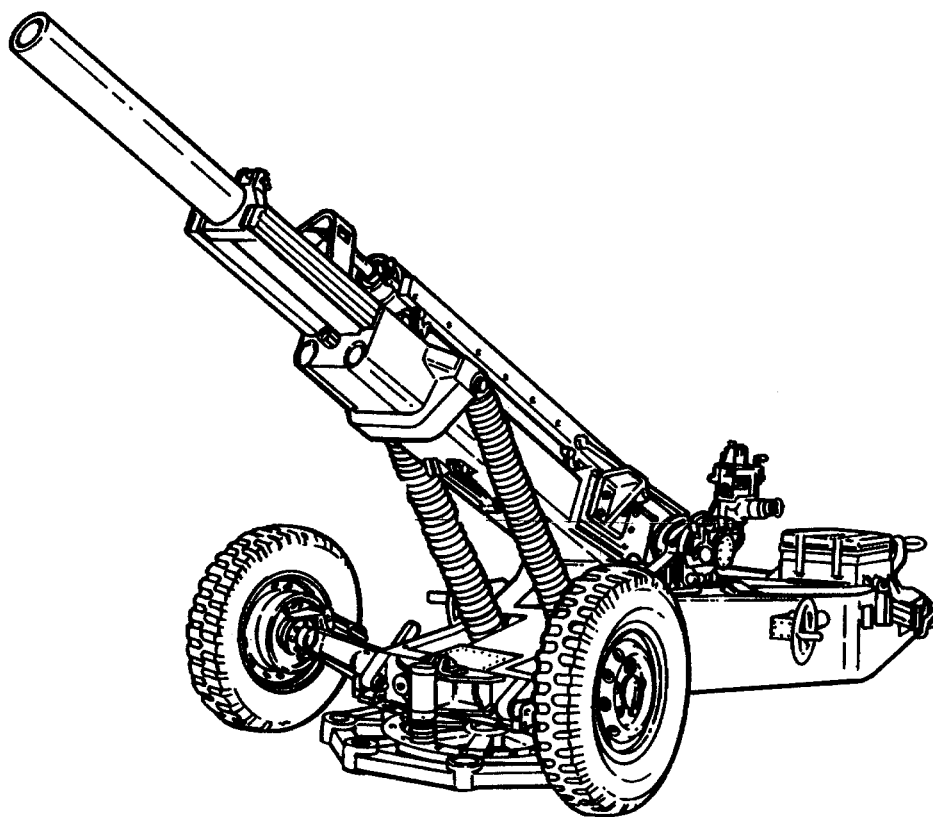


TECHNICAL MANUAL  
OPERATOR'S  
MANUAL  
FOR



DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

HOWITZER, LIGHT, TOWED:

105-MM, M102

(1015-00-086-8764)

HEADQUARTERS, DEPARTMENT OF THE ARMY

AUGUST 1985



**WARNING SUMMARY****RADIOACTIVE MATERIAL(S)****TRITIUM (HYDROGEN-3) GAS**

This item contains radioactive material. Control of this radioactive material is mandated by federal law. Immediately report any suspected lost or damaged items to your Radiation Safety Officer (RSO). If your RSO cannot be reached, contact the TACOM-RI safety office.

Handle with care. In the event the radioluminous source is broken, cracked, or there is no illumination, immediately wrap device in plastic bag (item 1, appendix D) and notify the local RSO. Contact the base safety officer for the name and telephone number of your local RSO.

LOCAL RSO: \_\_\_\_\_

Telephone: \_\_\_\_\_

**SAFETY PROCEDURES FOR NUCLEAR REGULATORY COMMISSION  
(NRC) TRITIUM FIRE CONTROL ITEMS**

1. Purpose: To implement mandatory license requirements for use and maintenance of tritium radioluminous fire control devices used on howitzers, mortars, tanks, and rifles.
2. Scope: This procedure is applicable to all personnel working with tritium devices, including unit, direct support, general support maintenance, and operator levels.
3. Radiological hazard: The beta radiation emitted by tritium presents no external radiation hazard. However, if taken internally, it can damage soft tissue. If a capsule is broken, the tritium gas will dissipate into the surrounding air and surfaces near the vicinity of the break may become contaminated. Tritium can be taken into the body by inhalation, ingestion, or skin absorption/injection.

4. Safety precautions:

- a. Check for illumination prior to use or service in low light or darkroom. If not illuminated, do not repair. Wrap the entire device in plastic bag (item 1, appendix D) and notify the local RSO.
- b. No eating, drinking, or smoking will be allowed in tritium device work areas.

5. Emergency procedures: If a tritium source breaks, inform other personnel to vacate the area or move upwind. If skin contact is made with any area contaminated with tritium, wash immediately with nonabrasive soap and water. Report the incident to the local RSO. Actions below will be taken under supervision of direction of the local RSO.

- a. Personnel handling the tritium device should wear rubber or latex gloves (item 15, appendix D). Device must be immediately double wrapped in plastic, sealed with tape (item 16, appendix D), and marked as "Broken Tritium Device – Do Not Open" per RSO direction. Dispose of used gloves as radioactive waste, per instructions from local RSO and wash hands well.
- b. Personnel who may have been exposed to the broken tritium device should report to health clinic for tritium bioassay. Optimum bioassay sample is at least 4 hours after exposure.
- c. Broken tritium sources indoors may result in tritium contamination in the area, such as work bench or table. The areas must be cordoned off, restricted until wipe tests indicate no contamination.

6. Further information:

- a. Requirements for safe handling and maintenance are located in TM 9-254, General Maintenance Procedures for Fire Control Materiel.
- b. If assistance is needed, contact your local or major command (MACOM) safety office(s) for information on safe handling, shipping, storage, maintenance, or disposal of radioactive devices.

c. The TACOM-RI RSO/licensee may be contacted by calling: DSN 793-2965/2969/2995, commercial (309) 782-2965/2969/2995. After duty hours, contact the Staff Duty Office through the operator at DSN 793-6001, commercial (309) 782-6001. The following rules and regulations are available from TACOM-RI, ATTN: AMSTA-LC-CZR, Rock Island, IL 61299-6000. Copies may be requested, or further information obtained by contacting the TACOM-RI Radiation Safety Office (RSO).

- (1) Title 10 CFR Part 19 – Notices, Instructions, and Reports to Workers.
- (2) Title 10 CFR Part 20 – Standards for Protection Against Radiation.
- (3) Title 10 CFR Part 21 – Reporting of Defects and Noncompliance.
- (4) NRC License, License Conditions, and License Application.

7. Safety, Care, and Handling:

**WARNING**

Nuclear, Biological, and Chemical (NBC) agents can kill you. If NBC exposure is suspected, all air filter media must be handled by personnel wearing full NBC protective equipment (FM 4-25.11, First Aid).

**WARNING**



**RADIATION HAZARD**

Fire control instruments containing tritium are used as part of a backup system for manual firing. Loss of illumination may indicate that leakage has occurred. Do not attempt to repair a non-illuminated device.

Pre-Maintenance Check:

- a. Prior to taking any maintenance action on fire control devices (e.g., purging or charging M1A1 Collimator), check for broken/cracked reticle or loss of illumination as follows:
  - (1) Place device in the dark for at least four hours to prevent exterior light from activating the phosphor.
  - (2) Check for cracks/illumination in a low light environment after allowing sufficient time to accustom eyes to the dark.
- b. If illumination is not observed, or illuminated but cracks are observed, take following action:
  - (1) Personnel handling the tritium device should wear rubber or latex gloves (item 15, appendix D).
  - (2) Seal entire device in two plastic bags (item 1, appendix D).
  - (3) Mark the outer bag as "Broken Tritium Device – Do Not Open".
  - (4) Dispose of used gloves as radioactive waste, per instructions from local RSO. Wash well with nonabrasive soap and water.
- c. If illumination is observed, maintenance actions may proceed.

**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.

**WARNING**

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

**WARNING**

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

**d Change 3**

**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.

**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.

**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.

**WARNING**

Before loading the M102 howitzer, all crewmembers must know what to do in the event of a misfire. For misfire/checkfire procedures, refer to paragraph 2-27.

**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.

**WARNING**

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

**WARNING**

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

**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.

**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 paragraph 2-27.

**WARNINGS**

- The breech should not be opened for at least 2 minutes after the firing attempt. All personnel not required 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.

**WARNINGS**

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

**WARNING**

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

**WARNING**

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

**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.



**WARNING**

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

**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 projectile assembled with the fuze, exercise extreme care to protect the fuze from impact. Keep pull wire on fuze in place until immediately prior to loading and firing.

**WARNING**

Do not fire artillery ammunition of any caliber without authorized fuze. Firing of such round without fuzes or with unauthorized fuzes could result in inbore premature explosions and other conditions hazardous to personnel.

**WARNING**

Inspect your ammunition. Failure to accomplish required inspections can result in unnecessary malfunctions and injury or death to personnel.

**WARNING**

The supplementary charge must be left in the projectile when firing short intrusion fuzes. The supplementary charge must be removed when firing a long intrusion VT fuze.

**WARNING**

Do not attempt to remove the supplementary charge by other means than the lifting loop. Use of screwdrivers or other tools to remove the charge by force is prohibited.

**WARNING**

When tightening fuze to projectile, do not hammer on fuze setter 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.

**WARNING**

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

**WARNING**

Exercise extreme care when handling a M501 Series fuzed projectile. Mishandling or dropping could cause the fuze to malfunction, expelling the base plate and contents. Keep pull wire on fuze in place until immediately before loading and firing.

**WARNING**

Do not fire projectile unless fuze is fully seated. Round fired with improperly seated fuzes may result in premature functioning causing serious injury to personnel and damage to equipment.

**WARNING**

An incorrect setting of MT and MTSQ fuzes can result and have resulted in down-range prematures.

**WARNING**

Rounds with pre-adjusted propelling charges for multiple round missions must be kept separate from other ammunition. Death or injury to personnel may result if this procedure is not followed.

**WARNINGS**

- Do not fire a projectile, which was impacted by a hard object. Impact to the ogive and nose area can cause a crack. Avoid rough handling.
- Do not reuse cartridges that 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.
- Do not fire the M60 Series WP projectiles that are known to have been stored in other than a base-down position. Firing of such projectiles can cause inbore premature or close-in premature malfunctions.
- Do not load or fire cartridge without a fuze, with an unauthorized fuze, with fuze not fully seated, or with an obstruction in cannon tube. These conditions can cause inbore prematures.

Do not fire proximity (VT) fuzed cartridges at targets closer than 750 meters from friendly troops.

- Fire complete round only with the originally packed projectile, cartridge case, propelling charge and fuze as authorized in Table 4-4. Failure to do so could result in injury or death to personnel.

**WARNINGS – continued**

- The fired cartridge case can be unexpectedly ejected resulting in injury to personnel. MK399 MOD 1 fuzes set in delay mode perform more effectively if the angle of attack (the angle between the round and the perpendicular of the target) is less than 45 degrees. Angles of attack more than 45 degrees will result in decreased effectiveness and increase the likelihood of unexploded ordnance in the battlefield.
- If a projectile fired with MK399 MOD 1 fuze impacts a substantial object, a high order detonation may occur even if the object is within the 400 caliber (138 feet/ 42 meters) minimum arming distance, which could result in damage to the weapon and/or death or serious injury to unprotected crew members.

**WARNING**

If cannon tube is hot, chambered rounds should be fired or removed from the weapon within 5 minutes to avoid injury or death to personnel. Refer to the misfire/checkfire procedures, paragraph 2-27.

**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. Repack and mark cartridges for disposal by Ammunition Supply Point (ASP) personnel.

**WARNINGS**

- 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 containing explosives to rain, excessive humidity, or ground moisture; otherwise, short ranges may result.

**WARNING**

Alteration of loaded ammunition or components is prohibited.

### WARNINGS

- 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 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 greater than +145°F (51.7°C)

Change  
No. 3

**Operator's Maintenance Manual**

**HOWITZER, LIGHT, TOWED:  
105-MM, M102  
(NSN 1015-00-086-8164)**

TM 9-1015-234-10, 19 August 1985, is changed as follows:

1. The purpose of this change is to update TM 9-1015-234-10.
2. New or changed material is indicated by a vertical bar in the outside margin of text changes and by a hand symbol beside illustration changes.
3. Remove the old page and insert the new page as indicated below:

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a and b

None

i and ii

4-1 thru 4-35/(4-36 blank)

A-1 and A-2

D-5/(D-6 blank)

Index 1 thru Index 16

Insert Pages

a thru j

A and B

i and ii

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A-1 and A-2

D-5/(D-6 blank)

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4. File this change in front of the publication.

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By Order of the Secretary of the Army:

PETER J. SCHOOMAKER  
*General, United States Army*  
*Chief of Staff*

Official:



SANDRA R. RILEY  
*Administrative Assistant to the*  
*Secretary of the Army*

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CHANGE

No. 2

**HEADQUARTERS  
DEPARTMENT OF THE ARMY**  
Washington, DC 17 December 1993

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

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1-7 and 1-8  
1-17 through 1-20  
1-21 through 1-27(1-28 blank)  
2-9 through 2-16  
2-23 and 2-24  
2-26.5 through 2-26.8  
2-26.17 through 2-26.20  
2-27 and 2-28  
2-37 through 2-42  
2-47 through 2-50  
2-59 and 2-60  
2-83 through 2-86  
3-33 and 3-34  
3-39 through 3-50  
3-55 through 3-60  
4-1 and 4-2  
4-7 and 4-8  
4-8.1(4-8.2 blank)  
4-9 through 4-14  
4-17 through 4-22  
4-27 through 4-30

Insert Pages

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

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Remove Pages      Insert Pages

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

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

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By Order of the Secretary of the Army:



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

GORDON R. SULLIVAN  
General, United States Army  
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CHANGE

No. 1

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
Washington, DC 7 September 1990

OPERATOR'S MAINNANCE MANUAL

HOWITZER, LIGHT, TOWED:  
105-MM, M102  
(NSN 1015-00-086-8164)

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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)

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4-31 and 4-32

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A-1 through A-3/

(A-4 blank)

B-7 through B-16

C-3 and C-4

D-3 and D-4

Insert Pages

4-23 through 4-24.5/  
(4-24.6 blank)

4-31 through 4-32.1

4-35/(4-36 blank)

A-1 through A-3/

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B-7 through B-16

C-3 and C-4

D-3 and D-4

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By Order of the Secretary of the Army:

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General, United States Army  
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**LIST OF EFFECTIVE PAGES**

NOTE: A vertical line in the outer margin of the page indicates the portion of the text affected by the changes. Changes to illustrations are indicated by miniature pointing hands.

Dates of issue for original and changed pages are:

Original	0	19 August 1985
Change 1	1	7 September 1990
Change 2	2	17 December 1993
Change 3	3	15 August 2005

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 340 CONSISTING OF THE FOLLOWING:

Page No.	*Revision No.	Page No.	*Revision No.
Cover	0	2-26.6 – 2-26.8	2
Blank	0	2-26.9 – 2-26.17	1
a - j	3	2-26.18 – 2-26.19	2
Change 3 Errata Added (2)	2	2-26.20	1
Change 2 Errata Added (2)	1	2-27	1
Change 1 Errata Added (1)	3	2-28	2
A – B	3	2-29 – 2-30	0
i-ii	0	2-31	1
1-1 – 1-5	1	2-32 – 2-34	0
1-6	0	2-35	1
1-7	2	2-36 – 2-37	1
1-8	0	2-38	2
1-9 – 1-12	1	2-39	0
1-13 – 1-17	0	2-40 – 2-41	2
1-18	2	2-42 – 2-46	1
1-19	1	2-47	2
1-20	2	2-48	1
2-1 – 2-7	0	2-49	0
2-8	1	2-50	2
2-9 – 2-10	2	2-51 – 2-52	1
2-11	1	2-53	0
2-12 – 2-13		2-54	1
2-14	2	2-55 – 2-56	0
2-15	1	2-57	1
2-16 – 2-22	2	2-58	0
2-23	1	2-59	1
2-24 – 2-26	2	2-60	2
2-26.1 – 2-26.5	1	2-61 – 2-62	0

\* Zero in this column indicates an original package.

**Change 3 A**

**TM 9-1015-234-10**

Page No.	*Revision No.	Page No.	*Revision No.
2-63	1	B-15	2
2-64 – 2-65	0	B-16	0
2-66	1	C-1	0
2-66.1 – 2-71	1	C-2 – C-4	2
2-72	0	D-1	0
2-73	1	D-2 – D-3	2
2-74 – 2-77	0	D-4	1
2-78 – 2-80	1	D-5/(D-6 blank)	3
2-81	0	E-1	0
2-82 – 2-83	1	E-2	2
2-84 – 2-85	2	E-3	0
2-86 – 2-88	0	E-4	2
2-89	1	Index 1 – Index 10	3
2-90	0	Index 11/(Index 12)	3
2-91 – 2-92	1	Auth Page/(blank)	0
3-1	1	DA Form 2028 Sample	0
3-2 – 3-3	0	Blank	0
3-4	1	DA Forms 2028 (2)	3
3-5 – 3-33	0	(blank)/Pin	0
3-34	2	Metric Chart/Cover	0
3-35	0		
3-36	1		
3-37	0		
3-38 – 3-39	1		
3-40 – 3-49	2		
3-50 – 3-53	1		
3-54	1		
3-54.1/(3-54.2 blank)	1		
3-55 – 3-56	2		
3-57	0		
3-58 – 3-59	2		
3-60	1		
3-61/(3-62 blank)	1		
4-1 – 4-58	3		
4-59/(4-60)	3		
A-1	3		
A-2	3		
B-1 – B-6	0		
B-7 – B-8	2		
B-9	1		
B-10	0		
B-11 – B-13	2		
B-14	0		

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**B Change 3**

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 publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028 (Recommended Changes to Equipment Technical Publications), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is <https://aeeps.ria.army.mil>. If you need a password, scroll down and click on "ACCESS REQUEST FORM". The DA Form 2028 is located in the ONLINE FORMS PROCESSING section of the AEPS. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or email your letter or DA Form 2028 direct to: AMSTA-LC-CI/ TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The email address is [TACOM-TECH-PUBS@ria.army.mil](mailto:TACOM-TECH-PUBS@ria.army.mil). The fax number is DSN 793-0726 or Commercial (309) 782-0726.

Page

CHAPTER	1.	INTRODUCTION	
	Section I.	General Information .....	1-1
	Section II.	Equipment Description .....	1-6
	Section III.	Section Drill .....	1-21
CHAPTER	2.	OPERATING INSTRUCTIONS	
	Section I.	Description Controls and Indicators .....	2-1
	Section II.	Preventive Maintenance Checks and Services (PMCS) .....	210
	Section III.	Operation Under Usual Conditions .....	2-27
	Section IV.	Operation Under Unusual Conditions .....	2-87

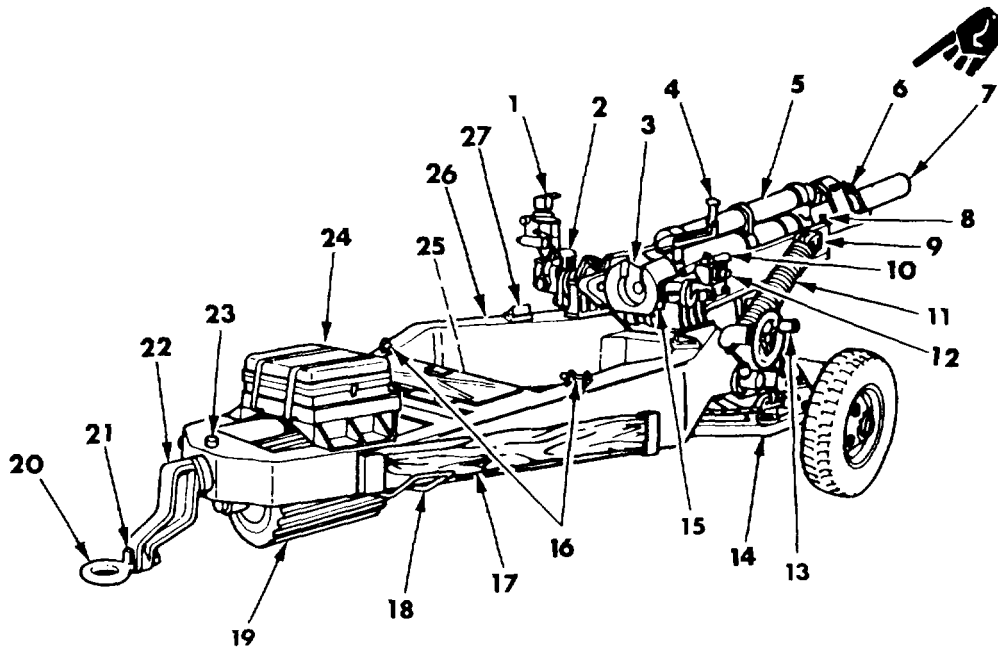
\*This manual supersedes TM 9-1015-234-10, 31 August 1979, including all changes in their entirety.

CHAPTER	3	MAINTENANCE INSTRUCTIONS	
Section	I.	Lubrication Instructions .....	3-1
Section	II.	Troubleshooting Procedures .....	3-12
Section	III.	Maintenance Procedures.....	3-29
Section	IV.	Maintenance of Auxiliary Equipment .....	3-41
Section	V.	Fire Control Alignment Tests and Measurements.....	3-41
CHAPTER	4	AMMUNITION FOR M102 HOWITZER WITH M137A1 SERIES CANNON	
Section	I.	Introduction .....	4-1
Section	II.	Preparation for Firing.....	4-27
Section	III.	Maintenance of Ammunition .....	4-55
APPENDIX	A.	REFERENCES .....	A-1
APPENDIX	B.	COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS	
Section	I.	Introduction .....	B-1
Section	II.	Components of End Item.....	B-3
Section	III.	Basic Issue Items .....	B-7
APPENDIX	C.	ADDITIONAL AUTHORIZATION LIST	
Section	I.	Introduction .....	C-1
Section	II.	Additional Authorization List .....	C-2
APPENDIX	D.	EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST	
Section	I.	Introduction .....	D-1
Section	II.	Expendable/Durable Supplies and Materials List.....	D-2
APPENDIX	E.	STOWAGE AND SIGN GUIDE (FOR COMPONENTS OF END ITEM, BASIC ISSUE ITEMS, AND APPLICABLE ADDITIONAL AUTHORIZATION LIST ITEMS) .....	E-1
ALPHABETICAL INDEX.....			Index 1

CHAPTER 1  
INTRODUCTION

Section I. GENERAL INFORMATION

M102 HOWITZER - RIGHT REAR VIEW (LRAVEL POSITION)

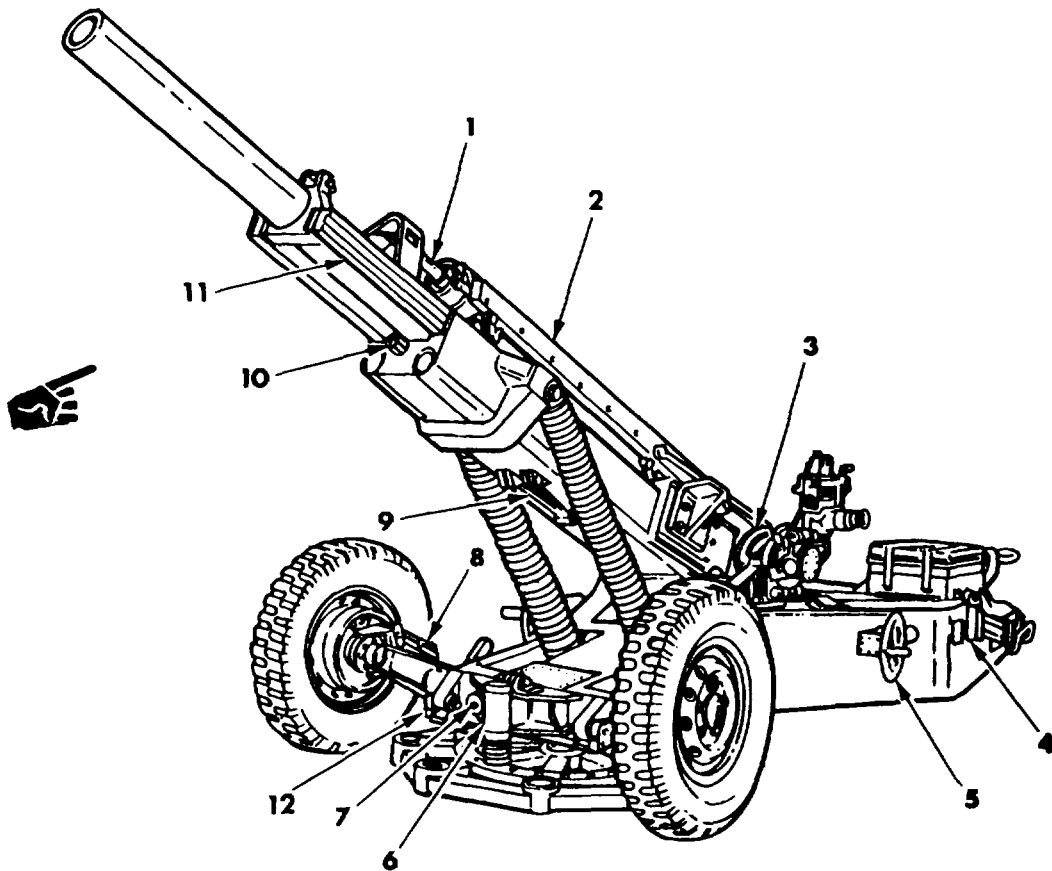


Legend

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



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

Change 1 1-2

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

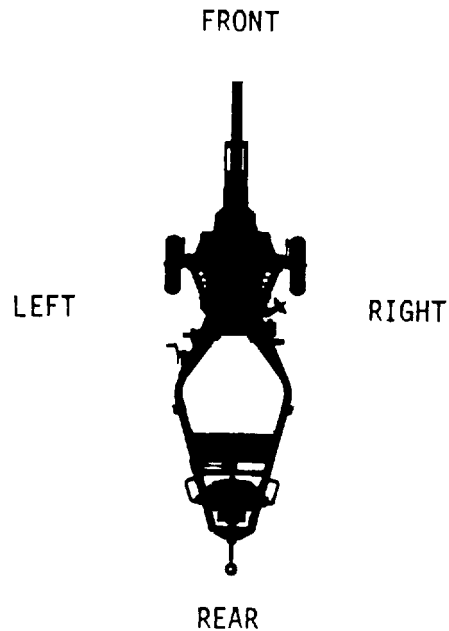
Change 1 1-5

## 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 CHARACTERISTICS, 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

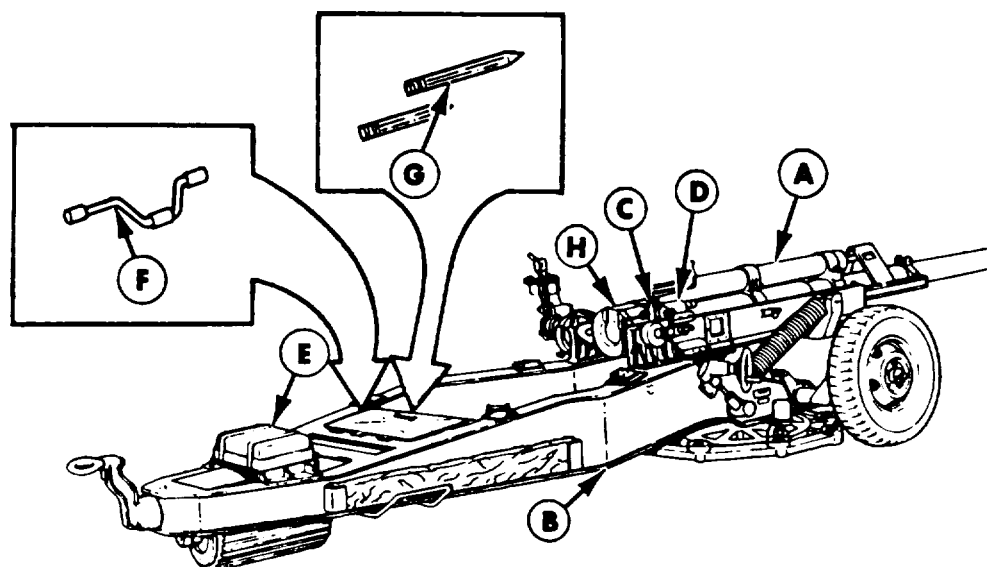
(3) Miscellaneous instruments include:

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)

**Change 2 1-7**

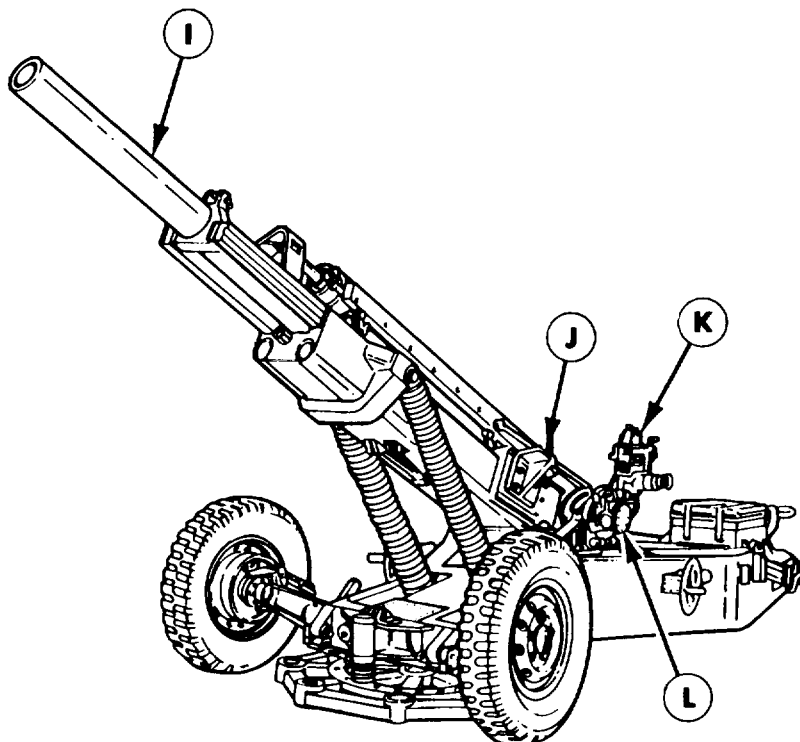
## 1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS



- 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 alignment 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 platform assembly. Stored in tool box.

H

**BREECH MECHANISM ASSEMBLY.** 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 ANIENNA 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.



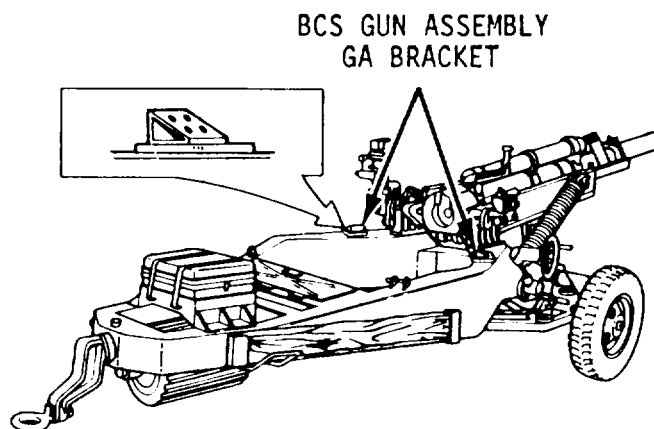
## 1-10. MODIFICATIONS AND PRODUCT IMPROVEMENT PACKAGE

## NOTE

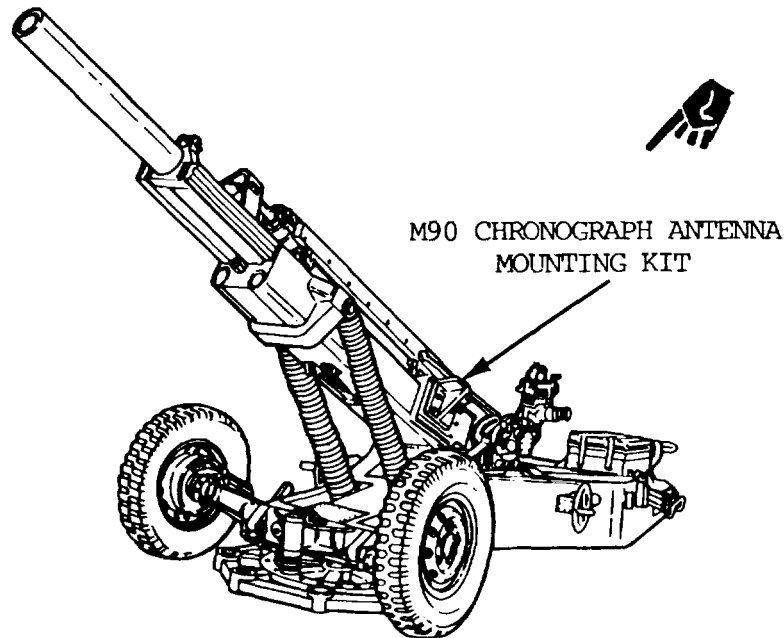
This manual has been written for both modified and unmodified M102 howitzers. When procedures vary depending on equipment configuration, both procedures are described and illustrated. Use the procedure which applies to your weapon. When procedures are the same for all configurations, the illustration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

## a. M102 Howitzer Modifications.

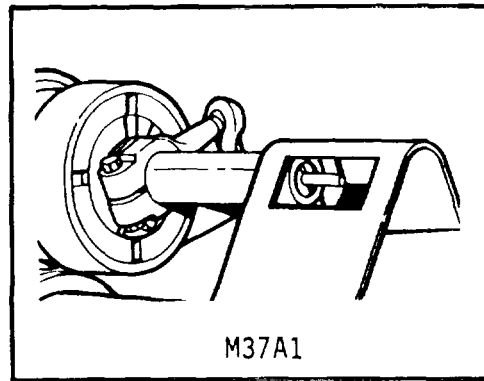
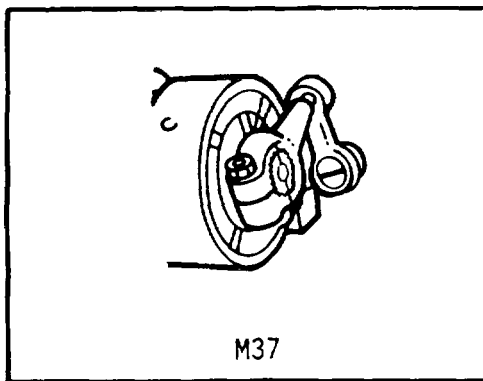
(1) All M102 howitzers are scheduled to be equipped with a product improvement package (MWO 9-1015-234-50-4) which includes reinforcement of the M31 carriage, travel lock bracket, and pneumatic tire wheel to eliminate cracking; and improved lubrication of trunnion bearings and hand brakes.



(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.

Change 1 1-11

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 0-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<sub>3</sub>..... 4.8 curies

Tritium H<sub>3</sub>..... 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 H<sub>3</sub> 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<sub>3</sub>..... 4.0 curies

Weight..... 5.75 lb (2.61 kg)

M14A1 Fire Control Quadrant

Correction..... ±50 mils

Depression..... -288 mils

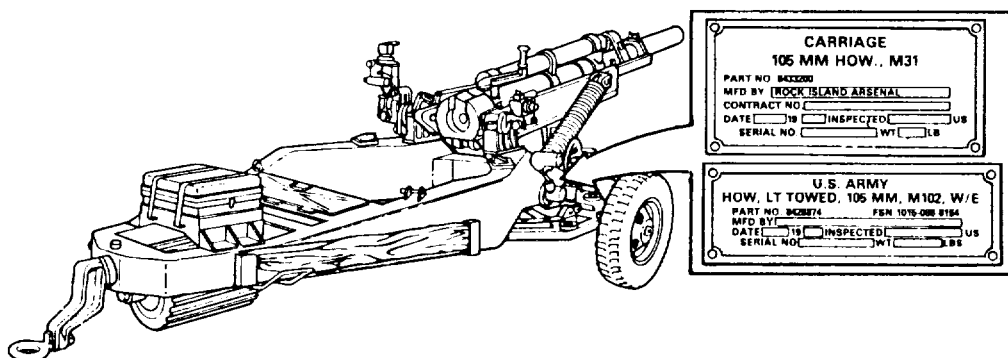
1-11. EQUIPMENT DATA (cont)  
 FIRE CONTROL EQUIPMENT DATA (cont)

M14A1 Fire Control Quadrant (cont)

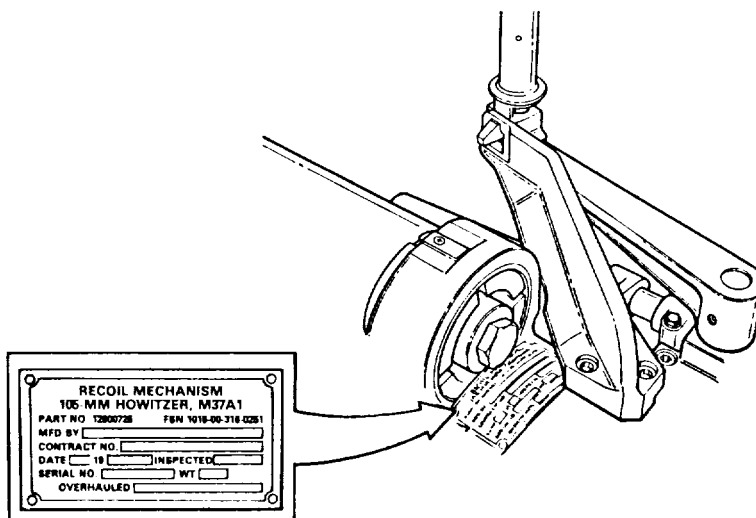
Elevation..... +1383 mils  
 Least increment reading (counters) ..... 1 mil  
 Radioactive material:  
     Max surface radiation..... 0 millirad per hour  
     Tritium H3..... 2.10 curies  
 Weight ..... 14.75 lb (6.69 kg)

1-12. M102 HOWITZER DATA PLATES

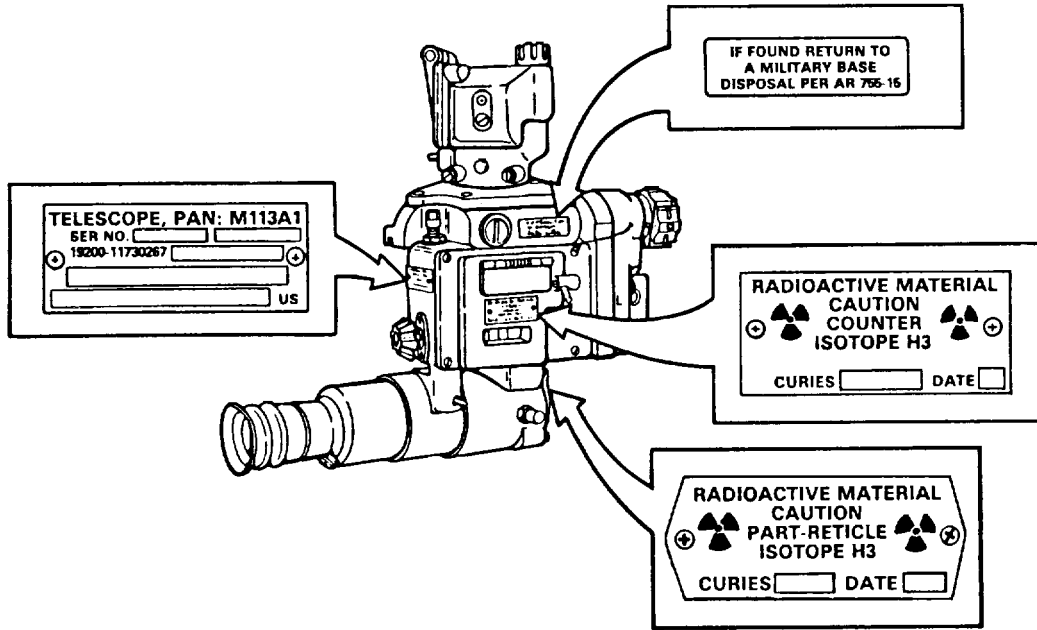
Identification, instruction, and caution/warning plates for the M102 howitzer and its fire control equipment are located as shown. Self-illuminated devices are identified with a radiation warning label. Replace missing or defaced labels as soon as possible and transfer information from old to new label.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



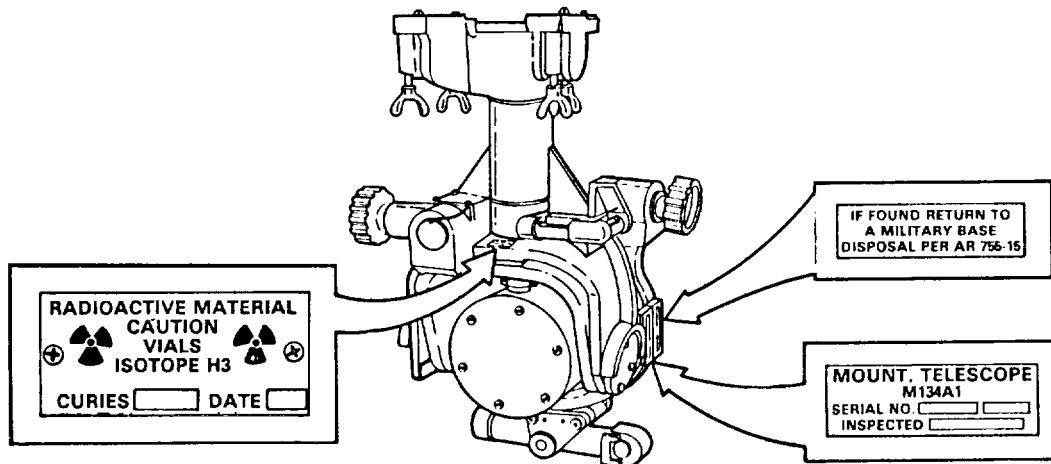
M102 HOWITZER



M37A1 RECOIL MECHANISM

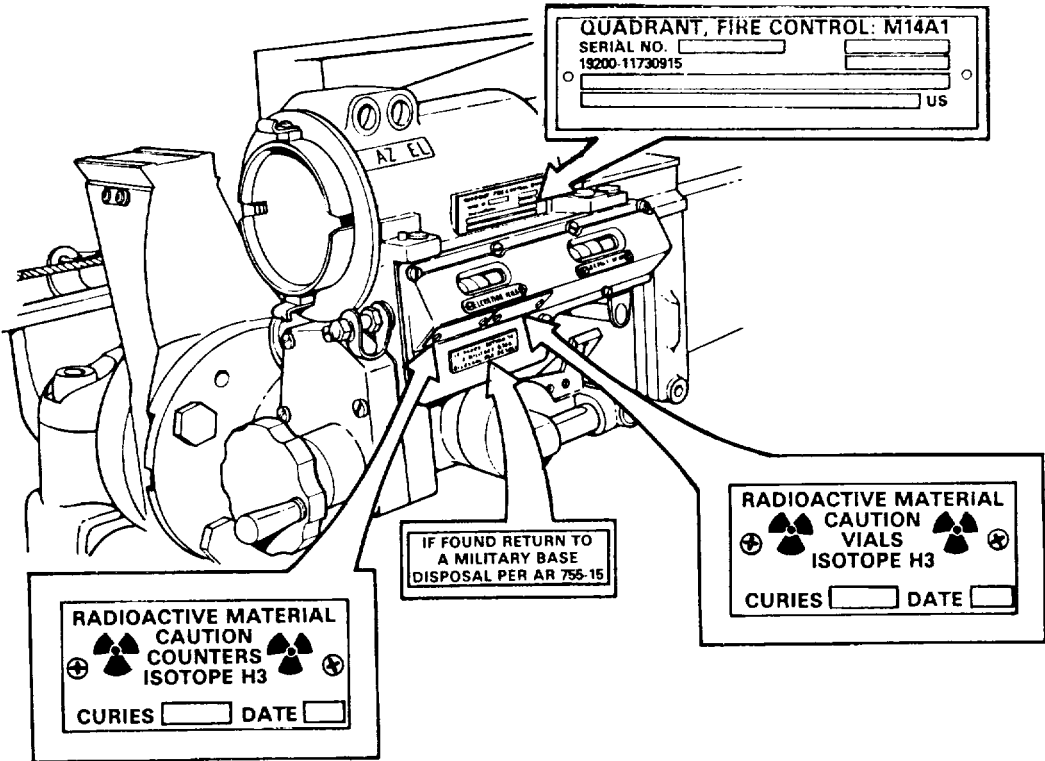


M113A1 PANTEL

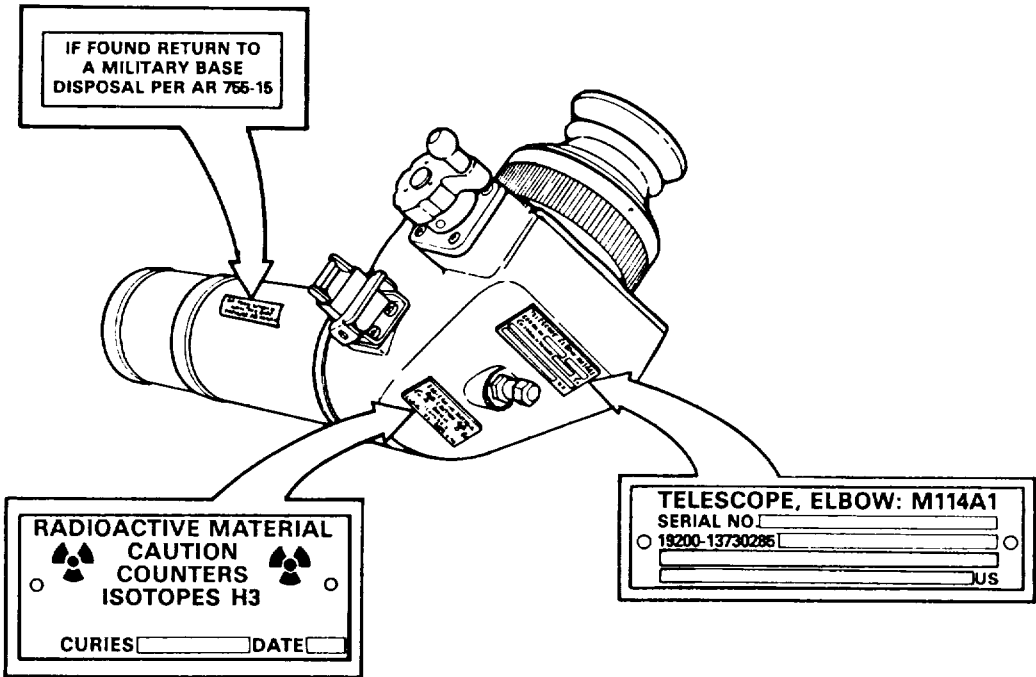


M134A1 MOUNT

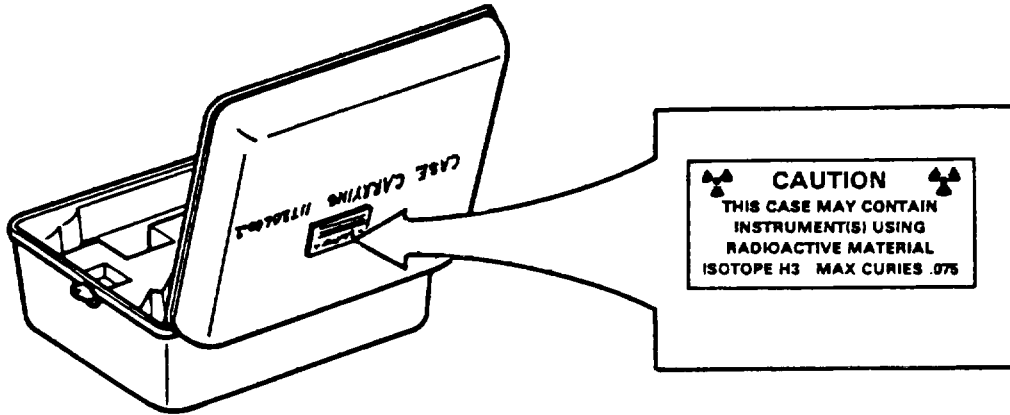
1-12. M102 HOWITZER DATA PLATES (CONT)



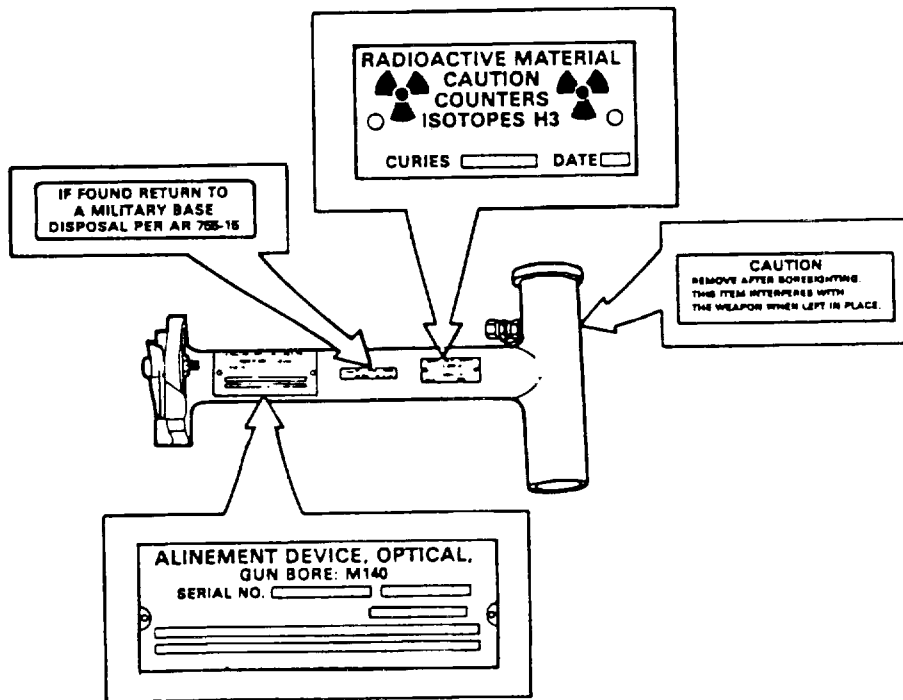
M14A1 QUADRANT



M114A1 TELESCOPE

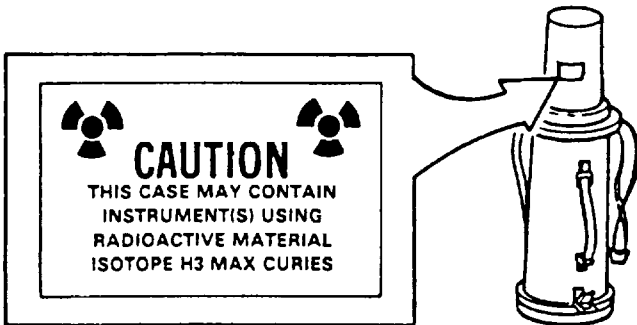
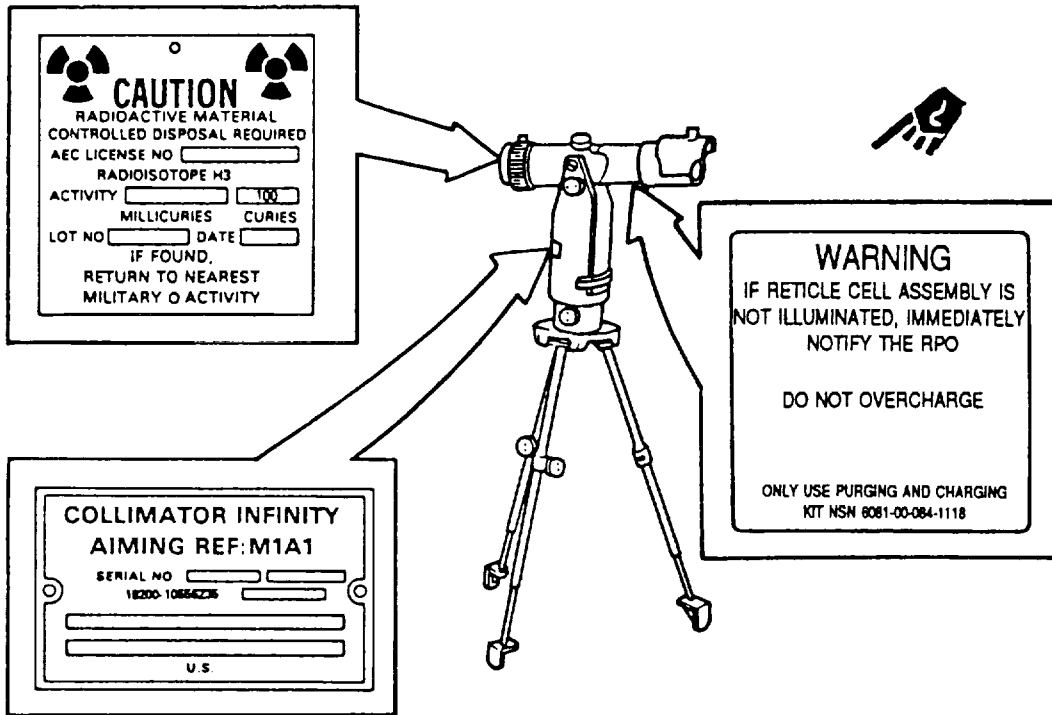


CARRYING CASE



M140 ALINR4ENET DEVICE

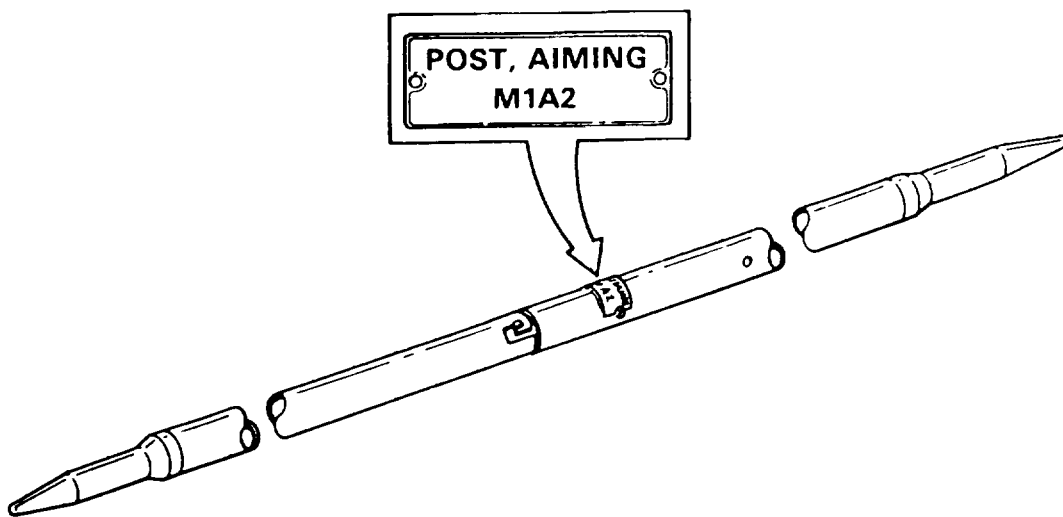




M1A1 COLLIMATOR

Change 2 1-18

M58 AND M59 AIMING LIGHTS—deleted



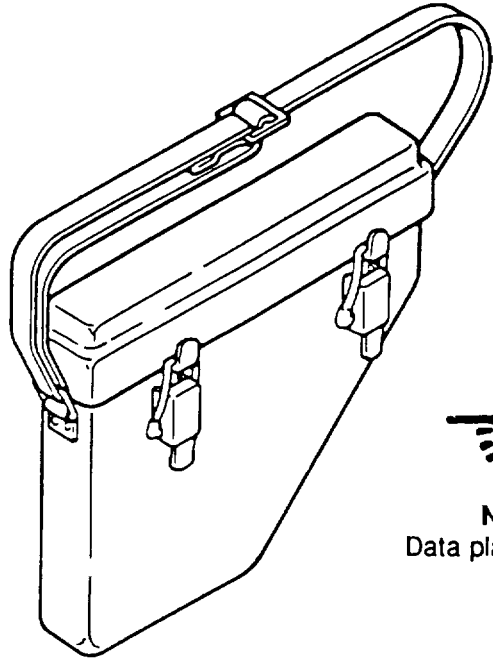
M1A2 AIMING POST

NOTE

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

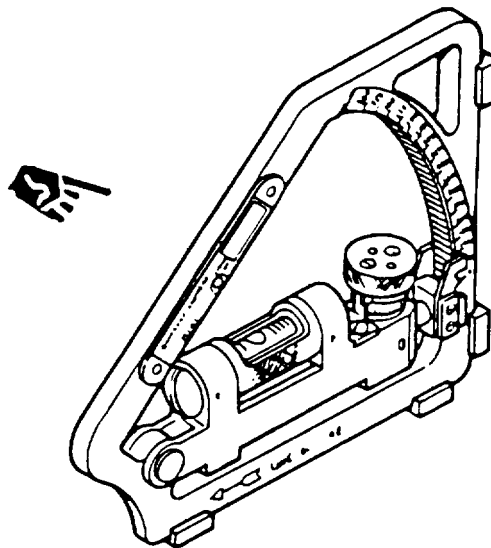
Change 1 1-19

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.

**Change 2 1-20**

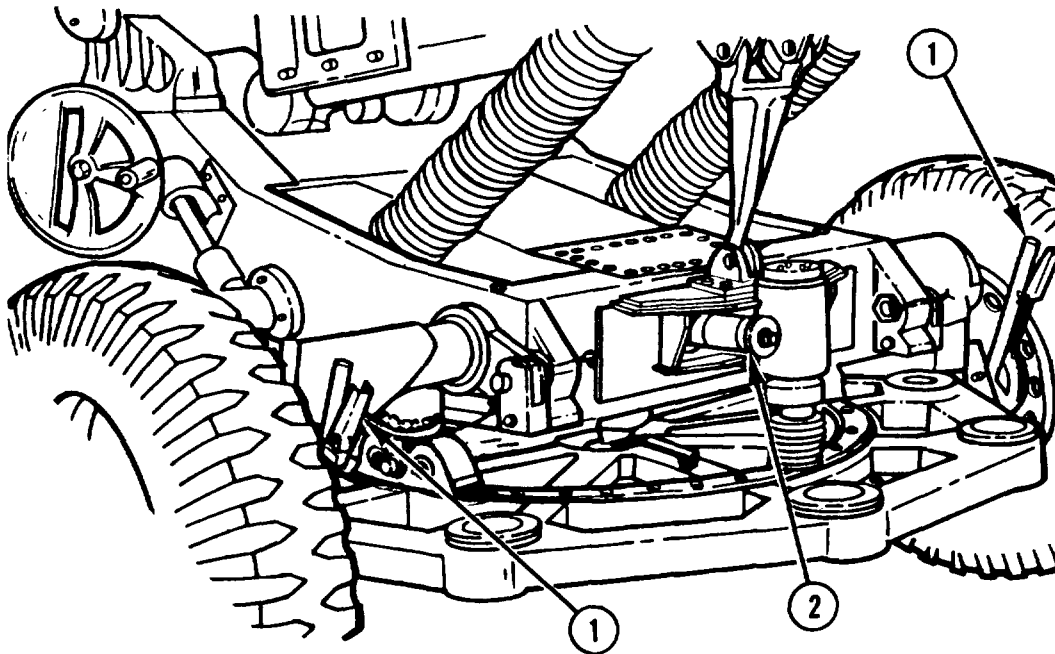
## CHAPTER 2 OPERATING INSTRUCTIONS

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

#### 2-1. GENERAL

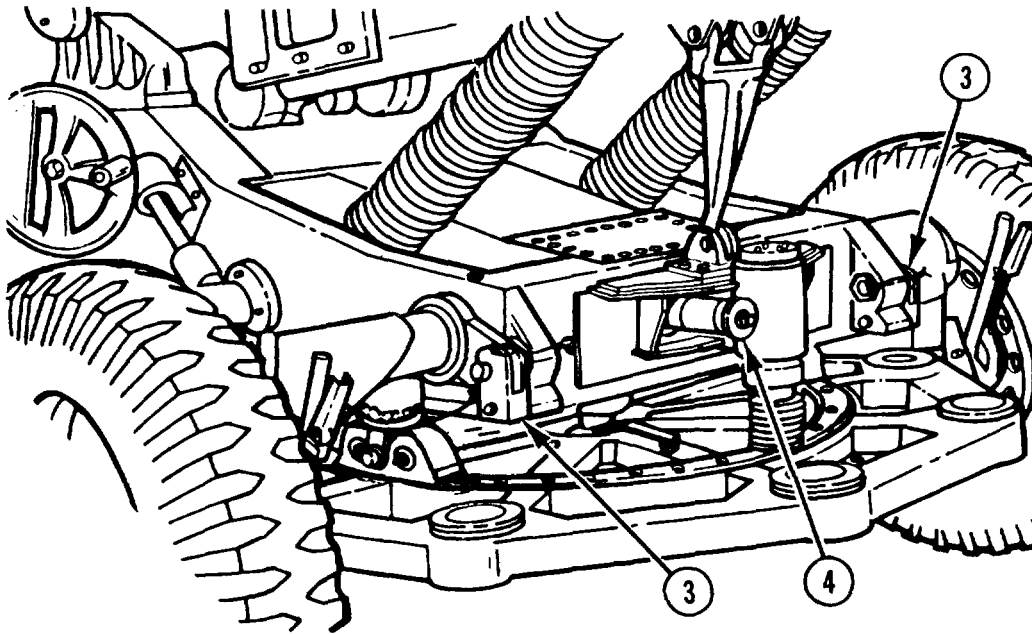
Before attempting to operate the M102 howitzer, make certain you are familiar with the location and operation of all controls and indicators.

#### 2-2. OPERATOR'S CONTROLS AND INDICATORS

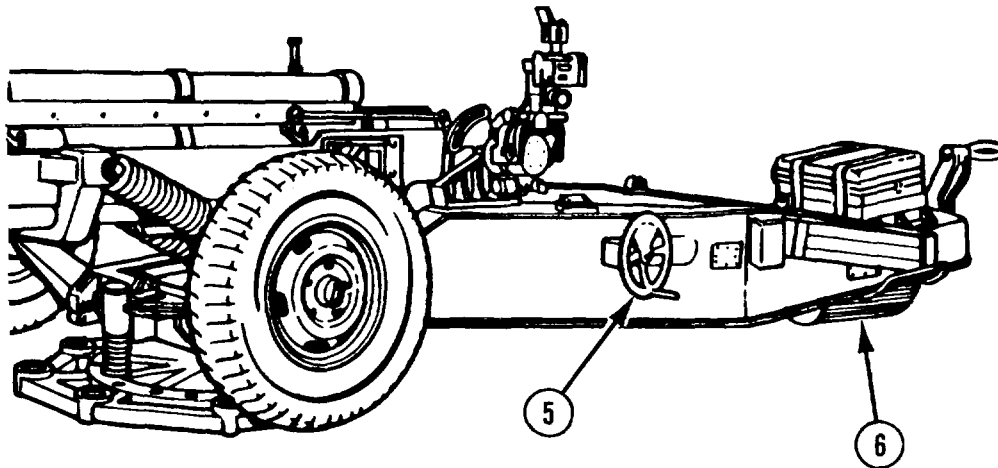


a. **HANDBRAKES.** To disengage each handbrake (1), grasp the clasp type handle and move your hand toward the breech mechanism assembly. The handbrakes must be engaged whenever the howitzer is in travel position while disconnected from the prime mover, and whenever the howitzer is in the firing position.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

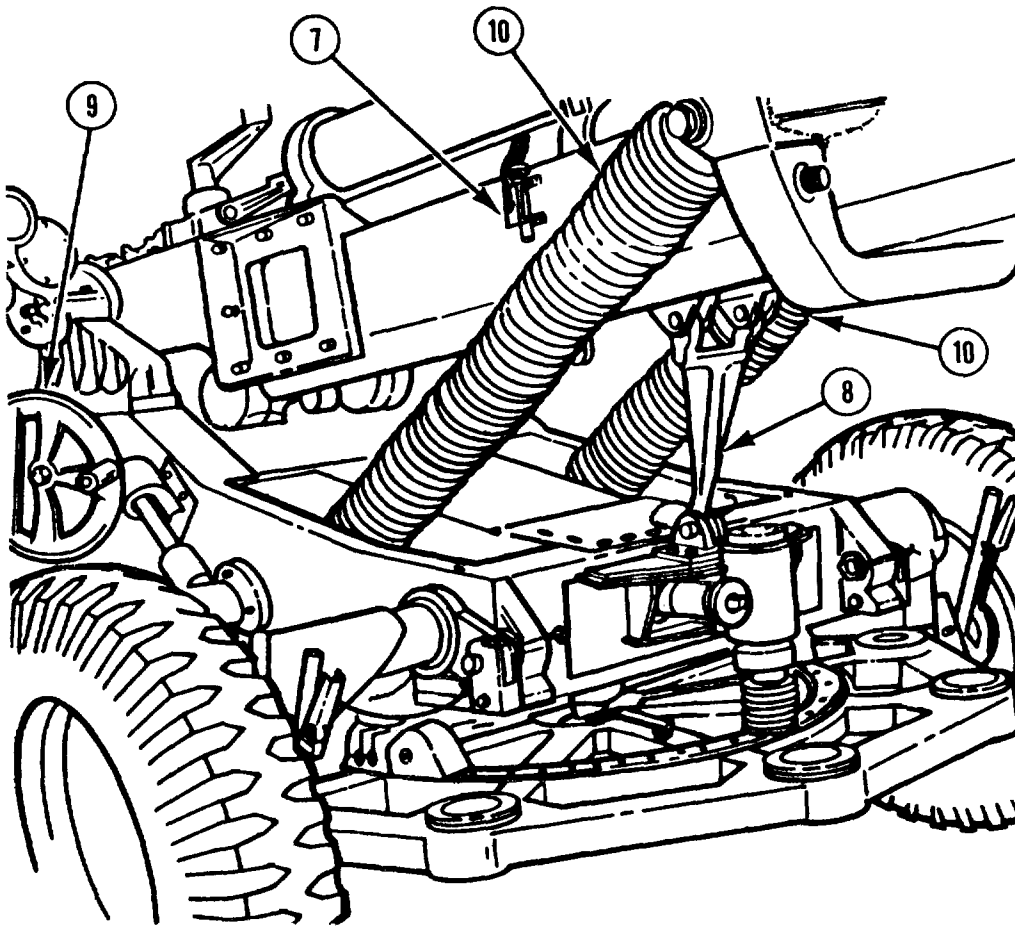
b. **CONTROL ASSEMBLY.** The mechanical type control assembly (2) provides a means of retracting and extending the wheels for raising and lowering the M31 carriage. (See page 2-30.)



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.



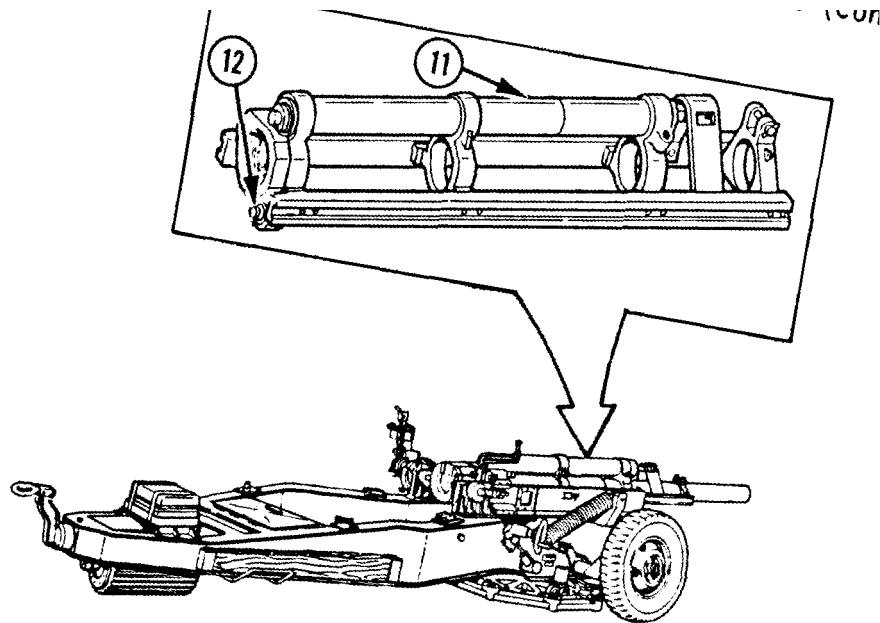
e. **OUT OF BATTERY LOCK.** The out of battery lock (7) secures the howitzer for internal aircraft loading.

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)

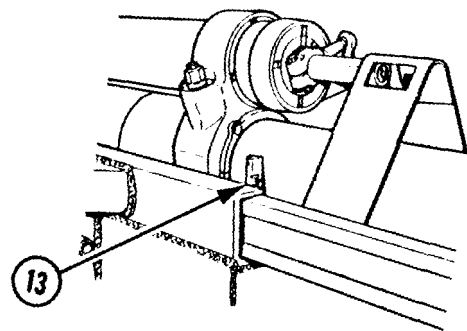


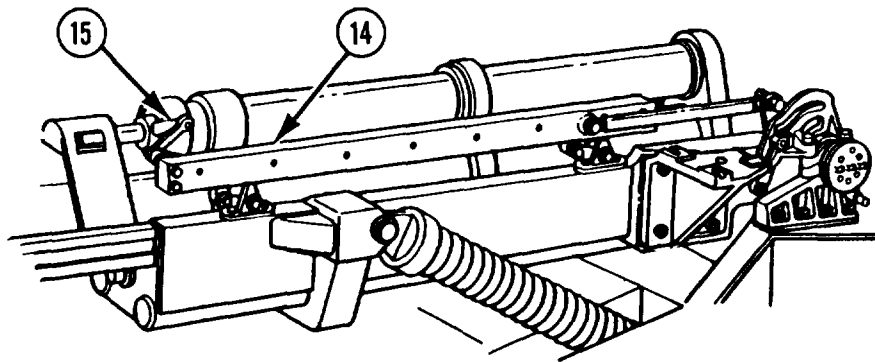
i. RECOIL MECHANISM. The M37A1 recoil mechanism has an increased oil reserve capacity with an extended indicator cap and guard assembly. All internal functions are the same as M37 recoil mechanism.

## NOTE

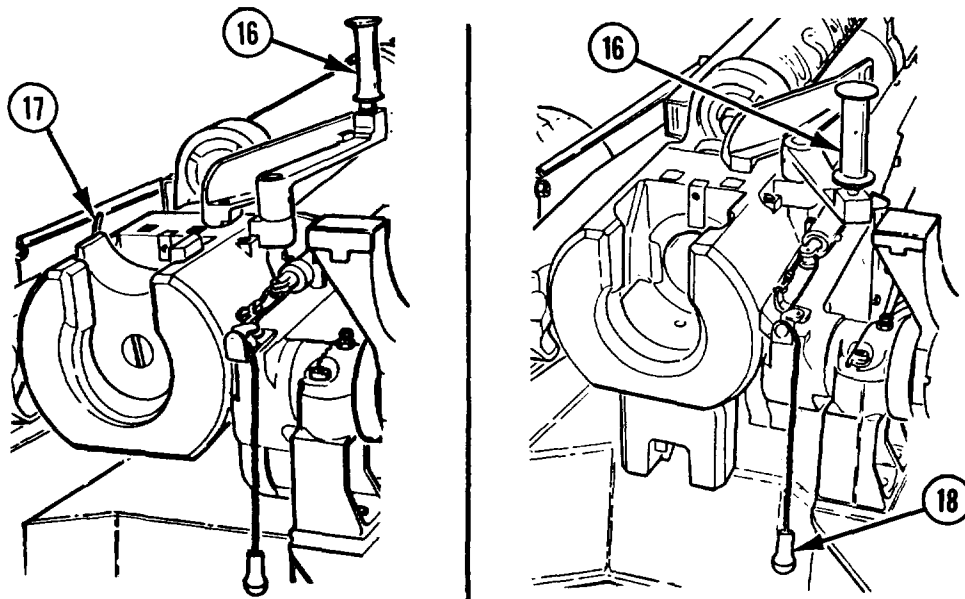
Recuperator cylinder assembly (11) contains compressed nitrogen gas, held between the piston and the head assembly. The front part of the recuperator cylinder assembly and the space between the piston and regulator assembly. The recoil cylinder assembly (12) contains recoil cylinder and recuperator cylinder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

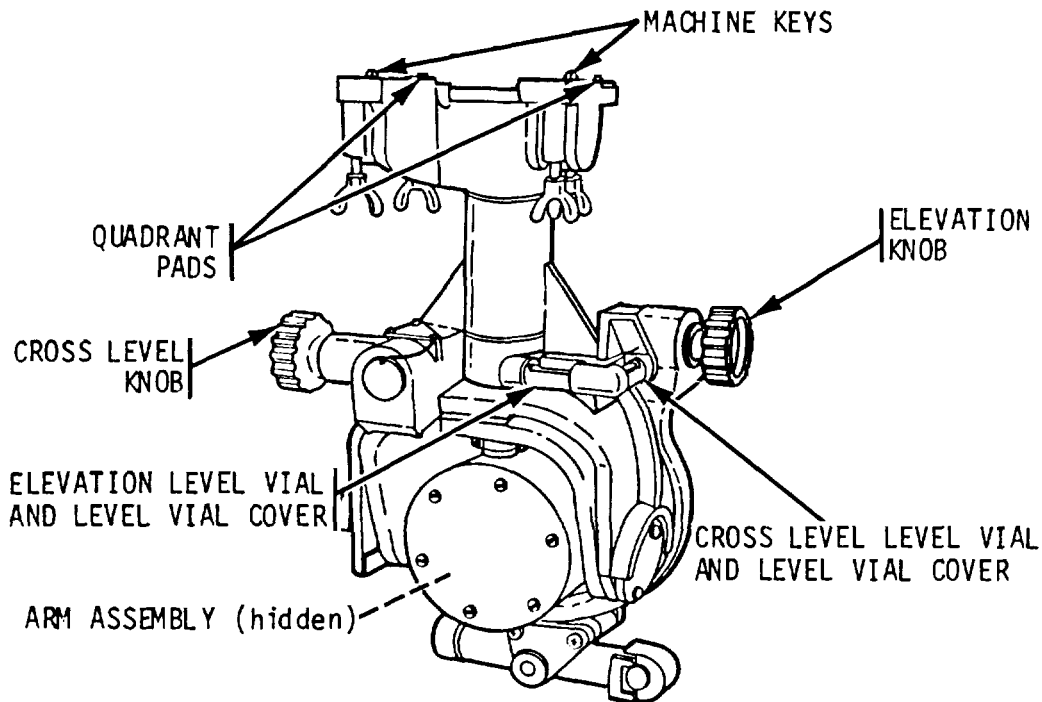
WARNING

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.

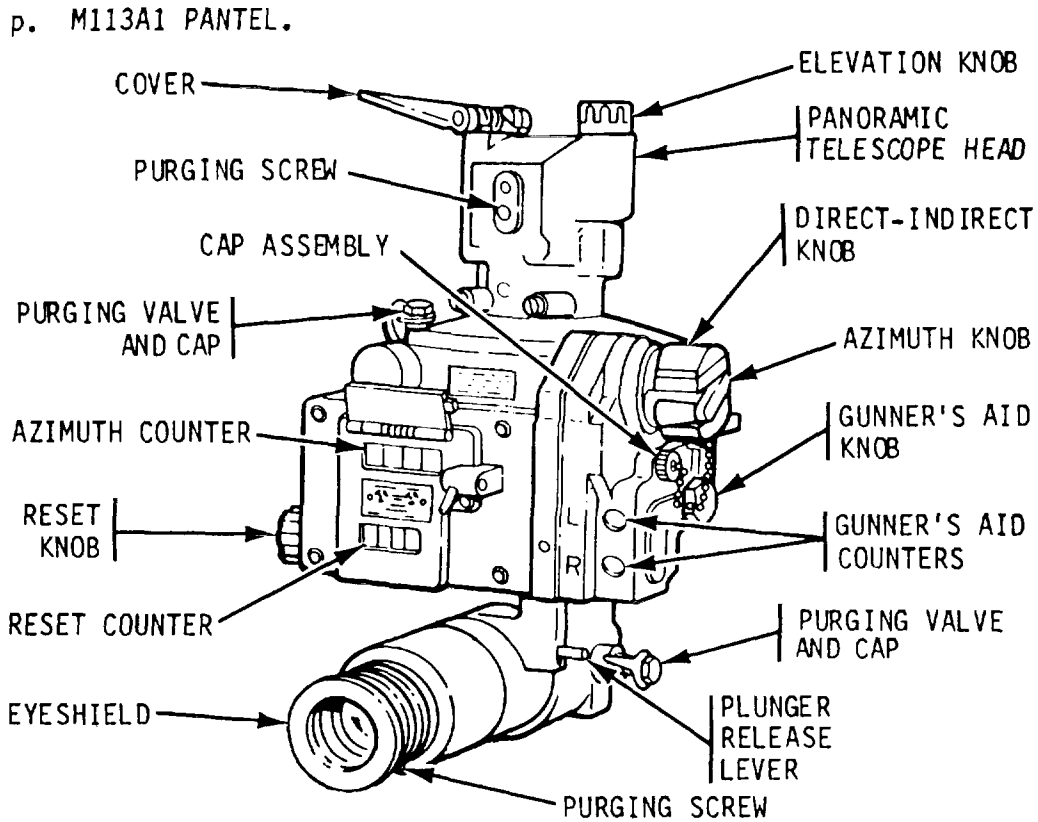
o. M134A1 TELESCOPE MOUNT.



The M134A1 telescope mount (M134A1 mount) provides an adjustable base for leveling the M113A1 panoramic telescope (M113A1 panel). 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 panel 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



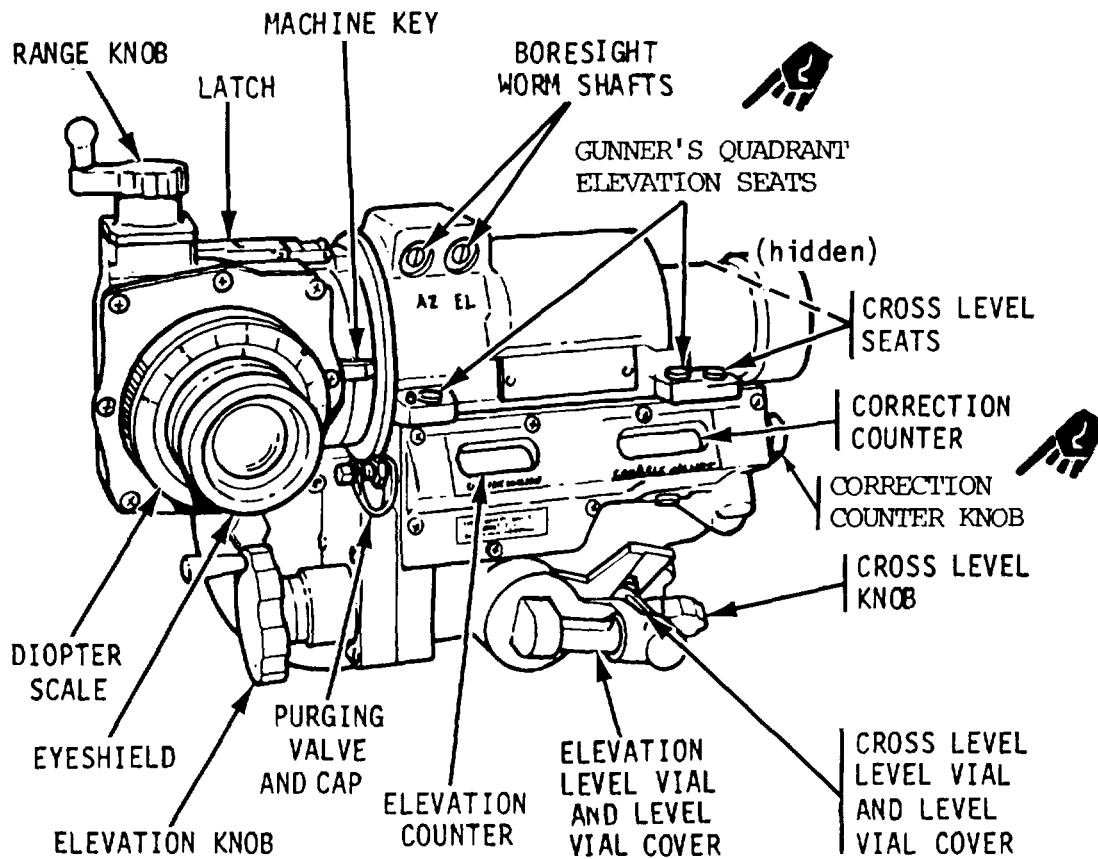
The M113A1 pantel is the basic instrument used in laying the weapon in azimuth. Azimuth reading is made from a mechanical mil counter unit. Included is a reset counter which can be set to show a reading of 3200 mils when the M113A1 pantel is alined with an aiming reference point and the weapon is parallel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

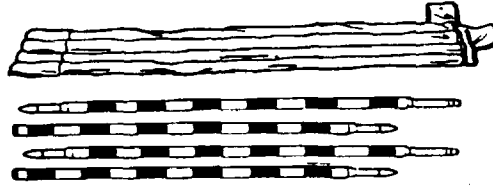
## 2-2. OPERATOR'S CONTROLS AND INDICATORS (cont)

## q. M14A1 FIRE CONTROL QUADRANT AND M114A1 ELBOW TELESCOPE



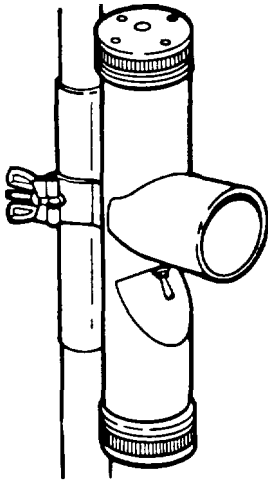
The M14A1 fire control quadrant (M14A1 quadrant), which is mounted on the right-hand trunnion, is used for adjustment of the weapon in elevation. The M14A1 quadrant is equipped with a mechanical mil counter for elevation readings. A correction counter is built in to permit quick, accurate insertion of 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.

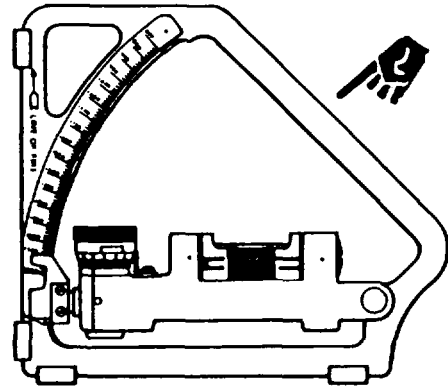


r. M1A2 AIMING POST. Two sets of aiming posts are provided for use as the alternate aiming reference point for indirect laying operations. The aiming posts normally are stored in M401 canvas cover and secured in the holders on the right trail.

s. deleted



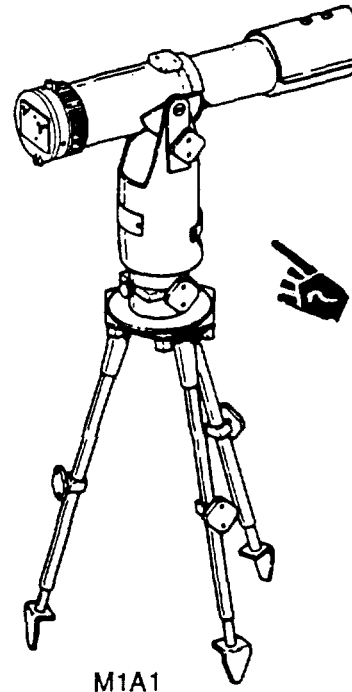
t. M14 AIMING POST LIGHTS illuminate aiming posts for night use. They are stored in the howitzer tool box.



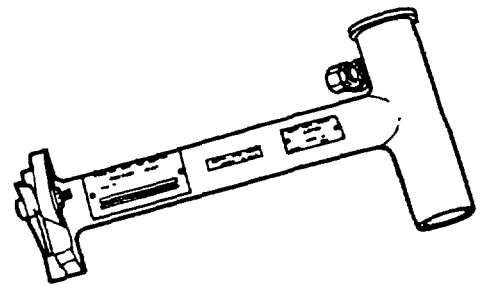
U. M1A1 GUNNER'S QUADRANT is used for checking fire control alignment and also may be used to lay for elevation. It has its own carrying case and is stored in the howitzer tool box.

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

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



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 AFTER 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.

**Change 1 2-11**

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 MIA1 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 Mission No.	Interval	Location Item to Check/ Service	Procedure	Not Fully Capable If:
1	Before 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.)	
13	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)

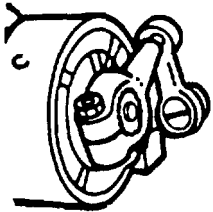
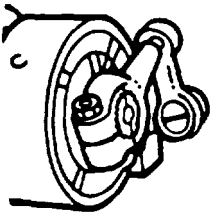
Item Mission No.	Interval	Location Item to Check/ Service	Procedure	Not Fully Capable If:
3	Before	M37/M37A1 RECOIL MECHANISM (cont)	<p>Check the indicator rod for correct oil reserve.</p>  <p>M37</p> <p>Indicator rod flush with face of indicator and control assembly: Normal.</p>  <p>M37</p> <p>Indicator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



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

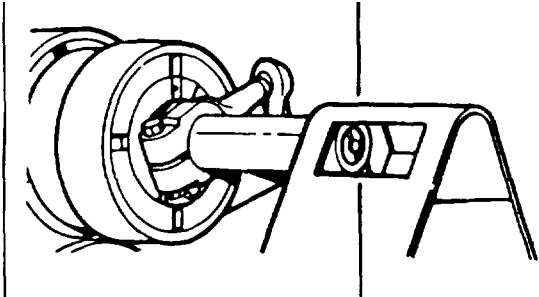
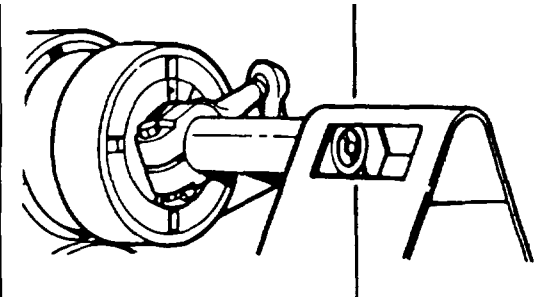
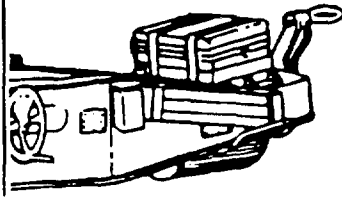
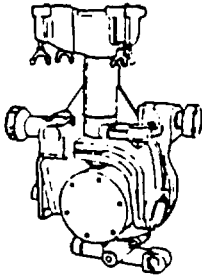
Item Mission No.	Interval	Location Item to Check/ Service	Procedure	Not Fully Capable If:
3	Before	M37/M37AI RECOIL MECHANISM (cont)	<p>Chief of Section</p>  <p>M37A1 Indicator rod flush with face of indicator and control assembly. Normal full oil reserve.</p> <p>Indicator rod extended but not to red tab. Howitzer will FIRE but oil reserve is not full.</p>  <p>M37A1 Indicator rod extended to red tab. Low oil reserve- DO NOT FIRE. Restore oil reserve.</p>	

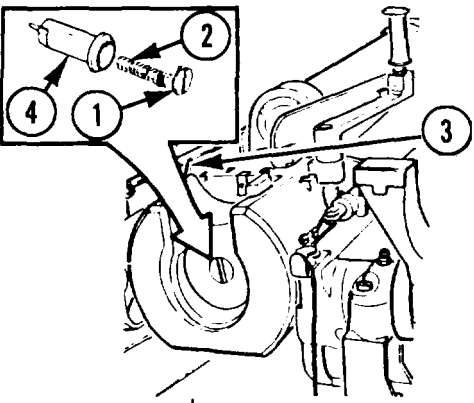
Table 2-1. Preventive Maintenance Checks and Services for M102 Howitzer (cont)

Item Mission No.	Interval	Location Item to Check/ Service	Procedure	Not Fully Capable If:
				
<p><b>CAUTION</b></p> <p>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.</p>				
4	Before	<p>M31 CARRIAGE</p> <p>M31 Carriage Traversing Mechanism</p>	<p>Gunner</p> <p>Check for smooth operation, watch for vibration, binding, or unusual noises.</p>	<p>Will not traverse.</p>
5		<p><u>FIRE CONTROL</u></p> <p>Before Mount</p>		

**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 Mission No.	Interval	Location Item to Check/ Service	Procedure	Not Fully Capable If:
10	Before	CANNON Percussion Mechanism	<p>Assistant Gunner</p> <p>a. Remove percussion mechanism as follows and check for weak or broken spring (2).</p> <p>(1) 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.</p>	 <p>Spring (2) is weak or broken.</p>

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 Mission No.	Interval	Location Item to Check/ Service	Procedure	Not Fully Capable If:
10	Before	CANNON Percussion Mechanism (cont)	<p>Assistant Gunner</p> <p>(2) Press in on retainer (1) and rotate 90 degrees in either direction to remove retainer and spring (2).</p> <p>(3) Pull back cocking lever (3). Remove percussion mechanism (4).</p> <p>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</p> <p style="text-align: center;"><b>2-20 Change 1</b></p>	

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	<p><u>CANNON</u> Percussion Mechanism (cont)</p>	<p>mechanism, pull back cocking lever, pull lanyard, and listen for click.</p> <p>b Check for missing or broken firing pin by first opening and closing breechblock, then pulling lanyard while at the same time looking between the rear of the tube and the breechblock. If firing pin is missing or broken, notify organizational maintenance.</p>	<p>Firing pin is missing or broken.</p>

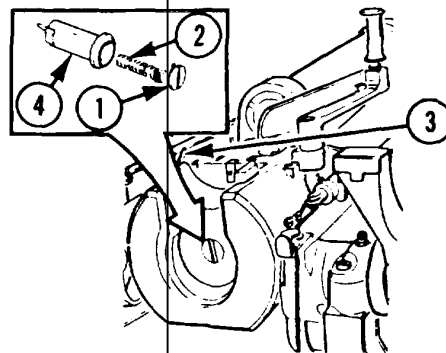


Table 2-2. Preventive Maintenance Checks and Services for M102 Howitzer (Cont'd)

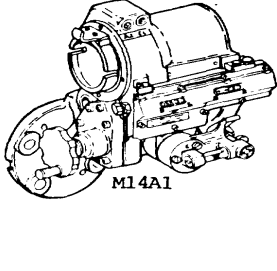
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
11	Before	<p><u>FIRE CONTROL</u> M14A1 Quadrant</p>	<div style="text-align: center;">  <p><b>WARNING</b></p> <p>When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.</p> <p><b>NOTE</b></p> <p>The M102 howitzer will not be mission capable if <u>BOTH</u> the M14A1 quadrant and the M1A2 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 <u>EITHER</u> quadrant is available.</p> <p><u>Assistant Gunner</u></p> <p>Check counters and level vials for illumination at night or in dark conditions during daylight.</p> <p>Check level vials for cracks, breaks, and legibility.</p> <p>Check knobs for smooth operation. Watch for moisture buildup in counters.</p> </div>	<p>M14A1 quadrant is missing or not operable.</p> <p>No illumination.</p>

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

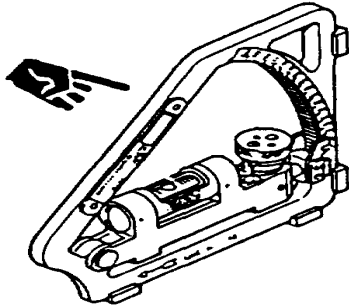
Item No.	Interval	Location	<u>Crewmember Procedure</u>	Not Fully Mission Capable if:
		Item to Check/Service		
12	Before	M1A1 Gunner's Quadrant	 <p><b>NOTE</b></p> <p>The M102 howitzer will not be mission capable if <u>BOTH</u> the M14A1 quadrant and the M1A1 gunner's quadrant are missing or inoperable.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

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

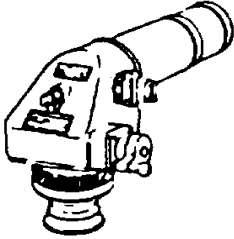

Item No.	Interval	Location	<u>Crewmember Procedure</u>	Not Fully Mission Capable if:
		Item to Check/ Service		
13	Before	M114A1 Telescope	 M114A1   <b>WARNING</b> When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.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



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

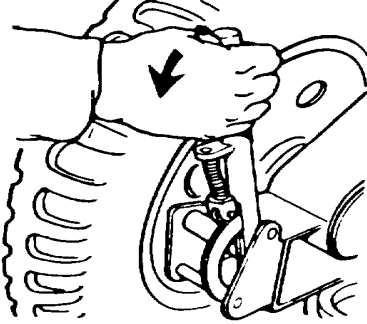
Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable if:
		Item to Check/Service		
15	Before	Handbrakes	 <p><u>Cannoneer No. 1</u> Make sure that handbrakes hold properly and engage in the first one-third of the brake rack.</p>	
16	Before	<u>CANNON</u> M137A1 Cannon	Wipe the bore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

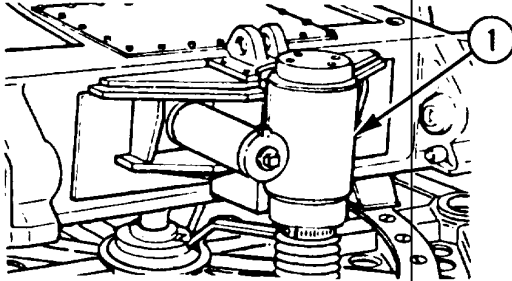
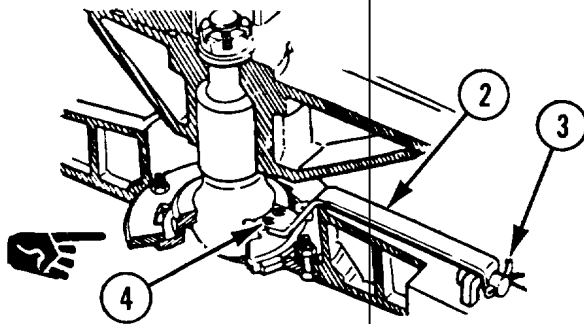
Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable if:
		Item to Check/Service		
18	Before	M31 Carriage	 <p><u>Cannoneer No. 2</u></p> <p>a. Inspect buffer assembly (1) for damage or leaks.</p>	<p>If buffer assembly is damaged or leaks, notify organizational maintenance.</p>
	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

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

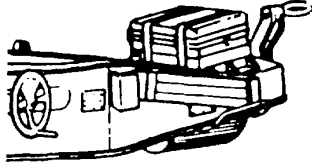
Item No.	Interval	Location	<u>Crewmember Procedure</u>	Not Fully Mission Capable if:
		Item to Check/Service		
19	During	M37/M37A1 RECOIL MECHANISM	<u>Chief of Section</u>  Observe operation of recoil mechanism and variable recoil mechanism. Watch for jerking or slamming; recoil length should decrease at high angles of fire.	
				
20	During	<u>M31 CARRIAGE</u> M31 Carriage Traversing Mechanism	<u>Gunner</u>  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)

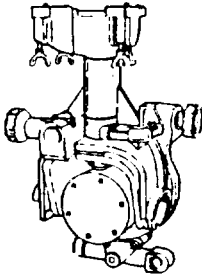

Item No.	Interval	Location Item to Check/ Service	<u>Crewmember</u> Procedure	Not Fully Mission Capable if:
21	During	<p><u>FIRE CONTROL</u> M134A1 Mount</p>	<div style="text-align: center;">  <p>M134A1</p> </div> <div style="text-align: center;">  <p><b>WARNING</b></p> <p>When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.</p> </div> <p><u>Gunner</u></p> <p>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.</p>	<p>M134A1 mount is missing or not operable.</p> <p>Level vials cracked, loose, or unreadable.</p> <p>No illumination</p>

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

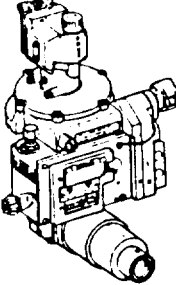

Item No.	Interval	Location Item to Check/ Service	<u>Crewmember</u> Procedure	Not Fully Mission Capable if:
22	During	M113A1 Panel	 <p>M113A1</p>  <p><b>WARNING</b></p> <p>When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.</p> <p><u>Gunner</u></p> <p>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.</p>	<p>M113A1 panel is missing or not operable.</p> <p>No illumination</p>

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

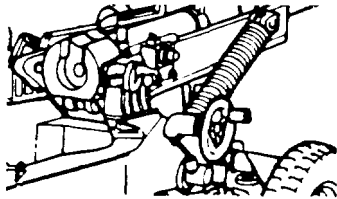
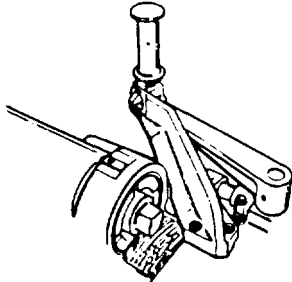
Item No.	Interval	Location	<u>Crewmember Procedure</u>	Not Fully Mission Capable if:
		Item to Check/ Service		
23	During	<u>M31</u> <u>CARRIAGE</u> M31 Carriage Elevating Mechanism	 <u>Assistant Gunner</u> Check for free and easy operation through entire range with no evidence of binding, sl	Will not 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)

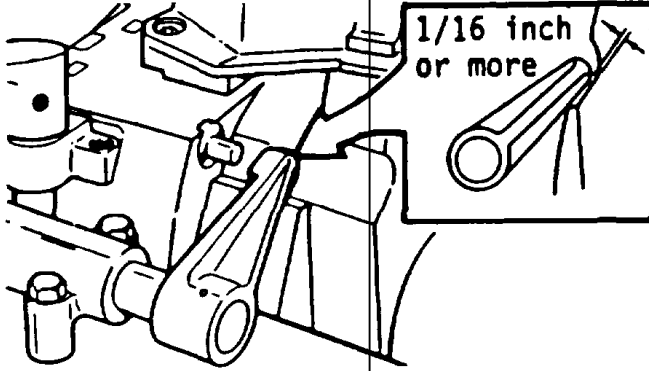
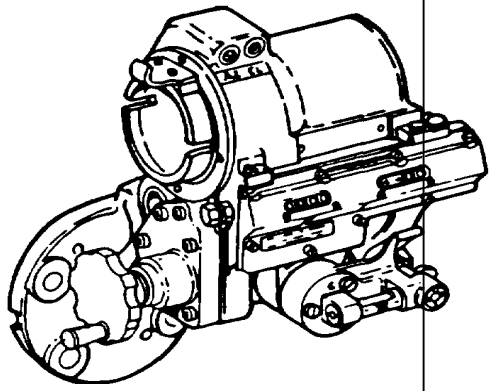

Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable if:
		Item to Check/Service		
25	During	Firing Mechanism Assembly	 <p>Check that clearance between firing mechanism assembly and rear yoke is at least 1/16 inch. at least 1/16 inch.</p>	Firing mechanical assembly is broken or missing.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

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

Item No.	Interval	Location	<u>Crewmember</u> Procedure	Not Fully Mission Capable if:
		Item to Check/ Service		
26	During	<u>FIRE CONTROL</u> M14A1 Quadrant (cont)	<p style="text-align: center;"><b>NOTE</b></p> <p>The M102 howitzer will not be mission capable if <u>BOTH</u> 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 <u>EITHER</u> quadrant is available.</p> <p><u>Assistant Gunner</u></p> <p>Check counters and level vials for illumination at night or in dark conditions during daylight.</p> <p>Check level vials for cracks, breaks, and legibility.</p> <p>Check knobs for smooth operation. Watch for moisture buildup in counters.</p>	<p>M14A1 quadrant is missing or not operable.</p> <p>No illumination</p>



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

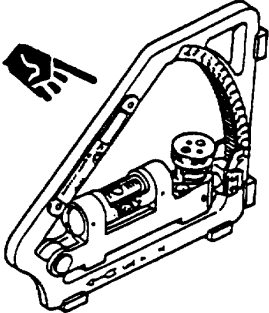
Item No.	Interval	Location Item to Check/ Service	<u>Crewmember</u> Procedure	Not Fully Mission Capable if:
27	During	M1A1 Gunner's Quadrant	 <p style="text-align: center;"><b>NOTE</b></p> <p>The M102 howitzer will not be mission capable if <u>BOTH</u> the M14A1 quadrant and the M1A1 gunner's quadrant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

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

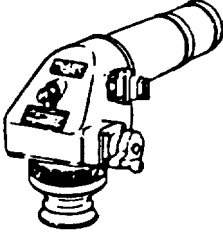

Item No.	Interval	Location Item to Check/ Service	<u>Crewmember</u> Procedure	Not Fully Mission Capable if:
28	During	M114A1 Telescope	   <p><b>WARNNG</b></p> <p>When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.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

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

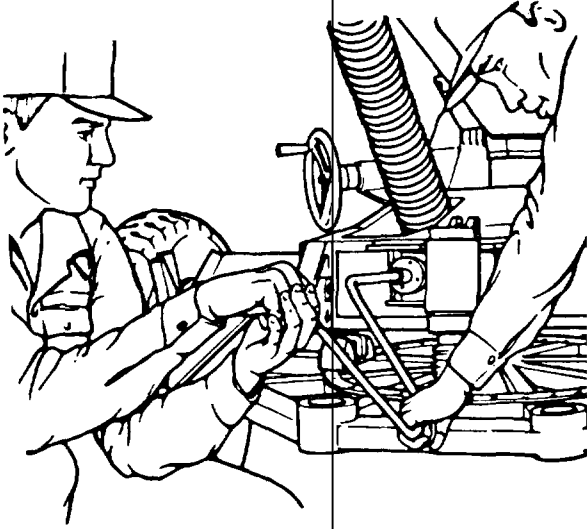
Item No.	Interval	Location	<u>Crewmember Procedure</u>	Not Fully Mission Capable if:
		Item to Check/Service		
29	During	<u>M31 CARRIAGE</u> Control Assembly	 <u>Cannoneer No. 1</u> Watch for slippage, unusual noises, or binding.	Control assembly will not raise or lower The weapon.
30	During	M37/M37A1 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	<u>Crewmember Procedure</u>	Not Fully Mission Capable if:
		Item to Check/Service		
31	During	<u>M31 CARRIAGE</u> Control Assembly	<u>Cannoneer No. 2</u> Watch for slippage, unusual noises, or binding	Control assembly will not raise or lower the weapon.
32	After	DA FORM 2408-4	<u>Chief of Section</u> 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	<u>Crewmember Procedure</u>	Not Fully Mission Capable if:
		Item to Check/Service		
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.
33	After	<u>CANNON</u> M137A1 Cannon	<p><b>CAUTION</b></p> <p>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.</p> <p><b>NOTE</b></p> <p>Shake the bottle well before each use.</p> <p><u>Chief of Section</u></p> <p>a. On day of firing, remove one bottle of pre-measured cleaner, lubrication cant, and preservative</p>	Total EFC round count exceeds 5,000.

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

Item No.	Interval	Location	<u>Crewmember Procedure</u>	Not Fully Mission Capable if:
		Item to Check/Service		
33	After	<u>CANNON</u> M137A1 Cannon	<u>Chief of Section</u> (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	<u>Crewmember</u> Procedure	Not Fully Mission Capable if:
		Item to Check/Service		
33	After	<u>CANNON</u> M137A1 Cannon (cont)	<p>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.</p> <p>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.</p> <p style="text-align: center;"><b>Change 1 2-26.13</b></p>	

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

Item No.	Interval	Location	<u>Crewmember Procedure</u>	Not Fully Mission Capable if:
		Item to Check/ Service		
33	After	<u>CANNION</u> M137A1 Cannon (cont)	<u>Chief of Section</u> 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. <u>Remove and dispose of the cleaning sleeve.</u> 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. <u>Remove and dispose of cleaning sleeve.</u>	
<b>Change 1 2-26.14</b>				



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

Item No.	Interval	Location	<u>Crewmember</u> Procedure	Not Fully Mission Capable if:
		Item to Check/Service		
33	After	<u>CANNON</u> M137A1 Cannon (cont)	<p>Repeat wet punch with last half of bottle.</p> <p>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.</p> <p style="text-align: center;"><b>Change 1 2-26.15</b></p>	

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

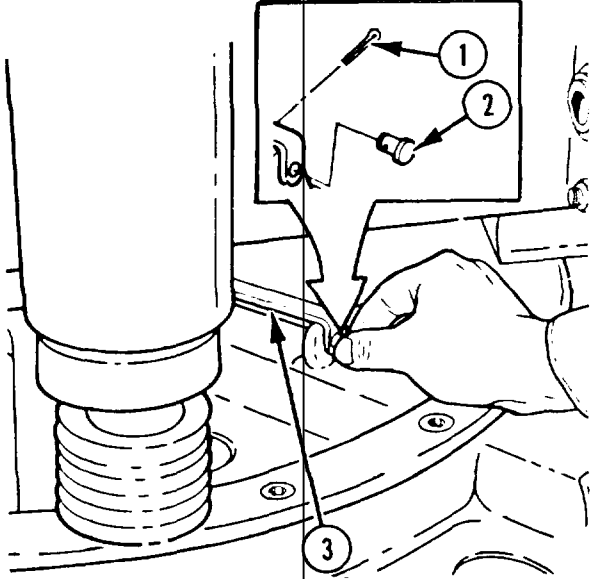
Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable if:
		Item to Check/Service		
33	After	<p><u>CANNON</u> M137A1 Cannon (cont)</p> <p>If cannon tube has not been previously cleaned with CLP and there is a heavy buildup of coppering or carbon deposits, or severe heat cracking, it may be necessary to repeat cleaning instructions until cannon tube has been thoroughly cleaned with CLP.</p>	<p><u>Chief of Section</u></p> <p><b>NOTE</b></p>	
34	After	<p><u>M31</u> <u>CARRIAGE</u> M31 Carriage</p>	<p><u>Cannoneer No. 2</u></p> <p>a. Remove cotter pin (1) and straight pin (2) from locking assembly handle (3). Unlock</p>	 <p>The diagram illustrates a hand operating a locking assembly handle (3) on the M31 carriage. A callout box shows a close-up of the handle with a cotter pin (1) and a straight pin (2) being removed. The cotter pin is shown being pulled out of the handle, and the straight pin is shown being inserted into the handle. The handle is shown in a locked position, and the hand is shown turning it to unlock it.</p>

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

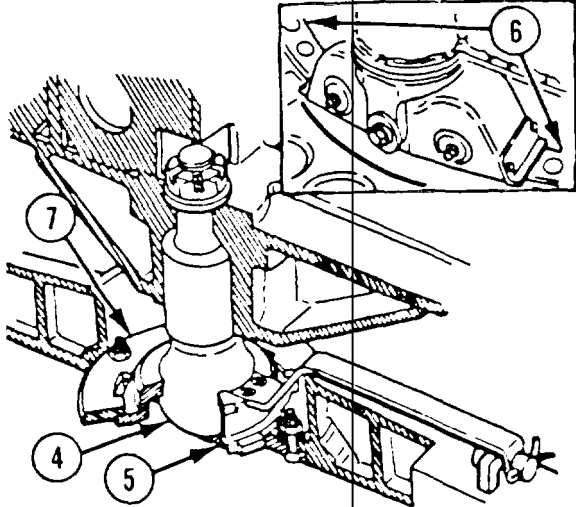
Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable if:
		Item to Check/Service		
34	After	<p><u>M31</u> <u>CARRIAGE</u> M31 Carriage (cont)</p>	<p>firing platform assembly by rotating locking assembly handle (3) counter- clockwise.</p>  <p>b. Clean ball stud (4), firing platform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

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

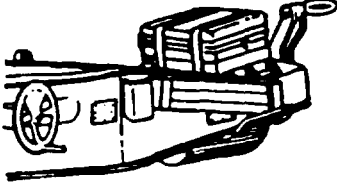
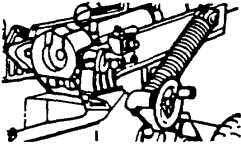
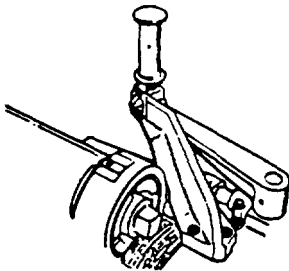
Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable if:
		Item to Check/Service		
35	Monthly	M31 Carriage Traversing Mechanism	 <p><u>Gunner</u></p> <ul style="list-style-type: none"> <li>a. Check for smooth operation, watch for vibration, binding, or unusual noises.</li> <li>b. Visually inspect drawbar, pin, and lunette to ensure they are not bent, broken, or missing.</li> <li>c. Inspect traversing wheel for cuts or missing bolts.</li> </ul>  <p><b>Change 2 2-26.18</b></p>	<p>Will not traverse.</p> <p>Drawbar or lunette is bent or cracked. Drawbar is missing</p> <p>Wheel is missing. cut through cords exposed, tire flat or has any bulges. Bolts are missing.</p>

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

Item No.	Interval	Location	<u>Crewmember</u> Procedure	Not Fully Mission Capable if:
		Item to Check/Service		
36	Monthly	M31 Carriage Elevating Mechanism	<u>Assistant Gunner</u>  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.	<u>Assistant Gunner</u>  Breech operating handle will not lock.

Change 2 2-26.19

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

Item No.	Interval	Location	Crewmember Procedure	Not Fully Mission Capable if:
		Item to Check/ Service		
38	Monthly	Wheel Assembly	<p><u>Cannoneer No. 2</u></p> <ul style="list-style-type: none"> <li>a. Check for correct air pressure (20 psi normally, 40 psi for long movements on superhighways).</li> <li>b. Check the wheel capnuts; if they are loose, have them torqued to 50-55 ft-lb.</li> <li>c. Check tires; if they show wear bars, notify organizational maintenance.</li> </ul>	
<p><b>Change 1 2-26.20</b></p>				

**Section III. OPERATION UNDER USUAL CONDITIONS****WARNING**

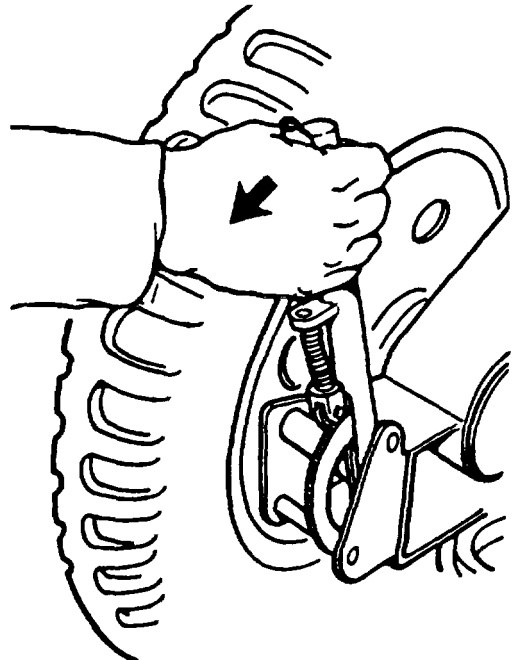
Do not store equipment of any kind inside the cannon tube. Foreign objects inadvertently left in bore of cannon tube before firing can cause a premature explosion resulting in death or injury to personnel.

**NOTE**

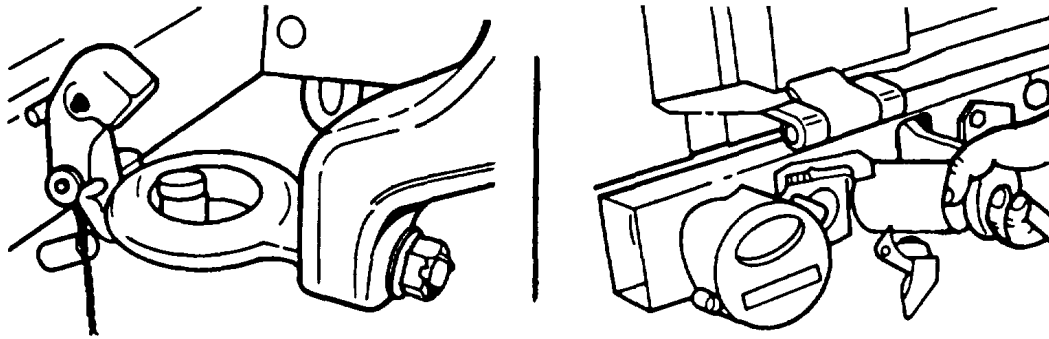
Occupation of the firing section position is performed under the direct supervision of the chief of section. The prime mover should be driven into position so that the howitzer is aligned on the direction of fire.

**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.

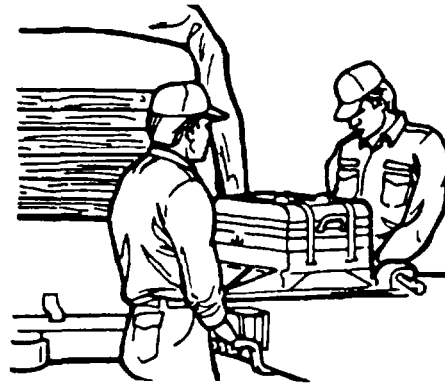


2-5. DISCONNECTING M102 HOWITZER FROM PRIME MOVER (cont)



- 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.

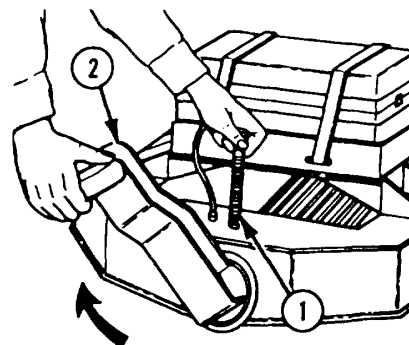


- 6 The chief of section directs the driver (D) to pull forward when the lunette is lifted from the towing pintle.

**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).

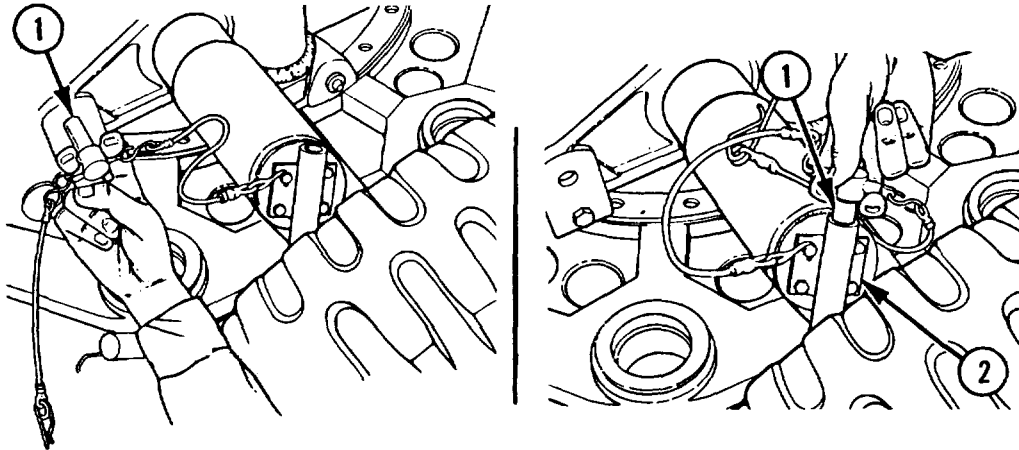




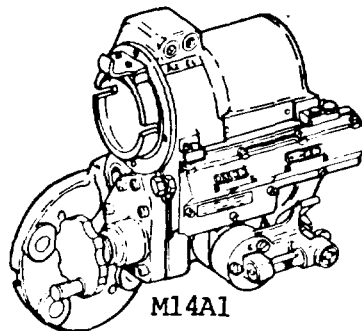
8. Cannoneer no. 2 removes tail and stop blackout lights by removing special pin.
9. Assistant gunner and cannoneer no. 2 remove overall cover from the M102 howitzer.

**2-6. EMPLACING M102 HOWITZER**

1. Cannoneer no. 2 removes muzzle plug.



2. Cannoneer no. 1 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.

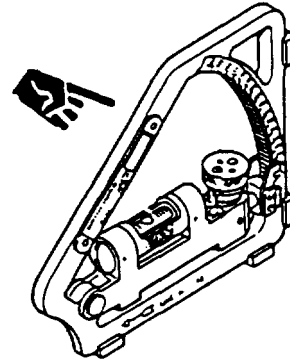


4. Cannoneer no. 2 removes travel lock pin assembly (3) from travel lock (4). He then places travel lock in stowed position and secures it with travel lock pin assembly.

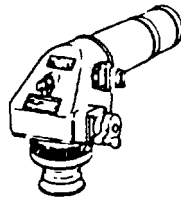
**2-6. EMLACING M102 HOWITZER (cont)**

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.

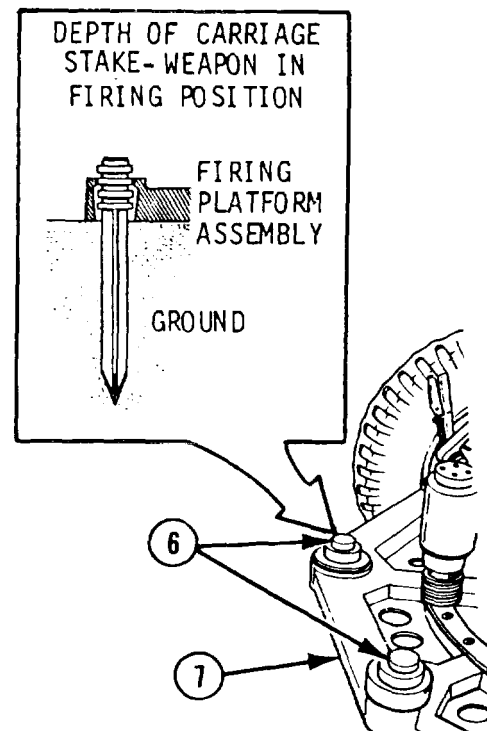
**NOTE**

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.

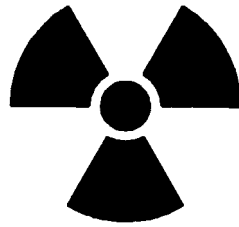
**NOTE**

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.



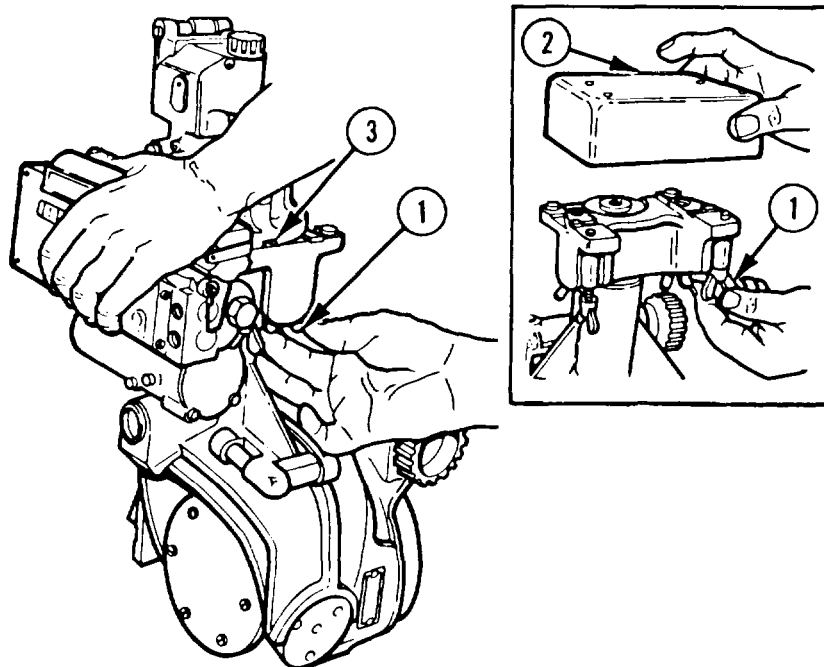
## 2-7. INSTALLING M113A1 PANTEL

**WARNING**

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

The M113A1 panel is installed by gunner as follows:

- 1 Remove canvas telescope and mount cover from M134A1 mount.

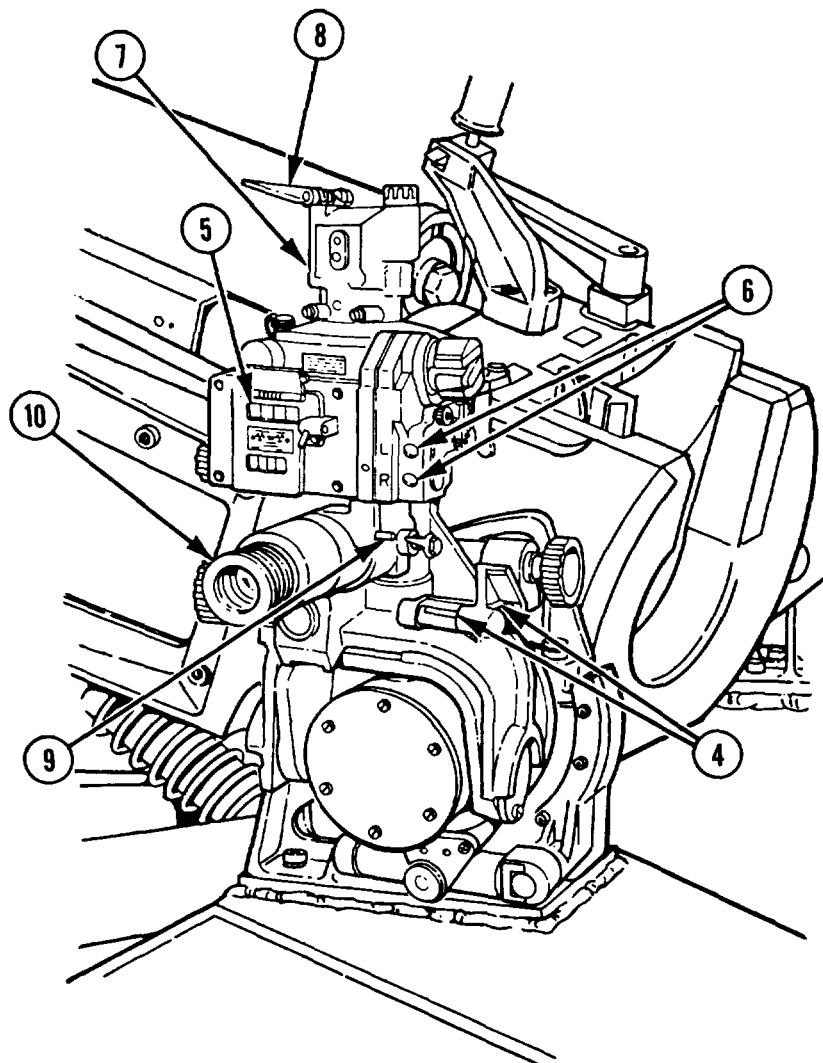


- 2 Loosen four quick release assemblies (1) and remove telescope mount cover (2).

**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.

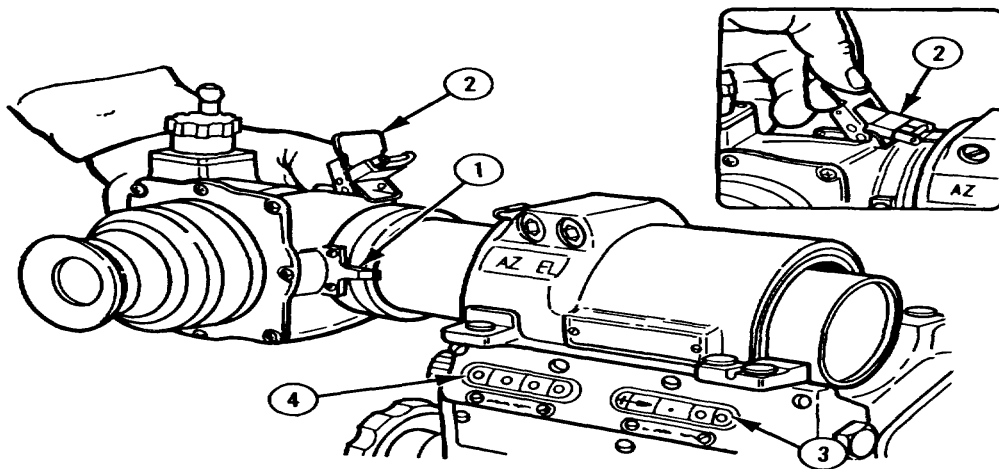
## 2-8. INSTALLING M114A1 TELESCOPE

**WARNING**

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

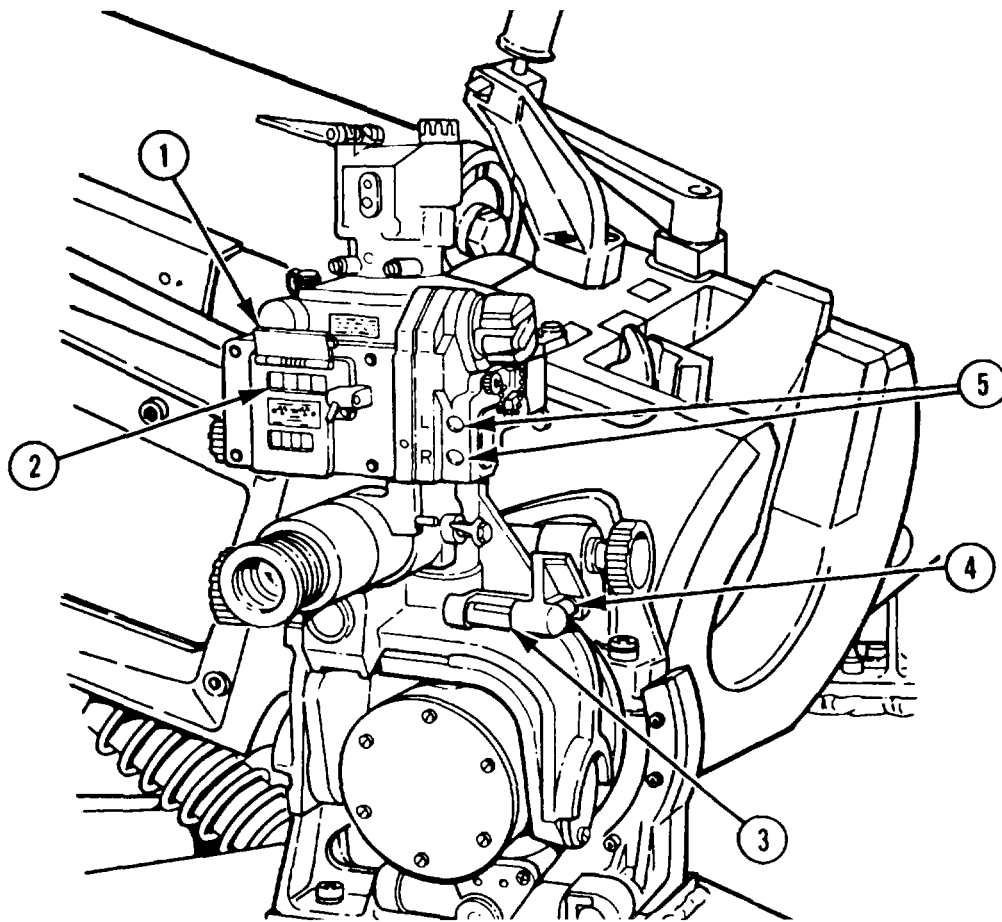
The M114A1 telescope is installed by the assistant gunner as follows:

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



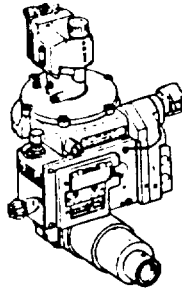
- 2 Remove M114A1 telescope from carrying case and insert into M14A1 quadrant, making certain machine key (1) engages in slot.
- 3 Fasten latch (2) as shown above.
- 4 Do your before operation PMCS, steps 12 and 14.
- 5 Set correction counter (3) to 0 and elevation counter (4) to 300.
- 6 Level M14A1 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 aligned 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).



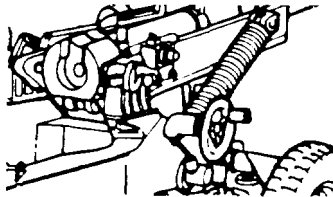
- 7 Upon announcement of the deflection, the gunner repeats the deflection by announcing NUMBER (SO AND SO), DEFLECTION (SO MUCH), and rotates the azimuth knob (6) until the announced deflection appears on the azimuth counter (2).
- 8 Operating the traversing handwheel assembly and sighting through the M113A1 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.

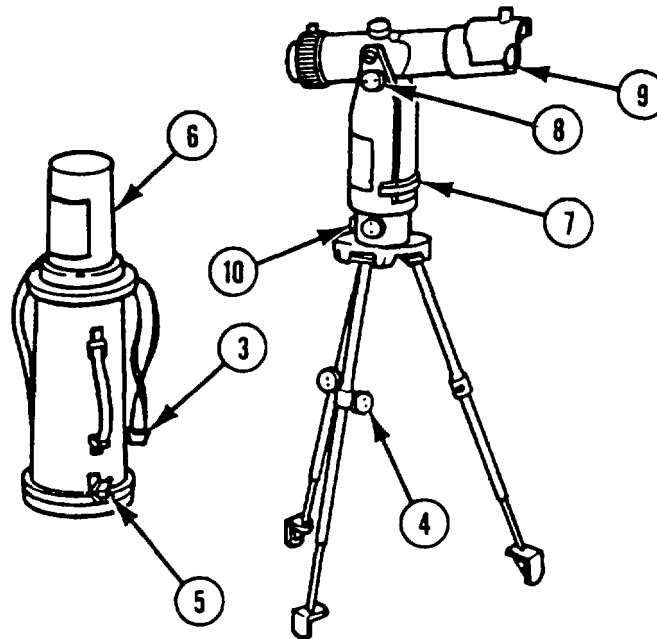


- 1 Sighting through M113A1 panel eyepiece (1), the gunner rotates the azimuth knob (2) until a convenient place to locate the collimator is sighted.

**NOTE**

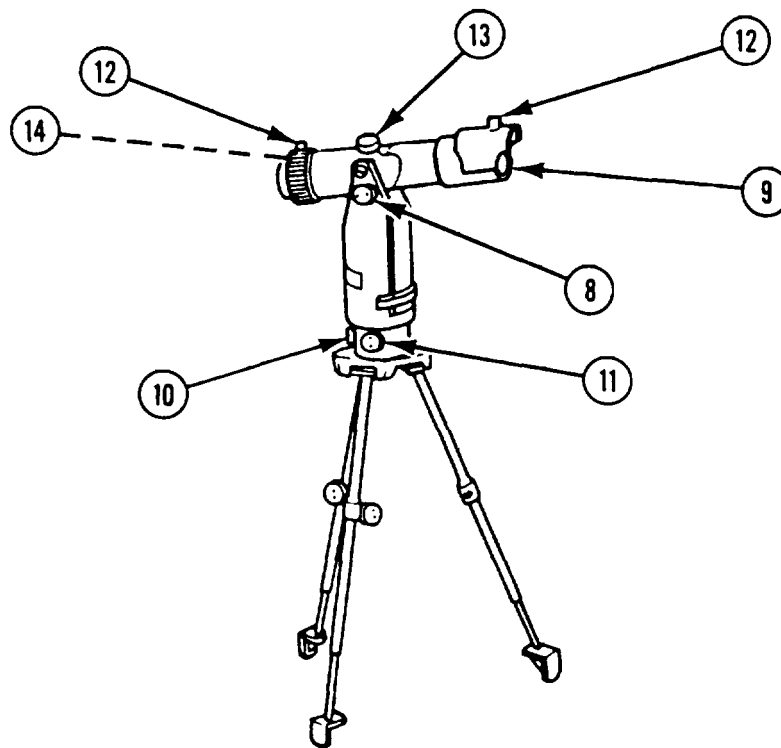
The collimator is the primary reference aiming point for the M102 howitzer. The collimator should be emplaced in a concealed position. Placing the collimator between 2400 mils and 2800 mils on the t1113A1 panel azimuth counter will minimize displacement. Emplacement distance away from the weapon will 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.

**Change 2 2-38**



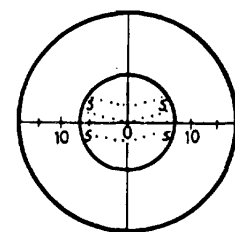
- 2 Under directions from the gunner, cannoneer no. 1 emplaces the collimator as follows:
- Unfasten strap (3) which retains tripod legs.
  - Extend tripod legs as necessary. Lock by tightening the locking knobs (4).
  - Rotate the tripod legs to the down position and set each leg firmly into the ground with one leg of tripod toward M113A1 panel.
  - Release latches (5) and remove cover assembly (6) from the collimator.
  - Unfasten strap (7). Loosen elevation clamping knob (8) and rotate collimator (9) to a horizontal position.
  - Ensure azimuth adjustment is in center of the traversing capabilities by operating the azimuth adjustment knob (10).

## ■ 2-10. EMPLACING M1A1 COLLIMATOR (cont)



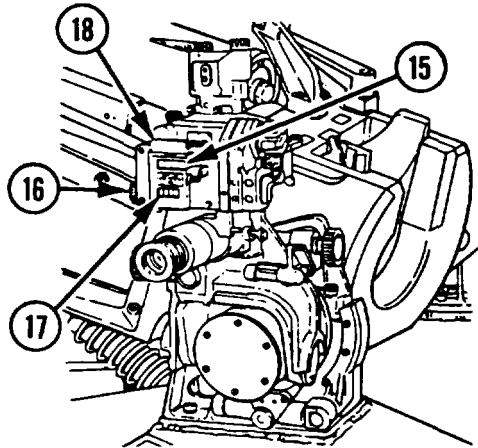
- g. Loosen azimuth clamping knob (11). Sighting down the front and rear sights (12), rough lay the collimator on the M113A1 panel objective lens. Tighten the elevation clamping knob (8) and azimuth clamping knob (11).
- h. Loosen the cross level clamping knob (13); rotate the collimator (9) until the 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).

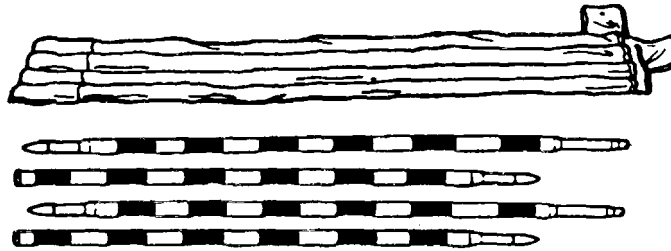
**2-11. EMPLACING M1A2 AIMING POSTS**

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.

**Change 2 2-41**

## 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**

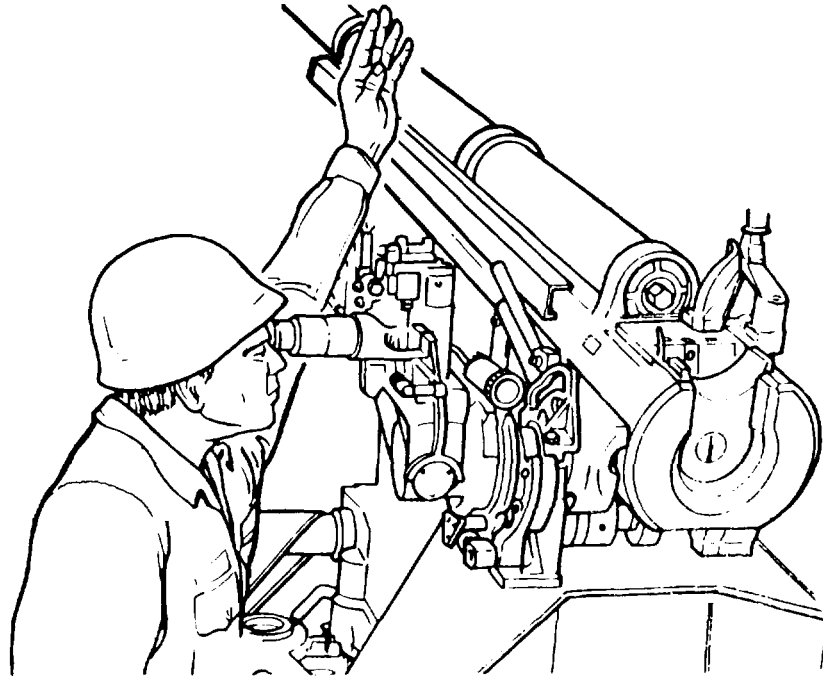
When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.

- 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) aligned with the body. The ATC returns to the near aiming post and positions it by observing hand signals of the gunner.



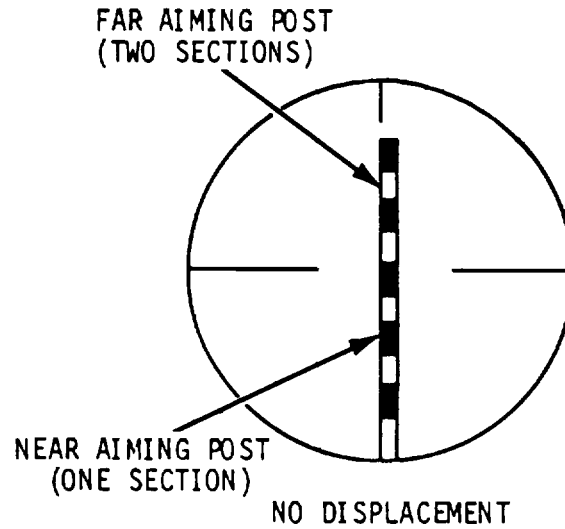
- 5 Sighting through the M13A1 panel, the gunner positions the aiming post by extending his left hand (right hand if aiming posts are to rear of weapon) above his head. ATC moves aiming post as directed by the following hand movements:
- Hand movement to the left or right means to move the aiming post in that direction.
  - Up and down hand movement means to emplace the aiming post.
  - Clenched fist means to stop.
  - Tapping on top of helmet and moving hand left or right means to move the top of the aiming post in that direction.
  - 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.

**Change 1 2-43**

## 2-11. EEMPLACING 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

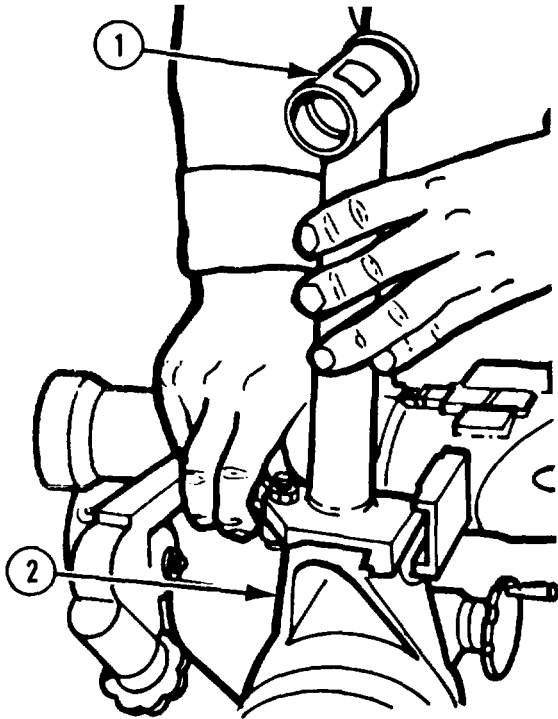
**WARNING**

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

**Change 1 2-44**



**The assistant gunner:**



- 1 Removes the M140 alignment 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.

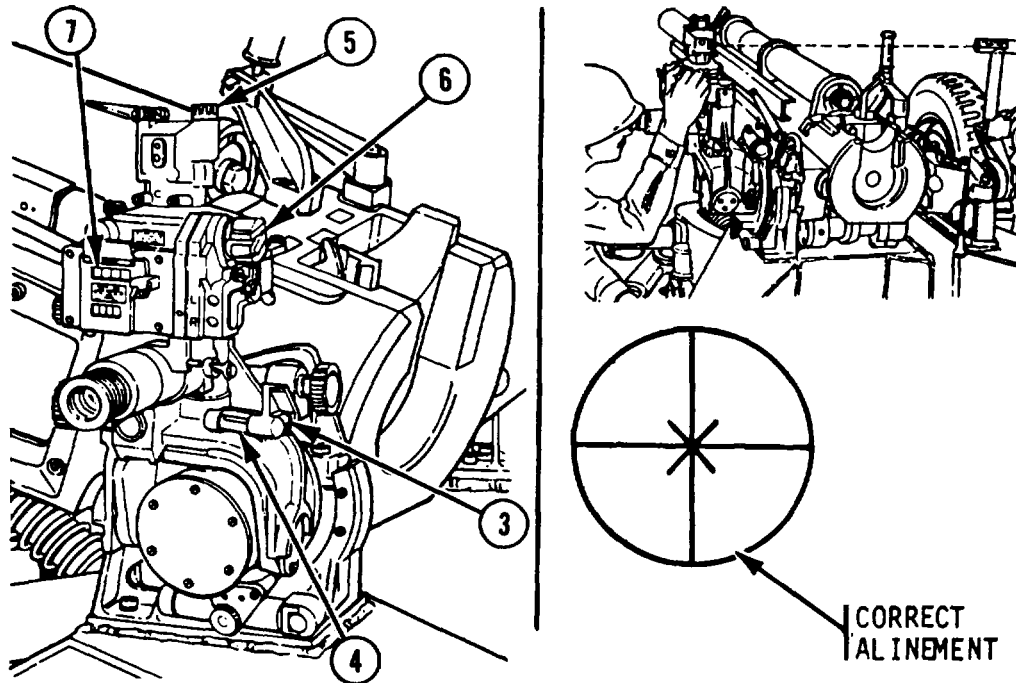
- 2 Inspects both mating surfaces for dirt, nicks, or burrs. Cleans surfaces with solvent cleaning compound (item 12, app D) and dries with wiping rag (item 22, app D). If surfaces have nicks or burrs, notify organizational maintenance.

**CAUTION**

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

- 3 Mates the M140 alignment device (1) to the adapter (2). Dovetails must align.
- 4 Depresses or elevates the cannon to zero elevation using the r114A1 quadrant. Ensures both M14A1 quadrant counters read 0.

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



### The gunner:

- 5 Levels the M113A1 mount by carefully centering the bubbles in the cross level level vial (3) and the elevation level vial (4).
- 6 Aligns 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 aligned, 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

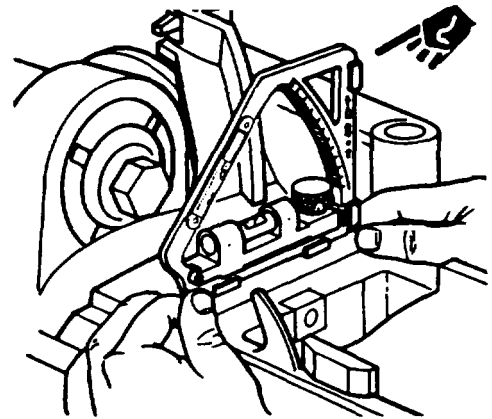
## 2-13. CHECKING BORESIGHT OF THE MI13AI PANEL USING THE DISTANT AIMING POINT METHOD



### WARNING

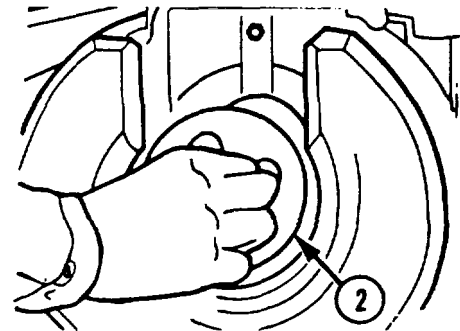
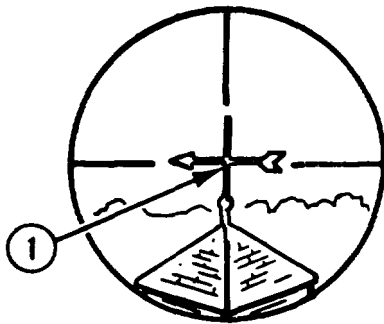
When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.

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



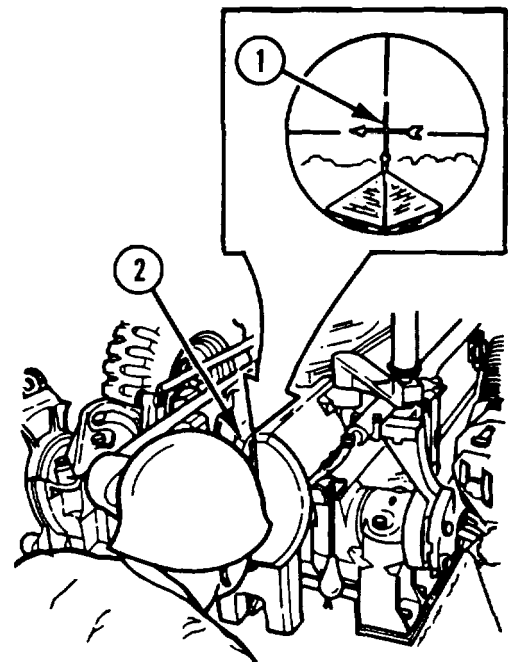
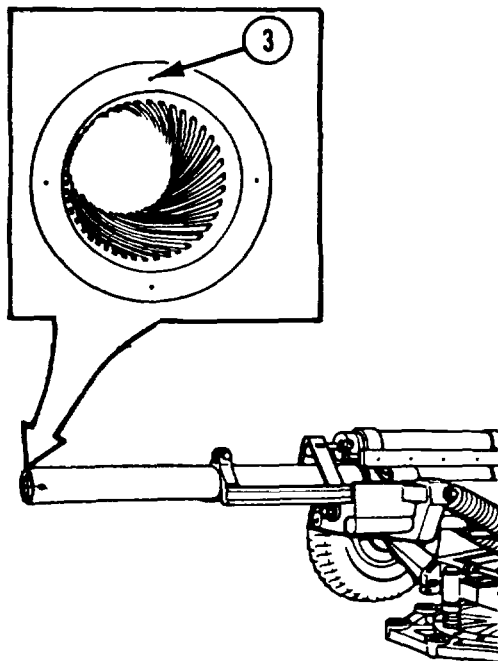
Change 2 2-47

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.

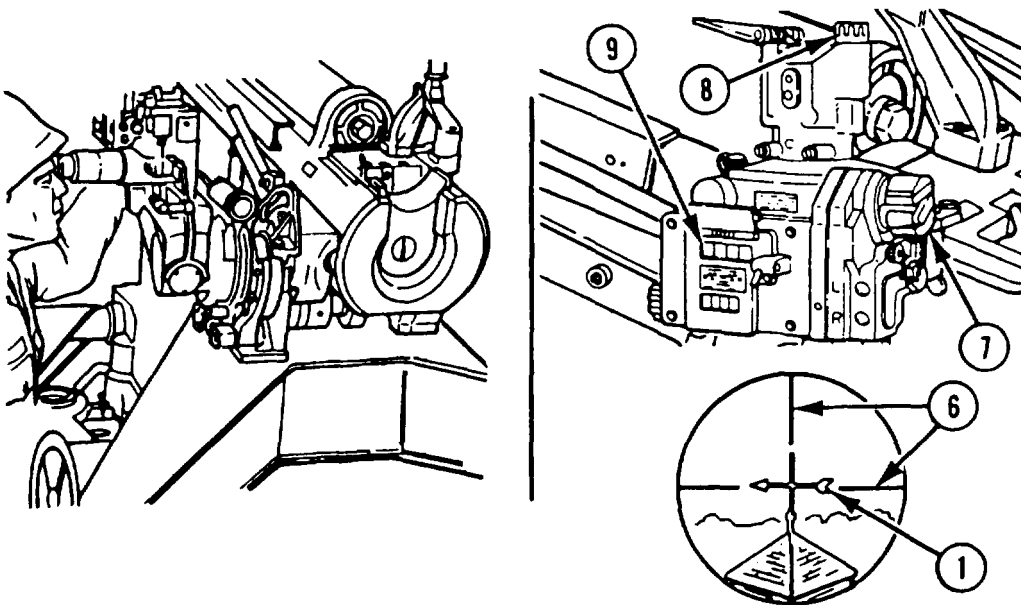
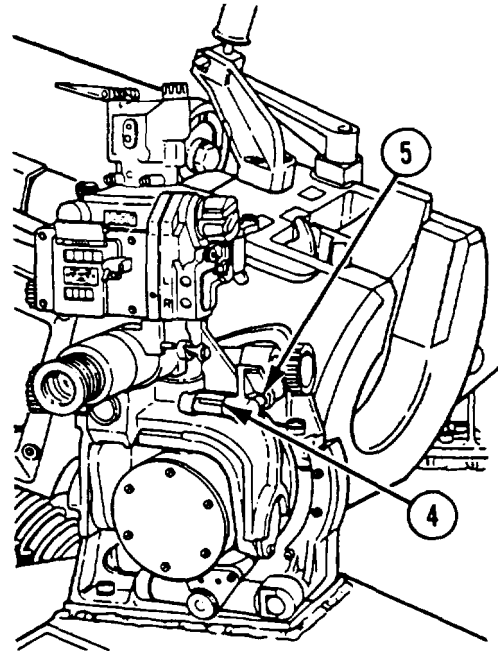
3 Install breech boresight disk (2).



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

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

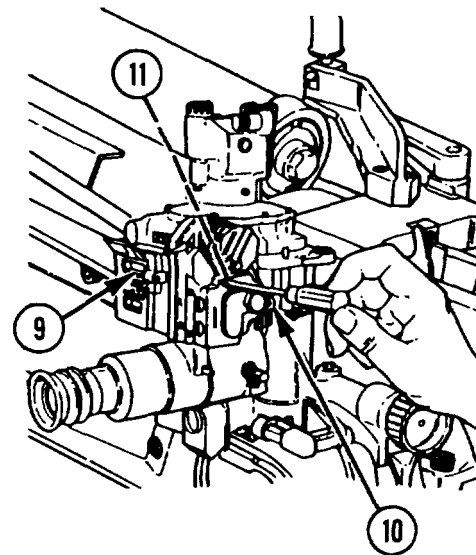
- 6 Center the elevation level vial bubble (4) and cross level level vial bubble (5) on the M1134A1 mount.



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

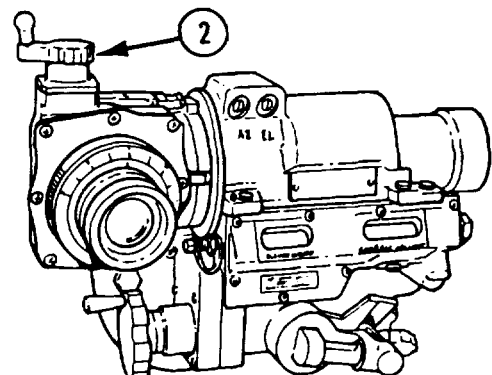
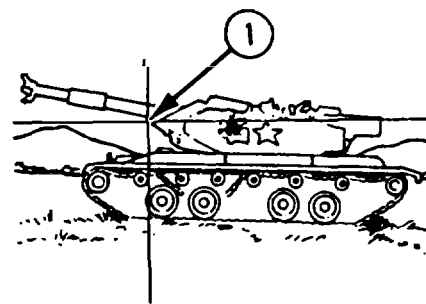
**2-14. CHEWING BORESIGHT OF THE M114A1 TELESCOPE USING THE DISTANT AIMING POINT METHOD**

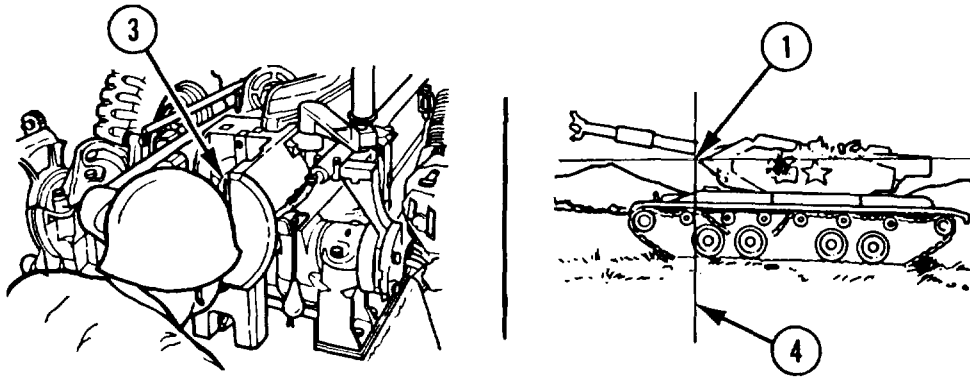


**WARNING**

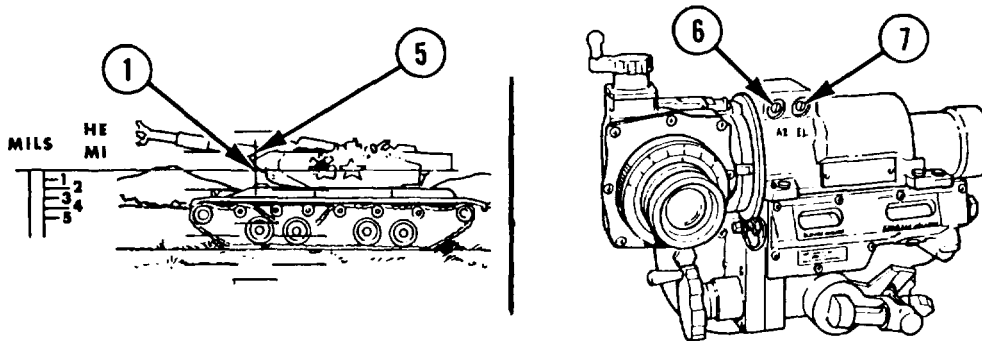
When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.

- 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 align the vertical muzzle cross-line (4) on the aiming point (1). Turn cross level knob on M14A1 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.

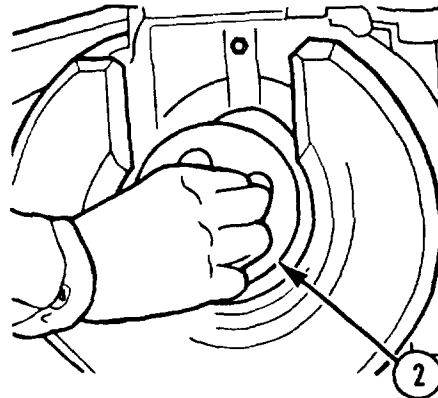
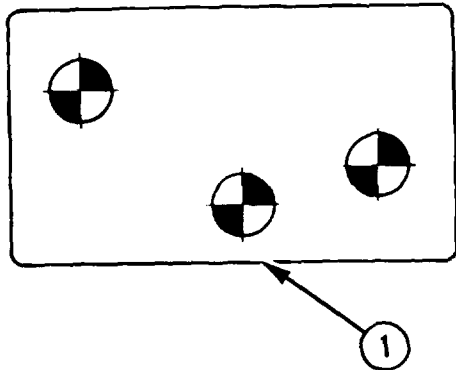
**2-15. CHECKING BORESIGHT OF M113A1 PANTEL AND M114A1 TELESCOPE USING THE TEST TARGMETHOD**



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

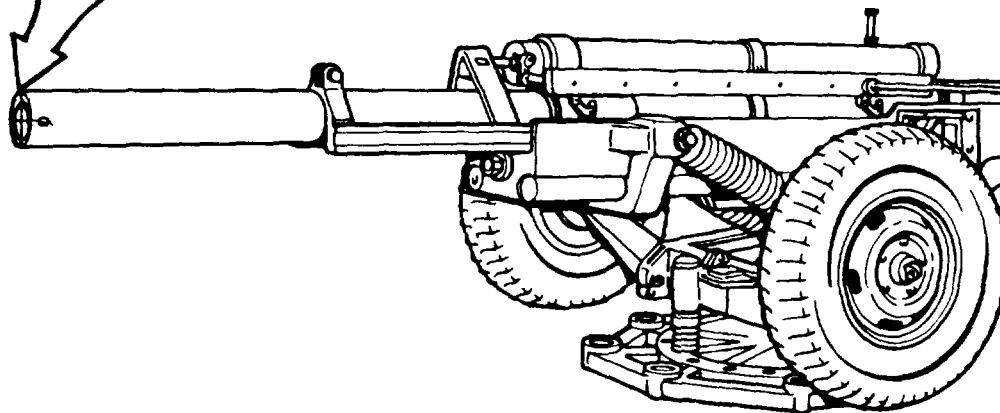
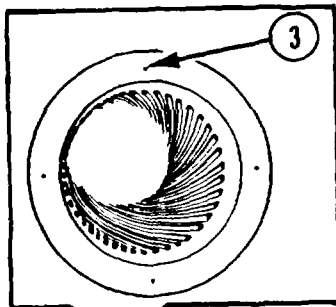
- 1 Emplace the weapon so the trunnions are reasonably level (no more than 90-mils cant when measured on breech mechanism assembly cross level seats), and zero the cannon tube using a tested M1A2 gunner's quadrant.

2-15. CHECKING BORESIGHT OF M113A1 PANTEL AND MI14A1 TELESCOPE USING THE TEST TARGET METHOD (cont)



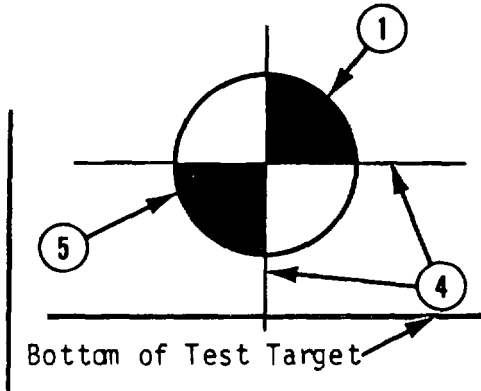
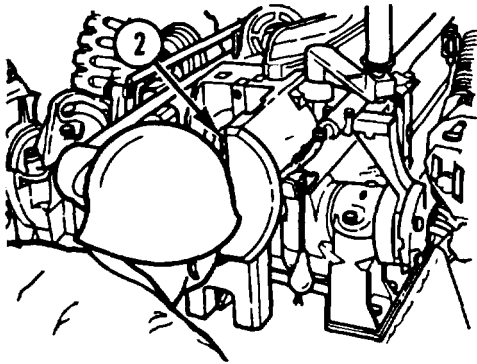
2 Place the test target (1) at least 50 meters from weapon but not more than 100 meters.

3 Install breech boresight disk (2).



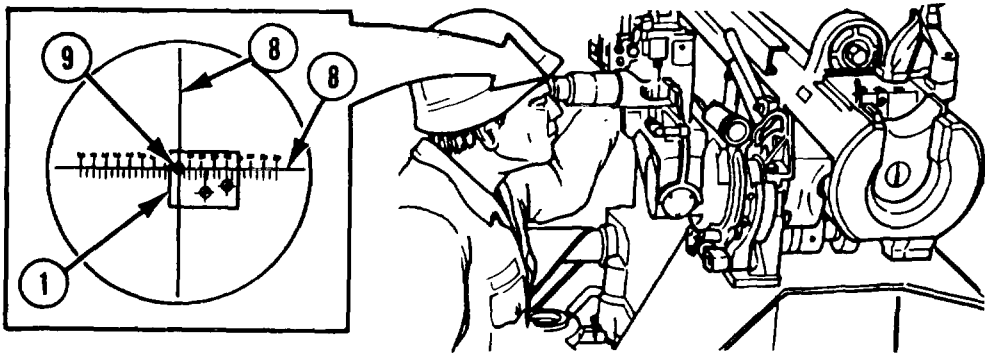
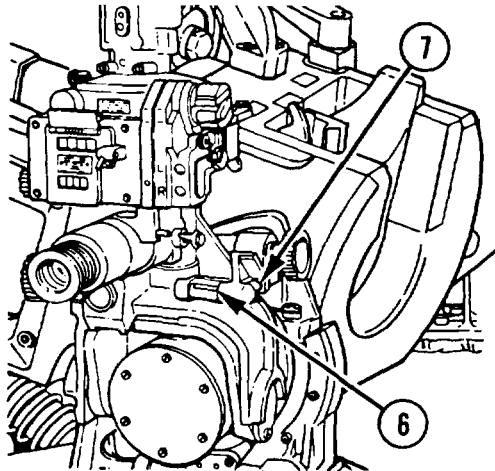
4 Using the four witness marks (3) on edge of muzzle as reference points, attach two pieces of boresighting string (item 27, app D) across the muzzle to form crosshairs.





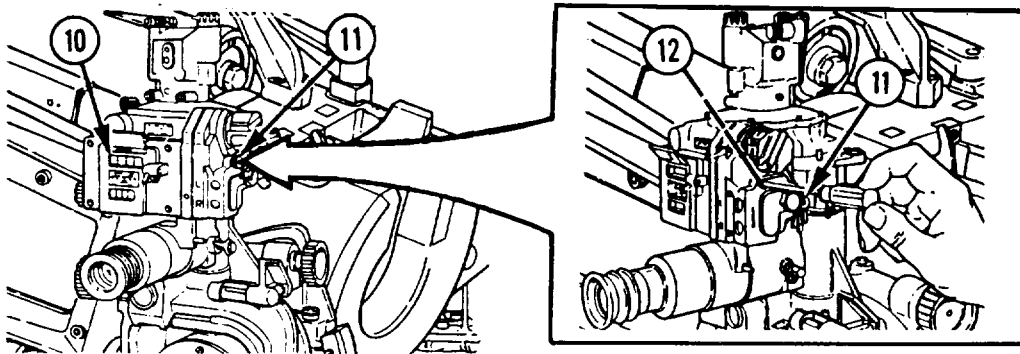
5 Sighting through the breech boresight disk (2) move the test target (1) until the muzzle crosshairs (4) are aligned with the center butterfly (5) on the test target.

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

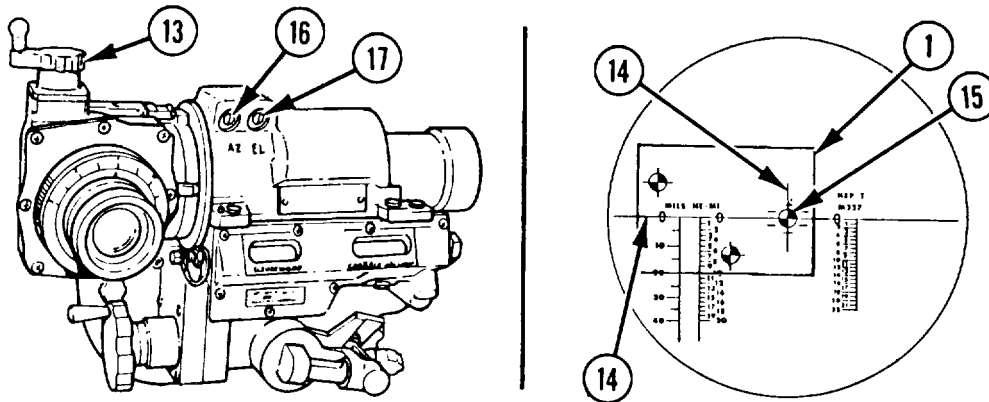
**2-15. CHECKING BORESIGHT OF M11A1 PANTEL AND M114A1 TELESCOPE USING THE TEST TARGET METHOD (cont)**



- 8 The M113A1 pantele azimuth counter (10) should now read 3200 mils; 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). The M113A1 pantele 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.

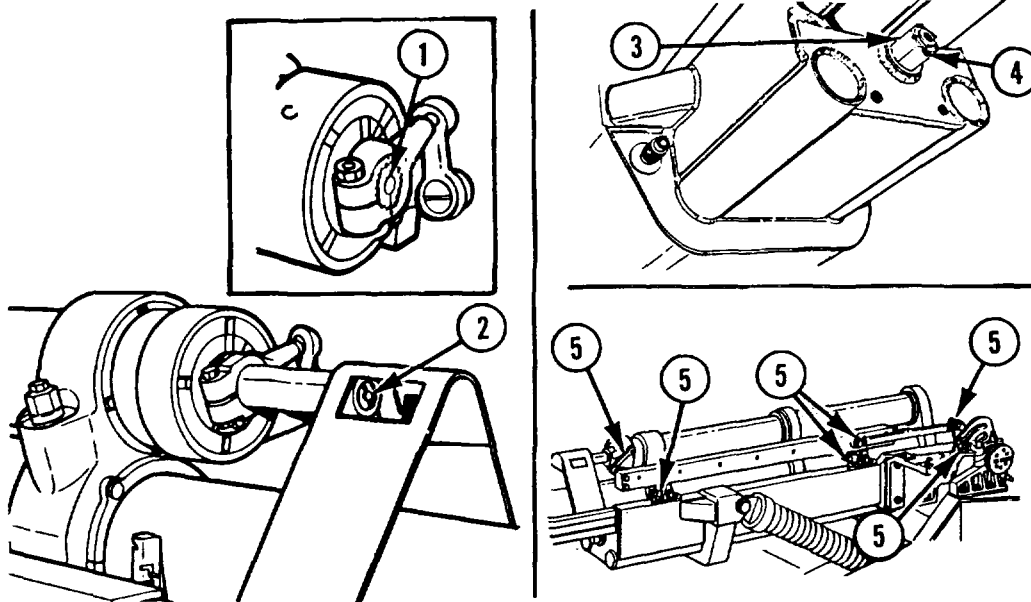


- 10 Rotate range knob (13) of M114A1 telescope until range gage line indicates zero. Center cross level level vial bubble.
- 11 The M114A1 telescope reticle crosshairs (14) should now intersect with the image on the right butterfly (15) of the test target (1). If not, rotate the azimuth boresight worm shaft (16) and elevation boresight worm shaft (17) with a screwdriver until the reticle crosshairs are aligned.

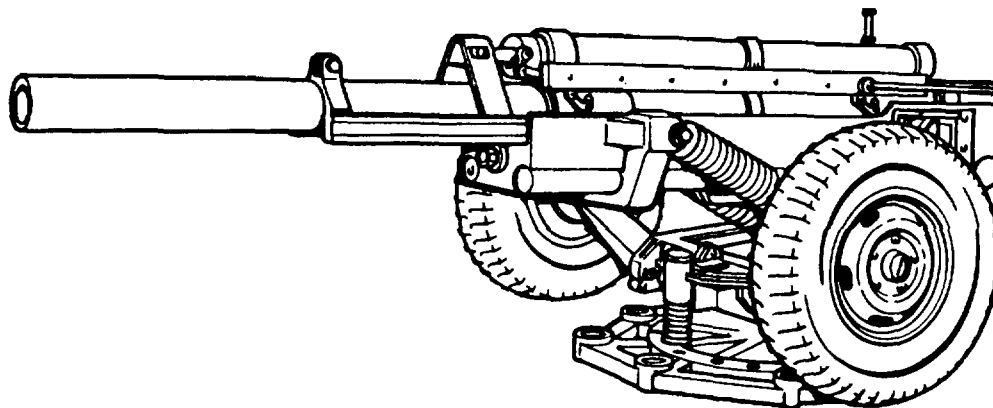
2-16. PREFIRING CHECKS

**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.

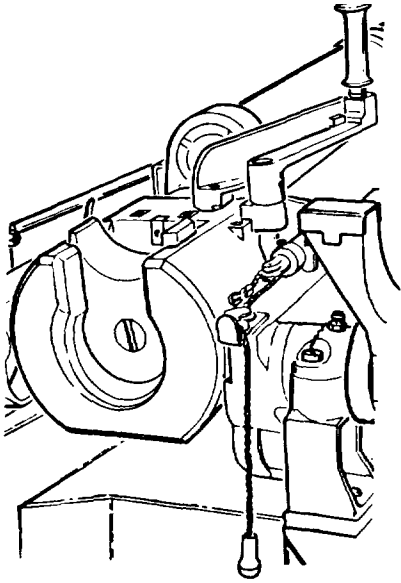


- 1 Recoil system: M37 indicator rod (1) flush or protruding not more than 3/16 inch, M37A1 indicator rod (2) flush or not extended to red tab, recoil rod nut (3) and cotter pin (4) installed, variable recoil mechanism linkage (5) serviceable.

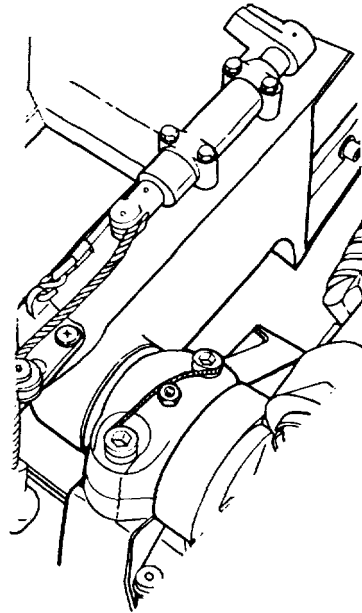


- 2 Cannon tube: unobstructed, no visible damage, no foreign matter present.

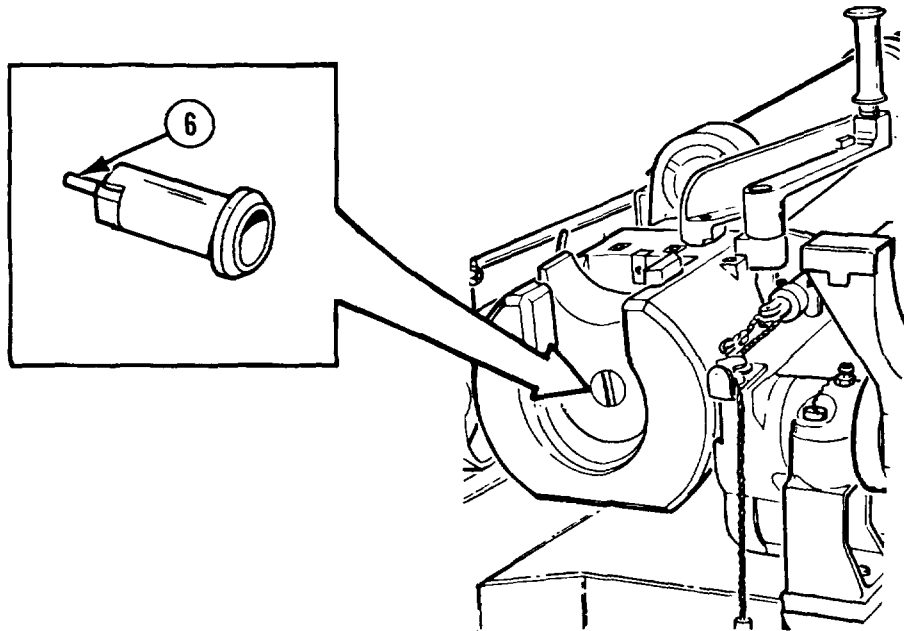
2-16 PREFIRING CHECKS (cont)



3 Breechblock: proper operation, complete closing.



4 Firing mechanism assembly: proper functioning.

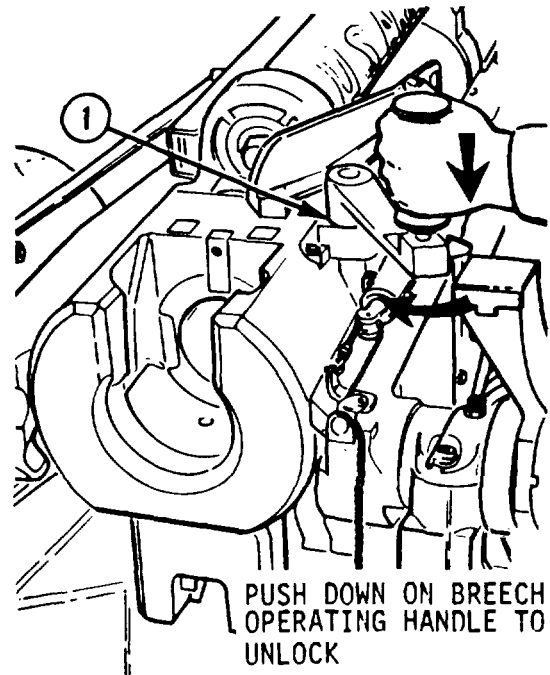


5 Percussion mechanism: firing pin (6) serviceable.

**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 breechblock in 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**

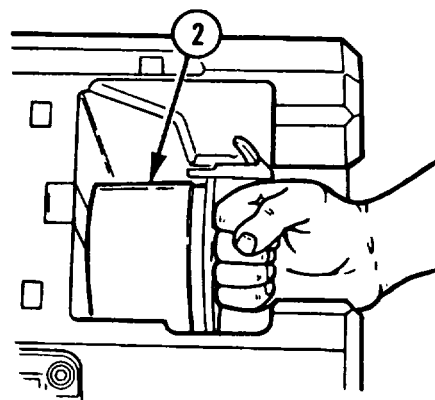
Ammunition is prepared for firing by the ATC and cannoneer no. 2. Preparation of ammunition for firing is explained on page 4-14.

Change 1 2-57

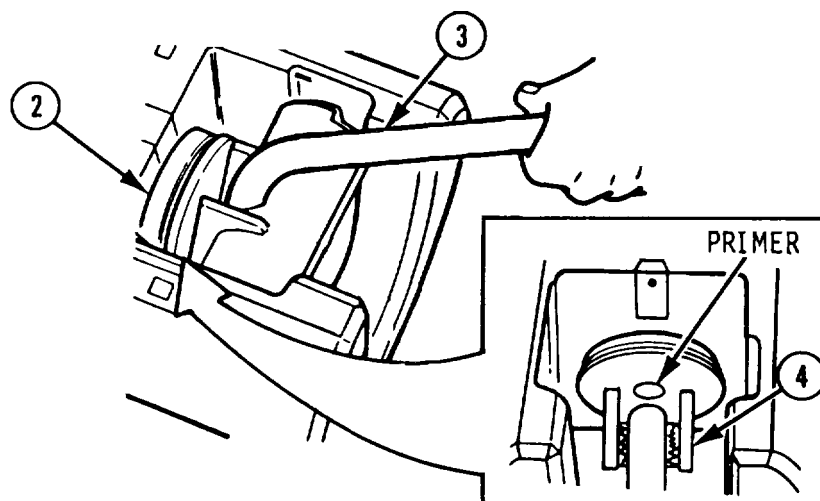
## 2-17. LOADING THE M102 HOWITZER FOR FIRING (cont)

**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.

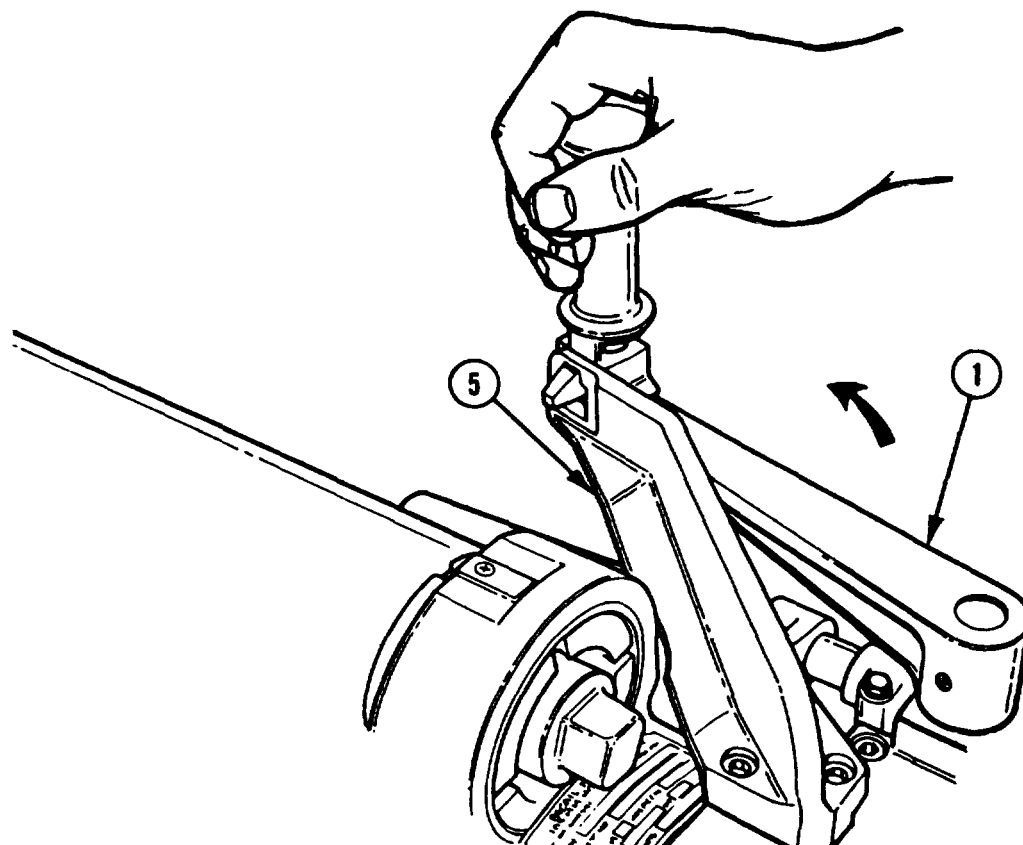


- 5 Upon receiving the last digit of QUADRANT (SO MUCH) command, cannoneer no. 1 rams the round (2) until the base of the cartridge case is flush with the breech end of the cannon tube.

**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 extracting 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 extracting 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.

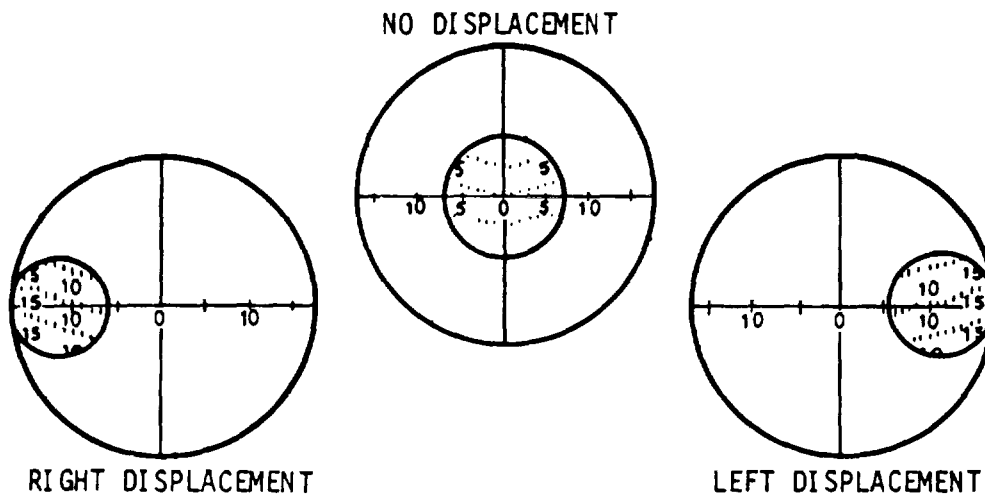
Change 1 2-59

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



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.

**Change 2 2-60**



- 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**

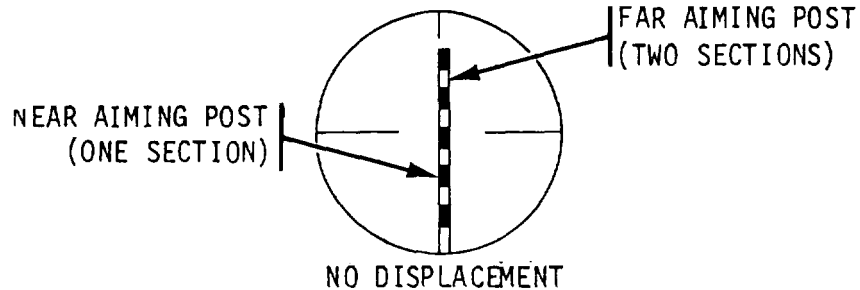
**NOTE**

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 and 2 below.

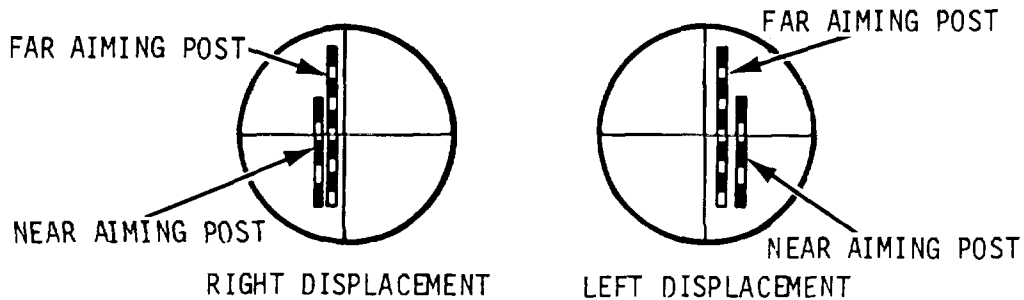
- 1 The gunner opens the door that covers the M113A1 pantel azimuth counter. He rotates the M1113A1 pantel azimuth knob until the azimuth on which the aiming posts were originally emplaced appears on the azimuth counter. If traverse is greater than 200 mils, he has cannoneers shift the weapon.
- 2 The 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 compensate 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, the M134A1 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, be aware of the radiation hazard procedures listed in the front of this manual.

**WARNING**

Direct fire on targets located closer than 600 meters 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:

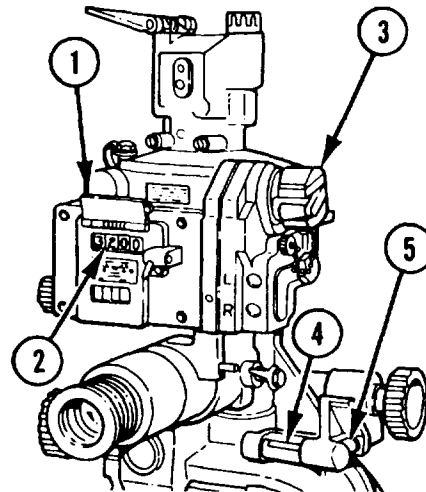
Command:	Example:
TARGET	TARGET THAT TANK
SHELL*	SHELL HE
CHARGE*	CHARGE SEVEN
FUZE*	FUZE QUICK
LEAD	LEAD RIGHT ONE ZERO MIL
RANGE	RANGE ONE THOUSAND
METHOD OF FIRE	FIRE AT WILL

\*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:

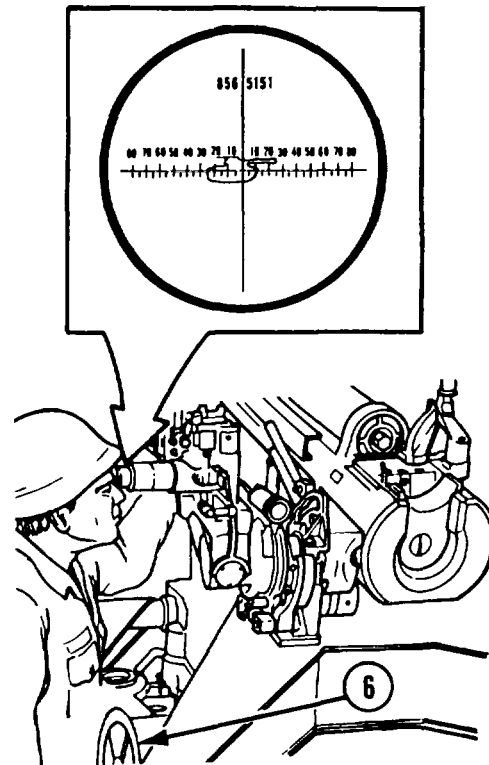
- a. Opens the cover (1) on the i1113A1 pantel azimuth counter (2) and sets the azimuth counter to 3200.
- b. Turns the direct/in-direct knob on the M113A1 pantel azimuth knob (3) so that the word DIRECT is visible and centers the bubbles in the elevation level vial (4) and cross level level vial (5).



- c. If the announced lead is to the left, adds the lead to 3200 and places that value on the azimuth counter (2). If the lead is to the right, subtracts the value from 3200 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 M113A1 pantel 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 M113A1 pantel 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

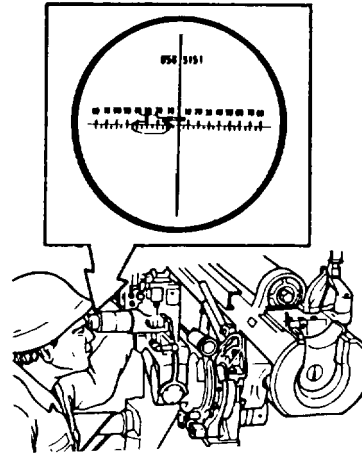
**NOTE**

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.

**Change 1 2-66**

- 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.

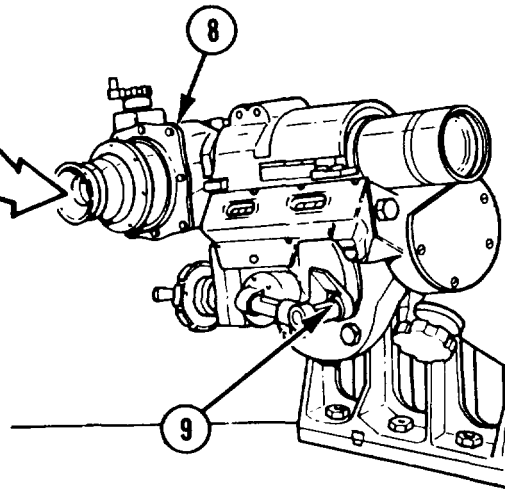
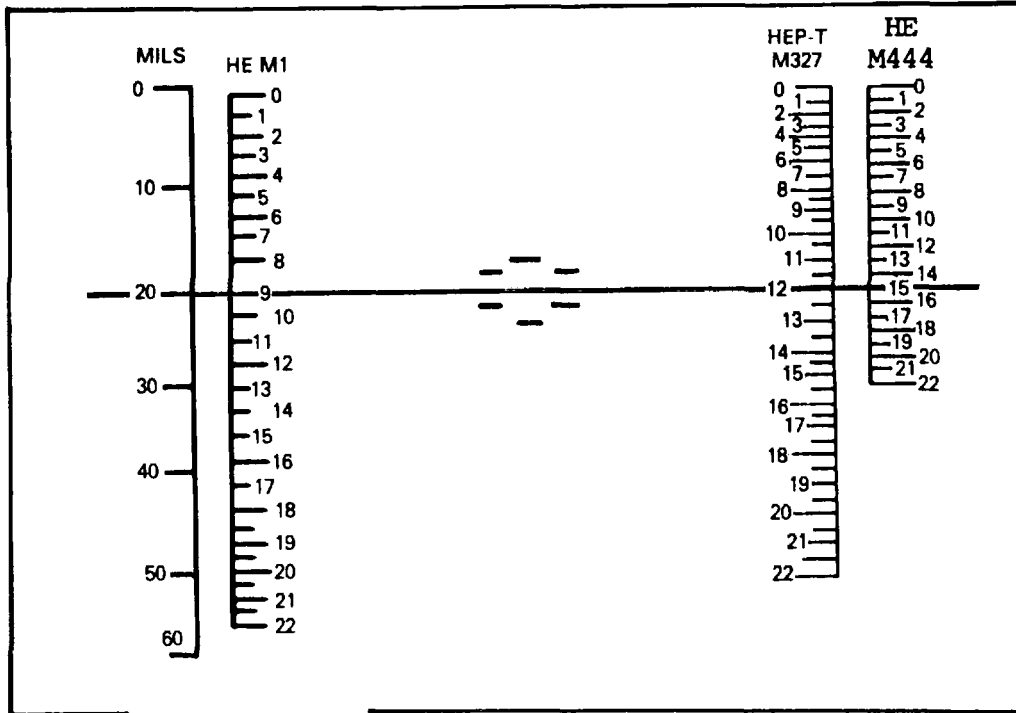


Change 1 2-66.1

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 level level vial bubble (9) of M14A1 quadrant, and checks the functioning of the range gage line.

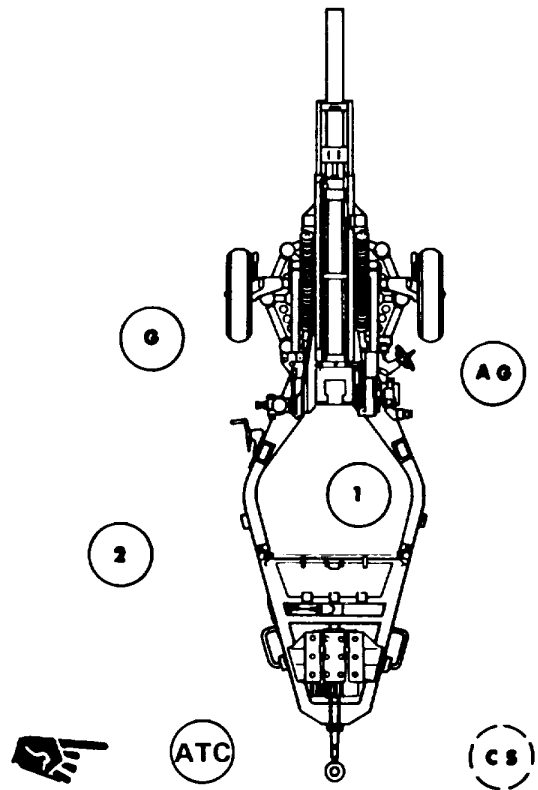


**2-22. LAYING FOR DIRECTION AND ELEVATION DURING DIRECT FIRE MISSIONS (cont)**

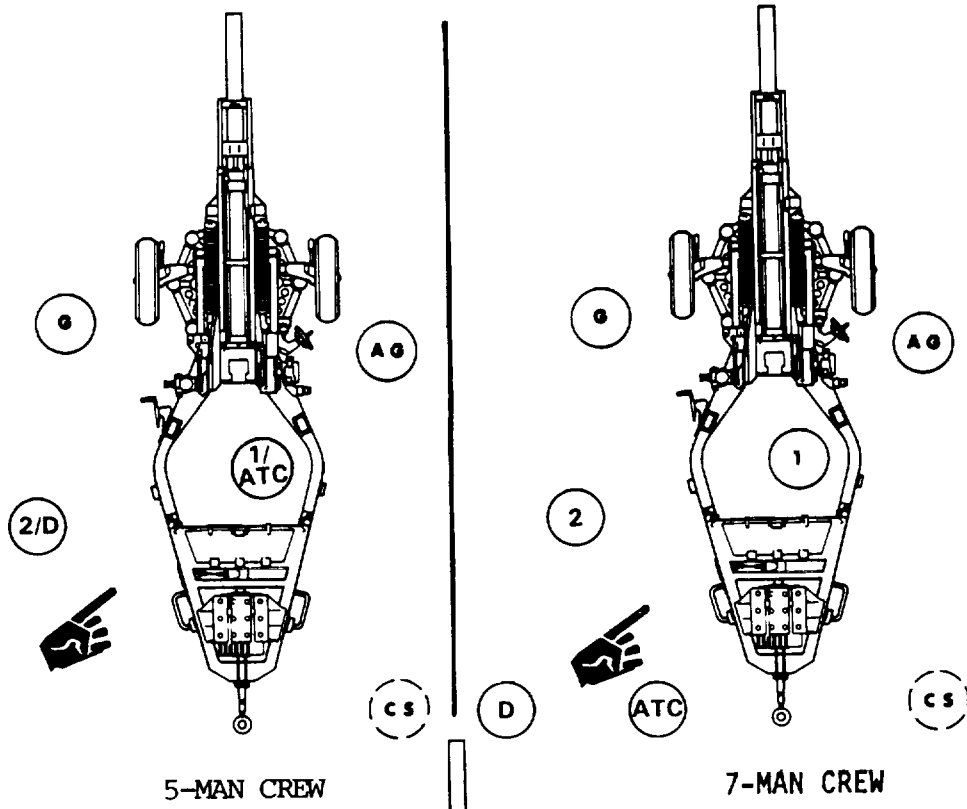
b. Lays the howitzer for range by sighting through the M114A1 telescope. Moves the range gage line up and down until the range gage line is on the announced range on the proper ammunition scale. Elevates or depresses the cannon tube until the target intersects the range gage line. Maintains the correct 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 command 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.

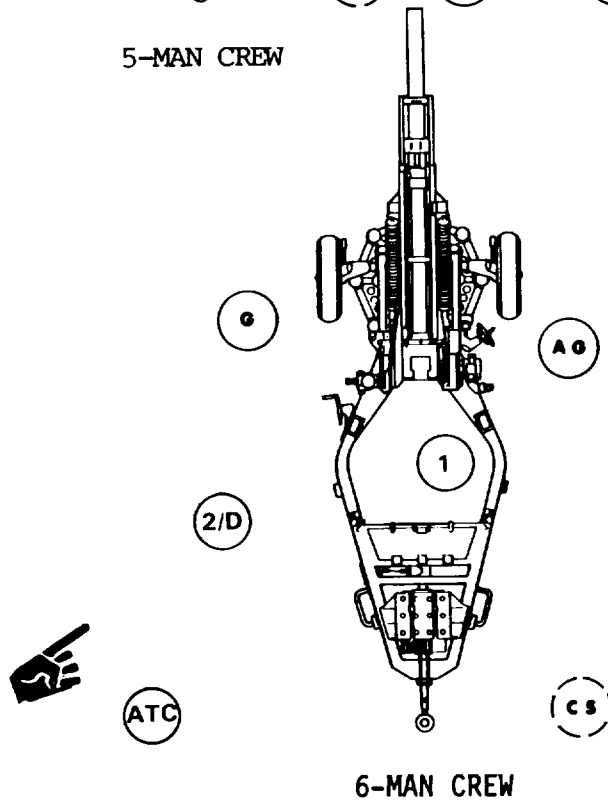


Change 1 2-68



5-MAN CREW

7-MAN CREW



6-MAN CREW

Change 1 2-69

**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**

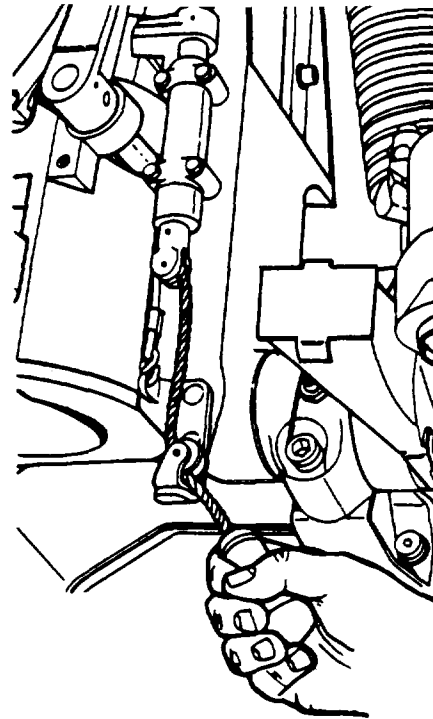
The M102 howitzer is fired only upon verbal or hand signal from the chief of section during indirect fire.

- 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-released, 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.



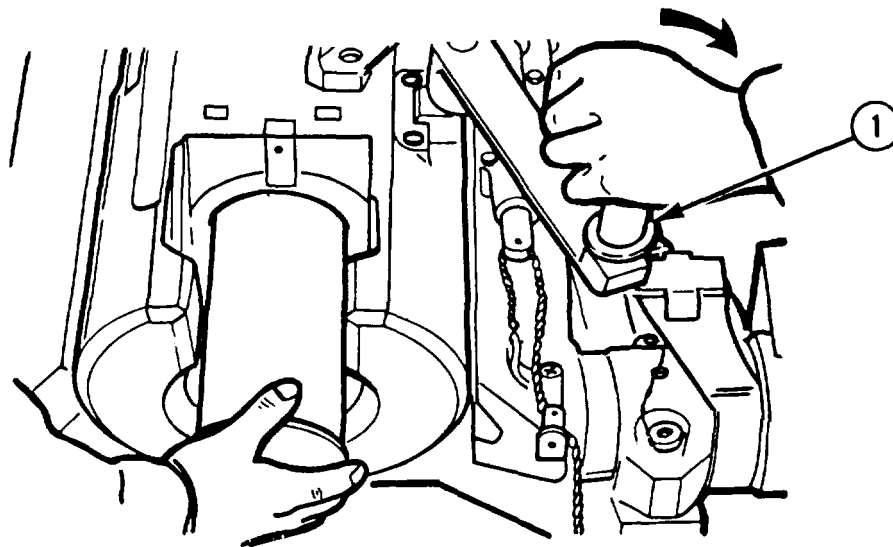
- 3 If the howitzer fails to fire, refer to misfire procedures on pages 2-75 and 2-76. If misfire cannot be corrected, refer to unloading procedures on page 2-73.

**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**

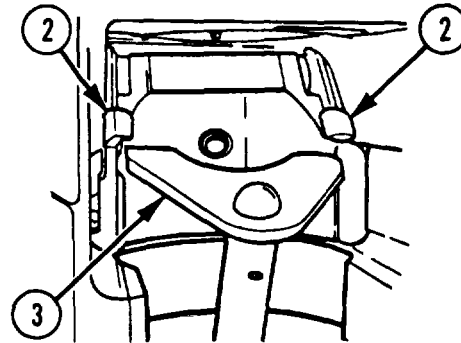
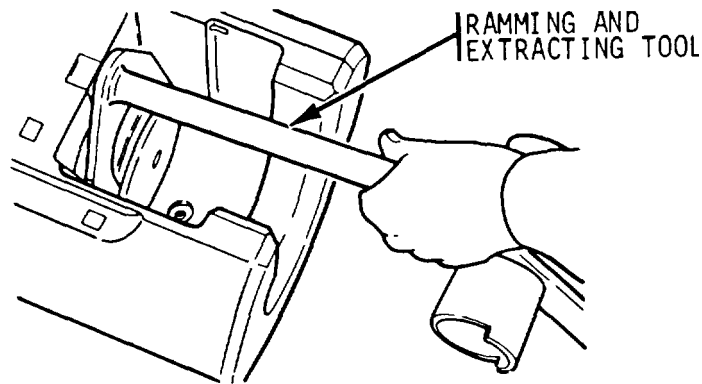


- 1 Cannoneer no. 1 positions his hand behind the breech access opening to receive the spent cartridge case.
- 2 The assistant gunner opens the breech mechanism assembly to eject the cartridge case by rotating the breech operating handle (1) to the rear.
- 3 Cannoneer no. 1 grasps the rear of the cartridge 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.

**Change 1 2-71**

**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**

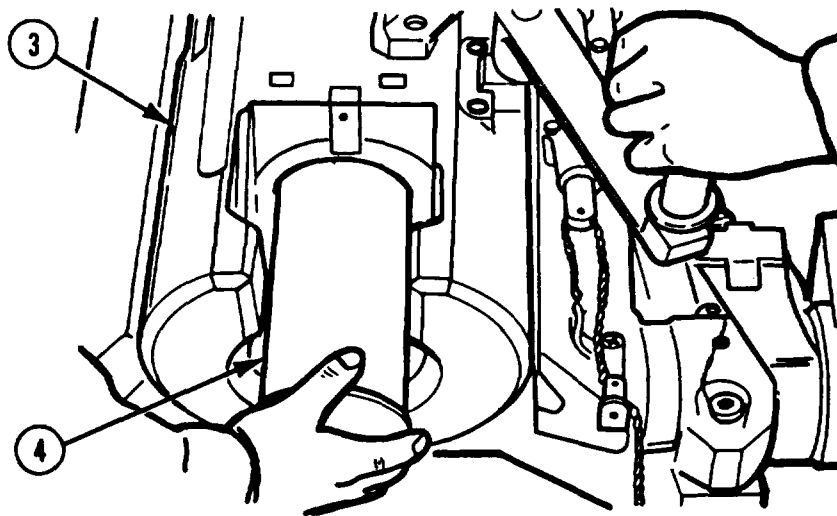
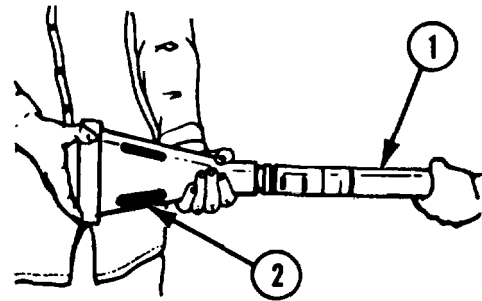
A complete round, once loaded, should be fired. However, if an unfired cartridge case and projectile must be removed, proceed as follows. For misfire/checkfire procedures, refer to page 2-75.

1 Level the cannon tube.

**WARNING**

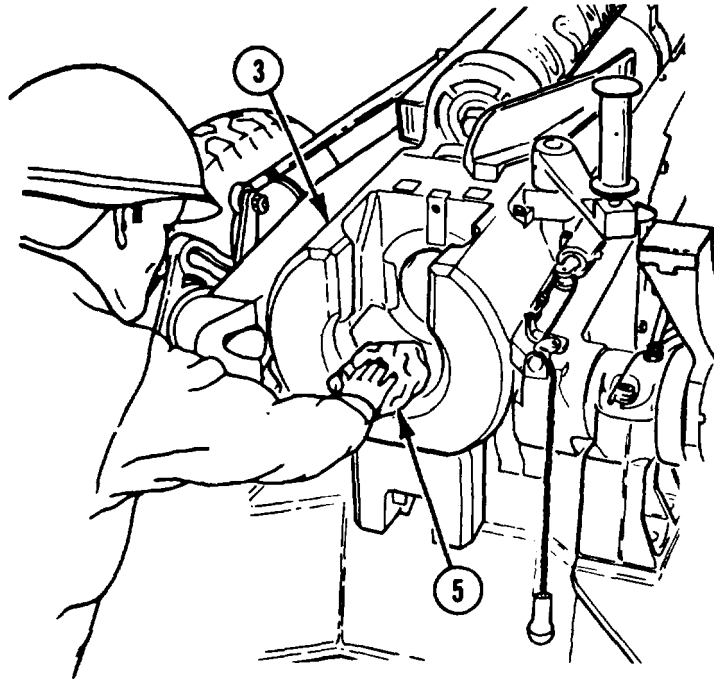
Be sure that proper artillery unloading rammer (bell rammer) (5591873) is used.

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



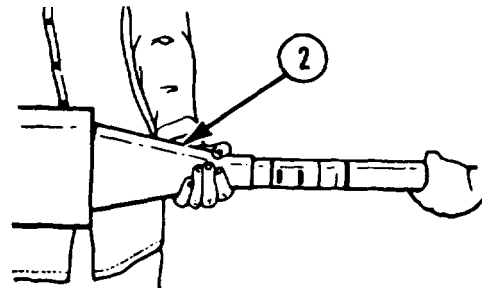
3 Open breech mechanism assembly (3) and remove cartridge case (4).

## 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.

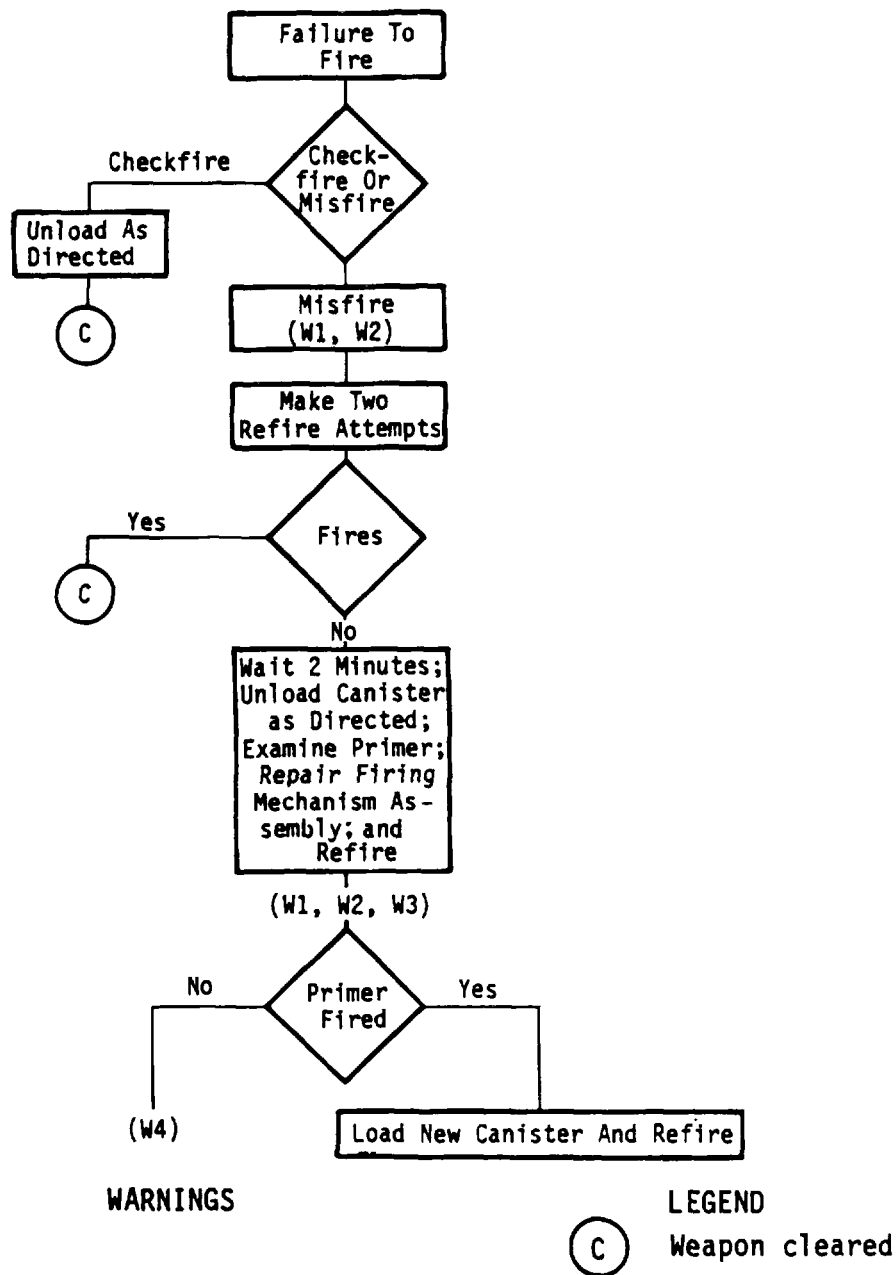
3 Unload the round following procedures on page 2-71.

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.

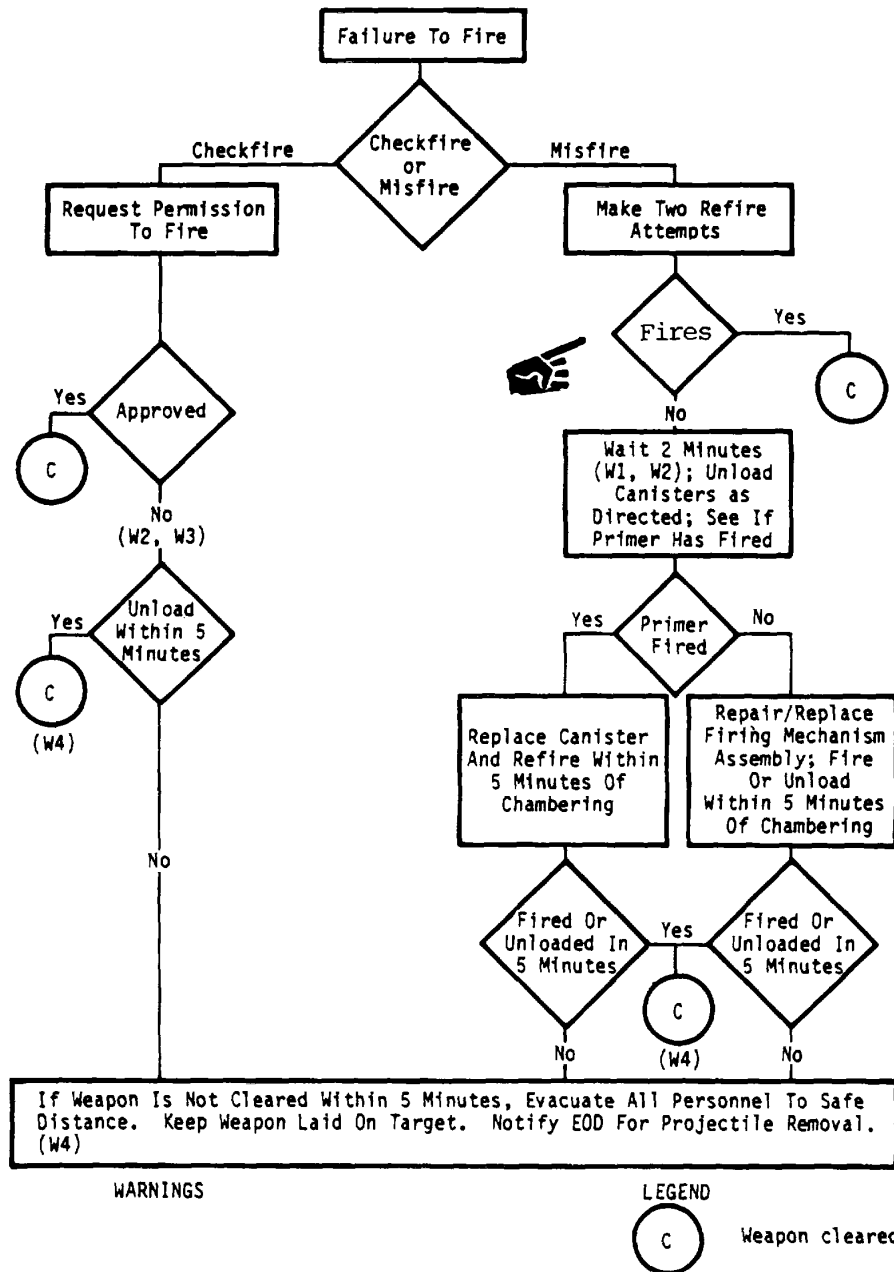
5 Notify EOD personnel to remove the projectile or evacuate the weapon.



- 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)

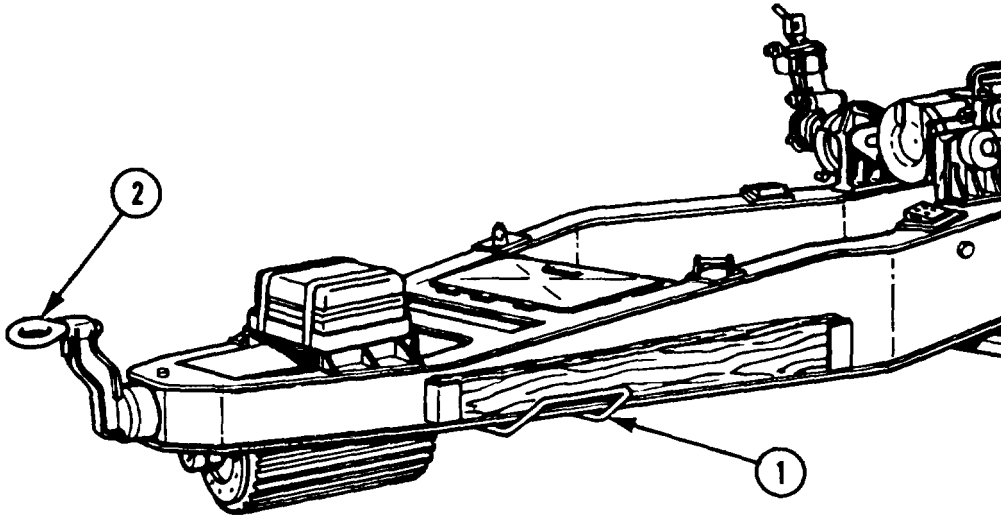


- W1-Hangfire possible
- W2-Stand clear of recoiling parts
- W3-Evacuate unnecessary personnel
- W4-Dispose of removed projectiles and fuze

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.

Change 1 2-79

## 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.

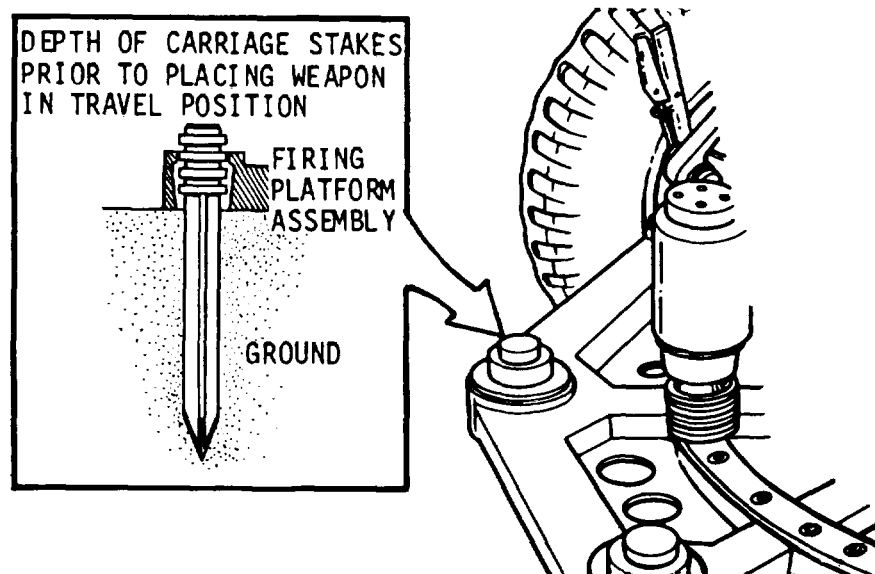
- 1 The chief of section ensures the weapon is not loaded, and supervises the work of all cannoneers.
- 2 Cannoneer no. 1 inspects the collimator for damage and proper illumination, covers the collimator, and prepares it for travel.
- 3 ATC retrieves the aiming posts, inspects aiming posts for damage, 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.

**Change 1 2-80**

- 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.

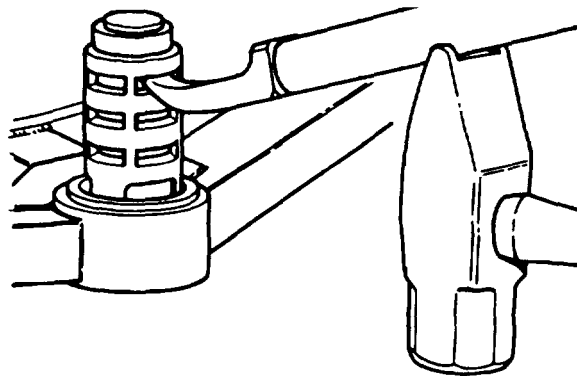
## 2-31. MARCH ORDER--PREPARATION OF M102 HOWITZER FOR TOWING

- 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)**

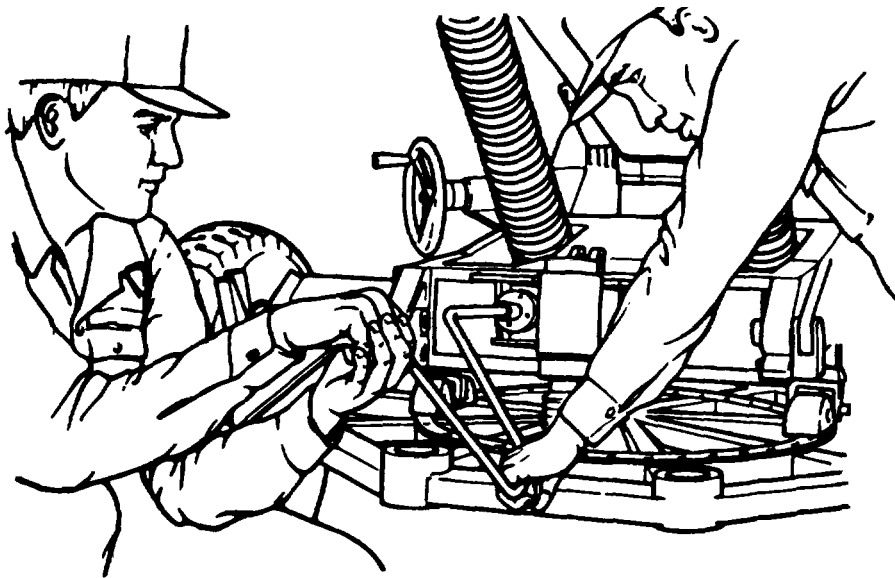
- 3 The gunner traverses the weapon to provide access to the carriage stakes.



- 4 The ATC and driver remove carriage stakes from ground.

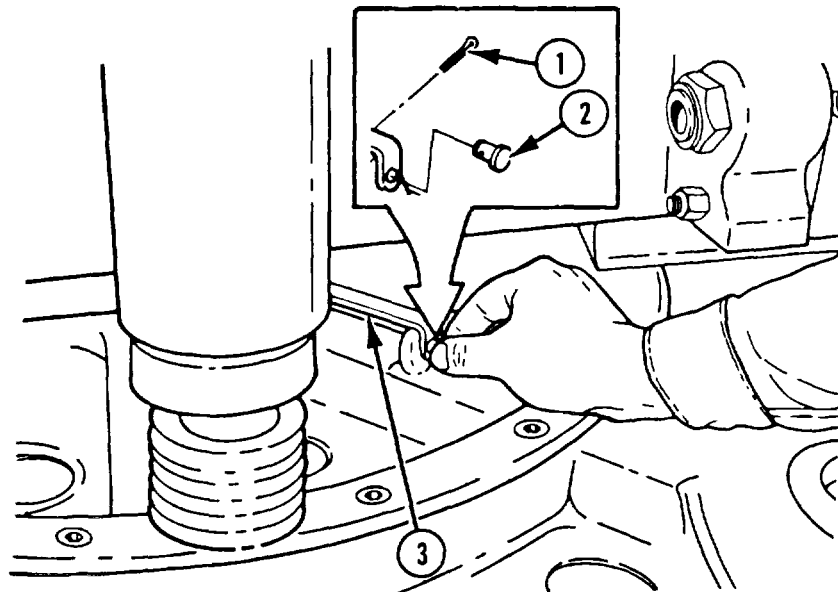
- 5 Cannoneer no. 2 releases the right handbrake.

- 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 M14A1 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:

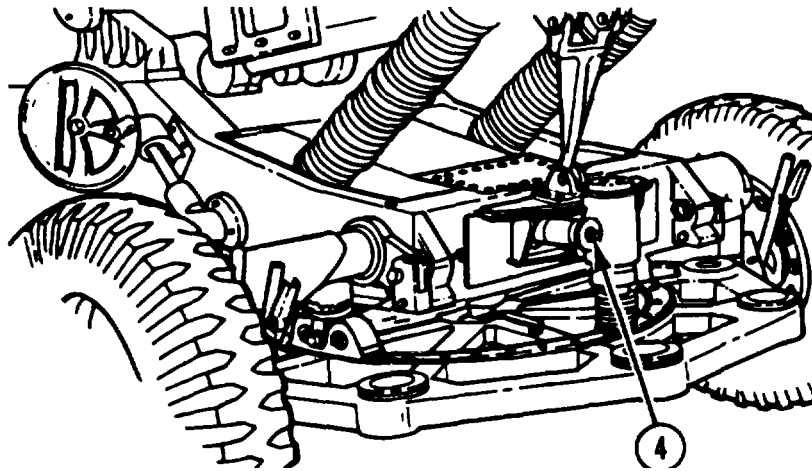


- a. Remove cotter pin (1) and straight pin (2) from locking assembly handle (3). Unlock firing platform assembly by rotating locking assembly handle (3) counterclockwise.

Change 1 2-83



## 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.

Change 2 2-84

- 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**

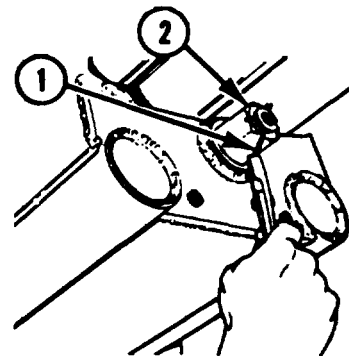
Refer to EM 55-450-1 and FM 55-450-2 for air-lift procedures.

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

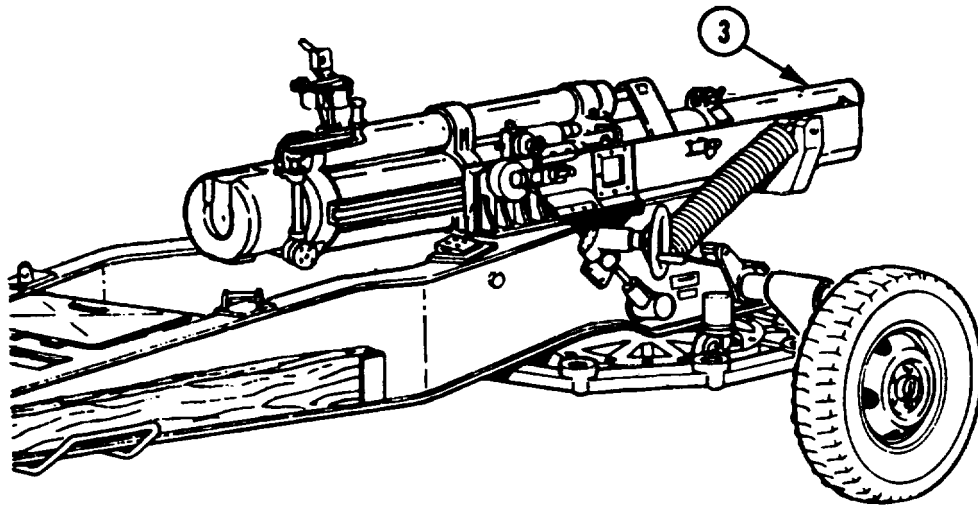
**NOTE**

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)

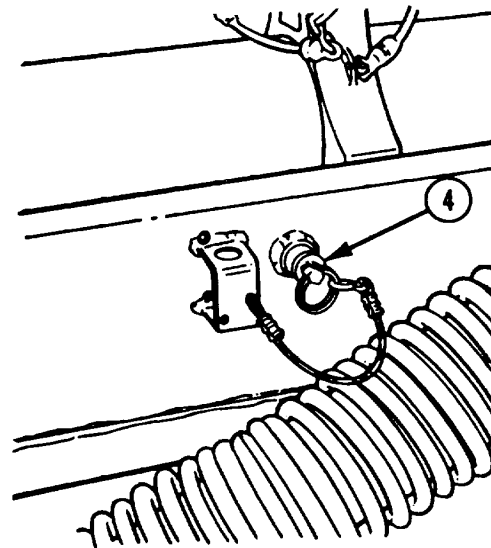


2 Push cannon (3) out of battery (toward rear of howitzer).

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.

**Change 1 2-91**



**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).

Change 1 2-92

## 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.

Change 1 3-1

LUBE INSTRUCTIONS

KEY

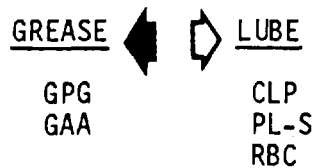
MAINTENANCE LEVEL

- C Operator/Crew
- O Organizational Maintenance
- F Direct Support Maintenance

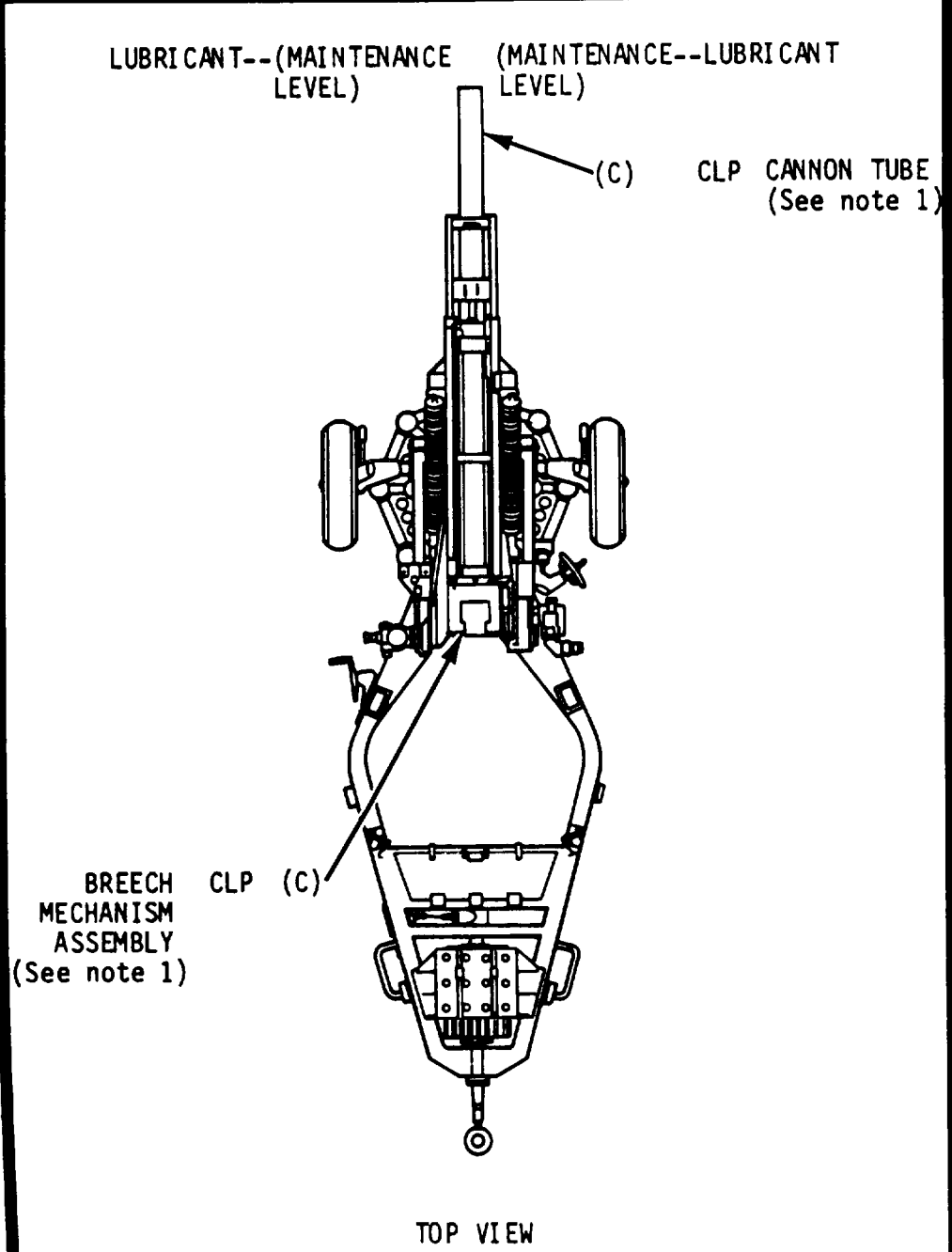
LUBRICANTS

- 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)



DAILY



**DAILY NOTE****NOTE 1****CANNON TUBE AND BREECH 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.

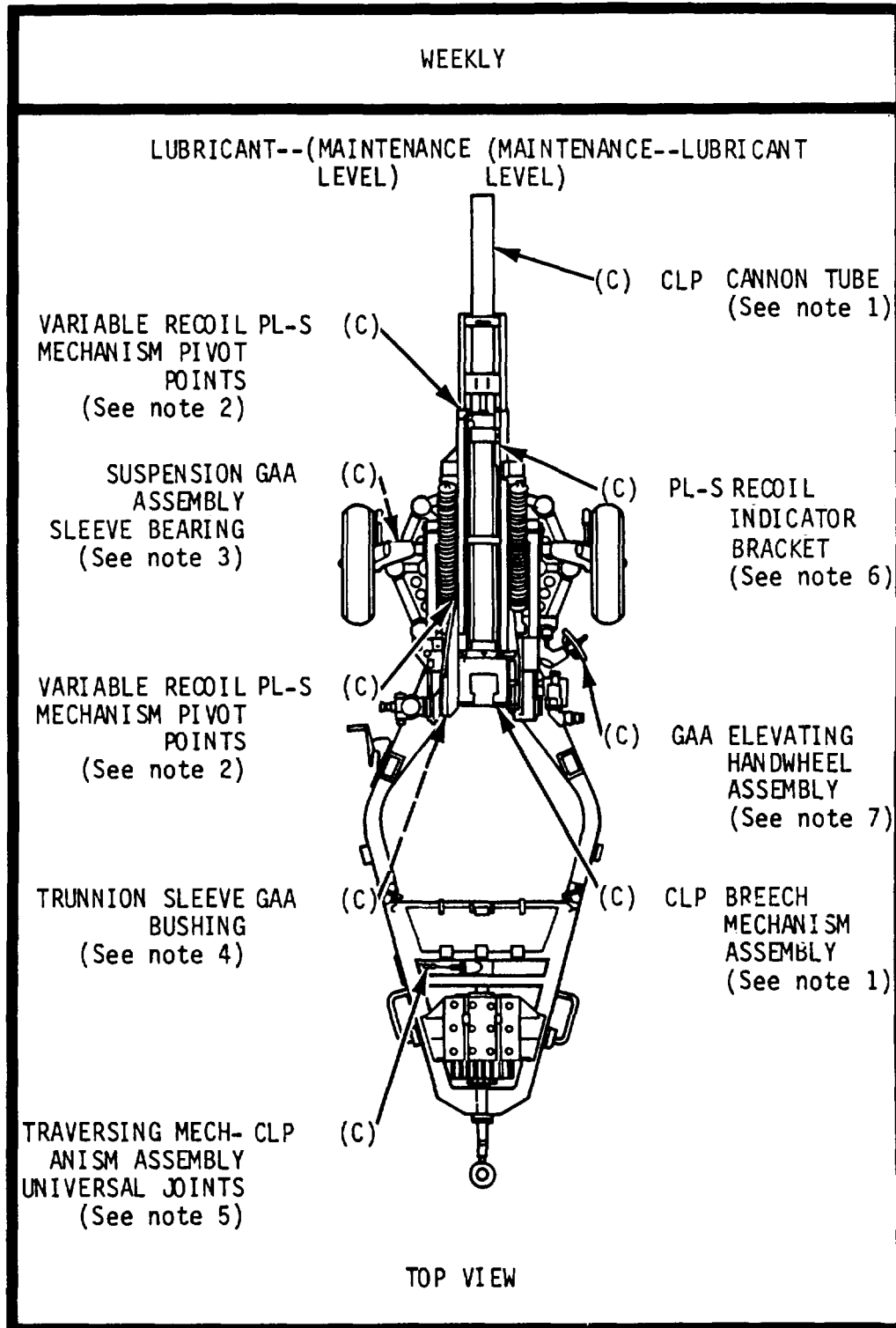
On the day after firing, remove two bottles of premeasured CLP, three disposable cleaning sleeves, and one bore brush assembly. Attach bore brush assembly to standard US Army rammer staff and wet punch cannon tube with one bottle of premeasured CLP following procedures above for day of firing. Next dry 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 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.

**BREECH**

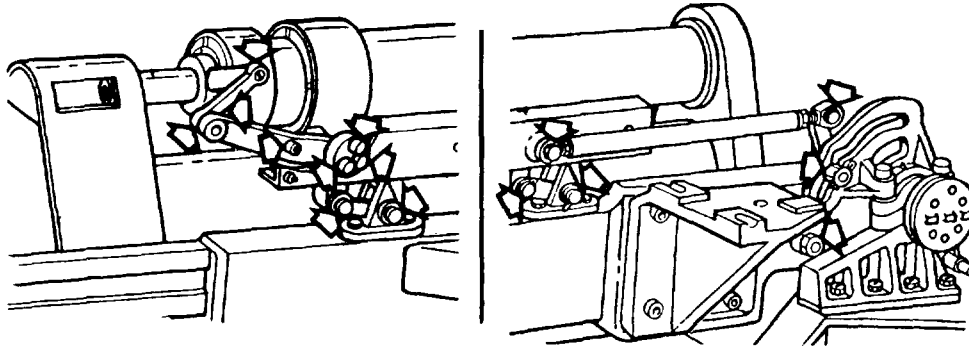
On day of firing, remove 1 liter bottle of CLP (with trigger sprayer and rags) from general supply. Wet all breech components thoroughly with CLP. Soak for 10 to 15 minutes and then wipe off. Reapply a light coat of CLP. Spray CLP onto all exposed metal surfaces.



WEEKLY NOTES

NOTE 2

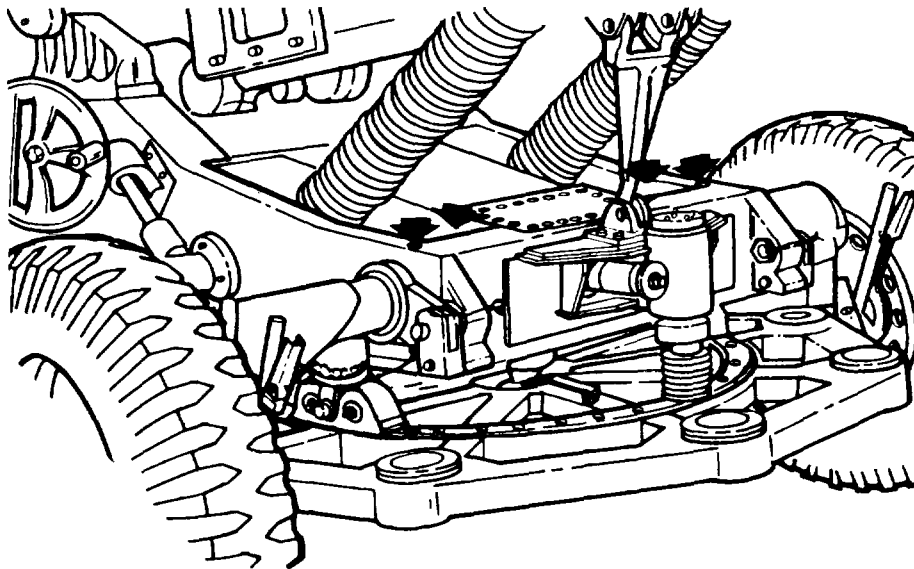
VARIABLE RECOIL MECHANISM PIVOT POINTS (C)



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

NOTE 3

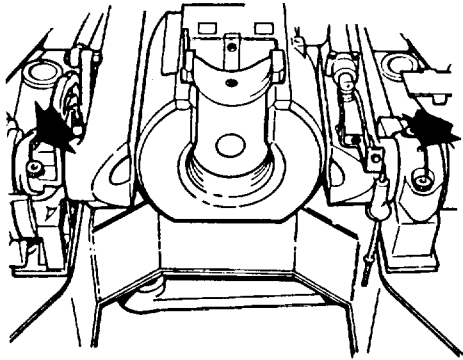
SUSPENSION ASSEMBLY SLEEVE BEARING (C)



Lube with GAA (modified weapon only).

NOTE 4

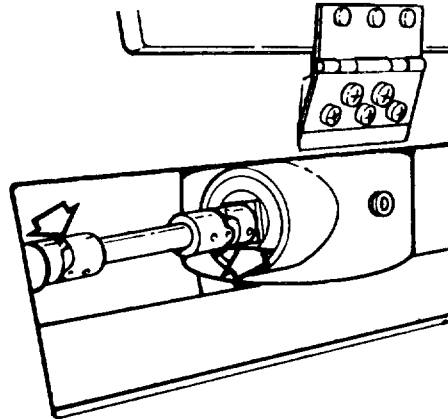
TRUNNION SLEEVE BUSHINGS (C)



Lube with GAA  
(modified weapon only).

NOTE 5

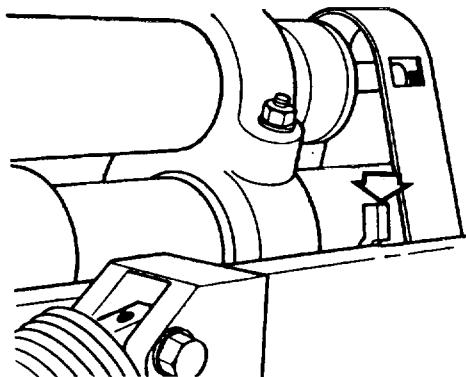
TRAVERSING MECHANISM  
ASSEMBLY UNIVERSAL  
JOINTS (C)



Lube with CLP.

NOTE 6

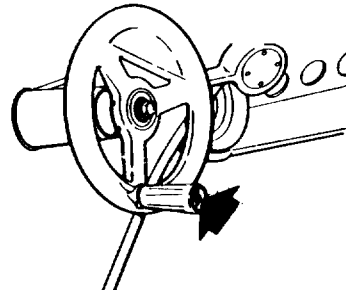
RECOIL INDICATOR BRACKET (C)



Lube with a couple drops  
of PL-S.

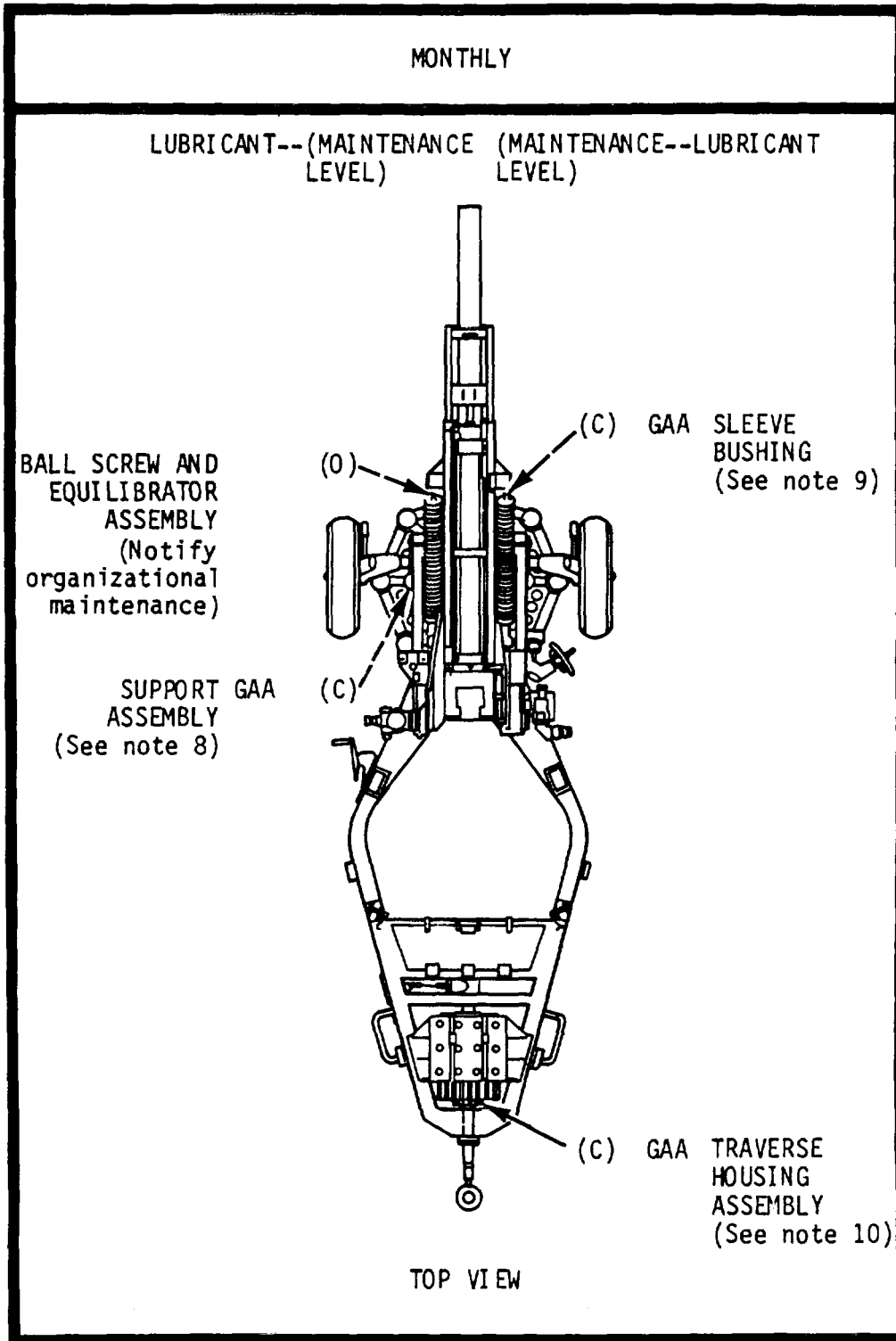
NOTE 7

ELEVATING HANDWHEEL  
ASSEMBLY (C)



Lube with GAA.

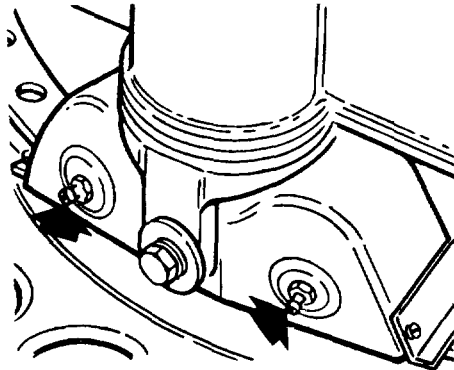




MONTHLY NOTES

NOTE 8

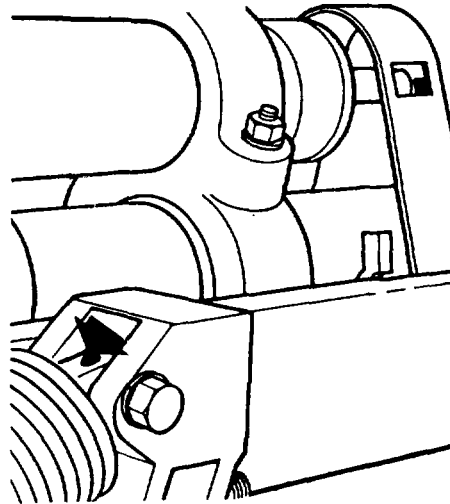
SUPPORT ASSEMBLY (C)



Lube with GAA.

NOTE 9

SLEEVE BUSHING (C)

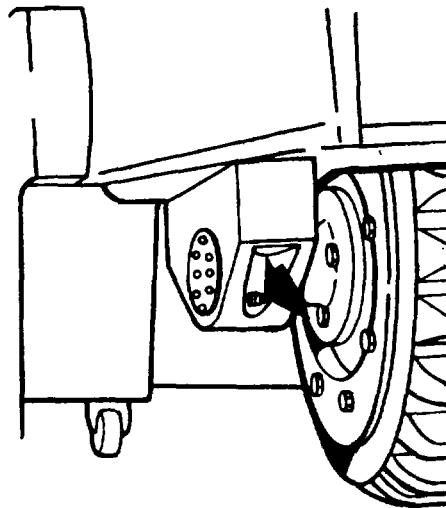


Lube with GAA.

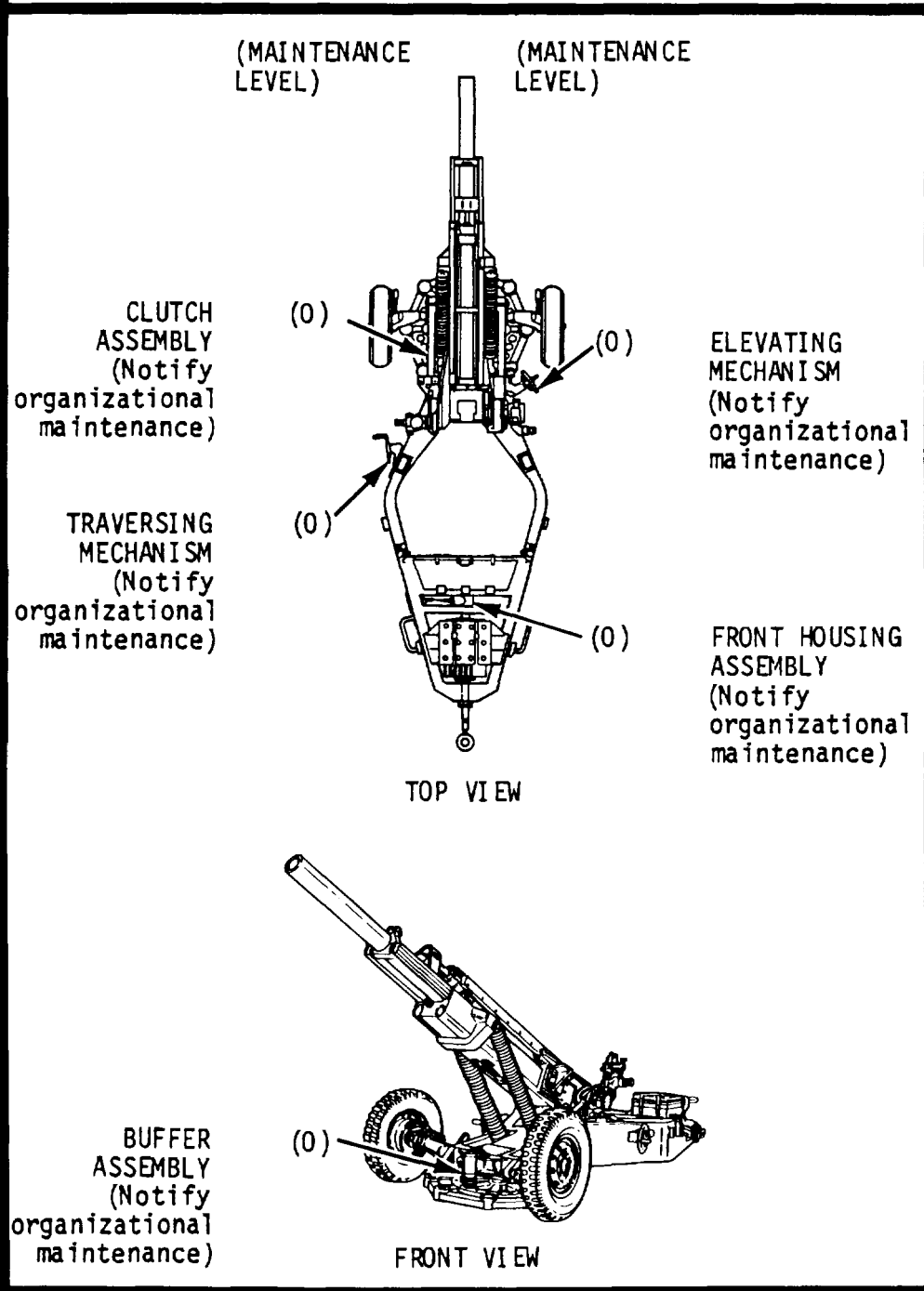
NOTE 10

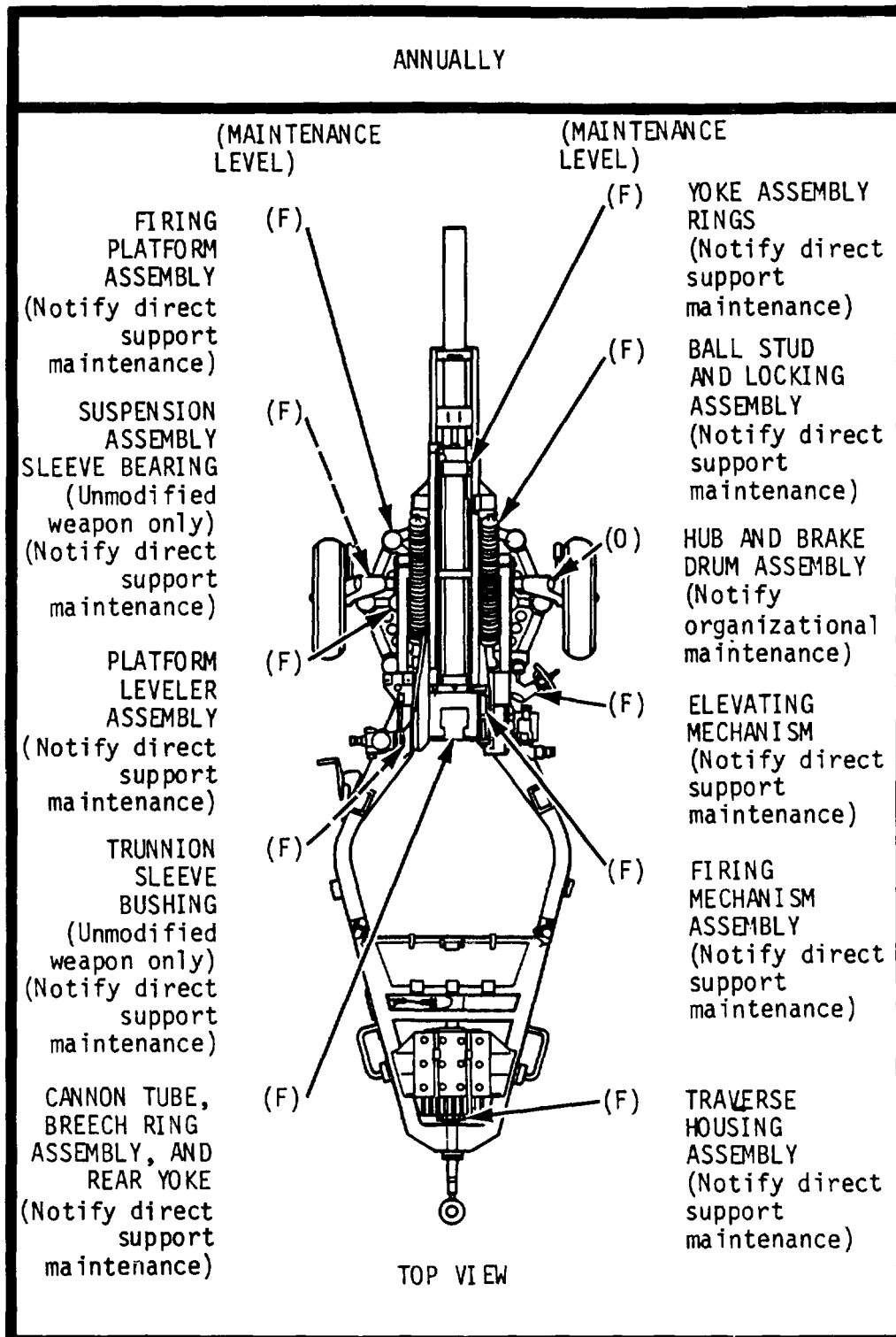
TRAVERSE HOUSING ASSEMBLY (C)

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



SEMIANNUALLY





**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

---

<b>MALFUNCTION</b>
<b>TEST OR INSPECTION</b>
<b>CORRECTIVE ACTION</b>

---

**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:

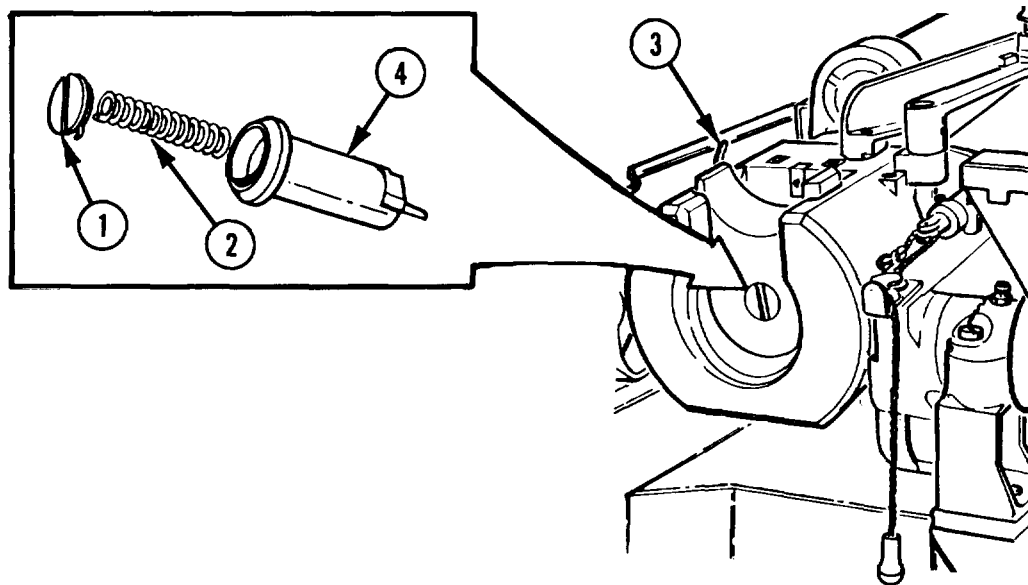
- a. Check that weapon is in firing position, chamber and bore are clear, and breech operating handle is in locked position. Pull lanyard to fire weapon.

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)

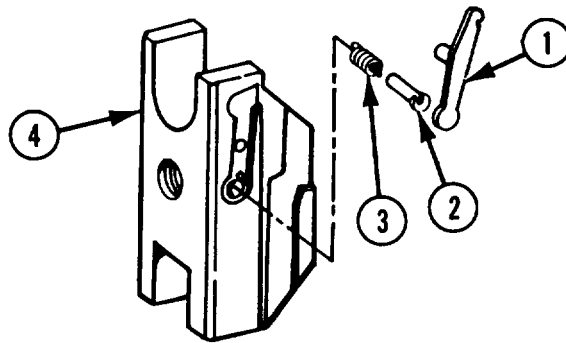
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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M137A1 CANNON (cont)

## 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:

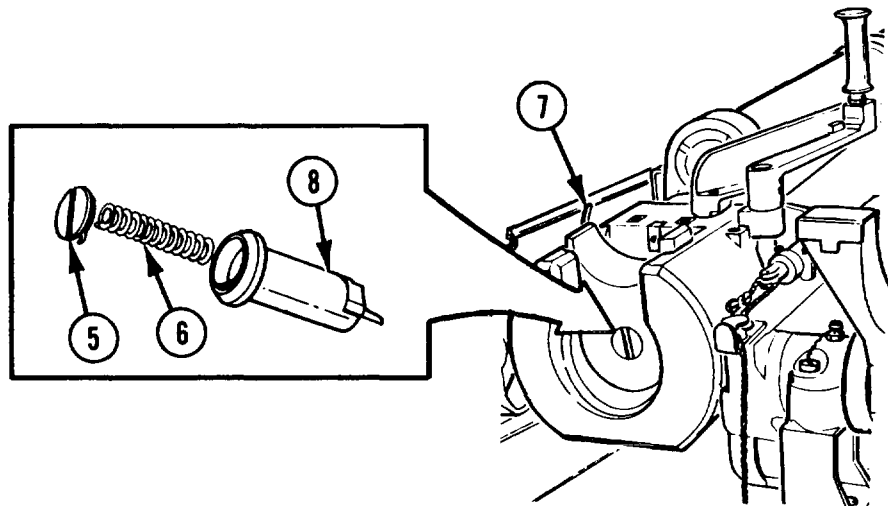
- a. Check that weapon is in firing position, chamber and bore are clear, and breech operating handle is in locked position. Pull lanyard to fire weapon.

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.



- Press in on retainer (5) and rotate 90 degrees in either direction to remove retainer and spring (6).
- Pull back cocking lever (7). Remove percussion mechanism (8).
- Check percussion mechanism (8) for damage.
- Install percussion mechanism (8), spring (6), and retainer (5). 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.

If percussion mechanism is damaged, notify organizational maintenance.



Table 3-1. Troubleshooting (cont)

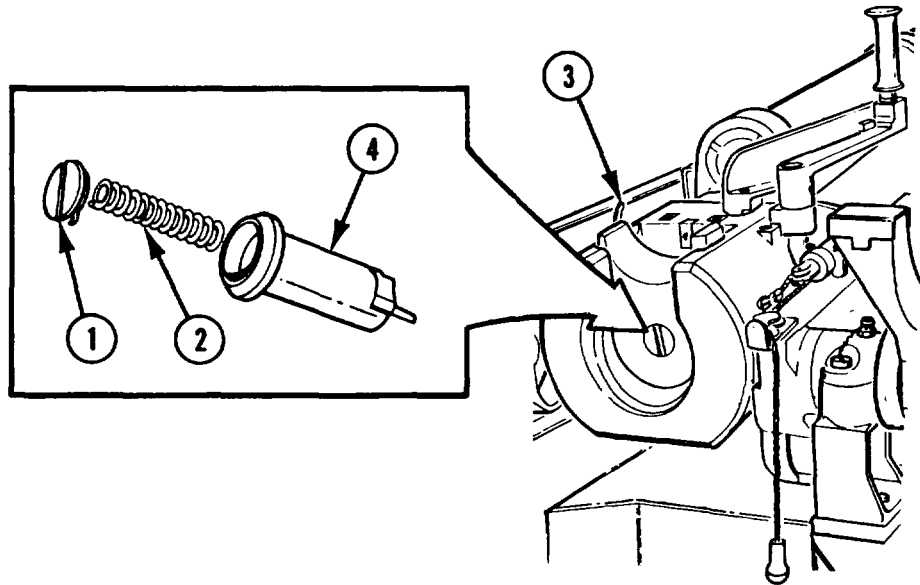
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
M137A1 CANNON (cont)		
3. BREECHBLOCK FAILS TO CLOSE.		
	Step 1.	Check to see if round is fully chambered.
	a.	Unload round and inspect for deformed casing. If casing is deformed, turn in round to EOD personnel.
	b.	Check for foreign matter in chamber. 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.



- Press in on retainer (1) and rotate 90 degrees in either direction to remove retainer and spring (2).
- Check for broken spring (2).
- 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
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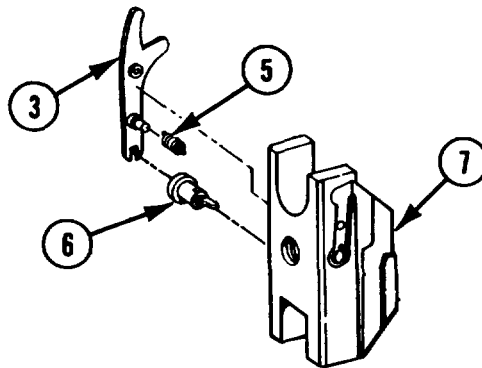
## M137A1 CANNON (cont)

## 4. PERCUSSION MECHANISM FAILS TO COCK. (cont)

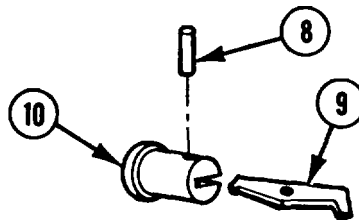
Step 2. Check to see if cocking mechanism retractor is sticking against percussion mechanism.

**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)

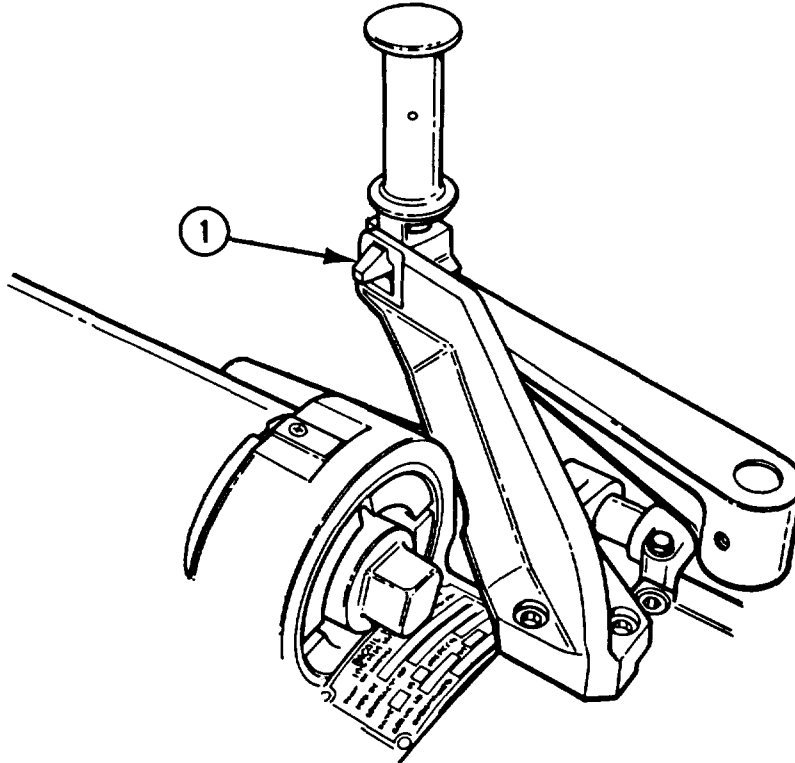
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MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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Remove any nicks, burrs, or rough spots using abrasive cloth (item 13, app D). If cocking mechanism retractor is bent or chipped, notify organizational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

5. BREECH OPERATING HANDLE UNLOCKS DURING FIRING.



Step 1. Check for broken latch (1).

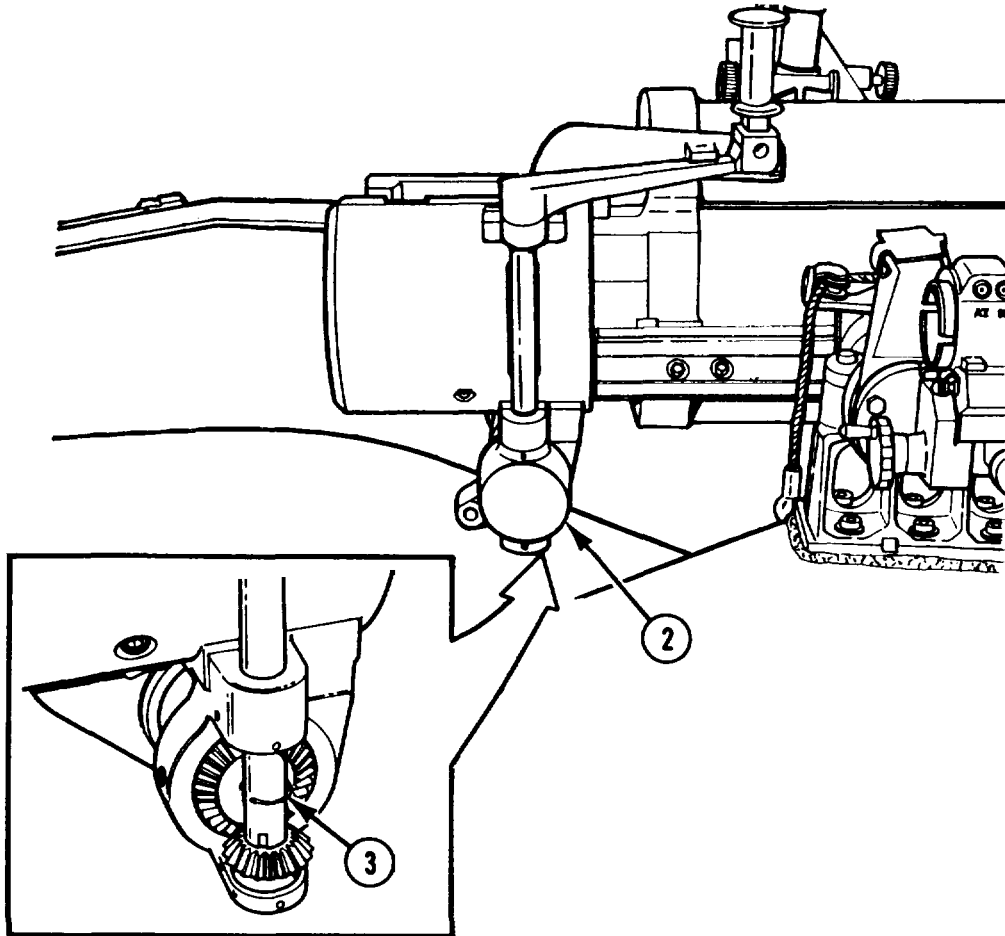
If latch is broken, notify organizational maintenance.

Table 3-1. Troubleshooting (cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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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.

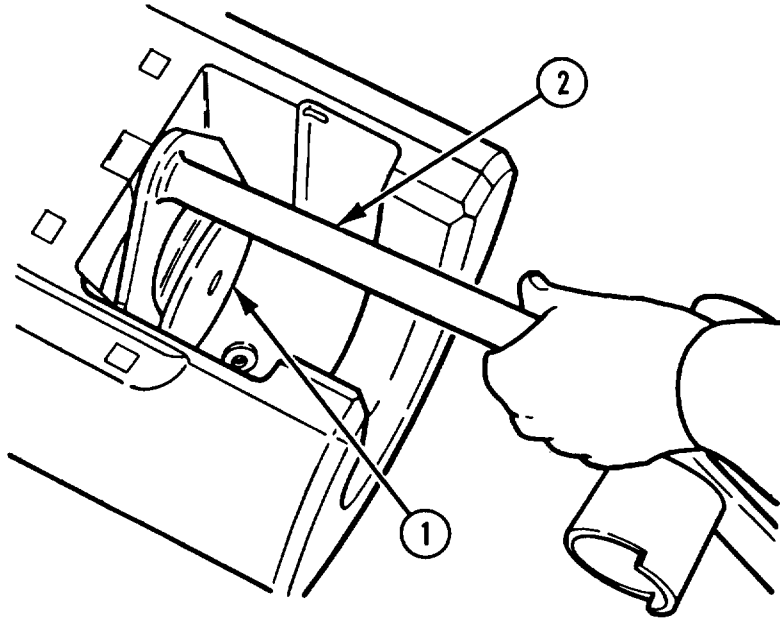
Table 3-1. Troubleshooting (cont)

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MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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## 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)

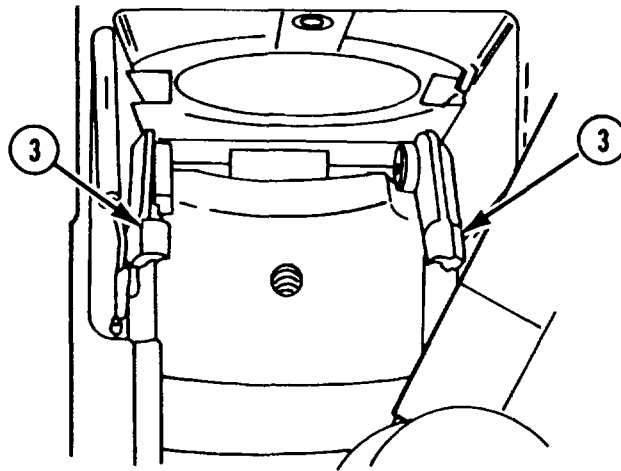
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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M137A1 CANNON (cont)

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.



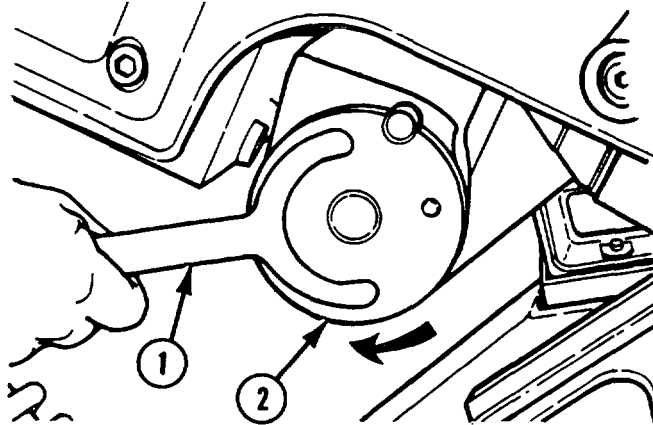
Step 3. Check for defective cartridge extractors (3).

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 adjuster (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.

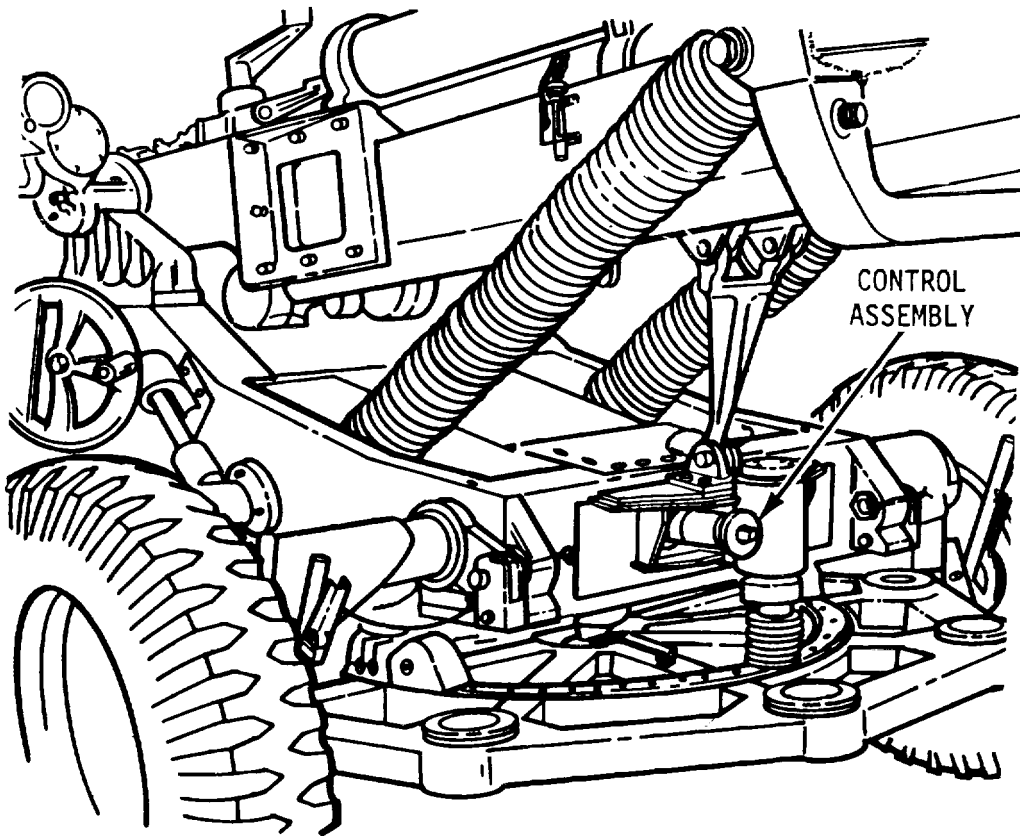


Table 3-1. Troubleshooting (cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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M31 CARRIAGE

8. CONTROL ASSEMBLY INOPERATIVE.



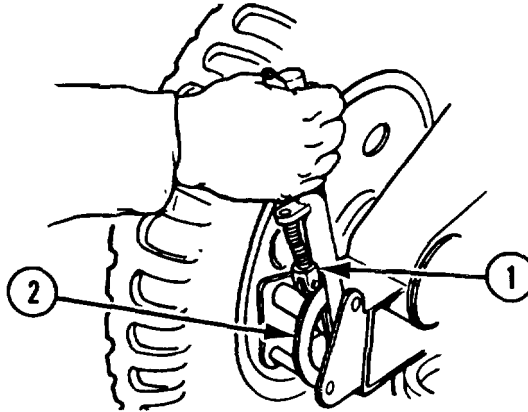
Perform no test or other inspection.

Notify organizational maintenance.

Table 3-1. Troubleshooting (cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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9. HANDBRAKES FAIL TO HOLD IN PARK POSITION.

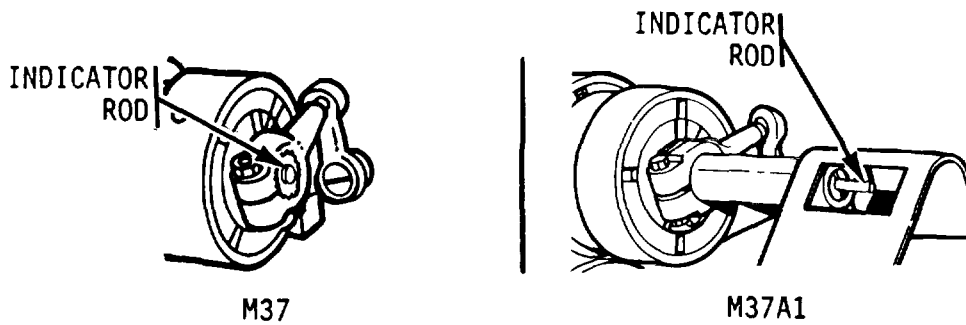


Check that pawl (1) engages in first third of brake rack (2) when brake is fully applied.

If brakes are improperly adjusted, notify organizational maintenance.

M37/M37A1 RECOIL MECHANISM

10. CANNON SLAMS INTO OR HANGS OUT OF BATTERY.



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.

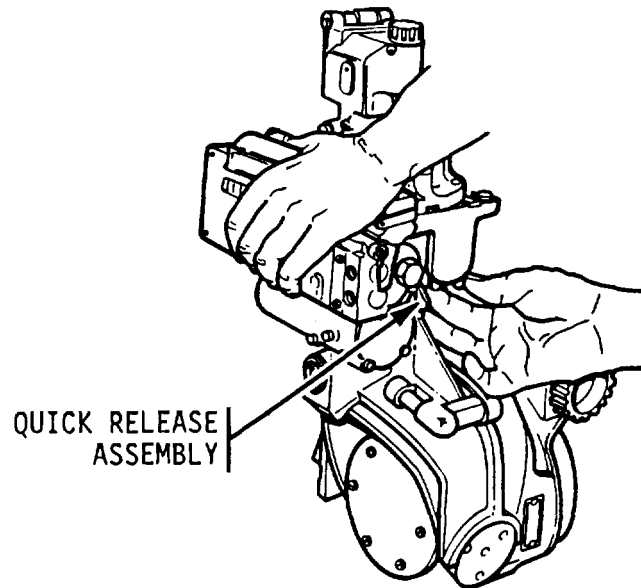


Table 3-1. Troubleshooting (cont.)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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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
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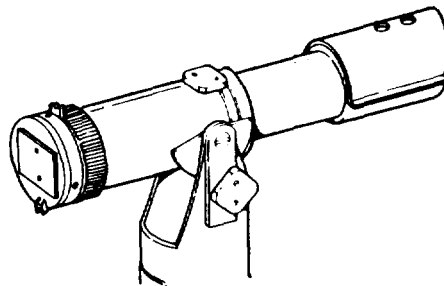
## FIRE CONTROL EQUIPMENT (cont)

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 reticle is dirty.  
If reticle 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.

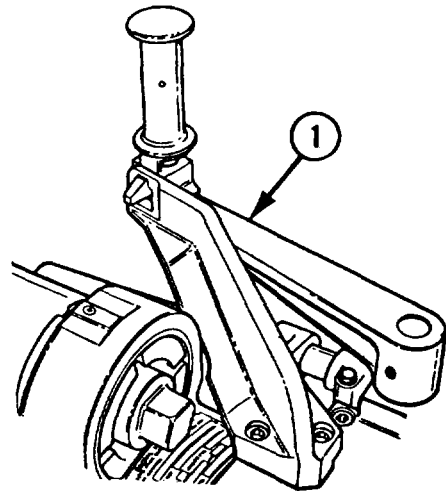
- 2 Spot paint with enamel (item 15, app D) as necessary. Do not paint threaded or bearing areas.

- 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.



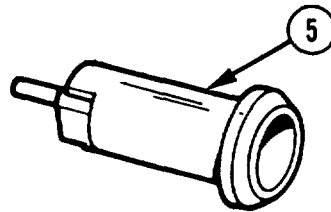
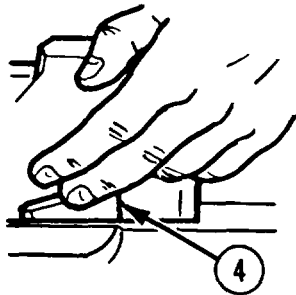
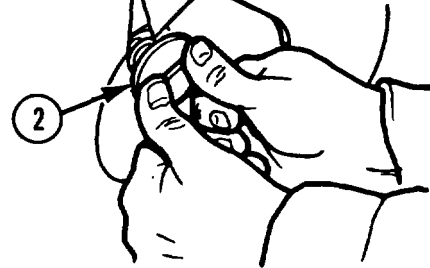
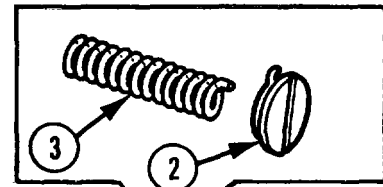
3-5. BREECH MECHANISM ASSEMBLY MAINTENANCE--REMOVAL OF BREECH-BLOCK FROM BREECH RING ASSEMBLY (cont.)

4 Pull lanyard to fire weapon.

**WARNING**

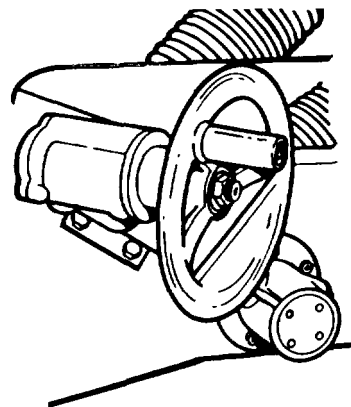
Be careful when removing retainer and spring. Spring is under extreme tension. Carelessness could result in personnel injury.

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

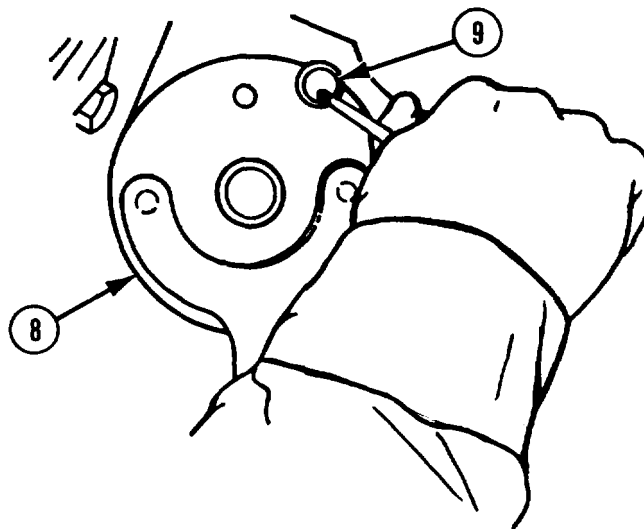
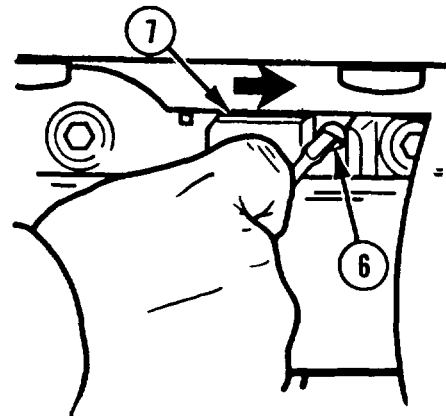


6 Pull back cocking lever (4). Remove percussive mechanism (5)

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.)

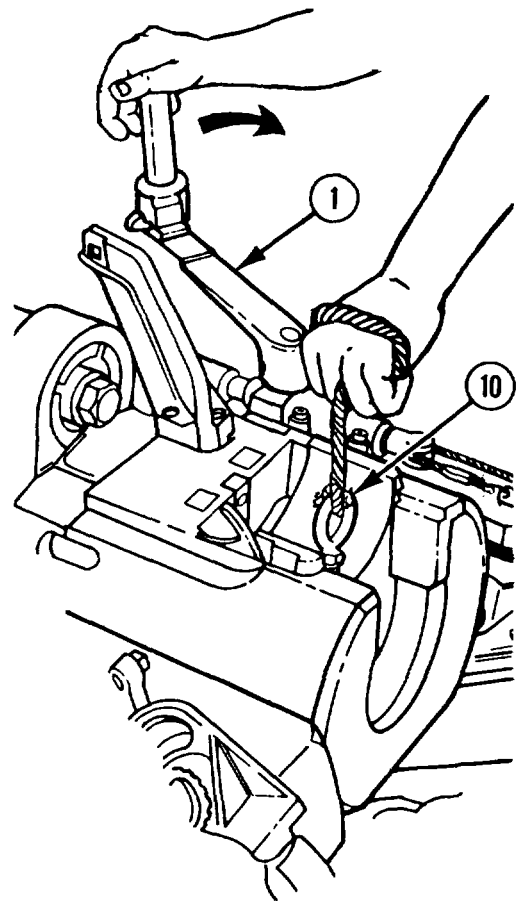
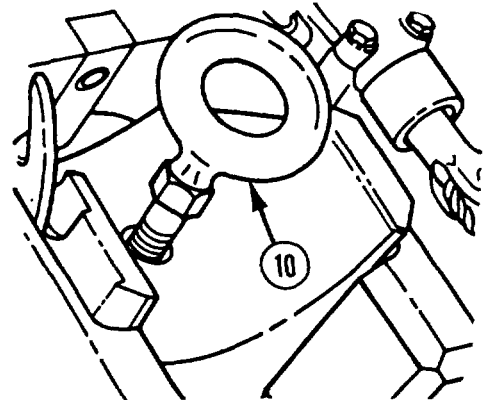
11 Screw eyebolt (10) into the top of the breechblock.

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.

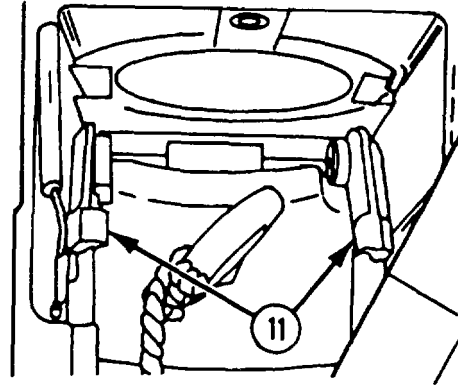
13 Grasp eyebolt (10) or rope with left hand. With right hand unlatch breech operating handle (1) and lower breechblock until it rests on carriage.



**NOTE**

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

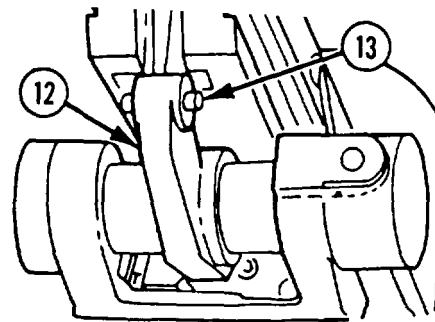
- 14 Remove cartridge extractors (11).



**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.

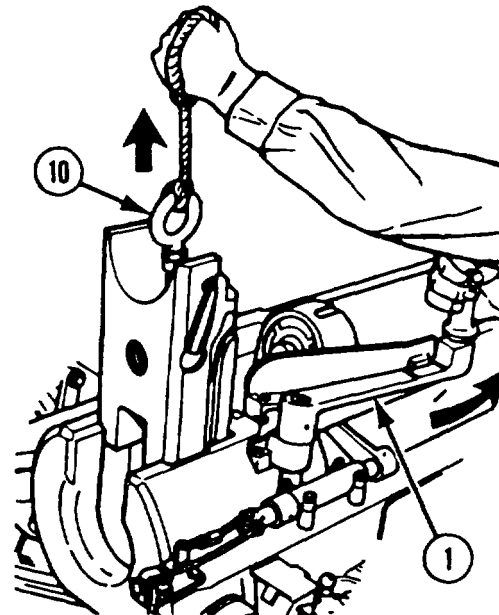


- 16 Grasp eyebolt (10) or rope with left hand and lift up on breechblock. With right hand move breech operating handle (1) counterclockwise and lock into position.

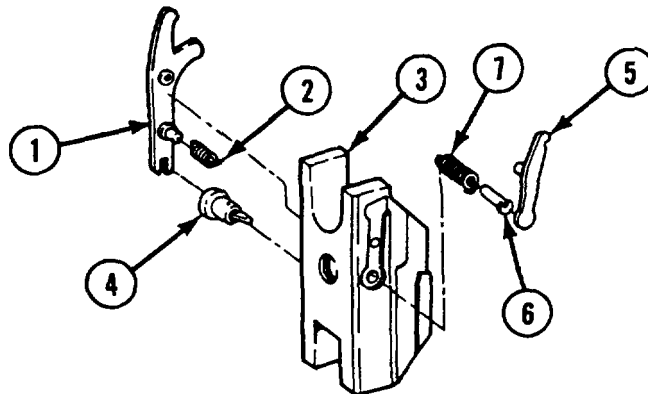
**NOTE**

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 MAINTENANCE—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).

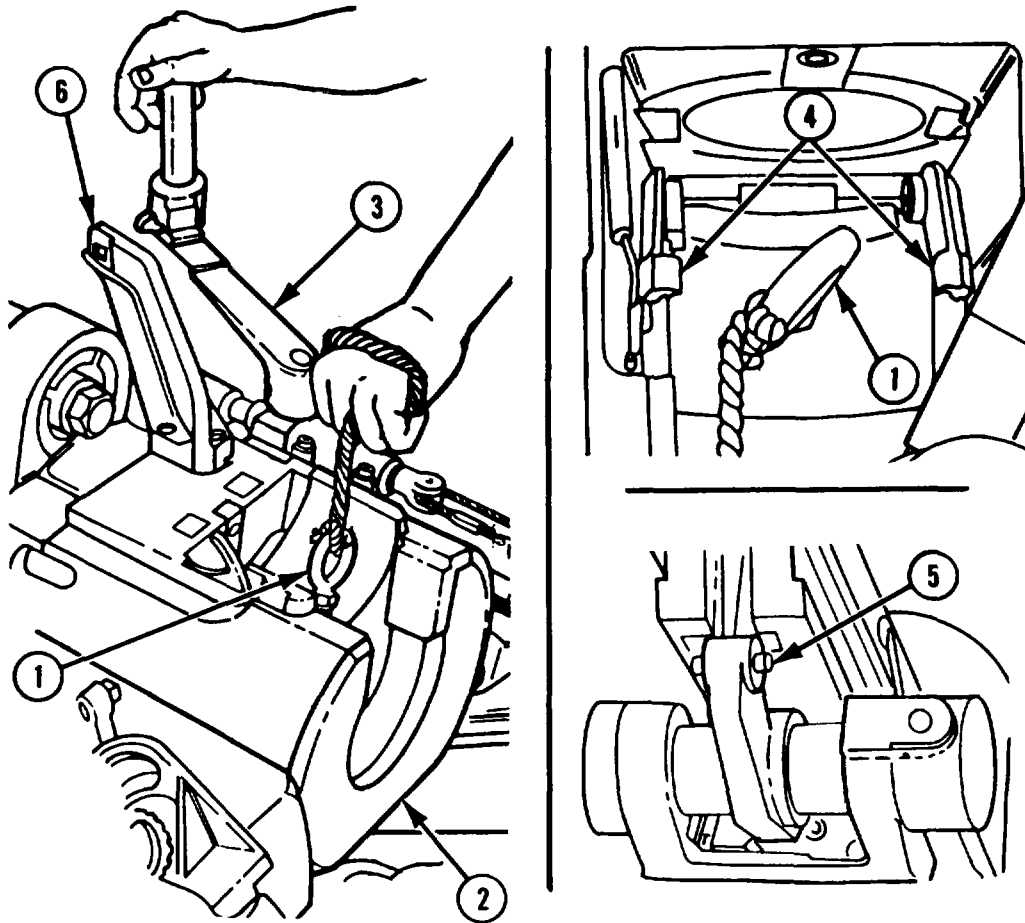
3-7. BREECH MECHANISM ASSEMBLY MAINTENANCE--INSTALLATION OF BREECHBLOCK INTO BREECH RING ASSEMBLY

- 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.

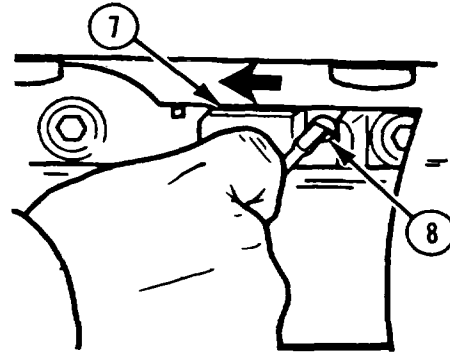
- 2 Using eyebolt (1), insert breechblock into breech ring assembly (2) from the top, and lower breechblock until it rests on carriage.
- 3 Release breech operating handle (3).



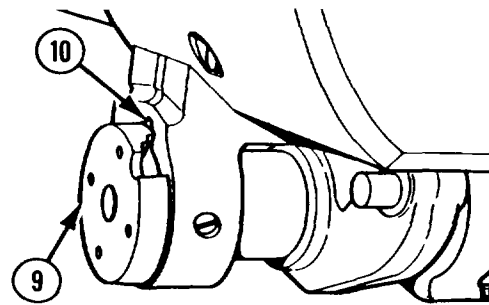
- 4 Install cartridge extractors (4).
- 5 Install breechblock operating crank pivot pin (5).
- 6 Grasp eyebolt (1) with left hand, raise breechblock slightly, and with right hand turn breechblock operating crank as required until pivot pin (5) engages the slot in the breechblock
- 7 Raise the breechblock 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)**

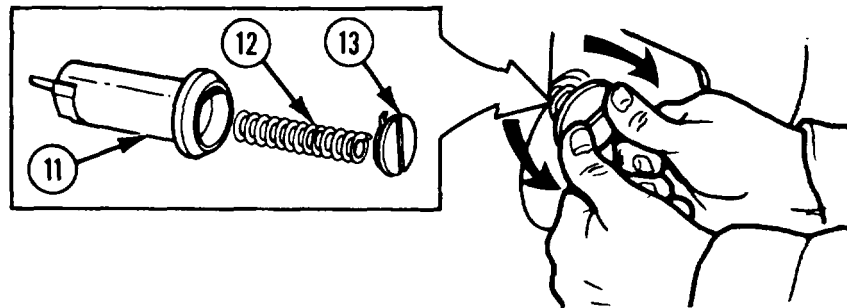
- 10 Slide breechblock crank stop (7) to the left until it is secured by detent plunger (8).



- 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.



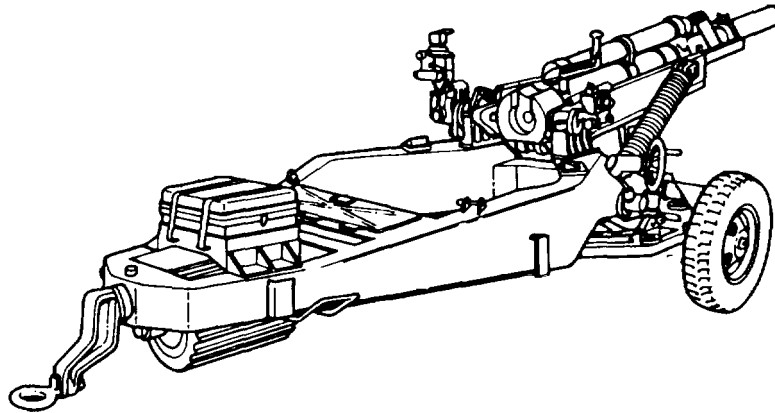
**WARNING**

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).

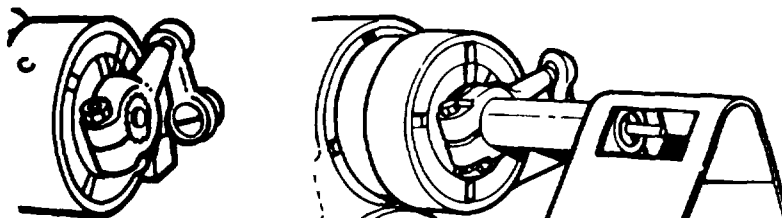
### 3-9. SUSPENSION PIN ASSEMBLY MAINTENANCE—INSPECTING SUSPENSION PIN ASSEMBLY

- 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.

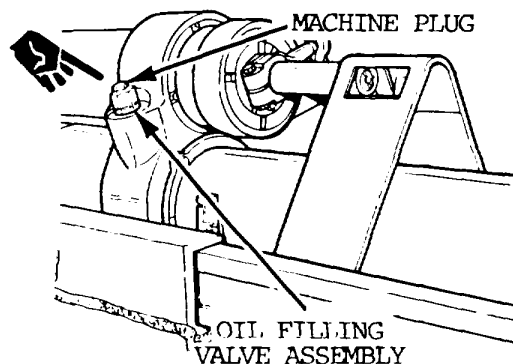
## 3-11. M37/M37A1 RECOIL MECHANISM MAINTENANCE

**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.

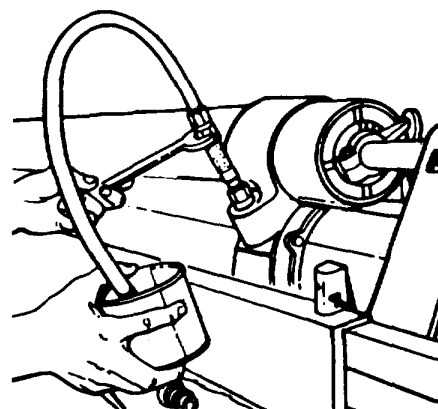
## 3-12. M37/M37A1 RECOIL MECHANISM MAINTENANCE--DRAINING OIL RESERVE

- 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.



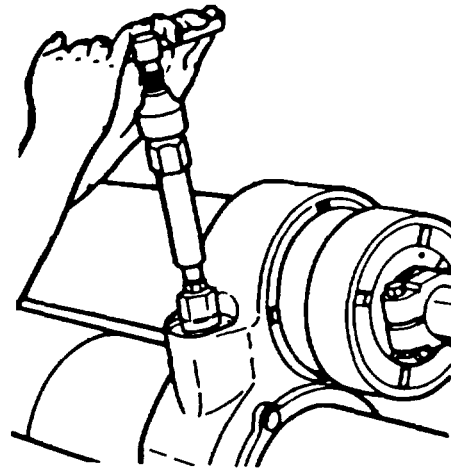
- 7 Inspect oil for evidence of air or nitrogen.
- 8 Remove drain hose and liquid releasing tool.

### 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 M37A1 recoil 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 COLLIMATOR MAINTENANCE--INSPECTING M1A1 COLLIMATOR**

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

**3-16. DELETED**

Change 2 3-40

**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.

**Change 2 3-41**

3-20. PREPARATION FOR FIRE CONTROL ALINEMENT TESTS

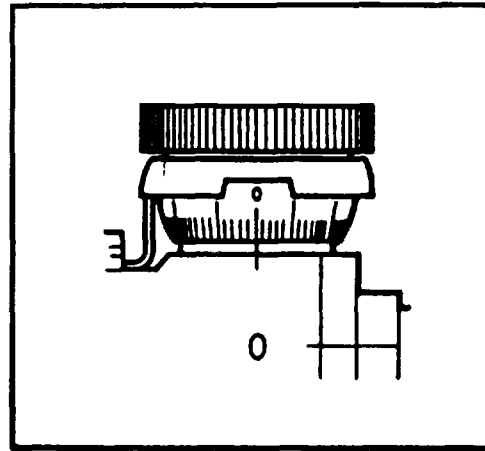
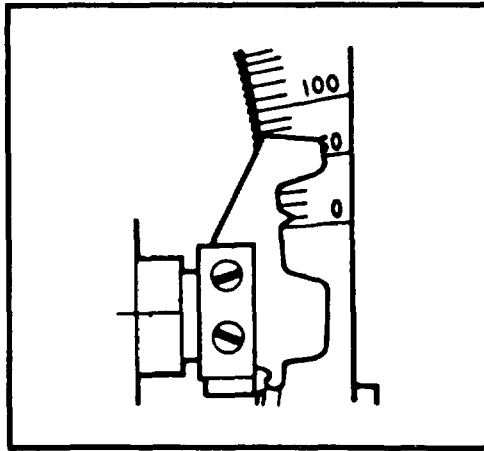


**WARNING**

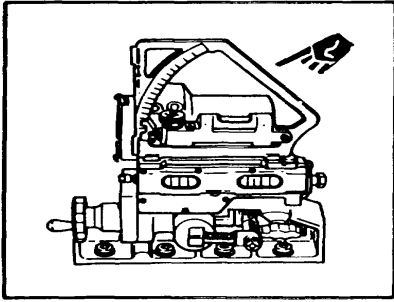
When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual .

- 1 Emplace the weapon on as firm and level ground as possible. Use hardstand if one is available.
- 2 Check the M14A1 quadrant, the M113A1 panel, 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.

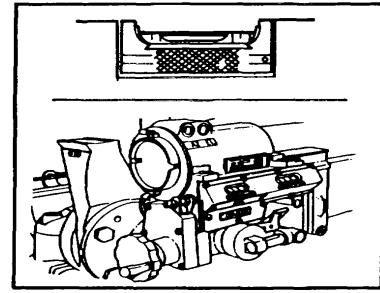
3-21. M1A1 GUNNER'S QUADRANT MICROMETER TEST



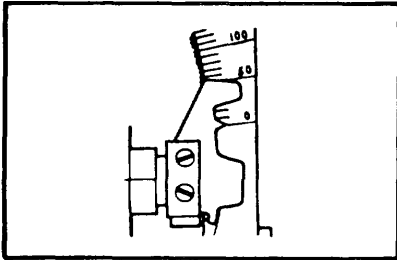
Change 2 3-42



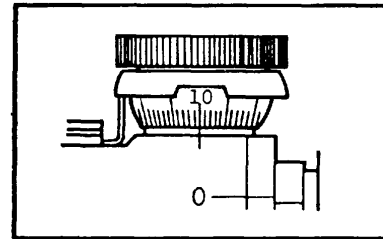
3 Point gunner's quadrant toward muzzle.



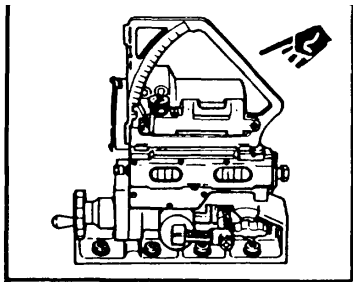
4 Depress/elevate cannon tube to center gunner's quadrant level vial bubble.



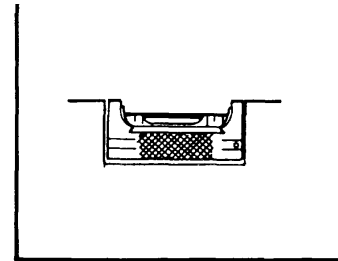
5 Set index at zero



6 Set micrometer at 10



7 Point gunner's quadrant toward muzzle



8 Gunner's quadrant level vial bubble should center.

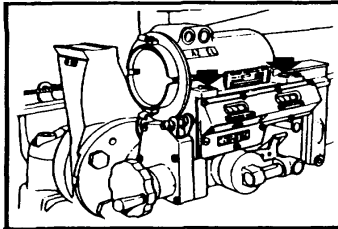
**3-21. M1A1 GUNNER'S QUADRANT MICROMETER TEST (cont)**

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.

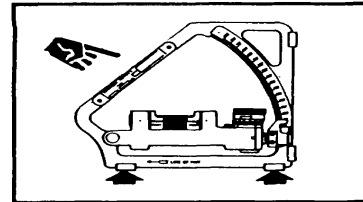
**3-22. M1A1 GUNNER'S QUADRANT END-FOR-END TEST**

**NOTE**

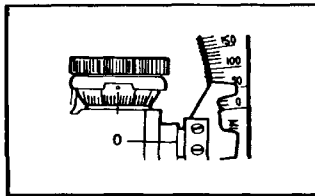
Maximum acceptable tolerance +0.4 mils.



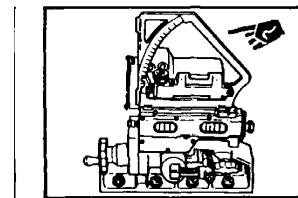
1 Inspect breech mechanism assembly or M14A1 quadrant elevation seats.



2 Inspect quadrant shoes.

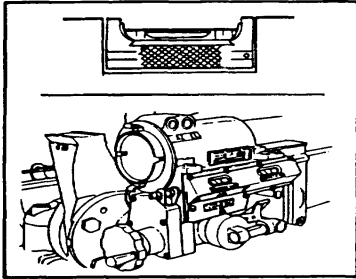


3 Zero the Index.

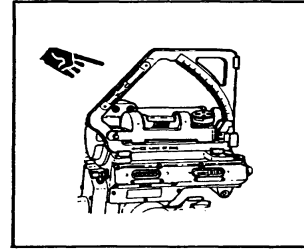


4 Place gunner's quadrant on M14A1 quadrant elevation seats with line of fire toward muzzle.

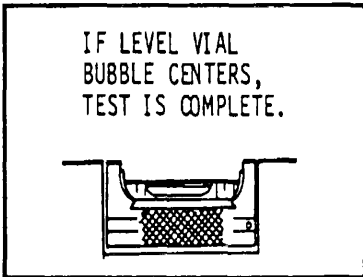
Change 2 3-44



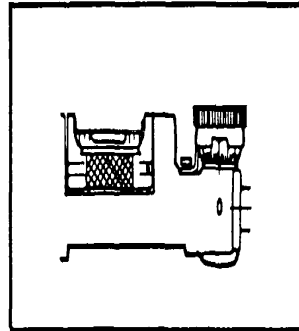
5 Depress/elevate cannon tube to center gunner's quadrant level vial bubble



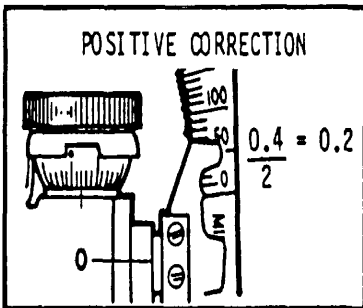
6 Reverse direction of gunner's quadrant



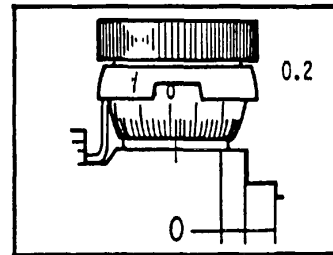
7 Gunner's quadrant level vial bubble should center. If not, go to step 8.



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.

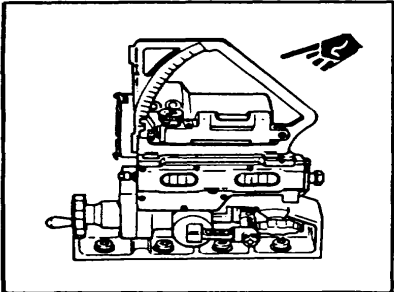


9 Divide micrometer reading by 2

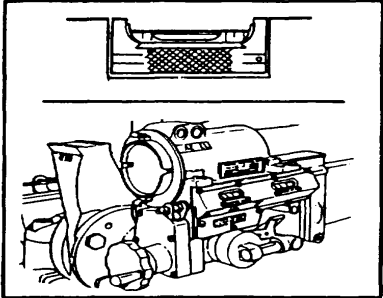


10 Set result on micrometer scale.

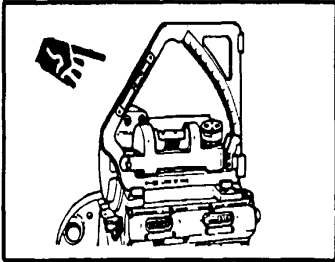
3-22. M1A1 GUNNER'S QUADRANT END-FOR-END TEST (cont)



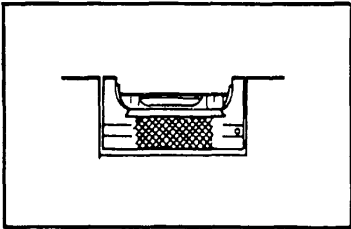
11 Point gunner's quadrant toward muzzle.



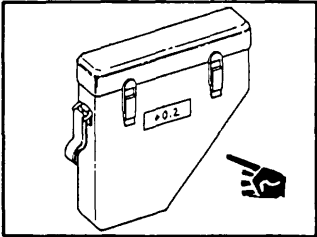
12 Depress/elevate cannon tube to center gunner's quadrant level vial bubble



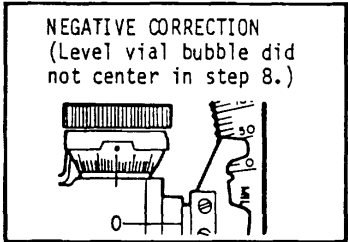
13 Reverse direction of gunner's quadrant



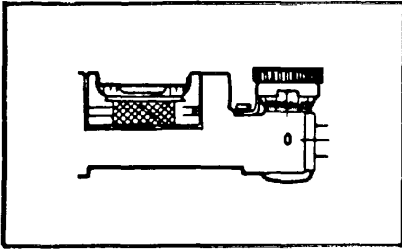
14 Gunner's quadrant level vial bubble should center



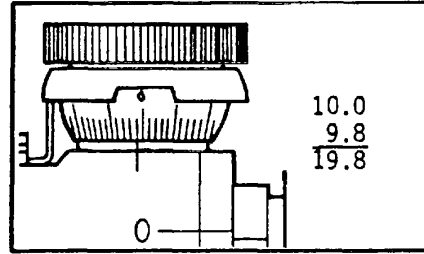
15 Record end-for-end- correction on gunner's quadrant carrying case



16 Set index at minus 10



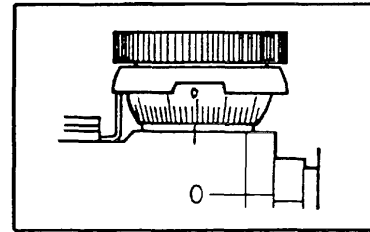
17 Center gunner's quadrant level vial bubble with micrometer knob



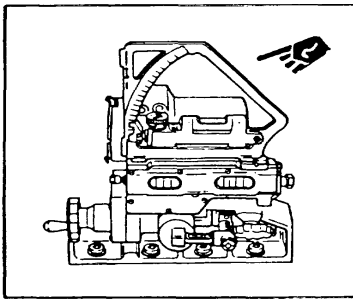
18 Add micrometer reading to 10.0.

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

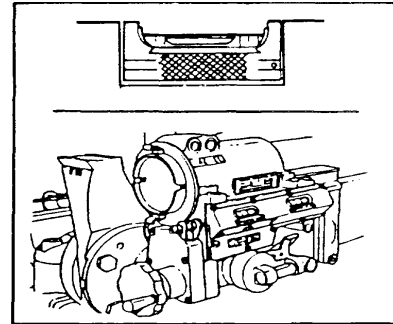
19 Divide step 18 answer by 2. This is your trial correction



20 Place answer on micrometer scale



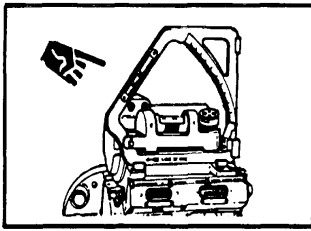
21 Point gunner's quadrant toward muzzle.



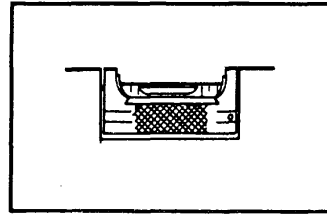
22 Depress/elevate cannon tube to center gunner's quadrant level vial bubble



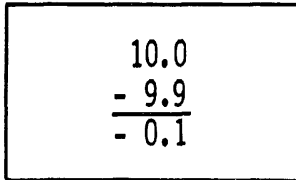
3-22. M1A1 GUNNER'S QUADRANT END-FOR-END TEST (cont)



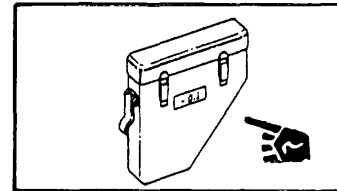
23 Reverse direction of gunner's quadrant



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



25 Subtract 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 alignment 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.

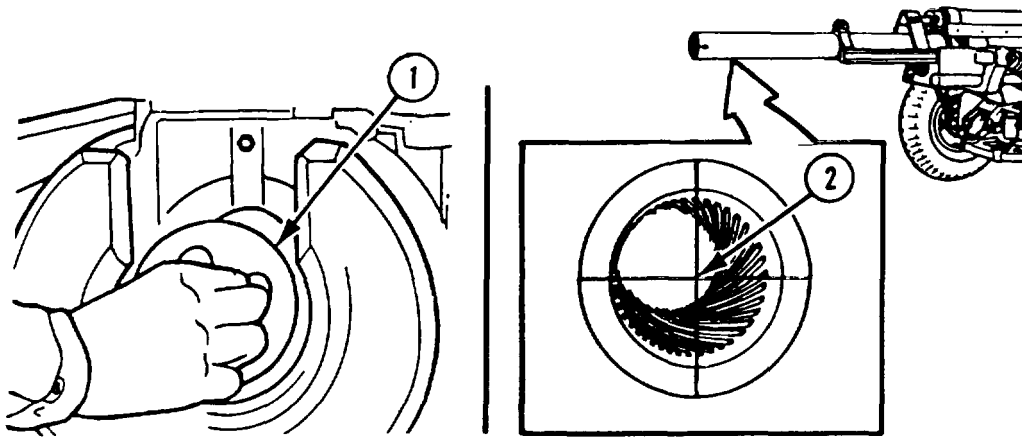
3-24. LEVELING THE TRUNNIONS USING THE PLUMBLINE



**WARNING**

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

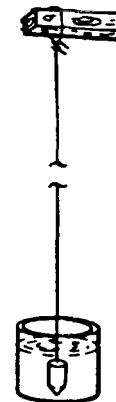
- 1 Release the howitzer travel lock and depress cannon tube to 0-mil elevation.
- 1.1 Lower the platform to firing position.



- 2 Install breach 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.



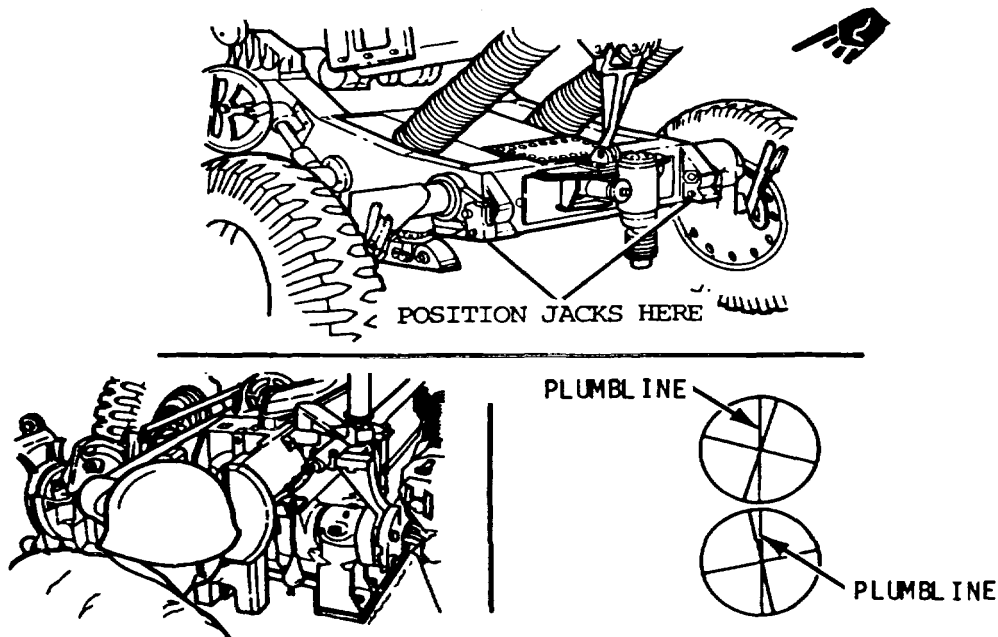
- 5 Hang the weight in a bucket of water or waste oil.
- 6 The plumbline must be stationary. Hang it where there is little or no wind so that it will not move during the test.
- 7 After hanging the plumbline, position the weapon so that the end of the cannon tube is within 12 inches of the plumbline.
- 8 Looking through the breach boresight disk, manually traverse the cannon tube until the vertical muzzle crossline is aligned 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.

**Change 1 3-50**

- 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 0-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 0-mil to 600-mil elevation, the trunnions are level.

**Change 1 3-50.1 (3-50.2 blank)**

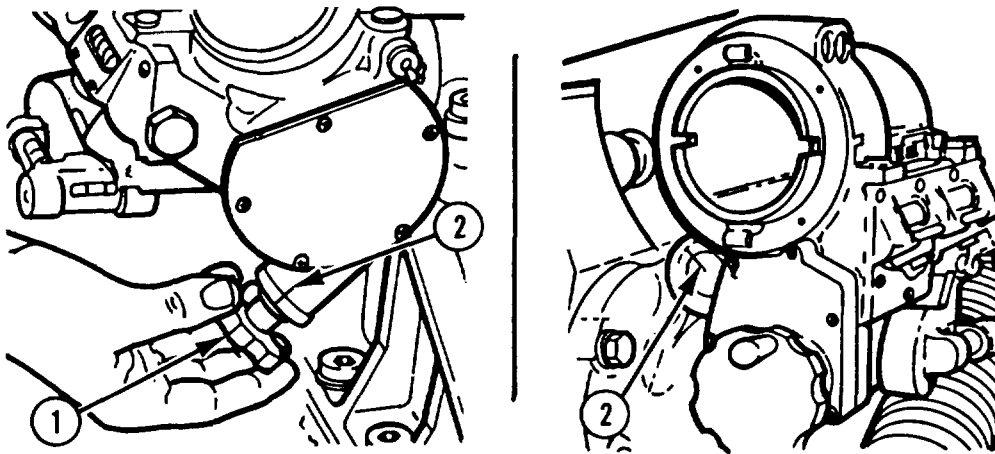
**3-25. LEVELING THE TRUNNIONS USING SCRIBE LINES ON M14A1 QUADRANT****WARNING**

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 align 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**

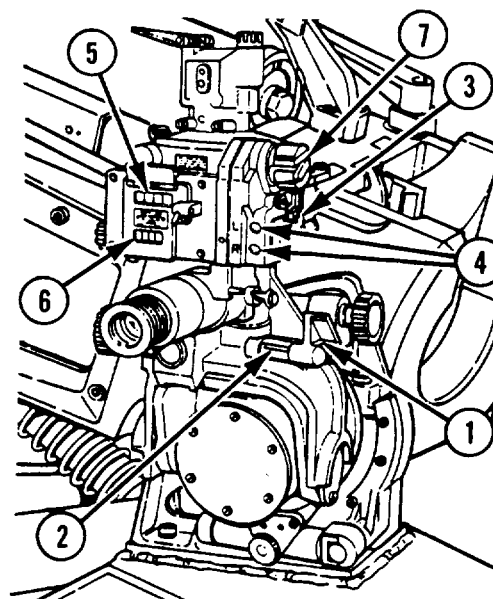
When handling radioactively illuminated fire control equipment, be aware of the radiation hazard procedures listed in the front of this manual.

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**

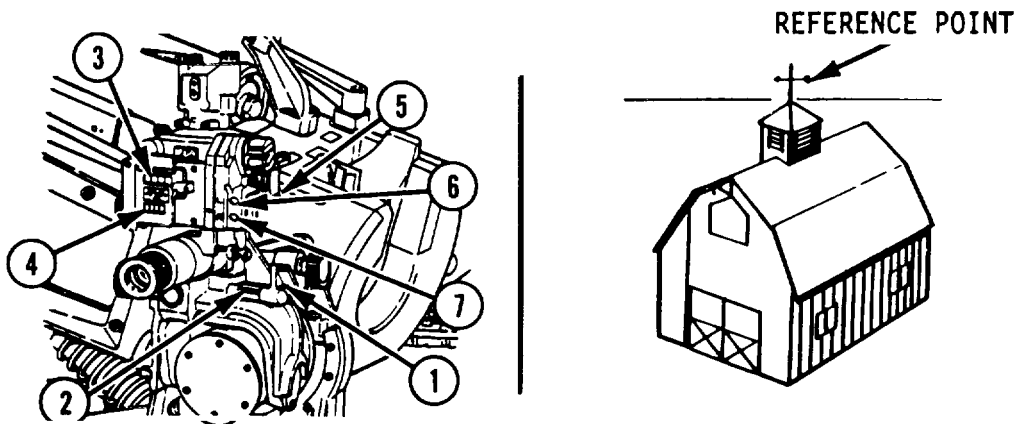
If you pass the reference point on the second revolution, rotate the M113A1 pantel head at least 50 mils counterclockwise and reapproach from left to right.

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



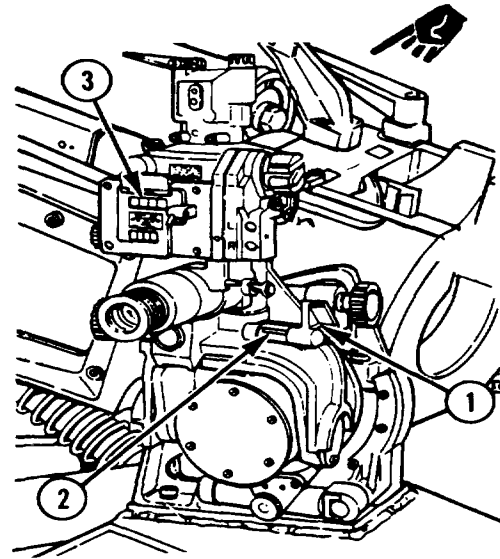
#### WARNING

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  $\pm 1$  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  $\pm 3$  mils of the reading in step 3.

**Change 1 3-54**



**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.

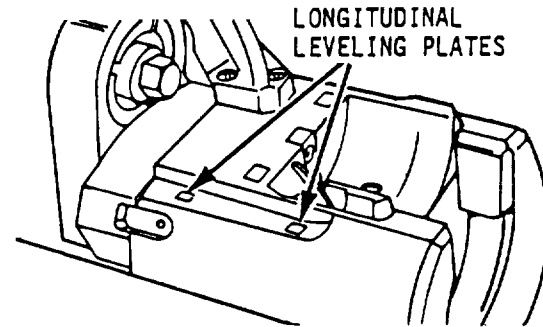
**NOTE**

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.

**Change 1 3-54.1 (3-54.2 blank)**

**NOTE**

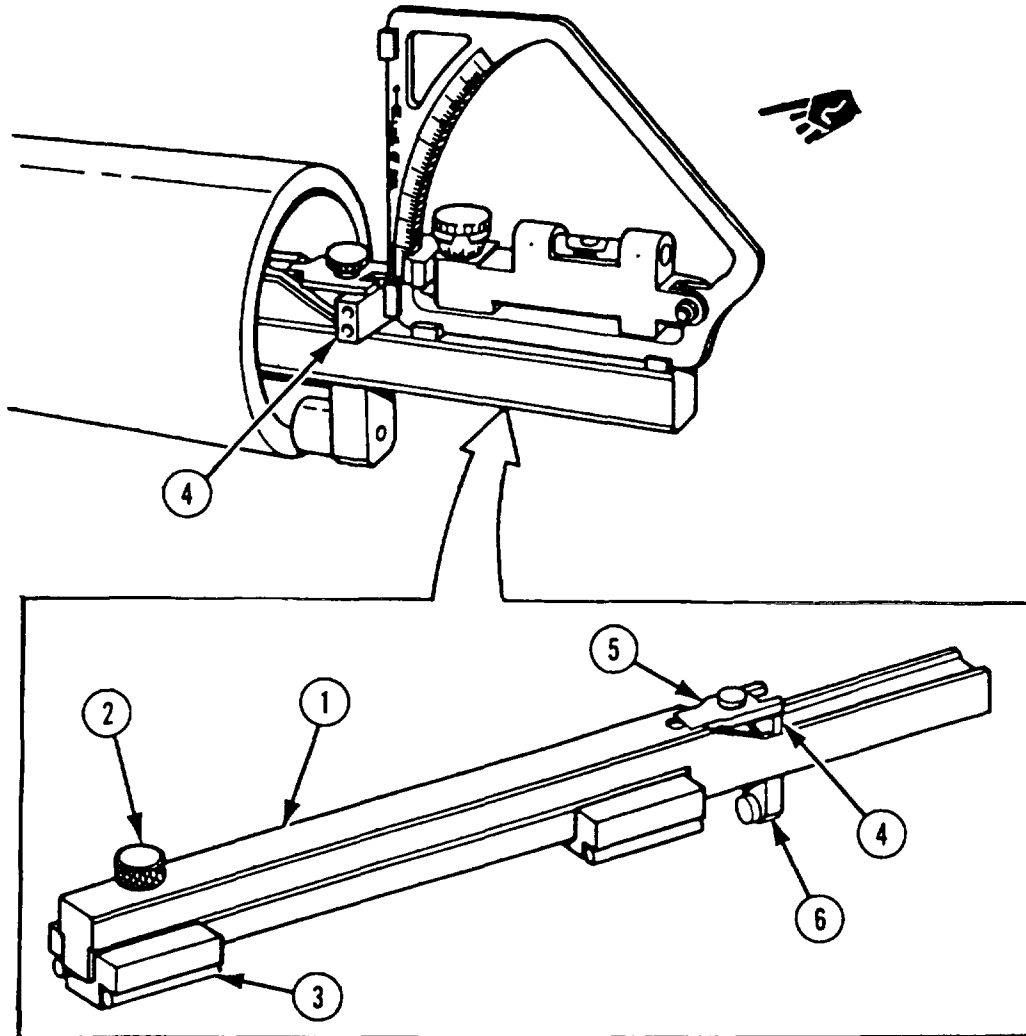
The longitudinal leveling plates on the breech mechanism assembly can be used only as a quick reference for checking elevation. They are not to be used for boresighting or for leveling the cannon tube.

**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.

**Change 2 3-55**

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.

Change 2 3-56

- 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.

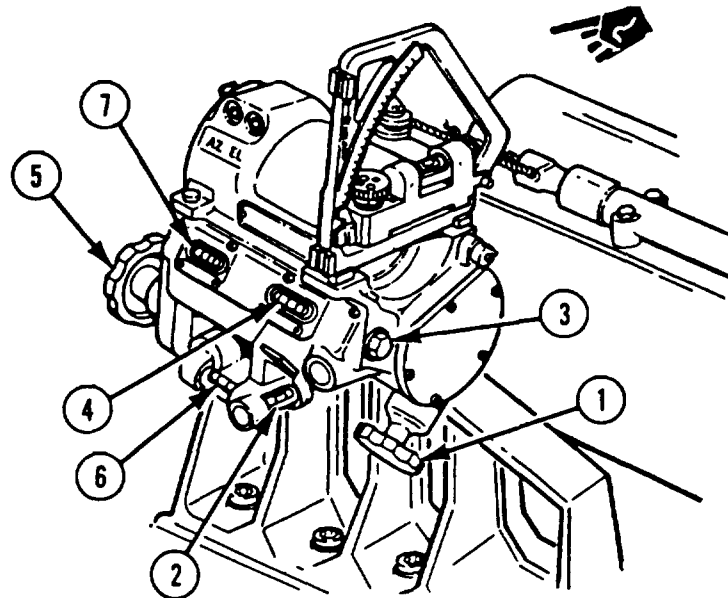
**CAUTION**

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

**NOTE**

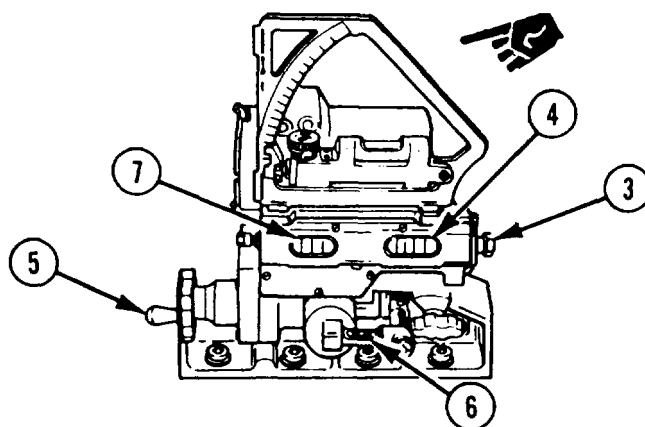
Be sure trunnions and cannon tube are level before performing this test, using the cannon tube quadrant seats or the gun tube leveling fixture procedures.

## 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.)

**Change 2 3-58**

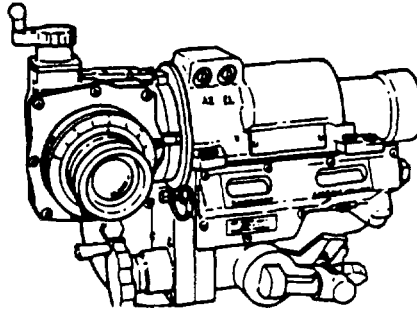


- 9 Set the gunner's quadrant on the M14A1 quadrant elevation seats and center the gunner's quadrant level vial bubble. Record the value on the gunner's quadrant.
- 10 Turn the M14A1 quadrant correction knob (3) to place a +5 mils reading on the correction counter (4). Check the reading on the elevation 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.

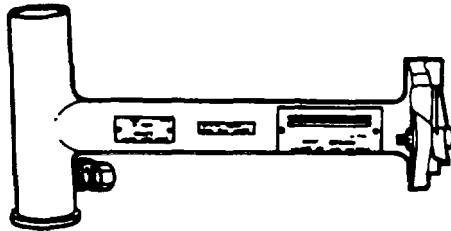
**Change 2 3-59**

**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  $\pm 0.5$ -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.

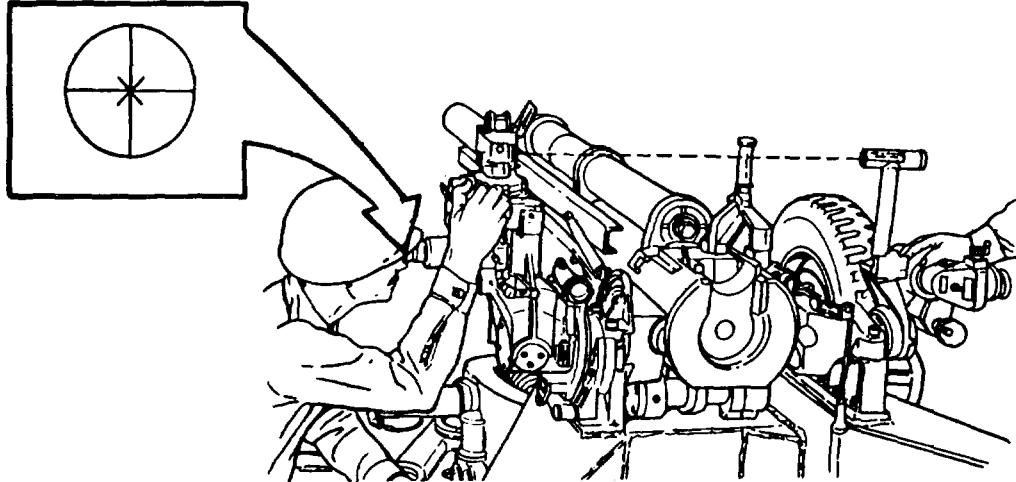
**3-34. M140 ALIGNMENT DEVICE COMPARISON TEST****WARNING**

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 panel, view through the eyepiece. If the crosshairs on the M113A1 panel and the alignment device align, you have verified the accuracy of the alignment device.
- 3 If the crosshairs on the M113A1 panel and the second alignment device do not align, or if the azimuth counter reading is not correct after the crosshairs are aligned, 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 panel cross-hairs is defective. Turn in defective alignment device to organizational maintenance for repair.
- 6 Deleted.

**Change 1 3-61 (3-62 blank)**





**CHAPTER 4  
AMMUNITION FOR M102 HOWITZER  
WITH M137A1 SERIES CANNON**

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**Section I INTRODUCTION**

**4-1. GENERAL**

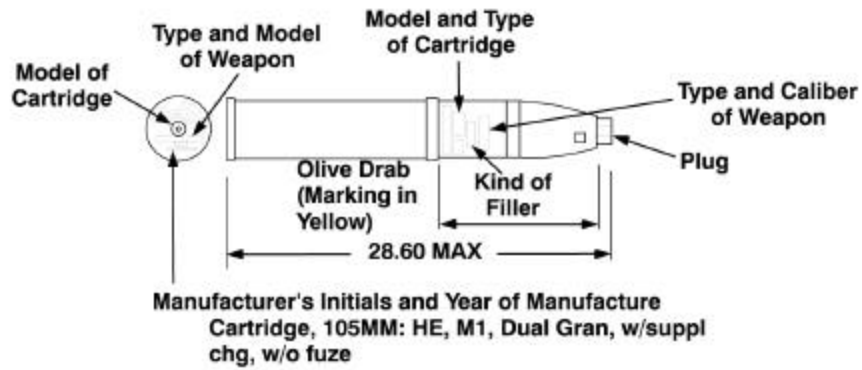
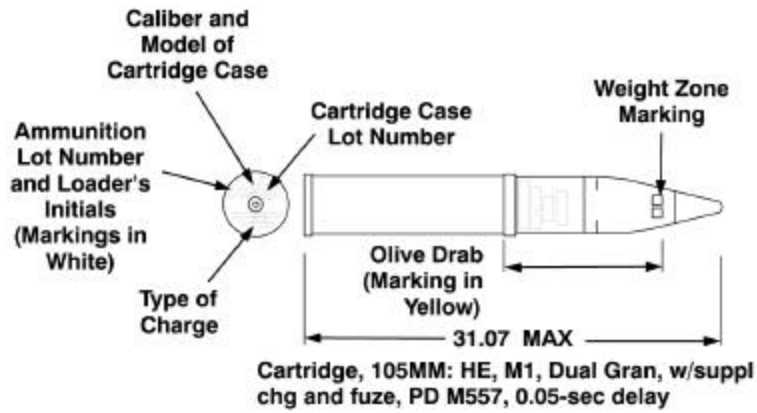
**a. Ammunition for the howitzer is of the semi-fixed type.** Most of this ammunition has an adjustable propelling charge for zone firing and the complete round is loaded into the weapon as a unit. Cartridges that do not have adjustable charges are the High Explosive Plastic (HEP) M327 and the Target Practice (TP) M67.

**b. Most 105-mm rounds are issued fuzed.** HE, some White Phosphorus (WP) M60 series, some Smoke M84 series, and some Illumination M314 series rounds are shipped without a fuze.

**4-2. PROJECTILE COLORING AND MARKING**

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

4-2. PROJECTILE COLORING AND MARKING - Continued



**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 Projectile	Number/Color of Bands	Marking	Color of Projectile	Number/Color of Bands	Marking
APERS-T M546	Olive Drab	1/Yellow	White (white diamonds indicate flechettes)	N/A	N/A	N/A
Dummy, M14	Unpainted 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	N/A	N/A	N/A
HE, M1	Olive Drab	None	Yellow	Olive Drab	None	Yellow
HERA, M548	Olive Drab	None	Yellow	N/A	N/A	N/A
Tactical CS M629	Gray	1/Red 1/Yellow	Red	N/A	N/A	N/A
HEP, M327	Olive Drab	1/Black	Yellow	Olive Drab	None	Yellow
Illuminating, M314 Series **	White	None	Black	Gray	1/White	White
Target Practice M67	Blue	None	White	Blue	None	N/A
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
HERA, M927	Olive Drab	None	Yellow	N/A	N/A	N/A

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

\*\* Some M314 Series rounds may come with M501 fuze (75 seconds); others are issued with either M548 or M565 fuzes (100 seconds) or M577 (200 seconds).

4-3. AUTHORIZED 105-MM PROJECTILES AND USE

**WARNING**

**Unauthorized assembly and use of projectiles and propelling charges are extremely dangerous. Ensure projectiles are marked 105H and not 105G.**

The weight zone markings are identified by one or more squares with or without a triangle of the same color as the marking. Two squares indicate standard or normal weight. Composition B loaded ammunition for the 105-mm howitzer contains an additional zone known as 2 1/2 (  $\ddot{y}\Delta$  ).

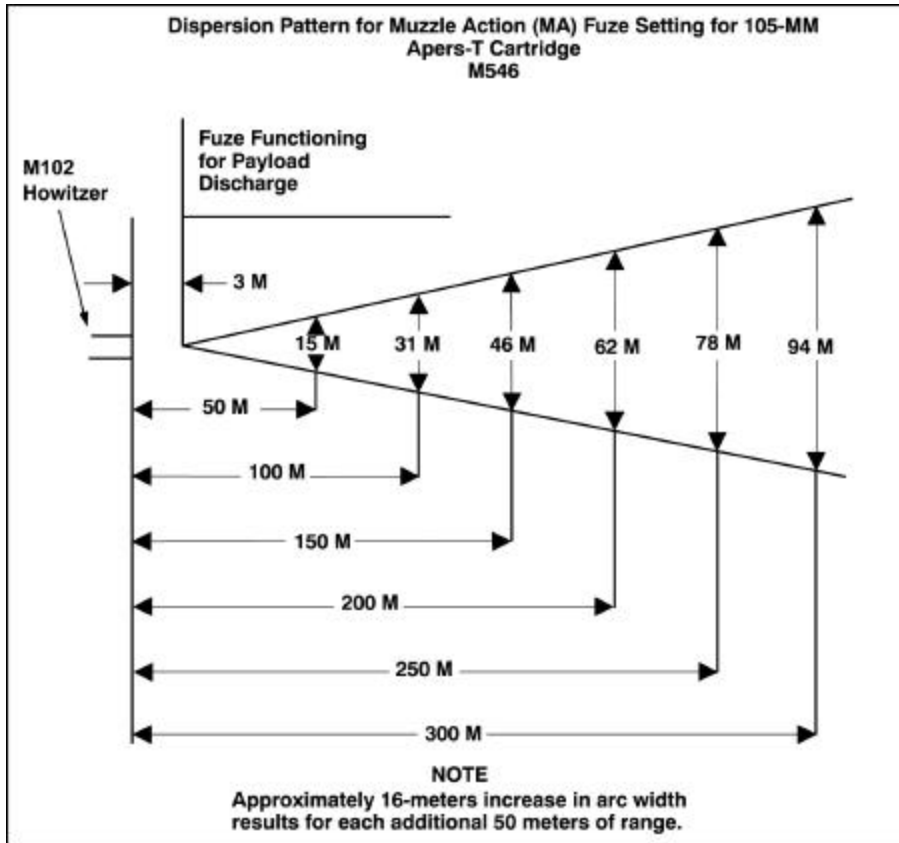
**Table 4-2. Authorized Projectiles.**

MODEL	ABBREVIATION	TYPE	USE
M546*	APERS-T	Flechette-loaded, aluminum projectile with MT, M563 fuze set on muzzle actions (MA)	Antipersonnel (effective in dense foliage)
M1	HE	High explosive–bursting	Antipersonnel, blast, mining
M60	H/HD	Bursting, chemical–mustard/distilled mustard	Antipersonnel, nonpersistent
M360	GB	Bursting, chemical–sarin	Antipersonnel, nonpersistent
M327	HEP/HEP-T	High explosive, bursting/high explosive, bursting tracer	Defeat armor (effective against concrete and timber targets)
M314 M314A1 M314A2	ILLUM	Base ejection projectile, parachute candle for use with M501/M501A1 and M762 fuzes only	Illumination
M314A3	ILLUM	Base ejection projectile, parachute candle for use with M548, M565, and 577 Series fuzes	Illumination
M60 Series	Smoke, WP	Bursting chemical	Screening, spotting, incendiary
M84A1	Smoke, HC	Base-ejection projectile with canisters for use with fuzes M548, M565, M577, or 762	Screening/target identification signaling
M84B1	Smoke, HC/colored	Base-ejection projectile canisters for use with M501/M501A1 fuze only	Screening/target identification signaling
M444	ICM	High-explosive bouncing grenades	Antipersonnel

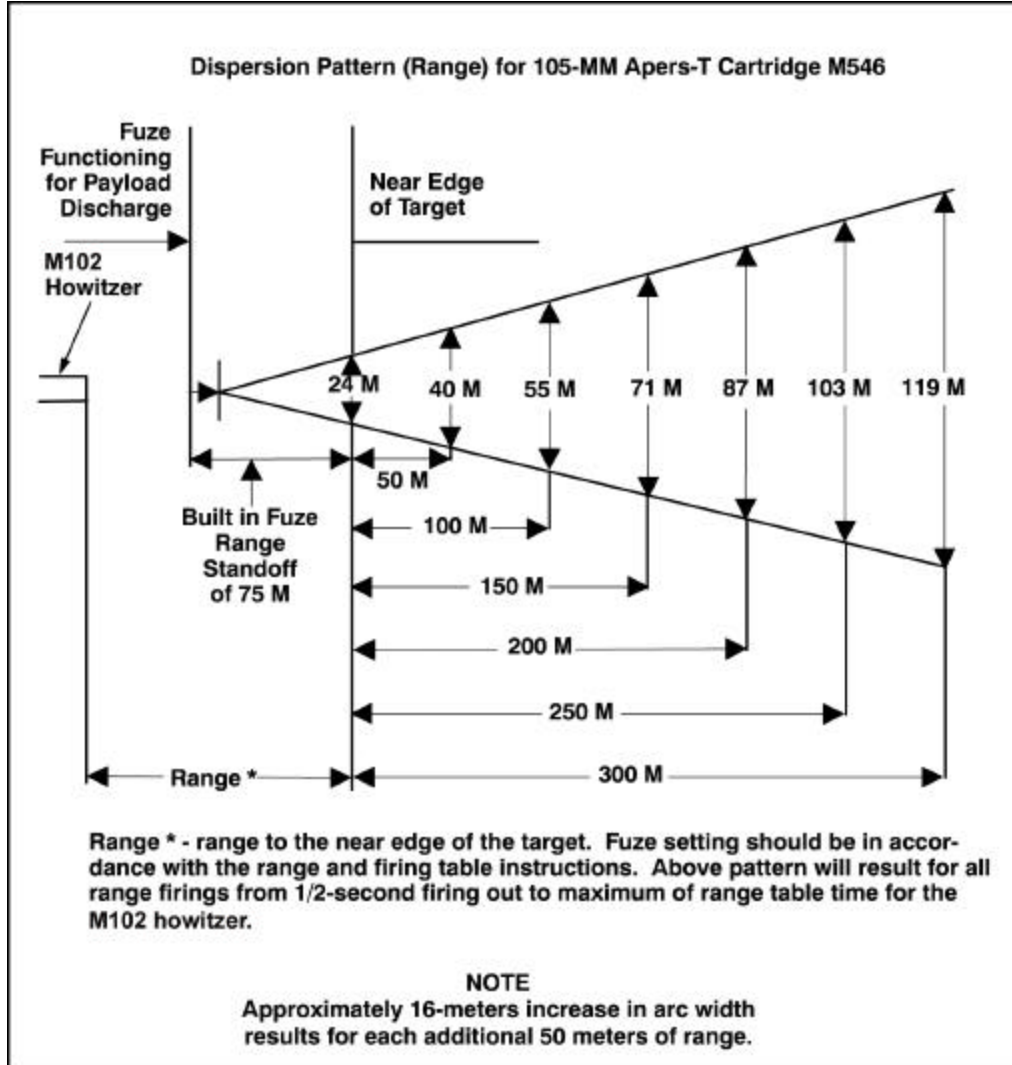
Table 4-2. Authorized Projectiles - Continued.

MODEL	ABBREVIATION	TYPE	USE
M548	HERA	High explosive rocket assisted	Antipersonnel, blast, mining
M629	Tactical CS	Base ejection projectile with CS canisters	Riot Control
M927	HERA	High-explosive rocket assisted	Antipersonnel blast, mining

\*Dispersion pattern for M546 set on MA (muzzle action) and time shown in following diagrams.



4-3. AUTHORIZED 105-MM PROJECTILES AND USE – Continued

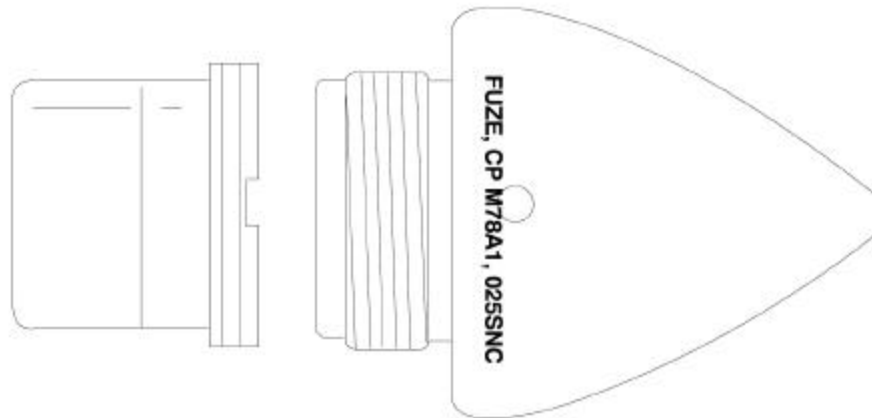


#### 4-4. AUTHORIZED FUZES FOR HOWITZER

a. **General.** The following paragraphs 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 4-4. For authorized projectile, fuze and propelling charge combination, see TM 43-0001-28-10.

b. **Fuze, Point Detonating, Concrete Piercing: M78A1 Series.** 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. These fuzes may be used with a normal or deep cavity shell; however, if these fuzes are used with a deep cavity shell, the supplementary charge must remain in the fuze well cavity.

#### POINT DETONATING CONCRETE PIERCING FUZE M78A1 AND BOOSTER M25

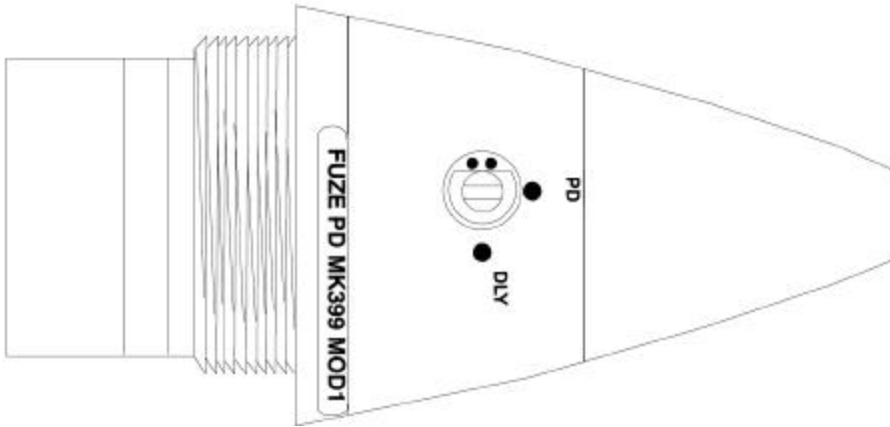




**4-4. AUTHORIZED FUZES FOR HOWITZER - Continued**

**c. Fuze, Point Detonating: MK399 MOD 1.** The MK399 MOD 1 MOUT fuze is primarily for use against urban structures (bunkers, buildings, etc.). The fuze has a setscrew that can be turned by a flathead screwdriver or M18 fuze wrench to select point detonating (PD) or delay (DLY) function. When set at PD, the fuze functions superquick, which is useful for spotting purposes. When set at DLY, the fuze penetrates the target to function the projectile inside the target. This fuze is assembled with a booster pellet and set on the DLY mark for shipping. This fuze is rain sensitive.

**MILITARY OPERATIONS ON URBAN TERRAIN (MOUT) PD FUZE, MK399 MOD 1**



**Table 4-3. MK399 MOD 1 Summary Matrix of Expected Performance Against MOUT Targets**

		MOUT Targets															
		Wood Frame				Single Brick				Triple Brick				Reinforced Concrete			
Obliquity angle →		0°	30°	45°	60°	0°	30°	45°	60°	0°	30°	45°	60°	0°	30°	45°	60°
105mm - M1 low zone		M <sup>1</sup>	M <sup>1</sup>	M <sup>1</sup>	M <sup>1</sup>	G	G	G	G	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>
105mm - M1 mid zone		G	G	G	G	G	G	G	G	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>
105mm - M1 high zone		G	G	G	G	G	G	G	G	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>	P <sup>2</sup>
		<b>G – Good M – Marginal P – Poor, not recommended</b>															

**Notes:**

Always be prepared to use multiple rounds to defeat targets

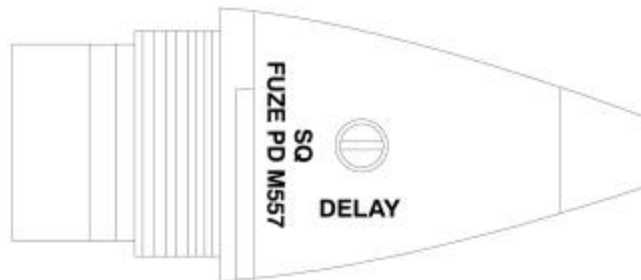
Obliquity angle of 0° = perpendicular to target wall

<sup>1</sup> – For lighter wood frame construction, at low zone, insufficient impact force may result in duds.

<sup>2</sup> – RAP rounds not recommended against MOUT targets; projectile may break up upon impact.

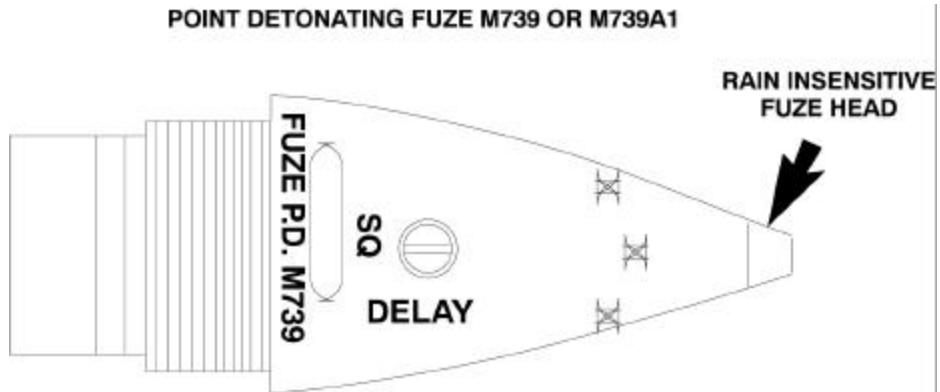
**d. Fuze, Point Detonating: M557/M572.** The M557/M572 fuzes have a selective superquick-delay setscrew. They are packed set for superquick and each has a booster attached. Premature functioning can occur when fuzes are fired through heavy precipitation, i.e., heavy rainfall, sleet, snow, or hail. The M572 fuze is the M557 fuze with the addition of epoxy filler under the ogive. It is handled, set, and fired the same as the M557 fuze. These fuzes can be set for superquick or delay action by turning the setscrew.

**POINT DETONATING FUZE M557 AND M572 FUZE**



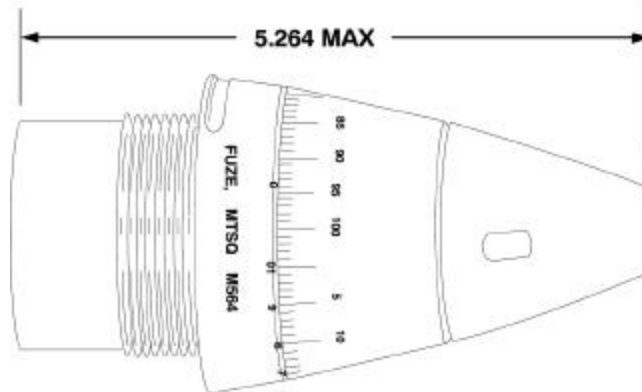
4-4. AUTHORIZED FUZES FOR HOWITZER - Continued

e. **Fuze, Point Detonating: M739 and M739A1.** These fuzes are the latest improved versions of the selective impact fuze. These fuzes have solid aluminum bodies, with threaded bases. The fuzes contain a rain insensitive head so that they can be fired through heavy rainstorms without premature functioning. These fuzes can be set for superquick or delay action by turning the setscrew. The M739A1 fuze contains a new impact module which provides more effective functioning in the delay mode. In addition to the stamped markings, the M739A1 fuze is anodized green for positive identification of fuze model.



f. **Fuze, Mechanical Time: M563 Series.** Intended for use with the flechette-loaded 105-mm cartridge M546 only. The M563 fuze employs a Vernier scale to attain a setting accuracy of 0.1 seconds. The scale contains an MA designation for muzzle action, a 0.5 second setting for minimum downrange functioning, and whole-second increments for preset downrange functioning. If muzzle action is selected, the fuze will function immediately as the projectile leaves the muzzle. If another range is set, fuze functioning will occur so as to result in optimum flechette dispersion for the range; for settings between 200 and 500 meters, the fuze will function 100 meters short of the range set. For longer-range settings up to 4400 meters, functioning will occur 75 meters short of the range set.

**FUZE, MECHANICAL TIME: M563 SERIES**



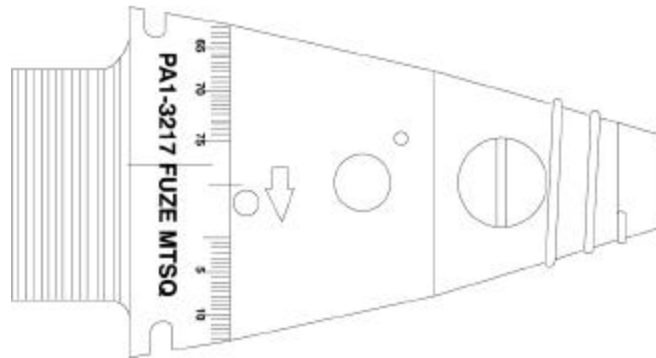
g. **Fuze, Mechanical Time and Superquick: M501 Series.** The M501 Series fuzes are combination mechanical time and superquick fuze with settings for time action (2 to 75 seconds) and an impact element for superquick action.

**WARNING**

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

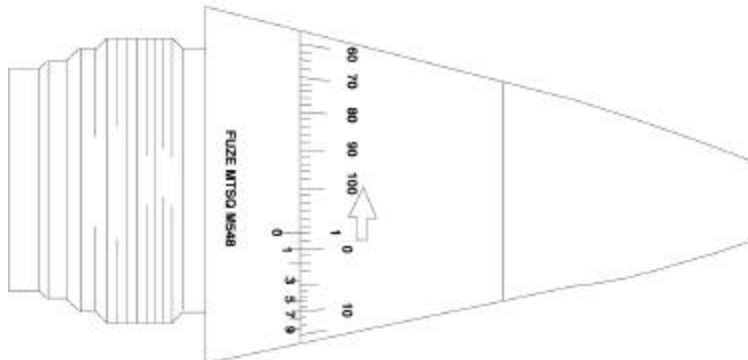
4-4. AUTHORIZED FUZES FOR HOWITZER - Continued

MECHANICAL TIME AND SUPERQUICK FUZE M501A1



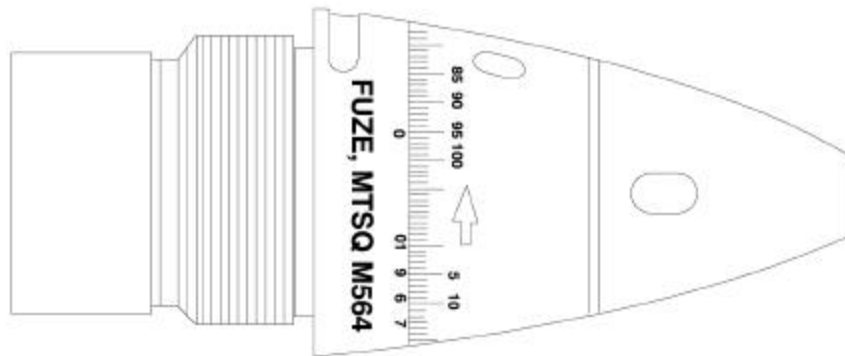
h. **Fuze, Mechanical Time and Superquick: M548.** Designed to function at time settings from 2 to 100 seconds or on impact, depending on which occurs first after arming. Does not contain a booster and is used with base-ejecting projectiles only. If superquick (impact) action is desired, the fuze must 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 AND SUPERQUICK M548 FUZE



i. **Fuze, Mechanical Time and Superquick: M564.** Intended for use with burster projectiles in which mechanical time settings (2 to 100 seconds) or impact superquick functioning is desired. The M564 fuze employs a vernier scale to attain a setting accuracy of 0.1 second. The delay arming mechanism prevents this fuze from arming for either action until the round has traveled a minimum distance of 200 feet from weapon muzzle. 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 rainfall.

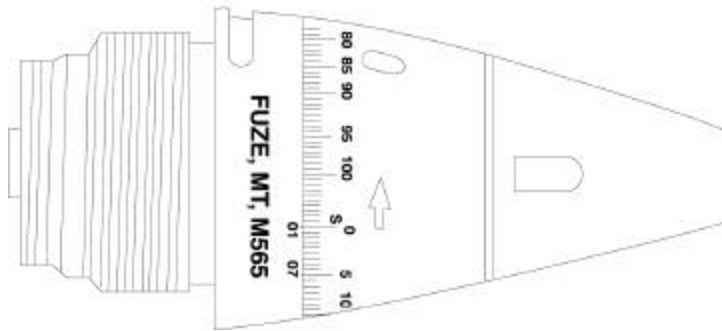
**MECHANICAL TIME AND SUPERQUICK FUZE M564**



**4-4. AUTHORIZED FUZES FOR HOWITZER - Continued**

j. **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 vernier scale to assure a setting accuracy of 0.1 second. This fuze is used with base ejection projectiles only.

**MECHANICAL TIME FUZE M565**



**k. Fuze, Mechanical Time and Superquick: M577 Series and M582 Series.**

These fuzes have a 200 second mechanical time mechanism with three movable digital dials similar to an odometer. Each fuze has a window through which the dials are viewed. The dials permit setting of the fuze to the nearest one-tenth (0.1) second. The M577A1 and M582A1 MTSQ fuzes contain a different mechanism for point detonating action. Externally the major difference is the configuration of the wrench slots. The M577A1 and M582A1 fuzes are handled, set, and fired the same as the basic models. Early manufactured basic and A1 fuzes have black (paint finish) ogives while the later product A1 fuze has a gold (chromatic finish) ogive. The dial closest to the fuze nose indicates the time in hundreds of seconds. (The triangle ( ) position is a non-time setting.) The second dial indicates time in tens of seconds, and the third dial indicates the nearest second and also tenth of seconds by using the scale on the right edge of the dial. These fuzes can be set with the M35 fuze setter, or a flat tip screwdriver. The time-setting key is located on the end of the fuze nose. The desired time is set under the hairline. Detailed setting instructions are outlined in paragraph 4-10. The M577 fuze does not contain a booster and is used with base-ejection projectiles. The M582 Series fuze is fitted with a booster for firing with burster-type and high-explosive projectiles. The fuzes are not

sensitive to rain. In order to minimize identification problems, current production of M582A1 fuzes contain a white stencil "M582A1" below the window on the fuze body. If the M577 series fuzes are set for time and the timing mechanism fails, the fuze may or may not function on impact.

**MECHANICAL TIME AND SUPERQUICK FUZE M577 SERIES OR M582 SERIES**



**I. Not used.**

**m. Fuzes, Electronic Time: M762 and M767 Series.** A reserve lithium battery powers these fuzes. The battery is activated manually by rotating the ogive or by a portable hand held inductive fuze setter. An electronic subassembly contains integrated circuits that provide controls and logic for 199.9 second electronic timing and transmits a fire pulse signal for time function. A Liquid Crystal Display (LCD) provides a visual readout of the fuze setting, as follows:

(1) The column closest to the base end indicates time in hundreds of seconds. (The triangle ( ) position is a non-time setting for the basic fuze. The M762A1/M767A1 will have a blank space, a "0", or a "1").

(2) The second column away from base end indicates time in tens of seconds.

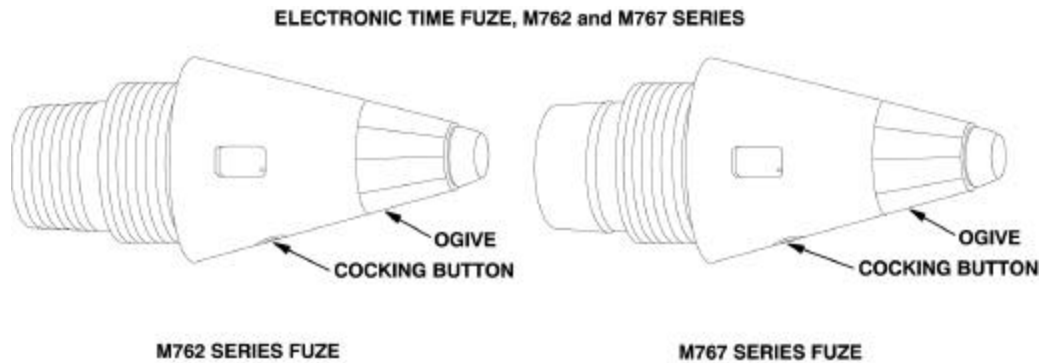
(3) The third column away from base end indicates time in seconds.

(4) The fourth column (closest to nose end) indicates time in tenths of seconds.

(a) These fuzes contain an electromechanical Safe & Arming Mechanism (S&A). When set for time function, the S&A provides overhead safety by arming at 50 milliseconds before set time. For this reason, if the fuze impacts before a time setting expires, there will be no PD back-up function. For PD setting, the S&A arms the fuzes at 0.45 seconds in flight. Upon impact, a crush switch assembly (contained in the ogive) senses the impact and transmits a fire signal for PD action.



4-4. AUTHORIZED FUZES FOR HOWITZER - Continued



(b) These fuzes can be set either by hand (rotating ogive and depressing selector and cocking buttons) or by using the M1155 Portable Inductive Artillery Fuze Setter (PIAFS). The settings can be changed as many times as required for the duration of the activated life of the battery (15 days).

(c) 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 for the basic fuzes and black plastic for the M762A1 and M767A1 fuzes. The nose cap is unpainted bronze for the basic fuzes and stainless steel for the M762A1/M767A1.

(d) The M762 series fuze does not contain a booster and is used with base-ejection projectiles. The M767 series fuze is fitted with a booster for firing with burster-type and high-explosive projectiles.

(e) If these fuzes fail in the time mode, there is no PD back up.

(f) The fuzes are not sensitive to rain.

#### NOTE

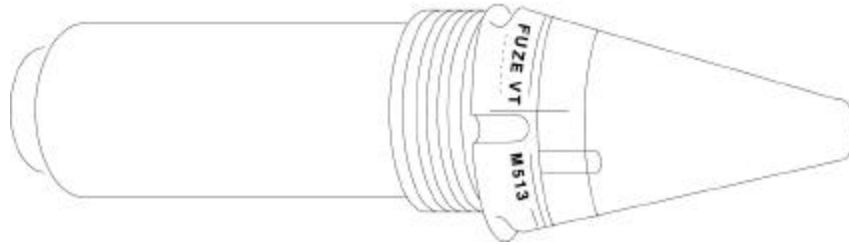
**Once activated, the M762 and M767 series fuze cannot be turned off; therefore, the fuzes have approximately 15 days service life before the battery runs down and the LCD goes blank. Contact EOD for disposal if battery runs down.**

(g) The M762 and M767 fuze series are replacing the M577/M582 fuze series.

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

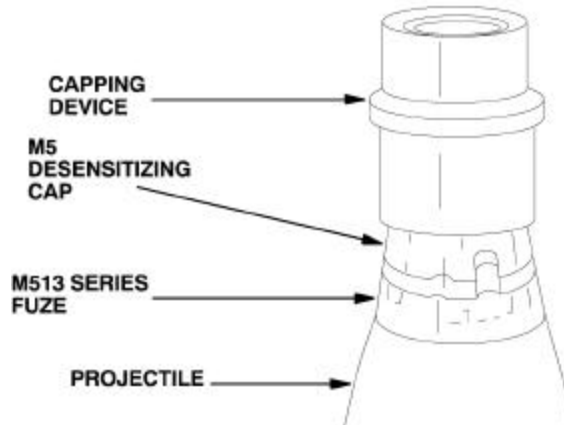
4-4. AUTHORIZED FUZES FOR HOWITZER - Continued

PROXIMITY (VT) FUZES M513 SERIES



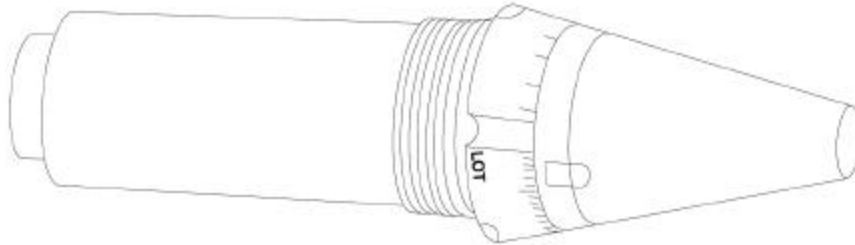
**o. Desensitizing Cap, M5 (for M513 Series Fuzes Only).** The M5 Desensitizing Cap is used to lower the burst height of the M513 Series proximity fuzes when burst height is observed to exceed 50 feet. The conical brass-desensitizing cap is applied over the nose of the fuze. To attach the cap to the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

DESENSITIZING CAP



**p. 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 impact action, whichever occurs first. The M728 should be set for impact action by setting the time ring to 90.0 seconds or PD mark. A protective coating is on the fuze ogive to reduce the possibility of static electricity causing early down range functioning.

**PROXIMITY (VT) FUZE M728**



**q. Fuze, Proximity (VT): M732 Series.**

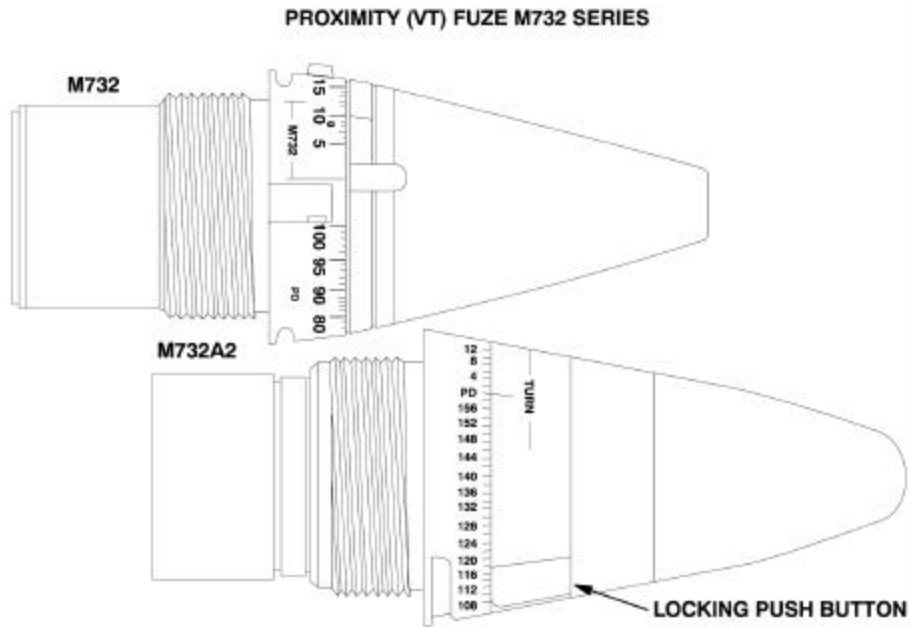
**NOTE**

**The PD setting of the M732 Series VT fuzes when fired into soft impact areas will be less deadly than the superquick setting of the M739 Series PD fuze.**

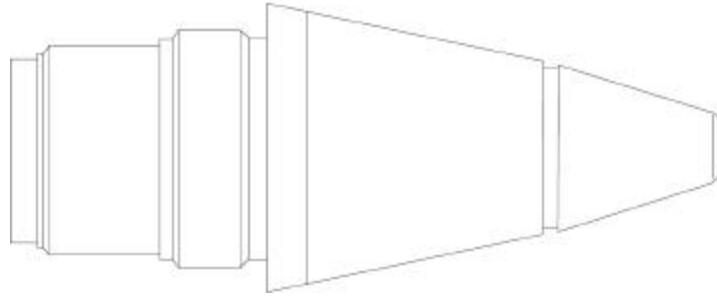
(1) The M732 Series fuzes are short intrusion fuzes and are used without removing supplemental charges from projectiles. These fuzes contain a self-powered radio and transmitting unit. The M732 fuze can be set from 5 to 150 seconds. The M732A2 fuze can be set from 4 to 156 seconds. At time settings, these fuzes arm at 3 to 5 seconds prior to set time for proximity function. These fuzes can also function PD as an option or proximity mode back-up and are always armed for PD at 400 calibers.

(2) The M732A2 was especially designed for compatibility with rocket-assisted rounds. The M732A2 is set by simultaneously depressing two push-buttons in the ogive and rotating the setting ring to the desired position. When the pushbuttons are released, the setting ring is locked into position.

4-4. AUTHORIZED FUZES FOR HOWITZER - Continued



r. **Fuzes, Artillery, Multi-Option (MOFA): M782.** These fuzes are intended for use with fragmentation (HE loaded) and burster-type projectiles. They may only be set with the M1155 Portable Inductive Artillery Fuse Setter (PIAFS) (refer to TM 9-1290-210-12&P). There are four functional modes on these fuzes: point detonating (PD), delay (DLY), variable time (VT), and time (TIME). An electronic subassembly of the fuze, containing integrated circuits, provides control and logic for 199.9 seconds of electronic timing, and transmits a fire pulse signal for time and proximity functions. The mission data transferred from the M1155 PIAFS to the fuze is confirmed by the setter and is displayed on a Liquid Crystal Display (LCD) module found on the setter.

**MULTI-OPTION FUZE ARTILLERY (MOFA) M782**

(1) MOFA utilizes a standard M739 Safety and Arming (S&A) mechanism that is housed in a retaining cup just below the detonator block. Both setback and spin locks are used to prevent accidental arming of the S&A prior to firing. This S&A mechanism provides a safe separation distance of at least 400 calibers of projectile travel when fired (45.9 yards or 41.97 meters).

(2) These fuzes are set by a M1155 PIAFS (refer to TM 9-1290-210-12&P). The setting can be changed as many times as required.

(3) This fuze is not sensitive to rain.

4-4. AUTHORIZED FUZES FOR HOWITZER - Continued

Table 4-4. Authorized Cartridge/Fuze Combinations for Howitzer, Light, Towed, M105-mm: M102

PD			MT		MTSQ					BD	MOFA
M557/ M572	M739 Series	M78A1/ MK399 MOD1 Series <sup>1</sup>	M563 Series	M565	M501 Series	M548	M564	M577 Series	M582 Series	M91 Series	M782 <sup>2</sup>
								X			
								X			
X	X	X					X		X		X
X	X	X					X		X		X
			X								
					X						
				X		X		X			
X	X						X		X		X
X	X								X		X
X	X										X
X	X										
				X		X					
					X						
				X		X		X			
										X <sup>9</sup>	
				X		X					
X	X								X		X
X <sup>10</sup>	X								X		X

X - As issued or comparable

- NOTE 1: Refer to Table 4-3 on page 0056 00-8 for expected performance against MOUT targets.
- NOTE 2: To set the M782 and M762/M767 series fuzes using the M1155 Portable Inductive Artillery Fuze Setter (PIAFS), refer to TM 9-1290-210-12&P.
- NOTE 3: Do not fire M513 series fuzes outside the following temperatures: lower than 0°F. Upper limit + 120°F. Use M5 desensitizing cap on M513 series fuzes only.
- NOTE 4: Rounds with M728 and M513 SER fuzes cannot be fired at Zone 7 except under emergency combat conditions.
- NOTE 5: Most HE rounds are issued without fuze.



4-4. AUTHORIZED FUZES FOR HOWITZER - Continued

Table 4-4. Authorized Cartridge/Fuze Combinations for Howitzer, Light, Towed, M105-mm: M102 - Continued

FUZES - Continued						Type and Model No. of Cartridge	Firing Limitations
MOFA	VT			ET			
M782	M513 Series 3,4	M728 <sup>4</sup>	M732 Series	M762 Series <sup>2</sup>	M767 Series <sup>2</sup>		
				X			
				X			Zones 4 through 7 only.
X					X	HE, M1 (Normal Cavity) <sup>5</sup>	
X	P <sup>3</sup>	P	X		X	HE, M1 (Deep Cavity) <sup>5</sup>	M513 or M728 fuzes are not to be fired at Charge 7 except under emergency combat conditions.
						APERS-T, M546	Not to be fired overhead of friendly troops. Restricted to Charge 7 for targets between 275 and 400 meters, firing at Charge 6 with a fuze setting of 0.5 seconds is permitted.
						Smoke, BE, M84/M84B1	
				X		Smoke, BE, M84A1	
X					X	Smoke, WP, M60 Series <sup>6</sup>	
X		P <sup>4</sup>			X	HERA, M548 <sup>5</sup>	Charge 7 authorized rocket-on and rocket-off modes. Charges 3, 4, 5, and 6 authorized rocket-off only under emergency combat conditions.
X						Gas, H or HD, M60 <sup>7</sup>	
						Gas, GB, M360 <sup>7</sup>	
						HE, M444 <sup>8</sup>	
						HEP/HEP-T, M327	
				X		ILLUM, M314, M314A1, M314A2	

**Table 4-4. Authorized Cartridge/Fuze Combinations for Howitzer, Light, Towed, M105-mm: M102 - Continued**

FUZES – Continued						Type and Model No. of Cartridge	Firing Limitations
MOFA	VT			ET			
M782	M513 Series 3,4	M728 <sup>4</sup>	M732 Series	M762 Series <sup>2</sup>	M767 Series <sup>2</sup>		
						ILLUM, M314A3	
						TP-T, M67	
						Tactical, CS, M629	
X			X <sup>5</sup>		X		
X			X <sup>5,11</sup>		X	HERA, M927	M927 Zone 7 rocket on and rocket off only. Observe rocket assist safety zone - 5000 meters from target area. Do not fire over- head of unprotected troops during training.

P - Requires removal of supplementary charge if present.

NOTE 6: The M60A2 WP smoke round is issued without fuze.

NOTE 7: Some gas projectiles may come with the M508 PD fuze.

NOTE 8: The M444 cartridges are assembled with modified M548 MTSQ or M565 MT fuzes which incorporate an expelling charge as an integral part of the fuze. Do not use standard M548 or M565 fuzes with the M444 projectiles.

NOTE 9: The M67 TP-T cartridges contain empty fuze bodies with a tracer.

NOTE 10: M557 only.

NOTE 11: Only the M732A2 fuze may be used for this combination.

**4-4. AUTHORIZED FUZES FOR HOWITZER - Continued**

**EQUIVALENT FULL CHARGE ROUNDS**

<b>Zone</b>	<b>No. of Rounds Equivalent in Erosion to One Full Charge</b>	<b>Equivalent Erosion Effect in Decimal</b>
8	1	1
7	2.5	0.40
1 thru 6	10	0.10

For the M546 APERS-T, all charges fired require an EFC factor of 1.00. This is important information required by the Section Chiefs.

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.

**4-5 CARTRIDGE CASE AND PROPELLING CHARGE**

**a. Cartridge Case.** Projectiles are assembled with the M14 Series cartridge cases. These include the M14 (brass), M14B1 (steel drawn), M14B2 (5-piece spiral-wrapped steel), and M14B4 (3-piece spiral-wrapped steel) cartridge cases. Blank cartridges are assembled with the M15 (brass) or M15B1 (steel) cartridge cases. Both dPICM M915 and M916 cartridges are assembled with the M217A1 (steel) or M217B1 (brass) cartridge cases. Each of the cartridge cases has a percussion type primer installed in the base of the case.

**b. Propelling Charge.** Most 105-mm cartridges contain propelling charge M67 that consists of seven zoned charges (7 increments) of dual-granulated M1 propellant.

(1) The M327 HEP-T cartridge will use the single zone M34 propelling charge of single granulation M1 propellant.

(2) The M67 TP-T will also use a single zone charge with single granulation M1 propellant.

(3) The M546 cartridges contain the M121 two zone propelling charge of dual granulation, M30E1 or M30A1 propellant for zones 6 and 7 only.

(4) The M548 HERA cartridge contains the five (3 thru 7) zoned XM176 propelling charge loaded with M30A1 propellant.

**Section II. PREPARATION FOR FIRING****4-6. GENERAL****WARNING**

**Do not fire artillery ammunition of any caliber without authorized fuze. Firing of such round without fuzes or with unauthorized fuzes could result in inbore premature explosions and other conditions hazardous to personnel.**

**a. Introduction.** Most cartridges for the 105-mm howitzer require preparation of projectile, propelling charge, and fuze.

**b. Temperature Limits** Unless otherwise specified, observe the following temperature limits when firing the howitzer:

Lower limit: -40°F (-40°C)  
Upper limit: +125°F (+52°C)

**4-7. PACKING AND UNPACKING****a. Packing Procedure**

(1) Projectiles are packed in individual fiber containers. The outer packing consists of a wooden box, metal container, or wire bound box.

(2) Fuzes are generally packed eight to a metal container, two containers to a wooden box (over pack).

**b. Unpacking Procedure****NOTE**

**Retain packing material for repacking, as required.**

- (1) Examine ammunition box marking to determine item identification.
- (2) Open outer pack and remove fiber container.

**WARNING**

**Protect primer at all times. Impact to primer may cause the primer to explode and result in serious injury.**

4-7. PACKING AND UNPACKING - Continued

**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.

**WARNING**

**Inspect your ammunition. Failure to accomplish required inspections can result in unnecessary malfunctions and injury or death to personnel.**

**NOTE**

**Slight amounts of rust do not make the projectile unserviceable. Do not remove setscrews or wax plug from setscrew hole in projectile.**

- (5) Inspect round and verify item identification. Check that round is not damaged or corroded and is free of foreign matter. If necessary, remove foreign matter.
- (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 1 through 5 above, as applicable.

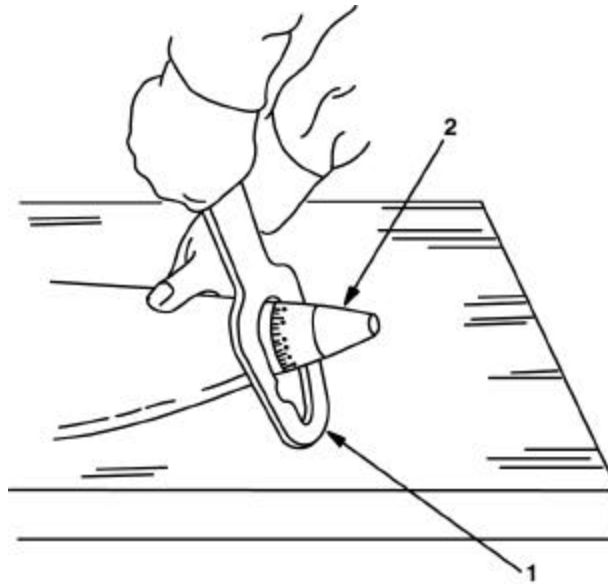
4-8. FUZING

a. Fuze Removal

**NOTE**

**The M1, HE projectile may be shipped with fuzes that 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) Place projectile on hard surface and hold projectile securely. Insert M18 fuze setter wrench (1) (item 47, App B) in wrench slots of fuze (2), taking care not to strike any part of the fuze. Turn wrench handle sharply in counterclockwise direction to loosen fuze from projectile. Unscrew and remove fuze with booster.



(3) Inspect cavity and projectile threads for damage. Remove loose material from cavity. If any high explosive is found adhering to the threaded portion of the projectile throat, reject the round and let qualified ammunition personnel dispose of it.

**b. Closing Plug Removal**

(1) Using screwdriver which fully fits screw slot, loosen setscrew in nose of projectile (when present).

(2) Insert M18 fuze setter wrench (item 47, App B) in wrench slots of closing plug (1); turn wrench handle sharply in counterclockwise direction.

(3) Remove closing plug (1) and spacer (2) beneath closing plug.

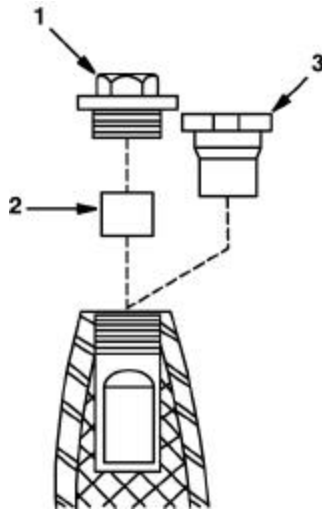
(4) Plastic closing plug (3) is a press fit, tear tab configuration which, on proper removal, results in separation from the side wall of the plug along a designated area so that the plug can be removed. It does not unscrew like the metal plug. Therefore, to remove it:

(a) Hold projectile securely and pull tab up, breaking its sides loose from the plug.

(b) Push tab into center of plug.

(c) Squeeze plug and withdraw it from fuze well.

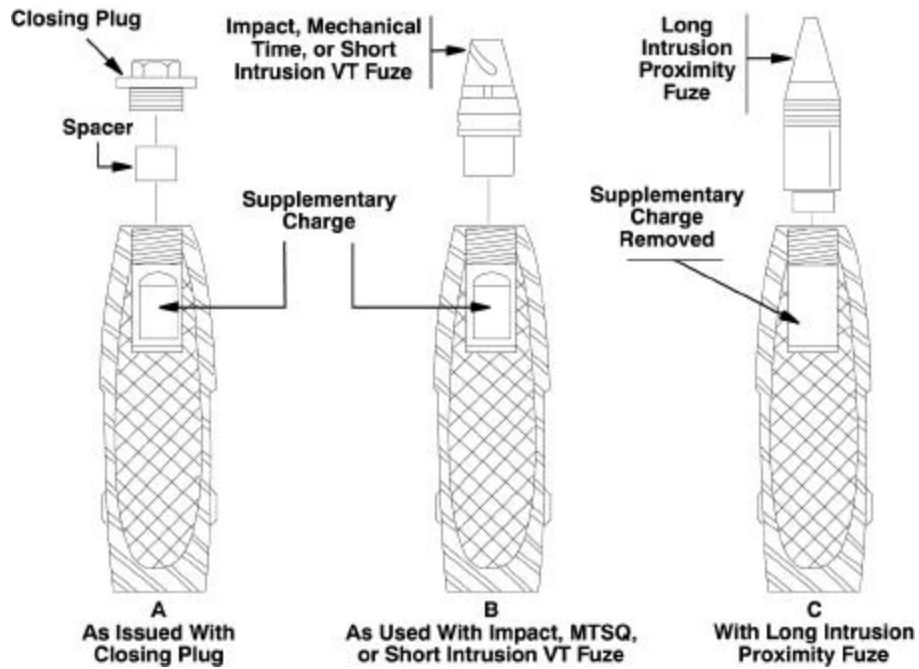
4-8. FUZING - Continued



(5) Inspect cavity and projectile threads for damage. Remove loose material from cavity. If any high explosive is found adhering to the threaded portion of the projectile throat, reject the round and let qualified ammunition personnel dispose of it.

**WARNING**

**Do not fire artillery ammunition of any caliber without authorized fuze. Firing of such round without fuzes or with unauthorized fuzes could result in inbore premature explosions and other conditions hazardous to personnel.**



c. **Supplementary Charge.** Illustration A shows a typical deep cavity projectile and supplementary charge variation that is shipped with a closing plug, spacer, and supplementary charge.

**WARNING**

**The supplementary charge must be left in the projectile when firing short intrusion fuzes. The supplementary charge must be removed when firing a long intrusion VT fuze.**

(1) When preparing rounds for PD, MTSQ, ET fuzes and short intrusion VT fuzes, inspect for presence of supplementary charge. Deep cavity rounds cannot be fired with these fuzes without a supplementary charge as shown in illustration B.

(2) For long intrusion M513 Series and M728 VT firing, remove supplementary charge as follows:



4-8. FUZING – Continued

**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 PD, MTSQ, ET fuze or short intrusion VT fuze or let EOD personnel dispose of round.

(b) Inspect cavity and projectile threads for damage. Remove loose material from cavity. If any high explosive is found adhering to the threaded portion of the projectile throat, reject the round and let EOD personnel dispose of it.

**d. Fuze Assembly**

(1) The following procedures apply to all fuzes, except the M78A1 CP fuze and M91 Series base detonating fuzes (see step (2) below).

**WARNING**

**When tightening fuze to projectile, do not hammer on fuze setter 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.**

(2) Screw fuze in by hand. If binding occurs, inspect fuze cavity and threads of both fuze and projectile. Reject whichever is at fault.

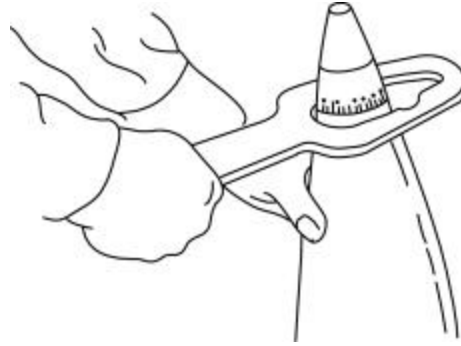
**WARNING**

**Round fired without a fuze or with improperly seated fuze may result in premature functioning.**

**NOTE**

**For proximity fuzes with gap between fuze shoulder and projectile, either replace supplementary charge in projectile and fire with impact PD or MTSQ fuzes, or short intrusion VT fuze, or ET fuze or dispose of round.**

(3) After assembling fuze by hand, back off 1/4 turn using M18 fuze setter wrench (item 47, App B). Tighten fuze to projectile with a sharp snap of the wrench so that fuze shoulder is seated flush firmly against nose of projectile.



(4) If projectile setscrew is present, tighten to below level of contour of projectile.

(5) Special preparations for M78 and M78A1 fuzes. Booster is not issued assembled to the fuze, and must be assembled to the projectile as follows:

#### CAUTION

**Always ensure that supplementary charge is in deep cavity projectile before adding fuze-booster combination.**

#### NOTE

**Booster must always be assembled to projectile first with M16 fuze setter wrench. It cannot be assembled to fuze, but is shipped in same fuze container.**

(a) Remove safety pin from M25 booster and screw booster into booster cavity of projectile. Tighten booster firmly with booster end of M16 fuze setter wrench (item 46, App B). Boosters issued without safety pins should not be used.

(b) Screw M78A1 fuze into fuze cavity and tighten securely using M16 fuze setter wrench. Make sure fuze shoulder seats firmly against nose of projectile. There should be no space between fuze shoulder and projectile. Do not stake fuze to the projectile.

(c) If projectile setscrew is present, tighten to below level of contour of projectile.

(d) Special preparations for M91 Series. These BD fuzes come installed and do not require any setting or other adjustments prior to firing. These fuzes are used on the M327 (HEP, HEP-T) projectiles. The M67 (TP/TP-T) cartridges contain empty M62 and M91 Series fuzes with tracers.

**4-9. FUZE SETTING PROCEDURES FOR THE HOWITZER**

**a. General.** The following procedures apply to the authorized fuze/projectile combinations for the howitzer. Fuze setting tools and procedure numbers are listed in Table 4-5.

(1) Impact fuze M557, MK399 MOD 1, MTSQ, M564, and M548 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 that occur during summer thunderstorms. In the case of the impact M557, MK399 MOD 1, MTSQ, M564, and M548 fuzes with delay-action option, setting the fuze for delay action may prevent premature detonation. The MK399 MOD 1 is rain-sensitive in both PD and delay modes.

(2) Impact fuze M739 Series, time fuzes M577 Series, and electronic time fuzes M762 and M767 Series are not sensitive to rain and may be fired during heavy precipitation.

(3) Any ammunition in the field, with PD fuze M51 not marked "MODIFIED" will not be used.

**NOTE**

**All fuzes are installed and tightened to the nose of the projectile with M18 fuze setter wrench except M78A1 Series and M91 Series fuzes. Use M16 fuze setter wrench to install M78A1 Series fuzes. Fuze assembly and installation procedures are in paragraph 4-8d.**

**b. The M732A1 fuze is set by hand only.**

**Table 4-5. Fuze Setting Tools and Procedures for M102 Howitzer.**

	FUZE											
	PD		MT		MTSQ				VT			ET
	M78A1 Series	M557 M572 M739 Series MK399 MOD 1	M563	M565	M501 Series	M577 Series M582 Series	M548	M564	M513	M728 M732 Series	M762 or M767 Series	M782
Fuze Setting Procedure	N/A	1	4	4	2	5	4	4	3	3	6	7
Setter Tool	N/A	M18	M34	M34	M27	M35	M34	M34	M27	M27	Hand or M1155	M1155

**c. Procedure No.1: M557, M572, MK399 MOD 1, and M739 Series****NOTE**

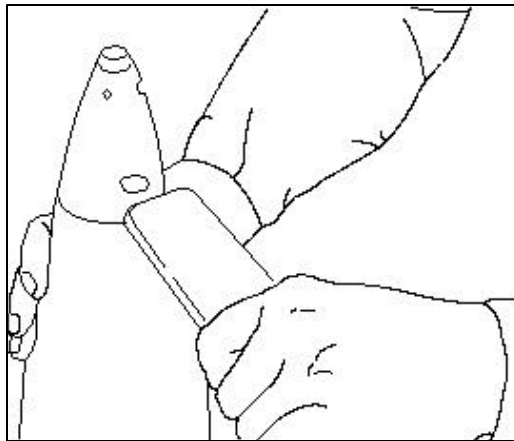
**Point-detonating (PD) fuzes with superquick (SQ) or delay functioning are shipped set for SQ action. The MK399 MOD 1 MOUT fuze is shipped set on the DLY (delay) mark.**

(1) If superquick action is desired, check the setting to make sure it is set at SQ or PD mark.

(2) To set fuzes for delay-action use screwdriver end of M18 fuze setter wrench (item 47, App B) or similar tool and turn slot 1/4 turn to align with index mark indicating DELAY (or DLY on MK399 MOD 1 fuze).

**NOTE**

**Fuzes can be set in the dark by feeling the position of the slot.**

**d. Procedure No. 2: M501 Series****WARNING**

**Exercise extreme care when handling a M501 Series fuzed projectile. Mishandling or dropping could cause the fuze to malfunction, expelling the base plate and contents. Keep pull wire on fuze in place until immediately before loading and firing.**

4-9. FUZE SETTING PROCEDURES FOR THE HOWITZER - Continued

**CAUTION**

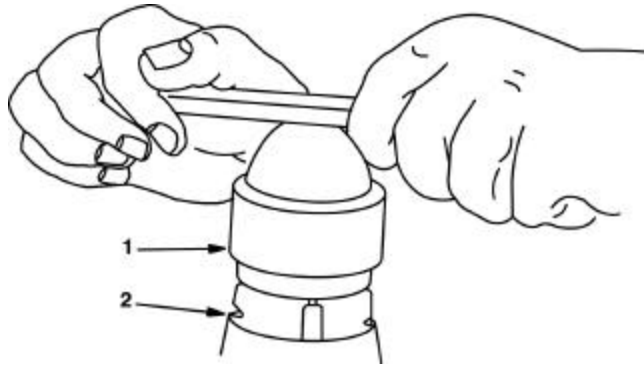
**Do not fire fuzes with cocked or loose lower caps.**

**NOTE**

**The M501 Series fuzes are shipped with index mark on lower cap aligned with the S engraved on the base.**

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 fuze.
- (c) With M27 fuze setter (1) (item 18, App B), set fuze by rotating lower cap (2) 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 aligned with desired time, in seconds, engraved on the base.



- (d) If the round is not fired after the fuze is set, reset the fuze to the S (safe) position and place the safety wire in its proper position.
- (e) Impact setting. Impact functioning of the MTSQ fuze M501 Series may be obtained by either leaving the S (shipping mark) aligned with the index mark on the base or by setting the graduated time ring so that the time setting is greater than the time of flight. The safety wire must be removed (pull free end of wire off and out of hole) before firing or setting the fuze.

e. **Procedure No. 3: M513 Series, M728, and M732 Series.**

**CAUTION**

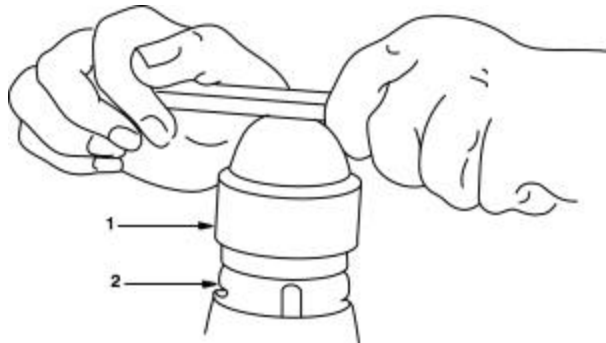
**Do not use fuzes M513 and M513B1 for PD functioning.**

(1) For M513 Series, M728, and M732 fuzes, plastic nose cone will rotate with the index mark. Damage to the plastic of nose cones will produce duds. However, since there is no backlash, fuze setting can be accomplished or changed one or more times with no harmful effect. Set VT fuze clockwise, but, if counterclockwise rotation is used, be sure that the fuze has not become loosened from the projectile.

**NOTES**

- **M728 fuzes are shipped with the index mark on the nose cone set at 10 seconds. The M732 fuzes are shipped with index mark on nose cone set on the PD line on the sleeve. The M513 Series fuzes are set on S, which is engraved on the nose cone.**
- **Rotation of the M732 nose cone has been experienced at top zones (not a safety hazard). If this occurs when M732 fuze is set on time for proximity function, PD function might occur instead. In such instance, set the fuze to a time of 10 seconds less than time of flight for proximity function.**

(2) To set the M513 Series, M728 and M732 fuzes for proximity use M27 fuze setter (1) (item 18, App B). Set fuze by rotating lower cap (2) to desired time in a counterclockwise direction or in the direction of the arrow on lower cap. Fuze is set when index line at base of nose cone is in line with time, in seconds, engraved on the fuze sleeve.



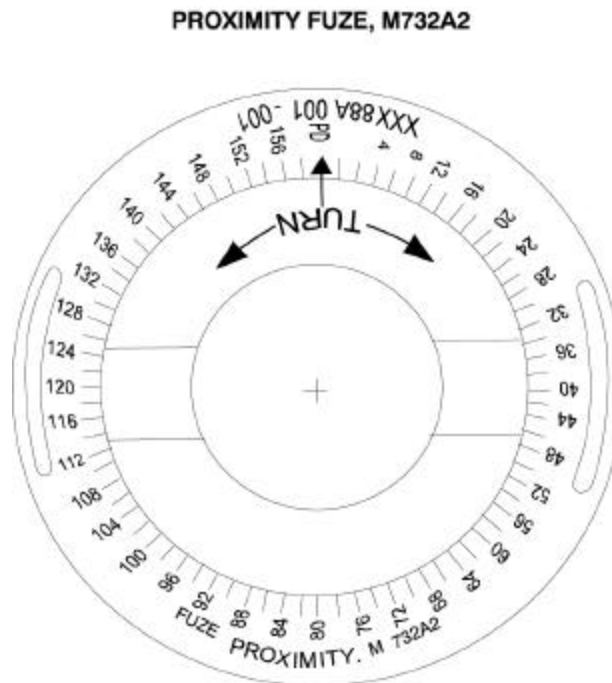
4-9. FUZE SETTING PROCEDURES FOR THE HOWITZER - Continued

(3) To set the M732A2 fuzes, simultaneously depress the two push-buttons in the ogive and rotate the setting ring to the desired position. When the push-buttons are released, setting ring is locked into position.

(4) For impact functioning of M513A1, M513A2, M728, and M732 fuzes set fuze to 90 seconds using M27 fuze setter. Fuze is set when index line at base of nose cone is in line with time, in seconds, engraved on base of fuze.

**WARNING**

**Do not fire projectile unless fuze is fully seated. Rounds fired with improperly seated fuzes may result in premature functioning causing serious injury to personnel and damage to equipment.**



NOTES

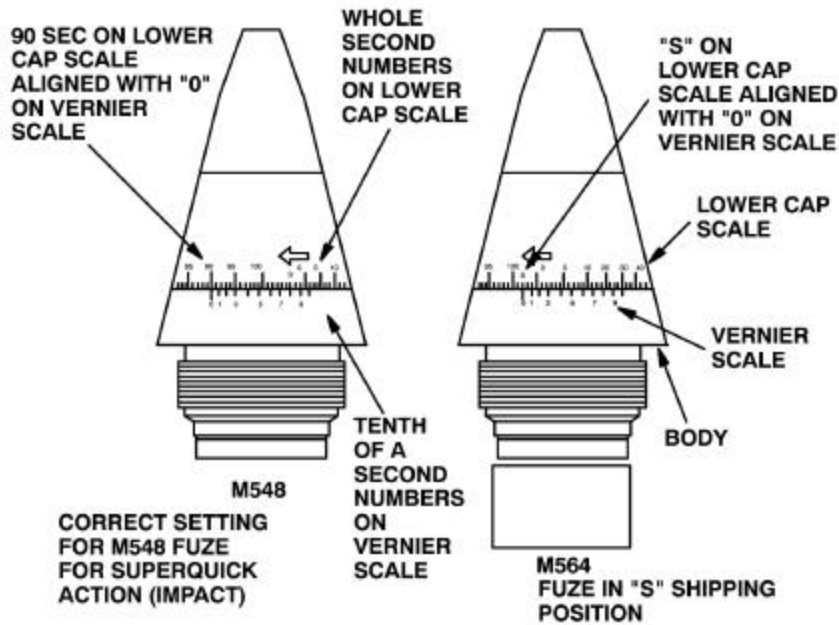
- Use of desensitizing fuze cap M5 to lower height of M513 Series fuzes is at the option of the artillery officer. Desensitizing fuze caps are assembled to the fuze just before firing.
- This cap is not used on the M728 or M732 fuze because HOB for these fuzes is 7 meters.

(5) Firing temperature limits for M728 and M732 proximity fuzes are -40°F to +140°F (-40°C to + 60°C).

(6) Firing temperature limits for M513 Series fuzes are 0°F to +120°F (-18°C to +49°C).

**f. Procedure No. 4: M563, M564, M565, and M548**

The following general procedures include instructions for setting the fuze for superquick (impact) action and airburst (time) and for meeting safety requirements. Specific instructions and warnings for setting the individual fuzes for proximity/superquick are also provided.





**4-9. FUZE SETTING PROCEDURES FOR THE HOWITZER - Continued**  
**WARNING**

To avoid accidental functioning of PD element in M564 and M548 fuzes, do not drop, roll, or strike the fuze under any circumstances (packaged, unpackaged, or assembled to the projectile). Mishandling could cause death or injury to personnel.

- (1) Set M563, M564, M565, and M548 fuzes for airburst (time) as follows:

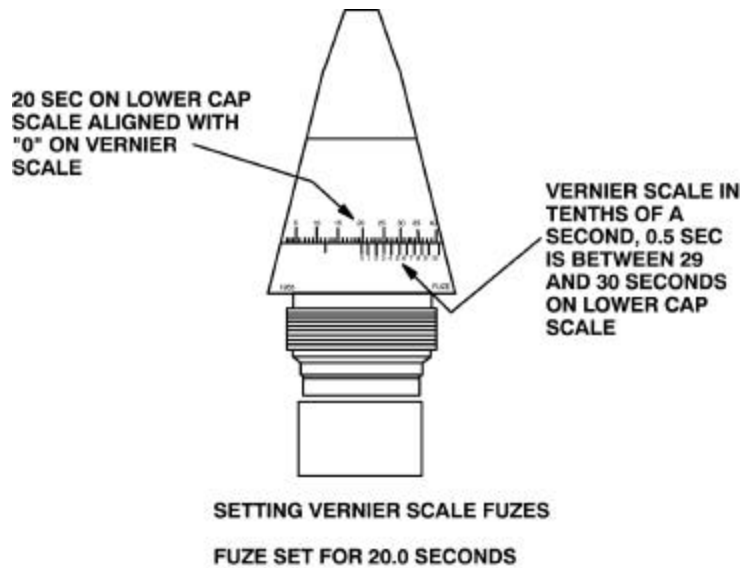
**WARNING**

An incorrect setting of MT and MTSQ fuzes can result and have resulted in down-range 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 pages 0056 00-5 and 0056 00-6 before setting M563 fuze.

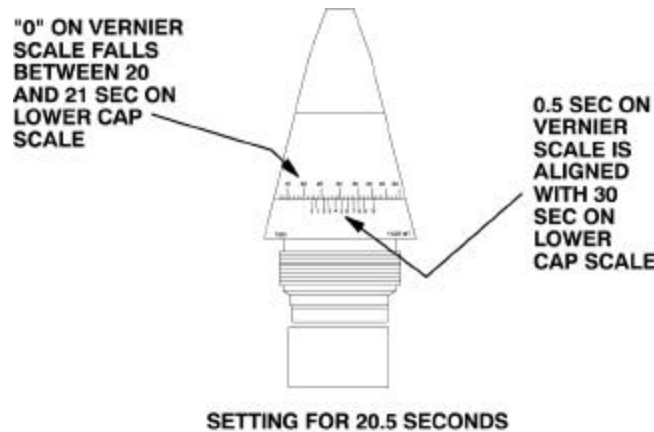
- (a) To set M563, M564, M565, and M548 fuzes for whole second time setting, use M34 fuze setter (item 19, App B) to rotate lower cap clockwise, as indicated by arrow imprinted on fuze, until desired whole number of seconds (e.g., 20.0 seconds) on the lower cap scale is aligned with "0" engraved on vernier scale.



## NOTES

- The fuze setting is always indicated by the position of the "0" on the vernier scale.
- Each vertical mark on the lower cap scale (movable portion of fuze) represents one whole-second of time. For other than whole-second settings, the "0" on the vernier scale (nonmovable portion of the fuze) must always be to the right of the whole-second portion of the desired fuze setting and between the whole-second portion of the desired fuze setting and the next one whole-second vertical mark. For example, for a setting of 20.5 seconds, the "0" on the vernier scale is to the right of the 20 second mark and midway between the 20- and 21-second marks on the lower cap scale.

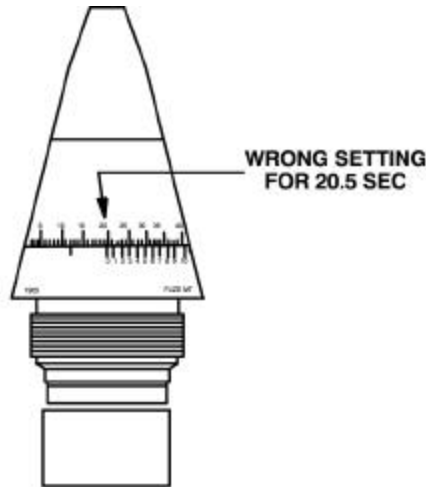
(b) To set M563, M564, M565, and M548 fuzes for tenths of a second (e.g., 20.5 seconds), use the M34 fuze setter (item 19, App B) to set the fuze for the whole second (20.0 seconds). Next find the desired tenth of a second on vernier scale (0.5-second mark is between 29 and 30 whole-second marks) and continue to rotate lower cap in direction of arrow until adjacent upper right graduation on lower cap scale is aligned with scale; 0.5-second mark is now aligned with 30-second mark on lower cap scale and the fuze setting of 20.5 seconds is complete.



4-9. FUZE SETTING PROCEDURES FOR THE HOWITZER - Continued

NOTES

- An incorrect fuze setting for 20.5 seconds is shown below. If a fuze is set in this way for 20.5 seconds firing, the fuze is actually set on and will function at 10.5 seconds. This would cause the fuze to function 10 seconds earlier than desired.
- Do not attempt to set the fuze until just before firing.



EXAMPLE OF WRONG SETTING

(2) Setting M548 fuzes for superquick action (impact). The M548 does not have a booster and therefore is not fired for impact action.

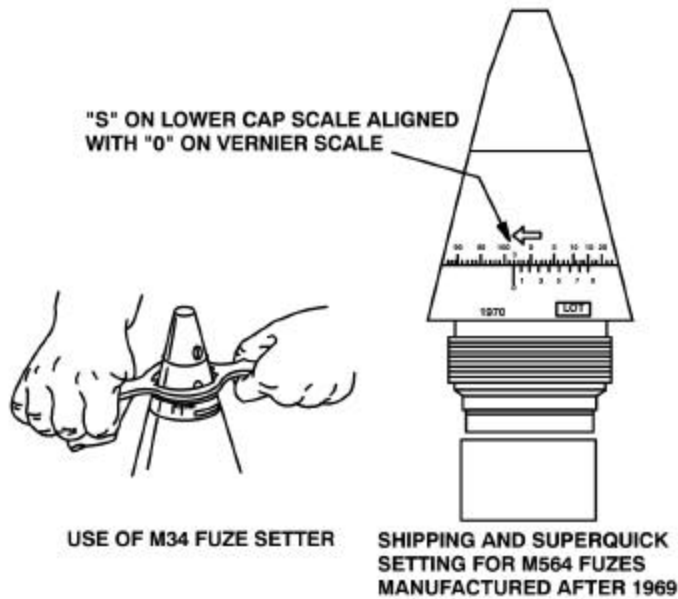
NOTES

- Do not set M548 fuzes on "S" for impact (PD) action. Set fuze for 90 seconds.
- Use M34 fuze setter to rotate the lower cap in the direction of the arrow (clockwise) from shipping "S" position until the 90.0 second position on the lower cap scale is aligned with the "0" on the vernier scale.

(3) Setting the M564 fuze for superquick (impact) action. M564 fuzes manufactured before January 1970 must be set on 90 seconds if superquick (impact) action is desired. M564 fuzes manufactured from January 1970 on should be set on "S" for superquick action. The year of manufacture is stamped on the M564 fuze body. These fuzes are shipped with the "S" on the lower cap scale aligned with the "0" on the vernier scale.

(a) M564 fuzes manufactured prior to January 1970. Use M34 fuze setter (item 19, App B) to rotate the lower cap in the direction of arrow (clockwise) from shipping "S" position until the 90-second position on the lower cap scale is aligned with the "0" on the vernier scale.

(b) M564 fuzes manufactured in January 1970 and later. Set the fuze on "S" as shipped for superquick action. Always be sure that the "S" on the lower cap scale is aligned with the "0" on the vernier scale.



4. Resetting fuze. If you miss the setting, use the M34 fuze setter (item 19, App B) and turn the lower cap in the opposite direction (counter-clockwise) 2 or 3 seconds below the desired setting. Then rotate the lower cap in the direction of the arrow (clockwise) and set the fuze on the correct time. This can also be done by turning the lower cap in the direction of the arrow (clockwise) all the way around (additional turn) to obtain the desired setting.

#### 4-9. FUZE SETTING PROCEDURES FOR THE HOWITZER – Continued

(5) Fuzes not fired. If prepared for firing but not fired, reset the fuze, using M34 fuze setter (item 19, App B), by turning the lower cap in the direction of the arrow (clockwise) until the "S" mark on the fuze lower cap scale is in line with the "0" mark on the vernier scale (MA on the M563 fuze).

(6) Fuzes fired in heavy precipitation. If M564 and M548 fuzes are fired in heavy precipitation (heavy rainfall, sleet, snow, or hail), occasional downrange premature functioning may occur. The precipitation necessary to cause malfunctioning is comparable to a heavy downpour that occurs during a summer thundershower. The premature rate will vary with the charge fired and the density of the precipitation.

##### g. Procedure No. 5: M577 Series and M582 Series

(1) The slotted setting key on the nose of the fuze is used for setting the fuze in the following steps:

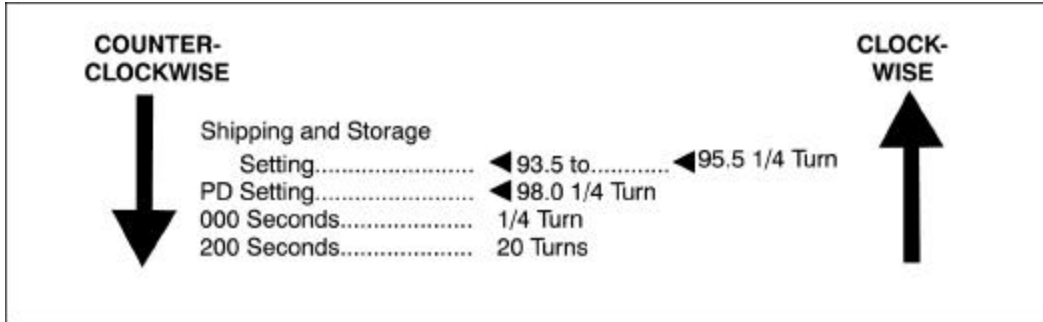
(a) Press the open end of M35 fuze setter (item 20, App B) against the setting key on fuze.



(b) Turn the knob handle of the fuze setter counterclockwise as viewed from the nose end until setter blade engages 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 the desired time by rotation of the fuze setter in a counterclockwise direction. To set from a higher number to a lower number or to return to shipping and storage setting, the fuze setter must be rotated in a clockwise direction. Fuze cannot be set to desired time setting and then back to shipping and storage setting by rotation in a counterclockwise direction.



**CAUTION**

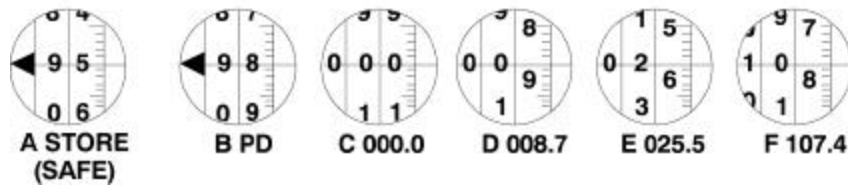
Do not attempt to set these fuzes below ◀ 93.5 when setting them in the clockwise direction or above 200 seconds when setting them in the counterclockwise direction. The settings of 000 and/or 200 are not authorized service settings.

(c) When setting fuze for PD action (superquick). Start with shipping and storage safe position ( ◀ 93.5 to ◀ 95.5) and then turn counterclockwise to 98.0 for PD action under the hairline in the window.

(d) To set 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 ( ◀ ) 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 below for settings of 008.7 and 107.4.

4-9. FUZE SETTING PROCEDURES FOR THE HOWITZER – Continued

g. Procedure No. 5: M577 Series and M582 Series



(c) To set a lower time on fuze already set, reseal fuze setter and turn clockwise (numbers get smaller) to a setting at least 1 second lower than the required setting (at least 24.5 for 25.5). Reverse direction to counterclockwise (numbers get larger) and set required time under the hairline.

(d) To return fuze to shipping and storage (safe) position turn fuze setter clockwise (numbers get smaller) until 000 is passed and continue to turn until setter stops turning freely. This point should be past the PD setting (◀98.0) and between ◀95.5 and ◀93.5. Notice that the triangle has reappeared in window. Do not apply excessive force on the fuze setter after it has stopped turning and the setting is between ◀95.5 and ◀93.5. Return fuze to reusable fuze container.

(e) Firing temperature limits for M577 Series and M582 Series MTSQ fuzes are -35° F to +145° F (-37° C to +63° C).

(f) 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.

h. **Procedure No. 6: M762 and M767 Series.** These fuzes can be set either by hand or by using the M1155 Portable Inductive Artillery Fuze Setter (PIAFS), as follows:

**CAUTION**

**Do not activate these fuzes unless they will be fired before 15 days elapses. Once activated, these fuzes have service life of approximately 15 days, before the battery runs down. Check if Liquid Crystal Display (LCD) is active to determine if fuze is still settable, otherwise turn in to EOD for disposal.**

- (1) Setting by Hand:

**CAUTION**

**If the LCD window is blank or shows other displays than indicated after steps 1b and 2 are completed, the fuze is considered unserviceable and should not be fired. Turn fuze in to EOD.**

**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. The M762A1 or M767A1 fuze ogive can be rotated bi-directionally to provide quicker manual setting.**

(a) Rotate ogive clockwise at least one quarter revolution to activate the battery. The LCD window will display ◀ 88.8 indicating that all segments are operating as a visual safety check.

(b) Depress the thumb operated cocking and selector button to clear the LCD window. The LCD window will display \_\_ insuring that no segments are stuck.

(c) Depress the thumb-operated cocking and selector button a second time; the LCD window will display 000.0. The cursor under the zero in the hundreds-of-seconds column indicates that this column is ready to be set.

**NOTE**

**The hundreds-of-seconds column can display 0, 1, or ◀ while the tens-of-seconds, seconds, and tenths-of-seconds columns each can display 0 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 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 M762 or M767 PD, set the fuze to ◀ 98.0. Any other setting with ◀ would result in a dud.

(f) For the M762A1 or M767A1 PD, place cursor in hundreds digit and rotate the ogive until the    (underline) is selected. At this point the fuze will be set to the point detonating setting and the display will be "  Pd".



**4-9. FUZE SETTING PROCEDURES FOR THE HOWITZER – Continued**

(g) The following are examples of fuze settings.

M762A1/ M767A1	M762/ M767				
— Pd	◀980	0008	0073	0401	1690
PD	PD	0.8 seconds	7.3 seconds	40.1 seconds	169 seconds

(h) When fuze setting is completed and selector button is released, the ogive can be rotated without changing the fuze setting.

(i) The settings can be changed as many times as required for the duration of the activated life of the battery (15 days).

(2) Setting by using the M1155 PIAFS. M1155 PIAFS setting is accomplished via an inductive data link between the fuze and the M1155 PIAFS. The desired fuze setting is input in the M1155 PIAFS, the M1155 PIAFS is placed on the fuze, and the ENTER button is depressed. The fuze will be activated and set and the M1155 PIAFS will display the actual fuze setting as a safety feature. Refer to TM 9-1290-210-12&P for operation of the M1155 PIAFS.

(3) To return fuze to the shipping and storage configuration, reset the fuze to 000.0. These fuzes should be segregated and used first in subsequent firings. The return to storage configuration can only be accomplished via manual handset.

(4) Firing temperature limits for M762 and M767 Series ET fuzes are -25° F to +110° F (-32° C to +43° C).

**i. Procedure No. 7: Fuze M782 (MOFA)**

(1) This fuze cannot be set by hand but can only be set by using the M1155 Portable Inductive Artillery Fuze Setter (PIAFS).

(2) M1155 PIAFS setting is accomplished via an inductive data link between the fuze and the M1155 PIAFS. The desired fuze setting is input in the M1155 PIAFS, the M1155 PIAFS is placed on the fuze, and the ENTER button is depressed. The fuze will be activated and set and the M1155 PIAFS will display the actual fuze setting as a safety feature. Refer to TM 9-1290-210-12&P for operation of the M1155 PIAFS.

#### 4-10. PREPARING PROPELLING CHARGE

**General.** Cartridges with an adjustable 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 the instructions for adjustable propelling charges below.

#### CAUTION

**Under no conditions will a fixed charge be altered.**

#### 4-11. Preparation of M67 and Other Adjustable Propelling Charges

a. Remove projectile from cartridge case, being careful not to damage lip of case (otherwise, cartridge may jam in chamber of howitzer cannon).

b. Withdraw increments from cartridge case and inspect. Remove increments numbered higher than charge to be fired, by breaking twine between designated charge and higher numbered increments. Discard unneeded increment bags to the powder pit.

c. 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, assemble remaining increments one, two, three, and four in cartridge case.

#### 4-12. Use of Single Zone and Other Propelling Charges

a. The M546 APERS rounds contain the M121 propelling charge for zone 6 and 7. If zone 6 is desired remove zone 7 by breaking twine between designated charges; then reassemble remaining charge into cartridge case.

b. To fire the M548 cartridge in the rocket-on mode, the selector cap must be removed prior to replacing the projectile in the cartridge case.

#### 4-12. Use of Single Zone and Other Propelling Charges - Continued

##### NOTES

- The M548 cartridge is authorized for Charge 7 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. If the M548 cartridge is to be fired at lower zones, the propelling charges may be adjusted as shown in the procedure immediately above.
- The M548 cartridge contains the five zoned XM176 propelling charge for zones 3 through 7.

#### 4-13. Multiple Round Mission

##### WARNING

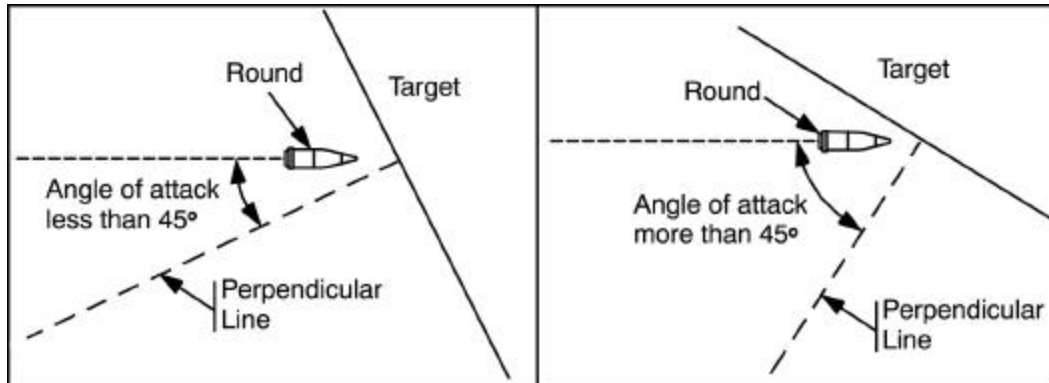
**Rounds with pre-adjusted propelling charges for multiple round missions must be kept separate from other ammunition. Death or injury to personnel may result if this procedure is not followed.**

- a. The ATC will adjust propelling charges for the correct number of rounds.
- b. The ATC and cannoneer no. 2 will separate these rounds from the other ammunition.
- c. The CS will verify the charge of each round.
- d. Cannoneer no. 2 will place the unneeded increment bags outside of the canister and place the projectile in the canister. Cannoneer no. 2 will finish preparing the rounds.
- e. Cannoneer no. 2 will break the strings of the unneeded charges.
- f. The CS will ensure the unneeded charges have been removed to the powder pit before firing rounds.
- g. Cannoneer no. 2 will pass the prepared rounds, one at a time, to cannoneer no. 1. Cannoneer no. 1 will load the prepared round into the howitzer. The ATC and CS will verify that the correct round was loaded.

**4-14. PROCEDURE FOR LOADING****WARNINGS**

- Do not fire a projectile, which was impacted by a hard object. Impact to the ogive and nose area can cause a crack. Avoid rough handling.
- Do not reuse cartridges that 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.
- Do not fire the M60 Series WP projectiles that are known to have been stored in other than a base-down position. Firing of such projectiles can cause inbore premature or close-in premature malfunctions.
- Do not load or fire cartridge without a fuze, with an unauthorized fuze, with fuze not fully seated, or with an obstruction in cannon tube. These conditions can cause inbore prematures. Do not fire proximity (VT) fuzed cartridges at targets closer than 750 meters from friendly troops.
- Fire complete round only with the originally packed projectile, cartridge case, propelling charge and fuze as authorized in Table 4-4. Failure to do so could result in injury or death to personnel.
- The fired cartridge case can be unexpectedly ejected resulting in injury to personnel.
- MK399 MOD 1 fuzes set in delay mode perform more effectively if the angle of attack (the angle between the round and the perpendicular of the target) is less than 45 degrees. Angles of attack more than 45 degrees will result in decreased effectiveness and increase the likelihood of unexploded ordnance in the battlefield.
- If a projectile fired with MK399 MOD 1 fuze impacts a substantial object, a high order detonation may occur even if the object is within the 400 caliber (138 feet/ 42 meters) minimum arming distance, which could result in damage to the weapon and/or death or serious injury to unprotected crew members.

4-14. PROCEDURE FOR LOADING – Continued



- a. Protect primer at all times.
- b. Ensure round is clean.
- c. Ensure propelling charge is assembled properly.
- d. Ensure fuze is installed and set properly.
- e. Ensure there are no obstructions in the cannon tube.

**NOTE**

**To fire M548 and M927 cartridges in the "rocket on" mode, the selector cap must be removed.**

- f. Mate projectile with cartridge case.
- g. Remove fuze safety devices just before loading cartridge into the weapon.

**NOTE**

In ammunition assembled with cartridge cases M14B2 and M14B4, the mouth of the case can expand slightly by uncoiling. This makes it easier to insert the projectile in the mouth of the case. However, if the loader is not careful to grasp the projectile at its point of balance the complete round may sag abnormally in the center. This can cause the lip of the cartridge case to catch on the lip of the chamber making it impossible to chamber the round. To prevent this, the projectile must be grasped at its balance point to keep the complete round from sagging.

h. Load, taking care not to strike the fuze, projectile, or cartridge case against the weapon.

**4-15. EXCESSIVE PRESSURE IN CANNON**

Observe the following precautions to prevent excessive pressure in the cannon:

- a. Do not load or fire ammunition, which is at a temperature above safe limits for firing.
- 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.

**4-16. DUDS**

Do not touch, move, or otherwise handle duds; their fuzes may be armed. Have duds destroyed in place by authorized personnel only.

**4-17. FIRING TABLES**

Firing tables for this howitzer are FT 105-AS-3 and 105-ADD F-1 for M444 ICM projectile.

#### 4-18. AMMUNITION PREPARED FOR FIRING BUT NOT FIRED

##### a. Unloading Operation

###### WARNING

**If cannon tube is hot, chambered rounds should be fired or removed from the weapon within 5 minutes to avoid injury or death to personnel. Refer to the misfire/check fire procedures (paragraph 2-27).**

A complete round will be removed under the direct supervision of an officer, exercising appropriate precautions. This operation is as follows:

- (1) Level the cannon and slowly move the breechblock to its open position.
- (2) Remove the cartridge case and propelling charge.
- (3) Fill the chamber with a shock absorbent material and close the breech.
- (4) Assemble the artillery rammer-unloading tool (item 33, App B) to the assembled cleaning staff sections (item 40, App B).
- (5) Insert the artillery rammer unloading tool into the muzzle until it fits around the fuze of the projectile. Then push, or if necessary, tap the rammer 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. Repack and mark cartridges for disposal by Ammunition Supply Point (ASP) personnel.**

- (1) Using applicable setter and procedure (Table 4-5), 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 applied torque.

- (2) Replace safety wires, remove fuze and repack in original packing.
- (3) Disassemble cartridge case and repack projectile and cartridge case in original packing.

#### **4-19. AMMUNITION FORMS AND RECORDS**

Record the number of rounds fired, by types, on DA Form 2408-4. This must be done on a daily basis when firing.

### **Section III. MAINTENANCE OF AMMUNITION**

#### **4-20. MAINTENANCE OF AMMUNITION**

##### **WARNINGS**

- **Handle explosive ammunition and components containing explosives with utmost care. Do not drop, throw, tumble, or strike packaged or unpacked ammunition or related components. Explosive elements in primers and fuzes are sensitive to shock.**
- **Do not expose ammunition and components to direct sunlight, flame, or other sources of heat.**
- **Do not expose ammunition and components containing explosives to rain, excessive humidity, or ground moisture; otherwise, short ranges may result.**

##### **a. Care**

(1) Ammunition is packed to withstand conditions ordinarily encountered in the field. Keep packing boxes from becoming broken or damaged.

(2) Since ammunition is impaired by moisture, frost, extreme temperatures, and foreign matter (mud, oil, etc.) observe the following:

(a) Do not break the moisture-resistant seal on the container until ammunition is to be used.



**4-20. MAINTENANCE OF AMMUNITION - Continued**

(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, primer, 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 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.

(3) 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.

**4-20. MAINTENANCE OF AMMUNITION - Continued**

**d. Storage**

**WARNINGS**

- **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 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 COMP B5 can be stored at temperatures greater than +145°F (62.8°C).**

(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 and 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 vases 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 (-28.9°C)	+130°F (54.4°C) (M513, M513B1)
-40°F (-40°C)	+130°F (54.4°C) (M513A1)
-60°F (-51.11°C)	+160°F (71.1°C) (M513A2)
-40°F (-40°C)	+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

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#### 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-2. FIELD MANUALS (FMs)

FM 3-87	Nuclear, Biological, and Chemical Reconnaissance and Decontamination Operations
FM 4-25.11	First Aid
FM 6-50	The Field Artillery Cannon Battery
FM 9-207	Operation and Maintenance of Ordnance Materiel in Cold Weather (0 to -65°F)
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 (TMs)

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 and 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: 105MM, M102

**A-3. TECHNICAL MANUALS (TMs) - Continued**

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 9-254	General Maintenance Procedures for Fire Control 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, M101A1, 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	The Army Maintenance Management System (TAMMS), as contained in Maintenance Management Update
SF Form 368	Quality Deficiency Report
TB 9-1300-385	Munitions, Restricted and Suspended
10 CFR Part 19	Notices, Instructions and Reports to Workers; Inspections
10 CFR Part 20	Standards for Protection Against Radiation

**A-2 Change 3**

**APPENDIX B****COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS**

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**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 (Illus Number). This column indicates the number of the illustration in which the item is shown.



**B-3. EXPLANATION OF COLUMNS (cont)**

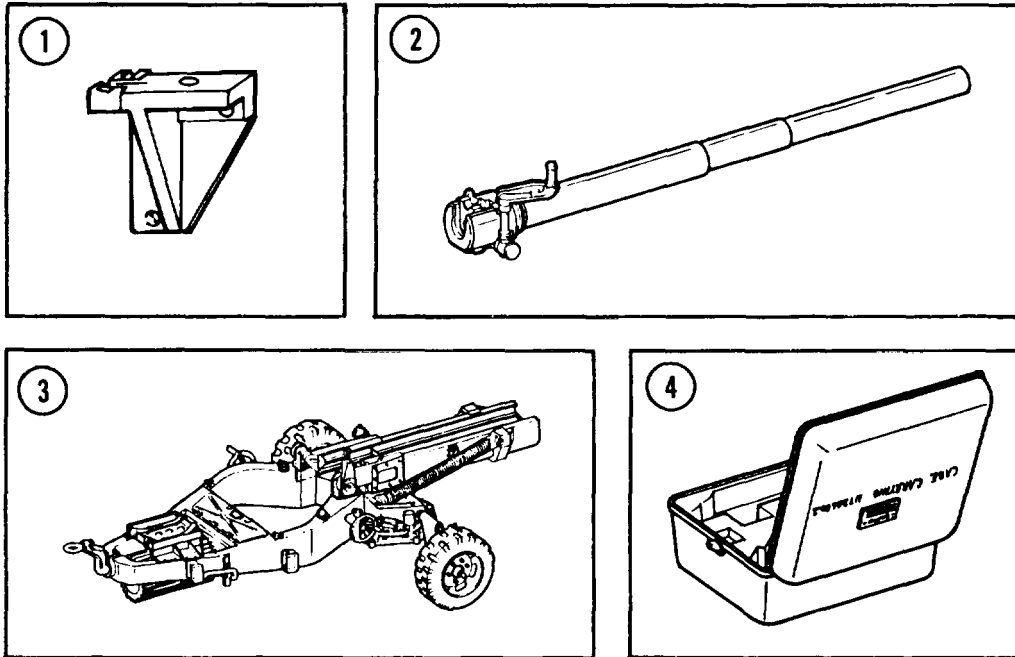
b. Column (2) - National Stock Number. Indicates the National Stock number assigned to the item and will be used for requisitioning purposes.

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).

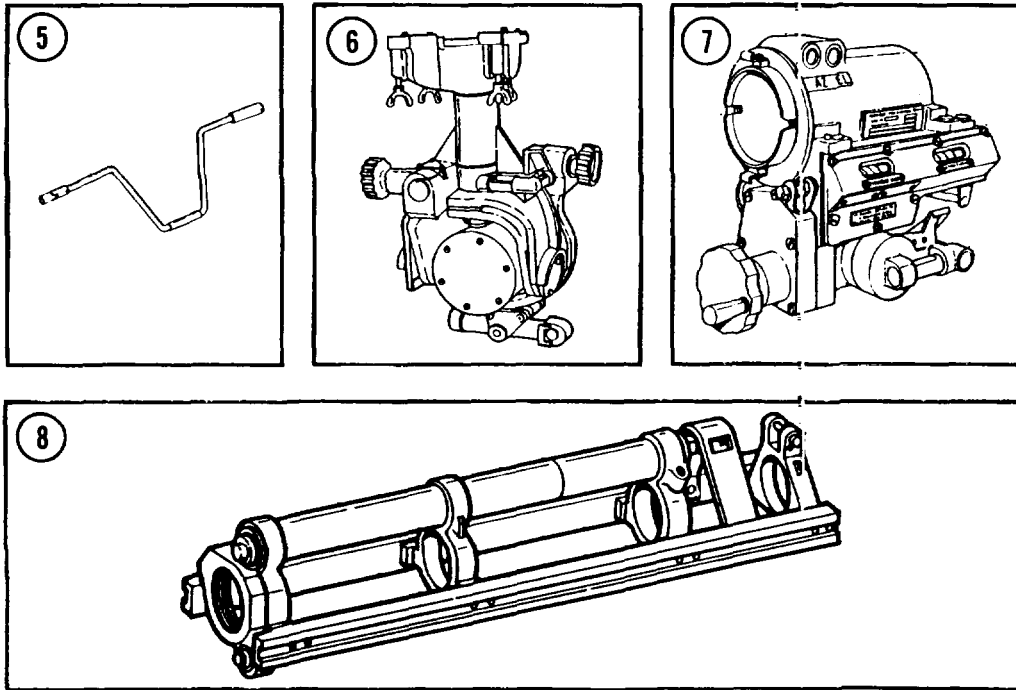
e. Column (5) - Quantity required (Qty reqd). Indicates the quantity of the item authorized to be used with/on the equipment.

Section II COMPONENTS OF END ITEM

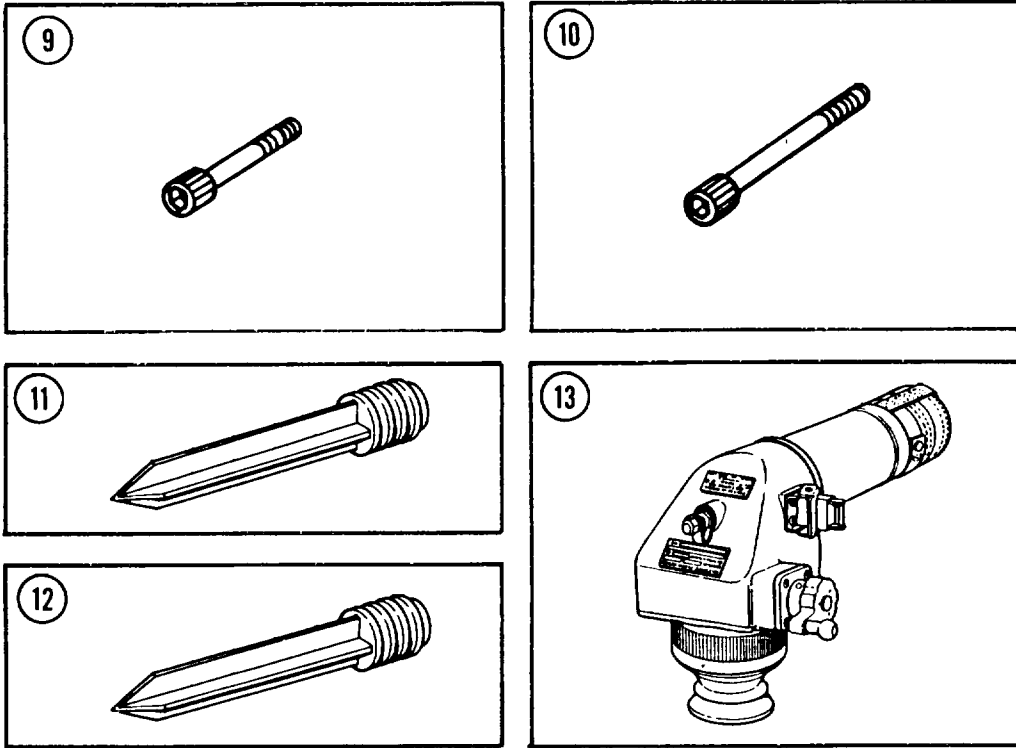


(1) Illus Num- ber	(2) National Stock Number	(3) Description FSCM and Part Number	(4)(5) U/M	Qty reqd
1	1290-01-127-7816	BRACKET, ANTENNA MOUNTING: (19200) 11785066	EA	1
2	1015-00-927-9421	CANNON, 105MM HOWITZER, M137A1: (19206) 11577648	EA	1
3	NA	CARRIAGE, 105MM HOWITZER, M31: (19204) 8433200	EA	1
4	1015-01-028-4582	CASE, CARRYING: (19200) 11729600-2	EA	1

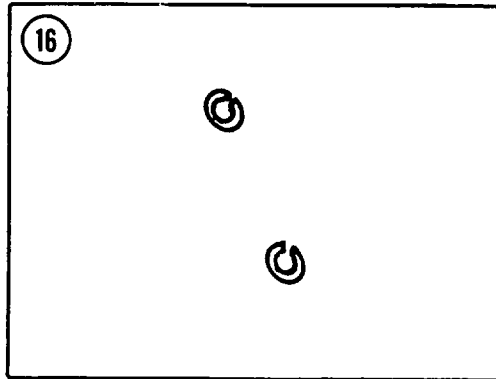
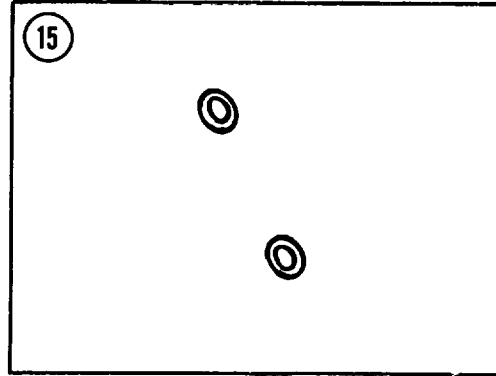
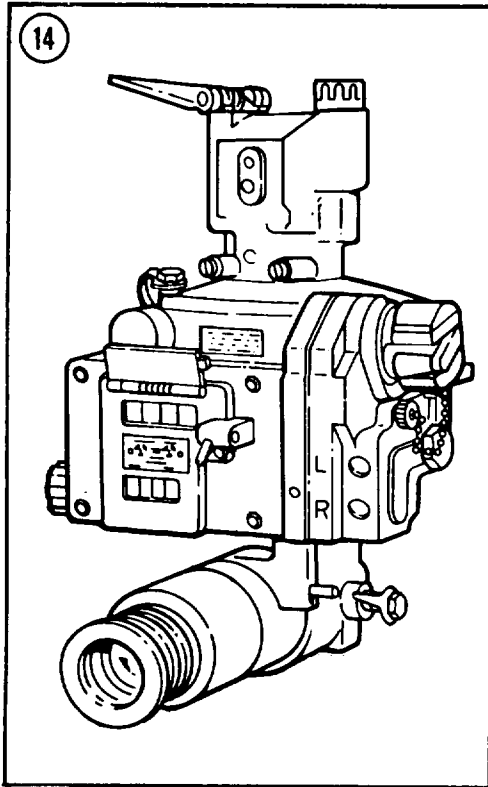
COMPONENTS OF END ITEM (cont)



(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

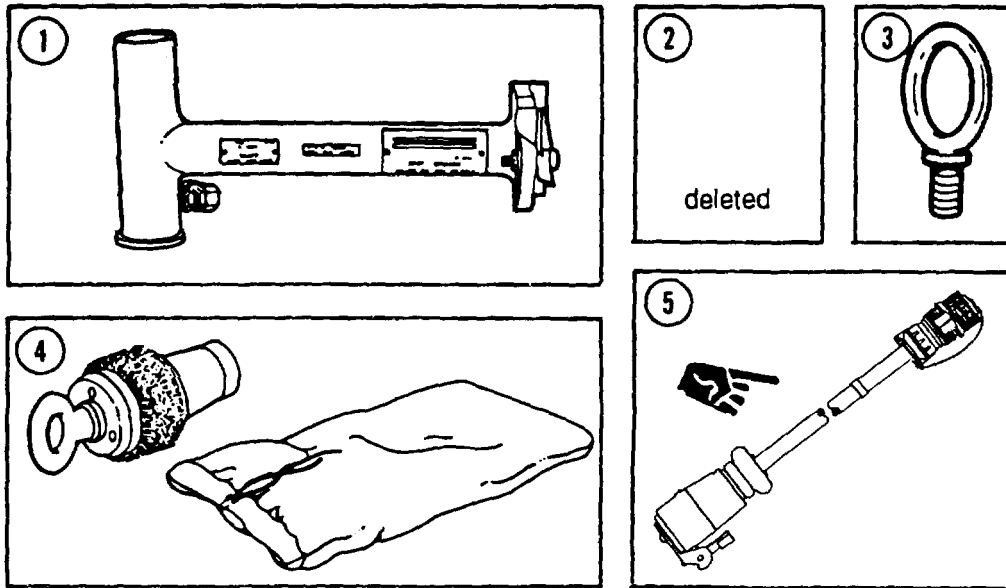


(1) Illus Num- ber	(2) National Stock Number	(3) Description FSCM and Part Number	(4)(5) U/M	Qty reqd
9	5305-00-983-7466	SCREW, CAP, SOCKET HEAD: (96906) MS16997-148	EA	1
1	05305-00-958-7483	SCREW, CAP, SOCKET HEAD: (96906) MS16997-151	EA	2
11	1015-00-987-8738	STAKE, CARRIAGE: 24-in. long (19204) 8436590	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

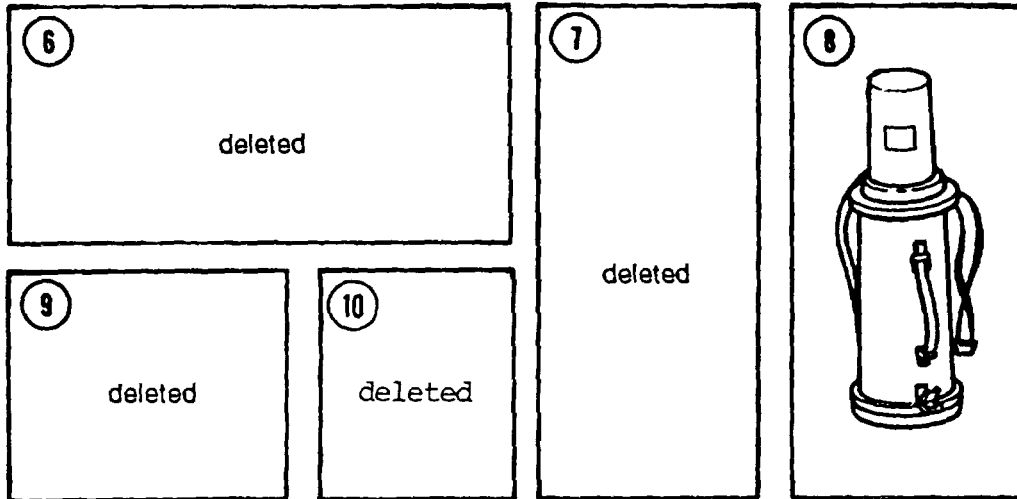


(1) Illus Num- ber	(2) National Stock Number	(3) Description FSCM and Part Number	(4)(5) U/M	Qty reqd
14	1240-00-150-8886	TELESCOPE, PANORAMIC, M113A1:	EA	1
15	5310-00-767-9425	(19200) 11730267 WASHER, FLAT:	EA	3
16	5310-00-933-8778	(96906) MS15795-818 WASHER, LOCK: (96906) MS35338-143	EA	3

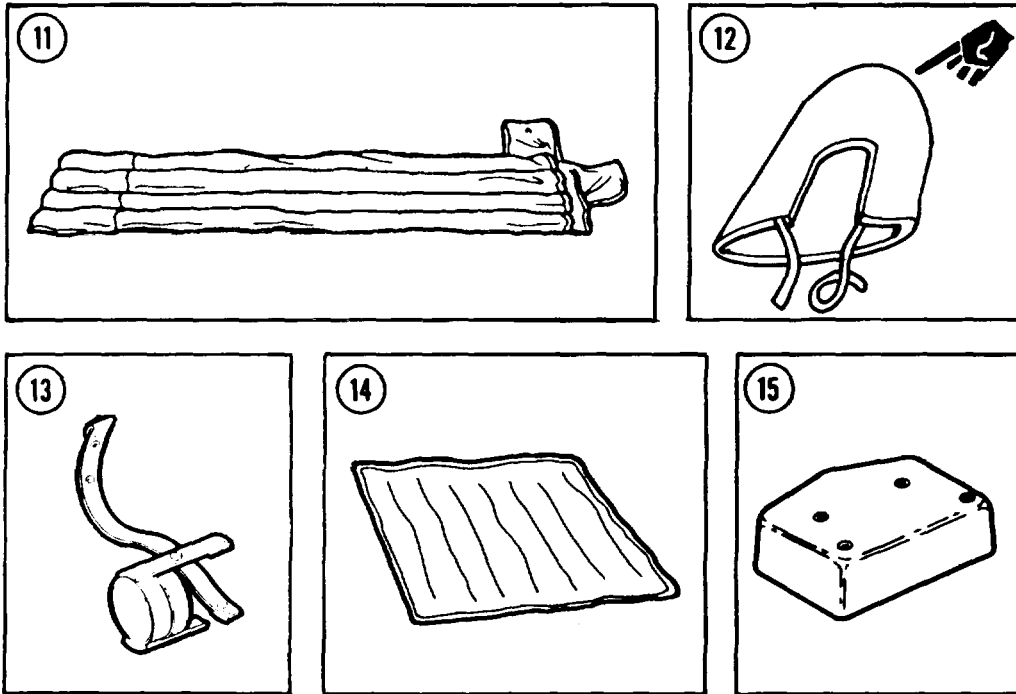
Section III. BASIC ISSUE ITEMS



(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
<p><b>Change 2 B-7</b></p>					

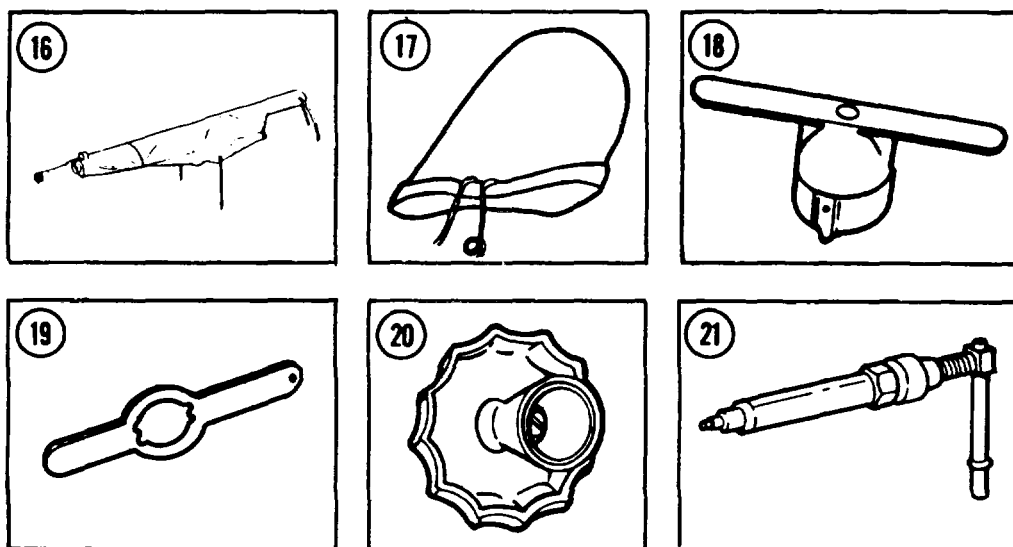


(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM ) and Part Number	(4) Usable On Code U/M	(5) QTY AUTH
6		DELETED		
7		DELETED		
8	1240-00-332-1780	COLLIMATOR, INFINITY AIMING: MIA1 (radio-actively illuminated) (19200) 10556235	EA	1
9		DELETED		
10		DELETED		
<p>Change 2 B-8</p>				

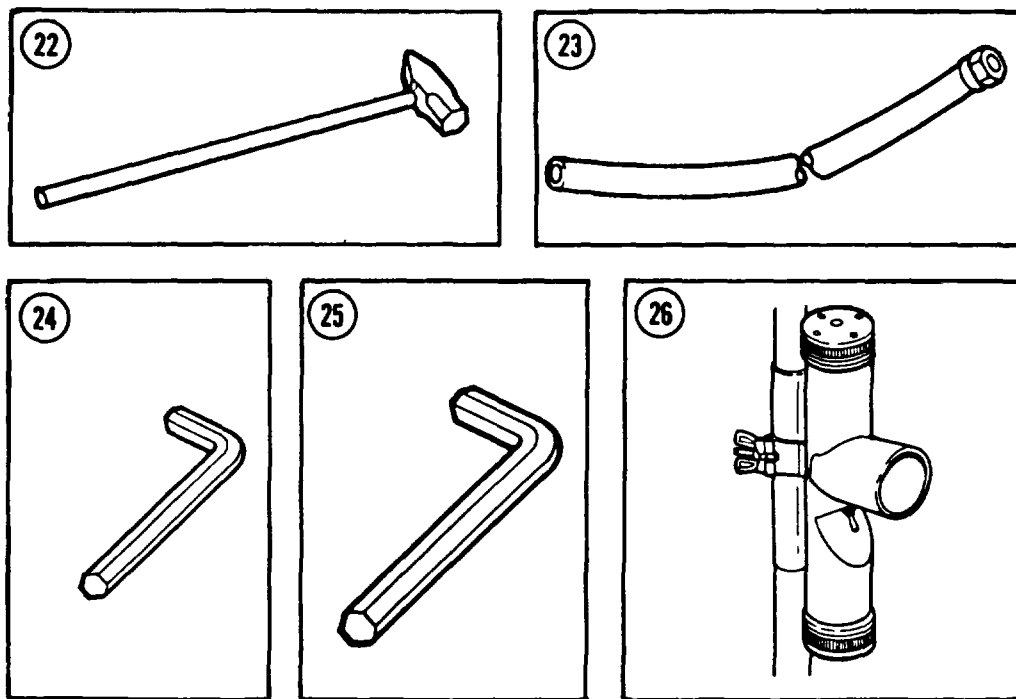


(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM ) and Part Number	Usable On Code	(4) U/M	(5) QTY AUTH
11	1290-00-653--7993	COVER, AIMING POST: M401 (19200) 6537993		EA	1
12	1240-00-003-8416	COVER, FIRE CONTROL: (quadrant and elbow telescope) (19200) 10548610		EA	1
13	1240-00-084-0280	COVER, 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
<b>Change 1 B-9</b>					

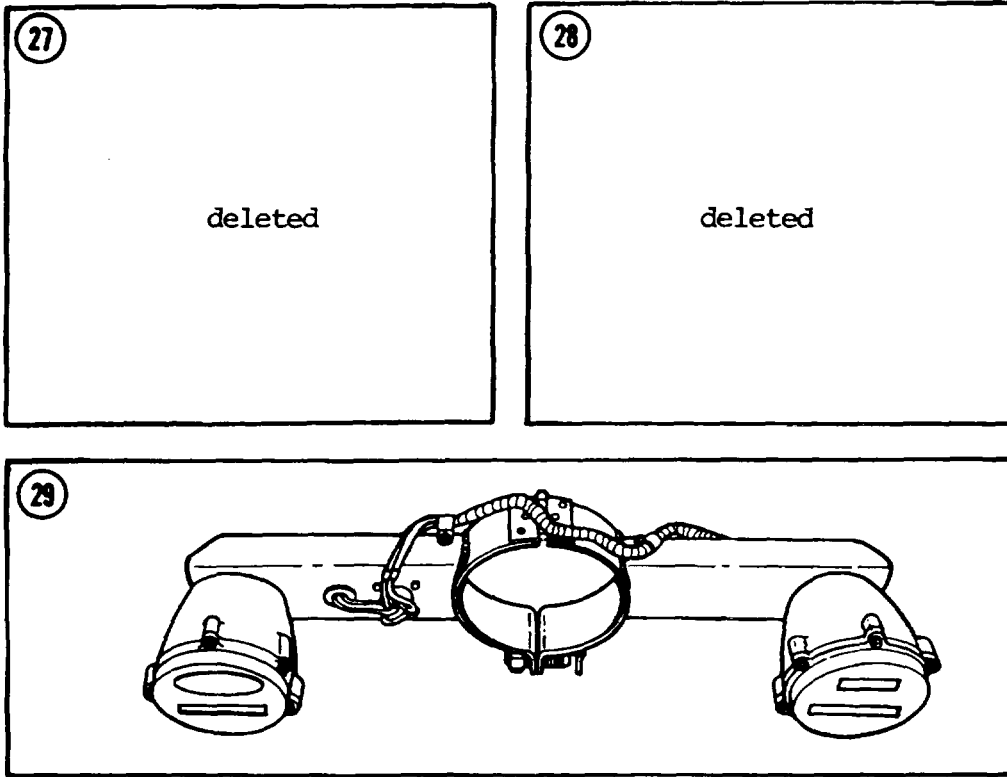




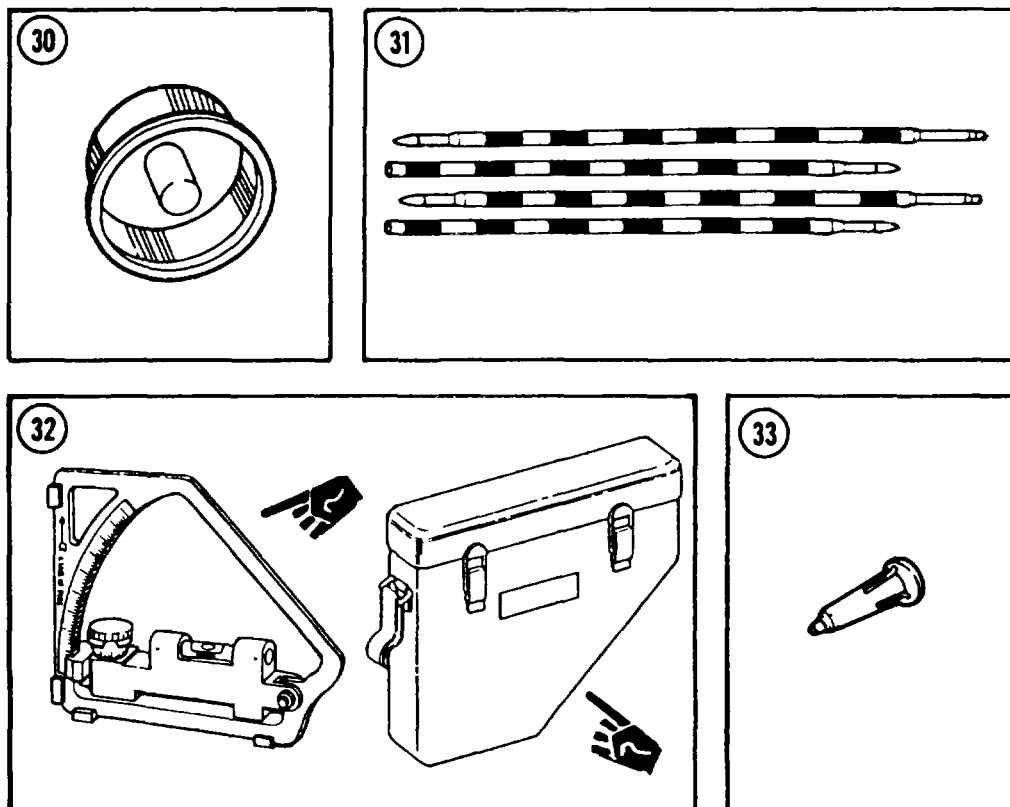
(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM ) and Part Number	Usable On Code	(4) U/M	(5) QTY AUTH
16	1015-01-032-0281	COVER, OVERALL (19204) 12000773		EA	1
17	1240-00-498-6358	COVER, TELESCOPE AND MOUNT (19200) 11730192		EA	1
18	1290-00-764-7761	FUZE SETTER: M27 (19200) 7647761		EA	1
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



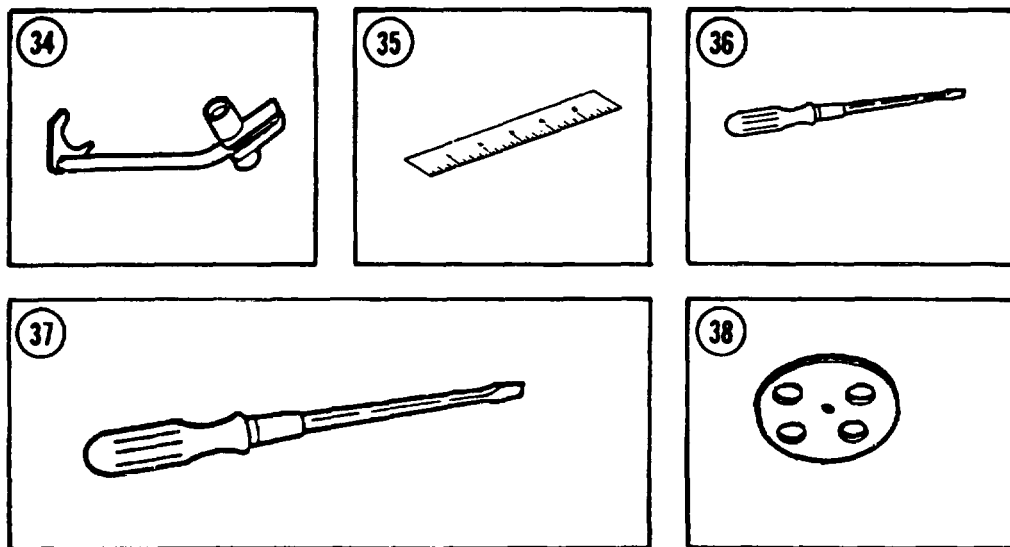
(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM ) and Part Number	Usable On Code	(4) U/M	(5) QTY AUTH
22	1015-00-780-4342	HAMMER, SLEDGE (19204) 8433121		EA	1
23	1015-00-832-9972	HOSE ASSEMBLY, RECOIL DRAIN (19204) 8432575		EA	1
24	5120-00-889-2162	KEY, SOCKET HEAD SCREW: 0.11-in. (81348) 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  <b>Change 2 B-11</b>		EA	2



(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM ) and Part Number	(4) Usable On Code U/M	(5) QTY AUTH
27		DELETED		
28		DELETED		
29	6220-01-366-3689	TAIL LIGHT ASSEMBLY (19204) 12953546  OPERATOR'S MANUAL FOR HOWITZER, LIGHT, TOWED: 105-MM, M102  Change 2 B-12	EA  EA	1  1



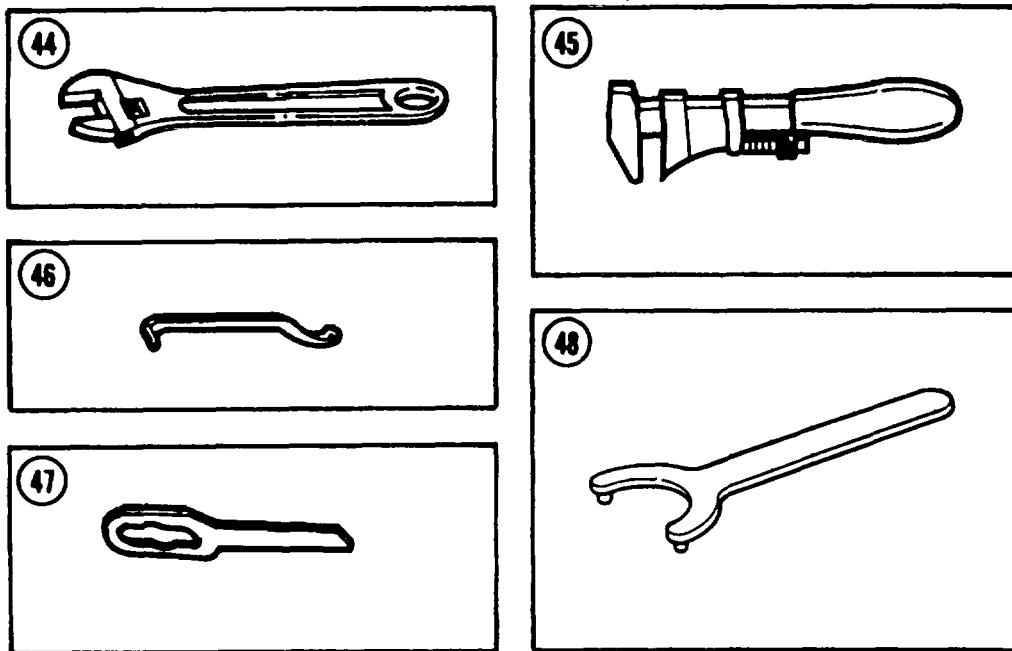
(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM ) and Part Number	Usable On Code	(4) U/M	(5) QTY AUTH
30	1015-00-529-5783	PLUG, MUZZLE (19206) 8767157		EA	1
31	1290-00-535-7617	POST, AIMING: M1A2 (19200) 7687114		EA	4
32	1290-00-891-9999	QUADRANT, FIRE CONTROL, GUNNER'S: M1A1 (19200) 7197156		EA	1
33	1015-00-559-1873	RAMMER, ARTILLERY, UNLOADING (19206) 5591873		EA	1
<p><b>Change 2 B-13</b></p>					



(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			
<p><b>Change 2 B-15</b></p>					





(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**

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**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
	5140-00-653-4198	CTA 50-970 AUTHORIZED ITEMS 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
		<b>Change 2 C-2</b>			

(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. PT 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 EQUIPMENT (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
<b>Change 2 C-3</b>					

## 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- INDICATING, 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
<b>Change 2 C-4</b>					

**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 (1)--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. EA (50.8 x 63.5 cm) (81349) MIL-B-117	
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- EA 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  <b>Change 2 D-2</b>	

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
8	C	7510-00-223-6700 7510-00-223-6701	CHALK, MARKING, round tapered, box of 144 blue white (81348) SS-C-255	BX BX
9	C	7930-01-M24-7971 9150-01-053-6688	CLEANER, LUBRICANT, PRESERVATIVE (CLP) (65983) 508-501-9901 1-gal. (3.79-1) bottle (81349) MIL-L-63460	PT I GL
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  <b>Change 2 D-3</b>	

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	9150-00-944-8953 9150-00-145-0268	GREASE, AIRCRAFT, GENERAL PURPOSE (GPG) 1-lb (0.45-kg) can 5-lb (2.27-kg) can (81349) MIL-G-81322	CN LB
17	C	9150-00-190-0905 9150-00-190-0907	GREASE, AUTOMOTIVE AND ARTILLERY (GAA), -65° to +225°F (-54° to +1070C) effective 5-lb (2.27-kg) can 35-lb (15.88-kg) can (81349) MIL-G-10924	CN CN
18	C	9150-00-935-9807 9150-00-935-9808	HYDRAULIC FLUID, PETROLEUM BASE (OHT) 1-qt (0.95-1) can 1-gal. (3.79-1) can (81349) MIL-H-6083	QT 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	9150-00-231-6689 9150-00-231-9062	LUBRICATING OIL, GENERAL PURPOSE (PL-S), noncor- rosive, low temp 1-qt (0.95-1) can 5-gal. (18.93-1) can (81348) VV-L-800	QT GL
21	C	6640-00-663-0832	PAPER, LENS, tissue, sheet form, type 1 (81348) NNN-P-40	SH
			<b>Change 1 D-4</b>	

(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-C-372	YD
26			DELETED	
27	C	4020-00-241-8875	TWINE, FIBROUS 1-lb (0.45-kg) ball (81348) T-T-911	LB
28	C	6515-01-150-2976 6515-01-150-2978 6515-01-150-2977	GLOVES, PATIENT, EXAM, package of 100 (89875) E-010 size small E-012 size medium E-011 size large	PG
29	C	7510-01-146-7767	TAPE, PRESSURE sensitive 2-in wide (81349) PPP-T-60	RO





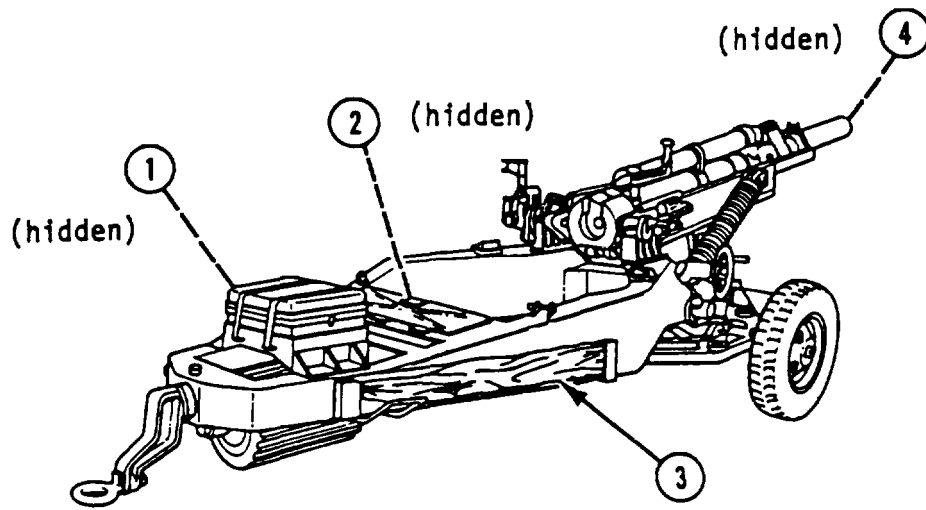
**APPENDIX E  
STOWAGE AND SIGN GUIDE (FOR COMPONENTS OF END ITEM,  
BASIC ISSUE ITEMS, AND APPLICABLE ADDITIONAL AUTHORIZATION  
LIST ITEMS)**

**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**

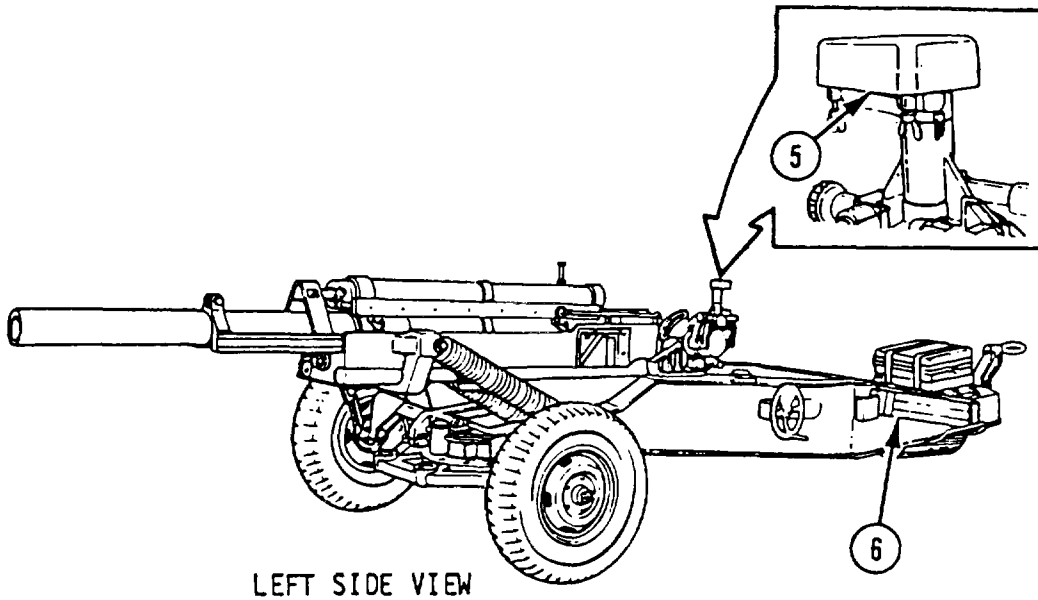
Locations of mounted and stowed components of end item are shown on pages 1-8 and 1-9. Basic issue items mounted or stowed on the M102 howitzer are shown in this appendix. Other basic issue items are stowed in the prime mover. Additional authorization list items are stowed at the discretion of the chief of section.



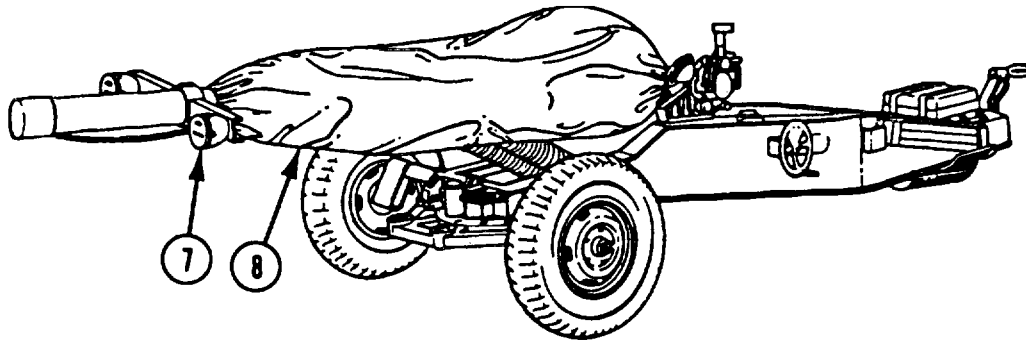
RIGHT SIDE VIEW

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

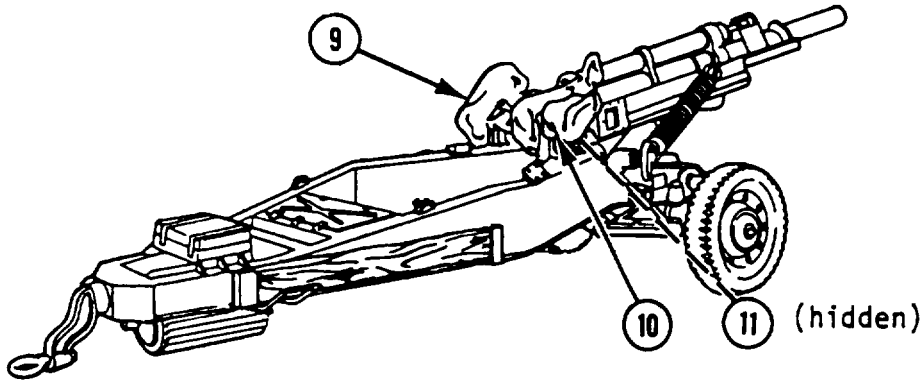
STOWAGE PLAN	
NO.	ITEM
3	M401 aiming post cover and
4	M1A2 aiming posts (2) Muzzle plug



STOWAGE PLAN	
NO.	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)

ALPHABETICAL INDEX

Subject	Page
<b>A</b>	
Abbreviations, list of .....	1-4
Additional authorization list .....	C-1
Aiming circle, M2/M2A2 (see M2/M2A2 aiming circle)	
Aiming posts, M1A2 (see M1A2 aiming posts manual)	
Air-lift, preparation of M102 howitzer for .....	2-85
Alinement device, M140 (see M140 alinement device)	
Alinement tests and measurements, fire control:	
General .....	3-41
Preparation for .....	3-42
Ammunition forms and records .....	4-55
Ammunition, maintenance of .....	4-55
Ammunition, prepared for firing but not fired .....	4-54
Artillery cleaning brush maintenance .....	3-41
Authorized fuzes for howitzer .....	4-7
Authorized 105-mm projectiles and use .....	4-3
Auxiliary equipment, maintenance of .....	3-41
Azimuth walk-off check .....	3-54

Subject	Page
<b>B</b>	
Basic issue items .....	B-7
Basic issue items, storage and sign guide for .....	E-1
Biological decontamination procedures .....	2-92
Boresighting M113A1 pantel:	
Using distant aiming point method .....	2-47
Using test target method .....	2-51
Using the M140 alinement device .....	2-44
Boresighting the M114A1 telescope:	
Using distant aiming point method .....	2-50
Using test target method .....	2-51
Breechblock:	
Disassembly/assembly of .....	3-34
Installation into breech ring assembly .....	3-34
Removal from breech ring assembly .....	3-29

<b>Subject</b>	<b>Page</b>
<b>B (cont)</b>	
Breech mechanism assembly:	
Maintenance .....	3-29
Servicing .....	3-29
Breech ring assembly:	
Installation of breechblock into .....	3-34
Removal of breechblock from .....	3-29
Brush, artillery cleaning, maintenance .....	3-41

<b>Subject</b>	<b>Page</b>
<b>C</b>	
Cannon, M137A1 (see M137A1 cannon)	
Cannon tube, leveling the:	
General .....	3-54
Using the cannon tube quadrant seats .....	3-55
Using the gun tube leveling fixture .....	3-56
Cannon tube quadrant seats, leveling the cannon tube using the .....	3-55
Carriage, M31 (see M31 carriage)	
Cartridge case and propelling charge .....	4-26
Charge, preparing propelling .....	4-28
Charge, propelling .....	4-14
Check, azimuth walk-off .....	3-54
Checkfire procedures .....	2-75
Checking reliability of deflections .....	3-52
Checking reliability of special corrections .....	3-53
Checks and services, preventive maintenance (PMCS) .....	2-10
Chemical decontamination procedures .....	2-92
Cold weather conditions, operation in extreme .....	2-87
Collimator (see M1A1 collimator)	
Comparison test, M140 alinement device .....	3-60
Components, location and description of major .....	1-8
Components of end item .....	B-3
Component of end item and basic issue items lists .....	B-1
Components of end item, stowage, and sign guide for .....	E-1
Controls and indicators, description and use of operator's .....	2-1
Corrections, checking reliability of special .....	3-53
Crank assembly maintenance .....	3-37
Crank, servicing .....	3-37
Crew drill, reduced .....	1-27
Cross-reference list, nomenclature .....	1-4

<b>Subject</b>	<b>Page</b>
<b>D</b>	
Damp atmosphere, operation in.....	2-89
Data plates, M102 howitzer .....	1-14
Decontamination procedures, nuclear, biological, and chemical (NBC) .....	2-92
Deflections, checking reliability of.....	3-52
Direct fire missions, laying for direction and elevation during.....	2-63
Disassembly/assembly of breechblock.....	3-34
Disconnecting M102 howitzer from prime mover .....	2-27
Distant aiming point method:	
Boresighting M113A1 pantel using .....	2-47
Boresighting M114A1 telescope using .....	2-50
Draining oil reserve .....	3-38
Drill:	
Reduced crew .....	1-27
Section .....	1-21
Duds.....	4-53

<b>Subject</b>	<b>Page</b>
<b>E</b>	
Emplacing M1A2 aiming posts.....	2-41
Emplacing M1A1 collimator .....	2-38
Emplacing M102 howitzer .....	2-29
End-for-end test, M1A1 gunner's quadrant.....	3-44
End item, components of .....	B-3
Equipment characteristics, capabilities, and features.....	1-6
Equipment data .....	1-12
Equipment description .....	1-6
Equipment improvement recommendations (EIRs), reporting.....	1-3
Equivalent service rounds .....	4-14
Errors, reporting and recommending improvements .....	i
Excessive pressure in cannon .....	4-53
Expendable/durable supplies and materials list .....	D-1
Explanation of columns.....	B-1, D-1
Explanation of listing .....	C-1
Extreme cold weather conditions, operation in.....	2-87
Extreme hot weather conditions, operation in.....	2-88



<b>Subject</b>	<b>F</b>	<b>Page</b>
Filing oil reserve .....		3-39
Fire control alinement tests and measurements .....		3-41
Fire control alinement tests, preparation for .....		3-42
Firing, preparation for .....		4-14
Firing tables .....		4-53
Firing the M102 howitzer .....		2-70
Fixture, gun tube leveling, leveling the cannon tube using .....		3-56
Fording and swimming operations .....		2-91
Forms and records, ammunition .....		4-31
Forms and records, maintenance .....		1-3
Fuze setting procedures for the howitzer .....		4-34
Fuzes for M102 howitzer, authorized .....		4-6
Fuzing .....		4-28

<b>Subject</b>	<b>G</b>	<b>Page</b>
Glossary .....		1-6
Gunner's quadrant, M1A1 (see M1A1 gunner's quadrant)		
Gun tube leveling fixture, leveling the cannon tube using .....		3-56

<b>Subject</b>	<b>H</b>	<b>Page</b>
Hand receipt (-HR) manuals .....		1-3
Hot, damp, and salty atmosphere, operation in .....		2-89
Hot weather conditions, operation in extreme .....		2-88
Howitzer (see M102 howitzer)		

<b>Subject</b>	<b>I</b>	<b>Page</b>
Indicators, description and use of operator's controls and .....		2-1
Indirect fire missions, laying for direction and elevation during .....		2-59
Inspecting M1A1 collimator .....		3-40
Inspecting suspension pin assembly .....		3-37

<b>Subject</b>	<b>I (cont)</b>	<b>Page</b>
Inspection of breechblock into breech ring assembly.....		3-34
Installing M113A1 pantel.....		2-32
Installing M114A1 telescope.....		2-34
Internal transport, preparation of M102 howitzer for.....		2-85

<b>Subject</b>	<b>L</b>	<b>Page</b>
Laying for direction:		
Using M1A2 aiming posts.....		2-61
Using M1A1 collimator.....		2-60
Laying for direction and elevation:		
During direct fire missions.....		2-63
During indirect fire missions.....		2-59
Laying for elevation.....		2-63
Laying the M102 howitzer using the M2/M2A2 aiming circle.....		2-35
Leveling fixture, leveling the cannon tube using gun tube.....		3-56
Leveling the cannon tube:		
General.....		3-54
Using the cannon tube quadrant seats.....		3-55
Using the gun tube leveling fixture.....		3-56
Leveling the trunnions:		
General.....		3-48
Using scribe lines on M14A1 quadrant.....		3-51
Using the plumbline.....		3-48
List of abbreviations.....		1-4
Loading, procedure for (ammunition).....		4-29
Loading the M102 howitzer for firing.....		2-57
Location and description of major components.....		1-8
Lubrication instructions.....		3-1

<b>Subject</b>	<b>M</b>	<b>Page</b>
Maintenance forms and records.....		1-3
Maintenance instructions.....		3-1
Maintenance of ammunition.....		4-31

Subject	Page
<b>M (cont)</b>	
Maintenance of auxiliary equipment .....	3-41
Maintenance procedures .....	3-29
Major components, location and description of .....	1-8
March order .....	2-80
Measurements, fire control alinement tests and .....	3-41
Micrometer test, M1A1 gunner's quadrant.....	3-42
Misfire/checkfire procedures .....	2-75
Modifications and product improvement package .....	1-10
Multiple round mission .....	4-50
Mount, M134A1 (see M134A1 mount)	
M1A1 collimator, inspecting.....	3-40
M1A2 aiming posts:	
Emplacing .....	2-41
Laying for direction using .....	2-61
M1A1 gunner's quadrant:	
End-for-end test .....	3-44
Micrometer test .....	3-42
M1A1 collimator:	
Emplacing .....	2-38
Laying for direction using .....	2-60
Maintenance.....	3-40
M102 howitzer:	
Authorized fuzes for .....	4-6
Data plates .....	1-14
Disconnecting from prime mover .....	2-27
Emplacing .....	2-29
Firing .....	2-70
Fuze setting procedures for .....	4-19
Laying using the M1/M2A2 aiming circle .....	2-35
Loading for firing .....	2-57
Preparation for air-lift .....	2-85
Preparation for internal transport.....	2-85
Preparation for towing.....	2-81
Unloading .....	2-71

<b>Subject</b>	<b>M (cont)</b>	<b>Page</b>
M102 howitzer: (cont)		
M113A1 pantel, boresighting:		
Using distant aiming point method.....		2-47
Using test target method.....		2-51
Using the M140 alinement device.....		2-44
M113A1 pantel, installing.....		2-32
M114A1 telescope, boresighting:		
Using distant aiming point method.....		2-50
Using test target method.....		2-51
M114A1 telescope, installing.....		2-34
M114A1 telescope test.....		3-60
M134A1 mount, inspection of the.....		3-54
M137A1 cannon:		
Excessive pressure in.....		4-29
Maintenance.....		3-29
Servicing.....		3-29
M14A1 quadrant, leveling the trunnions using scribe lines on.....		3-51
M14A1 quadrant test.....		3-57
M140 alinement device, boresighting M113A1 pantel using.....		2-44
M140 alinement device comparison test.....		3-60
M2/M2A2 aiming circle, laying the M102 howitzer using.....		2-35
M31 carriage:		
Maintenance.....		3-37
Servicing.....		3-37
M37/M37A1 recoil mechanism maintenance.....		3-38

<b>Subject</b>	<b>N</b>	<b>Page</b>
Nomenclature cross-reference list.....		1-4
Nuclear, biological, and chemical (NBC) decontamination procedures.....		2-92

<b>Subject</b>	<b>O</b>	<b>Page</b>
Oil reserve:		
Draining.....		3-38
Filling.....		3-39

<b>Subject</b>	<b>Page</b>
<b>O (cont)</b>	
Operation in extreme cold weather conditions.....	2-87
Operation in extreme hot weather conditions .....	2-88
Operation in hot, damp, and salty atmosphere.....	2-89
Operation in unusual terrain conditions .....	2-90
Operation under unusual conditions .....	2-87
Operation under usual conditions .....	2-27
Operator's controls and indicators, description and use of .....	2-1

<b>Subject</b>	<b>Page</b>
<b>P</b>	
Packing and unpacking (ammunition).....	4-27
Pantel, M113A1 (see M113A1 pantel)	
Pin assembly, suspension (see suspension pin assembly)	
Plates, M102 howitzer data.....	1-14
Plumbline, leveling the trunnions using .....	3-48
PMCS procedures.....	2-11
Prefiring checks.....	2-55
Preparation for fire control alinement tests .....	3-42
Preparation for firing .....	4-14
Preparation of M102 howitzer for air-lift.....	2-85
Preparation of M102 howitzer for internal transport .....	2-85
Preparation of M102 howitzer for towing .....	2-81
Preparation of M67 and other adjustable propelling charges.....	4-49
Preparing propelling charge.....	4-49
Pressure in M137A1 cannon, excessive.....	4-29
Preventive maintenance checks and services (PMCS).....	2-10
Primer.....	4-14
Procedure for loading (ammunition) .....	4-51
Product improvement package, modifications and .....	1-10
Projectile coloring and marking.....	4-1
Projectiles and use, authorized 105-mm .....	4-4
Propelling charge .....	4-14
Propelling charge, preparing.....	4-28

<b>Subject</b>	<b>Q</b>	<b>Page</b>
Quadrant, M1A1 gunner's (see M1A1 gunner's quadrant)		
Quadrant, M14A1 (see M14A1 quadrant)		
Quadrant seats, leveling the cannon tube using the cannon tube .....		3-55

<b>Subject</b>	<b>R</b>	<b>Page</b>
Rapid traverse.....		2-79
Recoil mechanism, M37/M37A1 (see M37/M37A1 recoil mechanism)		
Records, ammunition forms and .....		4-31
Records, maintenance forms and .....		1-3
Reduced crew drill .....		1-27
References.....		A-1
Reliability of deflections, checking .....		3-52
Reliability of special corrections, checking .....		3-53
Removal of breechblock from breech ring assembly.....		3-29
Reporting equipment improvement recommendations (EIRs) .....		1-3
Reporting errors and recommending improvements .....		i
Rounds, equivalent service.....		4-14

<b>Subject</b>	<b>S</b>	<b>Page</b>
Salty atmosphere, operation in .....		2-89
Scope .....		1-3
Scribe lines on M14A1 quadrant, leveling the trunnions using.....		3-51
Seats, leveling the cannon tube using cannon tube quadrant.....		3-55
Section drill.....		1-21
Servicing breech mechanism assembly .....		3-29
Servicing crank.....		3-37
Servicing M137A1 cannon .....		3-29
Servicing M31 carriage .....		3-37
Special corrections, checking reliability of .....		3-53
Stowage and sign guide for components of end item, basic issue items, and applicable additional authorization list items .....		E-1

<b>Subject</b>	<b>S (cont)</b>	<b>Page</b>
Suspension pin assembly:		
Inspecting.....		3-37
Maintenance.....		3-37
Swimming operations, fording and .....		2-91

<b>Subject</b>	<b>T</b>	<b>Page</b>
Tables, firing.....		4-30
Taillight assembly maintenance.....		3-41
Telescope, M114A1 (see M114A1 telescope)		
Terrain conditions, operation in unusual.....		2-90
Test:		
M1A1 gunner's quadrant end-for-end.....		3-44
M1A1 gunner's quadrant micrometer .....		3-42
M114A1 telescope .....		3-60
M14A1 quadrant .....		3-57
M140 alinement device comparison .....		3-60
Tests and measurements, fire control alinement.....		3-41
Tests, preparation for fire control alinement .....		3-42
Test target method, boresighting M113A1 pantel and M114A1 telescope using .....		2-51
To call off.....		1-22
To change posts.....		1-24
To dismount –prepare for action .....		1-26
To fall out—prepare for action .....		1-26
To form the section .....		1-21
To mount—march order .....		1-25
To post the section.....		1-23
Towing, preparation of M102 howitzer for .....		2-81
Troubleshooting procedures .....		3-12
Trunnions, leveling the:		
General .....		3-48
Using scribe lines on M14A1 quadrant.....		3-51
Using the plumbline .....		3-48
Tube, leveling cannon:		
General .....		3-54
Using the cannon tube quadrant seats .....		3-55
Using the gun tube leveling fixture.....		3-56

<b>Subject</b>	<b>U</b>	<b>Page</b>
Unloading an unfired round.....		2-73
Unloading a spent cartridge which failed to extract.....		2-72
Unloading a spent (fired) cartridge .....		2-71
Unloading the M102 howitzer .....		2-71
Unpacking (ammunition), packing and .....		4-16
Unusual conditions, operation under .....		2-87
Unusual terrain conditions, operation in .....		2-90
Use of single zone and other propelling charges .....		4-49
Usual conditions, operation under .....		2-27

<b>Subject</b>	<b>W</b>	<b>Page</b>
Walk-off check, azimuth.....		3-54
Weather conditions, operation in extreme cold.....		2-87
Weather conditions, operation in extreme hot.....		2-88





By Order of the Secretary of the Army:

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**METRIC CHART**

**UNITS OF MEASURE**

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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