TECHNICAL MANUAL
OPERATOR'S
MANUAL
FOR

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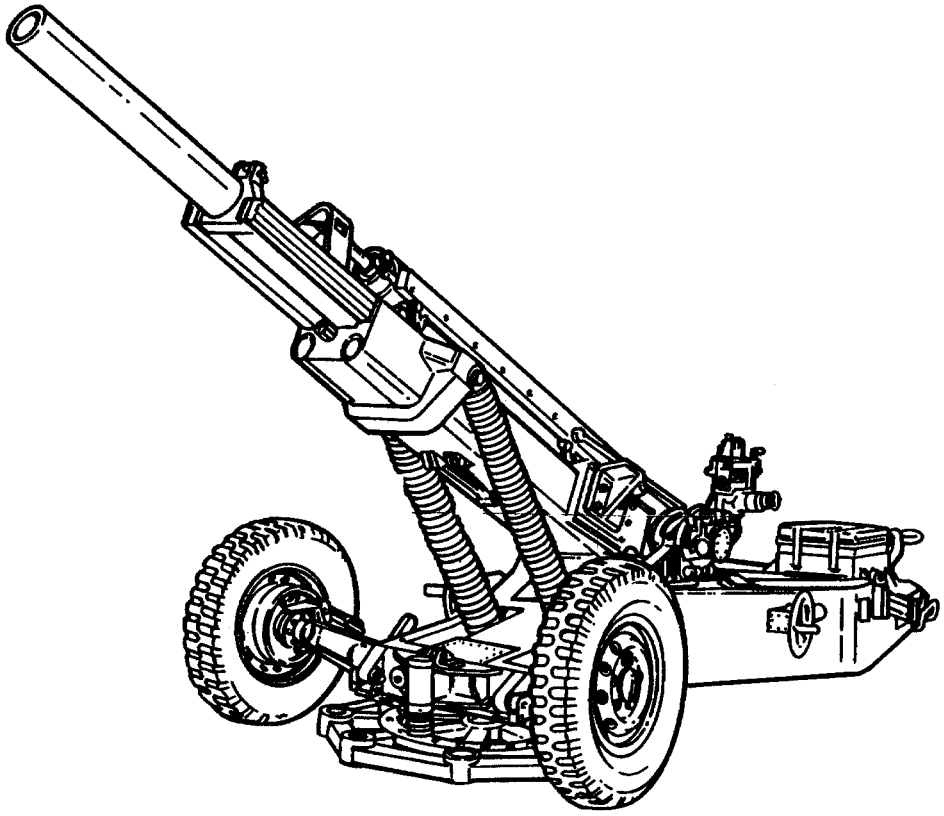

HOWITEZER,LIGHT,TOWED:

105-MM,M102

(1015-00-086-8764)

AUGUST 1985

HEADQUARTERS, DEPARTMENT OFTHE ARMY

CHANGE

HEADQUARTERS
DEPARTMENT OF THE ARMY

No. 2

Washington, DC 17 December 1993

OPERATOR'S MAINTENANCE MANUAL
HOWITZER, LIGHT, TOWED:
105-MM, M102
(NSN 1015-00-086-8164)

TM 9-101 .-234-10, 19 August 1985, is changed as follows:

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

Remove Pages	Insert Pages
1-7 and 1-8	1-7 and 1-8
1-17 through 1-20	1-17 through 1-20
1-21 through 1-27(1-28 blank)	None
2-9 through 2-16	2-9 through 2-16
2-23 and 2-24	2-23 and 2-24
2-26.5 through 2-26.8	2-26.5 through 2-26.8
2-26.17 through 2-26.20	2-26.17 through 2-26.20
2-27 and 2-28	2-27 and 2-28
2-37 through 2-42	2-37 through 2-42
2-47 through 2-50	2-47 through 2-50
2-59 and 2-60	2-59 and 2-60
2-83 through 2-86	2-83 through 2-86
3-33 and 3-34	3-33 and 3-34
3-39 through 3-50	3-39 through 3-50
3-55 through 3-60	3-55 through 3-60
4-1 and 4-2	4-1 and 4-2
4-7 and 4-8	4-7 and 4-8
4-8.1(4-8.2 blank)	4-8.1 and 4-8.2
4-9 through 4-14	4-9 through 4-14
4-17 through 4-22	4-17 through 4-22
4-27 through 4-30	4-27 through 4-30

Remove Pages	Insert Pages
4-33 and 4-34	4-33 and 4-34
A-1 and A-2	A-1 and A-2
B-7 and B-8	B-7 and B-8
B-11 through B-16	B-11 through B-16
C-1 through C-4	C-1 through C-4
D-1 through D-5(D-6 blank)	D-1 through D-5(D-6)
blank)	
E-1 through E-4	E-1 through E-4
Index 1 through Index 14	Index 1 through Index 14

File this sheet in the back of the manual for reference purposes.

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Official: Chief of Staff

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army
056080

DISTRIBUTION:
To be distributed in accordance with DA Form 12-40-E, block 0017 requirements for TM 9-1015-234-10.

CHANGE

No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC 7 September 1990

OPERATOR'S MAINNANCE MANUAL

HOWITZER, LIGHT, TOWED:
105-MM, M102
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Remove Pages	Insert Pages
1-1 through 1-12	1-1 through 1-12
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2- through 2-26	2-7 through 2-26.20
2-27 and 2-28	2-27 and 2-28
2-31 and 2-32	2-31 and 2-32
2-35 and 2-36	2-35 and 2-36
2-41 through 2-54	2-41 through 2-54
2-57 through 2-60	2-57 through 2-60
2-63 through 2-66 (2-66.2 blank)	2-63 through 2-66.1/
2-67 through 2-74	2-67 through 2-74
2-77 through 2-86	2-77 through 2-86
2-89 through 2-92	2-89 through 2-92
3-1 through 3-4	3-1 through 3-4
3-33 through 3-44	3-33 through 3-44
3-49 and 3-50 (3-50.2 blank)	3-49 through 3-50.1/
3-53 and 3-54 (3-54.2 blank)	3-53 through 3-54.1/
3-59 through 3-61/ (3-62 blank)	3-59 through 3-61/ (3-62 blank)
4-1 through 4-8 (4-8.2 blank)	4-1 through 4-8.1/
4-9 and 4-10 (4-10.4 blank)	4-9 through 4-10.3/
4-11 through 4-22	4-11 through 4-22.1/ (4-22.2 blank)

Remove Pages	Insert Pages
4-23 and 4-24	4-23 through 4-24.5/ (4-24.6 blank)
4-25 through 4-28 4-25 through 4-28/	
4-31 and 4-32 (4-32.2 blank)	4-31 through 4-32.1
4-35/(4-36 blank)	4-35/(4-36 blank)
A-1 through A-3/ (A-4 blank)	A-1 through A-3/ (A-4 blank)
B-7 through B-16	B-7 through B-16
C-3 and C-4	C-3 and C-4
D-3 and D-4	D-3 and D-4

File this sheet in the back of the manual for reference purposes.

By Order of the Secretary of the Army:

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

Official:

THOMAS F. SIKORA
Brigadier General, ,United States Army
The Adjutant General

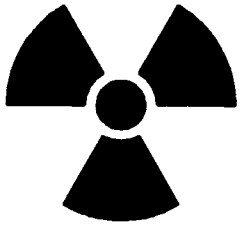
DISTRIBUTION:

To be distributed in accordance with DA Form 12-40E, (block 0017), Operator Maintenance requirements for TM 9-1015-234-10.

WARNING

11 personnel that operate and/or maintain the M102 howitzer -and its fire control equipment 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 HQ, AMCCOM, Rock Island, IL 61299-6000. Copies may be requested, or information pertinent to these rules and regulations obtained, by contacting the AMCCOM Radiological Protection Officer (RPO), AUTOVON 793-3482, Commercial (309) 794-3483.

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.

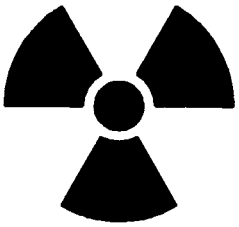
Safety Precautions

The radioactive material used in this instrument is tritium gas (H) 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 Radiological Protection Officer. Do not attempt to repair or replace the instrument in the field! If skin contact is made with any area contaminated with tritium, immediately wash with nonabrasive soap and water.

Identification

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

WARNING



Storage and Shipping

When radioactively illuminated instruments are defective, notify organizational maintenance. 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.

HOWITZER
General

The procedures in this technical manual involve the use of a weapon system and live ammunition. All standard safety precautions governing the handling of live ammunition and operation of artillery weapons must be observed.

AMMUNITION

Do not chamber ammunition except immediately prior to firing. When possible, fire or unload ammunition within 5 minutes after chambering. Ammunition left too long in a hot or warm weapon can result in cookoffs or inbore explosions which are hazardous to personnel. Use of ammunition other than that prescribed in this manual is prohibited.'

FIRST AID

For further information on first aid, see FM 21-11 (TEST).

Technical Manual

No. 9-1015-234-10

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 19 August 1985

Operator's Maintenance Manual
HOWITZER, LIGHT, TOWED:
105-MM, M102
(NSN 1015-00-086-8164)

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

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*This manual supersedes TM 9-1015-234-10, 31 August 1979, including all changes in their entirety.

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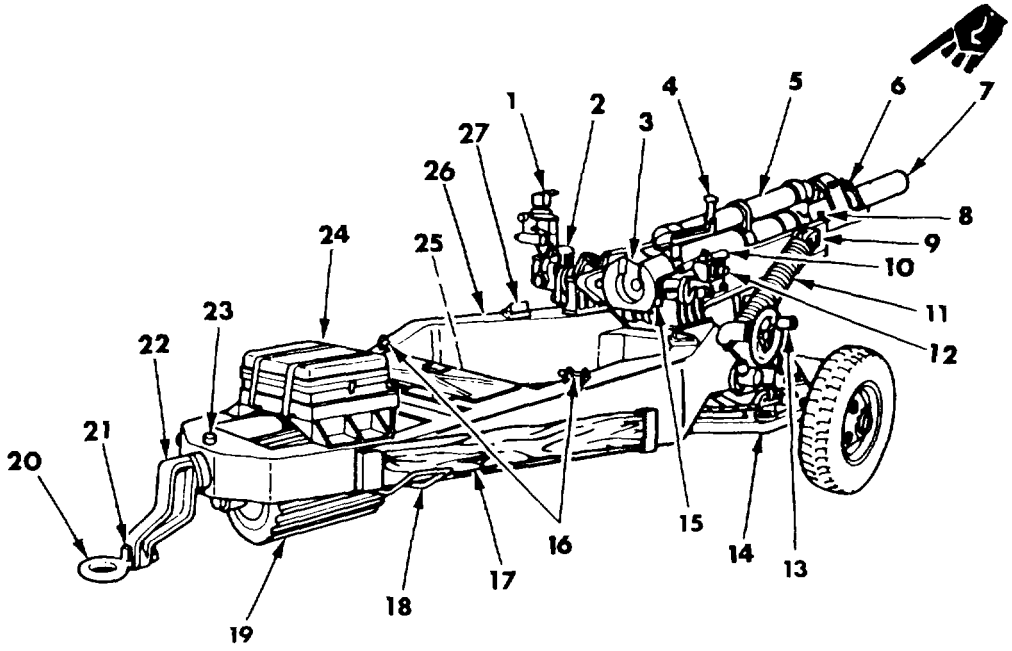
CHAPTER 1
INTRODUCTION

Section I. GENERAL INFORMATION

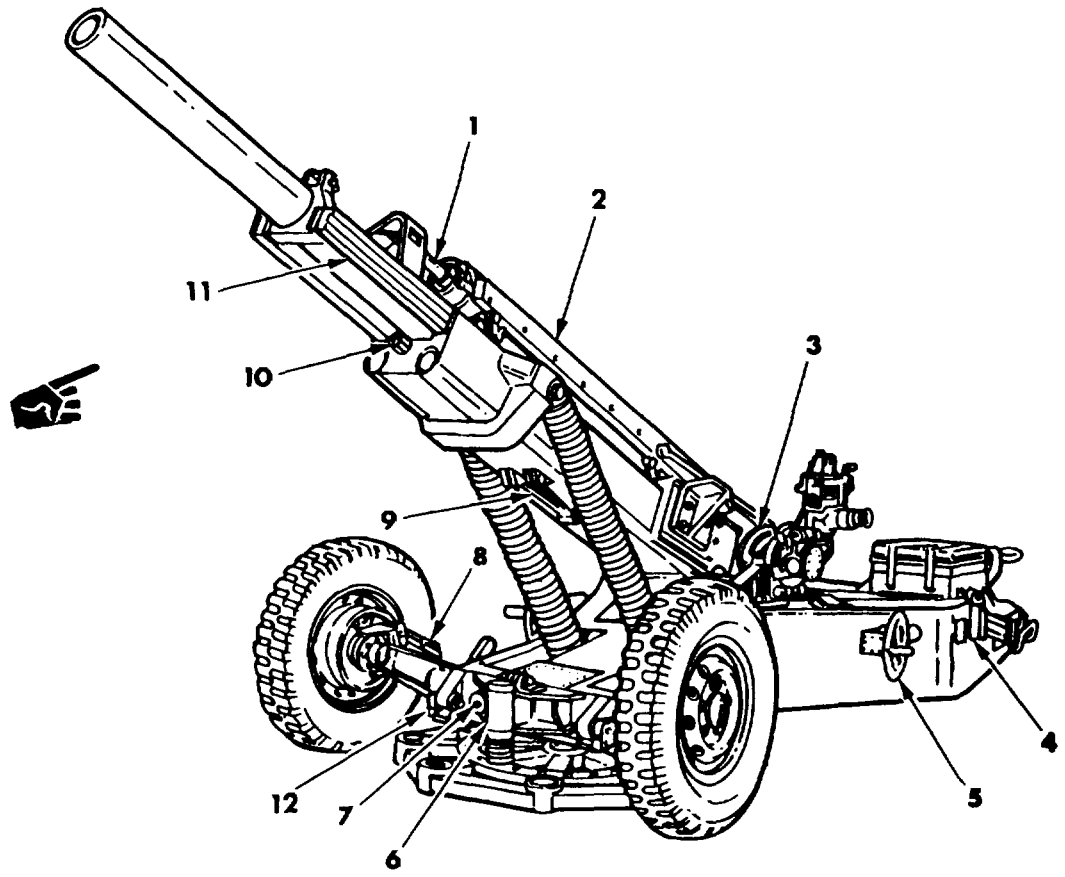
M102 HOWITZER - RIGHT REAR VIEW (LRAVEL POSITION)



Legend

1. M113A1 Panoramic Telescope
2. M134A1 Telescope Mount
3. Breech Mechanism Assembly
4. Breech Operating Handle
5. Recuperator Cylinder Assembly
6. Lifting Bracket (Front)
7. M137A1 Cannon
8. Recoil Indicator Bracket
9. Cradle Assembly
10. M114A1 Elbow Telescope
11. Ball Screw and Equilibrator Assembly
12. M14A1 Fire Control Quadrant
13. Elevating Handwheel Assembly
14. Firing Platform Assembly
15. Lanyard
16. Lifting Bracket (Rear)
17. M1A2 Aiming Post w/Cover
18. Carriage Handle
19. Roller Assembly
20. Lunette
21. Drawbar Bracket Piece (Lunette Lock)
22. Drawbar Bracket
23. Quick Release Pin (Drawbar Bracket)
24. Carrying Case
25. Tool Box
26. Trail and Bracket Assembly
27. BCS Gun Assembly Bracket i

M102 HOWITZER - LEFT FRONT VIEW (FIRING POSITION)



Legend

1. Indicator Rod (Recoil Oil)
2. Variable Recoil Mechanism
3. Control Cam
4. Cleaning Staff Holder
5. Traversing Handwheel Assembly
6. Buffer Assembly
7. Control Assembly
8. Handbrake
9. Travel Lock
10. Recoil Rod Nut
11. Recoil Mechanism Rails
12. Suspension Locks

1-1. SCOPE

a. Type of Manual. Operator's.

b. Model Number and Equipment Name. M102 105-mm towed light howitzer.

c. Purpose of Equipment. Provides artillery fire in support of ground-gaining troops.

d. Special Inclusions in Manual. Crew drill procedures.

1-2. MAINTENANCE FORMS AND RECORDS

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS), as contained in 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 9-1015-234-10-HR consists of preprinted hand receipts (DA Form 2062) that list end item related equipment (i.e., COEI, BII, and AAL) you must account for. As an aid to property accountability, additional -HR manuals may be requisitioned from the following source in accordance with procedures in AR 25-30:

Commander, US Army Publications and Distribution Center 2800 Eastern Boulevard Baltimore, MD 21220-2896

1-4. REPORTING EQUIPMENT IMPROVEMENT RECOMENDATIONS (EIR's)

If your M102 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 (Quality Deficiency Report). Mail it to us at US Army Armament, Munitions,, and Chemical Command, ATTN: A1SMC-QAD, Pock Island, IL 61299-6000. We'll send you a reply.

1-5. NOMENCLATURE CROSS-REFERENCE LIST

Throughout this manual, most items are referred to by their official nomenclature. The items referred to by their common names are listed below, followed by their official nomenclature.

Common Name	Official Nomenclature
Azimuth knob assembly	Knob assembly
Bell rammer	Rammer, artillery, unloading
Boresighting string	Twine, fibrous
Breech operating handle	Handle assembly
Cross level seat	Screw, machine
Elevation seat	Screw, machine
Exhaust port screw	Screw, machine
Handbrake	Spindle, brake and support assembly
Indicator rod	Piston
Level vial	Level, fire control
Lifting bracket (front)	Yoke, recoil mechanism assembly
Out of battery lock	Pin, quick release; hook, chain, S; cable assembly; and pin, cotter
Pantel	Telescope, panoramic
Plunger lever	Post, electrical-mechanical
Plunger release lever	Setscrew
Quadrant pad	Screw, machine
Range knob assembly	Knob assembly
Recoil rod nut	Nut, plain, slotted
Suspension lock	Bracket; and pin assembly
Travel lock	Traveling lock, cradle assembly
Trunnion	Bushing, sleeve; and cap

1-6. LIST OF ABBREVIATIONS

Abbreviation	Definition
A	After
AAL	Additional Authorization List
AG	Assistant Gunner
AR	Army Regulation
ATC	Ammunition Team Chief
B	Before
BCS	Battery Computer System
BII	Basic Issue Items
C	Operator/Crew
COEI	Components of End Item

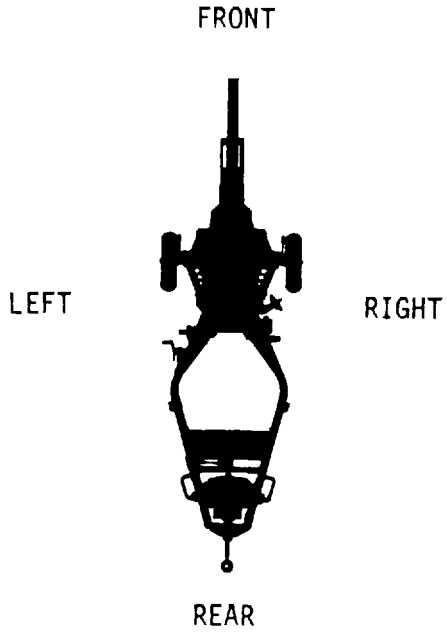
Abbreviation	Definition
CS	Chief of Section
CTA	Common Table of Allowances
DA	Driver; During
DA	Department of the Army
DAP	Department of the Army Procedure
EFC	Equivalent Full Charge
EIR	Equipment Improvement Recommendation
FM	Field Manual
G	Gunner
HR	Hand Receipt
GA	monthly
GDU	Gunner's Display Unit
MT	Mechanical Time
HR	Hand Receipt
M	Monthly
MT	Mechanical Time
MTOE	Modified Table of Organization and Equipment
NBC	Nuclear, Biological, and Chemical
O	Organizational Maintenance
PMCS	Preventive Maintenance Checks and Services
RPO	Radiological Protection Officer
SF	Standard Form
SQ/D	Superquick/Delay
TOE	Table of Organization and Equipment
TE	Technical Manual
TM	Technical Manual
U/M	Unit of Measure
W	Weekly

1-7. GLOSSARY

The following is a listing of terms with definitions used throughout this publication which require explanation and are not defined within the manual 's text.

a. Howitzer Section. Those personnel prescribed by the current table of organization and equipment that comprise a howitzer section.

b. Front, Rear, Left, and Right of Weapon. Check the drawing below:



Section II. EQUIPMENT DESCRIPTION

1-8. EQUIPMENT CHARACTERISITCS, CAPABILITIES, AND FEATURES

a. M102 Howitzer.

(1) Is a lightweight, towed weapon, which has a very low silhouette when in the firing position.

(2) Can be airlifted, dropped by parachute, or towed into position.

(3) Employs a roller assembly and firing platform assembly permitting a 6400-mil capability.

(4) Has a variable recoil system which eliminates the need for a recoil pit.

b. M102 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:

M113A1 panoramic telescope
M134A1 telescope mount
M14A1 fire control quadrant

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

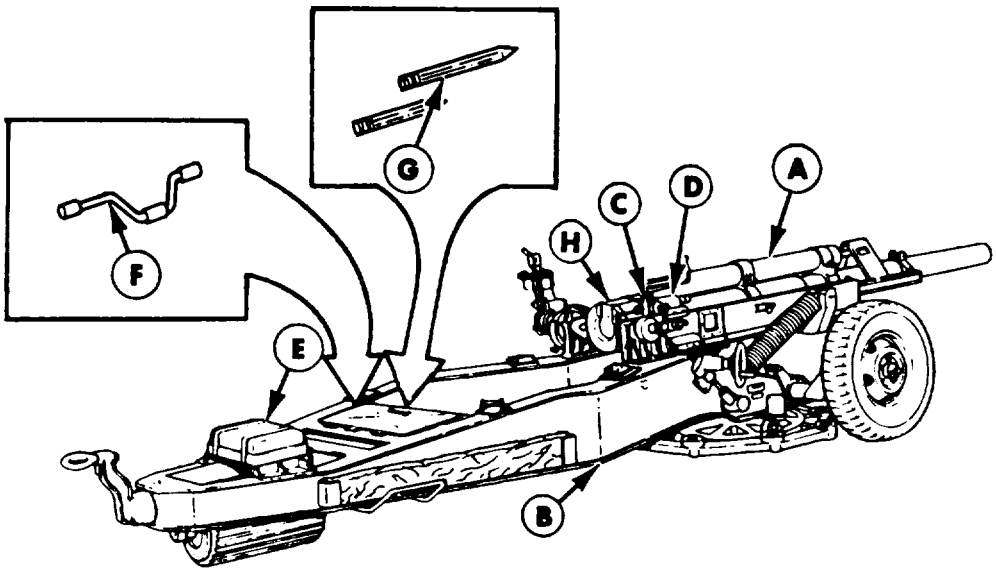
M113A1 panoramic telescope
M134A1 telescope mount
M114A1 elbow telescope
M14A1 fire control quadrant

(3) Miscellaneous instruments include:

M140 alinement device
M1A1 gunners quadrant
M1A1 infinity aiming collimator
M1A2 aiming posts
M14 aiming post lights
M16 fuze wrench
M18 fuze wrench
M27 fuze setter
M34 fuze setter
M35 fuze setter

(4) Associated equipment includes: M90 radar chronograph Battery computer system (BCS)

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS



A M37/M37A1 RECOIL MECHANISM. Holds M137A1 cannon in battery at all angles of elevation. Consists of recoil and recuperator cylinder assemblies.

B M31 CARRIAGE. Has aluminum box trail (main frame) for mounting M137A1 cannon and M37/M37A1 recoil mechanism. Transports and emplaces weapon. Consists of a gun cradle assembly, suspension system, traversing mechanism, elevating mechanism, and firing platform assembly.

C M114A1 ELBOW TELESCOPE. An 8-power telescope used for laying the weapon in elevation for direct fire.

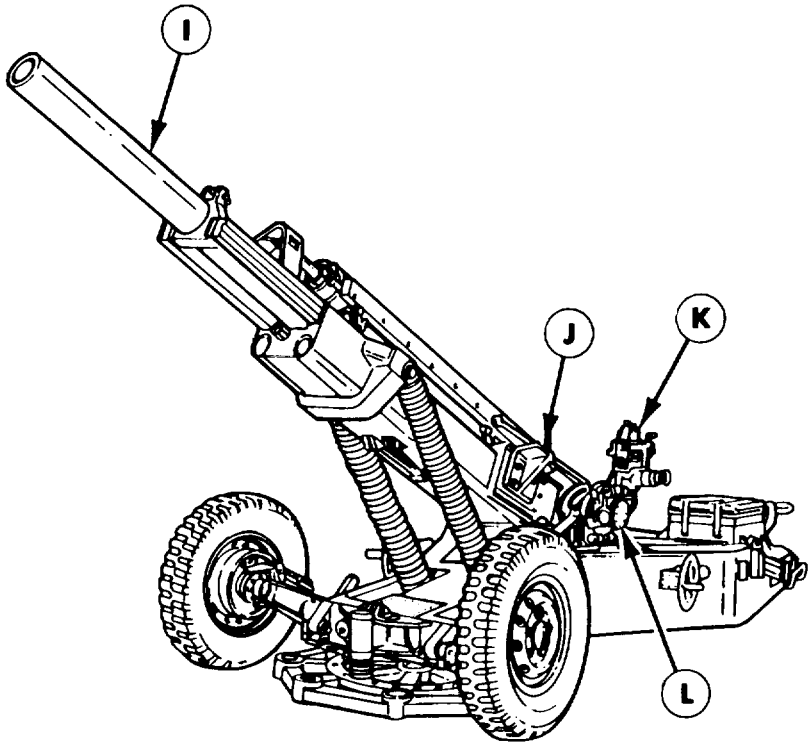
D M14A1 FIRE CONTROL QUADRANT. Instrument used to measure weapon elevation. Provides adjustable base for M114A1 elbow telescope.

E CARRYING CASE. Container for stowing telescopes and M140 alinement device during travel and storage.

F CRANK ASSEMBLY. Used to raise and lower weapon. Stored in tool box.

G CARRIAGE STAKES. Driven into ground to secure firing plat form assembly. Stored in tool box.

(H) BREECH MECHANISM ASSEIBLY. Consists of a breechblock, breech operating handle, operating crank, shaft, cartridge extractors. and cocking lever.



(I) M137A1 CANNON. Composed of cannon tube, which houses a complete round of ammunition and directs projectile when fired. It is rifled to rotate the projectile to aid in maintaining direction and to prevent tumbling in flight.

(J) M 90 CHRONOGRAPH ANIENNIA MOUNTING KIT AND ATTACHING HARD-WARE. Kit is mounted on carriage gun cradle assembly to hold M90 chronograph antenna bracket.

(K) M113A1 PANORAMIC TELESCOPE. A 4-power, fixed-focus telescope with a 178-mil field of view and a 7-mm exit pupil, used to lay weapon in azimuth. OL M134A1 TELESCOPE MOUNT. Adjustable base for leveling the

(L) M113A1 pantel regardless of pitch or cant of weapon.

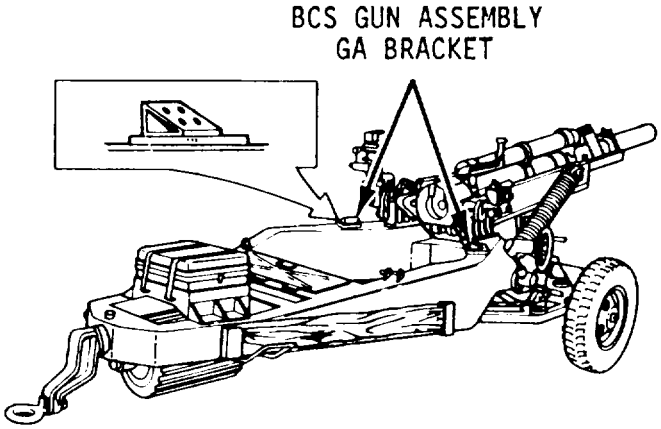
1-10. MODIFICATIONS ANID PRODUCT IFMPROVEMENT PACKAGE

NOTE

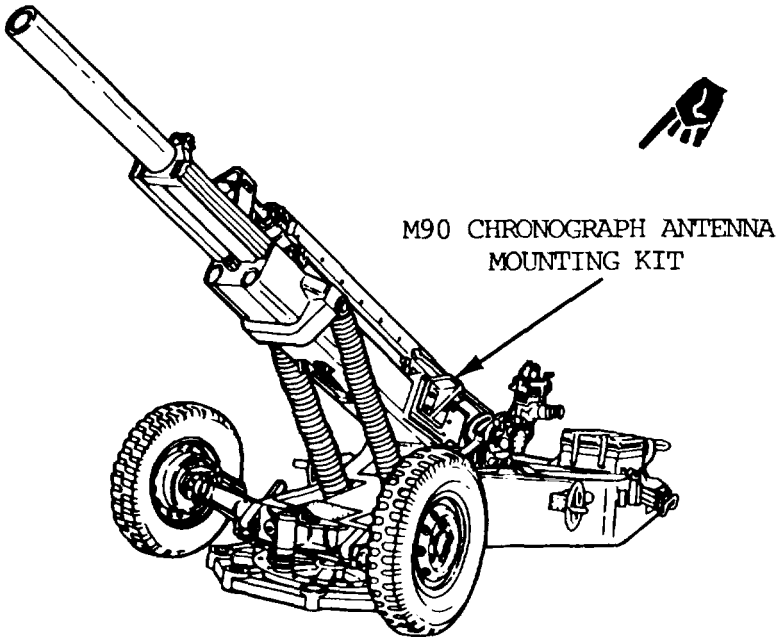
This manual has been written for both modified and unmodified M102 howitzers. When procedures vary depending on equipment configuration, both procedures are described and illustrated. Use the procedure which applies to your weapon. When procedures are the same for all configurations, the illustration shows only the modified equipment.

a. M102 Howitzer Modifications.

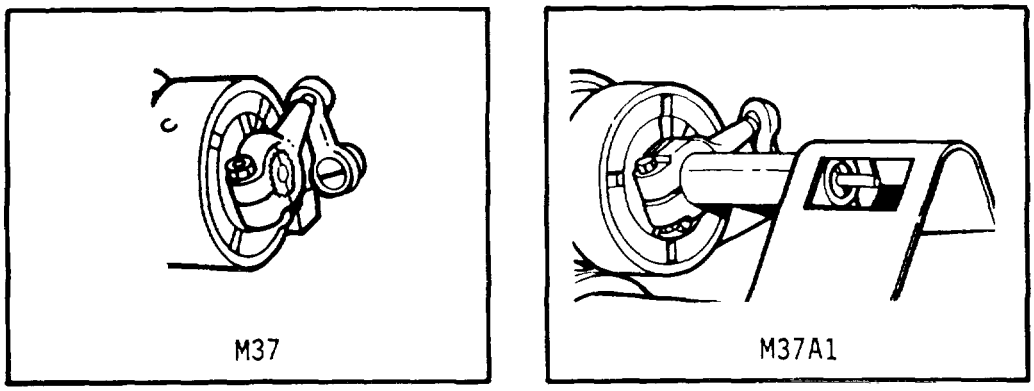
(1) All M102 howitzers are scheduled to be equipped with a product improvement package (MWO 9-1015-234-50-4) which includes reinforcement of the M31 carriage, travel lock bracket, and pneumatic tire wheel to eliminate cracking; and improved lubrication of trunnion bearings and hand brakes.



(2) All M102 howitzers are being modified with a gun assembly (GA) bracket on both the right and left box trail assemblies for mounting the battery computer system (BCS) gun assembly. Modifications are done by depot maintenance personnel. Operation of the BCS is covered in TM 11-7440-283-12-1, TM 11-7440-283-12-2, and TM 11-5820-882-10.



(3) All M102 howitzers are being equipped with a kit on the left side of the gun cradle assembly to hold the M90 chronograph antenna. Installation of the antenna mounting kit is completed by direct support and general support personnel. Operation of the M90 chronograph is covered in TM 9-1290-359-12&P.



(4) The M37 recoil mechanism is being modified to increase the oil reserve capacity. The modified recoil mechanism, designated M37A1, has a longer indicator rod and a guard assembly with a red tab visible through rectangular windows on both sides.

1-10. MODIFICATIONS AND PRODUCT IMPROVEMENT PACKAGE (cont)

b. Fire Control Equipment Modifications. Modification is completed by depot maintenance personnel on the M113A1 panoramic telescope, providing new seals to protect the optics against moisture and installing a wear resistant elbow lock plate; and modifies the M14A1 fire control quadrant to provide an improved rotating counter. 1-11. EQUIPMENT DATA

HOWITZER DATA

Weight:
- Complete M102 howitzer ..... 3180 lb (1442.448 kg)
- With on-carriage equipment ..... 3335 lb (1512.756 kg)
- With complete BII ..... 3670 lb (1664.712 kg)
- Cross country (airlift) ..... 3670 lb (1664.712 kg)
- Roll bar ..... 160 lb (72.576 kg)

Tire size ..... 7:00 x 16, 4 ply
Tire pressure ..... 20 psi normal
40 psi super highway

Maximum range ..... 11,500 meters
Designated prime movers ..... 1-1/4 ton and 2-1/2 ton truck
Dimensions (travel conditions):
- Length ..... 21 ft 10-1/2 in. (6.7 m)
- Width ..... 6 ft 4 in. (1.9 m)
- Height ..... 5 ft 2-3/4 in. (1.6 m)

Lunette load ..... 225 lb (101.25 kg)
Elevation range ..... -89 to +1333 mils
Rate of fire ..... Maximum (1st 3 minutes), 10 rpm; sustained, 3 rpm
Recoil length at O-mil elevation ..... 50 in. approx (1.3 m)
Recoil length at 1250-mil elevation ..... 30 in. approx (76 cm)
Maximum towing speed:
- Super highway ..... 45 mph
- Improved roads ..... 35 mph
- Cross country ..... 10 mph

FIRE CONTROL EQUIPMENT DATA

M113A1 Panoramic Telescope
- Field of view ..... 178 mils
- Movement:
- Azimuth counter ..... 6400 mils
- Azimuth (deflection) ..... 6400 mils
- Correction (AZ) ..... 50 mils
- Elevation ..... 300 mils

Least increment reading (AZ) ..... 1.0 mil
Optical characteristics:
Clear eye distance 0.88 in. (2.24 cm)
Effective focal length:
Eyeshield ..... 1.00 in. (2.54 cm)
Objective ..... 4.00 in. (10.16 cm)
Exit pupil diameter ..... 0.28 in. (0.71 cm)
Field of view ..... 178 mils
Power ..... 4 X
Radioactive material:
Max surface radiation ..... 0 millirad per hour
Tritium H_3. ..... 4.8 curies
Tritium H_3 ..... 4.8 curies
Weight ..... 12.50 lb (5.67 kg)

M134A1 Telescope Mount
Cross level adjustment:
Left ..... 178 mils
Right ..... 178 mils
Depression ..... -177 mils
Elevation ..... 1333 mils
Pitch level adjustment:
Aft 178 mils
Fore ..... 178 mils
Radioactive material:
Max surface radiation ..... 0 millirad per hour
Tritium H3 0.10 curies
Weight ..... 41.75 lb (18.94 kg)

M114A1 Elbow Telescope
Elevation ..... 60 mils
Field of view ..... 142.4 mils
Optical characteristics:
Diopter adjustment ..... +4 diopters
Effective focal length:
Clear eye distance ..... 6.60 in. (16.76 cm)
Eyeshield ..... 1.50 in. (3.81 cm)
Objective ..... 10.00 in. (25.40 cm)
Field of view ..... 4 mils
Power 8X
Radioactive material:
Max surface radiation ..... 0.millirad per hour
Tritium H_3 ..... 4.0 curies
Weight ..... 5.75 lb (2.61 kg)

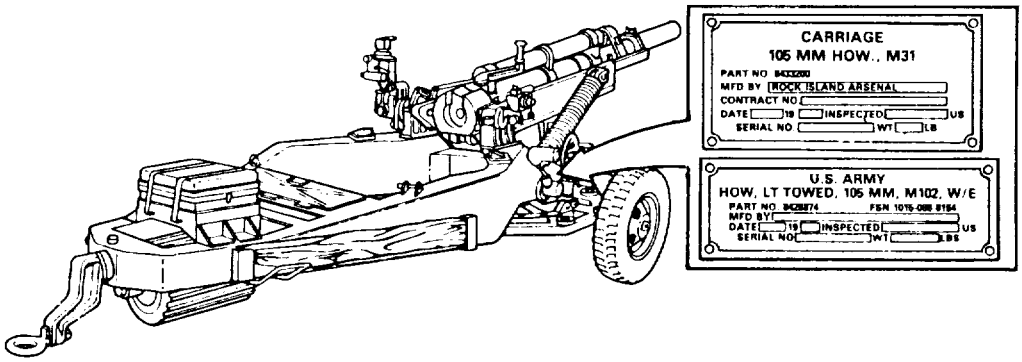
M14A1 Fire Control Quadrant
Correction ..... ±50 mils
Depression ..... -288 mils

1-11. EQUIPMENT DATA (cont)
FIRE CONTROL EQUIPMENT DATA (cont)

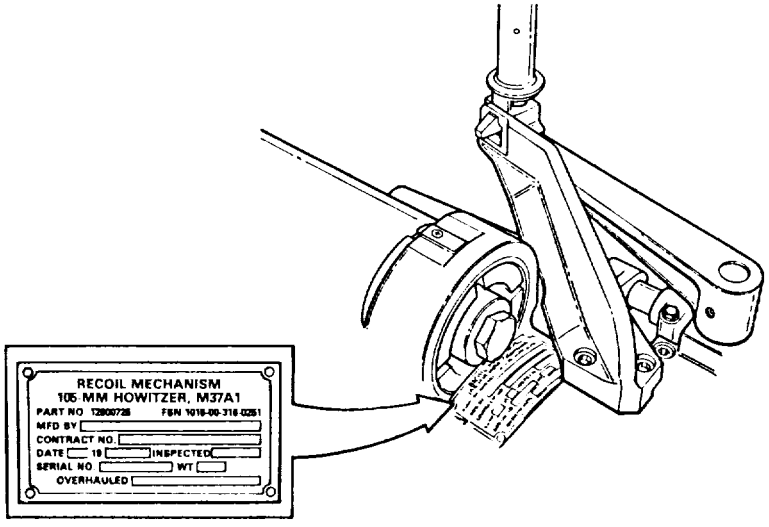
M14A1 Fire Control Quadrant (cont)
Elevation ..... +1383 mils
Least increment reading (counters) ..... 1 mil
Radioactive material:
Max surface radiation ..... 0 millirad per hour
Tritium H3 ..... 2.10 curies
Weight ..... 14.75 lb (6.69 kg)

1-12. M102 HOWITZER DATA PLATES

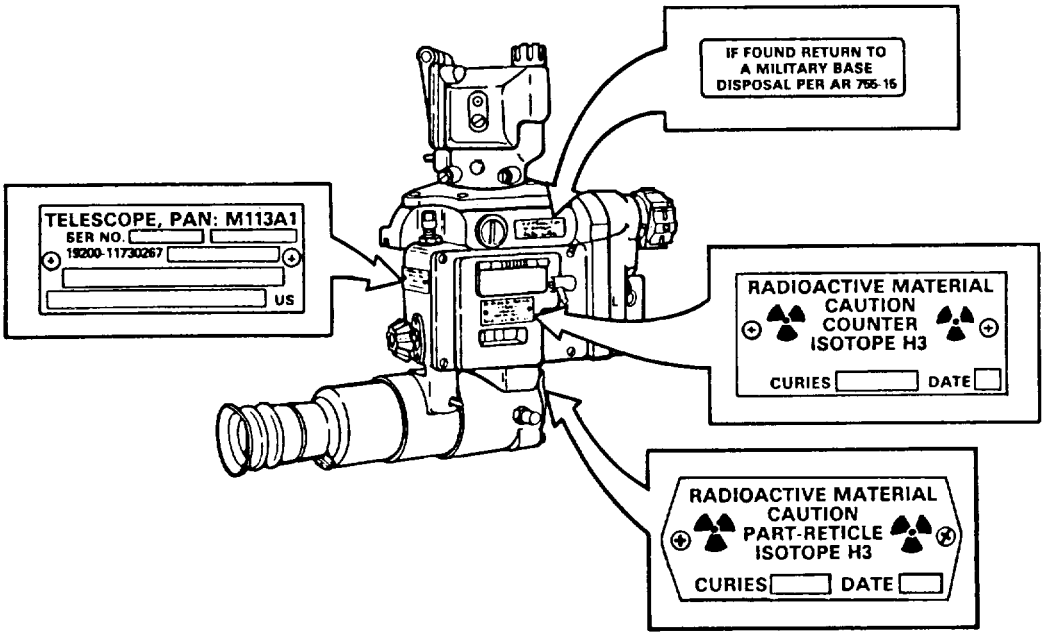
Identification, instruction, and caution/warning plates for the M102 howitzer and its fire control equipment are located as shown. Self-illuminated devices are identified with a radiation warning label. Replace missing or defaced labels as soon as possible and transfer information from old to new label. If unserviceable, turn in instrument as defective.



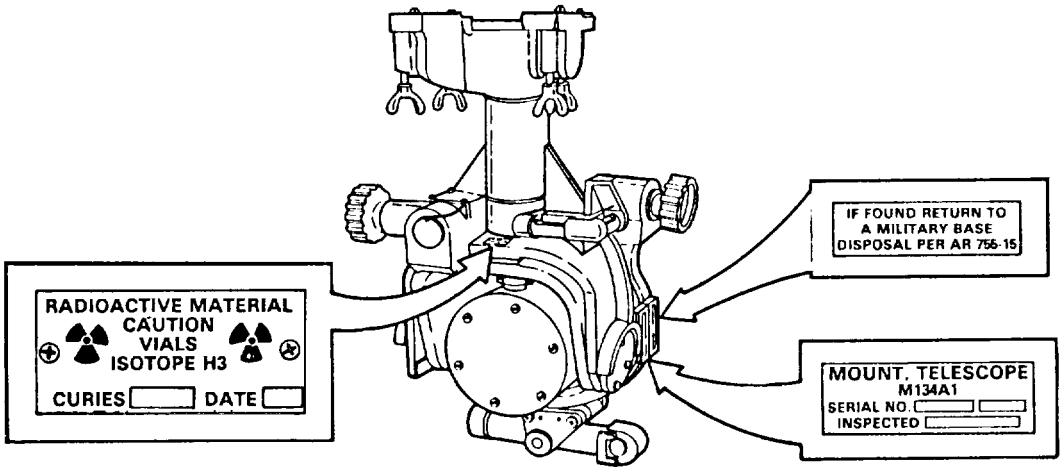
M102 HOWITZER



M37A1 RECOIL MECHANISM

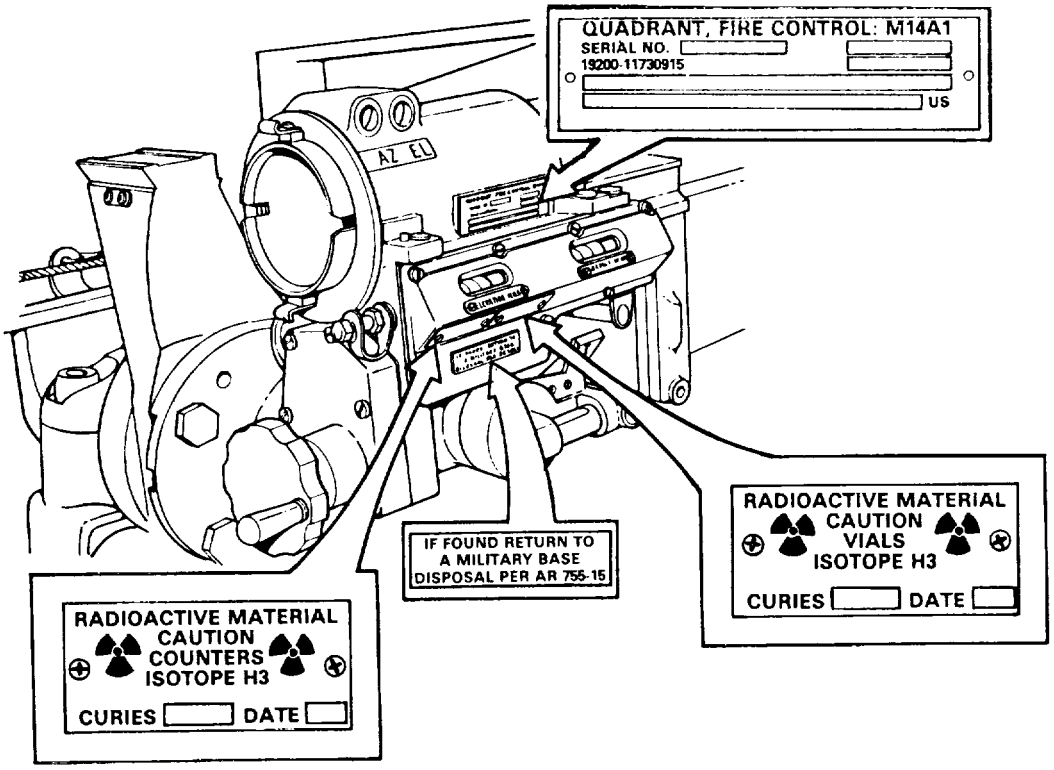


M113A1 PANTEL

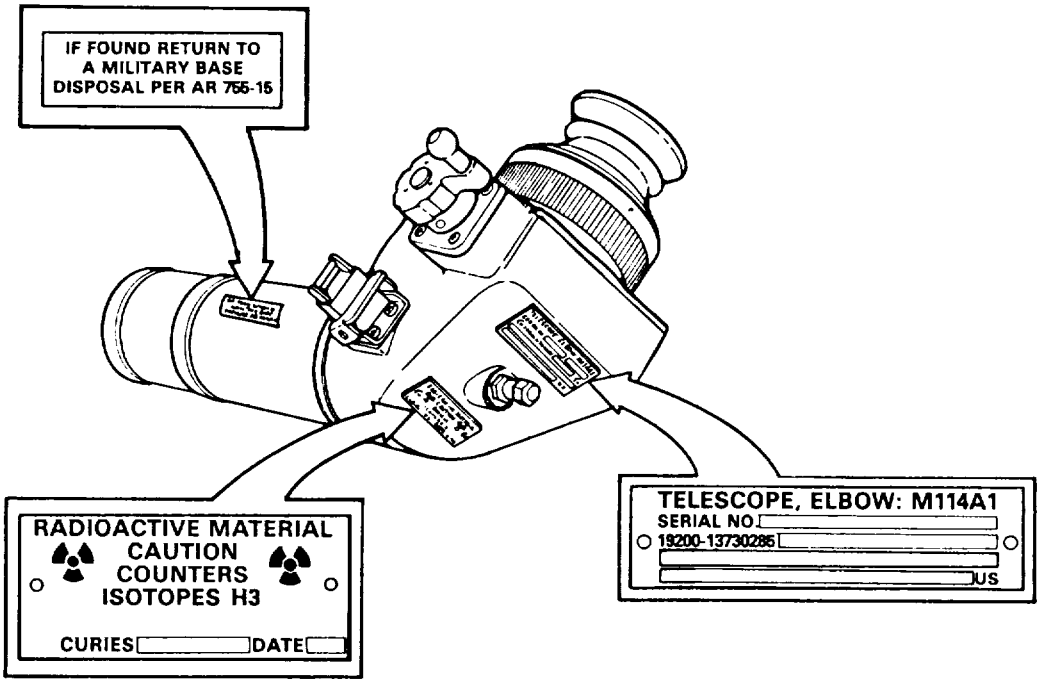


M134A1 MOUNT

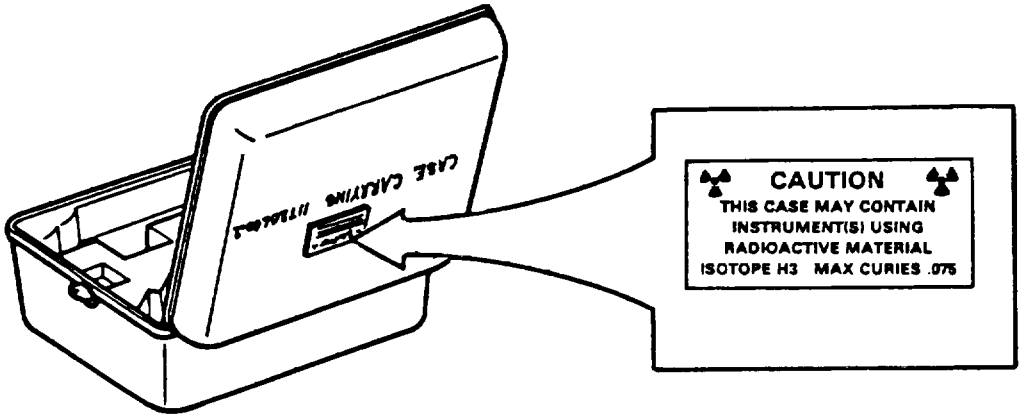
1-12. M102 HOWITZER DATA PLATES (CONT)



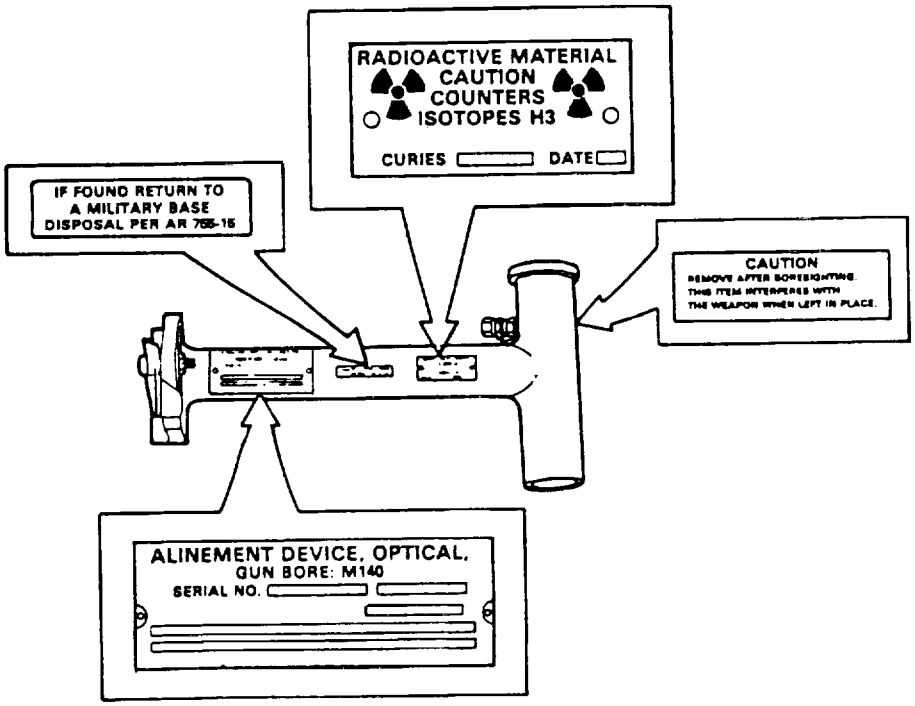
M14A1 QUADRANT



M114A1 TELESCOPE

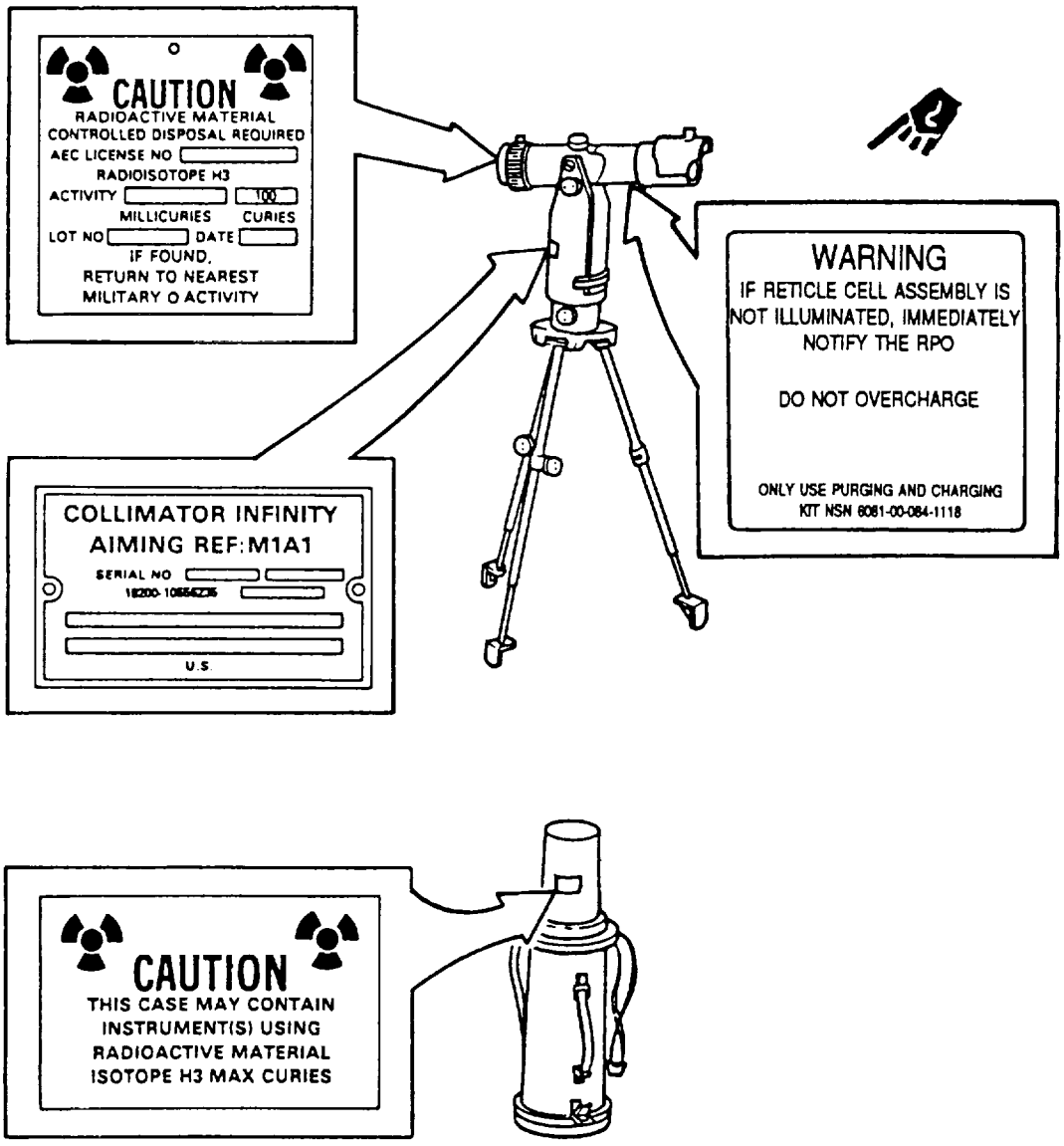


CARRYING CASE



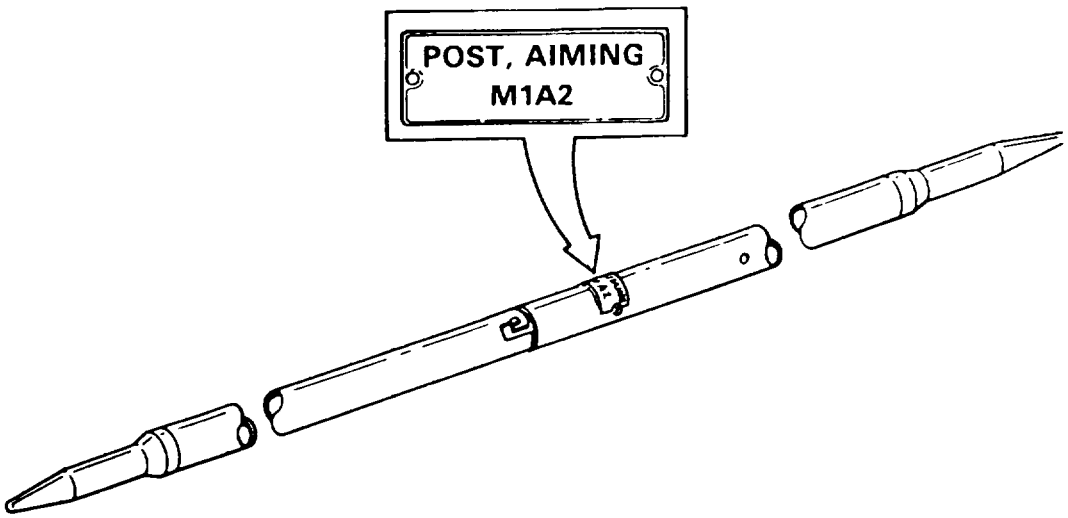
M140 ALINR4ENET DEVICE

1-12 M102 HOWITZER DATA PLATES (cont)



M1A1 COLLTMATOR

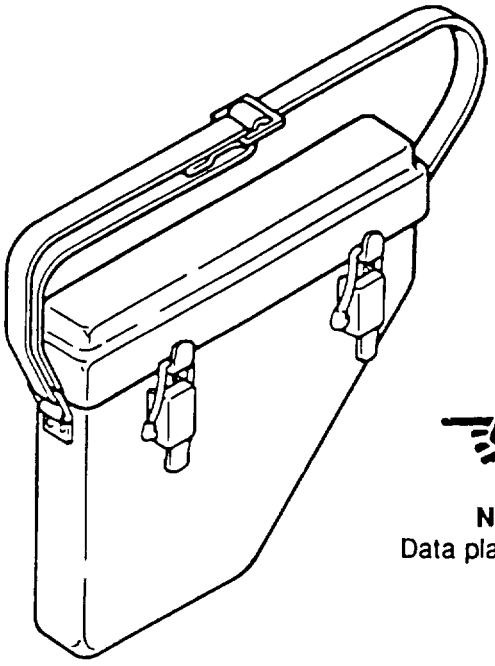
M58 AND M59 AIMING LIGHTS—deleted



M1A2 AIMING POST

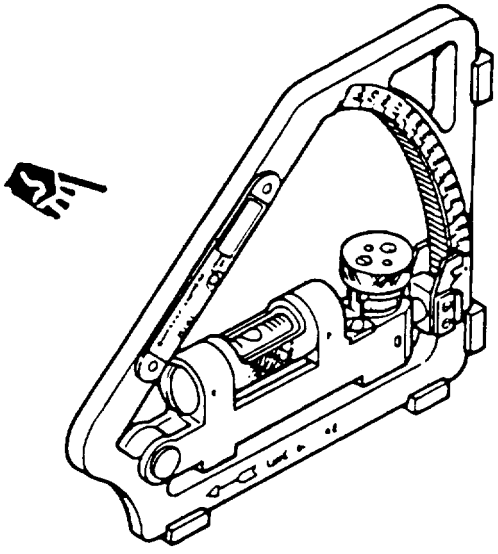
NOTE
Older models of the M1A2 aiming post have a data plate as shown.

1-12 M102 HOWITZER DATA PLATES (cont)



NOTE
Data plate deleted.

GUNNER'S QUADRANT CARRYING CASE



M1A1 GUNNER'S QUADRANT

All data for Section III. Section Drill on pages 1-21 thru 1-27(1-28 blank) has been deleted.

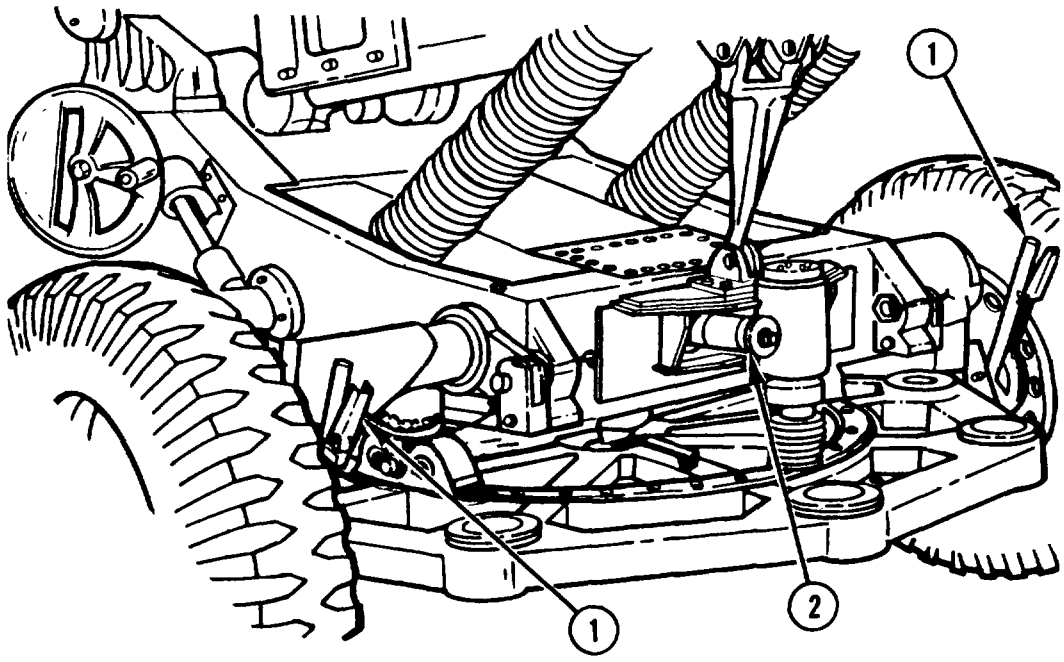
CHAPTER 2
OPERATING INSTRUCTIONS

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

2-1. GENERAL

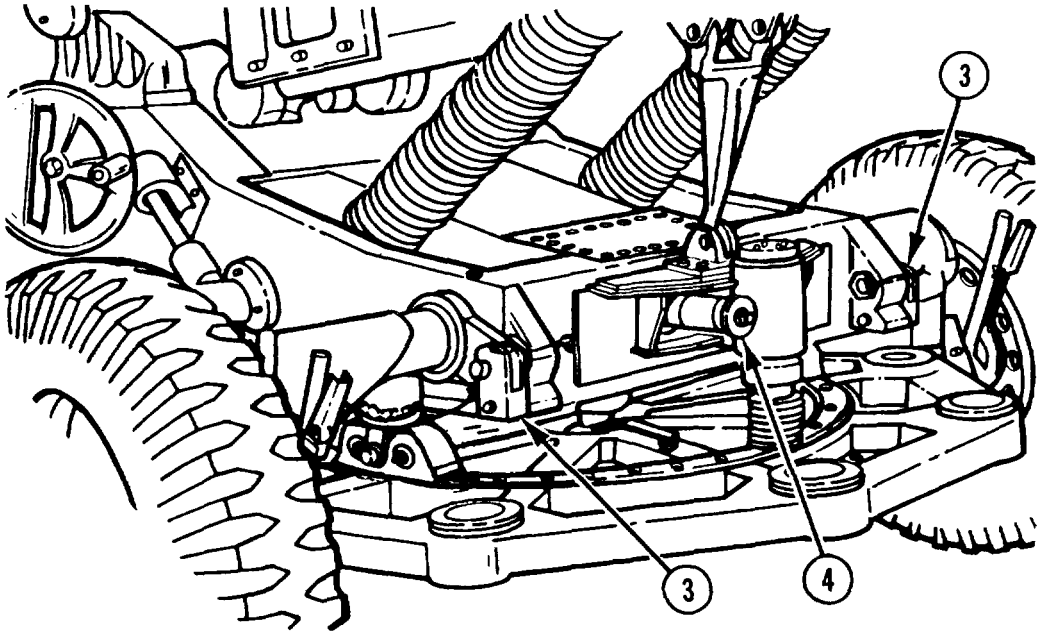
Before attempting to operate the M102 howitzer, make certain you are familiar with the location and operation of all controls and indicators.

2-2. OPERATOR'S CONTROLS AND INDICATORS

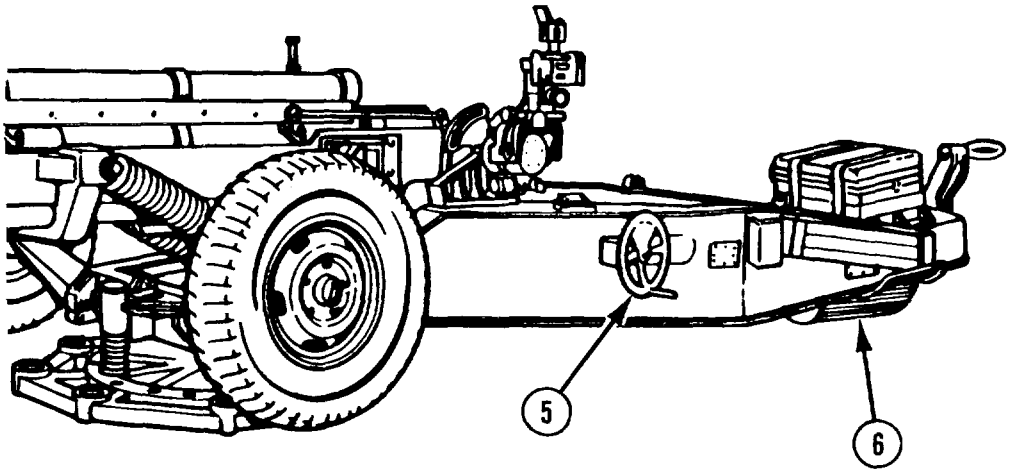


a. HANDBRAKES. To disengage each handbrake (1), grasp the clasp type handle and move your hand toward the breech mechanism assembly. The handbrakes must be engaged whenever the howitzer is in travel position while disconnected from the prime mover, and whenever the howitzer is in the firing position. The handbrakes must be disengaged before emplacing howitzer or march order.

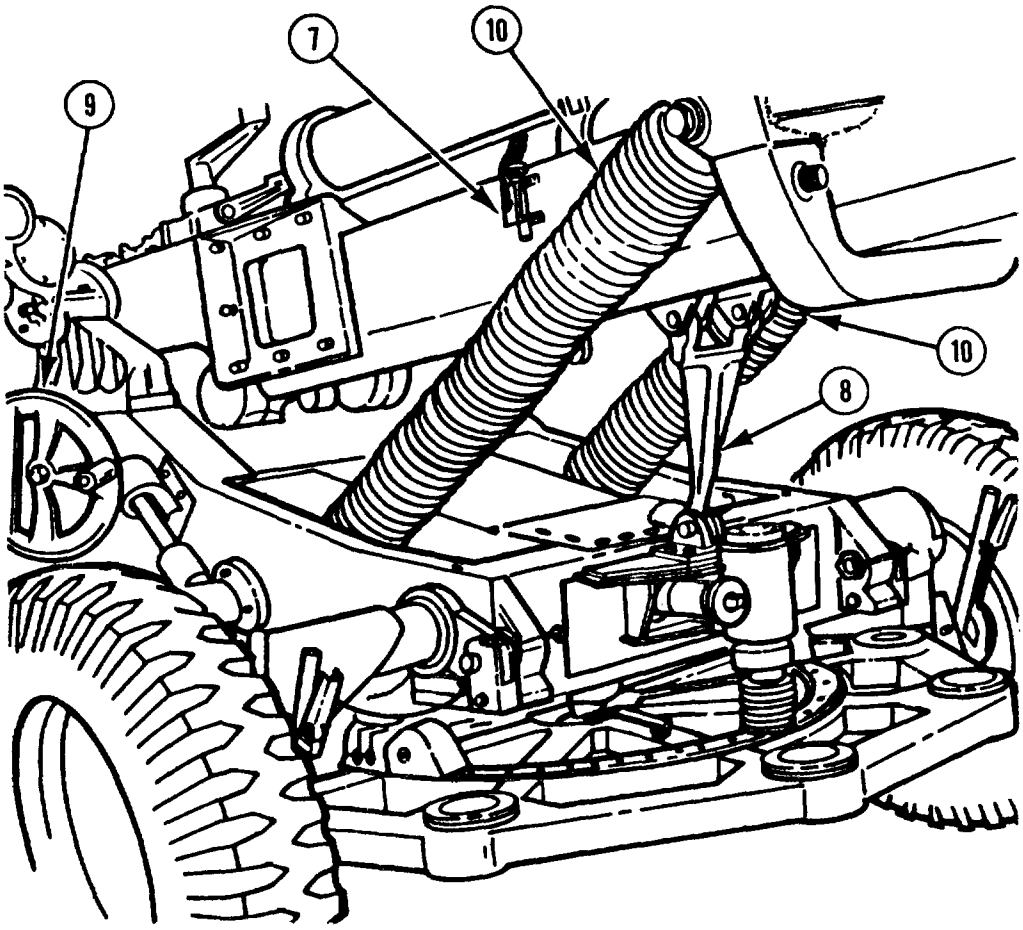
b. CONTROL ASSEMBLY. The mechanical type control assembly (2) provides a means of retracting and extending the wheels for raising and lowering the M31 carriage. (See page 2-30.)



c. SUSPENSION LOCKS. The suspension locks (3) secure the suspension system in the travel position and take stress off the control assembly (4) gears during travel.



d. TRAVERSING HANDWHEEL ASSEMBLY. The traversing handwheel assembly (5) provides power to the roller assembly (6) to traverse the howitzer. Turning the traversing handwheel assembly clockwise moves the weapon to the right; counterclockwise moves the weapon to the left.



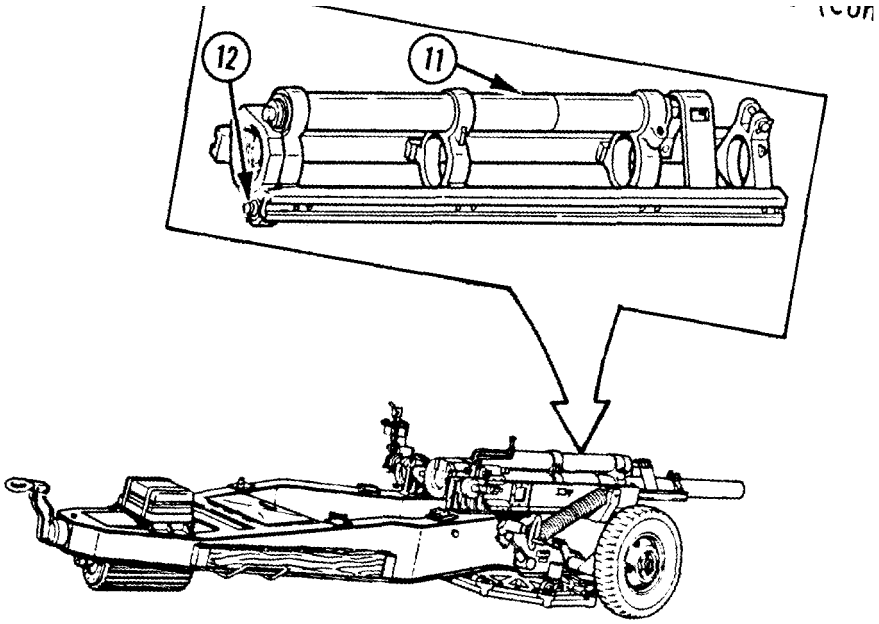
e. OUT OF BATTERY LOCK. The out of battery lock (7) secures the howitzer for internal aircraft loading.

f. TRAVEL LOCK. The travel lock (8) secures the gun cradle assembly during movement.

g. ELEVATING HANDWHEEL ASSEMBLY. Turning the elevating handwheel assembly (9) counterclockwise elevates cannon tube; clockwise depresses cannon tube.

h. BALL SCREW AND EQUILIBRATOR ASSEMBLIES. The two ball screw and equilibrator assemblies (10) reduce the manual effort required to elevate the cannon tube.

2-2. OPERATOR'S CONTROLS AND INDICATORS (cont)

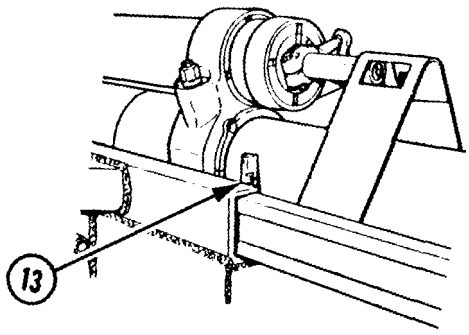


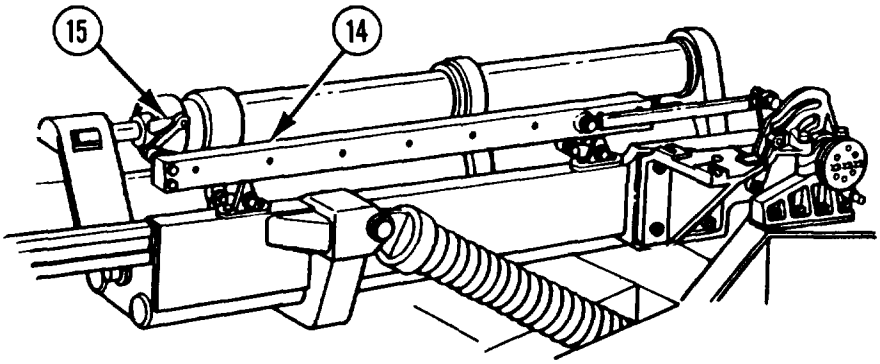
i. RECOIL MECHANISM. The M37A1 recoil mechanism has an increased oil reserve capacity with an extended indicator cap and guard assembly. All internal functions are the same as M37 recoil mechanism.

NOTE

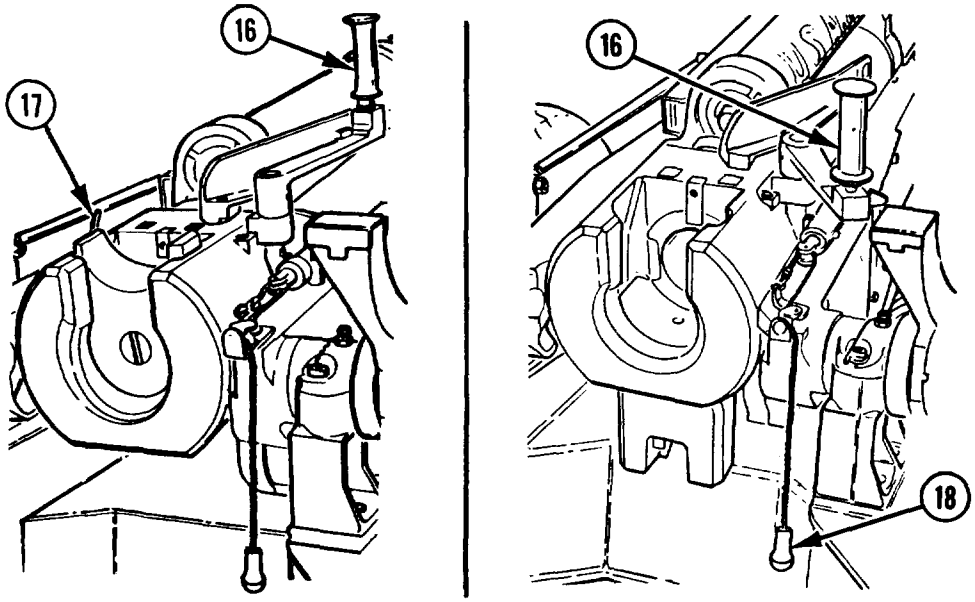
Recuperator cylinder assembly (11) contains compressed nitrogen gas, held between the piston and the head assembly. The front part of the recuperator cylinder assembly and the space between the piston and regulator assembly. The recoil cylinder assembly (12) contains recoil cylinder and recuperator cylinder assemblies.

j. RECOIL INDICATOR BRACKET. The recoil indicator bracket (13) measures the length of recoil when it is in the operating (down) position.





k. VARIABLE RECOIL MECHANISM. The variable recoil mechanism (14) alters the length of recoil by turning the recoil mechanism arm (15) and the regulator body when the weapon is elevated or depressed, and by opening or closing oil passages.



1. BREECH OPERATING HANDLE. The breech mechanism assembly is opened by depressing the breech operating handle (16) and rotating it to the rear.

m. COCKING LEVER. The cocking lever (17) recocks percussion mechanism each time breechblock is opened or in case of a failure to fire.

n. LANYARD ASSEMBLY. Assistant gunner pulls the lanyard assembly (18) to fire the weapon.

2-2. OPERATOR'S CONTROLS AND INDICATORS (cont)

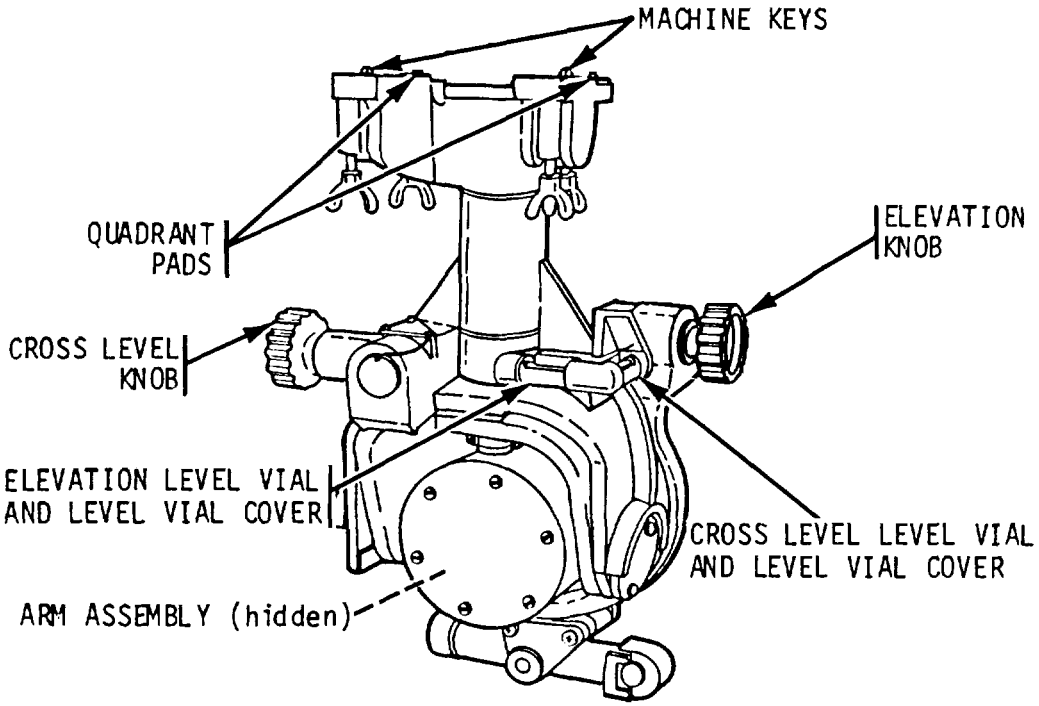
WARNING

The following fire control instruments incorporate radioactive material, tritium gas (H3), to provide night lighting capabilities. These items are designed to avoid a health hazard. However, in the event there is no illumination in a low light environment, or there is evidence of breakage, follow radioactive materials procedures listed in the front of this manual.

CAUTION

Level vial covers should be kept closed when not in use to protect the glass vials.

o. M134A1 TELESCOPE MOUNT.

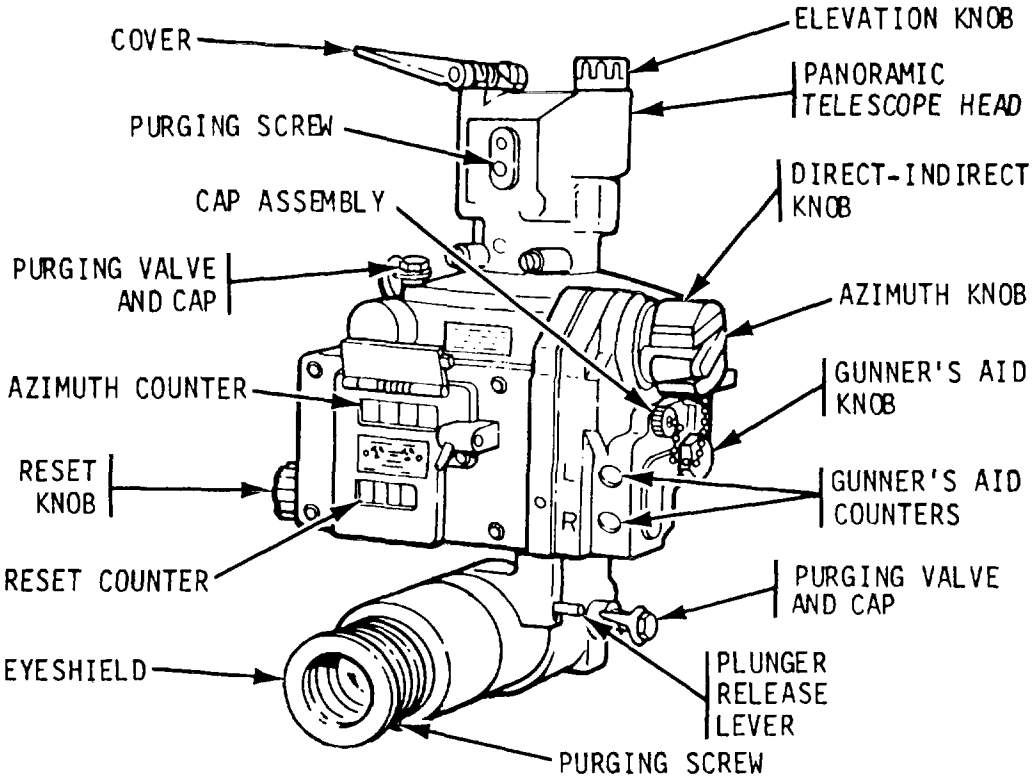


The M134A1 telescope mount (M134A1 mount) provides an adjustable base for leveling the M113A1 panoramic telescope (M113A1 pantel). The M134A1 mount is installed on the left trunnion. The mechanism of the M134A1 mount is essentially a universal joint which makes possible adjustment of the vertical axis of the M113A1 pantel to plumb, regardless of pitch or cant (within the range +178 mils) of the weapon. The mechanism also contains an arm assembly which is maintained parallel to the cannon tube at all times, since it is mounted directly on the

weapon trunnion. This arm assembly serves as a reference about which the M134A1 mount is adjusted to compensate the azimuth for the effects of trunnion cant. The M134A1 mount provides a vertical support for the M113A1 pantel to provide a true measurement of weapon azimuth.

p. M1131A1 PANTEL

p. M113A1 PANTEL.



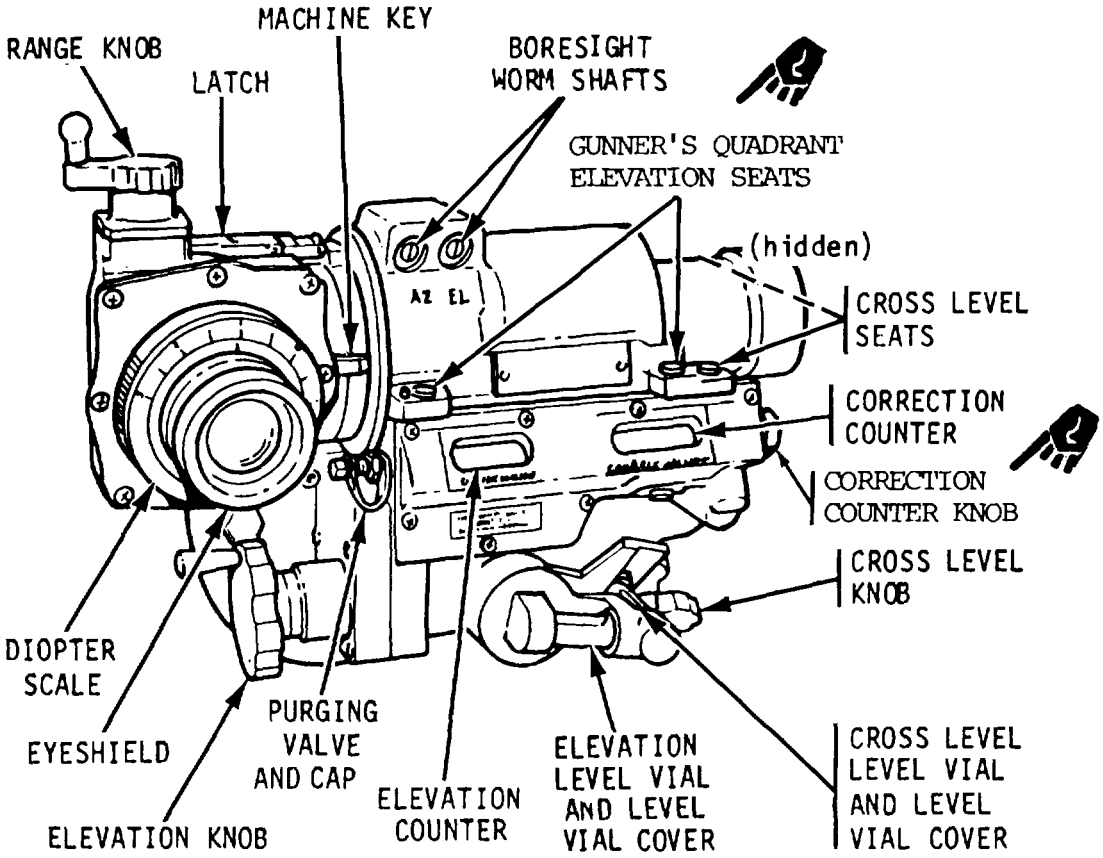
The M113A1 pantel is the basic instrument used in laying the weapon in azimuth. Azimuth reading is made from a mechanical mil counter unit. Included is a reset counter which can be set to show a reading of 3200 mils when the M113A1 pantel is alined with an aiming reference point and the weapon is parallel to the azimuth of lay.

A gunner's aid counter mechanism, which is an integral part of the reset counter mechanism, permits azimuth corrections for factors peculiar to the individual weapon and its emplacement to be entered easily into the instrument.

The 113A1 pantel is a 4-power, fixed-focus telescope, with a 178-mil field of view and a 7-mm exit pupil.

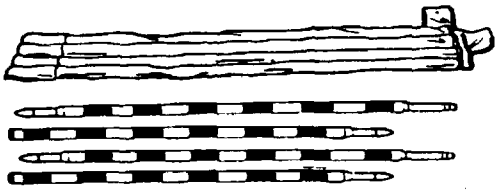
2-2. OPERATOR'S CONTROLS AND INDICATORS (cont)

q. M14A1 FIRE CONTROL QUADRANT AND M114A1 ELBOW TELESCOPE



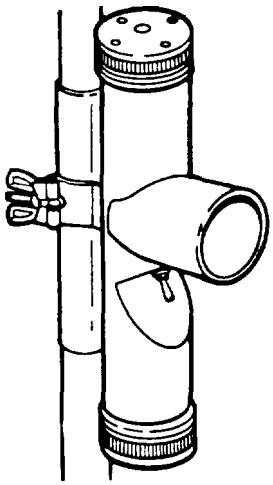
The M14A1 fire control quadrant (M14A1 quadrant), which is mounted on the right-hand trunnion, is used for adjustment of the weapon in elevation. The M14A1 quadrant is equipped with a mechanical mil counter for elevation readings. A correction counter is built in to permit quick, accurate insertion of elevation correction factors peculiar to the individual weapon and its emplacement. Quadrant seats also are provided on the instrument to allow the use of a gunner's quadrant for checking elevation settings.

The M114A1 elbow telescope (M114A1 telescope) is the basic instrument used for laying the weapon in elevation for direct fire. The M114A1 telescope is mounted and boresighted in the M14A1 quadrant. The reticle presents multiple ballistic data and the use of a movable range gage line that can be set to range values for direct fire. The M114A1 telescope has an 8- power lens and diopter which can be rotated to change the focus.

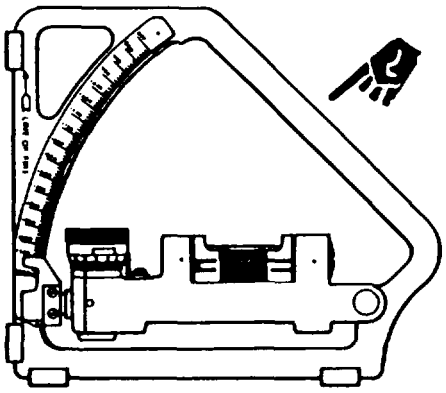


r. M1A2 AIMING POST. Two sets of aiming posts are provided for use as the alternate aiming reference point for indirect laying operations. The aiming posts normally are stored in M401 canvas cover and secured in the holders on the right trail.

s. deleted



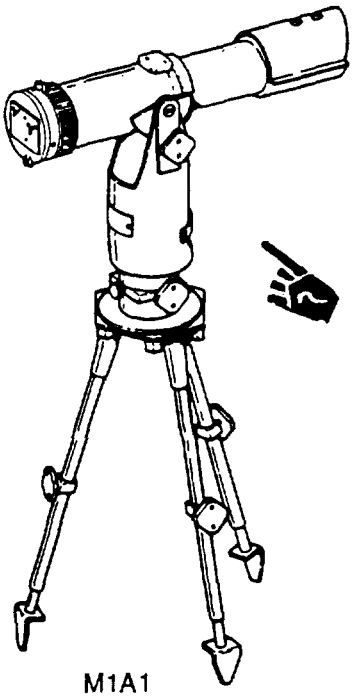
t. M14 AIMING POST LIGHTS illuminate aiming posts for night use. They are stored in the howitzer tool box.



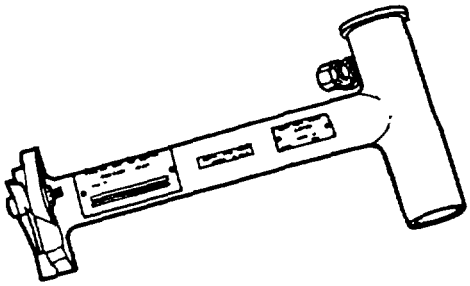
U. M1A1 GUNNER'S QUADRANT is used for checking fire control alignment and also may be used to lay for elevation. It has its own carrying case and is stored in the howitzer tool box.

capabilities for the M113A1 pantel. The device is stored in the carrying case.

v. M1A1 COLLIMATOR is the primary aiming reference point for indirect laying operations.



M1A1



w. M140 ALINEMENT DEVICE provides the gunner on-carriage boresight check

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-3. GENERAL

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 ATEER you operate the equipment. The warnings and cautions appear before certain procedures. You must observe these WARNINGS and CAUTIONS to prevent serious injury to yourself and others or prevent your equipment from being damaged.

2-4. EXPLANATION OF TABLE ENTRIES

a. 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 that you must do checks and services for the intervals listed.

b. 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.

c. Check/Service column. This column provides the location and the item to be checked or serviced. The item location is underlined.

d. 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.

2-4. EXPIANATICN OF TABL EIIES (cant)

e. 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.

NOTE

The M102 howitzer will not be mission capable if ROTH the M14A1 quadrant and the MlA1 gunner's quadrant are missing or inoperable. The M102 howitzer needs a quadrant to be mission capable. The M102 howitzer is mission capable as long as FITHER quadrant is available.

Table 2-1. Preventive Maintenance Checks and Services for M102 Howitzer

Item No.	Interval	Location Item to Check/ Service	Procedure	Not Fully Capable If:
1	Before Mission 2408-4	DA FORM	Chief of Section Check to see if your weapon has been borescoped within the past 180 days.	Weapon has not been borescoped within 180 days.
2	Before	BASIC ISSUE ITEMS	Make sure all basic issue items are present and are in proper working order. (See OOEI and AAL, appendix B.)	
I3	Before	M37/M37A1 REOOIL MECHANISM	Check variable recoil timing on M37/M37A1 recoil mechanism.	Recoil timing is out of adjustment.

Table 2-1. Preventive Maintenance Checks and Services for M102 Howitzer (cont)

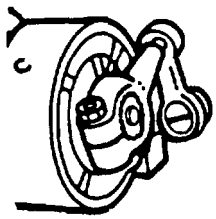
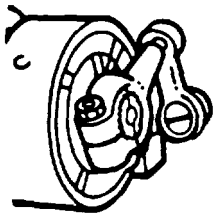
Item No.	Interval	Location Item to Check/ Service	Procedure	Not Fully Capable If:
3	Before	M37/M37A1 RECOIL MECHANISM (cont)	Check the indicator rod for correct oil reserve.  M37 Indicator rod flush with face of indicator and control assembly: Normal.  M37 Indicator rod extends 3/16 inch or more: Low. Do not fire. Restore oil reserve. NOTE Sane M37 models have a red scribe line at 3/16 inch on indicator rod.	

Table 2-1. Preventive Maintenance Checks and Services for M102 Howitzer (cont)

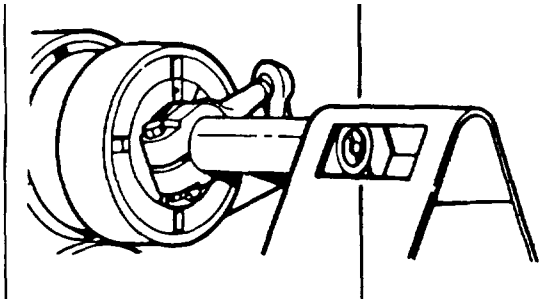
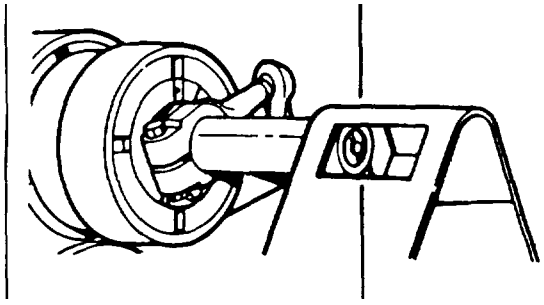
Item No.	Interval	Location Item to Check/ Service	Procedure	Not Fully Capable If:
3	Before	M37/M37Al RECOIL MECHANISM (cont)	Chief of Section  M37A1 Indicator rod flush with face of indicator and control assembly. Normal full oil reserve. Indicator rod extended but not to red tab. Howitzer will FIRE but oil reserve is not full.  M37A1 Indicator rod extended to red tab. Low oil reserve-DO NOT FIRE. Restore oil reserve.	

Table 2-1. Preventive Maintenance Checks and Services for M102 Howitzer (cont)

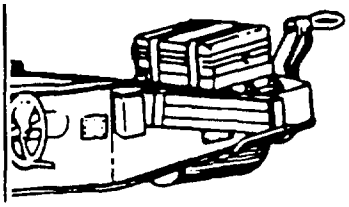
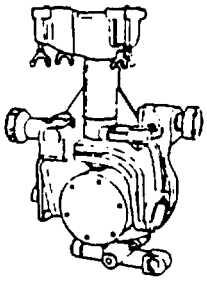
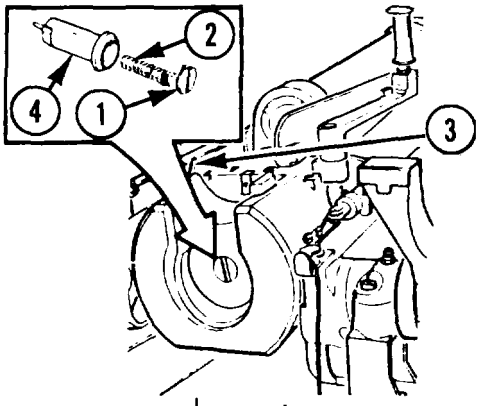
Item No.	Interval	Location Item to Check/ Service	Procedure	Not Fully Capable If:
				
			CAUTION Request that unit maintenance check the nitrogen in recoil mechanism if howitzer has moved from one location to another with a temperature change of plus or minus 200F.	
		M31 CARRIAGE		
4	Before	M31 Carriage Traversing Mechanism	Gunner Check for smooth operation, watch for vibration, binding, or unusual noises. 	Will not traverse.
5		FIRE CONTROL Before Mount	WARNING When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.	

Table 2-1. Preventive Maintenance Checks and Services for M102 Howitzer (cont)

Item No.	Interval	Location Item to Check/ Service	Procedure	Not Fully Capable If:
10	Before	CANNON Percussion Mechanism	Assistant Gunner a. Remove percussion mechanism as follows and check for weak or broken spring (2). (1)Check that weapon is in firing position, cham- ber and bore are clear, and breech operating handle is in locked position. Pull lanyard to fire weapon.  	Spring (2) is weak or broken.

Be careful when removing and installing retainer and spring. Spring is under extreme tension. Carelessness could result in personnel injury.

Table 2-1. Preventive Maintenance Checks and Services for M102 Howitzer (cont)

Item No.	Interval	Location Item to Check/ Service	Procedure	Not Fully Capable If:
10	Before	CANNON Percussion Mechanism (cont)	Assistant Gunner (2) Press in on retainer (1) and rotate 90 degrees in either direction to remove retainer and spring (2). (3) Pull back cocking lever (3). Remove percussion mechanism (4). If spring is broken, notify organizational maintenance. Install percussion mechanism, spring, and retainer. Twist retainer 90 degrees in either direction to lock. To check correct assembly of percussion	

Table 2-2. Preventive Maintenance Checks and Services for M102 Howitzer (Cont'd)

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
10	Before	CANNON Percussion Mechanism (cont)	mechanism, pull back cocking lever, pull lanyard, and listen for click.	
			b Check for missing or broken firing pin by first opening and closing breechblock, then pulling lanyard while at the same tirme looking between the rear of the tube and the breechblock. If firing pin is missing or broken, notify organizational maintenance.	Firing pin is missing or broken.

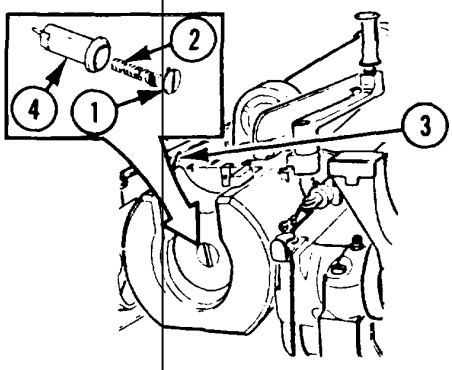


Table 2-2. Preventive Maintenance Checks and Services for M102 Howitzer (Cont'd)

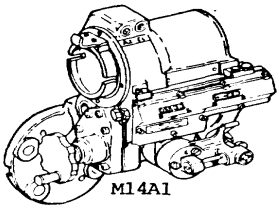
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
11	Before	FIRE CONTROL M14A1 Quadrant	  **WARNING** When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual. **NOTE** The M102 howitzer will not be mission capable if BOTH the M14A1 quadrant and the MlA2 gunner's quadrant are missing or inoperable. The M102 howitzer needs a quadrant to be mission capable. The M102 howitzer is mission capable as long as EITHER quadrant is available.	
			Assistant Gunner	
			Check counters and level vials for illumination at night or in dark conditions during daylight.	M14A1 quadrant is missing or not operable.
			Check level vials for cracks, breaks, and legibility. Check knobs for smooth operation. Watch for moisture buildup in counters.	No illumination.

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

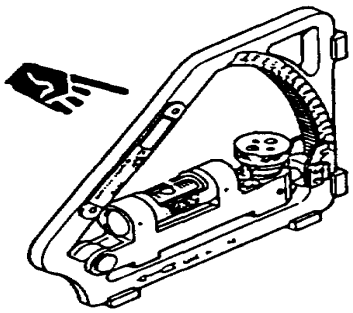
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
12	Before	M1A1 Gunner's Quadrant	 **NOTE** The M102 howitzer will not be mission capable if BOTH the M14A1 quadrant and the M1A1 gunner's quadrant are missing or inoperable. The M102 howitzer needs a quadrant to be mission capable. The M102 howitzer is mission capable as long as EITHER quadrant is available.	
			Assistant Gunner Check level vial for cracks, breaks, and legibility. Check for free cover movement.	
			Check to see if M1A1 gunner's quadrant is missing or not operable.	M1A1 quadrant is missing or not operable.

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

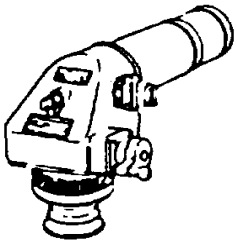
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
				
13	Before	M114A1 Telescope	M114A1 **WARNING** When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual. Assistant Gunner Check reticle for illumination at night or in dark conditions during daylight. Check range knob for smooth operation. Watch for moisture buildup in optics.	
		M31 CARRIAGE		
14	Before	Tail and stop Blackout Light	Ammunition Team Chief Check for proper operation of stop-light-taillights and blackout lights.	

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

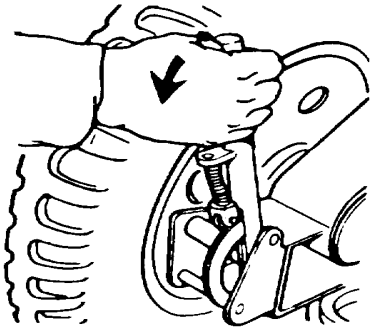
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
				
15	Before	Handbrakes	Cannoneer No. 1 Make sure that handbrakes hold properly and engage in the first one-third of the brake rack.	
		CANNON		
16	Before	M137A1 Cannon	Wipe the bore and chamber dry; for obstructions, dents, stripped lands, and other obvious defects.	M137A1 cannon check contains cracks, dents, or bulges.
		M31 CARRIAGE		
17	Before	Wheel Assembly	Cannoneer No. 2 Check the general condition of the tires; look for cuts, breaks, bulges.	One or both tires are unserviceable.

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

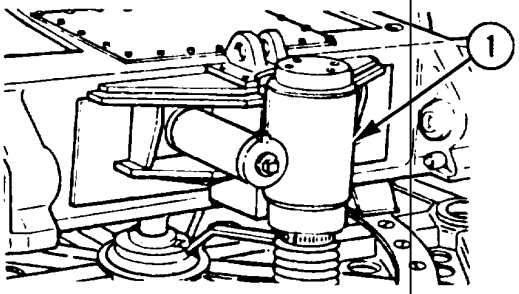
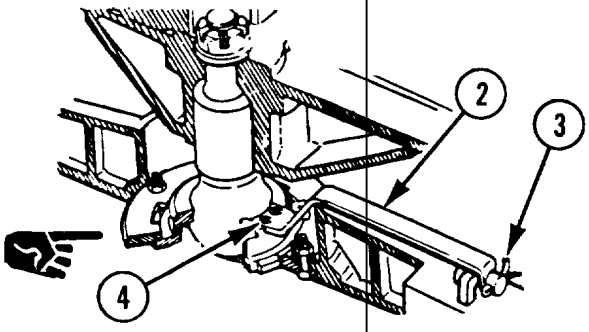
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
18	Before	M31 Carriage	 Cannoneer No. 2 a. Inspect buffer assembly (1) for damage or leaks.	If buffer assembly is damaged or leaks, notify organizational mainte nance.
			 b. Make sure firing platform assembly is properly secured, locking assembly handle (2) is in place, and cotter pin (3) is installed.	Firing plat-form assembly will not lock to the carriage. Pin (3) is missing. Screws (4) are loose.

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

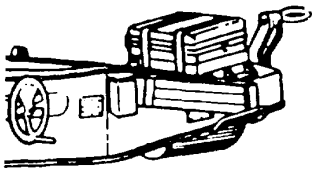
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
19	During	M37/M37A1 RECOIL MECHANISM	Chief of Section Observe operation of recoil mechanism and variable recoil mechanism. Watch for jerking or slamming; recoil length should decrease at high angles of fire. 	
		M31 CARRIAGE		
20	During	M31 Carriage Traversing Mechanism	Gunner Check for smooth operation, watch for vibration, binding, or unusual noises.	Will not traverse.

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

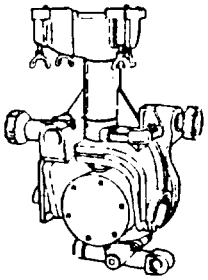
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
21	During	 M134A1 FIRE CONTROL M134A1 Mount	**WARNING** When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual. Gunner Check level vials for illumination at night or in dark conditions during daylight. Check level vial covers for free movement. Check elevation and cross level knobs for smooth operation Check mounting surface for nicks and burrs.	M134A1 mount is missing or not operable. Level vials cracked, loose, or unreadable. No illumination

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

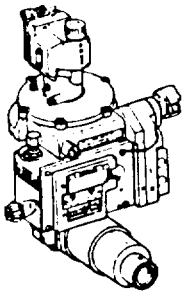
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
			 M113A1	
22	During	M113A1 Pantel	**WARING** When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual. Gunner Check counters for illumination at night or in dark conditions during daylight. Check knobs for smooth operation. Watch for moisture buildup in optics and counters.	M113A1 pantel is missing or not operable. No illumination

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

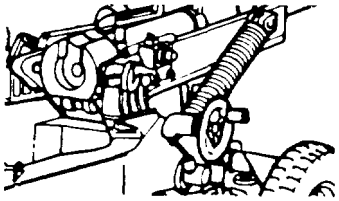
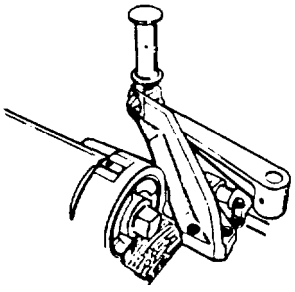
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
				
		M31 CARRIAGE		
23	During	M31 Carriage Elevating Mechanism	Assistant Gunner Check for free and easy operation through entire range with no evidence of binding, sl 	Will not elevate or depress.
24	During	Breech Operating Handle	Make sure breech operating handle locks in closed position each time breech mechanism assembly is closed.	Breech operating handle will not lock.

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

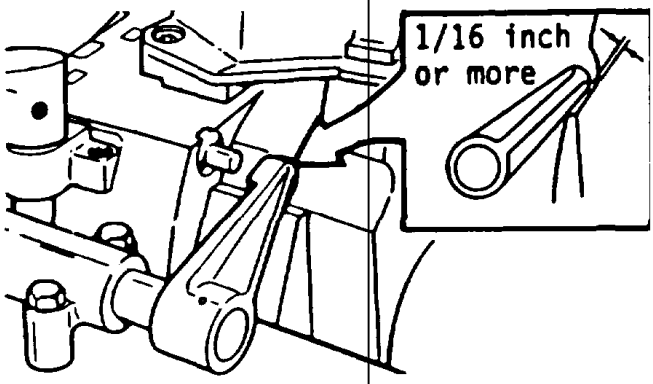
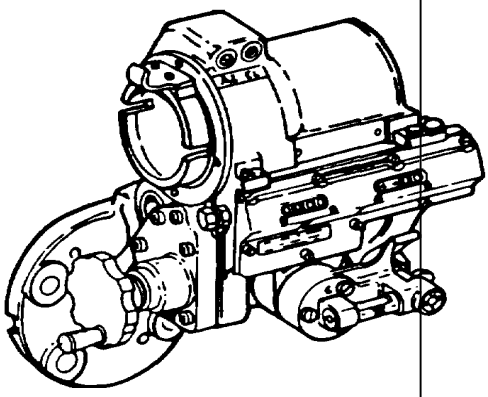
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
				
25	During	Firing Mechanism Assembly	Check that clearance between firing mechanism assembly and rear yoke is at least 1/16 inch. at least 1/16 inch.	Firing mechanical assembly is broken or missing.
				
		FIRE CONTROL	M14A1	
26	During	M14A1 Quadrant	**WARNING** When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.	

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
26	During	FIRE CONTROL M14A1 Quadrant (cont)	**NOTE** The M102 howitzer will not be mission capable if BOTH the M14A1 quadrant and the M1A1 gunner's quadrant are missing or inoperable. The M102 howitzer needs a quadrant to be mission capable. The M102 howitzer is mission capable as long as EI-THER quadrant is available.	
			Assistant Gunner	
			Check counters and level vials for illumination at night or in dark conditions during daylight.	M14A1 quadrant is missing or not operable.
			Check level vials for cracks, breaks, and legibility.	No illumination
			Check knobs for smooth operation. Watch for moisture buildup in counters.	

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

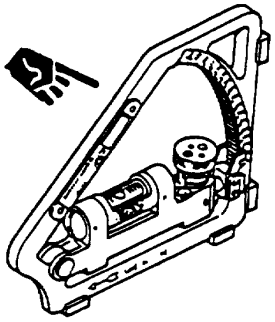
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
27	During	M1A1 Gunner's Quadrant	 **NOTE** The M102 howitzer will not be mission capable if BOTH the M14A1 quadrant and the M1A1 gunner's quadrant are missing or inoperable. The M102 howitzer needs a quadrant to be mission capable. The M102 howitzer is mission capable as long as EITHER quadrant is available. Assistant Gunner Check level vial for cracks, breaks, and legibility. Check level vial for illumination at night or in dark conditions during daylight. Check for free cover movement. Check to see if M1A1 gunner's quadrant is missing or not operable.	M1A1 quadrant is missing or not operable.

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

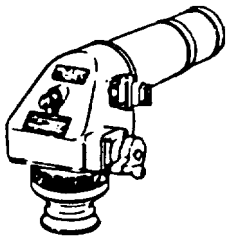
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
28	During	M114A1 Telescope	 **WARNNG** When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual. Assistant Gunner Check reticle for illumination at night or in dark conditions during daylight. Check range knob for smooth operation. Watch for moisture buildup in optics.	

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

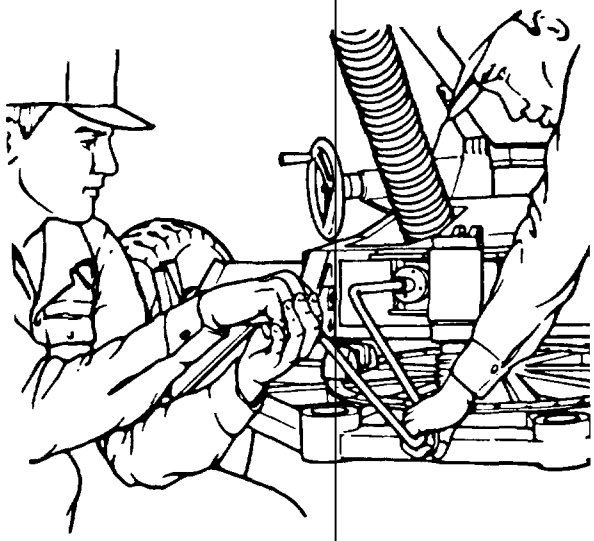
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
				
		M31 CARRIAGE		
29	During	Control Assembly	Cannoneer No. 1 Watch for slippage, unusual noises, or binding.	Control assembly will not raise or lower The weapon.
30	During	M37/M37A1 REMOIL MECHANISM	Observe operation of recoil mechanism and variable recoil mechanism. Watch for jerking or slamming; recoil length should decrease at high angles of fire.	

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

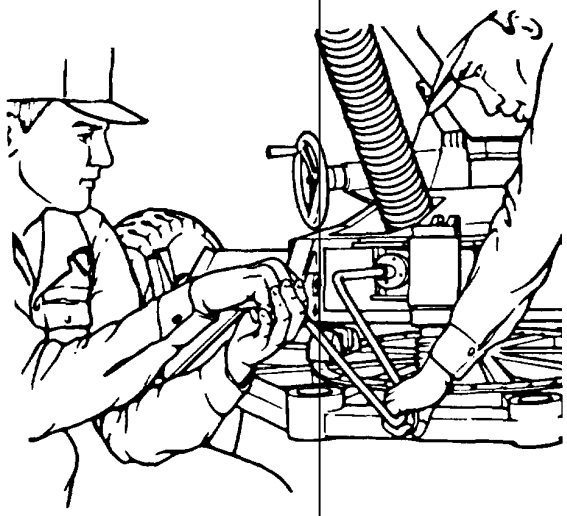
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
				
		M31 CARRIAGE		
31	During	Control Assembly	Cannoneer No. 2 Watch for slippage, unusual noises, or binding	Control assembly will not raise or lower the weapon.
32	After	DA FORM 2408-4	Chief of Section Enter the day's firing and update the Equivalent Full Charge (EFC) total.	Total cumulative round count exceeds 10,000, unless extension is granted for additional 2,000 Cumulative round count by depot level personnel.

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
32	After	DA FORM 2408-4 (cont)		Extension cumulative round count exceeds 2,000; unless additional 2,000 cumulative round count extension is granted by depot person nel. Total EFC round count exceeds 5,000.
33	After	CANNON M137A1 Cannon	**CAUTION** The nylon bore brush assembly issued with the artillery cleaning kit should not be used with cleaning compound, rifle bore cleaner (RBC). RBC will destroy the bore brush assembly. **NOTE** Shake the bottle well before each use. Chief of Section a. On day of firing, remove one bottle of pre-measured cleaner, lubrication cant, and preservative	

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
33	After	CANNON M137A1 Cannon	Chief of Section (CLP) (item 9, app D) and one bore brush assembly from kit (item 18.1, app D). Attach bore brush assembly to standard US Army rammer staff. Inspect breech mechanism and cannon tube; clear obstructions. Wet punch cannon tube. Pour 1/4 of the bottle onto bore brush assembly and punch the cannon tube once forward and once back. Pour second 1/4 of the bottle onto bore brush assembly and scrub back and forth the entire length of the cannon tube. Repeat	

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
33	After	CANNON M137A1 Cannon (cont)	this step with third 1/4 of the bottle. Pour final 1/4 of the bottle onto bore brush assembly. Wet the entire length of the cannon tube once forward and once back. b. On the day after firing, remove two bottles of pre-measured CLP (item 9, app D), three disposable cleaning sleeves (item 18.1, app D), and one bore brush assembly. Attach bore brush assembly to standard US Army rammer staff and wet punch the cannon tube following the procedures for day of firing in step a.	

Change 1 2-26.13

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
33	After	CANNION M137A1 Cannon (cont)	Chief of Section above. Dry punch cannon tube. Wrap the bore brush assembly with a new disposable cleaning sleeve and dry punch the entire length of the cannon tube once forward and once back. Remove and dispose of the cleaning sleeve. Wet punch cannon tube. Wrap the bore brush assembly with a new disposable cleaning sleeve. Pour on half a pre-measured bottle. Wet punch the entire length of the cannon tube once forward and once back. Remove and dispose of cleaning sleeve.	

Change 1 2-26.14

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
33	After	CANNON M137A1 Cannon (cont)	Repeat wet punch with last half of bottle. c. The following instructions are for cleaning, lubricating, and preserving the breech: Shake the liter bottle well before each use. See Chapter 3, Section III for component disassembly/ assembly. Thoroughly wet all breech components with CLP (item 9, app D). Let soak for 10-15 minutes and then wipe off. Reapply a light coat of CLP. Spray CLP from the liter bottle onto all exposed metal surfaces.	

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
33	After	CANNON M137A1 Cannon (cont)	Chief of Section **NOTE** If cannon tube has not been previously cleaned with CLP and there is a heavy buildup 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.	
34	After	M31 CARRIAGE M31 Carriage	Cannoneer No. 2 a. Remove cotter pin (1) and straight pin (2) from locking assembly handle (3). Unlock	

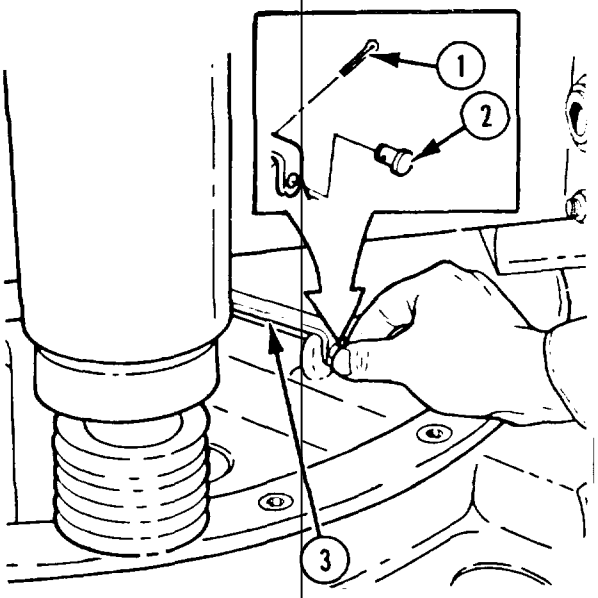


Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

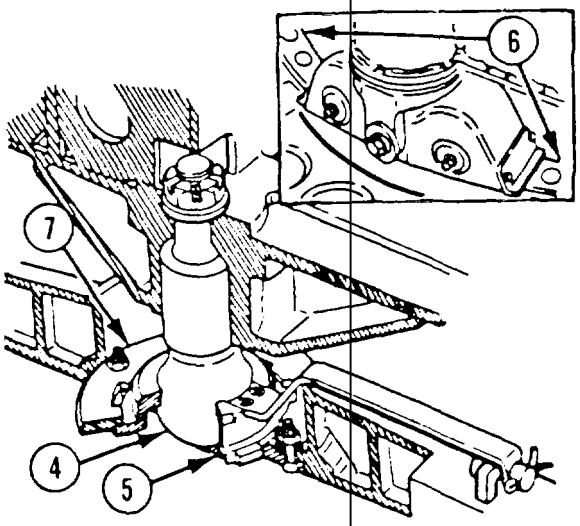
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
34	After	M31 CARRIAGE M31 Carriage (cont)	firing platform assembly by rotating locking assembly handle (3) counter-clockwise.  b. Clean ball stud (4), firing platform assembly socket (5), ring (6), and locking assembly plate (7), using cleaning compound (item 12, app D) and wiping rags (item 22, app D).	

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

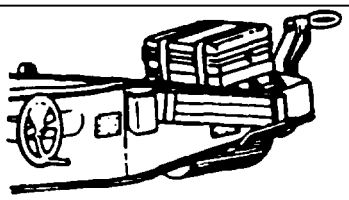
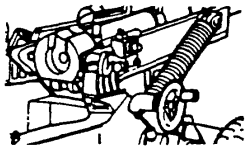
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
				
35	Monthly	M31 Carriage Traversing Mechanism	Gunner a. Check for smooth operation, watch for vibration, binding, or unusual noises.	Will not traverse.
			b. Visually inspect drawbar, pin, and lunette to ensure they are not bent, broken, or missing.	Drawbar or lunette is bent or cracked. Drawbar is missing
			c. Inspect traversing wheel for cuts or missing bolts.	Wheel is missing. cut through cords exposed, tire flat or has any bulges. Bolts are missing.
				

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

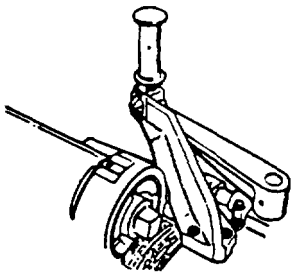
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
36	Monthly	M31 Carriage Elevating Mechanism	Assistant Gunner a. Check for free and easy operation through entire range with no evidence of binding, slippage, or unusual noises. b. Inspect for cracks, dents, or missing lube locking pin. Report faults to organizational maintenance. 	Will not elevate or depress
37	Monthly	Breech Operating Handle	Make sure breech operating handle locks in closed position each time breech mechanism assembly is closed.	Assistant Gunner Breech operating handle will not lock.

Table 2-2. Preventive Maintenance Checks and Services

for M102 Howitzer (Cont'd)

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
38	Monthly	Wheel Assembly	Cannoneer No. 2 a. Check for correct air pressure (20 psi normally, 40 psi for long movements on superhighways). b. Check the wheel capnuts; if they are loose, have them torqued to 50-55 ft-lb. c. Check tires; if they show wear bars, notify organizational maintenance.	

Section III. OPERATION UNDER USUAL CONDITIONS

WARNING

Do not store equipment of any kind inside the cannon tube. Foreign objects inadvertently left in bore of cannon tube before firing can cause a premature explosion resulting in death or injury to personnel.

NOTE

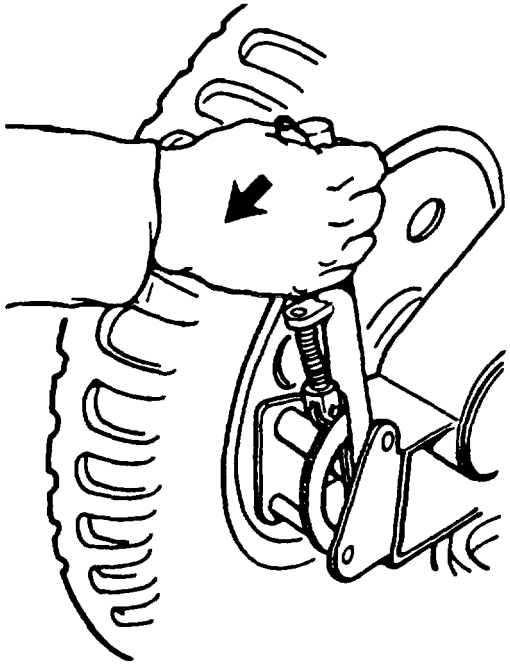
Occupation of the firing section position is performed under the direct supervision of the chief of section. The prime mover should be driven into position so that the howitzer is aligned on the direction of fire.

2-5. DISCONNECTING M102 HOWITZER FROM PRIME MOVER

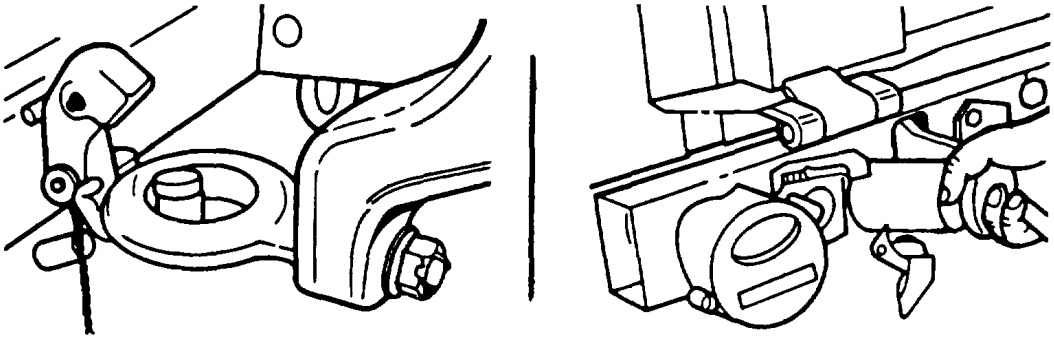
1 After the prime mover comes to a complete stop, the chief of section (CS) commands PREPARE TO DISMOUNT, DISMOUNT, or simply DISMOUNT.

2 Upon the command, DISMOUNT, the section personnel exit the rear of the prime mover.

3 The gunner (G) locks the left handbrake and the assistant gunner (AG) locks the right handbrake.

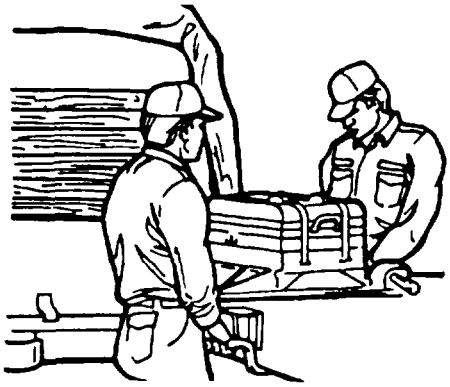


2-5. DISCONNECTING M102 HOWITZER FROM PRIME MOVER (cont)



■ 4 Cannoneer no. 2 unlatches towing pintle and disconnects the tail light assembly, if installed.

5 Cannoneers no. 1, 2, AG, and ATC lift the lunette from the towing pintle using the carriage handles.

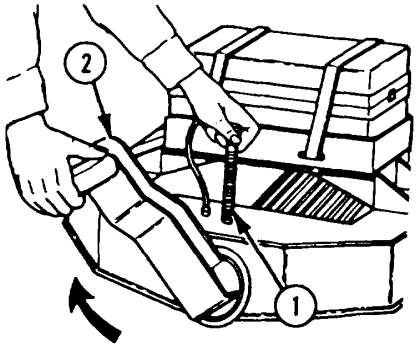


6 The chief of section directs the driver (D) to pull forward when the lunette is lifted from the towing pintle.

NOTE

Step 7 is not required when the drawbar bracket is already in the upright position, which occurs when the prime mover is a 2-1/2-ton vehicle.

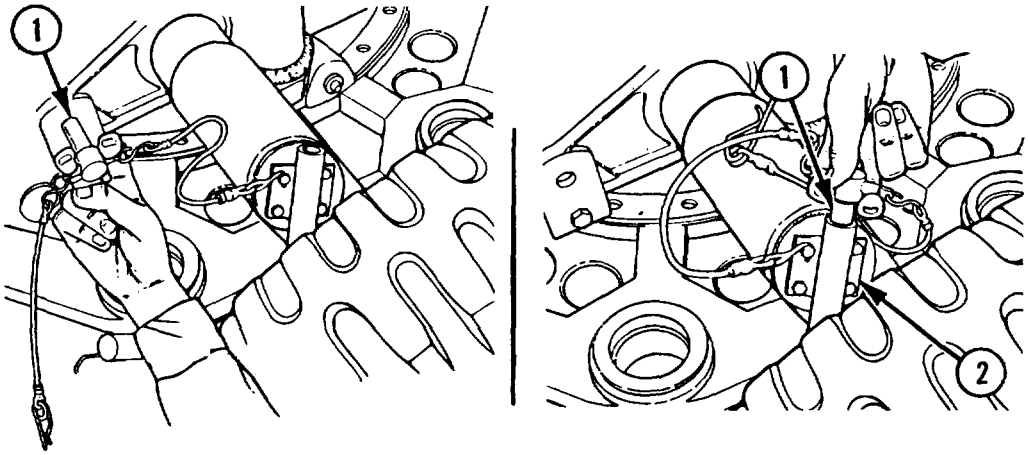
7 Cannoneer no. 1 removes quick release pin (1) and rotates drawbar bracket (2) to upright position. He then replaces quick release pin (1).



8. Cannoneer no. 2 removes tail and stop blackout lights by removing special pin.
9. Assistant gunner and cannoneer no. 2 remove overall cover from the M102 howitzer.

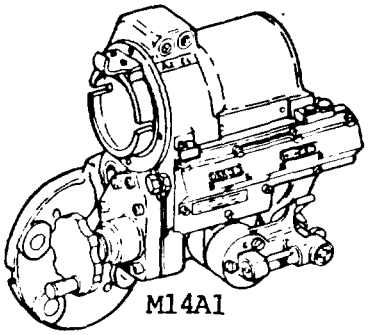
2-6. EMPLACING M102 HOWITZER

1. Cannoneer no. 2 removes muzzle plug.



2. Cannoneer no. I removes left wheel suspension pin assembly (1) and secures it in bracket assembly (2).

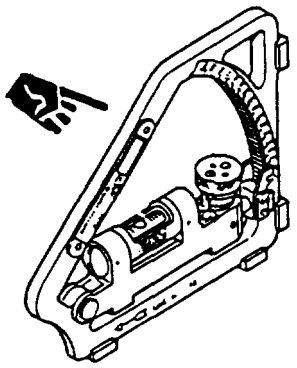
3. Cannoneer no. 2 removes and secures right wheel suspension pin assembly.



4 Cannoneer no. 2 removes travel lock pin assembly (3) from travel lock (4). He then places travel lock in stowed position and secures it with travel lock pin assembly.

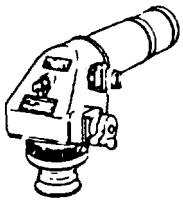
2-6. EMPLACING M102 HOWITZER (cont)

5 Cannoneer no. 1 releases left handbrake.
6 Cannoneer no. 2 releases right handbrake.



WARNING

Weapon must be elevated to approximately 800 mils. Personnel should be careful not to get directly under gun cradle assembly or cannon tube. Also, keep feet from under firing platform assembly.



7. Cannoneer no. 2 removes crank assembly (5) from tool box, and cannoneers no. 1 and 2 crank up wheels to firing position.
8. Cannoneers no. 1 and 2 lock the handbrakes.

CAUTION

Drive carriage stakes from the front of the weapon to prevent damage to buffer assembly, M31 carriage, and fire control instruments. Traverse weapon as necessary to provide access to stake hole in the firing platform assembly, and ensure buffer assembly is between stake holes. If weapon cannot be traversed, release the locking assembly handle to disengage firing platform assembly and move howitzer. Drive the carriage stakes and then move weapon over firing platform assembly and lower into place. Lock firing platform assembly with locking assembly handle.

9 The ATC, assisted by the driver, drives carriage stakes (6) to secure firing platform assembly (7).

CAUTION

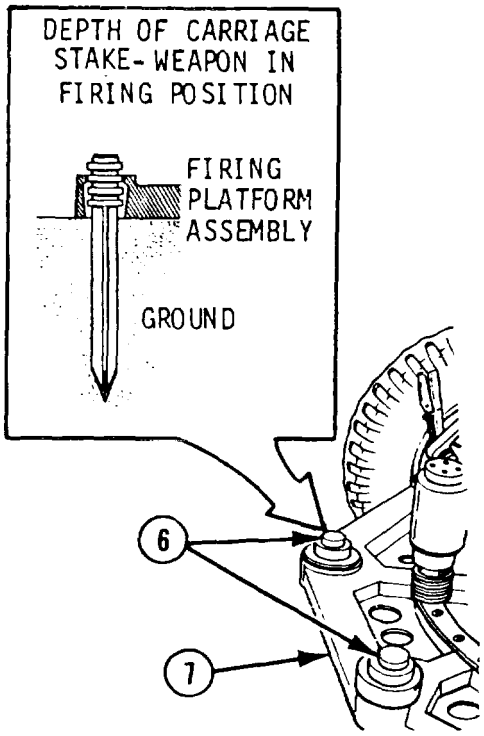
Emplace remaining carriage stakes as soon as possible to prevent damage to the firing platform assembly.

NOTE

Under normal conditions, all eight carriage stakes must be emplaced before firing charge 7. For firing charges 1 thru 6, firing may begin when a minimum of two carriage stakes have been emplaced.

NOTE

When shift is over 200 mils, lift box trail; perform rapid traverse procedures on page 2-79.



10. Cannoneers no. 1, 2, ATC, and driver assist gunner in shifting weapon when directed.
11. After laying, the ATC, assisted by the driver, drives remaining carriage stakes to secure firing platform assembly.

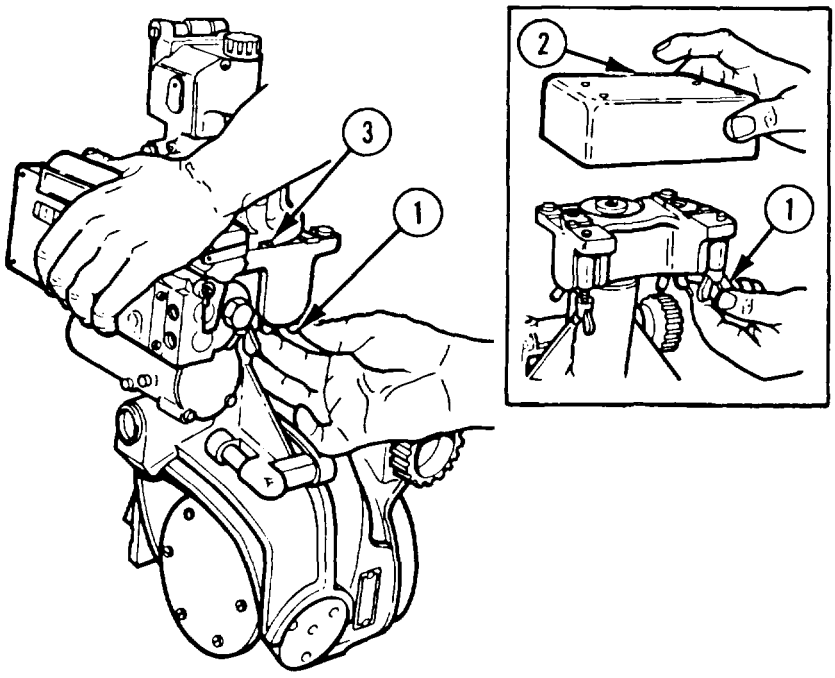
2-7. INSTALLING M113A1 PANTEL

WARNING

When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual

The M1113A1 panel is installed by gunner as follows:

1 Remove canvas telescope and mount cover from M134A1 mount.



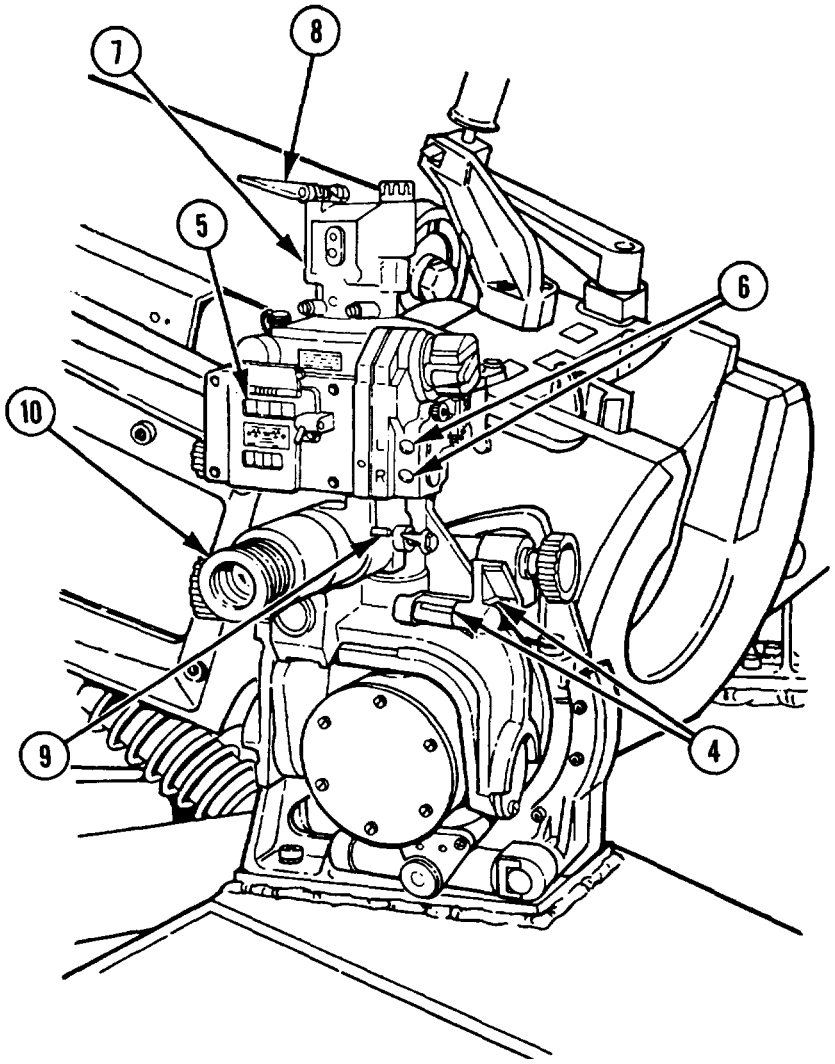
2 Loosen four quick release assemblies (1) and remove telescope mount cover (2).

CAUTION

Vent carrying case before opening to equalize air pressure.

3 Place telescope mount cover (2) in carrying case, and remove M113A1 panel from carrying case.

4 Position M113A1 panel by means of machine keys (3) on the M134A1 mount. Hand tighten the four quick release assemblies (1) to fasten M113A1 panel in place.



5 Uncover level vials (4) and azimuth counter (5), and set gunner's aid counters (6) to 0. Level the M134A1 mount.

6 Release plunger lever (7) to open cover (8).

7 Release plunger release lever (9) and turn M113A1 panel elbow (10) perpendicular to cannon tube. The elbow can be rotated 140 mils by releasing plunger release lever.

8 Do your before operation PMCS, steps 10 and 11.

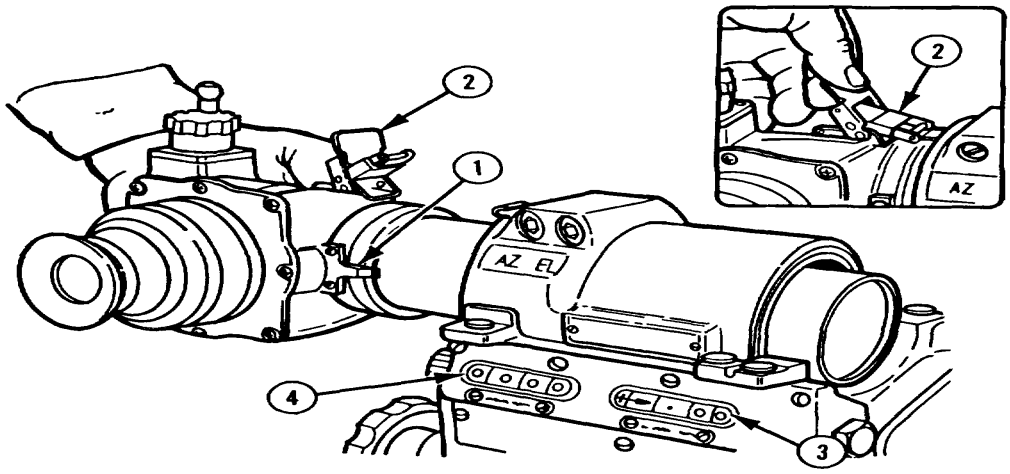
2-8. INSTALLING M114A1 TELESCOPE

WARNING

When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.

The MI114A1 telescope is installed by the assistant gunner as follows:

1. Remove quadrant and elbow telescope cover from M14A1 quadrant.



2 Remove M114A1 telescope from carrying case and insert into M14A1 quadrant, making certain machine key (1) engages in slot.

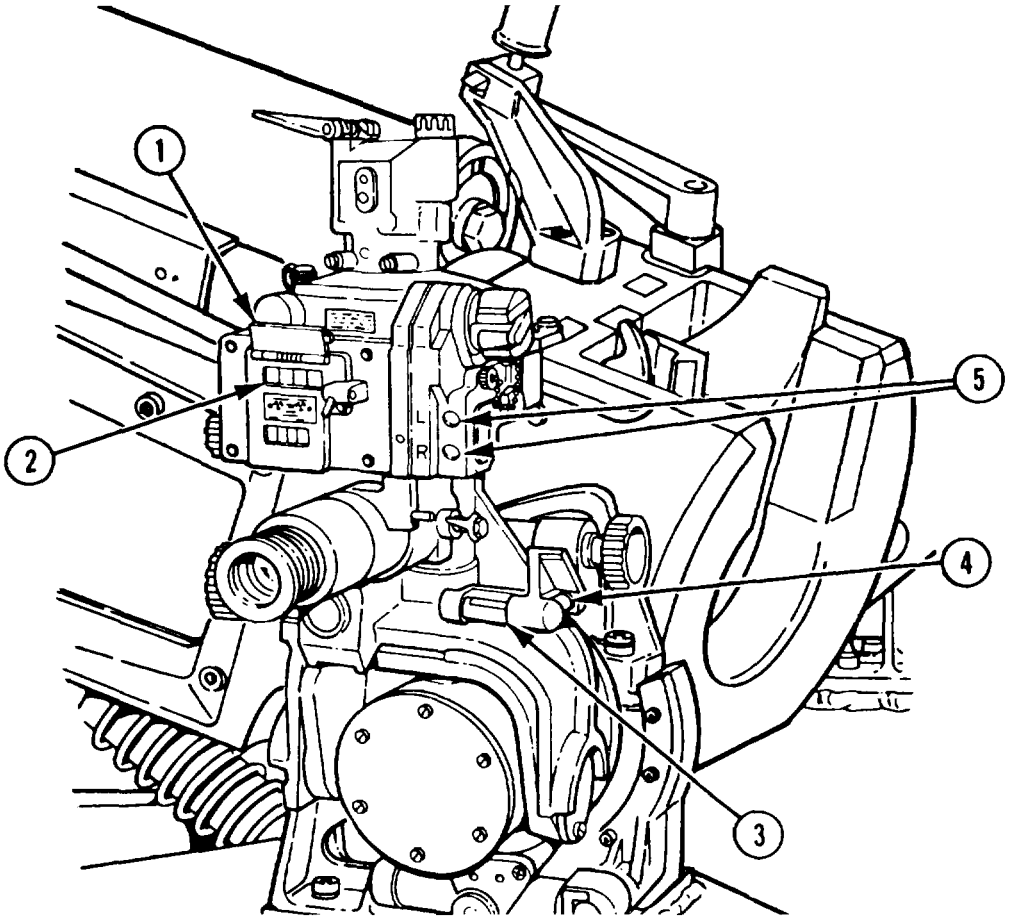
3 Fasten latch (2) as shown above.

4 Do your before operation PMCS, steps 12 and 14.

5 Set correction counter (3) to 0 and elevation counter (4) to 300.

6 Level M14A1 quadrant.

2-9. LAYING THE M102 HOWITZER USING THE M2/M2A2 AIMING CIRCLE



NOTE

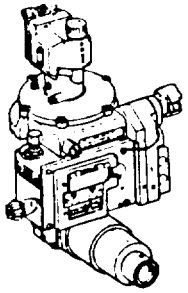
The gunner uses the M113A1 panel to lay the howitzer for direction. Refer to FM 6-50.

1 Upon executive officer's command, BATTERY ADJUST AIMING POINT THIS INSTRUMENT, the gunner lifts the door (1) covering the azimuth counter (2) on the M113A1 panel.

2 The gunner ensures the bubbles are centered in the M134A1 mount elevation level vial (3) and cross level level vial (4), and gunner's aid counter (5) is set at 0.

3 The assistant gunner sets 300 mils or at elevation dictated by unit SOP on M14A1 quadrant elevation counter, then depresses or elevates the howitzer until the M14A1 quadrant elevation level via bubble centers. Check that cross level level vial bubble. is centered and center if necessary.

2-9. LAYING THE M102 HOWITZER USING THE M2/M2A2 AIMING CIRCLE (cont)



4 Sighting through the M113A1 panel, the gunner rotates the panoramic telescope head by turning the azimuth knob (6) until the M113A1 panel crosshairs are centered on the reflector of the aiming circle. Horizontal crossline alignment is obtained by turning the elevation knob (7).

5 When the M113A1 panel crosshairs are alined on the aiming circle and all level vial bubbles are centered, the gunner announces to the executive officer NUMBER (SO AND SO), AIMING POINT IDENTIFIED.

6 The executive officer determines the aiming circle reading to the howitzer and announces NUMBER (SO AND SO), DEFLECTION (SO MUCH).

7 Upon announcement of the deflection, the gunner repeats the deflection by announcing NUMBER (SO AND SO), DEFLECTION (SO MUCH), and rotates the azimuth knob (6) until the announced deflection appears on the azimuth counter (2).

8 Operating the traversing handwheel assembly and sighting through the M113AI panel, the gunner traverses the weapon until the M113A1 panel crosshairs are centered on the reflector of the aiming circle, ensuring that bubbles are centered in elevation level vial (3) and cross level level vial (4).

9 The gunner announces to the executive officer NUMBER (SO AND SO), READY FOR RECHECK.

10 The executive officer determines a new aiming circle reading to the howitzer and announces NUMBER (SO AND SO), DEFLECTION (SO MUCH).

11 Upon announcement of the new deflection, the gunner repeats the deflection and the difference between the new deflection reading and the reading on the azimuth counter (2) to the executive officer by saying NUMBER (SO AND SO), DEFLECTION (SO MUCH), (SO MANY) MILS.

12 The gunner then rotates the M113A1 panel azimuth knob (6) until the new deflection appears on the azimuth counter (2).

13 Operating the traversing handwheel assembly and sighting through the M113A1 panel, the gunner traverses the weapon until the M113A1 panel crosshairs are centered on the reflector of the aiming circle with the bubbles centered in the M134A1 mount elevation level vial (3) and cross level level vial (4).

14 The gunner and executive officer repeat the recheck, steps 9 thru 13, until the difference between the aiming circle reading to the M113A1 panel and the reading on the azimuth counter (2) is 0. The executive officer then announces NUMBER (SO AND SO) IS LAID.

15 Upon the command, LAID, the gunner records the value appearing on the azimuth counter (2). The cannon tube is now oriented for direction and should not be traversed until an aiming point is established.

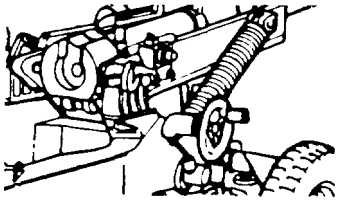
2-10. EMPLACING M1A1 COLLIMATOR

WARNING

The M1A1 collimator is radioactively illuminated and should be checked before using for illumination in a low light environment. If not illuminated, follow radiation hazard procedures listed in the front of this manual.

NOTE

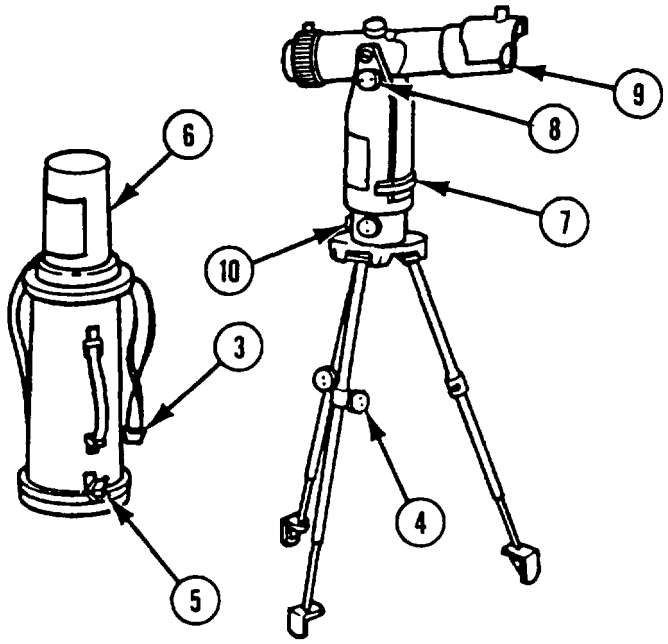
Collimator emplacement is performed immediately following laying operations.



1 Sighting through M113A1 panel eyepiece (1), the gunner rotates the azimuth knob (2) until a convenient place to locate the collimator is sighted.

NOTE

The collimator is the primary reference aiming point for the M102 howitzer. The collimator should be emplaced in a concealed position. Placing the collimator between 2400 mils and 2800 mils on the t1113A1 panel azimuth counter will minimize displacement. Emplacement distance away from the weapon will vary due to type of terrain encountered, but must be within a minimum of 4 meters and a maximum of 15 meters. Optimum distance is between 5 and 12 meters. The collimator should not be emplaced more than 4 meters above or below the M113A1 panel.



2 Under directions from the gunner, cannoneer no. 1 emplaces the collimator as follows:

a. Unfasten strap (3) which retains tripod legs.

b. Extend tripod legs as necessary. Lock by tightening the locking knobs (4).

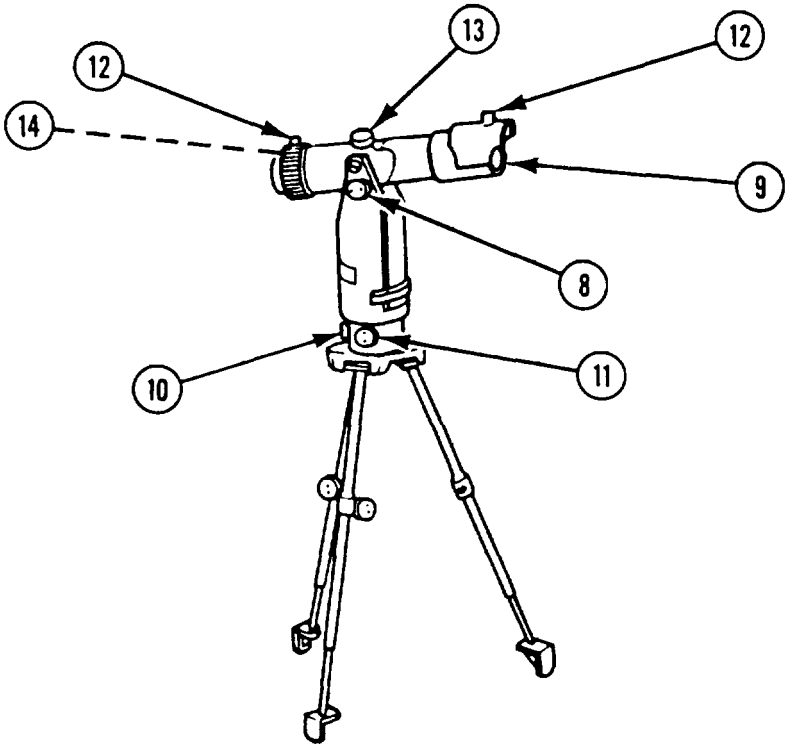
c. Rotate the tripod legs to the down position and set each leg firmly into the ground with one leg of tripod toward M113A1 panel.

d. Release latches (5) and remove cover assembly (6) from the collimator.

e. Unfasten strap (7). Loosen elevation clamping knob (8) and rotate collimator (9) to a horizontal position.

f. Ensure azimuth adjustment is in center of the traversing capabilities by operating the azimuth adjustment knob (10).

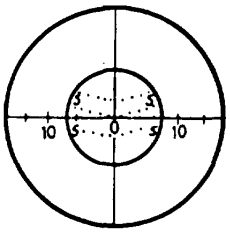
■ 2-10. EMPLACING M1A1 COLLIMATOR (cont)



g. Loosen azimuth clamping knob (11). Sighting down the front and rear sights (12), rough lay the collimator on the M113A1 panel objective lens. Tighten the elevation clamping knob (8) and azimuth clamping knob (11).

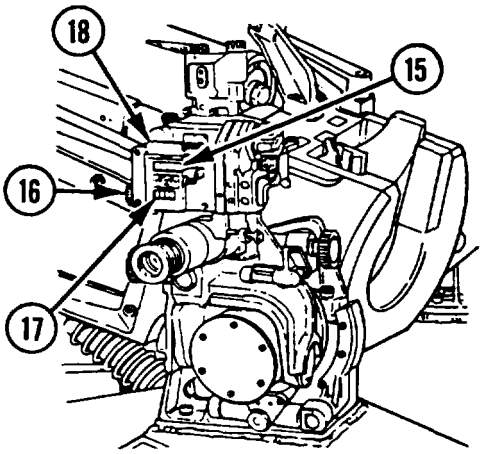
h. Loosen the cross level clamping knob (13); rotate the collimator (9) until the cross level level vial bubble (14) centers. Retighten the cross level clamping knob.

3 Sighting through the M113A1 panel, gunner commands cannoneer no. 1 to rotate the collimator azimuth adjustment knob (10) until the M113A1 panel cross-hairs are centered on the collimator reticle center as shown. He then motions the no. 1 cannoneer in.



NOTE

The M1A1 collimator reticule is illuminated by a self-contained radioactive light source.



4 The gunner then records the value appearing on the azimuth counter (15).

5 Gunner rotates reset counter knob (16) until 3200 appears on reset counter (17), and closes the door (18).

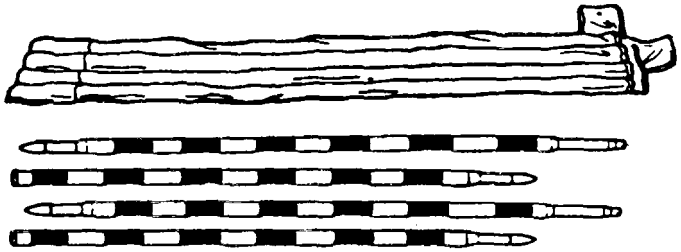
2-11. EMPLACING M1A2 AIMING POSTS

M1A2 aiming posts are the alternate aiming reference for the M102 howitzer and are emplaced, time permitting, immediately following emplacement of the collimator.

1 With the howitzer laid on the initial azimuth fire, the gunner checks to ensure that:
   a. The M134A1 mount elevation and cross level level vial bubbles are centered.
   b. The gunner's aid counters on the M113A1 panel are set at 0.

2 The gunner, sighting through the M113A1 panel, rotates the azimuth knob until a convenient place to emplace the aiming posts is sighted.

2-11. EMPLACING M1A2 AIMING POSTS (cont)



NOTE

Two M1A2 aiming posts are used for each weapon. To ensure equal spacing, the distance from the howitzer should be paced by the same cannoneer. 13 ATC emplaces the aiming posts as follows:

3. ATC emplaces the aiming posts as follows:

WARNING

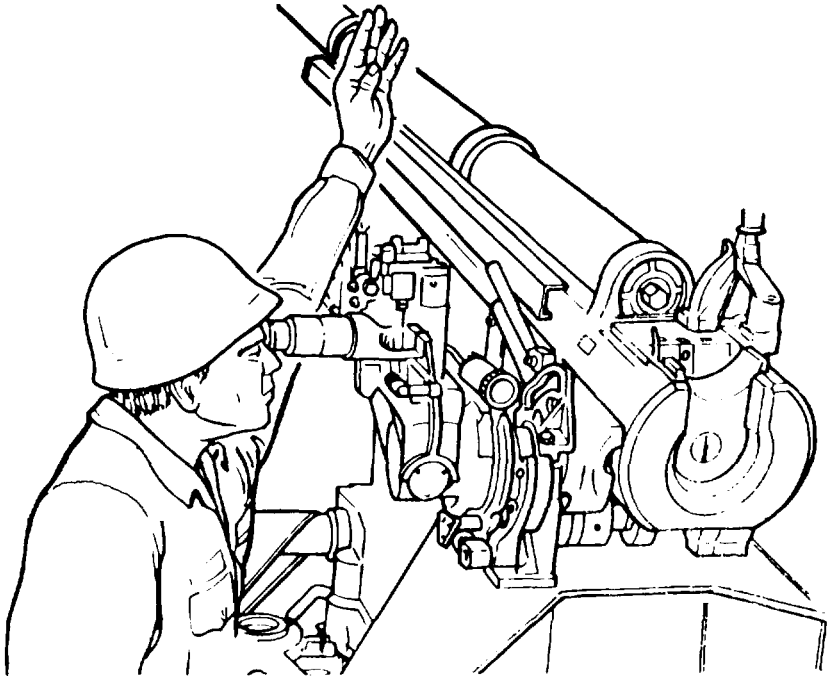
When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.

a. Removes aiming posts from aiming post holders on right side of howitzer trails.
b. Removes the aiming posts from aiming post cover and assembles.
c. At night, removes two M14 aiming post lights from case and installs on the aiming posts.

NOTE

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

4 The ATC runs out approximately 50 meters with both aiming posts, places the near aiming post (short aiming post) into the ground, continues an additional 50 meters, stops and faces the gunner, and emplaces the far aiming post (long aiming post) alined with the body. The ATC returns to the near aiming post and positions it by observing hand signals of the gunner.



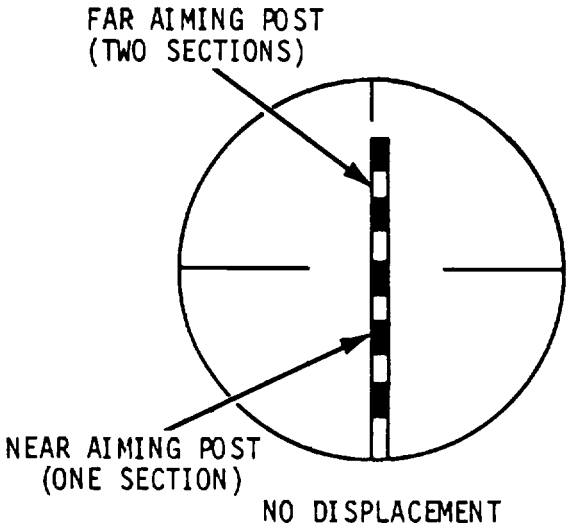
5 Sighting through the Ml13A1 panel, the gunner positions the aiming post by extending his left hand (right hand if aiming posts are to rear of weapon) above his head. ATC moves aiming post as directed by the following hand movements:

a. Hand movement to the left or right means to move the aiming post in that direction.
b. Up and down hand movement means to emplace the aiming post.
c. Clenched fist means to stop.
d. Tapping on top of helmet and moving hand left or right means to move the top of the aiming post in that direction.
e. Hand waved in a circle means to come in.

NOTE

At night, this method can be followed using a flashlight in the on and off mode.

2-11. EMPLACING M1A2 AIMING POSTS (cont)



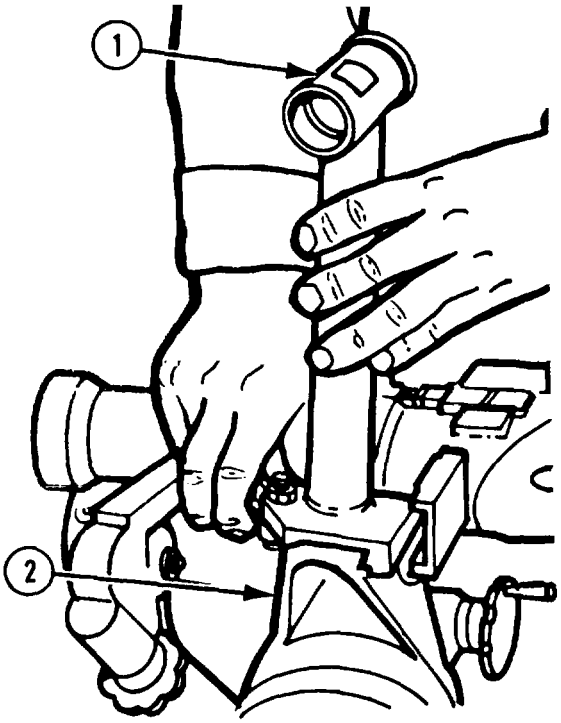
6 After the aiming posts are emplaced, the sight picture should be as illustrated (no displacement). The gunner then records the value indicated on the azimuth counter and returns to the sight picture on the collimator.

2-12. CHECKING BORESIGHT OF M113A1 PANTEL USING THE M140 ALIGNMENT DEVICE

WARNING

When handling radioactively illuminated fire control equipment, he aware of the radiation hazard procedures listed in the front of this manual.

The assistant gunner:



1 Removes the M140 alinement device (1) from carrying case and removes protective cover from adapter (2).

CAUTION

Do not use crocus cloth, sandpaper, or any abrasive on surface plates. Inaccuracy of surfaces will result in instrument errors.

2 Inspects both mating surfaces for dirt, nicks, or burrs. Cleans surfaces with solvent cleaning compound (item 12, app D) and dries with wiping rag (item 22, app D). If surfaces have nicks or burrs, notify organizational maintenance.

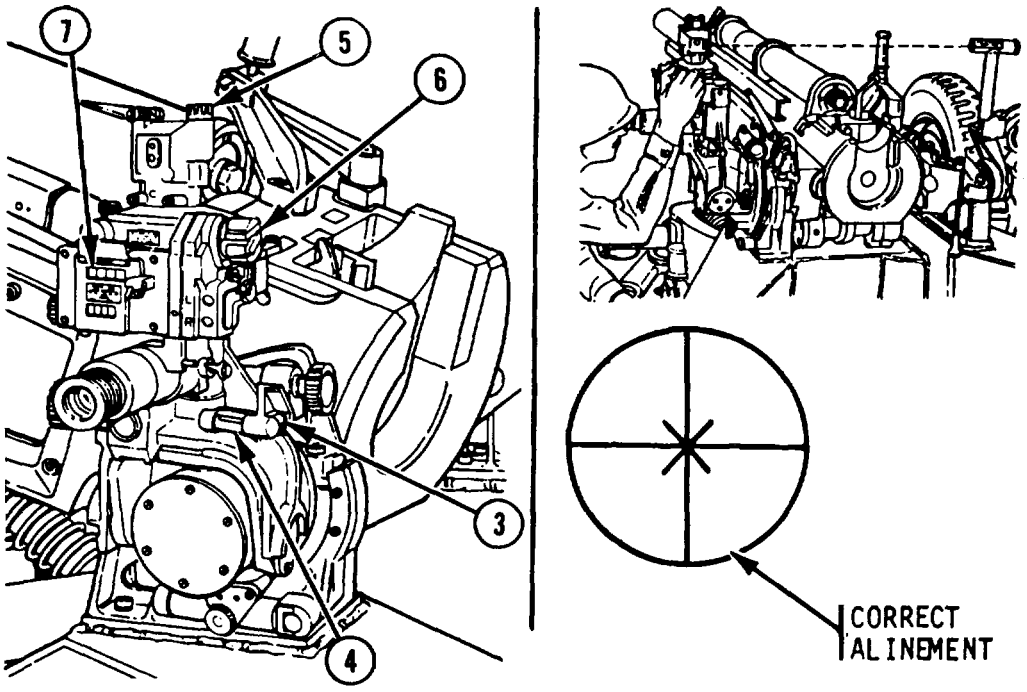
CAUTION

Do not operate breech operating handle with M140 alinement device installed.

3 Mates the M140 alignment device (1) to the adapter (2). Dovetails must aline.

4 Depresses or elevates the cannon to zero elevation using the r1l4A1 quadrant. Ensures both M14A1 quadrant counters read 0.

12-12. CHECKING BORESIGHT OF M113A1 PANTEL USING THE M140 AINEMENT DEVICE (cont)



The gunner:

5 Levels the M134A1 mount by carefully centering the bubbles in the cross level level vial (3) and the elevation level vial (4).

6 Alines the M113A1 panel crosshairs with the crosshairs of the M140 alignment device using the M113A1 panel azimuth knob (5) and elevation knob (6).

7 Checks that with crosshairs alined, bubbles centered in elevation level vial (4) and cross level level vial (3), and the cannon tube at zero elevation, the azimuth counter (7) reads 4800+1/2 mils.

8 Weapon is foresighted. If not, conduct M140 alignment device comparison test (page 3-60). After verifying accuracy of the M140, if the panel azimuth counter exceeds the tolerance of $\pm$ 0.5 mil, boresighting must be conducted using the test target or DAP before the weapon can be fired.

9. deleted

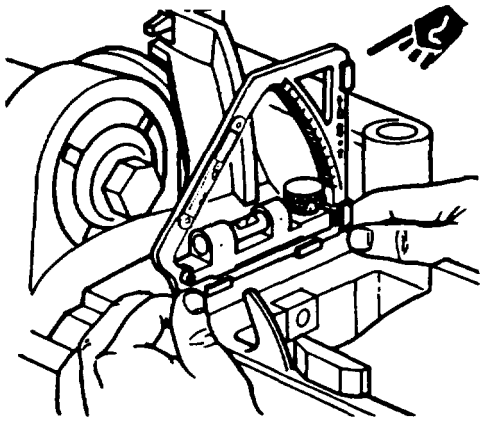
10. deleted

2-13. CHECKING BORESIGHT OF THE Ml13Al PANTEL USING 1THE DISTANT AIMING POINT METHOD

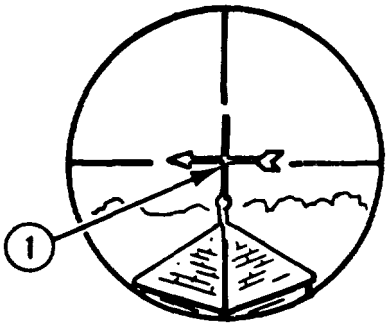
WARNING

When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.

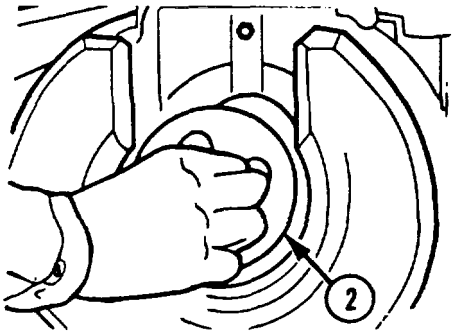
1 Emplace the weapon so the trunnions are reasonably level (no more than 90-mils cant when measured on breech mechanism assembly cross level seats).



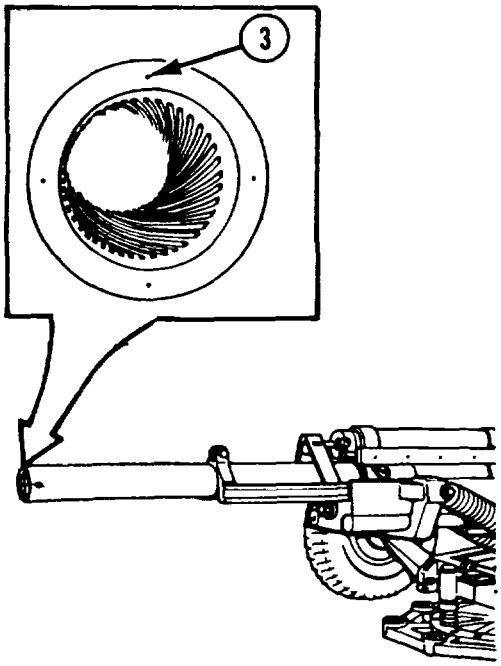
2-13. CHECKING BORESIGHT OF THE M113A1 PANTEL USING THE DISTANT AIMING POINT METHOD (cont)



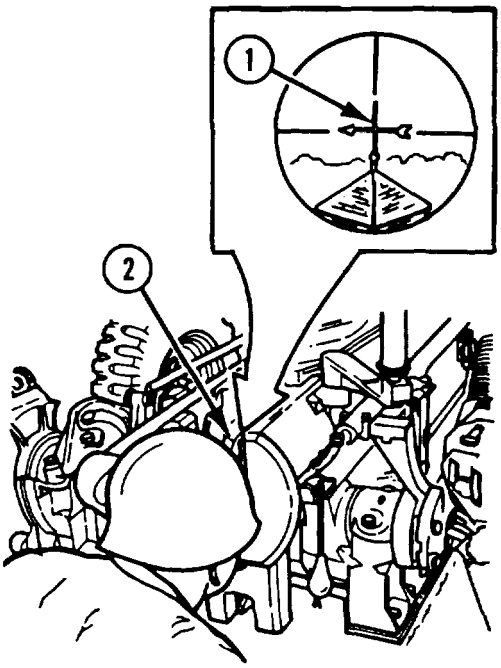
2 Select an aiming point (1) at minimum distance of 1500 meters.



3 Install breech boresight disk (2).

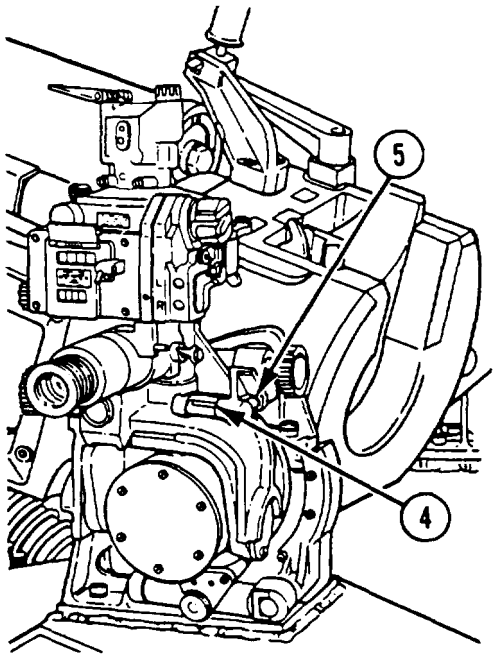


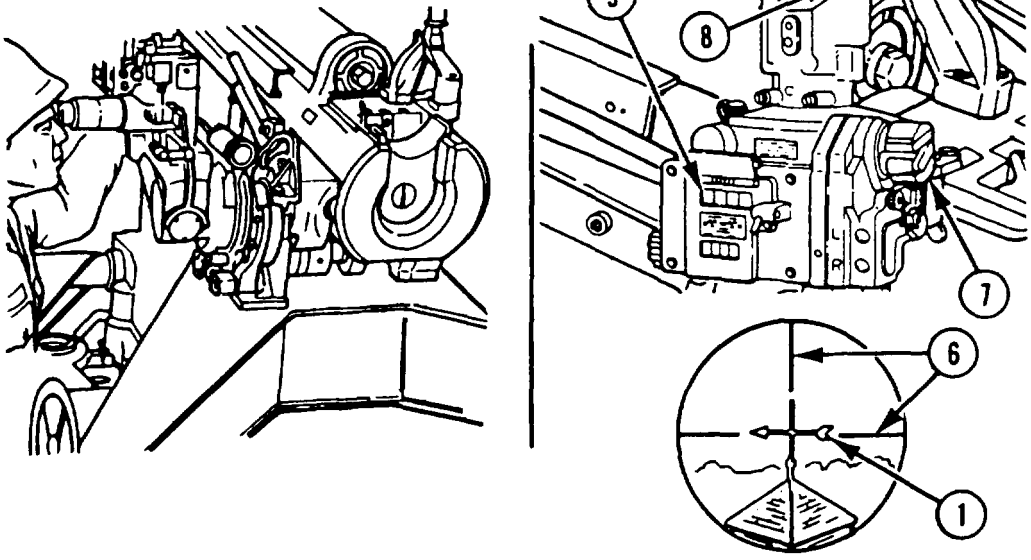
4 Using the four witness marks (3) on muzzle edge as reference points, attach two pieces of borel sighting string (item 27, app D) across muzzle to form crosshairs.



5 Sighting through breech boresight disk (2), elevate and traverse the weapon to aline the muzzle crosshairs on the aiming point (1).

6 Center the elevation level vial bubble (4) and cross level level vial bubble (5) on the M1134A1 mount.



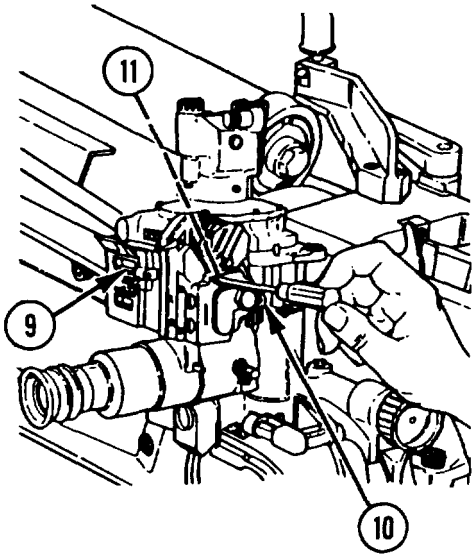


7 Sighting through the M113A1 panel, aline the M113A1 panel reticule crosshairs (6) on the distant aiming point (1) by turning azimuth knob (7) and elevation knob (8).

8 The M1113A1 panel azimuth counter (9) should now read 3200 mils. If it does not, adjust the boresight adjustment key as directed in step 9.

2-13. CHEWING BORESIGHT OF THE M113A1 PANIL USING THE DISTANT AIMING POINT MEIHOD (cont)

9 Remove the cap assembly (10). Depress the boresight adjustment key (11) with a screwdriver and rotate until azimuth counter (9) reads 3200 mils. Recheck your sight picture. Replace cap assembly (10).



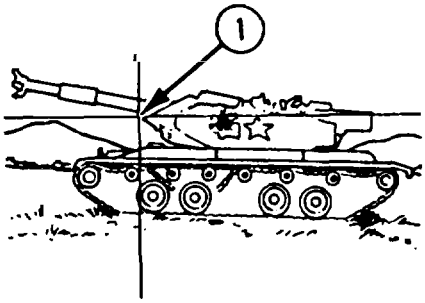
NOTE

After cap assembly has been removed and replaced, the charge of nitrogen is lost. Notify organizational maintenance to purge and charge with nitrogen to prevent moisture buildup in counters.

2-14. CHEWING BORESIGRT OF THE M114A1 TELESCOPE USING THE DISTANT AIMING POINT METHOD

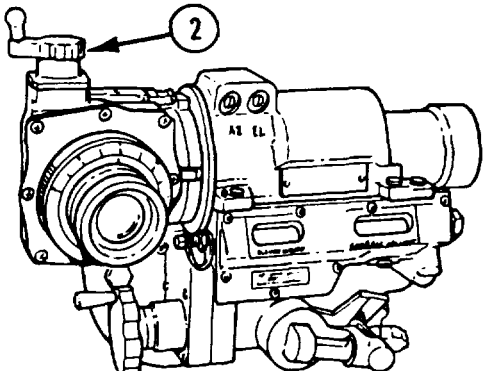
WARNING

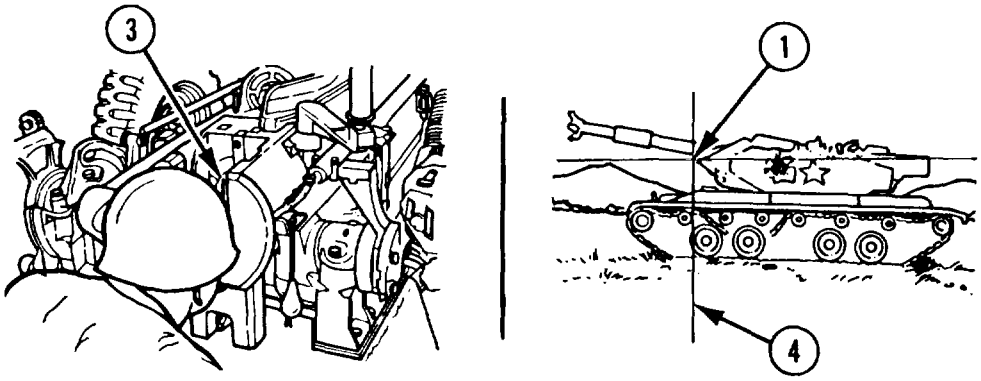
When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.



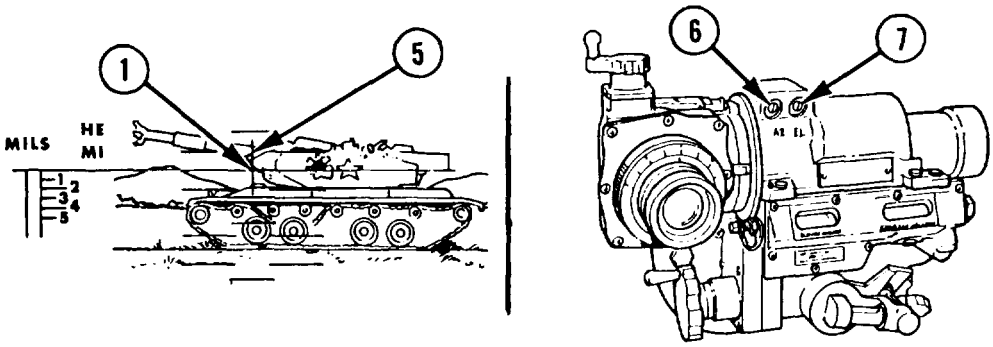
1 Select an aiming point (1) at the distance you expect to fire direct fire.

2 Rotate M114A1 telescope range knob (2) until the range gage line indicates zero.





3 Sighting through the breech boresight disk (3) elevate and traverse the cannon tube to aline the vertical muzzle cross-line (4) on the aiming point (1). Turn cross level knob onM14A1 quadrant and center cross level level vial bubble.



4 The M114A1 telescope vertical reticle crossline (5) should now intersect with the distant aiming point (1); if not, rotate the azimuth boresight worm shaft (6) and elevation boresight worm shaft (7) with a screwdriver until the vertical reticle crossline intersects with the aiming point.

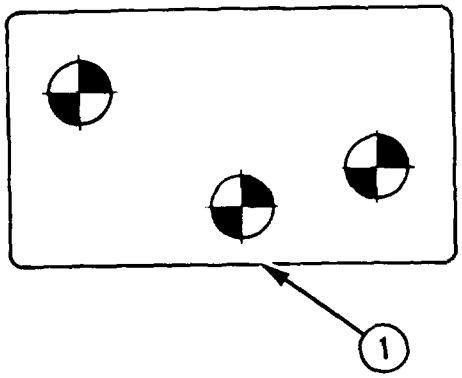
2-15. CHECKING BORESIGHT OF M113A1 PANTEL AND M114A1 TELESOOPE USING THE TEST TARGMETHOD

WARNING

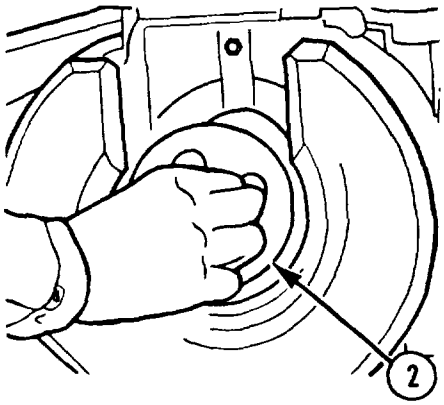
When handling radioactively illuminated fire control equipment, he aware of the radiation hazard procedures listed in the front of this manual.

1 Emplace the weapon so the trunnions are reasonably level (no more than 90-mils cant when measured on breech mechanism assembly cross level seats), and zero the cannon tube using a tested M1A2 gunner's quadrant.

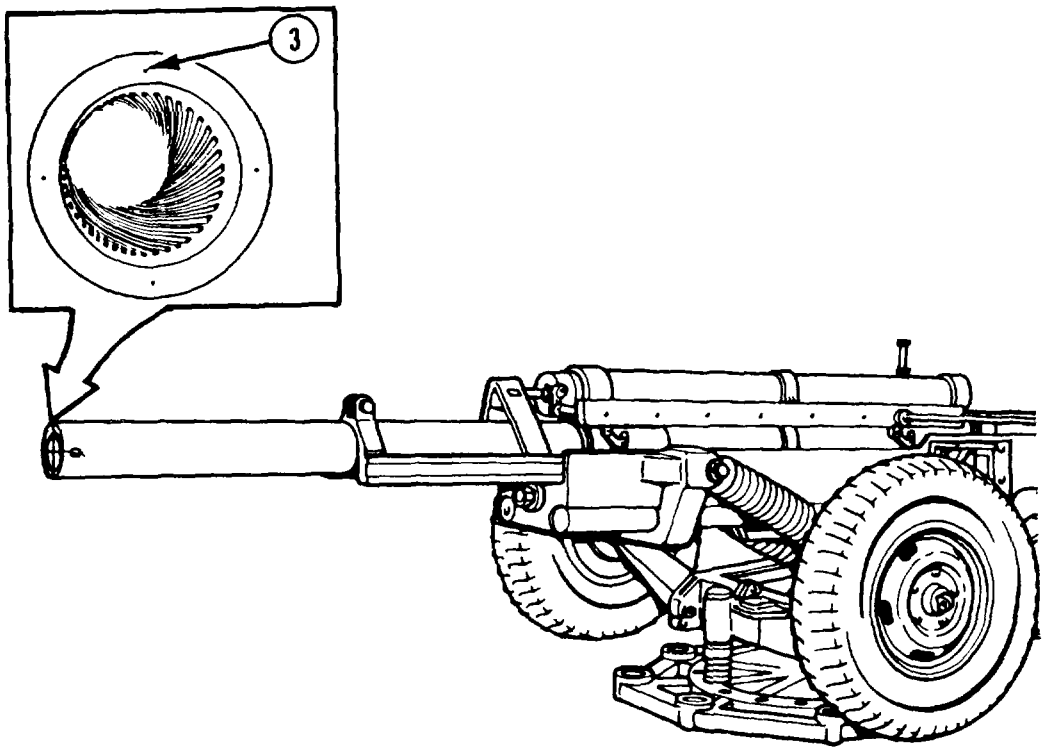
2-15. CHECKING BORESIGHT OF M113A1 PANTEL AND Ml14A1 TELESOOPE USING THE TEST TARGET METHOD (cont)



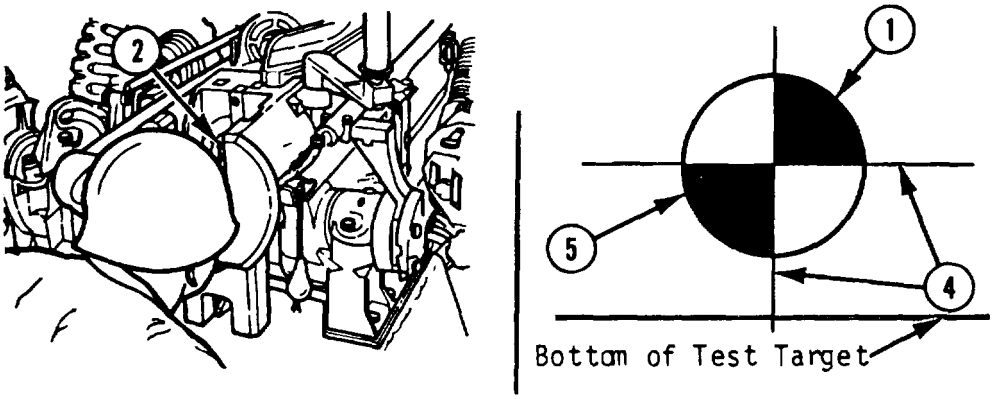
2 Place the test target (1) at least 50 meters from weapon but not more than 100 meters.



3 Install breech boresight disk (2).

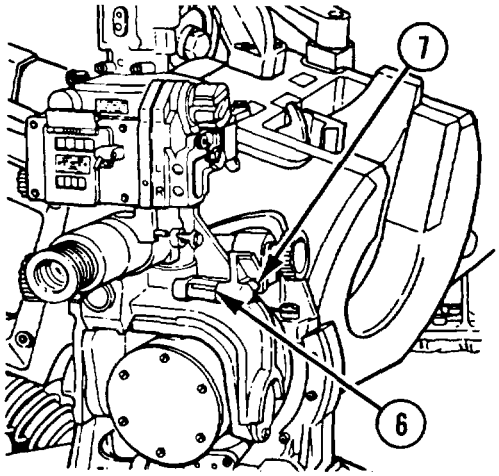


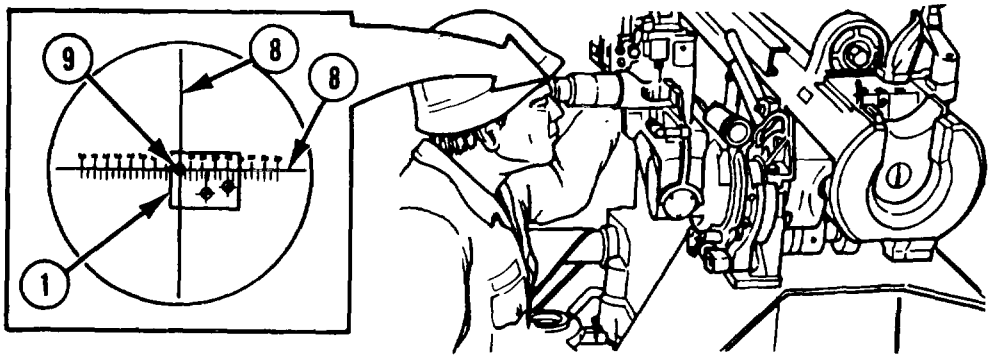
4 Using the four witness marks (3) on edge of muzzle as reference points, attach two pieces of boresighting string (item 27, app D) across the muzzle to form crosshairs.



5 Sighting through the breech boresight disk (2) move the test target (1) until the muzzle crosshairs (4) are alined with the center butterfly (5) on the test target.

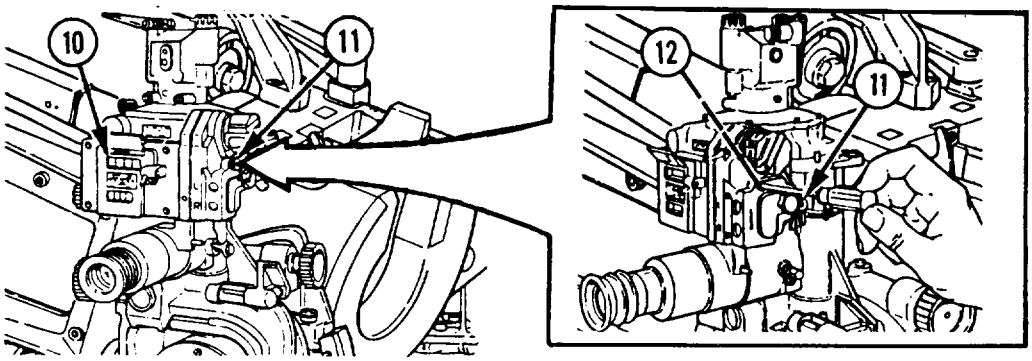
6 Center the elevation level vial bubble (6) and cross level level vial bubble (7)on the T1134A1 mount.





7 Look through the T1113A1 pantel and aline the M113A1 pantel reticle crosshairs (8) on the left butterfly (9) of the test target (1).2-53

2-15. CHECKING BORESIGHT OF M11A1 PANTEL AND M114A1 TELESCOPE USING THE TEST TARGET METHOD (cont)

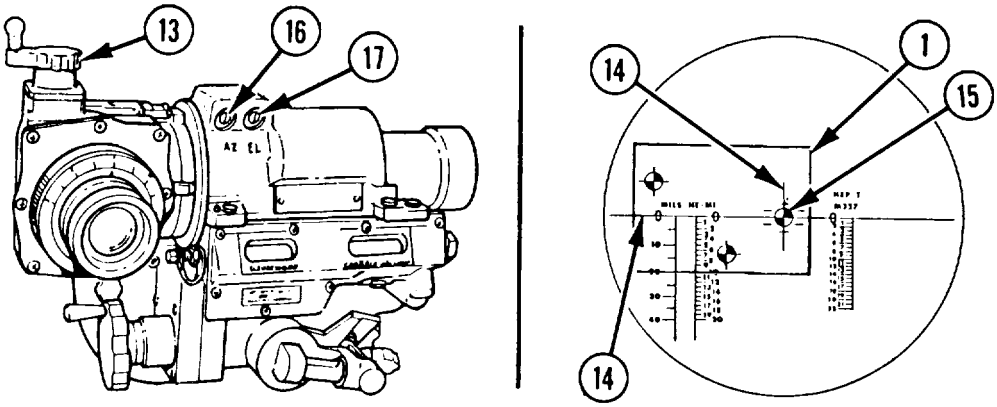


8 The M113A1 pantel azimuth counter (10) should now read 3200mils; if it does not, adjust as instructed in step 9.

9 Remove cap assembly (11).Depress the boresight adjustment key (12) with a screwdriver and rotate until azimuth counter(10) reads 3200 mils. Replace cap assembly (11). The11113A1 pantel is now boresighted. Verify sight picture.

NOTE

After cap assembly has been removed and replaced, the charge of nitrogen is lost. Notify organizational maintenance to purge and charge with nitrogen to prevent moisture buildup in counters.



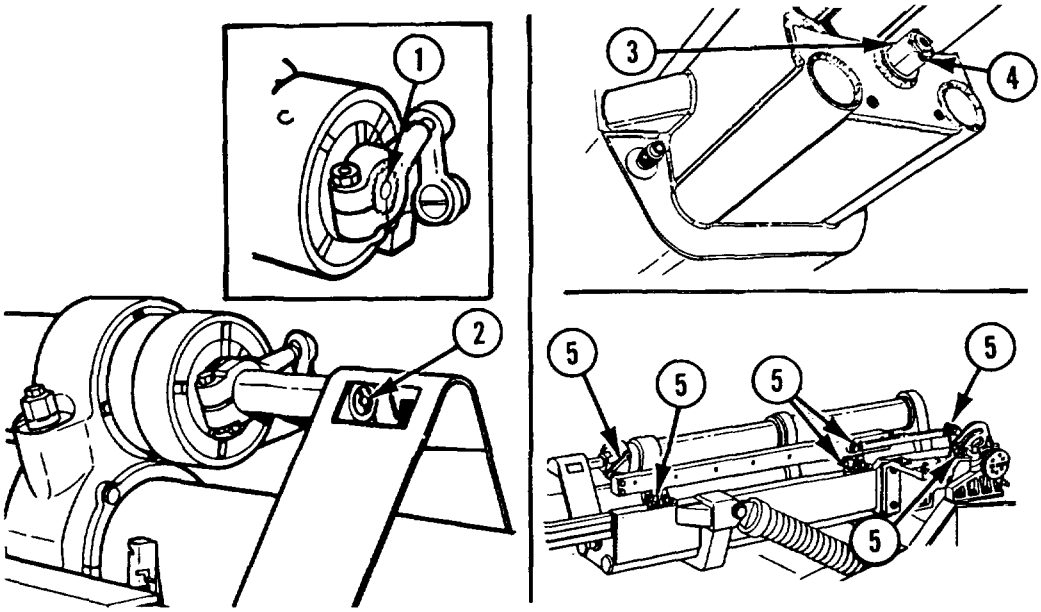
10 Rotate range knob (13) of 1114A1 telescope until range gage line indicates zero. Center cross level level vial bubble.

11 The M114A1 telescope reticle crosshairs (14) should now intersect with the image on the right butterfly (15) of the test target (1). If not, rotate the azimuth boresight worm shaft (16) and elevation boresight worm shaft (17) with a screwdriver until the reticle crosshairs are alined.

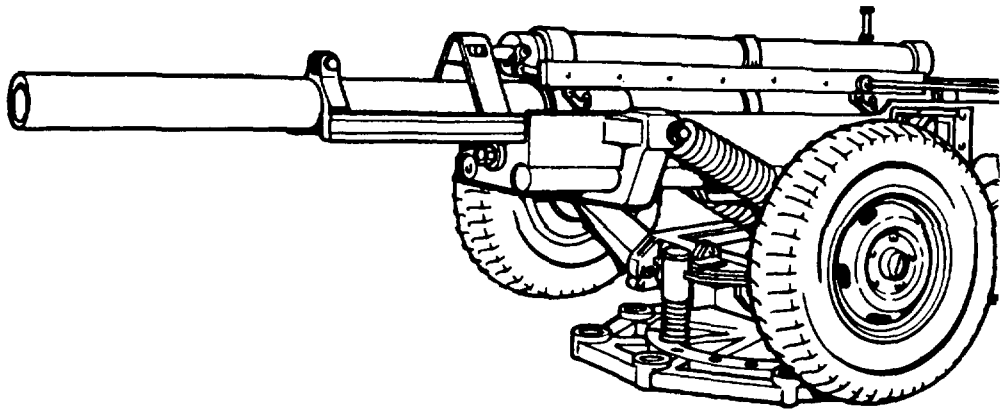
2-16. PREFIRING CHECKS

NOTE

Before operation checks are listed in table 2-1.As a minimum, the following checks will be made to ensure the weapon will fire, and fire safely.

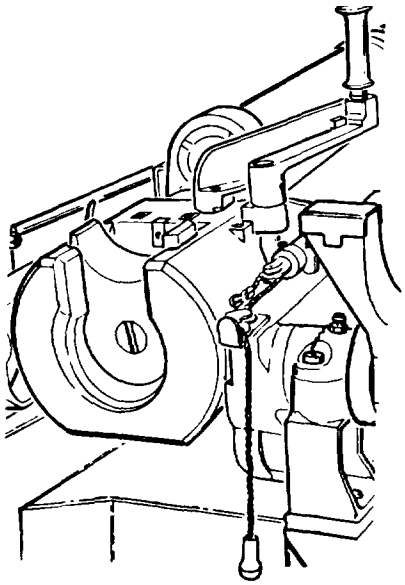


1 Recoil system: M37 indicator rod (1) flush or protruding not more than 3/16 inch, M37A1 indicator rod (2) flush or not extended to red tab, recoil rod nut (3) and cotter pin(4) installed, variable recoil mechanism linkage (5) serviceable.

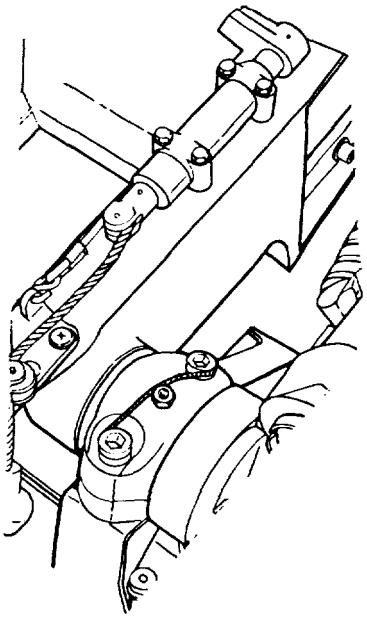


2 Cannon tube: unobstructed, no visible damage, no foreign matter present.

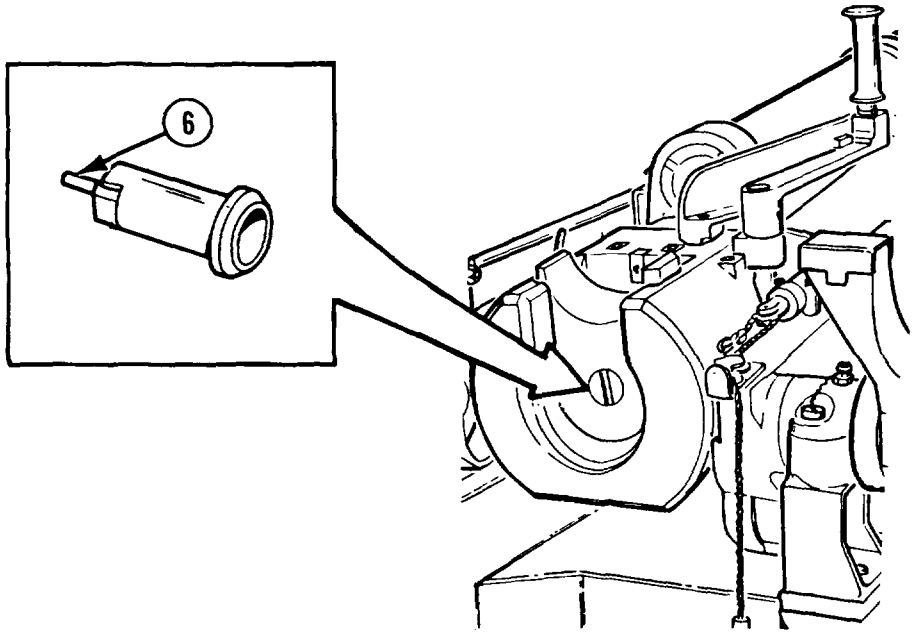
2-16 PREFIRING CHECKS (cont)



3 Breechblock: proper operation, complete closing.



4 Firing mechanism assembly: proper functioning.



5 Percussion mechanism: firing pin (6) serviceable.

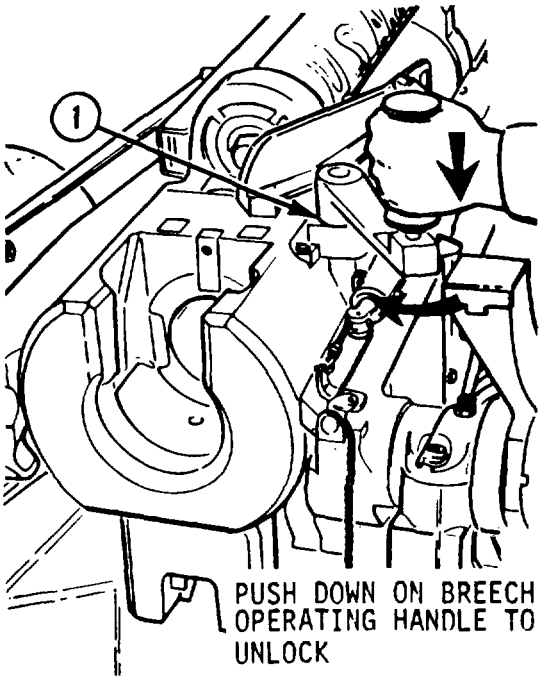
2-17. LOADING THE M102 HOWITZER FOR FIRING

WARNING

Before loading the M102 howitzer, all crew members must know what to do in the event of a misfire. Misfire procedures are explained on page 2-75.

1 Upon warning or receiving a fire mission, the chief of section indicates the aiming point reference to the gunner(collimator, aiming post, or distant aiming point).

2 The assistant gunner opens the breech mechanism assembly with his left hand by rotating the breech operating handle (1) to the rear until cartridge extractors lock breechblockin down position.



3 Cannoneer no. 1 inspects chamber and bore to see that they are clear.

4 Cannoneer no. 1 receives prepared round from cannoneer no. 2.

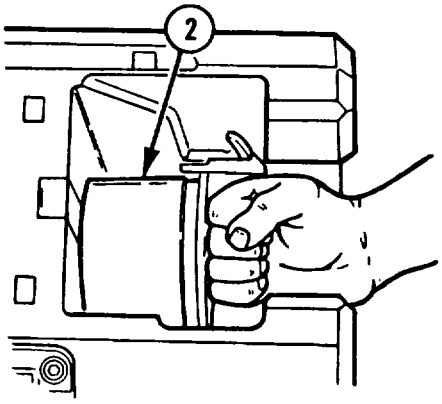
NOTE

Ammunition is prepared for firing by the ATC and cannoneer no. 2.Preparation of ammunition for firing is explained on page 4-14.

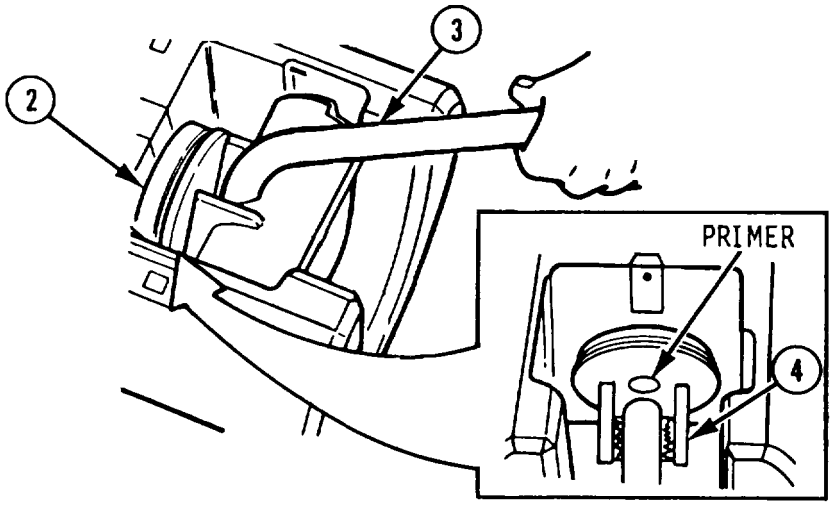
2-17. LOADING THE M102 HOWITZER FOR FIRING (cont)

WARNING

Ram the round (2)with closed fist to avoid injuring your hand. Be careful when handling live rounds to avoid striking the fuze and primer.



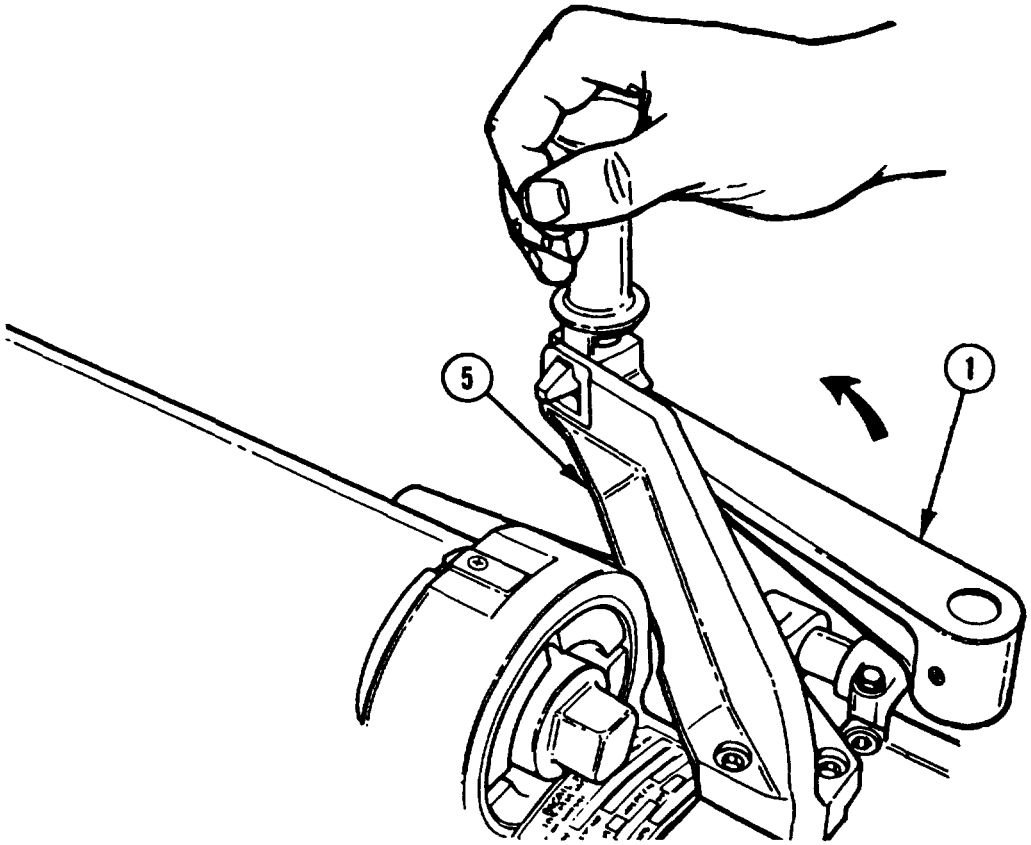
5 Upon receiving the last digit of QUADRANT (SO MUCH) command, cannoneer no. 1 rams the round (2) until the base of the cartridge case is flush with the breech end of the cannon tube.



CAUTION

The ramming and extracting tool (3) is designed so that the ears (4) won't contact the primer. Ensure that they don't before ramming. If the ears are contacting the primer, do not ram. Dispose of the ramming and extract-ing tool and get a new one.

6 If the round (2) doesn't seat flush, you can seat it with the ramming and extracting tool (3) as shown. Push down fork end to seat the round. Then remove ramming and extract-ing tool.



7 The assistant gunner closes the breech with his hand by rotating the breech operating handle (1) forward, locking it to the stop assembly (5) .

8 The chief of section verifies that cannoneer no. 2 has the designated charges removed from the prepared round, and that the breech operating handle (1) is locked to the stop assembly (5).

2-18. LAYING FOR DIRECTION AND ELEVATION DURING INDIRECT FIRE MISSIONS

NOTE

Laying the M102 howitzer for direction and elevation during indirect fire missions is the duty of the gunner and assistant gunner, respectively. These operations are normally performed simultaneously.

2-19. LAYING FOR DIRECTION AND ELEVATION DURING INDIRECT FIRE MISSIONS--LAYING FOR DIRECTION USING THE MA1 COLLIMATOR

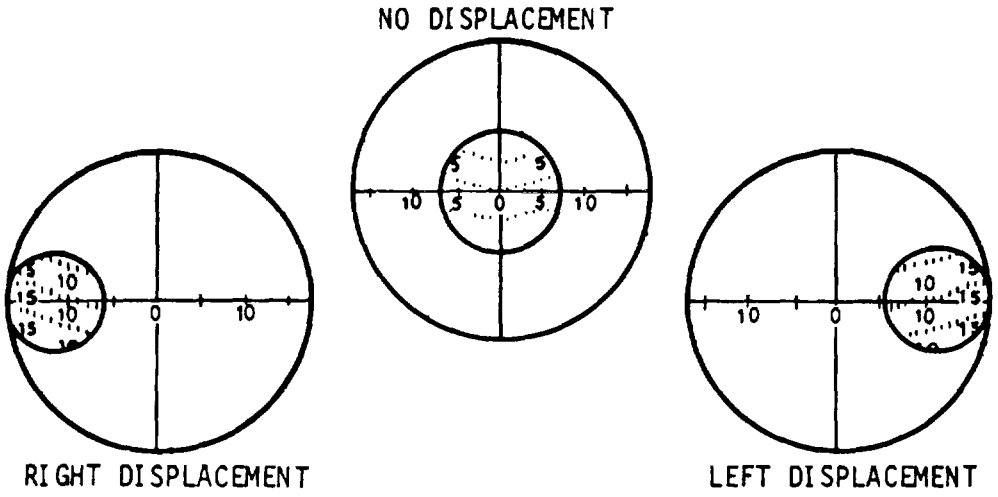
WARNING

When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.

1 Upon announcement of DEFLECTION (SO MUCH), the gunner repeats the command and rotates the M113A1 pantel azimuth knob until the announced deflection appears on the reset counter.

2 Sighting through the 1113A1 pantel, the gunner rotates the traversing handwheel assembly and traverses the M102 howitzer until a proper sight picture is obtained on the collimator.

3 The gunner centers the elevation and cross level level vial bubbles on the M134A1 mount.



NOTE

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

4 To correct for weapon displacement, the gunner must match the reticle of the M113A1 pantel with the collimator reticle pattern. The numbers in the collimator reticle indicate 5-mil increments. Individual mils are indicated by the shortlines in the V format of the pattern. For example, if the gunner sees 10 and 15 in the collimator and the pattern slopes upward from right to left, the weapon has experience right displacement. To compensate for this displacement, the gunner matches the left portion of the i'1113A1 pantel reticle with the collimator reticle as illustrated on page 2-60.

5 If the gunner sees 10 and 15 in the collimator and the pattern slopes upward from left to right, the weapon has experienced left displacement. To compensate for this displacement, the gunner matches the right portion of the M113A1 pantel reticle with the collimator reticle, as illustrated on page 2-60.

6 After the assistant gunner lays the cannon for elevation and announces SET, the gunner verifies that the announced deflection appears in the reset counter; the M134A1 mount elevation and cross level level vial bubbles are centered; and a proper sight picture is obtained on the collimator. The gunner then announces READY.

2-20. LAYING FOR DIRECTION AND ELEVATION DURING INDIRECT FIRE MISSIONS--LAYING FOR DIRECTION USING M1A2 AIMING POSTS

NOTE

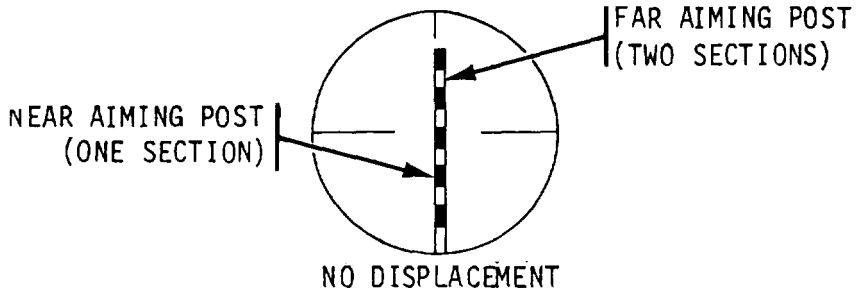
During rapid traverse operations, or if the collimator has become non-operational, it may be necessary to use an alternate aiming point, usually the aiming posts. If the aiming posts are used as the primary aiming point, omit steps 1 and2 below.

1 The gunner opens the door that covers the M113A1 pantel azimuth counter. He rotates the M1113A1 pantel azimuth knob until the azimuth on which the aiming posts were originally emplaced appears on the azimuth counter. If traverse is greater than 200 mils, he has cannoneers shift the weapon.

2 The gunner rotates the M113A1 pantel reset knob until 3200 appears on the reset counter. He then closes the door covering the azimuth counter.

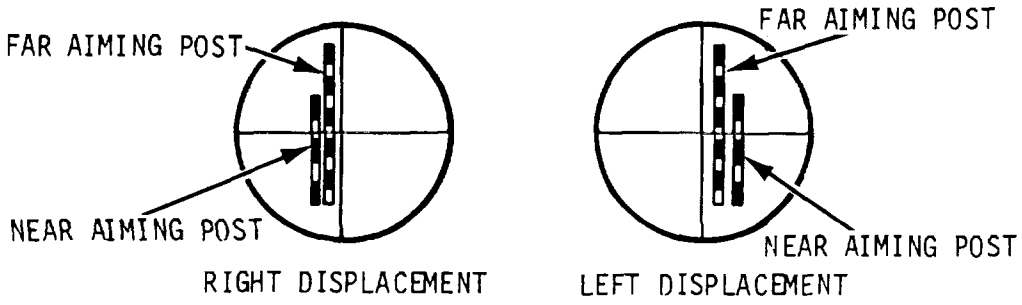
2-20. LAYING FOR DIRECTION AND ELEVATION DURING INDIRECT FIRE MISSIONS--LAYING FOR DIRECTION USING M1A2 AIMING POSTS (cont)

3 Upon announcement of DEFLECTION (SO MUCH), the gunner repeats the command and rotates the M113A1 pantel azimuth knob until the announced deflection appears on the reset counter.



4 Sighting through the M113A1 pantel, the gunner rotates the traversing handwheel assembly and traverses the howitzer until a proper sight picture is obtained on the aiming posts. If there is no weapon displacement, the gunner's sight picture should appear as shown above.

5 To correct for weapon displacement, the gunner must com-pensate so that the far aiming post appears exactly halfway between the near aiming post and the M113A1 pantel vertical reticle crossline. If the gunner sees the near aiming post to the right of the far aiming post, the weapon has experienced left displacement. To compensate, he traverses the weapon until the far aiming post is exactly halfway between the near aiming post and the M113A1 pantel vertical reticle crossline as shown below.



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

the far aiming post is exactly halfway between the near aiming post and the M113A1 pantel vertical reticle crossline as shown in the bottom illustration on page 2-62.

7 After the assistant gunner lays the cannon for elevation and announces SET, the gunner verifies that the announced deflection appears on the M113A1 pantel reset counter, theM134A1 mount elevation and cross level level vial bubbles are centered, and that a proper sight picture is obtained on the aiming posts. He announces READY.

2-21. LAYING FOR DIRECTION AND ELEVATION DURING INDIRECT FIRE MISSIONS--LAYING FOR ELEVATION

1 Upon announcement of QUADRANT (SO MUCH), the assistant gunner repeats the command and rotates the M14A1 quadrant elevation knob until the announced quadrant appears on the elevation counter.

NOTE

Each time the howitzer is traversed or the cannon elevated or depressed, the assistant gunner must repeat steps 2 and 3 until cannon is set.

2 Operating the elevating handwheel assembly, the assistant gunner elevates or depresses the cannon until the M14A1 quadrant elevation level vial bubble centers.

3 The assistant gunner centers the cross level level vial bubble on the M14A1 quadrant.

4 After the gunner has traversed the howitzer, the assistant gunner verifies that the cross level and elevation level vial bubbles are centered and the announced quadrant appears on the t114A1 quadrant elevation counter. He then announces SET.

2-22. LAYING FOR DIRECTION AND ELEVATION DURING DIRECT FIRE MISSIONS

WARNING

When handling radioactively illuminated fire control equipment, he aware of the radiation hazard procedures listed in the front of this manual.

WARNING

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

2-22. LAYING FOR DIRECTION AND ELEVATION DURING DIRECT FIRE MISSIONS (cont)

1 Chief of section:

a. Upon receipt of the command to fire direct fire, identifies the target to the crew. He repeats the target using the minimum of words; for example, TARGET THAT TANK.

b. Determines the range to the target from the range card. If the range card is not prepared, he estimates the range.

c. Determines the lead in mils, approximating the lead as follows:

Target speed (MPH) when target traveling perpendicular to line of fire	Target traveling 45 degrees to line of fire
5	5
10	5
15	10
20	15
25	15
30	20

d. Announces the initial commands as follows:

Command:	Example:
TARGET	TARGET THAT TANK
SHELL*	SHELL HE
CHARGE*	CHARGE SEVEN
FUZE*	FUZE QUICK
LEAD	LEAD RIGHT ONE ZERO MIL
RANGE	RANGE ONE THOUSAND
METHOD OF FIRE	FIRE AT WILL

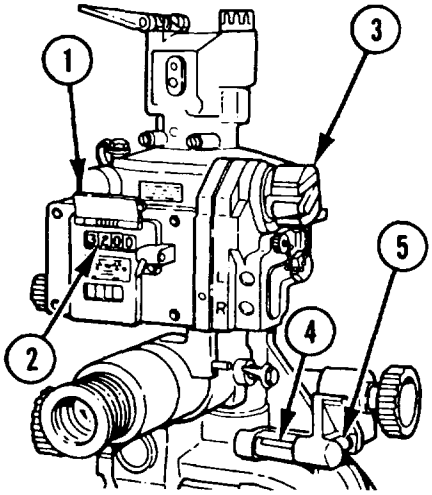
*The shell, fuze, and charge to be fired should be standardized in order to save time. If a shell/fuze combination other than the standard is desired, the command SHELL/CHARGE/FUZE is given after the direction to the target.

e. Announces subsequent commands for changes in lead and range as required.

2 The gunner:

a. Opens the cover (1) on the i1113A1 pantel azimuth counter (2) and sets the azimuth count-er to 3200.

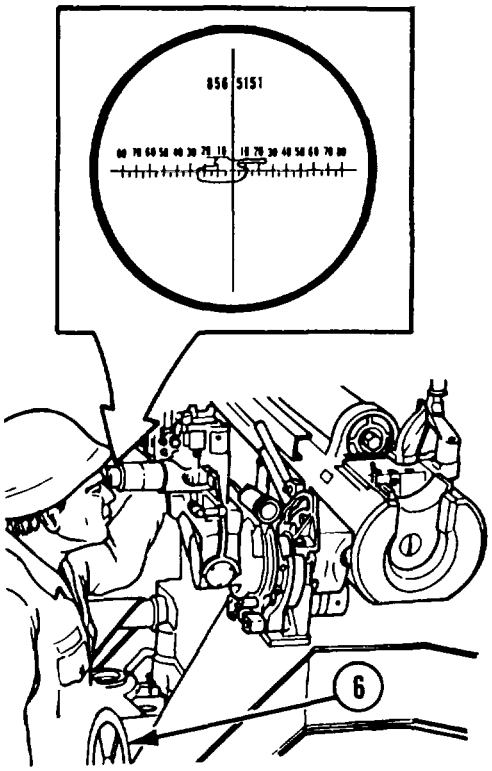
b. Turns the direct/in-direct knob on theM113A1 pantel azimuth knob (3) so that the word DIRECT is visible and centers the bubbles in the elevation level vial (4) and cross level level vial (5).



c. It the announced lead is to the left, adds the lead to3200 and places that value on the azimuth counter (2).If the lead is to the right, subtracts the value from3200 and places that value on the azimuth counter.

2-22. LAYING FOR DIRECTION AND ELEVATION DURING DIRECT FIRE MISSIONS (cont)

d. By using the traversing handwheel assembly (6), centers the M113A1pantel vertical reticle crossline on the target as illustrated. With the help of the assist-ant gunner, continues tracking even after the round is fired. As the chief of section announces subsequent commands, based on observed effects, sets the lead change by turning the M113A1pantel azimuth knob in 5-mil increments, while continuing to maintain his sight picture with the vertical reticle crossline centered on the mass of the target

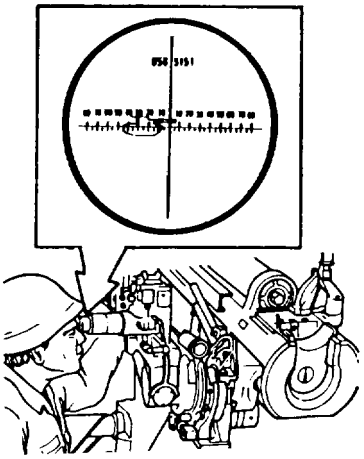


NOTE

If the command is right or left 10 mil, it is an additional 10 mil to that which has been set off.

The click-stop action of the M113A1 pantel azimuth knob enables the gunner to make the appropriate change by sound and feel without moving his eye from M113A1 pantel eyepiece.

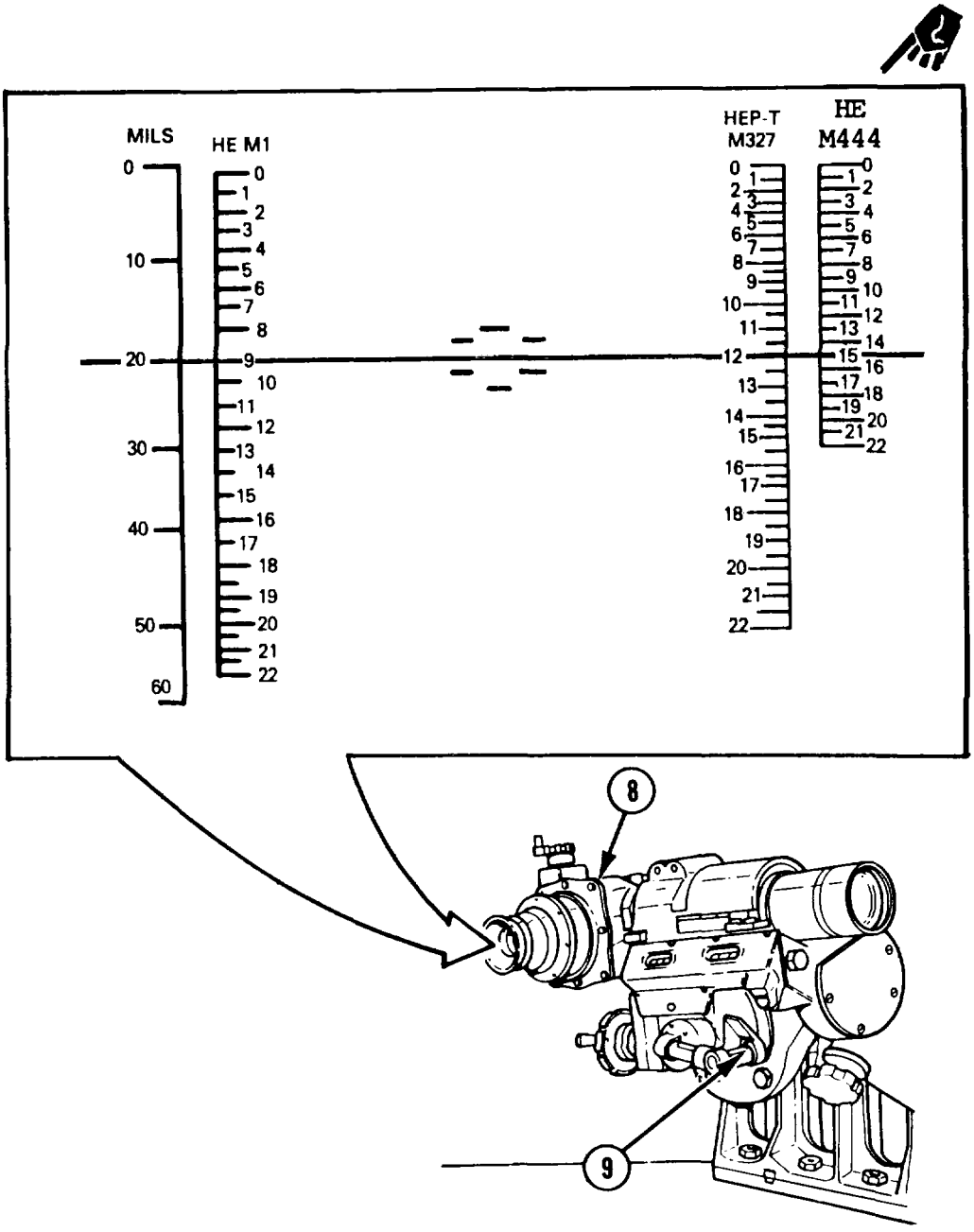
e. A less desirable method of laying is by reticle laying. The preparation of the sight in this method is the same as that in central laying except that the lead is set by placing the vertical reticle cross-line the required number of mils ahead of the center of the target.



3 The assistant gunner:

NOTE

Range lines are numbered in hundreds of meters except the left mil scale.



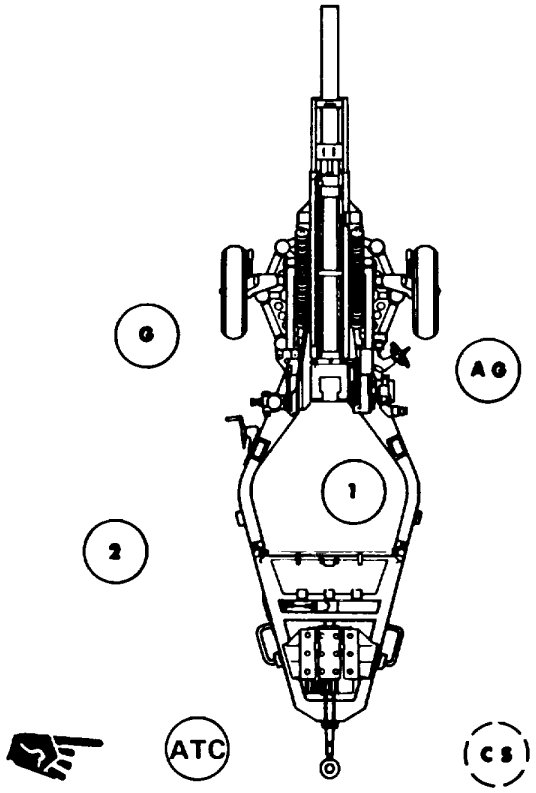
a. Prepares one M114Ai telescope (8) by centering the cross 5level level vial bubble (9) of M14A1 quadrant, and checks the functioning of the range gage line.

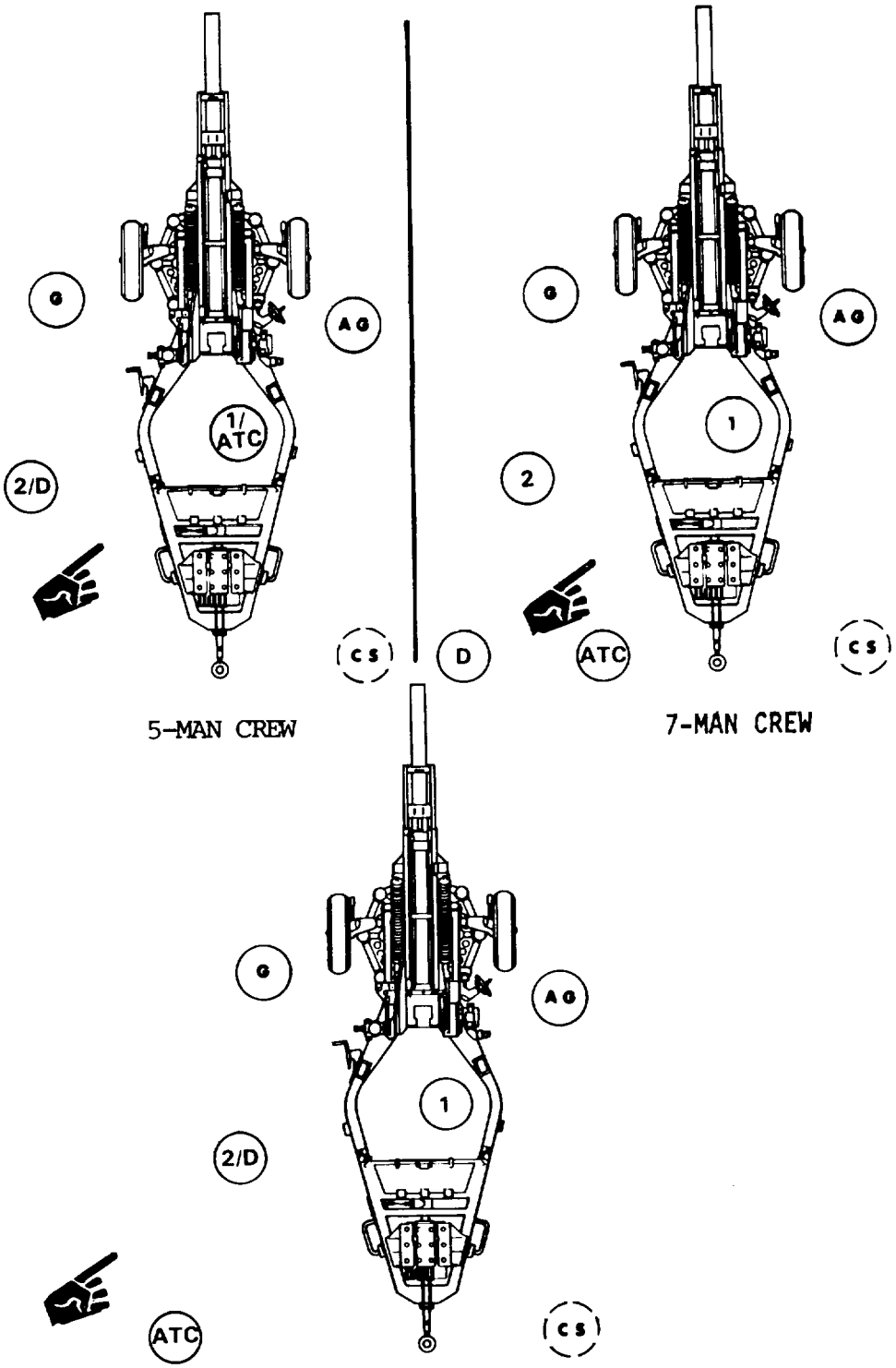
2-22. LAYING FOR DIRECTION AND ELEVATION DURING DIRECT FIRE MISSIONS (cont)

b. Lays the howitzer for range by sighting through theM114A1 telescope. Moves the range gage line up and down until the range gage line is on the announced range on the proper ammunition scale. Elevates or depresses the cannon tube until the target intersects the range gage line. Maintains the correct sight picture through continuous tracking and continues to call SET as long as the weapon is laid on the target. After a round is fired, the chief of section announces subsequent commands based on the observed effects. Based on these commands, the assistant gunner corrects the sight picture to apply any range changes commanded, and continues in the normal sequence as indicated above.

NOTE

Under direct firing, cannoneer no. 1 fires the weapon upon com-mand of the gunner. Cannoneer no. 2 and ATC prepare the ammunition for firing. Crew dispersion is shown in illustration. Reduced crew dispersion is shown on the next page.




G
AG
1/ ATC
2/D
CS
D
5-MAN CREW
G
AG
1
2
ATC
CS
7-MAN CREW
G
AG
1
2/D
ATC
CS
6-MAN CREW

2-23. FIRING THE M102 HOWITZER

WARNING

Cannoneer no. 1, loader, should remain inside the trail (at the point of widest curvature) to avoid injury from the recoil during firing.

NOTE

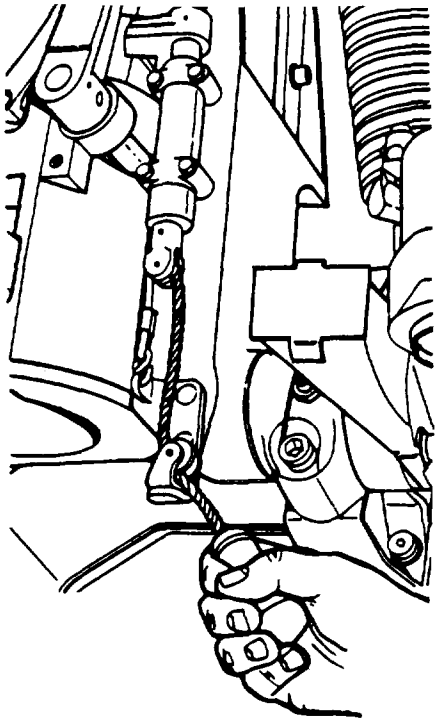
The M102 howitzer is fired only upon verbal or hand signal from the chief of section during indirect fire.

1 The chief of section gives the assistant gunner the command to fire by dropping his right arm sharply to his side, and at the same time commands FIRE.

CAUTION

Don't release the lanyard assembly during firing. The wooden knob, if re-leased, may lodge between breech ring assembly and carriage. Leave the breech mechanism assembly closed until the cannon returns to battery.

2 When the chief of section commands FIRE and drops his arm, the assistant gunner pulls the lanyard assembly to fire the howitzer. He should apply a gradual, steady pull to the lanyard assembly. Jerking may cause the firing mechanism assembly to malfunction.

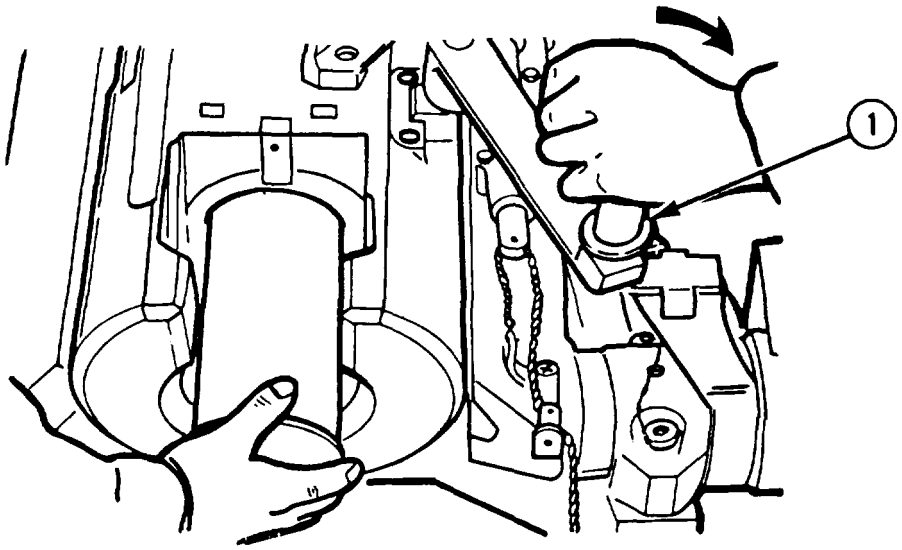


3 If the howitzer fails to fire, refer to misfire procedures on pages 2-75 and 2-76.If misfire cannot be corrected, refer to unloading procedures on page 2-73.

WARNING

If you do have a misfire, the gunner or cannoneer no. 1 will recock the percussion mechanism as shown. Keep away from in back of the breech.

2-24. UNLOADING THE M102 HOWITZER--UNLOADING A SPENT (FIRED) CARTRIDGE



1 Cannoneer no. 1 positions his hand behind the breech access opening to receive the spent cartridge case.

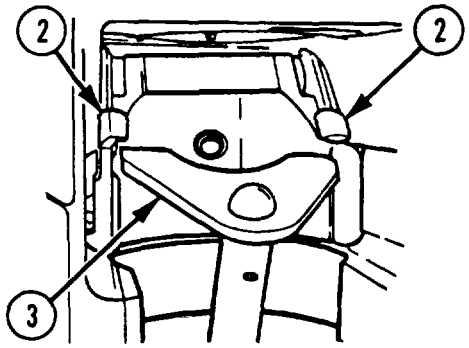
2 The assistant gunner opens the breech mechanism assembly to eject the cartridge case by rotating the breech operating handle (1) to the rear.

3 Cannoneer no. 1 grasps the rear of the cartridge case and removes the cartridge case from breech by pulling straight out.

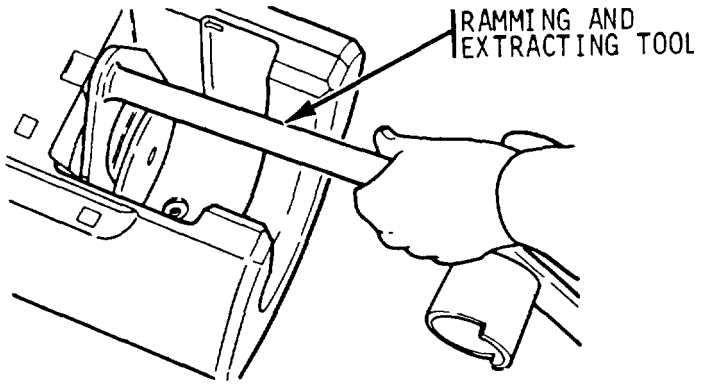
4 Cannoneer no. 1 inspects the cannon breech and bore and announces BORE CLEAR, if there are no obstructions or foreign material.

2-24. UNLOADING THE M10Z HOWITZER--UNLOADING A SPENT (FIRED) CARTRIDGE (cont)

5 The assistant gunner closes the breech mechanism assembly if another round will not be loaded. To close breech mechanism assembly, the cartridge extractors(2) must be pushed forward by inserting ramming and extracting tool (3) and pushing toward cannon tube.



2-25. UNLOADING THE M102 HOWITZER--UNLOADING A SPENT CARTRIDGE WHICH FAILED TO EXTRACT



1 Remove the cartridge case by installing ramming and extracting tool so that the lips on the fork fit between the cannon tube face and the rim of the cartridge case, and pry out the cartridge case.

2 If the cartridge case cannot be extracted with the ramming and extracting tool, insert the staff section through the muzzle end of the cannon tube and tap the bottom of the cartridge case until it is loosened and can be pushed out of the chamber.

3 Notify organizational maintenance to check the cartridge extractors.

2-26. UNLOADING THE M102 HOWITZER--UNLOADING AN UNFIRED ROUND

WARNING

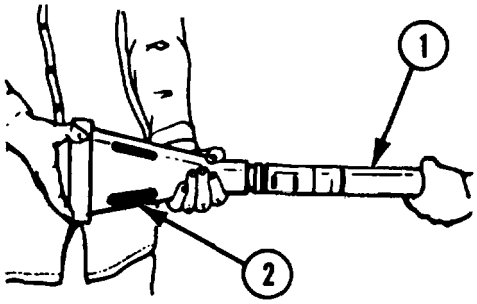
A complete round, once loaded, should be fired. However, if an unfired cartridge case and projectile must be removed, proceed as follows. For misfire/checkfire procedures, refer to page 2-75.

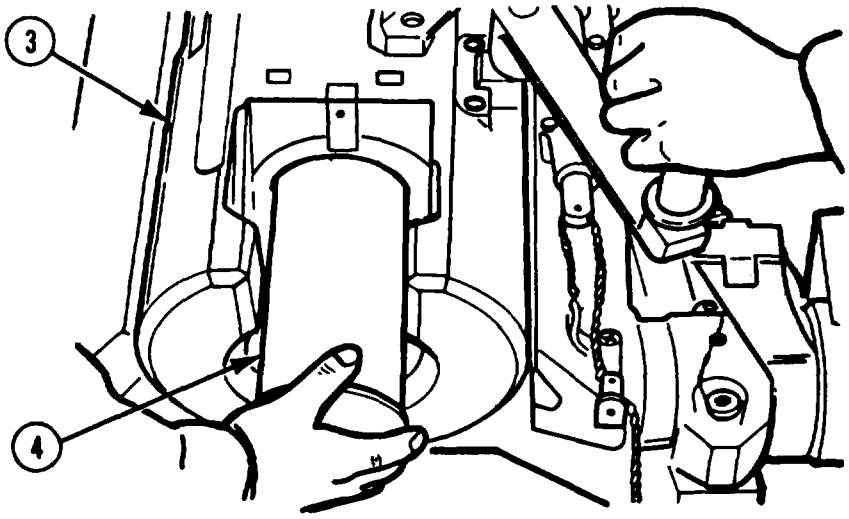
1 Level the cannon tube.

WARNING

Be sure that proper artillery unloading rammer (bell rammer) (5591873) is used.

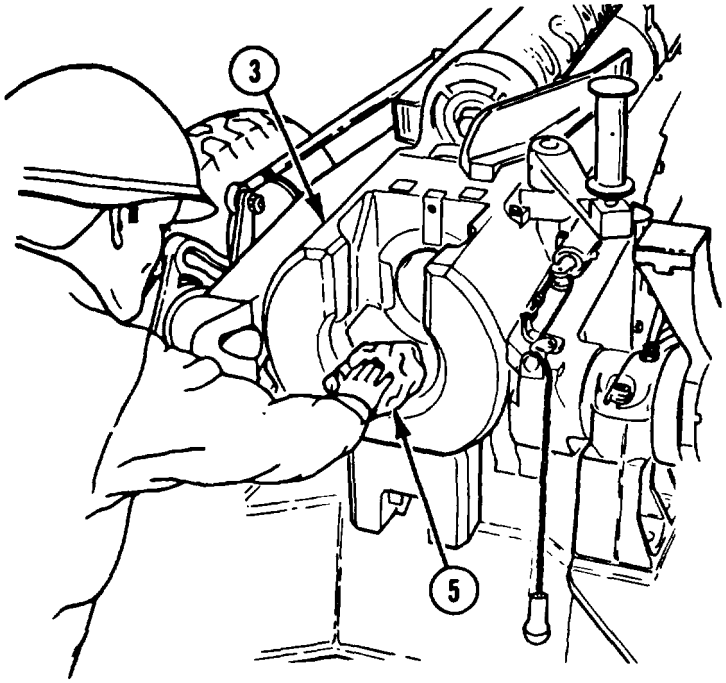
2 Assemble cleaning staff sections (1) to bell rammer (2).





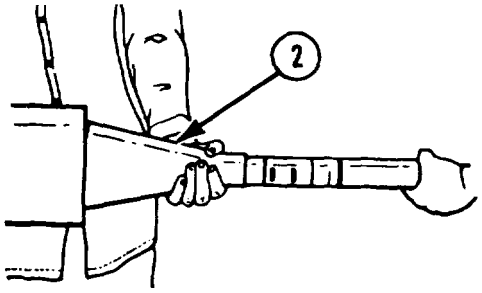
3 Open breech mechanism assembly (3) and remove cartridge case (4).

2-26. UNLOADING THE M102 HOWITZER--UNLOADING AN UNFIRED ROUND (cont)



4 Place wiping rags (5) (item 22, app D) in chamber and close breech mechanism assembly (3).

5 Insert bell rammer (2) into bore. Push carefully until bell rammer encloses fuze and comes into contact with the ogive of projectile.



6 Push or, if necessary, tap cleaning staff until projectile is dislodged from its seat.

7 Push projectile from cannon tube into chamber.

8 Open breech mechanism assembly and remove wiping rags. Push projectile out of chamber.

9 Remove cleaning staff sections from cannon tube.

10 Isolate removed round and notify EOD personnel.

2-27. MISFIRE/CHECKFIRE PROCEDURES

a. General precautions.

Conditions described below are rarely encountered with a properly maintained weapon and when authorized and properly maintained ammunition is fired. To avoid injury to personnel and equipment damage, however, it is important to understand the nature of these conditions and to be familiar with preventive and corrective procedures.

b. Definitions.

(1) 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 (percussion) mechanism or a faulty element in the propelling charge explosive train. A misfire in itself is not dangerous; however, it cannot be distinguished immediately from a delay in functioning of the weapon's firing mechanism assembly or from a hangfire. Therefore, misfires must be treated as delayed firings until determined otherwise.

(2) 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 immediately from a misfire.

(3) STICKER. A sticker is a projectile that is lodged in the cannon tube after being fired. Stickers result from insufficient chamber pressure.

(4) HOT WEAPON. A hot weapon is one in which the cannon tube and breech have been brought to a sufficiently high temperature by previous firings 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.

(5) COOK-OFF. The functioning of the propelling charge or projectile when initiated by the heat of the weapon.

(6) CHECKFIRE. CHECKFIRE is a command which normally is given by the battery executive officer, but in an emergency may be given by anyone present.

2-28. MISFIRE/CHECKFIRE PREVENTIVE OR CORRECTIVE PROCEDURES

1 At the command, CHECKFIRE, regardless of its source, cease firing immediately and unload as directed.

NOTE

Figure 2-1 shows a summary of procedures for correcting a misfire if the cannon tube is cold. Figure 2-2 summarizes corrective procedures if the cannon tube is hot.

2 If the cannon tube is cold, make two more attempts to fire. Although time is not as critical as when the cannon tube is hot, it is military policy to either fire or unload chambered rounds within 5 minutes, if possible.

WARNING

The breech should not be opened for at least 2 minutes after the firing attempt. All personnel not required for unloading should seek protective cover at least 50 meters from the weapon to avoid injury if weapon fires unexpectedly. Keep weapon trained on target and stand clear of muzzle and path of recoil until round is unloaded.

When firing is interrupted, remove projectile from chamber of hot weapon within 5 minutes of the time it was loaded.

If an explosive round cannot be fired or unloaded from a hot weapon within 5 minutes after being chambered, all personnel should seek cover at least 50 meters from the weapon for a period of 2 hours.

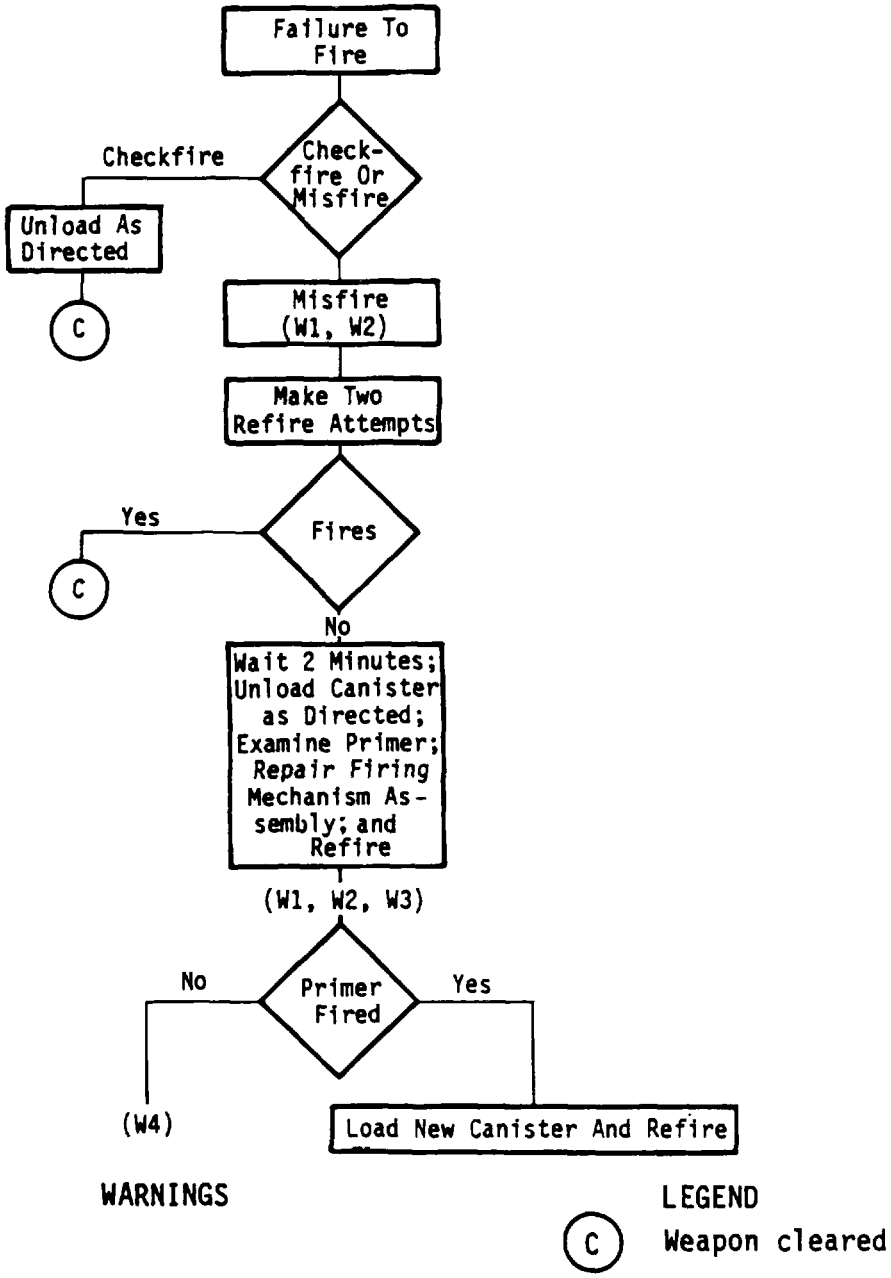
3 Unload the round following procedures on page 2-71.

4 Inspect the misfired cartridge. If the primer is dented, the propelling charge is faulty. If the primer is not dented, the weapon's percussion mechanism is faulty; repair percussion mechanism.

WARNING

Any round which has been unloaded from weapon, whether faulty or not, should be set aside for disposal by authorized ammunition personnel. Unloading may have created some nonstandard conditions in the round which could result in personnel injury.

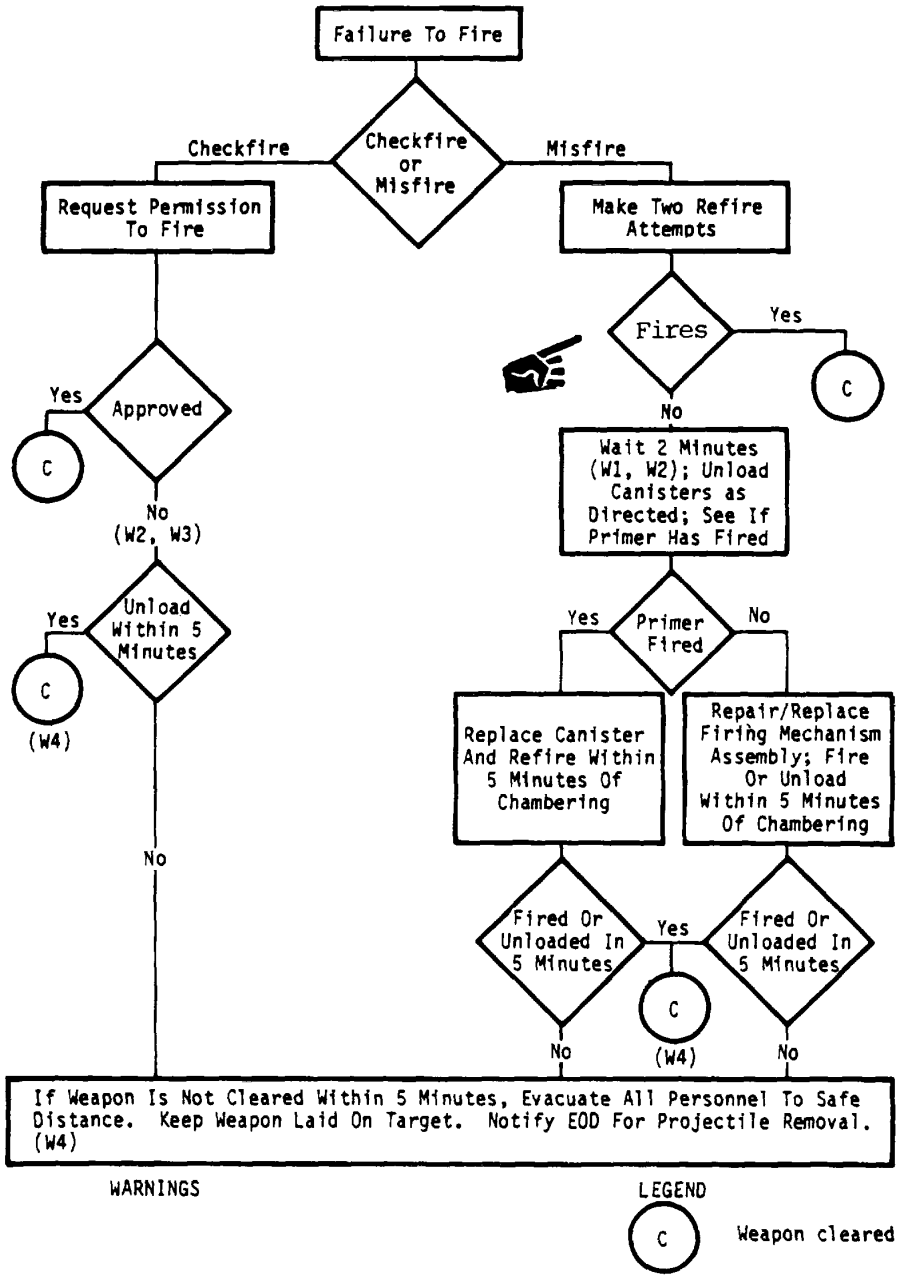
5 Notify EOD personnel to remove the projectile or evacuate the weapon.



W1-Hangfire possible
W2-Stand clear of recoiling parts
W3-Evacuate unnecessary personnel
W4-Dispose of removed projectiles and fuze

Figure 2-1. Misfire/checkfire procedures, semi-fixed ammunition--cold tube

2-28. MISFIRE/CHECKFIRE PREVENTIVE OR CORRECTIVE PROCEDURES (cont)

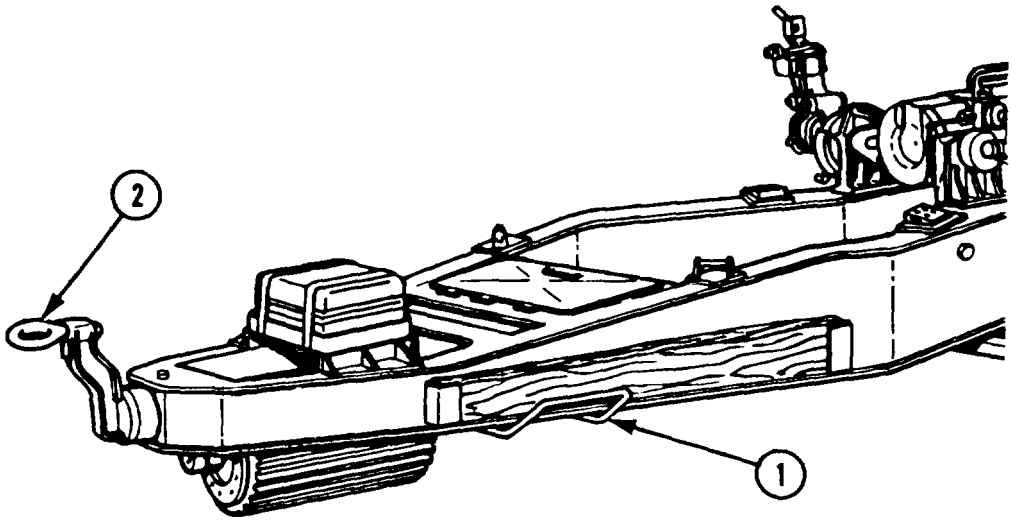


W1-HangTlre possible
W2-Stand clear of recoiling parts
W3-Evacuate unnecessary personnel
W4-Dispose of removed projectiles and fuze

Figure 2-2. Misfire/checkfire procedures, semi-fixed ammunition--hot tube

2-29. RAPID TRAVERSE

1 When the announced deflection calls for a rapid and major change in azimuth (more than 200 mils), the howitzer should be traversed manually as follows.



2 Upon announcement of AZIMUTH (SO MUCH), the chief of section should indicate the general direction of fire.

3 Crew members lift the trail end of howitzer by means of carriage handles (1) and the lunette (2) and rotate the cannon muzzle to the direction indicated by chief of section.

4 Laying howitzer for direction and elevation is explained on pages 2-59 thru 2-69.

2-30. MARCH ORDER--GENERAL PROCEDURES

WARNING

When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.

WARNING

Do not store equipment of any kind inside the cannon tube. Foreign objects inadvertently left in bore of cannon tube before firing can cause a premature explosion resulting in death or injury to personnel.

NOTE

March order and preparation of howitzer for travel is accomplished under supervision of the chief of section. When movement is ordered, the chief of section commands MARCH ORDER. These general procedures must be accomplished regardless of whether the weapon will be towed or airlifted from the firing position.

1 The chief of section ensures the weapon is not loaded, and supervises the work of all cannoneers.

2 Cannoneer no. 1 inspects the collimator for damage and proper illumination, covers the collimator, and prepares it for travel.

3 ATC retrieves the aiming posts, inspects aiming posts for damage, checks illumination of aiming post lights, and prepares for travel.

4 The other crew members prepare ammunition for travel. (Ammunition repacking requirements are explained on page 4-16.)

5 The gunner removes the M113A1 pantel and prepares it and M134A1 mount for travel as follows:

a. Places the traversing handwheel assembly in folded position.

b. Sets M113A1 pantel azimuth counter to read 3200.

c. Sets M113A1 pantel reset counter to 0.

d. Closes cover on M113A1 pantel optics.

e. Rotates M113A1 pantel elbow to travel position.

f. Inspects level vials and reticle on M113A1 pantel for illumination.

g. Covers level vials on M134A1 mount.

h. Loosens four quick release assemblies holding M113A1 pantel to M134A1 mount and removes M113A1 pantel.

i. Stores M113A1 pantel in carrying case.

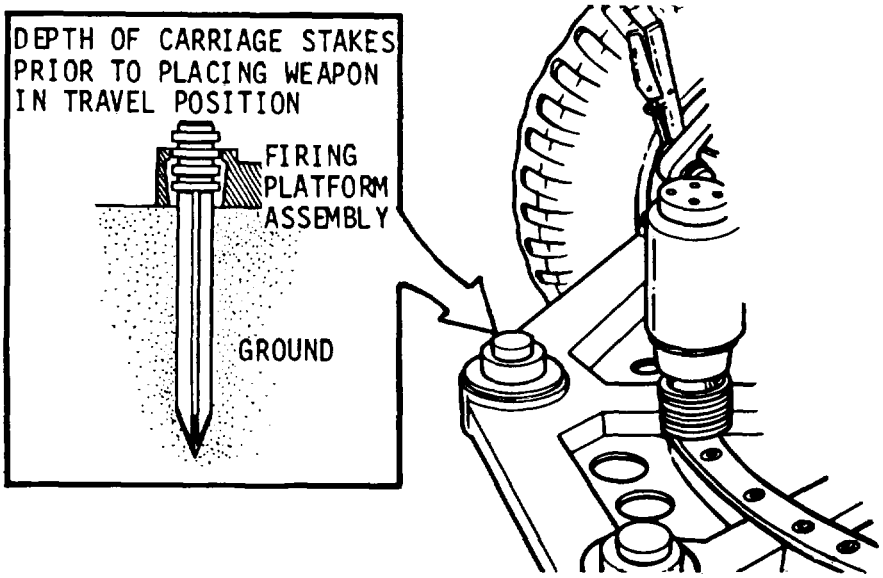
j. Installs telescope mount cover on M134A1 mount and tightens four quick release assemblies.

6 Assistant gunner removes M114A1 telescope and places it in carrying case.

2-31. MARCH ORDER--PREPARATION OF M102 HOWITZER FOR TOWING

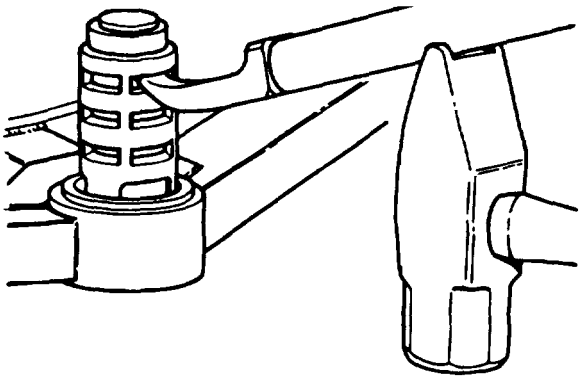
1 Cannoneer no. 1 makes sure the weapon is clear of ammunition and that the breech is closed, while cannoneer no. 2 installs the muzzle plug.

2 The assistant gunner elevates the cannon to approximately 800 mils.



2-31. MARCH ORDER--PREPARATION OF M102 HOWITZER FOR TOWING (cont)

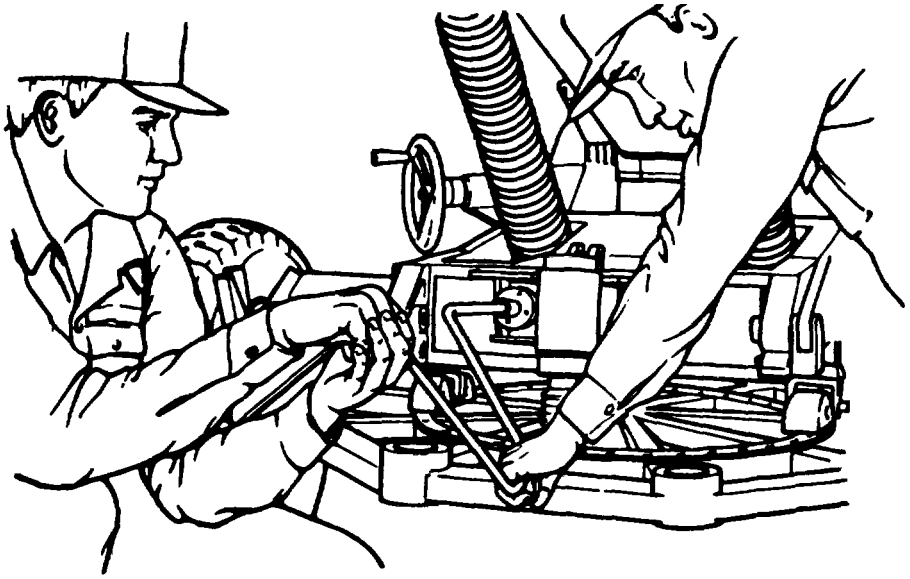
3 The gunner traverses the weapon to provide access to the carriage stakes.



4 The ATC and driver remove carriage stakes from ground.

5 Cannoneer no. 2 releases the right handbrake.

6 Cannoneer no. 1 releases the left handbrake.



7 Cannoneer no. 2 assisted by cannoneer no. 1 cranks weapon to travel position.

8 After the weapon has been cranked to the travel position, cannoneer no. 2 replaces right wheel suspension pin assembly and locks right handbrake.

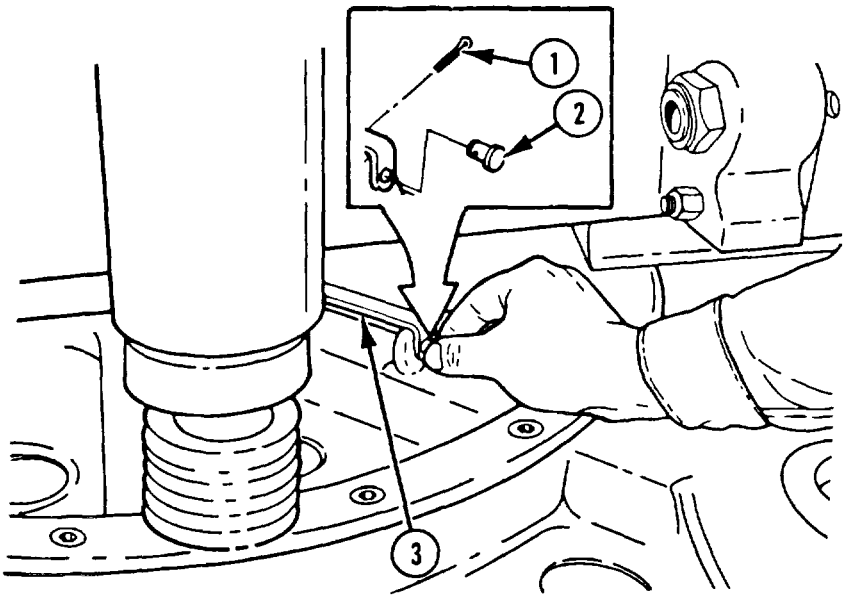
9 Cannoneer no. 1 replaces left wheel suspension pin assembly and locks left handbrake.

10 The assistant gunner depresses the cannon tube while cannoneer no. **2** removes travel lock from stowed position and places it in travel position.

10.1 The assistant gunner installs quadrant and elbow telescope cover on M14Al quadrant.

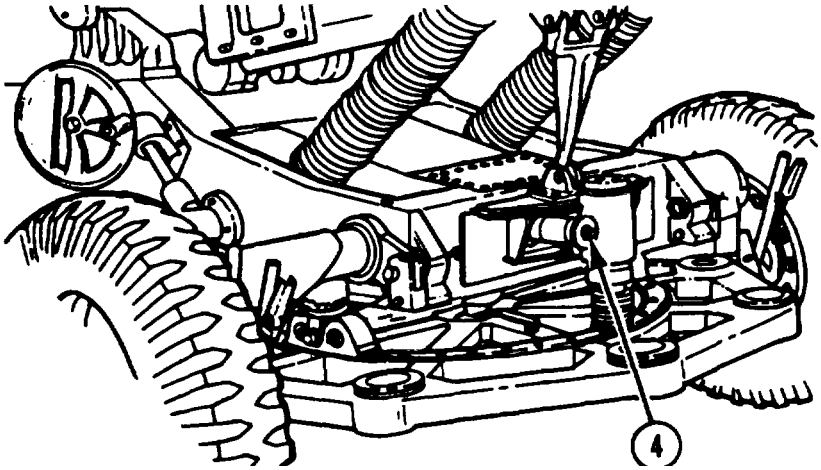
11 The assistant gunner and cannoneer no. 2 install overall cover on howitzer.

12 If firing platform is stuck in the ground, the weapon can not be placed into travel position using the preceding method without damaging the control assembly or shearing the crank assembly shear pin, use the following method:



a. Remove cotter pin (1) and straight pin (2) from locking assembly handle (3). Unlock firing platform assembly by rotating locking assembly handle (3) counterclockwise.

2-31. MARCH ORDER- - PREPARATION OF M102 HOWITZER FOR TOWING (cont)



b. With handbrakes released, cannoneers no. 1 and 2 manually operate the control assembly (4) clockwise to place the weapon in travel position, leaving the staked firing platform assembly on the ground. Manually traverse the weapon (p 2-79, step 3) 1/4 turn and move the weapon away from firing platform assembly.

c. Cannoneer no. 2 replaces right wheel suspension pin assembly and locks right handbrake.

d. Cannoneer no. 1 replaces left wheel suspension pin assembly and locks left handbrake.

e. Now the ATC and driver remove and store the carriage stakes and reinstall firing platform assembly on weapon.

f. Continue with steps 10 and 11 on page 2-83.

13 Cannoneer no. 2 installs the tail light assembly on the cannon tube and tightens the special pin.

14 If drawbar bracket is to be rotated, cannoneer no. 2 removes cotter pin and rotates drawbar bracket downward.

CAUTION

If the prime mover has a fixed towing pintle, the lunette lock plate must be secured in the position that permits the lunette to rotate.

15 Cannoneers no. 1 and 2, ATC, and AG raise the howitzer and engage to prime mover's towing pintle.

16 Cannoneer no. 2 connects tail light assembly to prime mover, if necessary.

17 Cannoneer no. 1 releases left handbrake and cannoneer no. 2 releases right handbrake.

18 The chief of section verifies firing section march order and commands PREPARE TO MOUNT, MOUNT or simply MOUNT. The chief of firing battery tells the chief of section in what order his section is to move out.

NOTE

Refer to page 2-91 for fording and swimming procedures.

2-32. MARCH ORDER--PREPARATION OF M102 HOWITZER FOR AIR-LIFT

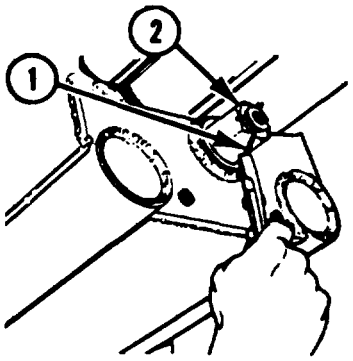
Refer to EM 55-450-1 and FM 55-450-2 for air-lift procedures.

2-33. MARCH ORDER--PREPARATION OF M102 HOWITZER FOR INTERNAL TRANSPORT

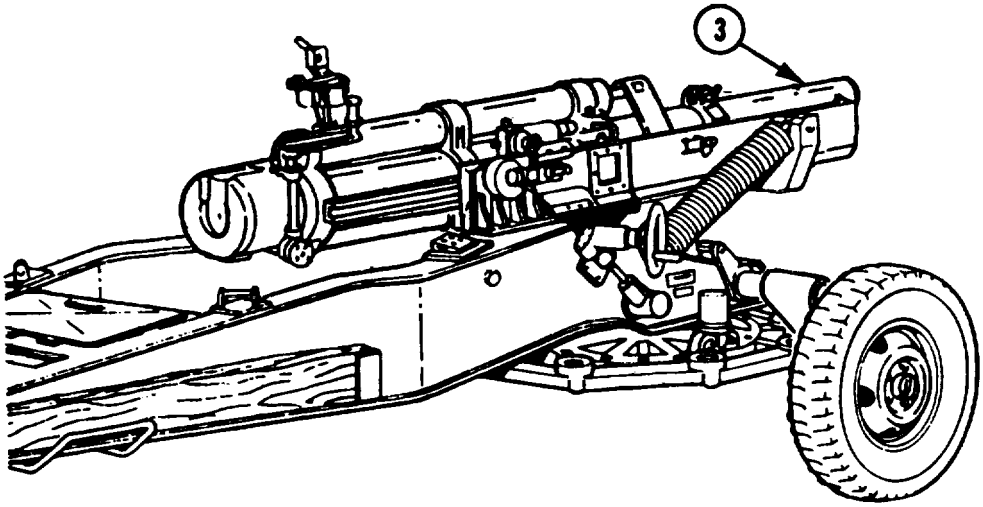
NOTE

Three personnel are required to perform this procedure. The M102 howitzer should be in travel position.

1 Remove cotter pin (1) and recoil rod nut (2). Store recoil rod nut on fastener stud.



2-33. MARCH ORDER--PREPARATION OF M102 HOWITZER FOR INTERNAL TRANSPORT (cont)

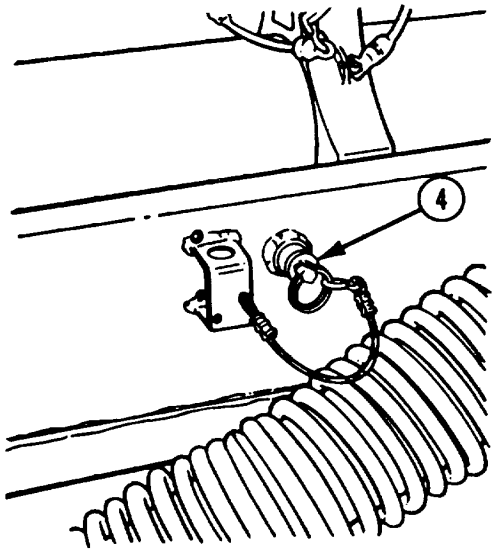


2 Push cannon (3) out of battery (toward rear of howitzer).

3 Install quick release pin (4).

NOTE

To prepare for loading, check that breech is closed and locked, muzzle plug is installed, fire control covers are in place, tool box is tied shut, and fire control equipment is padded. Loading and securing of the weapon will be performed under direction of the transport crew.



Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2-34. GENERAL

This section contains special instructions for operating and servicing the weapon under unusual conditions. Special care must be taken in cleaning and lubrication when extremes in temperature, humidity, and terrain conditions are present or anticipated, in addition to performing all normal preventive maintenance services. 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 the working parts and deterioration of the materiel. See lubrication instructions beginning on page 3-1.

2-35. OPERATION IN 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 congeal.

CAUTION

It is important that the approved practices and precautions be followed. FM 9-207 contains general cold weather information applicable to the M102 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.

(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 rags (item 22, app D) and dry lens paper (item 21, app D) for cleaning.

(4) Do not grasp metal parts such as knobs, levers, covers, etc., with bare hands.

2-35. OPERATION IN EXTREME COLD WEATHER CONDITIONS (cont)

(5) Working parts may operate or function sluggishly. The operator should be able to differentiate between sluggishness and lack of movement because of built-in stops. Do not force movements beyond their stops.

c. Emplacement on Frozen or Rocky Ground. In extremely rocky or frozen ground it may be difficult or impossible to use normal size carriage stakes. A 15-inch steel carriage stake, which can generally withstand the driving force required to penetrate frozen or rocky ground, is available (p C-3). This carriage stake requires less emplacement time and depth of penetration.

2-36. OPERATION IN EXTREME HOT WEATHER CONDITIONS

a. General Problems.

(1) In hot climates, the film of oil necessary for operation and preservation will quickly disappear. Inspect the cannon 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 (p 3-1).

b. Ammunition Problems.

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

(2) Whenever practicable, white phosphorous-loaded smoke projectiles should be stored at temperatures below the melting point (+111.40F (+44.11°C)) of the white phosphorous filler. If not practicable, white phosphorous rounds should be stored on their bases so that if the white phosphorous filler melts it will resolidify with void spaces in the normal position (in the nose of the projectile) when the temperature falls below its melting point. Premature explosions

have been caused by voids in the base end of the white phosphorous projectile and erratic performance may result from voids in its side. Refer to chapter 4 for precautions in handling ammunition in high temperature.

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 listed on page 1-12.

2-37. OPERATION IN HOT, DAMP, AND SALTY ATMOSPHERE

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

b. When the materiel is active, clean and lubricate the bore and exposed metal surfaces daily (p 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.

CAUTION

Never use gasoline or any solvent to remove oil or grease spots from canvas covers.

Canvas deteriorates quickly in this atmosphere. Wet canvas should be dried thoroughly before folding to prevent mildew and deterioration.

d. For care and cleaning of canvas, refer to FM 21-15.

e. When the materiel is inactive, the unpainted parts should be covered with a film of CLP (item 9, app D). All covers should be in place.

f. Do not break moisture-resistant seals of ammunition containers until the ammunition is to be used.

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

2-37. OPERATION IN HOT, DAMP, AND SALTY ATMOSPHERE (cont)

h. 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. Especially in tropical climates, the storage time of unpacked fuzes should be kept to a minimum. Fuzes must be stored in their original sealed containers as long as it is practical.

i. Optical instruments are protected against moisture by pressurized nitrogen. If moisture is present, notify organizational maintenance.

2-38. OPERATION IN UNUSUAL TERRAIN CONDITIONS

a. Soft Terrain. When traveling on soft or muddy ground, reduce the tire inflation to increase flotation. When emplacing howitzer in soft terrain, use four 24-inch carriage stakes and four 38-inch carriage stakes (p B-5).

b. Snow or Ice.

(1) Snow. The many types of snow encountered make it impossible to establish firm rules for oversnow operations. Experience in particular areas is required for accurate predictions of snow trafficability. Reconnaissance must be made.

(2) Ice. When ice crossings are contemplated, inspect first for cracks, ridges, and thin spots. Ice must be in contact with the water beneath it, as suspended ice is not strong.

(3) Side-Hill Travel. Traveling along the side of a hill in snow, ice, or soft ground must be avoided, as the weapon will not track properly.

c. Sand, Dust, and Dirt. Inspect and lubricate the materiel (p 3-1) frequently when operating in sandy or unusually dusty areas. 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. Keep all covers in place as much of the time as firing conditions permit. Shield parts from flying sand and dust with tarpaulins or with

the telescope and mount covers during disassembly and assembly operations. When beginning an action in sandy or dusty areas, remove lubricants from 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. Clean and lubricate all exposed parts (p 3-1) after the action is over.

2-39. FORDING 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 c below.

b. Deep-Water Fording. Refer to IM 9-238 for general information, description, and use of deep-water fording kits.

c. After-Fording Operations .

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

(a) Notify organizational maintenance to remove the wheel and hub and brake drum assemblies, and thoroughly clean with cleaning compound and dry all working parts of the handbrakes and wheel bearings. Lubricate the assemblies in accordance with the lubrication instructions (p 3-1).

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

2-39. FORDING OPERATIONS (cont)

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

2-40. NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) DECONTAMINATION PROCEDURES

Perform NBC detection and decontamination procedures in accordance with FM 3-87 and FM 21-40, using DS-2 portable decontamination apparatus (TM 3-4230-204-12&P or unit SOP).

CHAPTER 3

MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION INSTRUCTIONS

3-1. GENERAL

a. Intervals are based on normal operation. You should lube more during constant use and lube less during inactive periods. Relubricate after washing or fording. Clean fittings before lubricating. Clean parts with CLP or RBC, as specified. Dry before lubricating. DO NOT overlubricate; wipe off excess lubricant.

b. Dotted lines indicate lubrication points on both sides of the equipment. The level of maintenance responsible for each lube instruction is shown, and the lube instructions are divided into five sections based on lubrication intervals (DAILY, WEEKLY, MONTHLY, SEMI-ANNUALLY, and ANNUALLY). An overall view showing lubrication points precedes each set of detailed notes for each interval. The lubrication instructions are mandatory.

NOTE

CLP is the main lubricant for oil can points and after cleaning. Lubricating oil, general purpose, special preservative (PL-S) or RBC may be used as an alternative unless specifically mentioned otherwise. Grease, aircraft, general purpose (GPG) may be substituted for grease, automotive and artillery (GAA) in lubrication procedures.

Daily lubing means lube once each day after weapon has been fired.

LUBE INSTRUCTIONS

KEY

MAINTENANCE LEVEL

C	Operator/Crew
O	Organizational Maintenance
F	Direct Support Maintenance

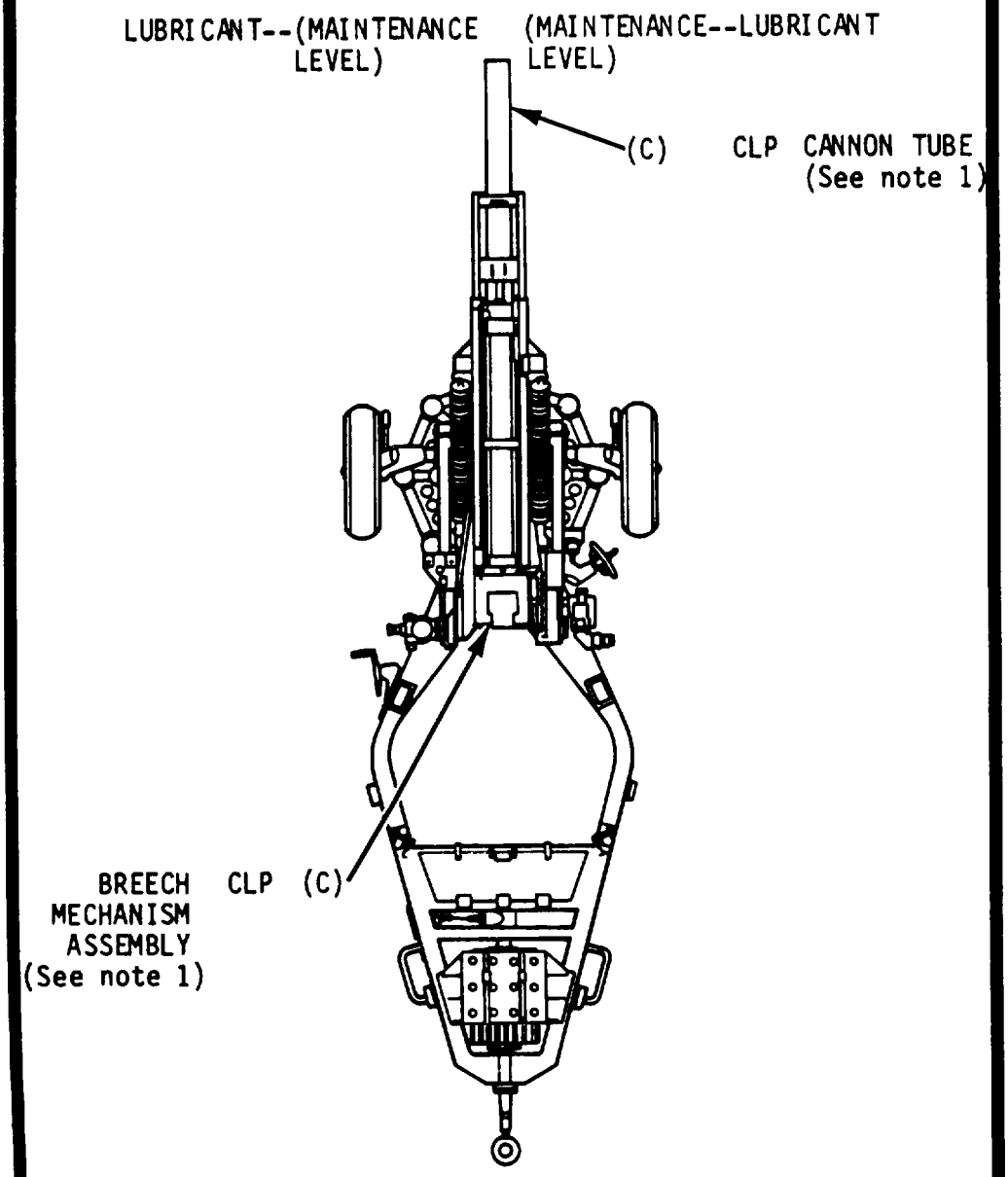
LUBRICANTS

CLP	Cleaner, Lubricant and Preservative, MIL-L-63460 (item 9, app D)
GAA	Grease, Automotive and Artillery, MIL-G-10924 (item 17, app D)
GPG	Grease, Aircraft, General Purpose, MIL-G-81322 (item 16, app D)
PL-S	Lubricating Oil, General Purpose, Special Preservative, MIL-L-21260 (item 20, app D)
RBC	Cleaning Compound, Rifle Bore Cleaner, MIL-C-372 (item 11, app D)

LUBRICATION POINTS (IN NOTES)

GREASE	LUBE
GPG	CLP
GAA	PL-S
	RBC

DAILY


LUBRICANT--(MAINTENANCE LEVEL)
(MAINTENANCE--LUBRICANT LEVEL)
(C)
CLP CANNON TUBE (See note 1)
BREECH MECHANISM ASSEMBLY (See note 1)
CLP (C)
TOP VIEW

DAILY NOTE

NOTE 1

CANNON TUBE AND B CH MECHANISM ASSEMBLY (C)

CAUTION

The nylon bore brush assembly issued with the artillery cleaning kit should not be used with RBC. RBC will destroy the bore brush assembly.

CANNON

On day of firing, remove one bottle of premeasured CLP and one bore brush assembly from kit. Attach bore brush assembly to standard US Army rammer staff. Inspect breech mechanism and cannon tube; clear obstructions. Wet punch cannon tube. Pour 1/4 bottle of CLP onto bore brush assembly and punch cannon tube once forward and once back. Repeat process with second, third, and final 1/4 of premeasured bottle of CLP.

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

NOTE-

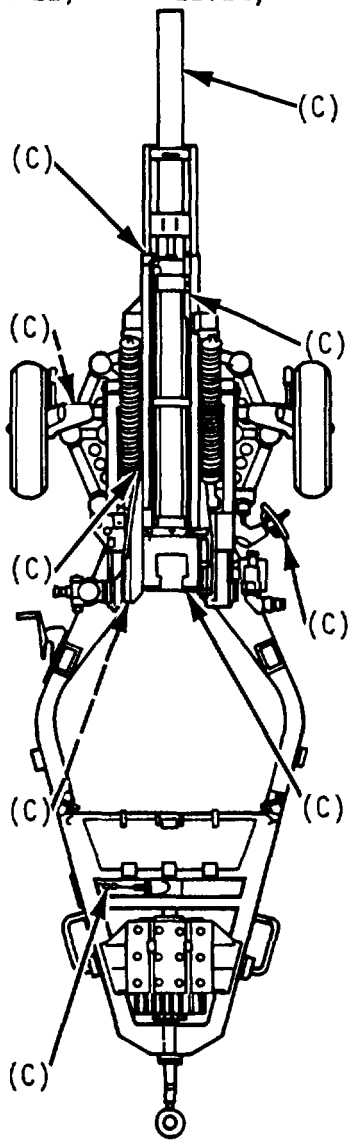
If cannon tube has not been previously cleaner with CLP and there is a heavy buildup of coppering or carbon deposits, or severe heat cracking, it may be necessary to repeat cleaning instructions until cannon tube has been thoroughly cleaned with CLP.

BREECH

On day of firing, remove 1 liter bottle of CLP (with trigger sprayer and rags) from general supply. Wet all breech components thoroughly with CLP. Soak for 10 to 15 minutes and then wipe off. Reapply a light coat of CLP. Spray CLP onto all exposed metal surfaces.

WEEKLY

LUBRICANT--(MAINTENANCE LEVEL) (MAINTENANCE--LUBRICANT LEVEL)

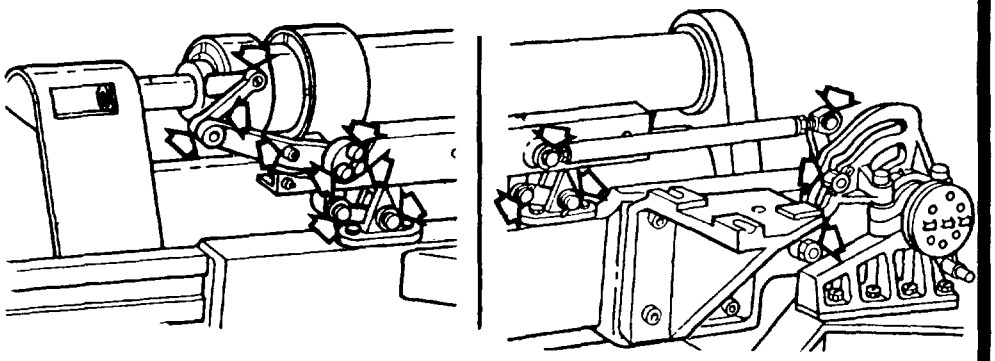


TOP VIEW

WEEKLY NOTES

NOTE 2

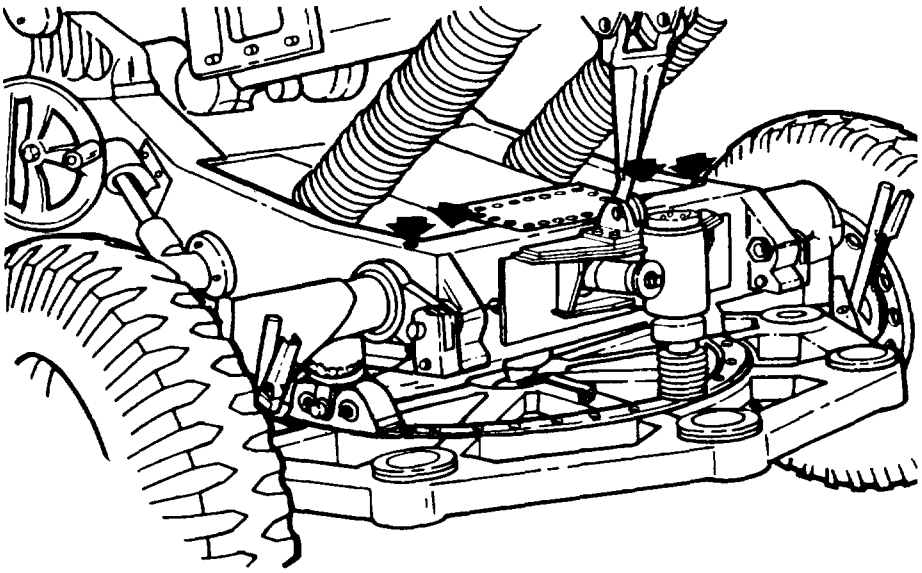
VARIABLE RECOIL MECHANISM PIVOT POINTS (C)



Lube with a couple drops of PL-S (15 places).

NOTE 3

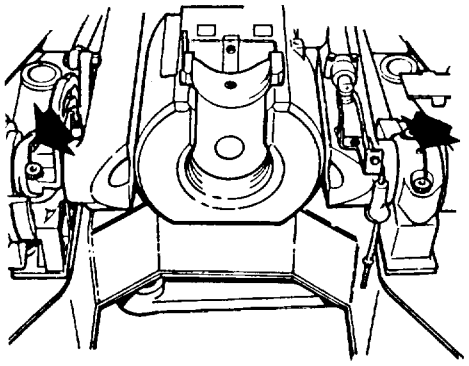
SUSPENSION ASSEMBLY SLEEVE BEARING (C)



Lube with GAA (modified weapon only).

NOTE 4

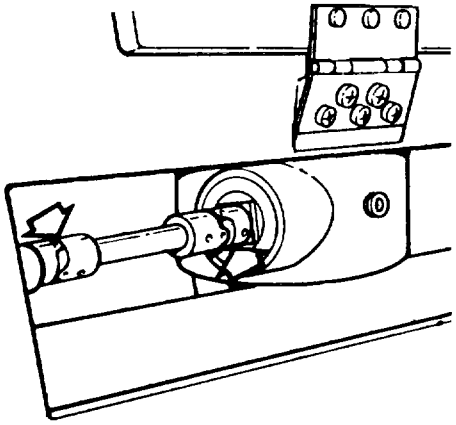
TRUNNION SLEEVE BUSHINGS (C)



Lube with GAA
(modified weapon only).

NOTE 5

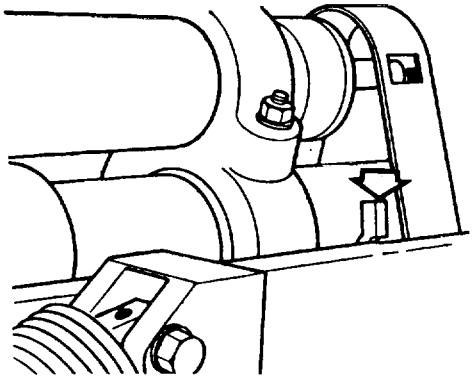
TRAVERSING MECHANISM ASSEMBLY UNIVERSAL JOINTS (C)



Lube with CLP.

NOTE 6

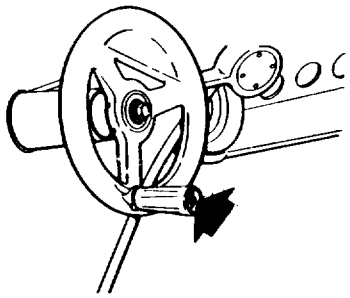
RECOIL INDICATOR BRACKET (C)



Lube with a couple drops of PL-S.

NOTE 7

ELEVATING HANDWHEEL ASSEMBLY (C)

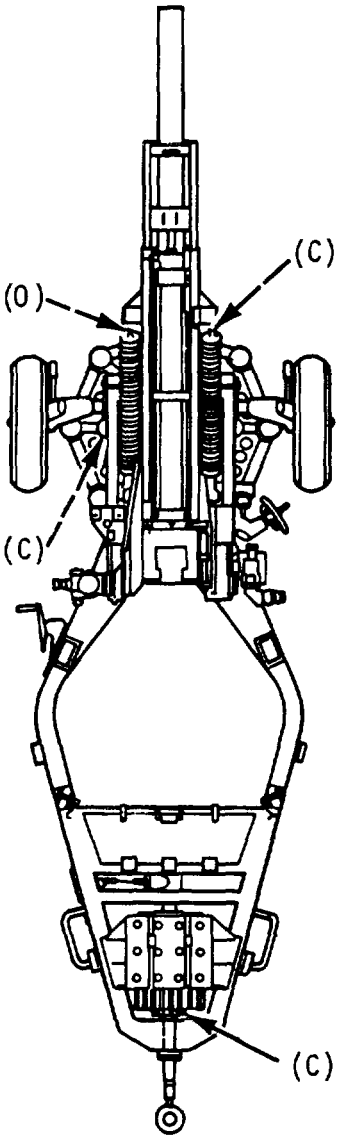


Lube with GAA.

MONTHLY

LUBRICANT--(MAINTENANCE LEVEL)

(MAINTENANCE--LUBRICANT LEVEL)

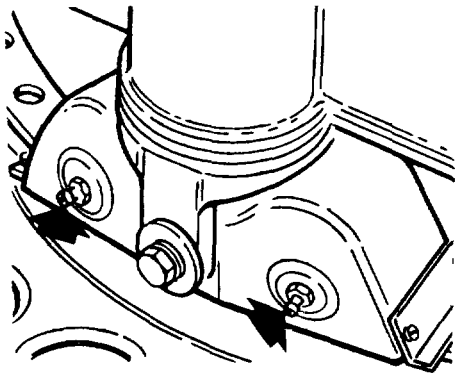


TOP VIEW

MONTHLY NOTES

NOTE 8

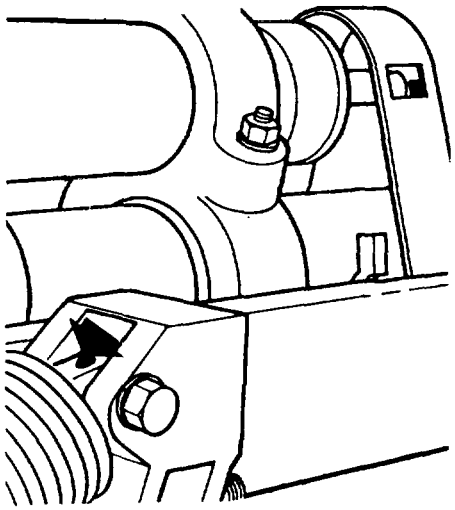
SUPPORT ASSEMBLY (C)



Lube with GAA.

NOTE 9

SLEEVE BUSHING (C)

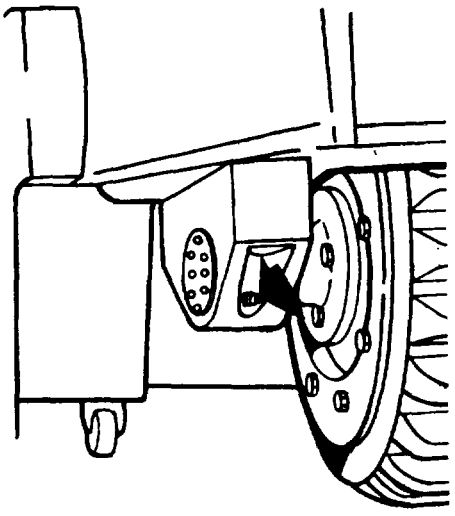


Lube with GAA.

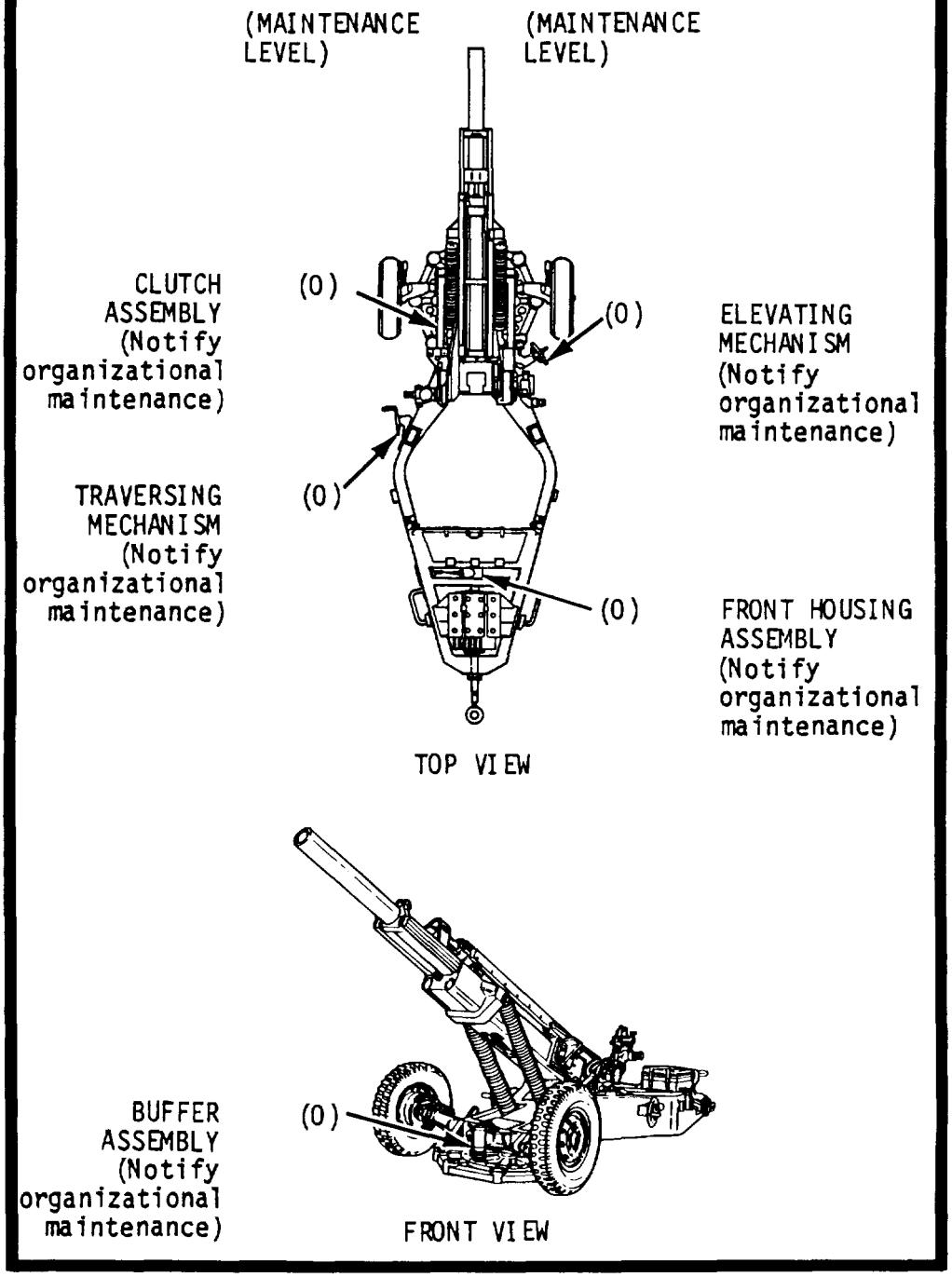
NOTE 10

TRAVERSE HOUSING ASSEMBLY (C)

If equipped with grease fitting, lube with GAA. If not equipped with grease fitting, notify organizational maintenance.

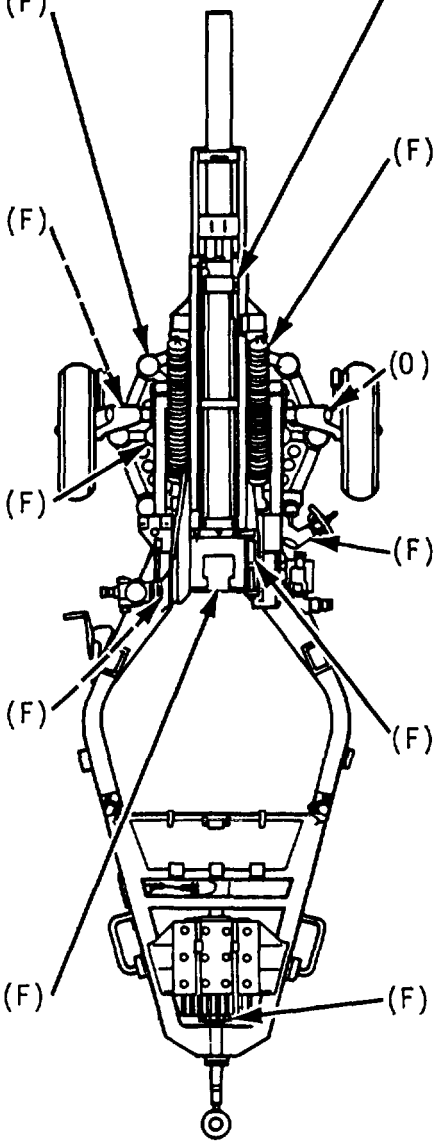


SEMIANNUALLY



ANNUALLY

(MAINTENANCE LEVEL)		(MAINTENANCE LEVEL)	
FIRING PLATFORM ASSEMBLY (Notify direct support maintenance)	(F)	(F)	YOKE ASSEMBLY RINGS (Notify direct support maintenance)
SUSPENSION ASSEMBLY SLEEVE BEARING (Unmodified weapon only) (Notify direct support maintenance)	(F)	(F)	BALL STUD AND LOCKING ASSEMBLY (Notify direct support maintenance)
		(O)	HUB AND BRAKE DRUM ASSEMBLY (Notify organizational maintenance)
PLATFORM LEVELER ASSEMBLY (Notify direct support maintenance)	(F)	(F)	ELEVATING MECHANISM (Notify direct support maintenance)
TRUNNION SLEEVE BUSHING (Unmodified weapon only) (Notify direct support maintenance)	(F)	(F)	FIRING MECHANISM ASSEMBLY (Notify direct support maintenance)
CANNON TUBE, BREECH RING ASSEMBLY, AND REAR YOKE (Notify direct support maintenance)	(F)	(F)	TRAVERSE HOUSING ASSEMBLY (Notify direct support maintenance)



TOP VIEW

Section II. TROUBLESHOOTING PROCEDURES

3-2. INTRODUCTORY INFORMATION

a. The table lists the common malfunctions which you may find during the operation or maintenance of the M102 howitzer or its components. You should perform the tests/inspections and corrective actions in the order listed.

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

c. For more detailed illustrations of test/inspection or corrective actions, refer to maintenance procedures in section III of this chapter.

Table 3-1. Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

WARNING

Never perform troubleshooting procedures with weapon loaded or personnel injury or death may result.

M137A1 CANNON

1. M102 HOWITZER FAILS TO FIRE.

Step 1. Check for defective round.

Follow misfire/checkfire procedures (p 2-75).

Step 2. Check for defective percussion mechanism as follows:

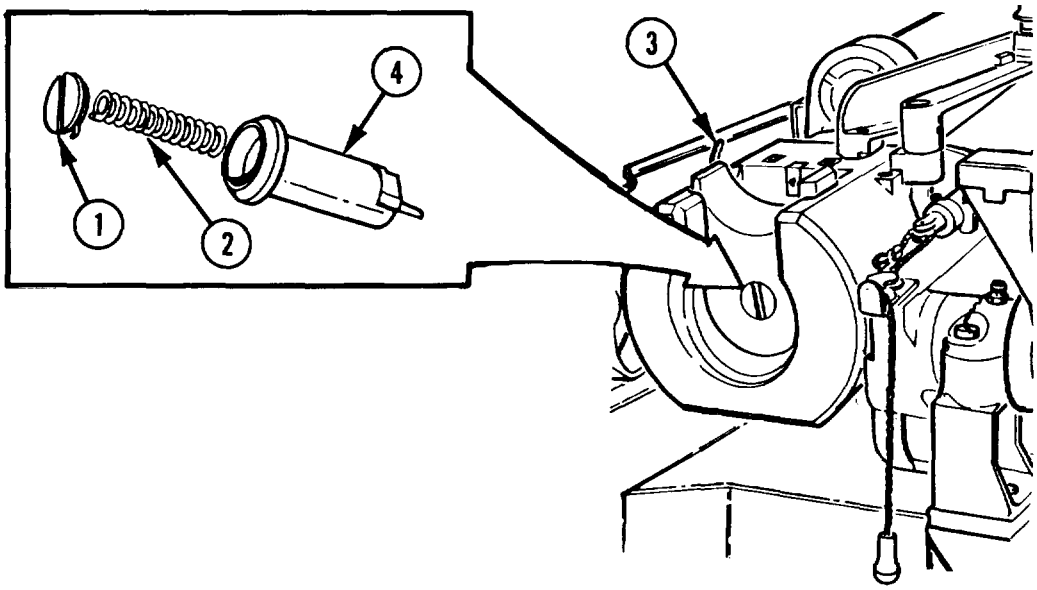
a. Check that weapon is in firing position, chamber and bore are clear, and breech operating handle is in locked position. Pull lanyard to fire weapon.

Table 3-1. Troubleshooting (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

WARNING

Be careful when removing and installing retainer and spring. Spring is under extreme tension. Carelessness could result in personnel injury.



b. Press in on retainer (1) and rotate 90 degrees in either direction to remove retainer and spring (2).

c. Pull back cocking lever (3). Remove percussion mechanism (4).

d. Check percussion mechanism (4) for damage.

e. Install percussion mechanism (4), spring (2), and retainer (1). Twist retainer 90 degrees in either direction to lock.

f. To check correct assembly of percussion mechanism, pull back cocking lever, pull lanyard, and listen for click.

If percussion mechanism is damaged, notify organizational maintenance.

Table 3-1. Troubleshooting (cont)

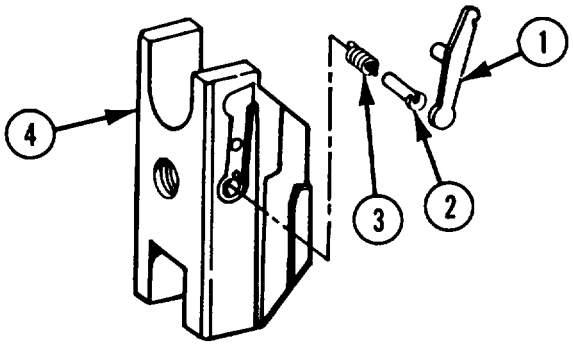
MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

M137A1 CANNON (cont)

2. M102 HOWITZER FIRES PREMATURELY.

NOTE

The inspection in step 1 requires removal of the breech block from the breech ring assembly. Follow removal procedures on page 3-29. Install breech block following procedures on page 3-34.



Step 1. Remove trigger (1), sear (2), and torsion spring (3) from breechblock (4). Check for bent, chipped, or burred trigger and sear. Check for weak or broken torsion spring.

Remove burrs with abrasive cloth (item 13, app D). If trigger or sear is bent or chipped, notify organizational maintenance. If torsion spring is weak or broken, notify organizational maintenance.

Step 2. Check for damaged percussion mechanism as follows:

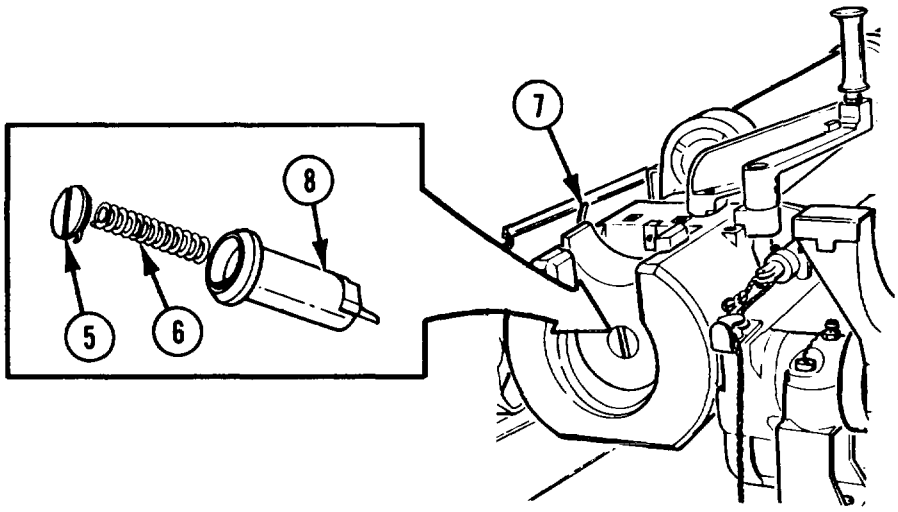
a. Check that weapon is in firing position, chamber and bore are clear, and breech operating handle is in locked position. Pull lanyard to fire weapon.

Table 3-1. Troubleshooting (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

WARNING

Be careful when removing and installing retainer and spring. Spring is under extreme tension. Carelessness could result in personnel injury.



b. Press in on retainer (5) and rotate 90 degrees in either direction to remove retainer and spring (6).

c. Pull back cocking lever (7). Remove percussion mechanism (8).

d. Check percussion mechanism (8) for damage.

e. Install percussion mechanism (8), spring (6), and retainer (5). Twist retainer 90 degrees in either direction to lock.

f. To check correct assembly of percussion mechanism, pull back cocking lever, pull lanyard, and listen for click.

If percussion mechanism is damaged, notify organizational maintenance.

Table 3-1. Troubleshooting (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

M137A1 CANNON (cont)

3. BREECHBLOCK FAILS TO CLOSE.

Step 1. Check to see if round is fully chambered.

a. Unload round and inspect for deformed casing.

If casing is deformed, turn in round to EOD personnel.

b. Check for foreign matter in chamber. Examine chamber for cracks and deformities.

Thoroughly clean (p 3-4). If damaged,notify organizational maintenance.

Step 2. Remove breechblock (p 3-29) and check for obstructions, nicks, burrs, gouges, or rough spots on operating surface of breechblock. Remove any obstructions, nicks, burrs, or rough spots using abrasive cloth (item 13, app D). Install breechblock (p 3-34).

Step 3. Check to see if cocking mechanism retractor is sticking against percussion mechanism by first opening and closing breechblock, then pulling lanyard while at the same time looking between the rear of the tube and the breechblock to make sure the firing pin moves. If firing pin does not move, notify organizational maintenance.

4. PERCUSSION MECHANISM FAILS TO COCK.

Step 1. Remove percussion mechanism as follows and check for broken spring and for correct installation:

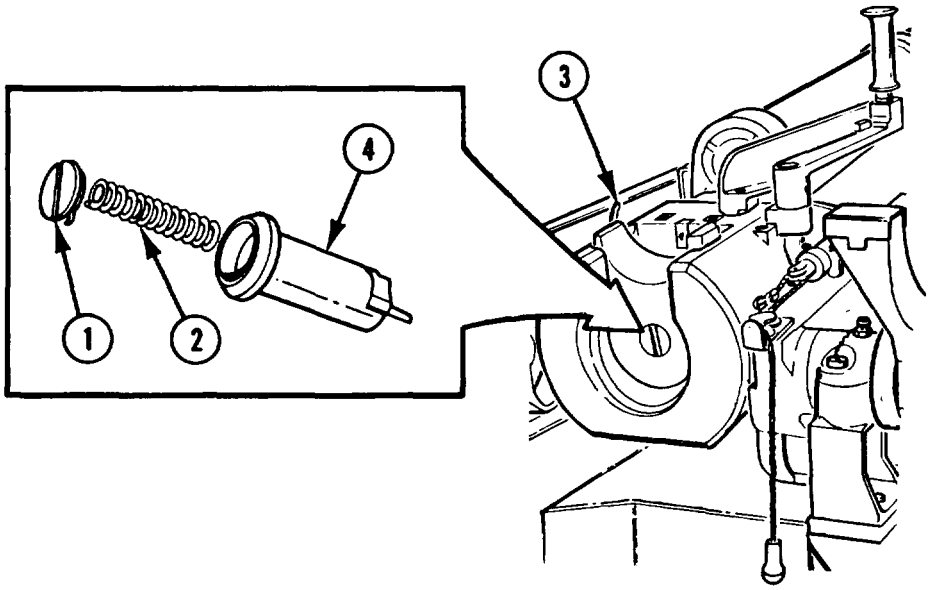
a. Check that weapon is in firing position, chamber and bore are clear, and breech operating handle is in locked position. Pull lanyard to fire weapon.

Table 3-1. Troubleshooting (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

WARNING

Be careful when removing and installing retainer and spring. Spring is under extreme tension. Carelessness could result in personnel injury.



b. Press in on retainer (1) and rotate 90 degrees in either direction to remove retainer and spring (2).

c. Check for broken spring (2).

d. Pull back cocking lever (3). Remove percussion mechanism (4).

If spring is broken, notify organizational maintenance. Install percussion mechanism, spring, and retainer. Twist retainer 90 degrees in either direction to lock. To check correct assembly of percussion mechanism, pull back cocking lever, pull lanyard, and listen for click.

Table 3-1. Troubleshooting (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

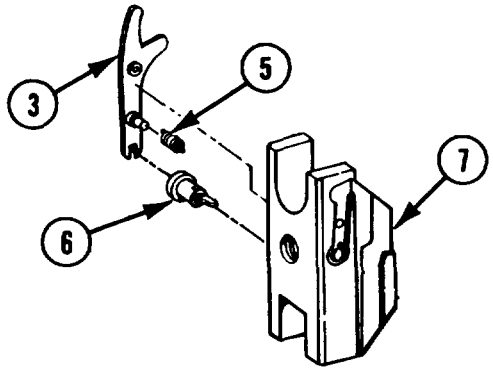
M137A1 CANNON (cont)

4. PERCUSSION MECHANISM FAILS TO COCK. (cont)

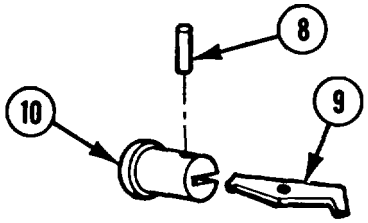
Step 2. Check to see if cocking mechanism retractor is sticking against percussion mechanism.

NOTE

The inspections in steps a. and b. require removal of breechblock from breech ring assembly. Follow removal procedures on page 3-29. Install breechblock following procedures on page 3-34.



a. Remove cocking lever (3), torsion spring (5), and cocking mechanism assembly (6) from breechblock (7).



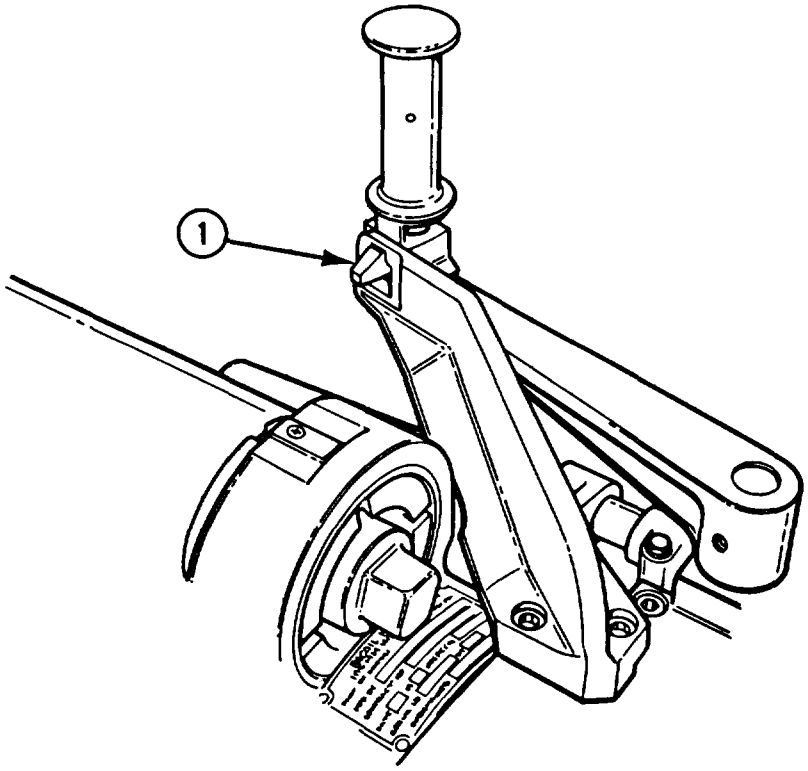
b. Check for free movement of cocking mechanism retractor. If cocking mechanism retractor movement is difficult, remove spring pin (8) and retractor (9) from sleeve bushing (10).

Table 3-1. Troubleshooting (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Remove any nicks, burrs, or rough spots using abrasive cloth (item 13, app D). If cocking mechanism retractor is bent or chipped, notify organizational maintenance.

5. BREECH OPERATING HANDLE UNLOCKS DURING FIRING.



Step 1. Check for broken latch (1).

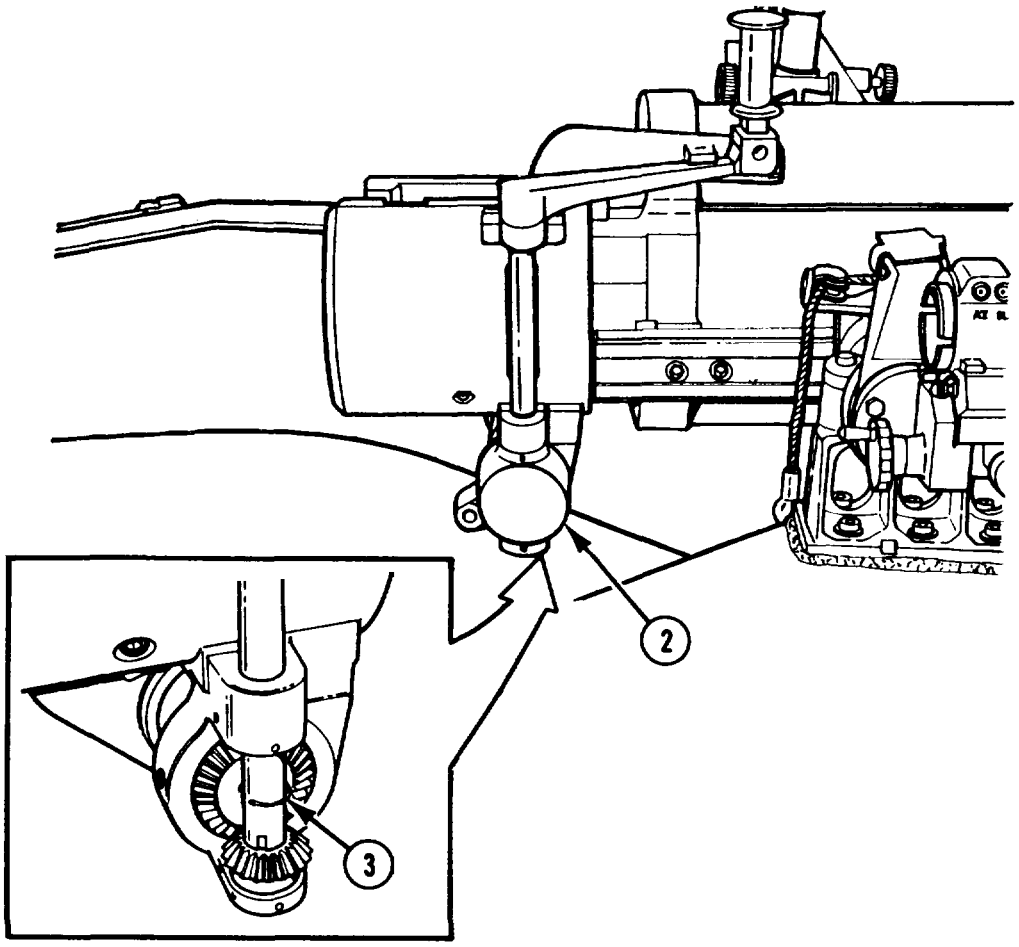
If latch is broken, notify organizational maintenance.

Table 3-1. Troubleshooting (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

M137A1 CANNON (cont)

5. BREECH OPERATING HANDLE UNLOCKS DURING FIRING. (cont)



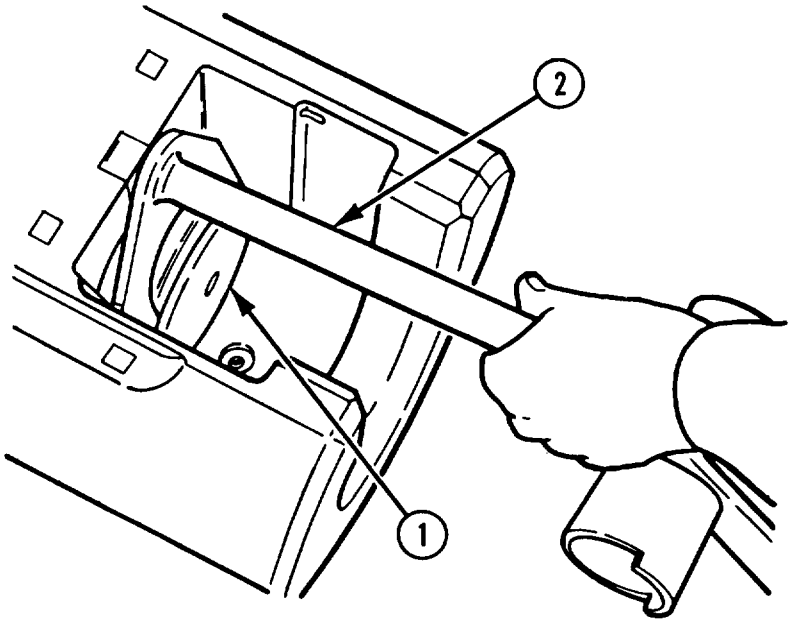
Step 2. Remove gear assembly cover (2) and check for broken or missing retaining ring (3).

If retaining ring is missing or broken, notify organizational maintenance.

Table 3-1. Troubleshooting (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

6. CARTRIDGE CASE FAILS TO EXTRACT.



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

Remove the cartridge case by installing ramming and extracting tool (2) so that the lips on the fork fit between the cannon tube face and the rim of the cartridge case, and pry out the case. If the cartridge case cannot be extracted with the ramming and extracting tool, insert the staff section through the muzzle end of the cannon tube and tap the bottom of the cartridge case until it is loosened and can be pushed out of the chamber.

Table 3-1. Troubleshooting (cont)

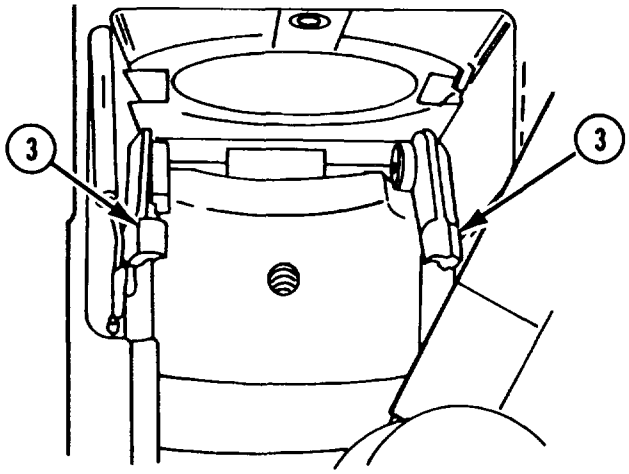
MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

M137A1 CANNON (cont)

6. CARTRIDGE CASE FAILS TO EXTRACT. (cont)

Step 2. Check for foreign matter in chamber. Check for cracks and deformities.

Thoroughly clean (p 3- 4). If damaged, notify organizational maintenance.



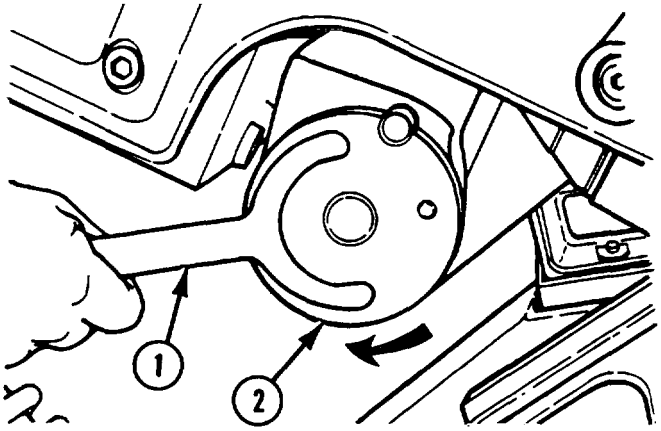
Step 3. Check for defective cartridge extractors (3).

If cartridge extractors are defective, notify organizational maintenance.

Table 3-1. Troubleshooting (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

7. BREECHBLOCK HARD TO CLOSE.



Step 1. Check for improperly adjusted torsion spring.

Using spanner wrench (1), turn closing spring adjustor (2) clockwise until closing mechanism plunger engages into first, second, or third notch. The proper engagement is determined by the spring tension required for easy closing of breechblock.

Step 2. Remove breechblock (p 3-29) and check for dirty or burred breech surface.

Clean breech surface with RBC (item 11, app D) and wiping rags (item 22, app D). Remove burrs with abrasive cloth (item 13, app D). Install breechblock (p 3-34).

Step 3. Check for broken or weak torsion helical spring by opening and closing breechblock. If breechblock cannot be adjusted, the torsion helical spring is defective.

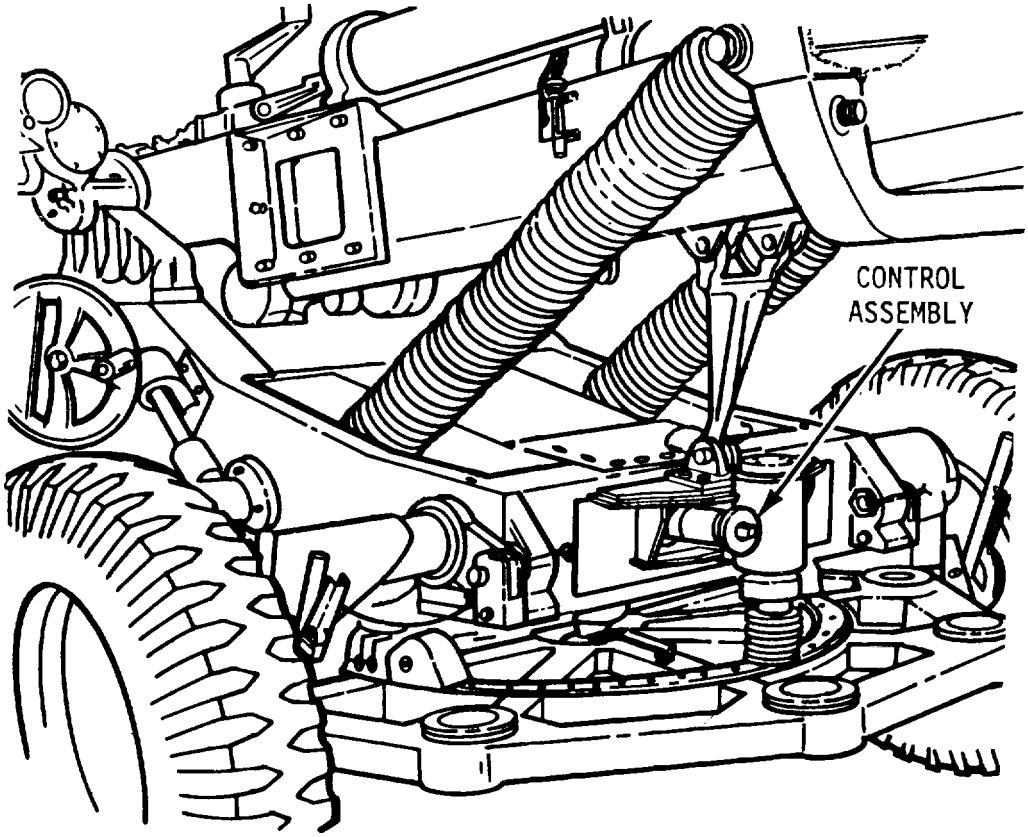
If torsion helical spring is weak or broken, notify organizational maintenance.

Table 3-1. Troubleshooting (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

M31 CARRIAGE

8. CONTROL ASSEMBLY INOPERATIVE.



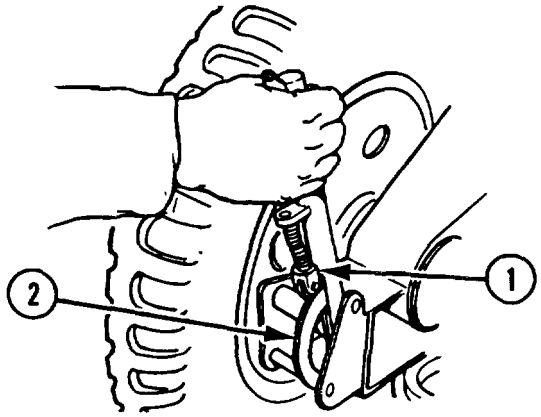
Perform no test or other inspection.

Notify organizational maintenance.

Table 3-1. Troubleshooting (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

9. HANDBRAKES FAIL TO HOLD IN PARK POSITION.

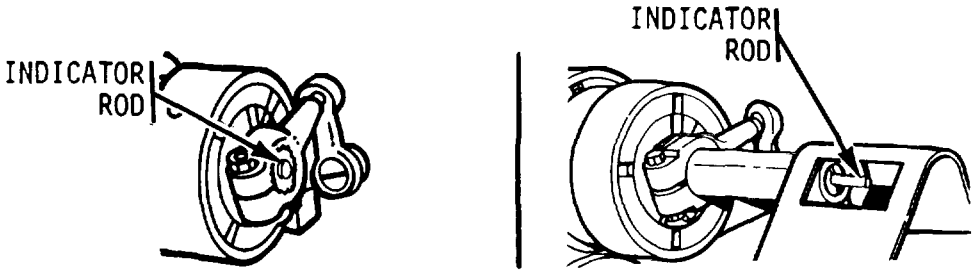


Check that pawl (1) engages in first third of brake rack (2) when brake is fully applied.

If brakes are improperly adjusted, notify organizational maintenance.

M37/M37A1 RECOIL MECHANISM

10. CANNON SLAMS INTO OR HANGS OUT OF BATTERY.



M37 M37A1

Check indicator rod for correct oil level.
If oil reserve is low, fill (p 3-39).

Table 3-1. Troubleshooting (cont.)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
M37/M37A1 RECOIL MECHANISM (cont.)
11. OVER RECOILS OR UNDER RECOILS. Drain oil reserves and check oil for foamy appearance (p 3-38). Reestablish oil reserves (p 3-39). If condition persists, notify organizational maintenance.
FIRE CONTROL EQUIPMENT
12. FITTED PARTS OF FIRE CONTROL EQUIPMENT ARE LOOSE.

WARNING

When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.

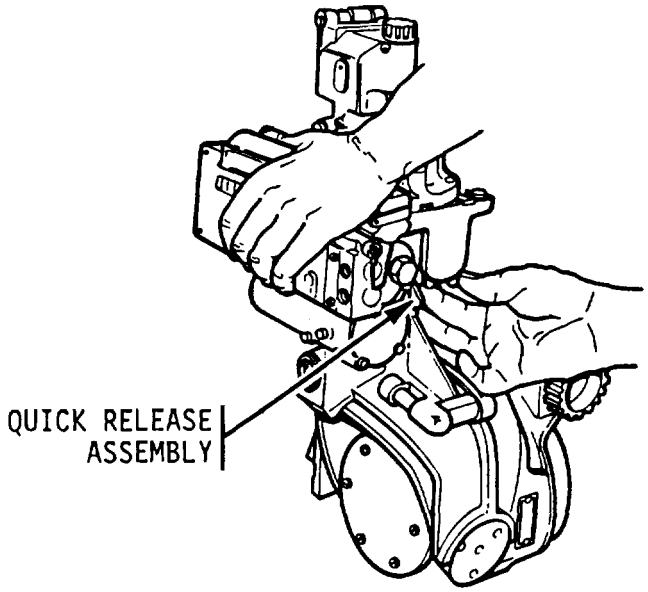


Table 3-1. Troubleshooting (cont.)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 1. Check to see if quick release assemblies are tight.
Tighten quick release assemblies.
Step 2. Check that lock wire is fastened to mounting screws.

If mounting screws are loose or missing, notify organizational maintenance.

13. MOISTURE IS IN FIRE CONTROL EQUIPMENT.
No further inspection is required.

Notify organizational maintenance.

14. COUNTERS, LEVELS, OR RETICLES ARE NOT ILLUMINATED.

WARNING

Put fire control equipment in a plastic bag (item 1, app D), wash hands, and follow radioactive materials procedures in the front of this manual. Notify organizational maintenance and the radiological protection officer.

Perform no further test or inspection.

15. KNOBS DO NOT TURN FREELY.
No further inspection is required.

Notify organizational maintenance.

Table 3-1. Troubleshooting (cont.)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

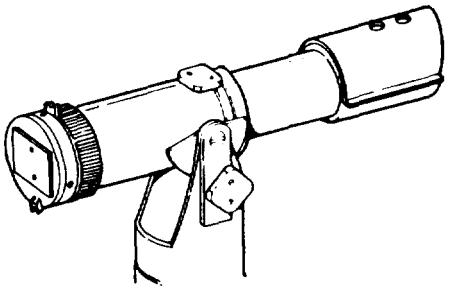
FIRE CONTROL EQUIPMENT (cont)

16. COUNTERS, RETICLES, OR LEVEL VIALS ARE BROKEN.

WARNING

Put fire control equipment in a plastic bag (item 1, app D), wash hands, and follow radioactive materials procedures in the front of this manual. Notify organizational maintenance and the radiological protection officer. Perform no further test or inspection.

17. COLLIMATOR RETICLE IMAGE IS NOT SHARP.



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

Notify organizational maintenance.

Step 2. Check to see if reticule is dirty.
If reticule is dirty, notify organizational maintenance.

Section III. MAINTENANCE PROCEDURES

3-3. M137A1 CANNON MAINTENANCE--SERVICING M137A1 CANNON

1 Clean and oil cannon tube according to the lube instructions

CAUTION

Do not over paint. Apply only one coat of paint on cannon tube. Do not paint any operating surfaces.

2 Spot paint with enamel (item 15, app D) as necessary. Do not paint threaded or bearing areas.

3-4. BREECH MECHANISM ASSEMBLY MAINTENANCE--SERVICING BREECH MECHANISM ASSEMBLY

1 Clean and service according to lube instructions (p 3-4).

2 Remove rust with abrasive cloth (item 13, app D).

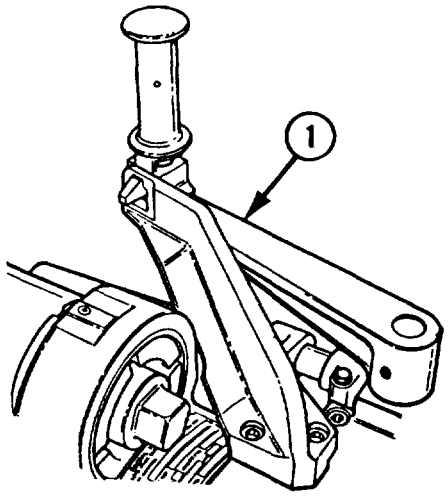
3 Disassemble breech mechanism assembly as follows.

3-5. BREECH MECHANISM ASSEMBLY MAINTENANCE--REMOVAL OF BREECHBLOCK FROM BREECH RING ASSEMBLY

1 For easy removal of the breechblock, place weapon in firing position.

2 Inspect chamber and bore to see that they are clear.

3 Close breech mechanism assembly and check to see that breech operating handle (1) is in locked position.



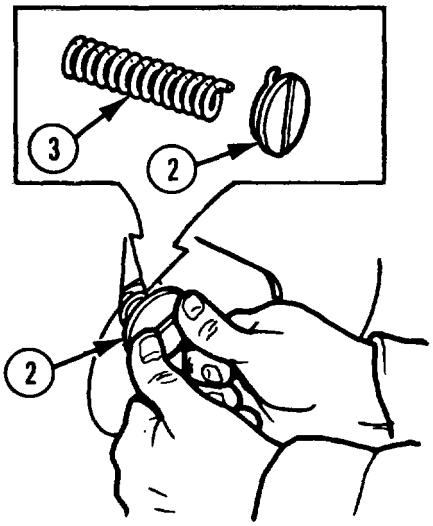
3-5. BREECH MECHANISM ASSEMBLY MAINTENANCE--REMOVAL OF BREECH-BLOCK FROM BREECH RING ASSEMBLY (cont.)

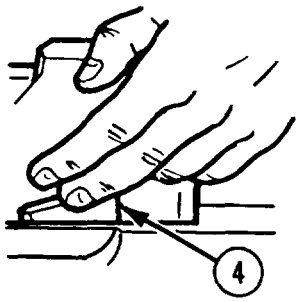
4 Pull lanyard to fire weapon.

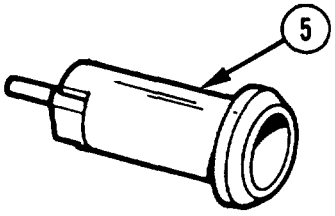
WARNING

Be careful when removing retainer and spring. Spring is under extreme tension. Carelessness could result in personnel injury.

5 Press in on retainer (2) and rotate 90 degrees in either direction to remove retainer and spring (3).

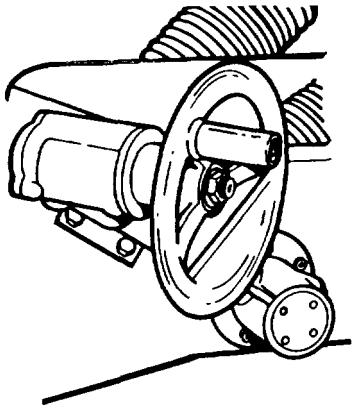




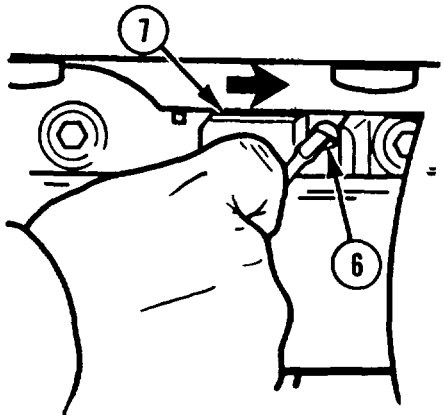


6 Pull back cocking lever (4). Remove percussion mechanism (5)

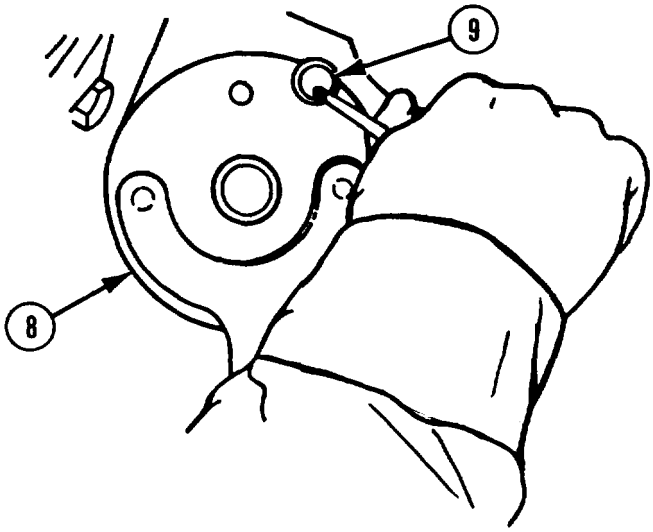
7 Raise cannon to approximately 1200-mil elevation.



8 Facing underside of gun cradle assembly depress detent plunger {6) and move breechblock crank stop (7) to the right (unlocked) position.



9 Lower cannon to 600-mil elevation.



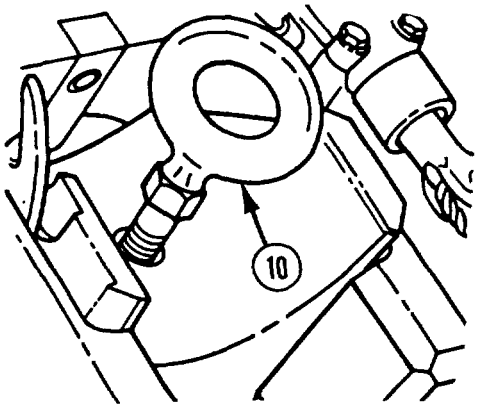
CAUTION

Don't turn closing spring adjustor clockwise more than necessary to relieve tension on torsion helical spring or you may damage the torsion helical spring.

10 Release tension on torsion helical spring using spanner wrench and screwdriver as follows: Apply leverage counter- clockwise on the closing spring adjustor (8) with spanner wrench. Then depress closing mechanism plunger (9) with screwdriver and allow closing spring adjustor (8) to rotate clockwise and relieve tension on the torsion helical spring.

3-5. BREECH MECHANISM ASSEMBLY MAINTENANCE--REMOVAL OF BREECH-BLOCK FROM BREECH RING ASSEMBLY (cont.)

11 Screw eyebolt (10) into the top of the breechblock.

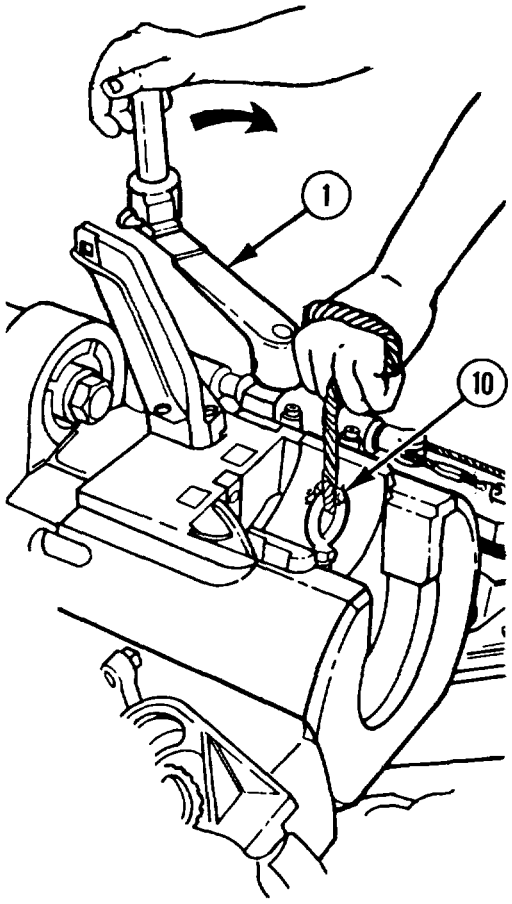


12 Place a wiping rag (item 22, app D) on the carriage to prevent chipping paint when you lower the breechblock.

NOTE

Using a rope passed through the eyebolt may make lifting the breechblock easier. Procedure may be performed by one or two personnel. One- man operation is illustrated.

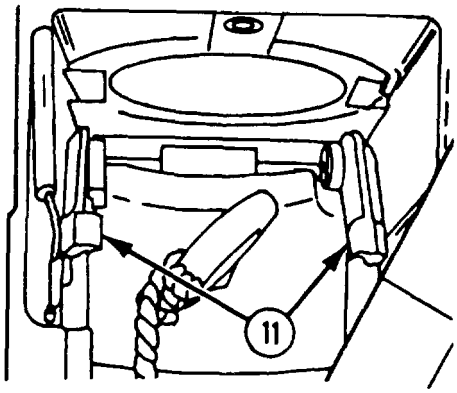
13 Grasp eyebolt (10) or rope with left hand. With right hand unlatch breech operating handle (1) and lower breechblock until it rests on carriage.



NOTE

If you can't remove cartridge extractors, try elevating the cannon just enough to allow removal.

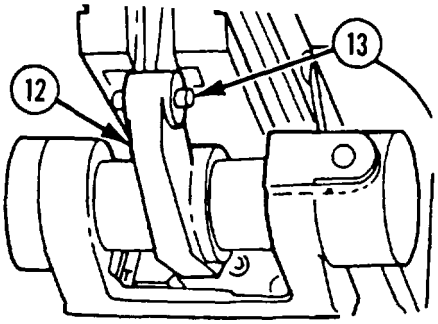
14 Remove cartridge extractors (11).



NOTE

If pivot pin does not totally disengage automatically during step 15, release it manually.

15 Move breechblock operating crank (12) clockwise and allow pivot pin (13) to disengage from the slot in the breechblock. Remove pivot pin.

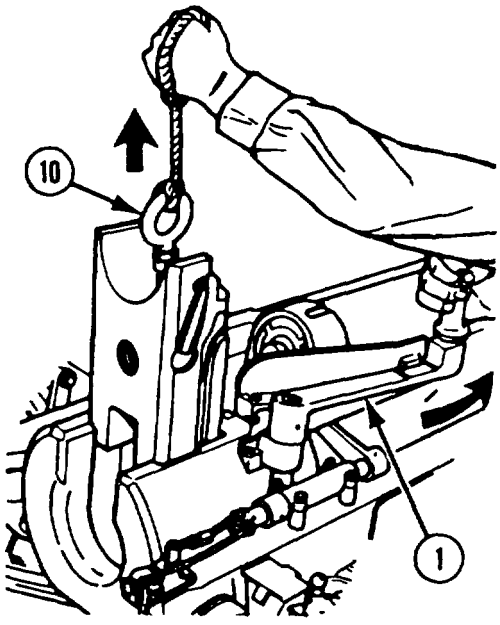


16 Grasp eyebolt (10) or rope with left hand and lift up on breechblock. With right hand move breech operating handle (1) counterclockwise and lock into position.

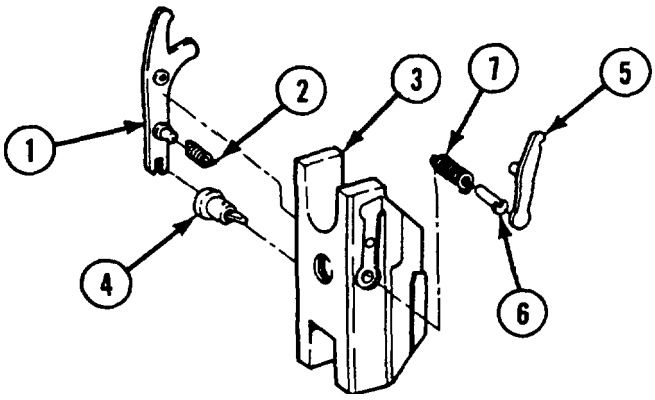
NOTE

Make sure the breech operating handle remains in locked position.

17 Lift breechblock completely out of breech ring assembly using both hands.



3-6. BREECH MECHANISM ASSEMBLY MAINTENCE—DISASSEMBLY/ASSEMBLY OF BREECHBLOCK



1 Remove cocking lever (1) and torsion spring (2) from breechblock (3).

2 Remove cocking mechanism assembly (4) from breechblock (3).

3 Remove trigger (5), sear (6), and torsion spring (7) from breechblock (3).

NOTE

Breech mechanism will jam if spring pin is broken or missing in cocking mechanism bushing sleeve.

4 Reverse disassembly sequence to assemble. Be careful not to confuse the two torsion springs. The cocking lever torsion spring (2) is shorter than the sear torsion spring (7).

3-7. BREECH MECHANISM ASSEMBLY MAINTENANCE--INSTALLATION OF BREECHBLOCK INTO BREECH RING ASSEMBLY

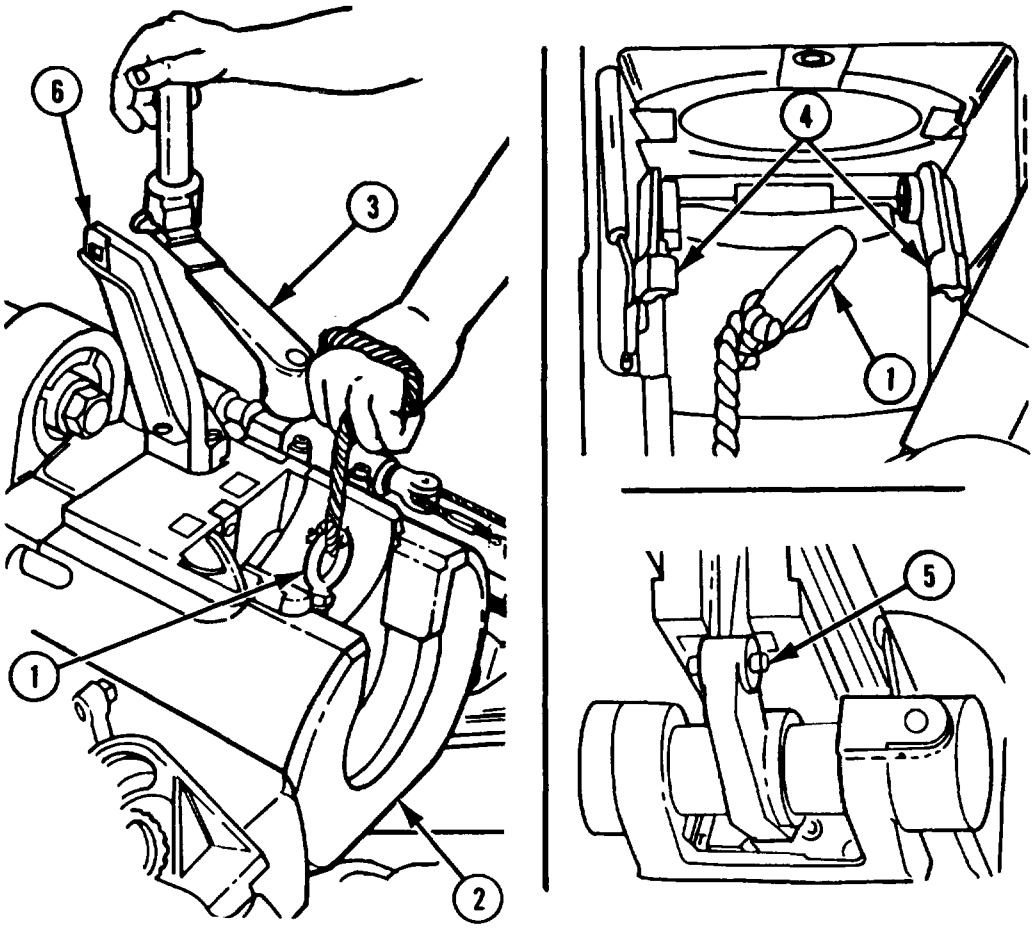
1 Elevate cannon to 600-mil elevation.

NOTE

Using a rope passed through the eyebolt may make lifting the breechblock easier. Procedure may be performed by one or two personnel. One-man operation is illustrated.

2 Using eyebolt (1), insert breechblock into breech ring assembly (2) from the top, and lower breechblock until it rests on carriage.

3 Release breech operating handle (3).



4 Install cartridge extractors (4).

5 Install breechblock operating crank pivot pin (5).

6 Grasp eyebolt (1) with left hand, raise breechblock slightly, and with right hand turn breechblock operating crank as required until pivot pin (5) engages the slot in the breechblock

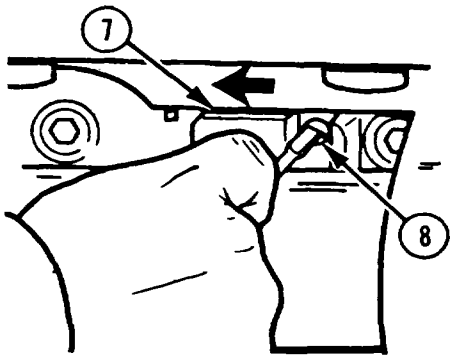
7 Raise the breechblock until the cartridge extractors (4) stop the breechblock.

8 Trip the cartridge extractors (4) by pushing them forward, and close the breechblock by rotating breech operating handle (3) counterclockwise into lock position on stop assembly (6), making sure latch is fully locked.

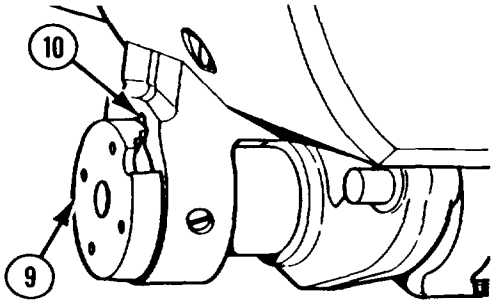
9 Remove eyebolt (1).

3-7. BREECH MECHANISM ASSEMBLY MAINTENANCE--INSTALLATION OF BREECHBLOCK INTO BREECH RING ASSEMBLY (cont)

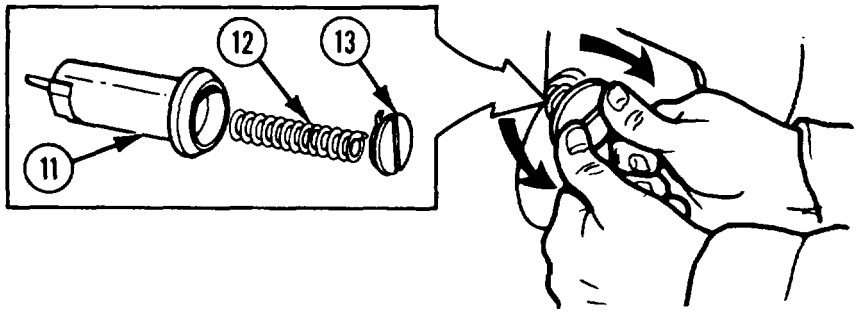
10 Slide breechblock crank stop (7) to the left until it is secured by detent plunger (8).



11 With spanner wrench, turn closing spring adjustor (9) counterclockwise until closing mechanism plunger (10) engages first, second, or third detent notch. The proper notch engagement is determined by the spring tension required for easy closing of breechblock.



12 Pull lanyard.



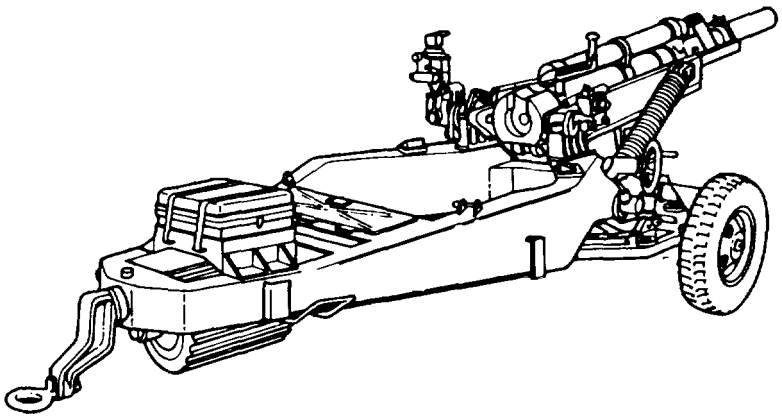
WARNING

Be careful when installing spring and retainer. Spring is under extreme tension. Carelessness could result in personnel injury.

13 Install percussion mechanism (11), spring (12), and retainer (13). Twist retainer 90 degrees in either direction to lock.

14 To check correct assembly of percussion mechanism, pull back cocking lever, pull lanyard, and listen for click.

3-8. M31 CARRIAGE MAINTENANCE--SERVICING M31 CARRIAGE



1 Apply touchup enamel (item 15, app D) as required.

2 Replace strap assemblies if worn or damaged.

CAUTION

There are no lubrication points on unmodified M31 carriage. Trunnions are covered with a dry film lubricant. Do not contaminate with conventional lubricant.

3 If M31 carriage has been modified, lubricate (p 3-1).

3-9. SUSPENSION PIN ASSEMBLY MAINTENANCE—INSPECTING SUSPENSION PIN ASSEMBLY

1 Inspect for missing or broken parts.

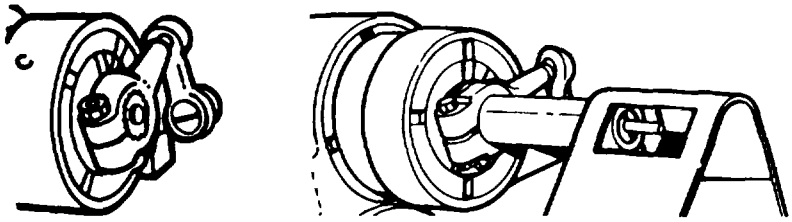
2 If parts are missing or broken, notify organizational maintenance.

3-10. CRANK ASSEMBLY MAINTENANCE--SERVICING CRANK

1 Touch up with enamel (item 15, app D) as necessary.

2 Check for damaged straight pin. If pin is damaged, notify organizational maintenance.

3-11. M37/M37A1 RECOIL MECHANISM MAINTENANCE



NOTE

The oil reserve is low when the indicator rod protrudes 3/16 inch or more. On some M37 recoil mechanisms there will be a red line on indicator rod at 3/16 inch. The M37A1 recoil mechanism has increased oil reserve capacity. The oil reserve is low when the indicator rod reaches the red tab visible through the windows in the guard assembly. Servicing of oil reserve is the same as for M37 recoil mechanism.

3-12. M37/M37A1 RECOIL MECHANISM MAINTENANCE--DRAINING OIL RESERVE

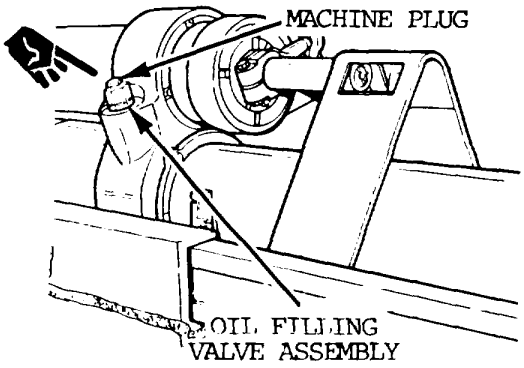
1 Level cannon tube.

2 Clean around machine plug with wiping rag (item 22, app D).

3 Remove machine plug from oil filling valve assembly'.

4 Clean recess in oil filling valve assembly with wiping rag (item 22, app D).

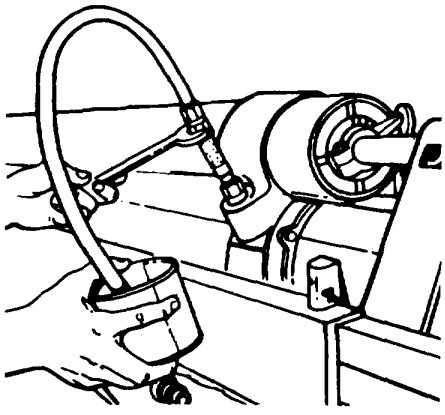
5 Connect drain hose to liquid releasing tool; insert liquid releasing tool into the oil filling valve assembly and hand tighten.



CAUTION

Overtightening may damage the oil filling valve assembly.

6 Using a wrench, slowly tighten only until oil spurts out.



7 Inspect oil for evidence of air or nitrogen.

8 Remove drain hose and liquid releasing tool.

3-13. M37/M37A1 RECOIL MECHANISM MAINTENANCE--FILLING OIL RESERVE

1 Fill fluid direct delivery gun as follows:

a. Turn handle fully counterclockwise.

b. Loosen locking screw on head, and remove handle and head.

c. Make sure inside of barrel is clean.

d. Pour hydraulic fluid (OHT) into barrel, avoiding formation of air bubbles.

e. Replace handle and head, and tighten locking screw.

f. Remove cap from nozzle head.

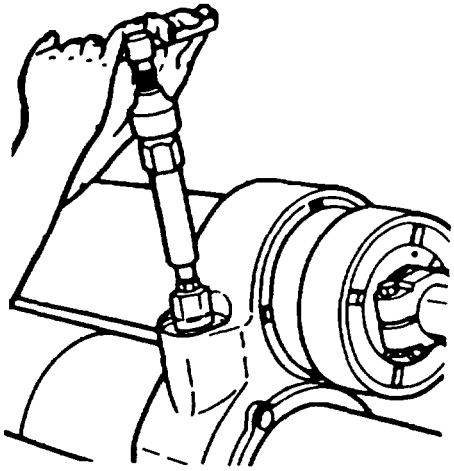
g. Hold nozzle end up for 1 to 2 minutes to allow air to rise to top.

h. Purge fluid direct delivery gun by turning handle until no air bubbles appear on nozzle end.

2 Screw nozzle of fluid direct delivery gun to oil filling valve assembly.

3 Tighten fluid direct delivery gun carefully two to three turns. Turn handle to force out any air in oil filling valve assembly.

CAUTION
Apply pressure evenly on the fluid direct delivery gun handle or you may damage threads.



4 Continue to tighten fluid direct delivery gun until seated into oil filling valve assembly.

5 Operate fluid direct deliver, gun.

3-13. M37/M37A1 RECOIL MECHANISM MAINTENANCE--FILLING OIL RESERVE (cont)

6 Fill M37 recoil mechanism until indicator rod is even with face of indicator and control assembly. Fill M37A1recoil mechanism until indicator rod is even with indicator cap. Remove fluid direct delivery gun, clear oil filling valve assembly and machine plug with wiping rag (item 22, app D), and install machine plug.

NOTE

If oil reserve is very low, or has been emptied, it may be necessary to repeat the filling process. If more than two fills from the fluid direct delivery gun are required, notify organizational maintenance.

3-14. M1A1 COLLIMATOR MAINTENANCE

WARNING

For M1A1 collimators, modified with the radioactive light source, if no light is present in a low light atmosphere or the lens is broken, observe radiation warning found in the front of this manual.

CAUTION

The collimator Is hermetically sealed. Breaking the seal by removing any part (with exception of the lamp housing) will expose the internal mechanism to moisture, and may eventually impair operation of instrument.

3-15. M1A1 COLUMATOR MAINTENANCE--INSPECTING M1A1 COLLIMATOR

Check for illumination. If no light is present, notify RPO.

3-16. DELETED

Section IV. MAINTENANCE OF AUXILIARY EQUIPMENT

3-17. DELETED

3-18. TAIL LIGHT ASSEMBLY MAINTENANCE

1 Clean with wiping rag (item 22, app D) as necessary.

2 If parts are damaged, notify organizational maintenance.

Section V. FIRE CONTROL ALINEMENT TESTS AND MEASUREMENTS

3-19. GENERAL

Fire control alinement tests are performed by the section crew members under the supervision of the battery executive officer, chief of firing battery, and artillery mechanic. These tests are performed at the discretion of the unit commander. Suggested times for these tests are as follows:

a. Once each year if the howitzer is used for nonfiring training.

b. Once every 3 months if the howitzer is fired.

c. As soon as possible after extensive use.

d. Following accidents.

e. Traversing extremely rough terrain.

f. When M134A1 mount or M14A1 quadrant has been replaced.

g. Whenever the howitzer fires inaccurately for no readily apparent reason.

h. When gun tube has been replaced.

3-20. PREPARATION FOR FIRE CONTROL ALINEMENT TESTS

WARNING

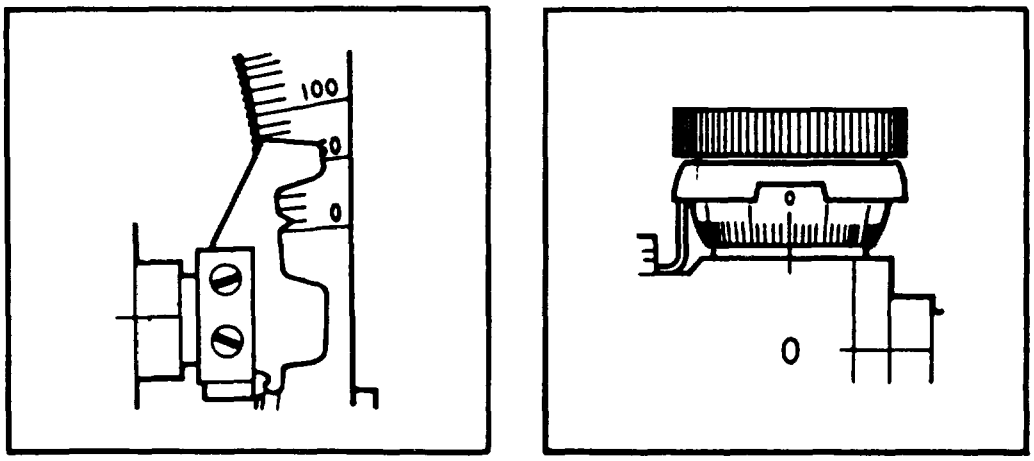
When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual .

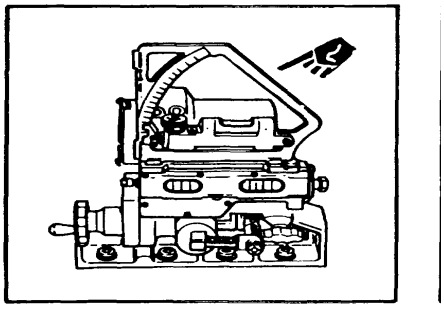
1 Emplace the weapon on as finn and level ground as possible. Use hardstand if one is available.

2 Check the M14A1 quadrant, the M113A1 pantel, and the M134A1 mount for looseness or other obvious defects.

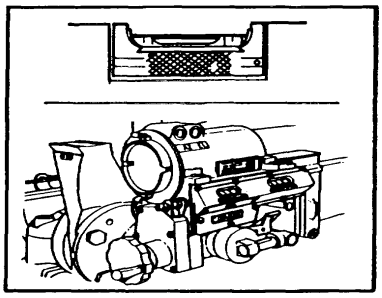
3 Inspect the M1A1 gunner's quadrant shoes for dirt, nicks, or burrs. If necessary, clean the shoes with oily rag (item 22, app D). If nicks or burrs are present, turn M1A1 gunner's quadrant in to organizational maintenance.

3-21. M1A1 GUNNER'S QUADRANT MICROMETER TEST

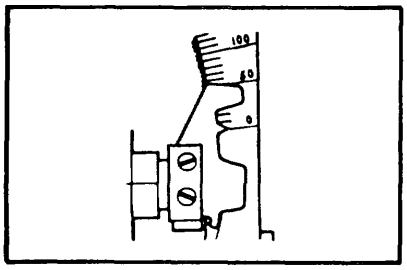




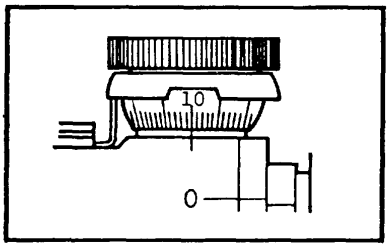
3 Point gunner's quadrant toward muzzle.



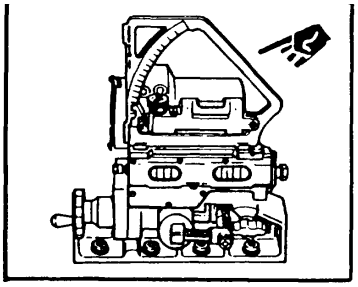
4 Depress/elevate cannon tube to center gunner's quadrant level vial bubble.



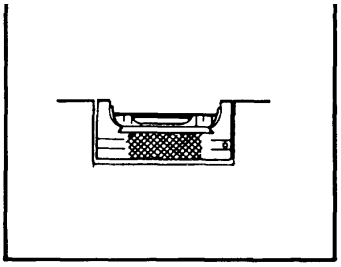
5 Set index at zero



6 Set micrometer at 10



7 Point gunner's quadrant toward muzzle



8 Gunner's quadrant level vial bubble should center.

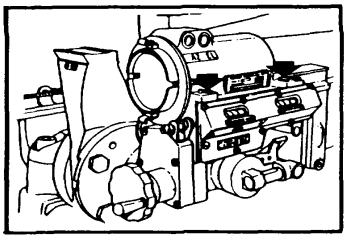
3-21. M1A1 GUNNER'S QUADRANT MICROMETER TEST (cont)

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

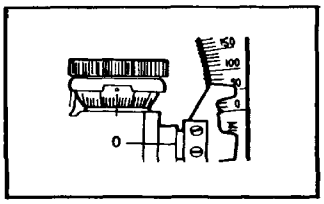
3-22. M1A1 GUNNER'S QUADRANT END-FOR-END TEST

NOTE

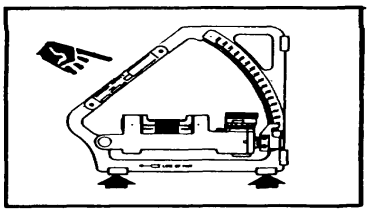
Maximum acceptable tolerance +0.4 mils.



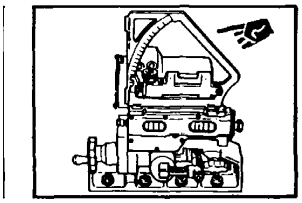
1 Inspect breech mechanism assembly or M14A1 quadrant elevation seats.



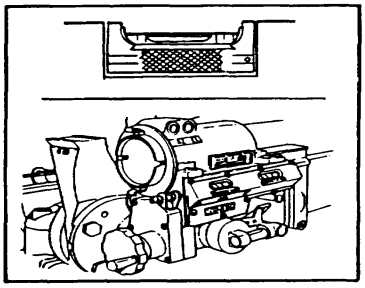
3 Zero the Index.



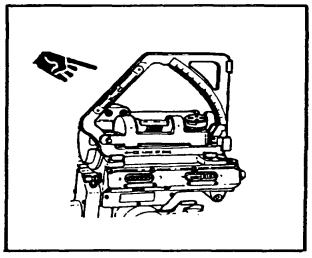
2 Inspect quadrant shoes.



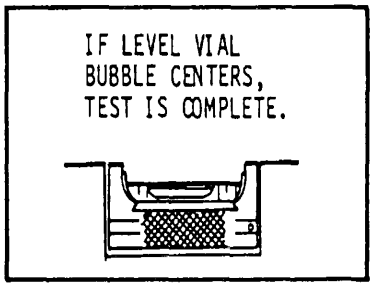
4 race gunner's quadrant on M14A1 quadrant elevation seats with line of fire toward muzzle.



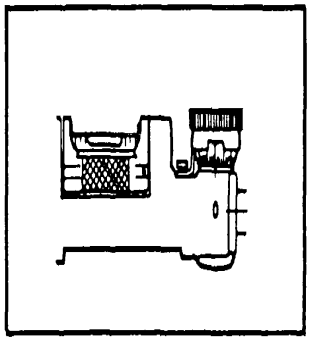
5 Depress/elevate cannon tube to center gunner's quadrant level vial bubble



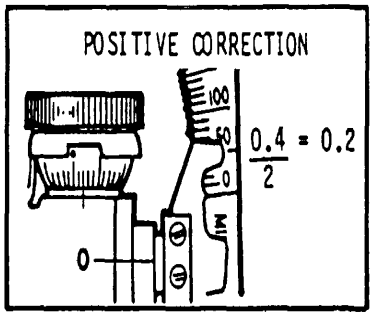
6 Reverse direction of gunner's quadrant



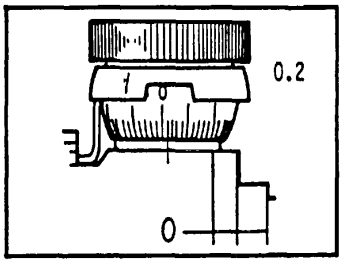
7 Gunner's quadrant level vial bubble should center. If not, go to step 8.



8 Center gunner's quadrant level vial bubble with micrometer knob. If level vial bubble centers, go to step 9. If not, go to step 16.

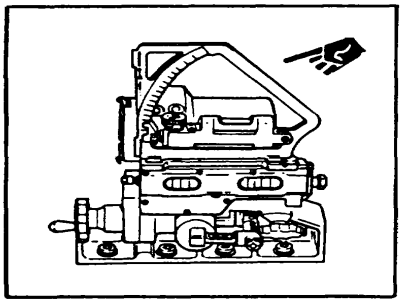


9 Divide micrometer reading by 2

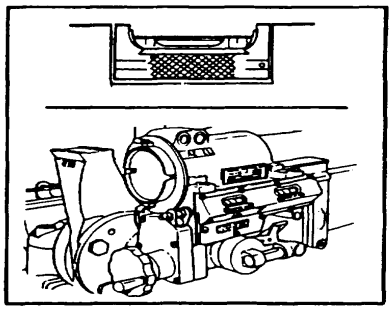


10 Set result on micrometer scale.

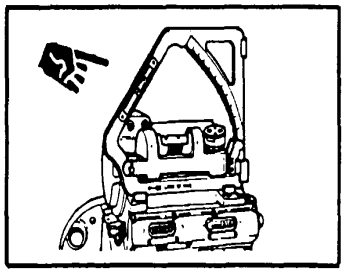
3-22. M1A1 GUNNER'S QUADRANT END-FOR-END TEST (cont)



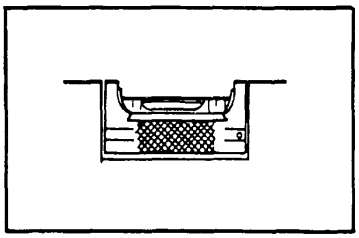
11 Point gunner's quadrant toward muzzle.



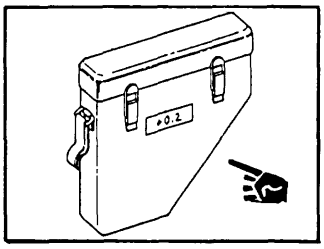
12 Depress/elevate cannon tube to center gunner's quadrant level vial bubble



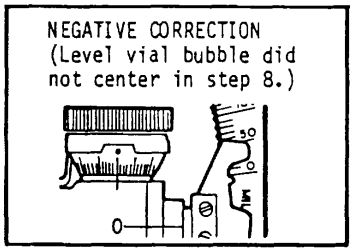
13 Reverse direction of gunner's quadrant



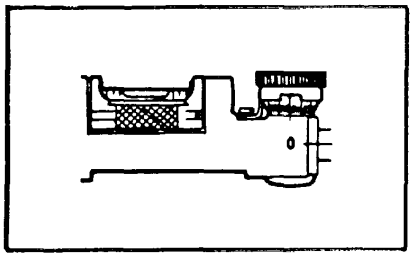
14 Gunner's quadrant level vial bubble should center



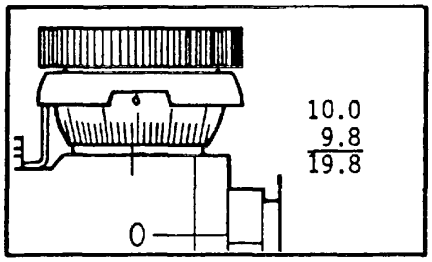
15 Record end-for-end- correction on gunner's quadrant carrying case



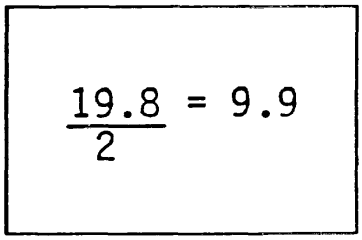
16 Set index at minus 10



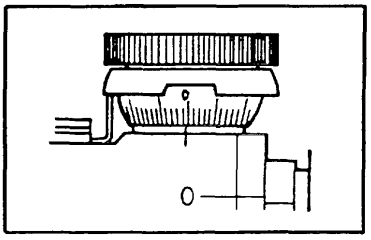
17 Center gunner's quadrant level vial bubble with micrometer knob



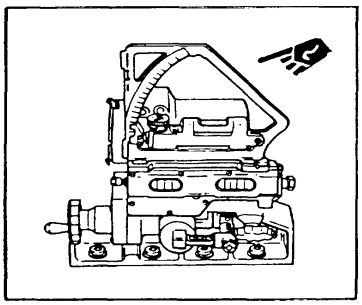
18 Add micrometer reading to 10.0.



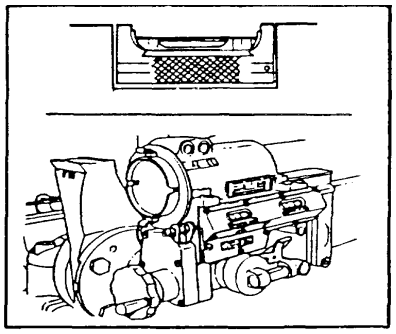
19 Divide step 18 answer by 2. This is your trial correction



20 Place answer on micrometer scale

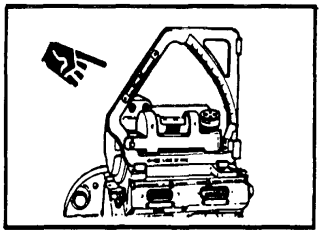


21 Point gunner's quadrant toward muzzle.

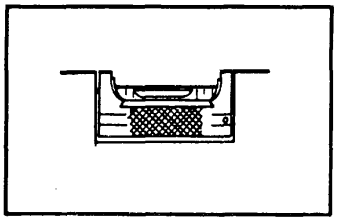


22 Depress/elevate cannon tube to center gunner's quadrant level vial bubble

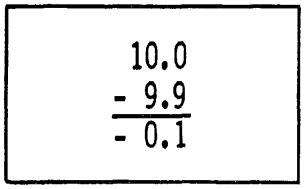
3-22. M1A1 GUNNER'S QUADRANT END-FOR-END TEST (cont)



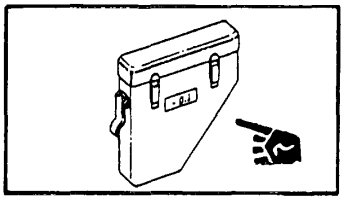
23 Reverse direction of gunner's quadrant



24 Gunner's quadrant level vial bubble should center. If not, go back to step 16.



25 Subcontract micrometer reading from 10. Since this is a negative correction (step 16), a minus sign must be placed in front of the correct factor



26 Record end-for-end correction on gunner's quadrant carrying case.

3-23. LEVELING THE TRUNNIONS

NOTE

Trunnions are leveled to ensure the M134A1 mount and M14A1 quadrant are in a parallel line with the cannon tube. If trunnions are canted, results of the fire control alinement tests may not be accurate. There are two ways to level the trunnions: one way is tracking the plumbline; the other is by using scribed lines on the M14A1 quadrant.

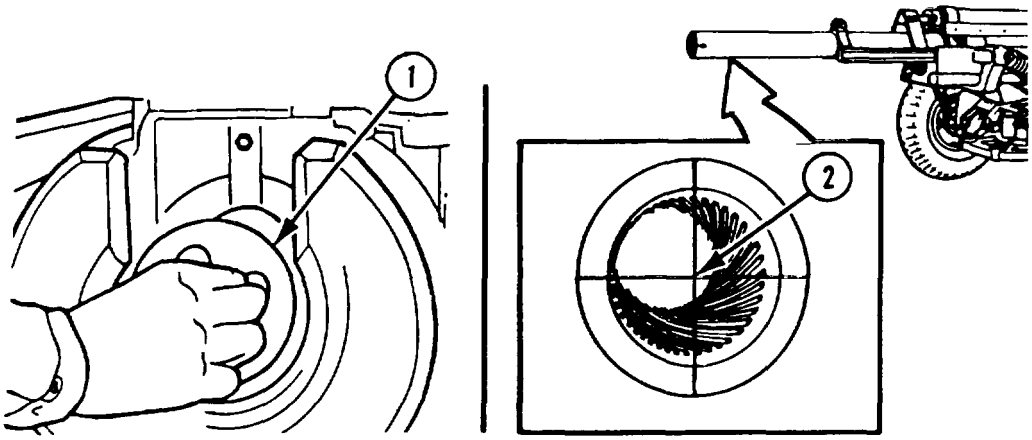
3-24. LEVELING THE TRUNNIONS USING THE PLUMBLINE

WARNING

When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.

1 Release the howitzer travel lock and depress cannon tube to 0-mil elevation.

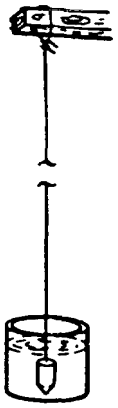
1.1 Lower the platform to firing position.



2 Install breech boresight disk (1). Install boresighting string (item 27, app D) to form muzzle boresight crosshairs

3 Attach the plumbline to a fixed object that is at least 9-feet high. The plumbline must extend 9 feet so that it can be seen while the cannon tube is elevated through a 600-mil range.

4 Tie a weight to the end of the plumbline. The weight may be a heavy wrench or a rock. It should weigh at least 1/2 pound.



5 Hang the weight in a bucket of water or waste oil.

6 The plumbline must be stationary. Hang it where there is little or no wind so that it will not move during the test.

7 After hanging the plumbline, position the weapon so that the end of the cannon tube is within 12 inches of the plumbline.

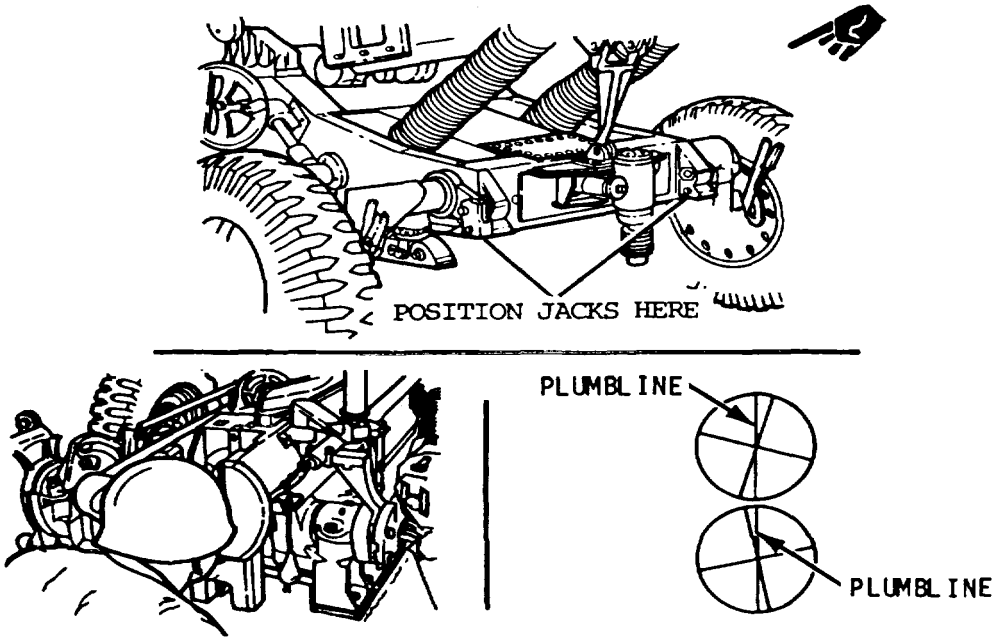
8 Looking through the breech boresight disk, manually traverse the cannon tube until the vertical muzzle crossline is alined with the plumbline.

3-24. LEVELING THE TRUNNIONS USING THE PLUMBLINE (cont)

9 Remove firing platform (p 2-83). Install one jack under right front and one jack under left front of carriage. Use mechanical or pinner jacks only.

NOTE

Hydraulic Jacks sometimes leak, and if the Jacked-up side of the vehicle lowers during the test, it may result in inaccuracy.



10 Set the elevation counter of the M14A1 quadrant to 600 U mils. Elevate the cannon tube to 600 mils. Observe the plumbline through the breech boresight disk. If the vertical muzzle crossline crosses over the plumbline, level the trunnions by use of jacks.

11 If the top of the vertical muzzle crossline moves to the right of the plumbline, the right side of the weapon must be Jacked up. If the top of the vertical muzzle crossline moves to the left of the plumbline, the left side must be Jacked up.

12 Watch through the breech boresight disk as the weapon is being Jacked up. When the vertical muzzle crossline is parallel to the plumbline, stop working the jack.

13 Set the elevation counter of the M14A1 quadrant on zero and depress the cannon tube to 0 mil. Traverse the cannon tube until the vertical muzzle crossline is back on the plumb- line.

14 Elevate and depress the cannon tube to ensure that the vertical muzzle crossline remains parallel and directly in line with the plumbline, from O-mil to 600-mil elevation. It may be necessary to repeat steps 11 thru 14.

15 When the vertical muzzle crossline tracks in line with the plumbline from O-mil to 600-mil elevation, the trunnions are level.

3-25. LEVELING THE TRUNNIONS USING SCRIBE LINES ON M14A1 QUADRANT

WARNING

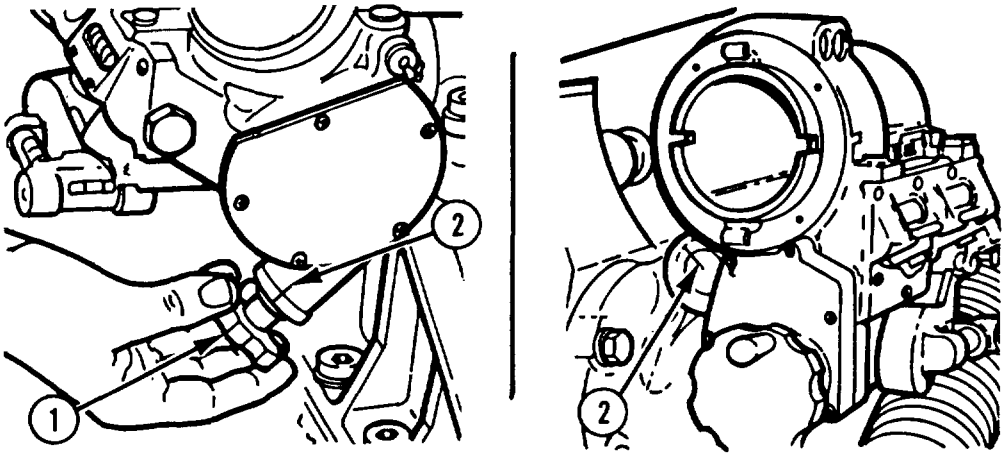
When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.

NOTE

When possible, stake the weapon.

1 Remove the M114A1 telescope.

2 Set M14A1 quadrant elevation counter and correction counter to zero and level cannon tube.



3 Turn the cross level knob (1) and carefully aline the scribe lines (2) (two sets) that have been cut on the M14A1 quadrant.

4 Operating the traversing handwheel assembly, traverse the weapon until the bubble centers in the M14A1 quadrant cross level level vial. If using jacks, do not traverse; jack up appropriate side of weapon.

5 Center M14A1 quadrant elevation level vial bubble. Repeat step 4 until both level vial bubbles are centered at the same time.

6 When the level vial bubbles center, the weapon trunnions are level.

7 Install M114A1 telescope.

3-26. CHECKING RELIABILITY OF DEFLECTIONS

WARNING

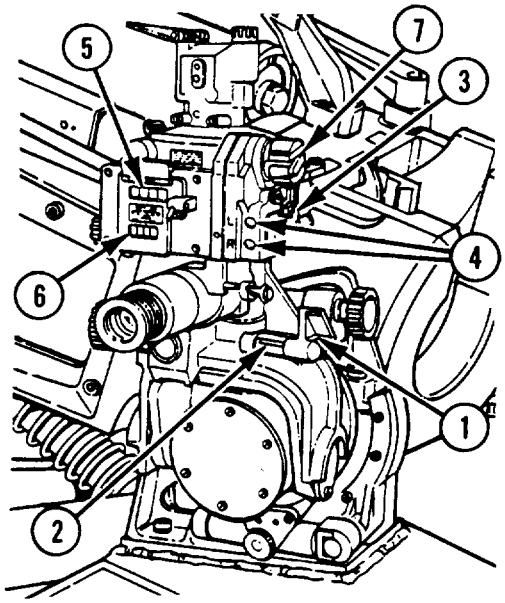
When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.

1 The assistant gunner levels the cannon tube using the M14A1

2 On the M134A1 mount, center the bubbles in the cross level level vial (1) and the elevation level vial (2).

3 Turn the gunner's aid knob (3) to set the gunner's aid counters (4) to zero.

4 Look through the eyepiece and pick out a reference point at least 50 meters away. (If the reference point is less than 50 meters distant, you must use the cover on M113A1 pantel head.)



5 Record the reading on the M113A1 pantel azimuth counter (5). Set the reset counter (6) to 3200.

6 Turn the azimuth knob (7) clockwise until the M113A1 pantel head turns two complete revolutions, returning to the reference point.

NOTE

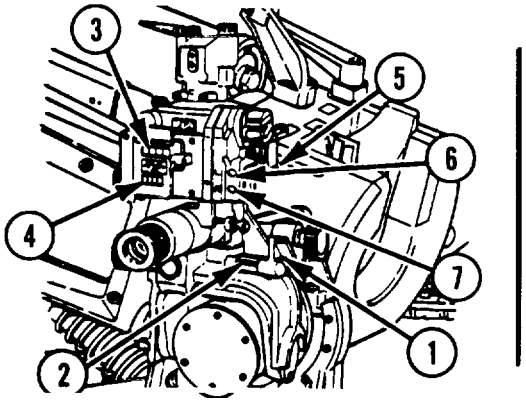
If you pass the reference point on the second revolution, rotate the M113A1 pantel head at least 50 mils counterclockwise and reapproach from left to right.

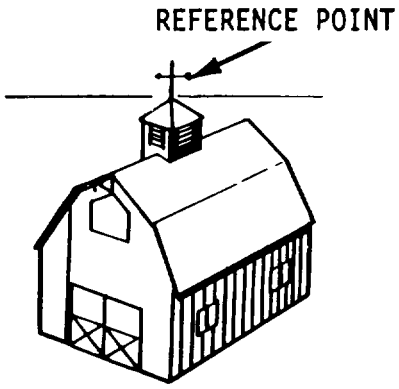
7 The reading on the azimuth counter (5) should be the same as recorded at the start of the test, plus or minus 1 mil.

8 The reading on the reset counter (6) should be 6000, plus or minus 1 mil.

9 The reading on the gunner's aid counters (4) still should be zero.

3-27. CHECKING RELIABILITY OF SPECIAL CORRECTIONS





WARNING

When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.

1 Center the bubbles in the M134A1 mount cross level level vial (1) and elevation level vial (2).

2 Look through the eyepiece and pick out a reference point at least 50 meters away. (Less than 50 meters, use the cover on M113A1 pantel head.)

3 Observe the reading on the M113A1 pantel azimuth counter (3). Reset the reset counter (4) to 3200.

4 Turn the gunner's aid knob (5) and set the left gunner's aid counter (6) to 10 mils.

5 The line of sight still must be on the reference point.

6 The azimuth counter (3) still should read the same (within 1/4 mil).

7 The reset counter (4) should be changed by 10 mils.

8 Repeat steps 4 and 5 for 20, 30, and 40 mils.

9 Repeat steps 4, 5, and 6 using the right gunner's aid counter (7).

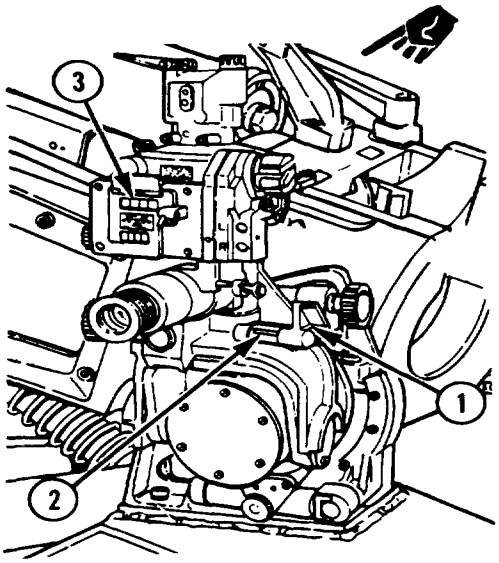
3-28. INSPECTION OF THE M134A1 MOUNT (AZIMUTH WALK-OFF CHECK)

NOTE

Recheck the trunnions. Trunnions must be absolutely level before conducting this test.

1 Depress the cannon tube to 0 mil.

2 Center the bubbles in the cross level level vial (1) and elevation level vial (2) on the M134A1 mount.



3 Sight the vertical reticle on any stationary object, at any deflection, approaching from left to right. Record the reading on the 11113A1 pantel azimuth counter (3) to the nearest 1/4 mil. (If aiming point is less than 50 meters distant, use the cover on M113A1 pantel head.)

4 Elevate the cannon tube to 400 mils. Center all level vial bubbles and realine the vertical reticle on the same stationary object. Always approach from left to right. Your reading on the azimuth counter must be within ±1 mil of the reading in step 3.

5 Now elevate the cannon tube to 800 mils. Once again center all level vial bubbles and realine the vertical reticle on the same stationary object, approaching from left to right. Your reading on the azimuth counter (3) must be within ±3 mils of the reading in step 3.

3-29. LEVELING THE CANNON TUBE

WARNING

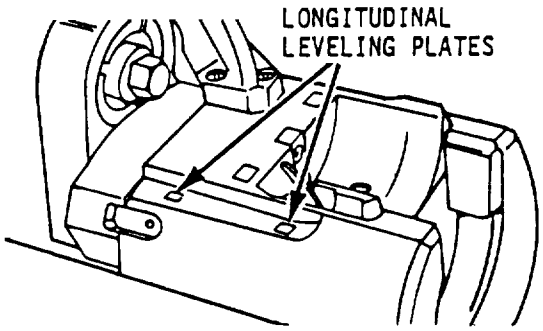
When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.

NOTE

The new manufacture cannon has quadrant seats on the top muzzle end of the cannon tube. Be sure trunnions are level before you level the cannon tube. For the M14A1 quadrant test (p 3-57), you must level the cannon tube as accurately as possible. There are two ways to accomplish this: using the cannon tube quadrant seats or using the gun tube leveling fixture.

NOTE

The longitudinal leveling plates on the breech mechanism assembly can be used only as a quick reference for checking elevation. They are not to be used for boresighting or for leveling the cannon tube.



3-30. LEVELING THE CANNON TUBE USING THE CANNON TUBE QUADRANT SEATS

1 Place weapon in firing position on a hard surface, such as concrete or asphalt, if possible.

2 Elevate or depress cannon tube to O-mil elevation. The last turn of the elevating handwheel assembly should be made in the direction of the most resistance.

3 Be sure cannon tube quadrant seats (1) are clean.

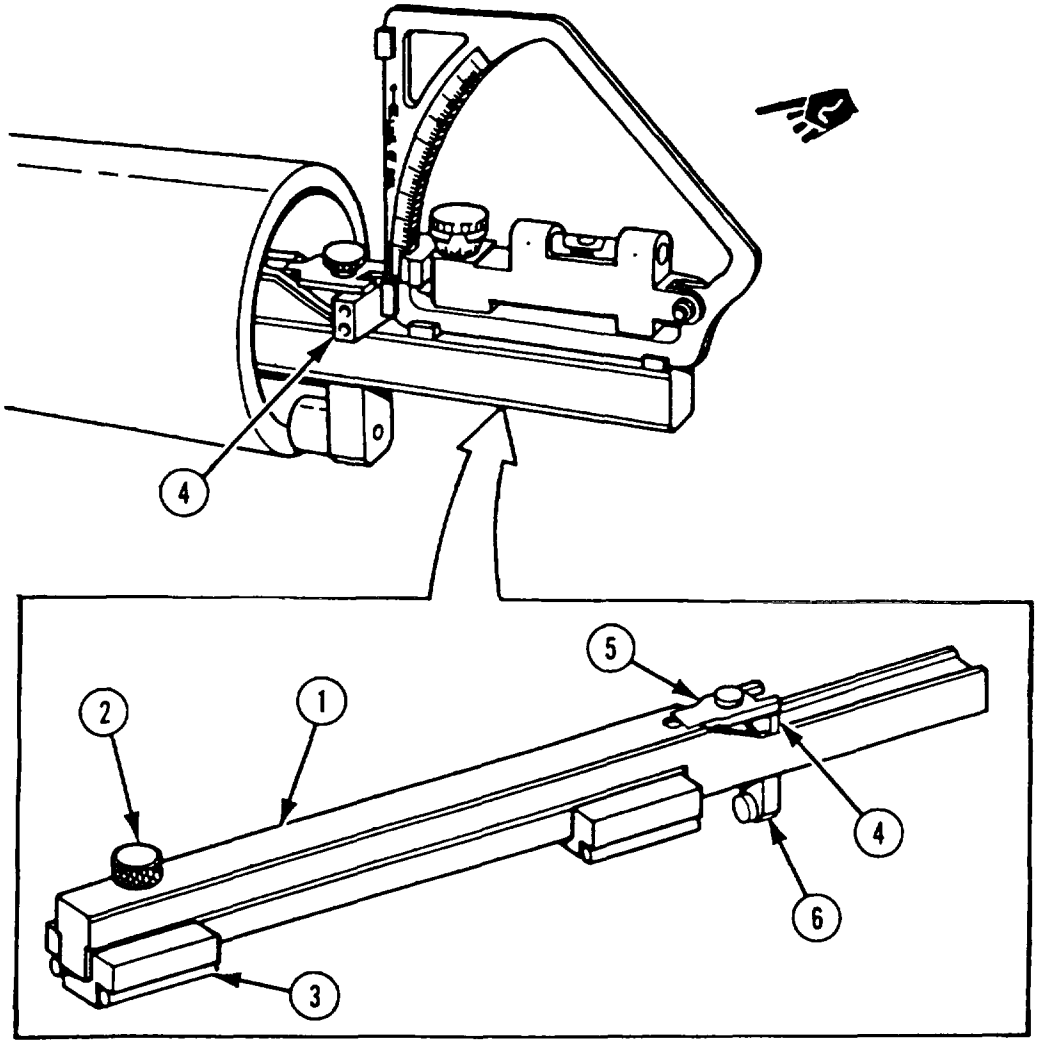
4 Place a prechecked gunner's quadrant (2), with zero reading, on the cannon tube quadrant seats (1) with LINE OF FIRE arrow pointing toward muzzle end.

5 Using the elevating handwheel assembly, elevate or depress the cannon tube until the gunner's quadrant level vial bubble (3) is centered.

6 Rotate the gunner's quadrant (2) end-for-end. The gunner's quadrant level vial bubble (3) should recenter. If not, verify the gunner's quadrant correction factor and repeat steps 4, 5, and 6.

7 The cannon tube is level.

3-31. LEVELING THE CANNON TUBE USING THE GUN TUBE LEVELING FIXTURE



1 Elevate or depress the cannon tube to zero elevation. The last turn of the elevating handwheel assembly should be made in the direction of the most resistance.

2 Remove the gun tube leveling fixture (1) from its case and install using the following procedure:

a. Remove screw (2) from the movable shoe (3) and place the movable shoe in the 105-mm position.

b. Replace screw in the proper hole and tighten securely.

c. Insert cross level vial (4) under the holder (5) on the gun tube leveling fixture. Place the stop assembly (6) on the screw protruding through the gun tube leveling fixture from the holder (5). Tighten securely.

d. Insert the gun tube leveling fixture into the muzzle end of the cannon tube until contact is made between the stop assembly and face of the cannon tube. Ensure magnet portion of stop assembly is flush with the cannon tube.

e. Rotate gun tube leveling fixture until the bubble is centered in the cross level vial (4).

3 Place a prechecked gunner's quadrant, with zero reading, in the groove of the gun tube leveling fixture. Apply the correction factor, if applicable.

4 Turn the elevation handwheel assembly in the direction of greatest resistance to elevate or depress the cannon tube until the gunner's quadrant level vial bubble is centered.

5 Rotate the gunner's quadrant. The level vial bubble should recenter.

6 The cannon tube is level.

3-32. M14A1 QUADRANT TEST

WARNING

When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.

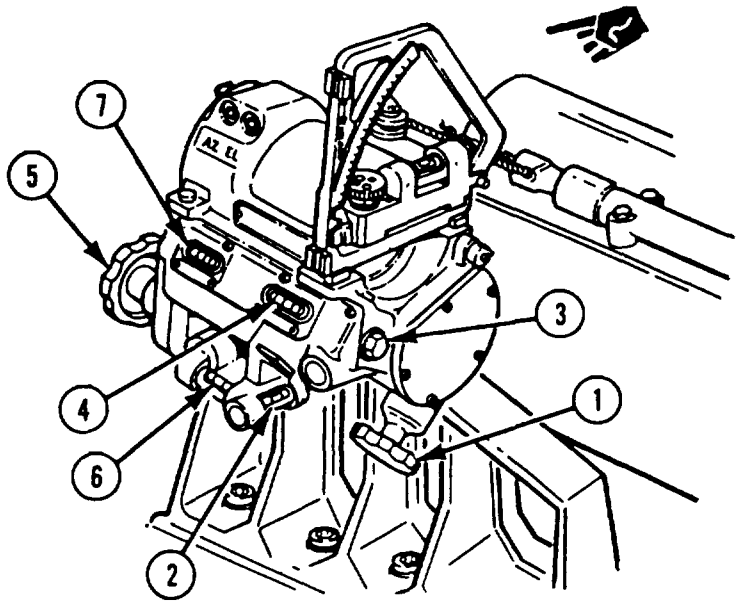
CAUTION

Do not move the level cannon tube until the beginning of step 8.

NOTE

Be sure trunnions and cannon tube are level before performing this test, using the cannon tube quadrant seats or the gun tube leveling fixture procedures.

3-32. M14A1 QUADRANT TEST (cont)



1 On the M14A1 quadrant, turn cross level knob (1) until bubble is centered in cross level level vial (2).

2 Turn the correction knob (3) to zero the correction counter (4).

3 Turn the elevation knob (5) to center the bubble in the elevation level vial (6).

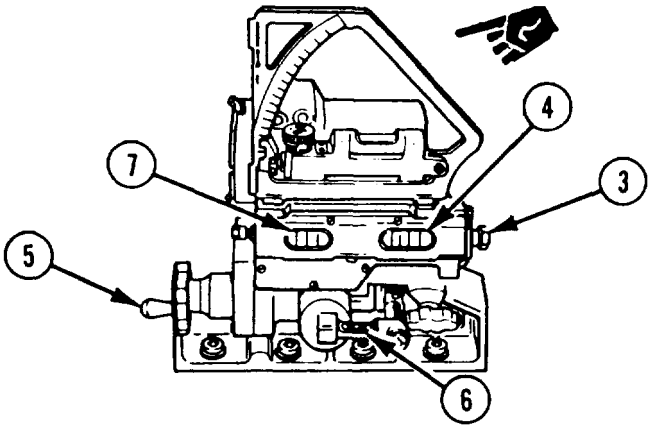
4 Check the reading on the elevation counter (7). The reading should be no less than 9999 (-1 mil elevation) and no more than 0001 (+1 mil elevation).

5 Place the gunner's quadrant on the M14A1 quadrant cross level seats. (Apply the gunner's quadrant correction value, if any.)

6 Center the level vial bubble in the gunner's quadrant with the micrometer knob. The value on the gunner's quadrant should not change more than +0.5 mil.

7 On the M14A1 quadrant, zero all counters, and center the bubble in the cross level level vial (2).

8 Using the M14A1 quadrant, zero the cannon tube. (Elevate or depress the cannon tube until the bubble in the elevation level vial (6) is centered.)



9 Set the gunner's quadrant on the M14A1 quadrant elevation seats and center the gunner's quadrant level vial bubble. Record the value on the gunner's quadrant.

10 Turn the M14A1 quadrant correction knob (3) to place a +5 mils reading on the correction counter (4). Check the reading on the elevation counter (7). The reading should have changed by 5 mils.

11 Turn the elevation knob (5) until the elevation counter (7) reads zero.

12 Elevate or depress the cannon tube until the bubble centers in the elevation level vial (6).

13 Set 5 mils, plus the value recorded in step 9, on the gunner's quadrant. The gunner's quadrant level vial bubble should center; if it does not, the M14A1 quadrant correction counter (4) is inaccurate.

14 Zero all counters. Repeat steps 10 thru 13, using a value of -5 mils. The gunner's quadrant level vial bubble must center; if not, the M14A1 quadrant correction counter is inaccurate.

15 Remove the -5 mils from the gunner's quadrant and M14A1 quadrant.

16 Using the M14A1 quadrant, zero the cannon tube.

17 Set the gunner's quadrant on the M14A1 quadrant elevation seats. Using the micrometer knob, center the level vial bubble on the gunner's quadrant. Record the value on the gunner's quadrant.

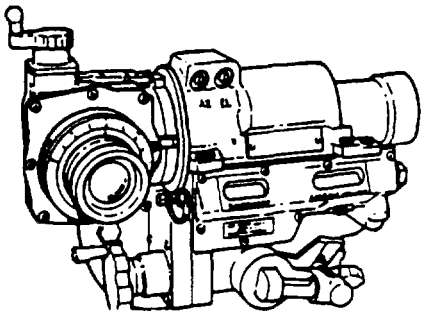
3-32. M14A1 QUADRANT TEST (cont)

18 Using the M14A1 quadrant, elevate the cannon tube from 0 mil to 400 mils and then to 800 mils. At each elevation place the value on the elevation counter (400 and then 800), plus the value recorded in step 17, on the gunner's quadrant.

19 Set the gunner's quadrant on the M14A1 quadrant elevation seats. The level vial bubble on the gunner's quadrant should center; if it does not, center using the micrometer knob.

20 Compare the first reading on the gunner's quadrant with the final reading on the gunner's quadrant. The readings at each elevation should be within ±0.5-mil tolerance.

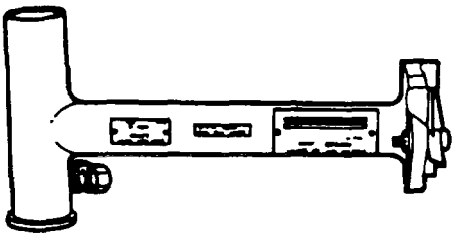
3-33. M114A1 TELESCOPE TEST



1 Boresight M114A1 telescope in accordance with instructions

2 If alignment cannot be made, turn the M114A1 telescope in to organizational maintenance for repair.

3-34. M140 ALIGNMENT DEVICE COMPARISON TEST



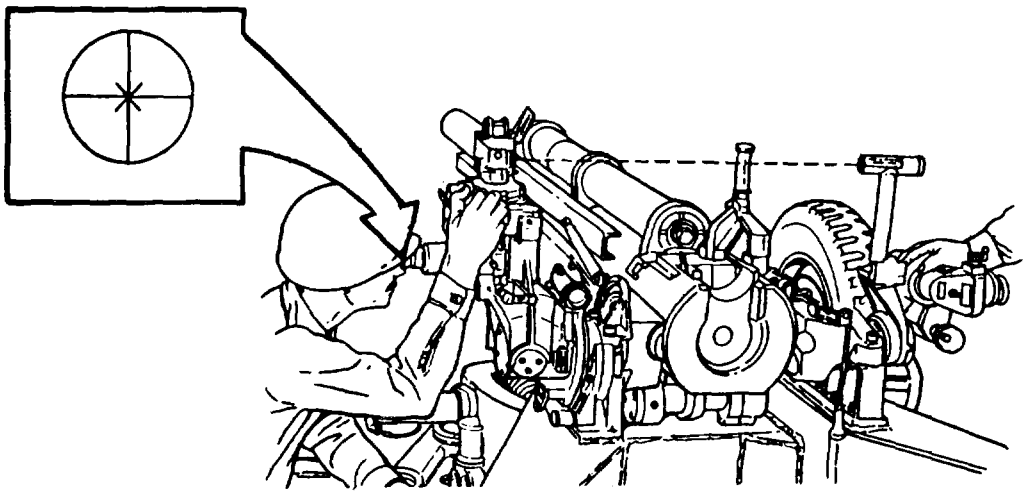
WARNING

When handling radioactive illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.

NOTE

The M140 alignment device comparison test is performed to identify any alignment device that has been bent or damaged due to accident or mishandling.

1 Check boresight, using the M140 alignment device (p 2-44). 1



2 Install a second alignment device. Without moving the position of the M113A1 pantel, view through the eyepiece. If the crosshairs on the M113A1 pantel and the alignment device align, you have verified the accuracy of the alignment device.

3 If the crosshairs on the M113A1 pantel and the second alignment device do not align, or if the azimuth counter reading is not correct after the crosshairs are alignd, one of the two alignment devices is unserviceable.

NOTE

The correct azimuth reading is 4800.

4 To determine which of the two alignment devices is unserviceable, obtain a third alignment device and again boresight the weapon.

5 Without changing the azimuth reading, install each of the other two alignment devices. The alignment device on which the crosshairs will not align with the M113A1 pantel cross- hairs is defective. Turn in defective alignment device to organizational maintenance for repair.

6 Deleted.

CHAPTER 4
AMMUNITION FOR 14102 HOWITZER WITH M137A1 SERIES CANNON

Section I. INTRODUCTION

4-1. GENERAL

Ammunition for your M102 howitzer is of the semi-fixed type. Most of these rounds have an adjustable propelling charge for zone firing, and the complete round is loaded into the weapon as a unit. The High Explosive Plastic (HEP) and the Target Practice (TP) rounds are exceptions and do not have adjustable charges. Semi-fixed ammunition is issued fuzed for all projectiles except HE, and sometimes WP rounds. Draw separate fuzes for these rounds.

4-2. PROJECTILE COLORING AND MARKING

Projectile colorings and markings (new and old) for the M102 howitzer are listed in table 4-1 (p 4-2). In addition, important information is stenciled on each projectile (see below). Knowing the meaning of this information will aid in the rapid selection of the required projectile when firing. KNOW YOUR AMMUNITION.

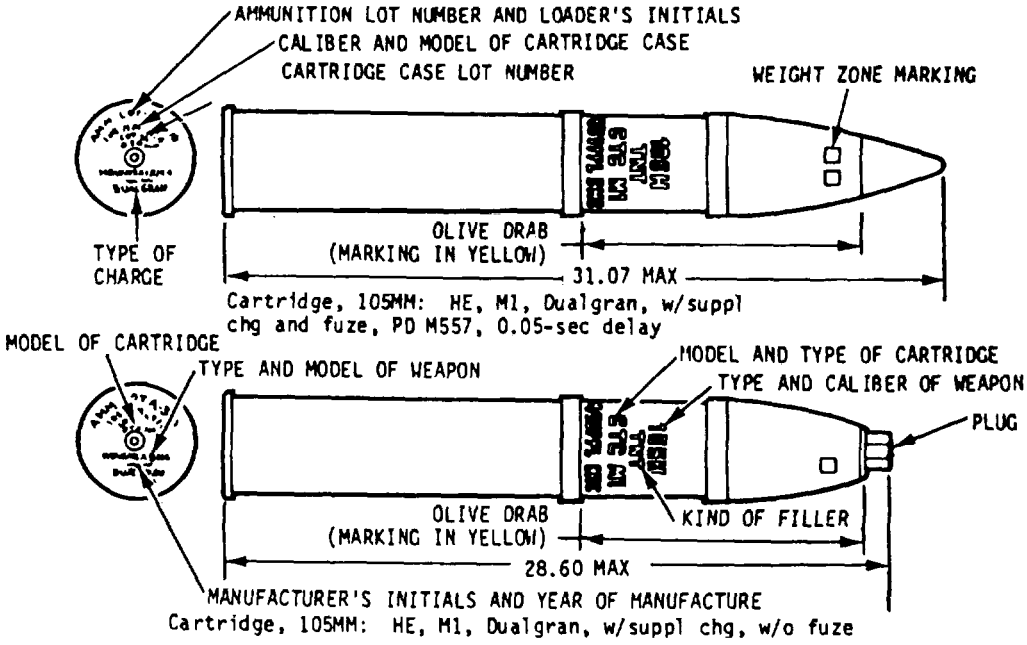


Figure 4-1. Identification markings.

4-2. PROJECTILE COLORING AND MARKING (cont)

Table 4-1. Model Numbers and Color Coding of Projectiles for M102 Howitzer

Type and model number of projectile	NEW MANUFACTURE			OLD MANUFACTURE		
	Color of pro-jec-tile	Number/ color of bands	Mark-ing	Color of pro-jec-tile	Number/ color of bands	Mark-ing
APERS-T XM546* and M546*	Olive drab	1/yellow	White (white dia-monds indi-cate fle-chettes)	NA	NA	NA
Dummy, M14	Un-painted or bronze	None	White	Black or Blue	None	White
Gas (H, HD), M60	Gray	2/green 1/yellow	Green	Gray	2/green	Green
Gas (GB), w/burster, M360	Gray	3/green 1/yellow	Green	Gray	2/green	Green
Gas (GB), w/o burster, M360	Gray	3/green	Green	Gray	2/green	Green
M444 ICM	Olive drab	None**	Yellow	NA	NA	NA

*The XM546 APERS (Beehive) round will not be fired over the heads of friendly troops. See table 4-4 for firing restrictions.

*Indicates a row of yellow diamonds around the ogive of the projectile.

Table 4-1. Model Numbers and Color Coding of Projectiles for M102 Howitzer (cont)

Type and model number of projectile	NEW MANUFACTURE			OLD MANUFACTURE		
	Color of pro-jec-tile	Number/ color of bands	Mark-ing	Color of pro-jec-tile	Number/ color of bands	Mark-ing
HE, M1	Olive drab	None	Yellow	Olive drab	None	Yellow
HEP, M327	Olive drab	1/black	Yellow	Olive drab	None	Yellow
HERA, M548	Olive drab	None	Yellow	NA	NA	NA
Illuminating, M314 series	White	None	Black	Gray	1/white	White
Target practice, M67	Blue	None	White	Blue	None	White
Smoke (HC and color), M84 series	Light green	None	Black	Gray	1/yellow	Yellow
Smoke (WP), M60 series	Light green	1/yellow	Light red	Gray	1/yellow	Yellow
Tactical, CS, M629	Gray	1/red 1/yellow	Red	NA	NA	NA

4-3. AUTHORIZED 105-MM PROJECTILES AND USE

WARNING

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

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 M102 howitzer contains an additional zone known as zone 2-1/2 (□□Δ).

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

Table 4-2. Authorized Projectiles for the M102 Howitzer

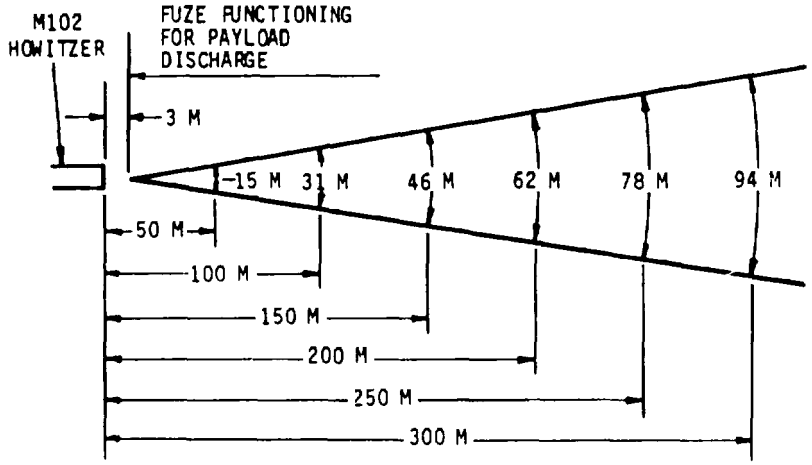
Model.	Abbre-Viation	Type	Use
XM546* and M546*	APERS-T	Flechette-loaded, aluminum projectile	Antipersonnel (effective in dense foliage)
M1	HE	High explosive-bursting	Antipersonnel, blast, mining
M60	H/HD	Bursting, chemical mustard/distilled mustard	Antipersonnel, persistent
M360	GB	Bursting, chemical-sarin	Antipersonnel, non-persistent
M327	HEP/HEP-T	High explosive, bursting/high explosive, bursting, tracer	Defeat armor (effective against concrete and timber targets)
M314-series	ILLUM	Base ejection projectile, parachute candle	Illumination
M60A3	Smoke, WP	Bursting chemical	Screening, spotting incendiary
M84A1	Smoke, HC	Base-ejection projectile with canisters for use with M548, M565, M577 series, or M762 fuzes	Screening/ target identification signaling
M84B1	Smoke, HC/ colored	Base-ejection projectile with canisters for use with M501 series fuze only	Screening/ target identification signaling

*Dispersion pattern for XM546 and M546 set on MA (muzzle action) and time are shown in figures 4-2 (p 4-5) and 4-3 (p 4-6) respectively.

Table 4-2. Authorized Projectiles for the M102 Howitzer (cont)

Model	Abbre-viation	Type	Use
M444*	ICM	High-explosive bouncing grenades	Antipersonnel
M67	TP/TP-T	Inert projectile/ inert projectile w/ tracer	Training
M548	HERA	High explosive rocket assisted	Antipersonnel, blast, mining
M629	Tactical, CS	Base-ejection projectile w/ CS canisters	Riot control
M14	Dummy	Completely inert round	Training

* Expect a higher submunition dud rate when M444 is fired at charges 6 and 7.



NOTE

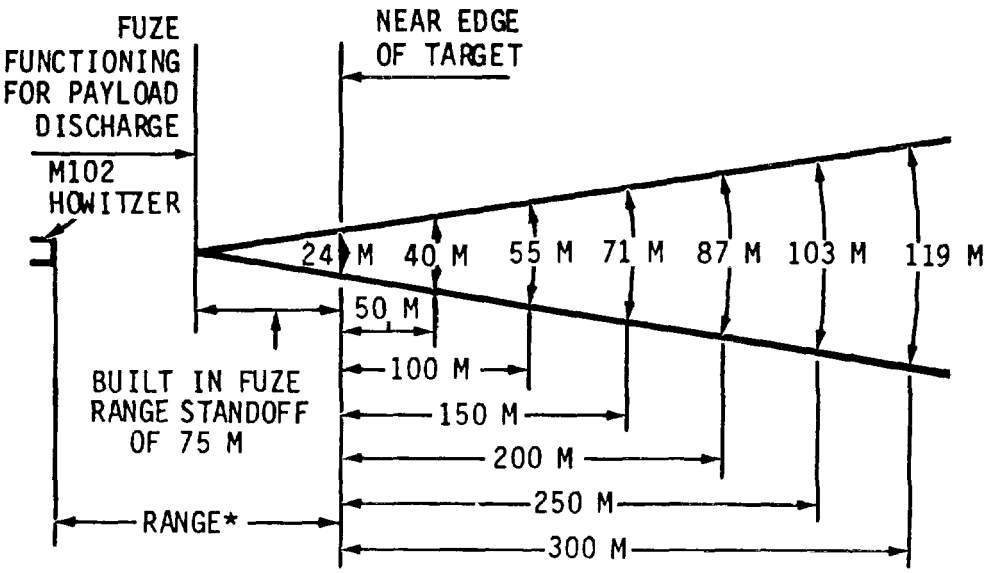
Approximately 16-meters increase in arc width results for each additional 50 meters of range.

Figure 4-2. Dispersion pattern (MA) for 105-mm APERS-T cartridge XM546 and M546.

NOTE

The conical dispersion pattern for time action is shown on next page.

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



RANGE* - Range to the near edge of the target. Fuze setting should be in accordance with the range and firing table instructions. Above pattern will result for all range firings from 1/2-second firing out to maximum of range table time for the M102 howitzer.

NOTE

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

Figure 4-3. Dispersion pattern (range) for 105-mm APERS-T cartridge XM546 and M546.

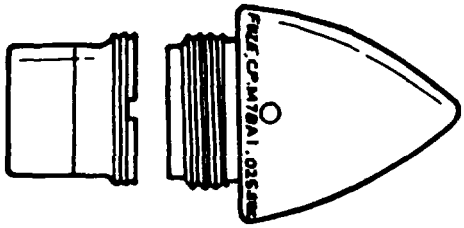
4-4. AUTHORIZED FUZES FOR M102 HOWITZER

WARNING

Fuze or fuze/projectile combinations may have a restriction or be suspended from issue and use (ex. MTSQ, M501A1). Refer to TB 9-1300-385.

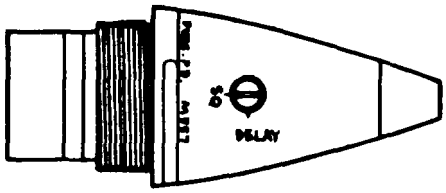
a. General. Paragraphs 4-4b (p 4-7) thru 4-4i (p 4-10) describe some of the fuzes to be used with the M102 howitzer. For additional information on description and functioning of authorized fuzes, see TM 43-0001-28. For authorized projectile/fuze combinations, see table 4-3 (p 4-11). For authorized projectile, fuze, and propelling charge combinations, see TM 43-0001-28-10.

POINT DETONATING CONCRETE PIERCING FUZE M78A1 AND BOOSTER M25



b. Fuze, Point Detonating, Concrete Piercing: M78A1 Series. The M78A1 series fuzes are constructed primarily for use against concrete targets. M78A1 fuzes are of two types--a non-delay type used for spotting purposes and a delay type for concrete targets. The non-delay 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.

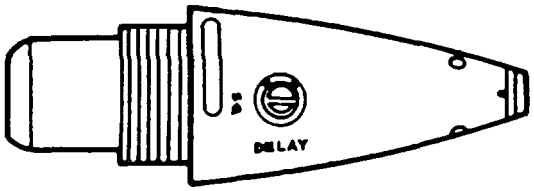
POINT DETONATING FUZE M557 AND M572



c. Fuze, Point Detonating: M557 and M572. The M557 fuze has a selective superquick-delay setscrew. It is packed set for superquick 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 can occur when these fuzes are fired in heavy precipitation; i.e., rainfall, sleet, snow, or hail. These fuzes can be set for superquick or delay action by turning the setscrew.

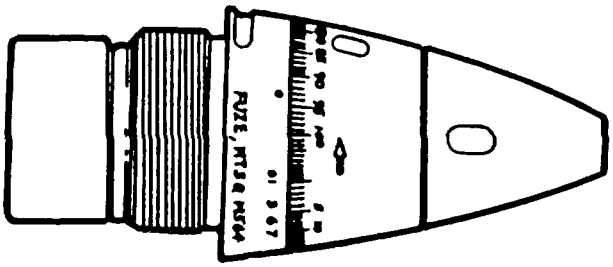
4-4. AUTHORIZED FUZES FOR M102 HOWITZER (cont)

POINT DETONATING FUZE M739



d. Fuze, Point Detonating: M739 Series. The M739 series fuzes are the latest improved version of the selective impact fuze. These fuzes have an aluminum-filled body and a rain-in- sensitive head so that they can be fired through heavy precipitation without premature functioning. These fuzes can be set for superquick or delay action by turning the setscrew. The M739A1 fuze contains an improved impact delay module which provides rmore effective functioning in the delay mode. In addition to the stamped marking, the M739A1 fuze body is anodized green for positive identification of fuze model.

MECHANICAL TIME AND SUPERQUICK FUZE M564

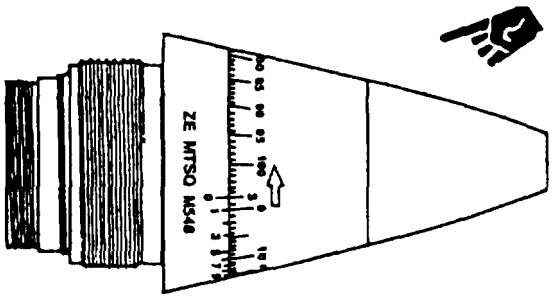


WARING

Fuze or fuze/projectile combinations may have a restriction or be suspended from issue and use (ex. MTSQ, M501A1). Refer to TB 9-1300-385.

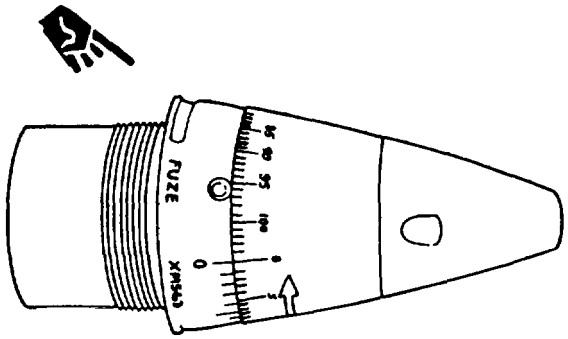
e. Fuze, Mechanical Time and Superquick: M564. The M564 fuze is an improvement over the older MTSQ fuzes, in that it provides a longer timing mechanism (100 seconds) for functioning at longer ranges. The date of manufacture is stamped on the fuze body before the lot number. Fuzes manufactured through 1969 must be set on 90 seconds if superquick (impact) action is desired. Setting of these fuzes between S and 2 seconds may result in functioning after approximately 2 seconds. Fuzes manufactured from 1970 on may be set as shipped on S for superquick (impact) functioning. Premature functioning of the fuze may occur downrange if the fuze is fired in heavy precipitation; i.e., rainfall, sleet, snow, or hail.

MECHANICAL TIME AND SUPERQUICK FUZE M548



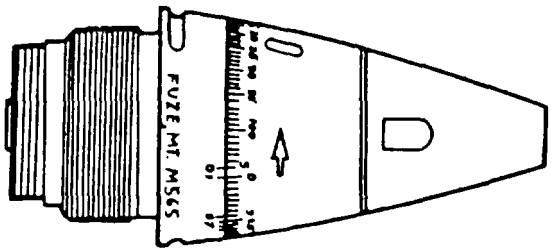
e.1. Fuze, Mechanical Time and Superquick, M548. The M548 fuze is designed to function at time settings from 2 to 100 seconds or upon impact, depending upon which occurs first after arming. It does not contain a booster and is used with base ejecting projectiles only. If superquick (impact) action is desired, the fuze must be set on 90 seconds. Premature functioning may occur downrange when the fuze is fired in heavy precipitation, i.e., rainfall, sleet, snow, or hail.

MECHANICAL TIME FUZE M563



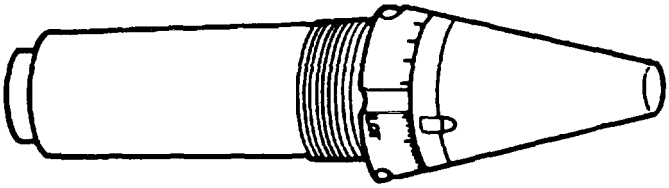
e.2. Fuze, Mechanical Time, M563 Series. These fuzes are comprised of a solid aluminum head, lower cap assembly with time graduation in seconds, and fuze body with vernier scale. Fuzes can be set to function at close range, and up to a range of 4400 meters. Overlapping centrifugally operated weights provide safety during handling.

MECHANICAL TIME FUZE M565



f. Fuze, Mechanical Time: M565. The M565 fuze is similar to MTSQ fuze M564 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.

PROXIMITY (VT) FUZE M728

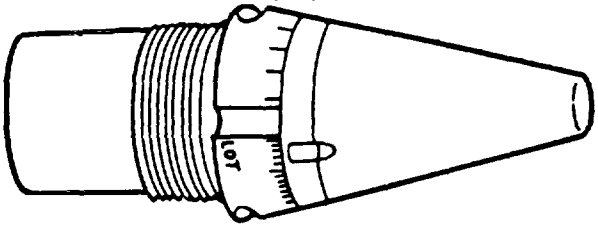


NOTE

See TM 43-0001-28-10 for earlier models of M513 series proximity VT fuzes for 105-mm howitzers.

g. Fuze, Proximity Variable Time (VT): M728. The M728 fuze is a long intrusion fuze used with the 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 irpact 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.

PROXIMITY (VT) FUZE M732



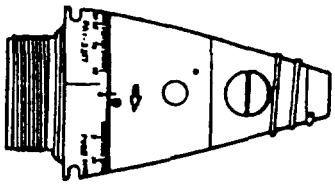
h. Fuze, Proximity Variable Time (VT): M732. The M732 is a short intrusion fuze and is used without removing supplemental charges from projectiles and contains a self-powered radio and transmitting unit. The fuze has a plastic nose cone fitted to a moveable steel ring which rotates on a steel sleeve. 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 the set time. If the fuze fails to function in the proximity mode, it will function on ground impact.

NOTE

he PD setting of the M732 VT fuze when fired into soft impact areas will be less deadly than the superquick setting of the M739 PD fuze.

4-4. AUTHORIZED FUZES FOR M102 HOWITZER (cont)

MECHANICAL TIME AND SUPERQUICK FUZE M501A1



WARNING

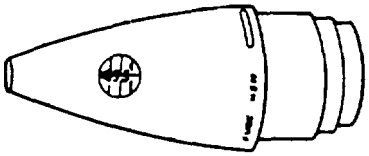
Fuze of fuze projectile combinations may have a restriction or be suspended from issued and use (ex. MTSQ, M501A1). Refer to TB 9-1300-385.

i. Fuze, Mechanical Time and Superquick: M501 Series. The M501-series fuzes are a combination mechanical time and superquick fuze with settings for time action (2 to 75 seconds) and an impact element for superquick 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 plateand contents. When handling projectiles assembled with the fuze, exercise extreme care to protect the fuze from impact. Keep pull wire on fuze inplace until immediately prior to firing.

MECHANICAL TIME AND SUPERQUICK FUZE M577



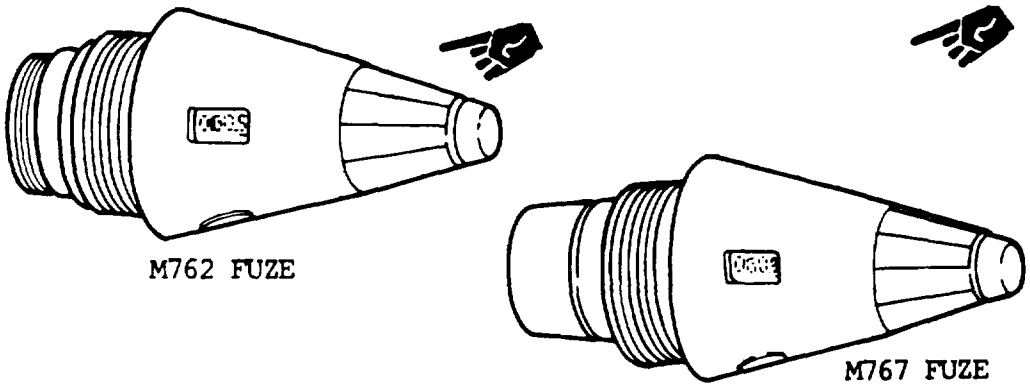
WARNING

The M577 and M582 series fuzes, when set for a time of less than 4 seconds,will allow the rotor to release almost immediately, fully arming the fuze, whichenables the fuze to explode at the set time. Any time setting of less than 2 seconds is a danger to the crew and should not be fired unless firing "KILLER JUNIOR".

j. Fuze, Mechanical Time and Superquick: 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 (4) 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 4-10f (p 4-25). The M35 fuze setter or a flat tip screwdriver is used to set these fuzes. The M582 series fuze is identical to the M577 series with the exception that it is used in bursting-type projectiles and has a standard booster. The M577 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 A1 models have a different wrench slot configuration. The A1 models are handled, set, and fired the same as the basic mrodels. Early manufactured basic and Al fuzes have a black paint finished ogive, while the later produced Al fuzes have a gold (chromate finish) color ogive. In order to minimize identification problems, current production of M582A1 fuzes contain a white stencil "M582Al" below the window on the fuze body. If the M577 series/M582 series fuzes are set for time and the timing mechanism fails, the fuzes may or may not function on impact.

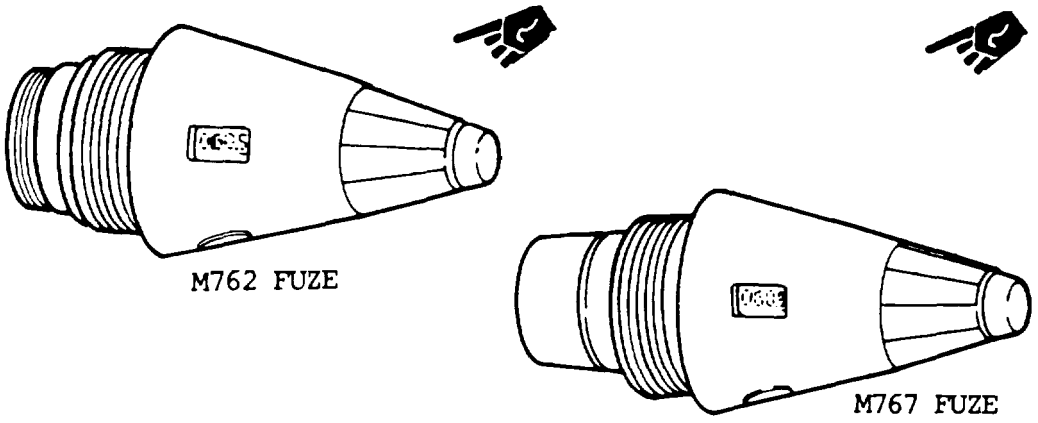
ELECTRONIC TIME FUZES M762 AND M767



k. Fuzes, Electronic Time: M762 and M767. These fuzes are powered by a reserve lithium battery. The battery is activated manually by rotating the ogive or remotely 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

4-4. AUTORIZED FUZES FOR M102 HOWITZER (cont)

k. Fuzes, Electronic Time: M762 and M767. (cont)



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 (1) 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 backup 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 auto-set fire control system. Detailed setting instructions are outlined in paragraph 4-10. 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 backup. The fuzes are not sensitive to rain.

NOTE

Once activated, the M762 and M767 cannot be turned off; therefore,the fuzes have approximately 15 days service life before the batteryruns down and the LCD goes blank.

Table 4-3. Authorized Projectile/Fuze Combinations for the M102 Howitzer

WARNING

Fuze of fuze projectile combinations may have a restriction or be suspended from issued and use (ex. MTSQ, M501A1). Refer to TB 9-1300-385.

(See Note 1)	PD			MT		MTSQ					BD	VT			ET	
Type and model number of projec-tile	M78, CP series	M557/ M572	M739 series	M563 series	M565	M501 series	M577 series	M548	M564	M582 series	M91 series	M513 series	M728	M732	M762	M767
APERS-T, XM546 (Note 2) or M1546				X												
Gas (H or HD), (Note 3) M60			X	X												
Gas, GB, M360 (Note 3)			X	X												
HE, M1 (normal cavity)	X	X	X						X	X				X		X

X--As issued or compatible

Note 1: All projectiles are issued with a fuze installed except the high-explosive projectile, and some lots of the WP round. The M67 TP-T is issued with an empty fuze body and tracer. The tracer burns for a minimum of 3 seconds during projectile flight.

Note 2: XM546 (Beehive) round is not to be fired over the heads of friendly troops. No restrictions on the M546.

Note 3: Sane gas projectiles may came with the M508 impact fuze.

4-4. AUTHORIZED FUZES FOR M102 HOWTZER (cont)

Table 4-3. Authorized Projectile/Fuze Combinations

(See Note 1) Type and model number of projec-tile	PD			MT		MTSQ					BD	VT			ET	
	M78A1, CP series	M557/ M572	M739 series	M563 series	M565	M501 series	M577 series	M548	M564	M582 series	M91 series	M513 series	M728	M732	M762	M767
HE, M1 (deep cavity (Note 4)	X	X	X						X	X		P	P	X		X
HE,M444 (Note 5)					X			X								
HEP/HEP-T,M327											X					
Illum, M314 (old series)						X										
Illum, M314A3 (new series)					X		X	X							X	
Smoke, BE, M84 (old series)						X										
Smoke, HC, M84A1 (new series)					X		X	X							X	

Table 4-3. Authorized Projectile/Fuze Combinations for the M102 Howitzer (cont)

(See Note 1) Type and model number of projec-tile	PD			MT		MTSQ					BD	VT			ET	
	M78A1, CP series	M557/ M572	M739 series	M563 series	M565	M501 series	M577 series	M548	M564	M582 series	M91 series	M513 series	M728	M732	M762	M767
Smoke, WP M60A2		X	X						X	X						X
HERA, M548		X	X							X			P	X		X
TP-T, M67 (Note 1)											X					
Tactical, CS, M629					X			X								
Smoke, WP M60/M60A1		X														

X--As issued or compatible
P--Requires removal of supplementary charge if present

Note 1: All projectiles are issued with a fuze installed except the high-explosive projectile, and same lots of the WP round. The M67 TP-T is issued with an empty fuze body and tracer. The tracer burns for a minimum of 3 seconds during projectile flight.

Note 4: Use M5 desensitizing cap only on the M513 series proximity fuzes.

Note 5: M444 cartridges are assembled with modified M548 MTSQ or M565 MT fuzes which incorporate an expelling charge as an integral part of the fuze.

4-5. EQUIVALENT SERVICE ROUNDS

Zone	No. of Rounds Equivalent in Erosion to One Full Charge	Equivalent Erosion Effect in Decimals	Tube Life
7	1	1.00	5,000 EFC or 10,000 cumulative *
1 thru 6	10	0.10	5,000 EFC or 10,000 cumulative *

* hichever comes first.

For Cartridge, HEP-T, M327, 0.30 rounds are equivalent in erosion to one full charge. The equivalent erosion effect in decimals is 3.20.

4-6. CARTRIDGE CASE, PRIMER, AND PROPELLING CHARE

a. Cartridge Case and Primer. Projectiles are assembled with the M14-series cartridge cases. These included the M14 (brass), M14B1 (steel), and M14B2 (5-piece, spiral-wrapped steel) cartridge cases. Blank cartridges are assembled with the M15 (brass) or M15B1 (steel) cartridge cases. Each of the cartridge cases has a percussion-type primer installed in the base of the case.

WARNING

Protect the primer from accidental strikes. A primer strike could cause premature primer functioning.

b. Deleted.

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. The APERS-T cartridge contains a two-zone propelling charge of dual-granulation M30E1, charges 6 and 7 only. The M548 HERA cartridge contains the five (3 thru 7) zones XM176 propellant charge loaded w/M30A1 propellant. (See table 4-4, p 4-15, for firing restrictions of charge 6.)

Section II. PREPARATION FOR FIRING

4-7. GENERAL

WARNING

Fuze of fuze projectile combinations may have a restriction or be suspended from issued and use (ex. MISQ, M501A1). Refer to TB 9-1300-385.

a. Introduction. Most cartridges for the M137Al cannon require preparation of projectile, propelling charge, and fuze. Restrictions on projectile, fuze, and propelling charge are contained in table 4-4 (p 4-15).

b. Unless otherwise specified, observe the following temperature limits when firing the M102 howitzer:

(1) Lower limit: -40°F (-40°C).

(2) Upper limit: +125°F (+52°C).

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, XM546, or 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 seconds is permitted.
Projectile, APERS-T, XM546	Firing over heads of friendly troops is prohibited.
Projectile, HE, MI	Rounds with M513 series or M728 VT fuzes are not to be fired at charge 7 for proximity action, except under 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.

4-8. 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 identification.

(2) Open outer pack and remove fiber container.

CAUTION

Do not use axes, crowbars, or other such implements which may damage inner pack or ammunition.

(3) Open fiber container and remove cartridge case and projectile.

(4) Remove U-shaped packing stop, if applicable.

(5) Inspect round and assure correctness of nomenclature. 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 setscrews or wax plug from setscrew hole in projectile.

(6) DO NOT use blank cartridges with loose or broken closing cups; report such items to ammunition officer for disposal.

(7) Unpack fuze, when issued separately, following steps 4-8b (1), (2), (3), (4), and (5), as applicable.

4-9. FUZING

a. Fuze Removal. The MI, HE projectile may be shipped with fuzes which must be removed if time or proximity fuze action is desired.

(1) Using screwdriver which fully fits screw slot, loosen booster setscrew in nose of projectile, when present.

(2) Insert M18 fuze wrench in wrench slots of fuze, taking care not to strike any part of fuze. Strike 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) For metal closing plugs, insert M18 fuze wrench in wrench slots of plug: strike wrench handle sharply in counterclockwise direction. Remove plug and spacer beneath plug.

(3) For plastic nose plugs, pull tab up breaking its sides loose from the plug. Push tab into the center of the plug. Squeeze plug and withdraw it from the fuze well.

(4) 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.

c. Supplementary Charge.

(1) When preparing rounds for CP, SQ/D, MTSQ, short intrusion VT, and ET fuzes, inspect for presence of supplementary charge.

WARNING

Do not fire anything except long intrusion proximity fuzed rounds without supplementary charge, unless projectile has shallow cavity.

4-9. FUZING (cont)

c. Supplementary Charge. (cont)

(2) For long intrusion VT fuze firing, remove supplementary charge as follows:

WARNING

Do not attempt to remove the supplementary charge by any other means 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 SQ/D, short intrusion VT, MISQ, or ET fuze or 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 qualified ammunition 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 the M78A1 CP fuze I (para 4-9d(2), p 4-19) and M91 series base detonating fuzes (para 4-9d(3), p 4-19).

(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, tighten fuze to projectile so that fuze shoulder is seated flush with nose of projectile.

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 fuzes with gap between fuze shoulder and projectile, either replace supplementary charge in projectile and fire with SQ/D, MTSQ, or ET 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. The booster is not issued assembled to the fuze and must be assembled to the projectile.

(a) Remove safety pin, if present, from M25 booster and screw the booster into the booster cavity of the projectile. Boosters issued without safety pins should not be used.

(b) Tighten booster, using booster end of M16 fuze wrench.

(c) Screw M78A1 CP fuze into fuze cavity, tighten, using M16 fuze wrench. Make sure fuze shoulder seats flush against nose of projectile. Do not stake fuze to the projectile.

(d) If projectile setscrew is present, tighten to below level of contour of projectile.

(3) Deleted.

4-10. FUZE SETTING PROCEDURES FOR THE M102 HOWITZER

a. General. The following procedures apply to the authorized fuze/projectile combinations for the M102 howitzer. Fuze setting tools and procedure numbers are listed in table 4-5 (p 4-21).

4-10. FUZE SETTING PROCEDURES FOR THE M102 HOWITZER (cont)

a. General. (cont)

(1) M557 and M572 impact fuzes, M564 and M548 time fuzes, and the proximity VT fuzes may prematurely explode 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 the fuze for delay-action may prevent prematures; however, see paragraph 4-10a(2).

(2) M739 series impact fuze, M577 series and M582 series time fuzes, and M762 and M767 electronic time fuzes are not sensitive to rain and may be fired during heavy precipitation.

(3) Any ammunition in the field, with M51A series PD fuze not marked "MODIFIED" will not be used.

CAUTION

Before setting MT, MTSQ, ET, or VT fuzes, refer to the appropriate firing table for required time setting.

b. Procedure No. 1, M557, M572, or M/39 Series. PD fuzes with SQ or delay functioning are shipped set for SQ action. To set fuzes for delay-action use screwdriver end of M18 fuze wrench or similar tool and turn slot 90 degrees to align with index mark "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.

c. Procedure No. 2, M501 Series.

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 firing.

CAUTION

Do not fire fuzes with cocked or loose lower caps.

NOTE

The M501 series fuzes are shipped with index mark on lower cap aligned with the S engraved on the base.

Table 4-5. Fuze Setting Tools and Procedures for M102 Howitzer

FUZE (See Note 1)												
PD		MT		MTSQ				VT		ET		
M78A1 CPM557 series (Note 2)	M572, or M739 series	M563 series	M565	M501 series	M577 series or M582 series	M548	M564	M513 series	M728 or M732	762M or M767	Fuze wrench or fuze setter	Procedure number
	X										M18	1
X											M16	(Note 2)
				X				X	X		M27	2&3
		X	X			X	X				M34	4
					X						M35	5
										X		6

X -- Denotes compatibility of fuzes and fuze setters.

Note 1: All fuzes are installed and tightened to the nose of the projectile with the 118 fuze wrench, except the M78A1 CP series fees.

Note 2: The M78A1 CP series fuzes and boosters are installed in the projectiles with the M1G fuze wrench. (See para 4-9d(2), p 4-19.)

(1) Time setting.

(a) Check fuzes for cocked or loose lower caps.

(b) To remove safety wire before setting, pull end of wire from the hole in the lower cap, sliding wire off end of

4-10. FUZE SETTING PROCEDURES FOR THE M102 HOWITZER (cont)

c. Procedure No. 2, M501 Series. (cont)

(c) With fuze setter, set fuze by rotating lower cap to desired time in counterclockwise direction or in direction of arrow marked on the lower cap. The fuze is properly set when the index mark on the lower cap is alignd with desired time, in seconds, engraved on base.

(d) M27 fuze setter will then be used to set the fuze to desired time.

(e) If, after the fuze is set, the round is not fired, reset the fuze to the safe S position and place the safety wire in its proper position.

(2) Impact setting. Impact functioning of the M501 series MTSQ fuze may be obtained either by 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. Remember, you must remove the safety wire (pull free end of wire off and out of hole) before firing or setting the fuze.

d. Procedure No. 3, M513 Series, M728, and M732.

CAUTION

The plastic nose cone will rotate with the index mark. Damage to the plastic will produce duds. However, since there is no backlash, fuze setting can be accomplished or changed one or rmore times by rotating the index mark in either direction. If counterclockwise rotation is used, be sure that the fuze has not become loosened from the projectile.

(1) These fuzes are set when index line at base of nose cone is aligned with time, in seconds, engraved on base of fuze.

NOTE

Rotation of the M732 fuze nose cone has been experienced at zone 7 (not a safety hazard). If this occurs when M732 is set on time for proximity function, PD function might occur instead. In such instances, set the fuze to a time of 10 seconds less than the time of flight for proximity function.

(2) To set fuze for proximity action, rotate nose cone with the M27 fuze setter, normally in the clockwise direction while looking down on the nose of the fuze, until the index mark coincides with the announced time. Fuze setting can be changed one or more times with no harmful effects.

NOTE

The M728 fuze is shipped with the index mark on the nose cone set at 10 seconds. The M732 is shipped with the index mark alined with PD. The M513 andM513B1 fuzes are shipped with index mark alined with S. The M513Al and M513A2 are shipped with index mark alined with shipping line (long vertical line with arrow).

CAUTION

Do not use M513 and M513B1 fuzes for PD functioning.

(3) For impact functioning, set M732 fuze to PD mark andM728, M513A1, and M513A2 fuzes to 90 seconds using M27 fuze setter.

WARNING

Do not fire projectile unless fuze is fully seat-ed. Inbore explosion may result.

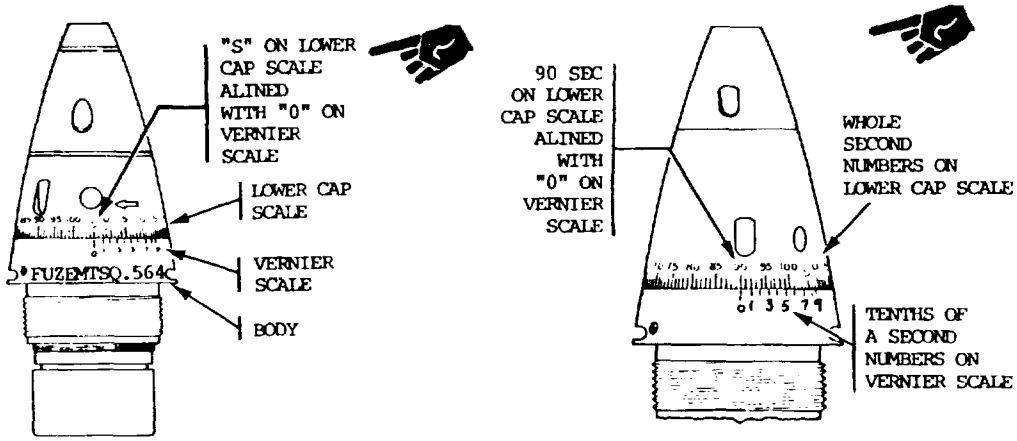
(4) Firing temperature limits for M728 and M732 proximity fuzes are -40° to +140° F (-40° to +60° C) and 0° to +120° F (-18° to +49° C) for M513 series.

NOTE

Do not attempt to set fuze until just before firing.

Use of M5 desensitizing fuze cap to lower height ofM513 series fuzes is at the option of the artillery officer. Desensitizing fuze caps are assembled to the fuze just before firing.

(5) The removal of the supplementary charge is not required to install the M732 short intrusion VT fuze.



WARNING

To avoid accidental functioning of PD element inM548 and M564 fuzes, do not drop, roll, or strike fuzes under any circumstances (packaged, unpackaged, or assembled to the projectile); mishandling could cause injury or death to personnel.

(1) Set M548 or M564 fuzes for superquick action (impact) as follows:

NOTE

Do not set M548 fuze on S for impact (PD) action. Set fuze for 90 seconds. These fuzes are shipped with the S on the lower cap alined with the 0 on the vernier scale.

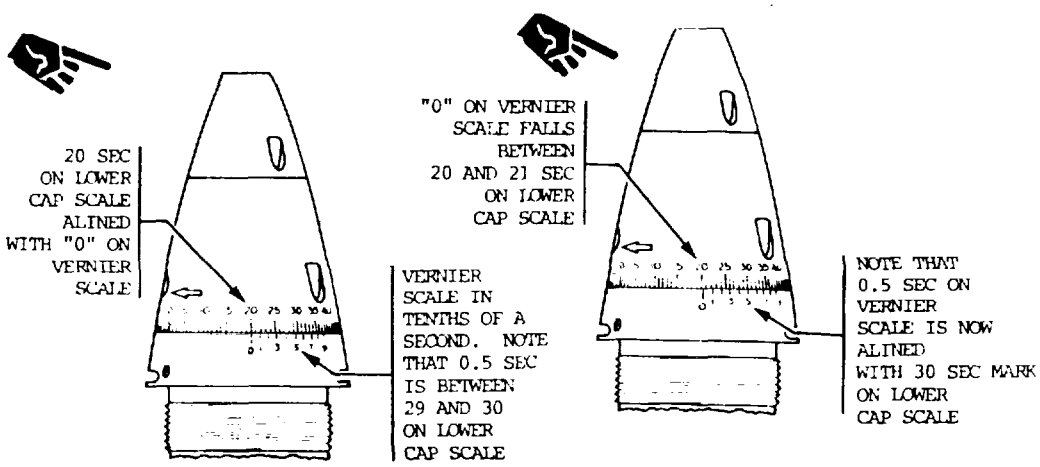
The date of manufacture is stamped on the M564fuze body. M564 fuzes manufactured before 1970must be set on 90 seconds if superquick action(impact) is desired.M564 fuzes manufactured from January 1970 on should be set on S for superquick action.

(a) M564 fuzes manufactured in January 1970 and later: set fuze on S as shipped for superquick action. Always be sure the S on lower cap is alined with the 0 on vernier scale.

(b) M548 and M564 fuzes manufactured before January1970: use M34 fuze setter to rotate lower cap in direction of the arrow (clockwise) from safe (S) position to the 90.0-secondsetting.

4-10. FUZE SETTING PROCEDURES FOR THE M102 HOWITZER (cont)

e. Procedure No. 4, M563, M564, m565, and M548 Fuzes. (cont)



(2) Set M563, M564, M565, and M548 fuzes for airburst (time) as follows:

WARNING

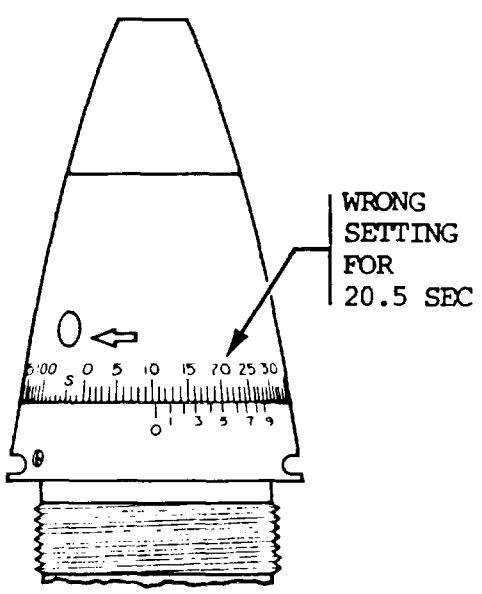
Incorrect settings of MT and MTI'SQ fuzes can and have resulted in downrange prematures.

NOTE

The M563 fuze is set MA (muzzle action), or on the time setting desired for the intended range. Refer to dispersion patterns on page 4-3 before settingM563 fuze.

(a) To set M548, M563, M564, or M565 fuze for a whole-second time setting, use M34 fuze setter to rotate lower cap in the direction of the arrow (clockwise), until whole number of seconds (i.e., 20.0 seconds) is alined with0 mark engraved on vernier scale.

(b) To set M564, M565, or M548 fuze for a tenth of a whole second (i.e., 20.5 seconds), use the M34 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 slightly rotate lower cap in direction of arrow until adjacent upper right graduation on lower cap scale(in this example, the 30 second mark) is alined with desired tenth of a second mark on vernier scale (30 second mark on lower cap scale is now alined with 0.5 second mark on vernier scale).



NOTE

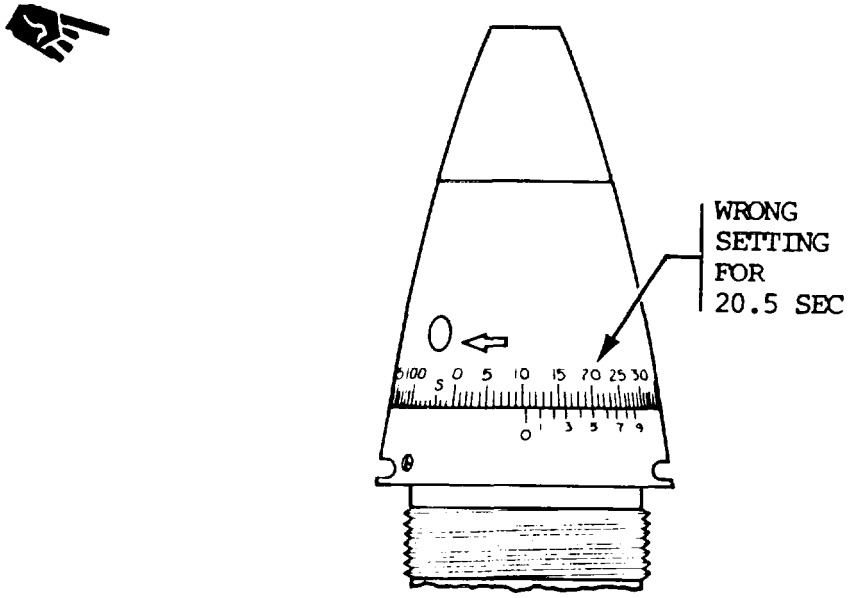
The fuze setting is always indicated by the position of the "0" on the vernier scale. Each vertical mark on upper body (removable portion of fuze)represents one whole second of time. For other than whole-second settings, 0 on lower cap (nonremovable portion of the fuze) must always be to right of whole-second portion of desired fuze setting, and between whole second portion of desired fuze setting and next 1-second vertical mark (i.e., 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 above. 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.

4-10. FUZE SETTING PROCEDURES FOR THE M102 HOWITZER (cont)

e. Procedure No. 4, M563, M564, m565, and M548 Fuzes. (cont)

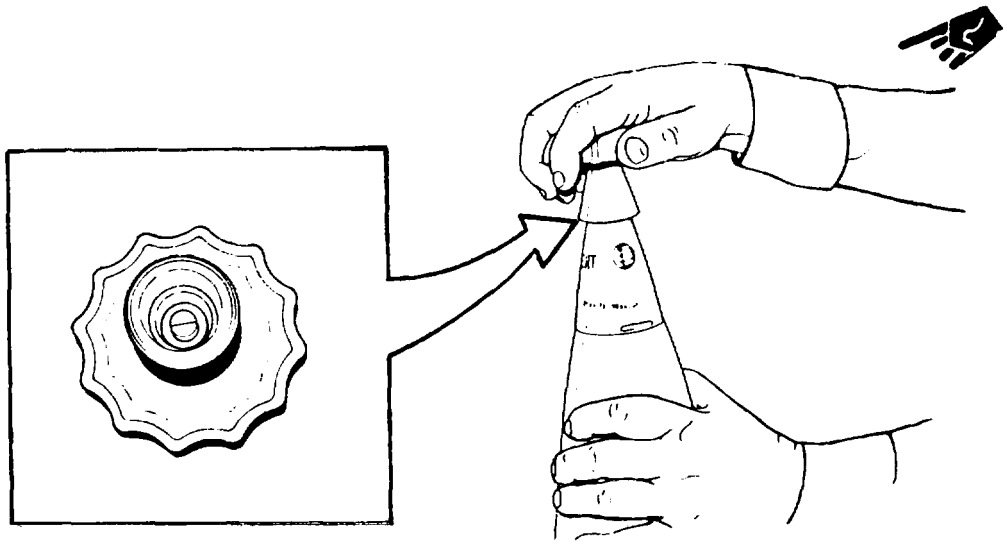


(3) If you miss the setting, reset fuze using M34 fuze setter and turn lower cap in the opposite direction (counter-clockwise) 2 or 3 seconds below desired setting. Then rotate lower cap in direction of arrow (clockwise) and set fuze on the correct time.

(4) If prepared for firing, but not fired, reset fuze using M34 fuze setter and turn lower cap in direction of the arrow (clockwise) until S mark on the fuze lower cap is alined with 0 mark on vernier scale (MA on the M563 fuze).

(5) If these fuzes are fired during heavy precipitation(rain, sleet, snow, or hail), occasional downrange premature functioning may occur. The precipitation necessary to cause malfunctioning is comparable to a heavy downpour which occurs during a summer thunder shower. The premature rate will vary with the charge fired and the density of the precipitation.

f. Procedure No. 5, Fuzes, M577 Series and M582 Series. The slotted setting key on the nose of the fuze is used for setting the fuze in the following steps:



(1) Press the open end of M35 fuze setter against the setting key.

(2) Turn the knob handle of the fuze setter counter-clockwise, as viewed from the nose end, until the fuze-setterblade6engages fuze-setting key slot. The hairline in the window is used for all settings.

NOTE

The M577 series or M582 series fuze is set to de-sired time by rotating the fuze setter in a counterclockwise direction. To return to shipping and storage setting, the fuze setter must be rotated in a clockwise direction.

DIRECTION OF SETTING OR RESETTING FUZE M577 SERIES OR M582 SERIES

COUNTERCLOCKWISE	CLOCKWISE
SHIPPING AND STORAGE SETTING (◀ 93.5 TO ◀95.5)	1/4 TURN
PD SETTING (◀ 98.0)	1/4 TURN
001 SECONDS	1/4 TURN
200 SECONDS	20 TURNS

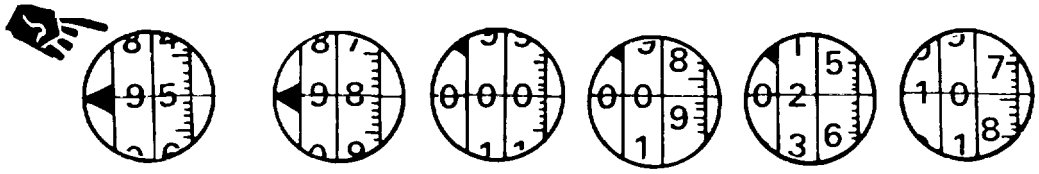
e. Procedure No. 4, M563, M564, m565, and M548 Fuzes. (cont)

CAUTION

Do not attempt to set these fuzes below ⇐ 93.5 when setting them in the clockwise direction or above200 seconds when setting them in the counter clock-wise direction. The settings of 000 and/or 200 are not authorized service settings.

(3) When setting the fuze for PD action (superquick), start with shipping and storage position (safe) (⇐ 93.5 to ⇐ 95.5); then turn counterclockwise to ⇐ 98.0 under the hair-line window for PD action.

FUZE SEITING SEQUENCE FOR M577 SERIES OR M582 SERIES FUZES



A STORE (SAFE) B PD C 000.0 D 8.7 E 25.5 F 107.4

(4) To set the fuze for mechanical time action, turn the fuze setter counterclockwise from safe position (⇐ 93.5 to⇐ 95.5) past PD (⇐ 98.0), until the triangle (4) (⇐)moves off the hairline. This action occurs near a 000 setting. Continue to turn fuze setter counterclockwise until desired time appears under the hairline. Maintain a very light turning force against the fuze setter while reading the setting. The sequence is illustrated above for settings of 8.7, 25.5, and 107.4.

(5) To set a lower time on fuze already set, reseat fuze setter and turn clockwise (numbers get smaller) to a setting at least one second lower than the required setting (for example, at least 24.5 for 25.5). Reverse direction to counter-clockwise (numbers get larger) and set required time under the hairline.

(6) To return fuze to the shipping and storage (safe) position, turn the fuze setter clockwise (numbers get smaller)until 000 is passed, and continue to turn until 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 the fuze to the reuseable fuze container.

(7) For special preparation for M577 series fuze, perform the following procedure. Inspect the fuze setting. The fuze will be considered unserviceable if the setting is not between ⇐ 93.5 and ⇐ 95.5, the fuze shows signs of damage, or the window is blackened or sooty inside.

(8) Firing temperature limits for M577 series and M582 series MTSQ fuzes are -35° to +145°F (-37° to +63° C).

g. Procedure No. 6, Fuzes, M762 and M767. 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 elapse. Once activated, these fuzes have a service life of approximately 15 days before the battery runs down. Check if ILD 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 indi-cated, 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 liquid crystal dis-play (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 ⇐ while the tens of seconds, seconds, and tenths of seconds columns each can display 0 through 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

4-10. FUZE SETTING PROCEDURES FOR THE M102 HOWITZER (cont)

g. Procedure No. 6, Fuzes, M762 and M767 (cont).

button depressed and rotate the ogive to select the desired digit or ⇐. Release the selector button and depress again to move cursor to the next column to continue setting.

(e) For PD, set the Fuze to ⇐ 98.0.Any other setting with ⇐ would result in a dud.

(f) The following are examples of fuze settings.

⇐ 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.

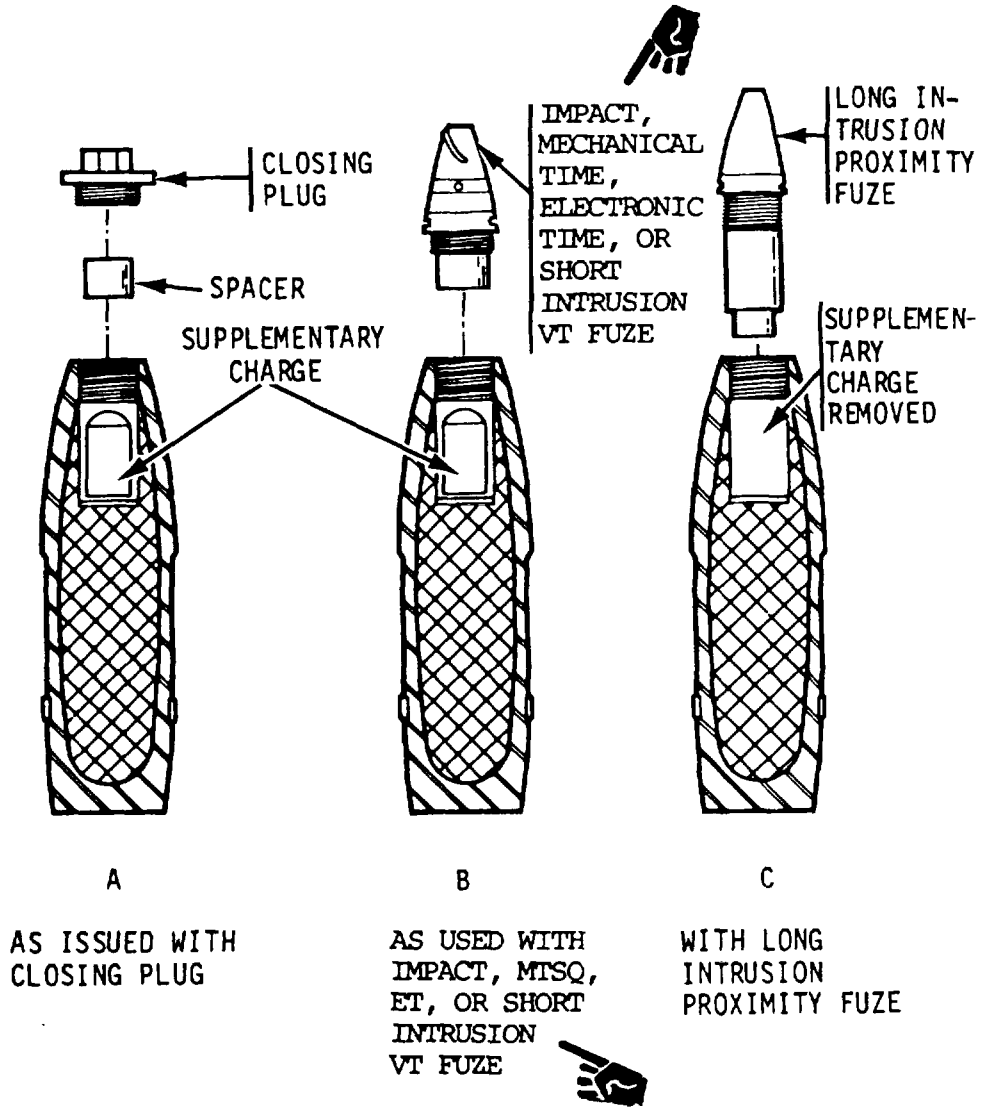
(h) The settings can be changed as many times as required for the duration of the activated life of the battery.

(2) Auto setting is accomplished via an inductive datalink between the fuze and a weapon equipped with an auto-set fire control system. The desired fuze setting is input in the setter console and the transmit button is depressed. The fuze will be remotely activated and set and the console will dis-play the actual fuze setting as a safety feature.

(3) To return fuze to the shipping and storage configuration, reset the fuze to ⇐ 88.8. These fuzes should be segregated and used first in subsequent firings.

(4) Firing temperature limits for M762 and M767 ET fuzes are -25° to 110°F (-32° to +43°C).

TYPICAL DEEP-CAVITY PROJECTILES



NOTE

The supplementary charge must be left in the projectile when firing short intrusion fuzes. The supplementary charge must be removed when firing the long intrusion VT fuzes.

4-11. PREPARING PROPELLING CHARGE

WARNING

Fire complete round only with projectile, cartridge case, and propelling charge type as originally packed.

a. General. Cartridges with an adjustable (semifixed)propelling charge have the charge divided into increment charges. When the cartridges are fired full charge, the charge is used as issued. When other than full charge is to be fired, adjust the propelling charge as indicated in paragraph 4-11b.

CAUTION

Under no conditions will the fixed charge of the HEP, HEP-T, and TP-T cartridges be altered. Maximum penetration of armored targets is secured with the fixed charges furnished.

b. Procedure For Preparing M67 Propelling Charge.

(1) Remove projectile from cartridge case, being careful not to damage lip of case (otherwise, cartridge may jam in chamber of M137A1 cannon).

(2) Withdraw increments from cartridge case. Excess powder increments will be disposed of as directed by the section chief.

(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 four, discard increments five, six, and seven, and assemble remaining increments one, two, three, and four in cartridge case.

NOTE

Insofar as the propelling charge is concerned, the cartridge is now ready for firing after it has been mated to the case and loaded into the powder chamber.

If the M548 HERA 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.

4-12. PROCEDURE FOR LOADING

WARNING

Do not reuse cartridges which have been ejected 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.

a. Ensure round is clean.
b. Ensure that there are no obstructions in the M137A1 cannon.

c. Remove fuze safety devices after assembling projectile to cartridge case and just before loading projectiles into the weapon.

d. Load, taking care not to strike the fuze against the weapon.

e. Do not fire an unfuzed round.

NOTE

The mouth of the M14B2 (M14E1) cartridge case can be expanded slightly by uncoiling, making it easier to insert the projectile. However, if the loader is not careful to grasp the projectile at its center of balance the lip may protrude enough to catch on the lip of the lower extractor recess making it impossible to chamber the round.

4-13. EXCESSIVE PRESSURE IN M137A1 CANNON

Observe the following precautions to prevent excessive pressure in the M137A1 cannon:

a. Do not load or fire ammunition which is at a temperature above safe limits for firing.

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.

4-14. DUDS

Do not touch, move, or otherwise handle duds; their fuzes may be armed. Have duds destroyed in place by authorized personnel only.

4-15. FIRING TABLES

Firing table 105-AS-3 provides firing data for ammunition fired in the M137Aicannon, except as indicated: Round M444-Firing table 105-ADD-F-1.

4-16. 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.

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 M137A1 cannon and slowly move the breechblock to its open position.

(2) Remove the cartridge case and charge.

(3) Fill the chamber with a shock-absorbent material and close the breech.

(4) Assemble the ramming and extracting tool head to the assembled cleaning staff sections.

(5) Insert the ramming and extracting tool head into the muzzle until it fits around the fuze of the projectile. Then push or, if necessary, tap the staff until the projectile is dislodged from its seat.

(6) Open the breech, remove the shock-absorbent material, and carefully remove the 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.

(1) Using applicable setter and procedure (table 4-5, p4-21), 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 firings. When the battery runs down on an activated M762/M767 fuze, the LCD goes blank. These fuzes are unserviceable and should be packed separately, marked unserviceable, and turned in to the ammunition supply point (ASP).To determine if an M762/M767 fuze has been activated and run down, gently attempt to turn the ogive clockwise by hand without depressing the selector button. If the ogive turns easily, the fuze has been activated. A fuze that has not been activated should resist the applied torque.

(2) Replace safety wires, remove fuze, and replace in original packing.

(3) Disassemble cartridge case and replace projectile and cartridge case in original packing.(See para 4-18.)

4-17. AMMUNITION FORMS AND RECORDS

Record the number of rounds by types fired on DA Form 2408-4. This must be done on a daily basis when fired.

Section III. MAINTENANCE OF AMMUNITION

4-18. 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.

4-18. MAINTENANCE OF AMMUNITION (cont)

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 (e.g., the direct rays of the sun).

b. Handling.

(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, 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 at all times from foreign matter and impact.

(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.

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 as a result of 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) Repackage serviceable ammunition in original containers, ensuring that all material is dry and sound. If original container is unsuitable, use expended 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 the components, make sure the supplementary charge is properly inserted (felt-pad end innermost). When necessary, plastic nose plugs can be reused. Secure loose plugs with tape.

(3) Unserviceable ammunition.

(a) Conspicuously mark unserviceable ammunition or explosive components UNSERVICEABLE, and return to ammunition supply personnel for disposition.

(b) Repackage the ammunition in original containers. If original container is unsuitable, use expended packing material and transfer all markings. All layers of packing must be conspicuously marked UNSERVICEABLE.

(4) Excess explosive components. Pack supplementary charges removed from projectiles prior to 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.

4-18. MAINTENANCE OF AMMUNITION (cont)

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 tetrytol-loaded bursters (e.g., cartridges, 105-mm: Smoke, WP, M60; gas, H and HD, persistent, M60) at temperatures exceeding +125°F(51.7°C).

NOTE

Ammunition assembled with bursters containing COMPB5 can be stored at temperatures up to +145°F(62.80C).

(1) Temperature limits.

(a) Except as otherwise specified, observe the following limits: Lower limit: -80°F(-62.2°C) for periods of not more than three days; upper limit: +160°F(71.1°C) for periods of not more than four hours per day.

(b) Store or transport projectiles containing WP at temperatures below the melting point (+111.4°F (44.1°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-fuzed rounds from long exposure to high humidity. Observe the following temperature limits:

Lower Limit	Upper Limit
-20°F (-28.90C)	+130°F (54.4°C) (M513, M513B1)
-40°F (-40 C)	+130° F (54.4°C) (M513A1)
-60°F (-51.110C)	+160°F (71.1°C) (M513A2)
-40°F (-400C)	+140°F (60°C) (M728, M732)

(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 inches 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 (e.g., tarpaulin) for all ammunition. Maintain an air space of approximately 18 inches between the cover and the ammunition. Keep the cover at least 6 inches 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.

APPENDIX A

REFERENCES

A-1. DEPARTMENT OF THE ARMY (DA) FORMS

DA Form 2028-2 ..... Recommended Changes to Equipment Technical Publications

DA Form 2404..... Equipment Inspection and Maintenance Worksheet

DA Form 2408-4 ..... Weapon Record Data

A-2FIELD MANUALS (FM)

FM 3-87 ..... Nuclear, Biological, and Chemical Reconnaissance and Decontamination Operations

FM 6-50 ..... The Field Artillery Cannon Battery

FM 9-207 ..... Operation and Maintenance of Ordnance Materiel in Cold Weather (O to -650F)

FM 21-11 (TEST .....)First Aid for Soldiers

FM 21-15 ..... Care and Use of Individual Clothing and Equipment

FM 21-40 ..... NBC (Nuclear, Biological and Chemical) Defense

FM 31-70 ..... Basic Cold Weather Manual

FM 31-71 ..... Northern Operations

FM 55-450-1 ..... Army Helicopter External Load Operations

FM 55-450-2 ..... Army Helicopter Internal Load Operations

A-3. TECHNICAL MANUALS (TM)

TM 3-4230-204-12&P..... Operator's and Organizational Maintenance Manual for Decontamination Apparatus Portable: DS-2

TM 9-1000-202-14 ..... Operator's, Organizational, Direct Support, and General Support Maintenance Manual for Evaluation of Cannon Tubes

TM 9-1015-234-10-HR ..... Hand Receipt Manual Covering Basic Issue Items (BII) and Additional Authorization List (AAL) Related to Howitzer, Light, Towed: 105-MM, M102

TM 9-1290-359-12&P..... Operator and Organizational Maintenance Manual for the M90 Radar Chronograph

TM 9-238 ..... Deepwater Fording of Ordnance Materiel

TM 9-4931-710-14&P Operator, Organizational, Direct Support, and General Support Maintenance Manual for Alignment Device M139 and M140 with Case

TM 11-5820-882-10..... Operator's Manual; Radio Set, AN/PRC-68

TM 11-7440-283-12-1..... Operator's and Organizational Maintenance Manual; Computer, Gun Direction CP 1317/GYK-29

TM 11-7440-283-12-2..... Operator's and Organizational Maintenance Manual; Data Display Group OD-144/GYK-29

TM 43-0001-28..... Army Ammunition Data Sheets for Artillery Ammunition: Guns, Howitzers, Mortars, Recoilless Rifles, Grenade Launchers, and Artillery Fuzes (FSC 1310, 1315, 1320, 1390)

TM 43-0001-28-10 Artillery Ammunition: Authorized Projectile, Fuze and Propelling Charge Combinations for Howitzer, Light, Towed, 105-mm: M101, M1O1Al, and M102

A-4. OTHER

AR 25-30.....	The Army Integrated Publishing and Printing Program
CTA 8-100	Army Medical Department Expendable/Durable Items
CTA 50-970.....	Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items)
DA PAM 738-750 Management Update	The Army Maintenance Management System (TAMMS), as contained in Maintenance
SF Form 368.....	Quality Deficiency Report
TB 9-1300-385	Munitions, Restricted or Suspended
10 CFR Part 19	Notices, Instructions and Reports to]0/ C ~ k Pat 19 Workers; Inspections
10 CFR Part 20	Standards for Protection Against Radiation

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APPENDIX B

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

Section I. INTRODUCTION

B-1. SCOPE

This appendix lists components of end item and basic issue items for the M102 howitzer to help you inventory items required for safe and efficient operation.

B-2. GENERAL

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

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

b. Section III. Basic Issue Items. These are the minimum essential items required to place the M102 howitzer in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the M102 howitzer during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to identify items. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end item.

B-3. EXPLANATION OF COLUMNS

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

a. Column (1) - Illustration Number (IIlus Number). This column indicates the number of the illustration in which the item is shown.

B-3. EXPLANATION OF COLUMNS (cont)

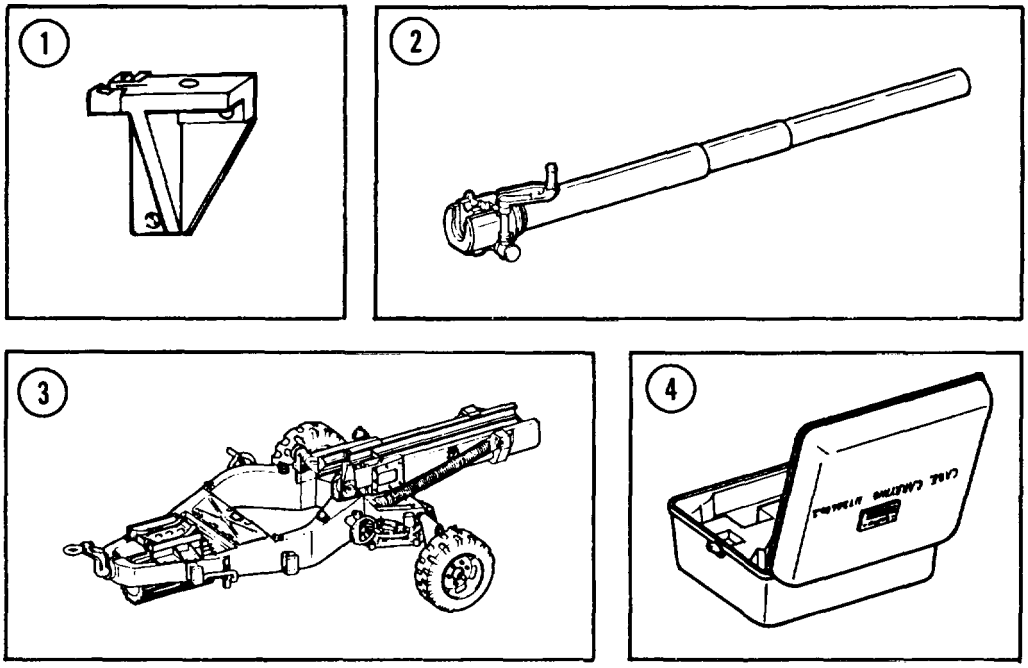
b. Column (2) - National Stock Number. Indicates the National Stock number assigned to the item and will be used for requisitioning purposes.

c. Column (3) - Description. Indicates the Federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.

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

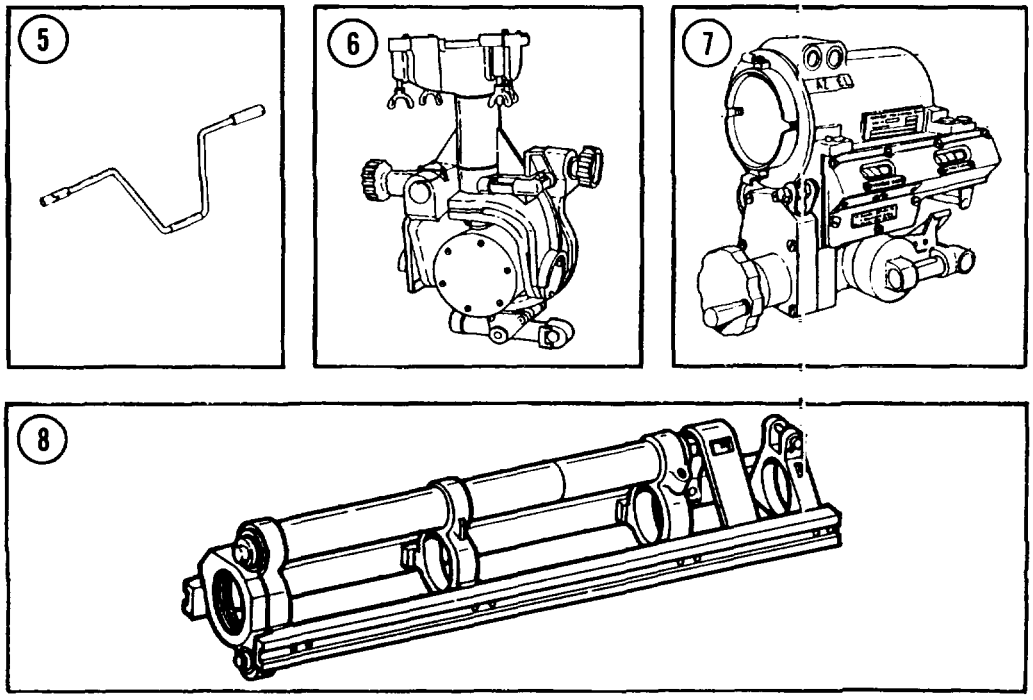
e. Column (5) - Quantity required (Qty reqd). Indicates the quantity of the item authorized to be used with/on the equipment.

Section II COMPONENTS OF END ITEM

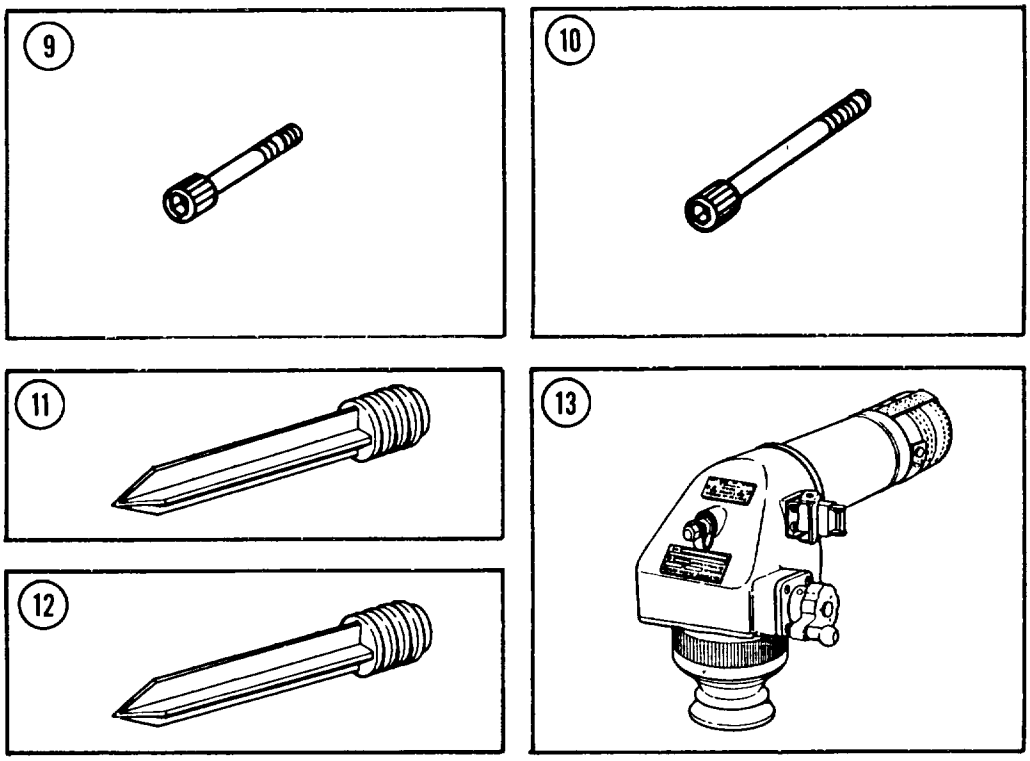


(1) Illus Num-ber	(2) National Stock Number	(3) Description FSCM and Part Number	(4)(5) U/M	Qty reqd
1	1290-01-127-7816	BRACKET, ANTENNA MOUNTING: (19200) 11785066	EA1	
2	1015-00-927-9421	CANNON, 105MM HOWITZER, M137A1: (19206) 11577648	EA1	
3	NA	CARRIAGE, 105MM HOWITZER, M31: (19204) 8433200	EA1	
4	1015-01-028-4582	CASE, CARRYING: (19200) 11729600-2	EA1	

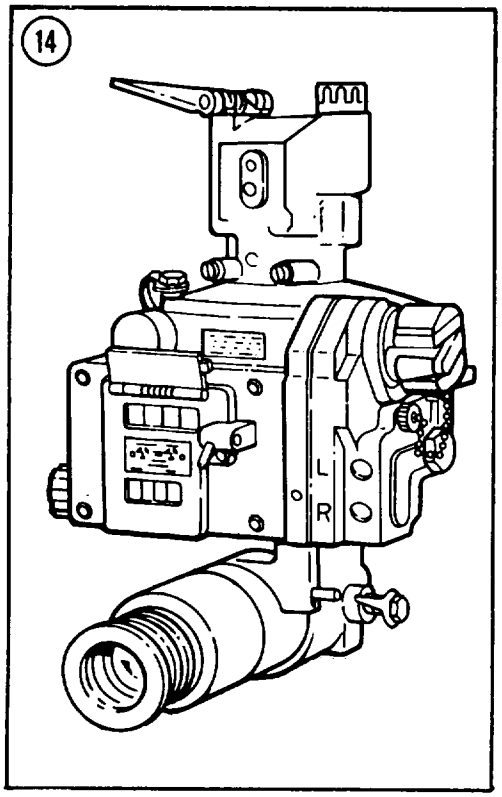
COMPONENTS OF END ITEM (cont)

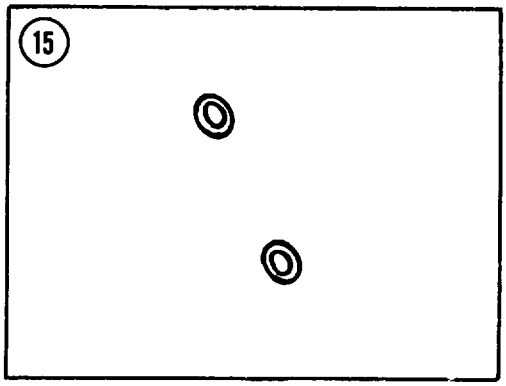


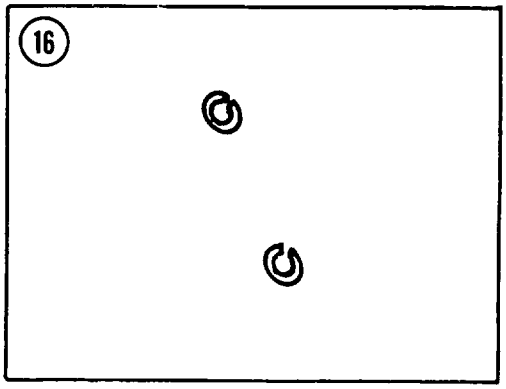
(1) Illus Num-ber	(2) National Stock Number	(3) Description FSCM and Part Number	(4)(5) U/M	Qty reqd
5	1015-00-073-5372	CRANK ASSEMBLY: (19204) 8432902	EA	1
6	1240-00-150-8890	MOUNT, TELESCOPE, M134A1: (19200) 10553215	EA	1
7	1290-00-150-8891	QUADRANT, FIRE CONTROL, M14A1: (19200) 11730915	EA	1
8	1015-00-316-0251	RECOIL MECHANISM, 105MM HOWITZER, M37A1: (19204) 12000725	EA	1



(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty reqd
9	5305-00-983-7466	SCREW, CAP, SOCKET HEAD: (96906) MS16997-148	EA	1
1	05305-00-958-7483	SCREW, CAP, SOCKET HEAD: (96906) MS16997-151	EA	2
11	1015-00-987-8738	STAKE, CARRIAGE: 24-in. long (19204) 8436590	EA	8
12	1015-00-658-0794	STAKE, CARRIAGE: 38-in. long (19204) 8436773	EA	4
13	1240-00-150-8889	TELESCOPE, ELBOW, M114A1: (19200) 11730285	EA	1

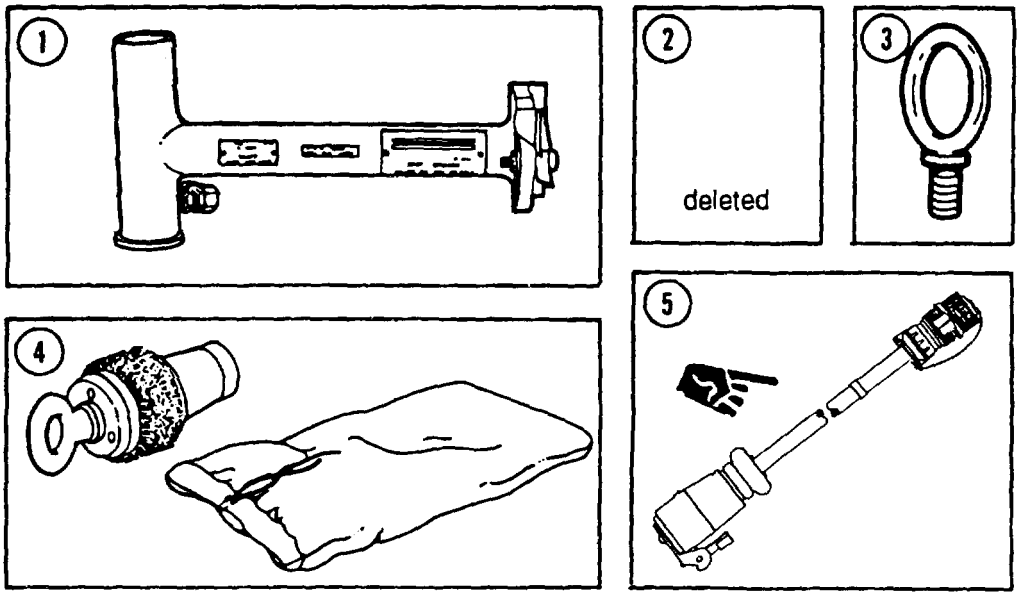




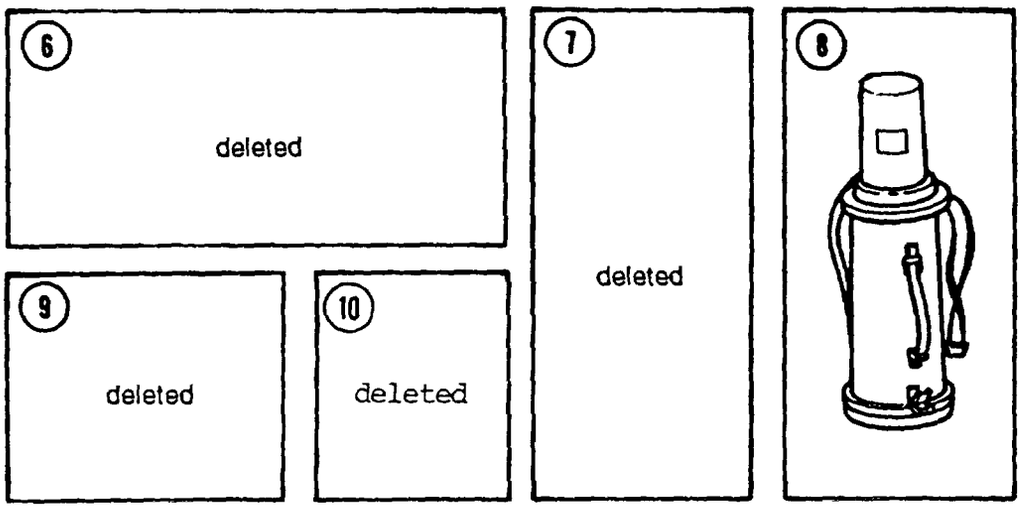


(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty reqd
14	1240-00-150-8886	TELESCOPE, PANORAMIC, M113A1: (19200) 11730267	EA	1
15	5310-00-767-9425	WASHER, FLAT: (96906) MS15795-818	EA	3
16	5310-00-933-8778	WASHER, LOCK: (96906) MS35338-143	EA	3

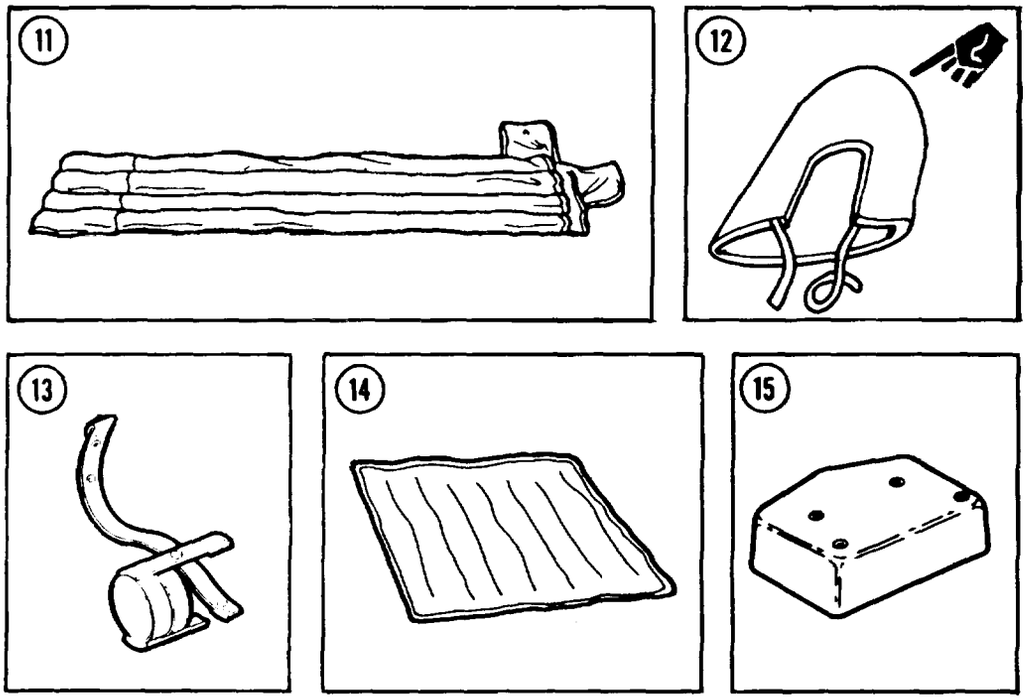
Section III. BASIC ISSUE ITEMS



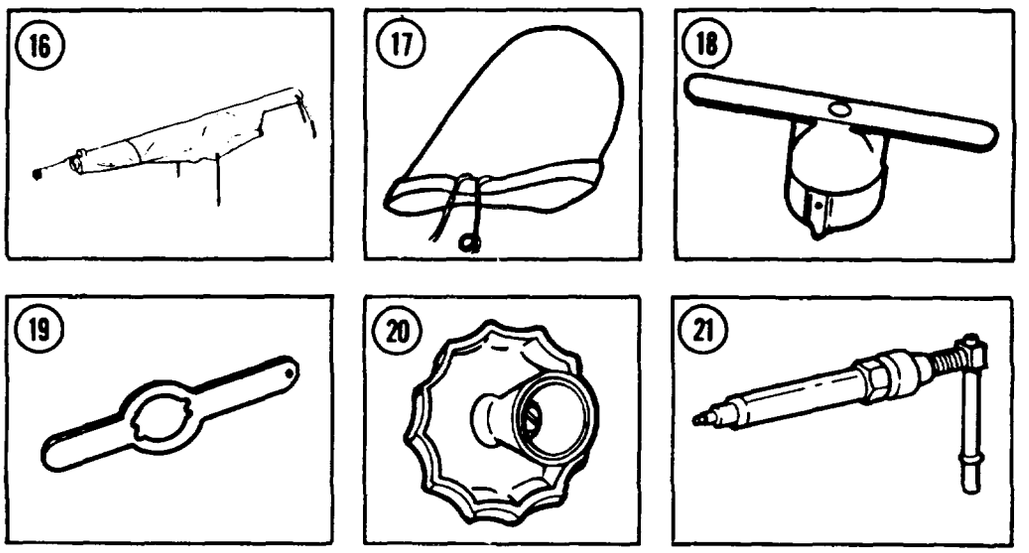
(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY AUTH
1	4931-00-341-5119	ALINEMENT DEVICE: M140 (radioactively illuminated) (19200) 11741648-2		EA	1
2		DELETED			
3	5306-00-017-6140	BOLT, EYE (96906) MS51937-7		EA	1
4	1015-01-196-2175	BRUSH AND BAG ASSEMBLY (27412) 105-110-401		EA	1
5	1015-01-130-5949	CABLE ASSEMBLY (19200) 9334051		EA	1



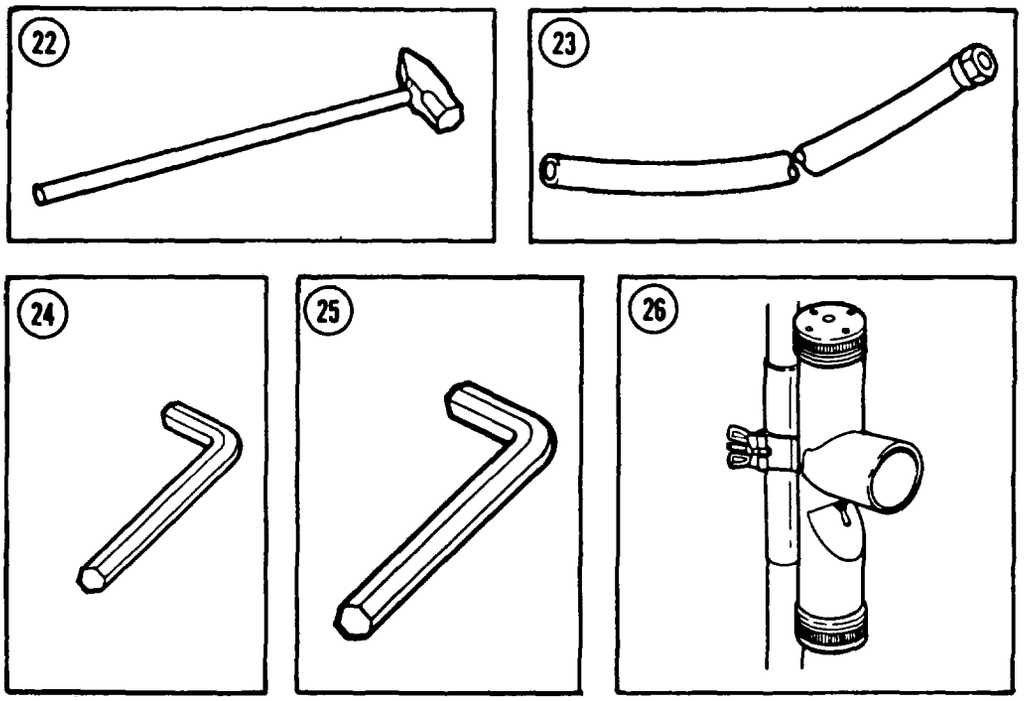
(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY AUTH
6		DELETED			
7		DELETED			
8	1240-00-332-1780	COLLIMATOR, INFINITY AIMING: MIA1 (radio-actively illuminated) (19200) 10556235		EA	1
9		DELETED			
10		DELETED			



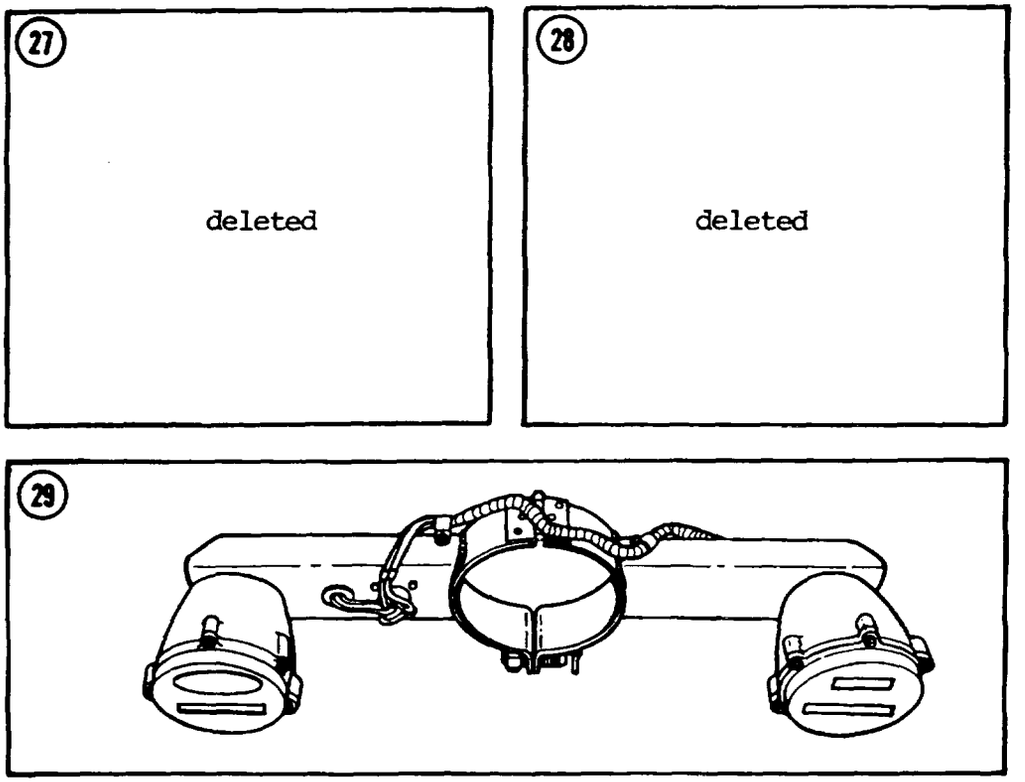
(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY AUTH
11	1290-00-653--7993	COVER, AIMING POST: M401 (19200) 6537993		EA	1
12	1240-00-003-8416	COVER, FIRE CONTROL: (quadrant and elbow telescope) (19200) 10548610		EA	1
13	1240-00-084-0280	COVER, FIRE CONTROL INSTRUMENT: (M114AI elbow telescope) (19200) 10549868		EA	1
14	1015-00-073-5378	COVER, GROUND (19204) 8433687		EA	1
15	1240-00-469-6657	COVER, MOUNT, TELESCOPE (19200) 11732203		EA	1



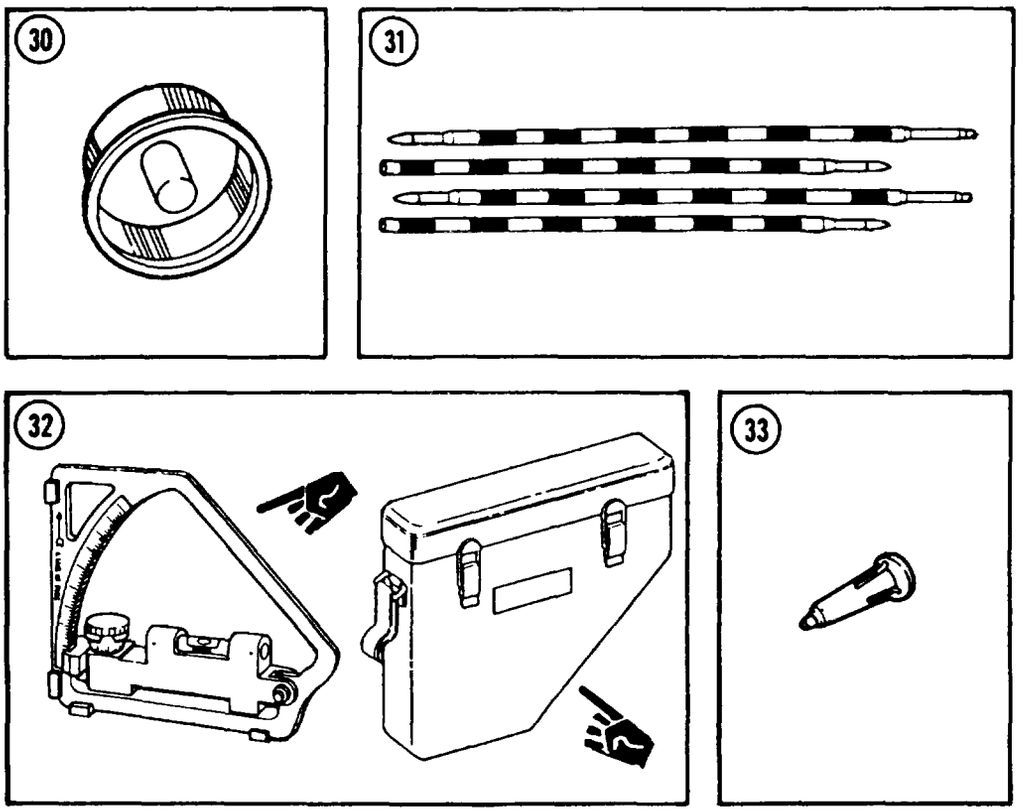
(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY AUTH
16	1015-01-032-0281	COVER, OVERALL (19204) 12000773		EA	1
17	1240-00-498-6358	COVER, TELESCOPE *AND* MOUNT (19200) 11730192		EA	1
18	1290-00-764-7761	FUZE SETTER: M27 (19200) 7647761		EA	1
19	1290-00-078-4367	FUZE SETTER: M34 (19200) 11747300		EA	1
20	1290-00-201-3507	FUZE SETTER: M35 (19200) 11729019		EA	1
21	4933-00-550-6661	GUN: (fluid direct delivery) (19204) 5506661		EA	1



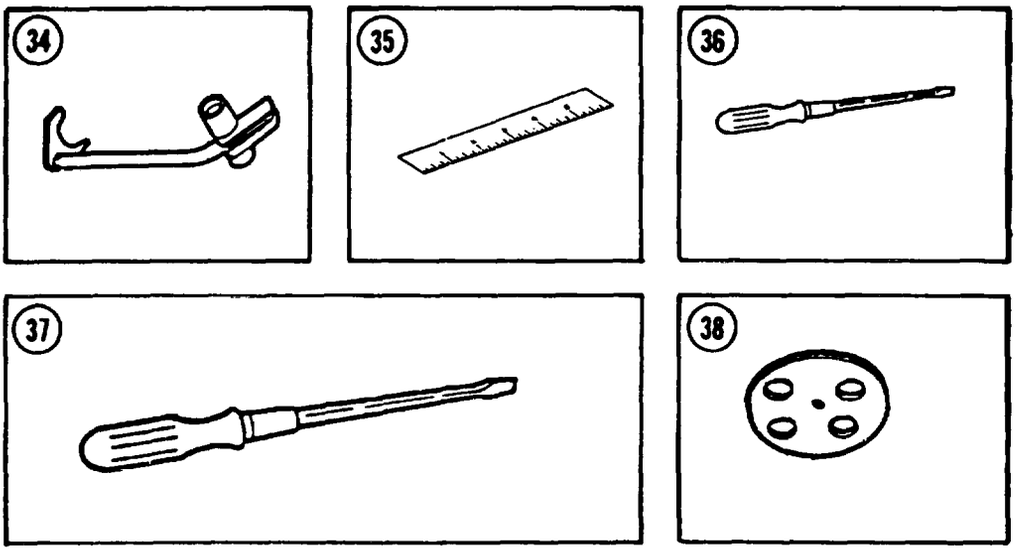
(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY AUTH
22	1015-00-780-4342	HAMMER, SLEDGE (19204) 8433121		EA	1
23	1015-00-832-9972	HOSE ASSEMBLY, RECOIL DRAIN (19204) 8432575		EA	1
24	5120-00-889-2162	KEY, SOCKET HEAD SCREW: 0.11-in. (81348) GGG-K-00275		EA	1
25	5120-00-889-2163	KEY, SOCKET HEAD SCREW: 0.14-in. (81348) GGG-K-00275		EA	1
26	1290-01-148-4821	LIGHT, AIMING POST: M14 (19200) 11785401		EA	2



(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY AUTH
27		DELETED			
28		DELETED			
29	6220-01-366-3689	TAIL LIGHT ASSEMBLY (19204) 12953546		EA	1
		OPERATOR'S MANUAL FOR HOWITZER, LIGHT, TOWED: 105-MM, M102		EA	1

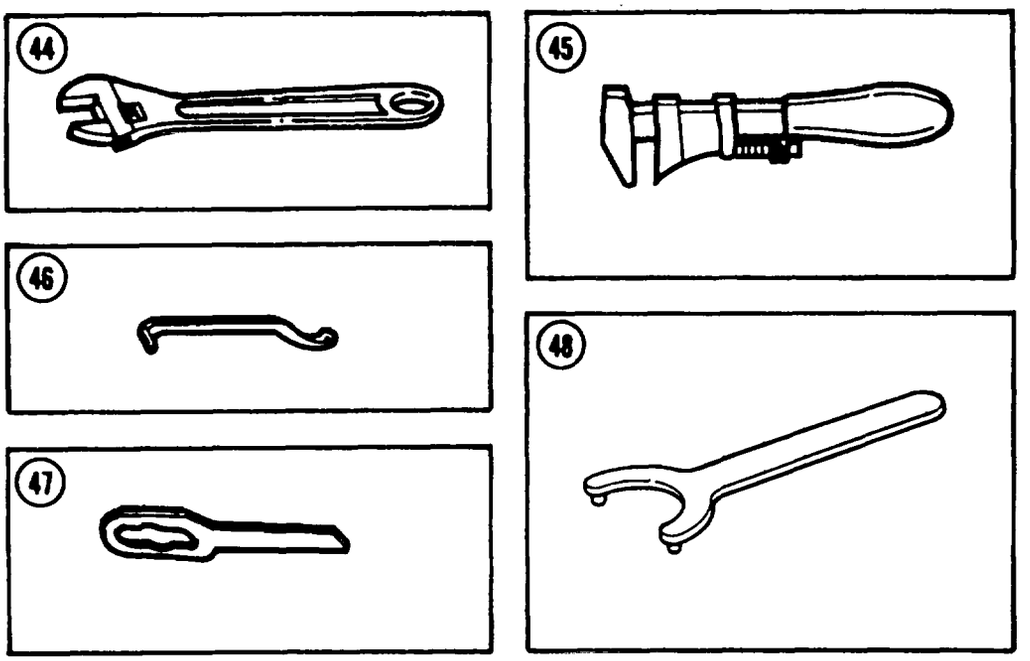


(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY AUTH
30	1015-00-529-5783	PLUG, MUZZLE (19206) 8767157		EA	1
31	1290-00-535-7617	POST, AIMING: M1A2 (19200) 7687114		EA	4
32	1290-00-891-9999	QUADRANT, FIRE CONTROL, GUNNER'S: M1A1 (19200) 7197156		EA	1
33	1015-00-559-1873	RAMMER, ARTILLERY, UNILOADING (19206) 5591873		EA	1



(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY AUTH
34	4933-00-927-7277	RAMMING AND EXTRACTING TOOL (19206) 1157764		EA	1
35	5210-00-234-5223	RULE, STEEL, MACHINIST'S: 6-IN., TYPE 4, CLASS 1, NO. 4 (81348) GGG-R-791		EA	1
36	5120-00-236-2140	SCREWDRIVER, FLAT TIP: 2-in., type 1, class 8, style 2 (81348) GGG-S-121		EA	1
37	5120-00-234-8910	SCREWDRIVER, FLAT TIP: 6-in. (81348) GGG-S-121		EA	1
38	4933-00-723-8954	SIGHT, BORE, BREECH (19206) 7238954		EA	1

(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY AUTH
39	1015-00-780-4340	STAFF ASSEMBLY, CARRIAGE (19204) 8433106		EA	1
40	1015-00-699-0633	STAFF SECTION, CLEANING, ARTILLERY (19206) 7309259		EA	3
41	4933-01-031-7229	TARGET, BORESIGHTING: (used when howitzer has been modified for self luminous fire control) (19204) 12000790		EA	1
42		DELETED			
43		DELETED			



(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY AUTH
44	5120-00-449-8083	WRENCH, ADJUSTABLE: 10-in. (81348) ANSI-B107.8		EA	1
45	5120-00-240-5336	WRENCH, ADJUSTABLE: 12-in. (81348) GGG-W-631		EA	1
46	4933-00-723-0851	WRENCH, FUZE SETTER, COMBINATION: M16 (19206) 7230851		EA	1
47	4933-00-723-1161	WRENCH, FUZE SETTER, COMBINATION: M18 (19206) 7231161		EA	1
48	512()-00-293-0204	WRENCH, SPANNER (81348) GGG-W-665		EA	1

APPENDIX C
ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

C-1. SCOPE

This appendix lists additional items you are authorized for the support of the M102 howitzer.

C-2. GENERAL

This list identifies items that do not have to accompany the M102 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.

C-3. EXPLANATION OF LISTING

National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type of document (i.e., CTA, MTOE, TDA, or JTA) which authorizes the item(s) to you.

Section II. ADDITIONAL AUTHORIZATION LIST

(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number Usable On Code	(4) U/M	(5) QTY AUTH
		CTA 50-970 AUTHORIZED ITEMS		
	5140-00-653-4198	CHEST, TOOL (19204) 6534198	EA	1
	5110-00-156-0054	FILE, HAND (81348) GGG-F-325	EA	1
	5110-00-241-9160	FILE, HAND (81348) GGG-F-325	EA	1
	4933-00-340-1129	FIXTURE AND CASE, GUN TUBE LEVELING (19206) 11578744	EA	1 per btry
	5120-00-061-8546	HAMPER, HAND (81348) GGG-H-86	EA	1
	5110-00-263-0349	HANDLE, FILE (81348) NN-H-00106	EA	2
	5120-00-595-9244	KEY SET, SOCKET HEAD SCREW: 1/16, 5/64, 3/32, 1/8, 5/32, 3/16, 7/32, 1/4, 5/16, 3/8 in. (81348) GGG-K-275	SE	1
	4930-00-250-8038	LUBRICATING GUN, HAND (81349) MIL-G-3859	EA	1
	4930-00-262-8868	OILER, HAND: 13-in. Flexible spout, 1-pt (0.47-1) (81348) GGG-0-591	EA	1
	5110-00-239-8253	PLIERS, DIAGONAL CUTTING: pe 1 class 1 (81348) GGG-P-468	EA	1

(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY AUTH
	5120-00-408-1434	PLIERS, RETAINING RING: size 2, type 2, class 2, style B (81348) GGG-P-00480		EA	1
	5120-00-223-7397	PLIERS, SLIP JOINT (81348) GGG-P-471		EA	1
	5120-00-240-6104	PUNCH, DRIVE PIN: 5/32 IN. PT DIA, 13/16 IN. PTr LG (81348) GGG-P-831		EA	1
	5120-00-242-5966	PNCH, DRIVE PIN: 1/8 IN. PT DIA, 3/4 IN. PT LG; (81348) GGGP-831		EA	1
	4933-00-939-0543	REMOVER, PLUNGER BUSHING, FIRING (19206) 11577251		EA	1
	4933-00-796-4537	ROLL ASSEMBLY, TOOL AND EOUIPMENT (19207) 7964537		EA	1
	5120-00-240-8716	SCREWDRIVER, CROSS TIP: 3-in., type VI, class 1, style 1 (81348) GGG-S-121		EA	1
	5120-0- 2 34-891 3	SCREWDRIVER, CROSS TIP: 4-in., type VI, class 1 (81348) GGG-S-121		EA	1
	5120-00-596-8502	SCREWDRIVER, FLAT TIP: 1-1/2-in., type 1, class 3 (81348) GGG-S-121		EA	1

ADDITIONAL AUTHORIZATION LIST (cont)

(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number Usable On Code	(4) U/M	(5) QTY AUTH
	5120-00-892-5931	SCREWDRIVER, RATCHET: 3.88-in. (81348) GGG-S-1408	EA	1
	1015-00-300-7907	STAKE, GUN PLATFORM, 105-MM: 15-in. (Required only when weapon is emplaced on rocky or frozen ground.) (19204) 12000736	EA	4
	6685-00-344-4603	THERMOMETER, SELF-INDICAT/NG, BIMETALLIC (81349) MIL-T-3618C	EA	1
	6675-00-240-1881	TRIPOD, SURVEYING: (Required only when aiming post M1 series is issued for arctic use.) (81349) MIL-T-11674	EA	2

APPENDIX D
EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

D-1. SCOPE

This appendix lists expendable supplies and materials you will need to operate and maintain the M102 howitzer. This listing is for informational purposes only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items), or CTA 8-100, Army Medical Department Expendable/Durable Items.

D-2. EXPLANATION OF COLUMNS

a. Column (I)--Item number. This number is assigned to the entry in the listing.

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

C.....Operator/Crew

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

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

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

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	C	8105-00-269-4662	BAG, PLASTIC, 20 x 25 in. (50.8 x 63.5 cm) (81349) MIL-B-117	EA
2		8135-00-292-9728	BARRIER MATERIAL, GREASE PROOFED-WATERPROOFED, FLEXIBLE, moldable, self-adhering, hvy duty, 36-in. (91.44-cm)wide, *100-yd* (91.44-m) roll (81349) MIL-B-121	RO
3	C	6135-01-036-3495	BATTERY,NON-RECHARGE (80058) BA-5590/U	EA
4	C	6135-00-120-1020	BATTERY (1) NONRECHARGE-ABLE, 1.5 V, no. BA-30 type, pkg of 24 96906) MS75059	EA
5		7920-00-255-7536	BRUSH, CHASSIS AND RUN-NING GEAR, 19.50-in. (49.53-cm) long, 2.50-in. (6.35-cm) wide, w/wood handle (81348) H-B-181	EA
6		7920-00-205-2401	BRUSH, CLEANING, TOOL AND PARTS, round,1.062-in. (2.70-an) diam;brush 2.875-in. (7.30-cm)long (81349) MIL-S-43871	EA
7	C	8020-00-242-7266	BRUSH, PAINT, flat, sq-edge, hog bristle, 3.00-in. (7.62-cm) wide, 3.250-in. (8.26-cm) long, 0.875-in. in. (2.22-ancm) stock, class 1, grade B, 3.00-in. size (81348) H-B-420	EA

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
8	C		CHALK, MARKING, round tapered, box of 144	
		7510-00-223-6700	blue	BX
		7510-00-223-6701	white	BX
			(81348) SS-C-255	
9	C		CLEANER, LUBRICANT, PRESERVATIVE (CLP)	
		7930-01-M24-7971	(65983) 508-501-9901	PT I
		9150-01-053-6688	1-gal. (3.79-1) bottle	GL
			(81349) MIL-L-63460	
10	C	6850-00-227-1887	CLEANING COMPOUND, OPTICAL LENS, liquid, 1-qt (0.95-1) bottle (81349) MIL-C-43454	QT
11	C	6850-00-224-6663	CLEANING COMPOUND, RIFLE BORE (RBC), solution type, 1-gal. (3.79-1) can (81349) MIL-C-372	GL
12	C	6850-00-597-9765	CLEANING COMPOUND, SOLVENT, solution type, 1-gal. (3.79-1) can (81348) O-C-1889	GL
13	C	5350-00-221-0872	CLOTH, ABRASIVE, crocus, SH jean-cloth backing, 9x11 sheet (81348) P-C-458	
14			DELETED	

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (cont)

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
15	C	8010-00-111-7937	ENAMEL, forest green 1-gal. (3.79-1) can (81349) MIL-E-52798	GL
16	C		GREASE, AIRCRAFT, GENERAL PURPOSE (GPG)	
		9150-00-944-8953	1-lb (0.45-kg) can	CN
		9150-00-145-0268	5-lb (2.27-kg) can (81349) MIL-G-81322	LB
17	C		GREASE, AUTOMOTIVE AND ARTILLERY (GAA), -65° to +225°F (-54° to +1070C) effective	
		9150-00-190-0905	5-lb (2.27-kg) can	CN
		9150-00-190-0907	35-lb (15.88-kg) can (81349) MIL-G-10924	CN
18	C		HYDRAULIC FLUID, PETROLEUM BASE (OHT)	
		9150-00-935-9807	1-qt (0.95-1) can	QT
		9150-00-935-9808	1-gal. (3.79-1) can (81349) MIL-H-6083	GL
18.1	C	1025-01-196-2172	KIT, ARTILLERY, CLEANING (59678) SK 1-84JS	EA
19	C	6240-00-539-9659	LAMP, INCANDESCENT (96906) MS35480	EA
20	C		LUBRICATING OIL, GENERAL PURPOSE (PL-S), noncorrosive, low temp	
		9150-{0-231-6689	1-qt (0.95-1) can	QT
		9150-00-231-9062	5-gal. (18.93-1) can (81348) VV-L-800	GL
21	C	6640-00-663-0832	PAPER, LENS, tissue, sheet form, type 1 (81348) NNN-P-40	SH

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
22	C	7920-00-205-3570	RAG, WIPING, cotton and combination fibers, bleached, white, 50-lb (22.68-kg) bale (58536) AA-531	BE
23	C	6850-00-281-1985	SOLVENT, DRY CLEANING 1-gal. (3.79-1) can (81348) P-D-680	GL
24	C	7920-00-240-2559	SPONGE, CELLULOSE, rect, 3.625-in. (9.21-cm) wide, 5.75-in. (14.61-cm) long, 1.75-in. (4.45-cm) thk (81348) L-S-626	EA
25	C	8305-00-268-2411	STRAP, WEBBING (81349) MIL-T-5661	YD
26			DELETED	
27	C	4020-00-241-8875	TWINE, FIBROUS 1-lb (0.45-kg) ball (81348) T-T-911	LB

APPENDIX E
STOWAGE AND SIGN GUIDE (FOR COMPONENTS OF END ITEM, BASIC ISSUE ITEMS, AND APPLICABLE ADDITIONAL AUTHORIZATION LIST ITEMS)

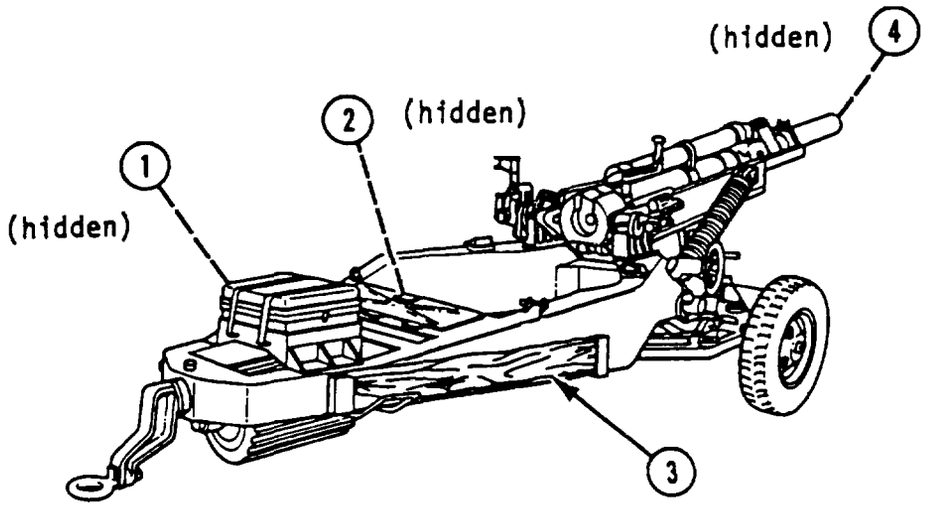
E-1. SCOPE

This appendix shows the locations for stowage of equipment and materiel required to be carried on the M102 howitzer.

E-2. GENERAL

Locations of mounted and stowed components of end item are shown on pages 1-8 and 1-9. Basic issue items mounted or stowed on the M102 howitzer are shown in this appendix. Other basic issue items are stowed in the prime mover. Additional authorization list items are stowed at the discretion of the chief of section.

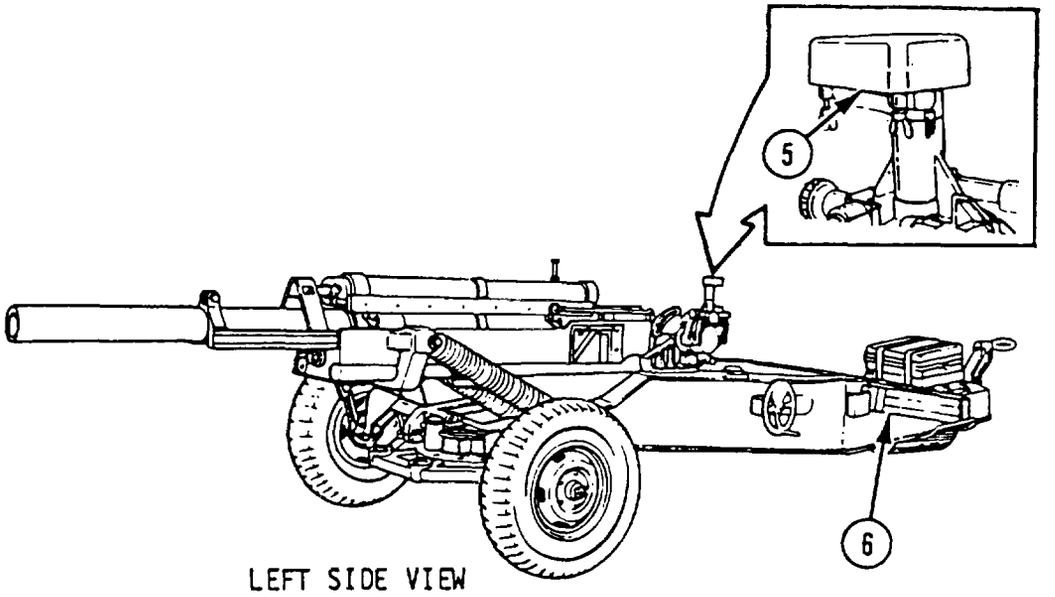
E-3. STOWAGE AND SIGN GUIDE



RIGHT SIDE VIEW

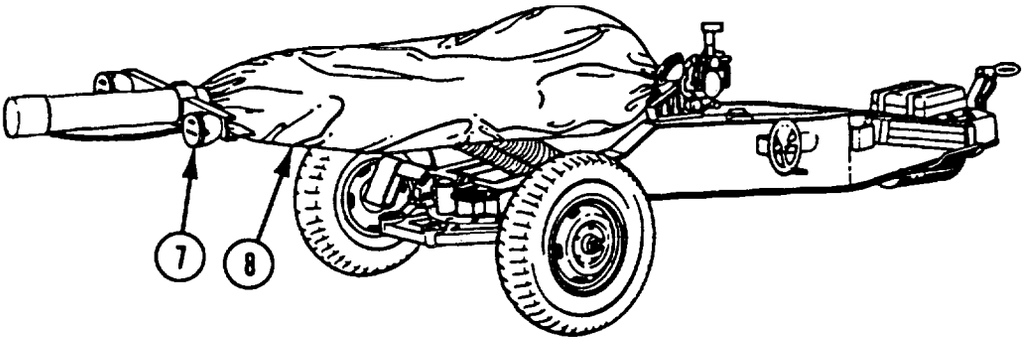
NO.	STOWAGE PLAN ITEM
1	M140 alinement device M58/M59 aiming post lights
2	Tools and equipment consisting of: Adjustable wrenches (2) Artillery cleaning brush with cover Artillery loading rammer (bell rammer) Bimetallic self-indicating thermometer Breech bore sight Eyebolt Flat tip screwdrivers (2) Gun (fluid direct delivery) Liquid releasing tool M1A1 gunner's quadrant M14 aiming post lights (2) and M14 chest M16 combination fuze setter wrench M18 combination fuze setter wrench M27 fuze setter M34 fuze setter M35 fuze setter Ramming and extracting tool Recoil drain hose assembly Socket head screw keys (2) Spanner wrench Steel rule Telescope mount cover

NO.	STOWAGE PLAN ITEM
3	M401 aiming post cover and M1A2 aiming posts (2)
4	Muzzle plug

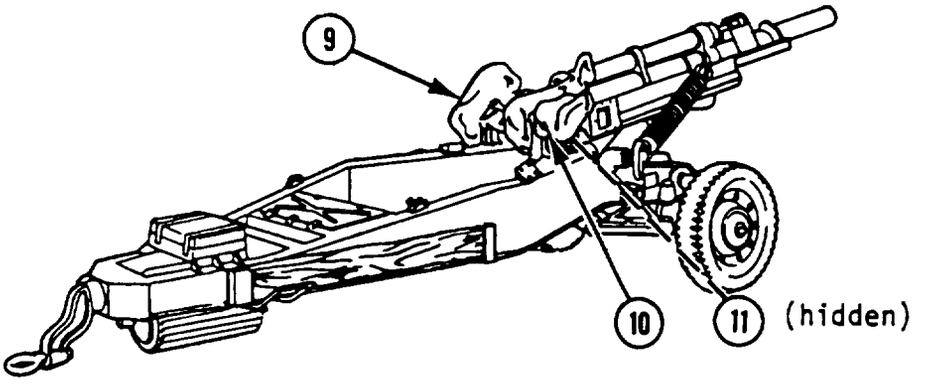


LEFT SIDE VIEW

NO.	STOWAGE PLAN ITEM
5	Telescope mount cover
6	Carriage staff assembly and Cleaning staff sections (3)



NO.	STOWAGE PLAN ITEM
7	Tail light assembly
8	Overall cover
RIGHT SIDE VIEW	



RIGHT SIDE VIEW

NO.	STOWAGE PLAN ITEM
9	Telescope and mount cover
10	Protective cloth cover (quadrant and elbow telescope)
11	Fire control instrument cover (M114A1 elbow telescope)

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When units of length, distance, temperature, weight, or volume are used in tabulated data in this manual, both US customary and metric units are shown. US customary units are shown first with equal metric units shown in parentheses in appendix D. When units identify weapons or ammunition, they stand alone. Also, when units describe tools or parts which are not interchangeable, only one kind of unit is used. Units of time and angle are the same for US customary and metric systems. No equal units are shown for seconds, minutes, hours, degrees of angle or mils. The list below shows the difference between US customary and metric units. It also shows the symbols used for the units.

US CUSTOMARY		METRIC
LENGTH AND DISTANCE		
inch:	1 in.	2.54 cm: centimeters
foot:	1 ft	0.3048 m: meter
yard:	1 yd	0.9144 m: meter
TEMPERATURE		
degree Fahrenheit: °F		(F°-32°) x 5/9 =°C: degree Celsius
WEIGHT		
ounce:	1 oz	28.3495 g: gram
pound:	1 lb	0.4536 kg: kilogram
VOLUME		
ounce:	1 oz	0.02957 l: liter
quart:	1 qt	0.9463 l: liter
gallon:	1 gal.	3.785 l: liters

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