 4mm hex head screws (4) using 4mm T-handle hex head wrench. See Figure 29.

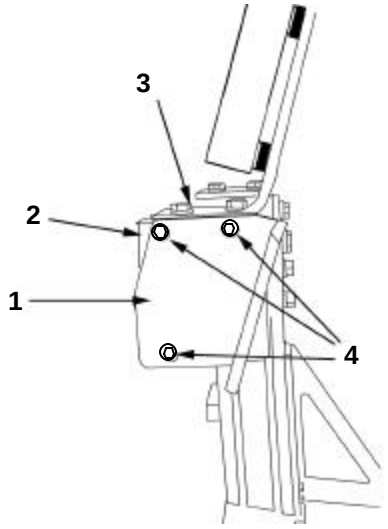


Figure 29. Installing Joystick Bracket

Installing Joystick Holder

Perform the following procedure to install the joystick holder.

1. Attach joystick holder (1) to joystick bracket (2) with three 4mm hex head screws (3) using 4mm T-handle hex head wrench. See Figure 30.

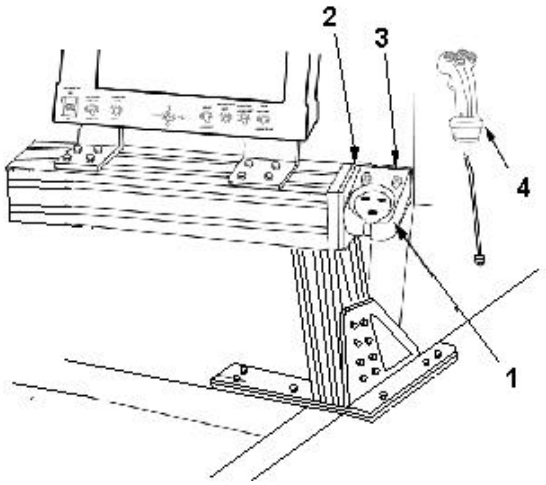


Figure 30. Installing Joystick Holder and Joystick

Installing Joystick

Perform the following procedure to install the joystick.

1. Install joystick (4) into joystick holder (1) by inserting joystick (4) at the 11 o'clock position, pushing down, and turning it CW to 12 o'clock position to lock. See Figure 30.

Installing the Display Unit

Perform the following procedure to install the display unit.

NOTE

The insulator brackets (shock mounts) required to mount the display unit to the upright mount brackets are a 2-piece unit, and may have to be disassembled to allow the insulator brackets to be mounted to the rear of the display unit.

1. Attach insulator brackets (1) to back of display unit (2). See Figure 31.

   a. Remove the nut (3) from the end of the bolt and separate the two halves of the insulator bracket (1).

NOTE

Attach insulator bracket to display unit with the bolt pointing upwards if at the top of the display unit. Attach insulator bracket with the bolt pointing downwards if at the bottom of the display unit.

   b. Attach the inner insulator bracket onto the back of the display unit with four short screws and star washers (provided).

   c. Reassemble the insulator by installing the outer half and securing with the self-locking nut.

2. Place the display unit (2) against the upright mounting brackets (4).

3. Insert the four tapping blocks (5) inside the inner insulated brackets (1).

4. Secure the display unit to the display unit upright mounting brackets (4) using 16 bolts (6), lock washers (7), and washers (8).

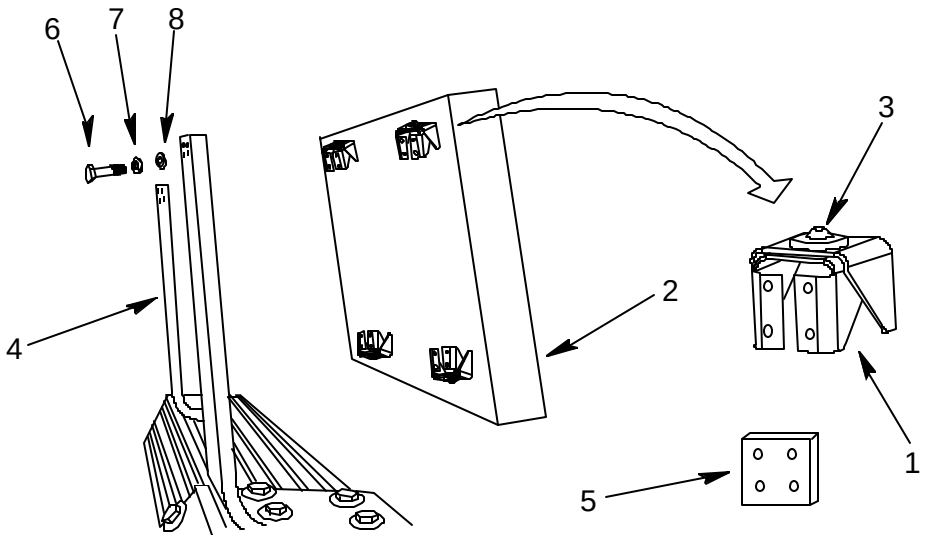


Figure 31. Installing the Display Unit

5. Hook up ICU J4 cable (21677-3715) to J1 connector on display unit (2).

Installing Switch Panel Unit (SPU) Adapter Bars and SPU - Alternative 1

Installing Switch Panel Unit (SPU) Adapter Bars

Perform the following procedure to install the SPU adapter bars.

NOTE

Ensure two 1-hole T-nuts (1) were installed in front grooves of vertical support arm (2) during installation of display unit support arm assembly.

Install T-nut with grommet side toward the outside.

1. Slide two each 1-hole T-nuts (1) into the upper groove on the front of horizontal support arm (3) and align with the grooves of the vertical support arm (2). See Figure 32.

2. Install first switch panel adapter bar (4) onto the two 1-hole T-nuts (1) on the horizontal support arm (3) with two 4mm hex bolts (5) using 4mm hex head wrench with T-handle.

NOTE

The lower adapter bar (4) is installed horizontally, but may need to be vertically adjusted to align adapter bar with mounting holes on SPU (6).

3. Install second switch panel adapter bar (4) onto the two 1-hole T-nuts with grommet (1) in the vertical support arm (2) and secure with two 4mm hex bolts (5).

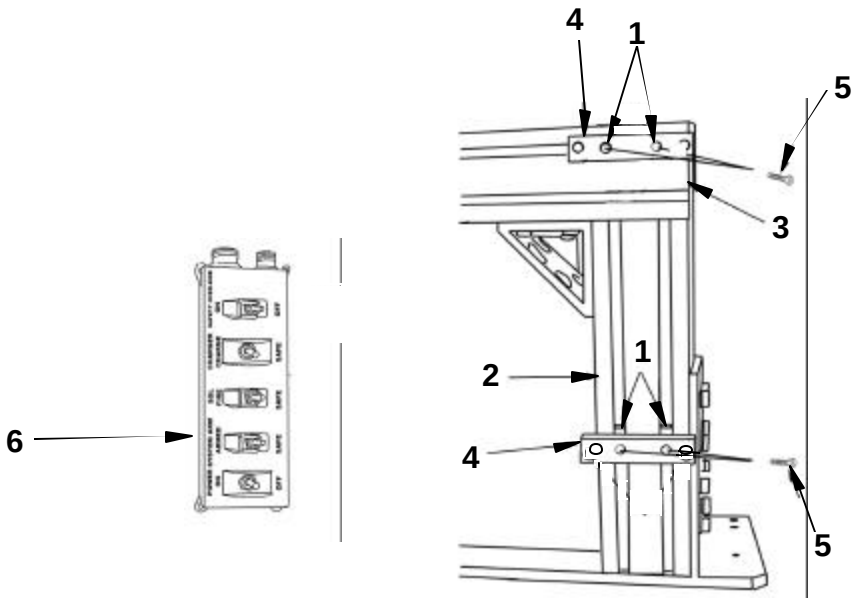


Figure 32. Installing Switch Panel Unit (SPU) Adapter Bars - Alternative 1 (NOTE: Display Unit and Upright Mounting Brackets Removed for Clarity)

Installing Switch Panel Unit (SPU)

Perform the following procedure to install the SPU.

NOTE

Ensure that panel is positioned so that switch guards, when raised, are on the left side of panel.

1. Hold SPU (1) vertically, then align four mounting holes (2) on SPU (1) with the four outer holes (3) of the two adapter bars (4) and secure with four bolts (5). See Figure 33.

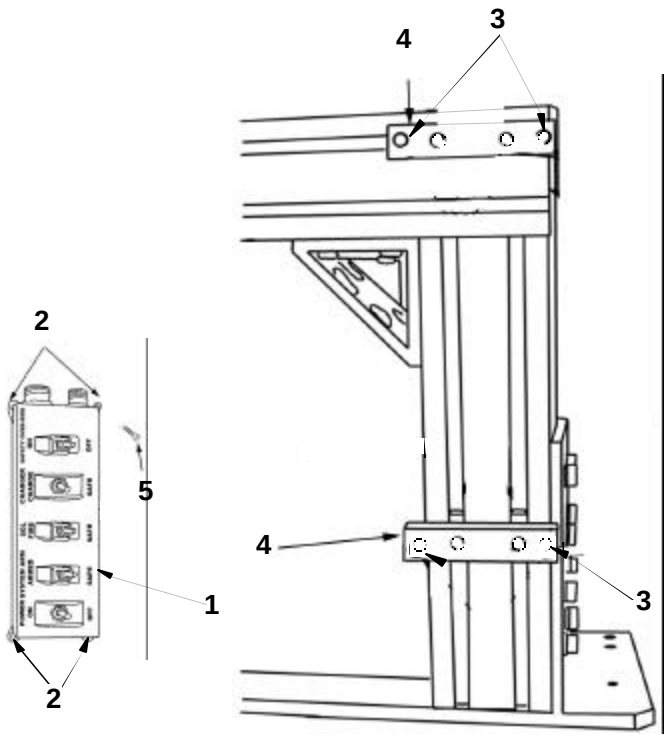


Figure 33. Installing the Switch Panel Unit - Alternative 1

2. Connect joystick cable to the J2 connector on the SPU (1).

Installing Switch Panel Unit (SPU) Adapter Bracket and SPU - Alternative 2

Installing Switch Panel Unit (SPU) Adapter Bracket

Perform the following procedure to install the SPU adapter bars.

NOTE

Install T-nut with grommet side toward the outside.

1. Slide four each 2-hole T-nuts (1) into the front of horizontal support arm (2) (two in each groove). See Figure 34.

2. Install SPU adapter bracket (3) onto the four 2-hole T-nuts (1) on the horizontal support arm (2) with eight 4mm hex bolts (4) using 4mm hex head wrench with T-handle.

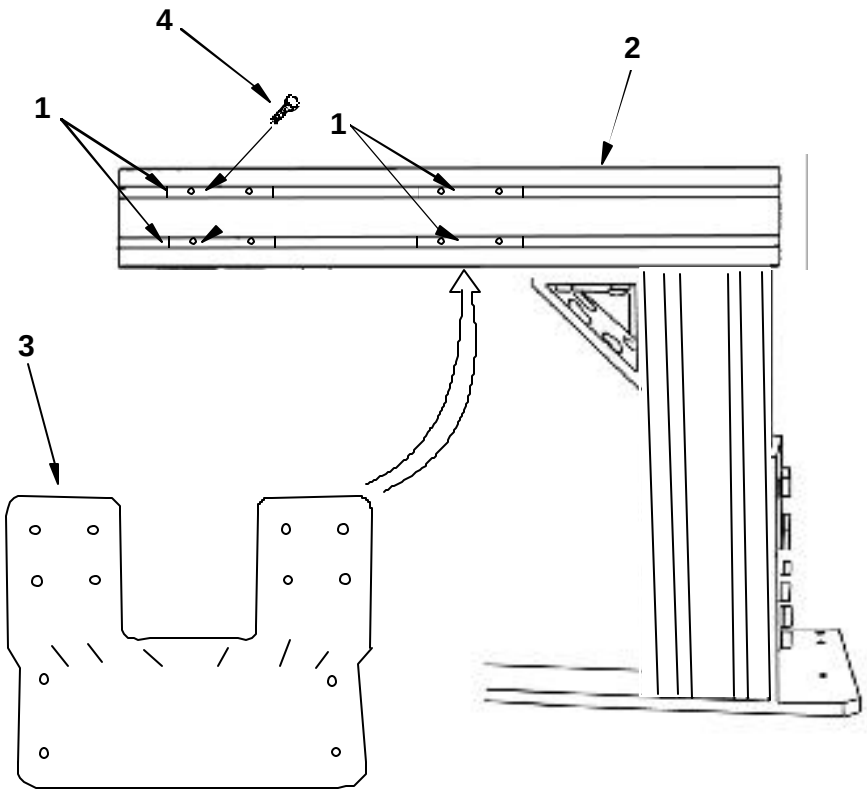


Figure 34. Installing Switch Panel Unit (SPU) Adapter Bracket - Alternative 2 (NOTE: Display Unit and Upright Mounting Brackets Removed for Clarity)

Installing Switch Panel Unit (SPU)

Perform the following procedure to install the SPU.

NOTE

Ensure that panel is positioned so that switch guards lift up when raised.

1. Align SPU (1) mounting holes (2) with the four lower holes (3) of the SPU adapter bracket (4) and secure with four bolts (5). See Figure 35.

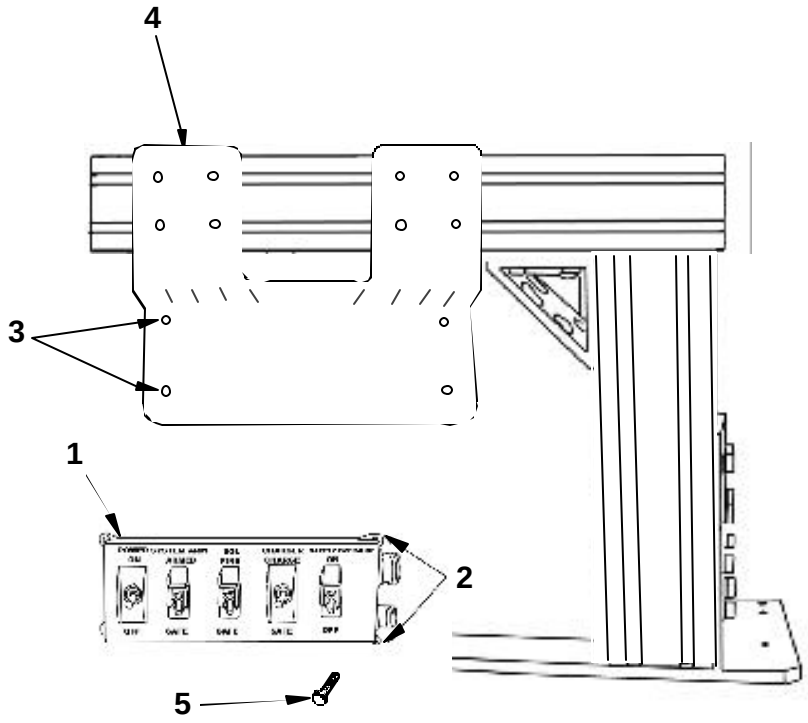


Figure 35. Installing the Switch Panel Unit (SPU) - Alternative 2

2. Connect joystick cable to the J2 connector on the SPU (1).

Installing Switch Panel Unit (SPU) Adapter Bars and SPU - Alternative 3

Installing Switch Panel Unit (SPU) Adapter Bars

Perform the following procedure to install the SPU adapter bars.

NOTE

Install T-nut with grommet side toward the outside.

1. Slide four each 1-hole T-nuts (1) into the grooves on the front of horizontal support arm (2) (two in each groove).

2. Install two switch panel adapter bars (3) onto the 1-hole T-nuts (1) on the horizontal support arm (2) with two 4mm hex bolts (4) using 4mm hex head wrench with T-handle. See Figure 36.

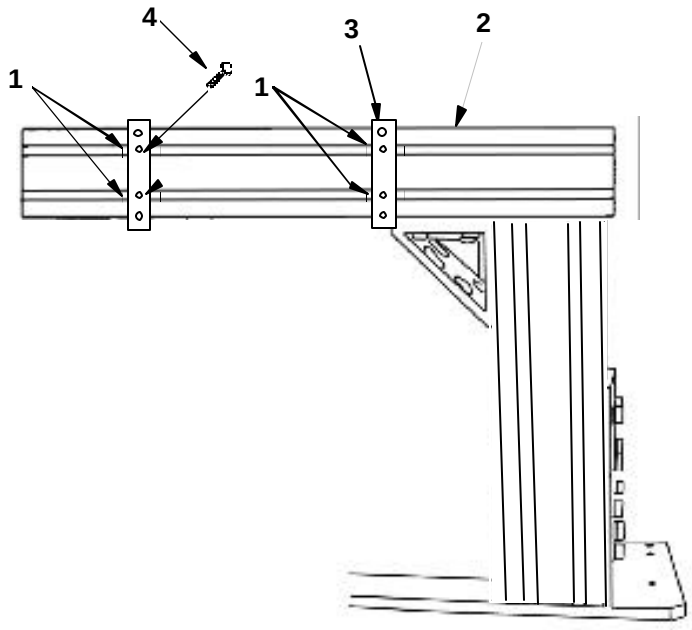


Figure 36. Installing Switch Panel Unit (SPU) Adapter Bars - Alternative 3 (NOTE: Display Unit and Upright Mounting Brackets Removed for Clarity)

Installing Switch Panel Unit (SPU)

Perform the following procedure to install the SPU.

NOTE

Ensure that panel is positioned so that switch guards lift up when raised.

1. Align SPU (1) mounting holes (2) with the four outer holes (3) of the SPU adapter bars (4). Secure with four bolts (5). See Figure 37.

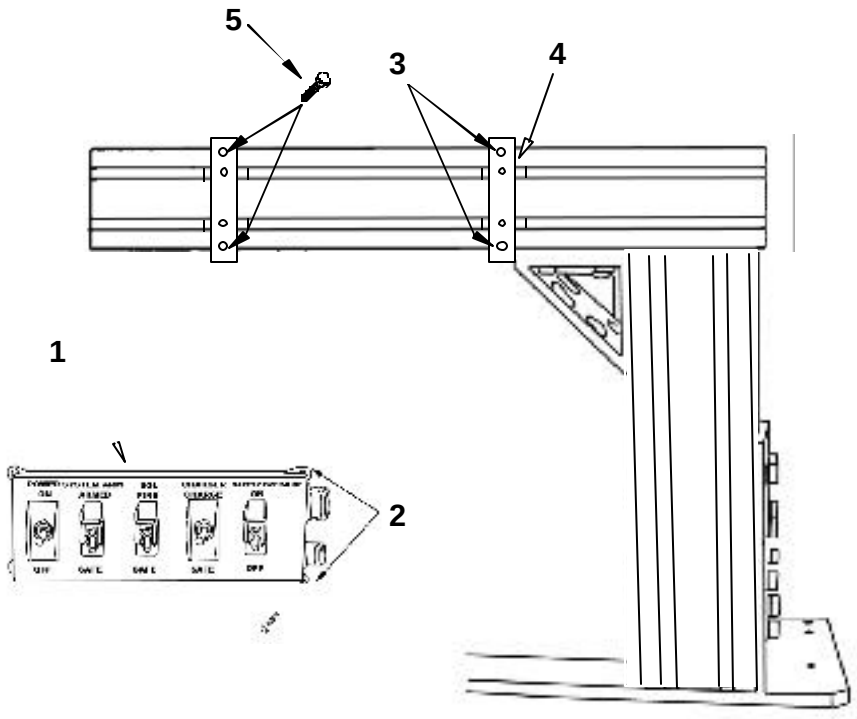


Figure 37. Installing the Switch Panel Unit (SPU) - Alternative 3

2. Connect joystick cable to the J2 connector on the SPU (1).

Installing End Cap into Display Unit Support Arm Assembly

Perform the following procedure to install the end cap into horizontal support arm.

1. Align end cap (1) with four holes at end of horizontal support arm (2) and install by pushing four push-in fasteners (3) into holes of end cap (1). See Figure 38.

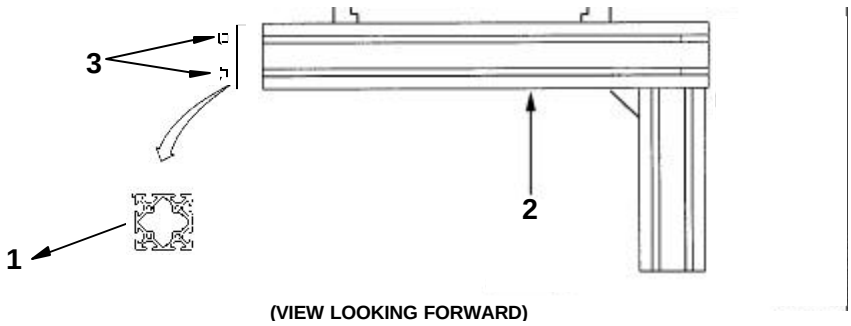


Figure 38. Installing End Cap into Display Unit Support Arm Assembly (For Clarity, Shown Without SPU Adapter Bars or SPU Installed)

Installing CROWS Weapon Mount onto Vehicle

Perform the following procedure to install the CROWS Weapon Mount onto the Pedestal.

Lifting Strap Procedure

NOTE

The straps can be used with the CROWS mount in multiple configurations (i.e., with different components attached/removed).

The only requirement is that all external cables must be removed.

External cables are listed below:

Part Number	Cable Name
21677-3700	Weapon Elevation Cable
21677-3702	M2 Weapon to Mount Cable
21677-3703	Mk19 Weapon to Mount Cable
21677-3705	M240/M249 Weapon to Mount Cable
21677-3706	Mount to Sensor Cable
21677-3730	Gimbal-Bulkhead Cable
21677-3731	Bulkhead-ICU Cable

The linear actuator (charger) assembly cable may be connected.

The external cables used inside the vehicle are not part of the strapping procedure:

Vehicle Power Cable (21677-3713),
ICU-SPU Cable (21677-3714),
ICU-Display Cable (21677-3715),
ICU-EMU Cable (21677-3716), and
Hatch Interlock Cable (21677-3720).

1. With the CROWS on a stable work surface, thread one strap around the elevation yoke arm and the second strap around the ammo yoke arm, as shown in Figures 39 and 40.

2. Securely attach the straps to the lifting device.

3. Once the CROWS is placed and secured in the new location, remove the straps.

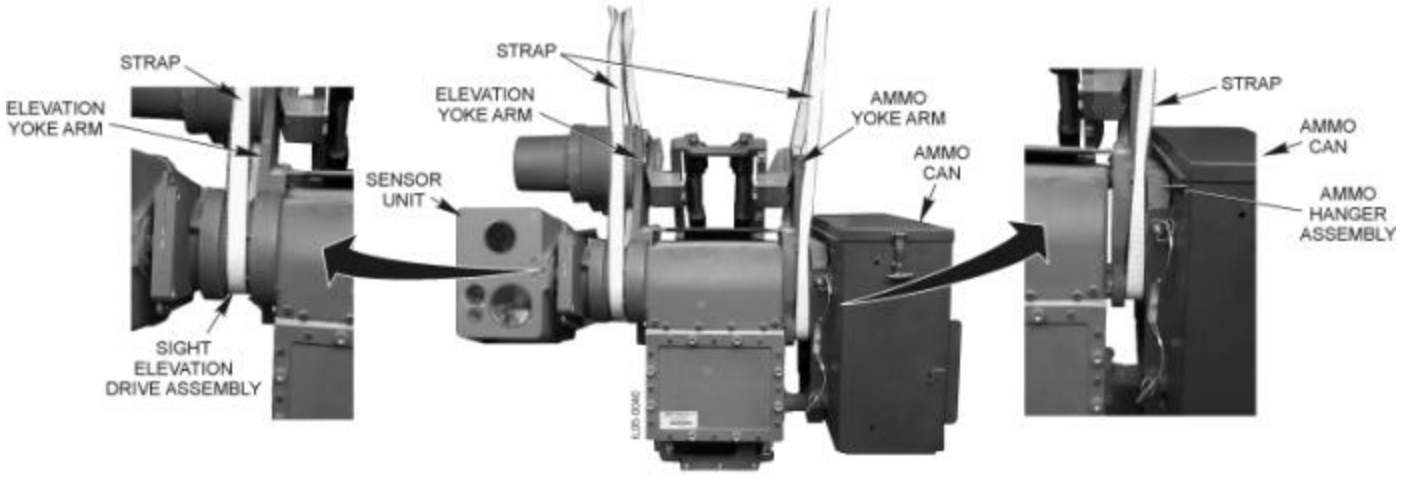


Figure 39. Front View (Barrel End of Weapon)

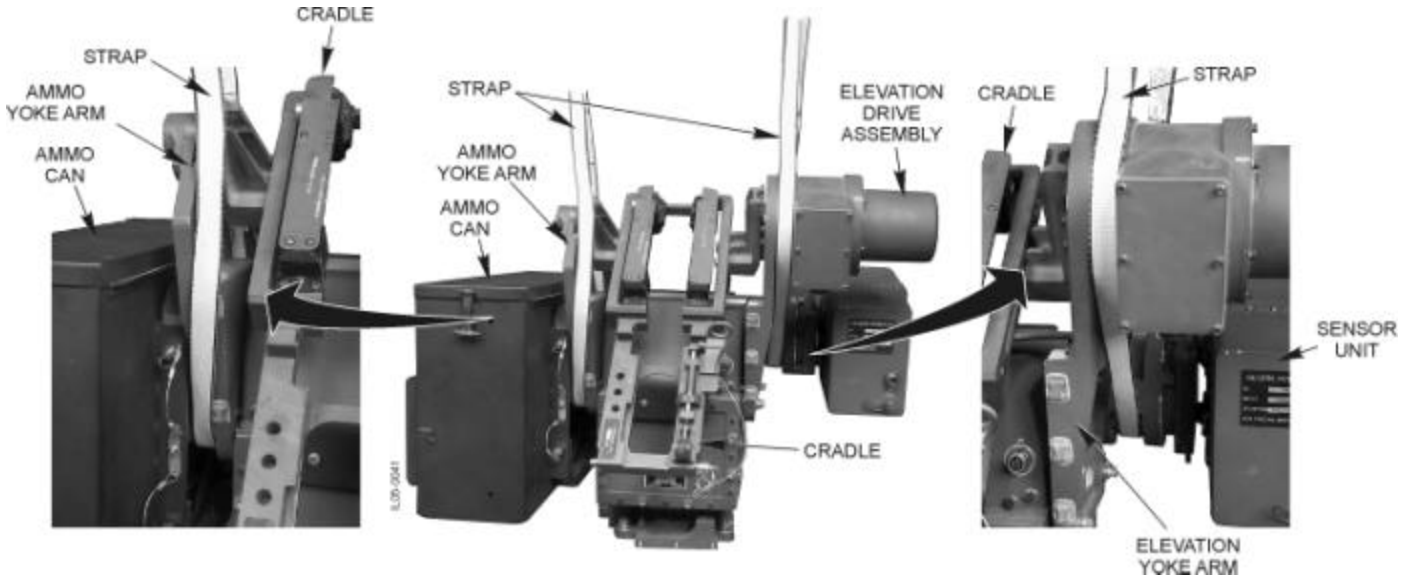


Figure 40. Rear View (Gunstock End of Weapon)

Installation of Mount Procedure

WARNING

The CROWS mount is extremely heavy. Use an overhead hoist or other suitable means to lift the mount onto the top of the vehicle. When securing lifting straps to the mount, route lifting straps around each end of the yoke arms (ammo can end and elevation end) ensuring not to cause damage to cable connections or other components. For ease of operation, remove ammo can from weapon mount and reinstall after installation of mount on vehicle.

Use care not to insert fingers between the mount and the pedestal during installation.

Failure to follow these instructions may result in personal injury.

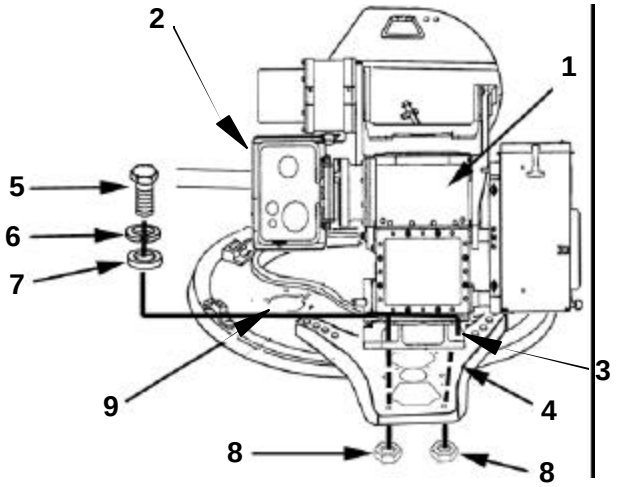


Figure 41. Installation of Mount

NOTE

Ensure all mounting hardware has been removed from the pedestal of the CROWS mount.

Ensure bottom of mount and mating surface of batwing are clean.

To assist in aligning the mount holes, insert two bolts into opposite corners of mount.

1. Position mount (1) on vehicle so that the optics assembly (2) is on the LH side (as viewed from the front of vehicle), and the four holes (3) in mount (1) align with the four holes on the batwing (4). See Figure 41.

2. Secure mount (1) to batwing (4) with four bolts (5), lock washers (6), washers (7), and nuts (8). Torque bolts to 66 ft lbs ± 1 ft lb.

Installing Cables

Installing Gimbal-Bulkhead Cable (Topside Power Cable)

1. Install J3 end of the gimbal-bulkead cable (21677-3730) through roof access hole (9) and secure by tightening nut from inside of vehicle until connector is secure. See Figure 41.

2. Connect P1 end of the gimbal-bulkead cable (21677-3730) to mount connection J1.

3. Connect P2 end of the gimbal-bulkead cable (21677-3730) to mount connection J2.

Installing Crew Compartment Cables (Inside Vehicle)

Equipment Condition: Terminal block installed on HMMWV.

Perform the following procedure to install the crew compartment cables.

NOTE

For information on connections and cables, refer to WP 0022, Interconnection Cables; WP 0043, Interconnection Cables; or WP 0013, Unit Functional Test and Troubleshooting.

There is no cable attachment for ICU connector J7. This connector is reserved for testing.

1. Connect P3 end of bulkhead-ICU cable (21677-3731) to J3 end of the gimbal-bulkead cable (21677-3730) on roof of vehicle. Route cable along the inside of turret ring to the equipment tray and secure to turret base ring with tie wraps. Coil up excess cable and store in the space above the ICU and ECU on the equipment tray.

2. Connect remainder of crew compartment cables per Table 2, Crew Compartment Cable Connections.

Table 2. Crew Compartment Cable Connections

CABLE PART #	FROM	Connector	TO	Connector	REMARKS
21677-3731	Bulkhead (Roof)	P3	ICU	J1	Power to Gimbal (mount connector J1)
			ICU	J2	I/O to Gimbal (mount connector J1)
21677-3716	ICU	J3	EMU	J1	
21677-3715	ICU	J4	Display Unit	J1	
21677-3714	ICU	J5	SPU	J1	
21677-3720	ICU	J8	Hatch Interlock Switch	none	
Joystick, 05823-01	Joystick	none	SPU	J2	
21677-3713	ICU	J6	Vehicle Battery	none	(see step 3 below)

WARNING

Ensure terminal cover is in place to prevent damage to vehicle or batteries.

Disconnect negative battery cable prior to removing terminal cover.

3. Disconnect negative battery cable on vehicle using 1/2 in wrench.

NOTE

Location of battery and terminal may vary from vehicle to vehicle.

Identify orientation of terminal cover for future replacement.

4. Remove protective cover (1) on terminal block (2) by turning two captive nuts (3) CCW. See Figure 42.

5. Remove two 9/16” nuts (4), washers (5), and lock washers (6) from terminal studs for both the positive (+) (7) and negative (-) (8) connections.

WARNING

Do not over tighten nuts on studs. Damage to terminal block may result.

6. Install the three positive terminal lugs (9) (red) with lock washer (6), washer (5), and 9/16 “nut (4) on positive stud (7). Tighten nut.

7. Install the three negative terminal lugs (10) (black) with lock washer (6), washer (5), and 9/16” nut (4) on negative stud (8). Tighten nut.

NOTE

Install terminal cover in same orientation as when it was removed.

8. Re-install protective cover (1) onto terminal block (2) by tightening the two captive nuts (3) CW until tight. Do not over tighten.

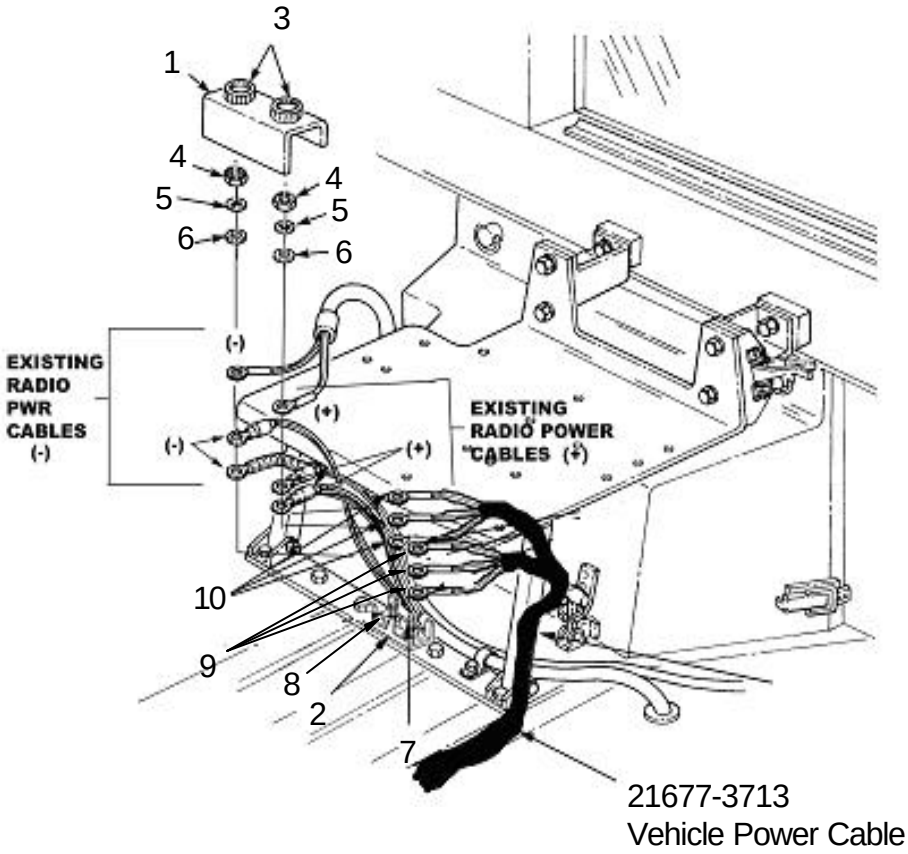


Figure 42. Installing Crew Compartment Cable

9. Reconnect negative battery terminal to battery.

10. Ensure all cables are secured to vehicle with tie wraps to prevent damage to cables or a hazard to personnel.

11. Perform pre-mission operational checkout IAW TM 9-1090-218-10.

REMOVING CROWS WEAPON MOUNT

WARNING

Disconnect negative battery cable on battery using 1/2 inch wrench. Ensure terminal is covered to prevent damage to vehicle or batteries.

CAUTION

Before removing any parts, grasp the part to prevent it from falling.

NOTE

Location of battery and terminal may vary from vehicle to vehicle.

For information on connections and cables, refer to WP 0022, Interconnection Cables; WP 0043, Interconnection Cables; or WP 0013, Unit Maintenance Functional Testing and Troubleshooting.

Removing Power Cable from Vehicle

Perform the following procedure to remove the power cable from the vehicle.

WARNING

Disconnect negative battery cable on battery using 1/2 inch wrench. Ensure terminal is covered to prevent damage to vehicle or batteries.

NOTE

Location of battery and terminal may vary from vehicle to vehicle.

1. Remove protective cover (1) on terminal block (2) by turning two captive nuts (3) CCW. See Figure 43.

2. Remove two nuts (4), flat washers (5), and lock washers (6) from terminal studs for both the positive (7) and negative (8) connections.

3. Disconnect and remove three positive (9) (red) and three negative (10) (black) terminal lug ends of ICU power cable 21677-3713 from terminal block (2).

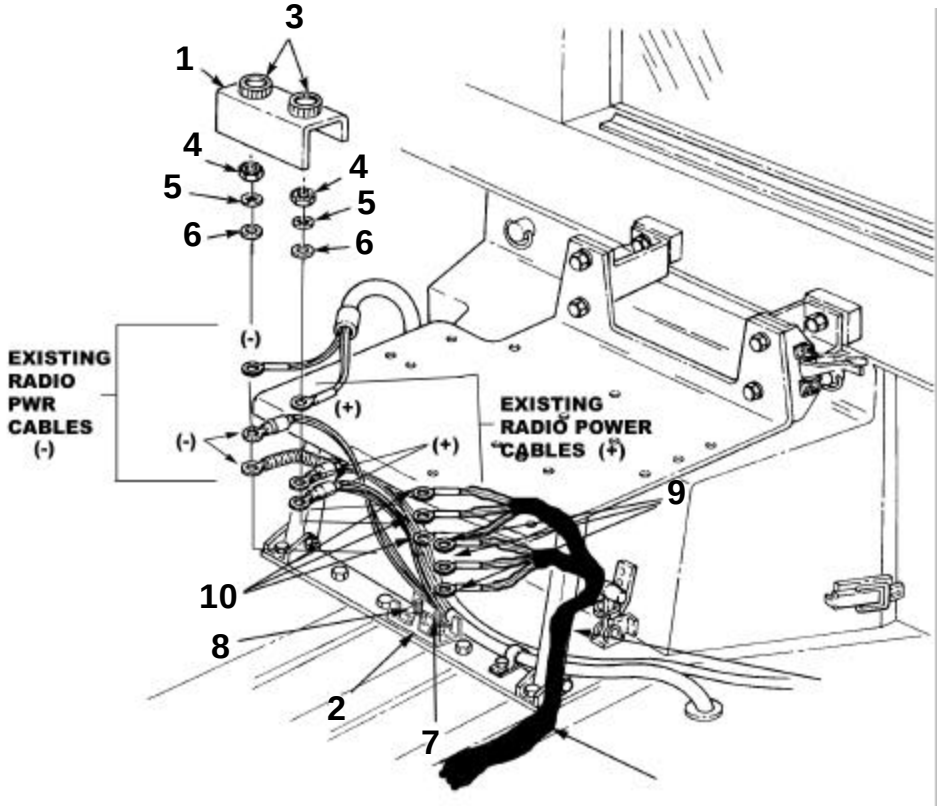


Figure 43. Removing Power Cable from Vehicle

Removing CROWS Weapon Mount from Vehicle

Perform the following procedure to remove the CROWS weapon mount from the vehicle.

Lifting Strap Procedure

NOTE

The straps can be used with the CROWS mount in multiple configurations (i.e., with different components attached/removed).

The only requirement is that all external cables must be removed.

External cables are listed below:

Part Number	Cable Name
21677-3700	Weapon Elevation Cable
21677-3702	M2 Weapon to Mount Cable
21677-3703	Mk19 Weapon to Mount Cable
21677-3705	M240/M249 Weapon to Mount Cable
21677-3706	Mount to Sensor Cable
21677-3730	Gimbal-Bulkhead Cable
21677-3731	Bulkhead-ICU Cable

The linear actuator (charger) assembly cable may be connected.

The external cables used inside the vehicle are not part of the strapping procedure:

Vehicle Power Cable (21677-3713), ICU-SPU Cable (21677-3714), ICU-Display Cable (21677-3715), ICU-EMU Cable (21677-3716), and Hatch Interlock Cable (21677-3720).

1. With the CROWS on a stable work surface, thread one strap around the elevation yoke arm and the second strap around the ammo yoke arm, as shown in Figures 44 and 45.

2. Securely attach the straps to the lifting device.

3. Once the CROWS is placed and secured in the new location, remove the straps.

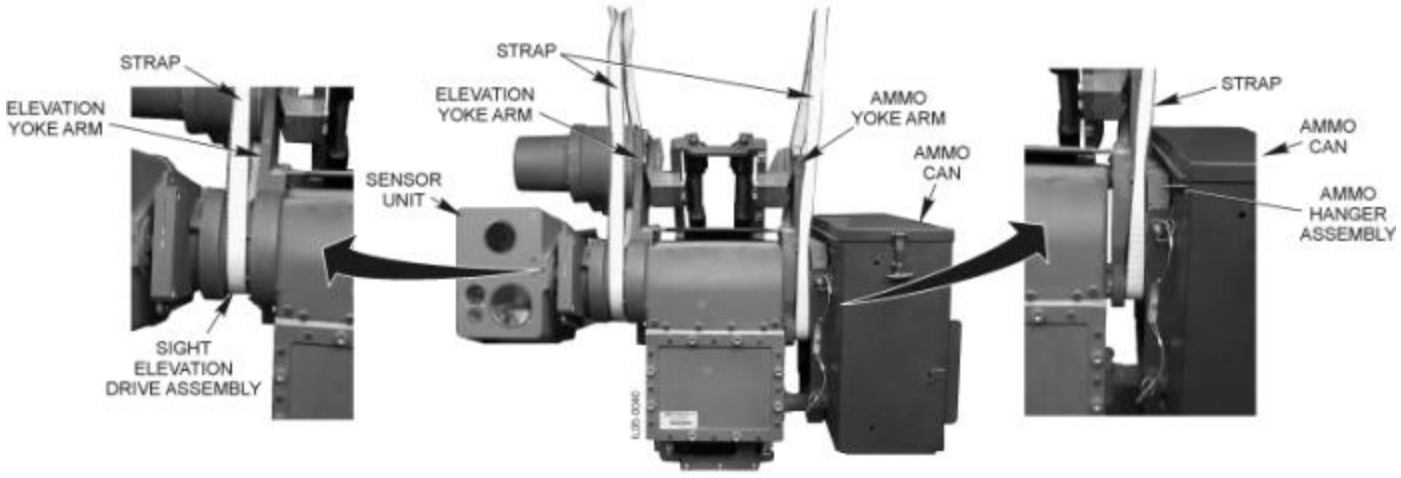


Figure 44. Front View (Barrel End of Weapon)

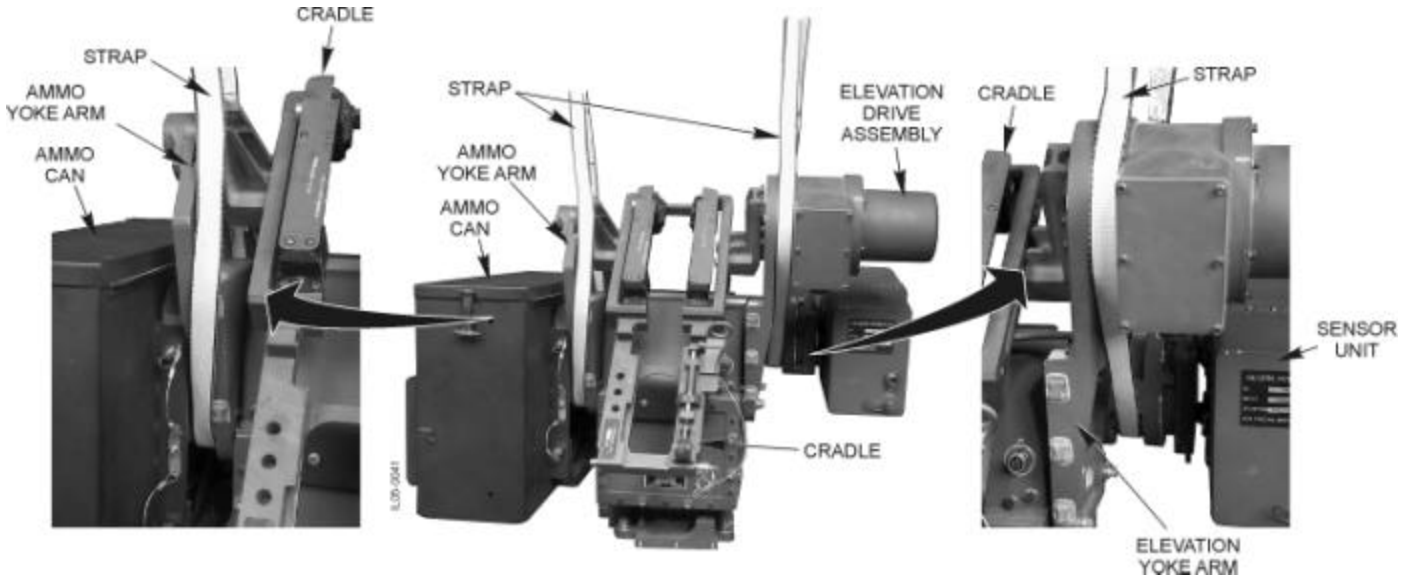


Figure 45. Rear View (Gunstock End of Weapon)

Removal from Mount Procedure

1. Ensure azimuth lock is in locked position.

2. Remove four bolts (1), flat washers (2), lock washers (3), and nuts (4) holding the CROWS weapon mount (5) to the batwing (6) using a 15/16 inch wrench. See Figure 46.

WARNING

When securing lifting straps to the mount, route lifting straps around each end of the yoke arms (ammo can end and elevation end), ensuring not to cause damage to the cables, cable connections, or other components.

NOTE

For ease of operation, remove ammo can (7) from weapon mount and reinstall it after weapon mount is removed.

Ensure all external cables are disconnected prior to removal of CROWS weapon mount. See Lifting Strap Procedure subsection immediately preceding.

2. Using an overhead hoist and safety straps, lift the mount from the vehicle.

3. Ensure spacer plate (8) under mount remains with mount.

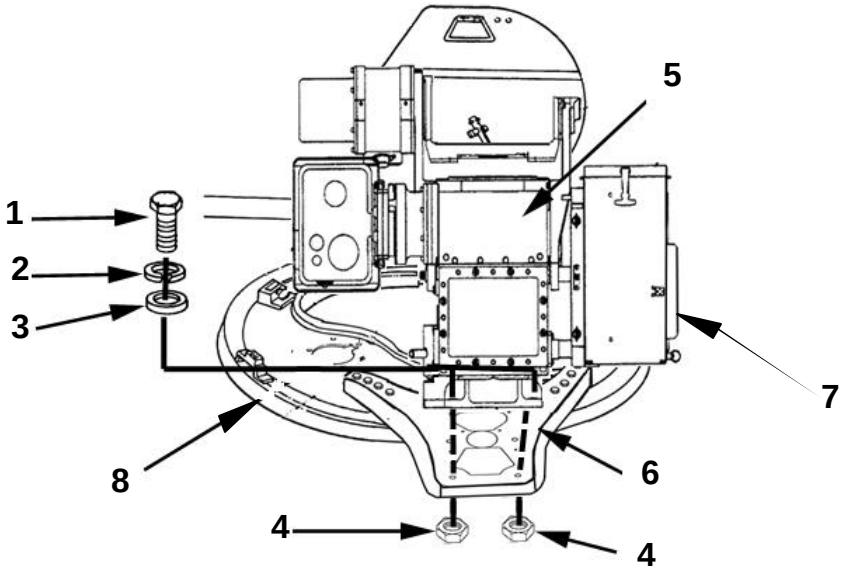


Figure 46. Removing Mount

Removing End Cap from Display Unit Support Arm Assembly

Equipment Condition: None.

Perform the following procedure to remove the end cap from the display unit support arm assembly.

1. Remove four push in fasteners (1) from holes of end cap (2). See Figure 47.
2. Remove end cap from horizontal support arm (3).

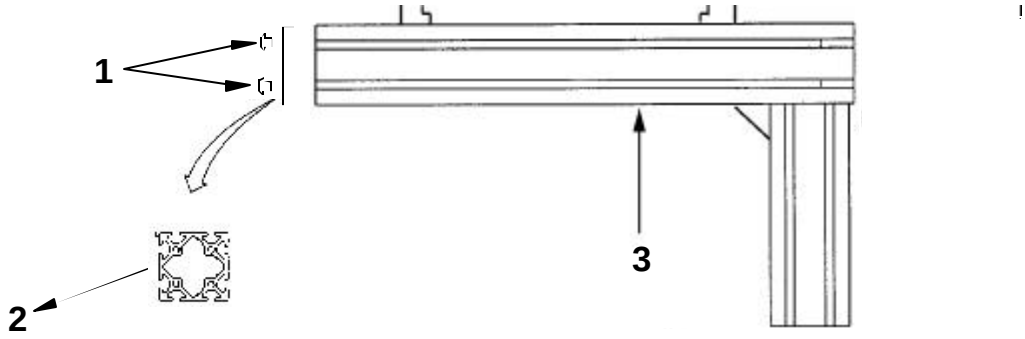


Figure 47. Removing End Cap (For Clarity, Shown Without SPU Adapter Bars or SPU Installed)

Removing Switch Panel Unit (SPU) and SPU Adapter Bars - Alternative 1

Removing Switch Panel Unit (SPU)

Equipment Condition: None.

Perform the following procedure to remove the SPU.

1. Ensure cables are removed from connections J1 and J2 on SPU (1).

NOTE

To access bottom bolt, a wrench may be necessary.

2. Remove four bolts (2) securing SPU (1) to display unit support arm assembly (3) adaptor bars (4) using 5/16 socket wrench. See Figure 48.

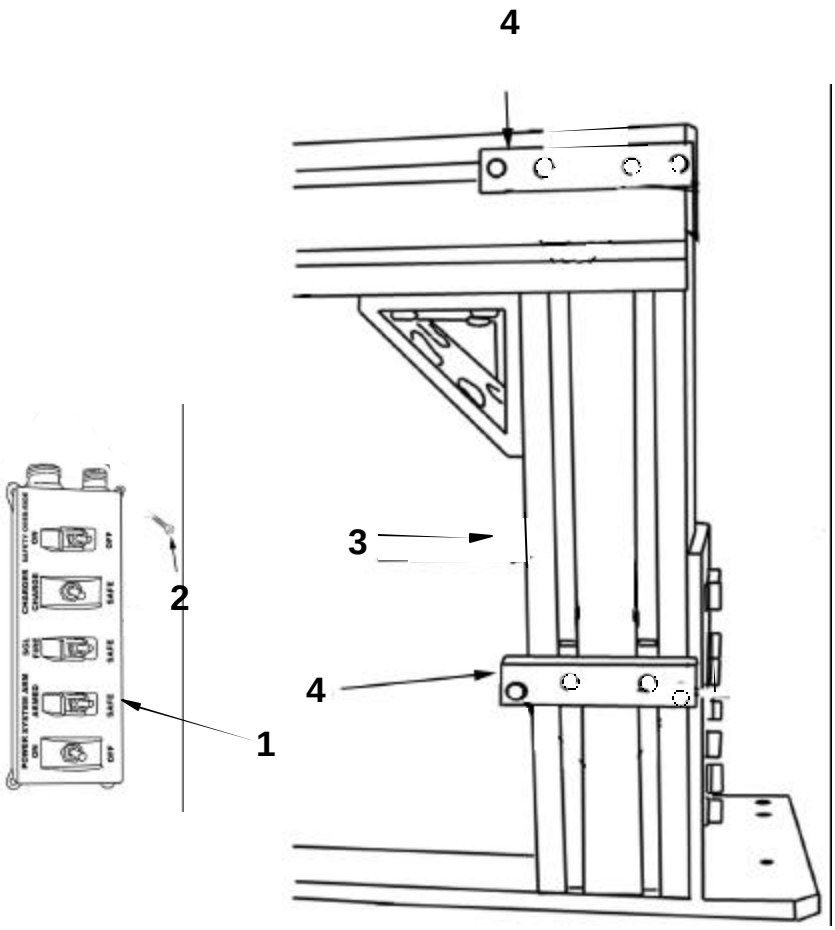


Figure 48. Removing SPU - Alternative 1

Removing SPU Adaptor Bars

Equipment Condition: SPU removed.

Perform the following procedure to remove the SPU adaptor bars.

1. Remove two bolts (1) from each adapter bar (2) securing adaptor bar to display unit support arm assembly (3). See Figure 49.

NOTE

Removal of two 1-hole T-nuts with grommet (4) from tracks of vertical arm of display unit support arm assembly (3) must be accomplished after assembly is removed from display unit base bracket.

2. Remove two 1-hole T-nuts with grommet (4) from tracks of horizontal arm of display unit support arm assembly (3).

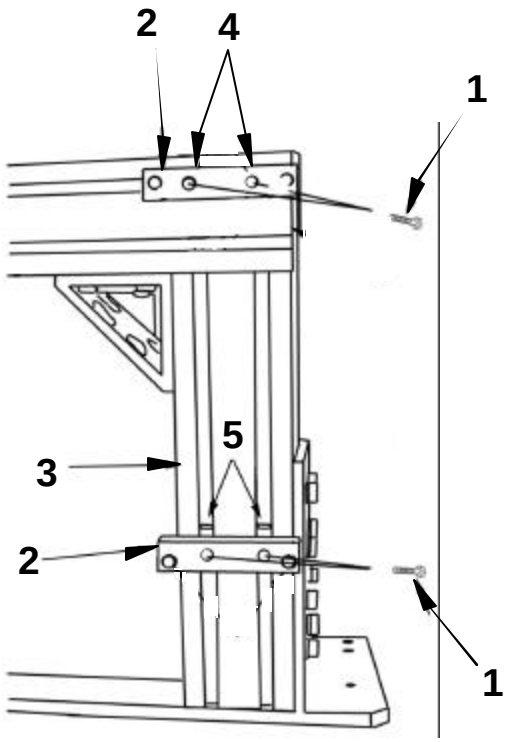


Figure 49. Removing SPU Adapter Bars - Alternative 1

Removing Switch Panel Unit (SPU) and SPU Adapter Bracket - Alternative 2

Removing Switch Panel Unit (SPU)

Equipment Condition: None.

Perform the following procedure to remove the SPU.

1. Ensure cables are removed from connections J1 and J2 on SPU (1).
2. Remove four bolts (2) securing SPU (1) to SPU adapter bracket (3) using 5/16 socket wrench. See Figure 50.

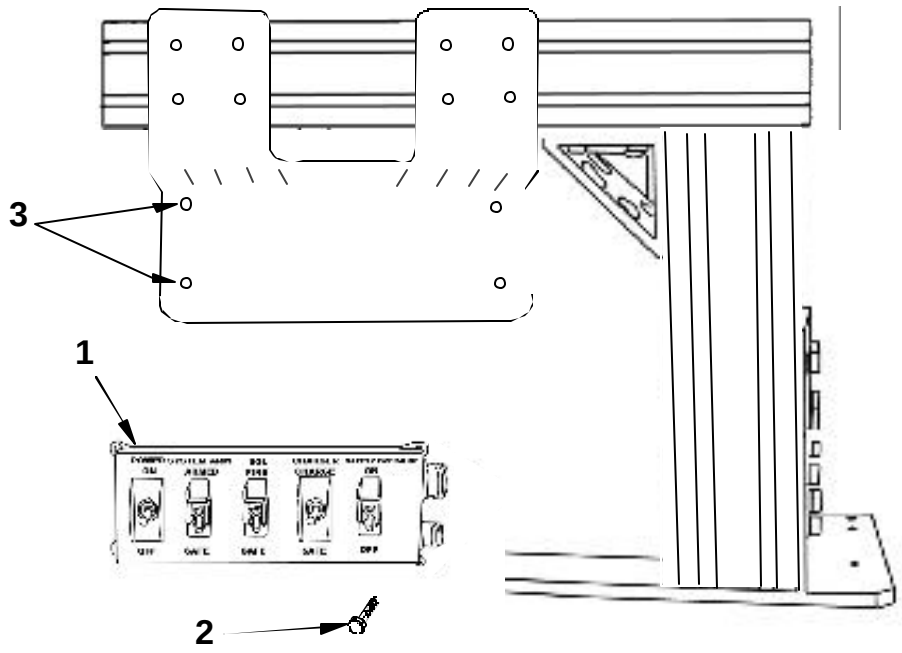


Figure 50. Removing Switch Panel Unit (SPU) - Alternative 2

Removing Switch Panel Unit (SPU) Adapter Bracket

Equipment Condition: SPU removed.

Perform the following procedure to remove the SPU Adapter Bracket.

1. Remove SPU adapter bracket (1) by removing eight 4mm hex bolts (2) using 4mm hex head wrench with T-handle.

2. Remove four each 2-hole T-nuts (3) from the front of horizontal support arm (4) (two in each groove). See Figure 51.

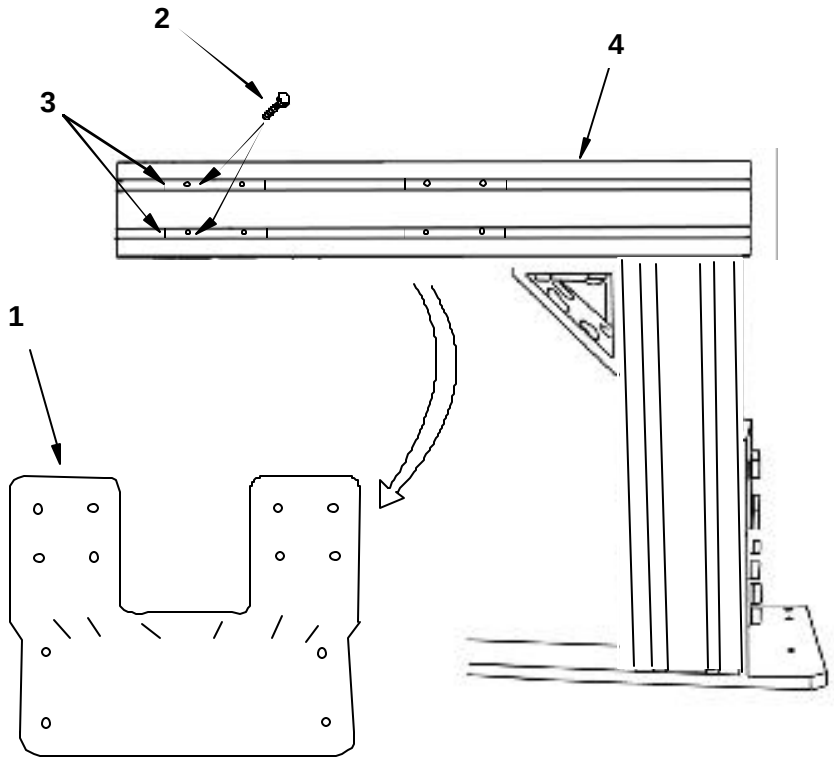


Figure 51. Removing Switch Panel Unit (SPU) Adapter Bracket - Alternative 2

Removing Switch Panel Unit (SPU) and SPU Adapter Bars - Alternative 3

Removing Switch Panel Unit (SPU)

Equipment Condition: None.

Perform the following procedure to remove the SPU.

1. Ensure cables are removed from connections J1 and J2 on SPU (1).

2. Remove four bolts (2) securing SPU (1) to display unit support arm assembly (3) adaptor bars (4). See Figure 52.

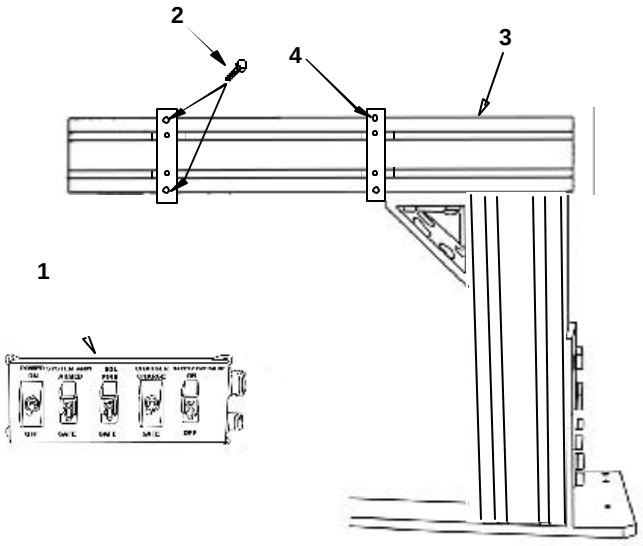


Figure 52. Removing the Switch Panel Unit (SPU) - Alternative 3

Removing SPU Adaptor Bars

Equipment Condition: SPU removed.

Perform the following procedure to remove the SPU adaptor bars.

1. Remove two bolts (1) from each adapter bar (2) securing adaptor bar to display unit support arm assembly (3). See Figure 53.

2. Remove four 1-hole T-nuts with grommet (4) from tracks of horizontal arm of display unit support arm assembly (3).

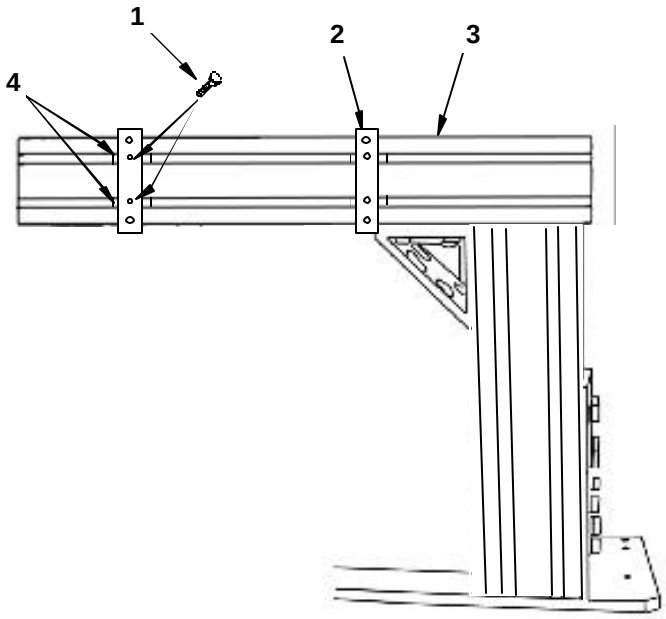


Figure 53. Removing Switch Panel Unit (SPU) Adapter Bars - Alternative 3

Removing Display Unit

Equipment Condition: None.

Perform the following procedure to remove the display unit.

1. Remove cable from connection J1 of the back of the display unit (1). See Figure 54.
2. Remove sixteen bolts (2), lock washers (3), and flat washers (4) using an 8mm open end box wrench.
3 Retain the four tapping blocks (5) from inside the inner insulated brackets (6).

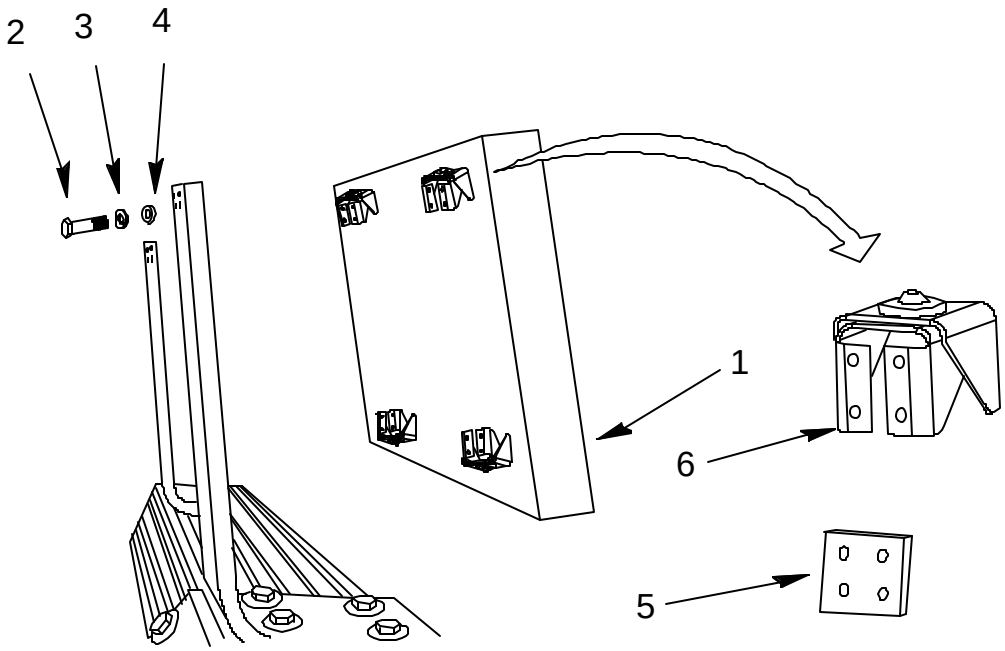


Figure 54. Removing Display Unit

Removing Display Unit Upright Mounting Brackets

Equipment Condition: Display unit removed. End cap removed.

Perform the following procedure to remove the display unit associated components.

NOTE

The procedure describes removal of both upright mounting brackets (1,2).

1. Remove eight bolts (3), lock washers (4), and flat washers (5) using 1/2-inch open end box wrench. See Figure 55.

2. Remove two 2-hole nutplates (6) from each horizontal support arm track (7).

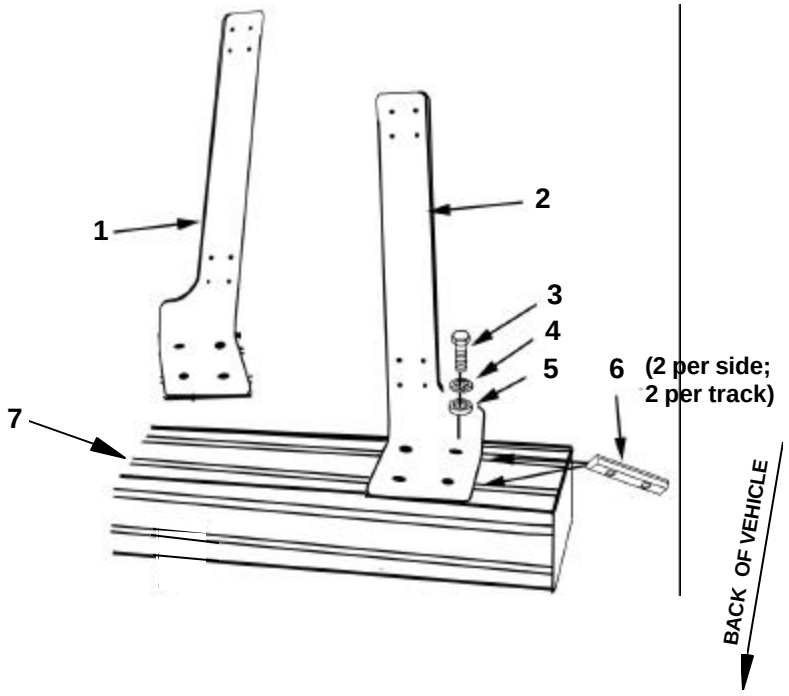


Figure 55. Removing Upright Mounting Brackets

Removing Joystick

Equipment Condition: None

Perform the following procedure to remove the joystick.

1. Disconnect joystick cable from J2 on the SPU (1). See Figure 56.
2. Grasp joystick (2) and remove by pushing down, turning CCW, and lifting up.

Removing Joystick Holder

Equipment Condition: Joystick removed.

Perform the following procedure to remove the joystick holder.

1. Remove joystick holder (3) from joystick bracket (4) by removing three 4mm hex screws (5) using 4mm hex head wrench with T-handle. See Figure 56.

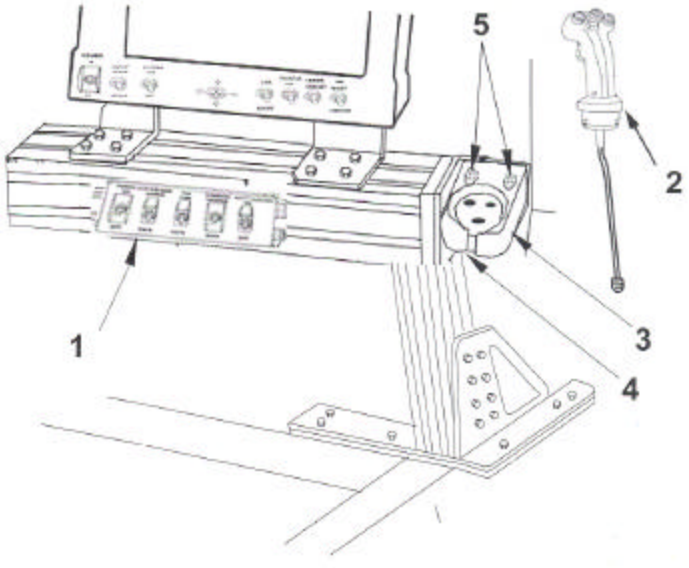


Figure 56. Removing Joystick and Joystick Holder

Removing Joystick Bracket

Equipment Condition: Joystick and joystick holder removed.

Perform the following procedure to remove the joystick bracket.

1. Remove joystick bracket (1) from horizontal support arm (2) by removing four countersunk 4mm hex screws (3) using 4mm hex head wrench with T-handle. See Figure 57.

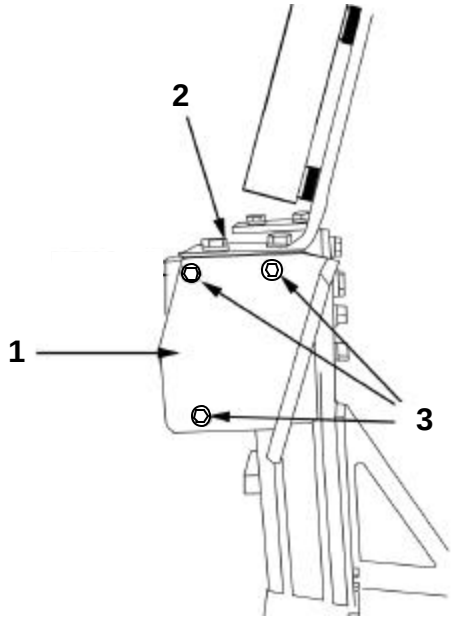


Figure 57. Removing Joystick Bracket

Removing Display Unit Support Arm Assembly from Display Unit Base Bracket

Equipment Condition: SPU removed; SPU adaptor bar and T-nuts removed; display unit removed; and joystick, joystick holder, and joystick bracket removed.

Perform the following procedure to remove the display unit support arm assembly from the display unit base bracket.

1. Remove four bolts (1), lock washers (2), and flat washers (3) from front of display unit base bracket (4). See Figure 58.

2. Remove eight bolts (5), lock washers (6), and flat washers (7) from side of display unit base bracket (4).

3. Remove display unit support arm assembly (8) from display unit base bracket (4).

4. Remove four 1-hole T-nuts with grommet (9) and two 4-hole T-nuts (10) from display unit support arm assembly (8).

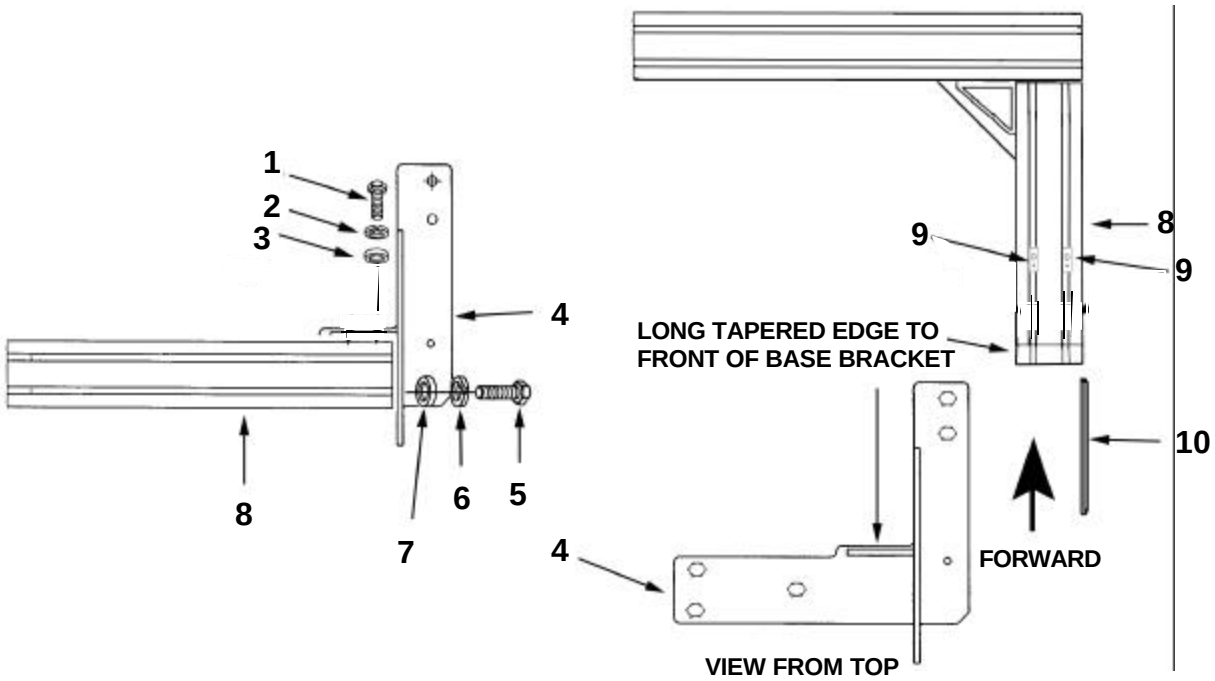


Figure 58. Removing Display Unit Support Arm Assembly

Removing Display Unit Base Bracket

Equipment Condition: SPU removed; SPU adaptor bar and T-nuts removed; display unit removed; display unit support arm assembly and associated components removed; and joystick, joystick holder, and joystick bracket removed.

Perform the following procedure to remove the display unit base bracket.

1. Remove five bolts (1) and washers (2) and display unit base bracket (3). See Figure 59.
2. Remove 3-hole display unit base bracket spacer (4) and upper shim (5).
3. Remove tunnel spacer shims (6) from the countersunk bolt holes.

NOTE

If nut plate is not secured to support beam, it may drop into the access panel upon removal of the bolts. You may need to remove access panel to remove the nut plate.

4. Remove 2-hole nut plate (7) from underside of support beam.
5. Remove two shims (8) from countersunk bolt holes.

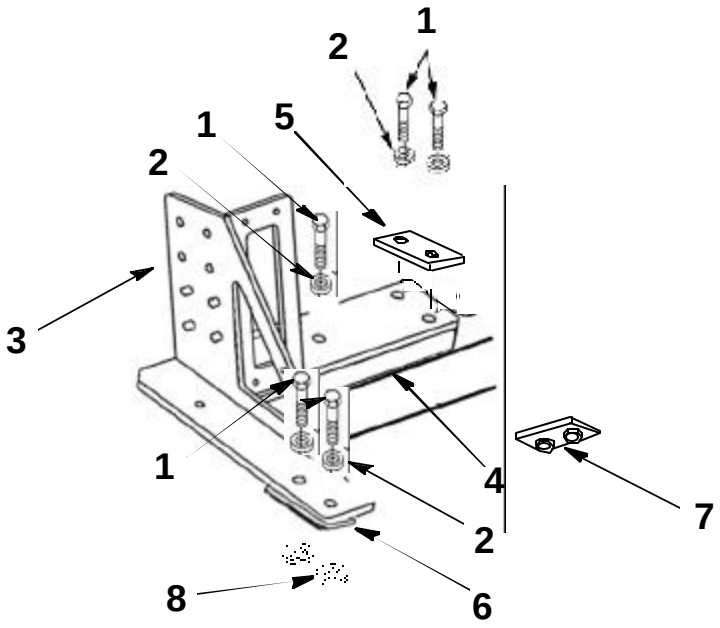


Figure 59. Removing Display Unit Base Bracket

Removing Hatch Interlock Switch

Perform the following procedure to remove the hatch interlock switch.

1. Remove one bolt (1) from hatch interlock switch (2). Remove front center hatch lock (3) and spacer block (4). See Figure 60.

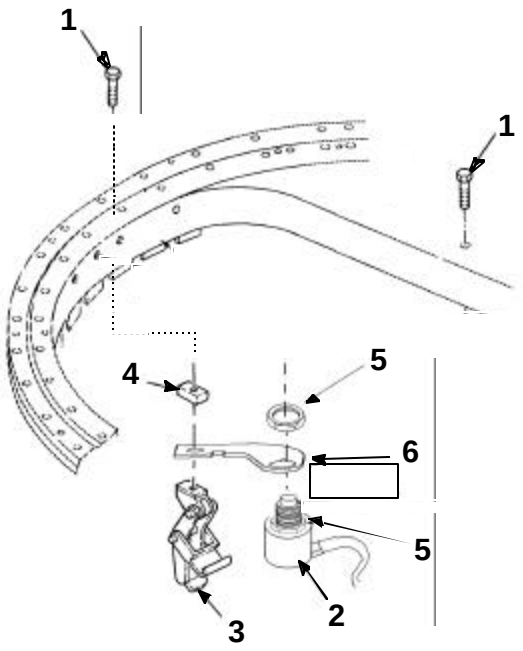


Figure 60. Removing Hatch Interlock Switch

2. Using two 13/16 inch open end wrenches, remove two nuts (5) from bracket (6) on hatch interlock switch (2).

Removing the EMU from Plate Assembly

NOTE

Disconnect all EMU cables prior to removing the EMU.

Perform the following procedure to remove the EMU from the plate assembly.

1. Firmly grasp the EMU (1), and remove four bolts (2) and lock washers (3) from the EMU (1) using a 4mm hex head wrench with T-handle. See Figure 61.

2. Remove EMU from plate assembly (4).

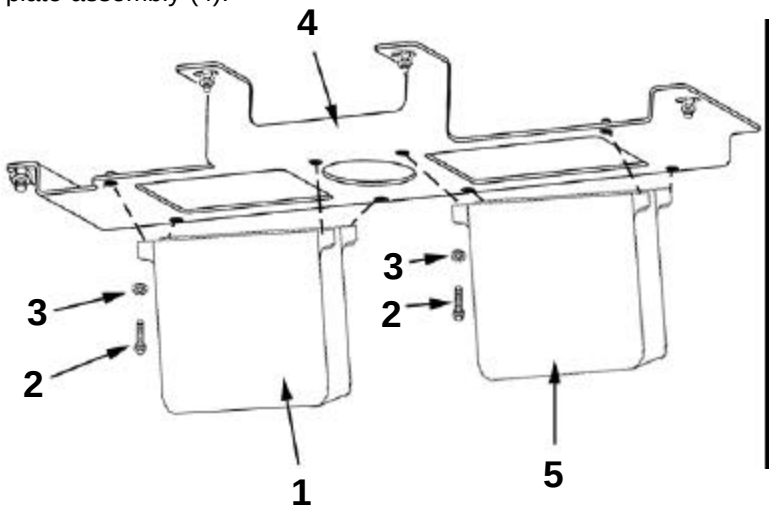


Figure 61. Removing the ICU and EMU from Plate Assembly

Removing the ICU from Plate Assembly

NOTE

Disconnect all ICU cables prior to removing the ICU.

Perform the following procedure to remove the ICU from the plate assembly.

1. Firmly grasp the ICU (5), and remove four bolts (2) and washers (3) from the ICU (5) using a 4mm hex head wrench with T-handle. See Figure 61.

2. Remove ICU (5) from plate assembly (4).

Removing Plate Assembly

Equipment Condition: ICU and EMU removed.

Perform the following procedure to remove the plate assembly.

1. Remove two nuts (1) and washers (2) from roof mounting studs (3) and two bolts (4) and washers (5) from center hatch mounting (6). See Figure 62.

2. Remove plate assembly (7).

3. Retain all hardware nuts and washers for re-installation.

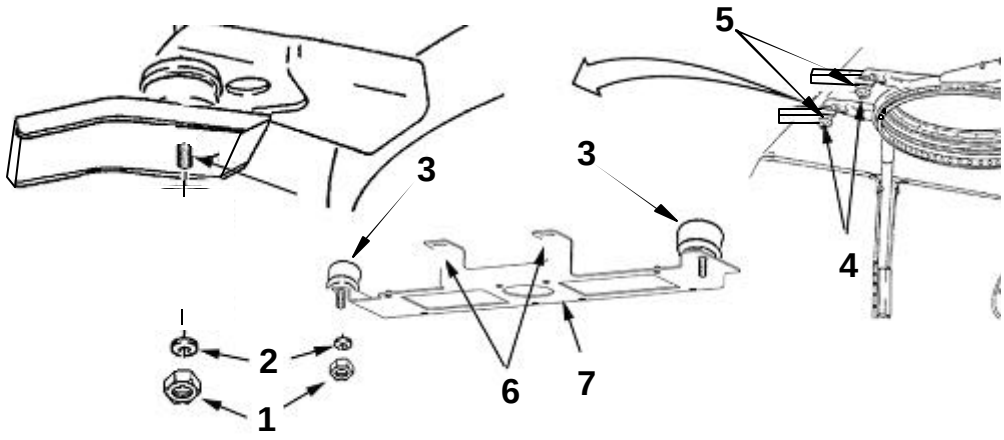


Figure 62. Removing Plate Assembly

Removing Batwing

NOTE

Two personnel may be needed for this procedure.

Perform the following procedure to remove the batwing.

1. Remove VIK batwing (1) by removing thirteen bolts (2), twenty-six washers (3), and thirteen nuts (4). See Figure 63.
2. Inspect gasket (5). Replace if needed.
3. Replace original pintle weapon mount per TM 9-2320-387-24 if converting back to original HMMWV configuration.

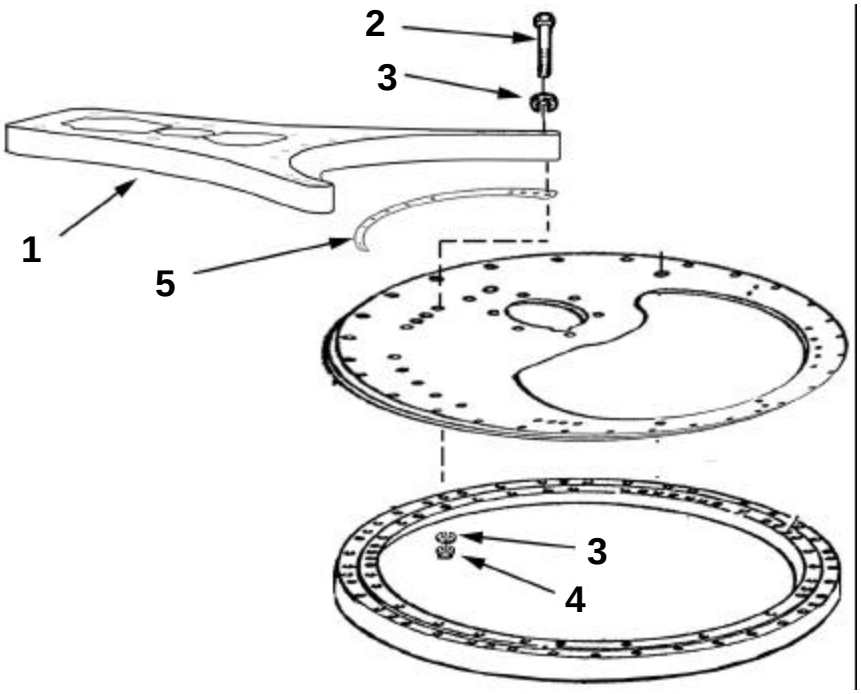


Figure 63. Removing Batwing

Removing Access Hole Cover and Nut Ring from Turret

Perform the following procedure to remove the access hole cover and nut ring from the turret.

1. Remove six hex head cap screws (1) and flat washers (2) on the access hole cover (3). Remove two hex head cap screws (4), four flat washers (5), and two hex locking nuts (6). Remove access hole cover (3) with gasket (7) and nut ring (8). See Figure 64.

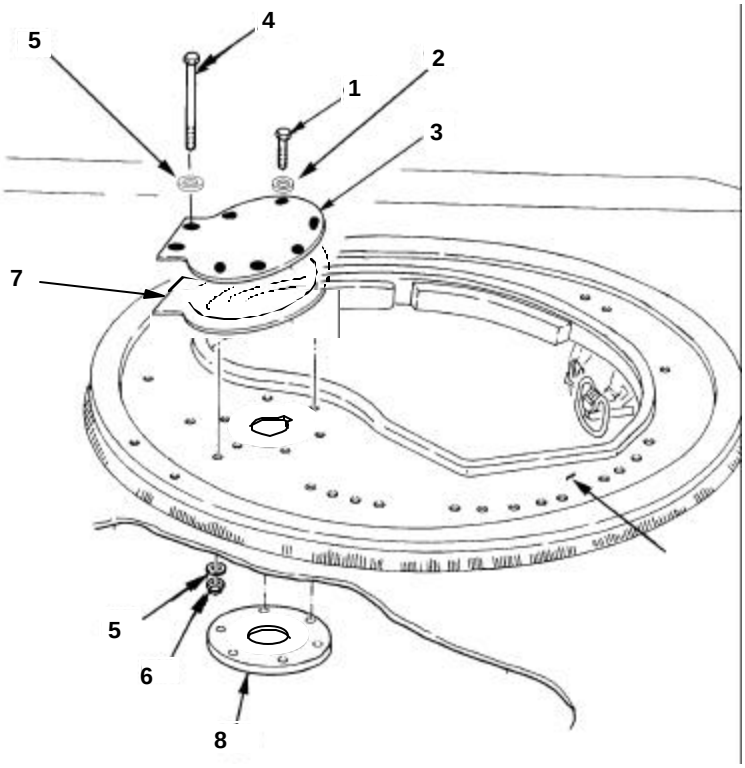


Figure 64. Removing Access Hole Cover and Nut Ring from Turret

Removing CROWS Non-Rotating Turret Spacer Ring

Perform the following procedure to remove the CROWS non-rotating turret spacer ring.

Refer to Removing Turret Bearing and Turret Components procedure of this work package.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

VEHICLE INTEGRATION KIT

This work package is left intentionally blank.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

ILLUSTRATED LIST OF MANUFACTURED ITEMS

There are no manufactured items in this manual.

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

TORQUE LIMITS

This work package provides general torque limits for screws used on the CROWS.

GENERAL INFORMATION

Special torque limits are indicated in the maintenance procedures for applicable components. The general torque limits given in this work package shall be used when specific torque limits are not indicated in the maintenance procedure. These general torque limits cannot be applied to screws that retain rubber components. The rubber components will be damaged before the correct torque limit is reached. If a special torque limit is not given in the maintenance instructions, tighten the screw or nut until it touches the metal bracket, then tighten it one more turn. Table 1 describes the markings on capscrew heads.

TORQUE LIMITS

Table 2 lists dry torque limits. Dry torque limits are used on screws that do not have lubricants applied to the threads. Table 3 lists wet torque limits. Wet torque limits are used on screws that have high-pressure lubricants applied to the threads. For metric fasteners, refer to Table 4 for torque limit requirements.

How to Use Torque Table 2

a. Measure the diameter of the screw you are installing. See Figure 1.

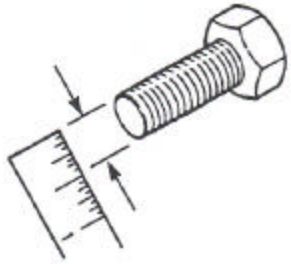


Figure 1. Measuring the Diameter of a Screw

b. Count the number of threads per inch. See Figure 1.

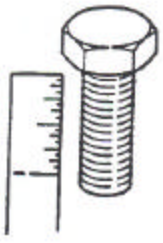


Figure 2. Counting Threads Per Inch of a Screw

c. Under the heading SIZE, look down the left hand column until you find the diameter of the screw you are installing (there will usually be two lines beginning with the same size).

d. In the second column under SIZE, find the number of threads per inch that matches the number of threads you counted in step b.

Table 1. Capscrew Head Markings

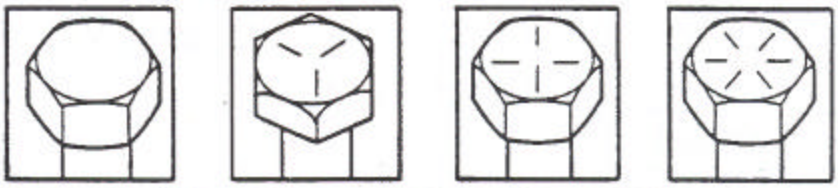
Manufacturer's marks may vary. These are all SAE Grade 5 (3-line).	Metric screws are of three grades: 8.8, 10.9, and 12.9. Grades & Manufacturer's marks appear on the screw head.
	
STANDARD	**METRIC**

e. To find the grade screw you are installing, match the markings on the head to the correct picture of CAPSCREW HEAD MARKINGS on the torque table.

f. Look down the column under the picture you found in step e. until you find the torque limit (in lb-f% or N.m) for the diameter and threads per inch of the screw.

Table 2. Torque Limits for Dry Fasteners

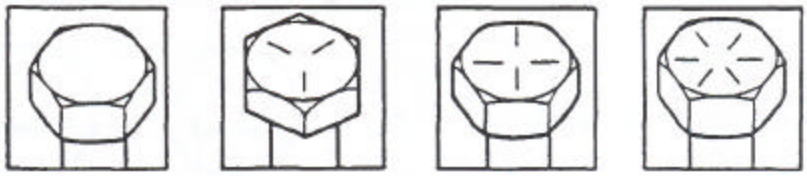
CAPSCREW HEAD MARKINGS



SIZE			TORQUE							
			SAE GRADE NO. 1 or 2		SAE GRADE NO. 5		SAE GRADE NO. 6 or 7		SAE GRADE NO. 8	
DIA. INCHES	THREADS PER INCH	DIA. MILLIMETERS	POUND FEET	NEWTON METERS	POUND FEET	NEWTON METERS	POUND FEET	NEWTON METERS	POUND FEET	NEWTON METERS
1/4	20	6.35	5	6.78	8	10.85	10	13.56	12	16.27
1/4	28	6.35	6	8.14	10	13.56	—	—	14	18.98
5/16	18	7.94	11	14.92	17	23.05	19	25.76	24	32.54
5/16	24	7.94	13	17.63	19	25.76	—	—	27	36.61
3/8	16	9.53	18	24.41	31	42.04	34	46.10	44	59.66
3/8	24	9.53	20	27.12	35	47.46	—	—	49	66.44
7/16	14	11.11	28	37.97	49	66.44	55	74.58	70	94.92
7/16	20	11.11	30	40.68	55	74.58	—	—	78	105.77
1/2	13	12.70	39	52.88	75	101.70	85	115.26	105	142.38
1/2	20	12.70	41	55.60	85	115.26	—	—	120	162.72
9/16	12	14.29	51	69.16	110	149.16	120	162.72	155	210.18
9/16	18	14.29	55	74.58	120	162.72	—	—	170	230.52
5/8	11	15.88	63	85.43	150	203.40	167	226.45	210	284.76
5/8	18	15.88	95	128.82	170	230.52	—	—	240	325.44
3/4	10	19.05	105	142.38	270	366.12	280	379.68	375	508.50
3/4	16	19.05	115	155.94	295	400.02	—	—	420	569.52
7/8	9	22.23	160	216.96	395	535.62	440	596.64	605	820.38
7/8	14	22.23	175	237.30	435	589.86	—	—	675	915.30
1	8	25.40	235	318.66	590	800.04	660	894.96	910	1233.96
1	14	25.40	250	339.00	660	894.96	—	—	990	1342.44
1-1/8	—	28.58	—	—	800-880	1084.8-1193.3	—	—	1280-1440	1735.68 1952.64
1-1/4	—	31.75	—	—	—	—	—	—	1820-2000	2467.92 2712.00
1-3/8	—	34.93	—	—	1460-1680	1979.8-2278.1	—	—	2380-2720	3227.28 3688.32
1-1/2	—	38.10	—	—	1940-2200	2630.6-2983.2	—	—	3160-3560	4284.96 4827.36

Table 3. Torque Limits for Wet Fasteners

CAPSCREW HEAD MARKINGS



SIZE			TORQUE							
			SAE GRADE NO. 1 or 2		SAE GRADE NO. 5		SAE GRADE NO. 6 or 7		SAE GRADE NO. 8	
DIA. INCHES	THREADS PER INCH	DIA. MILLIMETERS	POUND FEET	NEWTON METERS	POUND FEET	NEWTON METERS	POUND FEET	NEWTON METERS	POUND FEET	NEWTON METERS
1/4	20	6.35	4.5	6.1	7.2	9.76	9.0	12.20	10.8	14.64
1/4	28	6.35	5.4	7.32	9.0	12.20	—	—	12.6	17.09
5/16	18	7.94	9.9	13.42	15.3	20.75	17.1	23.19	21.6	29.29
5/16	24	7.94	11.7	15.87	17.1	23.19	—	—	24.3	32.95
3/8	16	9.53	16.2	21.97	27.9	37.83	30.6	41.49	39.6	53.70
3/8	24	9.53	18.0	24.41	31.5	42.71	—	—	44.1	59.80
7/16	14	11.11	25.2	34.17	44.1	59.80	49.5	67.12	63.0	85.43
7/16	20	11.11	27.0	36.61	49.5	67.12	—	—	70.2	95.19
1/2	13	12.70	35.1	47.60	67.5	91.53	76.5	103.73	94.5	128.14
1/2	20	12.70	36.9	50.04	76.5	103.73	—	—	108.0	146.45
9/16	12	14.29	45.9	62.24	99.0	134.24	108.0	146.45	139.5	189.16
9/16	18	14.29	49.5	67.12	108.0	146.45	—	—	153.0	207.47
5/8	11	15.88	56.7	76.89	135.0	183.06	150.3	203.81	189.0	256.28
5/8	18	15.88	85.5	115.94	153.0	207.47	—	—	216.0	292.90
3/4	10	19.05	94.5	128.14	243.0	329.51	252.0	341.71	337.5	457.65
3/4	16	19.05	103.5	140.35	265.5	360.02	—	—	378.0	512.57
7/8	9	22.23	144.0	195.26	355.5	482.06	396.0	536.98	544.5	738.34
7/8	14	22.23	157.5	213.57	391.5	530.87	—	—	607.5	823.77
1	8	25.40	211.5	286.79	531.0	720.04	594.0	805.46	819.0	1110.56
1	14	25.40	225.0	305.10	594.0	805.46	—	—	891.0	1208.20
1-1/8	—	28.58	—	—	720.0-792.0	976.32-1073.95	—	—	1152.0-1296.0	1562.11-1757.38
1-1/4	—	31.75	—	—	—	—	—	—	1637.99-1800.00	2221.11-2440.80
1-3/8	—	34.93	—	—	1314.0-1512.0	1781.78-2050.27	—	—	2142.0-2448.0	2904.55-3319.49
1-1/2	—	38.10	—	—	1746.0-1980.0	2367.58-2684.88	—	—	2844.0-3204.0	3856.46 4344.62

Table 4. Torque Limits for Metric Fasteners

CAPSCREW HEAD MARKINGS



SIZE	TORQUE	
	POUND FEET	NEWTON METERS
M6	7 - 11	9.49 - 14.92
M8	21 - 35	28.48 - 47.46
M10	45 - 65	61.02 - 88.14
M12	80 - 120	108.48 - 162.72
M14	130 - 190	176.28 - 257.64
M16	200 - 280	271.20 - 379.68
M20	400 - 520	542.40 - 705.12
M24	700 - 900	949.20 - 1220.40
M30	1400 - 1800	1898.40 - 2440.80
M36	2400 - 3000	3254.40 - 4068.00

CONVERSION FORMULA

Corrected dial or scale readings are determined by the use of the following formula:

$$\text{Corrected reading} = \text{Required torque value} \div \frac{\text{Length of torque wrench + Length of adapter}}{\text{Length of torque wrench}}$$

NOTE

The length of the torque wrench is measured from the center of the handle to the center of the drive. The length of the adapter is measured from the center of the drive to the center of the wrench. See Figure 3.

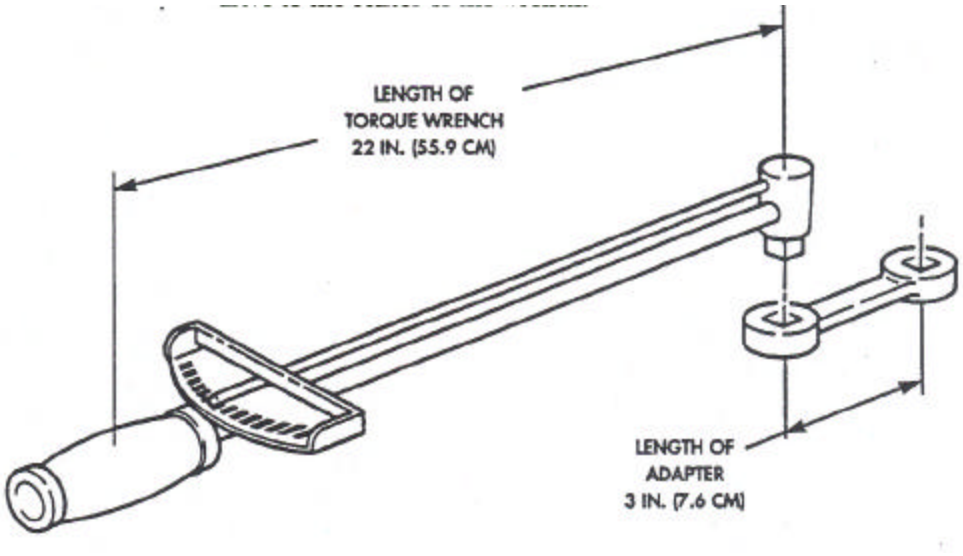


Figure 3. Example of Corrected Scale Reading

In this example, the torque wrench measures 22 in. (55.9 cm) and the adapter is 3 in (7.6 cm). The required torque is 19 ft lbs (25.8 Nm). See Table 5.

Table 5. Torque Corrected Readings

Corrected reading	=	19 ft lbs (25.8 Nm)	÷	~~22 in. + 3 in. (55.9 cm + 7.6 cm)~~ 22 in. (55.9 cm)
Corrected reading	=	19 ft lbs (25.8 Nm)	÷	~~25 in. (63.5 cm)~~ 22 in. (55.9 cm)
Corrected reading	=	19 ft lbs (25.8 Nm)	÷	1.14
Corrected reading	=	17 ft lbs (23.1 Nm)	÷	

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

GLOSSARY WITH METRIC CONVERSION CHART

This work package contains four 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
AAL	Additional Authorization List
AD	SMR source code
AEPS	Army Electronic Product Support
AF	SMR source code
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
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
BDU	Battle dress uniform
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; Ballistic Protection Assembly
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
CG	Control Group
COAX	Coaxial cable; called "coaxial" because it includes one physical channel that carries the signal surrounded (after a layer of insulation) by another concentric physical channel, both running along the same axis. The outer channel serves as a ground. Many of these cables or pairs of coaxial tubes can be placed in a single outer sheathing and, with repeaters, can carry information for a great distance.
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

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
DOL	Directorate of Logistics
DPW	Directorate of Public Works
DS	Direct Support maintenance
DSP	Digital Signal Processor
DVEA	Digital Video Electronics Assembly
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
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
FSR	Field Service Representative
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
GMTK	General Mechanic's Tool Kit
GWS	Gimballed weapon station
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

Table 1. General Abbreviations and Terms – Cont.

Term, Abbreviation (Acronym)	Definition
HDI	Chemical compound in CARC; hexamethylene-1,6-diisocyanate **WARNING** HDI is a potential sensitizer, especially to asthmatics. Soldiers who are asthmatic should not apply CARC because a severe, life-threatening allergic reaction may occur.
Hot, white or black	Polarity options when using the thermal camera
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
LAR	Logistics Assistance Representative
LCD	Liquid crystal displays
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
Loom	Cable or wiring harness (alternate term)
LOS	Line of Sight
LRF	Laser Rangefinder
LRU	Line Replacement Unit, equivalent to Unit-level maintenance
M2, M2 HB, M2 HB .50-cal	M2 Heavy Barrel (HB) .50-caliber automatic machine gun listed by model and ammunition caliber

Table 1. General Abbreviations and Terms – Cont.

Term, Abbreviation (Acronym)	Definition
M240, M240 7.62-mm	M240 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
MPI	Mean Point of Impact
MSDS	Material Safety Data Sheet Contain information about components, usage, storage, safety issues/concerns, and disposal of materials
MSI	Maintenance Significant Items; items required for operation of the CROWS but that do not require disassembly, including attaching hardware (e.g., screws, nuts, bolts, spacers) and switches/buttons
MI	Maintenance significant items; parts required for operation of the CROWS but that do not require disassembly, including attaching hardware (e.g., screws, nuts, bolts, spacers) and switches/buttons
MUX	Multiplexer
NBC	Nuclear, Biological, And Chemical Refers to contamination conditions
NFOV	Narrow Field of View
NHA	Next Higher Assembly
NOTE	Highlights essential procedures, conditions, or statements that follow.
NSN	National Stock Number
NUC	Non-Uniformity Correction, related to weapon offsets in the Menu system.
Numeric value	For data entry (Menu System), a numeric value is a series of numbers representing system data (e.g., distance or temperature).
O	SMR maintenance code (third position and fourth position) SMR recoverability code
OBIT	Operational BIT

Table 1. General Abbreviations and Terms – Cont.

Term, Abbreviation (Acronym)	Definition
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
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
PMCS	Preventive Maintenance Checks and Services
PN or P/N	Part number
PQDR	Product Quality Deficiency Report (SF Form 368)
Pr	Pressure Sensor
PSA	Power Supply Assembly
PSI	Pounds per square inch Pressure measurement related to compressed air and other items.
PWM	Pulse-width modulated
QTY, Qty, 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.
RFA	Remote Firing Assembly
RPSTL	Repair Parts and Special Tools List; see 'IPL'
RW	Range Wind
Safety wire	Material and method of securing attaching hardware and components/parts; also called "lock wire" or "tie wire" Refer to WP 0006
SEMA	Sensor Electronics Module Assembly
SG	Sensor Group

Table 1. General Abbreviations and Terms – Cont.

Term, Abbreviation (Acronym)	Definition
SGL	Smoke grenade launcher
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 direct support maintenance
SRWS	Stabilized Remote Weapon Station (in other words, CROWS)
SSEA	Sensor Support Electronics Assembly
SU	Sensor Unit
SVGA	Super Video Graphics Array (SVGA) computer display
SWM	Stabilized Weapon Mount; also referred to as 'mount'
Symbology	Text-and-graphics overlay generated by the EMU and shown on the display
Te	Temperature Sensor
TFT	Thin film transistor
TM	Technical Manual
TMDE	Test Measurement and Diagnostic Equipment
TP	Temperature pressure, as in the sensor unit's temperature pressure sensor
TRP	Target reference points
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	**Acce 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.
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 **Fo**c**c**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 Term also appears in screen messages
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	**St**abilization **ST** turns stabilization ON or OFF via a software toggle switch.
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.

Table 2. On-Screen Abbreviations and Definitions – Cont.

On-Screen Abbreviations	Definition and Description
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 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
deg	Degree (measurement of angle or temperature), also °
ft	feet
in	inches
In-lb.	inch-pound; measurement of torque
J	Joule, standard unit of energy
kg	kilograms
kmph	kilometers per hour
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
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
mm	millimeters
s, sec	second
µm	micrometers
X	Unit of magnification
Vdc, VDC	Volts direct current

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

SCHEMATICS

This work package contains schematics necessary for Unit and Direct Support maintenance of CROWS.

WP CONTENTS

Section/Subsection	Page
Stabilized Weapon Mount Assembly, Drawing 21677-0201-1	FO-1
Pedestal Assembly, Drawing 21677-1001 (Sheet 1)	FO-2
Pedestal Assembly, Drawing 21677-1001 (Sheet 2)	FO-3
Elevation Drive, Drawing 21677-3001	FO-4
Gimbal/SPU to Filter/ICU Boards and Relays/ICU Cable Schematic	FO-5
Gimbal/EM/FPD to Power/ICU boards ICU Cable Schematic	FO-6
Power in/Commander Module to Power Relay/ICU Board ICU Schematic	FO-7
Interface Control Unit Support Cap Schematic	FO-8
Flat Panel Display Switch Schematic	FO-9
Flat Panel Display Keypad Schematic	FO-10
Switch Panel Unit – Internal Cable Schematic	FO-11
Joystick Schematic Diagram	FO-12
Sensor Unit Schematic Diagram	FO-13
Electronic Module Unit Schematic Diagram	FO-14

END OF WORK PACKAGE

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

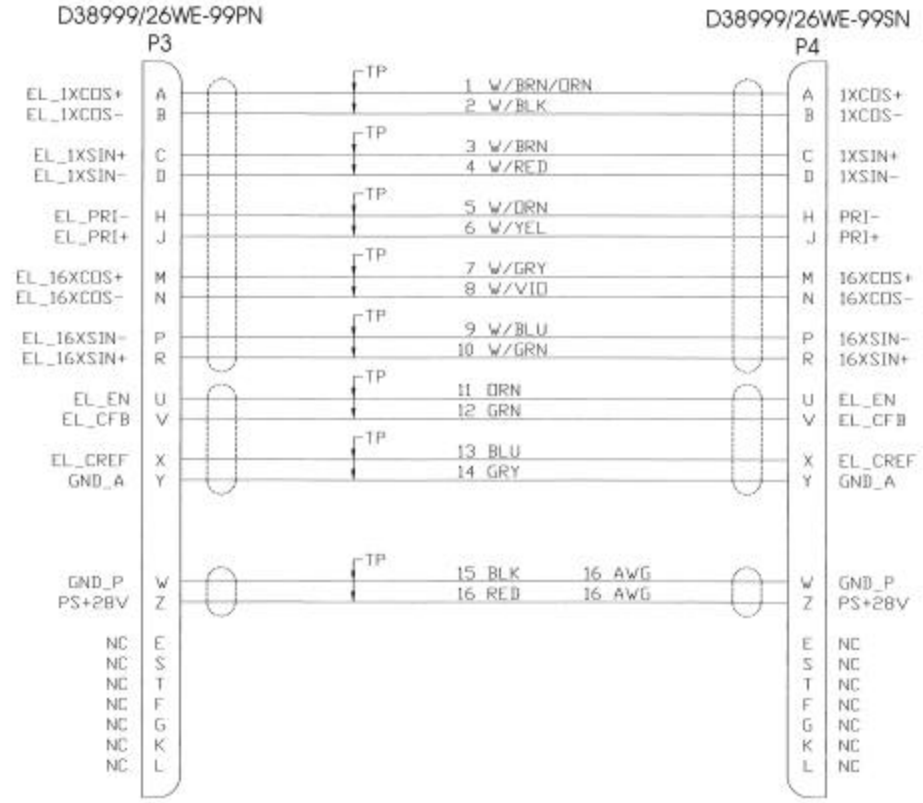
WIRING DIAGRAMS

This work package contains the wiring diagrams necessary for Unit and Direct Support maintenance of CROWS.

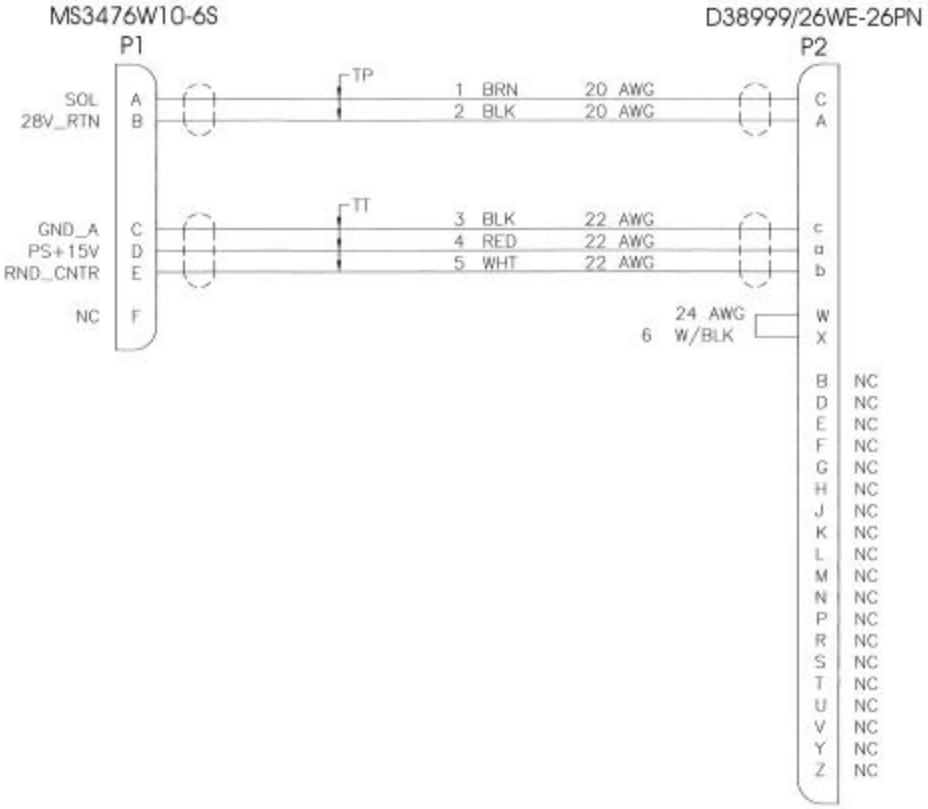
WP CONTENTS

Section/Subsection

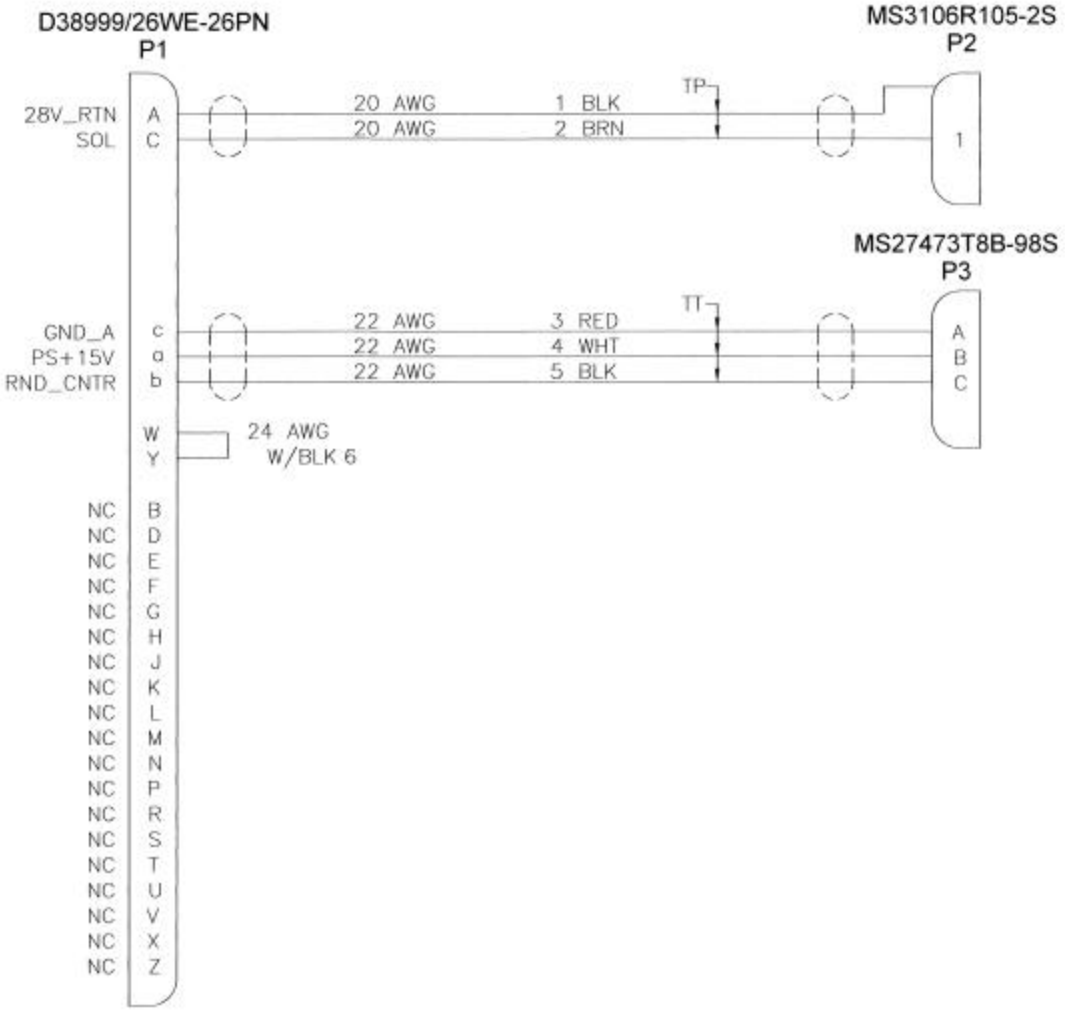
Wiring Diagram, Cable Assembly, Electrical – Weapon Elevation, 21677-3700....2
Wiring Diagram, Cable Assembly, Electrical – M2, 21677-3702....2
Wiring Diagram, Cable Assembly, Electrical – Mk19, 21677-3703....3
Wiring Diagram, Cable Assembly, Electrical – Mount to Sensor Unit, 21677-3706....4
Wiring Diagram, Cable Assembly, Electrical – Power, 21677-3713....4
Wiring Diagram, Cable Assembly, Electrical – ICU to SPU, 21677-3714....5
Wiring Diagram, Cable Assembly, Electrical – ICU to Display, 21677-3715....5
Wiring Diagram, Cable Assembly, Electrical – ICU to EMU, 21677-3716....6
Wring Diagram, Cable Assembly, Electrical – Hatch Interlock, 21677-3520....6
Wiring Diagram, Cable Assembly, Electrical – Gimbal to Bulkhead, 21677-3730....7
Wiring Diagram, Cable Assembly, Electrical – Bulkhead to ICU, 21677-3731....8
Wiring Diagram, Ogive Plunger Assembly, 21677-3225....9
Wiring Diagram, Remote Firing Assembly, 21677-3150....9
Wiring Diagram, Linear Actuator (Charger), 21677-3180....10
Pedestal Assembly, Drawing 21677-1001 (Sheet 1 of 2)....FO-15
Pedestal Assembly, Drawing 21677-1001 (Sheet 2 of 2)....FO-16



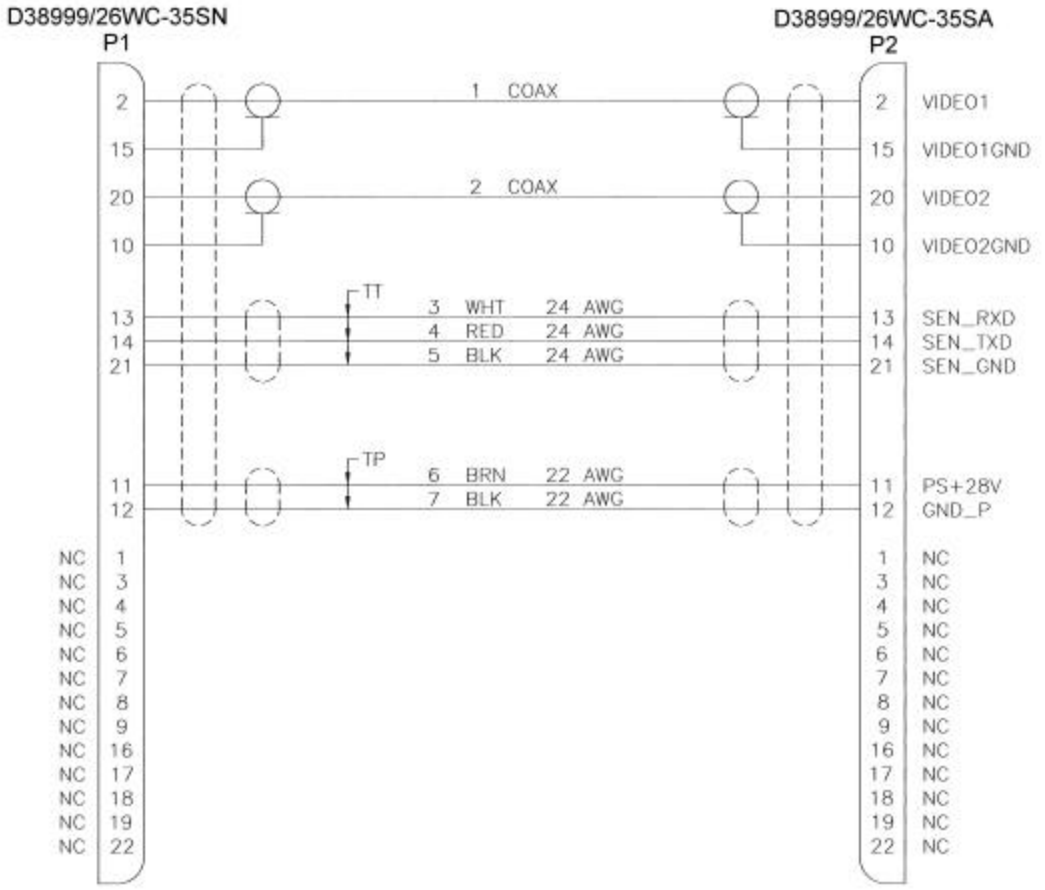
Wiring Diagram, Cable Assembly, Electrical – Weapon Elevation, 21677-3700



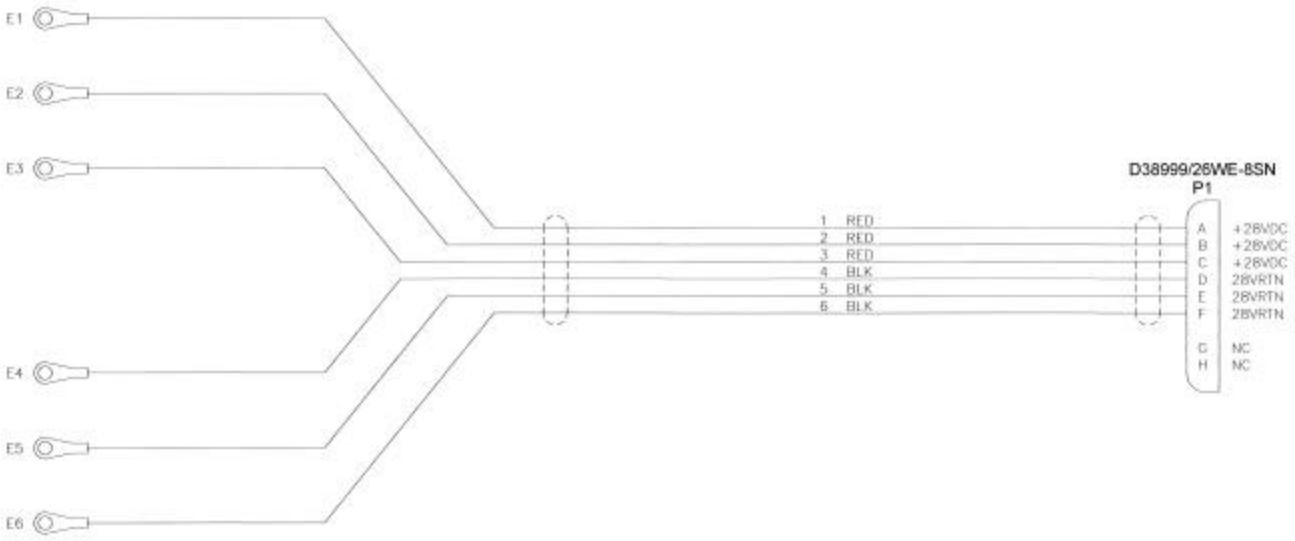
Wiring Diagram, Cable Assembly, Electrical – M2, 21677-3702



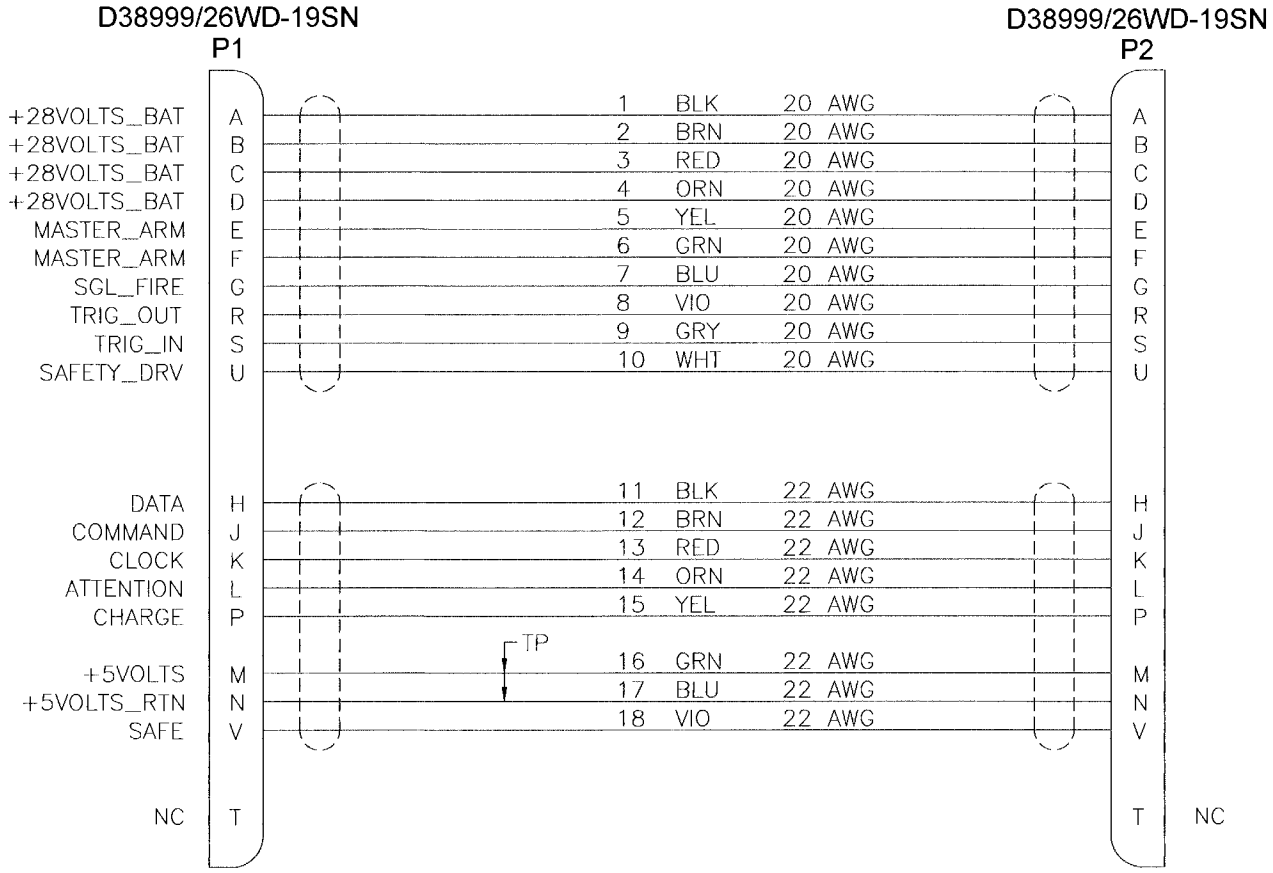
Wiring Diagram, Cable Assembly, Electrical – Mk19, 21677-3703



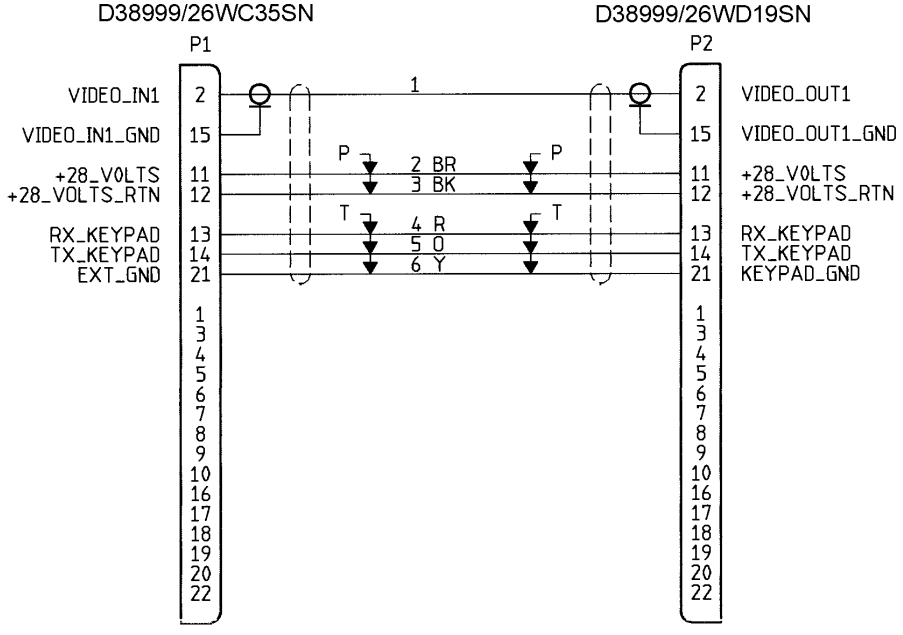
Wiring Diagram. Cable Assembly. Electrical – Mount to Sensor Unit. 21677-3706



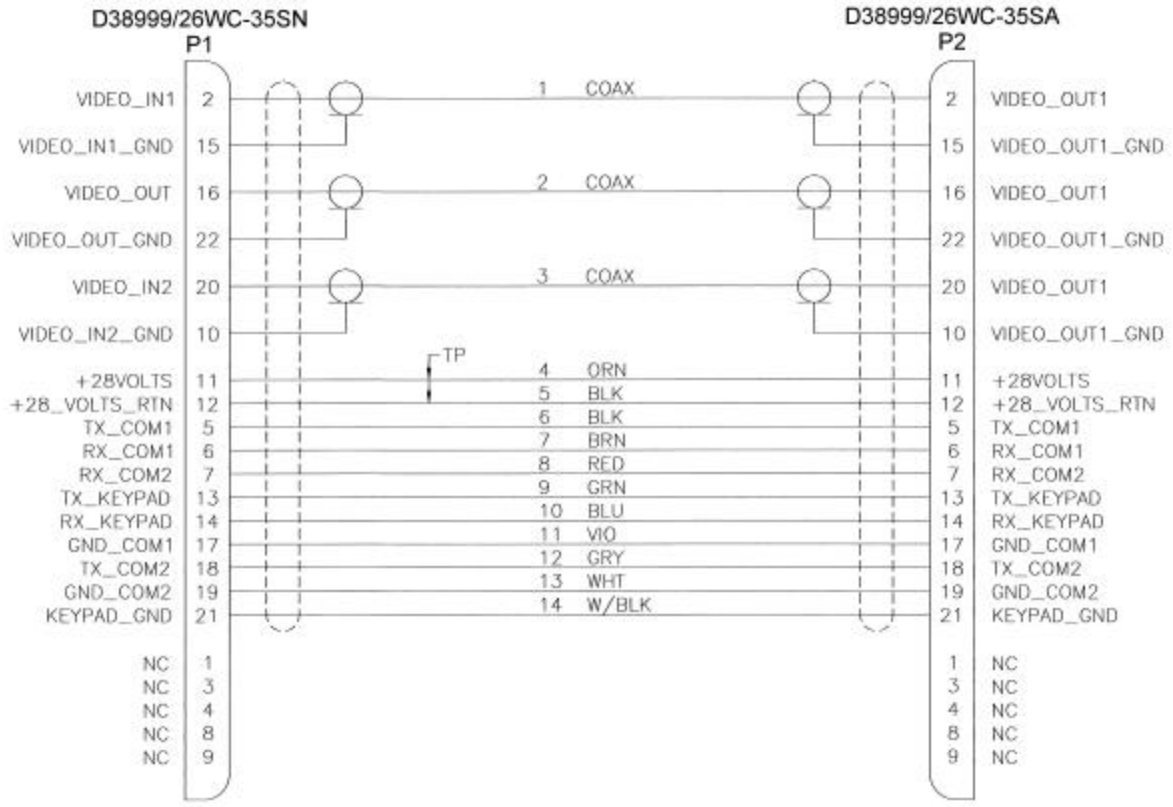
Wiring Diagram, Cable Assembly, Electrical – Power, 21677-3713



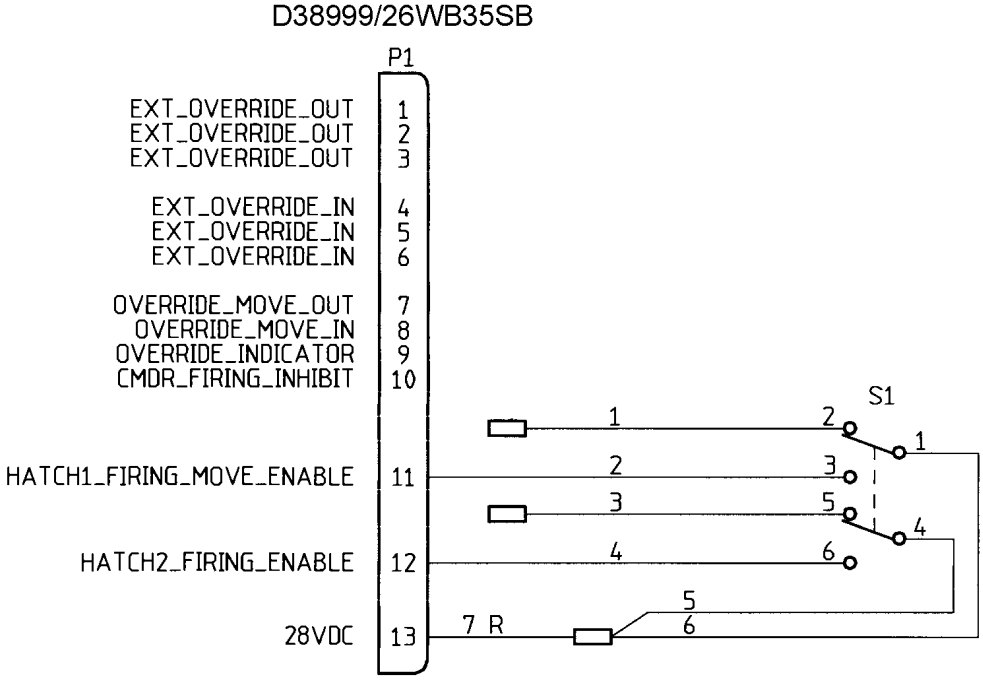
Wiring Diagram. Cable Assembly. Electrical – ICU to SPU. 21677-3714



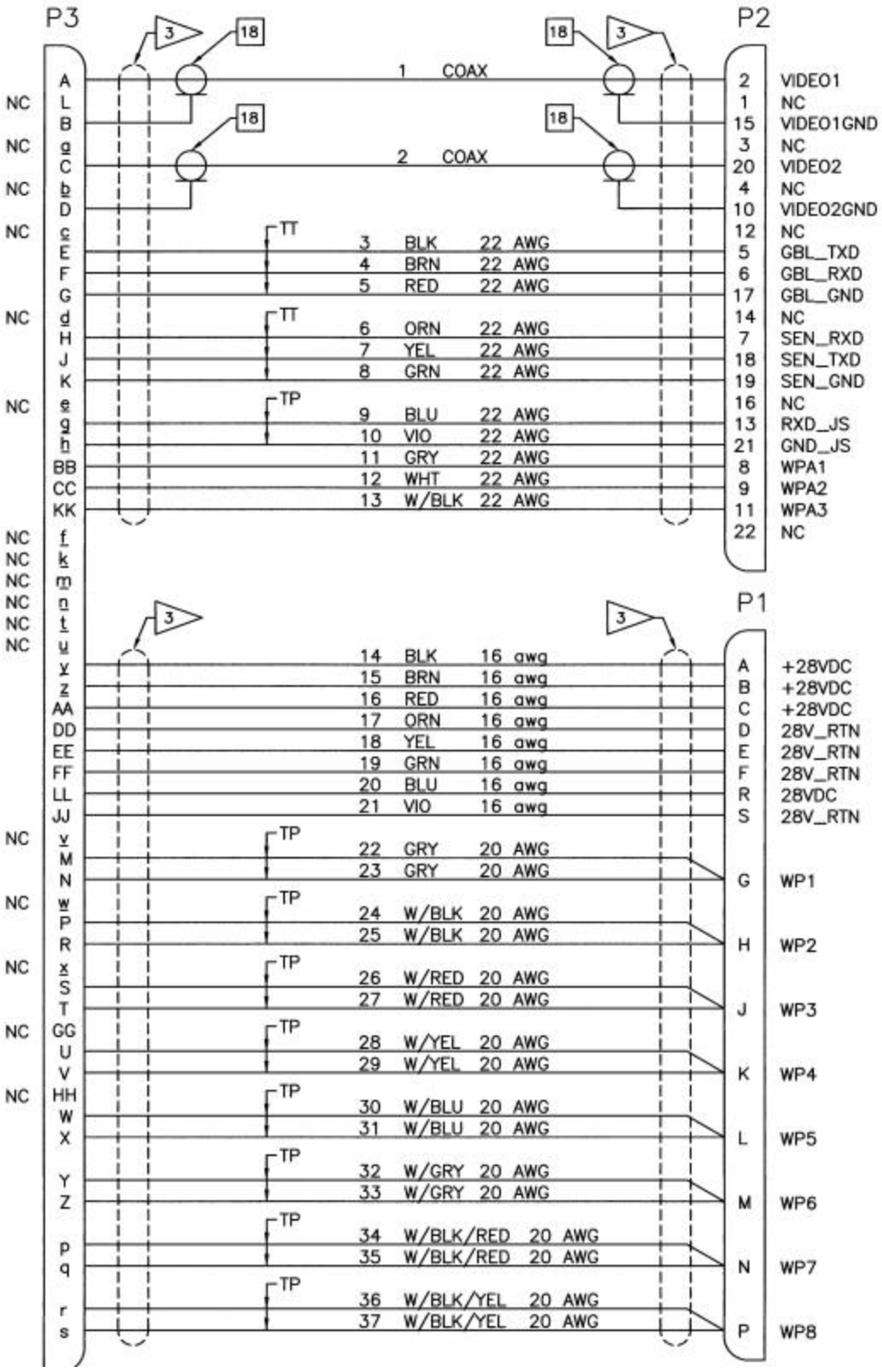
Wiring Diagram, Cable Assembly, Electrical – ICU to Display, 21677-3715



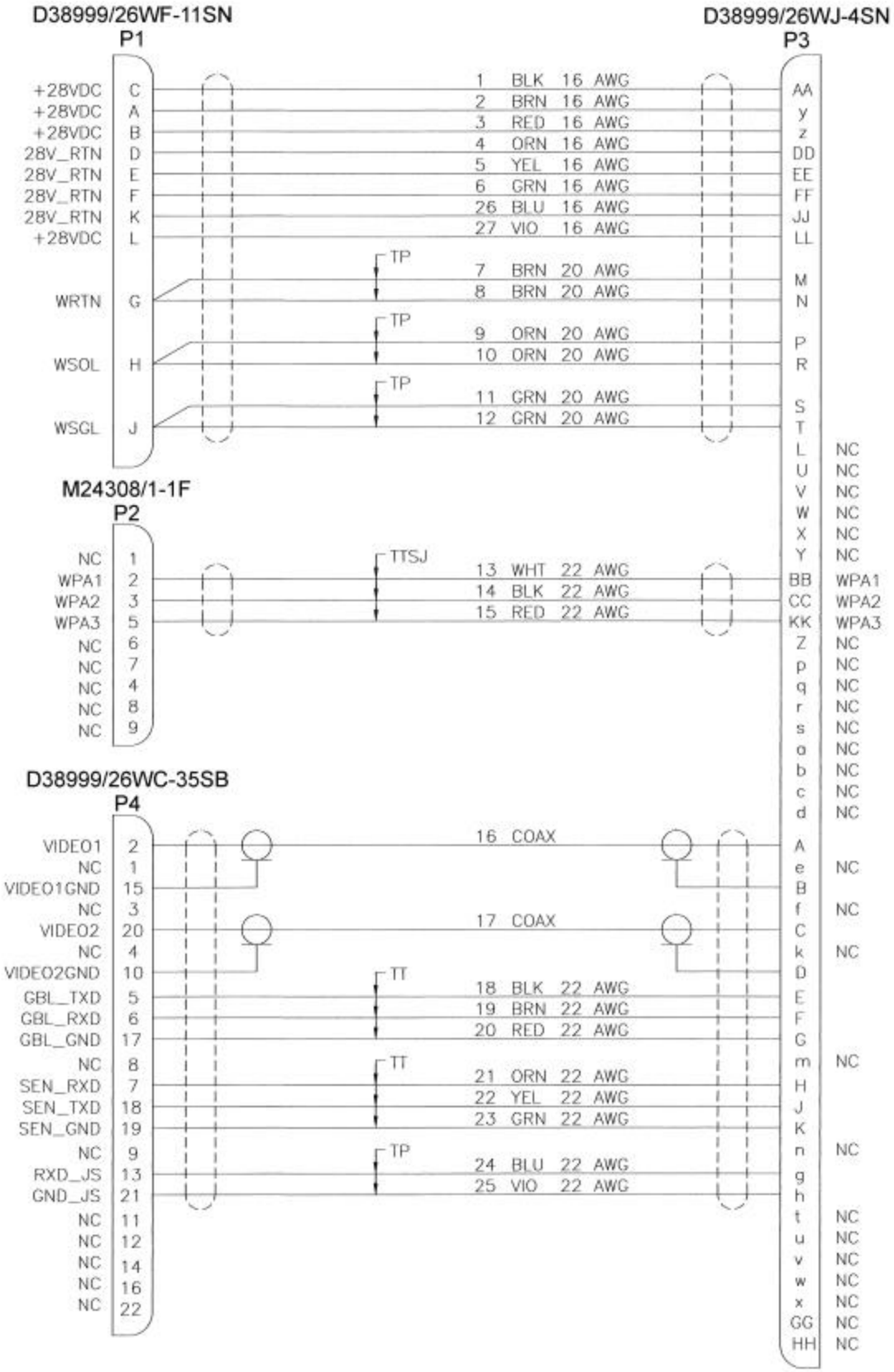
Wiring Diagram, Cable Assembly, Electrical – ICU to EMU, 21677-3716



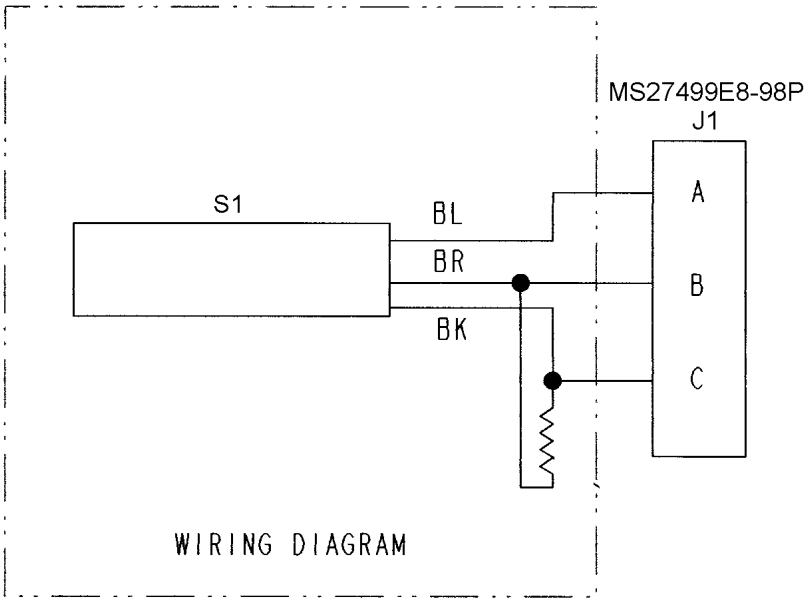
Wring Diagram, Cable Assembly, Electrical – Hatch Interlock, 21677-3520



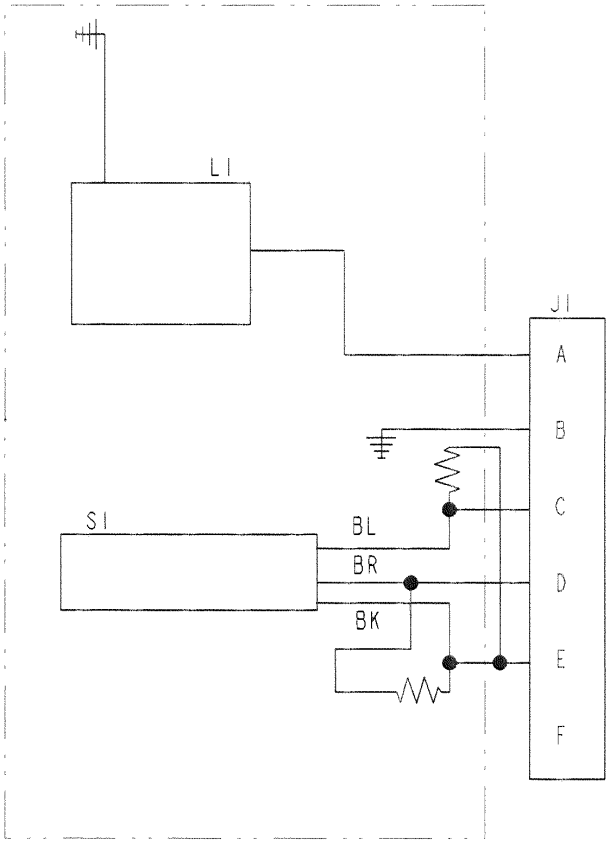
Wiring Diagram, Cable Assy., Electrical – Gimbal to Bulkhead, 21677-3730



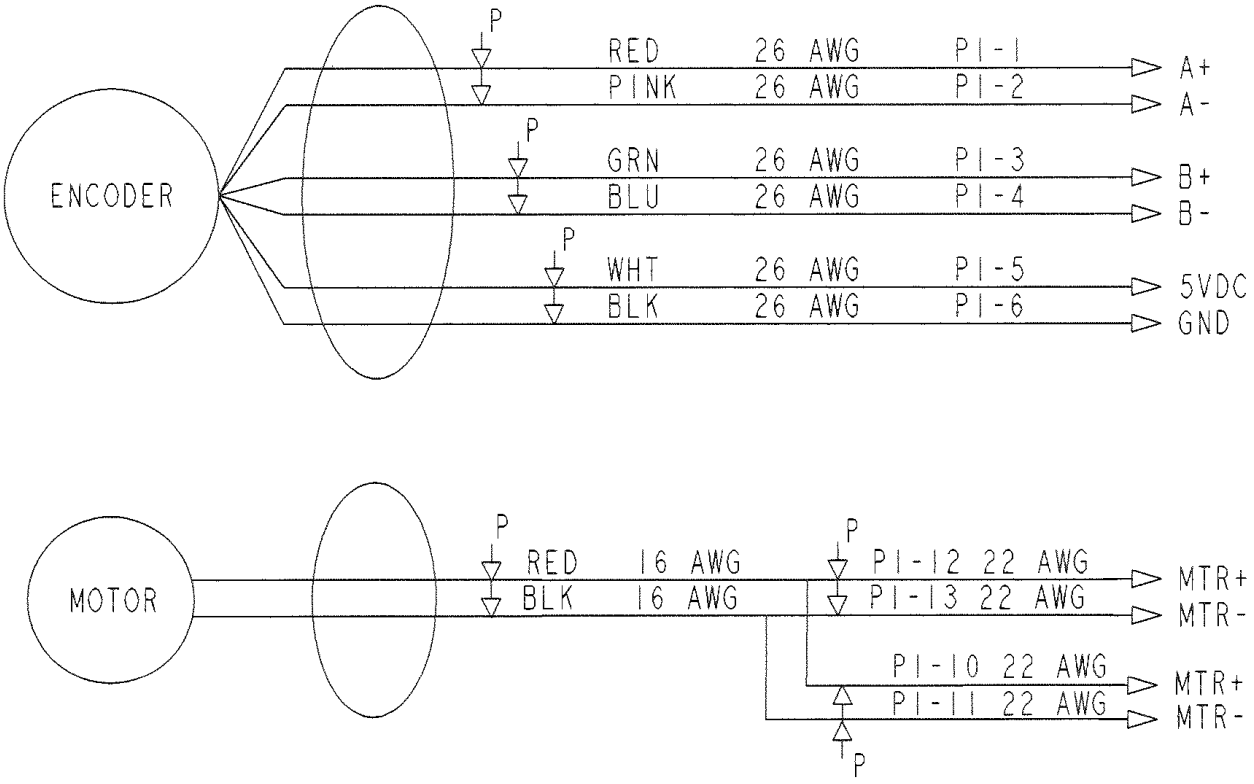
Wiring Diagram, Cable Assembly, Electrical – Bulkhead to ICU, 21677-3731



Wiring Diagram, Drive Plunger Assembly, 21677-3225



Wiring Diagram, Remote Firing Assembly, 21677-3150



Wiring Diagram, Linear Actuator (Charger), 21677-3180

CHAPTER 9

PARTS INFORMATION

MAINTENANCE MANUAL

FOR THE

ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;

COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

INTRODUCTION

This work package contains the introduction for the Repair Parts and Special Tools List (RPSTL) for the Common Remotely Operated Weapon Station (CROWS).

WP CONTENTS

Section/Subsection	Page
Scope	1
General	1
Explanation of Columns in the RPSTL	2
Item No. (Column (1))	2
SMR Code (Column (2))	2
NSN (Column (3))	5
CAGEC (Column (4))	5
Part Number (Column (5))	5
Description and Usable On Code (UOC) (Column (6))	6
QTY (Column (7))	6
Explanation of Cross Reference Index Work Package Format and Columns	6
Special Information	7
How to Locate Repair Parts	7

SCOPE

This RPSTL lists and authorizes spares and repair parts; special tools; special test, measurement, and diagnostic equipment (TMDE); and other special support equipment required for performance of Unit Maintenance of the Common Remotely Operated Weapon Station (CROWS). It authorizes the requisitioning, issue, and disposition of spares, repair parts, and special tools as indicated by the source, maintenance, and recoverability (SMR) codes.

GENERAL

In addition to the Introduction work package, this RPSTL is divided into the following work packages.

1. Repair Parts List Work Packages. Work packages containing lists of spares and repair parts authorized by this RPSTL for use in the performance of maintenance. These work packages also include parts which must be removed for replacement of the authorized parts. Parts lists are composed of functional groups in ascending alphanumeric sequence, with the parts in each group listed in ascending figure and item number sequence. Sending units, brackets, filters, and bolts are listed with the component they mount on. Bulk materials are listed by item name in FIG. BULK at the end of the work packages. Repair parts kits are listed separately in their own functional group and work package. Repair parts for reparable special tools are also listed in a separate work package. Items listed are shown on the associated illustrations.

2. Special Tools List Work Packages. Work packages containing lists of special tools, special TMDE, and special support equipment authorized by this RPSTL (as indicated by Basis of Issue (BOI) information in the DESCRIPTION AND USABLE ON CODE (UOC) column). Tools that are components of common tool sets and/or Class VII are not listed.

3. Cross-Reference Indexes Work Packages. There are two crossreference index work packages in this RPSTL: the National Stock Number (NSN) Index work package, and the Part Number (P/N) Index work package. The

National Stock Number Index work package refers you to the figure and item number. The Part Number Index work package refers you to the figure and item number.

EXPLANATION OF COLUMNS IN THE PARTS LIST WORK PACKAGES

Item No. (Column (1))

Indicates the number used to identify items called out in the illustration.

SMR Code (Column (2))

The SMR code containing supply/requisitioning information, maintenance level authorization criteria, and disposition instruction, as shown in the following breakout:

Table 1. SMR Code Explanation

Source Code	Maintenance Code		Recoverability Code
XX	XX		X
1st two positions: How to get an item	3rd position: Who can install, replace, or use the item	4th position: Who can do complete repair* on the item	5th position: Who determines disposition action on unserviceable items

* Complete Repair:
Maintenance capacity, capability, and authority to perform all corrective maintenance tasks of the “Repair” function in a use/user environment in order to restore serviceability to a failed item.

Source Code

The source code tells you how you get an item needed for maintenance, repair, or overhaul of an end item/equipment. Explanations of source codes follow:

Source Code	Application/Explanation
PA **PB** **PC** **PD** **PE** **PF** **PG** **PH** **PR** **PZ**	**NOTE** Items coded "PC" are subject to deterioration. Stock items: Use the applicable NSN to requisition/request items with these source codes. They are authorized to the level indicated by the code entered in the 3rd position of the SMR code.
KD **KF** **KB**	Items with these codes are not to be requested/requisitioned individually. They are part of a kit which is authorized to the maintenance level indicated in the 3rd position of the SMR code. The complete kit must be requisitioned and applied.
MO – Made at unit level **MF** – Made at DS **MH** – Made at GS level **ML** – Made at SRA **MD** – Made at depot	Items with these codes are not to be requested/requisitioned individually. They must be made from bulk material, which is identified by the P/N in the DESCRIPTION AND USABLE ON CODE (UOC) column and listed in the bulk material group work package of the RPSTL. If the item is authorized to you by the 3rd position code of the SMR code, but the source code indicates that it is made at a higher level, order the item from the higher level of maintenance.
AO – Assembled by unit level **AF** – Assembled by DS level **AH** – Assembled by GS level **AL** – Assembled by SRA **AD** – Assembled by depot	Items with these codes are not to be requested/requisitioned individually. The parts that make up the assembled item must be requisitioned or fabricated and assembled at the level of maintenance indicated by the source code. If the 3rd position of the SMR code authorizes you to replace the item, but the source code indicates the item is assembled at a higher level, order from the higher level of maintenance.
XA	Do not requisition an "XA" coded item. Order the next higher assembly. (Refer to NOTE below.)
XB	If an item is not available from salvage, order it using the CAGEC and P/N.
XC	Installation drawings, diagrams, instructions sheets, field service drawings; identified by manufacturer's P/N.
XD	Item is not stocked. Order an XD-coded item through normal supply channels using the CAGEC and P/N given, if no NSN is available.
NOTE Cannibalization or controlled exchange, when authorized, may be used as a source of supply for items with the above source codes except for those items source coded "XA" or those aircraft support items restricted by requirements of AR 750-1.	

Maintenance Code

Maintenance codes tell you the level(s) of maintenance authorized to use and repair support items. The maintenance codes are entered in the third and fourth positions of the SMR code as follows:

Third Position. The maintenance code entered in the third position tells you the lowest maintenance level authorized to remove, replace, and use an item. The maintenance code entered in the third position will indicate authorization to the following levels of maintenance:

Maintenance Code	Application/Explanation
O*	Unit level maintenance can remove, replace, and use the item.
F	Direct support maintenance can remove, replace, and use the item.
H	General support maintenance can remove, replace, and use the item.
L	Specialized repair activity can remove, replace, and use the item.
K	Contractor facility can remove, replace, and use the item.
Z	Item is not authorized to be removed, replaced, or used at any maintenance level.
D	Depot can remove, replace, and use the item.

*NOTE -- Army may use C in the third position. However, for joint service publications, Army will use O.

Fourth Position. The maintenance code entered in the fourth position tells you whether or not the item is to be repaired and identifies the lowest maintenance level with the capability to do complete repair (perform all authorized repair functions).

NOTE

Some limited repair may be done on the item at a lower level of maintenance, if authorized by the Maintenance Allocation Chart (MAC) and SMR codes.

Maintenance Code	Application/Explanation
O	Unit is the lowest level that can do complete repair of the item.
F	Direct support is the lowest level that can do complete repair of the item.
H	General support is the lowest level that can do complete repair of the item.
L	Specialized repair activity is the lowest level that can do complete repair of the item.
D	Depot is the lowest level that can do complete repair of the item.
K	Complete repair is done at contractor facility.
Z	Nonreparable. No repair is authorized.
B	No repair is authorized. No parts or special tools are authorized for maintenance of "B" coded item. However, the item may be reconditioned by adjusting, lubricating, etc., at the user level.

Recoverability Code

Recoverability codes are assigned to items to indicate the disposition action on unserviceable items. The recoverability code is shown in the fifth position of the SMR code as follows:

Recoverability Code	Application/Explanation
Z	Non-reparable item. When unserviceable, condemn and dispose of the item at the level of maintenance shown in the third position of the SMR code.
O	Reparable item. When uneconomically reparable, condemn and dispose of the item at the unit level.
F	Reparable item. When uneconomically reparable, condemn and dispose of the item at the direct support level.
H	Reparable item. When uneconomically reparable, condemn and dispose of the item at the general support level.
D	Reparable item. When beyond lower level repair capability, return to depot. Condemnation and disposal of item are not authorized below depot level.
L	Reparable item. Condemnation and disposal not authorized below Specialized Repair Activity (SRA).
A	Item requires special handling or condemnation procedures because of specific reasons (such as precious metal content, high dollar value, critical material, or hazardous material). Refer to appropriate manuals/directives for specific instructions.
K	Reparable item. Condemnation and disposal to be performed at contractor facility.

NSN (Column (3))

The National Stock Number for the item is listed in this column.

CAGEC (Column (4))

The Commercial and Government Entity Code (CAGEC) is a five-digit code used to identify the manufacturer, distributor, or Government agency/activity that supplies the item.

Part Number (Column (5))

Indicates the primary number used by the manufacturer (individual company, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items.

NOTE

When you use an NSN to requisition and item, the item you receive may have a different part number from the number listed.

Description and Usable On Code (UOC) (Column (6))

This column includes the following information:

1. The federal item name and, when required, a minimum description to identify the item.
2. P/Ns of bulk materials are referenced in this column in the line entry to be manufactured or fabricated.
3. Hardness Critical Item (HCI). A support item that provides the equipment with special protection from electromagnetic pulse (EMP) damage during a nuclear attack.
4. The statement END OF FIGURE appears just below the last item description in column (6) for a given figure in both the repair parts list and special tools list work packages.

QTY (Column (7))

The QTY (quantity per figure) column indicates the quantity of the item used in the breakout shown on the illustration/figure, which is prepared for a functional group, sub-functional group, or an assembly. A "V" appearing in this column instead of a quantity indicates that the quantity is variable and the quantity may change from application to application.

EXPLANATION OF CROSS-REFERENCE INDEXES WORK PACKAGES FORMAT AND COLUMNS

1. National Stock Number (NSN) Index Work Package. NSNs in this index are listed in National Item Identification Number (NIIN) sequence.

STOCK NUMBER Column. This column lists the NSN in NIIN sequence. The NIIN consists of the last nine digits of the NSN. When using this column to locate an item, ignore the first four digits of the NSN. However, the complete NSN should be used when ordering items by stock number.

For example, if the NSN is 5385-01-574-1476, the NIIN is 01-574-1476.

FIG. Column. This column lists the number of the figure where the item is identified/located. The figures are in numerical order in the repair parts list and special tools list work packages.

ITEM Column. The item number identifies the item associated with the figure listed in the adjacent FIG. column. This item is also identified by the NSN listed on the same line.

2. Part Number (P/N) Index Work Package. Part numbers in this index are listed in ascending alphanumeric sequence (vertical arrangement of letter and number combinations which places the first letter or digit of each group in order A through Z, followed by the numbers 0 through 9 and each following letter or digit in like order).

PART NUMBER Column. Indicates the part number assigned to the item.

FIG. Column. This column lists the number of the figure where the item is identified/located in the repair parts list and special tools list work packages.

ITEM Column. The item number is the number assigned to the item as it appears in the figure referenced in the adjacent figure number column.

SPECIAL INFORMATION

UOC. The UOC appears in the lower left corner of the Description Column heading. Usable on codes are shown as "UOC:..." in the Description Column (justified left) on the first line under the applicable item/nomenclature. Uncoded items are applicable to all models. Identification of the UOCs used in the RPSTL are:

Code Used On
There are no UOCs on the CROWS

Fabrication Instructions. Bulk materials required to manufacture items are listed in the bulk material functional group of this RPSTL. Part numbers for bulk material are also referenced in the Description Column of the line item entry for the item to be manufactured/fabricated.

Index Numbers. Items which have the word BULK in the figure column will have an index number shown in the item number column. This index number is a cross-reference between the NSN / Part Number (P/N) Index work packages and the bulk material list in the repair parts list work package.

HOW TO LOCATE REPAIR PARTS

1. When NSNs or Part Numbers Are Not Known.

First. Using the table of contents, determine the assembly group to which the item belongs. This is necessary since figures are prepared for assembly groups and subassembly groups, and lists are divided into the same groups.

Second. Find the figure covering the functional group or the subfunctional group to which the item belongs.

Third. Identify the item on the figure and note the number(s).

Fourth. Look in the repair parts list work packages for the figure and item numbers. The NSNs and part numbers are on the same line as the associated item numbers.

2. When NSN Is Known.

First. If you have the NSN, look in the STOCK NUMBER column of the NSN index work package. The NSN is arranged in NIIN sequence. Note the figure and item number next to the NSN.

Second. Turn to the figure and locate the item number. Verify that the item is the one you are looking for.

3. When Part Number Is Known.

First. If you have the part number and not the NSN, look in the PART NUMBER column of the part number index work package. Identify the figure and item number.

Second. Look up the item on the figure in the applicable repair parts list work package.

END OF WORK PACKAGE



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

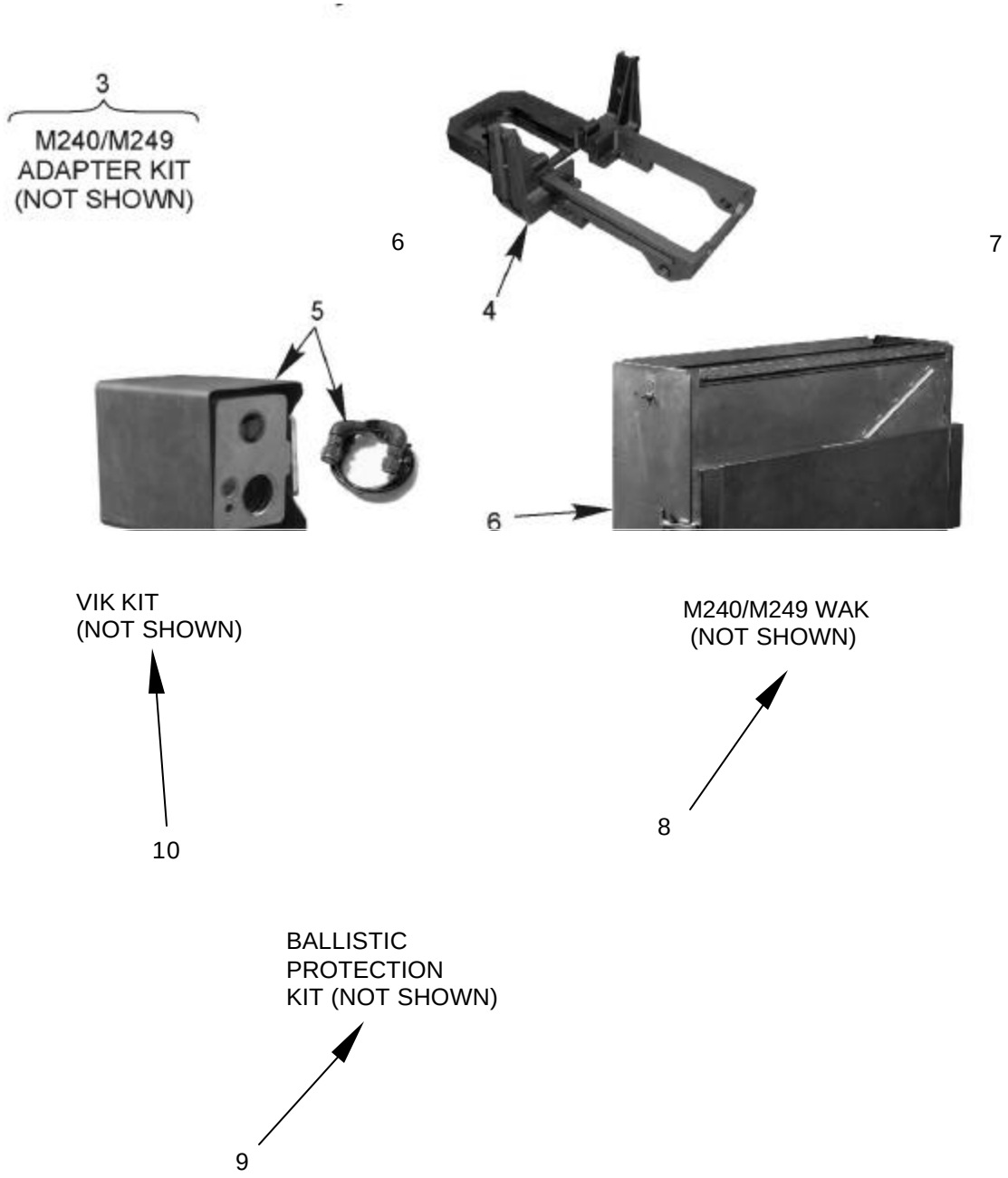


Figure 1. Common Remotely Operated Weapon Station (CROWS)
(Sheet 2 of 2)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 00 FIGURE 1. COMMON REMOTELY OPERATED WEAPON STATION (CROWS) REPAIR PARTS LIST.	
1	PDODD		11871	21677-0200-1	STABILIZED WEAPON MOUNT ASSEMBLY. (SEE FIGURE 2 FOR BREAKDOWN)	1
2	PD		11871	21677-4500	SENSOR GROUP. (SEE FIGURE 5 FOR BREAKDOWN)	1
3	AFFDD		11871	21677-5500	CONTROL GROUP. (SEE FIGURE 6 FOR BREAKDOWN)	1
4	PDOFF		11871	21677-0500	AMMUNITION CAN. (SEE FIGURE 7 FOR BREAKDOWN)	1
5	PAOFF	1010-01-530-1933	11871	21677-2600	CRADLE ASSEMBLY. (SEE FIGURE 8 FOR BREAKDOWN)	1
6	PBODD	1005-01-529-3139	11871	21677-3100	M2HB WEAPON ADAPTER KIT. (SEE FIGURE 9 FOR BREAKDOWN)	1
7	PBODD	1005-01-530-9636	11871	21677-3200	MK19 WEAPON ADAPTER KIT. (SEE FIGURE 11 FOR BREAKDOWN)	1
8					M240/M249 WEAPON ADAPTER KIT. (NOT SHOWN)	
9			11871	21677-0700	BALLISTIC PROTECTION KIT (MISSION-DEPENDENT). (SEE FIGURE 13 FOR BREAKDOWN)	1
10					VEHICLE INTEGRATION KIT (NOT SHOWN) (SEE FIGURE 14 FOR BREAKDOWN)	1
					END OF FIGURE	

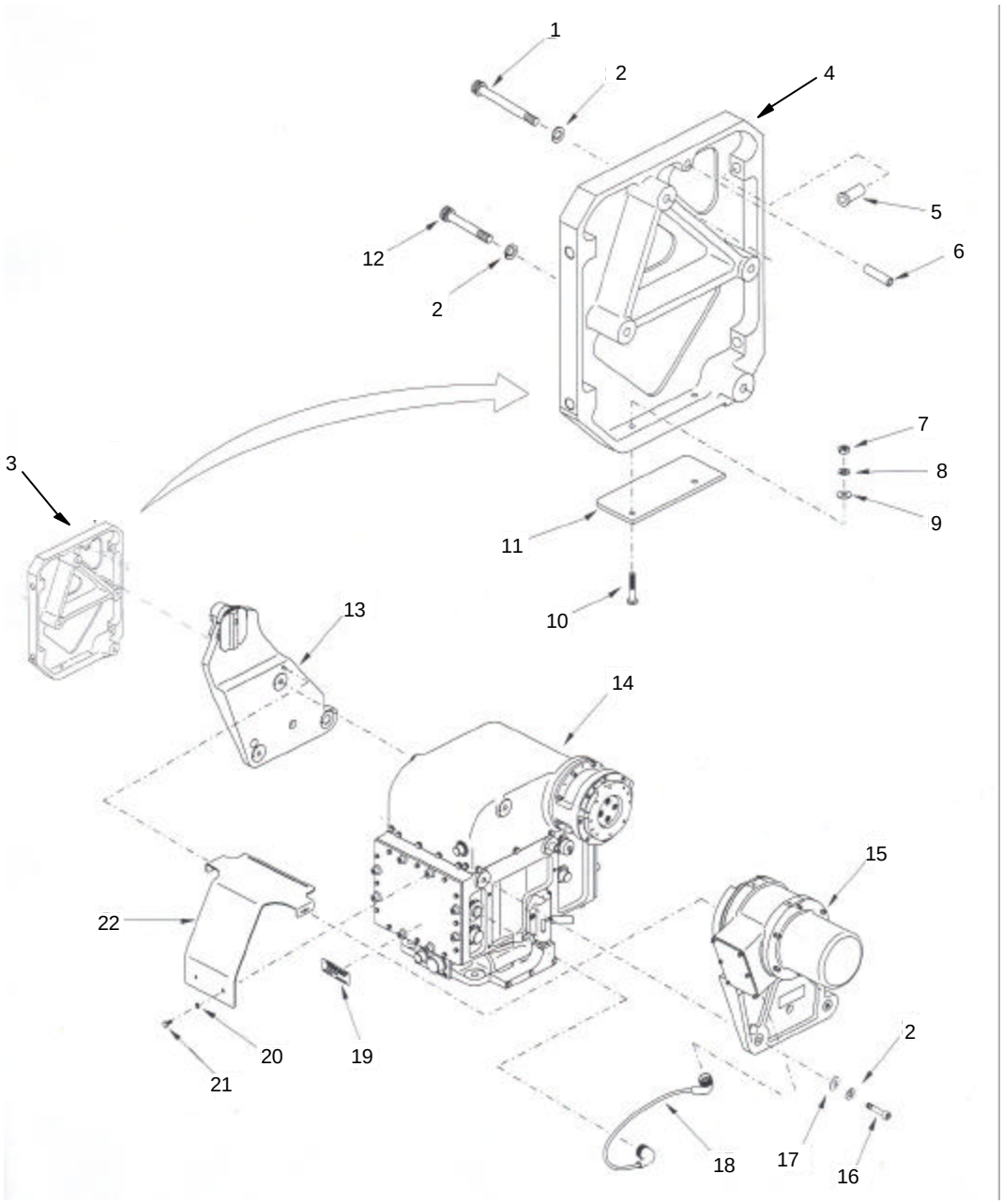


Figure 2. Stabilized Weapon Mount Assembly

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 01 FIGURE 2. STABILIZED WEAPON MOUNT ASSEMBLY REPAIR PARTS LIST. FOR NHA, GO TO FIGURE 1.	
1	PAFZZ	5306-00-177-5506	80205	NASM21250	BOLT, SHEAR	3
2	PAFZZ	5310-01-529-4364	1PUD1	NL3/8SS	NORD-LOCK WASHER	7
3	PAOOO	1005-01-531-6309	11871	21677-0505	AMMO HANGER ADAPTER ASSEMBLY	1
4	XAOZZ		11871	. 21677-0510	. BRACKET, MOUNTING	1
5	XAOZZ		11871	. 21677-0508	. INSERT, BRACKET	4
6	PAOZZ	5315-00-514-1353	80205	. MS16562-266	. PIN, SPRING	1
7	PAOZZ	5310-00-250-9477	80205	. MS35649-2254	. NUT, PLAIN, HEXAGON, MACHINE SCREW, UNC-2B	2
8	PAOZZ	5310-00-933-8121	80205	. MS35338-139	. WASHER, LOCK - SPRING, HELICAL, REGULAR SERIES	2
9	PAOZZ	5310-01-304-8733	80205	. MS15795-852	. WASHER – FLAT	2
10	PAOZZ	5305-00-576-5807	96906	. MS35307-311	. SCREW, CAP, HEX HEAD	2
11	XAOZZ		11871	. 21677-0509	. PLATE, SUPPORT	1
12	PAFZZ	5306-00-958-9162	96906	MS21250-06032	BOLT, SHEAR	1
13	PBFFF		11871	21677-2500	YOKE ARM ASSEMBLY - AMMO. SEE FIGURE 4 FOR BREAKDOWN	1
14	PAFDD	1015-01-530-9639	11871	21677-1000	PEDESTAL GUN MOUNT ASSEMBLY (SEE FIGURE 3 FOR BREAKDOWN)	1
15	PAFDD		11871	21677-2000	YOKE ARM ASSEMBLY– ELEVATION	1
16	PAFZZ	5306-00-762-2903	96906	MS21250-06022	BOLT, SHEAR	3
17	PAFZZ		11871	21677-1060-010	WASHER, FLAT (THICK)	3
18	PAODD		11871	21677-3700	WEAPON ELEVATION CABLE ASSEMBLY	1
19	XDDZZ		11871	21677-0203	PLATE, IDENTIFICATION	1
20	PAFZZ		11871	21677-1060-002	NORD-LOCK WASHER	2
21	PAFZZ	5305-00-688-2020	80205	MS35308-305	SCREW, CAP, HEX HEAD	2
22	PAFFF	1010-01-530-1931	11871	21677-1029	DEFLECTOR, LINK	1

END OF FIGURE

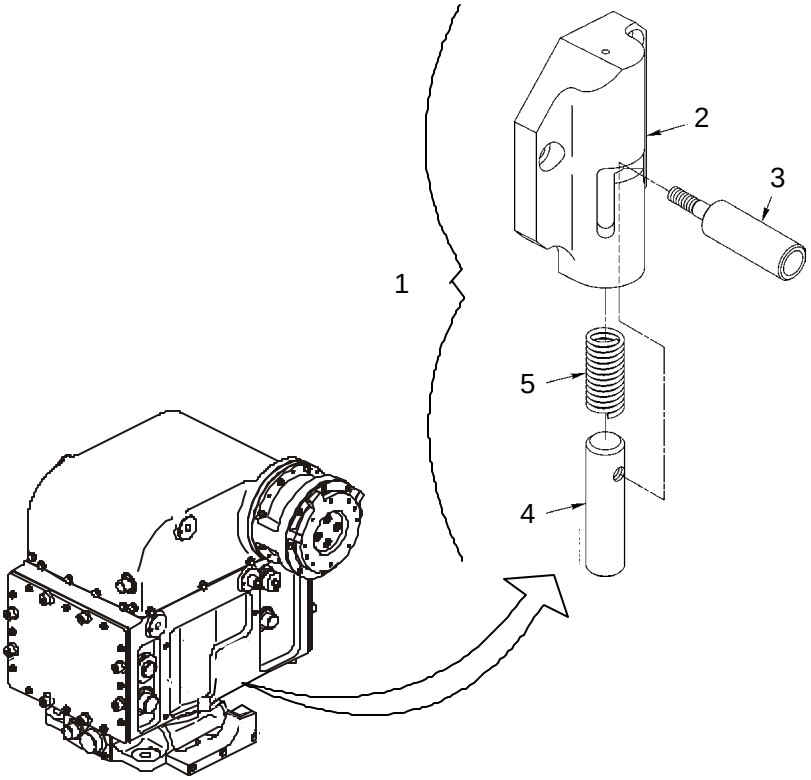


Figure 3. Pedestal Gun Mount Assembly

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 0101	
					FIGURE 3. PEDESTAL GUN MOUNT ASSEMBLY REPAIR PARTS LIST.	
					FOR NHA, GO TO FIGURE 2.	
1	PAOZZ	2540-01-529-4349	11871	21677-1035	AZIMUTH LOCK ASSEMBLY	1
2	XAOZZ		11871	. 21677-1036	. MOUNT, AZIMUTH LOCK	1
3	PAOZZ		11871	. 21677-1037	. HANDLE	1
4	PAOZZ		11871	. 21677-1033	. STUD.....	1
5	PAOZZ		84830	. LC-072H-8S	. SPRING	1
					END OF FIGURE	

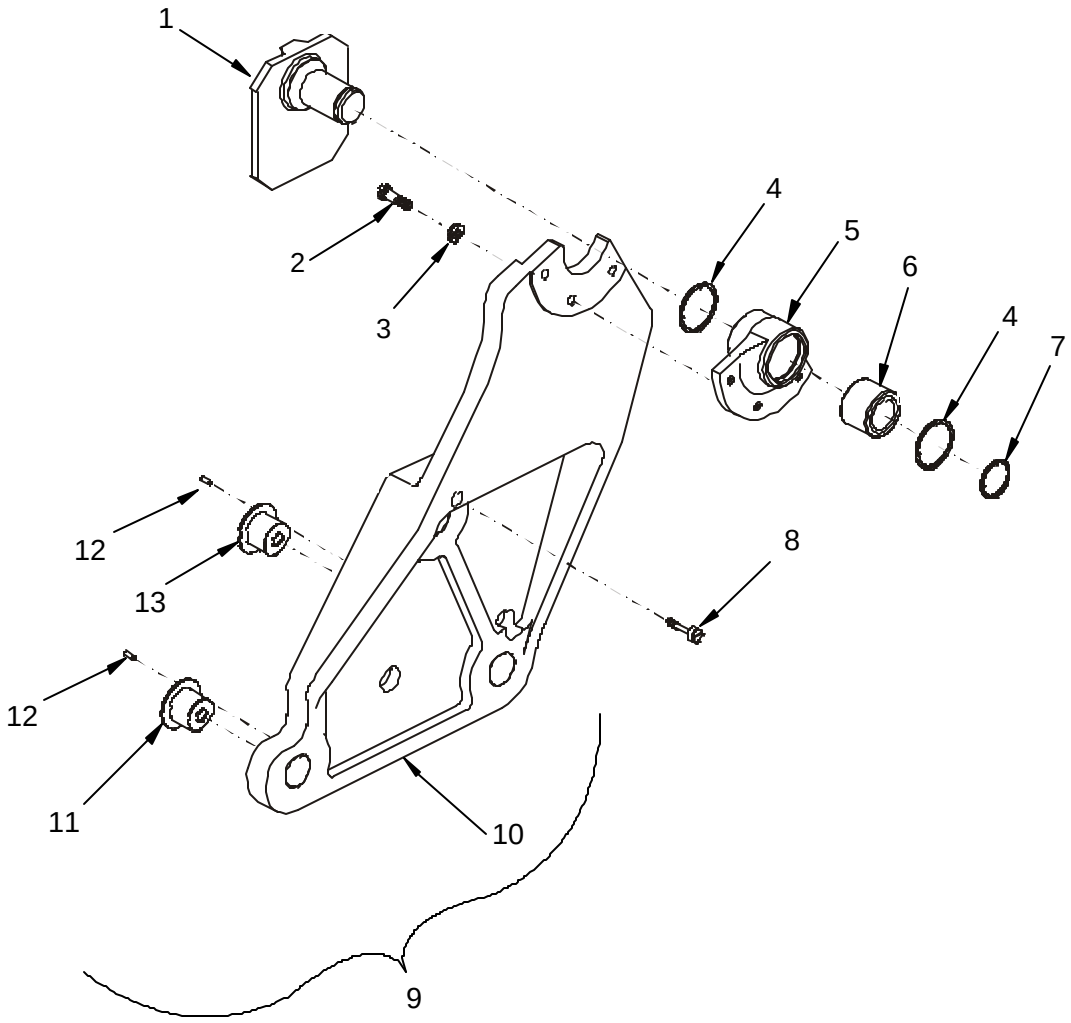


Figure 4. Ammo Yoke Arm Assembly

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 0104	
					FIGURE 4. AMMO YOKE ARM ASSEMBLY REPAIR PARTS LIST.	
					FOR NHA, GO TO FIGURE 2.	
1	XDFZZ		11871	21677-2506	AXLE, DEAD	1
2	PAFZZ		39428	92855A622	SCREW, LOW HEAD, SOCKET	3
3	PAFZZ		1PUD1	NL6SS	NORD-LOCK WASHER	3
4	PAFZZ	5325-00-531-3799	51814	WH-137-PA-S02	RING, RETAINING	2
5	XDFZZ		11871	21483-2510	HOUSING, DEAD AXLE	1
6	PAFZZ	3110-00-554-5572	39317	MR14SS	BEARING	1
7	PAFZZ		51814	WS-87-PS	RING, RETAINING	1
8	PAFZZ	5305-00-928-9570	00141	Y9-10	CAPTIVE SCREW	1
9	XDFZZ		11871	21677-2505	YOKE ARM, AMMO	1
10				. 21677-2505-10	. YOKE ARM	1
11				. 21677-2006	. SOCKET, PIVOT	1
12				. MS16555-625	. PIN	3
13				. 21677-2007	. SOCKET, FLANGED	2
14				CB9120V5	CABLE TIE ANCHOR	4
					END OF FIGURE	

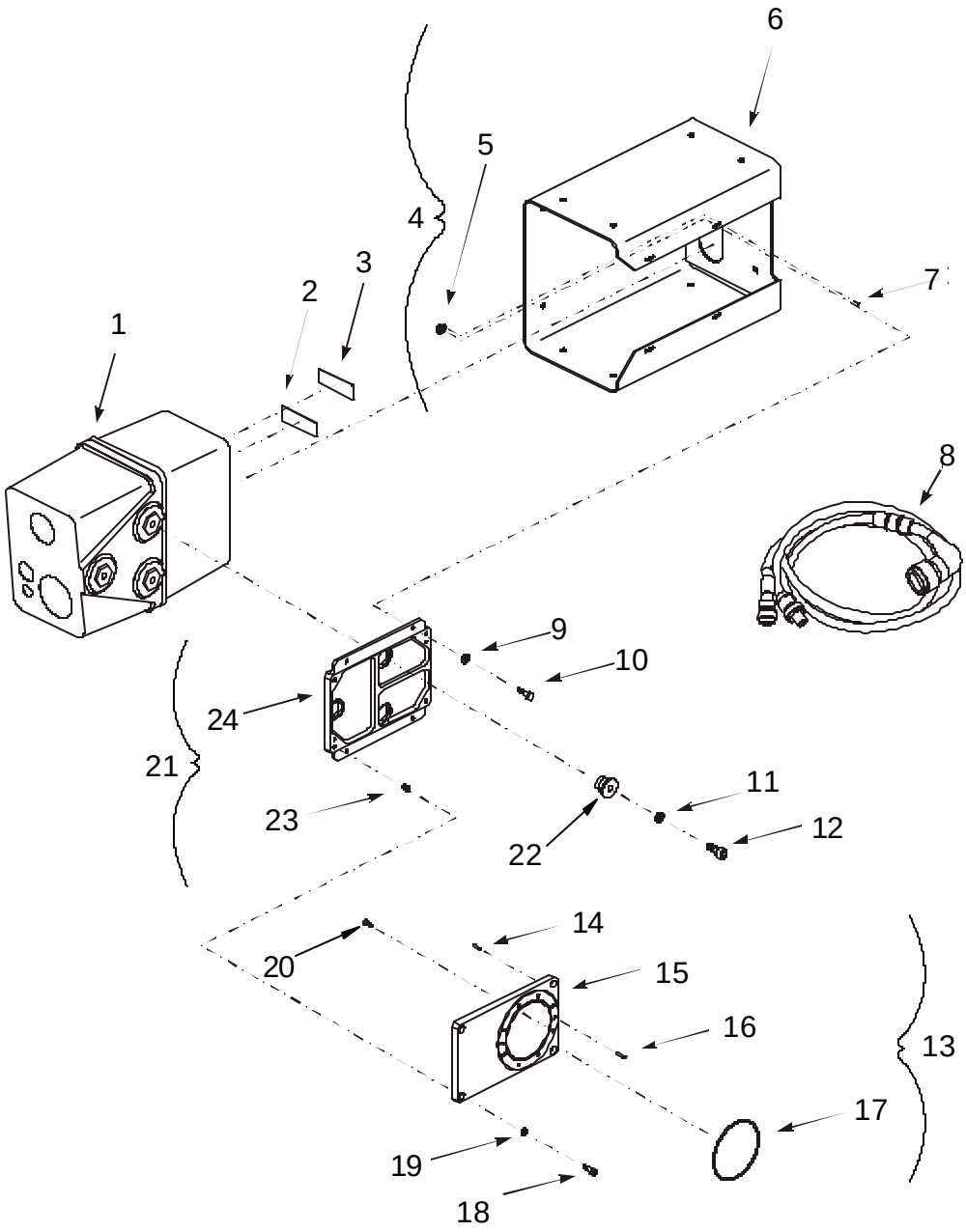


Figure 5. Sensor Group

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 02	
					FIGURE 5. SENSOR GROUP REPAIR PARTS LIST.	
					FOR NHA, GO TO FIGURE 1.	
1	PAODD		0U3N2	ASY06077	SENSOR UNIT.	1
2	XAOOO			21483-2104	LABEL, EYE SAFE.....	1
3	XAOOO			21483-2103	PLATE, CAUTION.....	1
4	PAOFF		11871	21677-0735	SUNSHADE ASSEMBLY.....	1
5	PAOZZ	5310-01-313-3977	96906	• MS21076L4N	• NUT, PLATE.....	4
6	XAOFF			• 21677-4505-10	• SUPPORT.....	1
7	PAOZZ	5320-00-234-1557	80205	• MS20426A3-6	• RIVET, SOLID, CSK, 100 DEG.....	8
8	PAODD		11871	21677-3706	CABLE ASSEMBLY, ELECTRICAL - MOUNT TO SENSOR.....	1
9	PAOZZ	5310-01-304-8733	80205	MS15795-852	WASHER - FLAT.....	4
10	PAOZZ		80205	MS35308-307	SCREW, CAP, HEX HEAD.....	4
11	PAOZZ		1PUD1	NL10SS	NORD-LOCK WASHER.....	3
12	PAOZZ		39428	91292A158	SCREW.....	3
13	PAOZZ		11871	21677-4506	SUPPORT PLATE - SIGHT.....	1
14	PAFZZ			• MS16555-627	• PIN.....	2
15	XAFZZ			• 21677-4506-10	• SUPPORT PLATE.....	1
16	PAFZZ			• MS16555-640	• PIN, STRAIGHT.....	2
17	XD		02697	B0612-70-2-154	O-RING.....	1
18	PAOZZ	5305-00-415-2187	80205	MS16996-23B	SCREW, CAP, SOCKET HEAD.....	4
19	PAOZZ		11871	21677-1060-002	NORD-LOCK WASHER.....	4
20	PAFZZ	5305-00-051-0227	80205	MS24693-C272	SCREW, FLAT HEAD, 100 DEG.....	8
21	PAOZZ		11871	21677-4507	PLATE, ADAPTER - SIGHT.....	1
22	XDFZZ			• 21439-2011	• BUSHING - SIGHT.....	3
23	PAFFF		0YC40	• 2TNF-4C-0375	• INSERT, COIL	4
24	XAOZZ			• 21677-4507-10	• ADAPTER PLATE.....	1
					END OF FIGURE	

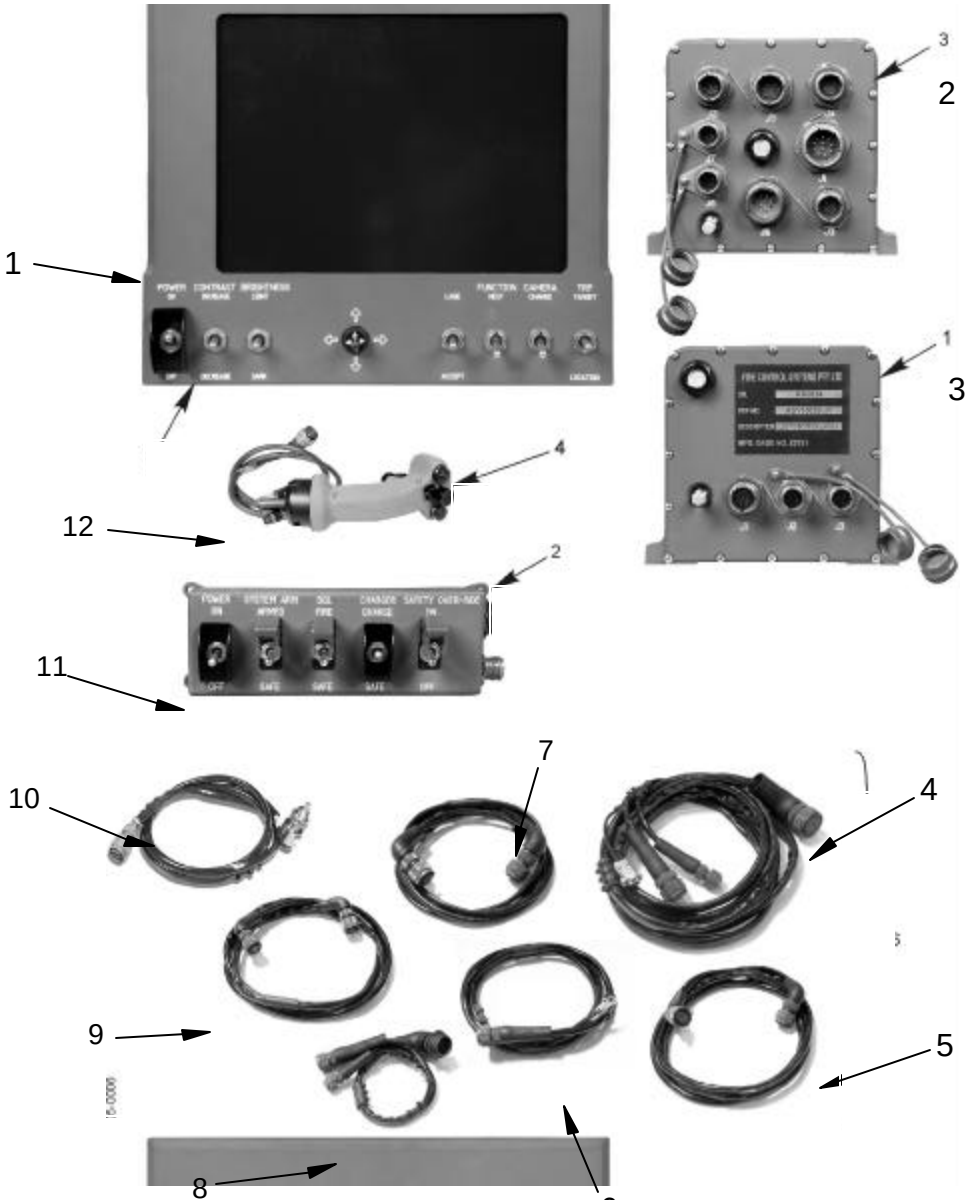


Figure 6. Control Group

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 03	
					FIGURE 6. CONTROL GROUP REPAIR PARTS LIST.	
					FOR NHA, GO TO FIGURE 1.	
1	PAFDD		0U3N2	ASY05843	DISPLAY UNIT	1
2	PAFDD		0U3N2	ASY05822	INTERFACE CONTROL UNIT (ICU)	1
3	PAFDD		0U3N2	ASY05820	ELECTRONICS MODULE UNIT (EMU)	1
4	PAODD		11871	21677-3731	ELECTRICAL - BULKHEAD TO ICU	1
5	PAODD		11871	21677-3715	ELECTRICAL - ICU TO DISPLAY	1
6	PAODD		11871	21677-3713	ELECTRICAL – POWER (VEHICLE)	1
7	PAODD		11871	21677-3714	ELECTRICAL - ICU TO SPU	1
8	PAODD		11871	21677-3730	ELECTRICAL - GIMBAL TO BULKHEAD	1
9	PAODD		11871	21677-3716	ELECTRICAL - ICU TO EMU	1
10	PAODD		11871	21677-3720	ELECTRICAL - HATCH INTERLOCK	1
11	PAFDD		0U3N2	ASY05821	SWITCH PANEL UNIT (SPU)	1
12	PAFDD		0U3N2	ASY05823	JOYSTICK	1
					END OF FIGURE	

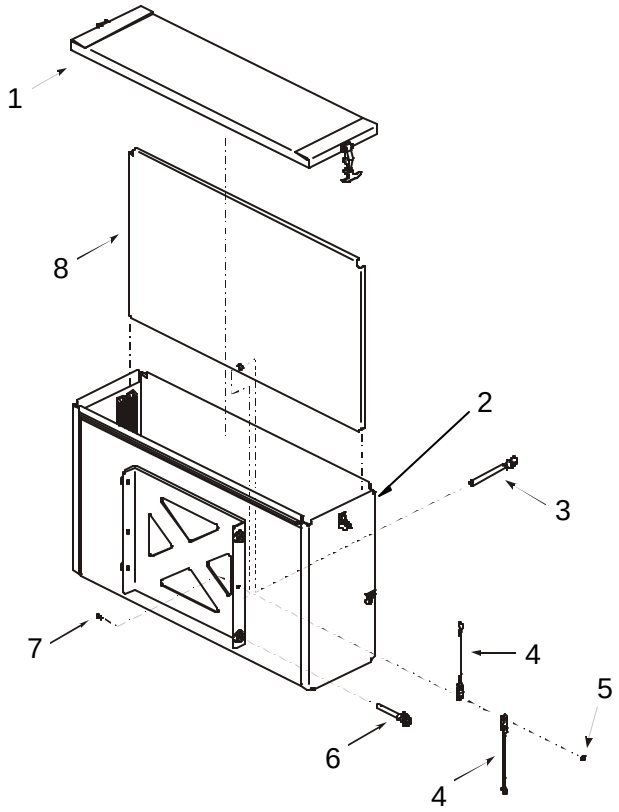


Figure 7. Ammo Can

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 05	
					FIGURE 7. AMMO CAN REPAIR PARTS LIST.	
					FOR NHA, GO TO FIGURE 1.	
1	PAOZZ		11871	21677-0525	COVER, WELDMENT.....	1
2	PAOZZ		11871	21677-0516	CAN WELDMENT, AMMUNITION	1
3	PAOZZ	5315-01-441-1177	39428	92384A063	PIN, QUICK RELEASE	1
4	PAOZZ	4010-01-429-6273	39428	30345T21	LANYARD, 6”	5
5	PAOZZ		72962	79NTM-82	NUT-HEX, LIGHT, THIN	2
6	PAOZZ	5315-01-378-3340	39428	92384A056	PIN, QUICK RELEASE.....	4
7	PAOZZ	5305-00-068-5287	80205	MS24693-C49	SCREW, FLAT CSK HEAD, 100 DEG.....	2
8	PAOZZ		11871	21677-0536	PARTITION WELDMENT	1
					END OF FIGURE	

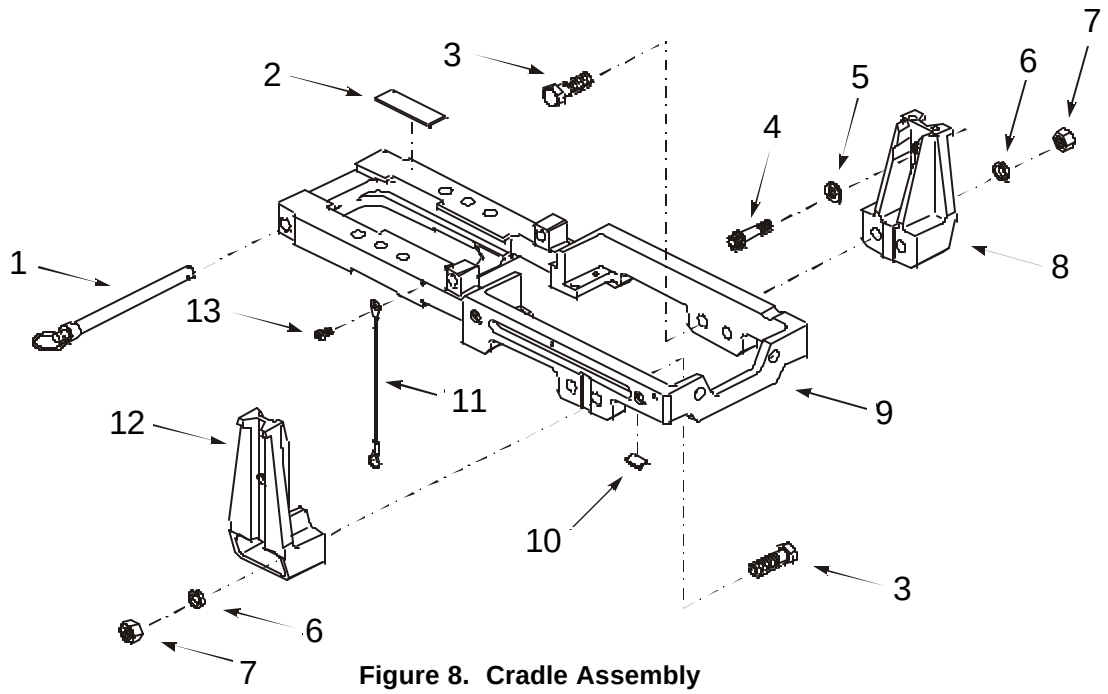


Figure 8. Cradle Assembly

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 06	
					FIGURE 8. CRADLE ASSEMBLY REPAIR PARTS LIST.	
					FOR NHA, GO TO FIGURE 1.	
1	PAFZZ		84256	BLC8R60N	PIN, DETENT	1
2	XDOZZ		11871	21483-2610	LABEL, 2 PERSON LIFT	1
3	PAOZZ		39428	92245A756	SCREW, CAP, HEX	4
4	PAOZZ	5306-00-958-9154	96906	MS21250-06016	BOLT, SHEAR	2
5	PAOZZ	5310-01-529-4364	1PUD1	NL3/8SS	NORD-LOCK WASHER	2
6	PAOZZ		39428	98437A130	WASHER, LOCK-SPRING	4
7	PAOZZ		39428	90047A140	NUT, LOCKING	4
8	PAOFF		11871	21677-2607	PIVOT ARM, LH CROWS	1
9	XAOZZ		11871	21677-2604	CRADLE, HEAVY	1
10				CB9120V5	CABLE TIE ANCHOR	4
11	PAOZZ		11871	21483-3146-5	LANYARD	1
12	PAOFF		11871	21677-2606	PIVOT ARM, RH CROWS	1
13	PAOZZ	5305-01-189-3770	80205	MS16995-35B	SCREW, CAP, SOCKET HEAD	1
					END OF FIGURE	

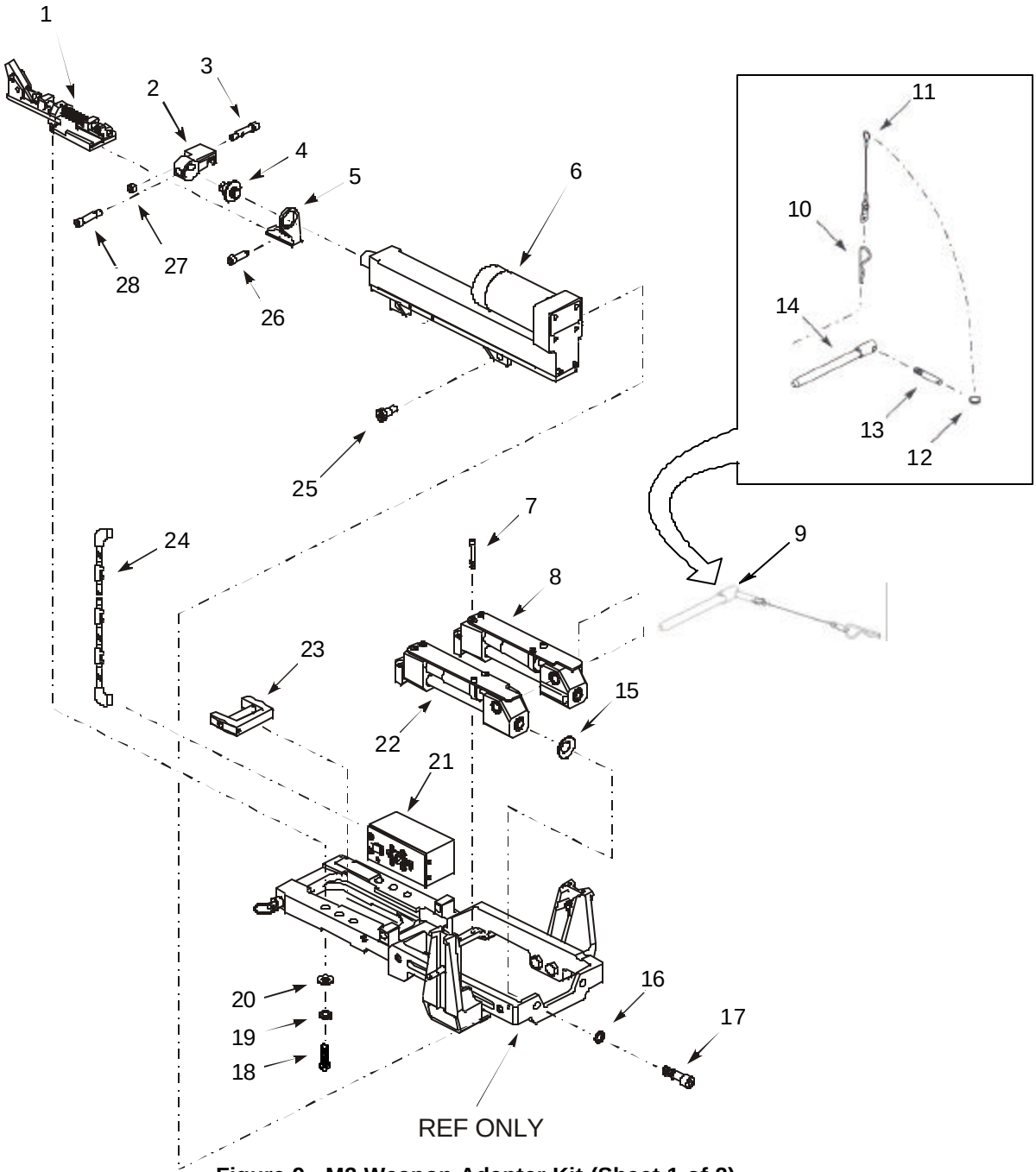


Figure 9. M2 Weapon Adapter Kit (Sheet 1 of 2)

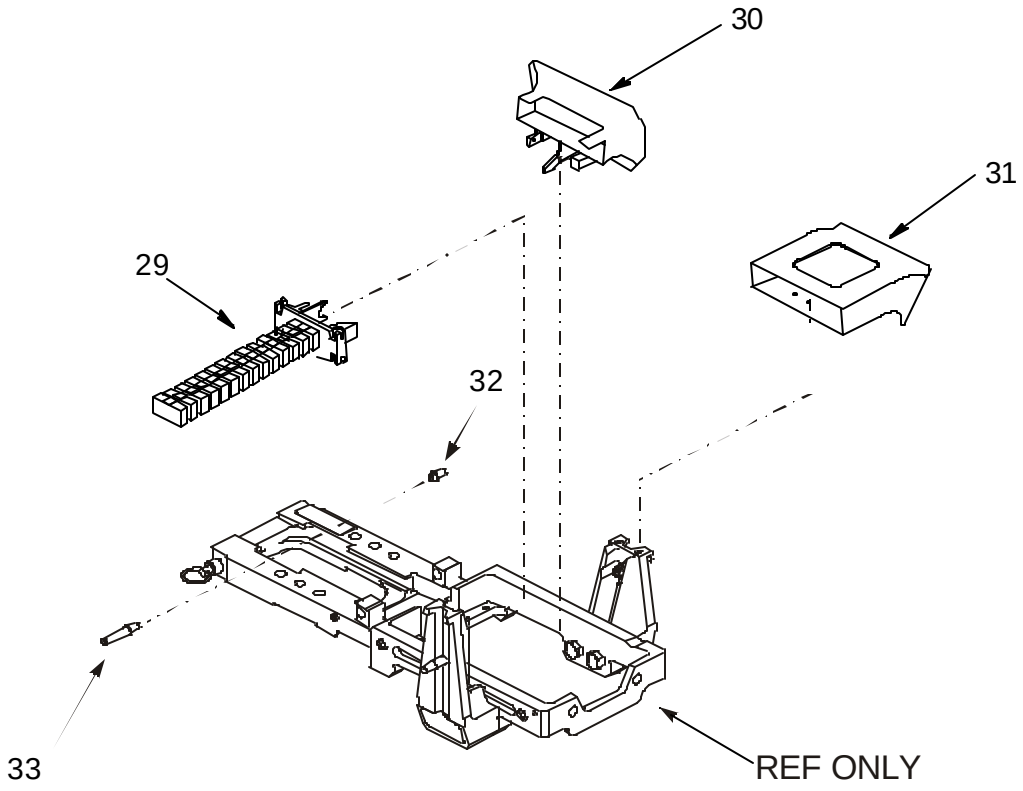


Figure 9. M2 Weapon Adapter Kit (Sheet 2 of 2)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 07	
					FIGURE 9. M2 WEAPON ADAPTER KIT REPAIR PARTS LIST.	
					FOR NHA, GO TO FIGURE 1.	
1	PAOFF	1005-01-529-3143	11871	21677-3160	SEAR ASSEMBLY.	1
2	PAOZZ		11871	21677-3164	EXTENSION, RETRACTING SLIDE.....	1
3	PAOZZ	5315-01-529-1431	11871	21677-3172	BOLT, SECURING, LH.....	1
4	PAOZZ	5340-01-529-4366	11871	21677-3165	END, ROD	1
5	PAOZZ	1005-01-529-1434	11871	21677-3176	SEAR SLIDE	1
6	XAODD		11871	21677-3170	LINEAR ACTUATOR ASSEMBLY. SEE FIGURE 10 FOR BREAKDOWN	1
7	PAOZZ		11871	21677-1060-008	SCREW, CAP, SOCKET HEAD.....	4
8	PAFDD	5985-01-529-2315	11871	21677-2625	ATTENUATOR ASSEMBLY - LH.	1
9	PAOOO	1010-01-528-9355	11871	21677-2614	PIN, FORWARD - M2/MK19	1
10	PAOZZ	5315-01-421-2003	39428	• 92391A056	• COTTER, LOCK.....	1
11	PAOZZ	4010-01-429-6273	39428	• 30345T21	• LANYARD.....	1
12	PAFZZ	5325-01-514-8047	2V507	• 90905A653	• RING, RETAINING.....	1
13	XADZZ		11871	• 21483-2614-12	• PIN, HANDLE	1
14	XADZZ		11871	• 21677-2614-10	• PIN, FORWARD	1
15	PAFZZ	5310-00-165-8320	70472	B1500-045	WASHER, SPRING.....	2
16	PAOZZ	5310-01-530-1932	11871	21677-1060-007	WASHER, NORD-LOCK.....	2
17	PAOZZ		11871	21677-1060-009	SCREW, CAP, SOCKET HEAD.....	2
18	PAFZZ	5305-01-312-3899	80205	MS16995-64B	SCREW , CAP, SOCKET HEAD.....	2
19	PAOZZ			MS35338-140B	WASHER, LOCK	2
20	PAOZZ	5310-00-625-5756	80205	MS15795-812	WASHER - FLAT.....	2
21	PAODD	1010-01-530-1045	11871	21677-3150	REMOTE FIRING ASSEMBLY..	1
22	PAFDD	5985-01-529-3136	11871	21677-2615	ATTENUATOR ASSEMBLY - RH.....	1
23	PAOZZ	1005-01-528-9357	11871	21677-3130	BLOCK GUIDE ASSEMBLY. ...	1
24	PAOFF	6150-01-530-1930	11871	21677-3702	CABLE ASSEMBLY, ELECTRICAL - M2	1
25	PAOZZ	5305-01-529-1430	11871	21483-2609	BOLT, SHOULDER SCREW....	2
26	PAOZZ	5305-01-528-9356	11871	21677-3133	SLIDE, SCREW.....	1
27	PAOZZ	5310-01-528-9352	11871	21483-3166	NUT, LOCKING - LONG.....	1

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 07	
					FIGURE 9. M2 WEAPON ADAPTER KIT REPAIR PARTS LIST.	
28	PAOZZ	5306-01-529-1432	11871	21677-3171	BOLT, SECURING, RH.....	1
29	PAOZZ		11871	21677-3111	LINK CHUTE ASSEMBLY	1
30	PAOZZ	1005-01-528-9351	11871	21483-3145	FEED THROAT ASSEMBLY, LH	1
31	PAOZZ	1005-01-528-9358	11871	21677-3134	AMMO GUIDE.....	1
32	PAOZZ	5315-01-529-1436	11871	21677-3175-1	PIN, BREECH BOLT.....	1
33	PAOZZ	5315-01-529-1433	11871	21677-3175-2	PIN, BREECH BOLT.....	1
					END OF FIGURE	

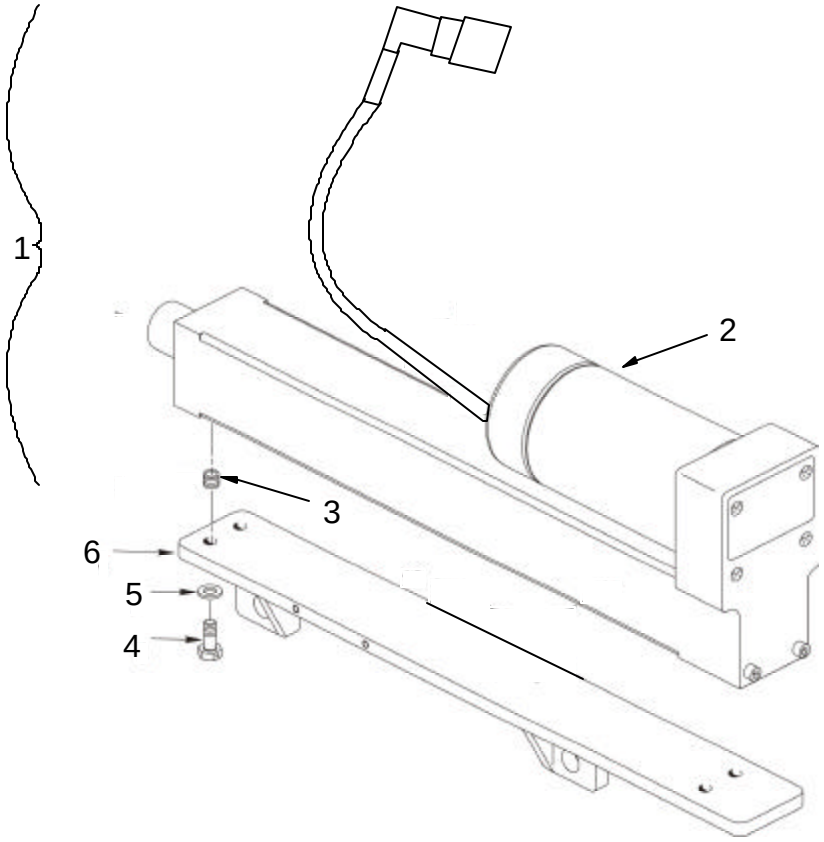


Figure 10. M2 WAK -- Linear Actuator Assembly

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 0702	
					FIGURE 10. M2 WAK -- LINEAR ACTUATOR ASSEMBLY REPAIR PARTS LIST.	
					FOR NHA, GO TO FIGURE 9.	
1	PAODD	1270-01-529-2303	11871	21677-3180	ACTUATOR ASSEMBLY.....	1
2	PAOZZ	4810-01-530-1928	3C6M7	• N2-D-31-5B-12-MS6-FT1-EMK	• ACTUATOR, LINEAR	1
3	PAFZZ	5325-00-200-7224	80205	• MS122081	• INSERT.....	1
4	PAOZZ	5305-01-529-2313	39428	90124A539	SCREW, CAP, HEX HD, DRILLED	4
5	PAOZZ	5310-01-385-3734	80205	NAS1149C0463B	WASHER, FLAT	4
6	PBOZZ		11871	21677-3173	PLATE, ACTUATOR - MOUNTING.....	1
					END OF FIGURE	

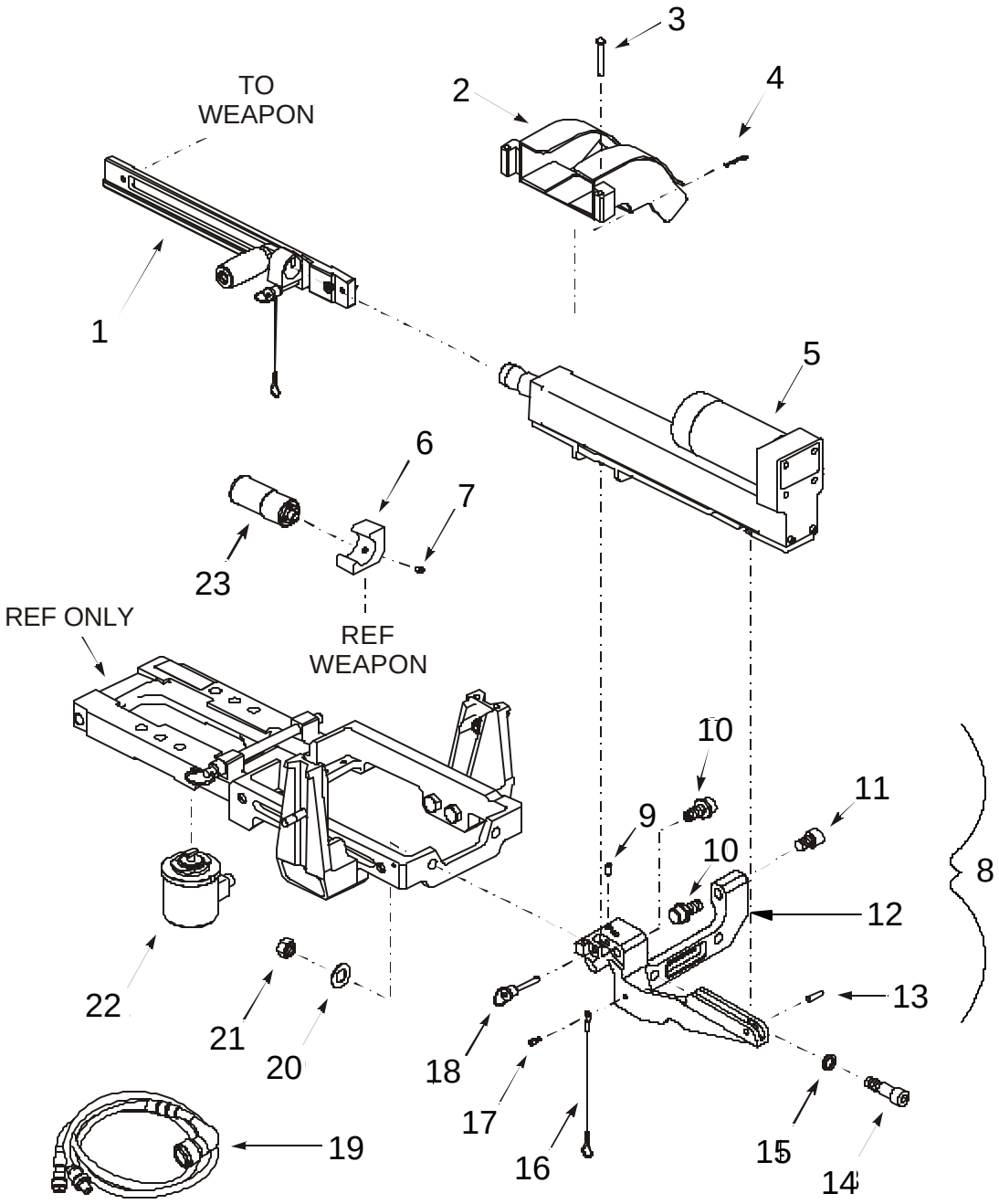


Figure 11. Mk19 Weapon Adapter Kit

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 08	
					FIGURE 11. MK19 WEAPON ADAPTER KIT REPAIR PARTS LIST.	
					FOR NHA, GO TO FIGURE 1.	
1	PAOFF	1005-01-528-9359	11871	21677-3210	CHARGER - REMOTE ASSEMBLY.	1
2	PAOZZ	1005-01-529-2306	11871	21677-3228	FEED THROAT	1
3	PAOZZ	5315-01-518-3224	71670	92390A165	PIN, CLEVIS	2
4			39428	92391A034	CLIP, HAIRPIN	2
5	XAFDD		11871	21677-3205	LINEAR ACTUATOR. SEE FIGURE 13 FOR BREAKDOWN	1
6	PAOZZ	1005-01-529-0632	11871	21677-3207	BLOCK, LOCKING - RDS COUNTER	1
7	MFDZZ		11871	21677-3208	SETSCREW, SELF-LOCKING.	1
8	PAOFF		11871	21677-3215	FRONT BRACKET ASSEMBLY	1
9	PAOZZ	5315-01-014-7545	00141	• D20-500	• PIN, STRAIGHT, HEADLESS	3
10			11871	• 21677-3217	• PIN - FRONT	2
11	PAOZZ	5305-01-531-6304	39428	• 91251A011	• SCREW, CAP, SOCKET HEAD	1
12	XDFZZ		11871	• 21677-3204	• BRACKET, ACTUATOR BRACKET - MK19	1
13			00141	• D20-750	• PIN, DOWEL	1
14	XDOZZ		11871	21677-1060-009	SCREW, CAP, BLACK OXIDE..	2
15	PAOZZ		11871	21677-1060-007	WASHER, NORD-LOCK, BLACK OXIDE	2
16	MFOZZ		11871	21483-3146-2	LANYARD	1
17	PAOZZ	5305-00-417-5251	80205	MS16995-25B	SCREW, CAP, SOCKET HEAD	1
18	PAOZZ		01599	SMP60	BALL LOCK PIN	1
19	PAODD	6150-01-529-3140	11871	21677-3703	CABLE ASSEMBLY, ELECTRICAL - MK19	1
20	PAOZZ	5310-00-167-0806	80205	NAS1149C0863R	WASHER - FLAT	2
21			39428	91845A310	NUT	2
22	PAOZZ	5945-01-133-6985	10001	3269501	SOLENOID, REMOTE FIRING (L1)	1
23	PAODD	5930-01-530-9637	11871	21677-3225	OGIVE PLUNGER ASSEMBLY.	1
					END OF FIGURE	

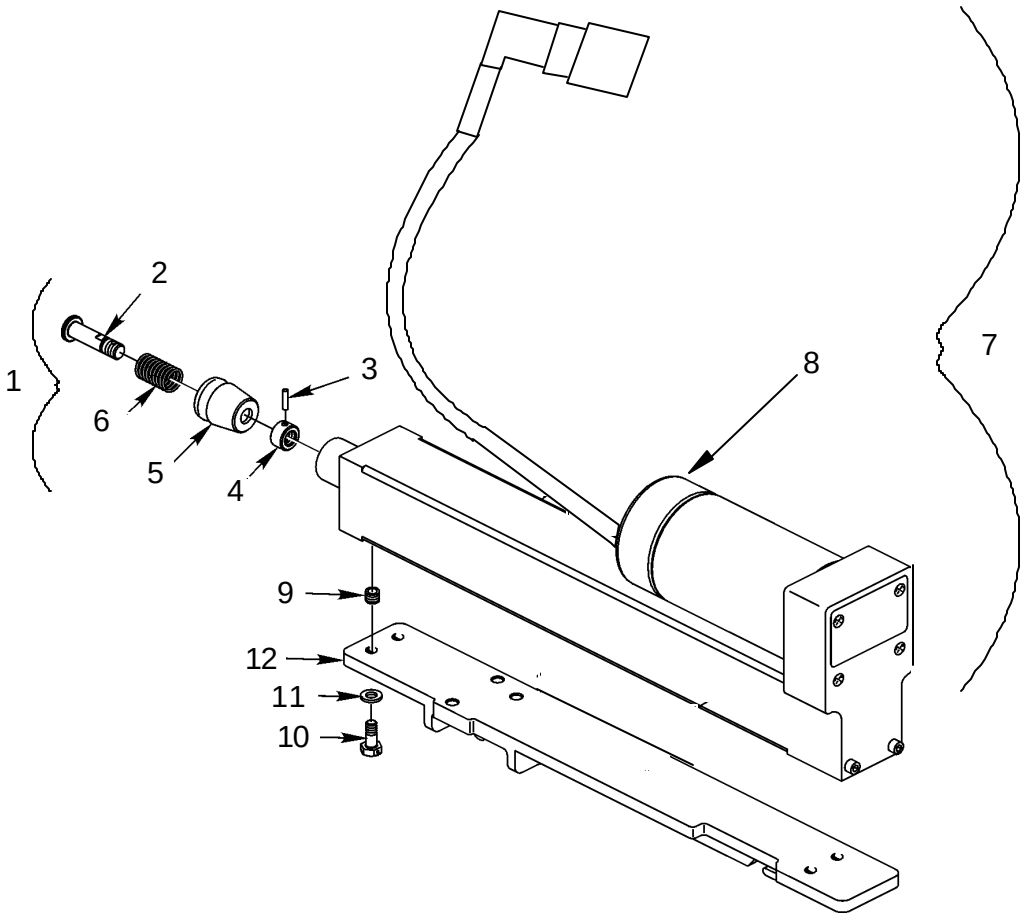


Figure 12. Mk19 WAK -- Linear Actuator Assembly

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 0802	
					FIGURE 12. Mk19 WAK -- LINEAR ACTUATOR ASSEMBLY REPAIR PARTS LIST.	
					FOR NHA, GO TO FIGURE 12.	
1	PAFFF	1005-01-M28-0527	11871	21677-3220	END ROD ASSEMBLY (REF)...	1
2				• 21677-3222	• STUD - END ROD	1
3	KDDZZ		01599	• P12	• PIN, SPRING.....	1
4				• 21677-3221	• BUSHING, THREADED.....	1
5				• 21677-3223	• END ROD - MK19.....	1
6	PAFZZ		39428	• 9434K127	• SPRING, COMPRESSION	1
7	PAODD	1270-01-529-2303	11871	21677-3180	ACTUATOR ASSEMBLY.....	1
8	PADZZ	4810-01-530-1928	3C6M7	• N2-D-31-5B-12-MS6-FT1-EMK	• ACTUATOR, LINEAR (A1)	1
9	PAOZZ	5325-00-200-7224	80205	• MS122081	• INSERT.....	4
10	PAOZZ	5305-01-529-2313	39428	90124A539	SCREW, CAP, HEX HD, DRILLED	4
11	PAOZZ	5310-01-385-3734	80205	NAS1149C0463R	WASHER, FLAT	4
12	PBOZZ		11871	21677-3206	PLATE, ACTUATOR - MOUNTING.....	1
					END OF FIGURE	

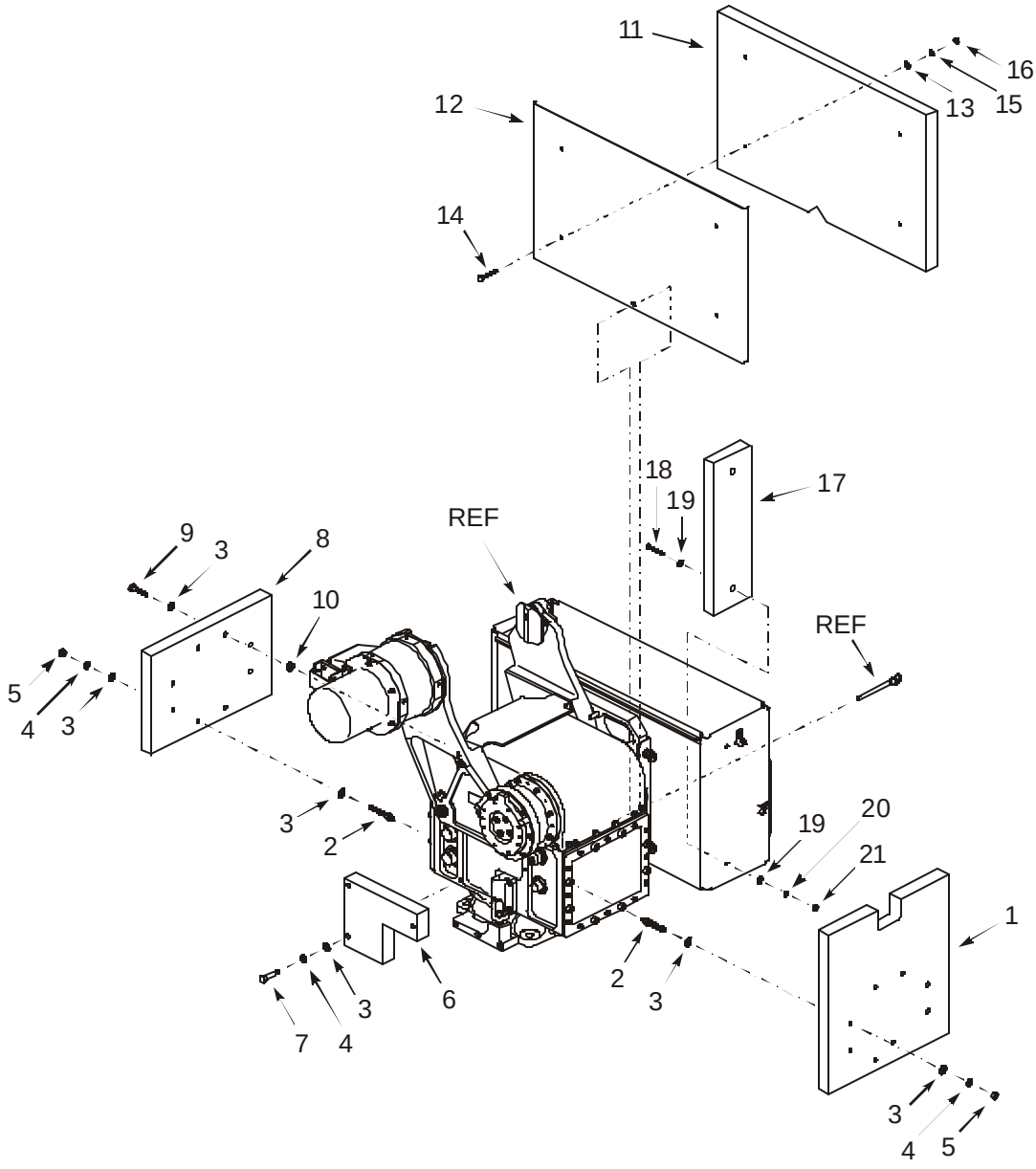


Figure 13. Ballistic Protection Kit (Sheet 1 of 2)

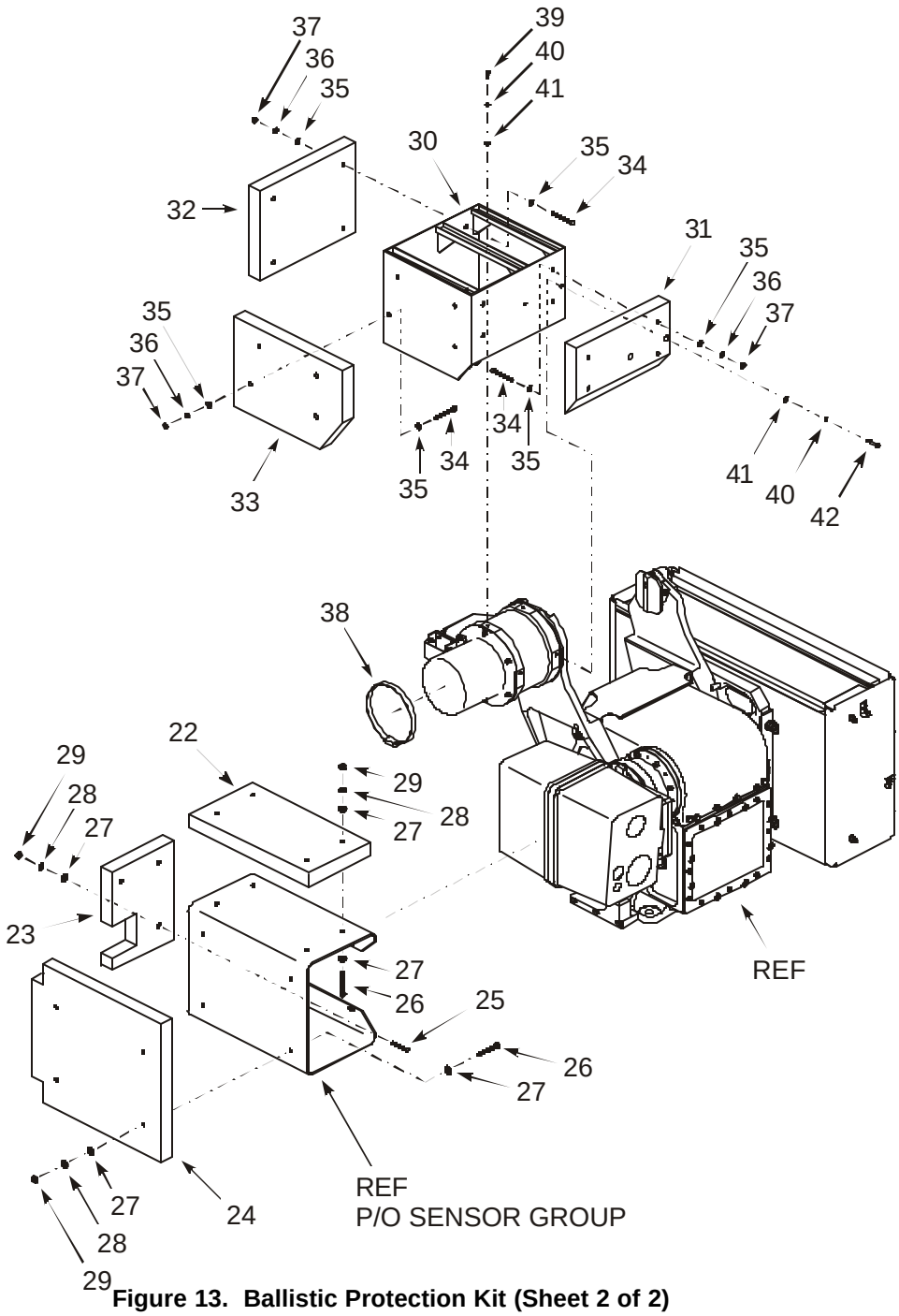


Figure 13. Ballistic Protection Kit (Sheet 2 of 2)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 10 FIGURE 13. BALLISTIC PROTECTION KIT REPAIR PARTS LIST. FOR NHA, GO TO FIGURE 1.	
1	PAOZZ		11871	21677-0705	BALLISTIC PANEL - FRONT	1
2	PAOZZ		11871	21677-0708	STANDOFF, FRONT/REAR	14
3	PAOZZ		11871	21677-1060-011	WASHER, FLAT	33
4	PAOZZ		11871	21677-1060-014	WASHER, LOCK	17
5	PAOZZ		11871	21677-1060-013	NUT, HEX	14
6	PAOZZ		11871	21677-0706	BALLISTIC PANEL - SIDE	1
7	PAOZZ		11871	21677-0712	BOLT, SHOULDER, RH PANEL	3
8	PAOZZ		11871	21677-0707	BALLISTIC PANEL - REAR	1
9	PAOZZ		11871	21677-1060-012	SCREW, CAP, HEX HEAD	2
10	PAOZZ		11871	21677-1060-010	WASHER, THICK	2
--	PAOZZ		11871	21677-0727	PARTITION ASSEMBLY, BALLISTIC PANEL	1
11	PAOZZ		11871	• 21677-0728	• PANEL, BALLISTIC, PARTITION	1
12	PAOZZ		11871	• 21677-0729	• PARTITION	1
13	PAOZZ		11871	• 21677-1060-015	• WASHER, FLAT	4
14	PAOZZ		39428	• 92356A544	• BOLT, CARRIAGE	4
15	PAOZZ		11871	• 21677-1060-016	• WASHER, LOCK	4
16	PAOZZ		11871	• 21677-1060-017	• NUT	4
17	PAOZZ		11871	21677-0730	BALLISTIC PANEL - END	2
18	PAOZZ		39428	91286A113	SCREW, HEX HD CAP 1/4-20 x 1.25	4
19	PAOZZ		11871	21677-1060-015	WASHER, FLAT	8
20	PAOZZ		11871	21677-1060-016	WASHER, LOCK	4
21	PAOZZ		11871	21677-1060-017	NUT, HEX	4
--	PAOZZ		11871	21677-0713	BALLISTIC PROTECTION ASSEMBLY, SIGHT	1
22	PAOZZ		11871	• 21677-0709	• BALLISTIC PANEL, END - SIGHT	2

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	
					GROUP 10	
					FIGURE 13. BALLISTIC PROTECTION KIT REPAIR PARTS LIST.	
23	PAOZZ		11871	• 21677-0710	• BALLISTIC PANEL, REAR - SIGHT.....	1
24	PAOZZ		11871	• 21677-0711	• BALLISTIC PANEL, SIDE - SIGHT.....	1
25	PAOZZ		39428	• 92356A587	• BOLT, CARRIAGE	3
26	PAOZZ		39428	• 92245A587	• SCREW, CAP HEX HD.....	12
27	PAOZZ		11871	• 21677-1060-011	• WASHER, FLAT	27
28	PAOZZ		11871	• 21677-1060-014	• WASHER, LOCK.....	15
29	PAOZZ		11871	• 21677-1060-013	• NUT, HEX.....	15
REF	PAOZZ		11871	• 21677-0735	• BALLISTIC SUNSHADE WELDMENT (P/O SENSOR GROUP, SEE FIGURE 12).....	1
--	PAOZZ		11871	21677-0715	BALLISTIC PANEL ASSEMBLY - ELEVATION DRIVE	1
30	PAOZZ		11871	• 21677-0716	• WELDMENT - BALLISTIC PANEL HOUSING.....	1
31	PAOZZ		11871	• 21677-0723	• BALLISTIC PANEL - FRONT, ELEVATION DRIVE	1
32	PAOZZ		11871	• 21677-0724	• BALLISTIC PANEL - REAR, ELEVATION DRIVE	1
33	PAOZZ		11871	• 21677-0725	• BALLISTIC PANEL - END ELEVATION DRIVE	1
34	PAOZZ		39428	• 92245A587	• SCREW, CAP, HEX HD.....	12
35	PAOZZ		11871	• 21677-1060-011	• WASHER, FLAT	24
36	PAOZZ		11871	• 21677-1060-014	• WASHER, LOCK.....	12
37	PAOZZ		11871	• 21677-1060-013	• NUT, HEX.....	12
38	PAOZZ		39428	54155K38	HOSE CLAMP.....	1
39	PAOZZ			MS16996-10	SCREW	2

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION	(7) QTY
					GROUP 10 – CONT.	
					GROUP 10	
					FIGURE 13. BALLISTIC PROTECTION KIT REPAIR PARTS LIST.	
40	PAOZZ			MS35338-138	WASHER, LOCK.....	4
41	PAOZZ			NAS1149C0363R	WASHER, FLAT.....	4
42	PAOZZ			MS16996-14	SCREW, CAP, SOCKET HEAD	2

END OF FIGURE

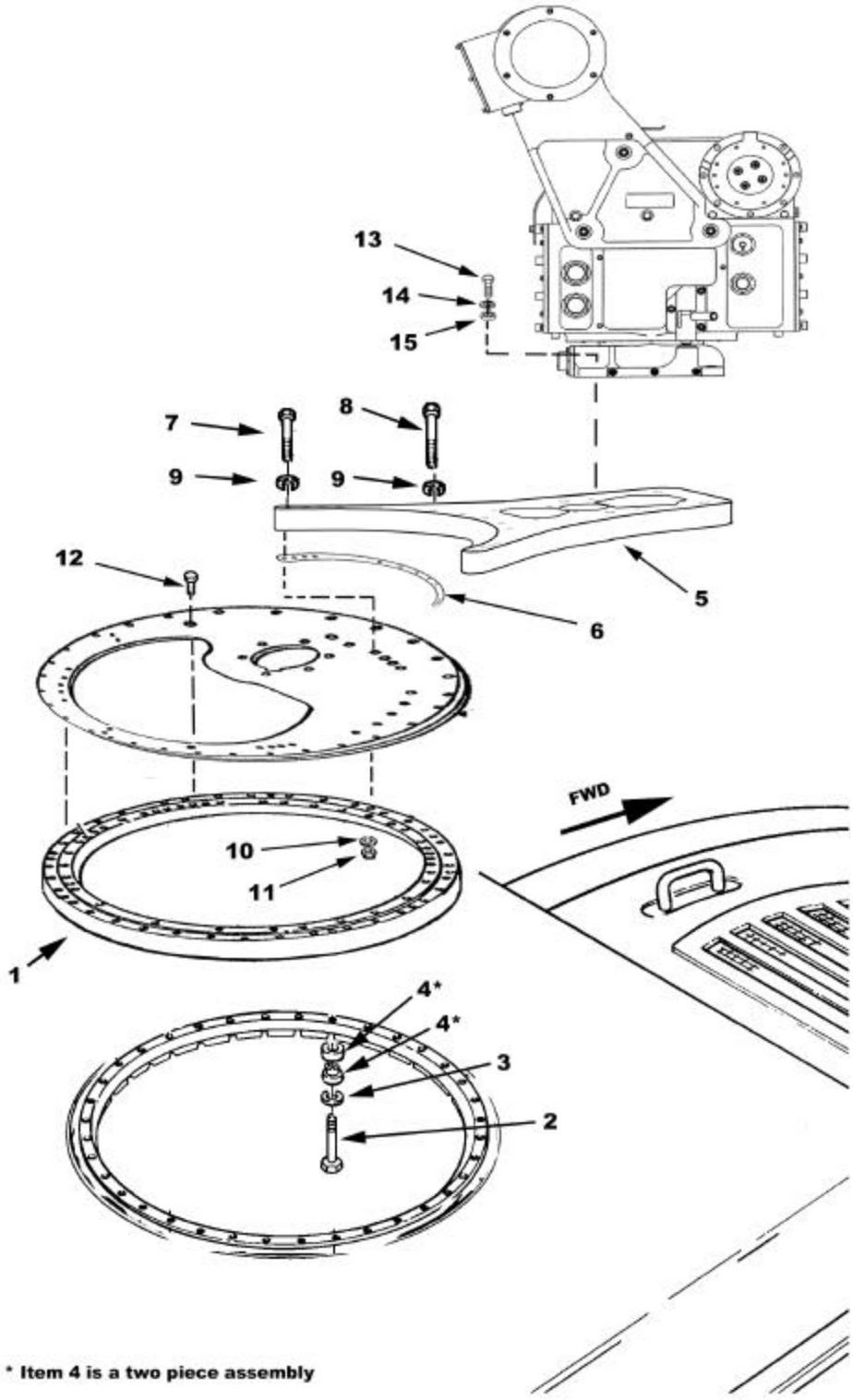


Figure 14. Vehicle Integration Kit (Sheet 1 of 12)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 11	
					FIGURE 14. VEHICLE INTEGRATION KIT REPAIR PARTS LIST.	
					FOR NHA, GO TO FIGURE 1.	
1	PFOZZ	TBD	6W728	6431434-01M1	NON-ROTATING TURRET MOUNTING RING ASSEMBLY.	1
2	PAOZZ	5306-01-434-3284	6W728	4397001-070	SCREW, HEX HEAD 3/8-24 UNF-2A 3 IN LONG.....	36
3	PAOZZ	5310-01-436-3742	6W728	4397005-015	WASHER, FLAT 3/8 IN.	36
4	PAOZZ	5365-01-474-6596	6W728	4668958-003	BUSHING, ISOLATION MOUNT.....	36
5	PAODD	TBD	6W728	6431428-01M1	PINTLE WEAPON MOUNT ASSEMBLY.....	1
6	PAOZZ	TBD	6W728	1000535-01M1	SPACER, PINTLE WEAPON MOUNT.....	1
7	PAOZZ	TBD	6W728	4397001-073	SCREW, HEX HEAD 3.75 IN.	11
8	PAOZZ	TBD	6W728	4397001-075	SCREW, HEX HEAD 4.25 IN.	2
9	PAOZZ	TBD	6W728	4397005-075	WASHER, FENDER 3/8 IN.....	13
10	PAOZZ	5310-01-419-2413	6W728	4397005-014	WASHER, FLAT 3/8 IN.	13
11	PAOZZ	5310-01-437-3845	6W728	4397064-006	NUT, SELF LOCKING 3/8 IN.	13
12	PAOZZ	5306-01-434-7267	6W728	4397001-058	SCREW, HEX HEAD .750 IN.	2
13	PAOZZ	TBD	6W728	4397000-162	SCREW, HEX HEAD 5/8-11 UNC-2A X 1.500 IN.....	4
14	PAOZZ	TBD	6W728	TBD	WASHER, LOCK	4
15	PAOZZ	TBD	6W728	TBD	WASHER, FLAT	4

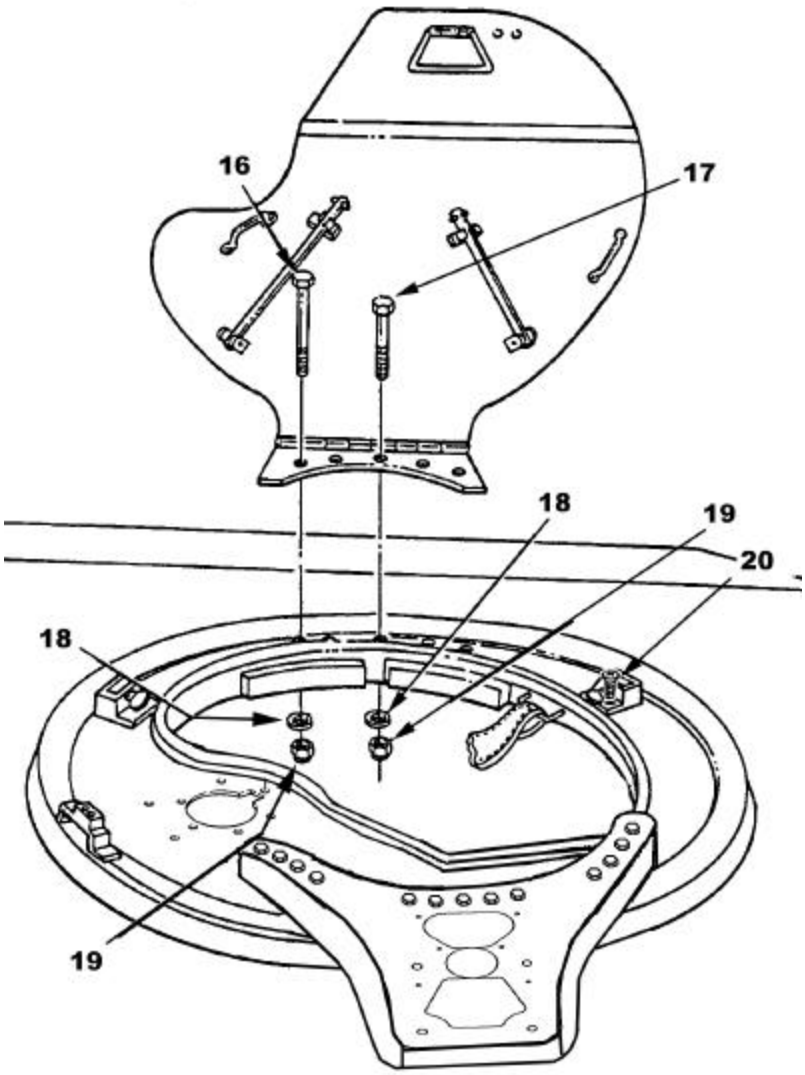


Figure 14. Vehicle Integration Kit (Sheet 2 of 12)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
16	PAOZZ	5305-00-269-3249	6W728	4397001-073	SCREW, HEX HEAD 3.75 IN.	4
17	PAOZZ	5306-01-434-3284	6W728	4397011-070	SCREW, HEX HEAD 3.00 IN.	1
18	PAOZZ	5310-01-419-2413	6W728	4397005-014	WASHER	5
19	PAOZZ	5310-01-437-3845	6W728	4397064-006	NUT, SELF LOCKING 3/8-24-UNF	5
20	PAOZZ	5305-01-437-6312	6W728	4397032-121	SCREW, COUNTERSUNK FLAT HEAD	4

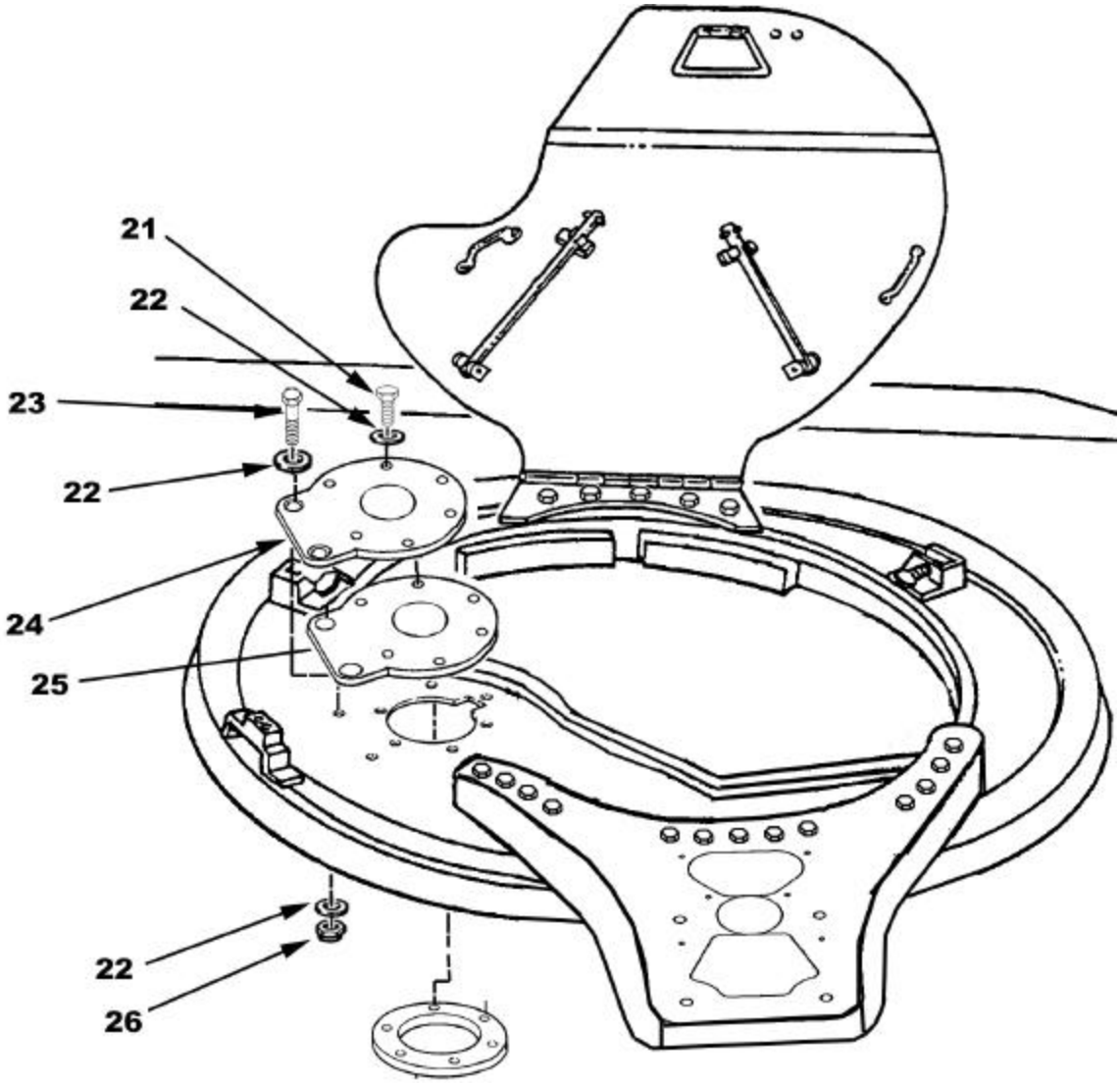


Figure 14. Vehicle Integration Kit (Sheet 3 of 12)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
21	PAOZZ	TBD	6W728	4397000-062	SCREW, HEX HEAD 1.25 IN.	6
22	PAOZZ	5310-01-419-2413	6W728	4397005-014	WASHER, FLAT	16
23	PAOZZ	TBD	6W728	4397001-073	SCREW, HEX HEAD 3.75 IN.	2
24	PAOZZ	TBD	6W728	6431432-01M1	TURRET COVER, PASS THRU	1
25	PAOZZ	TBD	6W728	6431433-01M1	TURRET COVER SEAL, PASS THR	1
26	PAOZZ	5310-01-437-3845	6W728	4397064-006	NUT, SELF LOCKING	2

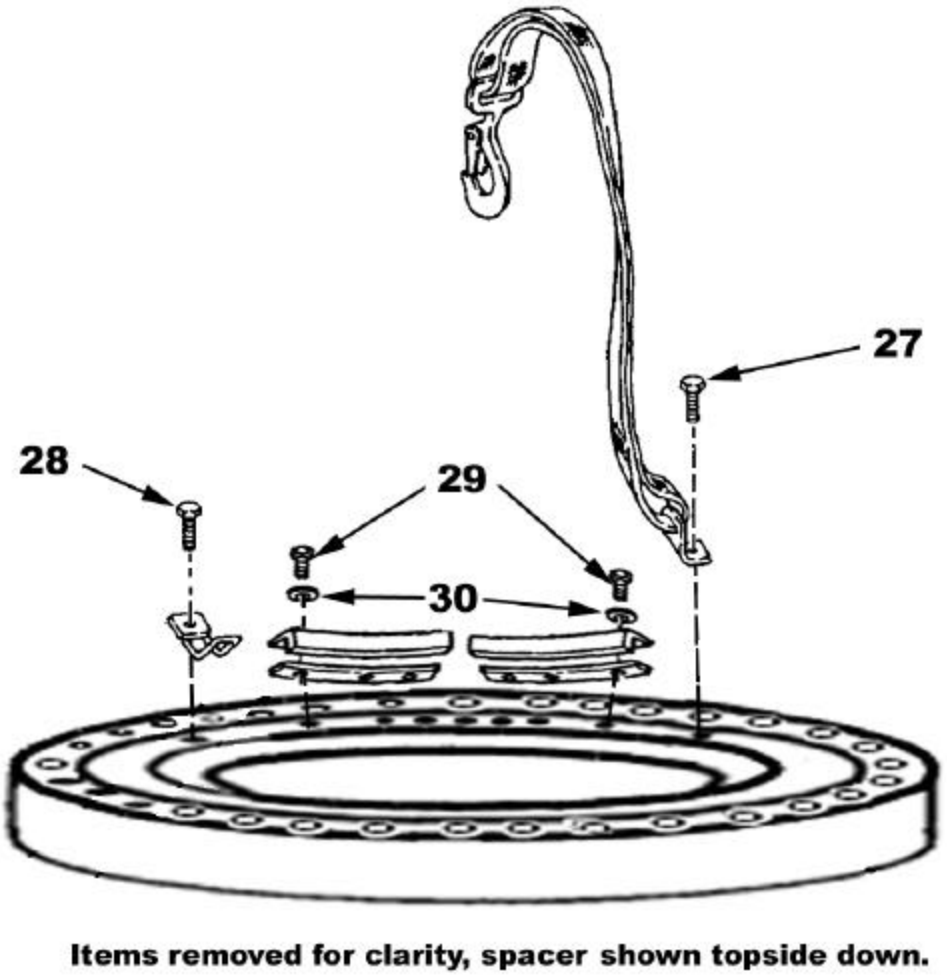


Figure 14. Vehicle Integration Kit (Sheet 4 of 12)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
27	PAOZZ	5306-01-434-7267	6W728	4397011-058	BOLT, MACHINE 3/8-24 0.75 IN	1
28	PAOZZ	5306-01-434-7263	6W728	4397011-060	BOLT, MACHINE 3/8-24 1.00 IN	1
29	PAOZZ	5306-01-434-7261	6W728	4397011-062	BOLT, MACHINE 3/8 –24 1.25 IN	2
30	PAOZZ	5310-01-419-2413	6W728	4397005-014	WASHER, FLAT	2

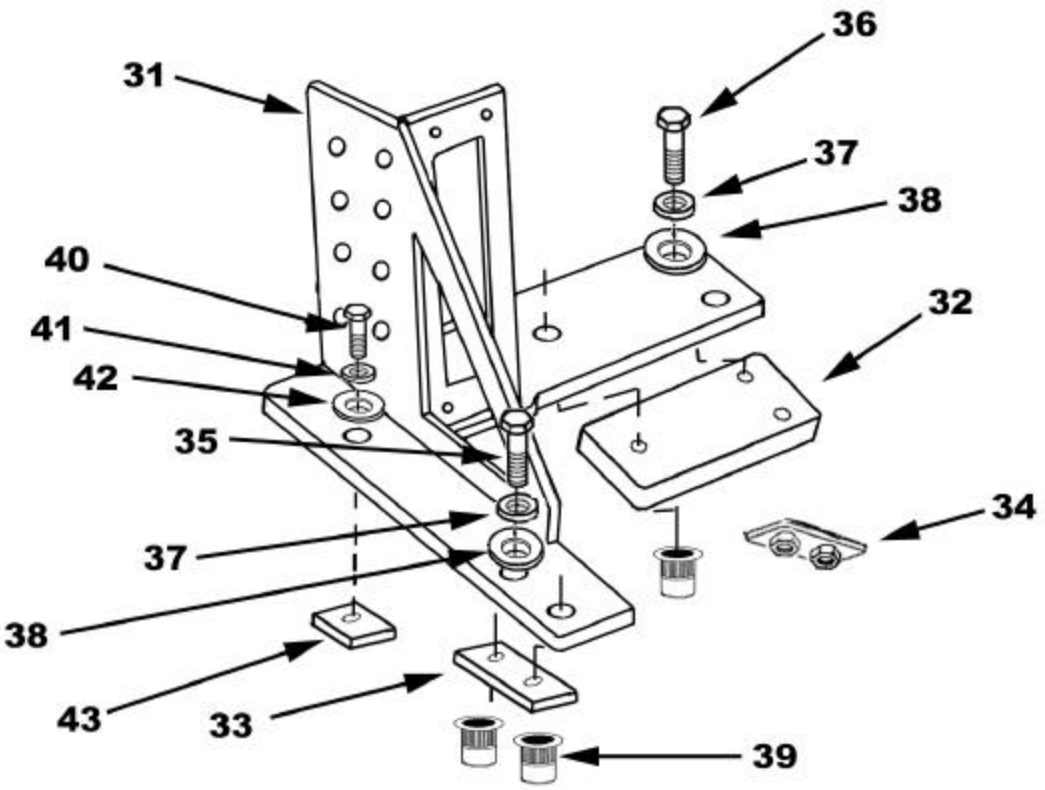


Figure 14. Vehicle Integration Kit (Sheet 5 of 12)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
31	PAOZZ	TBD	6W728	6431450-01M1	BASE WELDMENT, CROWS	1
32	PAOZZ	TBD	6W728	6431452-01M1	SHIM, B BEAM	1
33	PAOZZ	TBD	6W728	6431451-01M1	SHIM, TUNNEL	1
34	PAOZZ	TBD	6W728	6431453-01M1	NUTPLATE, B BEAM	1
35	PAOZZ	TBD	6W728	4397000-062	SCREW, HEX HEAD 3/8-16 UNC X 1.250 IN.	2
36	PAOZZ	TBD	6W728	4397000-066	SCREW, HEX HEAD 3/8-16 UNC X 2.00 IN.	3
37	PAOZZ	TBD	6W728	4397004-008	WASHER, LOCK 3/8 IN.	5
38	PAOZZ	TBD	6W728	4397005-014	WASHER, FLAT 3/8 IN.	5
39	PAOZZ	TBD	6W728	4397050-049	INSERT, NUT 3/8-16 UNC AVK	3
40	PAOZZ	TBD	6W728	4397000-012	SCREW, HEX HEAD 1/4 –20 UNC X 1.50 IN.	1
41	PAOZZ	TBD	6W728	4397004-006	WASHER, LOCK ¼ IN.	1
42	PAOZZ	TBD	6W728	4397005-011	WASHER, ¼ IN.	1
43	PAOZZ	TBD	6W728	6431618-01M1	SHIM, .250 IN.	1

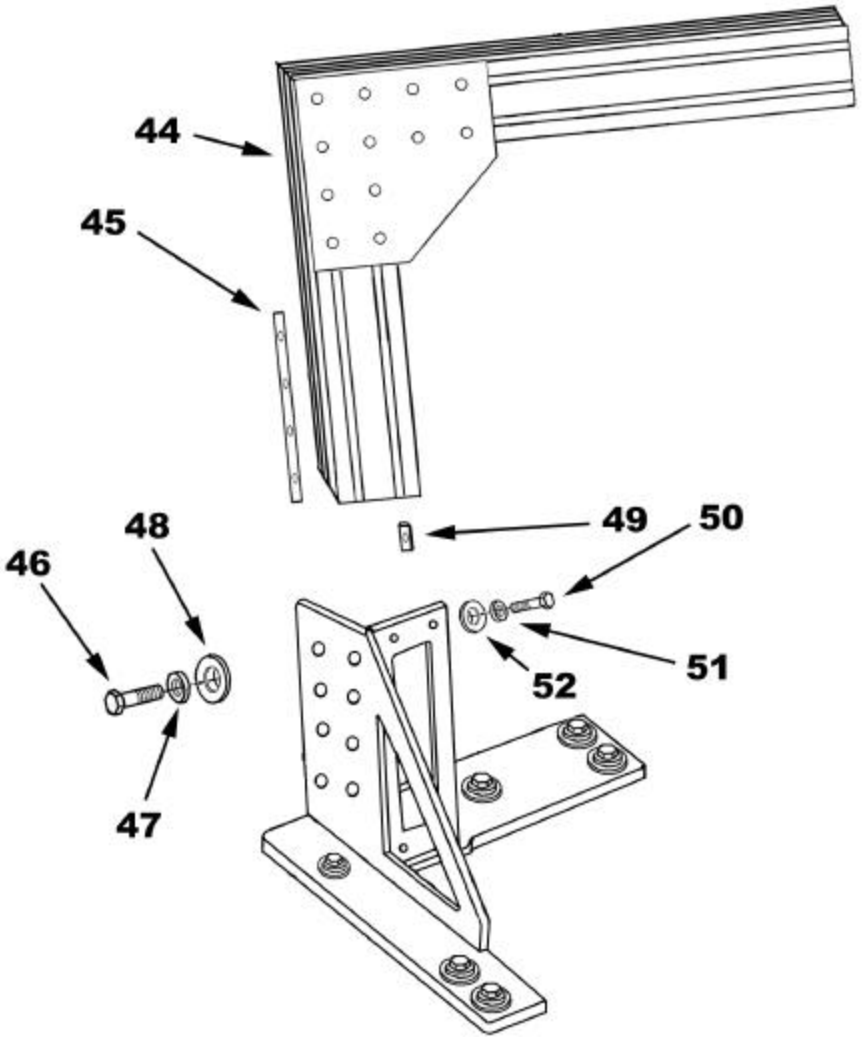


Figure 14. Vehicle Integration Kit (Sheet 6 of 12)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
44	PAOFF	TBD	6W728	6431435-01M1	MONITOR STAND SUBASSEMBLY.....	1
45	PAOZZ	TBD	6W728	6431442-01M1	T-NUT 4-HOLE .313-18 UNC	2
46	PAOZZ	TBD	6W728	4397000-033	SCREW, HEX .313-18 X .875	8
47	PAOZZ	TBD	6W728	4397004-007	WASHER, LOCK .313 IN.....	8
48	PAOZZ	TBD	6W728	4397005-012	WASHER, FLAT .313 IN.....	8
49	PAOZZ	TBD	6W728	6431445-01M1	T-NUT 1 HOLE .190-32 UNF	4
50	PAOZZ	TBD	6W728	4397051-033	SCREW, HEX HEAD .190-32 UNF .750 IN.....	4
51	PAOZZ	TBD	6W728	4397004-005	WASHER, LOCK .190 IN.....	4
52	PAOZZ	TBD	6W728	4397005-008	WASHER, FLAT .190 IN.....	4

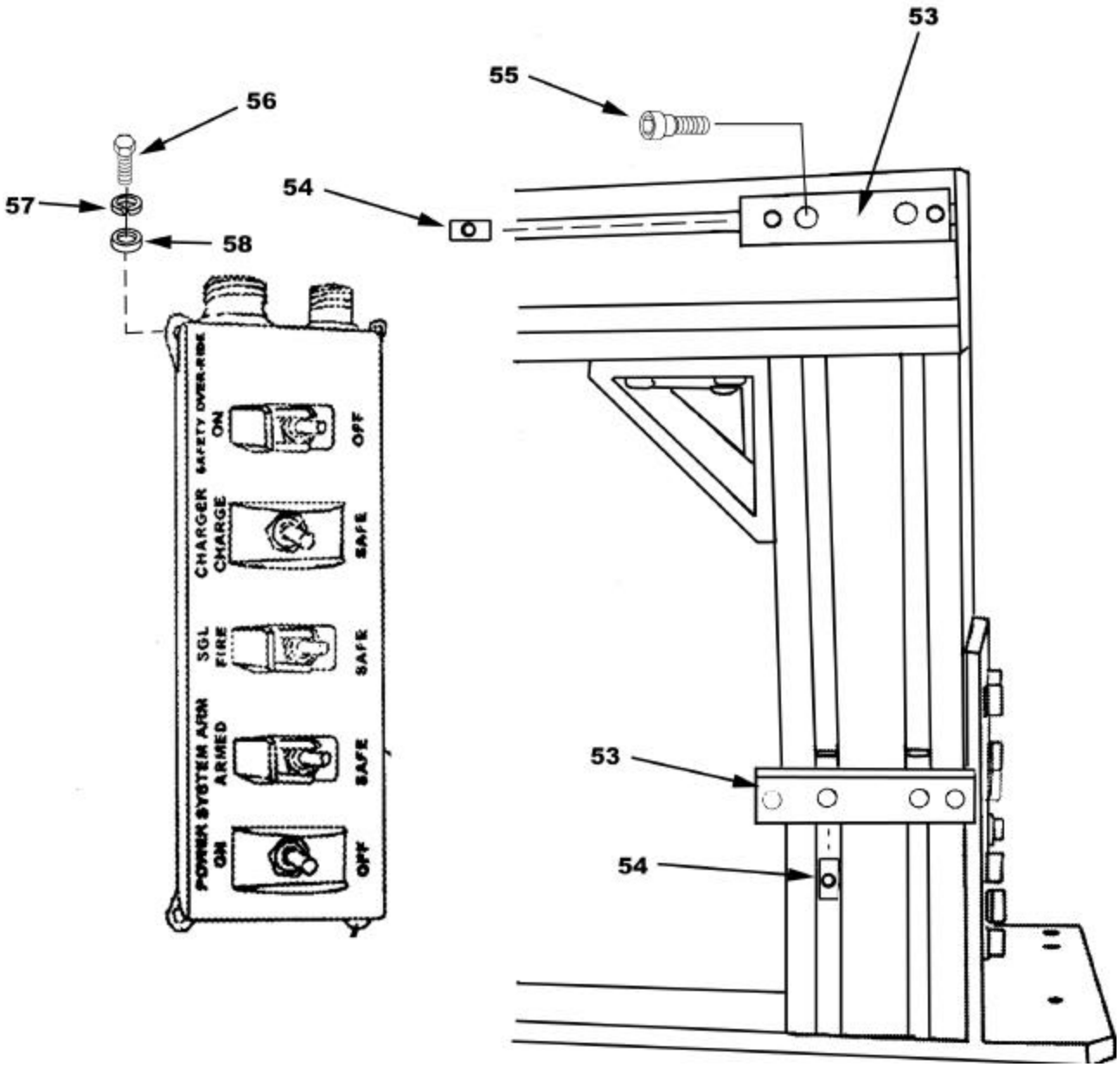


Figure 14. Vehicle Integration Kit (Sheet 7 of 12)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
53	PAOZZ	TBD	6W728	6431446-01M1	ADAPTER BAR SWITCH PANEL.....	2
54	PAOZZ	TBD	6W728	4397030-073	SCREW, CAP HEAD X 5/8 IN...	4
55	PAOZZ	TBD	6W728	6431445-01M1	T-NUT 1 HOLE, .190-32 UNF	4
56	PAOZZ	TBD	6W728	4397051-033	SCREW, HEX .190-32 X ¾ IN..	4
57	PAOZZ	TBD	6W728	4397004-005	WASHER, LOCK .190 IN.....	4
58	PAOZZ	TBD	6W728	4397005-008	WASHER, FLAT .190 IN.....	4

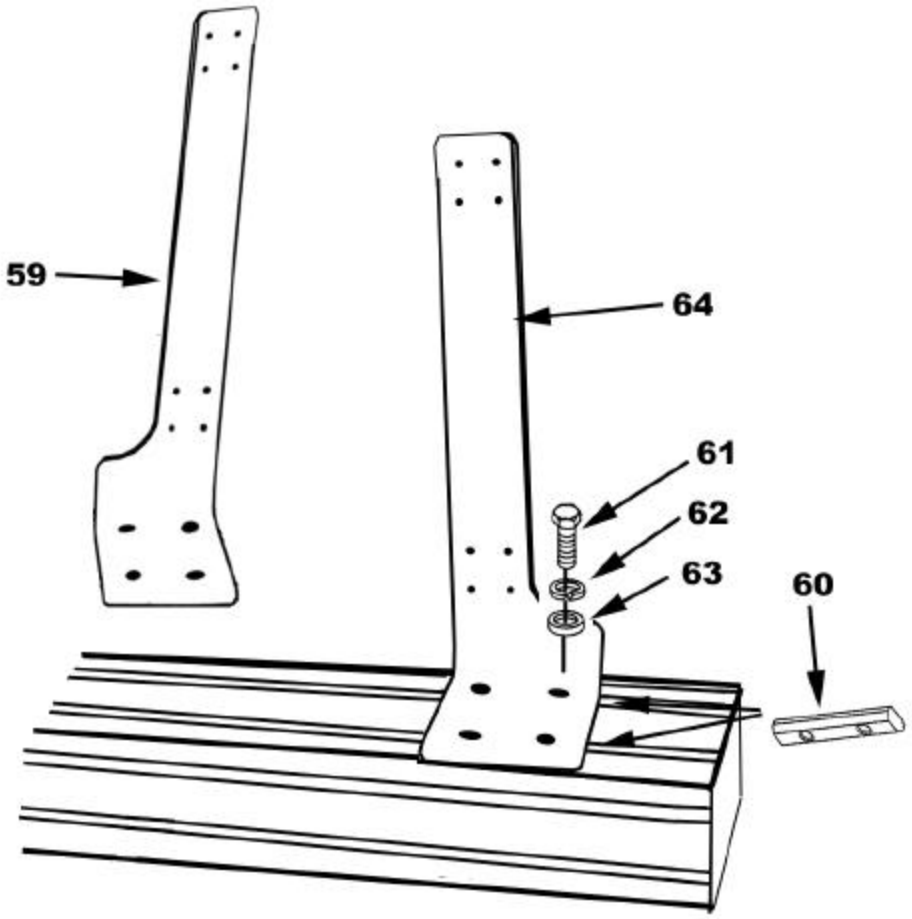


Figure 14. Vehicle Integration Kit (Sheet 8 of 12)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
59	PAOZZ	TBD	6W728	6431447-01M1	BRACKET, MONITOR MOUNTING LEFT.....	1
60	PAOZZ	TBD	6W728	6431441-01M1	T-NUT 2 HOLE .313 IN.	4
61	PAOZZ	TBD	6W728	4397000-032	SCREW, HEX .313-18 UNC X ¾ IN.	8
62	PAOZZ	TBD	6W728	4397004-007	WASHER, LOCK .313 IN.	8
63	PAOZZ	TBD	6W728	4397005-012	WASHER, FLAT .313 IN.....	8
64	PAOZZ	TBD	6W728	6431448-01M1	BRACKET, MONITOR MOUNTING RIGHT.....	1

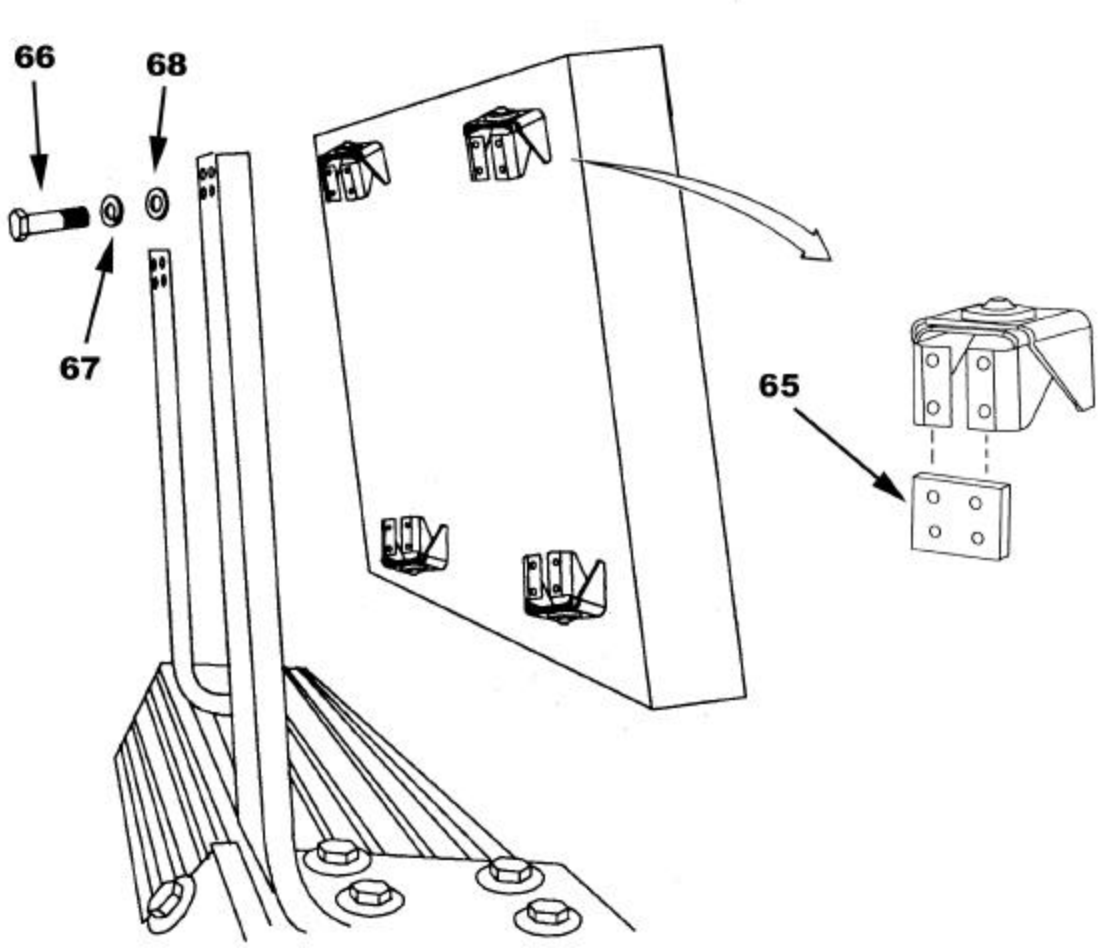


Figure 14. Vehicle Integration Kit (Sheet 9 of 12)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
65	PAOZZ	TBD	6W728	6431449-01M1	BLOCK, TAPPING.....	4
66	PAOZZ	TBD	6W728	4397051-033	SCREW, HEX .190-32 X ¾ IN..	16
67	PAOZZ	TBD	6W728	4397004-005	WASHER, LOCK .190 IN.....	16
68	PAOZZ	TBD	6W728	4397005-008	WASHER, FLAT .190 IN.....	16

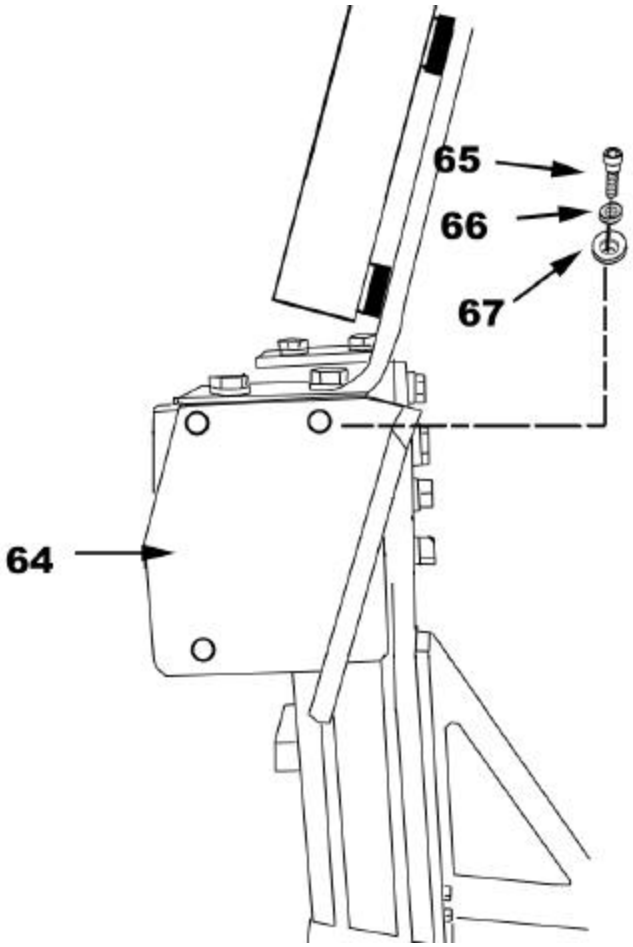


Figure 14. Vehicle Integration Kit (Sheet 10 of 12)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
64	PAOZZ	TBD	6W728	1000510-01M1	PLATE, JOYSTICK HOLDER	1
65	PAOZZ	TBD	6W728	4397000-032	SCREW, CAP .313-18 UNC X ¾ IN.	3
66	PAOZZ	TBD	6W728	4397004-007	WASHER, LOCK .313 IN.	3
67	PAOZZ	TBD	6W728	4397005-012	WASHER, FLAT .313 IN.	3

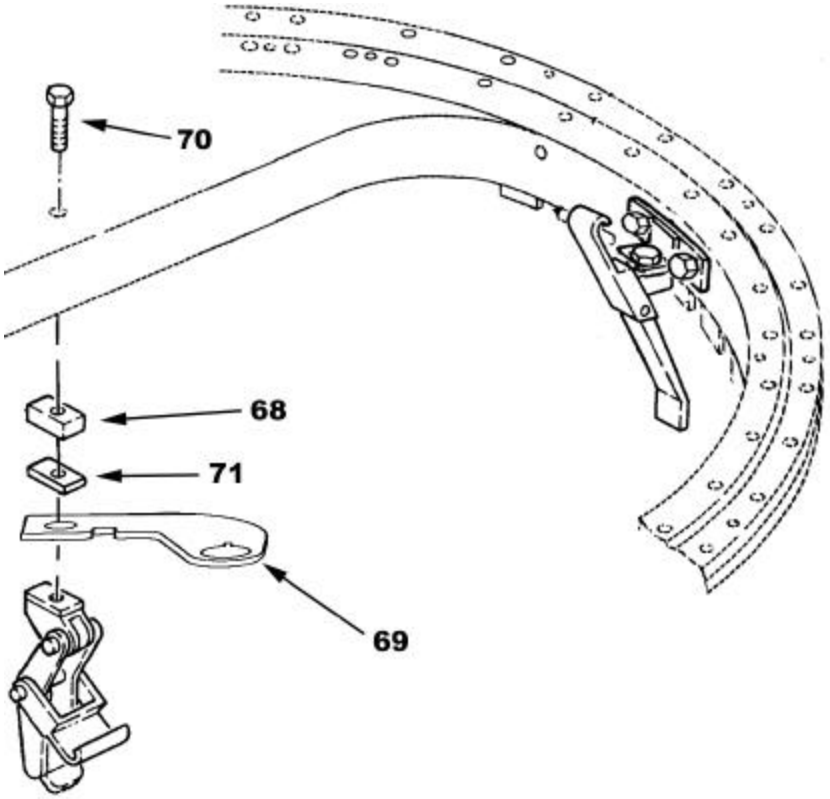


Figure 14. Vehicle Integration Kit (Sheet 11 of 12)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
68	PAOZZ	TBD	6W728	6431469-01M1	SPACER, CLAMP	1
69	PAOZZ	TBD	6W728	6431470-01M1	BRACKET, LIMIT SWITCH.....	1
70	PAOZZ	TBD	6W728	4397000-064	SCREW HEX 3/8-16 UNC X 1.50 IN.....	1
71	PAOZZ	TBD	6W728	6431620-01M1	SHIM, CLAMP.....	1

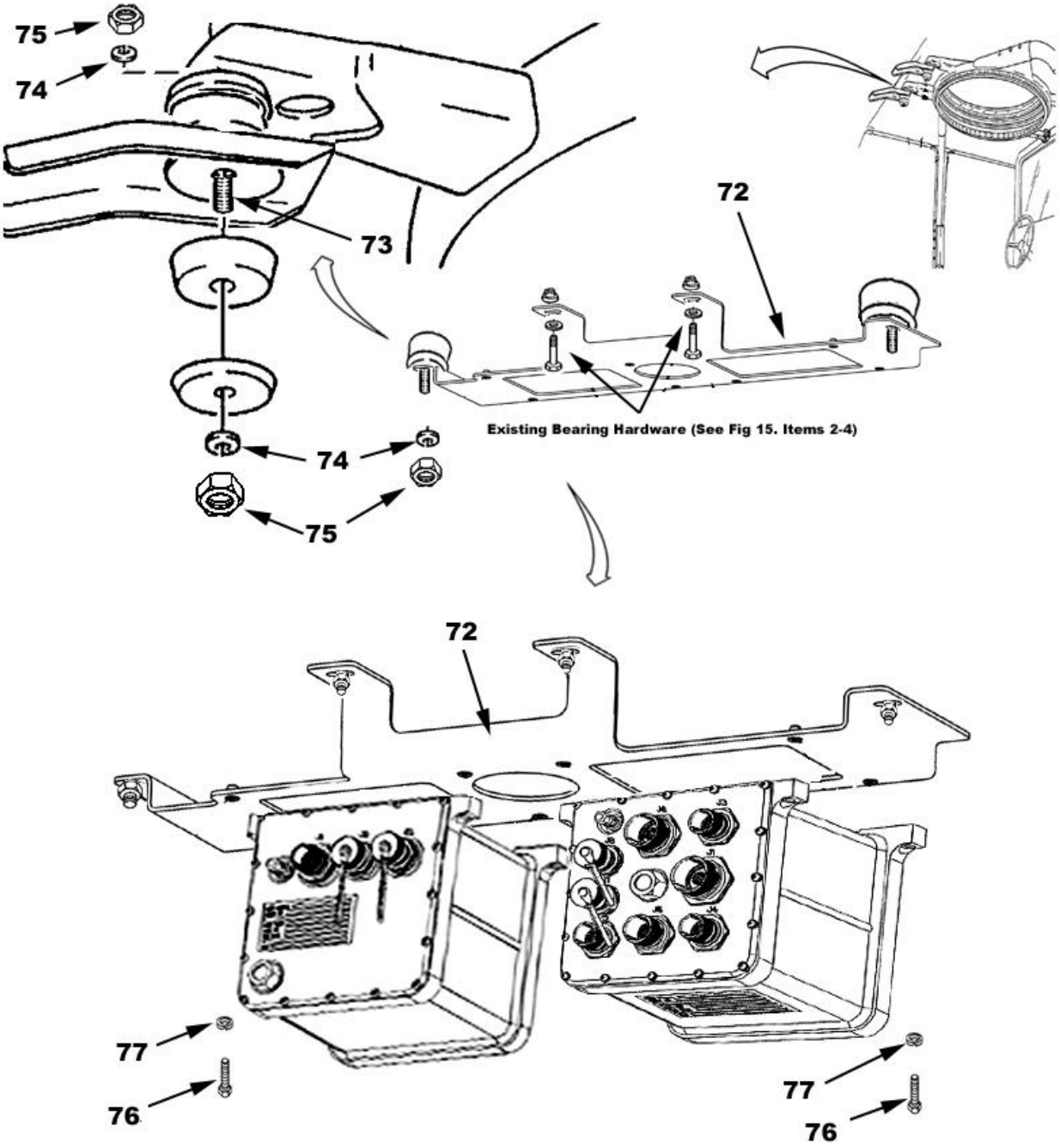


Figure 14. Vehicle Integration Kit (Sheet 12 of 12)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
72	PAOZZ	TBD	6W728	6431454-01M1	PLATE ASSEMBLY.....	1
73	PAOZZ	5307-01-254-2504	6W728	12339559	STUD, ROOF MOUNT 3/8-16 UNC X 3.75 IN.	2
74	PAOZZ	5310-01-419-2413	6W728	4397005-014	WASHER, FLAT	4
75	PAOZZ	5310-01-439-8177	6W728	4397064-005	NUT, SELF LOCKING 3/8-16	4
76	PAOZZ	TBD	6W728	4397051-035	SCREW, HEX .190-32 UNF X 1.00 IN.....	8
77	PAOZZ	TBD	6W728	4397004-005	WASHER, LOCK .190 IN.	8

END OF FIGURE

MAINTENANCE MANUAL
FOR THE
ARMAMENT SUBSYSTEM: REMOTELY OPERATED, M101;
COMMON REMOTELY OPERATED WEAPON STATION (CROWS)

INDEX

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

A

Adapter, Additional Weapon, Kit ..... WP 0029, WP 0050
Adapter, M2 HB Weapon, Kit ..... WP 0025, WP 0046
Adapter, M240 Weapon, Kit ..... WP 0027, WP 0048
Adapter, M249 Weapon, Kit ..... WP 0028, WP 0049
Adapter, Mk19 Weapon, Kit ..... WP 0026, WP 0047
Additional Weapon Adapter Kit ..... WP 0029, WP 0050
Allocation, Maintenance, Chart ..... WP 0055
Ammo Can ..... WP 0002
Ammo Yoke Arm Assembly ..... WP 0019, WP 0036
Ammunition Can Assembly ..... WP 0023, WP 0044
Applicable Documents ..... WP 0001
Arm, Ammo Yoke, Assembly ..... WP 0019, WP 0036
Arm, Elevation Yoke, Assembly ..... WP 0018, WP 0035
Assembling Display Unit Support Arm Assembly ..... WP 0060
Assembly, Ammo Yoke Arm ..... WP 0019, WP 0036
Assembly, Ammunition Can ..... WP 0023, WP 0044
Assembly, Cradle, (M2/Mk19) ..... WP 0024, WP 0045
Assembly, Elevation Drive ..... WP 0018
Assembly, Elevation Yoke Arm ..... WP 0018, WP 0035
Assembly, Pedestal ..... WP 0017, WP 0034
Assembly, Stabilized Weapon Mount ..... WP 0016, WP 0033
Attenuator Shaft Procedures, Lubrication ..... WP 0005
Auxiliary Equipment List ..... WP 0052
Auxiliary Equipment Maintenance Information ..... WP 0052
Azimuth Lock Assembly (Stud and Spring) Procedures, Lubrication ..... WP 0005
Azimuth Lock Assembly ..... WP 0013

B

Ballistic Protection Kit ..... WP 0030, WP 0051

C

Cables, Interconnect ..... WP 0022, WP 0043
Can, Ammunition, Assembly ..... WP 0023, WP 0044
Care of Auxiliary Equipment ..... WP 0052
CG (Control Group) ..... WP 0021
Chart, Maintenance Allocation ..... WP 0055
Chart, with Metric Conversion, Glossary ..... WP 6400
Checks, Unit Preventive Maintenance, and Services ..... WP 0014
Chemical Agent Resistant Coating (CARC) ..... WP 0008
Cleaning Procedures ..... WP 0004
Connectors and Cables ..... WP 0013
Connectors ..... WP 0013
Connectors, Cleaning ..... WP 0004
Contents, Table of iii
Control Group Components ..... WP 0013
Control Group ..... WP 0002
Control Group ..... WP 0021
Control, Corrosion Prevention and ..... WP 0008
Control, Interface, Unit ..... WP 0040
Controls and Indicators ..... WP 0002
Conversion Formula ..... WP 0063
Conversion, with Metric, Chart, Glossary ..... WP 6400
Correct Assembly or Stowing, PMCS ..... WP 0014
Corrective Action Procedures ..... WP 0008
Corrosion Prevention and Control (CPC) ..... WP 0001
Corrosion Prevention and Control Overview ..... WP 0008
Corrosion Prevention and Control ..... WP 0008
Cover ..... WP 0052
Cradle Assembly (M2/Mk19) ..... WP 0024, WP 0045
Cradles and Adapter Kits ..... WP 0002
CROWS Cover, Cleaning ..... WP 0004
CROWS Interconnect Diagram ..... WP 0013

C - Cont

CROWS Overview..... WP 0001
CROWS Signal Flow Diagram ..... WP 0013
CROWS Weapon Mount ..... WP 0002

D

DA Form 2028.....following Index
Data, Equipment Description and..... WP 0002
Description, Equipment, and Data..... WP 0002
Desiccant Reactivation and Nitrogen-Purging Procedures ..... WP 0009
Designated Intervals, PMCS ..... WP 0014
Destruction of Materiel to Prevent Enemy Use..... WP 0001
Diagrams, Wiring..... WP 0066
Direct Support Functional Test and Troubleshooting ..... WP 0032
Direct Support Maintenance .....Chapter 5, Chapter 6
Direct Support Troubleshooting Procedures..... WP 0031
Disassembly of the Ammo Yoke Arm..... WP 0019
Disassembly of the Pedestal ..... WP 0017
Disassembly of the Sensor Group..... WP 0020
Disassembly of the SWM..... WP 0016
Discharge, Electrostatic Instructions ..... WP 0010
Display Unit Base Bracket ..... WP 0060
Display Unit ..... WP 0042
Display Unit, Cleaning..... WP 0004
Drive, Elevation, Assembly ..... WP 0018
Durable, Expendable and, Materials ..... WP 0056

E

Electronics Module Unit ..... WP 0038
Electrostatic Discharge (ESD) ..... WP 0001
Electrostatic Discharge Instructions ..... WP 0010
Elevation Drive Assembly ..... WP 0018
Elevation Yoke Arm Assembly.....WP 0018, WP 0035
EMU (Electronics Module Unit)..... WP 0038
Engagement Mode Screen, Sample of..... WP 0013

E - Cont

Equipment Characteristics, Capabilities, and Features ..... WP 0002
Equipment Data ..... WP 0002
Equipment Description and Data ..... WP 0002
Equipment, Auxiliary, Maintenance Information ..... WP 0052
Examples of Safety Wiring CROWS Components/Parts ..... WP 0006
Expendable and Durable Materials ..... WP 0056

F

Finishing Off with a Pigtail, Safety Wiring ..... WP 0006
Fire-Control Solution ..... WP 0003
First Time Install ..... WP 0060
Form, DA 2028 ..... following Index
Functional, Direct Support, Test and Troubleshooting ..... WP 0032
Functional, Unit, Test and Troubleshooting ..... WP 0013

G

General Cable Inspection Procedures ..... WP 0022
General Cleaning Instructions ..... WP 0004
General Information ..... WP 0001
General Lubrication Procedures ..... WP 0005
Glossary with Metric Conversion Chart ..... WP 0064
Group 00 CROWS Repair Parts List ..... WP 0068
Group 01 Stabilized Weapon Mount Assembly Repair Parts List ..... WP 0069
Group 0101 Pedestal Gun Mount Assembly Repair Parts List ..... WP 0070
Group 0104 Ammo Yoke Arm Assembly Repair Parts List ..... WP 0071
Group 02 Sensor Group Repair Parts List ..... WP 0072
Group 03 Control Group Repair Parts List ..... WP 0073
Group 05 Ammo Can Repair Parts List ..... WP 0074
Group 06 Cradle Assembly Repair Parts List ..... WP 0075
Group 07 M2 HB Weapon Adapter Kit Repair Parts List ..... WP 0076
Group 0702 M2 HB WAK -- Linear Actuator Assembly Repair Parts List ..... WP 0077
Group 0704 M2 HB WAK -- Block Guide Assembly Repair Parts List ..... WP 0078
Group 08 Mk19 Weapon Adapter Kit Repair Parts List ..... WP 0079
Group 0802 Mk19 WAK -- Linear Actuator Assembly Repair Parts List ..... WP 0080

G - Cont

Group 10 Ballistic Protection Kit Repair Parts List ..... WP 0081
Group 11 Vehicle Integration Kit (VIK) Repair Parts List ..... WP 0082
Group, Control ..... WP 0021
Group, Sensor ..... WP 0020, WP 0037

H

Handling, Shipping and ..... WP 0059
How to Use This Manual vi
Humidity Indicator Strip ..... WP 0020

I

ICU (Interface Control Unit) ..... WP 0040
Index I-1
Information, Auxiliary Equipment Maintenance ..... WP 0052
Information, General ..... WP 0001
Inspection - Cables/Wiring Harneses, PMCS ..... WP 0014
Installation of Cables ..... WP 0022
Installation of the Ammo Yoke Arm Assembly and Ammo Hanger Assembly, SWM ..... WP 0016
Installation of the Armor, BPA ..... WP 0030
Installation of the Azimuth Lock Assembly and the Azimuth Lock Base, Pedestal ..... WP 0017
Installation of the Casing Deflector, SWM ..... WP 0016
Installation of the Dead Axle Housing ..... WP 0019
Installation of the Elevation Yoke Arm Assembly, SWM ..... WP 0016
Installation of the Weapon Elevation Cable, SWM ..... WP 0016
Installation ..... WP 0060
Installing Cables ..... WP 0060
Installing CROWS Weapon Mount onto Vehicle ..... WP 0060
Installing Display Unit Base Bracket ..... WP 0060
Installing Display Unit Support Arm Assembly onto Display Unit Base Bracket ..... WP 0060
Installing Electronic Module Unit (EMU) ..... WP 0060
Installing End Cap into Display Unit Support Arm Assembly ..... WP 0060
Installing Hatch Interlock Switch ..... WP 0060

I - Cont

Installing Interface Control Unit (ICU) ..... WP 0060
Installing Joystick Bracket ..... WP 0060
Installing Joystick Holder ..... WP 0060
Installing Joystick ..... WP 0060
Installing Non-Rotating Turret Spacer Ring and Associated Components ..... WP 0060
Installing Plate Assembly ..... WP 0060
Installing Switch Panel Unit (SPU) Adapter Bars and SPU - Alternative 1 ..... WP 0060
Installing Switch Panel Unit (SPU) Adapter Bars and SPU - Alternative 3 ..... WP 0060
Installing Switch Panel Unit (SPU) Adapter Bracket and SPU - Alternative 2 ..... WP 0060
Installing the Display Unit Upright Mounting Brackets ..... WP 0060
Installing the Display Unit ..... WP 0060
Instructions, Electrostatic Discharge ..... WP 0010
Integration Kit, Vehicle ..... WP 0061, WP 0062, WP 0063, WP 0064
Interconnect Cables ..... WP 0022, WP 0043
Interconnection of CROWS Components ..... WP 0013
Interface Control Unit ..... WP 0040
Introduction to MAC ..... WP 0054

J

Joystick ..... WP 0041 00

K

Kit, Additional Weapon Adapter ..... WP 0029, WP 0050
Kit, Ballistic Protection ..... WP 0030, WP 0051
Kit, Vehicle Integration ..... WP 0061, WP 0062, WP 0063, WP 0064
Kit, M2 HB Weapon Adapter ..... WP 0025, WP 0046
Kit, M240 Weapon Adapter ..... WP 0027, WP 0048
Kit, M249 Weapon Adapter ..... WP 0028, WP 0049
Kit, Mk19 Weapon Adapter ..... WP 0026, WP 0047

L

Laser Alignment for Target Engagement ..... WP 0003
Linear Actuator (Charger) Rod, Cleaning ..... WP 0004
List of Abbreviations ..... WP 0001
List, Tool Identification ..... WP 0057
Location and Description of Major Components ..... WP 0002
Locking, Thread, Procedures ..... WP 0007
Lubrication Procedures ..... WP 0005

M

(M2/Mk19) Cradle Assembly ..... WP 0024, WP 0045
M2 HB Weapon Adapter Kit: ..... WP 0025, WP 0046
M240 Weapon Adapter Kit ..... WP 0027, WP 0048
M249 Weapon Adapter Kit ..... WP 0028, WP 0049
MAC ..... WP 0055
MAC, Introduction to ..... WP 0054
Maintenance Allocation Chart ..... WP 0055
Maintenance Forms, Records, and Reporting ..... WP 0001
Maintenance, Auxiliary Equipment, Information ..... WP 0052
Maintenance, Unit Preventive, Checks and Services ..... WP 0014
Mandatory Replacement Parts/Spares ..... WP 0058
Manual, How to Use This vi
Material, Service at Receipt of Materiel ..... WP 0015
Materials, Expendable and Durable ..... WP 0056
Menu System ..... WP 0002
Method for Multiple Fasteners, Closely Spaced, Safety Wiring ..... WP 0006
Metric, with, Conversion Chart, Glossary ..... WP 6400
Mk19 Weapon Adapter Kit ..... WP 0026, WP 0047
Module, Electronics, Unit ..... WP 0038
Mount, Stabilized Weapon, Assembly ..... WP 0016, WP 0033

N

National Stock Number Index ..... WP 0083
Nitrogen, Desiccant Reactivation and, Purging Procedures ..... WP 0009
No-Fire Zones ..... WP 0003
Not Ready/Available, PMCS ..... WP 0014

O

Operation, Theory of, and Operational Overview ..... WP 0003
Operational, Theory of Operation and, Overview ..... WP 0003
Optics, Cleaning ..... WP 0004
Overview of System Operation ..... WP 0003
Overview, Theory of Operation and Operational ..... WP 0003

P

Painted and Metallic Surfaces, Cleaning ..... WP 0004
Panel, Switch, Unit ..... WP 0039
Part Number Index ..... WP 0084
Parts, Mandatory Replacement, /Spares ..... WP 0058
Pedestal Assembly ..... WP 0017, WP 0034
Pedestal Assembly, Drawing 21677-1001 (Sheet 1 of 2) FO-1
Pedestal Assembly, Drawing 21677-1001 (Sheet 2 of 2) FO-2
Pin Procedures, Lubrication ..... WP 0005
Preparation for Storage or Shipment ..... WP 0001
Prevention, Corrosion, and Control ..... WP 0008
Preventive Maintenance Checks and Services (PMCS) ..... WP 0014
Preventive Maintenance Overview ..... WP 0014
Preventive, Unit, Maintenance Checks and Services ..... WP 0014
Procedures, Cleaning ..... WP 0004
Procedures, Desiccant Reactivation and Nitrogen-Purging ..... WP 0009
Procedures, Direct Support Troubleshooting ..... WP 0031
Procedures, Lubrication ..... WP 0005
Procedures, Safety-Wire ..... WP 0006
Procedures, Thread-Locking ..... WP 0007
Procedures, Unit Maintenance Troubleshooting ..... WP 0012
Protection, Ballistic, Kit ..... WP 0030, WP 0051
Purging, Desiccant Reactivation and Nitrogen, Procedures ..... WP 0009
Purpose of Equipment ..... WP 0001

Q

Quality of Materiel ..... WP 0001

R

Reactivation, Desiccant, and Nitrogen-Purging Procedures ..... WP 0009
Reassembly of Sensor Group ..... WP 0020
Reassembly of the Ammo Yoke Arm ..... WP 0019
Reassembly of the Pedestal ..... WP 0017
Reassembly of the SWM, SWM ..... WP 0016
Receipt, Service at, of Materiel ..... WP 0015
References ..... WP 0053
Removal of Armor, BPA ..... WP 0030
Removal of Interconnection Cables ..... WP 0022
Removal of the Ammo Yoke Arm and Ammo Hanger Assembly, SWM ..... WP 0016
Removal of the Azimuth Lock Assembly and the Azimuth Lock Base, Pedestal ..... WP 0017
Removal of the Casing Deflector, SWM ..... WP 0016
Removal of the Dead Axle Housing ..... WP 0019
Removal of the Elevation Yoke Arm Assembly, SWM ..... WP 0016
Removal of the Weapon Elevation Cable, SWM ..... WP 0016
Removal of Thread Locked Parts ..... WP 0007
Removing Access Hole Cover and Nut Ring From Turret ..... WP 0060
Removing Batwing ..... WP 0060
Removing CROWS Non-Rotating Turret Spacer Ring ..... WP 0060
Removing CROWS Weapon Mount from Vehicle ..... WP 0060
Removing CROWS Weapon Mount ..... WP 0060
Removing Display Unit Base Bracket ..... WP 0060
Removing Display Unit Support Arm Assembly from Display Unit Base Bracket ..... WP 0060
Removing Display Unit Upright Mounting Brackets ..... WP 0060
Removing Display Unit ..... WP 0060
Removing End Cap from Display Unit Support Arm Assembly ..... WP 0060
Removing Hatch Interlock Switch ..... WP 0060
Removing Joystick Bracket ..... WP 0060
Removing Joystick Holder ..... WP 0060
Removing Joystick ..... WP 0060
Removing Plate Assembly ..... WP 0060
Removing Power Cable from Vehicle ..... WP 0060
Removing Switch Panel Unit (SPU) and SPU Adapter Bars - Alternative 1 ..... WP 0060
Removing Switch Panel Unit (SPU) and SPU Adapter Bars - Alternative 3 ..... WP 0060

R - Cont

Removing Switch Panel Unit (SPU) and SPU Adapter Bracket- Alternative 2..... WP 0060
Removing the EMU from Plate Assembly..... WP 0060
Removing the ICU from Plate Assembly..... WP 0060
Removing Turret Bearing and Turret Components..... WP 0060
Replacement, Mandatory, Parts/Spares ..... WP 0058
Reporting Corrosion Issues..... WP 0008
Reporting Equipment Improvement Recommenations (EIRs)..... WP 0001
RPSTL - Introduction..... WP 0067
Rubber Materials, Cleaning..... WP 0004

S

Safety Wire Locations..... WP 0006
Safety, Care, and Handling..... WP 0001
Safety-Wire Procedures ..... WP 0006
Schematics ..... WP 0065
Scope ..... WP 0001
Sear Assembly (Part of the M2 WAK) Procedures, Lubrication..... WP 0005
Sector Scan..... WP 0003
Sensor Group..... WP 0002
Sensor Group..... WP 0020, WP 0037
Sensor Unit..... WP 0013
Sensor Unit..... WP 0020, WP 0037
Service upon Receipt ..... WP 0015
SG (Sensor Group)..... WP 0020, WP 0037
Shipping and Handling ..... WP 0059
Single-Wire Method, Safety Wiring..... WP 0006
Soldering..... WP 0011
Spares, Mandatory Replacement Parts/ ..... WP 0058
Special Methods or Considerations, Safety Wiring..... WP 0006
Spider Mount ..... WP 0052
SPU (Switch Panel Unit)..... WP 0039
Stabilized Weapon Mount Assembly..... WP 0016, WP 0033
SU (Sensor Unit)..... WP 0020, WP 0037
Summary, Warning..... a

S - Cont

Support, Direct, Troubleshooting Procedures ..... WP 0031
Surveillance ..... WP 0003
Switch Panel Unit ..... WP 0039
SWM (Stabilized Weapon Mount Assembly) ..... WP 0016, WP 0033
System Interface ..... WP 0003

T

Table of Contents iii
Target Acquisition ..... WP 0003
Target Acquisition ..... WP 0003
Target Engagement ..... WP 0003
Target Reference Points ..... WP 0003
Test, Direct Support Functional, and Troubleshooting ..... WP 0031
Test, Unit Functional, and Troubleshooting ..... WP 0013
Theory of Operation and Operational Overview ..... WP 0003
Theory of Operation ..... WP 0003
Thread-Locking Azimuth Lock Handle ..... WP 0007
Thread-Locking Overview ..... WP 0007
Thread-Locking Procedures ..... WP 0007
Thread-Locking Procedures ..... WP 0007
Thread-Locking Retainers ..... WP 0007
Thread-Locking Screws ..... WP 0007
TOC (Table of Contents) iii
Tool Identification List ..... WP 0057
Torque Limits ..... WP 0063
Torque Table, How To Use ..... WP 0063
Trouble Spots, PMCS ..... WP 0014
Troubleshooting Messages Overview ..... WP 0012
Troubleshooting Reference ..... WP 0012
Troubleshooting, Direct Support Functional Test and ..... WP 0032
Troubleshooting, Direct Support, Procedures ..... WP 0031
Troubleshooting, Unit Functional Test and ..... WP 0013
Troubleshooting, Unit Maintenance, Procedures ..... WP 0012
Type of Manual ..... WP 0001

U

Unit Functional Test and Troubleshooting ..... WP 0013
Unit Maintenance Functional Testing and Troubleshooting Overview ..... WP 0013
Unit Maintenance Functional Testing and Troubleshooting Set-Up ..... WP 0013
Unit Maintenance Functional Testing and Troubleshooting ..... WP 0013
Unit, Display ..... WP 0042
Unit, Electronics Module ..... WP 0038
Unit, Interface Control ..... WP 0040
Unit Maintenance ..... Chapter 3, Chapter 4
Unit Maintenance Troubleshooting Procedures ..... WP 0012
Unit Preventive Maintenance Checks and Services ..... WP 0014
Unit, Sensor ..... WP 0020, WP 0037
Unit, Switch Panel ..... WP 0039
Use, How to, This Manual vi

V

Vehicle Integration Kit ..... WP 0061, WP 0062, WP 0063, WP 0064

W

WAK (Weapon Adapter Kit) ..... WP 0025 - WP 0029, WP 0045 - WP 0050
Warning Summary ..... a
Weapon Charging ..... WP 0003
Weapon Firing ..... WP 0003
Weapon, Additional, Adapter Kit ..... WP 0029, WP 0050
Weapon, M2 HB, Adapter Kit: ..... WP 0025, WP 0046
Weapon, M240, Adapter Kit ..... WP 0027, WP 0048
Weapon, M249, Adapter Kit ..... WP 0028, WP 0049
Weapon, Mk19, Adapter Kit ..... WP 0026, WP 0047
Weapon, Stabilized, Mount Assembly ..... WP 0016, WP 0033
Wire Size ..... WP 0006
Wire, Safety, Procedures ..... WP 0006
Wire-Twisting Practices and Criteria ..... WP 0006
Wiring Diagram, Cable Assembly, Electrical – Bulkhead to ICU, 21677-3731 ..... WP 0066

W - Cont

Wiring Diagram, Cable Assembly, Electrical – Gimbal to Bulkhead, 21677-3730 ..... WP 0066
Wiring Diagram, Cable Assembly, Electrical – ICU to Display, 21677-3715..... WP 0066
Wiring Diagram, Cable Assembly, Electrical – ICU to EMU, 21677-3716 ..... WP 0066
Wiring Diagram, Cable Assembly, Electrical – ICU to SPU, 21677-3714..... WP 0066
Wiring Diagram, Cable Assembly, Electrical – M2, 21677-3702..... WP 0066
Wiring Diagram, Cable Assembly, Electrical – Mk19, 21677-3703..... WP 0066
Wiring Diagram, Cable Assembly, Electrical - Mount to Sensor Unit, 21677..... WP 0066
Wiring Diagram, Cable Assembly, Electrical – Power, 21677-3713..... WP 0066
Wiring Diagram, Cable Assembly, Electrical – Weapon Elevation, 21677-3700..... WP 0066
Wiring Diagram, Linear Actuator (Charger), 21677-3180 ..... WP 0066
Wiring Diagram, Ogive Plunger Assembly, 21677-3225..... WP 0066
Wiring Diagram, Remote Firing Assembly, 21677-3150..... WP 0066
Wiring Diagrams..... WP 0066
Wring Diagram, Cable Assembly, Electrical – Hatch Interlock, 21677-3520..... WP 0066

X

--

Y

Yoke, Ammo, Arm Assembly .....WP 0019, WP 0036
Yoke, Elevation, Arm Assembly.....WP 0018, WP 0035

Z

--

END OF WORK PACKAGE

By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

SANDRA R. RILEY
Administrative Assistant to the
Secretary of the Army
0523416

DISTRIBUTION: To be distributed in accordance with the Initial Distribution Number (IDN) 401221 requirements for TM 9-1090-218-23&P.

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)* Commander, US Army Tank-automotive & Armaments Command ATTN: AMSTA-LC-CI Tech Pubs, TACOM-RI 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

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON *(Provide exact wording of recommended changes, if possible).*

SAMPLE

**Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE Your name and grade or title	TELEPHONE EXCHANGE/AUTOVON , PLUS EXTENSION Your phone extension	SIGNATURE Your signature

TO: (*Forward direct to addressee listed in publication*) Cmdr, US Army Tank-automotive&Armaments Cmd ATTN: AMSTA-LC-CI Tech Pubs, TACOM-RI 1 Rock Island Arsenal, Rock Island, IL 61299-7630	**FROM:** (*Activity and location) (Include ZIP Code)* Your military mailing address	**DATE** Today's Date

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE

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

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)* AMSTA-LC-LMIT / TECH PUBS, TACOM-RI 1 Rock Island Arsenal Rock Island, IL 61299-7630	**FROM:** *(Activity and location) (Include ZIP Code)*	

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 9-1090-218-23&P	1 September 2005	M101 Common Remotely Operated Weapon 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).*

**Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: (*Forward direct to addressee listed in publication*) AMSTA-LC-LMIT / TECH PUBS, TACOM-RI 1 Rock Island Arsenal Rock Island, IL 61299-7630	**FROM:** (*Activity and location) (Include ZIP Code)*	**DATE**

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE
TM 9-1090-218-23&P	1 September 2005	M101 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

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

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)* AMSTA-LC-LMIT / TECH PUBS, TACOM-RI 1 Rock Island Arsenal Rock Island, IL 61299-7630	**FROM:** *(Activity and location) (Include ZIP Code)*	

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 9-1090-218-23&P	1 September 2005	M101 Common Remotely Operated Weapon 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).*

**Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: (*Forward direct to addressee listed in publication*) AMSTA-LC-LMIT / TECH PUBS, TACOM-RI 1 Rock Island Arsenal Rock Island, IL 61299-7630	**FROM:** (*Activity and location) (Include ZIP Code)*	**DATE**

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE
TM 9-1090-218-23&P	1 September 2005	M101 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

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

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)* AMSTA-LC-LMIT / TECH PUBS, TACOM-RI 1 Rock Island Arsenal Rock Island, IL 61299-7630	**FROM:** *(Activity and location) (Include ZIP Code)*	

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 9-1090-218-23&P	1 September 2005	M101 Common Remotely Operated Weapon 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).*

**Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

DA FORM 2028, FEB 74 REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED. USAPPC V3.00

TO: (*Forward direct to addressee listed in publication*) AMSTA-LC-LMIT / TECH PUBS, TACOM-RI 1 Rock Island Arsenal Rock Island, IL 61299-7630	**FROM:** (*Activity and location) (Include ZIP Code)*	**DATE**

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE
TM 9-1090-218-23&P	1 September 2005	M101 Common Remotely Operated Weapon Station (CROWS)

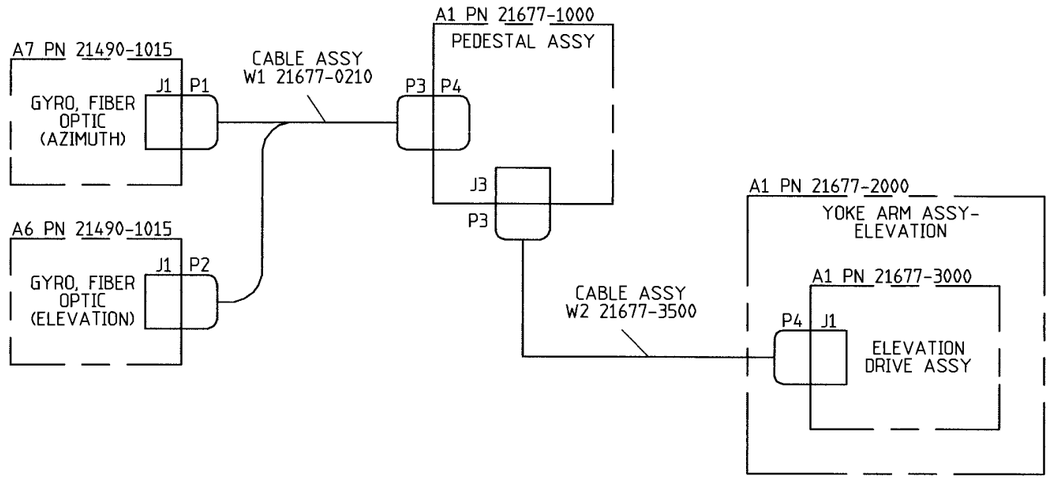
PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

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

USAPPC V3.00

REVISION				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



NOTES:

1. ASME 14.100M APPLIES.
2. UNLESS OTHERWISE SPECIFIED:
   RESISTANCE VALUES ARE IN OHMS.
   CAPACITANCE VALUES ARE IN MICROFARADS.
3. REFERENCE DESIGNATIONS ARE FOR REFERENCE ONLY AND MAY OR MAY NOT APPEAR ON PART.

NOTICE

THE INFORMATION CONTAINED IN THIS DOCUMENT WAS DEVELOPED AT PRIVATE EXPENSE BY CAI, A DIVISION OF RECON/OPTICAL, INC. THE CONTENTS ARE DEEMED PROPRIETARY AND ALL PATENT RIGHTS ARE RESERVED. ANY SUBMISSION IS IN A SPIRIT OF CONFIDENCE AND ACCEPTANCE IS DEEMED TO BE AN ACKNOWLEDGEMENT OF THE HEREON NOT LAWFULLY OBTAINED FROM ANOTHER SOURCE SHALL NOT BE RELEASED, DUPLICATED, USED OR DISCLOSED IN WHOLE OR IN PART FOR ANY PROCUREMENT OR MANUFACTURING PURPOSE WITHOUT THE PRIOR WRITTEN PERMISSION OF CAI, A DIVISION OF RECON/OPTICAL, INC., BARRINGTON, IL

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
.XX DEC ± — .XXX DEC ± — ANGLES ± —

CONTRACT NO.

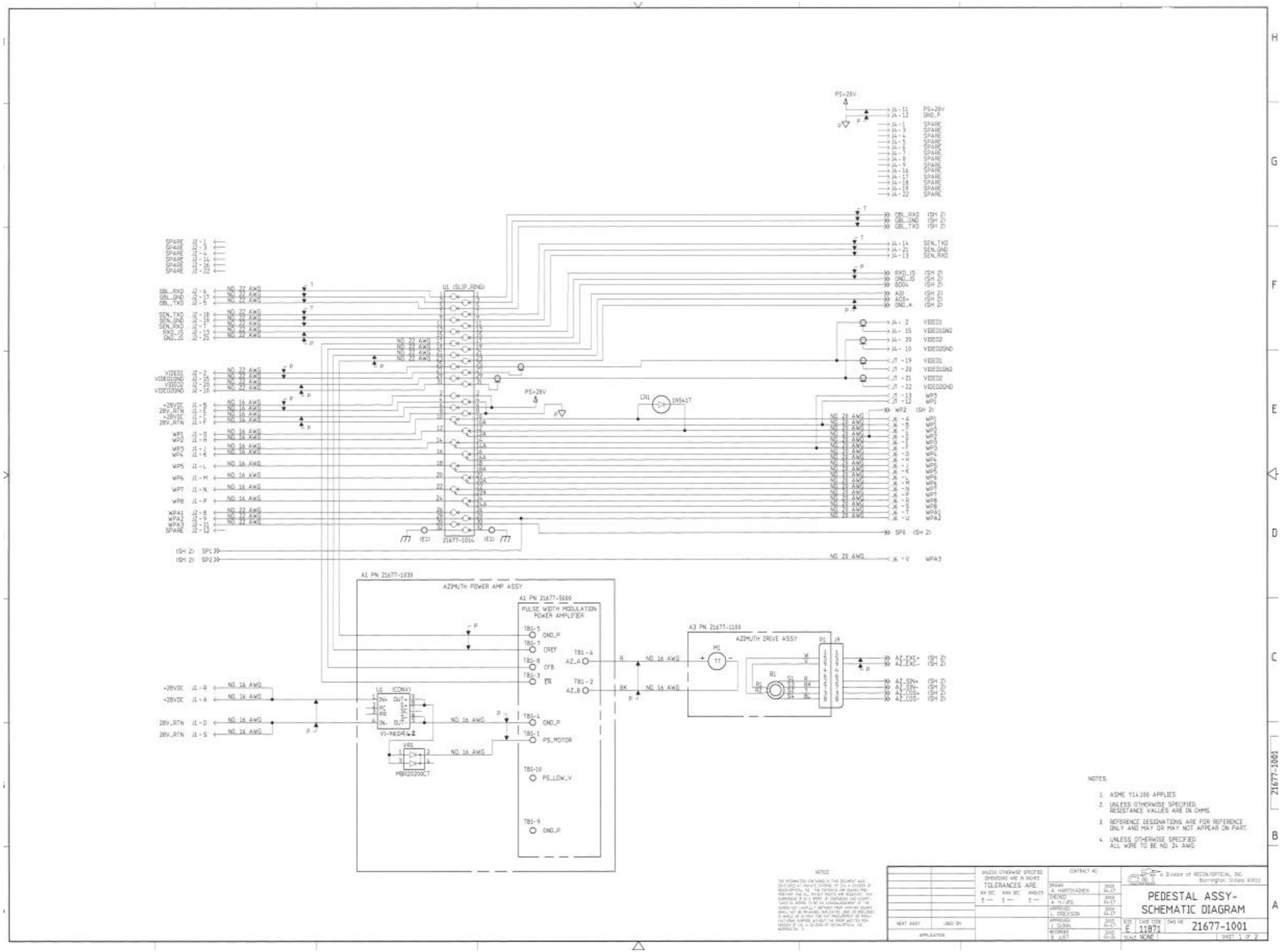
DRAWN	A. HARTIKAINEN	2004 02-09
CHECKED	J. QUINN/A.H.	2004 02-09
APPROVED	J. QUINN	2004 02-09
APPROVED	J. QUINN	2004 02-09
RECORDED	B. JUST	2004 02-10

CAI a Division of RECON/OPTICAL, INC.
Barrington, Illinois 60010

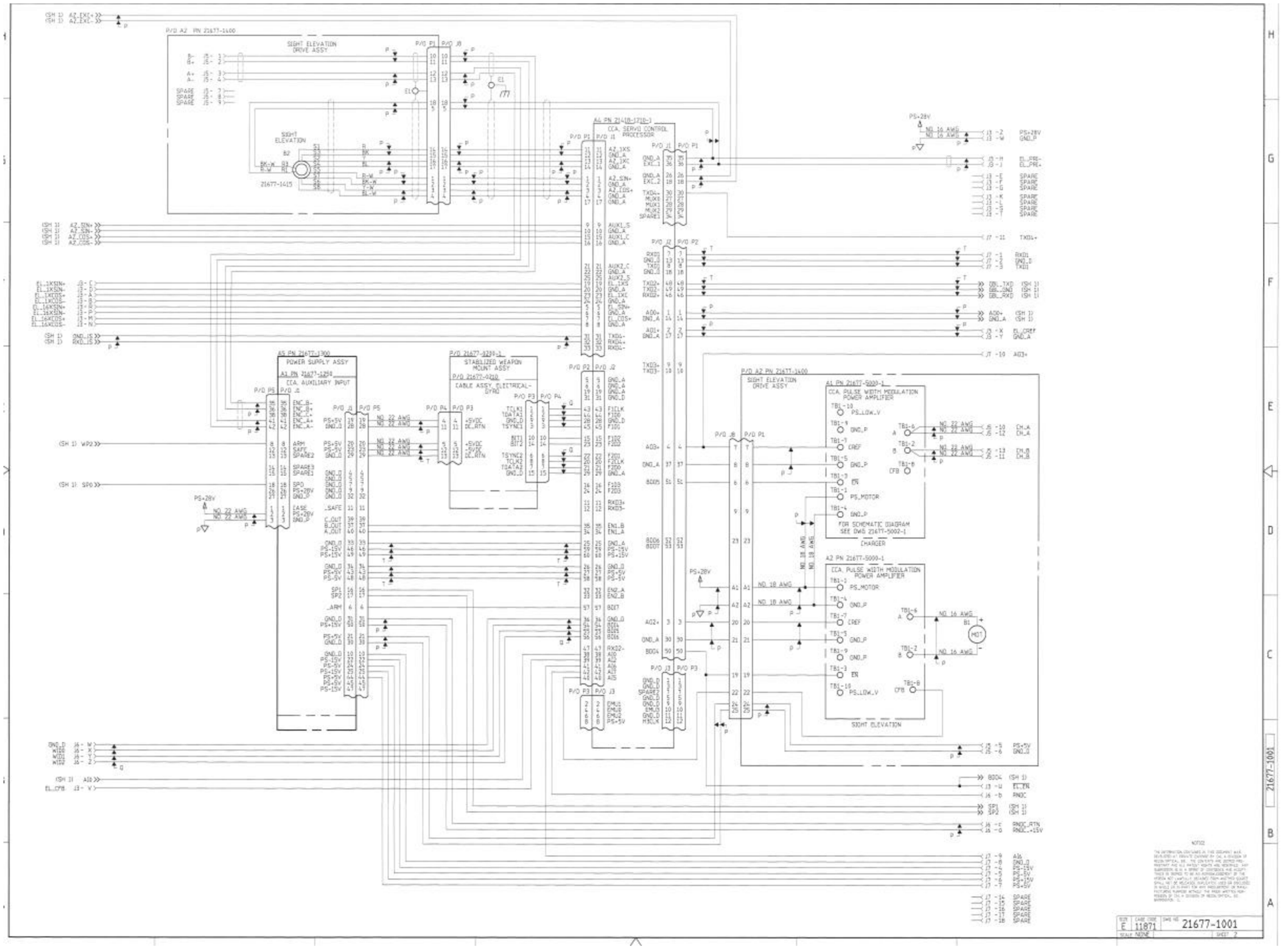
STABILIZED WEAPON MOUNT ASSY-SCHEMATIC DIAGRAM

SIZE	CAGE CODE	DWG NO.
C	11871	21677-0201-1

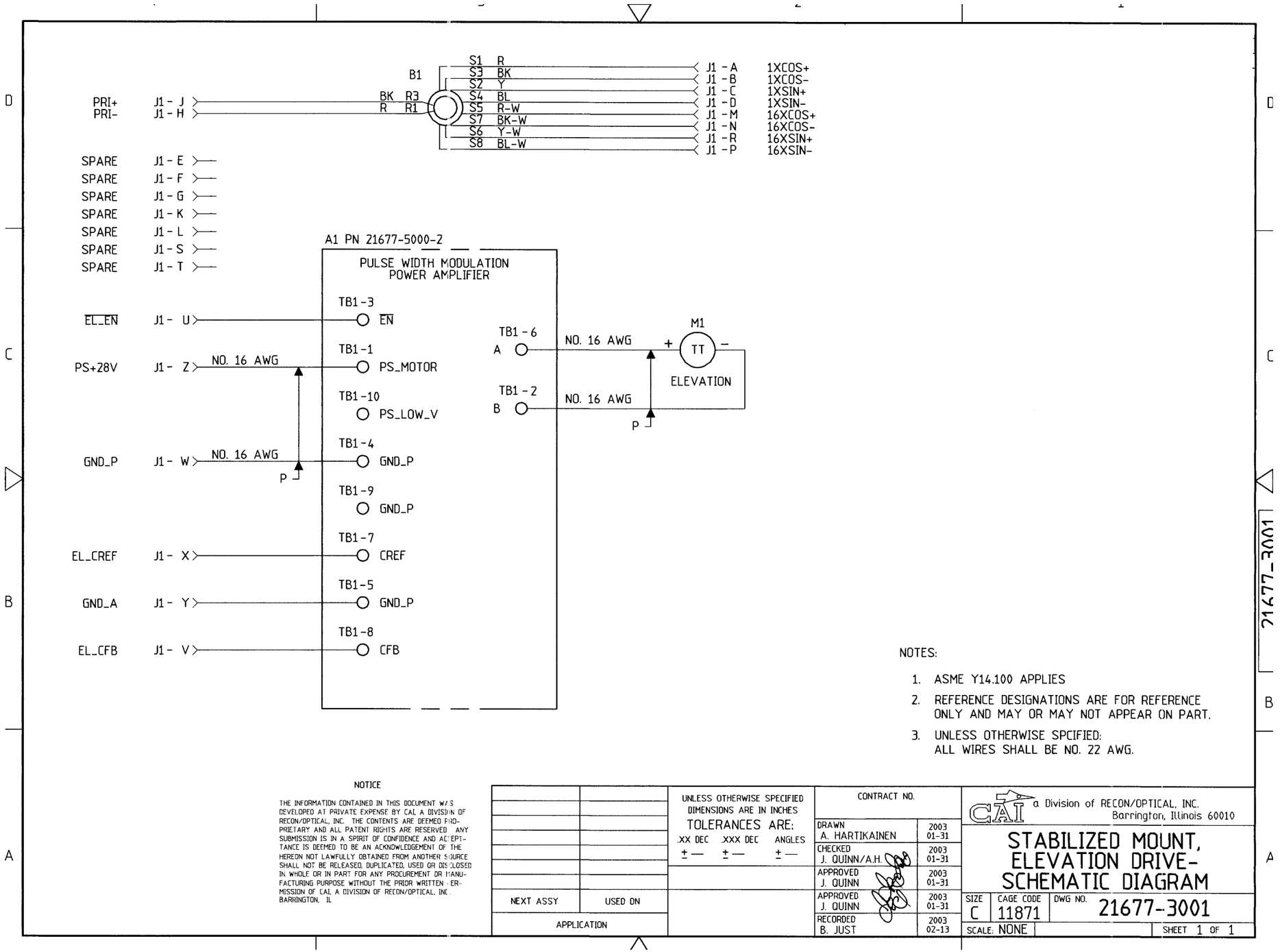
SCALE: NONE SHEET 1 OF 1


PS+28V
J4-11 PS+28V
J4-12 GND_P
J4-1 SPARE
J4-3 SPARE
J4-4 SPARE
J4-5 SPARE
J4-6 SPARE
J4-7 SPARE
J4-8 SPARE
J4-9 SPARE
J4-16 SPARE
J4-17 SPARE
J4-18 SPARE
J4-19 SPARE
J4-22 SPARE
GBL_RXD (SH 2)
GBL_GND (SH 2)
GBL_TXD (SH 2)
J4-14 SEN_TXD
J4-25 SEN_GND
J4-13 SEN_RXD
RXD_JS (SH 2)
GND_JS (SH 2)
BDDA (SH 2)
AUX (SH 2)
AUX+ (SH 2)
GND_A (SH 2)
J4-2 VIDEO1
J4-15 VIDEO1GND
J4-28 VIDEO2
J4-10 VIDEO2GND
J7-19 VIDEO1
J7-20 VIDEO1GND
J7-21 VIDEO2
J7-22 VIDEO2GND
J7-13 WP3
J7-12 WP2
WP2 (SH 2)
SP8 (SH 2)
SPARE J2-1
SPARE J2-3
SPARE J2-4
SPARE J2-14
SPARE J2-16
SPARE J2-22
GBL_RXD J2-6 NO 22 AWG
GBL_GND J2-17 NO 22 AWG
GBL_TXD J2-5 NO 22 AWG
SEN_TXD J2-18 NO 22 AWG
SEN_GND J2-19 NO 22 AWG
SEN_RXD J2-7 NO 22 AWG
RXD_JS J2-13 NO 22 AWG
GND_JS J2-23 NO 22 AWG
VIDEO1 J2-2 NO 22 AWG
VIDEO1GND J2-15 NO 22 AWG
VIDEO2 J2-20 NO 22 AWG
VIDEO2GND J2-10 NO 22 AWG
+28VDC J1-B NO 16 AWG
28V_ATN J1-E NO 16 AWG
+28VDC J1-C NO 16 AWG
28V_RTN J1-F NO 16 AWG
WP1 J1-D NO 16 AWG
WP2 J1-H NO 16 AWG
WP3 J1-J NO 16 AWG
WP4 J1-K NO 16 AWG
WP5 J1-L NO 16 AWG
WP6 J1-M NO 16 AWG
WP7 J1-N NO 16 AWG
WP8 J1-P NO 16 AWG
WPA1 J2-8 NO 22 AWG
WPA2 J2-9 NO 22 AWG
WPA3 J2-11 NO 22 AWG
SPARE J2-12
U1 (SLIP_RING)
NO 22 AWG
NO 22 AWG
NO 22 AWG
NO 22 AWG
PS+28V
CR1 1N5417
NO 28 AWG
J6-A
J6-B
J6-C
J6-D
J6-E
J6-F
J6-H
J6-J
J6-K
J6-L
J6-M
J6-N
J6-P
J6-R
J6-S
J6-T
J6-U
J6-V
WP1
WP2
WP3
WP4
WP5
WP6
WP7
WP8
WPA1
WPA2
WPA3
(E1) Z1677-1014 (E1)
ISH 2) SP1
ISH 2) SP2
A1 PN 21677-1039
AZIMUTH POWER AMP ASSY
A1 PN 21677-5666
PULSE WIDTH MODULATION POWER AMPLIFIER
TB1-5 GND_P
TB1-7 CREF
TB1-8 CFB
TB1-3 EN
TB1-6 AZ_A
TB1-2 AZ_B
TB1-4 GND_P
TB1-1 PS_MOTOR
TB1-10 PS_LOW_V
TB1-9 GND_P
A3 PN 21677-1100
AZIMUTH DRIVE ASSY
P1 J1
M1
B1
AZ_EXC+ (SH 2)
AZ_EXC- (SH 2)
AZ_SIN+ (SH 2)
AZ_SIN- (SH 2)
AZ_COS+ (SH 2)
AZ_COS- (SH 2)
+28VDC J1-R NO 16 AWG
+28VDC J1-A NO 16 AWG
28V_RTN J1-D NO 16 AWG
28V_RTN J1-S NO 16 AWG
U5 (CONV)
VI-J62-CU
VR1
MBR20200CT
NO 16 AWG
NOTES:
1. ASME Y14.100 APPLIES
2. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS
3. REFERENCE DESIGNATIONS ARE FOR REFERENCE ONLY AND MAY OR MAY NOT APPEAR ON PART.
4. UNLESS OTHERWISE SPECIFIED, ALL WIRE TO BE NO 24 AWG
NOTICE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
CONTRACT NO.
A Division of RECON/OPTICAL, INC. Barrington, Illinois 60010
DRAWN A. HARTIKAINEN 2003 04-17
CHECKED A. HUFFD 2003 04-17
APPROVED L. ERICKSON 2003 04-17
APPROVED J. OLDHA 2003 04-17
RELEASED R. GILL 2003 04-25
PEDESTAL ASSY-
SCHEMATIC DIAGRAM
NEXT ASSY USED ON
APPLICATION
SIZE E
CAGE CODE 11871
DWG NO 21677-1001
SCALE NONE
SHEET 1 OF 2
21677-1001

FP-3/4 blank


SIGHT ELEVATION DRIVE ASSY
A1 PN 21677-1300
POWER SUPPLY ASSY
A2 PN 21677-1400
A4 PN 21418-1710-1
CCA, SERVO CONTROL PROCESSOR
A1 PN 21677-5000-1
CCA, PULSE WIDTH MODULATION POWER AMPLIFIER
CHARGER
21677-1001

FP-5/6 blank



NOTES:

1. ASME Y14.100 APPLIES
2. REFERENCE DESIGNATIONS ARE FOR REFERENCE ONLY AND MAY OR MAY NOT APPEAR ON PART.
3. UNLESS OTHERWISE SPCIFIED: ALL WIRES SHALL BE NO. 22 AWG.

NOTICE

THE INFORMATION CONTAINED IN THIS DOCUMENT W/S DEVELOPED AT PRIVATE EXPENSE BY CAI, A DIVISION OF RECON/OPTICAL, INC. THE CONTENTS ARE DEEMED PROPRIETARY AND ALL PATENT RIGHTS ARE RESERVED. ANY SUBMISSION IS IN A SPIRIT OF CONFIDENCE AND ACCEPTANCE IS DEEMED TO BE AN ACKNOWLEDGEMENT OF THE HEREON NOT LAWFULLY OBTAINED FROM ANOTHER SOURCE SHALL NOT BE RELEASED, DUPLICATED, USED OR DISCLOSED IN WHOLE OR IN PART FOR ANY PROCUREMENT OR MANUFACTURING PURPOSE WITHOUT THE PRIOR WRITTEN PERMISSION OF CAI, A DIVISION OF RECON/OPTICAL, INC. BARRINGTON, IL

NEXT ASSY | USED ON

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
.XX DEC ± —
.XXX DEC ± —
ANGLES ± —

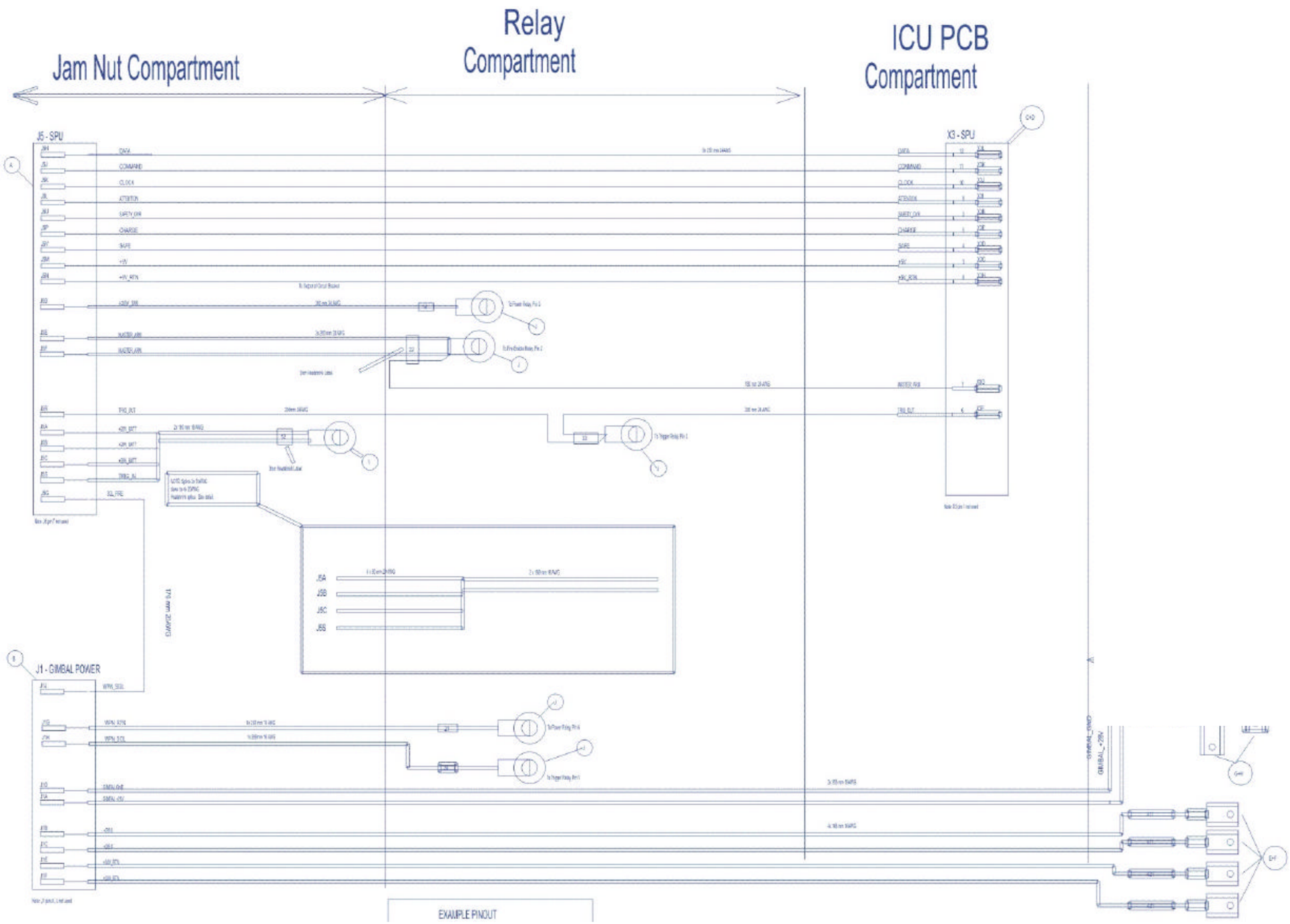
CONTRACT NO.		
DRAWN	A. HARTIKAINEN	2003 01-31
CHECKED	J. QUINN/A.H.	2003 01-31
APPROVED	J. QUINN	2003 01-31
APPROVED	J. QUINN	2003 01-31
RECORDED	B. JUST	2003 02-13

CAI a Division of RECON/OPTICAL, INC. Barrington, Illinois 60010

STABILIZED MOUNT, ELEVATION DRIVE-SCHEMATIC DIAGRAM

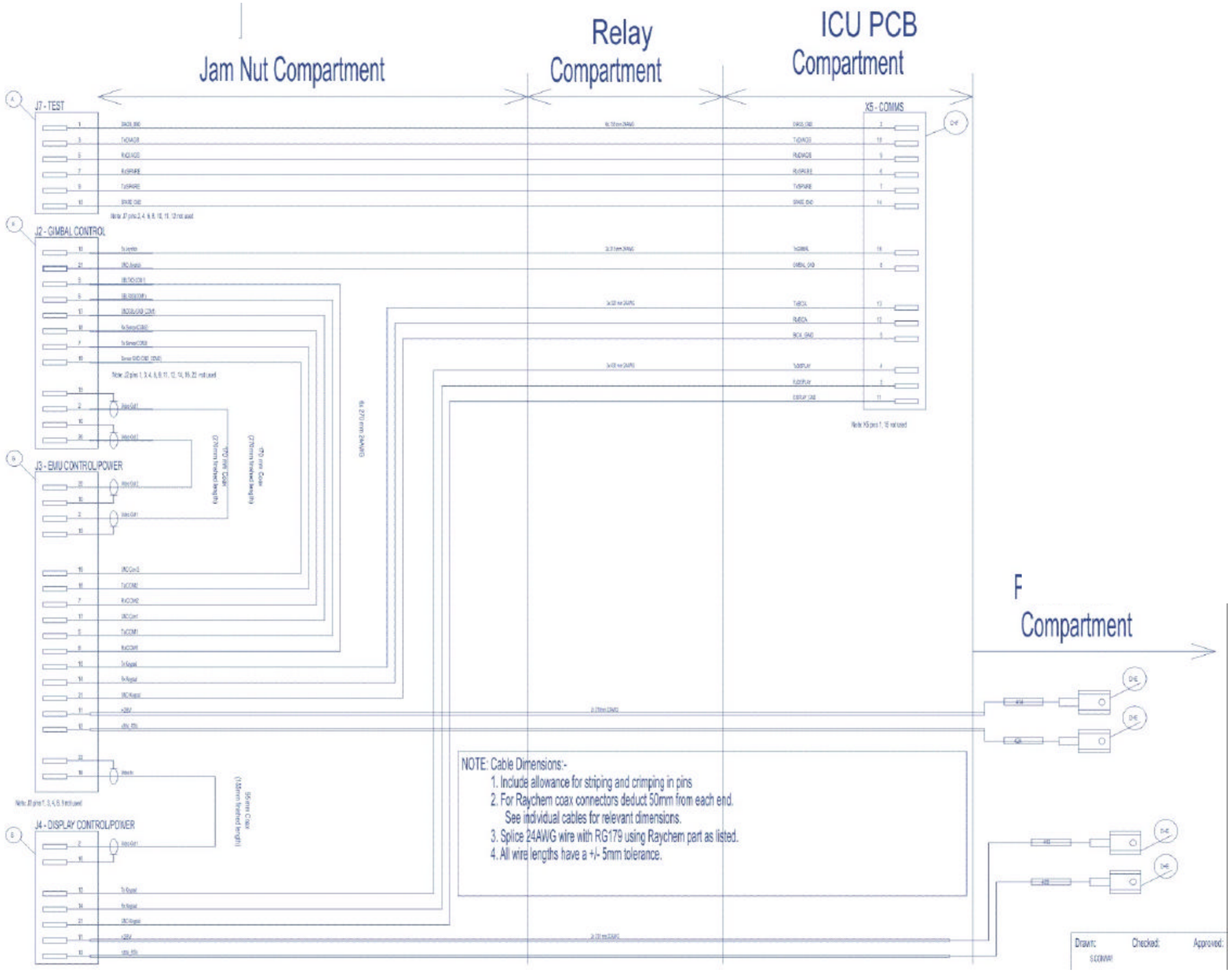
SIZE	CAGE CODE	DWG NO.
C	11871	21677-3001

SCALE: NONE SHEET 1 OF 1

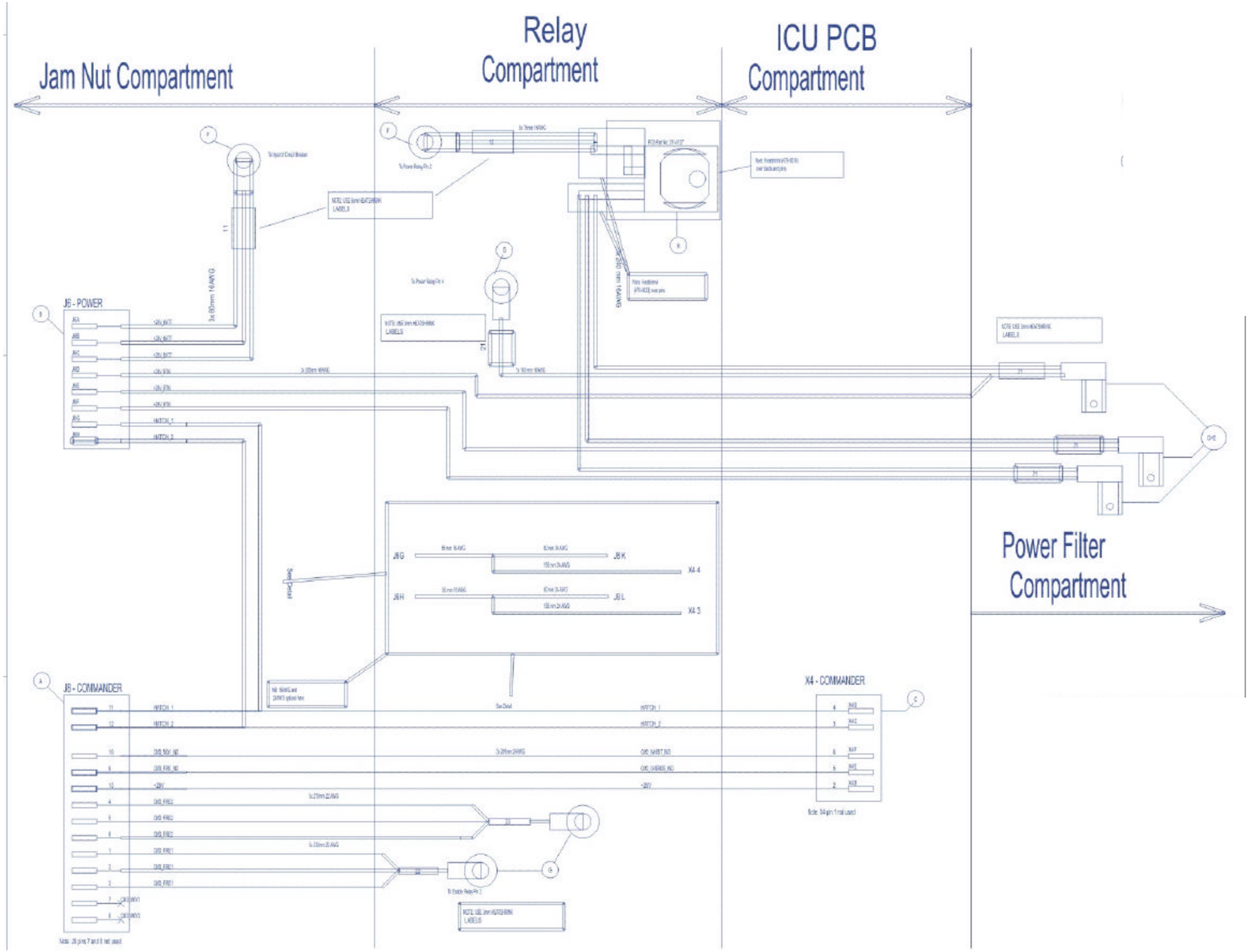


Gimbal/SPU to Filter/ICU Boards and Relays/ICU Cable Schematic

FP-9/10 blank



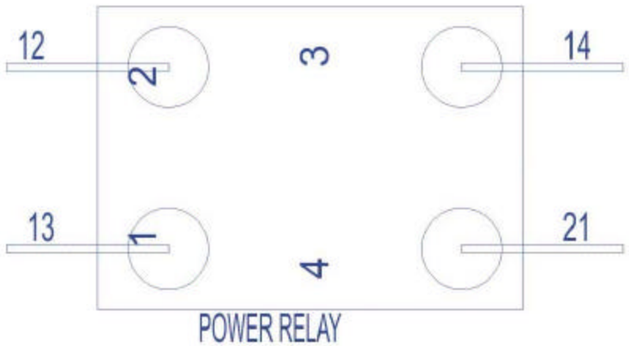
Gimbal/EM/FPD to Power/ICU boards ICU Cable Schematic

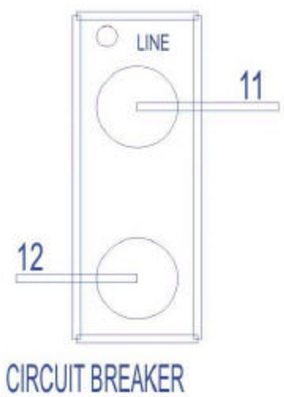


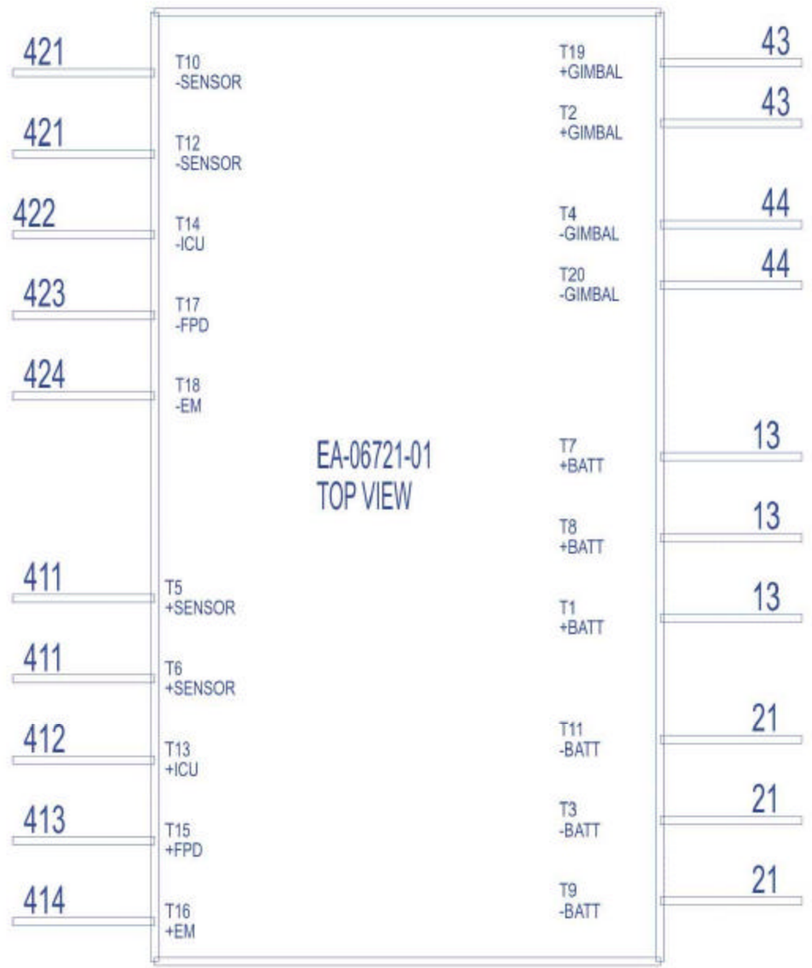
Power in/Commander Module to Power Relay/ICU Board ICU Schematic **FP-13/14 blank**

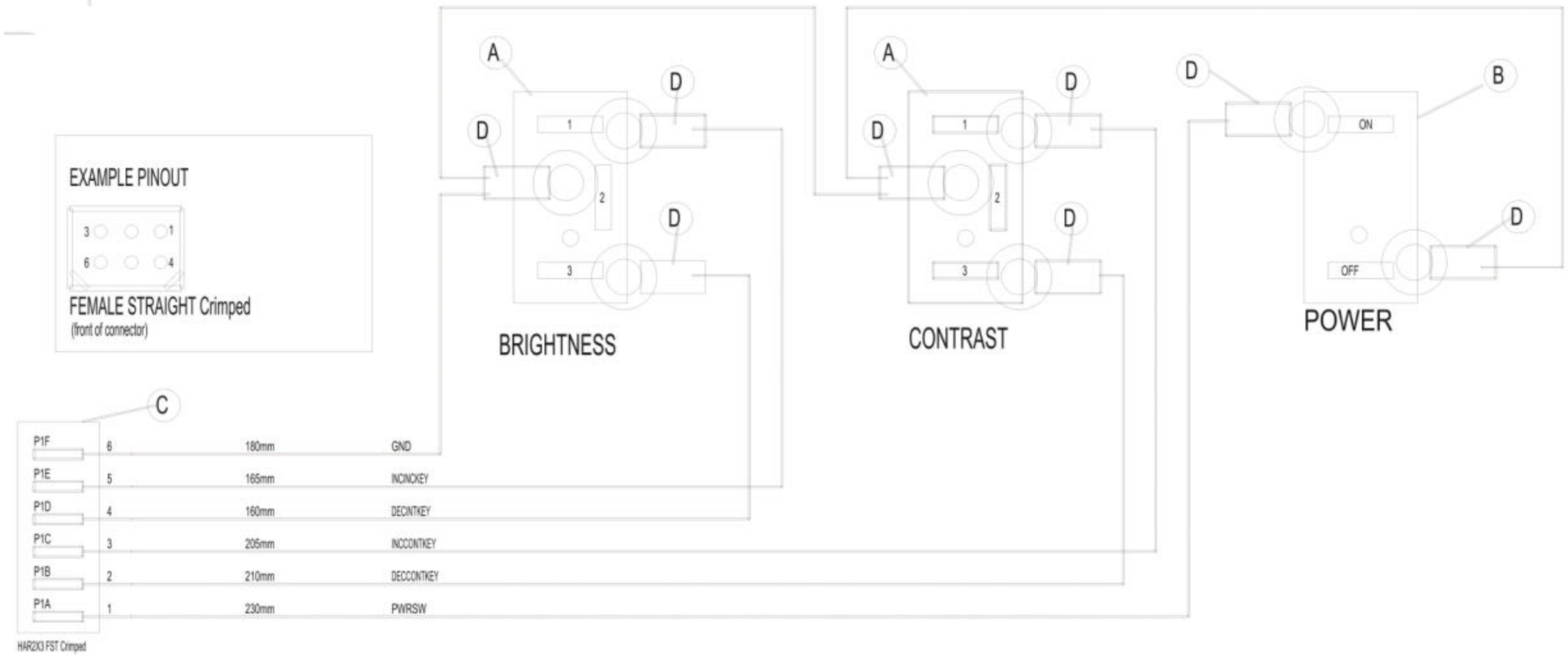

24
23
1
2
34
4
3
33
TRIGGER RELAY

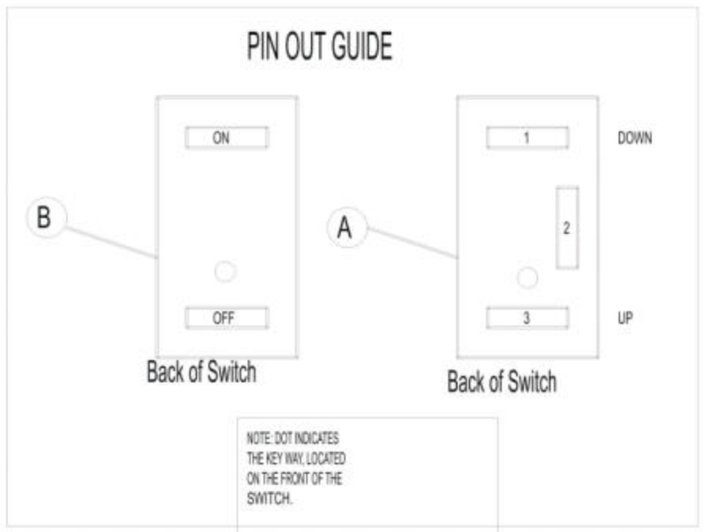
23
22
1
2
32
4
3
31
FIRE ENABLE RELAY

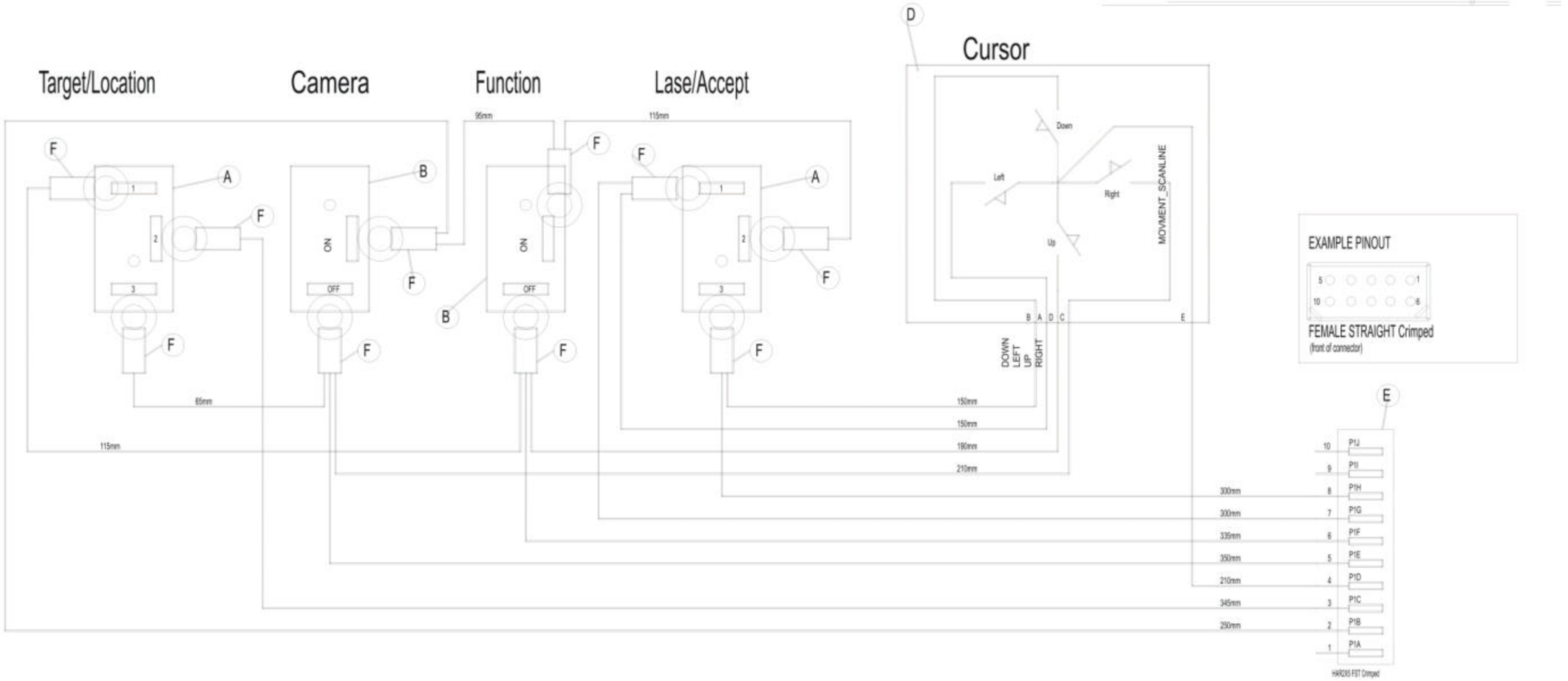

12
2
3
14
13
1
4
21
POWER RELAY

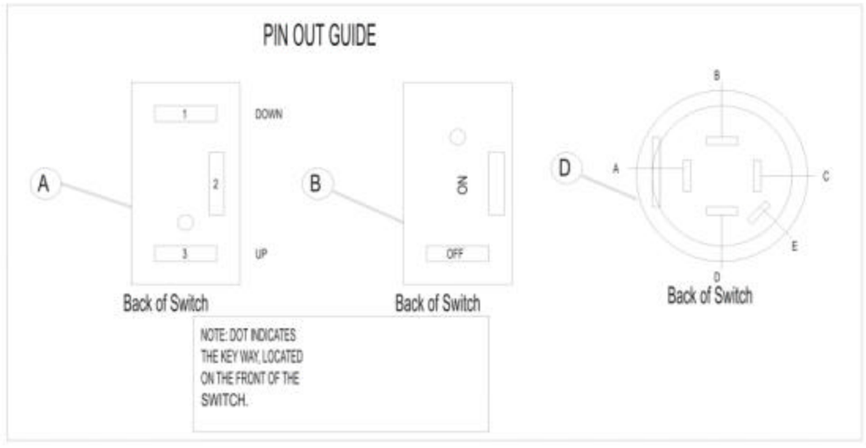

LINE
11
12
CIRCUIT BREAKER

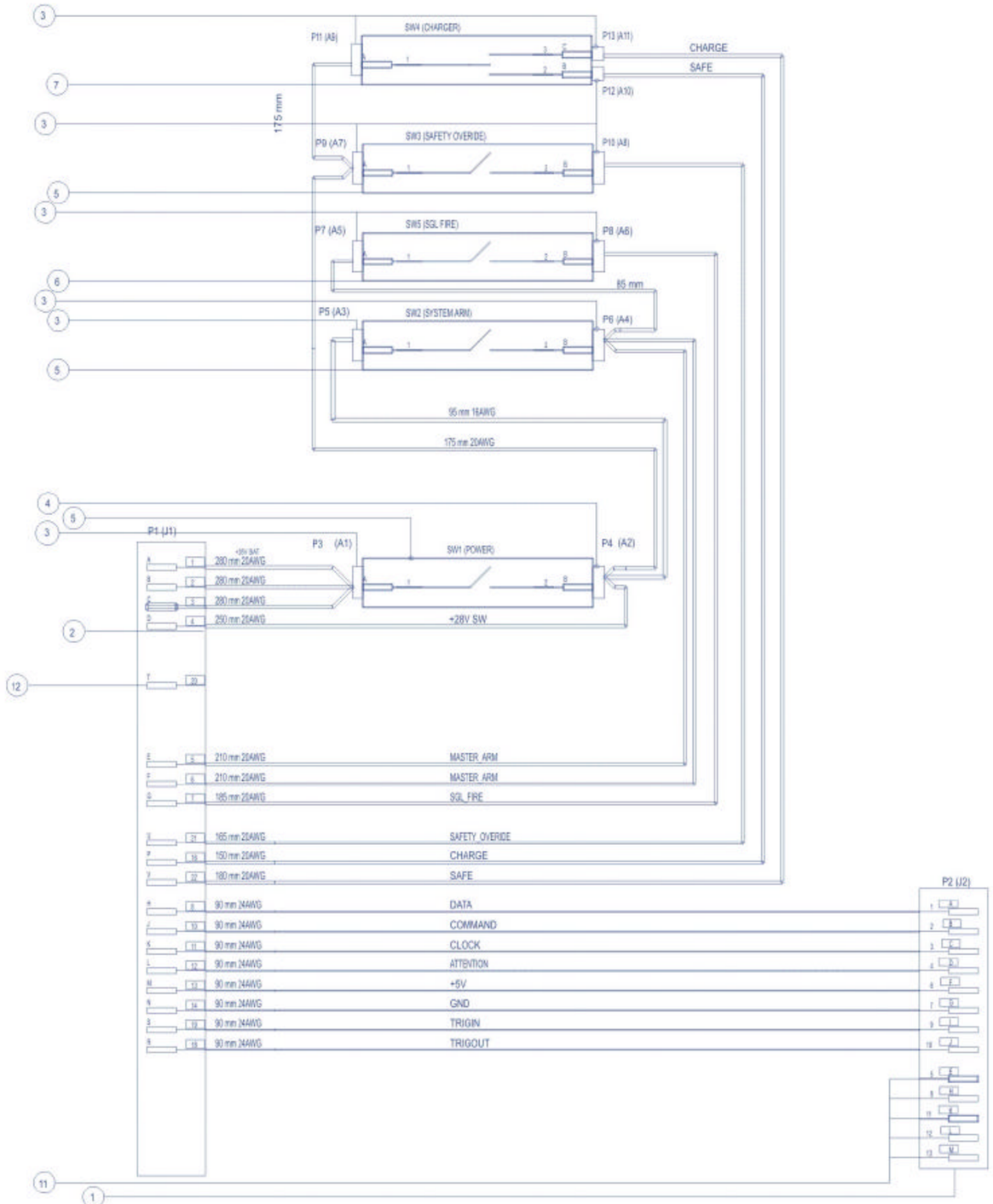

421
T10
-SENSOR
421
T12
-SENSOR
422
T14
-ICU
423
T17
-FPD
424
T18
-EM
EA-06721-01
TOP VIEW
411
T5
+SENSOR
411
T6
+SENSOR
412
T13
+ICU
413
T15
+FPD
414
T16
+EM
T19
+GIMBAL
T2
+GIMBAL
T4
-GIMBAL
T20
-GIMBAL
T7
+BATT
T8
+BATT
T1
+BATT
T11
-BATT
T3
-BATT
T9
-BATT
43
43
44
44
13
13
13
21
21
21


EXAMPLE PINOUT
3
1
6
4
FEMALE STRAIGHT Crimped
(front of connector)
A
D
D
1
2
3
D
BRIGHTNESS
A
D
D
1
2
3
D
CONTRAST
D
B
ON
OFF
D
POWER
C
P1F 6 180mm GND
P1E 5 165mm INCINCKEY
P1D 4 160mm DECINTKEY
P1C 3 205mm INCCONTKEY
P1B 2 210mm DECCONTKEY
P1A 1 230mm PWRSW
HAR2X3 FST Crimped

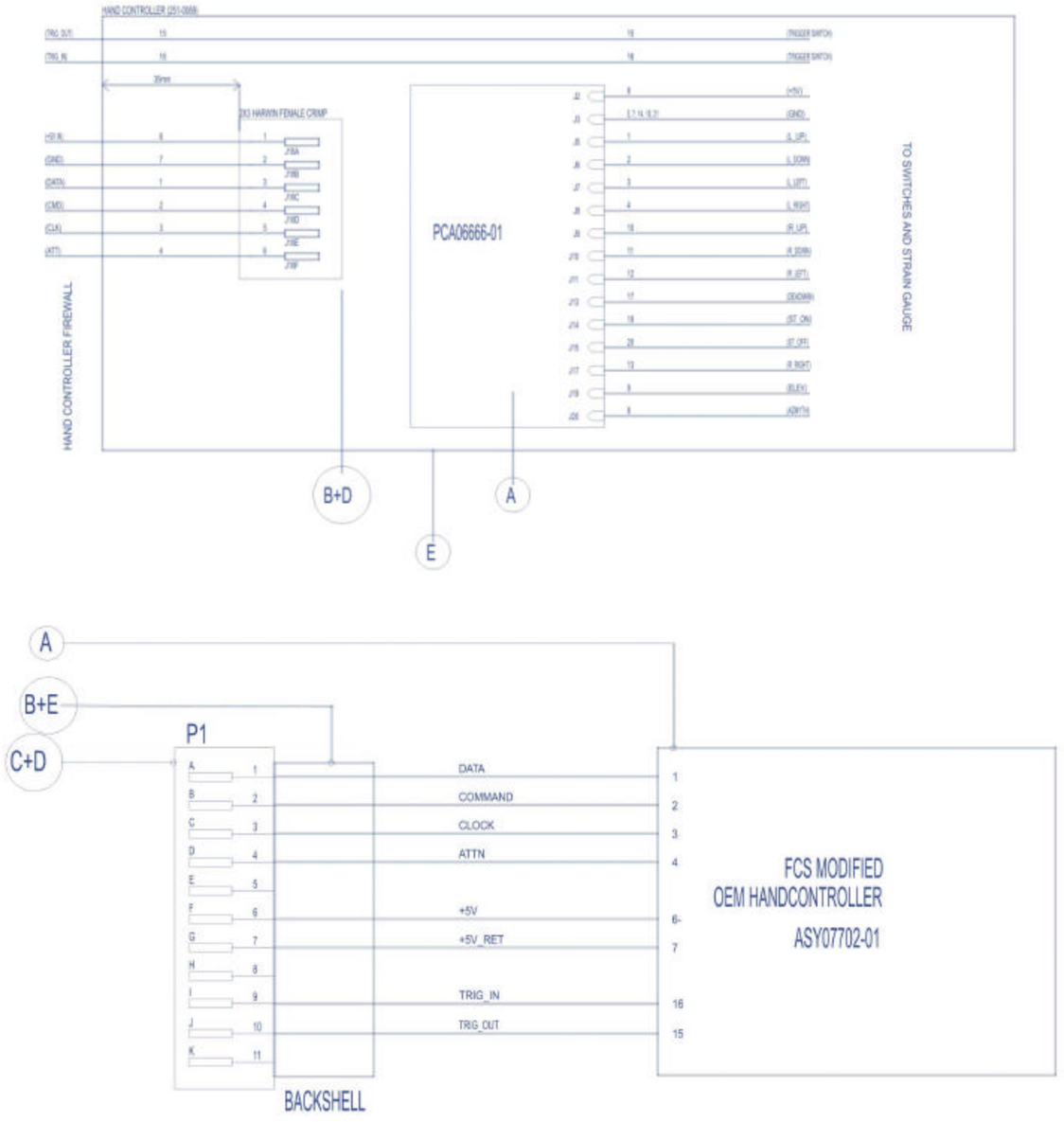

PIN OUT GUIDE
B
ON
OFF
Back of Switch
A
1
2
3
DOWN
UP
Back of Switch
NOTE: DOT INDICATES
THE KEY WAY, LOCATED
ON THE FRONT OF THE
SWITCH.

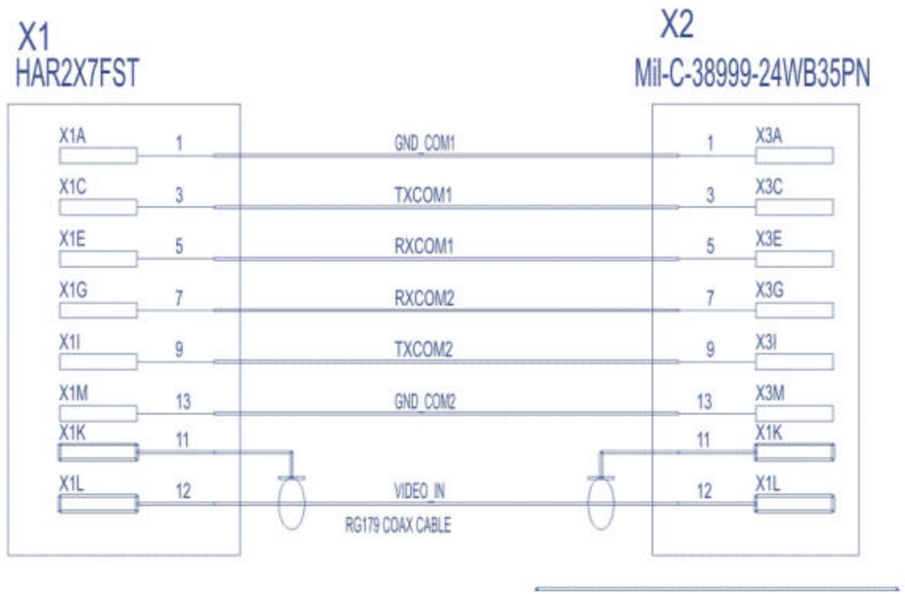

Target/Location
Camera
Function
Lase/Accept
Cursor
D
E
F
A
B
ON
OFF
95mm
115mm
65mm
150mm
180mm
210mm
300mm
335mm
350mm
345mm
250mm
Down
Left
Right
Up
MOVMENT_SCANLINE
B A D C E
DOWN
LEFT
UP
RIGHT
EXAMPLE PINOUT
5 1
10 6
FEMALE STRAIGHT Crimped
(front of connector)
10 P1J
9 P1I
8 P1H
7 P1G
6 P1F
5 P1E
4 P1D
3 P1C
2 P1B
1 P1A
HARD15 FST Crimped


PIN OUT GUIDE
1
DOWN
2
3
UP
A
B
ON
OFF
Back of Switch
Back of Switch
D
A
B
C
E
Back of Switch
NOTE: DOT INDICATES
THE KEY WAY, LOCATED
ON THE FRONT OF THE
SWITCH.

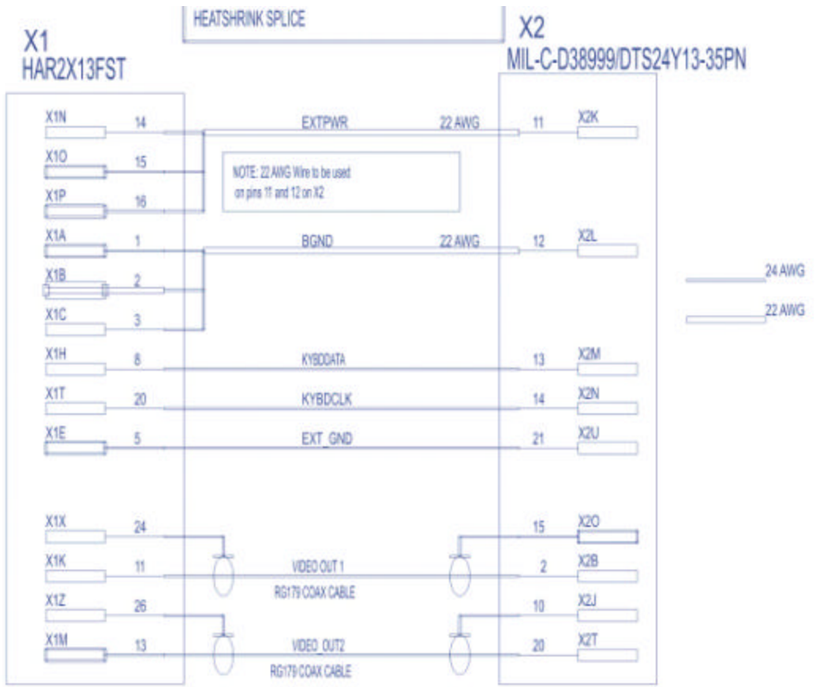


Switch Panel Unit – Internal Cable Schematic

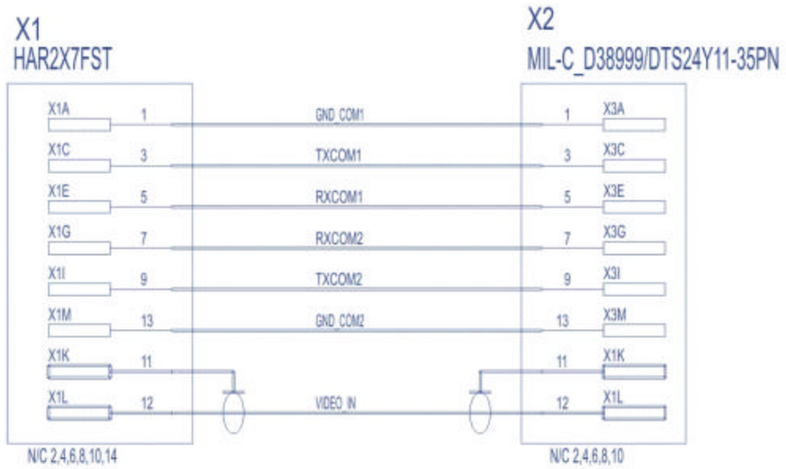

HAND CONTROLLER (251-0868)
TRIG_OUT
TRIG_IN
TRIGGER SWITCH
TRIGGER SWITCH
20mm
2X3 HARWIN FEMALE CRIMP
+5V IN
GND
DATA
CMD
CLK
ATT
J1/8A
J1/8B
J1/8C
J1/8D
J1/8E
J1/8F
PCA06666-01
+5V
GND
L_UP
L_DOWN
L_LEFT
L_RIGHT
R_UP
R_DOWN
R_LEFT
R_RIGHT
ELEV
AZIMTH
TO SWITCHES AND STRAIN GAUGE
HAND CONTROLLER FIREWALL
B+D
A
E
A
B+E
C+D
P1
DATA
COMMAND
CLOCK
ATTN
+5V
+5V_RET
TRIG_IN
TRIG_OUT
BACKSHELL
FCS MODIFIED
OEM HANDCONTROLLER
ASY07702-01



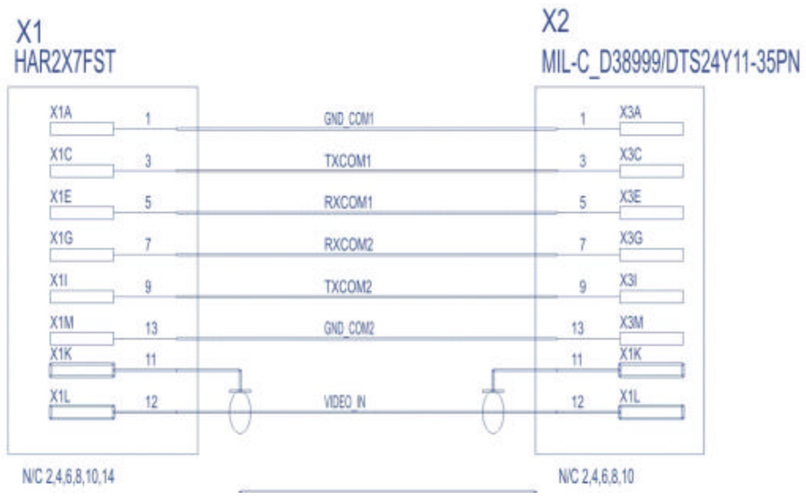
Sensor Unit Debug Port to IOA Schematic (Hermetic)



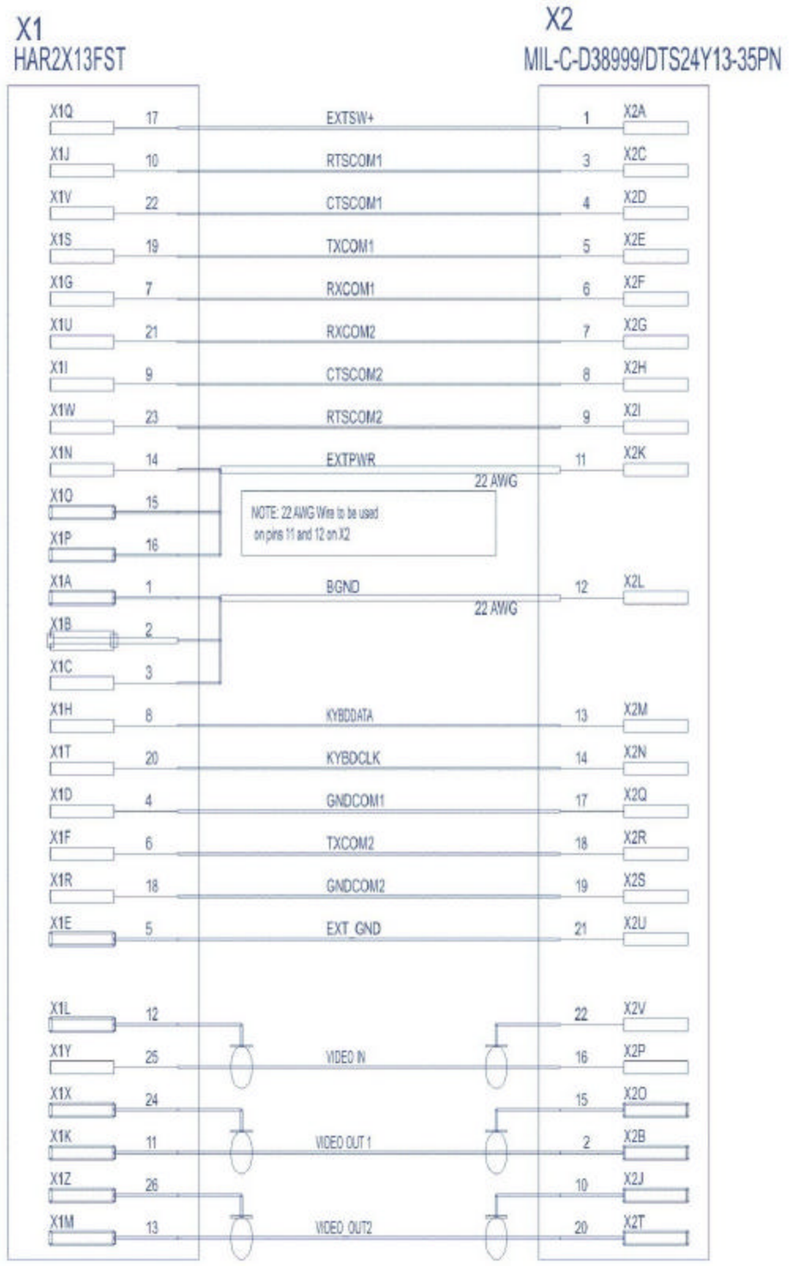
Sensor Unit Power Control Port to IOA Schematic (Hermetic)



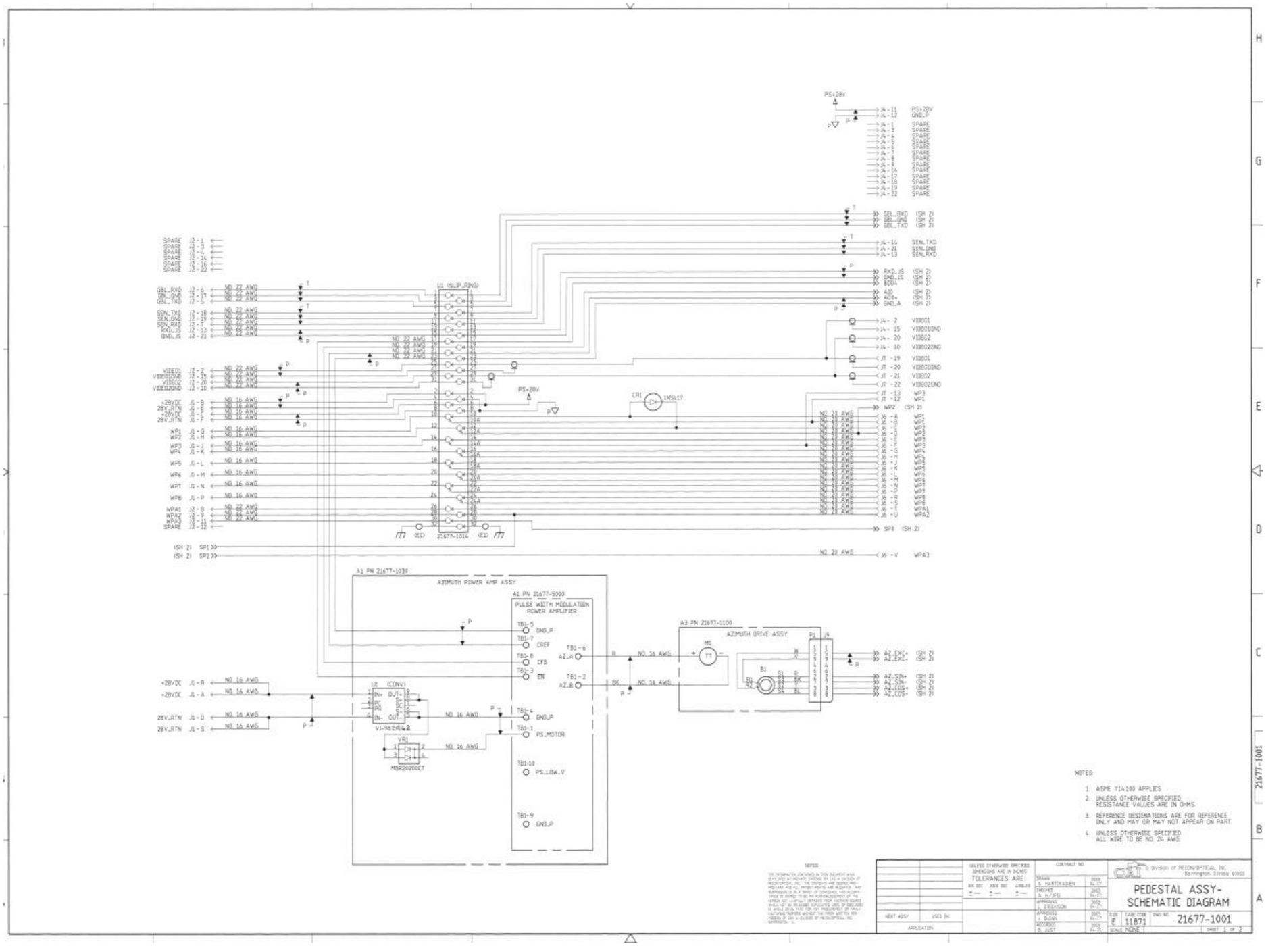
Expansion Port to IOA Schematic (EMU)



Debug Port to IOA Schematic (EMU)



Power Control Port to IOA Schematic (EMU)



NOTES:

1. ASME Y14.100 APPLIES.
2. UNLESS OTHERWISE SPECIFIED RESISTANCE VALUES ARE IN OHMS.
3. REFERENCE DESIGNATIONS ARE FOR REFERENCE ONLY AND MAY OR MAY NOT APPEAR ON PART.
4. UNLESS OTHERWISE SPECIFIED ALL WIRE TO BE NO. 24 AWG.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
XX ±.01 XXX ±.005 ANGLES ± —° —' —"

CONTRACT NO.

DRAWN A. MARTINSEN 2003 04-17
CHECKED A. KUSPA 2003 04-17
APPROVED L. ERICKSON 2003 04-17
APPROVED J. BURNS 2003 04-17
ENGINEER D. JUST 2003 04-17

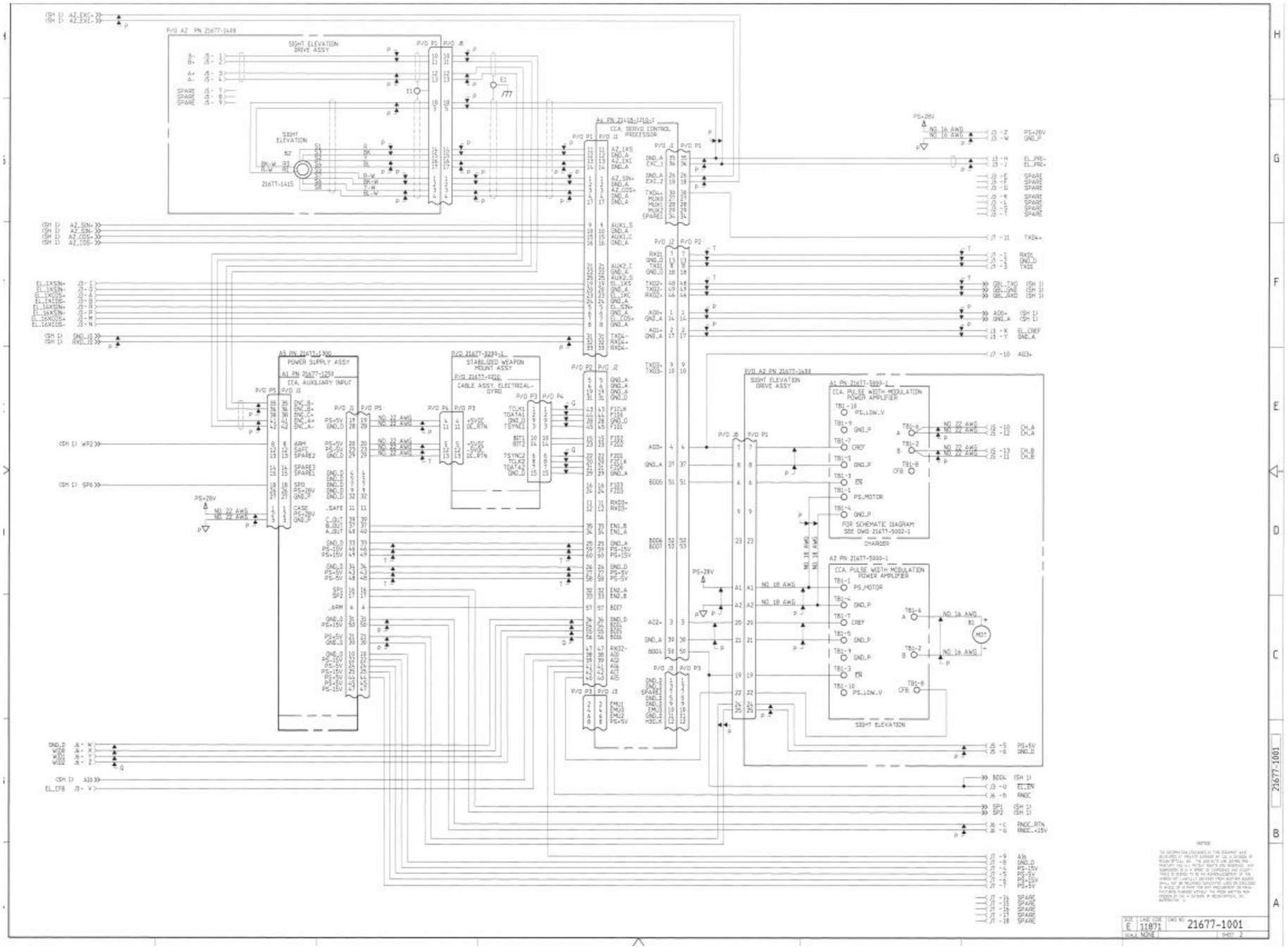
NEXT ASSY USED ON
APPLICATION

A DIVISION OF RECON/OPTICAL, INC. Barrington, Illinois 60010

PEDESTAL ASSY-
SCHEMATIC DIAGRAM

SIZE E | CAGE CODE 11872 | DWG NO. 21677-1001
SCALE NONE | SHEET 1 OF 2

21677-1001



END OF WORK PACKAGE

FP-31/32 blank

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 Milliileters = 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: 082694-000