

***TM 9-2350-304-10**

**HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 27 April 1990**

OPERATOR'S MANUAL

**HOWITZER, HEAVY, SELF-PROPELLED
8-INCH, M110A2**

(2350-01-041-4590) (EIC: 3E3)

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**HEADQUARTERS
DEPARTMENT OF THE ARMY
APRIL 1990**

*This manual supersedes TM 9-2350-304-10, 25 October 1979, including all changes.

CHANGE

No. 6

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON D.C., 17 OCTOBER 1995

OPERATOR'S MANUAL

For

**HOWITZER, HEAVY,
SELF-PROPELLED
8-INCH, M110A2
NSN 2350-01-041-4590**

TM 9-2350-304-10, 27 April 1990, is changed as follows:

1. Remove old pages and insert new pages as indicated below.
2. New or changed material is indicated by a vertical bar in the margin of the page.
3. New or revised illustrations are indicated by a miniature pointing hand.

Remove Pages

a and b
2-103 and 2-104

2-111 and 2-112
2-117 thru 2-120
3-63 and 3-64
3-85 and 3-86

Insert Pages

a and b
2-103 and 2-104
2-110.1/(2-110.2 blank)
2-111 and 2-112
2-117 thru 2-120
3-63 and 3-64
3-85 and 3-86

4. File this change sheet in front of the publication for reference purposes

By Order of the Secretary of the Army:

DENNIS J. REIMER
General, United States Army
Chief of Staff

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YVONNE M. HARRISON
Administrative Assistant to the
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**CHANGE
No. 5**

**HEADQUARTERS
DEPARTMENT OF THE ARMY**
Washington D.C., 1 February 1994

**OPERATORS, MANUAL
FOR
HOWITZER, HEAVY,
SELF-PROPELLED
8-INCH, M110A2
(2350-01-041-4590) (EIC: 3E3)**

TM 9-2350-304-10, dated 27 April 1990, is changed as follows:

1. The purpose of this change notice is to provide notification under Section 326 of Public Law 102-484, FY 93 National Defense Authorization Act, that Ozone Depleting Chemicals may no longer be used on Army equipment.

2. Throughout this publication the following items should be substituted for Ozone Depleting Chemicals used on your equipment:

FOR:

SUBSTITUTE:

Page D-3, (2 places)
MIL-C-22750

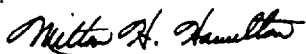
MIL-C-22750, Type 1.

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*U.S. G.P.O.:1994-546-042:80123

PIN: 043775-005

CHANGE

NO. 4

**HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 29 November 1993**

OPERATORS MANUAL

**HOWITZER, HEAVY, SELF-PROPELLED
8-INCH, M110A2
(2350-01-041-4590) (EIC: 3E3)**

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Remove Pages

i and ii
2-123 and 2-124
5-1 and 5-2
5-7 through 5-10
5-13 and 5-14
5-21 through 5-26
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5-31 and 5-32
B-5 and B-6
D-3 and D-4
I-3 and I-4
COVER

Insert Pages

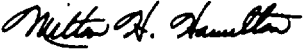
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5-7 through 5-10
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5-21 through 5-26
5-30.1 and 5-30.2
5-31 and 5-32
B-5 and B-6
D-3 and D-4
I-3 and I-4
COVER

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CHANGE

HEADQUARTERS
DEPARTMENT OF THE ARMY

No. 3

Washington, DC 28 May 1993

OPERATOR'S MANUAL

HOWITZER, HEAVY, SELF-PROPELLED
8-INCH, M110A2
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Remove Pages

c through f
i and ii
1-1 and 1-2
2-61 and 2-62
2-71 and 2-72
2-99 and 2-100
2-121 through 2-124
2-135 through 2-138
2-165 and 2-166
2-169 through 2-172
2-177 and 2-178
3-3 and 3-4
3-11 through 3-16
3-23 through 3-28
3-45 and 3-46
3-53 and 3-54
3-61 and 3-62
4-1 and 4-2
5-7 through 5-12
5-23 and 5-24
5-29 through 5-34
A-1 through A-3/(A-4 blank)
B-3 and B-4
B-7 and B-8
B-11 and B-12
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B-19 and B-20
B-23 through B-26
D-3 through D-6
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I-3 and I-4
Front Cover

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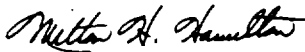
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i and ii
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2-169 through 2-172
2-177 and 2-178
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F-1 through F-22
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Front Cover

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Official:


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HEADQUARTERS

DEPARTMENT OF THE ARMY

No. 2

Washington, DC 9 April 1992

OPERATOR'S MANUAL

**HOWITZER, HEAVY, SELF-PROPELLED
8-INCH, M110A2
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Remove Pages

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2-39 and 2-40
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2-49 through 2-52
2-57 and 2-58
2-123 and 2-124
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3-53 and 3-54
3-75 and 3-76
B-3 through B-26
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D-1 through D-6

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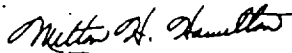
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2-123 and 2-124
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GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:



MILTON H. HAMILTON
Administrative Assistant to the
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Operator Maintenance requirements for TM 9-2350-304-10.

CHANGE

No. 1

**HEADQUARTERS
DEPARTMENT OF THE ARMY**
Washington D.C., 22 January 1991

OPERATOR'S MANUAL

**HOWITZER, HEAVY, SELF-PROPELLED
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2-53 through 2-56
2-59 and 2-60
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2-71 and 2-72
2-75 and 2-76
2-87 and 2-88
2-93 and 2-94
2-119 and 2-120
2-151 through 2-154
2-177 and 2-178
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By Order of the Secretary of the Army:

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

Official:

JOHN A. FULMER
Colonel, United States Army
Acting The Adjutant General

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Operator Maintenance Requirements for TM 9-2350-304-10.

WARNING**RADIATION HAZARD****TRITIUM (H₃)****Rules and Regulations**

Copies of the following rules and regulations are maintained at HQ, AMCCOM Rock island, IL 61299-6000. Copies may be requested or information obtained by contacting the AMCCOM Radiological Protection Officer (RPO), AUTOVON 793-2964, Commercial (309) 782-2964.

10CFR Part 19-Notices, Instructions, and Reports to Workers; Inspections.

10CFR Part 20-Standards for Protection Against Radiation.

NRC license, license condition, and license application.

Safety Precautions

The radioactive material used in these instruments is tritium gas (H₃) sealed in pyrex tubes. It poses no significant hazard to the repair person when intact. These sources illuminate the instrumentation for night operations. Tampering with or removal of the sources in the field is prohibited by Federal law. In the event there is no illumination, notify the local Radiological Protection Officer. Do not attempt to repair or replace the instrument in the field! If skin contact is made with any area contaminated with tritium, immediately wash with nonabrasive soap and water.

Identification

Radioactive self-luminous sources are identified by means of radioactive warning labels (as above). These labels should not be defaced or removed and should be replaced immediately when necessary. Refer to the local RPO or the AMCCOM RPO for instructions on handling, storage, or disposal.

Storage and Shipping

All radioactively illuminated instruments or modules which are defective will be evacuated to a depot maintenance activity. These items must be placed in a plastic bag and packaged in the shipping container from which the replacement was taken before evacuation to a higher echelon is made. Spare equipment must be stored in the shipping container, as received, until installed on the weapon. Storage of these items is recommended to be in an outdoor shed-type storage or unoccupied building.

Radioactive material is used in the M140 alignment device, M1A1 collimator and M1A2 gunner's quadrant. For damaged, broken, or defective item, follow the following procedures:

1. Evacuate to a safe distance upwind and cordon off immediate area around device.
2. Immediately notify the Installation Radiation Protection Officer (RPO) and the Installation Safety Officer (SO).
3. All personnel will stand fast at the safe area until released by the RPO or SO.

WARNING (cont)

4. Follow the RPO's instruction for decontamination so as to avoid excess spread of tritium contamination.
5. Personnel exposed to tritium will notify medical personnel.

GENERAL

Protect your hearing. Hearing protection is required when operating the vehicle due to high intensity noise.

Personal injury could result if crew members stand within loader-rammer swing arc.

Driver's cupola cover will be secured in either the open or closed position during operation.

The two man-one sight or one man-one sight system should only be used when the target and the howitzer are at the same elevation, with no mask (sight to crest) obstacles in between. Firing at targets above or below the howitzer position require adjustments to the quadrants, listed on the range chart. Adjustments must be computed by the FDC IAW TM 6-40, refer to chapter 6. For this reason the primary means of direct fire will be the two man-two sight method.

Do not use decontamination spray on personnel. It could cause personal injury.

Always wear protective goggles and stand upwind of blast when using compressed air.

Contaminated (NBC) filters must be handled using adequate precautions (refer to FM 21-40) and must be disposed of by authorized personnel.

Gunner's quadrant micrometer test and end-for-end test must be conducted prior to using gunner's quadrant for any fire control alignment test.

Unusable CARC mixtures may be considered hazardous waste and may require disposal in accordance with Federal, state, DOD, and DA hazardous waste regulations. Consult the installation environmental office for proper disposal guidance. Mixed CARC has a flashpoint of approximately 380F (30C) due to the incorporation of solvents and is highly flammable.

DRIVING

Fasten your seat belt. Drive carefully. Do not speed or oversteer. You could lose control of the vehicle.

Fasten your seat belt and alert crew members to fasten their seat belts to avoid injury in the event of a sudden stop or direction change of the vehicle.

Do not apply the brake if a track is thrown while the vehicle is moving-allow the vehicle to coast to a halt.

WARNING (cont)

Do not depress accelerator on towed vehicle and do not exceed 10 miles per hour when tow-starting vehicle. These procedures are for starting operations only, not for recovery operations. This must be performed on level ground to preclude damage to cannon tube and disabled vehicles.

Place transmission shift lever in neutral and lock brakes on both vehicles before removing tow cables.

Brake the vehicle to prevent vehicle speed from overrunning engine speed. If vehicle speed overruns engine speed, you will not be able to down shift to a lower range and may lose control of the vehicle.

Driver will remain in driver's compartment while engine is running.

Ensure no personnel are between vehicles while towing vehicle is running.

AMMUNITION

Do not force primer into primer chamber. Forcing primer could prematurely ignite powder charge, causing the howitzer to recoil, resulting in serious injury to the crew.

Use tray handles to stabilize projectile during movement.

Handle ammunition and ammunition components with care at all times.

If energy absorbing lifting plug has been broken, do not remove the stem. Return projectile to ammunition supply point.

Do not fire ammunition if energy absorbing plug is bent, broken, or if ammunition is mishandled.

The M845 projectile is designed to provide training in handling, loading, and ramming. It is not to be fired.

When tightening fuze to projectile, do not hammer on fuze wrench or use extension handle on fuze wrench. Do not stake fuze to projectile under any circumstances. Shocks transmitted to fuzes during assembly may cause a malfunction.

Do not load or fire artillery ammunition without authorized fuze.

Firing of rounds without fuzes or with improper fuzes can result in inbore prematures and other hazardous conditions.

Rounds fired without a fuze or with improperly seated fuzes may result in premature functioning.

Do not fire projectile unless fuze is fully seated. Inbore explosion may result.

Improper ramming may cause incomplete seating of the projectile which may cause damage to the weapon when fired.

Never fire a projectile or charge which has been allowed to cool in a hot tube.

Firing a round with an obstruction in the cannon tube can cause an inbore premature.

WARNING (cont)

Do not mix U.S. and/or any combination of NATO ammunition components. Fire only all components from one nation.

The projectiles and fuzes that have been rammed and then removed from the tube will not be reloaded or fired.

Never fire ammunition components that have been chambered and unloaded from the weapon. All ammunition components which have been unloaded from the weapon must be segregated and turned in for disposition.

Do not chamber ammunition until immediately prior to firing. Ammunition left in a hot weapon too long may result in hazardous conditions. Fire or unload ammunition within 5 minutes after chambering.

Do not store ammunition under trees or near tall buildings that attract lightning. When ammunition must be stored in the open, select a storage site free of power lines, electrical cables and flammable materials. Sites should not be adjacent to reservoirs, water mains, etc. Sites should be level and well drained.

Ammunition exposed directly to sunlight, or in unventilated containers, enclosures, shelters, freight cars, closed vehicles, and similar structures exposed to direct sunlight, may reach temperatures exceeding upper storage limits.

Unauthorized assembly and use of projectiles and propelling charges is extremely dangerous. Make sure projectiles are marked 8H, and propelling charges are marked 8-IN HOW. To verify authorized projectile/fuze combinations, check Projectiles, Use and Characteristics.

Make sure projectiles and propelling charges are marked 8H., 8 in., or 203 mm. To verify authorized projectile, fuze, and propelling charge, see U.S. and NATO COUNTRIES INTEROPERABLE MUNITIONS, chapter 6.

To avoid accidental functioning of PD element in M564 fuze, do not drop, roll, or strike the fuze under any circumstances (packaged, unpackaged, or assembled to the projectile).

Incorrect setting of MT and MTSQ fuzes can and have resulted in downrange prematures.

The M82 is the only primer authorized for firing in this cannon. Do not fire the MK2A4 in this cannon. Turn them in to ammunition supply point.

Do not use the MK2A4 primer in the howitzer. Turn them in to the ammunition supply point.

Firing of fuzes M557, M572 and M564 during heavy precipitation (rainfall, sleet, snow, or hail) may result in occasional downrange prematures. The amount of precipitation necessary to cause functioning is comparable to the heavy downpour which occurs during a summer thundershower.

WARNING (cont)

The supplementary charge is only removed when M728 proximity fuzes are to be fired. Do not fire PD, MTSQ, ET, or M732 proximity fuzes in deep cavity projectiles without the supplementary charge.

Do not attempt to remove the supplementary charge by any means other than the lifting loop. Use of a screwdriver or other tools to remove charge is dangerous.

When screwing the projectile spotting charge on to rear of the M577 series or M762 series fuze, ensure that shoulder of projectile spotting charge is seated squarely against shoulder of fuze. An improperly seated charge could cause a malfunction.

Do not fire the M650 projectile if the obturator band is missing or broken. If the obturator band is displaced and can be repositioned and will remain in the groove, the projectile can be fired.

Never close breechblock unless you can see red igniter bag on base of propelling charge.

Never load a propelling charge into chamber by increments. Only fully assembled charges with flash reducer properly located will be used.

Never insert primer in primer seat unless breechblock is closed and locked.

Under no circumstances will green bag and white bag charges be assembled together for firing.

Do not use projectiles with any trace of explosive filler on the outside of the projectile or in the fuze well cavity.

Ammunition components described in chapter 6 are authorized German (GE), Netherlands (NE), Belgium (BE), United Kingdom (UK), Italy (IT), Denmark (DA), and Greece (GR) only. Do not load or fire any components not listed in chapter 6 as it has not been determined safe to fire or cannot be fired from the M201A1 cannon.

Direct fire on targets located closer than 1000 m from the howitzer will be fired on during combat situations only. Lethal fragments can travel up to 800 m from point of burst.

Ensure that bell rammer (item 82, appx B) is used.

M201A1 CANNON

Do not fire beyond tube life.

Stand clear of breech to avoid injury from cannon recoil.

Before attempting to unload the howitzer, see MISFIRE/CHECKFIRE procedures.

Never stand directly behind the cannon when unloading.

WARNING (cont)

When a loaded cannon misfires see MISFIRE/CHECKFIRE procedures before continuing operation.

Do not attempt to free a jammed breechblock of a loaded cannon. Notify unit maintenance.

Prior to elevating/traversing cannon, crew must be alerted.

Ensure spade is emplaced prior to traversing.

Never manually elevate or traverse the weapon when power elevating and traversing systems are being used. Stay clear of manual elevating and traversing handles during power operations. A malfunction may cause the handles to spin, causing injury.

Gun tube must be manually traversed away from fan well to prevent personal injury. Refer to item 18, PMCS.

Cannon must be in travel lock prior to retracting/returning.

BREECH ASSEMBLY

If any interference prevents easy closing of the firing block, mechanism, do not force mechanism closed and do not loosen spindle nut to allow mechanism to close. Notify unit maintenance.

At very low temperatures, obturator pad may burst while firing. Keep clear of breech area.

After firing cannon, return to LOAD position before opening breechblock.

Elevate or depress cannon tube until LOAD marks aline before opening breech to avoid injury to personnel.

Do not attempt to remove breechblock by yourself. It takes two persons.

Check to make sure witness marks on breech ring and breechblock are alined.

BATTERY

Set MASTER switch OFF before checking batteries,

Before checking batteries, make sure all electrical switches are OFF and remove all jewelry and wristwatches from your person.

Electrolyte action forms EXPLOSIVE hydrogen gas. DO NOT cause a spark across the battery terminals. The battery may blow up in your face.

Battery corrosion is an acid and will eat holes in your clothing.

Wash any corrosion off your skin immediately.

WARNING (cont)

FUEL

Diesel fuel is FLAMMABLE; DO NOT smoke in vicinity while performing servicing operations.

Do not smoke within 50 ft (15.2 m) while servicing fuel system.

HYDRAULICS

DO NOT tighten or loosen hydraulic fittings when hydraulic system is pressurized. Failure to comply could result in injury.

High pressures in components of the recoil mechanism make it EXTREMELY DANGEROUS to attempt unauthorized maintenance of the recoil mechanism.

Do not take tube out of gun mount support (travel lock) or elevate until oil reserve has been established.

Do not fire weapon if recoil components are frozen.

Establish hydraulic oil reserve (index pin is extended) before elevating weapon. Failure to establish hydraulic oil reserve could result in cannon sliding out of battery and injuring personnel.

Make sure cannon is in battery position and oil reserve is established before releasing travel support.

Hydraulic pump operator should wear face shield.

Do not stand directly behind breech when hydraulic pump is being operated, as the extractor moves 9 in. (22.86 cm) rearward.

Do not exceed gage reading of 9550 psi (65,847 kPa). Overload zone is red.

COOLANT

Never remove radiator caps from an overheated engine.

Do not attempt to drain coolant from a hot engine.

WARNING (cont)



**WARNING
CARBON MONOXIDE POISONING IS DEADLY**

CARBON MONOXIDE IS A COLORLESS, ODORLESS, DEADLY POISONOUS GAS WHICH, WHEN BREATHED, DEPRIVES THE BODY OF OXYGEN AND CAUSES SUFFOCATION. EXPOSURE TO AIR CONTAMINATED WITH CARBON MONOXIDE PRODUCES SYMPTOMS OF HEADACHE, DIZZINESS, LOSS OF MUSCULAR CONTROL, APPARENT DROWSINESS, OR COMA. PERMANENT BRAIN DAMAGE OR DEATH CAN RESULT FROM SEVERE EXPOSURE.

CARBON MONOXIDE OCCURS IN THE EXHAUST FUMES OF FUEL-BURNING HEATERS AND INTERNAL-COMBUSTION ENGINES AND BECOMES DANGEROUSLY CONCENTRATED UNDER CONDITIONS OF INADEQUATE VENTILATION. THE FOLLOWING PRECAUTIONS MUST BE OBSERVED TO ENSURE THE SAFETY OF PERSONNEL WHENEVER THE PERSONNEL HEATER, MAIN, OR AUXILIARY ENGINE OF ANY VEHICLE IS OPERATED FOR MAINTENANCE PURPOSES OR TACTICAL USE.

1. DO NOT operate heater or engine of vehicle in an enclosed area unless it is ADEQUATELY VENTILATED.
2. DO NOT idle engine for long periods without maintaining ADEQUATE VENTILATION in personnel compartments.
3. DO NOT drive any vehicle with inspection plates, cover plates, or engine compartment covers removed unless necessary for maintenance purposes.
4. BE ALERT at all times during vehicle operation for exhaust odors and exposure symptoms. If either are present, IMMEDIATELY VENTILATE personnel compartments. If symptoms persist, remove affected personnel from vehicle and treat as follows: expose to fresh air; keep warm; DO NOT PERMIT PHYSICAL EXERCISE; if necessary, administer artificial respiration.

THE BEST DEFENSE AGAINST CARBON MONOXIDE POISONING IS ADEQUATE VENTILATION.

FIRST AID

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

TECHNICAL MANUAL

TM 9-2350-304-10

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 27 April 1990

OPERATORS MANUAL

**HOWITZER, HEAVY, SELF-PROPELLED
8-INCH, M110A2
(2350-01-041-4590) (EIC: 3E3)**

(CURRENT AS OF 30 September 1993)

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REPORTING ERRORS AND RECOMMENDING IMPROVEMENT

You can help improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in back of this manual directly to Commander, U.S. Army Armament, Munitions and Chemical Command, ATTN: AMSMC-MAS, Rock Island, IL 61299-6000. A reply will be furnished to you.

TABLE OF CONTENTS

CHAPTER			Page
	1	INTRODUCTION	
Section	I	General Information	1-1
Section	II	Equipment Description	1-2
Section	III	Technical Principles of Operation	1-17
Section	IV	Organization and Section Drill	1-17
	2	OPERATING INSTRUCTIONS	
Section	I	Description and use of Operators' Controls and Indicators	2-4
Section	II	Preventive Maintenance Checks and Services (PMCS)	2-23
Section	III	Operation Under Usual Conditions	2-58
Section	IV	Operation Under Unusual Conditions	2-169
	3	MAINTENANCE INSTRUCTIONS	
Section	I	Lubrication Instructions	3-2
Section	II	Troubleshooting Procedures	3-3
Section	III	Maintenance Procedures	3-29
	4	MAINTENANCE OF AUXILIARY EQUIPMENT	4-1

TABLE OF CONTENTS-CONTINUED

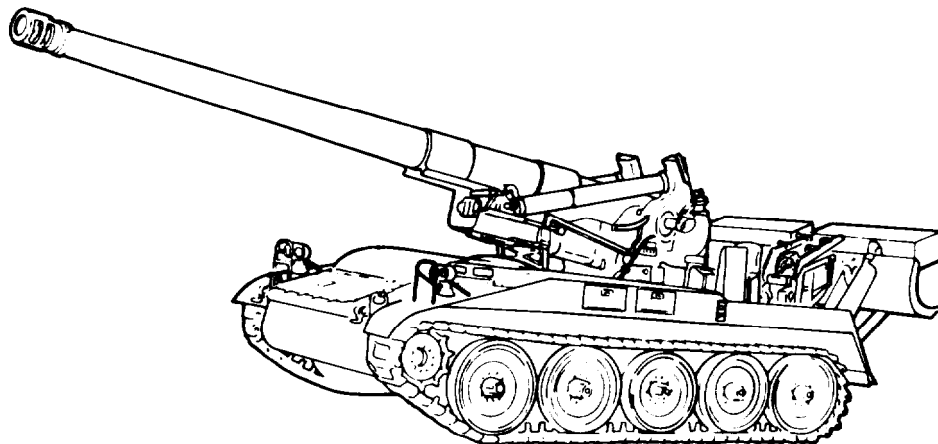
			Page
CHAPTER	5	AMMUNITION	
Section	I	Projectiles, Fuzes, Propelling Charges, and Primers	5-2
Section	II	Ammunition Preparation for Firing	5-19
Section	III	Ammunition Maintenance and Inspection	5-34
Section	IV	Operation and Maintenance of Dummy Projectile, M845	5-39
CHAPTER	6	FOREIGN AMMUNITION (NATO)	
Section	I	NATO Projectiles, Fuzes, Propelling Charges, and Primers	6-1
APPENDIX	A	REFERENCES	A-1
APPENDIX	B	COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS. ..	B-1
Section	I	Introduction	B-1
Section	II	Components of End Item	B-2
Section	III	Basic Issue Items List	B-4
APPENDIX	C	ADDITIONAL AUTHORIZATION LIST	C-1
Section	I	Introduction	C-1
Section	II	Additional Authorization List	C-2
APPENDIX	D	EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST	D-1
Section	I	Introduction	D-1
Section	II	Expendable/Durable Supplies and Materials List	D-2
APPENDIX	E	STOWAGE AND SIGN GUIDE.	E-1
APPENDIX	F	LUBRICATION INSTRUCTIONS.	F-1
		INDEX	I-1

CHAPTER 1 INTRODUCTION

CHAPTER INDEX

	Page
CORROSION PREVENTION AND CONTROL (CPC)	1-2
EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES	1-3
Capabilities and Features	1-3
Purpose	1-3
EQUIPMENT DATA	1-14
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS	1-3
MAINTENANCE FORMS AND RECORDS	1-2
ORGANIZATION	1-17
REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR's)	1-2
SCOPE	1-1
SECTIONDRILL	1-18

Section I. GENERAL INFORMATION



SECTION INDEX

	Page
CORROSION PREVENTION AND CONTROL (CPC)	1-2
MAINTENANCE FORMS AND RECORDS	1-2
REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR'S)	1-2
SCOPE	1-1

SCOPE

This manual contains data normally found in the technical manual and the field manual. It is for your use in operating and maintaining the M110A2 8-inch Self-Propelled Heavy Howitzer. The M110A2

Howitzer is a highly mobile field artillery piece capable of long range firing missions. Special purpose kits are provided to aid operations in cold climates. This manual also includes a section drill.

MAINTENANCE FORMS AND RECORDS

Department of the Army forms and procedures used for equipment maintenance will be those required by DA PAM 738-750, The Army Maintenance Management System (TAMMS). Keep your maintenance forms current at all times. For complete instructions on how to prepare the forms, refer to DA PAM 738-750.

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR'S)

If your M110A2 Howitzer needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Product Quality Deficiency Report). Mail it to us at Commander, U.S. Army Armament, Munitions and Chemical Command, ATTN: AMSMC-QAD, Rock Island, IL 61299-6000. We'll send you a reply.

CORROSION PREVENTION AND CONTROL (CPC)

a. Corrosion Prevention and Control (CPC) of Army material is a continuing

concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in the future.

b. While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of these materials may be a corrosion problem.

c. If a corrosion problem is identified, it can be reported using SF 368, Product Quality Deficiency Report. Use of key words such as "corrosion," "rust," "deterioration," or "cracking" will assure that the information is identified as a CPC problem.

d. The form should be submitted to: **Commander, U.S. Army Armament, Munitions and Chemical Command, ATTN: AMSMC-QAS/Customer Feedback Center, Rock Island, IL 61299-6000.**

Section II. EQUIPMENT DESCRIPTION

SECTION INDEX

	Page
EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.	1-3
Capabilities and Features	1-3
Purpose	1-3
EQUIPMENTDATA	1-14
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS	1-3

EQUIPMENT CHARACTERISTICS, CAPABILITIES AND FEATURES

PURPOSE

The M110A2 Howitzer is a weapon that defends against close-in or long-range ground targets.

CAPABILITIES AND FEATURES

The M110A2 is an unarmored, full-tracked, heavy, self-propelled, 8-inch (203 mm) howitzer. This diesel-powered artillery piece is highly mobile, maneuverable, and may be air transported. The vehicle is capable of long-range high-speed operation on

improved roads. It can traverse rough terrain, muddy or marshy ground, sand, and snow or ice. The M110A2 Howitzer can ford streams up to 42 in. (106.7 cm) deep.

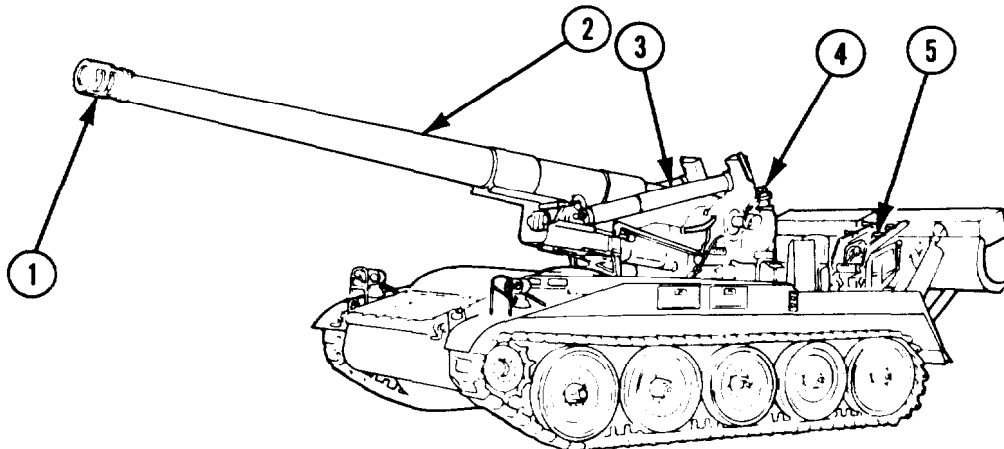
A hydraulic suspension lockout system and spade assembly help provide a stable platform for firing the cannon. The cannon elevating and traversing mechanisms and the projectile loader and rammer are also hydraulically powered. However, they may be manually operated in case of a power failure.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

The following pages show the location and give a brief description of the components and accessories that the crew must be

familiar with to effectively operate the M110A2 Howitzer.

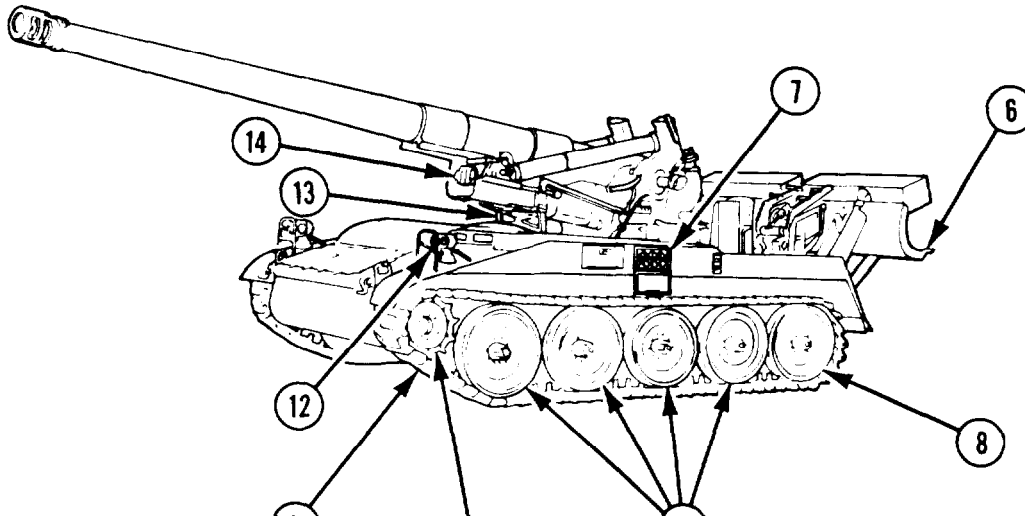
M110A2 HOWITZER—LEFT FRONT VIEW



- 1 **MUZZLE BRAKE.** The muzzle brake reduces recoil force.
- 2 **CANNON.** The cannon M201A1 is a long barrel 8-inch howitzer equipped with a muzzle brake.
- 3 **EQUILIBRATOR.** The equilibrator balances the cannon while it is being elevated or depressed. The tube should be as easy to elevate as it is to depress.
- 4 **PANORAMIC TELESCOPE (PANTEL) AND MOUNT.** The panoramic telescope is used for sighting the cannon for indirect fire. It can also be used for sighting the cannon for direct fire.
- 5 **LOADER AND RAMMER MECHANISM.** The loader and rammer mechanism lifts the projectile and rams it into the chamber. It is hydraulically powered, but can be operated manually.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS-CONTINUED

M110A2 HOWITZER- LEFT FRONT VIEW-CONTINUED



6 SPADE. The spade transfers recoil shock to the ground and prevents rear movement. It is raised or lowered by two hydraulic cylinders.

7 ENGINE AIR FILTERS. The two engine air filters provide clean intake air for the engine.

8 TRAILING IDLER ROAD WHEEL. The two pairs of trailing idler road wheels support, guide, and maintain tension for the tracks.

9 ROAD WHEEL. The eight pairs of road wheels provide support and guide the tracks.

10 DRIVE SPROCKET. The right and left drive sprockets are mounted on the final drives to drive each track.

11 TRACK. The right and left tracks consist of rubber-padded steel track shoes and are driven by the drive sprockets.

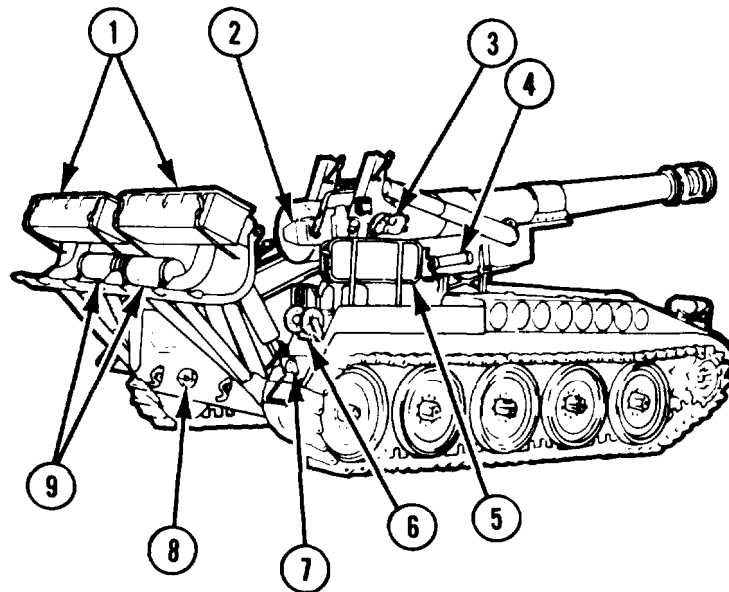
12 HEADLAMP. The headlamps provide light for night driving under normal or blackout (infrared) conditions.

13 TRAVEL LOCK AND SUPPORTS. The travel lock and supports secure the mount and cannon for travel (long support) or shipping (short support).

14 GUN MOUNT. The gun mount supports the cannon, fire control equipment, and recoil mechanisms.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS-CONTINUED

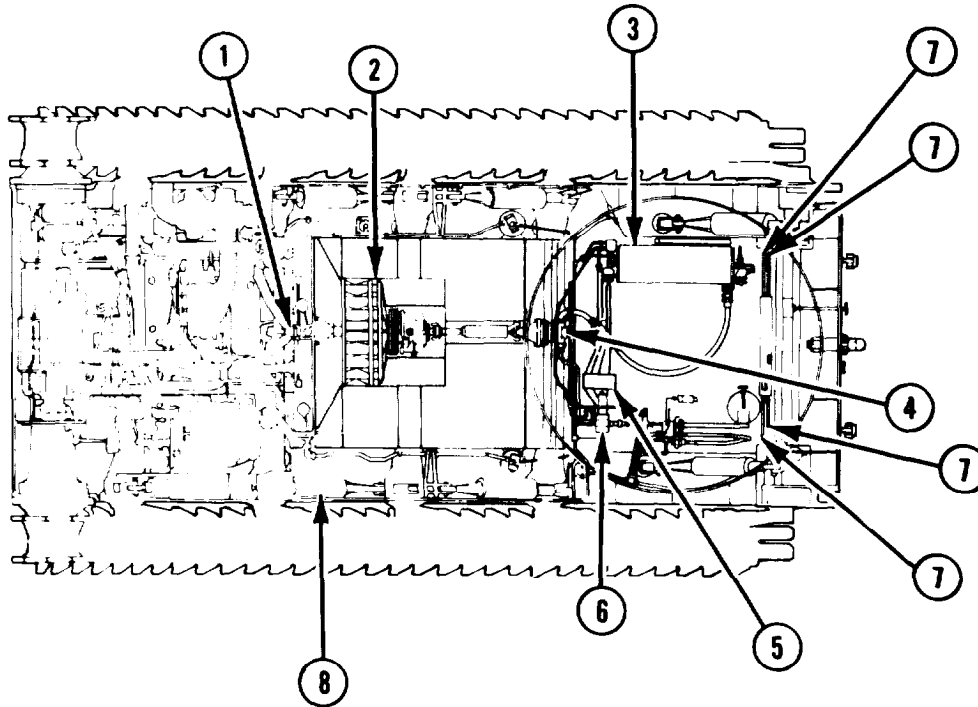
M110A2 HOWITZER-RIGHT REAR VIEW



- | | |
|--|---|
| <p>1 SPADE BOX. The two spade boxes provide storage for the components of the end item and basic issue items.</p> | <p>5 PERSONNEL SEAT. The personnel seat is for use by two crew members traveling with the vehicle.</p> |
| <p>2 BREECH. The rear of the cannon that includes the breechring, breechblock assembly, counterbalance, firing block, firing mechanism, and operating lever.</p> | <p>6 WIRE REEL. The wire reel provides storage for the communications wire.</p> |
| <p>3 DIRECT FIRE TELESCOPE, MOUNT, AND ELEVATION QUADRANT. This sighting equipment is used in sighting the cannon for direct fire. The elevation quadrant is also used in laying for indirect fire.</p> | <p>7 TAILLIGHT/STOPLIGHT. Taillight/stoplights provide rear light for night driving under normal and blackout (infrared) conditions.</p> |
| <p>4 REPLENISHER. The replenisher compensates for temperature changes and minor fluid loss in the recoil cylinder when the cannon is in battery.</p> | <p>8 TOWING PINTLE. The pintle is the point where the tow bar is attached during towing operations.</p> |
| | <p>9 PROPELLANT CHARGE. Two propellant charges are stowed for travel.</p> |

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS-CONTINUED

M110A2 HOWITZER- TOP VIEW, CUTAWAY



1 AUXILIARY DRIVE. When the engine is operating, the auxiliary drive powers the generator, cooling system fan, and (when the magnetic clutch is engaged) the hydraulic pump.

2 FAN. The fan forces air through the powerplant compartment and the radiators to cool the engine.

3 ACCUMULATOR. The accumulator is nitrogen charged. It maintains a supply of hydraulic oil at 1600 to 2400 psi (11,032 to 16,548 kPa) for powering hydraulic components.

4 HYDRAULIC PUMP. The hydraulic pump provides hydraulic pressure when the engine is operating and the magnetic clutch is engaged to power all hydraulic components.

5 LOCKOUT CYLINDER SHUTOFF VALVES. A shutoff valve has been installed in the hydraulic line to each lockout cylinder so that a faulty or leaking lockout cylinder can be isolated (blocked off) to allow firing the howitzer.

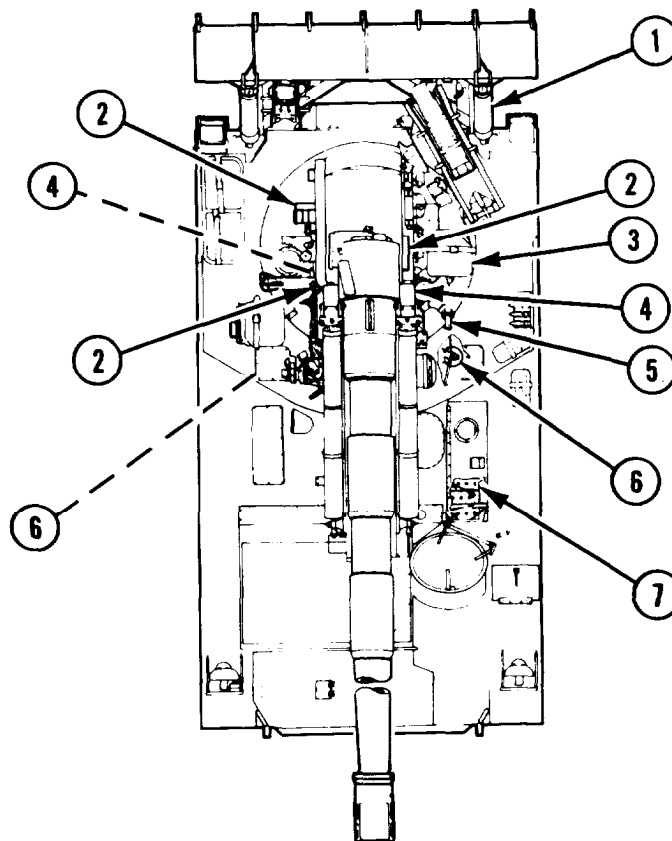
6 HYDRAULIC FILTER. This filter removes particles from the hydraulic oil. An indicator light on the gunner's panel lights when the filter requires service.

7 TORSION BAR. Each wheel is suspended by a torsion bar that acts as a spring.

8 LOCKOUT CYLINDER. The eight lockout cylinders act as a shock absorber, bump stop, and suspension lockout device.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS-CONTINUED

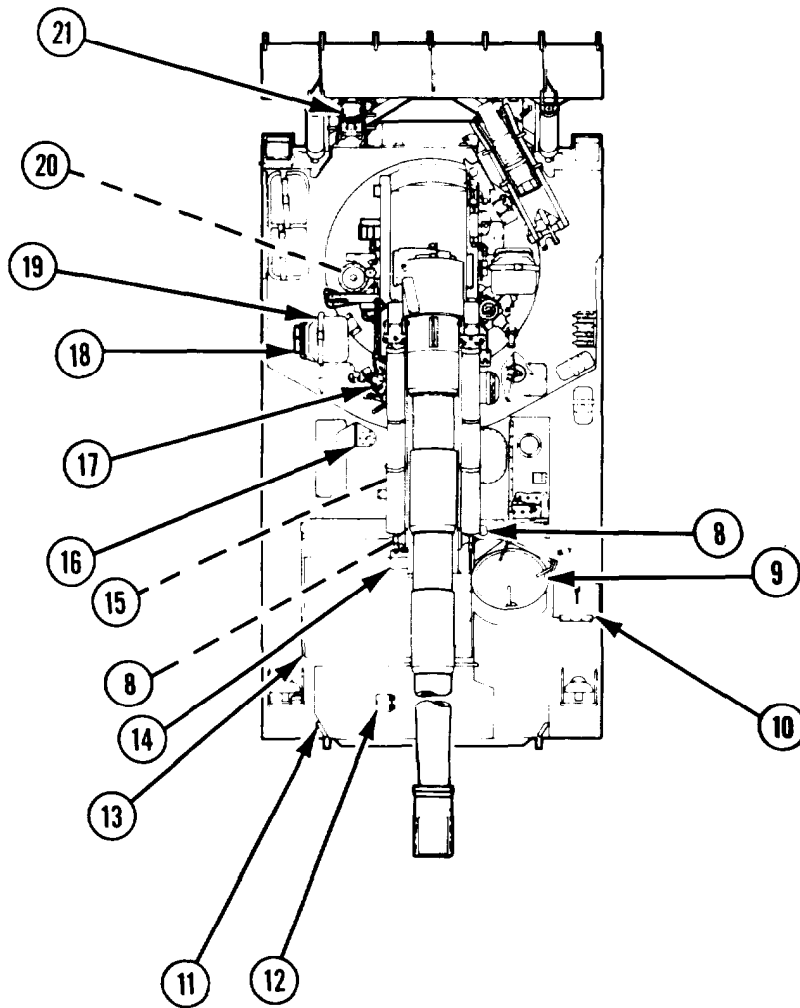
M110A2 HOWITZER- TOP VIEW



- | | |
|---|---|
| <p>1 SPADE CYLINDER. Two hydraulically powered spade cylinders raise or lower the spade.</p> <p>2 DATA DISPLAY GROUP. The data display group components receive and display firing commands from the Battery Computer Unit.</p> <p>3 GUNNER'S SEAT. This seat provides the gunner easy access to his controls.</p> <p>4 MOUNT HYDRAULIC FILTERS. These filters remove particles in the hydraulic oil from the electrically driven pump and the hand pump.</p> | <p>5 TRAVERSING SYSTEM. This system traverses the turret to the right or left. It is powered by hydraulic oil, but can be operated manually.</p> <p>6 FIXED FIRE EXTINGUISHER SYSTEM. The fixed fire extinguisher system protects the vehicle and crew in the event of fire in the engine compartment.</p> <p>7 BATTERY. The four batteries are connected in series parallel to provide 24 volts direct current (V dc) to power all electrical components.</p> |
|---|---|

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS-CONTINUED

M110A2 HOWITZER- TOP VIEW-CONTINUED



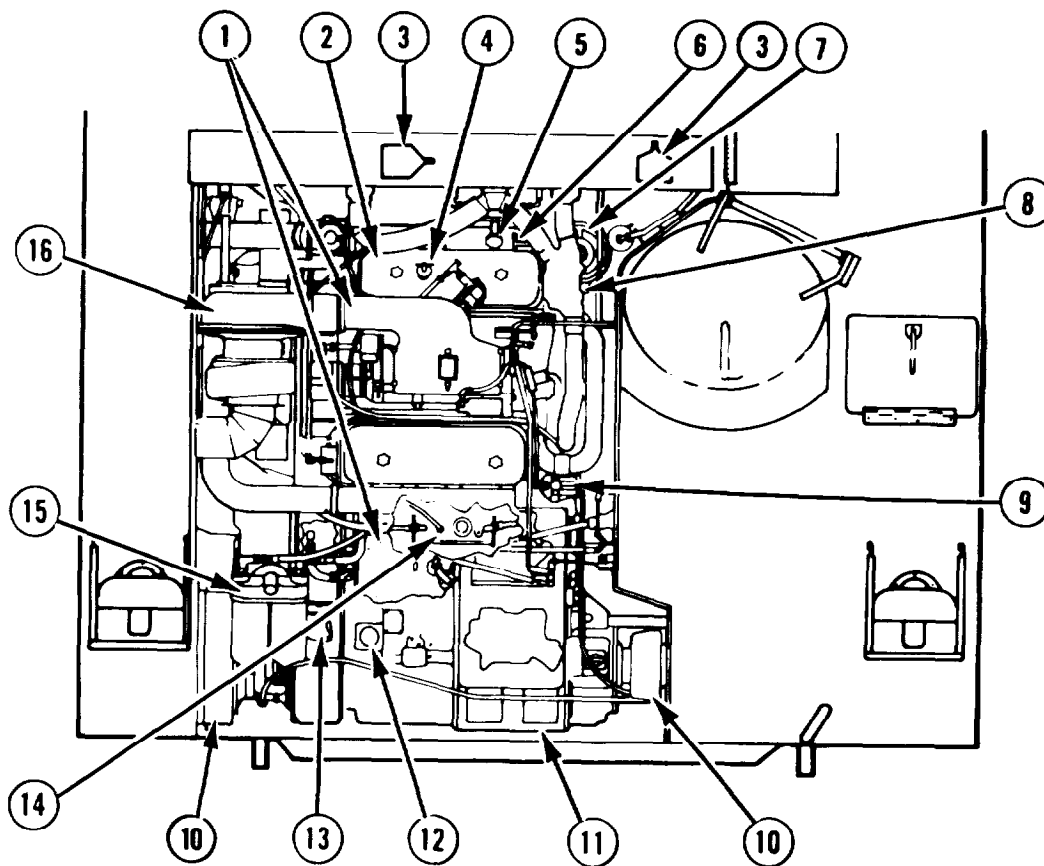
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS-CONTINUED

M110A2 HOWITZER- TOP VIEW- CONTINUED

- 8 RADIATOR FILL COVERS.** These two covers provide access to the radiator caps for checking the coolant level and filling the two radiators.
- 9 DRIVER'S CUPOLA.** The driver's cupola consists of an armor-plate mounting ring that is welded to the hull and an armor-plate cupola cover that is hinged to the hull deck and counterbalanced by a torsion bar. Three M17 periscopes provide external vision for the driver.
- 10 AIR CLEANER BLOWER ACCESS DOOR.** This door provides access to service and replace the air cleaner blower. The compartment provides stowage for the spare periscope.
- 11 TRANSMISSION DECK.** This cover provides access to the transmission and forward powerplant compartment.
- 12 TRANSMISSION OIL ACCESS DOOR.** This door provides access for checking and filling the transmission with oil.
- 13 ENGINE DECK.** This cover provides access to the engine and rear powerplant compartment.
- 14 AUXILIARY DRIVE AND ENGINE OIL ACCESS DOOR.** This door provides access for checking and filling the engine and auxiliary drive with oil.
- 15 FAN WELL COVER.** This cover screens out debris from the engine cooling air and provides access to the fan belt, tensioner, magnetic clutch, and drive shaft.
- 16 DIESEL FUEL FILL COVER.** This cover provides access to the fuel cap for filling the vehicle with fuel.
- 17 ELEVATING SYSTEM.** This system elevates the cannon. It is hydraulically powered, but can be operated manually.
- 18 VEHICULAR APPLIQUE SYSTEM.** The vehicular applique system provides electrical interface to enable the radio set to be operated with the data display group.
- 19 ASSISTANT GUNNER'S SEAT.** This seat provides the assistant gunner easy access to his controls.
- 20 HYDRAULIC OIL RESERVOIR.** The hydraulic oil reservoir provides reserve capacity and ensures a steady supply of hydraulic oil to the pumps.
- 21 PROJECTILE.** Two projectiles can be stowed on the spade racks.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS-CONTINUED

M110A2 HOWITZER- TOP VIEW, ENGINE AND TRANSMISSION DECKS REMOVED

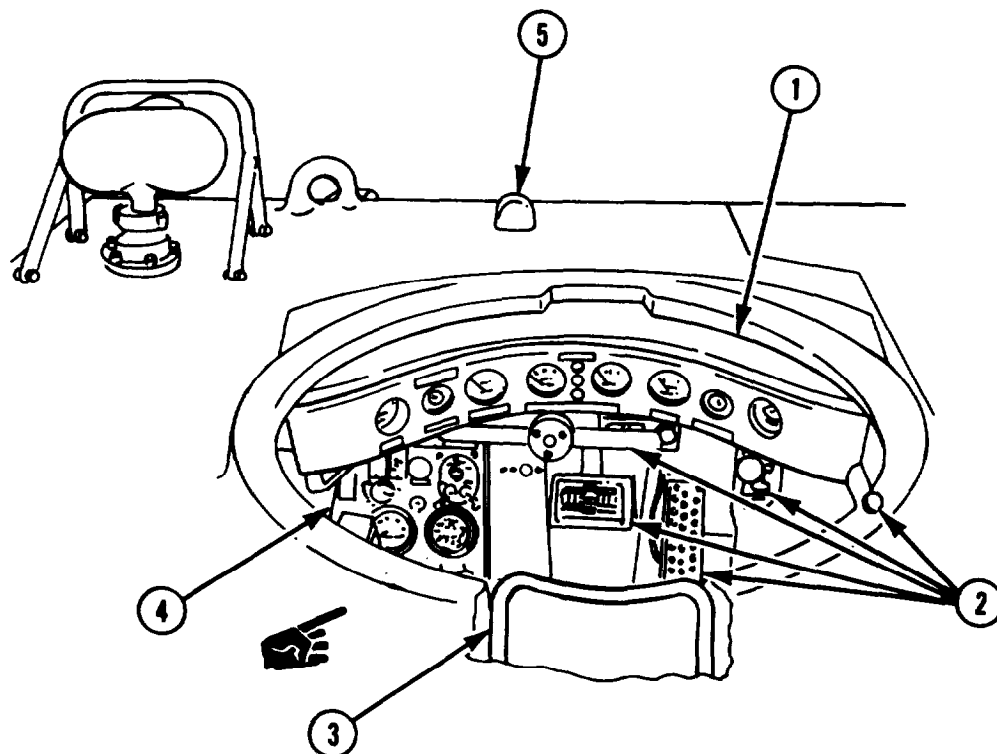


LOCATION AND DESCRIPTION OF MAJOR COMPONENTS -CONTINUED*M110A2 HOWITZER- TOP VIEW, ENGINE AND TRANSMISSION DECKS REMOVED*

- 1 **POWERPLANT.** The powerplant consists of a diesel engine, a transmission, and an input transfer assembly to provide power to the vehicle.
- 2 **ENGINE.** The engine is a Detroit Diesel GMC series 8V71T turbocharged 8-cylinder, V-type 2-cycle diesel with fuel injectors and overhead exhaust valves.
- 3 **RADIATORS.** Two radiators are provided to cool the engine. A surge tank is provided to catch excess coolant and gasses.
- 4 **ENGINE OIL FILL.** This is the cap and opening through which the engine crankcase is filled with oil.
- 5 **AUXILIARY DRIVE OIL FILL AND LEVEL.** This dipstick indicates the oil level and provides access to fill the auxiliary drive with oil.
- 6 **ENGINE OIL LEVEL.** This dipstick indicates the engine oil level.
- 7 **GENERATOR.** The 300 amperes (A) 24 V dc generator provides all electrical power for vehicle operation and battery charging and is controlled by a voltage regulator.
- 8 **PRIMARY FUEL FILTER.** This low-pressure filter removes water and larger particles from the fuel.
- 9 **SECONDARY FUEL FILTER.** This filter removes additional water and smaller particles from the fuel.
- 10 **FINAL DRIVES.** The right and left final drives connect the transmission to the tracks to move the vehicle.
- 11 **TRANSMISSION.** The transmission is an Allison model XTG-411-2A cross-drive which combines transmission, steering, and braking. It transmits engine power through final drives to the track. The transmission provides four forward and two reverse gear ranges. Vehicle steering is controlled by mechanical linkage from the steering bar that moves hydraulic controls in the transmission. Vehicle braking is controlled by the service brake pedal and linkage that moves brake discs in the transmission.
- 12 **TRANSMISSION FILL AND LEVEL.** This dipstick indicates the transmission oil level and provides access to fill the transmission with oil.
- 13 **TRANSMISSION OIL SCREEN.** This filter removes dirt from the transmission oil.
- 14 **POWERPLANT RESERVOIR.** The powerplant reservoir collects bypass oil and fuel from the engine and transmission to prevent accumulation in the bottom of the hull which would create a fire hazard.
- 15 **ENGINE OIL FILTERS.** These two filters remove dirt from the engine oil.
- 16 **TURBOCHARGER.** The turbocharger provides pressurized air to the engine.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS-CONTINUED

M110A2 HOWITZER-DRIVER'S COMPARTMENT VIEW



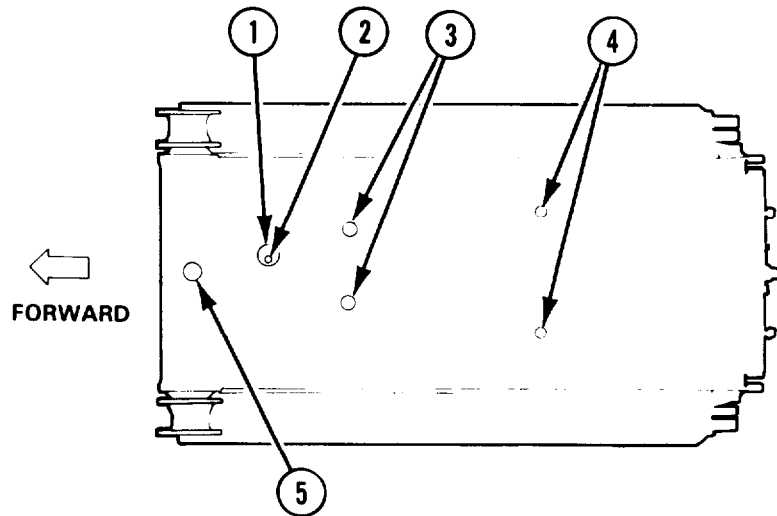
- 1 DRIVER'S INSTRUMENT PANEL. This panel contains gages and lights that allow the driver to observe vital engine, transmission, and electrical functions.
- 2 DRIVER'S CONTROLS. Controls which allow the driver to drive and operate the vehicle.
- 3 DRIVER'S SEAT. This seat provides the driver easy access to the controls and indicators. It can be adjusted up or down and back and forward.
- 4 DRIVER'S SWITCH PANEL. This panel contains switches and controls that allow the driver to energize the various

systems including hydraulic functions in the vehicle. A speedometer and tachometer indicate vehicle and engine speed.

- 5 DRIVER'S EXTERNAL ENGINE AND TRANSMISSION WARNING LIGHT. This warning light alerts the driver if the engine or transmission is overheating or the oil pressure is low.
- 6 Deleted. ■

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS-CONTINUED

M110A2 HOWITZER-TOP VIEW, HULL BOTTOM

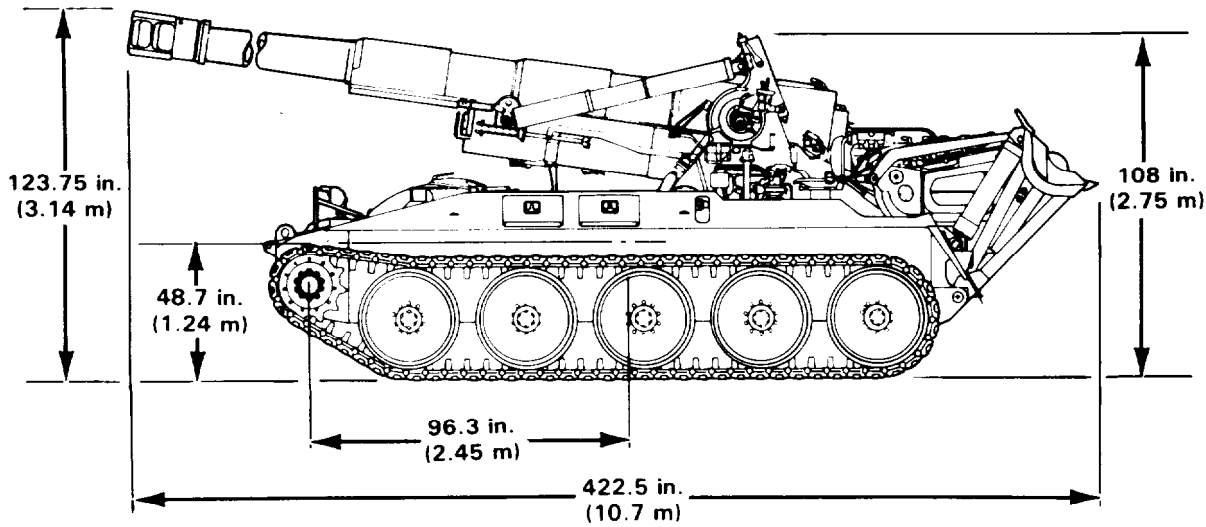


- | | |
|--|--|
| <p>1 ENGINE DRAIN COVER. This cover provides access for draining the engine oil.</p> <p>2 POWERPLANT RESERVOIR DRAIN PLUG. This plug is installed during fording operations to prevent flooding of the powerplant reservoir. The plug should be wired to the hand throttle control rod in the driver's compartment during normal operations.</p> <p>3 RADIATOR DRAIN COVERS. These two covers provide access to drain coolant from the radiators.</p> | <p>4 FUEL CELL DRAIN PLUGS. These two plugs are removed to drain the fuel cell.</p> <p>5 TRANSMISSION DRAIN COVER. This cover provides access to drain the transmission oil.</p> |
|--|--|

EQUIPMENT DATA

GENERAL

Weight, Combat Loaded	62,500 lb (28,350 kg)
Length	35 ft 2.50 in. (10.7 m)
Width	10 ft 4 in. (3.2 m)
Height	10 ft 3.75 in. (3.14 m)
Ground Clearance	1 ft 3.50 in. (39.4 cm)
Ground Pressure	11.6 psi (80 kPa)
Vehicle Classification, Combat Loaded	29



ENGINE

CAUTION

Do not let engine speed exceed 2300 rpm under any circumstances.

Manufacturer	Detroit Diesel Engine Division, GMC V-8, compression-ignition, liquid cooled
Type	Turbocharged, two-cycle diesel
Model (7083-7398) or (7083-7395)	8V71T
Weight, Dry (as installed)	2442 lb (1107.7 kg)
Number of Cylinders	8
Displacement	568 cu in. (9308 cm ³)
Bore	4.25 in. (10.8 cm)
Stroke	5.0 in. (12.7 cm)
Compression Ratio	17:1
Horsepower, Gross Brake (at 2300 rpm)	405 hp (302 kW)
Horsepower, Net Brake	345 hp (257 kW)
Maximum rpm, No Load (governed)	2450 rpm
Idle Speed	650-700 rpm
Cooling	Liquid

EQUIPMENT DATA-CONTINUED

TRANSMISSION

Manufacturer Allison Division, GMC
 Type Crossdrive, torque converter, planetary gear, all-torque-shifting
 Model XTG-411-2A
 Weight, Dry (as installed) 2390 lb (1084.1 kg)
 Range Selector Four forward speeds, two reverse speeds
 Oil Screen. Reusable screen disk-type or disposable element
 Lubrication Pressure 18 to 45 psi (124 to 310 kPa) at 1835 to 1900 engine rpm
 (minimum 10 psi (69 kPa) at 1000 engine rpm)

Gear ratios

First (1)	4.69:1
Second (2)	3.18:1
Third (3)	1.59:1
Fourth (4)	0.794:1
Reverse 1 (R1)	5.60:1
Reverse 2 (R2)	3.79:1
Input Torque (maximum)	880 ft-lb (1188 N-m)
Input Power, Net (maximum)	360 hp (269 kW)
Input Speed (maximum)	2300 rpm

GENERATOR

Voltage +24 V
 Amperage 300 A
 Driven By engine through auxiliary drive
 Cooled. By fan forced air
 Controlled. By voltage regulator

BATTERIES

Number 4
 Voltage +12 V
 Connected Series-parallel
 Output potential. +24 V
 Post to ground. Negative

ARMAMENT

Type Howitzer, 8-in. (203 mm)
 Model M201A1
 Projectiles and Propellant Charges (stowed) 2 rounds
 Maximum Range. 30,000 m w/RAP
 Rates of Fire Maximum rate of fire, 3 rounds every 1 minute
 sustained rate of fire, 1 round every 2 minutes

PERFORMANCE

Maximum Allowable Speed
 Fourth (4). 34 mph (54.7 km/h)

EQUIPMENT DATA -CONTINUED

PERFORMANCE - CONTINUED

Third (3)	17 mph (27.4 km/h)
Second (2)	9 mph (14.5 km/h)
First (1)	5 mph (8.1 km/h)
Reverse 1 (R1)	4 mph (6.4 km/h)
Reverse 2 (R2)	7 mph (11.3 km/h)
Cruising Range	325 miles (523 km)
Fuel Mileage.	1.3 mpg (2.1 km)
Grade Ascending/Descending Ability (maximum)	60% (533 mil)
Angle of Approach.	30° (533 mil)
Angle of Departure.	43° (764 mil)
Side Slope	30% (267 mil)
Fording Depth	42 in. (1.07 m)
Trench (maximum).	75 in. (1.91 m)
Vertical Wall (maximum)	42 in. (1.07 m)
Towed Load (maximum)	50,000 lb (22,680 kg)
Traverse (maximum to right & left)	30° (533 mil)
Elevation (maximum)	65° (1156 mil)
Elevation (minimum)	+ 2° (35 mil) (horizontal)

C A P A C I T I E S

Fuel Cell.	260 gal. (984 l)
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Use the following grades of fuel at the indicated temperatures:

Winter Grade (DF-1)	-25° to + 20°F (-32° to -7°C)
Arctic Grade (DF-A) (NATO F-56)	-65° to - 25°F (-54° to -32°C)

Fuel Type (DF-2) +20° to +115°F (-7° to +64°C).	Diesel, 40 cetane
Engine Oil,	
Dry	38 qt (36.0 l)
Refill	28 qt (26.5 l)
Transmission Oil,	
Dry	19 gal. (72 l)
Refill	12 gal. (45 l)
Auxiliary Drive Oil,	
Dry	4.50 qt (4.3 l)
Refill	4 qt (3.8 l)
Hydraulic Oil Reservoir,	
Dry	27 gal. (102 l)
Refill	27 gal. (102 l)
Engine Coolant.	24 gal. (90.8 l)

Section III. TECHNICAL PRINCIPLES OF OPERATION

Refer to TM 9-3305 for complete description of technical principles of operation.

Section IV. ORGANIZATION AND SECTION DRILL

SECTION INDEX

ORGANIZATION	Page 1-17
SECTION DRILL	1-18

ORGANIZATION

Composition of the Howitzer Section

The howitzer section consists of section personnel, an M110A2 8-inch self-propelled howitzer, a section vehicle, and auxiliary equipment.

Personnel of the howitzer section consist of:

- A chief of section (CS)
- A gunner (G)
- An ammunition team chief (ATC)
- An assistant gunner (AG)
- Six cannoneers, number (1) thru (6)
- A howitzer driver (HD)
- A section vehicle driver (SD)

Section equipment is listed in appropriate tables of organization and equipment (TOE) and tables of allowance (TA).

General Duties of Personnel

Chief of Section. The chief of section is the noncommissioned officer in command of the section and, as such, is responsible for:

- Training and efficiency of personnel.

- Performance of duties in section drill and duties in firing, tests, and adjustment of sighting and fire control equipment. Inspection and maintenance of all section equipment, including the performance of scheduled preventive maintenance checks and services (PMCS) on the howitzer and section vehicle.
- Observance of safety precautions.
- Preparation of field fortifications for protection of equipment, ammunition, and personnel.
- Camouflage, light, and noise discipline. Local security. Nuclear, biological, and chemical (NBC) warfare security discipline.
- Maintenance of equipment maintenance forms (refer to DA PAM 738-750).
- Police of the section area.

Gunner. The gunner is principal assistant to the chief of section in performing the duties specified above. The gunner's specific duties are prescribed in the appropriate chapters of this manual.

Ammunition Team Chief. The ammunition team chief leads and directs the handling of ammunition, performs duties as listed in this manual, and other duties as directed.

ORGANIZATION -CONTINUED

Assistant Gunner. The assistant gunner assists the gunner in performing his duties and, in an emergency, acts as gunner. The assistant gunner's specific duties are prescribed in appropriate chapters of this manual.

Cannoneers. The cannoneers perform the duties listed in this manual and any other duties assigned by the chief of section.

Drivers. The drivers' primary duties are driving their respective vehicles and performing preventive maintenance. They perform duties prescribed by this manual and by technical manuals pertaining to their vehicles. They also perform any other duties assigned by the chief of section, including substituting for any member of the section in firing.

SECTION DRILL

General

The purpose of section drill is to improve the performance of the howitzer section. Section drill will bring about quick and accurate execution of assigned tasks and cross training of section personnel.

Instructions

Doing the drills as prescribed in this manual is necessary to develop maximum performance and prevent injury to personnel and damage to equipment.

Section drill must be conducted in silence, except for commands and reports. The section must be drilled until reactions to commands are automatic, quick, and correct.

Errors will be corrected immediately. Each section member will immediately report any errors to the chief of section. The chief of section will immediately report errors to the executive.

Battery officers will supervise the drill.

Duties should be rotated during training so each member of the howitzer section can perform all duties within the section. Also, battery overhead personnel should take part in section drill so they will be capable of functioning efficiently with a howitzer section, if required.

SECTION DRILL-CONTINUED

To Form the Section

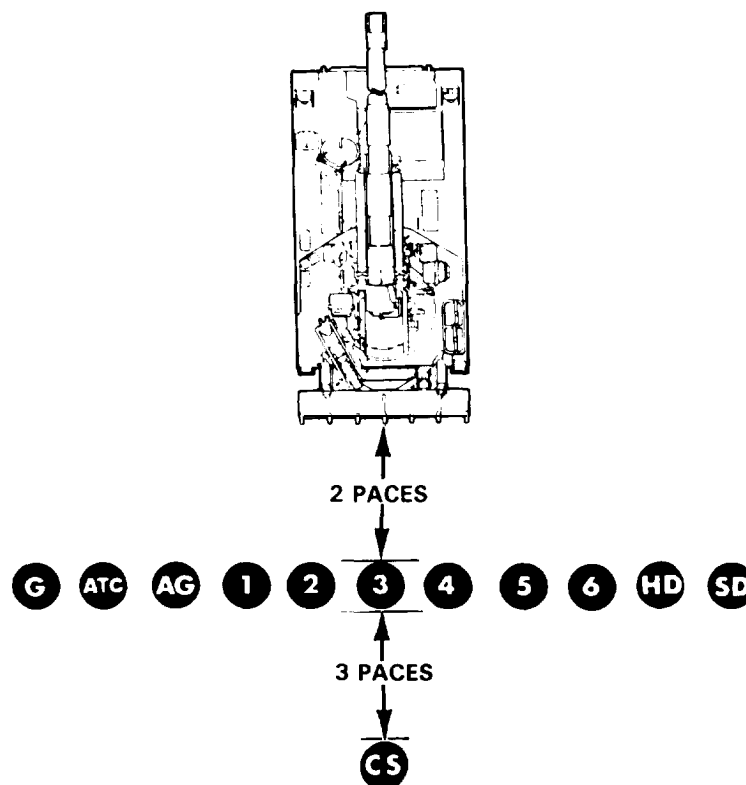
To Fall In. The chief of section takes his post. On the command of execution the section forms in a single rank, at close interval, centered on and facing the chief of section at a distance of 3 paces. Higher numbered cannoneers, if present, form in order between number 6 and the howitzer driver. The chief of section may indicate in his preparatory command the place and direction in which the section is to form. At the first formation for a drill or exercise, the caution "As howitzer section(s)"

precedes the command. The commands are:

- FALL IN, or
- 1. IN FRONT (REAR) OF THE PIECE(S), 2. FALL IN, or
- 1. ON THE ROAD FACING THE PARK, 2. FALL IN.

Execution is as follows: The section moves at double time and forms at close interval, at attention, guiding on the gunner. The driver of the section vehicle is to the left of the howitzer driver and is last in line.

To execute 1. IN REAR OF THE PIECE, 2. FALL IN, the section falls in as shown.



Formation of the section in rear of the piece.

To Call Off. The section being in formation, the command is CALL OFF. At the command, all personnel in ranks (except the gunner) execute eyes right. The section then calls off in sequence. For example,

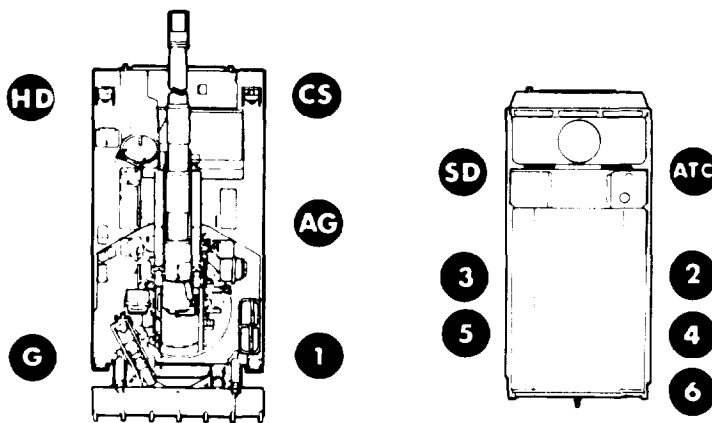
"Gunner," "Ammunition Team Chief," "Assistant Gunner," "1," "2," "3," "4," "5," "6," "Driver," "Driver." Each man, except the gunner, turns his head smartly to the front as he calls out his designation.

SECTION DRILL -CONTINUED

To Post the Section

The command is 1. CANNONEERS, 2. POSTS. The command is general and is applicable whether the section is in or out of ranks, at halt, or marching. All movements

are executed at double time and are terminated at the position of attention. Higher numbered cannoneers, if present, take posts as directed by the chief of section.

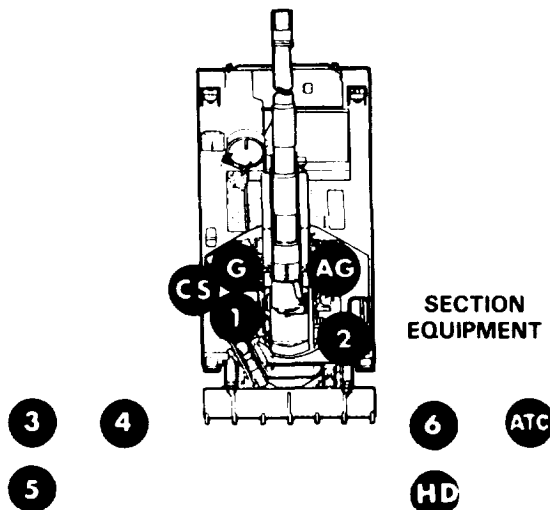


Posts of section dismounted.

Dismounted. The section moves to posts as shown. All personnel are 2 ft (0.61 m) outside the tracks and facing the front.



Personal injury could result if crew members stand within loader-rammer swing arc.



Posts of section prepared for action.

Prepared for Action. The piece having been prepared for action, the section is posted

as shown. All personnel face to the front.

SECTION DRILL-CONTINUED

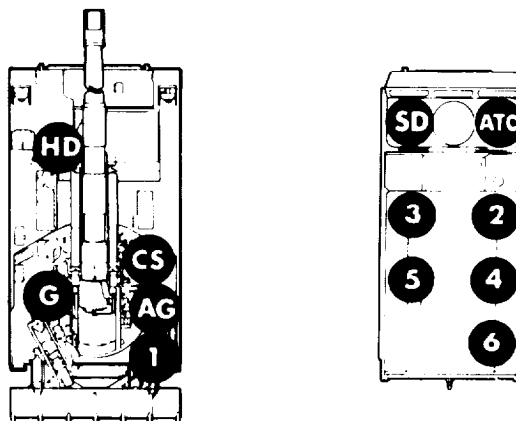
To Change Posts

Post should be changed often to acquaint members of the section with all duties and lend variety to drill. The section being in formation (page 1-19), the commands are: 1. CHANGE POSTS, 2. MARCH, or 1. SECTION CHANGE POSTS, 2. MARCH.

At the command 1. CHANGE POSTS, 2. MARCH, the assistant gunner and all numbered cannoneers except number 6

take two left steps, taking the position of the next higher numbered cannoneer. At the same time number 6 moves at double time in rear of the rank to the post of the assistant gunner. All other members of the section stand fast.

At the command 1. SECTION CHANGE POSTS, 2. MARCH, all members of the section except the individual at the extreme left take two left steps. The excepted man moves at double time in rear of the section and takes the post of the gunner.



Section mounted.

To Mount

The commands are: 1. PREPARE TO MOUNT, 2. MOUNT.

At the preparatory command, the section moves at double time to the positions of section dismounted. Refer to page 1-20. At the command of execution, all personnel mount as indicated.

The chief of section, driver of the howitzer, gunner, assistant gunner, and number 1 mount the howitzer. Likewise, at the command of execution, the driver of the section

vehicle, ammunition team chief, and numbers 2 thru 6 mount into the section vehicle as shown. If any members of the section are not to mount, their designation is announced with the caution "Stand fast," given between the preparatory command and the command of execution. For example: 1. PREPARE TO MOUNT, DRIVERS STAND FAST, 2. MOUNT.

If the command is MOUNT, the section mounts in the manner and order prescribed for the command 1. PREPARE TO MOUNT, 2. MOUNT. Dismounted posts are not taken.

SECTION DRILL-CONTINUED

To Dismount

The commands are 1. PREPARE TO DISMOUNT, 2. DISMOUNT.

At the preparatory command, personnel mounted in the section vehicle unlatch and open the doors (tailgate) of the vehicle and all members of the section assume positions from which they can dismount promptly. At the command of execution, they dismount and take (at double time) the posts of section dismounted. Refer to page 1-20.

If the command is simply DISMOUNT, the section executes all that is prescribed for the command 1. PREPARE TO DISMOUNT, 2. DISMOUNT.

To Fall Out

At Drill. When it is desired to give personnel a rest from drill or to relieve them temporarily from formation or post the command FALL OUT is given. The command may be given at any time and means the section is to remain in the drill area.

When Firing. When firing has been suspended temporarily, but it is desired to

have the section remain in the vicinity of the howitzer, the command FALL OUT is given. Men stand clear of the piece to make sure settings and laying remain undisturbed. During these periods the chief of section may direct the men to improve the position, replenish ammunition, or do other necessary work.

Reduced Crew Drill

At times the crew may be reduced to less than the prescribed TOE strength due to illness, casualties, battery taskings, and the need to rest personnel. To meet the need of these occasions and the need to maintain operations of the section in as orderly a manner as possible, the duties of the individuals of the section have been combined.

<u>11-Men</u>	<u>10-Men</u>	<u>9-Men</u>
CS	CS	CS
G	G	G
ATC	ATC	ATC
AG	AG	AG
#1	#1	#1
#2	#2	#2
#3	#3	#3/#6
#4	#4/HD	#4/HD
#5/SD	#5/SD	#5/SD
#6	#6	
HD		

CHAPTER 2 OPERATING INSTRUCTIONS

CHAPTER INDEX

	Page
ASSEMBLY AND PREPARATION FOR USE	2-60
BACKING VEHICLE	2-73
BORESIGHTING DIRECT FIRE TELESCOPE USING TESTING TARGET WITH SCRIBED M15 ELEVATION QUADRANT	2-110
BORESIGHTING M115 PANORAMIC TELESCOPE USING DISTANT AIMING POINT (DAP) METHOD..	2-112
BORESIGHTING M115 PANORAMIC TELESCOPE USING DISTANT AIMING POINT WITH M137 MOUNT AND M15 ELEVATION QUADRANT SCRIBED	2-115
BORESIGHTING M139 DIRECT FIRE TELESCOPE USING DISTANT AIMING POINT	2-114
BORESIGHTING M139 DIRECT FIRE TELESCOPE USING DISTANT AIMING POINT AND SCRIBED M15 ELEVATION QUADRANT	2-117
BORESIGHTING PROCEDURES FOR TEST TARGET METHOD USING SCRIBED M137 PANORAMIC TELESCOPE MOUNT	2-108
CHECKING BORESIGHT OF M115 PANORAMIC TELESCOPE USING M140 ALINEMENT DEVICE	2-118
CHECKING BORESIGHT OF M139 ELBOW TELESCOPE USING M140 ALINEMENT DEVICE	2-119
CHECKING M140 ALINEMENT DEVICE WHILE BORESIGHTING ON TEST TARGET	2-111
COMPARISON TEST OF THE M140 ALINEMENT DEVICE	2-120
DIRECT FIRE PROCEDURES..	2-140
General	2-140
Laying for direction and elevation: One man-one sight system	2-144
Laying for direction and elevation: Two man-one sight system	2-143
Laying for direction and elevation: Two man-two sight system	2-140
DRIVING VEHICLE	2-71
DRIVING VEHICLE ON ROUGH AND HILLY TERRAIN	2-74
EMERGENCY PROCEDURES	2-178
EMPLACING M1A2 AIMING POSTS	2-106
EMPLACING M1A1 INFINITY AIMING REFERENCE COLLIMATOR	2-104
ENGINE STARTING	2-64
ENTERING FIRE CONTROL CORRECTIONS	2-125
M15 Elevation fire control quadrant	2-125
M137 Telescope mount and M115 panoramic telescope	2-126

EQUILIBRATOR ADJUSTMENT	2-122
FIXED FIRE EXTINGUISHER	2-78
FORDING	2-176
After fording maintenance	2-177
GENERAL	2-23, 2-170
GUN MOUNT SUPPORT	2-78
Disengaging gun mount support	2-79
Engaging gun mount support	2-78
HAND RAMMING WITH M13 LOADING RAMMER	2-130
INITIAL ADJUSTMENTS AND DAILY CHECKS	2-60
INSERTING PRIMER AND FIRING	2-135
INSTRUMENT PANEL CHECKOUT PROCEDURES	2-65
KNOW YOUR CONTROLS AND INDICATORS	2-5
Assistant gunner's controls and indicators	2-12
Driver's controls and indicators	2-5
External controls	2-18
Gunner's controls and indicators	2-14
Loader/rammer and breech controls and indicators	2-16
Turret well controls	2-22
LAYING FOR DIRECTION AND QUADRANT DURING INDIRECT FIRE MISSIONS USING COLLIMATOR	2-136
LAYING FOR DIRECTION AND QUADRANT DURING INDIRECT FIRE MISSIONS USING M1A2 AIMING POSTS	2-138
LAYING HOWITZER USING M2 AIMING CIRCLE METHOD	2-102
LOADER/RAMMER PRELOADING PROCEDURES	2-89
Loader/rammer and cannon alinement	2-91
Marking the rammer chain.	2-94
Projectile tray adjustment	2-89
Verifying correct cannon elevation for loader/rammer	2-90
LOADING PROPELLING CHARGE	2-134
MANUAL LOADING AND RAMMING	2-127
MEASURING SITE TO CREST	2-108
MISFIRE/CHECKFIRE PROCEDURES	2-147
Cold tube misfire procedure M110A2	2-149
Definitions	2-147
General	2-147
Hot tube misfire procedure M110A2	2-148
NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) DECONTAMINATION PROCEDURES ..	2-178
Chemical detection and decontamination	2-178
Emergency procedures	2-178
General	2-178
OBTURATOR GAS CHECK PAD INSPECTION	2-124
OPERATING INSTRUCTIONS ON DECALS AND INSTRUCTION PLATES.	2-168
OPERATING PROCEDURES	2-61

OPERATION IN UNUSUAL WEATHER.	2-170
Cold weather starting	2-173
Extreme cold	2-171
Extreme dry heat	2-170
Extreme dust or sand	2-171
Extreme moist heat	2-170
Salt air or sea spray	2-171
OPERATION OF AUXILIARY EQUIPMENT	2-149
Arctic traction kit	2-165
Hull heater kit	2-157
M90 radar chronograph equipment and antenna mounting kit	2-151
Operation of coolant heater	2-160
Operation of crew personnel heater	2-163
Operation of crew personnel shelter.	2-164
Operation of data display group	2-151
Operation of driver's enclosure kit	2-156
Opening driver's enclosure	2-156
Removal of driver's enclosure	2-157
Operation of driver's heater	2-159
Operation of exhaust ports and intake covers.	2-162
Operation of fuel filter heaters	2-160
Operation of intercommunication system	2-149
Operation of portable fire extinguisher	2-154
Operation of special purpose kits	2-155
Operation of vehicular applique system	2-151
OPERATION OF DRIVING LIGHTS AND DOME LIGHT	2-69
Operation of dome light	2-69
Operation of light switch assembly	2-69
OPERATION OF FIRE CONTROL EQUIPMENT	2-95
Operation of M15 elevation quadrant	2-98
Operation of M137 telescope mount and M115 panoramic telescope	2-95
M115 panoramic telescope	2-96
M137 telescope mount	2-95
Operation of M138 telescope mount and M139 direct fire elbow telescope	2-97
PMCS PROCEDURES	2-23
Table 2-1. Preventive maintenance checks and services for the howitzer heavy, self-propelled, 8-inch, M110A2	2-26
POWER LOADING AND RAMMING.	2-131
PREFIRE CHECKS	2-124
PREPARATION FOR FIRING	2-99
Emplacing the howitzer	2-99

PREPARATION FOR MOVEMENT	2-165
PRE-STARTING INSTRUCTIONS	2-61
RECOIL MECHANISM CHECKOUT AND ESTABLISHING OIL RESERVE	2-121
RETRACTING AND RETURNING CANNON	2-88
Retracting cannon	2-88
Returning cannon	2-88
SECURING PERSONNEL SEAT AND PROJECTILE TRAYS	2-165
Personnel seat	2-165
Projectile trays	2-165
SHIFTING THE TRANSMISSION	2-70
SPADE	2-83
Emplacing	2-83
Securing spade	2-86
STARTING ENGINE BY TOWING	2-68
STARTING ENGINE USING AUXILIARY EQUIPMENT	2-67
STOPPING VEHICLE	2-75
SUSPENSION LOCKOUT	2-87
Locking suspension	2-87
Unlocking suspension	2-87
TOWING PROCEDURES	2-76
TRAVERSING TURRET AND ELEVATING CANNON	2-80
Manual elevating	2-80
Manual traversing	2-81
Manual traversing and elevating	2-80
Power elevating	2-82
Power traversing	2-83
Power traversing and elevating	2-81
UNLOADING HOWITZER	2-145
UNUSUAL TERRAIN	2-175
Ice	2-175
Mud	2-175
Sand	2-175
Snow	2-175

**Section I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS
AND INDICATORS**

SECTION INDEX

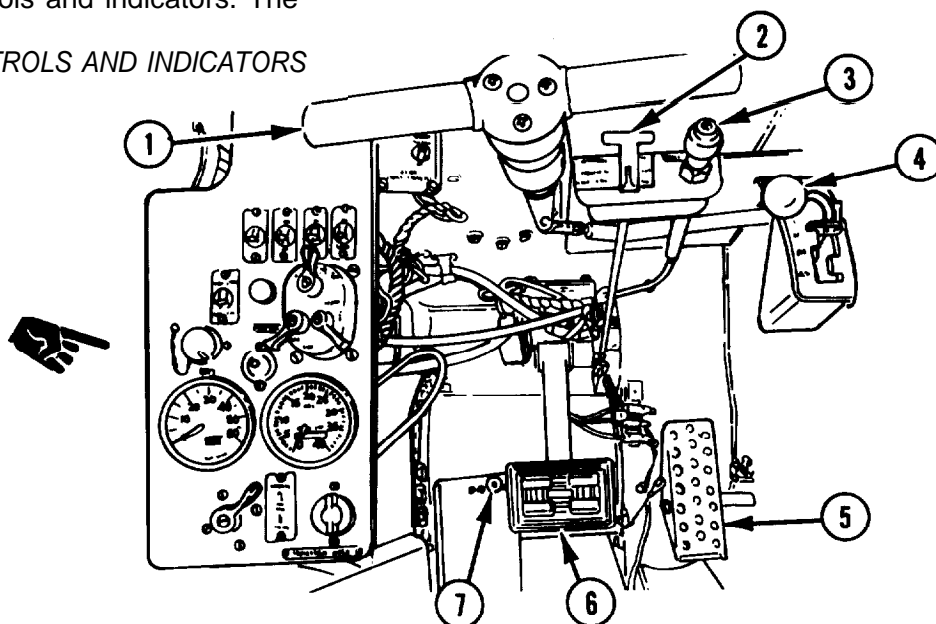
KNOW YOUR CONTROLS AND INDICATORS	Page 2-5
Assistant gunner's controls and indicators	2-12
Driver's controls and indicators	2-5
External controls	2-18
Gunner's controls and indicators	2-14
Loader/rammer and breech controls and indicators	2-16
Turret well controls	2-22

KNOW YOUR CONTROLS AND INDICATORS

Do not attempt to operate your equipment until you are familiar with the location and use of all controls and indicators. The

following pages describe the controls and indicators you will use.

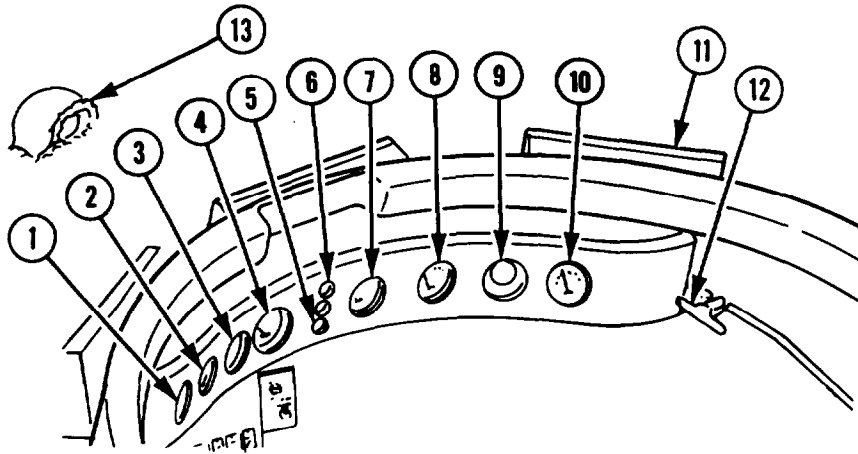
DRIVER'S CONTROLS AND INDICATORS



Key	Control or Indicator	Function
1	Steering bar	Turns the vehicle left or right by engaging clutches in the transmission.
2	Parking brake handle	Locks the service brake by pushing down on parking brake handle. Releases the service brake when pulling brake handle up.
3	Hand throttle control	Maintains engine speed when pulled out to warm the engine or to operate the hydraulic system.
4	Transmission shift control lever	Shifts transmission between four forward and two reverse gear ranges. A safety catch locks lever in neutral.
5	Foot throttle pedal	Controls engine speed.
6	Service brake pedal	Operates brakes in the transmission to slow, stop, or hold the vehicle.
7	Headlamp dimmer switch	Switches the headlamps between high and low beam.

KNOW YOUR CONTROLS AND INDICATORS-CONTINUED

DRIVER'S CONTROLS AND INDICATORS- CONTINUED



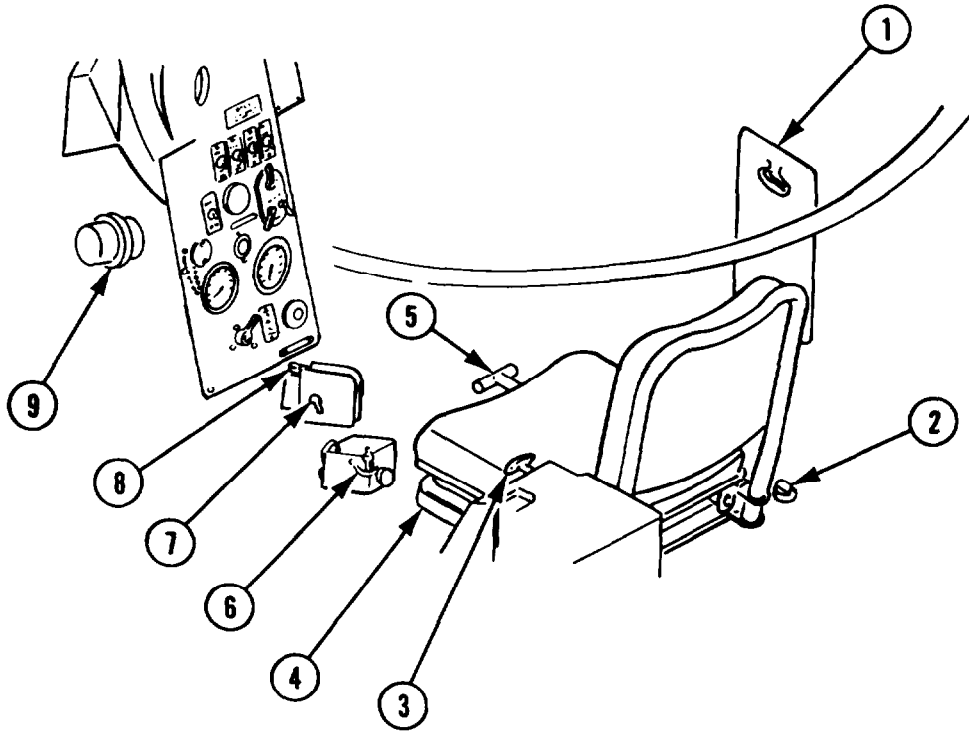
Key	Control or Indicator	Function
1	FUEL level indicator	Indicates (by quarters) the amount of fuel in the fuel cell.
2	ENGINE-TRANS TEMP-PRES light	Lights when engine coolant temperature is too high, when transmission oil temperature is too high, and/or when engine or transmission oil pressure is too low.
3	TRANS OIL temperature indicator	Indicates the transmission oil temperature in degrees Fahrenheit (°F). Normal is approximately 165-220°F (74-104°C).
4	TRANS OIL pressure indicator	Indicates transmission oil pressure in pounds per square inch (psi). Normal is 30 psi (207 kPa).
5	MASTER INDicator light	Lights when master switch is turned ON and remains on until master switch is turned OFF.

KNOW YOUR CONTROLS AND INDICATORS—CONTINUED*DRIVER'S CONTROLS AND INDICATORS—CONTINUED*

Key	Control or Indicator	Function
6	HI BEAM INDicator light	Lights when headlamps are on high beam.
7	ENGINE WATER indicator	Indicates the engine coolant temperature in degrees Fahrenheit (°F). Normal is 170-185°F (77-85°C).
8	ENGINE OIL pressure indicator	Indicates engine oil pressure in pounds per square inch (psi). Normal is 50-70 psi (345-483 kPa).
9	GENerator WARNING light	Lights when generator output is below normal.
10	BATTERY/generator indicator	Indicates battery condition. Indicates generator voltage when engine is running.
11	M17 Periscope	Three periscopes allow the driver to see out when cupola cover is closed.
12	Engine shutdown handle	Shuts off fuel supply and stops engine when handle is pulled out.
13	Driver' s external engine and trans- mission warning light	Lights when engine coolant temperature is too high, when transmission oil temperature is too high, and/or when engine or transmission oil pressure is too low.

KNOW YOUR CONTROLS AND INDICATORS—CONTINUED

DRIVER'S CONTROLS AND INDICATORS—CONTINUED



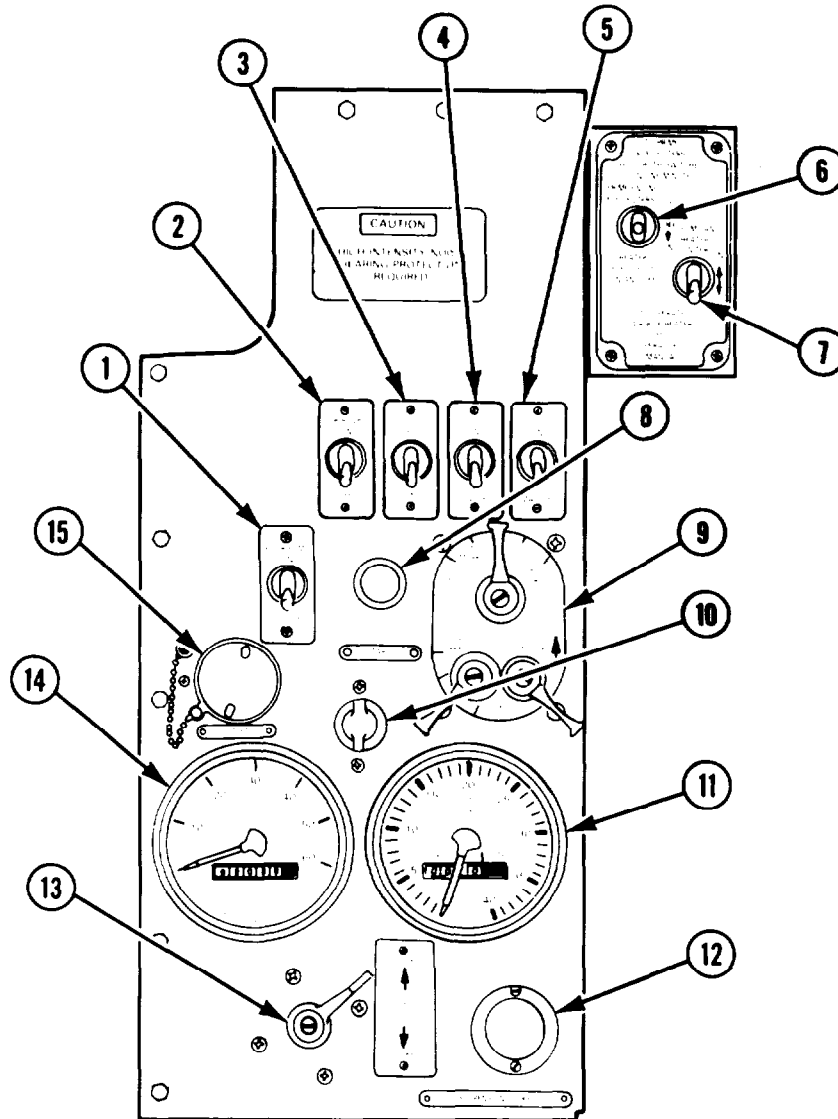
Key	Control or Indicator	Function
1	Fuel filter access door	Provides access to primary and secondary fuel filter drain cocks.
2	Drain valve handle	Drains driver's compartment of any fluid. Must be closed during vehicle operation.
3	Fixed fire extinguisher control handle	Controls two fixed fire extinguishers. Pull handle control to discharge CO ₂ into the engine compartment to suppress fire.

KNOW YOUR CONTROLS AND INDICATORS—CONTINUED*DRIVER'S CONTROLS AND INDICATORS—CONTINUED*

Key	Control or Indicator	Function
4	Seat horizontal lever	Locks or releases horizontal position of driver' s seat. Push lever right to release seat.
5	Seat vertical handle	Locks or releases vertical position of driver' s seat. Pull handle up to release seat and use body weight to adjust height.
6	Intercommunication control switch	Selects radio and interphone connections when headset is being used.
7	Dome light switch	Controls dome light for normal or blackout lighting. A locking plunger prevents accidentally turning on light.
8	Low engine coolant warning light	Lights when coolant level is low or air is present in cooling system.
9	Audible warning horn	Sounds when engine oil pressure is below 8 psi (55 kPa) or when engine coolant temperature is above 225°F (107°C).

KNOW YOUR CONTROLS AND INDICATORS—CONTINUED

DRIVER'S CONTROLS AND INDICATORS—CONTINUED



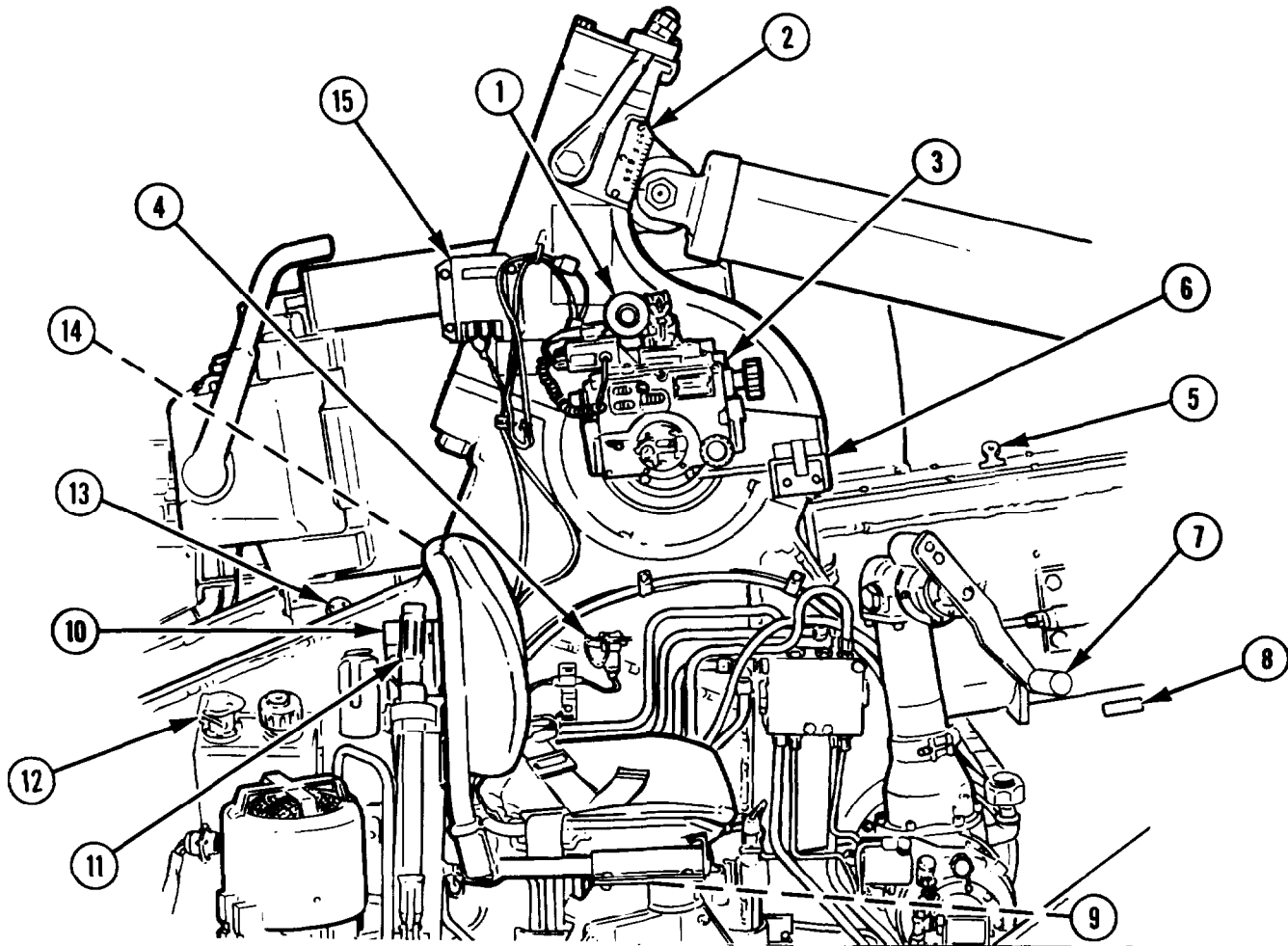
Key	Control or Indicator	Function
1	HYDRaulic PUMP PTO CLUTCH switch	Controls the magnetic clutch to provide power to the main hydraulic rotary pump.
2	IR-RCVR infrared receiver switch	Controls lamps in headlamps. Used with blackout (BO-IR) and main light BO switches.
3	BO-IR selector switch	Selects either infrared or blackout lights for operation. Used with infrared-receiver (IR-RCVR) and main light BO switches.

KNOW YOUR CONTROLS AND INDICATORS—CONTINUED*DRIVER'S CONTROLS AND INDICATORS—CONTINUED*

Key	Control or Indicator	Function
4	INSTRUMENT switch	Controls power to the start switch, air cleaner blowers, and indicators on instrument panel.
5	MASTER switch	Controls all electrical power to the vehicle.
6	Fuel prime and heater fuel cycle switch	Controls flow of fuel from airbox pump to purge and prime secondary fuel filter.
7	Pump and heater igniter switch	Controls airbox heater fuel pump and fuel ignition.
8	START switch	Controls starter to start engine when master switch and instrument switch are ON and shift control lever is in neutral.
9	Light switch assembly	Controls driving lights and switch panel light.
10	Panel light	Lights panel and is controlled by lever on light assembly.
11	Tachometer	Indicates engine speed in revolutions per minute (rpm).
12	Suspension locked indicator light	Lights when suspension is locked
13	Suspension lockout control valve handle	Controls suspension lockout cylinders to lock out suspension system
14	Speedometer	Indicates vehicle speed in miles per hour (mph). An odometer shows total miles traveled.
15	Utility outlet	Provides power from electrical system to operate auxiliary electrical equipment.

KNOW YOUR CONTROLS AND INDICATORS—CONTINUED

ASSISTANT GUNNER'S CONTROLS AND INDICATORS



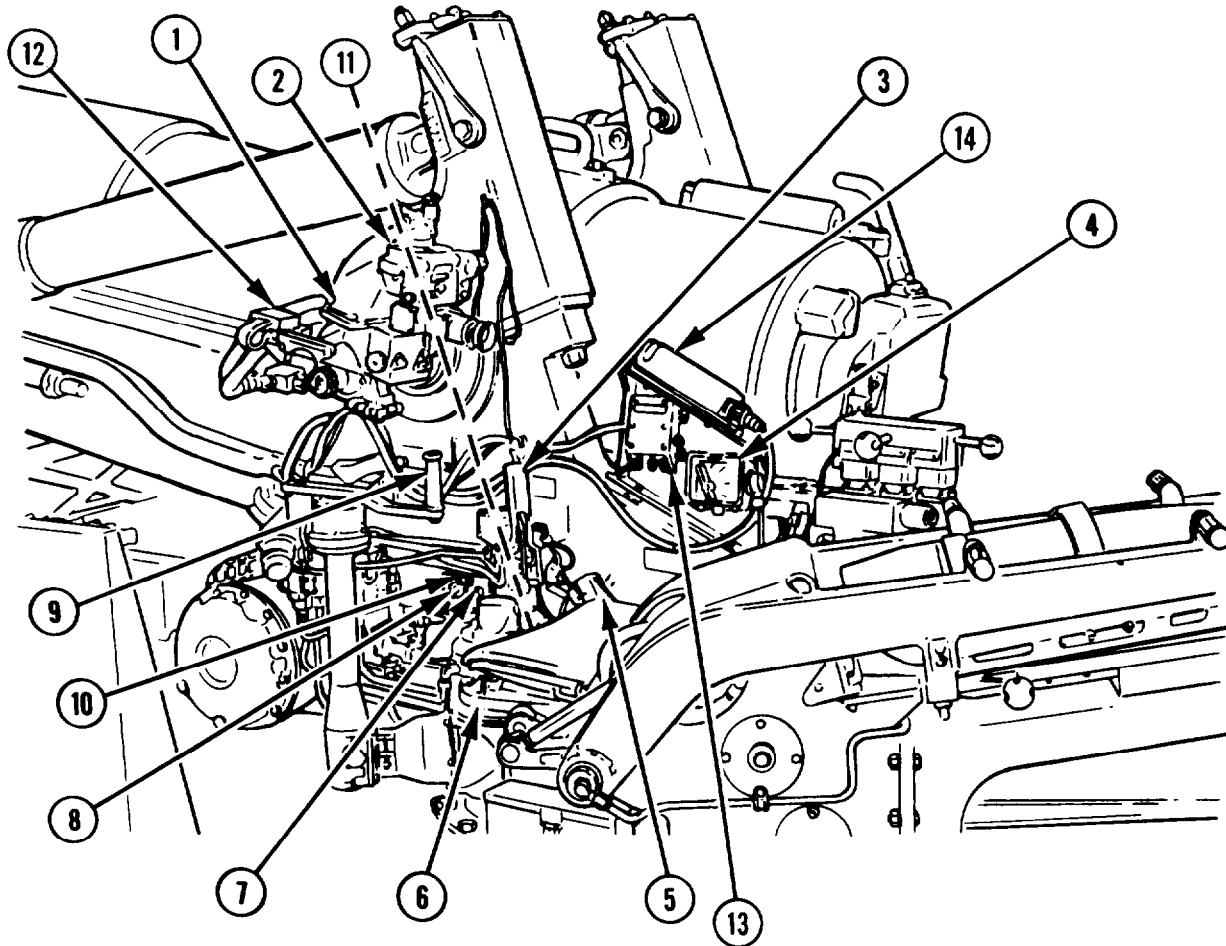
Key	Control or Indicator	Function
1	M139 telescope	See page 2-97 for description of M139 telescope controls.
2	Equilibrator temperature adjustment scale	Indicates the current adjustment of the equilibrators. Used to gage adjustment of equilibrators to compensate for temperature changes.
3	M15 elevation quadrant	See page 2-98 for description of M15 elevation quadrant controls.
4	Utility outlet	Provides connection to vehicle electrical system to operate auxiliary electrical equipment.
5	Recoil indicator	Inscribes the cannon recoil length by making a mark in the grease on the recoil strip.

KNOW YOUR CONTROLS AND INDICATORS—CONTINUED*ASSISTANT GUNNER'S CONTROLS AND INDICATORS—CONTINUED*

Key	Control or Indicator	Function
6	M140 alinement device mount	Provides mount for checking boresight accuracy with the M140 alinement device.
7	Manual elevating handle	Provides for manually elevating the cannon in case the hydraulic power system fails. Turn handle clockwise to depress cannon. Turn handle counterclockwise to elevate cannon.
8	Travel support stowage catch handle	Secures travel supports in stowed position. Pulling rear handle releases travel (long) support. Pulling forward handle releases shipping (short) support.
9	Seat adjustment lever	Controls horizontal adjustment of assistant gunner's seat.
10	Vehicular applique system	Connects vehicle radio set with data display group.
11	Hydraulic handpump handle	Operates hydraulic pump to provide emergency pressure if the hydraulic power system fails.
12	Hydraulic reservoir cap (dipstick)	Indicates the level of hydraulic oil in the reservoir.
13	Retracting valve handle	Operates control valve to move cannon in or out of battery position. Hold handle in RETURN to move cannon into battery or RETRACT to move cannon into travel position. NORMAL AND HOLD maintains battery or travel position.
14	Power elevating control handle	Operates control valve to hydraulically elevate or depress cannon. Squeeze actuator and move handle back to elevate cannon or move handle forward to depress cannon.
15	Gun assembly (GA)	Displays quadrant elevation data from Battery Computer Unit (BCU).

KNOW YOUR CONTROLS AND INDICATORS—CONTINUED

GUNNER'S CONTROLS AND INDICATORS



Key	Control or Indicator	Function
1	M137 telescope mount	See page 2-95 for description of M137 telescope mount controls.
2	M115 telescope	See page 2-96 for description of M115 telescope controls.
3	Power traversing control handle	Operates control valve to hydraulically traverse cannon. Squeeze actuator and move handle forward to traverse right or move handle back to traverse left.

KNOW YOUR CONTROLS AND INDICATORS—CONTINUED*GUNNER'S CONTROLS AND INDICATORS-CONTINUED*

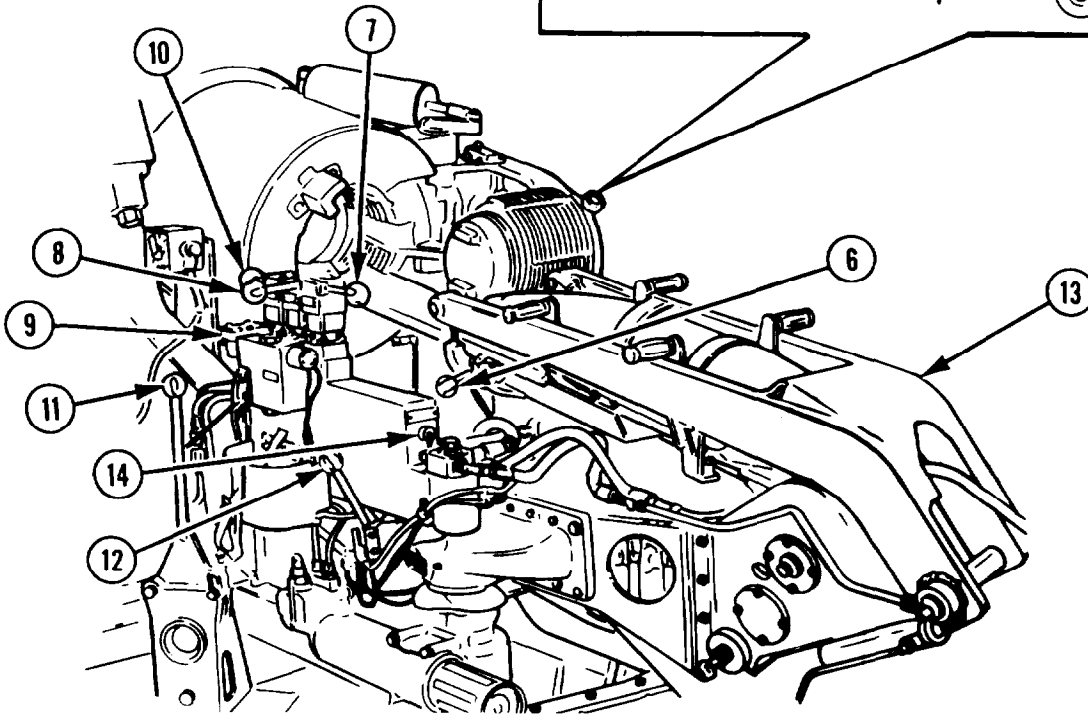
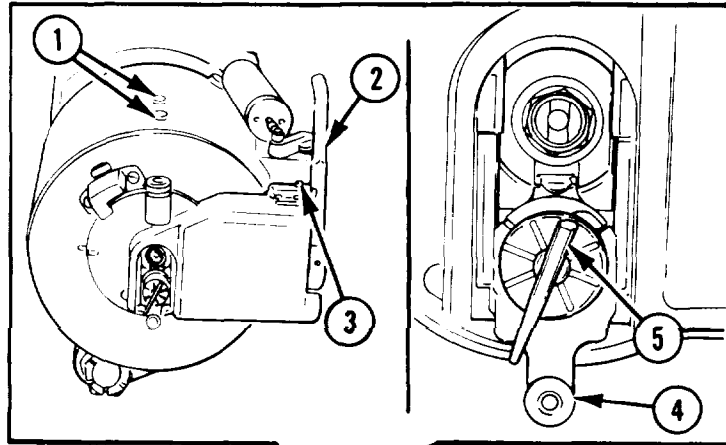
Key	Control or Indicator	Function
4	Intercommunication control box	Provides interphone and radio control facilities for gunner.
5	Power elevating control handle	Operates control valve to hydraulically elevate or depress cannon. Squeeze actuator and move handle back to elevate cannon or move handle forward to depress cannon.
6	Seat adjustment lever	Controls horizontal adjustment of gunner's seat.
7	Oil pump motor switch	Controls operation of hydraulic oil pump motor. The pump operates automatically when ON to maintain 1600-2400 psi (11,032-16,548 kPa) hydraulic pressure.
8	Suspension lockout indicator light	Lights when the suspension lockout cylinders are locked out.
9	Manual traversing handle	Provides for manually traversing the cannon in case the hydraulic power system fails. Cannon traverses in the same direction handle is turned.
10	Pressure filter indicator lamp assembly	Lights when hydraulic pump pressure filter element needs to be changed.
11	Seat adjustment lever	Controls vertical adjustment of gunner's seat.
12	M140 alinement device mount	Provides mount for checking boresight accuracy with the M140 alinement device.
13	Gun assembly (GA)	Displays deflection data from BCU.
14	Section chief assembly	Displays firing data from BCU. Keyboard allows selection of data.

KNOW YOUR CONTROLS AND INDICATORS—CONTINUED

LOADER/RAMMER AND BREECH CONTROLS AND INDICATORS

CAUTION

Do not operate hydraulic ram without projectile (live or dummy round).



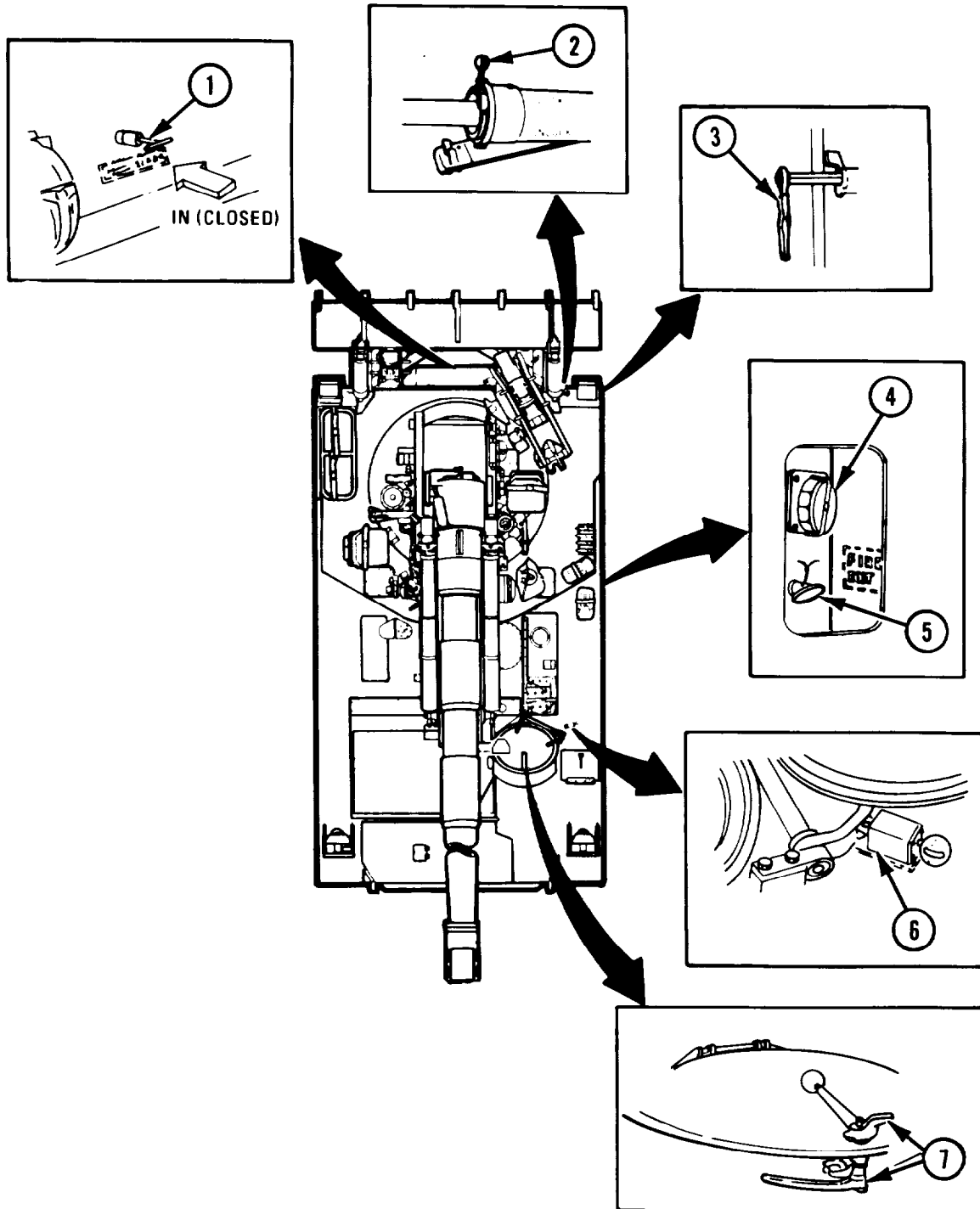
Key	Control or Indicator	Function
1	Breech ring quadrant seats	Provides level surface for placing gunner's quadrant during fire control alignment tests and for measuring quadrant during firing.
2	Breechblock operating lever	Unlocks or locks breechblock during loading operations.
3	Operating lever latch	Locks breechblock operating lever in locked position.

KNOW YOUR CONTROLS AND INDICATORS—CONTINUED*LOADER/RAMMER AND BREECH CONTROLS AND INDICATORS—CONTINUED*

Key	Control or Indicator	Function
4	Firing mechanism housing follower knob	Releases firing mechanism block to slide down and expose primer chamber.
5	Lanyard lever	Actuates the firing mechanism to fire the cannon when lanyard is attached and pulled.
6	Rammer trough handle	Used to slide rammer trough forward and back during loading operations. Left handle engages latch in forward position and activates the tray interlock switch.
7	Swing control valve handle	Operates control valve to hydraulically rotate loader/rammer between stow and ram positions.
8	Loader control valve handle	Operates control valve to hydraulically extend or retract the loader arm that lifts a projectile into ramming position.
9	Hydraulic pressure gage	Indicates hydraulic system pressure. Normal is 1600-2400 psi (11,032-16,548 kPa).
10	Rammer control valve handle	Operates control valve to hydraulically ram a projectile into the cannon chamber.
11	Loader/rammer stow position lock handle	Releases the stow position lock that secures the loader/rammer in stowed position.
12	Loader/rammer stow position lock handle	Releases the stow position lock that secures the loader/rammer in ram position.
13	Rammer	Rams and seats projectile in chamber.
14	Borescope outlet	Provides connection to vehicle electrical system to operate special purpose inspection device (borescope).

KNOW YOUR CONTROLS AND INDICATORS-CONTINUED

EXTERNAL CONTROLS

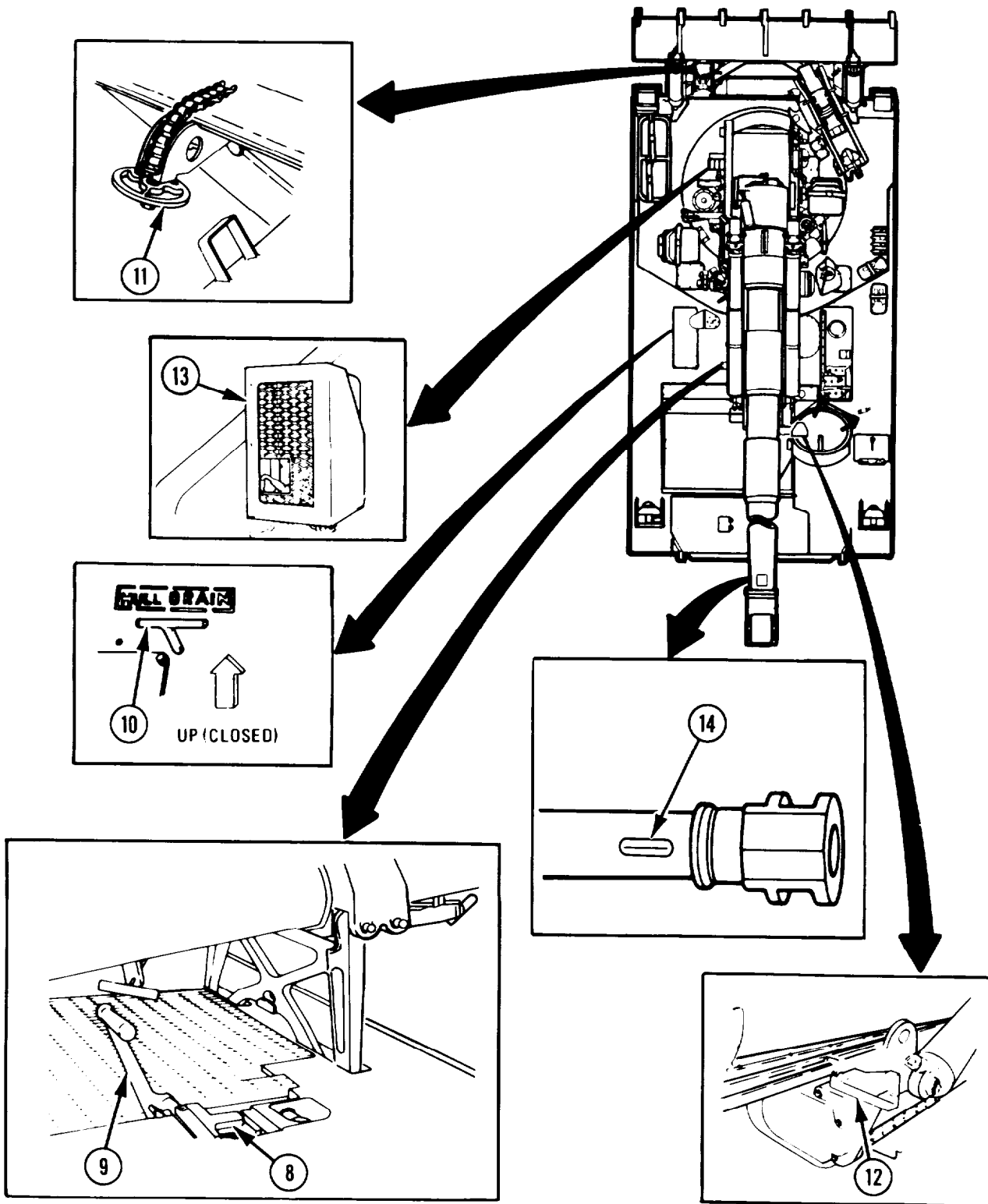


KNOW YOUR CONTROLS AND INDICATORS—CONTINUED*EXTERNAL CONTROLS—CONTINUED*

Key	Control or Indicator	Function
1	Hull rear drain valve handle	Operates drain valve to remove any fluid from the hull. Pull handle to open valve. Push handle to close valve.
2	Spade cylinder lock lever (one on each spade cylinder)	Locks spade in the up position for travel. Must be unlocked before lowering or emplacing spade.
3	Spade control lever	Operates control valve to hydraulically lower or raise spade. Pull handle and turn in desired direction to lower or raise spade.
4	Slave receptacle	Provides connection for external 24 V dc power source for emergency starting.
5	Fixed fire extinguisher control handle	Controls two fixed fire extinguishers. Pull handle to discharge CO ² into the engine compartment to suppress fire.
6	Driver's cover hold open lock	Secures driver's cover in open position. Pull knob to release cover.
7	Driver's cover handle	Secures and locks cover closed.

KNOW YOUR CONTROLS AND INDICATORS—CONTINUED

EXTERNAL CONTROLS—CONTINUED

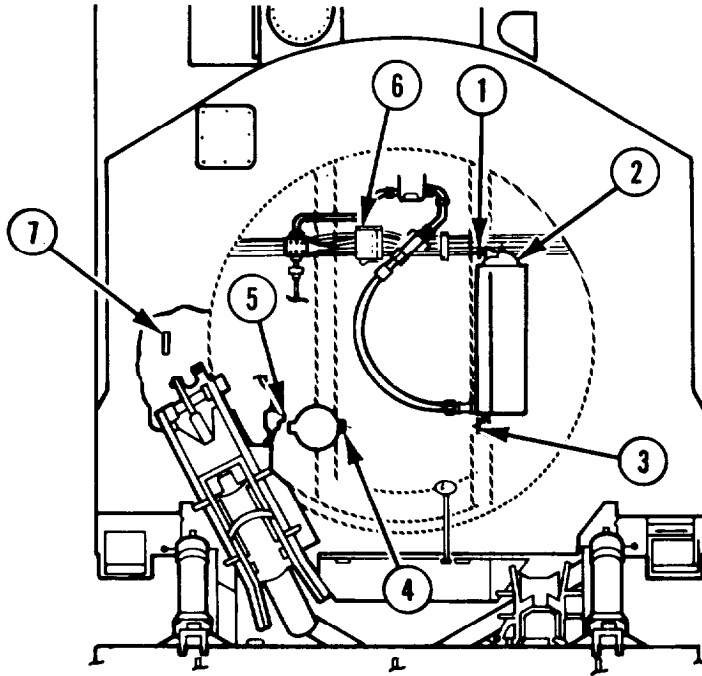


KNOW YOUR CONTROLS AND INDICATORS—CONTINUED*EXTERNAL CONTROLS—CONTINUED*

Key	Control or Indicator	Function
8	Travel lock handle latch	Secures travel lock handle in locked position.
9	Travel lock handle	Secures travel or shipping support to hull.
10	Hull forward drain valve handle	Operates drain valve to remove any fluid from the hull. Push handle to open valve. Pull handle to close valve.
11	Projectile tiedown chains	Secure projectiles to the spade projectile rack
12	M90 chronograph mounting kit	Used to mount M90 chronograph for muzzle velocity check
13	Control case	Provides circuits for data reception, transmission, and power conversion for data display operation.
14	Machine surface	Provides level surface for placing gunner's quadrant.

KNOW YOUR CONTROLS AND INDICATORS—CONTINUED

TURRET WELL CONTROLS



Key	Control or Indicator	Function
1	Accumulator dump valve	Drains accumulator by allowing hydraulic oil to flow into reservoir. Valve must be closed before operating vehicle.
2	Gas bottle nitrogen charging valve	Provides connection for charging the gas bottle with nitrogen.
3	Hydraulic reservoir drain valve	Drains the hydraulic oil reservoir.
4	Turret well cleanout cover	Provides access for cleaning the turret well. Must be closed during operation.
5	Spade hydraulic oil shutoff valve.	Stops the flow of hydraulic oil to the spade system.
6	Lockout cylinder shutoff valve	Stops the flow of hydraulic oil to individual lockout cylinders.
7	Emergency shutoff valve	Stops the flow of hydraulic oil to spade cylinders.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

SECTION INDEX

	Page
GENERAL.....	2-23
PMCS PROCEDURES.....	2-23
Table 2-1. Preventive maintenance checks and services for the howitzer heavy, self-propelled, 8-inch, M110A2	2-26

GENERAL

- a. *Corrosion.* Refer to page 1-2.

WARNING

Unusable CARC mixtures may be considered hazardous waste and may require disposal in accordance with Federal, state, DOD, and DA hazardous waste regulations. Consult the installation environmental office for proper disposal guidance. Mixed CARC has a flashpoint of approximately 38° (3°C) due to the incorporation of solvents and is highly flammable.

- b. *Monthly touchup/spot painting.* Painting at the operator level is limited to touchup/spot painting. CARC paint that has been opened must be used within 8 hours or it will deteriorate beyond use. Mix only what is needed for immediate use. Refer to TM 43-0139.

c. *Before you operate.* Always keep in mind the CAUTIONS and WARNINGS. Perform your before (B) PMCS prior to the equipment leaving its containment area or performing its intended mission.

d. *While you operate.* Always keep in mind the CAUTIONS and WARNINGS. Perform your during (D) PMCS when the equipment is being used in its intended mission.

e. *After you operate.* Be sure to perform your after (A) PMCS after the equipment

has been taken out of its mission mode or returned to its containment area.

f. *If your equipment fails to operate.* Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750.

PMCS PROCEDURES

a. Your Preventive Maintenance Checks and Services table lists the inspections and care of your equipment required to keep it in good operating condition.

b. The item number column of your PMCS table is to be used for reference. When completing DA Form 2404, Equipment Inspection and Maintenance Worksheet, include the item number for the check/service indicating a fault. Item numbers also appear in the order that you must do checks and services for the intervals listed.

c. The interval column of your PMCS table tells you when to do a certain check or service.

d. Perform weekly as well as before operations PMCS and check fluid levels if:

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

(2) You are operating the item for the first time.

e. While you perform PMCS, have tools with you and keep an eye out for the following:

PMCS PROCEDURES—CONTINUED

(1) Loose bolts. A loose bolt can be difficult to spot without using a wrench. However, you can often identify loose bolts by observing loose or chipped paint around bolt head and bare metal or rust at its base. Tighten loose bolts and spot paint as required.

(2) Damaged welds. Damaged welds may be detected by observing rust or chipped paint where cracks occur.

(3) Frayed electrical wires and loose connectors. Check electrical wiring for cracks due to aging and exposed wires that could cause an electrical short. Tighten loose clamps and connectors.

(4) Frayed brake cables and loose linkages. Check brake cables for signs of excessive wear near middle of cable. Ensure throttle and steering linkages are properly secured.

(5) Corrosion. Check for signs of deterioration, rust, unusual cracking, softening, swelling, or breaking.

f. Leakage definitions for operator/crew PMCS shall be classified as follows:

- Class I Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.
- Class II Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked/inspected.
- Class III Leakage of fluid great enough to form drops that fall from the item being checked/inspected.



Equipment operation is allowable with minor leakages (Class I or II). Of course, you must consider the fluid capacity in the item/system

being checked/inspected. When in doubt, notify your supervisor. When operating with Class I or Class II leaks, continue to check fluid levels as required in your PMCS.

Class III leaks should be reported to your supervisor or unit maintenance.

g. Damage definitions are as follows:

(1) Blowby. Powder markings beyond a sealing surface.

(2) Burrs. A raised portion, restricting the entrance of a part, component, or assembly.

(3) Cracks. A narrow break or separation in material.

(4) Gouges. A groove or cavity in a sealing surface that cannot be repaired.

(5) Nicks. An indentation caused by object(s) striking the material.

h. The check/service column of your PMCS table provides the location and the item to be checked or serviced.

i. The procedure column of your PMCS table tells you how to do the required checks and services. Carefully follow these instructions. If you do not have the tools, or if the procedure tells you to, have unit maintenance do the work.

j. If your equipment does not perform as required, refer to Chapter 3 under Troubleshooting for possible problems. Report any malfunctions or failures on DA Form 2404, or refer to DA Pam 738-750.

k. If an assembly must be removed and/or disassembled in order to perform PMCS, refer to the maintenance procedures in chapter 3.

l. Not used.

PMCS PROCEDURES—CONTINUED

m. The not fully mission capable if: column tells you when and why your equipment cannot be used.

CAUTION

Improper use of high pressure water hose or steam cleaner can damage seals and electrical components resulting in equipment failure. Use high pressure water only on suspension system.

NOTE

The terms ready/available and mission capable refer to the same status: Equipment is on hand and is able to perform its combat missions. Refer to AR 700-138.

n. Any faults found but not covered in PMCS should be reported on additional DA Form 2404.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2

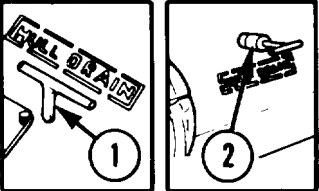
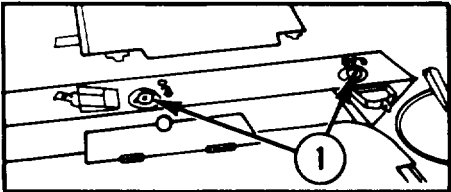
Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
1	Before	Vehicle Exterior (Ground) Exterior Leaks	Inspect for damage or missing items. Make sure all accessory items are properly secured to carrier. Inspect beneath vehicle for leakage of lubricant, fuel, coolant, or hydraulic fluid.	Any class III leakage evident.
2	Before	Hull Drain Valves	<p><u>Driver</u></p>  <p>Operate top hull (1) and rear hull (2), drain valve handles to check for free operation. Make sure all drain valves are closed.</p>	
3	Before	Radiators	<p><u>Driver</u></p>  <p>NOTE</p> <p>In cold weather when adding coolant, check with unit maintenance personnel so they can check antifreeze protection.</p> <p>Check coolant level of both radiators (1) and fill if necessary. Check for leaks and condition of radiator filler cap seals.</p>	Class III leaks.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A-CONTINUED

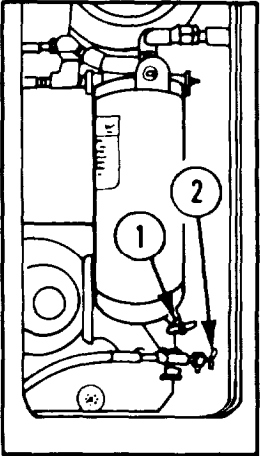
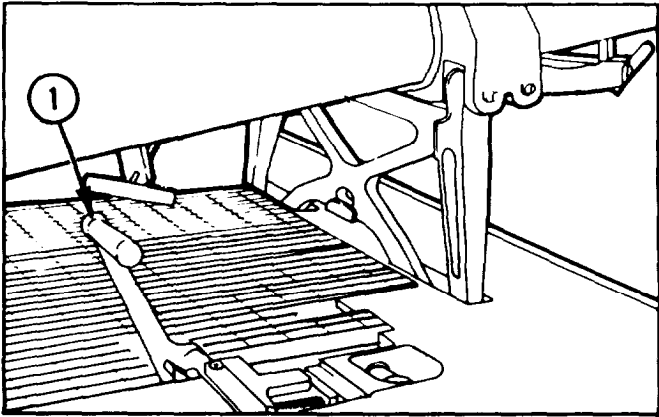
Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
4	Before	Fuel Filters and Lines	<p><u>Driver</u></p>  <p>Drain primary (1) and secondary (2) fuel filters of accumulated water (approximately one cup). Prime fuel system. Check fuel lines for leakage.</p>	Any fuel leakage.
5	Before	Travel Lock	<p><u>Cannoneers No. 1, No.2</u></p>  <p>Check lock handle (1) for proper operation. Make sure it is securely locked when traveling</p>	Cannon cannot be secured in travel lock.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2—CONTINUED

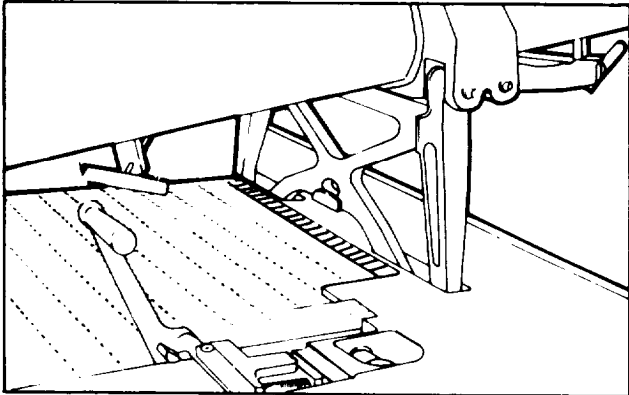
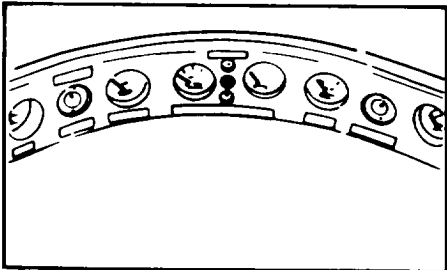
Item No.	Interval	Item to Check/Service	<u>Crewmember Procedure</u>	Not fully Mission Capable if:
6	Before	Fan Belt Grill	<p><u>Driver</u></p> 	
7	Before	Instruments and Warning Lights	<p><u>Driver</u></p>  <p>Check the fan well cover and area around it for foreign material and obstructions.</p> <p>Start and warm engine. Observe Instruments, gauges, and warning lights for proper operation</p>	<p>Improper operation cannot be corrected. Any of the following gauges: TRANSMISSION OIL temperature indicator, ENGINE OIL pressure indicator, or any temperature gauge reads high or fails to work. BATTERY-GENERATOR indicator is inoperative.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2-CONTINUED

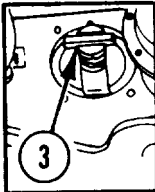
Item No.	Interval	Item to Check/Service	<u>Crewmember Procedure</u>	Not fully Mission Capable if:
8	Before	Intercommunications	<u>Chief of Section</u> Check all controls and indicators for proper operation.	
9	Before	Hull Drain Valves	<u>Driver</u>  Operate driver's drain valve, checking for free operation. Make sure valve is closed.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2-CONTINUED

Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
10	Before	Firing Mechanism	<p><u>Cannoneer No.2</u></p> <div> </div> <p>Do not pull lanyard on firing mechanism unless firing block is in firing position.</p> <p>Check operation of M35 firing mechanism (1) with a steady pull on the lanyard attached to lanyard lever (2). Make sure operation of block is smooth and unrestricted. Check primer extractor action. Check condition of firing pin. Replace defective parts. Clean mechanism with cleaner, lubricant, and preservative (CLP) (item 6, appx D). Clean primer chamber using brush. Oil mechanism with CLP (item 6, appx D).</p>	Firing mechanism is nonoperational.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2—CONTINUED

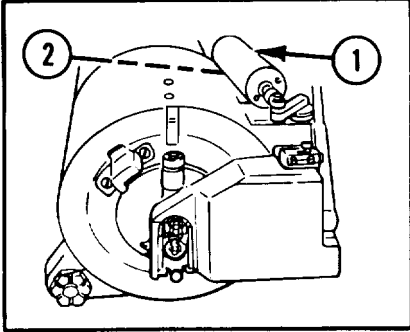
Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
11	Before	Counter-balance	<p><u>Cannoneer No.2</u></p>  <p>WARNING</p> <p>Elevate or depress cannon tube until LOAD marks aline before opening breech to avoid injury to personnel.</p> <p>Open and close breechblock to check counterbalance (1) and determine that breechblock operates properly. Clean and oil. Check that the four mounting screws (2) are tight and staked in place. Adjust as required.</p>	
12	Before	Cannon Tube Assembly	<p><u>Chief of Section</u></p> <p>Before firing check DA Form 2408-4 to make sure tube has been borescoped within 180 days. Wipe dry using staff sections and cloths. Inspect for exterior cracks. If incomplete or damaged, do not fire; notify unit maintenance.</p>	<p>Not borescoped within 180 days of firing. Visual damage/cracks in tube</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2-CONTINUED

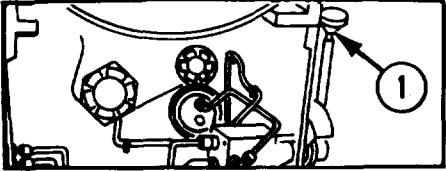
Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
13	Before	Recoil Mechanism	<p><u>Assistant Gunner</u></p>  <p>Check all connections for leaks. Operate retracting control handle (1) and check for smooth operation. When released the handle should automatically return to NORMAL AND HOLD position.</p>	Oil leak exceeds 3 drops per 5-minute period.
14	Before	Check Valve	<p><u>Cannoneer No.2</u></p> <div style="border: 2px solid black; padding: 5px; text-align: center; margin: 10px 0;">WARNING</div> <p>Cannon must be in travel lock prior to retracting.</p> <p>Check valve operation by retracting and returning cannon tube to battery position, placing hand in front of valve (1) and feeling if air is expelled. If not, notify unit maintenance.</p>	Check valve inoperative.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2-CONTINUED

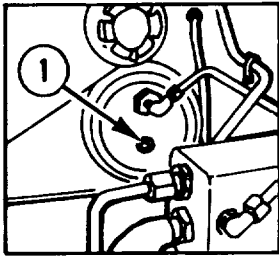
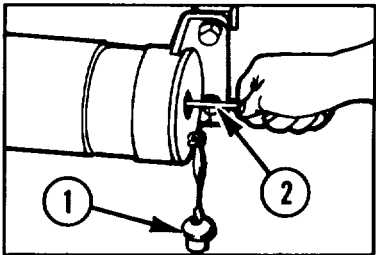
Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
15	Before	Recuperator	<p><u>Assistant Gunner</u></p>  <p>NOTE</p> <p>Oil index should project beyond face of index housing. If it does not project, oil reserve MUST be reestablished.</p> <p>Check recuperator cylinder head oil index (1) for proper amount of oil reserve and for leakage. If leaking, notify unit maintenance.</p>	<p>Oil index pin will not move.</p>
16	Before	Replenisher Assembly	<p><u>Cannoneer No. 2</u></p>  <p>Remove plug (1) and check operation by inserting steel rule (2) or improvised rod against end of piston. Place retracting valve handle in RETRACT and RETURN positions. Piston should move. If piston does not move, notify unit maintenance. Check for leakage at connections.</p>	<p>Piston does not move. Oil exceeds 3 drops per 5-minute period.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2—CONTINUED

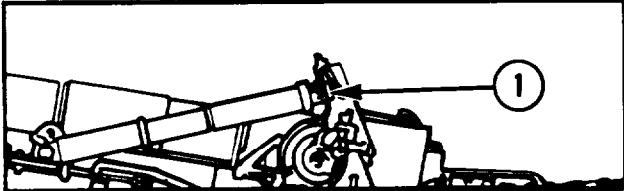
Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
17	Before	Equilibrator Temperature Scale	<p><u>Gunner/Assistant Gunner</u></p>  <p>Check for effective functioning. Check equilibrator temperature scale (1) for proper temperature adjustment. Adjust equilibrators, if required.</p>	Manual elevating efforts cannot be equalized.
18	Before	Elevating and Traversing Controls	<p><u>Gunner/Assistant Gunner</u></p> <div style="border: 1px dashed black; padding: 5px; text-align: center; width: fit-content; margin: 10px auto;">CAUTION</div> <ul style="list-style-type: none"> • If a control handle operates without squeezing actuator, notify unit maintenance. • Before operating turret, clear any obstructions from elevating and traversing gears. <p>Elevate and traverse cannon both manually and by power. Note smoothness of operation. Check for oil leaks.</p>	In both modes, traversing systems fail to function, do not operate smoothly, or oil leaks exceed 3 drops per 5-minute period.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2-CONTINUED

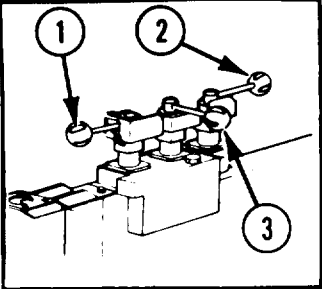
Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
19	Before	Swing, Loader, and Rammer Controls	<p><u>Cannoneer No. 1</u></p>  <p style="text-align: center;">CAUTION</p> <p>Do not operate rammer control valve handle (1) without a projectile in the trough.</p> <p>Operate swing control valve handle (2) and loader control valve handle (3). Check loader/rammer and loader arms for smoothness during operation. Make sure the handles return to neutral position automatically.</p>	
20	Before	Panoramic Telescope M115	<p><u>Gunner</u></p> <p>Check proper installation and damage. Replace burned out, broken, or missing lamps. Clean exposed surfaces of eye lens and window. Check reticle for clarity and illumination.</p>	<p>You cannot see reticle or target image, counters slip, knob movement inoperable, or mounting insecure. Loose or defective parts prevent satisfactory operation.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2-CONTINUED

Item No.	Interval	Item to Check/Service	<u>Crewmember Procedure</u>	Not fully Mission Capable if:
21	Before	Elevation Quadrant M15	<u>Gunner</u> Check for proper installation and damage. Replace burned out, broken, or missing lamps.	Loose, broken, or illegible level vials. Counters skip, knob movement inoperable, or mounting insecure. Loose or defective parts prevent satisfactory operation.
22	Before	Telescope Mount M138	<u>Assistant Gunner</u> Check for proper installation and damage. Replace burned out, broken, or missing lamps.	
23	Before	Elbow Telescope M139	<u>Assistant Gunner</u> Check for proper installation and damage.	
24	Before	Telescope Mount M137	<u>Gunner</u> Check for proper installation and damage. Replace burned out, broken, or missing lamps.	
25	Before	Infinity Collimator M1 or M1A1	<u>Assistant Gunner</u> Check for proper installation, damage, and dirt or moisture in optical system. Check exposed optical surfaces, window, and level vial for cracks. Replace burned out, broken, or missing lamps.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2-CONTINUED

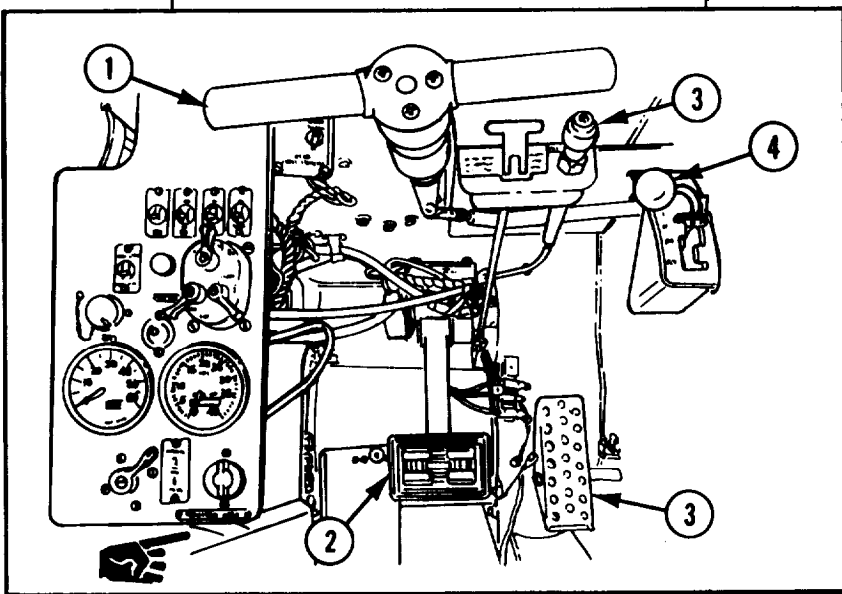
Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
26	During	Controls	<p><u>Driver</u></p>  <p>Check steering (1), foot and parking brake (2), hand and foot throttles (3), and shift controls (4) for binding and excessive play. One or both of the throttles (3) must operate properly. Check brakes for ability to hold vehicle. If adjustments are required, notify unit maintenance.</p>	<p>Inproper operation of steering, foot and parking brakes, and shift controls.</p>
27	During	Chamber of Howitzer	<p><u>Cannoneer No.2</u></p> <p>Swab and inspect the howitzer chamber and origin of rifling after every round to remove any remain-</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2—CONTINUED

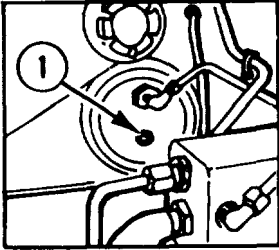
Item No.	Interval	Item to Check/Service	<u>Crewmember Procedure</u>	Not fully Mission Capable if:
28	During	Accumulator Nitrogen Pressure	<p><u>Chief of Section</u></p> <p>Check operation of electric motor. If motor cycles on and off more than normal, the accumulator nitrogen pressure may be low. Notify unit maintenance.</p>	
29	During	Recuperator	<p><u>Assistant Gunner</u></p>  <p>NOTE</p> <p>Oil index should project beyond face of index housing. If it does not project, oil reserve MUST be reestablished.</p> <p>Check recuperator cylinder head oil index (1) for proper amount of oil reserve and for leakage. If leaking, notify unit maintenance.</p>	<p>Oil index pin will not move.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2 -CONTINUED

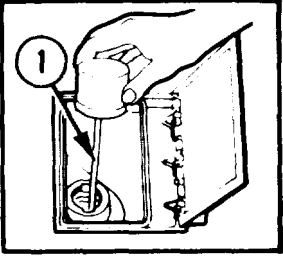
Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
3 0	After	Transmission Oil Level	<p><u>Driver</u></p>  <p>WARNING</p> <p>Driver will remain in driver's compartment while engine is running.</p> <p>NOTE</p> <p>Reference PMCS procedures, paragraph d, page 2-23.</p> <p>Run engine at 1200-1600 rpm for 3 to 5 minutes with transmission in neutral to stabilize oil temperature between 180° and 200°F (82.2° and 93.3°C). Stop engine, wait 3 to 5 minutes, and check oil level.</p> <p>Oil level should be within OPERATING RANGE stamped on dipstick (1). Do not overfill transmission oil level.</p>	Any class III leaks or oil is over filled.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2-CONTINUED

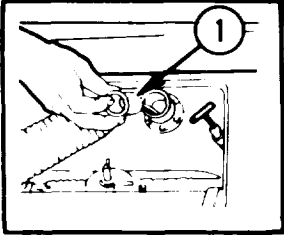
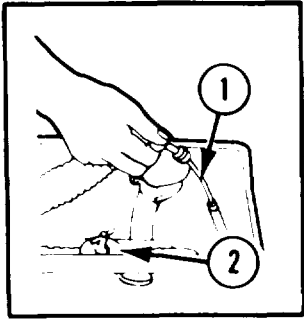
Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
31	After	Auxiliary Drive Oil Level	<p><u>Driver</u></p>  <p>NOTE Reference PMCS procedures, paragraph d, page 2-23.</p> <p>Check level. Level should be between FULL and ADD marks on bayonet gage (dipstick) (1). Add oil if required.</p>	Any class III leaks or oil is over filled.
32	After	Engine Oil Level	<p><u>Driver</u></p>  <p>NOTE Reference PMCS procedures, paragraph d, page 2-23.</p> <p>Check level. Level should be between low (L) and full (F) marks on dipstick (1). If required, remove cap (2) and add oil.</p>	Any class III leaks or oil is over filled.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2-CONTINUED

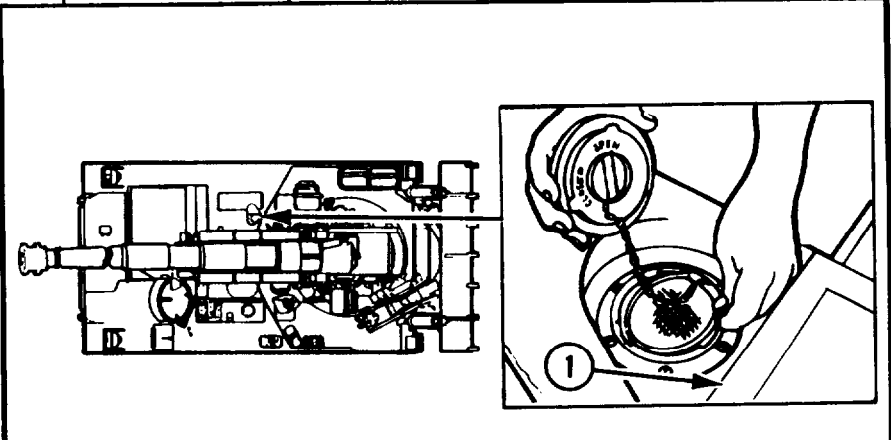
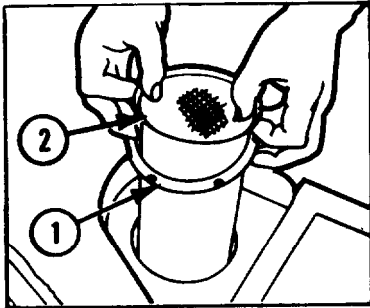
Item No.	Interval	Item to Check/Service	<u>Crewmember</u> Procedure	Not fully Mission Capable if:
33				
34	After	Fuel Cell and Lines	<p>Check fuel gauge for fuel level. Fill fuel cell (1) as required.</p> <p><u>Driver</u></p>  <p>Check fuel filler neck (1) and filter screen (2) for foreign material and clean as required.</p>	Any fuel leakage.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2—CONTINUED

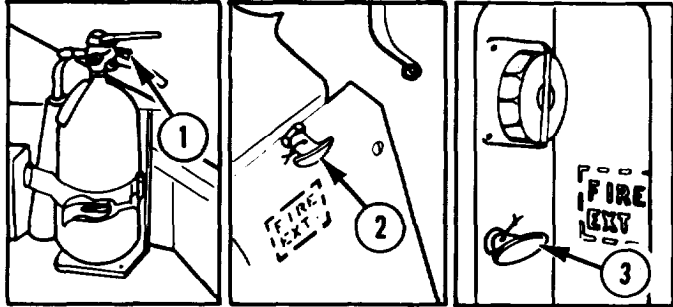
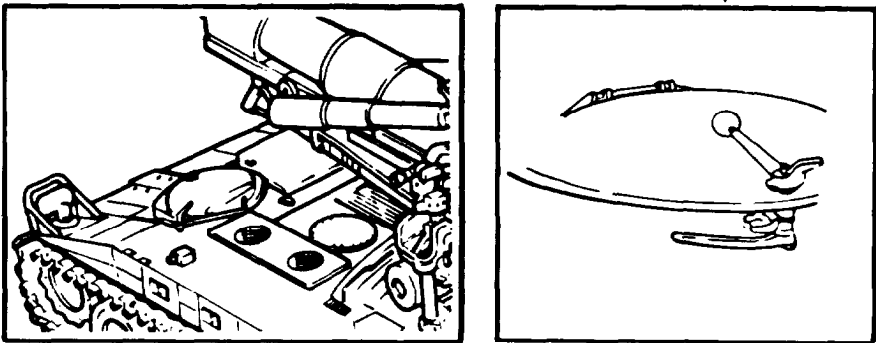
Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
35	After	Fire Extinguishers	<p><u>Driver</u></p>  <p>Check that portable fire extinguisher (1) is properly stowed and lead seal is not broken. Make sure nozzle is serviceable and secure. Check that lead seals on fixed fire extinguisher handles (2) and (3) are not broken and secured by clamps.</p>	If fire extinguishers are unserviceable or seals are broken.
36	After	Driver's Compartment Cover	<p><u>Driver</u></p>  <p>Operate cover to make sure it locks in both open and closed positions. Inspect cover seal for damage.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M1100A2—CONTINUED

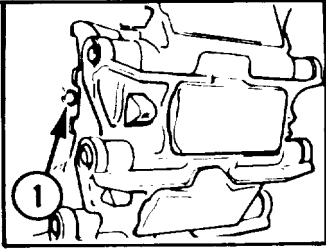
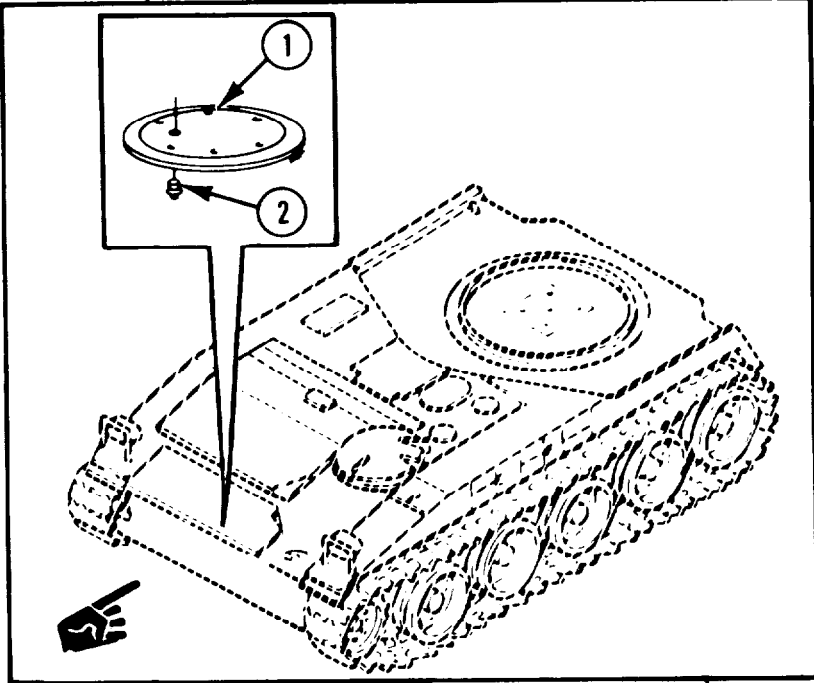
Item No.	Interval	Item to heck/Service	<u>Crewmember Procedure</u>	Not fully Mission Capable if:
37	After	Final Drive	<p><u>Driver</u></p>  <p>Check for oil leakage. Check that oil is level with bottom of plug opening (1). Add oil if required.</p>	Class III leaks.
38	After	Power Plant Reservoir	<p><u>Driver</u></p>  <p>Check and clean drain plug hole in access cover (1). Remove drain plug (2) and drain reservoir. Reinstall drain plug.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A-CONTINUED

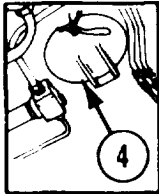
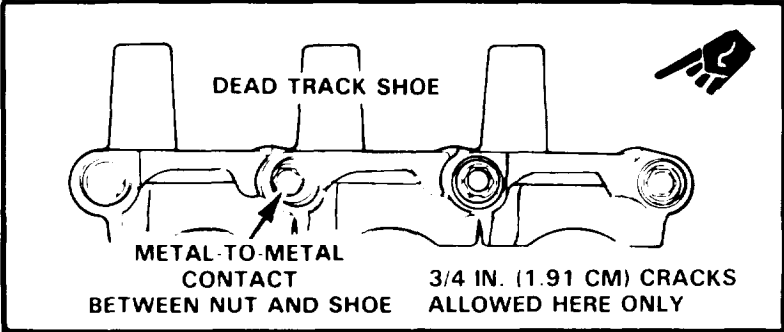
Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
39	After	Turret Well Cleanout Cover	Driver  Check turret well cleanout cover. Make sure cover is closed.	
40	After	Sprockets, Road Wheels, Tracks, and Suspension	 a. Check sprockets, road wheels, track tension, and suspension system components for looseness and damage. Check for dead track shoes by looking for metal-to-metal contact between track pin nut and track shoe.	One or more track shoes are dead on each track. Any shoe or pin broken, distorted, or cracked. Any missing or un-serviceable road wheel. Sprocket cracked or has two or more studs broken.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2-CONTINUED

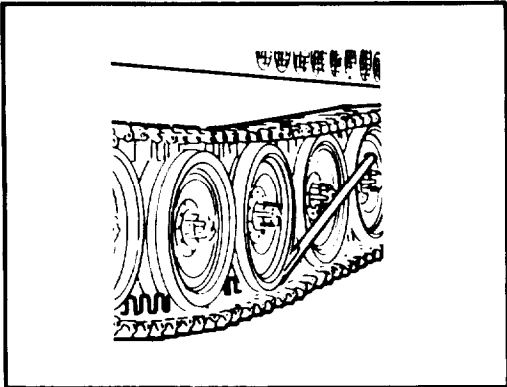
Item No.	Interval	Item to Check/Service	<u>Crewmember Procedure</u>	Not fully Mission Capable if:
40	After	Sprockets, Road Wheels, Tracks, and Suspension (Continued)	<p>Driver</p>  <p>b. Check for broken torsion bars by prying up on road wheel with crow bar. Check for defective lockout cylinders.</p> <p>c. Check road wheels for chunking and separation. Any chunking or separation that causes the road wheel to thump when placed in service notify unit maintenance.</p>	<p>Any shoe or pin broken, distorted, or cracked (except 3/4 in. (1.91 cm) max. cracks allowed on inside corners of two bushing side of shoe); any unserviceable or missing wheel or wheel with any rubber separation or missing chunk of rubber 3 x 4 in. (7.62 x 10.16 cm) long; sprocket cracked or has two or more nuts missing or studs broken; any torsion bar broken.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A—CONTINUED

Item No.	Interval	Item to Check/Service	<u>Crewmember Procedure</u>	Not fully Mission Capable if:
41	After	Track and Track Pads	<p><u>Driver</u></p> <p>Check wear and track tension and adjust as required. Check for loose track pads and tighten nuts as required. Check to see if any track pads are worn to the grousers. Notify unit maintenance to apply proper torque or if the track pads are worn to the grousers.</p>	
42	After	Sprocket	<p><u>Driver</u></p> <p>Check sprocket for cracks, missing bolts, nuts, and wear.</p>	Sprocket cracked or has two or more missing bolts or nuts. If sprocket is worn beyond wear limits.
43	After	Hubs	<p><u>Driver</u></p> <p>Cautiously feel road wheel and idler wheel hubs to make sure no one hub is hotter than any of the others.</p>	
44	After	Cannon Tube	<p><u>Cannoneer No.3</u></p> <p>Clean and lubricate cannon tube. If there was a reason to believe a fallback firing occurred during the current firing day, notify unit maintenance to inspect origin of rifling.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2-CONTINUED

Item No.	Interval	Item to Check/Service	<u>Crewmember Procedure</u>	Not fully Mission Capable if:
45	After	Muzzle Brake and Collar	<p><u>Cannoneer No. 2</u></p> <p>Visually check interior and exterior of muzzle brake for cracks and presence of key. Check muzzle brake collar for cracks and rotation. If muzzle brake collar is cracked, rotated, or key is missing, notify unit maintenance.</p>	Any crack 1 in. (2.54 cm) or more in length is observed, muzzle brake collar is rotated, or key is missing.
46	After	Obturator Group	<p><u>Cannoneer No.3</u></p> <p>Remove, disassemble, and inspect for burrs, powder fouling, or corrosion. Clean and lubricate with CLP (item 6, appx D). Clean vent hole by pushing cleaning tool through vent, rotating clockwise until hole is clean. Check obturator gas check pad for damage or signs of blowby. Replace pad if any of the above conditions exist.</p>	
47	After	Breechblock	<p><u>Cannoneer No.2</u></p> <div style="border: 1px dashed black; padding: 5px; text-align: center; margin: 10px 0;">CAUTION</div> <p>Improper use of reamer will elongate primer chamber causing the primer to stick, thus, preventing its removal.</p> <ol style="list-style-type: none"> a. Disassemble, clean, and lubricate components of breechblock b. Clean primer vent. Ream primer seat with reamer. Clean quadrant seat surfaces on breech ring. 	Component items are missing or replacement is required.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2-CONTINUED

Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
48	After	Hydraulic Reservoir	<p><u>Cannoneer No. 1</u></p> <div> </div> <p>a. With all power off, open accumulator dump valve (1) to allow oil to flow back to reservoir, then close accumulator dump valve securely. Oil level should be at the top full mark on dipstick (2) with the spade raised and/or at the lower full mark on dipstick (2) with spade extended. Fill reservoir (3) as required. Restore hydraulic pressure.</p> <p>b. With pressure up and spade emplaced, check lower reading on dipstick.</p>	
49	Weekly	Loading Tray	<p><u>Cannoneer No.2</u></p> <p>Check loading tray for bends, breaks, or damage that would cause improper fit with rammer trough. Adjust tray hooks if required.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A-ONTINUED

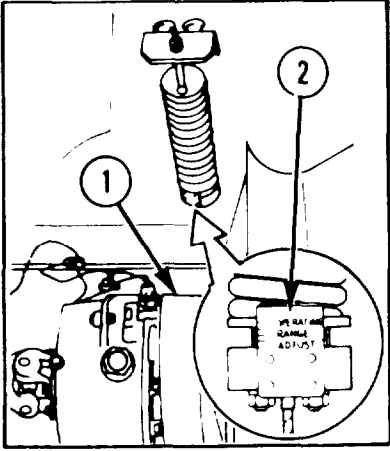
Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
50	Weekly	Fan Belt	<p><u>Driver</u></p>  <p>The diagram shows a close-up of the fan belt mechanism. A circular callout provides a magnified view of the belt and its tensioning spring. Callout 1 points to the fan belt, and callout 2 points to the tensioning spring. The magnified view shows a scale for adjusting the spring tension, with the text 'OPERATE RANGE ADJUST' visible.</p> <p>WARNING</p> <p>Gun tube must be manually traversed away from fan well to prevent personal injury.</p> <p>CAUTION</p> <p>Ensure driver's hatch is secured in the closed position prior to manually traversing gun tube.</p> <p>Remove fan belt grill. Inspect fan belt (1) for cracks, fraying, and tension adjustment (2). Spring may rotate to view scale. To adjust, notify unit maintenance.</p>	<p>Belt is missing or broken.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF -PROPELLED 8-INCH M110A2—CONTINUED

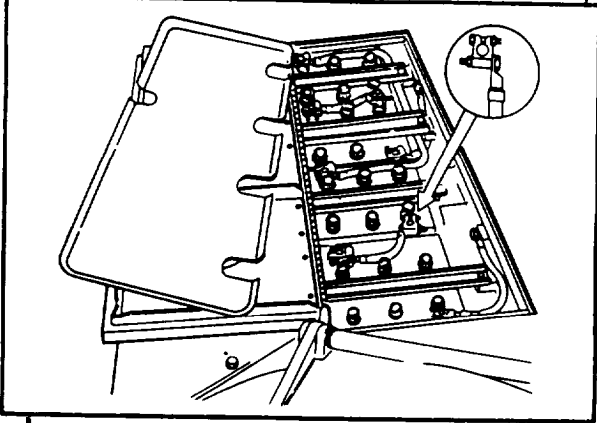
Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
51	Weekly	Batteries	<p><u>Driver</u></p>  <p>WARNING</p> <p>Set MASTER switch OFF before checking batteries.</p> <p>CAUTION</p> <p>In cold weather, after water has been added to batteries, start engine and fast idle for 30 minutes to recharge batteries and mix water with residual electrolyte, to prevent freezing of batteries.</p> <p>Check batteries for corrosion, correct electrolyte level (TM 9-6140-200-14), and cable connections.</p>	<p>One or more batteries are unserviceable or missing.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2-CONTINUED

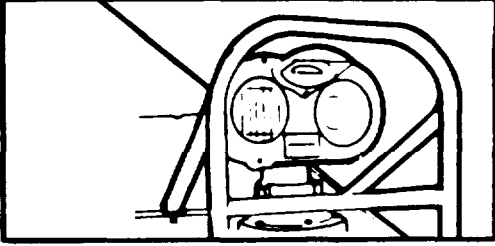
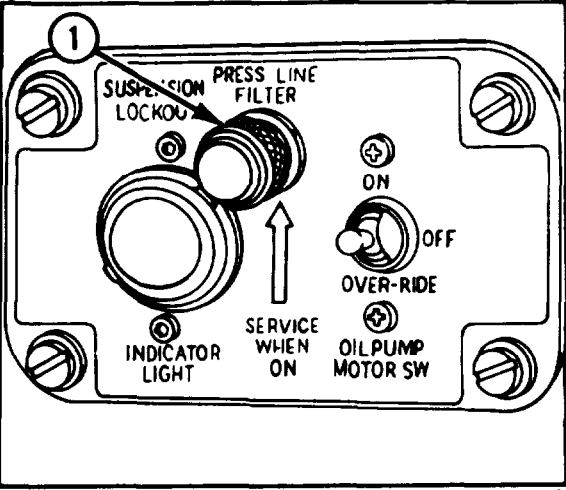
Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
52	Weekly	Lights	<p><u>Driver</u></p>  <p>Check operation of front and back lights. Inspect for discolored or broken lenses.</p>	
53	Weekly	Hydraulic Pump Pressure Filter	<p><u>Cannoneer No. 1</u></p>  <p>a. If lamp assembly is lit, notify unit maintenance for servicing filters.</p> <p>b. Press lamp assembly (1) to check for proper operation of light.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER. HEAVY SELF-PROPELLED 8-INCH M110A2-CONTINUED

Item No.	Interval	Item to Check/Service	<u>Crewmember Procedure</u>	Not fully Mission Capable if:
54	Weekly	Lockout Cylinder	<p><u>Driver</u></p> <p>Check for inoperative lockout cylinders.</p>	<p>More than two on one side or both front cylinders are inoperative.</p>
55	Weekly	Spade	<p><u>Chief of Section</u></p> <div style="border: 1px dashed black; padding: 5px; text-align: center; margin: 10px 0;"> <p>CAUTION</p> </div> <p>Do not step on spade cylinder rod. Scratches on rod will damage seals and cause leaks.</p> <p>Start engine. Raise spade and unlock cylinder locks. Lower and raise spade, checking for cracks cylinder mounting points, smoothness of operation, and leaks.</p>	<p>Spade is inoperative, cracks exist at cylinder mounting points, or class III leak is present.</p>
56	Weekly	Air Cleaners	<p><u>Driver</u></p> <p>Check air filter bags and clean as required. Check for missing or cracked door seals. Make sure doors lock and seal properly when closed.</p>	<p>Filter pacs are missing, seals are damaged, or air cleaner doors do not lock or seal properly.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2-CONTINUED

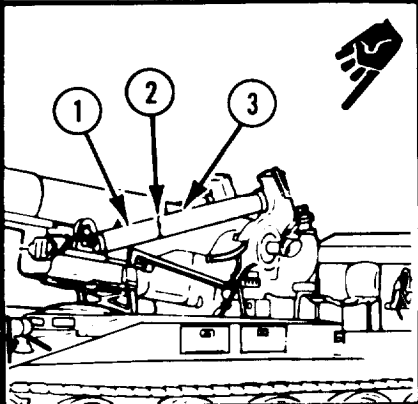
Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
57	Weekly	Periscope	<p><u>Driver</u></p> <div style="border: 1px dashed black; padding: 5px; text-align: center; width: fit-content; margin: 10px auto;"> CAUTION </div> <p>Do not use abrasive cloth, polishing liquids, or paste material to clean optics.</p> <p>Check that periscopes are clean, installed properly, and not damaged.</p>	
58	Weekly	Equilibrator	<p><u>Gunner/Assistant Gunner</u></p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  </div> <p>Check cover (1) for damage. Check retainer (2) for damage and dirt. Clean and lubricate unpainted area of case (3).</p>	

Table 2-I. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A—CONTINUED

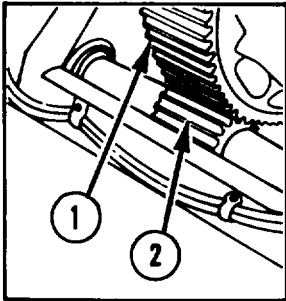
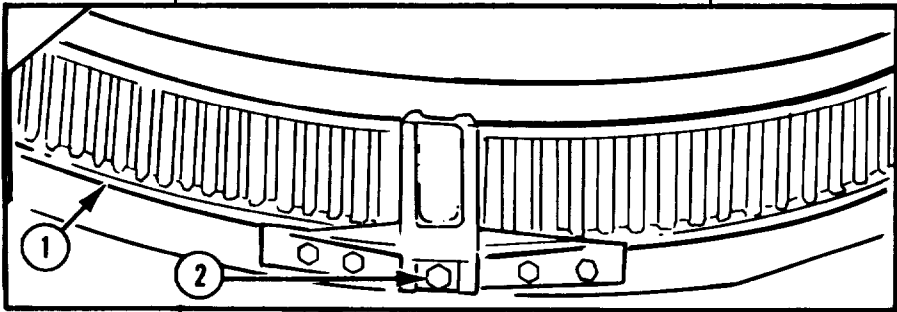
Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
59	Weekly	Elevating Mechanism	<p><u>Assistant Gunner</u></p>  <p>Check arc (1) and elevating final drive (2) gears for damage, obstructions, rust, and proper lubrication.</p>	<p>Cannon cannot elevate or depress.</p>
60	Weekly	Traversing Ring Gear	<p><u>Gunner</u></p>  <p>a. Check ring gear (1) for damage, obstructions, rust, and proper lubrication.</p> <p>b. Check traversing stops (2) inside turret well for cracks and breaks.</p>	<p>Turret cannot traverse.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M110A2—CONTINUED

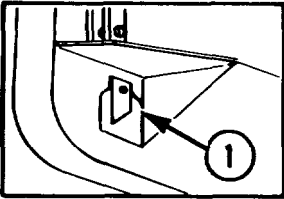
Item No.	Interval	Item to Check/Service	<u>Crewmember Procedure</u>	Not fully Mission Capable if:
61	Weekly	Loader/Rammer	<p><u>Assistant Gunner</u></p>  <p>a. Inspect chain case (1) and clean if required.</p> <p>b. Perform loader/rammer preloading procedures. Repeat procedures when howitzer is received from unit maintenance.</p>	
62			<p>Deleted</p> <p>All data on 2-56 including illustration deleted.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR THE HOWITZER, HEAVY SELF-PROPELLED 8-INCH M 110A -CONTINUED

Item No.	Interval	Item to Check/Service	Crewmember Procedure	Not fully Mission Capable if:
63	Monthly	Drain Plugs	<p><u>Driver</u></p> <div> <p>The diagram consists of two parts. The left part is a top-down view of a rectangular component with a circular drain plug in the center, indicated by a circled '1'. The right part is a side view of the 'BOTTOM OF HULL' showing a drain plug, also indicated by a circled '1'.</p> </div> <p>Check drain plugs (1) and trailing idler housing. Be sure plugs are present and mounting is secure for fording operations.</p>	<p>Drain plugs are missing for fording operations only.</p>
64	Monthly	Towing Pintle, Tow Hooks, and Slave Receptacle	<p><u>Driver</u></p> <p>Check pintle and tow hooks for damage and proper operation. Make sure retaining pins are present and properly installed. Check slave receptacle to make sure female connectors and screw cap are serviceable and rubber seal is present.</p>	

Section III. OPERATION UNDER USUAL CONDITIONS

SECTION INDEX

	Page
ASSEMBLY AND PREPARATION FOR USE	2-60
BACKING VEHICLE	2-73
BORESIGHTING DIRECT FIRE TELESCOPE USING TESTING TARGET WITH SCRIBED M15 ELEVATION QUADRANT	2-110
BORESIGHTING M115 PANORAMIC TELESCOPE USING DISTANT AIMING POINT (DAP) METHOD..	2-112
BORESIGHTING M115 PANORAMIC TELESCOPE USING DISTANT AIMING POINT WITH M137 MOUNT AND M15 ELEVATION QUADRANT SCRIBED.	2-115
BORESIGHTING M139 DIRECT FIRE TELESCOPE USING DISTANT AIMING POINT	2-114
BORESIGHTING M139 DIRECT FIRE TELESCOPE USING DISTANT AIMING POINT AND SCRIBED M15 ELEVATION QUADRANT.	2-117
BORESIGHTING PROCEDURES FOR TEST TARGET METHOD USING SCRIBED M137 PANORAMIC TELESCOPE MOUNT	2-108
CHECKING BORESIGHT OF M115 PANORAMIC TELESCOPE USING M140 ALIGNMENT DEVICE	2-118
CHECKING BORESIGHT OF M139 ELBOW TELESCOPE USING M140 ALIGNMENT DEVICE	2-119
CHECKING M140 ALINEMENT DEVICE WHILE BORESIGHTING ON TEST TARGET	2-111
COMPARISON TEST OF THE M140 ALINEMENT DEVICE	2-120
DIRECT FIRE PROCEDURES..	2-140
General	2-140
Laying for direction and elevation: One man-one sight system	2-144
Laying for direction and elevation: Two man-one sight system	2-143
Laying for direction and elevation: Two man-two sight system	2-140
DRIVINGVEHICLE.	2-71
DRIVING VEHICLE ON ROUGH AND HILLY TERRAIN	2-74
EMPLACING M1A2 AIMING POSTS	2-106
EMPLACING M1A1 INFINITY AIMING REFERENCE COLLIMATOR	2-104
ENGINE STARTING	2-64
ENTERING FIRE CONTROL CORRECTIONS	2-125
M15 Elevation fire control quadrant.	2-125
M137 Telescope mount and M115 panoramic telescope	2-126
EQUILIBRATOR ADJUSTMENT.	2-122
FIXED FIRE EXTINGUISHER	2-78
GUN MOUNT SUPPORT.	2-78
Disengaging gun mount support	2-79
Engaging gun mount support	2-78
HAND RAMMING WITH M13 LOADING RAMMER	2-130
INITIAL ADJUSTMENT SAND DAILY CHECKS	2-60
INSERTING PRIMER AND FIRING	2-135
INSTRUMENT PANEL CHECKOUT PROCEDURES	2-65

LAYING FOR DIRECTION AND QUADRANT DURING INDIRECT FIRE MISSIONS USING COLLIMATOR	2-136
LAYING FOR DIRECTION AND QUADRANT FIRE MISSIONS USING M1A2 AIMING POSTS	2-138
LAYING HOWITZER USING M2 AIMING CIRCLE METHOD	2-102
LOADER/RAMMER PRELOADING PROCEDURES	2-89
Loader/rammer and cannon alinement	2-91
Marking the rammer chain	2-94
Projectile tray adjustment	2-89
Verifying correct cannon elevation for loader/rammer	2-90
LOADING PROPELLING CHARGE	2-134
MANUAL LOADING AND RAMMING	2-127
MEASURING SITE TO CREST	2-108
MISFIRE/CHECKFIRE PROCEDURES.	2-147
Cold tube misfire procedure M110A2.	2-149
Definitions	2-147
General	2-147
Hot tube misfire procedure M110A	2-148
OBTURATOR GAS CHECK PAD INSPECTION	2-124
OPERATING INSTRUCTIONS ON DECALS AND INSTRUCTION PLATES	2-168
OPERATING PROCEDURES	2-61
OPERATION OF AUXILIARY EQUIPMENT	2-149
Arctic traction kit	2-165
Hull heater kit	2-157
M90 radar chronograph equipment and antenna mounting kit	2-151
Operation of coolant heater	2-160
Operation of crew personnel heater	2-163
Operation of crew personnel shelter.	2-164
Operation of data display group	2-151
Operation of driver' s enclosure kit	2-156
Opening driver' s enclosure	2-156
Removal of driver' s enclosure	2-157
Operation of driver' s heater	2-159
Operation of exhaust ports and intake covers	2-162
Operation of fuel filter heaters	2-160
Operation of intercommunication system	2-149
Operation of portable fire extinguisher	2-154
Operation of special purpose kits	2-155
Operation of vehicular applique system	2-151
OPERATION OF DRIVING LIGHTS AND DOME LIGHT	2-69
Operation of dome light.	2-69
Operation of light switch assembly	2-69
OPERATION OF FIRE CONTROL EQUIPMENT	2-95
Operation of M15 elevation quadrant	2-98
Operation of M137 telescope mount and M115 panoramic telescope	2-95
M1 15 panoramic telescope.	2-96
M 137 telescope mount	2-95
Operation of M138 telescope mount and M139 direct fire elbow telescope	2-97
POWER LOADING AND RAMMING	2-131
PREFIRE CHECKS	2-124
PREPARATION FOR FIRING.	2-99
Emplacing the howitzer	2-99

PREPARATION FOR MOVEMENT	2-165
PRE-STARTING INSTRUCTIONS	2-61
RECOIL MECHANISM CHECKOUT AND ESTABLISHING OIL RESERVE	2-121
RETRACTING AND RETURNING CANNON	2-88
Retracting cannon	2-88
Returning cannon	2-88
SECURING PERSONNEL SEAT AND PROJECTILE TRAYS	2-165
Personnel seat	2-165
Projectile trays	2-165
SHIFTING THE TRANSMISSION	2-70
SPADE	2-83
Emplacing	2-83
Securing spade	2-86
STARTING ENGINE BY TOWING	2-68
STARTING ENGINE USING AUXILIARY EQUIPMENT	2-67
STOPPING VEHICLE	2-75
SUSPENSION LOCKOUT	2-87
Locking suspension	2-87
Unlocking suspension	2-87
TOWING PROCEDURES	2-76
TRAVERSING TURRET AND ELEVATING CANNON	2-80
Manual elevating	2-80
Manual traversing	2-81
Manual traversing and elevating	2-80
Power elevating	2-82
Power traversing	2-83
Power traversing and elevating	2-81
UNLOADING HOWITZER	2-145

ASSEMBLY AND PREPARATION FOR USE

Before operating a new or reconditioned vehicle make sure unit maintenance services the vehicle.

INITIAL ADJUSTMENTS AND DAILY CHECKS

Performing the preventive maintenance checks and services (PMCS) on pages 2-26 thru 2-57 before, during, and after operation makes sure that all adjustments and daily checks required for effective vehicle operation will be completed.

OPERATING PROCEDURES

Familiarize yourself with all the controls, instruments, and procedures before attempting to operate the vehicle.

WARNING

- Fasten your seat belt. Drive carefully.
- Protect your hearing. Hearing protection is required when operating the vehicle due to high intensity noise.
- Do not apply the brake if a track is thrown while the vehicle is moving - allow the vehicle to coast to a halt.

CAUTION

- Driver will remain in drivers compartment while engine is running.

This vehicle does not have an automatic transmission. It must be shifted manually.

Instructions and procedures required to operate the vehicle under normal conditions are on the following pages. Special instructions and procedures for operating under unusual conditions are in Section IV. Refer to page 2-169.

PRE-STARTING INSTRUCTIONS

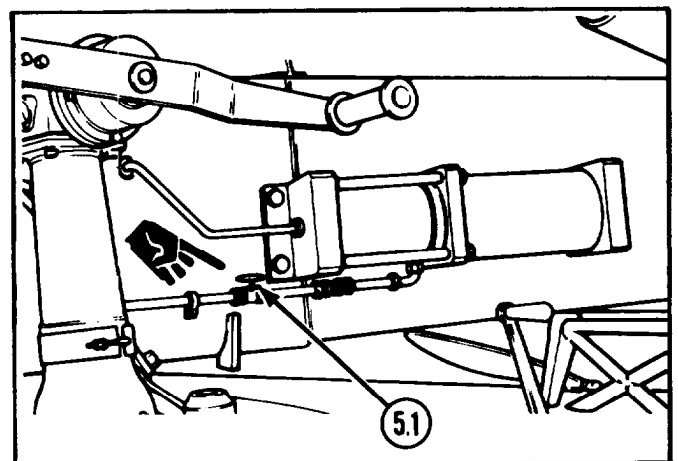
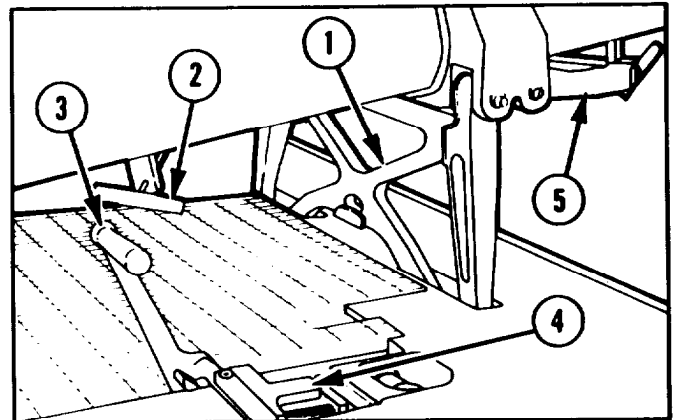
- 1 Do the before operation PMCS. Refer to pages 2-26 thru 2-57.

CAUTION

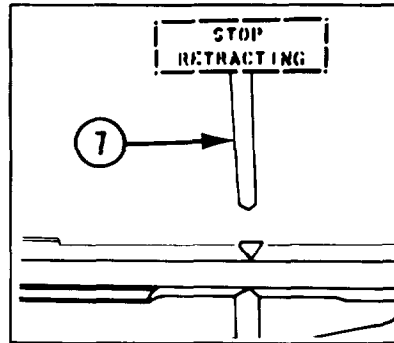
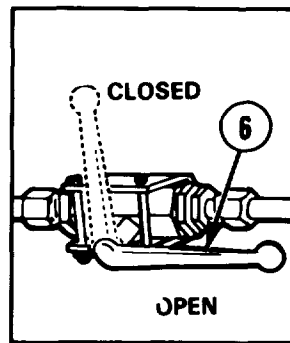
Failure to do steps 2 thru 5 before moving vehicle may cause damage to equilibrator seals.

- 2 Make sure travel support (1) is securely locked to hull. If not, unfasten travel support (1) from stowed position by pushing handle (2). Manually depress cannon and guide support into hull recess. Secure support with handle (3) and latch (4). Make sure shipping support (5) is securely latched in stowed position.

- 2.1 Make sure replenisher shutoff valve (5.1) is in closed position.

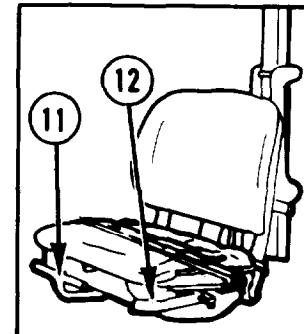
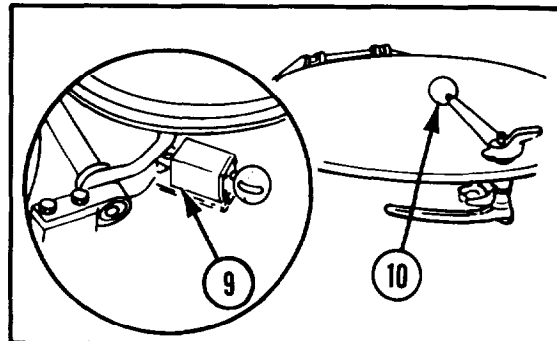
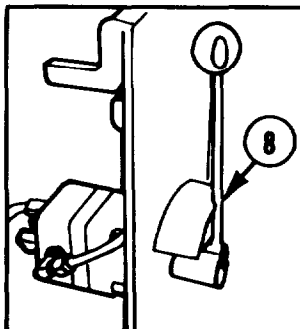


PRE-STARTING INSTRUCTIONS-CONTINUED



3 Make sure spade hydraulic system emergency shutoff valve (6) is open. The valve is located in the turret well below the left rear lockout cylinder.

4 Make sure cannon tube is retracted and that retracting witness marks (7) on cannon tube and slide align. If unmarked, retract cannon 54.25 in. (137.80 cm).

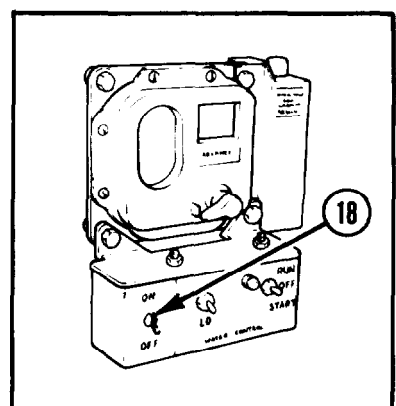
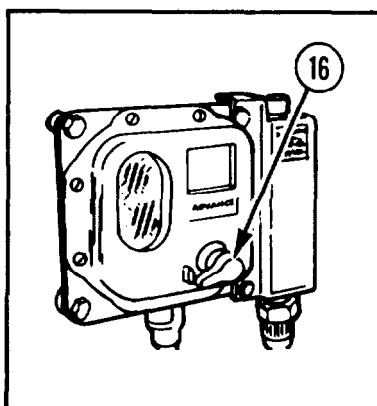
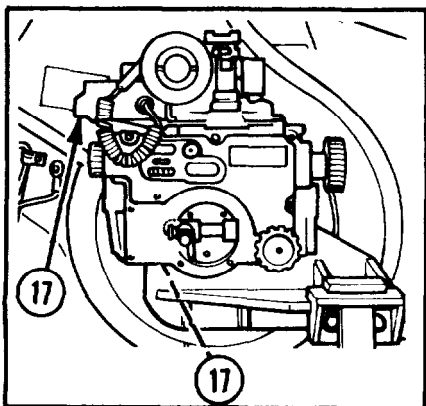
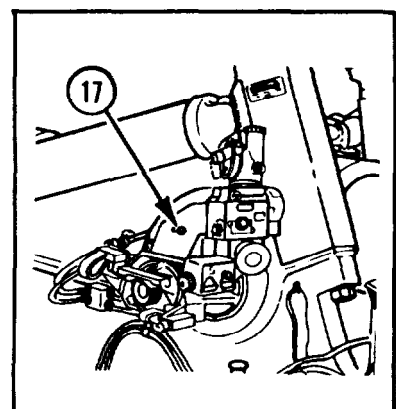
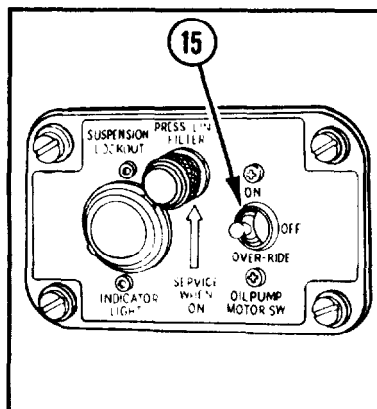
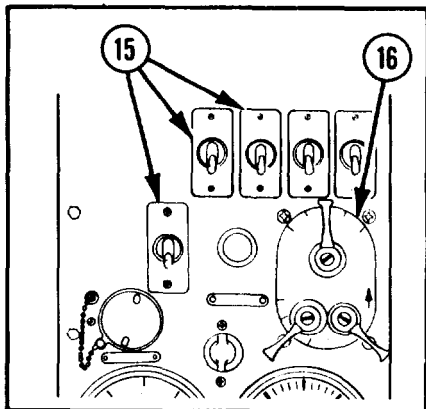
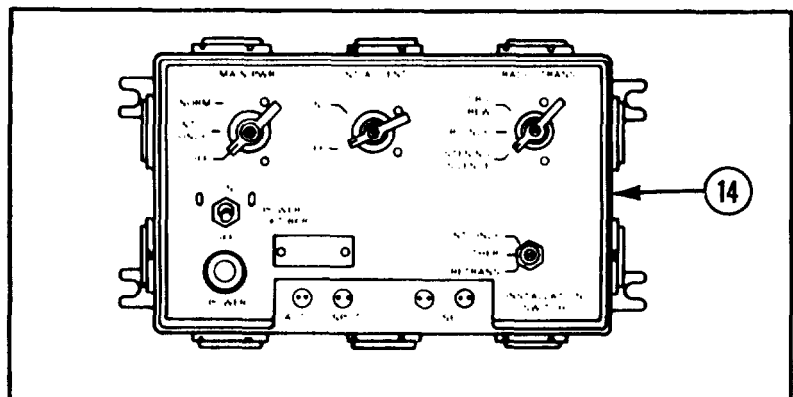
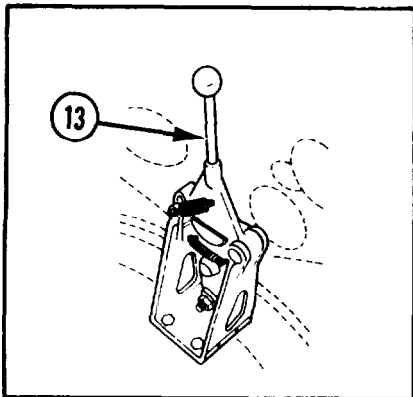


5 Make sure retracting valve handle (8) is in NORMAL AND HOLD position.

6 Lock driver's compartment cover in open position by engaging lock (9). If you want the cover closed, lock by rotating inner handle (10) until latch engages cupola ring.

7 Adjust the driver's seat. To adjust seat height, use your body weight to hold seat and pull up on vertical adjusting rod handle (11). To adjust seat forward or backward, push in horizontal adjusting lever (12). Release handle and lever to lock in position.

PRE-STARTING INSTRUCTIONS-CONTINUED



8 Make sure loader/rammer stow position lock (13) is engaged.

9 Make sure all communication (14), accessory (15), light (16), sighting equip-

ment lamp switches (17), and heater switch (18) are OFF.

ENGINE STARTING

WARNING

Protect your hearing. Hearing protection is required when operating the vehicle due to high intensity noise.

NOTE

Use the following procedures for starting the engine in temperate climates + 32 °F (0°C) and warmer. For procedures to start the engine in colder climates refer to page 2-173.

- 1 Perform the pre-starting procedures. Refer to page 2-61.
- 2 Set vehicle parking brake.
- 3 Shift transmission into N (neutral).
- 4 Depress the hand throttle control release button (1) and push throttle control (2) in completely.

NOTE

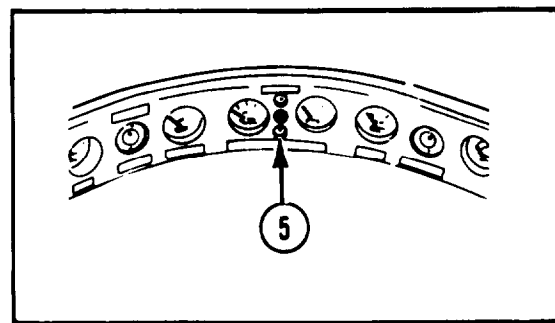
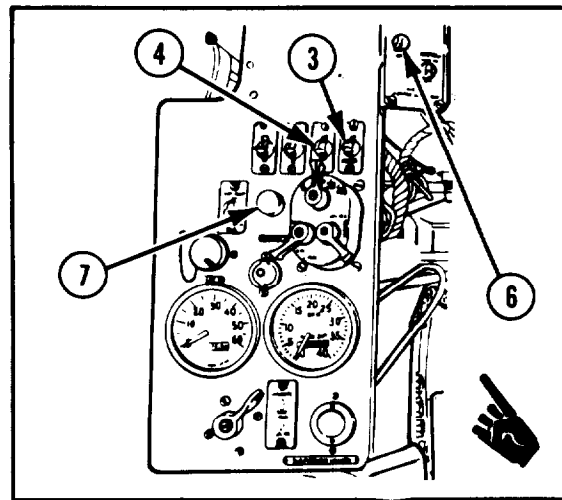
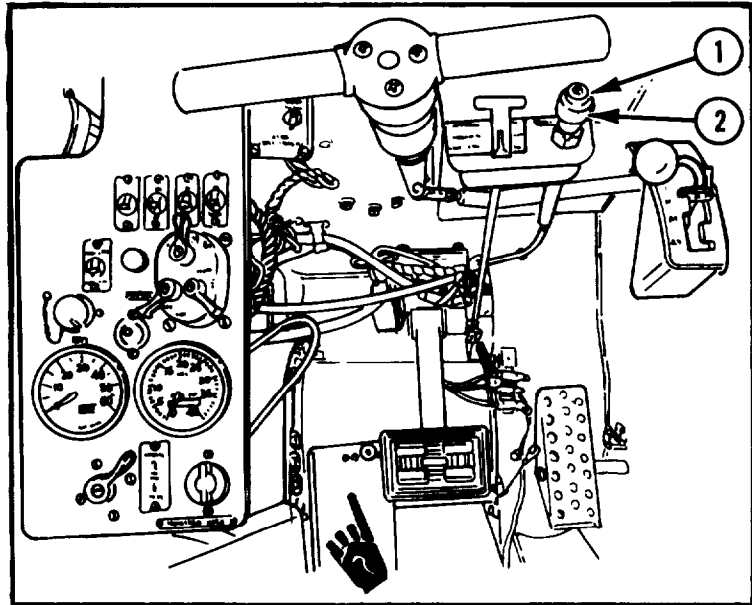
Before turning MASTER switch (3) and INSTRUMENT switch (4) to ON, make sure that all electrical switches are OFF.

- 5 Set MASTER switch (3) and INSTRUMENT switch (4) to ON. Master indicator light (5) will light.

NOTE

Perform step 6 only after fuel has been drained from fuel filters or engine has been repaired or replaced.

- 6 Push and hold PRIME ENGINE FUEL FILTERS switch (6) ON for 1 minute.



ENGINE STARTING -CONTINUED

CAUTION

Do not operate starter continuously for over 30 seconds. Allow starter to cool for 2 minutes between uses.

- 7 Release switch (6) (if used) and immediately push in on START switch (7). Do not crank engine longer than 30 seconds at a time. If engine does not start, release START switch for 2 minutes then repeat this step.

NOTE

At idle speed (650-700 rpm) the warning horn may sound and the engine-transmission oil pressure indicator may light. Increase speed to 800 rpm. If horn continues to sound and light does not go off, stop engine and notify unit maintenance.

- 8 When engine starts, release START switch.

CAUTION

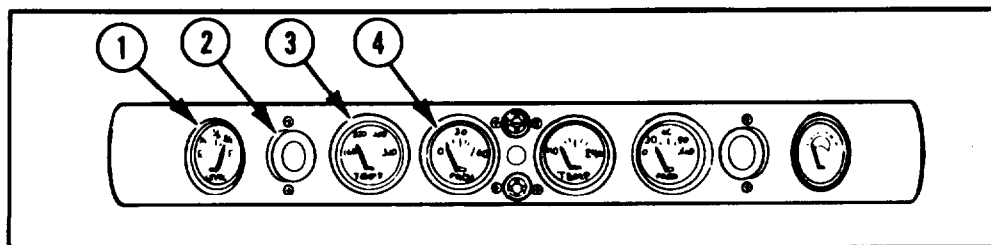
Do not increase or decrease engine speed abruptly. This action may cause damage to engine.

NOTE

If engine does not start after four 30-second tries or indication of firing stops for over 10 seconds, stop engine cranking and notify unit maintenance.

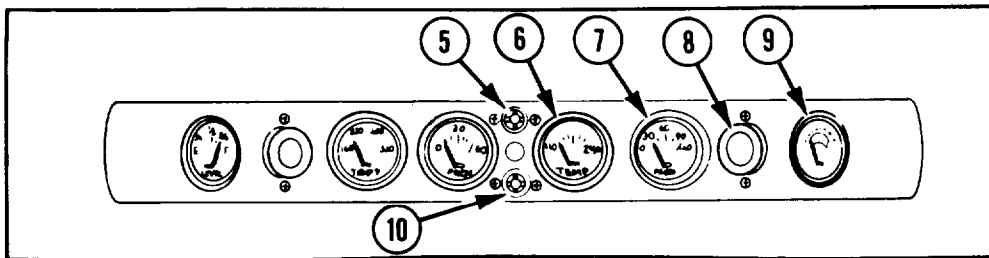
- 9 Adjust throttle control and run engine at 1000 to 1,200 rpm (fast idle) as indicated on the tachometer. Allow the engine to warm up at 1000 to 1200 rpm for approximately five minutes.
- 10 Perform instrument panel checkout procedure during engine warm-up.
- 11 Release parking brake and shift transmission into 1st range. Drive vehicle slowly for first 100 yards (91.4 m) to warm lubricants.

INSTRUMENT PANEL CHECKOUT PROCEDURES



- 1 FUEL GAGE (1). Should be near full mark.
- 2 ENGINE-TRANSMISSION high temperature/low pressure warning light (2). Light should be off during engine operation.
- 3 TRANSMISSION OIL temperature indicator (3). Normal operating temperature is 165-220°F (74-104°C); maximum allowable temperature is 300°F (149°C).
- 4 TRANSMISSION OIL pressure indicator (4). Normal pressure is 18-45 psi (124-310 kPa) at 1835-1900 rpm (minimum pressure is 10 psi (68.9 kPa) at 1000 rpm).

INSTRUMENT PANEL CHECKOUT PROCEDURES-CONTINUED



5 HI-BEAM indicator light (5). Lights when headlights are on high beam.

6 ENGINE WATER temperature indicator (6). Normal operating temperature is 170-185 °F (77-85 °C); maximum allowable temperature is 230°F (110°C).

7 ENGINE OIL pressure indicator (7). Normal operating pressure at 1800 rpm and above is 50-70 psi (345-483 kPa). Minimum allowable pressure is 5 psi (34.5 kPa) at 650 rpm; 28 psi (193 kPa) at 1800 rpm; 30 psi (207 kPa) at 2000 rpm and 35 psi (241 kPa) at 2300 rpm.

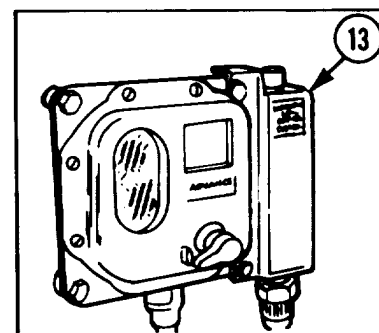
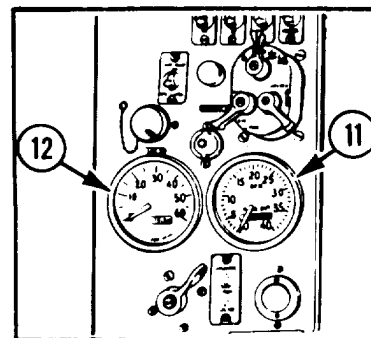
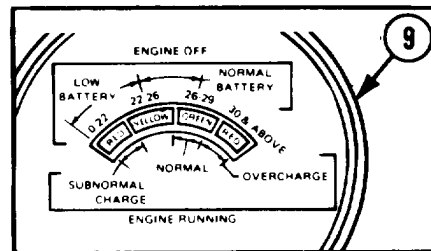
8 GENERATOR warning light (8). Should be off. Lights when generator is not charging.

9 BATTERY - GENERATOR indicator (9). Needle should be in GREEN (normal range).

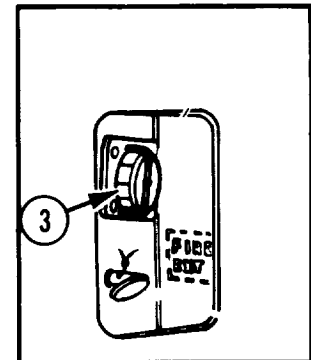
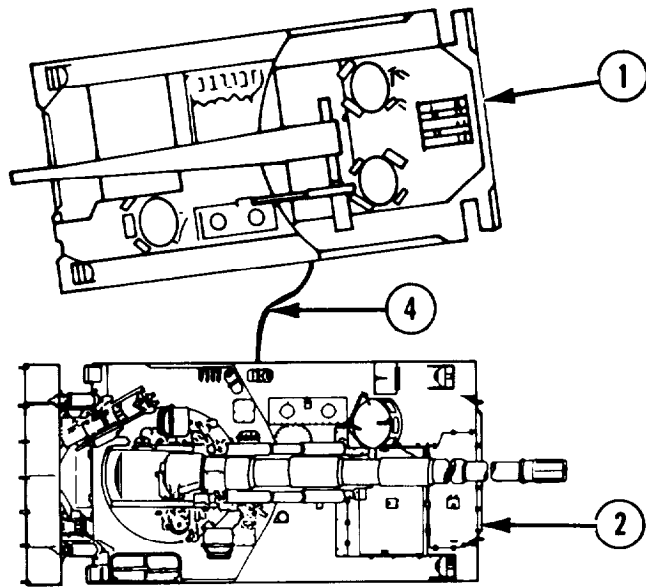
10 MASTER switch indicator light (10). Should be on. Lights when MASTER switch is ON.

11 TACHOMETER (11) and SPEED-OMETER (12) should operate without excessive fluctuation or unusual noises.

12 LOW ENGINE COOLANT WARNING LIGHT (13). Should be off. Lights and warning horn sounds when engine coolant is low or when air is present in cooling system. Press to test that lamp will light.



STARTING ENGINE USING AUXILIARY EQUIPMENT



- 1 Position slave vehicle (1) as close to receiving vehicle (2) as possible so that slave receptacles (3) of both vehicles are side by side.
- 2 Make sure that MASTER switch and all accessory switches in receiving vehicle are OFF and that transmission shift lever is in N (neutral).

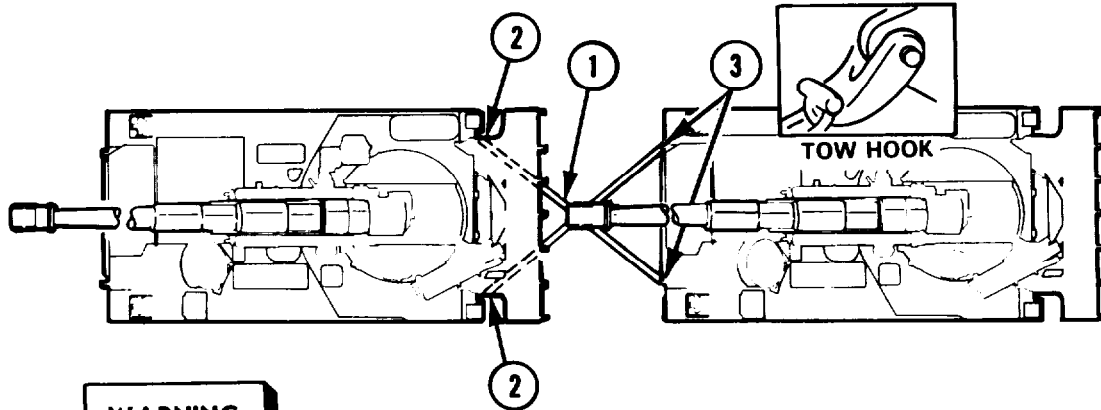
CAUTION

Polarity (plus-to-plus and minus-to-minus) and voltage (24 V dc) at slave receptacles of each vehicle must be the same.

- 3 Connect slave cable (4) to slave receptacle (3) in each vehicle.
- 4 Start engine in slave vehicle and set hand throttle at 1000 to 1200 rpm on engine tachometer.

- 5 Turn MASTER switch ON and set INSTRUMENT switch ON in receiving vehicle. Press engine start switch on receiving vehicle and start engine.
- 6 When engine in the receiving vehicle is running, disconnect the slave cable from both vehicles.
- 7 Adjust throttle control and run engine at 1000 to 1200 rpm (fast idle) as indicated on tachometer.
- 8 Allow the engine to warm-up at 1000 to 1200 rpm for approximately 5 minutes. Watch that the battery charge indicator returns to the NORMAL zone.
- 9 Perform your instrument panel checkout procedure during the engine warm-up period. Refer to page 2-65.

STARTING ENGINE BY TOWING



WARNING

- Do not depress accelerator on towed vehicle and do not exceed 10 miles per hour when tow-starting vehicle.
- These procedures are for starting operations only, not for recovery operations.
- This procedure must be performed on level ground to preclude damage to the cannon tube and disabled vehicles.
- Ensure no personnel are between vehicles while towing vehicle is running.

1 Perform pre-starting procedures. Refer to page 2-61.

CAUTION

Make sure tow cables are crossed to prevent damage to track.

- 2** Connect tow cables (1) between towing vehicle tow lugs (2) and the towed vehicle tow lugs (3).
- 3** Shift transmission to range 2 on towed vehicle.
- 4** Make sure that all electrical switches are OFF, that the hand throttle is

pushed in, and that the engine shut-down handle in towed vehicle is pushed in against the hull.

- 5** Turn MASTER switch and INSTRUMENT switch ON in towed vehicle.
- 6** Depress service brake, lift up on parking brake handle, and push handle to panel to release parking brake on towed vehicle.
- 7** Tow vehicle forward in a straight line. The engine should start by the time vehicle speed reaches 6 to 8 mph (10 to 13 km/hr).
- 8** When engine in the towed vehicle starts, shift into N (neutral) and adjust hand throttle until engine operates at fast idle (1000 to 1200 rpm).
- 9** Allow engine to warmup at 1000 to 1200 rpm for approximately 5 minutes. Watch that the battery charge indicator returns to the NORMAL zone.

WARNING

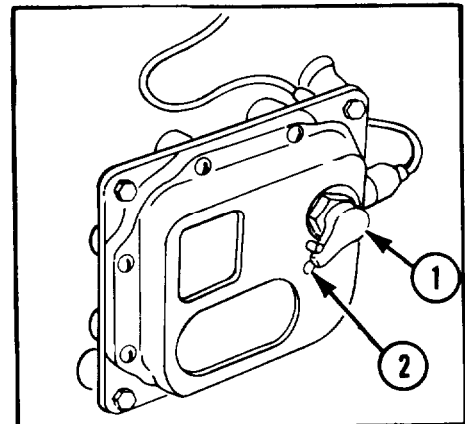
Place transmission shift lever in neutral and lock brakes on both vehicles before removing tow cables.

- 10** Disconnect the tow cables from both vehicles.
- 11** Perform your instrument panel checkout procedures during the engine warmup period. Refer to page 2-65.

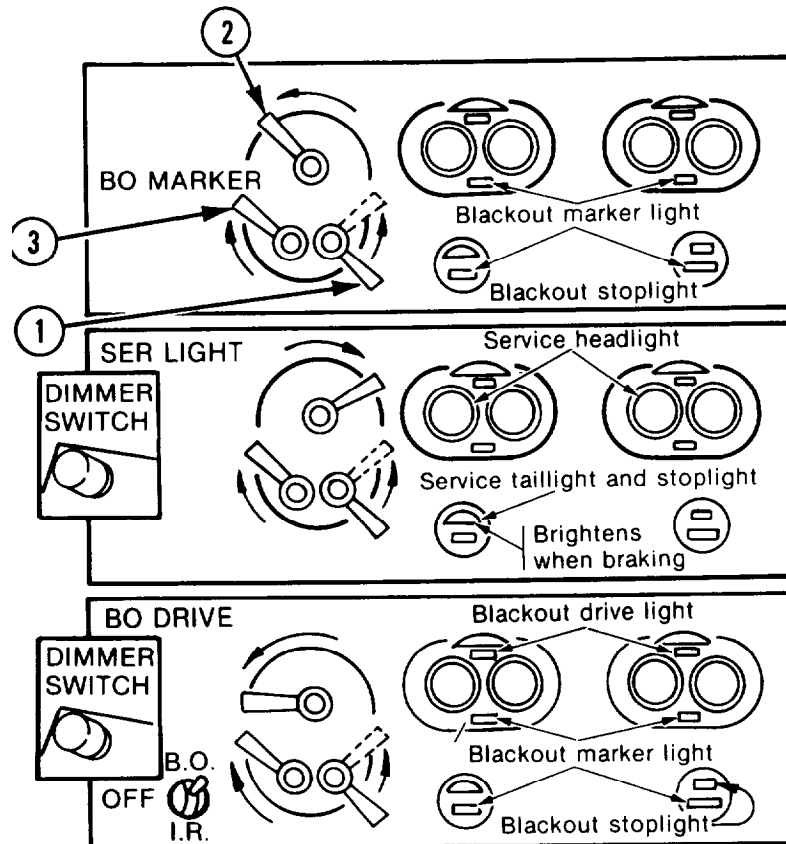
OPERATION OF DRIVING LIGHTS AND DOME LIGHT

OPERATION OF DOME LIGHT

- 1 Blue light ON. Turn lever (1) fully clockwise.
- 2 White light ON. Press safety latch (2) and turn lever (1) counterclockwise past stop.
- 3 Both lights OFF. Turn lever (1) counterclockwise or clockwise past stop.



OPERATION OF LIGHT SWITCH ASSEMBLY



The panels on the right show which lights are turned on by the different positions of the main light switch.

2 Instrument panel light switch (3). Push up to turn on panel light.

- 1 Safety switch (1). Push up to unlock main light switch (2). Release after main light switch is in position.

SHIFTING THE TRANSMISSION

4th GEAR

- 1 USE FOR NORMAL DRIVING CONDITIONS
- 2 MAXIMUM SPEED-34 MPH 155 km/hr).

3RD GEAR

- 1 USE TO START VEHICLE ON HARD SURFACED ROADS UNTIL SUFFICIENT VEHICLE SPEED (12 to 15 MPH (19.3 to 24.1 km/hr)) PERMITS SHIFTING TO FOURTH (4TH) GEAR RANGE.
- 2 USE FOR SUSTAINED HEAVY PULLING AND FOR GOING UP OR DOWN LONG GRADES.
- 3 MAXIMUM SPEED- 17 MPH (27 km/hr).

2ND GEAR

- 1 USE TO TOW HEAVY LOADS.
- 2 USE TO GO UP OR DOWN STEEP GRADES AND ON EXTREMELY MUDDY OR ROUGH TERRAIN.
- 3 USE DURING FORWARD SHORT RADIUS TURNS.
- 4 MAXIMUM SPEED-9 MPH (14 km/hr).

1st GEAR

- 1 USE TO SET VEHICLE IN FORWARD MOTION IN FIELD OPERATION. UPSHIFT TO A HIGHER GEAR RANGE WHEN VEHICLE
- 2 USE FOR GOING UP OR DOWN EXTREME STEEP GRADES AND ON SOFT, MUDDY, OR ROUGH TERRAIN.
- 3 USE DURING FORWARD SHORT RADIUS TURNS.
- 4 MAXIMUM SPEED-5 MPH (8 km/hr).

NEUTRAL

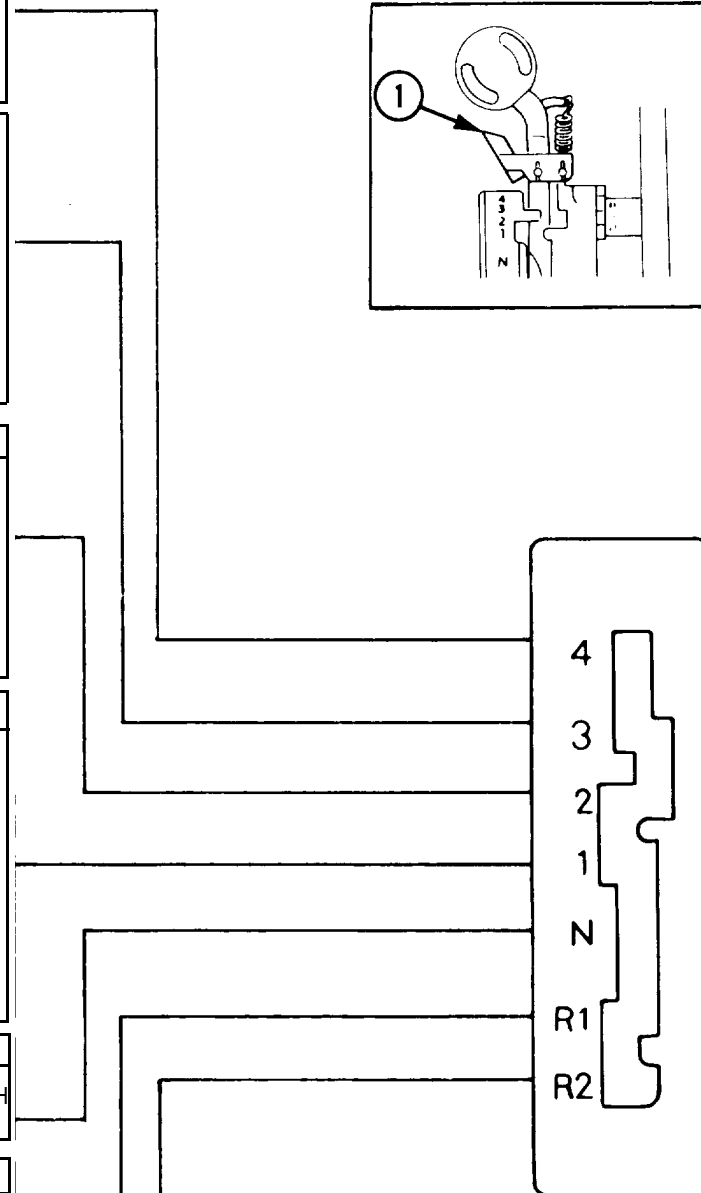
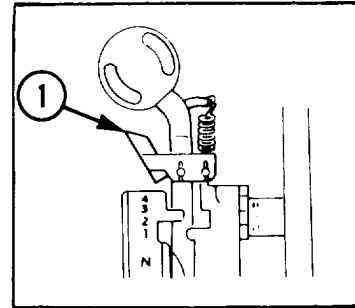
CAUTION: NEVER GO DOWN AN INCLINE WITH TRANSMISSION IN NEUTRAL (N) POSITION.

REVERSE RANGE 1

- 1 USE FOR REVERSE CLUTCH BRAKE TURNS, HEAVY LOADS OR SOFT GROUND.
- 2 USE FOR GOING UP STEEP GRADES IN REVERSE FOR MAXIMUM ENGINE POWER.
- 3 MAXIMUM SPEED-4 MPH (6 km/hr)

REVERSE RANGE 2

- 1 USE FOR LEVEL GROUND AND HARD SURFACES WHEN BACKING UP FOR LONG DISTANCES BECOMES NECESSARY.
- 2 MAXIMUM SPEED-7 MPH (11 km/hr).



CAUTION

NEVER ATTEMPT TO SHIFT INTO REVERSE GEAR RANGE UNLESS THE VEHICLE IS AT A DEAD STOP AND THE ENGINE IS OPERATING AT IDLE RPM.

SHIFTING THE TRANSMISSION - CONTINUED

The transmission is equipped with a shift inhibitor. It restricts movement of the shift lever and prevents down shifting of the transmission until the vehicle speed drops within the correct operating limits for the desired gear range. Brake the vehicle to prevent vehicle speed from overrunning engine speed while downshifting.

The shift lever is equipped with a latch (1) which must be depressed in order to shift the transmission from neutral into gear.

DRIVING VEHICLE

WARNING

- Drive carefully. Do not speed. Avoid oversteering, you could lose control of the vehicle.
- Driver's cupola cover will be secured in either the open or closed position during operation.
- Fasten your seat belt and alert crew members to fasten their seat belts to avoid injury in the event of a sudden stop or directional change of the vehicle.

Do not attempt to drive the vehicle until you are thoroughly familiar with all the controls, instruments, and procedures. Always keep in mind the WARNINGS and CAUTIONS found throughout this manual for the safe operation of the vehicle and accessories.

Before placing the vehicle in motion make sure of the following:

- Place cannon tube in the travel support position and retract the tube.

- Close replenisher shutoff valve.
- That all basic issue items are stowed and secure.
- That the lockout control valve handle is in the UNLOCKED position and the suspension locked indicator light is off.

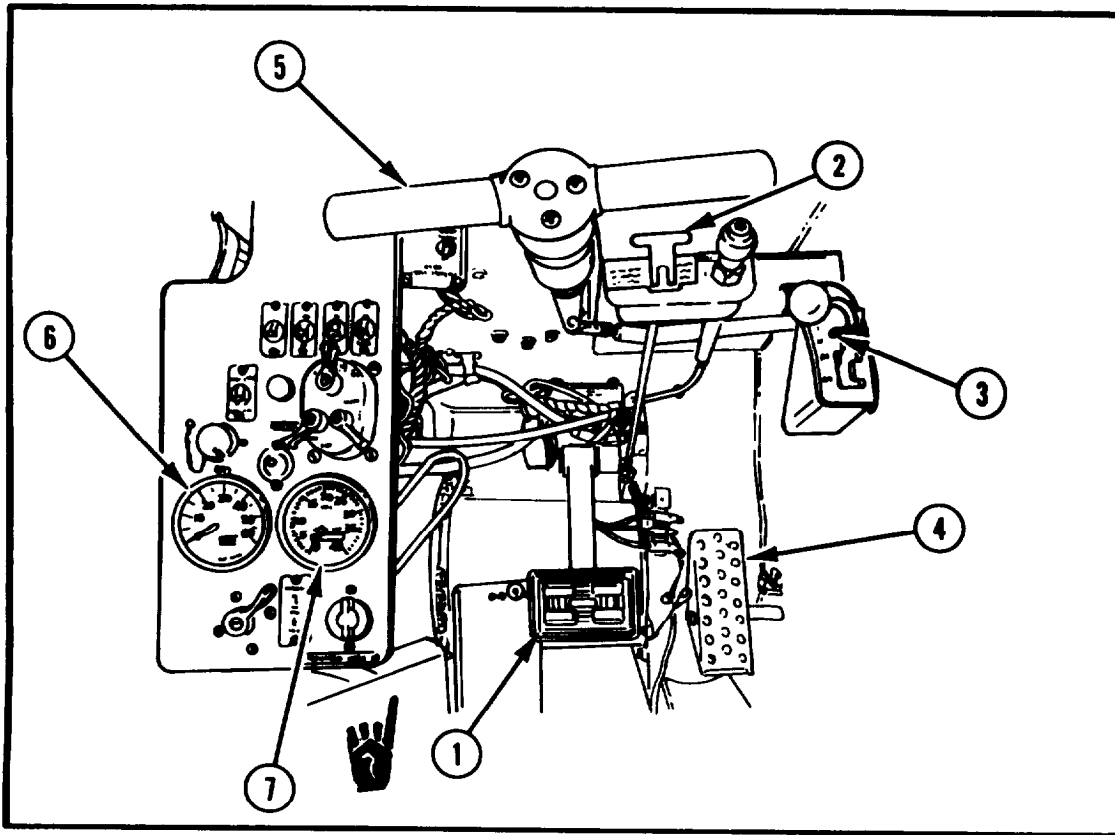
WARNING

Driver will remain in driver's compartment while engine is running.

CAUTION

- Reduce the engine speed to 650-700 rpm before shifting the transmission into gear.
- Do not shift into reverse gear unless the vehicle is at a dead stop.
- When starting on a hill, depress brake and place transmission in range 1 position, increase engine speed and release brake.
- Do not hold vehicle on an incline by using the accelerator as the transmission will overheat.
- Do not coast down grades. Downshift before going down steep hills. Use range 2 or 3 on long grades, and range 1 on steep grades.
- This vehicle does not have an automatic transmission. It must be shifted manually.

DRIVING VEHICLE-CONTINUED



- 1 Depress the brake pedal (1), lift up and push in on the parking brake handle (2) to release parking brake.
- 2 With the brake pedal (1) depressed and engine running at 650-700 rpm, release shift lever latch (3) and shift from N (neutral) to range 1.
- 3 Release brake pedal (1) and depress the accelerator (4) to obtain necessary vehicle speed. Shift through gear ranges to necessary speed range. Refer to page 2-70 for information on the range to use for different conditions.
- 4 Use steering bar (5) to turn the vehicle. Make a steady even turn. Vehicle will turn the same direction in reverse as in forward. Do not jerk or oversteer as you may lose control of the vehicle.

NOTE

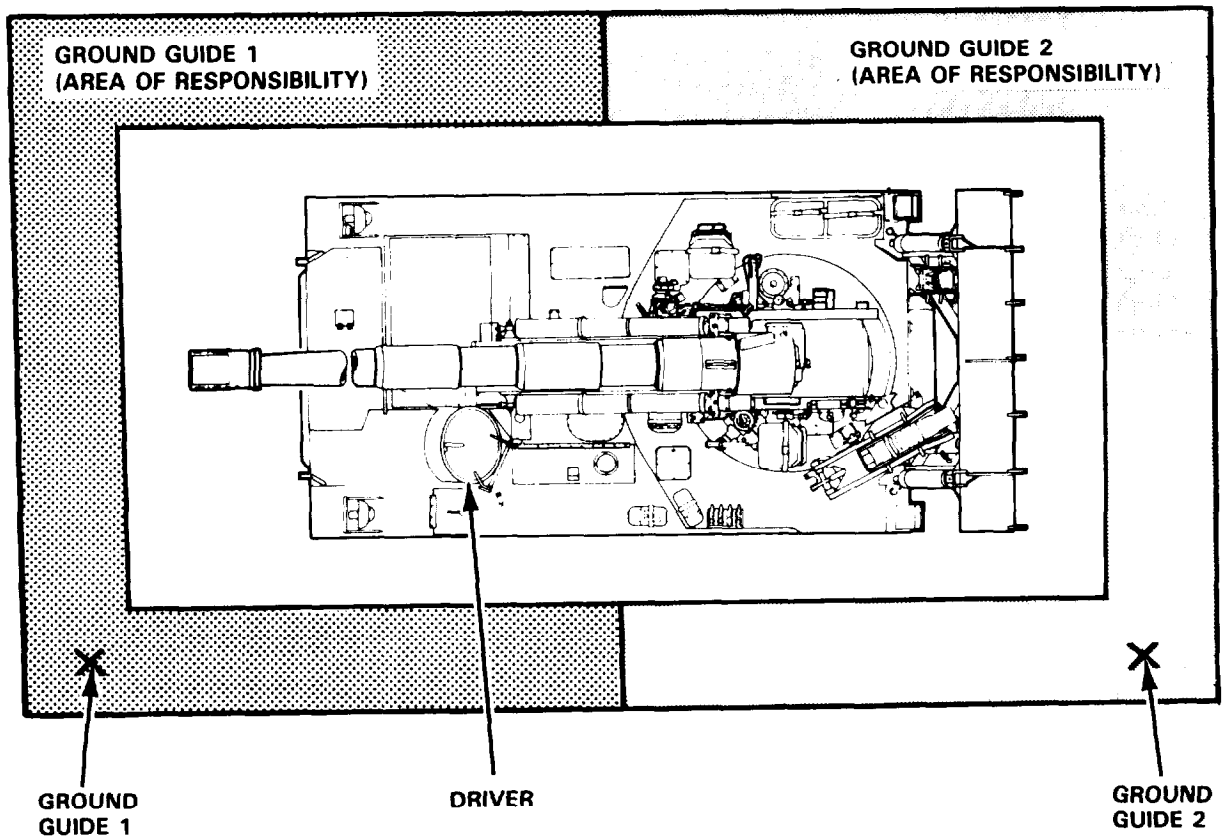
Minimum turning radius is 15 ft (4.6 m) with transmission in forward ranges 1 and 2 or reverse 1, and 38 ft (11.6 m) with transmission in forward ranges 3 and 4 or reverse 2.

- 5 While driving, check the speedometer (6) and tachometer (7). Do not exceed 2300 rpm in any speed range. Be alert for any malfunction by observing the instruments and warning lights.
- 6 Do your during operation PMCS. Refer to pages 2-26 thru 2-57.
- 7 When driving, make sure to observe overhead clearance and allow room for corners of vehicle when making turns. Shift to forward range 1 or 2 for sharp turns.

BACKING VEHICLE

To back vehicle:

- 1 Driver will step on brake and shift into reverse.
- 2 Driver will be directed by hand signals from ground guide 1.
- 3 Ground guide 1 will be positioned to left and front of vehicle. He will be highly visible to both driver and ground guide 2 and will relay signals from ground guide 2 to driver.
- 4 Ground guide 2 will be positioned to left and rear of vehicle and will direct vehicle movement by means of hand signals to ground guide 1.



DRIVING VEHICLE ON ROUGH AND HILLY TERRAIN

Go up and down long grades in range 3, steep grades in range 2. Don't coast.

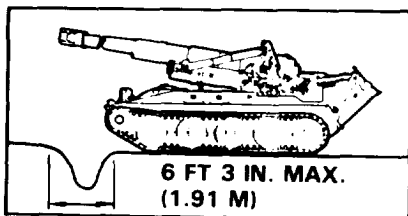
Shift the transmission to range 1 (low) before going up or down extreme grades and when starting on a hill.

WARNING

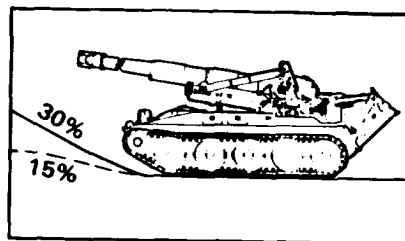
Brake the vehicle to prevent vehicle speed from overrunning engine speed. If vehicle speed overruns engine speed, you will not be able to down shift to a lower range and may lose control of the vehicle.

CAUTION

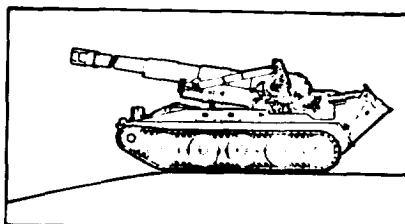
Steer the vehicle in a series of short turns rather than a long, even turn when operating in loose sand, dirt, or rocks. This will allow debris to feed out of the track. If debris accumulates, a thrown track or damage to the suspension system may result.



- 1 Trench Crossing. Reduce speed as vehicle approaches the edge of a trench; speed up when tracks contact the far side of the trench. Maximum width of a trench that can be safely crossed is 6 ft 3 in. (1.91 m).

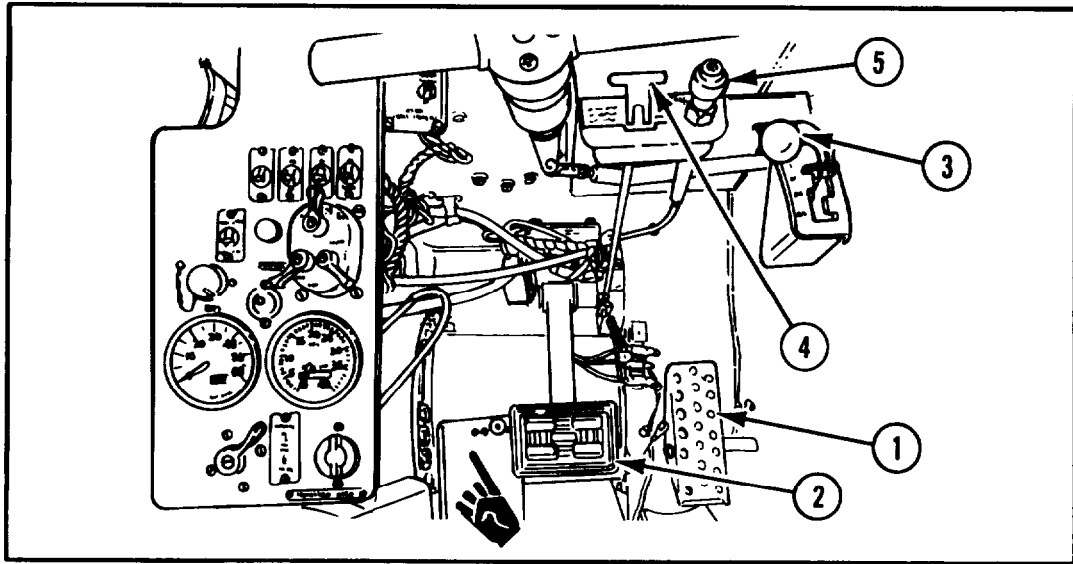


- 2 Steep Grades. Speed up as vehicle climbs hill; slow down at crest of hill and while going down. Use range 3 for normal grades 0-15 percent, range 2 for grades 15-30 percent, and range 1 for extreme grades over 30 percent.



- 3 Down Hill. Go down hills slowly; shift to lower range before starting down. Approach bottom of hill cautiously to avoid digging in and damaging the final drives or tracks.

STOPPING VEHICLE

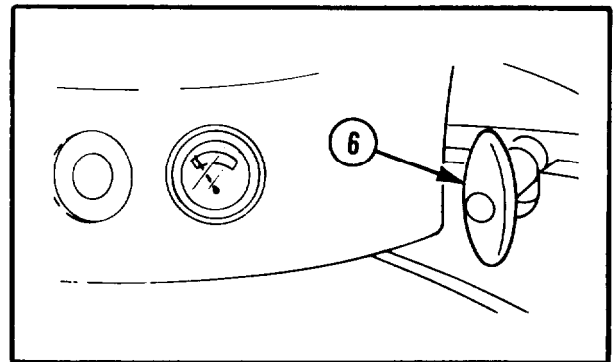


- 1 Release the accelerator (1) and depress the brake pedal (2) until the vehicle stops.
- 2 With the brake pedal depressed, move shift lever (3) into neutral, pull out and down on the brake release handle (4). Release the brake pedal.

CAUTION

Failure to observe engine shutdown procedures will result in high engine failure rate.

- 3 Set hand throttle control lever (5) to run engine at 1000 to 1200 rpm and allow engine to cool for 3 to 5 minutes until temperature reaches 170-185°F (77-85°C).
- 4 Push throttle control lever (5) to return engine to normal idle.
- 5 Turn off all communication and accessory switches.
- 6 Pull out engine shutdown handle (6) until engine stops.

**NOTE**

If engine doesn't stop, check shutdown linkage.

- 7 Set INSTRUMENT and MASTER switches OFF.
- 8 Do your after operation PMCS. Refer to pages 2-26 thru 2-57.

TOWING PROCEDURES

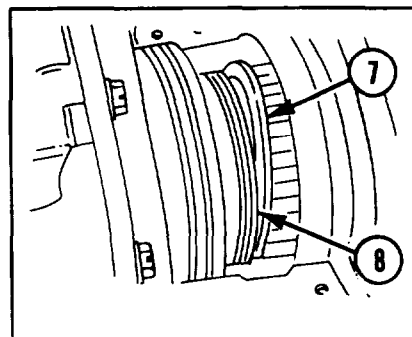
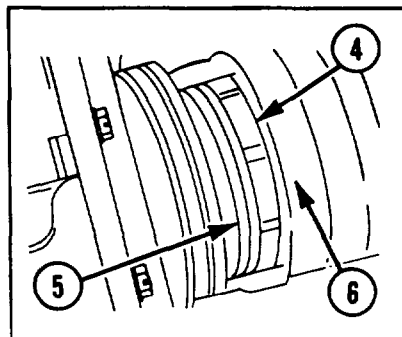
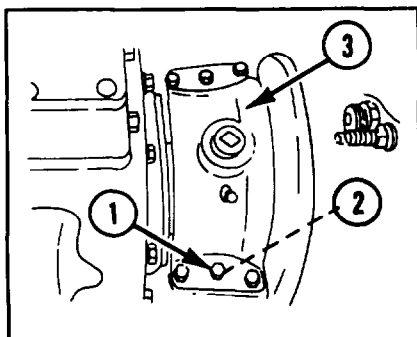
CAUTION

In an emergency, a disabled vehicle can be towed for a distance, not to exceed one-quarter mile, without disconnecting the final drives. Do not tow a disabled vehicle over 5 mph (8 km/hr). Proceed with steps 4 through 9 below, being careful not to accidentally shift the towed vehicle into gear.

NOTE

Coordinate with unit maintenance to disconnect the final drives.

- 1 Block the tracks of a disabled vehicle to prevent any movement.
- 2 Remove four nuts and remove the transmission deck to gain access to the final drive couplings.



3 Disconnect the final drives as follows:

- a. Remove six screws (1) and washers (2) securing saddle cap and seal (3).
- b. Using a spanner wrench, unscrew locknut (4) from output coupling (5); a hammer and drift pin may be used in an emergency.
- c. Push locknut (4) back into final drive housing (6).
- d. Using pliers, remove retainer (7) from groove in final drive shaft (8).
- e. Using screwdriver, remove final drive shaft (8) from output coupling (5) and push final drive shaft into final drive housing.

- f. Retrieve locknut (4) from final drive housing (6), place retainer (7) into interior shoulder of locknut (4) and screw locknut and retainer onto output coupling (5).
- g. Replace saddle cap and seal (3) and secure with six washers (2) and screws (1).
- h. Repeat the above steps to disconnect the opposite final drive.
- i. Replace and secure the transmission deck (cover).

TOWING PROCEDURES-CONTINUED

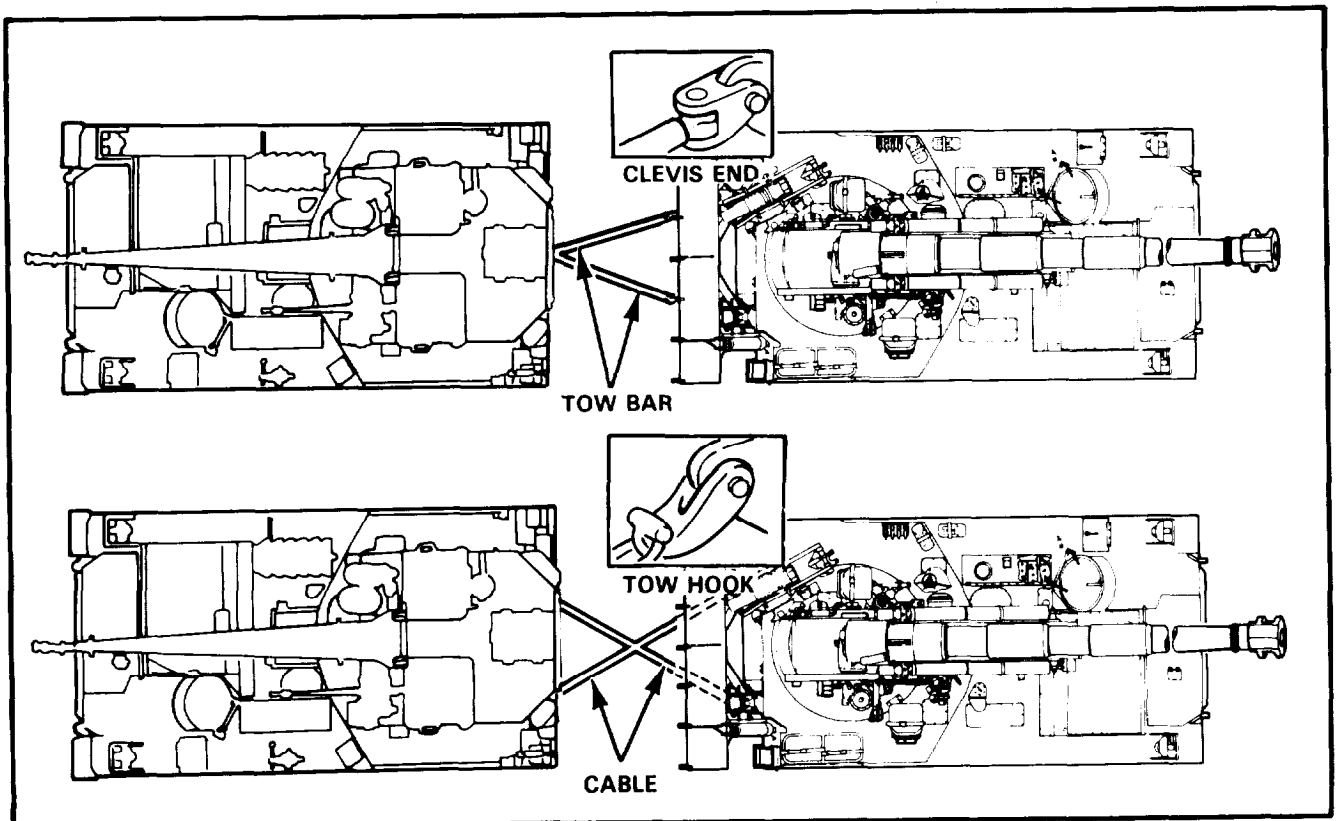
WARNING

Ensure no personnel are between vehicles while towing vehicle is running.

CAUTION

- Use a tow bar when towing another vehicle. When the final drives are disconnected, you can't steer or brake.

- Tow cables may be used to tow a disabled vehicle short distances on fairly level terrain only when the brakes are operational on the disabled vehicle. When towing a vehicle in neutral there is a danger of the towed vehicle overrunning the towing vehicle.
- Make sure tow cables are crossed to prevent damage to track.



- 4 Remove tow hooks from hull lugs and stow in stowage box.
- 5 Install tow bar between pintle on towing vehicle and tow lugs on towed

vehicle. The vehicles must be towed backwards to avoid hitting the recovery vehicle with the cannon.

TOWING PROCEDURES-CONTINUED

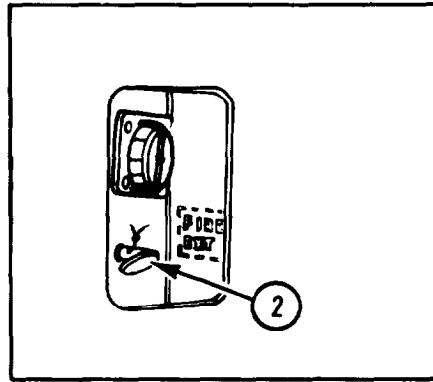
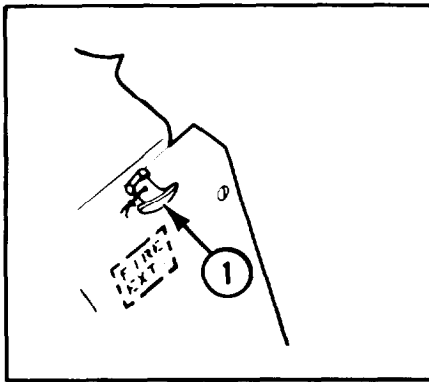
- 6 Remove blocks from the tracks of the towed vehicle.
- 7 Shift the towed vehicle into N (neutral).
- 8 Release brake on towed vehicle and signal towing vehicle to start.

CAUTION

When towing a vehicle, turn in a wide arc to prevent interference of tracks and undue side strain on tow bar.

- 9 When towing a vehicle at night, turn towed vehicle master switch and lights ON if tactical situation permits. All other switches should be OFF.

FIXED FIRE EXTINGUISHER

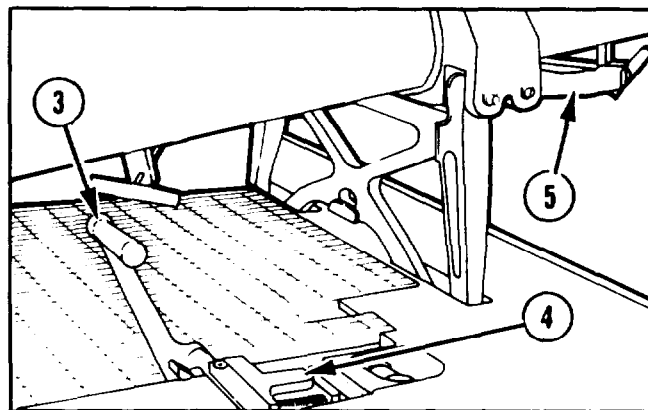
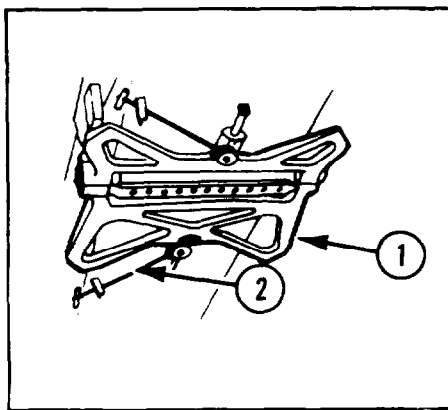


- 1 To discharge the fixed fire extinguisher cylinders, pull handle (1) or (2) out with a quick, hard jerk. This will break the seal and discharge the CO₂ into the engine compartment.

- 2 After using the fire extinguisher, notify unit maintenance.

GUN MOUNT SUPPORT

ENGAGING GUN MOUNT SUPPORT



GUN MOUNT SUPPORT-CONTINUED

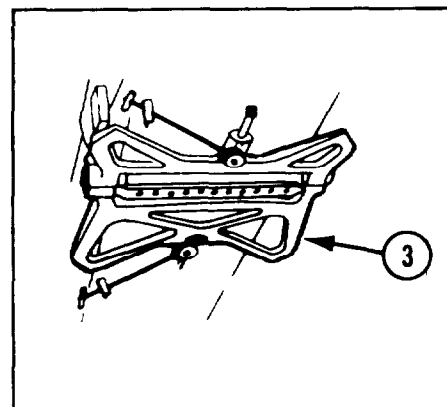
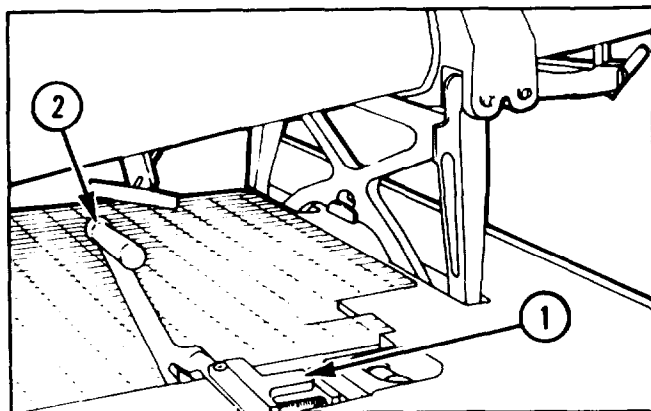
ENGAGING GUN MOUNT SUPPORT- CONTINUED

CAUTION

Be sure to perform the following steps before moving vehicle. If travel support is not engaged, damage may occur to equilibrator seals and cannon could elevate out of control.

- 1 Cannoneer No. 2 - Release travel support (1) from stowed position by pushing handle (2).
- 2 Assistant Gunner - Manually depress gun mount. Cannoneer No. 2 - Guide support (1) into hull recess.
- 3 Cannoneer No. 2 - Secure support in hull recess by engaging handle (3) and latch (4). Make sure shipping support (5) is secure in stowed position.
- 4 Retract cannon for travel. Refer to page 2-88.

DISENGAGING GUN MOUNT SUPPORT



WARNING

Make sure the cannon is in battery position and oil reserve is established before releasing travel support.

- 1 Return cannon to battery. Refer to page 2-88. Establish oil reserve. Refer to page 2-121.
- 2 Cannoneer No. 2 - Release support in hull recess by disengaging latch (1) and handle (2).
- 3 Assistant Gunner - Manually elevate gun mount until support clears hull recess. Cannoneer No. 2 - Raise support (3) and secure in stowed position.

TRAVERSING TURRET AND ELEVATING CANNON

MANUAL TRAVERSING AND ELEVATING

WARNING

Driver will remain in driver's compartment while engine is running.

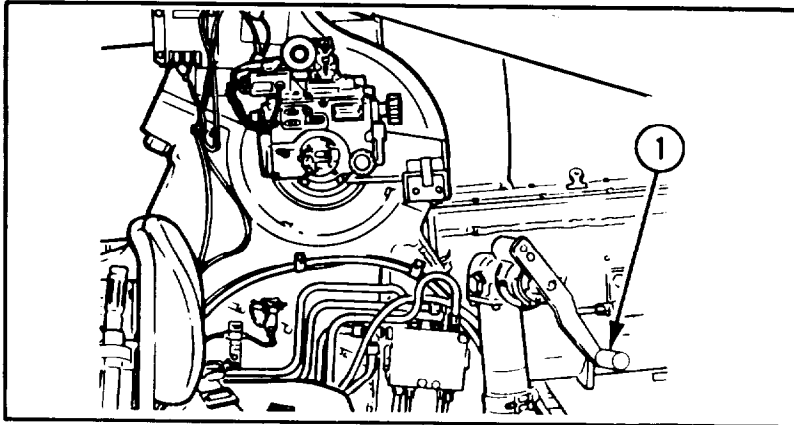
- 1 Driver - start engine, turn on PTO switch to establish hydraulic pressure.
- 2 Lower spade. Refer to page 2-83.

WARNING

Establish hydraulic oil reserve (index pin is extended) before elevating weapon. Failure to establish hydraulic oil reserve could result in cannon sliding out of battery and injuring personnel.

- 3 Establish oil reserve in recuperator cylinder. Refer to page 2-121.
- 4 Disengage gun mount travel support and secure in stowed position. Refer to page 2-79.
- 5 Driver - Set HYDRaulic PUMP/PTO CLUTCH switch OFF.
- 6 Driver - Stop engine and turn all switches OFF.
- 7 Gunner - Alert crew that you are going to elevate and traverse cannon.

MANUAL ELEVATING



WARNING

Prior to elevating cannon, crew must be alerted.

- 8 Assistant Gunner - Turn manual elevating handle (1) clockwise to depress cannon and counterclockwise to elevate cannon. Elevate cannon to 560 mils.

- 9 Assistant Gunner - Check that effort to elevate or depress cannon is approximately the same. Adjust equilibrators if turning effort in both directions is not equal. Refer to page 2-122.

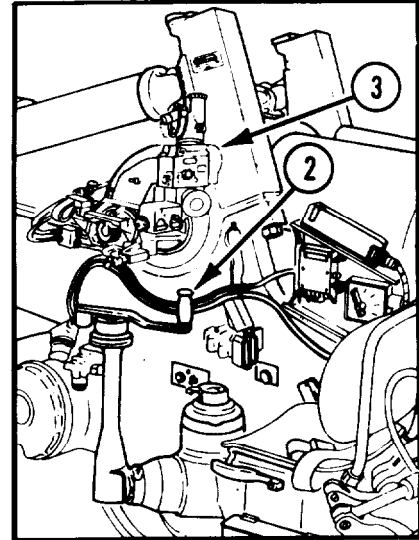
TRAVERSING TURRET AND ELEVATING CANNON-CONTINUED*MANUAL TRAVERSING***WARNING**

Prior to traversing cannon, crew must be alerted.

CAUTION

Secure driver's cupola cover in closed position before traversing with cannon near minimum elevation.

- 10 Gunner - Turn manual traversing handle (2) clockwise to traverse cannon right and counterclockwise to traverse cannon left.
- 11 Gunner - After traversing cannon, position handle (2) between 2 and 10 o' clock positions to prevent handle (2) and pantel (3) interference when elevating cannon.

*POWER TRAVERSING AND ELEVATING***WARNING**

- Never manually elevate or traverse the weapon when power elevating and traversing systems are being used. Stay clear of manual elevating and traversing handles during power operation. A malfunction may cause the handles to spin, causing injury.
- Ensure spade is emplaced prior to traversing.

CAUTION

Make sure cannon comes to a complete stop before traversing or elevating in the opposite direction.

- 1 Driver - Start engine, turn on PTO switch to establish hydraulic pressure.
- 2 Lower spade. Refer to page 2-83.

WARNING

Establish hydraulic oil reserve (index pin is extended) before elevating weapon. Failure to establish hydraulic oil reserve could result in cannon sliding out of battery and injuring personnel.

- 3 Establish oil reserve in recuperator cylinder. Refer to page 2-121.
- 4 Disengage gun mount travel support and secure in stowed position. Refer to page 2-79.

TRAVERSING TURRET AND ELEVATING CANNON -CONTINUED

POWER TRAVERSING AND EL E VA TING - CONTINUED

- 5 Driver - Turn off PTO switch, stop engine, turn off instruments, leave master switch ON.
- 6 Gunner or Assistant Gunner - Alert crew that you are going to elevate and traverse cannon.
- 7 Manually traverse and elevate weapon system, refer to page 2-80, before using power traversing and elevating systems.
- 8 Gunner or Assistant Gunner - Set oil pump motor switch on left trunnion ON.

POWER ELEVATING

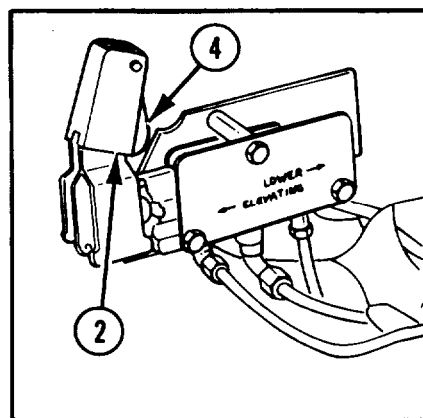
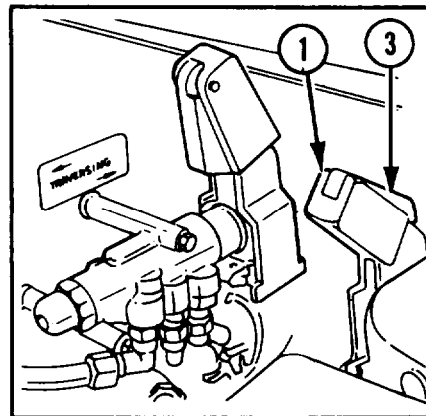
WARNING

Prior to elevating cannon, crew must be alerted.

NOTE

Cannon may be elevated from either the gunner's station (left side) or the assistant gunner's station (right side).

- 9 Gunner or Assistant Gunner - Grasp power elevating control handle (1) or (2) and squeeze actuator (3) or (4).
- 10 Gunner or Assistant Gunner - Move control handle forward to depress cannon and rearward to elevate cannon.
- 11 Gunner or Assistant Gunner - Regulate elevation speed by moving handle closer to neutral position to decrease speed and away from neutral position to increase speed.
- 12 Gunner or Assistant Gunner - Return control handle to neutral position and release actuator to stop elevation motion.



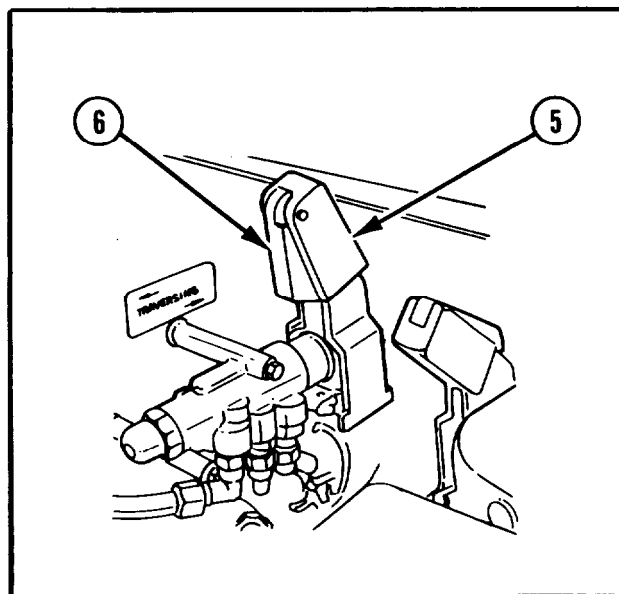
TRAVERSING TURRET AND ELEVATING CANNON -CONTINUED*POWER TRAVERSING***WARNING**

- Prior to traversing cannon, crew must be alerted.
- Ensure spade is emplaced prior to traversing.

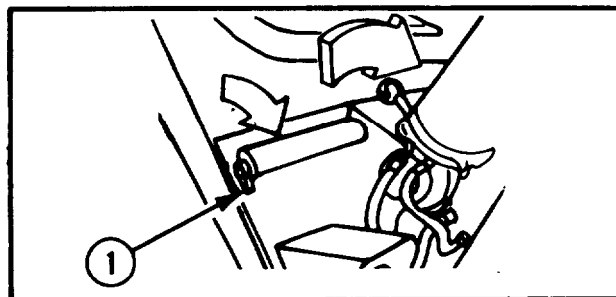
CAUTION

Secure driver's cupola cover in closed position before traversing with cannon near minimum elevation.

- 13** Gunner - Grasp power traversing control handle (5) and squeeze actuator (6).
- 14** Gunner - Move control handle (5) forward to traverse right and rearward to traverse left.
- 15** Gunner - Regulate traversing speed by moving handle (5) closer to neutral to decrease speed and away from neutral position to increase speed.
- 16** Gunner - Return handle (5) to neutral position and release actuator (6) to stop traversing motion.

**SPADE***EMPLACING*

- 1** Chief of Section and Driver - Position vehicle in direction of fire. Make sure cannon is secure in travel position.
- 2** Driver - Make sure engine speed is 650-700 rpm. Set HYdraulic PUMP/PTO CLUTCH switch ON. Pull out on spade control lever (1), move to raise position to release pressure.



SPADE-CONTINUED

EMPLACING- CONTINUED

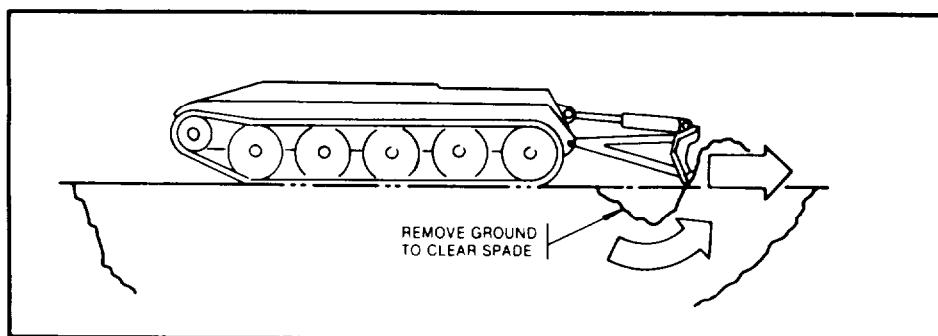
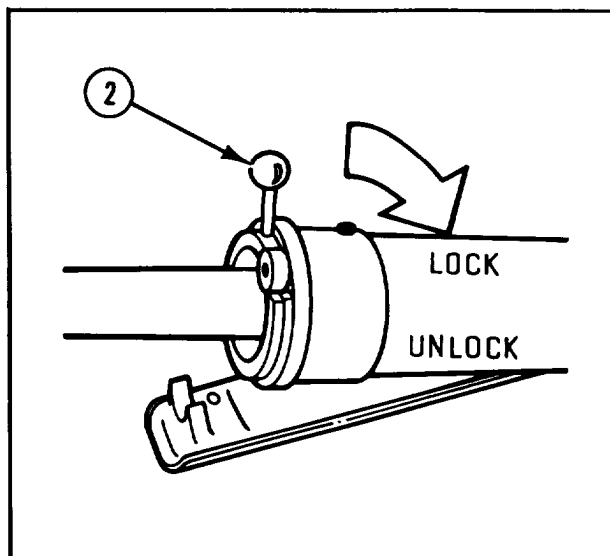
CAUTION

After hydraulic pump is in operation, engine speed should exceed 1200 rpm only when emplacing or lifting spade.

NOTE

It may be necessary, due to hard surface, to move vehicle forward while dragging spade prior to emplacing.

- 3 Chief of Section and Cannoneer No. 1
- Move spade cylinder lock lever (2) to unlock position. Driver - Increase engine speed. Chief of Section - Lower spade.

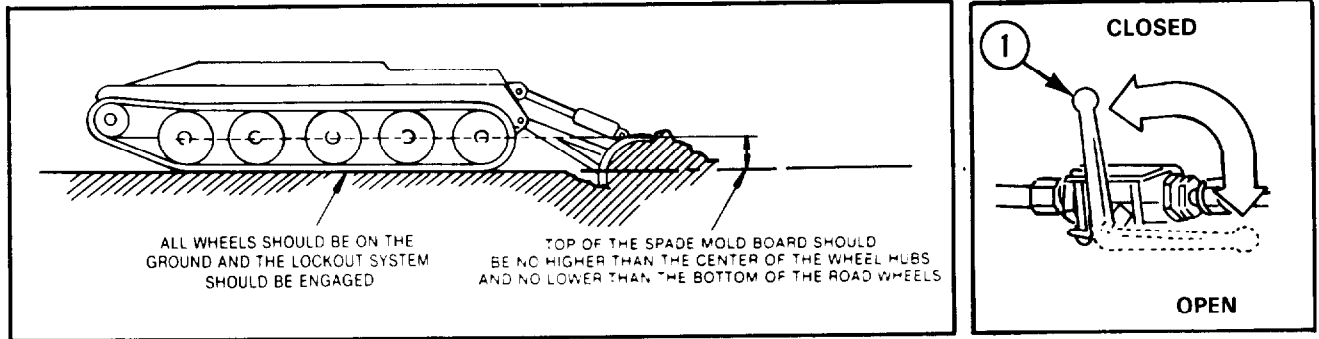


- 4 Driver - Slowly back vehicle. Chief of Section - Use spade as a bulldozer blade to remove ground to form an

emplacement for spade. Control depth of spade cut by raising or lowering spade while digging emplacement.

SPADE-CONTINUED

EMPLACING-CONTINUED



- 5 Chief of Section - Emplace spade with top of mold board no higher than the center of the wheel hubs and no lower than bottom of road wheels. Driver - Slowly back vehicle until spade is firmly emplaced.
- 6 Chief of Section - Make sure the spade does not jack up rear of vehicle.
- 7 Driver - Place transmission shift lever in N (neutral) and engage parking brake.
- 8 Driver - Cycle suspension lockout control valve handle between LOCKED and UNLOCKED position to make sure all road wheels are on the ground. Leave handle in LOCKED position.

CAUTION

Before firing, all road wheels must be on the ground and the spade must be firmly pressed against the ground. The shock of firing must be transmitted to the ground without the spade being a battering ram.

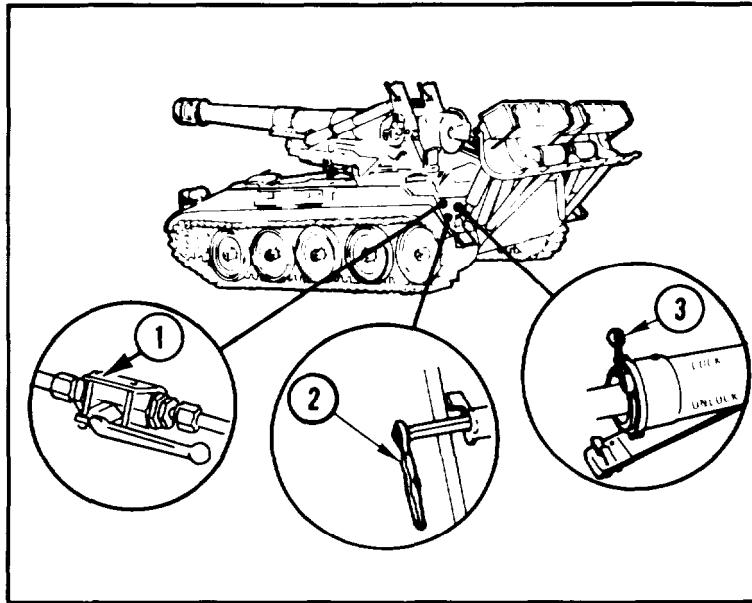
NOTE

During firing operations, the vehicle and spade tend to creep rearward and jack up the rear of the vehicle. The spade must be emplaced again whenever this condition develops.

- 9 After firing two or three rounds and periodically during firing, cycle suspension lockout system to allow road wheels to conform to ground surface.
- 10 In case of leaks in spade hydraulic tubes or hoses, isolate spade hydraulic system from vehicle hydraulic system by closing spade hydraulic system shutoff valve. The valve handle (1) is located in the turret well on the left behind rear lockout cylinder. Notify unit maintenance.

SPADE-CONTINUED

SECURING SPADE



NOTE

If, during firing, hydraulic system emergency shutoff valve (1) was closed due to leakage, open shutoff valve (1) and secure recoil spade in travel position. Then close shutoff valve (1) to ensure pressure to other vehicle systems.

1 Cannoneer No. 1 - Make sure loader/rammer is secured in stow position lock.

- 2 Chief of Section - Pull out spade control lever (2) to allow rotation counterclockwise to raise spade. Hold in this position until spade cylinders are completely retracted.
- 3 Chief of Section - Move spade cylinder locking lever (3) to LOCK position. Cannoneer No. 1 - Lock opposite spade cylinder in same manner.
- 4 Chief of Section - Return spade control lever (2) to neutral position and push in.

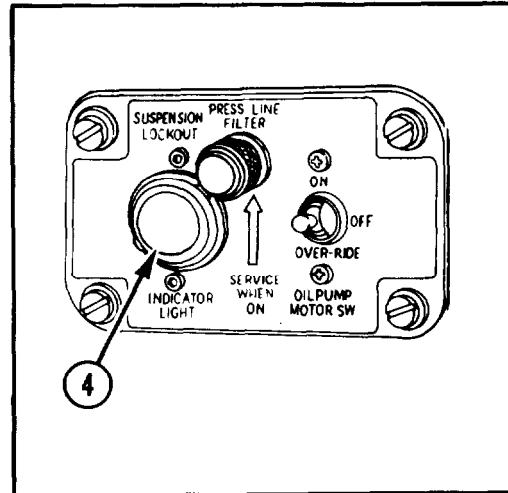
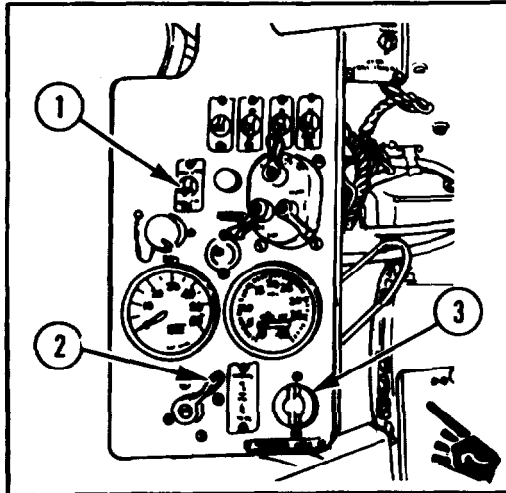
CAUTION

Clean and dry spade cylinder rods before raising spade to prevent damage to seals.

SUSPENSION LOCKOUT

CAUTION

Do not drive vehicle with the suspension system locked.



LOCKING SUSPENSION

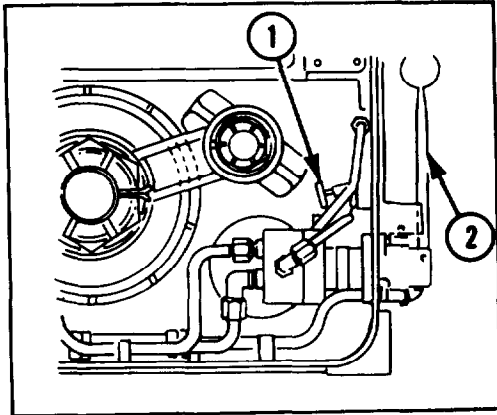
- 1 Driver - Make sure engine speed is 650-700 rpm. Set hydraulic pump PTO clutch switch (1) ON.
- 2 Driver - Set suspension lockout control valve handle (2) to LOCKED position.
- 3 Suspension locked indicator lights (3) and (4) will come on when suspension is locked.

UNLOCKING SUSPENSION

- 1 Driver - Set suspension lockout control valve handle (2) to UNLOCKED position.
- 2 Suspension locked indicator lights (3) and (4) will go off when suspension is unlocked.
- 3 Driver - Make sure engine speed is 650-700 rpm. Set hydraulic pump PTO clutch switch (1) to OFF.

RETRACTING AND RETURNING CANNON

RETRACTING CANNON

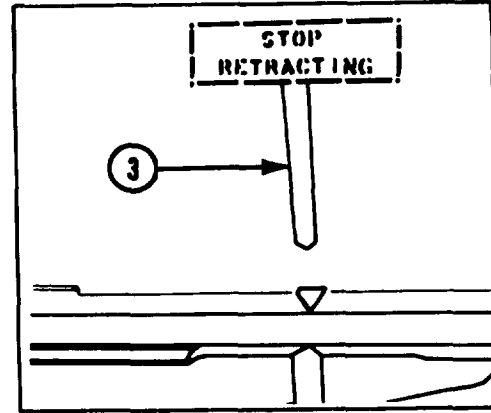


WARNING

Cannon must be in travel lock prior to retracting.

CAUTION

- Do not retract cannon beyond witness marks.
- Make sure travel support is engaged and gun mount is secure.



NOTE

Shutoff valve (kit 6 only) should remain open except prior to firing.

- 1 Assistant Gunner - Open shutoff valve (1) if present. Move retracting control valve handle (2) to RETRACT position and hold until cannon retracting witness marks (3) on cannon and slide align. If cannon and cradle do not have witness marks, retract cannon 54.25 in. (137.80 cm).
- 2 Assistant Gunner - Make sure retracting control valve handle (2) returns to NORMAL AND HOLD position.

RETURNING CANNON

WARNING

Establish hydraulic oil reserve (index pin is extended) before elevating weapon. Failure to establish hydraulic oil reserve could result in cannon sliding out of battery and injuring personnel.

- 1 Driver - Make sure engine speed is 650-700 rpm. Set hydraulic pump PTO clutch switch ON.

WARNING

Cannon must be in travel lock prior to returning.

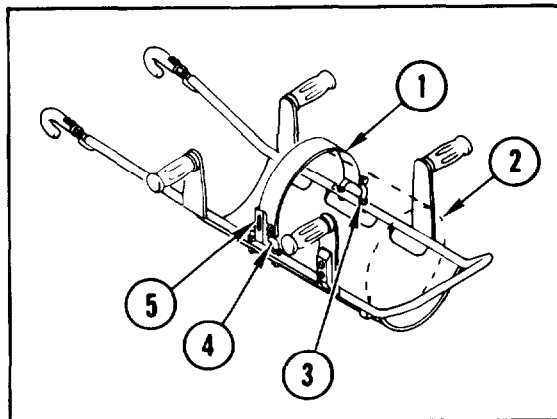
- 2 Assistant Gunner - Move retracting control valve handle (2) to RETURN position and hold until cannon is in battery.
- 3 Assistant Gunner - Make sure retracting control valve handle (2) returns to NORMAL AND HOLD position.

LOADER/RAMMER PRELOADING PROCEDURES

The following checks and adjustments, as necessary, should be performed to ensure the loader/rammer will operate properly. They must be performed upon receipt of a new weapon, retubing, and replacement or modification of the loader/rammer assembly. They must also be checked when the weapon is received back from support maintenance and on a weekly basis.

- **PROJECTILE TRAY ADJUSTMENT** - Makes sure that projectile will not bind.
- **VERIFYING CORRECT CANNON ELEVATION FOR LOADER/RAMMER** - Makes sure the load witness marks are located correctly so the cannon can
- return to the correct loading angle each time.
- **LOADER/RAMMER AND CANNON ALINEMENT** - Makes sure the loader/rammer will seat the projectile in the cannon chamber properly.
- **MARKING THE RAMMER CHAIN** - Ensures the rammer chain is marked with paint to ensure a check for depth of ram.
- **LOADER/RAMMER POSITION** - Makes sure the loader/rammer is mounted in the aft position so the longer 8-in. projectiles will not hit the cannon breech when being moved into ramming position.

PROJECTILE TRAY ADJUSTMENT



Cannoneer No. 1 - Perform the following procedure to adjust projectile trays.

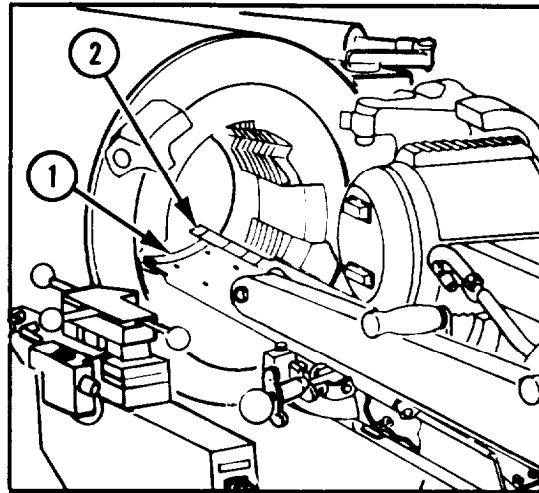
- 1 Place projectile (1) in tray.
- 2 Check clearance between strap (2) and projectile (1). Clearance should be 1/8 to 1/4 in. (0.32 to 0.64 cm).
- 3 Loosen nuts and adjust bracket (3) and/or catch U-bolt (4) to meet the clearance requirements.
- 4 Open and close strap (2) to make sure catch (5) automatically engages catch U-bolt (4). If needed, loosen nuts and adjust bracket (3) and/or catch U-bolt (4).
- 5 Place projectile tray and projectile in position on loader/rammer. Determine correct cannon elevation. Refer to page 2-90.

LOADER/RAMMER PRELOADING PROCEDURES-CONTINUED

VERIFYING CORRECT CANNON ELEVATION FOR LOADER/RAMMER

1 Chief of Section - Make sure the following have been done:

- Travel lock is released and stowed.. Refer to page 2-79.
- Cannon is in battery. Refer to page 2-88.
- Oil reserve is established and replenisher checked. Refer to page 2-121.



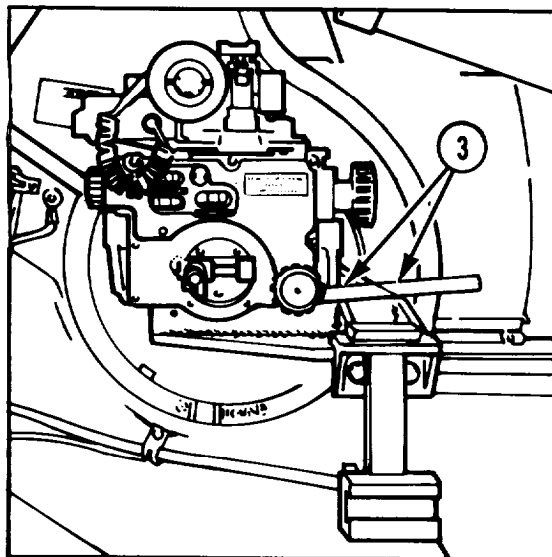
2 Cannoneer No. 1 - Release stow position lock and position loader/rammer into load position. Make sure ram position lock is engaged.

3 Cannoneers No. 1 and 2 - Extend rammer trough (1) into breech ring.

4 Assistant Gunner - Elevate and depress cannon manually until trough and tube are in rough alignment.

5 Cannoneer No. 1 - Lay any item (2) with a straight edge (steel ruler, aiming posts, or rammer staff section) across trough and breech to achieve fine alignment. Elevation or depression of the tube may be required.

6 Assistant Gunner - Verify that load marks (3) are alined. If load marks are missing, notify unit maintenance.



7 Cannon is now at proper elevation for loading and trough is parallel with cannon bore.

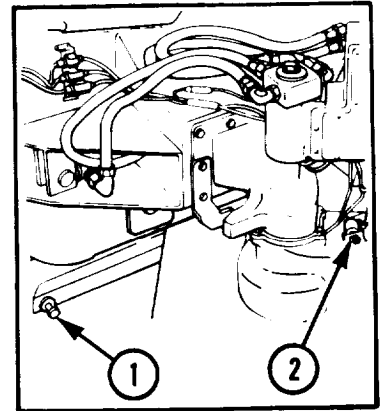
8 Aline loader/rammer and cannon. Refer to page 2-91.

LOADER/RAMMER PRELOADING PROCEDURES-CONTINUED

LOADER/RAMMER AND CANNON ALINEMENT

Cannoneer No. 1 - Perform the following procedure to aline loader/rammer and cannon under supervision of the chief of section.

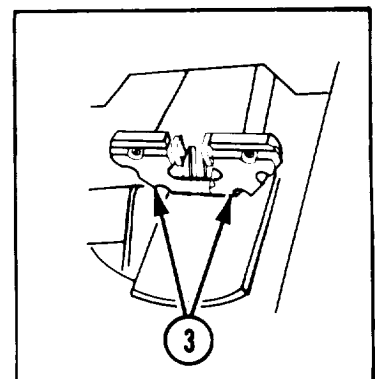
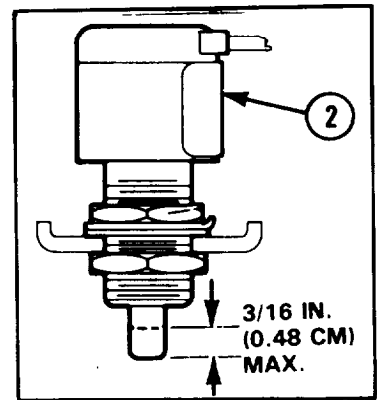
- 1 Check correct cannon elevation for loader/rammer. Refer to page 2-90.
- 2 Adjust stop (1) on rammer case with loader/rammer in load position and a-lined with cannon.



CAUTION

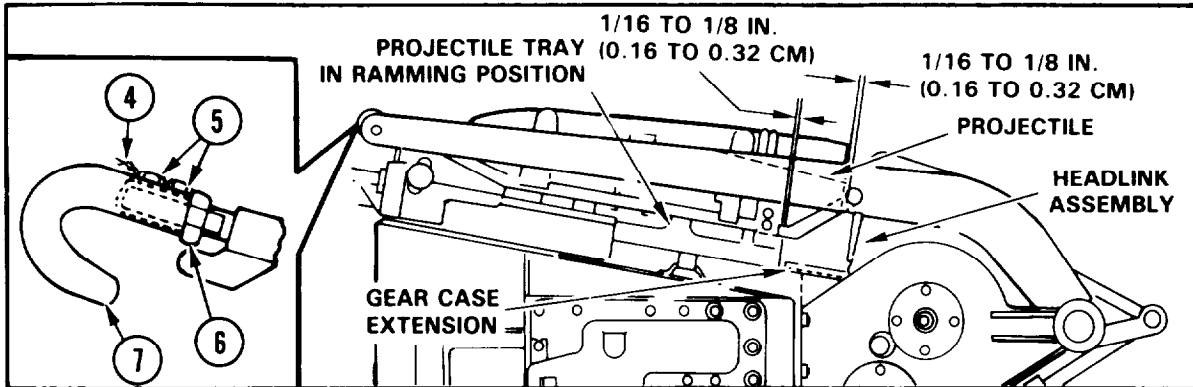
Improper adjustment of actuator plunger switch travel can damage switches. Be sure switches are adjusted and operating properly.

- 3 Adjust ram position switch (2) to close when loader/rammer and cannon are alined. Switch is closed when travel of plunger is 1/8 to 3/16 in. (0.32 to 0.48 cm).
- 4 Adjust headlink pads (3) to the extended position if necessary.
- 5 Elevate and lower loading arm with projectile and tray. Check rear of projectile as it moves past headlink for 1/16 to 1/8 in. (0.16 to 0.32 cm) clearance. If projectile does not clear headlink, remove projectile and proceed to steps 6 and 7 for tray hook adjustment.

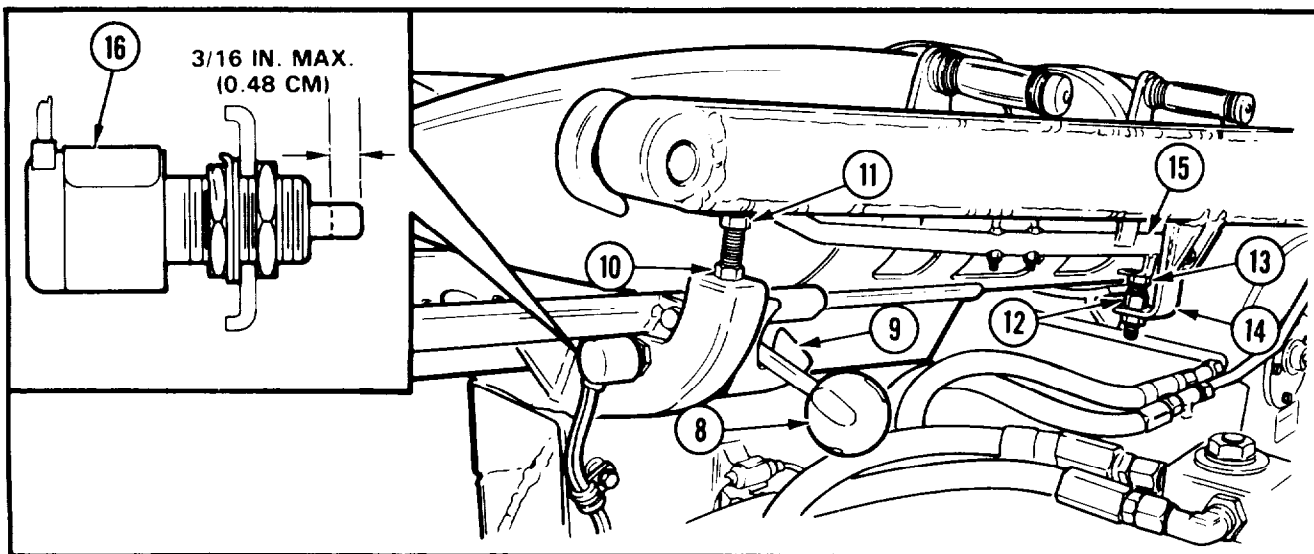


LOADER/RAMMER PRELOADING PROCEDURES-CONTINUED

LOADER/RAMMER AND CANNON ALINEMENT-CONTINUED



- 6 Elevate tray and load slowly onto trough. Remove lockwire (4). Loosen setscrews (5) and jamnuts (6) on tray hooks.
- 7 Turn hooks (7) to obtain 1/16 to 1/13 in. (0.16 to 0.32 cm) clearance between rear of tray and gear case extension.
- 8 Tighten jamnut (6) against hook (7). Tighten setscrews (5) in hooks (7) and secure with lockwire (4).
- 9 Adjust second tray (steps 5, 6, 7, and a).
- 10 Measure between rear of tray and gear case extension. Clearance should not exceed 1/8 in. (0.32 cm).



- 11 Slide trough forward until handle (8) locks in latch (9).
- 12 Adjust height of loader arm stops to aline projectile tray with gear case extension. Loosen jamnuts (10) and adjust screw stops (11) on each side of projectile tray with rear trough when rear trough is extended and locked in place. Tighten jamnuts (10) after adjustment.
- 13 Loosen jamnuts (12) and adjust screw stops (13) on both sides of loader arm stop bracket (14) to adjust height of projectile tray (15).

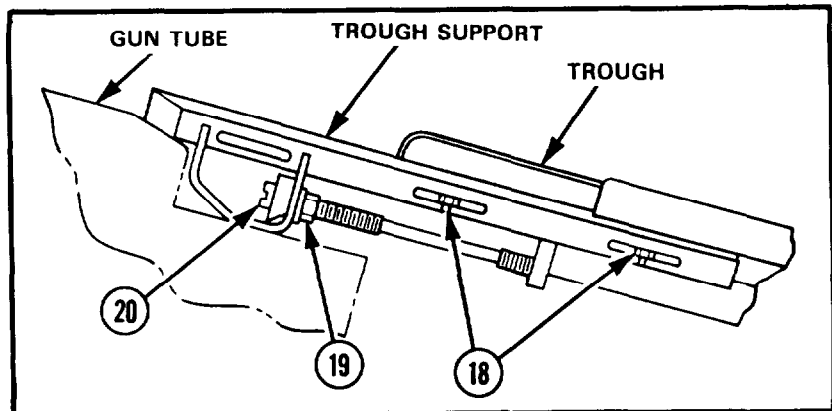
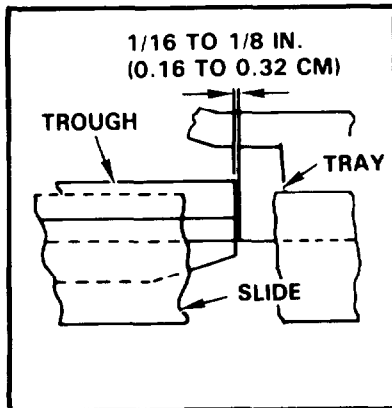
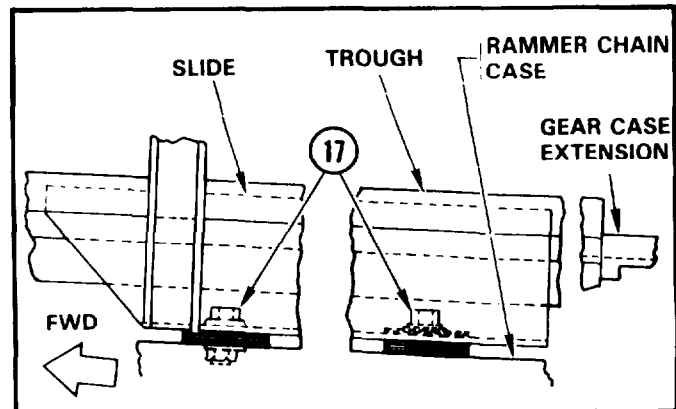
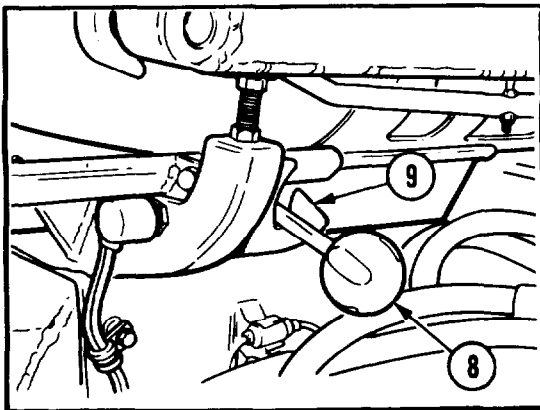
LOADER/RAMMER PRELOADING PROCEDURES-CONTINUED

LOADER/RAMMER AND CANNON ALINEMENT-CONTINUED

CAUTION

Improper adjustment of actuator plunger switch travel can damage switches.

- 14 Adjust tray interlock switch (16) to close when trough handle (8) locks in latch (9). Switch (16) is closed when travel of plunger is 1/8 to 3/16 in. (0.32 to 0.48 cm).



- 15 With trough handle (8) engaged in latch (9), check that clearance between aft end of trough and forward end of tray is 1/16 to 1/8 in. (0.16 to 0.32 cm). If required, loosen four screws (17) and move slide until proper clearance of 1/16 to 1/8 in. (0.16 to 0.32 cm) is obtained. Tighten screws (17).

- 17 Loosen nut (19) on screw (20). Turn screw (20) to position trough support to contact conical surface at entrance to tube. Tighten nut (19) on screw (20) and tighten four screws (18).

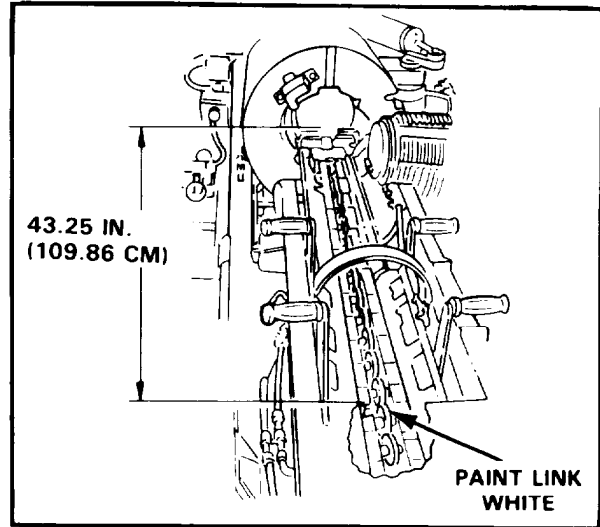
- 16 With trough handle (8) engaged in latch (9) and tray and projectile on trough, loosen four screws (18).

- 18 The support should slide freely into tube each time trough is moved to forward position. If necessary to adjust height of shim pack, notify unit maintenance.

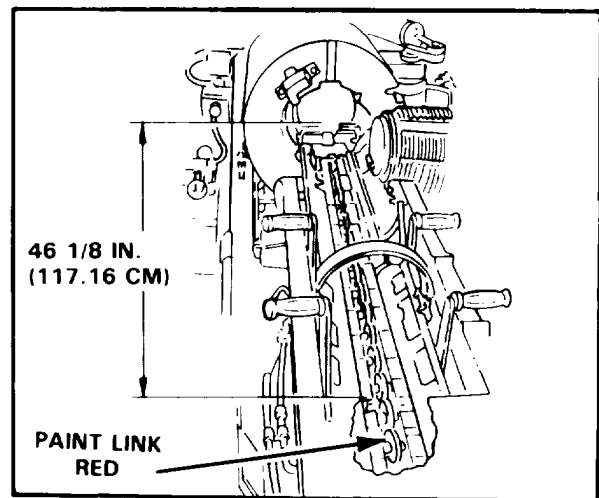
LOADER/RAMMER PRELOADING PROCEDURES -CONTINUED

MARKING THE RAMMER CHAIN

- 1 Attach a measuring device, such as a measuring tape, to the rammer head.
- 2 Manually crank out the rammer chain until there are 43.25 in. (109.86 cm) of chain extended from the face of the rammer head to the rear face of the breech ring.
- 3 At that point on the rammer chain directly opposite the rear face of the breech ring, paint the chain link on the rammer chain white. When ramming the M106, M404 or M426 projectiles, a proper depth of ram will be achieved when the white chain link is directly opposite the rear face of the breech ring.



- 4 Continue to manually crank out the rammer chain until there are 46 1/8 in. (117.16 cm) of chain extended from the face of the rammer head to the rear face of the breech ring.
- 5 At that point on the rammer chain directly opposite the rear face of the breech ring, paint the chain link on the rammer chain red. When ramming the M422A1, M424A1, M650, M753, and M509 projectiles, a proper depth of ram will be achieved when the red chain link is directly opposite the rear face of the breech ring.

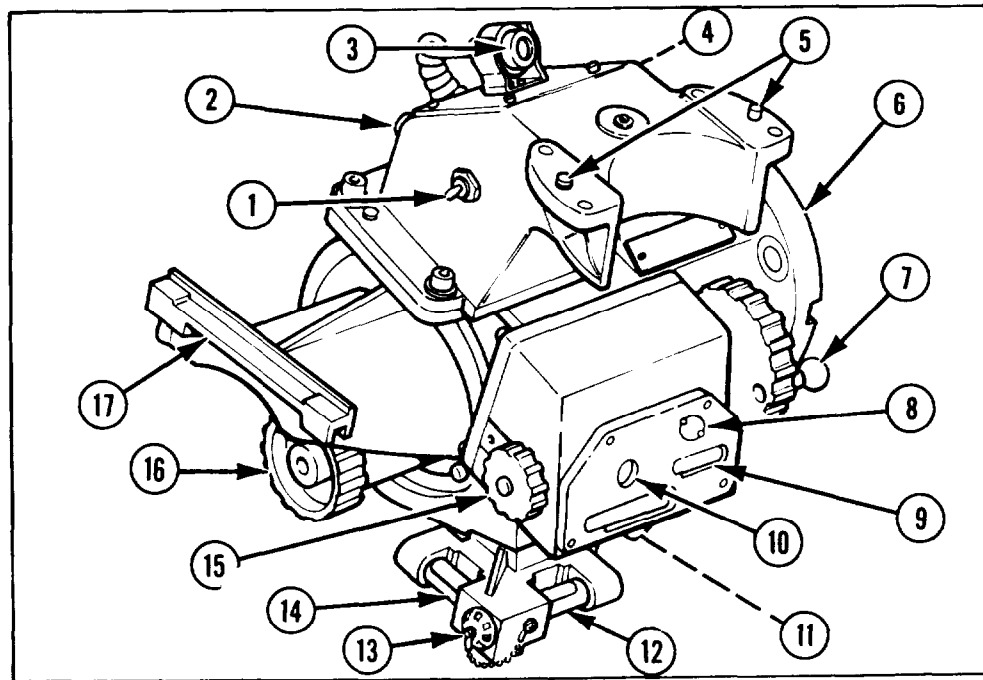


- 6 It must be understood that the above procedures have no effect on timing of the loader/rammer, but merely provide a check of the depth of ram for specific families of projectiles.

OPERATION OF FIRE CONTROL EQUIPMENT

OPERATION OF M137 TELESCOPE MOUNT AND M115 PANORAMIC TELESCOPE

M137 TELESCOPE MOUNT

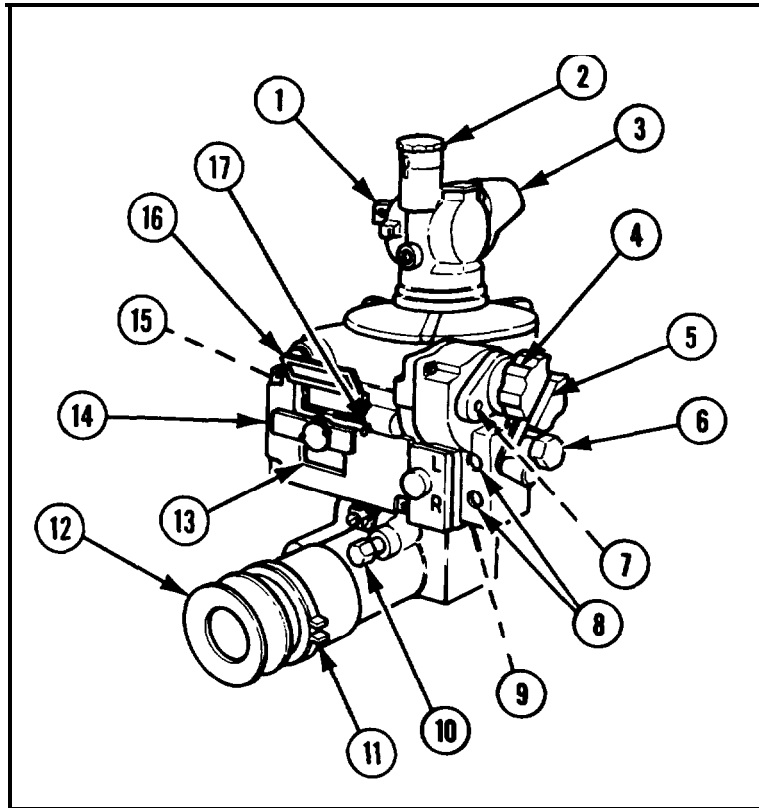


- | | |
|---|--|
| <p>(1) TOGGLE SWITCH. Push up to turn on lamps.</p> <p>(2) CONNECTOR. To connect power source.</p> <p>(3) INSTRUMENT LIGHT. To light M115 PANTEL reticle.</p> <p>(4) VARIABLE RHEOSTAT KNOB. Turn to vary amount of light for reticle lamp.</p> <p>(5) LOCATING PINS. Used to mount M115 PANTEL.</p> <p>(6) MOUNTING BRACKET. Secures mount to trunnion.</p> <p>(7) ELEVATION KNOB. Turn to set elevation counter (9) and center bubble in elevation-level vial.</p> <p>(8) LUMINATING ELECTRONIC DIODE (LED). Illuminates elevation counter (9).</p> | <p>(9) ELEVATION COUNTER. Registers elevation in mils.</p> <p>(10) CORRECTION COUNTER. Registers correction value for individual weapon in mils.</p> <p>(11) PURGING VALVE. Used to purge mount with nitrogen.</p> <p>(12) CROSS-LEVEL VIAL. Used to cross-level the mount.</p> <p>(13) LED. Illuminates level vials.</p> <p>(14) ELEVATION-LEVEL VIAL. Indicates a level position.</p> <p>(15) ELEVATION CORRECTION COUNTER KNOB. Turn to set correction counter.</p> <p>(16) CROSS-LEVEL CORRECTION KNOB. Turn to center cross-level vial.</p> <p>(17) LEVEL BAR. For gunner's quadrant.</p> |
|---|--|

OPERATION OF FIRE CONTROL EQUIPMENT-CONTINUED

OPERATION OF M137 TELESCOPE MOUNT AND M115 PANORAMIC TELESCOPE- CONTINUED

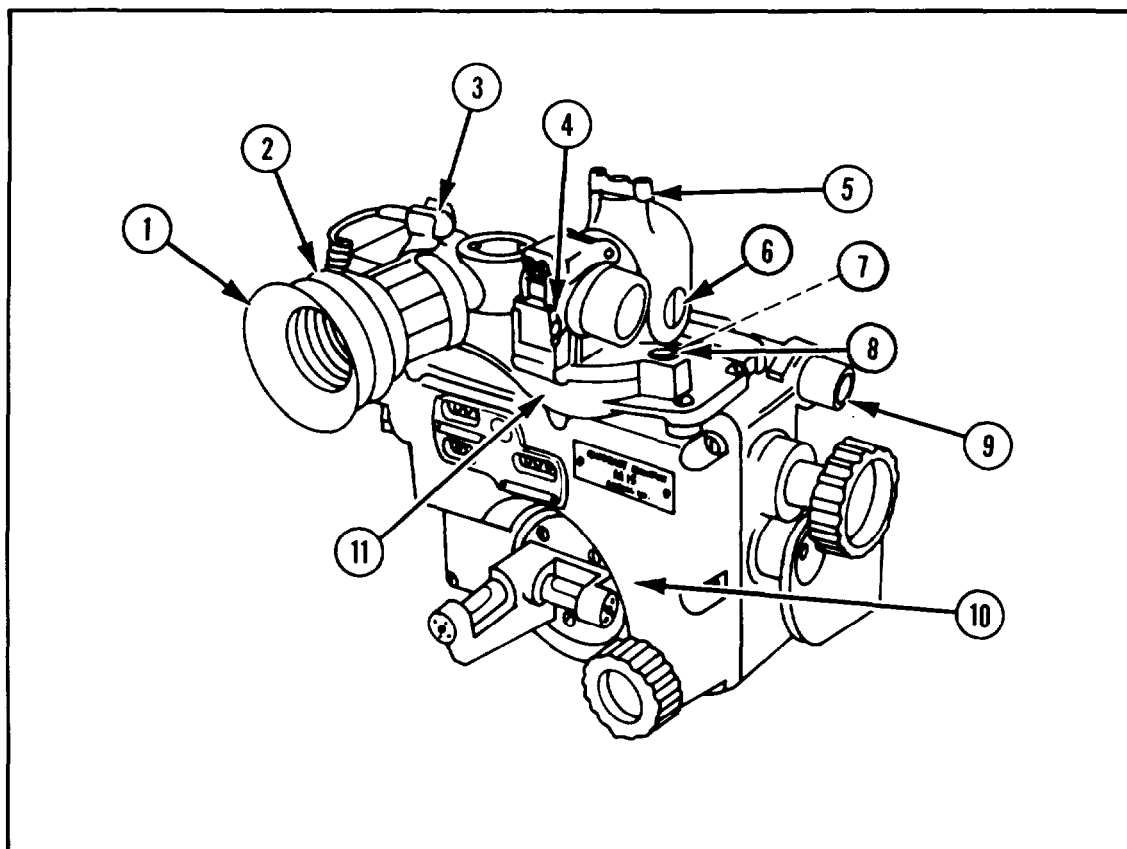
M115 PANORAMIC TELESCOPE



- | | |
|---|---|
| <p>(1) OPEN SIGHT. Sight on collimator or aiming post light.</p> <p>(2) ELEVATION KNOB. Turn to adjust reticle up or down 300 mils.</p> <p>(3) ROTATING-HEAD. Provides 6400 mil azimuth circle.</p> <p>(4) DIRECT FIRE BAR KNOB. Changes deflection in 5 mil increments for direct fire. When turned clockwise (so the word, DIRECT, faces the gunner), the panel will click every 5 mils.</p> <p>(5) AZIMUTH KNOB. Turn to set mils on azimuth and azimuth counter reset scale.</p> <p>(6) GUNNER' S AID KNOB. Turn to set correction in gunner' s aid counter.</p> <p>(7) BORESIGHT ADJUSTMENT. Slotted key adjusts azimuth and reset counter scales.</p> | <p>(8) GUNNER' S AID COUNTERS. Visual correction factor for individual weapon.</p> <p>(9) POWER RECEPTACLE. Receives power source.</p> <p>(10) VALVE ASSEMBLY. Used to purge and charge telescope with nitrogen.</p> <p>(11) EYEPIECE CLAMP. Secures eyepiece from M137 telescope mount.</p> <p>(12) EYEPIECE. Protects eyes.</p> <p>(13) RESET COUNTER. Registers azimuth travel in mils and resets azimuth.</p> <p>(14) LED. Illuminates all counters.</p> <p>(15) RESET KNOB. Push in and turn to reset the azimuth reset counter.</p> <p>(16) AZIMUTH COUNTER. Registers azimuth travel in mils.</p> <p>(17) COUNTER DOOR RELEASE. Slide dependent to rear to release counter door.</p> |
|---|---|

OPERATION OF FIRE CONTROL EQUIPMENT-CONTINUED

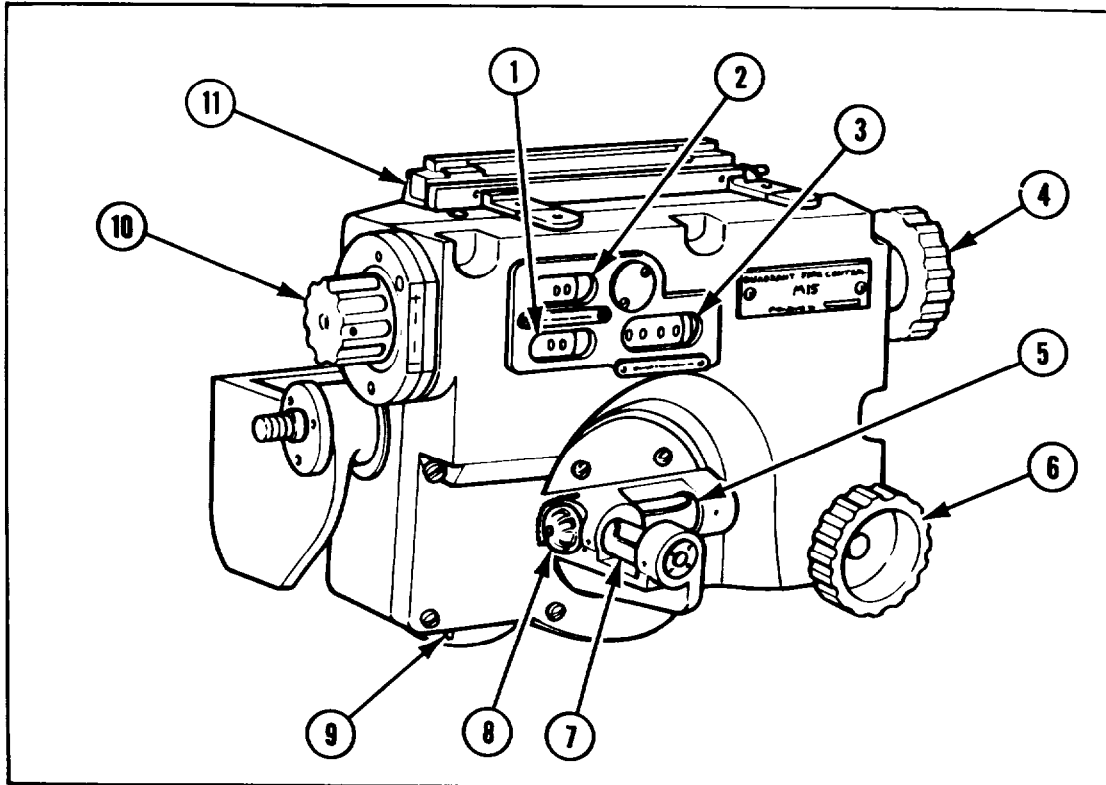
OPERATION OF M138 TELESCOPE MOUNT AND M139 DIRECT FIRE ELBOW TELESCOPE



- | | |
|---|---|
| <p>(1) EYEPIECE. Protects and shades eye.</p> <p>(2) LIGHT INTENSITY ADJUSTMENT (HIDDEN). Turn to vary amount of light for item (3).</p> <p>(3) RETICLE LED. Illuminates telescope reticle.</p> <p>(4) TELESCOPE HOLDDOWN LATCH. Secures M139 telescope to mount.</p> <p>(5) ELEVATION LOCKING LEVER. Locks mount in elevation after boresighting.</p> <p>(6) ELEVATION ADJUSTING SCREW. Used during boresighting to adjust mount in elevation.</p> | <p>(7) DEFLECTION LOCKING SCREW. Locks deflection adjustment cam in mount after boresighting.</p> <p>(8) DEFLECTION ADJUSTING CAM. Used during boresighting to adjust deflection in mount.</p> <p>(9) ELECTRICAL RECEPTACLE. To connect power source.</p> <p>(10) ELEVATION QUADRANT M15. Used to lay weapon and measure quadrant.</p> <p>(11) M138 TELESCOPE MOUNT. Provides mount for M139 telescope.</p> |
|---|---|

OPERATION OF FIRE CONTROL EQUIPMENT-CONTINUED

OPERATION OF M15 ELEVATION QUADRANT



- | | |
|--|--|
| <p>(1) NEGATIVE CORRECTION DIAL. Records negative correction.</p> <p>(2) POSITIVE CORRECTION DIAL. Records positive correction.</p> <p>(3) ELEVATION COUNTER DIAL. Records quadrant elevation.</p> <p>(4) ELEVATION KNOB. Changes elevation and operates elevation counter or centers elevation level vial.</p> <p>(5) ELEVATION LEVEL VIAL. Indicates a level position.</p> <p>(6) CROSS LEVEL KNOB. Turn to center cross level vial (7).</p> | <p>(7) CROSS LEVEL VIAL. Indicates a level position.</p> <p>(8) LED. Illuminates level vials.</p> <p>(9) TOGGLE SWITCH. Push to turn on LED.</p> <p>(10) CORRECTION KNOB. Turn to set correction for individual weapon. Registers on positive correction dial (2) or negative correction dial (1).</p> <p>(11) GUNNER'S QUADRANT SEAT. Used for gunner's quadrant.</p> |
|--|--|

PREPARATION FOR FIRING

EMPLACING THE HOWITZER

The vehicle being in position or approaching it, the command is PREPARE FOR ACTION.

The piece normally will be partially prepared for firing before reaching the firing position. The duties of the cannoneers in preparing for firing are the same whether the piece is moving or halted. Only the operations that are practicable are performed while moving. Immediately after the piece is established in position, preparation for firing is completed without further command.

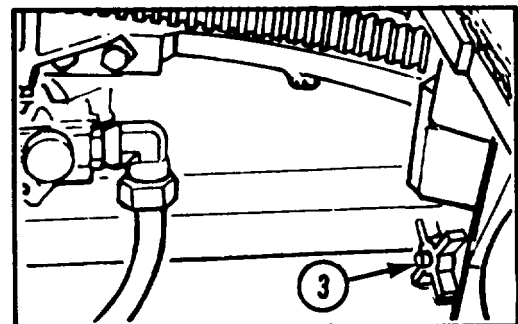
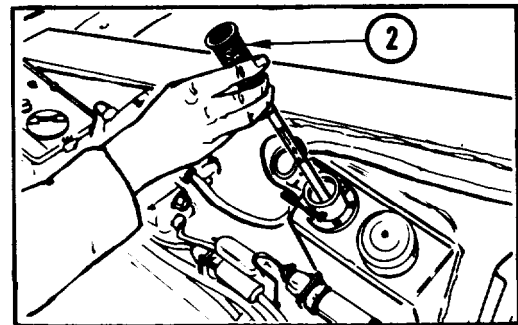
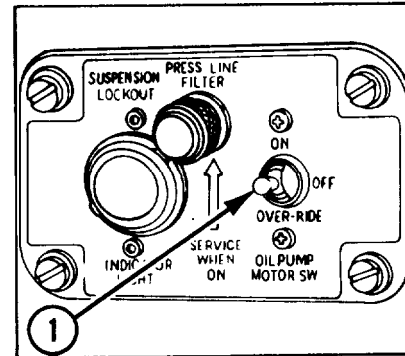
NOTE

Whenever the vehicle is unattended, the cannon will be returned to battery.

If PREPARE FOR ACTION has not been ordered before the piece is established in position, the command is habitually given by the chief of section as soon as the vehicle is halted. When preparation for firing is not desired, the command DO NOT PREPARE FOR ACTION must be given.

Duties of individuals follow. Each member takes his post on completion of his duties. Refer to page 1-18.

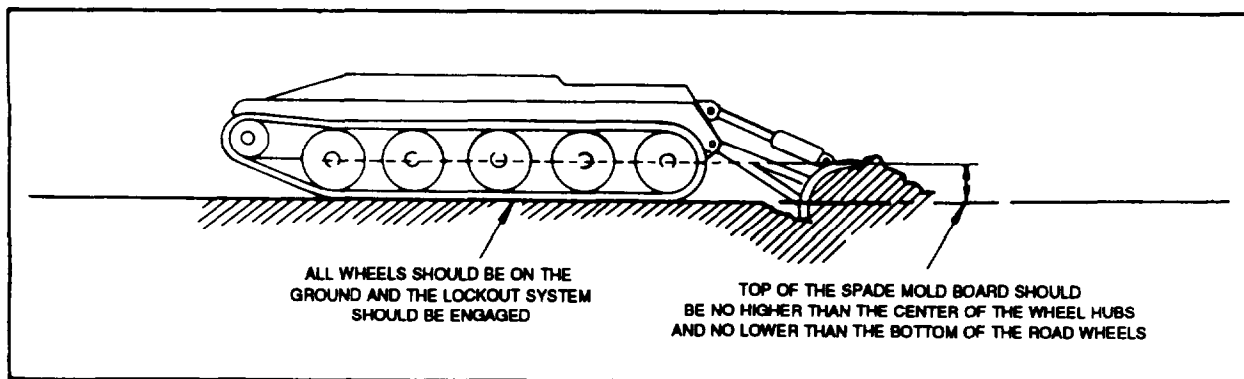
- 1 Chief of section commands PREPARE FOR ACTION and supervises the work of all section members.
- 2 Gunner sets OIL PUMP MOTOR switch (1) ON and then removes telescope cover.
- 3 Cannoneer No. 2 checks reservoir oil level (2) with cannon in battery and spade raised or lowered (emplaced). With HYDRaulic PUMP/PTO CLUTCH switch in OFF position, cannoneer No. 2 opens accumulator dump valve (3) to allow oil to flow back into reservoir, then closes valve securely. Oil should be at top FULL mark on dipstick. Cannoneer No. 2 fills reservoir as required (appx F) and restores pressure.



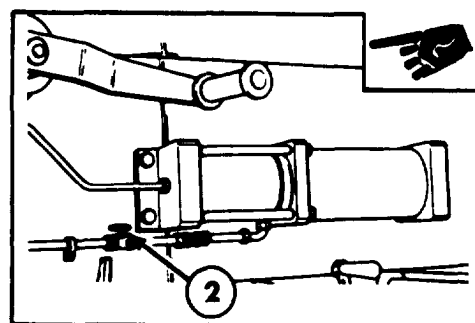
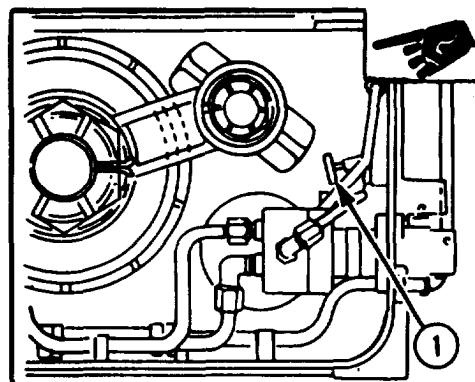
PREPARATION FOR FIRING -CONTINUED

EMPLACING THE HOWITZER- CONTINUED

- 4 Cannoneer No. 1 unlocks right spade cylinder. Chief of section unlocks left spade cylinder and lowers spade.
- 5 Assistant gunner removes quadrant cover, raises personnel seat, and assists cannoneer No. 1 in removing breech cover and placing it to right of vehicle.
- 6 ATC guides section vehicle into position.
- 7 Cannoneer No. 4 passes swab bucket and swab to cannoneer No. 2, while cannoneer No. 1 checks tubes and hoses for leaks and damage that would interfere with normal operation.
- 8 Cannoneers No. 3, 4, and ATC remove section boxes and powder charges from spade.
- 9 Cannoneer No. 5 lays wire to Fire Direction Center (FDC).



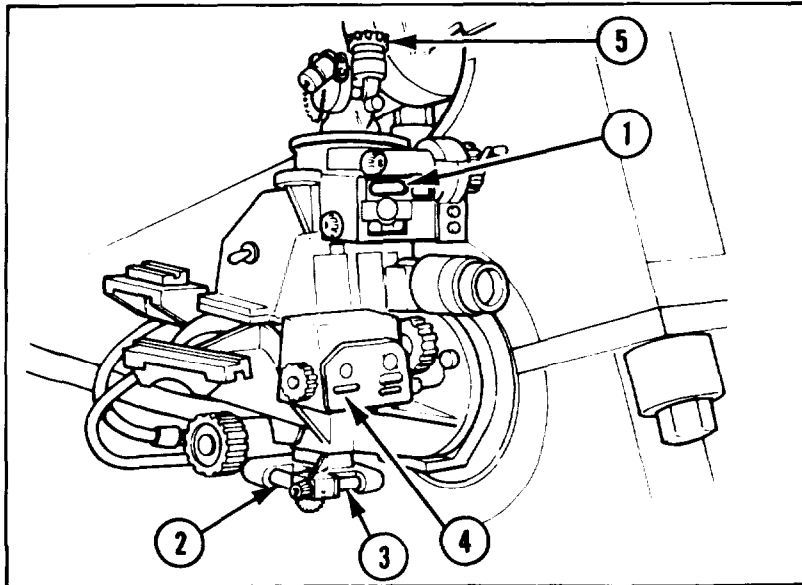
- 10 Gunner receives initial deflection and directs driver to shift howitzer as necessary.
- 11 Chief of section directs howitzer driver and emplaces spade. Refer to page 2-83.
- 12 Assistant gunner returns cannon to battery (refer to page 2-88) and closes shutoff valve (1)
- 13 Gunner and assistant gunner establish oil reserve in recuperator cylinder while cannoneer No. 2 opens replenisher shutoff valve (2) and checks replenisher for proper operation. Refer to page 2-121.



PREPARATION FOR FIRING -CONTINUED*EMPLACING THE HOWITZER- CONTINUED*

- 14** Cannoneer No. 6 obtains collimator and aiming posts and prepares them for emplacement.
- 15** Cannoneer No. 5 obtains fuse setters and wrenches.
- 16** Assistant gunner places cannon assembly to the in-battery position. Refer to page 2-88.
- 17** Cannoneer No. 6 removes muzzle brake cover and places with section equipment.
- 18** Assistant gunner, assisted by cannoneer No. 2, releases and stows travel support and places cannon at load elevation.
- 19** Gunner lays howitzer for direction of fire; directs cannoneer No. 6 in emplacing collimator, selects distant aiming point (DAP), and ensures that all aiming points are recorded on gunner's reference card.
- 20** Cannoneer No. 5 obtains primers and passes to cannoneer No. 2.
- 21** Cannoneer No. 2 opens breech and inspects cannon, breechblock, primer vent, obturator group, and witness marks.
- 22** Cannoneer No. 2 closes gunner recoil valve (modified vehicles only).
- 23** ATC directs ammo carrier driver to position vehicle.
- 24** Cannoneers No. 3, 4, 5, and 6 prepare ammunition as directed by the ATC.
- 25** Cannoneer No. 1 moves loader/rammer to rear and lowers loading arm.
- 26** Chief of section, assisted by gunner and assistant gunner, obtains sight and range crest and reports it to FDC. Refer to page 2-108.
- 27** Chief of section ensures that weapon is boresighted (refer to page 2-108), conducts prefire checks (refer to page 2-124), and reports to battery executive officer NUMBER (so and so) IN ORDER, or reports any defects that can't be corrected without delay.

LAYING HOWITZER USING M2 AIMING CIRCLE METHOD

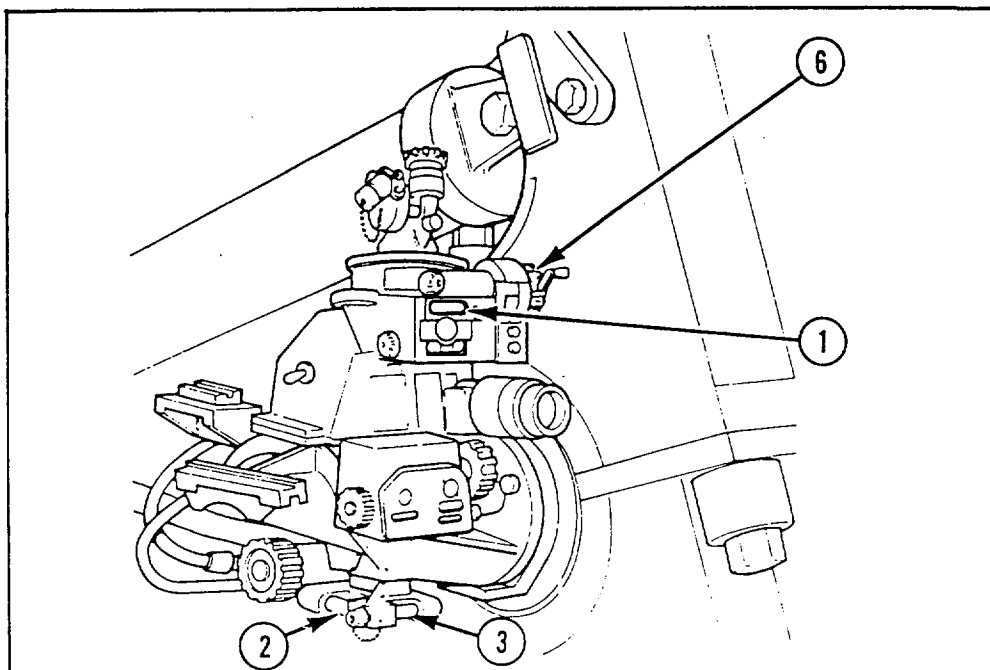


NOTE

Gunner uses M115 pantel to lay howitzer for direction.

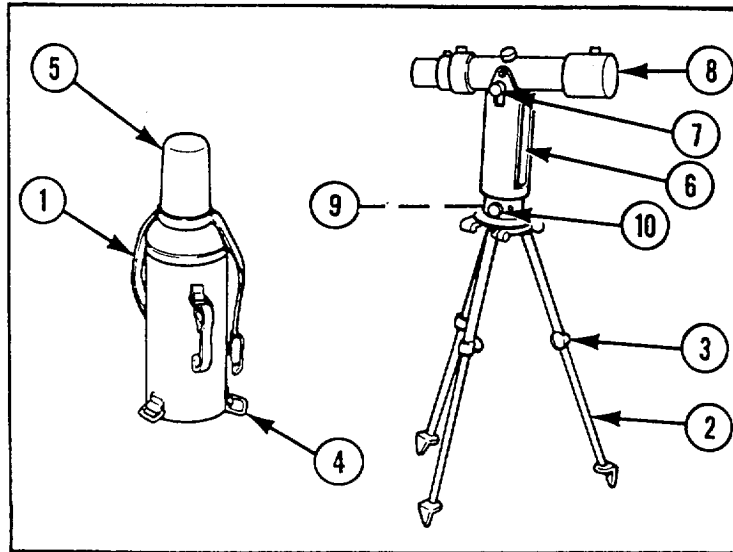
- 1 The piece being in position, cannon in center of traverse and not laid for direction, the gunnery sergeant commands BATTERY/PLT ADJUST AIMING POINT THIS INSTRUMENT.
- 2 The gunner rotates head of sight toward aiming circle and then replies NUMBER (SO AND SO), AIMING POINT IDENTIFIED. The gunnery sergeant commands NUMBER (SO AND SO), DEFLECTION (SO MUCH).
- 3 The gunner repeats the command, opens the door of the azimuth counter (1), and sets the deflection on the azimuth counter. He then directs the driver to move the howitzer until the vertical crosshair of the sight reticle is approximately on the aiming circle. The spade is emplaced and the cannon placed in battery.
- 4 Gunner ensures elevation level bubble (2) and cross level bubble (3) on the M137 mount are centered and gunner's aid zero correction counter (4) is set at zero.
- 5 Assistant gunner sets quadrant on M15 elevation quadrant, then depresses or elevates howitzer until elevation quadrant level vial bubble centers. Ensure that elevation and cross level vial bubbles are centered throughout laying process.
- 6 Sighting through M115 PANTEL, (and operating the traversing handwheel) the gunner traverses the tube until PANTEL vertical reticle line is centered on lens of aiming circle. Horizontal alinement is obtained by turning elevation knob (5). Gunner then announces NUMBER (SO AND SO) READY FOR RECHECK.
- 7 Gunnery sergeant determines azimuth reading to howitzer and announces NUMBER (SO AND SO), DEFLECTION (SO MUCH).

LAYING HOWITZER USING M2 AIMING CIRCLE METHOD-CONTINUED



- 8** Upon announcement of deflection, gunner repeats deflection by announcing NUMBER (SO AND SO), DEFLECTION (SO MUCH), and rotates azimuth knob (6) until announced deflection appears on azimuth counter (1).
- 9** Operating traversing mechanism and sighting through pantel, gunner traverses weapon until pantel crosshairs are centered on lens of aiming circle, ensuring that elevation level (2) and cross level (3) bubbles are centered.
- 10** Gunner announces to the gunnery sergeant, NUMBER (SO AND SO), READY FOR RECHECK.
- 11** Gunnery sergeant determines a new deflection reading to howitzer and announces, NUMBER (SO AND SO), DEFLECTION (SO MUCH).
- 12** Upon announcement of new deflection gunner repeats deflection and difference between new deflection reading and reading on azimuth counter (1) to gunnery sergeant by saying, NUMBER (SO AND SO), DEFLECTION (SO MUCH), (SO MANY), MILS.
- 13** Gunner then rotates azimuth knob (6) until new deflection appears on azimuth counter (1).
- 14** Operating traversing mechanism and sighting through pantel, gunner traverses the weapon until pantel crosshairs are centered on lens of aiming circle with mount elevation level (2) and cross level (3) bubbles centered.
- 15** Gunner and gunnery sergeant repeat steps 9 thru 13 until difference between azimuth reading to pantel and reading on pantel azimuth counter (1) is 0 mils. Gunnery sergeant then announces, NUMBER (SO AND SO) is LAID.
- 16** Upon the command, LAID, gunner records value appearing on azimuth counter (1). The tube is now oriented for direction and will not be traversed until an aiming point is established.

EMPLACING M1A1 INFINITY AIMING REFERENCE COLLIMATOR

**WARNING**

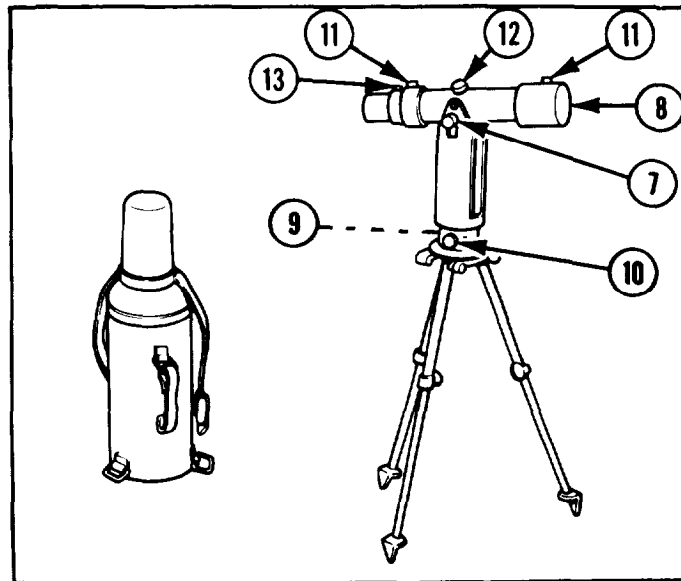
The M1A1 collimator is radioactively illuminated. Check for presence of illumination and damage. If discovered broken, damaged or defective, follow procedures listed on page a.

NOTE

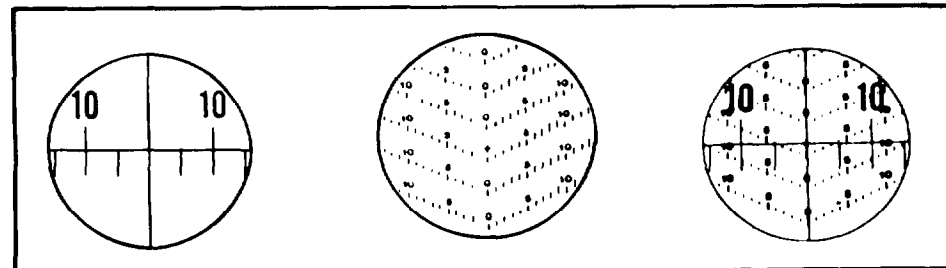
Although positioning of the collimator to the left front at 4-15 m gives the optimum sight picture, it should be pointed out that camouflaging is the most important consideration when emplacing the collimator.

- 1 Cannoneer No. 6-Unfasten strap (1).
- 2 Cannoneer No. 6-Extend legs (2) as necessary. Lock legs by tightening knobs (3).
- 3 Cannoneer No. 6-Swing legs to down position. At a location 4-15 m (best results are obtained from 5-12 m depending on the terrain) to the left front of vehicle and out of danger from muzzle blast, set each leg firmly into ground with one leg of tripod toward panel.
- 4 Cannoneer No. 6-Release three latches (4) and remove cover (5). Place cover between tripod legs, closed end facing toward vehicle. Place sandbags as necessary to hold tripod legs in or down.
- 5 Cannoneer No. 6-Unfasten strap (6), loosen clamping knob (7), and rotate collimator (8) to horizontal position.
- 6 Cannoneer No. 6-Center azimuth adjustment using adjustment knob (9).
- 7 Cannoneer No. 6-Loosen clamping knob (10).

EMPLACING M1A1 INFINITY AIMING REFERENCE COLLIMATOR -CONTINUED



- | | |
|--|---|
| <p>8 Cannoneer No. 6-Aim collimator (8) at pantel objective lens by sighting along front and rear sights (11).</p> <p>9 Cannoneer No. 6-Tighten clamping knobs (7 and 10).</p> <p>10 Cannoneer No. 6-Loosen clamping knob (12).</p> | <p>11 Cannoneer No. 6 -Rotate collimator (8) until cross level vial bubble (13) is centered.</p> <p>12 Cannoneer No. 6-Tighten clamping knob (12).</p> <p>13 Gunner-Lay weapon and aline corresponding mil graduations of pantel reticle with those of collimator reticle.</p> |
|--|---|



- 14** Gunner -Sight through pantel and have cannoneer No. 6 rotate collimator azimuth adjusting knob (9) until pantel crosshairs are centered with collimator reticle center as shown. Then motion cannoneer No. 6 in.

NOTE

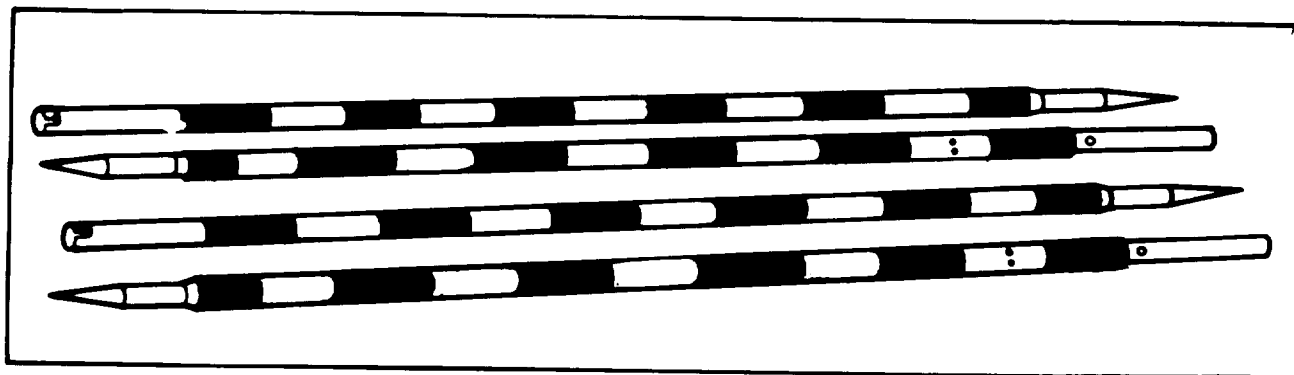
If weapon jumps during firing, traverse cannon until reticle match is obtained and cannon is alined parallel to its original position. Whenever a new deflection is set into pantel, traverse cannon until reticle match is again achieved. This will put cannon back on target.

EMPLACING M1A2 AIMING POSTS

NOTE

M1A2 aiming posts are an alternate aiming reference and are emplaced, time permitting, immediately following emplacement of M1A1 collimator.

- 1 With howitzer laid on initial azimuth of fire, gunner checks to ensure that:
 - (a) Pantel pitch and cross level vial bubbles are centered.
 - (b) Gunner's aid counters on pantel are set at zero.



- 2 Cannoneer No. 6 emplaces aiming posts as follows:

- (a) Removes aiming posts from carrying case and assembles two sections for far aiming post.
- (b) At night, remove M14 aiming post lights from light chest and installs lights on aiming posts.

NOTE

State which light to use on near post and which to use on far post and instructions for aiming post emplacement.

- 3 Cannoneer No. 6 runs out approximately 50 m with both aiming posts

and sticks near post (short post) in ground. He continues an additional 50 m stops and faces gunner, and emplaces far post (long post) aligned with body and waits for direction from gunner to align it with vertical line of pantel. Cannoneer returns to near aiming post and positions it by observing hand signals of gunner.

- 4 Sighting through pantel, gunner positions aiming posts by extending his left hand above his head having cannoneer move as directed by following hand movements.

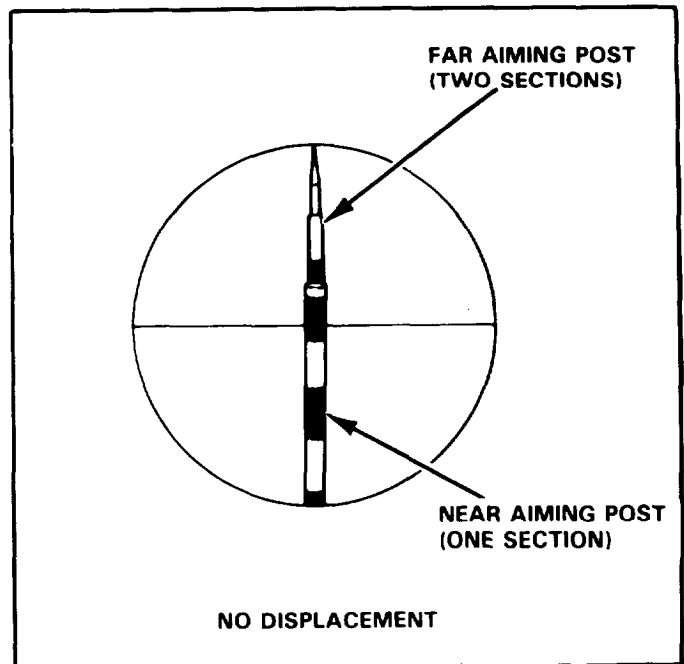
EMPLACING M1A2 AIMING POSTS-CONTINUED

NOTE

At night, this method can be used with a flashlight in an ON and OFF mode:

- (a) TO GO OUT: Position hand chest high, fingers up, palm out, and move arm in and out.
- (b) TO MOVE CLOSER: Position hand chest high, fingers up, palm in, and move arm in and out.
- (c) TO MOVE AIMING POST TO GUNNER'S LEFT: Raise hand head high to left of head, palm out, and move arm in and out.
- (d) TO MOVE AIMING POST TO GUNNER'S RIGHT: Raise hand head high to right of head, palm out, and move arm in and out.
- (e) TO STICK AIMING POST: Place hand head high, in front of body, fist clenched, and motion downward.
- (f) TO REMOVE AIMING POST: Place hand head high, in front of body, fist clenched, and motion upward.
- (g) TO ALINE AIMING POST: First, tap top of helmet with right or left hand, and then use same signals used to move aiming post left or right.
- (h) TO STOP AIMING POST MOVEMENT: Clench fist of hand being used to move aiming post.
- (i) TO COME IN: Raise arms chest high, place one hand in front of the other, and rotate hands inward.

5 After aiming posts are emplaced, sight picture should be as illustrated (no displacement).



MEASURING SIGHT TO CREST

NOTE

Make sure you have established your aiming points.

- 1 Chief of section selects highest crest in his sector of fire.
- 2 Chief of section sights along the bottom part of tube.
- 3 Directs gunner to traverse, and assistant gunner to elevate, tube until bottom of tube just clears crest.
- 4 Directs assistant gunner to level cross level vial and elevation bubbles.
- 5 Reads quadrant off of quadrant elevation scale, records this reading, and estimates range to crest (gunner's quadrant may also be used).
- 6 Reports quadrant and estimated range to executive officer, "SIR, NUMBER (SO AND SO) SITE TO CREST (SO MUCH) AT (SO MUCH) RANGE."
- 7 Chief of section may have gunner measure and record deflection to crest, if desired.
- 8 To measure deflection, gunner levels cross and pitch level vials, turns head of telescope to collimator/aiming post, and records deflection from azimuth counter reset scale.

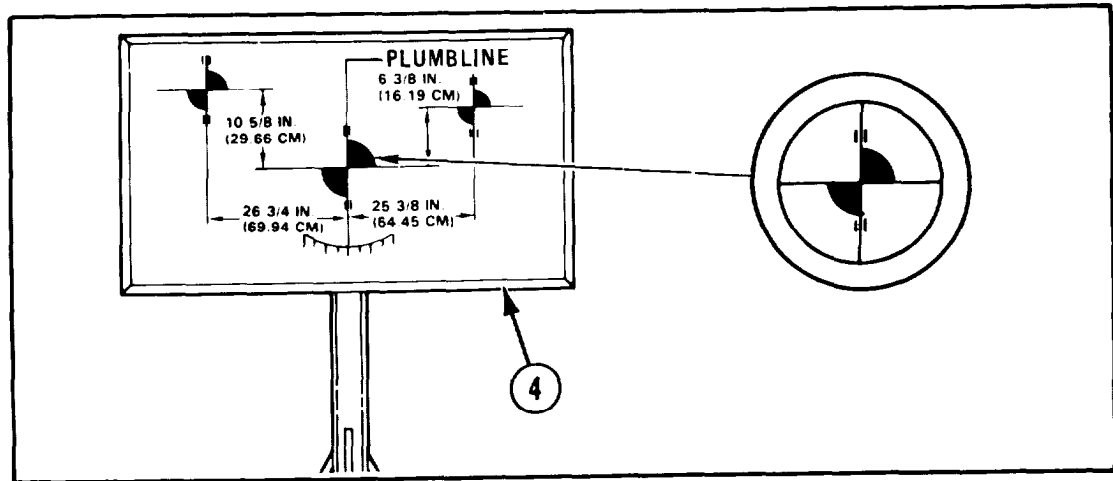
BORESIGHTING PROCEDURES FOR TEST TARGET METHOD USING SCRIBED M137 PANORAMIC TELESCOPE MOUNT

NOTE

Boresighting using these procedures does not require level trunnions. However, the M137 mount must be scribed, refer to page 3-86.

- 1 Depress gun tube to depression stops.
- 2 Retract firing mechanism block (1) from fire position so primer vent is exposed.
- 3 Insert muzzle crosshairs (2) through holes in muzzle brake and aline with witness marks on face of tube. Secure crosshairs with tape (3).

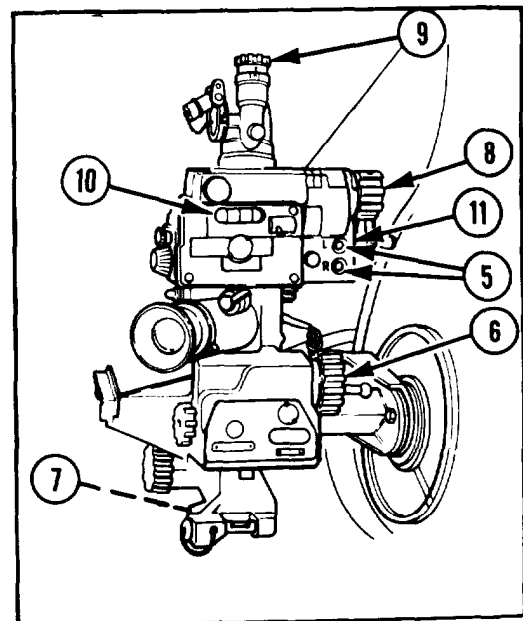
BORESIGHTING PROCEDURES FOR TEST TARGET METHOD USING SCRIBED M137 PANORAMIC TELESCOPE MOUNT-CONTINUED



NOTE

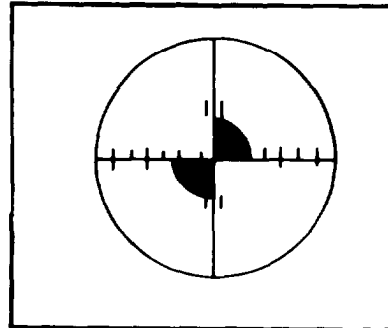
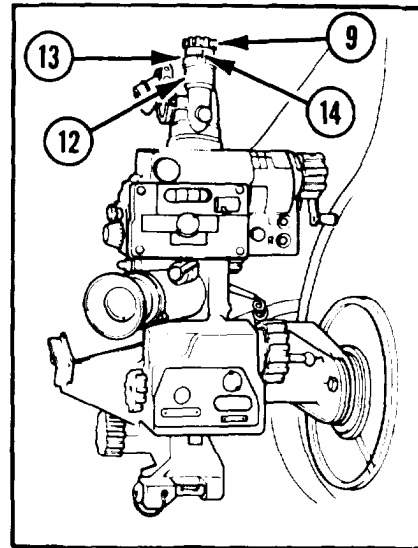
Test target is fabricated; measurements are added for fabrication only.

- 4 Position boresight test target (4) at least 50 m in front of weapon.
- 5 Moving the test target and not the tube, aline vertical and horizontal muzzle crosshairs on center aiming diagram.
- 6 Set gunner's aid counter (5) to 0.
- 7 Aline scribe lines on M137 mount.
- 8 Using mount elevation knob (6), center elevation level vial bubble (7).
- 9 Adjust azimuth (8) and pantel elevation (9) knobs to aline vertical and horizontal lines of pantel reticle pattern precisely on the left aiming point.
- 10 Check that muzzle crosshairs are still centered on the center aiming diagram.
- 11 The azimuth counter (10) should read 3200 mils. If it does not, insert small screwdriver in boresight adjustment detent (11), depress detent shaft, and turn until 3200 appears on azimuth counter (10). Recheck sight pattern to be sure pantel is still in boresight.



BORESIGHTING PROCEDURES FOR TEST TARGET METHOD USING SCRIBED M137 PANORAMIC TELESCOPE MOUNT-CONTINUED

- 12 Verify that muzzle crosshairs and pantel reticle lines are still properly aligned.
- 13 If the zero mark on pantel micrometer scale (12) is not on witness mark on rotating head assembly (13), loosen three screws in pantel elevation knob (9) and without moving pantel elevation knob (9), slip micrometer scale (12) until zero marks on micrometer scale (12) are aligned with witness mark. Tighten screws in pantel elevation knob (9) to secure. Recheck sight picture. Peep sight alignment scribe marks (14) should align with micrometer scale zero marks. If witness marks do not aline on M115 pantel, notify unit maintenance.
- 14 Weapon pantel is now boresighted.

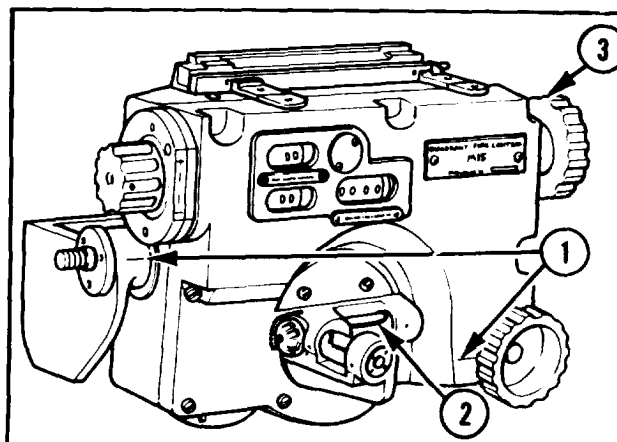


BORESIGHTING DIRECT FIRE TELESCOPE USING TESTING TARGET WITH SCRIBED M15 ELEVATION QUADRANT

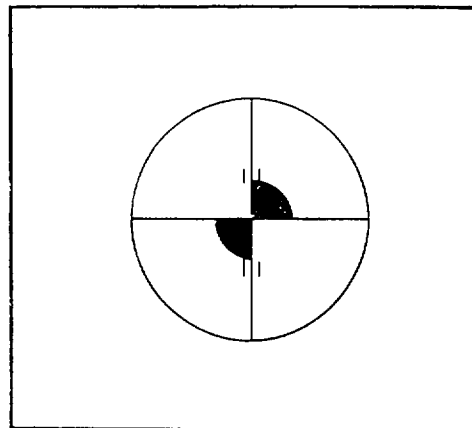
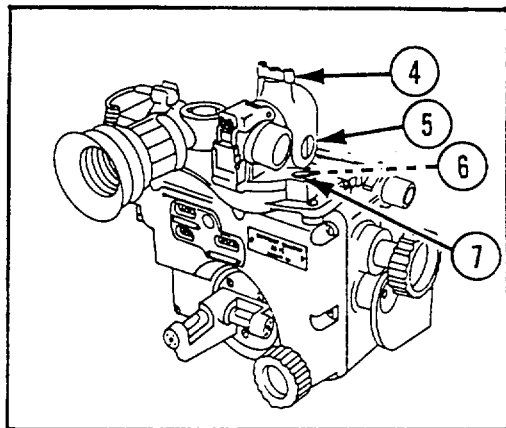
NOTE

When boresighting the direct fire telescope using the test target and a scribed M15 elevation quadrant, the trunnions do not have to be level.

- 1 Carefully aline both sets of scribe lines (1) on M15 quadrant.
- 2 Center elevation level vial bubble (2) using elevation knob (3).
- 3 Make sure muzzle crosshairs are still properly alined on center aiming diagram.



BORESIGHTING DIRECT FIRE TELESCOPE USING TESTING TARGET WITH SCRIBED M15 ELEVATION QUADRANT-CONTINUED



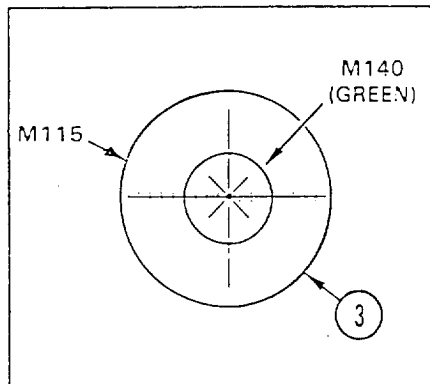
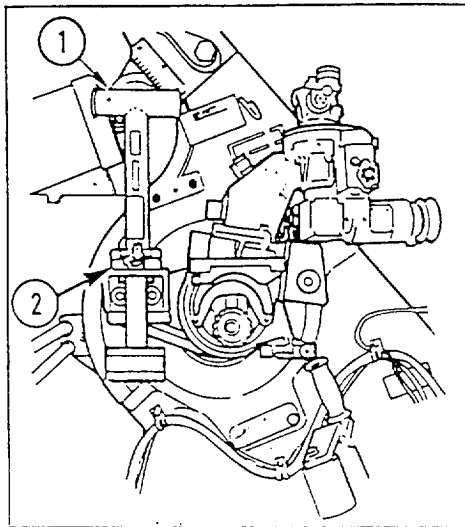
4 Turn elevation locking lever (4) to loosen elevation adjusting screw (5). Turn elevation adjusting screw (5) until horizontal line is laid precisely on right aiming diagram. Turn elevation locking lever (4) to lock elevation locking screw (5).

5 Loosen deflection locking screw (6) and rotate deflection adjusting cam (7) until vertical crosshair is laid precisely on right aiming diagram. Tighten deflection locking screw (6) to secure. Recheck sight picture.

6 Direct fire telescope is now boresighted.

CHECKING M140 ALINEMENT DEVICE WHILE BORESIGHTING ON TEST TARGET

- 1 Aline cannon, M115 pantel, and M139 elbow telescope on test target. Refer to pages 2-108 thru 2-111.



- 3 Check alinement of M140 alinement device reticle (3) against reticle of M115 pantel laid on left hand butterfly of test target. Reticles should aline within 0.5 mils.

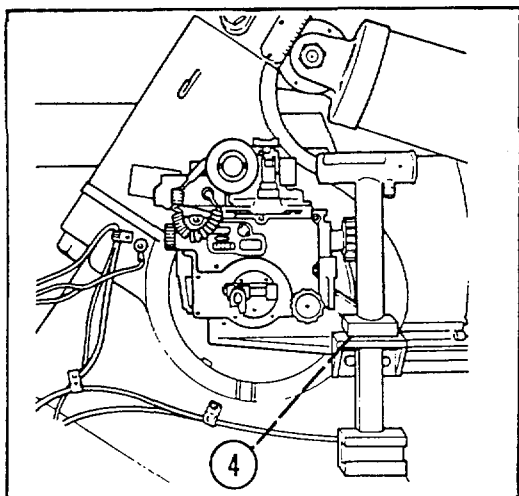


WARNING

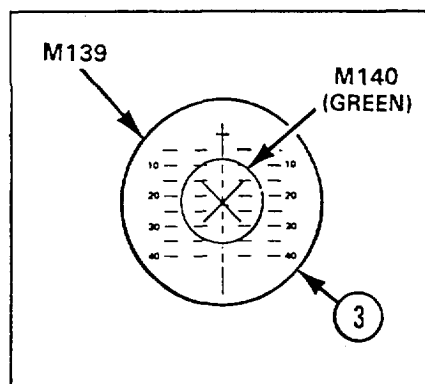
The M140 alinement device is radioactively illuminated. Check for loss of luminescence, breakage, damage or defects. If present, follow the procedures on page a.

- 2 Install M140 alinement device (1) on dovetail bracket (2).

CHECKING M140 ALINEMENT DEVICE WHILE BORESIGHTING ON TEST TARGET-CONTINUED



- 4 Remove M140 alinement device (1) from dovetail bracket (2) and install on dovetail bracket (4).
- 5 Check alinement of M140 alinement device reticle against reticle (3) of M139 elbow telescope laid



on right hand butterfly of test target. Reticles should aline within 0.5 mils.

- 6 If M140 alinement device does not aline with telescope reticles, notify unit maintenance.

BORESIGHTING M115 PANORAMIC TELESCOPE USING DISTANT AIMING POINT (DAP) METHOD

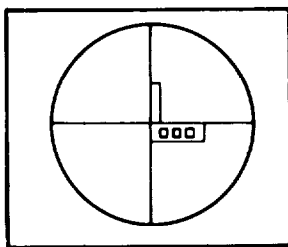
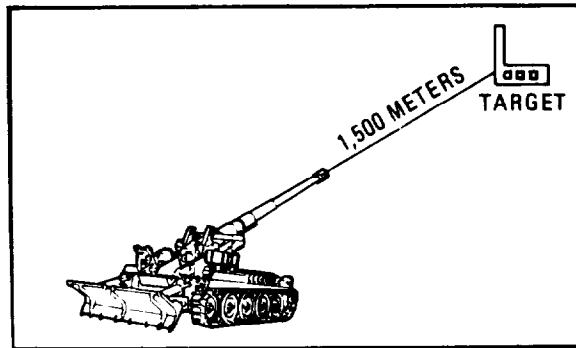
NOTE

Trunnions must be level within 5 degrees (90 mils).

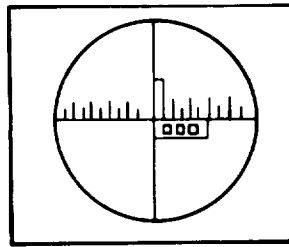
- 1 Select an aiming point with well-defined vertical and horizontal axis at least 1500 meters distant.

- 2 Retract firing mechanism block from fire position so primer vent is exposed. Insert muzzle crosshairs through holes in muzzle brake and aline with witness marks on face of tube. Secure crosshairs with tape, refer to page 2-108.

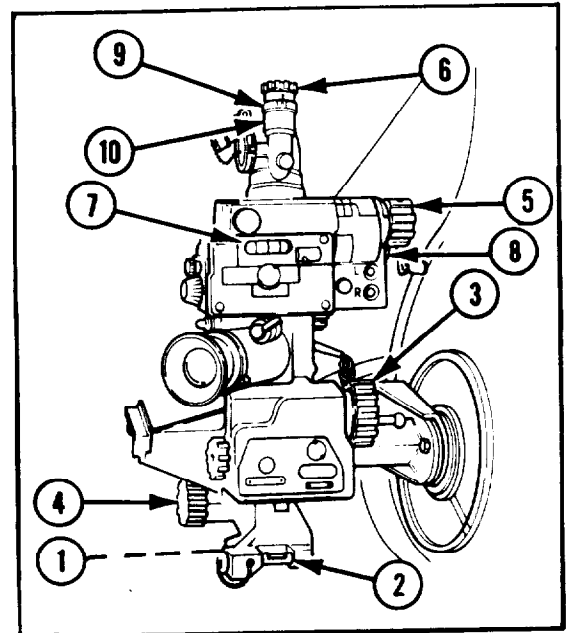
BORESIGHTING M115 PANORAMIC TELESCOPE USING DISTANT AIMING POINT (DAP) METHOD-CONTINUED



BORESIGHT PATTERN



M115 TELESCOPE SIGHT PATTERN

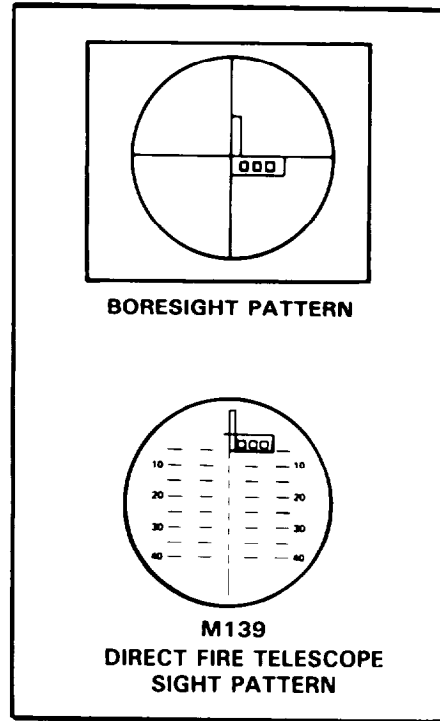
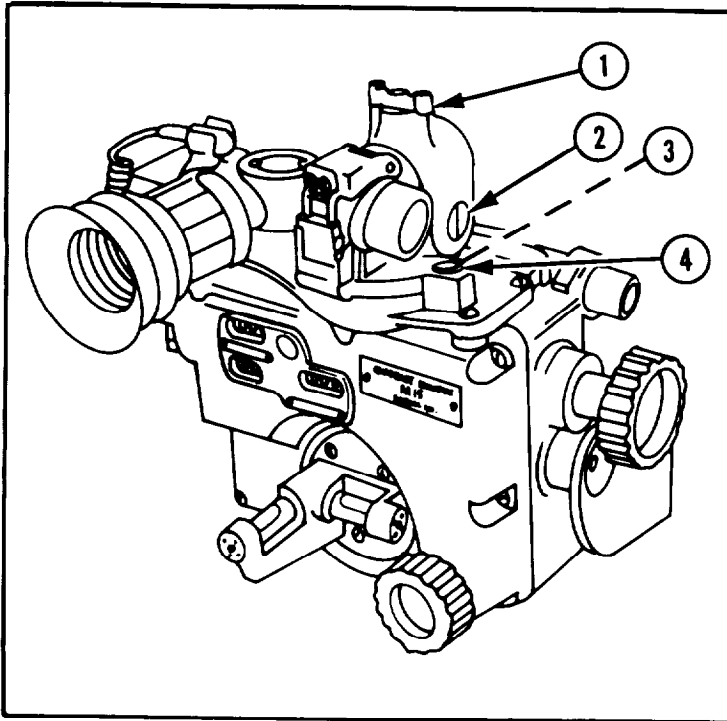


- 3 Depress tube to depression stops.
- 4 Level M137 mount by centering elevation (1) and cross level (2) bubbles by rotating elevation knob (3) and cross level knob (4).
- 5 Level M15 quadrant by centering cross level and elevation level bubbles by turning cross level and elevation knobs.
- 6 Elevate and traverse tube to the distant aiming point while sighting through tube primer vent.
- 7 Using pantel azimuth knob (5) and pantel elevation knob (6), align the vertical and horizontal crosshairs of the pantel reticle on the same aiming point as the muzzle crosshairs. See M115 telescope sight pattern.
- 8 The azimuth counter (7) should read 3200 mils. If it does not, remove cap from boresight adjustment shaft and insert small screwdriver in boresight adjustment detent (8). Depress detent shaft and turn until 3200 appears on azimuth counter (7). Recheck sight pattern to be sure pantel is still in boresight. Replace cap.
- 9 If the zero mark on pantel micrometer scale (9) is not on witness mark on rotating head assembly (10), loosen three screws in pantel elevation knob (6) and without moving pantel elevation knob (6), slip micrometer scale (9) until zero mark on micrometer scale is aligned with witness mark. Tighten screws in pantel elevation knob (6) to secure.
- 10 M115 pantel is now boresighted.

BORESIGHTING M139 DIRECT FIRE TELESCOPE USING DISTANT AIMING POINT

NOTE

Trunnions must be level within 5 degrees (90 mils).



- 1 Turn elevation locking lever (1) to loosen elevation adjusting screw (2). Turn elevation adjusting screw (2) until boresight crosshairs are aligned precisely on the distant aiming point. Turn elevation locking lever (1) to lock elevation locking screw (2).
- 2 Loosen deflection locking screw (3) and rotate deflection adjusting cam (4) until

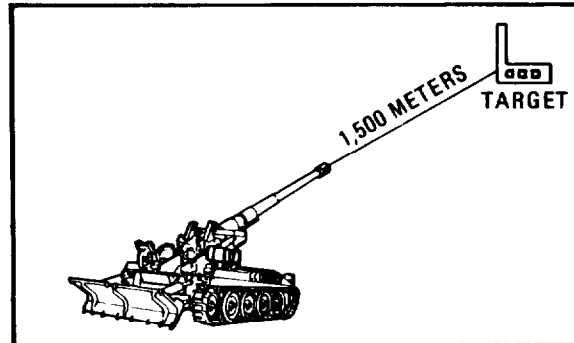
vertical crosshair is laid precisely on the distant aiming point. Tighten deflection locking screw (3) to secure. Recheck sight picture.

- 3 The direct fire telescope is now boresighted.

BORESIGHTING M115 PANORAMIC TELESCOPE USING DISTANT AIMING POINT WITH M137 MOUNT AND M15 ELEVATION QUADRANT SCRIBED

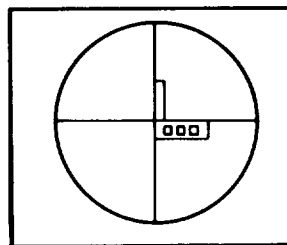
NOTE

Trunnions must be level within 5 degrees (90 mils).



- 1 Select aiming point with well-defined vertical and horizontal axis at least 1500 m distant.

- 2 Retract firing mechanism block from fire position so primer vent is exposed. Insert muzzle crosshairs through holes in muzzle brake and align with witness marks on face of tube. Secure crosshairs with tape, refer to page 2-108.



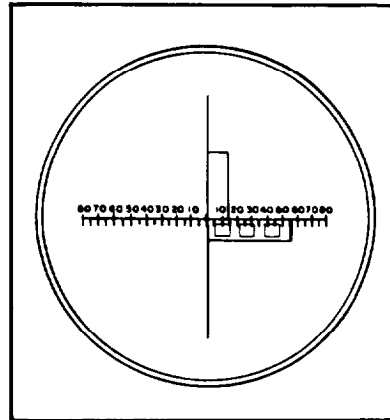
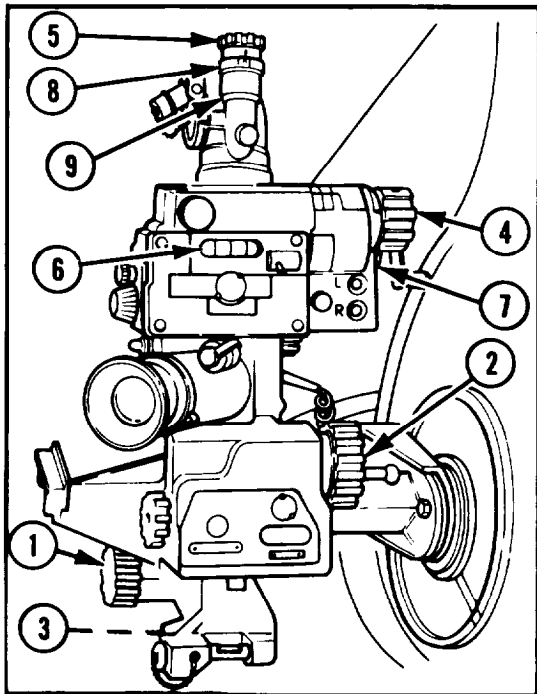
BORESIGHT PATTERN

CAUTION

If M115 pantel head assembly is loose, notify unit maintenance.

- 3 Looking through primer vent, align vertical and horizontal muzzle crosshairs as shown in boresight pattern. If image tilt is present, notify unit maintenance.

BORESIGHTING M115 PANORAMIC TELESCOPE USING DISTANT AIMING POINT WITH M137 MOUNT AND M15 ELEVATION QUADRANT SCRIBED-CONTINUED



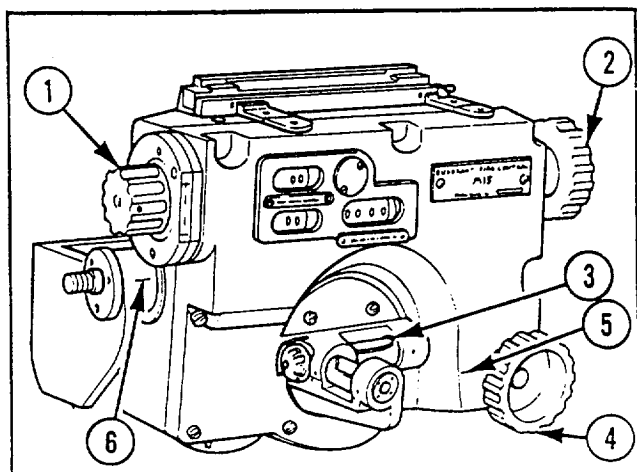
M115 TELESCOPE SIGHT PATTERN

- 4 Using cross level knob (1) on M137, center cross level bubble, or aline scribe lines if present.
- 5 Using M137 elevation knob (2), center elevation level vial bubble (3).
- 6 Using pantel azimuth knob (4) and pantel elevation knob (5), aline the vertical and horizontal crosshairs of the pantel reticle on the same aiming point as the muzzle crosshairs. See M115 telescope sight pattern.
- 7 The azimuth counter (6) should read 3200 mils. If it does not, insert small screwdriver in boresight adjustment detent (7), depress detent shaft, and turn until 3200 appears on azimuth counter (6). Recheck sight picture to be sure pantel is still in boresight.
- 8 If the zero mark on the pantel micrometer scale (8) is not on witness mark on rotating head assembly (9), loosen three screws in pantel elevation knob (5) and slip micrometer scale (8) until the zero mark on micrometer scale is alined with witness mark. Tighten screws in pantel elevation knob (5) to secure.
- 9 M115 pantel is now boresighted.

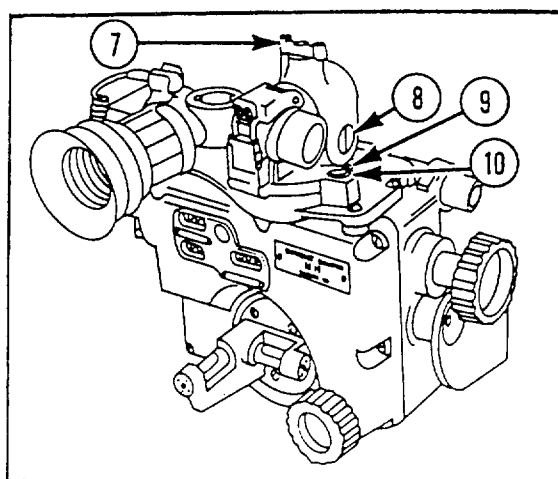
BORESIGHTING M139 DIRECT FIRE TELESCOPE USING DISTANT AIMING POINT AND SCRIBED M15 ELEVATION QUADRANT

NOTE

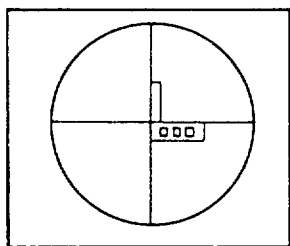
Trunnions must be level within 5 degrees (90 mils).



- 1 Using M15 quadrant correction knob (1), zero elevation correction counters.
- 2 Using M15 quadrant elevation knob (2), center elevation level vial bubble (3).

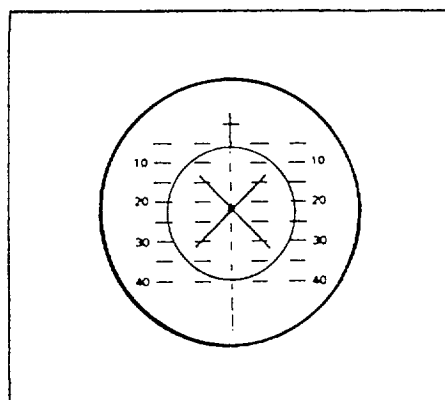


- 3 Using the M15 quadrant cross-level knob (4), aline scribe lines (5) and (6).



BORESIGHT PATTERN

- 4 Make sure the muzzle crosshairs on the tube are still alined as shown in boresight pattern.
- 5 Turn elevation locking lever (7) to loosen elevation adjusting screw (8). Turn elevation adjusting screw (8) until horizontal line is laid precisely on the distant aiming point. Turn elevation locking lever (7) to lock elevation adjusting screw (8).



M139 DIRECT FIRE TELESCOPE SIGHT PATTERN

- 6 Loosen deflection locking screw (9) and rotate deflection adjusting cam (10) until vertical crosshair is laid precisely on the distant aiming point. Tighten deflection locking screw (9) to secure. Recheck sight picture.
- 7 The direct fire telescope is now boresighted.

CHECKING BORESIGHT OF M115 PANORAMIC TELESCOPE USING M140 ALINEMENT DEVICE



WARNING

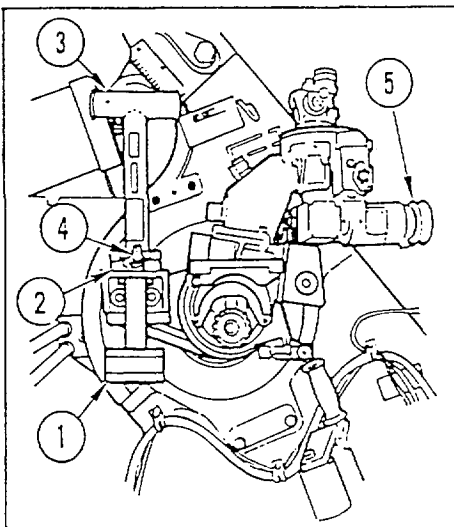
The M140 alinement device is radioactively illuminated. Check for loss of luminescence, breakage, damage or defects. If present, follow the procedures on page a.

CAUTION

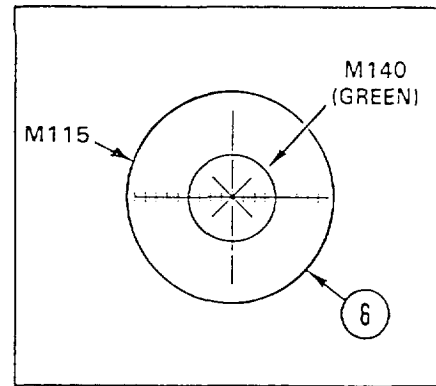
Do not fire howitzer with M140 alinement device installed.

- 1 Ensure M15 pantel azimuth scale is at 3200 mils and aline scribe lines on M137 mount.

- 4 Clamp M140 alinement device (3) to dovetail (2) with locking lever (4).



- 2 Remove cover (1) from dovetail (2).
- 3 Inspect dovetail (2) for nicks and burrs. Remove any nicks and burrs with crocus cloth (item 10, appx D).



NOTE

Do not apply excessive torque to clamp. A snug fit is sufficient.

- 5 Look through M115 pantel (5) and check alinement of reticles (6). Reticle pattern should line up. If reticles (6) aline, pantel is boresighted. If reticles (6) do not aline within ± 0.5 mil, boresight pantel. Refer to page 2-108.

CHECKING BORESIGHT OF M139 ELBOW TELESCOPE USING M140 ALINEMENT DEVICE



WARNING

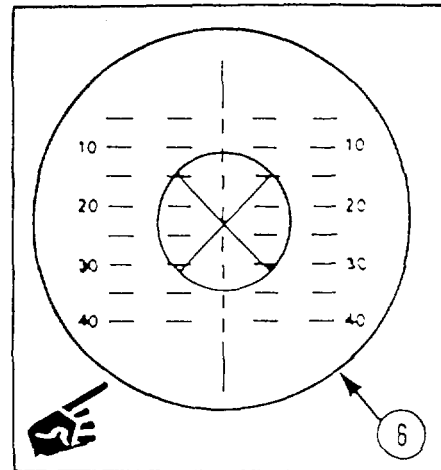
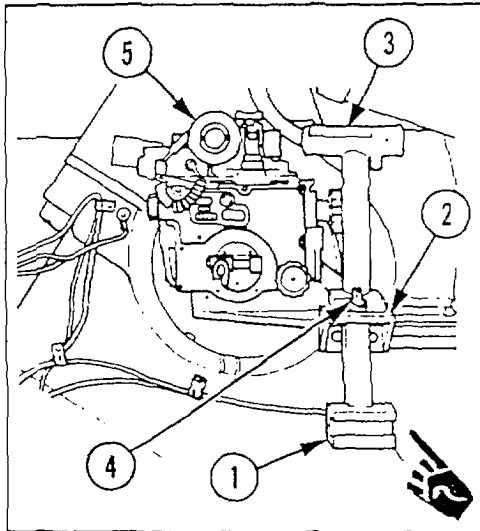
The M140 alinement device is radioactively illuminated. Check for loss of luminescence, breakage, damage or defects. If present, follow the procedures on page a.

CAUTION

Do not fire howitzer with M140 alinement device installed.

- 4 Clamp M140 alinement device (3) to dovetail (2) with locking lever (4).

- 1 Ensure M15 Quadrant scribe lines are alined.



NOTE

Do not apply excessive torque to clamp. A snug fit is sufficient.

- 2 Remove cover (1) from dovetail (2).
- 3 Inspect dovetail (2) for nicks and burrs. Remove nicks and burrs with crocus cloth.

- 5 Look through M139 elbow telescope (5) and check alinement of reticles (6). Reticle pattern should line up. If reticles (6) aline, the elbow telescope is boresighted. If reticles (6) do not aline, boresight M139 elbow telescope. Refer to page 2-117.

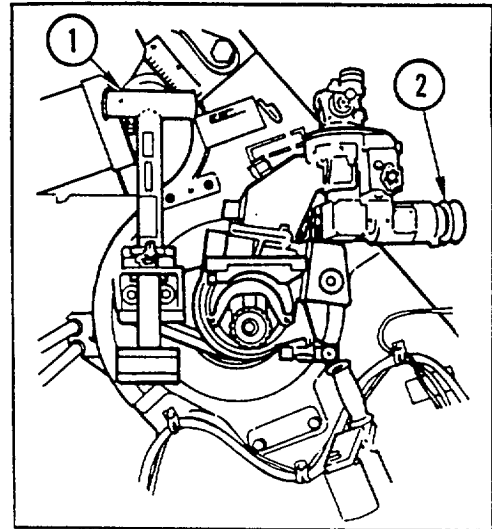
COMPARISON TEST OF THE M140 ALINEMENT DEVICE

NOTE

The comparison test of the M140 alinement device is performed to identify any device that has been bent or damaged due to an accident or mishandling. Reference to azimuth counters pertains to M115 pantel only.

Perform the test as follows:

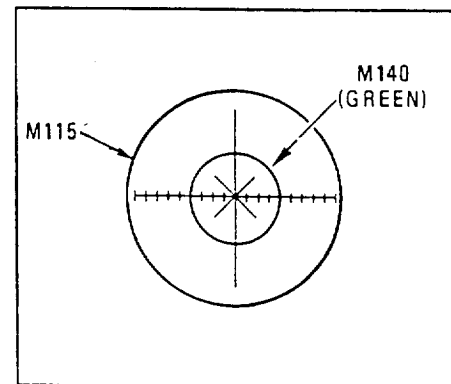
- 1 Check boresight using the M140 alinement device (1).
- 2 Install a second alinement device. Without moving the position of the telescope, view through the eyepiece (2). If the crosshairs on the telescope and the alinement device aline, the accuracy of the alinement device is verified.
- 3 If the crosshairs on the telescope and the second alinement device do not aline, or if the azimuth counter reading is not correct after the crosshairs are alined, one of the two alinement devices is unserviceable.



NOTE

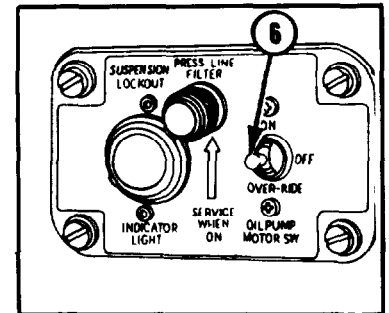
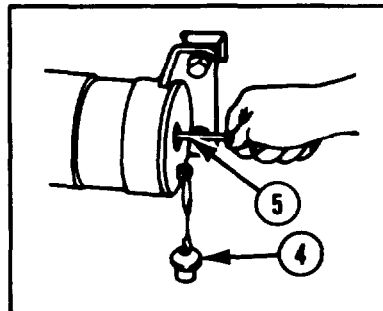
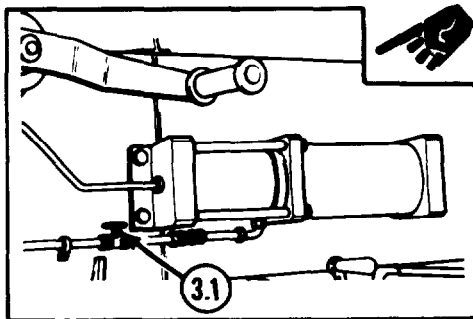
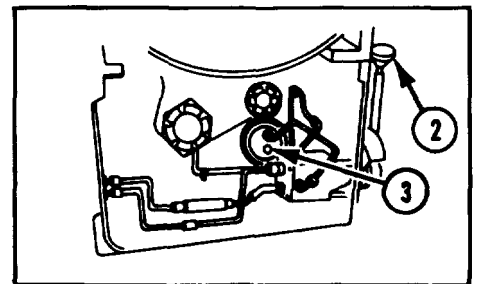
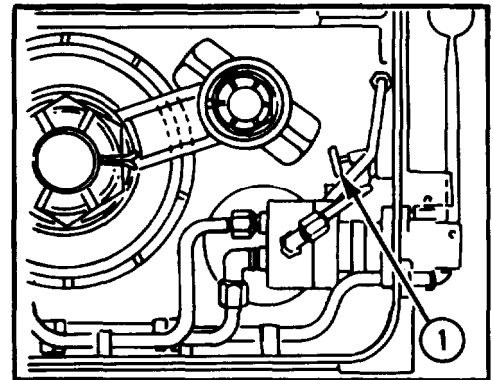
The correct azimuth reading is 3200 mils.

- 4 To determine which of the two alinement devices is unserviceable, obtain a third alinement device and again boresight the weapon.
- 5 Without changing the azimuth reading, install each of the other two alinement devices. The alinement device on which the crosshairs will not aline with the telescope crosshairs is defective. Turn in defective device to unit maintenance for repair.



RECOIL MECHANISM CHECKOUT AND ESTABLISHING OIL RESERVE

- 1 Driver -Set HYDRauiic PUMP/PTO CLUTCH switch ON and build hydraulic pressure to 2400 psi (16,548 kPa).
- 2 Assistant Gunner-Make sure cannon is in battery with mount in travel lock.
- 3 Assistant Gunner-Open shutoff valve (1), if present. Hold retracting control valve handle (2) in RETRACT until index pin (3) on recuperator moves in, then return retracting control valve handle (2) to NORMAL AND HOLD.



- 4 Cannoneer No. 2-Open replenisher shutoff valve (3.1) and remove plug (4) from replenisher. Insert a clean improvised rod (5) through opening and against piston.

CAUTION

Under no circumstances shall index pin be tapped to check for free operation.

NOTE

Shutoff valve must be open before retracting gun tube.

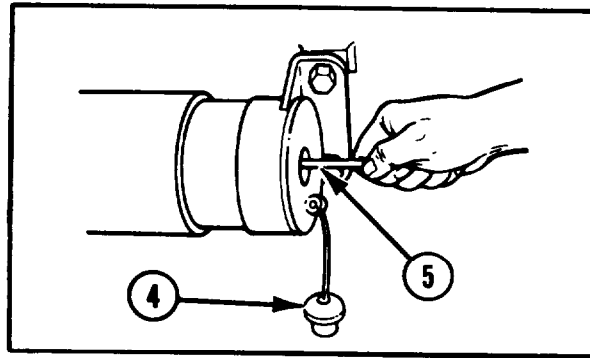
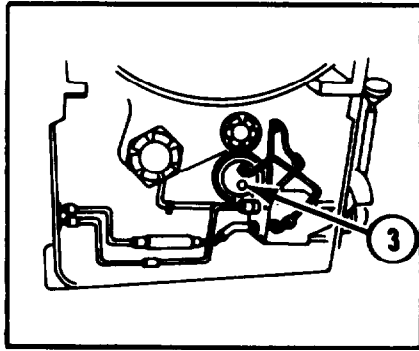
- 5 Assistant Gunner-Hold retracting control valve handle (2) in RETURN. After index pin (3) has moved out, continue

to hold handle (2) in RETURN for 3 seconds. If index pin (3) does not come out, proceed to step 6. If index pin (3) does come out, proceed to step 7.

- 6 Gunner-Hold OIL PUMP MOTOR Switch (6) in OVER-RIDE and build hydraulic system to maximum pressure. Assistant Gunner- Hold retracting control valve handle (2) in RETURN. After index pin (3) has moved out, continue to hold retracting control valve handle (2) in RETURN for 3 seconds. Gunner-Release OIL PUMP MOTOR Switch (6).

- 7 Assistant Gunner-Return retracting control valve handle (2) to NORMAL AND HOLD.

RECOIL MECHANISM CHECKOUT AND ESTABLISHING OIL RESERVE-CONTINUED



- 8 Assistant Gunner-If index pin (3) does not move, notify unit maintenance.
- 9 Cannoneer No. 2-Check piston movement in replenisher by observing position of improvised rod (5). If rod

moves during steps 4 and 5, replenisher is operating normally.

- 10 Cannoneer No. 2 -Remove rod (5) and replace plug (4) in replenisher.

EQUILIBRATOR ADJUSTMENT

Assistant Gunner-Perform the following procedure to adjust equilibrators.

CAUTION

Equilibrator adjustment should be performed periodically during exercise or firing of the cannon or whenever outside air temperature changes $\pm 20^{\circ}\text{F}$ ($\pm 7^{\circ}\text{C}$). This will

make sure equilibrators are maintained in proper adjustment. Adjustment will be made with gun mount at maximum depression.

- 1 Before changing adjustment, manually elevate and depress cannon at 560 mils to see if adjustment is required. No adjustment is required if effort to elevate and depress is the same.

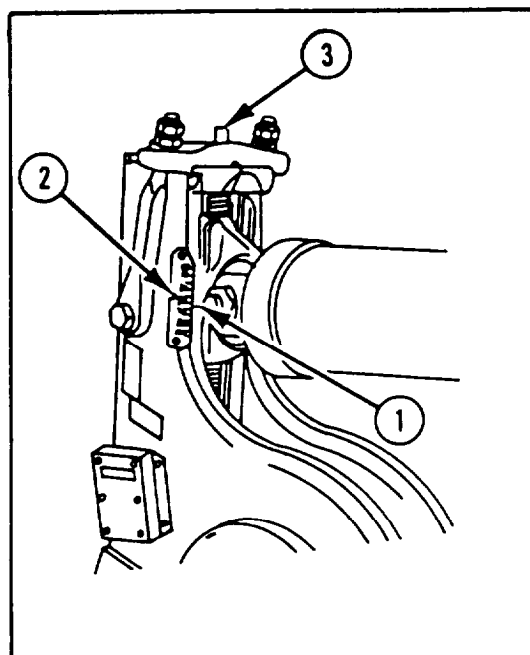
EQUILIBRATOR ADJUSTMENT-CONTINUED

- 2 If adjustment is required, lower cannon until it rests on depression stops. Note position of index mark (1) on temperature scale (2).

NOTE

Prior to making adjustment, make sure adjusting screws are clean and lightly oiled. Adjust using socket wrench (item 97, appx B).

- 3 Turn adjusting screw (3) clockwise to decrease turning effort required to elevate cannon, and counterclockwise to decrease effort required to depress cannon.
- 4 Adjust both equilibrators equally, using temperature scale (2), until effort required to raise or lower cannon at 560 mils is equal.

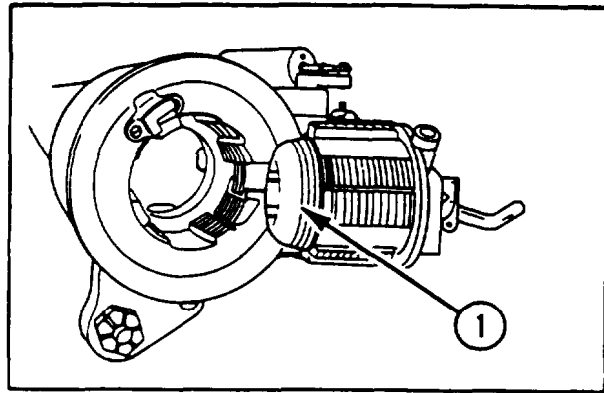
**NOTE**

If adjustment cannot be made within the limits of temperature scale (2), notify unit maintenance.

OBTURATOR GAS CHECK PAD INSPECTION

Cannoneer No. 2-Perform the following procedure to inspect obturator gas check pad.

- 1 Inspect obturator gas check pad (1) for evidence of blowby. Refer to page 2-24 for definition of blowby. Refer to page 3-58 for disassembly of breechblock group.
- 2 Check gas check pad for nicks, cracks, or evidence of faulty seating. Refer to page 2-24 for definitions. Refer to page 3-58 for disassembly of breechblock group.



PREFIRE CHECKS

- 1 Hydraulic Reservoir. Check hydraulic reservoir oil level with cannon in battery and loader/rammer in stowed position. Set HYDRaumatic PUMP/PTO CLUTCH switch OFF. Open accumulator dump valve to allow oil to flow back into reservoir, then close valve securely. Oil should be at FULL mark on dipstick. Fill reservoir as required (refer to appx F). Restore hydraulic pressure.
 - Check that split rings are 180 degrees apart, refer to page 3-60.
 - Check that witness marks on breech ring and breechblock are alined, refer to page 2-134.
 - Check that follower shaft and roller are functioning properly, refer to page 3-61.
 - With the breech closed, ensure the operating lever will lock in place and the firing mechanism will slide up and lock in firing position. Refer to page 2-134.
- 2 Cannon Tube. Make sure tube is clear, no foreign matter is present, and tube is dry.
- 3 Recuperator and Replenisher. Establish oil reserve in recuperator cylinder and check replenisher for proper operation. Close shutoff valve.
- 4 Breechblock.
 - Check for damaged gas check pad, refer to page 3-60.
- 5 Spade and Suspension. Check that spade is properly emplaced and suspension system is locked.

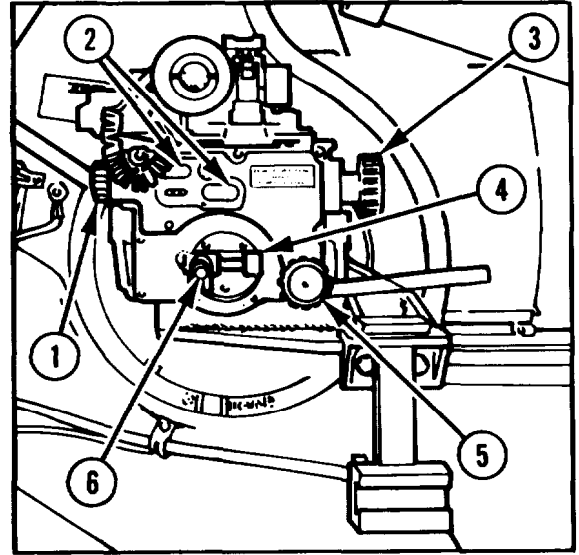
ENTERING FIRE CONTROL CORRECTIONS

The following instructions are for entering fire control corrections ordered by the fire direction center.

M15 ELEVATION FIRE CONTROL QUADRANT

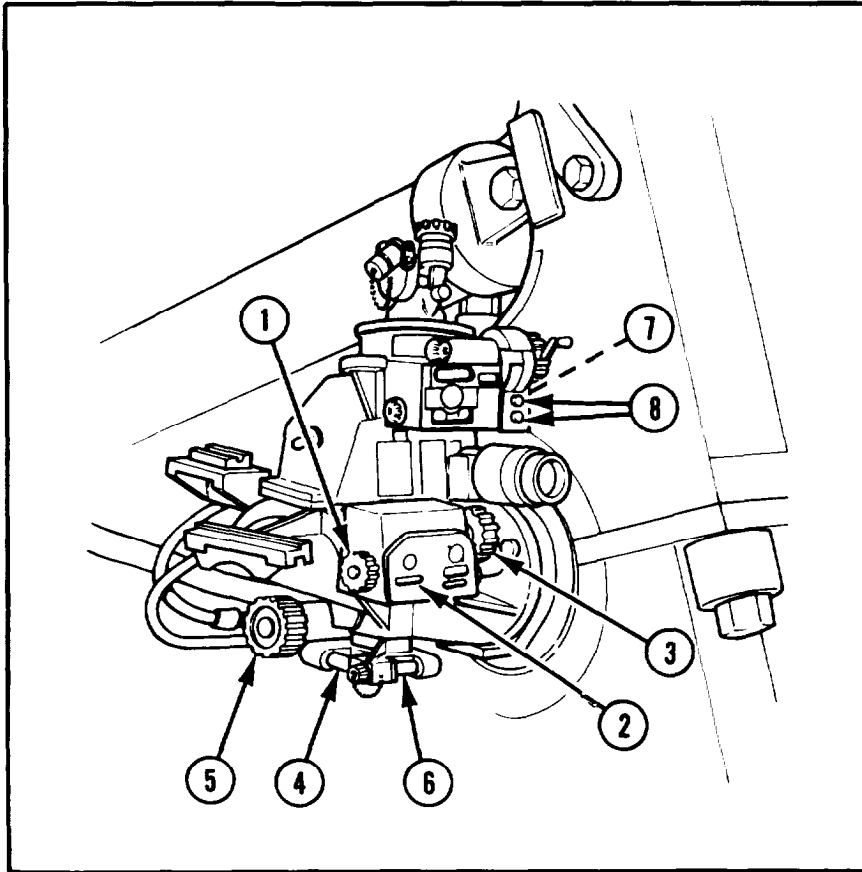
Assistant Gunner-Perform the following procedure to enter fire control corrections.

- 1 Make sure boresighting procedure (pages 2-108 thru 2-119) has been performed.
- 2 Rotate correction knob (1) until proper correction appears in either the plus (+) or minus (-) window (2).
- 3 Rotate elevation knob (3) and center bubble in elevation level vial (4).
- 4 Rotate cross level knob (5) and center bubble in cross level vial (6).



M137 TELESCOPE MOUNT AND M115 PANORAMIC TELESCOPE

Gunner-Perform the following procedure to enter fire control corrections.



1 Rotate M137 telescope mount correction knob (1) until proper elevation correction appears at correction counter window (2).

2 Rotate elevation knob (3) to center bubble in elevation level vial (4).

3 Rotate cross level knob (5) to center bubble in cross level vial (6).

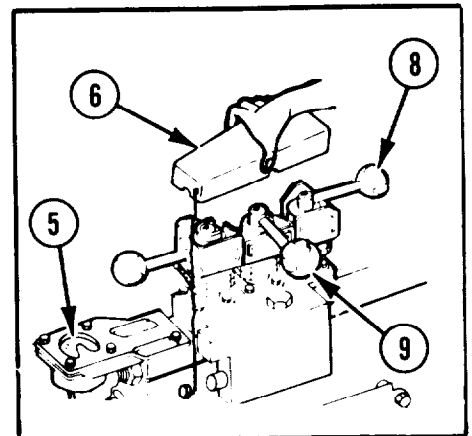
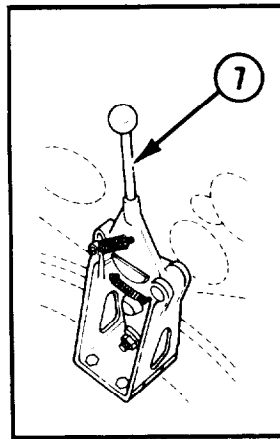
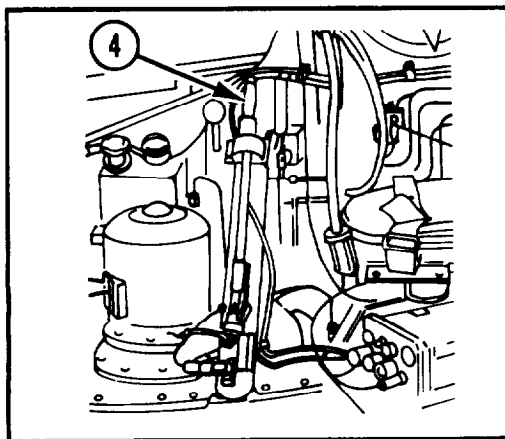
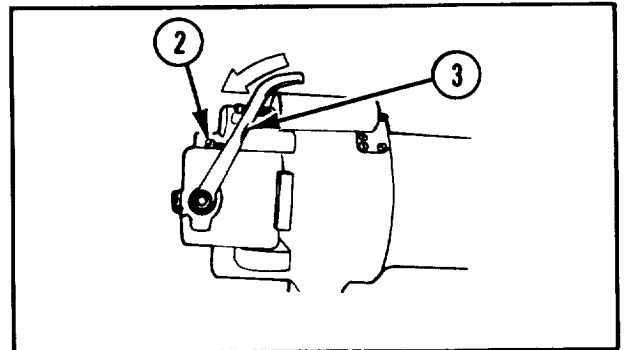
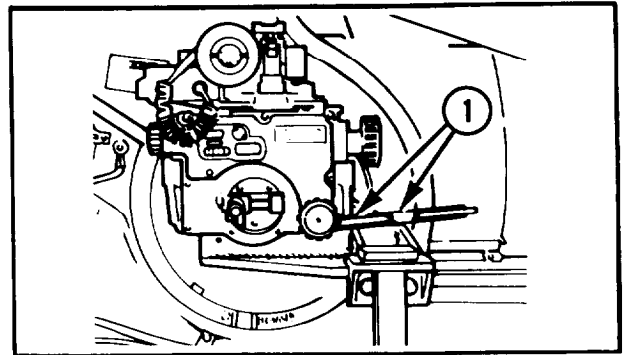
4 Rotate gunner's aid knob (7) until proper deflection correction factor appears in left (L) or right (R) gunner's aid counter windows (8).

MANUAL LOADING AND RAMMING

WARNING

Elevate or depress cannon tube until LOAD marks align before opening breech to avoid injury to personnel.

- 1 Assistant Gunner- Manually elevate or depress cannon tube until LOAD marks (1) are aligned.
- 2 Cannoneer No. 2-Push latch (2) in and pull breechblock operating lever (3) back to stop, then pull breechblock operating lever (3) to the right to open breechblock.

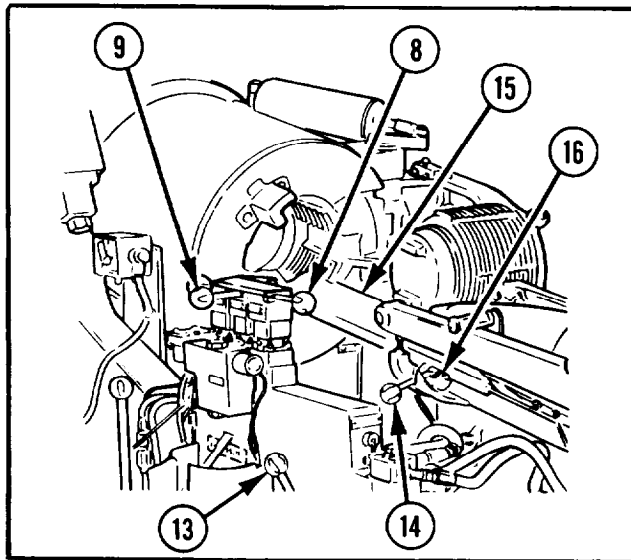
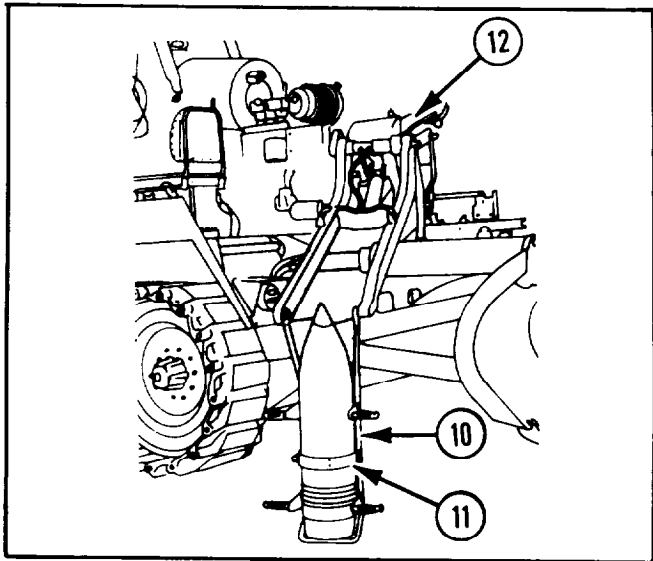


- 3 Cannoneer No. 2-Operate hydraulic hand pump (4) to pressurize hydraulic system until 1600 psi (11,032 kPa) or more is indicated on gage (5). Continue to operate hydraulic hand pump (4) during loading procedure to maintain hydraulic pressure.
- 4 Cannoneer No. 1-Remove safety cover (6) from loader/rammer control valve assembly.
- 5 Cannoneer No. 1-Release rammer stow position lock (7). Move SWING handle (8) to LOAD position and hold until loader is positioned over left rear of vehicle. Release SWING handle (8).
- 6 Cannoneer No. 1-Move LOADER handle (9) to OUT position and hold until loader arm is at ground level. Release LOADER handle (9).

MANUAL LOADING AND RAMMING -CONTINUED

WARNING

Serious or fatal injury to personnel may result if all warnings in chapter 5 are not observed.



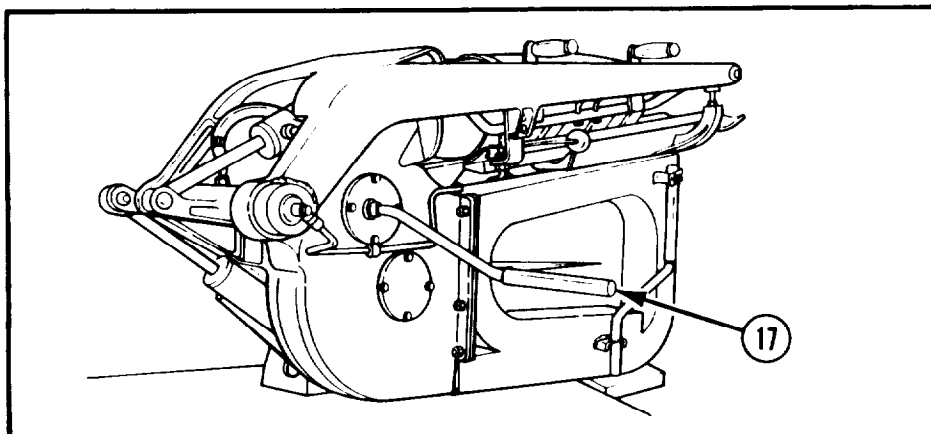
7 Cannoneers No. 3 and 4-Load projectile onto projectile tray (10) and engage tray hooks to loader arms. Make sure projectile retaining strap (11) is secured.

8 Cannoneer No. 1-Move LOADER handle (9) to IN position and hold until loader arm with projectile is positioned on loader/rammer (12). Release LOADER handle (9).

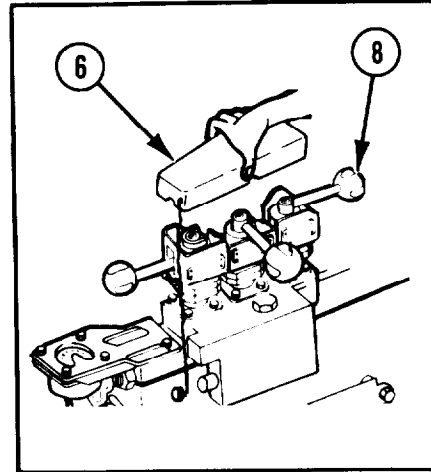
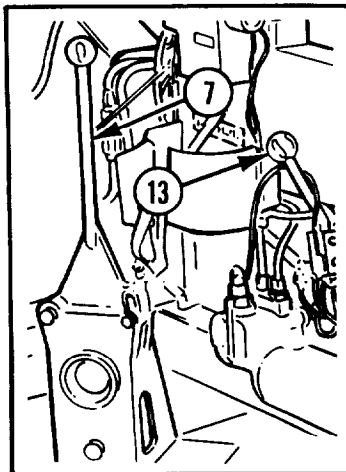
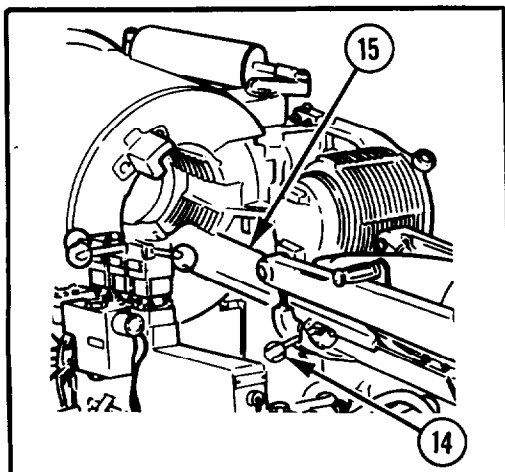
9 Cannoneer No. 1 -Move SWING handle (8) to LOAD position and hold until loader/rammer reaches its stop. Release SWING handle (8). Make sure that ram position lock (13) is engaged.

10 Cannoneers No. 1 and 2-Grasp projectile trough handles (14) and slide projectile trough (15) forward until it is positioned in the chamber. Cannoneer No. 1 - Make sure left projectile trough handle (14) engages latch (16).

MANUAL LOADING AND RAMMING -CONTINUED



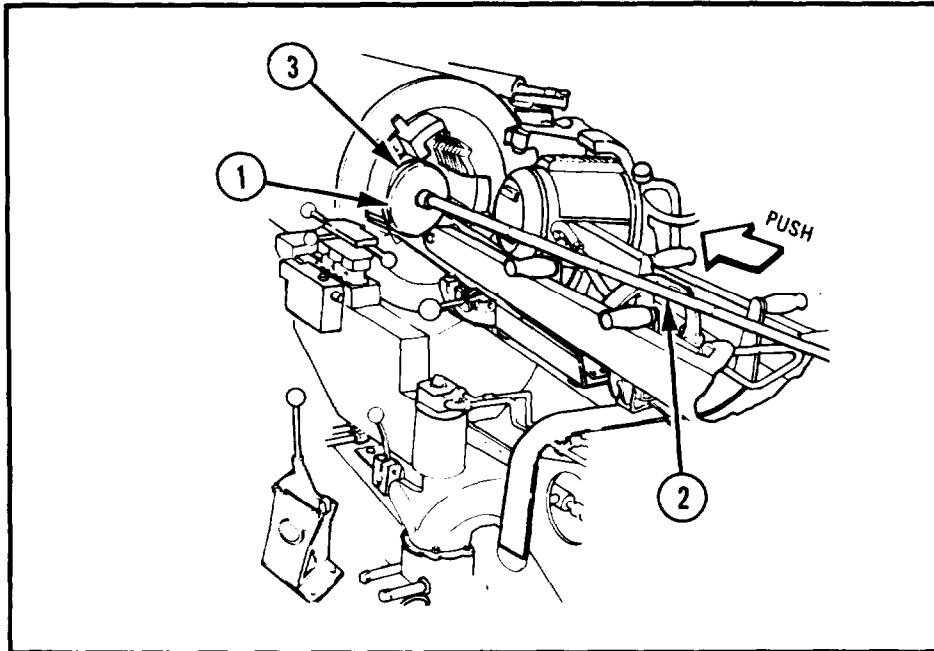
- 11 Cannoneers No. 1 and 2-Insert handcranks (17), stowed on right side of loader/rammer, into right and left side of rammer headshaft until crankpins engage shaft.
- 12 Cannoneers No. 1 and 2-Position one man on each handcrank and rotate, counterclockwise on the left side and clockwise on the right side, fast and hard to ram projectile.
- 13 Cannoneers No. 1 and 2-Rotate handcranks in reverse to retract rammer chain headlink.
- 14 Cannoneers No. 1 and 2-Remove handcranks from headshaft and stow on loader/rammer.
- 15 Cannoneers No. 1 and 2-Remove projectile tray and load propelling charge. Refer to page 2-134.



- 16 Cannoneers No. 1 and 2-Grasp projectile trough handles (14) and slide projectile trough (15) from chamber back onto loader/rammer slide.
- 17 Cannoneer No. 1-Release ram position lock (13) and move SWING handle (8) to STOW position. Hold until loader/rammer is in stow position and stow position lock (7) is engaged. Release handle (8).
- 18 Cannoneer No. 1-Install safety cover (6) on control valve assembly.
- 19 Cannoneer No. 2-Secure hydraulic hand pump with strap.

HAND RAMMING WITH M13 LOADING RAMMER

The projectile may be hand rammed when the loader/rammer chain cannot be operated hydraulically or manually.



WARNING

Serious or fatal injury to personnel may result if all warnings in chapter 5 are not observed.

chamber. No. 2 man-holds projectile (3) in place with M13 rammer (1) and staff (2).

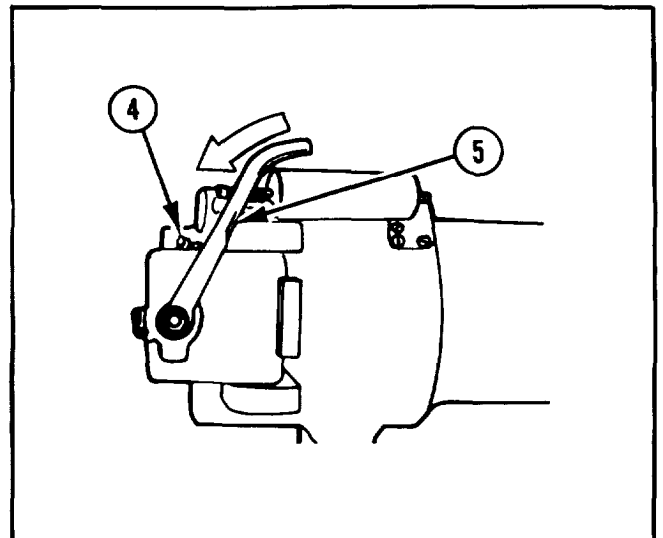
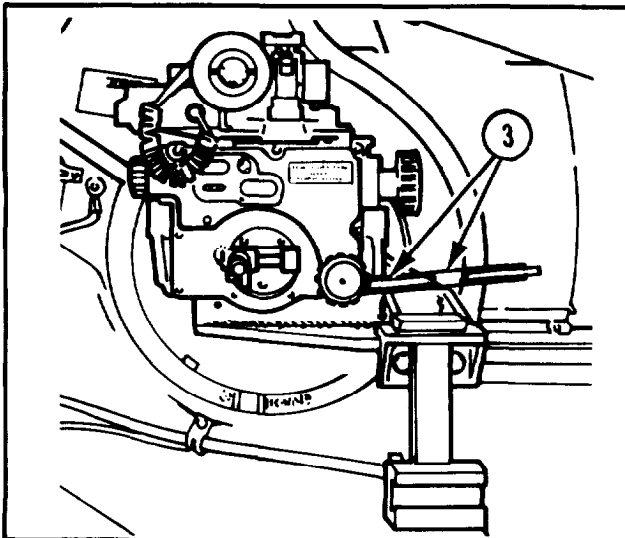
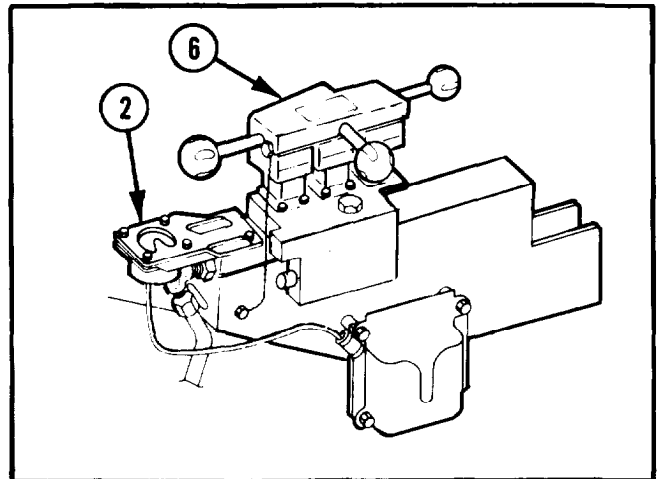
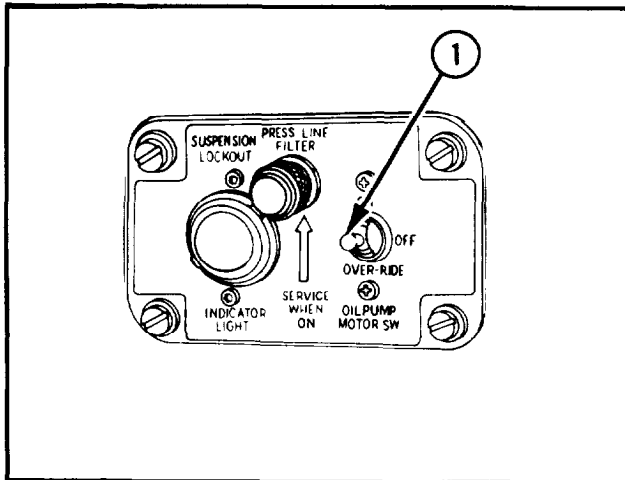
WARNING

Improper ramming may cause incomplete seating of the projectile which may cause damage to the weapon when fired.

- 1 Cannoneers No. 3 and 4-Assemble eight rammer staff sections and attach M13 loading rammer (1) to staff (2).
- 2 Assistant Gunner-Elevate or depress cannon tube until LOAD marks align before opening breech.
- 3 Cannoneer No. 2-Open breechblock. Cannoneer No. 1-Position loader/rammer tray in ram position.
- 4 Cannoneers No. 1 and 2-Position projectile trough in breech chamber.
- 5 Cannoneers No. 1 and 2 assisted by assistant gunner if necessary -push projectile (3) off loading tray into powder

- 6 Cannoneers No. 3, 4, 5, and 6-Stand on the ground to the rear of the spade. Place M13 rammer (1) and staff (2) against projectile (3) and ram the projectile into the forcing cone.
- 7 Cannoneers No. 1 and 2-Load propelling charge. Refer to page 2-134.

POWER LOADING AND RAMMING



- 1 Driver-Set MASTER switch ON.
- 2 Gunner-Set OIL PUMP MOTOR SWitch (1) ON.
- 3 Cannoneer No. 1-Check hydraulic pressure at gage (2). Gage (2) should indicate 1600-2400 psi (11,032-16,548 kPa).

WARNING

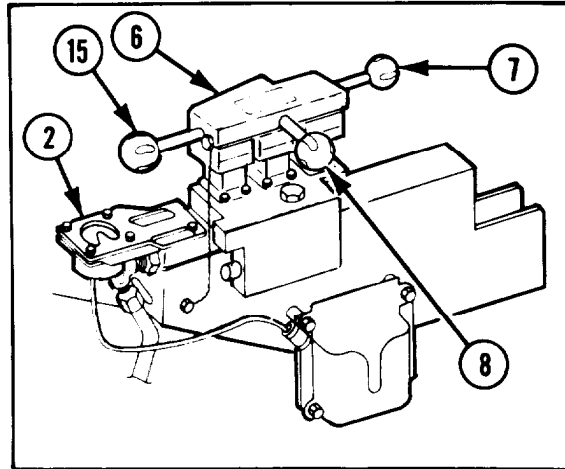
Elevate or depress cannon tube until LOAD marks align before opening breech to avoid injury to personnel.

- 4 Assistant Gunner-Elevate or depress cannon until LOAD marks (3) are alined.
- 5 Cannoneer No. 2-Release latch (4) by pushing in. Pull breechblock operating lever (5) to unlock breechblock. Open breech by pulling operating lever (5) to right.
- 6 Cannoneer No. 1-Remove safety cover (6) from loader/rammer control valve assembly.

POWER LOADING AND RAMMING-CONTINUED

7 Cannoneer No. 1-Release stow position lock. Move SWING handle (7) to LOAD position, and hold until loader/rammer is positioned over left rear of vehicle. Release SWING handle (7).

8 Cannoneer No. 1-Move LOADER handle (8) to OUT position and hold until loader arm is extended to ground level. Release LOADER handle (8).



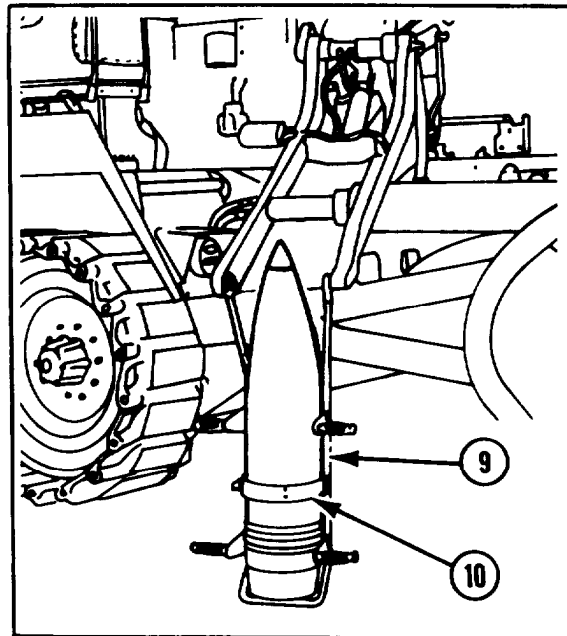
WARNING

Serious or fatal injury to personnel may result if all warnings in chapter 5 are not observed.

CAUTION

Do not drop projectile onto slide at maximum loader speed.

9 Cannoneers No. 3 and 4-Load projectile onto projectile tray (9) and engage projectile tray hooks to loader arms. Make sure projectile retaining strap (10) is secure.



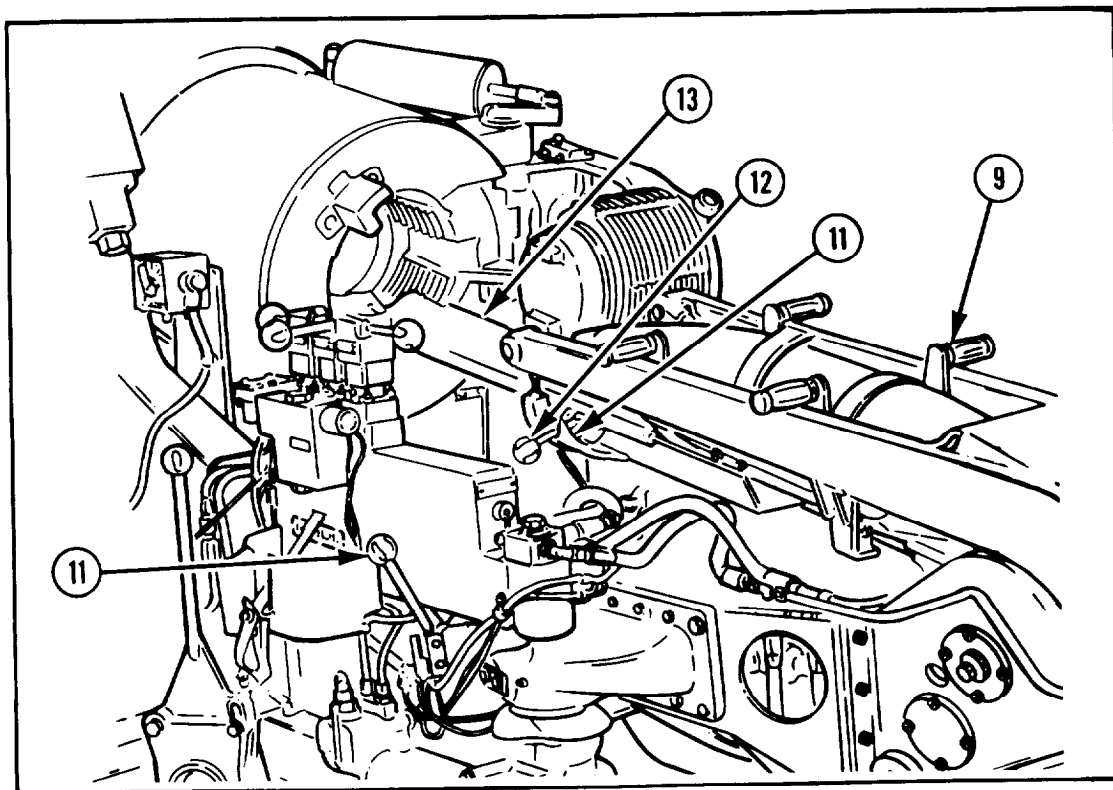
WARNING

- Do not place hand between projectile and loader/rammer headlink.
- Use tray handles to stabilize projectile during movement.

10 Cannoneer No. 1-Move LOADER handle (8) to IN position and hold until loader arm, with projectile, is positioned on loader/rammer. Release LOADER handle (8).

11 Cannoneer No. 1-Slowly move SWING handle (7) to LOAD position and hold until loader/rammer reaches its stop. Release SWING handle (7). Make sure ram position lock (11) is engaged.

POWER LOADING AND RAMMING-CONTINUED



- 12** Cannoneers No. 1 and 2-Grasp projectile trough handles (12) and slide projectile trough (13) forward until it is positioned in the chamber. Cannoneer No. 1 - make sure left projectile trough handle (12) engages latch (14). The lamp on gage (2) will light.

CAUTION

Do not operate RAMMER handle (15) without a projectile in trough.

- 13** Cannoneer No. 1 -Move RAMMER handle (15) to RAM position. Check depth marks after ramming to ensure proper ram.

NOTE

Chain will buckle slightly when projectile is fully seated.

- 14** Cannoneer No. 1 and 2-Remove projectile tray (9) and load propelling charge. Refer to page 2-134.

- 15** Cannoneers No. 1 and 2-Grasp projectile trough handles (12) and slide projectile trough (13) back onto loader/rammer slide.

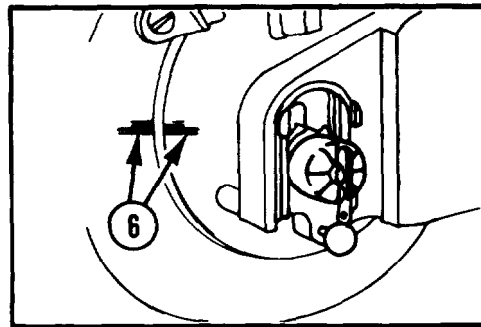
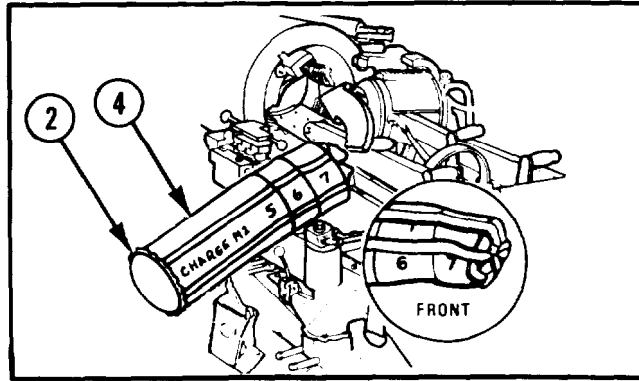
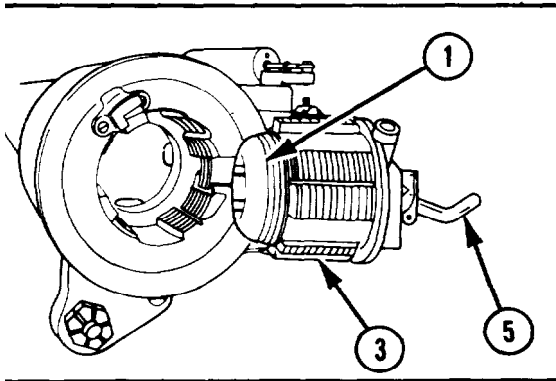
- 16** Cannoneer No. 1 -Release ram position lock (11) and move SWING handle (7) to STOW position. Hold SWING handle (7) until loader/rammer is in stowed position and stow position lock engages.

- 17** Cannoneer No. 1 -Install safety cover (6) on loader/rammer control valve assembly.

LOADING PROPELLING CHARGE

WARNING

Serious or fatal injury to personnel may result if all warnings in chapter 5 are not observed.



CAUTION

Obturator spindle head (1) must contact igniter (2) when breechblock (3) is closed.

- 1 Cannoneers No. 1 and 2-Place propelling charge (4) on projectile trough with igniter (2) to the rear. Insert charge into breech so obturator spindle head (1) and igniter (2) will make contact when breechblock (3) is closed.
- 2 Cannoneers No. 1 and 2-Slide projectile trough back onto loader/rammer slide. Stow loader/rammer.

- 3 Cannoneer No. 2-Close breechblock (3) by swinging breech operating lever (5) to left. When closed, push operating lever (5) up until latch engages.

WARNING

Check to make sure witness marks (6) on breech ring and breechblock are alined.

- 4 Cannoneer No. 2-Make sure breechblock (3) is closed and witness marks (6) are alined.

INSERTING PRIMER AND FIRING

Cannoneer No. 2-Perform the following procedure to insert the primer and fire the weapon.

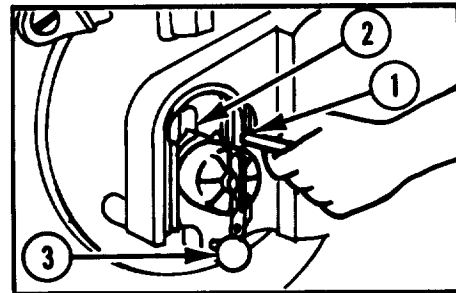
WARNING

- Serious or fatal injury to personnel may result if all warnings in chapter 5 are not observed.
- Do not force primer into primer chamber. Forcing primer could prematurely ignite powder charge, causing the howitzer to recoil, resulting in serious injury to the crew.

NOTE

Use only M82 primer in cannon. Refer to page 5-18.

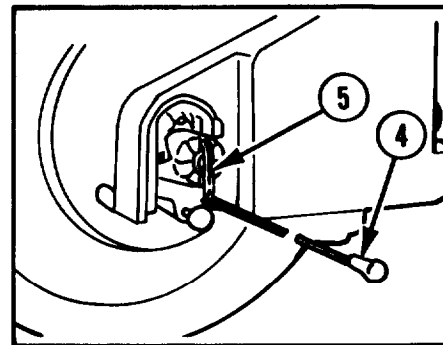
- 1 Insert primer (1) into primer chamber (2), making sure primer base flange is seated firmly against extractor. Do not force the primer. If the primer will not go in, check for distorted primer and dirty or burred obturator spindle chamber.



WARNING

If primer interference prevents easy closing of the firing block mechanism, do not force mechanism closed, and do not loosen spindle nut to allow mechanism to close. Notify unit maintenance.

- 2 Slide firing block mechanism up until follower knob (3) snaps in.
- 3 Hook lanyard (4) to lanyard lever eyelet (5).



INSERTING PRIMER AND FIRING -CONTINUED

WARNING

- Stand clear of breech to avoid injury from cannon recoil.
- High intensity noise. Hearing protection is required when firing.

CAUTION

Do not yank or jerk lanyard. Pull lanyard with a quick steady movement to the rear.

- 4 At the signal or command of the chief of section, fire the weapon by pulling lanyard with a quick and steady movement to the rear.

WARNING

After firing cannon, return to LOAD position before opening breechblock.

NOTE

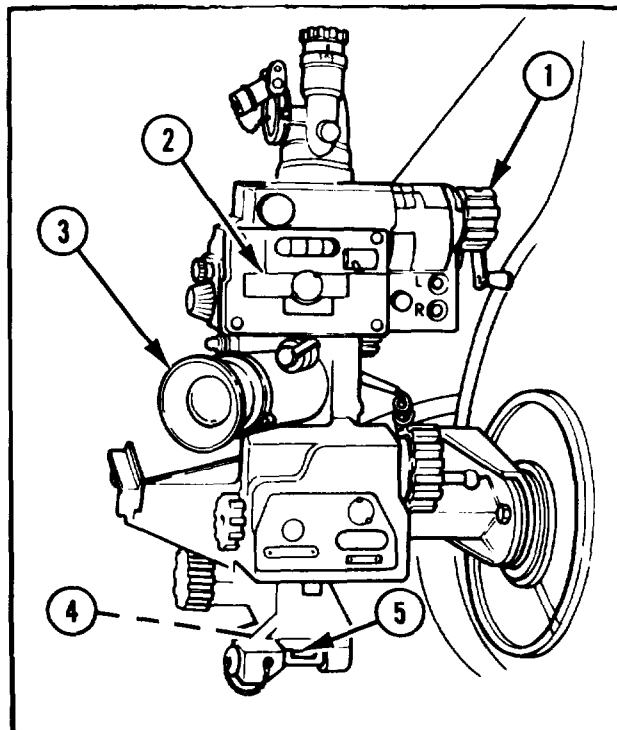
If weapon fails to fire, refer to page 2-147.

- 5 Assistant gunner returns cannon to load elevation.
- 6 Cannoneer No. 2 opens breech, swabs and inspects powder chamber and obturator head. After looking through the tube, announces BORE CLEAR, if bore is unobstructed.

LAYING FOR DIRECTION AND QUADRANT DURING INDIRECT FIRE MISSIONS USING COLLIMATOR

NOTE

Laying howitzer for direction and quadrant during indirect fire missions is the duty of gunner and assistant gunner, respectively. These operations are normally done at same time.



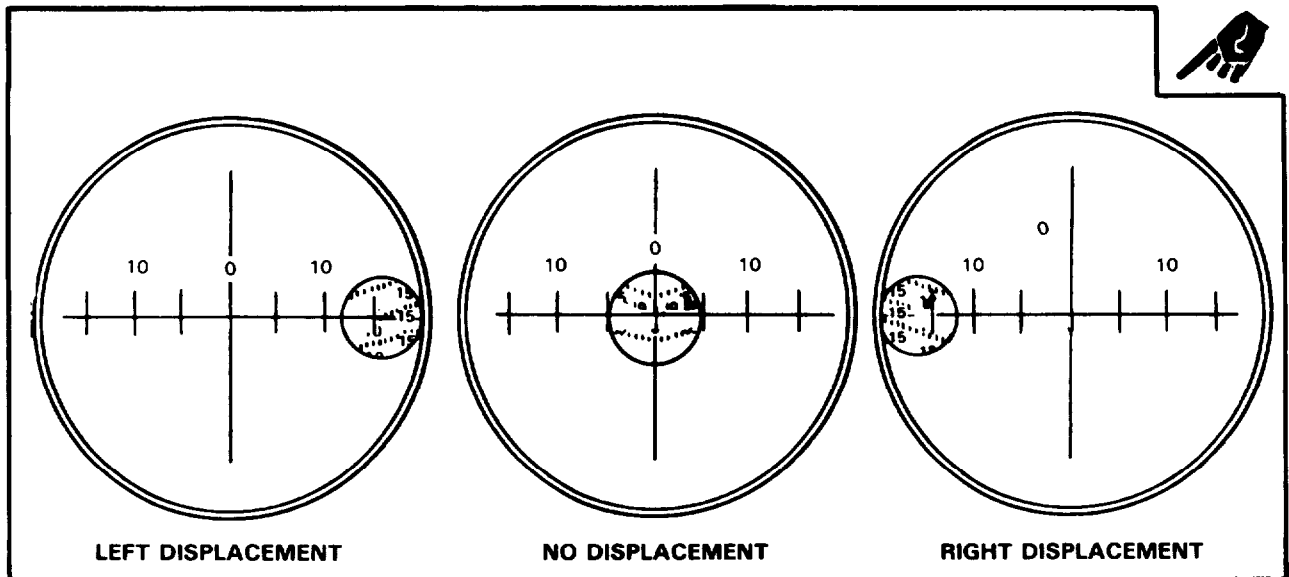
LAYING FOR DIRECTION AND QUADRANT DURING INDIRECT FIRE MISSIONS USING COLLIMATOR-CONTINUED

- 1 Upon announcement or data display of DEFLECTION (SO MUCH), gunner rotates pantel azimuth knob (1) until announced deflection appears in reset counter window (2). He then reads setting to chief of section.
- 2 Sighting through pantel eyepiece (3), gunner traverses howitzer until he gets a proper sight picture on aiming point.

- 3 Gunner centers ELEVATION (4) and cross level vial bubbles (5) on pantel mount.

NOTE

If there is no weapon displacement, gunner's sight picture should appear as shown below.



- 4 To correct for weapon displacement, gunner must match reticle of pantel with collimator reticle pattern. Numbers in collimator reticle indicate 5-mil increments. Individual mils are indicated by short lines in V format of pattern. For example, if gunner sees 10 and 15 in collimator and reticle pattern slopes upward from right to left, weapon has experienced right displacement. To compensate for this displacement, gunner matches left portion of pantel reticle with collimator as shown above.
- 5 If gunner sees 10 and 15 in collimator and pattern slopes upward from left to

right, weapon has experienced left displacement. To compensate for this displacement, gunner matches the right portion of pantel reticle with collimator reticle, as shown above.

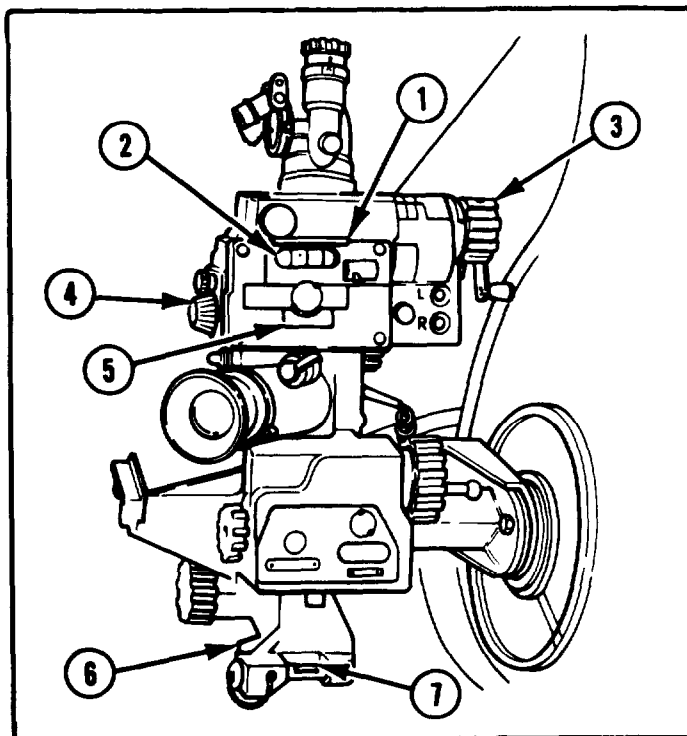
- 6 After assistant gunner lays the cannon for quadrant and announces SET, gunner verifies that announced deflection appears on reset counter (2), pantel mount elevation (4) and cross level vial bubbles (5) are centered, and a proper sight picture is on collimator. Gunner then announces READY.

LAYING FOR DIRECTION AND QUADRANT DURING INDIRECT FIRE MISSIONS USING M1A2 AIMING POSTS

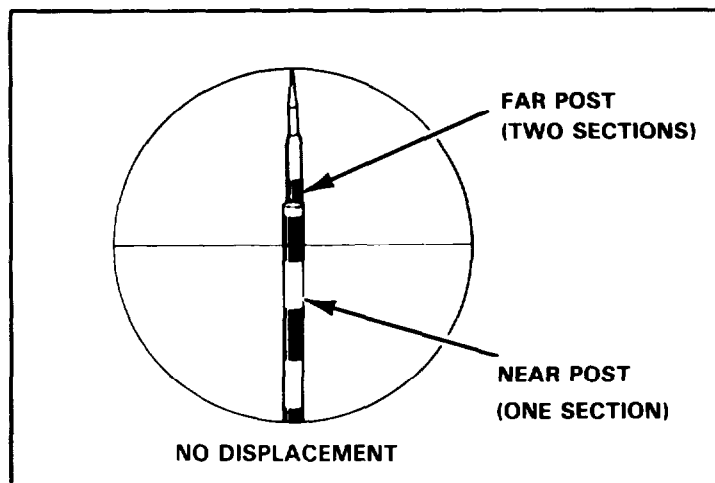
NOTE

During rapid traverse operations, or if collimator isn't working, you may have to use an alternate aiming point. If aiming posts are used as primary aiming point, go to step 3.

- 1 Gunner opens door (1) that covers pantel azimuth counter (2). He rotates azimuth knob (3) until azimuth, on which aiming posts were emplaced, appears on azimuth counter (2).
- 2 Gunner rotates counter reset knob (4) until 3200 appears on reset counter (5). He then closes door (1), covering azimuth counter (2).
- 3 Upon announcement, or data display, of DEFLECTION (SO MUCH), gunner rotates PANTEL azimuth knob (3) until announced deflection appears on reset counter (5). He then reads setting to chief of section.
- 4 Sighting thru pantel, gunner operates traverse control handle until he gets a proper sight picture on aiming posts. If there is no weapon displacement, gunner's sight picture on aiming posts should appear as shown.

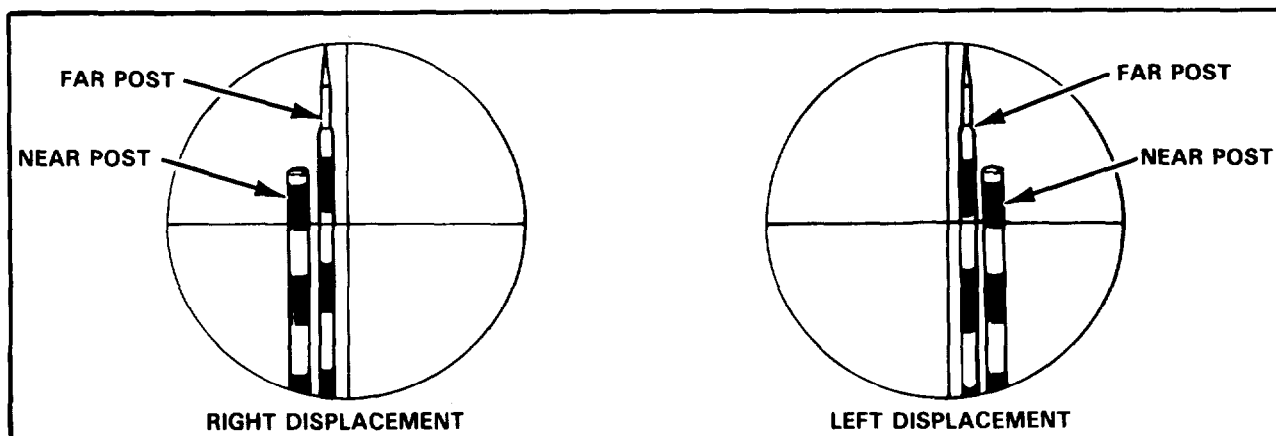


LAYING FOR DIRECTION AND QUADRANT DURING INDIRECT FIRE MISSIONS USING M1A2 AIMING POSTS-CONTINUED



5 To correct for weapon displacement, gunner must compensate so that far aiming post appears exactly halfway

between near aiming post and pantel vertical hairline.



6 If the gunner sees near aiming post to right of far post, weapon has experienced left displacement. To compensate, gunner traverses weapon until far aiming post is exactly halfway between near aiming post and pantel vertical hairline, as shown.

far aiming post is exactly halfway between near aiming post and pantel vertical hairline, as shown.

7 If gunner sees that near aiming post is to left of far aiming post, weapon has experienced right displacement. To compensate, gunner traverses weapon until

8 After assistant gunner lays cannon for elevation and announces SET, gunner verifies that announced deflection appears on reset counter (5); pantel mount ELEVATION (6) and cross level bubbles (7) are centered; and proper sight picture is obtained on aiming posts. He announces, READY.

DIRECT FIRE PROCEDURES



Direct fire on targets located closer than 1000 m from the howitzer will be fired on during combat situations only. Lethal fragments can travel up to 800 m from point of burst.

Three techniques are prescribed for use. They are the two man-two sight, the two man-one sight, and the one man-one sight systems. The one man-one sight system is the least effective of the three methods.

All cannoneers perform the same duties in direct fire as they do during indirect fire missions.

The driver of the howitzer takes his position in the driver's compartment, starts the engine, and prepares for immediate movement of the howitzer, if it becomes necessary. The driver closes his hatch to avoid adverse blast overpressure.

GENERAL

Direct fire is a technique used by the howitzer section to engage stationary or moving targets at relatively close range, normally less than 2000 m. The section will usually fire the HE projectile and the highest authorized charge. Either fuze quick, delay, or time may be used. Fuze quick is the most desirable fuze to use against close-in targets.

LAYING FOR DIRECTION AND ELEVATION: TWO MAN- TWO SIGHT SYSTEM

When the command to engage in direct fire is given, the chief of section is in complete control and directs the firing of his section. He first identifies the designated target. If the target is a group of vehicles or tanks, he selects the target that is the greatest threat to his position. The chief of section's fire command is given in the following sequence.

***NOTE**

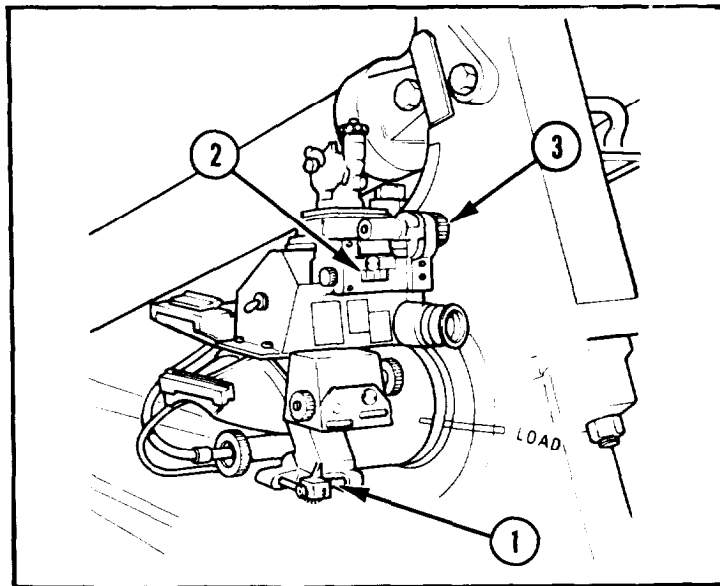
Fire is continuous until the target is defeated, method of fire is changed, or the command CEASE LOADING is given.

The chief of section estimates target range to the nearest 100 m, if accurate range data is not available. Lead for a stationary target is zero. Lead for a moving target is estimated based on target speed, range, direction of travel, and the type of ammunition being used. The chief of section approximates initial lead in 5-mil increments as follows.

<u>Command Element</u>	<u>Command Example</u>
Target designation	TARGET, LEAD TANK, LEFT/ RIGHT FRONT
Projectile, Charge, Fuze	SHELL HE, CHARGE 7, FUZE QUICK
Lead	LEAD RIGHT (LEFT) 10
Range	RANGE 800
Method of fire	FIRE AT WILL"

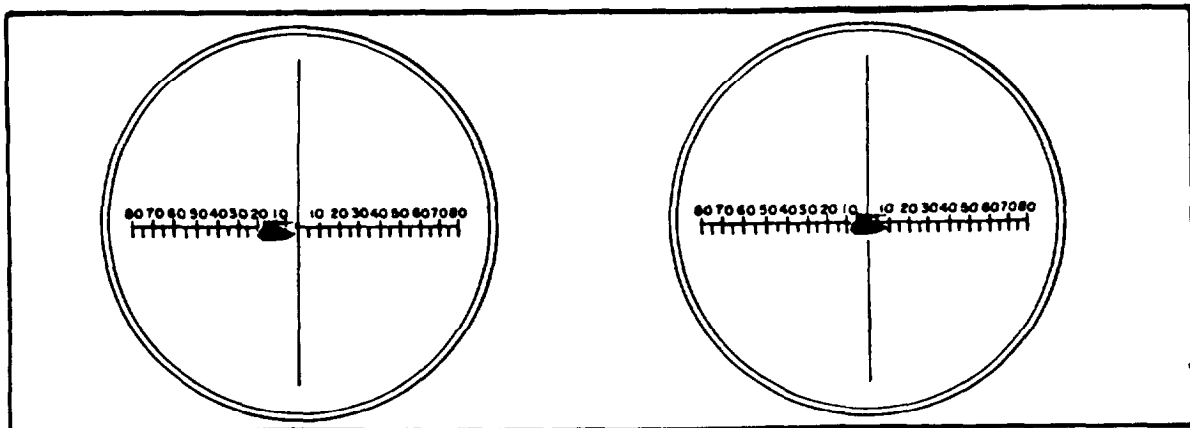
DIRECT FIRE PROCEDURES-CONTINUED

	TARGET SPEED (MPH)	TARGET TRAVELING 1600 MILS LEFT OR RIGHT TO LINE OF FIRE	TARGET TRAVELING 800 MILS LEFT OR RIGHT TO LINE OF FIRE	TARGET COMING HEAD ON
Slow	(5)	5	5	0
	(10)	10	5	0
	(15)	15	10	0
Medium	(20)	20	15	0
	(25)	20	15	0
Fast	(30)	30	20	0



The gunner centers the cross level bubble (1), sets azimuth counter (2) to 3200, and turns the direct/indirect fire bar (3) to the direct position to engage the click sight mechanism.

If central laying is used, the gunner places the announced lead on the azimuth counter, sights through the eyepiece, and traverses the tube until the vertical hairline of the pantel centers on the target.



If the reticle method is used, the gunner places the vertical hairline left or right of

the target the number of mils lead announced by the chief of section.

DIRECT FIRE PROCEDURES-CONTINUED

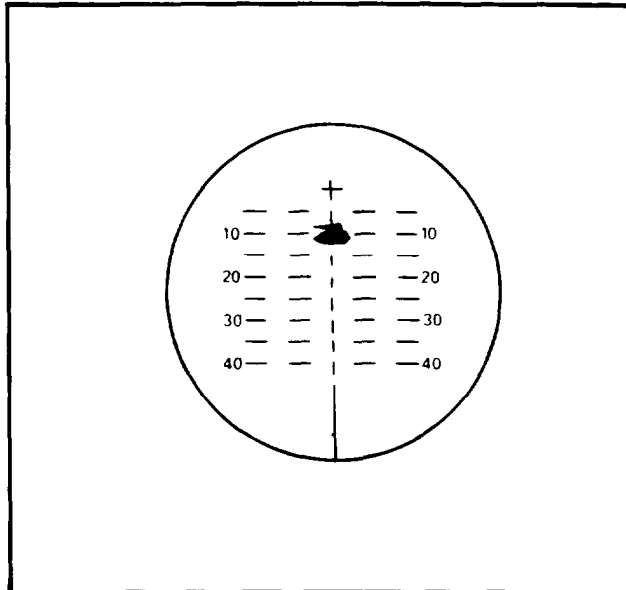
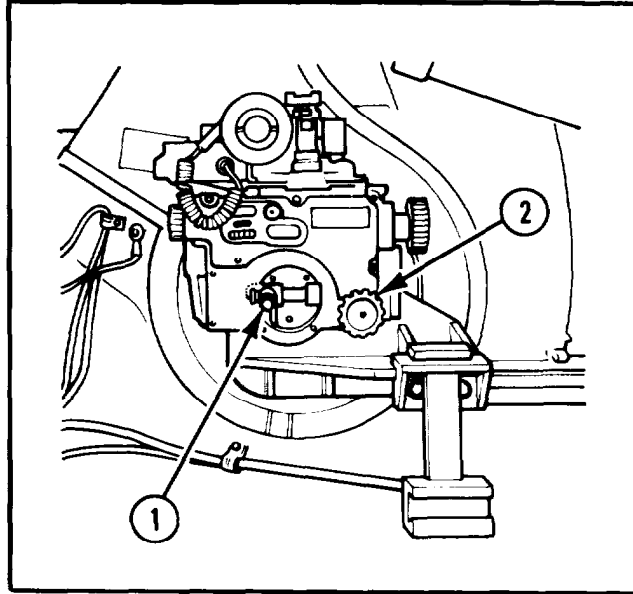
The assistant gunner checks the level vial bubble (1) on the M15 range quadrant and adjusts for cant with cant correction knob (2) to center the cross level bubble.

The assistant gunner sights through the direct fire scope and elevates or depresses the tube until the appropriate mil line passes through the center of mass of the target.

When the assistant gunner has established the correct sight picture he announces SET.

He continues to call SET as long as he is laid on the target.

The gunner tracks the target by traversing the tube and commands FIRE after the assistant gunner calls SET. The gunner and assistant gunner continue to track and fire on the target until it is destroyed or a subsequent fire command is given by the chief of section.



DIRECT FIRE PROCEDURES-CONTINUED

RANGE CHART M110A2 HOWITZER W/M139 EL TEL		
RANGE (METERS)	ELEVATION (MILS)	
	H.E.M106 PROJECTILE	
	P.C.M2 ZONE 7 MV607 M/S	P.C.M188A1 ZONE 9 MV771 M/S
400	6	3
500	7	4
600	8	5
700	10	6
800	11	7
900	13	8
1000	14	9
1100	16	10
1200	17	10
1300	19	11
1400	20	12
1500	22	13
1600	23	14
1700	25	15
1800	26	16
1900	28	17
2000	30	18
2100	31	19
2200	33	20
2300	35	21

The chief of section gives subsequent fire commands based on observed effects and changes range, lead, or both as necessary.

Command Element Command Example

Change in lead RIGHT (LEFT) 5
Change in range ADD (DROP) 100

The gunner turns the azimuth knob in 5-mil (1 click) increments to set lead changes. The assistant gunner elevates or depresses the tube until the appropriate range line is centered on the target center of mass.

LAYING FOR DIRECTION AND ELEVATION: TWO MAN-ONE SIGHT SYSTEM

WARNING

The two man-one sight or one man-one sight system should only be used when the target and the howitzer are at the same elevation, with no mask (sight to crest) obstacles in between. Firing at targets above or below the howitzer position require adjustments to the quadrants listed on the range chart.

Adjustments must be computed by the FDC IAW TC 6-40, para 6-17c thru 6-17i. For this reason, the primary means of direct fire will be the two man-two sight method.

When using the two man-one sight system, the duties of the chief of section are the same as for the two man-two sight system except that the chief of section announces quadrant in his fire command rather than range. The direct fire range chart can be used to convert range to quadrant.

DIRECT FIRE PROCEDURES-CONTINUED

LAYING FOR DIRECTION AND ELEVATION: TWO MAN-ONE SIGHT SYSTEM- CONTINUED

The duties of the gunner are the same as for the two man-two sight system.

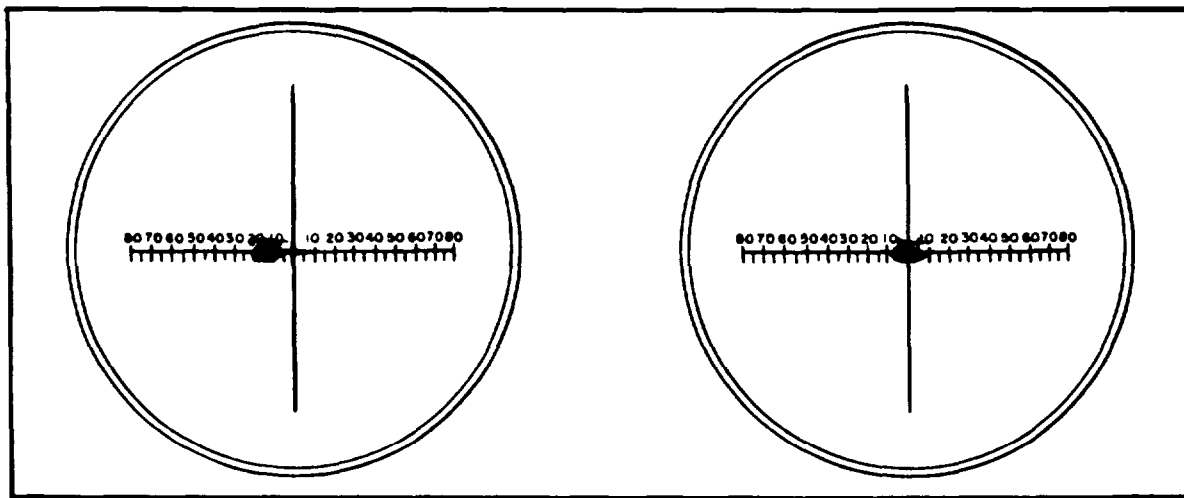
The assistant gunner sets the announced quadrant on the M15 range quadrant. He then elevates or depresses the tube until

the elevation level bubble is centered. When the bubble is centered, the assistant gunner announces SET. The assistant gunner continues to elevate or depress the tube, keeping the bubble centered until a change in fire commands is announced.

LAYING FOR DIRECTION AND ELEVATION: ONE MAN-ONE SIGHT SYSTEM

The duties of the chief of section are the same as for the two man-one sight system.

This technique also requires the chief of section to convert range to quadrant.



**GUNNER'S SIGHT PICTURE,
LEAD 10 MILS**

**GUNNER'S SIGHT PICTURE,
NO LEAD**

The gunner lays the piece for both deflection and elevation. He sets the announced quadrant on the auxiliary elevation counter and elevates or depresses the tube until the elevation-level bubble is centered. He then centers the cross level bubble. With 3200 set on the azimuth counter, he traverses the tube until the crosshair of the reticle

pattern is on the target center of mass or the correct lead is established. When the gunner establishes the correct sight picture, he commands FIRE. After firing, he continues to lay on the target until it is destroyed or a subsequent fire command is issued.

UNLOADING HOWITZER**WARNING**

Before attempting to unload the howitzer, see MISFIRE/CHECKFIRE procedures. Refer to page 2-147.

CAUTION

Do not use bell rammer to unload M845, M753, M422 and M422A1 projectiles.

NOTE

A complete round, once loaded, should always be fired, in preference to being unloaded. For unloading or extracting the M422 and M422A1 projectiles, see chapter 5. Refer to page 5-34.

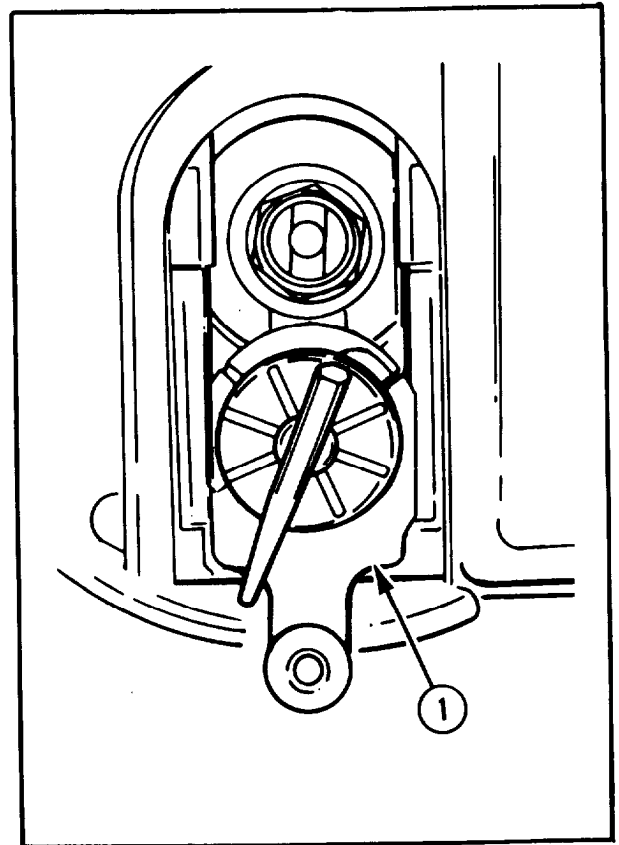
Unloading is supervised by the chief of section.

The command UNLOAD is given and the bell rammer is inspected to ensure freedom of obstructions.

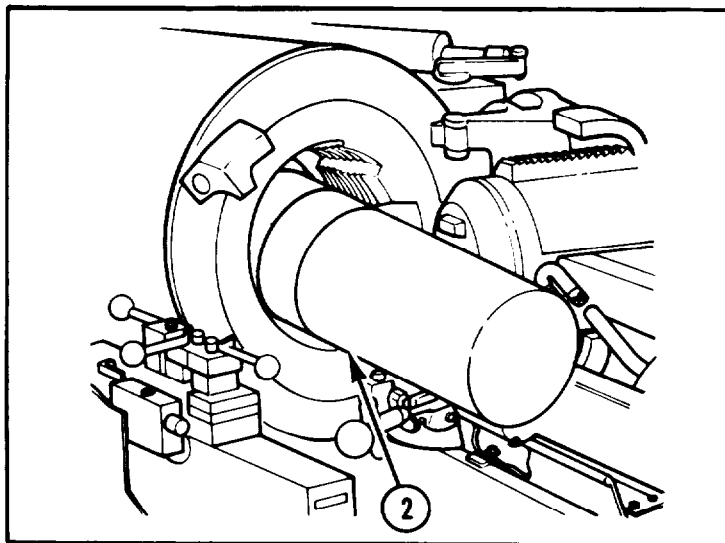
WARNING

Never stand directly behind the cannon when unloading.

- 1 Cannoneer No. 2 pulls breechblock handle down which slides firing mechanism block (1) down to remove primer.



UNLOADING HOWITZER-CONTINUED



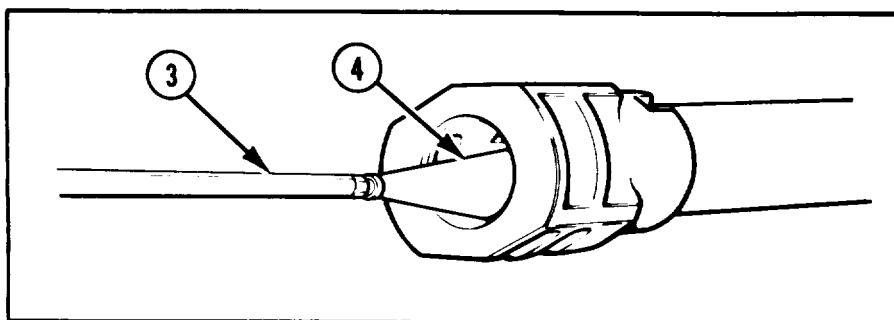
2 Cannoneer No. 2 opens breechblock and, assisted by cannoneer No. 1, removes propelling charge (2) and hands it to cannoneer No. 6 and ATC.

4 Assistant gunner depresses cannon tube until it comes to a stop.

3 Cannoneer No. 1 places rags or other waste material in propellant chamber and closes the breechblock.

WARNING

Ensure that bell rammer (item 82, appx B) is used.



5 Cannoneers No. 3 and 4 assemble rammer staff sections (3) with bell rammer (4). They insert bell rammer into muzzle end of tube and push carefully until bell rammer head encircles fuze and is seated against projectile. Steadily increasing

pressure is applied by tapping the end of the rammer staff with a wooden block until projectile is loose.

UNLOADING HOWITZER-CONTINUED

- 6 When projectile is loosened, cannoneers No. 3 and 4 suspend operation and remove bell rammer from the tube. Cannoneer No. 1 places the loader rammer into position with the trough stowed. The loading tray is placed in position to receive the projectile as the assistant gunner elevates the tube until LOAD marks are aligned. The chief of section has cannoneer No. 2 open breechblock and cannoneer No. 1 remove waste. Cannoneer No. 2 moves the tray into the forward position to receive the projectile. Cannoneer No. 1 stands at the breech, placing his hand at the base of the projectile. He steadies its backward movement as the assistant gunner and cannoneer No. 2 push projectile onto the loading trough.
- 7 Projectile is then disposed of as directed.

MISFIRE/CHECKFIRE PROCEDURES*GENERAL*

Conditions described are rarely encountered when authorized and properly maintained ammunition is fired in a properly maintained and operated weapon. However, to avoid injury to personnel and damage to equipment, it is important that all understand:

- What is involved when the weapon fails to fire.
- What should be done when a failure to fire occurs.

When authorized rates of fire are exceeded, propelling charge cookoffs may occur within 5 minutes after chambering. Maximum rate- 1 round every 40 seconds in a 3 minute period. Sustained rate- 1 round every 2 minutes.

If EXPLOSIVE ORDNANCE DISPOSAL (EOD) removes the projectiles using the water and explosive charge method, DS/GS maintenance must certify the condition and serviceability of the tube prior to any further firing from that tube. Once a projectile is removed, EOD is responsible for its evacuation and disposition.

DEFINITIONS

- Check fire-A command to interrupt firing when an unsafe act or condition exists. Check fire can be given by anyone present.
- Cold tube-Any tube that has not exceeded the prescribed rates of fire and does not cause water from a wet swab to boil, fry, or steam off when placed just forward of the gas check seat.
- Hot tube-Any tube that has exceeded the prescribed rates of fire and causes water from a wet swab to boil, fry, or steam off when placed just forward of the gas check seat.
- Cookoff - Functioning of the propelling charge initiated by heat of the weapon.
- Hangfire-A delay in functioning of the primer, igniter, or propelling charge. This delay, though unpredictable, ranges from a fraction of a second to 10 minutes.
- Misfire-When the weapon does not fire after an attempt to fire has been made. This failure may be due to failure of the primer, igniter, propelling charge, or firing mechanism to function wholly or in part.

MISFIRE/CHECKFIRE PROCEDURES-CONTINUED

WARNING

- W1 Cookoff may occur.
- W2 Hangfire may occur.
- W3 Stand clear of recoiling part.
- W4 Do not fire unloaded ammunition components.

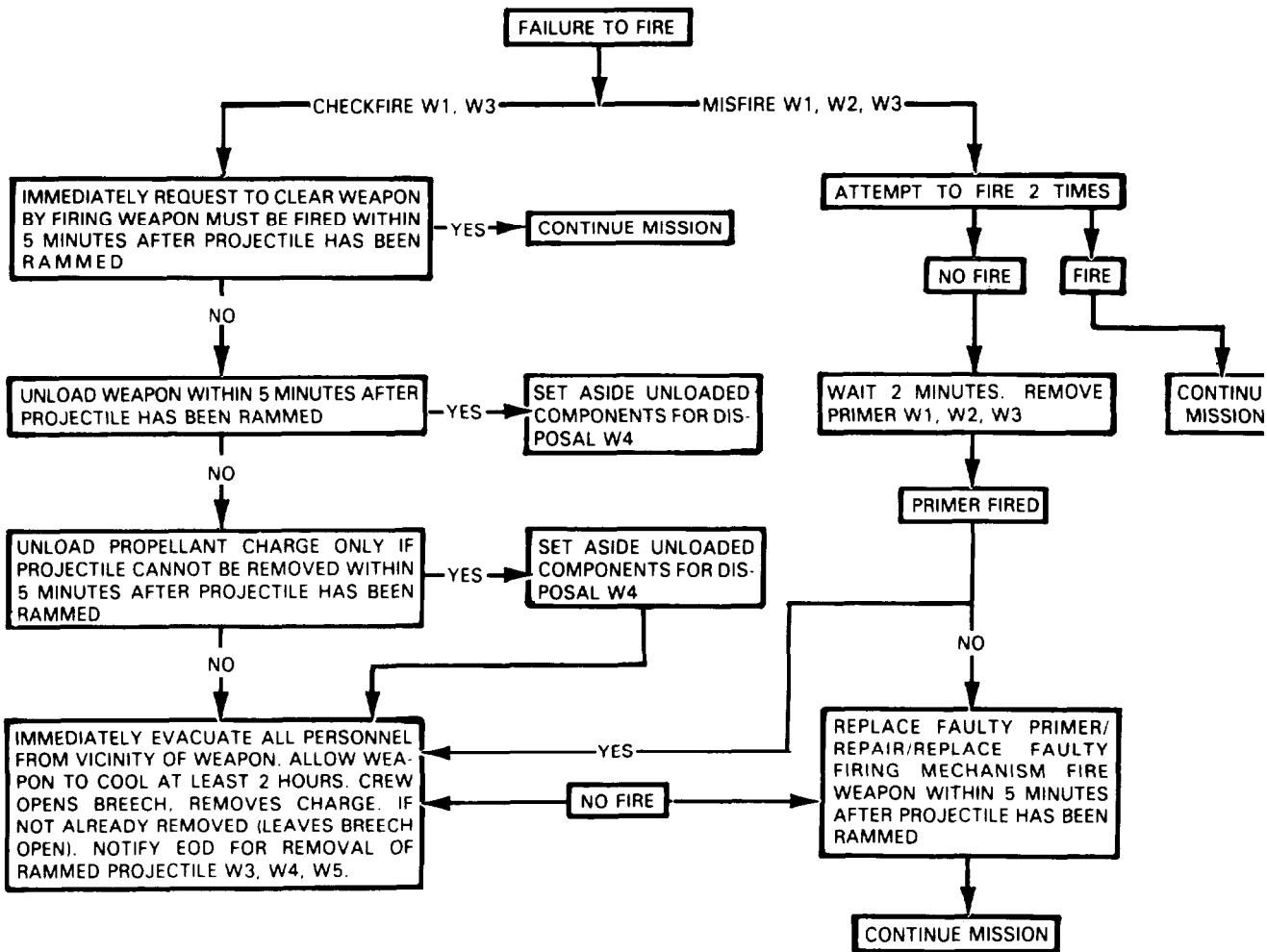
Any ammunition components which have been unloaded from the weapon must be segregated and turned in for disposition.

- W5 Never fire a projectile or charge which has been allowed to cool in a hot tube.

HOT TUBE MISFIRE PROCEDURE M110A2

WARNING

Only 5 minutes are available for corrective action after projectile has been rammed.

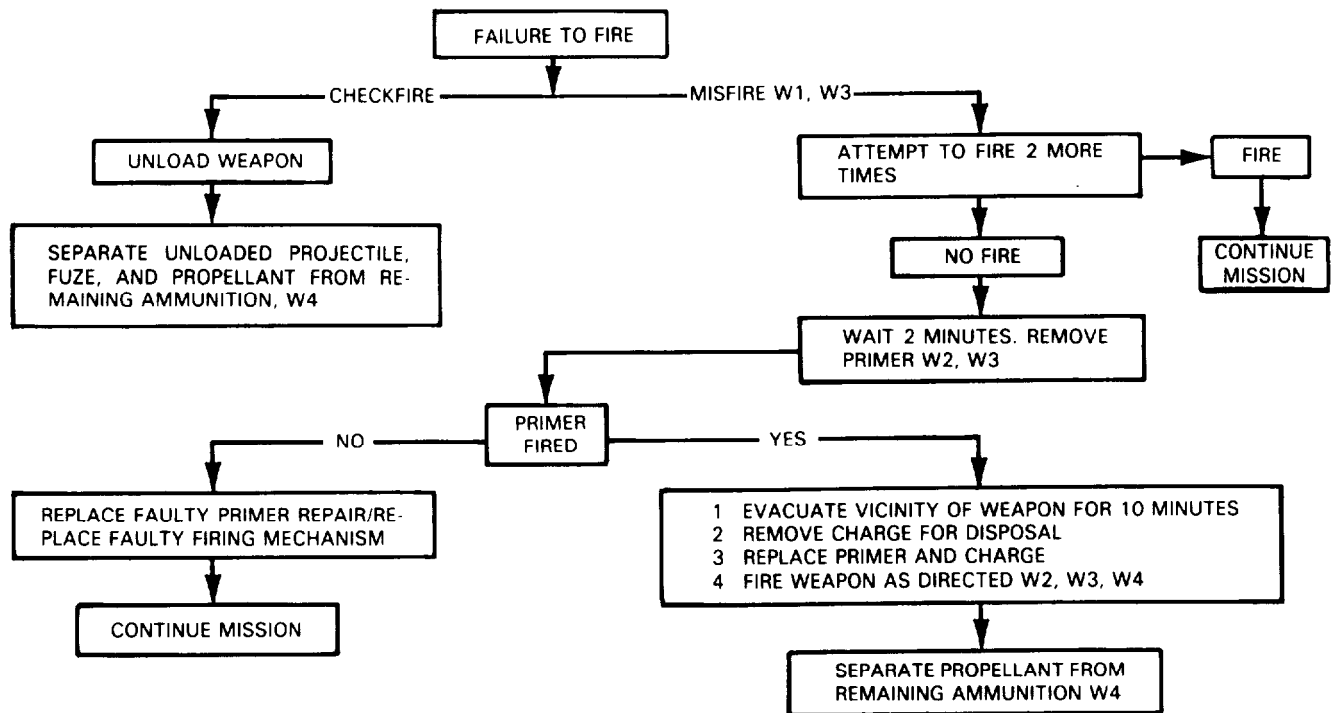


MISFIRE/CHECKFIRE PROCEDURES-CONTINUED

COLD TUBE MISFIRE PROCEDURE M110A2

NOTE

No time limit for corrective action.



OPERATION OF AUXILIARY EQUIPMENT

Instructions for operation of auxiliary equipment are contained on the following pages. The auxiliary equipment consists of

communications equipment, portable fire extinguisher, and special purpose kits.

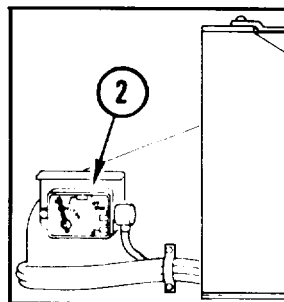
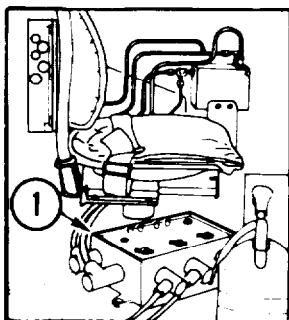
OPERATION OF IN TERCOMMUNICATION SYSTEM

Communications equipment on the howitzer consists of an amplifier, three intercom control boxes, and head sets and chest sets for each of the crew. Either an AN/UIC-1 or an AN/VIC-1 (V) communications set is provided for the vehicle.

Instructions for operation of the AN/UIC-1 are in TM 11-2643. Instructions for operation of the AN/VIC-1(V) are in TM 11-5830-340-12.

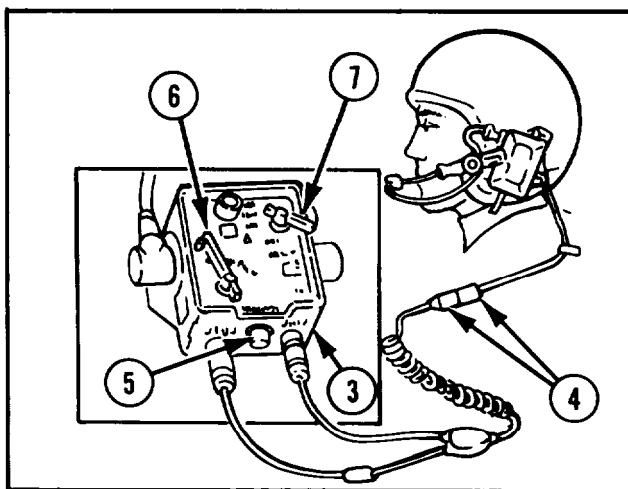
OPERATION OF AUXILIARY EQUIPMENT-CONTINUED

OPERATION OF INTERCOMMUNICATION SYSTEM- CONTINUED



- 1 The amplifier (1) is under assistant gunner's seat on right side of turret.
- 2 The assistant gunner's intercom box (2) is mounted at rear of right trunnion.

- 3 The gunner's intercom box is mounted on a bracket extending from left trunnion adjacent to breech ring.



- 4 The driver's intercom box (3) is on left wall of driver's compartment.
 - a. Turn MASTER switch ON and turn on power at amplifier AM-1780/VRC.
 - b. Connect CVC helmet cable connectors to C2298/VRC receptacles. Cable with yellow band (longer cable) connects to receptacle with yellow mark.

- c. Check that bail-out connectors (4) are connected firmly.
- d. Adjust VOLUME knob (5) as desired.
- e. With CVC helmet on, turn on AN/VIC 1 and radio; check intercom between crew members (6). Check to make sure vehicle has two-way communications over radio (7).

OPERATION OF AUXILIARY EQUIPMENT-CONTINUED

OPERATION OF VEHICULAR APPLIQUE SYSTEM

The vehicular applique assembly consists of the mounting harness and main control unit for operating the radio set with the

intercom system. Instructions for operating the vehicular applique system are in TM 11-5820-886-13 (to be published).

OPERATION OF DATA DISPLAY GROUP

The data display group consists of a control case assembly and mount, a section chief's assembly and mount, two gun assemblies, and connecting cables. Instructions for the

operation of the data display group are in TM 11-7440-283-12-1 and TM 11-7440-283-12-2.

M90 RADAR CHRONOGRAPH EQUIPMENT AND ANTENNA MOUNTING KIT

M90 radar chronograph measures muzzle velocity under field conditions. Consists of a data unit assembly, system test unit,

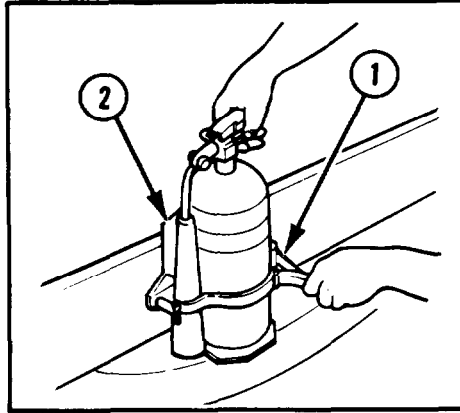
power cable, and a mount bracket antenna. Refer to TM 9-1290-359-12&P.

All data on 2-152 and 2-153 including illustrations deleted. ■

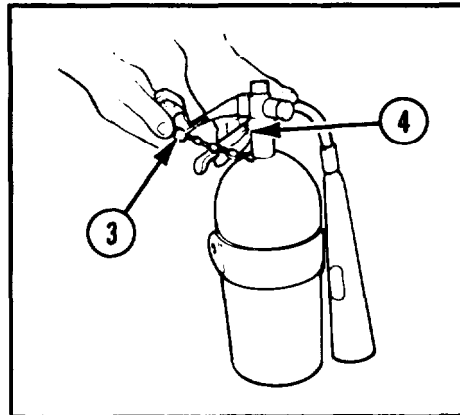
OPERATION OF AUXILIARY EQUIPMENT-CONTINUED

OPERATION OF PORTABLE FIRE EXTINGUISHER

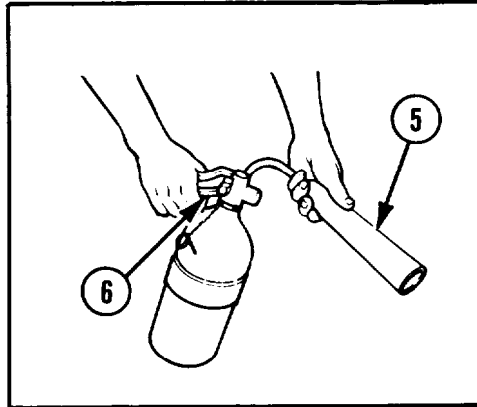
The portable fire extinguisher is to right of assistant gunner's seat.



- 1 Pull latch (1) and lift fire extinguisher from bracket (2).



- 2 Pull safety pin (3) and break safety wire (4).

OPERATION OF AUXILIARY EQUIPMENT-CONTINUED*OPERATION OF PORTABLE FIRE EXTINGUISHER- CONTINUED*

3 Aim nozzle (5) at base of fire and squeeze trigger (6) to discharge fire extinguisher.

4 After using fire extinguisher, notify unit maintenance to have cylinder recharged or replaced.

OPERATION OF SPECIAL PURPOSE KITS

Instructions for operation of special purpose kits are contained on the following pages. The special purpose kits consist of the driver's enclosure kit, crew personnel heater kit, crew personnel shelter kit, arctic traction kit, and on-vehicle equipment rack kit.

- The driver's enclosure kit protects the driver from the wet and cold while driving the vehicle with the cupola cover open. The enclosure will fold forward and not interfere with closing the cupola cover. An electric windshield wiper is installed on the windshield.
- The hull heater kit has a coolant heater to maintain engine coolant and battery temperatures at the level for starting the engine. It is authorized for issue when the vehicle is to be operated in arctic regions. The driver's

heater provides warm air for the driver's compartment.

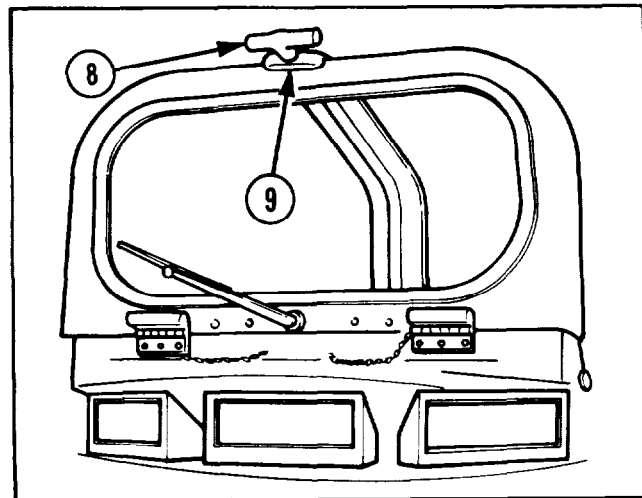
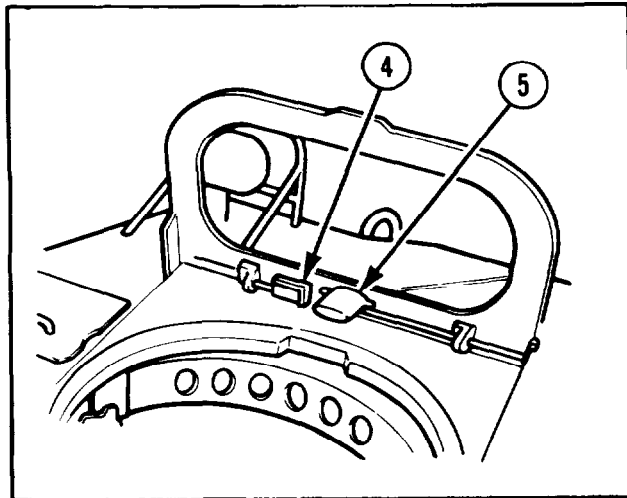
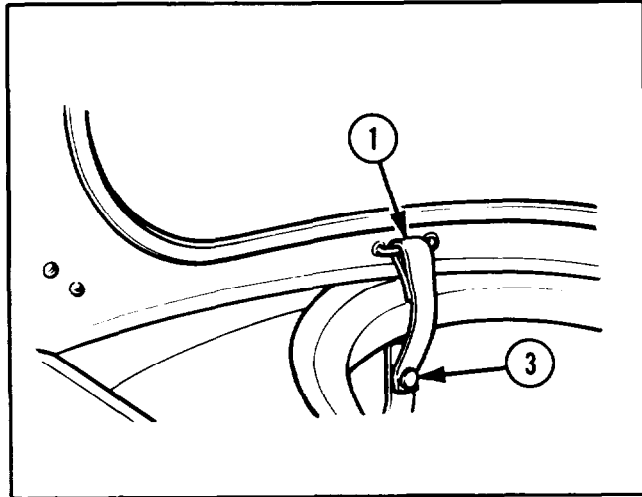
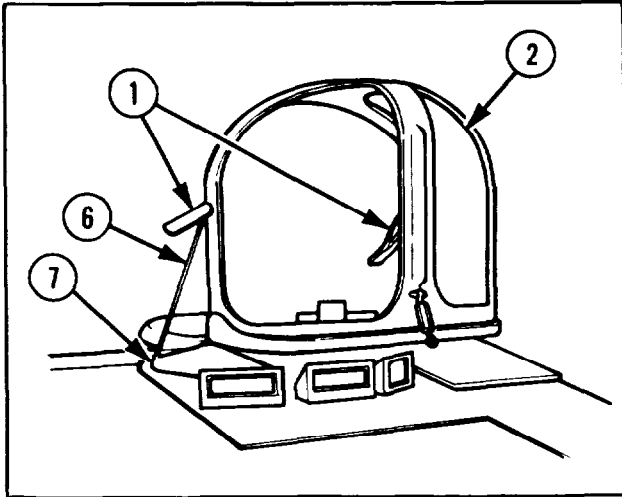
- The crew personnel heater kit provides warm air for the crew personnel shelter.
- The crew personnel shelter kit protects the crew from the wet and cold.
- The arctic traction kit provides special track pads that increase traction of the vehicle on ice and snow.
- The on-vehicle equipment rack kit provides a platform bolted to the hull for carrying boxed basic issue items.

Special purpose kits are installed on the howitzer by support maintenance. The following pages describe each kit and provide instructions for the operation of each item.

OPERATION OF AUXILIARY EQUIPMENT-CONTINUED

OPERATION OF DRIVER'S ENCLOSURE KIT

OPENING DRIVER'S ENCLOSURE



CAUTION

Do not traverse or fire weapon while driver's enclosure is open.

- 1 Pull down on straps (1) to lower driver's window (2) over cupola.
- 2 Secure enclosure by pushing snap fastener on strap (1) onto studs (3).

3 To open driver's window, pull strap (1) on each side of enclosure free from stud (3). Push up and forward on window (2) and fold windshield and window forward onto hull.

4 To operate windshield wiper, set wiper motor switch (4) located to left of wiper motor (5) ON.

OPERATION OF AUXILIARY EQUIPMENT-CONTINUED

OPERATION OF DRIVER'S ENCLOSURE KIT-CONTINUED

REMOVAL OF DRIVER'S ENCLOSURE

CAUTION

Do not traverse or fire weapon while driver's enclosure is open.

- 1 Remove window-to-cupola chain (6) from base link (7).
- 2 Turn catch assembly (8) counterclockwise until there is enough slack to allow

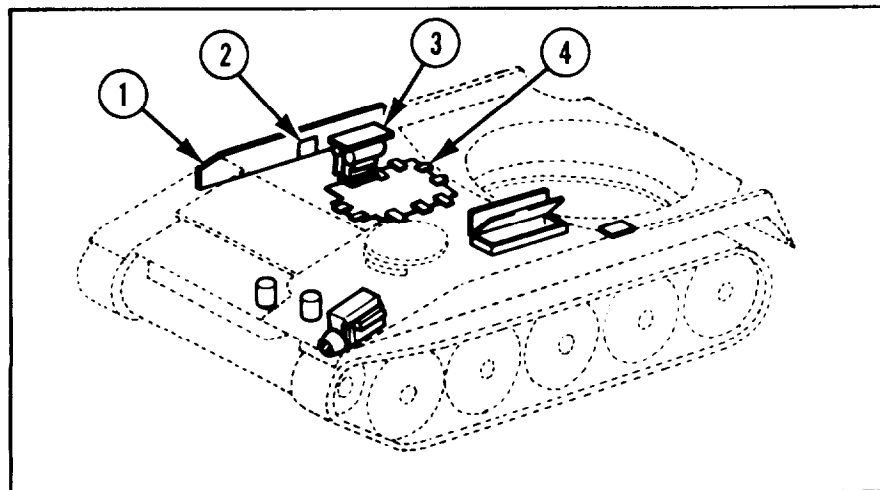
release of catch assembly (8) from latch (9) in window assembly. Lift catch assembly (8) from latch (9).

- 3 Lift window assembly (2) from windshield and remove from vehicle.
- 4 Make sure that windshield is folded down flat.
- 5 Installation is the reverse of removal.

HULL HEATER KIT

The hull heater kit allows the vehicle to be operated in arctic regions. The hull heater kit consists of a driver's heater, an engine

coolant heater, a fuel filter heater, vehicle closure covers, battery box, and plugs.



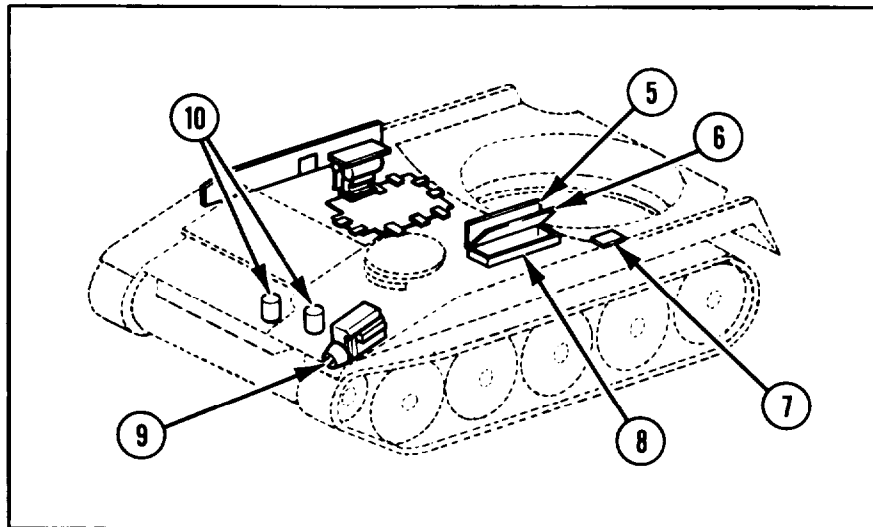
- 1 HULL EXHAUST PORT COVER. This cover prevents ice and snow from getting into the engine compartment.
- 2 COOLANT HEATER EXHAUST OUTLET COVER PLATE. This plate allows coolant heater to exhaust while protecting the exhaust port cover from damage.
- 3 COOLANT HEATER. The coolant heater maintains engine and battery temperatures at the starting level. The coolant

heater takes coolant from the engine, heats the coolant, and then sends it through the hollow bottom of the battery box, and back to the engine cooling system.

- 4 RADIATOR AIR INTAKE GRILL COVER. This cover prevents ice and snow from getting into the radiator and fan well compartment.

OPERATION OF AUXILIARY EQUIPMENT-CONTINUED

HULL HEATER KIT- CONTINUED



5 BATTERY COMPARTMENT AIR INTAKE PORT COVER. This cover prevents entry of ice and snow into the battery compartment and the engine air intake system.

6 INSULATED BATTERY COMPARTMENT COVER. This cover provides insulation to help maintain battery temperature at the starting level.

7 ENGINE INTAKE AIR VENT COVER. This cover prevents ice and snow from getting into the engine air intake system.

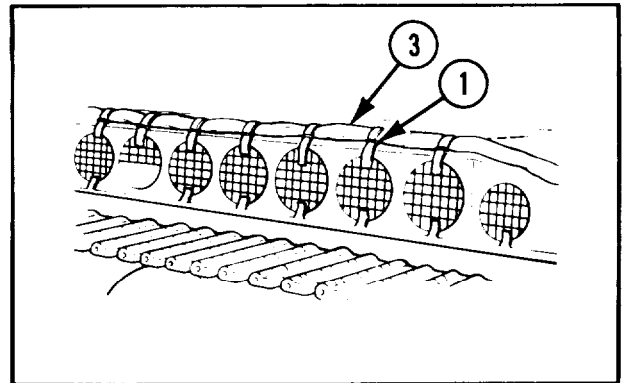
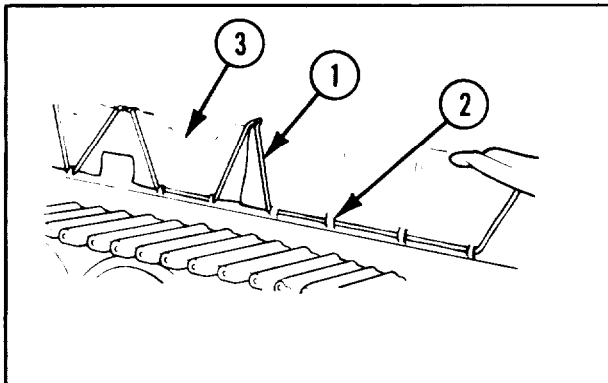
8 BATTERY BOX. The battery box has a hollow bottom through which heated coolant from the coolant heater is routed to warm the batteries.

9 DRIVER'S HEATER. The driver's heater provides warm air for the driver's compartment.

10 FUEL FILTER HEATER. The fuel filter heater warms the fuel and melts the ice before draining water from filters.

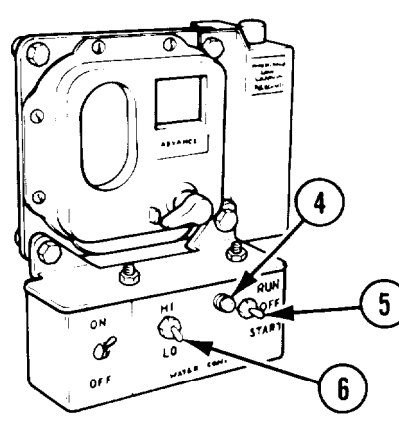
OPERATION OF AUXILIARY EQUIPMENT-CONTINUED

OPERATION OF DRIVER'S HEATER



- 1 Before operation of driver's heater, loosen rope (1) from cleats (2) and roll exhaust port cover (3) up. Secure

exhaust port cover (3) on top deck by attaching rope (1) to cleats (2) in deck.



- 2 Press light (4). Light should come on.
- 3 Hold RUN-OFF-START switch (5) in START position until light (4) comes on

NOTE

If light (4) does not come on in 5 minutes, notify unit maintenance.

- 4 When light (4) comes on, immediately move RUN-OFF-START switch (5) to

RUN position without stopping in OFF position.

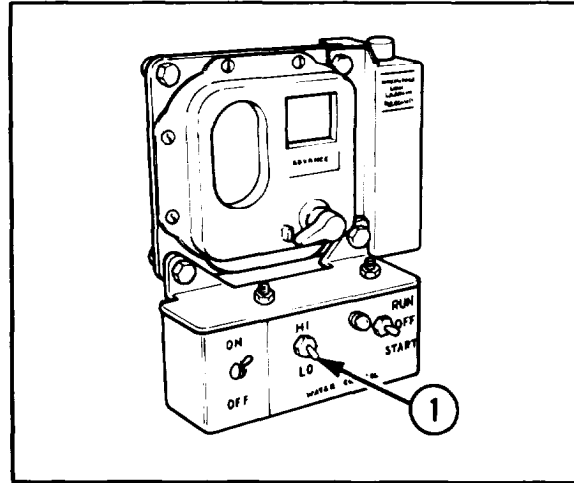
- 5 Set HI-LO switch (6) for desired rate of heating.

- 6 To turn heater off, turn heater RUN-OFF-START switch (5) to OFF. Light will stay on until heater is purged and blower will operate for about 1 minute after heater is turned off.

OPERATION OF AUXILIARY EQUIPMENT-CONTINUED

OPERATION OF FUEL FILTER HEATERS

- 1 Set ON-OFF switch (1) ON.
- 2 Allow heaters to operate until liquid in fuel filters flows freely from drain valves.
- 3 To turn off heaters, set ON-OFF switch (1) OFF.



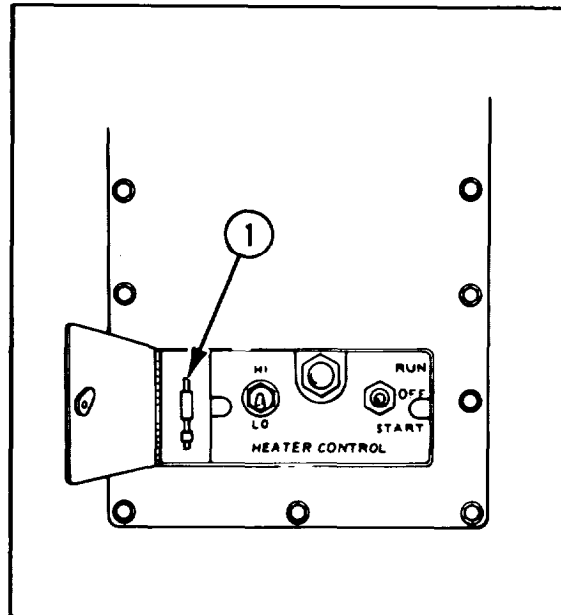
OPERATION OF COOLANT HEATER

CAUTION

- Operate coolant heater continually whenever engine is not operating and temperature is - 25°F (- 32°C) or below.
- Do not operate coolant heater longer than 12 hours without recharging vehicle batteries.

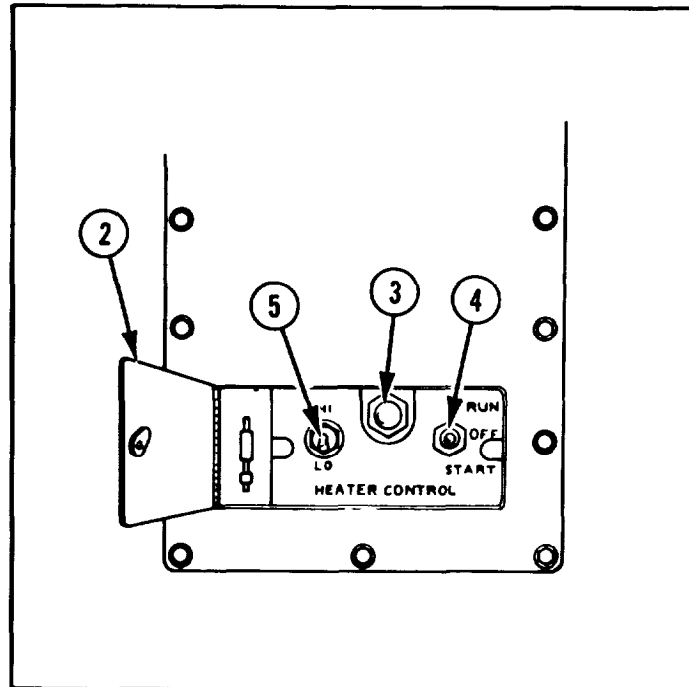
NOTE

Before first operation of coolant heater, or after coolant system has been drained and refilled, purge air from coolant heater by opening drain cock (1) located under cooling heater control panel. Run coolant heater until no air comes from drain cock (1), then close drain cock (1).



OPERATION OF AUXILIARY EQUIPMENT-CONTINUED

OPERATION OF COOLANT HEATER- CONTINUED



- 1 Install cover on radiator air intake grill and secure with snap fasteners.
- 2 Open spring-loaded cover (2) over coolant heater control panel and press light (3). Light (3) should come on.

NOTE

If light (3) does not come on within 5 minutes, notify unit maintenance.

- 3 Hold RUN-OFF-START switch (4) in start position until light comes on.
- 4 When light (3) comes on, immediately move RUN-OFF-START switch (4) to RUN position without stopping in OFF position.

- 5 Set HI-LO switch (5) for desired rate of heating.

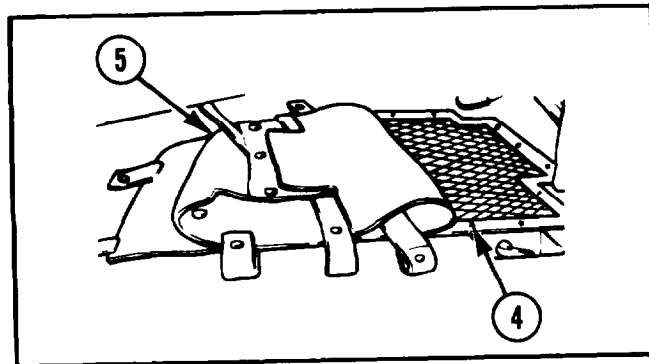
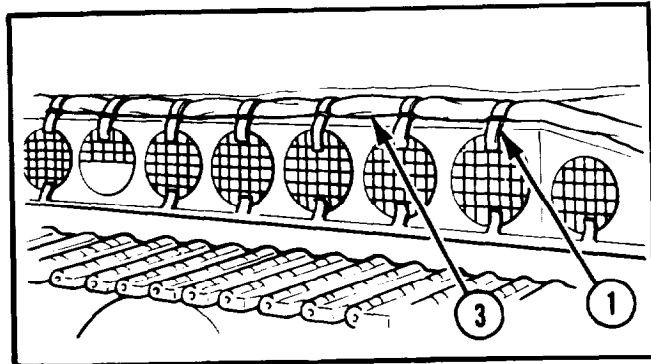
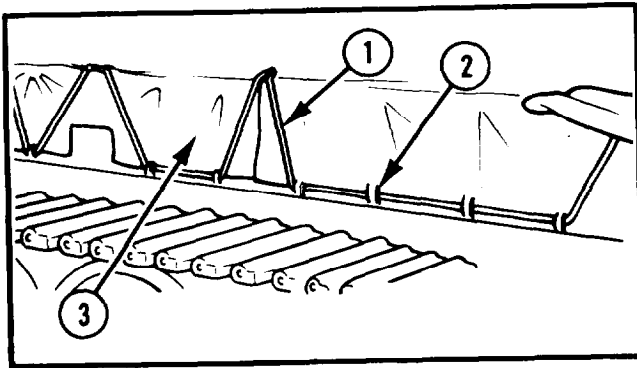
NOTE

If set for HI, the heater will automatically go into low heat when coolant temperature reaches 220°F (104°C). The LO position is proper for standby operation when heater will be used for a long period of time.

- 6 To shut heater off, set RUN-OFF-START switch (4) OFF. The flame will go out in a short time as soon as fuel is purged. The blower will operate for about one minute until heater has cooled, then will stop.

OPERATION OF AUXILIARY EQUIPMENT-CONTINUED

OPERATION OF EXHAUST PORTS AND INTAKE COVERS



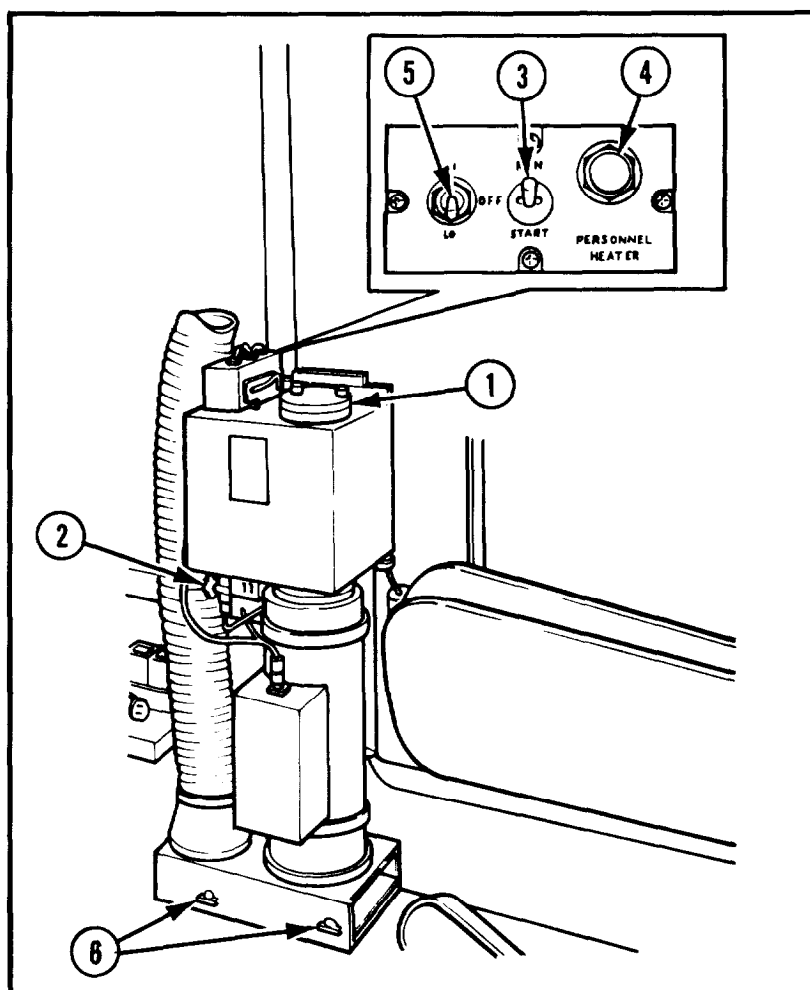
1 Before starting engine, loosen rope (1) from cleats (2) and roll exhaust port cover (3) up. Secure exhaust port cover (3) on top deck by attaching rope (1) to cleats in deck.

2 Partly uncover air intake by removing snaps from studs (4) securing cover (5) over air intake grill.

3 After engine is running, adjust cover (5) for engine cooling requirements.

OPERATION OF AUXILIARY EQUIPMENT-CONTINUED

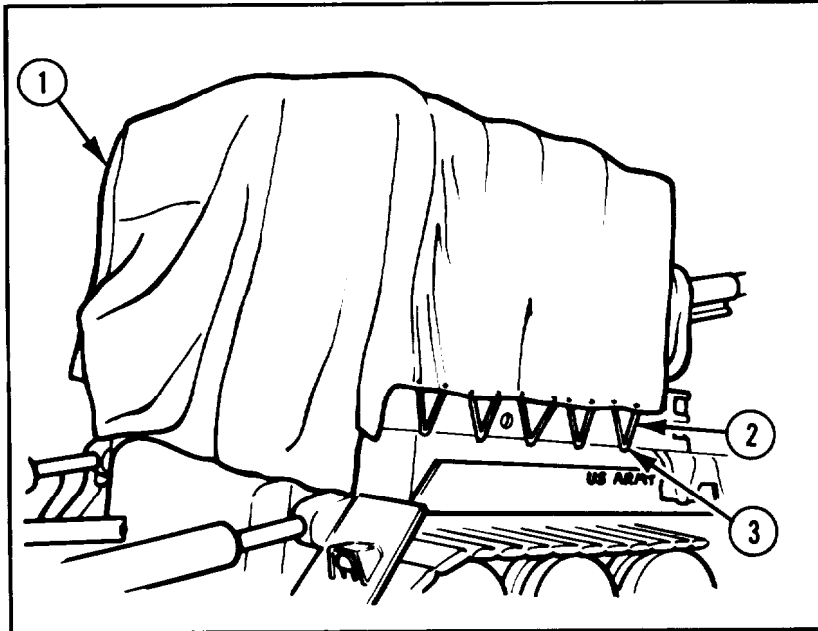
OPERATION OF CREW PERSONNEL HEATER



- 1 Remove fuel filler cap (1). Add diesel fuel to fill as required. Initial capacity is 5 gallons (19 l). Replace fuel filler cap (1).
- 2 Open fuel shutoff cock (2).
- 3 Hold RUN-OFF-START switch (3) in START pushbutton until light (4) comes on, then move RUN-OFF-SWITCH (3) to RUN position without stopping in OFF position.
- 4 Position HI-LO switch (5) to HI or LO as desired.
- 5 Heater airflow can be adjusted by operating deflectors (6).
- 6 To turn heater off, turn heater RUN-OFF-START switch (3) OFF. Light (4) will stay on until heater is purged and blower will operate for about 1 minute after heater is turned off.
- 7 Close shutoff cock (2).

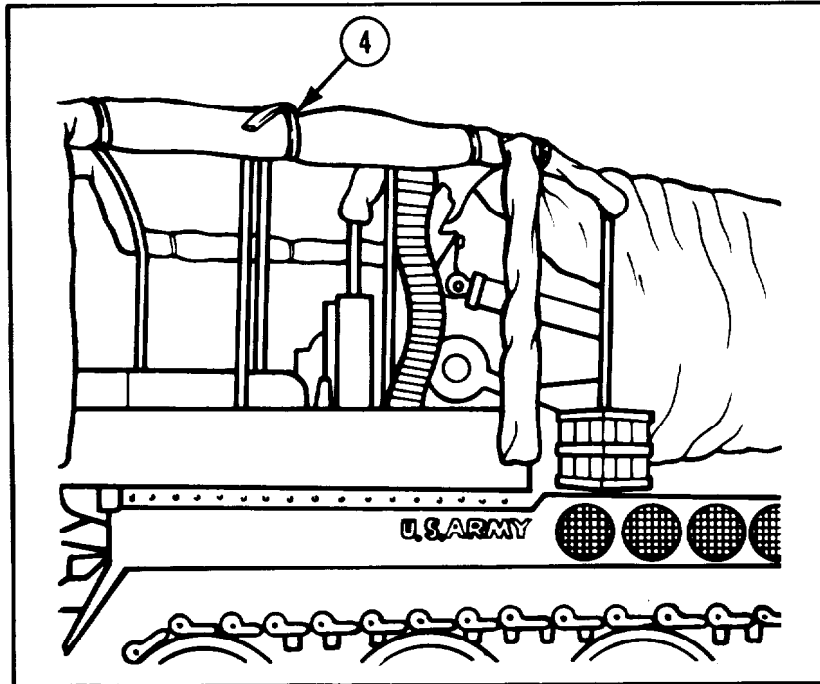
OPERATION OF AUXILIARY EQUIPMENT-CONTINUED

OPERATION OF CREW PERSONNEL SHELTER



1 For normal winter operation, all sides of crew personnel shelter (1) should be

strapped down and secured with rope (2) attached to cleats (3).



2 During firing, roll sides of shelter (1) up and secure in place with straps (4).

Three dome lights are mounted in the crew personnel shelter frame: one above the

assistant gunner's seat, one above the gunner's seat, and one above the weapons breach. These lights are operated the same as the dome light in the driver's compartment. Refer to page 2-69.

OPERATION OF AUXILIARY EQUIPMENT-CONTINUED

ARCTIC TRACTION KIT

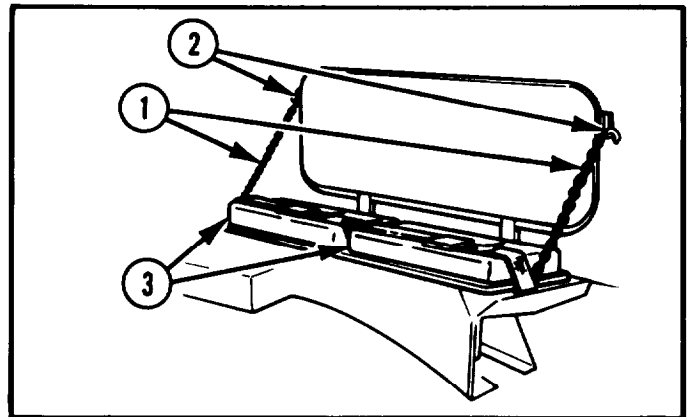
The arctic traction kit provides special track pads that increase the traction of the vehicle on ice and snow. Arctic track pads are installed and replaced by crew. Arctic track pads require no special maintenance.

Service and maintain the track, track tension, and track shoes in the normal manner. Notify unit maintenance for proper torque. Refer to pages 3-39 thru 3-45.

SECURING PERSONNEL SEAT AND PROJECTILE TRAYS

PERSONNEL SEAT

Release chain links (1) from slot in bracket (2) to lower seat to travel position (3) or raise seat to stowed position.



PROJECTILE TRAYS

CAUTION

Do not stow projectile lifting tray on projectile rack on left side of spade. Contact with loader/rammer when spade is raised may cause damage.

Stow one projectile lifting tray on projectile rack on right side of spade. Stow other projectile lifting tray on loader/rammer.

PREPARATION FOR MOVEMENT

To prepare for movement, the command is MARCH ORDER.

If the piece is to be moved a short distance and if firing is to be resumed promptly, the command MARCH ORDER is not given. When such a displacement is ordered, only those operations necessary for movement of the howitzer and security of equipment are performed.

If the command MARCH ORDER is given while the weapon is partially prepared for travel, the operations pertaining to march order are completed.

Duties of individuals follow:

- 1 Chief of section commands MARCH ORDER and supervises the work of all section members.

PREPARATION FOR MOVEMENT-CONTINUED



- Establish hydraulic oil reserve (index pin is extended) before elevating weapon. Failure to establish hydraulic oil reserve could result in cannon sliding out of battery and injuring personnel.
 - Prior to elevating cannon, crew must be alerted.
 - Elevate or depress cannon tube until LOAD marks aline before opening breech to avoid injury to personnel.
- 2 Cannoneer No. 2 makes sure the piece is not loaded and closes the breech.
 - 3 Gunner prepares the telescope and mount for travel by covering level vials and replacing cover. He then positions cannon in center of traverse.
 - 4 Cannoneer No. 1 secures loader/rammer in stowed position.
 - 5 Assistant gunner and cannoneer No. 2 engage travel lock support. Refer to page 2-78.
 - 6 Assistant gunner prepares the elevation quadrant for travel by covering level vials and replacing cover.
 - 7 Cannoneer No. 3 assists the ATC and section vehicle driver in loading equipment.

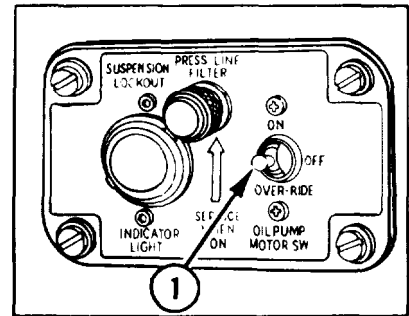
- 8 Cannoneer No. 5 recovers and stows communication wire and equipment.
 - 9 Cannoneer No. 6 recovers aiming posts and/or collimator. He then passes covers to appropriate crew members and replaces muzzle brake cover.
 - 10 Howitzer driver starts engine and makes operational checks. Refer to page 2-61.
 - 11 Cannoneer No. 2 passes swab bucket to cannoneer No. 4 and primers to chief of section.
 - 12 Assistant gunner opens shutoff valve (if present] and retracts cannon to travel position, refer to page 2-88. He then replaces elevation quadrant cover.
 - 12.1 Cannoneer No. 2 closes replenisher shutoff valve.
- NOTE
- Return the cannon to battery position whenever vehicle is to be parked for more than 1 hour.
- 13 Howitzer driver unlocks suspension. When directed by chief of section, driver moves vehicle forward to unseat spade.
 - 14 Cannoneers No. 3, 4, 5, and 6 load section boxes and equipment on the spade and section vehicle.

PREPARATION FOR MOVEMENT-CONTINUED

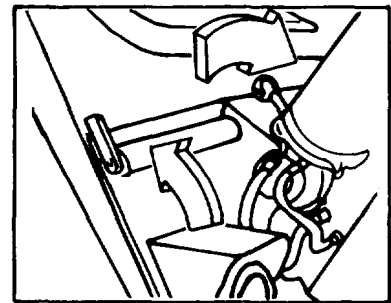
- 15 Gunner replaces telescope cover, then sets OIL PUMP MOTOR Switch (1) OFF.
- 16 Cannoneer No. 1 replaces breech cover.

CAUTION

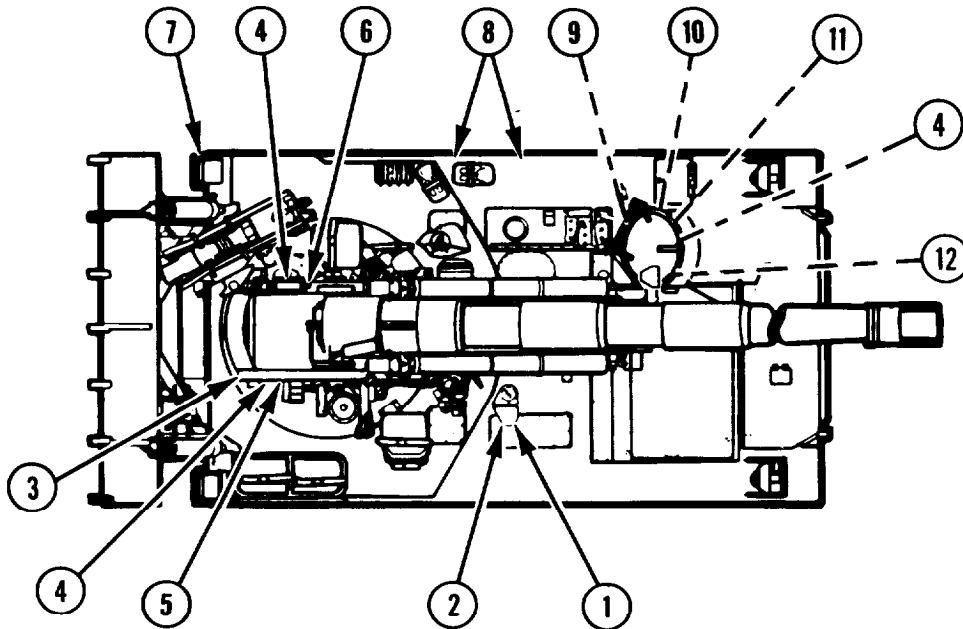
Wipe spade cylinder rods clean before raising spade to prevent damage to cylinder seals.



- 17 Chief of section raises spade to travel position and locks left spade cylinder. Cannoneer No. 1 locks right spade cylinder. Refer to page 2-83.
- 18 Chief of section verifies that the piece is prepared for travel and reports to the battery executive officer NUMBER (SO AND SO), IN ORDER or reports any defects that cannot be corrected without delay.



OPERATING INSTRUCTIONS ON DECALS AND INSTRUCTION PLATES



KEY	ITEM/LOCATION	DESCRIPTION
1	Diesel fuel only plate on fuel fill cover	Caution to fill fuel cell with diesel fuel only.
2	Fuel cell bladders installed caution plate on inside fuel filler access cover	Caution to remove fuel cell bladders before welding in fuel cell area.
3	Elevating plates on trunnion	Instructions for elevating and lowering howitzer.
4	High intensity noise caution plates on trunnions and driver's switch panel	Warning to wear hearing protection when vehicle is operating.
5	Range chart sign on right trunnion	Reference for changing range to mils for elevating howitzer.
6	Traversing plate on left trunnion	Instructions for traversing howitzer.
7	Spade control sign on left rear of vehicle	Instructions for raising and lowering spade.

OPERATING INSTRUCTIONS ON DECALS AND INSTRUCTION PLATES-CONTINUED

KEY	ITEM/LOCATION	DESCRIPTION
8	Air cleaner plates on inside of access door	Instructions for servicing and replacing engine air intake filters.
9	Aeration warning plate on aeration warning light in driver's compartment	Identifies low engine coolant level warning light.
10	Air box heater and fuel prime plate on driver's switch panel	Instructions for use of fuel purge and prime and air box heater.
11	Secondary fuel filter plate on high pressure fuel filter	Notice to drain filter and replace element.
12	Primary fuel filter plate on low pressure fuel filter	Notice to drain filter and replace element.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

SECTION INDEX

EMERGENCY PROCEDURES	Page 2-178
FORDING	2-176
After fording maintenance	2-177
GENERAL	2-170
NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) DECONTAMINATION PROCEDURES. ...	2-178
Chemical detection and decontamination	2-178
Emergency procedures.	2-178
General	2-178
OPERATION IN UNUSUAL WEATHER	2-170
Cold weather starting	2-173
Extreme cold	2-171
Extreme dry heat	2-170
Extreme dust or sand	2-171
Extreme moist heat	2-170
Salt air or sea spray	2-171
UNUSUAL TERRAIN	2-175
Ice	2-175
Mud	2-175
Sand	2-175
Snow	2-175

GENERAL

Special care in cleaning and lubrication must be observed where extremes of temperature, humidity, and terrain are present or expected. Proper cleaning and lubrication of equipment is necessary for proper operation and also guards against excessive wear and failure of equipment. Read the following manuals:

- FM 9-207 - Provides instructions for operation in extreme cold.
- FM 21-17 - Contains information on driver selection, training, and supervision.
- FM 21-306- Provides information on operation of tracked vehicles under all conditions.

These manuals are important and should be read.

OPERATION IN UNUSUAL WEATHER

EXTREME MOIST HEAT

- 1 Lubricate the vehicle at more frequent intervals (appx F).
- 2 Check level of electrolyte daily. Add distilled or rain water, if necessary.
- 3 Keep the vehicle and equipment clean and dry.
- 4 Inspect for corrosion, moisture, and fungus growth. Dry moisture and notify unit maintenance of corrosion or fungus growth.
- 5 Clean and lightly lubricate breech mechanism. Do not lubricate firing pin.
- 6 Do not park vehicle in sun for long periods. If shelter is not available, cover vehicle with paulin. Hang paulin above vehicle, if possible, to allow air ventilation.

- 7 Watch the engine temperature gage so engine does not overheat. Halt the vehicle for a cooling-off period whenever necessary. Do not turn off engine - set hand throttle to run engine at 1000 to 1200 rpm and allow to cool.
- 8 If engine keeps overheating, clean the filter bags and check air separators for clogging. If clogged, notify unit maintenance.

EXTREME DRY HEAT

- 1 Lubricate the vehicle more often (appx F).
- 2 Check level of electrolyte daily. Add distilled or rain water, if necessary.
- 3 Clean and lightly lubricate breech mechanism. Do not lubricate firing pin.
- 4 Do not park vehicle in sun for long periods. If shelter is not available, cover vehicle with paulin. Hang paulin above vehicle, if possible, to allow air ventilation.
- 5 Watch engine temperature gage that engine does not overheat. Halt the vehicle for a cooling-off period whenever necessary. Do not turn off engine - set hand throttle to run engine at 1000 to 1200 rpm and allow to cool.
- 6 If engine keeps overheating, clean the filter bags and check air separators and radiators for clogging. If clogged, notify unit maintenance.

OPERATION IN UNUSUAL WEATHER-CONTINUED*EXTREME DUST OR SAND*

- 1 Lubricate the vehicle more often (appx F). Be sure to force out all dirty lubrication.
- 2 Protect the sighting and fire control equipment and periscopes against etching by windblown sand.
- 3 When at halt, cover the vehicle with paulin. If entire vehicle can not be covered, protect the driver's and engine compartments.
- 4 Remove lubricants on exposed and non-critical surfaces. This prevents wind-blown dust and sand from sticking to the oil and forming an abrasive.
- 5 Clean the air filter bags daily. Inspect air separators for clogging. If clogged, notify unit maintenance.
- 6 If engine keeps overheating, clean the air filter bags. Check the air separators and radiators for clogging. If clogged, notify unit maintenance.

SALT AIR OR SEA SPRAY

- 1 Keep the vehicle and equipment clean and dry.
- 2 Inspect often for corrosion. Remove corrosion, and paint areas where the paint is cracked or peeling.
- 3 If the vehicle has been driven in salt water, perform after fording maintenance. Refer to page 2-177.

EXTREME COLD

Extreme cold will cause lubricants to thicken, prevent batteries from furnishing enough current for starting, and prevent fuel from vaporizing and properly combining with air to form a combustible mixture for starting.

Be cautious when operating after a shut-down. Components may be frozen in place. Track may have frozen to the ground. Thickened lubricants may cause a failure.

Read FM 9-207, FM 31-70, and FM 31-71 for descriptions of operations in extreme cold.

- 1 Lubricate the vehicle more often using arctic grade lubricant (appx F).
- 2 Fill fuel cell with arctic grade DF-A (NATO F-56) fuel.
- 3 Make sure cooling system antifreeze protection is correct for lowest possible temperature. Maintain antifreeze protection level when adding coolant.
- 4 Keep batteries fully charged. The colder it gets, the more battery output is reduced. Run engine at 1200 rpm for 5 minutes immediately after adding water to batteries to mix water and battery acid and prevent freezing.
- 5 Do not move sighting and fire control equipment suddenly from cold to warm temperatures, or vice versa. Condensation may result and cause cloudiness in optics and rusting of internal parts.

OPERATION IN UNUSUAL WEATHER-CONTINUED

EXTREME COLD-CONTINUED

- 6 Use the special purpose kits provided for extreme cold. Refer to page 2-155.
- 7 Start the engine by following the cold weather starting procedures. Refer to page 2-173.
- 8 Chip heavy ice from around tracks frozen to the ground before attempting to move the vehicle.
- 9 When starting, drive slowly in 1st gear for 100 yd (91.4 m) to warm lubricants for normal operation.
- 10 Watch the gages so that engine and transmission temperature and pressure are normal. If readings are consistently abnormal, stop the vehicle and troubleshoot.
- 11 Warm hydraulic fluid before operating hydraulic components in cold weather (32°F (0°C) or below) by engaging hydraulic system for 5 to 10 minutes.



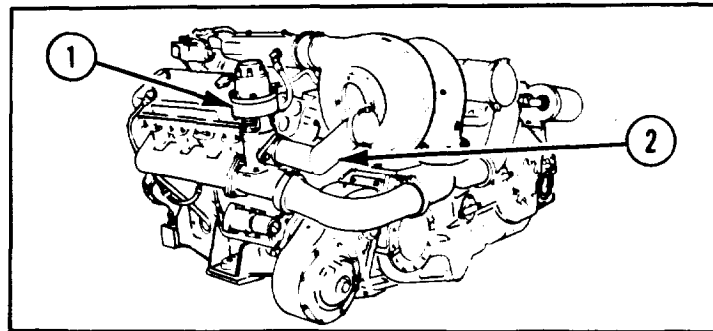
- Do not fire weapon if recoil components are frozen.
- At very low temperatures, obturator pad may burst while firing. Keep clear of breech area.
- 12 Before firing, make sure oil reserve is established and gun mount and recoil components are not frozen.
- 13 Use crew compartment heater, if installed, to maintain breechblock temperature above - 10 °F (- 23.4°C).
- 14 If the crew compartment heater is not installed, use jellied alcohol fuel in the

chamber just ahead of the breechblock to raise obturator pad temperature above - 10°F (-23.4° C).

- 15 If tactical situation requires firing cannon and time does not permit procedures in steps 13 or 14, fire a powder charge without projectile to warm obturator pad. Use zone 1 charge and clean tube after firing.
- 16 If warming methods in steps 13 and 14 are not available, warm obturator pad per step 15, then fire a round about every hour to keep obturator pad warm.
- 17 Keep cannon muzzle closed, with muzzle brake cover installed, between firing missions to prevent entry of snow and moisture.
- 18 Park the vehicle in a sheltered spot out of the wind. If shelter is not available, park with the left side of the vehicle facing into the wind to prevent snow and sleet from entering through the exhaust ports. When the vehicle is to be parked for a long period, be sure to park on solid ground, on planks, or on brush to avoid having the tracks freeze to the ground.
- 19 Clean the vehicle of snow, ice, and mud. If winterization kits are not installed, be sure to protect engine compartment and gun mount against snow and sleet.
- 20 Start the engine coolant heater, if installed, immediately after stopping engine. The heater is designed to operate unattended during overnight stops. Watch the battery charge. Do not operate coolant heater more than 12 hours without running engine to recharge batteries. If coolant heater is not installed, remove batteries and store in a warm place.

OPERATION IN UNUSUAL WEATHER-CONTINUED*COLD WEATHER STARTING***WARNING**

Protect your hearing. Hearing protection is required when operating the vehicle due to high intensity noise.

**NOTE**

The howitzer uses two different engine models. Model 7083-7398 has a turbocharger regulator (1) and exhaust pipe (2). Model 7083-7395 has a connector in place of a turbocharger regulator and exhaust pipe.

These cold weather starting procedures are normally used at 0° to -25°F (-17.8° to -31.7° C), but they also apply if the vehicle will not start at 32 ° to 0°F (0° to - 17.8°C). For extreme cold, -25°F (-31.7°C) and below, the special purpose kits should be installed and operated. Refer to page 2-155.

AIDS TO COLD WEATHER STARTING

Park one or two vehicles in garage or maintenance shop

or under cover if in the field. Use these vehicles with the assistance of unit maintenance to slave start those vehicles that will not start. Also, periodic starting and running of vehicles is recommended.

- 1 Make sure that batteries are fully charged.
- 2 If winter kit is installed, roll up and secure covers over exhaust ports and air intake grill. Refer to page 2-162. Turn coolant heater OFF, refer to page 2-160.
- 3 Perform normal engine starting procedure. Refer to pages 2-64 and 2-65.

OPERATION IN UNUSUAL WEATHER-CONTINUED

COLD WEATHER STARTING - CONTINUED

NOTE

Perform step 4 only after fuel has been drained from fuel filters or engine has been repaired or replaced.

- 4 Push and hold PRIME ENGINE FUEL FILTERS switch (1) ON for 1 minute, then release.
- 5 Push and hold PUMP AND HEATER IGNITOR switch (2) to ON during starting procedure.

NOTE

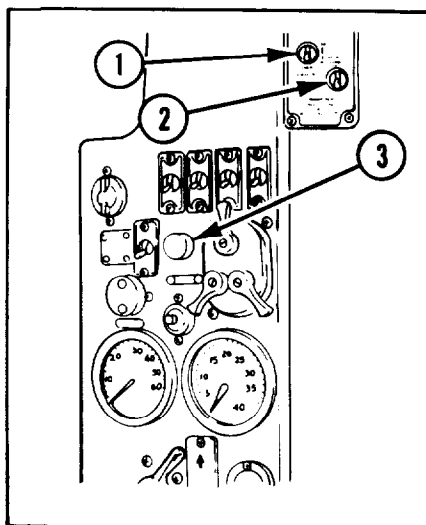
Cycle the HEATER FUEL CYCLE ON & OFF switch ON and OFF because continuous flame in the air box will use up the oxygen supply necessary for engine combustion.

- 6 For engine model 7083-7398, push and hold HEATER FUEL CYCLE ON & OFF switch to ON for 3-5 seconds at 5-second intervals while cranking engine.
- 7 For engine model 7083-7395, push and hold HEATER FUEL CYCLE ON & OFF switch to ON for 10-15 seconds while cranking engine.

CAUTION

Do not operate starter continuously for over 30 seconds. Allow starter to cool for 2 minutes between uses.

- 8 Push in on START switch (3) and hold it in until engine starts, but do not crank engine longer than 30 seconds at a time. If engine does not start, release START switch (3) for 2 minutes then repeat steps 5 thru 7.



NOTE

Warning horn may sound.

- 9 When engine starts, release START switch (3) and PUMP AND HEATER IGNITOR switch (2).

NOTE

If engine does not start after four 30-second tries or indication of firing stops for over 10 seconds, stop engine cranking and notify unit maintenance.

- 10 With brakes still locked, shift transmission into 4th range; adjust throttle to run engine at 1200 rpm. Run engine until coolant temperatures reaches 120- 140°F (49-60°C) then shift transmission into N (neutral) and reduce engine speed to slow idle (650-700 rpm).
- 11 Perform instrument panel checkout procedure, refer to page 2-65 during engine warmup.
- 12 Release parking brake and shift transmission into 1st range. Drive vehicle slowly for first 100 yd (91.4 m) to warm lubricants.

UNUSUAL TERRAIN*MUD*

- 1 Drive with transmission in a low range. Keep vehicle moving steadily to avoid digging in.
- 2 If vehicle becomes stuck, do not dig further in by attempting to drive out. Arrange to be towed out.
- 3 If freezing temperatures are expected, be sure to park on solid ground to avoid having tracks freeze in the mud.
- 4 Remove mud from the track and wheel-contacting surfaces.

SNOW

- 1 Drive with transmission in a low range.
- 2 Avoid grades and sharp turns when possible.
- 3 Drive as straight up or down grades as possible to equalize the track load.
- 4 It may be possible for the vehicle to ride on heavily crusted snow with only occasional breakthrough. To climb back onto the crust, reduce the engine speed and shift into low range to achieve a very low track speed for forward movement without slippage.

ICE

- 1 Select a higher gear range which will move the vehicle steadily without causing much strain on the engine.
- 2 Drive slowly and cautiously to avoid skidding. If vehicle skids, slow down engine and proceed with caution. Do not spin tracks.
- 3 Avoid grades and sharp turns, if possible.

SAND

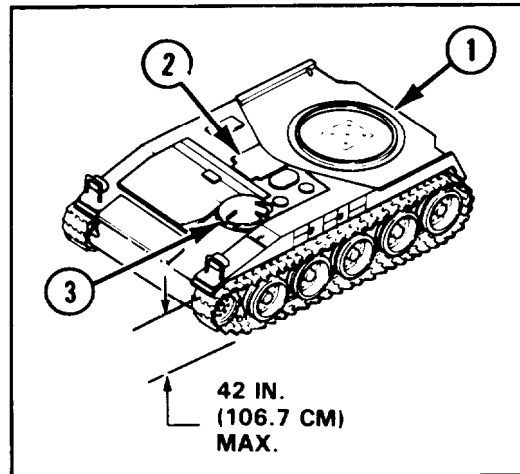
- 1 The main objective when driving in sand is to avoid spinning the tracks.
- 2 Drive slowly and use a gear high enough to move the vehicle steadily without causing much strain on the engine.
- 3 Avoid sharp and pivot turns to prevent buildup of debris in track that would cause the track to be thrown.

FORDING

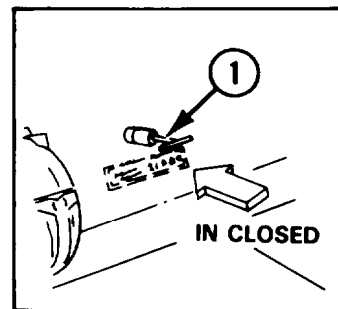
The howitzer is designed to cross a body of water only up to 42 in. (106.7 cm) deep.

CAUTION

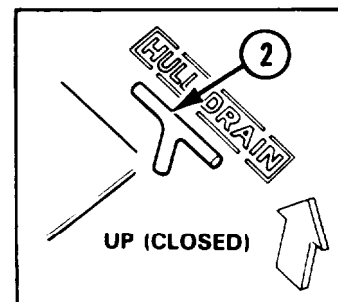
Do not ford water that exceeds 42 in. (106.7 cm) in depth. Check for soft mud or sandy bottoms.



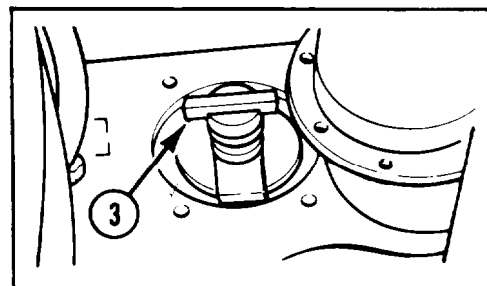
- 1 Close rear hull drain valve (1). Drain valve handle is located on right rear of hull.



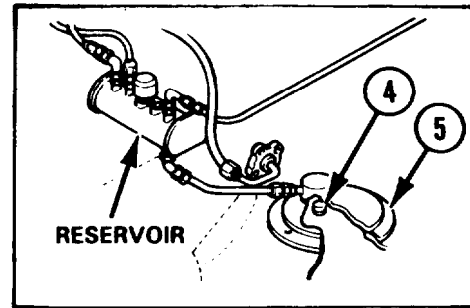
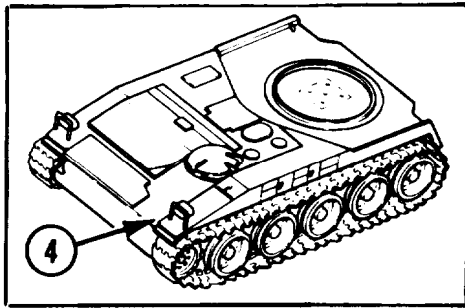
- 2 Close engine compartment drain valve (2). Drain valve handle is located on right deck, just forward of fan well.



- 3 Close driver's compartment drain valve (3). Drain valve handle is located in floor adjacent to right side of driver's seat.



FORDING-CONTINUED



- 4 Make sure power plant reservoir drain plug (4) is installed in power plant reservoir drain cover (5).
- 5 Inspect bottom of hull to make sure all access plates are installed.
- 6 Make sure engine is warmed up to prevent stalling while fording.

- 7 Shift transmission into range 1 and enter water slowly. Do not exceed 4 mph while crossing. Speed up vehicle when exiting.
- 8 Perform after fording maintenance.

AFTER FORDING MAINTENANCE

Perform the following maintenance after fording or exposing the howitzer to salt water.

- 1 Open three hull drain valves and drain hull. Close drain valves after all water is drained.
- 2 Clean and dry the vehicle. Make sure all mud and debris is removed from tracks.
- 3 Coat unpainted metal parts with CLP (item 6, appx D).
- 4 Check lubricating oil in engine, transmission, auxiliary drive, and final drives for water. If there is evidence of water in any of these components, drain, flush, refill with correct lubricant, and replace engine and transmission oil filters. Refer to appx F.
- 5 Lubricate all suspension grease-lubricated components. Make sure all water is forced out.
- 6 Check road wheel hubs for water. Drain and refill hubs if there is evidence of water in oil.
- 7 Remove, disassemble, and dry air filter bags and packs.
- 8 If armament has been splashed, disassemble, clean, dry, and lubricate all exposed unpainted parts.
- 9 Notify unit maintenance so a complete lubrication can be performed.

EMERGENCY PROCEDURES

Detailed procedures are found in Battle Damage Assessment Repair (BDAR), TM 9-2350-274-BD.

NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) DECONTAMINATION PROCEDURES

NOTE

Detailed decon procedures can be found in FM 3-87.

Refer to TM 3-4320-214-12&P for operation of the M 13 Decontamination Apparatus.

GENERAL

The following emergency procedures can be performed until NBC DECON facilities are available. Vehicle commander will supervise, assign crew duties, and assist supporting NBC unit.

EMERGENCY PROCEDURES

If NBC attack is known or suspected, mask at once and continue mission. If inside, do not leave vehicle. If outside, follow decon procedures below to avoid taking contamination into the vehicle. Do not unmask until told to do so.

NUCLEAR DECONTAMINATION. Brush fallout from skin, clothing, and equipment with available brushes, rags, and tree branches. Wash skin and have radiation check made as soon as tactical situation permits. (You can find instructions for the check in FM 3-5).

BIOLOGICAL DECONTAMINATION. The vehicle crew has no method to detect or decon biological agents. Remain masked and continue mission until told to unmask.

CHEMICAL DETECTION AND DECONTAMINATION

Use M8 paper from M256 chemical agent detector kit or M9 paper to determine if liquid agent is present on vehicle surface.

If exposure to liquid agent is known or suspected, clean exposed skin, clothing, and personal gear, in that order, using M25BA1 kit. Use the buddy system. Wash exposed skin and thoroughly decontaminate as soon as tactical situation permits.

WARNING

Do not use decontamination spray on personnel. It could cause personal injury.

If MB or M9 paper indicates that liquid chemical agent is present on vehicle surface use ABC-MI 1 decon apparatus for partial decon of vehicle. Use loader's hatch for exit/entry. Avoid getting liquid agent into crew compartment. Spray only surfaces that will be touched getting in and out of vehicle.

Decon procedures take time. Do as much as you can based on the tactical situation.

CHAPTER 3 MAINTENANCE INSTRUCTIONS

CHAPTER INDEX

	Page
AIR FILTERS	3-31
Filter bag cleaning	3-32
Installation	3-33
Removal and inspection	3-31
Wet air filters and hull compartment	3-33
BASIC ISSUE ITEMS (BI).	3-46
BATTERIES	3-37
Battery hookup	3-38
Corrosion	3-38
Deep cycling	3-39
Lead connections	3-38
Replacing batteries.	3-38
Unserviceable batteries	3-39
BORESIGHTING THE WEAPON.	3-88
BREECHBLOCK GROUP.. . . .	3-55
Counterbalance assembly removal and adjustment	3-57
M35 firing mechanism	3-55
Removal, disassembly, assembly, and replacement of firing mechanism block, firing mechanism housing, obturator spindle, and breechblock	3-58
Scored gas check seat repair	3-55
CHECKING RELIABILITY OF DEFLECTIONS (MI 15 PANORAMIC TELESCOPE)	3-75
CHECKING RELIABILITY OF SPECIAL CORRECTIONS (MI 15 PANORAMIC TELESCOPE)	3-76
Inspecting M137 telescope mount (azimuth walk-off check)	3-77
DRIVER'S AND CREW'S SEATS.	3-46
ENGINE COOLING SYSTEM	3-36
Adding coolant	3-36
Draining coolant.	3-36
FIRE CONTROL ALINEMENT TESTS AND MEASUREMENTS	3-63
FUEL SYSTEM	3-34
Fuel filler screen	3-35
Fuel filters..	3-34
Refueling..	3-35
GENERAL	3-3
GUNNER'S QUADRANT END-FOR-END TEST	3-67
GUNNER'S QUADRANT MICROMETER TEST	3-65
INTRODUCTION	3-30
LAMPREPLACEMENT	3-46
Dome light	3-48
Driver's external engine and transmission warning light	3-51
Engine-transmission low oil warning indicator light and generator charge indicator light	3-51
Headlamps and blackout marker lamp	3-46
High beam indicator light and master switch indicator light	3-51
Low engine coolant warning light	3-49
M 15 elevation quadrant	3-52

M137 telescope mount	3-52
Panel light	3-49
Pressure filter indicator light	3-50
Stoplight-taillight, left	3-47
Stoplight-taillight, right	3-48
Suspension lockout indicator light.	3-50
LEVELING TRUNNIONS USING PLUMBLINE	3-72
LEVELING TRUNNIONS USING SCRIBE LINES ON M15 ELEVATION QUADRANT.	3-74
LEVELING TUBE-GUNNER'S QUADRANT METHOD	3-78
LOCKOUT CYLINDER CHECK.	3-39
LUBRICATION AFTER FORDING OPERATIONS	3-3
LUBRICANT LEVELS	3-3
M201A1 CANNON	3-53
Borescoping	3-54
Clean and lubricate	3-54
Determining remaining cannon tube life.	3-54
Inspection	3-53
Muzzle break	3-55
Pullover gaging	3-54
OPERATION OF M1A1/M 1A2 GUNNER'S QUADRANT	3-64
OPERATION OF M17 PERISCOPE.	3-53
PREPARATION FOR FIRE CONTROL ALINEMENT TESTS.	3-63
SCOPE	3-3
SCRIBING M15 ELEVATION QUADRANT	3-80
SCRIBING M137 MOUNT FOR BORESIGHTING.	3-86
SERVICE INTERVALS-NORMAL	3-3
SERVICE INTERVALS-UNUSUAL CONDITIONS	3-3
SPECIALTOOLS	3-46
TESTING OF ELEVATION CORRECTION COUNTER, M137 TELESCOPE MOUNT	3-83
TESTING OF M15 ELEVATION QUADRANT	3-79
TOUCHUP AND RECOATING	3-30
TOW HOOKS	3-46
TRACK	3-39
Decreasing track tension	3-43
Increasing track tension	3-44
Installing track	3-45
Spindle and idler arm clearance	3-39
Track pad installation	3-40
Track shoe removal and installation	3-41
Track tension check	3-42
TROUBLESHOOTING	3-4
Table 3-1. Troubleshooting	3-5
VERIFICATION OF M15 ELEVATION QUADRANT SCRIBE LINES	3-82

Section 1. LUBRICATION INSTRUCTIONS

SECTION INDEX

GENERAL	Page 3-3
LUBRICATION AFTER FORDING OPERATIONS	3-3
LUBRICANT LEVELS	3-3
SERVICE INTERVALS-NORMAL	3-3
SERVICE INTERVALS-UNUSUAL CONDITIONS	3-3

GENERAL

- Appendix F provides the cleaning and lubricating procedures for this vehicle.

SERVICE INTERVALS - NORMAL

- Service intervals specified in appendix F are for normal operation-moderate temperature, humidity, and air conditions.

SERVICE INTERVALS - UNUSUAL CONDITIONS

NOTE

Lubricant that contains grit, dust, or sand acts as an abrasive mixture and causes rapid wear of parts.

Lubricate more often when operating in unusual conditions. High or low temperature, prolonged periods of high-speed operation, continued operation in sand or dust, immersion in water, or exposure to

moisture may destroy the protective qualities of the lubricants. Refer to FM 9-207 for instructions on special lubrication of the vehicle for continued operation below 0°F (-18°C).

LUBRICANT LEVELS

Lubricant levels in the engine, transmission, auxiliary drive, final drives, road wheel hubs, and hydraulic reservoir must be observed closely and the proper levels maintained at all times.

LUBRICATION AFTER FORDING OPERATIONS

After any fording operation, in water 12 in. (30.5 cm) or over, lubricate all chassis points to clean bearings of water and grit. Refer to page 2-177 for after fording maintenance.

Section II. TROUBLESHOOTING PROCEDURES

SECTION INDEX

	Page
SCOPE	3-3
TROUBLESHOOTING	3-4
Table 3-1. Troubleshooting.	3-5

SCOPE

The troubleshooting table lists the common malfunctions which you may find during the operation or maintenance of the M 11 OA2 howitzer or its components. You should perform the tests/inspections and corrective actions in the order listed.

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

TROUBLESHOOTING

SYMPTOM INDEX

**Troubleshooting
Procedure
Page**

ARMAMENT

Breechblock does not open (loaded cannon)	3-27
Breechblock does not open (unloaded cannon)	3-26
Breech closes hard	3-26
Breech mechanism does not operate freely	3-25
Cannon does not return to battery.	3-28
Cannon overrecoils on first round	3-27
Cannon returns to battery with excessive shock	3-27
Cannon underrecoils on first round	3-28
Evidence of blowback around breechblock	3-25
Fired primer does not eject	3-24
Primer does not insert easily	3-24
Primer fails to fire.	3-22
Primer fires but round fails to fire	3-23
Round fails to chamber	3-23

BATTERY AND GENERATING SYSTEM

Batteries discharge rapidly.	3-19
Batteries do not charge when engine is running	3-19
Batteries do not stay charged	3-20
No current in battery circuit	3-20

DRIVING CONTROLS AND LINKAGES

Spade does not raise or lower.	3-16
Transmission shift does not engage transmission properly	3-15
Vehicle does not steer properly, or pulls to one side	3-15

ENGINE

Engine cranks but fails to start	3-7
Engine fails to crank or cranks slowly when starter switch is pushed	3-5
Engine labors, runs unevenly, accelerates improperly or does not develop full power	3-9
Engine overheats	3-11
Engine speed varies or stalls frequently	3-10
Engine will not shut down at idle	3-13
Excessive smoke from exhaust after engine warmup	3-12
High oil pressure	3-13
Low or no oil pressure	3-13
Runaway engine.	3-14

LIGHTING SYSTEM

All lights do not operate	3-17
Driving lights burn dimly	3-18
Driving lights do not operate	3-17

TRACK AND SUSPENSION

Track center guide rides on top of road wheel(s) or track climbs sprocket.	3-21
Tracks require repeated adjustment	3-21
Vehicle throws track.	3-20

TROUBLESHOOTING-CONTINUED

SYMPTOM INDEX-CONTINUED

TRANSMISSION

Oil pressure too low	3-14
Oil temperature too high	3-1 5
Transmission does not drive in any range	3-1 5

TURRET ELECTRICAL SYSTEM

Oil pump motor does not operate automatically	3-22
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Table 3-1. TROUBLESHOOTING

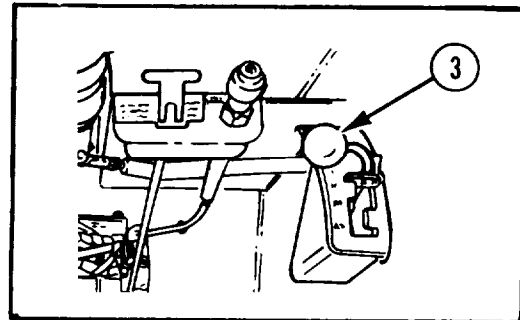
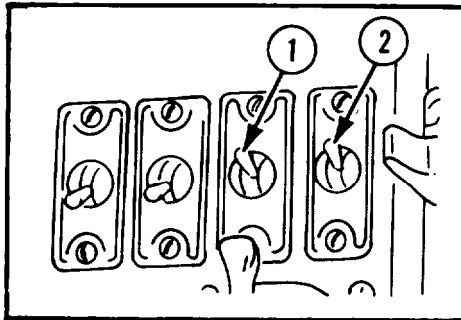
MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

ENGINE

- ENGINE FAILS TO CRANK OR CRANKS SLOWLY WHEN STARTER SWITCH IS PUSHED.



Step 1. Check to see if MASTER switch (1) and INSTRUMENT switch (2) are ON and that all other switches are OFF.

Set MASTER and INSTRUMENT switches (1 and 2) ON.

Step 2. Check to see if transmission lever (3) is in N (neutral) position.

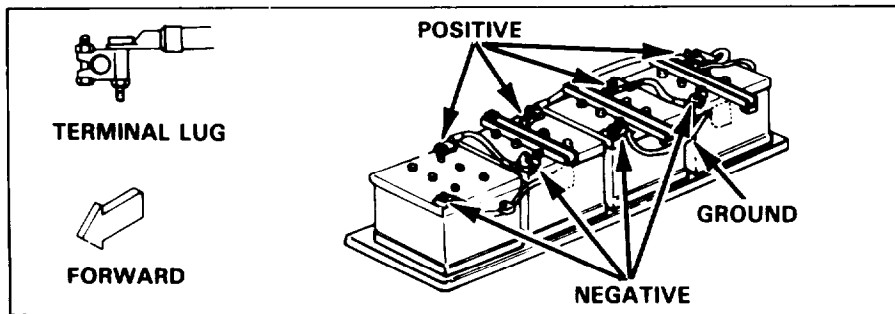
Move shift lever (3) to N (neutral).

Table 3-1. TROUBLESHOOTING -CONTINUED

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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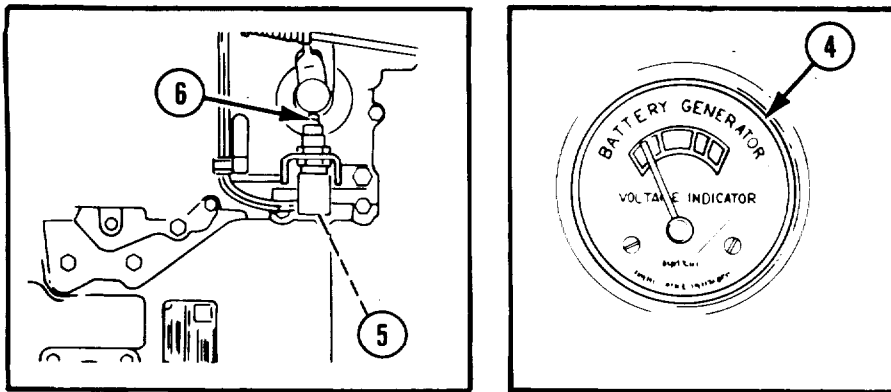
ENGINE-CONTINUED

- ENGINE FAILS TO CRANK OR CRANKS SLOWLY WHEN STARTER SWITCH IS PUSHED-CONTINUED.



Step 3. Check to see if battery cables are loose, broken, or corroded.

If loose, broken, or corroded, notify unit maintenance.



Step 4. Check to see if batteries are discharged.

See if battery indicator (4) reads in red band. Tow to start engine; then if engine doesn't start, notify unit maintenance.

Step 5. Check to see if neutral position switch (5) on transmission is properly adjusted.

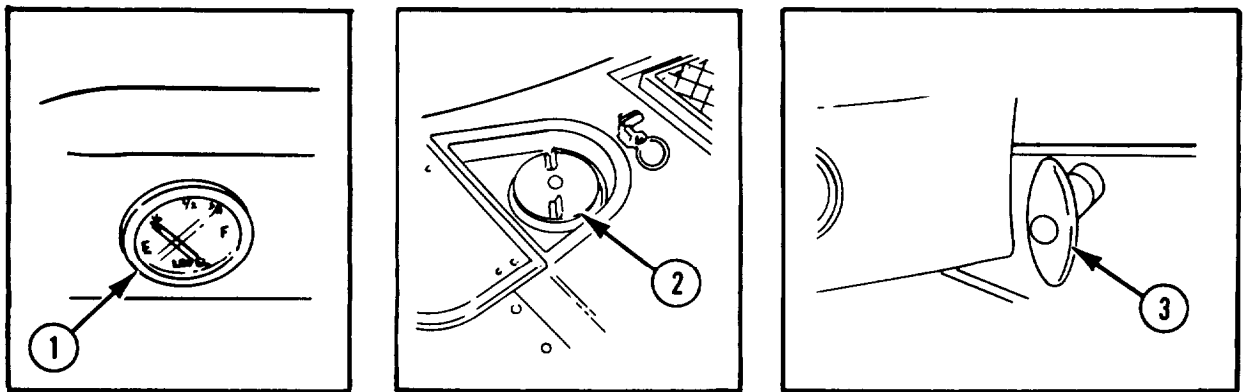
Remove transmission deck and inspect neutral position switch (5) to see if roller is in notch (6) and electrical leads are connected. Connect leads; then if engine doesn't start, notify unit maintenance.

Table 3-1. TROUBLESHOOTING -CONTINUED

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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ENGINE-CONTINUED

2. ENGINE CRANKS BUT FAILS TO START.

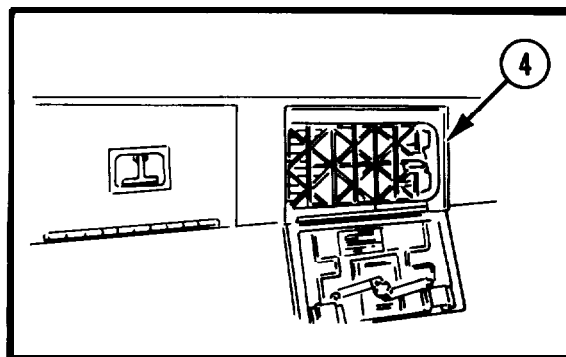


Step 1. Check to see if fuel gage (1) indicates empty.

Fill fuel cell (2), if empty. Refer to page 3-35.

Step 2. Check to see if engine shutdown control handle (3) is pulled out.

Check for missing or broken spring.



Step 3. Check for very dirty or clogged air filter bags (4).

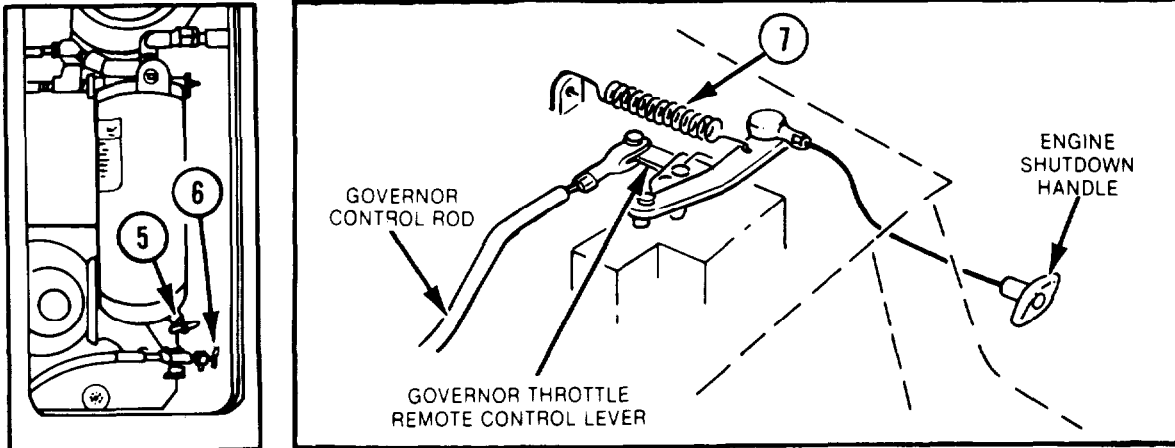
Clean air filter bags (4). Refer to page 3-32.

Table 3- 1. TROUBLESHOOTING -CONTINUED

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

ENGINE -CONTINUED

2. ENGINE CRANKS BUT FAILS TO START-CONTINUED.



Step 4. Check to see if water is in fuel filters (5 and 6).

Drain water from primary (5) and secondary (6) fuel filters. Refer to page 3-34.

Step 5. Check for disconnected, loose, or broken fuel lines.

Remove engine deck and check fuel lines. Connect or tighten loose connections. If lines are broken or split, notify unit maintenance.

Step 6. Check for disconnected or broken governor control spring (7).

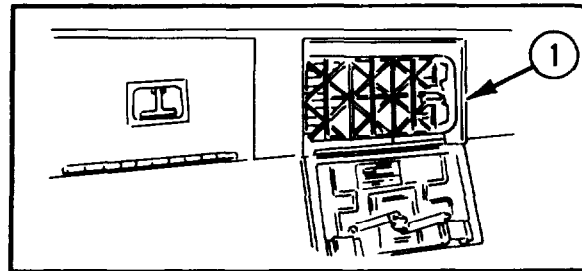
Check if spring (7) is disconnected or broken. Connect spring (7) if disconnected. If engine doesn't start, notify unit maintenance.

Table 3-1. TROUBLESHOOTING-CONTINUED

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

ENGINE-CONTINUED

3. ENGINE LABORS, RUNS UNEVENLY, ACCELERATES IMPROPERLY OR DOES NOT DEVELOP FULL POWER.



Step 1. Check for dirty or clogged air filter bags (1).

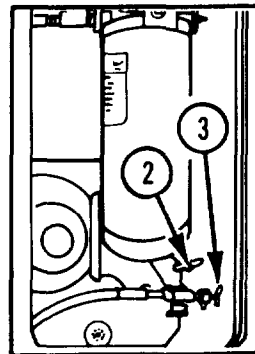
Check air filter bags (1). Refer to page 3-31.

Step 2. Check for fuel leaks.

Remove engine deck and check fuel lines. Tighten loose fuel line and hose connections.

Step 3. Check for obstructions on battery cover air intake grills and in forward end of battery compartment.

Remove obstructions from grills. Open battery compartment door and remove any obstructions in compartment.



Step 4. Check to see if water is in fuel filters (2 and 3).

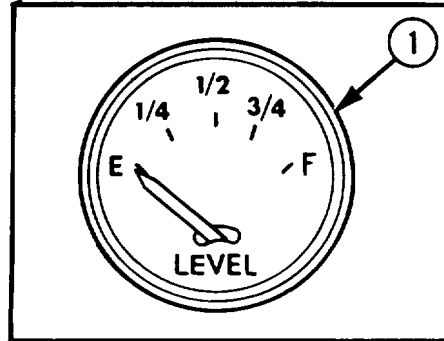
Drain water from primary (2) and secondary (3) fuel filters, refer to page 3-34. If engine does not run properly, notify unit maintenance.

Table 3-1. TROUBLESHOOTING-CONTINUED

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

ENGINE -CONTINUED

4. ENGINE SPEED VARIES OR STALLS FREQUENTLY.

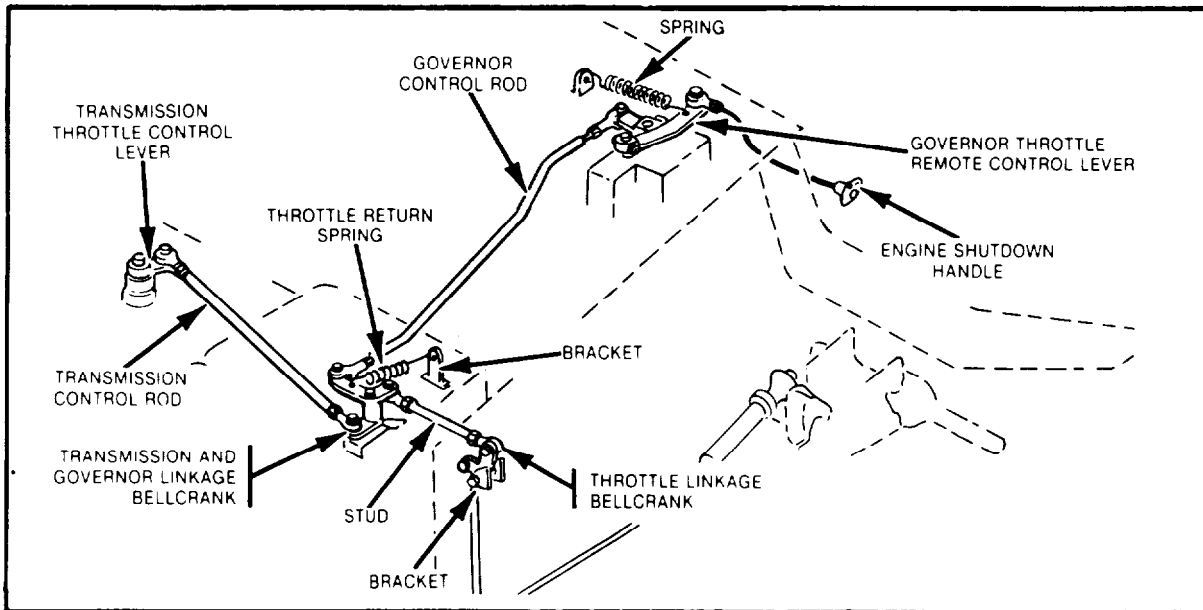


Step 1. Check to see if fuel gage (1) indicates empty.

Fill fuel cell, if empty. Refer to page 3-35.

Step 2. Check for fuel leaks.

Remove engine deck and check fuel lines. Tighten loose fuel line and hose connections.



Step 3. Check accelerator linkage to engine and governor.

Check linkage for looseness or damage. Connect springs if disconnected. If engine does not run properly, notify unit maintenance.

Table 3-1. TROUBLESHOOTING -CONTINUED

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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ENGINE-CONTINUED

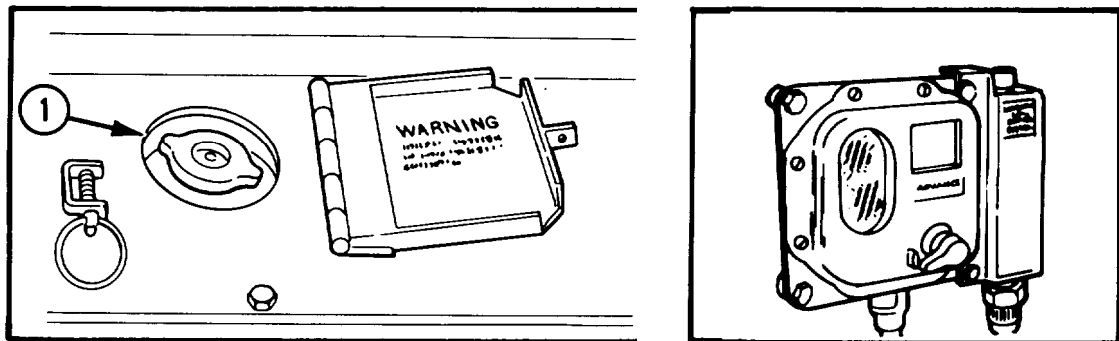
5. ENGINE OVERHEATS.

Step 1. Check to see if engine has been excessively operated at idle speed.

increase speed to 1000 to 1200 rpm.

WARNING

Never remove radiator caps from an overheated engine.



Step 2. Check engine coolant level. Check connections for leaks.

NOTE

In cold weather when adding coolant, check with unit maintenance personnel so they can check antifreeze protection.

Check to see if low engine coolant warning light is on. Fill radiators (1) with coolant as required. If leaks are visible, tighten connections or notify unit maintenance.

Step 3. Check that fan belt is not loose, broken, or missing.

Notify unit maintenance.

Step 4. Check to see if fan well deck is covered. Check radiators for obstructions and accumulated dirt.

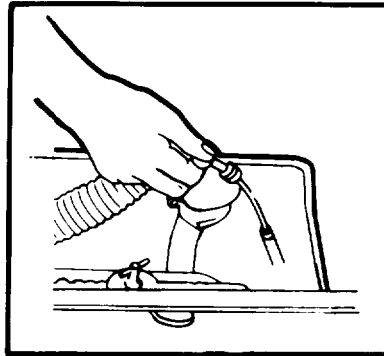
Remove obstructions. If radiators are clogged, notify unit maintenance.

Table 3-1. TROUBLESHOOTING -CONTINUED

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

ENGINE-CONTINUED

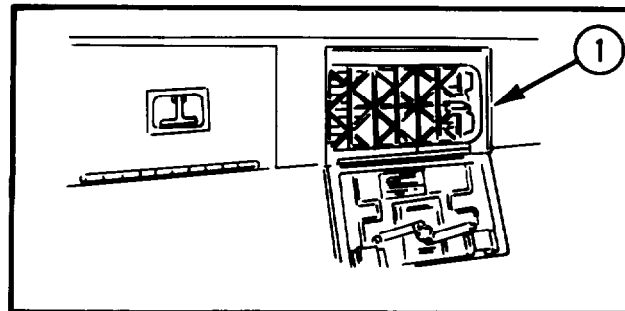
5. ENGINE OVERHEATS-CONTINUED.



Step 5. Check to see if engine oil is low.

Open engine access door and check engine oil level. Add oil as required (appx F). If engine still overheats, notify unit maintenance.

6. EXCESSIVE SMOKE FROM EXHAUST AFTER ENGINE WARMUP.



Check for dirty or clogged air filter bags (1).

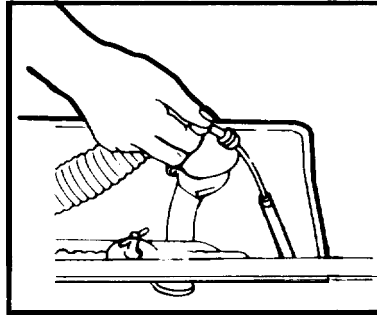
Clean filter bags, refer to page 3-32. If excessive smoke is still present, notify unit maintenance.

Table 3-1. TROUBLESHOOTING -CONTINUED

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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ENGINE-CONTINUED

7. LOW OR NO OIL PRESSURE.



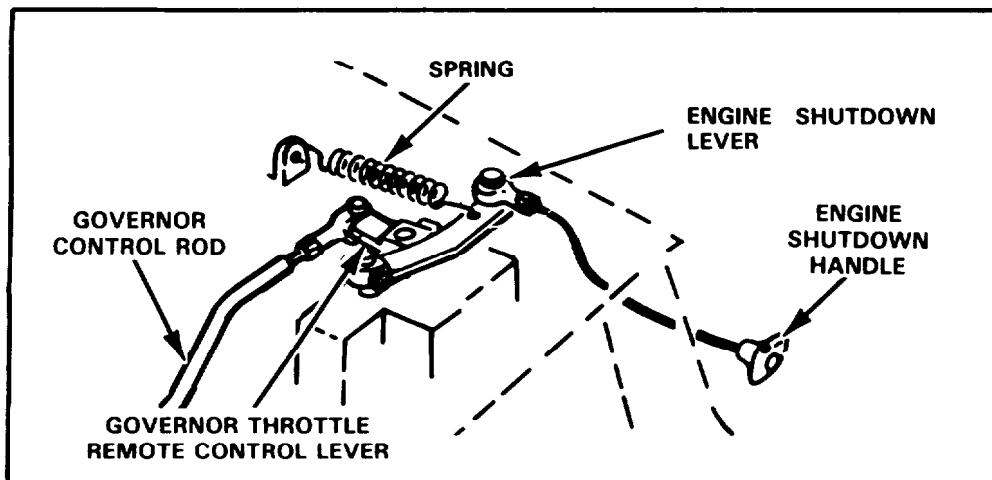
Check to see if engine oil is low.

Open engine access door and check engine oil level. Add oil as required (appx F). If oil pressure is still low, notify unit maintenance. ■

8. HIGH OIL PRESSURE.

Notify unit maintenance.

9. ENGINE WILL NOT SHUT DOWN AT IDLE.



Step 1. Check for loose or disconnected engine shutdown control linkage.

Open access door in engine deck and push engine shutdown lever toward driver's compartment. Notify unit maintenance.

Table 3- 1. TROUBLESHOOTING -CONTINUED

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

ENGINE -CONTINUED

9. ENGINE WILL NOT SHUT DOWN AT IDLE-CONTINUED.

Step 2. Defective governor.

If engine shutdown control does not work, place transmission shift lever in range 4 and apply brakes to load engine down until engine can be stopped. Notify unit maintenance.

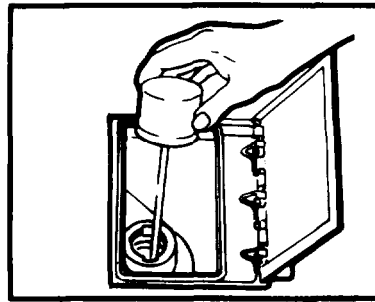
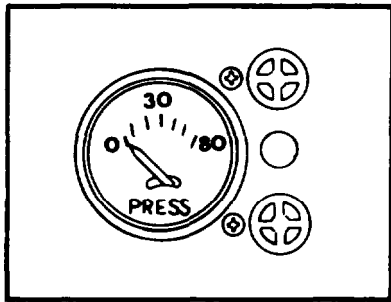
10. RUNAWAY ENGINE.

Defective governor.

Pull engine shutdown handle. Notify unit maintenance.

TRANSMISSION

11. OIL PRESSURE TOO LOW.



Step 1. Check engine rpm.

Increase engine speed to 800 rpm.

Step 2. Check to see if transmission oil is low.

Open transmission access door and check oil level. Add oil as required (appx F). If oil pressure is still low, notify unit maintenance.

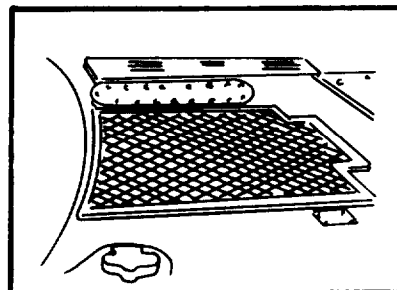
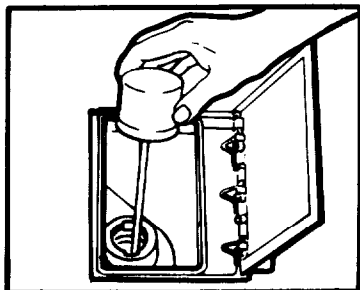


Table 3-1. TROUBLESHOOTING -CONTINUED

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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TRANSMISSION-CONTINUED

12. OIL TEMPERATURE TOO HIGH.



Step 1. Check to see if transmission oil is low.

Open transmission access door and check oil level. Add oil as required (appx F).

Step 2. Make sure fan well deck is not covered. Check radiators for obstructions and accumulated dirt.

Remove obstructions. If radiators are clogged or oil temperature is still too high, notify unit maintenance.

13. TRANSMISSION DOES NOT DRIVE IN ANY RANGE.

Check to see if transmission oil is low or overfull.

Open transmission access door and check oil level. Oil level should be within OPERATING RANGE stamped on dipstick. Add or drain oil as required (appx F). If transmission still does not operate, notify unit maintenance.

DRIVING CONTROLS AND LINKAGES

14. VEHICLE DOES NOT STEER PROPERLY, OR PULLS TO ONE SIDE.

Check for unequal track tension.

Adjust track tension on both tracks, refer to page 3-42. If vehicle still does not steer properly, notify unit maintenance.

15. TRANSMISSION SHIFT DOES NOT ENGAGE TRANSMISSION PROPERLY.

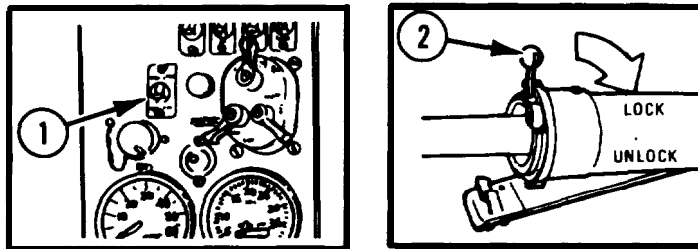
Notify unit maintenance.

Table 3-1. TROUBLESHOOTING -CONTINUED

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

DRIVING CONTROLS AND LINKAGES -CONTINUED

16. SPADE DOES NOT RAISE OR LOWER.

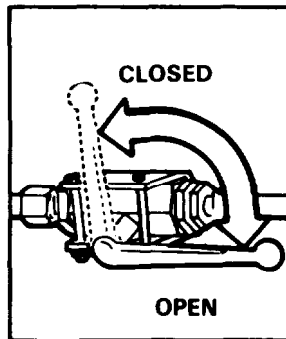


Step 1. Check to see that engine is operating and that HYDRaulic PUMP/PTO CLUTCH Switch (1) is ON.

Start engine and set HYDRaulic PUMP/PTO CLUTCH Switch (1) ON.

Step 2. Check to see that spade cylinder lock levers (2) are in unlocked position.

Move spade cylinder lock lever (2) to unlocked position.



Step 3. Check to see that spade hydraulic shutoff valve handle (3) is in the open position.

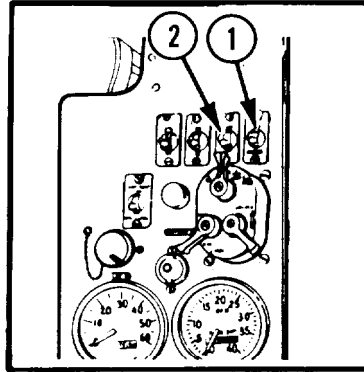
Move spade hydraulic shutoff valve handle (3) to open position. If spade still will not raise or lower, notify unit maintenance.

Table 3-1. TROUBLESHOOTING-CONTINUED

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

LIGHTING SYSTEM

17. ALL LIGHTS DO NOT OPERATE.



Step 1. Check to see that MASTER switch (1) and INSTRUMENT switch (2) are ON.

Set MASTER and INSTRUMENT switches (1 and 2) ON.

Step 2. Check to see that individual light switch is ON.

Set individual light switch ON. If lights still do not operate, notify unit maintenance.

18. DRIVING LIGHTS DO NOT OPERATE.

Check for loose wiring connections at vehicle light switch.

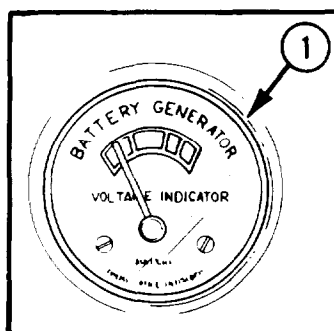
Tighten or connect loose connections. If lights still do not operate, notify unit maintenance.

Table 3-1. TROUBLESHOOTING -CONTINUED

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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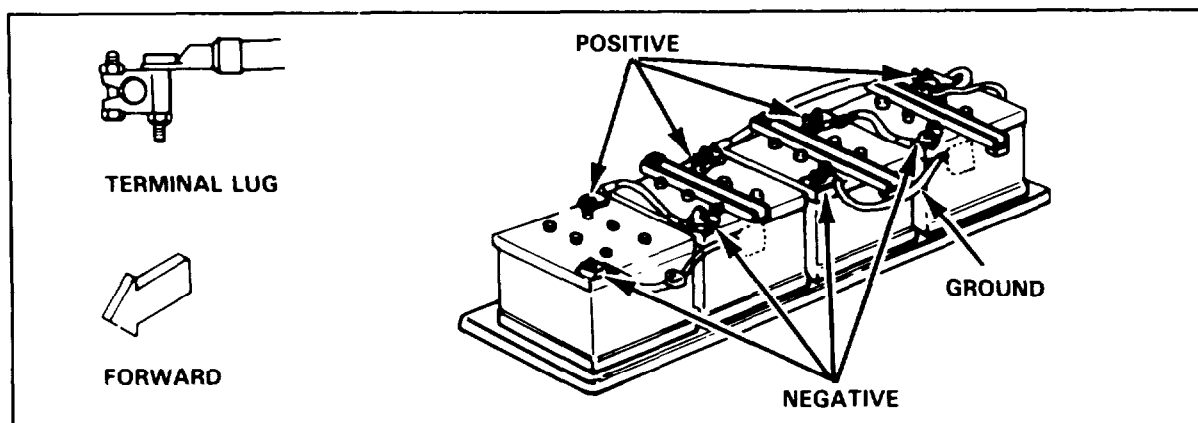
LIGHTING SYSTEM-CONTINUED

19. DRIVING LIGHTS BURN DIMLY.



Step 1. Check to see if batteries are discharged.

See if battery indicator (1) reads in red band. Increase engine speed, if batteries do not charge, notify unit maintenance.



Step 2. Check to see if battery cable connections are loose or corroded.

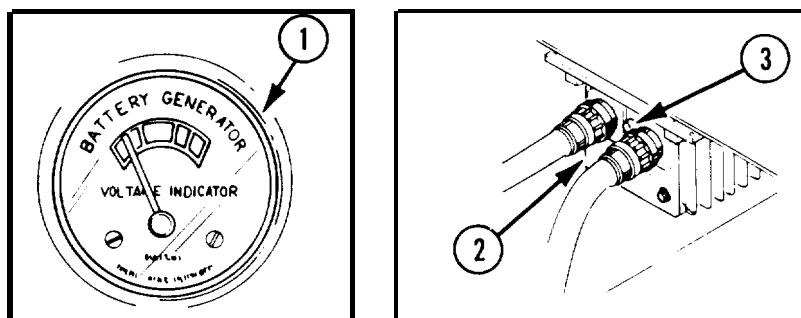
If battery cable connections are loose or corroded, notify unit maintenance.

Table 3-1. TROUBLESHOOTING-CONTINUED

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

BATTERY AND GENERATING SYSTEM

20. BATTERIES DO NOT CHARGE WHEN ENGINE IS RUNNING.



Check battery indicator (1) for voltage reading.

If no voltage reading, remove eight screws, washers, and lift CO₂ bottle access cover for access to voltage regulator (2). Idle engine at 650-700 rpm and press reset button (3) on voltage regulator (2). Increase engine speed to 1000 to 1200 rpm and observe battery indicator (1). Voltage should increase normally. If voltage does not increase or if voltage increases momentarily and then drops back, notify unit maintenance.

- 21 BATTERIES DISCHARGE RAPIDLY.

Check for improper use of electrical components.

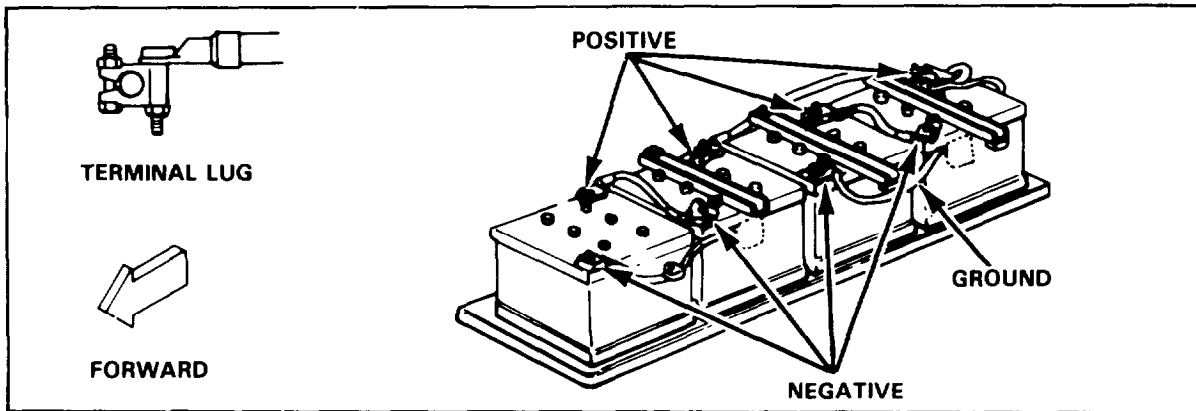
Do not use electrical components for long periods unless engine is running. If batteries still discharge rapidly, notify unit maintenance.

Table 3-1. TROUBLESHOOTING -CONTINUED

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

BATTERY AND GENERATING SYSTEM-CONTINUED

22. NO CURRENT IN BATTERY CIRCUIT.



Check battery cables for corroded or loose connections.

If battery cables are corroded or loose notify unit maintenance.

23. BATTERIES DO NOT STAY CHARGED.

Step 1. Check for improper use of electrical components.

Do not use electrical components for long periods unless engine is running.

Step 2. Check for long periods of idling engine at too low rpm.

Run engine at 1000 to 1200 rpm whenever electrical system utility outlets are being used. If batteries still do not stay charged, notify unit maintenance.

TRACK AND SUSPENSION

24. VEHICLE THROWS TRACK.

Step 1. Check for worn track.

Replace worn shoes. Refer to page 3-41.

Step 2. Improper driving/operation of vehicle.

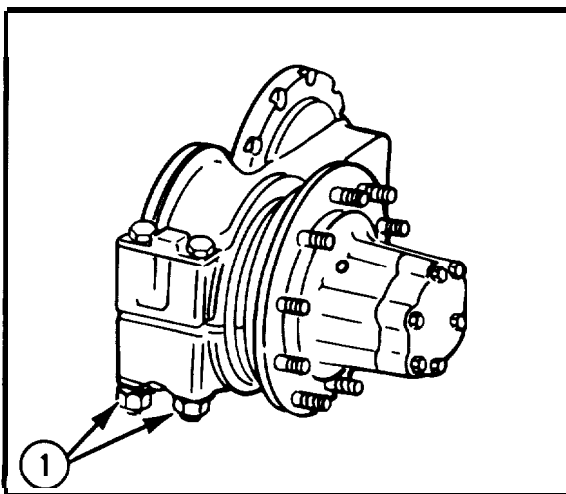
Do not make high speed turns, refer to page 2-71 and FM 21-306. Do not make pivot turns in very rough terrain or loose gravel.

Table 3-1. TROUBLESHOOTING -CONTINUED

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

TRACKS AND SUSPENSION-CONTINUED

25. TRACKS REQUIRE REPEATED ADJUSTMENT.



Step 1 Check for tightness of eccentric spindle bolts

Adjust track tension and tighten spindle bolts (1) as tight as possible. Notify unit maintenance to torque spindle bolts as soon as possible.

Step 2 Check for worn track.

Replace worn shoes and adjust track tension. Refer to pages 3-41 and 3-42.

26. TRACK CENTER GUIDE RIDES ON TOP OF ROAD WHEEL(S) OR TRACK CLIMBS SPROCKET.

Check for loose track

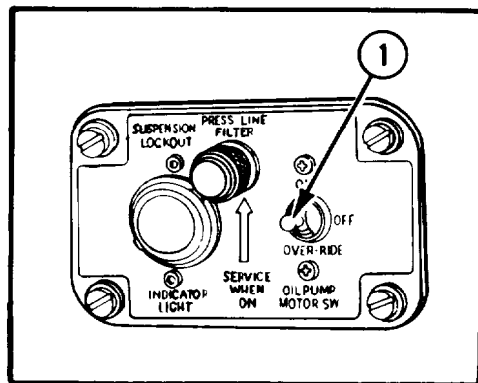
Adjust track tension. Refer to page 3-42.

Table 3-1. TROUBLESHOOTING -CONTINUED

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

TURRET ELECTRICAL SYSTEM

27. OIL PUMP MOTOR DOES NOT OPERATE AUTOMATICALLY.



Check that OIL PUMP MOTOR Switch (1) is ON.

Set OIL PUMP MOTOR Switch (1) ON. If pump does not operate, notify unit maintenance.

ARMAMENT

28. PRIMER FAILS TO FIRE.



When a loaded cannon misfires, see MISFIRE/CHECKFIRE PROCEDURES before continuing operation.

Step 1. Check for defective primer.

Replace primer. Refer to page 2-135.

Step 2. Check for defective firing pin.

Replace defective firing pin. Refer to page 3-58.

Step 3. Check for corroded or defective firing mechanism.

Clean and lubricate firing mechanism. If primer still fails to fire, notify unit maintenance.

Table 3-1. TROUBLESHOOTING -CONTINUED

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

ARMAMENT-CONTINUED

29. PRIMER FIRES BUT ROUND FAILS TO FIRE.

WARNING

When a loaded cannon misfires, see MISFIRE/CHECKFIRE PROCEDURES before continuing operation.

Follow misfire procedures. Refer to page 2-147.

30. ROUND FAILS TO CHAMBER.

Step 1. Check for residue in chamber.

Clean chamber. Refer to appendix F. ■

Step 2. Check for rifling marks on forward bourrelet of projectile.

if marked, remove projectile, tag, and notify explosive ordnance disposal (EOD) for disposal.

Step 3. Check loader/rammer for proper hydraulic pressure gage reading (1600-2400 psi (11,032-16,548 kPa)). Refer to page 2-131. If proper pressure is not present, notify unit maintenance.

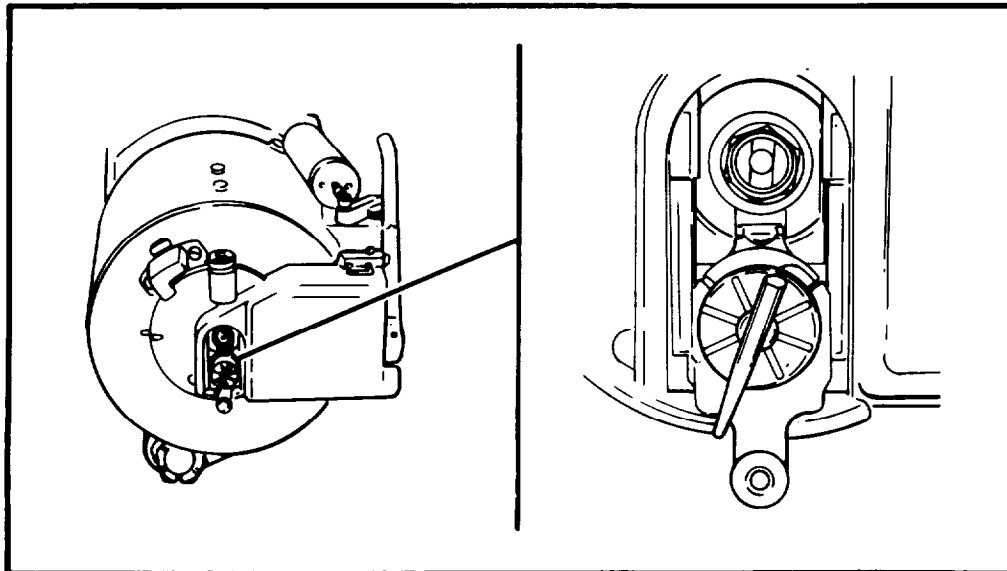
Step 4. If round still fails to chamber, notify unit maintenance to inspect rifling.

Table 3- 1. TROUBLESHOOTING -CONTINUED

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

ARMAMENT-CONTINUED

31. PRIMER DOES NOT INSERT EASILY.



Step 1. Check to see if primer chamber is fouled or dirty.

Clean primer chamber. Refer to page 3-53.

Step 2. Check for distorted primer.

Dispose of distorted primer. Refer to page 5-37.

Step 3. Check for burrs in obturator spindle chamber.

If burred, or still does not insert easily, notify unit maintenance.

32. FIRED PRIMER DOES NOT EJECT.

Step 1. Check to see if primer chamber is fouled, dirty, or pitted.

Drive fired primer from chamber with vent tool, then clean, refer to page 3-58. If primer still does not eject, notify unit maintenance.

Step 2. Check to see if extractor is worn, bent, or broken.

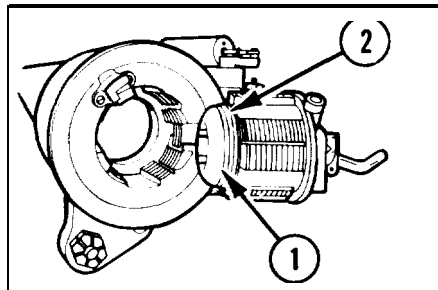
Replace defective extractor. Refer to page 3-58.

Table 3-1. TROUBLESHOOTING-CONTINUED

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

ARMAMENT-CONTINUED

33. EVIDENCE OF BLOWBACK AROUND BREECHBLOCK.



Step 1. Check for worn or defective gas check pad (1).

Replace defective gas check pad (1). Refer to page 3-58.

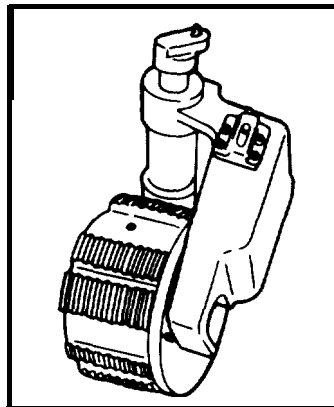
Step 2. Ensure obturator spindle nut is snug. Refer to page 3-58.

Release firing mechanism to gain access to obturator spindle nut and tighten.

Step 3. Check to see if split rings (2) were installed properly.

Rotate split rings (2) so splits are 180 degrees apart. If there is still evidence of blowback, notify unit maintenance.

34. BREECH MECHANISM DOES NOT OPERATE FREELY.



Check to see if breech, breechblock threads, or components are dirty or powder fouled.

Disassemble, clean, and lubricate breech and components, refer to page 3-58 and appendix F. If breech mechanism still does not operate freely, notify unit maintenance.

Table 3-1. TROUBLESHOOTING -CONTINUED

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

ARMAMENT-CONTINUED

35. BREECH CLOSSES HARD.

Step 1. Check breech mechanism and all threads for powder fouling or inadequate lubrication.

Disassemble, clean, and lubricate breech and components. Refer to page 3-58 and appendix F.

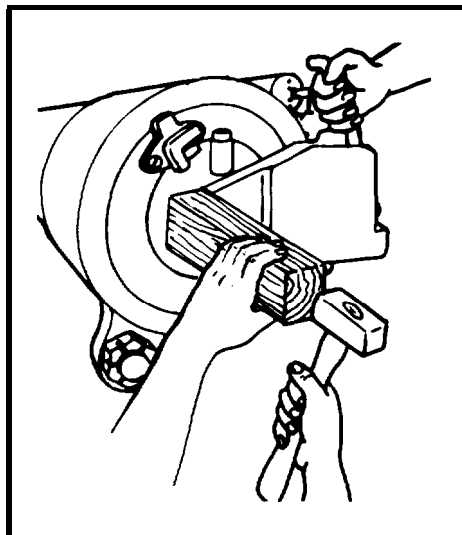
Step 2. Check for improper counterbalance adjustment.

Adjust counterbalance, refer to page 3-57. If breech still closes hard, notify unit maintenance.

Step 3. Check for loose obturator spindle nut.

Release firing mechanism to gain access to obturator spindle nut and tighten.

36. BREECHBLOCK DOES NOT OPEN (UNLOADED CANNON).



Check for seized breechblock.

Free breechblock by striking sharp blow against wood block and at same time pulling down and out on operating lever. If breech fails to open, notify unit maintenance.

Table 3-1. TROUBLESHOOTING -CONTINUED

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

ARMAMENT-CONTINUED

37. BREECHBLOCK DOES NOT OPEN (LOADED CANNON).

WARNING

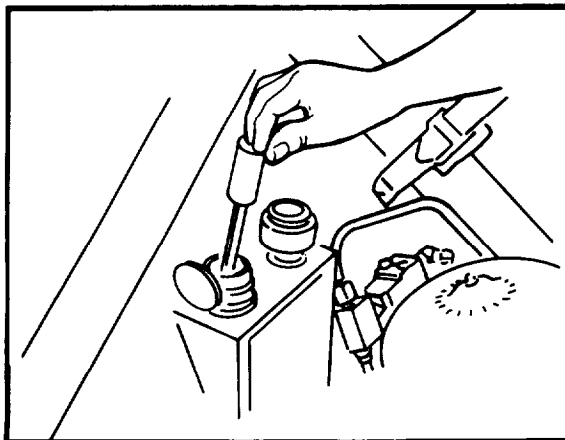
Do not attempt to free a jammed breechblock of a loaded cannon.
Notify unit maintenance.

38. CANNON RETURNS TO BATTERY WITH EXCESSIVE SHOCK.

Establish correct oil reserve. Refer to page 2-121.

If cannon still returns to battery with excessive shock, notify unit maintenance.

39. CANNON OVERRECOILS ON FIRST ROUND.



Step 1. Check hydraulic reservoir oil level.

Fill reservoir if low (appx F).

Step 2. Establish correct oil reserve. Refer to page 2-121.

If cannon still overrecoils, notify unit maintenance.

Table 3-1. TROUBLESHOOTING -CONTINUED

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

ARMAMENT-CONTINUED

40. CANNON UNDERRECOILS ON FIRST ROUND.

Step 1. Check replenisher shutoff valve. Ensure replenisher shutoff valve is open.
Open replenisher shutoff valve.

Step 2. Check temperature. Recoil oil viscosity may be too thick.
Oil will thin during successive firing.

Step 3. Check cannon-to-mount sliding surfaces for lack of lubrication.
Lubricate sliding surfaces. If cannon still underrecoils, notify unit maintenance.

41. CANNON DOES NOT RETURN TO BATTERY.

Step 1. Check replenisher shutoff valve. Ensure replenisher shutoff valve is open.
Open replenisher shutoff valve.

Step 2. Check that recuperator index pin is out.
If index pin is not out, establish correct oil reserve, refer to page 2-121. If cannon does not return to battery, notify unit maintenance.

Section III. MAINTENANCE PROCEDURES

SECTION INDEX

	Page
AIR FILTERS	3-31
Filter bag cleaning	3-32
Installation	3-33
Removal and inspection	3-31
Wet air filters and hull compartment	3-33
BASIC ISSUE ITEMS (BII)	3-46
BATTERIES..	3-37
Battery hookup	3-38
Corrosion	3-38
Deep cycling	3-39
Lead connections	3-38
Replacing batteries	3-38
Unserviceable batteries	3-39
BORESIGHTING THE WEAPON	3-88
BREECHBLOCK GROUP..	3-55
Counterbalance assembly removal and adjustment	3-57
M35 firing mechanism	3-55
Removal, disassembly, assembly, and replacement of firing mechanism block, firing mechanism housing, obturator spindle, and breechblock	3-58
Scored gas check seat repair	3-55
CHECKING RELIABILITY OF DEFLECTIONS (M115 PANORAMIC TELESCOPE)	3-75
CHECKING RELIABILITY OF SPECIAL CORRECTIONS (M115 PANORAMIC TELESCOPE)	3-76
Inspecting M 137 telescope mount (azimuth walk-off check)	3-77
DRIVER'S AND CREW'S SEATS	3-46
ENGINE COOLING SYSTEM	3-36
Adding coolant	3-36
Draining coolant	3-36
FIRE CONTROL ALINEMENT TESTS AND MEASUREMENTS	3-63
FUEL SYSTEM	3-34
Fuel filler screen	3-35
Fuel filters..	3-34
Refueling..	3-35
GUNNER'S QUADRANT END-FOR-END TEST	3-67
GUNNER'S QUADRANT MICROMETER TEST	3-65
INTRODUCTION	3-30
LAMPREPLACEMENT..	3-46
Dome light	3-48
Driver's external engine and transmission warning light	3-51
Engine-transmission low oil warning indicator light and generator charge indicator light	3-51
Headlamps and blackout marker lamp	3-46
High beam indicator light and master switch indicator light	3-51
Low engine coolant warning light	3-49
M15 elevation quadrant	3-52
M137 telescope mount	3-52
Panel light	3-49
Pressure filter indicator light	3-50
Stoplight-taillight, left	3-47
Stoplight-taillight, right	3-48

Suspension lockout indicator light.	3-50
LEVELING TRUNNIONS USING PLUMBLINE	3-72
LEVELING TRUNNIONS USING SCRIBE LINES ON M15 ELEVATION QUADRANT.	3-74
LEVELING TUBE-GUNNER'S QUADRANT METHOD	3-78
LOCKOUT CYLINDER CHECK.	3-39
M201A1 CANNON	3-53
Borescoping	3-54
Clean and lubricate	3-54
Determining remaining cannon tube life.	3-54
Inspection	3-53
Muzzle brake	3-55
Pullover gaging	3-54
OPERATION OF M1A1/M1A2 GUNNER'S QUADRANT	3-64
OPERATION OF M17 PERISCOPE.	3-53
PREPARATION FOR FIRE CONTROL ALINEMENT TESTS.	3-63
SCRIBING M15 ELEVATION QUADRANT	3-80
SCRIBING M137 MOUNT FOR BORESIGHTING.	3-86
SPECIALTOOLS	3-46
TESTING OF ELEVATION CORRECTION COUNTER, M137 TELESCOPE MOUNT	3-83
TESTING OF M15 ELEVATION QUADRANT	3-79
TOUCHUP AND RECOATING	3-30
TOW HOOKS	3-46
TRACK	3-39
Decreasing track tension	3-43
Increasing track tension	3-44
Installing track	3-45
Spindle and idler arm clearance	3-39
Track pad installation	3-40
Track shoe removal and installation	3-41
Track tension check.	3-42
VERIFICATION OF M15 ELEVATION QUADRANT SCRIBE LINES	3-82

INTRODUCTION

This section provides maintenance instructions that are normally performed by the operator and crew.

The tools required to perform operator maintenance are provided as part of the basic issue item (appendix B) and the additional authorization (appendix C) lists.

TOUCHUP AND RECOATING



Unusable CARC mixtures may be considered hazardous waste and may require disposal in accordance with Federal, state, DOD, and DA hazardous waste regulations. Consult the installation environmental office for proper disposal guidance. Mixed CARC has a flashpoint of approximately 38°F (3°C) due to the incorporation of solvents and is highly flammable.

TOUCHUP AND RECOATING—CONTINUED

Painting at the operator level is limited to touchup/spot painting. CARC paint that has been opened must be used within 8 hours or it will deteriorate beyond use. Mix only what is needed for immediate use. Refer to TM 43-0139.

When touching up damaged areas, the procedure should be as similar to the original

method of finishing as possible; a clean surface is imperative. Where general disintegration of the surface is evident, or the under surface is corroded, the coating must be stripped clean from the part. Corrosion must be removed or neutralized by mechanical or chemical treatment, or both, and the surface metal must be pretreated, primed, and then topcoated.

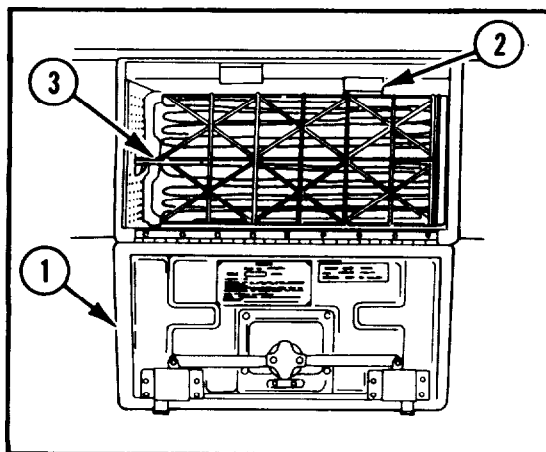
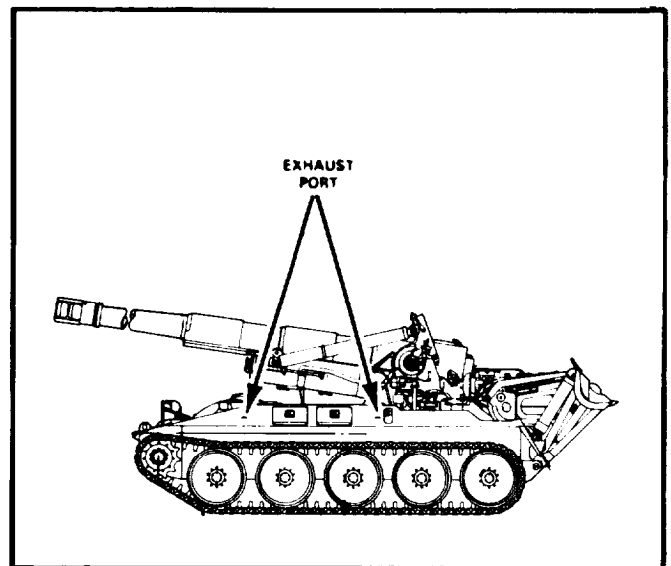
AIR FILTERS

REMOVAL AND INSPECTION

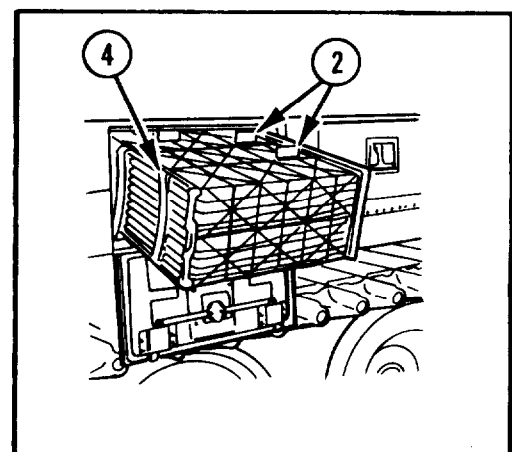
WARNING

Contaminated (NBC) filters must be handled using adequate precautions (refer to FM 21-40) and must be disposed of by authorized personnel.

- 1 Set MASTER switch and INSTRUMENT switch ON and check operation of the air separator blowers by holding hand at each blower exhaust port to detect air flow.
- 2 Set MASTER switch and INSTRUMENT switch OFF. If air flow was not felt in step 1, notify unit maintenance.



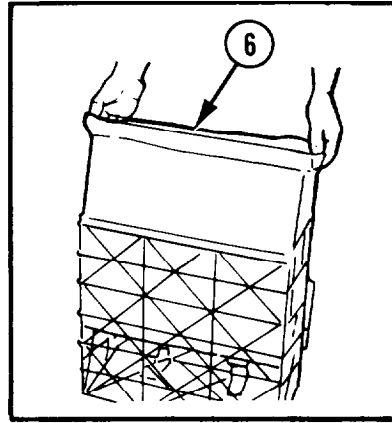
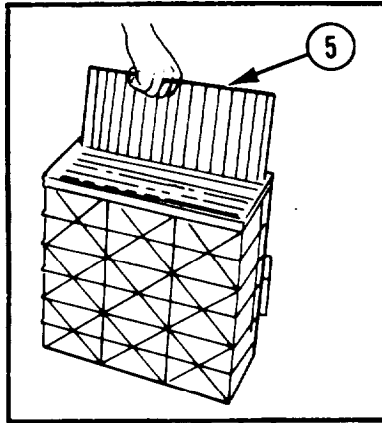
- 3 Open air cleaner access door (1). Note position of stops (2).



- 4 Turn air filter basket lock lever (3) to vertical position and pull basket (4) from compartment.

AIR FILTERS—CONTINUED

REMOVAL AND INSPECTION-CONTINUED



5 Remove 10 filter spacers (5) and lift filter bag (6) from basket.

6 Check filter bag (6) for leaks. If there is evidence of leaks, replace filter bag (6).

Heavy traces of dust on inside of filter bag (6) indicate a leak. Light traces of dust on inside of filter bag (6) are normal.

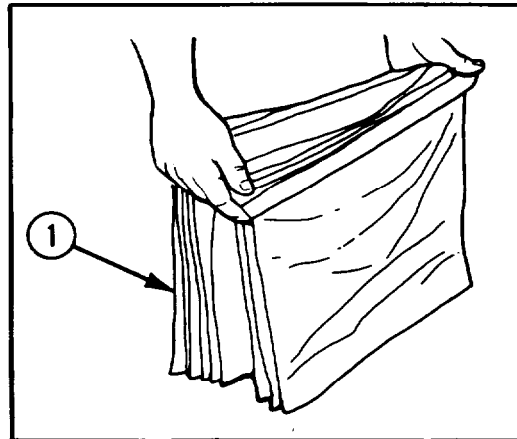
FILTER BAG CLEANING

Three methods of cleaning the filter bag are listed. The best method of cleaning is number three.

CAUTION

DO NOT strike the bag against any surface. Do not allow dust to enter inside filter bag pockets during cleaning.

1 Grasp rubber cap end of filter (1) with both hands and shake filter. Be sure to shake dust from filter pocket edges and from between pleats.



WARNING

Always wear protective goggles and stand upwind of blast when using compressed air.

and a 1/8 in. internal diameter nozzle are recommended for cleaning with compressed air.

CAUTION

Do not use steam to clean filter bag.

2 Use compressed air to remove dust from filter. Insert hose nozzle into each pocket and blow dust out. A maximum line pressure of 100 psi (689.5 kPa)

3 Wash filter with hot or cold water or water and a nonsudsing detergent. Hang filter bag to dry with rubber cap end in a horizontal position.

AIR FILTERS -CONTINUED

WET AIR FILTERS AND HULL COMPARTMENT

The following procedures should be followed if the air filters and hull compartment become wet from fording or washing of the vehicle.

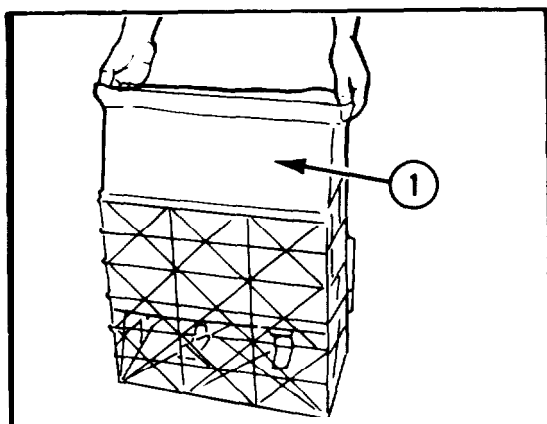
- 1 Remove air filter by following the procedure on page 3-31.

Do not use steam to clean filter bag.

- 2 Wash filters with hot or cold water or water and a nonsudsing detergent.

- 3 Hang filter bag to dry with rubber cap end of the bag in a horizontal position.
- 4 Clean and dry air filter hull compartment with clean rags (item 39, appx D) and low-pressure compressed air.
- 5 Check that air filter access door seals for nicks or tears. Report any damage to unit maintenance.
- 6 Install air filters using the following procedure.

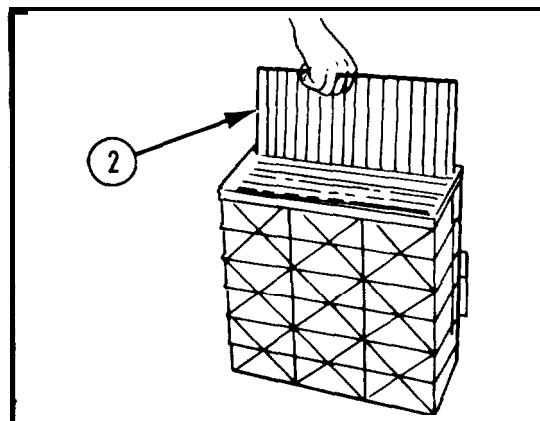
INSTALLATION



CAUTION

Incorrect installation can cause misalignment of rubber cap and damage to filter basket and access door latch.

- 1 Install filter bag (1) in basket and fit filter bag rubber cap firmly around rim of basket.



CAUTION

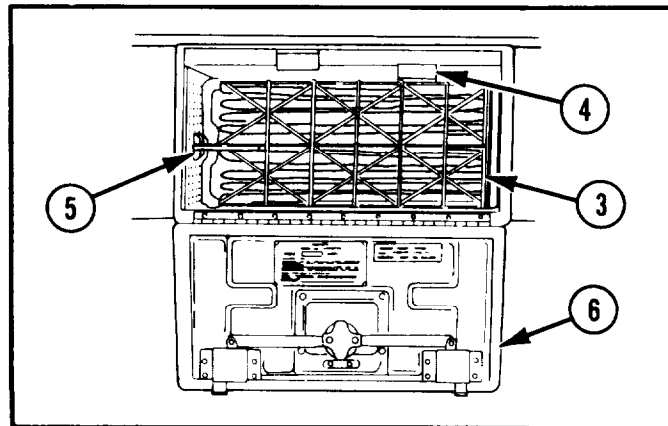
Do not tear bag while installing filter spacers.

- 2 Install 10 filter spacers (2) in filter bag pockets. Make sure the spacers are fully and evenly inserted.

AIR FILTERS—CONTINUED

INSTALLATION- CONTINUED

- 3 Position air filter basket and filter bag (3) in hull compartment with basket stops (4) on top and slide basket past stops in hull recess.
- 4 Push filter basket against hull and secure with lock lever (5). Close air filter access door (6) and make sure it is sealed.



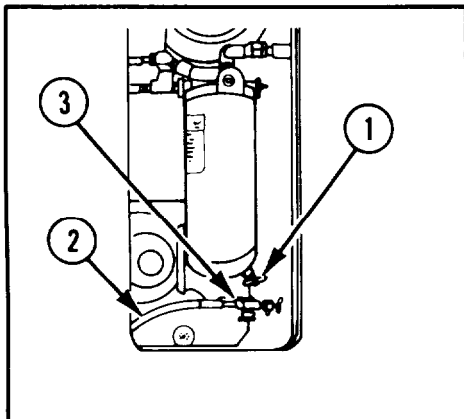
FUEL SYSTEM

FUEL FILTERS

WARNING

Diesel fuel is **FLAMMABLE**.
DO NOT smoke within 50 ft
(15.2 m) while servicing fuel
system.

- 1 Remove access door in driver's compartment by turning handle 90 degrees counterclockwise.

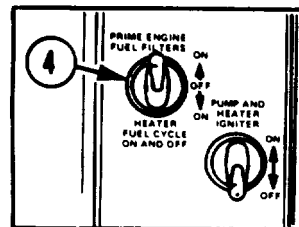


CAUTION

Always prime the fuel system after draining fuel filters. Air in the system will damage the fuel pump or injectors.

- 2 Place a suitable container under the primary fuel filter and turn drain valve (1) counterclockwise until fuel flows. When clear fuel appears, close the drain valve.

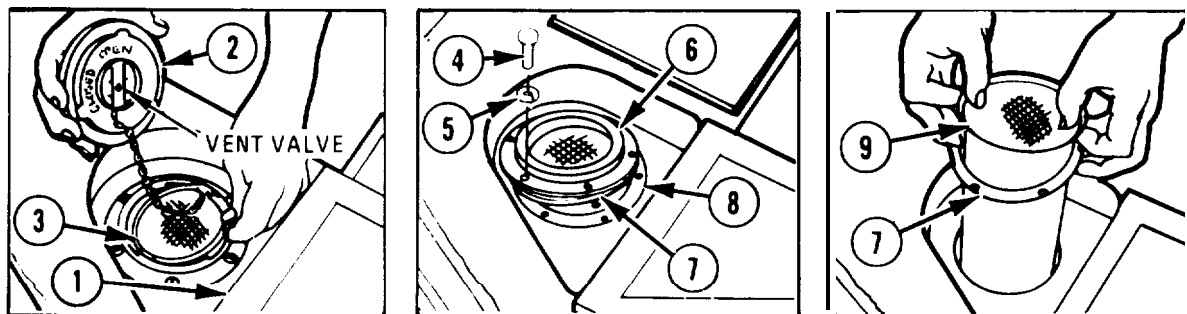
- 3 Lift secondary fuel filter drain hose (2) from clip (3) on engine and repeat step 2 above.
- 4 Secure hose in clip and replace access door in opening.
- 5 Discard drained fuel.
- 6 Set MASTER switch and INSTRUMENT switch ON.



- 7 Hold PRIME-AND-HEATER-FUEL-CYCLE switch (4) in PRIME-ENGINE-FUEL-FILTERS position for 1 minute.
- 8 Release switch (4) and set the MASTER switch and INSTRUMENT switch OFF.

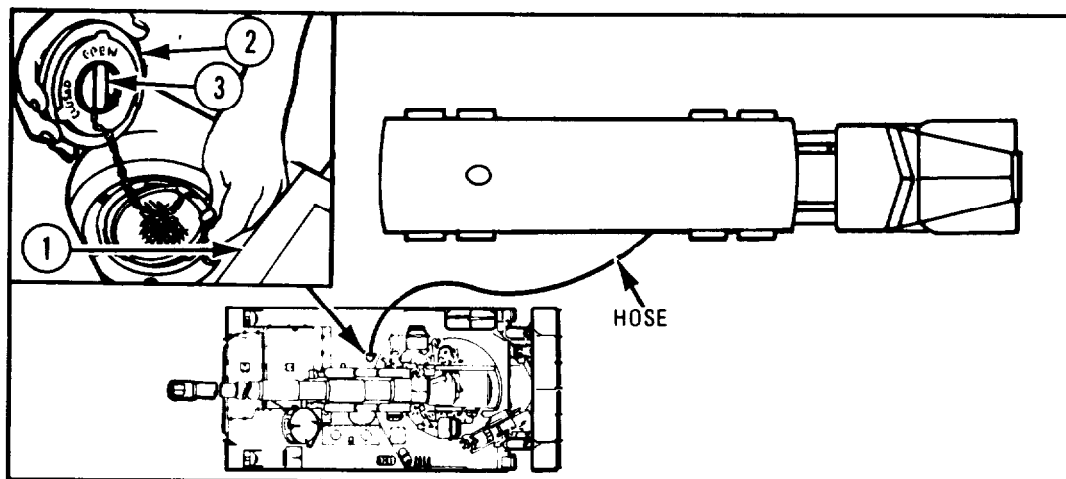
FUEL SYSTEM—CONTINUED

FUEL FILLER SCREEN



- 1 Open fuel fill cover (1) and remove fuel cell cap (2) and retaining ring (3).
- 2 Remove six screws (4) and lockwashers (5).
- 3 Remove bayonet ring (6), gasket (7), and washer (8). Lift filter (9) and second gasket (7) from fuel filler opening.
- 4 Clean filter (9) with dry cleaning solvent (item 19, appx D) and dry with low pressure air.
- 5 Make sure surface around fuel filler opening is clean and install clean filter by reversing the above steps.

REFUELING



- 1 Open fuel fill cover (1) and remove fuel cell cap (2). Fill only to 6 in. (15.2 cm) below top.
- 2 Ground vehicle and fill with proper grade of fuel and replace fuel cell cap.

CAUTION

Make sure fuel cap vent valve (3) is turned to OPEN.

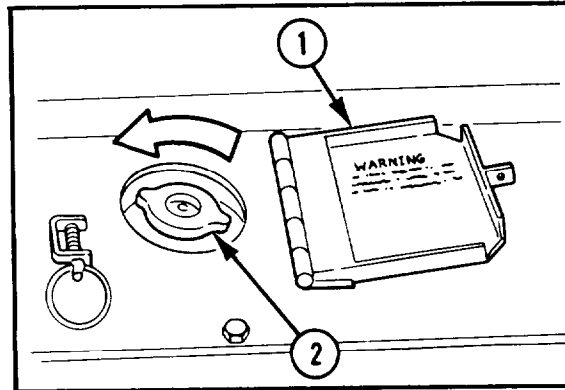
ENGINE COOLING SYSTEM

ADDING COOLANT



Never remove radiator caps on an overheated engine.

- 1 Open radiator cap covers (1) and, using a rag, slowly remove radiator caps (2) from both radiators.
- 2 Add coolant slowly until radiators are filled to a level approximately 1.5 in. (3.8 cm) below the base of fill neck.
- 3 Replace radiator caps and make sure covers are closed.
- 4 Run engine for at least 5 minutes and then check coolant level. Level should be approximately 0.5 in. (1.3 cm) below base of fill neck.



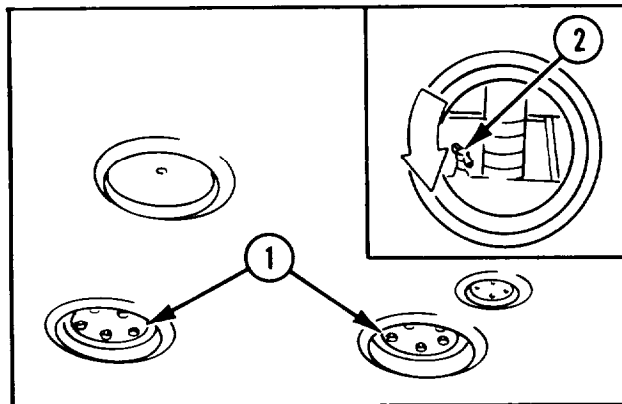
- 5 If the engine overheats and/or there is an excessive loss of coolant, the surge tank vent valve may be defective. Notify unit maintenance.

DRAINING COOLANT



Do not attempt to drain coolant from a hot engine.

- 1 Allow engine to completely cool.
- 2 Open radiator cap covers and, using a rag, slowly remove radiator caps from both radiators.
- 3 Remove radiator access plates (1). Open draincocks (2) in bottom of both radiators.
- 4 Notify unit maintenance to drain engine.
- 5 When radiators are completely drained, close all draincocks and install access plates.
- 6 Refill by adding coolant.



BATTERIES

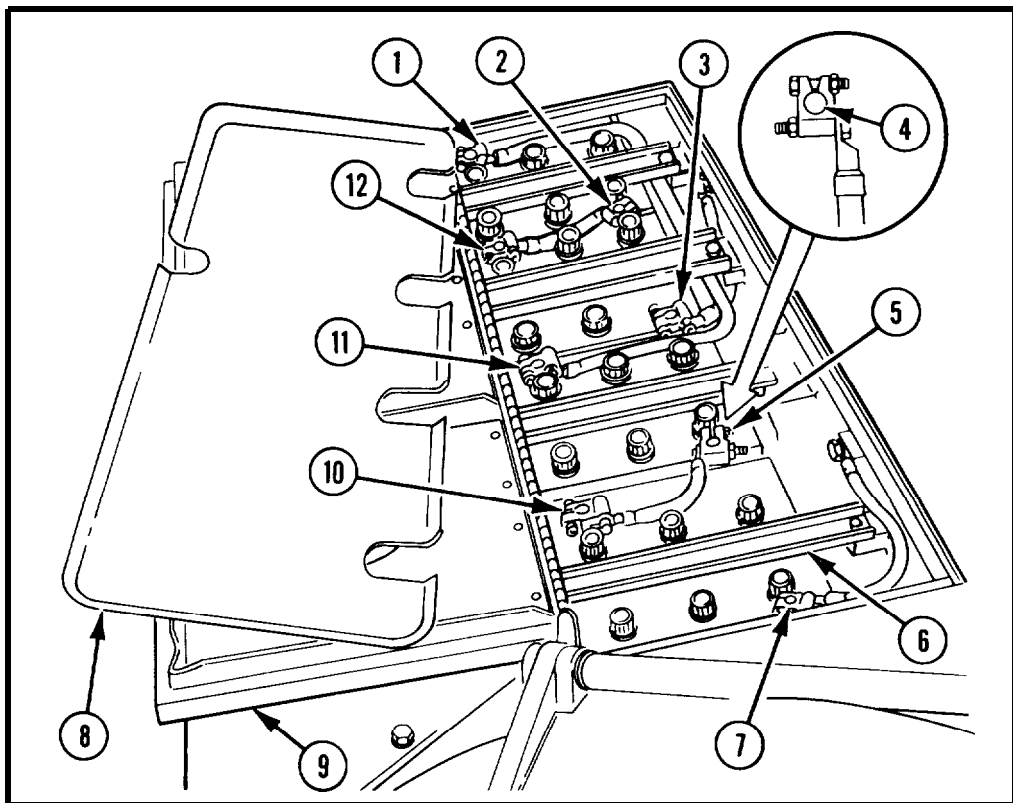
The following preventive maintenance procedures are performed by the operator. Refer to TM 9-6140-200-14 for further information pertaining to lead acid storage batteries.

WARNING

- Make sure all electrical switches are in OFF position.
- Remove all jewelry and wristwatches from your person before checking batteries.

CAUTION

Do not open driver's cupola cover while checking batteries. The cover handle may short out on the cable connections.



- (1) Positive-to-bus bar
- (2) Negative
- (3) Negative-to-ground
- (4) Terminal post
- (5) Negative
- (6) Battery tiedown

- (7) Negative-to-ground
- (8) Battery protective cover
- (9) Battery door
- (10) Positive
- (11) Positive-to-bus bar
- (12) Positive

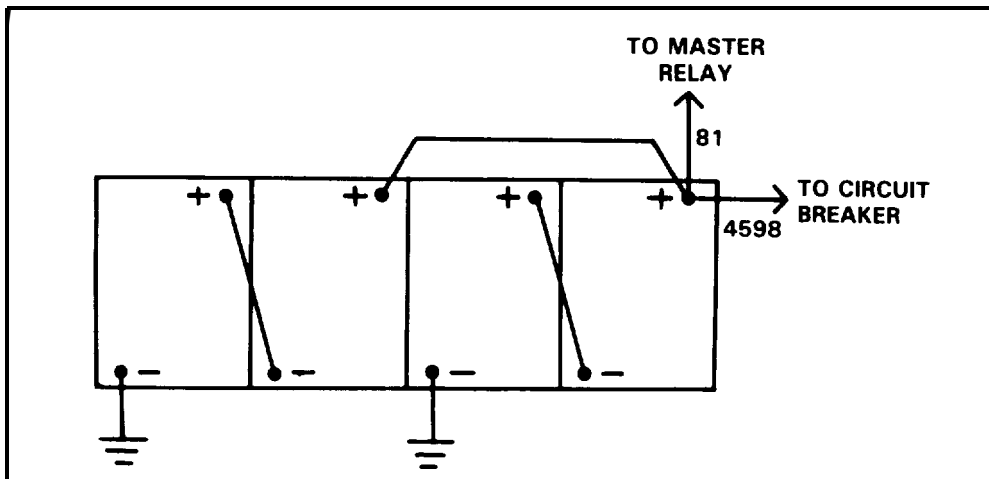
BATTERIES—CONTINUED

LEAD CONNECTIONS

- Electrolytic action forms **EXPLOSIVE** hydrogen gas. **DO NOT** cause a spark across the battery terminals. The battery may blow up in your face.
- Make sure all electrical switches are in the **OFF** position.

- 1 Check that connectors are all the way down on battery posts and tight.
- 2 Check that battery holddowns are snug, but not so tight as to damage battery case.
- 3 If bolt threads are corroded and prevent a tight hold, notify unit maintenance personnel for replacement.
- 4 Check cables for loose or broken connections. If connections are loose or broken, notify unit maintenance personnel.

BATTERY HOOKUP



REPLACING BATTERIES

Notify unit maintenance personnel.

CORROSION



Battery corrosion is an acid and will eat holes in your clothing. Wash any corrosion off your skin immediately.



Make sure battery caps are tight and no cracks are visible in battery case, so no alkaline

solution (acid neutralizer) reaches electrolyte.

Corrosion is greenish “fuzz” that builds up on battery posts, terminals, and cables. This corrosion not only can prevent starting, but will also eat up cables and connectors. If corroded, notify unit maintenance personnel.

BATTERIES—CONTINUED

DEEP CYCLING

Deep cycling is a complete discharge of batteries. This will lessen battery life and in freezing weather will burst battery case. Avoid running battery down.

UNSERVICEABLE BATTERIES

If batteries fail to respond, notify unit maintenance personnel.

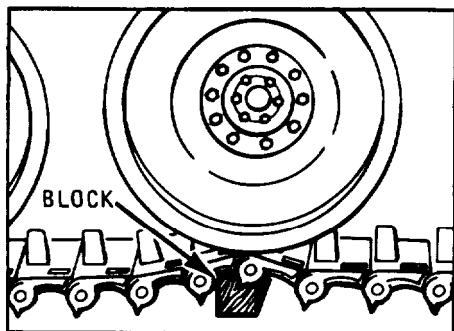
LOCKOUT CYLINDER CHECK

The following procedure to check for defective lockout cylinders should be performed on both tracks.

- 1 Place a wood block, 4 by 4 by 12 in. (10.16 by 10.16 by 30.48 cm) under one of the tracks.
- 2 Start engine.
- 3 Set lockout control valve handle in LOCKED position.

NOTE

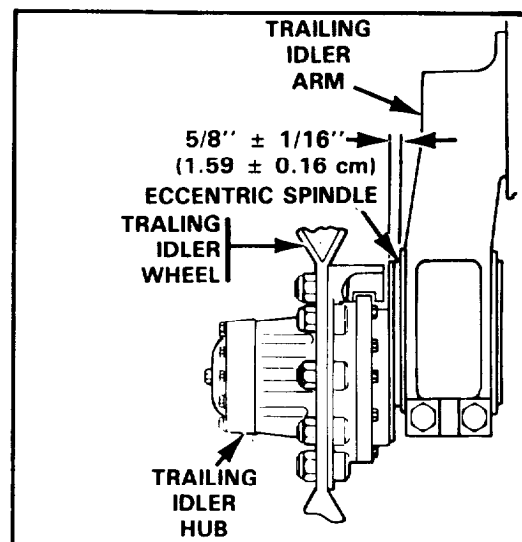
Most vehicles are not equipped with lockout cylinders on the third road wheel, which will rise when driven over the block.



- 4 Drive vehicle over block slowly. Watch the road wheel arms. All wheels and arms, except as noted above, should remain rigid. If any wheel rises, notify unit maintenance.

TRACK

SPINDLE AND IDLER ARM CLEARANCE



Make sure placement of spindle is correct. Proper spindle clearance is approximately 5/8 in. (1.59 cm) of spindle threaded portion extending outside of arm. If placement is incorrect, rotate spindle either in or out to achieve proper clearance as follows:

CAUTION

Check tolerance on each 360 degree turn of the spindle.

- 1 Decrease tension. Refer to page 3-43, steps 1 thru 4.
- 2 Adjust left side spindle:
 - a. Drive vehicle slowly until hole through hub flange of training idler wheel is aligned with hole in eccentric shaft spindle. Insert 10 in. (25.4 cm) of bar handle (item 45, appx B) through hub flange and into spindle.
 - b. To increase clearance to 5/8 in. (1.59 cm), drive vehicle forward until spindle has rotated 360 degrees. Measure clearance. Repeat above, if necessary. To decrease clearance, drive vehicle rearward.

TRACK—CONTINUED

SPINDLE AND IDLER ARM CLEARANCE-CONTINUED

3 Adjust right side spindle:

- a. Drive vehicle slowly until hole through hub flange of trailing idler wheel is aligned with hole in eccentric shaft spindle. Insert 10 in. (25.4 cm) of bar handle (item 45, appx B) through hub flange and into spindle.
- b. To increase clearance to 5/8 in. (1.59 cm), drive vehicle rearward until spindle has rotated 360 degrees. Measure clearance. Repeat above, if necessary. To decrease clearance, drive vehicle forward.

TRACK PAD INSTALLATION

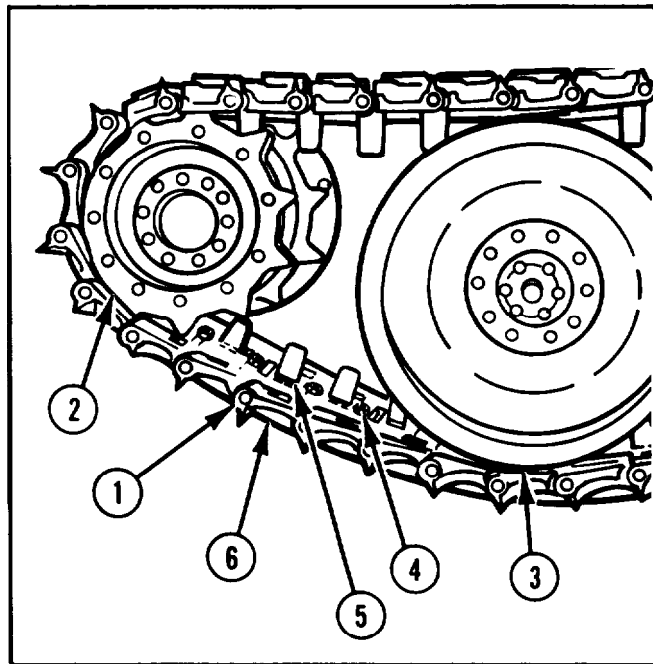
- 1 Inspect for missing or worn track pads. Refer to page 2-46.
- 2 Position track shoe (1) between drive sprocket (2) and road wheel (3) as shown.
- 3 Clean nut (4) using wire brush and lubricate using CLP (item 6, appx D).
- 4 Allow oil to penetrate for three to five minutes. Remove nut (4).
- 5 Strike stud (5) with hammer. Remove pad (6).

CAUTION

Do not damage track pin threads during removal.

- 6 Clean pad seating area of old rubber and dirt using stiff bristle brush.
- 7 Install new pad (6).
- 8 Install nut (4).

Text Unit maintenance will tighten to specification.



TRACK—CONTINUED

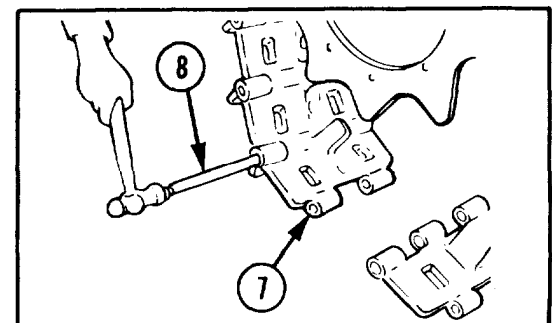
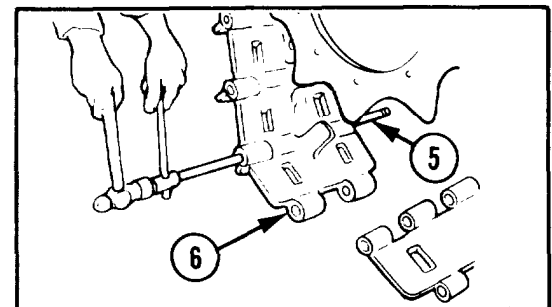
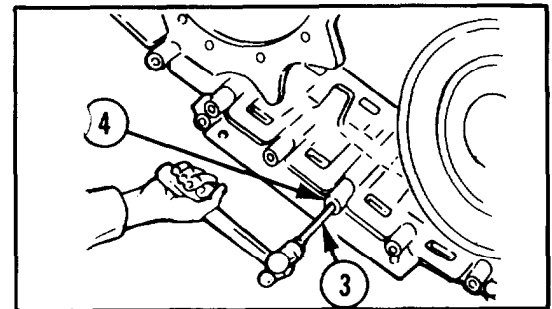
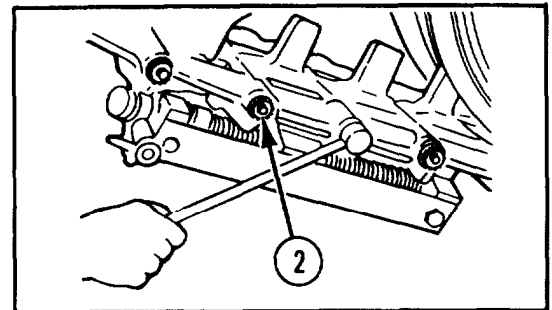
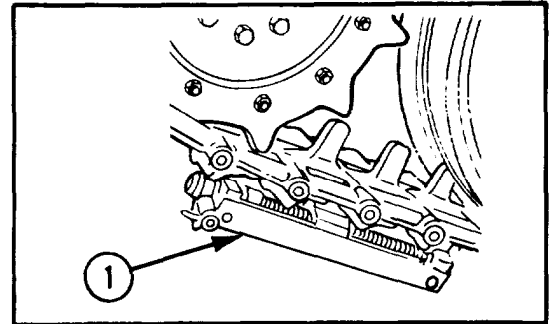
TRACK SHOE REMOVAL AND INSTALLATION

- 1 Decrease track tension. Refer to page 3-43.
- 2 Drive vehicle on level ground and position track shoe to be removed midway between bottom of drive sprocket and first road wheel.
- 3 Block opposite track to prevent vehicle movement. Do not lock vehicle brakes.
- 4 Install two track connecting fixtures (1) (item 38, appx B) across track shoe to be removed. Tighten fixtures equally to relieve tension on track pins.
- 5 Loosen nut (2) from link pin.

CAUTION

Do not damage track pin threads during removal.

- 6 Using short leg of drift pin (3) (item 30, appx B), start to drive pin (4) out of track shoe. Remove nut (2) and pin (4) with long leg of drift pin.
- 7 Remove track shoe connecting fixture.
- 8 Repeat steps 5 and 6 for remaining link pin (5) and remove track shoe (6).
- 9 Prior to installation, lubricate track shoe pins with oil (item 35, appx D).
- 10 Partially install one self-locking nut on each track pin.
- 11 Position track shoe (7) being installed at one end of disconnected track. Lift shoe approximately 15 degrees to align hexagon shape of bushings and insert link pin (8). Drive pin through shoes by tapping lightly with hammer on end of nut. Install remaining nut on opposite end of track pin.

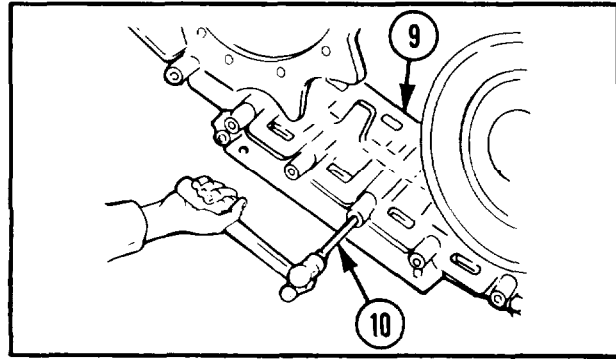


TRACK—CONTINUED

TRACK SHOE REMOVAL AND INSTALLATION-CONTINUED

12 Install two track connecting fixtures (9) across track shoes to be connected and tightened equally until holes in ends of track are alined. Connect shoes with track shoe link pin (10) as in step 11 and install remaining nut.

13 Tighten all nuts as much as possible. Remove track connecting fixture. As soon as possible, have unit maintenance tighten nuts.

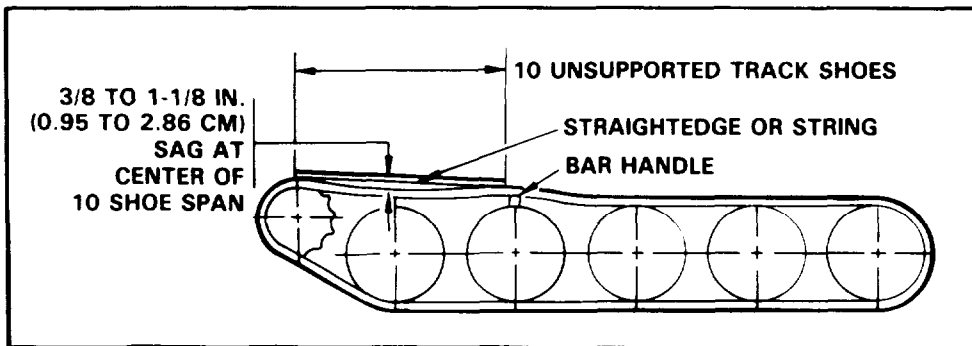


NOTE

A minimum of 1/8 in. (0.32 cm) of track pin thread must extend through both track pin nuts.

14 Adjust track tension.

TRACK TENSION CHECK



NOTE

Cannon tube must be in travel (retract) position.

1 Move vehicle slowly backward or forward over hard level ground; allow vehicle to coast to a stop without applying brake. Shift transmission into neutral.

2 Place bar handle between track and second road wheel. If track touches first road wheel, adjust track tension.

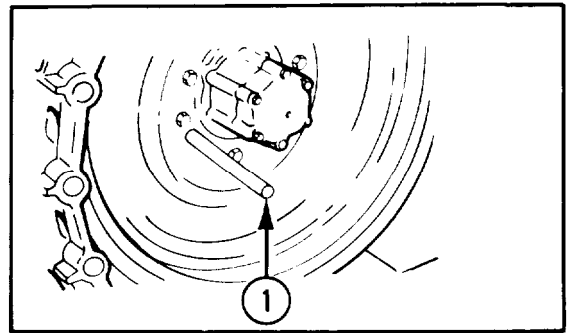
3 Place a straightedge or stretch string over a distance of 11 unsupported track shoe pins. Measure track sag midway between 10 unsupported track shoes as shown. If track sag does not fall within normal limits (3/8 to 1-1/8 in. (0.95 to 2.86 cm)), adjust track tension.

NOTE

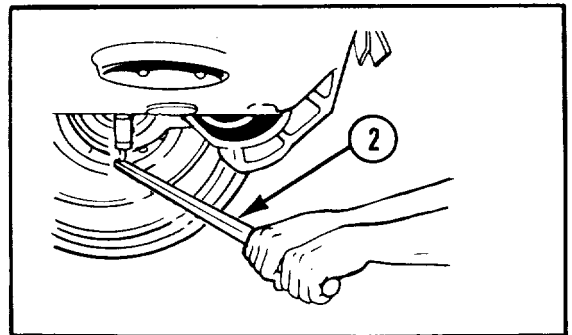
Track tension should be adjusted before the maximum allowable track sag is reached.

TRACK—CONTINUED*DECREASING TRACK TENSION*

- 1 Drive vehicle onto hard level ground.
- 2 Drive vehicle slowly in reverse until hole through hub flange of trailing idler wheel is aligned with hole in eccentric shaft spindle. Insert 10 in. (25.4 cm) of bar handle (1) (item 45, appx B) through hub flange and into spindle.

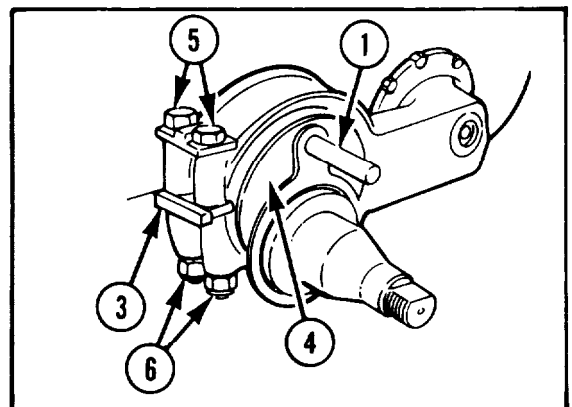


- 3 Loosen self-locking nuts on eccentric spindle screw, using socket wrench (2) (item 135, appx B). Drive wedge (3) (item 120, appx B) into joint to relieve tension on eccentric spindle (4). Notify unit maintenance for torquing.

**CAUTION**

Bar handle must not travel below centerline of trailing idler arm.

- 4 Move vehicle slowly rearward, rotating bar handle (1) and eccentric spindle (4) 1/4 to 1/2 turn, and decrease track tension.
- 5 Remove wedge (3) from eccentric spindle (4). Tighten eccentric spindle screws (5) and nuts (6) as tight as possible using socket wrench (2) (item 135, appx B). As soon as possible, have unit maintenance check and torque spindle nuts (6) (oiled (item 34, appx D) threads and washer).



TRACK—CONTINUED

INCREASING TRACK TENSION

- 1 Drive vehicle onto hard level ground.
- 2 Drive vehicle slowly forward until hole through hub flange of trailing idler wheel is alined with hole in eccentric spindle (1). Insert 10 in. (25.4 cm) of bar handle (2) (item 45, appx B) through hub flange and into eccentric spindle (1).
- 3 Using socket wrench (item 135, appx B), loosen self-locking nut (3) on eccentric spindle screw (4). Nuts are torqued (oiled threads and washer). Drive wedge (5) (item 120, appx B) into joint to relieve tension on eccentric spindle (1). Notify unit maintenance for torquing.

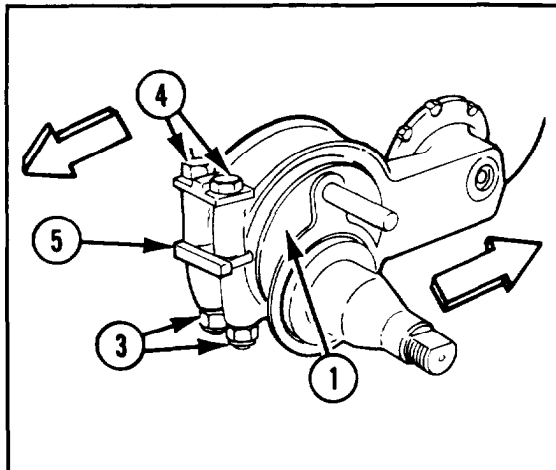
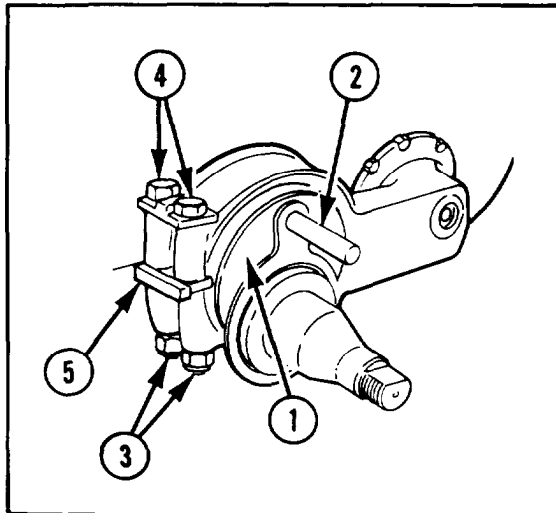
CAUTION

Bar handle must not travel below centerline of trailing idler arm.

- 4 Drive vehicle slowly forward to increase track tension.

NOTE

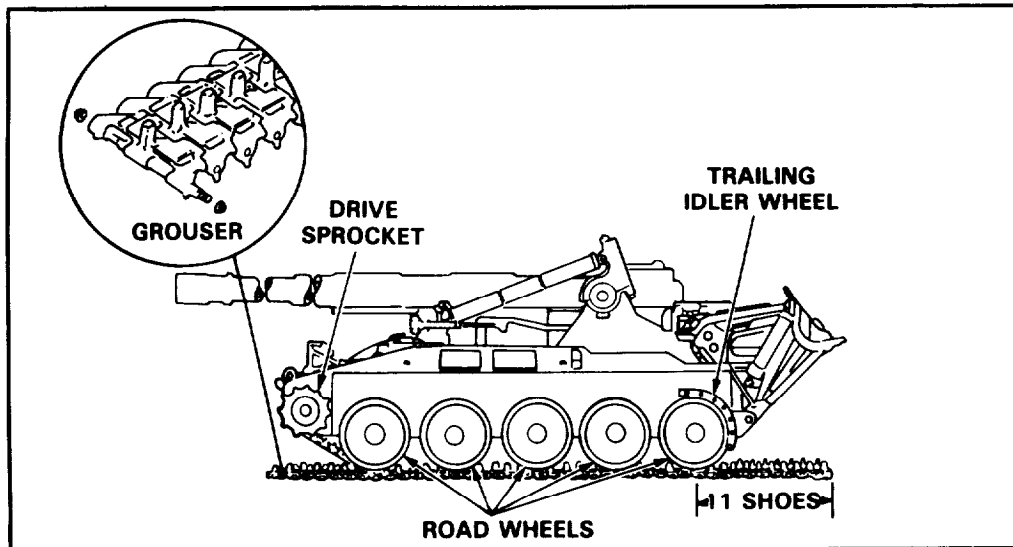
- | If proper tension has not been achieved by the time the bar handle reaches centerline of trailing idler arm, remove one track shoe. Reassemble track and adjust track to proper tension.
- | Make sure that track does not bunch up between road wheels during track tensioning.
- | Lubricate screws and nuts with oil (item 34, appx D) before installing.



CAUTION

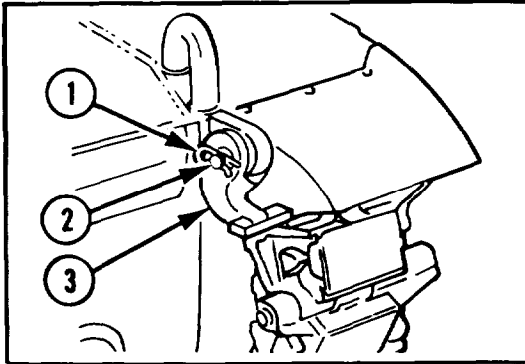
Ensure spindle arm clearance is correct. Refer to p 3-39.

- 5 Remove wedge (5) from eccentric spindle (1). Tighten eccentric spindle screws (4) and nuts (3) as tight as possible using socket wrench (item 135, appx B). As soon as possible have unit maintenance check and torque spindle nuts (3).

TRACK—CONTINUED*INSTALLING TRACK*

- 1 Lay track out in front of vehicle in a straight line, directly ahead of and touching the first road wheel. Position track on ground with shoe grousers facing forward.
- 2 Start engine and drive slowly onto track to a point where 11 track shoes extend past centerline of trailing idler wheel.
- 3 Stop engine; leave parking brake off.
- 4 Place drift pin (item 30, appx B) in track shoe pin hole on last shoe at rear of vehicle. Lift the end of track over trailing idler wheel.
- 5 Start engine and move vehicle forward slowly allowing track to rest on road wheels. Lift up on end of track, preventing end from getting caught between the road wheels. When track reaches drive sprocket, pry or lift track over sprocket.
- 6 Using drive sprocket, bring both ends of track together.
- 7 Install two track connecting fixtures (item 38, appx B) across track shoes to be connected and tighten equally until holes in ends of track are aligned. Connect shoes with track shoe link pin and install self-locking nut.
- 8 Tighten two nuts on track shoe link pin. Remove track connecting fixtures. As soon as possible, have unit maintenance tighten nuts.
- 9 Increase track tension. Refer to page 3-44.

TOW HOOKS



- 1 Remove two lock pins (1).
- 2 Remove pin (2) and tow hook (3).
- 3 Reverse steps 1 and 2 for installation.

DRIVER'S AND CREW'S SEATS

- 1 Lubricate seats in accordance with appendix F.
- 2 If seats will not operate, seat belts are damaged or seat cushions are torn. Notify unit maintenance.

SPECIAL TOOLS

Keep all tools clean and properly stowed. Notify unit maintenance of missing or damaged tools.

BASIC ISSUE ITEMS (BII)

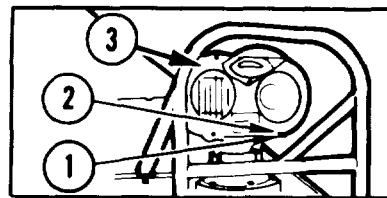
Keep all basic issue items clean and properly stowed. Notify unit maintenance of missing or damaged items. See appendix B for a list of basic issue items, and appendix E for their locations.

LAMP REPLACEMENT

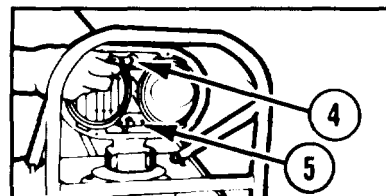
The following pages provide lamp replacement instructions to be performed by the operator. If lamp replacement does not remedy the malfunction, notify unit maintenance. Make sure lamps are replaced with new lamps of the same identification number.

HEADLAMPS AND BLACKOUT MARKER LAMP

Normally only the blackout marker lamps in the headlamps may be replaced, but in an emergency, if a headlamp becomes broken, the lamp may be exchanged depending on the driving conditions.



- 1 Remove four screws (1) and lock-washers (2) securing the headlamp cover and remove cover (3).

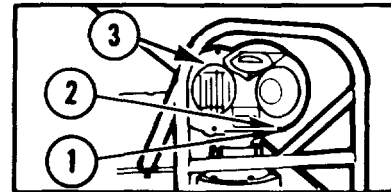
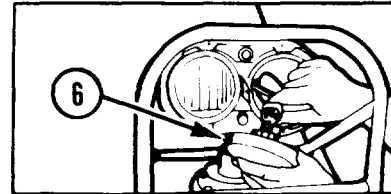


- 2 To remove drive lamp (4), depress and turn counterclockwise.
- 3 To remove blackout marker assembly (5), open cover and insert screwdriver in center slot, depress and turn counterclockwise.

LAMP REPLACEMENT—CONTINUED

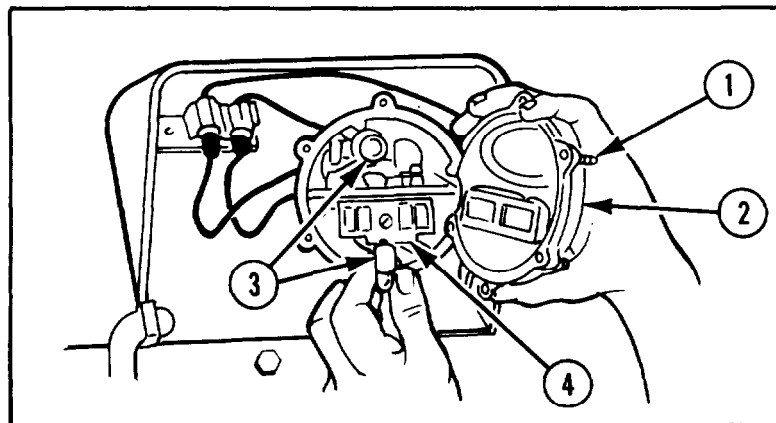
HEADLAMPS AND BLACKOUT MARKER LAMP- CONTINUED

- 4 Lightly apply silicone compound (item 41, appx D) to sockets.
- 5 Install new lamp, depress and turn clockwise to secure.
- 6 Insert blackout marker assembly (5) into socket. Insert screwdriver in center slot, depress and turn clockwise to secure. Close cover of blackout marker assembly.
- 7 Disconnect headlamp (6).
- 8 Connect headlamp (6).
- 9 Apply coating of grease (item 20, appx D) to cover (3) contact surfaces.



- 10 Apply anti-seize compound (item 5, appx D) to four screws (1).
- 11 Reinstall cover (3) with four screws (1) and lockwashers (2).

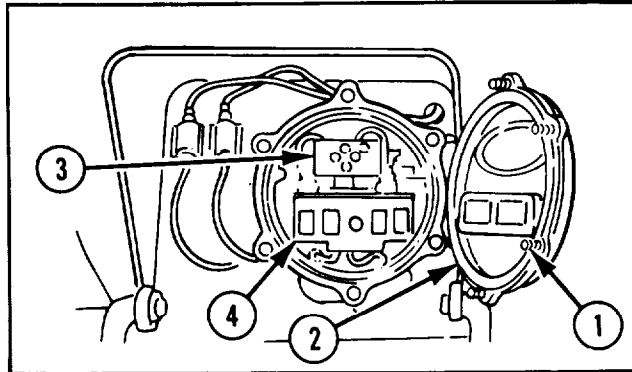
STOPLIGHT-TAILLIGHT, LEFT



- 1 Loosen six screws (1) and remove door (2).
- 2 To remove lamps (3), depress and turn counterclockwise.
- 3 To remove marker assembly (4), insert screwdriver in center slot, depress and turn counterclockwise.
- 4 Lightly apply silicone compound (item 41, appx D) to sockets.
- 5 Install new lamps (3), depress and turn clockwise to secure.
- 6 Install marker assembly (4), insert screwdriver in center slot, depress and turn clockwise to secure.
- 7 Apply anti-seize compound (item 5, appx D) to threads of screws (1).
- 8 Reinstall door (2) with six screws (1).

LAMP REPLACEMENT—CONTINUED

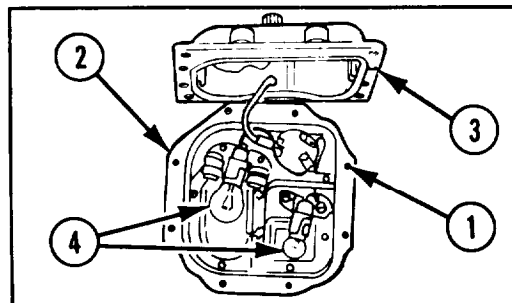
STOPLIGHT-TAILLIGHT, RIGHT



- 1 Loosen six screws (1) and remove door (2).
- 2 To remove stoplight assembly (3), open cover and insert screwdriver in center slot, depress and turn counterclockwise.
- 3 To remove marker assembly (4), insert screwdriver in center slot, depress and turn counterclockwise.
- 4 Lightly apply silicone compound (item 41, appx D) to sockets.
- 5 Install stoplight assembly (3), insert screwdriver in center slot, depress and turn clockwise to secure. Close cover.
- 6 Install marker assembly (4), insert screwdriver in center slot, depress and turn clockwise to secure.
- 7 Apply anti-seize compound (item 5, appx D) to threads of screws (1).
- 8 Reinstall door (2) with six screws (1).

DOMELIGHT

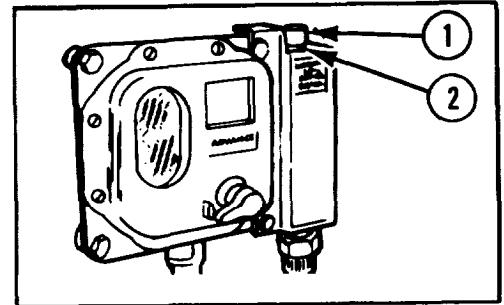
- 1 Loosen eight captive screws (1) and separate dome light door assembly (2) from light body (3).
- 2 To remove lamps (4), depress and turn counterclockwise. Install new lamp, depress and turn clockwise to secure.
- 3 Reinstall door assembly (2) onto light body (3) and tighten eight captive screws (1) to secure.



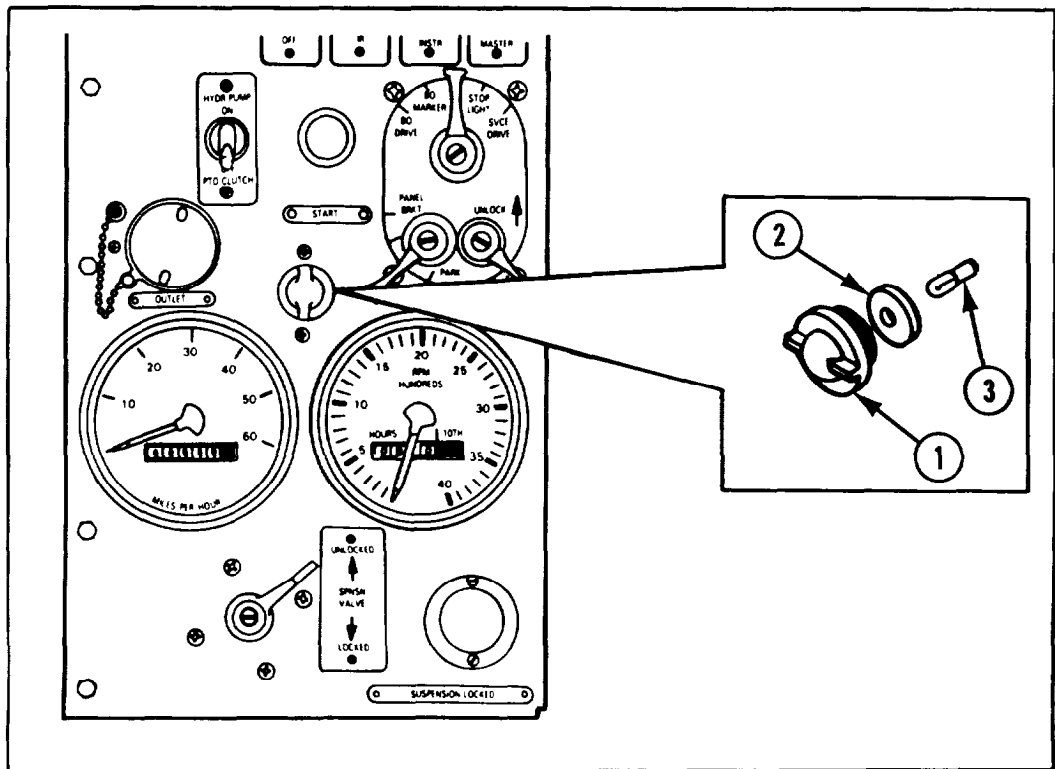
LAMP REPLACEMENT-CONTINUED

LOW ENGINE COOLANT WARNING LIGHT

- 1 Unscrew indicator light lens (1).
- 2 Depress and turn LED (2) counterclockwise with fingers to remove LED (2). Lightly apply silicone compound (item 41, appx D) to bulb socket. Install new LED (2) by depressing and turning LED (2) clockwise.
- 3 Screw indicator light lens (1) on securely. Press to make sure LED is good.



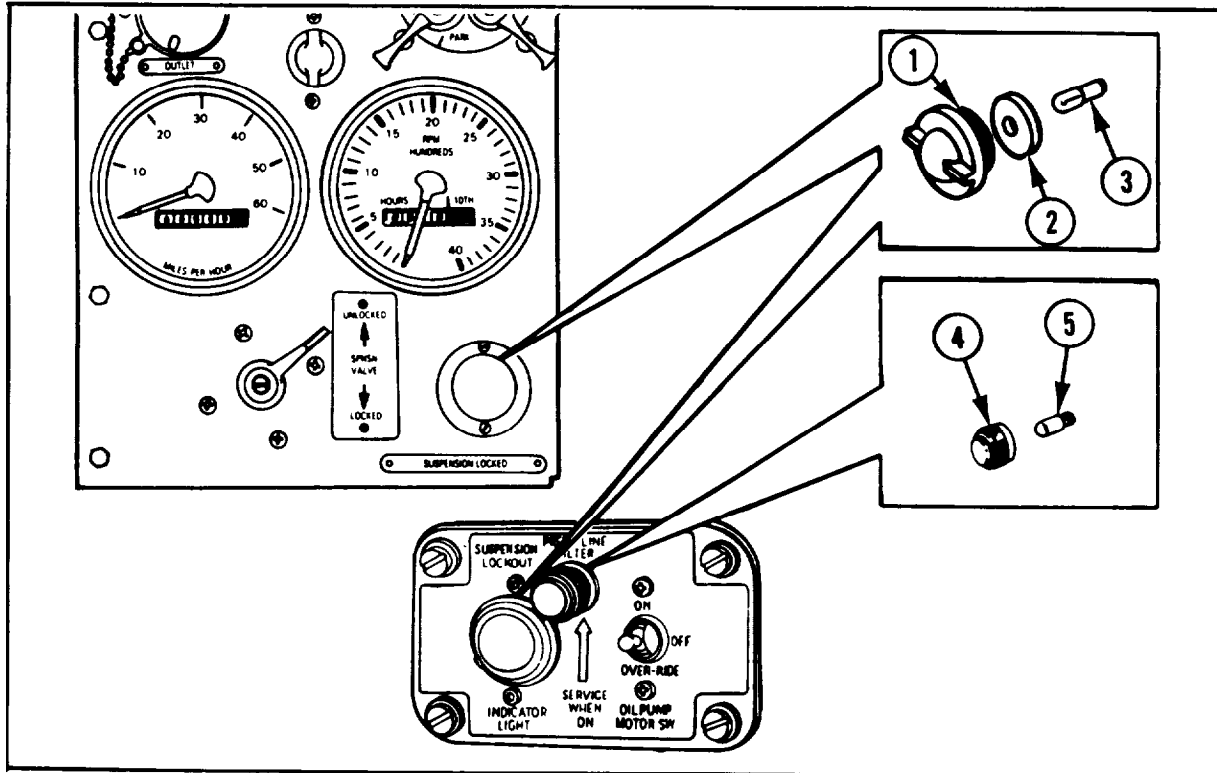
PANEL LIGHT



- | | |
|---|---|
| <ol style="list-style-type: none"> 1 Unscrew panel light lens (1). Remove lens (1) and gasket (2). 2 To remove lamp (3), depress and turn counterclockwise. | <ol style="list-style-type: none"> 3 Install new lamp (3), depress and turn clockwise. 4 Install gasket (2) and screw panel light lens (1) on securely. |
|---|---|

LAMP REPLACEMENT-CONTINUED

SUSPENSION LOCKOUT INDICATOR LIGHT



- 1 Unscrew lens (1). Remove lens (1) and gasket (2).
- 2 To remove LED (3), depress and turn counterclockwise. Lightly apply silicone compound (item 41, appx D) to bulb

socket. Install new LED (3), depress and turn clockwise to secure.

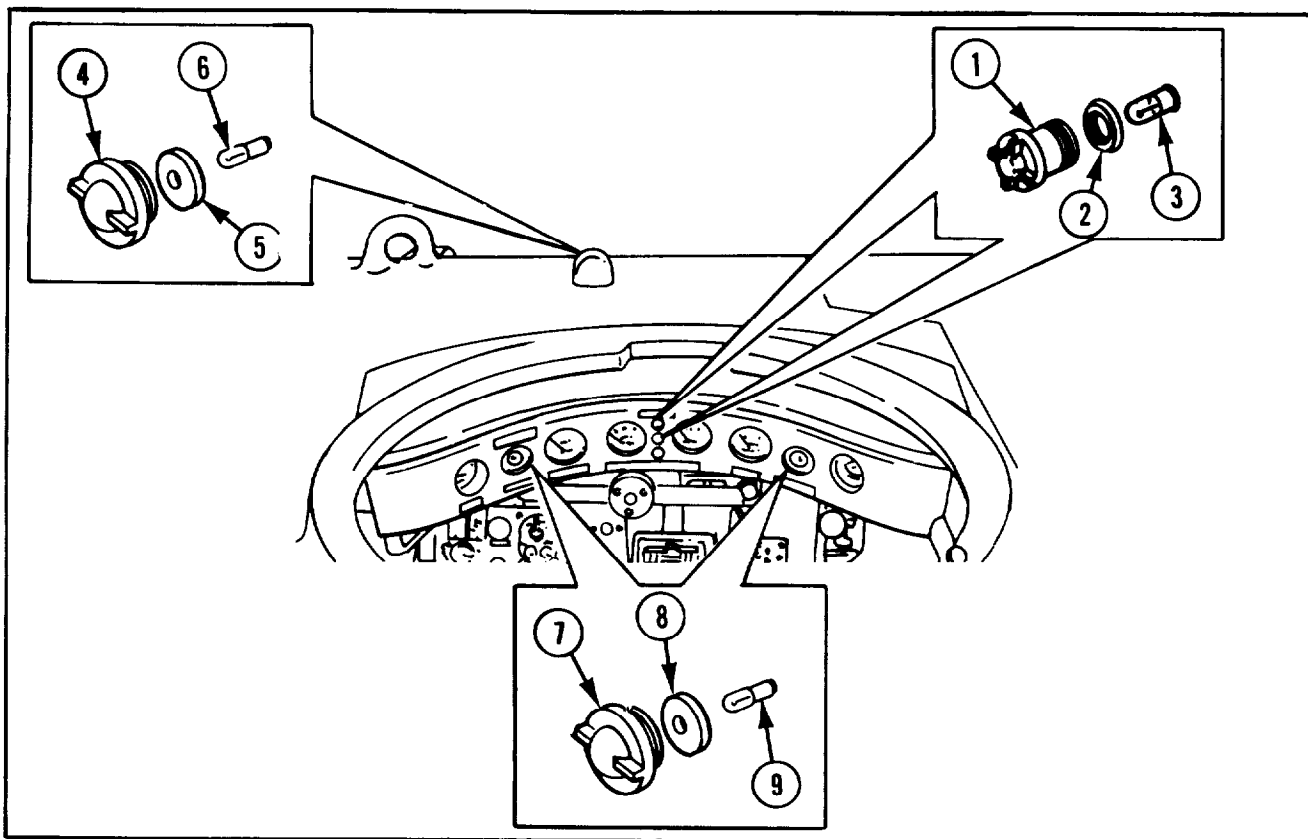
- 3 Install gasket (2) and screw lens (1) on securely.

PRESSURE FILTER INDICATOR LIGHT

- 4 Unscrew lens (4).
- 5 Remove LED (5) and lightly apply silicone compound (item 41, appx D) to bulb socket. Install new LED (5).

- 6 Screw lens (4) on securely.

LAMP REPLACEMENT—CONTINUED



HIGH BEAM INDICATOR LIGHT AND MASTER SWITCH INDICATOR LIGHT

- | | |
|--|---|
| <p>1 Unscrew lens (1). Remove lens (1) and gasket (2).</p> <p>2 To remove, pull LED (3) out of lens (1). Lightly apply silicone compound (item</p> | <p>41, appx D) to bulb socket. Install new LED (3) by pushing into lens (1).</p> <p>3 Install gasket (2) and screw lens (1) on securely.</p> |
|--|---|

ENGINE-TRANSMISSION LOW OIL WARNING INDICATOR LIGHT AND GENERATOR CHARGE INDICATOR LIGHT

- | | |
|---|--|
| <p>4 Unscrew lens (4). Remove lens (4) and gasket (5).</p> <p>5 To remove LED (6), depress and turn counterclockwise. Lightly apply silicone compound (item 41, appx D) to bulb</p> | <p>socket. Install new LED (6), depress and turn clockwise to secure.</p> <p>6 Install gasket (5) and screw lens (4) on securely.</p> |
|---|--|

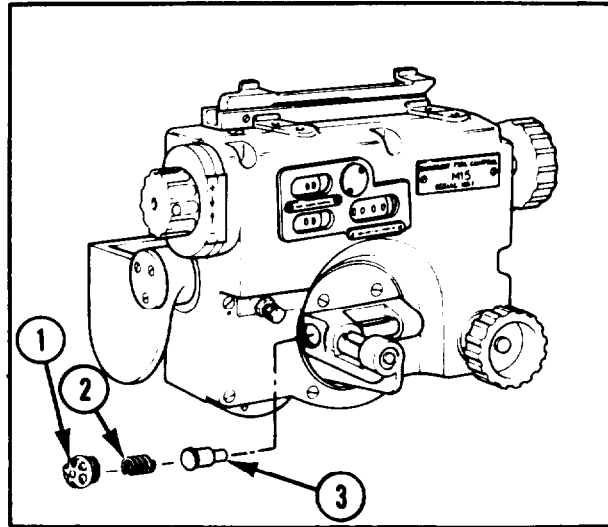
DRIVER' S EXTERNAL ENGINE AND TRANSMISSION WARNING LIGHT

- | | |
|---|--|
| <p>7 Unscrew lens (7). Remove lens (7) and gasket (8).</p> <p>8 To remove LED (9), depress and turn counterclockwise. Lightly apply silicone compound (item 41, appx D) to bulb</p> | <p>socket. Install new LED (9), depress and turn clockwise to secure.</p> <p>9 Install gasket (8) and screw lens (7) on securely.</p> |
|---|--|

LAMP REPLACEMENT—CONTINUED

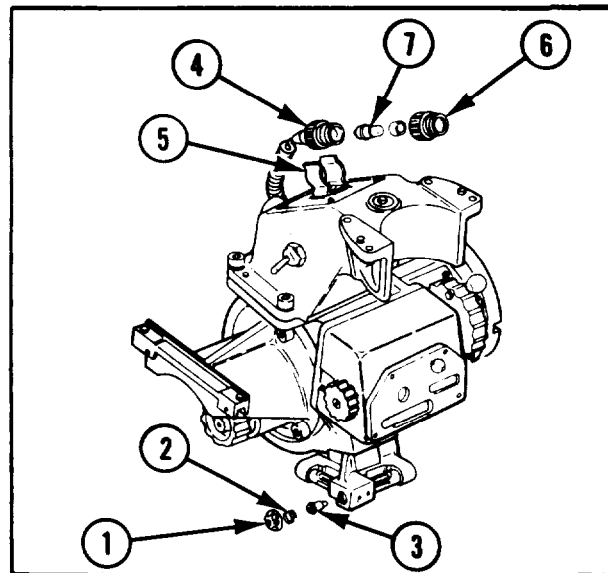
M15 ELEVATION QUADRANT

- 1 Unscrew cap assemblies (1) and remove springs (2).
- 2 Remove LED (3) and install new LED.
- 3 Replace springs (2) and screw cap assemblies (1) securely.



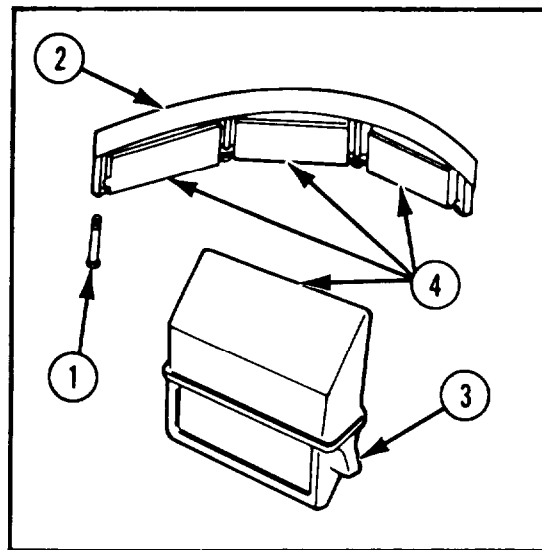
M137 TELESCOPE MOUNT

- 1 Unscrew cap assemblies (1) and remove springs (2).
- 2 Remove LED (3). Install new LED (3).
- 3 Replace springs (2) and screw cap assemblies (1) securely.
- 4 To replace LED in light extension (4), remove light from clip (5).
- 5 Unscrew adapter assembly (6) and remove LED (7). Install new LED (7).
- 6 Screw adapter assembly and socket on light and position light in clip (5).



OPERATION OF M17 PERISCOPE

- 1 Remove screw (1) and retainer (2) engaging periscope lug (3).
- 2 Hold periscope (4) in place and remove screw and retainer engaging opposite lug of periscope.
- 3 Remove periscope (4) from recess in hull.
- 4 Installation is the reverse of removal.

**M201A1 CANNON***INSPECTION*

Elevate or depress cannon tube until LOAD marks align before opening breech to avoid injury to personnel.

- 1 Check general appearance of bore for wear, and pitting of lands and grooves. If lands or grooves are worn or pitted, or if there is indication of cracking (inside or outside tube), notify unit maintenance.

NOTE

Do not confuse coppering of a bore with powder fouling.

- 2 Inspect breechblock, breech ring, and breech recess for burrs and cuttings on threads, rust, pitting, or evidence of blowby. If not possible to smooth or clean with crocus cloth (item 10, appx D), notify unit maintenance.

- 3 Inspect breechblock carrier machined surface on which breechblock rotates and hinge pin for roughened, scored condition. If not possible to smooth or clean with crocus cloth (item 10, appx D), notify unit maintenance.
- 4 Inspect gas check pad for blowby. Replace defective pad.
- 5 Inspect obturator spindle vent for cleanliness. If dirty, clean with vent cleaning tool.
- 6 Inspect obturator spindle for burrs. If burrs or scores are present, notify unit maintenance.
- 7 Inspect split rings in obturator spindle for burrs or cracks. If rings require replacement, notify unit maintenance.
- 8 Inspect primer chamber for cleanliness. If dirty, clean with reamer.

M201A1 CANNON-CONTINUED

CLEAN AND LUBRICATE

All parts should be cleaned and lubricated in accordance with appendix F.

BORESCOPING

It is a unit responsibility to make sure cannon tubes are pullover gaged and borescoped within 180 days of firing, or every 1000 equivalent full charge (EFC) rounds. Refer to TM 9-1000-202-14.

PULLOVER GAGING

The tube life is the wear of the bore beyond a specific dimension or the EFC round life, whichever occurs first. When the cannon is borescoped, the bore measurement shall be gaged by direct support. Refer to TM 9-4933-258-13.

DETERMINING REMAINING CANNON TUBE



Do not fire beyond tube life.

Convert round fired to EFC rounds. To figure EFC rounds, multiply the number of rounds fired times the EFC factor for the zone used. Subtract the EFC rounds fired from the estimated remaining life in the column g of Weapon Record Data (DA Form 2408-4). The total rounds fired, by zone, must be carried forward to a new Weapon Record Data card per DA PAM 738-750 and sent to Watervliet upon closeout.

Established Data for Determining Round Life for Cannon Assembly

VEHICLE	CANNON	EFC Life	EFC Factor
M110A2 8-inch howitzer	M201A1	10,000 rounds	Zone 9 1.00 Zone 7-8 0.75 Zone 1-6 0.25

SAMPLES

10 rounds fired with zone 7 charge:

10 rounds	4,328 estimated remaining life (column g of DA Form 2408-4)
<u>x 0.75 EFC factor</u>	<u>- 7.5 EFC rounds</u>
7.50 EFC rounds	4,320.5 new estimated remaining life (enter on DA Form 2408-4, column g)

100 rounds fired with zone 5 charge:

100 rounds	4,321 estimated remaining life (column g of DA Form 2408-4)
<u>x 0.25 EFC factor</u>	<u>- 25 EFC rounds</u>
25.00 EFC rounds	4,296 new estimated remaining life (enter on DA Form 2408-4, column g)

M201A1 CANNON-CONTINUED

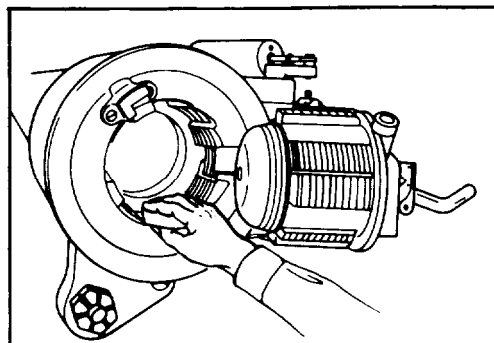
MUZZLE BRAKE

Inspect muzzle brake (interior and exterior) for cracks. If any crack 1 in. (2.54 cm) or greater in length is observed, notify unit maintenance.

BREECHBLOCK GROUP

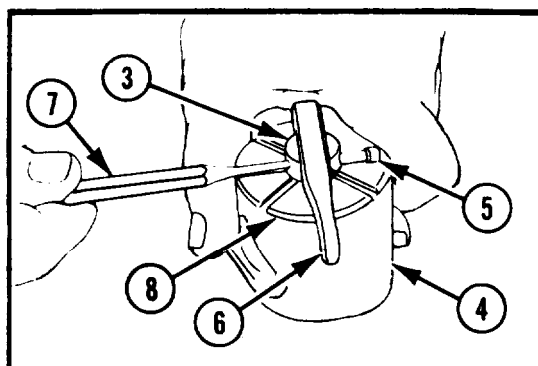
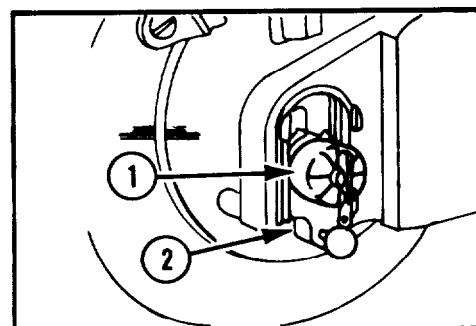
SCORED GAS CHECK SEAT REPAIR

- 1 Use a piece of crocus cloth (item 10, appx D) and try to smooth scored area by polishing. DO NOT use any other abrasive.
- 2 If not possible to smooth or clean scored area, notify unit maintenance



M35 FIRING MECHANISM

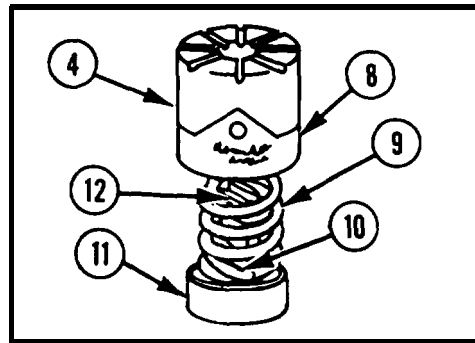
- 1 Remove firing mechanism (1) by pressing on firing mechanism (1) and rotating clockwise with firing block (2) in extract or disassembly position.
- 2 Place firing mechanism (1) on flat surface and press down on firing mechanism (1) until yoke (3) projects from case follower (4) sufficiently to permit removal of lever pin (5) and lever (6).
- 3 Using punch (7) remove lever pin (5) from yoke (3) and release slowly to prevent scattering of parts.



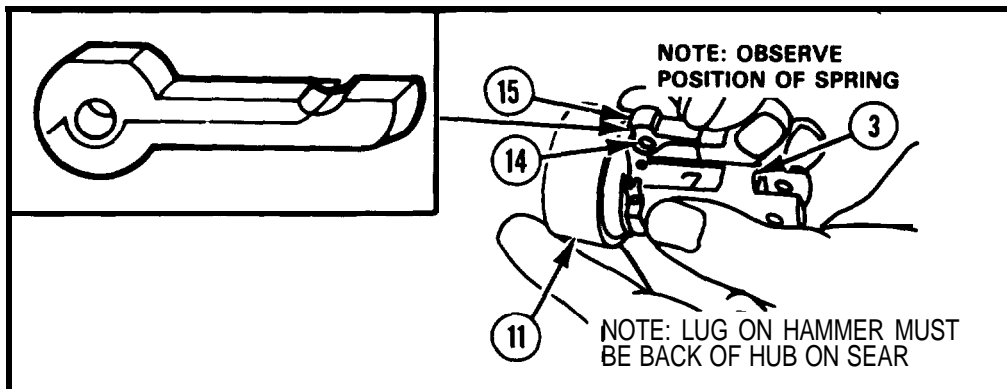
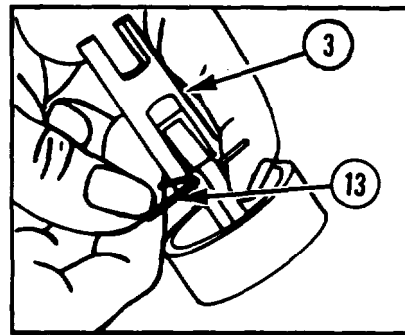
BREECHBLOCK GROUP-CONTINUED

M35 FIRING MECHANISM - CONTINUED

- 4 Remove case follower (4), case (8), and springs (9) and (10) from hammer (11) and sear group (12).



- 5 Pull up on yoke (3) and remove sear hinge pin (13).



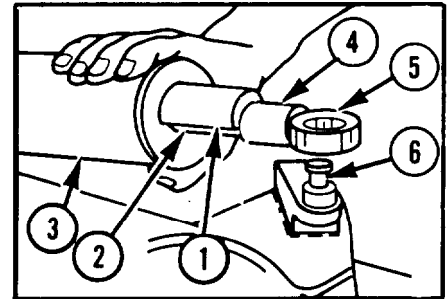
- 6 To assemble mechanism, insert hammer (11) into bore of yoke (3), position sear spring (14) on sear (15), and place sear with spring into slot in yoke (3). Engage

ends of sear spring into two grooves above sear pin hole. Complete assembly by reversing steps 1 thru 5.

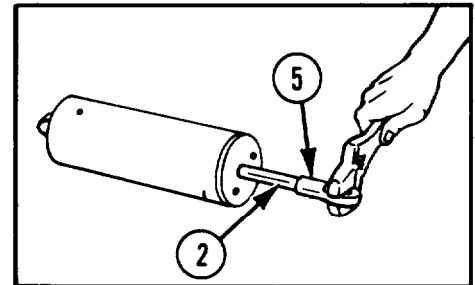
BREECHBLOCK GROUP—CONTINUED

COUNTERBALANCE ASSEMBLY REMOVAL AND ADJUSTMENT

- 1 Operate breechblock lever until spacer (1) (item 113, appx B) can be placed over piston rod (2) between cylinder head (3) and rod shoulder (4), then move carrier toward closed position. Lift rod end (5) from hinge arm pin (6).

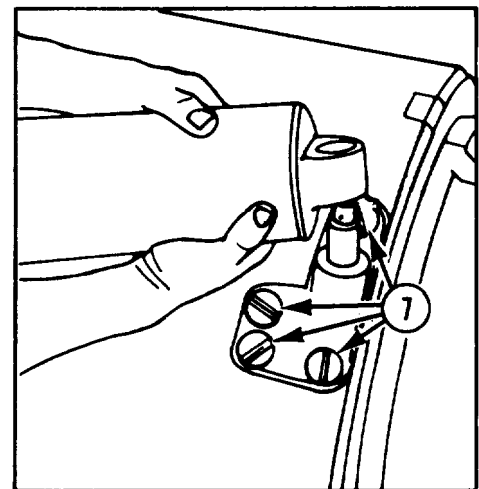


- 2 To adjust counterbalance, increase or decrease counterbalance tension by turning piston (2) with a wrench on rod end (5).



- 3 Check screws (7) to make sure they are tight. If loose, notify unit maintenance.

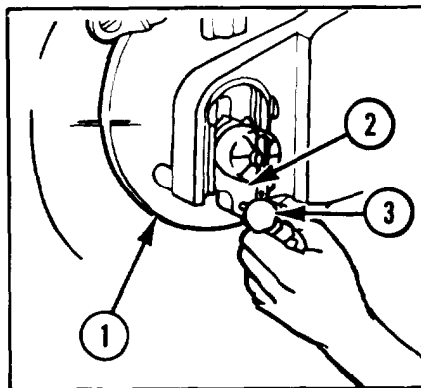
- 4 Reassembly by reversing steps 1 thru 4.



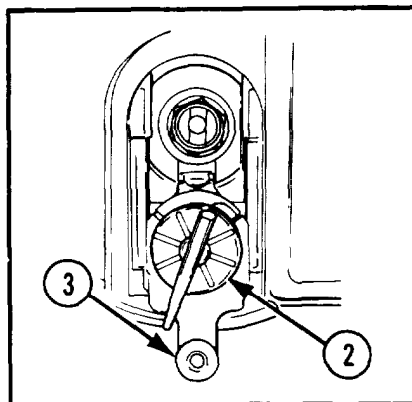
BREECHBLOCK GROUP-CONTINUED

REMOVAL, DISASSEMBLY, ASSEMBLY, AND REPLACEMENT OF FIRING MECHANISM BLOCK, FIRING MECHANISM HOUSING, OBTURATOR SPINDLE, AND BREECHBLOCK

- 1 Open breech (1) so firing block (2) will lower into cock position.



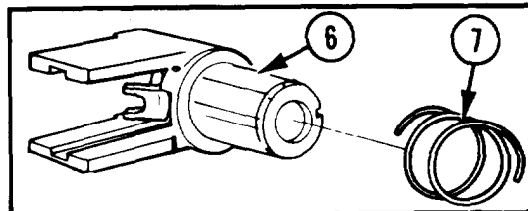
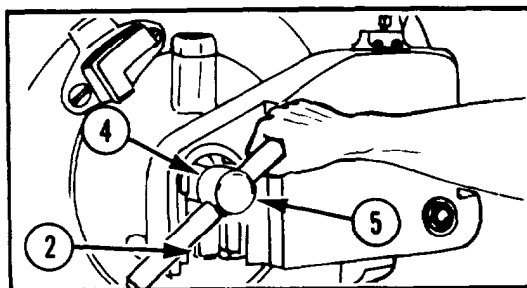
- 2 Remove firing block (2) by pulling follower knob (3) out, then down, to lower firing block (2) to disassembly position.



CAUTION

Hold hand under firing block (2) as obturator spindle nut (4) is loosened to prevent firing block (2) from falling.

- 3 Unscrew obturator spindle nut (4) using 1-3/8 in. socket, 3/4 in. drive extension, and T-sliding handle (5). Remove firing mechanism housing (6), firing block (2), and spindle spring (7).



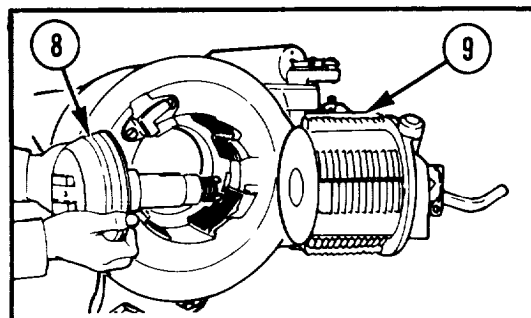
BREECHBLOCK GROUP-CONTINUED

REMOVAL, DISASSEMBLY, ASSEMBLY, AND REPLACEMENT OF FIRING MECHANISM BLOCK, FIRING MECHANISM HOUSING, OBTURATOR SPINDLE, AND BREECHBLOCK-CONTINUED

CAUTION

Do not burr spindle.

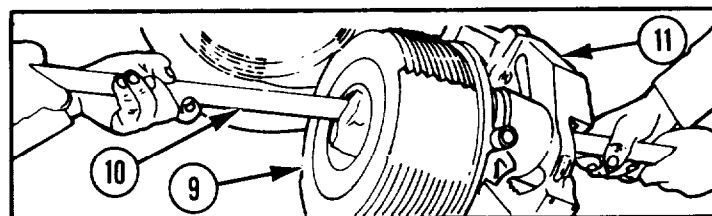
- 4 Remove obturator spindle group (8) from breechblock (9). If obturator spindle group (8) does not remove easily, place piece of wood against primer end of spindle and tap with hammer.

**WARNING**

Do not attempt to remove breechblock (9) by yourself. It takes two persons.

CAUTION

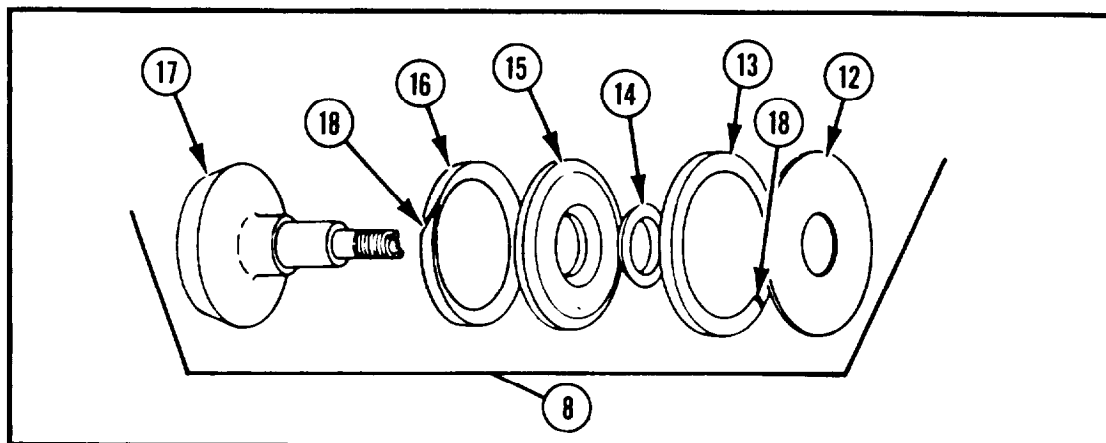
Wrap rammer staff (10) with rags to prevent damage to breechblock (9) and carrier (11).



- 5 Insert rammer staff (10) through breechblock (9) and carrier (11). Slide breechblock (9) off of carrier (11) onto rammer staff (10).
- 6 Keep rammer staff (10) and breechblock (9) level and slide rammer staff (10) from carrier (11). Place breechblock (9) on secure surface and remove rammer staff (10).
- 7 Insert rammer staff (10) through breechblock (9). Keeping rammer staff (10) level, lift and insert into carrier (11).
- 8 Slide breechblock (9) off rammer staff (10) and onto carrier (11).

BREECHBLOCK GROUP-CONTINUED

REMOVAL, DISASSEMBLY, ASSEMBLY, AND REPLACEMENT OF FIRING MECHANISM BLOCK, FIRING MECHANISM HOUSING, OBTURATOR SPINDLE, AND BREECHBLOCK- CONTINUED



- 9 Disassemble obturator spindle group (8) by removing thrust washer (12), rear split ring (13), packing retainer (14), obturator gas check pad (15), and front split ring (16) from obturator spindle (17).

CAUTION

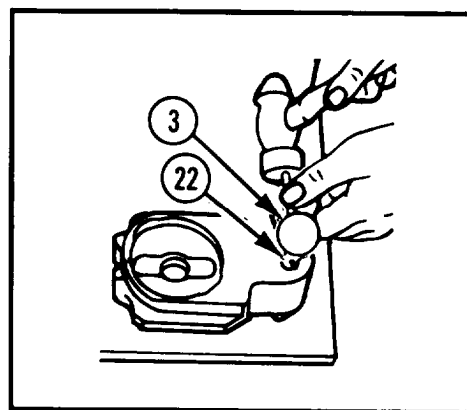
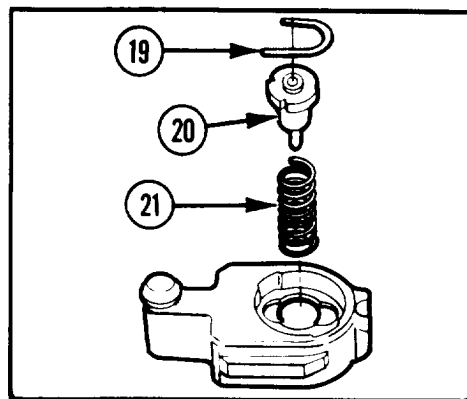
Do not clean gas check pad with gasoline or any solvent since this will quickly deteriorate gas check pad. Use soap and water only, wipe dry.

- 10 Inspect obturator gas check pad (15) for nicks, cracks, evidence of faulty seating, or evidence of blowby. Refer to page 2-24 for damage definitions. If seating surface shows evidence of nicks, cracks, faulty seating, or blowby, replace obturator gas check pad (15).

- 11 Inspect split ring expansion slots (18) for burnt areas, nicks, or gouges.

- 12 Assemble obturator spindle group (8) in reverse order of disassembly with split ring expansion slots (18) 180 degrees apart.

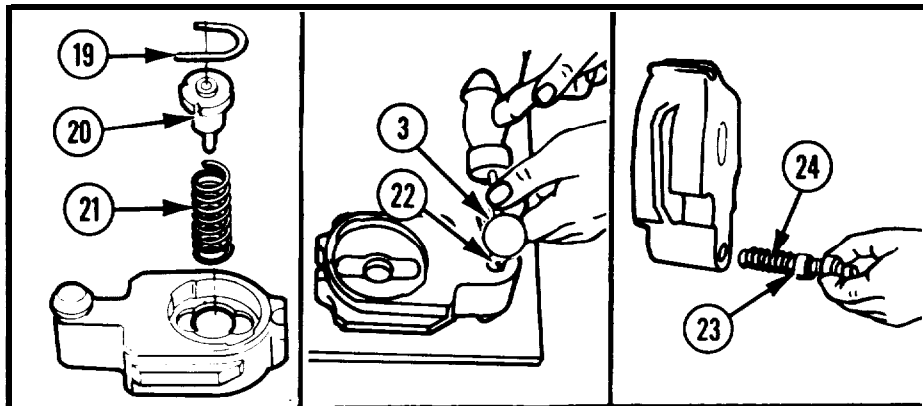
- 13 Remove firing pin retainer (19) with screwdriver and remove firing pin (20) and spring (21).



- 14 Use punch to drive out drive knob pin (22) and remove follower knob (3).

BREECHBLOCK GROUP-CONTINUED

REMOVAL, DISASSEMBLY, ASSEMBLY, AND REPLACEMENT OF FIRING MECHANISM BLOCK, FIRING MECHANISM HOUSING, OBTURATOR SPINDLE, AND BREECHBLOCK-CONTINUED



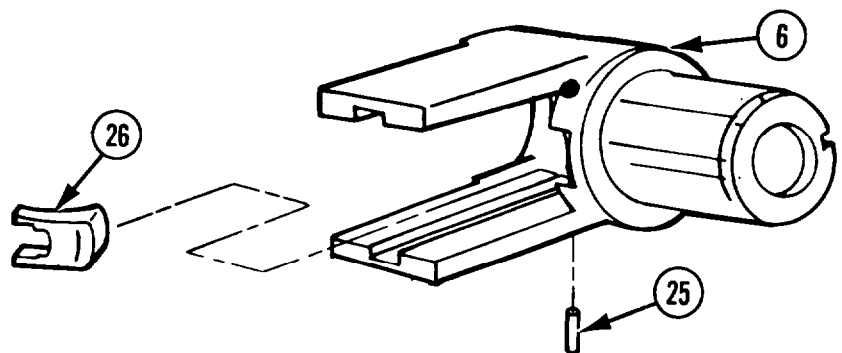
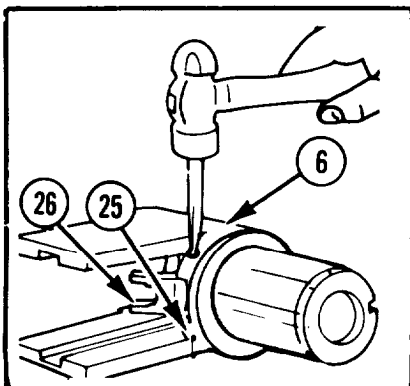
15 Remove follower shaft (23) and spring (24).

18 install follower knob (3) and drive knob pin (22) in place with hammer.

16 Clean and lubricate components (appx F).

19 Insert spring (21) and firing pin (20) and replace firing pin retainer (19).

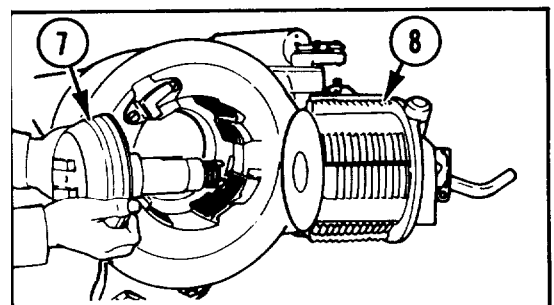
17 Install spring (24) and follower shaft (23).



20 Disassemble firing mechanism housing (6) by using punch to drive out spring pin (25) and removing extractor (26).

21 Assemble firing mechanism housing (6) by installing extractor (26) and spring pin (25).

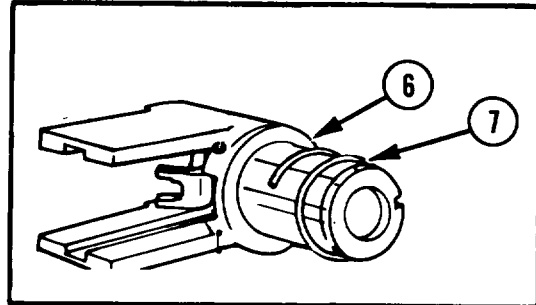
22 Install obturator spindle group (8).



BREECHBLOCK GROUP—CONTINUED

REMOVAL, DISASSEMBLY, ASSEMBLY, AND REPLACEMENT OF FIRING MECHANISM BLOCK, FIRING MECHANISM HOUSING, OBTURATOR SPINDLE, AND BREECHBLOCK—CONTINUED

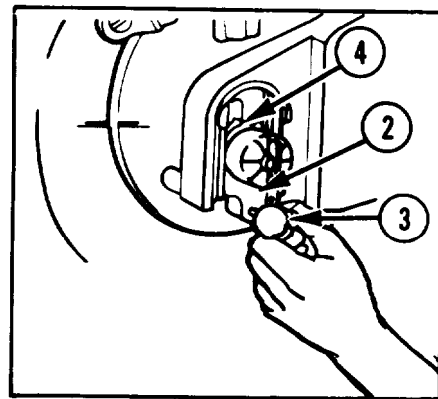
- 23** Install firing mechanism housing (6) and spindle spring (7). Start obturator spindle nut (4).



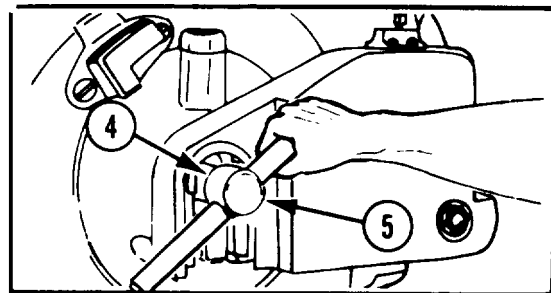
WARNING

If any interference prevents easy closing of the firing block (2), do not force firing block (2) closed, and do not loosen spindle nut (4) to allow firing block (2) to close.

- 24** Install firing block (2) by pulling follower knob (3) out and sliding firing block (2) into disassembly position.



- 25** Tighten obturator spindle nut (4), using 1-3/8 in. socket, 3/4 in. drive extension, and T-sliding handle (5), to a snug fit or when it bottoms out. Do not back off obturator spindle nut (4).



FIRE CONTROL ALINEMENT TESTS AND MEASUREMENTS

Fire control alinement tests (pages 3-63 thru 3-88) are performed by the section crew members under the supervision of the battery executive officer, chief of firing battery, and artillery mechanic. These tests are performed at the discretion of the unit commander. Suggested times for these tests are:

- Once each year if the piece is used for nonfiring training.
- Once every 3 months if the piece is fired.
- As soon as possible after extensive use.

- Following accidents.
- Traversing extremely rough terrain.
- When fire control mounts have been removed and/or replaced.
- Whenever the piece fires inaccurately for no apparent reason.
- After replacing gun tube.

PREPARATION FOR FIRE CONTROL ALINEMENT TESTS

- 1 Move weapon to as firm and level ground as possible. Use hardstand, if available.

CAUTION

If M115 pantel head assembly is loose, it will no longer be optically alined. If tightening or adjustment is required, notify unit maintenance.

- 2 Check M15 fire control quadrant, M115 pantel, and M137 telescope mount for looseness or other obvious defects.
- 3 Inspect M1A1 gunner's quadrant shoes for dirt, nicks, or burrs. If necessary, clean shoes with oil rag. M1A2 gunner's quadrant can be used as an alternate.
- 4 Make sure that equilibrators are properly adjusted. Refer to page 2-122.

- 5 Make sure that suspension lockout system is engaged and tube is in battery.

Equipment required:

- Three 30-ton mechanical jacks
- Stout cord, 100 ft (30.48 m)
- Weight of about 1/2 lb (0.23 kg)
- Muzzle sight cords (Cord)
- Tape (for taping sight cords)
- Gunner's quadrant
- Test target
- Bucket (3 or 5-gal. (11.36 or 18.93-l) capacity)
- Waste oil (enough to cover weight in bucket) (water can be used if there is no waste oil available)
- Screwdriver (3 in. and 6 in.)

OPERATION OF M1A1/M1A2 GUNNER'S QUADRANT



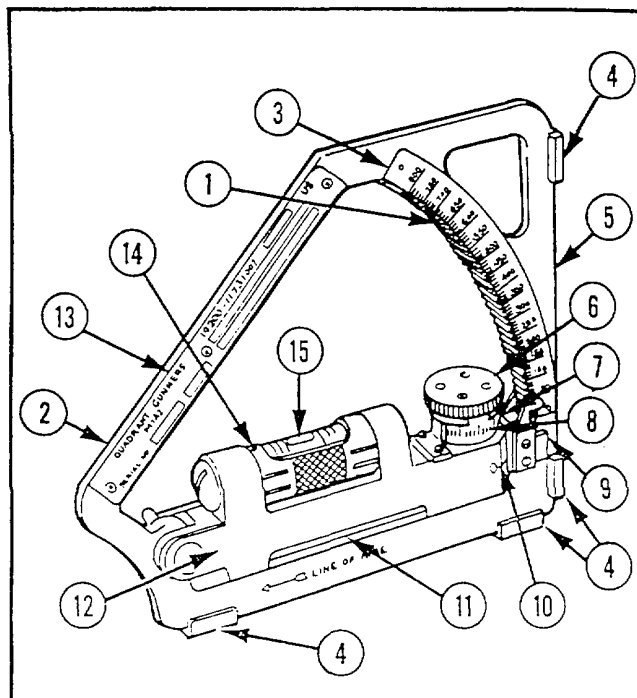
Radioactive material is used in the gunner's quadrant. If discovered broken, damaged, or defective, follow the procedures listed on page a.

- 1 Inspect shoes (4) for dirt, nicks, or burrs.
- 2 Inspect quadrant seats on breech, M137 mount, and M15 elevation quadrant for dirt, nicks, or burrs.

WARNING

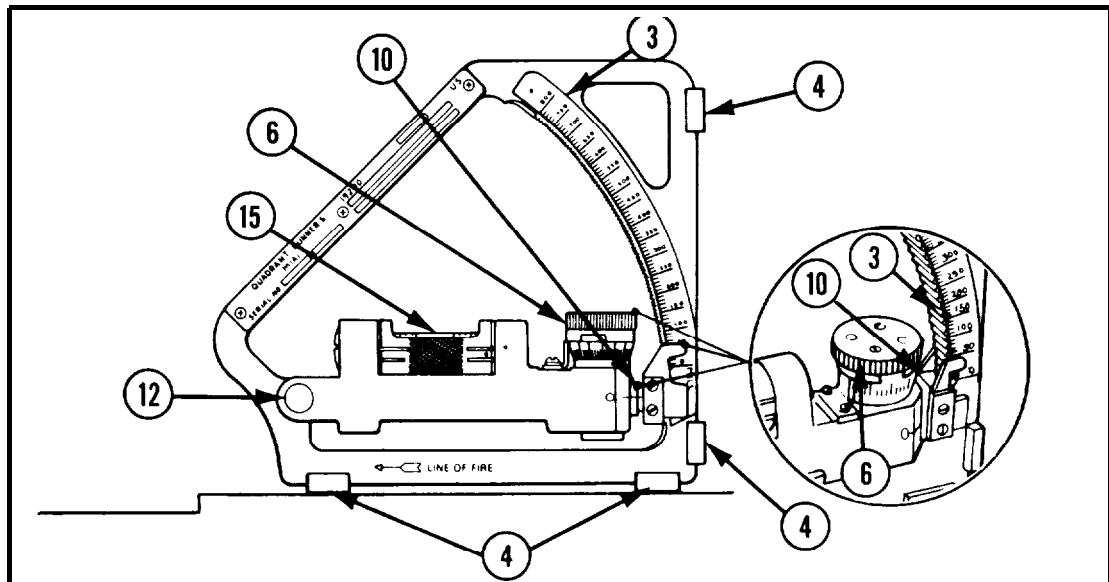
Gunner's quadrant micrometer test and end-for-end test must be conducted prior to using gunner's quadrant for any fire control alinement test.

- 3 Place gunner's quadrant on the cannon breech quadrant seat or on quadrant seat of M137 mount or M15 elevation quadrant. Make sure that LINE OF FIRE arrow is pointing forward.



- (1) ELEVATION SCALE 800-1600 MILS (RIGHT SIDE) (HIDDEN)
- (2) FRAME
- (3) ELEVATION SCALE 0-800 MILS (LEFT SIDE)
- (4) FRAME SHOE
- (5) REFERENCE SURFACE, 800-1600 MILS
- (6) KNOB
- (7) MICROMETER MASK
- (8) MICROMETER SCALE
- (9) LEFT RADIAL ARM PLUNGER PLATE
- (10) RADIAL ARM PLUNGER
- (11) REFERENCE SURFACE, 0-800 MILS
- (12) RADIAL ARM
- (13) NAME PLATE
- (14) COVER
- (15) LEVEL VIAL

OPERATION OF M1A1/M1A2 GUNNER'S QUADRANT-CONTINUED



4 Push in on radial arm plunger (10) and move radial arm (12) up or down on elevation scale (3) to center bubble in level vial (15) as closely as possible.

5 Turn micrometer knob (6) to accurately center bubble in level vial (15).

6 Read elevation (in 10-mil increments) on elevation scale (3) plus number of mils indicated on the micrometer scale (in 0.2-mil increments).

7 To level gun tube, M137 mount, or M15 elevation quadrant, proceed as

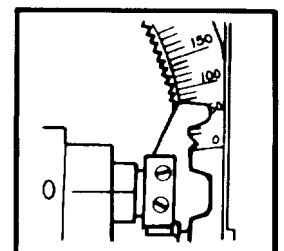
above, except set radial arm (12) to 0 mils on elevation scale (3) and turn micrometer knob (6) to 0 mils. Elevate or depress tube, mount, or elevation quadrant until bubble is accurately centered in level vial (15). Be sure LINE OF FIRE arrow points forward to muzzle end.

8 For elevation over 800 mils, place quadrant on quadrant shoes (4) and head elevation on (800-1600 mils) elevation scale (1) located on right side of quadrant. Be sure LINE OF FIRE arrow points forward to muzzle end.

GUNNER'S QUADRANT MICROMETER TEST

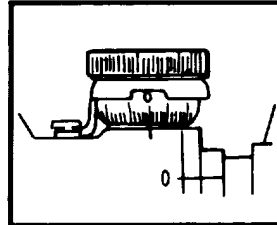
Gunner-Perform the gunner's quadrant micrometer test prior to using the quadrant for any fire control alignment tests.

1 Set index at + 10.

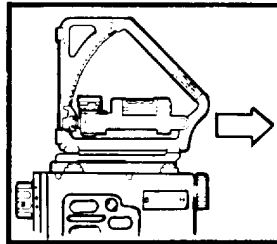


GUNNER'S QUADRANT MICROMETER TEST-CONTINUED

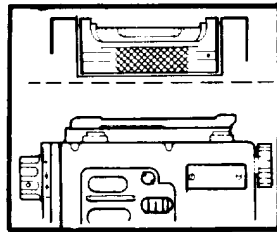
2 Zero micrometer.



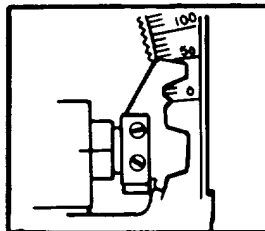
3 Point LINE OF FIRE arrow toward muzzle end.



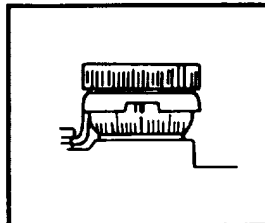
4 Elevate/depress tube to center bubble.



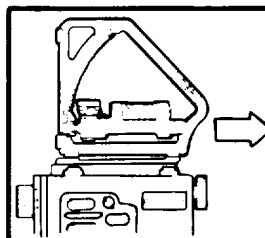
5 Set index at 0.



6 Set micrometer at 10.



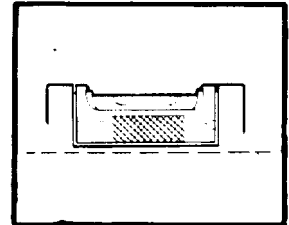
7 Point LINE OF FIRE arrow toward muzzle end.



GUNNER'S QUADRANT MICROMETER TEST-CONTINUED

8 Bubble should center.

9 If bubble does not recenter, the micrometer is in error. Turn in for repair to unit maintenance and perform no further test or adjustment made with the instrument.

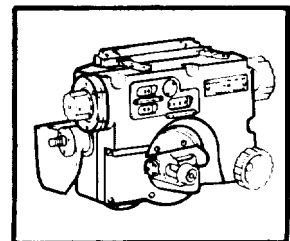


GUNNER'S QUADRANT END-FOR-END TEST

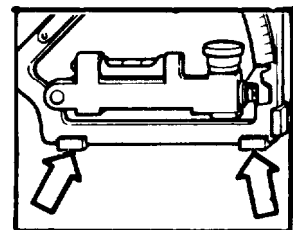
Gunner-Perform the gunner's quadrant end-for-end test prior to using the quadrant for any fire control alignment tests.

TOLERANCE + 0.4 to - 0.4, ANYTHING GREATER IS NOT ACCEPTABLE, TURN IN TO UNIT MAINTENANCE FOR REPAIR

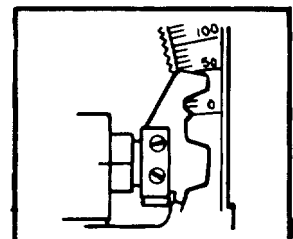
1 Inspect breech or elevation quadrant seats.



2 Inspect quadrant shoes.

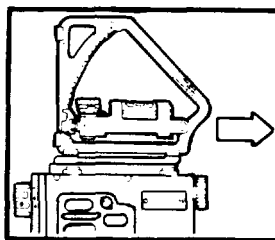


3 Zero the scales.

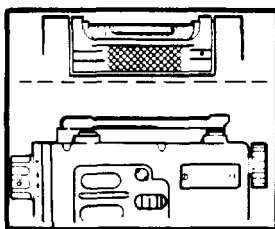


GUNNER'S QUADRANT END-FOR-END TEST-CONTINUED

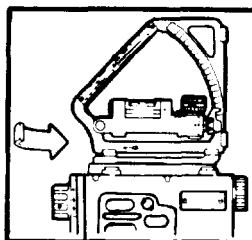
4 Point LINE OF FIRE arrow to muzzle.



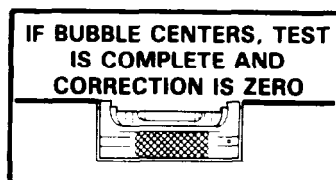
5 Elevate/depress tube to center bubble.



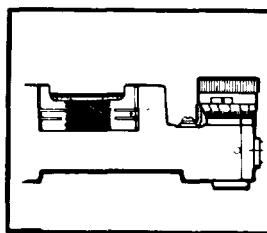
6 Reverse direction.



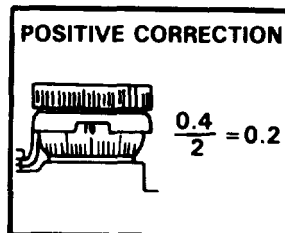
7 Bubble should center. If bubble does not center, go to step 8.



8 Center bubble with micrometer knob. If bubble centers, go to step 9. If it does not, go to step 16.

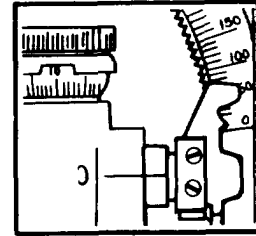


9 Divide micrometer reading by 2 to determine correction factor.

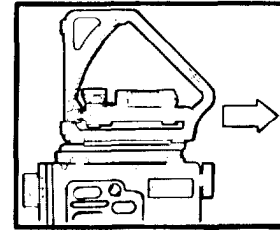


GUNNER' S QUADRANT END-FOR-END TEST-CONTINUED

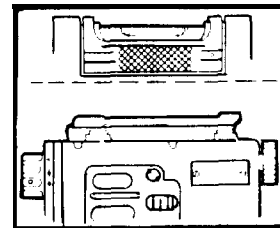
10 Put result on micrometer scale.



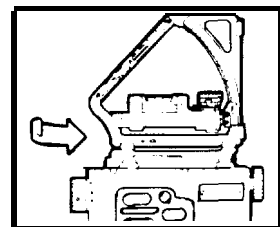
11 Point LINE OF FIRE arrow toward muzzle end.



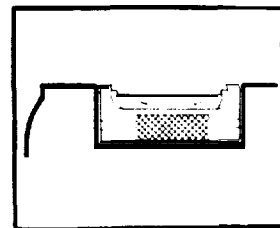
12 Elevate/depress tube to center bubble.



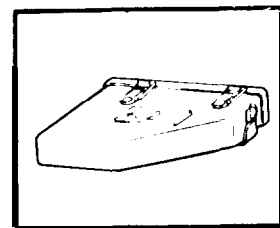
13 Reverse direction.



14 Bubble should center.

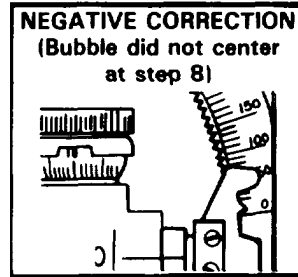


15 Record end-for-end correction.

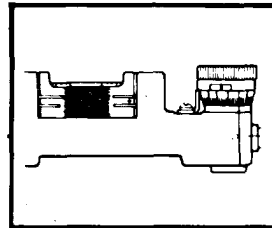


GUNNER'S QUADRANT END-FOR-END TEST-CONTINUED

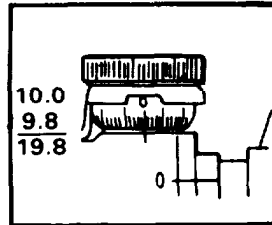
16 Set index at -10 (1600 on 800 to 1600 scale).



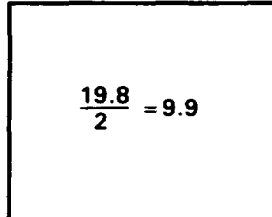
17 Center bubble with micrometer knob.



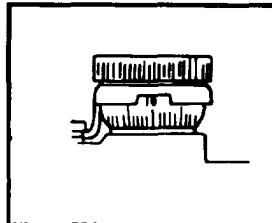
18 Add 10 to micrometer reading.



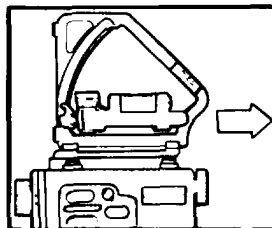
19 Divide answer by 2.



20 Place result on micrometer scale.

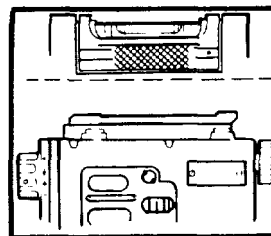


21 Point LINE OF FIRE arrow toward muzzle end.

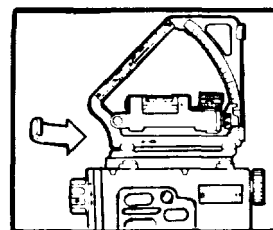


GUNNER'S QUADRANT END-FOR-END TEST-CONTINUED

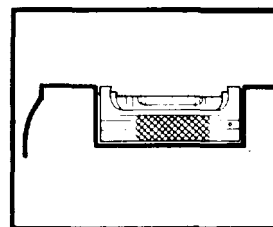
22 Elevate/depress tube to center bubble.



23 Reverse direction.



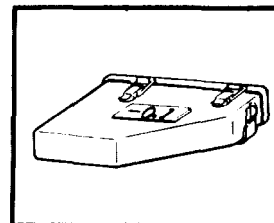
24 Bubble should center. If bubble does not center, go back to step 16.



25 Subtract micrometer reading from 10. Since this is a negative correction (step 16), a minus sign must be placed in front of the correction factor.

$$\begin{array}{r}
 10.0 \\
 - 9.9 \\
 \hline
 - 0.1
 \end{array}$$

26 Record end-for-end correction.

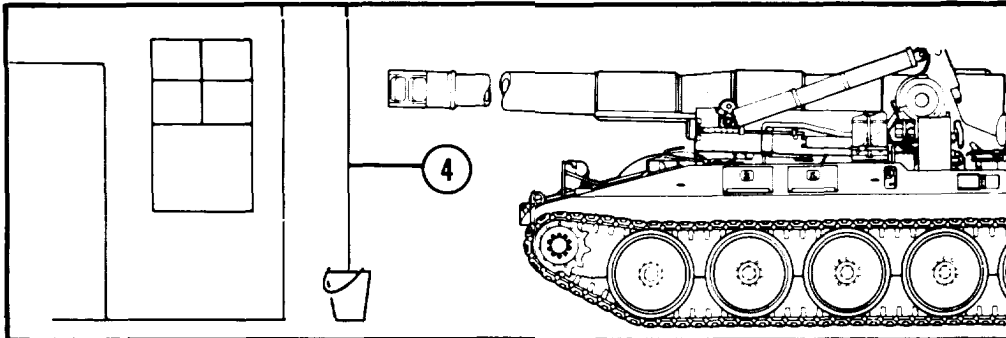
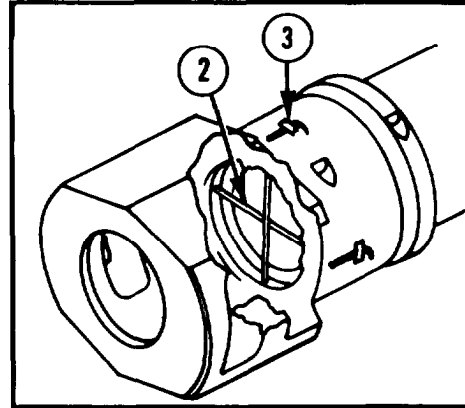
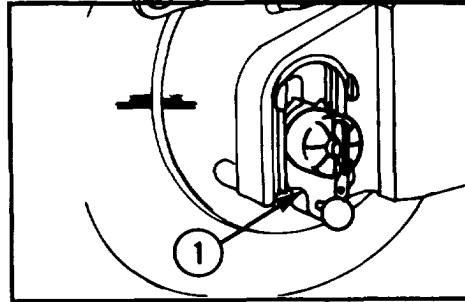


LEVELING TRUNNIONS USING PLUMBLINE

NOTE

Trunnions must be leveled to make sure that the fire control equipment mounts are parallel with the tube. If trunnions are canted, the results of the fire control alinement tests will not be accurate. There are two ways to level the trunnions. One way is by tracking a plumbline. The other is by using scribed lines on the elevation quadrant.

- 1 Drive the howitzer onto a firm, dry base that is as level as possible and will allow leveling of the tube (0-mil elevation).
- 2 Retract firing block (1) from fire position so primer vent is exposed.
- 3 Insert muzzle sight cords (2) through holes in muzzle brake and aline with witness marks on face of tube. Secure cords in place with tape (3).



- 4 Attach plumbline (4) (item 17, appx D) to a fixed object so it will hang free from any interference. The plumbline must be long enough to be seen through the breech primer vent while the tube is elevated through a 600-mil range.
- 5 Tie a weight of some type to the end of the plumbline. The weight may be a heavy wrench, a rock, etc., but it should weigh at least 1/2 lb (0.23 kg).
- 6 Hang the weight in a bucket of liquid (water can be used, but used oil is better). Do not let weight touch bucket.

LEVELING TRUNNIONS USING PLUMBLINE-CONTINUED

- 7 The plumbline must be tight. It should be hung where there is little or no wind so that it will not move during the procedure.
- 8 Release gun mount travel lock, refer to page 2-79. Make sure tube is in battery, refer to page 2-88.
- 9 Position weapon so that the end of the tube is within 12 in. (30.48 cm) of the plumbline.
- 10 Raise rear of vehicle, manually elevate or depress tube until it is at 0-mil elevation.

WARNING

Prior to traversing, crew must be alerted.

NOTE

Always traverse from left to right when alining plumbline.

- 11 Look through breech primer vent and manually traverse tube until the vertical crosshair on muzzle boresight is alined on the plumbline. The maximum allowable traverse from center position is 100 mils left or right. If the traverse is over 100 mils left or right, move the weapon or the plumbline.
- 12 Install one jack under the front center of the weapon so that the howitzer will tilt evenly when it is raised with either of the two rear jacks. Install one jack under the left rear side and the other jack under the right rear side. Use 30-ton mechanical jacks (item 5, appx C1).

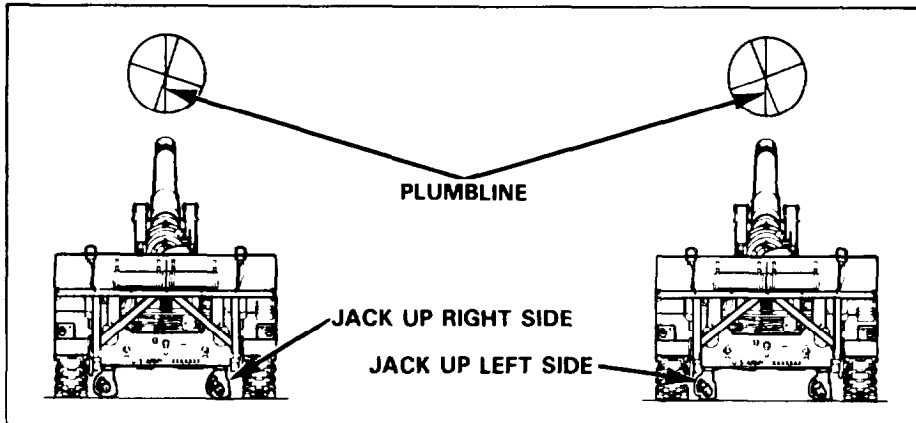
- 13 If the vertical crosshair on muzzle boresight crosses over the plumbline, level the trunnions by use of the jacks.
- 14 If the top of the vertical crosshair moves right of the plumbline, the right side of the weapon must be jacked up. If the top of the vertical crosshair moves left of the plumbline, the left side of the weapon must be jacked up.
- 15 Look through breech primer vent as the vehicle is being jacked up. As the vertical crosshair on the muzzle boresight approaches the plumbline, stop working the jack.

WARNING

Establish hydraulic oil reserve (index pin is extended) before elevating weapon. Failure to establish hydraulic oil reserve could result in cannon sliding out of battery and injuring personnel.

- 16 Set elevation mil counter on elevation quadrant to 100 mils and manually elevate tube to 100 mils. The chief of section must observe the plumbline through the breech primer vent during elevation to see if the vertical crosshair on the muzzle boresight tracks the plumbline.
- 17 Continue to manually elevate tube in 100-mil increments up to 600 mils elevation while chief of section watches the plumbline. Jack up the weapon as required to keep muzzle crosshair alined on plumbline.

LEVELING TRUNNIONS USING PLUMBLINE—CONTINUED



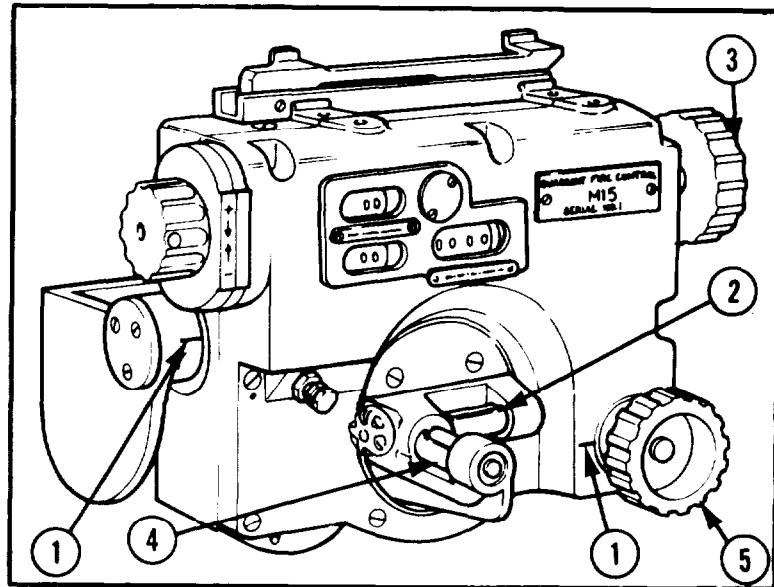
18 Set elevation mil counter on elevation quadrant to 0 mils. Slowly depress tube manually to 0 mils while chief of section watches the plumbline. Crosshair should track the plumbline. If it does, the trunnions are level.

19 If crosshair does not track plumbline, repeat steps 16 thru 18 until crosshair tracks plumbline without jacking. If plumbline cannot be tracked, notify unit maintenance.

LEVELING TRUNNIONS USING SCRIBE LINES ON M15 ELEVATION QUADRANT

NOTE

- This method applies only to weapons with scribed elevation quadrants. Refer to page 3-80.
- If required, shift howitzer to roughly center the cross level bubble on the elevation quadrant before traversing the tube to center the bubble exactly. When the weapon is emplaced, be sure that the tube can be leveled (0-mil elevation).



LEVELING TRUNNIONS USING SCRIBE LINES ON M15 ELEVATION QUADRANT — CONTINUED

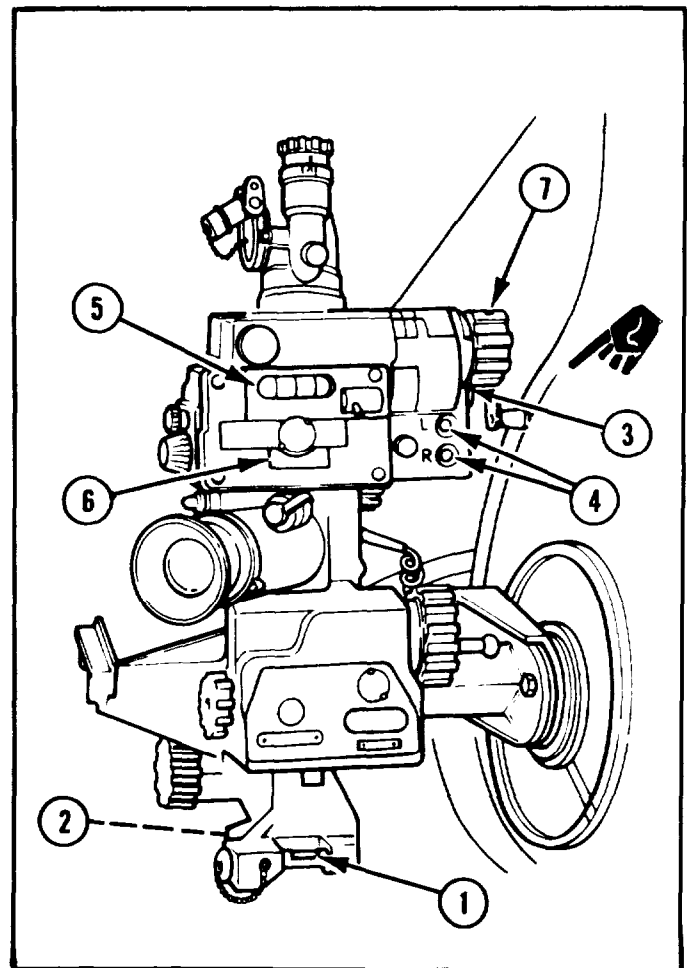
- 1 Before emplacing spade, roughly center elevation and cross level vial bubbles on elevation quadrant in the following manner:
 - a. Carefully aline both sets of scribe lines (1) on the quadrant.
 - b. Center elevation level vial bubble (2) by turning elevation knob (3).
 - c. Roughly center cross level vial bubble (4) by shifting the howitzer. Do not turn cross level knob (5).
- 2 Emplace weapon for firing, refer to page 2-99.
- 3 Depress tube until it rests on the depression stops.
- 4 Center elevation level vial bubble (2) on quadrant by turning the elevation knob (3). Do not turn cross level knob (5).
- 5 With scribe lines (1) still alined, traverse tube until cross level vial bubble (4) on quadrant is centered. Repeat steps 4 and 5 until both the elevation and cross level vial bubbles are centered. When both bubbles are centered, the trunnions are level.

CHECKING RELIABILITY OF DEFLECTIONS (M115 PANORAMIC TELESCOPE)

CAUTION

If M115 pantel head assembly is loose, it will no longer be optically alined. If tightening or adjustment is required, notify unit maintenance.

- 1 Center the bubbles in cross level (1) and elevation level (2) (hidden) vials of panoramic telescope mount.
- 2 Turn gunner's aid knob (3) to set gunner's aid counters (4) to 0.
- 3 Sight on a reference point at least 50 m away. If the reference point is less than 50 m away, a parallax shield is required.
- 4 Record the reading on azimuth counter (5). Reset the reset counter (6) to 3200.
- 5 Turn azimuth knob (7) clockwise until you have rotated the telescope through two complete circles returning to the same reference point.

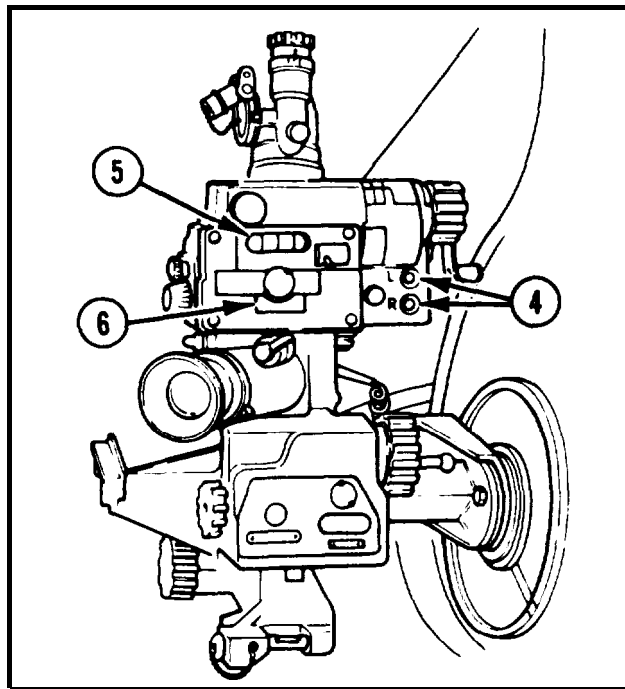


CHECKING RELIABILITY OF DEFLECTIONS (M115 PANORAMIC TELESCOPE) - CONTINUED

NOTE

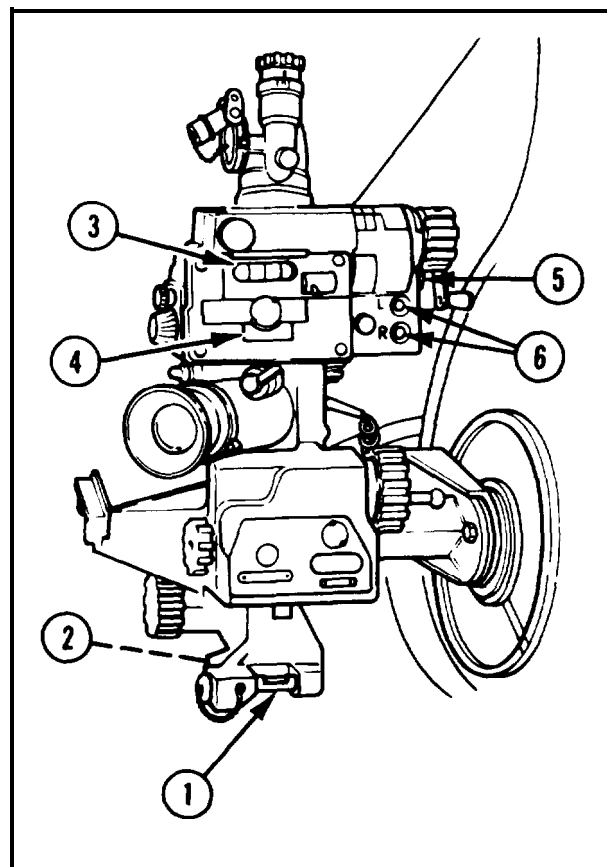
If you pass the reference point on the second circle, rotate panel at least 50 mils in the opposite direction (counterclockwise) and reapproach the reference point from left to right.

- 6 The reading on azimuth counter (5) should be within ± 1 mil of that recorded at the start of the test.
- 7 The reading on reset counter (6) should be 6000 ± 1 mil.
- 8 The reading on gunner's aid counters (4) should still be 0.
- 9 If above conditions cannot be met, notify unit maintenance.



CHECKING RELIABILITY OF SPECIAL CORRECTIONS (M115 PANORAMIC TELESCOPE)

- 1 Center the bubbles in cross level (1) and elevation level (2) vials of mount.
- 2 Look through eyepiece and sight on a reference point at least 50 m away.
- 3 Record the reading on azimuth counter (3). Reset the reset counter (4) to 3200.
- 4 Turn gunner's aid knob (5) to insert 10 mils into left gunner's aid counter (6).
- 5 Check the following:
 - a. The line of sight must be on the reference point.
 - b. The reading on azimuth counter (3) should not change by more than $1/4$ mil.
 - c. The reset counter (4) should be changed by 10 mils.



CHECKING RELIABILITY OF SPECIAL CORRECTIONS (M115 PANORAMIC TELESCOPE) -CONTINUED

- 6 Repeat steps 4 and 5 for 20, 30, and 40 mils.
- 7 Using the right gunner's aid counter (6), repeat steps 4, 5, and 6.
- 8 If any of the above conditions cannot be met, notify unit maintenance.

INSPECTING M137 TELESCOPE MOUNT (AZIMUTH WALK-OFF CHECK)

CAUTION

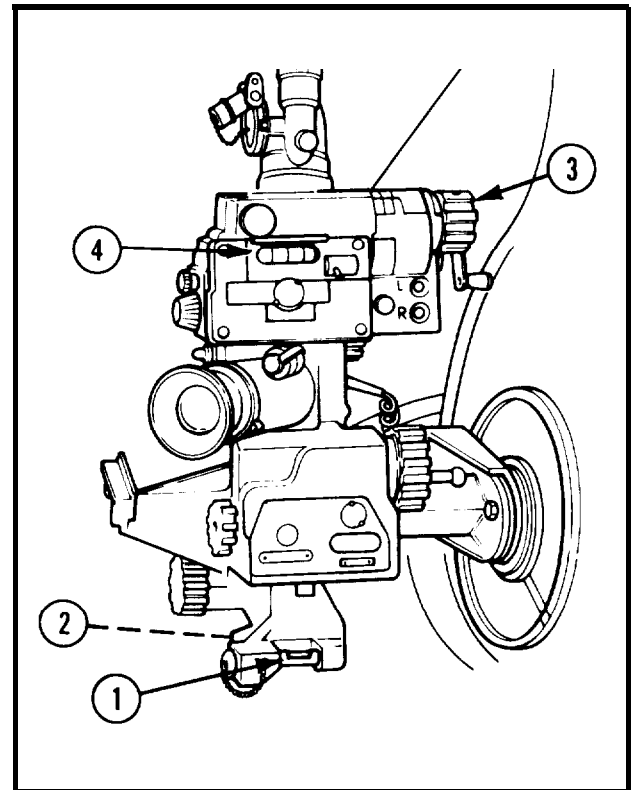
Recheck the trunnions. The trunnions must be absolutely level before this test is conducted.

- 1 Depress tube to depression stops.
- 2 Center the bubbles in cross level vial (1) and elevation level vial (2) on mount.
- 3 Turn azimuth knob (3) to place the vertical hairline of the pantel on any stationary object at any deflection. Approach object from left to right. The object must be at least 50 m away. Record the reading on azimuth counter (4) to the nearest 1/4 mil.

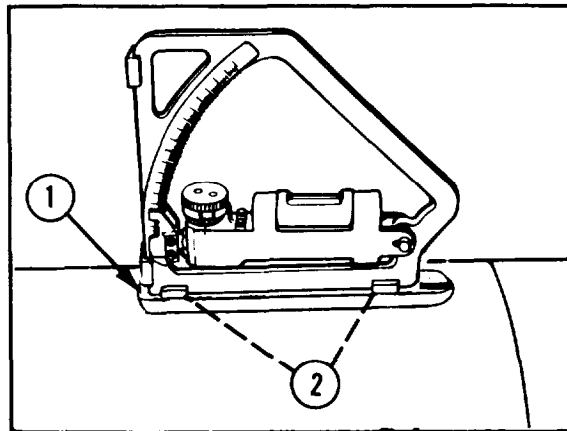
CAUTION

Do not traverse the tube.

- 4 Elevate tube to 300 mils. Center all bubbles and turn azimuth knob (3) to realine the vertical hairline on the same stationary object. Approach the objects from left to right. The reading on the azimuth counter (4) must be within ± 1 mil of the reading taken in step 3.
- 5 Elevate tube to 600 mils. Center all bubbles and realine vertical hairline (step 2 and 3) on the same stationary object. Approach object from left to right. The reading on the azimuth counter (4) must be within ± 2 mils of reading taken in step 3.
- 6 If any of the above conditions cannot be met, notify unit maintenance.



LEVELING TUBE-GUNNER'S QUADRANT METHOD



NOTE

The M201A1 cannon has a machined surface on the top muzzle end of the tube and quadrant seats on the top of the breech ring. The measured correction (the difference between muzzle and breech elevation) is measured rather than being stamped on the breech.

NOTE

- Failure to compensate for measured correction will result in misalignment on weapon being checked.
- The measured correction shall be re-determined when a breech is retubed.

1 Place a tested gunner's quadrant on the top surface of the muzzle end of machined surface (1). Apply only the gunner's quadrant correction, if any, and center the bubble by manually elevating or depressing the tube. The tube is now at 0 mils.

2 Place gunner's quadrant on breech ring quadrant seats (2) and center the bubble. The difference between 0 mils at muzzle end and the reading taken at breech ring is the measured correction.

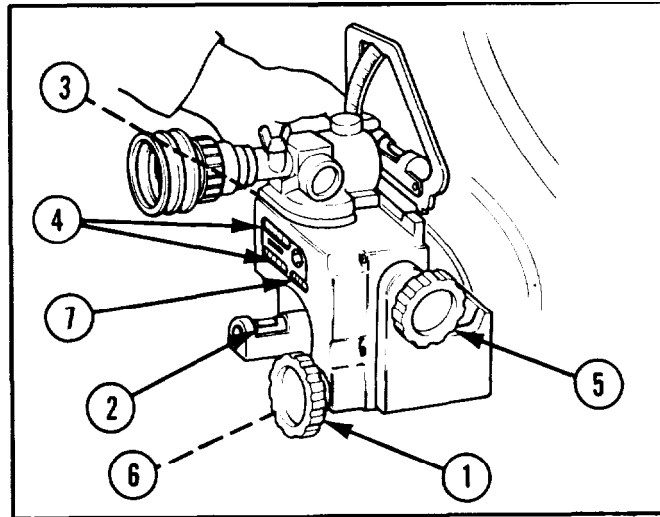
3 Add gunner's quadrant correction and measured correction; for example:

Gunner's quadrant correction	-0.4
Measured correction	<u>+1.9</u>
Place on gunner's quadrant	+1.5

4 Apply the total correction on the gunner's quadrant. Place gunner's quadrant on breech ring quadrant seat and center bubble by elevating or depressing the tube. When the bubble centers, the tube is level.

5 Record the measured correction in the remarks column on DA Form 2408-4. Refer to the measured correction when making elevating settings with the gunner's quadrant.

TESTING OF M15 ELEVATION QUADRANT



- 1 Level tube using gunner's quadrant method, refer to page 3-78.
- 2 On M15 quadrant, turn cross level knob (1) until cross level bubble (2) is centered.
- 3 Turn correction knob (3) and zero correction counters (4) on M15 quadrant.
- 4 Turn elevation knob (5) and center elevation level vial bubble (6) on M15 quadrant.
- 5 Check elevation counter reading (7). The reading should be no less than 9999 (-1 mil elevation) and no more than 0001 (+ 1 mil elevation).
- 6 Place gunner's quadrant on M15 quadrant seats. (Be sure to apply the gunner's quadrant correction factor.)
- 7 Turn micrometer knob to center gunner's quadrant bubble. The value on the gunner's quadrant should not change more than + 0.5 mil.
- 8 If any of the above conditions cannot be met, notify unit maintenance.
- 9 On M15 quadrant, zero all counters and center cross level vial bubble (2).
- 10 Using M15 quadrant, zero the tube. Elevate or depress tube until elevation level vial bubble (6) is centered.
- 11 Set gunner's quadrant on M15 quadrant seats. Turn micrometer knob on gunner's quadrant and center bubble in level vial. Record value on gunner's quadrant.
- 12 Turn correction knob (3) to place a + 5 mil reading on elevation correction counter (4). Check the reading on M15 quadrant elevation counter (7). It should have changed by 5 mils, if not, notify unit maintenance.
- 13 Turn elevation knob (5) until elevation counter (7) reads 0.
- 14 Elevate or depress tube until elevation level vial bubble (6) centers.
- 15 Place 5 mils plus the value recorded in step 11 on the gunner's quadrant. Set gunner's quadrant back on the M15; the gunner's quadrant bubble should center. If it does not, the M15 correction counter (4), is inaccurate, notify unit maintenance.

Example:

Gunner's quadrant correction - 0.4. The value on the gunner's quadrant should be between -0.9 and +0.1.

TESTING OF M15 ELEVATION QUADRANT-CONTINUED

Example:

Value recorded in step 11	+0.7
Add 5 mils	<u>+ 5.0</u>
Value to place on gunner' s quadrant	+ 5.7

16 Zero all counters. Repeat steps 12 thru 15, but use a value of - 5 mils. If the gunner' s quadrant bubble does not center, the correction counter (4) is inaccurate, notify unit maintenance.

NOTE

This part of the test is complete. Remove the -5 mils from the gunner' s quadrant and the elevation correction counter.

17 Using M15 quadrant, zero the tube.

18 Set gunner' s quadrant on M15 quadrant seats. Center gunner' s quadrant bubble by using micrometer knob on gunner' s quadrant. Record the micrometer scale reading.

19 Using M15 quadrant, elevate tube from 0 to 400 mils and then to 800 mils. At each elevation, place the value on the elevation counter (400 and then 800). Place 400 then 800 mils plus the value recorded in step 18 on gunner' s quadrant. Set gunner' s quadrant on M15 quadrant seats.

Example:

Elevations placed on elevation counter	400.0	800.0
Value measure in 18 above (0 elevation)	<u>+0.7</u>	<u>+0.7</u>
Values placed on gunner' s quadrant	400.7	800.7

20 Gunner' s quadrant bubble should center. If bubble centers, the test is complete.

21 If the bubble does not center, center it by turning the micrometer knob. The gunner' s quadrant reading should not vary more than ± 0.5 mil from the original reading. If it does, the M15 quadrant is in error and should be turned into unit maintenance.

22 Remove all corrections from M15 quadrant and gunner' s quadrant.

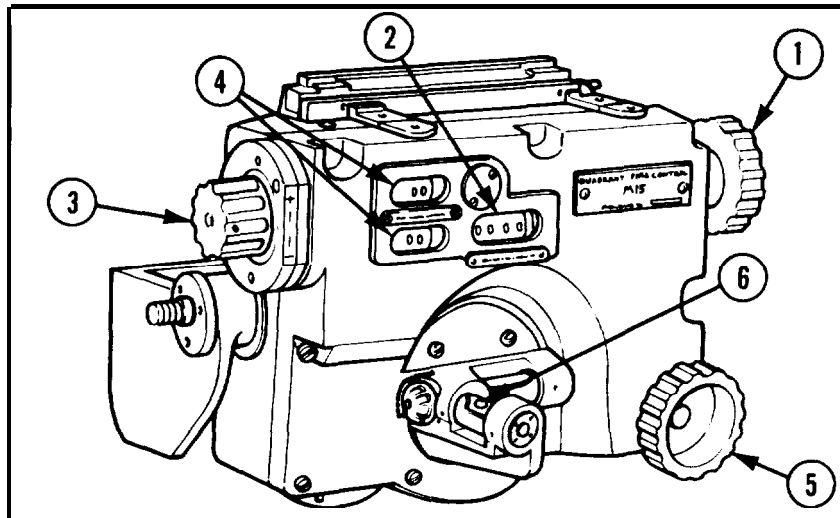
SCRIBING M15 ELEVATING QUADRANT



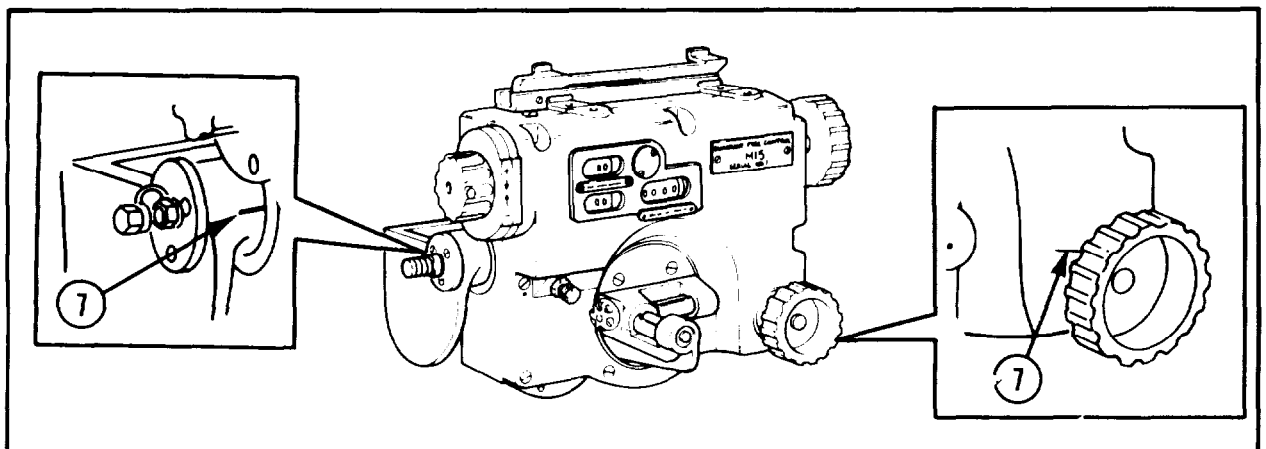
The trunnions must be level and the tube at 0-mil elevation before scribing the M15 quadrant.

If M15 elevation quadrant is not scribed, perform the fire control alinement tests, refer to pages 3-63 thru 3-88, then scribe M15 quadrant.

SCRIBING M15 ELEVATING QUADRANT - CONTINUED



- | | |
|---|--|
| <p>1 On M15 quadrant, turn elevation knob (1) to place elevation mil counter (2) on 0.</p> <p>2 Turn correction knob (3) to place correction counters (4) to 0.</p> <p>3 Turn cross level knob (5) to center cross level vial bubble (6).</p> <p>4 Set elevation mil counter to 600 mils and slowly elevate tube to 600 mils. Watch cross level vial bubble (6). The bubble must not move over 2 graduation marks from center of vial. If it does, the quadrant may be defective.</p> | <p>Stop the test and notify unit maintenance.</p> <p>5 If bubble does not move over 2 graduation marks on the vial, set elevation mil counter to 0 mils and depress tube to 0 mils. Observe cross level vial bubble (6). It must not move over 2 graduation marks on the vial.</p> <p>6 If cross level vial bubble (6) does not move over 2 graduation marks on vial during elevation and depression of the tube, scribe the mount. While the tube is at 0 elevation, recenter cross level bubble, if necessary.</p> |
|---|--|



- | | |
|---|---|
| <p>7 Take a machinists scribe (item 10, appx C) and scribe two lines (7) on M15 quadrant. Use a straightedge to be sure the lines (7) meet.</p> | <p>8 Scribe one line from the range quadrant mounting bracket pivot stud to the front side of the quadrant.</p> |
|---|---|

SCRIBING M15 ELEVATING QUADRANT - CONTINUED

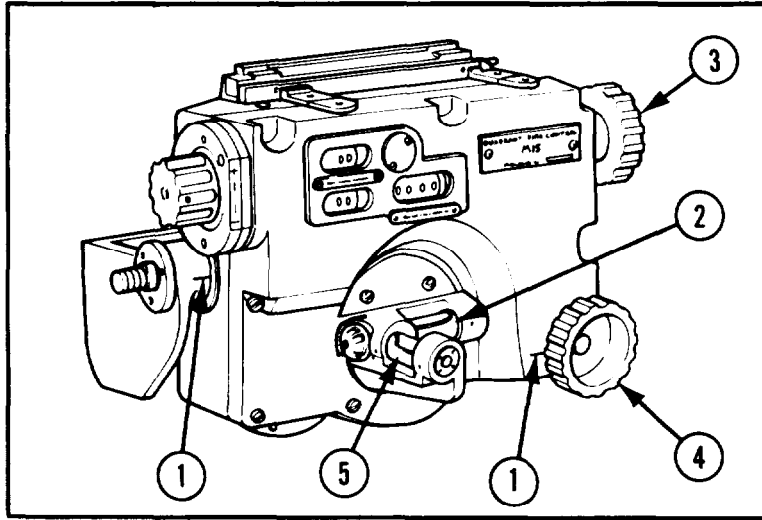
- 9 Scribe the other line from cross level knob to the face of the quadrant.
- 10 Paint scribe lines with paint that contrasts with the color of the quadrant and can be easily seen.
- 11 Wipe off excess paint and let dry.

- 12 When paint is dry, verify that the trunnions can be leveled and that an accurate M137 pantel mount azimuth walk-off-check can be performed on the weapon using scribe lines on M15 quadrant instead of a plumbline.

VERIFICATION OF M15 ELEVATION QUADRANT SCRIBE LINES

- 1 Remove jacks from under vehicle and prepare for travel.
- 2 Move the vehicle to another location.

Before spade is emplaced, roughly center elevation and cross level vial bubbles on M15 quadrant in the following manner:



- a. Carefully aline both sets of scribe lines (1) on M15 quadrant.
- b. Center elevation level vial bubble (2) by turning elevation knob (3).

- 5 Center elevation level vial bubble (2) on M15 quadrant by turning elevation knob (3).

NOTE

Do not turn cross level knob (4).

NOTE

Do not turn cross level knob (4)

- c. Roughly center cross level vial bubble (5) by shifting carriage.

- 6 With scribe lines (1) still alined, slowly traverse tube until cross level bubble (5) on M15 quadrant is centered.
- 7 Repeat steps 5 and 6 until both the elevation (2) and cross level (5) vial bubbles on M15 are centered.

- 3 When cross level vial bubble (5) is approximately centered, emplace the weapon for firing.

- 8 Perform the M137 pantel mount azimuth walk-off test following the procedures. Refer to page 3-77.

- 4 With weapon emplaced, depress tube until it rests on depression stops.

VERIFICATION OF M15 ELEVATION QUADRANT SCRIBE LINES - CONTINUED

9 After azimuth walk-off test, compare M137 pantel mount error with the M137 pantel mount error recorded in steps 3, 4, and 5 (page 3-78) while the weapon was on jacks.

Example:

Amount of error in pantel sight mount with vehicle on jacks:	0.2 mil
Amount of error in pantel sight mount with vehicle in the field:	0.6 mil
The difference between the two pantel sight mount readings:	0.4 mil

10 The difference between the two pantel sight mount error readings must not be over ± 1 mil.

11 If the difference is greater than ± 1 mil, start with step 5 and go through the entire procedure again to be sure there were no mistakes made and no steps overlooked. If the difference between pantel sight mount error readings in the two tests is still greater than ± 1 mil, notify unit maintenance.

12 If the readings are within the ± 1 mil tolerance, the trunnions can be leveled and the M137 mount check can be performed in the field by use of scribe lines painted on the M15 quadrant.

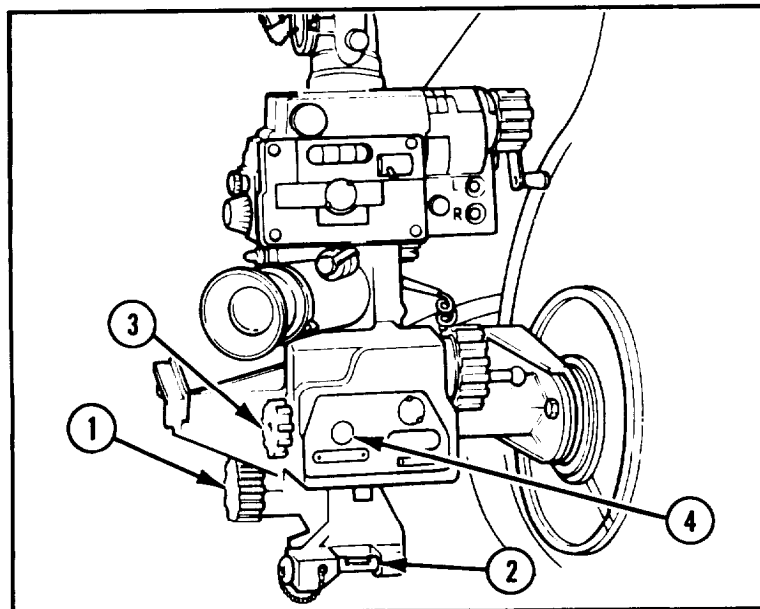
TESTING OF ELEVATION CORRECTION COUNTER, M137 TELESCOPE MOUNT

NOTE

The measured correction on the M201A1 cannon is measured rather than being stamped on the breech, refer to page 3-79. Failure to compensate for the measured

correction will result in misalignment on the weapon being checked.

1 Level tube using gunner's quadrant method. Refer to page 3-78.



2 On M137 mount, turn cross level knob (1) until cross level vial bubble (2) is centered.

3 Turn correction knob (3) and zero correction counter (4) on the M137 mount.

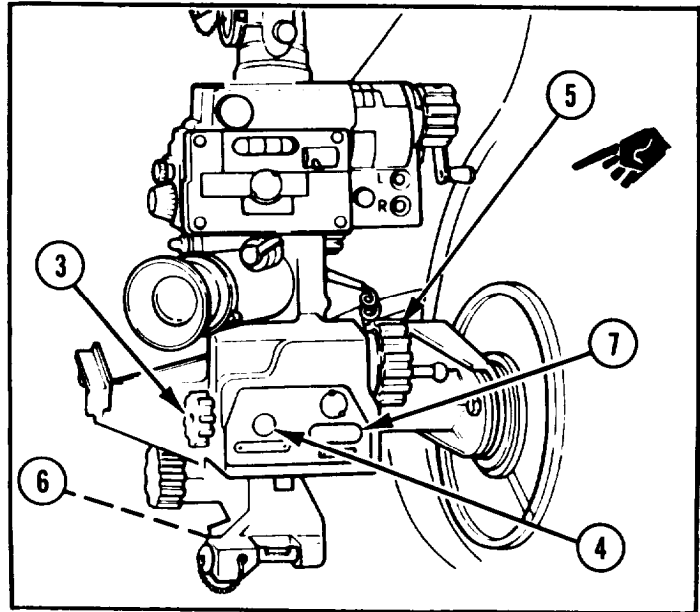
TESTING OF ELEVATION CORRECTION COUNTER, M137 TELESCOPE MOUNT-CONTINUED

4 Turn elevation knob (5) and center elevation level vial bubble (6) on M137 quadrant.

5 Check elevation counter reading (7). The reading should be no less than 9998 (-2 mil elevation) and no more than 0002 (+ 2 mil elevation).

6 Place gunner's quadrant on M137 gunner's quadrant seats. (Be sure to apply the gunner's quadrant correction factor, if any, but do not apply the measured correction.)

7 Turn micrometer knob to center gunner's quadrant bubble. The value on the gunner's quadrant should not change more than ± 1.0 mil. Record the value on the gunner's quadrant.



Example:

Gunner's quadrant correction - 0.4. The value on the gunner's quadrant should be between - 1.4 and + 0.6.

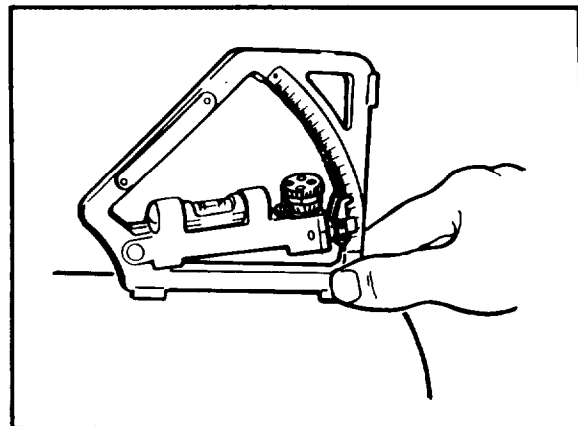
8 If any of the above conditions cannot be met, notify unit maintenance.

9 Turn correction knob (3) to place a + 5 mil reading on elevation correction counter (4). Check the reading on M137 mount elevation correction counter (7). It should have changed by 5 mils, if not, notify unit maintenance.

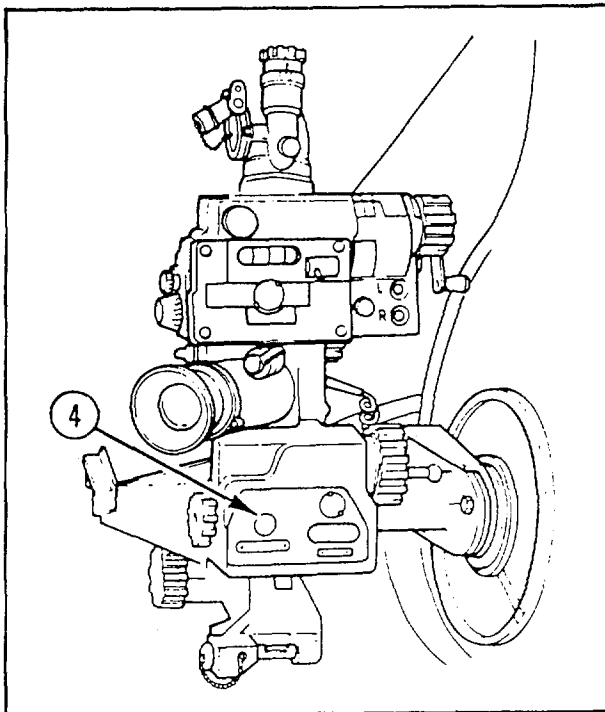
10 Turn elevation knob (5) until elevation correction counter (7) reads 0.

11 Elevate or depress tube until elevation level bubble (6) centers.

12 Place 5 mils plus the value recorded in step 7 on the gunner's quadrant. Set the gunner's quadrant back on M137; the gunner's quadrant bubble should center. If it does not, the elevation correction counter (4) is inaccurate, notify unit maintenance.



TESTING OF ELEVATION CORRECTION COUNTER, M137 TELESCOPE MOUNT--CONTINUED



Example:

Value recorded in step 7	+ 0.7
Value to place on gunner's quadrant	+ 5.7

13 Zero all counters. Repeat steps 9 through 12, but use a value correction of 5 mils. If gunner's quadrant bubble does not center, the elevation correction counter (4) is inaccurate. Notify unit maintenance.

NOTE

This part of test is complete. Remove the -5 mils from the gunner's quadrant.

14 Zero all counters on M137 mount and level tube using M137 elevation level vial.

15 Set gunner's quadrant on M137 gunner's quadrant seats. Center gunner's quadrant bubble by using

micrometer knob on gunner's quadrant, then record micrometer scale reading.

16 Using M137 elevation correction counter, elevate tube from 0 to 400 mils and then to 800 mils and center M137 elevation level vial bubble by elevating or depressing tube. At each elevation, place the value on the elevation correction counter (400 and then 800). Place 400 then 800 mils plus the value recorded in step 15 on gunner's quadrant. Set gunner's quadrant on M137 gunner's quadrant seats.

17 Gunner's quadrant bubble should center. If bubble centers, the test is complete.

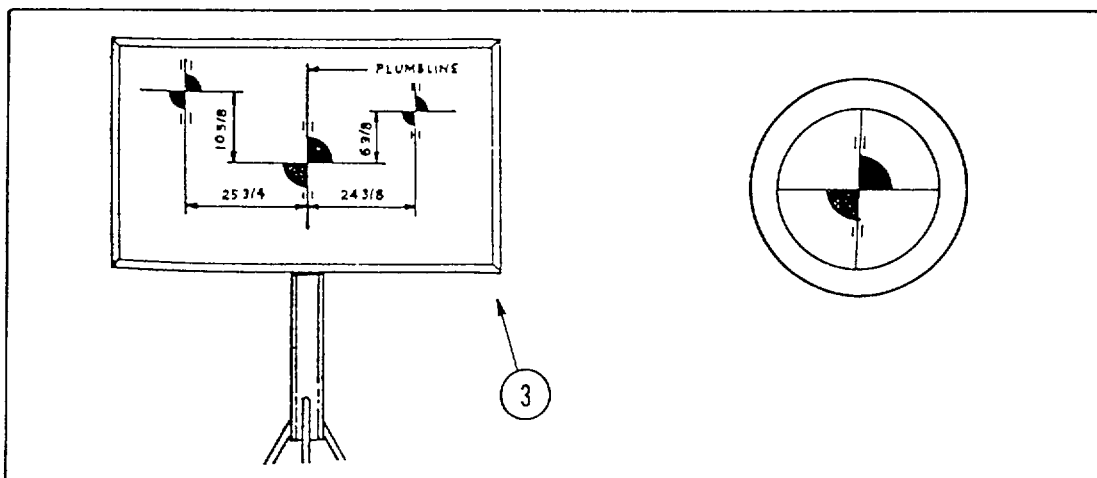
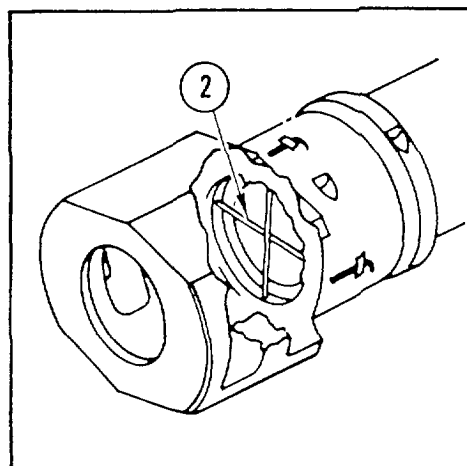
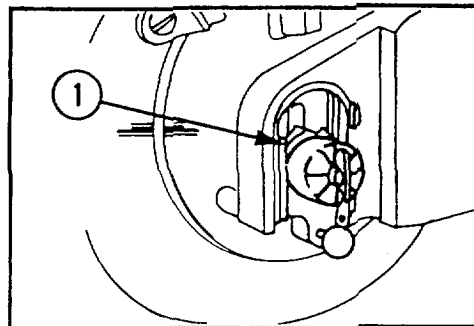
18 If bubble does not center, center it by turning micrometer knob. The gunner's quadrant reading should not vary more than ± 1.0 mil from the original reading. If it does, the M137 elevation correction counter is in error and should be turned in to unit maintenance.

SCRIBING M137 MOUNT FOR BORESIGHTING

NOTE

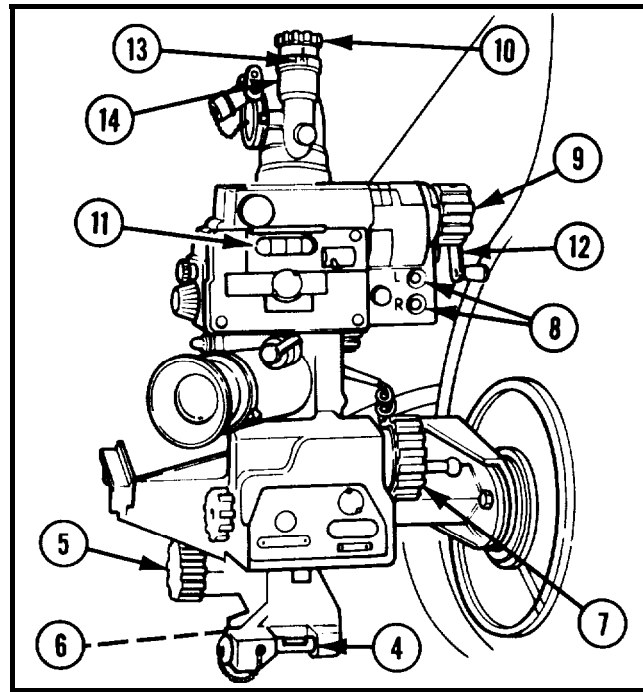
Before the M137 mount is scribed for boresighting, the trunnions must be level, the tube must be at 0-mil elevation, the M15 elevation quadrant must be scribed, and the fire control alignment tests must be completed.

- 1 Level the trunnions using the scribe lines on the M15 elevation quadrant. Refer to page 3-80.
- 2 Conduct fire control alignment tests starting on page 3-63.
- 3 Retract firing mechanism block (1) from fire position so primer vent is exposed. Insert muzzle crosshairs (2) through holes in muzzle brake and aline with witness marks on face of tube. Secure crosshairs with tape.



- 4 Position boresight testing target (3) at least 50 nm in front of weapon.
- 5 Moving the testing target and not the tube, aline the vertical and horizontal muzzle crosshairs on center aiming diagram.

SCRIBING M137 MOUNT FOR BORESIGHTING - CONTINUED



- 6 Center cross level vial bubble (4) using cross level knob (5), and center elevation level vial bubble (6) using mount elevation knob (7).
- 7 Set gunner's aid counters (8) to 0.
- 8 Adjust azimuth (9) and pantel elevation knobs (10) to align the vertical and horizontal hairlines of the pantel reticle pattern precisely on the left aiming diagram.
- 9 Check that muzzle crosshairs are still centered on the center aiming diagram.
- 10 The azimuth counter (11) should read 3200 mils. If it does not, insert small screwdriver into boresight adjustment detent (12), depress detent shaft and turn until 3200 appears on azimuth counter (11). Recheck sight pattern to be sure pantel is still in boresight.
- 11 Verify that muzzle crosshairs and pantel reticle hairlines are still properly aligned and that the tube is at 0-mil elevation.
- 12 If the zero mark on pantel micrometer scale (13) is not on witness mark on rotating head assembly (14), loosen three screws in pantel elevation knob (10). Without moving pantel elevation knob (10), slip micrometer scale (13) until zero mark on micrometer scale (13) is aligned with witness mark. Tighten three screws in pantel elevation knob (10) to secure.
- 13 Check M140 alignment device by following steps 2 thru 4 on page 2-118.
- 14 If reticles do not align, recheck boresight following steps 1 thru 12 above. If reticles still do not align, notify unit maintenance.

SCRIBING M137 MOUNT FOR BORESIGHT - CONTINUED

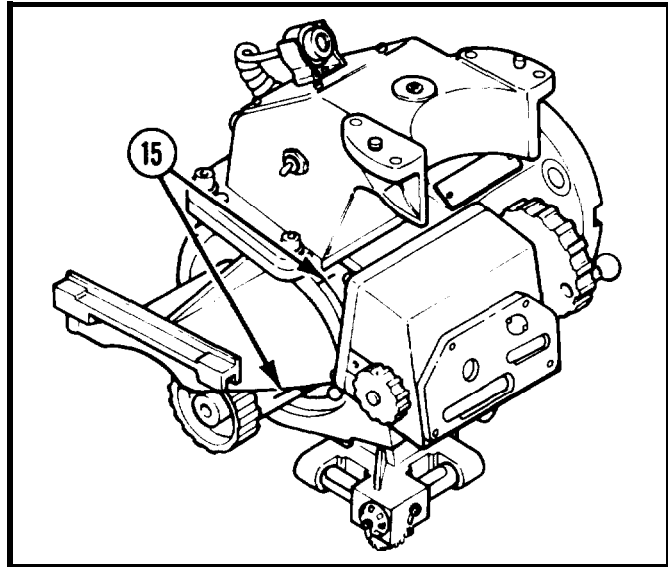
NOTE

The M140 alignment device or mount could be unserviceable or out of adjustment.

CAUTION

Do not move cross level knob when scribing.

- 15 Using straightedge and a machinist's scribe (item 11, appx C), scribe a line on the cross level knob and on the housing of M137 mount.
- 16 Paint scribe lines (15) with paint that contrasts with the color of the cross level knob and housing and can be easily seen.
- 17 Wipe off excess paint.



BORESIGHTING THE WEAPON

Boresight the weapon using one of the following methods.

- Using scribe marks on M137 mount. Refer to page 2-108.
- Using distant aiming point. Refer to page 2-112.

NOTE

The fire control alignment tests are now complete.

CHAPTER 4 MAINTENANCE OF AUXILIARY EQUIPMENT

CHAPTER INDEX

	Page
GENERAL	4-1
SPECIAL PURPOSE KITS	4-1
Arctic traction kit	4-2
Crew personnel heater kit	4-2
Crew personnel shelter kit	4-2
Driver's enclosure kit	4-1
Hull heater kit	4-1

GENERAL

Instructions for maintenance of auxiliary equipment (special purpose kits) are contained on the following pages.

SPECIAL PURPOSE KITS

DRIVER'S ENCLOSURE KIT

- 1 Oil windshield pin assemblies with proper oil for expected temperatures (appx F).



- Do not use solvent or abrasive agent on driver's enclosure.
- 2 Wash sand and dirt from driver's enclosure with stream of water. Then clean enclosure and windshield with mild soap, water, and soft cloth.
 - 3 Set MASTER switch ON and check operation of windshield wiper on driver's enclosure. Check driver's enclosure for damaged window or windshield glass. If windshield wiper does not operate or driver's enclosure is damaged, notify unit maintenance.

HULL HEATER KIT

- 1 Inspect driver's heater, hoses, and fittings for leaks. Test indicator light on control box by pressing. If light does not come on, or if any components are leaking or damaged, notify unit maintenance.
- 2 Check vehicle fuel level before notifying unit maintenance that driver's heater is not working.
- 3 Oil engine coolant heater control box access cover hinge with proper oil for expected temperatures. Refer to appendix F for lubrication instructions.

HULL HEATER KIT- CONTINUED

- 4 Inspect coolant heater, hoses, and fittings for leaks. Test indicator light on control box by pressing. If light does not come on, or if any components are leaking or damaged, notify unit maintenance.
- 5 Check vehicle fuel level before notifying unit maintenance that coolant heater is not working.

CREW PERSONNEL HEATER KIT

- 1 Inspect crew heater, fuel tank, lines, and fittings for leaks. Set MASTER switch ON and test indicator light on control box by pressing. If light does not come on, or if any components are leaking or damaged, notify unit maintenance.
- 2 Check fuel level in heater tank before notifying unit maintenance that crew heater is not working.

CREW PERSONNEL SHELTER KIT

Check that all covers and plugs are correctly installed or stowed and not damaged. If any covers or plugs are missing or damaged, notify unit maintenance.

ARCTIC TRACTION KIT

Arctic track pads require no special maintenance. Service and maintain track, track tension, and track shoes in the normal manner. Refer to pages 3-39 thru 3-45.

CHAPTER 5 AMMUNITION

CHAPTER INDEX

	Page
AFTER FIRING PROCEDURES	5-34
AMMUNITION OF COMPONENTS PREPARED FOR FIRING, BUT NOT FIRED	5-35
AMMUNITION PREPARED FOR FIRING BUT NOT FIRED	5-34
DEFECTIVE AMMUNITION	5-37
EXCESS EXPLOSIVE COMPONENTS	5-37
FUZES	5-10
FUZE SETTING	5-23
Impact fuzes	5-24
Multi-option fuze setting	5-31
Proximity fuze setting	5-24
FUZING	5-20
Fuze assembly	5-22
Lifting plug removal	5-20
Supplementary charge (deep cavity projectiles only)	5-20
Typical deep-cavity projectiles	5-21
GENERAL	5-36, 5-39
GENERAL PREPARATION	5-19
Packing and unpacking	5-19
LOADING	5-32
LOADING AND RAMMING	5-39
PRIMERS	5-18
PROJECTILE COLORING AND MARKINGS	5-2
PROJECTILE EXTRACTION USING BELL RAMMER	5-39
PROJECTILE EXTRACTION USING M4277 EXTRACTOR,	5-40
PROJECTILES	5-36
PROJECTILES, USE AND CHARACTERISTICS	5-3
PROPELLING CHARGE PREPARATION	5-32
Propelling charge M188	5-32
Propelling charge M188A1	5-32
Propelling charges M1 and M2	5-32
PROPELLING CHARGES	5-15
PROPELLING CHARGES M1 AND M2	5-36
PROPELLING CHARGES M188 AND M188A1	5-36
REPACKAGING	5-44
REPLACING WORN M845 DUMMY PROJECTILE ROTATING BAND	5-45
REVERSING M845 DUMMY PROJECTILE ROTATING BAND	5-44
STORAGE	5-38
Provisions	5-38
Sites	5-38
Temperature limits	5-38
UNPACKING AND INSPECTION	5-39

Section I. PROJECTILES, FUZES, PROPELLING CHARGES, AND PRIMERS

SECTION INDEX

FUZES	Page 5-10
PRIMERS	5-18
PROJECTILE COLORING AND MARKINGS	5-2
PROJECTILES, USE AND CHARACTERISTICS	5-3
PROPELLING CHARGES	5-15

Ammunition for the howitzer is the separate-loading type. The loading of each round into the cannon requires four separate operations:

- Fuzing the projectile.
- Loading the fuzed projectile.
- Loading the propelling charge.
- Inserting the primer.



Use only authorized projectile/fuze combinations listed on page 5-8.

PROJECTILE COLORING AND MARKINGS

Projectile colorings and markings (new and old) are shown below. Important information is stenciled on each projectile, see page 5-3 thru 5-7. The meaning of each

marking will aid the rapid selection of the required projectile when firing. **KNOW YOUR AMMUNITION.**

Model Number and Color Coding of Projectiles for 8-inch Howitzer, M110A2

Type and Model No. of Projectile	New Manufacture			Old Manufacture		
	Color of Projectile	No/Color of Bands	Marking	Color of Projectile	No/Color of Bands	Marking
* *Agent (GB) w/burster, M426	Gray	3/Green 1 /Yellow	Green	Gray	1 /Green	Green
* *Agent (VX) w/burster, M426	Gray	3/Green 1 /Yellow	Green	Gray	2/Green	Green
HE, (ICM) M404	Olive Drab	*Diamonds	Yellow	Olive Drab	None	Yellow

PROJECTILE COLORING AND MARKINGS - CONTINUED

Model Number and Color Coding of Projectiles for 8-inch Howitzer, M110A2-CONTINUED

Type and Model No. of Projectile	New Manufacture			Old Manufacture		
	Color of Projectile	No/Color of Bands	Marking	Color of Projectile	No/Color of Bands	Marking
HE, M106, TNT filler, deep or shallow cavity	Olive Drab	None	Yellow	Olive Drab	None	Yellow
HE, (ICM) M509A1	Olive Drab	I Diamonds	Yellow	N/A	N/A	N/A
HERA, M650	Olive Drab	None	Yellow	N/A	N/A	N/A

*Row of yellow diamonds between nose and bourrelet of projectile.

**Renovated or newly manufactured projectile (post 1976) will be marked with one green band and if burster, one yellow band.

PROJECTILES, USE AND CHARACTERISTICS

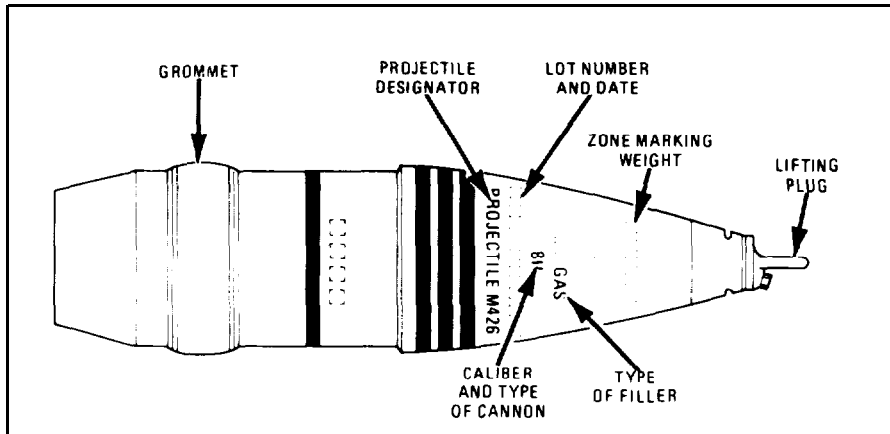


Unauthorized assembly and use of projectiles and propelling charges is extremely dangerous. Make sure projectiles are marked 8H, and propelling charges are marked 8-IN HOW. Verify authorized projectile/fuze combinations on page 5-8.

GENERAL. Projectiles with deep fuze cavities and supplementary charges are suitable for use with M728 proximity fuzes and are identified by the words W/SUPPL CHG marked on the projectile. Weight zones are indicated on projectiles by one or more squares of the same color as the marking. Four squares indicate standard or normal weight. Authorized projectile-fuze combinations are listed on page 5-8.

PROJECTILES, USE AND CHARACTERISTICS - CONTINUED

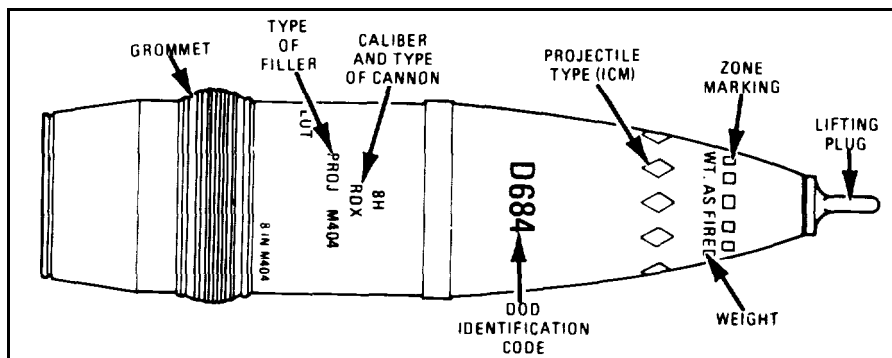
MARKING OF 8-INCH GAS, NONPERSISTENT, GB, M426 AND GAS, PERSISTENT, VX, M426 PROJECTILE



PROJECTILES, 8-INCH: GAS, NONPERSISTENT, GB, M426 AND GAS, PERSISTENT, VX, M426. These projectiles are used as casualty producing agents. The projectile is similar in configuration to HE Projectile M106. It is composed of a steel forging fitted with steel burster case, a nose adapter, and a gilding metal rotating band. The burster case contains a burster loaded with

Composition B4. The projectile is shipped with a supplementary charge consisting of TNT, an eyebolt lifting plug, and spacer with a removable grommet fitted over the rotating band to protect it during shipment and handling. The M426 projectile weighs approximately 199 lb (90 kg). Refer to page 5-8 for authorized fuze combinations.

MARKING OF 8-INCH ICM, M404 PROJECTILE

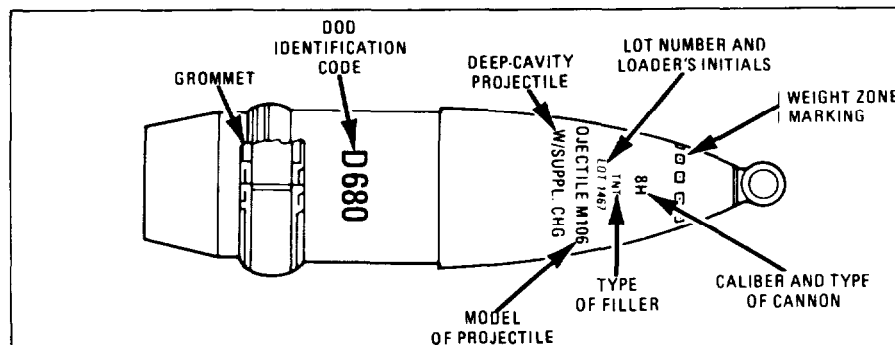


PROJECTILE, 8-INCH: ICM, M404. These projectiles are improved conventional munitions (ICM) used primarily against personnel. The projectile has the same external configuration and ballistic characteristics as the M106 and is provided with a fusible lifting plug (yellow). The cargo consist of 104 M43A1 antipersonnel grenades which are expelled from the projectile in flight when a preset fuze ignites an expulsion charge. The projectile spin centrifugally disperses the grenades from the projectile

line of flight. Upon impact with the target area an expulsion charge is initiated which propels a high explosive filled sphere upward 4 to 6 ft (1.22 to 1.83 m) above the impact area. The elevated sphere is detonated sending high-velocity fragments in a spherical pattern. Each projectile weighs approximately 200 lb (91 kg). Refer to page 5-8 for authorized fuze combinations. This projectile is intended for use with the M1 and M2 propelling charges only.

PROJECTILES, USE AND CHARACTERISTICS - CONTINUED

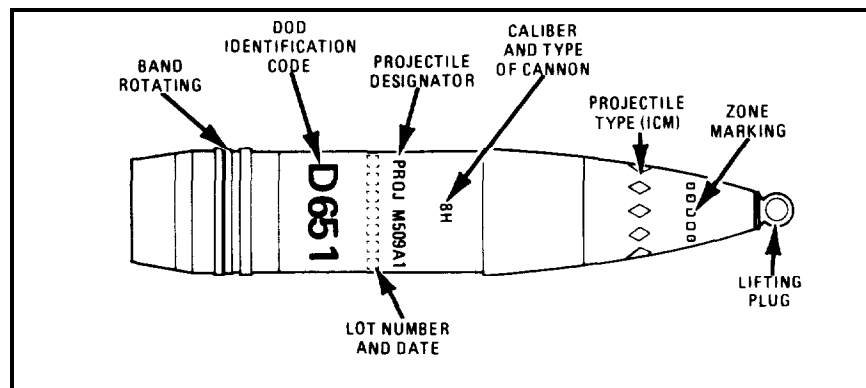
MARKING OF 8-INCH HE, M106 PROJECTILE



PROJECTILE, 8-INCH: HE, M106. This projectile is used for blast, fragmentation, and mining. The projectile consist of a hollow steel forging with a gilding metal rotating band. The projectile may be either a shallow or deep cavity and is loaded with TNT. The deep cavity projectile contains supplementary charge of TNT. Both shallow

and deep cavity projectiles are shipped with an eyebolt lifting plug or energy lifting plug, cardboard spacer, and removable grommet fitted over the rotating band to protect it during shipment and handling. The M106 projectile weighs 200 lb (91 kg). Refer to page 5-8 for authorized fuze combinations.

MARKING OF 8-INCH DPICM. M509A1 PROJECTILE

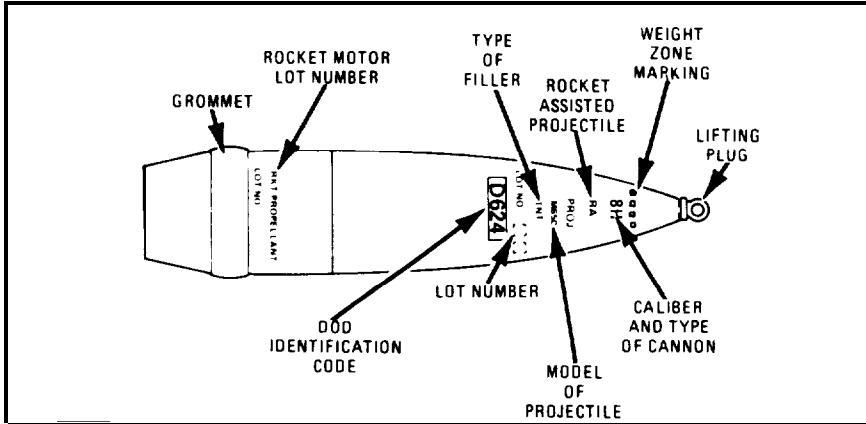


PROJECTILE, 8-INCH: DPICM, M509A1. This projectile is used to deliver a concentration of grenades effective against personnel and materiel. The projectile is longer than the M404 projectile (requiring it to be loaded over the rear of the vehicle) and requires separate registration. The projectile is provided with a fusible or universal lifting plug (yellow). The cargo consists of 180 M42 dual purpose grenades which are expelled from the projectile in flight when a preset fuze ignites an expulsion charge. Upon ejection from the carrier, the grenades are dispersed by the projectile spin

and are oriented and armed by a stabilizing ribbon device. On impact, the grenade fuze initiates the high explosive charge producing an armor penetrating shaped-charge jet and a large number of small fragments. A spotting charge is available as a separate item of issue and when substituted for the expulsion charge permits observation of the projectile functioning in relation to the target. The M509A1 projectile weighs approximately 208 lb (94 kg). Refer to page 5-8 for authorized fuze combinations.

PROJECTILES, USE AND CHARACTERISTICS - CONTINUED

MARKING OF 8-INCH HERA, M650 PROJECTILE



WARNING

- Do not fire the M650 projectile if the obturator band is missing or broken. If the obturator band is displaced and can be repositioned and will remain in the groove, the projectile can be fired.
- Do not fire ammunition if energy absorbing plug is bent, broken, or if ammunition is mishandled.

NOTE

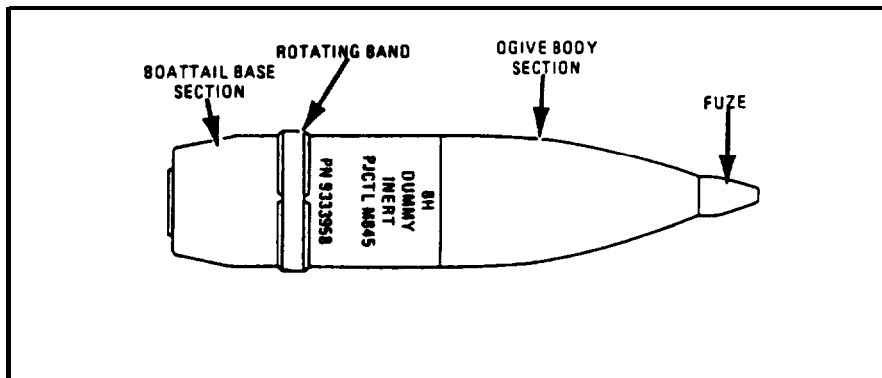
Refer to TM 9-1110-220-10 for information on the M753 nuclear projectile. Data in the manual that is the same for M650 and M753 projectiles is indicated by the designation M650/M753.

materiel targets at ranges in excess of those currently attainable with the standard M106 projectile. The projectile consists of three major components: an ogive, the warhead, and a solid propellant rocket motor. The three components thread together to form a streamlined projectile. The M650 contains a shallow cavity fuze well (no supplementary charge) and therefore will only accept shallow intrusion fuzes. The high fragmentation steel warhead is filled with TNT explosive. The alloy steel rocket motor contains the solid propellant grain and delay ignition assembly. A rocket-off cap is threaded onto the nozzle exit cone at the base of the rocket motor. The cap is left in place when firing the round ROCKET-OFF. It is removed by the cannoneer when firing the round ROCKET-ON. The rocket motor is encircled with a copper rotating band, which is backed up by a nylon obturating band. The projectile is fitted with an eyebolt or energy absorbing lifting plug at the nose and grommet which protects the rotating band during shipping and handling. Refer to page 5-8 for authorized fuze combinations.

PROJECTILE, 8-INCH: HERA, M650. This is a high-explosive, rocket-assisted projectile with extended range capability. It is intended to be employed against personnel and

PROJECTILES, USE AND CHARACTERISTICS - CONTINUED

MARKING OF 8-INCH M845 DUMMY PROJECTILE



DUMMY PROJECTILE, 8-INCH: M845.

WARNING

The M845 Projectile is designed to provide training in handling, loading, ramming, and extracting. It is not to be fired.

The projectile is designed to provide an inert training projectile which can be used to develop and maintain proficiency in the proper operation and maintenance of the loader/rammer system in other than live-fire operations.

PROJECTILES, USE AND CHARACTERISTICS - CONTINUED

Authorized Projectile-Fuze Combinations for 8-Inch
Howitzer, SP, M110A2 Cannon M201A1

Type and Model Number of Projectile	FUZE												
	PD				MT	MTSQ			PROX (VT)		ET		MOFA
	MK399 MOD1	M739 Series	M557	M572	M565	M564	M577 Series	M582 Series	M728	M732 Series	M762	M767	XM773
Agent GB, Non-Persistent, M426		X	X										
Agent VX, Persistent, M426		X	X	X									
HE, M106 (Shallow Cavity)	X	X	X	X		X 3		X		X		x	x
HE, M106 (Deep Cavity)	X	X	X	X		X 3		x	x 2	x		x	x
HE, M404, ICM							X 4				X 4		
HE, M509A1, ICM							X				X		
HERA, M650 (Rocket-On)		x	x	x		X		X 6		X 7		x 6	x
HERA M650 ¹ (Rocket-Off)		x	x	x		X 5		X		X		x	x

WARNING 1 - DO NOT FIRE THE M650 PROJECTILE IF THE OBTURATING BAND IS MISSING OR BROKEN. IF THE BAND IS DISPLACED AND CAN BE REPOSITIONED AND REMAIN IN THE GROOVE, THE PROJECTILE CAN BE FIRED.

NOTE 2 - AUTHORIZED, REQUIRES REMOVAL OF SUPPLEMENTARY CHARGE.

3 - FUZE, MTSQ, M564 IS RESTRICTED FROM FIRING WITH ZONE 9 M188A1. PROPELLING CHARGE.

4 - AUTHORIZED FOR ZONE 7 ONLY.

5 - ROCKET OFF ONLY.

6 - COMBAT EMERGENCY USE ONLY.

7 - ONLY M732A2 FUZE IS AUTHORIZED FOR ROCKET-ON.

PROJECTILES, USE AND CHARACTERISTICS - CONTINUED

**Authorized Propelling Charges Combinations for 8-Inch
Howitzer, SP, M110A with Cannon M201A1**

Type and Model Number of Projectile	M1 ZONE					M2 ZONE			M188 ZONE	M188A1 ZONE	
	1	2	3	4	5	5	6	7	8	8	9
Agent, GB, Non- Persistent, M426	•	•	•	•	•	•	•	•	•	•	•
Agent VX, Persistent, M426	•	•	•	•	•	•	•	•	•	•	•
HE, M106 (Shallow Cavity)	•	•	•	•	•	•	•	•	•	•	•
HE, M106 (Deep Cavity)	•	•	•	•	•	•	•	•	•	•	•
HE, M404, ICM	•	•	•	•	•	•	•	•			
HE, M509A1, ICM	•	•	•	•	•	•	•	•	•	•	•
HERA M650 (Rocket-On)								•	•	•	•
HERA M650 ¹ (Rocket-Off)	•	•	•	•	•	•	•	•	•	•	•

WARNING: 1 - DO NOT FIRE THE M650 PROJECTILE IF THE OBTURATING BAND IS MISSING OR BROKEN. IF THE BAND IS DISPLACED AND CAN BE REPOSITIONED AND REMAIN IN THE GROOVE, THE PROJECTILE CAN BE FIRED.

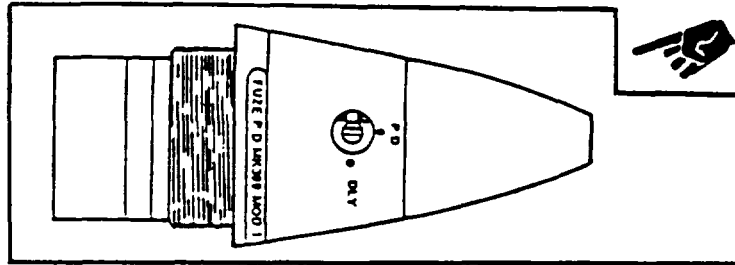
FUZES

Some fuzes to be used are described. For additional information, more detailed descriptions, and functioning of the

authorized fuzes, read TM 43-0001-28 and TM 43-0001-28-4. Refer to page 5-8 for approved projectile/fuze combinations.

FUZE, POINT DETONATING: MK399 MOD1, M557, M572 OR M739

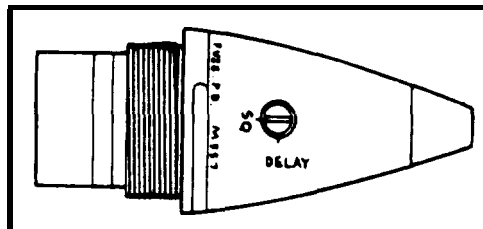
MILITARY OPERATIONS ON URBAN TERRAIN (MOUT) PD FUZE, MK399 MOD 1



- 1 The MK399 MOD 1 MOUT fuze is primarily for use against urban structures (bunkers, buildings, etc.). The fuze has a setscrew that can be turned by a flat-head screwdriver or M18 fuze wrench to select or PD or DLY (delay) function. When set PD. the fuze functions

superquick which is useful for spotting purposes. When set DLY, the fuze penetrates the target to activate the projectile inside the target. The fuze is assembled with a booster pellet and set on the PD mark for shipping. This fuze is rain sensitive.

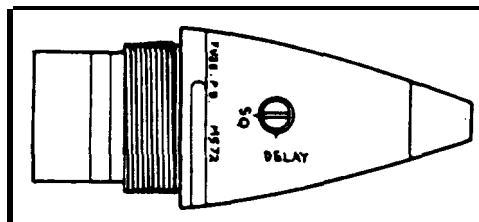
FUZE, POINT DETONATING: M557



- 2 The M557 fuze has a selective superquick-delay setscrew. It is packed set for superquick action and has a booster attached. Premature functioning can

occur when fuzes are fired in heavy precipitation (rainfall, sleet, snow, or hail). This fuze can be set for superquick or delay action by turning the setscrew.

FUZE, POINT DETONATING: M572

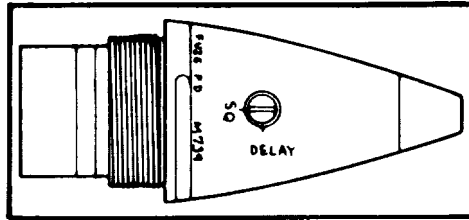


- 3 The M572 fuze is identical to the M557, with the exception of epoxy filler under the steel ogive, and is

handled, set, and fired the same as the M557.

FUZES-CONTINUED

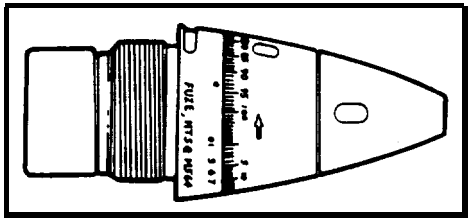
FUZE, POINT DETONATING: M739



4 The M739 series fuzes are the latest improved version of the selective impact fuze. These fuzes have a solid aluminum ogival body with a 2 in. (5.08 cm) threaded base. These fuzes contain a rain insensitive head so that they can be fired through a heavy rainstorm without premature functioning. These fuzes can be set for superquick or delay by turning the setscrew.

5 The M739A1 fuze contains an improved impact delay module which provides more effective functioning in the delay mode. In addition to the stamped marking, the M739A1 fuze body is anodized green for positive identification of fuze model.

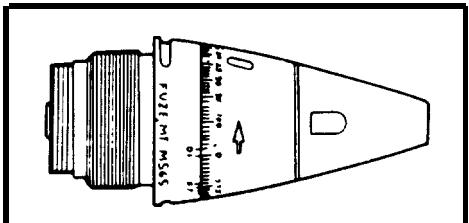
MECHANICAL TIME AND SUPERQUICK FUZE M564



FUZE, MECHANICAL TIME AND SUPERQUICK, M564. The M564 MTSQ fuze is designed to function at time settings from 2 to 100 seconds or upon impact. Fuzes manufactured through 1969 must be set on 90 seconds if superquick (impact) action is desired. Setting of these fuzes between S and 2 seconds may result in functioning of the fuze after approximately 2 seconds.

The date of manufacture is stamped on the fuze body before the lot number. Fuzes manufactured from 1970 on may be set as shipped on S for superquick (impact) functioning. Premature functioning of this fuze may occur downrange if the fuze is fired in heavy precipitation (rainfall, sleet, snow, or hail).

MECHANICAL TIME FUZE M565

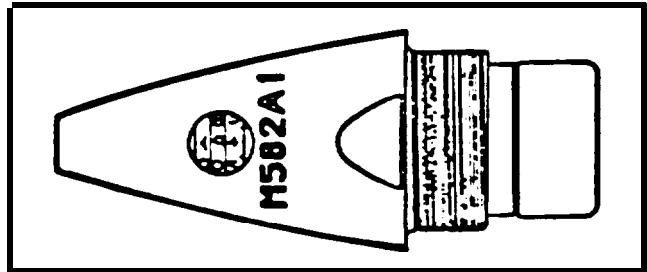
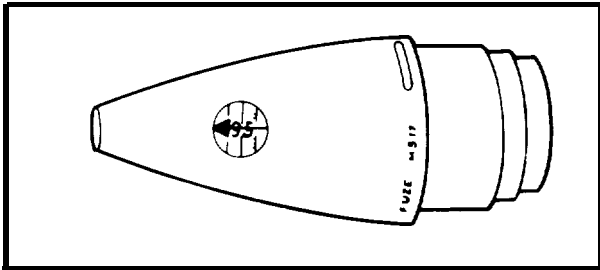


FUZE, MECHANICAL TIME, M565. The M565 fuze is similar to MTSQ fuze M564 except that it does not contain the point detonating assembly nor the booster assembly. The M565 fuze can be set from

2 to 100 seconds and, like the M564, employs a vernier scale to assure a setting accuracy of 0.1 second. This fuze is used with base ejection projectiles only.

FUZES-CONTINUED

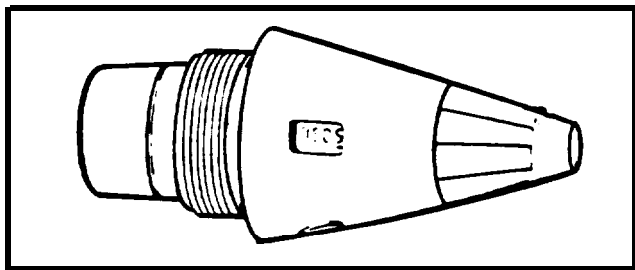
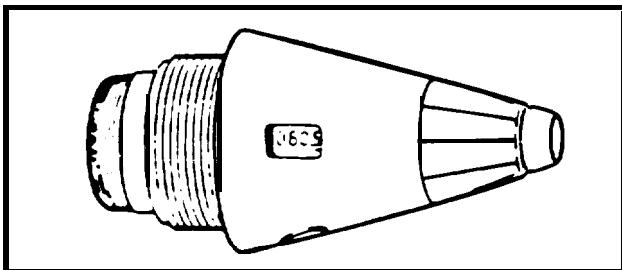
MECHANICAL TIME AND SUPERQUICK FUZE, M577 SERIES AND M582 SERIES



FUZE MECHANICAL TIME AND SUPER-QUICK, M577 AND M582. These fuzes have a 200 second mechanical time mechanism with three movable digital dials similar to a speedometer. Each fuze has a window through which the dials are viewed. The dials permit setting of the fuze to the nearest tenth of a second. The M577A1 and M582A1 MTSQ fuzes contain a different mechanism for point detonating action. Externally the major difference is the configuration of the wrench slots. The M577A1 and M582A1 fuzes are handled, set and fired the same as the basic models. Early manufactured basic and A1 fuzes have black paint finished ogives, while the later produced A1 fuze has a gold (chromite finish) color ogive.

The dial closest to the fuze nose indicates the time in hundreds of seconds. (The triangle (◄!) position is a nontime setting). The second dial indicates time in ten second intervals. The third dial indicates the nearest second and also tenths of seconds by using the scale on the right edge of the dial.

ELECTRONIC TIME FUZE, M762 AND M767



The M582 series fuze is fitted with a booster and is used with burster type projectiles. The M577 series fuze does not contain a booster, and is used with base-ejection projectiles. In order to minimize identification problems, current production of the M582A1 fuzes contain a white stencil "M582A1" below the window on the fuze body.

The M577 series fuze can be used with a special spotting charge when firing the M509A1 projectile in the self-registration mode. See page 5-23.

If M577 series/M582 series fuzes are set for time and the timing mechanism fails, the fuze may or may not function on impact.

The fuzes are not sensitive to rain.

FUZES - CONTINUED

FUZES, ELECTRONIC TIME: M762 AND M767. These fuzes are powered by a reserve lithium battery. The battery is activated manually by rotating the ogive or remotely via inductive auto-set fire controls. An electronic sub-assembly contains integrated circuits that provides controls and logic for 199.9 seconds electronic timing and transmits a fire pulse signal for time function. A Liquid Crystal Display (LCD) provides a visual readout of the fuze setting, as follows:

- a. The column closest to the base end indicates time in hundreds of seconds (the triangle (◄)) position is a nontime setting).
- b. The second column away from base end indicates time in tens of seconds.
- c. The third column away from base end indicates time in seconds.
- d. The fourth column (closest to nose end) indicates time in tenths of seconds.

These fuzes contain an electromechanical Safe & Arming Mechanism (S&A). When set for time function, the S&A provides overhead safety by arming at 50 milliseconds before set time. For this reason, if the fuze impacts before a time setting expires, there will be no PD back-up function. For PD setting, the S&A arms the fuzes at 0.45 seconds in flight. Upon impact, a crush switch assembly (contained in the ogive) senses the impact and transmits a fire signal for PD action.

These fuzes can be set either by hand (rotating ogive) and depressing selector and cocking buttons or remotely by a weapon equipped with auto-set fire control system. The settings can be changed as many times as required for the duration of the activated life of the battery.

These fuze bodies are anodized gold. The rear portion of the ogive is coated with a gold phosphate finish. The forward portion of the ogive is brown plastic and the nose cap is unpainted bronze.

The M762 fuze does not contain a booster and is used with base-ejection projectiles. The M767 fuze is fitted with a booster for firing with burster-type and high-explosive projectiles.

The M762 fuze can be used with a special spotting charge when firing the M509A1 projectile in the self-registration mode. See page 5-23.

If these fuzes fail in the time mode, there is no PD backup.

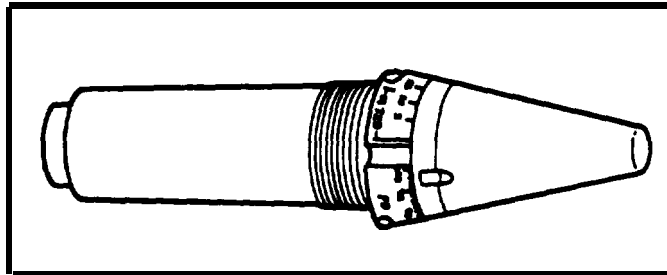
The fuzes are not sensitive to rain.

NOTE

Once activated, the M762 and M767 cannot be turned off; therefore, the fuzes have approximately 15 days service life before the battery runs down and the LCD goes blank.

FUZES-CONTINUED

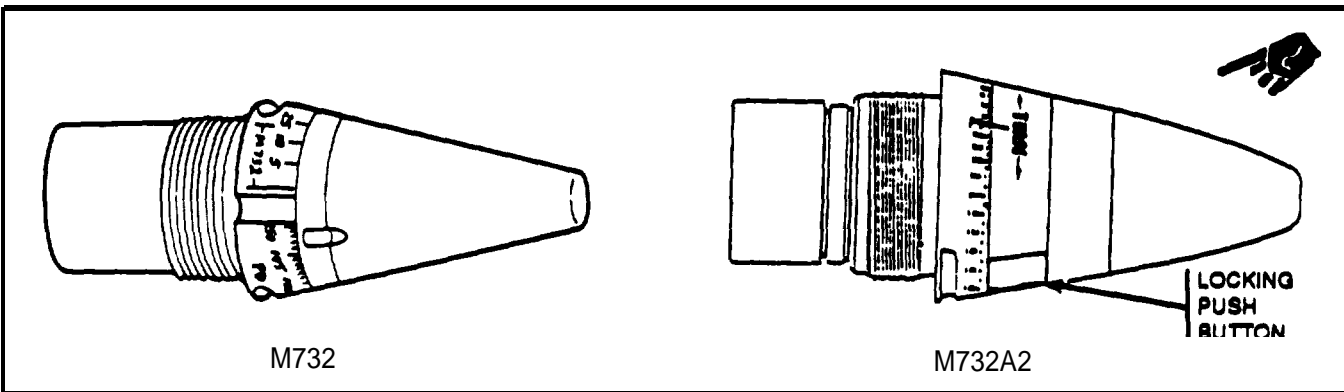
FUZE, PROXIMITY: M728



FUZE, PROXIMITY VARIABLE TIME (VT) M728. The M728 proximity (VT) fuze is a long-intrusion fuze used with deep cavity projectiles and is essentially a self-powered radio end transmitting unit. The fuze can be set from 5 to 100 seconds. The time setting determines at what time along the trajectory the fuze will become activated. The M728 has an impact element that is armed

3 seconds after firing and will function either on proximity action or impact action, whichever occurs first. The M728 should be ret for impact action by setting the time ring to 90.0 seconds or PD mark. A protective coating is on the fuze ogive to reduce the possibility of static electricity causing early downrange functioning.

FUZE, PROXIMITY: M732 SERIES



FUZE, PROXIMITY VARIABLE TIME (VT) M732 SERIES. These proximity variable time (VT) fuzes are short intrusion fuzes of the same overall length as the standard impact or mechanical time fuze. The removal of the supplementary charge is not required. In fact, the supplementary charge must be left in deep cavity projectiles. The M732 fuze can be set from 5 to 150 seconds. The M732A2 fuze can be set from 4 to 156 seconds. Time settings are used to arm these fuzes 3 to 5 seconds prior to set time for proximity function. These fuzes can also function PD as an option of proximity-mode back-up and are always armed for PO at 400 calibers.

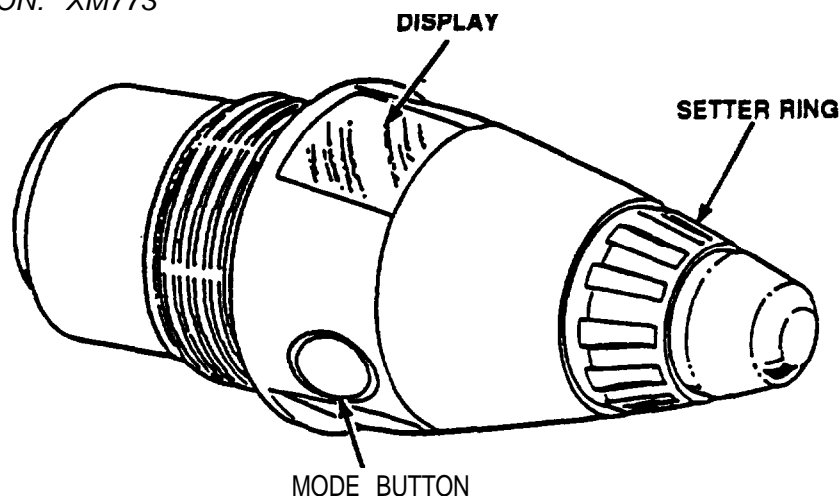
The M732A2 was specially designed for compatibility with rocket-assisted rounds. The M732A2 is set by simultaneously depressing two pushbuttons in the ogive and rotating the setting ring to the desired position. When the pushbuttons are released, the setting ring is locked into position.

NOTE

The PO setting of the M732 series VT fuze, when fired into soft impact areas, will produce less lethality than the superquick setting of the M739 series PO fuze.

FUZES - CONTINUED

FUZE, MULTI-OPTION: XM773



FUZE ARTILLERY, MULTI-OPTION: XM773. This fuze is intended for use with fragmentation (HE loaded) and burster type projectiles. The XM773 is powered by a reserve lithium battery which may be activated manually by rotating the setter ring, or remotely by Inductive auto-set fire controls. There are four functional modes on the fuze; impact (PO), delay (DLY), proximity (PROX), and time (TIME) which are controlled by an electronic subassembly containing integrated circuits that provides control and logic for 199.9 seconds electronic timing, and transmits a fire pulse signal for time and proximity functions. The mission data is displayed on a Liquid Crystal Display (LCD) module in two rows, with the firing mode in the top row and the set time in the bottom row. The readout provided for the fuze setting is as follows:

(1) Top Row: displays one of four modes.

- a. PD
- b. DLY
- c. PROX
- d. TIME

(2) Bottom row: Displays time for proximity and time modes.

- a. The column closest to the base end indicates time in hundreds of seconds.

- b. The second column from the base end indicates time in tens of seconds.
- c. The third column from the base end indicates time in seconds.
- d. The fourth column (the one closest to the nose end) indicates time in tenths of seconds.

The MOFA utilizes a standard M739 Safety and Arming (S&A) mechanism which is housed in a retaining cup just below the detonator block. Both setback and spin locks are used to prevent accidental arming of the S&A prior to firing. This S&A mechanism provides a safe separation distance of at least 400 calibers of projectile travel when fired.

The fuze can be set either by hand (no tools required) or remotely by a weapon equipped with auto-set fire control system. The setting can be changed as many times as required for the duration of the activated life of the battery.

This fuze is not sensitive to rain.

NOTE

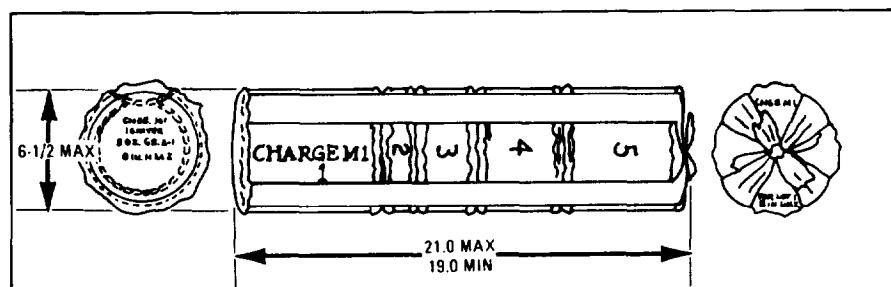
Once activated, the MOFA XM773 cannot be turned off, therefore the fuze will have approximately 15 days of service life before the battery runs down and the LCD goes blank.

PROPELLING CHARGES

Propelling charges authorized for use in the howitzer are divided into a base section and unequally sized increments to provide for zone firing. Service propelling charges consist of smokeless propellant in green or white cloth bags. An igniter charge of black powder contained in a red cloth bag (pad) is sewed to the rear (breach end) of the base section. Red cloth is used for identification and to indicate the presence of

black powder. An igniter protector cap is placed over the igniter pad to protect it during shipment and storage and must be removed before loading the charge into the powder chamber. Four straps (sewed to the base section) secure the other increments to the base section. The following paragraphs list the authorized propelling charges for the howitzer.

8-IN. PROPELLING CHARGE M1

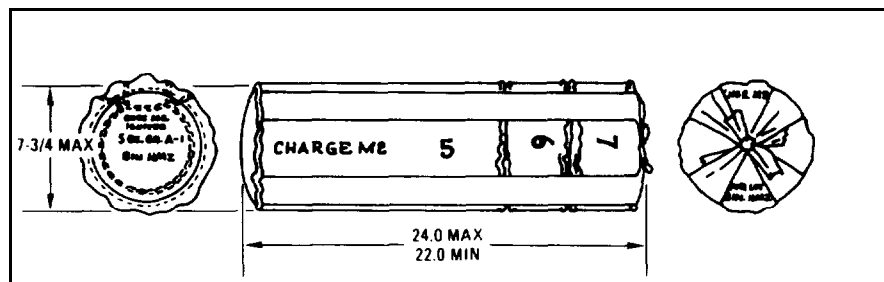


PROPELLING CHARGE M1. This is a "green bag" charge divided into a base and four increments for firing in zones 1 thru 5. The increment bags are tied together by cloth tying straps. An igniter charge in a red

cloth bag is sewed to the rear of the base section. Some M1 propelling charges may have primer MK2A4 packed inside the container. This primer, MK2A4, is not authorized for firing in the M201A1 cannon.

PROPELLING CHARGES - CONTINUED

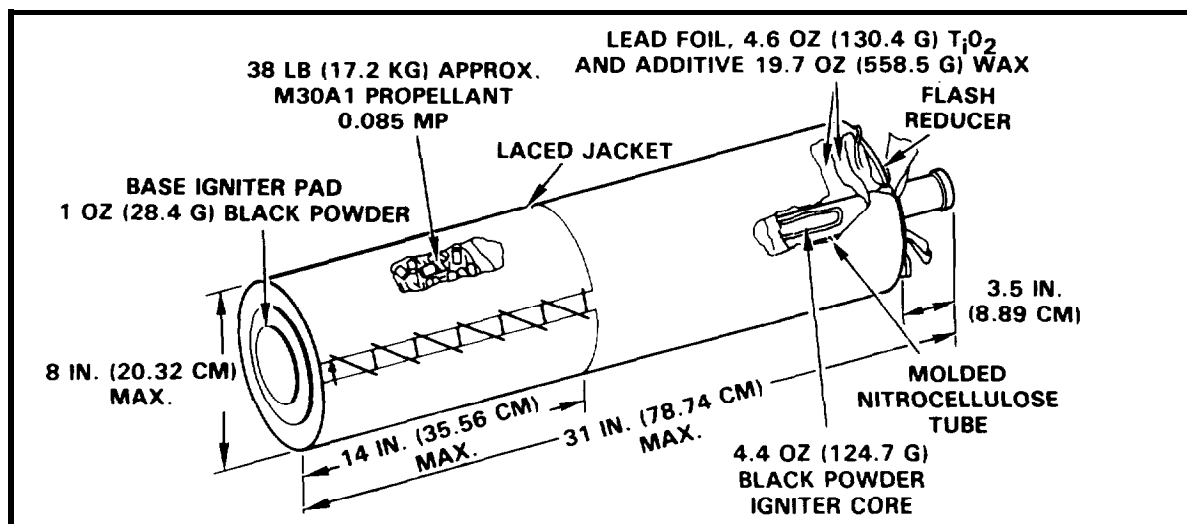
8-IN. PROPELLING CHARGE M2



PROPELLING CHARGE M2. This is a “white bag” charge divided into a base charge (charge 5) and two increments numbered 6 and 7. The two increment bags 6 and 7 are secured to the base charge by cloth tying straps. An igniter charge in a red cloth bag

is sewed to the rear of the base section. Some M2 propelling charges may have primer MK2A4 packed inside the container. This primer, MK2A4, is not authorized for firing in the M201A1 cannon.

8-IN. PROPELLING CHARGE M188

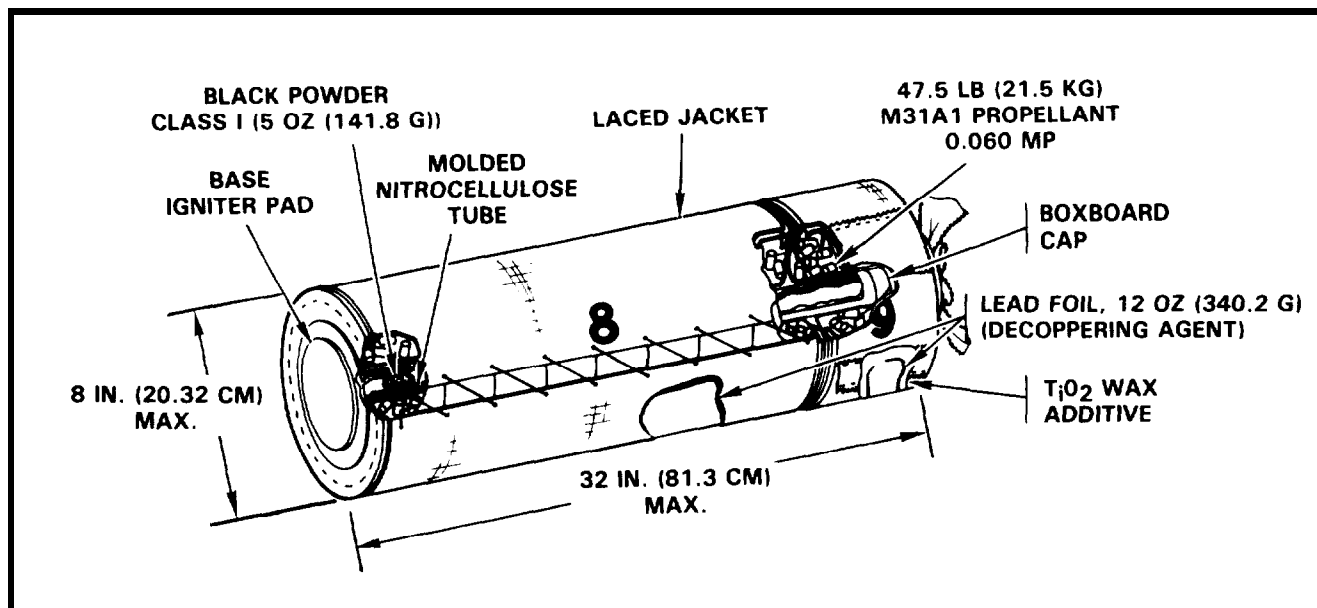


PROPELLING CHARGE M188. This is a one-increment “white bag” charge, 31 in. long by 8 in. (79.74 cm long by 20.32 cm) in diameter. A red cloth igniter charge is sewed to the rear (breech end) of the main charge. An igniter core extends through the center of the charge, protruding approximately 3-1/2 in. (8.89 cm) out of the

forward end. An additive to reduce gun tube wear lines the forward end of the charge. A jacket made of acrylicviscose rayon is wrapped around the charge assembly and laced up with cord. The jacket serves to maintain the proper propellant charge configuration.

PROPELLING CHARGES - CONTINUED

8-IN. PROPELLING CHARGE M188A1



NOTE

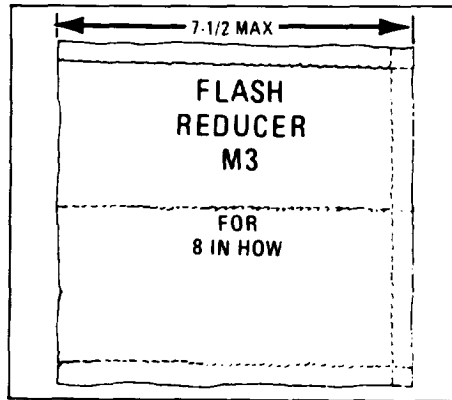
A yellow discoloration of the M188A1 bag may occur but does not affect performance and is safe to fire.

PROPELLING CHARGE M188A1. This is a two-increment "white bag" charge, 32 in. long by 8 in. (81.28 cm long by 20.32 cm)

in diameter. A red cloth igniter charge is sewed to the rear (breach end] of increment 8. An igniter core extends through the center of the charge. An additive to reduce gun-tube wear is part of increment 9. A jacket made of acrylicviscose rayon is wrapped around increment 8 and laced up with cord. The jacket serves to maintain the proper propellant charge configuration.

PROPELLING CHARGES - CONTINUED

FLASH REDUCER M3 (T3) FOR 8-IN. WHITE BAG PROPELLING CHARGE

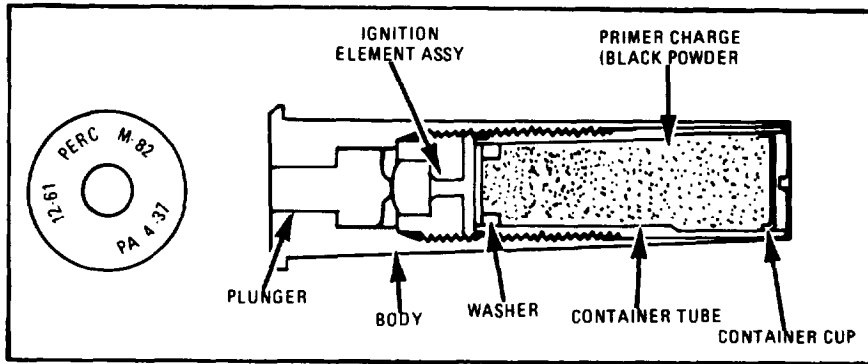


Flash reducer M3 (T3) is a separate item of issue that is used with propelling charge M2 (charges 5, 6, and 7) only. Although the flash reducer increases the quantity of smoke, it should be used in daylight as well as night unless tactically unsound. Flash reducer M3 (T3) is placed in front of the

highest white bag charge of the M2 propelling charge that is being fired. Be sure that the flash reducer is slipped underneath the tying straps so that when the charge is loaded, the flash reducer is toward the base of the projectile.

PRIMERS

PRIMER M82



WARNING

The M82 is the only primer authorized for firing in this cannon. Do not fire the MKZA4 in this cannon. Turn them in to the ammunition supply point.

Percussion primer M82 is packed one per waterproof bag. Primers are ready for firing when unpacked and should be protected from blows that might cause accidental malfunctioning.

Section II. AMMUNITION PREPARATION FOR FIRING

SECTION INDEX

	Page
AFTER FIRING PROCEDURES	5-34
AMMUNITION PREPARED FOR FIRING BUT NOT FIRED	5-34
FUZE SETTING	5-23
Impact fuzes	5-24
Proximity fuze setting	5-24
FUZING	5-20
Fuze assembly	5-22
Lifting plug removal	5-20
Supplementary charge (deep-cavity projectiles only)	5-20
Typical deep-cavity projectiles	5-21
GENERAL PREPARATION.	5-19
Packing and unpacking	5-19
LOADING	5-32
PROPELLING CHARGE PREPARATION	5-32
Propelling charge M188	5-32
Propelling charge M188A1	5-32
Propelling charges M1 and M2	5-32

GENERAL PREPARATION

Unless otherwise specified, observe the following temperature limits when firing.

Lower limit: - 40°F (- 40°C)

Upper limit: +125°F (+52°C)

M188A1: - 50°F (- 46°C)
+ 145°F (+63°C)

NOTE

Powder temperature should be constantly monitored with self-indicating thermometer (item 13, appx C) and powder temp provided to the FDC upon request.

PACKING AND UNPACKING



Do not use axes, crowbars, etc which may damage ammunition or packaging.

Retain packing materials that may be required for repacking.

- Propelling charges M1, M2, M188, and M188A1 are packed one complete charge per metal container.
 - Flash reducer M3 (T3) is packed 10 to a barrier bag, 1 bag per carton, and 4 cartons per wooden box.
 - Fuzes are usually packed in metal boxes, and then packed in wooden boxes.
- 1 Inspect ammunition and verify item identification.
 - 2 Unpack ammunition and perform inspections in section III. Refer to page 5-34.
 - 3 Return all defective ammunition to the ammunition supply point.

FUZING

LIFTING PLUG REMOVAL

WARNING

If energy absorbing lifting plug has been broken, do not remove the stem. Return projectile to ammunition supply point.

NOTE

- Use any available bar to remove lifting plug to gain access to fuze well.
- The fusible or universal lifting plug has been provided on all M509A1 projectiles and on some M404 projectiles as a safety device. This plug provides the projectiles with a venting port should it become subjected to extreme heat or fire. This

vent allows pressure to escape rather than build up and cause ejection of the cargo.

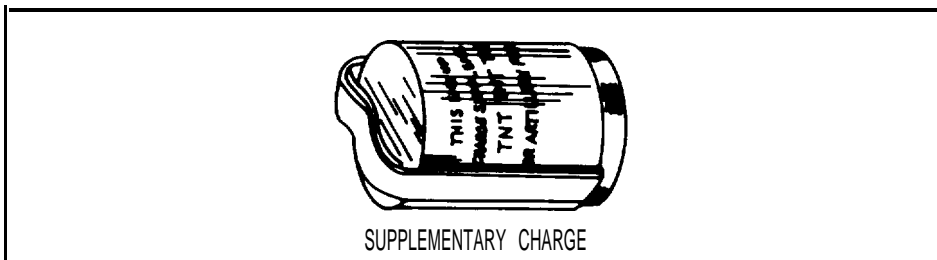
- 1 Remove lifting plug by unscrewing counterclockwise.
- 2 Remove spacer beneath plug if present.
- 3 Inspect fuze well cavity and projectile threads for damage and presence of foreign material.
- 4 Remove foreign material.

WARNING

Do not use projectiles with any trace of explosive filler on the outside of the projectile or in the fuze well cavity.

- 5 If any high explosive is observed in the fuze well cavity or on the projectile threads, reject the round and return it to ammunition supply point.

SUPPLEMENTARY CHARGE (DEEP-CAVITY PROJECTILES ONLY)



FUZING - CONTINUED

SUPPLEMENTARY CHARGE (DEEP-CAVITY PROJECTILES ONLY)-CONTINUED

WARNING

- The supplementary charge is only removed when M728 proximity fuzes are to be fired. Do not fire PD, MTSQ, ET, or M732 series proximity fuzes in deep cavity projectiles without the supplementary charge.
- Do not attempt to remove the supplementary charge by any means

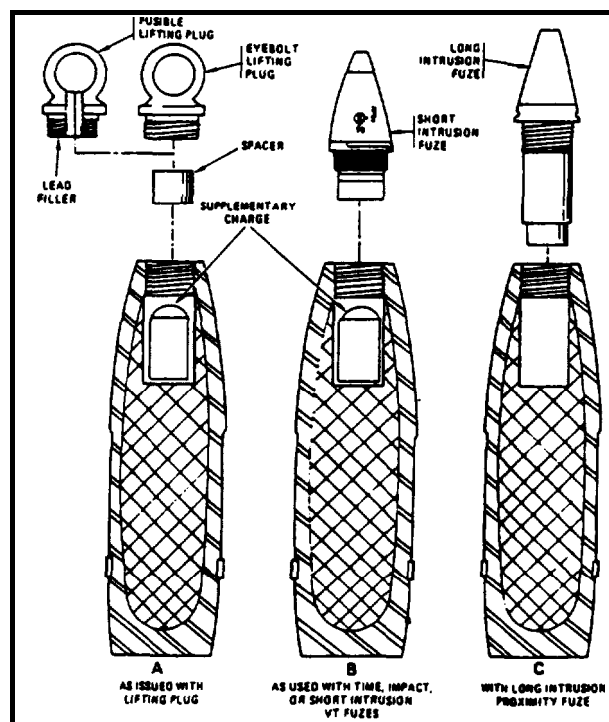
other than the lifting loop. Use of a screwdriver or other tools to remove charge is dangerous.

- 1 For firing with M728 proximity fuzes, remove the supplementary charge by means of its lifting loop.
- 2 If charge can not be removed by lifting loop, either fire with PD, MTSQ, ET, short intrusion proximity fuze, or turn round in to ammunition supply point.
- 3 Pack supplementary charges in containers from which proximity fuzes have been removed and turn in to ammunition supply point. Do not try to burn.

TYPICAL DEEP-CAVITY PROJECTILES

NOTE

The supplementary charge must be left in the projectile when firing short intrusion fuzes such as the mechanical time, electronic time, impact, or short intrusion (VT) fuzes. The supplementary charge must be removed when firing the long proximity (VT) fuzes.



FUZING - CONTINUED

FUZE ASSEMBLY

The following procedures apply to all fuzes.

- 1 Screw fuze in by hand. If binding occurs, inspect fuze cavity and threads on both fuze and projectile. Reject whichever is damaged.

WARNING

When tightening fuze to projectile, do not hammer on fuze wrench or use extension handle on fuze wrench. Do not stake fuze to projectile under any circumstances. Shocks transmitted to fuzes during assembly may cause a malfunction.

- 2 Using fuze wrench M18, tighten fuze to projectile so fuze shoulder is seated flush with nose of projectile.

WARNING

Rounds fired without a fuze or with improperly seated fuzes may result in premature functioning.

NOTE

For proximity fuzes with a gap between the fuze shoulder and projectile, either replace the supplementary charge and fire with impact PD, MTSQ, or ET fuze or dispose of round.

- 3 If projectile setscrew is present, tighten to below level of contour of projectile.

CAUTION

Always be sure that supplementary charge is in deep cavity projectile before adding fuze-booster combination.

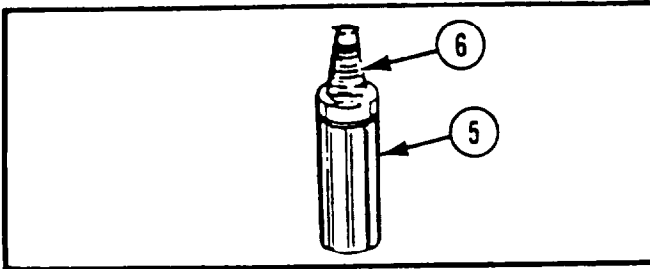
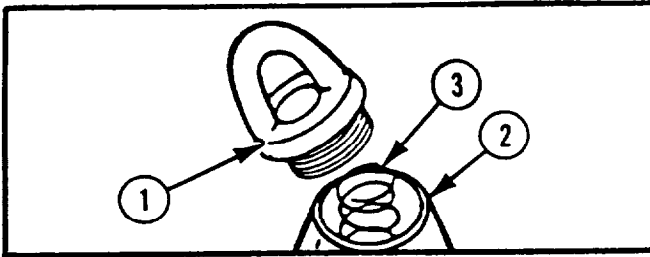
SPECIAL PREPARATION FOR M565. The MT M565 fuze is used with base ejection rounds and cannot be used with conventional high explosive rounds because it has no booster. It has no superquick action and if fired in a conventional HE round, duds will always occur in the target area. Use this fuze in base ejection projectiles only, such as improved conventional munitions round M404. Do not use the M565 fuze in M509A1 ICM round.

SPECIAL PREPARATION FOR M577 SERIES/M582 SERIES. Before fuzing projectile, inspect fuze setting. If setting is not between ◀93.5 and ◀95.5, fuze shows signs of damage, or window is blackened or sooty inside, fuze will be considered unserviceable. After inspecting, assemble fuze handtight, back off one quarter turn, and with M18 fuze wrench, tighten fuze to projectile with a sharp snap of wrench. Make sure fuze shoulder seats firmly against projectile nose. The M577 series fuze is used with base ejection projectiles only. It can be fired in ICM projectile M404, or in M509A1.

SPECIAL PREPARATION OF ICM PROJECTILE M509A1 FOR SELF REGISTRATION MODE. When the command for use of the M509A1 projectile includes self registration mode, the expulsion charge in the projectile must be removed and a separate issue spotting charge threaded on the fuze as follows:

FUZING - CONTINUED

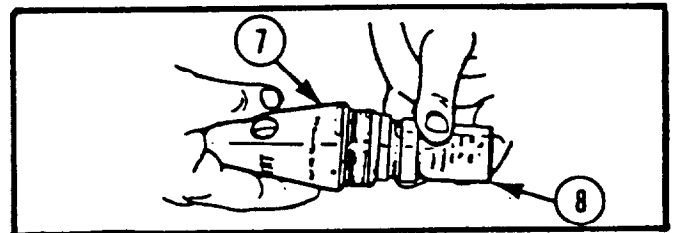
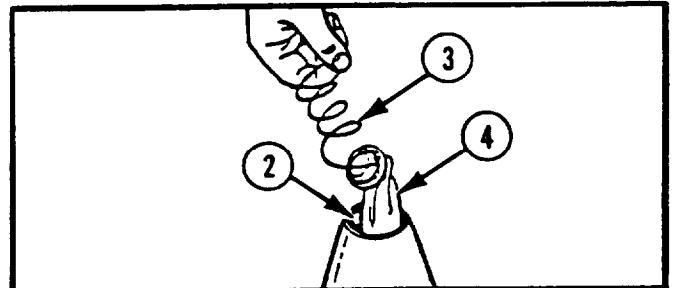
FUZE ASSEMBLY-CONTINUED



- 1 Remove the fusible or universal lifting plug (1) with attached gasket and inspect the fuze well (2). When the lifting plug is removed, the compressed coiled pullwire (3) will expand and protrude beyond the fuze well of the projectile ogive.
- 2 Remove the bagged expulsion charge assembly (4) by grasping and firmly pulling the pullwire (3). If the projectile is assembled with the cylindrical plastic expulsion charge (5), remove it by pulling the tab (6). Set charge assembly aside for disposition. Visually inspect the fuze well (2) for loose grains of propellant or other foreign material. Remove any loose material.
- 3 Obtain an M577 series or M762 series fuze (7) and a projectile spotting charge (8).

WARNING

When screwing the projectile spotting charge (8) on to rear of the M577 series or M762 series fuze, ensure that shoulder of projectile spotting



charge is seated squarely against shoulder of fuze. An improperly seated charge could cause a malfunction.

CAUTION

When assembling projectile spotting charge to fuze, exercise care to avoid damaging threads. If binding occurs, consider charge unserviceable and report it for disposition. If binding has occurred, reinspect fuze to assure it is still serviceable.

- 4 If firing the M509A1 projectile in the self-registration mode, screw the projectile spotting charge (8) handtight onto the M577 series or M762 series fuze (7) (left-hand thread).

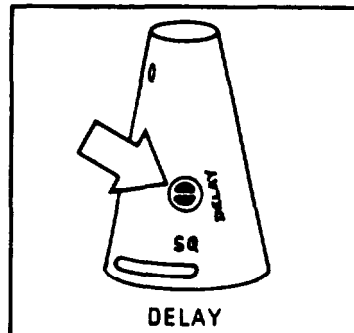
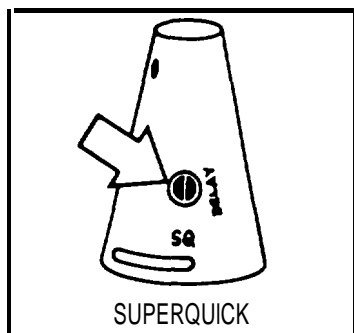
FUZE SETTING

The following procedures apply to authorized fuzes for the howitzer. Fuze setting tools and procedure numbers are listed on page 5-31.

FUZE SETTING - CONTINUED

IMPACT FUZES

PROCEDURE NO. 1, M557, M739 SERIES, M572, and MK399 MOD 1 IMPACT FUZES



NOTE

If M557, M572, or MK399 MOD 1 PD fuze is fired in heavy rainfall, downrange prematures may occur.

for delay action, use the screwdriver end of M18 fuze wrench or similar tool. Turn slot 90 degrees to align with index mark indicating DELAY or DLY. If superquick action is desired, there should be no setting preparation required since the fuze, as issued, is set for superquick action; however, always check the setting to make sure.

Impact PD fuzes for the 8 in. weapons with superquick or delay functioning are shipped set for superquick or PD action. To set fuzes

PROXIMITY FUZE SETTING

■ PROCEDURE NO. 2, M728 AND M732 SERIES PROXIMITY FUZES

WARNING

Do not fire projectile unless fuze is fully seated. Inbore explosion may result.

CAUTION

Plastic nose cone rotates with index mark and damage to plastic cone will produce duds. If counterclockwise rotation is used in setting fuze, be sure that fuze has not become loosened from projectile.

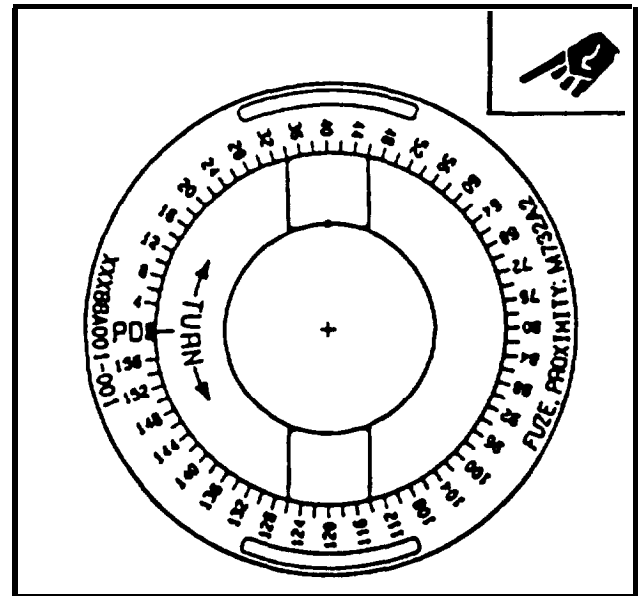
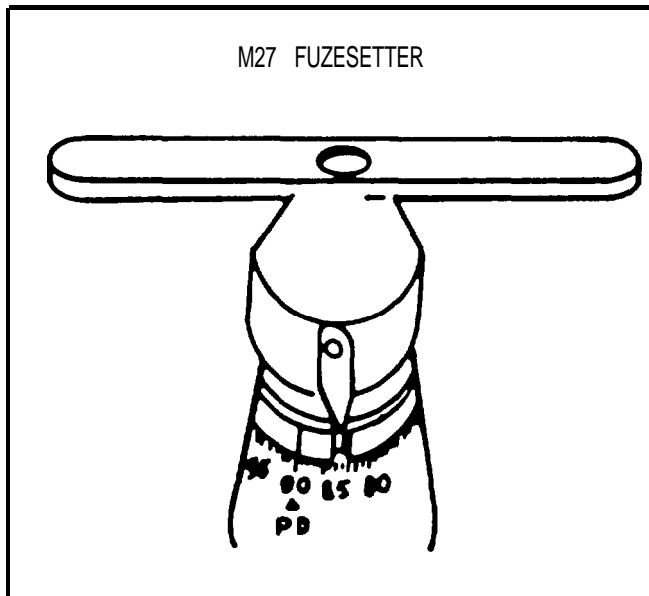
NOTE

Rotation of the M732 nose cone has been experienced at top zones (not a safety hazard). If this occurs when M732 fuze is set on time for proximity function, PD function might occur instead. In such instances, set the fuze to a time of 10 seconds less than the time of flight for proximity function. If this occurs when M732 fuze is set on PD mark, proximity functioning may occur instead of impact functioning. In such instances, set the fuze to a time equal to time of flight plus 10 seconds for impact function.

FUZE SETTING - CONTINUED

PROXIMITY FUZE SETTING-CONTINUED

PROCEDURE NO. 2, M728, AND M732 PROXIMITY FUZES-CONTINUED



- 1 These fuzes are set when the index line at the base of the nose cone is aligned with time, in seconds engraved on the base of the fuze.
- 2 To set fuze for proximity action, rotate nose cone with M27 fuze setter, normally in clockwise direction, until the index mark coincides with the announced time. Since there is no backlash, the fuze setting can be accomplished, or changed one or more times, by rotating the index mark in either direction. These fuzes are shipped with the index mark on the nose cone set as follows:

M728 at 10 second setting.

M732 at PD.
- 3 For impact functioning, set the M732 fuze on PD and set the M728 fuze to 90 seconds (100 second line for flight times exceeding 85 seconds).

- 3.1 Set the M732A2 fuze manually by aligning the index mark on the movable aluminum setting ring to the desired setting as marked on the fuze sleeve.
- 3.2 For proximity functioning, set the M732A2 by simultaneously depressing the two locking pushbuttons on the setting ring and rotate the setting ring to align the index mark to the desired time setting. After pushbuttons are released, the setting will be locked in place. This procedure may be repeated as necessary.
- 3.3 For impact functioning of the M732A2 fuze, align the index mark with the PD mark on the fuze sleeve.
- 4 Firing temperature limit for M728 and M732 proximity fuzes is -40° to + 140°F (-40° to +60°C).

NOTE

Do not attempt to set fuze until just before firing.

FUZE SETTING - CONTINUED

PROXIMITY FUZE SETTING - CONTINUED

PROCEDURE NO. 3, M564 AND M565 FUZES

Setting M564 Fuze for Superquick (Impact) Action.

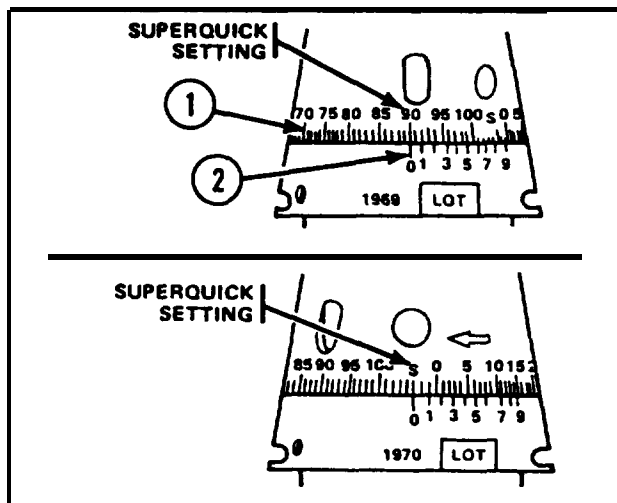


To avoid accidental functioning of PD element in M564 fuze, do not drop, roll, or strike the fuze under any circumstances (packaged, unpackaged, or assembled to the projectile).

NOTE

If M564 fuzes are fired in heavy precipitation (rain, sleet, snow, or hail), occasional downrange premature functioning may occur. The precipitation necessary to cause malfunctioning is comparable to a heavy downpour which occurs during a summer thundershower. The premature rate will vary with the charge fired and the density of the precipitation.

- 1 For M564 fuzes manufactured prior to January 1970, use M34 fuze setter to



rotate the lower cap in the direction of the arrow (clockwise) from shipping "S" position until the 90-second position on the lower cap scale is aligned with the "O" on the vernier scale.

NOTE

Whole second numbers (1) are on lower cap scale and tenths of a second numbers (2) are on vernier scale.

- 2 For M564 fuzes manufactured in January 1970 and later, set the fuze on "S" as shipped for superquick action. Always be sure the "S" on the lower cap scale is aligned with the "O" on the vernier scale.

Setting M564 and M565 Fuzes for Airburst (Time).

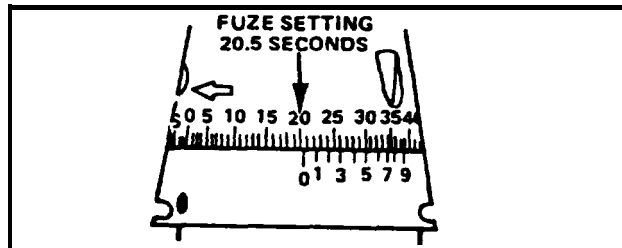


Incorrect setting of MT and MTSQ fuzes can and have resulted in downrange prematures.

NOTE

Do not attempt to set the fuze until just before firing.

- 3 To set the M564 and M565 fuzes for a whole-second time setting, use the M34



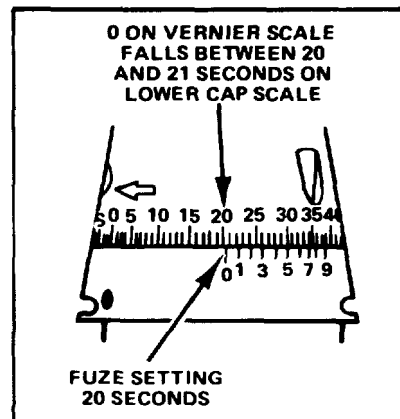
fuze setter to rotate the lower cap in the direction of the arrow (clockwise), until the desired whole number of seconds (e.g., 20.0 seconds) on the lower cap scale is aligned with the "O" mark engraved on the vernier scale.

FUZE SETTING - CONTINUED

PROXIMITY FUZE SETTING - CONTINUED

SETTING M564 AND M565 FUZES FOR AIRBURST (TIME)-CONTINUED

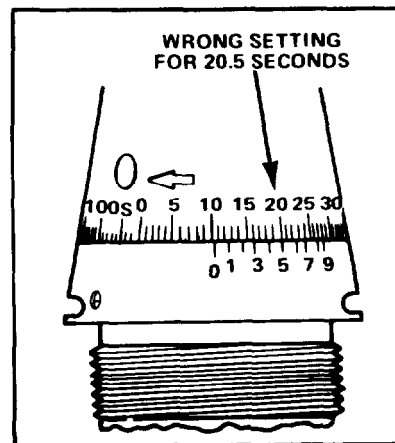
4 To set the M564 and M565 fuzes for a tenth of a whole second (e.g., 20.5 seconds), use the M34 fuze setter to set the fuze for the whole seconds on the lower cap scale (in this case the whole is 20 seconds). Next find the desired tenth of a second mark on the vernier scale. Continue to slightly rotate the lower cap in the direction of the arrow until the adjacent upper right graduation on the lower cap scale is aligned with the desired tenth of a second mark on the vernier scale.



NOTE

The whole second fuze setting is always indicated by the position of the "O" on the vernier scale. Each vertical mark on the lower cap scale (movable portion of the fuze) represents one whole second of time. For other than whole-second settings, the "O" on the vernier scale (nonmovable portion of the fuze) must always be to the right of the whole-second portion of the desired fuze setting and between the whole-second portion of the desired fuze setting and the next one whole-second vertical mark. For example, for a setting of 20.5 seconds, the "O" on the vernier scale is to the right of the 20-second mark and midway between the 20- and 21- second marks on the lower cap scale.

An incorrect fuze setting for 20.5 seconds is shown above. If a fuze is set in this way for 20.5 seconds firing, the fuze is actually set on and will function at 10.5 seconds. This would cause the fuze to function earlier than desired.



FUZE SETTING - CONTINUED

PROXIMITY FUZE SETTING-CONTINUED
 RESETTING FUZE

If you miss the setting, use the M34 fuze setter and turn the lower cap in the opposite direction (counterclockwise) 2 or 3 seconds below the desired setting. Then rotate the lower cap in the direction of the arrow (clockwise) and set the fuze on the correct time. This can also be done by turning the lower cap in the direction of the arrow (clockwise) all the way around (additional turn) to obtain the desired setting.

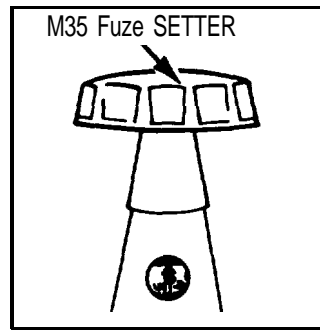
PROCEDURE NO. 4, M577 SERIES AND M582 SERIES FUZES.

The slotted setting key on nose of the fuze is used for setting the fuze in the following steps:

- 1 Press the open end of M35 fuze setter against setting key.
- 2 Turn knob handle of fuze setter counterclockwise (as viewed from nose end) until setter blade engages fuze setting key slot. The hairline in window is used for all settings.

FUZES NOT FIRED

If prepared for firing but not fired, reset the fuze, using M34 fuze setter, by turning the lower cap in the direction of the arrow (clockwise) until the "S" mark on the fuze lower cap scale is in line with the "O" mark on the vernier scale.



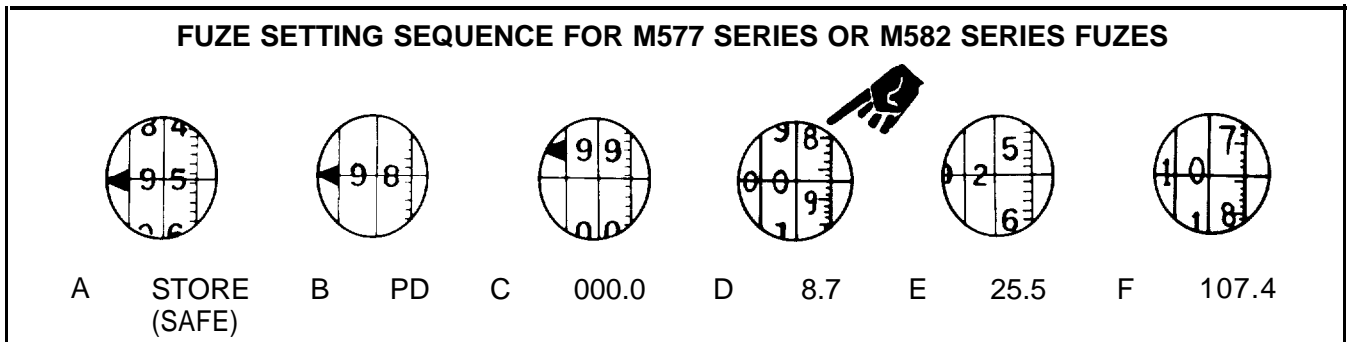
NOTE

The M577 series or M582 series fuzes are set to the desired time by rotating fuze setter in a counterclockwise direction. To return to shipping and storage setting, the fuze setter must be rotated in a clockwise direction.

DIRECTION OF SETTING OR RESETTING M577 SERIES OR M582 SERIES FUZES	
<u>COUNTERCLOCKWISE</u>	<u>CLOCKWISE</u>
<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> </div> <div> <p>SHIPPING AND STORAGE SETTING (93.5 TO 95.5)</p> <p>PD SETTING (98.0)</p> <p>001 SECONDS.</p> <p>200 SECONDS</p> </div> </div>	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> </div> <div> <p>1/4 TURN</p> <p>1/4 TURN</p> <p>1/4 TURN</p> <p>20 TURNS</p> </div> </div>

FUZE SETTING - CONTINUED

PROXIMITY FUZE SETTING - CONTINUED



CAUTION

Do not attempt to set these fuzes below 93.5 when setting them in the clockwise direction or above 200 seconds when setting them in the counterclockwise direction. The settings of 000 and/or 200 are not authorized service settings.

- 3 When setting the fuze for PD action (superquick), start with shipping and storage position (safe) (◀93.5 to 495.5); then turn counterclockwise to ◀98.0 under the hairline window for PD action.
- 4 To set the fuze for mechanical time action, turn the fuze setter counterclockwise from safe position (◀93.5 to 495.5) past PD (◀98.0), until the triangle (◀) moves off the hairline. This action occurs near a 000 setting. Continue to turn fuze setter counterclockwise until desired time appears under the hairline. Maintain a very light turning force against the fuze setter while reading the setting. The sequence is illustrated above for settings of 8.7, 25.5 and 107.4.
- 5 To set a lower time on fuze already set, reseal fuze setter and turn clockwise (numbers get smaller) to a setting at least one second lower than the required setting (for example, at least 24.5 for 25.5). Reverse direction to counterclockwise (numbers get larger) and set required time under the hairline.
- 6 To return fuze to the shipping and storage (safe) position, turn the fuze setter clockwise (numbers get smaller) until 000 is passed, and continue to turn until setter stops turning freely. This point should be past the PD setting (◀98.0) and between ◀95.5 and ◀93.5. Notice that the triangle has reappeared in the window. Do not apply excessive force on the fuze setter after it has stopped turning and the setting is between ◀95.5 and ◀93.5. Return the fuze to the reusable fuze container.
- 7 For special preparation for M577 series fuze, perform the following procedure. Inspect the fuze setting. The fuze will be considered unserviceable if the setting is not between ◀93.5 and ◀95.5, the fuze shows signs of damage, or the window is blackened or sooty inside.
- 8 Firing temperature limits for M577 series and M582 series TS fuzes are -35° to + 145°F (-37° to + 63°C).

FUZE SETTING - CONTINUED

PROXIMITY FUZE SETTING-CONTINUED

PROCEDURE NO. 5, M762 AND M767 FUZES. These fuzes can be set either by hand or remotely by a weapon equipped with auto-set fire control system, as follows:



Do not activate these fuzes unless they will be fired before 15 days lapse. Once activated, these fuzes have a service life of approximately 15 days, before the battery runs down. Check if liquid crystal display (LCD) is active to determine if fuze is still settable.

1 Setting by Hand:



After steps (a) and (b) are completed, if the LCD display is blank or shows other displays than indicated, the fuze is considered unserviceable and should not be fired.

NOTE

The M762 or M767 fuze ogive will rotate only clockwise (as viewed from nose end). If a desired digit was passed, continue rotating clockwise until the desired digit appears again.

- a. Rotate ogive clockwise at least one quarter revolution to activate the battery. The LCD window will display ◀88.8 indicating that all segments are operating as a visual safety check.
- b. Depress the thumb operated cocking and selector button to clear the LCD display. The LCD window will display - - - - insuring that no segments are stuck.

- c. Depress the thumb operated cocking and selector button a second time; the LCD window will display 000.0. The cursor under the zero in the hundreds of seconds column indicates that this column is ready to be set.

NOTE

The hundreds of seconds column can display 0, 1 or ◀, while the tens of seconds, seconds, and tenths of seconds columns each can display 0 thru 9.

- d. Each column is set independently. Depress and release the selector button as required to move the cursor to the desired column. At the desired column, keep the selector button depressed and rotate the ogive to select the desired digit or ◀. Release the selector button and depress again to move cursor to the next column to continue setting.
- e. For PD, set the fuze to ◀ 98.0. Any other setting with ◀ would result in a dud.
- f. The following are examples of fuze settings:

<u>◀980</u>	<u>0008</u>	<u>0073</u>
PD	0.8 seconds	7.3 seconds

<u>040.1</u>	<u>169.0</u>
40.1 seconds	169 seconds

- g. When fuze setting is completed and selector button is released, the ogive can be rotated without changing the fuze setting.
- h. The settings can be changed as many times as required for the duration of the activated life of the battery.

FUZE SETTING - CONTINUED

PROXIMITY FUZE SETTING-CONTINUED

PROCEDURE NO. 5, M762 AND M767 FUZES-CONTINUED

- 2 Auto setting is accomplished via an inductive data link between the fuze and a weapon equipped with an auto-set fire control system. The desired fuze setting is inputted in the setter console and the transmit button is depressed. The fuze will be remotely activated and set and the console will display the actual fuze setting as a safety feature.
- 3 To return fuze to the shipping and storage configuration, reset the fuze to 88.8. These fuzes should be segregated and used first in subsequent firings.
- 4 Firing temperature limits for M762 and M767 ET fuzes are - 25°F to 110°F (- 32°C to + 43°C).

MULTI-OPTION FUZE SETTING

PROCEDURE NO. 6, XM773 FUZE

PROCEDURE NO. 6, FUZE XM773. This fuze can be set either by hand or remotely by a weapon equipped with auto-set fire control system, as follows:



Do not activate this fuze unless it will be fired before 15 days elapse. Once activated, the fuze has a service life of approximately 15 days before the battery runs down. Check if LCD is active during the setting procedure to determine if fuze is still settable.

1 Setting by hand.

a. Setting for Impact (PD) mode.

- (1) Rotate setter ring clockwise to activate pre-launch reserve battery.

Once the battery is activated, the LCD segment display appears for visual check-out.

- (2) Depress and hold the mode button located on the side of the fuze, then rotate the setter ring "ONE CLICK" while still holding the mode button. The LCD will display PD.

- (3) Release the mode button, in 20 seconds the LCD display disappears. The fuze is now set for PD.

b. Setting for Delay (DLY) mode.

The setting procedures for the Delay mode are the same as those for the Impact mode, except for procedure (2). The setter ring is rotated "TWO CLICKS" instead of one, the LCD will display DLY.

c. Setting for Proximity (PROX) mode.

- (1) Rotate setter ring clockwise to activate the pre-launch reserve battery. Once the battery is activated, the LCD segment display appears for visual check-out.

- (2) Depress and hold the mode button located on the side of the fuze, then rotate the setter ring "THREE CLICKS" while holding the mode button. The LCD will display PROX.

- (3) Release the mode button and the mode option is fixed (proximity mode setting).

- (4) Depress and hold the mode button, and the bottom row of the LCD displays the column closest to the base end of the fuze. This represents hundreds (100' s) of seconds.

FUZE SETTING - CONTINUED

MULTI-OPTION FUZE SETTING - CONTINUED

PROCEDURE NO. 6, XM773 FUZE - CONTINUED

(5) Rotate the setter ring one click while still holding the mode button. The LCD displays "1," further rotation of the setter ring toggles the "1" on and off.

(6) Release the mode button and the 100' s digit is fixed.

(7) Depress and hold the mode button, the LCD displays the second column from the base end of the fuze. This represents tens (1 0' s) of seconds.

(8) Rotating the setter ring while holding the mode button will advance the set from 0 thru 9 and wrap around after the 9 (returning back to 0).

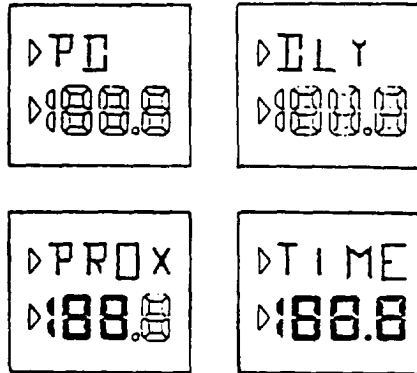
(9) Release the mode button at the desired 10' s digit and the 10' s digit is fixed.

(10) Repeat procedures 7 thru 9 to set the unit and decimal digits. The LCD display disappears 20 seconds after releasing the mode button for the decimal digit. The fuze is now set for PROX with enable time.

d. Setting for time (TIME) mode.

The setting procedures for the time mode are the same as those for the proximity mode except for procedure (2). The setter ring is rotated "FOUR CLICKS" instead of three. The LCD will display TIME.

e. The following are examples of fuze settings.



f. When fuze setting is completed and the mode select button is released, the setter ring can be rotated without changing the fuze setting.

g. Setting can be changed as many times as required for the duration of the activated life of the battery.

- 2 Auto-setting is accomplished by an inductive data link between the fuze and a weapon equipped with an auto-set fire control system. The desired fuze setting is input in the setter console and the transmit button is depressed. The fuze will be remotely activated and set, and the console will display the actual fuze setting as a safety feature.
- 3 Firing temperature limits for the XM773 fuze are -25 °F to +125 °F (-32 °C to +52 °C).

Fuze Assembly, Fuze Setting Tools and Procedures for 8-inch Howitzer, M110A

Fuze													Wrench or Setter	Fuze Setting Procedure Number
MOFA	Impact (PD)				MT	MTSQ			ET		Proximity (VT)			
XM773	MK399 MOD 1	M739 Series	M557	M572	M565	M564	M577 Series	M582 Series	M762	M767	M732 Series	M728		
	•	•	•	•									M18	1 (page 5-24)
											•	•	M18 to tighten fuze in projectile M27 to set time (except M732A2)	2 (page 5-24)
					•	•							M18 to tighten fuze in projectile, M34 to set time	3 (page 5-25)
							•	•					M18 to tighten fuze in projectile, M35 to set time or PD	4 (page 5-28)
									•	•			M18 to tighten fuze in projectile	5 (page 5-30)
•													M18 to tighten fuze in projectile	6 (page 5-30.1)

PROPELLING CHARGE PREPARATION

PROPELLING CHARGES M1 AND M2

WARNING

Under no circumstances will green bag and white bag charges be assembled together for firing.

CAUTION

Due to occasional blast overpressure when firing white bag propelling charge M2, it is recommended that flash reducer M3 be used with this charge. If the flash reducer is not available, it is recommended that green bag propelling charge M1 be used in lieu of white bag propelling charge M2 when firing zone 5.

- 1 If required, untie straps and remove unrequired increments from charge.
- 2 Retie straps tightly over top of charge.
- 3 When firing M2 charge, assemble flash reducer M3 under tie straps at forward end of propelling charge.

PROPELLING CHARGE M188

- 1 Untie straps.
- 2 Remove spacer and middle cushion.
- 3 Remove igniter bag protector.
- 4 Reassemble flash reducer and retie straps tightly over top of charge.

PROPELLING CHARGE M188A1

NOTE

The yellow discoloration of M188A1 charges does not indicate a faulty or damaged charge. Stained M188A1 charges should be considered safe and serviceable.

- 1 Remove igniter pad protector
- 2 Untie straps and remove increment 9 if round is to be fired at zone 8.
- 3 Retie straps tightly over top of charge.

LOADING

WARNING

- Do not load or fire artillery ammunition without authorized fuze. Firing of rounds without fuzes or with unauthorized fuzes could result in inbore prematures and other hazardous conditions.
- Do not load or fire round if fuze is not fully seated.
- Firing of fuzes M557, M572 and M564 during heavy precipitation (rainfall, sleet, snow, or hail) may result in occasional downrange prematures. The amount of precipitation necessary to cause functioning is comparable to the heavy downpour which occurs during a summer thundershower.

LOADING - CONTINUED**NOTE**

During heavy precipitation use the M739 series fuze.

- 1 Make sure round is clean and fuze is present and fully seated.

WARNING

Firing a round with an obstruction in the cannon tube can cause an in-bore premature.

- 2 Make sure there are no obstructions in the cannon tube.
- 3 Check cannon firing lock to see that primer expended in previous firing has been removed.
- 4 Remove grommet from projectile.

WARNING

Do not fire the M650 projectile if the obturator band is missing or broken. If the band is displaced and can be repositioned and will remain in the groove, the projectile can be fired.

- 5 When firing M650/M753 projectile, be sure to remove rocket motor cap if extended range is required. If a rocket-off firing is planned, be sure to check that the rocket motor-off cap is firmly in place on rocket nozzle.

NOTE

Immediately after M650/M753 projectile is fuzed, it should be placed on projectile lifting tray and lowered to horizontal position. The rocket motor cap should be removed prior to attaching lifting tray to loader-rammer. The rocket motor-off cap has left hand threads. An arrow

on rocket motor-off cap indicates the direction (clockwise) cap must be turned for removal. Assembly is accomplished by threading on cap in opposite direction that the direction arrow is pointing (counterclockwise).

- 6 Load fuzed projectile into cannon and ram it solidly into firing chamber.

WARNING

Never load a propelling charge into chamber by increments. Only fully assembled charges with flash reducer properly located will be used.

- 7 Remove igniter protective cap from propelling charge. Load propelling charge into cannon chamber, with igniter end (red bag) toward breech.

WARNING

Never close breechblock unless you can see red igniter bag on base of propelling charge.

- 8 Close and lock breechblock. The stand-off lugs on the face of the obturator spindle must touch red igniter pad of propelling charge to avoid a misfire or hangfire.

WARNING

Never insert primer in primer seat unless breechblock is closed and locked.

- 9 Insert primer and move firing block to firing position.

AFTER FIRING PROCEDURES

- 1 Open breechblock and secure in open position.

NOTE

If cannon chamber is not swabbed properly, the M650/M753 projectile may stick and not seat properly.

- 2 Swab cannon powder chamber at least 3 in. (7.62 cm) past forcing cone with water-saturated sponge after each round.
- 3 All ammunition fired must be recorded by charge number, type, and total number of each fired, and entered in DA Form 2408-4 for the day's firing.

AMMUNITION PREPARED FOR FIRING BUT NOT FIRED



The projectiles and fuzes that have been rammed and then removed from the tube will not be reloaded or fired.

Using applicable fuze setter and procedure, see page 5-31, reset fuzes on projectiles prepared for firing but not fired. Reset time fuzes to safe; reset VT fuzes to initial setting at which they were shipped; reset point detonating fuzes to SQ or PD.

M762/M767 ET fuzes that have been activated and not fired should be reset to 88.8, segregated and used first in subsequent firings. When the battery runs down on an activated M762/M767 fuze the LCD goes blank. These fuzes are unserviceable and should be packed separately, marked unserviceable and turned in to the ammunition supply point (ASP). To determine if an M762/M767 fuze has been activated and

run down, gently attempt to turn the ogive clockwise by hand without depressing the selector button. If the ogive turns easily the fuze has been activated, a fuze that has not been activated should resist the applied torque. Replace safety wires on these fuzes furnished.

Disassemble fuze from projectile and repack in original packing. When long intrusion proximity fuze is removed from projectile, replace supplementary charge in projectile before assembling spacer and lifting plug. Replace grommet over rotating band. Restore propelling charges to original condition (i.e., with all zone/increments present and tied). Replace fuzes, primers, flash reducers, and propelling charges in original packing containers and seal to protect from moisture. Reinstall rocket motor cap on M650/M753 projectile prepared for rocket-on firing after inspecting to make sure that foreign material or moisture have not been forced into the rocket motor nozzle.

Section III. AMMUNITION MAINTENANCE AND INSPECTION

SECTION INDEX

	Page
AMMUNITION OF COMPONENTS PREPARED FOR FIRING, BUT NOT FIRED	5-35
DEFECTIVE AMMUNITION	5-37
EXCESS EXPLOSIVE COMPONENTS	5-37
GENERAL	5-36
PROJECTILES	5-36
PROPELLING CHARGES M1 AND M2	5-36
PROPELLING CHARGES M188 AND M188A1	5-36
STORAGE	5-38
Provisions	5-38
Sites	5-38
Temperature limits	5-38

AMMUNITION OF COMPONENTS PREPARED FOR FIRING, BUT NOT FIRED**WARNING**

Never fire ammunition components that have been chambered and unloaded from the weapon. All ammunition components which have been unloaded from the weapon must be segregated and turned in for disposition.

- 1 Return such ammunition to original condition and packing. Mark appropriately and use first in subsequent firings to keep stocks of open packings to a minimum.
- 2 Reassemble supplementary charge and lifting plug (with gasket and spacer) to projectile to restore it to its original packing. In reassembling components, make certain that supplementary charge is properly inserted (felt-pad end innermost).
- 3 Reassemble rocket motor-off cap to M650/M753 projectiles prepared for rockets-on firings. Reassembly is accomplished by threading cap on counterclockwise (cap has left hand threads). Inspect rocket motor nozzle to make sure foreign material or moisture have not been forced into the opening.
- 4 Reassemble fusible or universal lifting plug and gasket to M509A1 projectile. If M509A1 projectile has been prepared for self-registration mode, replace the expulsion charge in the projectile. Remove the spotting charge from the fuze and return to original container, see page 5-10.
- 5 Reassemble propelling charges M1 and M2 prepared for firing, and not used, as follows:
 - If increment was removed, reinstall and retie. Refer to page 5-32.
- Remove M3 (T3) flash reducer and return to its original packing.
- Replace igniter protective cap.
- Repack charge in container (igniter end first). Close and secure container.
- Mark appropriately and use first in subsequent firings.
- 6 Reassemble propelling charge M188 as follows:
 - Replace igniter protective cap.
 - Assemble middle cushion on igniter tube.
 - Assemble spacer around igniter tube, retie straps.
 - Install wrapper and tape to charge.
 - Repack in metal container. Close and secure container.
- 7 Reassemble propelling charge M188A1 prepared for zone 8 firing as follows:
 - Untie straps, and assemble increment 9 over igniter tube.
 - Retie straps.
 - Replace igniter protector cap.
 - Install wrapper and tape to charge.
 - Repack in metal container. Close and secure container.
- 8 Reassemble propelling charge M188A1 prepared for zone 9 firing as follows:
 - Replace igniter cap.
 - Install wrapper and tape to charge.
 - Repack in metal container. Close and secure container.

GENERAL

WARNING

Handle ammunition and ammunition components with care at all times.

- 1 Ammunition is designed to withstand conditions ordinarily encountered in the field. Keep packing boxes and containers from becoming broken or damaged.
- 2 Since ammunition is damaged by moisture, frost, extreme temperatures, and foreign matter (mud, oil, etc.), observe the following:
 - Do not break the moisture-resistant seal on container until ammunition is to be used.
 - Shield ammunition, particularly fuzes and propelling charges, from sources of high temperatures. Keep ammunition out of direct rays of sun.
- 3 Protect fuzes, primers, and flash reducers at all times from foreign matter and impact.

NOTE

Proper performance of ammunition maintenance procedures when ammunition is received by using units assures that ammunition on hand is kept ready for use.

PROJECTILES

- 1 Visually inspect projectiles for the following defects:
 - Distorted, out of round, or damaged body.
 - Dirt or other foreign material.
 - Seepage of explosive filler.
 - Rust through projectile base plate.

- 2 Clean dirt or foreign material from projectile by wiping with a damp rag.
- 3 Return defective projectiles to ammunition supply point.

PROPELLING CHARGES M1 AND M2

- 1 Visually inspect propelling charges M1 and M2 for defects as follows:
 - Loose tie straps allowing separation of charge into increments.
 - Missing increment, extra increment, or incorrect order of increments.
 - Increment bags torn or damaged to extent black powder or propellant spills out.
 - Propelling charge wet.
 - Red igniter pad on base of charge wet, missing, or damaged.
- 2 Charges requiring retying may be retired as follows:
 - Assemble increments in correct order.
 - Tie four straps tightly over top of charge using two interlapping square knots.
- 3 Repackage and return all defective charges to ammunition supply point.

PROPELLING CHARGES M188 AND M188A1

- 1 Inspect metal container markings to determine that proper ammunition is in container.
- 2 Open metal container.
- 3 Remove top cushion.
- 4 Remove charge from container, lifting by tie straps.

PROPELLING CHARGES M188 AND M188A1-CONTINUED

- 5 Remove corrugated wrapper.
- 6 Inspect charge for the following:

NOTE

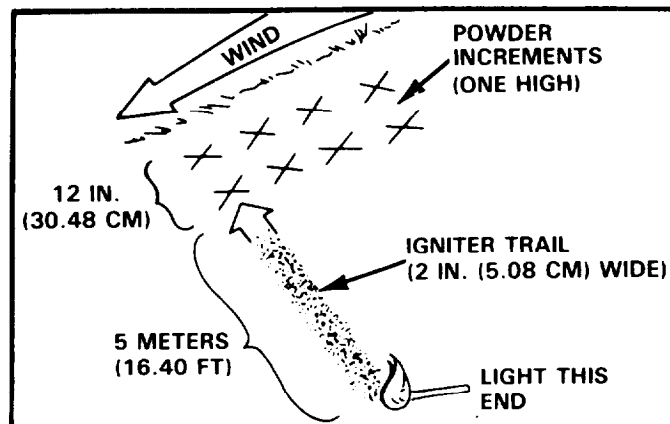
The yellow discoloration of M188A1 charges does not indicate a faulty or damaged charge. Stained M188A1 charges should be considered safe and serviceable.

- Missing or damaged middle cushions of spacers (M188 charge only).
 - Bag ripped or damaged.
 - Black powder leaking.
 - Base igniter pad not centered with respect to outer diameter of charge.
 - Propellant escaping.
 - Evidence of broken or damaged igniter tube.
 - Tie straps tight. If tie straps are loose, they may be tightened by undoing knots and retying straps using two interlapping square knots.
 - Lacing jacket secure on charge.
 - Cord missing or broken on lacing jacket.
 - Presence of increments 8 and 9 (M188A1 charge only).
 - Evidence of moisture.
- 7 Repackage and return all defective charges to ammunition supply point.

DEFECTIVE AMMUNITION

- 1 Plainly mark defective ammunition or explosive components UNSERVICEABLE, and return to ammunition supply point for disposition.
- 2 Repackage ammunition in original containers. If original container is unsuitable, use available packing material and transfer all markings. All layers of packing must be plainly marked UNSERVICEABLE.

EXCESS EXPLOSIVE COMPONENTS



- 1 Pack supplementary charges removed from projectiles prior to assembling long intrusion proximity fuzes in containers from which long intrusion proximity fuzes were removed.
- 2 Properly mark these supplementary charge containers and return them to ammunition supply point for disposition.
- 3 Destroy any unused powder increments or expelling charges left over after round has been fired by performing the following steps:
 - a. Locate proper burning area. Area should be 50 m from any combustible material.
 - b. Ensure proper firefighting equipment and personnel are present.

WARNING

Do not stack powder increments more than one increment high.

- c. Lay out powder increments parallel to wind direction in 12 in. (30.48 cm) wide column.

EXCESS EXPLOSIVE COMPONENTS - CONTINUED

- d. Lay out an igniter trail at the downwind end of the line of increments by opening one powder bag and making a trail of powder at 90 degrees to the powder increments. The igniter trail should be approximately 5 m long and 2 in. (5.08 cm) wide. See diagram.
- e. Light the end of the igniter trail, then move away from the powder increments.
- f. While powder is burning, be alert for sparks or burning fragments caught by the wind.
- g. When powder is through burning, be sure all flames are extinguished and no smouldering ashes remain. **BE SURE ASHES ARE COMPLETELY BURNED.**

STORAGE

WARNING

Ammunition exposed directly to sunlight, or in unventilated containers, enclosures, shelters, freight cars, closed vehicles, and similar structures exposed to direct sunlight, may reach temperatures exceeding upper storage limits.

TEMPERATURE LIMITS

- 1 Except as noted in steps 2 and 3, observe the following limits:

Lower limit: - 80°F (-62°C) for periods of not more than 3 days.
Upper limit: + 160°F (+71°C) for periods of not more than 4 days.

- 2 Proximity fuzes M728 and M732 and proximity rounds must be protected from long exposure to high humidity. They should be stored at -65° to +145°F (-54° to + 63°C).
- 3 Projectile M650/M753 should be stored at -50° to + 145°F (-46° to + 63°C).

SITES

WARNING

Do not store ammunition under trees or near tall buildings that attract lightning. When ammunition must be stored in the open, select a storage site free of power lines, electric cables, and flammable materials. Sites should not be adjacent to reservoirs, water mains, etc. Sites should be level and well drained.

PROVISIONS

- 1 Use heavy, well supported dunnage to keep bottom tier of ammunition stack off the ground and to prevent it from sinking into the ground.
- 2 Allow at least 6 in. (15.24 cm) of space beneath pile for air circulation. Dig trenches to prevent water from flowing under pile.
- 3 Provide nonflammable covers (e.g., tarpaulin) for all ammunition. Maintain air space of approximately 18 in. (45.72 cm) between cover and ammunition. Keep cover at least 6 in. (15.24 cm) from pile on ends and sides to permit circulation of air.
- 4 Store ammunition and primer containers with top side up. Labels or markings on boxes and containers indicate which side should be up.

Section IV. OPERATION AND MAINTENANCE OF DUMMY PROJECTILE, M845

SECTION INDEX

	Page
GENERAL	5-39
LOADING AND RAMMING	5-39
PROJECTILE EXTRACTION USING BELL RAMMER	5-39
PROJECTILE EXTRACTION USING M4277 EXTRACTOR	5-40
REPACKAGING	5-44
REPLACING WORN M845 DUMMY PROJECTILE ROTATING BAND	5-45
REVERSING M845 DUMMY PROJECTILE ROTATING BAND	5-44
UNPACKING AND INSPECTION	5-39

GENERAL

The dummy round is an inert loaded, modified M106 projectile designed to be rammed, but never fired, in the howitzer. The M845 allows the crew to familiarize themselves with the operation of the loader/rammer and the other armament systems. The crew will also be familiarized with fuzeing, handling, loading, ramming, and extracting 8 in. projectiles. The M845 consists of a steel ogive body section, a steel boattail base section, a replaceable plastic rotating band, and an inert M51 Series Fuze. It is shipped in a storage box with an eyebolt lifting plug, a removable protective grommet, and an M51 series fuze. A rotating band replacement kit is available separately.

UNPACKING AND INSPECTION

- 1 Remove projectile from packing box.
- 2 Remove grommet from rotating band. Retain grommet in packing box.
- 3 Inspect rotating band for damage. If damaged, rotate (page 5-44) or replace (page 5-45) rotating band.
- 4 Unscrew lifting plug from projectile and retain plug in packing box.
- 5 Remove M51 Series Fuze from packing box and install fuze on projectile.

LOADING AND RAMMING

WARNING

The M845 projectile is designed to provide training in handling, loading, and ramming. It is not to be fired.

Follow standard loading and ramming procedures, refer to page 2-127.

PROJECTILE EXTRACTION USING BELL RAMMER

- 1 Remove primer, propelling charge, and insert rag bundle or similar waste into chamber.
- 2 Depress cannon to depression stops.
- 3 Insert rammer into muzzle end and push carefully until rammer head encircles fuze and is seated against the projectile. Steadily increase pressure by tapping the end of the rammer staff with a wood block, if necessary to loosen projectile.
- 4 Open breech and elevate cannon to LOAD position.
- 5 Push projectile out of tube through breech onto loading trough.

PROJECTILE EXTRACTION USING M4277 EXTRACTOR

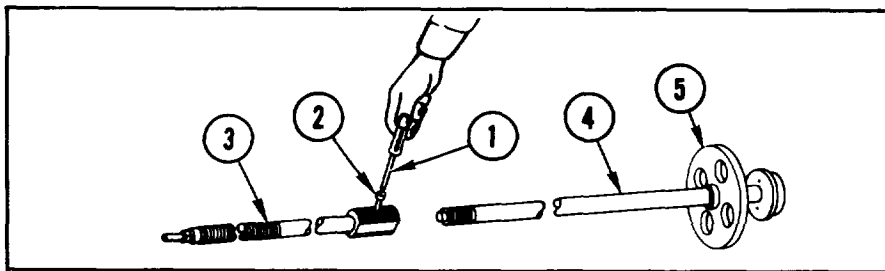
WARNING

NOTE

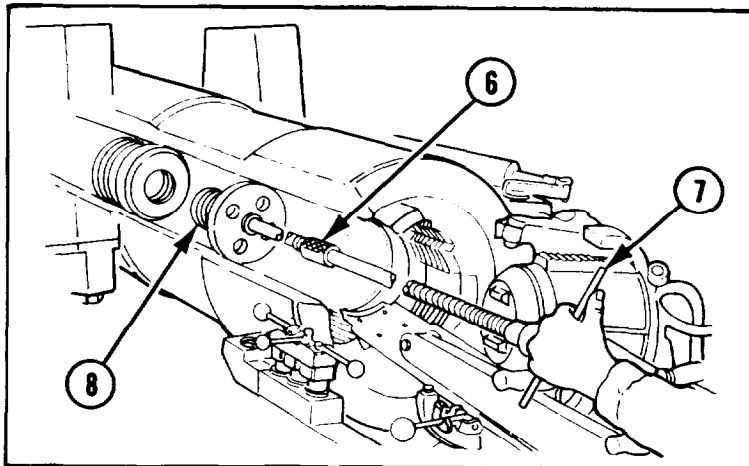
Extractor M4277 may also be used to extract M845, M422, and M422A1 projectiles.

Elevate or depress cannon tube until LOAD marks align before opening breech to avoid injury to personnel.

- 1 Move loader/rammer to stowed position.
- 2 Depress cannon to depression stops.
- 3 Open breech fully and make sure primer and propelling charge have been removed.

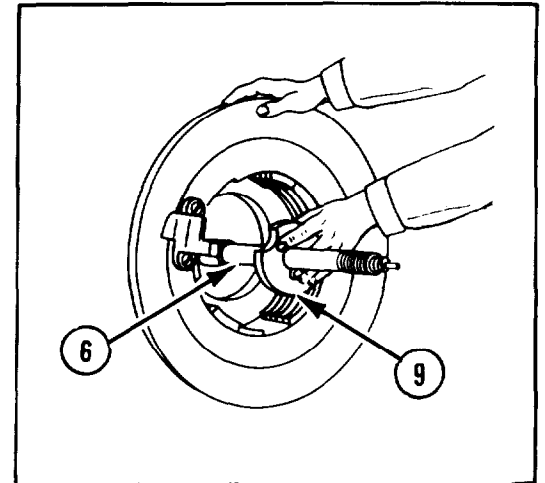
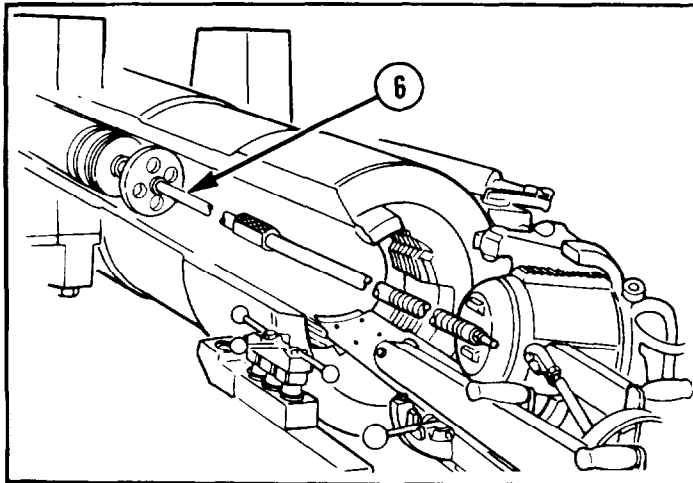


- 4 Using key driver (1), remove screw (2) from rear rod (3). tighten securely.
- 5 Assemble plug and rod assembly (4) to rear rod (3). Install screw (2) and
- 6 Position plastic guide (5) on plug and rod assembly (4) approximately 4 in. (10.16 cm) from rear face of plug.



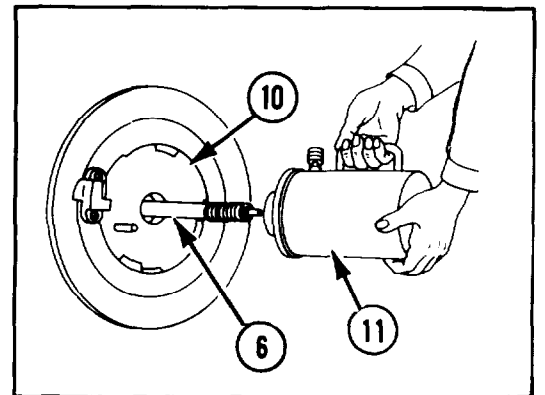
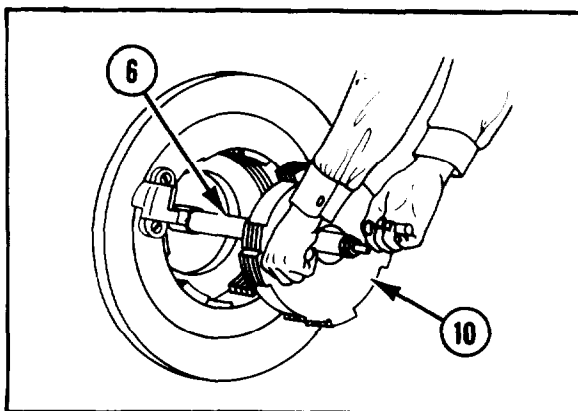
- 7 Insert rod assembly (6) into howitzer tube, attach ratchet bar wrench (7), and engage pins in holes of projectile base plug (8) (two white dots show pin orientation).
- 8 Turn wrench (7) clockwise and remove rod assembly (6) and projectile base plug (8) from chamber. (Projectile base plug may be loose in chamber. A stick may be required to reach and remove plug). Set base plug (8) aside.

PROJECTILE EXTRACTION USING M4277 EXTRACTOR-CONTINUED



9 Install rod assembly (6) in base of projectile by turning assembly fully counterclockwise. Tighten with wrench and remove.

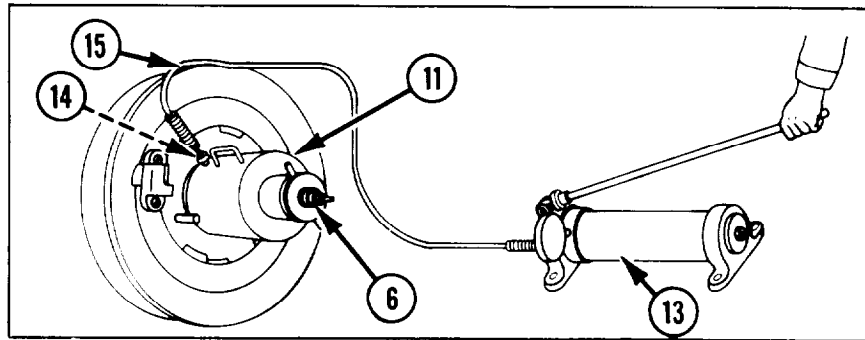
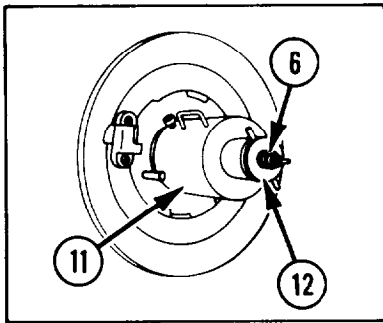
10 Slide bumper plate (9) over rear of rod (6) as far as it will go.



11 Slide breechblock slab (10) over rear of rod (6). When rear of breechblock slab (10) meets rear of breech, slide breechblock slab (10) approximately 1 in. (2.54 cm) further, then rotate clockwise approximately 35 degrees until locked.

12 Slide hydraulic ram (11) over rear of rod (6) until bushing on hydraulic ram (11) engages hole in breechblock slab (10).

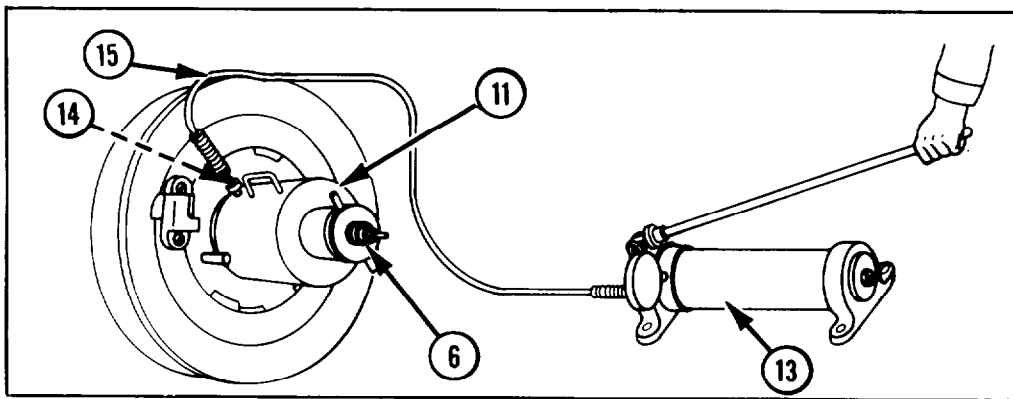
PROJECTILE EXTRACTION USING M4277 EXTRACTOR-CONTINUED



- 13 Slide thread nut (12) over rear of rod (6) and thread on clockwise until snug against hydraulic ram (11).
- 14 Close release valve on hydraulic pump (13) by turning clockwise until finger-tight. Remove dust cover (14) from hydraulic ram connector. Connect hose (15) to hydraulic ram connector. Be careful not to kink hose (15) and make sure collar is completely threaded into hose (15).
- 15 Place loader/rammer in ram position and retract loading arm.

WARNING

- Do not stand directly behind breech when hydraulic pump is being operated, as the extractor moves 9 in. (22.86 cm) rearward.
- Do not exceed gage reading of 9550 psi (65,847 kPa). Overload zone is red.
- Hydraulic pump operator should wear face shield.

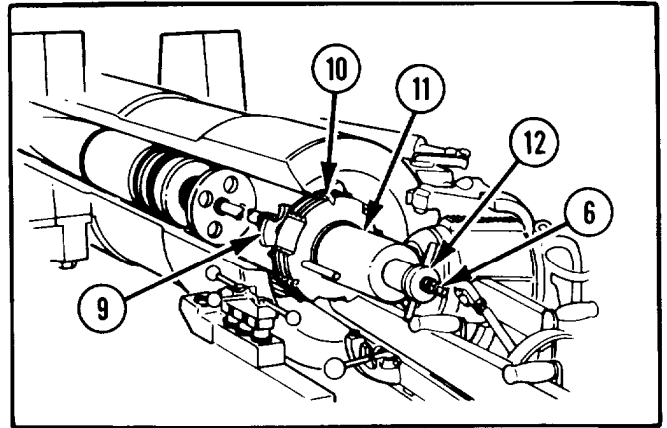


- 16 Pump handle on hydraulic pump (13), moving rod assembly (6) rearward until hydraulic ram (11) drops slightly, indicating release of projectile. Pump handle of pump four or more times.

Release pressure by returning release valve counterclockwise. Disconnect hose (15) from hydraulic ram (11). Install dust cover (14) on hydraulic ram connector.

PROJECTILE EXTRACTION USING M4277 EXTRACTOR - CONTINUED

- 17 Remove threadnut (12), hydraulic ram (11), breechblock slab (10), and bumper (9) from rod assembly (6).

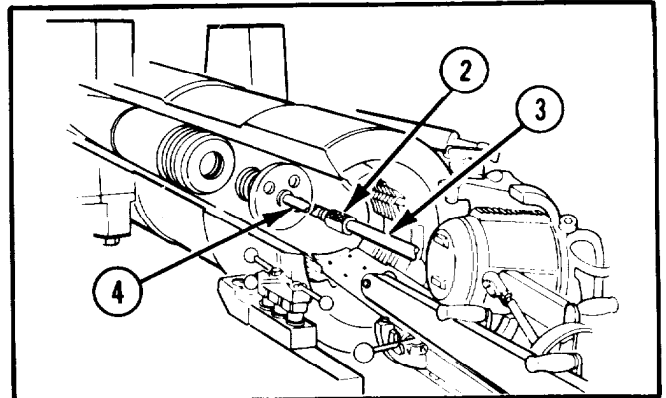


- 18 Elevate cannon to LOAD position and move loading tray to breech. Remove screw (2) and rear rod (3).

CAUTION

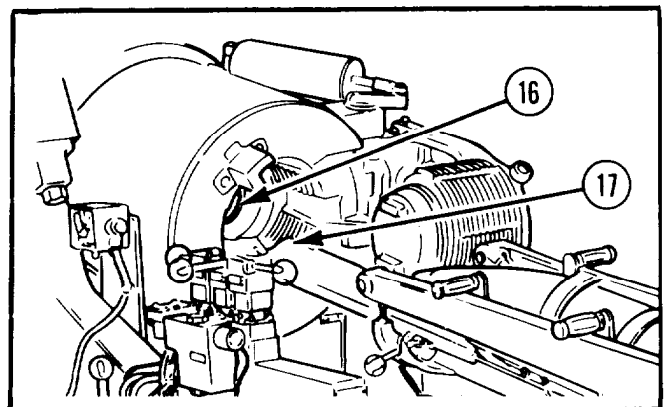
Do not let projectile slip out of breech while removing plug and rod assembly.

- 19 Remove plug and rod assembly (4) from projectile by turning clockwise.



- 20 Move loading arm and tray into loading position. Using at least two persons, slide projectile (16) onto loading tray (17). Fasten round into tray and retract loading arm.

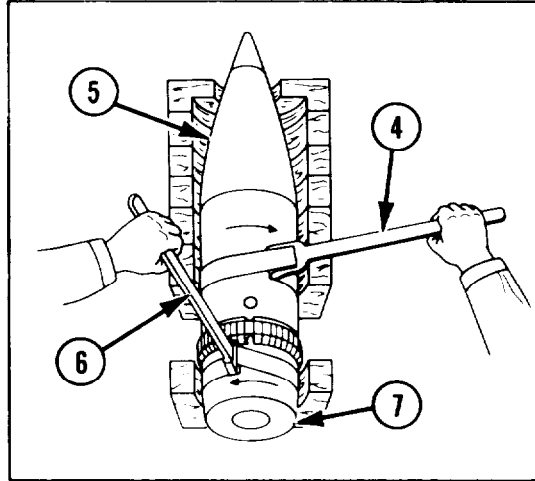
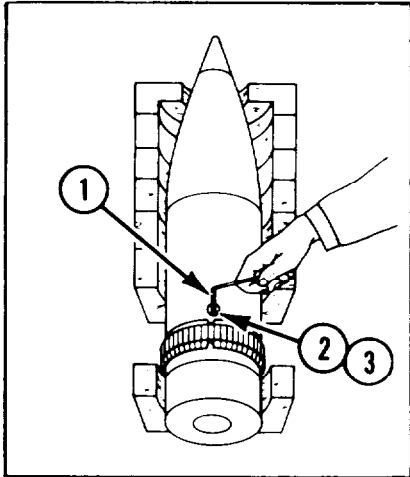
- 21 Reinstall base plug onto projectile by turning counterclockwise.



REPACKAGING

- 1 If removed, reinstall base plug onto projectile by turning counterclockwise.
- 2 Remove M51 series fuze from projectile.
- 3 Reinstall eyebolt lifting plug on projectile.
- 4 Reinstall grommet onto rotating band.
- 5 Repack projectile and fuze into packing box.

REVERSING M845 DUMMY PROJECTILE ROTATING BAND

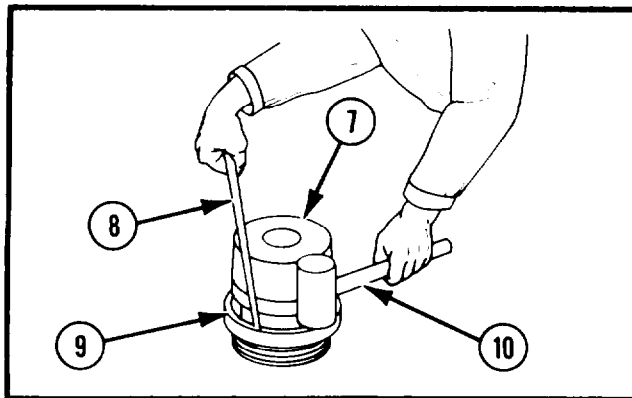


NOTE

The rotating band is made of nylon and can be rammed and extracted 100 times. Then it can be reversed for an additional 100 rams and extractions.

hole is facing downward. Gently tap projectile with mallet to cause copper plug (3) to fall out. Repeat step for other three setscrews and plugs. Retain setscrews and plugs.

- 1 Support projectile on wood blocks or saddles on a level surface.
- 2 Using wrench (1), remove setscrew (2). Rotate projectile until removed setscrew
- 3 Install strapwrench (4) on projectile body (5), set to turn clockwise. Install strapwrench (6) on base (7) set to turn counterclockwise. Holding body (5) still, turn base to loosen. Remove strap wrenches (4 and 6) and remove base (7) by hand.

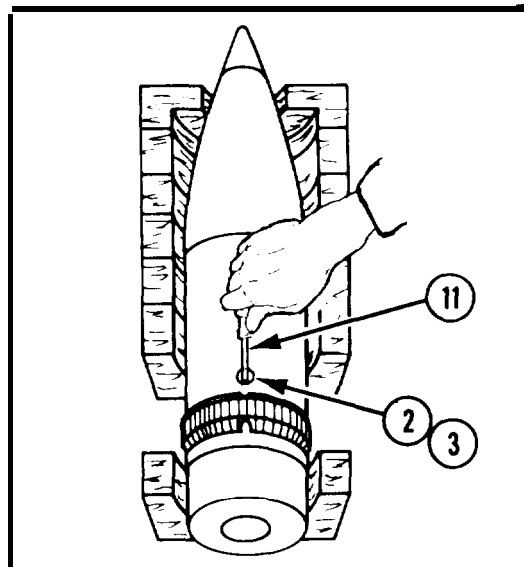
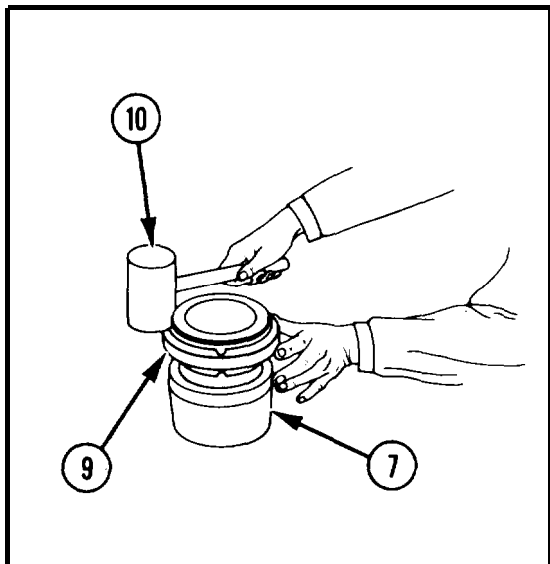


REVERSING M845 DUMMY PROJECTILE ROTATING BAND-CONTINUED

CAUTION

Pressure applied to rotating band must be even and gentle to avoid damaging rotating band.

4 Insert lever (8) into groove of rotating band (9) and pry gently against base (7). Tap gently with mallet (10) until rotating band (9) is removed.



5 Reverse band (9) so that original front edge becomes rear edge.

body (5). Use strap wrenches (4 and 6) if required.

CAUTION

Rotating band shall be tapped gently to avoid damage.

8 Rotate projectile until one of four holes above rotating band is facing upward. Insert copper plug (3) and setscrew (2). Using screwdriver (11), torque setscrew (2) to 50-100 in.-lb (5.65-11.30 N-m). Repeat step for other three setscrews and plugs.

6 Install rotating band (9) on base (7). Tap gently with mallet (10) until seated.

7 Install base (7) to projectile body (5). Tighten by hand until rotating band (9) is flush with base (7) and projectile

REPLACING WORN M845 DUMMY PROJECTILE ROTATING BAND

NOTE

Units can order the rotating band kit using NSN 1320-01-112-2627.

Use reversing dummy projectile rotating band procedures to replace dummy projectile rotating band. Refer to page 5-44. Discard worn rotating band, screws, and copper plugs. Install new rotating band, screws, and copper plugs.

CHAPTER 6 FOREIGN AMMUNITION (NATO)

Section I. NATO PROJECTILES, FUZES, PROPELLING CHARGES, AND PRIMERS

SECTION INDEX

	Page
AUTHORIZED PROJECTILES	6-2
FLASH REDUCERS	6-8
FUZES	6-5
GENERAL	6-1
PRIMERS	6-8
PROJECTILES, USE AND CHARACTERISTICS	6-4
PROPELLING CHARGES	6-6

GENERAL

Agreements between the United States and NATO allies have established interoperability of ammunition and weapon systems. The data described in this chapter enable safe and effective firing of foreign 8-in. components from the M201A1 cannon.



- Do not mix U.S. and/or any combination of NATO ammunition components. Fire only all components from one nation.
- Make sure projectiles and propelling charges are marked 8H, 8 in., or 203 mm. Verify authorized projectile, fuze, and propelling charge listed on page 6-2.
- Ammunition components described in this chapter are authorized German (GE), Netherlands (NE), Belgium (BE), United Kingdom (UK), Italy (IT),

Denmark (DA), and Greece (GR) only. Do not load or fire any components not listed in this chapter as it has not been determined safe to fire or can not be fired from the M201A1 cannon.

NOTE

- At the conclusion of any exercise, ammunition obtained from a NATO nation, but not fired, should be returned to the troops of the NATO nation from whom it was obtained.
- General preparation, fuze setting, propelling charge preparation, loading, after firing procedures, ammunition prepared but not fired, maintenance, inspection, and storage are the same for NATO ammunition as U.S. except where noted.

AUTHORIZED PROJECTILES - CONTINUED

e. The following DA munitions are authorized for use in M110A2 howitzers:

Projectile	8 IN. (203MM), HE, M106
Charge, Propelling	GREEN BAG, M1 ZONES 1-5
Charge, Propelling.	WHITE BAG, M2 ZONES 5-7
Fuze	POINT DETONATING, M557C1* MTSQ, M564
Primer	US MUST USE M82 PRIMER DA MUST USE MK2A4 PRIMER
Flash Reducer.	M3

*NL MANUFACTURE

f. The following GR munitions are authorized for use in howitzers:

Projectile	8 IN. (203MM), HE, M106
Charge, Propelling	GREEN BAG, M1 ZONES 1-5
Charge, Propelling.	WHITE BAG, M2 ZONES 5-7
Fuze	POINT DETONATING, M557 MTSQ, M564
Primer	US AND GR MUST USE M82 IN SP WEAPON GR MUST USE MK2A4 IN TOWED WEAPON
Flash Reducer	M3

g. The following BE munitions are authorized for use in howitzers:

Projectile	8 IN. (203MM), HE, M106
Charge, Propelling	GREEN BAG, M1 ZONES 1-5
Charge, Propelling	WHITE BAG, M2 ZONES 5-7
Fuze	POINT DETONATING, M557 MTSQ M564
Primer	M82
Flash Reducer	M3

NOTE

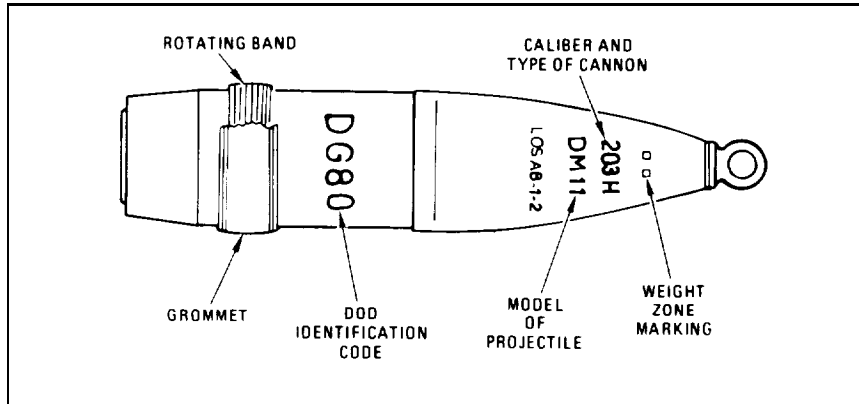
Except as noted above, preparations for firing GE, UK, NL, IT, DA, GR or BE munitions in US weapons system (preparation for firing, precautions during firing, etc.) are contained in chapter 5 of this manual. Misfire procedures are contained in chapter 2.

h. The following US munitions are authorized for use in GE M110, UK M110, NL M110, IT M115, DA M115, GR M110 or M115, and BE M110 weapons:

Projectile	8 IN. (203MM), HE, M106
Charge, Propelling	GREEN BAG, M1 ZONES 1-5
Charge, Propelling.	WHITE BAG, M2 ZONES 5-7
Fuze	POINT DETONATING, M557 POINT DETONATING, M572(GE,UK) MTSQ, M564 (BE, IT, DA, GR) POINT DETONATING, M739 (IT)
Primer	M82 (NL, BE, GR) MK2A4 (UK, NL, IT, DA, GR) GE MUST USE DM191A1

PROJECTILES, USE AND CHARACTERISTICS

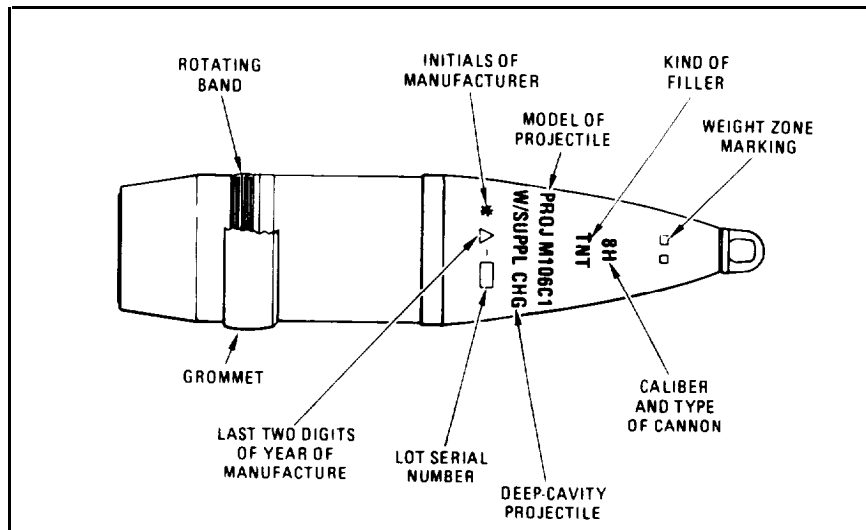
MARKING OF 8-IN. (203MM) HE DM11 (GE) PROJECTILE



PROJECTILE, 8-IN. (203MM): HE DM11 (GE). This projectile is used for blast, fragmentation, and mining. The projectile consists of a hollow steel forging with a boattail base and a gilding metal rotating band. A base cover is welded to the base of the projectile for added protection against entrance of hot gasses from the propelling charge during firing. The

projectile may be either a shallow or deep cavity and is loaded with TNT. The deep cavity projectile contains a supplementary charge of TNT. Both shallow and deep cavity projectiles are shipped with an eyebolt lifting lug, spacer, and removable grommet fitting over the rotating band to protect it during shipment and handling.

MARKING OF 8-IN. (203MM) M106C1 HE (NL) PROJECTILE



PROJECTILE, 8-IN. (203 MM): HE, M106C1 (NL). This projectile is used for blast, fragmentation, and mining. The projectile consists of a hollow steel forging with a boattail base and a gilding metal rotating band. A base cover is welded to the base of the projectile for added protection against entrance of hot gasses from the propelling charge during firing. The

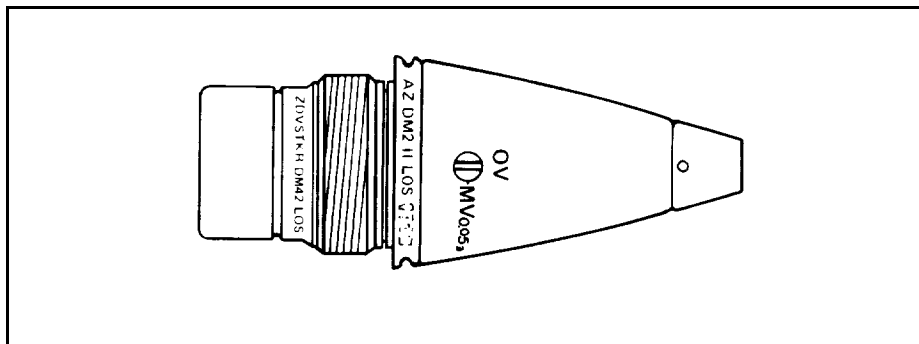
projectile may be either a shallow or deep cavity and is loaded with TNT. The deep cavity projectile contains a supplementary charge of TNT. Both shallow and deep cavity projectiles are shipped with an eyebolt lifting lug, spacer, and removable grommet fitted over the rotating band to protect it during shipment and handling.

FUZES

For additional information, detailed descriptions, and functioning of the authorized fuzes, see TM 43-0001-28-3. Refer to

page 6-2 for approved projectile/fuze combinations.

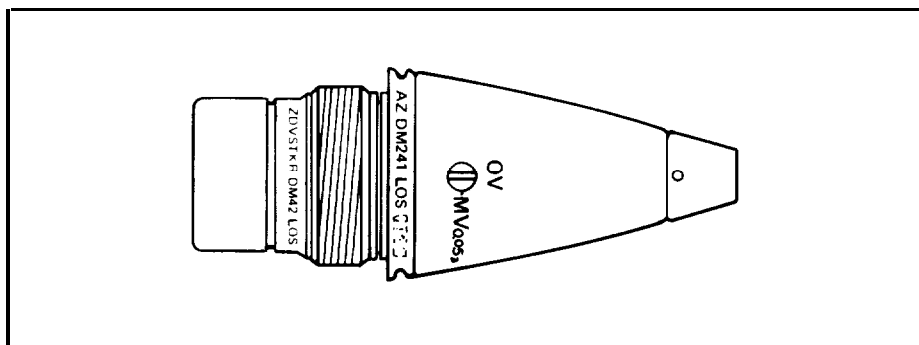
FUZE, POINT DETONATING: DM211 (GE)



The DM211 fuze has a selective superquick-delay setscrew and comes with a DM42 booster. The fuze can be set for superquick (OV) or delay (MV) of 0.05

seconds by turning the setscrew. Premature functioning of this fuze may occur downrange when the fuze is fired in heavy precipitation.

FUZE, POINT DETONATING: DM241 (GE)

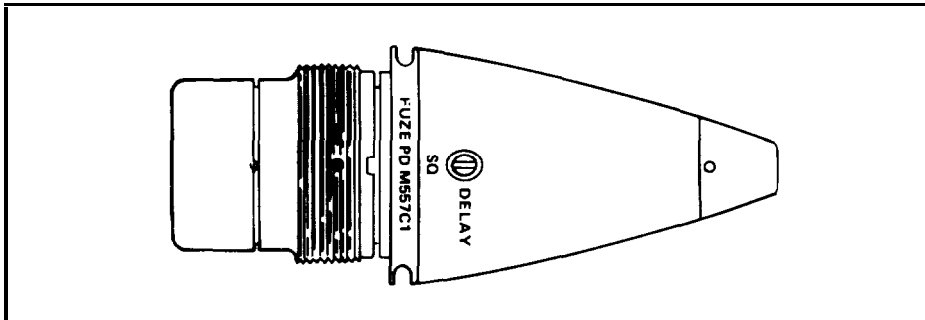


The DM241 fuze consists essentially of fuze DM211 modified with an epoxy filler in the ogive for reinforcement. The fuze has a selective superquick-delay setscrew and comes on a DM42 booster. The fuze

can be set for superquick (OV) or delay (MV) of 5 seconds by turning the setscrew. Premature functioning of this fuze may occur downrange when the fuze is fired in heavy precipitation.

FUZES-CONTINUED

FUZE, POINT DETONATING: M557C1 (NL)

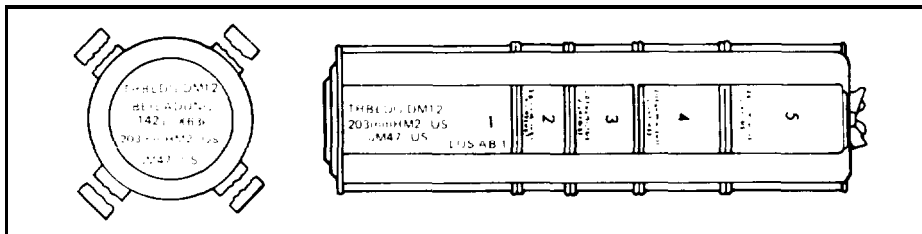


The M557C1 fuze consists of an M557 fuze with an M125C1 booster of Italian origin. The fuze has a selective superquick-delay setscrew. Premature functioning of

this fuze may occur downrange when the fuze is fired in heavy precipitation.

PROPELLING CHARGES

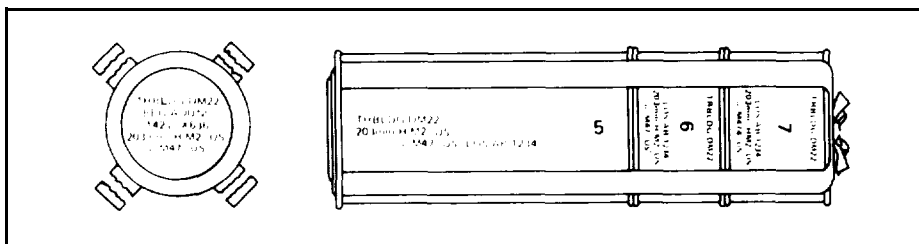
PROPELLING CHARGE, 8-IN. (203 MM): DM 12 (GE)



This is a green bag charge divided into a base and four increments for firing zones 1 thru 5. The increment bags are tied

together by cloth tying straps. An igniter charge in a red cloth bag is sewed to the rear of the base section.

PROPELLING CHARGE, 8-IN. (203 MM): DM22 (GE)

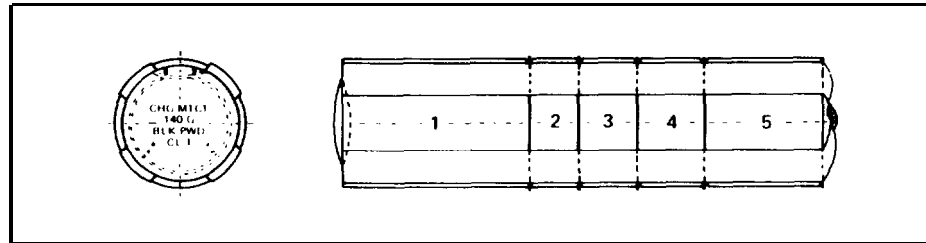


This is a white bag charge divided into a base (charge 5) and two increments numbered 6 and 7. The two increment bags 6 and 7 are secured to the base

charge by cloth tying straps. An igniter charge in a red cloth bag is sewed to the rear of the base section.

PROPELLING CHARGES - CONTINUED

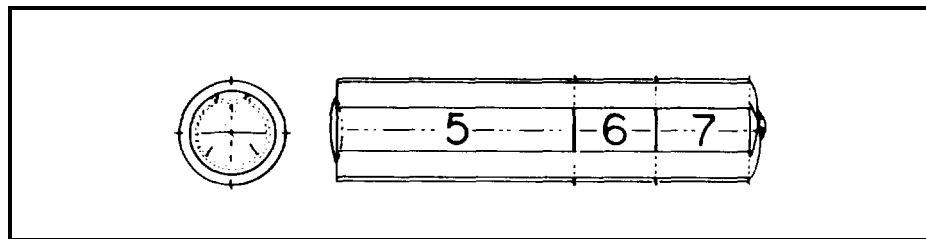
PROPELLING CHARGE, 8-IN. (203 MM): M1C1 (NL)



This is a green bag charge divided into a base and four increments for firing in zones 1 thru 5. The increment bags are tied

together by cloth tying straps. An igniter charge in a red cloth bag is sewed to the rear of the base section:

PROPELLING CHARGE, 8-IN. (203 MM): M2C1 (NL)



This is a white bag charge divided into a base charge (charge 5) and two increments numbered 6 and 7. The two increment bags 6 and 7 are secured to the base

charge by cloth tying straps. An igniter charge in a red cloth bag is sewed to the rear of the base section.

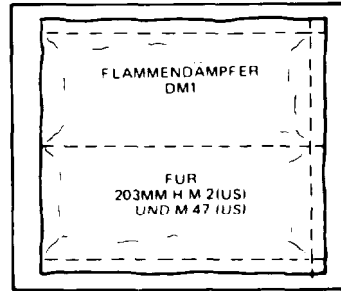
PROPELLING CHARGE, 8-IN. (203 MM): M1 (NL and BE)

This is a green bag charge divided into a base and four increments for firing in zones 1 thru 5. The increment bags are tied

together by cloth tying straps. An igniter charge in a red cloth bag is sewed to the rear of the base section.

FLASH REDUCERS

FLASH REDUCER: DM1 (GE)

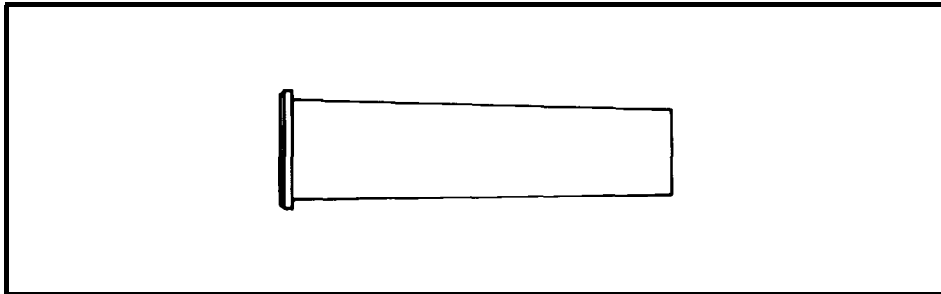


The flash reducer DM1 is used when firing 8-in. (203 mm) white bag propelling charge DM22 (all zones). Although the flash reducer increases the quantity of smoke, it should be used in daylight as well as night unless tactically unsound. Flash reducer

DM1 is placed in front of the highest charge of DM22 propelling charge underneath the tying straps so that when the charge is loaded, the flash reducer is toward the base of the projectile.

PRIMERS

PRIMER, PERCUSSION: M82C1 (NL)



Percussion primer M82C1 is used to ignite the propelling charge in the howitzer. Primers are ready for firing when unpacked

and should be protected from blows that might cause accidental functioning.

APPENDIX A

REFERENCES

SCOPE

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

FIELD MANUALS

FM 3-5	NBC Decontamination
FM 9-207	Operation and Maintenance of Ordnance Materiel in Extreme Cold Weather 0° to - 65°F
FM 21-11	First Aid for Soldiers
FM 21-17	Driver Selection, Training, and Supervision, Tracked Vehicles
FM 21-40	NBC (Nuclear, Biological, and Chemical) Defense
FM 21-306	Manual for the Tracked Combat Vehicle Driver
FM 31-70	Basic Cold Weather Manual
FM 31-71	Northern Operations

FORMS

DA Form 2028.	Recommended Changes to Publications and Blank Forms
DA Form 2028-2	Recommended Changes to Equipment Technical Manuals
DA Form 2404.	Equipment Inspection and Maintenance Worksheet
DA Form 2408-4	Weapons Record Data
SF Form 368	Product Quality Deficiency Report

TECHNICAL MANUALS

TM 3-4240-280-10	Operator's Manual for Mask, Chemical-Biological, Aircraft, ABC-M24 and Accessories: Mask, Chemical-Biological, Tank M25/M25A1 and Accessories
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TECHNICAL MANUALS (cont)

TM 3-4320-214-12&P	Operator' s and Organizational Maintenance Manual Including Repair Parts and Special Tools List for Decontaminating Apparatus: Portable, 14 Litre, M13
TM 9-1000-202-14	Operator' s, Organizational, Direct Support and General Support Maintenance Manual for Evaluation of Cannon Tubes
TM 9-1100-218-10	Operator' s Manual for M422 Nuclear Projectile
TM 9-1110-220-10	Operator' s Manual for M753 Atomic Nuclear Projectile and M754 Training Nuclear Projectile
TM 9-1290-359-12&P	Operator' s and Organizational Maintenance Manual Including Repair Parts and Special Tools List for M90 Radar Chronograph
TM 9-2350-274-BD	Operator' s, Organizational, Direct Support and General Support Maintenance Battlefield Damage Assessment and Repair: for M109/ M110/M578 Vehicles
TM 9-3305	Principles of Artillery Weapons
TM 9-4933-258-13&P	Operator' s, Organizational and Direct Support Maintenance Manual Including Repair Parts and Special Tools List for Pullover Gage Kit
TM 9-6140-200-14	Operator' s, Organizational, Direct Support and General Support Maintenance Manual for Lead-acid Storage Batteries
TM 11-2643	Intercommunications Sets AN/UIC-1 and AN/UIC-1X
TM 11-5820-886-13	To be published
TM 11-5830-340-12	Operator' s and Organizational Maintenance Manual, for Intercommunications Set AN/VIC-1 (V)
TM 11-7440-283-12-1	Operator' s and Organizational Maintenance Manual for Computer Groups, Gun Direction CP-1317/GYK-29
TM 11-7440-283-12-2	Operator' s and Organizational Maintenance Manual for Data Display Groups OD-144/GYK-29

TECHNICAL MANUALS (cont)

- TM 43-0001-28 Army Ammunition Data Sheets for Artillery Ammunition: Guns, Howitzers, Mortars, Recoilless Rifles, and Grenade Launchers
- TM 43-0001-28-3 Interoperable Ammunition Data Sheets for Artillery Ammunition: Guns, Howitzers, Mortars, and Artillery Fuzes
- TM 43-0001-28-4 Artillery Ammunition Authorized Projectile Fuze and Propelling Charge Combinations for Howitzer, Heavy, Self-Propelled, 8 in., M110A2 with Cannon M201A1
- TM 43-0139 Painting Instructions for Field Use

MISCELLANEOUS PUBLICATIONS

- AR 700-138 Army Logistics Readiness and Sustainability
- CTA 8-100 Army Medical Department Expendable/Durable Items
- CTA 50-970 Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items)
- DA PAM 25-30 Consolidated Index of Army Publications and Blank Forms
- DA PAM 738-750 The Army Maintenance Management System (TAMMS)
- TC 6-40 Field Artillery Cannon Gunnery
- TC 6-50 Field Artillery Cannon Battery

APPENDIX B

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

Section I. INTRODUCTION

SCOPE

This appendix lists components of end item and basic issue items for the M110A2 Howitzer to help you inventory items required for safe and efficient operation.

GENERAL

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

a. Section II. Components of End Item.

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

b. Section III. Basic Issue Items. These are the minimum essential items required to place the M110A2 Howitzer in operation, to operate it and to perform emergency repairs. Although shipped separately packaged, BII must be with the M110A2 Howitzer during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition BII, based on TOE/MTOE authorization of the end item.

EXPLANATION OF COLUMNS

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

a. Column (1) - Illustration Number (Illus Number). This column indicates the number of the illustration in which the item is shown.

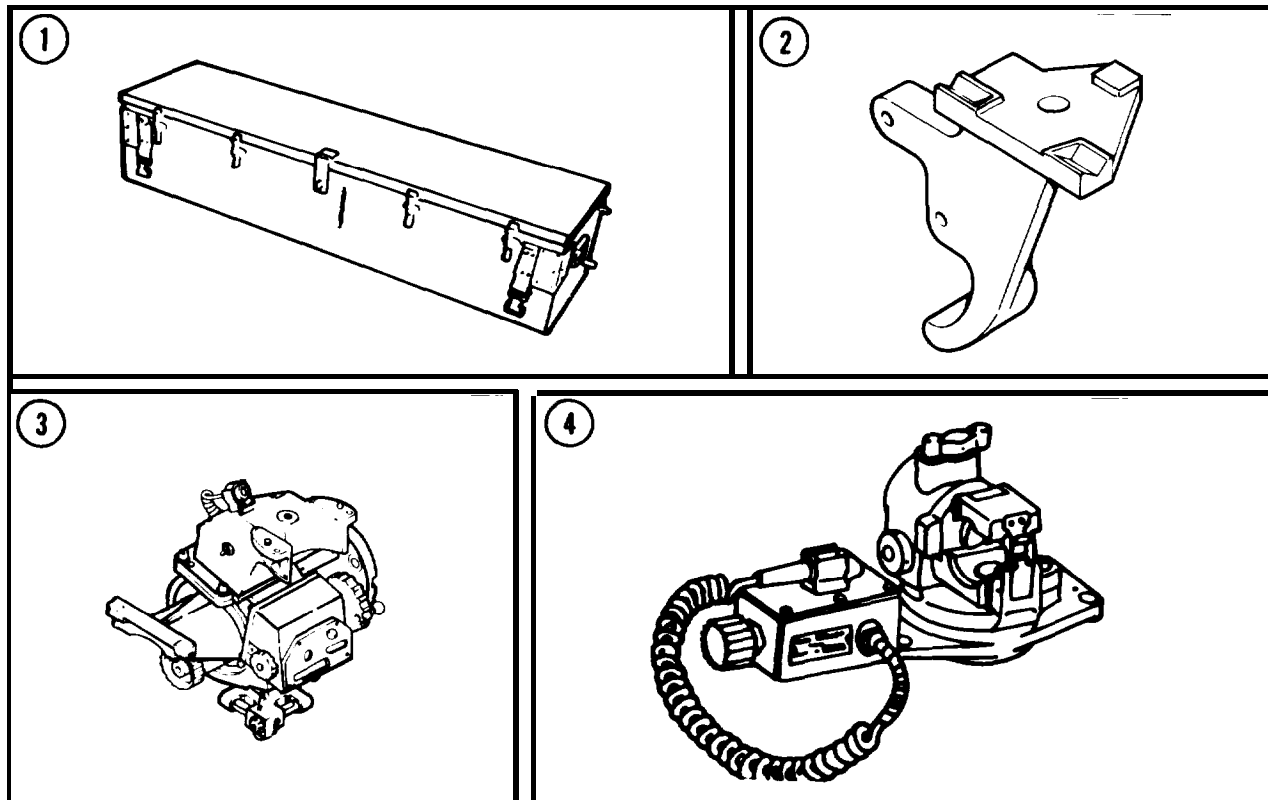
b. Column (2) - National Stock Number. Indicates the National stock number assigned to the item and will be used for requisitioning purposes.

c. Column (3) - Description. Indicates the Federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.

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

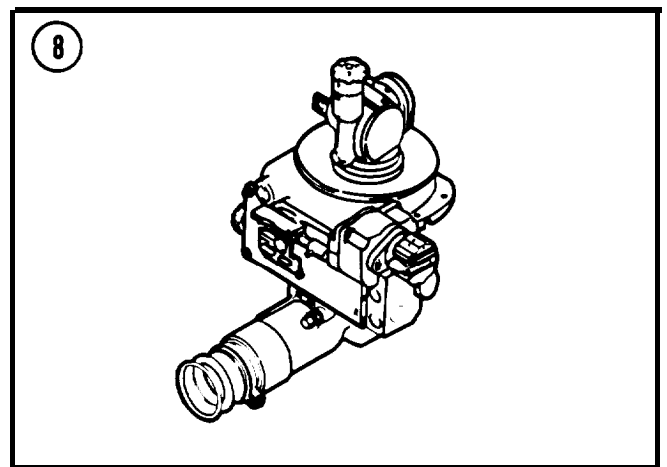
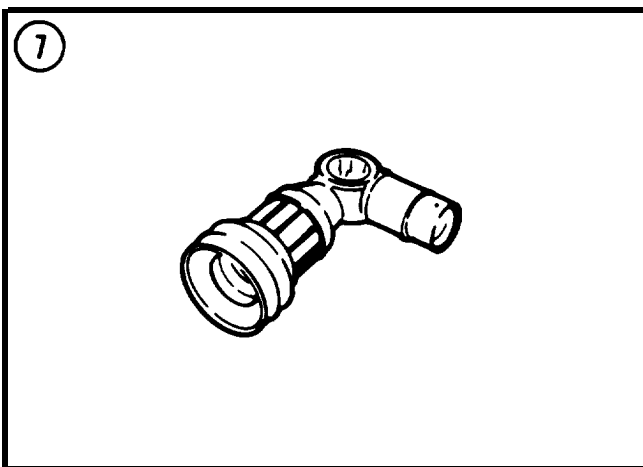
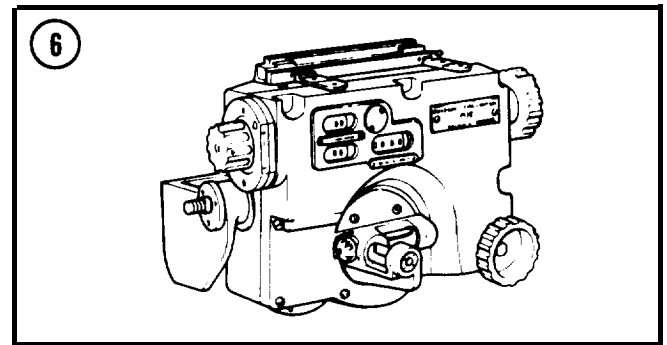
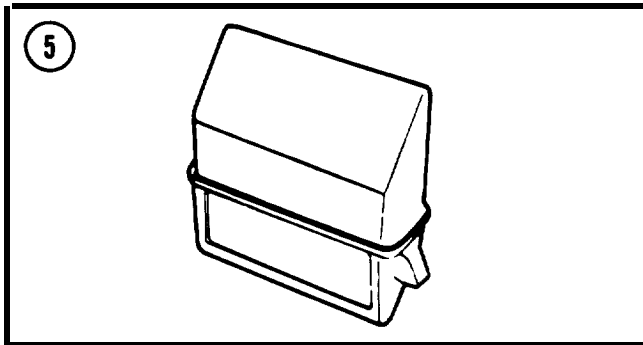
e. Column (5) - Quantity required (Qty rqr). Indicates the quantity of the item authorized to be used with/on the equipment.

Section II. COMPONENTS OF END ITEM



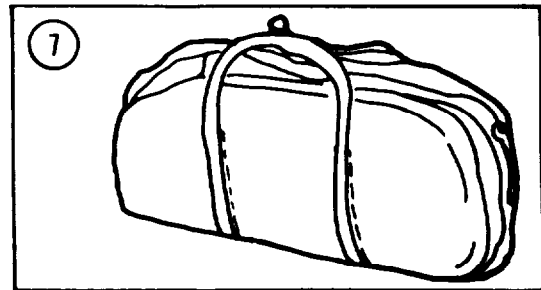
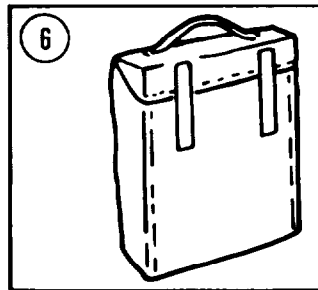
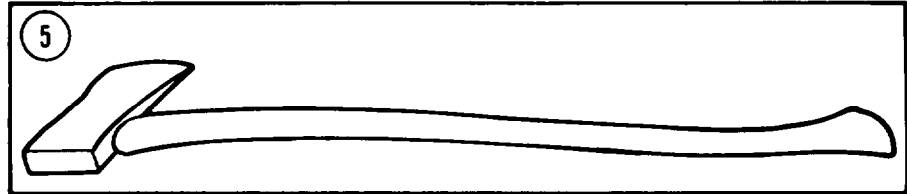
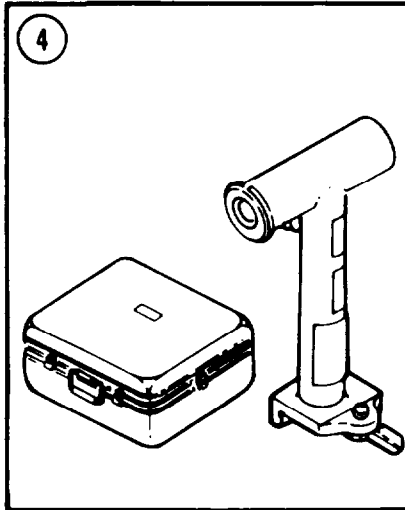
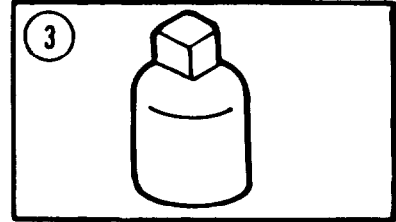
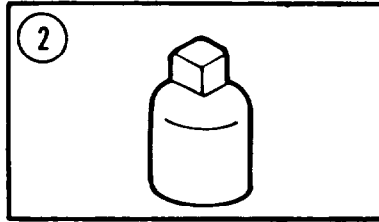
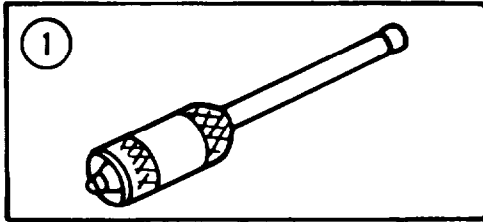
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1	2540-01-087-6987	BOX ASSEMBLY (19207) 12254081		EA	2
2	5985-01-137-5389	BRACKET, ANTENNA MOUNTING (19200) 11785071		EA	1
3	1240-00-895-6492	MOUNT, TELESCOPE, M137 (19200) 8587295		EA	1
4	1240-00-896-2240	MOUNT, TELESCOPE, M138 (19200) 8587500		EA	1

Section II. COMPONENTS OF END ITEM-CONTINUED



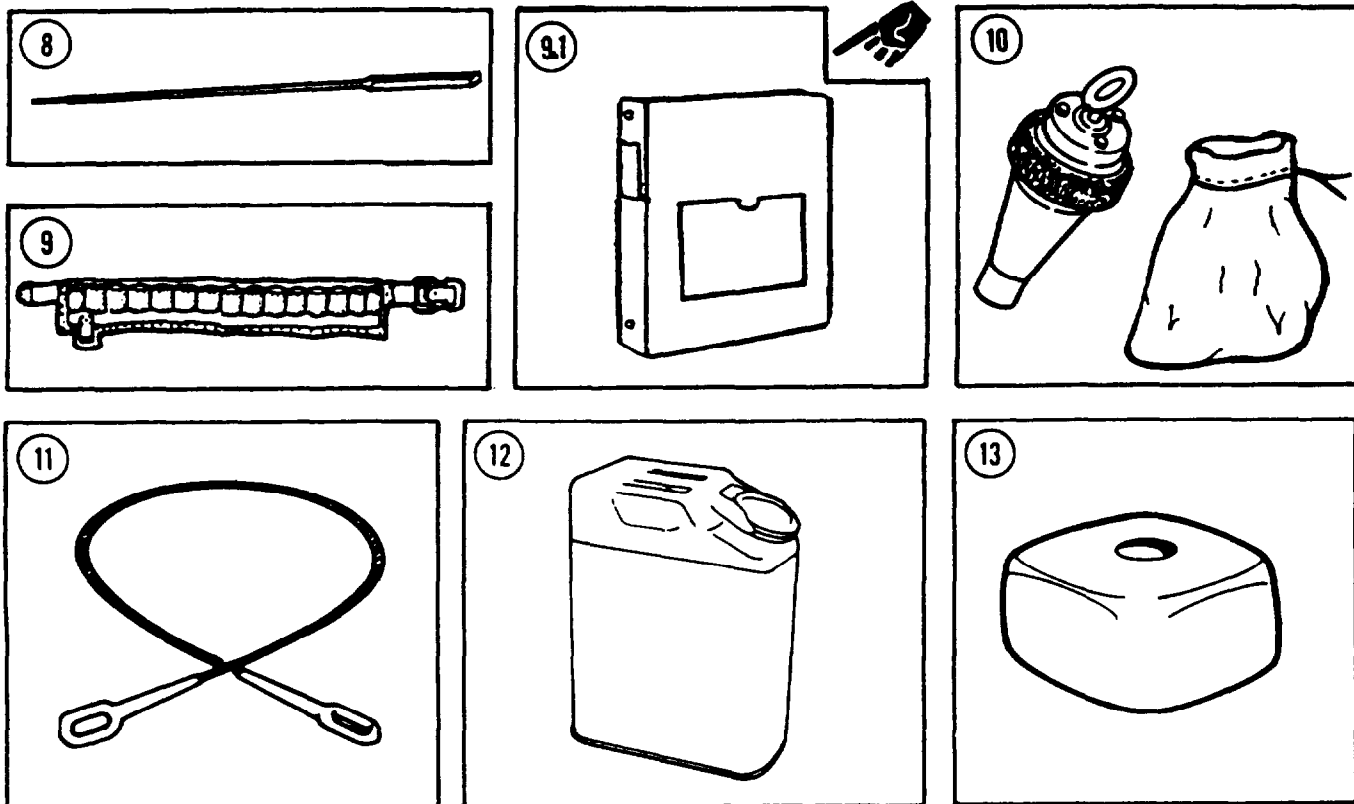
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) Usable On Code U/M	(5) Qty Rqr
5	6650-00-704-3549	PERISCOPE, M17 (19200) 7043549	EA	4
6	1290-00-896-2236	QUADRANT, FIRE CONTROL, M15 (19200) 8247683	EA	1
7	1240-00-328-5631	TELESCOPE, ELBOW, M139 (19200) 10556120	EA	1
8	1240-00-895-9186	TELESCOPE, PANORAMIC, M115 (19200) 8587340	EA	1

Section III. BASIC ISSUE ITEMS LIST



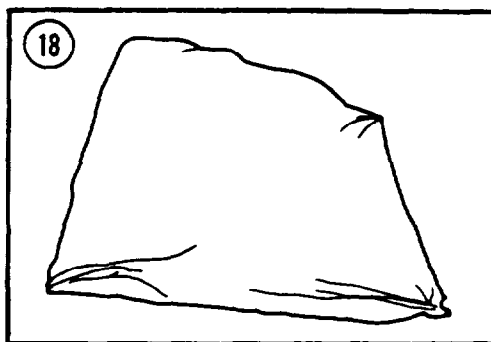
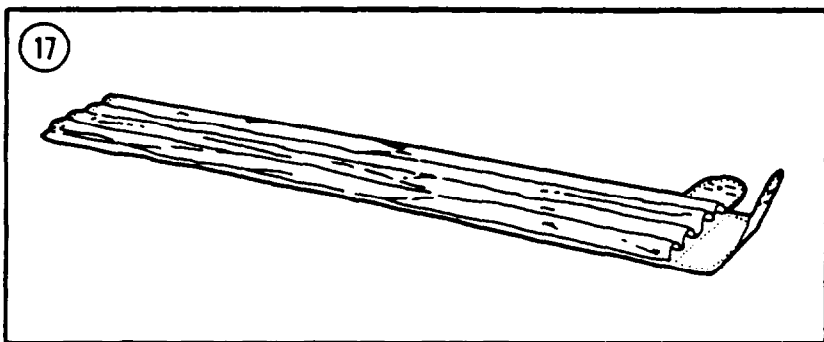
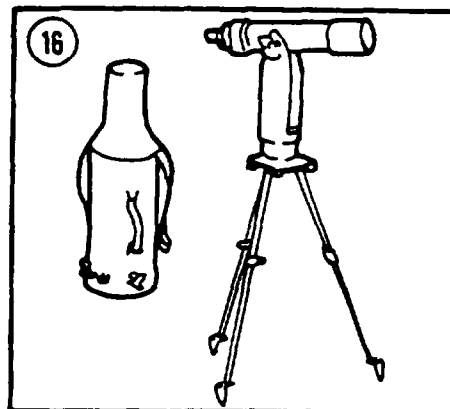
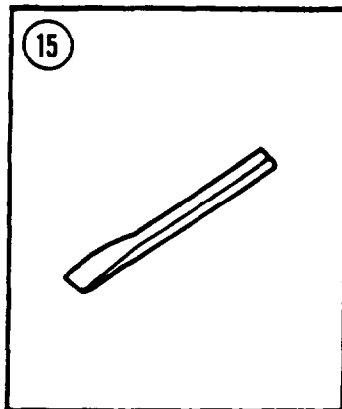
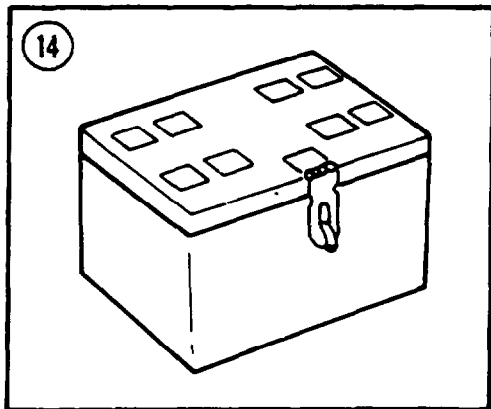
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
1	4930-00-204-2550	ADAPTER: lub gun, sleeve type (81349) MILL4387		EA	1
2	5120-00-227-8095	ADAPTER: 1/4-in. male, 3/8-in. female (58536) A-A-2172		EA	1
3	5120-00-227-8088	ADAPTER: 1/2-in. male, 3/4-in. female (58536) A-A-2172		EA	1
4	4931-01-187-9713	ALINEMENT DEVICE, M140: w/case (19200) 9360187		EA	1
5	5110-00-293-2336	AXE: single bit, 4-3/4-in. blade, 4 lb (19207) 6150925		EA	1
6	2540-00-670-2459	BAG, PAMPHLET (19207) 7961712		EA	1
7	5140-00-473-6256	BAG, TOOL (19207) 11655979		EA	1

Section III. BASIC ISSUE ITEMS LIST-CONTINUED



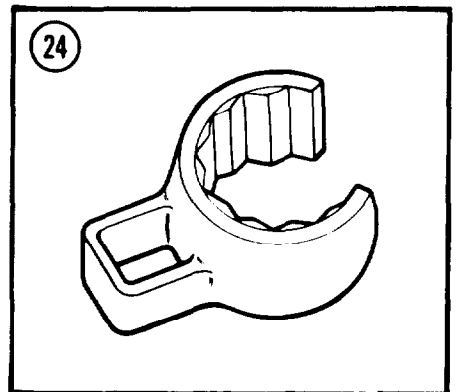
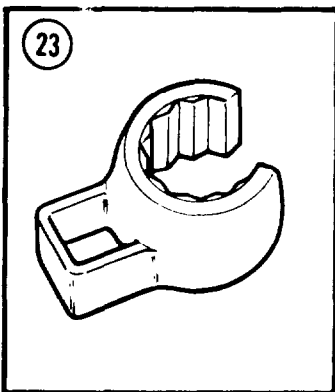
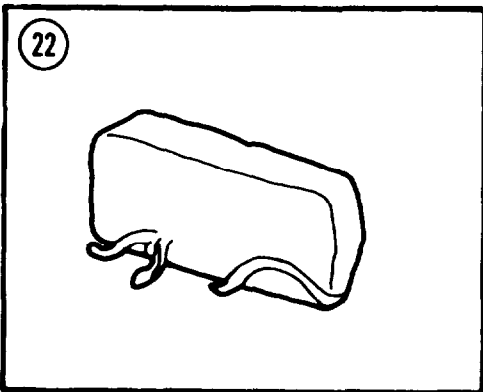
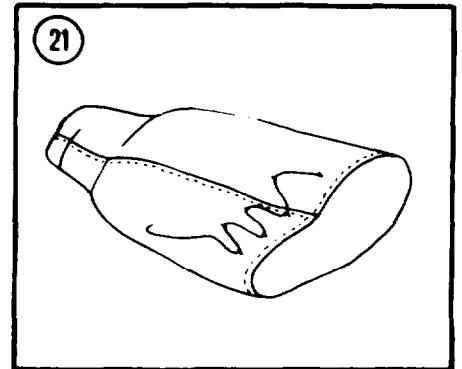
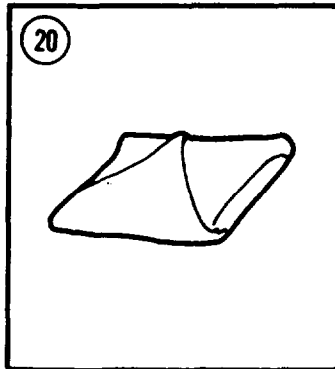
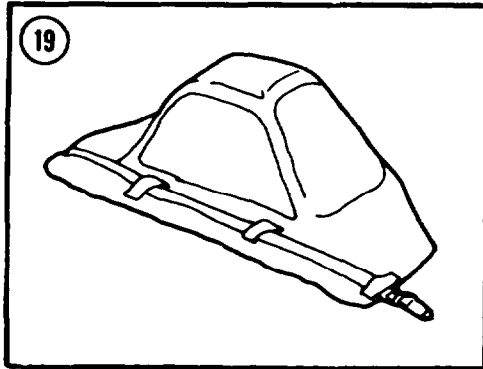
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) Usable On Code U/M	(5) Qty Rqr
8	5120-00-224-1390	BAR, CROW (81348) GGG-B-101	EA	1
9	5340-00-860-5446	BELT, PRIMER STRAP WEBBING (19206) 8767215	EA	1
9.1	7510-00-889-3494	BINDER, LOOSE-LEAF (19207) 11677003	EA	1
10	1030-01-196-2177	BRUSH AND BAG ASSY (27412) 203-110-401	EA	1
11	4010-00-202-2425	CABLE, TOWING (19207) 7360553	EA	1
12	7240-00-089-3827 7240-01-365-5317	CAN, WATER, MILITARY: 5 gal. (81349) MIL-C-43613 Tan Plastic Green Plastic	EA	2
13	1025-01-232-6821	CHAMBER SWAB (27412) 203CS	EA	1

Section III. BASIC ISSUE ITEMS LIST-CONTINUED



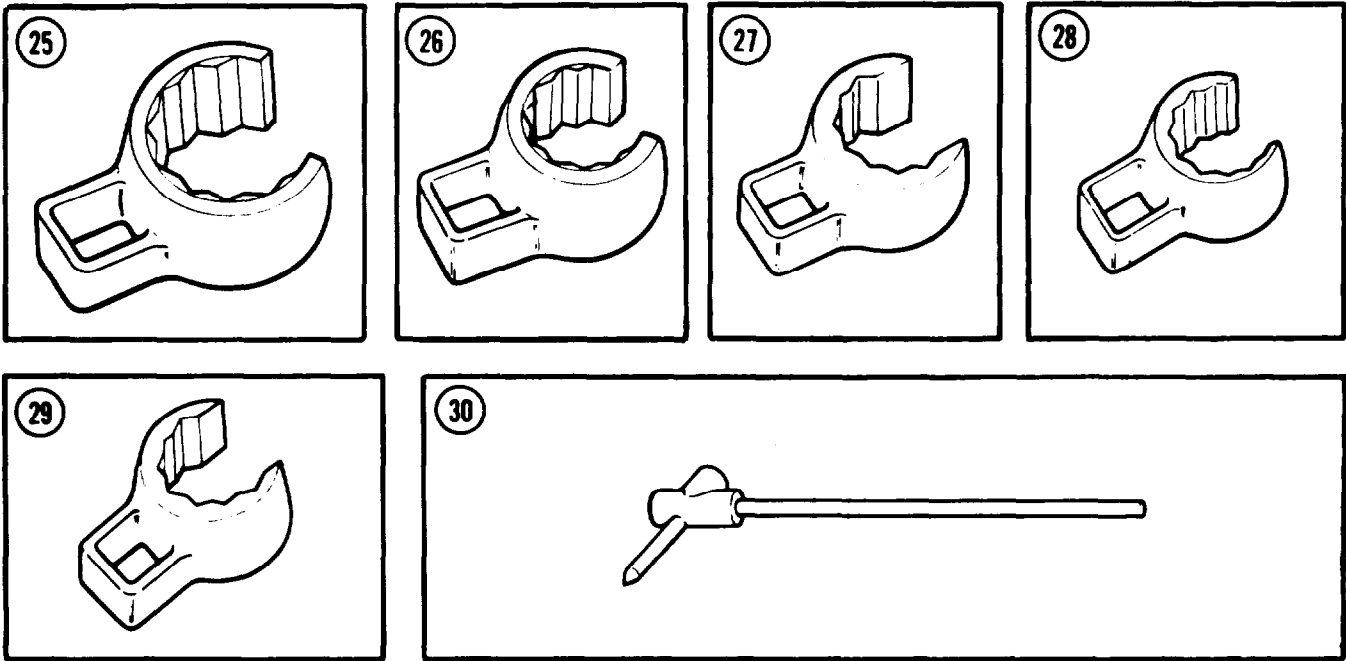
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14	1240-00-654-6089	CHEST, M14 (19200) 6546089		EA	1
15	5110-00-240-6034	CHISEL: hand, cold (81348) GGG-B-101 Type 1		EA	1
16	1240-00-332-1780	COLLIMATOR, INFINITY AIMING: M1A1 (19200) 10556235		EA	1
17	1290-00-653-7993	COVER, AIMING POST: M401 (19207) 6537993		EA	1
18	1025-00-862-9093	COVER, BREECH (19206) 8767936		EA	1

Section III. BASIC ISSUE ITEMS LIST-CONTINUED



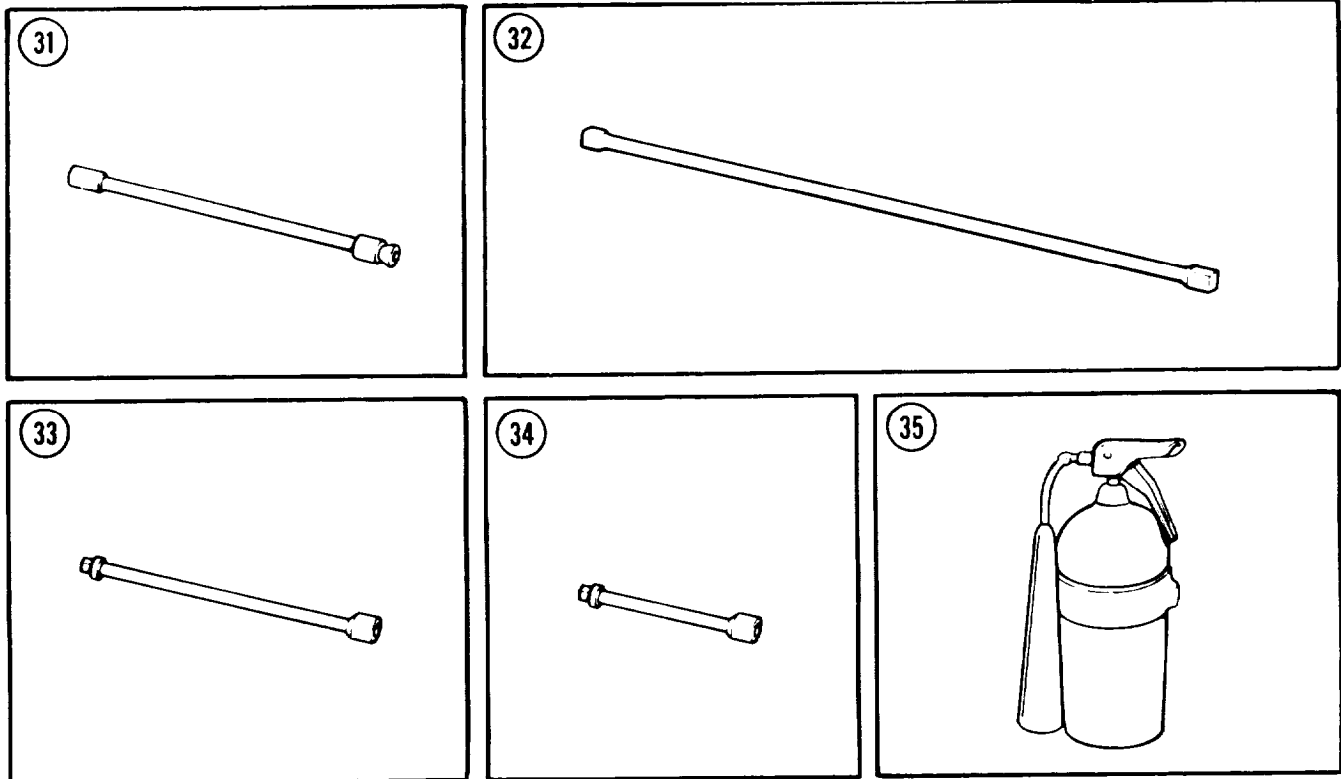
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
19	1240-00-819-4524	COVER, FIRE CONTROL INST. (19200) 8587508		EA	1
20	1240-00-819-4527	COVER, FIRE CONTROL INST. (19200) 8587509		EA	1
21	1025-01-054-5781	COVER, MUZZLE BRAKE (19206) 11579522		EA	1
22	1030-00-794-9764	COVER, RAMMER (19207) 10956573		EA	1
23	5120-00-541-4074	CROWFOOT ATTACHMENT: 1/4-in. drive 9/16 in. (81348) GGG-C-1507		EA	1
24	5120-00-189-7896	CROWFOOT ATTACHMENT: 3/8-in. drive, 11/16 in. (81348) GGG-C-1507		EA	1

Section III. BASIC ISSUE ITEMS LIST- CONTINUED



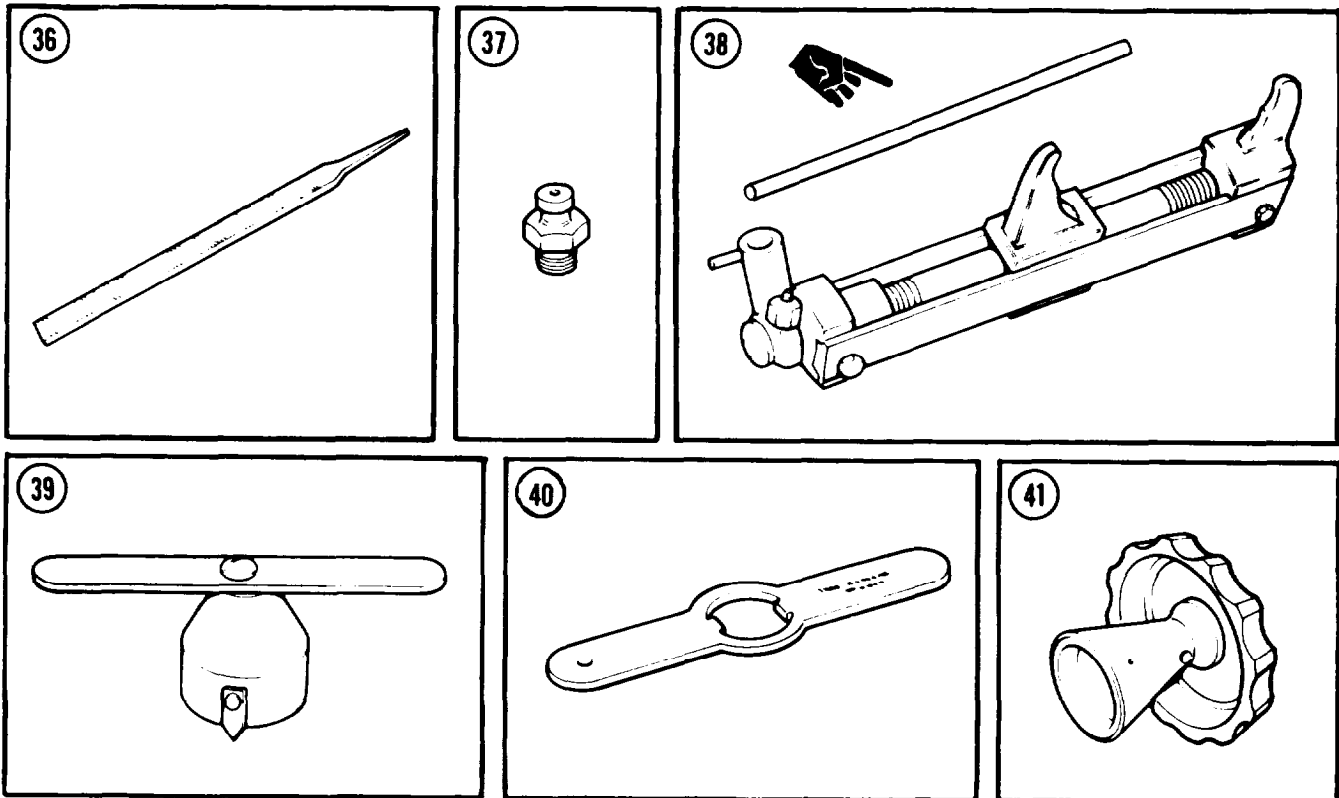
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) Usable On Code U/M	(5) Qty Rqr
25	5120-00-181-6765	CROWFOOT ATTACHMENT: 3/8-in. drive, 7/8 in. (81348) GGG-C-1507	EA	1
26	5120-00-229-2772	CROWFOOT ATTACHMENT: 3/8-in. drive, 1 in. (81348) GGG-C-1507	EA	1
27	5120-00-229-2773	CROWFOOT ATTACHMENT: 1/2-in. drive, 1-1/8 in. (81348) GGG-C-1507	EA	1
28	5120-00-181-6759	CROWFOOT ATTACHMENT: 1/2-in. drive, 1-1/2 in. (55719) AN8508-20	EA	1
29	5120-00-181-6757	CROWFOOT ATTACHMENT: 1/2-in. drive, 1-3/8 in. (81348) GGG-C-1507	EA	1
30	5120-00-708-3639	DRIFT (19207) 7083639	EA	1

Section III. BASIC ISSUE ITEMS LIST - CONTINUED



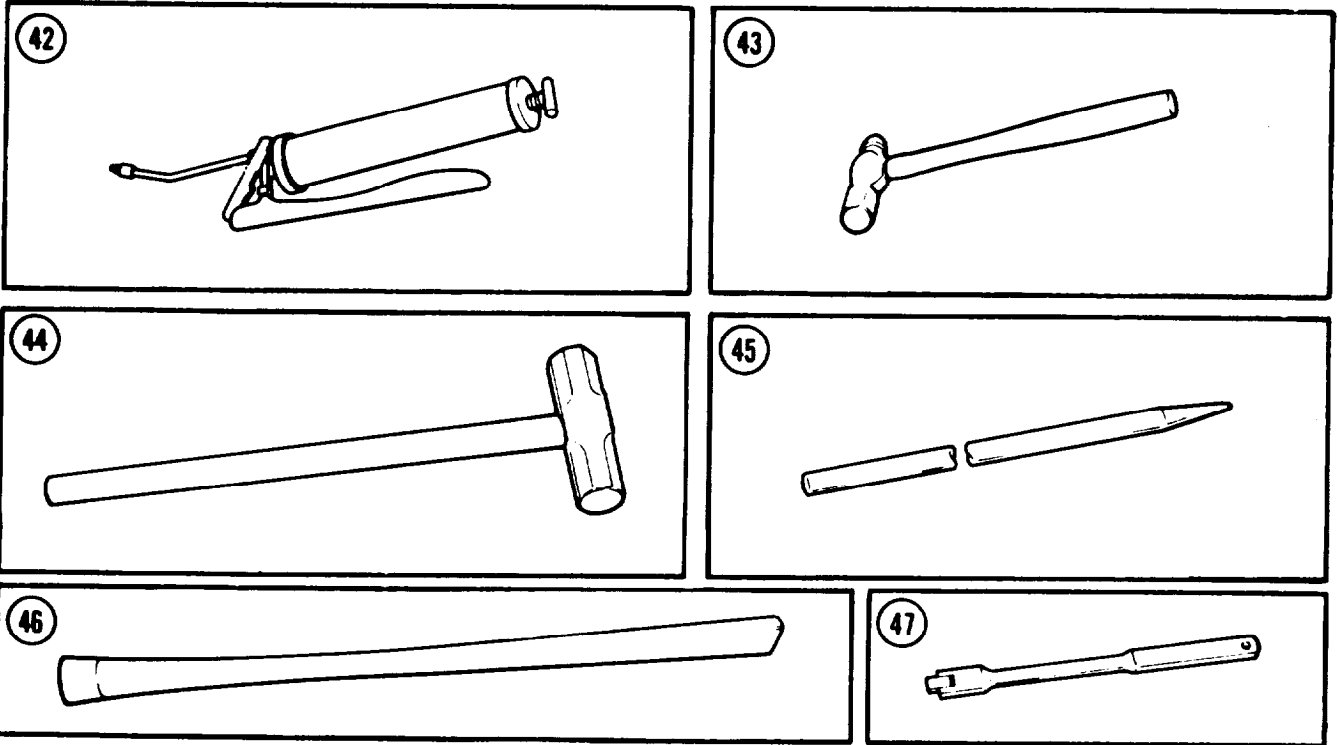
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
31	4930-00-288-1511	EXTENSION: lubr. gun, 12-in. long (81349) MILL4387		EA	1
32	5120-00-273-9205	EXTENSION: socket wr, 3/8-in. drive, 18 in. long (81348) GGGW641		EA	1
33	5120-00-243-7326	EXTENSION: socket wr, 1/2-in. drive, 5 in. long (81348) GGG-W-641		EA	1
34	5120-00-273-9208	EXTENSION: socket wr, 3/4-in. drive (81348) GGG-W-641		EA	1
35	4210-00-270-4512	EXTINGUISHER, FIRE: CO ₂ , portable, 5 lb (19207) 7714780		EA	1

Section III. BASIC ISSUE ITEMS LIST -CONTINUED



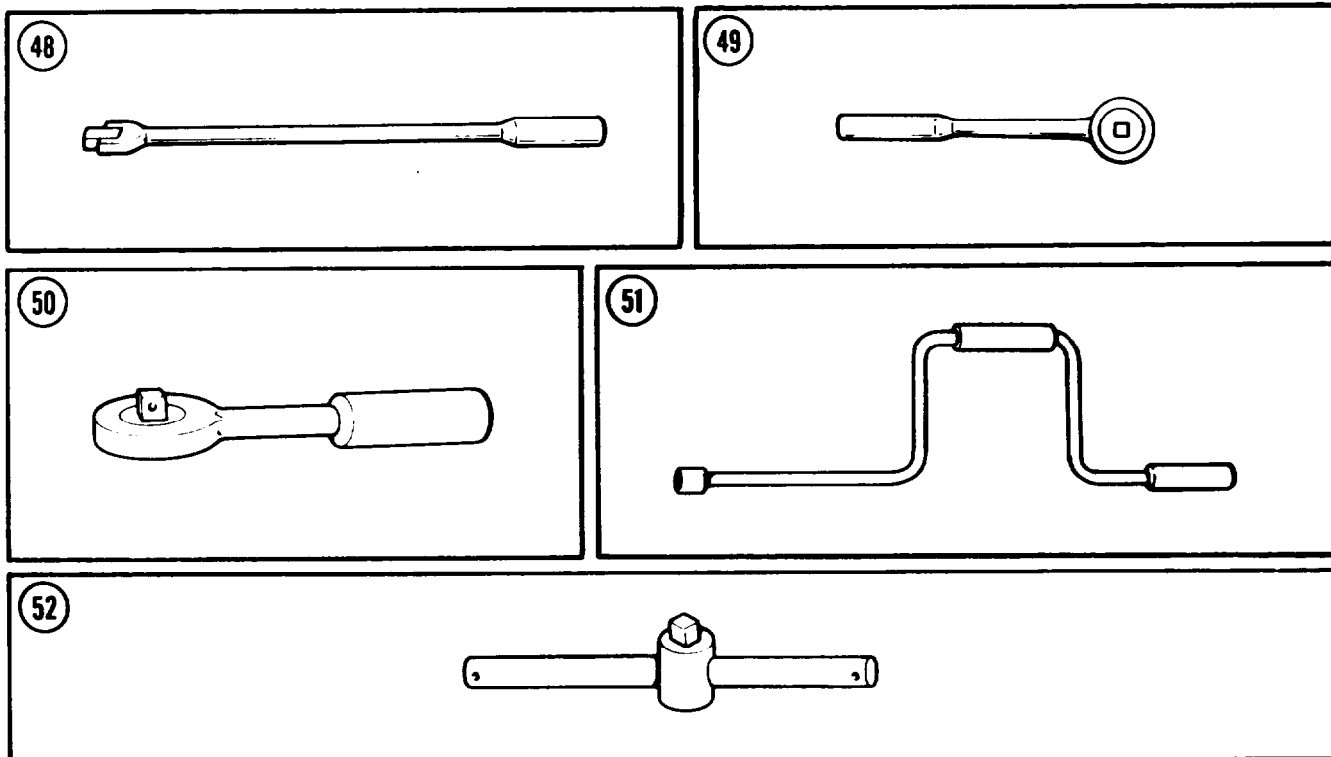
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
36	5110-00-156-0059	FILE: hand, smooth, 10-in. long (81348) GGG-F-325		EA	1
37	4730-00-050-4208	FITTINGS: lubr, straight, 1/8 in. 27 NPT (96906) MS15003-1		EA	3
38	5120-00-605-3926	FIXTURE: track connecting, with bar (19207) 8741739		EA	2
39	1290-00-764-7761	FUZE SETTER: M27 (19200) 7647761		EA	1
40	1290-00-078-4367	FUZE SETTER: M34 (19200) 11747300		EA	1
41	1290-00-201-3507	FUZE SETTER: M35 (19200) 11729019		EA	1

Section III. BASIC ISSUE ITEMS LIST - CONTINUED



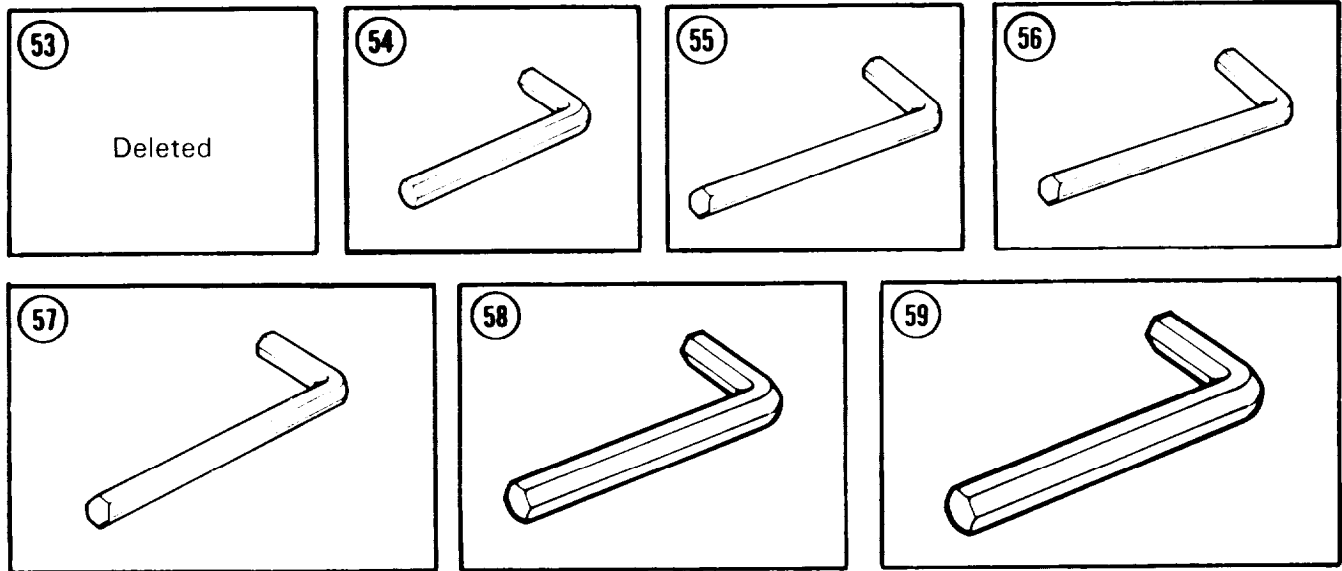
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) Usable On Code U/M	(5) Qty Rqr
42	4930-00-253-2478	GUN, GREASE: 16 oz. (81349) MIL-G-3859	EA	1
43	5120-00-061-8546	HAMMER, HAND: ball peen (81348) GGG-H-86	EA	1
44	5120-00-900-6097	HAMMER, SLEDGE: 10 lb (81348) GGG-H-86	EA	1
45	5120-00-243-2419	HANDLE, BAR: 3/4 in. by 30 in. long (19207) 6196147 (used with Track Con- necting Fixture)	EA	1
46	5120-00-288-6574	HANDLE, MATTOCK/PICK (19207) 11677021	EA	2
47	5120-00-240-5396	HANDLE, SOCKET WRENCH: hinged 3/8-in. drive, 8 in. long (81348) GGGW641TYPE 5	EA	1

Section III. BASIC ISSUE ITEMS LIST - CONTINUED



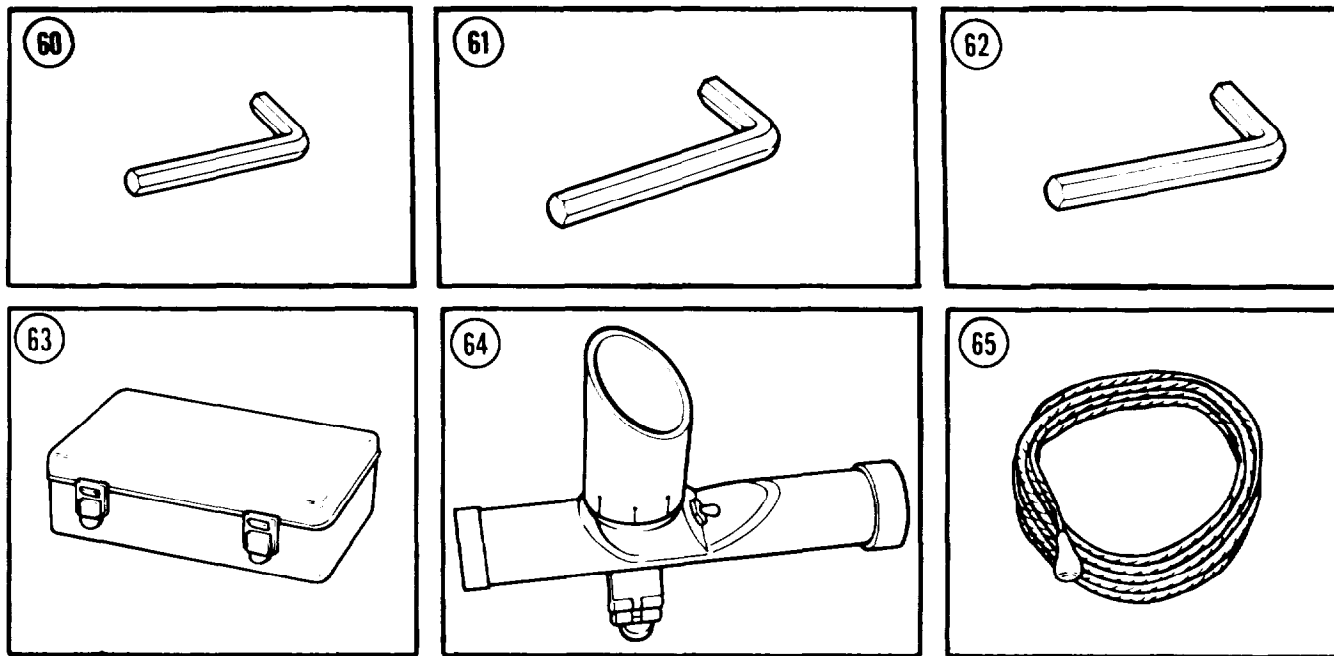
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
48	5120-00-236-7590	HANDLE, SOCKET WRENCH: hinged 1/2-in. drive, 16-18 in. long (58536) A-A-2164		EA	1
49	5120-00-240-5364	HANDLE, SOCKET WRENCH: ratchet 3/8-in. drive (19207) 5226183		EA	1
50	5120-00-230-6385	HANDLE, SOCKET WRENCH: 1/2-in. drive, 9-12 - 15-1/2 in. long (58536) A-A-2165		EA	1
51	5120-00-249-1071	HANDLE, SOCKET WRENCH: speeder, 1/2-in. drive (58536) A-A-2166		EA	1
52	5120-00-099-8544	HANDLE, SOCKET WRENCH: T sliding, 3/4-in. drive (34871) FAC01022		EA	1

Section III. BASIC ISSUE ITEMS LIST-CONTINUED



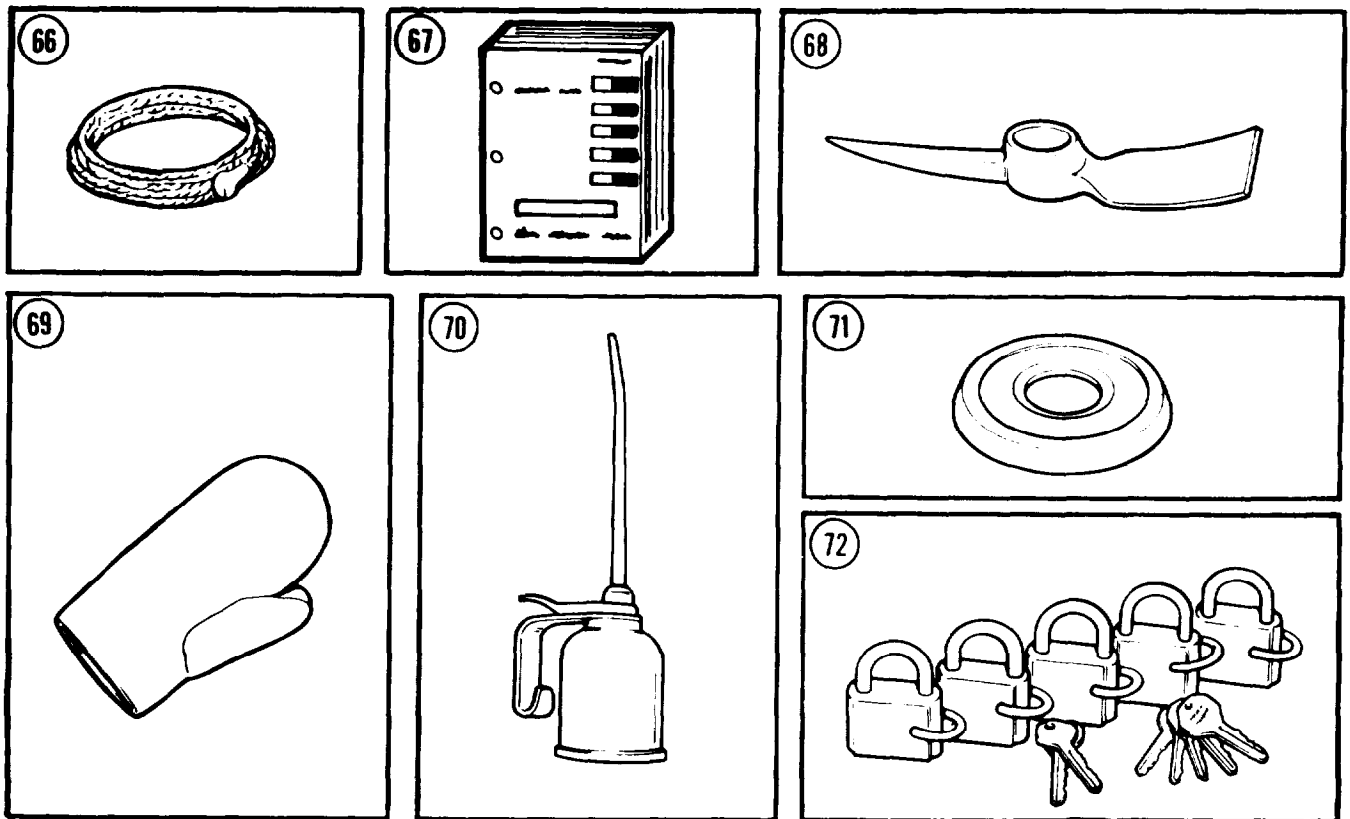
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) Usable On Code U/M	(5) Qty Rqr
53		Deleted		
54	5120-00-242-7410	KEY: socket head, hex screw, 3/32 in. (81348) GGG-K-275	EA	1
55	5120-00-240-5292	KEY: socket head, hex screw, 1/8 in. (19200) 10545649-1	EA	1
56	5120-00-198-5392	KEY: socket head, hex screw, 5/32 in. (81348) GGG-K-275	EA	1
57	5120-00-240-5300	KEY: socket head, hex screw, 3/16 in. (81348) GGG-K-275	EA	1
58	5120-00-242-7411	KEY: socket head, hex screw, 7/32 in. (81348) GGG-K-275	EA	1
59	5120-00-224-4659	KEY: socket head, hex screw, 1/4 in. (81348) GGG-K-275	EA	1

Section III. BASIC ISSUE ITEMS LIST - CONTINUED



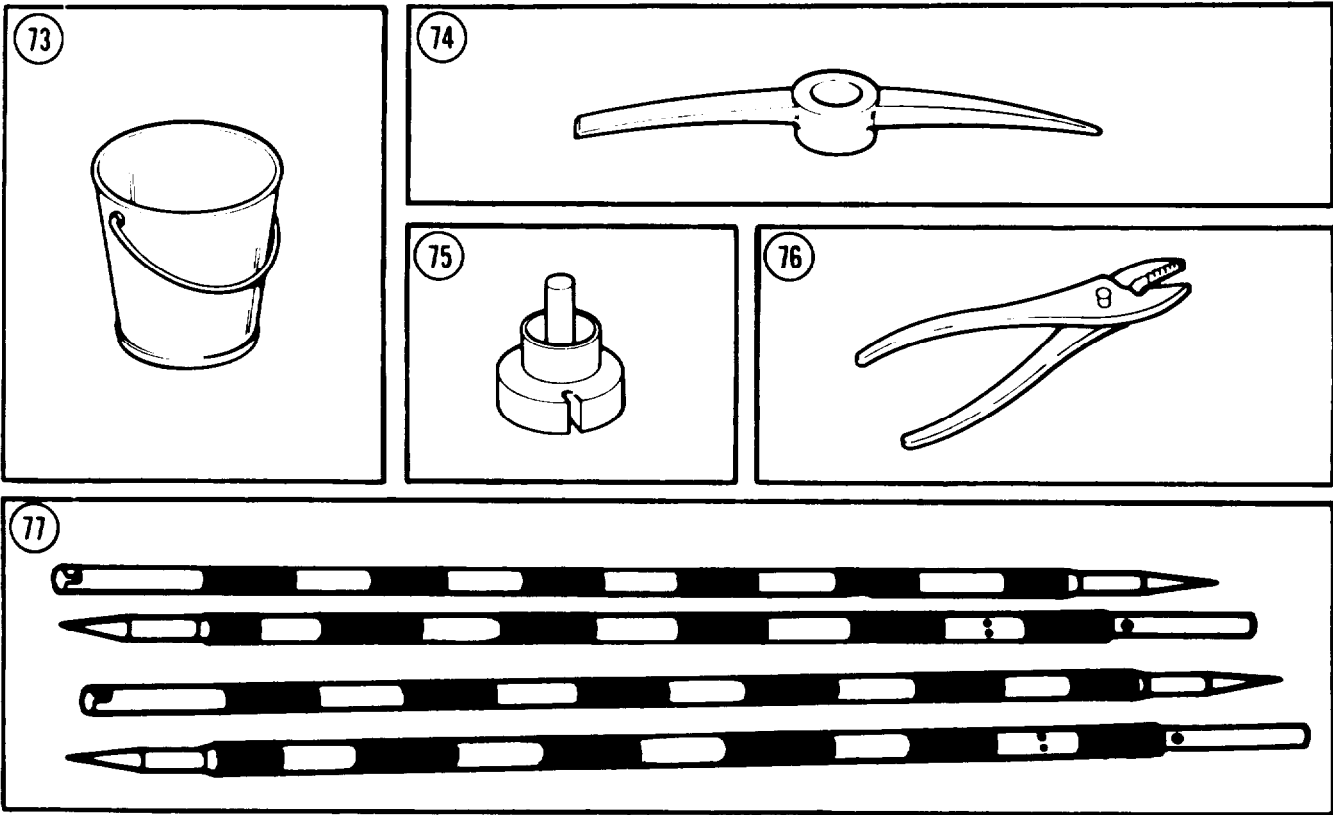
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
60	5120-00-240-5274	KEY: socket head, hex screw, 5/16 in. (81348) GGG-K-275		EA	1
61	5120-00-198-5390	KEY: socket head, hex screw, 3/8 in. (81348) GGG-K-275		EA	1
62	5120-00-224-2510	KEY: socket head, hex screw, 5/8 in. (81348) GGG-K-275		EA	1
63	6545-00-922-1200	KIT: first aid, 12 unit (19207) 11677011		EA	1
64	1290-01-148-4821	LIGHT, AIMING POST, M14 (19200) 11785401		EA	2
65	1095-00-600-6780	LANYARD, FIRING, M12: 6 ft (19206) 6006780		EA	1

Section III. BASIC ISSUE ITEMS LIST-CONTINUED



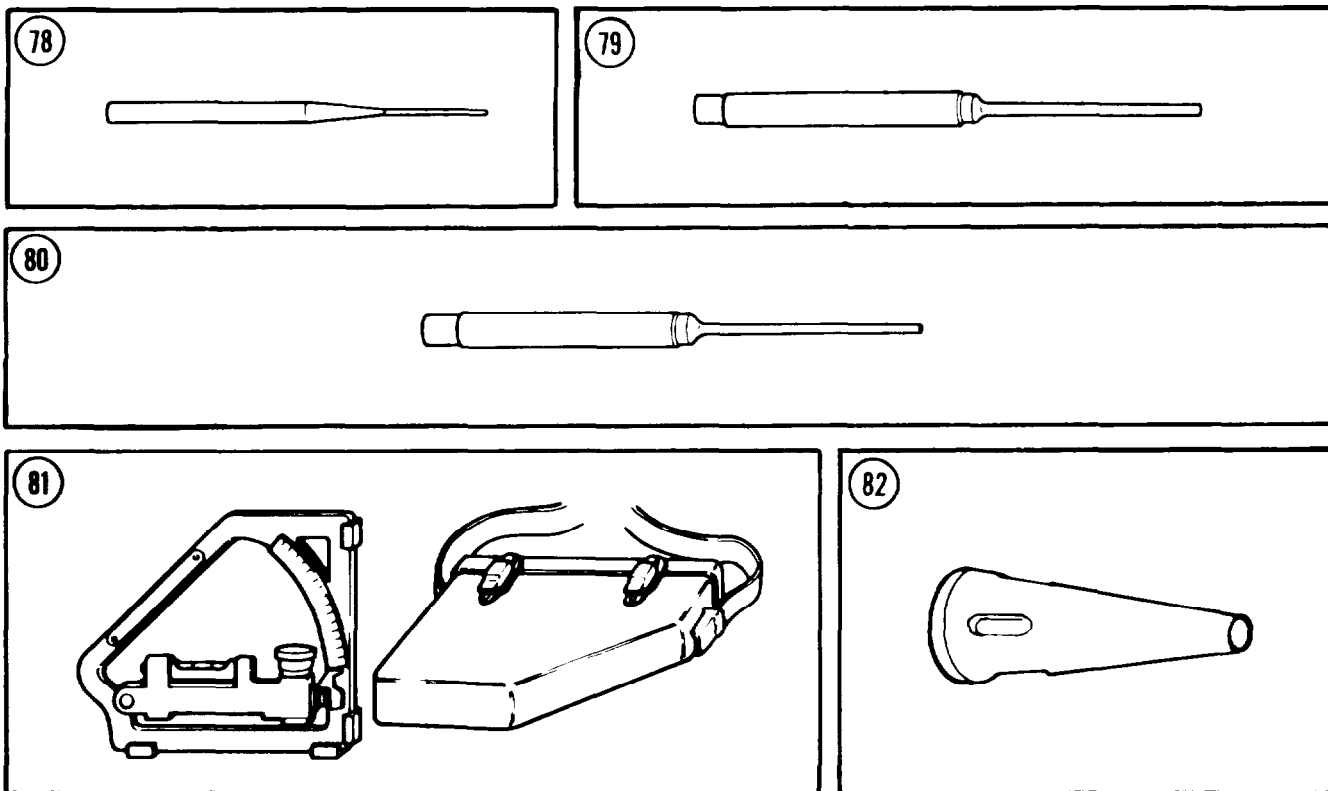
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
66	4020-00-610-9018	LANYARD, FIRING: 50 ft (19204) 6109018		EA	1
67	DA PAM 25-30	MANUAL, OPERATOR' S: TM 9-2350-304-10		EA	1
68	5120-00-243-2395	MATTOCK: pick w/o handle (19207) 11677022		EA	1
69	8415-01-092-0039	MITTEN, HEAT PROTECTIVE (81349) MIL-M-11199F		EA	2
70	4930-00-262-8868	OILER: pump type, 1-pt cap. (81348) GGG-O-591		EA	1
71	5340-01-032-5117	PAD, OBTURATOR (19206) 11579507		EA	1
72	5340-01-050-7059	PADLOCK SET (96906) MS21313-50		SE	1

Section III. BASIC ISSUE ITEMS LIST - CONTINUED



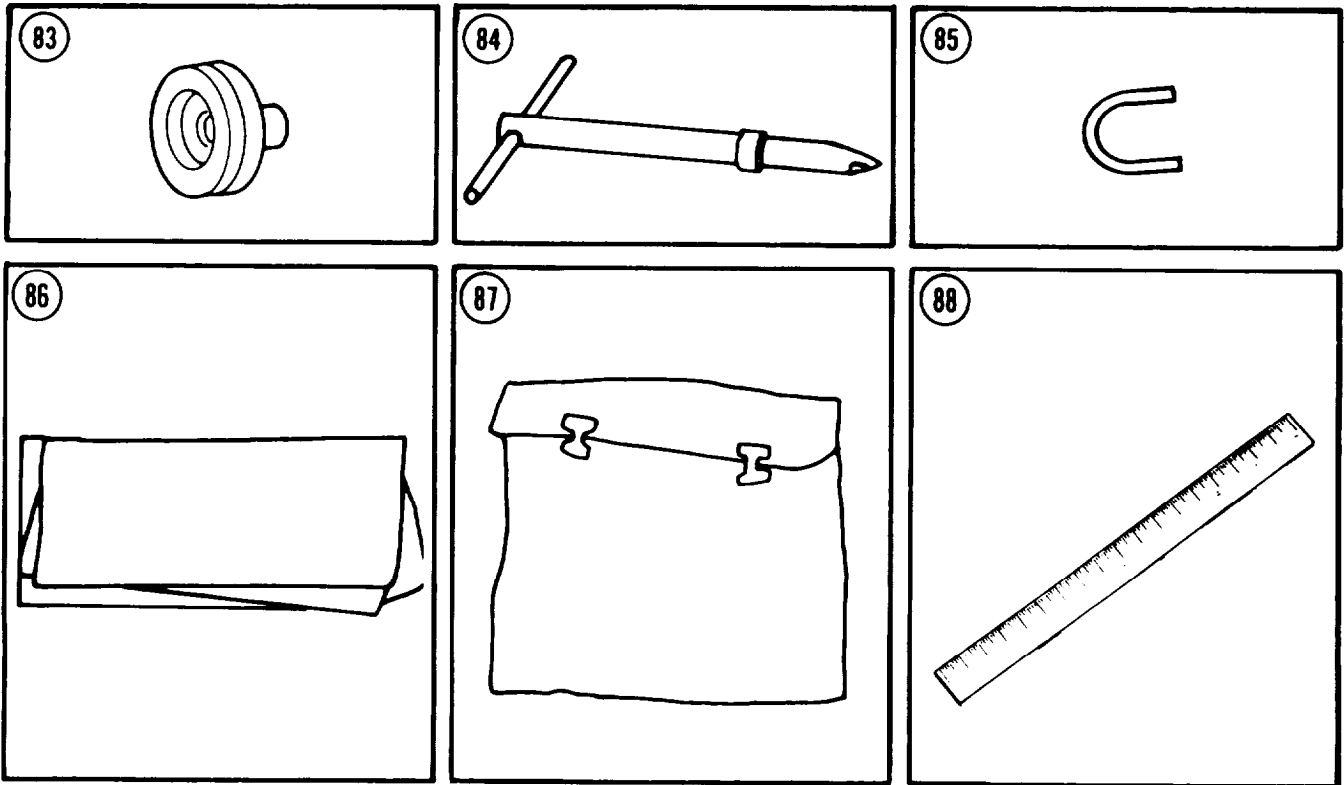
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
73	7240-00-160-0455	PAIL, METAL: 3-1/2 gal. (58536) A-A-1273		EA	1
74	5120-00-194-9458	PICK, DIGGING: railroad, 7 lb, w/o handle (58536) A-A-338		EA	1
75	1025-00-860-9169	PIN, FIRING: S, 0.130 dia striking end (19206) 8767183		EA	1
76	5120-00-223-7397	PLIERS: comb., slip joint w/cutter (19207) 11655775-3		EA	1
77	1290-00-535-7617	POST, AIMING, M1A2 (19200) 7687114		EA	2

Section III. BASIC ISSUE ITEMS LIST-CONTINUED



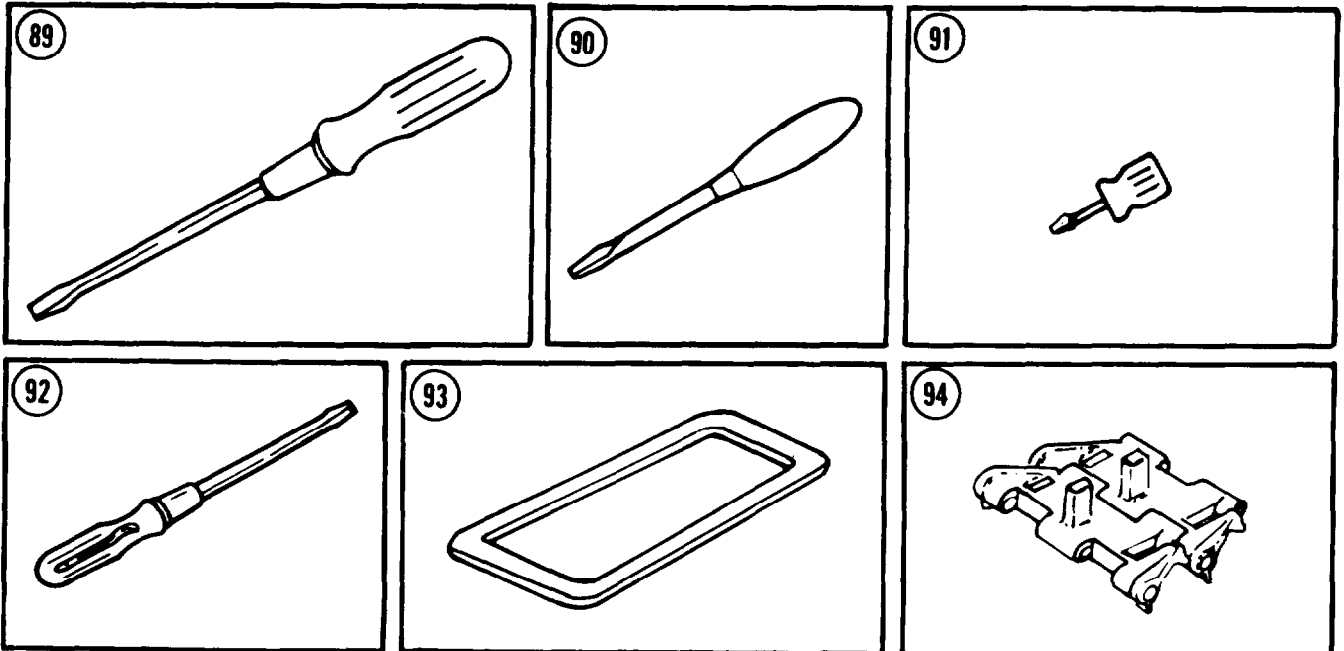
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) Usable On Code U/M	(5) Qty Rqr
78	5120-00-752-9030	PUNCH, DRIVE, PIN: 1/16-in. dia. 1-1/2 in. point length (81348) GGG-P-831	EA	1
79	5120-00-752-9031	PUNCH, DRIVE, PIN: 5/32-in. dia, 2 in. point length (81348) GGG-P-831	EA	1
80	5120-00-223-1015	PUNCH, DRIVE PIN: 3/16-in. dia, 3-1/2 in. point length (81348) GGG-P-831	EA	1
81	1290-00-891-9999	QUADRANT, FIRE CONTROL, M1A1 or M1A2 (19200) 7197156	EA	1
82	1025-00-607-9509	RAMMER, CLEANING AND UNLOADING (19206) 7309681	EA	1

Section III. BASIC ISSUE ITEMS LIST- CONTINUED



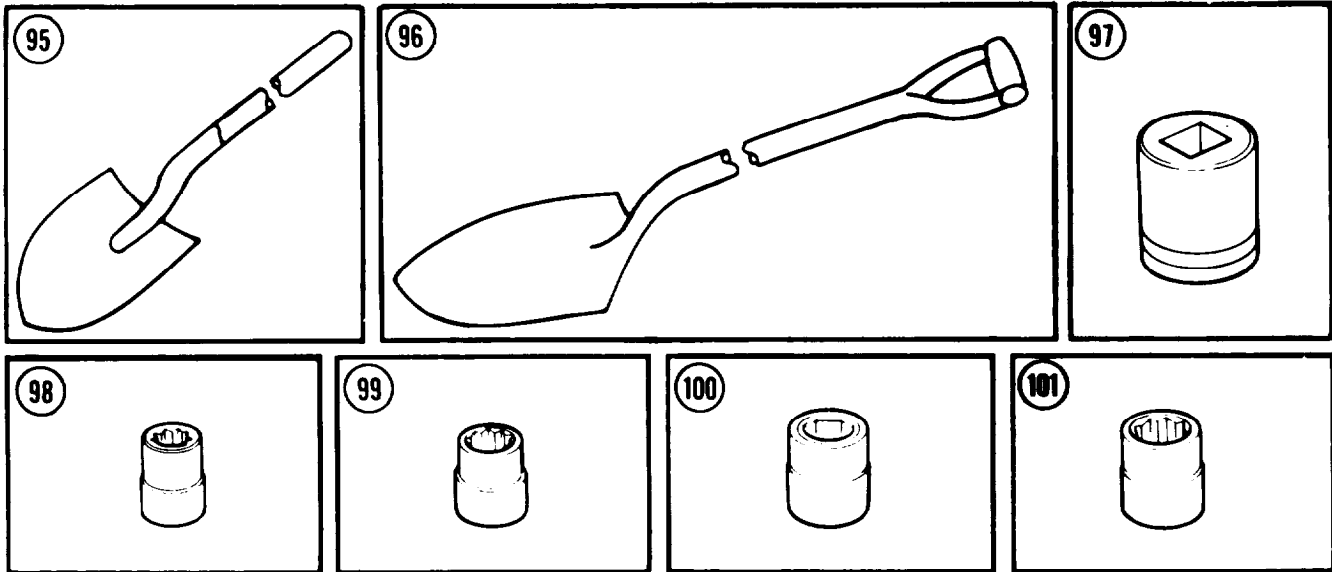
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
83	1025-01-207-5621	RAMMER, LOADING, ASSY (19206) 11579808		EA	1
84	4933-01-026-5253	REAMER, ASSEMBLY (19206) 11578743		EA	1
85	5315-00-861-1473	RETAINER, FIRING PIN (19206) 8767184		EA	1
86	5140-00-158-6379	ROLL, TOOL: Crowfoot (19204) 8448988		EA	1
87	4933-00-796-4537	ROLL, TOOL, ASSEMBLY (19207) 7964537		EA	1
88	5210-00-243-3367	RULE, STEEL: 18 in. (81348) GGG-R-791		EA	1

Section III. BASIC ISSUE ITEMS LIST-CONTINUED



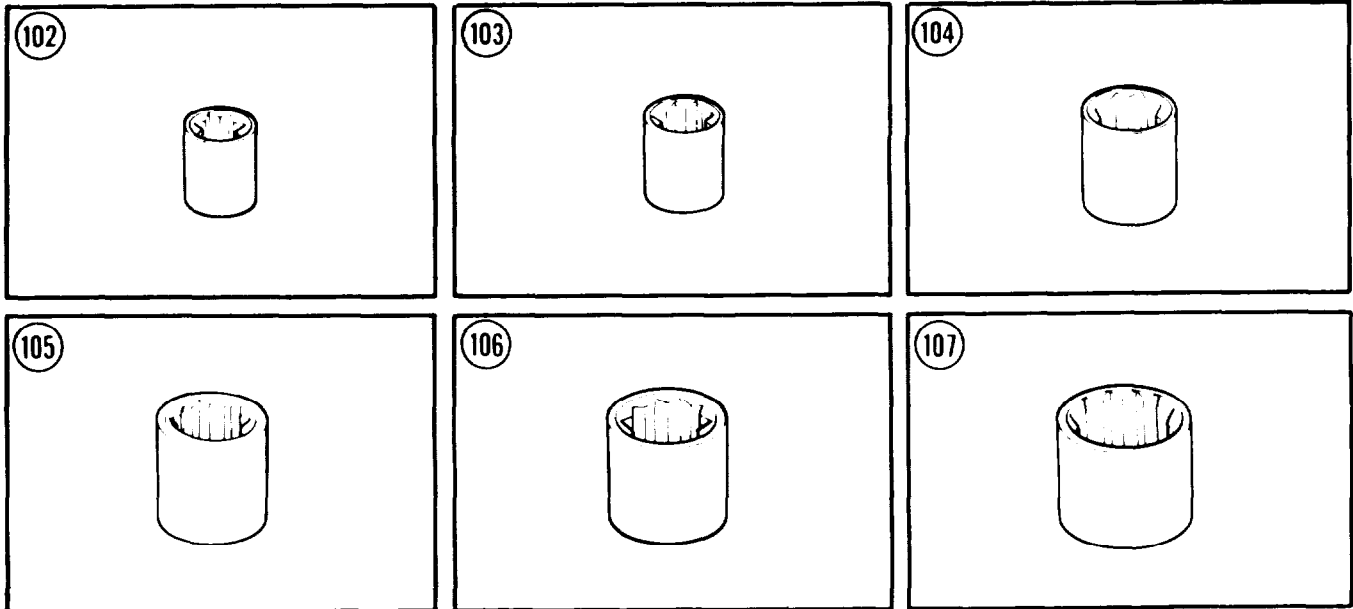
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Rqr
89	5120-00-278-1283	SCREWDRIVER: Common, 6-in. blade (19207) 41S1104		EA	1
90	5120-00-227-7338	SCREWDRIVER: mach. extra heavy duty (81348) GGS121		EA	1
91	5120-00-596-8502	SCREWDRIVER: special purpose, 1/4 in. blade, 1-1/2 in. long (63653) 45-11465TW		EA	1
92	5120-00-236-2140	SCREWDRIVER: flat tip, 1/8-in. tip w/pocket clip (32242) 49-11630		EA	1
93	5330-00-930-7177	SEAL: M17 periscope (19207) 11592732		EA	3
94	2530-00-076-7115	SHOE ASSEMBLY, TRACK (19207) 10934639		EA	2

Section III. BASIC ISSUE ITEMS LIST- CONTINUED



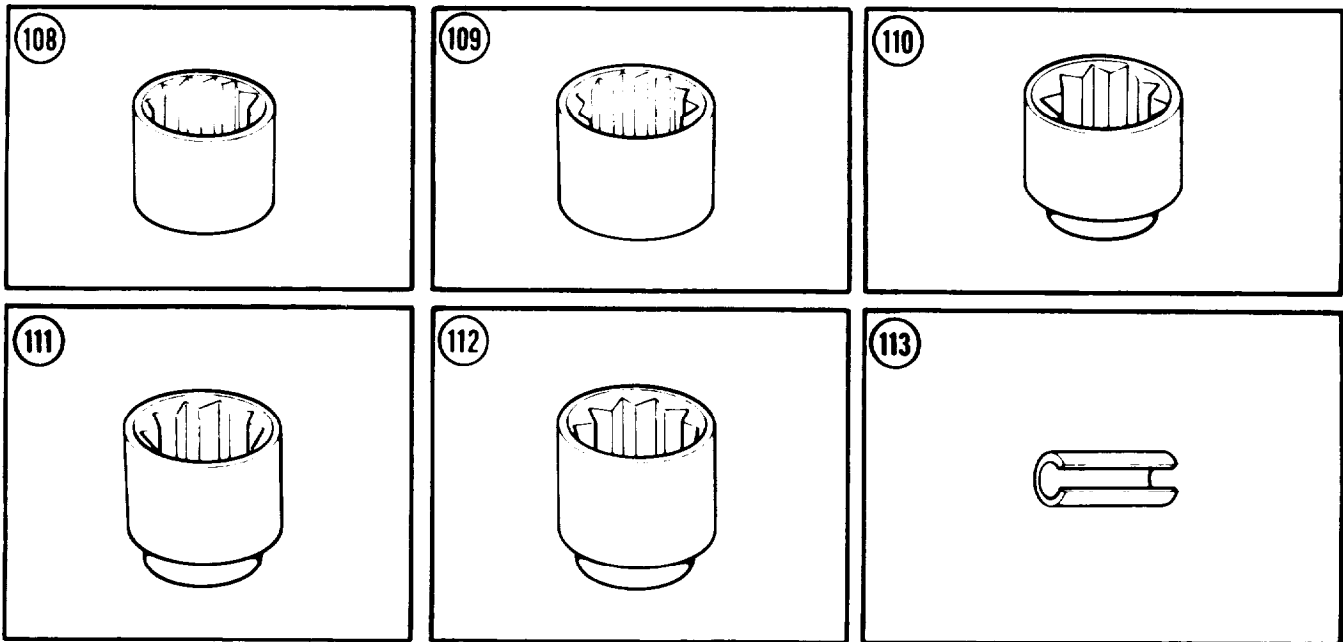
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) Usable On Code U/M	(5) Qty Rqr
95	5120-00-188-8450	SHOVEL, HAND: general purpose (81348) GGG-S-326	EA	1
96	5120-00-293-3336	SHOVEL, HAND: rd pt, D-hdle (19207) 11655784	EA	1
97	5130-00-969-1773	SOCKET: socket wrench, heavy duty, 4 pt, 3/4-in. drive, 3/4 in. (81348) GGG-W-660	EA	1
98	5120-00-189-7924	SOCKET: socket wrench, 12 pt, 1/2-in. drive, 7/16 in. (58536) A-A-1399	EA	1
99	5120-00-237-0984	SOCKET: socket wrench, 12 pt, 1/2-in. drive, 1/2 in. (58536) A-A-1399	EA	1
100	5130-00-221-8007	SOCKET: socket wrench, 6 pt, 1/2-in. drive, 9/16 in. (81348) GGG-W-660	EA	1
101	5120-00-189-7932	SOCKET: socket wrench, 12 pt, 1/2-in. drive, 9/16 in. (19207) 11677025-1	EA	1

Section III. BASIC ISSUE ITEMS LIST-CONTINUED



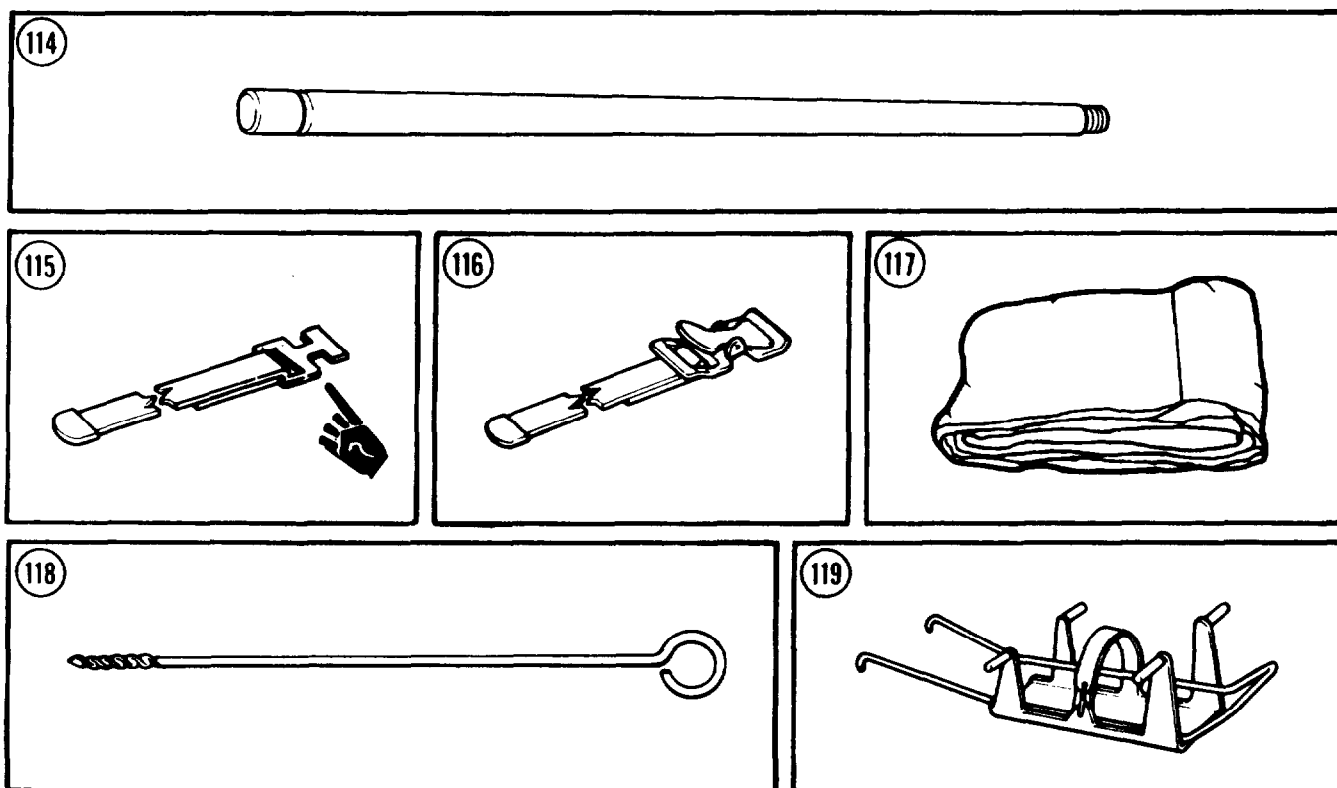
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) Usable On Code U/M	(5) Qty Rqr
102	5120-00-189-7946	SOCKET: socket wrench, 12 pt, 1/2-in. drive, 5/8 in. (19207) 11677025-2	EA	1
103	5120-00-189-7985	SOCKET: socket wrench, 12 pt, 1/2-in. drive, 3/4 in. (19207) 11677025-4	EA	1
104	5120-00-189-7935	SOCKET: socket wrench, 12 pt, 1/2-in. drive, 15/16 in. (19207) 11677025-6	EA	1
105	5120-00-189-7927	SOCKET: socket wrench, 12 pt, 1/2-in. drive, 1 in. (192071) 11677025-7	EA	1
106	5120-00-189-7913	SOCKET: socket wrench, 12 pt, 1/2-in. drive, 1-1/16 in. (19207) 11677025-8	EA	1
107	5120-00-189-7914	SOCKET: socket wrench, 12 pt, 1/2-in. drive, 1-1/8 in. (19207) 11677025-10	EA	1

Section III. BASIC ISSUE ITEMS LIST - CONTINUED



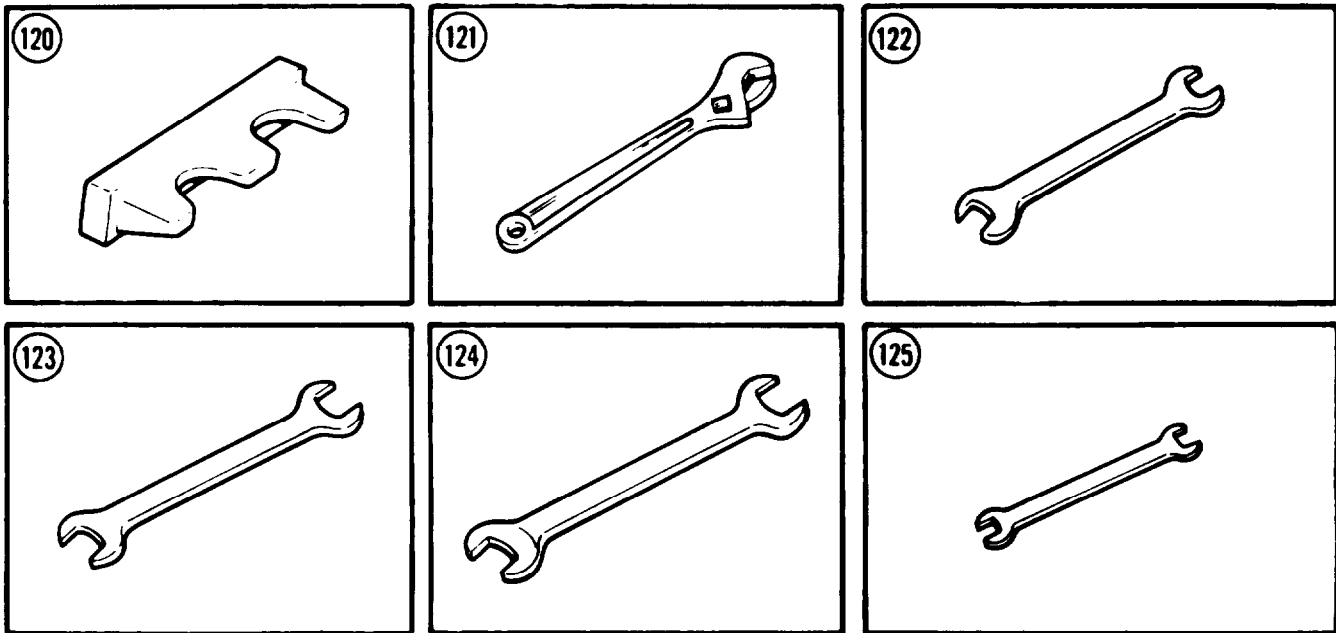
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) Usable On Code U/M	(5) Qty Rqr
108	5120-00-235-5871	SOCKET: socket wrench, 12 pt, 3/4-in. drive, 1-1/4 in. (58536) A-A-1394	EA	1
109	5120-00-232-5681	SOCKET: socket wrench, 12 pt, 3/4-in. drive, 1-5/16 in. (58536) A-A-1394	EA	1
110	5120-00-189-7930	SOCKET: socket wrench, 12 pt, 3/4-in. drive, 1-3/8 in. (58536) A-A-1394	EA	1
111	5120-00-189-7931	SOCKET: socket wrench, 12 pt, 3/4-in. drive, 1-7/16 in. (58536) A-A-1394	EA	1
112	5120-00-293-0094	SOCKET: socket wrench, 12 pt, 3/4-in. drive, 1-1/2 in. (58536) A-A-1394	EA	1
113	5365-00-520-7129	SPACER: counterbalance cylinder (19206) 5207129	EA	1

Section III. BASIC ISSUE ITEMS LIST - CONTINUED



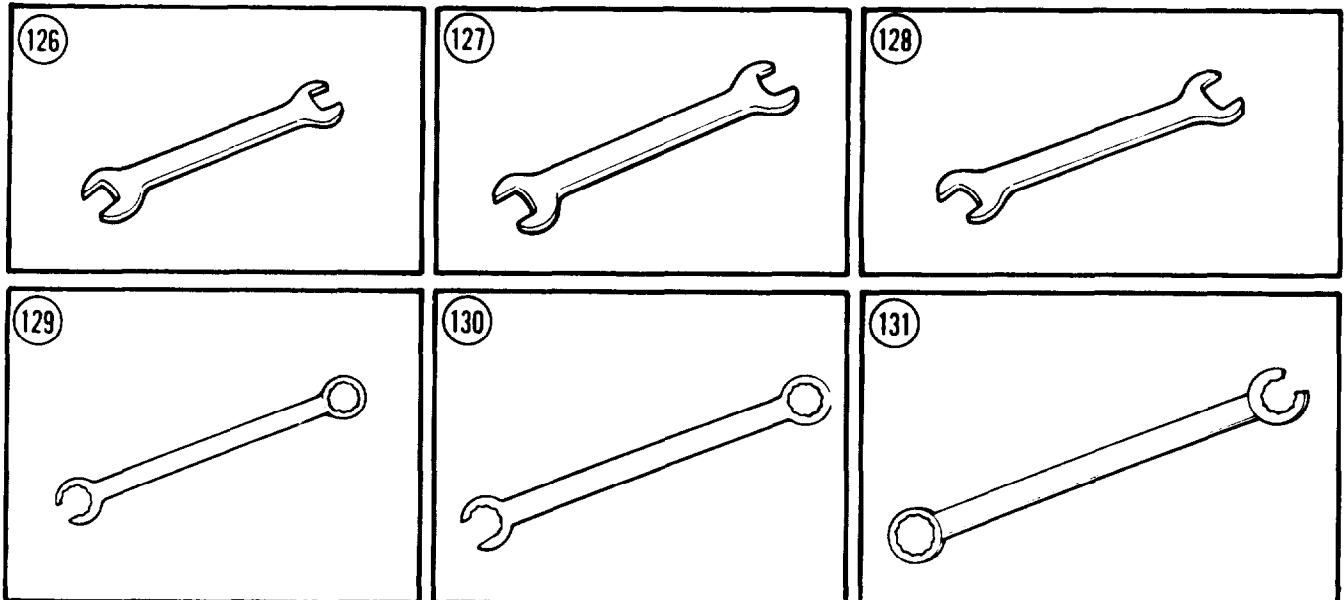
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) Usable On Code U/M	(5) Qty Rqr
114	1025-00-563-7232	STAFF SECTION, CLEANING ARTILLERY: M15 (19206) 7309228	EA	10
115	2540-00-757-1955	STRAP, WEBBING (19207) 10903978	EA	9
116	5340-00-543-3398	STRAP, WEBBING (19207) 8690462	EA	3
117	2540-00-653-7589	TARPAULIN: canvas 12 by 12 ft (19207) 6537589	EA	1
118	4933-00-601-9667	TOOL, CLEANING, VENT (19206) 6019667	EA	1
119	1030-01-014-4663	TRAY, PROJECTILE LIFTING (19204) 11675458-2	EA	2

Section III. BASIC ISSUE ITEMS LIST - CONTINUED



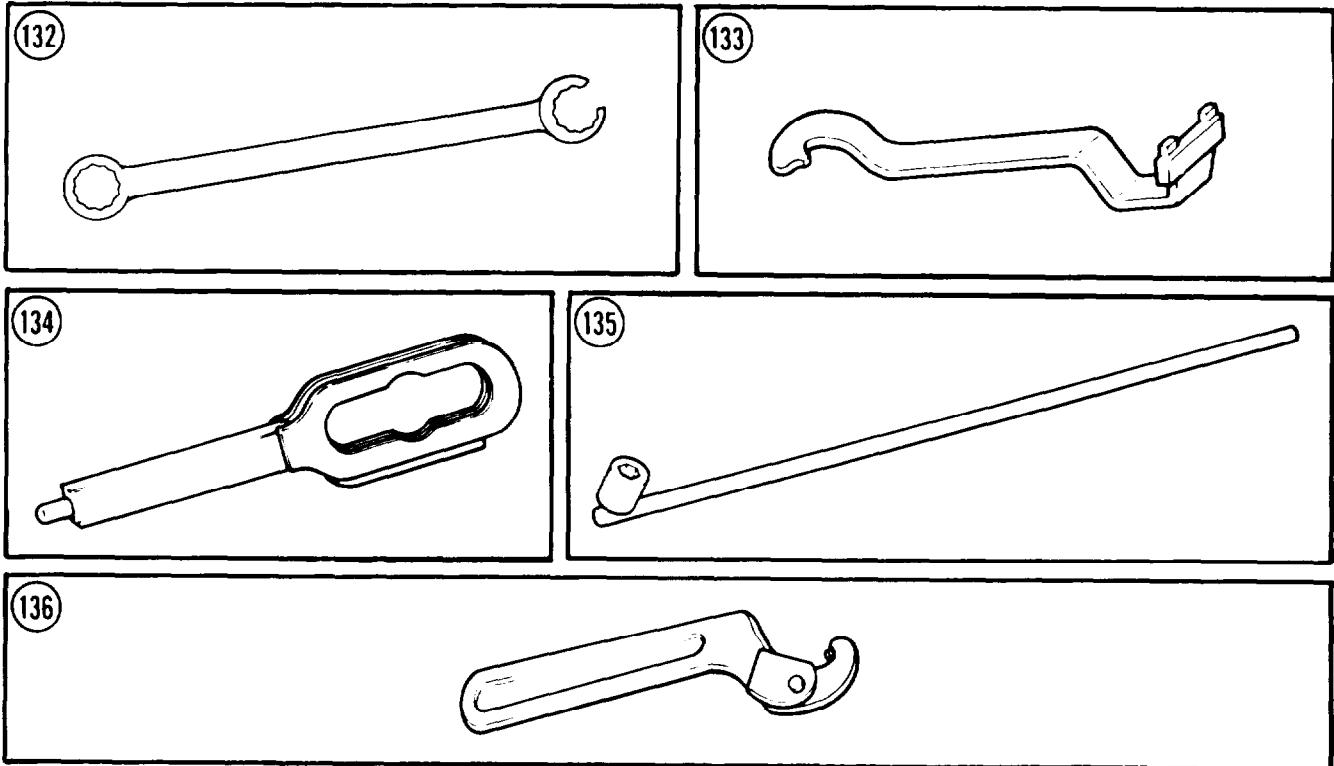
(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) Usable On Code U/M	(5) Qty Rqr
120	2530-00-302-6784	WEDGE, TRAILING IDLER (19207) 11643492	EA	2
121	5120-00-264-3796	WRENCH: adjustable, 12 in., 1-5/16 opening (19207) 5323324	EA	1
122	5120-00-277-2307	WRENCH: engr, 15-deg angle, open end, 5/16 by 3/8 in. (58536) A-A-1356	EA	1
123	5120-00-277-2342	WRENCH: engr, 15-deg angle, open end, 7/16 by 3/8 in. (19207) 11655789-1	EA	1
124	5120-00-187-7123	WRENCH: engr, 15-deg angle, open end, 7/16 by 1/2 in. (58536) A-A-1356	EA	1
125	5120-00-293-2134	WRENCH: engr, 15-deg angle, open end, 9/16 by 11/16 in. (58536) A-A-1356	EA	1

Section III. BASIC ISSUE ITEMS LIST- CONTINUED



(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) Usable On Code	(5) Qty Rqr
126	5120-00-224-3102	WRENCH: engr, 15-deg angle, open end, 5/8 by 3/4 in. (58536) A-A-1356	EA	1
127	5120-00-187-7124	WRENCH: engr, 15-deg angle, open end, 9/16 by 1/2 in. (58536) A-A-1356	EA	1
128	5120-00-187-7130	WRENCH: engr, 15-deg angle, open end, 13/16 by 7/8 in. (58536) A-A-1356	EA	1
129	5120-00-895-9570	WRENCH: engr, 15-deg angle, box/open, 9/16 by 9/16 in. (81348) GGG-W-645	EA	1
130	5120-00-895-9572	WRENCH: engr, 15-deg angle, box/open, 11/16 by 11/16 in. (81348) GGG-W-645	EA	1
131	5120-00-895-9574	WRENCH: engr, box/open, 7/8 by 7/8 in. (81348) GGG-W-645	EA	1

Section III. BASIC ISSUE ITEMS LIST - CONTINUED



(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) Usable On Code	(5) Qty Rqr
132	5120-00-895-9577	WRENCH: engr, box/open, 1-1/8 by 1-1/8 in. (81348) GGG-W-645	EA	1
133	5120-00-723-0851	WRENCH, FUZE, M16 (19206) 7230851	EA	1
134	4933-00-723-1161	WRENCH, FUZE, M18 (19206) 7231161	EA	1
135	5120-00-980-9283	WRENCH: socket, 4 ft. long handle (19207) 10904436	EA	1
136	5120-00-277-9076	WRENCH: spanner, adj 2 to 4-3/4 in. (19207) 5218469	EA	1

APPENDIX C

ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

SCOPE

This appendix lists additional items you are authorized for the support of the M110A2 Howitzer.

GENERAL

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

EXPLANATION OF LISTING

National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type document (i.e., CTA, MTOE, TDA, or JTA) which authorizes the item(s) to you.

Section II. ADDITIONAL AUTHORIZATION LIST

(1) Item Number	(2) National Stock Number	(3) Description FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Auth
1	5140-00-261-4994	CARRIER CASE: cutters, wire (19207) 11655787		EA	1
2	5110-00-595-8229	CUTTER, WIRE ROPE: M1938 (19207) 11655981		EA	1
3	6230-00-264-8261	FLASHLIGHT: hand, 2 cell (83149) MIL-F-3747		EA	3
4	7510-01-065-0166	FOLDER EQUIPMENT RECORD BOOK: (DA PAM 738-750)		EA	1
5	5110-00-222-0457	HATCHET, CLAW: 3-7/8-in. edge (81348) GGG-H-131		EA	1
6	5120-00-596-8097	JACK, PLANNER (35 ton) (81348) GGG-J-51		EA	3
7		Deleted			
8	1320-01-112-2627	KIT, ROTATING BAND (19200) 9340711		KT	1
9	9905-00-534-8376	KIT, WARNING DEVICE (58536) A-A-2128		SE	1
10	8345-00-174-6865	PANEL, MARKER: signal, air to ground. 2 ft by 6 ft (81349) MIL-P-40061		EA	2
11	5120-00-224-9728	SCRIBE, MACHINIST' S (81348) GGG-S-131		EA	1
12	8345-00-375-0223	SET, FLAG: M238 (81349) MIL-F-40045 Consisting of:		EA	1
	8345-00-178-8437	1-CASE			
	8345-00-227-1406	1-FLAG, GREEN			
	8345-00-227-1511	1-FLAG, RED			
	8345-00-227-1405	1-FLAG, YELLOW			
	8345-00-242-3650	3-STAFF, FLAG			
12.1	4030-01-187-0964	SHACKLE: Anchor 1-1/4 in. dia pin (19207) 12328579		EA	4

Section II. ADDITIONAL AUTHORIZATION LIST (cont)

(1) Item Number	(2) National Stock Number	(3) Description FSCM and Part Number	Usable On Code	(4) U/M	(5) Qty Auth
13	7310-00-285-6155 7310-00-379-2418 7310-00-281-2215	STOVE, GASOLINE BURNING: cooking, 1 burner, MI 950 (81349) MIL-S-10736 Consisting of: 1-CASE: stove 1-STOVE: cooking		EA	1
14	6685-00-344-4603	THERMOMETER, SELF INDICATING, BIMETALLIC, CONCENTRIC DIAL, - 80 to 160°F (-62.2 to 71.1°C) (19200) 8268609		EA	1
15	6675-00-240-1881	TRIPOD, SURVEYING: (for arctic use only) (81349) MIL-T-11674		EA	2
16	5120-00-776-1840	WRENCH, STRAP: 18 in. long; 1-6 in. capacity; 36 in. strap length (18876) 9171739		EA	1

APPENDIX D

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

SCOPE

This appendix lists expendable/durable supplies and materials you will need to operate and maintain the M110A2 Howitzer. This listing is for informational purposes 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

- a. Column (1) -Item number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, item 5, appx D").*
- b. Column (2)-Level. This column identifies the lowest level of maintenance that requires the listed item.*
- C -Operator/Crew
- c. Column (3) -National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.*
- d. Column (4) -Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM) in parentheses followed by the part number.*
- e. Column (5)-Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in., pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.*

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	C	9100-00-391-7813	ALCOHOL, FUEL, JEL: 25 oz can 4006 (94745)	OZ
2	C	8040-00-262-9025	ADHESIVE: reclaimed rubber, liquid, general purpose (81349) MIL-A-5092	OZ
		8040-00-262-9026	4 oz tube (81348) MMM-A-1617 type 1 1/2 pt can (81348) MMM-A-1617	PT
3	C	6850-00-174-1806	ANTIFREEZE: arctic type, inhibited 55 gal. drum (81348) MIL-A-11755	GL
4	C	6850-00-181-7929	ANTIFREEZE: coolant, engine, ethyleneglycol, inhibited (81348) MIL-A-46153	GL
		6850-00-181-7933	1 gal. can	GL
5	C	8030-00-111-6266	ANTI-SEIZE COMPOUND: (73165) FEI.-PRO C-300 16 oz aerosol can	CN
6	C	9150-01-053-6688	CLEANER, LUBRICANT, PRESERVA- TIVE: CLP (81349) MIL-L-63460	GL
		9150-01-054-6453	1 gal. container	PT
7	C	6850-00-227-1887	CLEANING COMPOUND: optical lens, 1 qt can (81349) MIL-C-43454	QT
8	C	6850-00-598-7328	CLEANING COMPOUND, ENGINE COOLING SYSTEM: w/conditioner and inhibitor 1 kit for 18-22 qt capacity (81349) MIL-C-10597	KT
9	C	6850-00-224-6665	CLEANING COMPOUND, SOLVENT: degreasing self-emulsifying, 5 gal. can (81349) MIL-C-11090	GL
10	C	5340-00-221-0872	CLOTH, ABRASIVE: crocus, ferric oxide and quartz, cloth back, 50 sheet pack (81348) A-A-1206	SH

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (cant)

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
11	C	8010-01-229-7540 8010-01-229-7541	COATING, aliphatic polyurethane: black 37030 (81349) MIL-C-53039 1 qt kit 1 gal. kit	QT GL
12	C	8010-01-229-7543 8010-01-229-7544	COATING, aliphatic polyurethane: brown 383, 30051 (81349) MIL-C-53039 1 qt kit 1 gal. kit	QT GL
13	C	8010-01-229-7546 8010-01-229-9561	COATING, aliphatic polyurethane: green 383, 34094 (81349) MIL-C-53039 1 qt kit 1 gal. kit	QT GL
14	C	8010-01-234-2934 8010-01-234-2935	COATING, aliphatic polyurethane: sand 33303 181349) MIL-C-53039 1 qt kit 1 gal. kit	QT GL
15	C	8010-01-313-8702	COATING, epoxy-polyamide: clear, (81349) MIL-C-22750, Type I 1 qt kit	QT
16	C	8010-01-313-8700 8010-01-053-2647 8010-01-313-8701	COATING, epoxy-polyamide: white (81349) MIL-C-22750, Type I 1 qt kit 2 qt kit 2 gal. kit	QT QT GL
17	C	4020-00-242-4072	CORD, FIBROUS (81349) MIL-C-7515	
18	C	6850-00-901-0591	DEICING-DEFROST, FLUID: 1 gal. can (81349) MIL-A-8243	GL
19	C	6850-00-281-3061 6850-00-281-1985	DRY CLEANING SOLVENT: liquid, white, 140 degree flash point (SD-2) (81348) P-D-680 4 oz can 1 gal. can	OZ GL

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (cont)

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
20	C	9150-01-197-7693 9150-01-197-7690 9150-01-197-7689	GREASE, AUTOMOTIVE AND ARTILLERY: (GAA) (81349) MIL-G-10924 14 oz cartridge 1.75 lb can 6.5 lb can	OZ LB LB
21	C	9150-00-935-9807 9150-00-935-5808	HYDRAULIC FLUID, PETROLEUM BASE: (OHT) (81349) MIL-G-6083 1 qt can 1 gal. can	QT GL
22			Deleted.	
23	C	1025-01-196-2172	KIT, ARTILLERY CLEANING (59678) SKI 84J5	EA
24	C	6220-01-297-3217	LAMP ASSEMBLY: stop, rear blackout: (taillight) (19207) 12360870-2	EA
25	C	6240-01-284-1925	LAMP, HALOGEN: (headlamps) (19207) 12360840-1	EA
26	C	6240-00-019-3093	LAMP, INCANDESCENT: single contact, bayonet candelabra base, No. 623 (dome light) (96906) MS15570-623	EA
27	C	6240-00-295-2668	LAMP, INCANDESCENT: single contact, bayonet candelabra base, No. 1691 (dome light) (96906) MS35478-1691	EA
28	C	6240-00-950-1727	LAMP, INCANDESCENT: single contact, No. 757 (winter kit coolant heater) (08806) 11621411	EA
29	C	5980-01-285-6689	LED: T1 -3/4 based (high beam and master switch indicator lights) (19207) 12360905-1	EA

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (cont)

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
30	C	5980-01-285-6688	LED: T3-1/4 based (low engine coolant, suspension locked, instrument and switch lamps, filter bypass, flasher indicator, and clutch engaged lights) (19207) 12360890-1	EA
31			Deleted.	
32	C	6220-01-284-2709	MARKER ASSEMBLY: (taillight) (19207) 12360850-1	EA
33	C	6220-01-290-9346	MARKER ASSEMBLY: (headlamp) (19207) 12360860-2	EA
34	C	9150-00-234-5199	OIL, LUBRICATING: chain and wire rope, Type II (CWII), 5 lb can (81348) VV-L-751	LB
35	C	9150-01-152-4117 9150-01-152-4118	OIL, LUBRICATING INTERNAL COMBUSTION ENGINE: (OE/HDO) (81349) MIL-L-2104D 1 qt can OE/HDO 15/40 5 gal. can OE/HDO 15/40	QT GL
36	C	9150-00-402-2372	OIL, LUBRICATING, INTERNAL COMBUSTION ENGINE: (OEA) (81349) MIL-L-46167 5 gal. can	GL
37	C	6640-00-285-4694	PAPER, LENS: cleaning paper, Type I Class 3, packet (81348) NNN-P-40	PZ
38	C	9150-00-250-0926 9150-00-250-0933	PETROLATUM, TECHNICAL: (81348) VV-P-236 1 lb can 5 lb can	LB LB

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (cont)

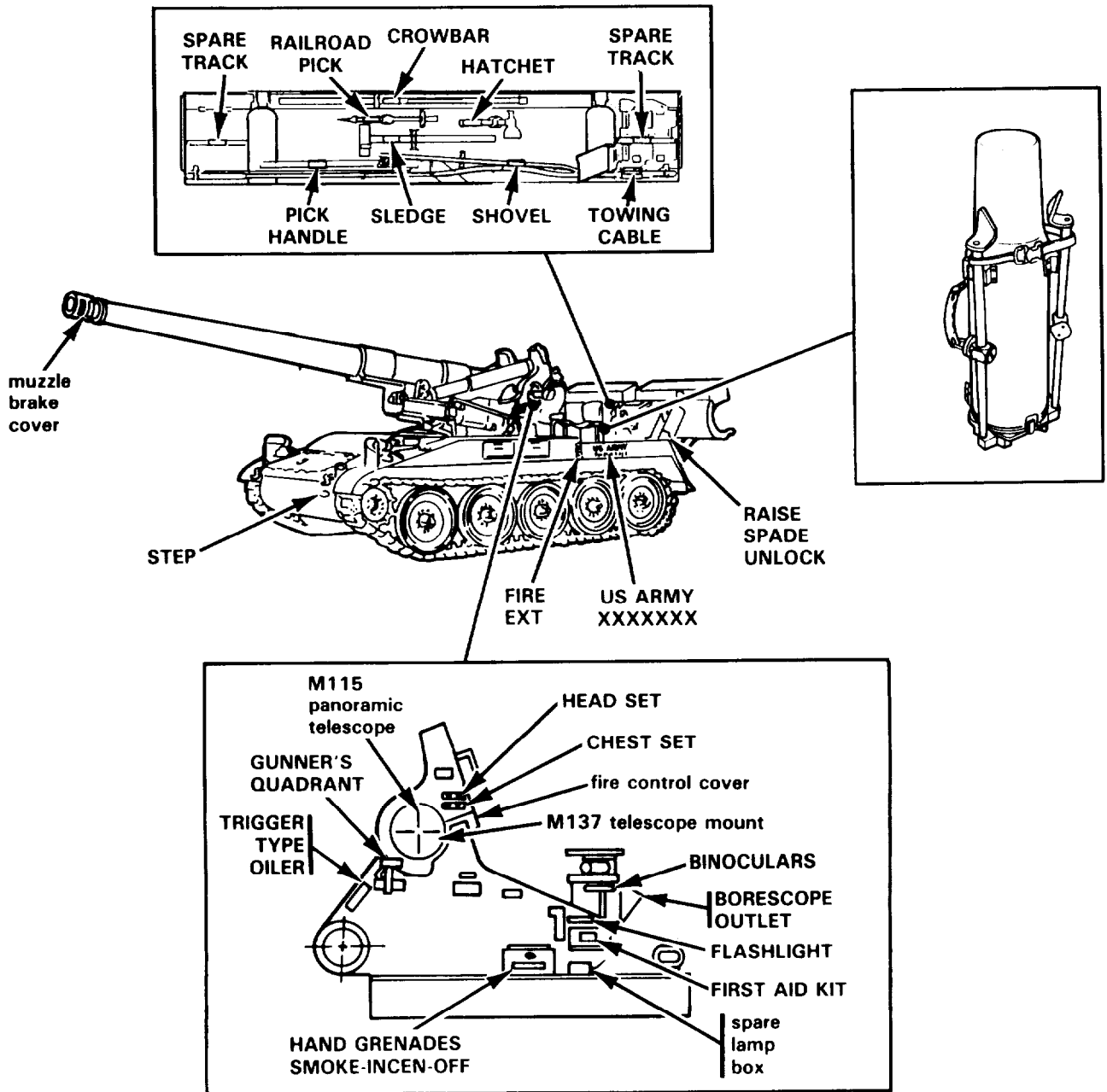
(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
39	C	7920-00-205-1711	RAG, WIPING: cleaned, 50 lb bale (58536) A-A-2522	EA
40	C	8030-00-656-1426 8030-00-252-3391	SEALING COMPOUND: w/brush (81349) MIL-S-45180 1 pt can 11 oz tube	PT OZ
41	C	6850-00-880-7616	SILICONE COMPOUND: 8 oz tube (81349) MIL-S-8660	OZ
41.1	C	1025-01-311-3770	SLEEVE, CLEANING (27412) 155/203-140	EA
42	C	8010-00-181-8080	THINNER. 1 gal., Type I (for use with aliphatic polyurethane coatings) 180244) MIL T-81772	GL
43	C	8010-01-200-2637	THINNER: 1 gal., Type II (for use with epoxy-polyamide coatings) (80244) MIL T-81772	GL
44	C	4020-00-241-8875	TWINE, FIBROUS (81348) A-A-228	BA
45	C	5610-00-141-7838	WALKWAY COMPOUND, NO: type 2. 1 gal. can (81349) MIL W-5044	GL

APPENDIX E STOWAGE AND SIGN GUIDE

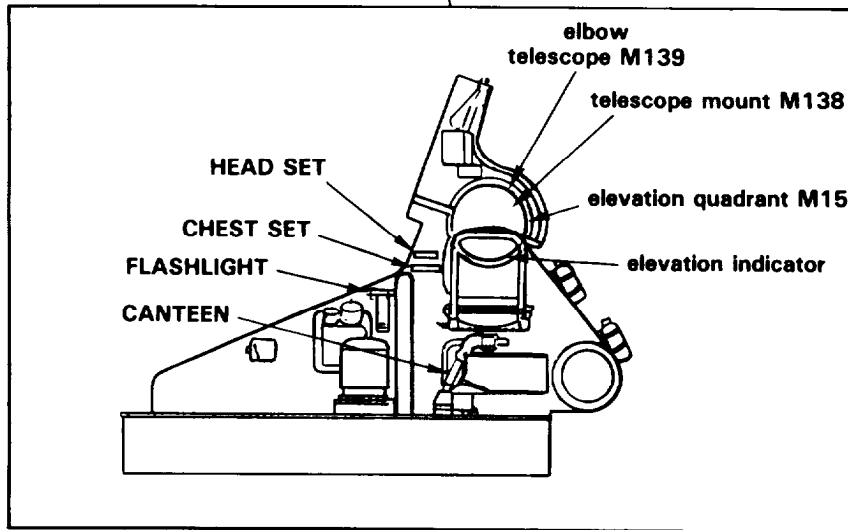
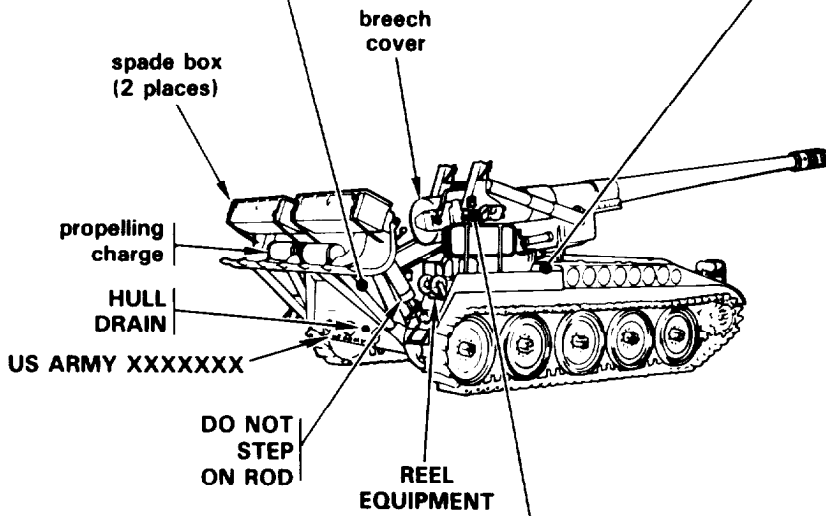
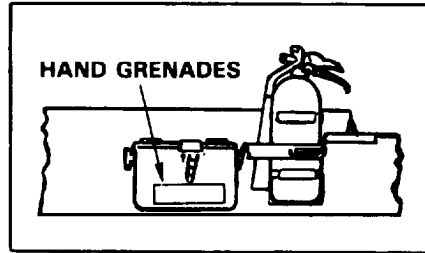
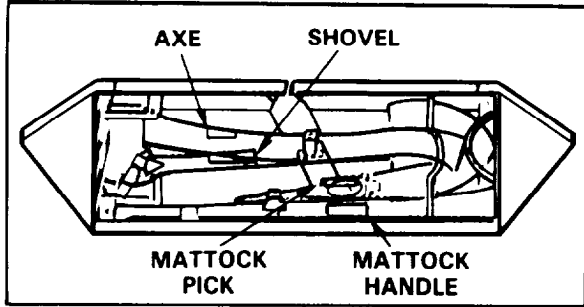
STOWAGE AND SIGN GUIDE

This appendix shows the location of signs and stowed equipment. Signs are shown with capital letters. Locations of stowed

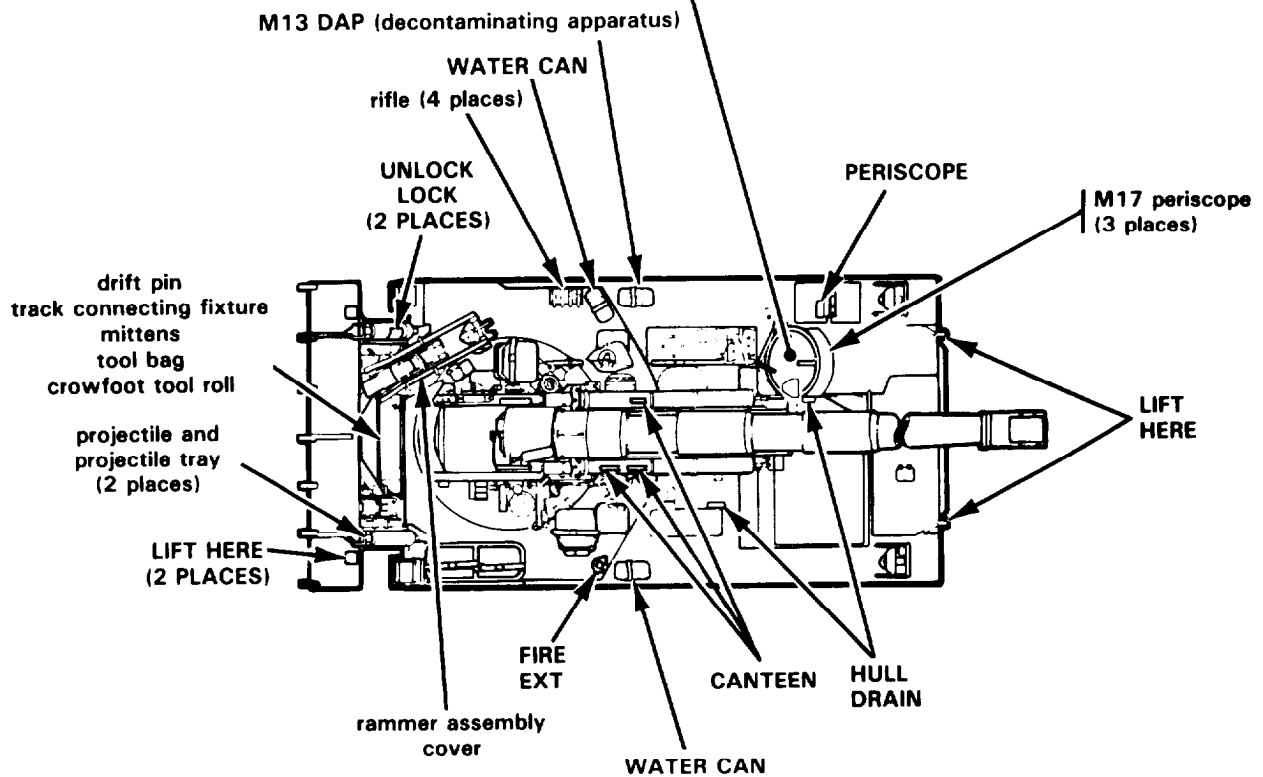
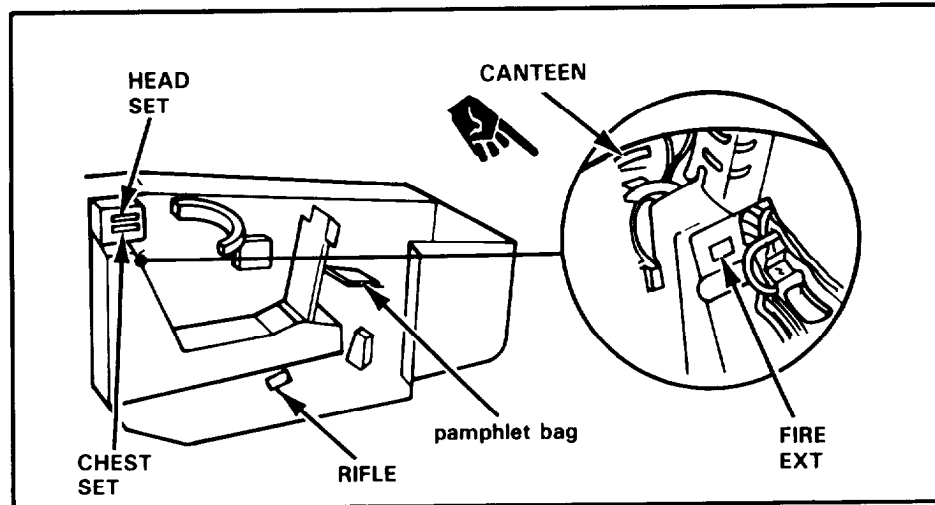
equipment that are not identified by signs are shown in lower case letters.



STOWAGE AND SIGN GUIDE-CONTINUED



STOWAGE AND SIGN GUIDE-CONTINUED



APPENDIX F

LUBRICATION INSTRUCTIONS

GENERAL

These lubrication instructions are divided into three sections based on lubrication intervals (daily, weekly, and quarterly (three months)).

An overall view showing lubrication points precedes each set of detailed notes.

A broken leader line (- - -) means there are lubrication points on both sides of the vehicle.

Intervals are based on normal operation.

- Lubricate more during constant operation.
- Perform a quarterly lubrication as soon as possible after a water fording operation.
- For operation of vehicle in protracted cold temperatures below 0°F (-18°C), remove lubricants prescribed in the key for temperatures above 0°F (-18°C), clean parts with dry cleaning solvent, and relubricate with lubricants specified in the key for temperatures +40°F to -70°F (+4°C to -57°C).

MAN-HOUR TIMES


The man-hour time specified is the time you need to do all the services prescribed for a particular interval.

LEVEL OF MAINTENANCE:

C-Operator/Crew

LUBRICANT POINTS

Type of lubricants used at each point are identified by arrows:

 CLP  GAA

OBSERVE THE FOLLOWING:

- NEVER use the wrong type lubricant.
- NEVER use too much lubrication.
- ALWAYS clean grease fittings before lubrication.
- ALWAYS use the lubrication instructions.

KEY

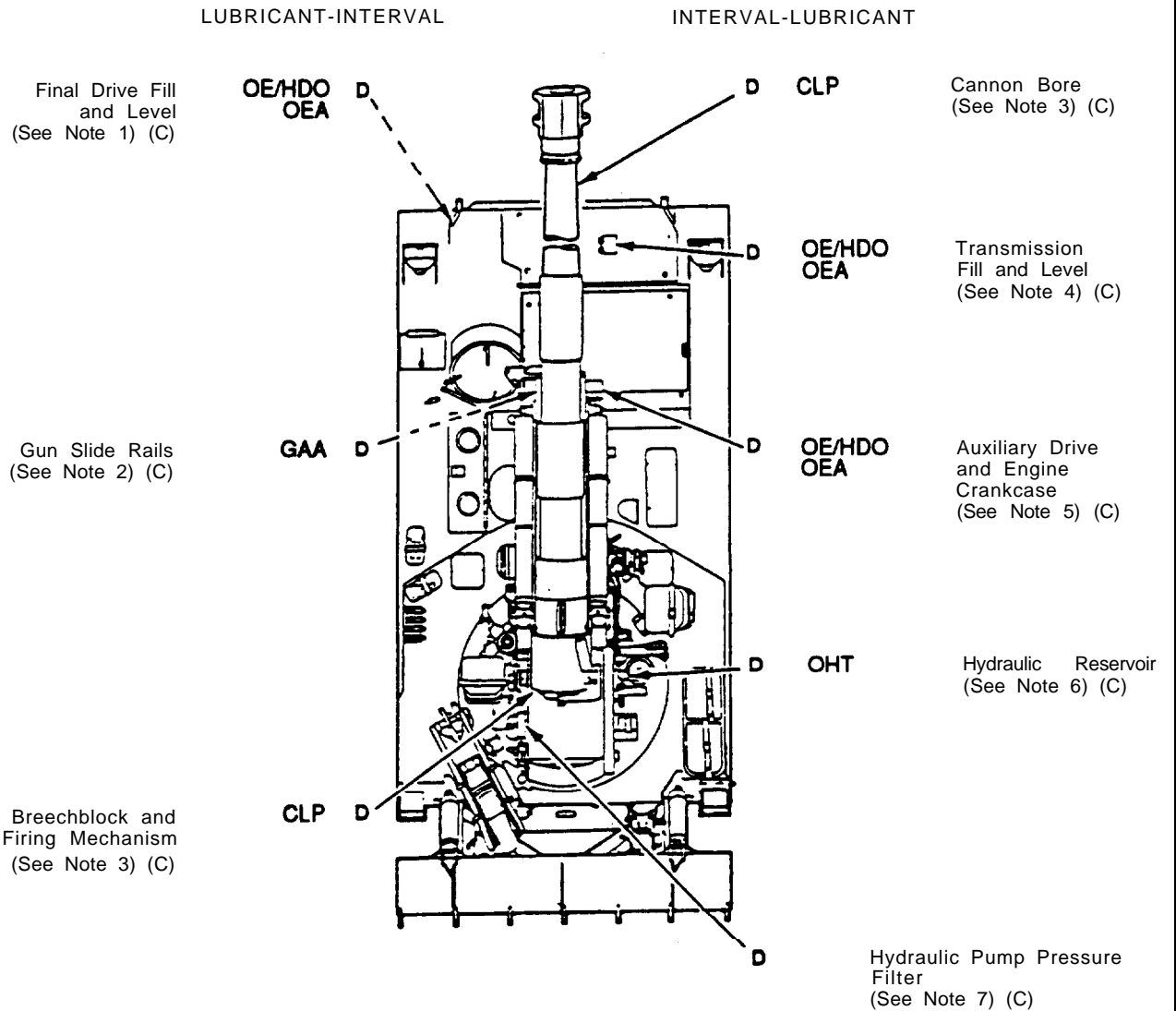
LUBRICANTS	CAPACITIES	EXPECTED TEMPERATURES		INTERVALS
		Above 0°F (Above -18%)	Below +40°F (Below +4°C)	
OE/HDO (MIL-L-21040) LUBRICATING OIL, Internal Combustion Engine, Tactical Service		OE/HDO-15/40	OEA	D - Daily W-Weekly Q-Quarterly 750 mi (1207 km), or 75 hr of operation, whichever occurs first
(MIL-L-46167) LUBRICATING OIL, internal Combustion Engine, Arctic				
Engine Crankcase. Add Three Additional Quarts (2.8 l) for Filters.	Refill 28 qt (28.5 l) Dry 38 qt (35.9 l)			
Auxiliary Drive	Refill qt (3.8 l) Dry 4-1/2 qt (4.2 l)			
Final Drive (Left)	13 qt (12.35 l)			
Final Drive (Right)	7 qt (8.85 l)			
Transmission	Refill 12 gal (45.4 l) Dry 19 gal (72 l)	OEA OE/HDO-15/40	OEA	
OHT (MIL-H-6083) FLUID, HYDRAULIC, PETROLEUM BASE, PRESERVATIVE				
Hydraulic Reservoir	27 gal (102.2 l)	OHT	OHT	
(MIL-G-10924) GREASE Automotive and Artillery		ALL TEMPERATURES		
CLP (MIL-L-63460) LUBRICANT, CLEANER and PRESERVATIVE		CLP	CLP	
Cannon Bore and Breech Mechanism Oil Can Points				
SD2 (P-D-680) SOLVENT, Dry Cleaning		ALL TEMPERATURES		

For Arctic operation, refer to FM 9-207.

TOTAL MAN-HOURS	
Interval	Man-Hours
DS	DS
D	2
W	3
Q	14

DAILY NOTES

This page shows what to check or lubricate each day the weapon is fired or operated.



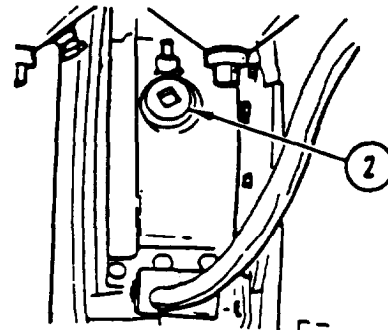
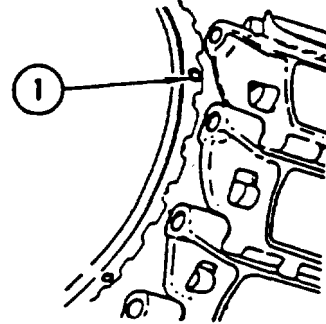
DAILY NOTES (CONTINUED)

Note 1

FINAL DRIVE FILL AND LEVEL

Check oil level from outside vehicle. Fill plug access is under transmission deck

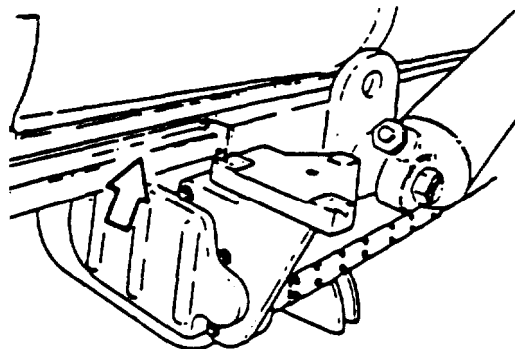
- A Remove level check plug (1).
- B Check that oil is level with bottom of opening
remove transmission deck and remove oil fill plug (2) in
final drive saddle.
- C Add oil (OE/HDO or OEA), slowly, until oil flows from
check level plug (1) opening.
- D Clean level check plug (1) and oil fill plug (2) with solvent
SD2 and install.
- E Repeat steps A through D for opposite side.



Note 1

GUN SLIDE RAILS

Clean with CLP and coat with GAA before and after firing.



DAILY NOTES (CONTINUED)

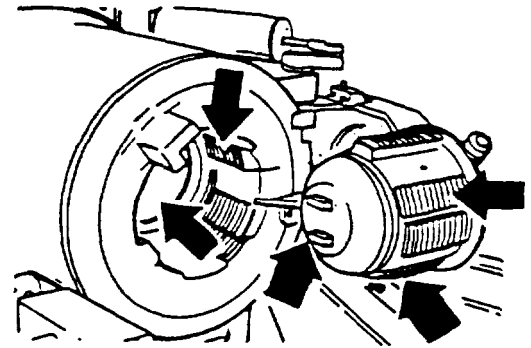
Note 3

CANNON BORE, BREECHBLOCK, AND FIRING MECHANISM

Day of Firing:

A Cannon Tube:

- 1 Pour approximately 8 oz (240 ml) of CLP on a bore brush and wet punch the tube once forward and
- 2 Pour an additional 4 oz (120 ml) of CLP on the bore brush and scrub the entire length of the tube with a back and forth motion. Repeat this step as necessary.
- 3 Pour an additional 4 oz (120 ml) of CLP on the bore brush. Again wet punch the entire length of the tube, once forward and once back. Do not wipe dry.



B Breech and Muzzle Brake:

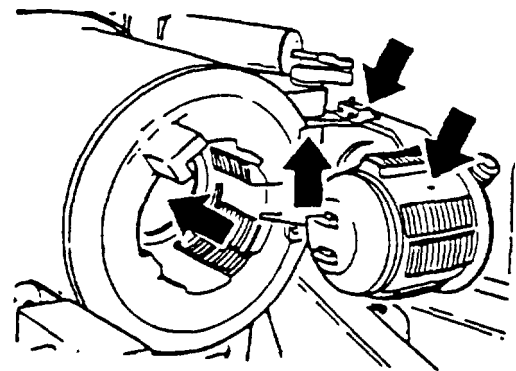
NOTE

Do not clean obturator pad with CLP. Use soap and water only.

- 1 Remove and disassemble the M35 Firing Mechanism and Obturator Group.
- 2 Thoroughly wet all breech components with CLP and let soak for 10-15 minutes then brush or wipe dry. Reapply a light coat of CLP to all breech surfaces.
- 3 Thoroughly wet the internal surfaces of the muzzle brake with CLP and let soak for 30-40 minutes. Wipe off and reapply a light coat of CLP.

Apply CLP primer vent and thoroughly brush with primer vent brush.

- 5 Thoroughly wet firing, locks with CLP and wipe off all carbon and firing residue. Reapply a light coat of

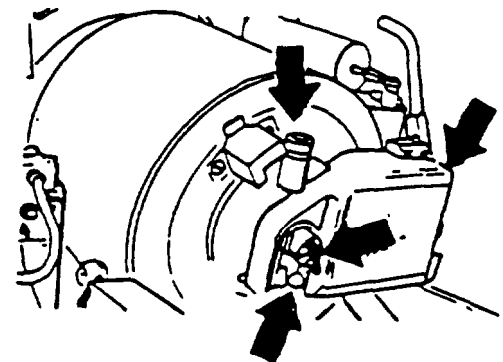


On Day After Firing:

- 1 Wet punch the tube following the procedures for day of firing.
- 2 Wrap the brush with a new disposable cleaning sleeve and dry punch the entire length of the tube once forward and back.
- 3 Wrap the brush with a new disposable cleaning sleeve and wet punch the entire length of the tube once forward and once back.
- 4 With new cleaning sleeve, repeat wet punching the tube at least two more times, or until tube is clean.

NOTE

When weapon is not fired, clean and lubricate weekly with CLP. Wipe dry before firing.



DAILY NOTES (CONTINUED)

Note 4

TRANSMISSION FILL AND LEVEL

Access is through door in transmission deck.

CAUTION

- Do NOT check oil with engine running.
- Do NOT overfill.

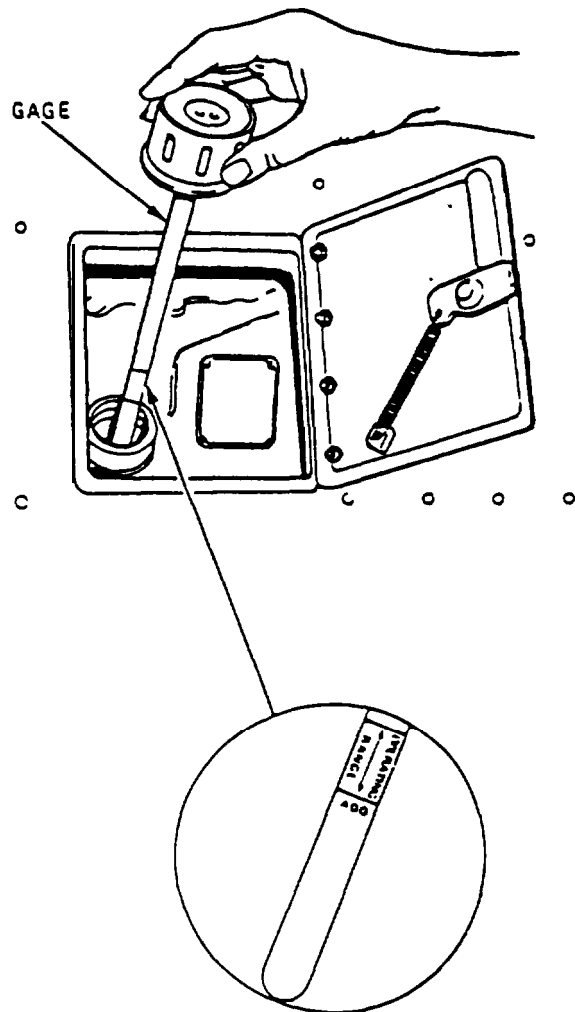
NOTE

Always think about oil temperature when adding oil. The oil level will vary within OPERATING RANGE due to oil temperature.

- A Check that oil level is within OPERATING RANGE on gage. Do not add or drain oil if in this range. Add oil only when below ADD mark.
- B Add or drain oil (OE/HDO or OEA) as required. See Unit Maintenance for drain procedures.
- C Take oil sample every 25 hours of operation or every 60 days, whichever occurs first. Refer to DA PAM 738-750 for sampling requirements.

NOTE

New transmissions are delivered with preservative oil MIL-L-21260. Until first scheduled oil change maintain proper oil level by adding OE/HDO or OEA.



DAILY NOTES (CONTINUED)

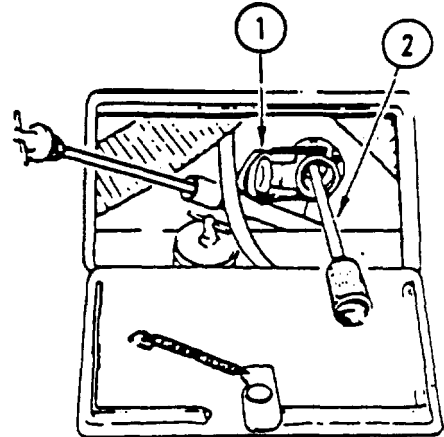
Note 5

AUXILIARY DRIVE AND ENGINE CRANKCASE

Access is through door in engine deck.

A Auxiliary Drive

- 1 Lift cap (1) and check oil level. Oil level should be between FULL and ADD marks on gage (2).
- 2 Add or drain OE/HDO or OEA, as required.



B Engine Crankcase

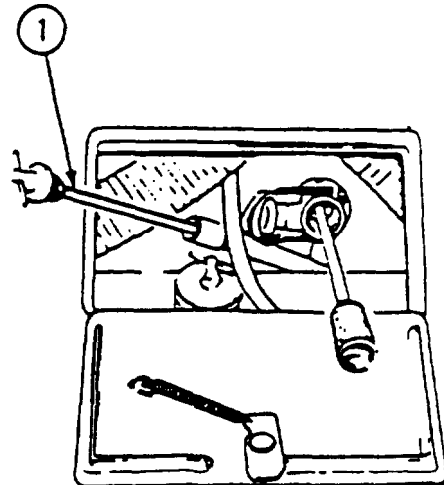
NOTE

After overnight stand, oil level may indicate up to 3/4 in. (19 mm) over FULL mark. This is normal.

- 1 Level should be between low (L) and full (F) marks on gage (1). If required, add or drain oil (OE/HDO or OEA).
- 2 Take oil samples every 25 hours of operation or every 60 days whichever occurs first. Refer to DA PAM 738-750 for sampling requirements.

NOTE

New engines are delivered with preservative oil MIL-L-21260 (see DD Form 1397). Until first scheduled oil change, maintain proper level by adding OE/HDO or OEA as required for expected temperatures.



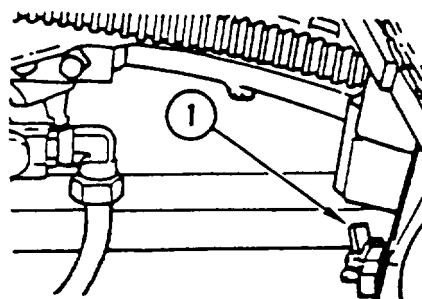
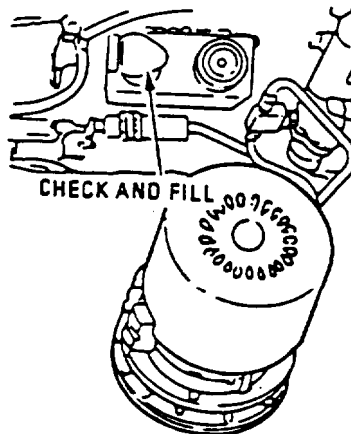
DAILY NOTES (CONTINUED)

Note 6

HYDRAULIC RESERVOIR

Check fluid level before operation.

- A With cannon in battery, open pressure dumping valve (1) to allow hydraulic fluid to flow back into reservoir.
- B Close pressure dumping valve (1).
- C Fill reservoir with OHT to applicable FULL mark (spade raised or spade extended) on level gage.

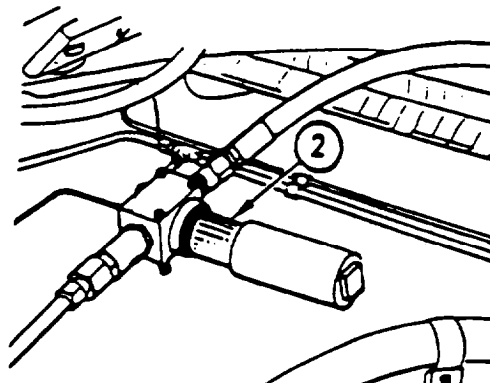
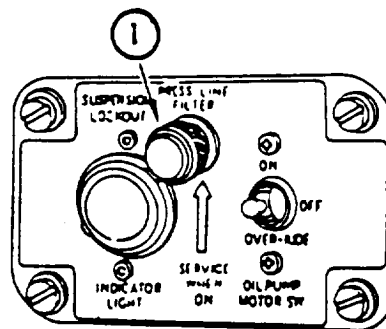


Note 7

HYDRAULIC PUMP PRESSURE FILTER

A Start hydraulic pump.

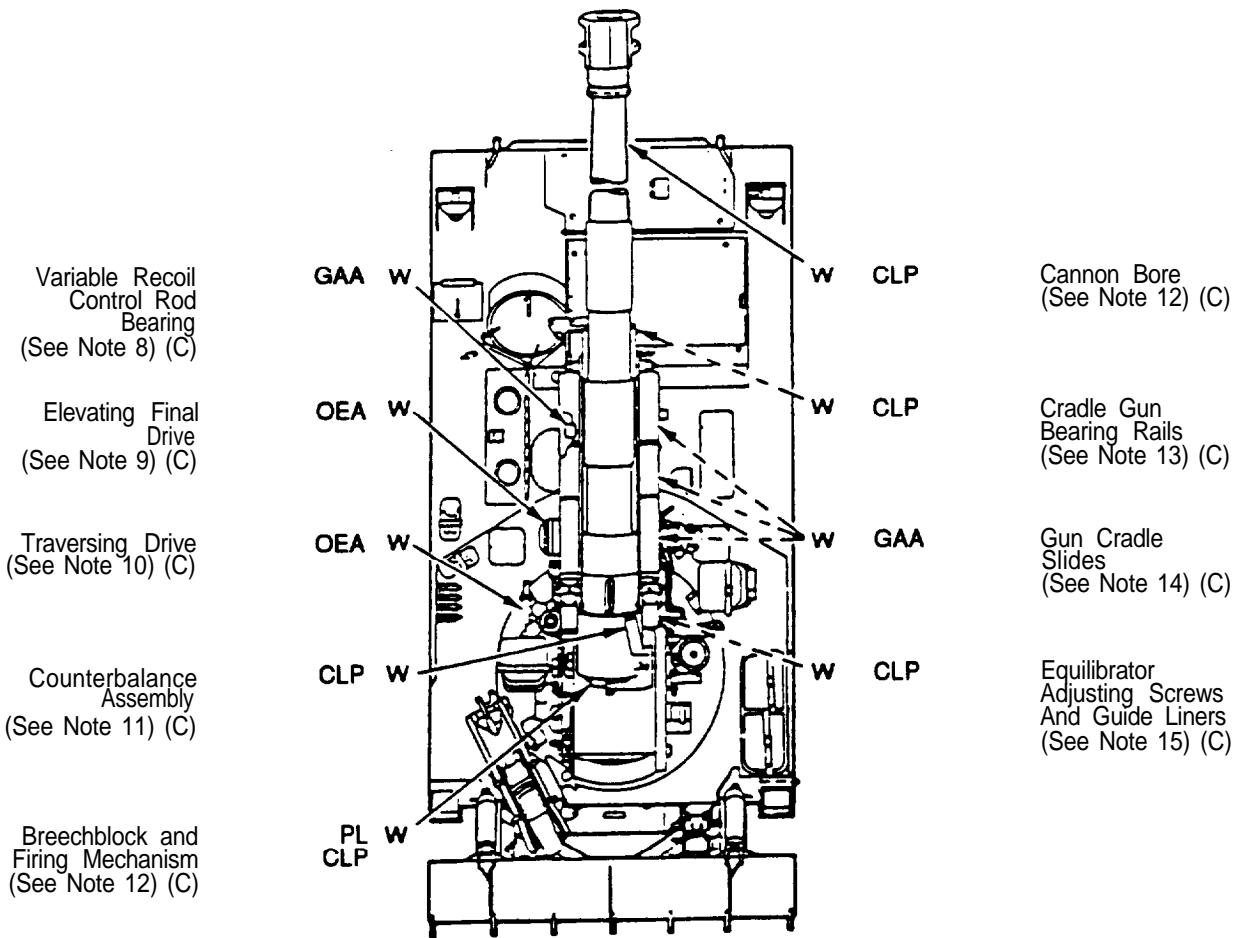
- B Check indicator light (1). If it lights, the hydraulic pump pressure filter is dirty. Remove, clean housing, and install new element (2)



WEEKLY NOTES

LUBRICANT-INTERVAL

INTERVAL-LUBRICANT

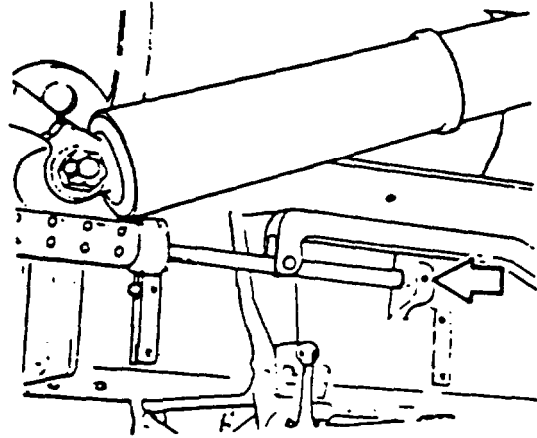


WEEKLY NOTES (CONTINUED)

Note 8

VARIABLE RECOIL CONTROL ROD BEARING

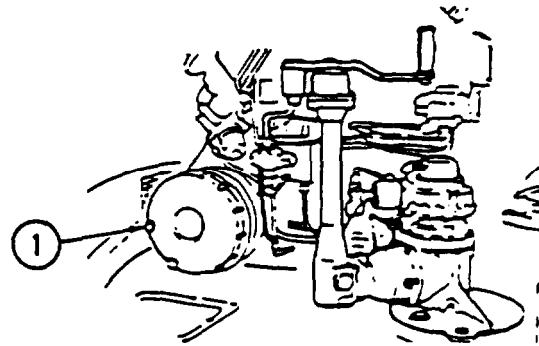
Lubricate fitting with GAA.



Note 9

ELEVATING FINAL DRIVE

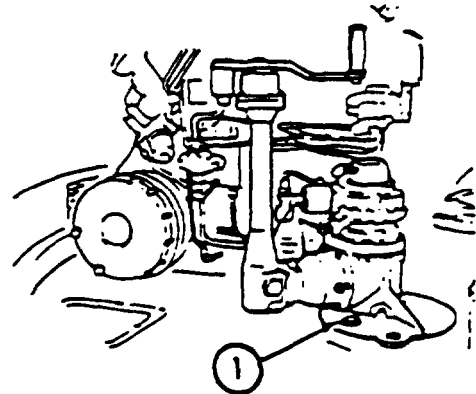
- A Remove fill and level plug (1).
- B Fill to bottom of level hole with OEA.
- C Clean with CLP and install fill and level plug.



Note 10

TRAVERSING DRIVE

- A Remove fill plug (1).
- B Check level.
- C Fill with OEA to 2.5 in. (6.4 cm) from top of filler plug hole.
- D Initial fill 3 quarts (2.6 l).
- E Clean fill plug with CLP and install.

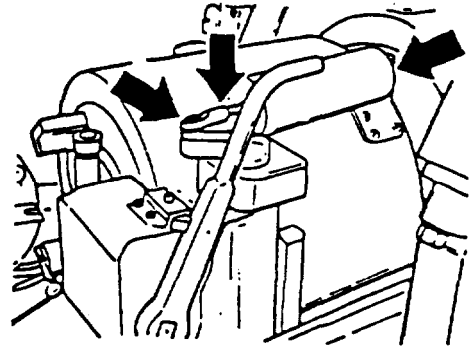


WEEKLY NOTES (CONTINUED)

Note 11

COUNTERBALANCE ASSEMBLY

- A Apply a couple of drops of CLP as indicated.
- B Extend and lube piston rod with CLP.



Note 12

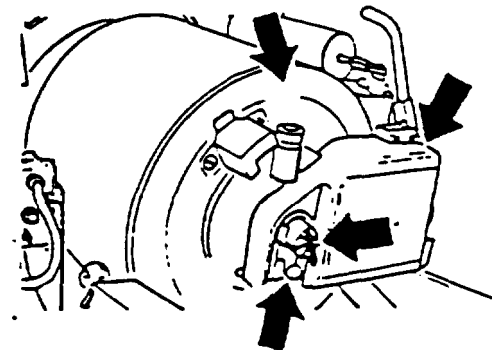
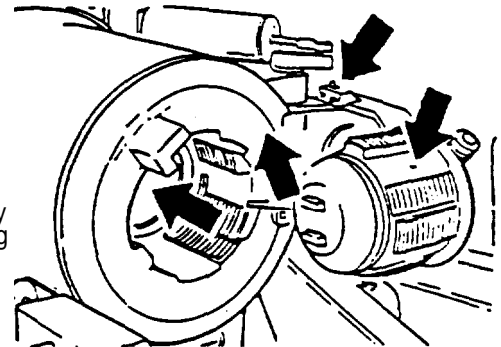
CANNON BORE, BREECHBLOCK, AND FIRING MECHANISM

When cannon is not being fired:

- A Clean with CLP and wipe dry.
 - B Coat with CLP. Wipe clean before firing.
- OR
- C Inspect cannon bore for cleanliness and corrosion. If required, dry punch bore with dean wiping rag, then wet punch bore with wiping rags soaked in CLP.
 - D Apply CLP as indicated.

NOTE

Do not clean obturator pad with CLP. Use soap and water only.

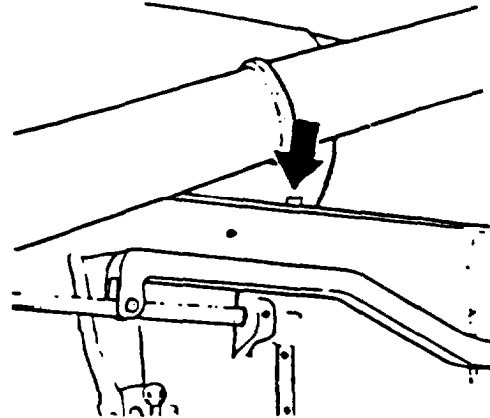


WEEKLY NOTES (CONTINUED)

Note 13

CRADLE GUN BEARING RAILS

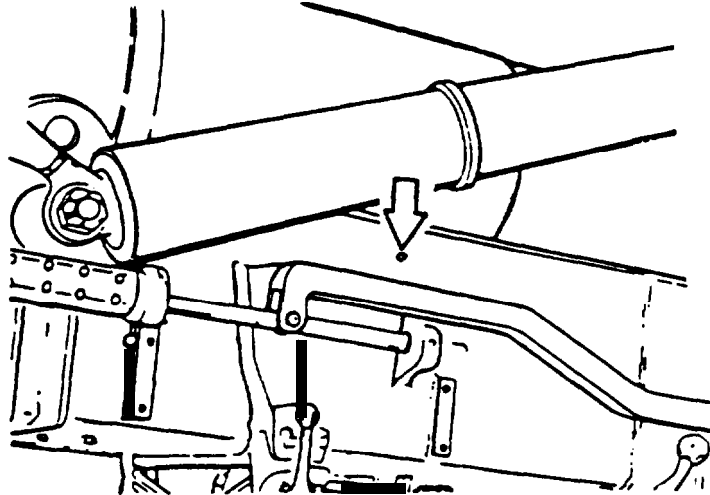
Lubricate eight oil cups (four on each side) with CLP.



Note 14

GUN CRADLE SLIDES

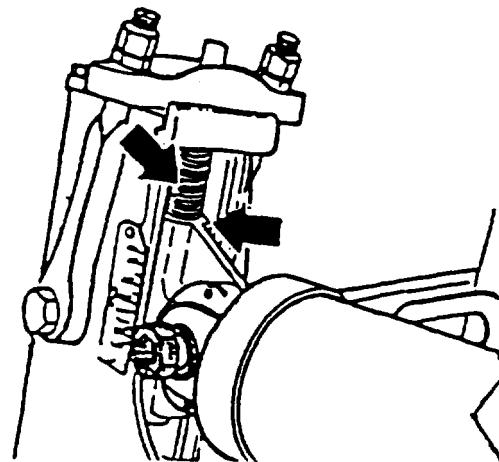
Lubricate six fittings (three on each side) with GAA.



Note 15

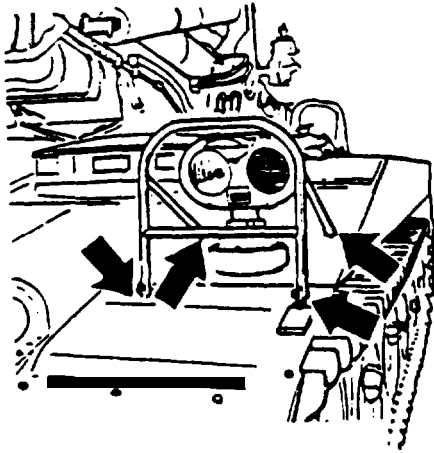
EQUILIBRATOR ADJUSTING SCREWS AND GUIDE LINERS

Clean and oil with CLP.

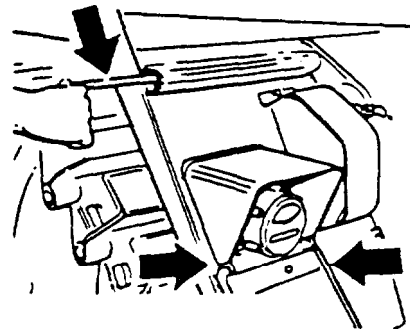


OIL CAN POINTS

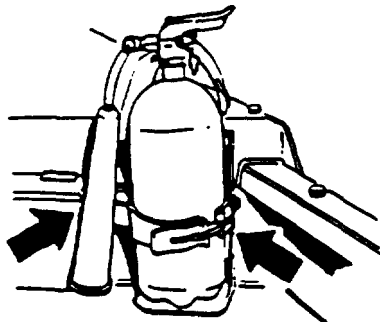
Quarterly, lubricate with CLP



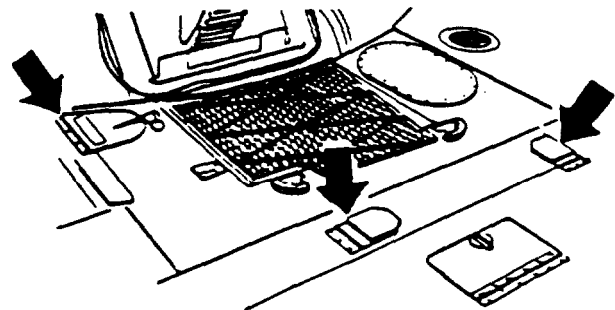
HEADLIGHT GUARD ASSEMBLIES



SPADE CONTROL VALVE LEVER AND
FENDER EXTENSION STEP



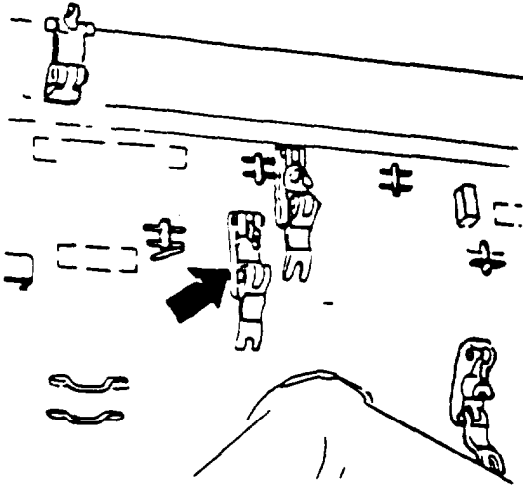
FIRE EXTINGUISHER BRACKET
HINGES



RADIATOR AND. FUEL FILL COVER
HINGES

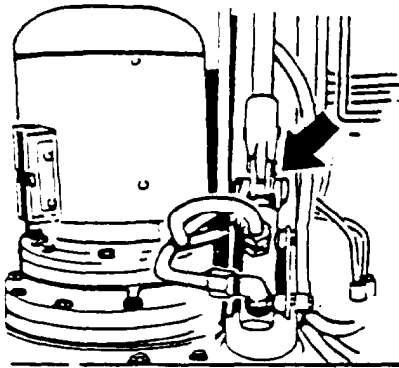
OIL CAN POINTS (CONTINUED)

Quarterly, lubricate with CLP

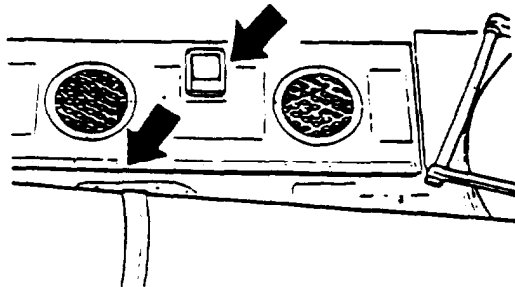


STORAGE BRACKETS HINGES AND PINS (TYPICAL)

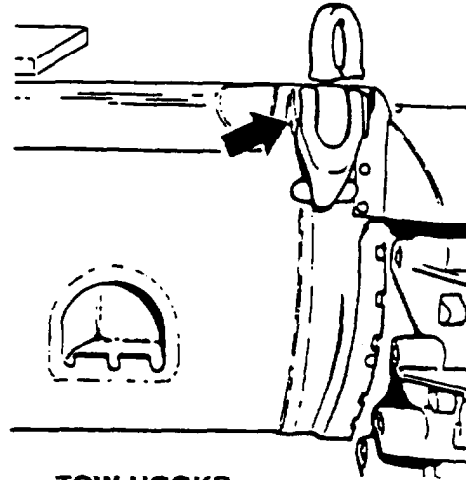
TIEDOWN BRACKETS (TYPICAL)



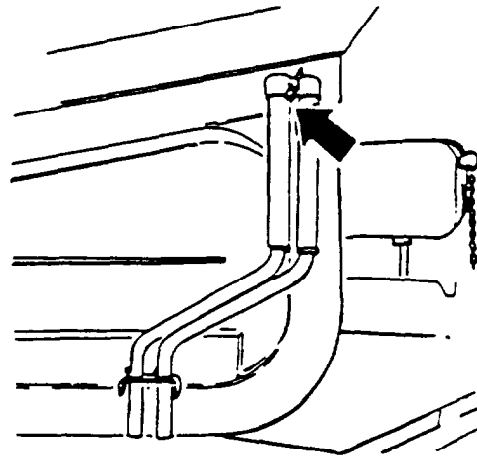
**HAND DRIVEN HYDRAULIC
RAM PUMP**



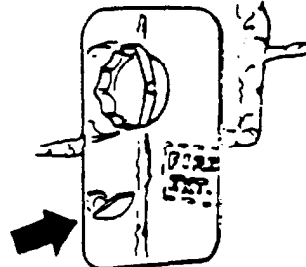
**BATTERY COMPARTMENT DOOR
HINGES AND LATCHES**



TOW HOOKS



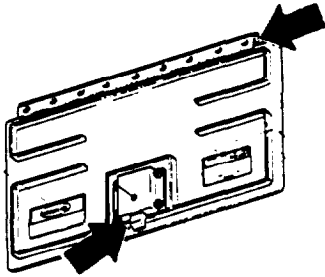
**RAMMER HANDCRANK
MOUNTING BRACKET**



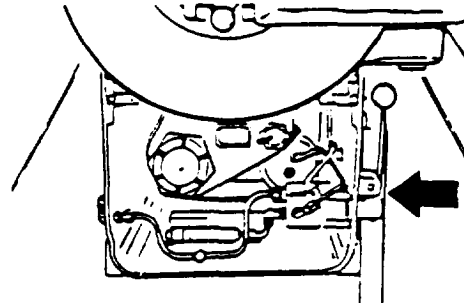
**FIRE EXTINGUISHER CYLINDER
CO₂ CONTROL RELEASE (HULL
AND DRIVER'S COMPARTMENT).**

OIL CAN POINTS (CONTINUED)

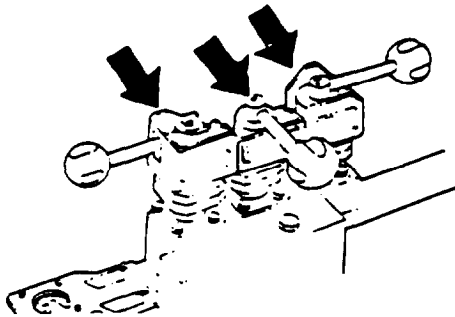
Quarterly, lubricate with CLP



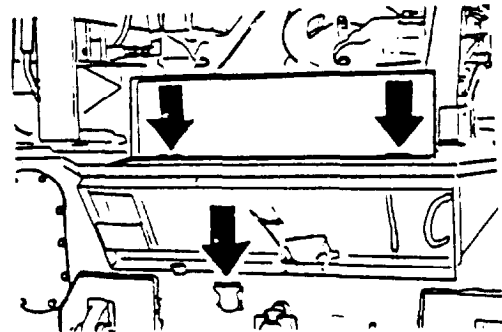
**AIR CLEANER ACCESS DOORS
HINGES AND LATCHES**



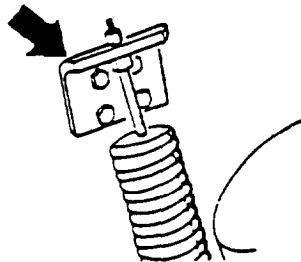
RETRACTING VALVE HANDLE



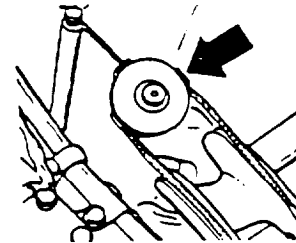
**LOADER AND RAMMER CONTROL
VALVE HANDLES**



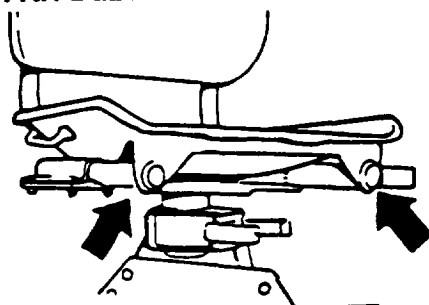
**STORAGE BOX HINGES (TYPICAL)
TRAILER RECEPTACLE COVER ASSEMBLY**



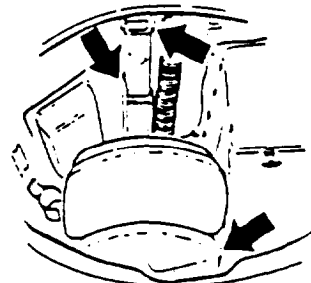
FAN BELT TENSIONER



BRAKE CABLE PULLEY



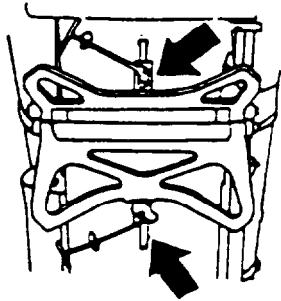
CREW SEATS MOVING PARTS



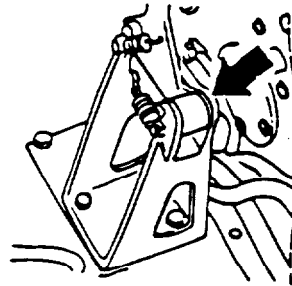
DRIVER'S SEAT MOVING PARTS

OIL CAN POINTS (CONTINUED)

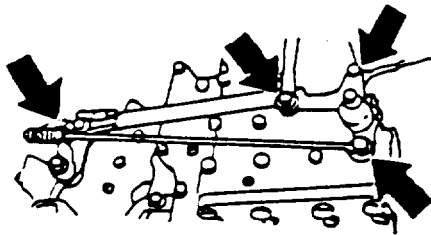
Quarterly, lubricate with CLP



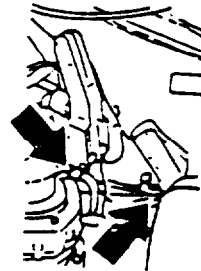
TRAVEL LOCK SUPPORT STOW LOCK



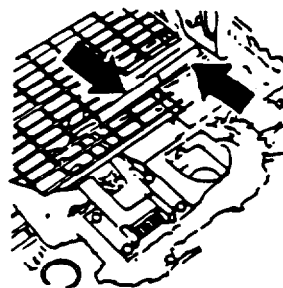
LOADER-RAMMER STOW LOCK



ENGINE CONTROL LINKAGE THREADED PORTION OF RODS AND YOKES AND THROTTLE YIELD LINK



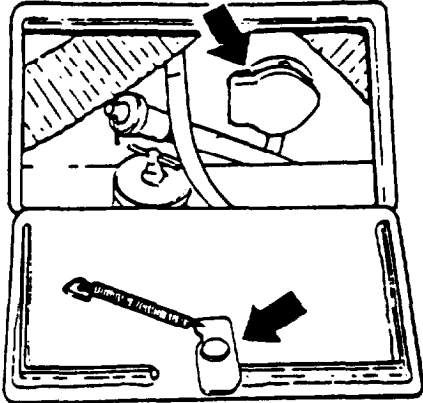
GUNNER'S CONTROL HANDLE RETAINING PINS



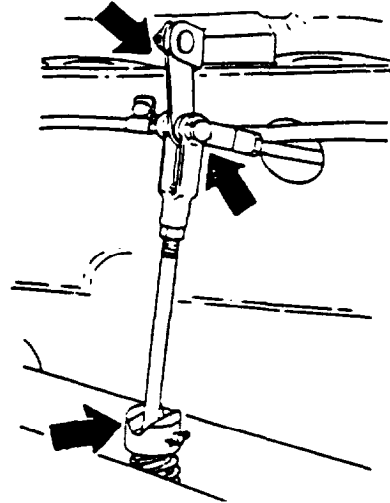
TRAVEL LOCK SPRING AND LATCH SLIDING SURFACES

OIL CAN POINTS (CONTINUED)

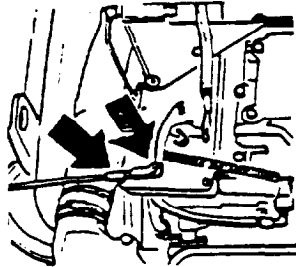
Quarterly, lubricate with CLP



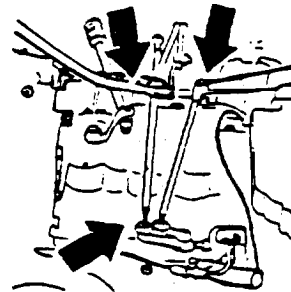
ENGINE DECK DOOR HINGES



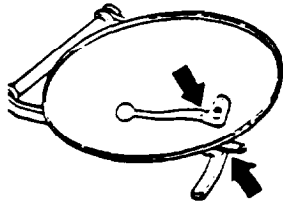
HULL DRAIN VALVES



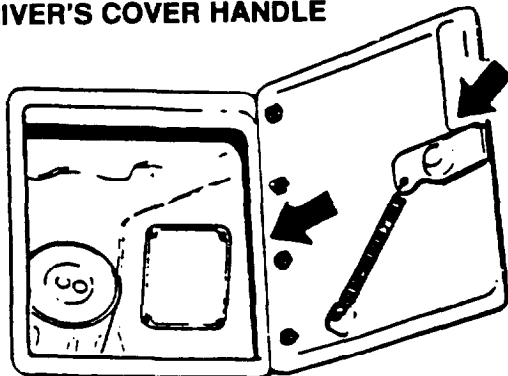
ENGINE SHUT-OFF CONTROL AND CABLE



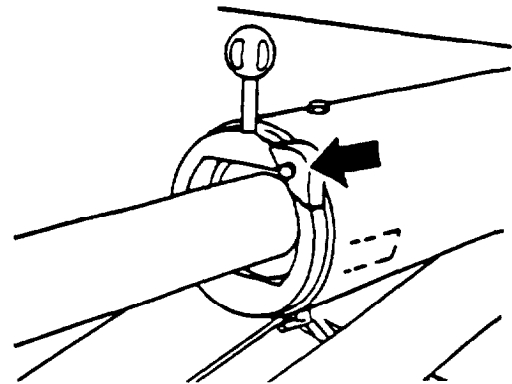
ENGINE CONTROL LINKAGE THREADED PORTION OF RODS AND YOKES



DRIVER'S COVER HANDLE



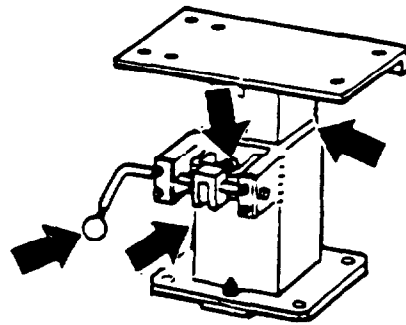
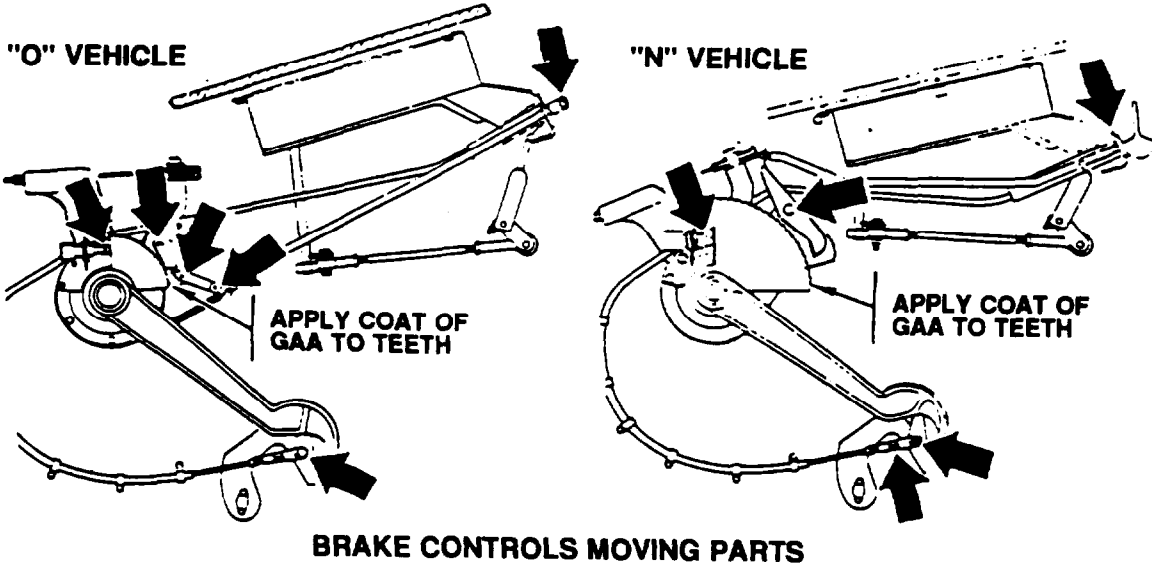
TRANSMISSION AND ENGINE DECK DOOR HINGES (TYPICAL)



SPADE CYLINDERS DETENT LOCK

OIL CAN POINTS (CONTINUED)

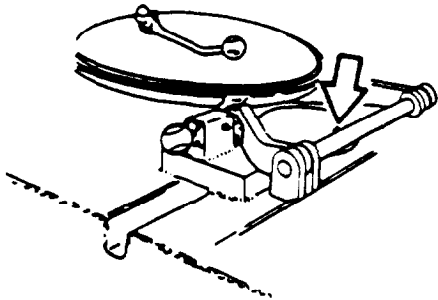
Quarterly, lubricate with CLP or GM as indicated



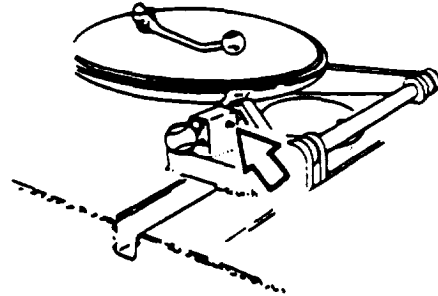
GUNNER'S SEAT MOVING PARTS

GREASE POINTS

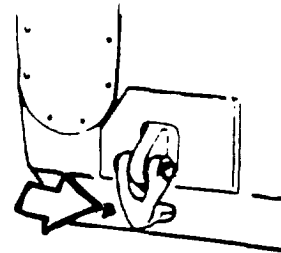
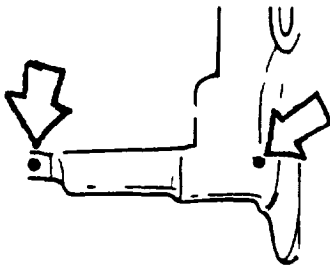
Quarterly, lubricate with GM



CUPOLA COVER TORSION BAR



CUPOLA COVER HOLD OPEN LOCK



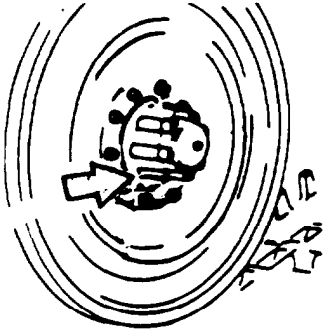
NOTE

Pump grease gun 5 or 6 times to properly lubricate bearings.

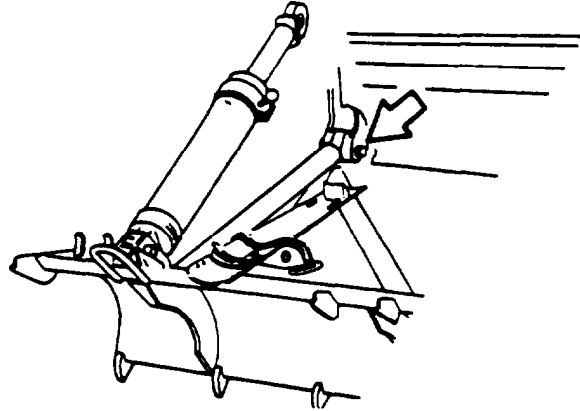
TRAILING IDLER WHEEL ARM BEARINGS

GREASE POINTS (CONTINUED)

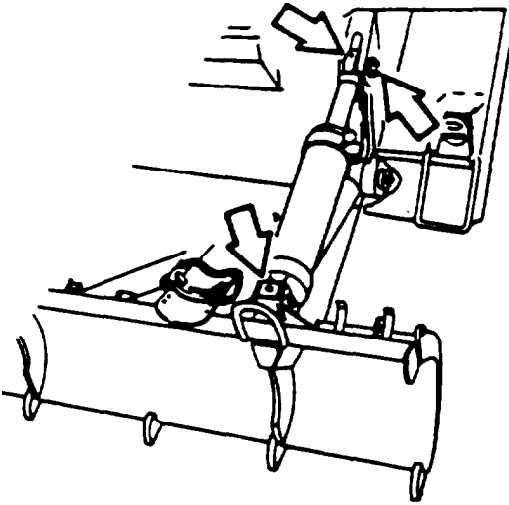
Quarterly, lubricate with GM



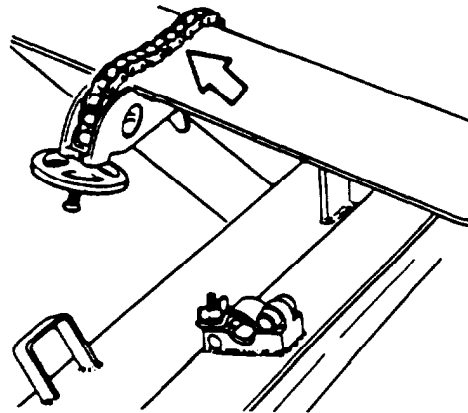
**GREASE FILLED HUBS
ROAD WHEEL AND TRAILING
IDLER HUB BEARINGS**



SPADE HINGE PINS



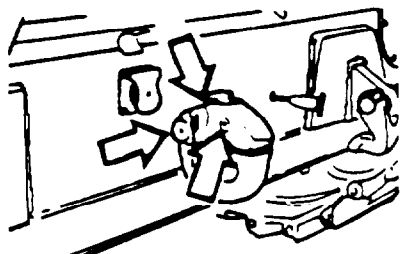
**SPADE LIFTING CYLINDER
BEARINGS**



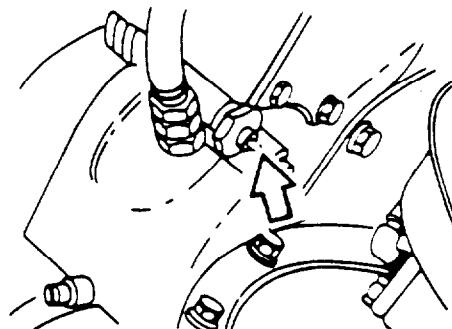
SHELL RACK CHAIN ASSEMBLY

GREASE POINTS (CONTINUED)

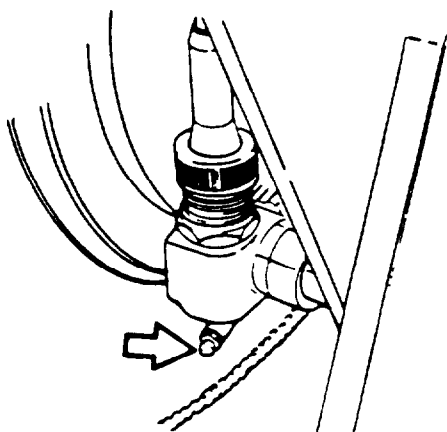
Quarterly, lubricate with GM



TOWING PINTLE



TACHOMETER CABLE ADAPTER



SPEEDOMETER CABLE ADAPTER

LUBRICATED AT TIME OF ASSEMBLY BY SUPPORT MAINTENANCE

The following parts are lubricated at time of assembly:

- Starter
- Generator
- Elevating drive assembly
- Traversing drive assembly
- Lockout cylinders
- Engine mounting bolt
- Loader-rammer traversing cylinder assembly
- Fan assembly

DO NOT LUBRICATE

Do not lubricate the following parts:

- Hydraulic pump electric motor
- Winterization kit electric fuel pump and coolant pump
- Personnel heater motor
- Driver's heater motor

NOTES

- 1 New engines are delivered with preservative oil MIL-L-21260 (see DD Form 1397) Unless an oil change is necessary to meet ambient temperature requirements or until first scheduled oil change, maintain proper oil level by adding OE/HDO or OEA as required for expected temperatures.

At time of powerplant removal, clean and coat threads on engine bolt with BAA. Do not lubricate bracket mounting screws.
- 2 New transmissions are delivered with preservative oil MIL-L-21260 Until first scheduled oil change, maintain proper oil level by adding OE/HDO or OEA.
- 3 Perform a quarterly lubrication after any fording operation.
- 4 Perform complete servicing of all lubrication points when a vehicle which has been in storage for an extended period of time is put into service.
- 5 Before initial start of new or overhauled engine, or one removed from storage, remove both rocker assembly covers and pour one quart of oil (OE/HDO or OEA) over rocker arms and push rods. Use oil required for expected temperature.

INDEX

Subject	Page
A	
After firing procedures	5-34
Air filters	3-31
Filter bag cleaning	3-32
Installation	3-33
Removal and inspection	3-31
Wet air filters and hull compartment.	3-33
Ammunition of components prepared for firing, but not fired	5-35
Ammunition prepared for firing but not fired	5-34
Arctic traction kit	2-165
Assembly and preparation for use	2-60
Authorized projectiles	6-2
B	
Backing vehicle.	2-73
Basic issue items (BI)	3-46
Batteries	3-37
Battery hookup	3-38
Corrosion	3-38
Deep cycling	3-39
Lead connections	3-38
Replacing batteries	3-38
Unserviceable batteries	3-39
Boresighting direct fire telescope using testing target with scribed M15 elevation quadrant	2-110
Boresighting M115 panoramic telescope using distant aiming point (DAP) method	2-112
Boresighting M115 panoramic telescope using distant aiming point with M137 mount and M15 elevation quadrant scribed	2-115
Boresighting M139 direct fire telescope using distant aiming point	2-114
Boresighting M139 direct fire telescope using distant aiming point and scribed M15 elevation quadrant	2-117
Boresighting procedures for test target method using scribed M137 panoramic telescope mount	2-108
Boresighting the weapon.	3-88
Breechblock group	3-55
Counterbalance assembly removal and adjustment	3-57
M35 firing mechanism	3-55
Removal, disassembly, assembly, and replacement of firing mechanism block, firing mechanism housing, obturator spindle, and breechblock	3-58
Scored gas check seat repair	3-55
C	
Checking boresight of M115 panoramic telescope using M140 alinement device	2-118
Checking boresight of M139 elbow telescope using M140 alinement device	2-119
Checking M140 alinement device while boresighting on test target	2-111
Checking reliability of deflections (M115 panoramic telescope)	3-75

Subject	Page
Checking reliability of special corrections (M115 panoramic telescope)	3-76
Inspecting M137 telescope mount (azimuth walk-off check)	3-77
Comparison test of the M140 alinement device	2-120
Corrosion prevention and control (CPC)	1-2

D

Defective ammunition	5-37
Direct fire procedures	2-140
General	2-140
Laying for direction and elevation: One man-one sight system	2-144
Laying for direction and elevation: Two man-one sight system	2-143
Laying for direction and elevation: Two man-two sight system	2-140
Driver's and crew's seats	3-46
Driver's enclosure kit	2-156
Driving vehicle	2-71
Driving vehicle on rough and hilly terrain	2-74

E

Emergency procedures	2-178
Emplacing M1A2 aiming posts	2-106
Emplacing M1A1 infinity aiming reference collimator	2-104
Engine cooling system	3-36
Adding coolant	3-36
Draining coolant	3-36
Engine starting	2-64
Entering fire control corrections.	2-125
M15 elevation fire control quadrant	2-125
M137 telescope mount and M115 panoramic telescope	2-126
Equilibrator adjustment	2-122
Equipment characteristics, capabilities, and features	1-3
Capabilities and features	1-3
Purpose	1-3
Equipment data	1-14
Excess explosive components	5-37

F

Fire control alinement tests and measurements	3-63
Fixed fire extinguisher.	2-78
Flash reducers	6-8
Fording	2-176
After fording maintenance	2-177
Fuel system	3-34
Fuel filler screen	3-35
Fuel filters.	3-34
Refueling	3-35
Fuzes	5-10,
	6-5
Fuze setting	5-23
Impact fuzes	5-24

Subject	Page
Multi-option fuze setting	5-31
Proximity fuze setting	5-24
Fuzing	5-20
Fuze assembly.	5-22
Lifting plug removal.	5-20
Supplementary charge (deep-cavity projectiles only).	5-20
Typical deep-cavity projectiles	5-21
G	
General	2-23, 2-170, 3-3, 4-1, 5-36, 5-39, 6-1
General preparation.	5-19
Packing and unpacking	5-19
Gun mount support.	2-78
Disengaging gun mount support.	2-79
Engaging gun mount support	2-79
Gunner' s quadrant end-for-end test	3-67
Gunner' s quadrant micrometer test	3-65
H	
Hand ramming with M13 loading rammer	2-130
I	
Initial adjustments and daily checks	2-60
Inserting primer and firing	2-135
Instrument panel checkout procedures.	2-65
Introduction	3-30
K	
Know your controls and indicators	2-5
Assistant gunner' s controls and indicators	2-12
Driver' s controls and indicators	2-5
External controls	2-18
Gunner' s controls and indicators	2-14
Loader/rammer and breech controls and indicators	2-16
Turret well controls	2-22
L	
Lamp replacement	3-46
Dome light	3-48
Driver' s external engine and transmission warning light.	3-51

Subject	Page
Engine transmission low oil warning indicator light and generator charge indicator light	3-51
Headlamps and blackout marker lamp.	3-46
High-beam indicator light and master switch indicator light	3-51
Low engine coolant warning light.	3-49
M15 elevation quadrant	3-52
M137 telescope mount	3-52
Panel light	3-49
Pressure filter indicator light.	3-50
Stoplight-taillight, left	3-47
Stoplight-taillight, right	3-48
Suspension lockout indicator light	3-50
Laying for direction and quadrant during indirect fire missions using collimator	2-136
Laying for direction and quadrant during indirect fire missions using M1A2 aiming posts	2-138
Laying howitzer using M2 aiming circle method	2-102
Leveling trunnions using plumbline	3-72
Leveling trunnions using scribe lines on M15 elevation quadrant.	3-74
Leveling tube -gunner's quadrant method	3-78
Loader/rammer preloading procedures	2-89
Loader/rammer and cannon alinement	2-91
Marking the rammer chain	2-94
Projectile tray adjustment.	2-89
Verifying correct cannon elevation for loader/rammer	2-90
Loading	5-32
Loading and ramming	5-39
Loading propelling charge	2-134
Location and description of major components.	1-3
Lockout cylinder check	3-39
Lubrication after fording operations	3-3
Lubricant levels.	3-3

M

Maintenance forms and records.	1-2
Manual loading and ramming.	2-127
Measuring site to crest	2-108
Misfire/checkfire procedures	2-147
Cold tube misfire procedure M110A2	2-149
Definitions	2-147
General	2-147
Hot tube misfire procedure M110A2	2-148
M201A1 cannon	3-53
Borescoping	3-54
Clean and lubricate	3-54
Determining remaining cannon tube life	3-54
Inspection	3-53
Muzzle break	3-55
Pullover gaging	3-54

Subject	Page
N	
Nuclear, biological, and chemical (NBC) decontamination procedures	2-178
Chemical detection and decontamination	2-178
Emergency procedures.. . . .	2-178
General.	2-178
O	
Obturator gas check pad inspection	2-124
Operating instructions on decals and instruction plates.	2-168
Operating procedures	2-61
Operation in unusual weather	2-170
Cold weather starting	2-173
Extremecold	2-171
Extreme dry heat	2-170
Extreme dust or sand.	2-171
Extreme moist heat	2-170
Salt air or sea spray.	2-171
Operation of auxiliary equipment	2-149
Arctic traction kit	2-165
Hull heater kit	2-157
M90 radar chronograph equipment and antenna mounting kit	2-151
Operation of coolant heater	2-160
Operation of crew personnel heater	2-163
Operation of crew personnel shelter	2-164
Operation of data display group	2-151
Operation of driver' s enclosure kit	2-156
Opening driver' s enclosure	2-156
Removal of driver' s enclosure	2-157
Operation of driver' s heater	2-159
Operation of exhaust ports and intake covers	2-162
Operation of fuel filter heaters	2-160
Operation of intercommunication system	2-149
Operation of portable fire extinguisher	2-154
Operation of special purpose kits	2-155
Operation of vehicular applique system	2-151
Operation of driving lights and dome light	2-69
Operation of dome light	2-69
Operation of light switch assembly.	2-69
Operation of fire control equipment	2-95
Operation of M15 elevation quadrant	2-98
Operation of M137 telescope mount and M115 panoramic telescope	2-95
M115 panoramic telescope	2-96
M137 telescope mount	2-95
Operation of M138 telescope mount and M139 direct fire elbow telescope	2-97
Operation of M1A1/M1A2 gunner' s quadrant	3-64
Operation of M17 periscope	3-53
Organization	1-17

Subject	Page
P	
PMCS procedures	2-23
Table 2-1. Preventive maintenance checks and services for the howitzer heavy, self-propelled, 8-inch, M110A2	2-26
Power loading and ramming	2-131
Prefire checks.	2-124
Preparation for fire control alinement tests	3-63
Preparation for firing	2-99
Emplacing the howitzer	2-99
Preparation for movement	2-165
Pre-starting instructions	2-61
Primers	5-18, 6-8
Projectile coloring and markings	5-2
Projectile extraction using bell rammer	5-39
Projectile extraction using M4277 extractor	5-40
Projectiles	5-36
Projectiles, use and characteristics	5-3, 6-4
Projectile tray	2-89
Propelling charge preparation.	5-32
Propelling charge M188	5-32
Propelling charge M188A1	5-32
Propelling charges M1 and M2	5-32
Propelling charges.	5-15, 6-6
Propelling charges M1 and M2	5-36
Propelling charges M188 and M188A1	5-36
R	
Recoil mechanism checkout and establishing oil reserve.	2-121
Repackaging.	5-44
Replacing worn M845 dummy projectile rotating band.	5-45
Reporting equipment improvement recommendations (EIR' s)	1-2
Retracting and returning cannon.	2-88
Retracting cannon	2-88
Returning cannon.	2-88
Reversing M845 dummy projectile rotating band.	5-44
S	
Scope.	1-1, 3-3
Scribing M15 elevation quadrant	3-80
Scribing M137 mount for boresighting	3-86
Section drill	1-18
Securing personnel seat and projectile trays.	2-165
Personnel seat	2-165
Projectile trays.	2-165
Service intervals-normal	3-3
Service intervals-unusual conditions	3-3

Subject	Page
Shifting the transmission	2-70
Spade	2-83
Emplacing	2-83
Securing spade	2-86
Special purpose kits	4-1
Arctic traction kit	4-2
Crew personnel heater kit	4-2
Crew personnel shelter kit	4-2
Driver's enclosure kit.....	4-1
Hull heater kit	4-1
Special tools	3-46
Starting engine by towing	2-68
Starting engine using auxiliary equipment	2-67
Stopping vehicle	2-75
Storage	5-38
Provisions	5-38
Sites	5-38
Temperature limits	5-38
Suspension lockout.....	2-87
Locking suspension	2-87
Unlocking suspension	2-87

T

Testing of elevation correction counter, M137 telescope mount	3-83
Testing of M15 elevation quadrant	3-79
Touchup and recoating	3-30
Tow hooks..	3-46
Towing procedures	2-76
Track..	3-39
Decreasing track tension	3-43
Increasing track tension	3-44
Installing track	3-45
Spindle and idler arm clearance	3-39
Track pad installation	3-40
Track shoe removal and installation	3-41
Track tension check	3-42
Traversing turret and elevating cannon	2-80
Manual elevating	2-80
Manual traversing	2-81
Manual traversing and elevating	2-80
Power elevating	2-82
Power traversing	2-83
Power traversing and elevating	2-81
Troubleshooting	3-4
Table 3-1. Troubleshooting	3-5

U

Unloading howitzer	2-145
Unpacking and inspection	5-39

Subject	Page
Unusual terrain	2-175
Ice	2-175
Mud	2-175
Sand	2-175
Snow	2-175

V

Verification of M15 elevation quadrant scribe lines	3-82
Verifying correct cannon elevation for loader/rammer	2-90

By Order of the Secretary of the Army:


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

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METRIC CHART

THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

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

WEIGHTS

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

LIQUID MEASURE

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

SQUARE MEASURE

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

CUBIC MEASURE

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

TEMPERATURE

$5/9 (^{\circ}\text{F} - 32) = ^{\circ}\text{C}$
 212 $^{\circ}$ Fahrenheit is equivalent to 100 $^{\circ}$ Celsius
 90 $^{\circ}$ Fahrenheit is equivalent to 32.2 $^{\circ}$ Celsius
 32 $^{\circ}$ Fahrenheit is equivalent to 0 $^{\circ}$ Celsius
 $9.5 \text{ C}^{\circ} + 32 = \text{F}^{\circ}$

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	6.451
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	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
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	2.354
Kilometers per Hour	Miles per Hour	0.621

