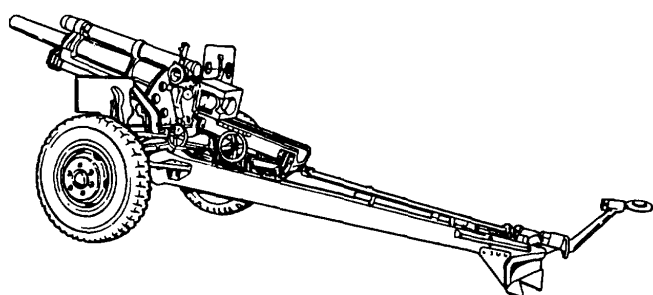


**SUPERSEDES COPY:
SEE PAGE i FOR DETAILS**

TECHNICAL MANUAL

**OPERATOR'S AND UNIT
MAINTENANCE MANUAL**
FOR
HOWITZER, LIGHT, TOWED:
105-MM, M101A1
(1015-00-322-9752) (EIC: 3EC)



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HEADQUARTERS, DEPARTMENT OF THE ARMY

APRIL 1993

WARNING

All personnel that operate and/or maintain fire control equipment on the M101A1 howitzer must be aware of the following special precautions.

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

Copies of the following rules and regulations are maintained at Headquarters, Army Armament, Munitions and Chemical Command (HQ, AMCCOM), Rock Island, IL 61299-6000. Copies may be requested or information obtained by contacting the HQ, AMCCOM Radiological Protection Officer (RPO), DS 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 conditions, 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 maintenance personnel 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 RPO. 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 to the HQ, AMCCOM RPO for instructions on handling, storage, or disposal.

Storage and Shipping

All radioactively illuminated instruments which are defective will be evacuated to a Direct Support 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. For further instructions, refer to AR 385-11.

WARNING**HOWITZER**

Ram the round with closed fist to avoid injury. Be careful when handling a live round to avoid striking the fuze or primer.

The rammer extractor tool is designed so that the ears will not contact primer; be sure that they do not before ramming. Contact could cause premature firing, causing injury or death to personnel. If the ears are contacting the primer, dispose of the rammer extractor tool and obtain a new one.

To prevent injury to hands in extreme cold weather conditions, do not grasp metal parts such as knobs, levers, covers, etc., with bare hands.

A blocked equilibrators assembly is under great pressure and requires great care in handling to avoid injury to personnel.

Check cannon bore for obstruction. Firing with foreign objects left in cannon bore may cause weapon to explode, causing injury or death to personnel.

Use extreme care when moving heavy components and have correct number of crew-members available when needed. One crew member must supervise and coordinate lifting and removal of cannon or recoil mechanism to prevent injury to personnel.

Breechblock handle is under spring tension. Release tension slowly when removing machine key.

Do not attempt to remove wheel and tire assembly with howitzer supported by the jack only. For safety, blocking must always be placed under axle pintle assembly.

When inflating tire, use tire gage or inflate with locking side ring grounded. Always deflate tire before attempting repairs. Release air pressure in tire by depressing valve before removing valve core.

Dry cleaning solvent (SD-2), used to clean parts, is potentially dangerous to personnel and property. DO NOT use near open flame or excessive heat. Flash point of drycleaning solvent is 138 °F (59 °C).

AMMUNITION SAFETY

Refer to Ammunition and Explosive Standards (TM 9-1300-206).

The procedures in this manual involve the use of a weapon system and live ammunition. Normal safety precautions, as well as warnings preceding potentially hazardous operations, must be observed any time live ammunition is handled or the howitzer is operated or serviced.

Gun crew members assigned tasks involving the preparation and loading of ammunition must observe those precautions shown in the procedures governing such operations. Particular note must be made of the warnings involving rounds which fail to fire or eject, and the time and distances recommended while processing such malfunctions.

Unauthorized assembly and use of projectiles and propelling charges are extremely dangerous. Make sure that projectile to be fired from M101A1 105-mm howitzer is marked 105H (not G or R).

In case of failure to fire, keep weapon trained on target. Have crew members stand clear of muzzle and path of recoil. Do not open breech mechanism for at least 1 minute after the firing attempt.

Chambered rounds should be fired or removed from a hot weapon within 5 minutes.

Do not reuse rounds which have been extracted from weapons by ramming.

When tightening fuze to projectile, do not hammer on fuze wrench. Do not use extension handle on fuze wrench. Do not stake fuze to projectile under any circumstances. Shock transmitted to fuzes during assembly may increase percentage of malfunctions. Know which fuze goes to which projectile, and do not fire round unless fuze is fully seated.

The blast of the howitzer can damage hearing of crew members. In addition to supervised wearing of properly fitted earplugs, effects of the blast can be further reduced by moving away from blast area. All crew members not required to fire the weapon should stand in back of trails during firing.

Do not fire white phosphorous (WP) projectiles which are known to have been stored in other than a base down position. Firing of such projectiles could contribute to inbore or close-in premature malfunctions, causing conditions hazardous to crew members.

Dropping or rough handling of a projectile assembled with M501/M501A1 MTSQ fuze may result in fuze functioning and explosion of projectile base and contents. When handling projectile assembled with fuze, exercise extreme care to protect fuze from impact. Keep pull wire on fuze in place until immediately before firing.

Do not alter loaded ammunition or components.

Cartridge upper temperature limit of +125 °F (+52 °C) must not be exceeded. Keep ammunition in the shade when the outside temperature is expected to exceed +100 °F (+38 °C). Do not expose ammunition and components to direct sunlight, flame, or other sources of heat.

Observe all precautions in AR 385-63 and FM 6-40, particularly limitations regarding overhead fire in training and combat.

WARNING

HOWITZER (cont)

Do not touch, move, or otherwise handle duds. Have duds destroyed in place by Explosive Ordnance Disposal (EOD) personnel only.

Handle explosive ammunition and components containing explosives with utmost care. Do not drop, throw, tumble, or strike packaged or unpackaged ammunition or related components.

Do not expose ammunition and components containing explosives to rain, lightning, excessive humidity, or ground moisture.

FIRST AID

For first aid information, refer to FM 21-11.

d

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC 21 April 1993

Operator's and Unit Maintenance Manual
for
HOWITZER, LIGHT, TOWED:
105-MM, M101A1
(1015-00-322-9752) (EIC: 3EC)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

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

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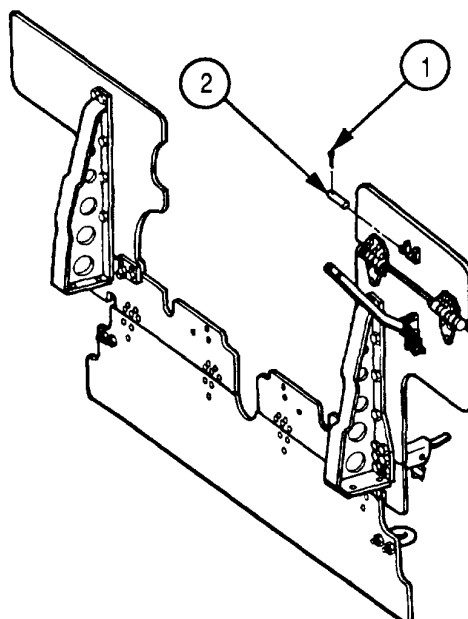
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HOW TO USE THIS MANUAL

a. This manual sometimes uses illustrations from the parts list (TM 9-1015-203-20P) in the maintenance procedures. The parts list, in turn, repeats illustrations from the DS/GS parts list. This means that sometimes parts are shown removed which are not removed at the Unit level. When this happens, the part is not given a callout number. For example:

LEGEND

1. Cotter pin
2. Straight pin



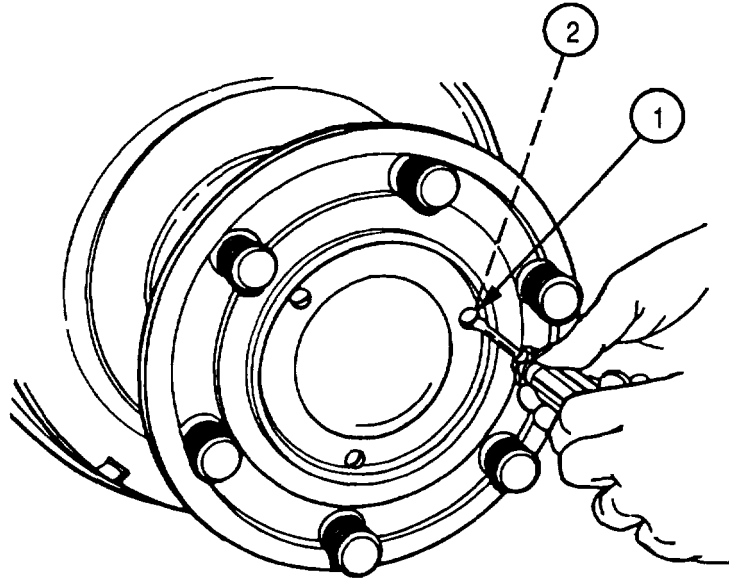
NOTE
SOME PARTS ARE
SHOWN REMOVED
FOR CLARITY.

TOP RIGHT/UPPER RIGHT SHIELD ASSEMBLIES

- (1) Parts 1 and 2 can be removed. Do not remove the shield assembly, which has no call out number.
- (2) When parts are missing on a locator view, a note is added: Some parts are shown removed for clarity.
- (3) Always pay attention to the equipment conditions and the written procedures to determine what parts to remove.

HOW TO USE THIS MANUAL (cont)

b. A dashed arrow in the lube instructions indicates lube points on both sides. A dashed call out arrow in the procedures means the part being called out is hidden, i.e., can't be seen on the illustration. For example:



(1) Callout 1 is the screw.

(2) Callout 2 is the washer, which is hidden by the screw.

c. All lube fittings authorized to be removed are shown on page 5-30. The same lube fittings are also removed/installed in the maintenance procedures when they are part of a major assembly. However, only remove a lube fitting if damage is suspected.

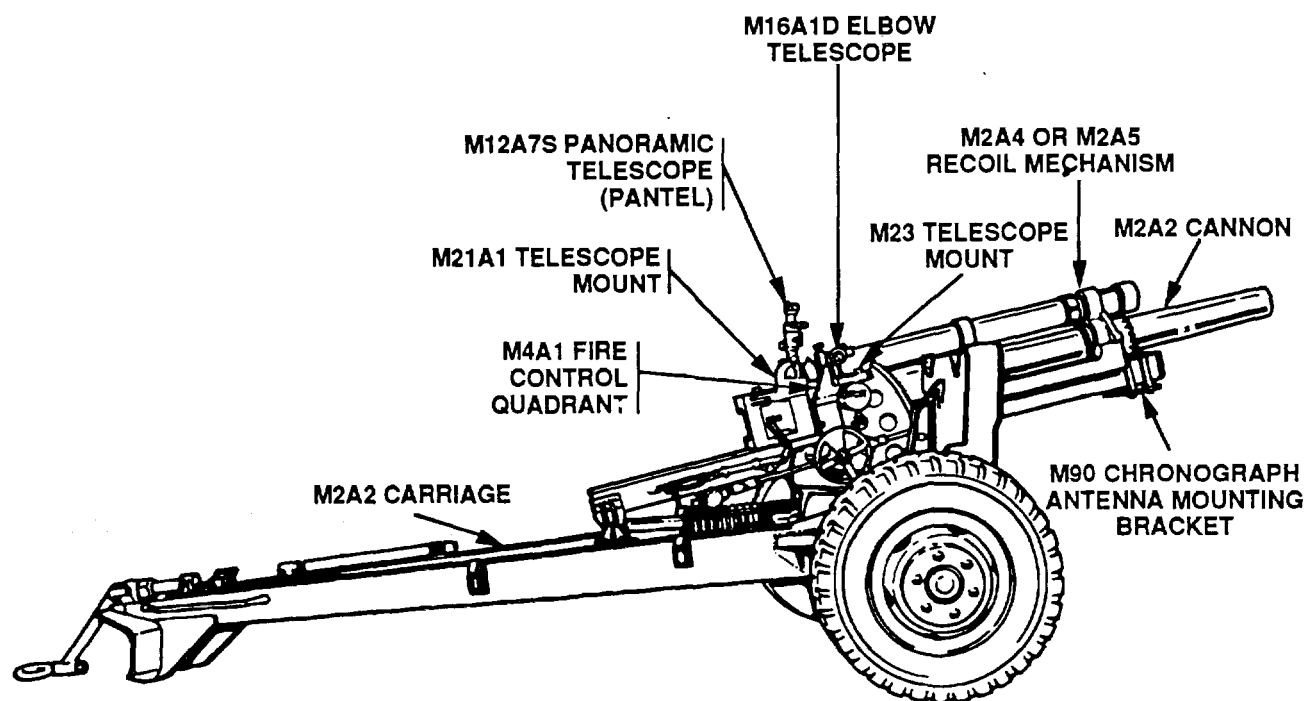
d. When a part (for example, gasket) is listed under materials/parts in the initial setup, it means that if that part is removed, replace the old part with a new one.

e. The M101A1 is equipped with a new taillight assembly. The difference from the old taillight assembly is the tube clamp and turn and marker stop taillights.

f. Appendix E lists all expendable/durable supplies and materials that are needed to maintain the M101A1 howitzer.

CHAPTER 1 INTRODUCTION

Section I. GENERAL INFORMATION



HOWITZER, LIGHT, TOWED, 105-MM, M101A1

1-1. SCOPE

- a. **Type of Manual.** Operator's and Unit maintenance.
- b. **Model Number and Equipment Name.** M101A1 105-mm towed light howitzer.
- c. **Purpose of Equipment.** Provides artillery fire in support of ground-gaining troops.

1-2. MAINTENANCE FORMS AND PROCEDURES

Department of the Army forms and procedures used for equipment maintenance will be those pre-scribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS) (Maintenance Management UPDATE).

1-3. HAND RECEIPT (HR) MANUALS

This manual has a companion document with a TM number followed by "HR" (which stands for Hand Receipt). The TM 9-1015-203-12-HR consists of preprinted hand receipts (DA Form 2062) that list end item related equipment (i.e., COEI, BII, and AAL) you must account for. As an aid to property accountability, additional -HR manuals may be requisitioned from the following source in accordance with procedures in chapter 12, AR 25-30:

The U.S. Army Publications Distribution Center
ATTN: AGLD-OD
2800 Eastern Boulevard
Baltimore, MD 21220-2896

1-4. CORROSION PREVENTION AND CONTROL (CPC)

a. Corrosion prevention and control (CPC) of Army materiel 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 future items.

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. 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. Submit the form to: Commander, U.S. Army Armament, Munitions and Chemical Command, ATTN: AMSMC-QAD/Customer Feedback Center, Rock Island, IL 61299-6000.

1-5. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

Refer to TM 750-244-7.

1-6. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR's)

If your M101A1 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.

1-7. REFERENCE INFORMATION

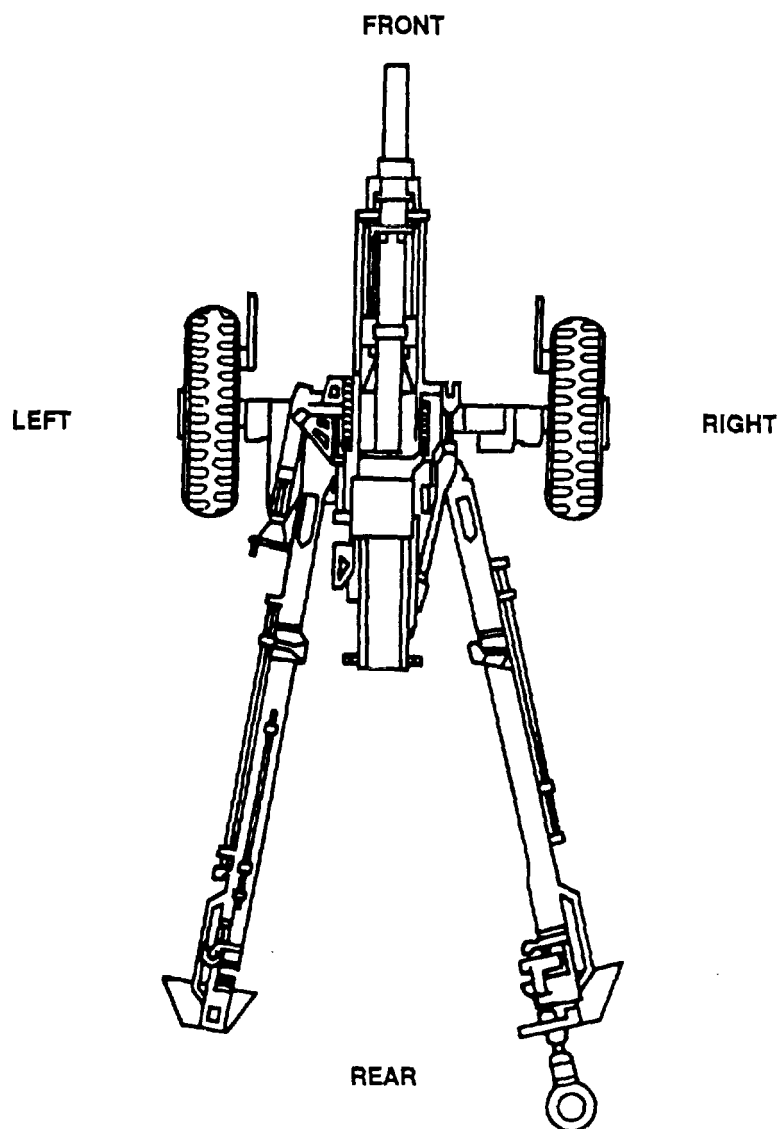
This listing includes the nomenclature cross-reference list, list of abbreviations/acronyms, and explanation of terms (glossary) used in this manual.

a. NOMENCLATURE CROSS-REFERENCE LIST

Common Name	Official Nomenclature
Azimuth micrometer knob	Knob
Bore-cap brush	Brush, cleaning, artillery
Boresight screw	Worm, shaft
Bottom shield latches	Shield assembly, latch
Bracket	Bracket and roller assembly, lanyard
Bracket rotating knob	Knob
Cradle	Cradle, elevating mechanism with bearing strips
Cross leveling knob	Knob
Cross leveling worm knob	Knob
Detent handle	Breechblock handle
Drawbar lock assembly	Shaft, drawbar, locking, trail and spade assembly
Elevating arcs	Elevating and bushing assembly arc
Elevation micrometer	Micrometer
Elevation worm	Worm
Equilibrator guide rods	Rod, threaded end
Handbrakes	Brake, operating assembly, RH and LH
Illumination window	Window, observation
Left index	Pointer, dial
Locking nut	Knob
Longitudinal leveling knob	Knob
Nonslipping azimuth scale	Scale
Oil index	Recuperator cylinder index head
Pantel	Telescope, panoramic, M12A7S
Protective eyeshield	Eyeshield, optical
Purge plug	Setscrew
Ratchet rack	Rack, brake operating mechanism assembly
Recoil slides, recoil mechanism	Rail, right and left
Slides	Strip, bearing, cradle, LH and RH
Slipping azimuth scale	Scale assembly
Slipping micrometer scale	Scale dial
Stowage bracket	Support, aiming posts
Tangent screw	Setscrew
Throwout lever	Worm shoe
Wing knob	Knob
Wingnut	Bolt assembly
Worm wheel and pinion	Elevating shaft assembly

1-7. REFERENCE INFORMATION (cont)**b. LIST OF ABBREVIATIONS/ACRONYMS**

ADAM	Area denial artillery munition
AG	Assistant gunner
APERS	Antipersonnel
BE	Base ejection
CHG.....	Charge
Comp.....	Composition
CP.....	Concrete piercing
CS.....	Chief of section
CTA	Common table of allowances
D.....	Driver
DAP	Distant aiming point
DF.....	Deflection
EFC	Equivalent full charge
EOD.....	Explosive ordnance disposal
FZ	Fuze
G.....	Gunner
H.....	Mustard gas
HC	White chemical smoke mixture
HD	Distilled mustard gas
HE.....	High explosive
HEAT.....	High explosive, anti-tank
HEAT-T	High explosive, anti-tank with tracer
HEP	High explosive, plastic
HEP-T.....	High explosive plastic with tracer
HERA.....	High explosive, rocket assist
HOB.....	Height of burst
HMMWV	High mobility, multiple wheeled vehicle
ICM	Improved conventional munitions
ILLUM	Illumination
JTA	Joint table of allowance
LED.....	Light emitting diode
MA	Muzzle action
MT	Mechanical time
MTOE	Modified table of organization and equipment
MTSQ	Mechanical time and superquick
PD.....	Point detonating
SOP	Standard operational procedure
SQ	Superquick
SRA	Specialized repair activity
TMDE	Test, measurement, and diagnostic equipment
TOE's	Tables of organization and equipment
TP	Inert projectile
TP-T	Inert projectile with tracer
UUT	Unit under test
VT.....	Variable time
WP	White phosphorous



TOP VIEW OF M101A1 HOWITZER

c. GLOSSARY

Front, Rear, Right, and LeftLocations of the howitzer as shown in illustration.
 Howitzer SectionThose personnel specified by the current table of organization and
 equipment (TOE) that make up a howitzer section.

1-8. PREPARATION FOR STORAGE OR SHIPMENT

Refer to chapter 5, Section VI, Administrative Storage of Equipment (p 5-88).

1-9. FORDING AND SWIMMING OPERATIONS

a. Shallow-Water Fording.

- (1) Cover the weapon with canvas covers provided to protect it from water being splashed against the weapon.
- (2) If accidental complete submersion occurs, the weapon will be treated as described in step b. below.

b. After-Fording Operations.

- (1) Immediately after weapon is towed from the water, if tactical situation permits, perform the following services:

(a) Notify Unit maintenance to remove the wheel and hub and brake drum assemblies. Thoroughly clean with cleaning compound (item 9, appx E) and dry all working parts of the hand-brakes and wheel bearings. Lubricate the assemblies in accordance with the lubrication instructions.(Refer to page 3-1.)

- (b) Empty any water from the materiel and clean, dry, and apply the proper lubricant (refer to page 3-1) to all exposed unpainted surfaces, paying special attention to the bore and chamber, the recoil rollers, and the gun cradle assembly rails.

(2) If parts of the materiel are accidentally submerged or badly splashed, apply temporary preservative and notify Unit maintenance personnel so that necessary complete disassembly, cleaning, and lubrication may be performed as soon as possible.

(3) Saltwater immersion greatly increases rusting and corrosion, especially on unpainted surfaces. It is most important to remove all traces of saltwater and salt deposits from every part of the weapon. Apply temporary preservative and notify Unit maintenance so that necessary complete disassembly, cleaning, and lubrication may be performed as soon as possible.

1-10. NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) DECONTAMINATION PROCEDURES

Perform NBC detection and decontamination procedures in accordance with TM 3-220 and FM 21-40, using DS-2 portable decontamination apparatus (TM 3-4230-204-12&P or unit SOP).

1-11. SAFETY, CARE, AND HANDLING

- a. Observe all WARNINGS, safety precautions, and safety regulations in this manual.
- b. Safety precautions to be observed during training are prescribed in AR 385-63 and local range regulations.
- c. Instructions for general ammunition care, handling, and safety are provided in TM 9-1300-206.
- d. Safety precautions given in chapter 4 of this manual must be adhered to for storage, handling, and firing of ammunition.
- e. Safety, care, and handling of radioactive commodities shall be in accordance with AR 700-64.

Section II. EQUIPMENT DESCRIPTION

1-12. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

a. M101A1 Howitzer.

- (1) Provides direct or indirect fire.
- (2) Is a split-range weapon that can be airlifted, dropped by parachute, or towed into position.

b. M101A1 Howitzer Fire Control and Sighting Equipment. Is divided into three groups:

- (1) Indirect fire instruments are used when the target is not visible from the weapon and include:

- M12A7S panoramic telescope (pantel)
- M21A1 telescope mount
- M4A1 fire control quadrant
- M1A1 collimator with case
- M1A2 aiming post with M401 cover

- (2) Direct fire instruments are used when the target is visible from the weapon and include:

- M16A1 D elbow telescope
- M23 telescope mount
- M4A1 fire control quadrant
- M12A7S panoramic telescope (pantel)
- M21A1 telescope mount

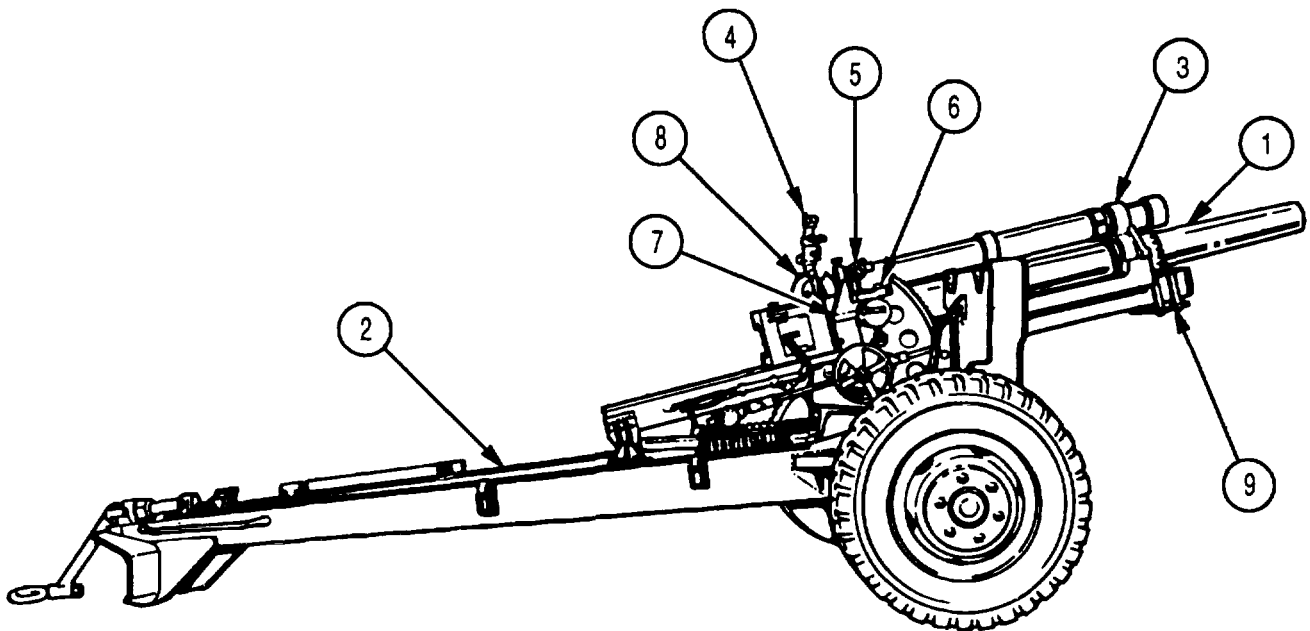
- (3) Miscellaneous instruments include:

- M1A1 gunner's quadrant with case
- M14, M19, and M36 instrument lights
- M21 chest
- M27, M34, and M35 fuze setters

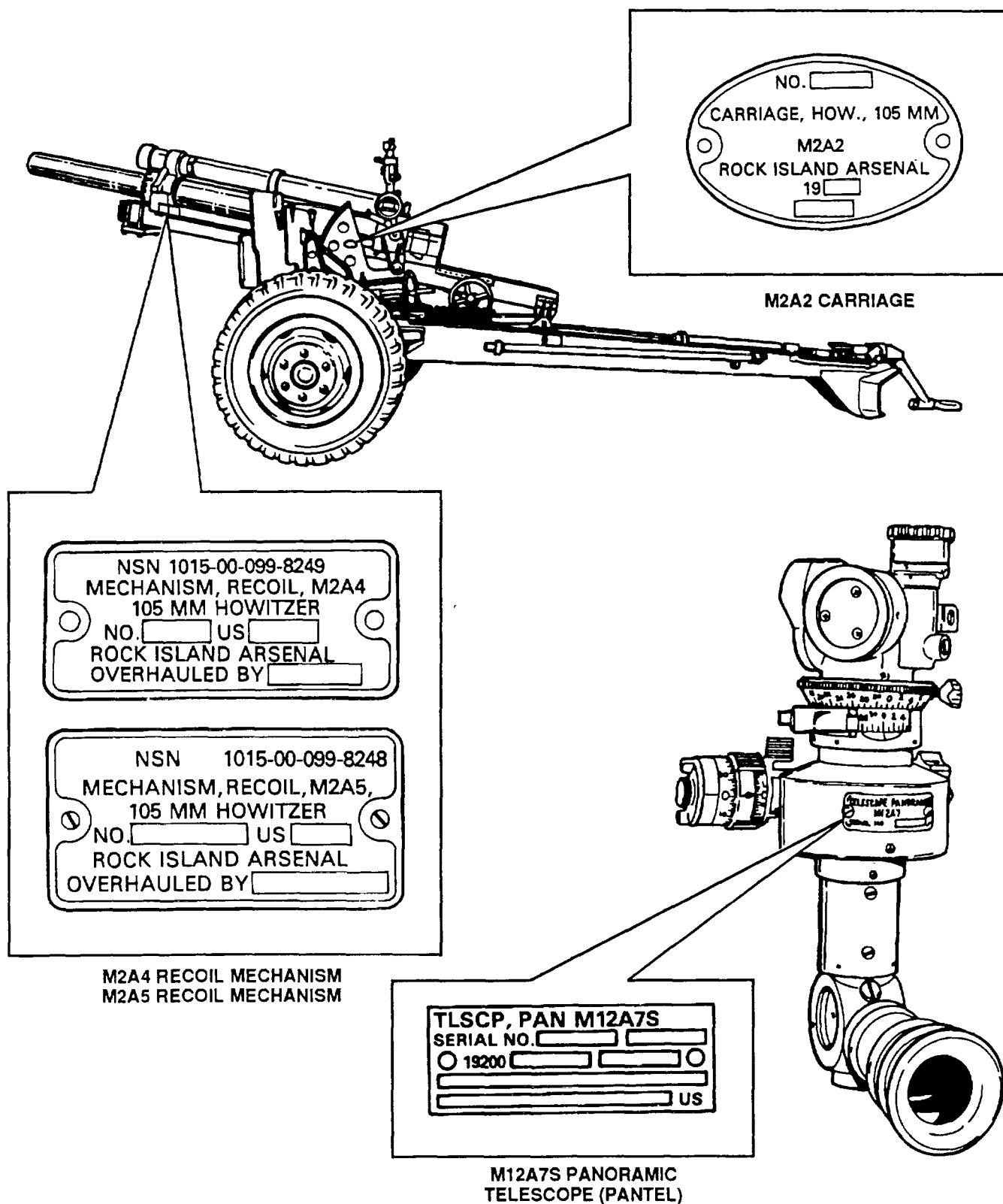
1-13. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

a. M101A1 Howitzer Components.

- (1) **M2A2 CANNON.** Single-loaded, air-cooled, and uses semifixed ammunition. Houses ammunition at the time of firing.
- (2) **M2A2 CARRIAGE.** Single axle and split-trail type which is used to transport and emplace weapon.
- (3) **M2A4 OR M2A5 RECOIL MECHANISM.** Hydropneumatic system that absorbs the energy of fired projectile. Also supplies mounting base for fire control equipment.
- (4) **M12A7S PANORAMIC TELESCOPE (PANTEL).** Is used with the M21 A1 telescope mount in azimuth for indirect fire. May also be used for direct fire.
- (5) **M16A1D ELBOW TELESCOPE.** 3-power field-of-view instrument used for direct fire.
- (6) **M23 TELESCOPE MOUNT.** Mounts on the M4A1 fire control quadrant, and also serves as a mount for M16A1 D elbow telescope.
- (7) **M4A1 FIRE CONTROL QUADRANT.** Manually-operated, elevation-indicating instrument used for laying the howitzer in elevation for direct or indirect fire.
- (8) **M21 A1 TELESCOPE MOUNT.** Is used with the M12A7S panoramic telescope (pantel) for laying the howitzer for direct and indirect fire. Mounts on left side of cradle.
- (9) **M90 CHRONOGRAPH ANTENNA MOUNTING BRACKET.** Provides mounting base for the M90 chronograph.

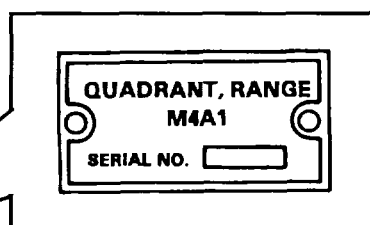
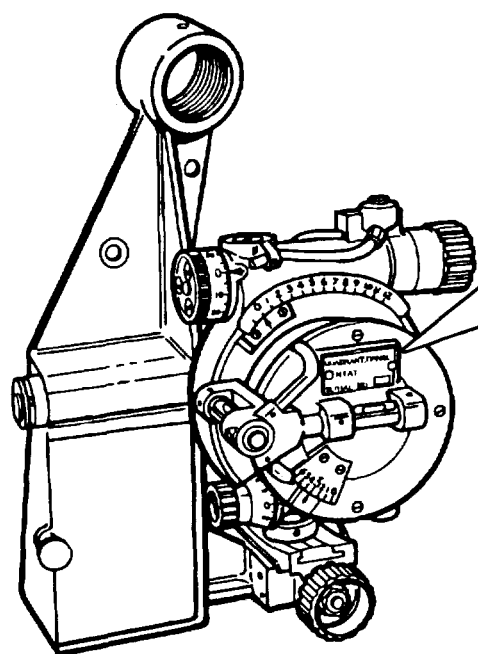


b. Data Plates. Refer to the following illustrations for location of data plates on the M101A1 howitzer and fire control equipment.

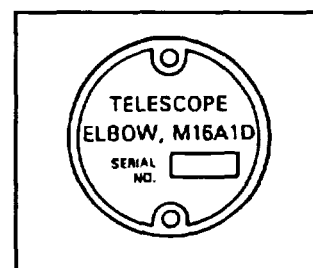
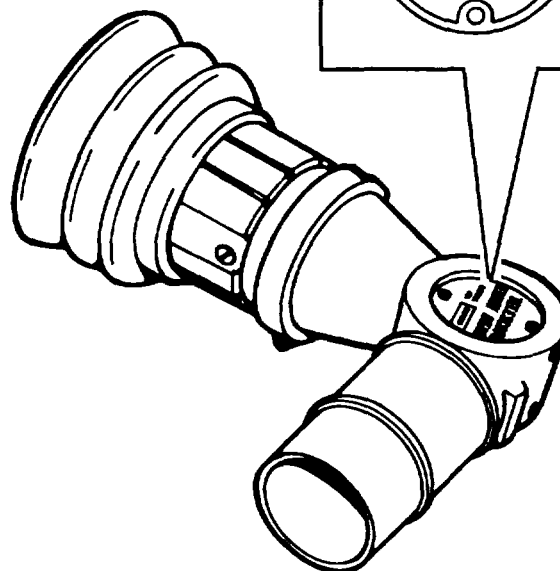


1-13. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (cont)

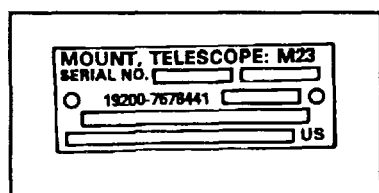
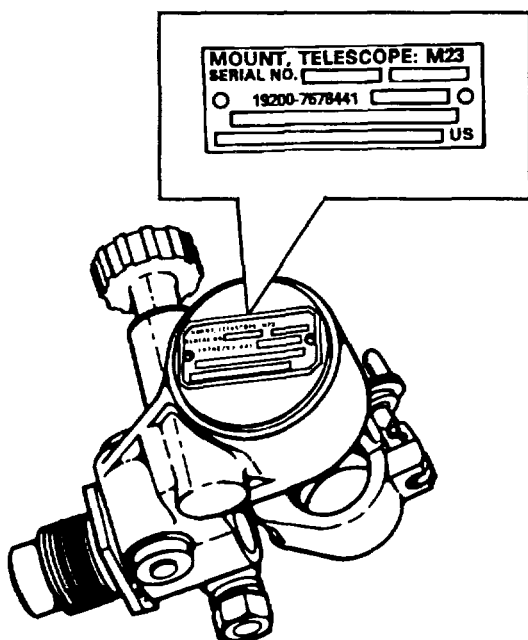
b. Data Plates (cont).



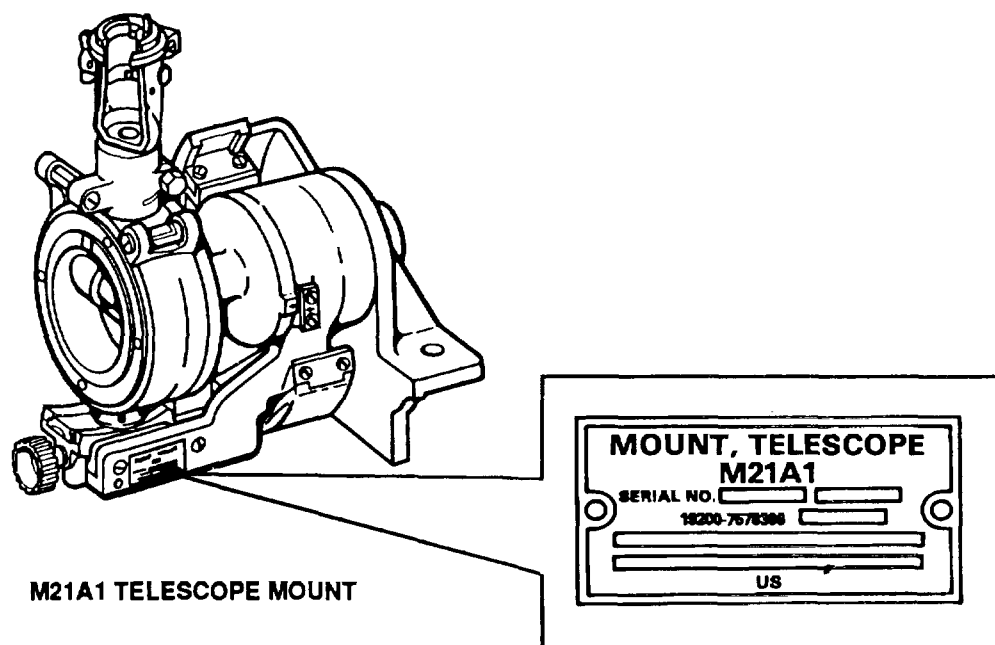
M4A1 FIRE CONTROL QUADRANT



M16A1D ELBOW TELESCOPE



M23 TELESCOPE MOUNT



M21A1 TELESCOPE MOUNT

1-14. DIFFERENCES BETWEEN MODELS

a. This manual covers only the M101A1 howitzer. However, there may be a few M101 howitzers still in the field. Use the paragraph below to verify model in use. The operation of both models is basically the same, and this manual can be used by an M101 howitzer crew.

b. The difference between the M101A1 and M101 howitzer is that the M101 is equipped with the M2A1 carriage and the M101A1 is equipped with the M2A2 carriage. The carriages differ primarily in the shield assembly. The M2A1 carriage has right and left main shields and a top shield. The M2A2 carriage has a main shield group including right upper and lower shields, left upper and lower shields, a right top flap, a bottom flap, and auxiliary right and left shields.

1-15.EQUIPMENT DATA

a. Howitzer Equipment Data.

Angle of departure	36.13 in. (91.77 cm) lunette height 28 deg
Brakes:	
Hand.....	manually-operated band type
Breech type	horizontal, sliding-wedge
Breechblock weight	74 lb (33.57 kg)
Bridge weight classification	4
Dimensions (travel conditions):	
Ground clearance at axle	14 in. (35.56 cm)
Height at muzzle (towed position)	62 in. (157.48 cm)
Length (towed position)	19.18 ft (5.85 m)
Width	50 ft (2.29 m)

1-15. EQUIPMENT DATA (cont)**a. Howitzer Equipment Data (cont).**

EFC rating

M2A15000 EFC rd
 M2A2 zone 1 thru 77500 EFC rd

Handwheel load:

Elevating..... 16 lb
 Traversing 8 lb

Length of recoil 39 to 42 in. (99.06 to 106.68 cm)

Lunette load 235 lb (106.59 kg)

Maximum range..... 12, 330 yd (11.27 km)

Maximum towing speed:

Cross country 10 mph (16 km/hr)
 Improved roads 45 mph (72 km/hr)
 Secondary roads 30 mph (48 km/hr)

Mils of movement per turn of handwheel:

Elevating..... 10 mils
 Traversing 19 mils

M2A2 cannon weightapproximately 1070 lb (485.35 kg)

On-carriage elevating range - 90 to +1155 mils

Overall length8.47 ft (2.58 m)

Prime mover MI 037 HMMWV with Artillery Kit

Rate of fire:

Maximum (first 3 minutes)..... 10 rpm
 Sustained3 rpm

Recoil capacity8.5 pt (4.02 l)

Recoil mechanism hydropneumatic

Recoil mechanism weight 470 lb (213.19 kg)

Tires:

Air pressure:

Higher speeds over hard surfaces 48 psi (3.38 ko/cm²)
 Lower speeds over soft ground 32 psi (2.25 kg/cm²)
 Normal conditions 40 psi (2.81 kg/cm²)
 Size 900 x 20

Traversing range:

Left400 mils
 Right.....409 mils

Weight 4980 lb (2259 kg)

b. Fire Control Equipment Data.

M12A7S panoramic telescope (pantel):

Elevation.....±300 mils
 Least increment reading..... 1 mil
 Weight 5 lb (2.49 kg)

M16A1 D elbow telescope:

Effective focal length:

Eyepiece 1.374 in. (3.48 cm)
 Objective4.123 in. (10.47 cm)
 Field of view 13 deg 20 min
 Power 3 x
 Weight 2.75 lb (1.25 kg)

M21A1 telescope mount:

Correction (cross level)533.4 mils of arc
 Elevation (limits).....1955.8 mils of arc
 Least increment reading (scale)..... 1 mil
 Weight 46 lb (20.87 kg)

M23 telescope mount:

Adjustable in elevation only.....0 to 2200 yd (0 to 2012 m)
 Height..... 4.75 in. (12.07 cm)
 Length 6.13 in. (15.57 cm)
 Weight 6.67 lb (3.03 kg)
 Width 6.13 in. (15.57 cm)

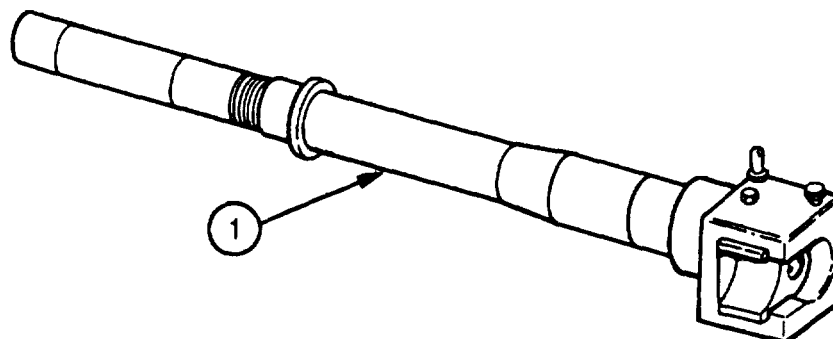
M4A1 fire control quadrant:

Elevation.....0 to 1200 mils
 Least increment reading..... 1 mil
 Weight 32 lb (14.52 kg)

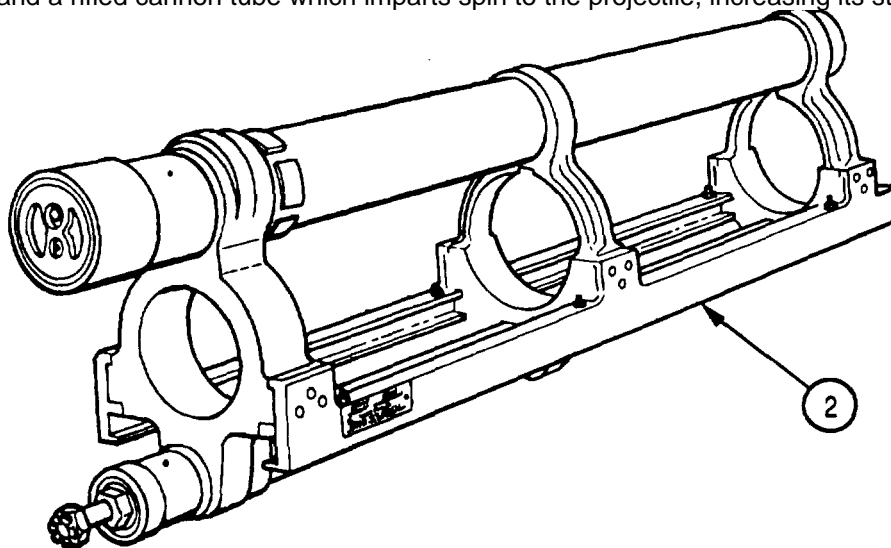
Section III. PRINCIPLES OF OPERATION

1-16. PRINCIPLES OF OPERATION

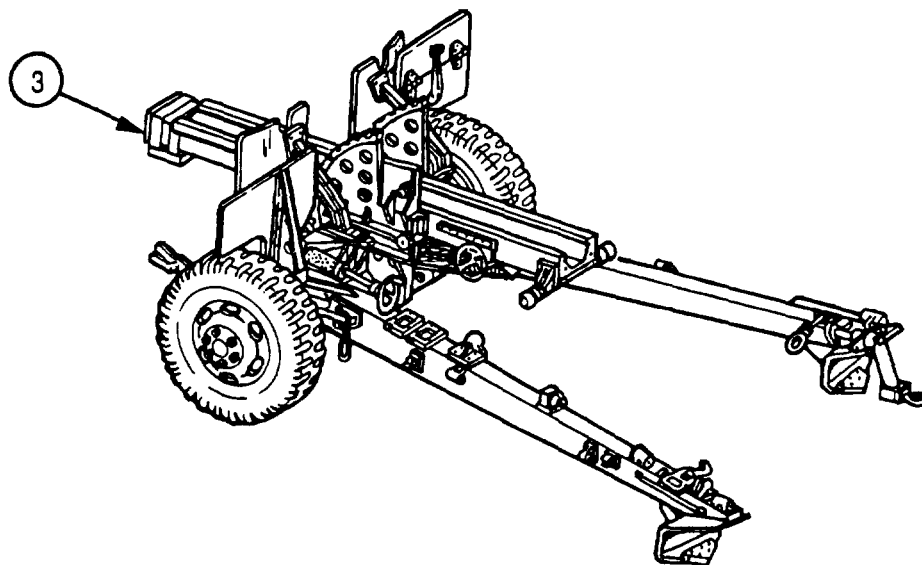
The M101A1 howitzer is a light, towed, general purpose field artillery weapon, used in direct support of an infantry division. The weapon consists of an M2A2 carriage, M2A4 or M2A5 recoil mechanism, and M2A2 105-mm cannon. Fires both direct and indirect fire.



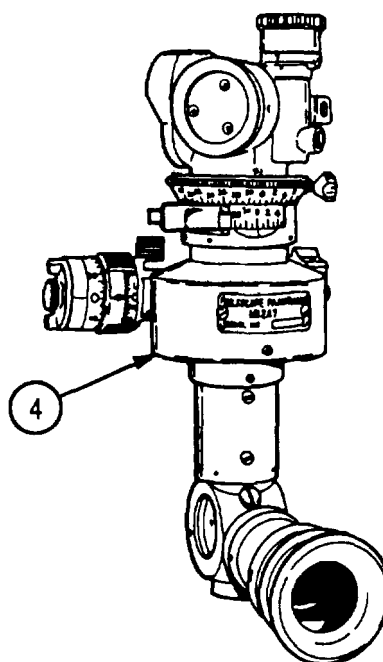
M2A2 CANNON (1). Portion of the weapon which fires the projectile. Consists of a breech mechanism to house the semifixed ammunition and a rifled cannon tube which imparts spin to the projectile, increasing its stability during flight.



M2A4 OR M2A5 RECOIL MECHANISM (2). Is a hydropneumatic system which absorbs the recoil shock during firing and returns the M2A2 cannon to battery position after firing. Is installed in the cradle of the carriage and is attached to the cradle and barrel.

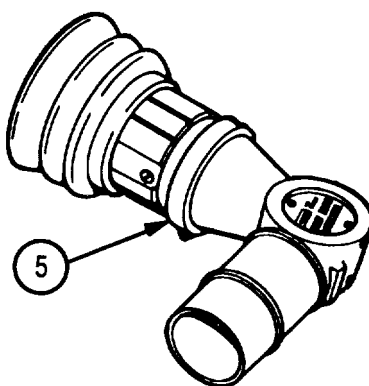


M2A2 CARRIAGE (3). Is a single axle and split-trail type which supports the M2A4 or M2A5 recoil mechanism, cannon tube, and the fire control mounts and instruments.

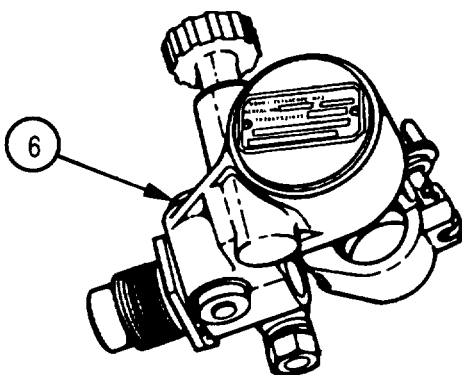


M1 2A7S PANORAMIC TELESCOPE (PANTEL) (4). Is used for direct and indirect fire. The line of sight can be traversed in either direction in a complete circle without the observer changing position.

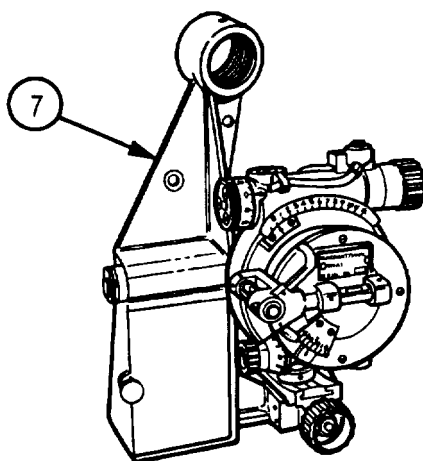
1-16. PRINCIPLES OF OPERATION (cont)



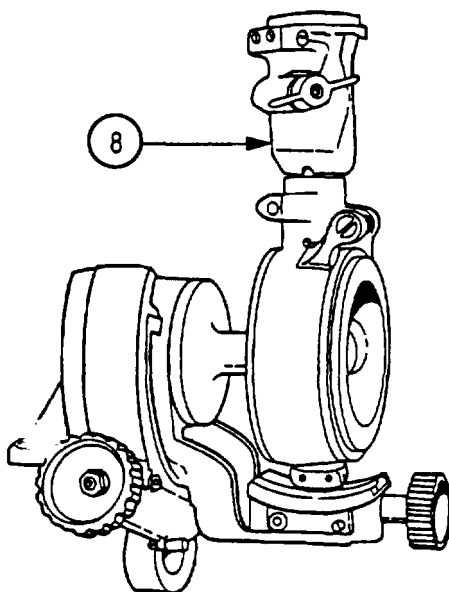
M16A1D ELBOW TELESCOPE (5). Reticle is illuminated by M36 instrument light and is used for direct fire. Reticle is also graduated in meters for range.



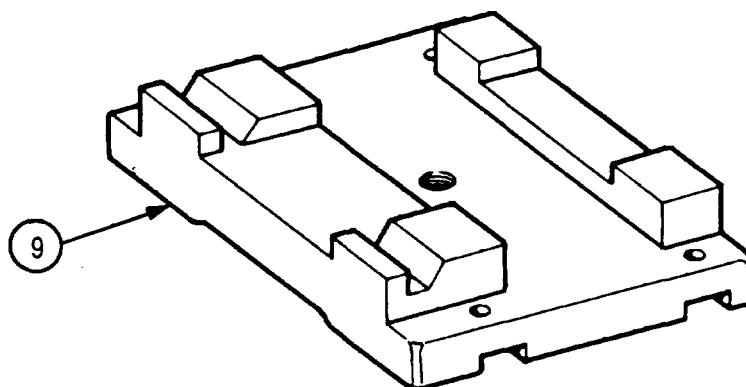
M23 TELESCOPE MOUNT (6). Lays M16A1D elbow telescope line of sight in elevation for direct fire or provides elevation movement for M16A1D elbow telescope line of sight.



M4A1 FIRE CONTROL QUADRANT (7). Quadrant graduations are utilized with the M16A1D elbow telescope reticle graduations to determine range for direct fire operations.



M21A1 TELESCOPE MOUNT (8). Is designed to correct azimuth errors when the howitzer elevated and the trunnions are not level.



M90 CHRONOGRAPH BRACKET (9). Mounts M90 chronograph. Has no operational function.

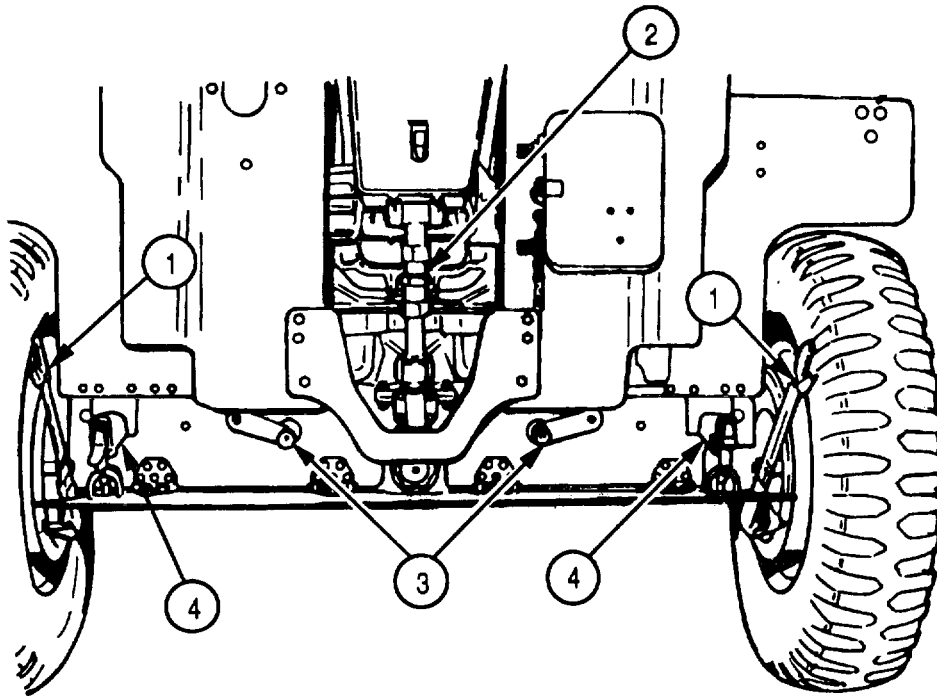
CHAPTER 2 OPERATING INSTRUCTIONS

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

2-1. GENERAL

Before attempting to operate the M101A1 howitzer, be familiar with the location of all controls and indicators.

2-2. HOWITZER CONTROLS AND INDICATORS



a. Handbrakes (1). To disengage either handbrake, grasp and move the clasp-type handle as far forward (toward weapon) as handle will go. Apply handbrakes when howitzer is in firing position.

b. Cradle Lock Strut Assembly (2). Supports front of cradle during travel to reduce shock and strain on elevating mechanism. Locks to underside of cradle by a latch when firing.

c. Right and left Axle Locks (3). Engage to lock axles together during travel. Disengage to provide three-point suspensions during firing.

d. Bottom Shield Latches (4). Support bottom shield in raised position during travel.

2-2. HOWITZER CONTROLS AND INDICATORS (cont)

e. **Breechblock Operating Lever (5).** Opens breech mechanism by pressing and rotating to rear. Closes breech mechanism by rotating forward (toward weapon) until latch engages catch.

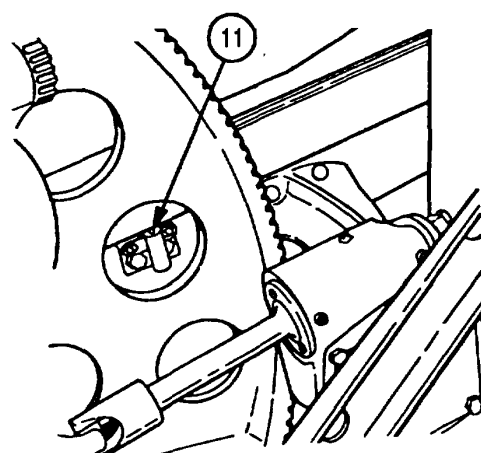
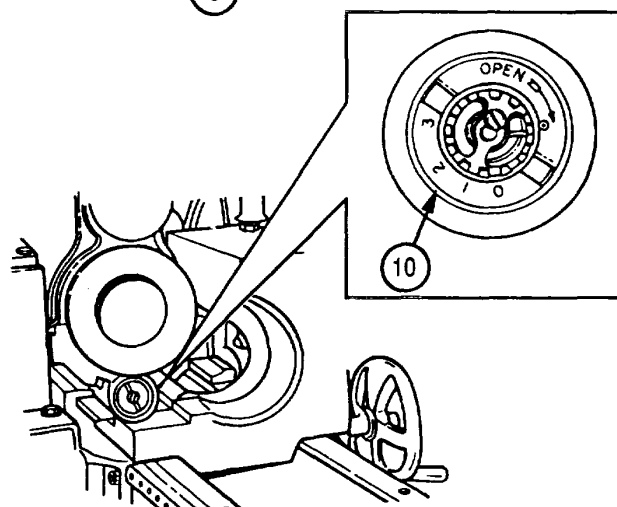
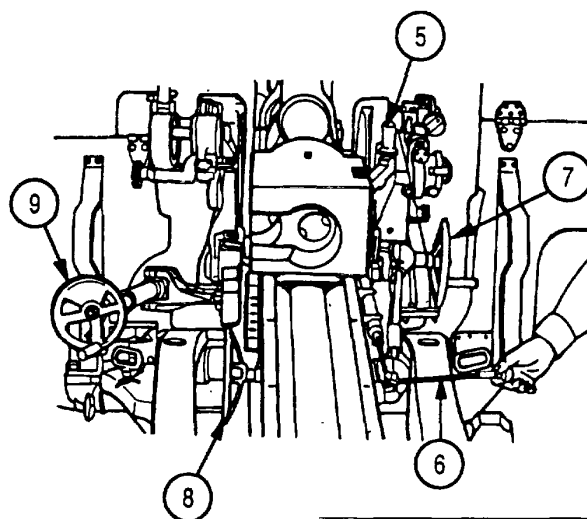
f. **Firing mechanism (6).** Continuous pull on the lanyard fires weapon. Used to activate the firing lock.

g. **Right or Left Elevating Handwheel (7 and 8).** Elevates cannon by rotating clockwise. Depresses cannon by rotating counterclockwise.

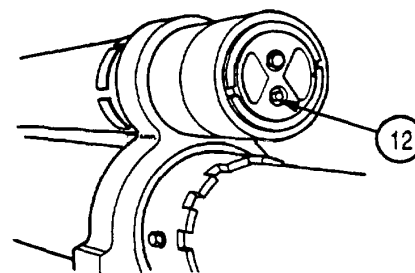
h. **Traversing Handwheel (9).** Rotate clockwise to traverse howitzer right, counterclockwise to traverse left.

i. **Respirator (10).** Provides counterrecoil adjustment to prevent excessive shock when returning to battery position. Turn respirator valve head clockwise or counterclockwise with respirator wrench to adjust properly. Turning clockwise increases setting. Set respirator at 0 for traveling; 1 for normal low angle firing; 2 for sustained high angle firing; or 3 for minimum buffing action.

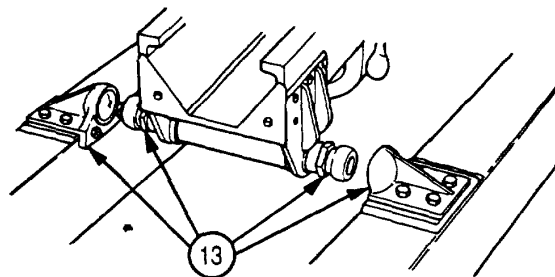
j. **Recoil Indicator (11).** Measures length of recoil.



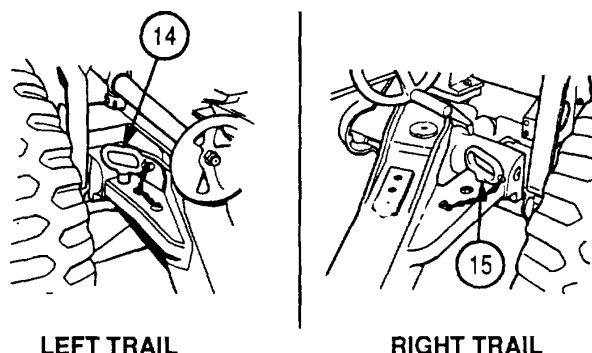
k. **Oil Index (2).** Indicates oil reserve pressure in the recoil mechanism.



l. **Travel Lock (13).** Used to support rear of cradle when trails are closed, and reduces shock and strain on the elevating mechanism during travel.



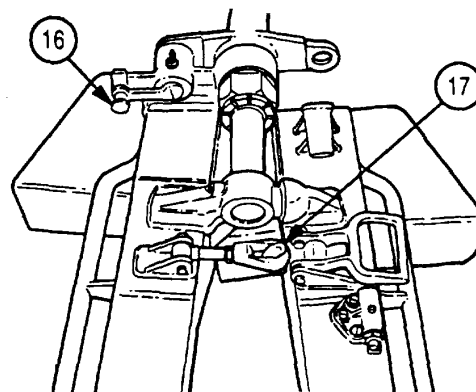
m. **Left and Right Trail Locking Pins (14 and 15).** Lock trails in firing position (front hole) and traveling position (rear Hole).



LEFT TRAIL

RIGHT TRAIL

n. **Drawbar Lock Assembly (16).** Locks drawbar in up position for firing and in down position for travel.



o. **Trail Lock Assembly (17).** Locks trails together for travel.

2-3. M21A1 TELESCOPE MOUNT CONTROLS AND INDICATORS

a. **Tangent Screws (1).** Located at top of M21A1 telescope mount socket. Used to boresight pantel and to keep pantel from moving laterally. Locked in place by two setscrews.

b. **Wing Knob (2).** Rotates a retaining shaft which secures the pantel in the socket. Turning counterclockwise allows pantel to be removed from M21A1 telescope mount.

c. **Longitudinal Leveling Knob (3).** Controls longitudinal level.

d. **Cross Leveling Knob (4).** Controls cross level.

2-4. PANTEL CONTROLS AND INDICATORS

a. **Slipping Azimuth Scale (1).** Consists of a circular ring graduated into 64 divisions of 100 mils each, and numbered every 200 mils from 0 to 3200 mils in two consecutive semicircles. When unlocked, scale can slip freely to either deflection; locked, scale turns only with the rotating head as controlled by the azimuth micrometer knob and the throwout lever. Locking screw is located on the circular ring of slipping azimuth scale. When tightened, it locks slipping azimuth scale to rotating head.

b. **Azimuth Micrometer Know (2).** Used to turn rotating head and slipping azimuth scale; or rotating head and nonslipping azimuth scale.

c. **Throwout Lever (3).** Along with azimuth micrometer knob, turns, rotating head and slipping azimuth scale; or rotating head and nonslipping azimuth scale.

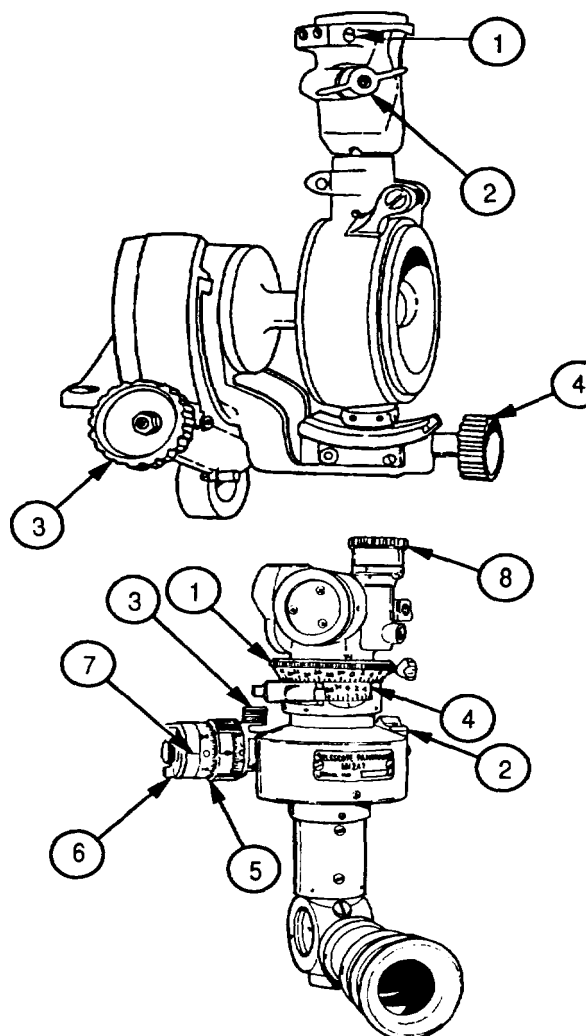
d. **Nonslipping Azimuth Scale (4).** Graduated into divisions of 100 mils and is numbered every 200 mils. This scale turns only with the rotating head as controlled by azimuth micrometer knob and throwout lever. Can be read by opening protective door. When closed, the protective door covers this scale and provides an index for slipping azimuth scale.

e. **Slipping Micrometer Scale (5).** Graduated into divisions of 1 mil each and can be slipped freely to any setting; locked, it moves only with the azimuth micrometer knob.

f. **Locking Nut (6).** Located outside the slipping micrometer scale. When tightened, locks the slipping micrometer scale to the azimuth micrometer shaft.

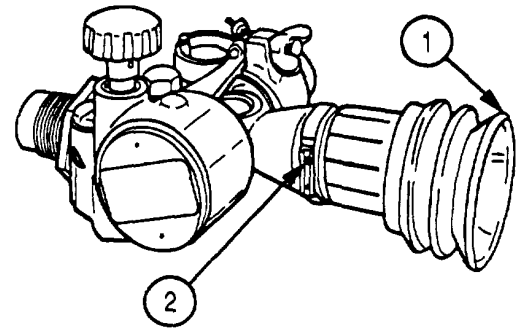
g. **Left Index (7).** Moved by turning azimuth micrometer knob.

h. **Elevation Knob (8).** Must turn freely when adjusting the prism assembly.



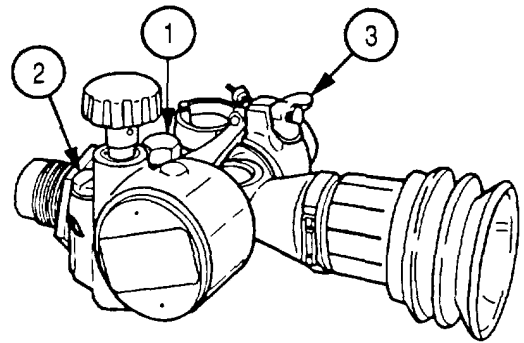
2-5. M16A1D ELBOW TELESCOPE CONTROLS AND INDICATORS

- a. **Rubber Eyeshield (1).** Attached to eye-piece and protects operator when weapon is fired.
- b. **Illumination Window (2).** Provides a means of illuminating the reticle with the M36 instrument light.



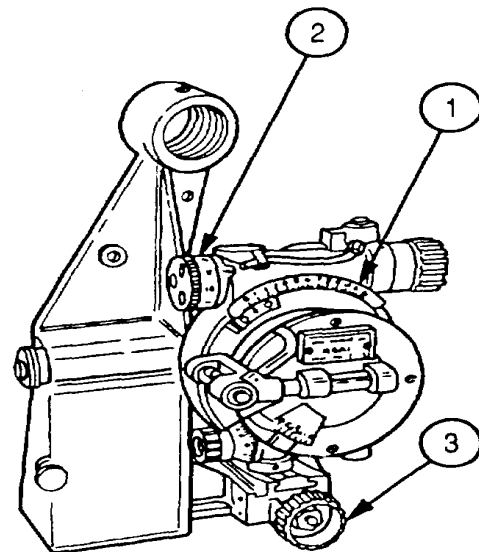
2-6. M23 TELESCOPE MOUNT CONTROLS AND INDICATOR

- a. **Clamping Screw (1).** Locks elevation worm.
- b. **Boresight Screw (2).** Used to boresight the elbow telescope.
- c. **Wingnut (3).** Holds elbow telescope

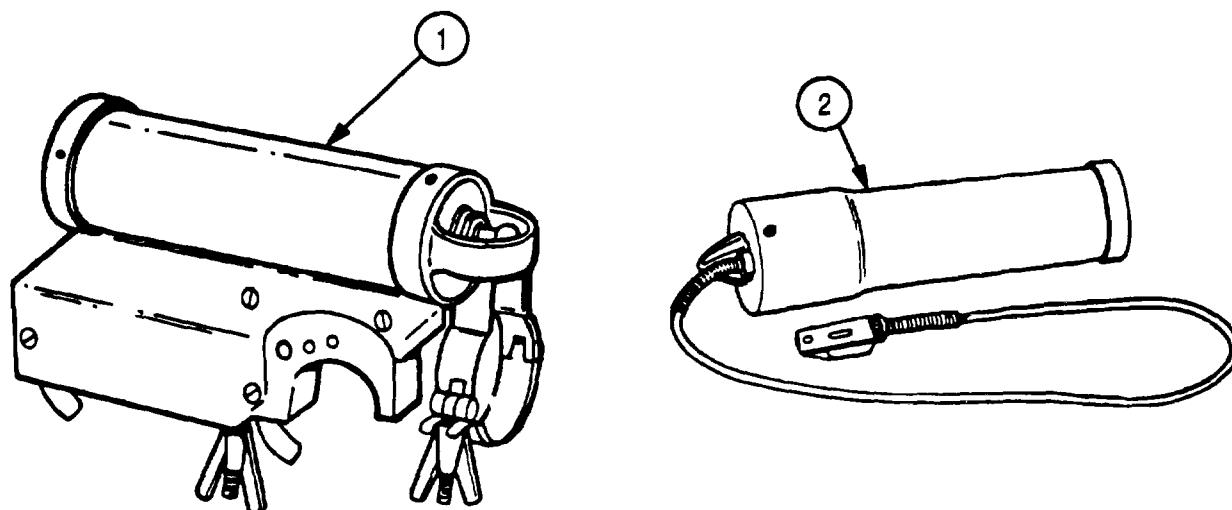


2-7. M4A1 FIRE CONTROL QUADRANT CONTROLS AND INDICATORS

- a. **Elevation Scale (1).** Graduated in 100-mil increments from 100 to + 1200.
- b. **Elevation Micrometer (2).** Graduated in 1-mil increments from 0 to + 100. One complete revolution of the elevation micrometer causes elevation scale index to move one graduation (100 mils). Longitudinal bubble is moved by any movement of the elevating handwheel or by means of the elevating knob.
- c. **Cross Leveling Worm Knob (3).** Controls the leveling of the cross level bubble.

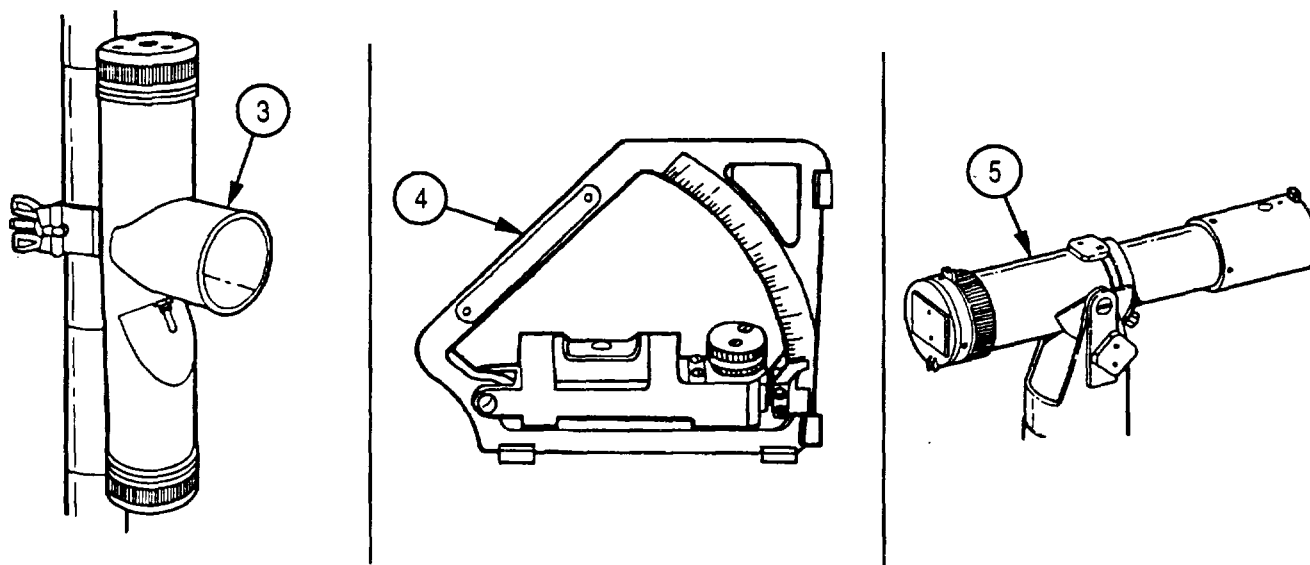


2-8. AUXILIARY EQUIPMENT CONTROLS AND INDICATORS



a. **M19 Instrument Light (1).** Used to illuminate the reticle of pantel, slipping azimuth scale, nonslipping azimuth scale, and slipping micrometer scale.

b. **M36 Instrument Light (2).** Used to illuminate the reticle of elbow telescope.



c. **M14 Aiming Post Light (3).** Used to sight during darkness when the aiming post is not visible.

d. **M1A1 Gunner's Quadrant (4).** Used for checking fire control alignment. Has its own carrying case and is stored in the howitzer section chest.

e. **M1A1 Collimator (5).** Primary aiming reference point for indirect laying operations.

Section II. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-9. INTRODUCTION TO PMCS TABLE

a. General. Your PMCS table (table 2-1) has been provided so you can keep your equipment in good operating condition and ready for its primary mission.

b. Warnings and cautions. Always observe the WARNINGS and CAUTIONS appearing in your PMCS table BEFORE, DURING, and AFTER you operate the equipment. The warnings and cautions appear before applicable procedures. You must observe these WARNINGS and CAUTIONS to prevent serious injury to yourself and others or to prevent your equipment from being damaged.

c. Explanation of table entries.

(1) Item number column. Numbers in this column are 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 in which checks and services must be performed for the intervals listed.

(2) Interval column. This column tells you when you must do the procedure in the procedure column. BEFORE procedures must be done before you operate or use the equipment for its intended mission. DURING procedures must be done during the time you are operating or using the equipment for its intended mission. AFTER procedures must be done immediately after you have operated or used the equipment. When a check and service procedure is required for both weekly and before intervals, it is not necessary to do the procedure twice if the equipment is operated during the weekly period.

(3) Location, check/service column. This column provides the location and the item to be checked or serviced. The item location is underlined.

(4) Procedure column. This column gives the procedure you must do to check or service the item listed in the check/service column to know if the equipment is ready or available for its intended mission or for operation. You must do the procedure at the time stated in the interval column.

(5) Not fully mission capable if: column. Information in this column tells you what faults will keep your equipment from being capable of performing its primary mission. If you make check and service procedures that show faults listed in this column, do not operate the equipment. Follow standard operating procedures for maintaining the equipment or reporting equipment failure.

d. Other table entries. Be sure to observe all special information and notes that appear in your table.

2-9. INTRODUCTION TO PMCS TABLE (cont)

e. leakage classification and definitions. Fluid leakage for operator/crew PMCS is classified and defined as follows:

(1) Class I. Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

(2) Class II. Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked.

(3) Class III Leakage of fluid great enough to cause drops to drip from the item being checked.

NOTE

Fluid levels of items with Class I or Class II leaks must be checked often so proper levels can be kept.

Class III leaks must be reported to your supervisor or Unit maintenance for corrective action.

2-10. PMCS PROCEDURES

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M10A1 HOWITZER

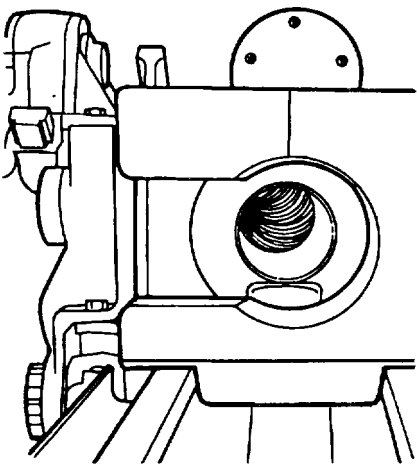
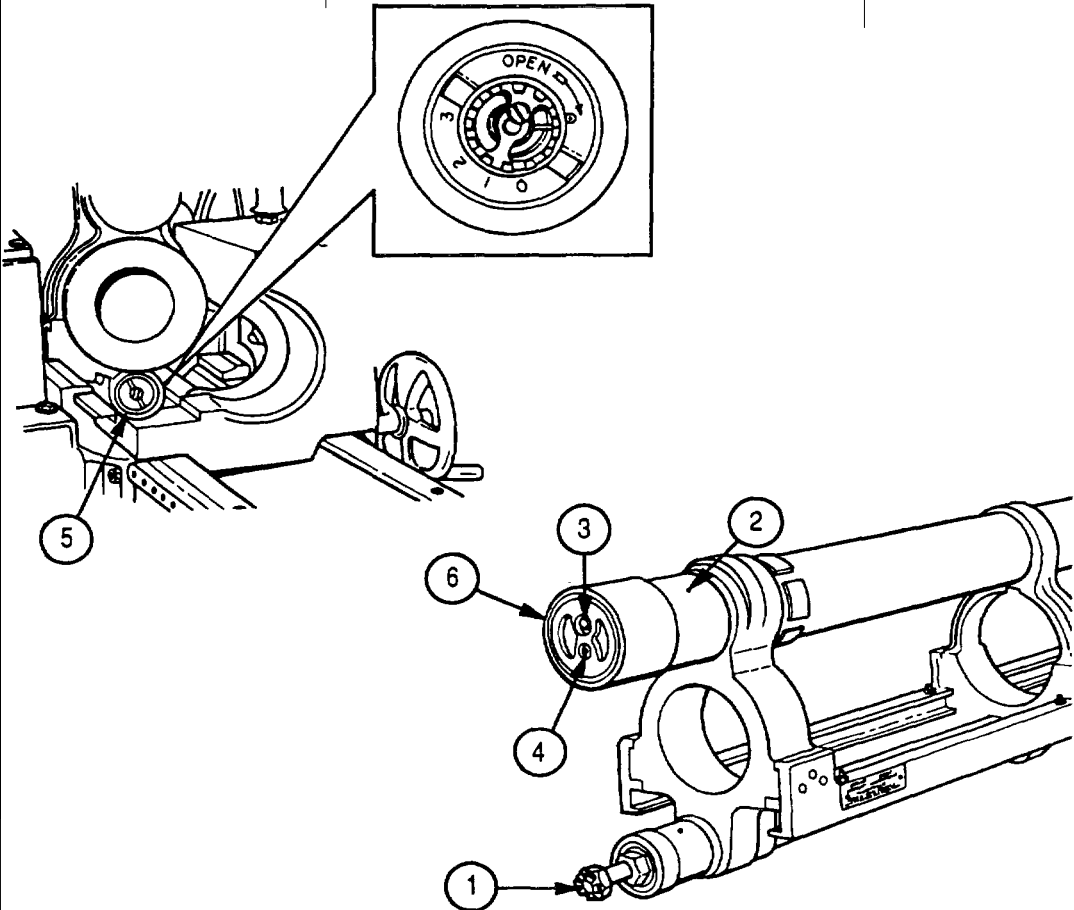
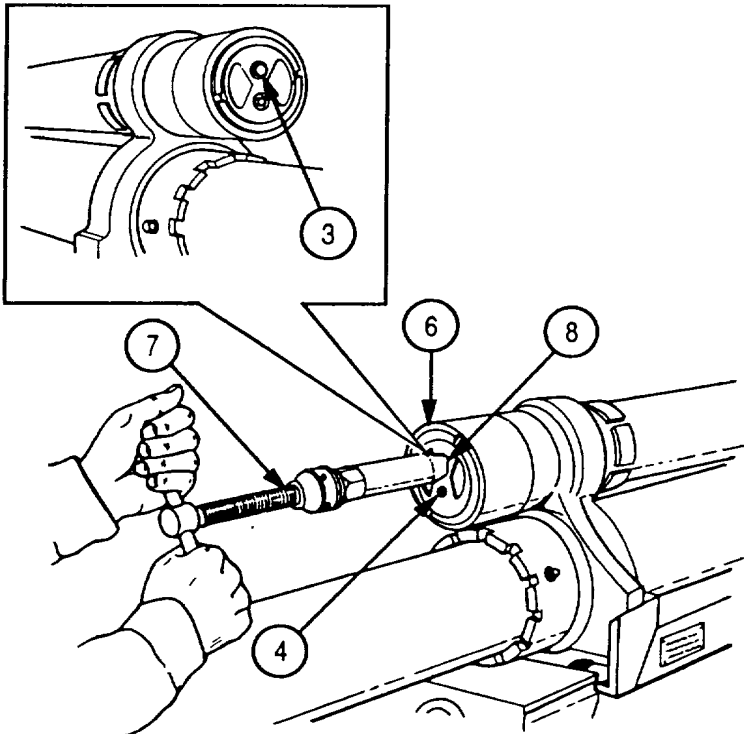
Item No.	Interval	<u>Location</u> Item to Check Service	Crewmember Procedure	Not Fully Mission Capable If:
1	Before	<u>CANNON</u>	Crewmember 1	 <p>Before fire mission, be sure bore and chamber are dry; check for obstructions, dents, stripped lands, and other obvious defects.</p> <p>Cannon contains cracks, dents, or bulges.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR
M101A1 HOWITZER (cont)

Item No.	Interval	Location Item to Check Service	Crewmember Procedure	Not Fully Mission Capable If:
2	Before	<u>RECOILMECHANISM</u>	<p>Chief of Section</p>  <p>The diagram illustrates the Recoil Mechanism of the M101A1 Howitzer. It includes a detailed view of the oil index (4) and its relationship to the recuperator cylinder front head assembly (6). The oil index (4) is a circular gauge with a needle and a scale from 0 to 5. The recuperator cylinder front head assembly (6) is a large, cylindrical component. Other components labeled include the stuffing box head (1), purge plug (2), machine plug (3), and respirator (5). A callout box shows a close-up of the oil index (4) with the word 'OPEN' and a scale from 0 to 5.</p>	
<p>a. Check for evidence of oil leakage at stuffing box head (1), purge plug (2), machine plug (3), oil index (4), and respirator (5).</p> <p>b. Check for proper oil reserve. Full reserve of oil is indicated when oil index (4) is flush with face of recuperator cylinder front head assembly (6).</p>				Oil index is not flush with recuperator.

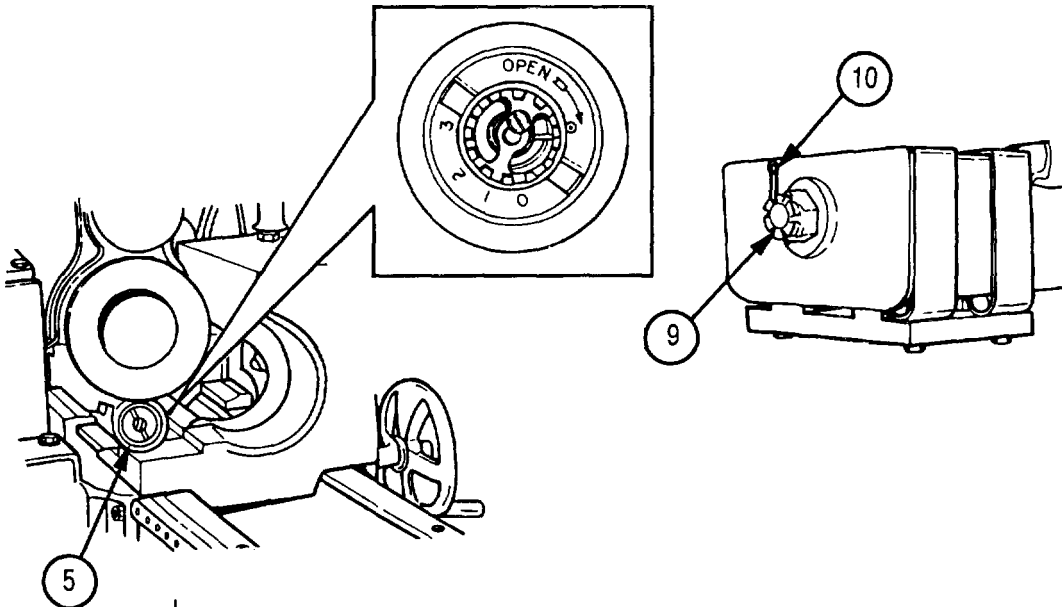
2-10. PMCS PROCEDURES (cont)

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR
M1 M101 A1 HOWITZER (cont)

Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable If:
		Item to Check/ Service		
2	Before	<u>RECOIL MECHANISM</u> (cont)	<p>Chief of Section</p>  <p>c. If oil index (4) is below face, add OHT (item 14, appx E). Remove machine plug (3) above oil index (4) and carefully screw oil gun (7) into filling hole (8). Tighten oil gun (7) into filling hole (8). Using both hands, turn handle of oil gun (7) to force oil into recoil mechanism. When oil index (4) is flush with face of recuperator cylinder front head assembly (6), indicating full reserve, unscrew oil gun (7). Install machine plug (3).</p>	

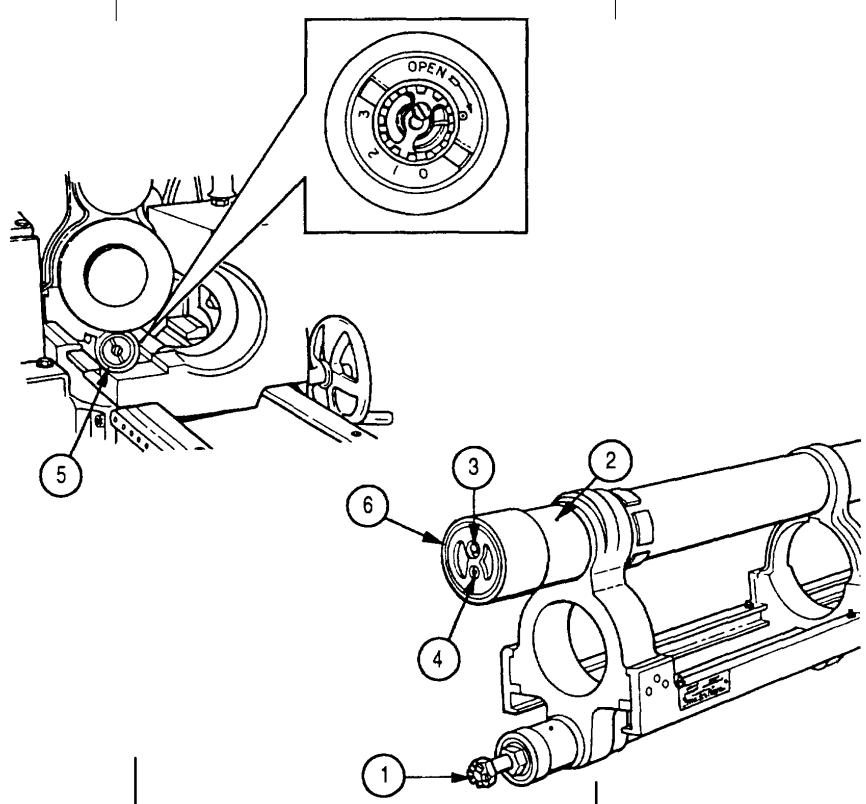
2-10. PMCS PROCEDURES (cont)

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M101A1 HOWITZER (cont)

Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable If:
		Item to Check/ Service		
			<p>d. Be sure that castellan nut (9) is in place and secured with cotter pin (10). Check respirator (5) for proper setting by turning respirator valve head clockwise or counterclockwise with respirator wrench to adjust properly. Set respirator at 0 for traveling; 1 for normal low angle firing; 2 for sustained high angle firing; or 3 for minimum buffing action.</p> <p>e. Check slides for burrs, scoring, corrosion, and other damage. Check for oil leakage. If loss of fluid requires replenishment of entire reserve during a normal day's firing, notify Unit maintenance.</p>	Castellan nut not in place or secured with cotter pin.

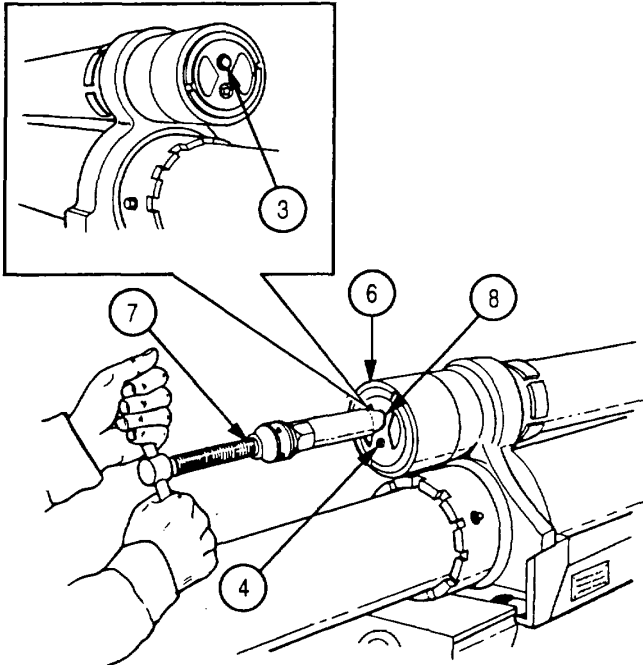
2-10. PMCS PROCEDURES (cont)

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR
M101A1 HOWITZER (cont)

Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable If:
		Item to Check/Service		
3	During	RECOIL MECHANISM	Chief of Section	
				
			<p>a. Check for evidence of oil leakage at stuffing box head (1), purge plug (2), machine plug (3), oil index (4), and respirator (5).</p> <p>b. Check for proper oil reserve. Full reserve of oil is indicated when oil index is flush with face of recuperator cylinder front head assembly (6).</p>	Oil index is not flush with recuperator.

2-10. PMCS PROCEDURES (cont)

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR
M101A1 HOWITZER (cont)

Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable If:
		Item to Check/ Service		
			<div></div>	
			<p>c. If oil index (4) is below face, add OHT (item 14, appx E). Remove machine plug (3) above oil index (4) and carefully screw oil gun (7) into filling hole (8). Tighten oil gun (7) into filling hole (8). Using both hands, turn handle of oil gun (7) to force oil into recoil mechanism. When oil index (4) is flush with face of recuperator cylinder front head assembly (6), indicating full reserve, unscrew oil gun (7). Install machine plug (3).</p>	

2-10.PMCS PROCEDURES (cont)

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR
M101A1 HOWITZER (cont)

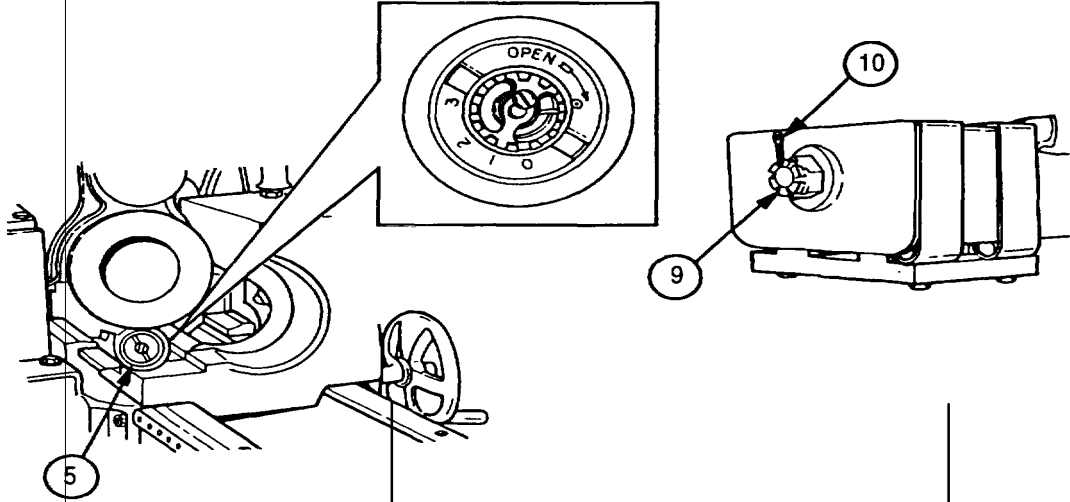
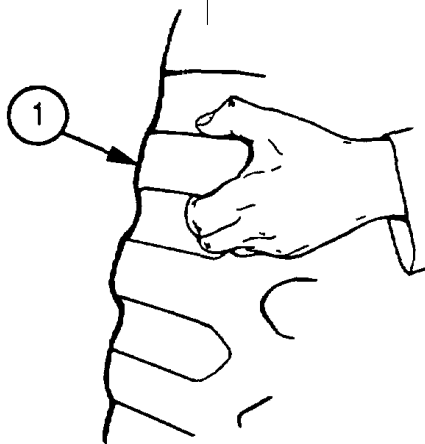
Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable If:
		Item to Check/ Service		
3	During	RECOIL MECHANISM (cont)	Chief of Section	
			<p>d. Be sure that castellated nut (9) is in place and secured with cotter pin (10). Check respirator (5) for proper setting by turning respirator valve head clockwise or counterclockwise with respirator wrench to adjust properly. Set respirator at 0 for traveling; 1 for normal low angle firing; 2 for sustained high angle firing; or 3 for minimum buffing action.</p> <p>e. Check slides for burrs, scoring, corrosion, and other damage. Check for oil leakage. If loss of fluid requires replenishment of entire reserve during a normal day's firing, notify Unit maintenance.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR
M101A1 HOWITZER (cont)

Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable If:
		Item to Check/ Service		
4	During	TIRES	<p>Crewmember 2</p>  <p>Check tire tread (1) by pinching with thumb and index finger. Notify Unit maintenance if thumb and index finger keep slipping off.</p>	One or both tires are unserviceable.
5	After	<u>DA FORM 2408-4</u>	<p>Chief of Section</p> <p>Enter day's firing and update EFC total.</p>	Total EFC count exceeds 7500 rounds.
6	After	<u>BREECH MECHANISM</u>	<p>Chief of Section</p> <p>a. Immediately after firing, disassemble breech mechanism.</p> <p>NOTE CLP (item 7, appx E) is main lubricant for oil can points and after cleaning.</p> <p>b. Clean all parts with wiping rag (item 25, appx E) and CLP (item 7, appx E); wipe dry with a clean wiping rag (item 25, appx E). Inspect for damaged or worn parts, and lubricate.</p>	

2-10. PMCS PROCEDURES (cont)

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M101A1 HOWITZER (cont)

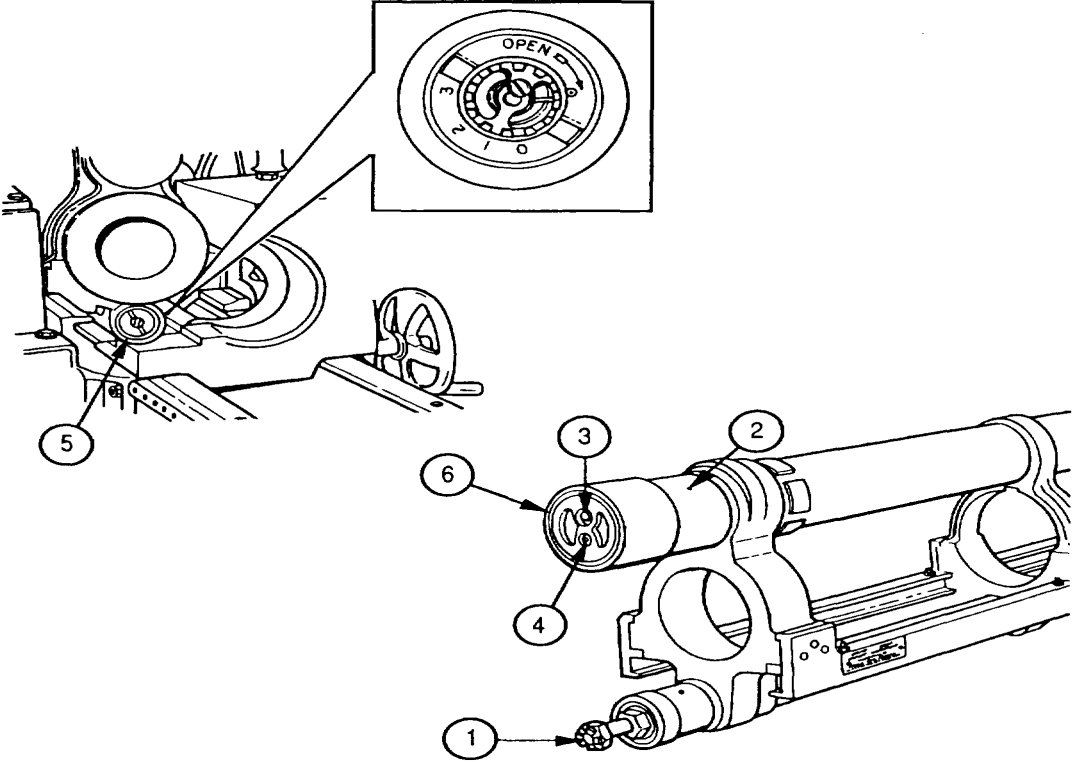
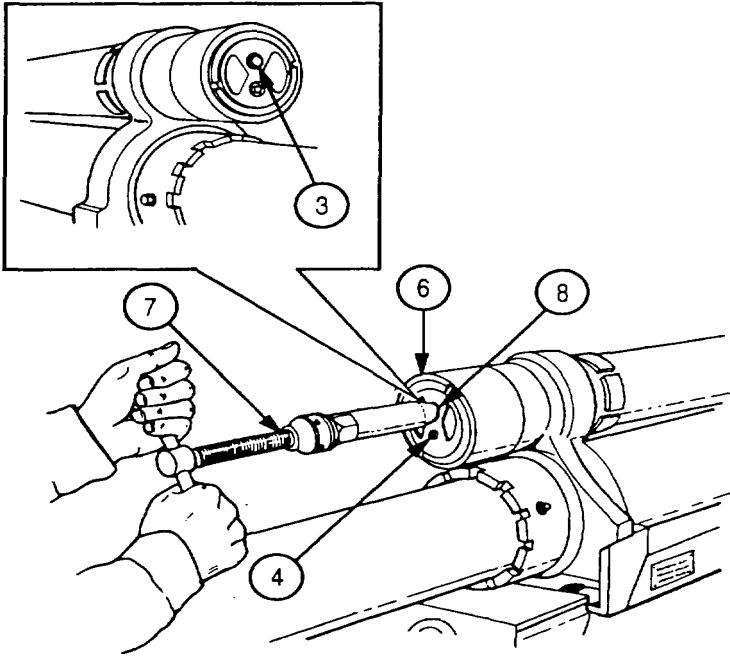
Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable If:
		Item to Check/Service		
7	After	<u>RECOIL MECHANISM</u> (cont)	Chief of Section	
				
<p>a. Check for evidence of oil leakage at stuffing box head (1), purge plug (2), machine plug (3), oil index (4), and respirator (5).</p> <p>b. Check for proper oil reserve. Full reserve of oil is indicated when oil index (4) is flush with face of recuperator cylinder front head assembly (6).</p>				Oil index is not flush with recuperator.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR
M101A1 HOWITZER (cont)

Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable If:
		Item to Check/Service		
			 <p>c. If oil index (4) is below face, add OHT (item 14, appx E). Remove machine plug (3) above oil index (4) and carefully screw oil gun (7) into filling hole (8). Tighten oil gun (7) into filling hole (8). Using both hands, turn handle of oil gun (7) to force oil into recoil mechanism. When oil index (4) is flush with face of recuperator cylinder front head assembly (6), indicating full reserve, unscrew oil gun (7). Install machine plug (3).</p>	

2-10. PMCS PROCEDURES (cont)

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR
M101A1 HOWITZER (cont)

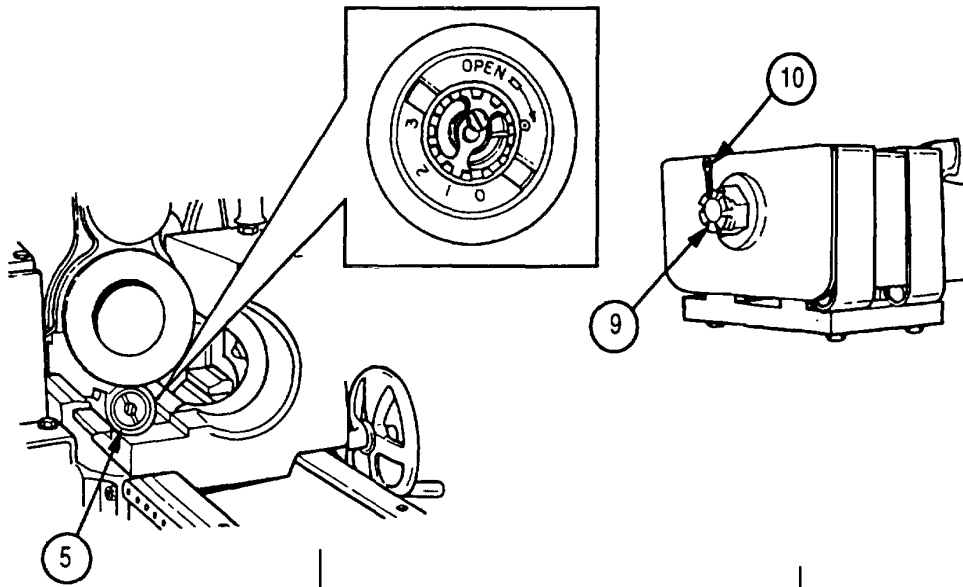
Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable If:
		Item to Check/Service		
7	After	RECOIL MECHANISM (cont)	Chief of Section	
			<p>d. Be sure that castellan nut (9) is in place and secured with cotter pin (10). Check respirator (5) for proper setting by turning respirator valve head clockwise or counter-clockwise with respirator wrench to adjust properly. Set respirator at 0 for traveling; 1 for normal low angle firing; 2 for sustained high angle firing; or 3 for minimum buffing action.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR
M101A1 HOWITZER (cont)

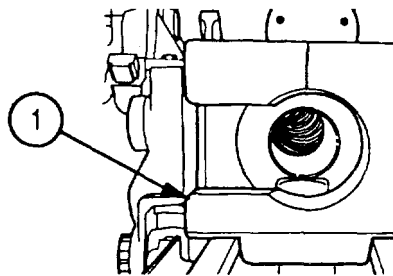
Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable If:
		Item to Check/Service		
8	After	<u>CANNON</u>	<p>e. Check slides for burrs, scoring, corrosion, and other damage. Check for oil leakage. If loss of fluid requires replenishment of entire reserve during a normal day's firing, notify Unit maintenance.</p> <p>Chief of Section</p> <p><u>CAUTION</u> The bore-cap brush assembly issued with the artillery cleaning kit should not be used with cleaning compound, rifle bore cleaner (RBC). RBC will destroy the bore-cap brush assembly.</p> <p><u>NOTE</u> Shake the bottle well before each use.</p> <p>a. On day of firing, remove the bottle of premeasured cleaner, lubricant, and preservative (CLP) (item 7, appx E) and one bore-cap brush assembly from kit.</p>	

2-10. PMCS PROCEDURES (cont)

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR
M101A1 HOWITZER (cont)

Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable If:
		Item to Check/ Service		
8	After	<u>CANNON (cont)</u>	<p>Chief of Section</p> <div> </div> <p>NOTE CLP (item 7, appx E) is main lubricant for oil can points and after cleaning. When using CLP (item 7, appx E), follow cleaning instructions in steps b and c.</p> <p>b. Cannon tube (1) is cleaned on day of firing immediately after firing is completed. Apply CLP (item 7, appx E) to bore-cap brush, using approximately 5 to 6 fl oz (148 to 177 ml) during cleaning operation. Thoroughly wet punch cannon tube (1) at least 10 times, using a scrubbing action with bore-cap brush. Check bore-cap brush after every two or three punches to make sure it is still soaked with CLP (item 7, appx E).</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR
M101A1 HOWITZER (cont)

Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable If:
		Item to Check/ Service		
9	After	<u>TIRES</u>	<p>c. Day after firing, perform following:</p> <ol style="list-style-type: none"> (1) Soak a wiping rag (item 25, appx E) wrapped around bore-cap brush with CLP (item 7, appx E) and wet punch cannon tube (1) at least 10 times. (2) Wrap clean wiping rag (item 25, appx E) around bore-cap brush and dry punch cannon tube (1) at least 10 times. (3) Wrap clean wiping rag (item 25, appx E) around bore-cap brush soaked with CLP (item 7, appx E) and wet punch cannon tube (1) at least five times. <p>Crewmember 2</p> <p>Notify Unit maintenance for wheel bearing cleaning and packing after fording.</p>	
10	Weekly	<u>BREECH MECHANISM</u>	<p>Chief of Section</p> <p>Check breech mechanism (1) for smooth operation. Check for rusty, damaged, or missing parts. Lubricate moving parts lightly with CLP (item 7, appx E).</p>	

2-10. PMCS PROCEDURES (cont)

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR
M101A1 HOWITZER (cont)

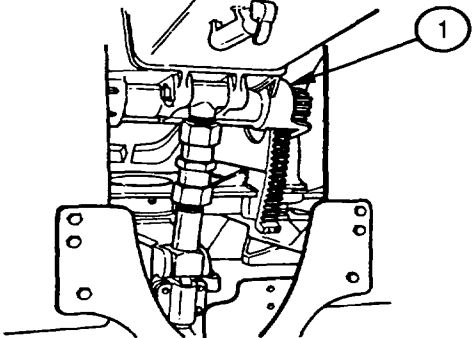
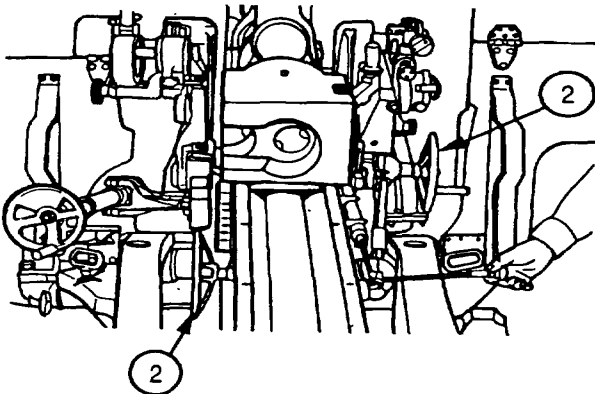
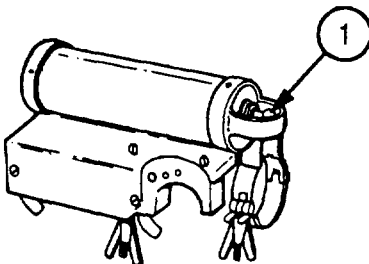
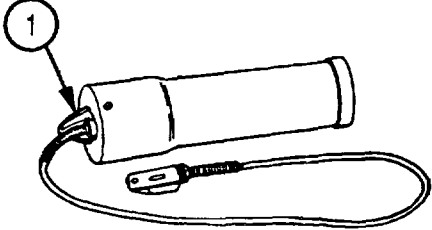
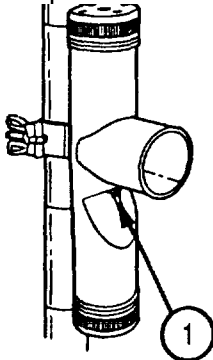
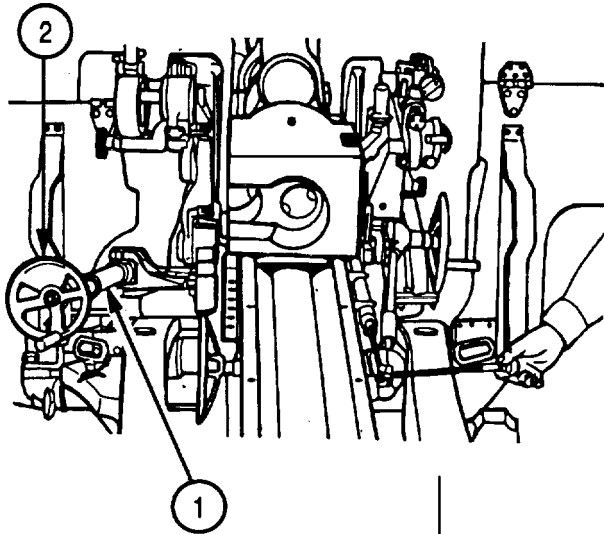
Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable If:
		Item to Check/ Service		
11	Weekly	ELEVATING MECH- ANISM	Assistant Gunner	
				
			Check operation of elevating mechanism (1). Operation should be smooth throughout entire range. Be sure there are no obstructions. Check for freeplay or backlash in elevating handwheels (2). Freeplay should not exceed one-sixth of a turn (3-1/8 in. (8 cm)). If it does, notify Support maintenance.	Elevating mechanism will not elevate or depress.
12	Weekly	M19 AND M36 INSTRUMENT LIGHTS AND M14 AIMING POST LIGHT	Gunner and Assistant Gunner	
				
		M19 INSTRUMENT LIGHT	M36 INSTRUMENT LIGHT	M14 AIMING POST LIGHT

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR
M101A1 HOWITZER (cont)

Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable If:
		Item to Check/Service		
13	Weekly	<u>TRAVERSING MECHANISM</u>	<p>Be sure that batteries and lamps are serviceable. Operate lamp switch (1); it must dim and brighten lamps.</p> <p>Gunner</p>  <p>Check operation of traversing mechanism (1). Operation should be smooth throughout entire range. Be sure there are no obstructions. Check traversing handwheel (2) for freeplay or backlash. Freeplay should not exceed one-sixth of a turn (3-1/8 in. (8 cm)). If it does, notify Support maintenance.</p>	Traversing mechanism will not traverse.

2-10. PMCS PROCEDURE (cont)

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M101A1 HOWITZER (cont)

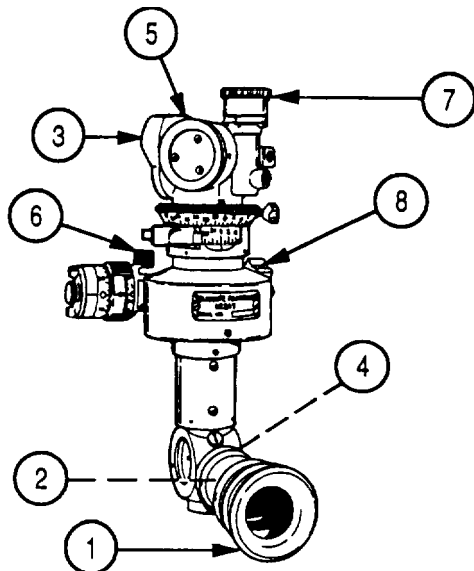
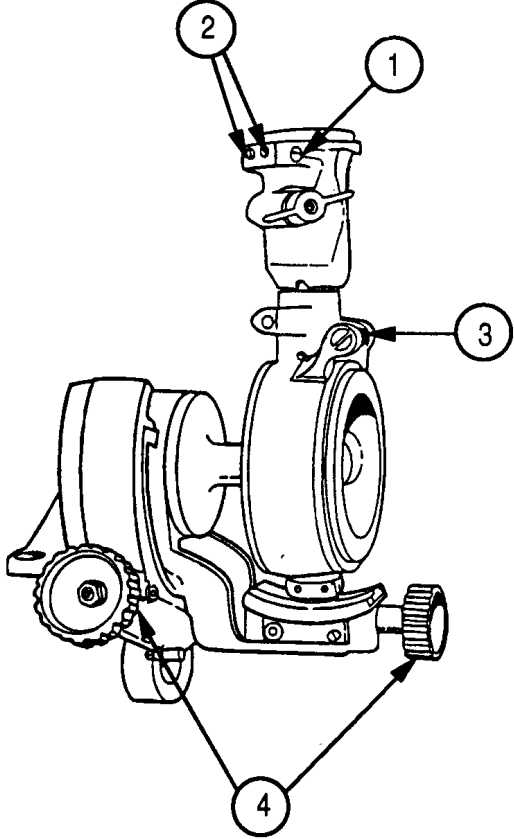
Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable If:
		Item to Check/ Service		
14	Weekly	<u>PANTEL</u>	Gunner <div></div>	<div><p>a. Check protective eyeshield (1) for damage. Check lenses (2) and illumination window (3) for smears, scratches, cracks, or other obstructions. Check reticle (4) to make sure it is upright and illuminated when instrument light is turned ON. Check for moisture in optics. Rotating head (5) should move freely when throwout lever (6) is depressed, and gears should reengage when throwout lever (6) is released. Check all scales for legibility.</p><p>b. Rotate elevation knob (7) and azimuth micrometer knob (8) to check for smooth operation and no excessive backlash.</p></div> <div><p>Pantel is missing or inoperable or scales are not legible.</p><p>Azimuth micrometer backlash exceeds 0.75 mil.</p><p>Elevation knob backlash exceeds 1.0 mil.</p></div>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M101A1 HOWITZER (cont)

Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable If:
		Item to Check/ Service		
15	Weekly	<u>M21A1 TELESCOPE MOUNT</u>	Gunner	 <p>Pantel must clamp securely in socket. Socket mounting surface must be free of dirt, dents, burrs, and paint. Tangent screws (1) must not be damaged and must turn freely. Setscrews (2) must not move easily and function properly. Level vials (3) must not be cracked, broken, loose in mounting, or have their covers missing. Rotate longitudinal and crossleveling knobs (4) and check for smooth operation, with no excessive backlash.</p> <p>M21A1 telescope mount is missing or inoperable.</p> <p>Longitudinal knob backlash exceeds 0.5 mil (3/64 in. on periphery of adjustment index.)</p> <p>Cross leveling knob backlash exceeds 0.5 mil (5/64 in. On periphery of knob).</p>

2-10. PMCS PROCEDURE (cont)

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M101A1 HOWITZER (cont)

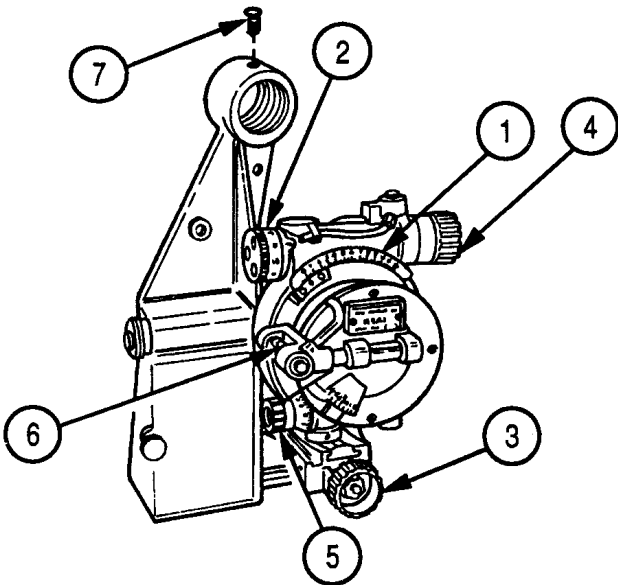
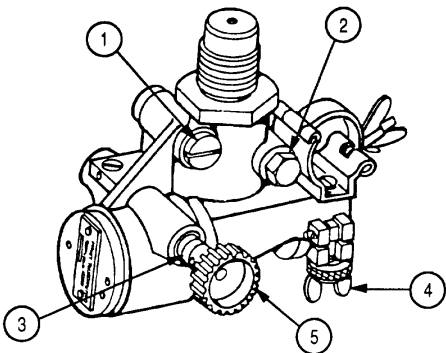
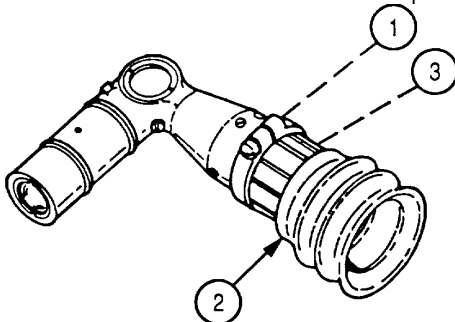
Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable If:
		Item to Check/ Service		
16	Weekly	<u>FIRE CONTROL</u>	Gunner	
				
			<p>a. Check to see that elevation scale 91) and elevation micrometer (2) are legible and that instrument light illuminates all scales. Turn cross leveling worm knob (3) and elevating knob (4); check for smooth operation. Angle of sight scale (5) must be immobilized at reading 300 mils. Level vials (6) must not be cracked, broken, or loose in mountings or have their covers missing.</p> <p>b. Check to see if cone point screw (7), which secures M23 telescope mount to bracket of M4A1 range quadrant, is seated in the M23 support housing by 1/8 in. (0.32 cm) diameter by 1/16 in. (0.16 cm) deep counterbored hole.</p>	Fire control quadrant is missing or inoperable.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR
M101A1 HOWITZER (cont)

Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable if:
		Item to Check/Service		
17	Weekly	<u>M23 TELESCOPE MOUNT</u>	<p>GUNNER</p>  <p>Rotate boresight screw (1) and check for smooth operation. Clamping screw (2) must lock elevation worm (3). Wingnut (4) must hold telescope firm when locked. Rotate bracket rotating knob (5) and check for smooth operation</p>	M23 telescope mount is missing or inoperable.
18	Weekly	<u>ELBOW TELESCOPE</u>	<p>Gunner</p>  <p>Check to be sure that reticle (1) is illuminated when instrument light is turned on. Check for damaged rubber eyeshield (2) and cracked, dirty, or scratched lenses (3).</p>	Elbow telescope is missing or inoperable.

2-10. PMCS PROCEDURES (cont)

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR
M101A1 HOWITZER (cont)

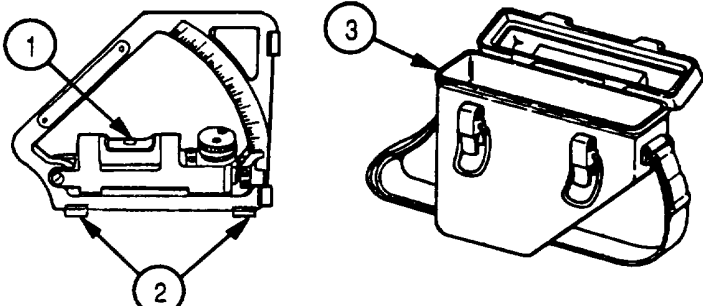
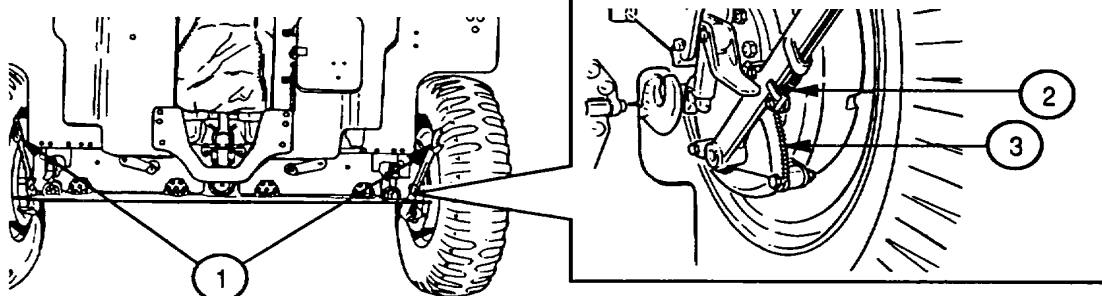
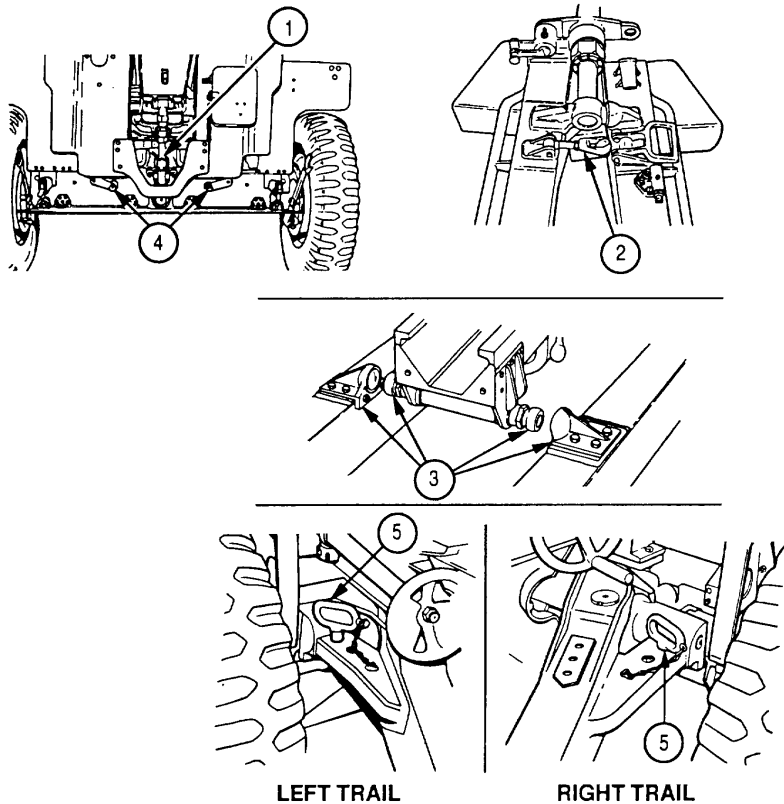
Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable if:
		Item to Check/Service		
19	Weekly	<u>GUNNER'S QUADRANT</u>	<p>Gunner</p>  <p>Check level vial (1) to be sure that it is not broken, cracked, or loose in mounting. Check moveable parts to be sure that they function properly. Examine frame shoes (2) and segment teeth for nicks, burrs, dirt, and paint. Scales must be legible. Carrying case (3) must not be damaged.</p>	Gunner's quadrant is missing or inoperable.
20	Weekly	<u>HANDBRAKES</u>	 <p>Check function and adjustment of handbrakes (1). If handbrake pawl (2) is more than halfway down on ratchet rack (3) when handbrake is set, adjust. Handbrakes are properly adjusted if handbrakes are fully engaged when handbrake pawl (2) is approximately halfway down on ratchet rack (3).</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR
M101A1 HOWITZER (cont)

Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable if:
		Item to Check/Service		
21	Weekly	TRAVEL LOCK, LATCHES, AND PINS	Crewmember 2	
		 <p style="text-align: center;">LEFT TRAIL RIGHT TRAIL</p>	<p>Check cradle lock strut assembly (1), trail lock assembly (2), and travel lock (3) for proper alignment and engagement. Check all latch assemblies to see that they latch properly. Check function and engagement of right and left axle locks (4) and right and left trail locking pins (5).</p>	

2-10. PMCS PROCEDURES (cont)

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M101A1 HOWITZER (cont)

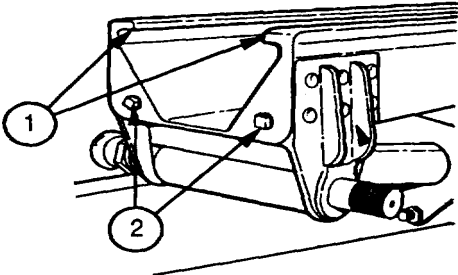
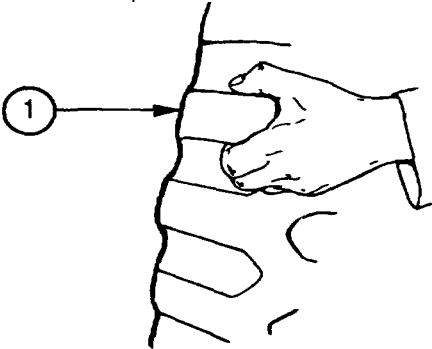
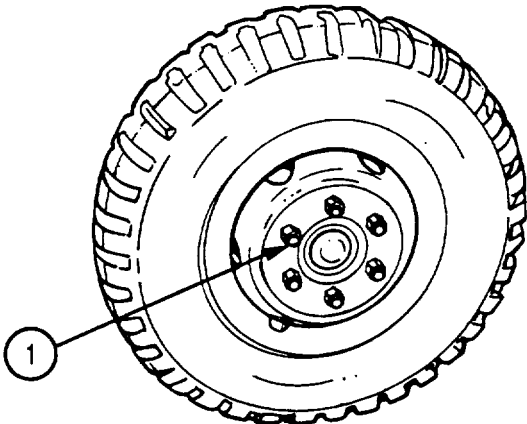
Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable if:
		Item to Check/Service		
22	Weekly	<u>CRADLE</u>	Crewmember 2	
			 <p>Check slides (1) at forward edge for burrs, scoring, corrosion, and other damage. Remove pipe plugs (2) at rear of cradle. Elevate to drain trapped water and install pipe plugs.</p>	
23	Weekly	<u>TIRES</u>	Crewmember 2	
			 <p>a. Check general condition of tires (1); look for cuts, breaks, and bulges.</p> <p>b. Check tire tread (1) by pinching with thumb and index finger. Notify Unit maintenance if thumb and index finger keep slipping off.</p>	<p>One or both tires are unserviceable.</p> <p>One or both tires are unserviceable.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR
M101A1 HOWITZER (cont)

Item No.	Interval	Location	<u>Crewmember</u> Procedure	Not Fully Mission Capable if:
		Item to Check/Service		
24	Monthly	<u>DA FORM</u> <u>2408-4</u>	Chief of Section Check to see if weapon has been borescoped within past 180 days.	Weapon has not been borescoped within 180 days.
25	Monthly	<u>WHEEL LUGS</u> <u>AND TIRES</u>	Crewmember 2  a. Check wheel lugs (1) with lug wrench. b. Check for correct air pressure (40 psi (276 kPa) normally).	
				If loose, notify Unit maintenance to torque to 350 ± 50 ft-lb (475 ± 68 N-m).

Section III. OPERATION UNDER USUAL CONDITIONS

2-11. GENERAL

a. This section contains instructions for the crew procedures necessary to operate the M101A1 howitzer under normal conditions. For instructions for operating under unusual conditions, see page 2-79.

b. The personnel of the howitzer section consists of the following:

(1) A chief of section (CS) whose duties and responsibilities include the following:

(a) Training and efficiency of crewmembers.

(b) Performance of assigned section in training; firing, testing, and adjusting fire control equipment; and inspection and maintenance of all section equipment, including the prime mover.

(c) Observance of safety precautions.

(d) Preparation of field fortifications for protection of equipment, ammunition, and personnel.

(e) Camouflage discipline; local security; and radiological, biological, and chemical security discipline.

(f) Maintenance of forms in the equipment record holder.

(g) Policing the section area.

(h) Storage, handling, and preparation of ammunitions for firing.

(2) A gunner (G) who assists the chief of section in carrying out the duties specified in subparagraph (1) above. The gunner's specific duties are described in this manual.

(3) An ammunition team chief (ATC) who leads and directs the handling of ammunition and assists the chief of section (CS) with the supervision of the howitzer section. The ammunition team chief performs duties listed in this manual and other duties as directed.

(4) An assistant gunner (AG) who assists the gunner and, in an emergency, acts as the gunner. The assistant gunner's specific duties are described in this manual.

(5) Two cannoneers, numbered 1 and 2, who perform duties as listed in this manual and any other duties directed by the chief of section.

(6) A driver (D) whose primary duty is to drive the prime mover of the section. Maintenance and other duties are described in this manual or directed by the chief of section.

c. Section equipment is listed in the appropriate TOE's and appendix B of this manual.

2-12. EMPLACING THE HOWITZER

NOTE

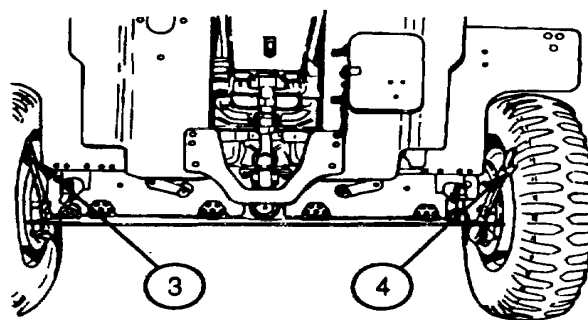
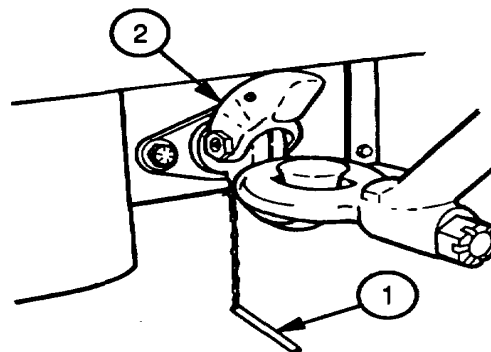
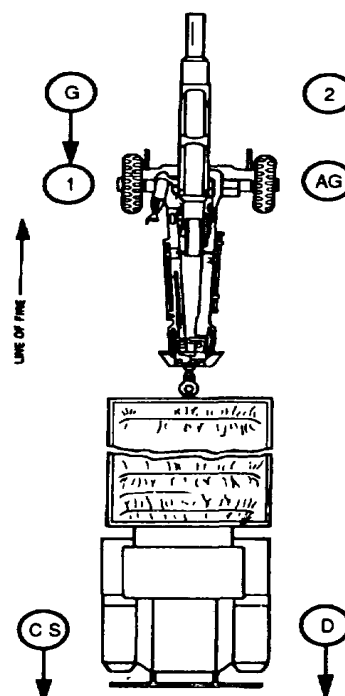
Occupation of the firing section position is performed under the direct supervision of the chief of section. The prime mover should be driven into the firing position opposite the direction of fire.

- 1 After prime mover comes to a complete stop, chief of section commands, DISMOUNT, and section personnel exit and take positions as illustrated.
- 2 Chief of section commands, PREPARE FOR ACTION.
- 3 Cannoneer no. 2 removes taillight assembly (when installed), while ammunition team chief removes safety release pin (1) and unlatches pintle (2).

NOTE

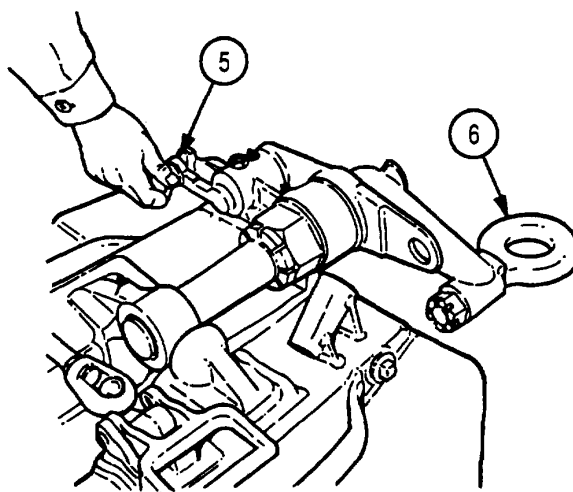
When performing step 4, do not set brakes beyond first notch of significant resistance.

- 4 Cannoneer no. 2 locks right handbrake (3) while ammunition team chief locks left handbrake (4).
- 5 Cannoneer no. 1 and ammunition team chief lift left trail and cannoneer no. 2 and assistant gunner lift right trail off the pintle (2). Trails are then lowered to ground.

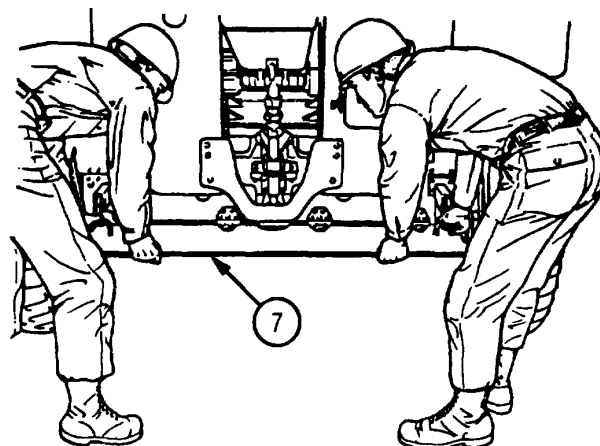


2-12.EMPLACING THE HOWITZER (cont)

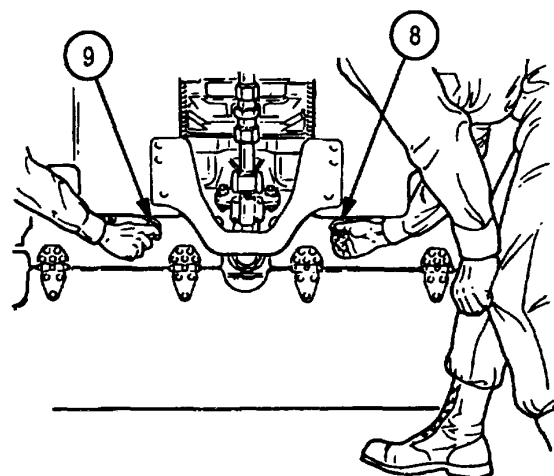
- 6** Cannoneer no. 2 disengages drawbar lock assembly (5) and rotates drawbar (6) to upward position.



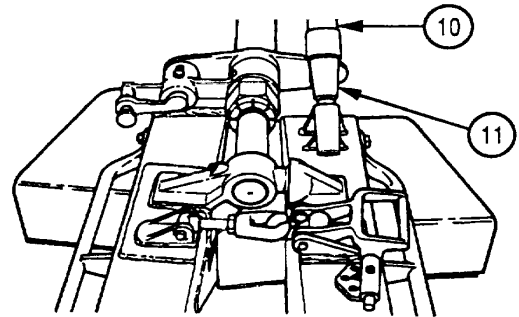
- 7** Cannoneers no. 1 and 2 lower bottom shield (7).



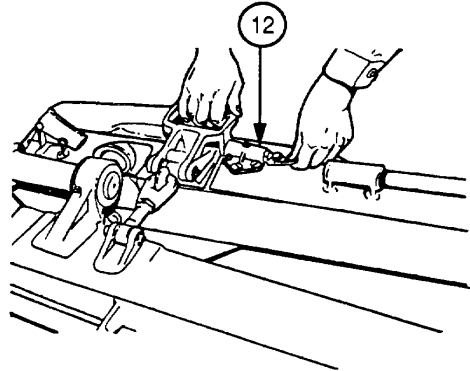
- 8** Ammunition team chief unlocks left axle by rotating left axle lock (8) 180 degrees inward. Cannoneer no. 2 unlocks right axle by rotating right axle lock (9) in the same inward direction.



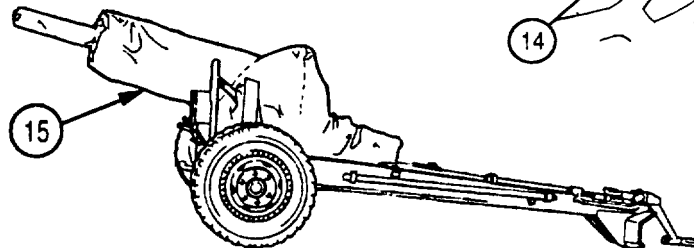
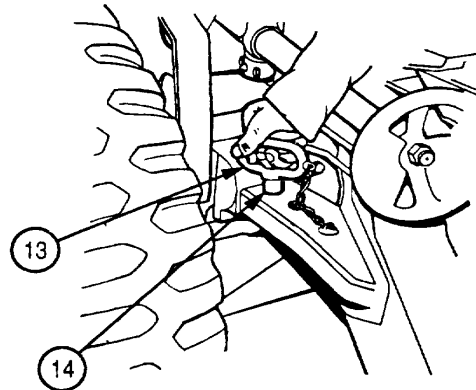
- 9** Ammunition team chief removes handspike (10) and places it in socket (11) of left trail.



- 10** Cannoneer no. 1 unlocks trail lock assembly (12). Ammunition team chief commands, SPREAD, and cannoneer no. 1 and ammunition team chief spread left trail while assistant gunner and cannoneer no. 2 spread right trail.



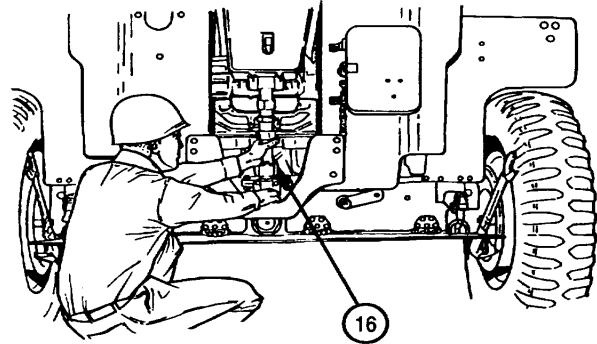
- 11** Gunner inserts trail locking pin (13) in forward hole (14) of left trail, while assistant gunner inserts trail locking pin in forward hole of right trail.



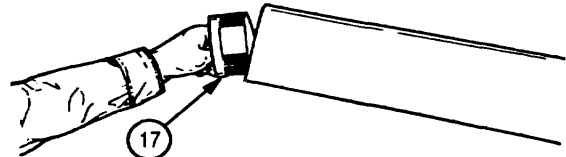
- 12** Cannoneers no. 1 and 2 unfold overall cover (15) and fold front flaps back to gunner and assistant gunner. Gunner and assistant gunner remove overall cover to the front. Assistant gunner folds and places overall cover to right of right tire.

2-12. EMPLACING THE HOWITZER (cont)

- 13** Cannoneer no. 1 and assistant gunner unlock cradle lock strut assembly (16).

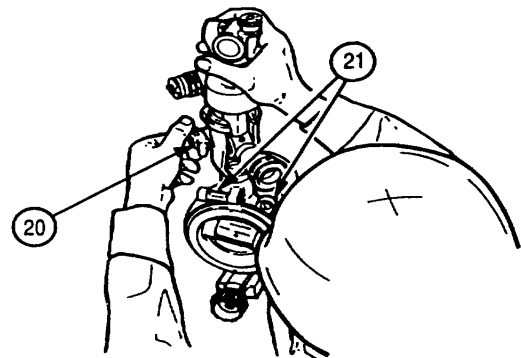
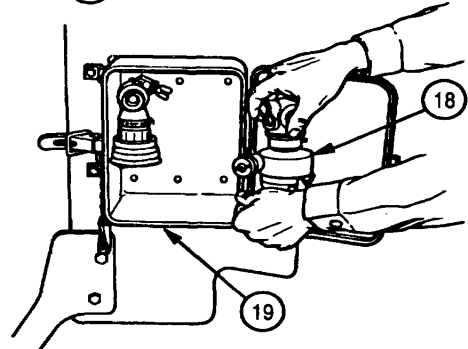


- 14** Cannoneer no. 2 removes muzzle plug (17) and places it to right of right tire.



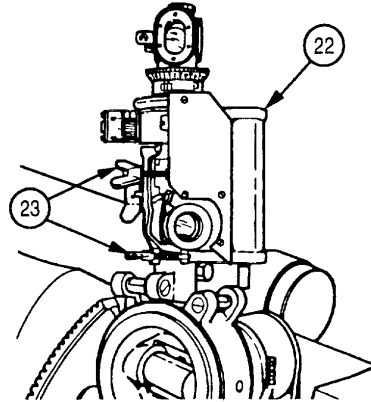
- 15** Gunner removes pantel (18) from panoramic telescope case (19) and installs as follows:

- a. Turns wing knob (20) and places pantel in M21A1 telescope mount.
- b. Releases wing knob (20)
- c. Uncovers and levels M21 A1 telescope mount level vials (21). (Refer to pages 2-39 and 2-44.)
- d. Aligns the coarse and fine elevation indexes on pantel (18). (Refer to pages 2-47 and 2-50.)

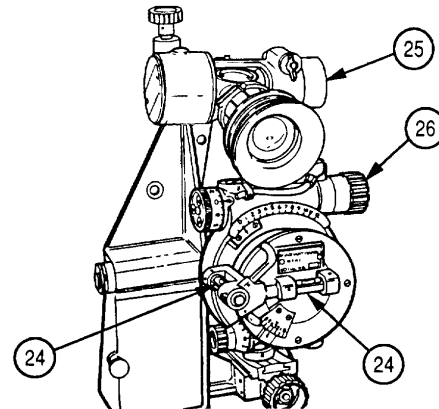


16. Gunner installs M19 instrument light (22), if needed, as follows:

- a. Loosens two wingnuts (23).
- b. Installs M19 instrument light (22) and tightens wingnuts (23).

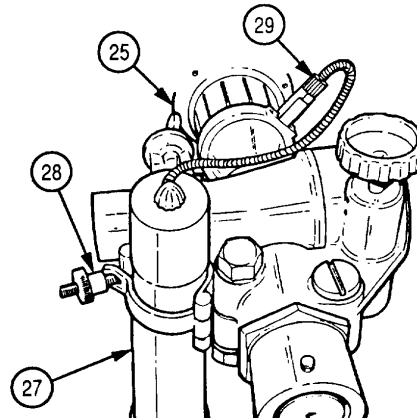


17. Assistant gunner uncovers fire control quadrant level vials (24), checks that elevation is per unit SOP, and centers bubbles. (Refer to pages 2-47 and 2-50.) Assistant gunner then loosens wingnut, removes, and mounts elbow telescope (25) on the M23 telescope mount (26).



18. Assistant gunner installs M36 instrument light (27), if needed, as follows:

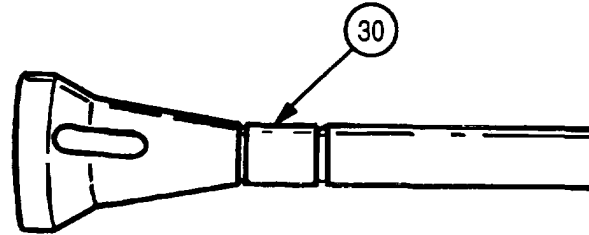
- a. Loosens clamp (28) on M23 telescope mount.
- b. Installs M36 instrument light (27) and tightens clamp (28).
- c. Installs lamp (29) in elbow telescope (25).



2-12. EMPLACING THE HOWITZER (cont)

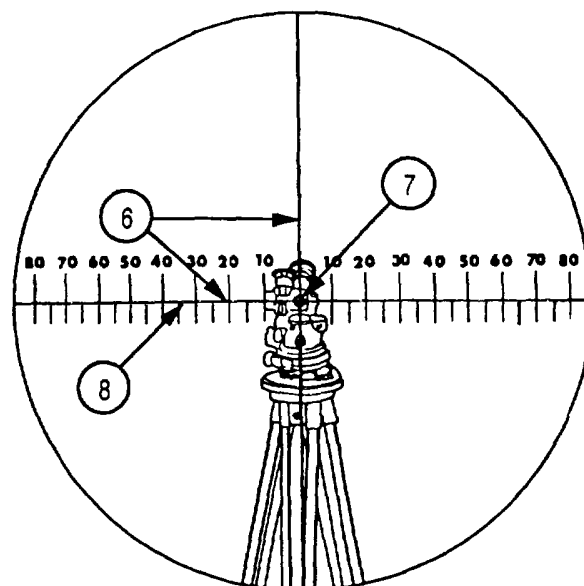
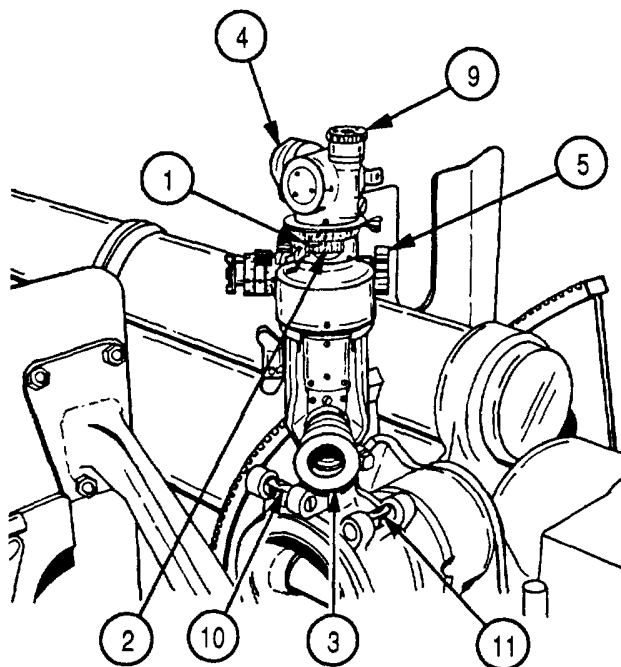
19. Cannoneer no. 1 places cable assembly to left of gun and lays cable assembly to the remote control light source.
20. Cannoneer no. 1 prepares M1 A2 aiming posts for emplacement by removing them from right trail stowage brackets, removing M1A2 aiming post cover, and assembling the M1A2 aiming posts.
21. Gunner lays weapon (refer to page 2-39); directs emplacement of the M1A1 collimator (refer to page 2-41), which is positioned by cannoneer no. 2; and directs emplacement of M1A2 aiming post (refer to page 2-44), which is positioned by cannoneer no. 1.

22. Cannoneer no. 1 removes cleaning section staff from its traveling position and places unloading artillery rammer tool (30) on it. Cannoneer no.1 then aids assistant gunner as required.



23. Cannoneer no. 1 marks left trail, and, aided by ammunition team chief, closes left trail far enough to permit digging spade hole. Cannoneer no. 1 and ammunition team chief dig spade hole and move left spade into hole.
24. Assistant gunner marks right trail, and, aided by cannoneer no. 2, closes right trail far enough to permit digging spade hole. Assistant gunner and cannoneer no. 2 dig spade hole and move right spade into hole.
25. Chief of section measures the site to crest. Cannoneers no. 1 and 2 and ammunition team chief prepare ammunition.
26. Chief of section verifies that howitzer is prepared for action, performs prefire checks (refer to page 2-56), and reports to executive officer that the section is in order or reports any defects that cannot be remedied without delay.

2-13. LAYING THE HOWITZER, USING THE M2/M2A2 AIMING CIRCLE



1 Upon command, BATTERY ADJUST, AIMING POINT THIS INSTRUMENT, gunner opens protective door (1), uncovers nonslipping azimuth scale (2) on pantel, and sets all scales on 0 mil.

2 Assistant gunner sets laid elevation.

NOTE

Unit operating procedures should specify the elevation to be used. When readings are available from advance party personnel, the gunner directs the crew to shift trails until readings between pantel and aiming circle are less than 10 mils.

3 Sighting through eyepiece (3), gunner turns rotating head (4) of pantel with azimuth micrometer knob (5) until pantel crosslines (6) are centered on the reflector of M2/M2A2 aiming circle (7). Alignment of pantel horizontal crossline (8) is obtained by turning elevation knob (9).

4 When pantel crosslines are aligned on M2/M2A2 aiming circle and longitudinal bubble (10) and cross level bubble (11) are centered, gunner announces to the executive officer, NUMBER (SO AND SO), AIMING POINT IDENTIFIED.

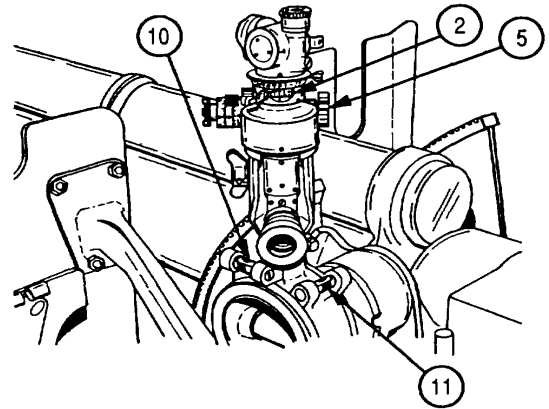
5 Executive officer determines deflection to howitzer and announces, NUMBER (SO AND SO), DEFLECTION (SO MUCH).

6 Upon announcement of deflection, gunner repeats the deflection by announcing, NUMBER (SO AND SO), DEFLECTION (SO MUCH), and turns azimuth micrometer knob (5) until announced deflection appears on azimuth and micrometer scales.

7 Operating traversing handwheel and sighting through the eyepiece (3), gunner traverses weapon until pantel crosslines are centered on the reflector of M2/M2A2 aiming circle, making sure that longitudinal bubble (10) and cross level bubble (11) are centered.

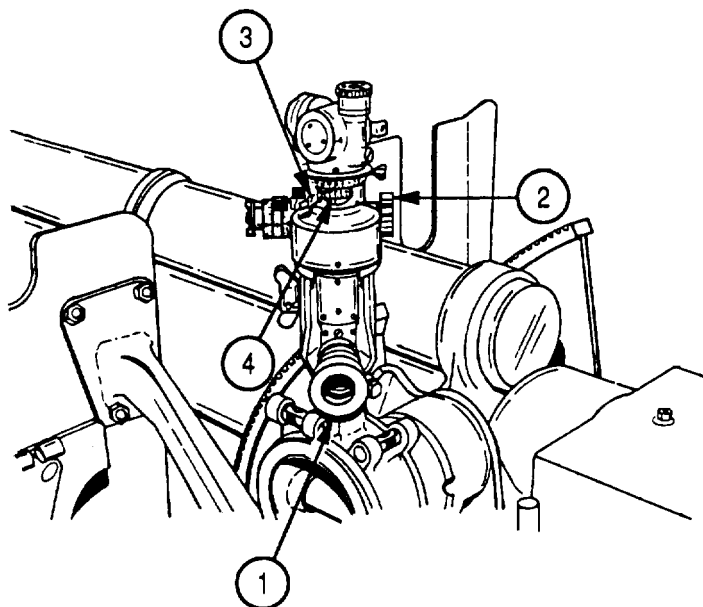
2-13. LAYING THE HOWITZER, USING THE M2/M2A2 AIMING CIRCLE (cont)

- 8** Gunner announces to the executive officer, NUMBER (SO AND SO), READY FOR RECHECK.
- 9** Executive officer determines a new aiming circle reading and announces, NUMBER (SO AND SO), DEFLECTION (SO MUCH).
- 10** Upon announcement of new deflection, gunner repeats deflection and difference between new deflection reading and reading on nonslipping azimuth scale (2) to executive officer by saying, NUMBER (SO AND SO), DEFLECTION (SO MUCH), (SO MANY) MILS.
- 11** Gunner rotates azimuth micrometer knob (5) until new deflection appears on nonslipping azimuth scale (2).
- 12** Operating traversing handwheel and sighting through eyepiece, gunner again traverses weapon until pantel crosslines are centered on the reflector of M2/M2A2 aiming circle with longitudinal bubble (10) and cross level bubble (11) centered.
- 13** Gunner and executive officer repeat steps 9 thru 12 until the difference between the deflection announced from the aiming circle and the reading on the pantel nonslipping azimuth scale (2) is zero mils.
- 14** Upon command, LAID, gunner records the value appearing on nonslipping azimuth scale (2).

**NOTE**

The cannon tube is now oriented for direction and must not be traversed until an aiming point is established.

2-14. EMPLACING M1A1 COLLIMATOR



NOTE

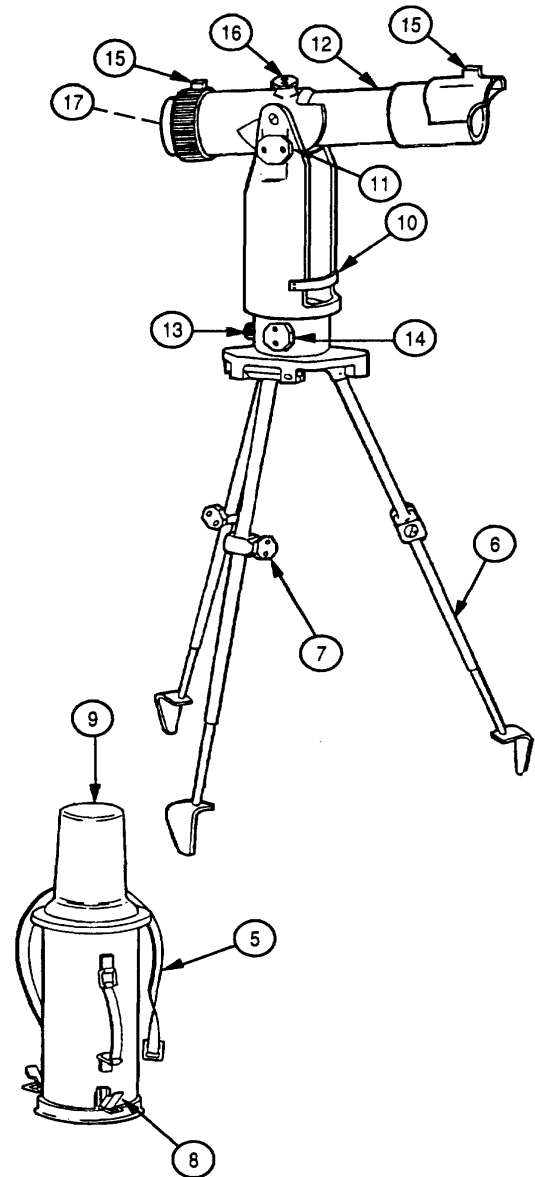
Collimator emplacement is performed immediately following laying operation. Hand signals to be used are the same as those used to emplace the aiming posts. (Refer to page 2-44.)

The M1A1 collimator is the primary reference aiming point for the howitzer. The collimator should be emplaced to the left front of the weapon, between 2400- and 2800- mil readings on nonslipping azimuth scale. Emplacement distances away from weapon will vary with the type of terrain encountered, but must be between 4 and 15 meters. Optimum distance is between 5 and 12 meters. The collimator should not be emplaced more than 4 meters above or below pantel.

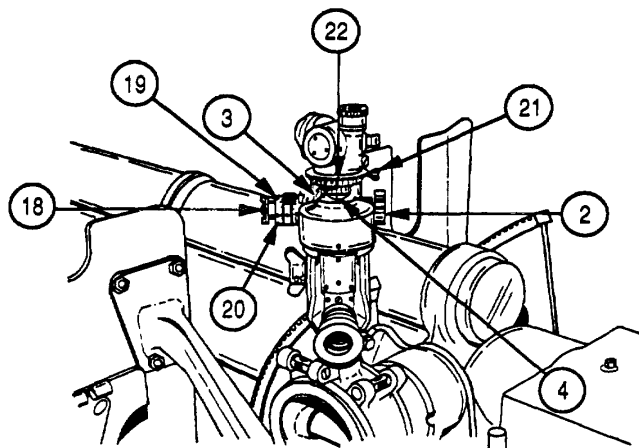
- 1 Sighting through eyepiece (1), gunner rotates azimuth micrometer knob (2) until a place to locate the collimator is sighted.
- 2 Gunner opens protective door (3) and sets off common deflection on nonslipping azimuth scale (4). If terrain is suitable, gunner emplaces collimator following procedure in step 3. If terrain is not suitable at this deflection, but is suitable at another even-hundred deflection (e.g., 2400, 2500, 2600, etc), go to step 3. If collimator must be emplaced between even hundreds (e.g., 2610, 2591, etc), go to step 4.
- 3 Gunner selects even-hundred deflection that is closest to gunner's common deflection and emplaces collimator following procedures in steps 5 and 7.
- 4 Gunner selects deflection closest to common deflection and emplaces collimator following procedures in steps 5 thru 7.

2-14. EMPLACING M1A1 COLLIMATOR (cont)

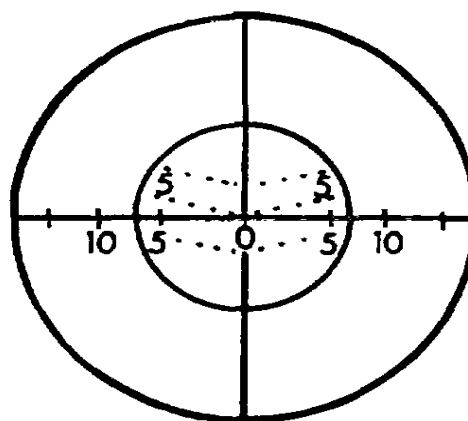
- 5 Under directions from gunner, cannoneer no. 2 emplaces the collimator as follows:
- Unfastens strap (5) which retains tripod legs (6).
 - Rotates tripod legs (6) to the down position and sets each firmly into the ground.
 - Extends tripod legs as necessary. Locks by tightening locking knobs (7).
 - Releases latches (8) that retain cover, and removes cover (9) from collimator.
 - Unfastens strap (10), loosens elevation clamping knob (11), and rotates collimator (12) to a horizontal position.
 - Makes sure azimuth adjustment is in center of the traversing capabilities by turning azimuth adjustment knob (13) counterclockwise to stop, then back four complete turns.
 - Loosens azimuth clamping knob (14). Sighting down front and rear sights (15), rough lays collimator on panel lens. Tightens elevation clamping knob (11) and azimuth clamping knob.
 - Loosens cross level clamping knob (16). Rotates collimator (12) until cross level vial bubble (17) centers. Tightens cross level clamping knob.



- 6 Sighting through eyepiece of pantel, gunner operates azimuth micrometer knob (2), commands cannoneer no. 2 to rotate azimuth adjustment knob until pantel crosslines are centered, and then announces to cannoneer no. 2, SET.
- 7 Gunner then unlocks locking nut (18) on slipping micrometer scale (19), moves slipping micrometer scale until zero is aligned with left index (20), and then locks slipping micrometer scale.
- 8 Gunner then opens protective door (3), unlocks locking screw (21), turns slipping azimuth scale (22) until common deflection is aligned with nonslipping azimuth scale (4), tightens locking screw (21), and closes protective door (3).

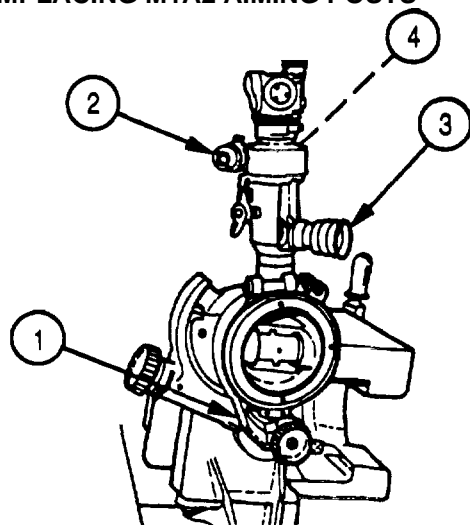

WARNING

When using radioactively illuminated fire control equipment, follow radiation hazard procedures in the front of this manual.

NO DISPLACEMENT


- 9 Gunner then records the value appearing on nonslipping azimuth scale (4) of pantel.

2-15. EMPLACING M1A2 AIMING POSTS

**NOTE**

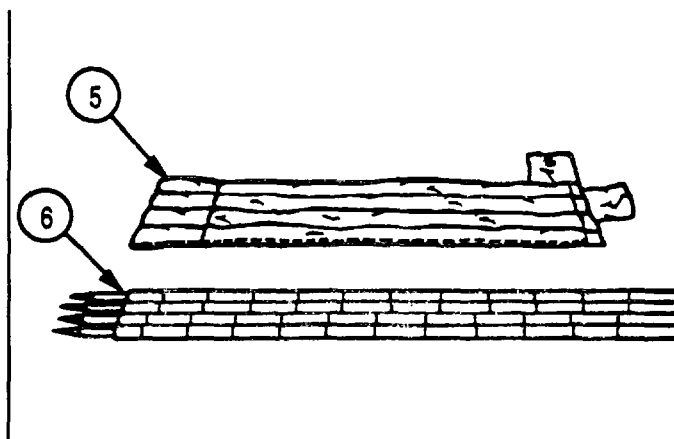
M1A2 aiming posts are the alternate aiming reference for the howitzer and are emplaced, time permitting, immediately following emplacement of M1A1 collimator.

- 1 With howitzer laid (refer to page 2-39) on initial azimuth of fire, gunner checks to be sure that:
 - a. Longitudinal and cross level bubbles on M21A1 telescope mount (1) are centered.
 - b. Gunner's aid scale (2) is set to zero.
- 2 Gunner, sighting through eyepiece (3), rotates micrometer azimuth knob (4) until a convenient place to emplace M1 A2 aiming posts is sighted.

NOTE

Two M1A2 aiming posts are used for each howitzer. To be sure of equal spacing of M1A2 aiming posts, distance from howitzer should be paced out by the same cannoneer.

- 3 Cannoneer no. 2 emplaces M1A2 aiming posts as follows:
 - a. Removes M1A2 aiming post cover (5) and M1A2 aiming posts (6) from right trail stowage brackets.



- b. Removes M1A2 aiming posts (6) from M1A2 aiming post cover (5) and assembles them.

NOTE

Unit SOP should state which light will be used on near post and which will be used on far post, and instructions for aiming post placement.

- c. Removes M14 aiming post light (green and orange) from case and installs lights on aiming posts, if required.
- d. With both M1A2 aiming posts, paces 50 meters from howitzer in direction indicated by gunner and sticks near M1A2 aiming post (short one) in ground. Paces out an additional 50 meters as directed by gunner and sticks far M1A2 aiming post in ground.

NOTE

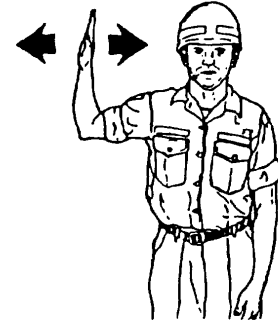
In many cases, ideal spacing of the M1A2 aiming posts at 50 and 100 meters will not be possible; however, the M1A2 aiming posts will be spaced satisfactorily if the near M1A2 aiming post is halfway between pantel and far M1A2 aiming post.

- 4 Sighting through eyepiece, gunner positions the aiming post by extending his or her left hand (right hand if aiming posts are to rear of weapon) above his or her head. Cannoneer no. 2 moves aiming post as directed by the following hand movements:

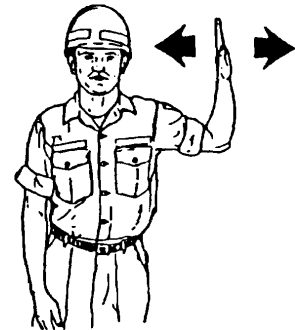
a. TO GO FURTHER OUT. Positions hands chest high, fingers up, palms out, and moves arms in and out.



b. TO MOVE M1A2 AIMING POST TO GUNNER'S RIGHT. Raises right hand, head high to right of head, palm out, and moves arm in and out.



c. TO MOVE M1A2 AIMING POST TO GUNNER'S LEFT. Raises left hand head high to left, palm out, and moves arm in and out.



d. TO STICK M1A2 AIMING POST. Places both hands, head high, in front of body, fists clenched one on top of the other, and motions downward.



2-15. EMPLACING M1A2 AIMING POSTS (cont)

- e. TO ALIGN M1A2 AIMING POST. First, taps top of helmet with right or left hand, and then uses same signals used to move M1A2 aiming post left or right.



- f. TO STOP M1A2 AIMING POST MOVEMENT. Clenches fist of hand used to move M1A2 aiming post.



- g. TO REMOVE M1A2 AIMING POST. Places both hands head high, in front of body and clenches fists. Places one fist on top of the other and motions upwards.



- h. TO COME IN. Raises arms chest high, places one hand in front of the other, and rotates hands inward.

**NOTE**

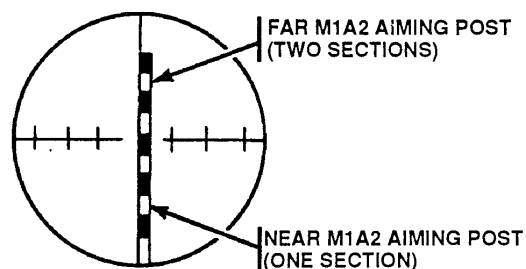
At night, this method may be followed using a flashlight in the ON and OFF mode.

- 5 After M1A2 aiming posts are emplaced, sight picture should be as illustrated (no displacement). Gunner then records the value indicated on nonslipping azimuth scale and returns to sight picture on collimator.

NOTE

The same signals are used for emplacing the collimator as shown for aiming posts,

Unit operating procedures will indicate having the door either opened or closed at this time.



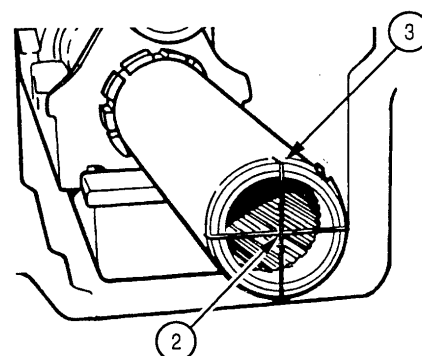
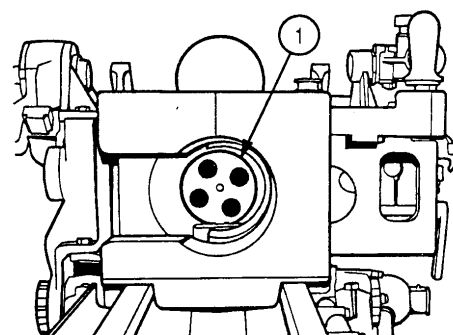
NO DISPLACEMENT

2-16. BORESIGHTING PANTEL, USING DISTANT AIMING POINT METHOD (INDIRECT FIRE)

NOTE

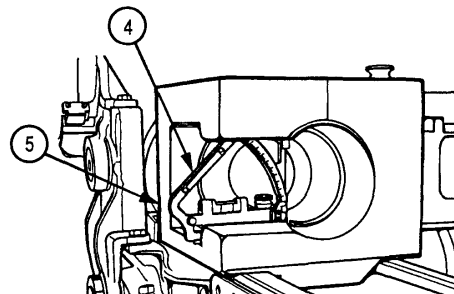
Boresighting is done by gunner and assistant gunner. It can be done by distant aiming point (DAP) method, test target method (refer to page 2-50), or the standard angle method (refer to page 2-54). The standard angle method should be used only when conditions prohibit using either the DAP or test target methods.

- 1 Select an aiming point with well defined vertical and horizontal axis and at a minimum distance of 1500 meters from howitzer.
- 2 Install breech boresight disk (1) and, using tape and cord, tape muzzle crosslines (2) on the four witness marks (3).



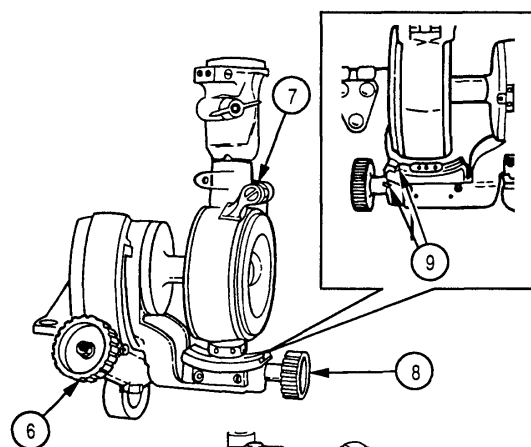
2-16. BORESIGHTING PANTEL, USING DISTANT AIMING POINT METHOD (INDIRECT FIRE) (cont)

- 3** Place pretested M1A1 gunner's quadrant (4) (refer to page 3-72) in breech mechanism (5) and measure amount of cant. Level weapon to 90-mil cant or less.



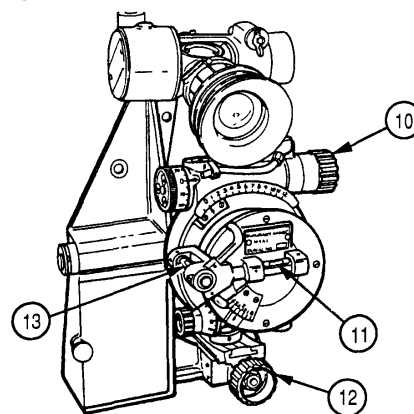
- 4** Using longitudinal leveling knob (6), center longitudinal bubble (7).

- 5** Using cross leveling knob (8), align cross level scribe lines (9).

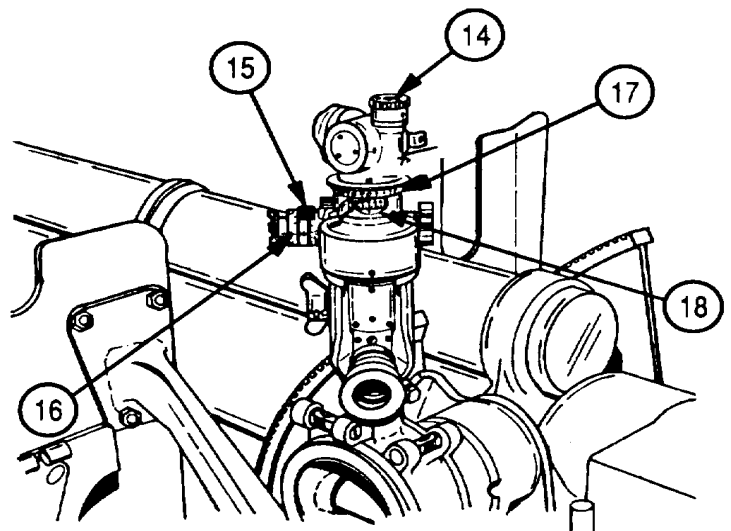


- 6** Using elevating knob (10) of M4A1 fire control quadrant, center elevation bubble (11).

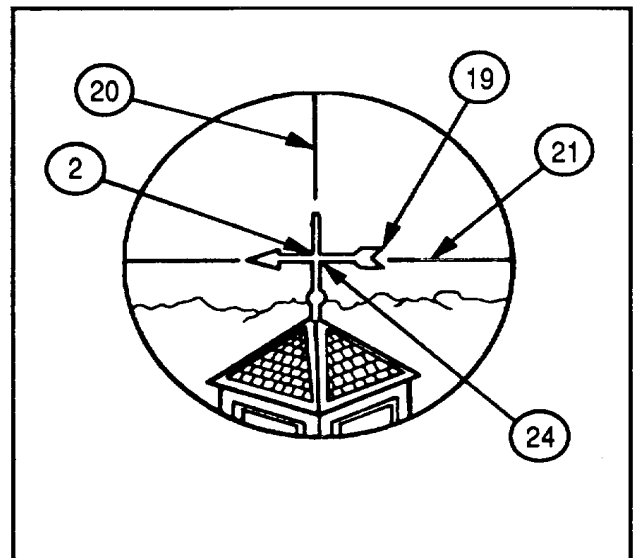
- 7** Use cross leveling worm knob (12) to center cross level bubble (13).



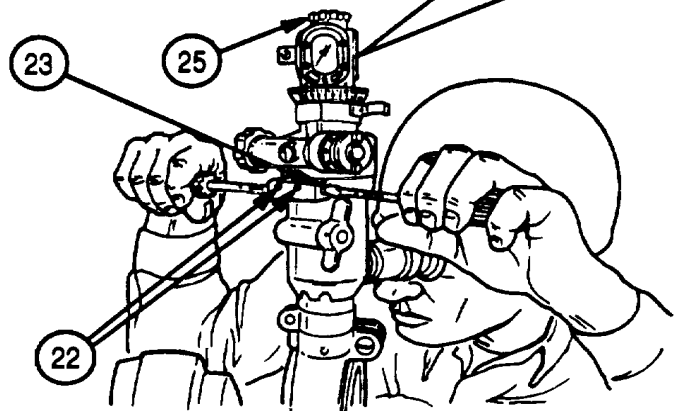
8. Align panel coarse and fine elevation indexes (14) and zero the gunner's aid scale (15), azimuth micrometer index (16), slipping azimuth scale (17), and nonslipping azimuth scale (18).

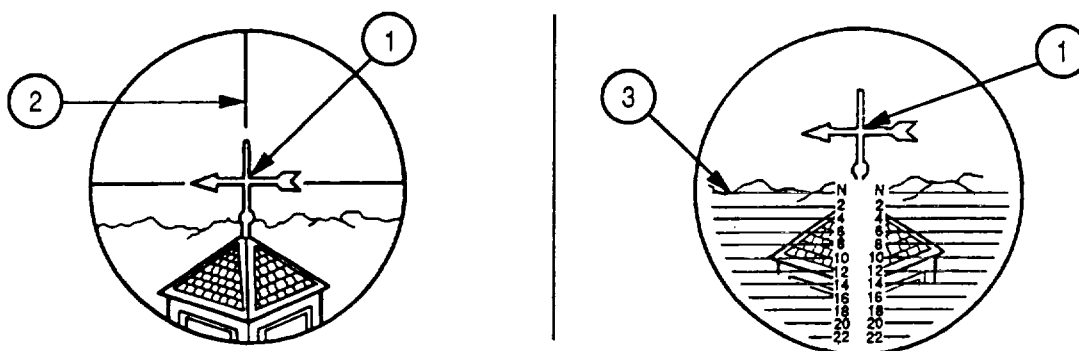


9. Sighting through breech boresight disk, elevate and traverse weapon to align muzzle crosslines (2) on distant aiming point (19).



10. When looking through the eyepiece, the vertical reticle line (20) and horizontal reticle line (21) should be seen intersecting at the same point as muzzle crosslines.
11. If vertical reticle line (20) is off, correct by loosening setscrews (22) and adjusting tangent screws (23). Tighten setscrews and tangent screws and check for proper alignment of vertical crossline (24).
12. If horizontal reticle line (21) is off, turn elevation knob (25) until horizontal reticle line (21) is correct. Then loosen three screws located on top of elevation knob (25). Turn pointer to indicate zero, then tighten screws.



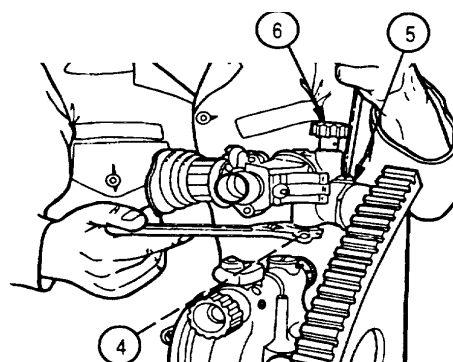
2-17. BORESIGHTING ELBOW TELESCOPE, USING DISTANT AIMING POINT METHOD (DIRECT FIRE)

1. Select an aiming point (1) at expected firing distance.
2. Sight through breech boresight disk; elevate and traverse cannon tube to align muzzle crosslines(2) on aiming point (1).

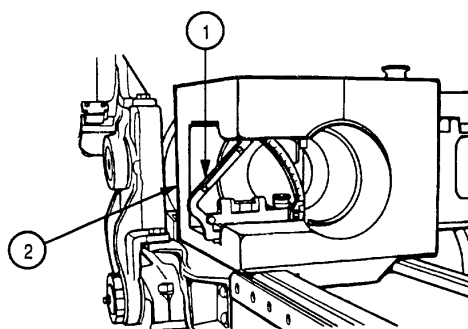
NOTE

The direct fire telescope horizontal line (N line) (3) should now intersect aiming point (1) and be on the same point. If not, go to step 3.

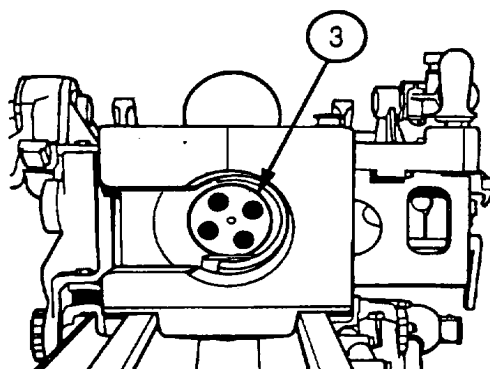
3. To adjust N line (3), loosen clamping screw(4) on the M23 telescope mount and turn boresight screw (5) until N line is properly positioned in elevation. Tighten clamping screw. If reticle patterns appear tilted in relation to terrain, turn bracket rotating knob (6) on top of M23 telescope mount until range lines are horizontal.

**2-18. BORESIGHTING PANTEL, USING TEST TARGET METHOD (IN _____)**

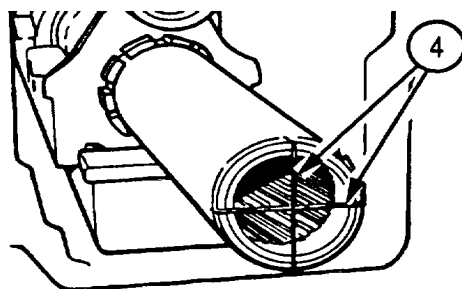
1. Emplace weapon. (Refer to page 2-33.) Place pretested M1A1 gunner's quadrant (1) (refer to page 3-72) in breech mechanism (2) and measure amount of cant. Level trunnions to 90-mil cant or less.



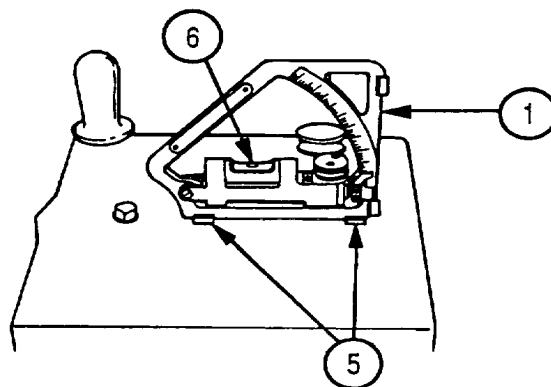
2. Install breech boresight disk (3) and, using tape and cord, tape muzzle crosslines (4) on four witness marks.



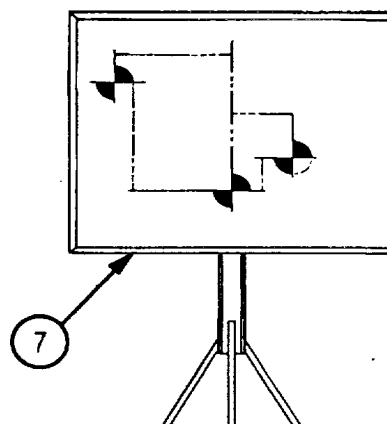
3. Place pretested M1A1 gunner's quadrant (1) (refer to page 3-72) on breech ring leveling plates (5). Set M1 A1 gunner's quadrant to read value as indicated on embedded correction if available.



4. Using elevating handwheel, elevate or depress cannon tube to center bubble (6) on M1A1 gunner's quadrant.

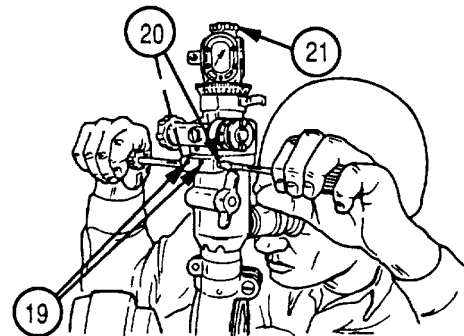
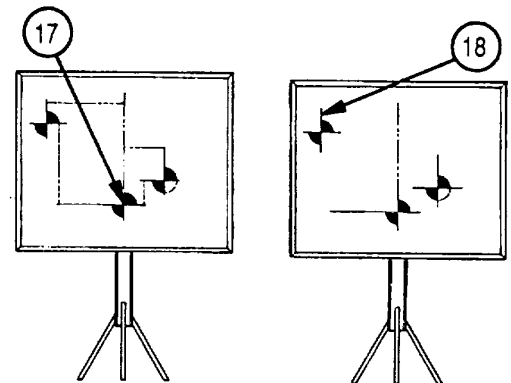
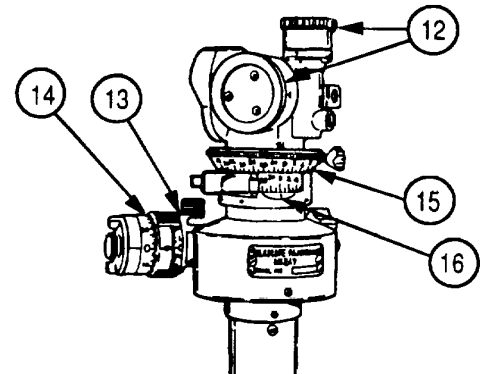
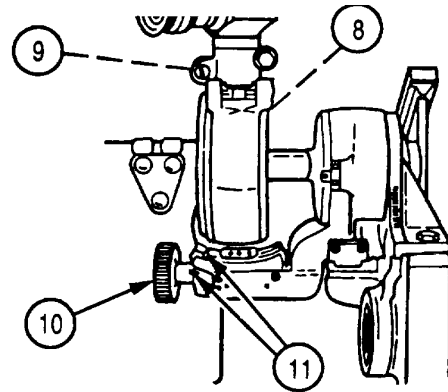


5. Fasten test target (7) to test stand and place it at least 50 meters but no further than 100 meters, in front of weapon.



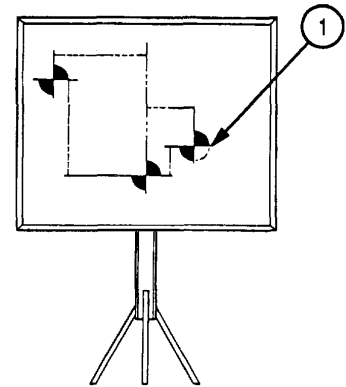
2-18. BORESIGHTING PANTEL, USING TEST TARGET METHOD (INDIRECT FIRE) (cont)

6. Using longitudinal leveling knob (8) on M21A1 telescope mount, center longitudinal bubble (9).
7. Using cross leveling knob (10), align crosslevel scribe lines (11).
8. Align pantel coarse and fine elevation indexes (12) and zero the gunner's aid scale (13), slipping micrometer scale (14), slipping azimuth scale (15), and nonslipping azimuth scale (16).
9. Without moving cannon tube, move test target so that center test target diagram (17) is aligned with vertical and horizontal muzzle crosslines.
10. Look through eyepiece; if vertical reticle line is not aligned with vertical line of left test target diagram (18), loosen two setscrews (19) and adjust two tangent screws (20) by tightening one and loosening the other until vertical line is properly aligned.
11. Tighten two setscrews (19) and recheck alignment.
12. Look through eyepiece; if horizontal reticle line is not aligned with left test target diagram (18), elevation knob (21) must be adjusted.
13. Turn elevation knob (21) until the horizontal reticle line is properly aligned.

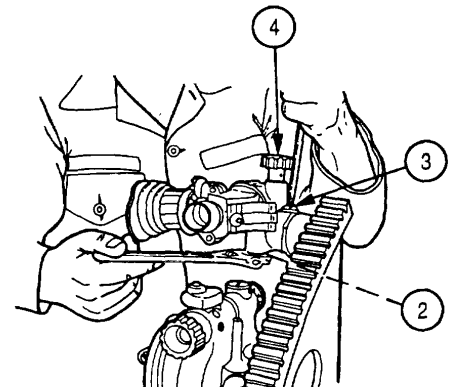


2-19. BORESIGHTING ELBOW TELESCOPE, USING TEST TARGET METHOD (DIRECT FIRE)

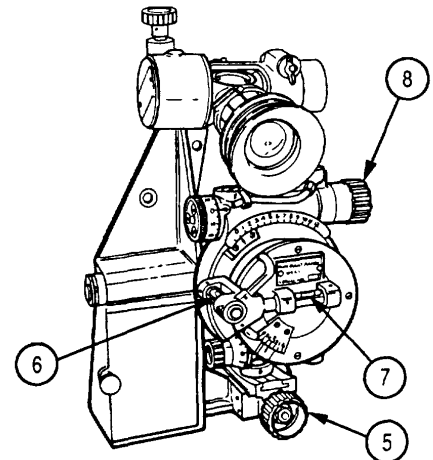
1. Without moving cannon tube or test target, look through elbow telescope. The N line should be aligned with the horizontal line of right test target diagram (1).



2. If necessary, adjust N line by loosening clamping screw (2) and turning boresight screw (3) until N line is properly aligned.
3. Tighten clamping screw (2).
4. If reticle pattern appears tilted in relation to horizontal line, turn bracket rotating knob (4) until N line is horizontal.



5. Using cross leveling worm knob (5), center cross level bubble (6).
6. Center elevation bubble (7), using elevating knob (8).

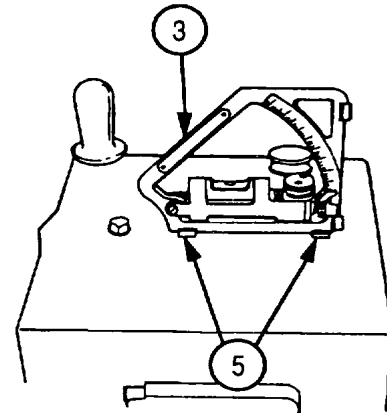
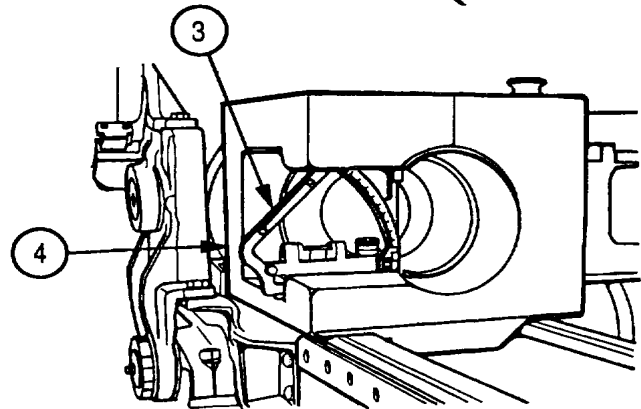
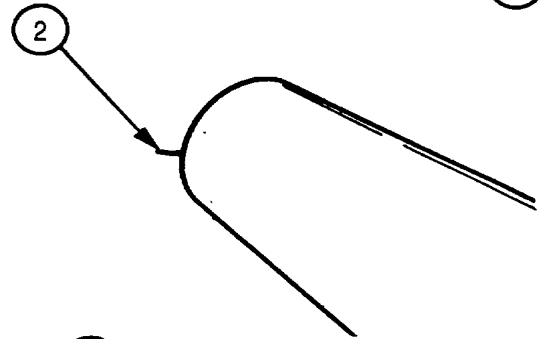
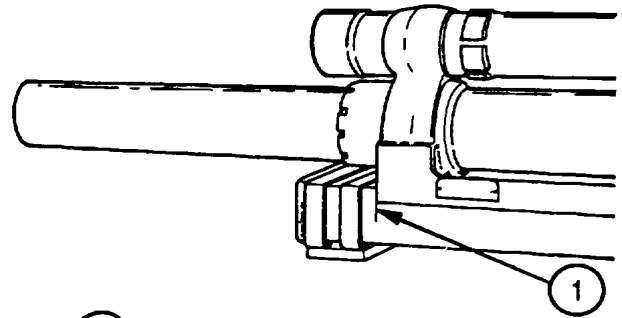


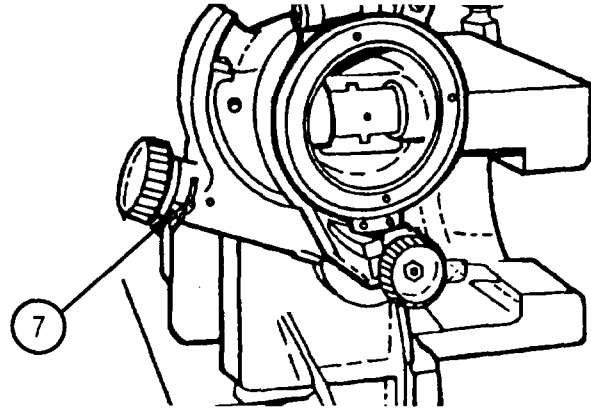
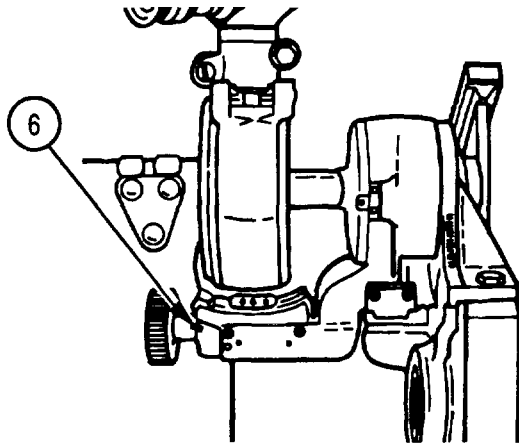
2-20. BORESIGHTING, USING STANDARD ANGLE METHOD

NOTE

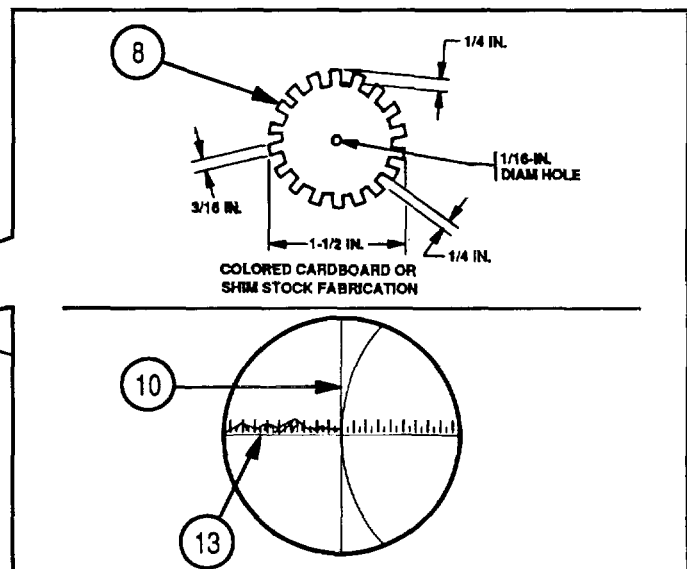
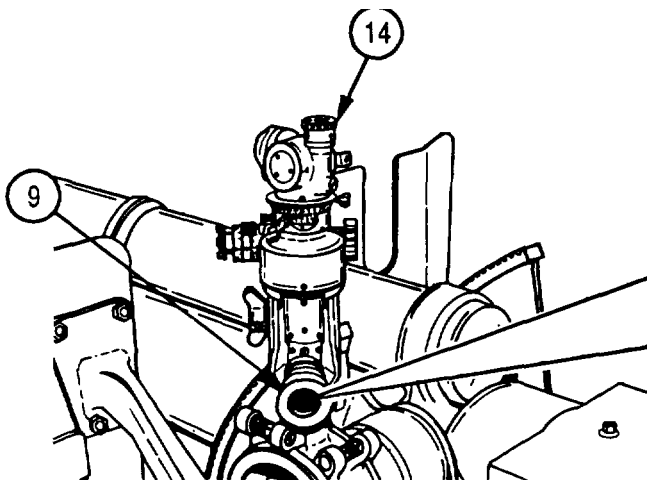
Conditions may exist when use of DAP or test target may not be practical. Aligning scribe marks and setting a predetermined deflection and elevation in order to refer the line of sight of the telescope to the center of muzzle is called standard angle method of boresighting.

1. Emplace weapon (refer to page 2-33) and make sure that cannon tube is all the way in battery by checking alignment of recoil scribe line (1).
2. Using tape, fasten a pin or nail (2) to left witness mark on edge of cannon tube.
3. Place pretested M1A1 gunner's quadrant (3) (refer to page 3-72) in breech mechanism (4) and measure amount of cant. Level weapon to 90-mil cant or less.
4. Set predetermined elevation on pretested M1A1 gunner's quadrant (3).
5. Place M1A1 gunner's quadrant (3) on breech ring leveling plates (5). Using elevating handwheel, level gunner's quadrant bubble.

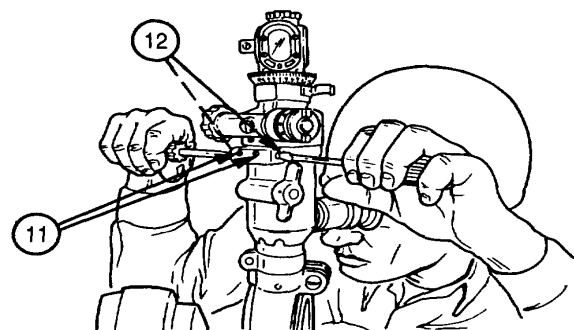




6. Align coarse cross level scribe lines (6) and fine longitudinal index (7) of M21A1 telescope mount.



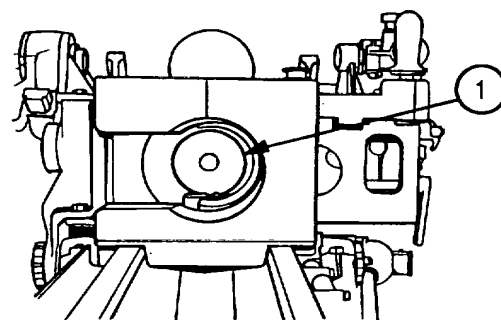
7. Place parallax shield (8) in eyepiece (9).
8. Set off predetermined deflection and look through eyepiece (9). Sight picture should look similar to illustration.
9. If the vertical line (10) is off, loosen setscrews (11) and adjust tangent screws (12). Tighten setscrews (11) and recheck alignment.
10. If the horizontal line (13) is off, adjust by turning elevation knob (14) until horizontal line is properly aligned.



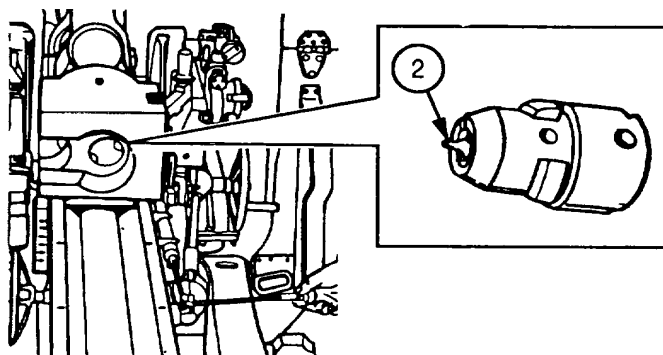
2-21. PREFIRING CHECKS

The following checks must be made by the chief section before firing first round to make sure that weapon will fire safely.

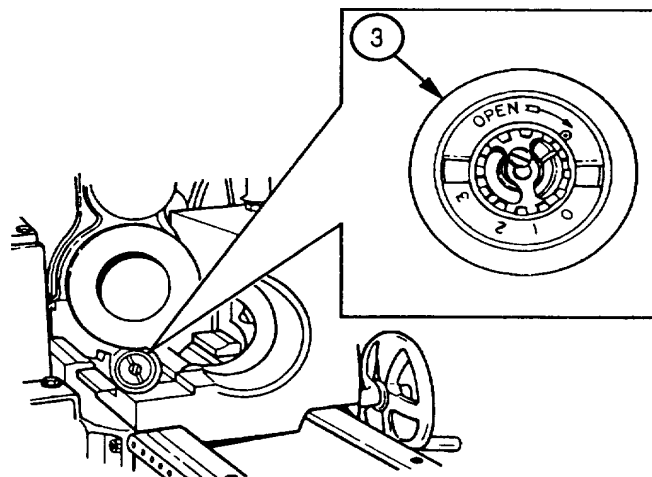
1. Visually check cannon bore (1) to make sure there are no obstructions.



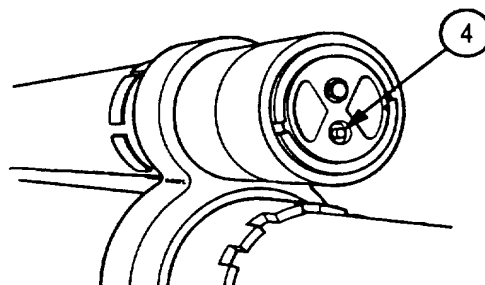
2. Check that firing pin (2) is serviceable.



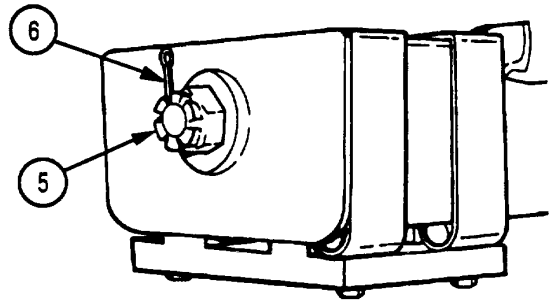
3. Check to make sure respirator (3) is properly set. Set respirator at 0 for traveling; 1 for normal low angle firing; 2 for sustained high angle firing; or 3 for minimum buffing action.



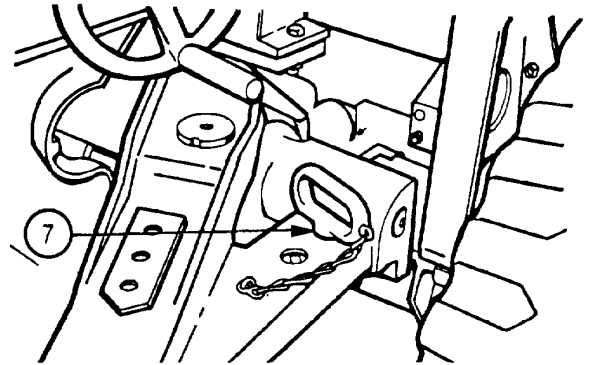
4. Check that oil index (4) is flush with face. (Refer to page 3-1.)



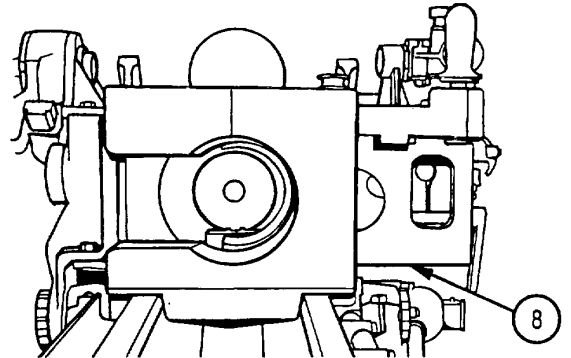
5. Ensure that the piston rod outer nut (5) is in place and secured with the cotter pin (6).



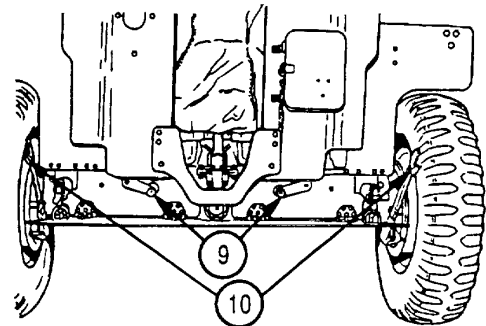
6. Check trails to make sure they are properly emplaced (refer to page 2-33) and traillocking pins (7) are installed.



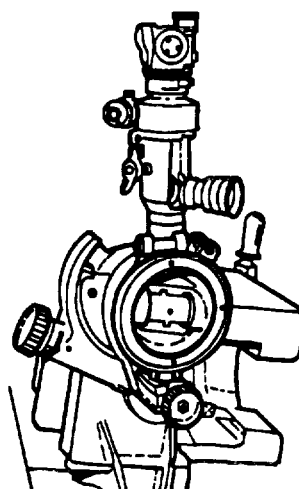
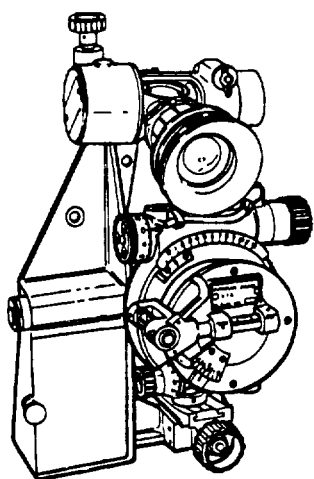
7. Check breechblock (8) for smooth operation during opening and closing of breech mechanism.



8. Check that axle locks (9) are in unlocked position. Check to ensure that handbrakes(10) are engaged.



2-21. PREFIRING CHECKS (cont)



FIRE CONTROL INSTRUMENTS

9. Check fire control instruments for obvious defects and smooth operation. Make sure weapon has been boresighted. (Refer to page 2-47.)

2-22. LOADING THE HOWITZER FOR FIRING

WARNING

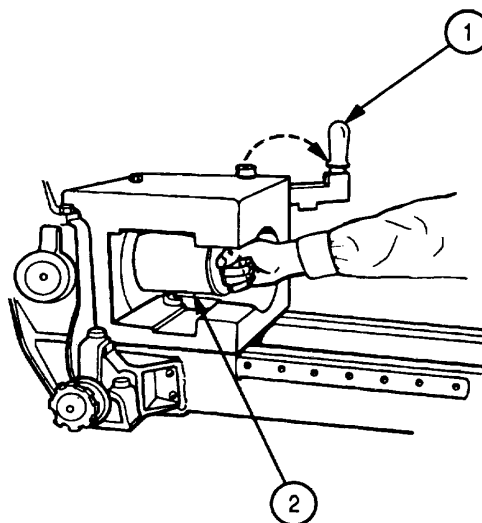
Before loading the howitzer for actual fire, to avoid injury or death, all personnel must know what to do in the event of a misfire. Refer to page 4-33.

1. Upon receiving a fire mission, chief of section indicates aiming point reference to gunner (collimator, aiming post, or distant aiming point).
2. Assistant gunner opens breech mechanism by depressing and pulling breechblock operating lever (1) to the rear until it stops.
3. Cannoneer no. 1 inspects chamber and bore to make sure they are clear.

NOTE

Ammunition is prepared for firing by cannoneers no. 1 and 2 and ammunition team chief. Preparation of ammunition for firing is explained in chapter 4.

4. Cannoneer no. 1 receives prepared round from ammunition team chief.



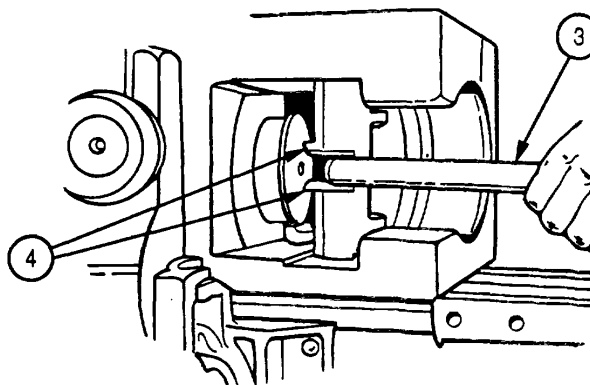
WARNING

Ram the round with closed fist to avoid injuring hand. Be careful when handling a live round to avoid striking fuze or primer.

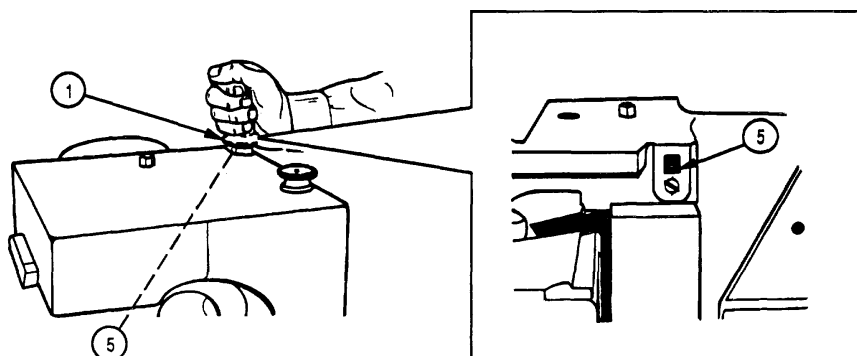
5. Upon receiving quadrant setting, cannoneer no. 1 rams the round (2) until base of cartridge case is flush with breech end of tube.

WARNING

The rammer extractor tool (3) is designed so that the ears (4) will not contact primer; be sure they do not contact primer before ramming. Contact could result in premature firing, causing injury or death to personnel. If the ears are contacting primer, dispose of rammer extractor tool and obtain a new one.

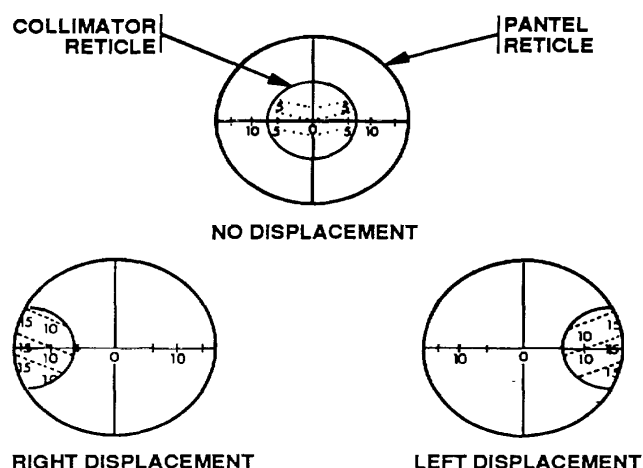


6. If round does not seat flush, seat it with rammer extractor tool (3) by pushing on end of handle.



7. Assistant gunner closes breech mechanism by rotating breech operating lever (1) forward until catch (5) engages.
8. Chief of section verifies that ammunition team chief has designated number of charges removed from prepared round and that breechblock operating lever (1) is secured by catch (5) by pulling on breechblock operating lever without depressing it.

2-23. LAYING FOR DIRECTION AND ELEVATION, USING M1A1 COLLIMATOR(INDIRECT FIRE)

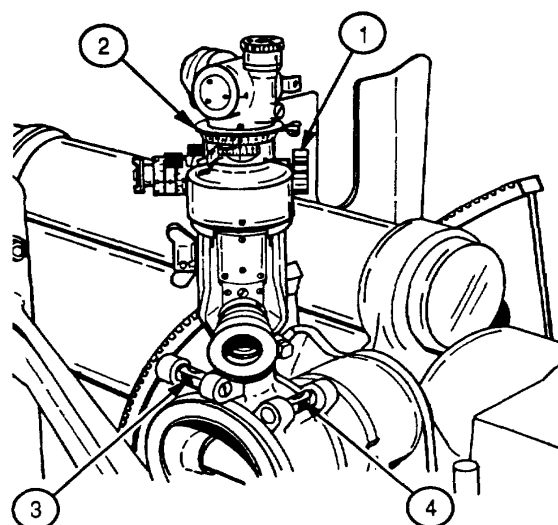
**NOTE**

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

1. Upon announcement, DEFLECTION (SO MUCH), gunner repeats command and rotates pantel azimuth micrometer knob (1) until announced deflection appears on slipping azimuth scale (2).
2. Gunner centers longitudinal bubble (3), using longitudinal leveling knob, and, using cross leveling worm knob, centers crosslevel bubble (4) on M21A1 telescope mount.

NOTE

Each time howitzer is traversed or cannon tube is elevated or depressed, gunner must repeat step 2 before aligning pantel on any aiming reference point.



3. Sighting through pantel, gunner rotates traversing handwheel and traverses howitzer until a proper sight picture is obtained on M1A1 collimator.
4. If there is no weapon displacement, gunner's sight picture should appear as shown.
5. To correct for weapon displacement, gunner must match reticle of pantel with collimator reticle pattern. Numbers in collimator reticle are in 5-mil increments. Individual mils are indicated by short lines in V format of pattern.
6. If gunner sees 10-mil and 15-mil marks in M1A1 collimator and pattern slopes upward from right to left, weapon has experienced right displacement. To compensate for displacement, gunner matches the left portion of pantel reticle with M1A1 collimator reticle as shown.

7. If gunner sees 10-mil and 15-mil marks in M1A1 collimator and pattern slopes upward from left to right, weapon has experienced left displacement. To compensate for displacement, gunner matches right portion of pantel reticle with collimator reticle as shown on previous page.
8. After assistant gunner lays weapon for elevation (refer to page 2-41) and announces, SET, gunner verifies that:
 - a. Announced deflection appears on slipping azimuth scale (5).
 - b. M21A1 telescope mount longitudinal bubble (3) and cross level bubble (4) are centered.
 - c. A proper sight picture is obtained on M1A1 collimator.

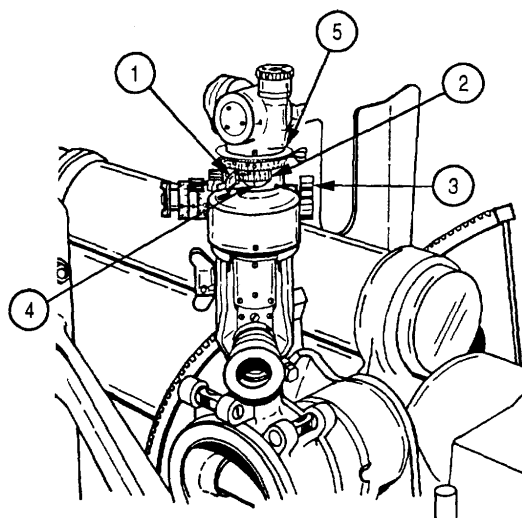
Gunner then announces, READY.
9. Cannoneers no. 1 and 2 and ammunition team chief prepare ammunition as directed by chief of section. (Refer to page 4-15).

2-24. LAYING FOR DIRECTION, USING M1A2 AIMING POSTS (INDIRECT FIRE)

NOTE

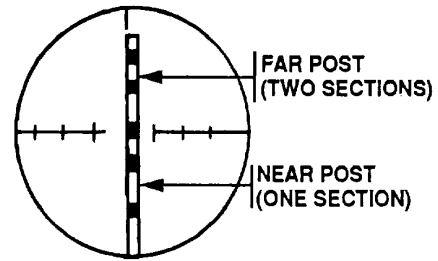
During rapid traverse operations, or if M1A1 collimator has become nonoperational, it may be necessary to use an alternate aiming point (usually M1A2 aiming posts). If M1A2 aiming posts are used as the primary aiming point, omit steps 1 and 2.

1. Gunner opens protective door (1), covering nonslipping azimuth scale (2) on pantel, and rotates azimuth micrometer knob (3) until azimuth on which M1A2 aiming posts were originally emplaced is aligned with azimuth scale index (4).
2. If necessary, gunner unlocks and rotates slipping azimuth scale (5) until common deflection is aligned with azimuth scale index. Gunner then closes protective door, covering nonslipping azimuth scale (2).
3. Upon announcement, DEFLECTION (SOMUCH), gunner repeats command and rotates pantel azimuth micrometer knob (3) until announced deflection appears on the nonslipping azimuth scale (2).

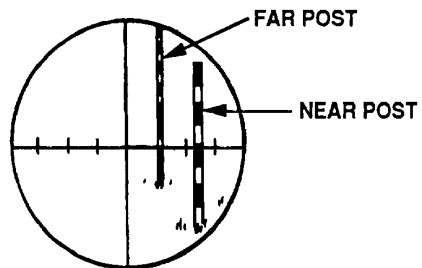


2-24. LAYING FOR DIRECTION, USING M1A2 AIMING POSTS (INDIRECT FIRE) (cont)

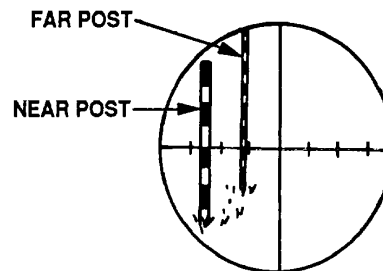
4. Sighting through pantel, gunner rotates traversing handwheel and traverses howitzer until a proper sight picture is obtained on M1A2 aiming posts. If there is no weapon displacement, gunner's sight picture on M1A2 aiming posts should appear as shown.

**NO DISPLACEMENT**

5. To correct for weapon displacement during firing, gunner must compensate so that the far M1A2 aiming post appears exactly half-way between near M1A2 aiming post and pantel vertical crossline.

**LEFT DISPLACEMENT**

6. If gunner sees near M1A2 aiming post to the right of far M1A2 aiming post, weapon has experienced left displacement. To compensate, gunner traverses weapon until far M1A2 aiming post is exactly halfway between near M1A2 aiming post and pantel vertical crossline as shown.

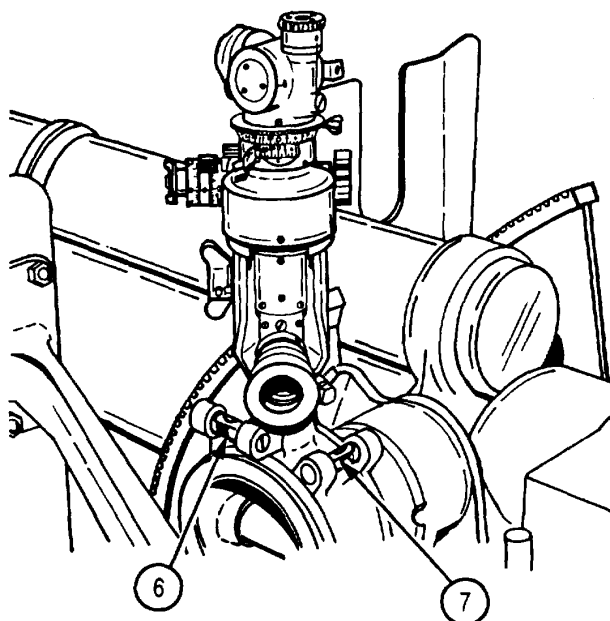
**RIGHT DISPLACEMENT**

7. If gunner sees near M1A2 aiming post is to the left of far M1A2 aiming post, weapon has experienced right displacement. To compensate, gunner traverses weapon until far M1A2 aiming post is exactly halfway between near M1A2 aiming post and pantel vertical cross-line as shown.

8. After assistant gunner lays weapon for elevation (refer to page 2-39) and announces, SET, gunner verifies that:

- a. Announced deflection appears on azimuth scale being used
- b. M21A1 mount longitudinal bubble (6) and cross level bubble (7) are centered.
- c. A proper sight picture appears.

Gunner announces, READY.



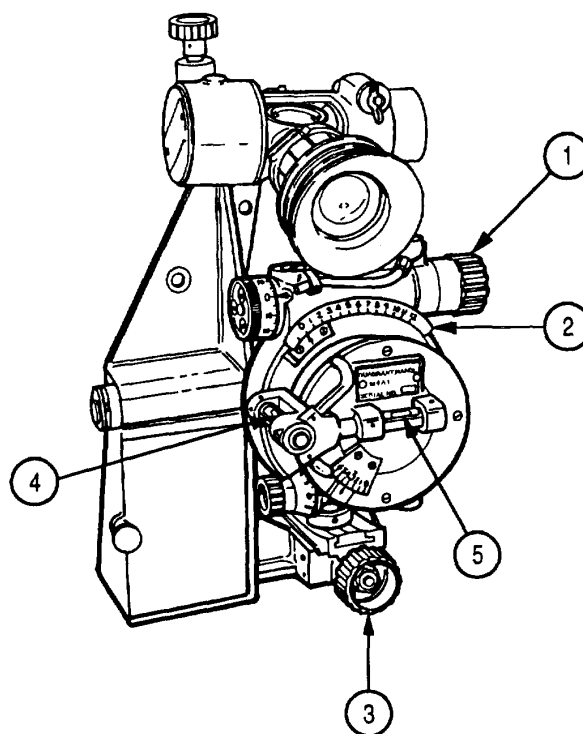
2-25. LAYING FOR ELEVATION

1. Upon announcement, QUADRANT (SO MUCH), assistant gunner repeats the command and rotates elevating knob (1) on M4A1 fire control quadrant until the announced quadrant setting appears on elevation scale (2).
2. Using cross leveling worm knob (3), the assistant gunner centers cross level bubble (4).

NOTE

Each time howitzer is traversed or the cannon tube is elevated or depressed, assistant gunner must repeat step 2.

3. Operating the elevating handwheel, assistant gunner elevates or depresses the cannon tube until elevation bubble (5) centers.
4. After gunner has traversed howitzer, assistant gunner verifies that cross level bubble (4) and elevation bubble (5) are centered and announced quadrant setting appears on elevation scale (2). Assistant gunner then announces, SET.

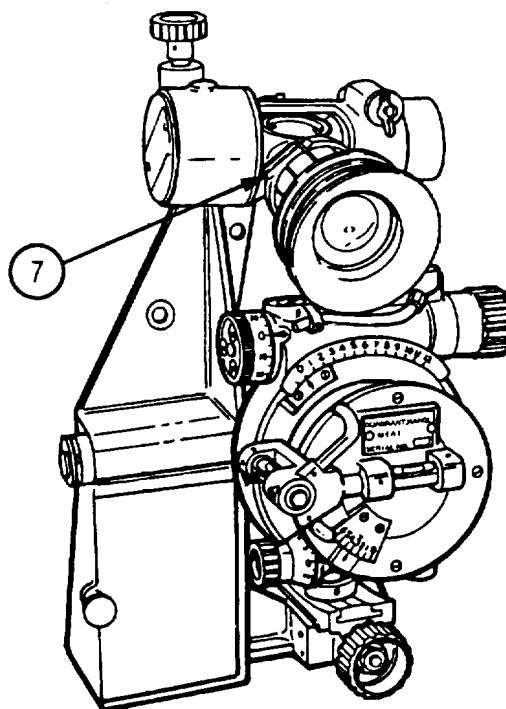
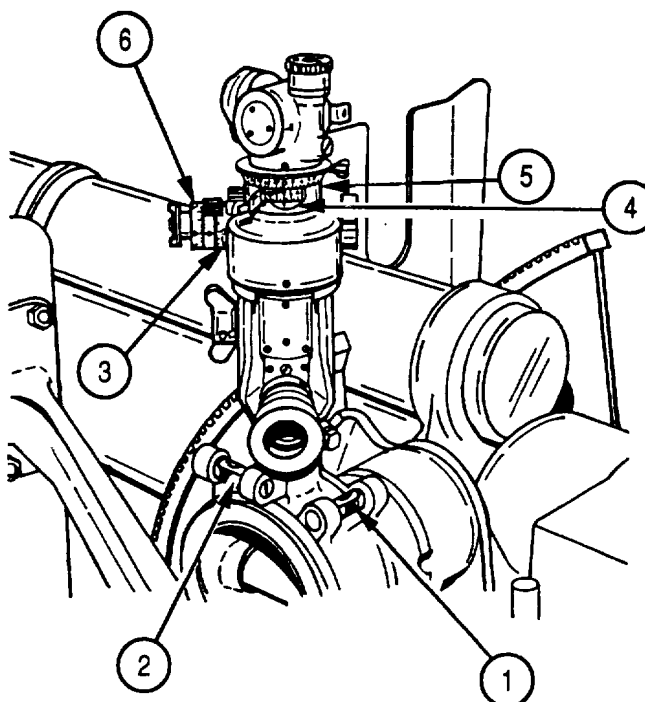


2-26. TWO-CREWMEMBER TWO-SIGHT SYSTEM (DIRECT FIRE)

WARNING

Direct fire on targets located closer than 600 meters from the howitzer will be fired upon only during combat situations. Lethal fragments can travel up to 400 meters from point of burst.

1. When executive officer commands, TARGET, (SO AND SO), RIGHT (LEFT)FRONT, FIRE AT WILL, or simply, FIRE ATWILL, chief of section takes control of section and conducts firing of the howitzer.
2. Gunner prepares pantel for direct laying by using cross leveling worm knob to center crosslevel bubble (1) and using longitudinal leveling knob to center longitudinal bubble(2) on M21A1 telescope mount and verifies that gunner's aid scale (3), nonslipping azimuth scale (4), slipping azimuth scale (5), and slipping micrometer scale (6) are set on zero. Head of sight should point towards muzzle end of cannon tube.
3. Assistant gunner checks that elbow telescope (7) is in place.
4. Cannoneers no. 1 and 2 and ammunition team chief prepare ammunition as directed by chief of section.
5. Chief of section identifies target designated by executive officer. If target is a group of vehicles, chief of section selects the target that is the greatest threat to the crew's position. Chief of section repeats target designation to the section (e.g., LEAD (SO AND SO), MOVING (SO AND SO)). Chief of section then takes his or her post to the flank, slightly to rear of weapon. If accurate measurements are not available, chief of section estimates range of target to be used and determines lead in mils. Lead for a moving target is based on target's speed, range, direction of travel, and type of ammunition being used. Chief of section approximates initial lead as follows:



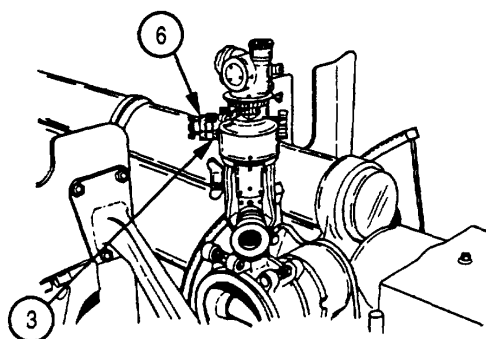
TARGET SPEED.	MPH	TARGET TRAVELING PERPENDI- CULAR TO LINE OF FIRE	TARGET TRAVELING 45 DEGREES to LINE OF FIRE
Slow	5	5	5
	10	10	10
Medium	15	15	10
	20	20	15
Fast	25	20	15
	30	30	20

6 Chief of section gives initial commands in sequence indicated below:

ELEMENT	EXAMPLE
Target designation.	TARGET, LEAD (SO AND SO)
Projectile, charge, and fuze	SHELL HEP-T (no charge or fuze designation required); SHELL HE, CHARGE 7, FUZE QUICK; or SHELL HE, CHARGE 7, FUZE DELAY
Lead.....	LEAD RIGHT (LEFT) 10
Range	RANGE 600
Method of fire	Continuous fire unless otherwise commanded

For abbreviations, refer to page 1-4.

7. Gunner sets initial lead on gunner's aid scale(3), zeroes slipping micrometer scale (6), and traverses howitzer until center vertical reticle is centered on target and maintains this sight picture by continuous tracking of target. Gunner withdraws his or her eye slightly and commands, FIRE.



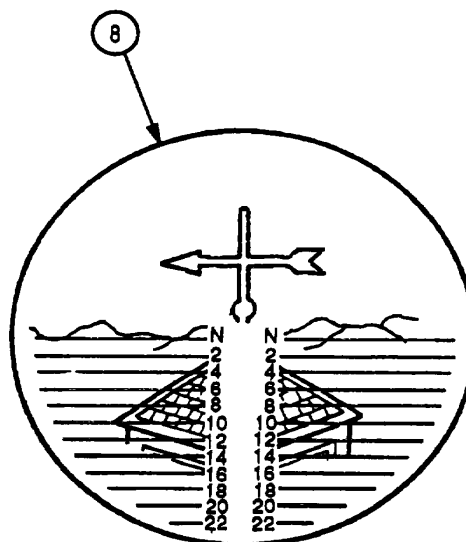
2-26. TWO-CREWMEMBER TWO-SIGHT SYSTEM (DIRECT FIRE) (cont)

8. Assistant gunner elevates or depresses cannon tube until target is centered on appropriate range line in reticle and calls, SET.

NOTE

Gunner and assistant gunner track in deflection and elevation as a team while adjusting for correct sight picture(8). They will continue tracking after the round is fired and make corrections as directed by chief of section.

The reticle in the elbow telescope is patterned for use with shell HE, charge 7. To use shell HEP-T with elbow telescope, prepare a conversion table by comparing elevations for shell HEP-T with ranges for charge 7. Assistant gunner maintains target on appropriate range line by continuous tracking. When assistant gunner calls, SET, assistant gunner withdraws his or her eye slightly from elbow telescope.



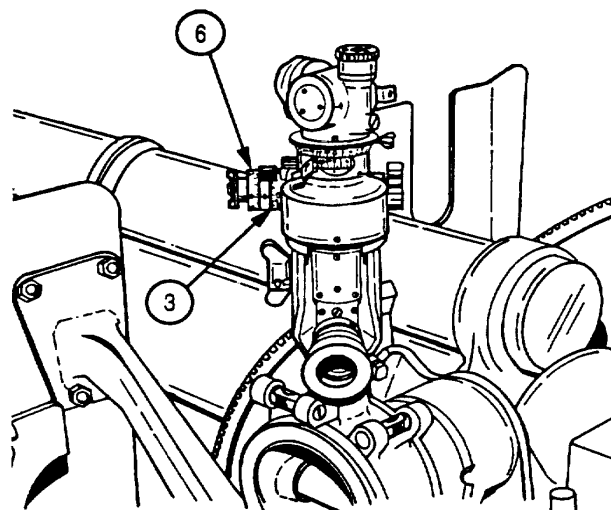
9. Cannoneer no. 2 opens and closes breech mechanism, announces CLOSE when cannon tube is loaded to indicate weapon is ready to fire, and fires when the gunner commands, FIRE.
10. Chief of section gives subsequent commands based on observed effect as follows:

ELEMENT	EXAMPLE
---------	---------

Change in lead	RIGHT (LEFT) 5
----------------	----------------

Change in range	ADD (DROP) 100
-----------------	----------------

11. When chief of section commands, RIGHT(LEFT), gunner sets lead change on gunner's aid scale (3) and zeroes slipping micrometer scale (6). Gunner traverses weapon until center vertical reticle is again centered on mass of target, checks that cross level bubble is centered, waits for assistant gunner to announce, SET, and commands, FIRE.



12. When chief of section commands, ADD (DROP) (SO MUCH), assistant gunner elevates or depresses cannon tube until appropriate range line is centered on mass of target and calls, SET.

NOTE

During the laying sequence, assistant gunner checks direction of the lead as set by the gunner.

13. Chief of section announces, END OF MISSION, when target is destroyed or neutralized.

NOTE

New targets selected will be taken under fire as outlined above.

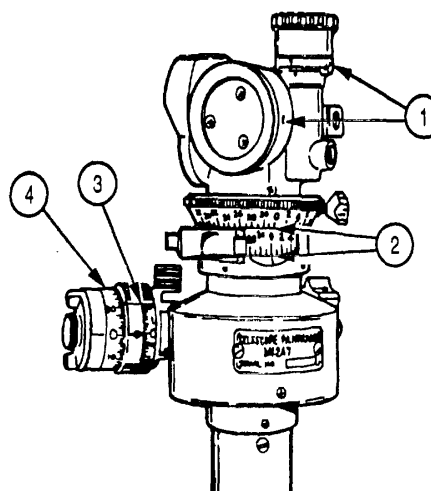
2-27. ONE-CREWMEMBER ONE-SIGHT SYSTEM (DIRECT FIRE)

NOTE

The duties of the chief of section are the same as for the two-crew member two-sight system. (Refer to page 2-64.)

The reticle on the pantel is graduated for shell HE, charge 5. When firing charge 7 at ranges under 2400meters, use one-half of true range for laying on the target. For shell HEP-T, use one-third of true range for ranges under 2000 meters.

1. Gunner lays for both deflection and range on pantel by:
 - a.. Matching coarse and fine elevation indexes (1).
 - b.. Setting coarse and fine elevation indexes (1) and slipping and nonslipping azimuth scales (2) to zero.
 - c.. Using cross leveling worm knob to center cross level bubble and using longitudinal leveling knob to center longitudinal bubble on the M21 A1 telescope mount.
 - d.. Setting lead on gunner's aid scale (3) and setting slipping micrometer scale (4) at zero.



2-27. ONE-CREWMEMBER ONE-SIGHT SYSTEM (DIRECT FIRE) (cont)

- e.. Laying intersection of center verticle reticle and appropriate range line on target using traversing and elevating handwheels.
 - f.. Commanding, FIRE.
2. Assistant gunner opens and closes breech mechanism; calls, SET, when howitzer is loaded; and fires weapon at the gunner's command, FIRE.

2-28. FIRING THE HOWITZER**WARNING**

Cannoneer no. 1 (loader) remains inside the trails during firing, but must not sit on trails. Crewmembers may be thrown or trapped under trails.

NOTE

The howitzer is fired only upon verbal or hand signal from the chief of section unless direct fire is being conducted. Cannoneer no. 2 and ammunition team chief prepare ammunition as directed by the chief of section.

1. When chief of section has verified data and all cannoneers are in assigned places, chief of section directs firing of weapon (unless restricted by fire commands) by raising his or her hand and dropping his or her arm sharply to his or her side as chief of section commands, FIRE.
2. When restricted by fire command, chief of section will raise his or her right arm vertically as a signal that weapon is ready to fire. When arm signals cannot be seen, chief of section reports verbally to executive officer, NUMBER (SO AND SO) READY. Chief of section then orders firing on command of executive officer.

WARNING

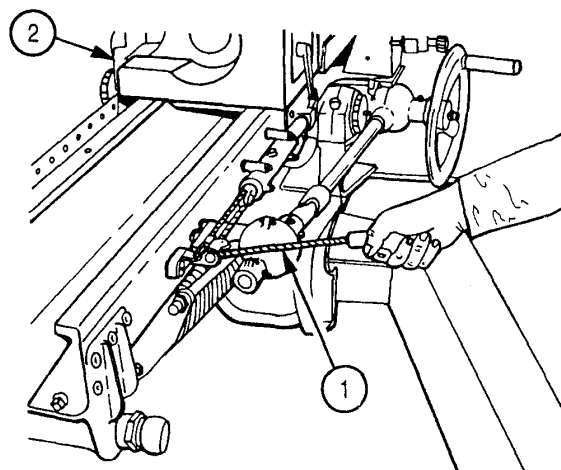
If the howitzer fails to fire, refer to misfire/checkfire procedures on page 4-33.

CAUTION

Lanyard should be pulled with a gradual and steady motion; spasmodic motion may cause firing mechanism to malfunction.

To prevent damage to equipment, do not release the lanyard during firing. Keep breech mechanism closed until the cannon returns to battery.

3 When chief of section drops his or her arm and commands, FIRE, assistant gunner pulls lanyard (1) to fire howitzer (2).



2-29. TRAVERSING BEYOND CARRIAGE TRAVERSE LIMITS

- 1** Upon receipt of fire command from fire direction center, gunner commands, THAILS RIGHT, as required, and announces which azimuth marker to shift towards. EXAMPLE: TRAILS RIGHT, AZIMUTH MARKER ZERO.
- 2** Gunner locks left handbrake and sets off predetermined deflection that corresponds to new azimuth marker.
- 3** Upon command, TRAILS UP, from gunner or chief of section, cannoneer no. 1 and ammunition team chief lift left trail and cannoneer no. 2 and assistant gunner lift right trail and move trails in the direction indicated by gunner. When vertical crossline of pantel is aligned, or close to the azimuth marker, gunner commands, TRAILS DOWN. Spades are then emplaced.

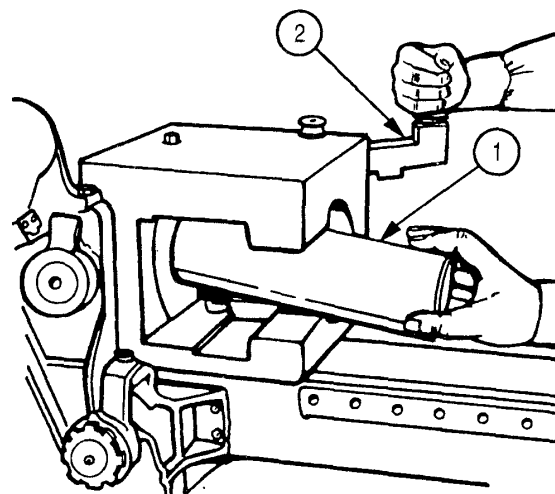
2-30. UNLOADING HOWITZER

a. Unloading Spent (Fired) Cartridge.

WARNING

Do not place hand behind breech until tube has reached its full recoil and has started to go back into battery.

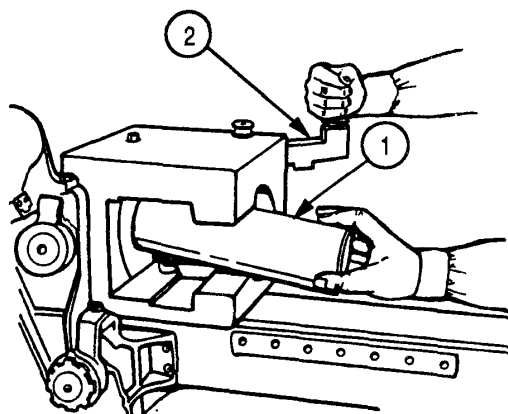
- (1)** Cannoneer no. 1 positions his or her hand behind breech mechanism access opening to receive spent cartridge case (1).
- (2)** Assistant gunner opens breech mechanism to eject cartridge case (1) by rotating breech operating lever (2) to rear.



2-30. UNLOADING HOWITZER (cont)

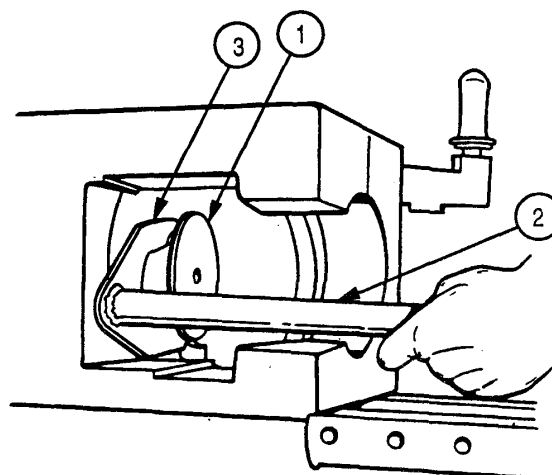
a. Unloading Spent (Fired) Cartridge. (cont)

- (3) Cannoneer no. 1 grasps rear of cartridge case (1) and removes it by pulling it straight out from breech mechanism.
- (4) Cannoneer no. 1 inspects breech mechanism and cannon tube and announces, BORE CLEAR, if there are no obstructions or foreign materials observed.
- (5) Assistant gunner closes breech mechanism if another round is not going to be loaded.



b. Unloading Spent (Fired) Cartridge with Rammer Extractor Tool.

- (1) Remove cartridge case (1) by using rammer extractor tool (2). Install rammer extractor tool so that lips of fork (3) fit between cannon tube and rim of spent cartridge case, and pry it out of chamber.
- (2) If cartridge case (1) cannot be extracted with rammer extractor tool (2), insert cleaning section staff through muzzle end of the cannon tube and tap bottom of cartridge case until it is loosened and can be removed.
- (3) Notify Unit maintenance to check cartridge extractor.



c. Unloading an Unfired Round.

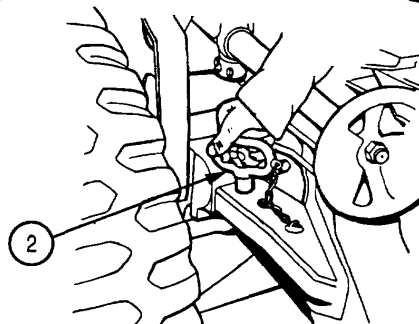
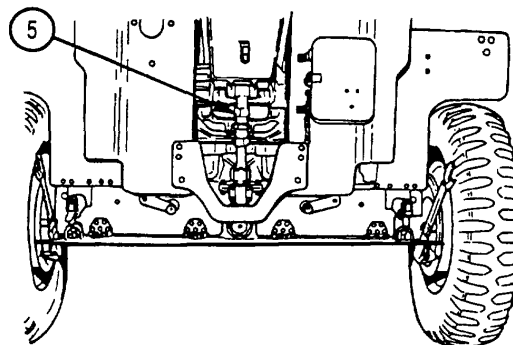
WARNING

A complete round, once loaded, should be fired. A cook off could result, causing injury or death to personnel.

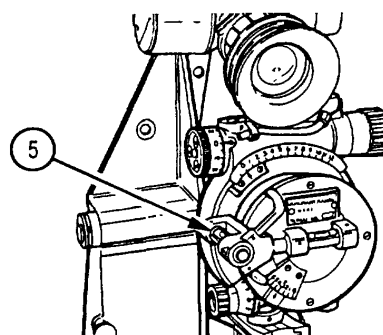
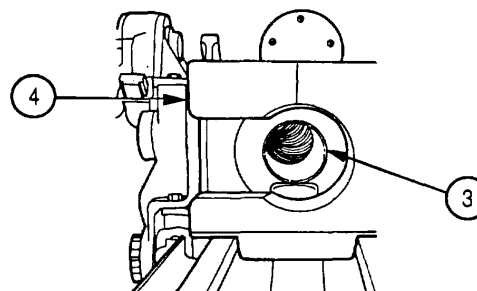
For unloading an unfired round, refer to misfire/checkfire procedures. (Refer to page 4-33.)

2-31. PREPARATION FOR TRAVEL (MARCH ORDER) (Cont)**a. Procedure 1.**

- (1) Chief of section, upon receipt of a movement order, issues march order command for the section and supervises work of all members of the section throughout all sequences of preparation and checks to make sure respirator is properly set for travel.
- (2) Gunner aids ammunition team chief in locking cradle lock strut assembly (1) after weapon is placed in center of traverse. Gunner withdraws left trail locking pin (2) from forward hole (firing position) and inserts it into rear hole (traveling position).

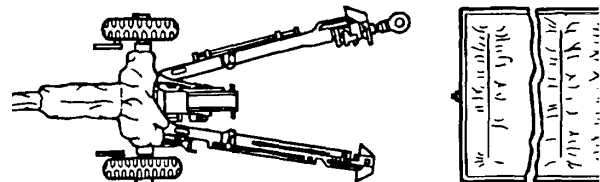
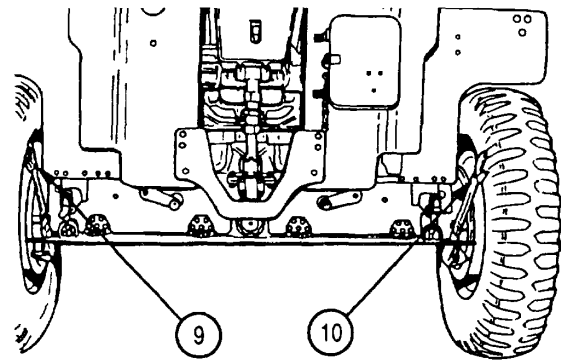
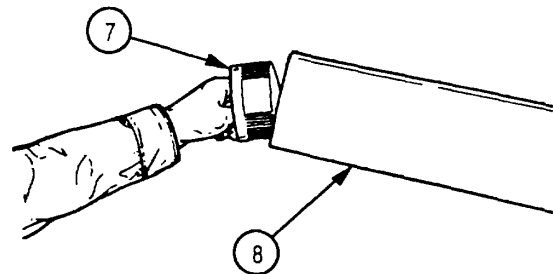
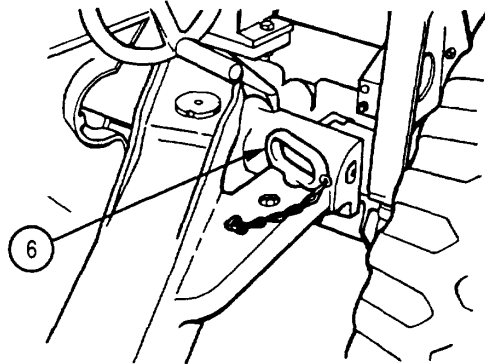


- (3) Assistant gunner performs the following:
 - (a) Inspects chamber (3) to be sure that gun is not loaded.
 - (b) Closes breech mechanism (4) after inspection by chief of section.
 - (c) Closes covers on fire control quadrant vials (5).
 - (d) Aids ammunition team chief in locking cradle lock strut assembly (1) by operating elevating handwheel.



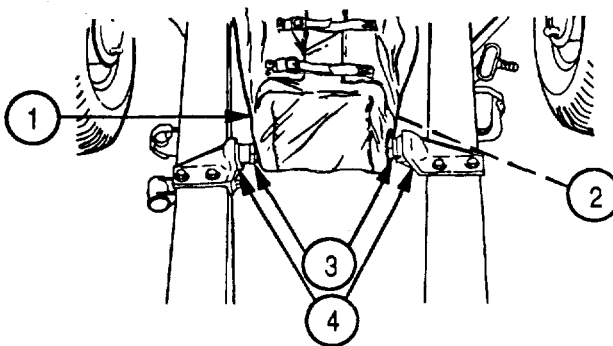
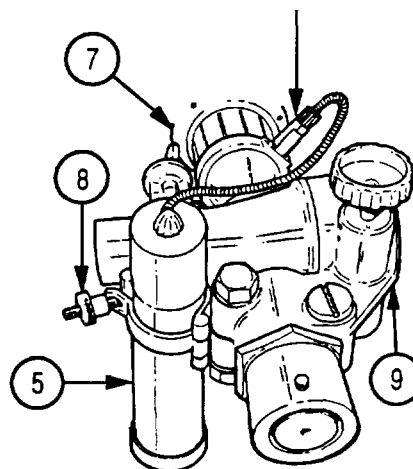
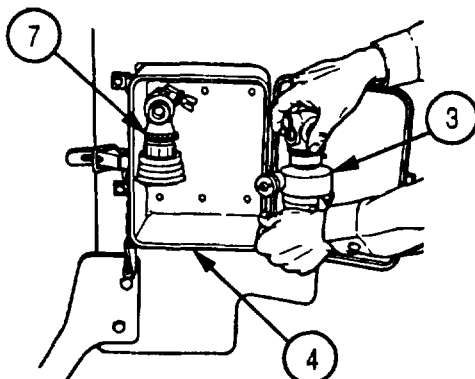
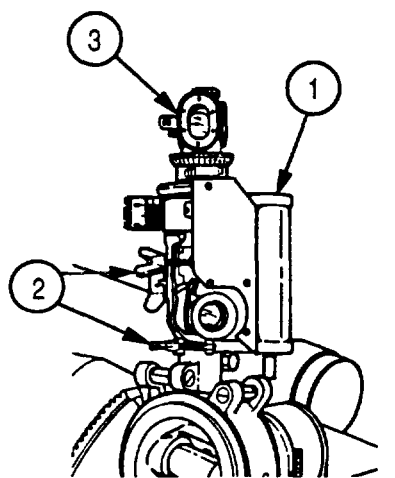
2-31. PREPARATION FOR TRAVEL (MARCH ORDER) (cont)**a. Procedure 1. (cont)**

- (e) Withdraws right trail locking pin (6) from forward hole (firing position) and inserts it in rear hole (traveling position).
- (f) Picks up overall cover from right of gun and places it over cradle.
- (g) Moves to right trail.
- (4) Cannoneer no. 1 moves to his or her position at left trail, prepared to aid in closing it.
- (5) Assistant gunner picks up muzzle plug (7), and, after cannon tube has been inspected by chief of section and found cleared, fastens muzzle plug (7) on muzzle (8).
- (6) Cannoneer no. 2 moves to his or her position at right trail, prepared to aid in closing it.
- (7) Ammunition team chief releases left handbrake (9) to raise and secure bottom shield. Assistant gunner releases right handbrake (10) to raise and secure bottom shield.
- (8) Ammunition team chief inserts handspike, if required, in its socket in rear of left trail, and moves to his or her position at left trail, prepared to aid in closing it.
- (9) Driver maneuvers prime mover into position as directed by chief of section



b. Procedure 2.

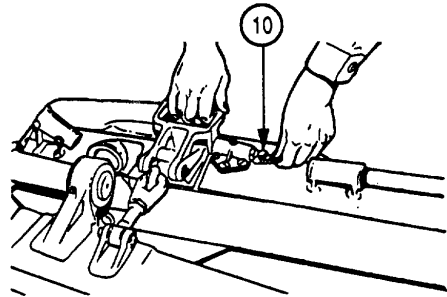
- (1) Gunner places overall cover (1) over muzzle and drapes remainder of overall cover over cradle (2) and breech mechanism.
- (2) Assistant gunner, aided by cannoneer no. 2, closes right trail when ammunition team chief calls, CLOSE, and verifies that two end pieces on travel lock shaft (3) fit into travel lock brackets (4).
- (3) Cannoneer no. 1, using handspike for leverage and aided by ammunition team chief, closes left trail when ammunition team chief calls, CLOSE.
- (4) Cannoneer no. 2, using drawbar for leverage and aided by assistant gunner, closes right trail when ammunition team chief calls, CLOSE.
- (5) When ammunition team chief sees that gunner and assistant gunner have finished fitting overall cover over travel lock shaft, ammunition team chief calls, CLOSE, to assistant gunner, cannoneers no. 1 and 2, and gunner, to indicate that trails may be closed.

**c. Procedure 3.**

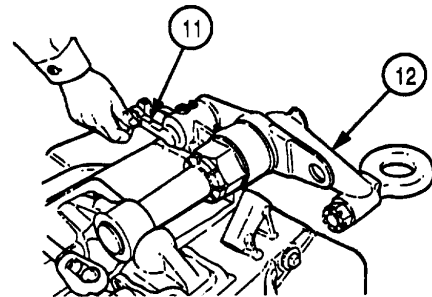
- (1) Gunner removes M19 instrument light (1) by loosening two wingnuts (2), removing M19 instrument light (1) from pantel (3), and tightening two wingnuts (2).
- (2) Gunner sets rotating head and deflection of pantel at zero, closes covers on M21A1 telescope mount level vials, removes pantel (3) from M21A1 telescope mount, places it in case (4), and locks the case.
- (3) Assistant gunner removes M36 instrument light (5) by removing lamp (6) from elbow telescope (7), loosening clamp (8) on M23 telescope mount (9), and removing M36 instrument light (5).
- (4) Assistant gunner removes elbow telescope (7), if mounted, and places it in case (4).

2-31. PREPARATION FOR TRAVEL (MARCH Order) (cont)**c. Procedure 3. (cont)**

- (5) Cannoneer no. 1 locks trail locking latch (10) after trails are closed.

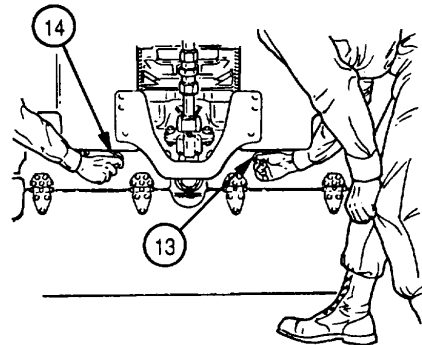


- (6) Cannoneer no. 2 disengages drawbar locking shaft (11), rotates drawbar (12) 180 degrees to the downward position, and reengages drawbar locking shaft.

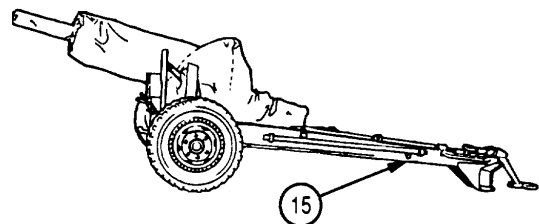


- (7) Ammunition team chief locks left axle in traveling position by rotating left axle lock (13) 180 degrees outward toward wheel and engages left axle lock in outer hole.

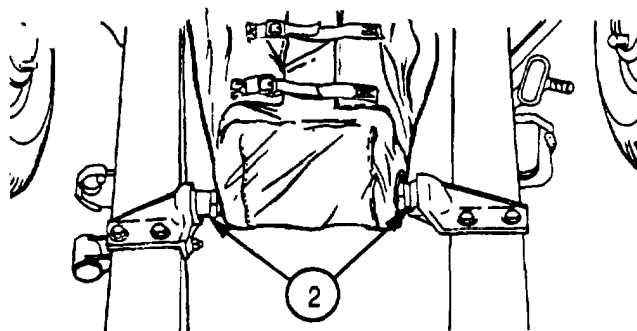
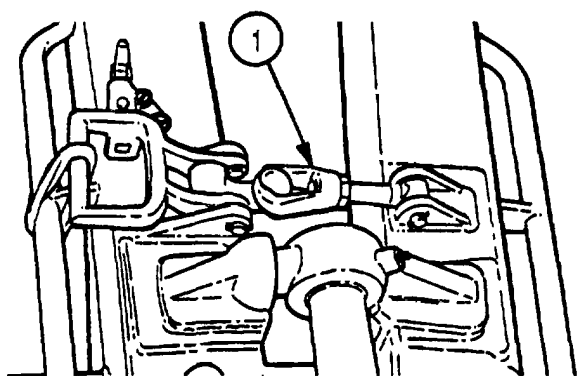
- (8) Assistant gunner locks right axle in traveling position by rotating right axle lock (14) 180 degrees outward toward wheel and engages right axle lock in outer hole.



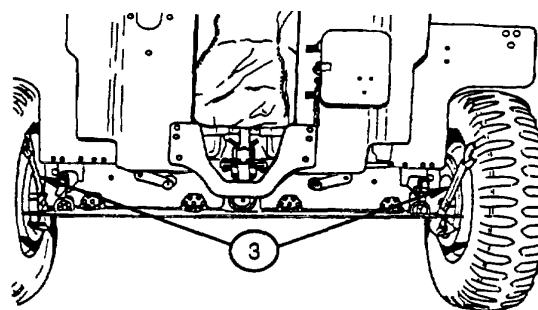
- (9) Ammunition team chief removes handspike (15), if used, fastens it in its carrying socket on left trail, picks up wire from executive officer's control station, and power supply and cable assembly to the remote control light source.



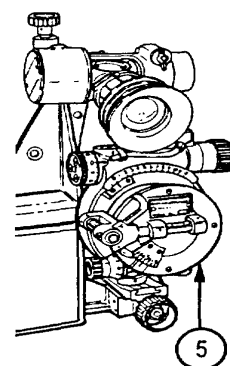
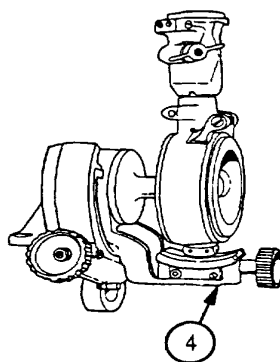
d. Procedure 4.



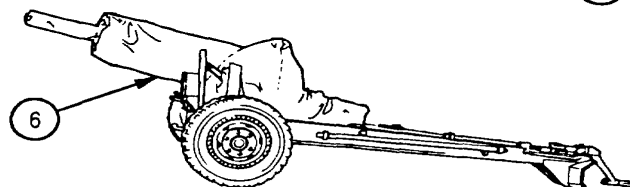
- (1) Chief of section performs a check of trail lock assembly (1), travel lock (2), and handbrakes (3).



- (2) Chief of section makes sure that M21A1 telescope mount (4) and M4A1 fire control quadrant (5) are in an upright, level position.

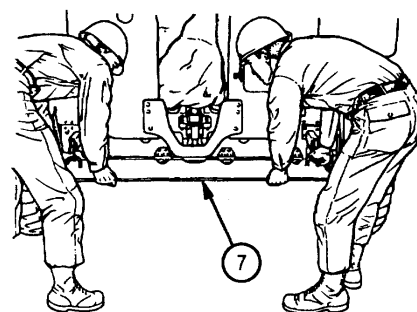


- (3) Gunner fits and fastens breech mechanism end of overall cover (6).

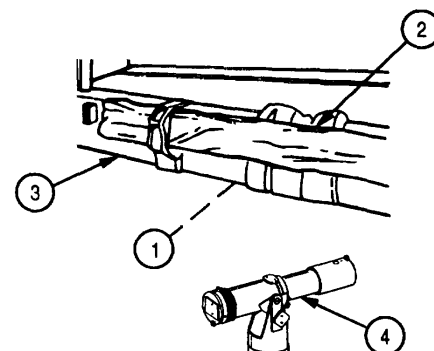


2-31. PREPARATION FOR TRAVEL (MARCH ORDER) (cont)**d. Procedure 4. (cont)**

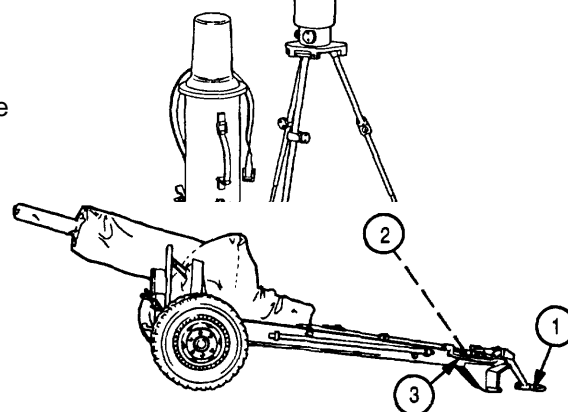
- (4) Cannoneer no. 1 disassembles cleaning section staff, removes rammer extractor tool and places it in the section chest, and fastens sections of the cleaning section staff in their brackets on left trail.
- (5) Cannoneer no. 2 prepares and loads ammunition and equipment on prime mover, aided by other members of the section.

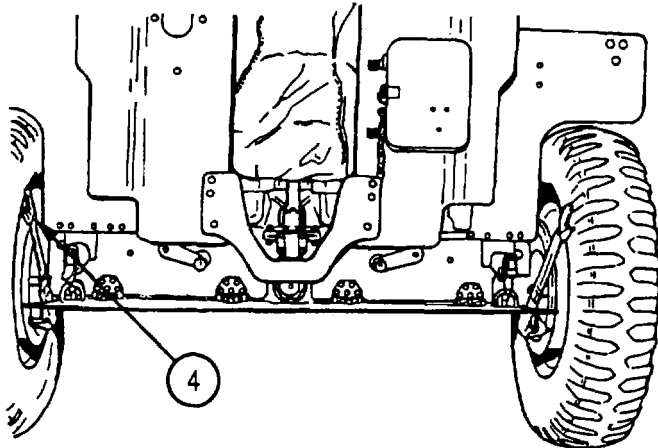
**e. Procedure 5.**

- (1) Gunner aids chief of section in supervising the march order.
- (2) Cannoneers no. 1 and 2 and ammunition team chief prepare ammunition and equipment for loading on prime mover.
- (3) Cannoneer no. 2 retrieves and disassembles the M1A2 aiming posts (1), places them in their cover (2), and fastens them in their brackets on the right trail (3). Cannoneer no. 2 also prepares M1A1 collimator (4) for travel.

**f. Procedure 6.**

- (1) Chief of section directs maneuvering of prime mover until pintle is just short of drawbar (1).
- (2) Assistant gunner grasps right trail handrail (2).
- (3) Cannoneer no. 1 grasps left trail handrail (3).
- (4) Cannoneer no. 2 grasps right trail handrail (2).

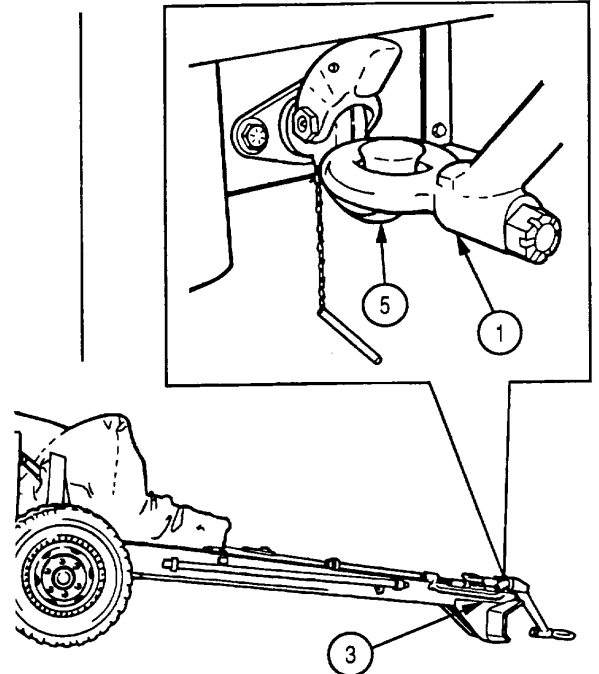




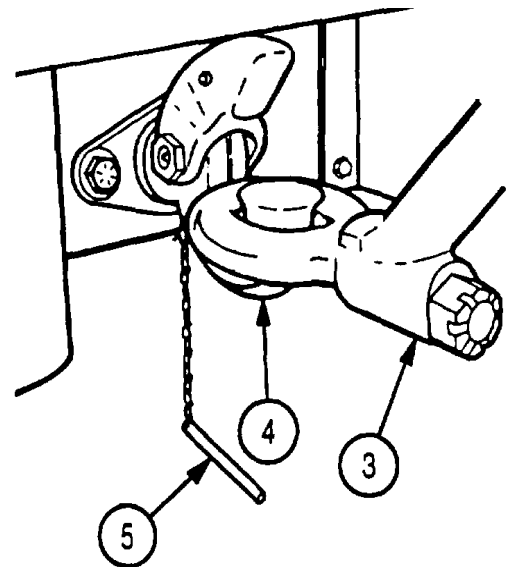
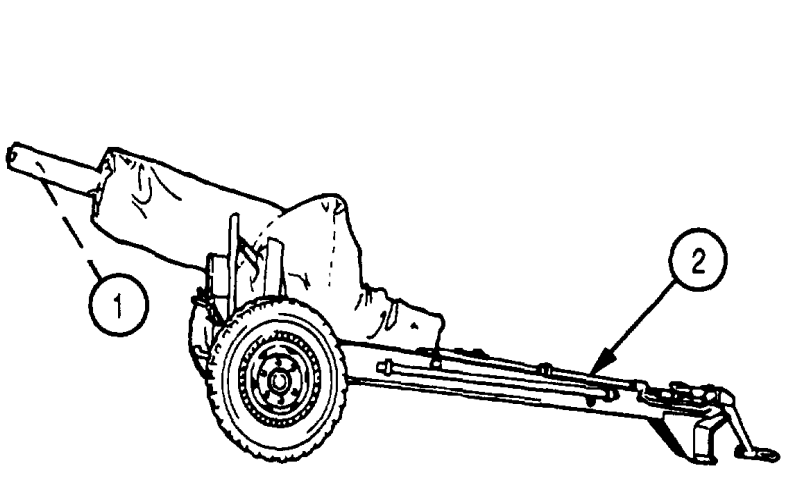
(5) Ammunition team chief releases left handbrake (4).

(6) Ammunition team chief grasps left trail handrail (3).

(7) Driver positions prime mover as directed by chief of section so that drawbar (1) is over pintle (5).



g. Procedure 7.



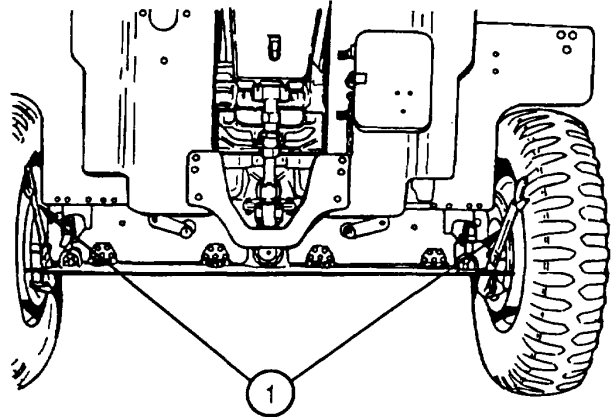
(1) While ammunition team chief places his or her weight on cannon tube (1), assistant gunner and cannoneers no. 1 and 2 raise trails (2).

(2) Assistant gunner and cannoneers no. 1 and 2 lower drawbar (3) on pintle (4). Cannoneer no. 2 latches and secures pintle (4) by installing safety release pin (5) into pintle (4).

2-31. PREPARATION FOR TRAVEL (MARCH ORDER) (Cont)**h. Procedure 8.**

(1) Cannoneer no. 2 installs the taillight assembly on the cannon tube and tightens the pin.

(2) Gunner connects taillight assembly to prime mover.

**i. Procedure 9.**

(1) All crewmembers of the section take their posts (except chief of section) and board prime mover on the chief of section's command, MOUNT.

(2) Driver raises and fastens tailgate, fastens safety strap, and boards cab of prime mover.

(3) Chief of section verifies that:

(a) Handbrakes (1) are released.

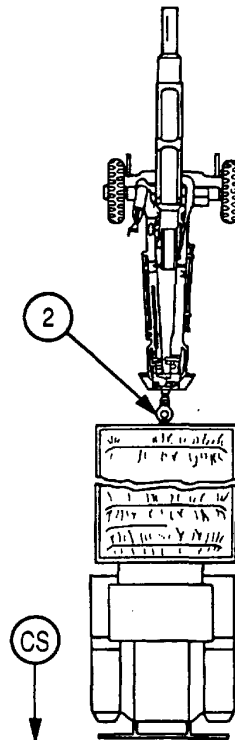
(b) Taillight assembly is connected.

(c) Pintle (2) is latched and locked.

(d) Equipment and crewmembers are aboard and secure.

(e) Tailgate and safety straps are secure.

(f) Reports to executive officer, SIR, NUMBER (SO AND SO) IN ORDER, or reports any defects the section cannot remedy immediately.



Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2-32. GENERAL

This section contains special instructions for operating and servicing the weapon under unusual conditions. In addition to performing all normal preventive maintenance services, special care must be taken in cleaning and lubrication when extremes in temperature, humidity, and terrain conditions are present or expected. Proper cleaning, lubrication, and storage and handling of oil and lubricants not only ensure proper operation and functioning, but also guard against excessive wear of working parts and deterioration of materiel.

2-33. EXTREME COLD WEATHER CONDITIONS

a. General Problems.

(1) Extensive preparation of materiel scheduled for operation in extreme cold weather is necessary. Generally, extreme cold will cause lubricants to thicken or freeze.

CAUTION

It is important that the approved practices and precautions be followed. FM 31-70 contains general cold weather information applicable to the M101A1 howitzer. It must be considered an essential part of this technical manual.

(2) For description of operation in extreme cold, refer to FM 31-70, FM 31-71, and FM 9-207.

b. Fire Control Equipment.

WARNING

To prevent injury to hands, in extreme cold weather, do not grasp metal parts, such as knobs, lever, covers, etc., with bare hands.

(1) When not in use, fire control equipment should be kept covered in the proper carrying cases or properly stowed.

(2) Do not let snow or ice accumulate on equipment. Moving parts must be kept free of moisture.

(3) Use only dry wiping rags and dry lens tissue for cleaning.

CAUTION

Do not force movements beyond their stops.

(4) Working parts may operate or function sluggishly. Operator should be able to tell the difference between sluggishness and lack of movement because of built-in stops.

2-34. EXTREME HOT WEATHER CONDITIONS

a. General Problems.

(1) In hot weather, the film of oil necessary for operation and preservation will quickly disappear. Inspect cannon tube and carriage daily, paying particular attention to hidden surfaces, such as bore and chamber, springs, spring seats, firing pin, and other likely places where corrosion might occur and not be quickly noticed.

(2) Perspiration from the hands can help cause rusting. After handling, clean, wipe dry, and lubricate. (Refer to page 3-1.)

b. Ammunition Problems.

(1) Since explosives are adversely affected by high temperatures, ammunition must be protected from high temperatures, including the direct rays of the sun. Elements in primers and fuzes are particularly sensitive to high temperatures.

WARNING

Do not fire WP projectiles which are known to have been stored in other than a base down position. Firing of such projectiles could contribute to inbore or close-in premature malfunctions, causing hazardous conditions to personnel.

(2) Whenever possible, white phosphorous-loaded smoke projectiles should be stored at temperatures below the melting point (+111.4° F (+44.11° C)) of the white phosphorous filler. If not possible, white phosphorous projectiles should be stored on their bases so that if the filler melts, it will reharden with empty spaces in the normal position (in the nose of the projectile) when the temperature falls below its melting point.

c. **Tires.** Keep tires covered with available materials to protect them from direct rays of the sun, to prevent excessive air pressure, and to prevent deterioration of rubber. Correct tire pressure is 40 psi (276 kPa).

2-35. OPERATION IN HOT, DAMP, AND SALTY ATMOSPHERES

a. Materiel should be inspected daily when being operated in hot, moist, and salty areas.

b. When materiel is active, clean and lubricate bore and exposed metal surfaces daily. (Refer to page 3-1.)

c. Moist and salty atmospheres can destroy the rust-preventive qualities of oils and greases. Inspect parts daily for corrosion. Keep covers in place as much of the time as firing conditions permit.

d. When the materiel is inactive, the unpainted parts should be covered with a film of CLP (item 7, appx E). All covers should be in place.

e. Do not break moisture-resistant seals on ammunition containers until ammunition is to be used.

f. Keep ammunition dry and free from mud, corrosion, or foreign matter. Provide proper drainage around the area to keep it as dry as possible.

g. Proximity (VT) fuzes must be protected against dampness. Although the fuzes are nearly waterproof, any exposure to dampness may increase the number of duds. Rain or immersion in water will speed up deterioration. The storage time of unpacked fuzes should be kept to a minimum, especially in tropical climates. Fuzes must be stored in their original sealed containers as long as it is practical.

h. If moisture is present, notify Unit maintenance.

i. Salt deposits are especially harmful to optical surfaces. Deposits should be loosened by sponging with a clean wiping rag (item 26, appx E). Deposits should not be rubbed.

2-36. UNUSUAL TERRAIN CONDITIONS

NOTE

Never emplace the weapon in swampy areas.

a. Soft or Rough Terrain. When traveling on soft or rough terrain, such as mud, sand, or snow, use care when backing weapon attached to prime mover.

b. Sand, Dust, and Dirt.

(1) Inspect and lubricate materiel (refer to page 3-1) frequently, except exposed lubricated parts, when operating in sandy or dusty areas.

(2) Be careful to keep sand and dust out of mechanisms and oil receptacles when carrying out inspection and lubrication operations and when making adjustments and repairs.

(3) Keep all covers in place as much of the time as firing conditions permit.

(4) Shield parts from flying sand and dust with tarpaulins or with telescope and mount covers during disassembly and assembly operations.

(5) When beginning an action in sandy or dusty areas, remove lubricants from recoil rails and any other exposed lubricated parts, situation permitting. Lubricants will pick up sand and dirt, forming an abrasive which will cause rapid wear. With surfaces dry, there is less wear than when they are coated with lubricant contaminated with sand or dirt.

CAUTION

At no time is gasoline or any solvent to be used to remove oil or grease spots from canvas.

(6) Clean and lubricate all exposed parts (refer to page 3-1) after the action is over.

2-37. FORDING OPERATIONS

a. Shallow-Water Fording.

(1) Cover weapon with provided covers to protect it from water splashing against it.

(2) During fording operations, watch for water seepage into gear housing or other parts which could contaminate the lubricant.

(3) If complete submersion occurs, weapon will be treated as described below.

b. After-Fording Operations.

(1) Immediately after weapon is towed from water, if tactical situation permits, perform the following services:

(a) Notify Unit maintenance to remove wheel and hub assemblies and thoroughly clean and dry all working parts of brakes and wheel bearings. (Refer to page 5-53.) Lubricate assemblies in accordance with lubrication instructions. (Refer to page 3-1.)

(b) Empty any accumulated water from materiel. Clean, dry, and apply prescribed lubricant to all exposed unpainted surfaces, paying special attention to the bore, chamber, and cradle rails.

(c) Remove all drain plugs to allow trapped water to drain out.

(2) If parts of materiel are accidentally submerged or splashed, apply temporary preservative and notify Unit maintenance so that necessary complete disassembly, cleaning, and lubrication may be performed as soon as possible.

CAUTION

Wet canvas should be dried thoroughly before folding.

(3) Salt-water immersion greatly increases rusting and corrosion. It is most important to remove all salt water deposits from every part of weapon. Apply temporary preservative and notify crew to perform maintenance so that necessary complete disassembly, cleaning, and lubrication may be performed as soon as possible.

CHAPTER 3 OPERATOR MAINTENANCE

Section I. LUBRICATION INSTRUCTIONS

3-1. GENERAL

a. Introduction. The lube instructions prescribe cleaning and lube procedures, proper materials for lubing, and lube intervals. The lube location is also included. The lube instructions are divided according to maintenance levels and lube intervals; i.e., all operator daily lube instructions are together, all operator weekly lube instructions are together, all monthly lube instructions are together, and all unit annual lube instructions are together. Overall views showing lube points precede the detailed notes for each interval.

NOTE

The lubrication instructions are mandatory.

b. General Lube Instructions.

(1) Service Intervals. Service intervals specified in the lube instructions are for normal operation and when moderate temperature, humidity, and atmospheric conditions prevail. In hot, humid, and dusty areas, or if rain or snow exists, lubricate and clean more frequently. Daily lubing means once each day after weapon has been fired unless specified otherwise.

(2) Lube Equipment. Each weapon is supplied with lube equipment adequate for its maintenance. Clean this equipment with a wiping rag (item 25, appx E) before and after use. Use lubricating guns carefully to make sure of proper distribution of lubricant.

(3) Grease and Oil Points. Lube fittings and oil holes are shown in the lube instructions. Wipe these items and the surrounding surfaces with a wiping rag (item 25, appx E) before lubricant is applied. If a lube fitting is missing, cover the hole with tape to keep out the dirt. A new lube fitting must be installed as soon as possible.

NOTE

**CLP (item 7, appx E) is the main lubricant for the oil can points and for lubrication after cleaning.
GAA (item 13, appx E) will be used as the main lubricant for unit lubing at lube fittings.**

LUBE INSTRUCTIONS

Intervals are based on normal operation. Lube more during constant use and less during inactive periods.

Relubricate after washing or fording.

DO NOT overlubricate. Wipe off excess lubricant.



Dotted lines indicate lube points on both sides of the equipment.

KEY

MAINTENANCE

- C Operator/Crew
- O Unit

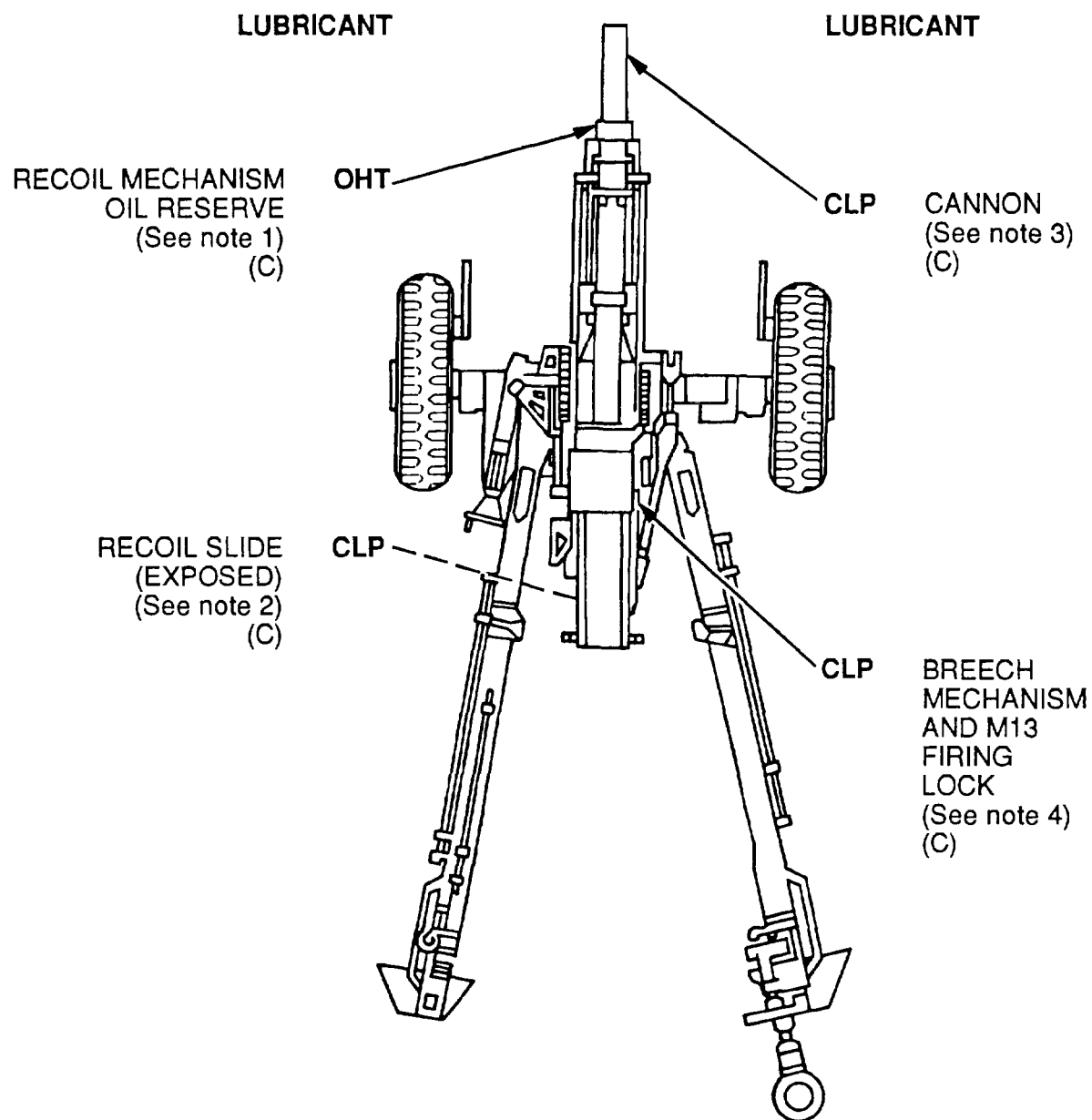
LEVEL LUBRICATION POINTS

- GREASE**
- GAA 
- LUBE**
- CLP 
- OHT

LUBRICANTS

- CLP** Cleaner, Lubricant, Preservative, MIL-L-63460 (item 7, appx E)
- GAA** Grease, Automotive and Artillery, MIL-G-10924 (item 13, appx E)
- OHT** Hydraulic Fluid, Petroleum Base, Preservative, MIL-H-6083 (item 14, appx E)

DAILY LUBING

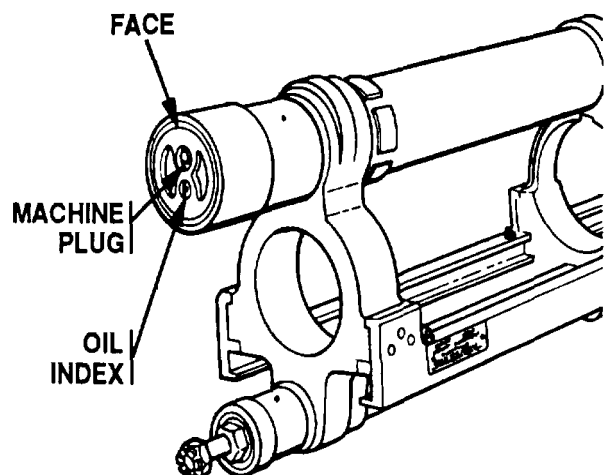


TOP VIEW

DAILY NOTES

NOTE 1

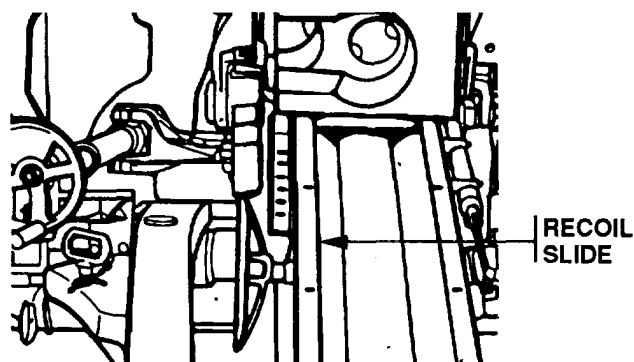
RECOIL MECHANISM OIL RESERVE (C)



Check daily when firing. Full reserve of oil is indicated when oil index is flush with face of recuperator cylinder front head assembly. If oil index is below face, remove machine plug above oil index and add OHT (item 14, appx E). (Refer to page 3-50.)

NOTE 2

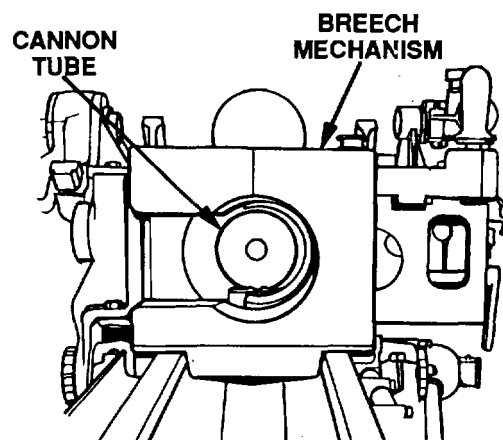
RECOIL SLIDE (EXPOSED) (C)



Clean with wiping rag (item 26, appx E) and cleaning compound (item 9, appx E), and apply light coat of CLP (item 7, appx E).

NOTE 3

CANNON (C)



Cannon tube is cleaned on day of firing immediately after firing is completed. Apply CLP (item 7, appx E) to bore brush, using approximately 5 to 6 ounces during cleaning operation. Wet punch cannon tube thoroughly with bore-cap brush at least 10 times, using a scrubbing action. Check bore-cap brush after every two or three punches to make sure it is still soaked with CLP (item 7, appx E). Day after firing, soak a wiping rag (item 26, appx E) wrapped around bore-cap brush with CLP (item 7, appx E) and wet punch cannon tube at least 10 times. Wrap clean wiping rag (item 26, appx E) around bore-cap brush and dry punch cannon tube at least 10 times.

OR

The artillery cleaning kit (item 15, appx E) (bore-cap) may be used as an optional method for cleaning and preserving the cannon on day of firing or after day of firing.

CAUTION

The bore-cap brush assembly issued with the artillery cleaning kit (item 15, appx E) should not be used with RBC. RBC will destroy the bore-cap brush assembly.

DAILY NOTES (cont)**NOTE 3 (cont)****NOTE**

Shake the bottle well before each use.

On day of firing, remove one bottle of premeasured CLP (item 7, appx E) and one bore-cap brush assembly from kit. Attach nylon bore-cap brush assembly to standard U.S. Army rammer staff. Inspect breech mechanism and cannon tube; clear obstructions. Wet punch cannon tube. Pour 1/4-bottle of CLP (item 7, appx E) onto bore-cap brush assembly and punch cannon tube once forward and back. Repeat process with second, third, and final 1/4 of premeasured bottle of CLP (item 7, appx E).

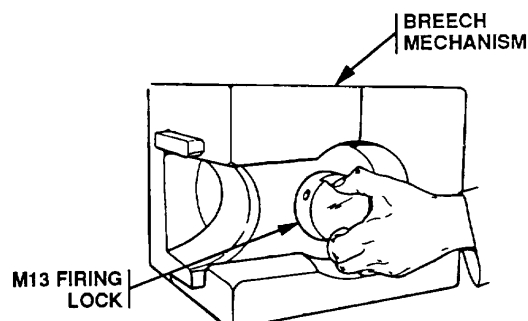
On the day after firing, remove two bottles of premeasured CLP (item 7, appx E), three cleaning sleeves (item 10, appx E), and one bore-cap brush assembly. Attach bore-cap brush assembly to standard U.S. Army rammer staff and wet punch cannon tube with one bottle of premeasured CLP (item 7, appx E) following procedures for day of firing above. Next dry punch cannon tube. Wrap bore-cap brush assembly with a new cleaning sleeve (item 10, appx E) and dry punch entire length of cannon tube once forward and back. Remove and dispose of cleaning sleeve. Wrap bore-cap brush assembly with new cleaning sleeve (item 10, appx E) and prepare wet punch with 1/2 of premeasured bottle of CLP (item 7, appx E). Wet punch entire length of cannon tube once forward and once back. Remove and dispose of cleaning sleeve (item 10, appx E). Repeat wet punch with last 1/2 of bottle.

NOTE

If cannon tube has not been previously cleaned with CLP (item 7, appx E) and there is a heavy build-up of coppering or carbon deposits, or severe heat cracking, it may be necessary to repeat cleaning instructions until cannon tube has been thoroughly cleaned with CLP (item 7, appx E).

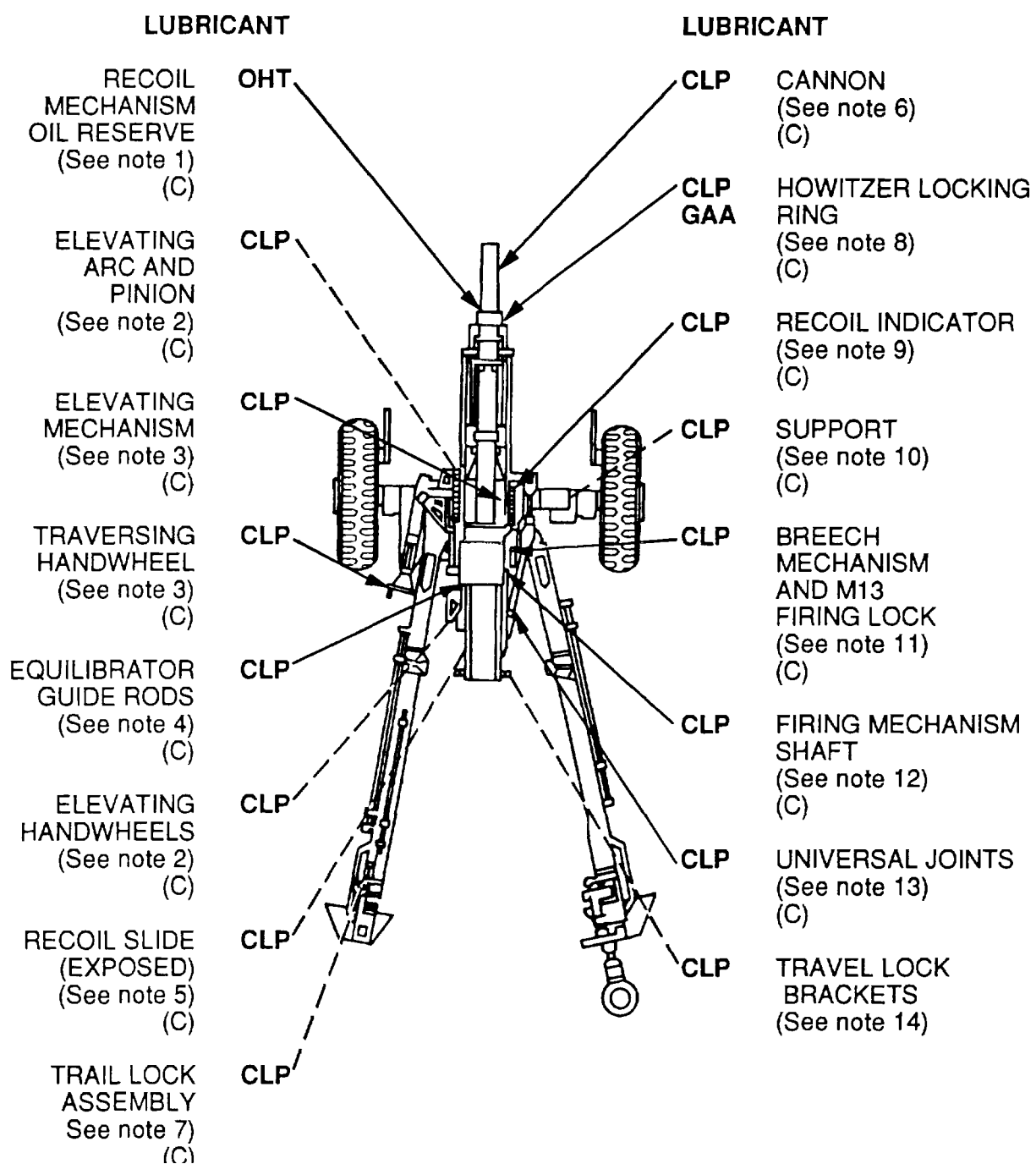
NOTE 4**BREECH MECHANISM AND M13 FIRING LC**

Immediately after firing and day after firing, disassemble breech mechanism. (Refer to page 3-37.) Clean all parts with wiping rag (item 25, appx E) and CLP (item 7, appx E); wipe dry with a clean wiping rag (item 25, appx E). Inspect for damaged or worn parts, and lubricate with CLP (item 7, appx E).

**OR**

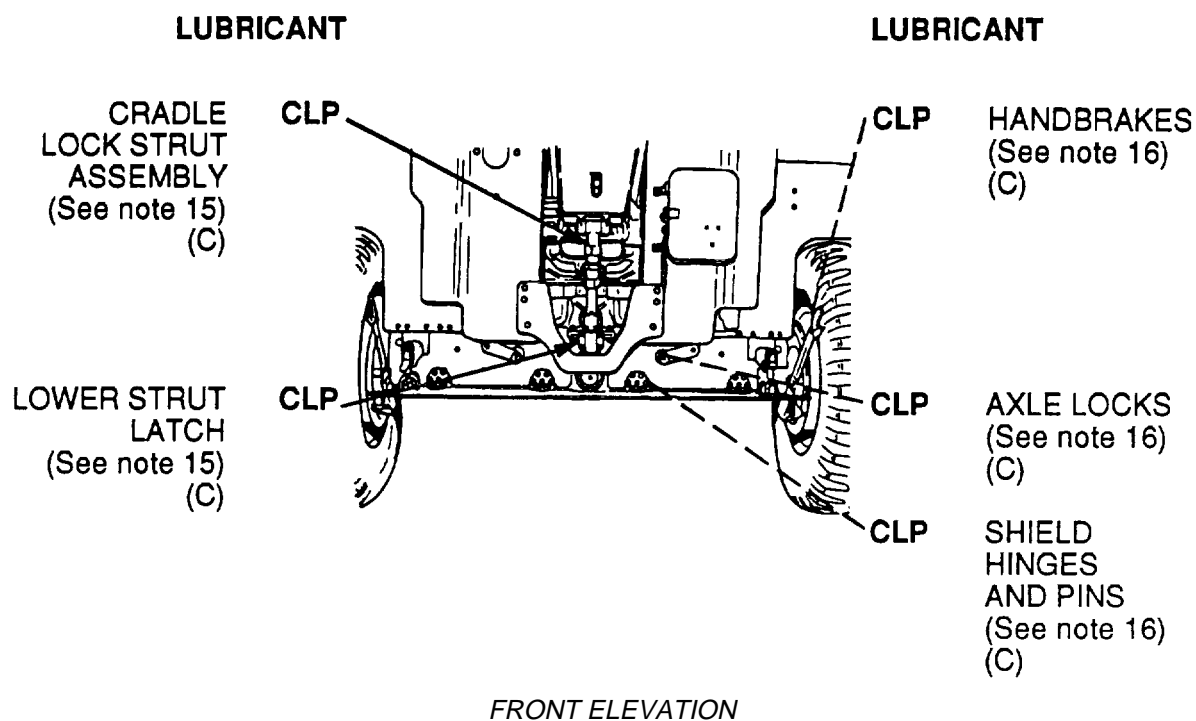
The artillery cleaning kit (item 15, appx E) may be used as an optional method for cleaning and preserving the breech mechanism. On day of firing remove 1-l bottle of CLP (item 7, appx E) (with trigger sprayer and rags) from general supply. Wet all breech components thoroughly with CLP (item 7, appx E). Soak for 10 to 15 minutes and then wipe off. Reapply a coat of CLP (item 7, appx E). Spray CLP (item 7, appx E) onto all exposed metal surfaces.

WEEKLY LUBING



TOP VIEW

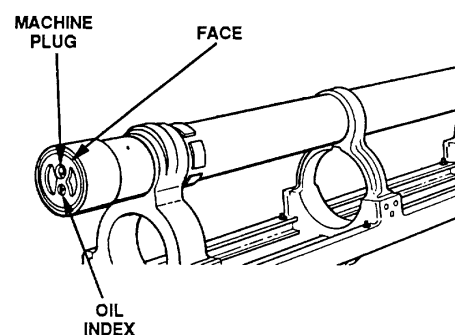
WEEKLY LUBING (cont)



WEEKLY NOTES

NOTE 1**RECOIL MECHANISM OIL RESERVE (C)**

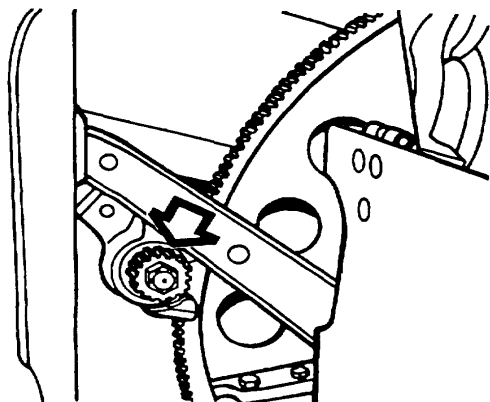
Check oil reserve. Full reserve of oil is indicated when oil index is flush with face of recuperator cylinder front head assembly. If oil index is below face, remove machine plug above oil index and add OHT (item 14, appx E). (Refer to page 3-50.)



WEEKLY NOTES (cont)

NOTE 2

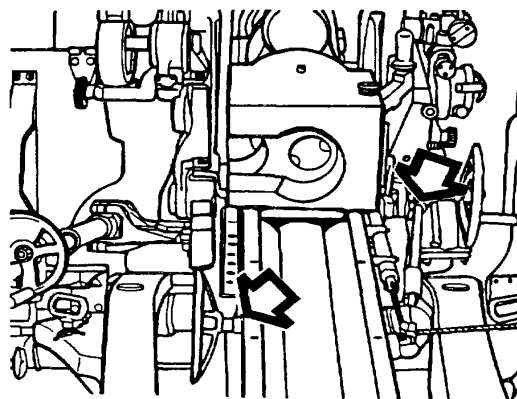
ELEVATING ARC AND PINION (C)



Lubricate with CLP (item 7, appx E).

NOTE 3

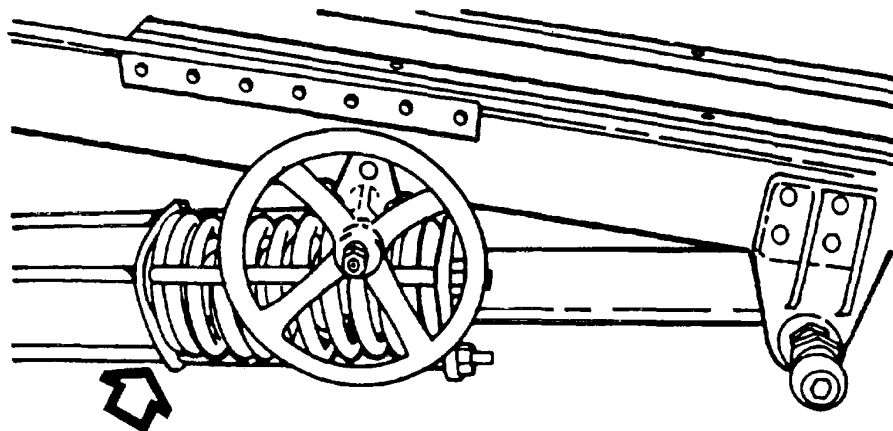
ELEVATING MECHANISM, TRAVERSING HANDWHEEL, AND ELEVATING HANDWHEELS (C)



Lubricate oil can points with CLP (item 7, appx E).

NOTE 4

EQUILIBRATOR GUIDE RODS (C)

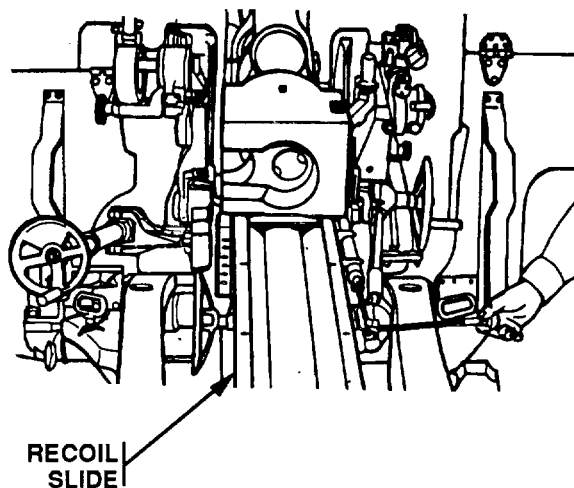


Lubricate oil can point with CLP (item 7, appx E).

WEEKLY NOTES (cont)

NOTE 5

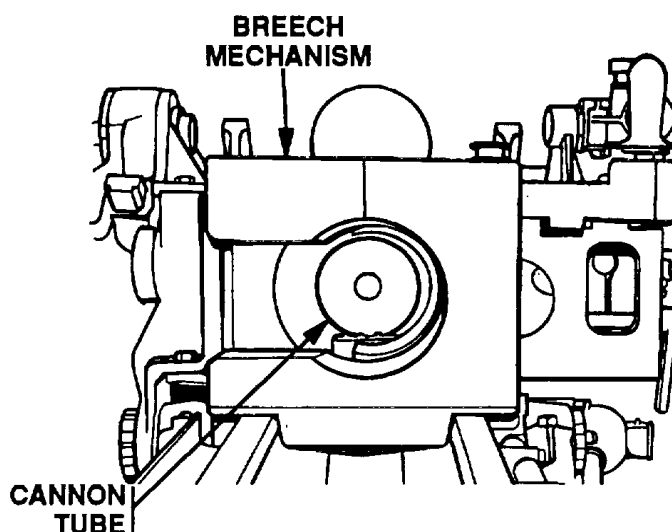
RECOIL SLIDE (EXPOSED) (C)



Clean with wiping rag (item 26, appx E) and cleaning compound (item 9, appx E), and apply light coat of CLP (item 7, appx E).

NOTE 6

CANNON (C)

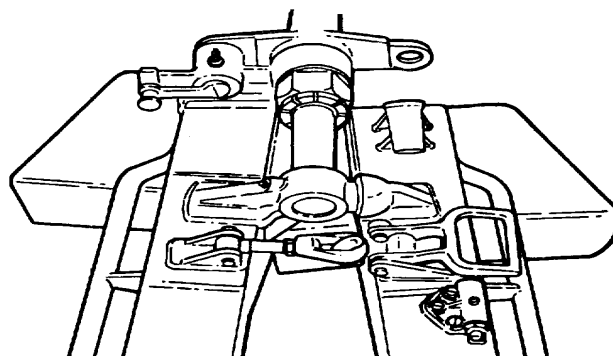


When weapon is not being fired, soak a wiping rag (item 26, appx E) wrapped around bore-cap brush with CLP (item 7, appx E) and wet punch cannon tube at least 10 times. Wrap clean wiping rag (item 26, appx E) around bore-cap brush and dry punch cannon tube at least 10 times. Wrap clean wiping rag (item 26, appx E) around bore-cap brush soaked with CLP (item 7, appx E) and wet punch cannon tube at least five times.

NOTE 7

TRAIL LOCK ASSEMBLY (C)

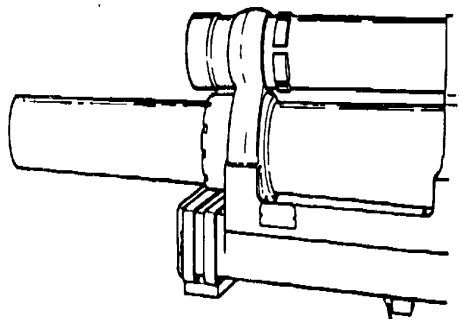
Lubricate with CLP (item 7, appx E).



WEEKLY NOTES (cont)

NOTE 8

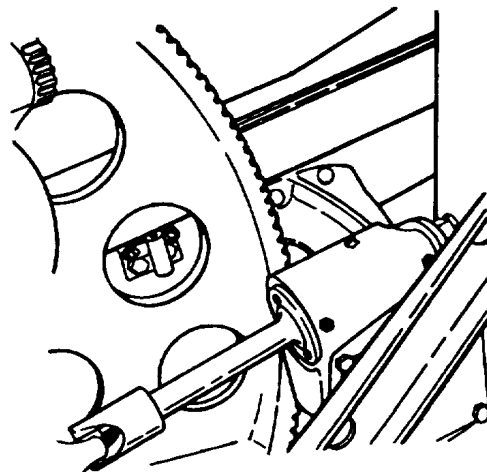
HOWITZER LOCKING RING (C) RECOIL INDICATOR (C)



Clean howitzer locking ring and bearing surface with CLP (item 7, appx E), wipe dry, and lubricate bearing surfaces with GAA (item 13, appx E). Coat howitzer locking ring with GAA (item 13, appx E)

NOTE 9

RECOIL INDICATOR (C)

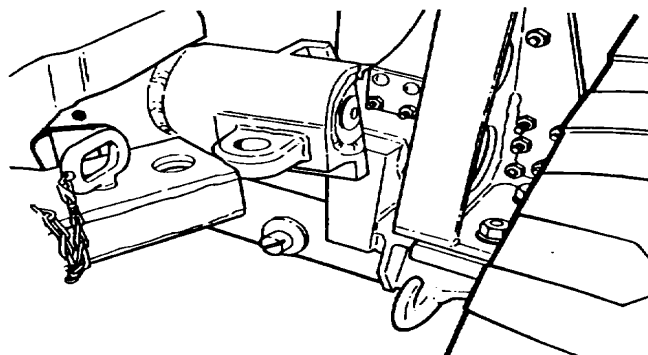


Lubricate oil can point with CLP (item 7, appx E)

NOTE 10

SUPPORT (C)

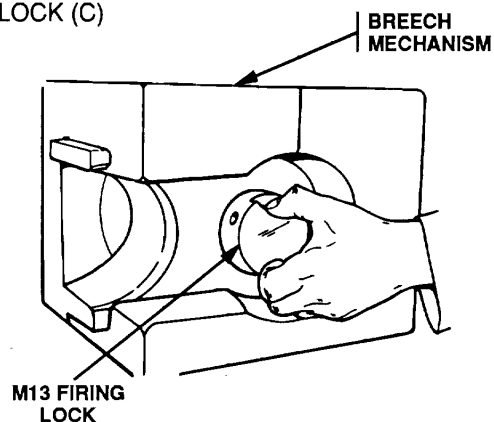
Clean support and bearing surfaces with wiping rags (item 26, appx E) and cleaning compound (item 9, appx E). Wipe dry with wiping rag (item 26, appx E) and lubricate with CLP (item 7, appx E). Support must be kept clean and well oiled at all times to prevent rust. Release axle locks, lift up and swing right trail to center. Weapon should tilt. Repeat procedure with left trail



WEEKLY NOTES (cont)

NOTE 11

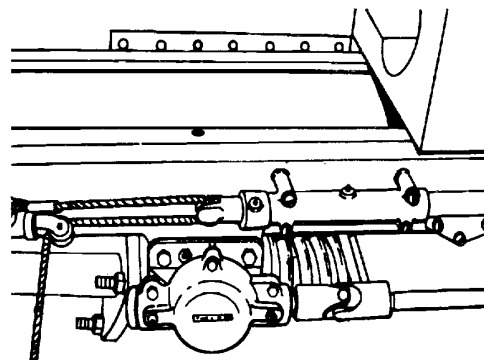
BREECH MECHANISM AND M13 FIRING LOCK (C)



Disassemble breech mechanism. (Refer to page 3-37.) Clean all parts with wiping rag (item 26, appx E) and CLP (item 7, appx E), wipe dry with a clean wiping rag (item 26, appx E), and lubricate with CLP (item 7, appx E).

NOTE 12

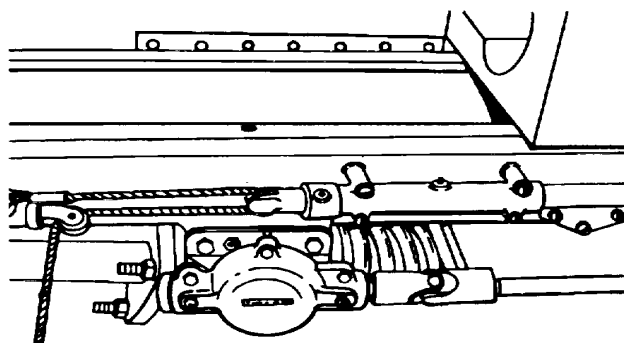
FIRING MECHANISM SHAFT (C)



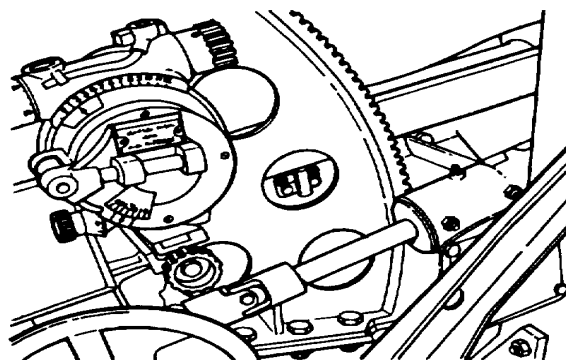
Oil with CLP (item 7, appx E).

NOTE 13

UNIVERSAL JOINTS (C)



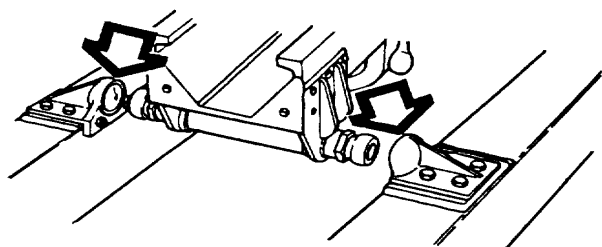
Lubricate oil can points with CLP (item 7, appx E).



WEEKLY NOTES (cont)

NOTE 14

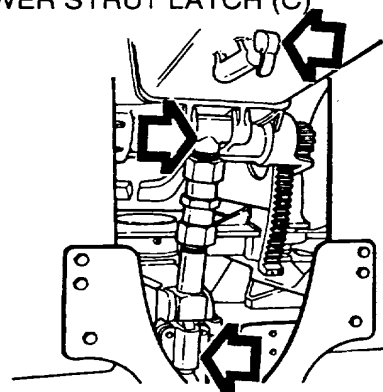
TRAVEL LOCK BRACKETS (C)



Lubricate oil can points with CLP (item 7, appx E).

NOTE 15

CRADLE LOCK STRUT ASSEMBLY AND LOWER STRUT LATCH (C)



Elevate howitzer. Lubricate oil can points lightly with CLP (item 7, appx E).

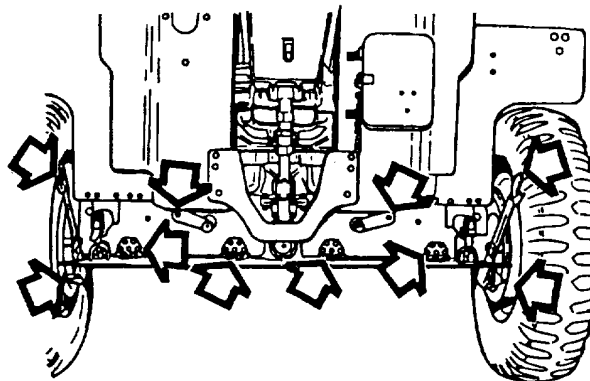
NOTE 16

HANDBRAKES, AXLE LOCKS, AND SHIE HINGES AND PINS (C)

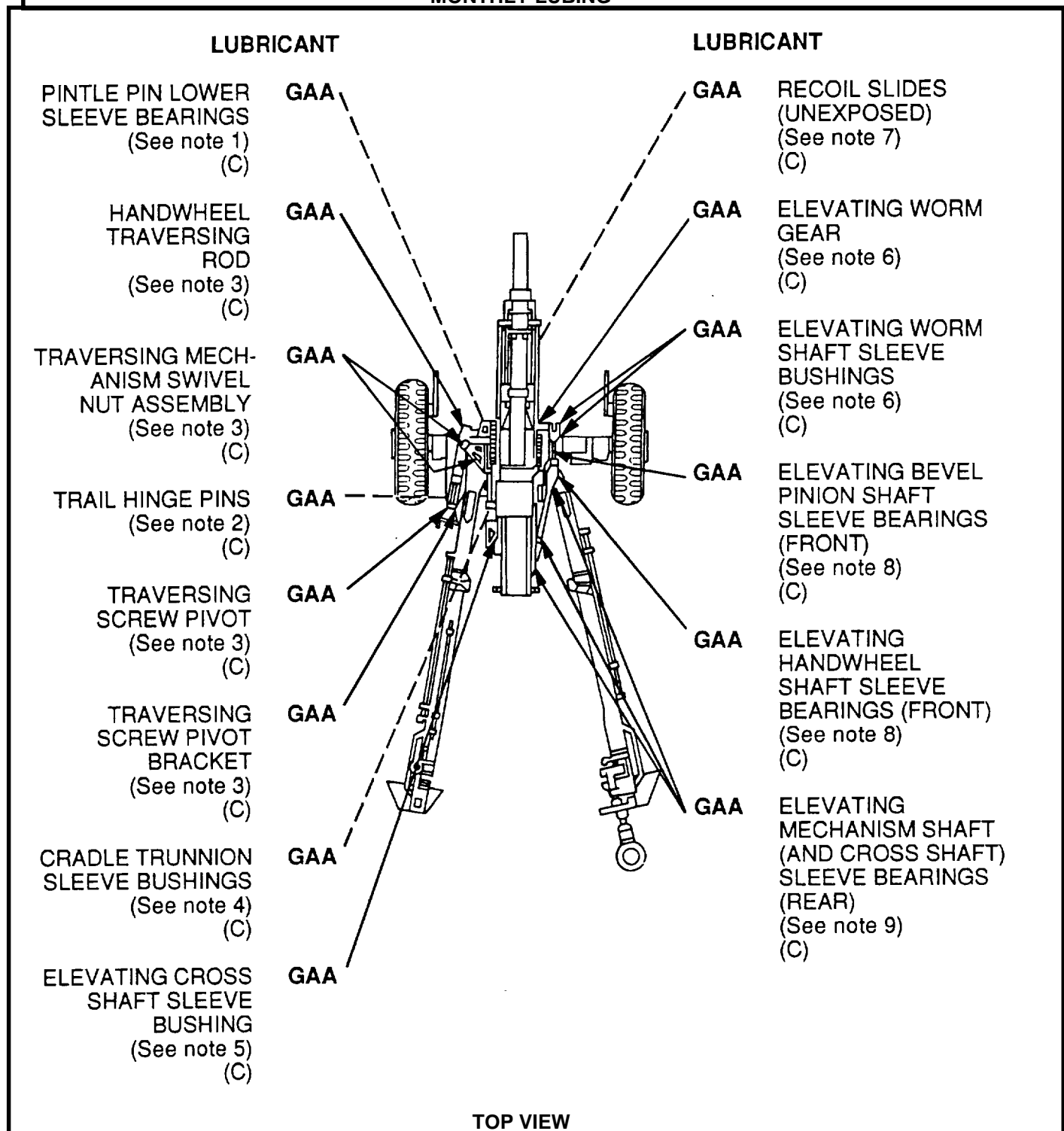
WARNING

Lock trail when howitzer is tilted to prevent injury to fingers when lubricating axle locks.

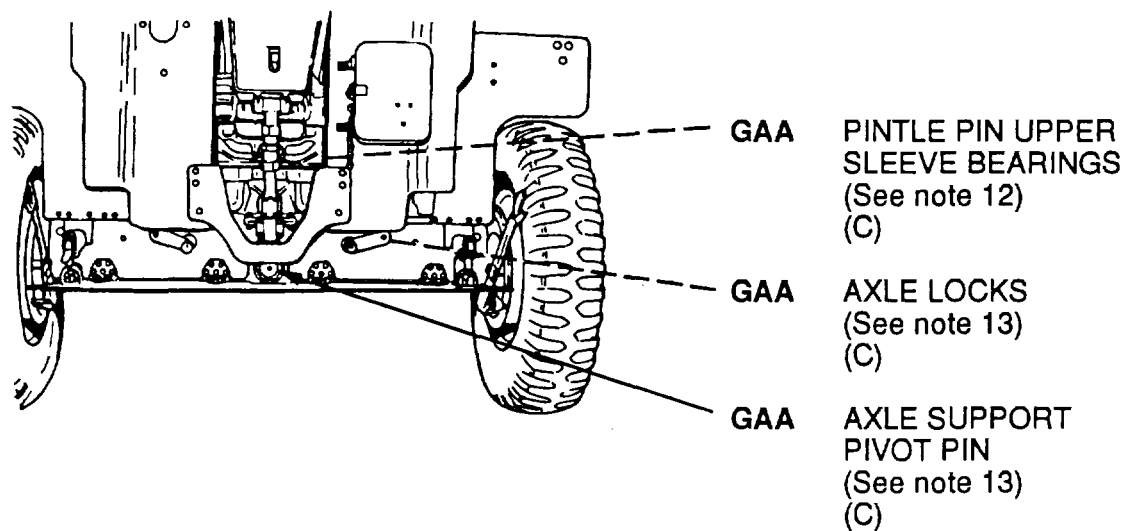
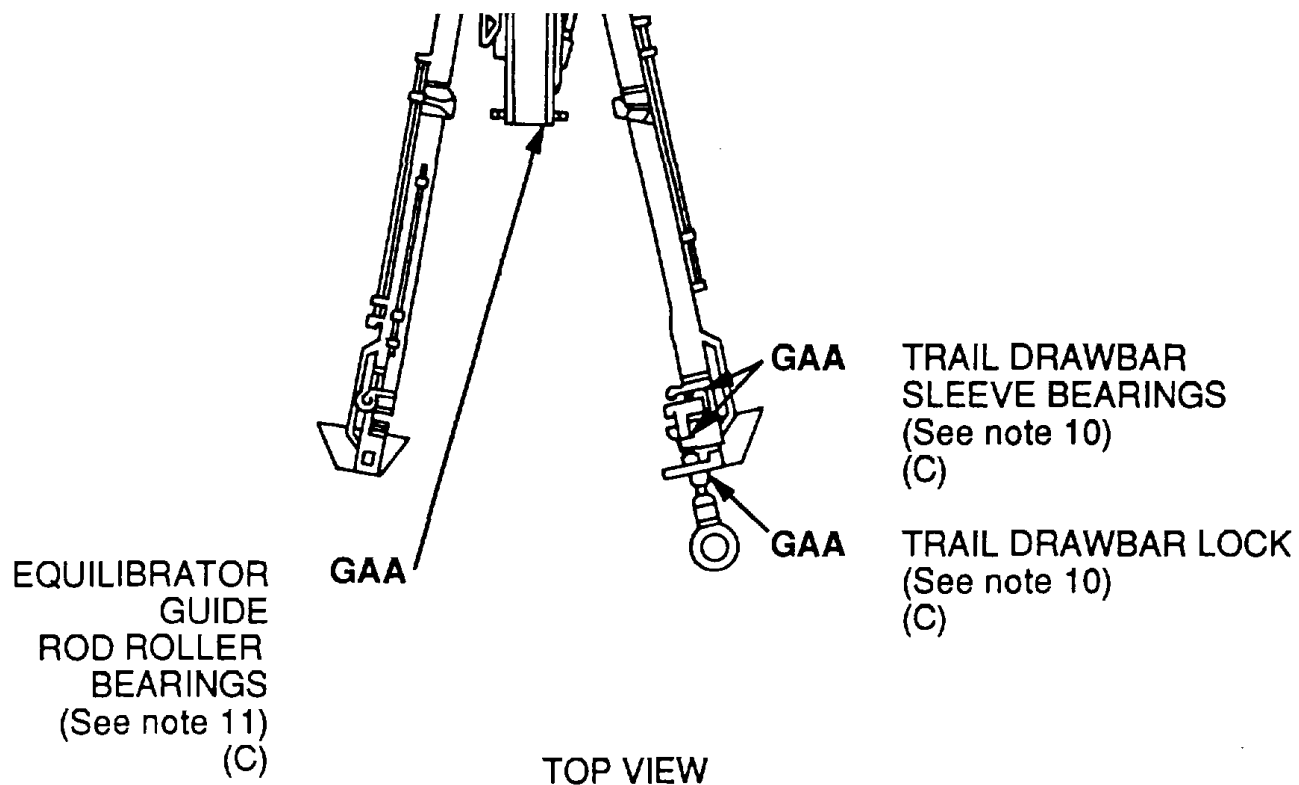
Lubricate oil can points with CLP (item 7, appx E).



MONTHLY LUBING



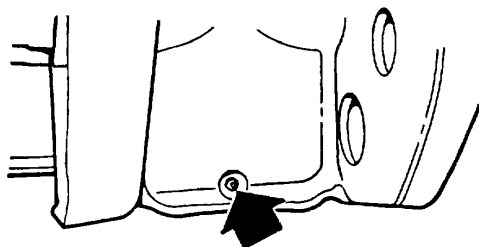
MONTHLY LUBING (cont)



MONTHLY NOTES

NOTE 1

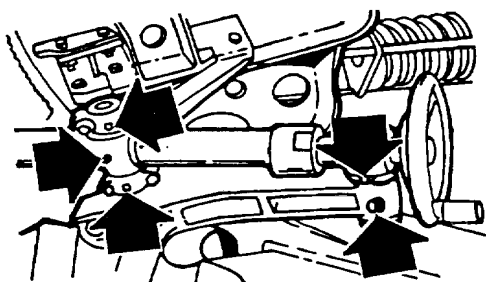
PINTLE PIN LOWER SLEEVE BEARINGS
(C)



To reach lube fitting, level cannon tube to 0-mil elevation. Lubricate pintle pin lower sleeve bearing with GAA (item 13, appx E)

NOTE 3

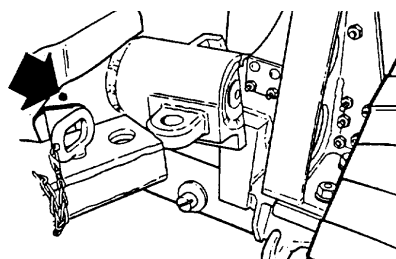
TRAVERSING MECHANISM SWIVEL NUT ASSEMBLY, HANDWHEEL TRAVERSING ROD, TRAVERSING SCREW PIVOT, AND TRAVERSING SCREW PIVOT BRACKET
(C)



Lubricate with GAA (item 13, appx E)

NOTE 2

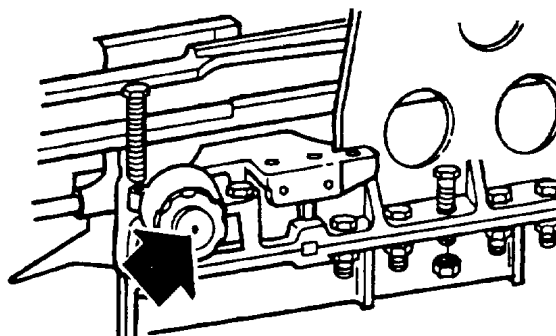
TRAIL HINGE PINS (C)



Close trails. Lubricate with GAA (item 13, appx E). Some models have only one lube fitting.

NOTE 4

CRADLE TRUNNION SLEEVE BUSHINGS
(C)

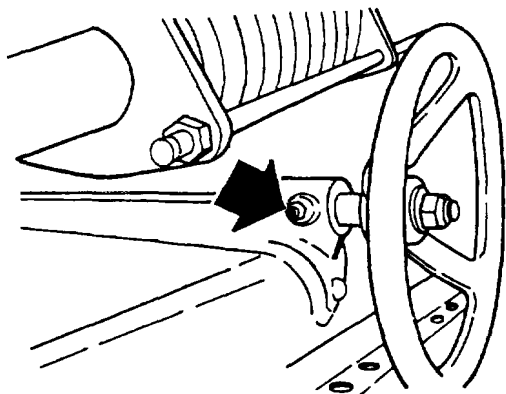


Lubricate with GAA (item 13, appx E)

MONTHLY NOTES (cont)

NOTE 5

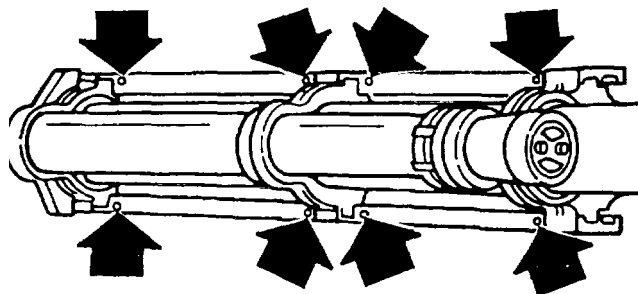
ELEVATING CROSS SHAFT SLEEVE BUSHING (C)



Lubricate with GAA (item 13, appx E).

NOTE 7

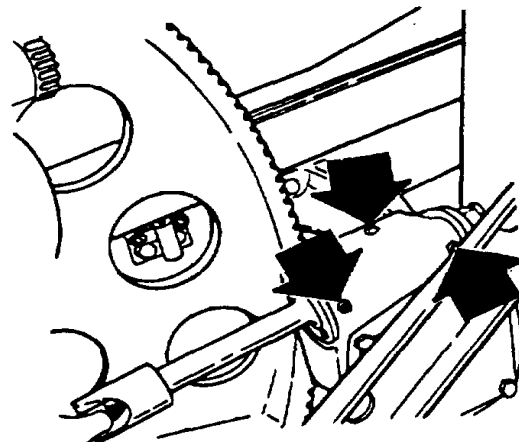
RECOIL SLIDES (UNEXPOSED) (C)



Lubricate with GAA (item 13, appx E)

NOTE 6

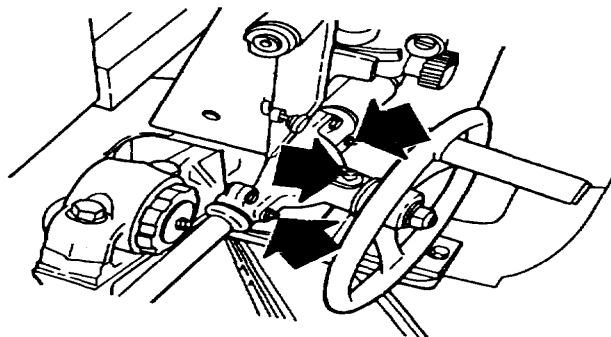
ELEVATING WORM GEAR AND ELEVATING WORM SHAFT SLEEVE BUSHINGS (C)



Lubricate with GAA (item 13, appx E).

NOTE 8

ELEVATING BEVEL PINION SHAFT SLEEVE BEARINGS (FRONT) AND ELEVATING HANDWHEEL SHAFT SLEEVE BEARINGS (FRONT) (C)

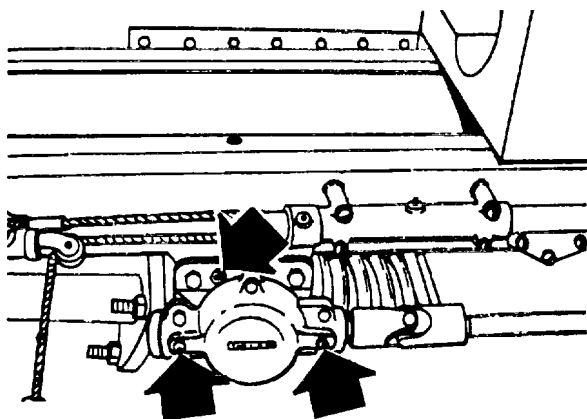


Lubricate with GAA (item 13, appx E).

MONTHLY NOTES (cont)

NOTE 9

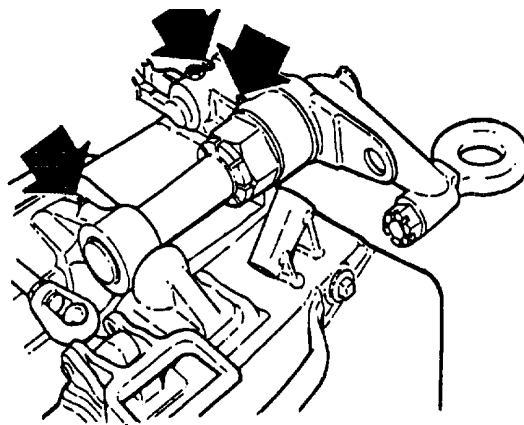
ELEVATING MECHANISM SHAFT (AND
CROSS SHAFT) SLEEVE BEARINGS
(REAR) (C)



Lubricate with GAA (item 13, appx E)

NOTE 10

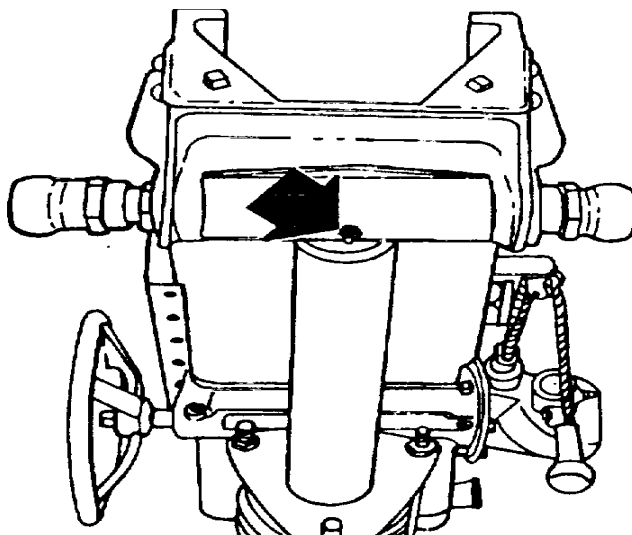
TRAIL DRAWBAR SLEEVE BEARINGS
AND TRAIL DRAWBAR LOCK (C)



Lubricate with GAA (item 13, appx E).

NOTE 11

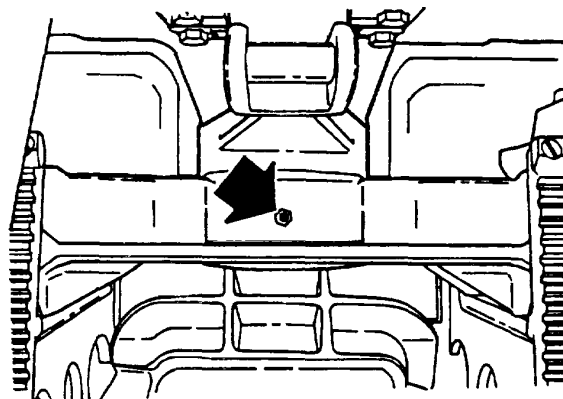
EQUILIBRATOR GUIDE ROD ROLLER
BEARINGS (C)



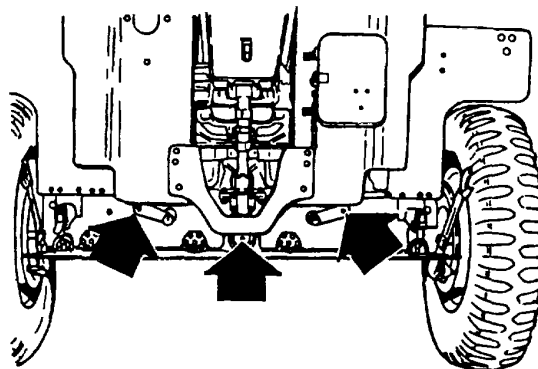
Lubricate with GAA (item 13, appx E).

MONTHLY NOTES (Cont)**NOTE 12****PINTLE PIN UPPER SLEEVE BEARINGS (C)**

Elevate howitzer to lubricate pintle pin upper sleeve bearings with GAA (item 13, appx E).

**NOTE 13****AXLE LOCKS AND AXLE SUPPORT PIVOT PIN (C)**

Lubricate with GAA (item 13, appx E).

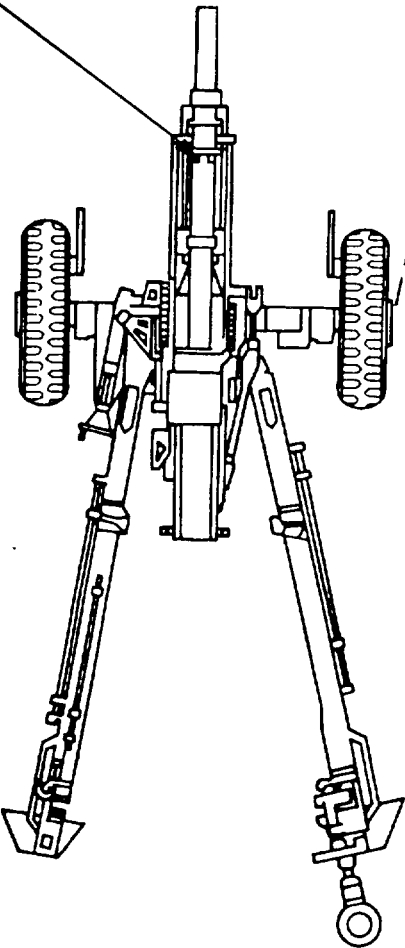


ANNUAL LUBING

LUBRICANTLUBRICANT

RECOIL MECHANISM
(See note 1)
(O)

GAA
CLP



GAA
CLP

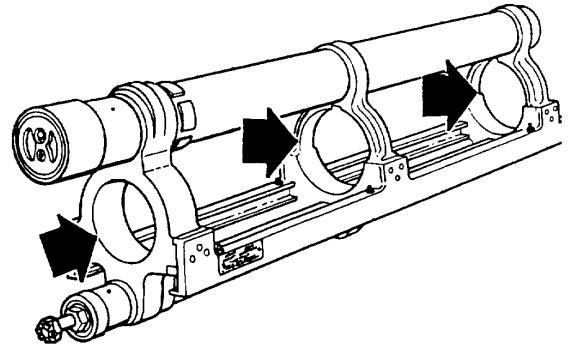
WHEEL BEARINGS
(See note 2)
(O)

ANNUAL NOTES

NOTE 1

RECOIL MECHANISM (O)

Remove recoil mechanism (refer to page 5-43) and clean with CLP (item 7, appx E); lightly coat bearing surfaces with GAA (item 13, appx E).



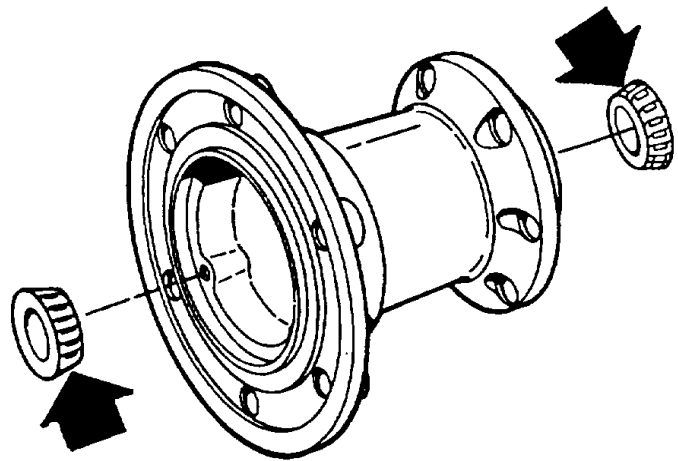
NOTE 2

WHEEL BEARINGS (O)

CAUTION

Do not use compressed air to clean wheel bearings. Moisture in compressed air may damage equipment.

Remove wheel bearings. (Refer to page 5-57.) Clean thoroughly with CLP (item 7, appx E) or cleaning compound (item, appx E), and dry thoroughly. Pack GAA (item 13, appx E) into wheel bearings until it comes out other side through rollers. Relubricate with GAA (item 13, appx E) after washing or fording.



Section II. TROUBLESHOOTING PROCEDURES

3-2. TROUBLESHOOTING INFORMATION

a. The malfunction index can be used as a quick guide to troubleshooting. Common malfunctions are listed in alphabetical order with a page number reference to the troubleshooting table where a test or inspection and corrective action are provided.

b. Table 3-1 (refer to page 3-22) lists the common malfunctions found during the operation or maintenance of the M101 A1 howitzer or its components. Perform the tests/inspections and corrective actions in the order listed.

c. 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 Unit maintenance.

d. Refer to lubrication instructions (refer to page 3-1) for location of lubricating points.

MALFUNCTION INDEX

	Troubleshooting Procedure (Page)
CANNON	
Breechblock fails to close	3-22
Cartridge case fails to extract	3-23
Howitzer fails to fire	3-22
RECOIL MECHANISM	
Howitzer returns to battery too slowly	3-26
Howitzer slams into battery	3-25
Oil index does not move from a low position when oil is added	3-28
Recoil mechanism leaks	3-24
There is insufficient recoil	3-27
There is uneven or spasmodic counterrecoil	3-27
Weapon recoils too far	3-27
CARRIAGE	
Elevating mechanism jams	3-28
Handbrakes are worn or inoperative.....	3-32
Howitzer is difficult to elevate or depress.....	3-29
Howitzer is difficult to traverse	3-30
There is play in traversing handwheel or elevating handwheels.....	3-30
Tires are worn	3-31
FIRE CONTROL EQUIPMENT	
Fire control knobs do not turn freely	3-33
Fitted parts of fire control equipment are loose	3-32
M1A1 collimator reticle image is not sharp	3-34
There is moisture in fire control equipment.....	3-33
TAILLIGHT ASSEMBLY	
Taillights will not work	3-34

3-3. TROUBLESHOOTING PROCEDURES

Table 3-1. TROUBLESHOOTING

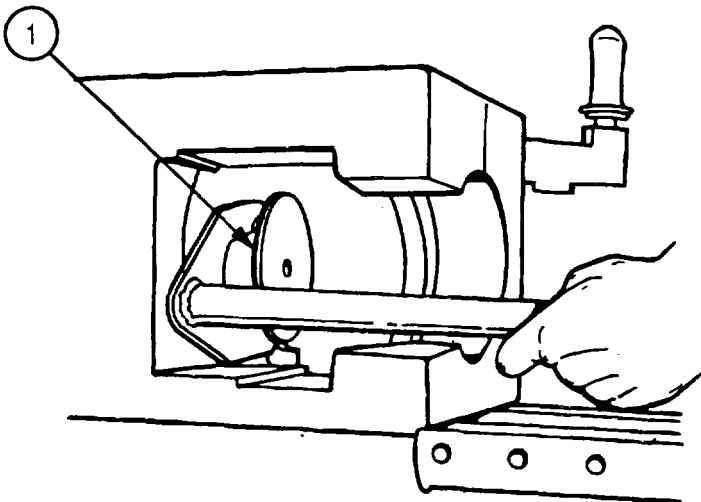
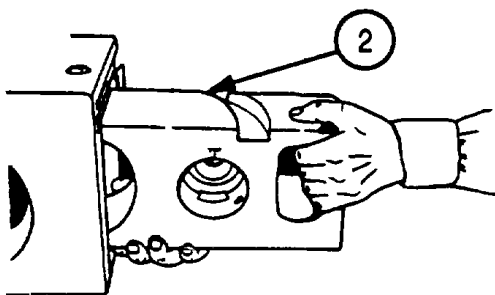
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
CANNON		
1 HOWITZER FAILS TO FIRE.		Follow misfire/checkfire procedures (refer to page 4-33); check for defective round or broken firing pin. Notify Unit maintenance.
2. BREECHBLOCK FAILS TO CLOSE.		Step 1. Check for round not fully chambered. If cartridge case (1) is cracked or deformed, remove using rammer extractor tool and notify Ammunition section.
		

Table 3-1. TROUBLESHOOTING (cont)

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

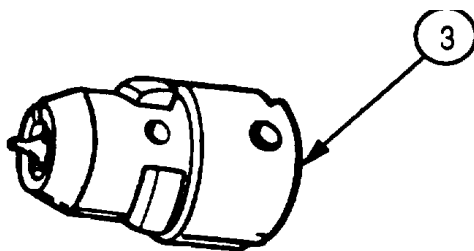
Step 2. Check for obstructions, nicks, burrs, gouges, or rough spots on operating surface of breechblock (2).

Remove obstructions. Notify Unit maintenance to remove nicks, burrs, and rough spots, or if malfunction is not corrected.



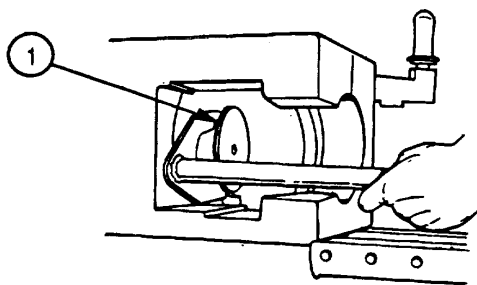
Step 3. Check for defective M13 firing lock (3). (Refer to page 3-43.)

Notify Unit Maintenance.

**3. CARTRIDGE CASE FAILS TO EXTRACT.**

Step 1. Check for deformed cartridge case (1).

Remove cartridge case, using rammer extractor tool.



3-3. TROUBLESHOOTING PROCEDURES (cont)*Table 3-1. TROUBLESHOOTING (cont)*

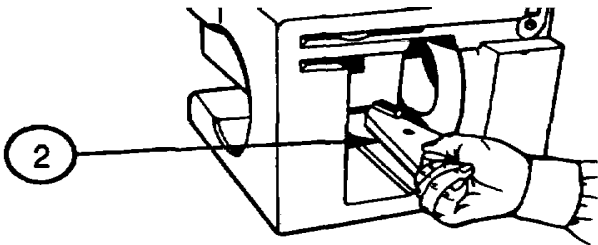
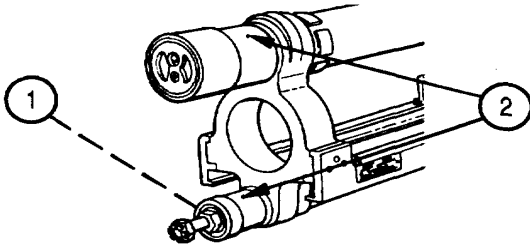
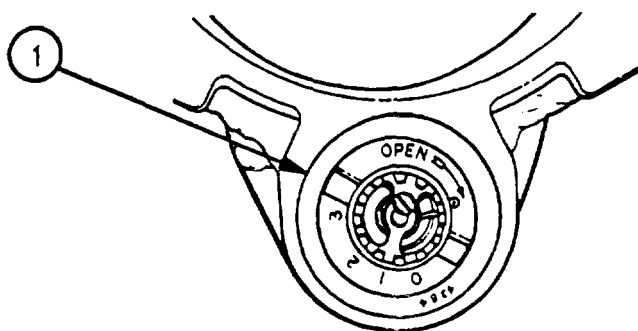
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
CANNON (cont)		
3. CARTRIDGE CASE FAILS TO EXTRACT. (cont)		
	Step 2. Check for burred, worn, or broken cartridge extractor (2).	Notify Unit maintenance.
	Step 3. Check for foreign matter in chamber.	
	Disassemble breech mechanism (refer to page 3-37) and examine for cracks and deformities. Clean all parts with wiping rag (item 26, appx E) and CLP (item 7, appx E). Wipe dry with a clean wiping rag (item 26, appx E), and lubricate with CLP (item 7, appx E).	
		
	RECOIL MECHANISM	
4. RECOIL MECHANISM LEAKS.		
	Check recoil mechanism for leaks around stuffing box assembly (1) and purging setscrews (2), and check rate of leakage.	
	If leakage exceeds three drops per minute (class III leaks), notify Unit maintenance.	
		

Table 3-1. TROUBLESHOOTING (cont)

MALFUNCTION**TEST OR INSPECTION****CORRECTIVE ACTION****5 HOWITZER SLAMS INTO BATTERY.**

Step 1. Check for high setting (setting of 2 or 3) or dirty respirator (1). Using respirator wrench, reduce respirator setting to 1. Notify Unit maintenance to clean respirator.

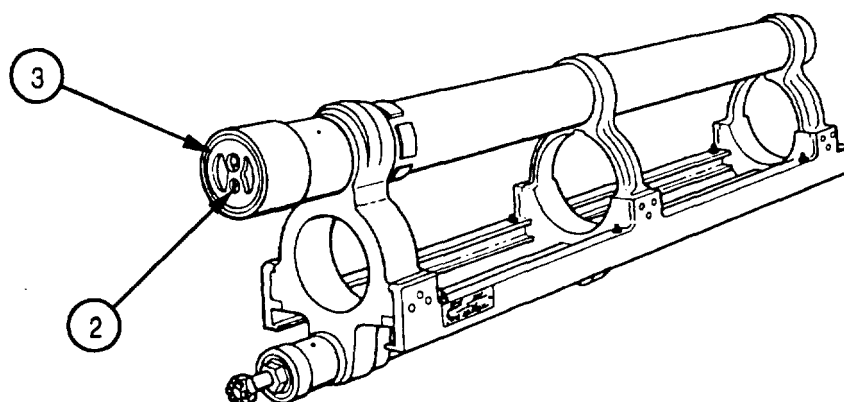


Step 2. Check that oil index (2) is not beyond the face of the recuperator cylinder front head assembly (3), indicating high oil reserve.

Drain off oil reserve until oil index is flush with the face of the recuperator cylinder front head assembly. (Refer to page 3- 48.)

Step 3. If malfunction is not corrected after performing steps 1 and 2, there may be excessive nitrogen pressure.

Notify Unit maintenance.



3-3. TROUBLESHOOTING PROCEDURES (cont)*Table 3-1. TROUBLESHOOTING (cont)*

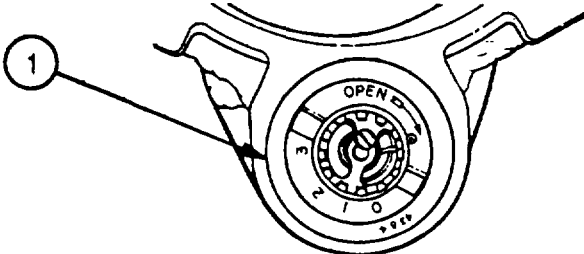
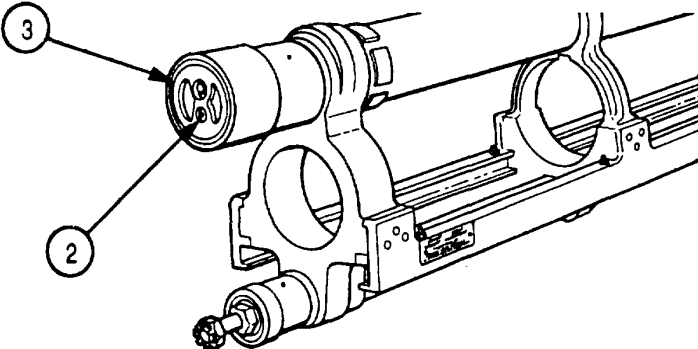
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
RECOIL MECHANISM (cont)		
6. HOWITZER RETURNS TO BATTERY TOO SLOWLY.		
Step 1. Check for closed or low setting (setting of 0 or 1) on respirator (1).		
Using respirator wrench, open respirator or increase setting to 2 or 3.		
		
Step 2. Check that oil index (2) is not below the face of the recuperator cylinder front head assembly (3), indicating low oil reserve.		
Add oil (item 20, appx E) until oil index is flush with face of the recuperator cylinder front head assembly. (Refer to page 3-50.) Notify Unit maintenance if condition persists.		
Step 3. If malfunction is not corrected after performing steps 1 and 2, there may be low nitrogen pressure.		
Notify Unit maintenance.		
		

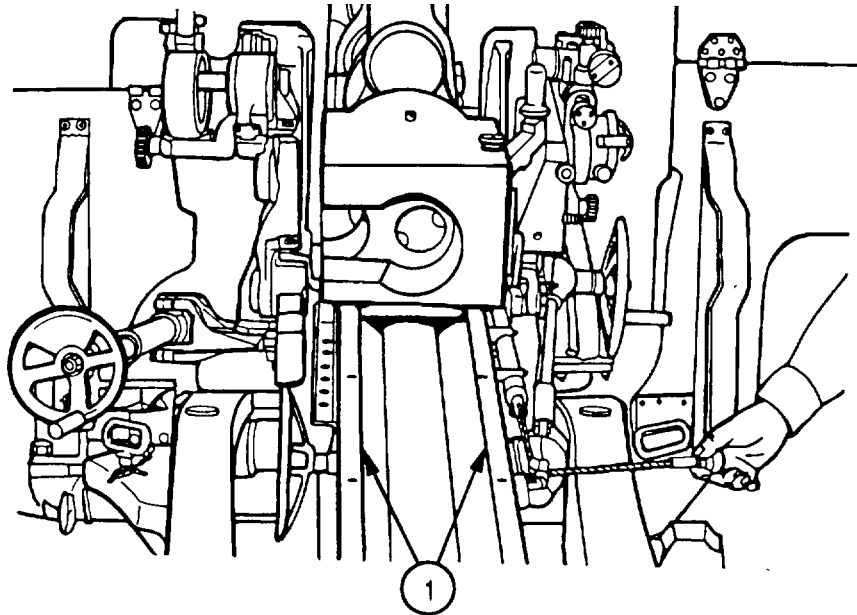
Table 3-1. TROUBLESHOOTING (cont)

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

7. THERE IS UNEVEN OR SPASMODIC COUNTERRECOIL.		
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	Check for lack of lubrication on recoil slide (1).	
--	--	--

	Lube with CLP (item 7, appx E).	
--	---------------------------------	--



8. WEAPON RECOILS TOO FAR.		
-----------------------------------	--	--

	There may be low nitrogen pressure; no further inspection is required.	
--	--	--

	Notify Unit maintenance.	
--	--------------------------	--

9. THERE IS INSUFFICIENT RECOIL.		
---	--	--

	Step 1. Oil may be thick due to low temperature.	
--	--	--

	Fire two more rounds and check oil. (During extreme cold weather conditions, more rounds may have to be fired.)	
--	---	--

	Step 2. If malfunction is not corrected after performing step 1, there may be excessive nitrogen pressure.	
--	--	--

	Notify Unit maintenance.	
--	--------------------------	--

3-3. TROUBLESHOOTING PROCEDURES (cont)

Table 3-1. TROUBLESHOOTING (cont)

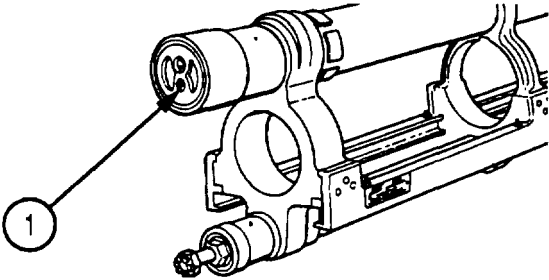
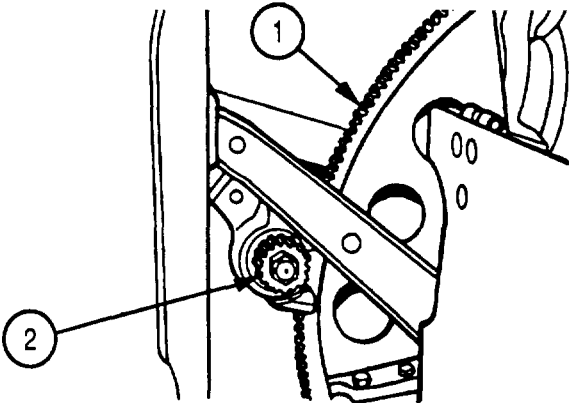
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
RECOIL MECHANISM (cont)		
10. OIL INDEX DOES NOT MOVE FROM A LOW POSITION WHEN OIL IS ADDED.		<p>Step 1. Check for dirt or corrosion binding oil index (1).</p> <p>Drain and refill reserve (refer to page 3-47) and free oil index. Notify Unit maintenance if oil index cannot be moved.</p> <p>Step 2. Check for broken oil index (1). Notify Unit maintenance.</p> 
CARRIAGE		
11. ELEVATING MECHANISM JAMS.		<p>Check for obstruction in elevating arc (1) or pinion (2).</p> <p>Clear obstruction.</p> 

Table 3-1. TROUBLESHOOTING (cont)

MALFUNCTION**TEST OR INSPECTION****CORRECTIVE ACTION****12. HOWITZER IS DIFFICULT TO ELEVATE OR DEPRESS.**

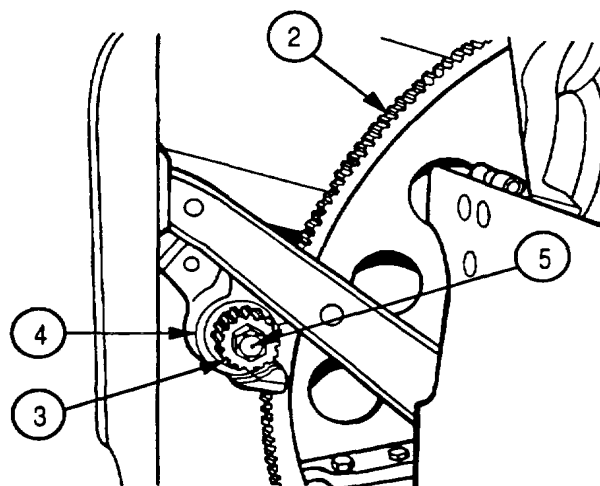
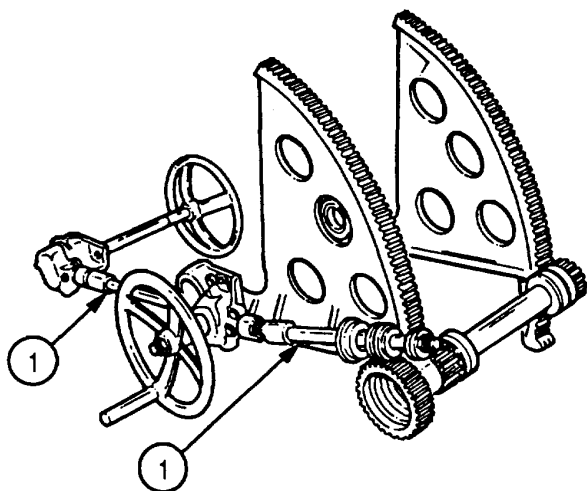
Step 1. Check for lack of lubrication of elevating mechanism (1), elevating arc (2), and pinion (3).

Lube elevating mechanism, elevating arc, and pinion with CLP (item 7, appx E).

Step 2. Check for seal (4) binding against pinion (3) (overlubrication of housing has forced seal against pinion). Remove lube fitting (5) to relieve pressure and tap seal back into seat.

Step 3. If howitzer is difficult to depress and easy to elevate or easy to depress and difficult to elevate, equilibrator assembly needs adjustment.

Notify Unit maintenance.



3-3. TROUBLESHOOTING PROCEDURES (cont)

Table 3-1. TROUBLESHOOTING (cont)

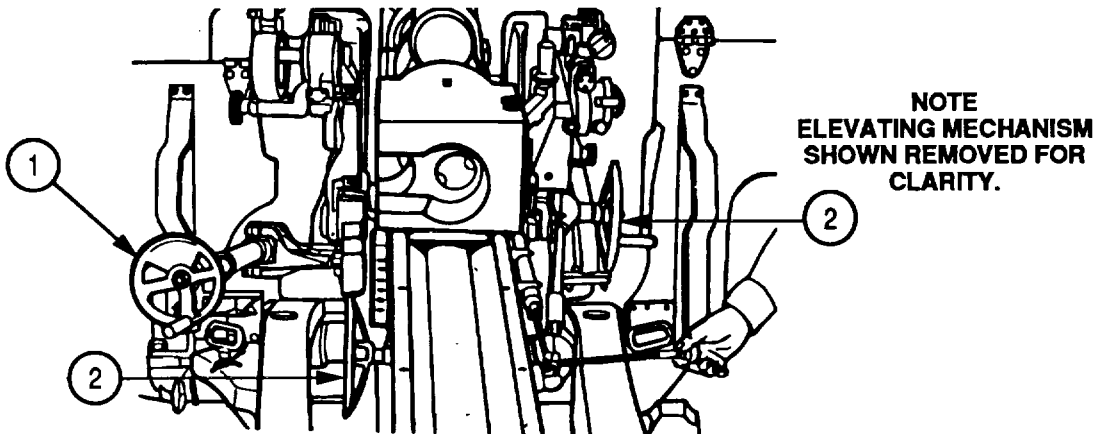
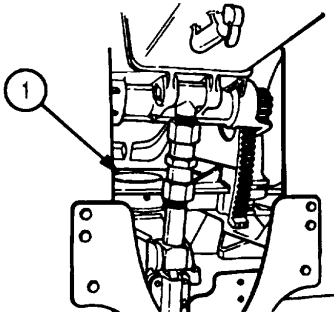
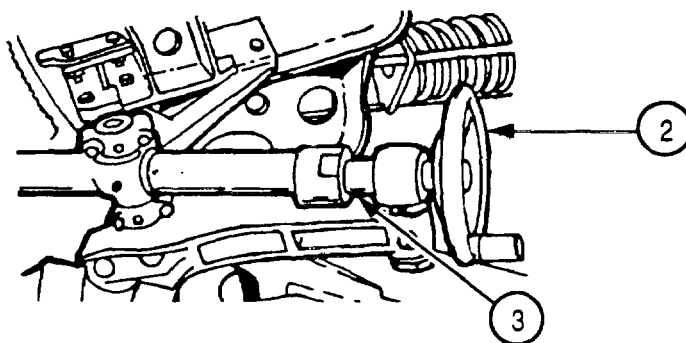
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
CARRIAGE (cont)		
13. THERE IS PLAY IN TRAVERSING HANDWHEEL OR ELEVATING HANDWHEELS.		
<p>Traversing handwheel (1) or elevating handwheels (2) exceed one-sixth turn (3-1/8 in. (7.938 cm)).</p> <p>Notify Unit maintenance.</p>		
 <p style="text-align: right;">NOTE ELEVATING MECHANISM SHOWN REMOVED FOR CLARITY.</p>		
14. HOWITZER IS DIFFICULT TO TRAVERSE.		
<p>Step 1. There may be insufficient lubrication on pintle pin assembly (1); no further inspection is required.</p> <p>Notify Unit maintenance.</p>		
		

Table 3-1. TROUBLESHOOTING (cont)

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

Step 2. Turn traversing handwheel (2) completely to the right, then left. Check for bent traversing handwheel rod (3). Notify Unit maintenance.

**15. TIRES ARE WORN.**

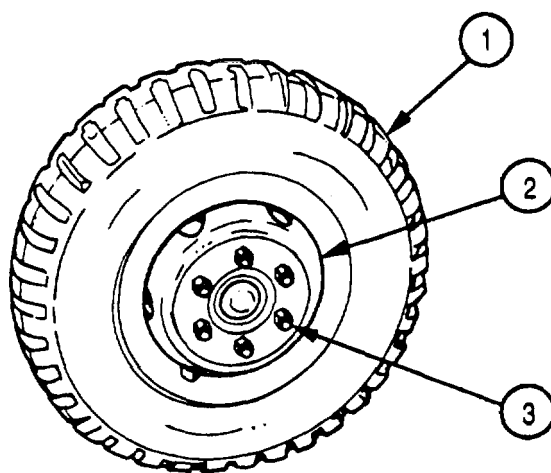
Step 1. Check for incorrect pressure in tires (1).
Inflate to correct air pressure (40 psi (276 kPa)).

Step 2. Check for bent wheel (2).

Notify Unit maintenance.

Step 3. Check for loose wheel lugs (3).

Tighten wheel lugs (3), using lug wrench. Notify Unit maintenance to torque wheel lugs (3) as soon as possible.



3-3. TROUBLESHOOTING PROCEDURES (cont)

Table 3-1. TROUBLESHOOTING (cont)

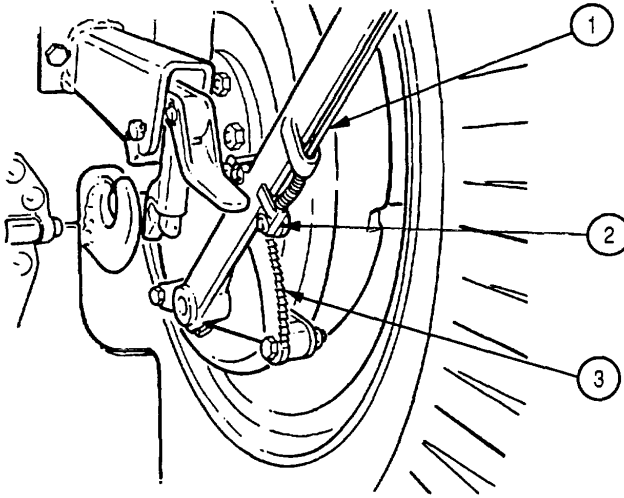
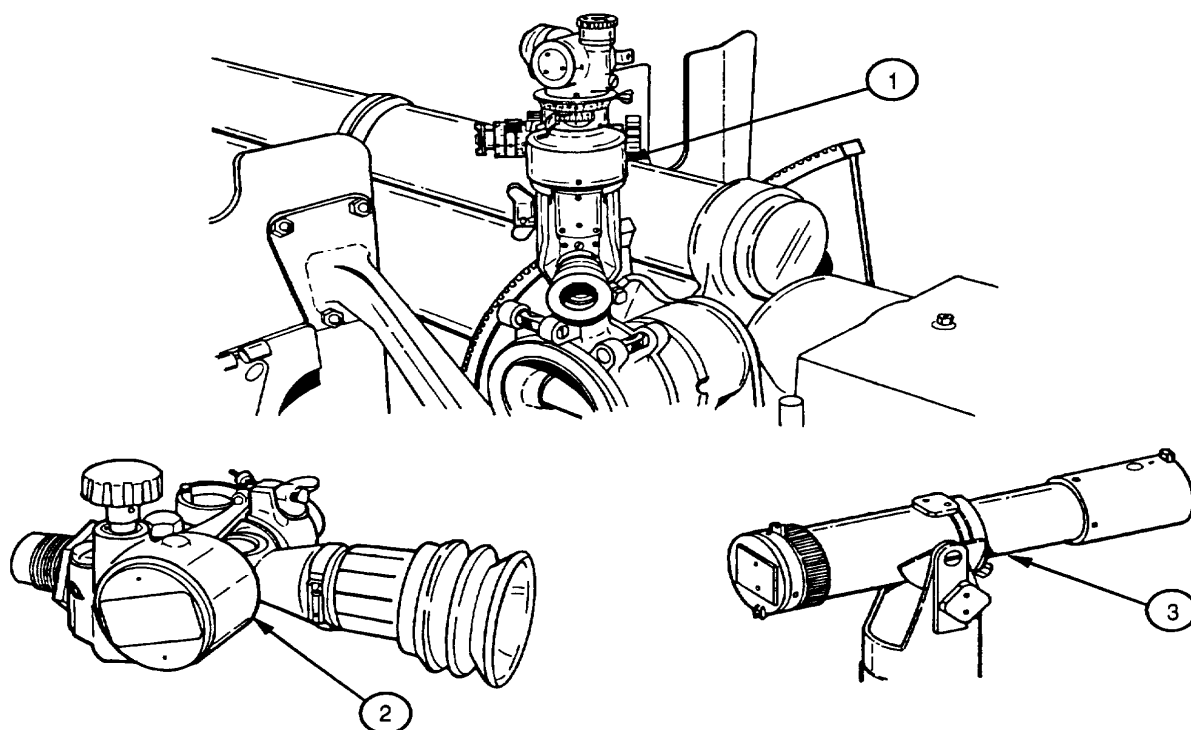
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
CARRIAGE (cont)		
16. HANDBRAKES ARE WORN OR INOPERATIVE.		
<p>Check adjustment of handbrakes (1). Handbrakes (1) are properly adjusted if handbrakes (1) are fully engaged when handbrake pawl (2) is approximately halfway forward on ratchet rack (3).</p> <p>Notify Unit maintenance if not properly adjusted.</p>		
		
FIRE CONTROL EQUIPMENT		
17. FITTED PARTS OF FIRE CONTROL EQUIPMENT ARE LOOSE.		
<p>Check to see if knobs and nuts are tight.</p> <p>Tighten.</p>		

Table 3-1. TROUBLESHOOTING (cont)

MALFUNCTION**TEST OR INSPECTION****CORRECTIVE ACTION****18. THERE IS MOISTURE IN FIRE CONTROL EQUIPMENT.**

Check that there is not moisture in pantel (1), elbow telescope (2), or M1A1 collimator (3).

Notify Unit maintenance.

**19. FIRE CONTROL KNOBS DO NOT TURN FREELY.**

No further test or inspection is required.

Notify Unit maintenance

3.3. TROUBLESHOOTING PROCEDURES (cont)

Table 3-1. TROUBLESHOOTING (cont)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

FIRE CONTROL (cont)

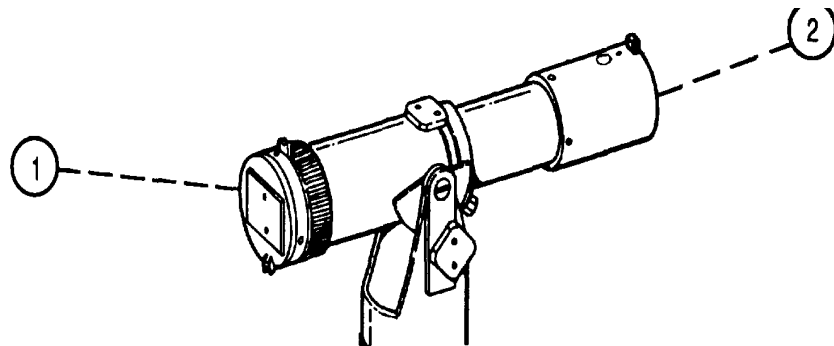
20. M1A1 COLLIMATOR RETICLE IMAGE IS NOT SHARP.

Step 1. Check to see if optical lenses (1) are dirty, wet, or fogged.

Clean with optical lens cleaning compound (item 8, appx E) and lens tissue (item 25, appx E).

Step 2. Check to see if reticle (2) is dirty.

Notify Unit maintenance.



TAILLIGHT ASSEMBLY

21. TAILLIGHTS WILL NOT WORK.

Step 1. Check to be sure cable assembly (1) is connected to prime mover and taillight assembly.

Connect cable assembly (1) to prime mover and taillight assembly.

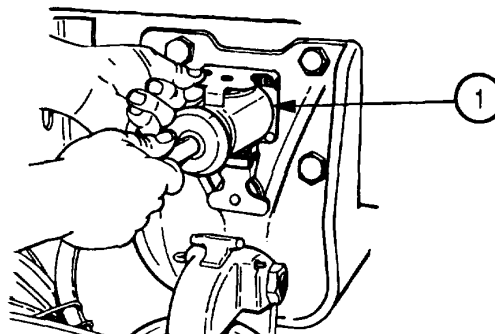
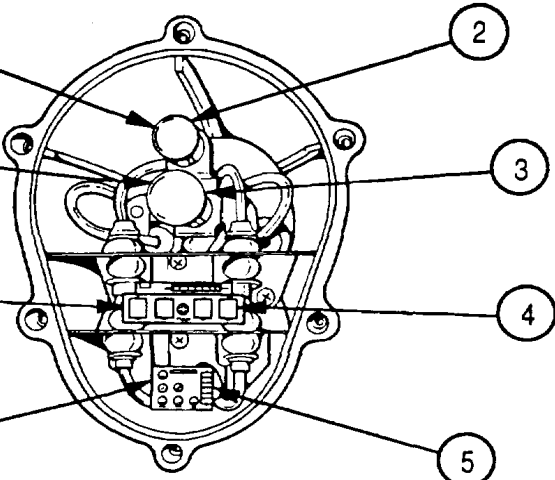
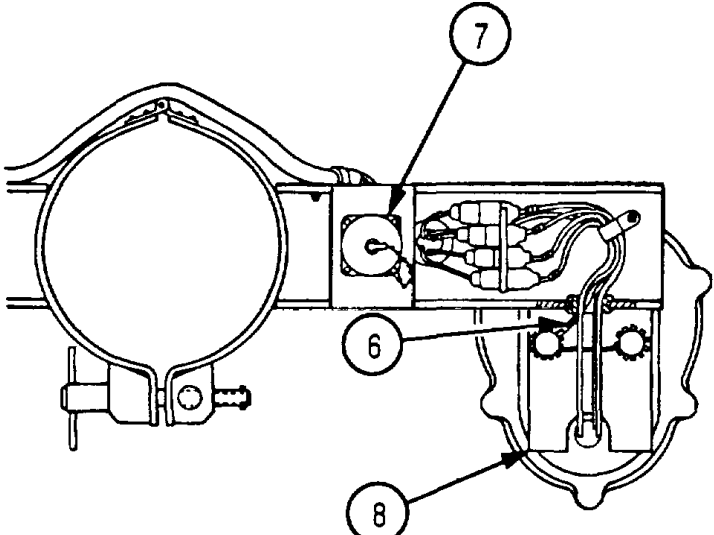


Table 3-1. TROUBLESHOOTING (cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
Step 2. Check for broken or missing lamps (2, 3, 4, and 5).		
<p>Replace.</p> <p>TAILLIGHT</p> <p>STOPLIGHT (BRAKE AND SIGNAL)</p> <p>BLACKOUT MARKER LIGHT</p> <p>BLACKOUT STOPLIGHT</p>		
Step 3. Check to be sure ground wire (6) leading from receptacle connector (7) is properly attached to tube clamp (8).		
Notify Unit maintenance.		
Step 4. Check receptacle connector (7) for bent or broken electrical terminal pins and loose or broken wires.		
Notify Unit maintenance.		
		

Section III. MAINTENANCE PROCEDURES

3-4. GENERAL

- a. **Responsibility.** The crew, supervised by the chief of section, is responsible for crew maintenance of M101A1 howitzer. Crew maintenance consists of the procedures on pages 3-36 thru 3-67, PMCS (p 2-9), and lubing (p 3-1).
- b. **Repairs.** Repairs by crew will be limited to those listed in this manual.
- c. **Tools.** Tools required to maintain the weapon are listed in appendix B.
- d. **Materials and Parts.** Materials and parts required to maintain the weapon; e.g., wiping rags, cleaning compound, and CLP; are listed in appendix E.
- e. **Lubrication.** CLP (item 7, appx E) is the main lubricant for the M01A1 howitzer.
- f. **Painting.** Check paint for blistering and rust. Spot paint as needed, refer to TM 43-0139.

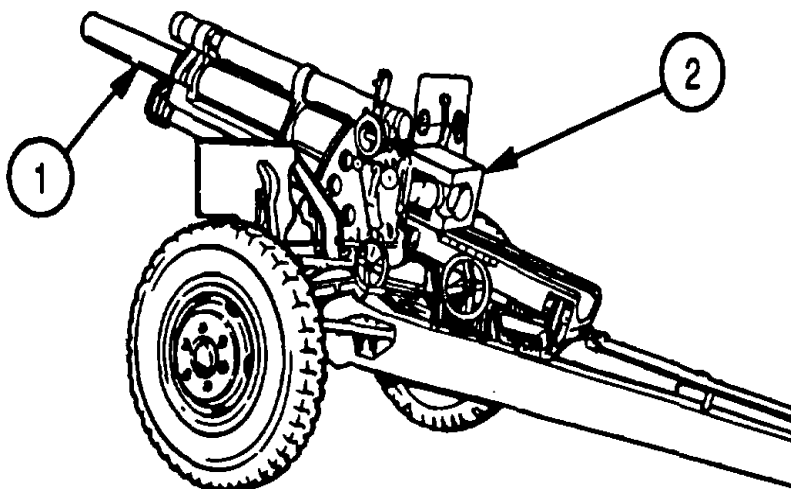
3-5. M2A2 CANNON MAINTENANCE

NOTE

The following maintenance includes the procedures for the breech mechanism assembly.

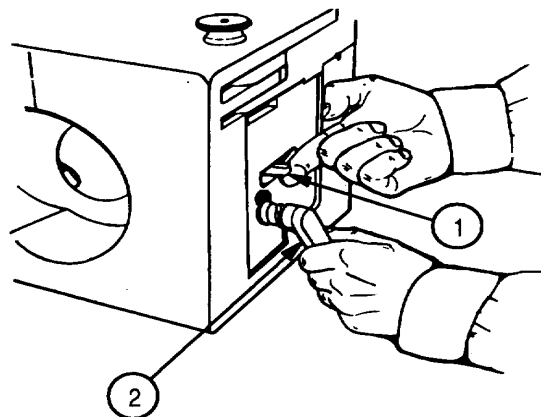
INSPECTION

- 1 Inspect cannon (1) weekly for moisture, rust, corrosion, and foreign matter.
- 2 Check cannon (1) weekly for loose bolts and missing parts.
- 3 After firing, inspect inside of cannon (1) for rust, corrosion, foreign matter, and cracks.
- 4 Check breech mechanism (2) for smooth operation. Check for rusty, damaged, or missing parts.
- 5 Clean out any moisture or foreign matter. (Refer to page p 3-9.) Notify Unit maintenance if cannon and breech mechanism (2) do not meet inspection criteria.

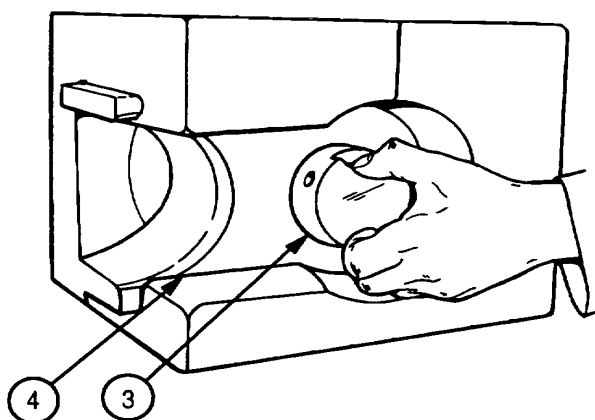


DISASSEMBLY OF BREECH MECHANISM

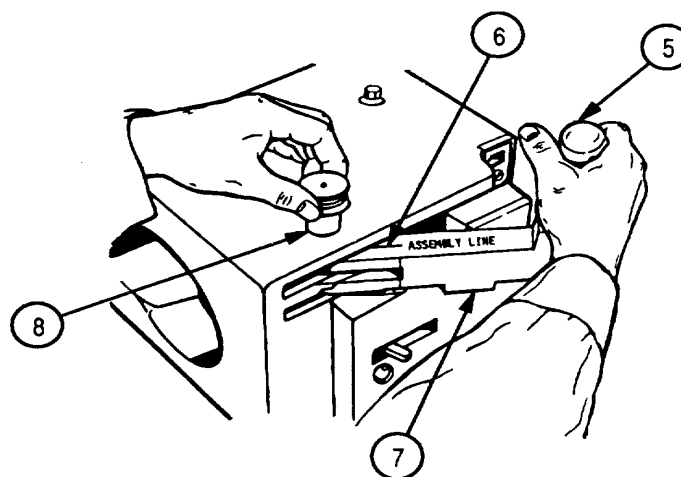
- 1 Set handbrakes and elevate or depress cannon tube to 0 mil.
- 2 Lift detent handle (1), and remove trigger shaft (2).



- 3 Turn M13 firing lock (3) one-sixth of a turn counterclockwise and remove from breechblock (4).

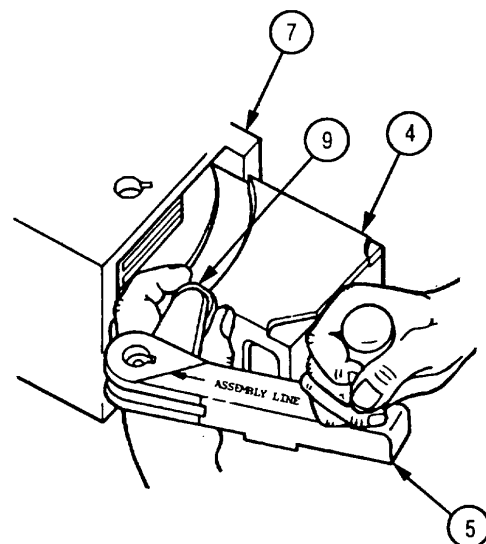


- 4 Using breechblock operating lever (5), open breechblock (4) until assembly line (6) is at edge of breech ring (7). Remove breech mechanism pivot (8).

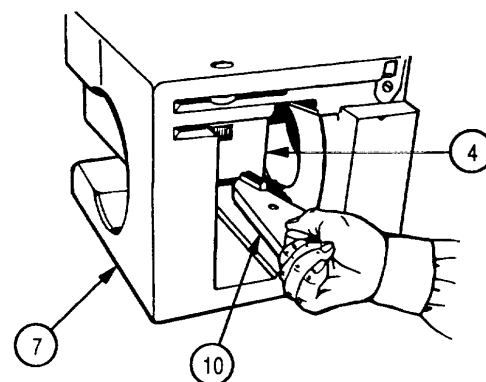


3-5. M2A2 CANNON MAINTENANCE (cont)**DISASSEMBLY OF BREECH MECHANISM (cont.**

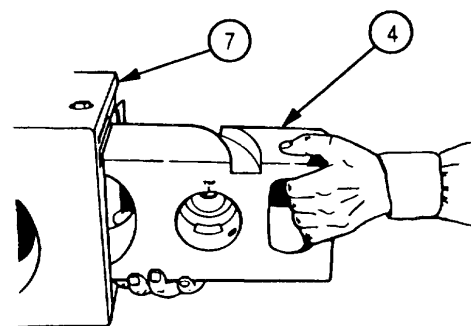
- 5 Pull breechblock (4) to the right until breechblock crosshead (9) on breechblock operating lever (5) clears breech ring (7). Remove breechblock operating lever (5), being careful to catch the breechblock crosshead (9) as it is freefitting on the breechblock operating lever (5).



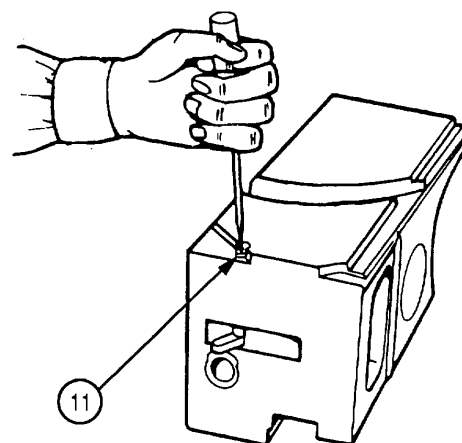
- 6 Push breechblock (4) far enough to the left to clear cartridge extractor (10). Rotate cartridge extractor (10) out of its seat, and lift it enough so that cartridge extractor (10) clears its recess in breech ring (7). Remove cartridge extractor (10).



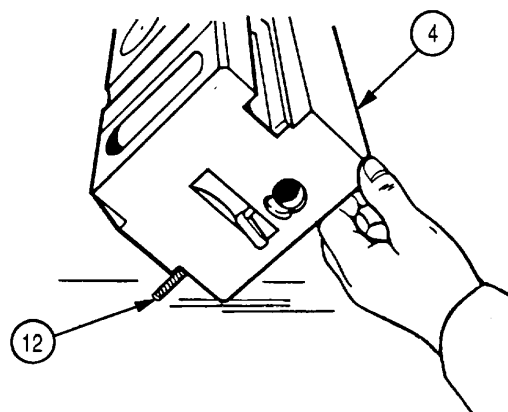
- 7 Slide breechblock (4) to extreme right and lift it out of breech ring (7).



- 8 Unscrew and remove setscrew (11).

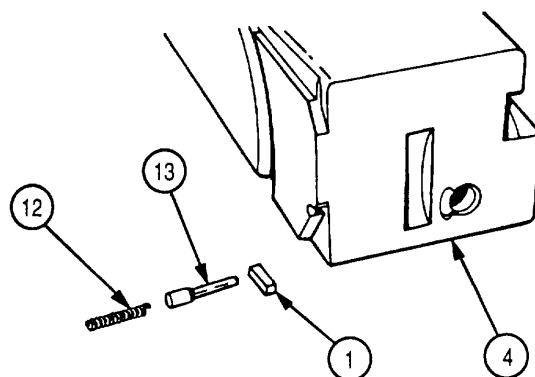


- 9 Tip breechblock (4) and allow spring (12) and pin (13) to fall from their seats. Detent handle (1) will fall from its recess on the right side of breechblock (4).



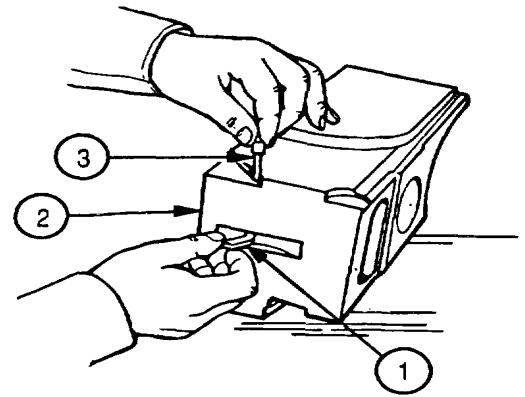
SERVICING OF BREECH MECHANISM

Refer to lubrication instructions (p 3-5 and 3-11).

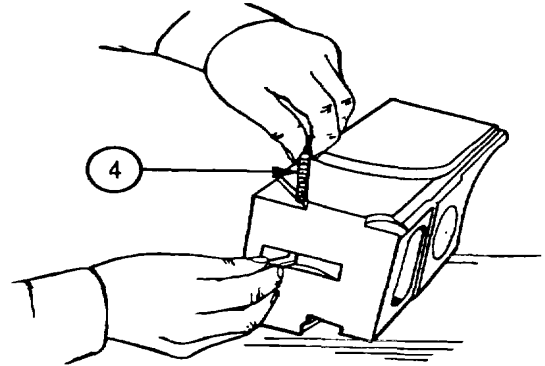


3-5. M2A2 CANNON MAINTENANCE (cont)**REASSEMBLY OF BREECH MECHANISM****NOTE**

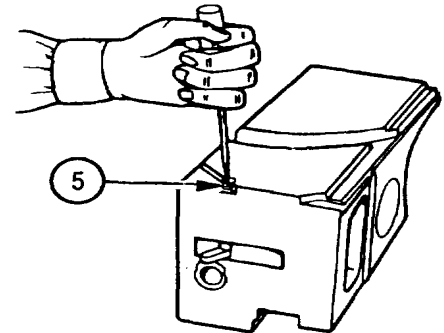
Before installation, handbrakes must be set and cannon tube elevated or depressed to 0 mil.



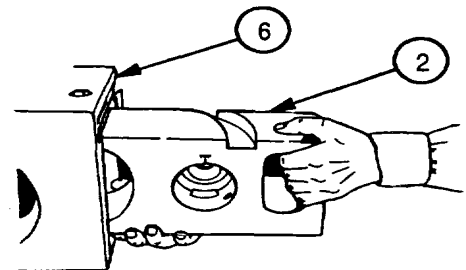
- 1 Insert detent handle (1) into recess on right side of breechblock (2).
- 2 Drop pin (3), shoulder end up, into hole on top of breechblock (2).
- 3 Guide pin (3) to engage with detent handle (1).



- 4 Insert spring (4) into its seat and secure with setscrew (5).

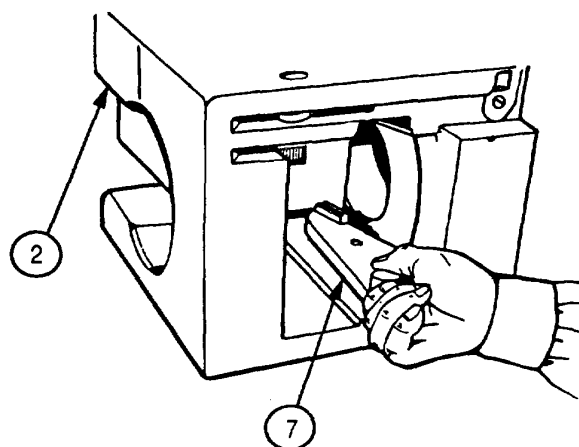


- 5 Install breechblock (2) in breech ring (6).

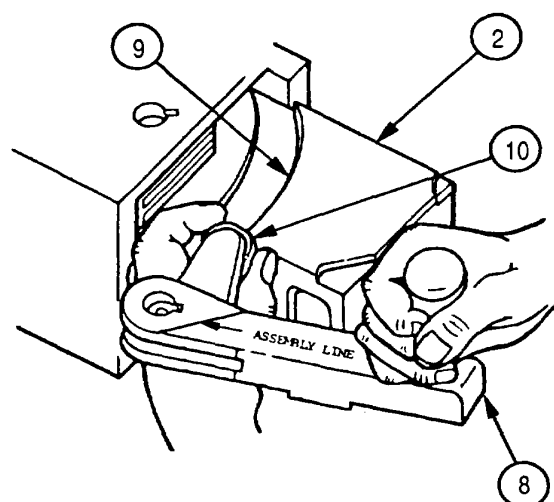


6 Push breechblock (2) just far enough to the left to allow for installation of cartridge extractor (7).

7 Install cartridge extractor (7).



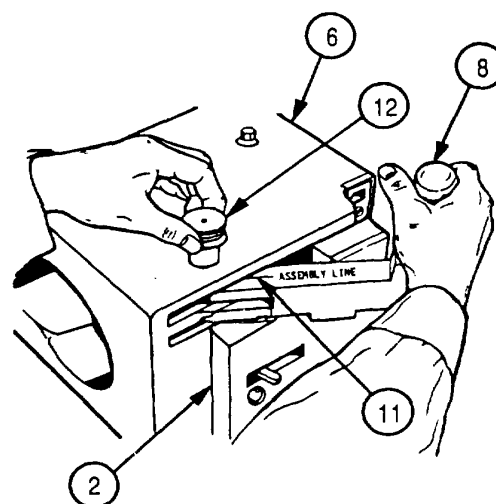
8 Install breechblock operating lever (8) by pulling breechblock (2) to the right until breechblock crosshead groove (9) in top of breechblock (2) is exposed; place breechblock crosshead (10) onto breechblock operating lever (8) and while holding, fit breechblock crosshead (10) into breechblock crosshead groove (9) in breechblock (2).



9 Push breechblock (2) to the left until assembly line (11) on breechblock operating lever (8) is at edge of breech ring (6), and breech mechanism pivot (12) holes in breechblock operating lever (8) and breech ring (6) are lined up.

10 Install breech mechanism pivot (12).

11 Use operating lever (8) to close breechblock (2).



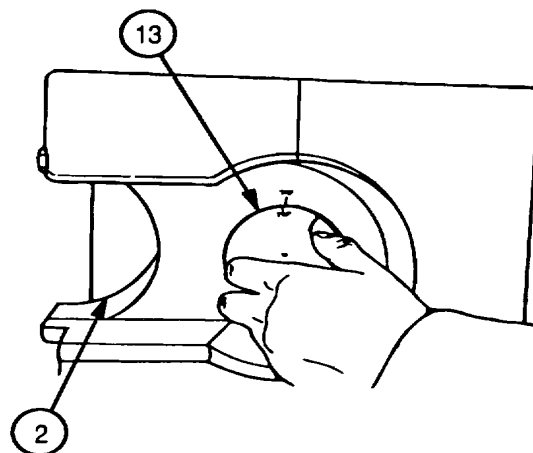
3-5. M2A2 CANNON MAINTENANCE (cont)

REASSEMBLY OF BREECH MECHANISM (cont)

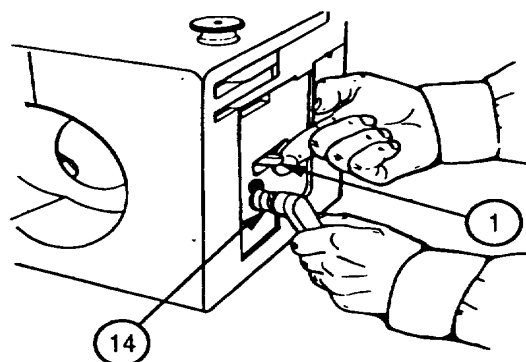
NOTE

The word **TOP** on the M13 firing lock should be aligned with the word **TOP** on the breechblock (2).

- 12 Install M13 firing lock (13) in breechblock (2) and rotate one-sixth of a turn clockwise.



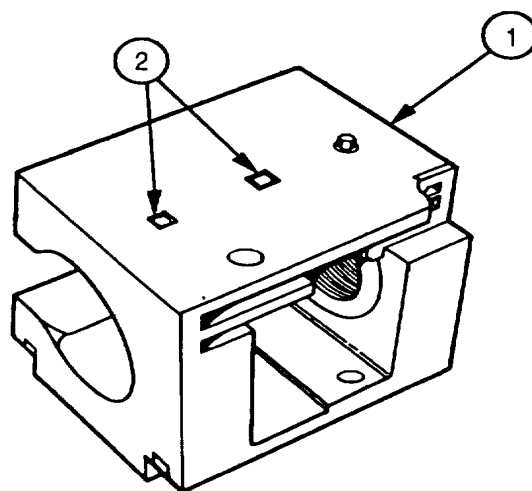
- 13 Lift detent handle (1), and install trigger shaft (14).



3-6. BREECH RING MAINTENANCE

INSPECTION

- 1 Examine exterior of breech ring (1) for damage.
- 2 Inspect interior for cracks and damage resulting from pressure.
- 3 Inspect breech ring leveling plates (2) for roughness and distortion.

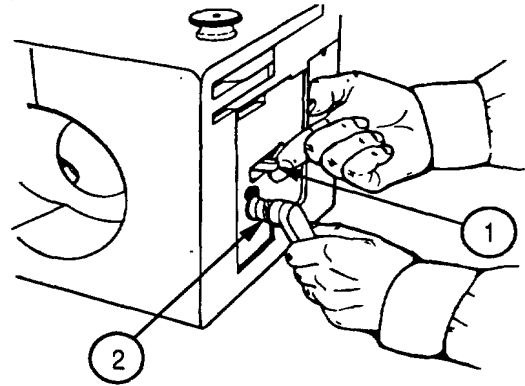


NOTE
SOME PARTS ARE SHOWN REMOVED
FOR CLARITY.

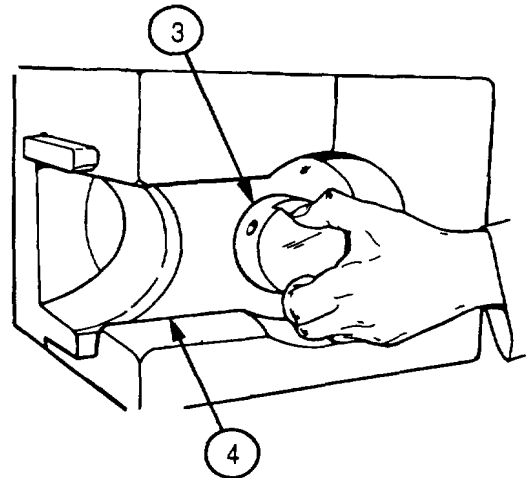
3-7. M13 FIRING LOCK MAINTENANCE

REMOVAL

- 1 Lift detent handle (1), and remove trigger shaft (2).

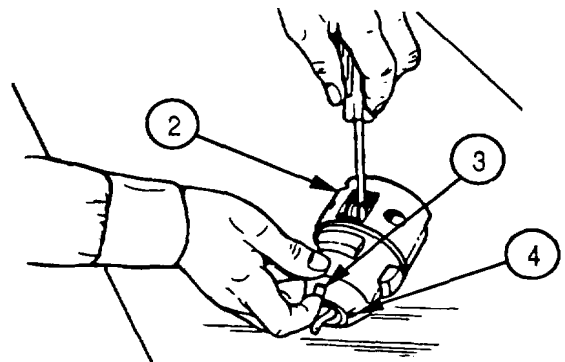
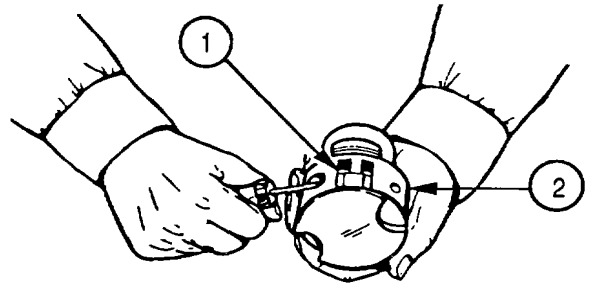


- 2 Turn M13 firing lock (3) one-sixth of a turn counterclockwise and remove from breechblock (4).



DISASSEMBLY

- 1 Pry trigger fork (1) out of firing lock case (2) with screwdriver inserted through trigger shaft hole.
- 2 Completely remove trigger fork (1) from outside of firing lock case (2).
- 3 While holding sear (3) to outside of firing lock case (2), push out and remove firing pin holder (4).



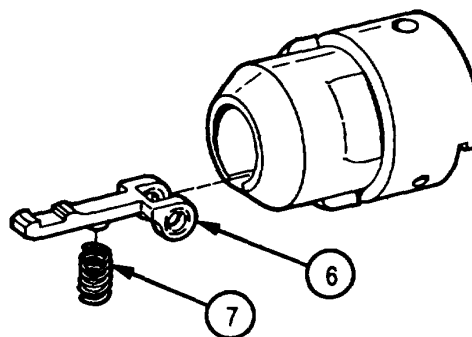
3-7. M13 FIRING LOCK MAINTENANCE (cont)

DISASSEMBLY (cont)

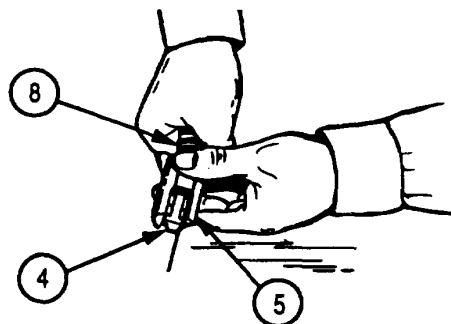
NOTE

Firing pin holder sleeve (5), sear (6), and helical spring (7) will come out also.

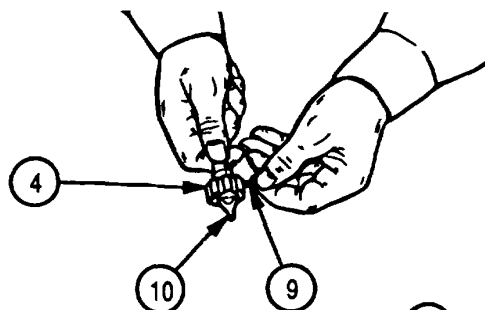
- 4 Separate sear (6) and helical spring (7).



- 5 Release firing pin holder (4) and spring (8) from firing pin holder sleeve (5) by pushing against a hard surface.



6. Remove spring pin (9), and unscrew firing pin (10) counterclockwise from firing pin holder (4).

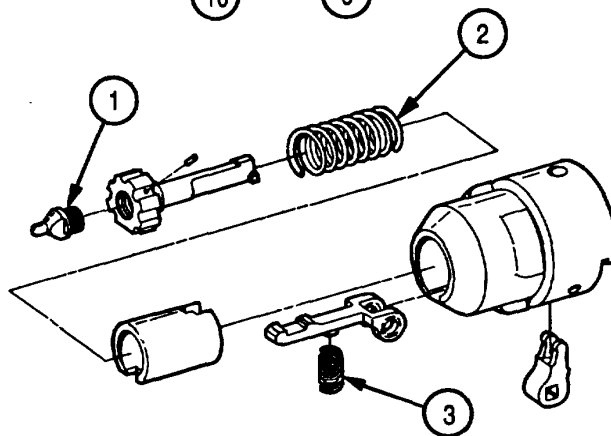


INSPECTION

- 1 Check for burrs, scores, and worn or damaged parts.
- 2 Check firing pin (1) for pits, deformities, cracks, or a broken point.
- 3 Check to see if springs (2 and 3) are set, kinked, cracked, or broken.
- 4 If any defective parts are found, notify Unit maintenance.

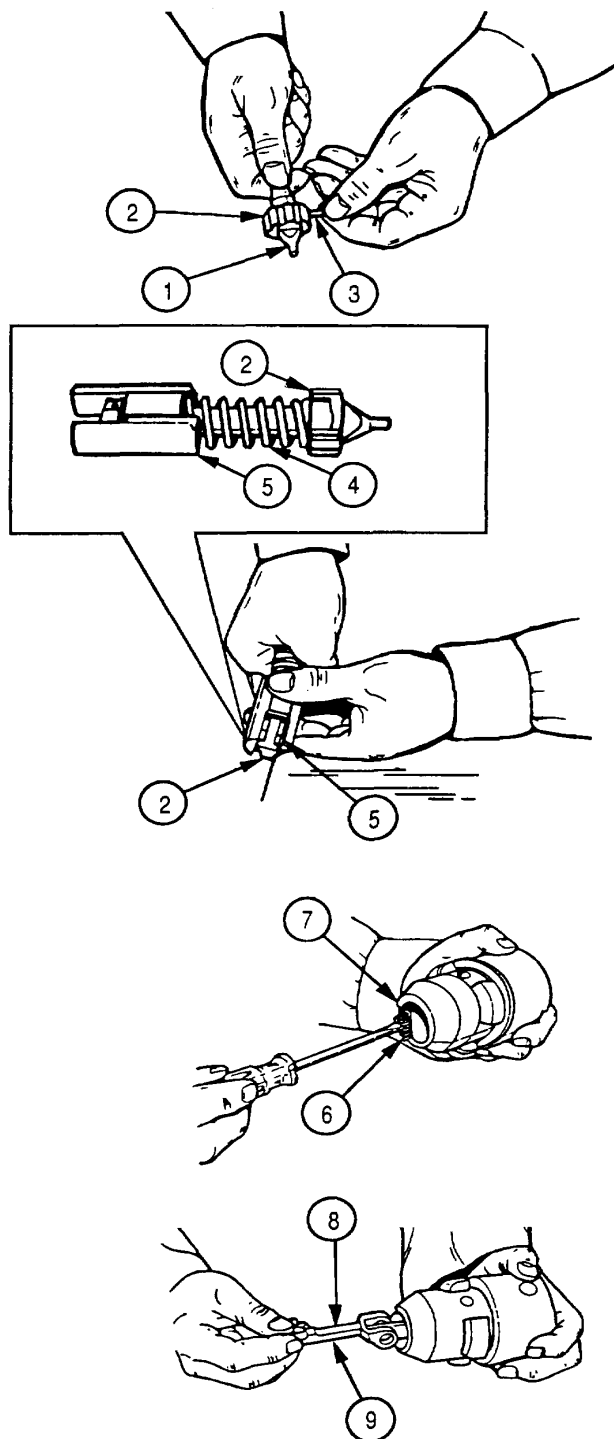
SERVICING

Clean all parts with CLP (item 7, appx E). Wipe with wiping rag (item 26, appx E), and lube with CLP (item 7, appx E).



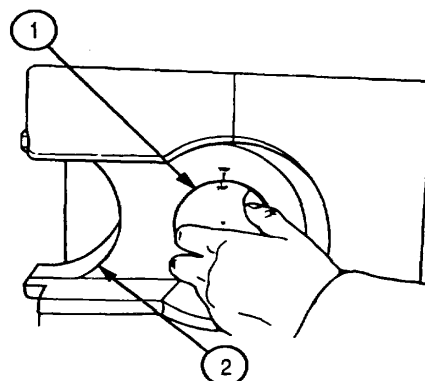
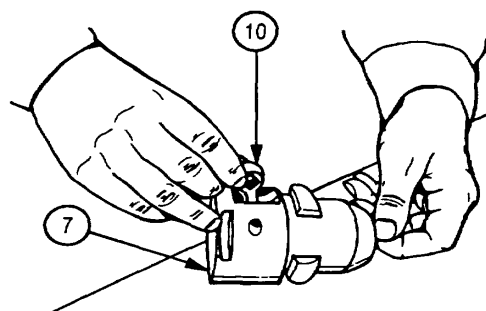
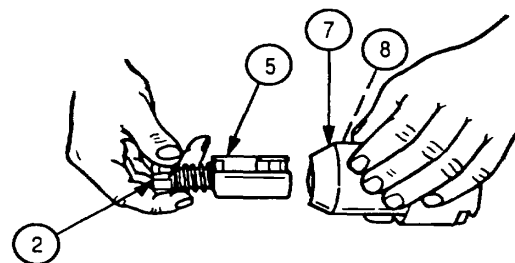
REASSEMBLY

- 1 Screw firing pin (1) clockwise into firing pin holder (2).
- 2 Install spring pin (3) with split up.
- 3 Assemble helical spring (4) over firing pin holder (2) and firing pin holder sleeve (5) over helical spring (4) and firing pin holder (2).
- 4 Push rear of firing pin holder sleeve (5) against a solid surface until firing pin holder (2) hooks to firing pin holder sleeve (5).
- 5 Attach spring (6) to end of screwdriver and insert into firing lock case (7).
- 6 Insert sear (8) so that sear stud (9) enters spring (installed in step 5 above).

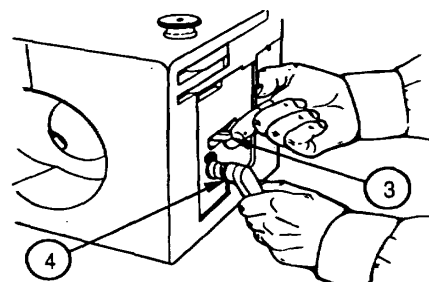


3-7. M13 FIRING LOCK MAINTENANCE (cont)**REASSEMBLY (cont)**

- 7** Insert assembled firing pin holder (2) and firing pin holder sleeve (5) into firing lock case (7).
- 8** Hold flat portion of firing pin holder sleeve (5) and sear notch of firing pin holder (2) downward to engage sear (8).
- 9** Hold sear (8) from slipping backward and push firing pin holder (2) back until it is latched by sear (8).
- 10** Insert trigger fork (10) into opening in bottom of firing lock case (7) with part marked MUZZLE toward front.
- 11** Push trigger fork (10) until it snaps into position.

**INSTALLATION**

- 1** Install M13 firing lock (1) into breechblock (2) and rotate one-sixth turn clockwise. The word TOP on the M13 firing lock (1) should be aligned with the word TOP on the breechblock (2).
- 2** Lift detent handle (3), and install trigger shaft (4).



3-8. M2A4 OR M2A5 RECOIL MECHANISM MAINTENANCE

NOTE

The following maintenance includes the procedures for the recuperator cylinder front head assembly and respirator.

INSPECTION

NOTE

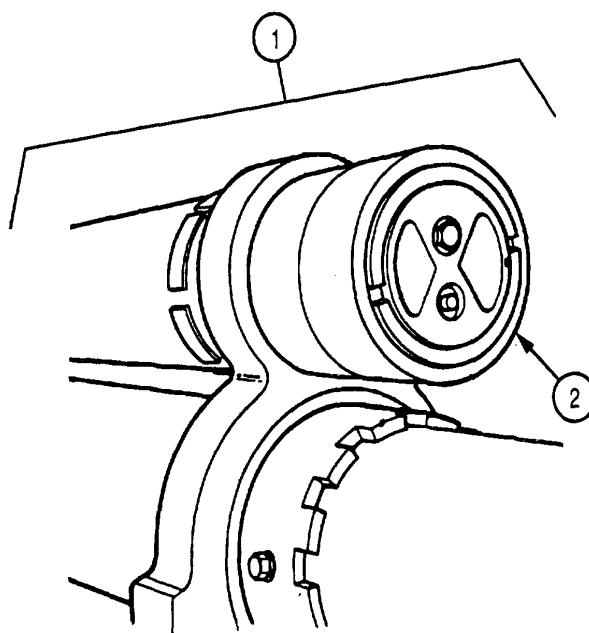
Leakage from recoil mechanism (1) is considered normal unless it is serious enough to require adding to the oil reserve during a day of firing.

- 1 Check recoil mechanism (1) for oil leakage.
- 2 Check for smooth operation, length of recoil, and complete movement to battery without shock.

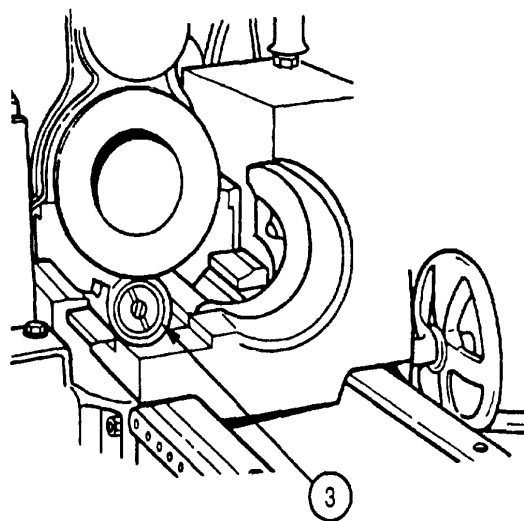
NOTE

Leakage from recuperator cylinder front head assembly (2) and respirator (3) is considered normal unless it exceeds Class III leakage.

- 3 Check recuperator cylinder front head assembly (2) for leakage.
- 4 Check respirator (3) for oil leakage.
- 5 Notify Unit maintenance if recoil mechanism (1) does not meet inspection criteria.



FRONT VIEW



REAR VIEW (CUTAWAY)

3-8. M2A4 OR M2A5 RECOIL MECHANISM MAINTENANCE (cont)**DRAINING OIL RESERVE****NOTE**

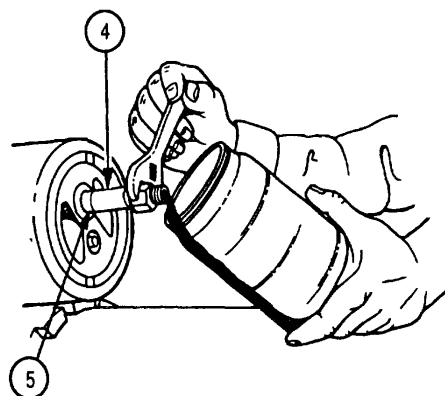
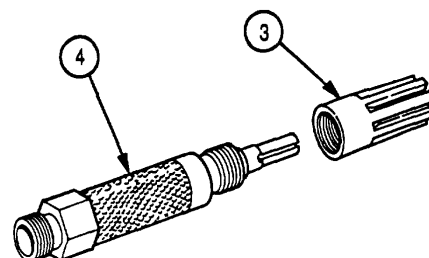
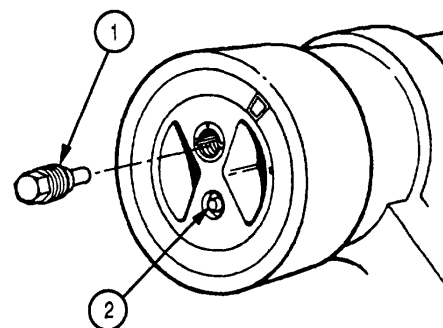
Oil reserve may be drained to inspect condition of oil and only fresh, clean oil should be used to establish oil reserve.

- 1 Bring cannon to 0-mil elevation, and clean area around filling hole to prevent dirt from entering system. Remove machine plug (1), located above oil index (2).
- 2 Remove protective cap (3) from liquid releasing tool (4) and wipe off tool filling hole with wiping rag (item 25, appx E).

NOTE

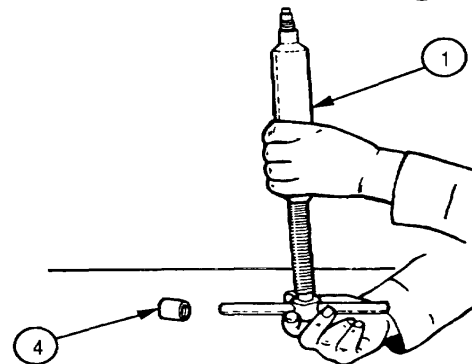
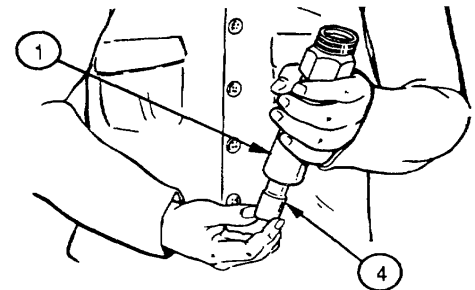
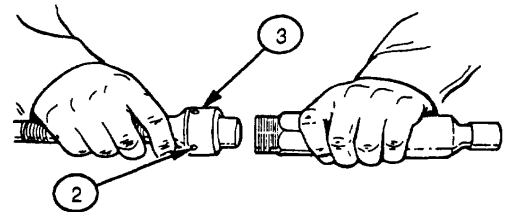
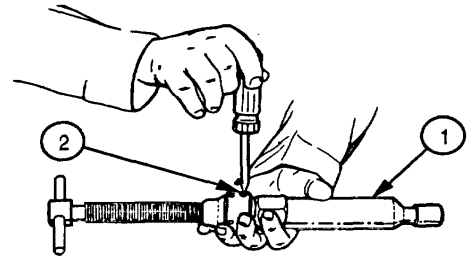
To check oil reserve before firing, drain only enough oil to cause oil index (2) to withdraw slightly.

- 3 Install liquid releasing tool (4) into filling hole (5). Tighten with suitable wrench until oil spurts out in a stream. Catch oil in a clean container.
- 4 When oil has stopped flowing, remove liquid releasing tool (4) and install protective cap (3).
- 5 Install machine plug (1).



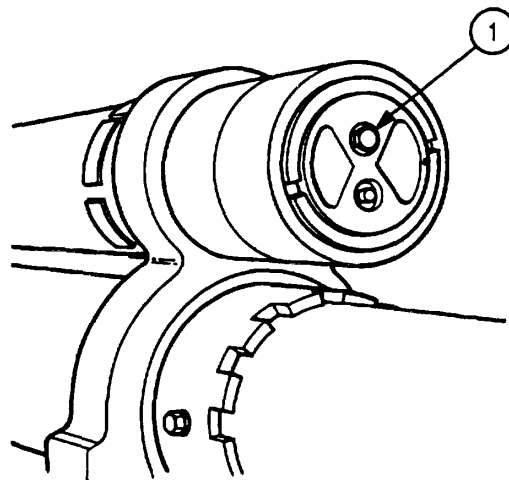
FILLING OIL GUN

- 1 Turn handle of oil gun (1) counterclockwise as far as it will go. Loosen locking screw (2) on head of oil gun.
- 2 Unscrew and remove head and handle (3) as a unit. Be sure cap (4) is on oil gun.
- 3 With opening held upright, fill body of oil gun (1) with oil.
- 4 Install head and handle (3) as a unit, and tighten locking screw (2).
- 5 With nozzle end of oil gun held upright, remove cap (4) from nozzle and allow air to escape for a minute or two.
- 6 Purge remaining air from oil gun (1) by turning handle until no more air bubbles appear at nozzle.

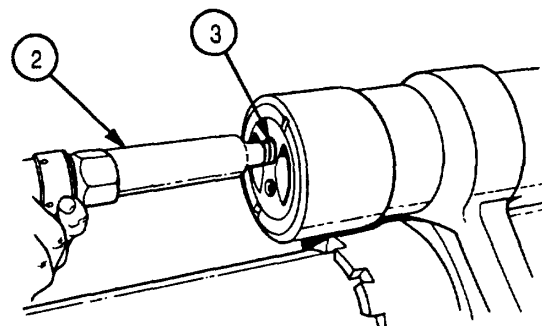


3-8. M2A4 OR M2A5 RECOIL MECHANISM MAINTENANCE (cont)**ESTABLISHING OIL RESERVE**

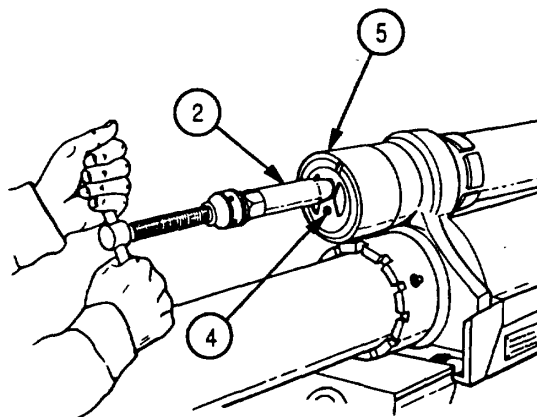
- 1 Remove machine plug (1).



- 2 Carefully screw oil gun (2) into filling hole (3).
- 3 Before tightening oil gun (2) completely into filling hole (3), turn handle of oil gun to force air out of filling hole (3).
- 4 Tighten oil gun (2) into filling hole (3).
- 5 Using both hands, turn handle of oil gun (2) to force oil into recoil mechanism.



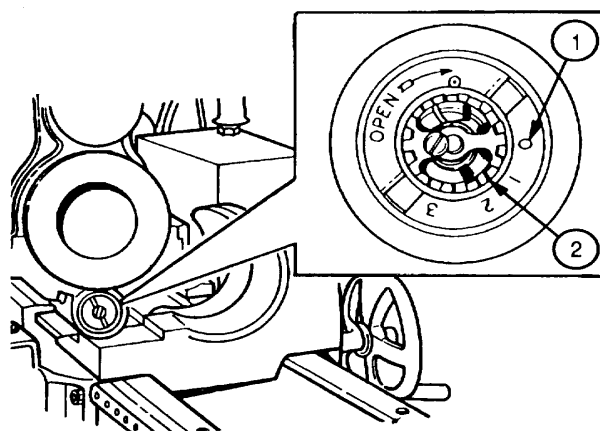
- 6 When oil index (4) is flush with face of recuperator cylinder front head assembly (5), indicating full reserve, unscrew oil gun (2).
- 7 Install machine plug (1).
- 8 Install cap on oil gun (2).



ADJUSTMENT

- 1 Set respirator on 0 (1), using respirator wrench.
- 2 Turn respirator valve head (2) counterclockwise as far as it will go.
- 3 To set respirator at any other setting, turn respirator valve head clockwise one click for a setting of 1, two clicks for a setting of 2, and three clicks for a setting of 3.

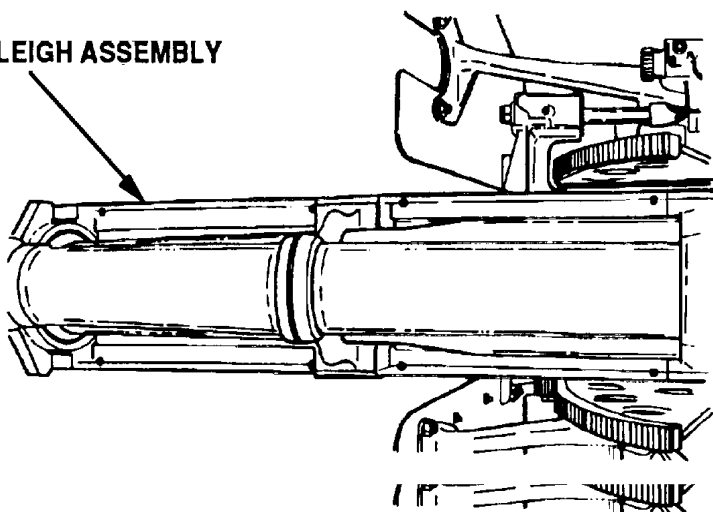
- a. A setting of 0 is for traveling.
- b. A setting of 1 is for normal low angle firing.
- c. A setting of 2 is for sustained high angle firing.
- d. A setting of 3 is for minimum buffing action.



CUTAWAY VIEW

3-9. RECOIL SLEIGH ASSEMBLY MAINTENANCE

RECOIL SLEIGH ASSEMBLY



NOTE

Maintenance procedures for recoil sleigh assemblies on M2A4 and M2A5 recoil mechanisms are identical.

INSPECTION

Inspect recoil sleigh assembly for burrs, nicks, and cracks. Notify Unit maintenance to correct problems.

SERVICING

Using a wiping rag (item 26, appx E) and cleaning compound (item 9, appx E), clean firing residue from recoil sleigh assembly.

3-10. M2A2 CARRIAGE MAINTENANCE

INSPECTION

Check for any unusual or loud noise during movement or firing that may be caused by improper adjustment, worn or loose parts, lack of lubricant, foreign matter, or moisture.

Notify Unit maintenance.

SERVICING

Lubricate parts indicated in lube instructions. (Refer to page 3-1.) Notify Unit maintenance for further lubing.

3-11. PANORAMIC AND ELBOW TELESCOPE CASE MAINTENANCE

NOTE

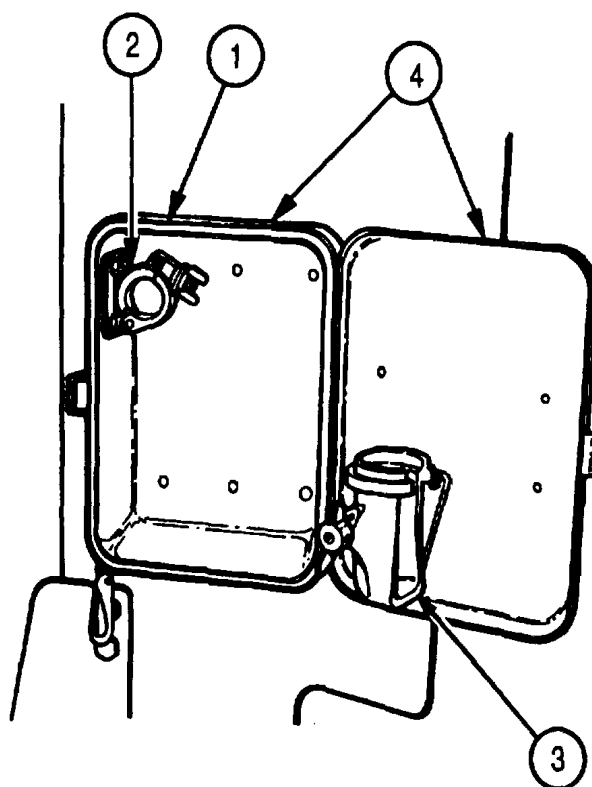
The following maintenance procedures include maintenance of elbow telescope holder and holder assembly.

INSPECTION

- 1 Check rubber seal (1) for moisture or cracks.
- 2 Check elbow telescope holder (2) to see that no moisture is present.
- 3 Inspect holder assembly (3) and elbow telescope holder (2) for missing bolts or parts.
- 4 Check all latches (knob, clamping bolt, and lock assembly) to see if they operate freely.
- 5 Check panoramic telescope case (4) for nicks, burrs, and cracks.
- 6 Notify Unit maintenance to correct problems.

SERVICING

- 1 Clean with wiping rags (item 26, appx E) and cleaning compound (item 9, appx E).
- 2 Oil all latches with CLP (item 7, appx E).



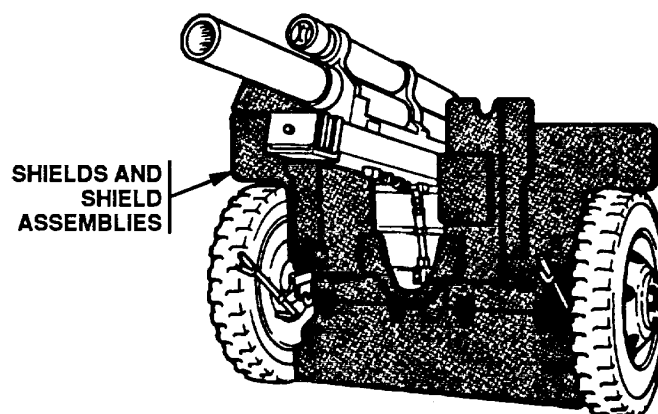
3-12. SHIELDS, SHIELD ASSEMBLIES, AND SHIELD ASSEMBLY LATCH MAINTENANCE

INSPECTION

Inspect shields, shield assemblies, and shield assembly latch for broken or missing parts. Notify Unit maintenance if required.

SERVICING

- 1 Clean with wiping rags (item 26, appx E) and cleaning compound (item 9, appx E).
- 2 Lubricate hinges and latches with CLP (item 7, appx E).



NOTE
SHIELDS AND SHIELD ASSEMBLIES ARE SHOWN SHADED IN ILLUSTRATION.

3-13. ELEVATING MECHANISM MAINTENANCE

NOTE

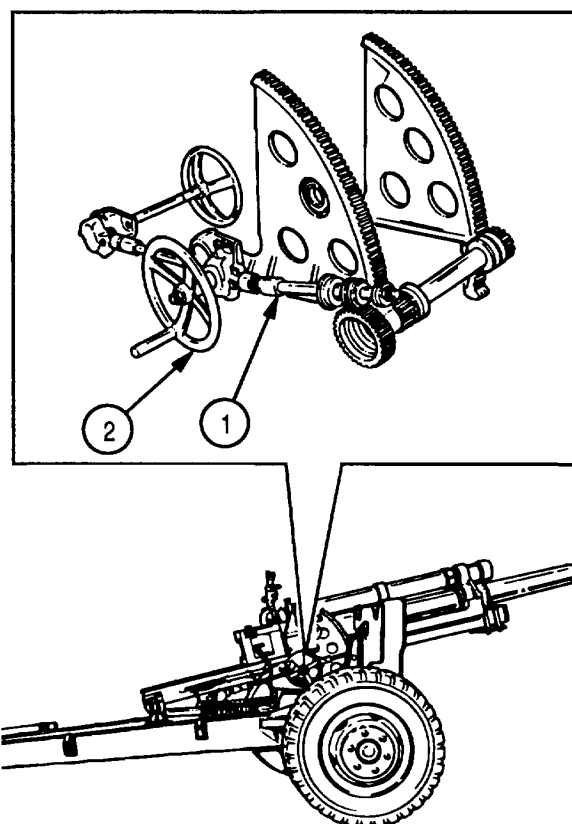
The following maintenance includes the procedures for elevating handwheel, cradle, and recoil indicator.

INSPECTION

- 1 Inspect elevating mechanism (1) for worn, broken, bent, or missing parts and defective elevating mechanism.
- 2 Check to see that elevating handwheel (2) turns freely.
- 3 Notify Unit maintenance if elevating mechanism does not meet inspection criteria.

SERVICING

- 1 Clean with wiping rags (item 26, appx E) and cleaning compound (item 9, appx E).
- 2 Lube oil can points with CLP (item 7, appx E).



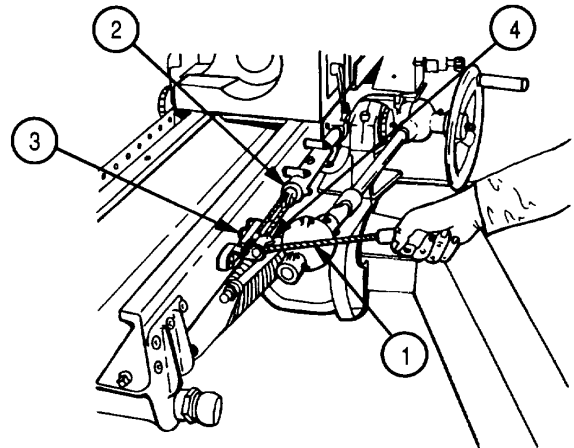
3-14. FIRING MECHANISM MAINTENANCE

INSPECTION

NOTE

The lanyard (1) should be pulled with a gradual and steady motion; jerking may cause the firing mechanism (2) to malfunction.

- 1 Check firing mechanism (2) by pulling lanyard (1). Firing mechanism (2) must operate smoothly and without binding.
- 2 Inspect bracket (3) and roller (4) for wear and broken or missing parts.
- 3 Notify Unit maintenance if firing mechanism (2) does not meet inspection criteria.



SERVICING

- 1 Clean with wiping rag (item 26, appx E) and cleaning compound (item 9, appx E).
- 2 Lube with CLP (item 7, appx E).

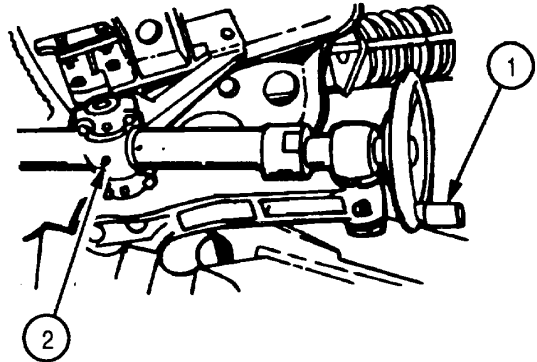
3-15. TRAVERSING MECHANISM MAINTENANCE

NOTE

The following maintenance includes the procedures for traversing handwheel (1) and collar assembly.

INSPECTION

- 1 Inspect traversing mechanism (2) for wear and broken or missing parts.
- 2 Check to see that traversing handwheel (1) turns freely.
- 3 Notify Unit maintenance if traversing mechanism does not meet inspection criteria.



SERVICING

- 1 Clean with cleaning compound (item 9, appx E) and wiping rags (item 26 appx E).
- 2 Lube oil can points with CLP (item 7, appx E).

3-16. TOP CARRIAGE AND ELEVATING ARC MAINTENANCE

NOTE

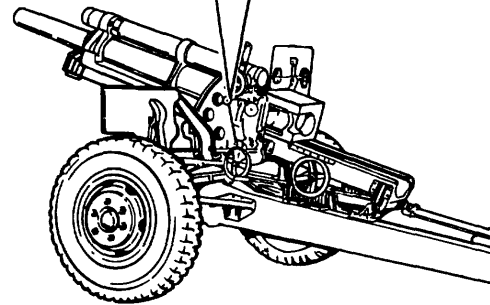
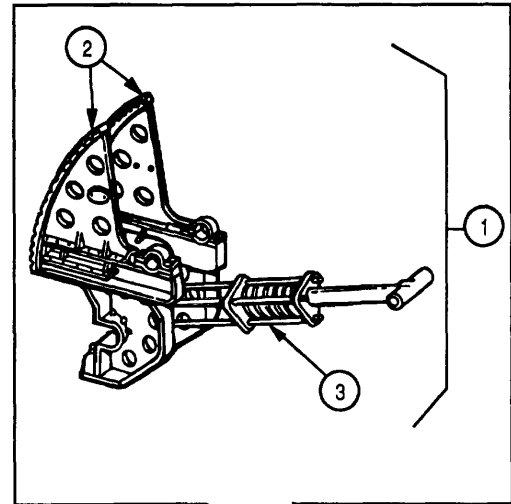
The following maintenance includes the procedures for elevating arc assembly top carriage, elevating arc and bushing assembly, and equilibrator assembly.

INSPECTION

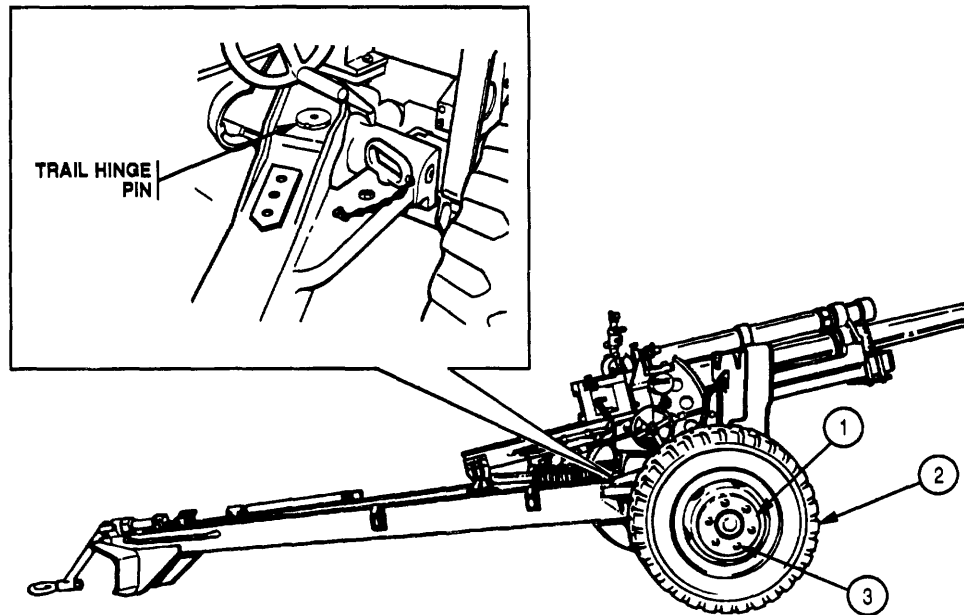
- 1 Inspect top carriage and elevating arc (1) for cracked flanges or damaged surfaces.
- 2 Inspect elevating arc (1) and bushing assembly (2) for worn, broken, or missing parts.
- 3 Elevate and depress weapon. It should take the same effort to elevate and to depress the weapon. If difficult or spasmodic, equilibrator assembly (3) should be adjusted.
- 4 Notify Unit maintenance if top carriage and elevating arc (1) do not meet inspection criteria.

SERVICING

- 1 Clean with cleaning compound (item 9, appx E) and wiping rags (item 26, appx E).
- 2 Lube with CLP (item 7, appx E).



3-17. WHEEL AND HUB ASSEMBLY MAINTENANCE



NOTE

The following maintenance includes procedures for the entire left and right wheel and hub assemblies.

INSPECTION

- 1 Inspect wheel (1) for wear, chipping, scoring, or corrosion.
- 2 Inspect for loose, broken, or missing parts.
- 3 Check tires (2) for cuts, stones, nails, and proper inflation (40 psi (276 kPa)). Check tire tread by pinch method. (Refer to page 2-15.)
- 4 Visually check for uneven tread wear.
- 5 Check wheel lugs (3) with lug wrench to make sure that they are tight.
- 6 Notify Unit maintenance if wheel and hub assembly does not meet inspection criteria.

SERVICING

- 1 Check air pressure for 40 psi (276 kPa); fill if needed.
- 2 Tighten all wheel lugs. If needed, notify Unit maintenance to have wheel lugs torqued to 350 ± 50 ft-lb (475 ± 68 N-m).
- 3 If repair is needed, notify Unit maintenance.

3-18. TRAIL HINGE PIN MAINTENANCE

INSPECTION

Check trail hinge pin for wear, rust, and missing parts. Notify Unit maintenance if trail hinge pin does not meet inspection criteria.

CLEANING

Clean with wiping rag (item 26, appx E) and cleaning compound (item 9, appx E).

3-19. TRAIL AND SPADE ASSEMBLY MAINTENANCE

NOTE

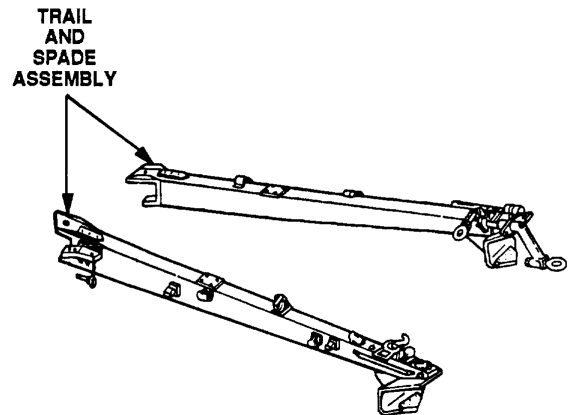
The following maintenance includes procedures for the left trail assembly, hand-spike support assembly, drawbar, knob assembly, trail latch assembly, right trail assembly, and aiming post support.

INSPECTION

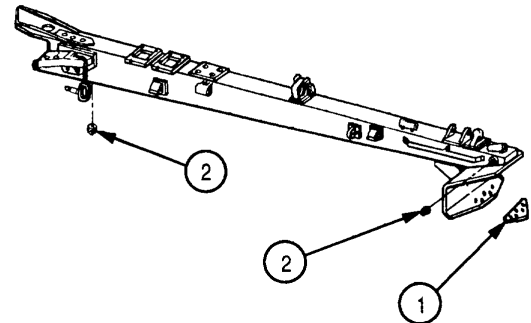
- 1 Inspect trail and spade assembly for burrs and bent, broken, or missing parts.
- 2 Check for water collection or dirt in trail and spade assembly.
- 3 Check for proper operation of trail and spade assembly.
- 4 Notify Unit maintenance if the trail and spade assembly does not meet inspection criteria.

SERVICING

- 1 Clean dirt from trail assembly points (1) with wire brush (item 5, appx E) and wiping rag (item 26, appx E).
- 2 Clean all other parts with wiping rags (item 26, appx E) and cleaning compound (item 9, appx E).
- 3 Drain all water by removing pipe plugs (2). When drained, install pipe plugs.
- 4 Lube. (Refer to page 3-9.)



NOTE
SOME PARTS ARE SHOWN
REMOVED FOR CLARITY.



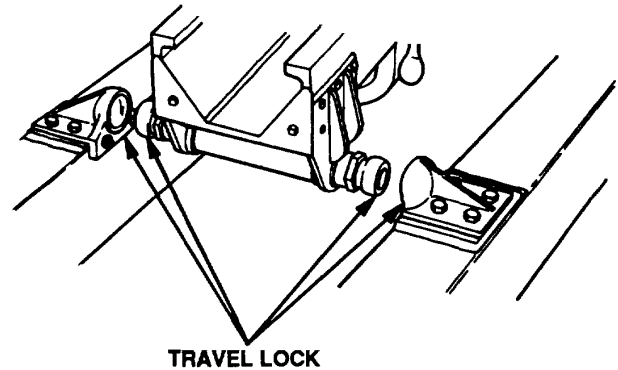
3-20. TRAVEL LOCK MAINTENANCE

INSPECTION

Inspect travel lock for worn, loose, broken, or missing parts. Notify Unit maintenance if travel lock does not meet inspection criteria.

SERVICING

- 1 Clean with wiping rag (item 26, appx E) and cleaning compound (item 9, appx E).
- 2 Lube with CLP (item 7, appx E).



3-21. CRADLE LOCK STRUT ASSEMBLY MAINTENANCE

NOTE

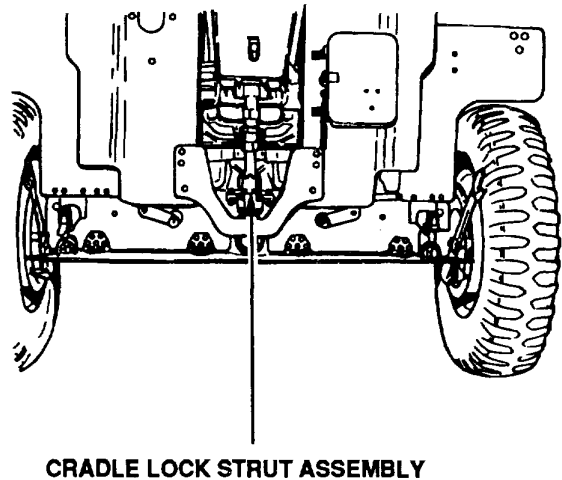
The following maintenance includes the procedures for the strut assembly latch.

INSPECTION

Inspect cradle lock strut assembly for loose, broken, or missing parts. Notify Unit maintenance if cradle lock strut assembly does not meet inspection criteria.

SERVICING

- 1 Clean cradle lock strut assembly with wiping rags (item 26, appx E) and cleaning compound (item 9, appx E).
- 2 Lube with CLP (item 7, appx E).



3-22. PINTLE ASSEMBLY MAINTENANCE**NOTE**

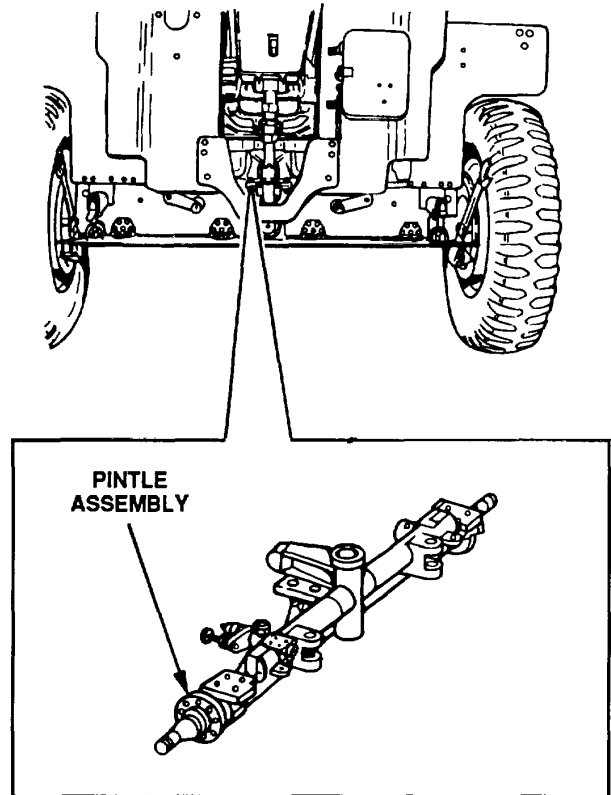
The following maintenance includes procedures for the lower strut latch.

INSPECTION

Inspect pintle assembly for loose, broken, or missing parts. Notify Unit maintenance if pintle assembly does not meet inspection criteria.

SERVICING

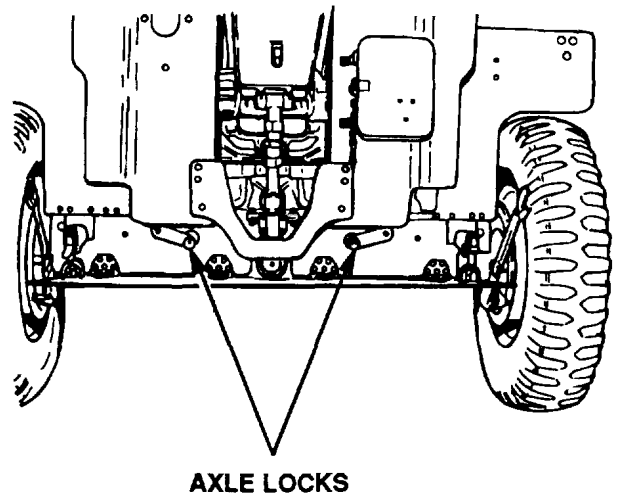
- 1 Clean with cleaning compound (item 9, appx E) and wiping rags (item 26, appx E).
- 2 Lube support with CLP (item 7, appx E).
- 3 Lube lower strut latch with CLP (item 7, appx E).

**3-23. AXLE LOCKS (RIGHT AND LEFT) MAINTENANCE****INSPECTION**

Inspect axle locks for burrs and loose, bent, broken, or missing parts. Notify Unit maintenance if axle locks do not meet inspection criteria.

SERVICING

- 1 Clean with cleaning compound (item 9, appx E) and wiping rags (item 26, appx E).
- 2 Lube with CLP (item 7, appx E).



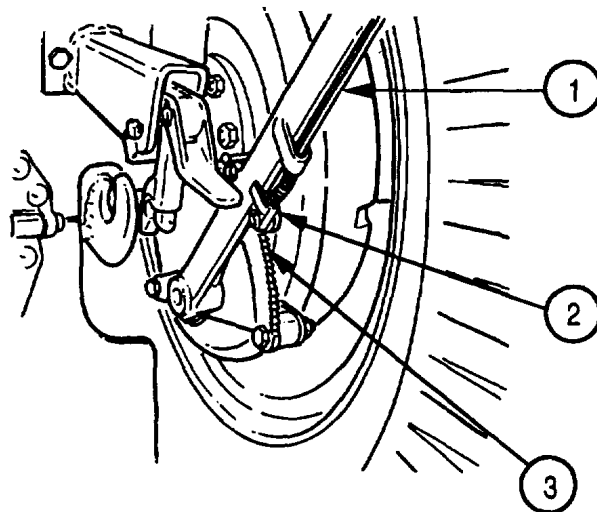
3-24. HANDBRAKES MAINTENANCE

NOTE

The following maintenance includes procedures for handbrake lever.

INSPECTION

- 1 Check handbrakes (1) for loose, broken, bent, or missing parts.
- 2 Check adjustment of handbrakes (1). Handbrakes (1) are properly adjusted if handbrakes (1) are fully engaged when handbrake pawl (2) is approximately halfway down on ratchet rack (3).
- 3 Notify Unit maintenance if handbrakes (1) appear worn, inoperative, or do not meet inspection criteria.



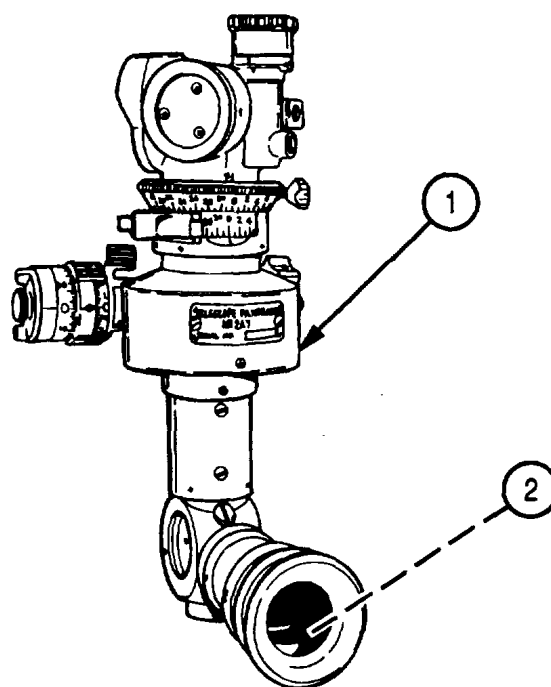
SERVICING

- 1 Clean with cleaning compound (item 9, appx E) and wipe with wiping rags (item 26, appx E).
- 2 Apply CLP (item 7, appx E) on hinge points of handbrakes (1).

3-25. M12A7S PANORAMIC TELESCOPE (PANTEL) MAINTENANCE

INSPECTION

- 1 Check for smooth operation.
- 2 Check pantel (1) for wear, tears, and missing parts.
- 3 Check lenses (2) for smears, scratches, cracks, or other obstructions; moisture in optics; and loose fitted parts.
- 4 Notify Unit maintenance if pantel (1) does not meet inspection criteria.



SERVICING

Clean lens with optical lens cleaning compound (item 8, appx E) and lens tissue (item 25, appx E). Wipe dry with lens tissue (item 25, appx E). If moisture is present within optics, notify Unit maintenance to purge.

3-26. M21A1 TELESCOPE MOUNT MAINTENANCE

INSPECTION

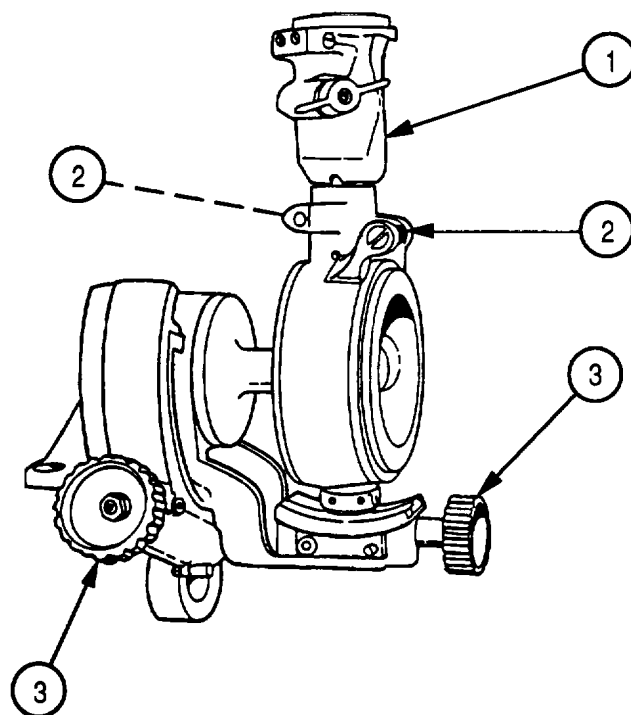
- 1 Check that surfaces of M21A1 telescope mount (1) are free of dirt, dents, burrs, and paint.
- 2 Check for missing, damaged, or worn hardware.
- 3 Level vials (2) must not be cracked or broken, loose in mounting, or missing their covers.
- 4 Check that knobs (3) and locking parts function properly.
- 5 Notify Unit maintenance if M21A1 telescope mount does not meet inspection criteria.

SERVICING

Clean with wiping rags (item 26, appx E) and cleaning compound (item 9, appx E). If moisture is present within optics, notify Unit maintenance to purge.

ADJUSTMENT

Refer to boresighting pantel, using distant aiming point method. (Refer to page 2-47.)



3-27. M16A1D ELBOW TELESCOPE MAINTENANCE

INSPECTION

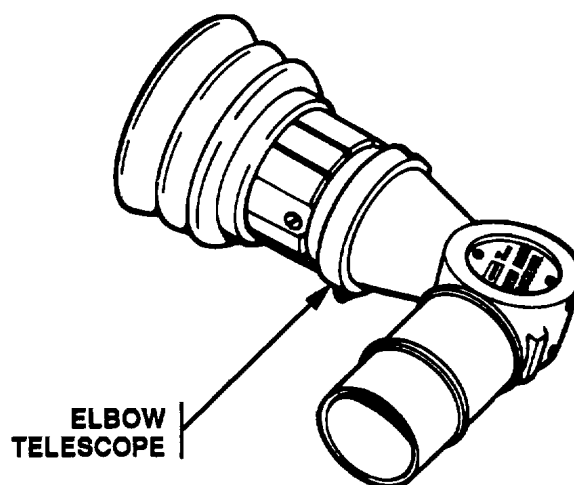
- 1 Inspect elbow telescope for burrs and loose, bent, broken, or missing parts.
- 2 Check to be sure reticule and scales are illuminated when instrument light is turned ON.
- 3 Notify Unit maintenance if elbow telescope does not meet inspection criteria.

SERVICING

Clean lens with optical lens cleaning compound (item 8, appx E) and lens tissue (item 25, appx E). Wipe dry with wiping rags (item 26, appx E). If moisture is present within optics, notify Unit maintenance to purge.

ALIGNMENT

Boresight elbow telescope, using test target method. (Refer to page 2-53.)



3-28. M23 TELESCOPE MOUNT MAINTENANCE

INSPECTION

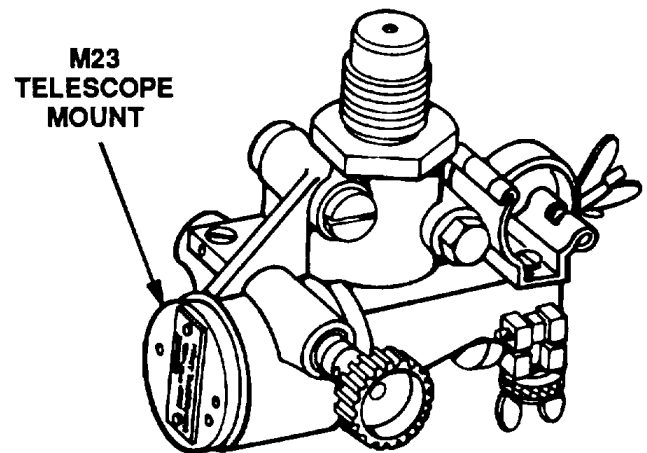
- 1 Check for smooth operation.
- 2 Check for loose, missing, or broken parts.
- 3 Notify Unit maintenance if M23 telescope mount does not meet inspection criteria.

SERVICING

Clean with cleaning compound (item 9, appx E) and wipe with wiping rags (item 26, appx E).

ADJUSTMENT

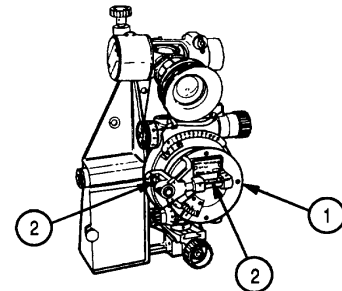
Boresight the howitzer. (Refer to page 2-47.)



3-29. M4A1 FIRE CONTROL QUADRANT MAINTENANCE

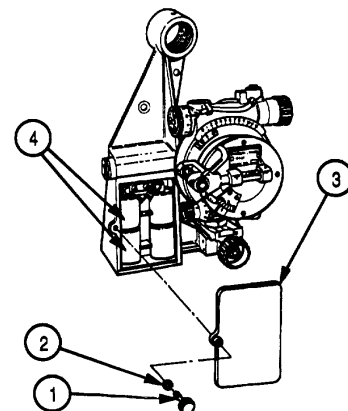
INSPECTION

- 1 Inspect fire control quadrant (1) for burrs and loose, bent, broken, or missing parts.
- 2 Install batteries and check lamp switch, lamps, and batteries for operation.
- 3 Check to be sure that level vials (2) are not cracked. Notify Unit maintenance if fire control quadrant does not meet inspection criteria.



BATTERY REPLACEMENT

- 1 Remove machine screw (1), lockwasher (2), and cover (3).
- 2 Remove batteries (4).
- 3 Install new batteries (item 4, appx E) with positive end facing upward.
- 4 Install cover (3), lockwasher (2), and machine screw (1). Tighten machine screw (1).



SERVICING

- 1 Clean fire control quadrant with wiping rags (item 26, appx E) and cleaning compound (item 9, appx E).
- 2 Clean level vials with optical lens cleaning compound (item 8, appx E) and lens tissue (item 24, appx E).

ADJUSTMENT

Boresight pantel, using test target method. (Refer to page 2-50.)

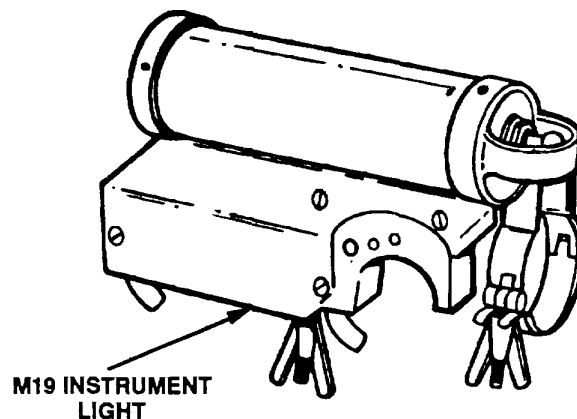
3-30. M19 INSTRUMENT LIGHT MAINTENANCE

NOTE

Refer to page 2-37 for installation of M19 instrument light.

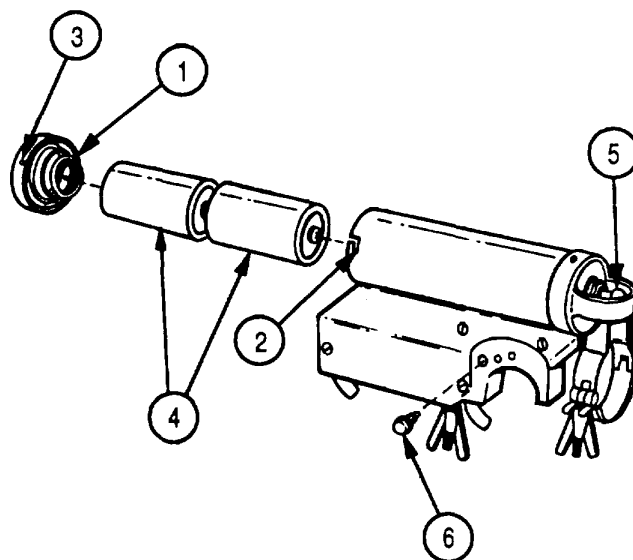
INSPECTION

Install batteries and check lamp switch, lamp, and batteries for operation.

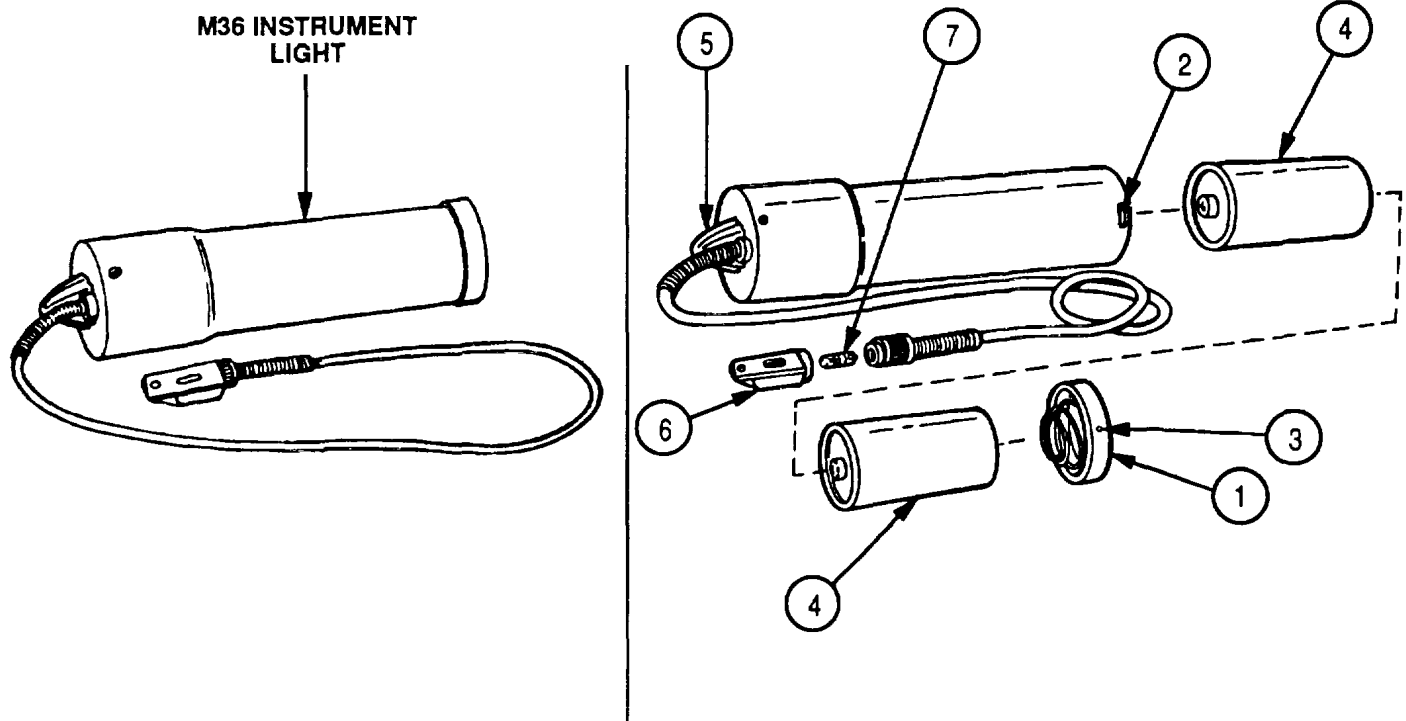


BATTERY AND LAMP REPLACEMENT

- 1 If batteries are dead, push in and turn cap assembly (1) until bayonet slots (2) align with pins (3).
- 2 Remove cap assembly (1) and batteries (4).
- 3 Install new batteries (item 4, appx E) with positive end toward lamp switch (5).
- 4 Install cap assembly (1).
- 5 If lamp is burned out, unscrew lamp (6) and remove.
- 6 Screw new lamp (item 20, appx E) back into housing.



3-31. M36 INSTRUMENT LIGHT MAINTENANCE

**NOTE**

Refer to page 2-37 for installation of M36 instrument light.

INSPECTION

Install batteries and check lamp switch, lamp, and batteries for operation prior to night operation.

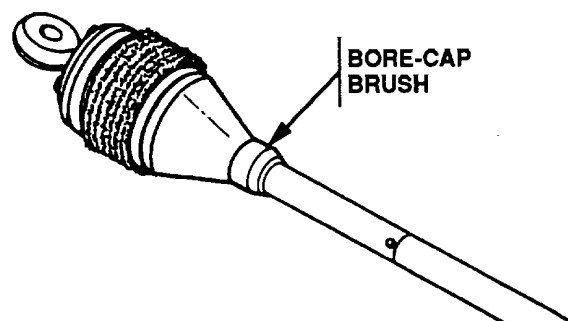
BATTERY AND LAMP REPLACEMENT

- 1 If batteries are dead, push in and turn cap assembly (1) until bayonet slots (2) and pins (3) are aligned.
- 2 Remove cap assembly (1) and batteries (4).
- 3 Install new batteries (item 4, appx E) with positive end toward lamp switch (5).
- 4 Install cap assembly (1).
- 5 If lamp is burned out, remove bracket (6).
- 6 Remove lamp (7) and install new lamp (item 19, appx E).
- 7 Install bracket (6).

3-32. BORE-CAP BRUSH MAINTENANCE

SERVICING

- 1 Clean bore-cap brush with cleaning compound (item 9, appx E) and wiping rags (item 26, appx E).
- 2 Apply a few drops of CLP (item 7, appx E) to the thread area.



3-33. TAILLIGHT ASSEMBLY MAINTENANCE

INSTALLATION

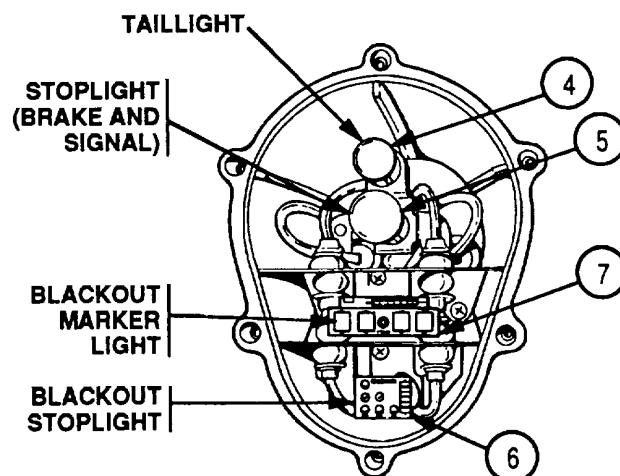
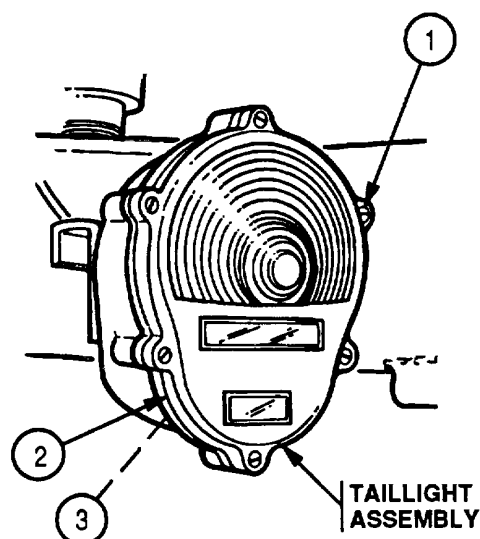
- 1 Cannoneer no. 2 installs the taillight assembly on the cannon tube and tightens the pin.
- 2 Gunner connects taillight assembly to prime mover.

INSPECTION

Inspect for broken or burned-out lamps. Inspect for broken or missing parts.

LAMP REPLACEMENT

- 1 Remove six screws (1), light lens cover (2), and preformed packing (3).
- 2 Remove lamps (4 and 5) by pressing in and rotating counterclockwise until released; then remove lamps from sockets. Using screwdriver, remove one LED lamp unit (6) and one LED light marker (7) by pressing in and turning counterclockwise.
- 3 Insert new lamp (4) (item 16, appx E) and new lamp (5) (item 17, appx E) by pressing in and rotating clockwise until locked in place.
- 4 Insert new LED lamp unit (6) (item 21, appx E) and new LED light marker (7) (item 22, appx E) by using screwdriver. Press in and turn clockwise.
- 5 Install preformed packing (3) and light lens cover (2). Tighten six screws (1).



3-34. M14 AIMING POST LIGHT MAINTENANCE**NOTE**

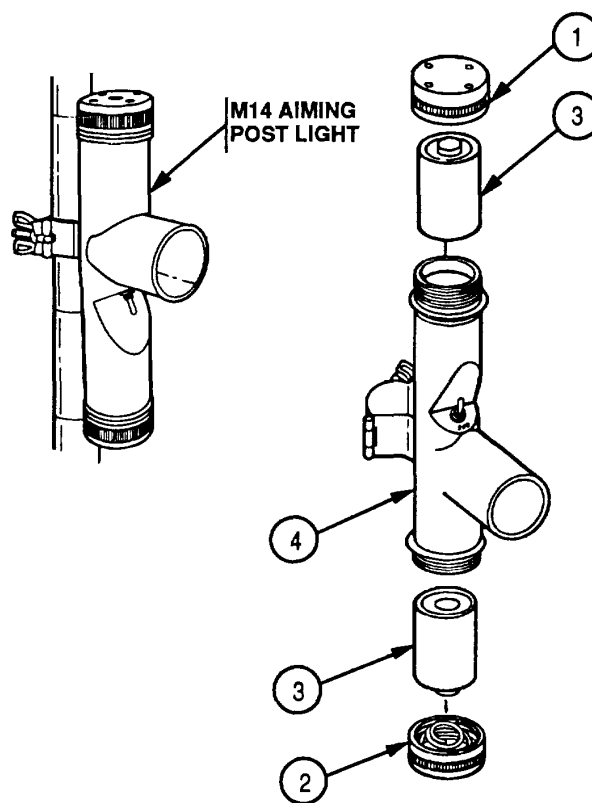
Refer to page 2-44 for installation of M14 aiming post lights.

INSPECTION

Install batteries and check lamp switch, lamps, and batteries for operation.

BATTERY REPLACEMENT

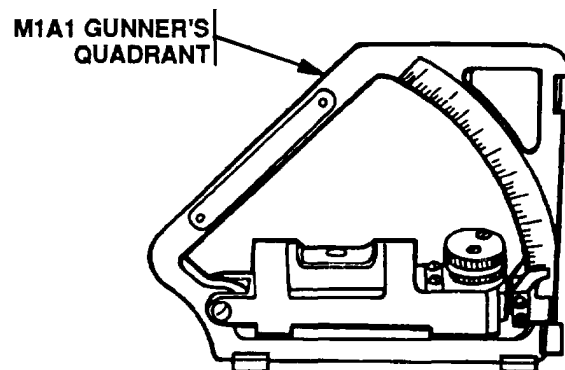
- 1 If batteries are dead, push in on cap assembly (1) and cover assembly (2).
- 2 Remove cap assembly (1), cover assembly (2), and batteries (3).
- 3 Install new batteries (item 4, appx E) with positive end toward center of case (4).
- 4 Install cap assembly (1) and cover assembly (2). Turn clockwise to engage.

**3-35. M1A1 GUNNER'S QUADRANT (WITH CARRYING CASE) MAINTENANCE****INSPECTION**

- 1 Inspect gunner's quadrant for loose, bent, broken, or missing parts.
- 2 All scales and data plates must be legible.
- 3 Notify Unit maintenance if gunner's quadrant does not meet inspection criteria.

TESTING

Refer to page 3-72, gunners quadrant end-for- end test.

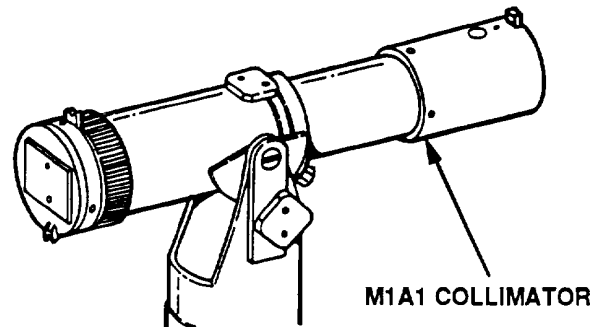


3-36. M1A1 COLLIMATOR MAINTENANCE

When using radioactively illuminated fire control equipment, follow radiation hazard procedures in the front of this manual.

INSPECTION

If collimator image is not sharp or if collimator has missing, broken, or damaged parts, notify Unit maintenance.



Section IV. FIRE CONTROL ALIGNMENT TESTS AND MEASUREMENTS

3-37. PURPOSE

Fire control alignment tests and measurements are performed by section crewmembers under the supervision of the battery executive officer and the chief of firing battery. Fire control alignment tests and measurements are used to determine if the on-carriage fire control and gunner's quadrant are in correct adjustment. Any equipment that fails these tests must be sent to Unit maintenance.

3-38. FREQUENCY

The following tests are performed:

- a. As soon as possible after periods of intensive use.
- b. Following an accident.
- c. After traveling over extremely rough terrain.
- d. Once a year if weapon is used for nonfiring training.
- e. Once every 3 months if weapon is fired.
- f. When fire control mounts have been replaced.
- g. When weapon fires inaccurately for no readily apparent reason.

3-39. PREPARATION

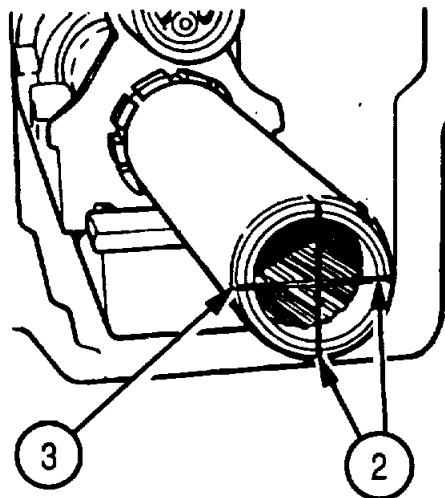
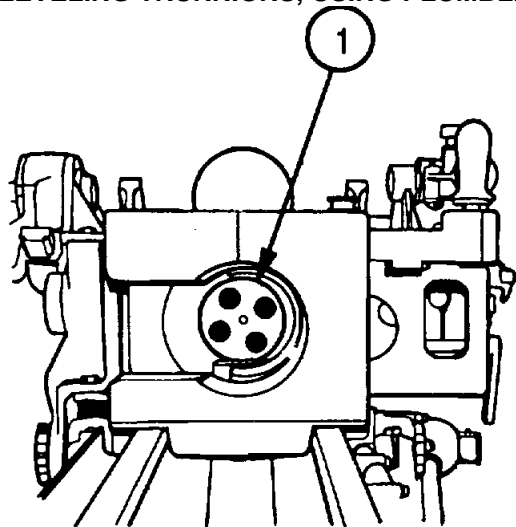
Prepare weapon as follows:

- a. Emplace weapon. (Refer to page 2-33.)
- b. Be sure that all equipment required to perform the test is on hand.
- c. Install fire control equipment in mounts. (Refer to page 2-36.)
- d. Check M4A1 fire control quadrant, pantel, and M21A1 telescope mount for looseness or other obvious defects.
- e. Inspect gunner's quadrant seats for dirt, nicks, or burrs.

3-40. EQUIPMENT REQUIREMENTS

The following equipment is required for alignment tests and measurements.

- a. Two jacks. (Use mechanical jacks if possible.)
- b. A cord, at least 30 ft (9 m) long, and a 1/2-lb (0.23-kg) weight (to be used as a plumbline).
- c. One 3- to 5-gal. (11- to 19-l) can of oil.
- d. Muzzle strings.
- e. Tape.
- f. Breech boresight disk.
- g. Gunner's quadrant.

3-41. LEVELING TRUNNIONS, USING PLUMBLINE

- 1 Position the weapon. (Refer to page 2-33.)
- 2 Install breech boresight disk (1) and tape muzzle crosslines (2) on witness marks (3).

- 3 Attach plumbline (4) to a fixed object.

NOTE

Plumbline must be long enough to be seen through breech boresight disk (1) when cannon tube is elevated through an 1100-mil range.

- 4 Tie a weight to end of plumbline. Weight may be any object weighing at least 1/2 lb (0.23 kg).
- 5 Hang weight in a bucket of oil.

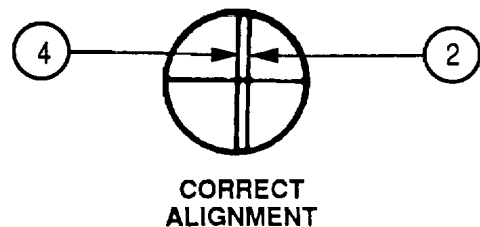
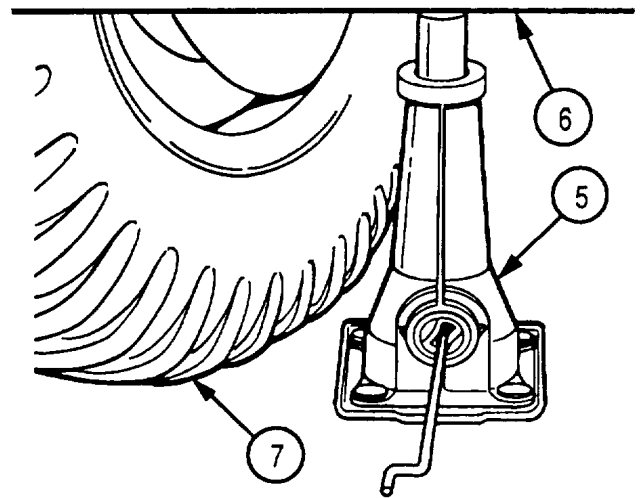
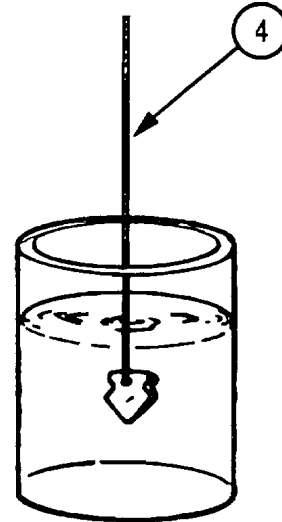
NOTE

Plumbline should be hung where there is little or no wind.

- 6 Position weapon so that end of cannon tube is within 12 in. (30 cm) of plumbline (4) and within 100 mils of center traverse of bottom carriage.
- 7 Be sure that vertical muzzle crossline (2) is on plumbline (4).
- 8 Spread trail assemblies and lock with trail locking pins.

- 9 Place a mechanical jack (5) under each axle (6) close to the left and right wheels (7). Raise wheels (7) to lower carriage onto mechanical jacks. Raise weapon until bottom of tires are at least 4 in. (10 cm) from floor.

- 10 Look through breech boresight disk (1) and manually traverse weapon, if necessary, until vertical muzzle crossline (2) is aligned with plumbline (4).



3-41. LEVELING TRUNNIONS, USING PLUMBLINE (cont)

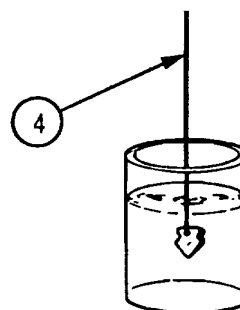
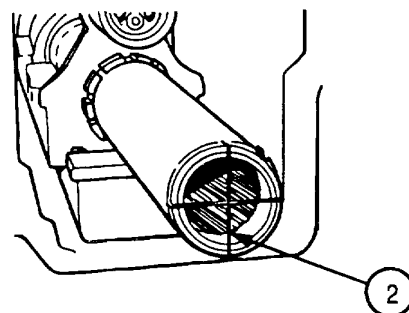
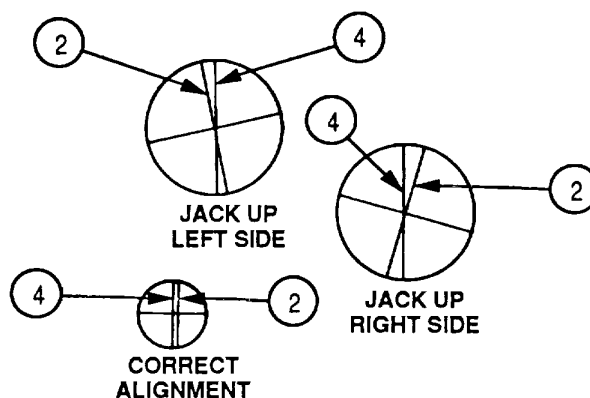
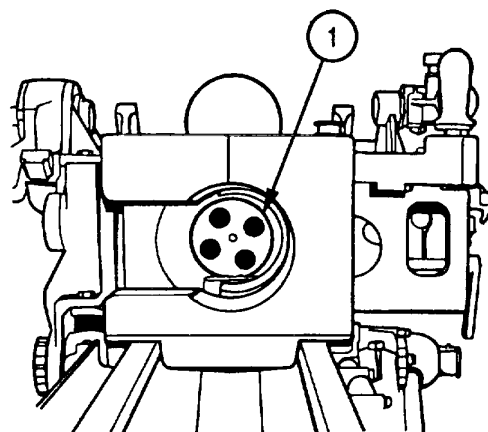
NOTE

Maximum allowable traverse from center position is 100 mils left or right. If weapon must be traversed more than 100 mils left or right, reposition weapon or move plumbline (4).

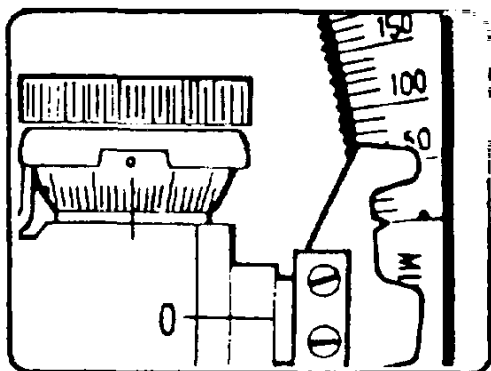
- 11 Elevate and depress cannon tube until vertical muzzle crossline (2) remains on plumbline (4) at elevations from 0 to 1100 mils.
- 12 If top of vertical muzzle crossline (2) moves to right of plumbline (4), right side of axle pintle assembly must be jacked up.
- 13 If top of vertical muzzle crossline (2) moves to left of plumbline (4), left side of axle pintle assembly must be jacked up.
- 14 Gunner must watch through breech boresight disk (1) as weapon is being jacked up. When vertical muzzle crossline (2) approaches plumbline (4), gunner tells cannoneer when to stop adjusting jack.
- 15 Elevate cannon tube to 1100 mils while observing plumbline (4) through breech boresight disk (1) to see if vertical muzzle crossline (2) tracks plumbline (4). Trunnions are now level.

NOTE

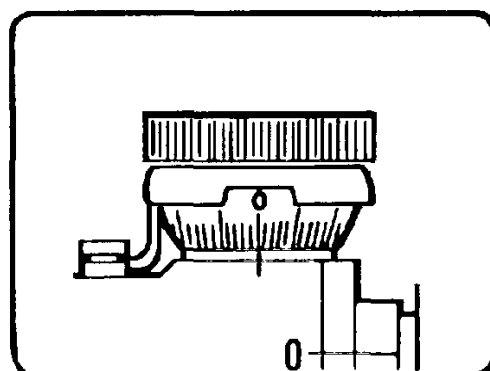
Repeat steps 10 thru 14 until vertical muzzle crossline (2) tracks plumbline (4).



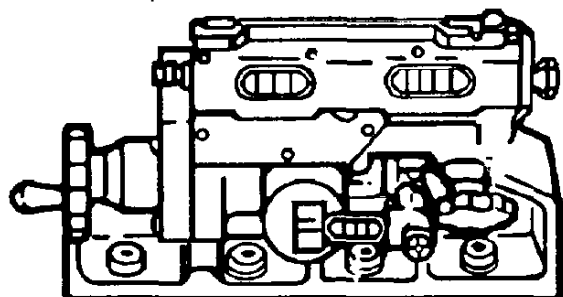
3-42. M1A1 GUNNER'S QUADRANT MICROMETER TEST



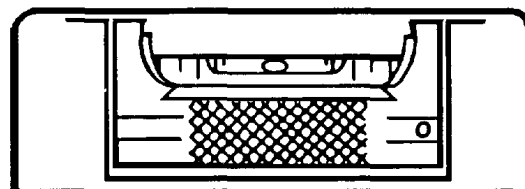
- 1 Set index at plus 10.



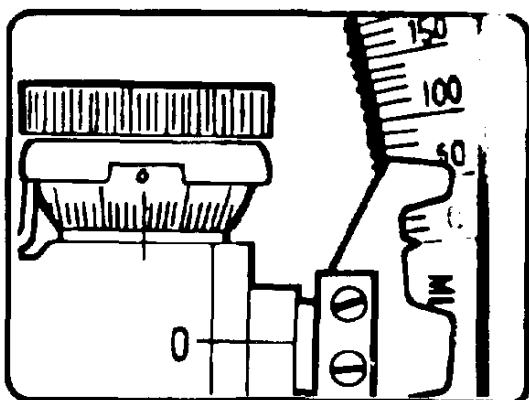
- 2 Zero the micrometer.



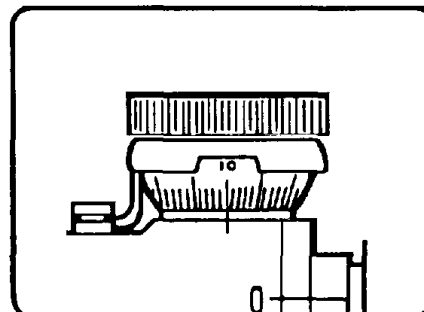
- 3 Point gunner's quadrant toward muzzle.



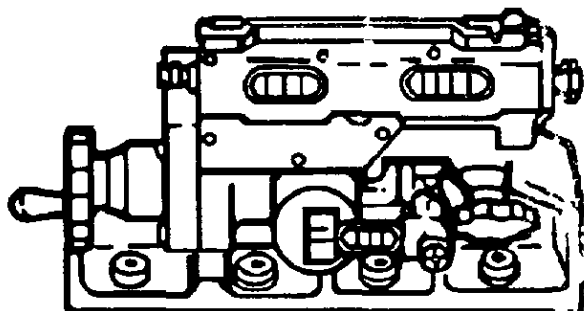
- 4 Depress/elevate cannon tube to center gunner's quadrant level vial bubble.



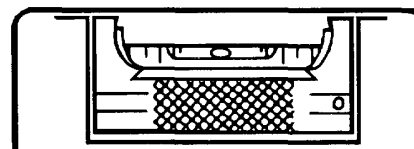
- 5 Set index at zero.



- 6 Set micrometer at 10.

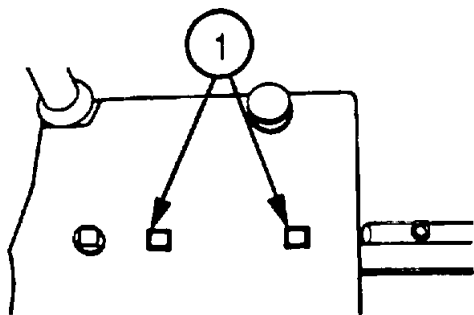


- 7 Point gunner's quadrant toward muzzle.
8 Gunner's quadrant level vial bubble should center.



- 9 If level vial bubble does not recenter, the micrometer is in error. The gunner's quadrant should be turned into Unit maintenance for repair.

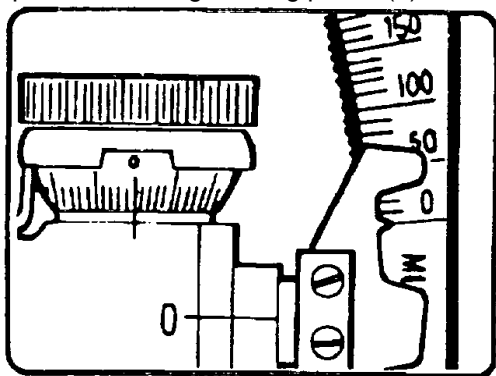
3-43. GUNNER'S QUADRANT END-FOR-END TEST



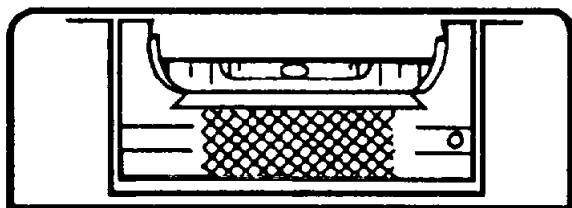
NOTE

After end-for-end test, gunner's quadrant should read ± 0.4 mils.

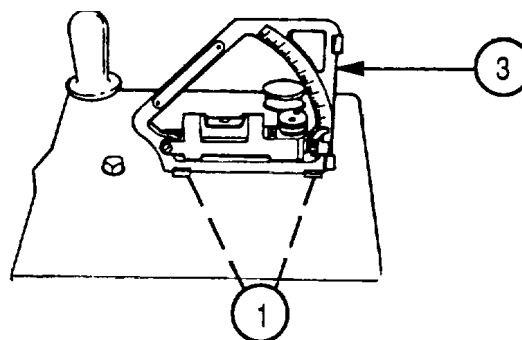
- 1 Inspect breech ring leveling plates (1).



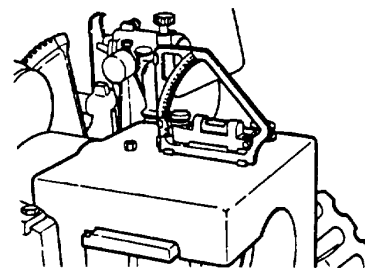
3. Zero the scales.



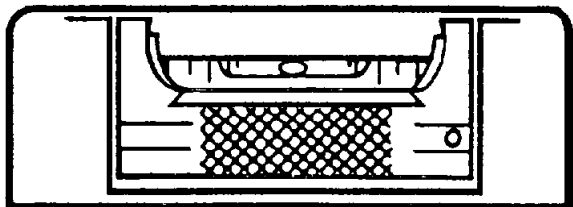
- 2 Inspect gunner's quadrant shoes (2).



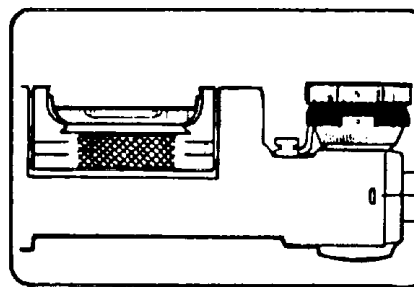
- 4 Place gunner's quadrant (3) on breech ring leveling plates (1) with the line-of-fire arrow pointing toward the muzzle.



- 5 Depress or elevate cannon tube to center bubble.



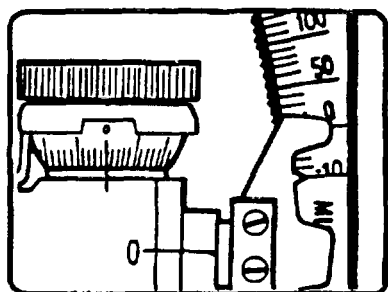
- 6 Reverse direction.



- 7 Bubble should recenter. If bubble does not recenter, go to step 8.

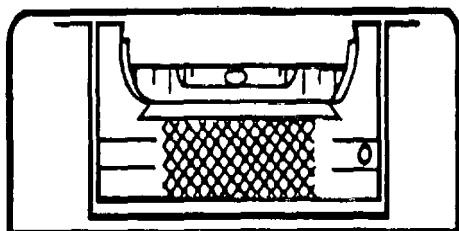
- 8 Center bubble with micrometer knob. If bubble centers, go to step 9. If it does not, go to step 16.

POSITIVE
CORRECTION
 $\frac{0.4}{2} = 0.2$

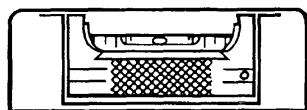


9 Divide micrometer reading by 2.

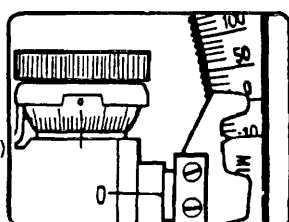
10 Put result on micrometer scale.



12. Depress or elevate cannon tube to center bubble.

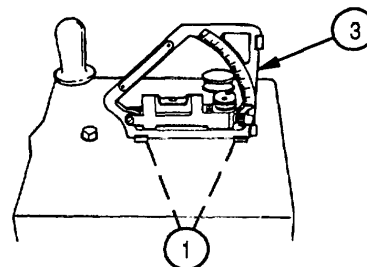


14. Bubble should recenter.

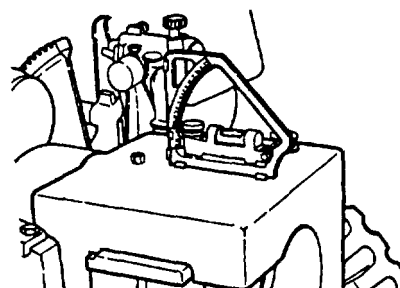


NEGATIVE
CORRECTION
(Bubble did not
center at step 8.)

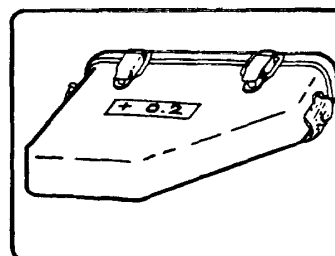
16. Set index at-



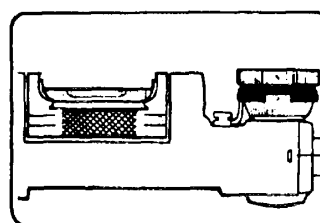
11 Place gunner's quadrant (3) on breech ring leveling plates (1) with the line-of-fire arrow pointing toward the muzzle



13. Reverse direction



15. Record end-for-end correction.

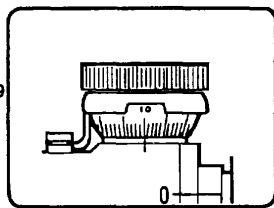


10.

17. Center bubble with micrometer knob.

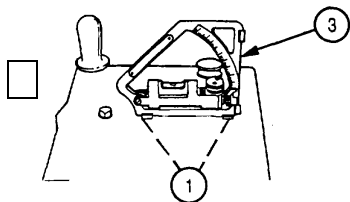
3-43. GUNNER'S QUADRANT END-FOR-END TEST

$$\frac{19.8}{2} = 9.9$$

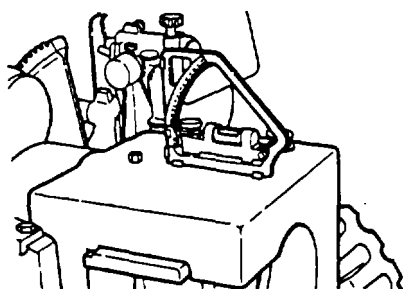


18 Add 10 to micrometer reading.

19 Divide sum by 2.

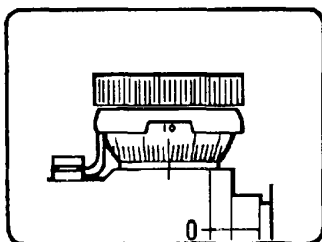


21 Place gunner's quadrant (3) on breech ring leveling plates (1) with the line-of fire arrow pointing toward the muzzle.

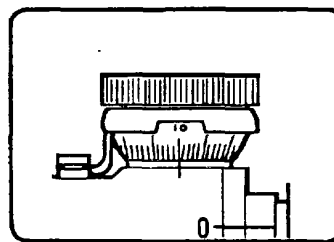


23 Reverse direction.

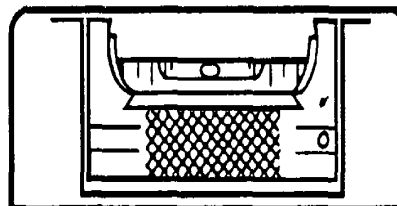
$$\begin{array}{r} 10.0 \\ -9.9 \\ \hline 0.1 \end{array}$$



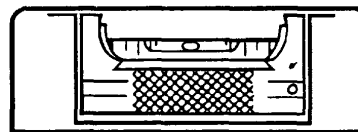
25 Subtract micrometer reading from 10.0.



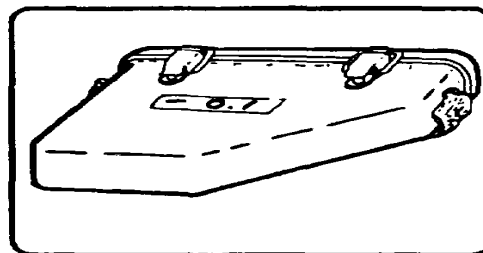
20 Place answer on micrometer scale.



22 Depress or elevate cannon tube to center bubble.



24 Bubble should recenter.



26 Record end-for-end correction.

NOTES

If bubble centers, test is complete. If not, notify Unit maintenance.

3-44. LEVELING CANNON TUBE

NOTE

Be sure trunnions are level (refer to page 3-68) before cannon tube is leveled. Cannon tube can be leveled, using breech ring leveling plates or the gun tube leveling fixture.

A correction value is stamped on breech ring of new production howitzers and represents angular difference between bore centerline and breech ring leveling plates. If correction value has a plus (+) sign, it is added to gunner's quadrant; if it has a minus (-) sign, it is subtracted. Correction value varies from weapon to weapon. Failure to compensate for a correction value will cause misalignment of fire control equipment.

EXAMPLE: If correction value is -2.2 and there is a +0.4 error on gunner's quadrant, set -1.8 on gunners quadrant before leveling cannon tube.

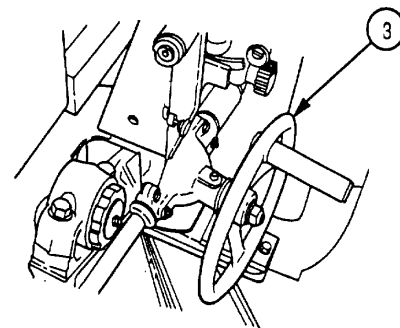
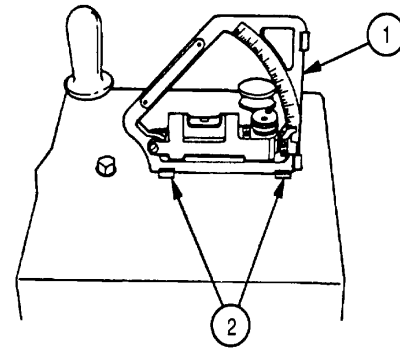
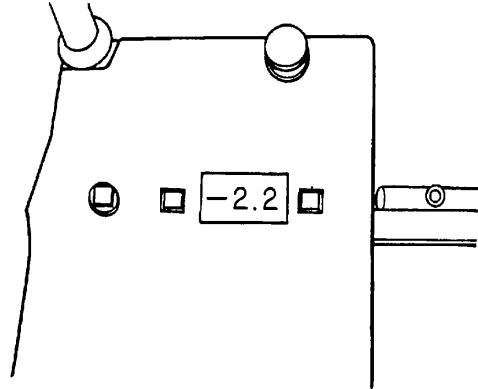
LEVELING CANNON TUBE, USING BREECH RING LEVELING PLATES

- 1 Place prechecked gunner's quadrant (1) (refer to page 3-72) on breech ring leveling plates (2) with line-of-fire arrow pointing toward muzzle. Compensate for gunner's quadrant correction factor as well as correction value stamped on breech ring.

NOTE

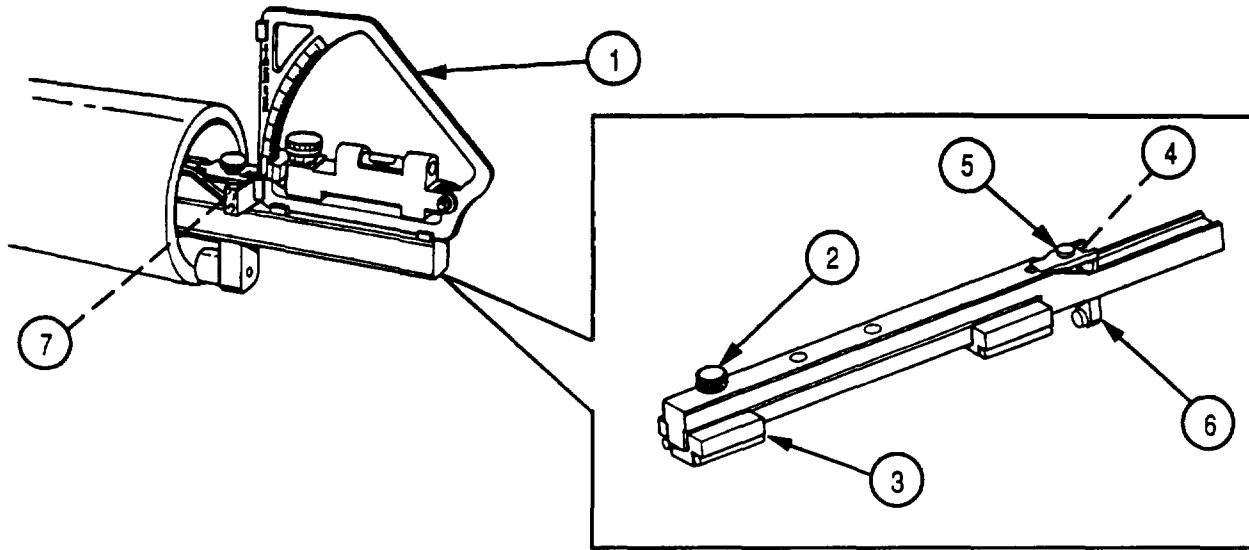
Last turn of elevating handwheel should be made in direction of most resistance.

- 2 Using elevating handwheel (3), elevate or depress cannon tube until gunner's quadrant level vial is centered.
- 3 Cannon tube is now level.



3-44. LEVELING CANNON TUBE (cont)

LEVELING CANNON TUBE, USING GUN TUBE LEVELING FIXTURE

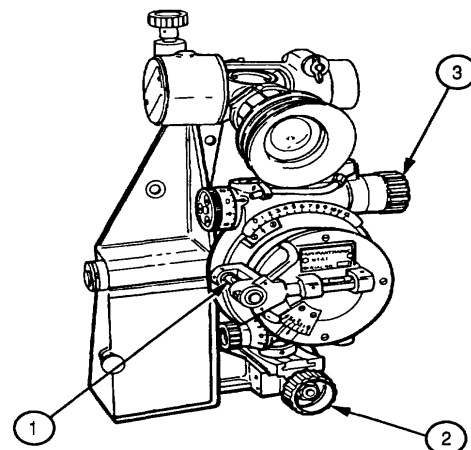
**NOTE**

Last turn of elevating handwheel should be made in direction of most resistance.

- 1 Elevate or depress cannon tube to zero elevation.
- 2 Remove gun tube leveling fixture (1) from its case and install as follows:
 - a. Remove screw (2) from movable shoe (3) and set movable shoe to 105-mm position.
 - b. Install screw (2) in proper hole and tighten securely.
 - c. Insert cross level vial (4) under cross level holder (5) on gun tube leveling fixture.
 - d. Place magnet base stop (6) on cross level screw protruding through gun tube leveling fixture from cross level holder (5) and tighten securely.
- 3 Insert gun tube leveling fixture (1) into muzzle end of cannon tube until contact is made between magnet base stop (6) and face of cannon tube, making sure magnet is flush with cannon tube.
- 4 Rotate gun tube leveling fixture (1) until cross level vial bubble (7) is centered.
- 5 Place a prechecked gunner's quadrant, with zero reading, in groove of gun tube leveling fixture in direction of fire. Apply correction factor, if applicable
- 6 Use elevating handwheel to elevate or depress weapon in direction of greatest resistance until level vial bubble of gunner's quadrant is centered.
- 7 Reverse gunner's quadrant. Gunner's quadrant level vial bubble should recenter. Cannon tube is now level.
- 8 Place gun tube leveling fixture and gunner's quadrant back in their cases.

3-45. TESTING M4A1 FIRE CONTROL QUADRANT**CROSS LEVEL TEST**

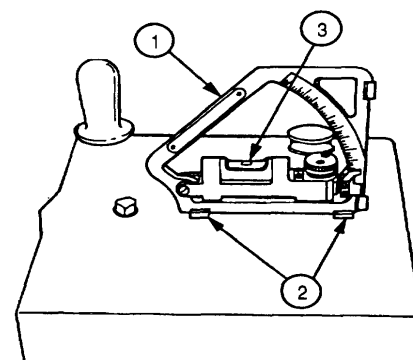
- 1 Check to be sure that trunnions and cannon tube are still level. (Refer to page 3-68.)
- 2 Center cross level bubble (1) by turning cross leveling worm knob (2).
- 3 Turn elevating knob (3) throughout its limits and observe cross level bubble (1). Cross level bubble must remain centered within one-half vial graduation. If the cross level bubble does not remain centered within one-half vial graduation, notify Unit maintenance.

**PIVOT AZIMUTH ALIGNMENT TEST**

- 1 Check to be sure that trunnions are still level. (Refer to page 3-68.)
- 2 Center previously tested cross level bubble (1) by turning cross leveling worm knob (2).
- 3 While observing cross level bubble (1), elevate cannon tube to 600 mils and then depress back to 0 mil. If cross level bubble does not remain centered within one-half vial graduation, the actuating arm pivot is not aligned in azimuth with cannon tube; notify Unit maintenance.

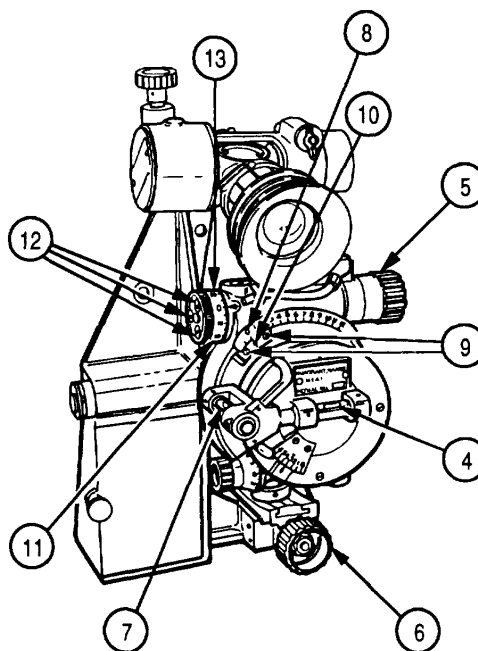
PIVOT VERTICAL ALIGNMENT TEST

- 1 Check to be sure that trunnions are still level. (Refer to page 3-68.)
- 2 Level cannon tube by placing a previously tested gunner's quadrant (1), with any required correction factor applied, on breech ring leveling plates (2). Elevate or depress cannon tube until bubble (3) centers.



3-45. TESTING M4A1 FIRE CONTROL QUADRANT (cont)**PIVOT VERTICAL ALIGNMENT TEST (CONT)**

- 3** Center elevation bubble (4) by turning elevating knob (5)
- 4** While observing elevation bubble (4), turn cross leveling worm knob (6) throughout its limits. If elevation bubble (4) moves more than one-half vial graduation, either the actuating arm pivot is not aligned vertically with cannon tube or the level vial is not correctly aligned; notify Unit maintenance.
- 5** Center cross level bubble (7) and elevation bubble (4) using cross leveling worm knob
- 6** Check elevation scale (8) for 0 reading. If it does not read 0, loosen two screws (9) and (6) and elevating knob (5). align index (10) to read 0. Tighten two screws (9).
- 7** Check elevation micrometer (11) for 0 reading. If it does not read 0, loosen three screws (12) and slip elevation micrometer to align the 0 with index (13). Tighten three screws (12).

**COMPARISON TEST**

Compare readings indicated by gunner's quadrant with those on fire control quadrant at 0, 600, and 1100 mils of cannon tube.

NOTE

If the two instruments do not agree within ± 1.0 mil at all elevations, weapon and gunner's quadrant should be sent to Unit maintenance for adjustment.

3-46. TEST OF AZIMUTH COMPENSATING MECHANISM OF M21A1 TELESCOPE MOUNT**NOTE**

The purpose of testing azimuth compensating mechanism of M21 A1 telescope mount is to determine if it keeps cannon tube in correct vertical plane at all elevations. The tests listed below should be performed.

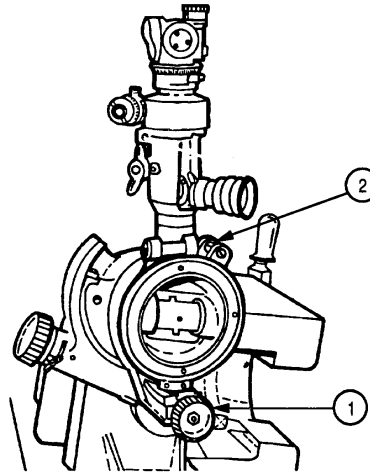
MUZZLE VERTICAL CROSSLINE TEST WITH TRUNNIONS LEVEL

Boresight howitzer. (Refer to page 2-47.) Elevate and depress cannon tube. Check to see that muzzle vertical crossline tracks a plumbline placed in front of cannon tube (refer to page 3-68) and, at the same time, watch cross level bubble on M21A1 telescope mount

CROSS LEVEL TEST**NOTE**

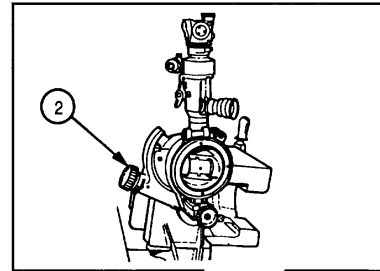
M21A1 telescope mount cross level bubble must be in proper adjustment before test of the azimuth compensating mechanism is completed.

- 1 Check to be sure trunnions are still level. (Refer to page 3-68.)
- 2 Turn cross leveling knob (1) to center cross level bubble (2). Use test target method (refer to page 2-50) or distant aiming point method (refer to page 2-47).
- 3 Elevate cannon tube to maximum elevation while keeping M21A1 telescope mount level longitudinally.

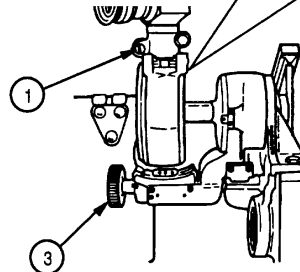
**NOTE**

Do not readjust cross level bubble after initial setting.

- 4 Line-of-sight must not deviate from target by more than 1 mil at any elevation checked and cross level bubble must not travel more than one-half vial graduation. If amount of deviation exceeds tolerance, level vial or actuating arm pivot is incorrectly aligned and weapon must be sent to Unit maintenance.

**VERTICAL ALIGNMENT TEST**

- 1 Level cannon tube longitudinally with gunner's quadrant.
- 2 Center longitudinal level bubble (1) using longitudinal leveling knob (2).
- 3 Operate cross leveling worm knob (3) throughout limits of motion.

**NOTE**

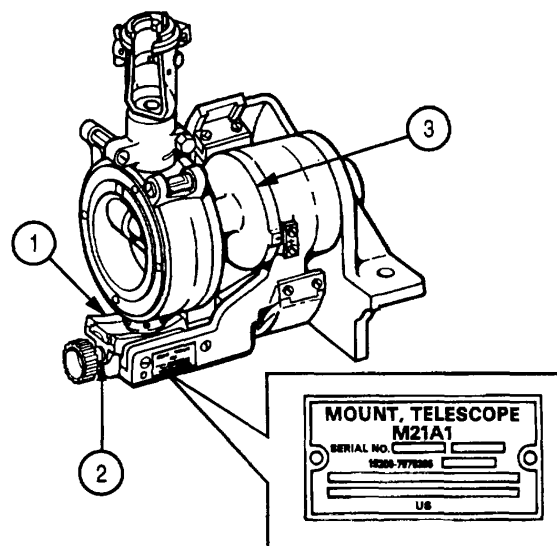
Longitudinal level bubble should remain centered within one-half vial graduation. If longitudinal level bubble moves in excess of tolerance, level vial or actuating arm pivot is not aligned correctly and weapon should be sent to Unit maintenance for adjustment.

3-47. ESTABLISHING STANDARD ANGLE AND SCRIBING MOUNT

NOTE

The following procedures should only be done during, or at the conclusion of, fire control alignment tests.

- 1 With the tube in battery, scribe lines in the paint to mark the position of parts which move in recoil with respect to parts which do not move in recoil.
- 2 Carefully level the trunnions.
- 3 Boresight the gun using a testing target.
- 4 With adhesive tape (item 31, appx E), fasten a bright common pin in the left horizontal witness mark. Allow the point to project to the left of the muzzle.
- 5 Fasten a telescope parallax shield in place over the eyepiece.
- 6 Verify that the elevation index and the micrometer on the telescope are at zero.
- 7 Elevate the tube until it is approximately level with the top of the panoramic telescope.
- 8 Center the bubbles of the telescope mount and refer the telescope to the junction of the pin with the muzzle. Adjust the tube elevation and turn the azimuth micrometer knob until, with the bubbles centered, the horizontal and vertical hairs of the telescope are exactly on the junction of the pin with the muzzle.
- 9 Read the angle from the panoramic telescope to the nearest 1/4 mil. Since the graduations are to the nearest mil it is necessary to interpolate to the nearest 1/4 mil. This is the standard azimuth (horizontal) angle for the gun tested.
- 10 With either the range quadrant or gunner's quadrant, measure the elevation of the tube to the nearest 1/4 mil. This is the standard elevation (vertical) angle for the gun tested.
- 11 With a knife blade or other sharp metal point, scribe lines in the paint on the following parts:
 - (a) Straight across the junction of the cross-leveling segment and the cross-leveling worm knob (1).
 - (b) Straight across the junction of the cross-leveling worm housing and the cross-leveling worm knob shaft (2).
 - (c) Straight across the junction of the rocker and the actuating arm (3)
- 12 Fill the scribed lines with red paint (item 24, appx E) and wipe off the excess.



CHAPTER 4 AMMUNITION

Section I. INTRODUCTION

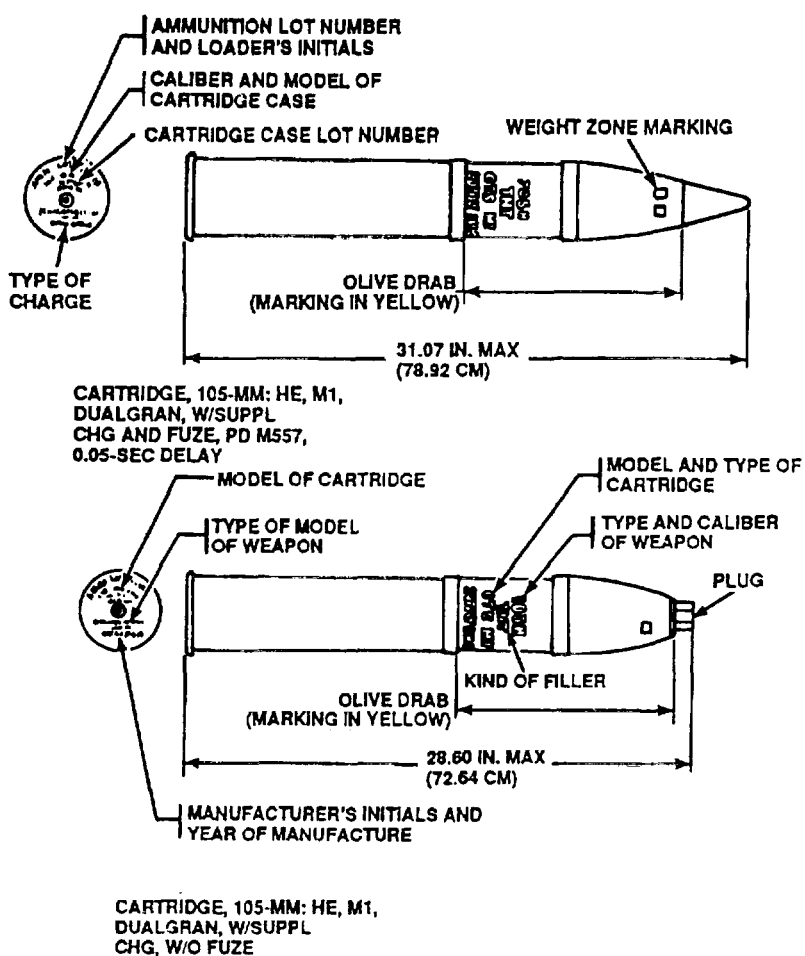
4-1. GENERAL

Ammunition for the M101A1 howitzer is the semifixed type. This ammunition has an adjustable propelling charge for zone firing, and the complete round is loaded into the weapon as a unit. The HEP cartridge does not have an adjustable charge. Semifixed ammunition is issued fuzeed for all projectiles except HE, HERA, and sometimes WP rounds. Draw separate fuzes for these rounds

4-2. PROJECTILE COLORINGS AND MARKINGS

Projectile colorings and markings (new and old) for the M101A1 howitzer are listed in table 4-1. (Refer to page 4-2.) In addition, important information is stenciled on each projectile. Knowing the color coding and meaning of this information will aid in the rapid selection of the required projectile when firing. Know which ammunition to use.

IDENTIFICATION MARKINGS



4-2. PROJECTILE COLORINGS AND MARKINGS (cont)

Table 4-1. MODEL NUMBERS AND COLOR CODING OF PROJECTILES

New Manufacture				Old Manufacture		
Model Number and Type of Projectile	Color of Projectile	No./Color of Bands	Marking	Color of Projectile	No./Color of Bands	Marking
M546 APERS-T	Olive drab	1/yellow	White diamonds white indicate flechettes)	Not applicable		
M14 dummy	Unpainted or bronze	None	White	Black or blue	None	White
M60 gas (H, HD)	Gray	2/green 1 /yellow	Green	Gray	2/green	Green
M360 gas (GB), w/burster	Gray	3/green 1 /yellow	Green	Gray	2/green	Green
M360 gas (GB), w/o burster	Gray	3/green	Green	Gray	2/green	Green
M444 ICM	Olive drab	None*	Yellow			Not applicable
M1 HE	Olive drab	None	Yellow	Olive drab	None	Yellow
M327 HEP	Olive drab	1/black	Yellow	Olive drab	None	Yellow
M314 series illuminating	White	None	Black	Gray	1/white	White

Table 4-1. MODEL NUMBERS AND COLOR CODING OF PROJECTILES

Model Number and Type of Projectile	New Manufacture				Old Manufacture		
	Color of Projectile	No./Color of Bands	Marking		Color of Projectile	No./Color of Bands	Marking
M67 target practice	Blue	None	White		Blue	None	White
M84 series smoke (HC and	Light green	None	Black		Gray	1/yellow	Yellow
M60 series smoke (WP)	Light green	1/yellow	Light red		Gray	1/Yellow	Yellow
HERA, M548	Olive drab	None	Yellow		Not applicable		
Tactical, CS, M629	Gray	1/red 1/yellow	Red		Not applicable		

Row of yellow diamonds around the ogive of projectile.

4-3. AUTHORIZED 105MM PROJECTILES AND USE

WARNING

Unauthorized assembly and use of projectiles and propelling charges are extremely dangerous. Make sure the projectiles are marked 105H (not G).

The weight zone markings are identified by means of one or more squares with or without a triangle of the same color as the marking. Two squares indicate standard or normal weight. Composition B loaded ammunition for the 105-mm howitzer contains an additional zone known as zone 2-1/2 (□□Δ). Authorized projectiles for the M101A1 howitzer are given in table 4-2. (Refer to page 4-4.)

Table 4-2. AUTHORIZED PROJECTILES

Model	Abbreviation	Type	Use
M546	APERS-T	Flechette-loaded, aluminum projectile MA, MT, M563	Antipersonnel (effective in dense foliage)
M1	HE	High explosive-bursting	Antipersonnel, blast,
M60	H/HD	Bursting, chemical mustard/distilled mustard	Antipersonnel, persistent
M360	GB	Bursting, chemical-sarin	Antipersonnel, non-
M327	HEP/HEP-T	High explosive, bursting/high explosive, bursting, tracer	Defeat armor (effective against concrete and timber targets)
M314, M314A1, and M314A2	ILLUM	Base ejection projectile, parachute candle for use with M501/M501A1 fuzes only	illumination
M314A3 (M314A2E1)	ILLUM	Base ejection projectile, parachute candle for use with M548, M565, and M577 fuzes	Illumination
M60 series	Smoke, WP	Bursting chemical	Screening, spotting,
M84A1	Smoke, HC	Base-ejection projectile with canisters for use with M548, M565, or M577 fuzes	Screening/target identification signaling
		4-4	

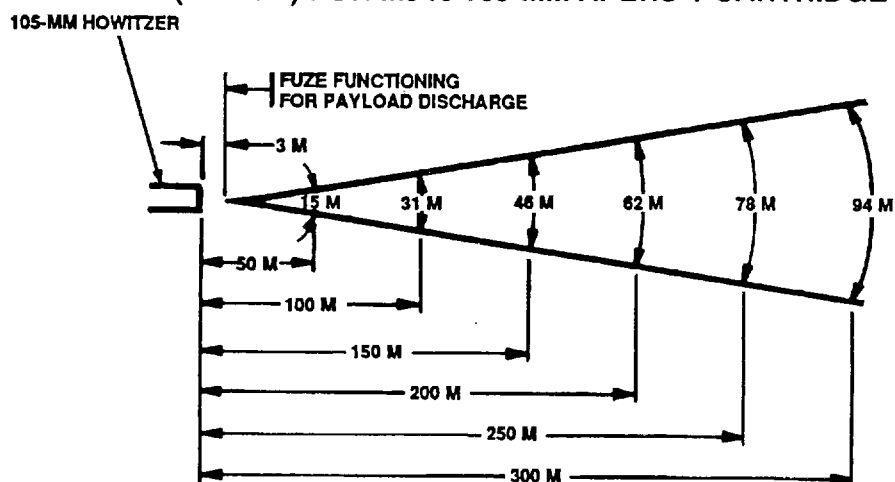
Table 4-2. AUTHORIZED PROJECTILES

Model	Abbreviation	Type	Use
M84 and M84B1	Smoke, HC/ colored	Base-ejection projectile with canisters for use with M501 or M501A1 fuzes only	Screening/target identification signaling
M444	ICM	High-explosive bouncing grenades	Antipersonnel
M67	TP/TP-TI	inert projectile/inert projectile w/tracer	Training
M14	Dummy	Completely inert round	Training
M548	HERA	High-explosive rocket assisted	Antipersonnel, blast,
M629	Tactical, CS	Base ejection projectile with CS, canisters	Riot control

*Dispersion pattern for M546 set on MA (muzzle action) and time are shown below and on page 4-6.

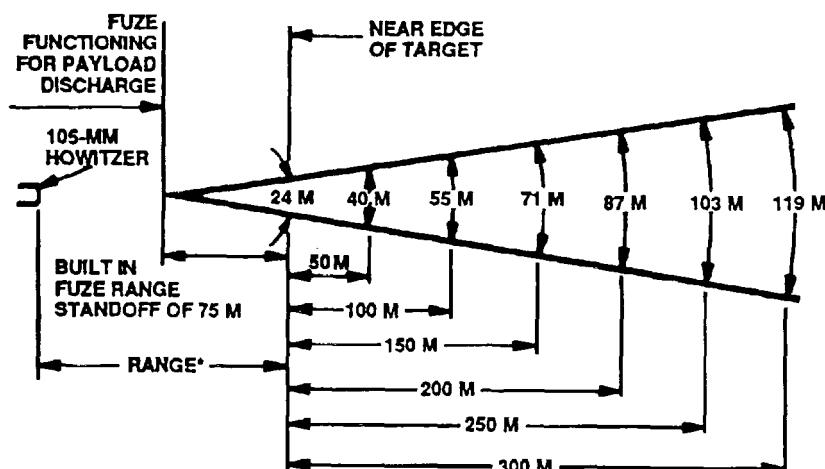
NOTE

Approximately 16 meters increase in arc width results for each additional 50 meters of range.

DISPERSION PATTERN (RANGE) FOR M546 105-MM APERS-T CARTRIDGE

4-3. AUTHORIZED 105MM PROJECTILES AND USE (cont)

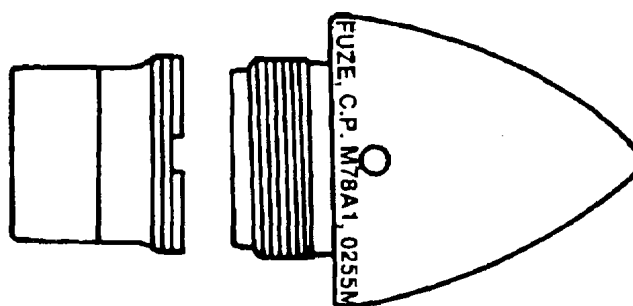
DISPERSION PATTERN (RANGE) FOR M546 105-MM APERS-T CARTRIDGE



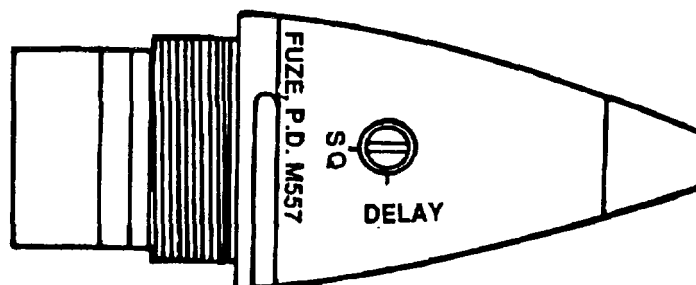
*Range to the near edge of the target. Fuze setting should be in accordance with range and firing table instructions. Above pattern will result for all range firings from 0.5-second firing out to maximum of range table time for the 105-mm howitzer.

4-4. AUTHORIZED FUZES FOR M101A1 HOWITZER

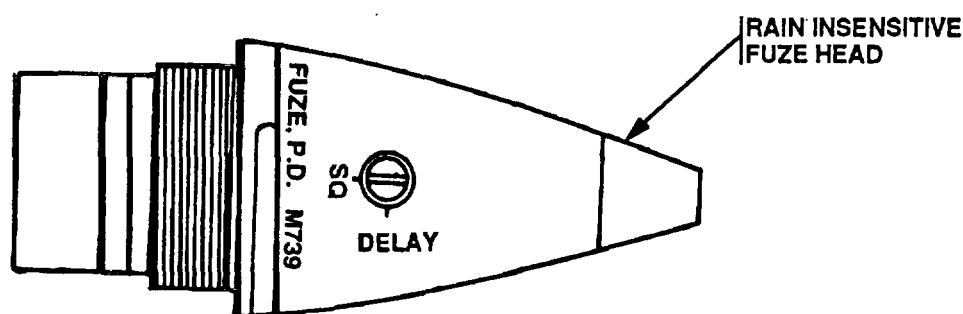
a. General. The following paragraphs describe some of the fuzes to be used with the M101A1 howitzer. For additional information on description and function of authorized fuzes, see TM 43-0001-28. For authorized projectile/fuze combinations, see table 4-3. (Refer to page 4-12.)



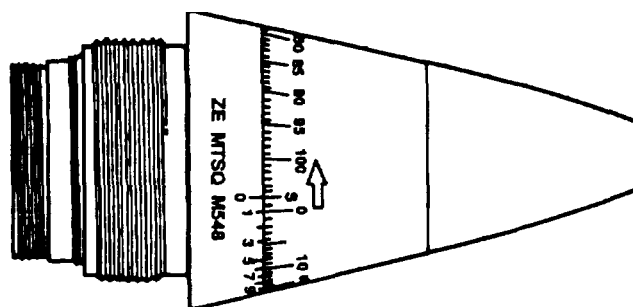
b. **Fuze, Point Detonating, Concrete Piercing (CP), M78 Series.** The M78 CP series fuzes are constructed primarily for use against concrete targets. M78A1 fuzes are of two types; a nondelay type used for spotting purposes and a delay type for concrete targets. The nondelay type has its nose painted white for identification. If these fuzes are used with a deep cavity shell, the supplementary charge must remain in the fuze well cavity.



c. **Fuze, Point Detonating (PD), M557 and M572.** The M557 PD fuze has a selective superquick-delay setscrew. It is packed set for superquick (SQ) and has a booster attached. The M572 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. Premature functioning of these fuzes can occur downrange when the fuze is fired through heavy precipitation, i.e., rainfall, sleet, snow, or hail. These fuzes can be set for SQ or delay action by turning the setscrew.

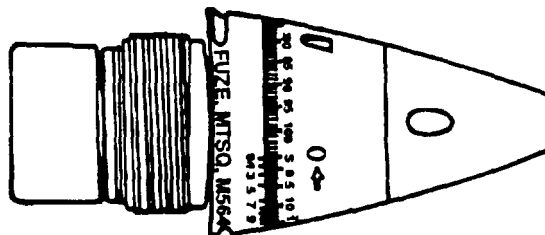


d. **Fuzes, PD, M739 and M739A1.** These latest improved fuzes are the versions of the selective impact fuze. These fuzes have solid aluminum bodies and a rain-insensitive head so that they can be fired through a heavy rainstorm without premature functioning of the round of ammunition. These fuzes can be set for SQ or delay action by turning the setscrew. The M739A1 fuze contains a new impact delay module which provides more effective functioning in the delay mode. In addition to the stamped markings, the M739A1 fuze body is anodized green for positive identification of fuze model.

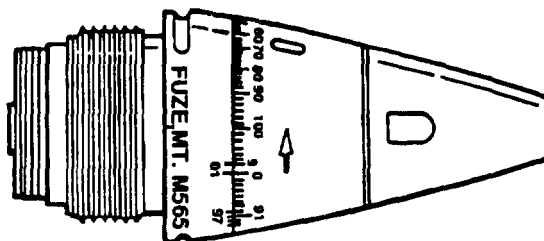


e. **Fuze, Mechanical Time and Superquick (MTSQ), M548.** The M548 MTSQ fuze is designed to function at time settings from 2 to 100 seconds or upon impact, depending upon which occurs first after arming. It does not contain a booster and is used with base ejecting projectiles only. If SQ (impact) action is desired, the fuze must be set on 90 seconds. Premature functioning may occur down-range when the fuze is fired in heavy precipitation, i.e., rainfall, sleet, snow, or hail.

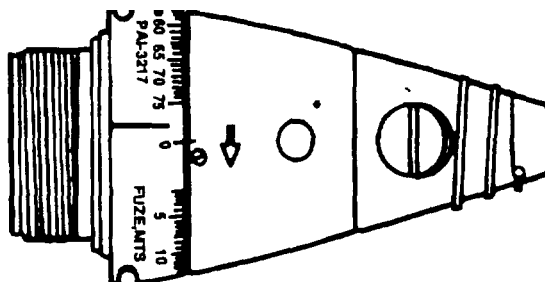
4-4. AUTHORIZED FUZES FOR M101A1 HOWITZER (cont)



f. **Fuze, MTSQ, M564.** The M564 MTSQ fuze is intended for use with burster projectiles in which mechanical time settings (from 2 to 100 seconds) or impact SQ functioning is desired. The M564 MTSQ fuze is designed to function either at a set time or upon impact, whichever occurs first after arming. However, the delay arming mechanism prevents this fuze from arming for either action until the round has traveled a minimum distance of 200 feet from weapon muzzle. Setting of these fuzes between S and 2 seconds may result in functioning after approximately 2 seconds. The M564 MTSQ fuze employs a vernier scale to attain a setting accuracy of 0.1 second.



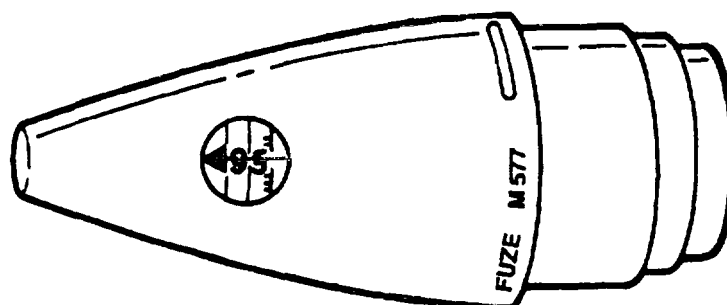
g. **Fuze, Mechanical Time (MT), M565.** The M565 MT fuze is similar to M564 MTSQ fuze except that the fuze contains neither the point detonating assembly nor the booster assembly. The M565 fuze can be set from 2 to 100 seconds and, like the M564, employs a vernier scale to assure a setting accuracy of 0.1 second. This fuze is used in base ejection projectiles only.



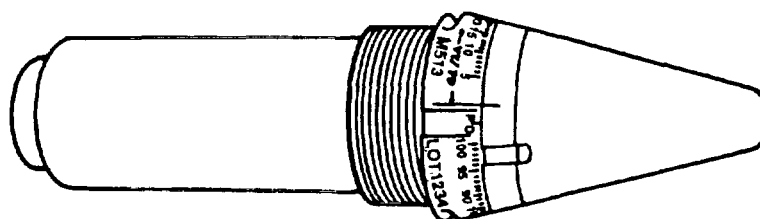
h. **Fuze, MTSQ, M501 series.** The M501 MTSQ series fuzes are a combination mechanical time and superquick fuze with settings for time action (2 to 75 seconds) and an impact element for SQ action.

WARNING

Dropping or rough handling of a projectile assembled with M501/M501A1 MTSQ fuze may result in fuze functioning and expulsion of projectile base plate and contents. When handling projectiles assembled with the fuze, exercise extreme care to protect the fuze from impact. Keep pull wire on fuze in place until immediately prior to loading and firing.

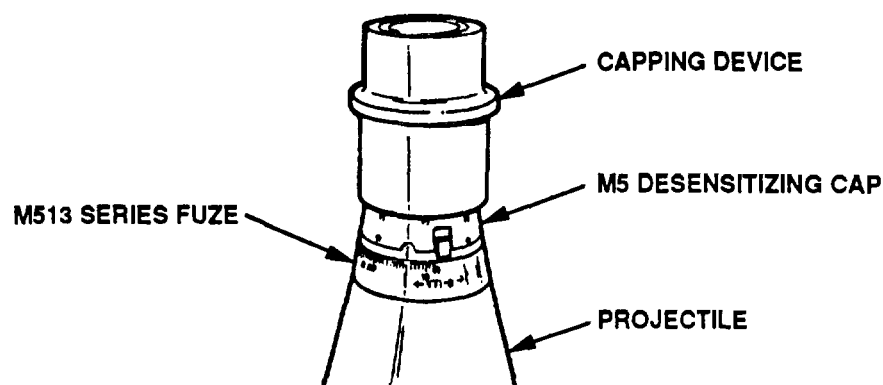


i. Fuze, MTSQ, M577 Series and M582 Series. These fuzes have a 200 second mechanical time mechanism with three movable digital dials. The fuzes have a window through which the dials are viewed. The dials permit setting the fuzes to the nearest one-tenth (0.1) second. The dial closest to the fuze nose indicates the time in hundreds of seconds. (The black triangle (◄) position on this dial is a nontime setting.) The second dial indicates time in tens of seconds, and the third dial indicates the nearest second and also one-tenth second by using the scale on the right edge of the dial. A time setting key is located on the end of the fuze nose, and the time desired is set under the hairline in the window. Detailed setting instructions are outlined in paragraph 4-9. A new fuze setter, the M35, or a flat tip screwdriver is used to set these fuzes. The M582 MTSQ series fuze is identical to the M577 MTSQ series with the exception that it is used in bursting-type projectiles and has a standard booster. The M577 MTSQ series is used in base-ejection projectiles, and does not have the booster. The M577A1 and M582A1 contain a different mechanism for point detonating action. Externally, the AI models have a different wrench slot configuration. The AI models are handled, set and fired the same as the basic models. Early manufactured basic and AI fuzes have a black paint finished ogive, while the later produced AI fuzes have a gold (chromate finish) color ogive. In order to minimize identification problems, current production of M582A1 fuzes contain a white stencil "M582A1" below the window on the fuze body. If the M577 and M582 MTSQ series fuzes are set for time and the timing mechanism fails, the fuze may or may not function on impact.

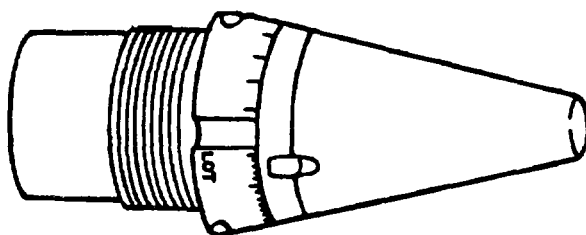


j. Fuze, Proximity Variable Time (VT), M513 Series. The M513 and M513B1 VT fuzes must always be set for proximity action because the impact electronic switch cannot be engaged until proximity action is activated. If, after activation, fuze does not function to produce an airburst, then it should go off on impact because the SQ element is armed when proximity element starts broadcasting signals. These fuzes cannot be set for impact action only; they must be set for proximity action. The M513A1 and M513A2 VT fuzes contain an impact element which arms 2 to 3 seconds outside muzzle of weapon regardless of time set for proximity action. Thus, if the fuzed projectile strikes the target before the time expires on the time mechanism, the result will be impact SQ action. For impact action only from these fuzes, set fuze for 90 seconds.

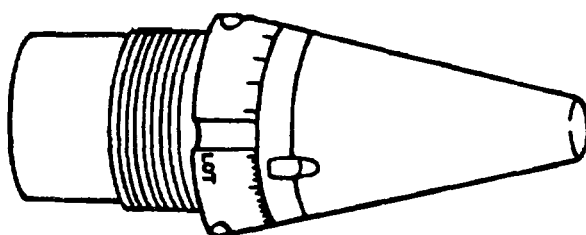
4-4. AUTHORIZED FUZES FOR M101A1 HOWITZER (cont)



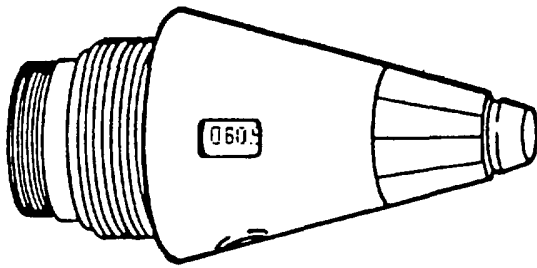
k. Desensitizing Cap, M5 (for M513 Series Fuzes Only): The M5 desensitizing cap is used to lower the burst height of the M513-series proximity fuzes when burst height is observed to exceed 50 feet (15 m). The conical brass desensitizing cap is applied over the nose of the fuze. To attach the cap to the fuze, place the capping device (plastic cover of the shipping tube) over the cap and strike a sharp blow with the fist, a lightweight (16 oz (454 g)) mallet, or other equivalent tool



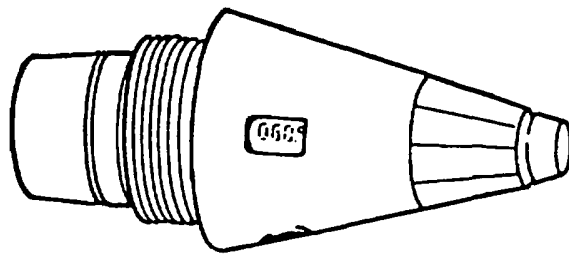
l. Fuze, Proximity VT, M728. The M728 VT fuze is a long intrusion fuze used with deep cavity projectiles and is essentially a self-powered radio and transmitting unit. The fuze can be set from 5 to 100 seconds. The setting on the time ring determines at what time along the trajectory the fuze will become activated. It also 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 set 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.



m. Fuze, Proximity VT, M732. The M732 VT fuze is a short intrusion fuze, used without removing supplemental charges from projectiles, and contains a self-powered radio and transmitting unit. The fuze has a plastic nose cone fitted to a moveable steel ring which rotates on a steel sleeve. The fuze is shipped with the index mark on the steel ring aligned with the PD mark on the sleeve. When set between 5 and 150 seconds, proximity arming occurs approximately 3 seconds prior to set time. If the fuze fails to function in the proximity mode, it will function on ground impact.



M762 FUZE



M767 FUZE

n. Fuzes, Electronic Time (ET), M762 and M767. These fuzes are powered by a reserve lithium battery. The battery is activated manually by rotating the ogive or remotely activated via inductive auto-set fire controls. An electronic subassembly contains integrated circuits that provide controls and logic for 199.9 seconds electronic timing and transmit a fire pulse signal for time function. A Liquid Crystal Display (LCD) provides a visual readout of the fuze setting. The column closest to the base end indicates time in hundreds of seconds (the triangle (◀) position is a nontime setting). The second column away from base end indicates time in tens of seconds. The third column away from base end indicates time in seconds. The fourth column (closest to nose end) indicates time in tenths of seconds. These fuzes contain an electromechanical Safe and 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 button or remotely by a weapon equipped with autoset fire control system. Detailed setting instructions are outlined in paragraph 4-9. 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. If these fuzes fail in the time mode, there is no PD back-up. 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.

o. Fuze, MT, M563 Series. These fuzes are comprised of a solid aluminum head, lower cap assembly with time graduation in seconds, and fuze body with vernier scale. Fuzes can be set to function at close range and up to a range of 4400 meters. Overlapping centrifugally operated weights provide safety during handling.

Table 4-3. AUTHORIZED PROJECTILE/FUZE COMBINATIONS FOR THE M101A1 HOWITZER

Type and model number of projectile ¹	PD			MT		MTSQ					BD		VT			ET	
	CP, M78 series	M557/M572	M739 series	M563 series	M565	M501 series	M582 series	M548	M564	M577 series	M62 series	M91 series	M513 series ^{3,4}	M728 ⁴	M732	M762	M767
APERS-T, M546 ⁵				X													
Gas, (H or HD), M60 ⁶		X	X														
Gas, GB, M360 ⁶		X	X														
HE, M1 (normal cavity)	X	X	X				X		X						X		X
HE, M1 (deep cavity) ⁴	X	X	X				X		X				P	P	X		X
HE, M444 ²					X			X									
HERA, M548 ^{4,7}		X	X				X							P			X
Tactical, CS M629					X			X									

X - As issued or compatible

P - Requires removal of supplementary charge if present

(Footnotes can be found on page 4-14).

Table 4-3. AUTHORIZED PROJECTILE/FUZE COMBINATIONS FOR THE M101A1 HOWITZER

Type and model number of projectile ¹	PD			MT		MTSQ					BD		VT			ET	
	CP, M78 series	M557/M572	M739 series	M563 series	M565	M501 series	M582 series	M548	M564	M577 series	M62 series	M91 series	M513 series ^{3,4}	M728 ⁴	M732	M762	M767
HEP/HEP-T, M327											X	X					
Illum, M314, M314A1, M314A2						X											
Illum, M314A3 (M314A2E1)					X			X		X						X	
Smoke, BE, M84, M84B1						X											
Smoke, HC, M84A1					X			X		X						X	
Smoke, WP, M60A2		X	X				X		X								X
TP, M67 ^a											X	X					
TP-T, M67 ^a											X	X					
Smoke, WP, M60/M60A1		X															

X - As issued or compatible

4-4. AUTHORIZED FUZES FOR M101A1 HOWITZER (cont)

- NOTE 1:** All projectiles are issued with a fuze installed except the high-explosive projectile and some lots of the WP round.
- NOTE 2:** M444 cartridges are assembled with modified M548 MTSQ or M565 MT fuzes which incorporate an expelling charge as an integral part of the fuze. Do not use standard M548 or M565 fuzes in the M444 projectiles.
- NOTE 3:** Use M5 desensitizing cap only on the M513 series proximity fuzes.
- NOTE 4:** M728 and M513 series fuzes cannot be fired with zone 7 propelling charges for 105-mm cartridges in other than emergencies.
- NOTE 5:** Not to be fired over the heads of friendly troops. Restricted to charge 7 for targets between 275 and 400 meters. Firing at charge 6 with fuze setting of 0.5 seconds is permitted.
- NOTE 6:** Some gas projectiles may come with the M508 impact fuze.
- NOTE 7:** Charge 7 authorized ROCKET-ON and ROCKET-OFF modes. Charges 3, 4, 5, and 6 authorized ROCKET-OFF only under emergency combat.
- NOTE 8:** Fuze bodies are empty except for tracer.

4-5. CARTRIDGE CASE, PRIMER, AND PROPELLING CHARGE

- a. **Cartridge Case.** Projectiles are assembled with M14 series cartridge cases. These include M14, (brass), M14B1 (steel), M14B2 (5-piece, spiral-wrapped steel), and M14B4 (3-piece, spiral-wrapped steel) cartridge cases. Blank cartridges are assembled with M15 (brass) or M1 5B1 (steel) cartridge cases.
- b. **Primer.** M1B1A1, M28B2, M28A2, M90, and XM108 percussion primers are used with these cartridges.
- c. **Propelling Charge.** Most 105-mm cartridges contain M67 propelling charge which contains zoned charges (7 increments) of dual-granulation M1 propellant. HEP, HEP-T, TP, and TP-T cartridges contain a single, nonadjustable bag charge of single granulation M1 propellant. APERS-T cartridge contains a two-zone propelling charge of dual-granulation M30E1, charges 6 and 7 only. HERA cartridge contains five (3 thru 7) zoned propelling charges. (See table 4-4 for firing restrictions of charge 6.)

EQUIVALENT EQUIPMENT FULL CHARGE ROUNDS		
<u>Zone</u>	<u>No. of Rounds Equivalent in Erosion to One Full Charge</u>	<u>Equivalent Erosion Effect in Decimals</u>
7	1	1.00
1 thru 6	10	0.25

For M327 HEP-T cartridge 0.30 rounds are equivalent in erosion to one full charge.
The equivalent erosion effect in decimals is 3.20.

Table 4-4. FIRING RESTRICTIONS

Projectile/Propelling Charge/Fuze Model Number	Restriction
Fuze, VT, M513, M513A1, and M513B1	Do not fire outside the following fuze temperatures: Lower limit 0 °F (-18 °C) Upper limit +120 °F (+49 °C)
Projectile, APERS-T, M546	Restricted to firing at charge 7; however, when engaging stationary targets at ranges between 275 and 400 meters, firing at charge 6 with a fuze setting of 0.5 second is permitted.
Projectile, APERS-T M546	Firing over heads of friendly troops is prohibited.
Projectile, HE, MI or HERA, M548 (w/M728	Rounds with M513 series or M728 VT fuzes are not to be fired at charge 7 for proximity action, except under only emergency combat conditions.
Projectile, HERA, M548	Charge 7 is authorized for firing in both ROCKET-ON and ROCKET-OFF modes. Charges 3, 4, 5, and 6 are authorized for ROCKET-OFF mode firing only under emergency combat conditions.

Section II. PREPARATION FOR FIRING

4-6. GENERAL

WARNING

Do not fire artillery ammunition of any caliber without authorized fuze. Firing of such rounds without fuzes or with unauthorized fuzes could result in inbore prematures and other conditions hazardous to personnel.

a. Most cartridges for the 105-mm howitzer require preparation of projectile, propelling charge, and fuze. Restrictions on projectile, fuze, and propelling charge are contained in table 4-4.

b. Unless otherwise specified, observe the following temperature limits when firing the M101A1 Howitzer:

(1) Lower limit: -40 °F (-40 °C)

(2) Upper limit: +125 °F (+52 °C)

4-7. PACKING AND UNPACKING

a. Packing Procedure.

(1) Projectiles are packed in individual fiber containers. The outer packing consists of a wooden box, metal container, or crate.

(2) Fuzes are generally packed eight to a metal container, two containers to a wooden box (overpack).

b. Unpacking Procedure.

NOTE

Retain packing materials for repacking, as required.

(1) Examine ammunition box marking to determine item identification.

(2) Open outer pack and remove fiber container.

CAUTION

Do not use axes, crowbars, or other such implements which may damage ammunition or inner packaging.

(3) Open fiber container and remove cartridge case and projectile.

(4) Remove U-shaped packing stop (if present)

WARNING

Inspect your ammunition. Failure to accomplish required inspections can result in unnecessary malfunctions and injury or death to personnel.

(5) Inspect round and verify item identification. Check that round is not damaged or corroded and is free of foreign matter. If necessary, remove foreign matter.

NOTE

Slight amounts of rust do not make the projectile unserviceable. Do not remove set- screws or wax plug from setscrew hole in projectile.

(6) Do not use blank cartridges with loose or broken closing cups; report such items to EOD officer for disposal.

(7) Unpack fuze, when issued separately, following steps (1) thru (5) above, as applicable.

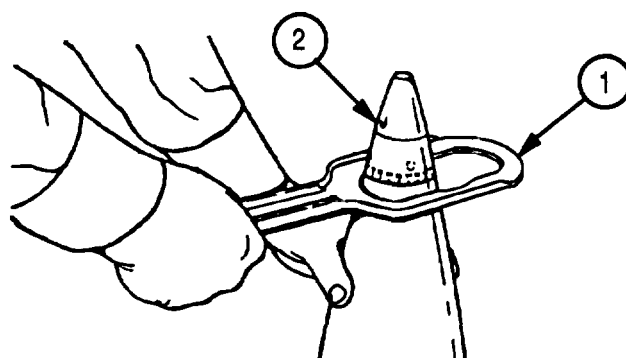
4-8. FUZING

NOTE

M1, HE projectile may be shipped with fuzes which must be removed if time or proximity fuze action is desired.

a. Fuze Removal.

(1) Using screwdriver which fully fits screw slot, loosen booster setscrew in nose of projectile (when present).

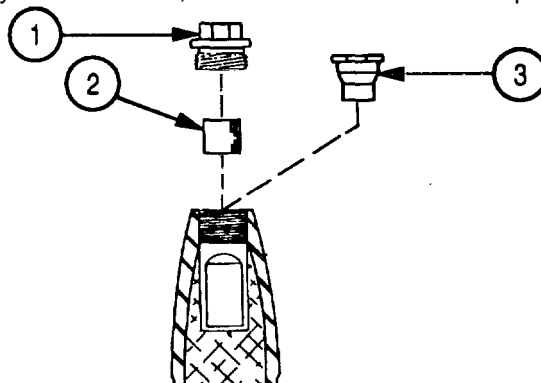


(2) Insert M18 fuze wrench (1) in wrench slots of fuze (2), taking care not to strike any part of fuze. Turn wrench handle sharply in counterclockwise direction to loosen fuze from projectile. Unscrew and remove fuze with booster.

(3) Inspect cavity and projectile threads for damage. Remove loose material from cavity. If any high explosive is found adhering to the threaded portion of the projectile throat, reject the round and let qualified ammunition personnel dispose of it.

b. Closing Plug Removal.

(1) Using screwdriver which fully fits screw slot, loosen setscrew in nose of projectile (when present).



(2) Insert M18 fuze wrench in wrench slots of closing plug (1); turn wrench handle sharply in counterclockwise direction.

(3) Remove closing plug (1) and spacer (2) beneath closing plug.

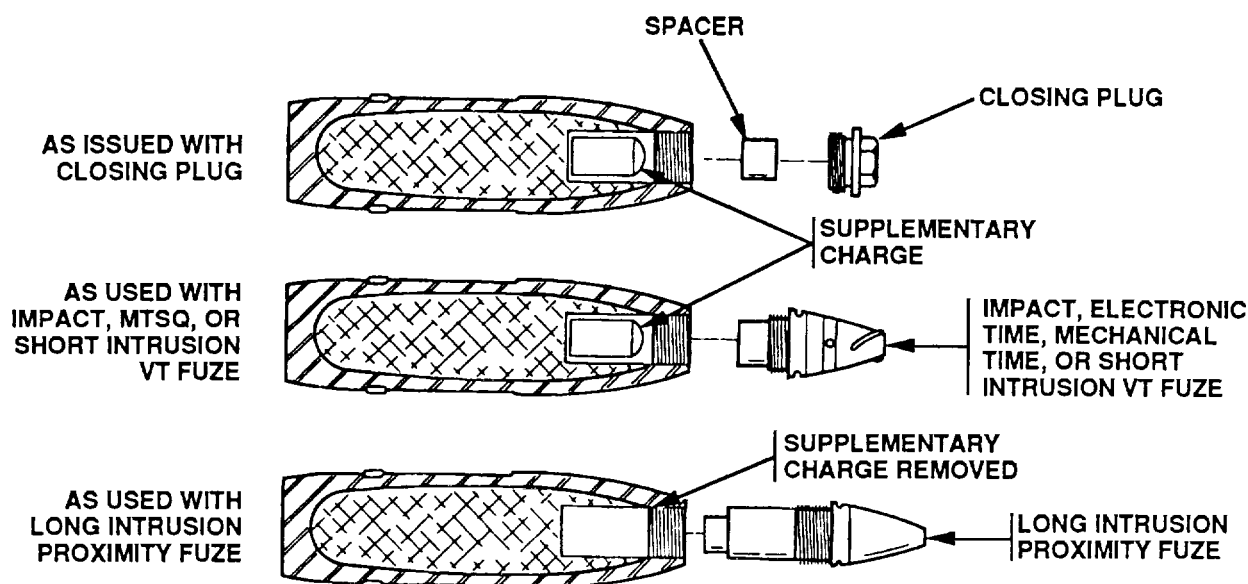
(4) Plastic closing plug (3) is a press fit, tear tab configuration which, on proper removal, results in separation from the side wall of the plug along a designated area so that the plug can be removed. It does not unscrew like the metal plug. Therefore, to remove it:

(a) Hold projectile securely and pull tab up, breaking its sides loose from the plug.

(b) Push tab into center of plug.

(c) Squeeze plug and withdraw it from fuze well.

(5) Inspect cavity and projectile threads for damage. Remove loose material from cavity. If any high explosive is found adhering to the threaded portion of the projectile throat, reject the round and let qualified ammunition personnel dispose of it.



WARNING

Illustration shows a typical deep cavity projectile and supplementary charge variation that are shipped with a closure plug, spaces, and supplementary charge.

The supplementary charge must be left in the projectile when firing short intrusion fuzes.
The supplementary charge must be removed when firing a long intrusion VT fuze.

- (1) When preparing rounds for CP, PD, MTSQ, ET fuzes, and short-intrusion VT fuzes, inspect for presence of supplementary charge. Deep cavity rounds cannot be fired with these fuzes without a supplementary charge as shown.
- (2) For long intrusion M513 series and M728 VT firing, remove supplementary charge as follows.

WARNING

Do not attempt to remove the supplementary charge by any means other than the lifting loop. Use of screwdrivers or other tools to remove the charge by force is prohibited.

(a) Remove the supplementary charge by means of the lifting loop. If charge cannot be removed by lifting loop, either fire with PD, MTSQ, ET fuze, or short-intrusion VT fuze or let EOD personnel dispose of round.

(b) Inspect cavity and projectile threads for damage. Remove loose material from cavity. If any high explosive is found adhering to the threaded portion of the projectile throat, reject the round and let EOD personnel dispose of it.

WARNING

Do not fire artillery ammunition of any caliber without authorized fuze. Firing of such rounds without fuzes or with unauthorized fuzes could result in inbore prematures and other hazardous conditions.

d. Fuze Assembly

(1) The following procedures apply to all fuzes, except M78A1 CP fuze (see step (2) below), and M62/M62A1 and M91 series base detonating (BD) fuzes (see step (3) below).

(a) Screw fuze in by hand. If binding occurs, inspect fuze cavity and threads of both fuze and projectile. Reject whichever is at fault.

WARNING

When tightening fuze to projectile, do not hammer on fuze wrench. Do not use extension handle on fuze wrench. Do not stake fuze to projectile under any circumstances. Shocks transmitted to fuzes during assembly may increase percentage of malfunctions.

(b) Using M18 fuze wrench, back-off 1/4 turn, then tighten fuze to projectile with a sharp snap of the wrench so that fuze shoulder is seated firmly against projectile nose.

WARNING

Do not fire round unless fuze is fully seated. Rounds fired with improperly seated fuzes may result in premature functioning, causing serious injury to personnel and damage to equipment.

NOTE

For VT fuze with gap between fuze shoulder and projectile, either replace supplementary charge in projectile and fire with PD, short-intrusion VT, ET fuze, or MTSQ fuze; or dispose of round.

(c) If projectile setscrew is present, tighten to below level of contour of projectile.

(2) Special preparations for M78 and M78A1. Booster is not issued assembled to the fuze and must be assembled to the projectile as follows:

CAUTION

Always be sure that supplementary charge is in deep cavity projectile before adding fuze-booster combination.

NOTE

Booster must always be assembled to projectile first; it cannot be assembled to fuze, but it is shipped in same fuze container.

(a) Remove safety pin from M25 booster, and screw booster into booster cavity of projectile. Tighten booster firmly with booster end of M16 fuze wrench. Boosters that are issued without safety pins should not be used.

4-8.FUZING (cont)

d. Fuze Assembly. (cont)

(b) Screw the M78 or M78A1 fuze into the fuze cavity and tighten it securely with the fuze end of the M16 fuze wrench. Make sure that the fuze shoulder seats firmly against nose of projectile. There should be no space between fuze shoulder and projectile. Do not stake fuze to projectile.

(c) If projectile setscrew is present, tighten to below level of contour of projectile.

(3) Special preparation for M62/M62A1 and M91 series. These BD fuzes come installed and do not require any setting or other adjustments before firing. These fuzes are used on M327 (HEP/ HEP-T) and M67 (TP/TP-T) projectiles.

4-9. FUZE SETTING PROCEDURES FOR THE M101A1 HOWITZER

a. **General.** The following procedures apply to the authorized fuze/projectile combinations for the M101A1 howitzer. Fuze setting tools and procedure numbers are listed in table 4-5. (Refer to page 4-21.)

(1) M557 and M572 impact fuzes, M548 and M564 time fuzes, and the VT proximity fuzes may explode prematurely when fired during heavy precipitation, i.e.; rainfall, sleet, snow, or hail. Precipitation necessary to cause malfunctioning is comparable to heavy downpours which occur during summer thundershowers. In the case of the M557 and M572 impact fuzes with delay-action option, setting fuze for delay-action may prevent prematures; however, see step (2) below.

(2) M739 series impact fuze, M577 series and M582 series MTSQ fuzes, M762 and M767 ET fuzes, and M732 VT fuze are not sensitive to rain and may be fired during heavy precipitation. (3) Any ammunition in the field with M577 PD fuze not marked, MODIFIED, will not be used.

b. **Procedure Number 1, M557, M572, and M739 series.** These PD fuzes with SQ or delay functioning are shipped for SQ action. To set fuzes for delay action, use screwdriver end of M18 fuze wrench or similar tool, and turn slot 90 degrees turn to align with index mark, indicating DELAY engraved in ogive. When firing fuze for SQ functioning, always check to make sure index mark is on SQ.

NOTE

Fuzes can be set in the dark by feeling the position of the slot.

Table 4-5. FUZE, FUZE SETTING TOOLS, AND PROCEDURES

CAUTION

Before setting MT, MTSQ, or VT fuzes, refer to the appropriate firing table for required time setting.

FUZE ¹													
PD		MT		MTSQ				VT		ET			
M78 CP series ²	M557, M572 or M739 series	M563 series	M565	M501 series	M577 series or M582 series	M548	M564	M513 series	M728 and M732	M762 or M767	Fuze Wrench or Fuze Setter		Procedure Number
	X										M18		1
X											16 ²		
				X				X	X		M27		2,5 ³
		X	X			X	X				M34		3
					X						M35		4
										X			6

x--Denotes compatibility of fuzes and fuze setters.

¹All fuzes are installed and tightened to nose of projectile with M18 fuze wrench, except M78 CP series fuzes.²M78 CP series fuzes and boosters are installed in projectiles with M16 fuze wrench.³Proximity VT fuzes may be set with M27 fuze setter.

4-9 FUZE SETTING PROCEDURES FOR THE M101AI HOWITZER (cont)

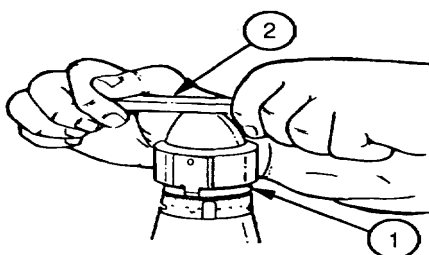
c. Procedure Number 2, M513 Series, M728 and M732 Fuzes.

CAUTION

Plastic nose cones rotate with index mark. Damage to plastic of nose cones will produce duds. However, since there is no backlash, fuze setting can be accomplished or changed one or more turns with no harmful effect. If counterclockwise rotation is used, be sure that the fuze has not come loose from the projectile.

NOTE

The M728 VT fuze is shipped with the index mark on the nose cone set at 10 seconds. The M732 is shipped with the index mark aligned with PD. The M513 and M513B1 VT fuzes are shipped with index mark aligned with S. The M513A1 and M513A2 are shipped with index mark aligned with shipping line (long vertical line with arrow).



(1) To set fuze for proximity action, rotate nose cone (1) with M27 fuze setter (2), normally in clockwise direction while looking down on nose cone of fuze, until index mark coincides with announced time. Fuze setting can be changed one or more times with no harmful effects.

CAUTION

Do not use M513 and M513B1 fuzes for PD functioning

(2) For impact functioning, set M732 fuze to PD mark and M513A1, M513A2, and M728 fuzes to 90 seconds using M27 fuze setter.

WARNING

Do not fire projectile unless fuze is fully seated. Rounds fired with improperly seated fuzes may result in premature functioning, causing serious injury to personnel and damage to equipment.

(3) Fuze is set when index line at base of nose cone is in line with time, in seconds, engraved on base of fuze.

(4) Firing temperature limits for M728 and M732 proximity fuzes are -40 to +140 °F (-40 to +60 °C).

(5) Firing temperature limits for the M513 series fuzes are 0 to +120 °F (-18 to +49 °C).

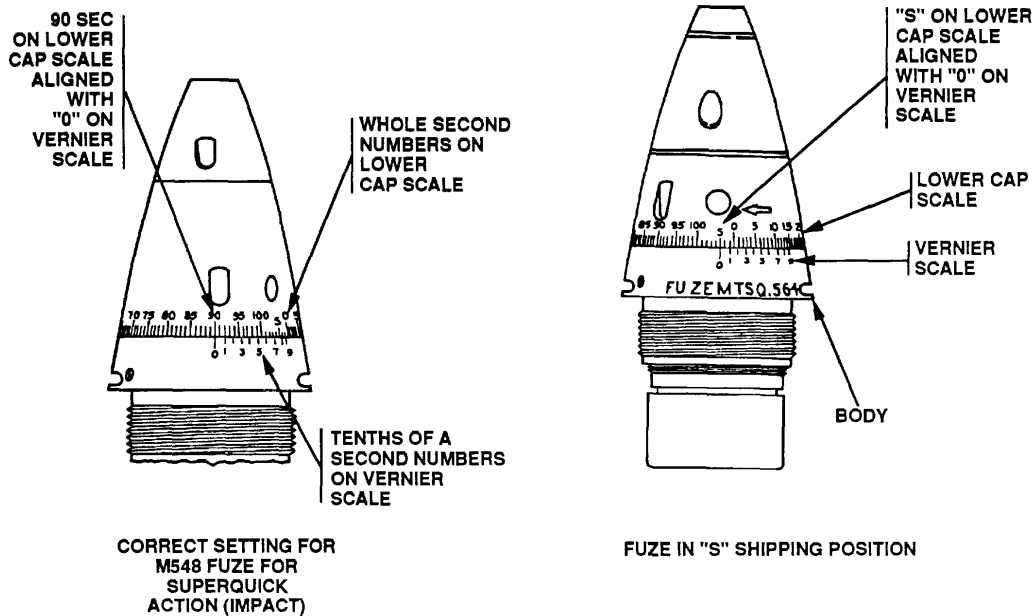
NOTE

Use of M5 desensitizing cap to lower height of M513 series fuzes is at option of artillery officer. Desensitizing fuse caps are assembled to fuze just before firing.

d. Procedure Number 3, M563, M564, M565, and M548 Fuzes.

WARNING

To avoid accidental functioning of PD element in M548 and M564 fuzes, do not drop, roll, or strike fuzes under any circumstances (packaged, unpacked, or assembled to the projectile); mishandling could cause injury or death to personnel.



(1) Setting M548 fuzes for SQ action (impact).

NOTE

Do not set M548 fuze on S for impact (PD) action. Set fuze for 90 seconds.

Use M34 fuze setter to rotate the lower cap in the direction of the arrow (clockwise) from shipping "S" position until the 90.0 second position on the lower cap scale is aligned with the "0" on the vernier scale.

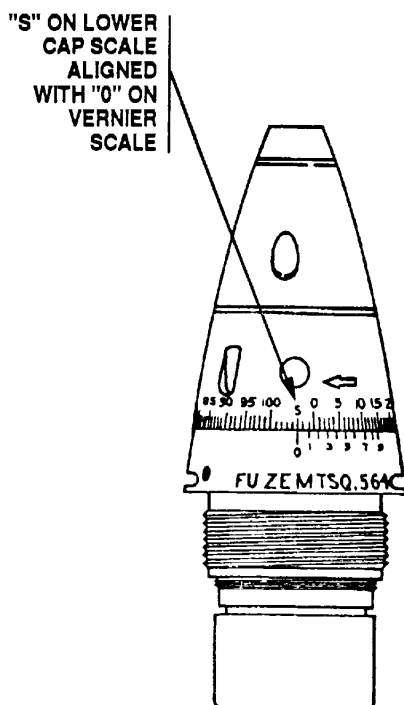
4-9. FUZE SETTING PROCEDURES FOR THE M101A1 HOWITZER (cont)

d. Procedure Number 3, M563, M564, M565, and M548 Fuzes. (cont)

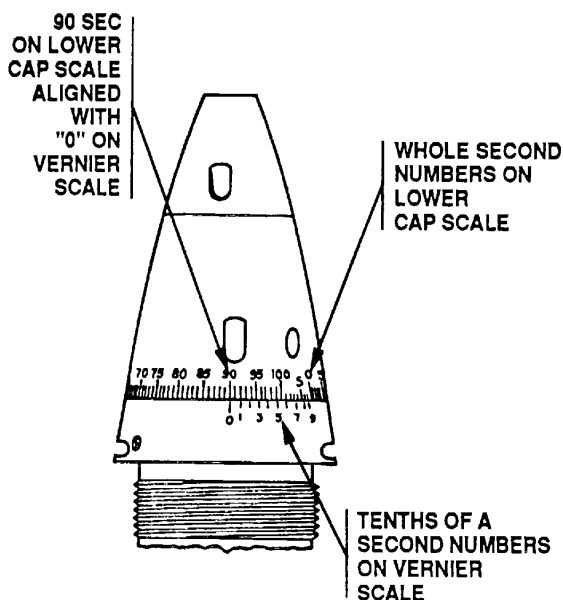
(2) Setting M564 fuzes for SQ action (impact).

NOTE

The date of manufacture is stamped on the M564 fuze body. M564 fuzes manufactured before 1970 must be set on 90 seconds if SQ action (impact) is desired. M564 fuzes manufactured from January 1970 on should be set on S for SQ action. The M564 fuzes are shipped with "S" on the lower cap scale aligned with the "0" on the vernier scale.



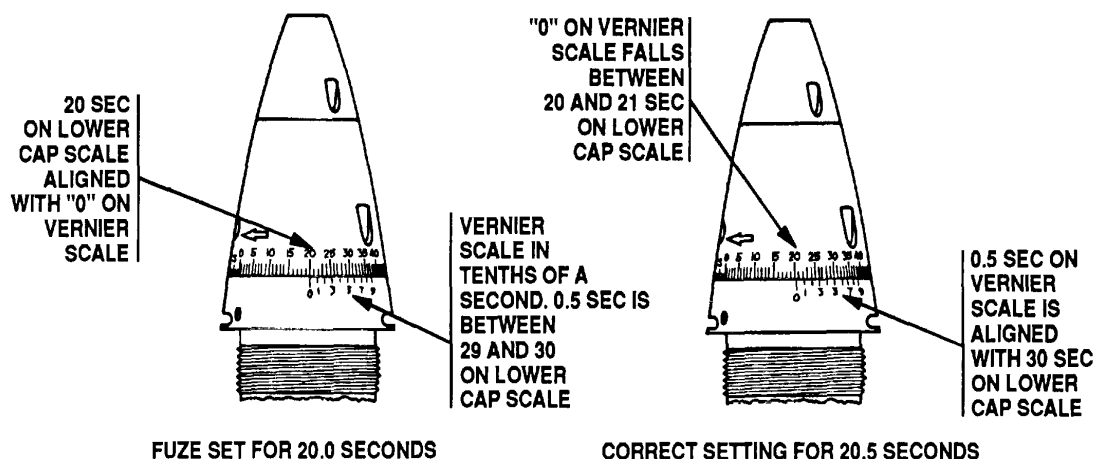
CORRECT SETTING FOR
M564 FUZE MANUFACTURED FROM
JANUARY 1970 ON FOR SUPERQUICK
ACTION (IMPACT)



CORRECT SETTING FOR
M564 FUZE MANUFACTURED PRIOR
TO JANUARY 1970 FOR SUPERQUICK
ACTION (IMPACT)

(a) M564 fuzes manufactured before January 1970: use M34 fuze setter to rotate lower cap in direction of the arrow (clockwise) from safe (S) position to the 90.0-second setting.

(b) M564 fuzes manufactured in January 1970 and later: set fuze on S as shipped for SQ action. Always be sure the S on lower cap is aligned with the "0" on vernier scale.



- (3). Set M563, M564, M565, and M548 fuzes for airburst (time) as follows:

WARNING

Incorrect settings of MT and MTSQ fuzes can and have resulted in downrange premature.

NOTE

The M563 fuze is set muzzle action (MA), or on the time setting desired for the intended range. Refer to dispersion patterns on page 4-5 before setting M563 fuze.

(a) To set M548, M563, M564, or M565 fuze for a whole-second time setting, use M34 or M63 fuze setter to rotate lower cap in the direction of the arrow (clockwise), until whole number of seconds (e.g., 20.0 seconds) is aligned with "O" mark engraved on vernier scale.

(b) To set M563, M548, M564, or M565 fuze for a tenth of a whole second (e.g., 20.5 seconds), use the M34 or M63 fuze setter to set the fuze for the whole second (20.0 seconds). Next, find the desired tenth of a second mark on vernier scale. (0.5-second mark is between 29 and 30 whole-second marks.) Continue to rotate lower cap in direction of arrow until adjacent upper right graduation on lower cap scale is aligned with desired tenth of a second mark on vernier scale. (0.5-second mark is now aligned with 30-second mark on lower cap scale.)

NOTE

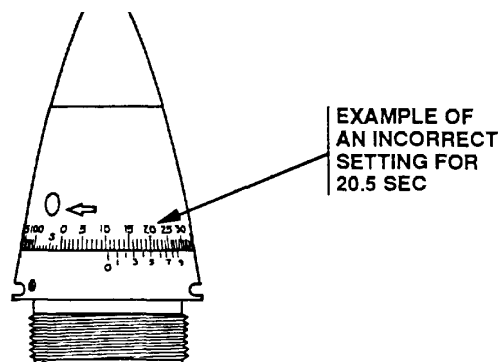
The fuze setting is always indicated by the position of the "0" on the vernier scale. Each vertical mark on the lower cap scale (movable portion of fuze) represents one whole second of time. For other than whole-second settings, the "0" on the vernier scale (nonmovable portion of the fuze) must always be to the right of the whole-second portion of the desired fuze setting, and between whole-second portion of desired fuze setting and next 1-second vertical mark; (e.g., for a setting of 20.5, "0" is to right of 20-second mark, and midway between 20- and 21-second marks.)

An incorrect fuze setting of 20.5 seconds is shown on page 4-26. If a fuze is set in this way for 20.5 seconds firing, fuze is actually set on and will function at 10.5 seconds. This would cause the fuze to function 10 seconds earlier than desired.

Do not attempt to set the fuze until just before firing.

4-9. FUZE SETTING PROCEDURES FOR THE M101A1 HOWITZER (cont)

d. Procedure Number 3, M563, M564, M565, and M548 Fuzes. (cont)

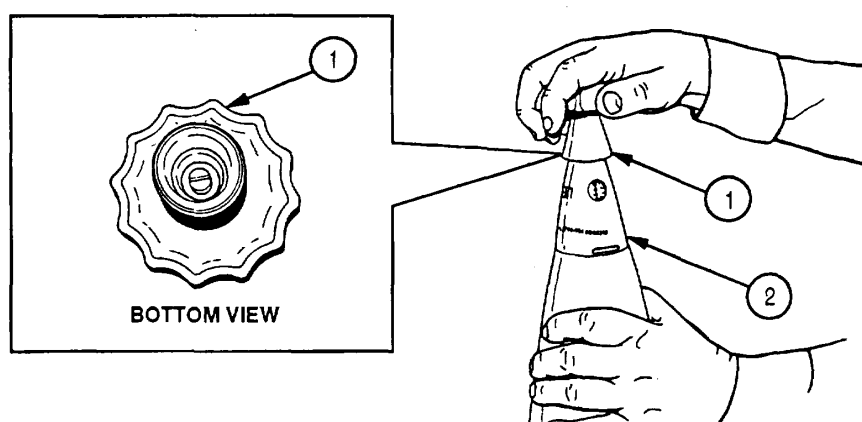


(4) Resetting fuze. If setting is missed, reset fuze using M34 fuze setter and turn lower cap in the opposite direction (counterclockwise) 2 or 3 seconds below the desired setting. Then rotate lower cap in direction of arrow (clockwise) and set fuze on the correct time. This can also be done by turning the lower cap in the direction of the arrow (clockwise) all the way around (additional turn) to obtain the desired setting.

(5) 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 "0" mark on the vernier scale (MA on the M563 fuze).

(6) Fuzes fired in heavy precipitation. If M564 and M548 fuzes are fired in heavy precipitation (heavy rainfall, sleet, snow, or hail), occasional downrange premature functioning may occur. The precipitation necessary to cause malfunctioning is comparable to a heavy downpour that occurs during a summer thundershower. The premature rate will vary with the charge fired and the density of the precipitation.

e. **Procedure Number 4, M577 Series and M582 Series Fuzes.** The slotted setting key on the nose of the fuze is used for setting the fuze in the following steps:



(1) Press open end of M35 fuze setter (1) against setting key on fuze (2).

(2). Turn knob handle of fuze setter counterclockwise, as viewed from the nose end, until fuze setter blade engages fuze setting key slot. The hairline in the window is used for all settings.


CAUTION

Do not attempt to set these fuzes below 93.5 seconds when setting them in clockwise direction, or above 200 seconds when setting them in counterclockwise direction. Setting of 000 and/or 200 are not authorized settings.

(3). When setting fuze for PD action (SQ), start with the shipping and storage position (safe) (93.5 to 95.5); then turn counterclockwise to 98.0 for PD action under the hairline window.

COUNTERCLOCKWISE

CLOCKWISE

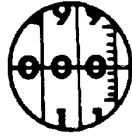
	SHIPPING AND STORAGE	
	SETTING (93.5 TO 95.5)	1/4 TURN
	PD SETTING (98)	1/4 TURN
	000 SECONDS	1/4 TURN
	200 SECONDS	20 TURNS



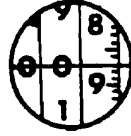
A STORE (SAFE)



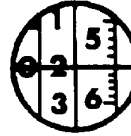
B PD



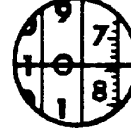
C 000.0



D 8.7



E 25.5



F 107.4

(4) To set for mechanical time action, turn fuze setter counterclockwise from the safe position (93.5 to 95.5) past PD (98.0), until the triangle () disappears. 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 for a setting of 8.7, 25.5, and 107.4.

4-9. FUZE SETTING PROCEDURES FOR THE M101A1 HOWITZER (cont)

e. Procedure Number 4, M577 Series and M582 Series Fuzes. (cont)

(5) To set a lower time on a fuze already set, reseal fuze setter and turn clockwise (numbers get smaller) to a setting at least 1 second lower than the required setting (i.e., at least 24.5 or 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 fuze setter clockwise (numbers get smaller) until 000 is passed, and continue to turn until fuze 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 fuze to reusable 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 MTSQ fuzes are -35 to +145 °F (-37 to +63 °C).

f. Procedure Number 5, M501 Series Fuze.

WARNING

Exercise extreme care when handling an M501 series fuzed projectile. Mishandling or dropping could cause the fuze to malfunction, expelling the baseplate and contents. Keep pull wire on fuze in place until immediately before loading and firing.

CAUTION

Do not fire fuzes with cocked or loose lower caps.

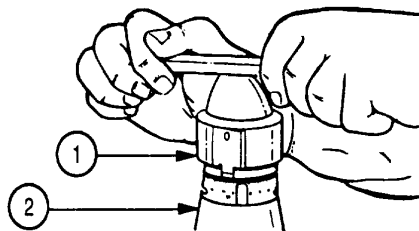
NOTE

The M501 series fuzes are shipped with the index mark on the lower cap aligned with the "S" engraved on the base.

(1) Set time as follows:

(a) Check fuzes for cocked or loose lower caps.

(b) To remove safety wire before setting, pull end of wire from hole in lower cap, sliding wire off end of fuze.



(c) With the M27 fuze setter (1), set fuze by rotating lower cap (2) to desired time in counterclock direction or in direction of arrow on lower cap. The fuze is properly set when index mark on lower cap is aligned with desired time, in seconds, engraved on the base.

(d) If the round is not fired after fuze is set, reset fuze to "S" (safe) position and place safety wire in its proper position.

(2) Impact functioning of the M501 MTSQ series fuze may be obtained by either leaving the "S" (shipping mark) aligned with the index mark on the base, or by setting the graduated time ring so that the time setting is greater than the time of flight. The safety wire must be removed (pull free end of wire off and out of hole) before firing or setting the fuze.

g. Procedure Number 6, 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:

CAUTION

Do not activate these fuzes unless they will be fired before 15 days elapses. Once activated, these fuzes have a service life of approximately 15 days before the battery runs down. Check if LCD is active to determine if fuze is still settable.

(1) Setting by Hand:

CAUTION

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 --.-, ensuring 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 4 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 4. Release the selector button and depress again to move cursor to the next column to continue setting.

(e) For PD, set the fuze to 4 98.0. Any other setting with 4 would result in a dud.

4-9. FUZE SETTING PROCEDURES FOR THE M101A1 HOWITZER (cont)

g. Procedure Number 6, M762 and M767 Fuzes. (cont)

(f). The following are examples of fuze settings:

PD 98.0

000.8

007.3

040.1

169.0

PD

0.8 seconds

7.3 seconds

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.

(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 1 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 to +110 °F (-32 to +43 °C).

4-10. PROPELLING CHARGE PREPARATION

WARNING

Fire complete round only with the originally packed projectile, cartridge case, propelling charge, and fuze as authorized in table 4-3, page 4-12. Failure to do so could result in injury or death to personnel.

a. **General.** Cartridges with an adjustable (semifixed) propelling charge have the propelling charge divided into increment charges. When the cartridges are fired full charge, the propelling charge is used as issued. When other than full charge is to be fired, adjust propelling charge as indicated in paragraph b below.

CAUTION

Under no conditions will the fixed charge of HEP, HEP-T, and TP-T cartridges be altered. Maximum penetration of armored targets is secured with the fixed charges furnished.

b. Procedures for Preparing M67 Propelling Charge and the Other Adjustable Charges.

(1) Remove projectile from cartridge case. Be careful not to damage lip of cartridge case, otherwise, cartridge may jam in chamber of cannon tube.

(2) Withdraw increments from cartridge case. Remove and discard increments numbered higher than charge to be fired, by breaking twine between designated charge and higher numbered increments.

(3) Reassemble remaining increments (up to and including numbered charge to be fired) in cartridge case in original order. For example, when adjusting seven-section charge for charge 4, discard increments five, six, and seven, and assemble remaining increments one, two, three, and four in cartridge case.

NOTE

As far as the propelling charge is concerned, the cartridge is now ready for firing.

If the M548 cartridge is to be fired in the ROCKET-ON mode, the rocket cap must be removed prior to replacing the projectile in the cartridge case. The M548 HERA cartridge is authorized charge 7 firing in both the ROCKET-ON and ROCKET-OFF modes. Charges 3, 4, 5, and 6 are authorized for ROCKET-OFF mode firing only under emergency combat conditions.

4-11. LOADING PROCEDURE

WARNING

Do not reuse cartridges which have been removed from weapons by ramming. Ejection difficulty may have been caused by some nonstandard condition in the ammunition, and also, the fuze may have been damaged during the ramming process. Repack and mark for disposal.

Do not fire M60 series WP projectiles which are known to have been stored in other than a base-down position. Firing of such projectiles can cause inbore premature or close-in premature malfunctions.

Do not load or fire cartridge without a fuze, with an unauthorized fuze, with fuze not fully seated, or with an obstruction in cannon tube; it can cause inbore prematures.

Do not fire proximity (VT) fuzed cartridges at targets closer than 750 meters from friendly troops.

Do not fire a projectile which was impacted by a hard object. Impact to the ogive/nose arc can cause a crack. Avoid excessive rough handling.

- a. Be sure round is clean.
- b. Be sure there are no obstructions in the cannon tube.
- c. Remove fuze safety devices after assembling projectile to cartridge case and just before loading projectiles into weapon.
- d. Load, taking care not to strike the fuze against the weapon.

NOTE

The mouths of the M14B2 and M14B4 cartridge cases can be expanded slightly by uncoiling, making it easier to insert the projectile. However, if the loader is not careful to grasp projectile at its center of balance, the lip of the cartridge case may protrude enough to catch on the lip of the lower extractor recess, damaging the cartridge case and making it impossible to chamber the round.

4-12. EXCESSIVE PRESSURE IN CANNON

Observe the following precautions to prevent excessive pressure in the cannon:

- a. Do not load or fire ammunition which is at a temperature above safe limits for firing.
 Lower limit.....-80 °F (62 °C) for a period of not more than 3 days.
 Upper limit.....+160 F (+71 °C) for periods of not more than 4 hours per day.
- b. In case of a round chambered in a hot weapon, fire or unload immediately.
- c. Use only propelling charges authorized for the particular round.
- d. Use no more propellant than in the full charge authorized for the round.

4-13. DUDS

Do not touch, move, or otherwise handle duds; their fuzes may be armed. Have duds destroyed in place by authorized personnel only.

4-14. FIRING TABLES

FT 1 05-H-7 w/C6 provides firing data for ammunition fired in the M2A2 cannon, except as indicated: Round M444, FT 105 ADD-B-2 w/C1.

4-15. AMMUNITION PREPARED FOR FIRING, BUT NOT FIRED

WARNING

If the cannon tube is hot, chambered rounds should be fired or removed from the weapon within 5 minutes to avoid injury or death to personnel. (Refer to misfire/checkfire procedures, page 4-33.)

- a. Unloading Operation. A complete round will be removed under the direct supervision of an officer, exercising appropriate precautions. This operation is as follows:
 - (1) Level the cannon, and slowly move breechblock to its open position.
 - (2) Remove cartridge case and propelling charge.
 - (3) Fill the chamber with shock absorbent material and close breechblock.
 - (4) Assemble the cleaning and unloading rammer to the assembled cleaning staff section.
 - (5) Insert cleaning and unloading rammer into the muzzle until it fits against the fuze of projectile. Push, or if necessary, tap the cleaning section staff until the projectile is dislodged from its seat.
 - (6) Open breechblock, remove the shock absorbent material, and carefully remove projectile.

b. Ammunition Preparations After Removal.**WARNING**

Do not use rounds extracted from weapons by ramming. Extraction difficulty may have been caused by some nonstandard condition in the ammunition, or the fuze may have been damaged during the ramming process. Repackage and mark for disposal by EOD personnel.

(1) Using applicable fuze setter and procedure (see table 4-5, page 4-21), reset fuze to safe. M762/M767 ET fuzes that have been activated and not fired should be reset to 88.8, segregated and used first in subsequent firing. When the battery runs down on an activated M762/M767 ET 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 ET 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.

(2) Replace safety wires, remove fuze, and replace in original packing.

(3) Disassemble cartridge case and place projectile and cartridge case in original packing and mark for disposal by EOD personnel.

4-16. AMMUNITION FORMS AND RECORDS

All ammunition must be recorded daily by charge number, type, and total number of each fired; and entered on DA Form 2408-4.

Section III. MISFIRE/CHECKFIRE PROCEDURES**4-17. GENERAL PRECAUTIONS**

Conditions described below are rarely encountered with a properly maintained weapon, or when authorized and properly maintained ammunition is fired. To avoid injury to personnel and damage to equipment, it is important that the nature of these conditions is understood and that personnel are familiar with misfire/checkfire procedures. The flow charts summarize cold and hot misfire/checkfire procedures.

4-18. DEFINITIONS

a. Checkfire. A checkfire is a command normally given by the battery executive officer. In an emergency, the command may be given by anyone present. At this command, regardless of its source, firing will cease immediately and the unloading will be initiated.

4-18. DEFINITIONS (cont)

b. Misfire. A misfire is a failure of a round to fire after initiating action is taken. The failure may be due to a faulty firing mechanism or a faulty element in the propelling charge explosive train. A misfire in itself is not dangerous; however, it cannot be immediately distinguished from a delay in functioning of the weapon firing mechanism or from a hangfire. Therefore, misfires must be treated as delayed firings until determined otherwise.

c. Hangfire. A hangfire is a delay in the functioning of a propelling charge explosive train at the time of firing. The delay, though unpredictable, ranges from a fraction of a second to several minutes. A hangfire cannot be distinguished from a misfire immediately.

WARNING

When firing is interrupted, remove projectile from chamber of hot weapon within 5 minutes from the time it was loaded to prevent cook-off.

In the event of a failure to fire, keep the weapon trained on the target. Have personnel stand clear of the muzzle and path of recoil.

d. Sticker. A sticker is a projectile that is lodged in the cannon tube after being fired. Stickers result from insufficient chamber pressure.

e. Cook-off. The functioning of the propelling charge or projectile when initiated by the heat of the weapon.

f. Hot Weapon. A hot weapon is one in which the cannon tube and breech mechanism have been brought to a sufficiently high temperature by previous firings so that they can transmit, in several minutes, enough heat to the round to activate its explosive components. A weapon should be considered hot if it has violated the prescribed rates of fire.

g. Hot Weather. Hot weather is any weather in which the outside temperature is expected to exceed +100 °F (+38 °C) during the day.

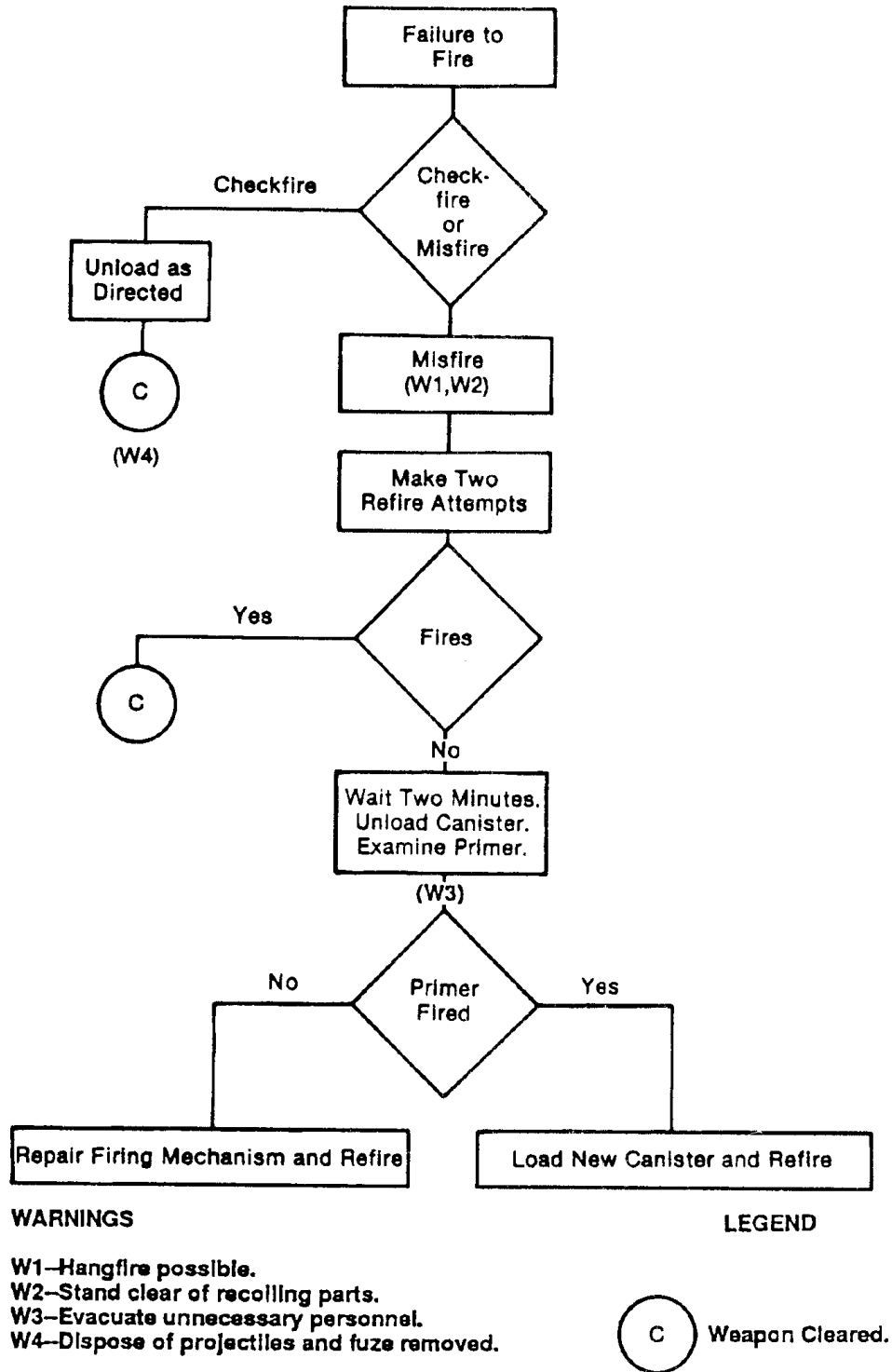
4-19. MISFIRE/CHECKFIRE PREVENTIVE OR CORRECTIVE PROCEDURES

WARNING

If an explosive round cannot be fired or unloaded from a hot weapon within 5 minutes after being chambered, personnel should be evacuated from the area or seek adequate protective cover at least 50 meters from the weapon for a period of 2 hours.

a. General. Misfires and checkfires are not dangerous in themselves; however, two conditions hazardous to crew and equipment can develop if the proper corrective procedures are not followed. First, in the case of either a checkfire or misfire, the weapon may unexpectedly fire. All personnel should, therefore, stay clear of the muzzle and path of recoil, and the weapon should be kept trained on the target until the cartridge case and propellant have been removed from the weapon. Second, in the case of a misfire, if the round is chambered in a hot weapon, the possibility of cook-off exists.

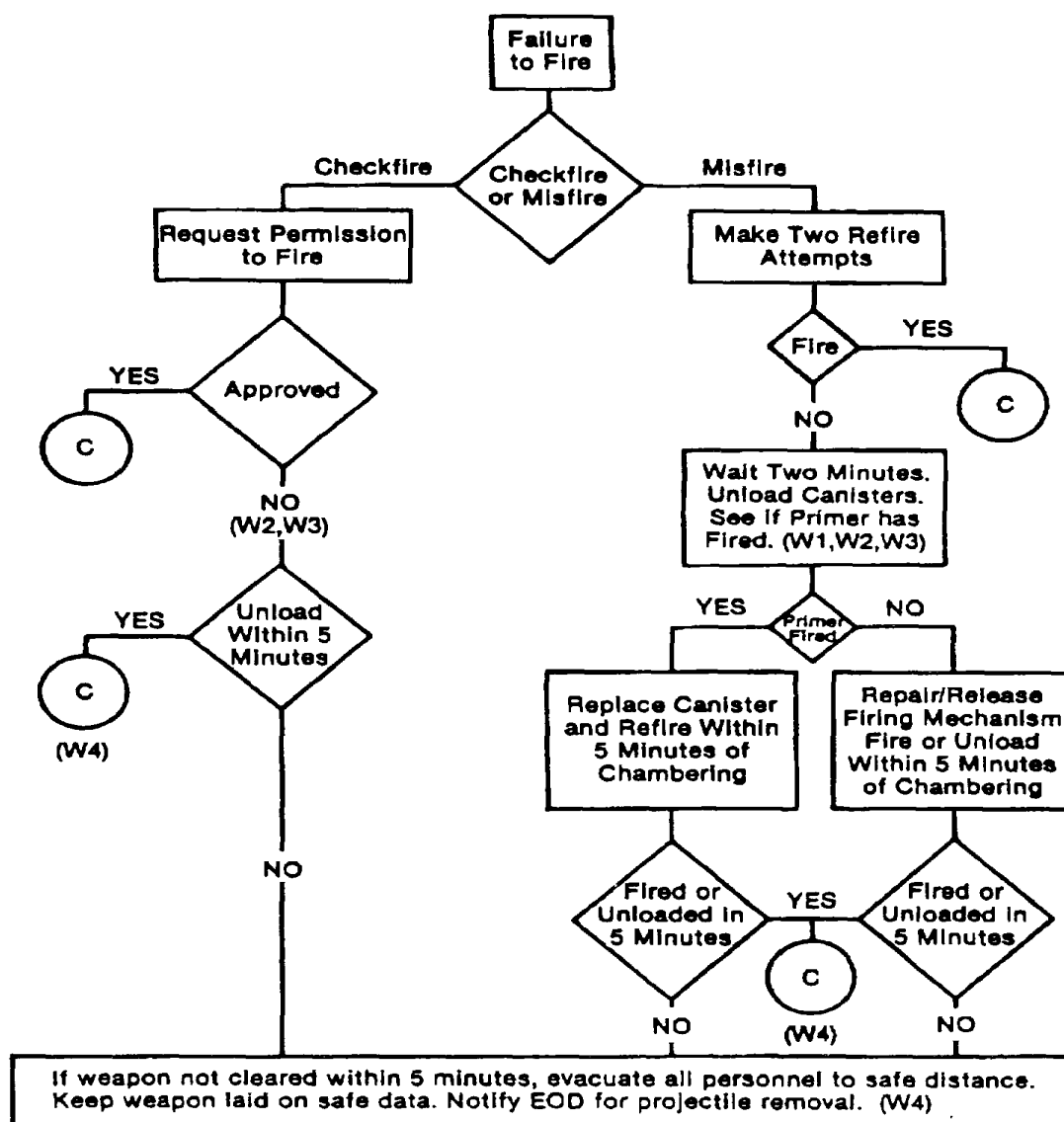
b. **Misfire and Checkfire Procedures.** Charts on this page and 4-36 summarize misfire and checkfire procedures.



MISFIRE/CHECKFIRE PROCEDURES—COLD TUBE

(1) **Cold Tube Misfire.** The danger of the chambered round cooking off under these conditions is greatly reduced. Should a misfire occur, two additional attempts to fire should be made before initiating the unloading operation. Although time is not as critical in this situation, it is military policy to either fire or unload chambered rounds within 5 minutes, if possible.

4-19. MISFIRE/CHECKFIRE PREVENTIVE OR CORRECTIVE PROCEDURES (cont)

**WARNINGS**

W1—Hangfire possible.

W2—Stand clear of recoiling parts.

W3—Evacuate unnecessary personnel.

W4—Dispose of projectiles and fuze removed.

LEGEND

Weapon Cleared.

**MISFIRE/CHECKFIRE PROCEDURES—HOT TUBE**

(2) **Hot Tube Misfire.** The misfire procedures should be completed within 5 minutes from the time it was loaded; the safety procedures and precautions described in paragraph a. (p 4-34) should be followed. Refer to page 4-32 for unloading operations.

WARNING

In all situations requiring the unloading of a round which would not fire, the breech mechanism should not be opened for at least 1 minute after the firing attempt and until all personnel not required for unloading are at least 50 meters away from the weapon.

(3) Inspection After Unloading. After a misfired cartridge case has been unloaded, it should be inspected to determine whether the propelling charge or the firing mechanism caused the misfire. If the primer has been dented, the propelling charge was at fault. If the firing mechanism caused the misfire, notify Unit maintenance.

WARNING

Any round which has been unloaded from this weapon, whether it has been determined faulty or not, should be set aside for disposal by authorized EOD personnel. Unloading may have created some nonstandard conditions in the round.

(4) Notification of EOD Personnel. If a projectile cannot be cleared from the weapon within the specified times, EOD personnel must be notified to remove the stuck projectile or the weapon with the stuck projectile.

Section IV. MAINTENANCE OF AMMUNITION

4-20. MAINTENANCE OF AMMUNITION

WARNING

Handle explosive ammunition and components containing explosives with utmost care. Do not drop, throw, tumble, or strike packaged or unpackaged ammunition or related components. Explosive elements in primers and fuzes are sensitive to shock.

Do not expose ammunition and components to direct sunlight, flame, or other sources of heat.

Do not expose ammunition and components containing explosives to rain, excessive humidity, or ground moisture; otherwise, short ranges may result.

a. Care.

(1) Ammunition is packed to withstand conditions ordinarily encountered in the field. Keep packing boxes from becoming broken or damaged.

(2) Since ammunition is impaired by moisture, frost, extreme temperatures, and foreign matter (mud, oil, etc.), observe the following:

(a) Do not break the moisture-resistant seal on the container until ammunition is to be used.

(b) Shield ammunition, particularly fuzes and propelling charges, from sources of high temperatures (i.e., the direct rays of the sun).

4-20. MAINTENANCE OF AMMUNITION (cont)

b. Handling and Transportation.

(1) Cartridge cases are dented easily and should be protected from hard knocks and blows. A dented cartridge case may result in loss of obturation, prevent chambering, and cause jamming in the chamber and difficulties in extraction.

(2) Protect propellant from moisture and foreign matter during handling. Keep mouth of cartridge case containing propellant covered when moving ammunition.

(3) Protect fuzes, primers, and rotating bands from foreign matter and impact at all times.

(4) Proximity fuzed ammunition may be safely transported short distances with normal care and handling. When such ammunition is to be transported considerable distances, it is advisable to transport the fuze in its original container.

(5) Cartridges/projectiles are not to be moved/transported in a loose or unpacked configuration.

(6) Impact to the nose/ogive area of M1 projectiles with a hard object may cause a crack. Projectiles may crack at any temperature, but are more likely to crack at temperatures below 30 °F (-1 °C). Avoid impact to projectile nose.

c. Maintenance.

WARNING

Alteration of loaded ammunition or components is prohibited.

(1). Procedures.

(a) Inspect ammunition packaging daily. Open boxes or containers which show severe evidence of contamination or deterioration, and inspect ammunition. Do not open sealed boxes or containers for inspection purposes only.

(b) Inspect unpackaged ammunition and explosive components daily. Do not open sealed boxes or containers for inspection purposes only.

(c) Wipe off wet or dirty ammunition at once. Remove light corrosion or the green or bluish deposits formed on copper, brass, or bronze surfaces that result from exposure to the weather.

CAUTION

Do not polish ammunition to make it look better.

(d) Consider ammunition which exhibits severe rust or propellant contamination, particularly moisture, unserviceable. Do not use except in emergencies.

(e) Any projectile found to have impact damage to the nose/ogive area or are suspect due to known impact shall be reported for demil IAW DA PAM 738-750.

(f) Repackage serviceable ammunition in original containers, making sure that all material is dry and sound. If original container is unsuitable, repackage in used packing material and transfer all markings.

(2) Ammunition or Components of Ammunition Prepared for Firing, But Not Fired.

(a) Return such ammunition to the original condition and packing. Mark appropriately and use first in subsequent firings in order to keep stocks of open packings to a minimum.

(b) Reassemble the supplementary charge and closing plug (with gasket and spacer) or fuze to the projectile to restore the round to its original condition. Return fuzes to original packaging. In reassembling components, make sure the supplementary charge is properly inserted (felt pad end innermost).

(3) To Reinsert the Plastic Plug:

(a) Ensure there is no cardboard spacer in the fuze well.

(b) Insert plug in nose of projectile and tap with hand.

(c) Ensure plug is secure and will not fall out with normal handling. If necessary, tape plug in place.

NOTE

The plastic closing plug was designed for one time use. However, it can be reinserted for short term storage at the user level.

(4). Unserviceable Ammunition.

(a) Conspicuously mark unserviceable ammunition or explosive components UNSER- VICEABLE, and return to ammunition supply personnel for disposition.

(b) Repackage the ammunition in original containers. If original container is unsuitable, repackage in used packing material and transfer all markings. All layers of packing must be conspicuously marked UNSERVICEABLE.

(5) Excess Explosive Components. Pack supplementary charges, removed from projectiles before assembling VT fuzes, in the containers from which the VT fuzes were removed. Properly mark the container and return to the ammunition supply personnel for disposition.

d. 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. Avoid exposure of ammunition and ammunition components to direct sunlight.

Do not store ammunition under trees or adjacent to towers or other structures that attract lightning. When ammunition must be stored in the open, select a storage site free of power lines, electric cables, and readily ignitable and flammable materials. Site should be level and well drained.

Do not store ammunition assembled with tetryl-loaded bursters (i.e., M60 WP smoke 105-MM cartridge and M60 persistent H and HD gas) at temperatures exceeding +125 °F (+52 °C).

4-20. MAINTENANCE OF AMMUNITION (cont)**d. Storage. (cont)****NOTE**

Ammunition assembled with bursters containing COMP B5 can be stored at temperatures up to +145 °F (+63 °C).

(1) Temperature Limits.

(a) Except as otherwise specified, observe the following limits:

1. Lower limit -80 °F (-2 °C) for a period of not more than 3 days.
2. Upper limit +160 °F (+71 °C) for periods of not more than 4 hours per day.

(b) Store or transport projectiles containing WP at temperatures below the melting point (+111 °F (+44 °C)) of the WP filler. If this is not practicable, store or transport such projectiles on their bases so that, should the WP filler melt, it will resolidify with the void in the nose of the projectile. Complete rounds of recent manufacture are packed in boxes marked NOSE END.

(c) Protect VT fuzes and VT fuze rounds from long exposure to high humidity. Observe the following storage temperature limits:

Below -20 °F (-29 °C) and above +130 °F (+54 °C) for M513, M513A1, and M513B1.

Below -40 °F (-40 °C) and above +140 °F (+60 °C) for M513A1 E1, M728, and M732.

Below -65 °F (-54 °C) and above +160 °F (+71 °C) for M513A2.

(2) Provisions.

(a) Use heavy, well supported dunnage to keep the bottom tier of the stack off the ground, and to prevent it from sinking into the ground.

NOTE

A hardstand of blacktop or gravel and sand is preferable to excessive use of dunnage. Allow at least 6 in. (15 cm) of space beneath the pile for air circulation. Dig suitable trenches to prevent water from flowing under the pile.

(b) Provide nonflammable or fire-resistant covers (i.e., tarpaulin) for all ammunition. Maintain an air space of approximately 18 in. (46 cm) between the cover and the ammunition. Keep the cover at least 6 in. (15 cm) from the pile on the ends and at the sides to permit circulation of air.

(c) Store WP rounds nose up.

(d) Store ammunition containers with top side up. Labels or markings on boxes and containers indicate which side should be up.

CHAPTER 5 UNIT MAINTENANCE

Section I. REPAIR PARTS; SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

5-1. COMMON TOOLS AND EQUIPMENT

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to unit.

5-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

Special tools are illustrated and described in TM 9-1015-203-20P. There is no TMDE or support equipment authorized.

5-3. REPAIR PARTS

Repair parts are listed and illustrated in the repair parts and special tools list (TM 9-1015-203-20P) covering Unit maintenance for this equipment.

Section II. SERVICE UPON RECEIPT

5-4. GENERAL

a. This section contains instructions for services to be performed by the using organization upon receipt of a new or overhauled howitzer. These services include unpacking, deprocessing, and checking the howitzer and equipment.

b. Materials and parts required to maintain the weapon; e.g., wiping rags, cleaning compound, and CLP; are listed in appendix E.

5-5. SERVICE UPON RECEIPT OF MATERIEL

Table 5-1 contains instructions for performing those services required upon receipt of this equipment.

5-5. SERVICE UPON RECEIPT OF MATERIEL (cont)*Table 5-1. SERVICE UPON RECEIPT-M101A1 HOWITZER WITH EQUIPMENT*

LOCATION	ITEM	ACTION	REMARKS
1. CANNON	a. Cannon	Remove all sealing material from end of cannon tube and breech mechanism.	
	b. Cannon tube	(1) Remove packing material from tube inside bore.	
		(2) Thoroughly clean and lube bore.	Refer to page 3-4
		(3) Inspect to see that all rust-preventive compound or other preservatives have been removed.	
	c. Breech mechanism	(1) Disassemble, and thoroughly clean with wiping rag (item 26, appx E) and CLP (item 7, appx E). Inspect for corrosion and damaged or missing parts.	Refer to page 3-37.
		(2) Lubricate with CLP (item 7, appx E).	
(3) Reassemble.		Refer to page 3-40.	
(4) Open and close breechblock, and check for smooth operation.			
(5) Disassemble M13 firing lock. Inspect for damaged and missing parts. Clean corrosion and rust, using CLP (item 7, appx E) and wiping rag (item 26, appx E).		Refer to page 3-43.	
2. RECOIL MECHANISM	a. Recoil	Check for oil leakage.	Refer to page 2-9 and notify Direct Support maintenance.
	b. Respirator	Using respirator wrench, check settings 1-2-3 for movement; reset at 0. Clean all foreign material from respirator.	
	c. Recuperator cylinder	Have Direct Support maintenance verify nitrogen pressure	

Table 5-1. SERVICE UPON RECEIPT-M101A1 HOWITZER WITH EQUIPMENT

LOCATION	ITEM	ACTION	REMARKS
3. CARRIAGE	d. Recuperator cylinder front head Assembly	Check oil index for proper oil reserve. Reestablish oil reserve, if needed.	Refer to page 3-47.
	e. Recoil slides	Clean exposed areas with wiping rag (item 26, appx E) and cleaning compound (item 9, appx E), and lubricate lightly with CLP (item 7, appx E). Lubricate unexposed areas with GAA (item 13, appx E).	
	a. Equilibrator assembly	Check adjustment for equal elevating handwheel pressure in both elevation and depression. Adjust, if needed.	Refer to page 5-52.
	b. Elevating mechanism	Check for smooth operation. There should be no binding or spasmodic motion, and elevating handwheel backlash should not exceed 1/6 turn of elevating handwheel.	Notify Direct Support maintenance if any correction is required.
	c. Traversing mechanism	Check for smooth operation. There should be no binding or spasmodic motion, and traversing handwheel backlash should not exceed 1/6 turn of traversing handwheel.	Notify Direct Support maintenance if any correction is required.
	d. Handbrakes	Check adjustment, When fully engaged, handbrake pawl should be located not more than halfway forward on the ratchet rack. Adjust as needed.	Refer to page 5-63.

5-5. SERVICE UPON RECEIPT OF MATERIEL (cont)

Table 5-1. SERVICE UPON RECEIPT-M101A1 HOWITZER WITH EQUIPMENT

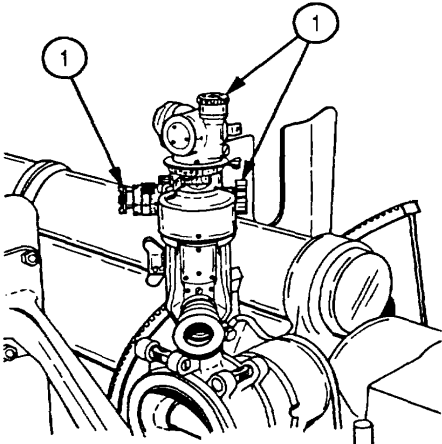
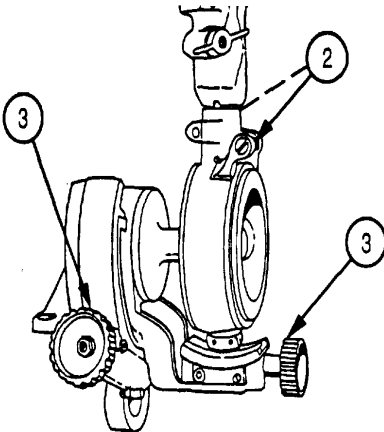
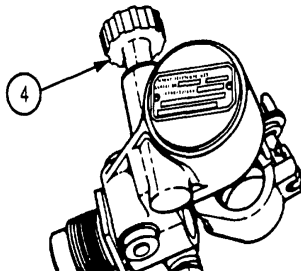
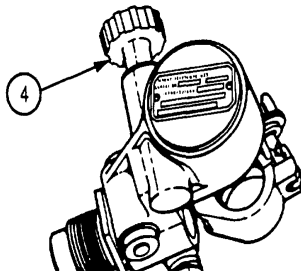
LOCATION	ITEM	ACTION	REMARKS
3. CARRIAGE (cont)	e. Wheels and tires	<p>CAUTION Wrong tire pressure could damage weapon during towing.</p> <p>Check tires for cuts, stones, nails, and proper inflation (40 psi (276 kPa)). Adjust as needed. Check for uneven tread wear. Check wheel lugs to make sure they are tight.</p>	Refer to page 2-43.
	f. Travel lock brackets and travel lock	Check that travel lock locks properly in travel lock brackets. Adjust nuts as required for proper retention.	Refer to page 5-15.
4. FIRE CONTROL EQUIPMENT	a. Instruments and mounts	<p>Unpack fire control equipment. Check against packing slip for completeness.</p> 	

Table 5-1. SERVICE UPON RECEIPT-M101A1 HOWITZER WITH EQUIPMENT

LOCATION	ITEM	ACTION	REMARKS
	b. Pantel	<p>(1) Check optics for moisture or fogging. Purge, if necessary.</p> <p>(2) Check knobs (1) for binding and free movement.</p> 	Refer to page 5-65.
	c. M21 A1 telescope mount	<p>Check level vials (2); covers must move freely. Markings must be clean, and there must be a bubble. Check cross leveling and longitudinal leveling knobs (3) for free movement.</p> 	
	d. Elbow telescope and M23 Mount	<p>(1) Check optics and reticle on elbow telescope for moisture and fogging. Purge, if necessary.</p> <p>(2) Check bracket rotating knob (4) for free movement.</p> 	Refer to page 5-69.

5-5. SERVICE UPON RECEIPT OF MATERIEL (cont)

Table 5-1. SERVICE UPON RECEIPT-M101A1 HOWITZER WITH EQUIPMENT

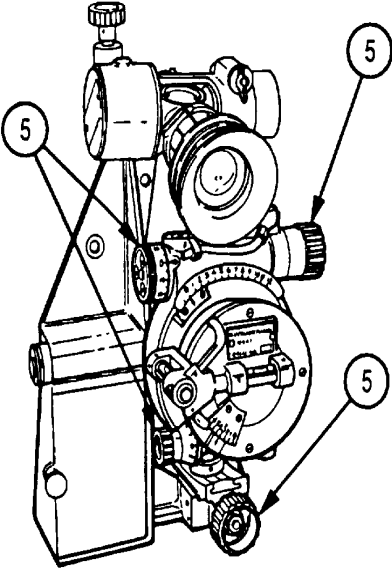

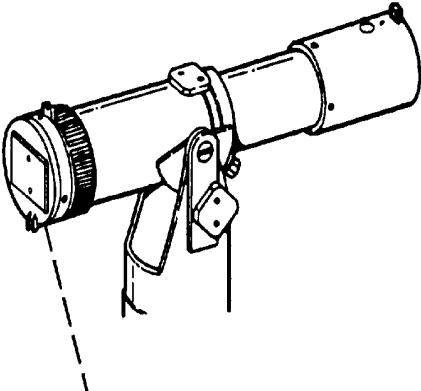
LOCATION	ITEM	ACTION	REMARKS
4. FIRE CONTROL EQUIPMENT	e. M4A1 fire control quadrant	 <p>(1) Check level vials for cracked glass, presence of bubble, and free movement of covers.</p> <p>(2) Check all knobs (5) for free movement.</p>	Notify Direct Support maintenance if any correction is required.
	a. Tools and equipment	<p>(1) Remove all packing boxes, containers, and wrappings.</p> <p>(2) Unpack tools and equipment from containers.</p> <p>(3) Check tools and equipment against packing slip for completeness.</p> <p>(4) Remove packing material from all surfaces.</p>	

Table 5-1. SERVICE UPON RECEIPT-M101A1 HOWITZER WITH EQUIPMENT

LOCATION	ITEM	ACTION	REMARKS
		<p>(5) Using wiping rag (item 26, appx E) and cleaning compound (item 9, appx E), thoroughly clean all parts coated with rust-preventive compound or other preservative.</p> <p style="text-align: center;">  <u>WARNING</u> </p> <p>If illumination of M1A1 collimator is insufficient or nonexistent, follow radioactive materials procedures on inside front cover of this manual.</p> <p style="text-align: center;">  RETICLE </p>	
	b. M1A1 collimator	<p>(1) Check for completeness and operation.</p> <p>(2) Check for illumination. For M1A1 collimator, check reticle.</p>	

5-5. SERVICE UPON RECEIPT OF MATERIEL (cont)

Table 5-1. SERVICE UPON RECEIPT-M101A1 HOWITZER WITH EQUIPMENT

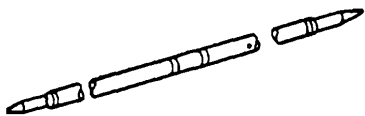
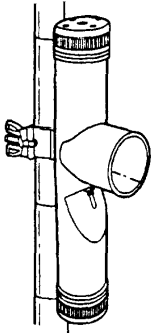
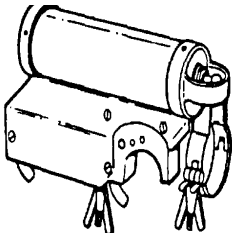
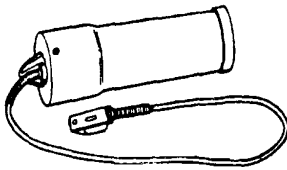
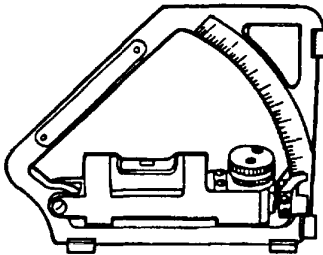
LOCATION	ITEM	ACTION	REMARKS
5. AUXILIARY EQUIPMENT (cont)	c. M1A2 aiming post lights and M14 aiming post lights	 <p>M1A2 AIMING POST</p>  <p>M14 AIMING POST LIGHT</p> <p>Check for completeness, good condition, and operation.</p>	
	d. M19 and M36 instrument lights	 <p>M19 INSTRUMENT LIGHT</p>  <p>M36 INSTRUMENT LIGHT</p> <p>Check for completeness, good condition, and operation.</p>	

Table 5-1. SERVICE UPON RECEIPT--M101A1 HOWITZER WITH EQUIPMENT (cont)

Location	Item	Action	Remarks
	e. M1A1 gunner's quadrant	 <p>M1A1 GUNNER'S QUADRANT</p> <p>Check for completeness and good condition</p>	

5-6. CHECKING UNPACKED EQUIPMENT

The following actions will be taken as soon as possible upon receipt of the equipment:

- a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on SF 364, Report of Discrepancy (ROD).
- b. Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.
- c. Check to see whether the equipment has been modified.

**Section III. UNIT PREVENTIVE MAINTENANCE
CHECKS AND SERVICES (PMCS)**

5-7. INTRODUCTION TO PMCS TABLE

a. General. Your PMCS table (table 5-2) has been provided so you can keep your equipment in good operating condition and ready for its primary mission.

b. Warnings and cautions. Always observe the WARNINGS and CAUTIONS appearing in your PMCS table BEFORE, DURING, and AFTER you operate the equipment. The warnings and cautions appear before applicable procedures. You must observe these WARNINGS and CAUTIONS to prevent serious injury to yourself and others or to prevent your equipment from being damaged.

5-7. INTRODUCTION TO PMCS TABLE (cont)**c. Explanation of table entries.**

(1) **Item number column.** Numbers in this column are 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 in which checks and services must be performed for the intervals listed.

(2) **Interval column.** This column tells you when you must do the procedure in the procedure column.

(3) **Item to be checked or serviced column.** This column provides the item to be checked or serviced.

(4) **Procedure column.** This column gives the procedure you must do to check or service the item listed in the check/service column to know if the equipment is ready or available for its intended mission or for operation. You must do the procedure at the time stated in the interval column.

(5) **Not fully mission capable if: column.** Information in this column tells you what faults will keep your equipment from being capable of performing its primary mission. If you make check and service procedures that show faults listed in this column, do not operate the equipment. Follow standard operating procedures for maintaining the equipment or reporting equipment failure.

d. Other table entries. Be sure to observe all special information and notes that appear in your table.

NOTE

Marine Corps users, refer to TI 8300-24/2 for Unit maintenance intervals.

5-8. PMCS PROCEDURES

*Table 5-2. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES
FOR M101A1 HOWITZER*

Item No.	Interval	Item to be Checked or Serviced:	Procedure	Not Fully Mission Capable If:
1	Quarterly	WHEELS AND TIRES	<p>NOTE Procedure is written for one wheel and tire, but applies to both sides.</p> <p>Check wheels for loose wheel lugs. Be sure they are tight. Check tires for cuts, stones, and nails. Check pressure for 40 psi (276 kPa). Torque wheel lugs to 350 ± 50 ft-lb (475 ± 68 N•m).</p>	One or both wheels are cracked or missing, or tires are unserviceable.

5-8. PMCS PROCEDURES

Table 5-2. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES
FOR M101A1 HOWITZER (cont)

Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
2	Quarterly	PANTEL	Purge to prevent moisture from entering. (Refer to page 5-65.)	One or both lenses are cracked or missing. Elevation or azimuth knob has excessive back-lash or moisture in optics.
3	Quarterly	ELBOW TELESCOPE	Purge to prevent moisture from entering. (Refer to page 5-69.)	Lenses are cracked, missing, or dirty. Moisture on lenses.
4	Semiannually	CANNON TUBE	<p>a. Inspect for moisture and accumulation of rust, corrosion, or foreign material.</p> <p>b. Clean and wipe dry (refer to page 3-36) and inspect visually for cracks or other defects.</p> <p>c. Inspect origin of rifling for cracking, peeling, or chipping (TM 9-1000-202-14).</p>	<p>Cannon tube is cracked or contains dents or bulges.</p> <p>Rifling is cracked, peeling, or chipped. Cannon tube has not been borescoped within past 180 days (TM 9-1000-202-14).</p>

5-8. PMCS PROCEDURES (cont)

Table 5-2. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES
FOR M101A1 HOWITZER (cont)

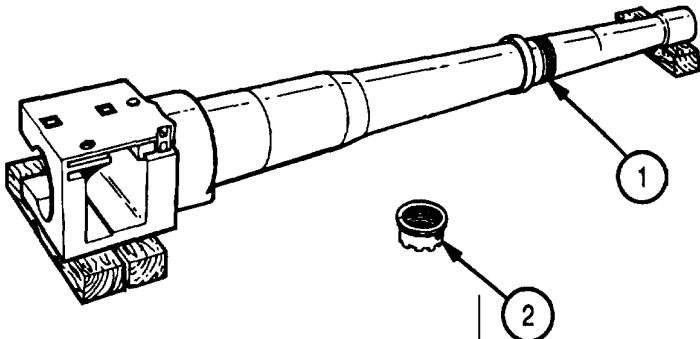
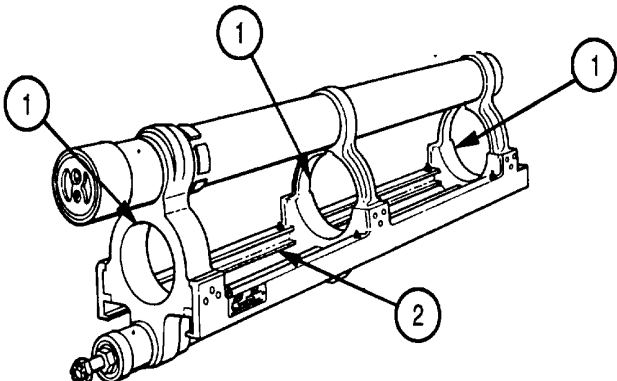
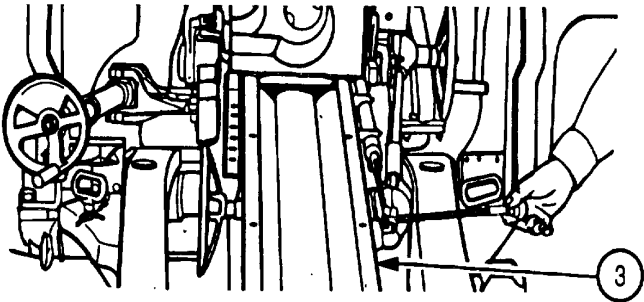
Item No.	Interval	Item to Check or Serviced	Procedure	Not Fully Mission Capable If:
4	Semi-annually	CANNON TUBE (cont)	 <p>d. Remove cannon. (Refer to page 5-36.) Clean cannon bearing surfaces (1) and howitzer locking ring threads (2) with CLP (item 7, appx E). Wipe dry with wiping rag (item 26, appx E) and lubricate with GAA (item 13, appx E).</p>	
5	Annually	BREECH MECHANISM	<p>a. Open and close breechblock. Check for smoothness of operation. Check for positive locking operation.</p> <p>b. Remove M13 firing lock (refer to page 3-43), manually operate, and check functioning. Inspect firing pin for damage and corrosion. Clean parts with wiping rag (item 26, appx E) and CLP (item 7, appx E), wipe dry with clean wiping rag (item 26, appx E), and lubricate with CLP (item 7, appx E).</p>	<p>Breech mechanism is cracked, broken, or inoperable.</p> <p>Firing pin is bent, broken, or missing. Firing lock is inoperable.</p>

Table 5-2. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES
FOR M101A1 HOWITZER (cont)

Item No.	Interval	Item to be Check or Serviced	Procedure	Not Fully Mission Capable If:
6	Annually	RECOIL MECHANISM	  <p>a. Remove recoil mechanism. (Refer to page 5-42.) Using wiping rag (item 26, appx E) and cleaning compound (item 9, appx E), clean cannon bearing surfaces (1) in yokes and recoil slides (2) on recoil sleigh assembly and recoil slide (3) on cradle.</p> <p>b. Remove, clean, and lubricate respirator. (Refer to page 5-42.)</p> <p>c. Check for oil leakage. If loss of fluid requires replenishment of the entire reserve during a normal day's firing, notify Direct Support maintenance.</p>	<p>Respirator is broken, missing, or inoperable.</p> <p>Leakage exceeds three drops per minute. Oil index is not flush with recuperator front head.</p>

5-8. PMCS PROCEDURES (cont)

Table 5-2. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES
FOR M101A1 HOWITZER (cont)

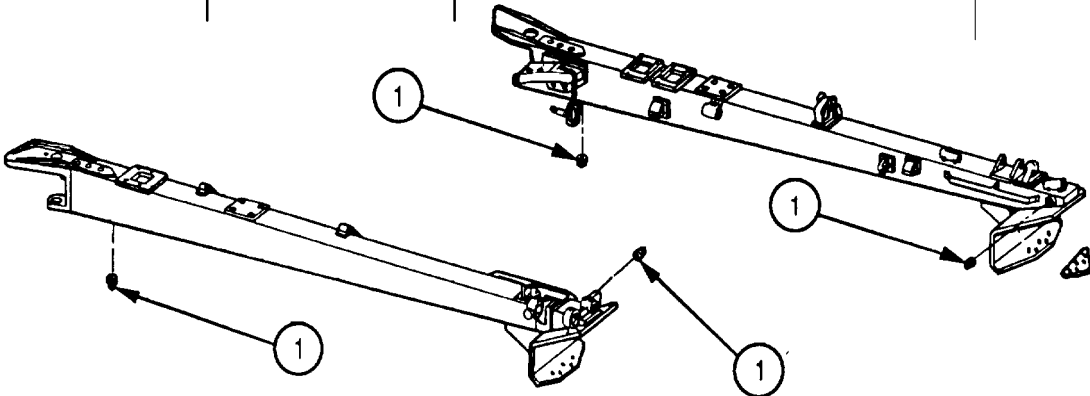
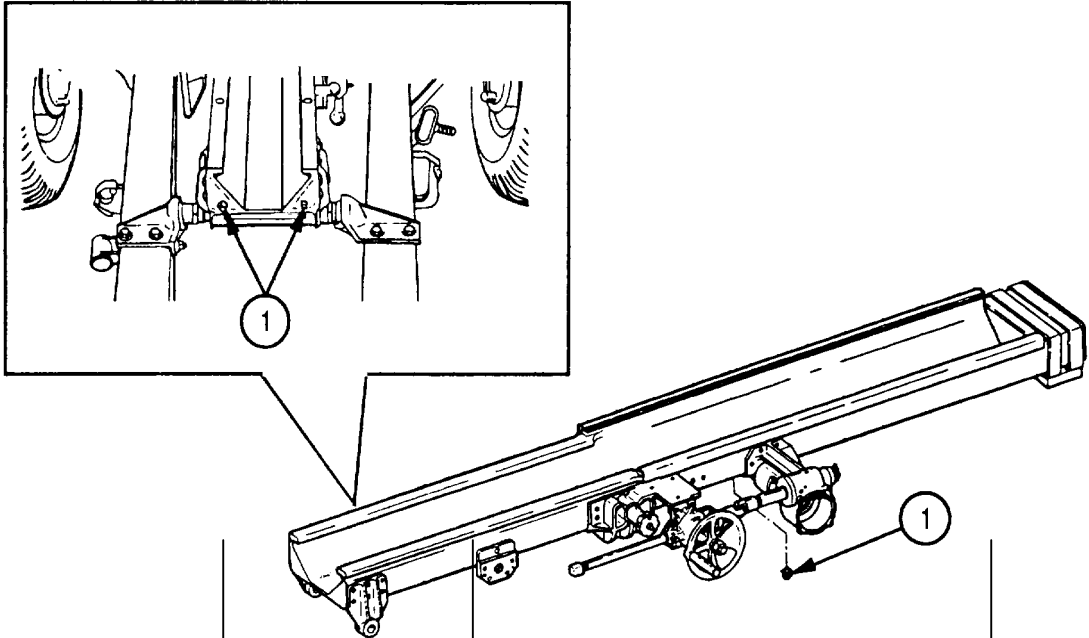
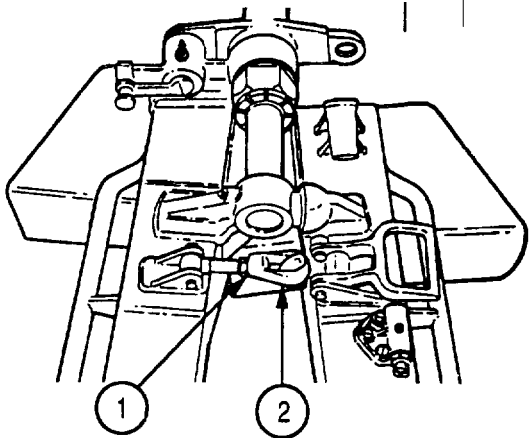
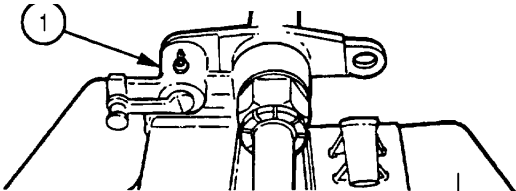
Item No.	Interval	Item to be Checked or Serviced	Not Fully Procedure	Mission Capable If:
7	Annually	CARRIAGE	<p>a. Check all areas for accumulation of foreign material.</p>  <p>b. Remove pipe plugs (1); drain accumulated moisture.</p> 	

Table 5-2. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES
FOR M101A1 HOWITZER (cont)

Item No.	Interval	Item to be Checked or Serviced	Not Fully Procedure	Mission Capable If:
8	Annually	EQUILIBRATOR ASSEMBLY	<p>c. Check adjustment of handbrakes, and adjust if necessary. - (Refer to page 5-63.)</p> <p>d. Using paint, spot paint areas where paint is missing and bare metal is exposed.</p> <p>e. Have welder repair broken chains and straighten bent brackets and miscellaneous hardware.</p> <p>f. Check entire carriage for loose bolts, nuts, and safety wires, and tighten if necessary. Replace damaged or missing authorized parts (TM 9-1015-203-20P).</p> <p>Check adjustment. (Refer to page 5-52.)</p>	<p>Handbrakes are broken, missing, or inoperable.</p> <p>Carriage is bent, broken, or inoperable.</p> <p>One or more rods are bent, cracked, or broken. Springs are cracked or broken.</p>
9	Annually	TRAVEL LOCK	<p>Check to see if travel lock (1) locks securely in travel lock brackets (2). If not, notify Direct Support maintenance.</p>	<p>Travel lock is missing or inoperable.</p>

5-8. PMCS PROCEDURES (cont)

Table 5-2. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES
FOR M101A1 HOWITZER (cont)

Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
10	Annually	TRAIL LOCK ASSEMBLY	 <p>Check to see if trail lock assembly locks securely. If not, back off nut (1), move loop (2) in or out, and tighten nut (1).</p>	Travel lock assembly is broken, bent, missing, or inoperable.
11	Annually	DRAWBAR	 <p>Check to see if drawbar (1) locks securely in the up and down positions. If not, notify Direct Support maintenance.</p>	Drawbar or drawbar lock is bent, broken, missing, or inoperable.
12	Annually	WHEEL BEARINGS	<p>Remove wheel bearings. Clean, inspect, repack, install, and adjust. (Refer to page 5-57.)</p> <p>NOTE</p> <p>After fording, wheel bearings must be removed cleaned, inspected, repacked, installed, and adjusted.</p>	Wheel bearings are broken, binding, or missing.

Section IV. TROUBLESHOOTING

5-9.TROUBLESHOOTING INFORMATION

Troubleshooting procedures are limited to those listed in the troubleshooting table. Other malfunctions or unusual conditions noted but not authorized will be referred to Direct Support maintenance personnel.

MALFUNCTION INDEX

	Troubleshooting Procedure (Page)
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Breechblock fails to close	5-19
Breechblock operating lever fails to latch on catch	5-20
Cannon tube has reached maximum EFC wear limits	5-18
Cannon tube is cracked	5-18
Cartridge case fails to extract.....	5-20
Howitzer fails to fire	5-18
RECOIL MECHANISM	
Howitzer hangs out of battery or returns slowly	5-22
Howitzer overrecoils	5-23
Howitzer slams into battery	5-21
Oil index does not move when oil is added or released	5-24
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There is insufficient recoil.....	5-23
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CARRIAGE	
Handbrakes are worn or inoperative	5-26
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FIRE CONTROL EQUIPMENT	
Fire control knobs do not turn freely.....	5-27
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M1 A1 collimator reticle image is not sharp	5-27
There is excessive backlash in knobs on M21A1 telescope mount.....	5-28
There is excessive backlash in pantel knobs	5-27
There is moisture in fire control equipment	5-26
TAILLIGHT ASSEMBLY	
Taillights will not work	5-29

5-10. TROUBLESHOOTING PROCEDURES

Table 5-3. TROUBLESHOOTING

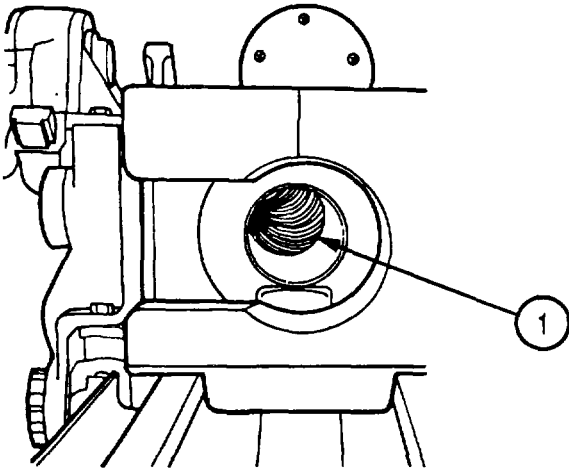
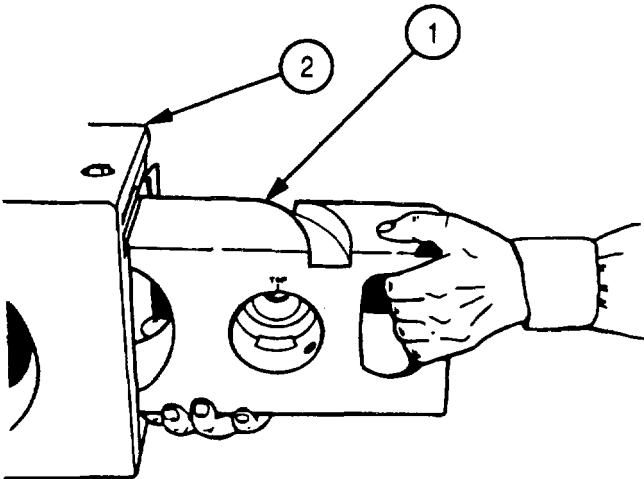
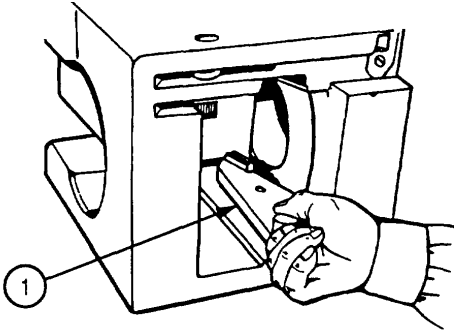
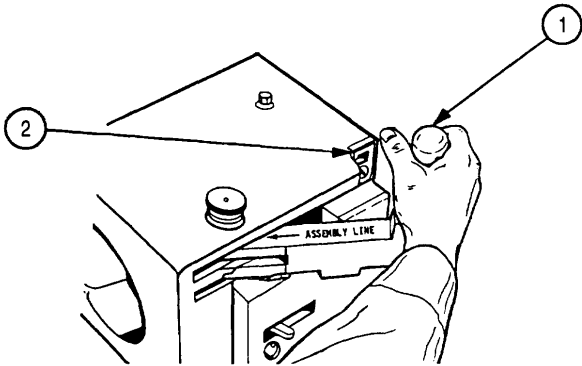
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
CANNON		
1. CANNON TUBE IS CRACKED.	Observe visually.	Notify Direct Support maintenance.
2. CANNON TUBE (1) HAS REACHED MAXIMUM EFC WEAR LIMITS.	Check weapon record data card (DA Form 2408-4).	Notify Direct Support maintenance.
		
3. HOWITZER FAILS TO FIRE.	Check for defective firing pin.	Replace firing pin. (Refer to page 3-43.)

Table 5-3. TROUBLESHOOTING (cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
4. BREECHBLOCK (1) FAILS TO CLOSE.		
<u>WARNING</u>		
Firing with foreign objects left in cannon bore may cause weapon to explode and result in injury or death to personnel.		
Step 1. Check cannon bore for obstruction.		
Remove obstruction.		
Step 2. Check breechblock operating lever for worn and defective parts.		
Replace worn and defective parts. (Refer to page 5-40.)		
Step 3. Check for nicks, burrs, gouges, or rough spots on operating surface of breech-block (1) and breech ring (2).		
Using crocus cloth (item 11, appx E), remove nicks, burrs, and rough spots.		
Step 4. Check for defective M13 firing lock.		
Replace M13 firing lock. (Refer to page 3-43.)		
 <p>The diagram shows a cross-section of a breechblock assembly. A hand is shown operating a lever. Label 1 points to the breechblock, and label 2 points to the breech ring. The assembly is shown in a partially open position.</p>		

5-10. TROUBLESHOOTING PROCEDURES (cont)

Table 5-3. TROUBLESHOOTING (cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
CANNON (cont)		
5. CARTRIDGE CASE FAILS TO EXTRACT.		
	Check for burred, worn, or broken cartridge extractor (1).	
	Notify Direct Support maintenance.	
		
6. BREECHBLOCK OPERATING LEVER (1) FAILS TO LATCH ON CATCH (2).		
	Step 1. Check for loose catch (2).	
	Tighten catch (2) screw.	
		
	Step 2. Check for weak spring or broken latch in operating lever (1).	
	Replace worn and defective parts. (Refer to page 5-40.)	

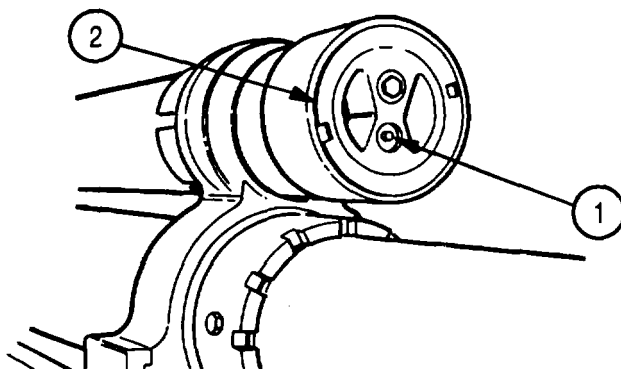
5-21

5-10. TROUBLESHOOTING PROCEDURES (cont)

MALFUNCTION**TEST OR INSPECTION****CORRECTIVE ACTION****RECOIL MECHANISM (cont)****9. HOWITZER HANGS OUT OF BATTERY OR RETURNS SLOWLY.**

Step 1. Check to see if oil index (1) is still below face of recuperator cylinder front head assembly (2) after operator has added oil.

Notify Direct Support maintenance if condition persists.



Step 2. Using liquid releasing tool (3), check for thickened oil.

Drain and replace OHT oil (item 14, appx E). (Refer to page 3-, 48.)

Step 3. If malfunction is not corrected after performing steps 1 and 2, nitrogen pressure may be low.

Notify Direct Support maintenance.

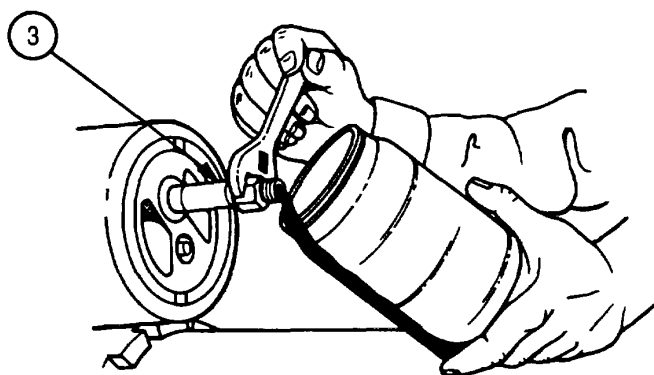
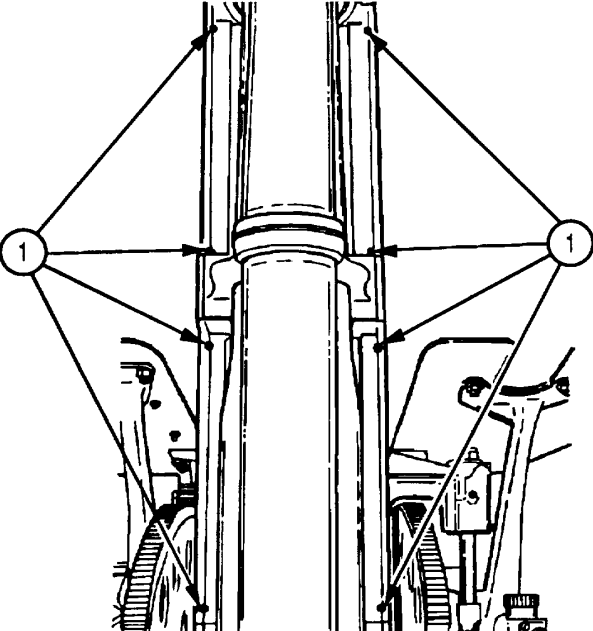


Table 5-3. TROUBLESHOOTING (cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
10. THERE IS UNEVEN OR SPASMATIC COUNTERRECOIL.		
Step 1. Check for lack of lubrication on recoil slides.		
Lubricate recoil slides with GAA (item 13, appx E) at lube fittings (1).		
Step 2. Check for thickened oil.		
Drain and replace OHT oil (item 14, appx E). (Refer to page 3-48.)		
		
11. HOWITZER OVERRECOILS.		
Check to see if OHT oil index is still below face of recuperator cylinder front head assembly after operator has added OHT oil (item 14, appx E).		
Notify Direct Support maintenance to check for low nitrogen pressure.		
12. THERE IS INSUFFICIENT RECOIL.		
There may be excessive nitrogen pressure. No further test or inspection is required.		
Notify Direct Support maintenance.		

5-10. TROUBLESHOOTING PROCEDURES (cont)*Table 5-3. TROUBLESHOOTING (cont)*

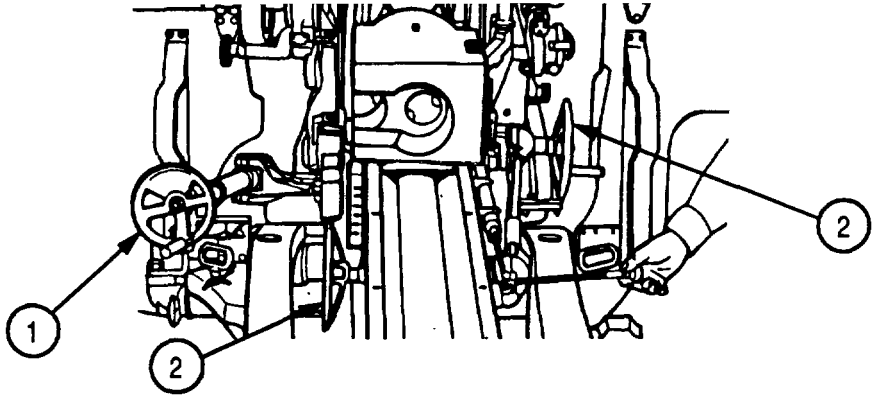
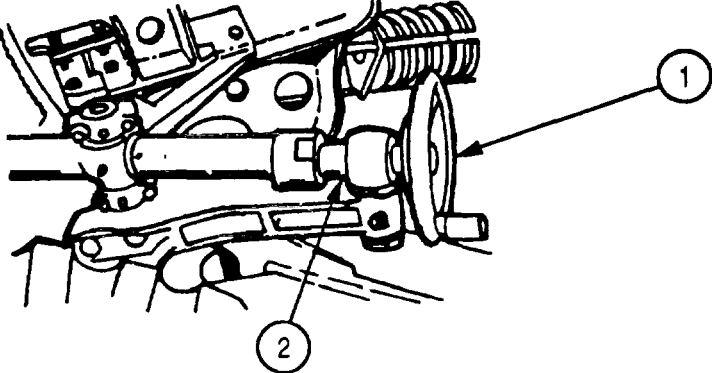
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
RECOIL MECHANISM (cont)		
13. OIL INDEX DOES NOT MOVE WHEN OIL IS ADDED OR RELEASED.		<p>Check for corrosion or damaged oil index.</p> <ol style="list-style-type: none"> Clean corrosion with wiping rag (item 26, appx E) and CLP (item 7, appx E). Notify Direct Support maintenance if oil index remains immobile after filling or draining oil reserve.
CARRIAGE		
14. HOWITZER IS DIFFICULT TO ELEVATE OR DEPRESS.		<p>Step 1. Check for improper equilibrator assembly adjustment.</p> <p>Adjust equilibrator assembly. (Refer to page 5-52.)</p> <p>Step 2. Check for lack of lubrication of cradle trunnions or elevating mechanism.</p> <p>Lubricate. (Refer to pages 3-8 and 3-15 thru 3-17.)</p>
15. THERE IS PLAY IN TRAVERSING HANDWHEEL (1) OR ELEVATING HANDWHEELS (2).		<p>Traversing handwheel (1) or elevating handwheels (2) exceed one-sixth turn (3-1/8 in. (7.94 cm)).</p> <p>Notify Direct Support maintenance.</p>
 <p>The diagram illustrates the mechanical components of the carriage. It shows a central vertical structure with various gears and levers. On the left, a large handwheel is labeled with a circled '1'. On the right, there are two smaller handwheels, each labeled with a circled '2'. Arrows point from the labels to the respective handwheels. The diagram is a technical line drawing showing the internal mechanical linkages.</p>		

Table 5-3. TROUBLESHOOTING (cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
16. HOWITZER IS DIFFICULT TO TRAVERSE.		
Step 1. Pintle pin assembly and support may need lubrication.		
Lubricate. (Refer to pages 3-10 and 3-18.)		
Step 2. Turn traversing handwheel (1) completely to the right, then left. Check for bent traversing handwheel rod (2).		
Notify Direct Support maintenance.		
Step 3. Swivel nut assembly may need adjustment. No further test or inspection is required.		
Notify Direct Support maintenance.		
		
17. TIRES ARE WORN.		
Step 1. Check for bent wheel.		
Replace wheel. (Refer to page 5-53.)		
Step 2. Check for loose or defective wheel bearings.		
Tighten or replace wheel bearings. (Refer to page 5-57.)		
Step 3. Check for loose wheel lugs.		
Torque wheel lugs, using torque wrench, to 350 ± 50 ft-lb (475 ± 68 N•m).		

5-10.TROUBLESHOOTING PROCEDURES (cont)

Table 5-3. TROUBLESHOOTING (cont)

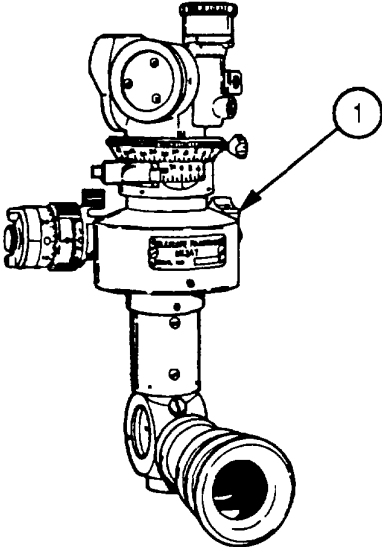
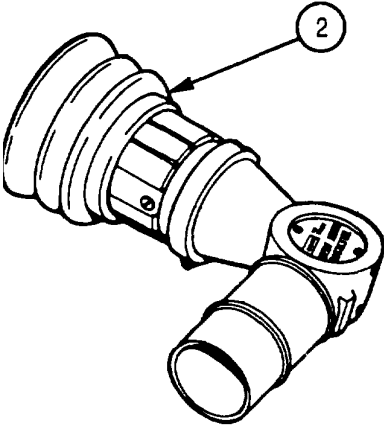
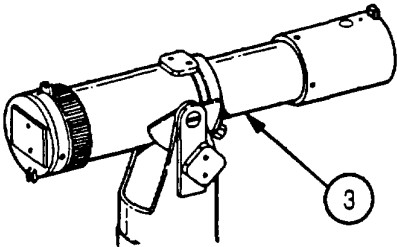
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
CARRIAGE (cont)		
18. HANDBRAKES ARE WORN OR INOPERATIVE.		
	Step 1. Check for too much handbrake travel.	
	Adjust handbrakes. (Refer to page 5-63.)	
	Step 2. Remove hub and stud assembly (refer to page 5-57), and check for greasy, worn, or defective brake bands and linings.	
	Notify Direct Support maintenance.	
FIRE CONTROL EQUIPMENT		
19. THERE IS MOISTURE IN FIRE CONTROL EQUIPMENT.		
	Check that there is no moisture in pantel (1), elbow telescope (2), or M1A1 collimator (3).	
	Purge. (Refer to pages 5-65, 5-69, and 5-83.)	
		

Table 5-3. TROUBLESHOOTING (cont)

MALFUNCTION**TEST OR INSPECTION****CORRECTIVE ACTION****20. THERE IS EXCESSIVE BACKLASH IN PANTEL KNOBS.**

Step 1. Check azimuth micrometer knob for backlash not to exceed 0.75 mils.

Notify Direct Support maintenance.

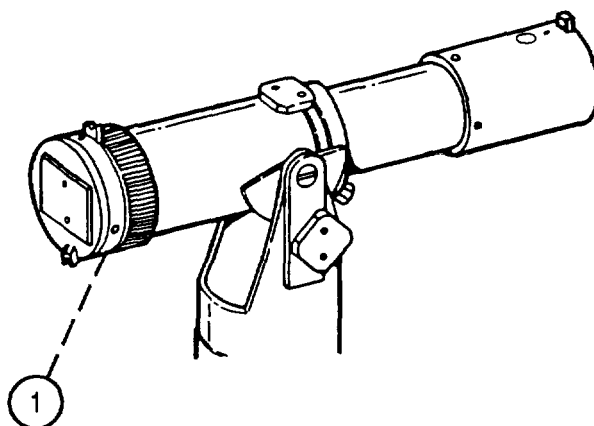
Step 2. Check elevation knob for backlash not to exceed 1.0 mil.

Notify Direct Support maintenance.

21. M1A1 COLLIMATOR RETICLE (1) IMAGE IS NOT SHARP.

Check to see if reticle (1) is dirty.

Notify Direct Support maintenance.

**22. FIRE CONTROL KNOBS DO NOT TURN FREELY.**

No further test or inspection is required.

Notify Direct Support maintenance.

5-10. TROUBLESHOOTING PROCEDURES (cont)

Table 5-3. TROUBLESHOOTING (cont)

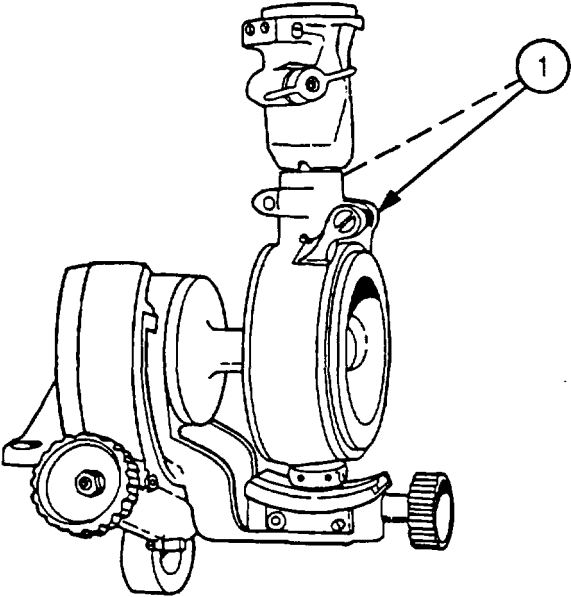
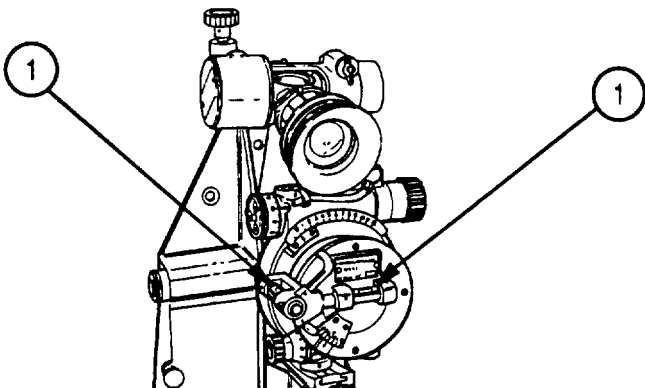
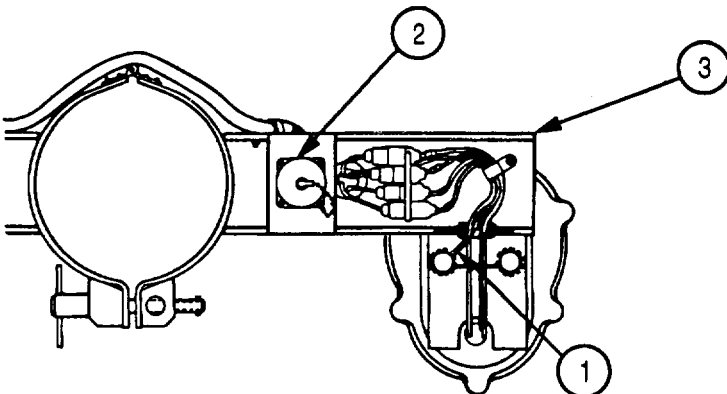
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
FIRE CONTROL EQUIPMENT (cont)		
23. THERE IS EXCESSIVE BACKLASH IN KNOBS ON M21A1 TELESCOPE MOUNT.		
	Step 1. Check longitudinal knob for backlash not to exceed 0.5 mil (3/64 in. (0.12 cm) on periphery adjustment index)	
	Notify Direct Support maintenance.	
	Step 2. Check cross leveling knob for backlash not to exceed 0.5 mil (5/64 in. (0-20 cm) on periphery of knob).	
	Notify Direct Support maintenance.	
24. LEVEL VIALS (1) ARE BROKEN OR DEFECTIVE IN M21A1 TELESCOPE MOUNT.		
	Observe visually. Bubble must not be elongated, and glass must not be cracked.	
	Notify Direct Support maintenance.	
		

Table 5-3. TROUBLESHOOTING (cont)

MALFUNCTION		
TEST OR INSPECTION		
CORRECTIVE ACTION		
25.	LEVEL VIALS (1) ARE BROKEN OR DEFECTIVE IN M4A1 FIRE CONTROL QUADRANT.	
	Observe visually. Bubble must not be elongated.	
	Notify Direct Support maintenance.	
		
TAILLIGHT ASSEMBLY		
26.	TAILLIGHTS WILL NOT WORK.	
Step 1.	Check to be sure ground wire (1) leading from receptacle connector (2) is properly attached to tube clamp (3).	
	Repair or replace ground wire (1). (Refer to page 5-75.)	
Step 2.	Check receptacle connector (2) for loose or broken wires and bent or broken electrical terminal pins.	
	Repair or replace receptacle connector (2). (Refer to page 5-75.)	
		

Section V. MAINTENANCE PROCEDURES

5-11. GENERAL MAINTENANCE INSTRUCTIONS

- a. Clean all metal parts during maintenance with wiping rags (item 26, appx E) and cleaning compound (item 9, appx E). Lubricate connecting surfaces and gears with GAA (item 13, appx E).
- b. Unit maintenance, MOS13B, is required for the maintenance procedures.
- c. Spot paint as needed. (Refer to TM 43-0139.)
- d. Unit lube instructions begin on page 3-19.

5-12. LUBE FITTINGS-MAINTENANCE INSTRUCTIONS

THIS TASK COVERS:

Inspection/repair

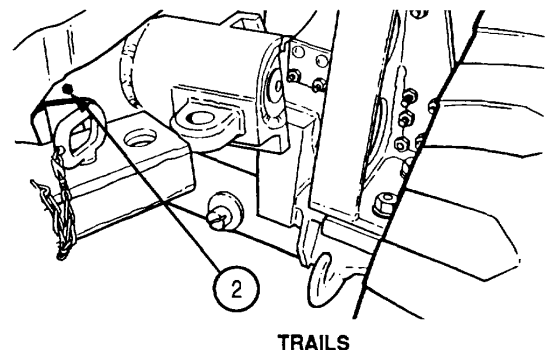
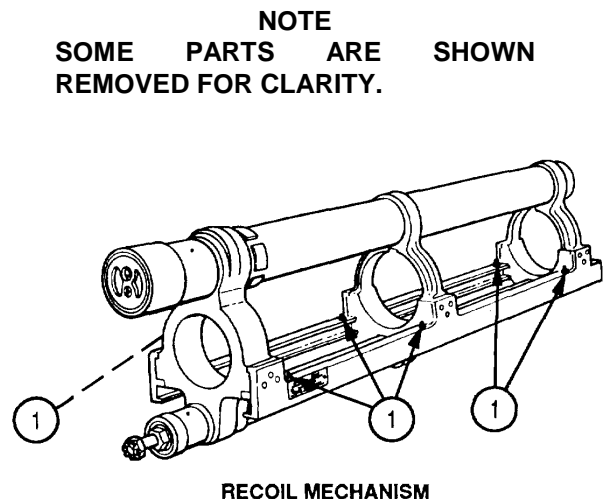
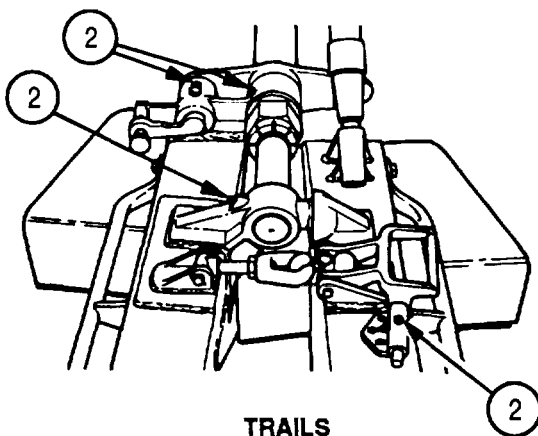
INSPECTION/REPAIR

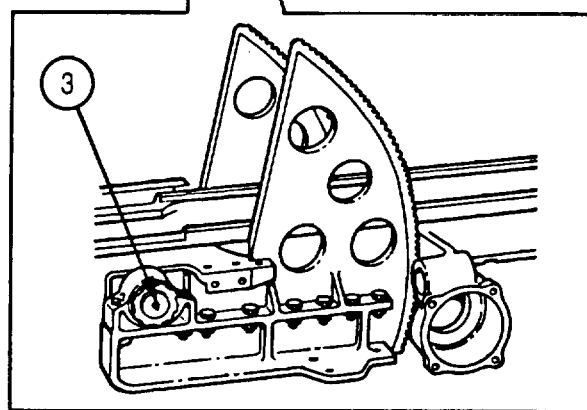
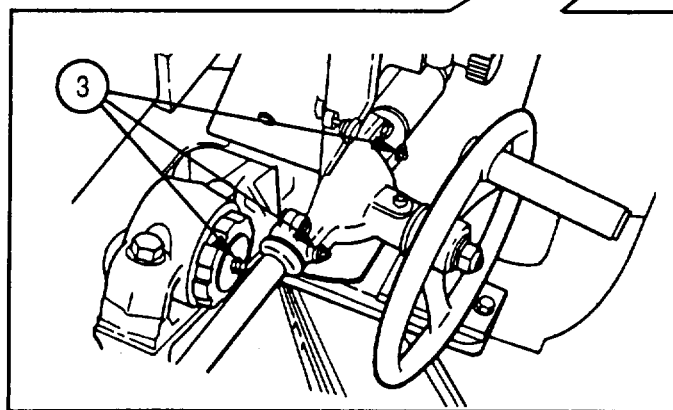
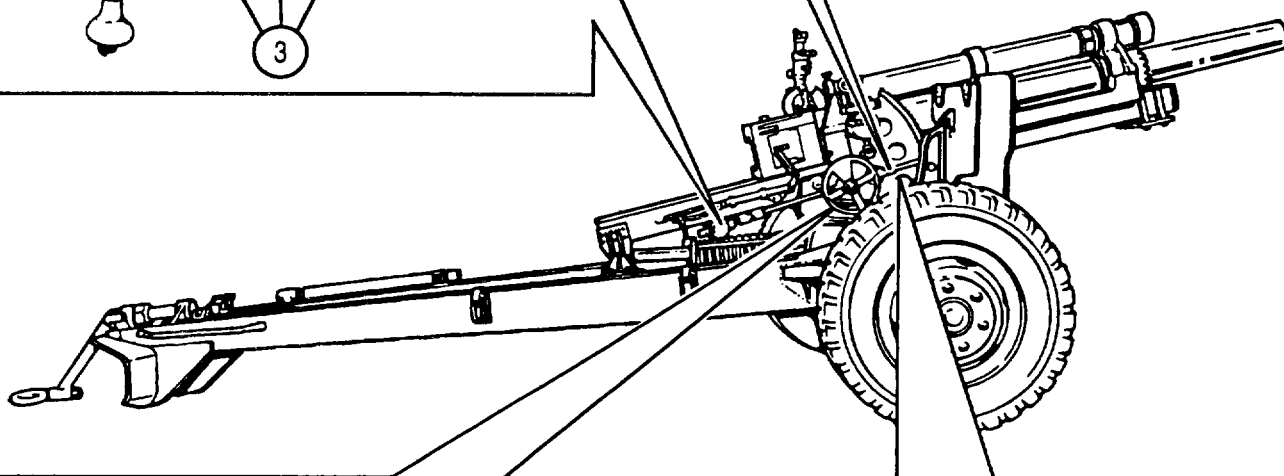
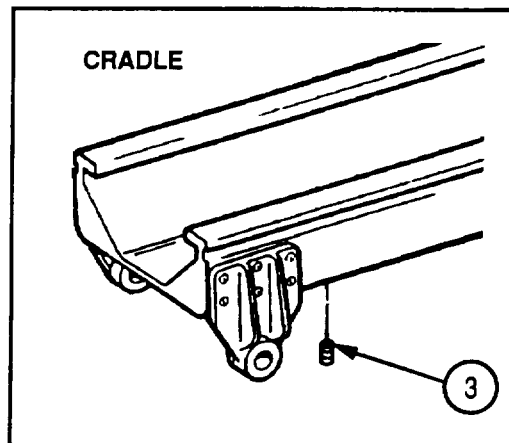
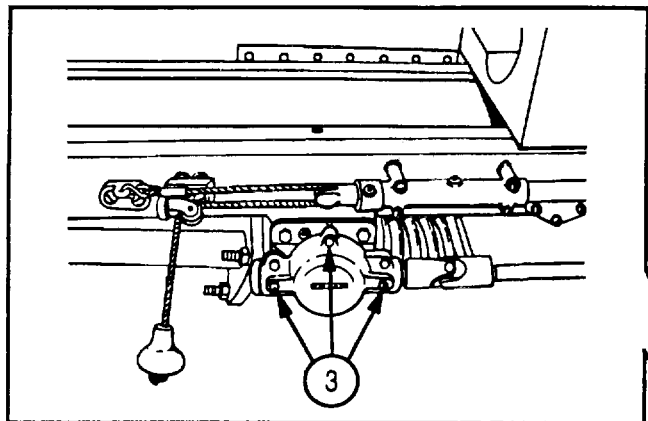
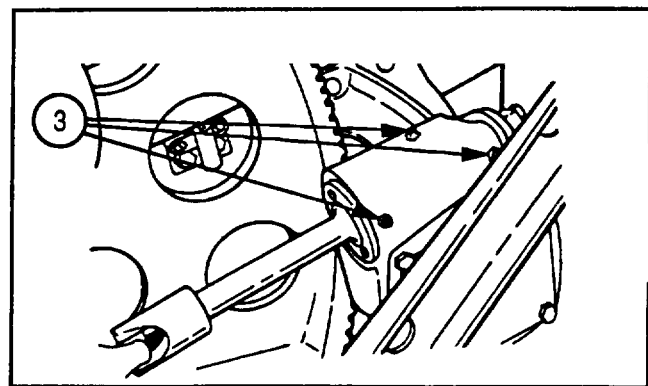
NOTE
Locations of lube fittings are indicated on illustrations.

Check all lube fittings during periodic inspection to make sure that they will accept grease. Replace any lube fittings that will not accept grease.

LEGEND

1. Recoil slides lube fittings
2. Trails lube fittings





LEGEND

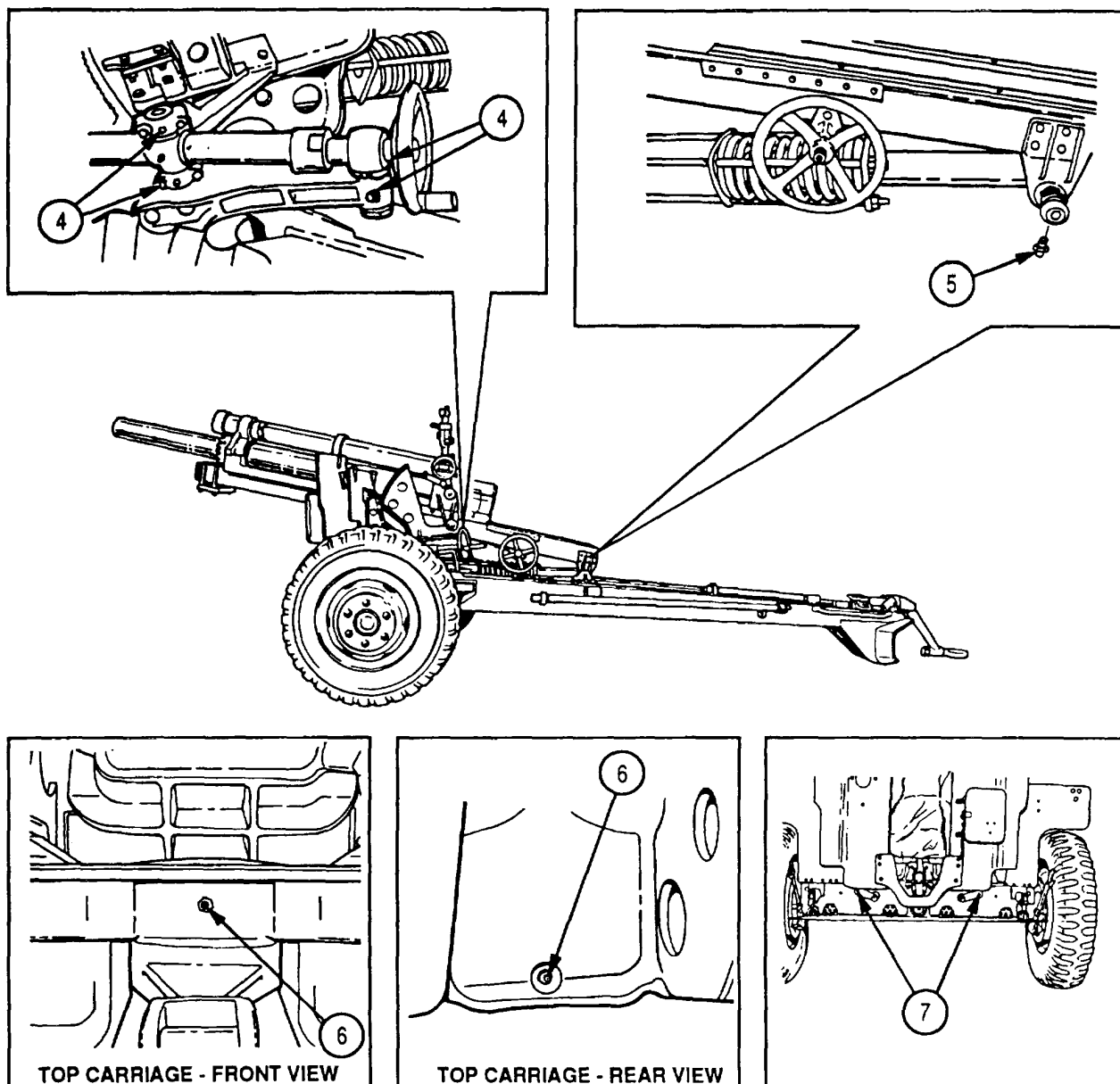
- 3. Elevating mechanism lube fittings

5-12. LUBE FITTINGS-MAINTENANCE INSTRUCTIONS (cont)

INSPECTION/REPAIR (cont)

LEGEND (cont)

4. Traversing mechanism lube fittings
5. Equilibrator assembly lube fittings
6. Axle pintle assembly lube fittings
7. Axle locks lube fittings



5-13. FIRE CONTROL PURGING EQUIPMENT-SETTING UP AND REMOVING EQUIPMENT

THIS TASK COVERS:

- a. Setting up equipment b. Removing equipment

INITIAL SETUP

Tools and Special Tools

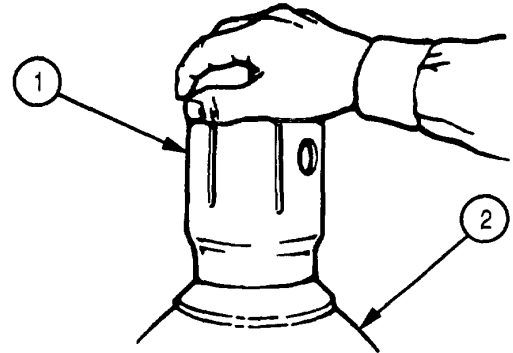
- Artillery mechanic's tool kit (appx B)
- Compressed gas cylinder (appx B)
- Fire control purging kit (appx B)

NOTE

On all newly designed fire control instruments, a pressure relief valve is installed to relieve pressure at 5 psi (34 kPa). This is to simplify the purging operation. Pressure relief valves will be installed at exhaust port openings and are readily visible.

SETTING UP EQUIPMENT

- 1 Remove protective cover (1) from outlet of dry nitrogen tank (2).

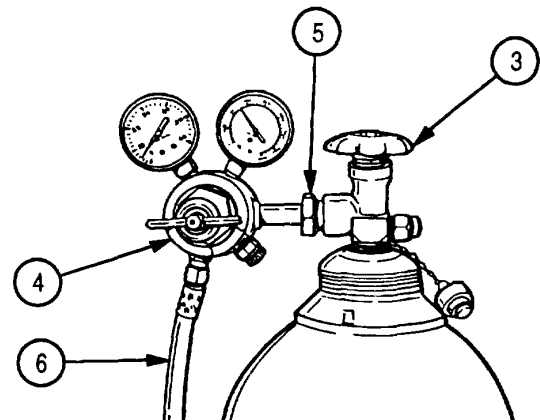


- 2 Open tank valve (3) just enough to rid valve seat of any foreign matter. Close tank valve (3).

NOTE

With regulator (4) use a right or left hand threaded 9/16 x 18NF adapter from kit as required.

- 3 Attach regulator (4) to tank valve (3) using appropriate adapter (5) from kit.
- 4 Attach hose assembly (6) to low pressure port on regulator (4).



5-13. FIRE CONTROL PURGING EQUIPMENT--SETTING UP AND REMOVING EQUIPMENT

SETTING UP EQUIPMENT (cont)

- 5 Rotate pressure regulator valve (7) counter-clockwise to extreme closed position.
- 6 Open tank valve (3) slowly until the maximum tank pressure registers on high pressure gage (8).

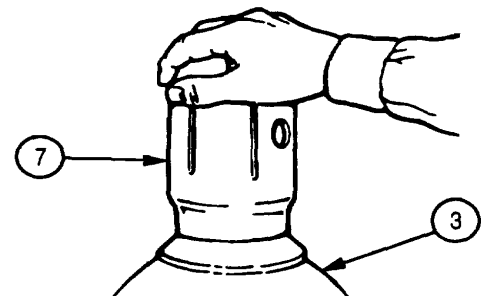
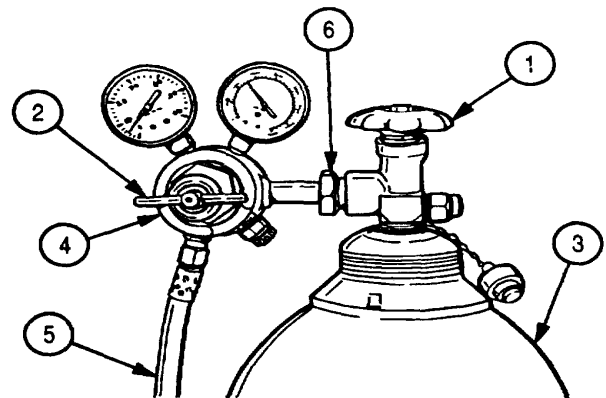
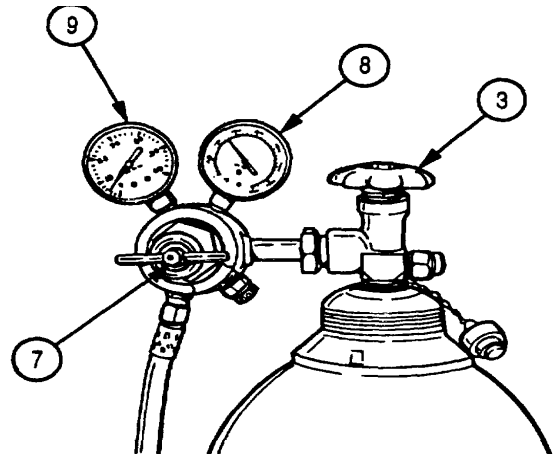
NOTE

If pressure indicated is less than 100 psi (690 kPa), replace tank.

- 7 Rotate pressure regulator valve (7) until approximately 5 psi (34 kPa) is registered on low pressure gage (9).
- 8 Check pressure regulator valve (7) for interference and eliminate.
- 9 Close pressure regulator valve (7).

REMOVING EQUIPMENT

- 1 Close tank valve (1).
- 2 Rotate pressure regulator valve (2) clock-wise to relieve pressure between dry nitrogen tank (3) and regulator (4).
- 3 Remove hose assembly (5) from low pressure port on regulator (4).
- 4 Remove regulator (4) and adapter (6) from dry nitrogen tank (3).
- 5 Place protective cover (7) on dry nitrogen tank (3).



5-14. M101A1 HOWITZER M90 CHRONOGRAPH BRACKET AND HANDSPIKE--MAINTENANCE INSTRUCTIONS**THIS TASK COVERS:****a.** Disassembly**b.** Inspection/repair**c.** Reassembly**INITIAL SETUP**

Tools and Special Tools

Artillery mechanic's tool kit (appx B)

References

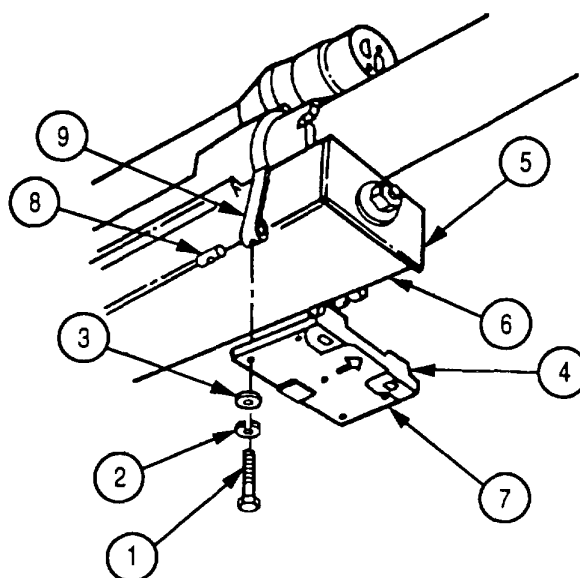
TM 9-1015-203-20P

Materials/Parts

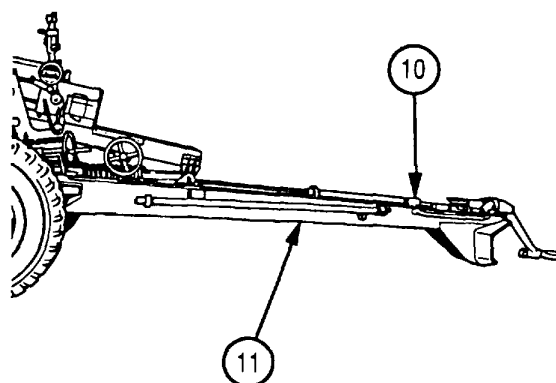
Lockwasher (4) (TM 9-1015-203-20P)

DISASSEMBLY

- 1** Remove four bolts (1), lockwashers (2), and flat washers (3).
- 2** Unhook bracket tabs (4) from front plate (5) on cradle (6). Remove bracket (7).
- 3** Remove four barrel nuts (8) from straps. Remove two straps (9) from cradle (6).
- 4** Check to be sure handspike (10) is not missing from left trail (11).

**INSPECTION/REPAIR**

- 1** Inspect for missing, broken, or damaged parts.
- 2** Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.



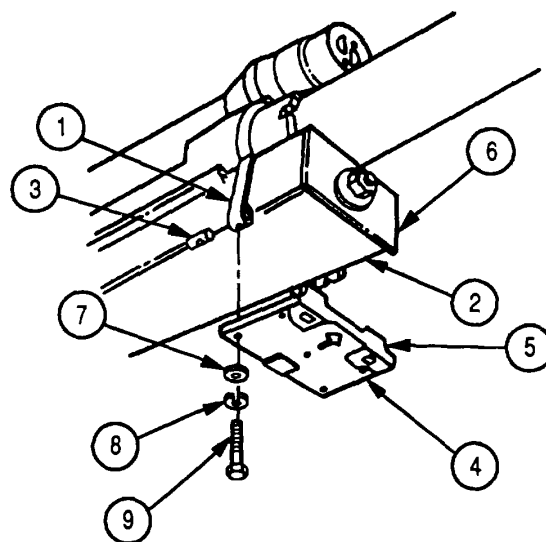
5-14. M101A1 HOWITZER M90 CHRONOGRAPH BRACKET AND HANDSPIKE--MAINTENANCE INSTRUCTIONS (cont)

REASSEMBLY

- 1 Position two straps (1) over top of cradle (2). Insert a barrel nut (3) in both ends of each strap.
- 2 Hold bracket (4) in position with arrow pointing toward muzzle of cannon. Hook bracket tabs (5) over front plate (6) on cradle (2).
- 3 Install four flat washers (7), new lockwashers (8), and bolts (9). Handtighten bolts.
- 4 Using a wrench, tighten bolts alternately to be sure of proper bracket alignment. Then, using torque wrench, torque bolts to 6 to 9 ftlb (8 to 12 N•m).

NOTE

Check mounting hardware periodically to be sure bracket is secure.



5-15. M2A2 CANNON-MAINTENANCE INSTRUCTIONS

THIS TASK COVERS:

- a. Servicing b. Removal c. Inspection/repair d. Installation

INITIAL SETUP

Tools and Special Tools

- Artillery mechanic's tool kit (appx B)
- Spanner wrench (appx B)

Materials/Parts

- Sealing compound (item 27, appx E)

References

- TM 9-1015-203-20P

Personnel Required: 7

Equipment Conditions

- Handbrakes engaged
- Cannon tube elevated or depressed to 0 mil
- 3-36 Breechblock removed

SERVICING

Refer to PMCS, page 5-11.

REMOVAL

WARNING

Cannon weighs approximately 1070 lb (486 kg). To remove, use a hoist if available. If hoist is not available, seven soldiers are required to remove cannon. Use care to avoid injury.

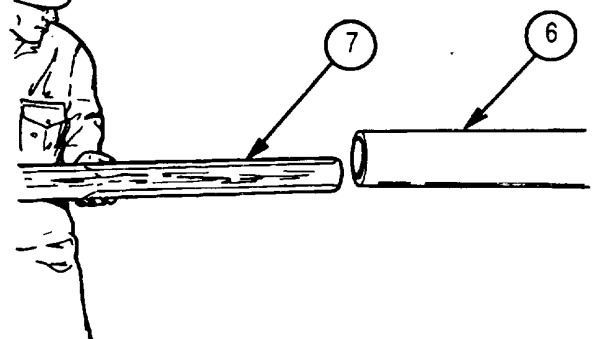
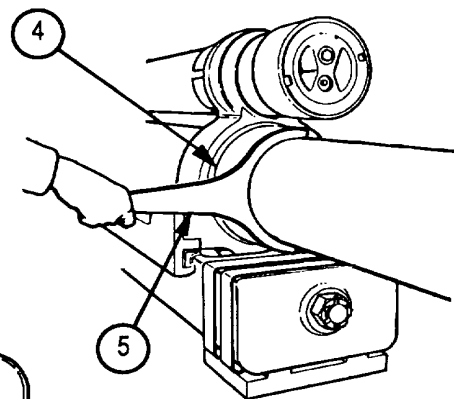
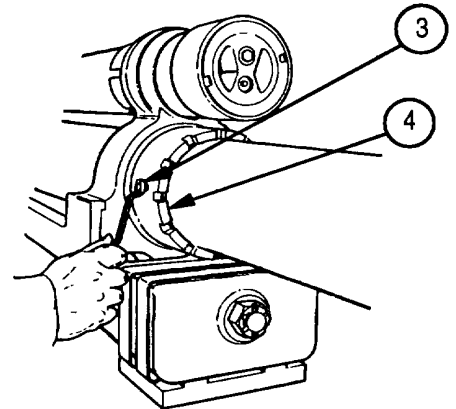
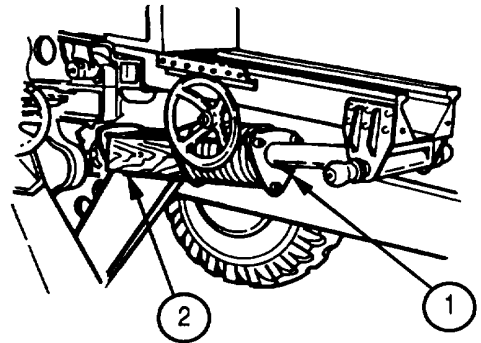
A blocked equilibrator assembly is under great pressure and requires care in handling.

- 1 To block equilibrator assembly (1), insert a 4x 4x 12-in. (10- x 10- x 30-cm) piece of timber (2) in equilibrator assembly. Cannon may need to be depressed to install timber.

- 2 Remove setscrew (3) from howitzer locking ring (4).

- 3 Using spanner wrench (5), unscrew and remove howitzer locking ring (4).

- 4 Pry cannon tube (6) with pinch bar or bump muzzle with heavy timber (7) to start cannon moving. Move cannon far enough rearward to clear bearing surface of rear sleigh yoke.



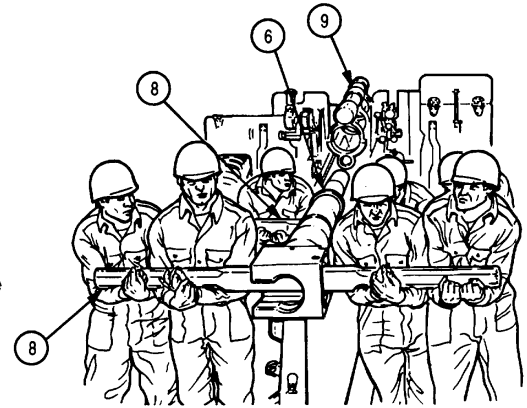
5-15. M2A2 CANNON-MAINTENANCE INSTRUCTIONS (cont)

REMOVAL (cont)

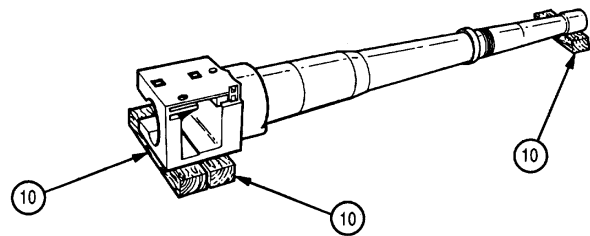
CAUTION

Guide cannon with timber to prevent marring surfaces of cannon tube or catching on sleigh yokes. Take care not to damage breech ring bearing strips.

- 5 Using two suitable pieces of timber (8), one inserted in breech ring end and one under cannon tube, guide cannon tube (6) out of recoil mechanism (9).

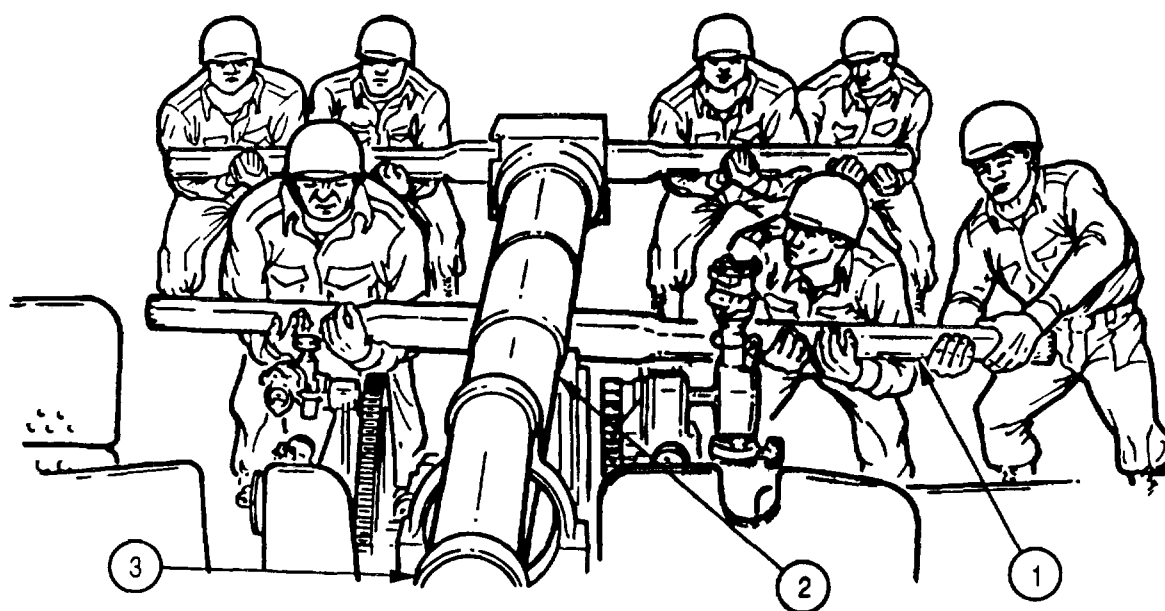


- 6 Place cannon on wooden blocks (10). Remove timber.

**INSPECTION/REPAIR**

- 1 Inspect for missing, broken, or damaged parts.
- 2 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.
- 3 Request Direct Support maintenance to borescope cannon tube every 180 days (TM 9-1000-202-14). In order for inspection to reveal all flaws in bore, cannon tube must be thoroughly clean and dry for best borescope results.

INSTALLATION

**WARNING**

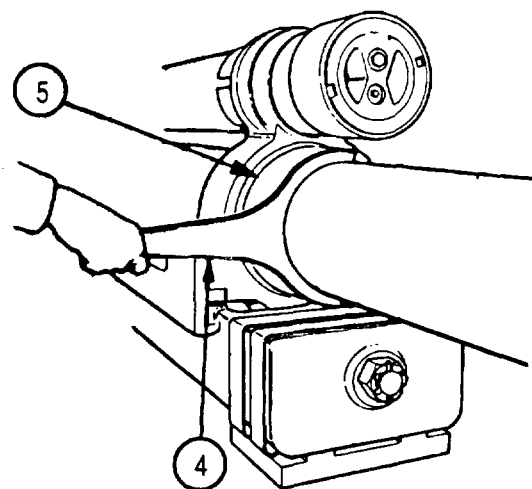
Cannon weighs approximately 1070 lb (486 kg). To install, use a hoist if available. If hoist is not available, seven personnel are required to install cannon. Use care to avoid injury.

CAUTION

Guide cannon with timber to prevent marring surfaces of cannon tube or catching on sleigh yokes. Take care not to damage breech ring bearing strips.

- 1 Using two suitable pieces of timber (1), one inserted in breech ring end and one under cannon, guide cannon tube (2) into recoil mechanism (3).
- 2 Slowly push cannon tube (2) toward into battery.

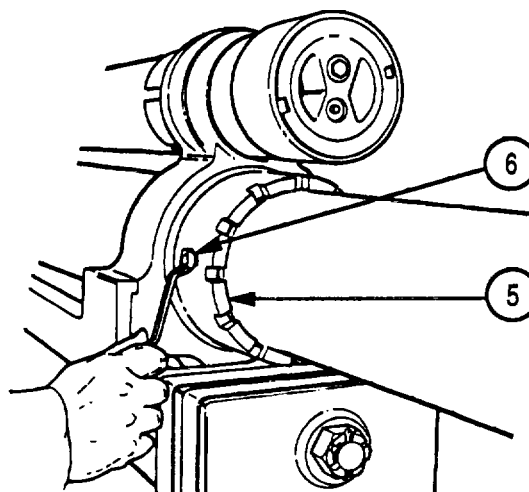
- 3 Using spanner wrench (4), install and tighten howitzer locking ring (5).



5-15. M2A2 CANNON-MAINTENANCE INSTRUCTION

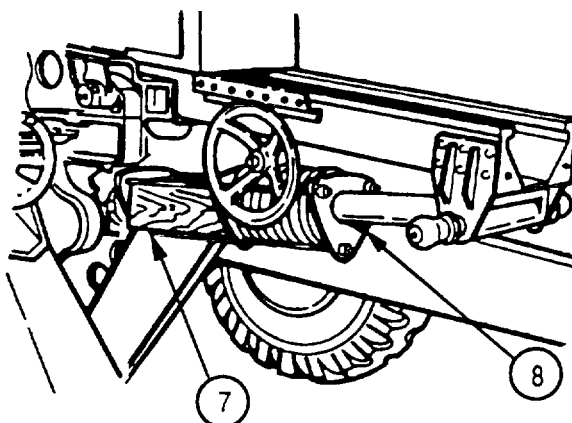
INSTALLATION (cont)

- 4 Coat setscrew (6) with sealing compound, and install in howitzer locking ring (5).

**WARNING**

A blocked equilibrator assembly is under great pressure and requires care in handling.

- 5 Depress cannon tube and remove timber (7) from equilibrator assembly (8).



5-16. BREECH MECHANISM, BREECHBLOCK OPERATING LEVER, AND M13 FIRING LOCK-MAINTENANCE INSTRUCTIONS

THIS TASK COVERS:

a. Disassembly

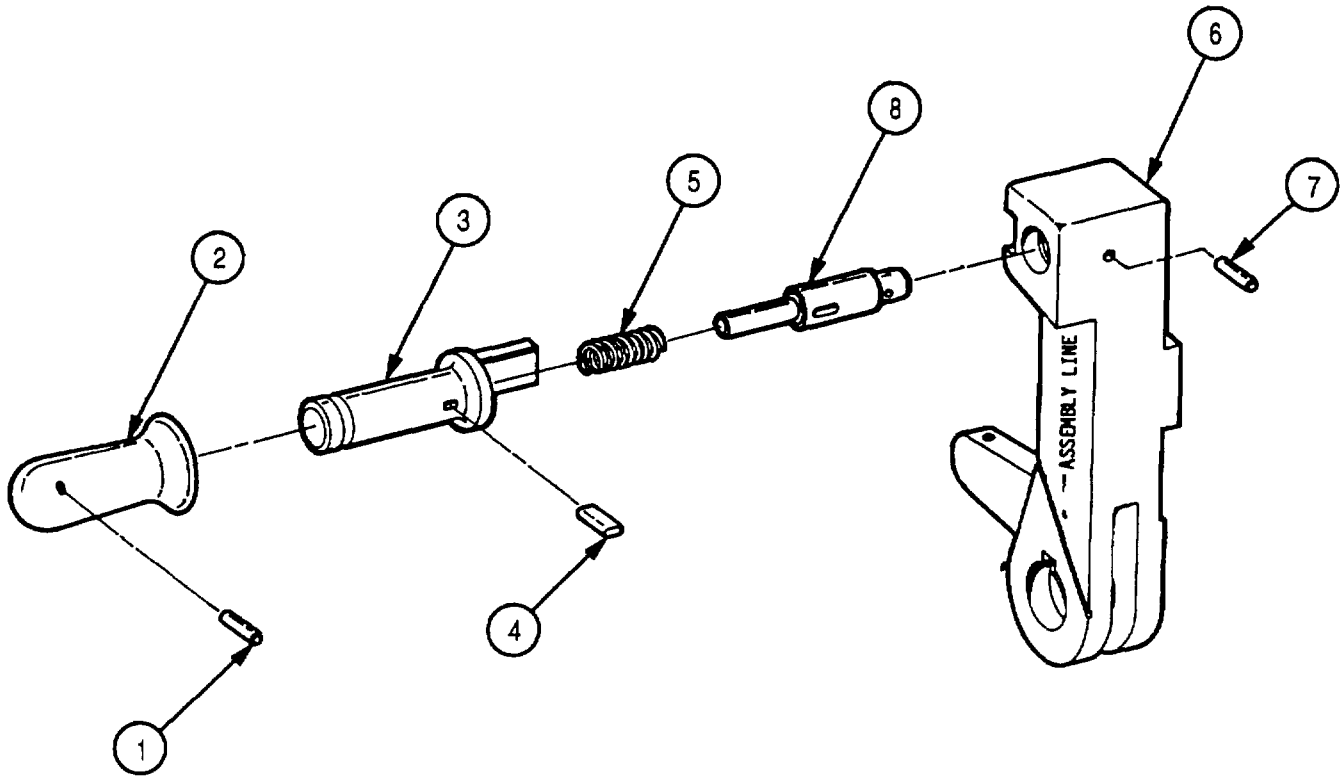
b. Inspection/repair

c. Reassembly

INITIAL SETUP

Tools and Special Tools
Artillery mechanic's tool kit (appx B)

References
TM 9-1015-203-20P



- 1 Check parts for proper operation.
- 2 Assemble breech mechanism. (Refer to page 3-36.)
- 3 Remove and disassemble M13 firing lock. (Refer to page 3-43.)
- 4 Remove spring pin (1) from breechblock sleeve (2).
- 5 Remove breechblock sleeve (2) from breechblock handle (3).

WARNING

Breechblock handle (3) is under spring tension. To avoid injury, release tension slowly when removing machine key (4).

- 6 Remove machine key (4) from breechblock handle (3).
- 7 Remove breechblock handle (3) and spring (5) from breechblock lever (6).
- 8 Remove spring pin (7) and pivot (8) from breechblock lever (6).

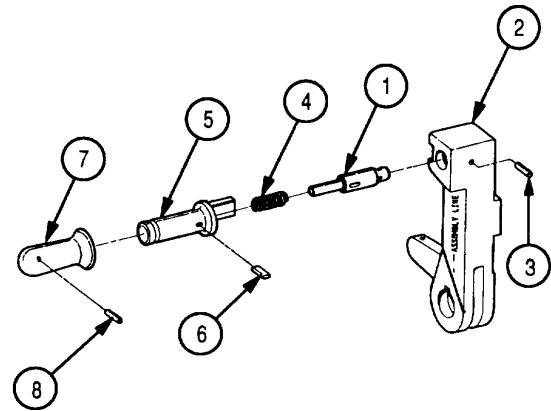
INSPECTION/REPAIR

- 1 Check for kinked or weak springs.
- 2 Check for missing, broken, or damaged parts.
- 3 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

5-16. BREECH MECHANISM, BREECHBLOCK OPERATING LEVER, AND M13 FIRING LOCK-MAINTENANCE INSTRUCTIONS (cont)

REASSEMBLY

- 1 Install pivot (1) into breechblock lever (2) and secure with spring pin (3).
- 2 Install spring (4) and breechblock handle (5) into breechblock lever (2) and secure with machine key (6).
- 3 Install breechblock sleeve (7) on breechblock handle (5) and secure with spring pin (8).
- 4 Reassemble and install M13 firing lock. (Refer to page 3-43.)
- 5 Reassemble breech mechanism. (Refer to page 3-36.)



5-17. M2A4 OR M2A5 RECOIL MECHANISM, RECUPERATOR CYLINDER FRONT HEAD ASSEMBLY, RESPIRATOR, AND PISTON ROD ASSEMBLY-MAINTENANCE INSTRUCTIONS

THIS TASK COVERS:

- | | |
|-------------------------|----------------------|
| a. Inspection | b. Removal |
| c. Servicing/inspection | d. Inspection/repair |
| e. Installation | |

INITIAL SETUP

Tools and Special Tools

Artillery mechanic's tool kit (appx B)
Respirator wrench (appx B)

Materials/Parts

Cleaning compound (item 9, appx E)
CLP (item 7, appx E)
Cotter pin (TM 9-1015-203-20P)
Crocus cloth (item 11, appx E)
GAA (item 13, appx E)
Wiping rag (item 26, appx E)
Personnel Required: 4

References

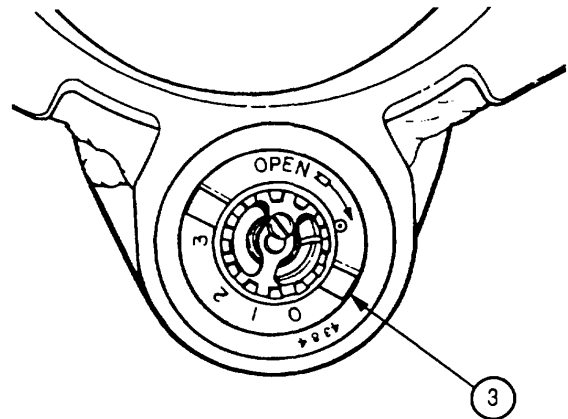
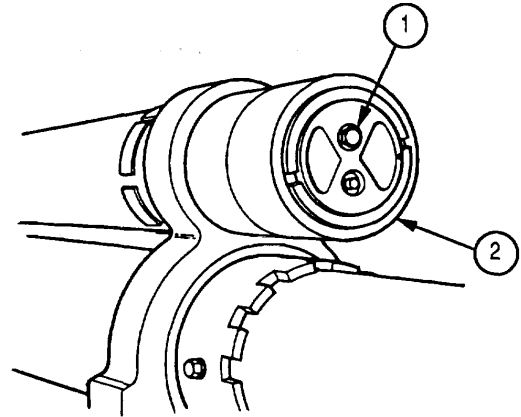
TM 9-1015-203-20P

Equipment Conditions

5-36 Cannon removed
Howitzer elevated or depressed to 0 mil
Howitzer handbrakes applied

INSPECTION

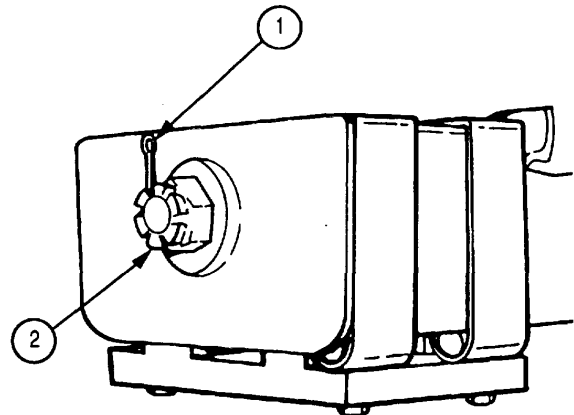
- 1 Inspect for oil leakage around machine plug (1) on recuperator cylinder front head assembly (2). Using wiping rag (item 25, appx E), clean area around filling hole. Remove and check machine plug for damaged threads. Install and tighten machine plug, and if leak continues, or if leakage is in excess of three drops per minute, notify Direct Support maintenance.
- 2 Using respirator wrench, check respirator (3) for free movement while rotating it through 0-1-2-3 settings. Notify Direct Support maintenance if respirator does not rotate freely.

**REMOVAL****WARNING**

Recoil mechanism weighs approximately 470 lb (213 kg). To remove, use hoist if available. If hoist is not available, four soldiers are required to remove recoil mechanism. Use care to avoid injury.

NOTE

Recoil mechanism must be removed for servicing. Before removal of recoil mechanism, cannon must be removed and suitable blocking must be positioned at rear of howitzer upon which recoil mechanism can be placed when removed.



- 1 Remove cotter pin (1) and castellated nut (2).

5-17. M2A4 OR M2A5 RECOIL MECHANISM, RECUPERATOR CYLINDER FRONT HEAD ASSEMBLY, RESPIRATOR, AND PISTON ROD ASSEMBLY--MAINTENANCE INSTRUCTIONS (cont)

REMOVAL (cont)

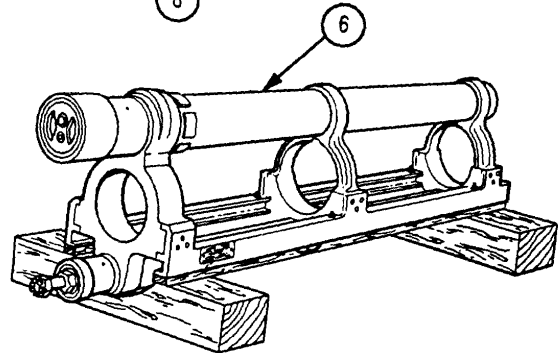
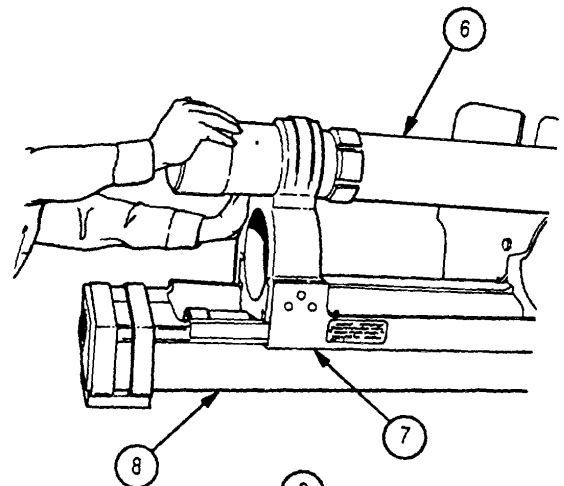
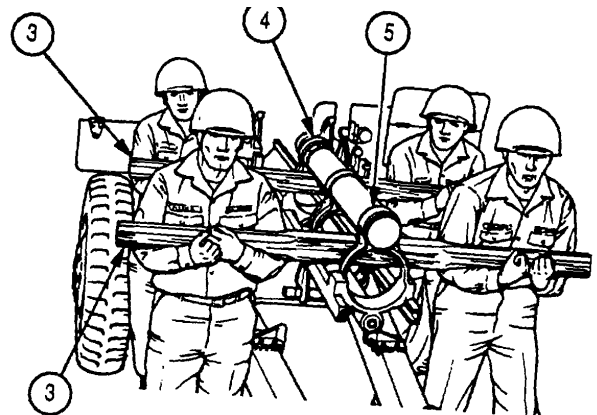
- 2 Place two suitable pieces of timber (3) between front sleigh yoke (4) and rear sleigh yoke (5), as illustrated.

WARNING

Recoil mechanism weighs approximately 470 lb (213 kg). To install, use hoist if available. If hoist is not available, four soldiers are required to install recoil mechanism. Use care to avoid injury.

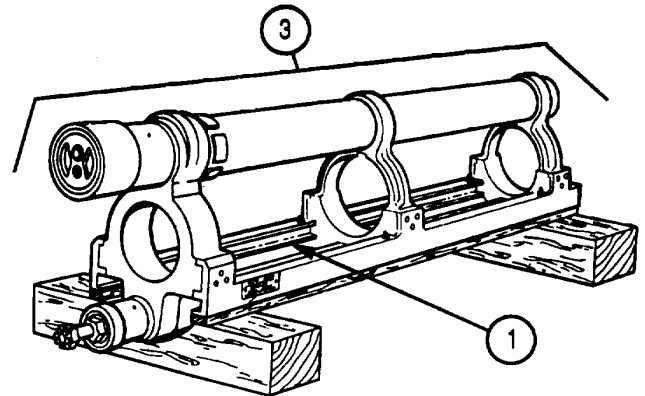
- 3 Slide recoil mechanism (6) to the rear. Lift rear of recoil mechanism enough to prevent binding of rails (7) on cradle (8).

- 4 Place recoil mechanism (6) on suitable blocking.

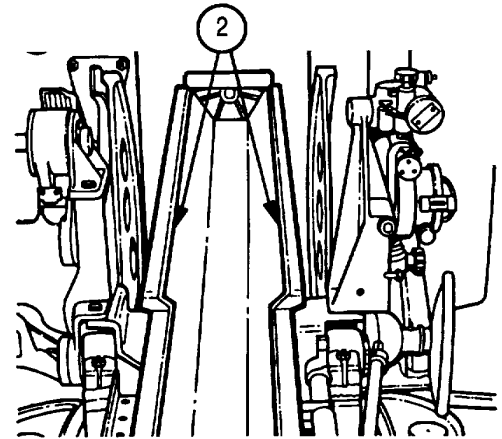


SERVICING/INSPECTION

1 Annually, thoroughly clean sleigh assembly slides (1), cradle recoil slide (2), and sleigh assembly (3) with cleaning compound (item 9, appx E) or CLP (item 7, appx E).

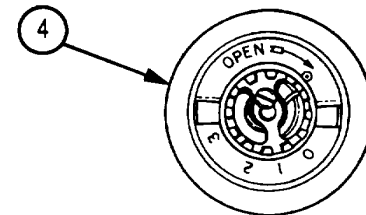


2 Before installing recoil mechanism, coat sleigh assembly recoil slides lightly with GAA (item 13, appx E) and cradle recoil slide lightly with GAA (item 13, appx E).

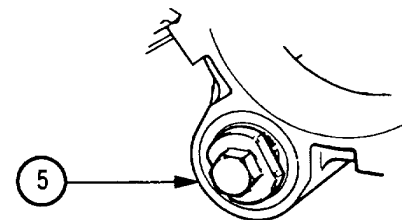


3 Using recoil wrench, remove respirator (4).

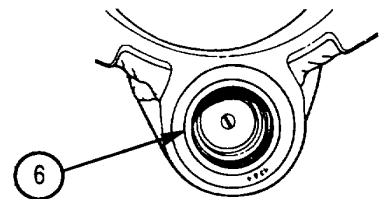
4 Clean respirator by agitating it in a container of cleaning compound (item 9, appx E); then remove respirator and shake off excess.



5 Wipe opening at rear of recoil cylinder (5) with a clean, lint-free wiping rag (item 26, appx E).



6 Wash cavity (6) with cleaning compound (item 9, appx E), dry with wiping rag (item 26, appx E), and lightly oil with CLP (item 7, appx E).



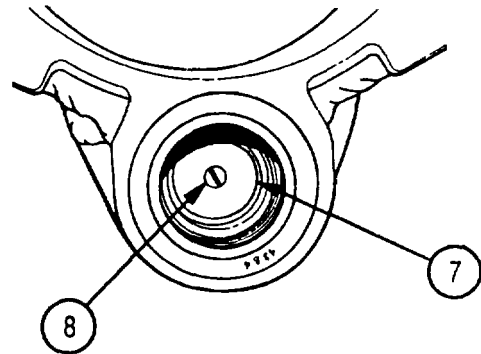
5-17. M2A4 OR M2A5 RECOIL MECHANISM, RECUPERATOR CYLINDER FRONT HEAD ASSEMBLY, RESPIRATOR, AND PISTON ROD ASSEMBLY-MAINTENANCE INSTRUCTIONS (cont)

SERVICING/INSPECTION (cont)

- 7 Check wiper disk (7) attached to end of recoil piston to make sure that its attaching screw (8) is secure.
- 8 Lightly oil respirator with CLP (item 7, appx E) before installing and tightening.

NOTE

Respirator should be set on 0 when weapon is not in operation.



INSPECTION/REPAIR

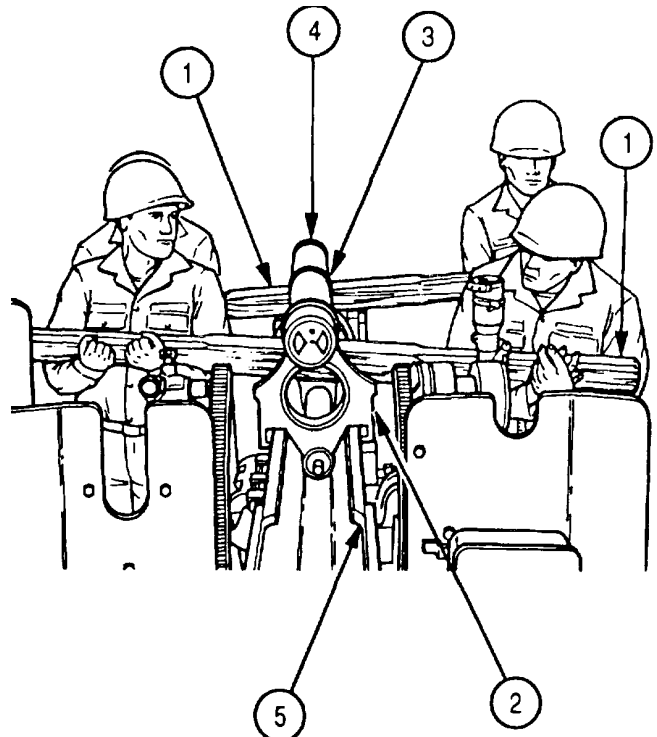
- 1 Inspect for missing, broken, or damaged parts.
- 2 Check all recoil slides for damage, and remove burrs or corrosion, using crocus cloth (item 11, appx E).
- 3 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

INSTALLATION

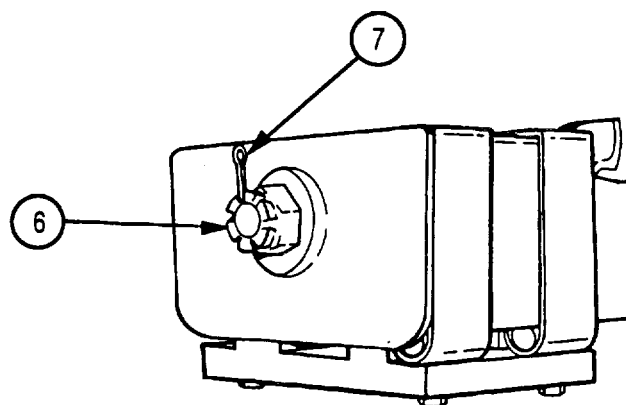
WARNING

Recoil mechanism weighs approximately 470 lb (213 kg). To install, use hoist if available. If hoist is not available, four soldiers are required to install recoil mechanism. Use care to avoid injury.

- 1 Place two suitable pieces of timber (1) between front sleigh yoke (2) and rear sleigh yoke (3), as illustrated.
- 2 Slide recoil mechanism (4) onto cradle (5), taking care to prevent binding or damage to cradle.



- 3 Install and tighten castellated nut (6) just enough to prevent end play. Back castellated nut off one notch, and install new cotter pin (7).
- 4 Remove timber.
- 5 Install cannon. (Refer to page 5-36.)
- 6 Lubricate sleigh assembly recoil slides at lube fittings with GAA (item 13, appx E).



5-18. SHIELD ASSEMBLY-MAINTENANCE INSTRUCTIONS

THIS TASK COVERS:

a. Disassembly

b. Inspection/repair

c. Reassembly

INITIAL SETUP

Tools and Special Tools
Artillery mechanic's tool kit (appx B)

References
TM 9-1015-203-20P

Materials/Parts
Cotter pin (TM 9-1015-203-20P)

DISASSEMBLY

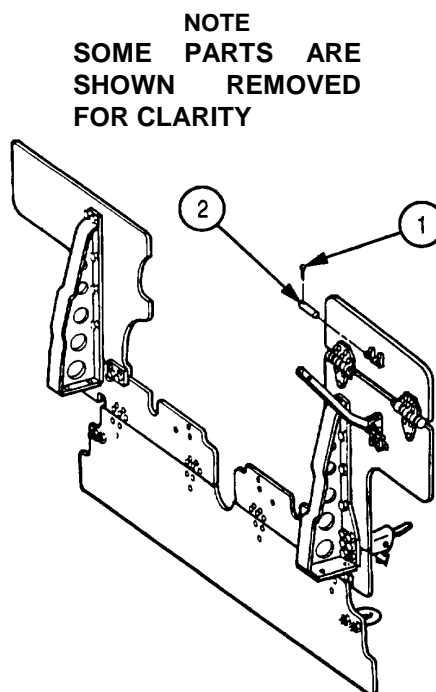
Remove cotter pin (1) and straight pin (2).

INSPECTION/REPAIR

- 1 Check for missing, broken, or damaged parts.
- 2 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

REASSEMBLY

Install straight pin (2) and new cotter pin (1).



TOP RIGHT/UPPER RIGHT SHIELD ASSEMBLIES

5-19. SHIELD ASSEMBLY LATCH-MAINTENANCE INSTRUCTIONST**THIS TASK COVERS:**

- a.** Disassembly **b.** Inspection/repair **c.** Reassembly

INITIAL SETUP

Tools and Special Tools
Artillery mechanic's tool kit (appx B)

References
TM 9-1015-203-20P

Materials/Parts
Cotter pin (2) (TM 9-1015-203-20P)

DISASSEMBLY**NOTE**

Procedure is written for one shield assembly latch, but applies to both.

Remove two cotter pins (1).

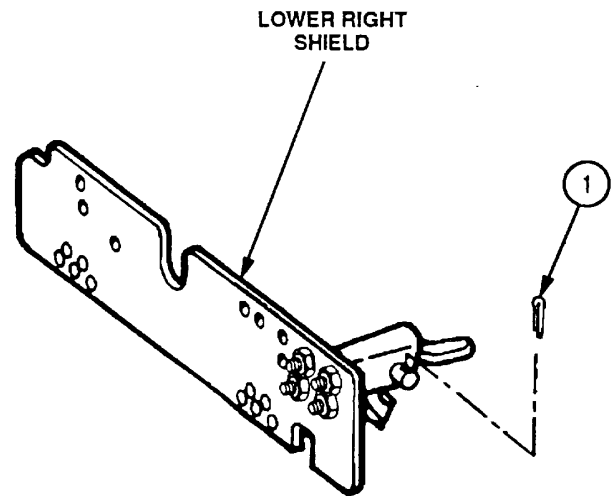
INSPECTION/REPAIR

- 1** Inspect for missing, broken, or damaged parts.
- 2** Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

REASSEMBLY**NOTE**

Procedure is written for one shield assembly latch, but applies to both.

Install two new cotter pins (1).



NOTE
SOME PARTS ARE SHOWN REMOVED FOR CLARITY.

5-20. ELEVATING MECHANISM-MAINTENANCE INSTRUCTIONS**THIS TASK COVERS:**

a. Disassembly

b. Inspection/repair

c. Reassembly

INITIAL SETUP

Tools and Special Tools

Artillery mechanic's tool kit (appx B)

DISASSEMBLY**NOTE**

See lubrication instructions on pages 3-6 and 3-17 and lube fittings paragraph on page 5-30 for location of all lube fittings.

NOTE
SOME PARTS ARE
SHOWN REMOVED
FOR CLARITY.

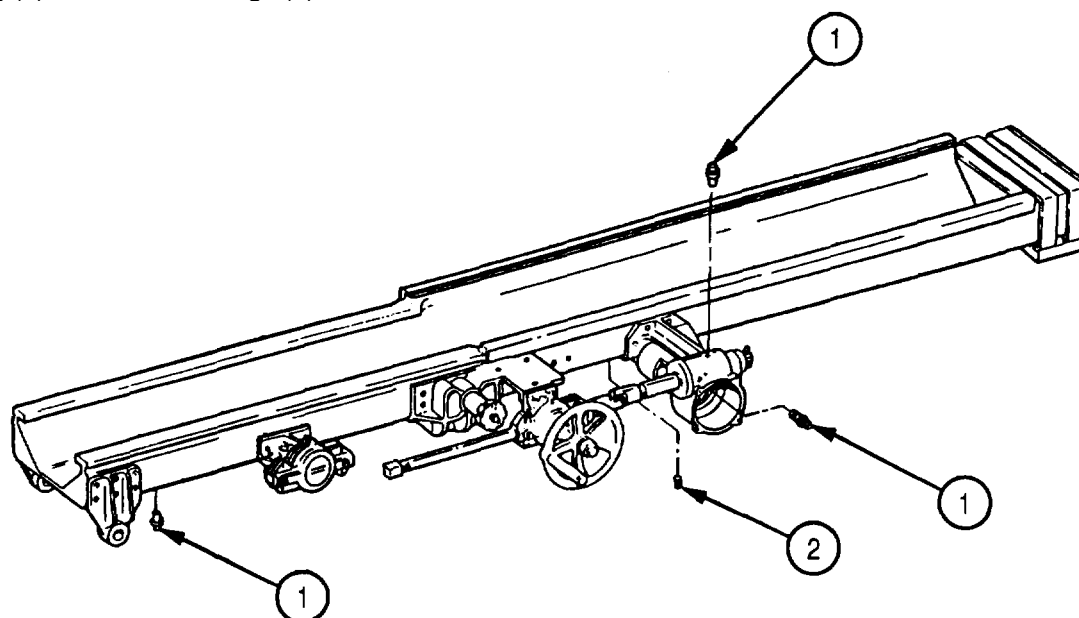
Remove 12 lube fittings (1) and pipe plug (2).

INSPECTION/REPAIR

- 1 Check for missing, broken, or damaged parts.
- 2 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

REASSEMBLY

Install pipe plug (2) and 12 lube fittings (1).



5-21. CRADLE-MAINTENANCE INSTRUCTIONS**THIS TASK COVERS:****a.** Disassembly**b.** Inspection/repair**c.** Reassembly**INITIAL SETUP**

Tools and Special Tools
 Artillery mechanic's tool kit (appx B)

References
 TM 9-1015-203-20P

DISASSEMBLY

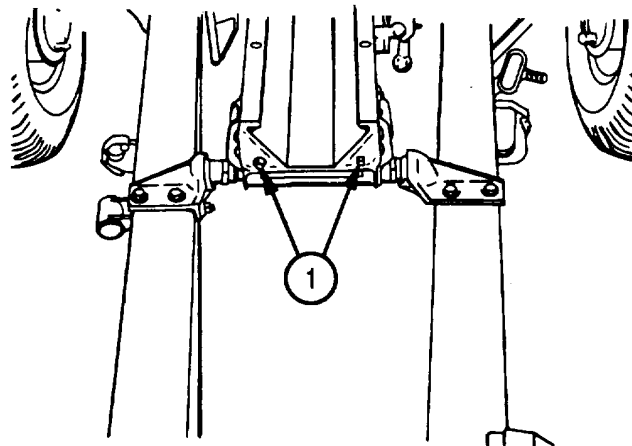
Remove two pipe plugs (1).

INSPECTION/REPAIR

- 1** Check for missing, broken, or damaged parts.
- 2** Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

REASSEMBLY

Install two pipe plugs (1).

**5-22. FIRING MECHANISM-MAINTENANCE INSTRUCTIONS****THIS TASK COVERS:****a** Inspection**b.** Disassembly**c.** Inspection/repair**d.** Reassembly**INITIAL SETUP**

Tools and Special Tools
 Artillery mechanic's tool kit (appx B)

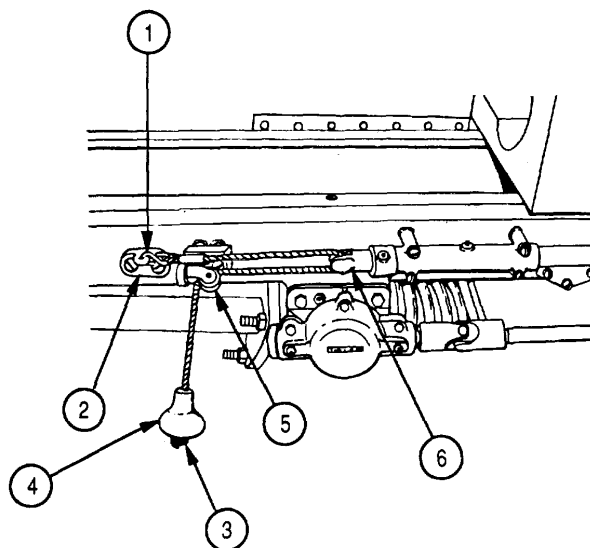
References
 TM 9-1015-203-20P

INSPECTION

Check firing mechanism by pulling lanyard; it must operate smoothly without binding.

DISASSEMBLY

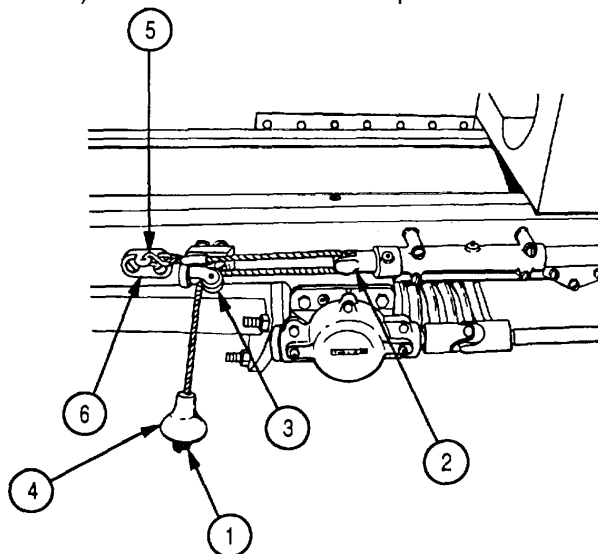
- 1 Unhook S-hook (1) from bracket (2).
- 2 Untie knot in lanyard (3) at end of handle (4).
- 3 Pull lanyard (3) through handle (4) and roller (5).
- 4 Pull lanyard (3) through bracket (6).

**INSPECTION/REPAIR**

- 1 Inspect for missing, broken, or damaged parts.
- 2 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

REASSEMBLY

- 1 Thread lanyard (1) through bracket (2).
- 2 Thread lanyard (1) through roller (3) and handle (4).
- 3 Tie knot in lanyard (1) at end of handle (4).
- 4 Hook S-hook (5) in bracket (6).



5-23. EQUILIBRATOR ASSEMBLY-MAINTENANCE INSTRUCTIONS

THIS TASK COVERS:

a. Inspection/repair

b. Adjustment

INITIAL SETUP

Tools and Special Tools
 Artillery mechanic's tool kit (appx B)

References
 TM 9-1015-203-20P

INSPECTION/REPAIR

- 1 Check for missing, broken, or damaged parts.
- 2 Elevate and depress howitzer through full range of movement. If it takes approximately the same effort to elevate as it does to depress, equilibrator assembly adjustment is satisfactory; if it does not, adjustment is required.
- 3 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

ADJUSTMENT

- 1 Loosen three nuts (1) on three equilibrator guide rods (2).
- 2 Adjust tension of spring (3) by tightening or loosening nuts (1).

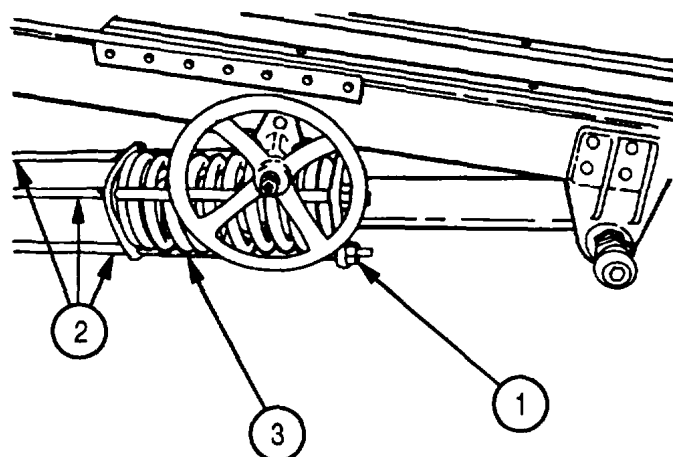
NOTE

Three nuts (1) must be adjusted evenly so that the same number of threads are showing behind each nut (1).

- 3 If howitzer is difficult to depress and easy to elevate, loosen three nuts (1) the same amount; if howitzer is easy to depress and difficult to elevate, tighten nuts (1) the same amount.
- 4 Check equilibrator adjustment, and if adjustment is satisfactory, replace and tighten jam nuts (if provided).

NOTE

If adjustment is unsatisfactory, repeat step 3.



5-24. WHEEL AND TIRE ASSEMBLY AND PNEUMATIC TIRE WHEEL-MAINTENANCE INSTRUCTIONS

THIS TASK COVERS:

- | | |
|----------------|----------------------|
| a. Servicing | b. Removal |
| c. Disassembly | d. Inspection/repair |
| e. Reassembly | f. Installation |

INITIAL SETUP

Tools and Special Tools
 Automotive maintenance shop equipment (appx B)
 Lug wrench

Materials/Parts
 CLP (item 7, appx E)
 Paint (item 24, appx E)
 Wiping rag (item 26, appx E)

References
 TM 9-1015-203-20P
 TM 9-2610-200-20
 TM 43-0139

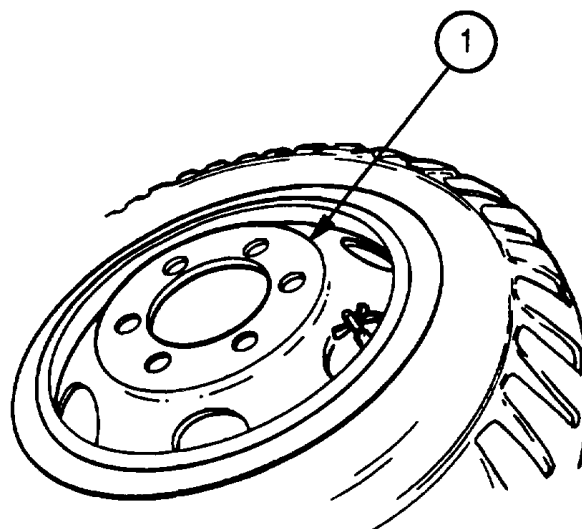
Equipment Conditions
 Howitzer is on blocks
 Handbrakes are engaged

NOTE

Maintenance procedures for the wheel and hub assembly are contained in this paragraph and the next. (Refer to page 5-57.)

SERVICING

Clean rust off wheel (1), using CLP (item 7, appx E) and wiping rag (item 26, appx E), and spot paint. (Refer to TM 43-0139.)



5-24. WHEEL AND TIRE ASSEMBLY AND PNEUMATIC TIRE WHEEL-MAINTENANCE INSTRUCTIONS (cont)

REMOVAL

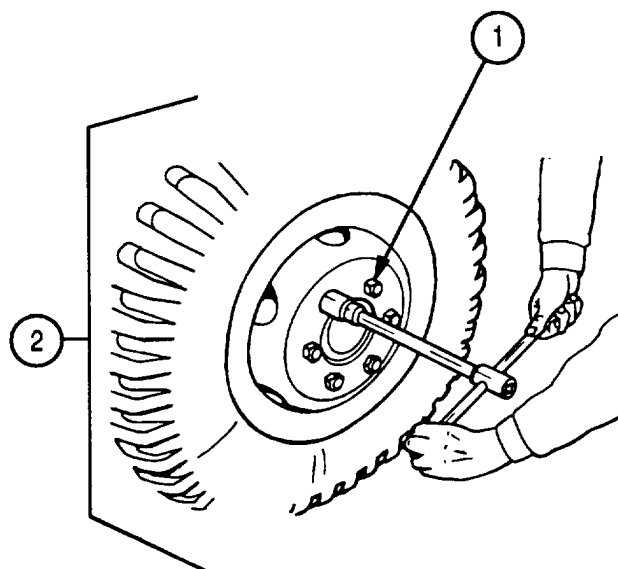
WARNING

Do not attempt to remove wheel and tire assembly with howitzer supported by jack only. For safety, blocking must always be placed under axle pintle assembly.

NOTE

Procedures are written for one wheel and tire assembly, but apply to both.

Remove six wheel lugs (1), and lift wheel and tire assembly (2) from hub and stud assembly.



DISASSEMBLY

WARNING

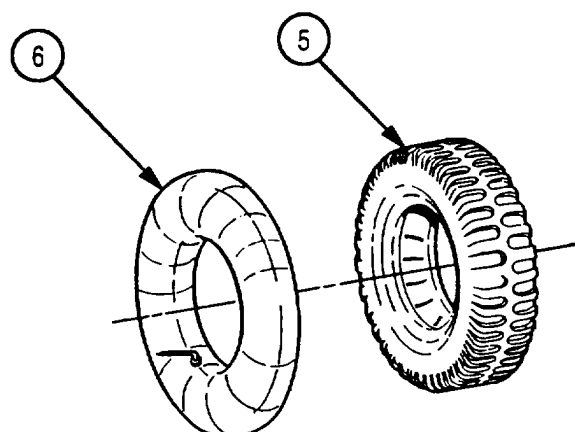
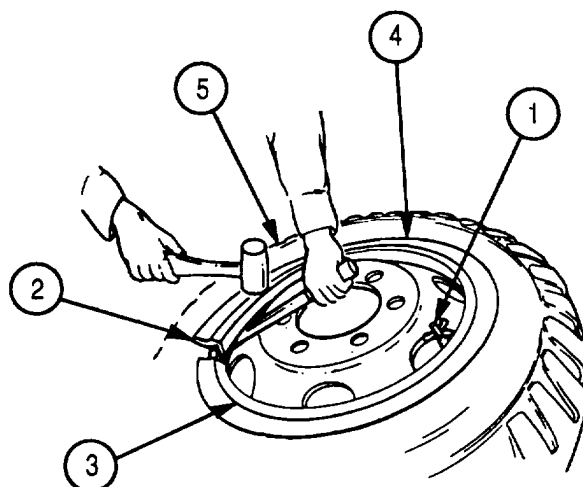
Release air pressure in tire by depressing valve before removing valve core.

- 1 Remove valve core (1), using valve core removing tool.
- 2 Break tire bead (2) loose from wheel (3), using a sledge hammer or heavy machinist's hammer.

NOTE

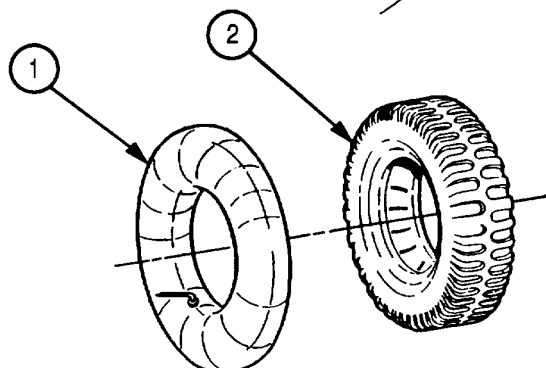
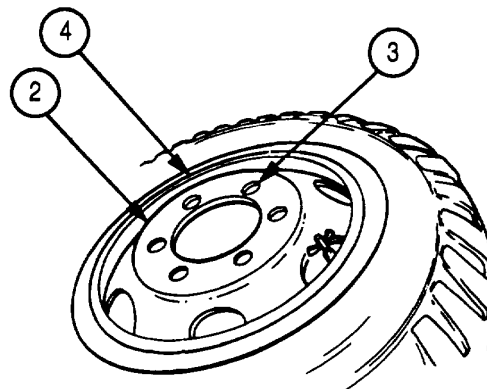
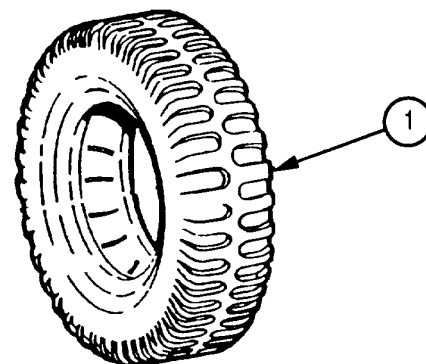
To dissolve any rust, clean with CLP (item 7, appx E) and wiping rag (item 25, appx E).

- 3 Insert tire irons under locking side ring (4) and lift out of wheel (3) while pounding downward on locking side ring (4) to release locking ridge from rim gutter on wheel (3).
- 4 Remove tire (5) and inner tube (6) from wheel (3).

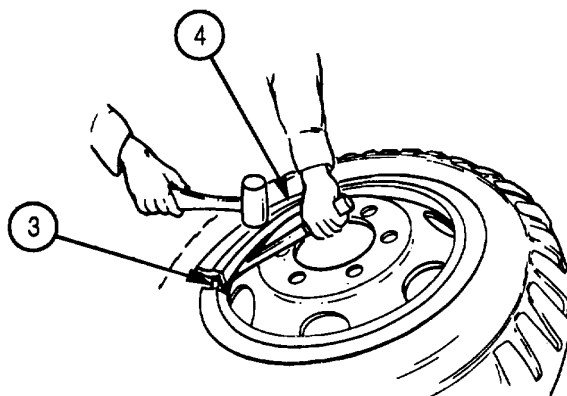


INSPECTION/REPAIR

- 1 Inspect tire (1) for damage and repair if needed. (See TM 9-2610-200-20.)
- 2 Check that wheel (2) is straight by placing it on a flat surface; wheel (2) should make complete contact with flat surface all the way around.
- 3 Check stud holes (3) for stretching. If stretched, replace wheel (2).
- 4 Check locking side ring (4); it must lock completely in wheel recess groove.
- 5 Check tires for loss of air pressure, cuts, and bulges.
- 6 Check wheels for alignment; they should not be bent or wobbly.
- 7 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

**REASSEMBLY**

- 1 Install inner tube (1) in tire (2), and install tire on wheel (3).
- 2 Position locking side ring (4) on wheel (3) with lip engaged in wheel.



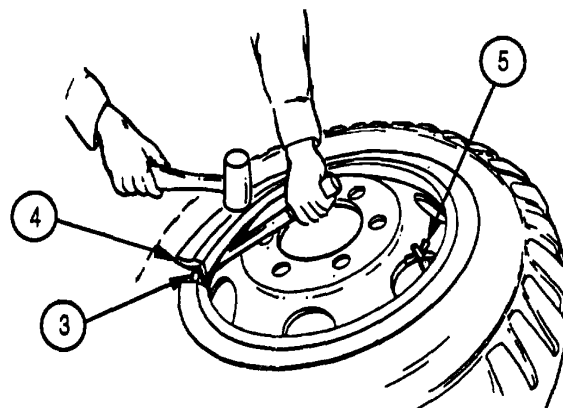
5-24. WHEEL AND TIRE ASSEMBLY AND PNEUMATIC TIRE WHEEL-MAINTENANCE INSTRUCTIONS (cont)

REASSEMBLY (cont)

WARNING

Make sure lip of locking side ring is properly seated when pounding locking side ring into wheel or locking side ring could fly up and cause injury.

- 3 Pound locking side ring (4) down into wheel (3) in a counterclockwise direction.

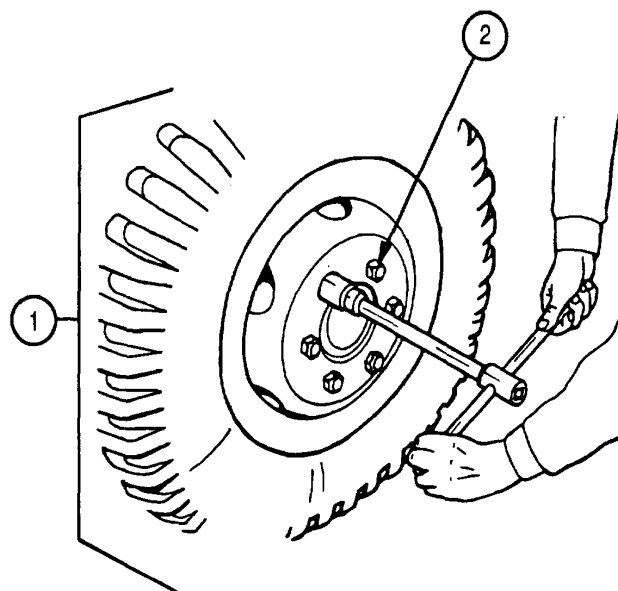
**WARNING**

When inflating tire, use tire cage if available. If not available, inflate with locking side ring grounded. If not properly seated, locking side ring can fly off and cause injury.

- 4 Install valve core (5), and inflate tire to 40 psi (276 kPa).

INSTALLATION

- 1 Position wheel and tire assembly (1) on hut and stud assembly.
- 2 Install six wheel lugs (2). Using torque wrench, torque wheel lugs to 350 ± 50 ft-lb (475 ± 68 N•m). Check torque on wheel lug after approximately 50 miles (80 km).



5-25. HUB AND STUD ASSEMBLY--MAINTENANCE INSTRUCTIONS

THIS TASK COVERS:

- | | |
|----------------------|---------------|
| a. Disassembly | b. Servicing |
| c. Inspection/repair | d. Reassembly |
| e. Adjustment | |

INITIAL SETUP

Tools and Special Tools

Artillery mechanic's tool kit (appx B)
 Automotive maintenance shop equipment
 appx B)
 Vehicle prime mover lug wrench

Personnel Required: 2

References

TM 9-1015-203-20P

Equipment Conditions

Howitzer wheels jacked up
 Howitzer supported by wood blocks
 5-53 Wheel and tire assembly removed

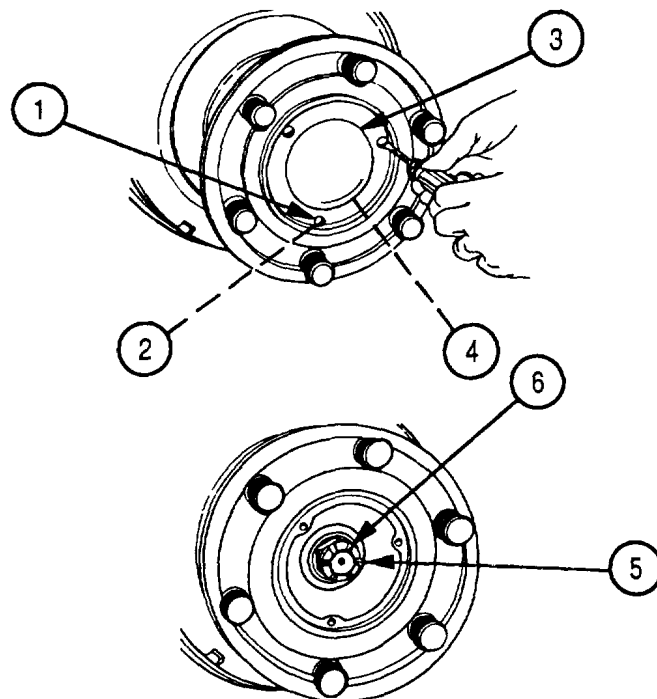
Materials/Parts

Cleaning compound (item 9, appx E)
 Cotter pin (TM 9-1015-203-20P)
 GAA (item 13, appx E)
 Gasket (TM 9-1015-203-20P)
 Lockwasher (3) (TM 9-1015-203-20P)
 Wiping rag (item 26, appx E)

DISASSEMBLY**NOTE**

Procedures are written for one hub and stud assembly, but apply to both.

- 1 Remove three screws (1), three lockwashers (2), hubcap (3), and gasket (4).
- 2 Remove cotter pin (5) and nut (6).



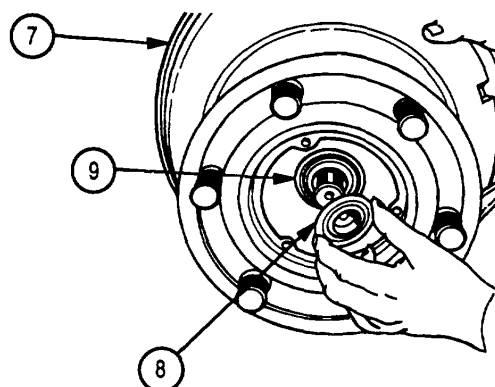
5-25. HUB AND STUD ASSEMBLY-MAINTENANCE INSTRUCTIONS (cont)

DISASSEMBLY{cont}

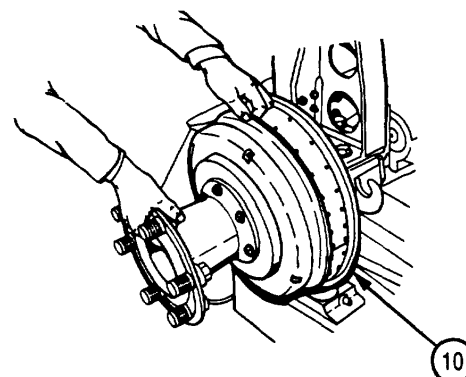
NOTE

Cone of outer roller bearing need not be removed unless it is damaged.

- 3 Pull out slightly on hub and stud assembly (7), and remove washer (8) and outer roller bearing (9).



- 4 Pull hub and stud assembly with brake drum (10) attached off spindle and place, brake drum side down, on a clean working surface.

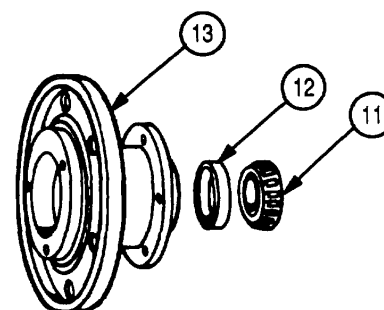


- 5 Place end of a brass drift or edge of a wooden block against inner roller bearing (11), and tap lightly with a hammer.

NOTE

Bearing cup need not be removed.

- 6 Gradually move brass drift or wooden block around inner roller bearing (11) and continue tapping to drive seal (12) and inner roller bearing (11) out of hub (13).

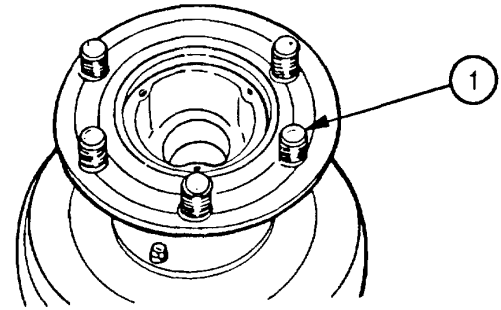


SERVICING

- 1 Clean inner and outer roller bearings thoroughly with wiping rag (item 26, appx E) and cleaning compound (item 9, appx E).
- 2 Dry bearings thoroughly. Do not use compressed air.
- 3 Pack GAA (item 13, appx E) into bearings until it comes out other side and through rollers.

INSPECTION/REPAIR

- 1 Inspect for missing, broken, or damaged parts.
- 2 Check studs (1) for stripped threads. Notify Direct Support maintenance.
- 3 Inspect bearings for wear, chips, scores, or corrosion; and replace if necessary.
- 4 Repair is by replacement of authorized part. (TM 9-1015-203-20P) which do not meet the inspection criteria.



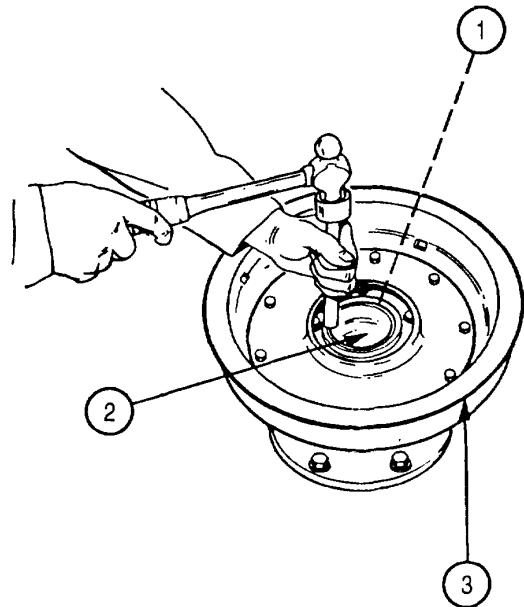
REASSEMBLY

NOTE

Procedures are written for one hub and stud assembly, but apply to both.

Be sure all parts are serviceable and leather edge of seal faces bearings.

- 1 After packing bearings, install the inner roller bearing (1) and seal (2) in hub (3).
- 2 Using a brass drift or wooden block and hammer, tap lightly around seal (2) until it is seated firmly.

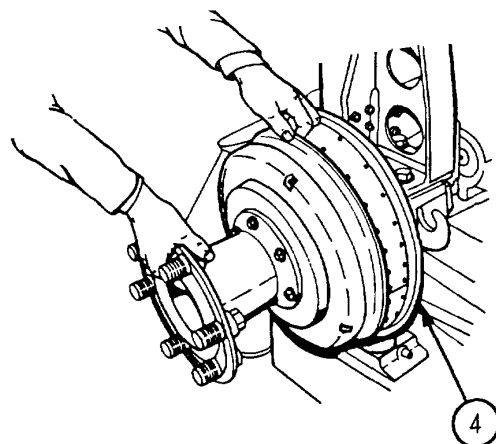


CAUTION

Hubs have right- and left-hand threaded studs. Be sure hub with left-hand threaded studs is installed on right side of axle pintle assembly.

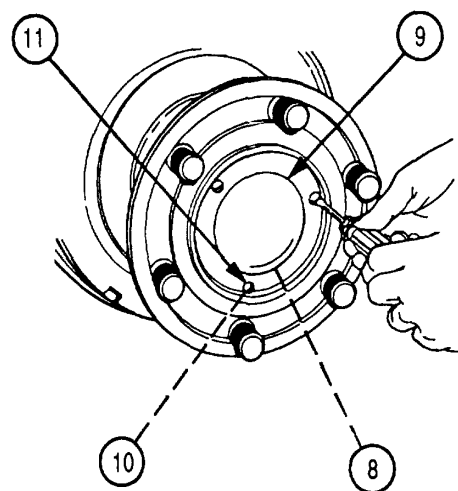
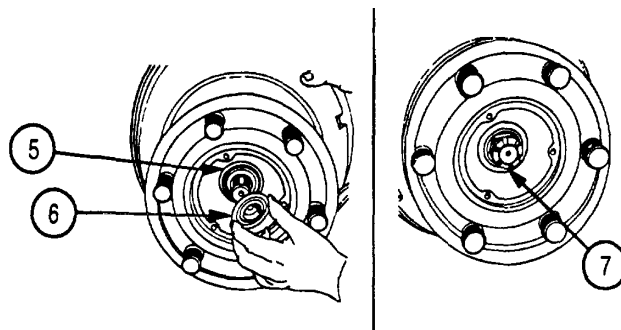
Use care in step 3 to prevent damage to seal.

- 3 Slide hub with attached brake drum (4) over spindle.

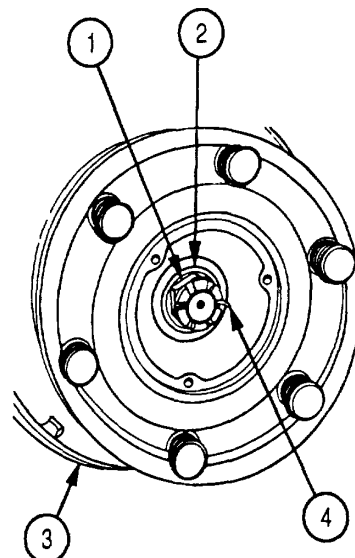


5-25. HUB AND STUD ASSEMBLY-MAINTENANCE INSTRUCTIONS (cont)**REASSEMBLY (cont)**

- 4 Slide outer roller bearing (5) onto spindle.
- 5 Install washer (6) and nut (7).
- 6 Perform adjustment procedure.
- 7 Install new gasket (8), hubcap (9), three lockwashers (10), and three screws (11).
- 8 Install wheel and tire assembly (refer to page 5-53), and remove blocking from under axle pintle assembly.

**ADJUSTMENT**

- 1 Adjust wheel bearings by tightening nut (1) until it fits snugly against washer (2).
- 2 While tightening nut (1), spin hub and stud assembly (3) until a slight drag is felt on wheel bearings. Then reverse nut just enough to allow hub and stud assembly to turn freely. Adjust nut one way or the other to line up nearest slot in nut with cotter pin hole in spindle.
- 3 Check adjustment by shaking hub and stud assembly (3) toward and away from carriage to make sure that wheel bearings are not loose on spindle and by spinning hub and stud assembly to make sure that it spins freely with no dragging or binding.
- 4 Insert new cotter pin (4) through spindle and nut (1), and spread cotter pin (4).



5-26. LEFT/RIGHT TRAILS-MAINTENANCE INSTRUCTIONS

THIS TASK COVERS:

a. Disassembly

b. inspection/repair

c. Reassembly

INITIAL SETUP

Tools and Special Tools
 Artillery mechanic's tool kit (appx B)

References
 TM 9-1015-203-20P

DISASSEMBLY**NOTE**

There are two mounting plates on the left trail and one on the right trail. Procedure is written for one mounting plate, but applies to all three.

Remove four screws (1) and four washers (2) from each mounting plate (3).

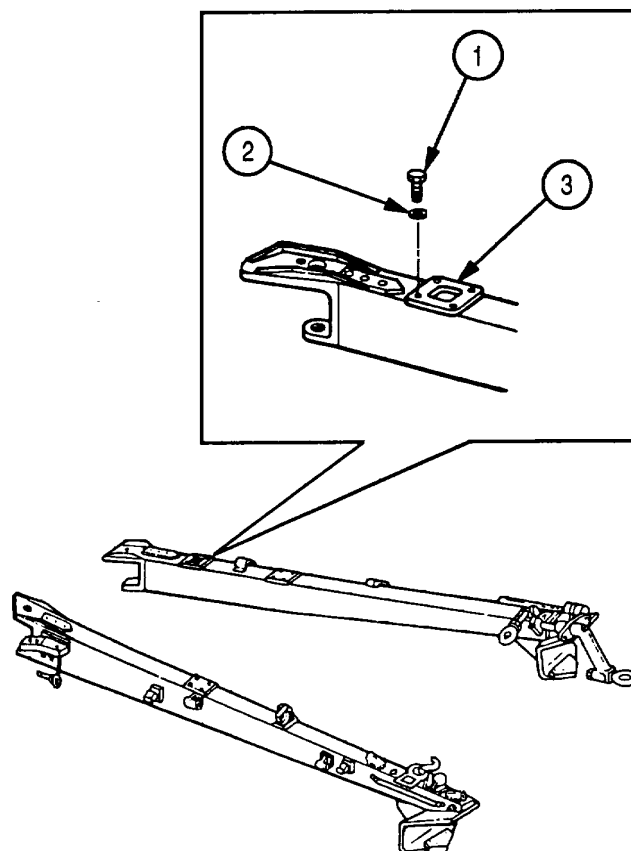
INSPECTION/REPAIR

- 1 Check for missing, broken, or damaged parts.
- 2 Repair is by replacement of authorized parts TM 9-1015-203-20P) which do not meet the inspection criteria.

REASSEMBLY**NOTE**

There are two mounting plates on the left trail and one on the right trail. Procedure is written for one mounting plate, but applies to all three.

Install four washers (2) and four screws (1) on each mounting plate (3).



NOTE
SOME PARTS ARE
SHOWN REMOVED
FOR CLARITY.

5-27. CRADLE LOCK STRUT ASSEMBLY-MAINTENANCE INSTRUCTIONS

THIS TASK COVERS:

Adjustment

INITIAL SETUP

Tools and Special Tools

Artillery mechanic's tool kit (appx B)

Equipment Conditions

2-85 Howitzer in travel position with cannon tube at center of traverse

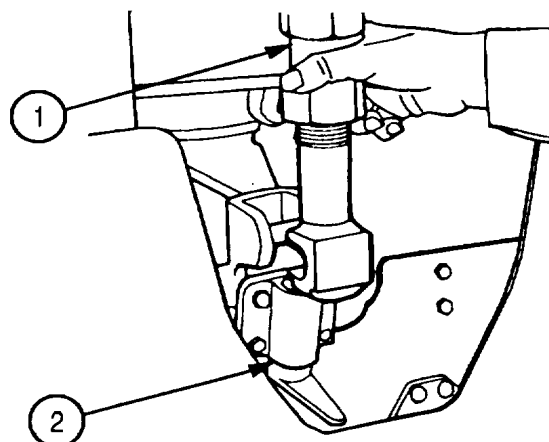
2-87 Trails closed

2-87 Travel lock engaged

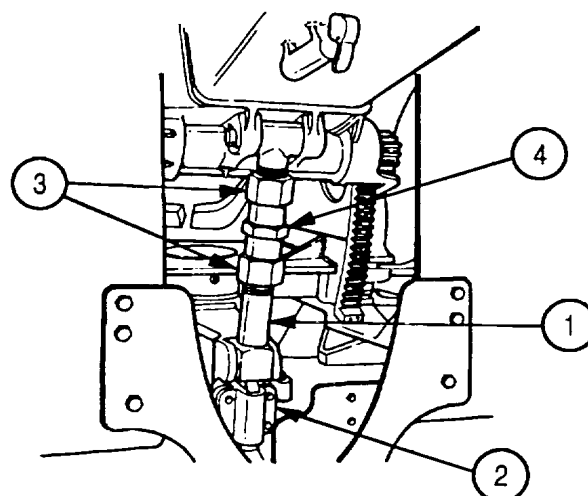
ADJUSTMENT**NOTE**

Cradle lock strut assembly (1) must be adjusted to proper length so that it engages lower strut latch (2) when weapon is in travel position.

- 1 Attempt to engage cradle lock strut assembly (1) in lower strut latch (2). If it will not readily engage, or binds, adjust as directed in steps 2 thru 4.



- 2 Loosen nuts (3).
- 3 Turn tumbuckle body (4) until cradle lock strut assembly (1) is proper length for it to engage lower strut latch (2).
- 4 When proper length is obtained, tighten nuts (3).



5-28. HANDBRAKES-MAINTENANCE INSTRUCTIONS

THIS TASK COVERS:

a. Inspection

b. Adjustment

INITIAL SETUP

Tools and Special Tools
 Artillery mechanic's tool kit (appx B)

Materials/Parts
 Chalk (item 6, appx E)

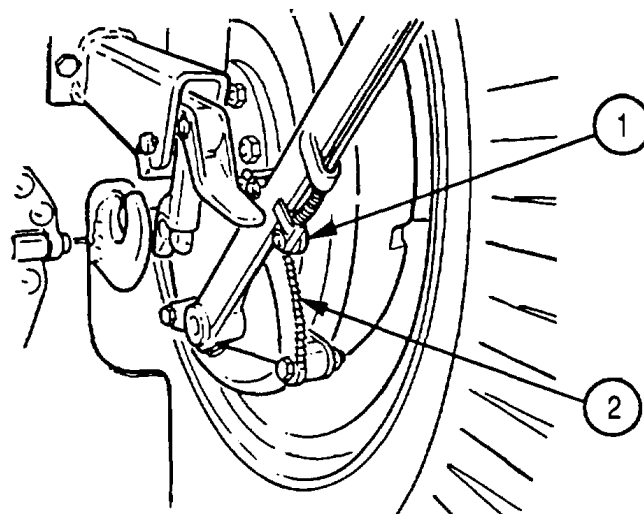
Personnel Required: 2

Equipment Conditions
 Wheels are jacked up
 Howitzer supported by wood blocks

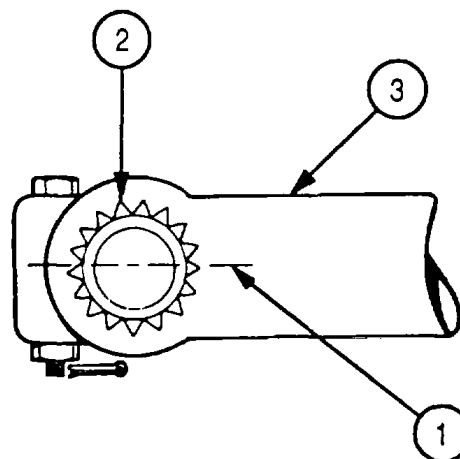
INSPECTION**NOTE**

Procedures are written for one handbrake, but apply to both.

When handbrake is fully engaged, check to see if the handbrake lever is properly adjusted. Handbrake lever is properly adjusted if the handbrake is fully engaged when handbrake pawl (1) is approximately halfway forward on ratchet rack (2). If not, perform adjustment procedure.

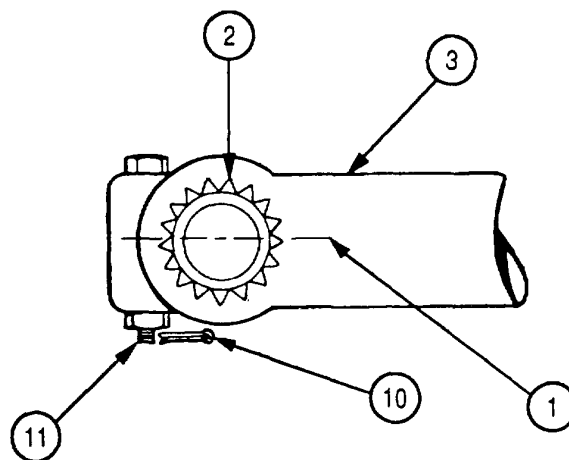
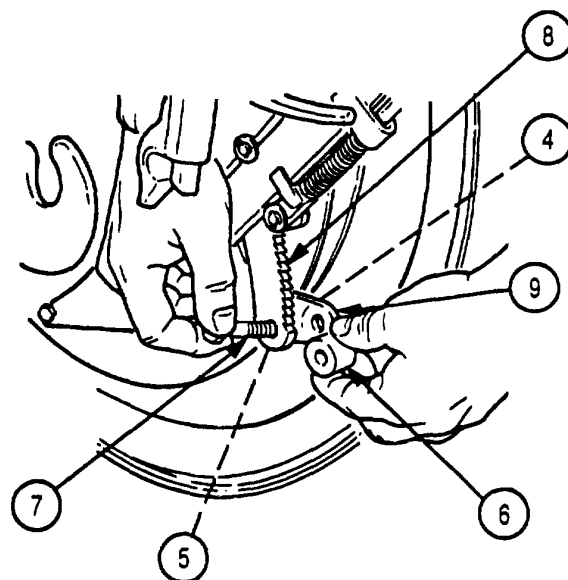
**ADJUSTMENT**

- 1 Mark a sharp chalk line (1) across center of brake camshaft (2) and onto handbrake lever (3).



5-28. HANDBRAKES-MAINTENANCE INSTRUCTIONS (cont)**ADJUSTMENT (cont)**

- 2** Remove nut (4), washer (5), spacer (6), and screw (7) from ratchet rack (8) and ratchet plate (9).
- 3** Remove cotter pin (10).
- 4** Loosen nut (11) which locks handbrake lever (3) to brake camshaft (2).
- 5** Pull handbrake lever (3) and ratchet rack (8) off brake camshaft (2).
- 6** Using chalk line (1) on brake camshaft (2) as a reference, move handbrake lever (3) up or down a distance approximately equal to required adjustment; then slide hand brake lever (3) back onto brake camshaft (2).
- 7** Position ratchet rack (8) on ratchet plate (9), and install spacer (6) and screw (7).
- 8** Check adjustment by setting handbrake. If necessary, repeat steps 4 thru 7 until proper adjustment is obtained.
- 9** Install washer (5) and nut (4).
- 10** Tighten nut (11); then install cotter pin (10).



5-29. M12A7S PANORAMIC TELESCOPE (PANTEL), ROTATING HEAD, AND ELBOW ASSEMBLY-MAINTENANCE INSTRUCTIONS

THIS TASK COVERS:

- | | |
|----------------------|------------------------|
| a. Inspection | b. Removal |
| c. Disassembly | d. Servicing (purging) |
| e. Inspection/repair | f. Reassembly |
| g. Installation | |

INITIAL SETUP

Tools and Special Tools

Artillery mechanic's tool kit (appx B)
Compressed gas cylinder (appx B)
Fire control purging kit (appx B)

Equipment Conditions

5-33 Fire control purging equipment set up

References

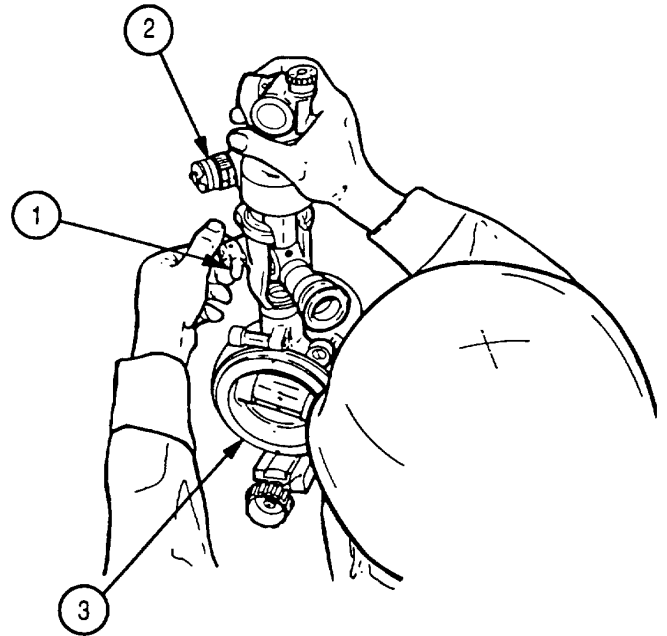
TM 9-1015-203-20P

INSPECTION

Check for moisture in optics. Purge to remove moisture.

REMOVAL

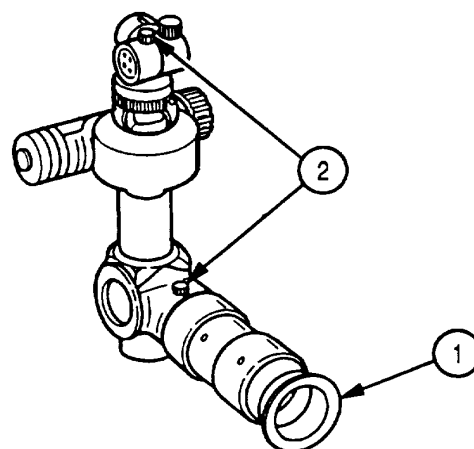
Turn wing knob (1) clockwise, and remove pantel (2) from M21A1 telescope mount (3).



5-29. M12A7S PANORAMIC TELESCOPE (PANTEL), ROTATING HEAD, AND ELBOW ASSEMBLY-MAINTENANCE INSTRUCTIONS (cont)

DISASSEMBLY

Remove protective eyeshield (1) and two purging screws (2).

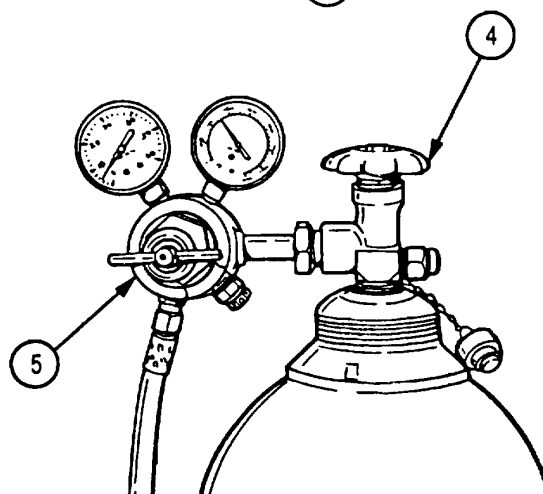
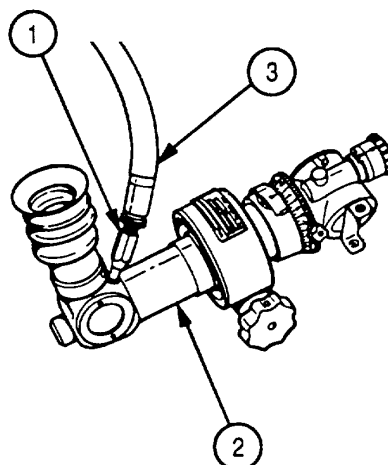


SERVICING (PURGING)

NOTE

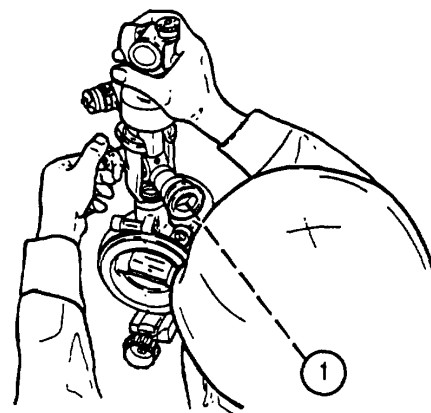
If pressure is less than 100 psi (690 kPa), replace compressed gas cylinder.

- 1 Install adapter (1) in elbow (2).
- 2 Connect hose assembly (3) to adapter (1).
- 3 Open tank valve (4).
- 4 Set regulator (5) at 5 psi (34 kPa), and purge for 5 minutes or until all traces of moisture disappear from optics.
- 5 Close regulator (5).
- 6 Close tank valve (4).
- 7 Disconnect hose assembly (3).
- 8 Remove adapter (1).



INSPECTION/REPAIR

- 1 Inspect for missing, broken, or damaged parts.
- 2 Check reticle (1) to be sure it is illuminated when instrument light is turned ON. If not, remove panel and forward to Direct Support maintenance.
- 3 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

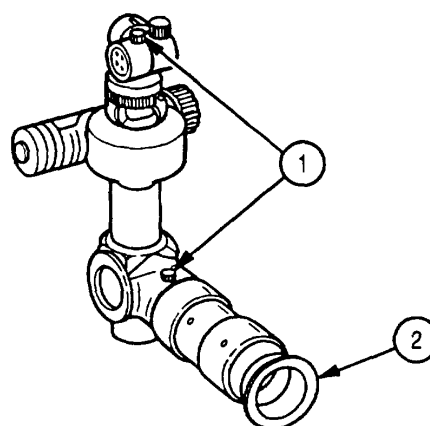


REASSEMBLY

NOTE

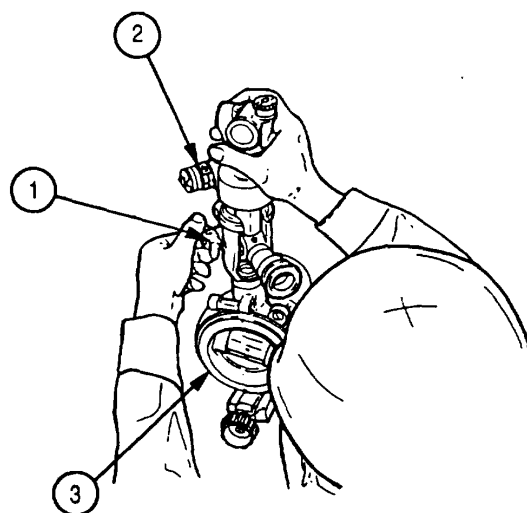
Do not twist protective eyeshield when installing.

Install two purging screws (1) and protective eyeshield (2).



INSTALLATION

Turn wing knob (1), install panel (2) in M21A1 telescope mount (3), and release wing knob.



5-30. M21A1 TELESCOPE MOUNT-MAINTENANCE INSTRUCTIONS**THIS TASK COVERS:****a.** Disassembly**b.** Inspection/repair**c.** Reassembly**INITIAL SETUP**

Tools and Special Tools

Artillery mechanic's tool kit (appx B)

Equipment Conditions

5-65 Pantel removed

References

TM 9-1015-203-20P

DISASSEMBLY

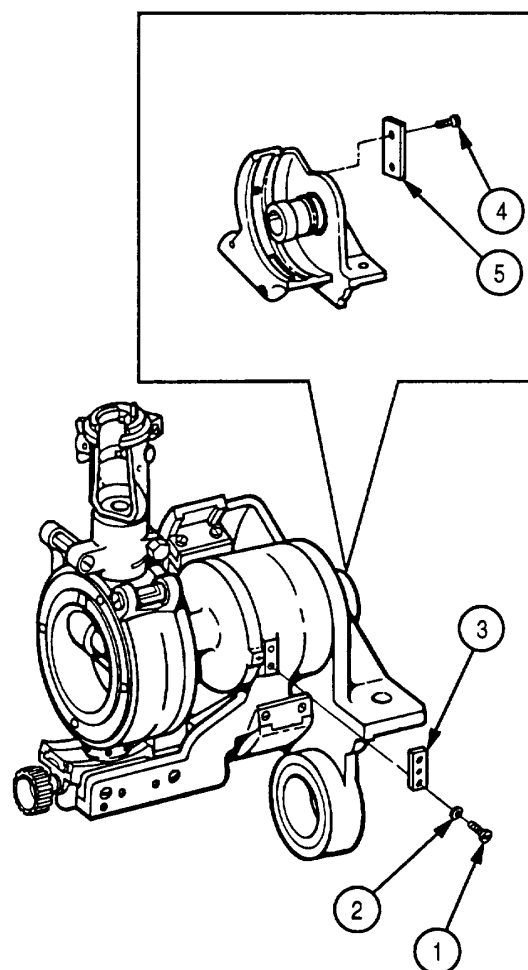
- 1 Remove two screws (1), lockwashers (2), and coarse longitudinal index (3).
- 2 Remove two screws (4) and identification plate (5).

INSPECTION/REPAIR

- 1 Inspect for missing, broken, or damaged parts.
- 2 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

REASSEMBLY

- 1 Install identification plate (5) and two screws (4).
- 2 Install coarse longitudinal index (3), two lockwashers (2), and screws (1).



5-31. M16A1 D ELBOW TELESCOPE-MAINTENANCE INSTRUCTIONS**THIS TASK COVERS:**

- | | |
|----------------------|------------------------|
| a. Inspection | b. Removal |
| c. Disassembly | d. Servicing (purging) |
| e. Inspection/repair | f. Reassembly |
| g. Installation | |

INITIAL SETUP**Tools and Special Tools**

Artillery mechanic's tool kit (appx B)
Compressed gas cylinder (appx B)
Fire control purging kit (appx B)

Equipment Conditions

5-33 Fire control purging equipment set up

References

TM 9-1015-203-20P

INSPECTION

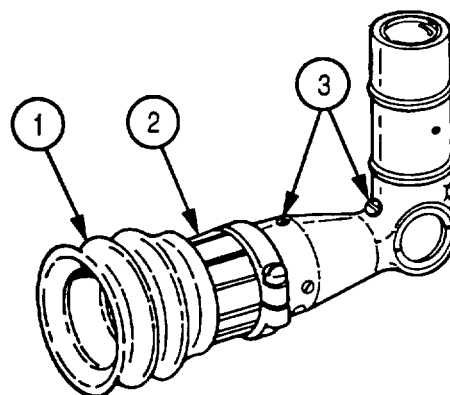
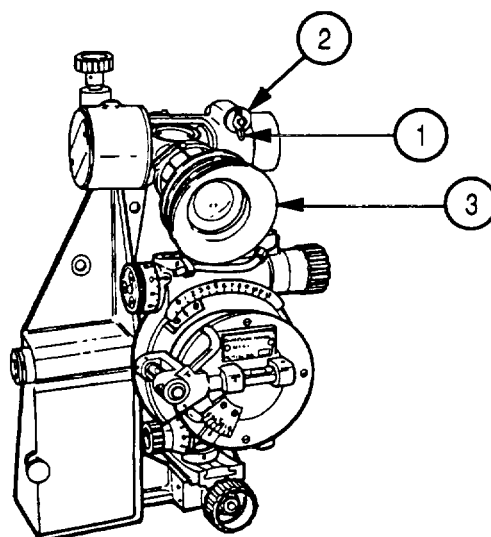
Check for moisture in optics. Purge to remove moisture.

REMOVAL

Loosen wingnut (1) on clamp (2), and remove elbow telescope (3).

DISASSEMBLY

- 1 Remove rubber eyeshield (1) and adapter (2), if necessary for replacement.
- 2 Remove two purging screws (3).



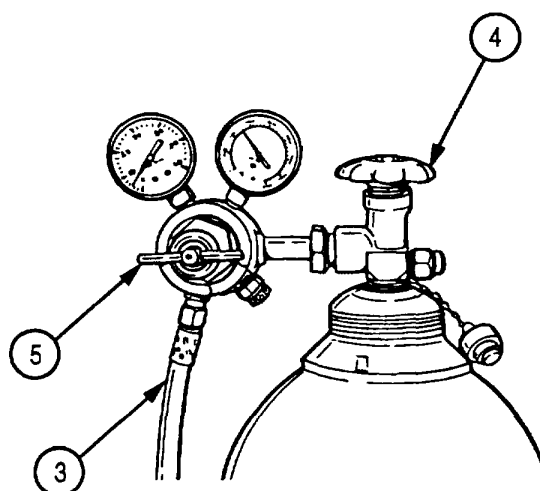
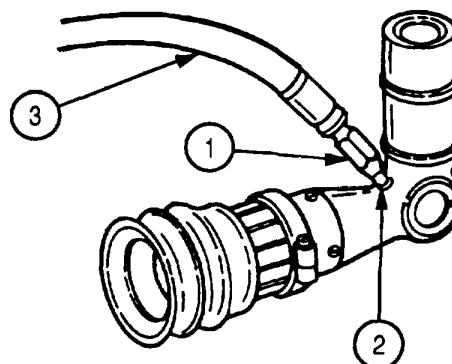
5-31. M16A1D ELBOW TELESCOPE-MAINTENANCE INSTRUCTIONS (cont)

SERVICING (PURGING)

NOTE

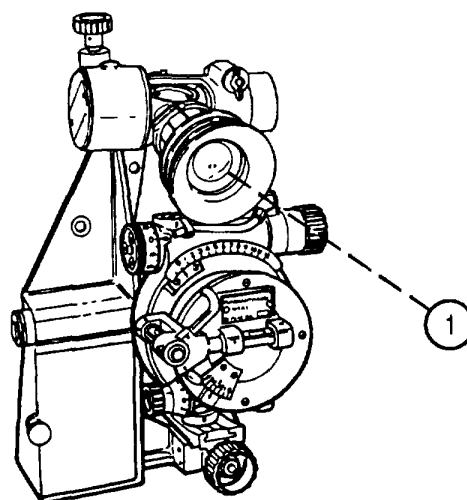
If it is necessary to replace a compressed gas cylinder, only the compressed gas can be obtained. The empty cylinder must be taken to the proper location point for filling with nitrogen.

- 1 Install adapter (1) in entrance port (2).
- 2 Hook up hose assembly (3) to adapter (1), and open tank valve (4).
- 3 Open pressure regulator valve (5) to 5 psi (34 kPa) for 5 minutes or until all traces of moisture disappear from optics.
- 4 Close pressure regulator valve (5).
- 5 Close tank valve (4).
- 6 Unhook hose assembly (3).
- 7 Remove adapter (1).



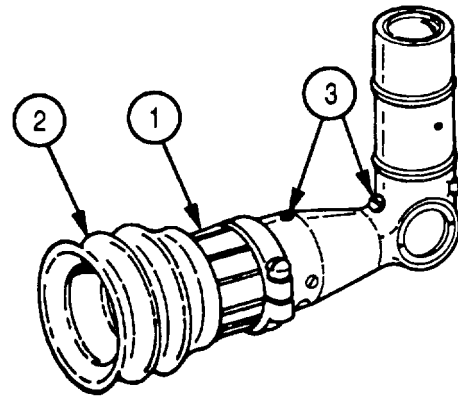
INSPECTION/REPAIR

- 1 Inspect for missing, broken, or damaged parts.
- 2 Check reticle (1) to be sure it is illuminated when instrument light is turned on. If not, remove elbow telescope, and forward to direct support maintenance.
- 3 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

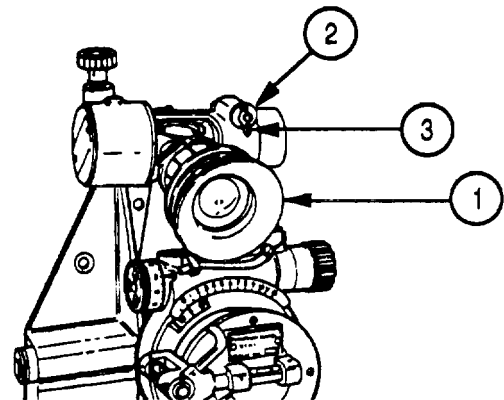


REASSEMBLY

- 1 Install adapter (1) and rubber eyeshield (2).
- 2 Install two purging screws (3).

**INSTALLATION**

Install elbow telescope (1) in clamp (2), and tighten wingnut (3).

**5-32. M23 TELESCOPE MOUNT-MAINTENANCE INSTRUCTIONS****THIS TASK COVERS:**

Inspection/repair

INITIAL SETUP

Tools and Special Tools
Artillery mechanic's tool kit (appx B)

Equipment Conditions
5-69 Elbow telescope removed

References
TM 9-1015-203-20P

INSPECTION/REPAIR

- 1 Inspect for missing, broken, or damaged parts.
- 2 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

5-33. M4A1 FIRE CONTROL QUADRANT-MAINTENANCE INSTRUCTIONS**THIS TASK COVERS:**

a. Disassembly

b. Inspection/repair

c. Reassembly

INITIAL SETUP

Tools and Special Tools
 Artillery mechanic's tool kit (appx B)

References
 TM 9-1015-203-20P

Materials/Parts
 Lamp, incandescent (item 20, appx E)

Equipment Conditions
 5-71 M23 telescope mount removed

DISASSEMBLY

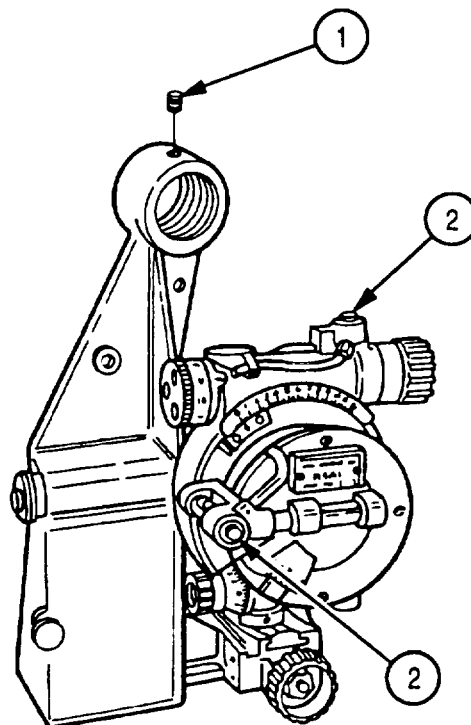
- 1 Remove cone point screw (1).
- 2 Remove two lamps (2).

INSPECTION/REPAIR

- 1 Inspect for missing, broken, or damaged parts.
- 2 Check for burned out lamps (2).
- 3 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

REASSEMBLY

- 1 Install two lamps (2).
- 2 Install cone point screw (1).



5-34. M19 INSTRUMENT LIGHT-MAINTENANCE INSTRUCTIONS**THIS TASK COVERS:**

a. Disassembly

b. Inspection/repair

c. Reassembly

INITIAL SETUP

Materials/Parts

Lamp, incandescent (item 20, appx E)

References

TM 9-1015-203-20P

DISASSEMBLY

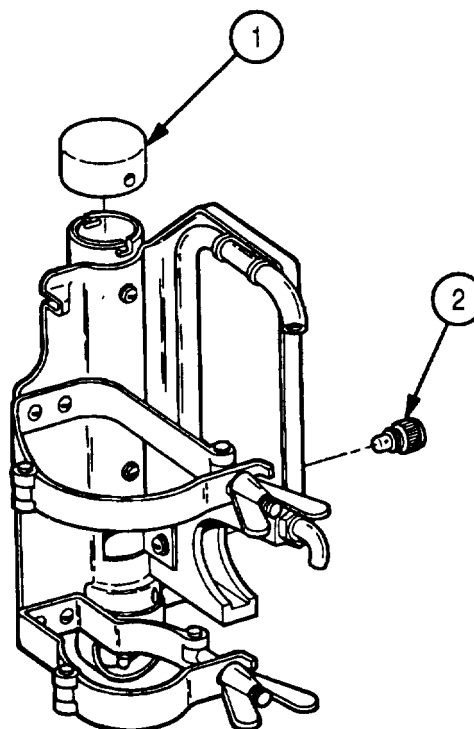
Remove cap assembly (1) and lamp (2).

INSPECTION/REPAIR

- 1 Check for missing, broken, or damaged parts.
- 2 Check for burned out lamp (2).
- 3 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.
- 4 Replace M19 instrument light if any parts other than the cap assembly or lamp are damaged and cannot perform their proper function.

REASSEMBLY

Install lamp (2) and cap assembly (1).



5-35. M36 INSTRUMENT LIGHT-MAINTENANCE INSTRUCTIONS**THIS TASK COVERS:**

a. Disassembly

b. Inspection/repair

c. Reassembly

INITIAL SETUP

Materials/Parts

Lamp, incandescent (item 19, appx E)

References

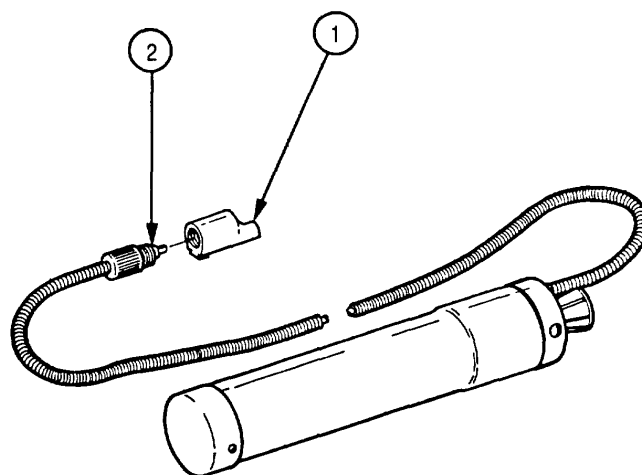
TM 9-1015-203-20P

DISASSEMBLY

Remove bracket (1) and lamp (2).

INSPECTION/REPAIR

- 1 Inspect for missing, broken, or damaged parts.
- 2 Check for burned out lamp (2).
- 3 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.
- 4 Replace M36 instrument light if any parts other than the lamp (2) are damaged and cannot perform their proper function.

**REASSEMBLY**

Install lamp (2) and bracket (1).

5-36. GUN TUBE LEVELING FIXTURE AND CASE-MAINTENANCE INSTRUCTIONS**THIS TASK COVERS:**

Inspection/repair

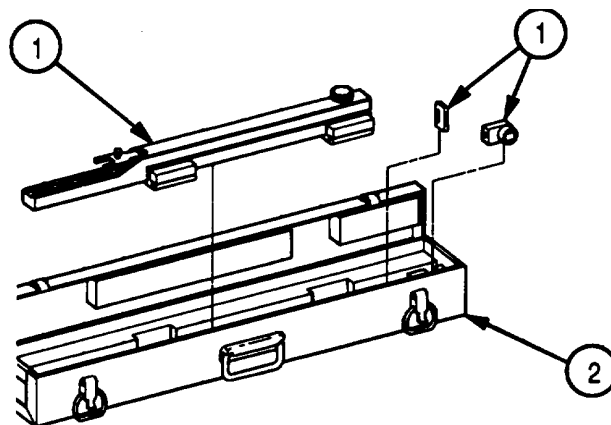
INITIAL SETUP

References

TM 9-1015-203-20P

INSPECTION/REPAIR

- 1 Check for worn or broken fixture (1) and case (2).
- 2 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

**5-37. TAILLIGHT ASSEMBLY AND COMPOSITE LIGHT-MAINTENANCE INSTRUCTIONS****THIS TASK COVERS:**

- | | |
|----------------------|----------------|
| a. Removal | b. Disassembly |
| c. Inspection/repair | d. Reassembly |
| e. Installation | |

INITIAL SETUP

Tools and Special Tools

Artillery mechanic's tool kit (appx B)

References

TM 9-1015-203-20P

Materials/Parts

LED light marker (item 22, appx E)

LED light unit (item 21, appx E)

Lockwasher (4) (TM 9-1015-203-20P)

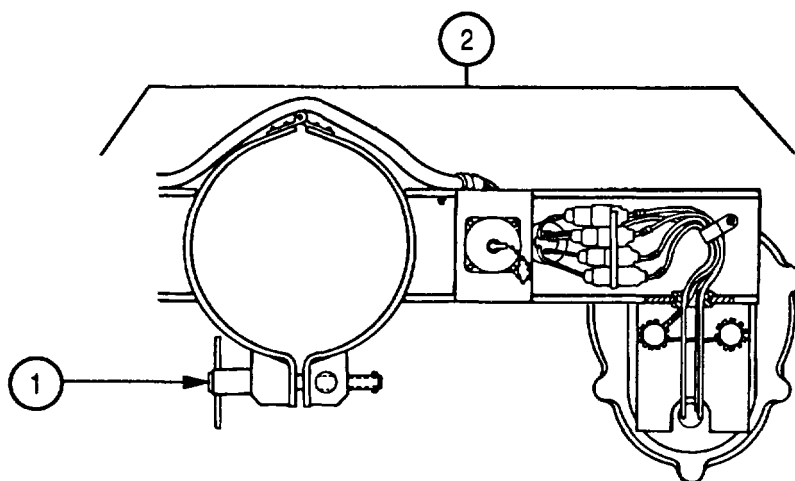
Lock wire (item 33, appx E)

Preformed packing (TM 9-1015-203-20P)

Strap (TM 9-1015-203-20P)

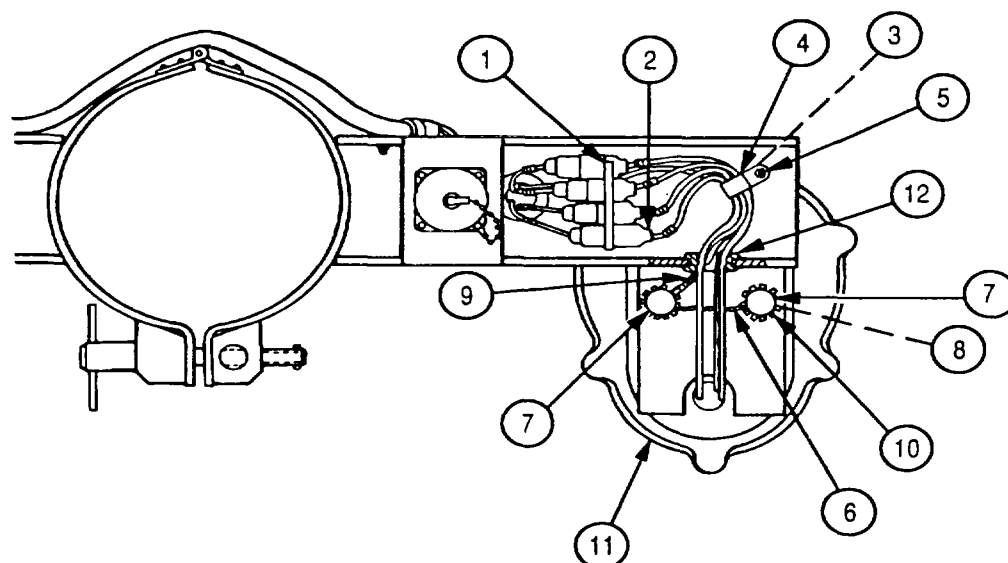
5-37. TAILLIGHT ASSEMBLY AND COMPOSITE LIGHT-MAINTENANCE INSTRUCTIONS (cont)

REMOVAL

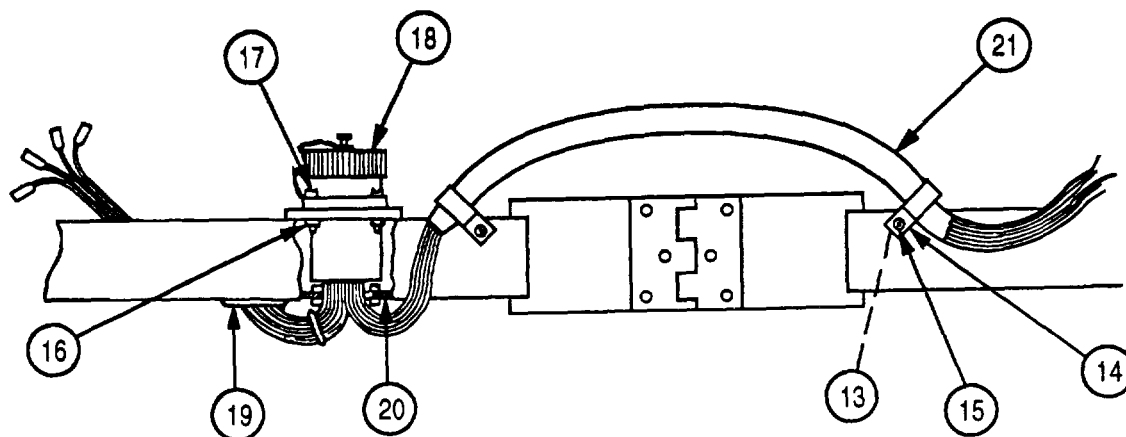


- 1 Unplug cable assembly from taillight assembly.
- 2 Loosen clamp (1), and remove taillight assembly (2).

DISASSEMBLY

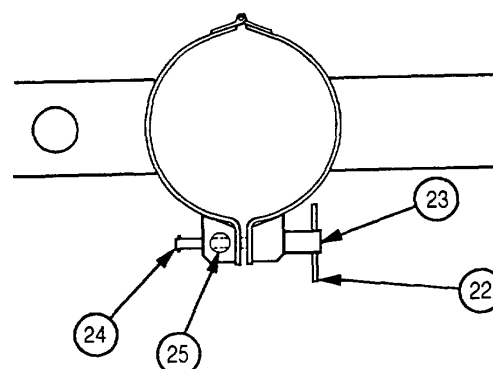


- 1 Cut strap (1) holding four wire connectors (2).
- 2 Uncouple four connectors (2).
- 3 Remove nut (3), clamp (4), and screw (5) holding wires.
- 4 Cut lock wire (6) and remove from the two screws (7).
- 5 Remove two screws (7), washers (8), ground wire (9), and two lockwashers (10) from the left light assembly (11).
- 6 Remove split grommet (12) and left light assembly (11).
- 7 Repeat steps 3 thru 6 for removal of right light assembly.

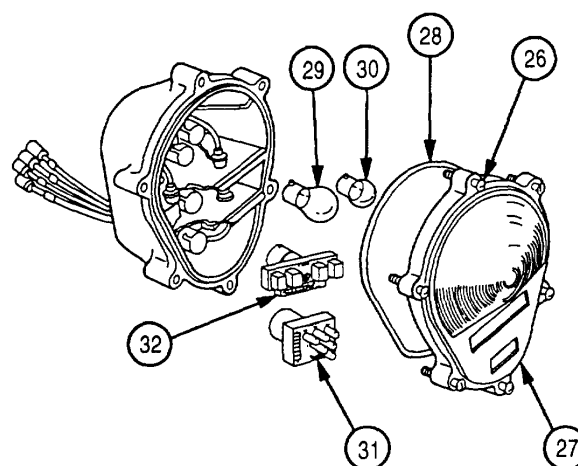


- 8 Remove two nuts (13), two clamps (14), and two screws (15).
- 9 Remove four nuts (16), four screws (17), and cap (18) from receptacle connector.
- 10 Remove split grommet (19), split grommet (20), and wiring harness (21).

- 11 Remove pin (22), screw (23), pin (24), and nut (25).

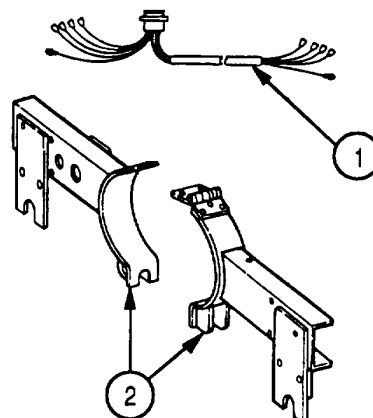


- 12 Remove six screws (26), light lens cover (27), and preformed packing (28).
- 13 Remove two lamps (29 and 30) by pressing in and rotating counterclockwise until released; then remove lamps from sockets. Using screwdriver, remove one LED lamp unit (31) and one LED light marker (32) by pressing in and turning counterclockwise.

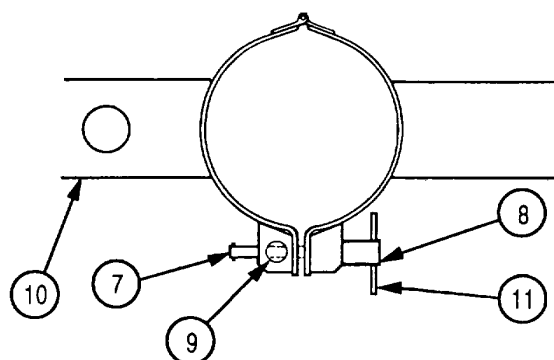
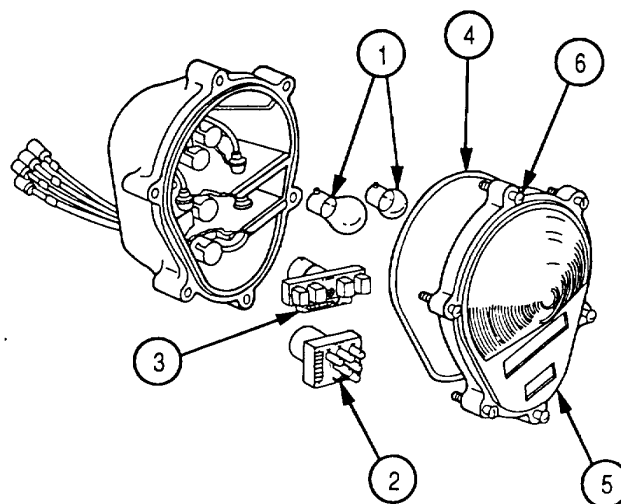


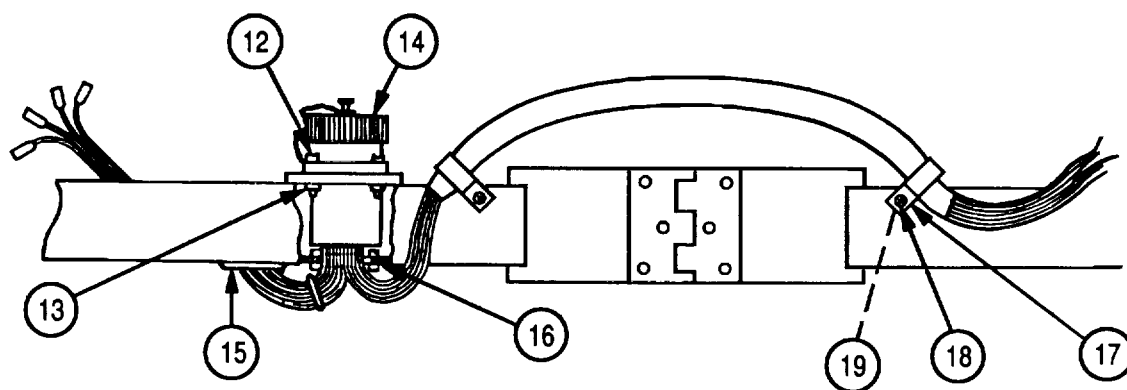
5-37. TAILLIGHT ASSEMBLY AND COMPOSITE INSTRUCTIONS (cont)**INSPECTION/REPAIR**

- 1 Inspect for missing, broken, or damaged parts.
- 2 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.
- 3 Replace entire taillight assembly if wiring harness (1) or tube clamps (2) are damaged and cannot perform their proper function.

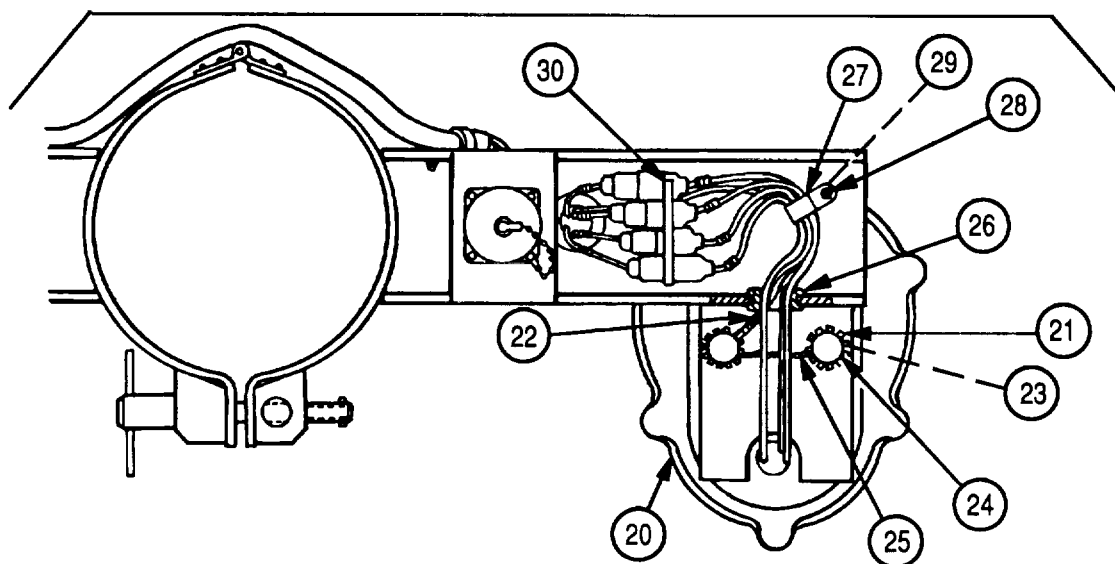
**REASSEMBLY**

- 1 Install two lamps (1) by pressing in and turning clockwise. Install two LEDs (2 and 3) by use of screwdriver.
- 2 Attach preformed packing (4) and door assembly (5) to body assembly with six screws (6).
- 3 Connect light to vehicle and check for proper light before reassembly.
- 4 Install pin (7) in screw (8).
- 5 Position nut (9) in left tube clamp (10); install screw (8).
- 6 Install pin (11) in screw (8).





- 7 Install wiring harness receptacle connector with four screws (12) and four nuts (13). Screw cap (14) on receptacle connector.
- 8 Install split grommets (15 and 16).
- 9 Install two clamps (17) with two screws (18) and two nuts (19).



- 10 Install left light assembly (20), two new lockwashers (21), ground wire (22), two washers (23), and two screws (24).
- 11 Secure two screws (24) with new lock wire (item 33, appx E) (25).
- 12 Install split grommet (26).
- 13 Connect four wiring harness and light assembly connectors. (Refer to figure 5-1.)
- 14 Install clamp (27) with screw (28) and nut (29).
- 15 Install strap (30).
- 16 Repeat steps 10 thru 15 for installation of right light assembly.
- 17 Paint unpainted, exposed metal parts with paint (refer to TM 43-0139).

5-37. TAILLIGHT ASSEMBLY AND COMPOSITE LIGHT-MAINTENANCE INSTRUCTIONS (cont)

REASSEMBLY (cont)

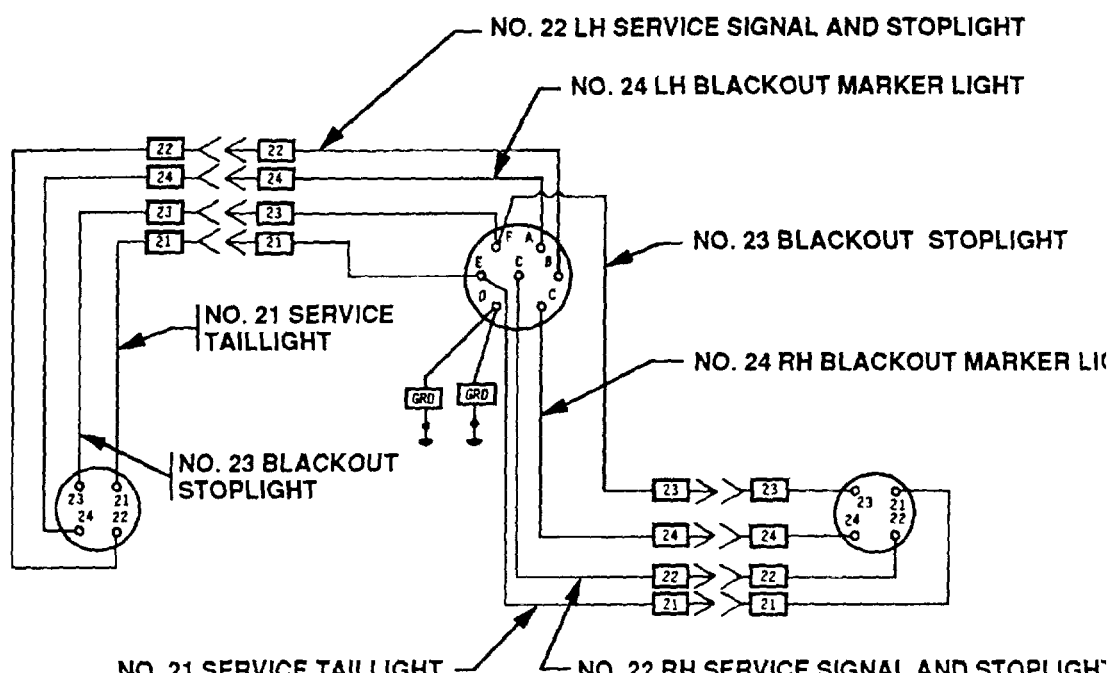
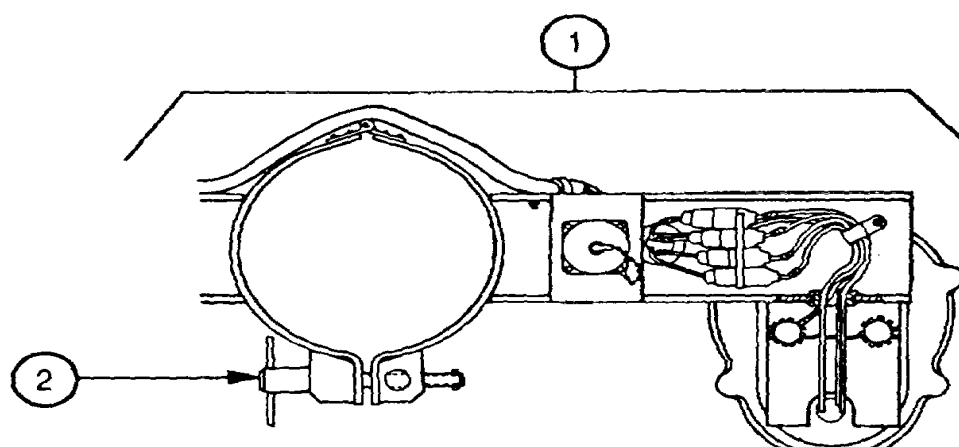


Figure 5-1. Taillight Assembly Wiring Diagram.

INSTALLATION



- 1 Install taillight assembly (1), and tighten clamp (2).
- 2 Plug cable assembly into taillight assembly (1).

5-38. LIQUID RELEASING TOOL-MAINTENANCE INSTRUCTIONS**THIS TASK COVERS:**

Inspection/repair

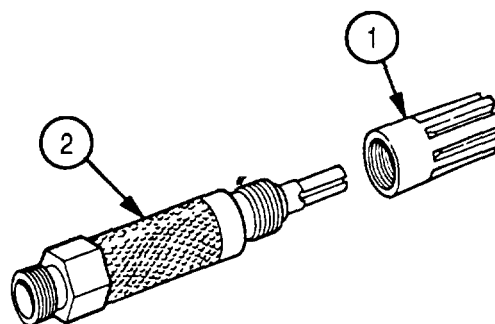
INITIAL SETUP

References

TM 9-1015-203-20P

INSPECTION/REPAIR

- 1 Check for worn or broken cap (1) and tool (2).
- 2 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

**5-39. OIL GUN-MAINTENANCE INSTRUCTIONS****THIS TASK COVERS:**

a. Disassembly

b. Inspection/repair

c. reassembly

INITIAL SETUP

Tools and Special Tools

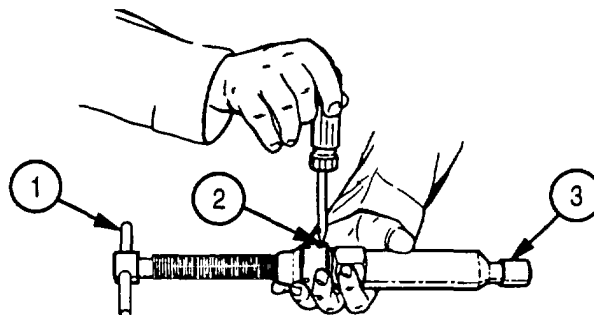
Artillery mechanic's tool kit (appx B)

References

TM 9-1015-203-20P

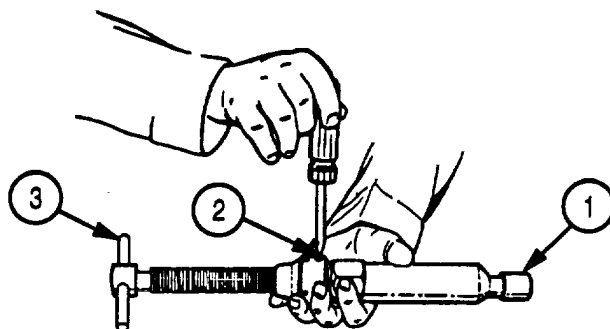
DISASSEMBLY

Remove handle (1), machine screw (2), and cap (3).



5-39. OIL GUN-MAINTENANCE INSTRUCTIONS (cont)**INSPECTION/REPAIR**

- 1 Inspect for missing, broken, or damaged parts.
- 2 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.
- 3 Replace oil gun if any parts other than the handle, machine screw, and cap are damaged and cannot perform their proper function.

**REASSEMBLY**

Install cap (1), machine screw (2), and handle (3).

5-40. M1A2 AIMING POST-MAINTENANCE INSTRUCTIONS**THIS TASK COVERS:**

a. Disassembly

b. Inspection/repair

c. Reassembly

INITIAL SETUP

References
TM 9-1015-203-20P

DISASSEMBLY

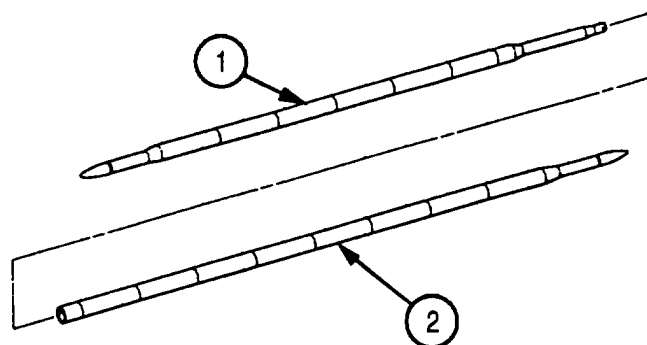
Remove tube (1) from tube (2).

INSPECTION/REPAIR

- 1 Inspect for missing, broken, or damaged parts.
- 2 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

REASSEMBLY

Install tube (2) into tube (1).



5-41. M1A1 GUNNER'S QUADRANT-MAINTENANCE INSTRUCTIONS**THIS TASK COVERS:**

Inspection/repair

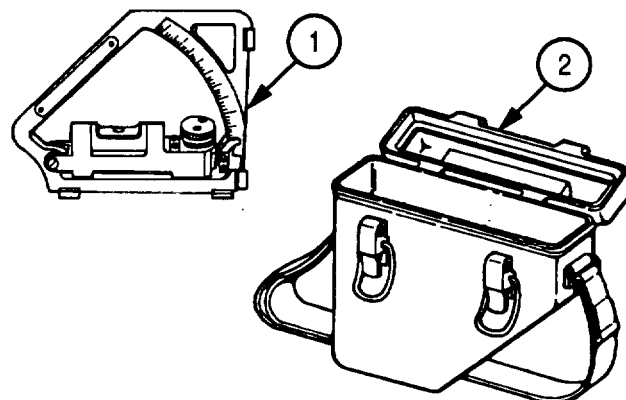
INITIAL SETUP

References

TM 9-1015-203-20P

INSPECTION/REPAIR

- 1 Check for damaged M1A1 gunner's quadrant (1) and carrying case (2).
- 2 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

**5-42. M1A1 COLLIMATOR-MAINTENANCE INSTRUCTIONS****THIS TASK COVERS:**

- | | |
|-------------------------------------|----------------|
| a. Servicing (purging and charging) | b. Disassembly |
| c. Inspection/repair | d. Reassembly |

INITIAL SETUP**Tools and Special Tools**

Automotive maintenance shop equipment (appx B)
 Compressed gas cylinder (appx B)
 Fire control purging kit (appx B)

Equipment Conditions

Fire control purging equipment set up

General Safety Instructions**Materials/Parts**

Lens tissue (item 25, appx E)
 Optical lens cleaning compound (item 8, appx E)

References

TM 9-1015-203-20P

WARNING

When maintaining radioactively illuminated fire control equipment, follow radiation hazard procedures on inside front cover of this manual.

5-42. M1A1 COLLIMATOR-MAINTENANCE

SERVICING (PURGING AND CHARGING)



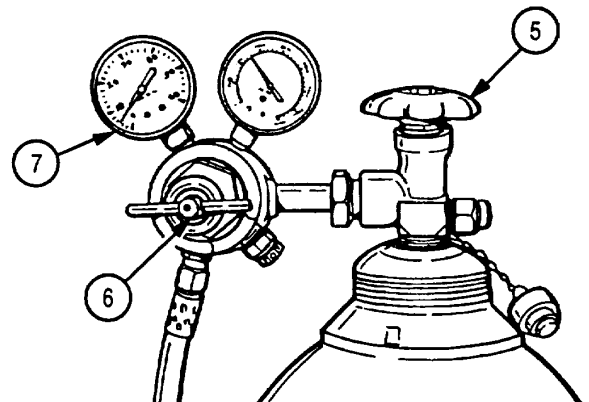
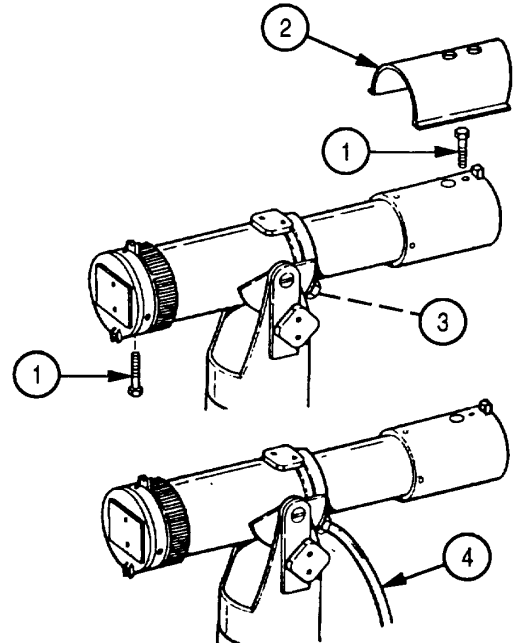
WARNING

Never exceed pressures indicated in the following procedure.

M1A1 collimator is illuminated with radioactive materials. If illumination is insufficient or nonexistent, do not purge. Notify radiological protection officer. Replace the M1A1 collimator with a serviceable one, place unserviceable M1A1 collimator in plastic bag, and evacuate it to Direct Support maintenance.

NOTE

If it is necessary to replace a compressed gas cylinder, only the compressed gas can be obtained. The empty cylinder must be taken to the proper location point for filling with nitrogen. Purge screw (1) may be out of position shown.



- 1 Remove collimator shield (2).
- 2 Remove pneumatic valve cap (3).
- 3 Remove screws (1).
- 4 Attach hose assembly (4).
- 5 Open tank valve (5) and pressure regulator valve (6).
- 6 Turn pressure regulator valve (6) clockwise until 5 psi (34 kPa) is shown on low pressure gage (7). Maintain this pressure for 5 minutes.
- 7 Turn pressure regulator valve (6) clockwise until low pressure gage (7) indicates 1 psig (7 kPa). Maintain this pressure for 10 seconds.
- 8 Close pressure regulator valve (6) and tank valve (5).

DISASSEMBLY

- 1 Remove M1A1 collimator (1) from case (2).
- 2 Remove collimator shield (3).
- 3 Remove two screws (4).
- 4 Remove pneumatic valve cap (5).
- 5 Remove valve core (6), using pneumatic tire valve repair tool.

INSPECTION/REPAIR

- 1 Inspect for missing, broken, or damaged parts.
- 2 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet the inspection criteria.

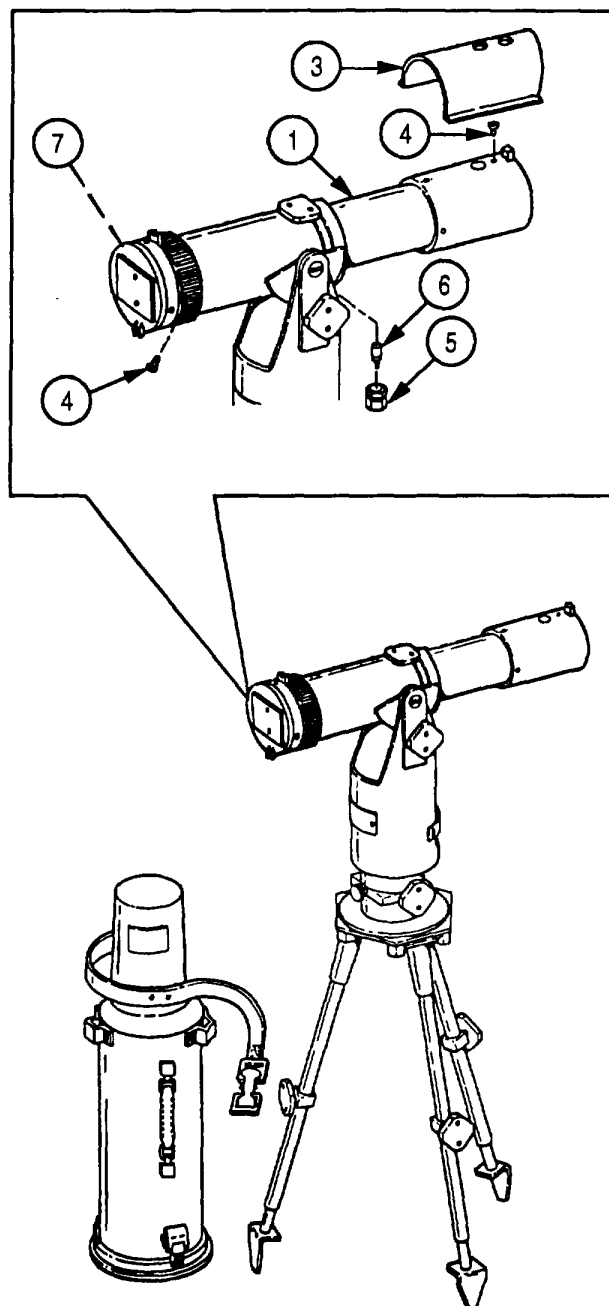
**WARNING**

If illumination of M1A1 collimator is insufficient or nonexistent, immediately follow radiation materials procedures on inside front cover of this manual.

- 3 If reticle (7) of M1A1 collimator is not illuminated, replace entire M1A1 collimator.

REASSEMBLY

- 1 Install valve core (6), using tire valve repair tool.
- 2 Install pneumatic valve cap (5).
- 3 Install two screws (4).
- 4 Install collimator shield (3).
- 5 Install M1A1 collimator (1) into case (2).



5-43. CABLE ASSEMBLY-MAINTENANCE INSTRUCTIONS**THIS TASK COVERS:**

a. Disassembly

b. Inspection/repair

c. Reassembly

INITIAL SETUP**Tools and Special Tools**

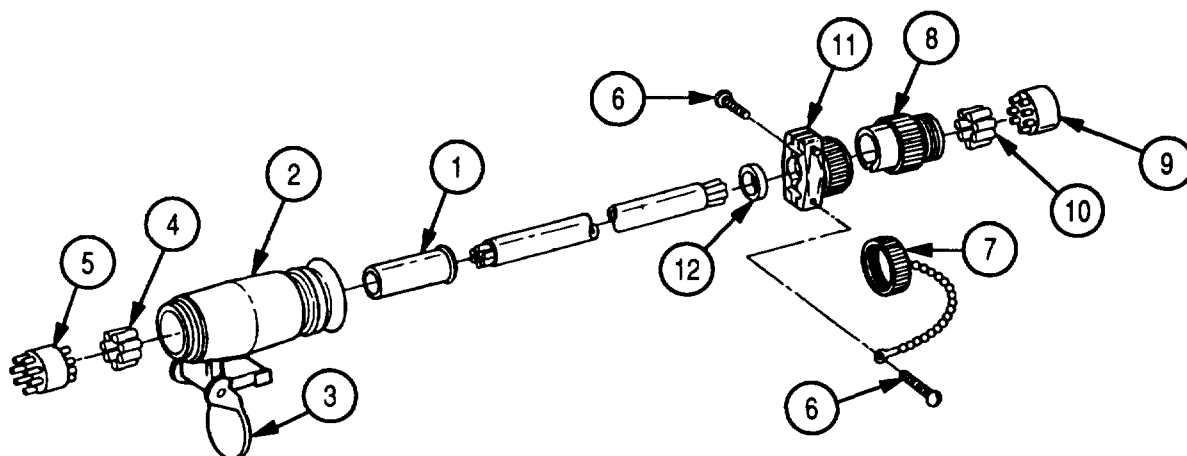
Artillery mechanic's tool kit (appx B)
Automotive maintenance shop
equipment (appx B)

References

TM 9-1015-203-20P

Materials/Parts

Solder (item 29, appx E)

DISASSEMBLY

- 1 Push back bushing (1) from connector (2).
- 2 Open cover (3) of connector (2). Push back insulation sleeving (4), and unsolder seven cable wires from connector plug (5).
- 3 Remove insulation sleeving (4), connector (2), and bushing (1).
- 4 Remove two clamp screws (6) and cover (7).
- 5 Push back connector (8), and unsolder seven cable wires from connector plug (9).
- 6 Remove insulation sleeving (10), connector (8), clamp (11), and band (12).

INSPECTION/REPAIR

- 1 Inspect for missing, broken, or damaged parts.
- 2 Repair is by replacement of authorized parts (TM 9-1015-203-20P) which do not meet inspection criteria.
- 3 If cable is damaged and needs replacing, replace entire cable assembly.

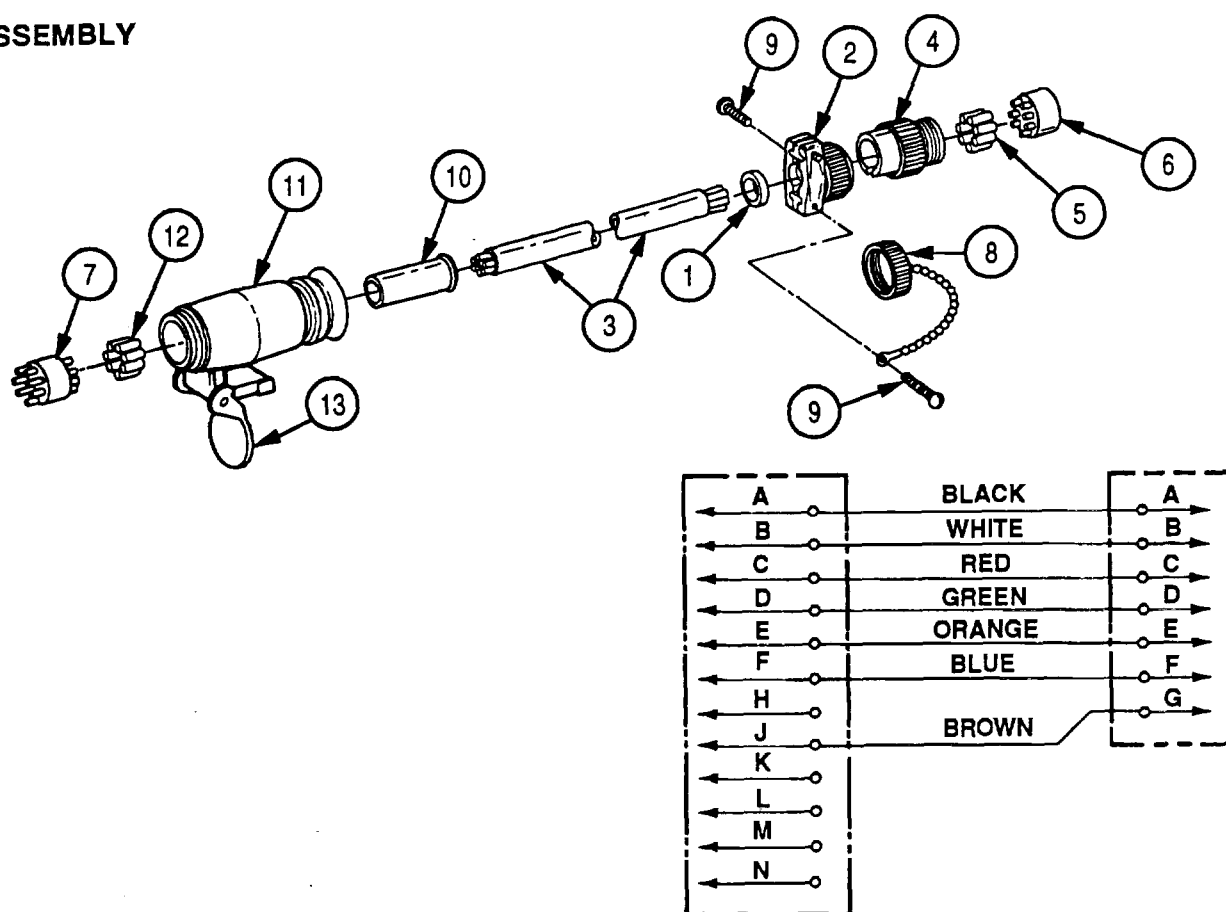
REASSEMBLY

Figure 5-2. Cable Assembly Wiring Diagram.

- 1 Place band (1) and clamp (2) on cable (3).
- 2 Install connector (4).
- 3 Install 1/2-in. (1.27-cm) long piece of insulation sleeving (5) on seven cable wires.

NOTE

Refer to figure 5-2 for correct wiring of connector plug (6) and connector plug (7).

- 4 Solder seven cable wires to connector plug (6).
- 5 Assemble connector (4), clamp (2), and cover (8); tighten with two clamp screws (9).
- 6 Slide bushing (10) and connector (11) on cable (3).
- 7 Install 1-in. (2.54-cm) long piece of insulation sleeving (12) on seven cable wires.
- 8 Solder wires to the connector plug (7).
- 9 Assemble connector (11), and install bushing (10).
- 10 Close cover (13) of connector (11).

SECTION VI. PREPARATION FOR STORAGE OR SHIPMENT**5-44. DEFINITION OF ADMINISTRATIVE STORAGE**

Placement of equipment in administrative storage can be for short periods of time not to exceed 90 days when a shortage of maintenance effort exists. Howitzers should be ready for use within time factors determined by the directing authority. During storage, appropriate maintenance records will be kept.

5-45. SCOPE

The requirements specified herein are necessary to maintain M101A1 howitzers in administrative storage in such a way as to achieve maximum readiness.

5-46. GENERAL INFORMATION

a. Equipment placed in administrative storage should be capable of being readied to perform its mission within 24 hours or as otherwise prescribed by the approving authority. Before equipment is placed in administrative storage, current maintenance services should be completed, shortcomings and deficiencies should be corrected, and all modification work orders (MWOs) should be applied.

b. Report equipment in administrative storage in Materiel Condition Status Report (AR 220-1) and Unit Status Report (AR 700-138) as prescribed for all reportable equipment.

c. Perform inspections, maintenance services, and lubrications IAW applicable technical manuals (TMs).

d. Records and reports to be maintained for equipment in administrative storage are those prescribed by DA PAM 738-750.

e. Perform applicable services on a quarterly basis.

f. Install all applicable covers.

5-47. SECURITY

Instructions contained herein do not modify security procedures and requirements for classified or pilferable items (AR 380-5).

5-48. STORAGE SITE

a. Select the best available site for administrative storage. Separate stored equipment from equipment in use. Conspicuously mark the area "Administrative Storage."

b. Covered space is preferred. When sufficient covered space for all stored howitzers is not available, select an open site.

c. Open sites should be improved hardstand, if available. Unimproved site should be firm, well-drained, and kept free of excessive vegetation.

5-49. STORAGE PLAN

- a.** Store equipment so as to provide maximum protection from the elements and to provide access for inspection, maintenance, and exercising. Anticipate removal or deployment problems and take suitable precautions.
- b.** Take into account environmental conditions such as extreme heat or cold; high humidity; blowing sand, dust, or loose debris; soft ground; mud; heavy snows; earthquakes; or combinations thereof and take adequate precautions.
- c.** Establish a fire plan and provide for adequate firefighting equipment and personnel.

5-50. MAINTENANCE SERVICES AND INSPECTION

- a.** Prior to storage, perform the next scheduled PMCS (monthly, quarterly, or semi-annually).
- b.** Inspect and approve equipment prior to storage. Do not place equipment in storage in NMC condition.

5-51. AUXILIARY EQUIPMENT AND BASIC ISSUE ITEMS

Process auxiliary and basic issue items simultaneously with the howitzer to which they are assigned. If possible, store auxiliary equipment and basic issue items with the howitzer. If stored apart from the howitzer, mark auxiliary equipment and basic issue items with tags indicating the howitzer, its registration or serial number, and location, and store in protective closures. In addition, place a tag or list indicating the location of the removed items in a conspicuous place on the howitzer.

5-52. CORRECTIONS OF SHORTCOMINGS AND DEFICIENCIES

Correct all shortcomings and deficiencies prior to storage, or obtain a deferment from the approving authority for uncorrected shortcomings.

5-53. LUBRICATION

Lubricate equipment IAW the applicable lubrication order or TM. Retract hydraulic systems and coat exposed portion of shafts with grease.

5-54. GENERAL CLEANING, PAINTING, AND PRESERVATION**CAUTION**

Do not direct water or steam under pressure against fire control instruments, covers, or any exterior opening that will damage a component.

- a.** Clean the equipment of dirt, grease, and other contaminants IAW this manual.
- b.** Remove rust and damaged paint by scraping, wire brushing, sanding, or buffing. Sand to a smooth finish and spot paint as necessary.
- c.** After cleaning and drying, immediately coat unpainted metal surfaces with an oil or grease, as appropriate.

5-54. GENERAL CLEANING, PAINTING, AND PRESERVATION (cont)**NOTE**

Air circulation under draped covers reduces deterioration from moisture and heat.

d. Sunlight, heat, moisture (humidity), and dirt tend to accelerate deterioration. Install all covers authorized from the equipment. Close and secure all openings except those required for venting and draining. Seal openings to prevent entry of rain, snow, and dust. Place equipment and provide blocking or framing to allow for ventilation and water drainage. Support cover away from howitzer surfaces that may rust, rot, or mildew.

e. For further information and instructions regarding corrosion prevention and control, refer to this manual and TM 43-0139.

5-55. PREPARATION OF CANNON AND FIRE CONTROL INSTRUMENTS**a. Cannon**

(1) Thoroughly clean, dry, and coat cannon tube with preservative (item 7, appx E) and insert a strip of Volatile Corrosion Inhibitor (VCI) paper (item 32, appx E) the full length of the tube. Seal breech and muzzle to sustain VCI benefits.

(2) Thoroughly clean and dry gun tube.

(3) Thoroughly clean and dry breechblock and breech ring before coating with preservative oil (item 7, appx E). Set breechblock in closed position.

(4) Wrap breech assembly with barrier material (item 2, appx E) and seal with tape (item 31, appx E).

b. Fire Control Instruments

(1) Remove M12A7S panoramic telescope (refer to p 5-65) and M16A1D elbow telescope (refer to p 5-69) from weapon. Clean M12A7S panoramic telescope and M16A1D elbow telescope with cleaning compound (item 9, appx E) and dry with a clean wiping rag (item 26, appx E). Preserve with general purpose lubricating oil (item 23, appx E) wrap with barrier material (item 2, appx E), and secure with tape (item 31, appx E). Place wrapped items in BII box.

(2) With M23 direct fire mount and M21 A1 telescope mount assembled and in mounted position, preserve unpainted metallic surfaces with automotive and artillery grease (item 13, appx E). Wrap preserved surfaces with barrier material (item 2, appx E) and secure with tape (item 31, app E). Rewrap with waterproof barrier material (item 2, appx E) and secure with tape (item 31, appx E). Cut a 1 in. (2.54-cm) opening on the underside of the wrap to provide for drainage.

5-56. CARE OF EQUIPMENT IN ADMINISTRATIVE STORAGE

a. Maintenance Services. After equipment has been placed in administrative storage, suspend all regularly scheduled PMCS and inspect and exercise as specified herein. Do not reduce Prescribed Load List (DA PAM 710-2-1).

b. Inspection. Inspection will usually be visual and must consist of at least a walk-around examination of all equipment to observe any deficiencies that may have occurred. Inspect equipment in open storage weekly and that in covered storage monthly. Inspect equipment immediately after any severe storm or environmental change. The following are examples of things to look for during visual inspection:

- (1) Leaks: oil or hydraulic fluid.
- (2) Condition of preservatives, seals, and wraps. Seals may develop leaks during storage or shortly thereafter. If leaking continues, refer to the repair procedures in this manual or notify Direct Support maintenance.
- (3) Corrosion or other deterioration (refer to this manual).
- (4) Missing or damaged parts.
- (5) Water in compartments.
- (6) Purge and charge fire control instruments as required (refer to TM 750-116).
- (7) Any other readily recognizable shortcomings or deficiencies.

c. Rotation. To ensure utilization of all assigned materiel, rotate items IAW any rotational plan that will keep equipment in an operational condition and reduce maintenance effort.

d. Removal From Administrative Storage. Remove preservative materials. Perform the next scheduled PMCS and prepare equipment for service as outlined in this manual.

e. Servicing. Resume the maintenance service schedule in effect at the commencement of storage or service the equipment before the scheduled dates in order to produce a staggered maintenance workload.

APPENDIX A REFERENCES

A-1. TECHNICAL MANUALS (TM)

TM 3-220	Chemical, Biological, and Radiological (CBR) Decontamination
TM 3-4230-204-12&P	Operator's and Unit Maintenance Manual for Decontamination Apparatus Portable: DS-2
TM 9-1000-202-14.....	Operator's, Unit, Direct Support, and General Support Maintenance Manual for Evaluation of Cannon Tubes
TM 9-1015-203-12-HR	Hand Receipt Manual Covering Basic Issue Items (BII) and Additional Authorization List (AAL) for Howitzer, Light: Towed, 105-MM, M101 (NSN 1015-00-322-9728) and M101AI (NSN 1015-00-322-9752)
TM 9-1015-203-20P	Unit Maintenance Repair Parts and Special Tools List for Howitzer, Light, Towed: 105-MM, M101AI
TM 9-1015-203-34P	Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Howitzer, Light, Towed: 105-MM, M101A1
TM 9-1200-210-34P	Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Telescope, Panoramic: M12A7S; Mount, Telescope: M21A1; Telescope, Elbow: M16A1D; Mount, Telescope: M23; and Quadrant, Range: M4A1 (for M101A1 Howitzer)
TM 9-1300-206.....	Ammunition and Explosives Standards
TM 9-2610-200-20.....	Unit Care, Maintenance, and Repair of Pneumatic Tires, Inner Tubes, and Radial Tires
TM 43-0001-28.....	Army Ammunition Data Sheets for Artillery Ammunition: Guns, Howitzers, Mortars, Recoilless Rifles, Grenade Launchers, and Artillery Fuzes
TM 43-0001-28-10.....	Artillery Ammunition: Authorized Projectile, Fuze, and Propelling Charge Combination for Howitzer, Light, Towed; 105-MM, M101A1, and M102
TM 43-0139	Paint Instructions for Field Use

A-1. TECHNICAL MANUALS (TM) (cont)

TM 55-450-12	Air Transport of Supplies and Equipment Helicopter External Loads for Sling, Nylon and Chain, Multiple Leg
TM 750-116	General Procedures for Purging and Charging of Fire Control Instruments
TM 750-244-7	Procedures for Destruction of Equipment in Federal Supply Classifications 1000, 1005, 1010, 1015, 1020, 1025, 1030, 1055, 1090, and 1095 to Prevent Enemy Use

A-2. DEPARTMENT OF THE ARMY FORMS (DA Form)

DA Form 2028	Recommended Changes to Publications
DA Form 2028-2	Recommended Changes to Equipment Technical Publications
DA Form 2062	Hand Receipt/Annex Number
DA Form 2404	Equipment Inspection and Maintenance Worksheet
DA Form 2408-4	Weapon Record Data

A-3. SUPPLY CATALOGS (SC)

SC 4910-95-CL-A74	Shop Equipment, Automotive Maintenance and Repair: Unit Maintenance, Common No. 1, Less Power and MAP Only
SC 4910-95-CL-J54	Purging Kit, Fire Control: Unit, Direct Support, and General Support Maintenance
SC 5180-95-CL-A43	Tool Kit, Artillery Mechanics

A-4. OTHER

AR 25-30	Identification and Distribution of DA Publications and Issue of Agency and Command Administrative Publication
AR 220-1	Unit Status Reporting
AR 380-5	Department of the Army Information Security Program
AR 385-11	Ionizing Radiation Protection (Licensing, Control, Transportation Disposal, and Radiation Safety)
AR 385-63	Policies and Procedures for Firing Ammunition for Training, Target Practice, and Combat

AR 700-64	Radioactive Commodities in the Department of Defense Supply Systems
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 710-2-1	Using Unit Supply System, Manual Procedures
DA PAM 738-750.....	The Army Maintenance Management System (TAMMS)
FM 6-40	Field Artillery Cannon Gunnery
FM 9-207	Operation and Maintenance of Ordnance Material in Cold Weather (O to -65°F (-18 to -54°C))
FM 21-11	First Aid for Soldiers
FM 21-40	NBC (Nuclear, Biological, and Chemical) Defense
FM 31-70	Basic Cold Weather Manual
FM 31-71	Northern Operations
FT 105 ADD-B-2.....	Addendum to FT 105-H-6 for Cartridge, HE, M444
FT 105-H-7	Cannon, 105-MM Howitzer: M2A2 and M2A1 on Howitzer, Light, Towed: 105-MM, M101A1 and M101 and Cannon, 105-MM Howitzer: M4 on Howitzer, Light, Self-Propelled, Full-Track, 105-MM: M52A1 and M52; Firing Cartridge, HE: M1; Cartridge, Gas Persistent, H and HD, M60; Cartridge, Gas, Nonpersistent, GB, M360; Cartridge, Smoke, WP, M60; Cartridge, Smoke, BE, M84 and M84B1 (HC and Colored); Cartridge, Smoke, HC, BE, M84A1 (M84E1); Cartridge, Illuminating, M314A3 (M314A2E1); Cartridge, HEP-T, M327; Cartridge, Antipersonnel, XM546 and Cartridge, HEAT-T, M622
MWO 9-1000-260-20-1	Secure Lights
SB 708-42.....	Federal Supply Code for Manufacturers; United States and Canada-Name to Code and Code to Name
SF 364	Report of Discrepancy (ROD)
SF 368	Product Quality Deficiency Report

A-4. OTHER (cont)

TB 9-1300-385 Munitions; Restricted or Suspended

TI 8300-24/2 Performance of Annual/Semi-Annual Preventive
Maintenance on Howitzer, Towed, 105-MM and
155-MM Mounts and Ancillary Fire Control Equip-
ment

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

10 CFR Part 20 Standards for Protection Against Radiation

APPENDIX B MAINTENANCE ALLOCATION CHART (MAC)

SECTION I. INTRODUCTION

B-1. The Army Maintenance System MAC

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels under the standard Army Maintenance System concept.

b. The Maintenance Allocation Chart (MAC) in section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance levels, which are shown on the MAC in column (4) as:

Unit-includes two subcolumns, C (operator/crew) and O (unit) maintenance.

Direct-Support-includes an F subcolumn.

General-Support-includes an H subcolumn.

Depot-includes a D subcolumn.

c. Section III lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. Maintenance Functions. Maintenance functions are limited to and defined as follows: (except for ammunition MAC1).

a. **Inspect.** To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).

b. **Test.** To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. **Service.** Operations required periodically to keep an item in proper Operating condition, e.g., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. **Adjust.** To maintain or regulate, within prescribed limits, by bringing into proper position or by setting the operating characteristics to specified parameters.

¹Exception is authorized for ammunition MAC to permit use of maintenance function headings that better describe or identify ammunition maintenance functions. The headings used and their definitions shall be included in the appropriate ammunition technical manual(s).

B-2. Maintenance Functions. (cont)

- e. Align.** To adjust specified variable elements of an item to bring about optimum or desired performance.
- f. Calibrate.** To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.
- g. Remove/install.** To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.
- h. Replace.** To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and assigned maintenance level is shown as the 3d position code of the SMR code.
- i. Repair.** The application of maintenance services², including fault location/troubleshooting³, removal/installation, and disassembly/assembly⁴ procedures, and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.
- j. Overhaul.** That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications (i.e., DMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.
- k. Rebuild.** Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (e.g., hours/miles) considered in classifying Army equipment/components.

B-3. Explanation of Columns in the MAC, Section II

- a. Column 1, Group Number.** Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly.
- b. Column 2, Component/Assembly.** Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

²Services-inspect, test, service, adjust, align, calibrate, and/or replace.

³Fault location/troubleshooting-the process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or unit under test (UUT).

⁴Disassembly/assembly-the step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned an SMR code for the level of maintenance under consideration (i.e., identified as maintenance significant).

⁵Actions-welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in column 2. (For detailed explanation of these functions, refer to para B-2.)

d. Column 4, Maintenance Level. Column 4 specifies each level of maintenance authorized to perform each function listed in Column 3, by indicating work time required (expressed as manhours in whole hours or decimals) in the appropriate subcolumn. This work-time figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance levels, appropriate work-time figures are shown for each level. The work-time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC. The symbol designations for the various maintenance levels are as follows:

C.....	Operator or crew maintenance
O.....	Unit maintenance
F.....	Direct support maintenance
H.....	General support maintenance
L.....	Specialized Repair Activity (SRA) ⁶
D.....	Depot maintenance

e. Column 5, Tools and Equipment. Column 5 specifies, by code, those common tool sets (not individual tools), common TMDE, and special tools, special TMDE, and special support equipment required to perform the designated function. Codes are keyed to tools and test equipment in section III.

f. Column 6, Remarks. When applicable, this column contains a letter code, in alphabetic order, which is keyed to the remarks contained in section IV.

B-4. Explanation of Columns in Tool and Test Equipment Requirements, Section III

a. Column 1, Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.

b. Column 2, Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, National Stock Number. The National Stock Number of the tool or test equipment.

e. Column 5, Tool Number. The manufacturer's part number, model number, or type number.

⁶This maintenance level is not included in section II, column (4) of the MAC. Functions to this level of maintenance are identified by a work-time figure in the "H" column of section II, column (4), and an associated reference code is used in the Remarks column (6). This code is keyed to Section IV, Remarks, and explain the SRA complete repair application there.

B-5. Explanation of Columns in Remarks, Section IV

- a. **Column 1, Reference Code.** The code recorded in column 6, section II.
- b. **Column 2, Remarks.** This column lists information pertinent to the maintenance function being

**Section II. MAINTENANCE ALLOCATION CHART
FOR
M101A1 HOWITZER**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
00	M101A1 TOWED LIGHT HOWITZER 12000669	Service Repair Overhaul		0.1 0.5		0.2	40.0	31	
01	M2A2 105-MM CANNON 7827208	Inspect Service Remove/ Install Replace Repair	0.3 0.2	0.4 4.0				2,27	
				0.3		2.0 0.5		31,39 32,47,48 21,25	
0101	BREECH MECHANISM ASSEMBLY 7307432	Inspect Service Remove/ Install Repair	0.1 0.2	0.1					
			0.3	0.5	2.0			17,18,19 31,32,47, 48	A
010101	BREECH RING 7307430	Inspect Repair	0.1		1.0		0.5	17,18,19 32,47,48	
010102	BREECHBLOCK LEVER 7307145	Inspect Remove/ Install Replace Repair		0.1				17,18,19	
			0.1	0.1 0.5	2.0			32 32	
010103	M13 FIRING LOCK 5508662	Inspect Service Remove/ Install Replace Repair	0.1 0.3	0.1 0.3					
			0.1	0.1 0.5				17,18,19	

**Section II. MAINTENANCE ALLOCATION CHART
FOR
M101A1 HOWITZER (cont)**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
02	M2A4 AND M2A5 RECOIL MECHANISM 8412425 8412320	Inspect Test Service Adjust Remove/ Install Replace Repair Overhaul	0.1 0.5 0.1 0.1	0.5 1.0 0.3 0.1	1.0 2.0 1.0			30,32 3,14 11,30 39 31 26,32 21,43,44, 45,46 20.0	
0201	RECUPERATOR CYLINDER REAR HEAD ASSEMBLY 5565114	Repair			0.5		2.0	20,21,43, 44,45,46	
020101	RECUPERATOR CYLINDER HOUS- ING AND DOWEL ASSEMBLY 7717367	Replace Repair					0.5 2.0		
0202	FLOATING PISTON 8401347	Repair					3.25		
020201	PISTON AND GASKET ASSEMBLY 8407779	Replace Repair					0.5 3.5		
020202	FLOATING RETAINER 7124186	Replace					0.5		
0203	CHARGING REGULATOR 6532112	Repair					3.0		
0204	RECUPERATOR CYLINDER FRONT HEAD ASSEMBLY 6532064	Inspect Repair	0.1	0.1	1.0		1.25	31,32	

**Section II. MAINTENANCE ALLOCATION CHART
FOR
M101A1 HOWITZER (cont)**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
020401	OIL INDEX DOWEL HEAD 7117194	Repair					0.25		
020402	OIL FITTING RETAINER 7110386	Replace Repair			0.1 1.5			32	
0205	RESPIRATOR 6195116	Inspect Service Adjust Replace Repair	0.1 0.1	0.2	1.0 5.0			38 38 32,43,44, 45,46	
020501	HEAD ASSEMBLY VALVE RESPIRATOR 7123279	Replace Repair			0.3 0.3			32 43,44,45, 46	
0206	RECOIL PISTON 8401348	Replace Repair			0.5		0.5 2.5	32	
020601	RECOIL PISTON GLAND 7117371	Replace Repair					1.0 0.1		
0207	PISTON ROD ASSEMBLY 5548036	Replace Repair		0.1	0.3		0.5 0.5	31	
0208	STUFFING BOX ASSEMBLY 8401349	Replace Repair					1.0 2.5		
020801	RECOIL STUFF- ING BOX GLAND 7117372	Replace					0.5		
0209	RECOIL SLEIGH ASSEMBLY (M2A4 ONLY) 8412424	Inspect Service Replace Repair	0.1 0.2				1.0 4.0	11 31,32	

**Section II. MAINTENANCE ALLOCATION CHART
FOR
M101A1 HOWITZER (cont)**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
0210	RECOIL SLEIGH ASSEMBLY (M2A5 ONLY) 8412322	Inspect Service Replace Repair	0.1 0.2					11 31,32	
03	M2A2 HOWITZER CARRIAGE 7141820	Inspect Service Adjust Repair	0.2 0.5	0.2 0.2 0.5				12,21,25, 31,32 12,21,25,	
301	PANORAMIC AND ELBOW CASE 6540871	Inspect Service Replace	0.1 0.5					21,25,32	
030101	PANORAMIC TELESCOPE HOLDER ASSEMBLY 7117208	Replace Repair			0.2 0.2			21,25,32 32	
030102	ELBOW TELE- SCOPE HOLDER 7110385	Replace Repair			0.2 0.2			21,25,32 32	
0302	AUXILIARY SHIELD ASSEMBLY 6584528	Service Replace Repair	0.1		0.2 0.2			21,25,32 32	
0303	SHIELD ASSEMBLY 65845289	Service Replace Repair	0.1		0.5 0.1			21,25,32 31,32	
030301	TOP RH SHIELD ASSEMBLY 7110058	Service Replace Repair	0.1	1.0			0.5	21,25,32	
030302	UPPER RH ASSEMBLY 7110059	Service Repair	0.1				0.5		

**Section II. MAINTENANCE ALLOCATION CHART
FOR
M101A1 HOWITZER (cont)**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
030303	BOTTOM SHIELD ASSEMBLY 7110054	Service Replace Repair	0.1		1.0		0.5	21,25,32	
030304	LOWER LH SHIELD ASSEMBLY 711055	Service Replace Repair	0.1		1.0		0.5	21,25,32	
030305	LOWER RH SHIELD ASSEMBLY 7110056	Service Replace Repair	0.1		0.1		0.5	21,25,32	
030306	SHIELD ASSEMBLY LATCH 6292121	Service Replace Repair	0.1		0.3 0.3			21,25,32 31,32	
030307	UPPER RH SHIELD ASSEMBLY 7110060	Service Replace Repair	0.1		1.0		0.5	21,25,32	
0304	ELEVATING MECHANISM ASSEMBLY 6536786	Inspect Service Replace Repair	0.1 0.1	0.3	6.0 4.0	8.0		21,25,32 21, 31, 32	
030401	ELEVATING HANDWHEEL ASSEMBLY 5572537	Inspect Service Replace Repair	0.1 0.1		0.2 0.2			21,32 32	
030402	GEAR CASE 7100139	Service Replace Repair		0.3		0.4 0.4			21,32 32
030403	ELEVATING GEAR ASSEMBLY HOUSING 7100140	Service Replace Repair		0.1	1.0 1.0			21,32 32	

**Section II. MAINTENANCE ALLOCATION CHART
FOR
M101A1 HOWITZER (cont)**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
030404	ELEVATING SHAFT ASSEMBLY 7100143	Service Replace Repair		0.1	2.0 0.2			21,32 32	
030405	M2A2 CARRIAGE CRADLE 7109050	Inspect Service Replace Repair	0.1 0.3	0.3		4.0 0.5	4.0	35,36,37 21,25,32 31,32	
03040501	ELEVATING MECHANISM WITH BEARING STRIPS CRADLE	Replace Repair				4.0	4.0	32	
030406	RECOIL ASSEMBLY INDICATOR 7116209	Service Replace Repair	0.1	0.2	0.2		32	21,32	
0305	FIRING MECHANISM ASSEMBLY 6536814	Service Replace Repair	0.1	0.1	0.5 1.5			21,32 31,32	
0306	TRAVERSING MECHANISM ASSEMBLY 6554401	Inspect Service Replace Repair	0.1 0.1	0.3	1.0 1.0			21,32 32	
030601	HANDWHEEL ASSEMBLY 5593056	Inspect Service Replace Repair	0.1 0.1		0.2 0.2			32 32	
030602	BRACKET ASSEMBLY 7109365	Replace Repair			0.4 0.4			32 32	
03060201	BRACKET AND CAP ASSEMBLY 12000583	Repair			0.4			32	

**Section II. MAINTENANCE ALLOCATION CHART
FOR
M101A1 HOWITZER (cont)**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
030603	BRACKET ASSEMBLY 7109364	Service Replace Repair		0.1	0.2 0.2			32 32	
030604	COLLAR ASSEMBLY 7109366	Replace Repair			0.3 0.3			32 32	
0307	TOP CARRIAGE AND ELEVATING ARC 6534353	Service Replace Repair	0.1			2.0 1.0	2.0	12,21,25, 32 32	
030701	TOP CARRIAGE 7100138	Service Replace Repair		0.1		8.0 1.0		32 32	
030702	ELEVATING AND BUSHING ASSEMBLY ARC 7111843	Replace Repair				2.0 2.0		32 32	
030703	EQUILIBRATOR ASSEMBLY 6536732	Inspect Service Adjust Replace Repair	0.2	0.1 0.4 0.1 0.1	0.5 1.0		1.0	31 32 31,32	
03070301	EQUILIBRATOR END 7109367	Replace Repair				0.5 0.5		32 32	
0308	RH AND LH WHEEL AND HUB ASSEMBLY 6540951-1 6540951-2	Inspect Service Adjust Replace Repair	0.1	0.1 0.1 0.2 0.2	0.5 1.0			21,25,32 22,32	
030801	WHEEL AND TIRE ASSEMBLY 7148539	Inspect Replace Repair	0.1	0.1 0.5 0.5				22 22	

**Section II. MAINTENANCE ALLOCATION CHART
FOR
M101A1 HOWITZER (cont)**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
03080101	PNEUMATIC TIRE WHEEL 7389618	Inspect	0.1	0.1					
		Service	0.1	0.1					
		Replace		0.5					22
		Repair		0.2					22
030802	RH AND LH HUB AND STUD ASSEMBLY 6195809 7106095	Inspect		0.1					
		Adjust		0.1					22,31
		Replace			0.5				32
		Repair			1.0				32
03080201	HUB AND CUP ASSEMBLY 7122054	Inspect		0.1					
		Service		0.1					
		Adjust		0.1					31
		Replace			0.1				12,21,25,
0309	TRAIL HINGE PIN 5572556	Repair		1.0	1.0				32
		Service		0.1					22,32
		Replace			1.0				21,25,32
		Repair		0.1	1.0				31,32
0310	TRAIL AND SPADE ASSEMBLY 6536026	Inspect	0.1	0.1					
		Service	0.1						
		Adjust			0.2				32
		Replace			2.0				21,25,32
031001	LH TRAIL ASSEMBLY 6536984	Repair		0.1	0.5				31,32
		Replace			2.0				32
		Repair		0.1	0.5				32
		Replace			0.2				32
03100101	HANDSPIKE SUPPORT ASSEMBLY 6159496	Replace			0.2				32
		Repair			0.2				32
		Inspect		0.1					
		Adjust			0.1				32
031002	TRAIL ASSEMBLY M12 DRAWBAR 6531673	Replace			0.2				32
		Repair			0.2				32
		Inspect		0.1					32
		Adjust			0.1				32

**Section II. MAINTENANCE ALLOCATION CHART
FOR
M101A1 HOWITZER (cont)**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
031003	KNOB ASSEMBLY 6144281	Replace Repair			0.2 0.2			32 32	
031004	TRAIL LOCKING LATCH ASSEMBLY 5174779	Replace Repair			0.1 0.5			32 32	
031005	RH TRAIL ASSEMBLY 7109047	Replace Repair		0.1	2.0 0.5			32 31,32	
03100501	AIMING POST SUPPORT 6159704	Replace Repair			0.2 0.2			32 32	
0311	TRAVEL LOCK ASSEMBLY 6537653	Inspect Service Adjust Replace Repair	0.1 0.1	0.1		0.3 0.5 0.5		31 21,25,32 32	
0312	CRADLE LOCK STRUT ASSEMBLY 6537654	Inspect Service Adjust Replace Repair	0.1 0.1	0.2		0.5 0.2		31 21,25,32 32	
031201	STRUT LATCH ASSEMBLY 6160189	Service Replace Repair	0.1		0.2 0.2			32 32	
0313	PINTLE ASSEMBLY 6554169	Service Replace Repair	0.1	0.1		2.0 4.0		12,21,32 31,32	
031301	SUPPORT 7114329	Service Replace Repair	0.2	0.3		2.0 2.5		32 32	
031302	PINTLE AXLE ASSEMBLY 7110053	Replace Repair				3.0 2.5		32 32	

**Section II. MAINTENANCE ALLOCATION CHART
FOR
M101AI HOWITZER (cont)**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
031303	LOWER STRUT LATCH 6167214	Service Replace Repair	0.1				0.5 0.3	32 32	
0314	RH AND LH AXLE LOCK ASSEMBLY 6536791-2 6536791-1	Inspect Service Replace Repair	0.1 0.1	0.4 0.1	0.5 0.5			32 31,32	
0315	RH AND LH BRAKE OPERAT- ING ASSEMBLY 6554164-1 6554164-2	Inspect Service Adjust Replace Repair	0.1 0.1	0.1 0.2	0.2 0.5 2.0			31,32 21,25,32 32	
031501	RH AND LH BRAKE ASSEM- BLY LEVER 7106569 7106570	Service Replace Repair	0.1		1.5 0.5			32 32	
031502	BRAKE ASSEMBLY 6554163	Replace Repair			1.5 1.0			32 32	
03150201	BACKING PLATE ASSEMBLY 6554161	Replace Repair			0.2 0.5			32 32	
031502- 0101	BRAKE BAND AND LINING 6537585	Replace Repair			1.0 1.0			32 32	
031502- 0102	PLATE AND BUSHING ASSEMBLY 8403795	Replace Repair			0.2 0.5			32 32	
0316	SIGHT ASSEMBLY BRACKET 7119041	'Adjust Align Replace Repair			0.2 0.1	0.3	0.2	6,7,8,16 21,25,32 32	23

**Section II. MAINTENANCE ALLOCATION CHART
FOR
M101A1 HOWITZER (cont)**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
04	M12A7S PANORAMIC TELESCOPE 8213037	Inspect Service Align	0.2	0.2		1.0		4,13,23, 24	
		Remove/ Install	0.1						
		Replace	0.2						
		Repair	0.1		0.2	2.0		4,23,31, 33	
		Overhaul					8.0		
0401	ROTATING HEAD ASSEMBLY 7687283	Replace Repair		0.1	0.2	0.5 1.0		4,23 23,31,33	
040101	PRISM ASSEM- BLY HOLDER 7669744	Replace Repair				0.2 0.3		4,23 23,31,33	
0402	SCALE ASSEMBLY 7687283	Replace Repair				0.1 0.2		23 23	
0403	COLLAR 7687280	Replace Repair				0.1 0.1		33 23	
0404	AZIMUTH WORM HOUSING ASSEMBLY 7687285	Replace Repair				0.4 0.6		33 23	
0405	GEAR ASSEMBLY 7636238	Replace Repair				0.3	0.2	4,23	
0406	OPTICAL INSTRU- MENT PRISM 7635302	Replace Repair				0.1 0.2		23 23	
0407	SHANK ASSEMBLY 7636577	Replace Repair				0.2 0.1		33 23	

**Section II. MAINTENANCE ALLOCATION CHART
FOR
M101A1 HOWITZER (cont)**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
0408	OBJECTIVE ASSEMBLY 7635305	Replace Repair				0.2 0.2		23, 39 23, 39	
0409	EYEPiece ASSEMBLY 8289215	Replace Repair				0.2 0.1		33 23, 39	
040901	RETICLE CELL ASSEMBLY 8289214	Replace Repair				0.2 0.2		23, 39 23, 39	
040902	EYELENS CELL ASSEMBLY 7687265	Replace Repair				0.2 0.2		23, 39 23, 39	
0410	ELBOW ASSEMBLY 7199579	Align Replace Repair	0.3			0.2 0.5	33	23, 31	
041001	ELBOW 7199972	Replace Repair				0.5 0.1		23 23, 39	
05	M21A1 TELESCOPE MOUNT 7578396	Inspect Test		0.1		0.1		5, 9, 10, 13, 14, 16, 20, 23, 24, 29, 42	
		Adjust	0.1			0.3		5, 9, 10, 13, 14, 16, 20, 23, 24, 29, 42	
		Align				1.0		5, 9, 10, 13, 14, 16, 20, 23, 24, 29, 42	
		Replace Repair Overhaul		0.5 0.1	1.0	2.0	6.0	31 23, 31, 33	
0501	SOCKET ASSEMBLY 5577667	Replace Repair			0.1 0.3			33 33	

**Section II. MAINTENANCE ALLOCATION CHART
FOR
M101 A1 HOWITZER (cont)**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
0502	CLAMP ASSEMBLY 6271166	Replace Repair				0.1 0.2		23, 33 33	
0503	CROSS LEVEL- ING MECHANISM ASSEMBLY 6529350	Replace Repair				0.2 0.5		23, 33 33	
050301	SEGMENT ASSEMBLY 6177107	Replace Repair				0.5 0.5		33 33	
050302	HOUSING ASSEMBLY 7634047	Replace Repair				0.2 0.2		33 23	
0504	ACTUATING ARM ASSEMBLY 5631044	Replace Repair				0.3 0.3		23, 33 23, 33	
06	M1GA1D ELBOW TELESCOPE 7597781	Inspect Service Align Remove/ Install Replace Repair	0.1 0.1	0.1 0.5 0.1		1.0 0.5		4, 5, 13, 23 31 5, 31, 33,	
0601	EYEPIECE ASSEMBLY 6139342	Replace Repair				0.2 0.3		5, 33, 39 39	
0602	OPTICAL RETICLE 7641312	Replace Repair				0.2 0.2		5, 33, 39 39	
0603	COVER ASSEMBLY 7640259	Replace Repair				0.1 0.1		5, 33, 39 39	

**Section 11. MAINTENANCE ALLOCATION CHART
FOR
M101A1 HOWITZER (cont)**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
0604	OPTICAL INSTRUMENT CELL ASSEMBLY 6139343	Replace Repair				0.2 0.3		5, 33, 39 39	
07	M23 TELESCOPE MOUNT 7578441	Inspect Adjust	0.1 0.1					16, 17, 18, 19, 28, 35, 36, 37	
		Align Replace Repair Overhaul		0.2		1.0 0.6	2.0	33 31 33	
0701	BRACKET ASSEMBLY 6139366	Replace Repair				0.3 0.3		33 33	
0702	PLUG ASSEMBLY 6139364	Replace Repair				0.1 0.2		33 33	
08	M4A1 FIRE CONTROL QUADRANT 7597761	Inspect Adjust	0.1 0.1					16, 17, 18, 19, 28	
		Align				1.0		1, 3, 4, 6, 13, 16	
		Replace Repair Overhaul		0.3 0.1	1.5	2.0	3.0	31 31, 33	
0801	ELECTRIC SWITCH BRACKET 5577688	Replace Repair				1.2 0.2		33 23	
080101	COVER ASSEMBLY 7646052	Replace Repair				0.1 0.1		33 33	
080102	CONTACT ASSEMBLY 7634775	Replace Repair				0.2 0.2		23 23	

**Section 11. MAINTENANCE ALLOCATION CHART
FOR
M101AI HOWITZER (cont)**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
0802	HOUSING ASSEMBLY 5577686	Replace Repair			0.1	0.4 0.6		33 33	
080201	LEVEL HOUSING 6139113	Replace Repair				0.2 0.1		33 23	
0803	CROSS LEVEL- ING MECHANISM ASSEMBLY 5577691	Replace Repair				0.1 0.6		33 33	
080301	SEGMENT ASSEMBLY 7646054	Replace Repair				0.5 0.5		33 33	
0804	STAKED BRACKET 7676329	Replace Repair				0.2 0.2		33 33	
0805	GEAR WORM 7677471	Replace Repair				0.2 0.1		33 33	
09	M19 INSTRUMENT LIGHT 6543648	Inspect Remove/ Install Replace Repair	0.1 0.1	0.1 0.2					
10	M36 INSTRUMENT LIGHT 7690564	Inspect Remove/ Install Replace Repair	0.1 0.1	0.1 0.2	1.0				
11	GUN TUBE LEVELING FIXTURE AND CASE 11578744	Remove/ Install Replace Repair	0.1	0.1 0.3				32	

**Section II. MAINTENANCE ALLOCATION CHART
FOR
M101A1 HOWITZER (cont)**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
12	ARTILLERY BORE CLEANING BRUSH 105-110-401	Service	0.1						
13	TAILLIGHT ASSEMBLY 9334046	Inspect Remove/ Replace Install Repair	0.1	0.1 0.1 0.5				31 31	
1301	TURN AND MARKER STOP STOP LIGHT- TAILLIGHT MS521 25-2	Inspect Replace Repair		0.1 0.1 0.5				31 31	
14	LIQUID RELEAS ING TOOL ASSEMBLY 8410594	Replace		0.1					
15	HAND OPERATED OIL GUN 5506661	Replace Repair		0.1 0.1					
16	M1A2 AIMING POST 7687114	Remove/ Install Replace Repair	0.1	0.1 0.1					
17	M1A1 GUNNER'S QUADRANT (WITH CARRYING CASE) 7197156	Inspect Test Replace Repair Overhaul	0.1 0.2	0.1	1.0		2.0		

**Section II. MAINTENANCE ALLOCATION CHART
FOR
M101AI HOWITZER (cont)**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
18	M1A1 COLLIMATOR 10556235	Inspect Service Adjust Replace Repair	0.1	0.1 0.5 2.5 4.0	0.1 0.5 7.0	0.1 0.5 0.1		3, 15, 22, 31	
		Overhaul				6.0			
1801	COVER ASSEMBLY 10556129	Inspect Replace Repair	0.1 0.5 1.0						
1802	COLLIMATOR SCOPE ASSEMBLY M1A1- 10556232	Inspect Service Replace Repair			0.1 0.5 0.5 0.2	0.1 0.5 0.5 0.5	3.0		
180201	OBJECTIVE CELL ASSEMBLY 1055922	Inspect Replace Repair				0.1 0.5 1.0			
180202	RETICLE CELL ASSEMBLY (M1A1) 10556128	Inspect Replace Repair				0.1 1.0			
1803	MOUNT TRIPOD M1A1- 10556234	Inspect Replace Repair			0.1 0.5 1.0				
180301	COLLAR ASSEMBLY M1A1- 10556237	Inspect Replace Repair			0.1 0.5 1.0				
180302	LEG ASSEMBLY 8644326	Inspect Replace Repair			0.1 0.5 1.0				

**Section II. MAINTENANCE ALLOCATION CHART
FOR
M101A1 HOWITZER (cont)**

(1) Group Number	(2) Component/assembly	(3) Maintenance Function	(4) Maintenance level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		DS	GS	Depot		
			C	O	F	H	D		
18030201	TUBE ASSEMBLY 10553447	Inspect Replace Repair			0.1 0.5 1.0				
18030202	LEG 8644331	Inspect Replace Repair			0.1 0.5 1.0				
1804	COLLIMATOR CASE M1A1- 10556091	Inspect Replace Repair			0.1 1.5 2.0				

**Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR
M101A1 HOWITZER**

(1) TOOL OR TEST EQUIPMENT REF CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE STOCK NUMBER	(4) NATIONAL/NATO NUMBER	(5) TOOL
1	H	ADAPTER ASSEMBLY	4931-00-346-8314	6510677
2	C	BRUSH AND BAG ASSEMBLY	1015-01-196-2175	105-110-401
3	O	CYLINDER, COMPRESSED GAS	...	MIL-V-2/33
4	H	FIRE-CONTROL MAINTENANCE AND REPAIR SHOP SPECIAL- IZED EQUIPMENT TOOL SET, DEPOT MAINTENANCE, SUP- PLEMENTARY TOOLS, FIX- TURES, AND EQUIPMENT	4931-00-798-7583	SM 9-4-4931- J40

**Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR
M101A1 HOWITZER (cont)**

(1) TOOL OR TEST EQUIPMENT REF CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL NUMBER	(5) TOOL NUMBER
5	H	FIRE CONTROL MAINTENANCE AND REPAIR SHOP SPECIALIZED EQUIPMENT TOOL SET, DS, GS, AND DEPOT MAINTENANCE: GENERAL PURPOSE TOOLS	4931-00-574-6433	SC 4931-95-CL-J51
6	C	FIXTURE AND CASE, GUN TUBE LEVELING	4933-00-340-1129	11578744
7	H	GAGE	4931-00-763-1862	7631862
8	H	GAGE, CHECK	4931-00-768-0737	7680737
9	H	GAGE, PERPENDICULARITY	4931-00-763-1862	7631862
10	H	GAGE, PUSH-PULL	5220-00-403-1138	719-20
11	C	GUN, OIL, HAND OPERATED	4933-00-550-6661	5506661
12	F	JACK, HYDRAULIC, HAND	5120-00-224-7330	GGG-J-63
13	H	LEVEL	5210-00-546-6362	7686087
14	O	NITROGEN, TECHNICAL	6830-00-782-2641	8449334
15	O	PURGING KIT, FIRE CONTROL: UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE	4931-00-065-1110	SC 4931-95-CL-J54
16	C	QUADRANT, FIRE CONTROL, M1A1 (GUNNER'S) (WITH CARRYING CASE)	1290-00-891-9999	7197156
17	C	SCREWDRIVER, FLAT TIP (1/4-IN. (0.6-CM))	5120-00-222-8852	GGG-S-121
18	C	SCREWDRIVER, FLAT TIP (5/16-IN. (0.8-CM))	5120-00-278-1283	GGG-S-121
19	C	SCREWDRIVER, FLAT TIP (5/32-IN. (0.4-CM))	5120-00-293-3183	GGG-S-121

**Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR
M101A1 HOWITZER (cont)**

(1) TOOL OR TEST EQUIPMENT REF CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL NUMBER	(5) TOOL NUMBER
20	F	SHIELD, SAFETY, AIR	4933-00-616-6474	6166474
21	F	SHOP EQUIPMENT, ARTILLERY MAINTENANCE: FIELD MAIN- TENANCE, SET N	4933-00-754-0704	SC 4933-95- CL-A12
22	O	SHOP EQUIPMENT, AUTOMO- TIVE MAINTENANCE AND RE- PAIR: UNIT MAINTENANCE, COMMON NO. 1	4910-00-754-0654	SC 4910-95- CL-A74
23	H	SHOP EQUIPMENT, INSTRU- MENT AND FIRE CONTROL: FIELD MAINTENANCE, BASIC	4931-00-754-0740	SC 4931-95- CL-A07
24	H	SHOP EQUIPMENT, INSTRU- MENT AND FIRE CONTROL SYSTEM REPAIR: FIELD MAIN- TENANCE, SPECIALIZED	4931-00-078-4087	SC 4931-95- CL-A11
25	F	SHOP EQUIPMENT, MACHINE SHOP: FIELD MAINTENANCE, BASIC	3470-00-754-0708	SC 3470-95- CL-A02
26	F	SLING, ROPE		9681357
27	C	STAFF, SECTION, CLEANING, ARTILLERY	1015-00-699-0633	7309259
28	C	TARGET, BORESIGHTING	6920-00-714-8907	7148907
29	H	TEST FIXTURE	4931-00-191-9215	10555619
30	C	TOOL ASSEMBLY, LIQUID RELEASING	4933-00-626-4157	8410594
31	O	TOOL KIT, ARTILLERY MECHANIC'S	5180-00-699-3594	SC 5180-95- CL-A43
32	F	TOOL KIT, ARTILLERY MECHANIC'S: ORDNANCE	5180-00-357-7727	SC 5180-95- CL-A12

**Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR
M101A1 HOWITZER (cont)**

(1) TOOL OR TEST EQUIPMENT REF CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL NUMBER	(5) TOOL NUMBER
33	F	TOOL KIT, INSTRUMENT AND FIRE CONTROL SYSTEM RE- PAIR: FIELD MAINTENANCE	4931-00-947-8243	SC 4931-95- CL-A09
34	C	WRENCH, ADJUSTABLE	5120-00-240-5328	GGG-W-631
35	C	WRENCH, BOX	5120-00-224-3136	QQ-C-320
36	C	WRENCH, ADJUSTABLE	5120-00-423-6728	GGG-W-631
37	C	WRENCH, RESPIRATOR	4933-00-622-4486	6224486
38	H	WRENCH SET, SPANNER	4931-00-580-0012	5800012
39	O	WRENCH, SPANNER	5120-00-550-7928	5507928
40	F	WRENCH, SPANNER	5120-00-616-9841	6169841
41	...	...	...	...
42	H	TEST FIXTURE ADAPTER	1240-01-325-1824	6510877
43	F	ADAPTER, PURGE PIPE	4933-00-332-4200	5191033
44	F	PIPE, PURGE: SUBASSY	4933-00-332-4207	6221024
45	F	WRENCH, SPANNER	4933-00-500-7488	5007488
46	F	KIT, TOOL, RECOIL MECH EQUILIBRATOR CHARGING REGULATOR	5180-00-713-7483	7137483
47	F	WRENCH, TUBE REMOVING: TOOL KIT, FIELD ARTILLERY	5120-00-866-5850	8769153
48	F	SLING, GUN TUBE: FABRIC	4933-00-699-9304	8735439

Section IV. REMARKS

REMARKS	REMARKS
A	Direct support maintenance will inspect the breech ring and dispose of it.
B	General support maintenance will inspect the lower latch strut and dispose of it.

B-25/(B-26 blank)

**APPENDIX C
COMPONENTS OF END ITEM
AND BASIC ISSUE ITEMS LIST**

SECTION I. INTRODUCTION

C-1. SCOPE

This appendix lists components of the end item and basic issue items for the M101 AI howitzer to help you inventory the items for safe and efficient operation of the equipment.

C-2. GENERAL

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

a. Section II, Components of End Item. This listing is for information purposes only, and is not authority to requisition replacements. These items are part of the M101A1 howitzer, but they are to be 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 help you find and identify the items.

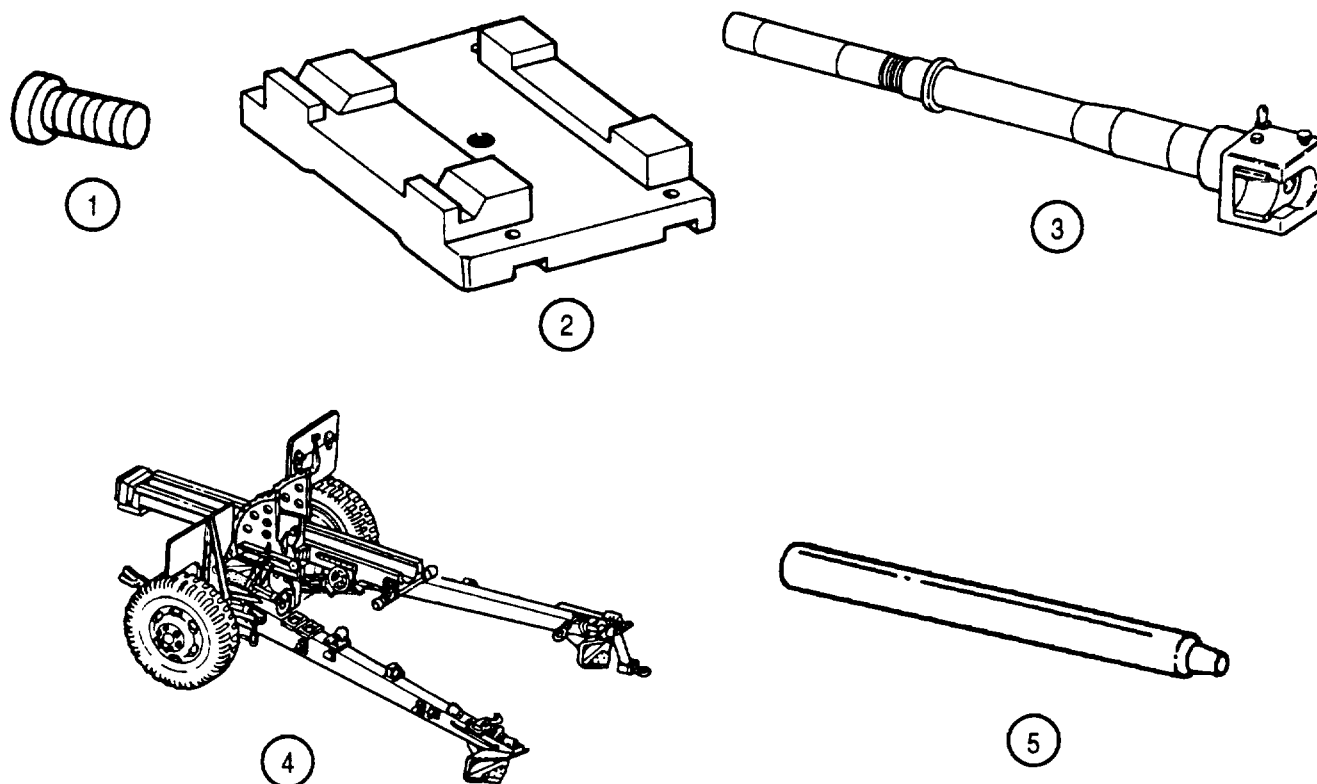
b. Section III, Basic Issue Items. These essential items are required to place the M101A1 howitzer in operation, operate it, and to do emergency repairs. Although shipped separately packaged, BII must be with the M101 AI howitzer during operation and when it is transferred between property accounts. Listing these items is your authority to request/requisition them for replacement based on authorization of the end item by the TOE/MTOE. Illustrations are furnished to help you find and identify the items.

C-3. EXPLANATION OF COLUMNS

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

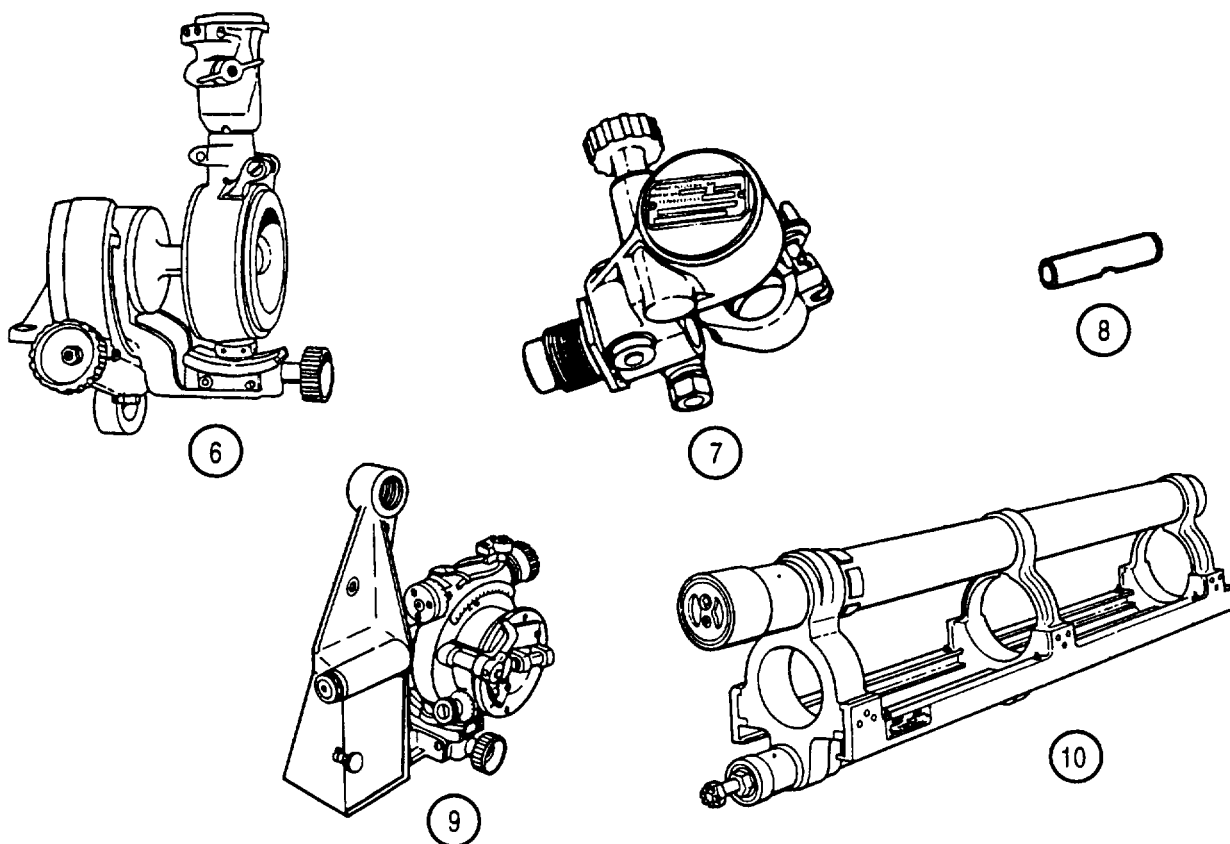
- a. Column (1), Illus Number, gives you the number of the item illustrated.
- b. Column (2), National Stock Number, identifies the stock number of the item to be used for requisitioning purposes.
- c. Column (3), Description and Usable On Code, identifies the Federal item name (in all capital letters) followed by a minimum description when needed. The last line below the description is the CAGEC (Commercial and Government Entity Code) (in parenthesis) and the part number.
- d. Column (4), U/I (Unit of Issue), indicates how the item is issued for the NSN shown in column two.
- e. Column (5), Qty rqr, indicates the quantity required.

Section II. COMPONENTS OF END ITEM



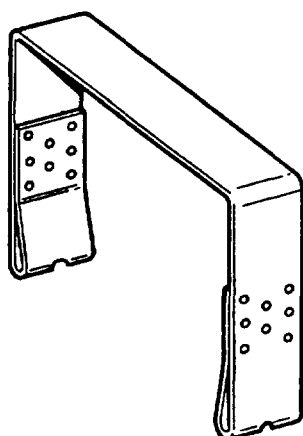
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, CAGEC and Part Number	(4) U/I	(5) QTY rqr
1	5306-00-087-1458	BOLT, MACHINE (96906) MS16208-32	EA	4
2	1294-01-124-0300	BRACKET, ANTENNA MOUNTING (19200) 11785062	EA	1
3	1015-00-782-7208	CANNON, 105-MM, M2A2 (19206) 7827208	EA	1
4	...	CARRIAGE, M2A2 (19204) 7241820	EA	1
5	1015-00-556-0682	HANDSPIKE (19204) 5560682	EA	1

Section II. COMPONENTS OF END ITEM (cont)

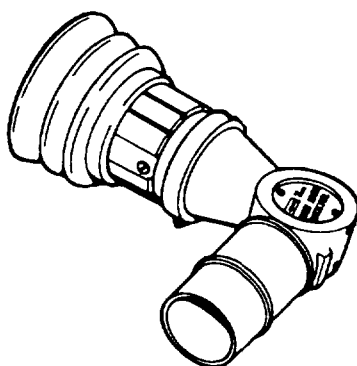


(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, CAGEC and Part Number	(4) U/I	(5) QTY rqr
6	1240-00-757-8596	MOUNT, TELESCOPE, M21A1 (19200) 7578396	EA	1
7	1240-00-757-8441	MOUNT, TELESCOPE, M23 (19200) 7578441	EA	1
8	5310-01-122-9734	NUT, PLAIN, BARREL (19200) 11785064	EA	4
9	1290-00-759-7761	QUADRANT, GUNNER'S FIRE CONTROL), M4A1 (19200) 7597761	EA	1
10	1015-00-099-8249	RECOIL MECHANISM, M2A4 (19204) 8412425	EA	1
10	1015-00-099-8248	RECOIL MECHANISM, M2A5 (19204) 8412320	EA	1

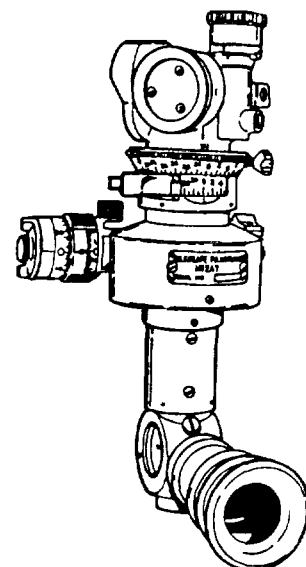
Section II. COMPONENTS OF END ITEM (cont)



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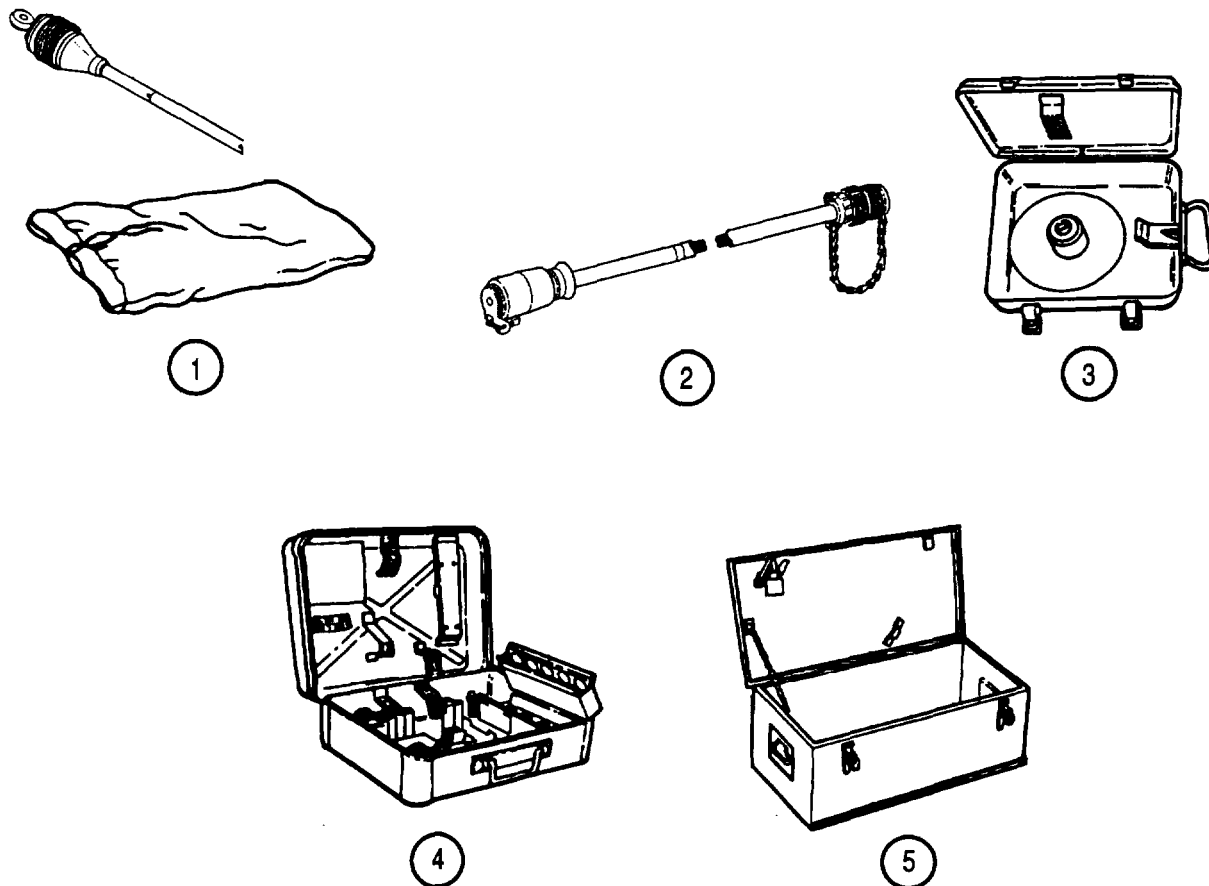
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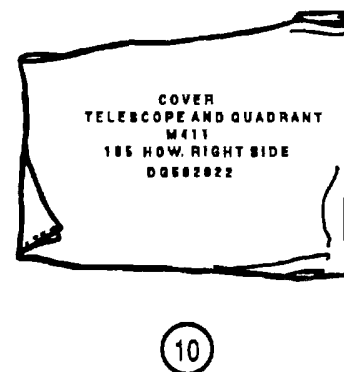
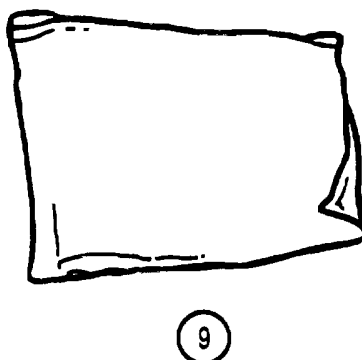
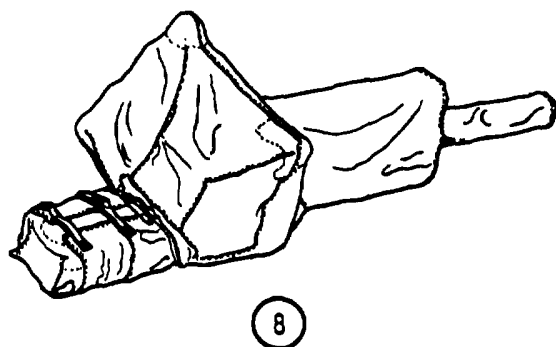
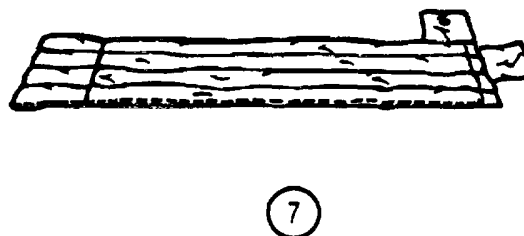
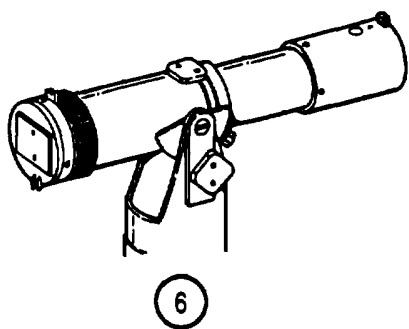
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, CAGEC and Part Number	(4) U/I	(5) QTY rqr
11	5340-01-124-0343	STRAP, RETAINING (19200) 11785063	EA	2
12	1240-00-759-7781	TELESCOPE, ELBOW, M16A1D (19200) 7597781	EA	1
13		TELESCOPE, PANORAMIC, M12A7S (19200) 8213037	EA	1
14	5310-00-625-5756	WASHER, FLAT (96906) MS15795-812	EA	4
15	5310-00-974-6623	WASHER, LOCK (96906) MS35338-140	EA	4

Section III. BASIC ISSUE ITEMS



(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, CAGEC and Part Number	(4) U/I	(5) QTY rqr
1	1015-01-196-2175	BRUSH AND BAG ASSEMBLY (27412) 105-110-401	AY	1
2	1015-01-130-5949	CABLE ASSEMBLY (19200) 9334051	EA	1
3	1290-00-824-7245	CASE, CARRYING (19200) 8247245	EA	2
4	1290-00-654-5472	CHEST, LIGHT, M21 (19200) 6545472	EA	1
5	5140-00-653-4198	CHEST, TOOL (19204) 6534198	EA	1

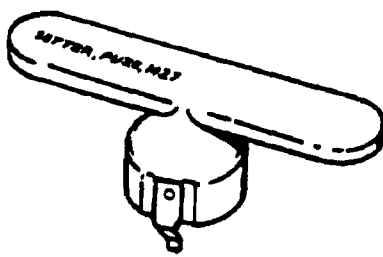
Section III. BASIC ISSUE ITEMS (cont0



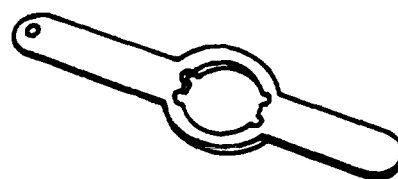
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, CAGEC and Part Number	(4) U/I	(5) QTY rqr
6	1240-00-332-1780	COLLIMATOR, M1A1 (19200)10556235	EA	1
7	1290-00-653-7993	COVER, AIMING POST, M40 (19200) 6537993	EA	1
8	1015-00-089-9634	COVER, OVERALL (19204) 8436770	EA	1
9	1240-00-658-2823	COVER, TELESCOPE AND MOUNT, M412 (19200) 6582823	EA	1
10	1240-00-658-2822	COVER, TELESCOPE AND QUADRANT, M411 (19200)6582822	EA	1



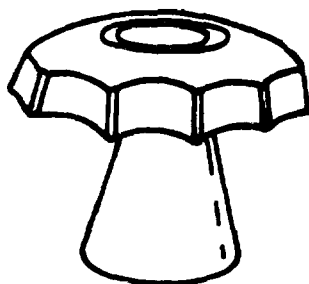
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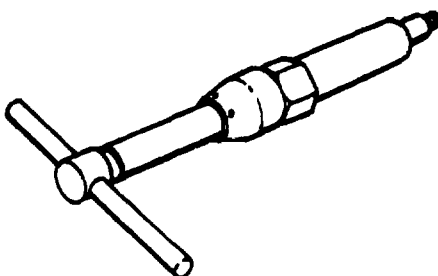
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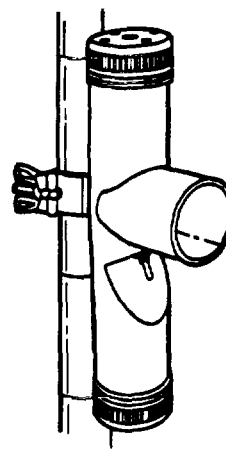
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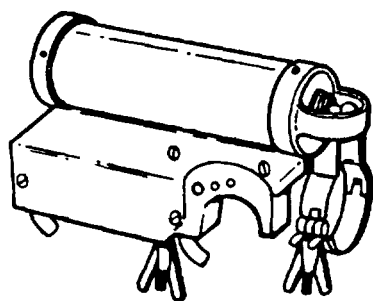


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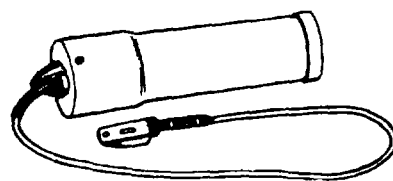


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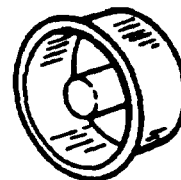
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, CAGEC and Part Number	(4) U/I	(5) QTY rqr
11	4933-00-189-5743	EXTRACTOR TOOL, RAMMER (19206) 11578436 (19200) 7647761	EA EA	1 1
12	1290-00-764-7761	FUZE SETTER, M27 (19200) 7647761	EA	1
13	1290-00-078-4367	FUZE SETTER, M34 (19200) SK87038	EA	1
14	1290-00-201-3507	FUZE SETTER, M35 (19200) 11729019	EA	1
15	4933-00-550-6661	GUN, OIL, HAND OPERATED (19204) 5506661	EA	1
16	1290-01-148-4821	LIGHT, AIMING POST, M14 (19200) 11785401	EA	2



17



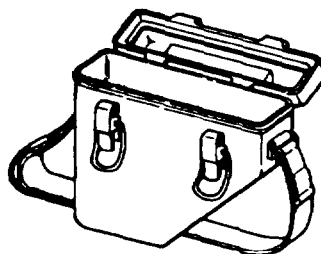
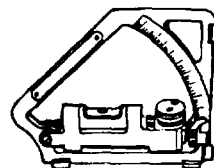
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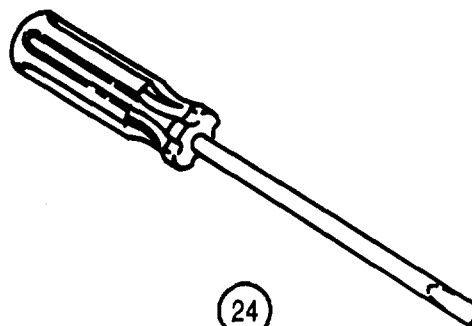


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(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, CAGEC and Part Number	(4) U/I	(5) QTY rqr
17	1290-00-654-3648	LIGHT, INSTRUMENT, M19 (19200) 6543648	EA	1
18	1290-00-769-0564	LIGHT, INSTRUMENT, M36 (19200) 7690564	EA	1
19	1015-00-529-5783	PLUG, MUZZLE (19206) 8767157	EA	1
20	1290-00-535-7617	POST, AIMING, M1A2 (19200) 7687114	EA	4
21	1290-00-891-9999	QUADRANT, GUNNER'S, M1AI (19200) 7197156	EA	1
22	1015-00-559-1873	RAMMER, ARTILLERY, UNLOADING (19206) 5591873	EA	1



23



24

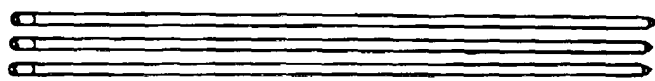


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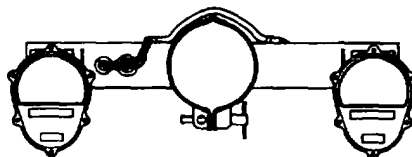


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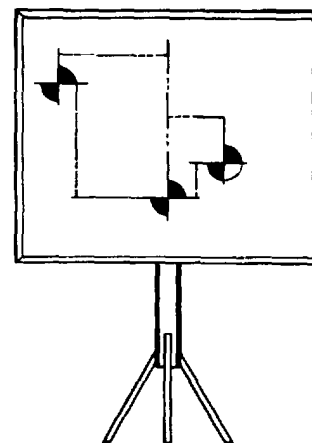
(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, CAGEC and Part Number	(4) U/I	(5) QTY rqr
23	5120-00-222-8852	SCREWDRIVER, FLAT TIP: 1/4-in. tip, 4-in. blade, type 1, class 5, style 1, design A (81348) GGG-S-121	EA	2
24	5120-00-278-1283	SCREWDRIVER, FLAT TIP: 5/16-in. tip, 6-in. blade, type 1, class 5, style 1, design B (81348) GGG-S-121	EA	1
25	5120-00-293-3183	SCREWDRIVER, FLAT TIP: 5/32-in. tip, 2-in. blade, type 1, class 6, style 1, design A (81348) GGG-S-121	EA	1
26	4933-00-723-8954	SIGHT, BORE, BREECH (19206) 7238954	EA	1



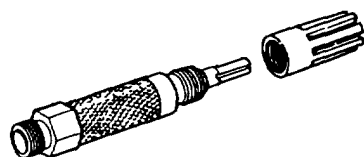
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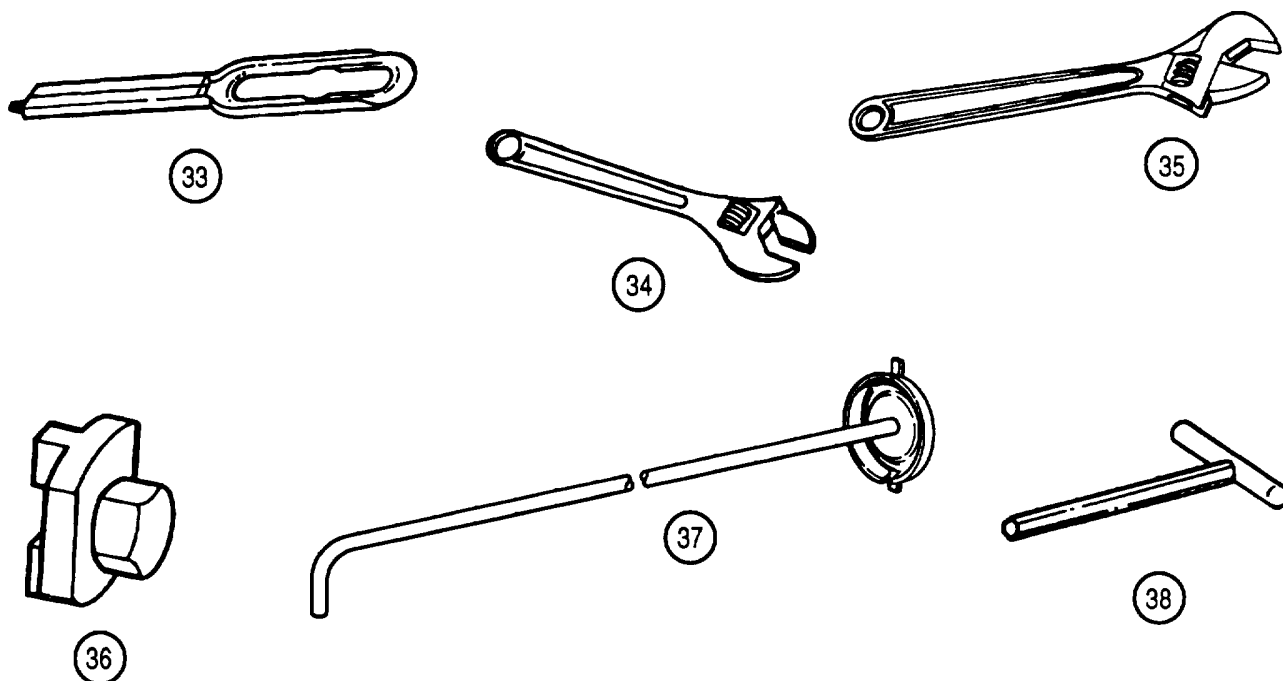


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(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, CAGEC and Part Number	(4) U/I	(5) QTY rqr
27	1015-00-699-0633	STAFF, SECTION, CLEANING, ARTILLERY (19206) 7309259	EA	3
28	1015-01-130-6273	TAILLIGHT ASSEMBLY (19200) 9334046	EA	1
29	6920-00-714-8907	TARGET, BORESIGHTING (19204) 7148907	EA	1
30	4933-00-626-4157	TOOL ASSEMBLY, LIQUID RELEASING (19204) 8410594	EA	1
31	5120-00-224-3136	WRENCH, BOX: 1/2 x 9/16 in. type 1, class 2 (81238) QQ-C-320	EA	1
32	4933-00-723-0851	WRENCH, FUZE SETTER, COMBINA- TION, M16 (19206) 7230851	EA	1



(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, CAGEC and Part Number	(4) U/I	(5) QTY rqr
33	4933-00-723-1161	WRENCH, FUZE SETTER, COMBINATION, M18 (19206) 7231161	EA	1
34	5120-00-240-5328	WRENCH, ADJUSTABLE: 8-in., type 2, class 1 (81348) GGG-W-631	EA	1
35	5120-00-423-6728	WRENCH, ADJUSTABLE: 15 in. (81348) GGG-W-631	EA	1
36	5120-00-622-4479	WRENCH, RECOIL MECHANISM (19204) 6224479	EA	1
37	4933-00-622-4486	WRENCH, RESPIRATOR (19204) 6224486	EA	1
38	5120-00-293-2224	WRENCH, KEY, T-HANDLE (80244) GGG-K-00275 TY6ST	EA	2

C-11/C-12 (blank)

APPENDIX D ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

D-1. SCOPE

This appendix lists additional items authorized for the support of the M101A1 howitzer.

D-2. GENERAL

This list identifies items that do not have to accompany the M101A1 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.

D-3. EXPLANATION OF LISTING

National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name. If the item you require differs between serial numbers of the same model, effective serial numbers are shown in the last line of the description.

Section II. ADDITIONAL AUTHORIZATION LIST

(1) NATIONAL STOCK NUMBER	(2) DESCRIPTION CAGEC and Part Number	(3) U/I	(4) QTY Recm
CTA AUTHORIZED ITEMS			
1015-00-523-0374	BRUSH, CLEANING, ARTILLERY: S, wire med hard, M7 flat wooden handle, 3/4-in. w, 5-1/2 in. lg (80572) M065	EA	1
7920-00-205-1401	BRUSH, CLEANING, TOOL AND PARTS: Chinese bristle, rd, brush part clear of block 2 lg, 1-1/2 diam (81349) MIL-S-43871	EA	1
8020-00-242-7266	BRUSH, PAINT: fl sq-edge, hog bristle, 3 w, 7/8 thk, 3-1/4 exposed lg, 3-in. size, class 1, grade B (81348) H-B-420	EA	1

Section II. ADDITIONAL AUTHORIZATION LIST (cont)

(1) NATIONAL STOCK NUMBER	(2) DESCRIPTION CAGEC and Part Number	(3) U/I	(4) QTY Recm
	CTA AUTHORIZED ITEMS (cont)		
8145-00-769-1521	CHEST, PACKING, M27 (19200) 7691521	EA	1
4933-00-340-1129	FIXTURE AND CASE, GUN TUBE LEVELING (19206) 1157844	EA	1
4930-00-287-8474	OILER, HAND: type 1, class A (81348) GGG-O-591	EA	1
7240-00-160-0455	PAIL, UTILITY (81348) RR-P-35	EA	1
5120-00-239-8251	PLIERS: type 9, class 1, style A (81348) GGG-P-471	EA	1
5140-00-712-4170	ROLL, TOOLS AND ACCESSORIES (19204) 7123170	EA	1
7920-00-240-2559	SPONGE, CELLULOSE: rectangular, 3-5/8 in. w x 5-3/4 in. lg x 1-7/8 in. thk (81348) L-S-626	EA	1
6675-00-240-1881	TRIPOD, SURVEYING (81349) MIL-T-11674	EA	2

APPENDIX E EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

E-1. SCOPE

This appendix lists expendable/durable supplies and materials you will need to maintain the M101A1 howitzer. This listing is for informational purposes only and is not authority to requisition the listed item. These items are authorized to you by CTA 50-970, Expendable/Durable Items (except Medical, Class V, Repair Parts, and Heraldic Items).

E-2. EXPLANATION OF COLUMNS

- a. **Column (1)-Item number.** This number is assigned to the entry in the listing for referencing when required.
- b. **Column (2)-Level.** This column identifies the lowest level of maintenance that requires the listed item.

C
O

Operator/Crew
Unit Maintenance

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 Commercial and Government Entity Code (CAGEC) in parentheses followed by the part number.

e. **Column (5)-Unit of Measure (U/M)/Unit of Issue (U/I).** 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 as shown in the Army Master Data File (AMDF), 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 PART NO. AND FSCM	(5) UNIT OF MEAS.
1	C	8150-00-269-4662	BAG, PLASTIC: (81349) MIL-B-117	EA
2	C	8135-00-292-9728	BARRIER, MATERIAL, GREASEPROOF- WATER, FLEXIBLE (81349) MIL-B-121	EA
3	C	6135-00-050-3280	BATTERY, DRY: 6 V, BA200/U (81349) MILB 18-34	EA
4	C	6135-00-120-1020	BATTTERY, DRY: 1.5 V, BA-30 (96906) MS75059	EA
5	C	7920-00-291-5815	BRUSH, WIRE SCRATCH (81348) HB-178	EA
6	C	7610-00-223-6706	CHALK, MARKING white, cylindrical 0.375-in. (0.952-cm) o/a dia (81348) SS-C-266	BX
7	C	9150-01-054-6453 9150-01-053-6668	CLEANER, LUBRICANT, PRESERVATIVE (CLP): 1-pint (0.47-1) trigger spray 1-gal. (3.79-1) bottle (81349) MIL-L-63460	PT GL
8	C	6850-00-227-1887	CLEANING COMPOUND, OPTICAL LENS: liquid, 1-qt (0.95-1) container (81349) MIL-C-43454	QT
9	C	6850-00-597-9765	CLEANING COMPOUND, SOLVENT: solution type, 1-gal. (3.79-1) can (81349) MIL-C-18718	GL
10	C	1025-01-316-9250	CLEANING SLEEVE: box 30 (27412) 105-140	EA
11	0	5350-00-221-0872	CLOTH, ABRASIVE: crocus, 9x 11 sh (81348) P-C-458	EA

**Section II. EXPENDABLE/DURABLE SUPPLIES AND
MATERIALS LIST (cont)**

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) (U/M)/ (U/I)
12	C	4020-00-240-2154	CORD, FIBROUS 500 yd sp (81349) MIL-C-5040	YD
13	C	9150-00-190-0905 9150-00-190-0907	GREASE, AUTOMOTIVE AND ARTILLERY (GAA): -65 to +125°F (-54 to +107°C) effective temp range 5-lb (2.27-kg) can, type V, C12 35-lb (15.88-kg) can, type II ' (81349) MIL-G-10924	LB LB
14	C	9150-00-935-9807 9150-00-935-9808	HYDRAULIC FLUID, PETROLEUM BASE (OHT): 1-qt (0.95-1) can 1-gal. (3.79-1) can (81349) MIL-H-6083	CN CN
15	C	1025-01-196-2172	KIT, ARTILLERY CLEANING: (59678) SK1-84J5	KT
16	C	6240-00-019-3093	LAMP, INCANDESCENT: (96906) MS15570-623	EA
17	C	6240-00-019-0877	LAMP, INCANDESCENT: (96906) MS15570-1251	EA
18	C	6240-00-044-6914	LAMP, INCANDESCENT: (96906) MS35478-1683	EA
19	C	6240-00-635-0900	LAMP, INCANDESCENT: (96906) MS51608-3	EA
20	C	6240-00-155-7864	LAMP, INCANDESCENT: (81348) W-L-001 11/10	EA
21	C	6220-01-297-3217	LED LAMP, UNIT VEHICULAR: (19207) 12360870-2	EA
22	C	6220-01-284-2709	LED LIGHT, MARKER CLEARANCE (19207) 123060850-1	EA
23	C	9150-00-231-6689	LUBRICATING OIL, GENERAL PURPOSE (PL-S) (81348) VV-L-800	QT

**Section II. EXPENDABLE/DURABLE SUPPLIES AND
MATERIALS LIST (cont)**

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) (U/M)/ (U/I)
24	C	7510-01-558-2112	PAINT STICK, marking	BX
25	C	6640-00-663-0832	PAPER, LENS, TISSUE: sheet form, 5/9, type I or II (81348) NNN-P-40	PK
26	C	7920-00-205-1711	RAG, WIPING: cotton, bleached or unbleached, mixture of white or colored, general purple, 50-lb (22.68-kg) bale (80244) DDD-R-30	BE
27	O	8030-00-081-2329	SEALING COMPOUND, grade E (81349) MIL-S-22473	BT
28	C	8520-00-228-0598	SOAP, TOILET: Liquid, 6-gal. (22.71-1) can (81348) P-S 624	GL
29	O	3439-00-453-5472	SOLDER, TIN ALLOY 1-lb (0.45-kg) SPOOL (81348) QQ-S-575	SP
30	O	8030-00-889-3534	TAPE, ANTI-SEIZING (81349) MIL-T-27730	RL
31	C	7510-01-146-7767	TAPE, PRESSURE SENSITIVE ADHESIVE, black, 60-yd roll, 1/4-in. wide (58536) A-A-884	YD
32			VOLATILE CORROSION INHIBITOR (VCI), paper	
33	O	9505-00-248-9350	WIRE, NONELECTRICAL, steel 0.048 in. (0.012 cm) (96906) MS20995-47	BT

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*C-Operator/crew

**O-Unit

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By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army
03885

DISTRIBUTION:

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THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter = 10 Millimeters = .39 Inch
1 Decimeter = 10 Centimeters = 3.94 Inches
1 Meter = 10 Decimeters = 100 Centimeters
= 1000 Millimeters 39.37 Inches
1 Dekameter = 10 Meters = 32.8 Feet
1 Hectometer = 10 Dekameters = 328.08 Feet
1 Kilometer = 10 Hectometers = 1000 Meters
= 0.621 Mile = 3,280.8 Feet
Millimeters = Inches times 25.4
Inches = Millimeters divided by 24.4

WEIGHTS

1 Centigram = 10 Milligrams = .15 Grain
1 Decigram = 10 Centigrams = 1.54 Grains
1 Gram = 0.001 Kilogram = 10 Decigram
= 1000 = 0.035 Ounce
1 Dekagram = 10 Grams = .353 Ounce
1 Hectogram = 10 Dekagrams = 3.527 Ounces
1 Kilogram = 10 Hectograms = 1000 Grams = 2.205 Pounds
1 Quintal = 100 Kilograms = 220.46 Pounds
1 Metric Ton = 10 Quintals = 1000 Kilograms = 1.1 Short Tons

LIQUID MEASURE

1 Millimeter = 0.001 Liter - 0.034 Fluid Ounce
1 Centiliter = 10 Milliliters = 0.34 Fl. Ounce
1 Deciliter = 10 Centiliters = 3.38 Fl. Ounces
1 Liter = 10 Deciliters = 1000 Milliliters = 33.81 Fl. Ounces
1 Dekaliter = 10 Liters = 2.64 Gallons
1 Hectoliter = 10 Dekaliters = 26.42 Gallons
1 Kiloliter = 10 Hectoliters = 264.18 Gallons

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inch
1 Sq. Decimeter = 100 Sq. Centimeters = 15.5 Sq. Inches
1 Sq. Meter (Centare) = 10 Sq. Decimeters
1,000,000 = 10.764 Sq. Feet
1 Sq. Dekameter (Are) = 100 Sq. Meters = 1,076.4 Sq. Feet
1 Sq. Hectometer (Hectare) = 100 Sq. Dekameters
= 2.471 Acres
1 Sq. Kilometer = 100 Sq. Hectometers
1,000,000 = .386 Sq. Mile

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = .06 Cu. Inch
1 Cu. Decimeter = 1000 Cu. Centimeters = 61.02 Cu. Inches
1 Cu. Meter = 1000 Cu. Decimeters
= 1,000,000 Centimeters-35.31 Cu feet

TEMPERATURE

$5/9 (^{\circ}\text{F} - 32^{\circ}) = ^{\circ}\text{C}$
 $(9/5 \times ^{\circ}\text{C}) + 32^{\circ} = ^{\circ}\text{F}$
-35° Fahrenheit is equivalent to - 37° Celsius
0° Fahrenheit is equivalent to - 18° Celsius
32° Fahrenheit is equivalent to - 0° Celsius
90° Fahrenheit is equivalent to - 32.2° Celsius
100° Fahrenheit is equivalent to - 38° Celsius
212° Fahrenheit is equivalent to - 100° Celsius

Approximate Conversion Factors

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters .....	.093
Square Yards	Square Meters .....	.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers .....	.405
Cubic Feet	Cubic Meters .....	.028
Cubic Yards	Cubic Meters .....	.765
Fluid Ounces	Milliliters	29.573
Pints	Liters .....	.473
Quarts	Liters .....	.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
Pound-Inches	Newton-Meters .....	.0.11375
Pounds per Square Inch	Kilopascals	6.895
Ounce-inches	Newton-Meters	0.007062
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609
Centimeters	Inches	0.394

TO CHANGE	TO	MULTIPLY BY
Meters	Feet .....	.3.280
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
°Fahrenheit	°Celsius	$^{\circ} = (^{\circ}\text{F}-32)\times 5/9$
°Celsius	°Fahrenheit	$^{\circ}\text{F} = (9/5\times^{\circ}\text{C})+32$

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