

**TECHNICAL BULLETIN**  
**FOR**  
**EXERCISING OF RECOIL MECHANISMS AND**  
**EQUILIBRATORS**

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

**\*SUPERSESSION NOTICE:** Supersedes TB 9-1000-234-13, 15 September 1993, including all changes.

---

**HEADQUARTERS, DEPARTMENT OF THE ARMY**

.....G9DH9A69F &\$%



## WARNING SUMMARY

This warning summary contains general safety warnings and hazardous materials warnings that must be understood and applied during operation and maintenance of this equipment. Failure to observe these warnings could result in serious injury or death to personnel.

### WARNING

Keep the winch cable as short as possible. The shorter the cable, the safer the operators are from danger of broken cable. Use of a winch with a power-reverse is the best way to prevent excess unreeling and snarling of the cable.

### WARNING

Cylinder support assembly weighs 85.7 pounds (38.87 kg). Two individuals are required to position and install cylinder support assembly to prevent injury to personnel.

Ensure cylinder support assembly is held in place until front and rear lower shoes are installed to prevent personnel injury.

### WARNING

Cylinder support assembly has moving parts. Keep clear of cylinder support assembly during operation to avoid injury.

### WARNING

The cannon tube must be blocked during cleaning to prevent cannon tube from returning to battery resulting in injury to personnel.

### WARNING

Be sure hands, arms, and loose clothing are clear of cannon tube and breech prior to removing the wooden block to prevent injury to personnel.

### WARNING

The cannon tube must be blocked while lubricating to prevent cannon tube from returning to battery resulting in injury to personnel.

**WARNING**

Ensure all hydraulic pressure has been released before disconnecting hose assembly to avoid injury to personnel.

**WARNING**

Ensure cylinder support assembly is held in place while the front and rear lower shoes are removed to prevent injury to personnel.

**WARNING**

Cylinder support assembly weighs 85.7 pounds (38.87 kg). Two individuals are required to remove cylinder support assembly to prevent injury to personnel.

## LIST OF EFFECTIVE PAGES

†Gi dYfgYXYg'H6 · - !%\$\$\$!& ( !% ž%) 'GYdHya VYf'&\$\$' "8 UH'cZ]ggi Y'Z:f'cf][ ]bU'UbX'W Ub[ YX'dU[ Yg'UfY.' BcHf. "NYfc ]b'h ]g'Vt`i a b]bX]WUHyg'Ub'cf][ ]bU'dU[ Y"

Original..... ' \$'GYdHya VYf'&\$\$

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 42, CONSISTING OF THE FOLLOWING:

Page No.	*Change No.	Page No.	*Change No.
Title.....	0	2-1 - 2-2 .....	0
a - b .....	0	2-3 - 2-4 .....	0
A/(B blank).....	0	2-5 - 2-6 .....	0
i/(ii blank) .....	0	2-7 - 2-8 .....	0
iii/(iv blank) .....	0	2-9 - 2-10 .....	0
1-1 - 1-2.....	0	2-11/(2-12 blank).....	0
1-3 - 1-4.....	0	Appendix A-1 - A-2.....	0
1-5/(1-6 blank).....	0	Appendix B-1 - B-11/(B-12 blank).....	0



HEADQUARTERS,  
DEPARTMENT OF THE ARMY  
WASHINGTON, D.C. 30 September 2010

## TECHNICAL BULLETIN

### EXERCISING OF RECOIL MECHANISMS AND EQUILIBRATORS

#### REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any errors, or if you would like to recommend any improvements to the procedures in this publication, please let us know. The preferred method is to submit your DA Form 2028 (Recommended Changes to Publications and Blank Forms) through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is <https://aeps.ria.army.mil>. The DA Form 2028 is located under the Public Applications section in the AEPS Public Home Page. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, email, or fax your comments or DA Form 2028 directly to the U.S. Army TACOM Life Cycle Management Command. The postal mail address is U.S. Army TACOM Life Cycle Management Command, ATTN: AMSTA-LCL-MPP / TECH PUBS, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The email address is [tacomlcmc.dafom2028@us.army.mil](mailto:tacomlcmc.dafom2028@us.army.mil). The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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

**\*SUPERSESION NOTICE:** Supersedes TB 9-1000-234-13, 15 September 1993, including all changes.





## TABLE OF CONTENTS

		Paragraph	Page
CHAPTER 1	Introduction		
	Purpose .....	1.1 .....	1-1
	Scope.....	1.2 .....	1-1
	General Exercising Procedures.....	1.3 .....	1-1
CHAPTER 2	Exercising Procedures		
	Exercising Hydropneumatic Recoil Mechanism .....	2.1 .....	2-1
	Exercising Hydrospring Recoil Mechanisms .....	2.2 .....	2-4
	Exercising Equilibrators .....	2.3 .....	2-10
	Exercising Unmounted Hydropneumatic Recoil Mechanisms and Equilibrators in Storage .....	2.4 .....	2-10
	Exercising Recoil Mechanisms and Equilibrators Under Extreme Climatic Conditions.....	2.5 .....	2-11
APPENDIX A	References		
	Technical Manuals and Supply Bulletins.....	A.1.....	A-1
	Other Publications .....	A.2.....	A-1
	RIA Drawings.....	A.3.....	A-2
APPENDIX B	Recoil Exerciser Instructions		
	Installation.....		B-1
	Operation .....		B-5
	Removal.....		B-9



# CHAPTER 1 INTRODUCTION

**1.1. Purpose.** This bulletin provides instructions and guidance on methods of exercising all types of recoil mechanisms and equilibrators, on weapons mounted or unmounted, not fired for prolonged periods, in the field, in storage, or at a manufacturer or overhaul facility.

**1.2. Scope.**

- a. The instructions in this publication are applicable to operator, organizational, direct support, general support, and depot maintenance personnel responsible for exercising recoil mechanisms and equilibrators.
- b. This publication provides periodic preventive maintenance that is not covered in pertinent weapon manuals and specific methods for exercising each type of hydropneumatic recoil mechanism, hydrospring recoil mechanism, and equilibrator.
- c. Only the particular recoil mechanisms listed in table 1-1 do not require exercising.

**Table 1-1. Recoil Mechanisms Which Do Not Require Exercising**

RECOIL MECHANISM MODEL NUMBER	WEAPON SYSTEM
M1A8	HOWITZER, PACK: 75-mm, M116
M2A4	*HOWITZER, LIGHT-TOWED: 105-mm, M101 and
M2A5	M101A1
M6A1	*HOWITZER, MEDIUM, TOWED: 155-mm, M114
M6A2	
M6B2	
M37	HOWITZER, LIGHT, TOWED: 105-mm, M102
M37A1	

\*M101, M101A1, and M114 Howitzers with other recoil mechanisms will require exercising.

**1.3 General Exercising Procedures.**

- a. **General.** Exercising is the moving of rods and pistons in the recoil mechanism to reestablish a fluid film between the packings, seals, and sliding surfaces. It prevents drying of seals and corrosion of rod surface at the packing. Variations of exercising methods may be used, depending on availability of equipment. The exercising method selected must not be performed in such a way as to be injurious to the weapon and thereby cause future malfunctions. Deficiencies noted will be recorded on appropriate forms in accordance with DA PAM 750-8. Update your DA Form 2408-4 after exercising the recoil. Go to: <https://aeps2.ria.army.mil/commodity/guncard/index.cfm>.
- b. **Exercising Frequency.** Hydropneumatic and hydrospring recoil mechanism and pneumatic and hydropneumatic equilibrators must be inspected and exercised at least every 120 days.

- (1) On serviceable weapons in the field which will not be fired for prolonged periods. A prolonged period is 180 days for all weapons except the Towed Howitzer M119 Series. Those M119 Series Howitzers with the LTR recuperator (NSN 3040-01-340-4823) must be exercised every 90 days IAW TM 9-1015-252-10. Armored Reconnaissance Airborne Assault Vehicle M551 and M551A1 and Self-Propelled Howitzer M110A2 must be exercised every 90 days when in administrative storage and every 30 days when in the hands of using units.
- (2) On weapons in all types and classes of storage, in storage at manufacturer's, or in storage at overhaul facilities.
- (3) On serviceable unmounted recoil mechanisms and equilibrators in the field or in storage.

**c. Exercising Procedures (General).**

**CAUTIONS**

- **The recoil mechanism may be seriously and permanently damaged if the extension of the piston rod reaches the point at which metal-to-metal contact between the recoiling and non-recoiling parts occur. The distance of the piston rod extension where this occurs is given in table 2-1 in the "Inches distance rod NOT to be extended" column. Never extend the piston rod the distance given in this column. If the metal-to-metal contact distance of any weapon is unknown, do not exceed the distance given as "maximum recoil" in the pertinent technical manual.**
- **NEVER attempt to exercise recoil mechanisms on combat vehicle by placing cannon muzzle against an immovable object and driving the vehicle forward to create a moving force.**

NOTE

**The recoil piston rod must be extended a sufficient distance to leave a film of fluid between the packings and respective sliding surfaces.**

- (1) Move the recoil piston rod back. Refer to tables 2-1 and 2-2 for the distance the piston rod should be moved on the various weapons for all methods of exercising, except when exercising with the oil pump M3 (paragraphs 2.1h and 2.2b).
- (2) The initial procedure in the exercising process is to remove discolorations on the piston rod caused by the packing. The cleaning must be done when the piston rod is extended the first time, as follows: retain the piston rod in the extended position and use an oiled crocus cloth, worked in a longitudinal direction, to remove discolorations from rod. Under no circumstances will discoloration be removed with abrasives other than crocus cloth. With the piston rod still extended, remove the recoil cylinder head (respirator) and clean the exposed part of the cylinder, where the recoil piston normally rests, with a fine lint-free cloth dampened with dry cleaning solvent.
- (3) Move the recoil piston rod back and forth three times to make sure a satisfactory film of fluid is established under the packings.

## NOTE

If the recoil cylinder is independent of the counter-recoil assembly (for example, recoil mechanisms used with 8-inch Howitzer M115 and 155-mm Howitzer M114 Series) the counter-recoil cylinder head will be removed instead of the recoil cylinder head. Remove any grit or chips from critical surfaces to prevent damage by further exercising. Apply a thin coat of wide temperature range (WTR) grease to the exposed surfaces of the piston rod, and a thin coat of preservative general purpose lubricating oil (PL-S) to the cylinder wall where the packing normally rests. Take special care to prevent fingerprints being left on highly machined surfaces. Replace the cylinder head and finish exercising.

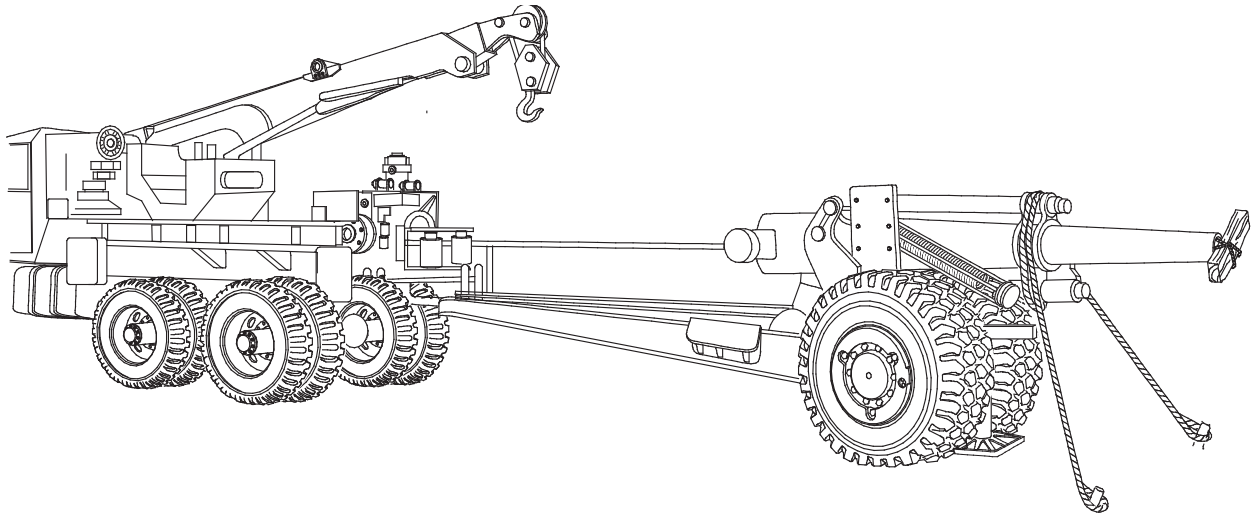
**d. Exercising Procedures with Power Winch.**

- (1) Use a rope or cable of sufficient strength and length to pull the cannon out-of-battery. Use 1-1/2 inch rope or 7/8-inch steel cable. Secure one end of the rope or cable to a 4-inch by 4-inch by 24-inch piece of wood and install the rope or cable through the cannon bore (figures 1-1, 1-2, and 1-3). Adjust the cannon elevation so that the rope or cable installed through the bore and connected to a winch will not rub the rifling. To prevent damage, bend the rope over a sleeve instead of a small diameter hook or cable. Select a winch with the necessary capacity for the amount of pull required. If a winch of the necessary capacity is not available, a block and tackle may be used with the winch, or independently, to increase the pulling force. If a steel cable is used, protect the lands and grooves with strips of wood. Be careful that the material used for securing the rope or cable at the muzzle end will not slip and damage the bore.

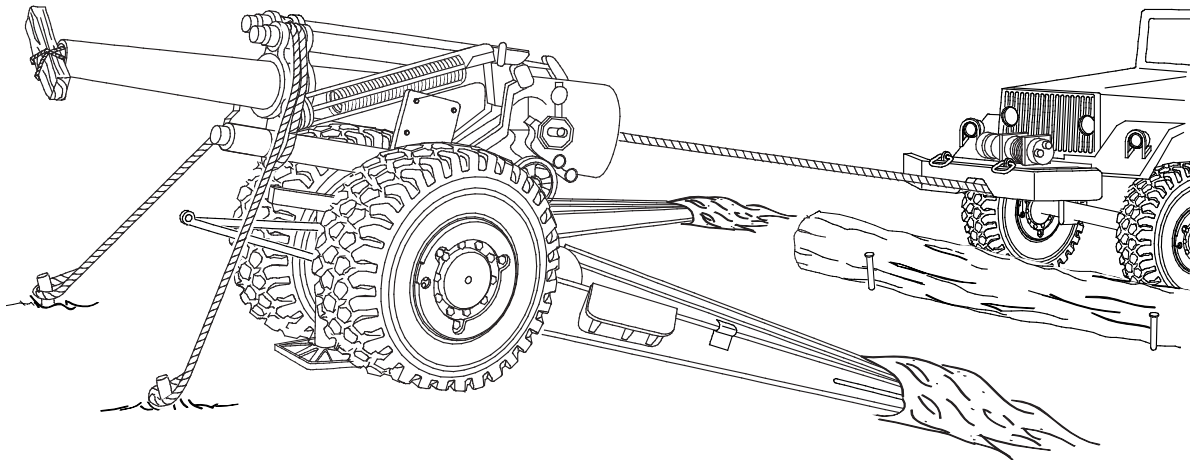
**WARNING**

**Keep the winch cable as short as possible. The shorter the cable, the safer the operators are from danger of broken cable. Use of a winch with a power-reverse is the best way to prevent excess unreeling and snarling of the cable.**

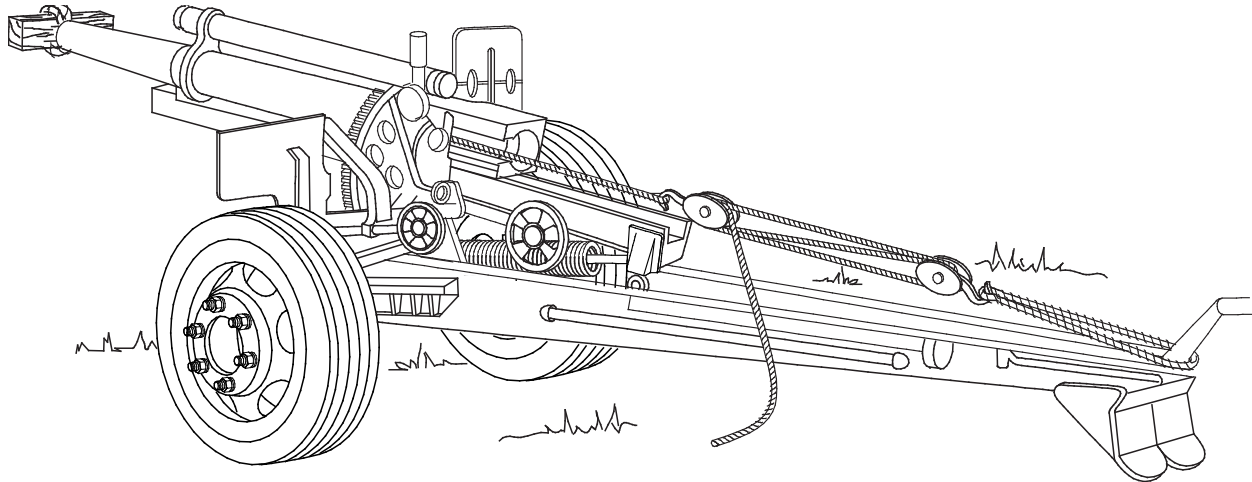
- (2) A steel bar with a reinforced disk head to press against the muzzle may be constructed for use in the bore instead of a rope or cable, when a sufficient number of weapons are to be exercised to warrant it. Wrap the bar with cloth to keep it from damaging the lands. This steel bar has the following advantages:
  - (a) It can be inserted quickly and easily through the bore.
  - (b) Dragging a hook over the lands of the rifling becomes unnecessary.
  - (c) The bar may have an eye on the end, to which the winch hook can be connected easily.
  - (d) The danger of a broken cable damaging the bore is eliminated.



**Figure 1-1. Exercising Recoil Mechanism of Towed Artillery in Traveling Position by Using Winch on Wrecker Truck**

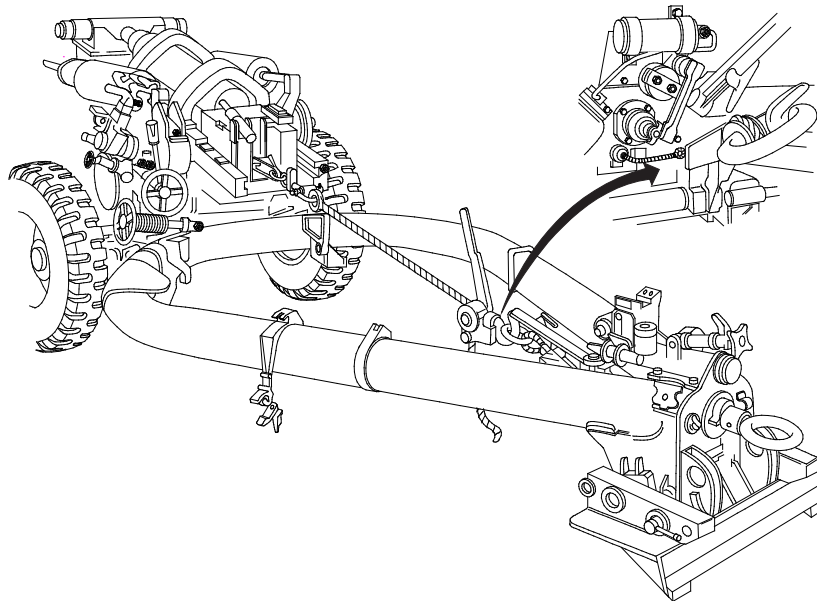


**Figure 1-2. Exercising Recoil Mechanism of Towed Artillery with Trails Spread and Spades Dug in by Using Winch on Heavy Truck or Tractor**



**Figure 1-3. Exercising Recoil Mechanism of Towed Artillery with Trails in Traveling**

- e. **Lubrication of Recoil Pistons.** During the process of exercising, when the cannon is out-of-battery the last time, block the cannon with a 2-inch by 4-inch piece of wood about 8 inches long to prevent it from returning to battery. Coat the exposed surfaces of the recoil piston rod or cannon tube lightly with WTR grease. Remove the block and allow gun to return to battery.
- f. **Preservation.** When exercising has been completed, return preservation to original condition (figure 1-4) in accordance with SB 740-98-1.



**Figure 1-4. Exercising Recoil Mechanism of Towed Artillery with Chain Hoist**





## CHAPTER 2 EXERCISING PROCEDURES

### 2.1 Exercising Hydropneumatic Recoil Mechanism.

#### a. General.

- (1) Prior to exercising, an inspection shall be made to make certain that recoil mechanisms contain the correct amount as well as the right type of hydraulic fluid, in accordance with pertinent lubrication order.
- (2) To make certain that the floating piston will be moved sufficiently and to determine the condition of the hydraulic fluid, the recoil fluid reserve shall be drained and reestablished before exercising.
- (3) Exercising procedures pertinent to specific weapons are prescribed in table 2-1.

- b. **Firing Weapon.** Firing the weapon (tables 2-1 and 2-2) exercises the recoil mechanism. It is one of the best methods, but is not always practical.

**CAUTION**

**This method is not to be used on the 8-inch Howitzer M115 or larger similar carriages when in traveling position with the lumber, as the powerful forces needed to pull the cannon out-of-battery might buckle the lumber.**

- c. **Winch-Weapon in Traveling Position.** Certain field artillery weapons (table 2-1) may be exercised in traveling position by connecting the weapon to a wrecking truck with a suitable winch (figure 1-1). Refer to paragraph 1.3d.
- d. **Winch-Weapon with Trails Spread/Spades Dug In.** Certain field artillery guns (table 2-1) set up with the trails spread and spades dug in and self-propelled weapons anchored in place utilizing parking brakes or blocking may be exercised by using a sufficiently strong winch on a heavy truck or tractor to pull the cannon rearward (figure 1-2). The cannon must be positioned at an elevation angle that will permit a straight pull with the winch. Anchor the truck or tractor if the required pull is too great for the weight of the truck or tractor. Stake or weigh the carriage down, if necessary. Refer to paragraph 1.3d for instructions on the use of a power winch.
- e. **Block and Tackle-Weapon in Traveling Position/Direct Pull Against Spades.** A block and tackle may be used to exercise a weapon (table 2-1) with the trails in traveling position (figure 1-3). The block and tackle may be anchored to the trail spades and to a rope or cable through the cannon. The cannon is pulled to the rear to exercise the recoil mechanism. Refer to paragraph 1.3d.

- f. **Block and Tackle-Weapon in Firing Position/Direct Pull Against Spades.** For M119 Series Howitzer, refer to TM 9-1015-252-10 to place weapon in firing position and TM 9-1015-252-23 to exercise recoil mechanism.
- g. **Power Winch.** Recoil mechanisms on self-propelled weapons listed in table 2-1 may be exercised using a power winch. See paragraph 1.3d.
- h. **Oil Pump M3 (Howitzers, excluding M109 Series and M110A2).**
  - (1) Place cannon at approximately zero mils.
  - (2) Clean accumulated dust and dirt from around the filling plug in the recoil mechanism.
  - (3) Assemble purge pipe to the liquid releasing tool. Remove filling plug from recoil mechanism. Make sure the valve in purge pipe is closed and install liquid releasing tool with purge pipe into filling hole.

**CAUTION**

**Do not permit cannon to slide more than one foot out-of-battery since self-elevation may result if cannon slides beyond this point.**

- (4) Elevate the Howitzer sufficiently to allow cannon to slide out-of-battery as additional fluid is released. Open the valve allowing the fluid to drain into container. Close the valve. Emit the cannon to slide out-of-battery one foot, then close the valve. It may be necessary to use a pry bar to start the cannon to recoil.
- (5) Level the cannon and remove the liquid releasing tool.
- (6) Filter the fluid drained from the recoil mechanism into the oil pump M3 if it is considered suitable for reuse. Install the proper fluid filling plug adapter into the filling hole and loosely attach the oil hose and oil pump. Operate the pump slowly until the line is purged of air and tighten all connections. Continue pumping until the cannon returns to battery and fluid reserve is established.

NOTE

**Make certain the oil pump is not allowed to become empty during operation to avoid pumping air into the system.**

- (7) To exercise the floating piston pump, add 50 strokes into the recoil mechanism for the 105-mm Howitzer M101 and M101A1. Add 100 strokes for the 155-mm Howitzer M114 Series and for the 8-inch Howitzer M115.
- (8) Repeat the above procedure two more times to establish the correct fluid reserve according to the pertinent technical manual.
- (9) Close the trails and return the weapon to its original condition.

**Table 2-1. Exercising Procedures for Hydropneumatic Recoil Mechanisms**

(For exceptions to exercising, see table 1-1 on page 1-1)

Weapon System	Method Paragraph References										Inches distance rod to be extended	Inches distance rod NOT to be extended	
	2.1b	2.1c	2.1d	2.1e	2.1f	2.1h	2.1i	2.2d	2.2e	App B			
HOWITZER, LIGHT TOWED: 105-mm, M101 and M101A1	X	X	X	X		X						*26	*44.89
HOWITZER, MEDIUM SELF-PROPELLED: 155-mm, M109 A2-A5	X				X			X	X			24	Not applicable
HOWITZER, MEDIUM SELF-PROPELLED: 155-mm, M109A6	X				X			X	X	X		24	Not applicable
HOWITZER, LIGHT TOWED: 105-mm, M119 Series	X		X	X								20-24	24
HOWITZER, MEDIUM TOWED: 155-mm, M198	X						X					14	
HOWITZER, MEDIUM TOWED: 155-mm, M777A2	X						X						

\*Not applicable when using oil pump M3 (paragraph 2.1h).

**i. M198 and M777A2 Howitzers Recoil Exerciser/Hydraulic Ram.**

- (1) Elevate or depress cannon tube to approximately zero mils.
- (2) Assemble hydraulic ram support assembly on cannon tube.
- (3) Connect the hydraulic ram support assembly to the cradle assembly with attaching hardware.
- (4) Block out replenisher indicator rod by installing the replenisher indicator rod clamp on the indicator rod guard (M198 only).
- (5) Connect hydraulic hose to the hydraulic ram support assembly and to either the hand or electric operated hydraulic pump.
- (6) Operate pump until the hydraulic ram is extended approximately 14 inches.
- (7) Release hydraulic pressure, allowing the M45 recoil mechanism to return to battery.
- (8) Repeat steps 6 and 7 two more times.
- (9) Remove hydraulic ram support assembly and attaching parts from the cannon and cradle assembly.
- (10) Remove the replenisher indicator rod clamp from the indicator rod guard (M198 only).
- (11) Return Howitzer to the respective travel lock position prior to exercising the recoil mechanism.

**2.2 Exercising Hydrospring Recoil Mechanisms.**

**a. General.**

- (1) When exercising hydrospring recoil mechanisms with the oil pump M3, the replenisher is disconnected from the recoil cylinder or cradle and must be exercised independently as outlined in paragraph 2.2b below. Recoil Mechanisms cannot be exercised through the replenisher when using oil pump M3.
- (2) Prior to exercising, an inspection should be made to make certain that recoil mechanisms contain the correct amount as well as the right type of hydraulic fluid, in accordance with the pertinent lubrication order.
- (3) Exercising procedures pertinent to specific weapons are prescribed in table 2-2.

NOTE

**The following step is not required for the Abrams tanks or M119s.**

- (4) After exercising the recoil mechanism, stencil the date on the cannon tube using 1-inch letters. Stencil should read "Exercised month-day-year."

**b. Oil Pump M3 (Single or Double Type Recoil Mechanisms).**

- (1) On certain types of replenishers (table 2-2), remove hydraulic fluid from replenisher cylinder.
- (2) Remove replenisher hose from recoil cylinder or cradle.
- (3) Install plug or cap to seal replenisher hose hole.
- (4) Level cannon and remove plug from rear of recoil cylinder.
- (5) Attach hose from oil pump M3 to recoil cylinder.
- (6) Mark the cannon tube 6 to 8 inches from gun shield.
- (7) Using oil as specified in the lubrication order for weapon being exercised, operate the oil pump and hydraulically force the gun 6 to 8 inches out-of-battery, as marked on the gun tube.

**Table 2-2. Exercising Procedures for Hydrospring Recoil Mechanisms**

Weapon System	Method Paragraph References			Inches distance rod to be extended
	2.1b	2.2b	2.2g	
TANK, COMBAT, FULL-TRACKED: 105-mm gun, M48A5	X	X		6-8
TANK, COMBAT FULL-TRACKED: 120-mm, gun, M1A1 ABRAMS	X	X	X	6-8
TANK, COMBAT FULL-TRACKED: 120-mm, gun, M1A2SEP ABRAMS	X	X	X	6-8

- (8) Release valve on oil pump and allow cannon to move back into battery.
- (9) Repeat operation at least three times to ensure that recoil slide area and seals are lubricated.

## NOTE

**Steps 10 and 11 are not required for Abrams tanks.**

- (10) Apply WTR grease as specified in paragraph 1.3e.
- (11) Remove 2 by 4 and proceed as in step (8) above.
- (12) Remove plug or cap and attach replenishment hose by one or two threads.
- (13) Fill replenisher, bleeding out any air in replenisher hose.
- (14) Tighten replenisher hose and recheck for proper amount of oil as specified in the pertinent technical manual.

**c. Replenisher.**

- (1) Replenisher may be exercised with either oil pump M3 or an 8-ounce filler gun.
- (2) Drain fluid from replenisher into a clean container.
- (3) Attach oil pump hose loosely into filter plug hole. Force air out of hose, tighten hose, and pump fluid into replenisher. Fill replenisher until indicator tape shows smooth edges.
- (4) Drain replenisher until the proper reading is showing on the indicator tape.
- (5) Using an oil spray gun, spray petroleum base hydraulic fluid (MII-H-46170 FRH) to the inner surface of replenisher cylinder. This is accomplished by placing the nozzle of gun into each hole alongside indicator tape and alongside tape through the center hole. This procedure should be repeated each time cannon is exercised.

## NOTE

**The replenisher is exercised independently, but in conjunction with exercising the recoil mechanism. The recoil mechanism cannot be exercised through the replenisher.**

- d. Hydraulic Jack.** Position vehicle (tables 2-1 and 2-2) so that hydraulic jack can be placed between protected cannon muzzle and a vertical, solid, immovable object.

**CAUTIONS**

- **Ensure that cannon bore is square with object, and jack is placed parallel with bore and at right angle to the side or flat face of the object.**
  - **Make sure traversing and elevating controls are locked in place before operating jack to move weapon out-of-battery.**
  - **Repeat movement at least three times. Lubricate as specified in paragraph 1.3e.**
- e. Wrecker M62, M543A2, M816, M977, or M98E1 HEMTT and Improvised Exercising Bracket.** When exercising a number of combat vehicle recoil mechanisms, an improvised exercising bracket (figure 2-1) can be fabricated to save time and effort. With this exercising device, any number of combat vehicles (tables 2-1 and 2-2) can be exercised by using the wrecker boom and exercise recoil mechanism as outlined below.

**CAUTIONS**

- **Ensure that turret lock is engaged and vehicle master switch is off.**
  - **Ensure that wrecker boom and gun tubes are horizontally and laterally squared to prevent damage to the tube, turret and other components.**
  - **Operators should be in both vehicles to keep brakes fully applied to prevent movement of either vehicle while tube is being pushed out-of-battery.**
- (1) Using black paint, stencil a 1-inch by 6-inch stripe on cannon tube 6 to 8 inches from the gun shield.

- (2) With the improvised bracket attached to the wrecker boom, extend boom until distance prescribed in tables 2-1 and 2-2 "Inches distance rod to be extended" column, is reached. Retract boom and allow gun to return to the in-battery position.

NOTE

**On M551/M551A1 vehicles only, the recoil mechanism must be at precharged pressure. Hand pump (see TM 9-2350-230-10) will be used if gun-launcher fails to return to in-battery position.**

- (3) Repeat operation a minimum of three times to ensure recoil slide area and seals are lubricated. For M551/M55A1 vehicles, repeat operation a minimum of ten times. See paragraph 1.3b for frequency of exercising recoil mechanisms.
  - (4) Lubricate other areas according to the procedures outlined in paragraph 1.3e.
- f. **Exercise of 152-mm Gun/Launcher Armored Reconnaissance/Airborne Assault Vehicle M551 and M551A1.** When conditions (lack of space, etc.) deny conventional use of wrecker, an improvised harness may be fabricated and used as follows:

NOTE

**Two men required.**

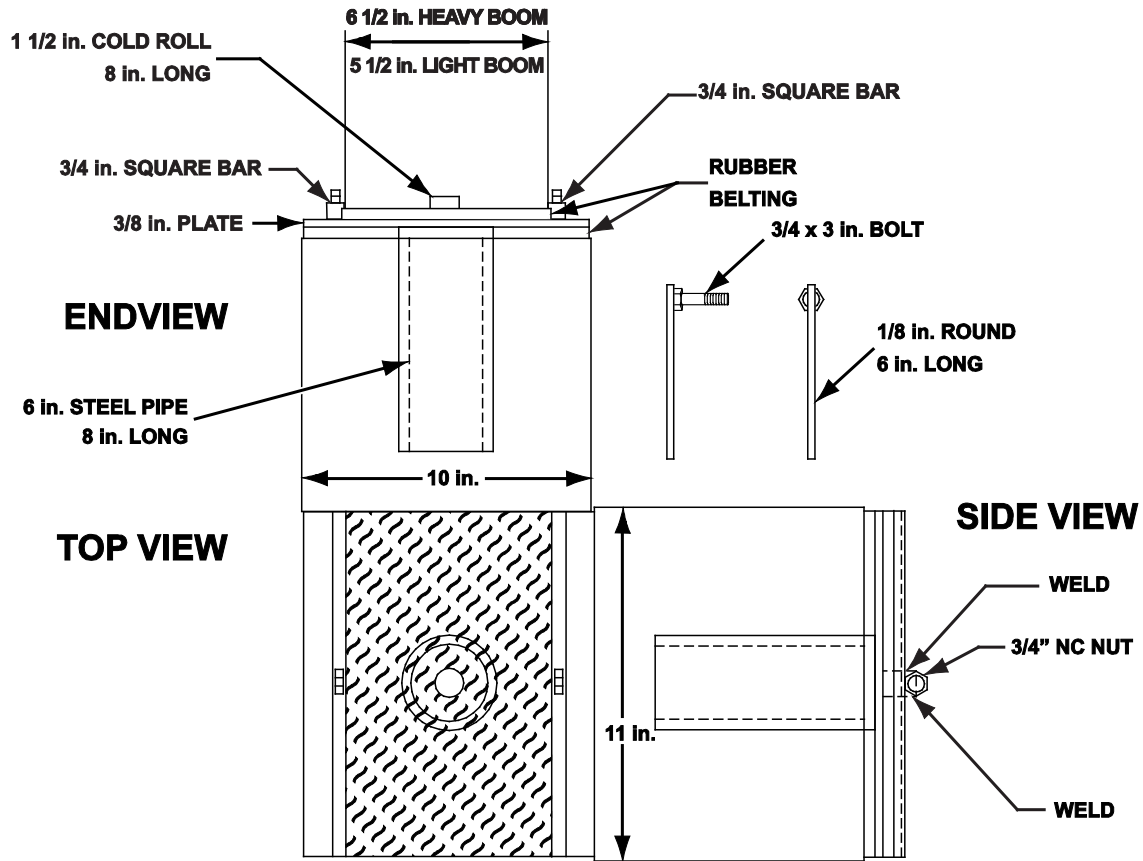
- (1) Obtain chain hoist, 1/2 ton capacity or equivalent.
- (2) Obtain two gun shield lifting eye bolts.
- (3) Fabricate or locally obtain two eye bolts 5/8-inch in diameter, eye opening 2-1/2 to 3 inches, and shaft length 4 to 4-1/2 inches. Appropriate washers and nuts are also required.
- (4) Fabricate or locally obtain two steel rings 5/8-inch in diameter and 3-1/2 to 4 inches in circumference.
- (5) Fabricate gun muzzle attachment as follows:
  - (a) Utilizing oak or similar hard wood block 12 inches long, 8 inches wide, and 4 inches thick, remove approximately 1 inch of wood from one side except for a centered disk approximately 5 inches in diameter and 1 inch high.
  - (b) Drill holes to accommodate eye bolts (step (3) above) at each end and centered approximately 2 inches from end of block. Insert eye bolts with bolt eye on side with raised deck.
- (6) Insert eye bolts to gun shield.

- (7) Utilize two suitable lengths of rope, chain, cable with a 1/2 ton capacity and attach the end of one to the eye bolt in the gun shield and the end of the other to an eye bolt of the improvised muzzle block (step (5) above). Thread a steel ring (step (4) above) through each length, attach opposite end of respective eye bolt (gun shield or muzzle block). Adjust length so chain hoist can be attached to steel ring. Provide adequate length to rope, chain, etc., on gun shield eye bolts to avoid damage to transmitter cover.

**CAUTIONS**

- **Make sure traversing and elevating controls are locked in place before using the chain hoist.**
  - **Make sure gun launcher is at zero elevation. Gun may slide completely out-of-battery if elevated.**
- (8) One man operates the chain hoist and the other, from within the vehicle, opens the manual relief valve on the side of the reservoir releasing gun mount precharge pressure. The chain hoist is utilized to back the gun launcher out-of-battery for a distance of 6 to 8 inches. The chain hoist is then released, the manual relief valve closed, and the pump handle actuated until the gun launcher is returned to full battery position. This procedure is repeated at least 10 times. Upon completion, the recoil system should be left in full precharge pressurized condition.
- g. Exercise of 120-mm Gun (M1A1/M1A2SEP Series Tank Only).** The Gun Mount Exerciser is another method for exercising the recoil mechanisms for the M1A1/M1A2SEP Series Tank. Refer to the applicable manual for operation of the Gun Mount Exerciser (TM 9-2350-264-20-2-4 for M1A1 Tank, and TM 9-2350-388-23-2-4 for M1A2SEP Tank).





<b>MATERIAL – LOW ALLOW STEEL</b>		<b>RUBBER BELTING</b>	<b>1/4 in. to 1/2 in.</b>
<b>STEEL PLATE</b>	<b>3/8 in.</b>	<b>SQUARE BAR</b>	<b>3/4 in.</b>
<b>COLD ROLL</b>	<b>1 1/8 in.</b>	<b>STEEL PIPE</b>	<b>6 in.</b>

**RUBBER BELTING IS CUT TO FIT BETWEEN 3/4 in. SQUARE BARS ON BOOM SIDE AND CUT TO FIT AROUND PIPE ON TUBE SIDE.**

*Figure 2-1. Dimensional Drawing for Fabricating Improved Recoil Mechanism Exercising Bracket of M98E1 HEMTT (M109 Series Only)*

### 2.3 Exercising Equilibrators.

- a. **General.** Pneumatic and hydropneumatic equilibrators must be exercised periodically for reasons given in paragraph 1.3. Proper exercising of equilibrators at least every six months, as outlined in paragraph 2.3b below, is essential to maintain them in serviceable condition.
- b. **Angled Equilibrators.** To exercise equilibrators mounted on a carriage or vehicle, elevate and depress the cannon at least three times.
- c. **Equilibrated Elevating Cylinders (Howitzer M109 Series).**
  - (1) To exercise the equilibrated elevating cylinders on the Howitzer M109 Series, activate the cab hydraulic system and elevate and depress the cannon through its full range at least three times.
  - (2) If it is not practical to activate the cab hydraulic system, use the elevation hand pump and elevate and depress the cannon through its full range at least once.

### 2.4 Exercising Unmounted Hydropneumatic Recoil Mechanisms and Equilibrators in Storage.

- a. **General.** The procedures given in the preceding paragraphs apply to hydropneumatic type recoil mechanisms or equilibrators in storage. When exercising has been completed, restore proper preservatives in accordance with MIL-P-14232 and pertinent Packaging and Data Sheets. Record the date of exercising on a tag and attach to recoil mechanism or equilibrator.
- b. **Unmounted Hydropneumatic Recoil Mechanisms.** If the hydropneumatic recoil mechanism is of the independent type and unmounted, it will be necessary to exercise the recoil cylinder assembly and counter-recoil assembly separately. The force required to exercise the recoil cylinder assembly is only that force necessary to overcome friction. Extension of 6 inches will be enough for the recoil cylinder and counter-recoil assembly. An adapter may be improvised for extending and retracting the recoil piston by a direct pull or a jacking process. The counter-recoil assembly will return to a retracted position on its own volition due to nitrogen pressure. Recoil mechanisms may also be exercised with 7-1/2 horsepower portable gymnasticator (RIA drawing E7113950) and pertinent adapters as follows:

Adapter D7123504 (RIA drawing (for M1 Series recoil mechanisms)

Adapter D7123508 (RIA drawing (for M2 Series recoil mechanisms)

Adapter D7123510 (RIA drawing (for M6 Series recoil mechanisms)

Adapter D7123512 (RIA drawing (for M4 Series recoil mechanisms)
- c. **Equilibrators.** Equilibrators in storage may or may not contain high nitrogen pressure. Equilibrators may be exercised by anchoring one end to the floor or wall and pulling the other end with a suitable power source. Extend the equilibrators 8 inches.

**2.5 Exercising Recoil Mechanisms and Equilibrators Under Extreme Climatic Conditions.**

- a. The extreme temperatures of the arctics and tropics will affect the rate of corrosive action.
- b. The heat of the tropics will lower the viscosity of the hydraulic fluid, thereby causing the film of fluid between the packings and sliding surfaces to dry out more quickly. Consequently, more frequent exercising will be required to maintain the necessary film of fluid. An increase of 18°F approximately doubles the rate of corrosion due to chemical reaction.
- c. The freezing temperatures of the arctics will also affect the efficiency of the fluid seal and packings.
- d. It is impractical to prescribe the increased frequency at which recoil mechanisms should be exercised in various climates. On hydropneumatic systems under extreme climatic conditions, special inspections must be made of the surfaces of the recoil piston rod and cylinder on which the stuffing and piston packings rest when in battery position. This inspection should be made while the recoil mechanism is being exercised, in accordance with instructions in paragraph 1.3c. The frequency of exercising should be increased in accordance with the findings of the above inspections.



## APPENDIX A REFERENCES

**A.1 Technical Manuals and Supply Bulletins.** The technical manuals and supply bulletin which follow are applicable to this bulletin.

SB 740-98-1 .....	Storage Serviceability Standard: Tracked Vehicles, Wheeled Vehicles, and Component Parts
TM 9-1015-252-10 .....	Operator's Manual for Howitzer, Light, Towed: 105-mm M119A2 (1015-01-482-4914)
TM 9-1015-252-24 .....	Field and Sustainment Maintenance Manual for Howitzer, Light, Towed: 105-mm M119A2 (1015-01-482-4914)
TM 9-2350-230-10 .....	Operator's Manual for Armored Reconnaissance/Airborne Assault Vehicle, Full-Tracked, 152-mm Gun/Launcher M551A1 (2350-00-140-5151) and M551NTC (2350-010-115-1579)
TM 9-2350-264-20-2-4 .....	Unit Maintenance Manual Volume 4 of 4 for Tank, Combat, Full-Tracked: 120-mm Gun, M1A1 (2350-01-087-1095) General Abrams Turret
TM 9-2350-388-23-2-4 .....	Field Maintenance Manual for Tank, Combat, Full-Tracked: 120-mm Gun, M1A2SEP (2350-01-328-5964) General Abrams Turret

**A.2 Other Publications.** The following publications are related to information contained in this bulletin.

MIL-P-14232 .....	Parts, Equipment and Tools for the Packaging and Packing of Army Material
DA Pam 750-8.....	The Army Maintenance Management Systems (TAMMS)
DA Form 2408-4.....	Weapon Record Data

**A.3 RIA Drawings.** The following drawings are related to information contained in this bulletin.

E7113950..... 7 1/2 Horsepower Portable Gymnasticator  
D7123504..... Adapter for M1 Series Recoil Mechanisms  
D7123508..... Adapter for M2 Series Recoil Mechanisms  
D7123510..... Adapter for M6 Series Recoil Mechanisms  
D7123512..... Adapter for M4 Series Recoil Mechanisms

## APPENDIX B RECOIL EXERCISER INSTRUCTIONS

**Table B-1. Materials**

Item Number	National Stock Number	Description	(U/M)/(U/I)
1	5350-00-221-0872	Cloth, abrasive crocus, 50 sheets	PG
2	9150-00-935-9808	Fluid, hydraulic (MILPRF6083) (81349)	GL
3	1015-01-255-4144	Sealant, pipe, teflon 12297953 (19207)	TU
4	5510-01-445-1027	Wood, 4x4 MM-L-751 (81348)	FT

### B-1 Installation

#### WARNING

- Cylinder support assembly weighs 85.7 pounds (38.87 kg). Two individuals are required to position and install cylinder support assembly to prevent injury to personnel.
  - Ensure cylinder support assembly is held in place until front and rear lower shoes are installed and the assembly has been slid towards the dust cover for a snug fit to prevent personnel injury.
1. Position cylinder support assembly (1) on top of cannon tube (2), so that the upper front yoke (3) is 15 inches (38.1 cm) behind the bore evacuator (4) (see figure B-1).

#### NOTE

Do not force fit cylinder support assembly on cannon tube.

2. Install lower front shoe (5) and secure with two flat washers (6) and two screws (7) finger tight.
3. Install lower rear shoe (8) and secure with two flat washers (9) and two screws (10) finger tight.
4. Slide cylinder support assembly (1) towards dust cover (11) until there is a snug fit.

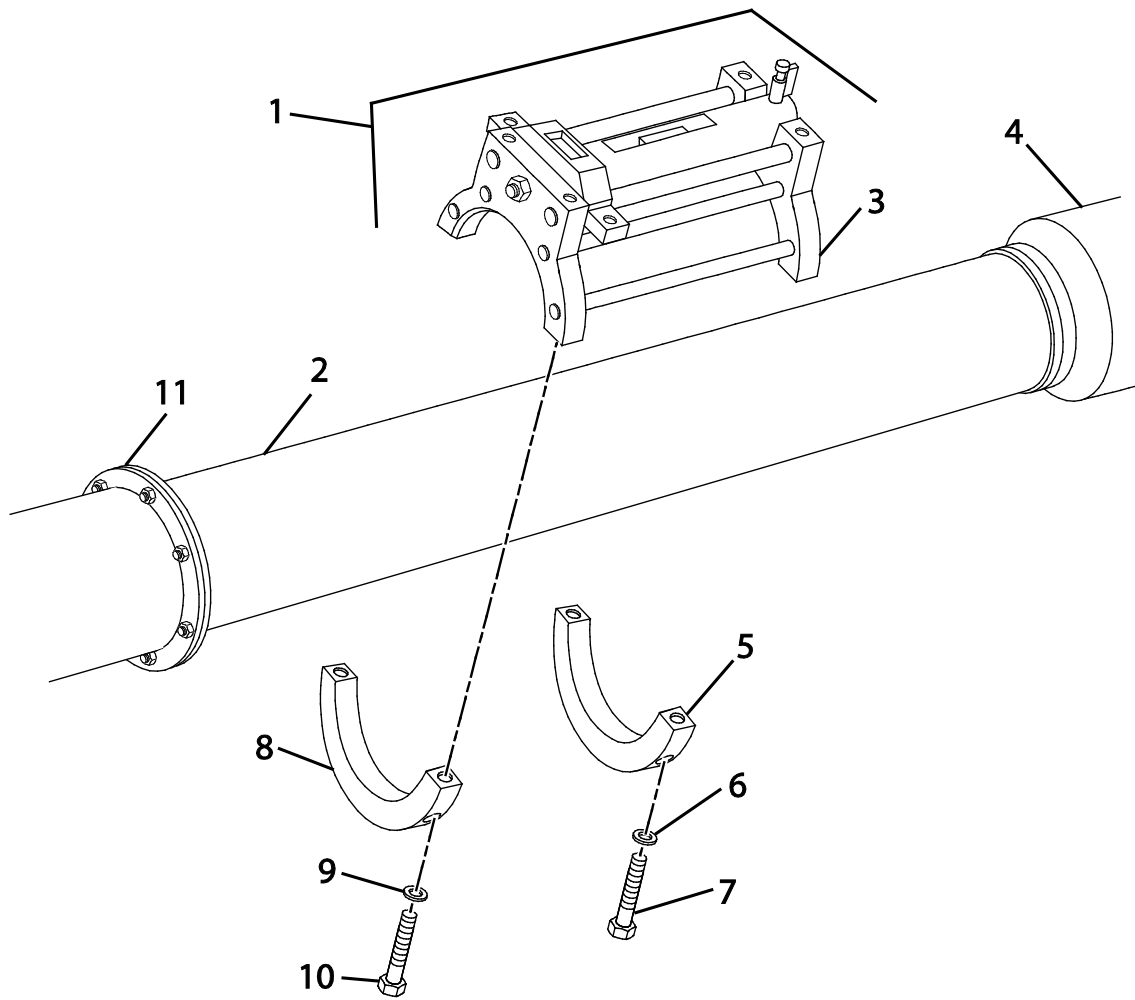


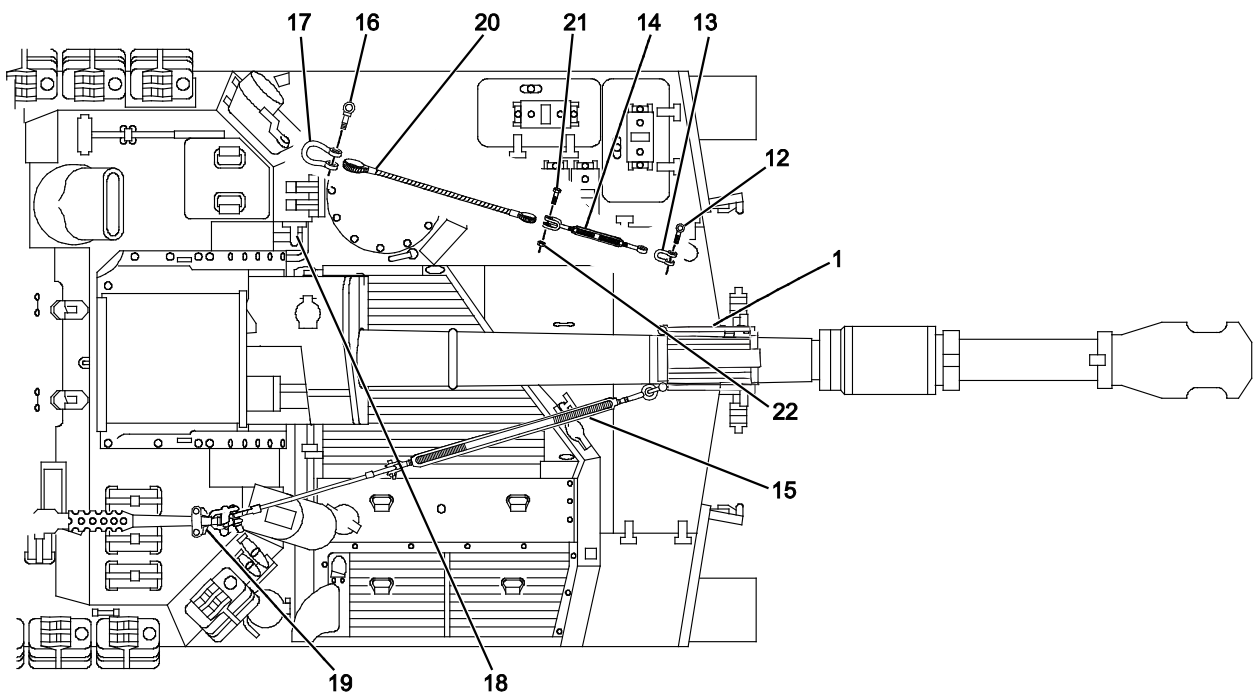
Figure B-1.



## NOTE

Item 14 is the 6-inch turnbuckle and Item 15 is the 18-inch turnbuckle.

5. Remove pin (12) from each of two 5/8-inch shackles (13). Insert one 5/8-inch shackle into each of two turnbuckle (14) eyes. Secure 5/8-inch shackles to cylinder support assembly (1) using two pins (see figure B-2).
6. Remove pin (16) from each of two 1-inch shackles (17). Insert one 1-inch shackle into each of two cab lifting eyes (18) and (19). Secure 1-inch shackle to each of two wire rope assembly (20) thimbles using two pins.
7. Remove screw (21) and nut (22) from each of two turnbuckles (14). Insert each turnbuckle into wire rope assembly (20) and secure with screw and nut.
8. Adjust two turnbuckles (14) evenly to remove slack from two wire rope assemblies (20).



**Figure B-2.**

NOTE

Perform steps 9 and 10 if pipe nipple and quick disconnect coupling have not been installed on pump.

9. Apply teflon pipe sealant (Item 3, table B-1) to threads of pipe nipple (21). Install pipe nipple in outlet port on electric hydraulic pump (22) (see figure B-3).
10. Connect quick disconnect coupling (23) to pipe nipple (21).
11. Attach one end of hose assembly (24) to cylinder support assembly (1) and quick disconnect coupling (23).

NOTE

Electric hydraulic pump fluid capacity is 3/4 gallon (2.8 l).

12. Fill electric hydraulic pump (22) reservoir with hydraulic fluid (Item 2, table B-1) to the proper level.
13. Connect electric hydraulic pump (22) to an electrical power source.

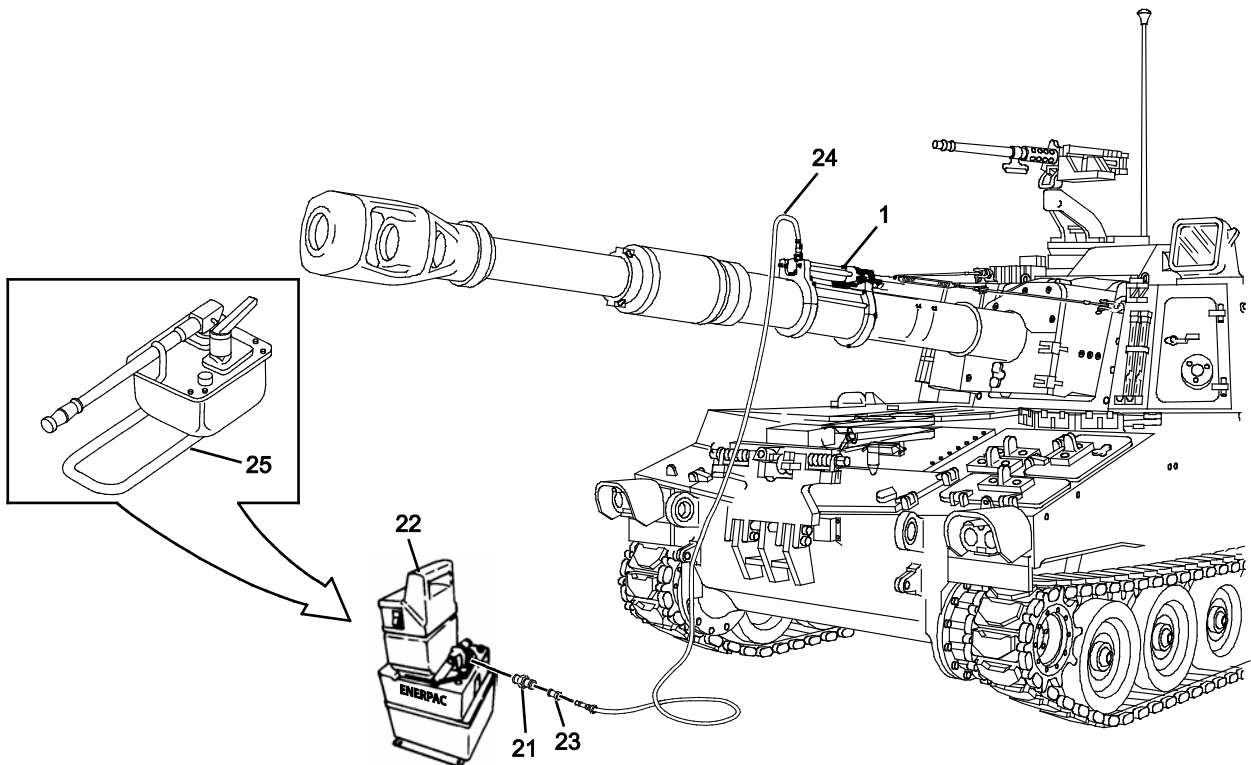


Figure B-3.

**B-2 Operation**

1. Release cannon tube (2) from travel lock (25) and position cannon tube at the same elevation as when held by travel lock. Slow travel lock (see figure B-4).
2. Place chalk markings on cannon tube (2) 12 and 14 inches (30.4 and 35.5 cm) from front of dust cover (5).

**CAUTIONS**

- Breech must be closed prior to pumping to prevent damage to operating cam rollers.
  - Longer of the two recoil exerciser cable assemblies must clear top plate of the replenisher (M109A6).
3. Close breech (29).

**WARNING**

Cylinder support assembly has moving parts. Keep clear of cylinder support assembly during operation to avoid injury.

**NOTE**

- The electric hydraulic pump has a three position REMOTE ON-OFF-MOMENTARY ON switch. To operate the electric hydraulic pump using the remote control, place the REMOTE ON-OFF-MOMENTARY ON switch in the REMOTE ON position. To operate the electric hydraulic pump without the remote control, hold the REMOTE ON-OFF-MOMENTARY ON switch in the MOMENTARY ON position.
  - Make sure quick disconnect couplings are fully seated.
4. If using electric hydraulic pump (22), place manual valve (27) in upright position. Using the electric hydraulic pump, begin pumping. During pumping, check for hydraulic leaks. If leaks are found, slowly release hydraulic pressure and replace defective parts (see figure B-5).
  5. Continue pumping until front of dust cover (5) is between the chalk markings.
  6. Inspect buffer piston rod (28) for discoloration. If no discoloration is found, skip to step 9.

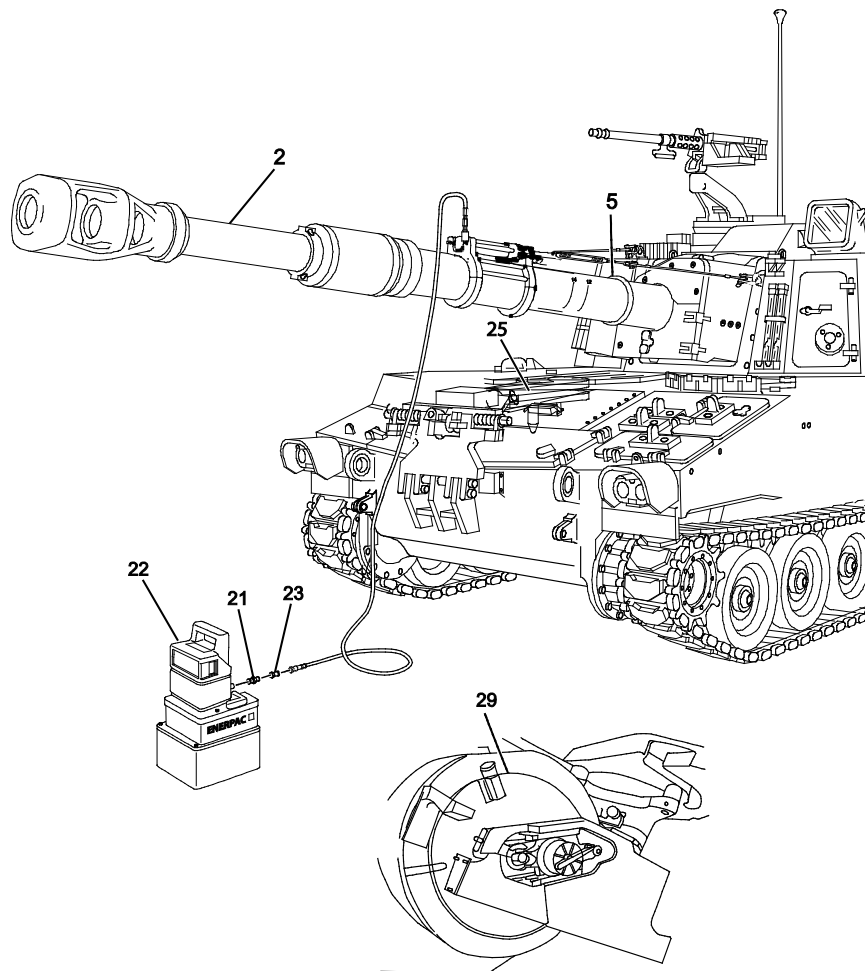
**WARNING**

The cannon tube must be blocked during cleaning to prevent cannon tube from returning to battery resulting in injury to personnel.

**CAUTION**

Do not use abrasives other than crocus cloth (Item 1, table B-1) when cleaning to prevent damage to the buffer piston rod.

7. Block cannon tube (2) while out-of-battery with a 4-inch x 4-inch x 12-inch wooden block (29) (Item 4, table B-1). Hold wooden block in position and slowly release pump pressure until wooden block stops cannon tube movement. Rub crocus cloth soaked with hydraulic fluid in a longitudinal direction, along the buffer piston rod (28) to remove all discoloration (see figure B-5). Remove wooden block.



**Figure B-4.**

**WARNING**

Be sure hands, arms, and loose clothing are clear of cannon tube and breech prior to removing the wooden block to prevent injury to personnel.

8. If using electric hydraulic pump (22), place manual valve (27) in upright position. Using the electric hydraulic pump, begin pumping to move the cannon tube off of the wooden block. Remove wooden block (see figure B-5).
9. If using electric hydraulic pump (22), turn manual valve (27). Release hydraulic pressure at the electric hydraulic pump allowing cannon tube (2) to return to battery.
10. Repeat steps 3, 4, 5, and 9.
11. Repeat steps 3, 4, and 5.

**WARNING**

The cannon tube must be blocked while lubricating to prevent cannon tube from returning to battery resulting in injury to personnel.

**CAUTION**

Do not use abrasives other than crocus cloth when cleaning to prevent damage to the buffer piston rod.

12. Block cannon (2) while out-of-battery with a 4-inch x 4-inch x 12-inch wooden block (29). Hold wooden block in position and slowly release pump pressure until wooden block stops cannon tube movement. Coat exposed buffer piston rod (28) surface lightly with hydraulic fluid. Remove wooden block.

**WARNING**

Be sure hands, arms, and loose clothing are clear of cannon tube and breech prior to removing the wooden block to prevent injury to personnel.

13. If using electric hydraulic pump (22), place manual valve (27) in upright position. Using the electric hydraulic pump, begin pumping to move the cannon tube off of the wooden block. Remove wooden block.
14. If using electric hydraulic pump (22), turn manual valve (27). Release hydraulic pressure at electric hydraulic pump allowing cannon tube (2) to return to battery.

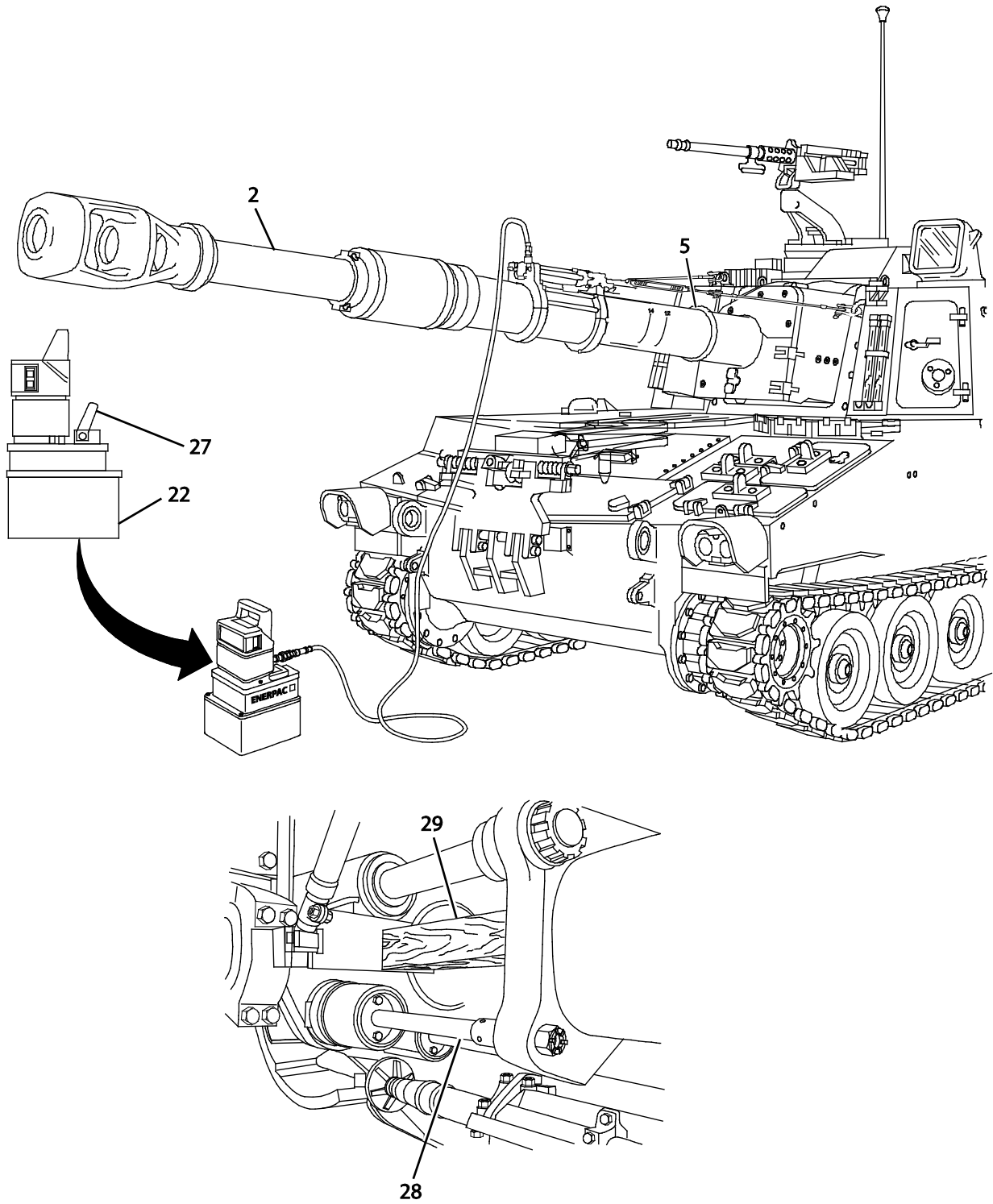


Figure B-5.

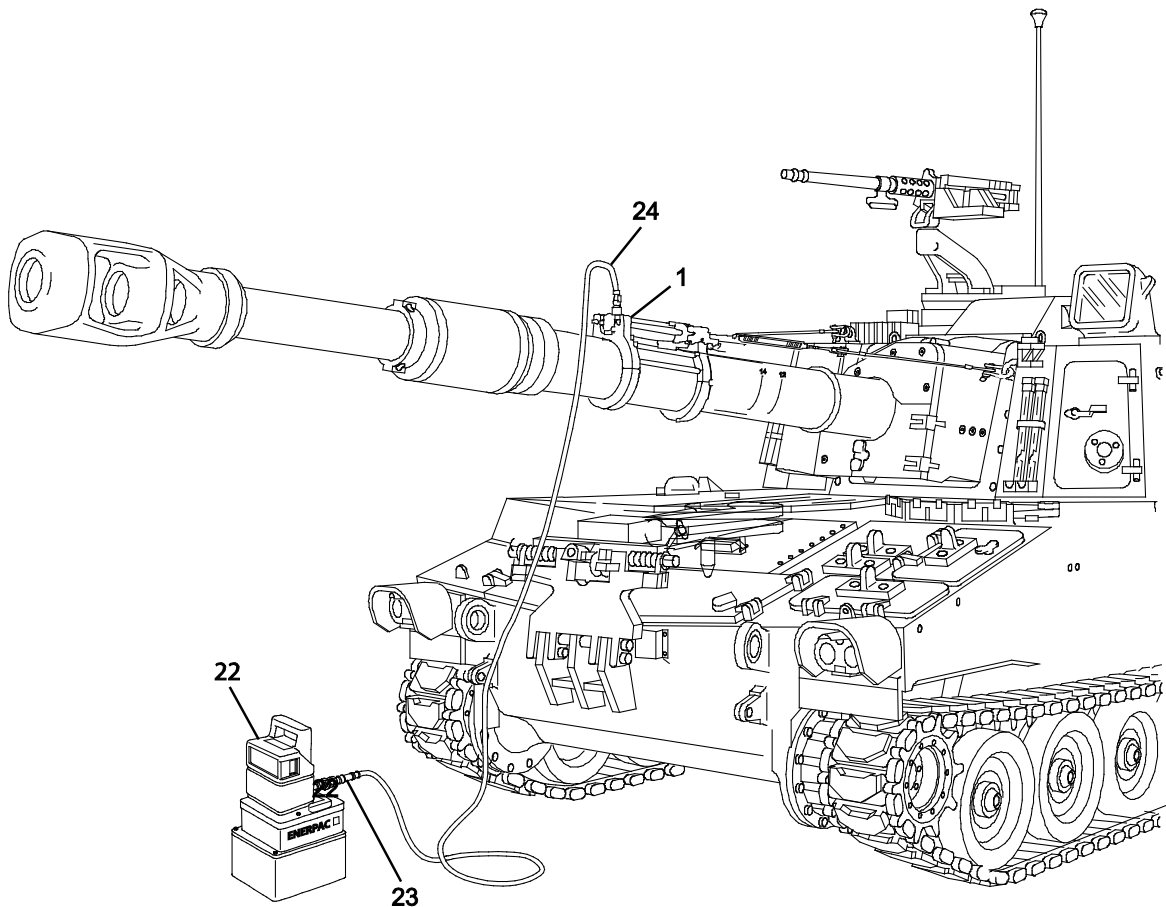
**B-3 Removal****WARNING**

Ensure all hydraulic pressure has been released before disconnecting hose assembly to avoid injury to personnel.

## NOTE

Before disconnecting hose assembly, place a suitable container below end being disconnected to catch excess hydraulic fluid. Dispose of hydraulic fluid in accordance with local regulations.

1. Disconnect hose assembly (24) from cylinder support assembly (1) and quick disconnect coupling (23) on electric hydraulic pump (22) (see figure B-6).



*Figure B-6.*

2. Loosen two turnbuckles (14) evenly to release tension on two wire rope assemblies (20) (see figure B-7).
3. Remove screw (21) and nut (22) from each of two turnbuckles (14). Remove two wire rope assemblies (20) from two turnbuckles. Install screw and nut in each of two turnbuckles.
4. Remove pin (16) from each of two 1-inch shackles (17) and remove two wire rope assemblies (20). Remove two 1-inch shackles from two cab lifting eyes (18) and (19). Install pin in each of two 1-inch shackles.
5. Remove pin (12) from each of two 5/8-inch shackles (13). Remove two 5/8-inch shackles from cylinder support assembly (1) and remove two turnbuckles (14). Install pin in each of two 5/8-inch shackles.

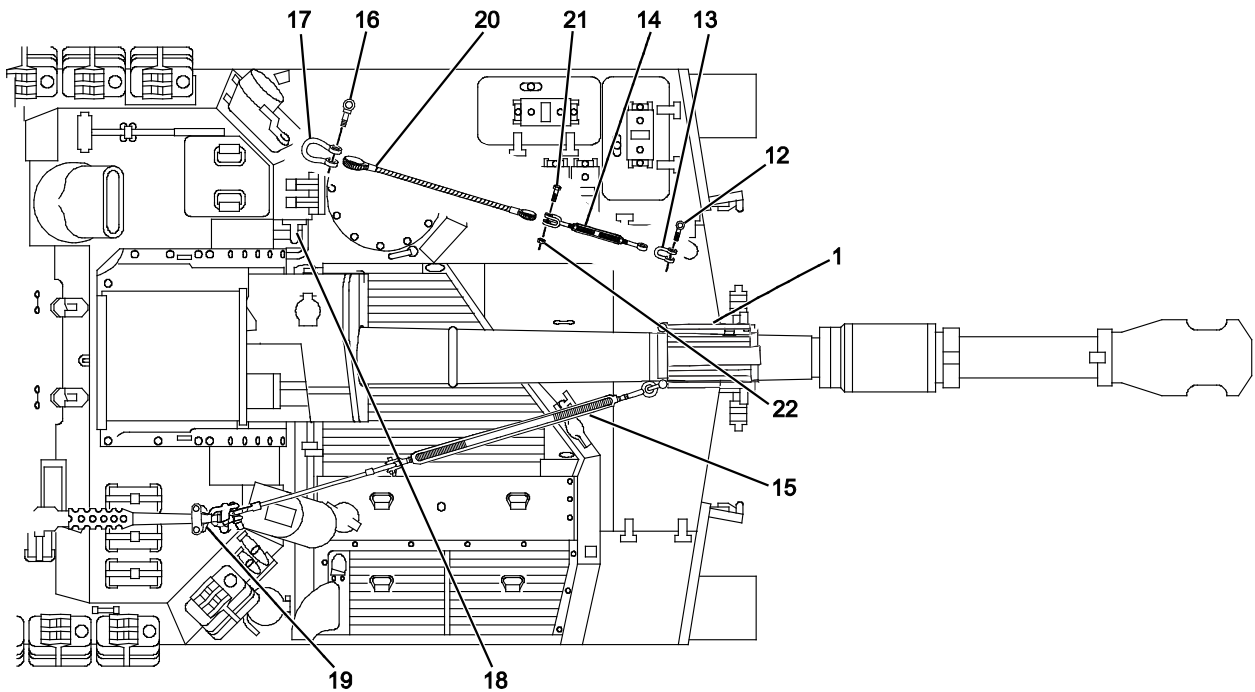


Figure B-7.



**WARNING**

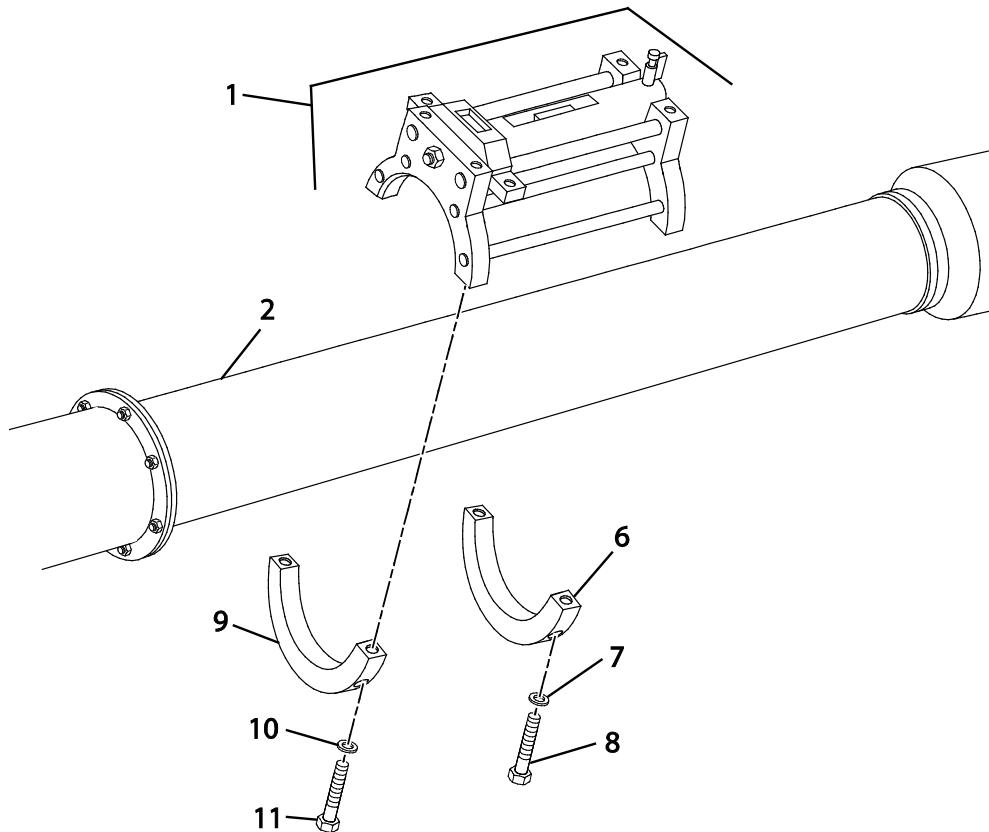
Ensure cylinder support assembly is held in place while the front and rear lower shoes are removed to prevent injury to personnel.

6. Remove two screws (11) and two flat washers (10) to remove lower rear shoe (9) from cylinder support assembly (1) (see figure B-8).
7. Remove two screws (8) and two flat washers (7) to remove lower front shoe (6) from cylinder support assembly (1).

**WARNING**

Cylinder support assembly weighs 85.7 pounds (38.87 kg). Two individuals are required to remove cylinder support assembly to prevent injury to personnel.

8. Remove cylinder support assembly (1) from cannon tube (2).



**Figure B-8.**



<b>RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS</b> For use of this form, see AR 25-30; the proponent agency is ODISC4.						Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE Date you filled out this form.
TO: <i>(Forward to proponent of publication or form) (Include ZIP Code)</i> U.S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 1 Rock Island Arsenal, Rock Island, IL 61299-7630						FROM: <i>(Activity and location) (Include ZIP Code)</i> Your mailing address	
<b>PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS</b>							
PUBLICATION/FORM NUMBER TB 9-1000-234-13						DATE 30 Sep 10	Title Technical Bulletin for Exercising of Recoil Mechanisms and Equilibrators
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Provide exact wording of recommended changes, if possible).	
						<b>SAMPLE</b>	
<i>*Reference to line numbers within the paragraph or subparagraph.</i>							
TYPED NAME, GRADE OR TITLE  <i>Your Name</i>						TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	Signature <i>Your Signature</i>

<b>TO: (Forward direct to addressee listed in publication)</b> U. S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 1 Rock Island Arsenal, Rock Island, IL 61299-7630	<b>FROM: (Activity and location) (Include ZIP Code)</b> Your address	<b>DATE</b> Date you filled out this form
--	---	--

**PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS**

PUBLICATION NUMBER TB 9-1000-234-13			DATE 30 Sep 10			TITLE Technical Bulletin for Exercising of Recoil Mechanisms and Equilibrators		
PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION
<b>SAMPLE</b>								

**PART III – REMARKS** (Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)

TYPED NAME, GRADE OR TITLE Your Name	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE Your Signature
---	--	-----------------------------

<p><b>RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS</b></p> <p>For use of this form, see AR 25-30; the proponent agency is ODISC4.</p>	<p>Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).</p>	<p>DATE</p>
--	--	-------------

<p>TO: (Forward to proponent of publication or form)(Include ZIP Code)</p> <p>U.S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 1 Rock Island Arsenal, Rock Island, IL 61299-7630</p>	<p>FROM: (Activity and location) (Include ZIP Code)</p>
---	---

**PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS**

<p>PUBLICATION/FORM NUMBER</p> <p>TB 9-1000-234-13</p>	<p>DATE</p> <p>30 Sep 10</p>	<p>TITLE Technical bulletin for Exercising of Recoil Mechanisms and Equilibrators</p>
--	------------------------------	---

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Provide exact wording of recommended changes, if possible).

<p>TYPED NAME, GRADE OR TITLE</p>	<p><i>*Reference to line numbers within the paragraph or subparagraph.</i></p> <p>TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION</p>	<p>SIGNATURE</p>
-----------------------------------	--	------------------

<b>TO: (Forward direct to addressee listed in publication)</b> U. S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 1 Rock Island Arsenal, Rock Island, IL 61299-7630	<b>FROM: (Activity and location) (Include ZIP Code)</b>	<b>DATE</b>
--	---	-------------

**PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS**

PUBLICATION NUMBER TB 9-1000-234-13					DATE 30 Sep 10		TITLE Technical Bulletin for Exercising of Recoil Mechanisms and Equilibrators	
PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

**PART III – REMARKS** (Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
----------------------------	--	-----------

<b>RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS</b>						Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	<b>DATE</b>
For use of this form, see AR 25-30; the proponent agency is ODISC4.							
<b>TO: (Forward to proponent of publication or form) (Include ZIP Code)</b> U. S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 1 Rock Island Arsenal, Rock Island, IL 61299-7630						<b>FROM: (Activity and location) (Include ZIP Code)</b>	
PUBLICATION/FORM NUMBER TB 9-1000-234-13						DATE 30 Sep 10	TITLE Technical Bulletin for Exercising of Recoil Mechanisms and Equilibrators
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Provide exact wording of recommended changes, if possible).	
<i>*Reference to line numbers within the paragraph or subparagraph.</i>							
TYPED NAME, GRADE OR TITLE				TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION		SIGNATURE	

<b>TO: (Forward direct to addressee listed in publication)</b> U. S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 1 Rock Island Arsenal, Rock Island, IL 61299-7630	<b>FROM: (Activity and location) (Include ZIP Code)</b>	<b>DATE</b>
--	---	-------------

**PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS**

PUBLICATION NUMBER TB 9-1000-234-13				DATE 30 Sep 10			TITLE Technical Bulletin for Exercising of Recoil Mechanisms and Equilibrators	
PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

**PART III – REMARKS** *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

--

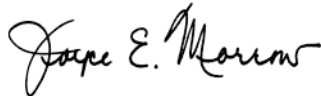
TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
----------------------------	--	-----------



By Order of the Secretary of the Army:

GEORGE W. CASEY, JR.  
*General, United States Army*  
*Chief of Staff*

Official:

A handwritten signature in black ink that reads "Joyce E. Morrow". The signature is written in a cursive style with a large, stylized initial "J".

JOYCE E. MORROW  
*Administrative Assistant to the*  
*Secretary of the Army*  
1025101

DISTRIBUTION: To be distributed in accordance with the initial distribution requirements for IDN 344014, requirements for TB 9-1000-234-13.



## THE METRIC SYSTEM AND EQUIVALENTS

<p><b>Linear Measure</b></p> <p>1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches          1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches          1 Kilometer = 1000 Meters = 0.621 Miles</p> <p><b>Weights</b></p> <p>1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces          1 Kilogram = 1000 Grams = 2.2 Pounds          1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons</p> <p><b>Liquid Measure</b></p> <p>1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces          1 Liter = 1000 Milliliters = 33.82 Fluid Ounces</p>	<p><b>Square Measure</b></p> <p>1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inches          1 Sq Meter = 10,000 Sq Centimeters = 10.76 Sq Feet          1 Sq Kilometer = 1,000,000 Sq Meters = 0.386 Sq Miles</p> <p><b>Cubic Measure</b></p> <p>1 Cu Centimeter = 1,000 Cu Millimeters = 0.06 Cu Inches          1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet</p> <p><b>Temperature</b></p> <p><math>9/5 \text{ } ^\circ\text{C} + 32 = \text{ } ^\circ\text{F}</math>  <math>5/9 (\text{ } ^\circ\text{F} - 32) = \text{ } ^\circ\text{C}</math>          212° Fahrenheit is equivalent to 100° Celsius          90° Fahrenheit is equivalent to 32.2° Celsius          32° Fahrenheit is equivalent to 0° Celsius</p>
--	---

## APPROXIMATE CONVERSION FACTORS

To Change	To Multiply By	To Change	
Inches	Centimeters	2.540	
Feet	Meters	0.305	
Yards	Meters	0.914	
Miles	Kilometers	1.609	
Sq Inches	Sq Centimeters	6.451	
Sq Feet	Sq Meters	0.093	
Sq Yards	Sq Meters	0.836	
Sq Miles	Sq Kilometers	2.590	
Acres	Sq Hectometers	0.405	
Cubic Feet	Cubic Meters	0.028	
Cubic Yards	Cubic Meters	0.765	
Fluid Ounces	Milliliters	29.573	
Pints	Liters	0.473	
Quarts	Liters	0.946	
Gallons	Liters	3.785	
Ounces	Grams	28.349	
Pounds	Kilograms	0.454	
Short Tons	Metric Tons	0.907	
Pound-Feet	Newton-Meters	1.356	
Pounds per Sq Inch	Kilopascals	6.895	
Miles per Gallon	Kilometers per Liter	0.425	
Miles per Hour	Kilometers per Hour	1.609	
	<b>To Multiply By</b>		
	Centimeters	Inches	0.394
	Meters	Feet	3.280
	Meters	Yards	1.094
	Kilometers	Miles	0.621
	Sq Centimeters	Sq Inches	0.155
	Sq Meters	Sq Feet	10.764
	Sq Meters	Sq Yards	1.196
	Sq Kilometers	Sq Miles	0.386
	Sq Hectometers	Acres	2.471
	Cubic Meters	Cubic Feet	35.315
	Cubic Meters	Cubic Yards	1.308
	Milliliters	Fluid Ounces	0.034
	Liters	Pints	2.113
	Liters	Quarts	1.057
	Liters	Gallons	0.264
	Grams	Ounces	0.035
	Kilograms	Pounds	2.205
	Metric Tons	Short Tons	1.102
	Newton-Meters	Pound-Feet	0.738
	Kilopascals	Pounds per Sq Inch	0.145
	Kilometers per Liter	Miles per Gallon	2.354
	Kilometers per Hour	Miles per Hour	0.621

PIN: 071588-000