CHAPTER 2

OPERATING INSTRUCTIONS

Section Index

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

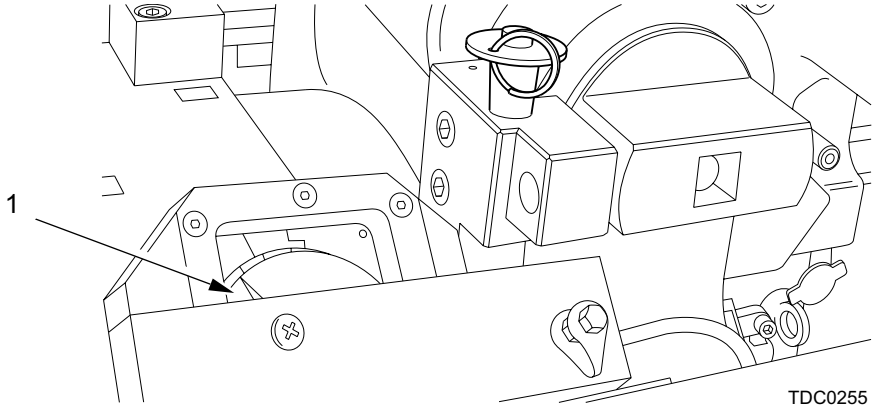
2-1 GENERAL

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

2-2 CANNON CONTROLS AND INDICATORS

a. Thermal Warning Device (TWD) (1). Measures the temperature of the cannon tube in a region just behind the origin of rifling. Different misfire/check firing procedures apply, dependant on whether the indicator points to the green, yellow or red area of the dial. See Paragraphs 2-59 through 2-62 for misfire and check firing procedures.

2-2 CANNON CONTROLS AND INDICATORS (cont)

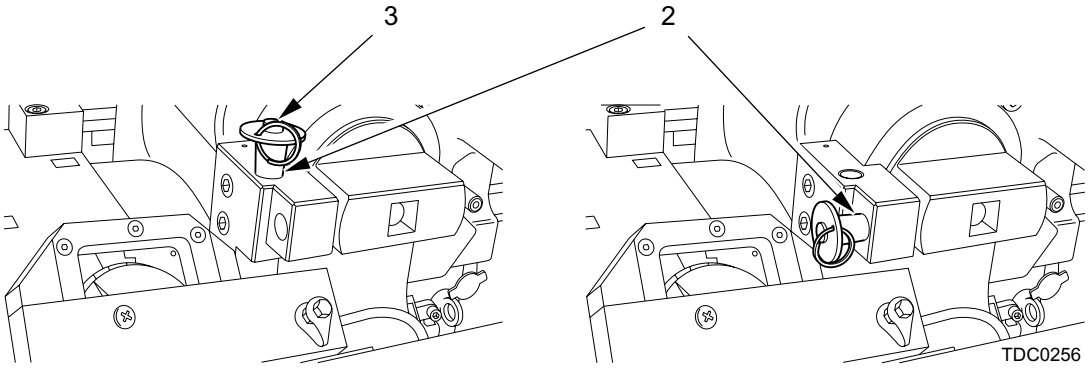


b. Breech Crank Locking Pin (2) is located on the left side of the breech ring. It is used during sticker procedures.

(1) To stow pin (2) depress release button (3), lift out and insert pin into crank lock bracket.

(2) To engage pin (2) depress release button (3), lift up and insert pin into crank.

Stow **Engage**

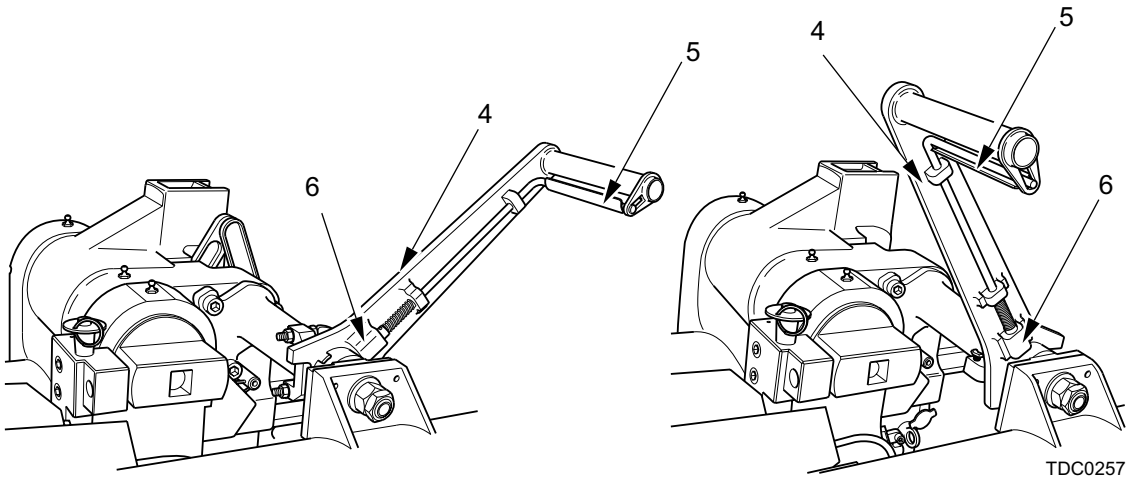


c. Primer Feed Mechanism (PFM) Manual Handle (4) is located on the top left cradle tube. It is used for loading and extracting primers during fire mission cycles.

(1) To load a primer, squeeze lever (4) and handle (5) together and pull handle to the PRIMED position. Ensure detent (6) is engaged.

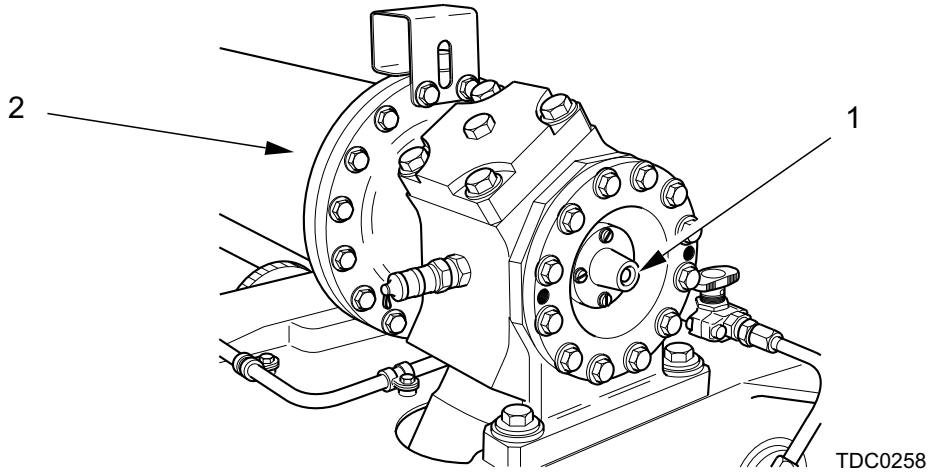
(2) To extract a primer, squeeze lever (4) and handle (5) together and push handle to the EXTRACT position. Ensure detent (6) is engaged.

Primed **Extract**



2-3 RECOIL MECHANISM CONTROLS AND INDICATORS

a. Oil Index Pin (1) is located on the rear of the accumulator (2). The oil index pin provides an indication of low oil status within the recoil system; if the oil index pin is not flush a low oil condition exists.

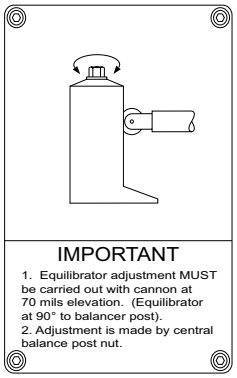


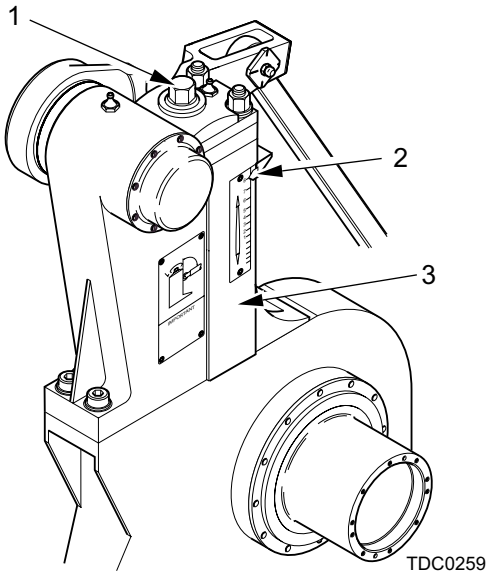
2-4 CARRIAGE CONTROLS AND INDICATORS

a. Equilibrator Adjustment Screws (1) and Indicator (2) are located on each equilibrator post (3). Use to adjust equilibrators during minor temperature changes, correcting for unequal force required to turn elevation handwheel during elevation or depression of cannon tube.

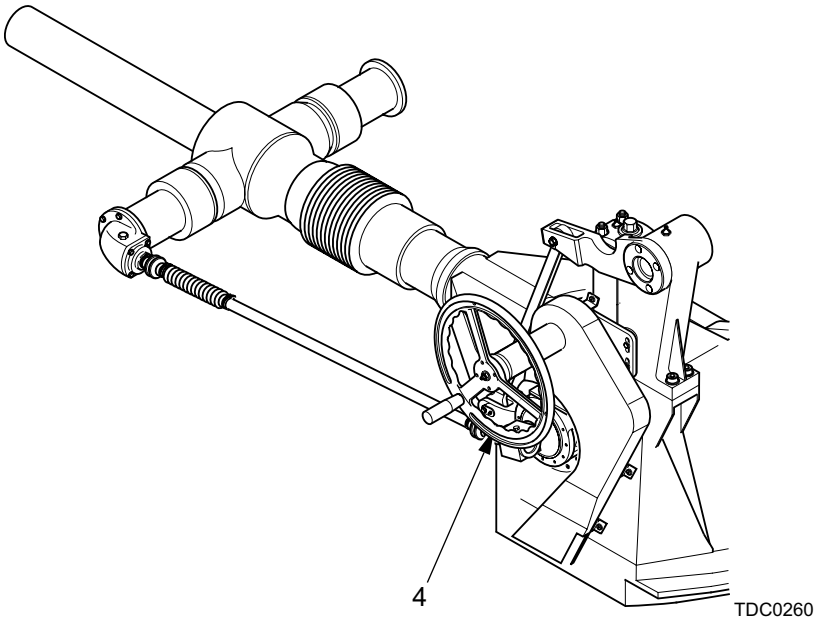
2-4 CARRIAGE CONTROLS AND INDICATORS (cont)

(1) Difficult to Elevate or Depress. Using equilibrator socket wrench turn equilibrator screws (1) CW or CCW (adjust indicator (2) at 1/2 increments only) until effort required to elevate or depress cannon tube is equal. If equal effort between elevation and depression cannot be obtained, notify unit maintenance.

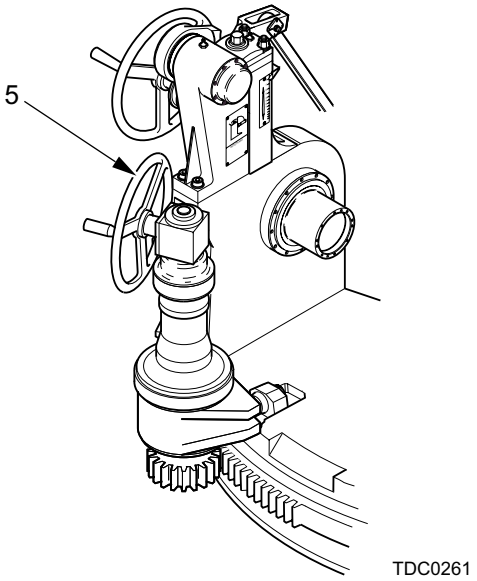




b. Elevation Handwheels (4). Control elevation and depression of the cannon from either or both sides of the howitzer. To operate the handwheels on the Gunner's side, turning handwheel CW elevates cannon and turning handwheel CCW depresses cannon. On the Assistant Gunner's side, turning handwheel CW depresses cannon and turning handwheel CCW elevates cannon. One complete turn of the handwheel is approximately 10 mils (0.5 deg).



c. Traverse Handwheel (5) is used for traversing the top carriage during firing operations and to stow during traveling. Turning handwheel CW moves cannon to the right; turning handwheel CCW moves cannon left.



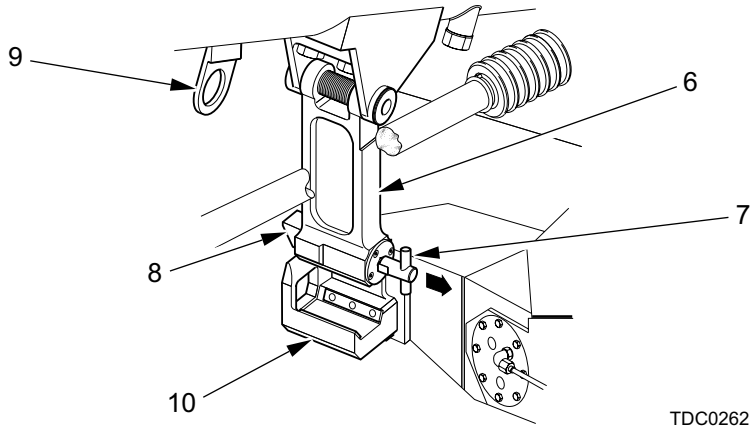
d. Travel Locks (6) are located on the lower cradle tubes and secures the top and bottom carriage together when the howitzer is towed.

(1) To disengage travel locks (6), pull tee-bar (7) out, elevate howitzer then raise lock and engage plunger (8) into stowage bracket (9).

CAUTION

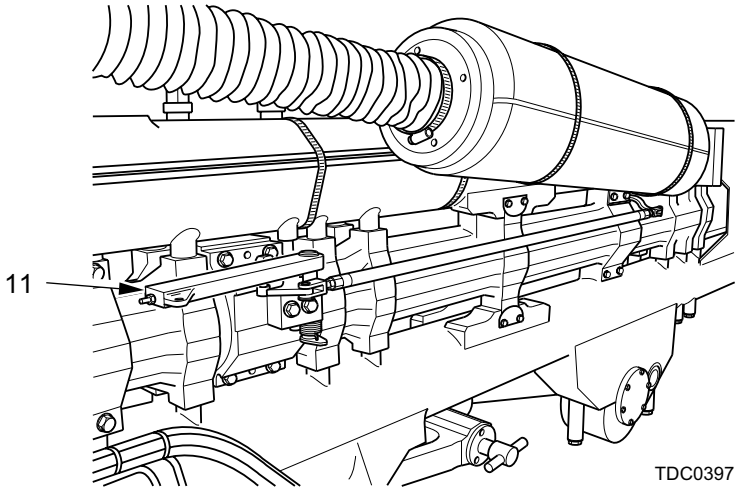
Before engaging travel locks, ensure traverse lock is engaged. Failure to do so will damage equipment.

(2) To engage travel locks (6), elevate cannon tube until locks clear locking bracket (10). Pull tee-bar (7) out and allow lock to swing to a vertical position. Depress cannon tube until plunger (8) engages locking bracket. Ensure travel locks are engaged.



2-4 CARRIAGE CONTROLS AND INDICATORS (cont)

e. Firing Lever (11) is located on the right hand side of the recoil cylinder. To fire the howitzer, attach lanyard to lever and pull lanyard.

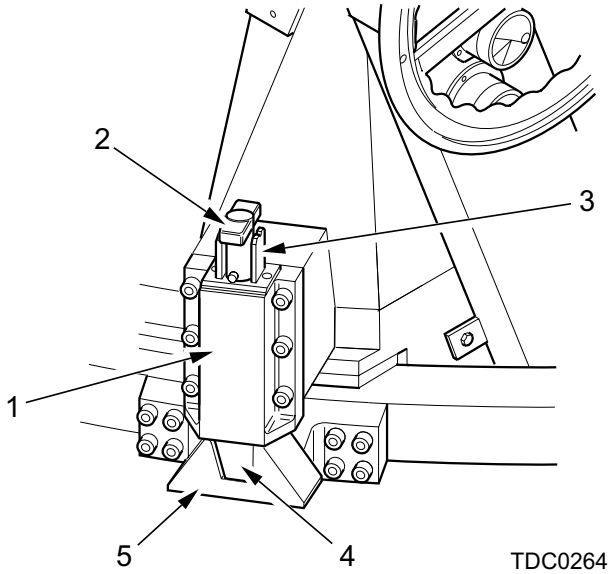


2-5 TOP CARRIAGE CONTROLS AND INDICATORS

a. Traverse Lock (1) is located at the right rear of the saddle and secures the saddle to the body, to prevent damage to the traverse gear.

(1) To disengage lock (1), raise and turn tee-handle (2) and lower onto the slot (3) provided.

(2) To engage lock (1), raise and turn tee-handle (2) and lower into lock. Traverse howitzer until plunger (4) engages bracket (5).

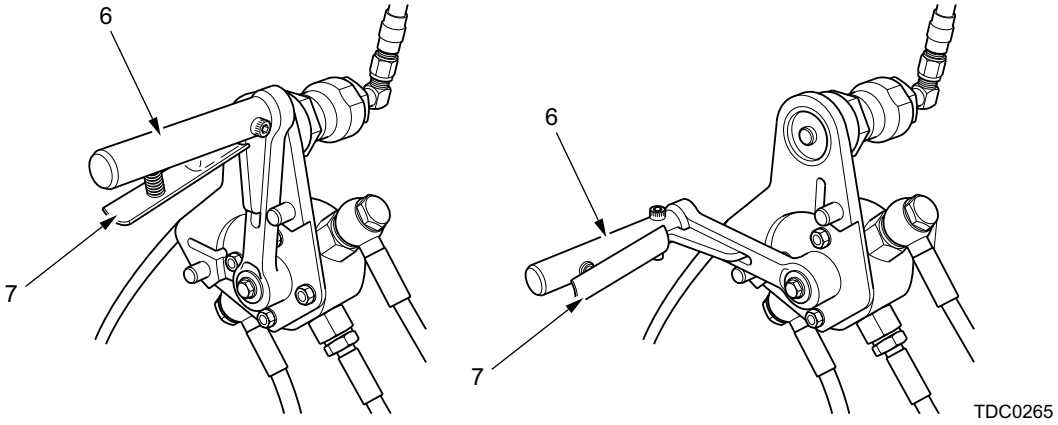


b. Breech Lever (6) is located on the left recoil cylinder and controls the breech, when opening and closing.

(1) To open the breech, squeeze lever (6) and handle (7) together and pull the lever rearward to the OPEN position.

(2) To close the breech, squeeze lever (6) and handle (7) together and push the lever forward to the CLOSE position.

Open **Close**

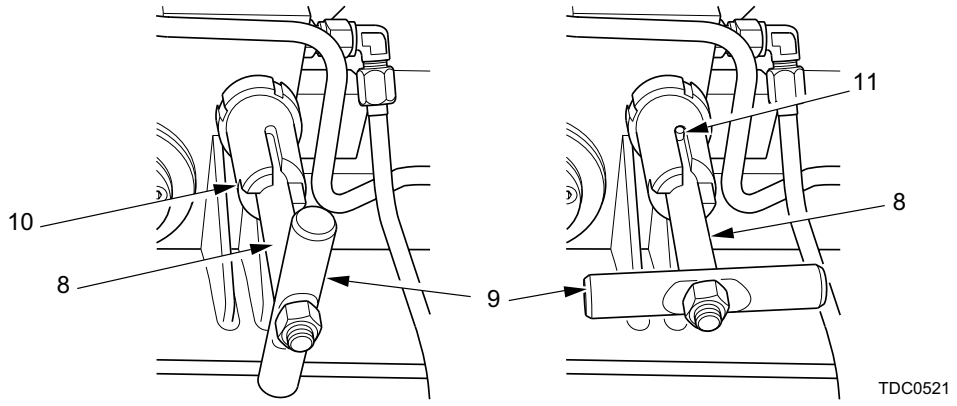


c. Breech Lock Out Plunger (8) is provided for maintenance purposes and can only be engaged when the breech is open.

(1) To engage plunger (8), pull tee-bar (9) out and turn 90° CCW, release tee-bar and allow plunger to engage horizontal slot (10).

(2) To disengage plunger (8), pull tee-bar (9) out and turn 90° CW, release tee-bar and allow plunger to engage vertical slot (11).

To Engage **To Disengage**



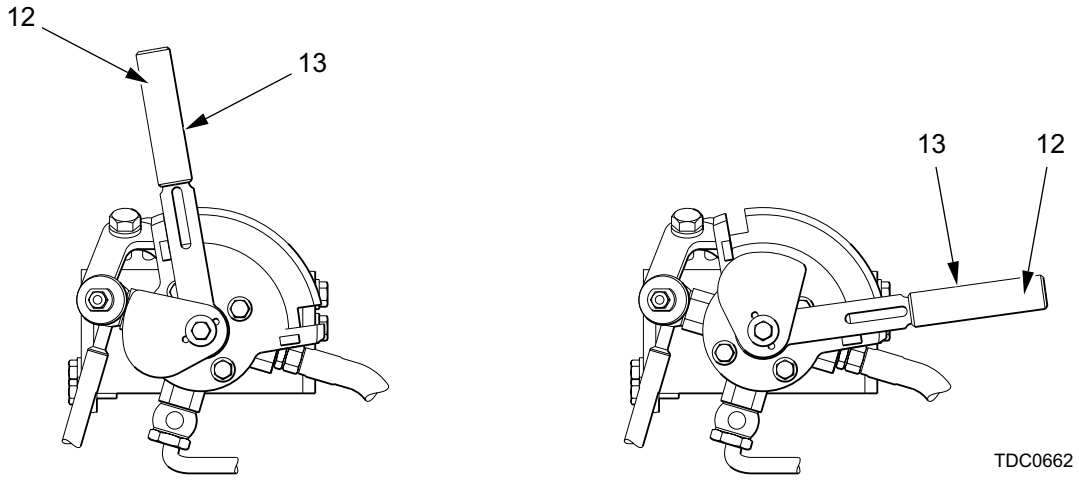
2-5 TOP CARRIAGE CONTROLS AND INDICATORS (cont)

d. Loading Tray Lever (12) is located on the top right rear cradle tube and controls the loading tray, when lowering and raising.

(1) To lower the tray, squeeze lever (12) and handle (13) together and push lever to the DOWN position.

(2) To raise the tray, squeeze lever (12) and handle (13) together and pull lever to the UP position.

Lower **Raise**

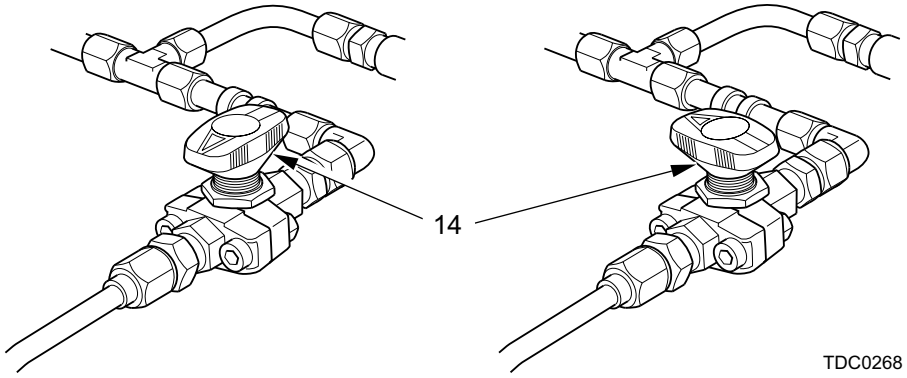


e. Scavenge Isolator Valve (14) is located on the center bridge and isolates the scavenge pump from the breech actuator and loading system. The valve is only closed for maintenance and manual procedures.

(1) To open the scavenge system from the closed position, turn valve (14) CCW.

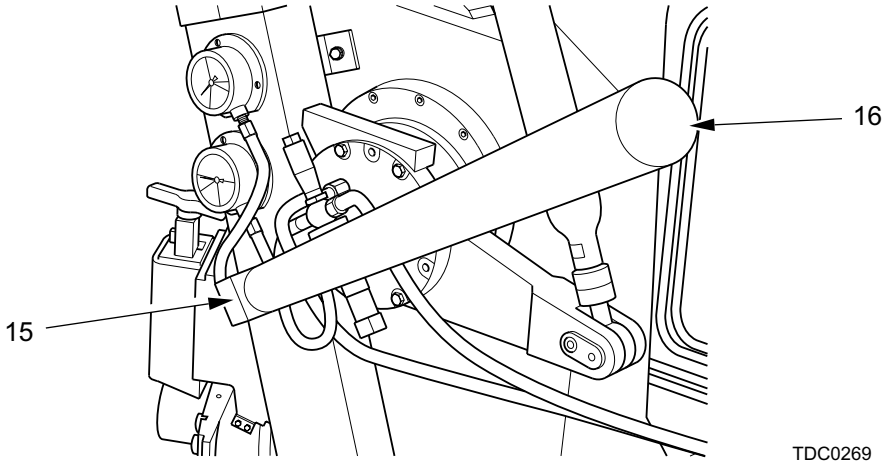
(2) To close the scavenge system from the open position, turn valve (14) CW.

Open **Closed**



f. Trunnion Pump (15) is located on the right trunnion post and is used to pressurize the scavenge system, and manual operations.

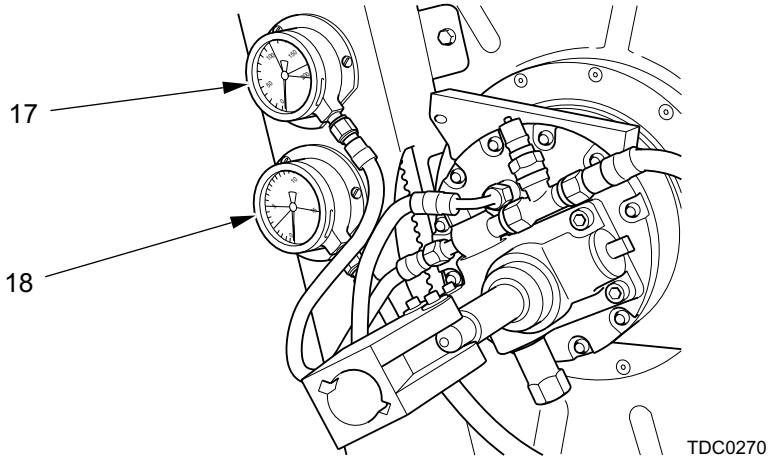
(1) To operate the trunnion pump (15), insert pump handle (16) into the pump adaptor. Pump on handle until the system is pressurized to 1761psi (120 bar).



g. High Pressure (HP) and Low Pressure (LP) Gauges are located on the right saddle post.

(1) The HP gauge (17) indicates scavenge system pressure.

(2) The LP gauge (18) indicates exhaust cylinder pressure.



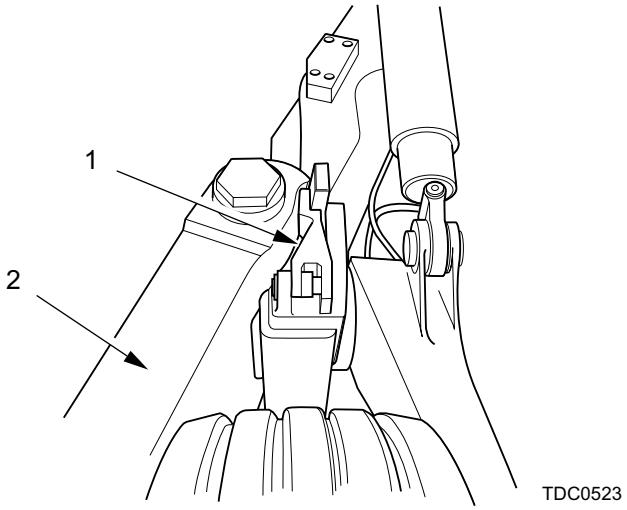
2-6 BOTTOM CARRIAGE CONTROLS AND INDICATORS

a. Stabilizer Locking Latches (1) are located on the front of the body and secure the stabilizers in the towed or firing position.

(1) To deploy stabilizers (2) into the firing position, raise latch (1) and swing stabilizer forward, ensuring latch re-engages.

(2) To stow stabilizers (2) into the stowed position, raise latch (1) and swing stabilizer rearward, ensuring latch re-engages.

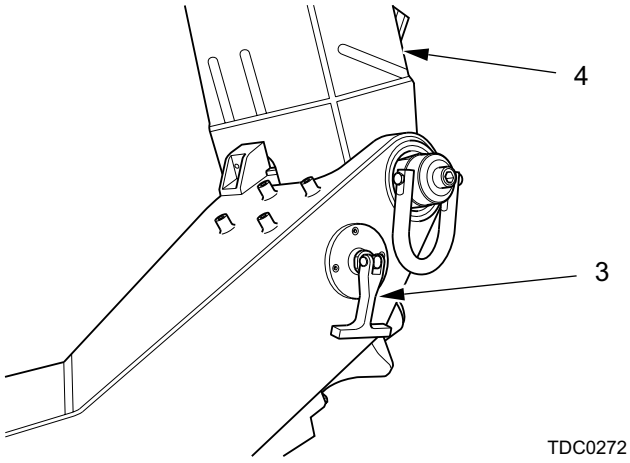
2-6 BOTTOM CARRIAGE CONTROLS AND INDICATORS (cont)



b. Trail Arm Locking Plungers (3) are located to the rear of the body and secures the trail arm in the firing or towed position.

(1) To disengage locking plunger (3), pull handle out and move trail arm (4) to the stowed or firing position.

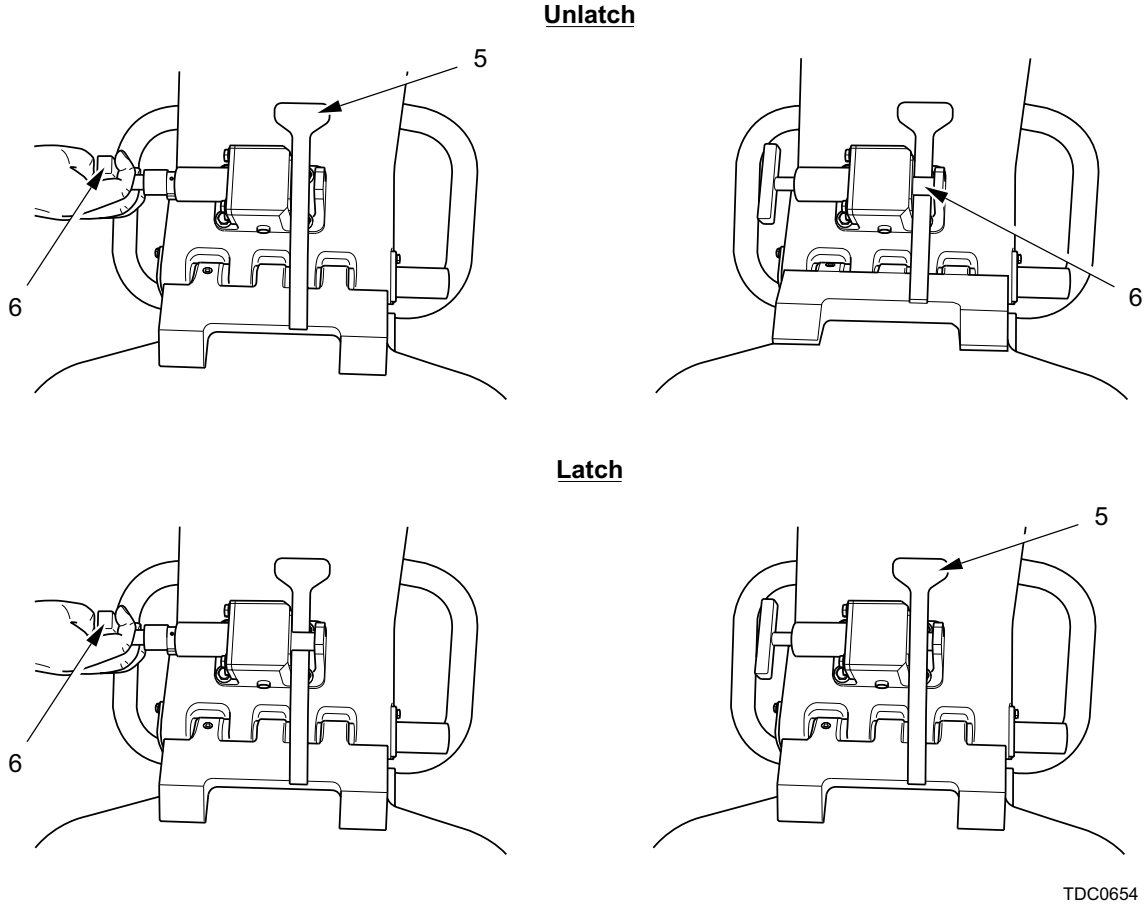
(2) To engage locking plunger (3), allow plunger to return to the engaged position. Ensure locking plunger is engaged.



c. Spade Locking Latches (5) are located between the trail arm and spade assemblies and are used to secure the spade in the firing position.

(1) To unlatch the spade assembly from the trail arm, pull spade locking plunger (6) out and push spade locking latch (5) down to the open position, allow plunger to return over the latch. Ensure plunger is engaged.

(2) To latch the spade assembly, pull spade locking plunger (6) out and turn 90° CW and lock. Spade locking latch (5) will return to the closed position. Relatch spade assembly to the trail arm, by lifting spade towards trail arm and latch. When spade is latched, turn plunger 90° CCW. Ensure plunger is engaged.

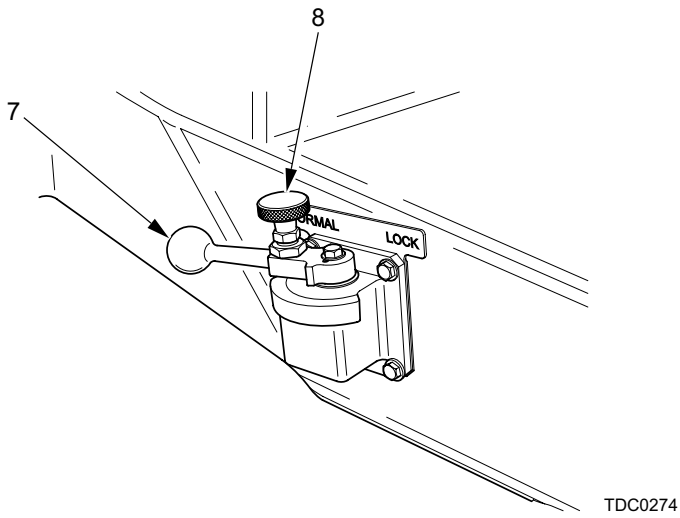


d. Spade Damper Lever (7) are located on the inside of the rear body, each trail arm has a two position spade damper, which assists spade emplacement during firing.

(1) To engage lever (7) into the locked position, pull plunger (8) up and swing lever rearward to the LOCK position. Plunger will automatically engage.

(2) To engage lever (7) into the normal position, pull plunger (8) up and swing lever forward to the NORMAL position. Plunger will automatically engage.

2-6 BOTTOM CARRIAGE CONTROLS AND INDICATORS (cont)

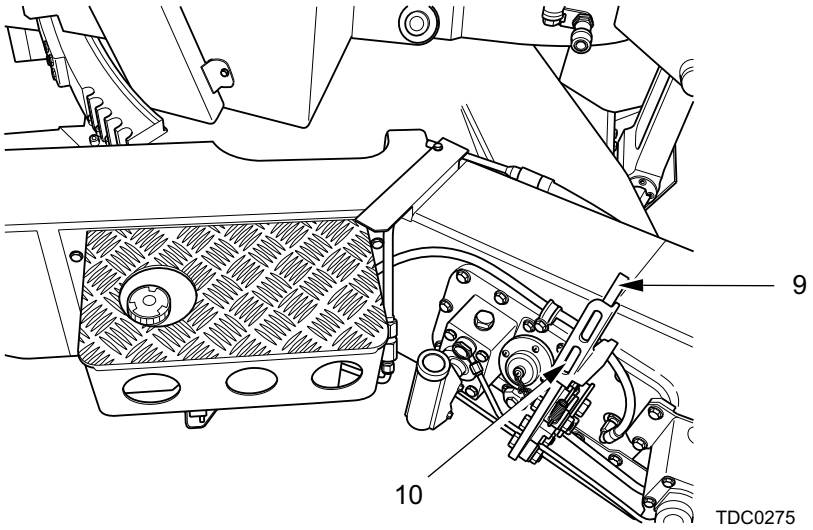


e. Handbrakes (9) are located on either side of the body; the handbrake is used to prevent howitzer movement.

NOTE
Excessive force is not required to apply handbrakes.

(1) To apply handbrake, pull lever (9) out.

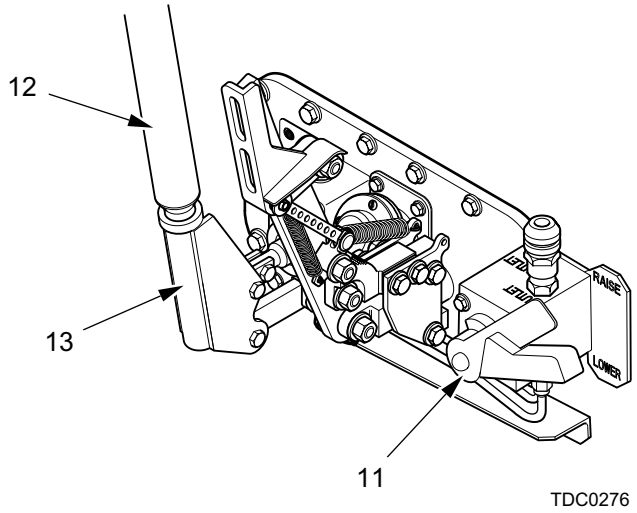
(2) To release handbrake, squeeze lever (9) and handle (10) together and push lever in fully.



f. Suspension Levers (11) are located on either side of the body, and are used when raising or lowering the howitzer.

(1) To lower the howitzer, move lever (11) to the LOWER position.

(2) To raise the howitzer, move lever (11) to the RAISE position. Install pump handle (12) into pump adaptor (13) and pump on handle until the howitzer is raised.

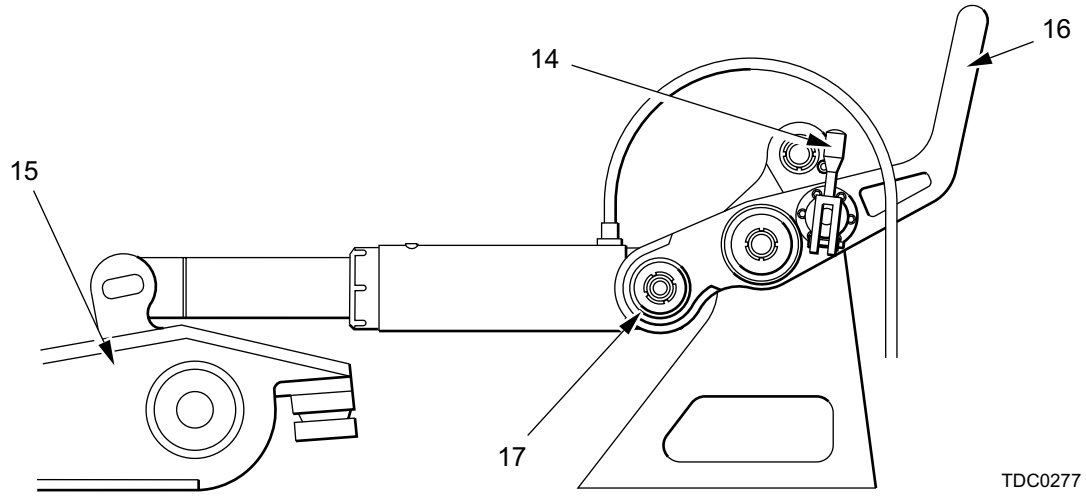


g. Wheel Locking Levers (14) are located on either side of the howitzer, and are used when raising and lowering the wheel assembly.

NOTE
Excessive force is not required to disengage hydrostrut lock.

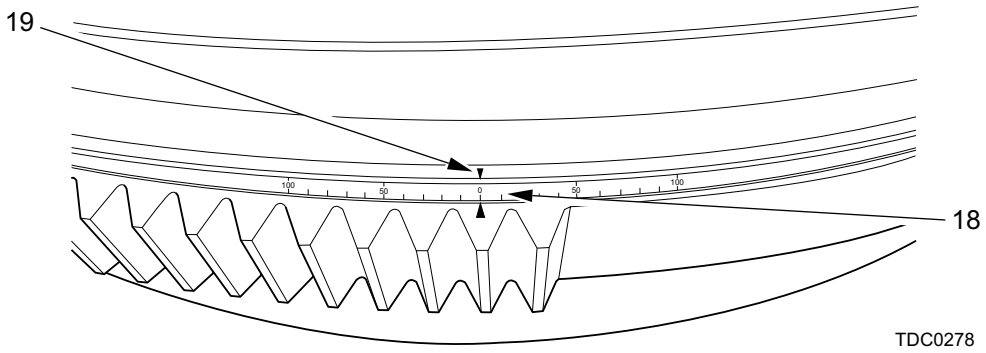
(1) To raise the wheel assembly (15) onto the body, pull locking lever (14) out and move crank handle (16) up until hydrostrut lock (17) is disengaged. Lift wheel assembly onto body.

(2) To lower the wheel assembly (15) onto the ground, lift and push wheel assembly. Ensure that hydrostrut lock (17) is engaged.



h. Coarse Azimuth Scale (18) is located above the traverse rack, and indicates saddle and top carriage traverse angle in mils. The azimuth scale is read in conjunction with a scribe line on the saddle (19).

2-6 BOTTOM CARRIAGE CONTROLS AND INDICATORS (cont)



2-7 M171A1 TELESCOPE AND QUADRANT MOUNT AND M17A1 FIRE CONTROL QUADRANT CONTROLS AND INDICATORS

a. M171A1 Telescope and Quadrant Mount (1). Provides a mount for the Pantel and the M17A1 fire control quadrant (2).

b. Cover (3). Protects surface of M171A1 telescope and quadrant mount (1).

c. Latches (4). Hold Pantel to M171A1 telescope and quadrant mount (1).

d. Pitch Level Control Knob (5). Centers the bubble in the pitch level vial (6).

e. M17A1 Fire Control Quadrant (2). Controls the cannon tube elevation during one-person indirect fire and laying operations.

f. Elevation Control Knob (7). Changes the reading in the elevation counter (8).

g. Elevation Counter (8). Registers cannon tube elevation in mils during laying and one-person operations.

h. Elevation Correction Counter (9). Registers corrections in mils during one-person operations.

i. Elevation Correction Knob (10). Changes the readings in the elevation correction counter (9).

j. Elevation Level Vial (11). When the bubble in the elevation level vial is centered, the M17A1 fire control quadrant (2) is level vertically.

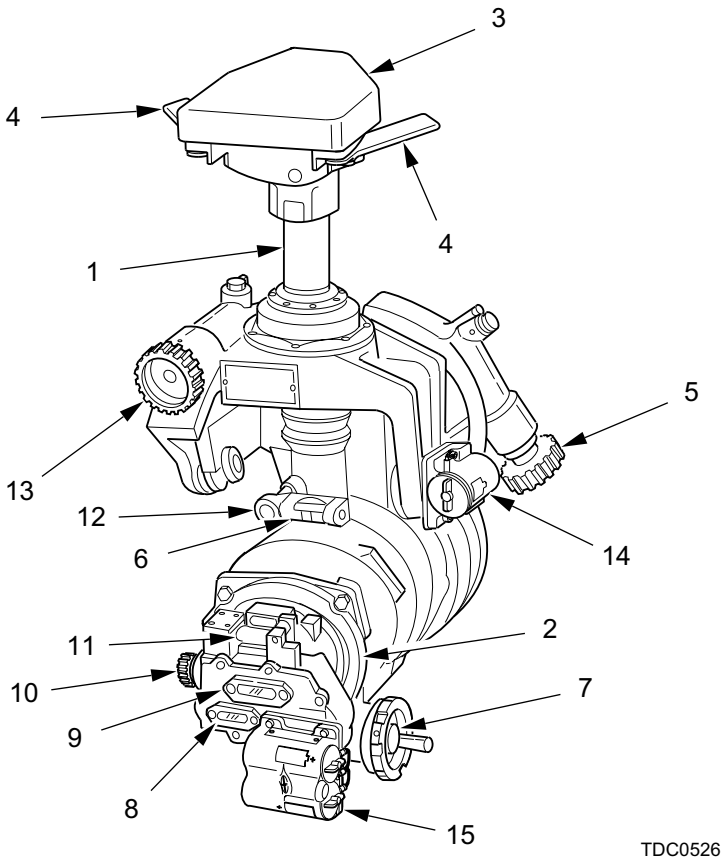
k. Pitch Level Vial (6). When the bubble in the pitch level vial is centered, the M171A1 telescope and quadrant mount (1) is level vertically.

l. Cross Level Vial (12). When the bubble in the cross level vial is centered, the M171A1 telescope and quadrant mount (1) is level horizontally.

m. Cross Level Control Knob (13). Centers the bubble in the cross level vial (12).

n. Single Battery Enclosure (14). Houses the battery that provides power to illuminate the M171A1 telescope and quadrant mount level vials.

o. Double Battery Enclosure (15). Houses the batteries that provide power to illuminate the M17A1 fire control quadrant level vials and counters.



2-8 M172A1 TELESCOPE AND QUADRANT MOUNT AND M18A1 FIRE CONTROL QUADRANT CONTROLS AND INDICATORS

a. M172A1 Telescope and Quadrant Mount (1). Provides a mount for M18A1 fire control quadrant (2) and M138A1 elbow telescope.

b. Elevation Correction Knob (3). Changes the reading in the elevation correction counter (4).

c. Elevation Level Vial (5). When the bubble in the elevation level vial is centered, the M18A1 fire control quadrant (2) is level vertically.

d. Cross Level Vial (6). When the bubble in the cross level vial is centered, the M18A1 fire control quadrant (2) is level horizontally.

e. Elevation Correction Counter (4). Registers elevation corrections in mils.

f. Elevation Control Knob (7). Changes the readings in the elevation counter (8).

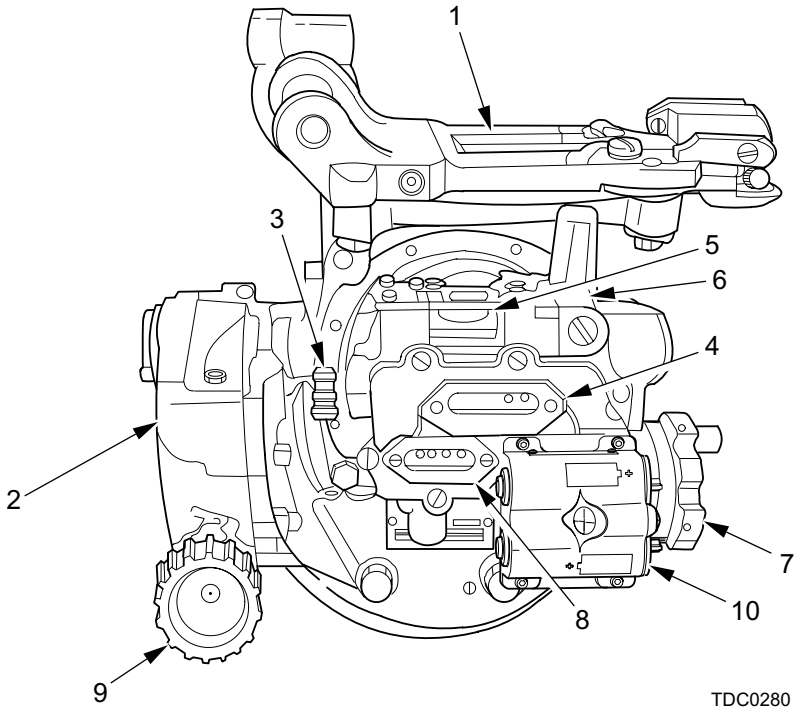
g. Elevation Counter (8). Registers the cannon tube elevation in mils.

h. M18A1 Fire Control Quadrant (2). Controls cannon tube elevation during all operations.

i. Cross Level Control Knob (9). Turning the cross level control knob centers the bubble in the cross level vial (6).

2-8 M172A1 TELESCOPE AND QUADRANT MOUNT AND M18A1 FIRE CONTROL QUADRANT CONTROLS AND INDICATORS (cont)

j. Double Battery Enclosure (10). Houses the batteries that provide power to illuminate the M18A1 fire control quadrant level vials and counters.



2-9 PANTEL CONTROLS AND INDICATORS

a. Pantel (1). Provides direction indirect fire operations.

b. Parallax Shield (2). Reduces distortion and glare and protects the lens.

c. Elevation Knob (3). Raises and lowers the recticle pattern in the Pantel (1).

d. Azimuth Knob (4). Turns the top of the Pantel (1) and changes the readings in the deflection counter (5) and the azimuth counter (6).

e. Azimuth Knob Bar (7). When turned CW (so the word, DIRECT, faces the Gunner), the Pantel (1) will click every 5 mils.

f. Deflection Knob (8). When pushed to the left, keeps the deflection counter (5) from moving while the azimuth knob (4) is turned.

g. Gunner's Aid Knob (9). Changes the reading in the correction counter (10).

h. Locking Pin (11). When raised, locks elbow assembly with eyepiece (12). When locking pin is depressed, the elbow assembly and eyepiece may be moved horizontally.

i. Eyepiece (12). Provides a means for looking through the Pantel (1). Rubber eyeshield (13) protects the eye and prevents fogging.

j. Correction Counter (10). Registers left and right correction values in mils.

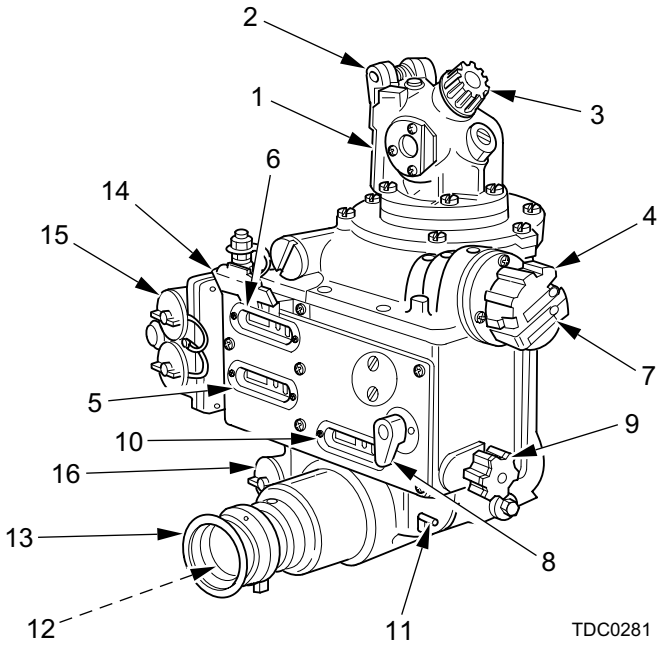
k. Deflection Counter (5). Registers deflection movement in mils.

l. Azimuth Counter (6). Registers azimuth travel in mils.

m. Azimuth Counter Door (14). Covers and protects the azimuth counter (6).

n. Double Battery Enclosure (15). Houses the batteries that provide power to illuminate the Pantel quadrant counters.

o. Single Battery Enclosure (16). Houses the battery that provides power to illuminate the Pantel and quadrant reticle.



2-10 M138A1 ELBOW TELESCOPE CONTROLS AND INDICATORS

a. The M138A1 Elbow Telescope (1). Provides elevation in direct fire operations.

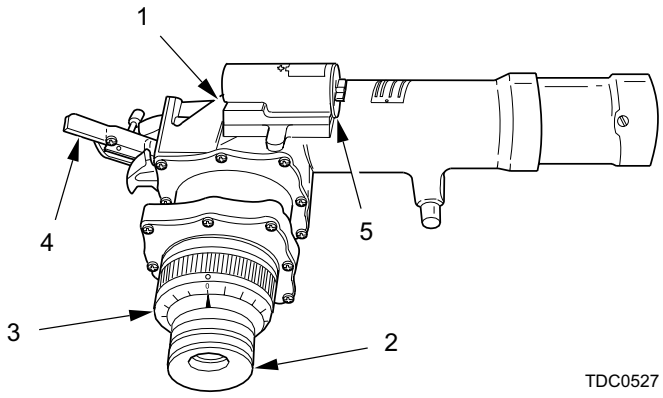
b. Eyeshield (2). Provides a means to look through the M138A1 elbow telescope (1) and protects the eye.

c. Diopter Scale (3). Provides adjustment focus.

d. Locking Latch (4). Holds the telescope (1) to the M172A1 telescope and quadrant mount.

e. Single Battery Enclosure (5). Houses the battery that provides power to illuminate the M138A1 elbow telescope reticle.

2-10 M138A1 ELBOW TELESCOPE CONTROLS AND INDICATORS (cont)



2-11 SECTION CHIEF CONTROL AND DISPLAY UNIT (CSD) CONTROLS AND INDICATORS

a. Section Chief Control and Display Unit (CSD). The CSD provides visual data interface between the DFCS and SC.

b. PWR. Removes power to the CSD only.

c. TEST. Momentary action switch provides a means to test function of display screen.

d. Numeric Key Pad (0 thru 9). Allows operator to enter numeric values.

e. CLR. Clears an entry from the display and returns entry point to previous operation.

f. ENT. Key function to enter data into the MSC database.

g. GNR/CSD. Future application (not currently used).

h. NVG. Sets the screen brightness for use with night vision goggles.

i. BRT UP. Momentary action switch increases the brightness of the display by one level.

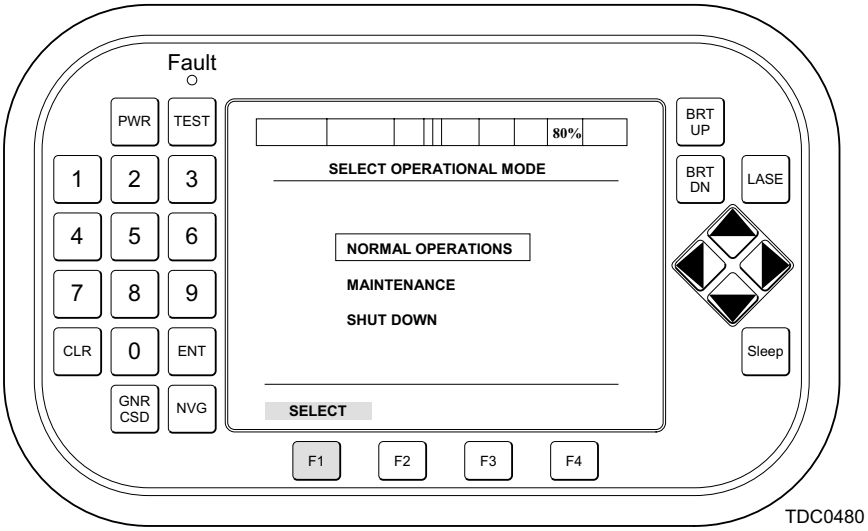
j. BRT DN. Momentary action switch decreases the brightness of the display by one level.

k. LAZE. (Future application not currently used).

l. CURSOR KEYS. Allows the operator to move the cursor on the screen in order to make a menu selection.

m. SLEEP. When depressed, saves power by turning off the screen display. By depressing any key on the right side of the CSD display, the last screen displayed will again be visible.

n. F1 – F4 Keys. A set of function keys used to select commands that appear above the keys depending on the screen being displayed.

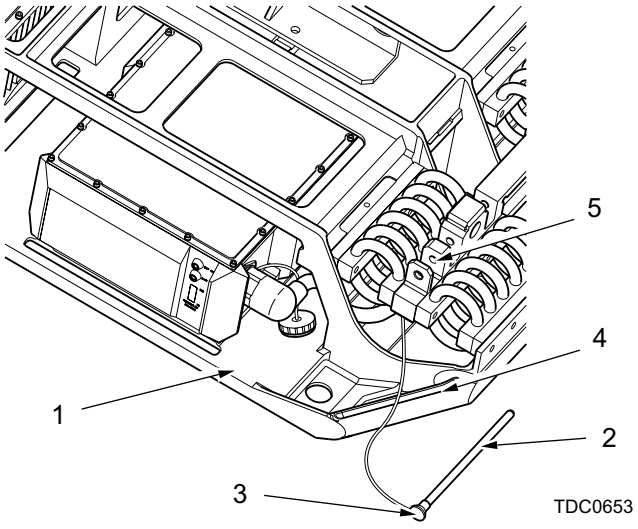


2-12 UNDER CRADLE ELECTRONIC ASSEMBLY CONTROLS AND INDICATORS

a. Under Cradle Electronic Assembly (1) is located and mounted to the underside of the cradle assembly. Provides installation for the following DFCS LRUs, MSC, PSP and BATT.

(1) To unlatch and lower the under cradle electronic assembly from the cradle assembly, pull quick release pin (2) out by pressing plunger (3) and using handle (4), lower the under cradle electronic assembly.

(2) To latch under cradle electronic assembly to the cradle assembly, using handle (4), lift assembly until quick release holes (5) are aligned, insert quick release pin (2). Ensure pin is engaged.



2-13 MISSION COMPUTER (MSC) CONTROLS AND INDICATORS

a. Mission Computer (MSC) is located under the cradle assembly and is mounted to the under cradle electronics assembly. Provides an interface between all DFCS components. Displays operator information at the CSD, GND and AGD units.

b. OFF/RESET SWITCH is a spring-loaded two-position OFF/RESET SWITCH, located on the side of the MSC enclosure and provides MSC system reset capability through interruption of its power supply.

NOTES

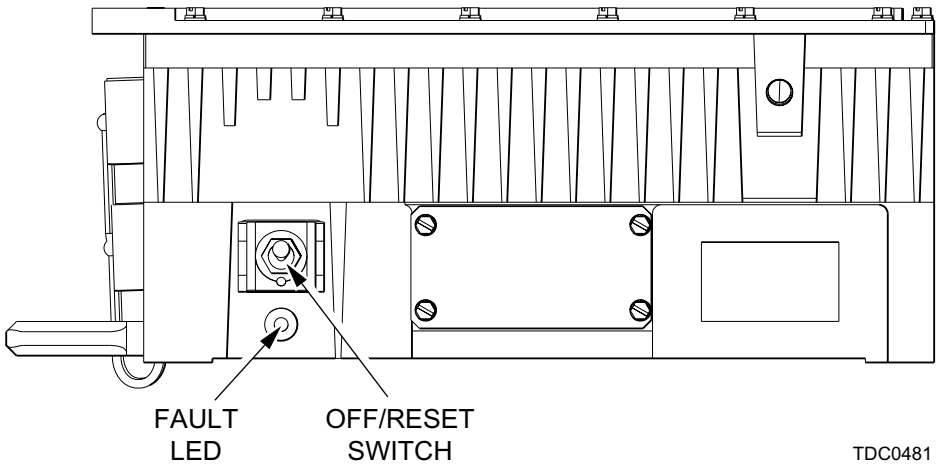
Resetting the MSC is not considered a controlled shut down. It may take longer to complete initialization on the next power up cycle.

If the previous power down was not completed in a controlled manner, a warning message will be displayed to the SC on the CSD that an abnormal power down had previously occurred.

To apply power to the MSC from an OFF state the SC must select “DFCS ON” switch at the PSP.

c. FAULT LED is located on the side of the MSC enclosure and will illuminate RED during MSC boot-up.

d. During the initialization process, the FAULT LED will be illuminated. Upon completion of the initialization process, if no faults are detected, the FAULT LED will extinguish.



e. J1 Connector Port. Connection point for power cable [W6] from PSP.

f. J2 Connector Port. Connection point for CSD signal cable [W4].

g. J3 Connector Port. Connection point for GND signal cable [W9].

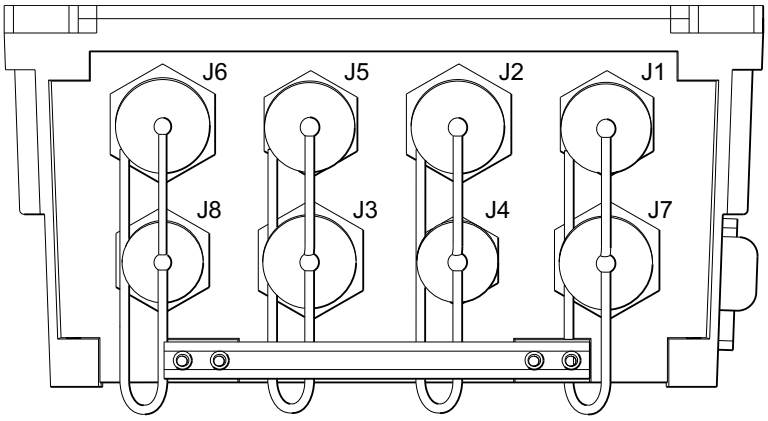
h. J4 Connector Port. Connection point for AGD signal cable [W7].

i. J5 Connector Port. Connection point for CLA signal cable [W10].

j. J6 Connector Port. Connection points for the PNS and VMS signal cables [W8].

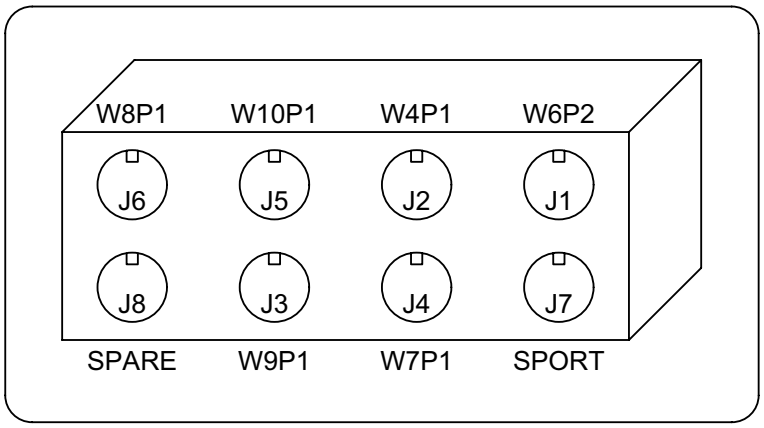
k. J7 Connector Port is the connection point for the MSD signal cable (TBD).

l. J8 Connector Port. SPARE.



TDC0482

m. A connector instruction plate is mounted on the under cradle electronic assembly. This plate is used for quick reference to location of cable connections to MSC.



TDC0483

2-14 POWER CONDITIONING AND CONTROL MODULE (PSP) CONTROLS AND INDICATORS

a. Power Conditioning and Control Module (PSP) is located under the cradle assembly and is mounted to the under cradle electronics assembly. This device is a power supply and power regulator for the DFCS components.

b. Function Control Switch. The function control switch is a four-position rotary switch providing the following positions:

NOTE

When in the OFF position, the PSP draws a small amount of current to power the SOC and BAT indicators.

2-14 POWER CONDITIONING AND CONTROL MODULE (PSP) CONTROLS AND INDICATORS (cont)

(1) **OFF** position removes power from the DFCS.

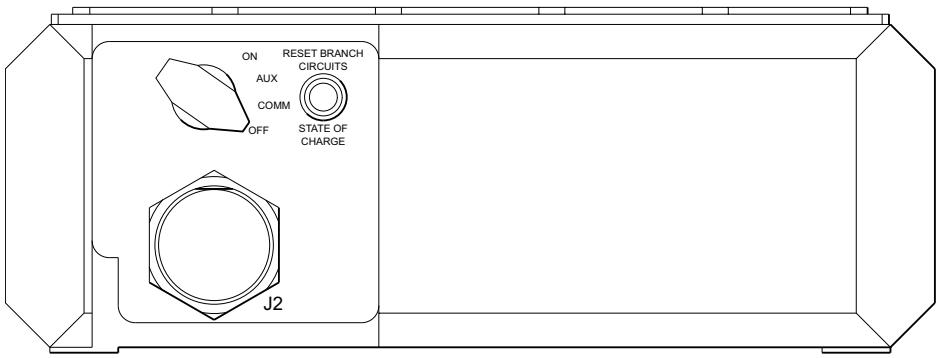
(2) **COMM** position applies power only to the CLA to enable SINCGARS communication independent of remainder of DFCS.

(3) **AUX** position applies power to the J4 connector port.

(4) **ON** position applies power to the PSP. Which distributes/controls power to the remainder of the DFCS components.

c. RESET BRANCH CIRCUITS STATE OF CHARGE. A momentary toggle switch resets the PSP circuit breakers (up position) turns on SOC display (down position).

d. J2 Connector Port connects PSP to battery power input via power cable [W5].



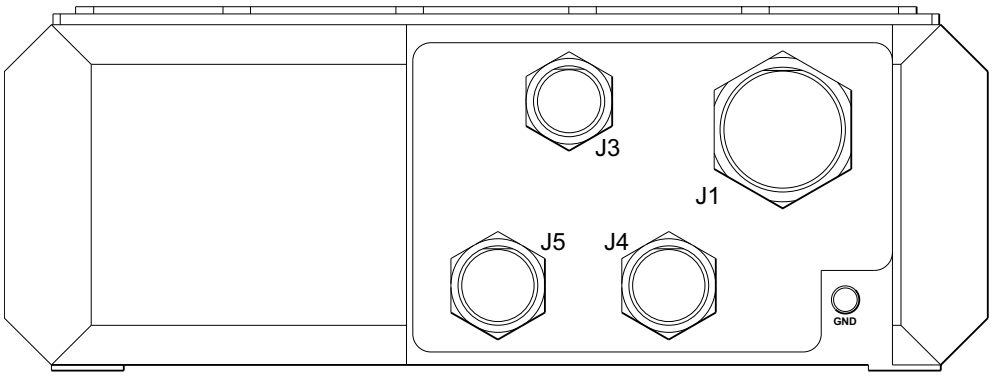
TDC0484

e. J1 Connector Port. Connection point to prime mover DC power cable [W20].

f. J3 Connector Port. Connection point to MSC signal cable [W6].

g. J4 Connector Port. Connection point to PNS, and VMS signal cable [W8].

h. J5 Connector Port. Connection point to CLA signal cable [W12].

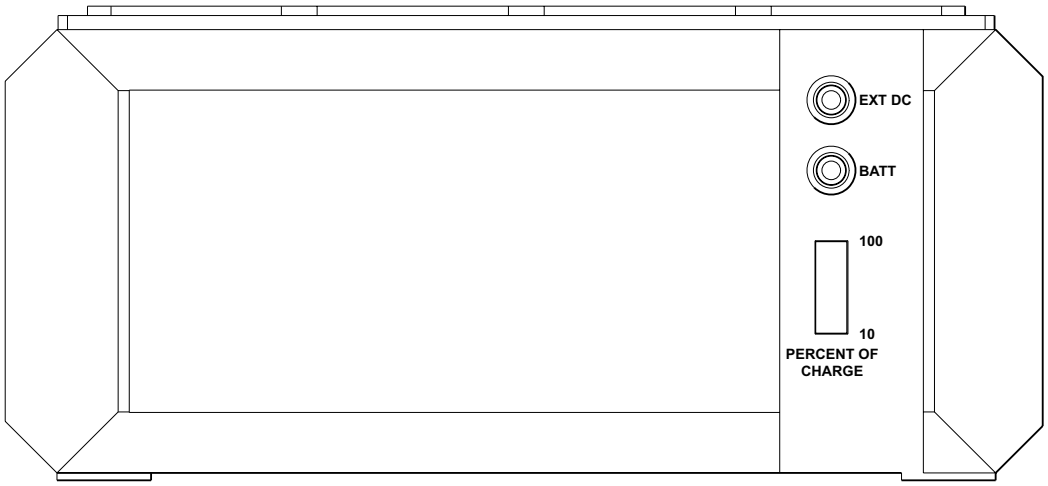


TDC0485

i. EXT DC. LED indicator, when lit indicates prime mover is source of power.

j. BATT. LED indicator, when lit indicates DFCS batteries are source of power.

k. PERCENT OF CHARGE 10 TO 100. Indicates percentage of charge remaining in batteries.



TDC0486

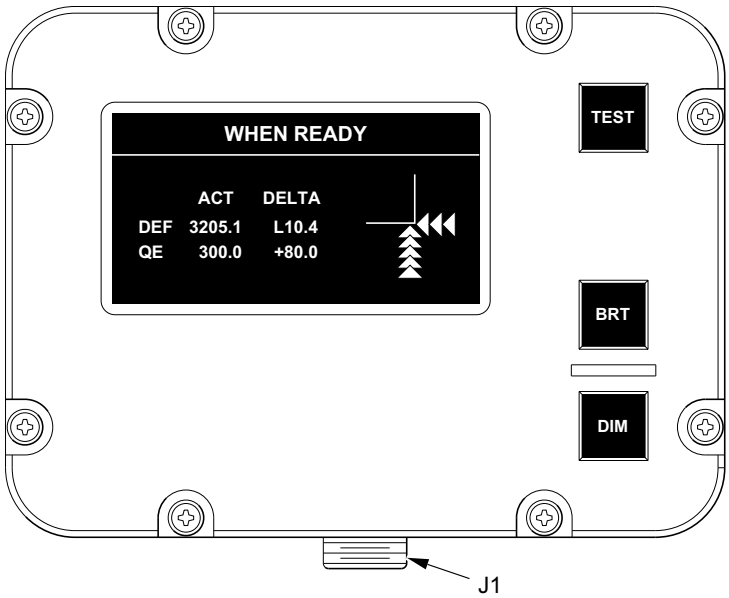
2-15 GUNNER (GND) AND ASSISTANT GUNNERS DISPLAYS (AGD) CONTROLS AND INDICATORS

a. Gunners Display (GND) and Assistant Gunners Display (AGD). Displays commands for laying the howitzer. Located and mounted to the left and right sight posts.

b. TEST. Momentary action switch provides a means to display a series of test patterns on screen.

c. BRT. Momentary action switch increases the brightness of the display by one level.
d. DIM. Momentary action switch decreases the brightness of the display by one level.

e. J1 Connector Port. Connection point to MSC via power signal cable [W9] to GND and [W7] to AGD.



TDC0487

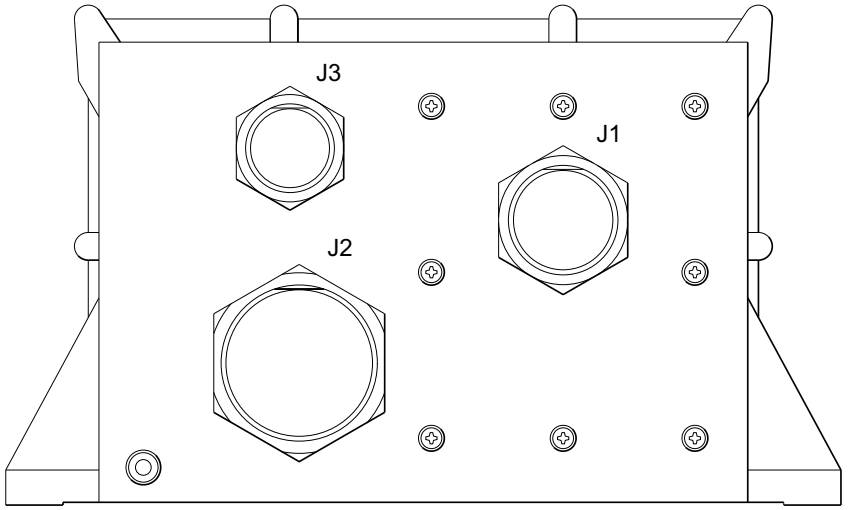
2-16 POSITION/NAVIGATION UNIT (PNS) CONTROLS AND INDICATORS

a. Positioning/Navigation Unit (PNS) is located on the right side of the cradle assembly. Provides the capability to self-locate the howitzer.

b. J1 Connector Port. Connection point to PSP signal/power cable [W8].

c. J2 Connector Port. Connection point to MSC signal/power cable [W8].

d. J3 Connector Port. Future application (not currently used).



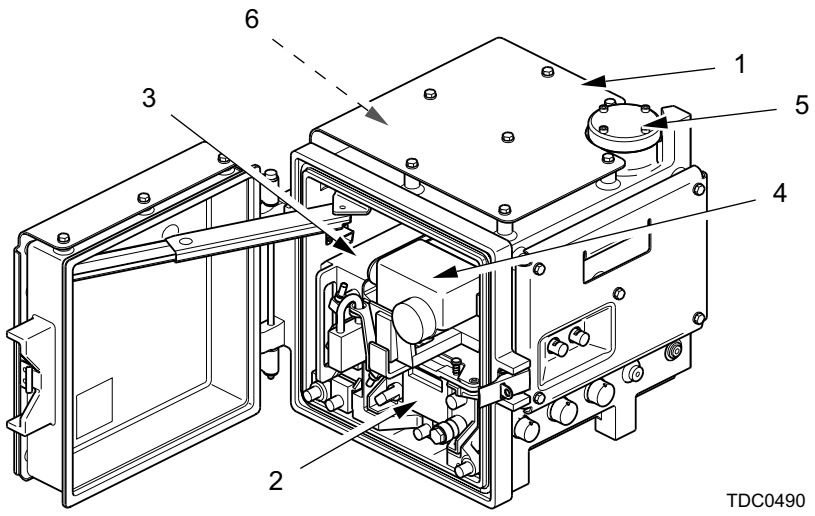
2-17 COMMUNICATIONS LOCATION ASSEMBLY (CLA) CONTROLS AND INDICATORS

a. Communications Location Assembly (CLA) (1) is located on the left side of the cradle assembly and mounted on the top carriage electronics assembly. The CLA contains the CLE, RTA (2) and data cable [W23] connected to the AMP (3) via the inter-connecting coaxial cable [W2 (GFE)] and ANT coaxial cable [W22], PLGR (4) PLA antenna (5) and RSP (6).

NOTES

Refer to:

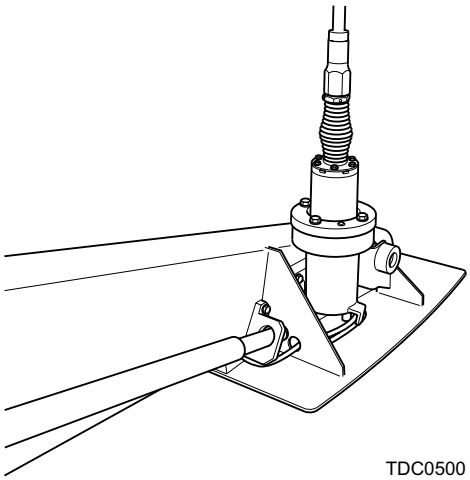
- TM 11-5820-890-10-8 for complete description and operation of SINCGARS RT-1532E.
- TM 11-5820-890-10-8 for complete description and operation of Radio Amplifier.
- TM 11-5825-291-13 for complete description and operation of PLGR AN/PSN-11.



2-18 RADIO ANTENNA (ANT) CONTROLS AND INDICATORS

a. Radio Antenna (ANT) is located on the right stabilizer and mounted on the radio antenna mount. The antenna is used with the long-range communications, vehicle SINCGARS radio configuration.

b. J3 Connection Port. Connection point for antenna cable [W21].



2-19 COMMUNICATIONS LOCATION ENCLOSURE (CLE) CONTROLS AND INDICATORS

a. Communication Location Enclosure (CLE). The CLE houses the CLA components. The enclosure provides environmental and damage protection for these components.

b. J1 Connector Port. Connects CLA to PSP via signal cable [W12].

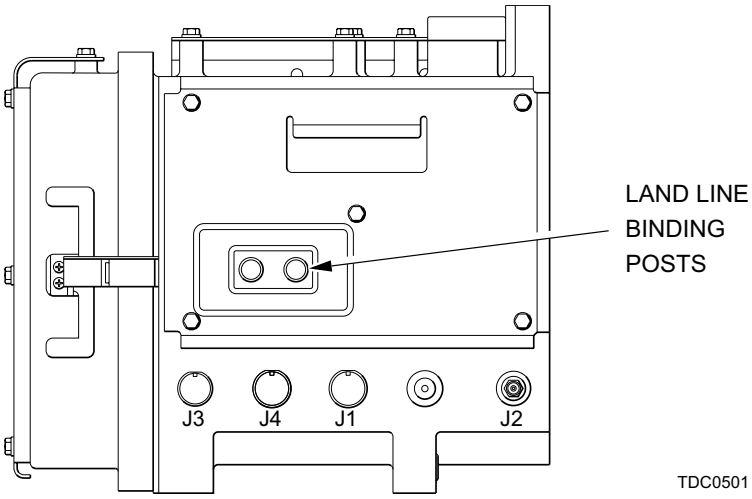
c. J2 Connector Port. Connects RF output to SINCGARS antenna via signal cable [W11].

d. J3 Connector Port. Connects CLA (voice/data) to MSC via signal cable [W10].

2-19 COMMUNICATIONS LOCATION ENCLOSURE (CLE) CONTROLS AND INDICATORS (cont)

e. J4 Connector Port. Connects PLGR to PNS via signal cable [W8].

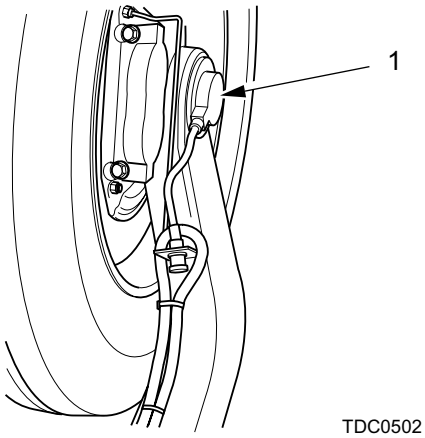
f. Land Line Binding Posts. Connect CLA to hardware landline communications.



2-20 VEHICLE MOTION SENSOR (VMS) CONTROLS AND INDICATORS

a. Vehicle Motion Sensor (VMS) is located on the right howitzer road wheel. The VMS transmits electronic signals/data from howitzer wheel to the PNS and MSC.

b. J1 Connection Port. Provides connection port for the PSP power/signal cable [W14].



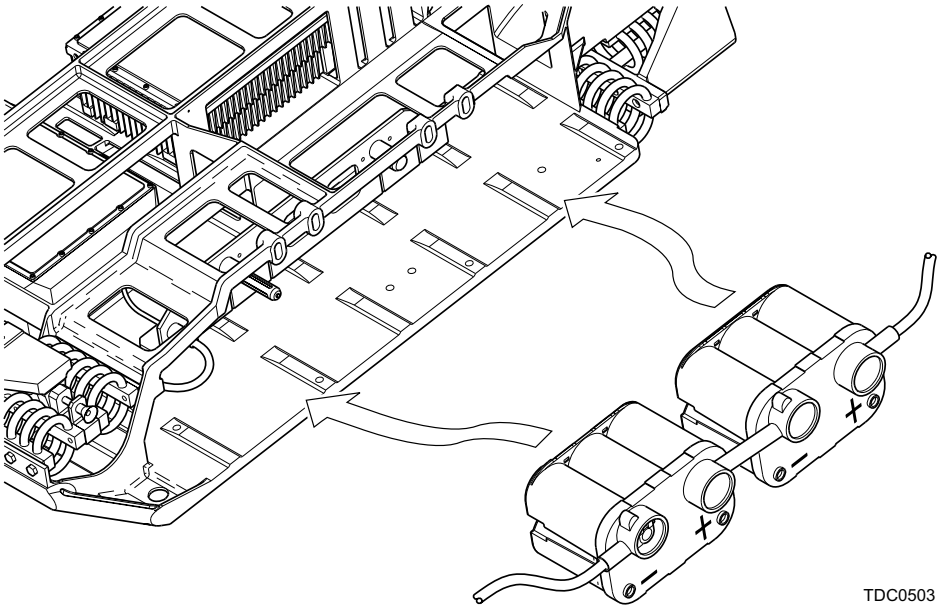
2-21 BATTERIES (BAT) CONTROLS AND INDICATORS

a. Batteries (BAT) are located under the cradle assembly and is mounted to the under cradle electronics assembly. The batteries provide the electrical energy storage capability that enables the autonomous operation of the system in the absence of an external power source.

b. W5E1/W5E2 Connectors. Connects batteries to PSP via power cables [W5].

c. W17E1/W17E2 Connectors. Connects batteries together via power cable [W17].

d. Battery Temperature Sensor (BTT). Provides output signal [W5] to PSP to control different rate of charge at different temperatures.



TDC0503

SECTION II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-22 PMCS PROCEDURES

a. General. Your PMCS table (Table 2-1) has been provided so you can keep your equipment in good operational 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 to prevent your equipment from being damaged.

c. Explanations of Table entries.

(1) Item Number column. Numbers in this column are for reference. When completing DA Form 2404, Equipment Inspection and Maintenance Worksheet, include the item number for the check/service indicating a fault. Items numbers also appear in the order in which checks and services must be performed for the intervals listed.

(2) Interval column. This column tells you when you must do the procedure in the procedure column. BEFORE procedures must be done before you operate or use the equipment for its intended mission. DURING procedures must be done during the time you are operating or using the equipment for its intended mission. AFTER procedures must be done immediately after you have operated or used the equipment. WEEKLY as well as BEFORE PMCS procedures must be performed if:

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

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

(c) When a check and service procedure is required for both weekly and before intervals, it is not necessary to do the procedure twice.

(3) Location Item to Check/Service column. This column provides the location and the item to be checked or serviced. The item location is underlined.

(4) Crew Member Procedure column. This column gives the procedures 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. Carefully follow these instructions. If you do not have the tools, or if the procedure tells you to, have unit maintenance do the work.

(5) Not Fully Mission Capable If: column. Information in this column tells you what faults will keep your equipment from being capable of performing its primary mission. If you make checks 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

Under normal operations, both the M17A1 and M18A1 fire control quadrants are required for use. However, for PMCS purposes, only one of the fire control quadrants is required for the M777 howitzer to be serviceable.

d. Other table entries. Information other than warnings, cautions and notes appear in the PMCS table. Be sure to observe all special information appearing in your table.

e. Leakage definitions. Leakage definitions for operator/crew PMCS are classified as follows:

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

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

(3) Class III. Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

CAUTIONS

Equipment operation is allowable with minor leakage (Class I or II). Of course, the fluid capacity in the system being checked or inspected must be considered. When in doubt, notify SC.

When operating with Class I or II leaks, continue to check fluid levels as required in PMCS. Class III leaks should be reported to SC or unit maintenance.

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

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
1	**Before and After**	**DA FORM 2408-4/Weapon Record Book NAVMAC 10558/10558a**	**SC** Check to see if your weapon has been borescoped within 180 days immediately preceding firing and after 1000 EFC rounds, and pullover gauged at 1000, 1500 and every 100 EFC rounds thereafter (TM 9-1000-202-14).	 Weapon has not been borescoped/pullover gauged in accordance with instructions.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
	WARNING MAKE SURE ALL PERSONNEL ARE CLEAR OF CANNON RECOIL PATH. LOSS OF NITROGEN PRESSURE CAN ALLOW CANNON TO FALL OUT OF BATTERY.			
2	**Before and After**	**RECOIL SYSTEM**	**SC** Notify unit maintenance to check the nitrogen pressure of the recoil accumulator before firing the howitzer, or when any of the following conditions are met: (1) Howitzer has been deployed to a temperature change of ± 40°F (22° C). (2) Temperature change of 40ºF (22ºC) or more. (3) Howitzer has not been fired within a week. (4) Nitrogen pressure has not been checked within a month.	Nitrogen pressure is below 329 psi (23 bar).
3	**Before and After**	**RECOIL SYSTEM AND LINES**	**Cannoneers Nos. 1 and 2** a. Check recoil accumulator (1), cylinders (2), end cap yoke (3) and lines for loose nuts/bolts missing or damaged parts. If nuts/bolts are loose, missing, or damaged, notify unit maintenance. b. Check for oil leakage. If oil leaks are present, notify unit maintenance. c. Check oil index pin is flush. If oil index pin is not flush, notify unit maintenance.	If leakage is a Class III. If oil index pin is showing red indicator line.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

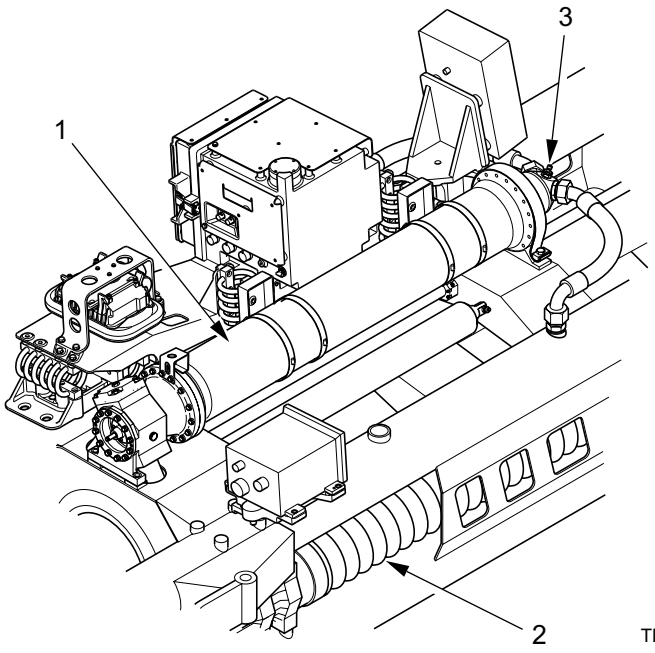
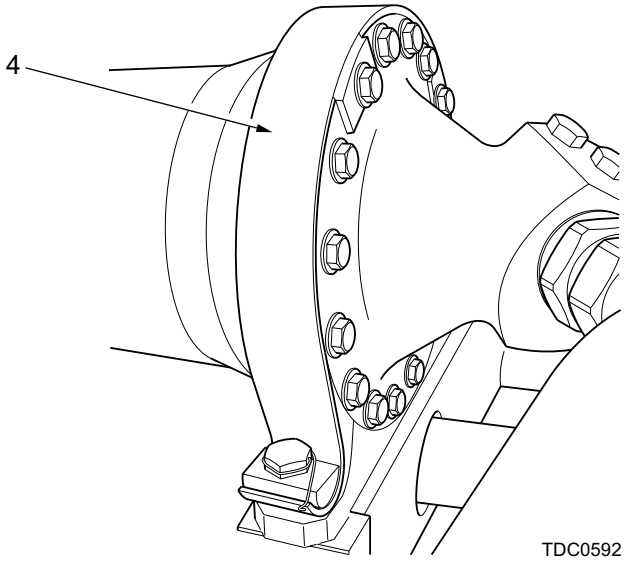
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			 TDC0283 d. Check recoil accumulator retaining strap (4) for loose nuts/bolts missing or damaged parts. If nuts/bolts are loose, missing, or not lockwired, or damaged, notify unit maintenance.  TDC0592	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

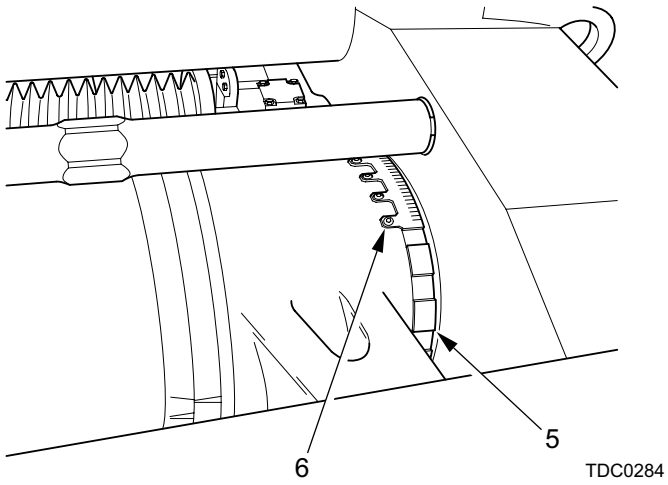
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			e. Check recoil yoke thrust collar (5) and locking tab (6) for positive locking. If not locked, notify unit maintenance. f. Check recoil cylinders and bellows for damage, tears, and wear. If damaged, torn or worn, notify unit maintenance. g. Check recoil cylinders and bellows for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or not lock wired, or if parts are damaged, notify unit maintenance.  	Thrust collar and locking tab not locked.
4	**Before and After**	**SCAVENGE SYSTEM AND LINES**	**Cannoneer No. 2** a. Check scavenge manifold (1), piston (2), pressure (3) exhaust cylinders (4), and lines for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, or missing, or if parts are damaged, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

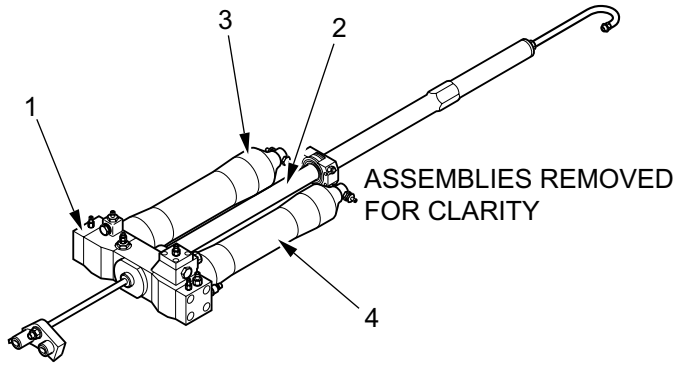
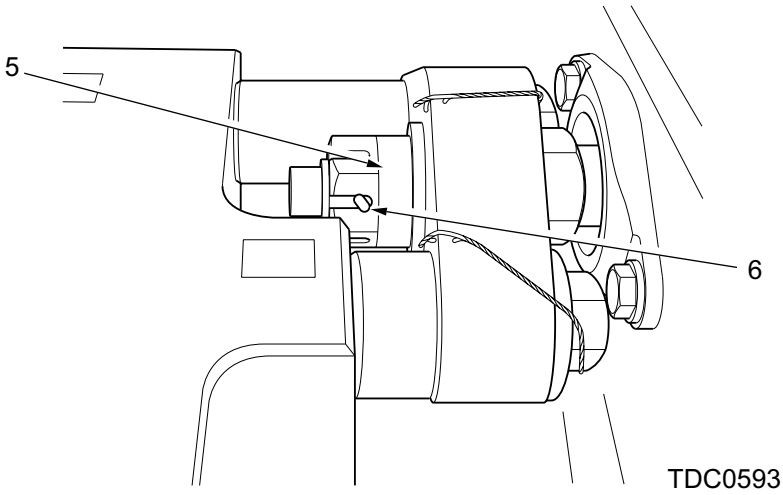
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			 TDC0285	
			b. Check scavenge rod-end nut (5), split pin (6) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or not lock wired, or if parts are damaged, notify unit maintenance.	
			 TDC0593	
			c. Check scavenge key washer (7), and locking collar (8) for loose, missing or damaged parts. If parts are loose, missing, or if parts are damaged, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

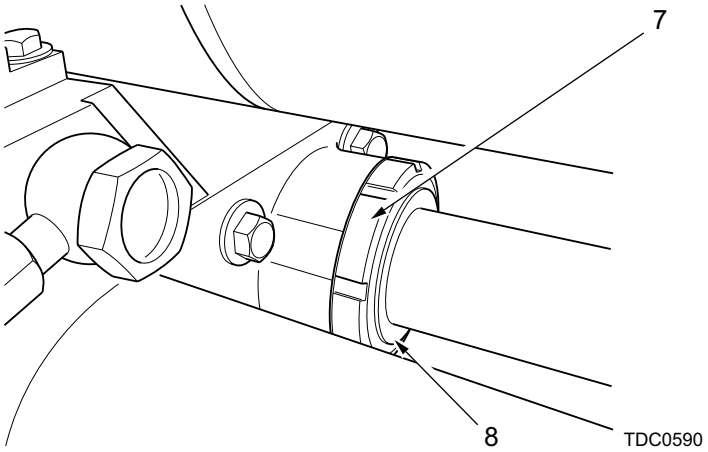
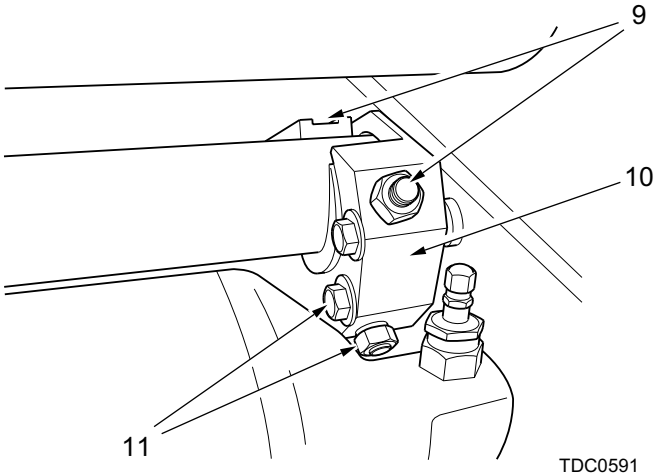
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			 d. Check scavenge doughnut and collar (9), setscrews (10) and mounting bolts (11) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, or missing, or if parts are damaged, notify unit maintenance.	
			 e. Check for oil leakage. If oil leaks are present, notify unit maintenance.	If leakage is a Class III.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			WARNING ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.	
5	**Before and After**	**SCAVENGE ISOLATOR VALVE AND FILTER**	**Cannoneer No. 1** a. Check scavenge isolator valve (1) and filter (2) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, or missing, or if parts are damaged, notify unit maintenance. b. Check for oil leakage. If oil leaks are present, notify unit maintenance. c. Check isolator valve for smooth operation, if sticking or binding occurs, notify unit maintenance.	If leakage is a Class III.

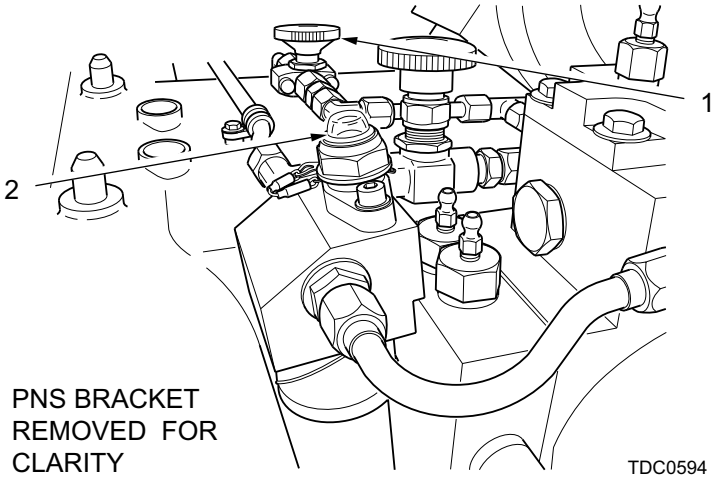


Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
6	**Before and After**	**TRUNNION PUMP AND LINES**	**Cannoneer No. 1**	
			a. Check trunnion pump and lines for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.	
			b. Check for oil leakage. If oil leaks are present, notify unit maintenance.	If leakage is a Class III.
			c. Check pump for smooth operation, if binding and/or jerky, notify unit maintenance.	
7	**Before and After**	**HIGH AND LOW PRESSURE GAUGES**	**Cannoneer No. 1**	
			a. Check high and low pressure gauges for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.	
			b. Check gauges for damage. If damaged notify unit maintenance.	
			c. Check gauges for oil leaks. If oil leaks present notify unit maintenance.	If leakage is a Class III.
			d. Operate trunnion pump (Para 2-5 f.) for one full stroke and check high pressure gauge is reading 1160 psi (80 bar), if not, notify unit maintenance.	If pressure gauge is reading below 1160 psi (80 bar).
			e. Operate trunnion pump (Para 2-5 f.) for one full stroke and check low pressure gauge is reading between 44 and 73 psi (3 and 5 bar), if not, notify unit maintenance.	If low pressure gauge is reading below 44 psi (3 bar).
			f. Check lines for oil leakage. If oil leaks are present, notify unit maintenance.	If leakage is a Class III.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

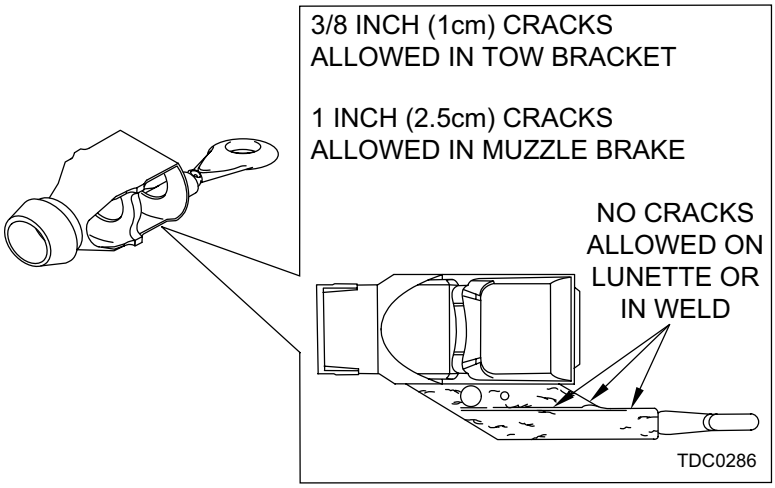
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
8	**Before and After**	**MUZZLE BRAKE ASSEMBLY**	**Cannoneer No. 4**	
			a. Inspect muzzle brake assembly for cracks over 1in (2.54cm) long. If cracks appear over 1in (2.54cm) long, notify unit maintenance.	Muzzle brake assembly cracks are over 1in (2.54cm) long.
			b. Inspect lunette assembly for cracks. If cracks are present, notify unit maintenance.	Cracks are present.
			c. Inspect towing bracket for cracks over 3/8in (1cm) long. If cracks appear over 3/8in (1cm) long, notify unit maintenance.	Towing bracket cracks are over 3/8in (1cm) long.
			d. Inspect towing eye for cracks. If cracks are present, notify unit maintenance.	Cracks are present.
				
			e. Inspect the muzzle brake key (1) if bolts or lockwire loose, broken or missing, notify unit maintenance.	
			f. Check cotter pin (2) on lunette assembly for loose, damaged or missing. If loose damaged or missing, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

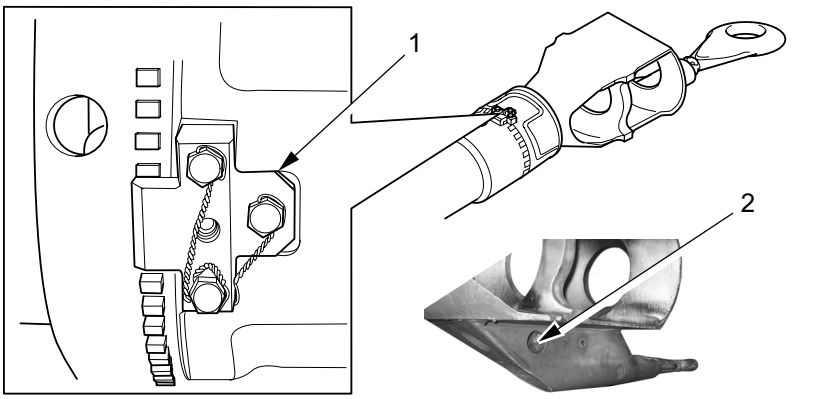
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			 TDC0287	
			WARNING ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.	
9	**Before and After**	**BREECH LEVER AND LINES**	**Cannoneer No. 2** a. Check breech lever and lines for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance. b. Check for oil leakage. If oil leaks are present, notify unit maintenance. c. Check breech lever for smooth operation, if bindings occurs, notify unit maintenance.	If leakage is a Class III.
			WARNING THE BREECH LOCKOUT PLUNGER MUST BE ENGAGED PRIOR TO PERFORMING ANY MAINTENANCE TASKS THAT REQUIRE THE BREECH TO BE OPEN. FAILURE TO ENGAGE THE PLUNGER COULD RESULT IN ACCIDENTAL BREECH CLOSURE. THIS COULD RESULT IN SERVERE CRUSHING INJURIES TO PERSONNEL.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
10	**Before and After**	**BREECH MECHANISM ASSEMBLY**	**Cannoneer No. 2**	
			a. Check roller (1) for smooth operation. Check cam way (2) for corrosion, nicks, or burrs. If required, remove corrosion with crocus cloth (item 11, appx D). Remove nicks and burrs with a file.	Roller is broken.
			b. Before firing, open and close breechblock (3) to be sure it operates freely and smoothly. If breechblock or breechring (4) threads are burred and prevent smooth operation, notify unit maintenance.	Breechblock will not close completely (witness marks do not align) breech is seized.
			c. Inspect breechblock detent plunger (5) for smooth operation, distortion and wear. If worn, notify unit maintenance.	
			d. Unit maintenance should also be notified for plunger, spring, and spring pin replacement at 750 rounds (as recorded on DA FORM 2408-4/Weapon Record Book NAVMAC 10558/10558a).	
			e. Check catches (6) for loose bolts and missing or damaged parts. If bolts are loose, missing or damaged or not lock wired, notify unit maintenance.	
			f. Check breech roller cam (7) for loose or missing screws. If loose or missing, notify unit maintenance.	
			NOTE Two types of obturator pad are used; a non-mesh type and a mesh type. If using the non-mesh type proceed to step g., if using the mesh type, proceed to step h.	
			g. Using go/no go gauge (Para 3-7 g.), test and inspect obturator pad (8) for damage and/or wear. If obturator fails go/no go test and inspection, replace obturator pad and notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

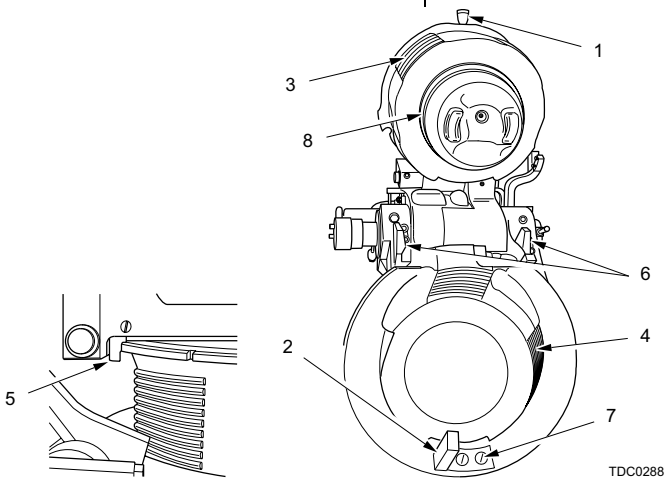
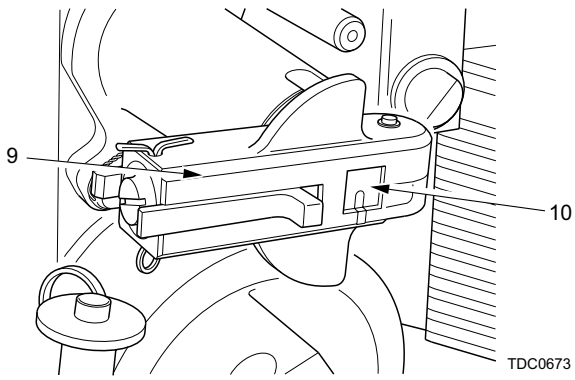
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			NOTE If steel mesh is visible but not torn, obturator pad is still serviceable.	
			h. Check obturator pad for damage or wear, if steel mesh is visible and torn, replace.  	
			i. Check dog coupler (9) for smooth operation. Check coupler for corrosion, nicks, or burrs. If required, remove corrosion with crocus cloth (item 11, appx D). Remove nicks and burrs with a file. j. Check drive shaft (10) for loose bolts and missing or damaged parts. If bolts are loose, missing, or if parts are damaged or not lock wired, notify unit maintenance.  	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

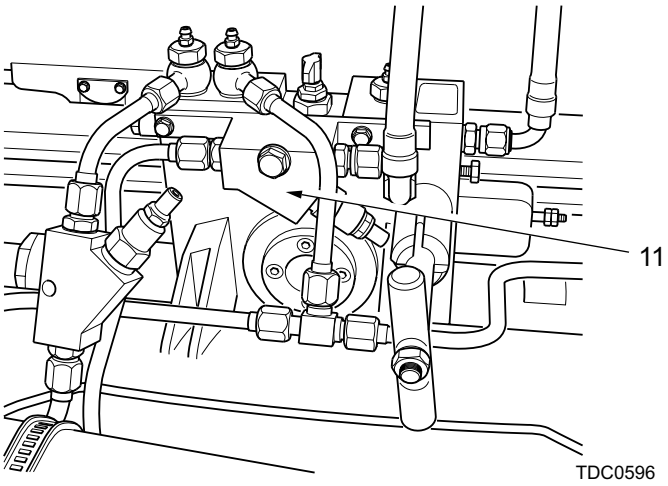
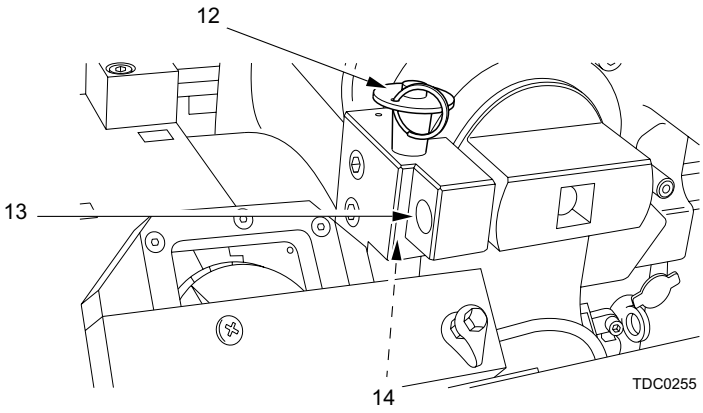
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			k. Check actuator housing (11) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.	
				
			l. Check breech crank locking pin (12) for smooth operation. Check pin can be removed and installed from retaining bracket (13) to the crank bracket (14). If binding occurs notify unit maintenance. m. Check pin for corrosion, nicks, or burrs. If required, remove corrosion with crocus cloth (item 11, appx D). Remove nicks and burrs with a file.	
				

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

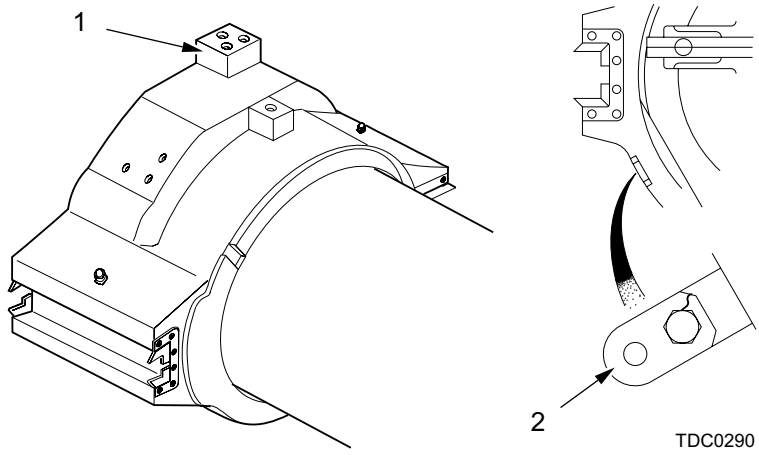
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			WARNING THE BREECH LOCKOUT PLUNGER MUST BE ENGAGED PRIOR TO PERFORMING ANY MAINTENANCE TASKS THAT REQUIRE THE BREECH TO BE OPEN. FAILURE TO ENGAGE THE PLUNGER COULD RESULT IN ACCIDENTAL BREECH CLOSURE. THIS COULD RESULT IN SERVERE CRUSHING INJURIES TO PERSONNEL.	
11	**Before and After**	**BREECH COLLAR ASSEMBLY**	**Cannoneer No 2** a. Inspect the stop (1) for loose or missing bolts. If loose or missing, notify unit maintenance. b. Inspect breech collar key (2) for loose, missing, or broken bolt and lockwire. If lockwire is missing or a bolt is loose, missing or broken, notify unit maintenance.	Breech collar/key/bolt/lockwire missing.
				
			WARNING THE BREECH LOCKOUT PLUNGER MUST BE ENGAGED PRIOR TO PERFORMING ANY MAINTENANCE TASKS THAT REQUIRE THE BREECH TO BE OPEN. FAILURE TO ENGAGE THE PLUNGER COULD RESULT IN ACCIDENTAL BREECH CLOSURE. THIS COULD RESULT IN SEVERE CRUSHING INJURIES TO PERSONNEL.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

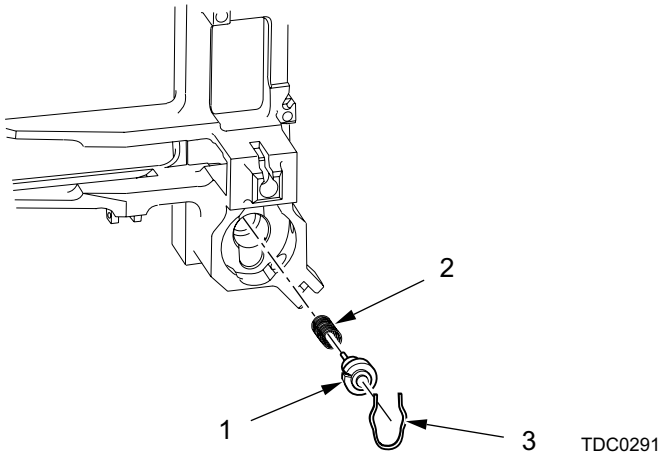
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
12	Before and After	TRAY ASSEMBLY	Cannoneer No. 2 a. Inspect firing pin (Para 3-7 d.) (1), spring (2) and retainer (3) for damage or broken parts. b. Remove corrosion and small burrs from the tray sub-assembly rails that mate with the body assembly with crocus cloth (Item 11, appx D) and a small file.	
				
			WARNING ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.	
13	Before and After	THERMAL WARNING DEVICE (TWD)	Cannoneer No. 2 a. Inspect for moisture inside TWD (fogging of window) (1), if moisture present notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

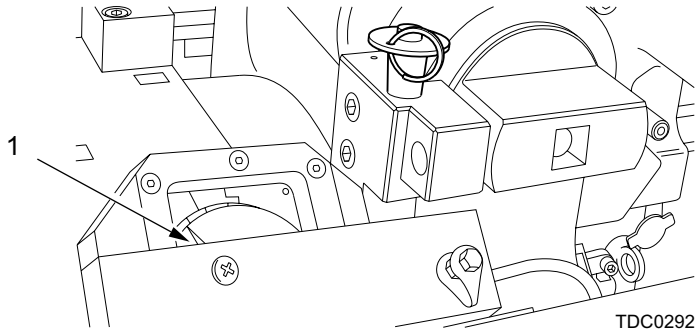
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			b. Check TWD for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.	
			NOTE If TWD is inoperable, refer to cannon tube temperature definitions in Misfire/Hangfire procedures (Para 2-59 to 2-62) to determine cannon tube temperatures.	
			c. Check operation of TWD. Indicator should show approximate outside temperature before firing.	
				
14	Before and After	**PRIMER FEED MECHANISM (PFM)**	**Cannoneer No. 2** a. Check PFM (1) for loose bolts and missing or damaged parts. If bolts are loose, missing, or if parts are damaged, notify unit maintenance. b. Check connector (2), quick release (3) and drive link (4) assemblies for secure attachment, if unable to secure, notify unit maintenance.	
			NOTE If injector arm assembly fail to operate correctly, refer to Section VII Operation Under Degraded Conditions, and carryout, Injector Arm Assembly Failure Procedures (Para 2-73), and notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

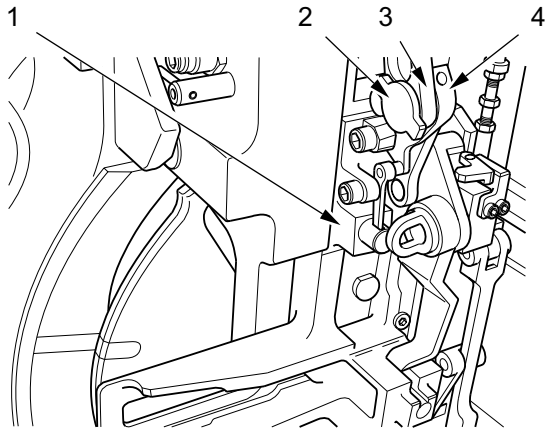
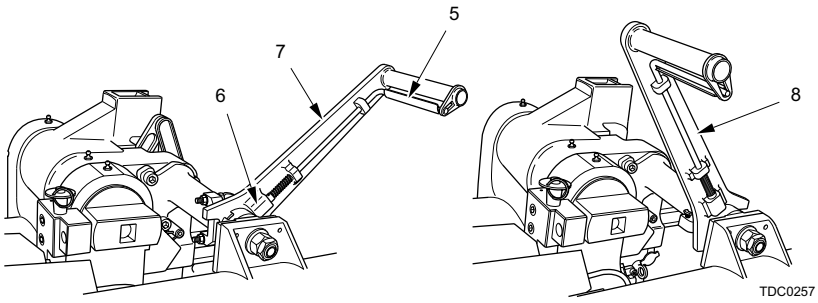
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			 TDC0293	
			c. Check manual handle (5) for smooth operation, loose nut/bolts and missing, or damaged parts. If nuts/bolts are loose, missing or damaged, notify unit maintenance.	
			NOTE If PFM manual handle fails to operate correctly, refer to Section VII Operation Under Degraded Conditions, and carryout, PFM Manual Handle Failure Procedures (Para 2-72), and notify unit maintenance.	
			d. Operate manual handle (5), ensure locking mechanism (6) engages in PRIMED (7) and EXTRACT (8) position. Ensure locking plunger is not deformed and or broken, if deformed or broken notify unit maintenance.	
			 TDC0257	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

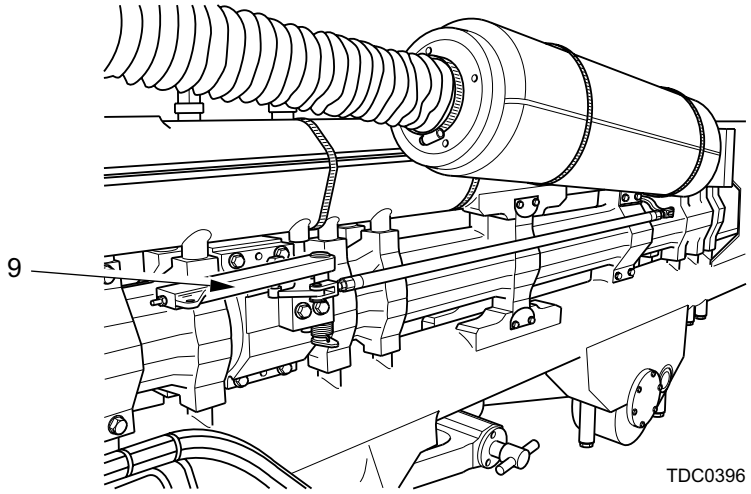
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			NOTE If firing lever fails to operate correctly, refer to Section VII Operation Under Degraded Conditions, and carryout, Firing Lever Failure Procedures (Para 2-71), and notify unit maintenance.	
			e. Check firing lever (9) for loose nuts/bolts and missing, or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.	
				
			f. Inspect magazines (Para 3-8) for damaged parts. If damaged, notify unit maintenance.	
			g. Check M54 firing mechanism (Para 3-7 a.) for damaged parts. If damaged, replace M54 firing mechanism and notify unit maintenance.	
15	**Before and After**	**LOADING TRAY AND LINES**	**Cannoneer No. 1**	
			a. Check loading tray (1), damper (2), hinge brackets (3), lever (4) and mechanical plunger (5), for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

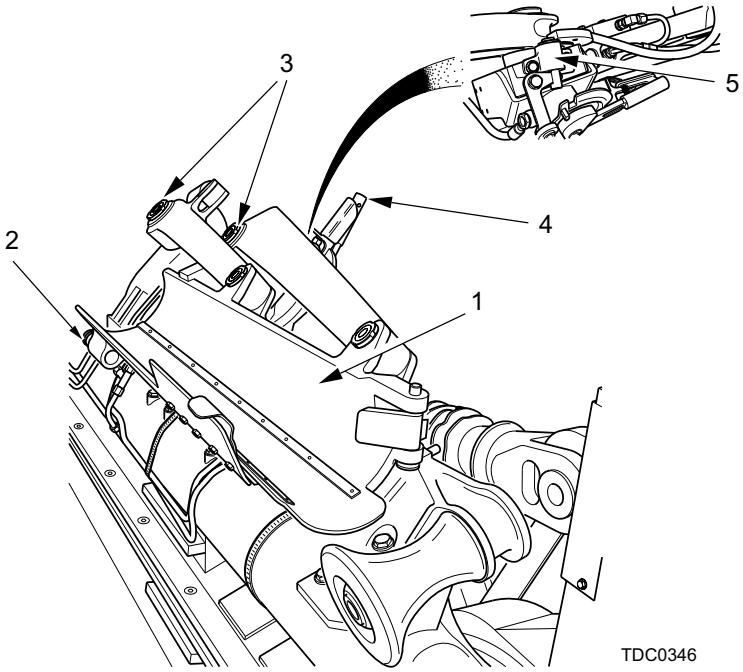
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
				
			b. Check MACS spring clip (6), for loose nuts/bolts and missing, or damaged parts. If nuts/bolts are loose, missing, or damaged, notify unit maintenance.	
				
			c. Check for oil leakage. If oil leaks are present, notify unit maintenance.	If leakage is a Class III.
			d. Check loading tray lever for smooth operation, if binding occurs, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			e. Check damper and actuator for oil leaks. If oil leaks are present, notify unit maintenance.	If leakage is a Class III.
16	**Before and After**	**ROUND CATCH AND ROLLER**	**Cannoneer No. 1** a. Check round catch and roller for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or damaged, notify unit maintenance. b. Check round catch and roller for smooth operation, if defective, notify unit maintenance.	
17	**Before and After**	**EQUILIBRATOR SYSTEM**	**SC** Notify unit maintenance to check the nitrogen pressure of the equilibrator system before firing the howitzer, or when any of the following conditions are met: (1) Howitzer has been deployed to a temperature change of ± 40°F (22° C). (2) Temperature change of 40°F (22°C) or more. (3) Howitzer has not been fired within a week. (4) Nitrogen pressure has not been checked within a month.	
18	**Before and After**	**EQUILIBRATOR SYSTEM AND LINES**	**Gunner and Assistant Gunner** a. Check equilibrator cylinders and lines for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or damaged, notify unit maintenance. b. Check cylinder, cylinder-retaining straps and insulation cover for damage, cracks, and wear. If damaged, cracked or worn, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			c. Check handwheels for smooth operation, if unable to elevate /depress howitzer or unable to adjust notify unit maintenance.	Unable to elevate/depress or adjust howitzer.
19	**Before and After**	**EQUILIBRATOR INDICATOR**	**Gunner and Assistant Gunner**	
			a. Check equilibrator indicators and bracket pins for loose screws and missing or damaged parts. If screws are loose, missing, or damaged, notify unit maintenance.	Bracket pins damaged.
			b. Elevate and depress cannon tube by operating elevating handwheels. Check for smooth operation, if effort required is difficult, carryout equilibrator adjustment procedures (Para 2-4 a.), if unable to adjust, notify unit maintenance.	Unable to adjust equilibrator.
20	**Before and After**	**ELEVATION SYSTEM**	**Gunner and Assistant Gunner**	
			a. Check elevation handwheel (1), drive shaft (2), roll screw bellow (3) and mitred (4), intermediate (5), resilient (6) and roll screw (7) gearboxes for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.	

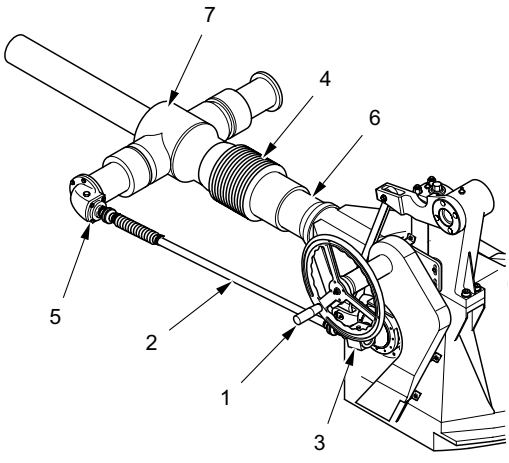


Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

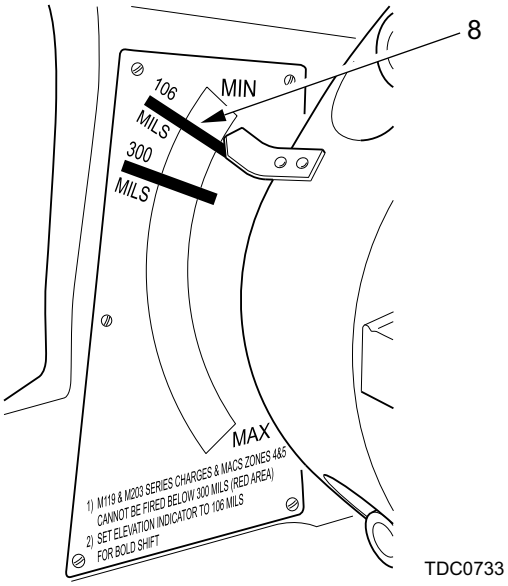
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			b. Inspect charge plate elevation indicator plate (8) for damage, visibility and cleanliness. If plate is damaged or not visible, notify unit maintenance. Clean with a clean wiping rag (item 29, appx D).	
			 TDC0733	
21	**Before and After**	**TRAVEL LOCKS**	**Gunner and Assistant Gunner** a. Check travel locks for loose nuts/bolts and missing, or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.	
			b. Check for smooth operation, if unable to engage or disengage, notify unit maintenance.	Travel locks will not engage or disengage.
22	**Before and After**	**TRAVERSE SYSTEM**	**Gunner** a. Check traverse handwheel, course azimuth scale, gear rack, pinion and mesh adjuster for loose nuts/bolts and missing, or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			b. Traverse cannon tube. Check for smooth operation, making sure there is no binding or jerking motion of the handwheel, if binding or jerking motion present, notify unit maintenance.	
23	**Before and After**	**TRAVERSE LOCK**	**Gunner and Assistant Gunner** a. Check traverse lock for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance. b. Check traverse lock, for smooth operation, if unable to engage or disengage, notify unit maintenance.	Traverse lock will not engage or disengage.
24	**Before and After**	**CRADLE ASSEMBLY**	**Cannoneers Nos. 3 and 4** a. Check elevation (1), and main trunnions (2), tubes (3), end caps (4) and lines for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged or lock wire missing, notify unit maintenance. b. Check cradle tube insulation covers (5) and retaining straps (6) for damage and wear. If damaged or worn, notify unit maintenance.	

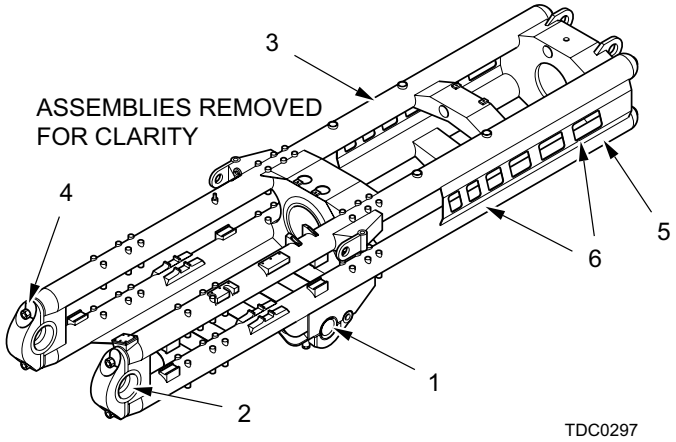


Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

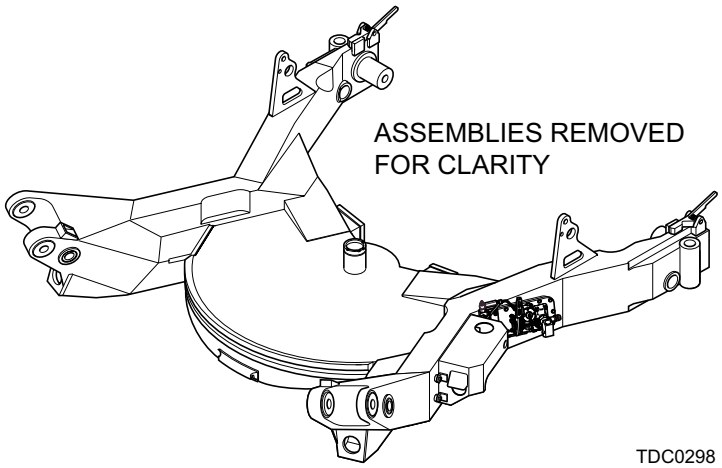
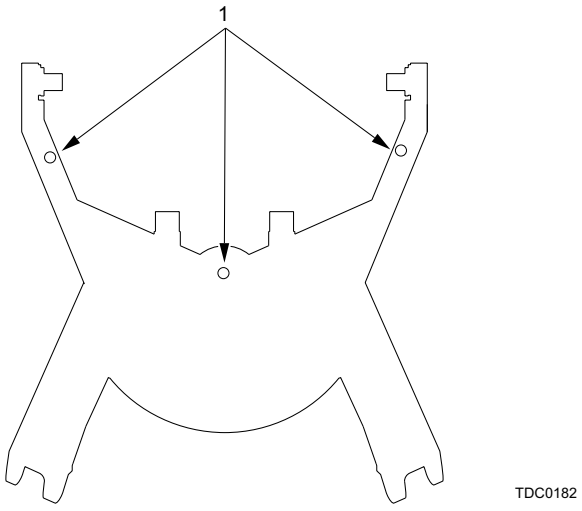
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
25	**Before and After**	**BODY ASSEMBLY**	**Cannoneers Nos. 3 and 4** a. Check body assembly for missing or broken or damaged parts. If missing or damaged, notify unit maintenance.	
				
			b. Inspect the three drain holes (1) underneath the body for debris, dirt or blockages. If blocked, remove debris, dirt or blockages. If unable to clean or remove blockages, notify unit maintenance.	
				

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

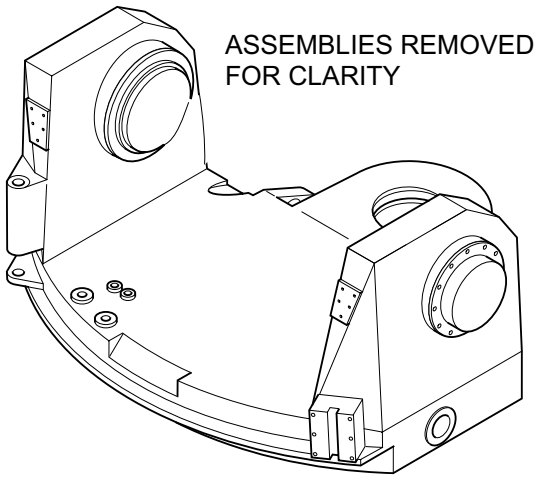
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
26	**Before and After**	**SADDLE ASSEMBLY**	**Cannoneers Nos. 3 and 4** a. Check saddle assembly for missing or broken or damaged parts. If missing or damaged, notify unit maintenance.	
			 TDC0299	
27	**Before and After**	**STABILIZERS**	**Cannoneers Nos. 3 and 4** a. Check stabilizers (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance. b. Check bump stops (2) for cleanliness. Before deployment of stabilizers, check bump stops for embedded debris or grit. Remove and clean debris or grit from surface.	
			CAUTION Do not attempt to lower howitzer if bump stop end plate is NOT in contact with the howitzer body.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

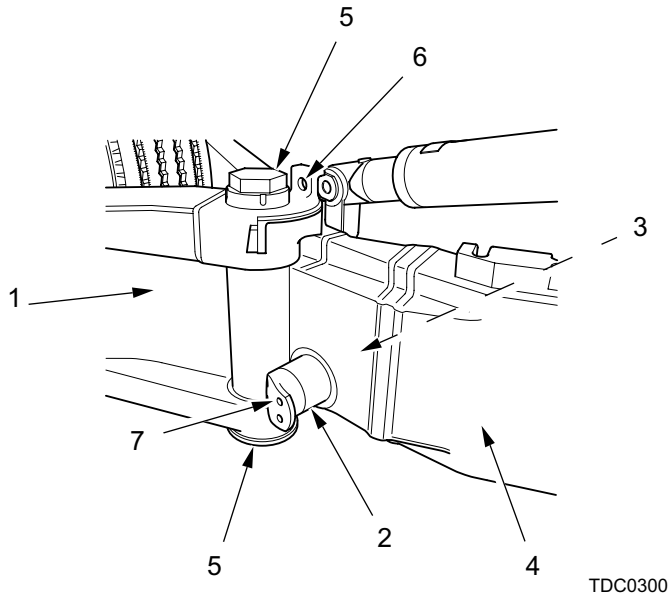
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			c. Deploy stabilizers into firing position and check that bump stop end plates (3) contact howitzer body (4), if no contact, notify unit maintenance. d. Check for smooth operation of stabilizer (1), hinge pin (5), locking latch (6) and bump stop (2), and bump stop bracket (7) if binding or excessive wear/play is present, notify unit maintenance.	Bump stop end plate fails to contact howitzer body.
				
28	**Before and After**	**TRAIL ARM AND SPADE ASSEMBLIES**	**Cannoneer No. 5 and ATC** a. Check trail arms, spades, latches and spade cotter pins (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

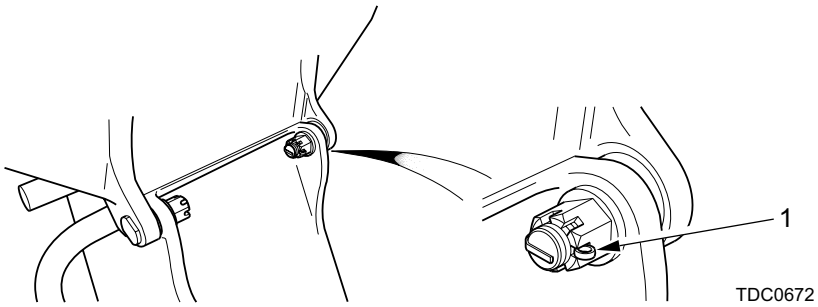
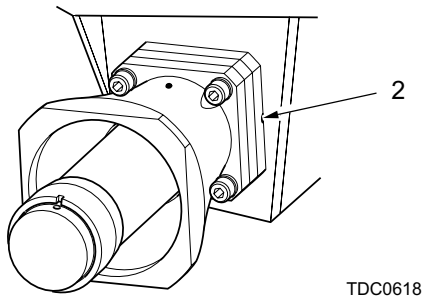
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
				
			WARNING TO PREVENT INJURY TO PERSONNEL, MOVEMENT OF TRAIL ARM MUST BE SUPPORTED BY A MINIMUM OF TWO PERSONNEL.	
			b. Check smooth operation of trail arm, spade assemblies, locking plungers and handles, if binding or excessive wear/play is present, notify unit maintenance. c. Inspect drain holes (2) on trail arm for debris, dirt or blockages. If blocked, remove debris, dirt or blockages. If unable to clean or remove blockages, notify unit maintenance.	
				
29	**Before and After**	**SPADE DAMPER ASSEMBLIES**	**Cannoneer No. 5 and ATC**	
			NOTE Notify unit maintenance to check the nitrogen pressure of the spade damper before firing the howitzer, or when any of the following conditions are met:	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

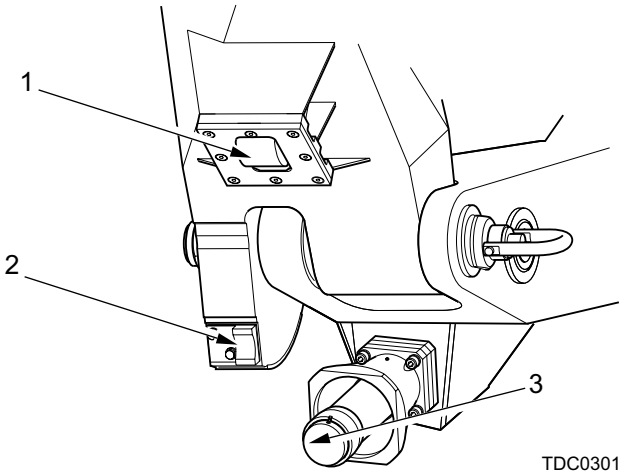
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
	(1) Howitzer has been deployed to a temperature change of ± 40°F (22° C). (2) Temperature change of 40ºF (22ºC) or more. (3) Howitzer has not been fired within a week. (4) Nitrogen pressure has not been checked within a month.			
			a. Check spade damper assemblies, for loose bolts and missing or damaged parts. If bolts are loose, missing, or if parts are damaged or lock wire missing, notify unit maintenance. b. Check spade damper striker plate (1), trail arm stops (2) for loose bolts and missing or damaged parts. If bolts are loose, missing, or if parts are damaged, notify unit maintenance.	
			NOTE If spade dampers fail to operate correctly, refer to Section VII Operation Under Degraded Conditions, and carryout, Spade Damper Failure Procedures (Para 2-74), and notify unit maintenance.	
			c. Check operation of spade damper piston (3) by applying pressure to the piston, if piston collapses, notify unit maintenance. 	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

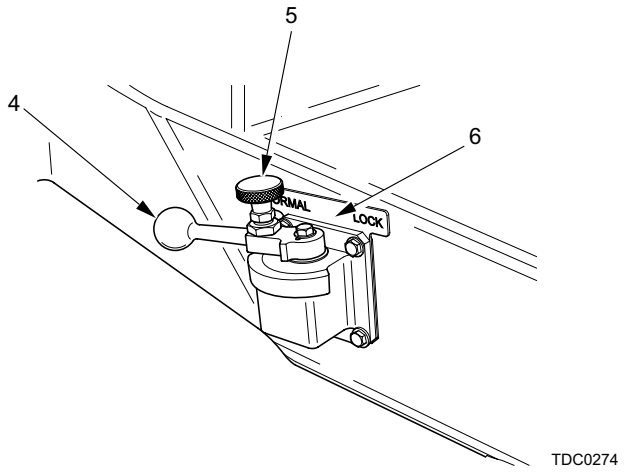
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			d. Check spade damper lockout levers (4) for loose bolts and missing or damaged parts. If bolts are loose, missing, or if parts are damaged, notify unit maintenance. e. Check spade damper levers (4) and plungers (5) for smooth operation, if binding or excessive wear/play is present, notify unit maintenance. f. Inspect instruction plate (6) for damage, visibility and cleanliness. If plate is damaged, or not visible, notify unit maintenance. Clean with a clean wiping rag (item 29, appx D). 	
30	**Before and After**	**SUSPENSION SYSTEM**	**Cannoneers Nos. 1 and 2** a. Check suspension pump (1), for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance. b. Check for oil leakage. If oil leaks are present, notify unit maintenance.	If leakage is a Class III.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

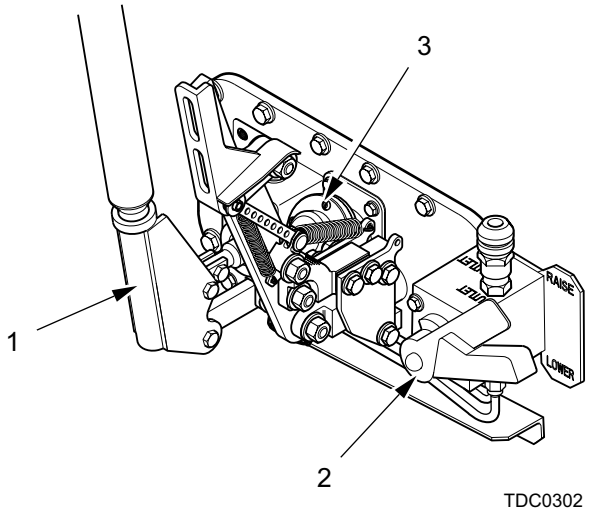
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			c. Check suspension pump (1) and lever (2) for smooth operation, if binding or excessive wear/play is present, notify unit maintenance.	Unable to pressurize or raise/lower howitzer.
			d. Check oil fluid level (3) (wheel in stowed position), if oil low, notify unit maintenance.	
				
			e. Check wheel assembly pad (4), for cracks, dry rot and gouges. If cracked, dry rot or gouges are present, notify unit maintenance.	
			f. Check hydro-strut (5) for smooth operation, if binding or wear/play of hydro-strut, plunger (6) and/or crank handle (7) is present, notify unit maintenance.	Unable to raise/lower howitzer.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

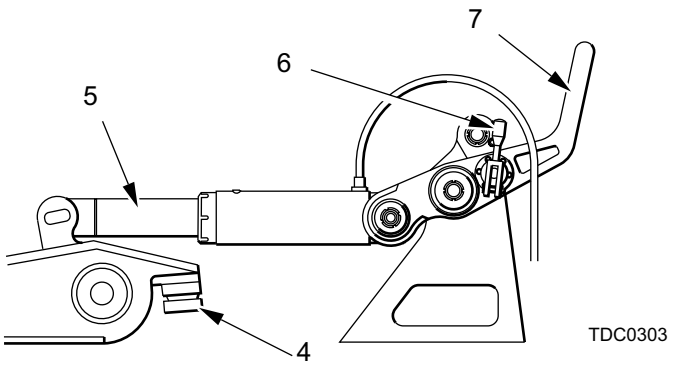
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
				
			CAUTION Use only authorized tires when towing the howitzer. Never re-inflate a tire that has been run flat without first having the wheel and tire disassembled and inspected by unit maintenance.	
31	**Before and After**	**WHEEL AND HANDBRAKE ASSEMBLIES**	**Cannoneers Nos. 1 and 2** a. Check wheel nuts (1). If loose, have unit maintenance torque. b. Check wheels for damage or cracks. If damaged, notify unit maintenance. c. Check tread indicators for wear. If tread indicators are no longer visible, notify unit maintenance. d. Check tires and sidewalls (2) for damage and swelling. If damaged or swollen, notify unit maintenance. e. Check tires for proper inflation (Para 1-14).	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

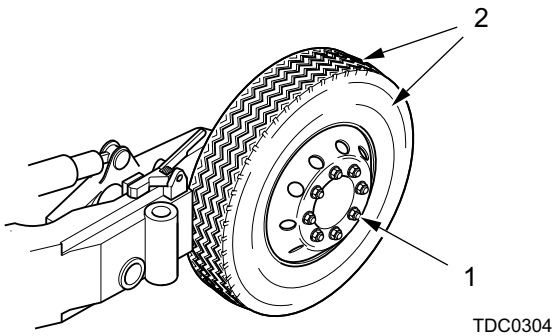
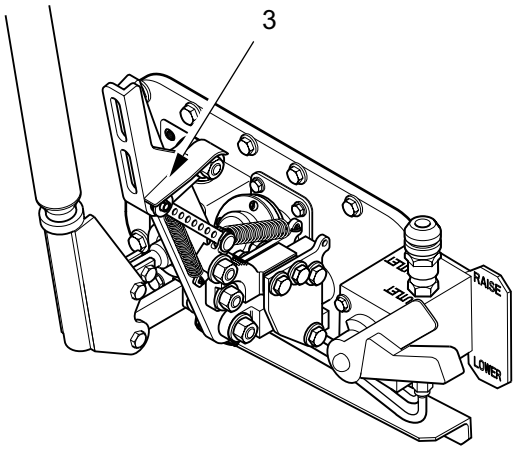
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			 TDC0304	
			f. Check handbrake assemblies (3), for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.	
			g. Check handbrakes (3) for smooth operation, if binding or wear/play of handbrakes is present, notify unit maintenance.	
			h. Check operation of handbrakes. Apply handbrakes, try to rotate wheels, if wheels rotate, notify unit maintenance.	Wheels rotate, when handbrakes are applied.
			 TDC0302	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

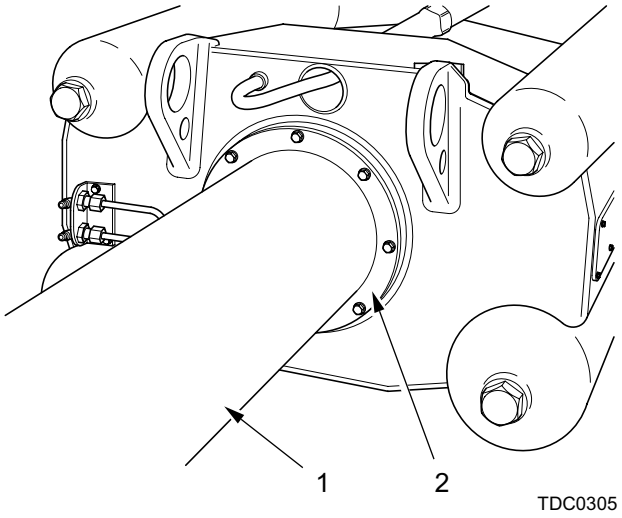
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
32	**Before and After**	**CANNON TUBE, CHASE BEARING**	**Cannoneer No. 2** a. Check cannon tube bearing surface (1) for corrosion and pitting, if corrosion or pitting present, clean with CLP and crocus cloth (item 11, appx D), wipe dry with a clean wiping rag (item 29, appx D), apply WTR (item 16/17, appx D) to exposed areas (see Chap 3 Sect I NOTE 2). b. Check chase bearing (2) for loose bolts and missing or damaged parts. If bolts are loose, missing, or if parts are damaged, notify unit maintenance.  TDC0305	
33	**Before and After**	**FIRING LEVER and LINKAGE**	**Cannoneer No. 1** a. Check firing lever (1), linkage (2), connector link (3) for loose nuts, cotter pins and missing or damaged parts. If nuts, cotter pins are loose, missing, or if parts are damaged, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

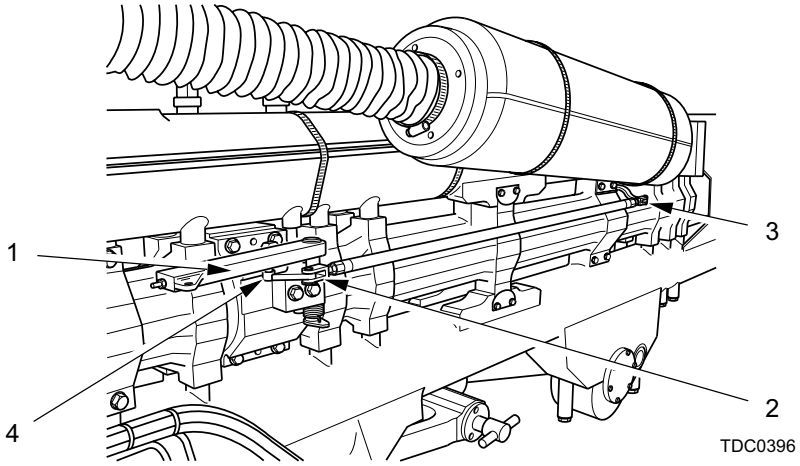
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			b. Check for smooth operation, if firing linkage does not re-cock notify unit maintenance. c. Check roller (4) for smooth operation. If binding occurs notify unit maintenance.  	
			NOTE To carryout the air brake system check, howitzer must be connected to the prime mover.	
34	**Before and After**	**AIR BRAKE SYSTEM**	**SC** a. Check air brake system for loose bolts and missing or damaged parts. If bolts are loose, missing, or if parts are damaged, notify unit maintenance. b. Check for oil leakage. If oil leaks are present, notify unit maintenance. c. Check emergency, service airline and couplings for defects, dry rot or cracks, if any present, notify unit maintenance.	If leakage is a Class II.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

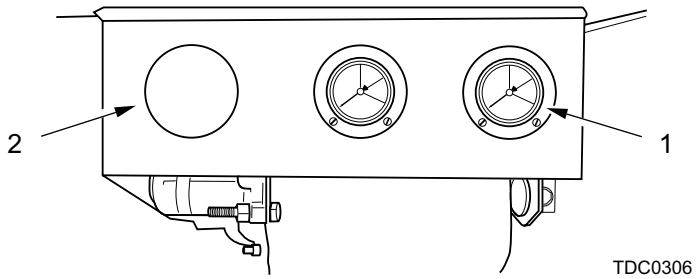
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
35	**Before and After**	**AIR/OIL INTENSIFIER**	**SC and Driver**	
			a. Check air/oil intensifier (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.	
			b. Check for oil leakage. If oil leaks are present, notify unit maintenance.	If leakage is a Class II.
			c. Check brake fluid level (2).	
			d. Check operation of brakes, if gauges remain in red, notify unit maintenance.	Gauges remain in red area.
			e. Check that needle moves to green area once prime mover brakes are released.	Needle does not move to green area.
				
			f. Check breather cap (3) and bellow (4) for loose, missing or damaged parts. If parts loose, missing or damaged, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

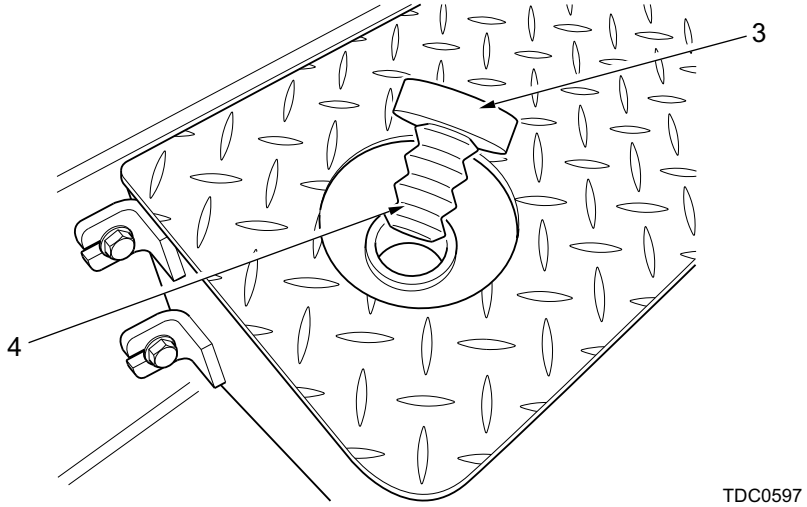
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
				
			**WARNING** Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.	
36	**Before and After**	**M171A1 TELESCOPE AND QUADRANT MOUNT AND M17A1 FIRE CONTROL QUADRANT**	**Gunner**	
			a. Check level vials (1) and counters (2 and 3) for illumination.	Level vials and counters are not illuminated or level vials are broken.
			b. Markings must be clear and level vials and bubble must be present. Wipe level vials (1) with cheesecloth (item 12, appx D) moistened with lens cleaning compound (item 8, appx D). Wipe dry.	
			c. Check for smooth operation of control knobs by turning pitch level control knob (4) and cross level control knob (5).	Control knobs do not operate.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

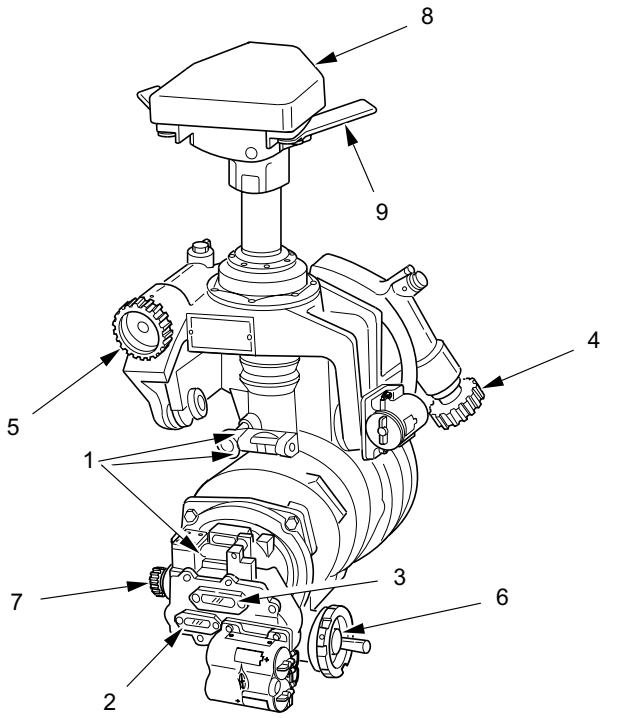
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			d. Turn elevation control knob (6). Elevation counter (2) should turn and elevation correction counter (3) should not turn. Turn elevation correction knob (7). Elevation correction counter (3) should move in 1-mil increments. Elevation counter should change by amount of correction applied.	Correction counter turns when elevation counter turns and M17A1 quadrant is non-operational. Elevation counter does not move in 1-mil increments or the elevation counter is not accurate, and M17A1 quadrant is non-operational.
			e. M171A1 mount must have a cover (8). Mounting surface must be free of nicks or burrs. Clean surface with crocus cloth (item 11, appx D), and wipe dry.	
			f. Check for presence of latches (9).	One or more latches missing.
				

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
37	**Before and After**	**PANTEL**	**Gunner**	
			a. All knobs (1, 2, 3 and 4) should turn freely. Check for rust. Clean with a clean wiping rag (item 29, appx D) moistened with cleaning compound (item 8, appx D). Wipe dry.	Knobs do not turn.
			b. Check counters (5, 6 and 7) and reticles (8) for illumination.	Reticles or counters are not illuminated.
			(1) Press red power switch (9) on counter box battery enclosure (10). Wait 3 seconds and recheck.	Counters are not illuminated.
			WARNING Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.	
			(2) Install new batteries in battery enclosure on counterbox and telescope elbow then recheck.	Reticles or counters are not illuminated.
			c. Install Pantel on mount and check for tight mounting.	Pantel cannot be secured to mount.
			d. Turn azimuth knob (2). Deflection counter (5) and azimuth counter (6) should turn; correction counter (7) should not turn.	Counters will not turn or correction counter turns.
			e. Turn gunner's aid knob (3). It should move in 1-mil increments. Deflection counter (5) should change by amount of correction applied. Azimuth counter (6) should not change.	Gunners aid knob will not move in one direction or in 1- mil, increments. Deflection counter does not change by amount of correction applied. Azimuth and/or deflection counter move more than 1/4 –mil.
			f. Check reticle image.	Reticle image is not clearly visible.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

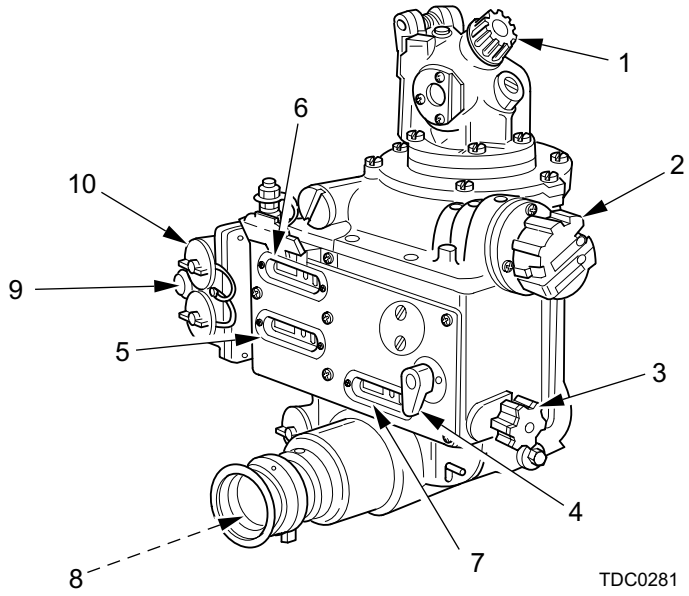
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			g. Turn deflection knob (4) to RELEASE position. Turn azimuth knob (2). Deflection counter (5) should not turn and azimuth counter (6) should turn. Turn deflection knob (4) back to ENGAGE position.	Deflection counter turns.
			h. Check Pantel with M154 alignment device. If Pantel cannot be aligned to 4800 mils ± 0.5-mil tolerance, notify unit maintenance.	Deflection counter turns.
				

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
38	**Before and After**	**M172A1 TELESCOPE AND QUADRANT MOUNT AND M18A1 FIRE CONTROL QUADRANT**	**Assistant Gunner**	
		**WARNING** Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.		
		a. Check level vials (1) and counters (2) and (3) for illumination by turning battery enclosure switch ON.		Level vials or counters will not illuminate if level vials are broken.
		b. Check that level vial covers (4) move freely. Markings on level vials must be clear, and bubble must be present. Wipe level vials (1) and gunner's quadrant seats (5) clean with cheesecloth (item 12, appx D) moisten with lens cleaning compound (item 8, appx D). Wipe dry.		Bubble is missing from one or more level vials.
		c. Turn cross level control knob (6). Check for binding.		Cross level control knob does not operate and M18A1 fire control quadrant is inoperable.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

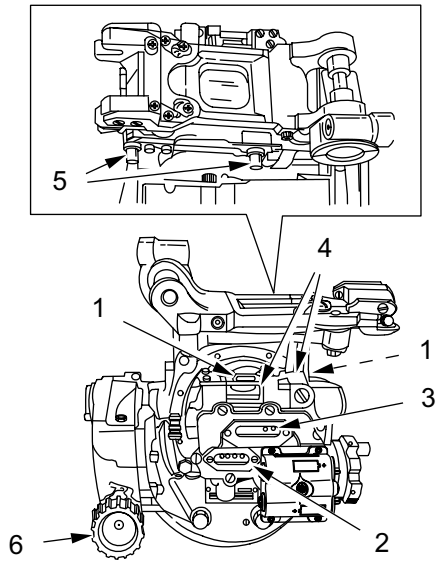
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			 TDC0309	
			d. Turn elevation control knob (7). Elevation control counter (2) should turn, and elevation correction counter (3) should not turn.	Correction counter turns when elevation control knob is turned and M18A1 quadrant is non-operational.
			e. Turn elevation correction knob (8). Elevation correction counter (3) should move in 1-mil increments. Elevation counter (2) should change by amount of correction applied.	Elevation correction counter does not move in 1- mil increments or does not change by the amount of correction applied, and the M18A1 fire control quadrant is non-operational.
			f. Telescope mounting surface must not be nicked or burred. Clean surface with crocus cloth (item 11, appx D).	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

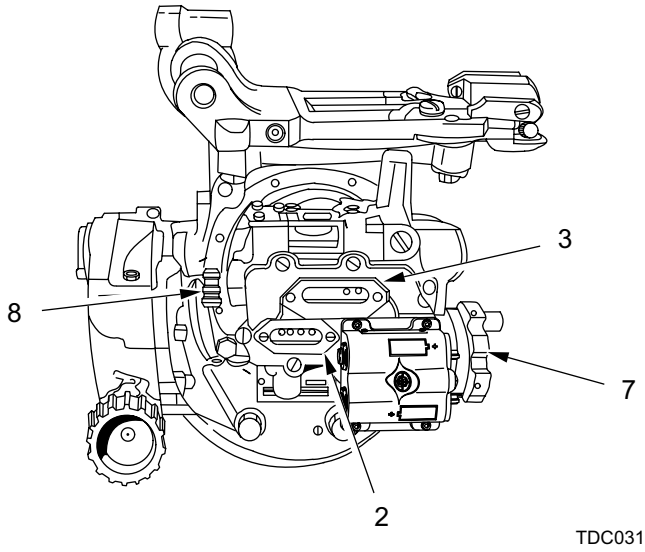
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
				
			WARNING Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.	
39	**Before and After**	**M138A1 ELBOW TELESCOPE**	**Assistant Gunner**	
			a. Check reticle for illumination.	Reticle is not illuminated.
			(1) Replace battery and recheck.	If reticle will not illuminate.
			(2) If still not illuminated after replacing battery, notify unit maintenance.	
			b. Check optics. Diopter scale should turn freely and allow individual focus. No inside moisture is allowed.	Optics fogged or will not focus.
			c. Mount M138A1 elbow telescope and check for secure mounting.	If M138A1 elbow telescope cannot be mounted securely.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

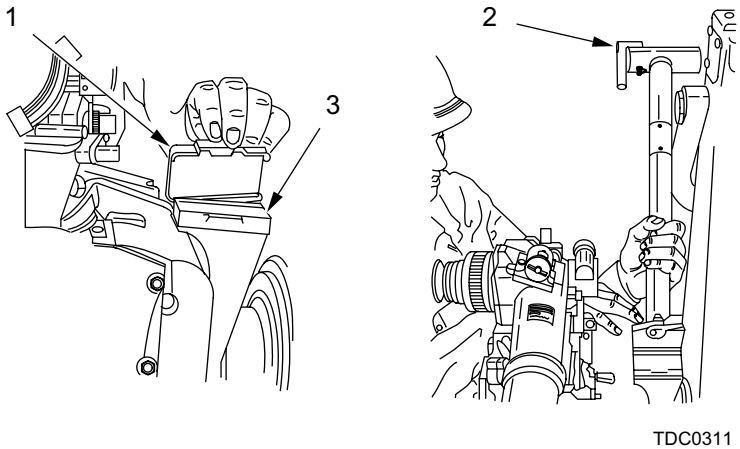
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
40	Before and After	M154 ALIGNMENT DEVICE	Assistant Gunner	
			a. Check for illumination.	If reticle will not illuminate.
			WARNING Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.	
			(1) Replace battery and recheck.	If reticle will not illuminate.
			(2) If still not illuminated after replacing battery, notify unit maintenance.	
			b. Remove protective cover (1). Check mounting surface for nicks and burrs. Install alignment device (2) on trunnion dovetail (3), and check for tight mounting.	Surface has nick and/or burrs. Mounting not tight.
				
41	Before and After	M1A2 COLLIMATOR	Cannoneer No. 3	
			a. Check to ensure collimator three locking knobs (1) operate smoothly and lock.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

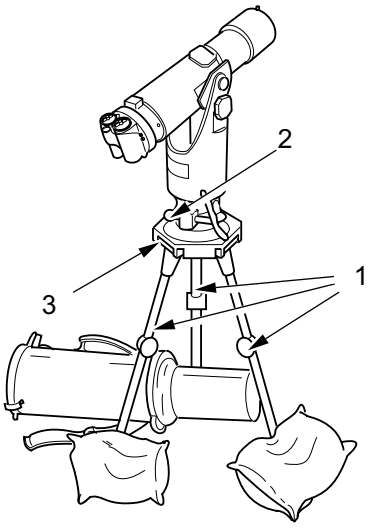
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			b. Check to ensure azimuth adjustment knob (2) operates smoothly.	
			c. Check level vial (3) to ensure markings are clear and bubble is present.	
			d. Check for dirt or moisture on internal optics.	Dirt or moisture on internal optics.
			e. Check reticle image for illumination.	Not illuminated.
			(1) Press red power on/off switch on battery enclosure. Wait three seconds and recheck.	Not illuminated.
		**WARNING** Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.		
			(2) Install new batteries in battery enclosure then recheck.	Not illuminated.
			f. Check for damage. If damaged notify unit maintenance. If not damaged, clean and mount.	Collimator is damaged and aiming posts are not available.
			 TDC0312	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

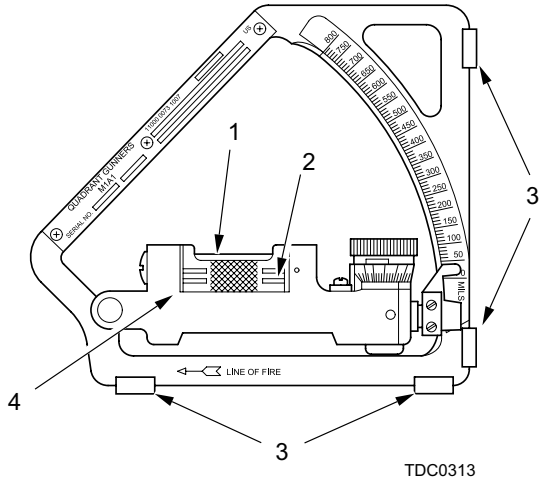
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
42	**Before and After**	**M1A1 GUNNER'S QUADRANT**	**SC** a. Check gunners quadrant level vial (1) for cracks, and markings. b. Check level vial cover (2) and quadrant arm (3) for smooth operation. c. Check shoes (4) for burrs wear and damage. If shoes are burred, worn or damaged, notify unit maintenance.  	Level vial is cracked and markings are not visible. Quadrant arm does not move freely. Shoes are burred or worn.
43	**Before and After**	**DFCS CABLES**	**All** a. Check all DFCS cables and connectors for cuts, gouges, and general serviceability. b. Check all DFCS cable connectors are tight and that Plug completely covers the red line on the Jack. Check dust caps for secure attachment, if missing, notify unit maintenance. c. Check cable routing for missing/damaged cable ties, and replace.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			d. Notify unit maintenance if cable and/or cable connectors are not serviceable.	
44	**Before and After**	**SC CONTROL DISPLAY UNIT (CSD)**	**SC** a. Check CSD (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance. b. Clean display glass (2) with a clean, cheesecloth, (item 12, appx D) and perform external physical inspection of display surface of the screen for condition of display glass. (1) Clean exterior surfaces of CSD with a clean cheesecloth, (item 12, appx D) dampened with warm water. (2) Gently clean the display surface with a clean camel hair lens brush (AA List) or clean cheesecloth, (item 12, appx D). Apply light pressure to remove dust and other particles without scratching the display surface. If the display surface is still not clean, blow on the display surface to remove any dust or other particles. (3) To remove any remaining fragments of dirt or fingerprints, apply a small amount of non-ammonia, isopropanol or ethanol based, mild, non-abrasive detergent onto a clean cheesecloth (item 12, appx D). Gently clean the display surface without scratching the display surface. (4) If display glass is scratched and degrades video image beyond readability, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

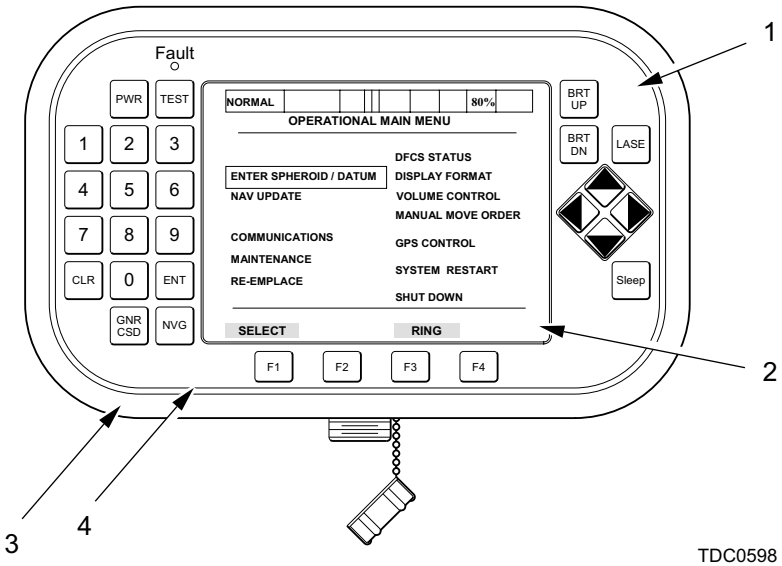
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			c. Check rubber bumper attachment (3) around bezel (4) for loose screws/washers and missing or damaged parts. If screws/washers are loose, missing, tighten or notify unit maintenance. If rubber bumper is damaged, replace bumper (Para 3-12).  TDC0598	
45	**Before and After**	**GUNNERS DISPLAY (GND) AND MOUNT**	**Gunner** a. Check GND (1) and mount (2) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance. b. Clean display glass (3) and perform external physical inspection of display surface of the screen for condition of display glass. (1) Clean exterior surfaces of GND with a clean cheesecloth, (item 12, appx D) dampened with warm water.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			(2) Gently clean the display surface with a clean camel hair lens brush (AA List) or clean, cheesecloth (item 12, appx D). Apply light pressure to remove dust and other particles without scratching the display surface. If the display surface is still not clean, blow on the display surface to remove any dust or other particles. (3) To remove any remaining fragments of dirt or fingerprints, apply a small amount of non-ammonia, isopropanol or ethanol based, mild, non-abrasive detergent onto a clean cheesecloth (item 12, appx D). Gently clean the display surface without scratching the display surface. (4) If display glass is scratched and degrades video image beyond readability, notify unit maintenance. c. Check isolators (4) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.	

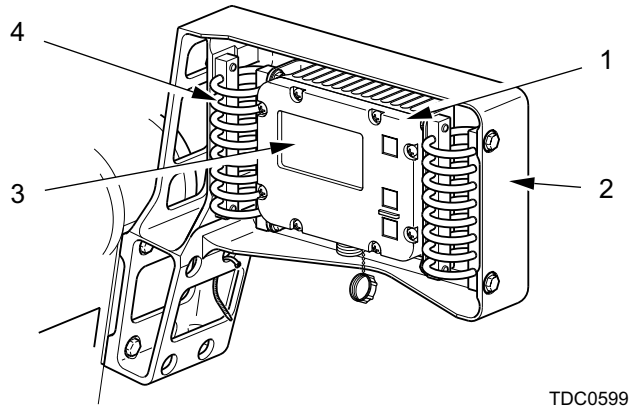


Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

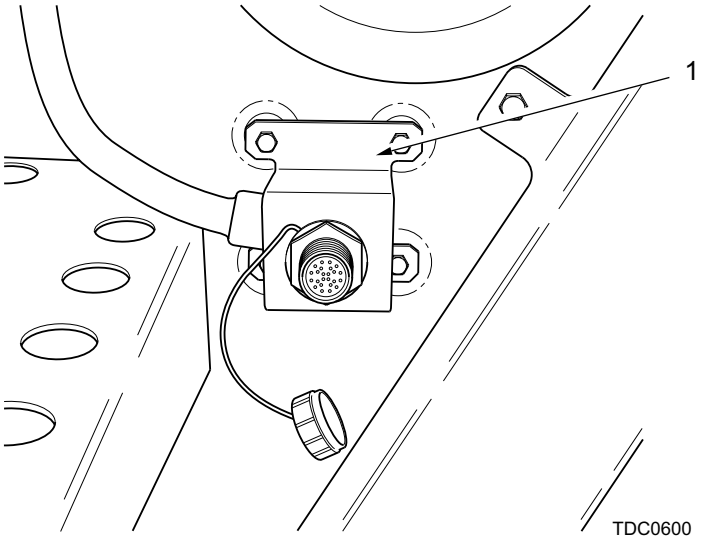
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
46	Before and After	CSD CABLE CONNECTION BRACKET	Gunner Check CSD cable connection bracket (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.  	
47	Before and After	TOP CRADLE ELECTRONIC ASSEMBLY AND MOUNT	Cannoneer No. 2 a. Check top cradle electronics assembly (1), mount (2), and MVS mount (3) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance. b. Check retaining straps (4) for damage and wear. If damaged or worn, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

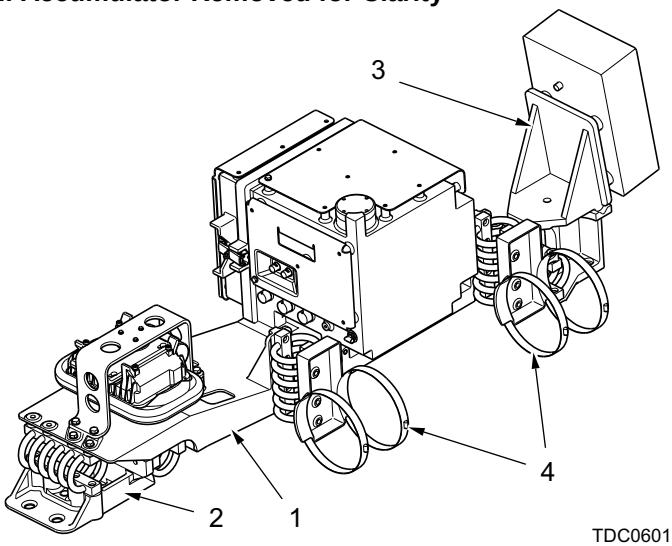
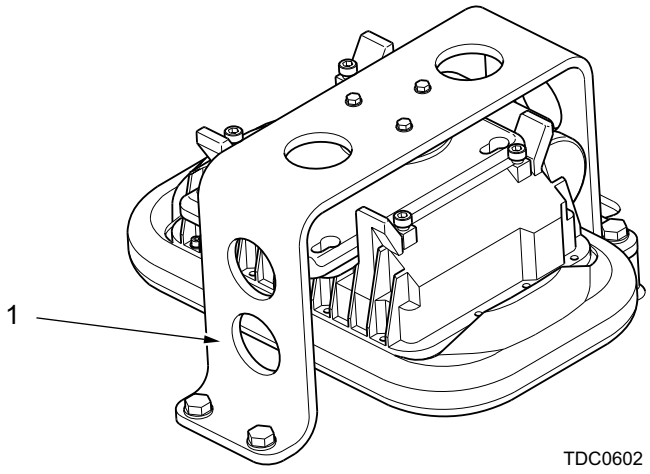
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			Recoil Accumulator Removed for Clarity  TDC0601	
48	**Before and After**	**CSD STOWAGE BRACKET**	**Cannoneer No. 2** Check stowage bracket (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.  TDC0602	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

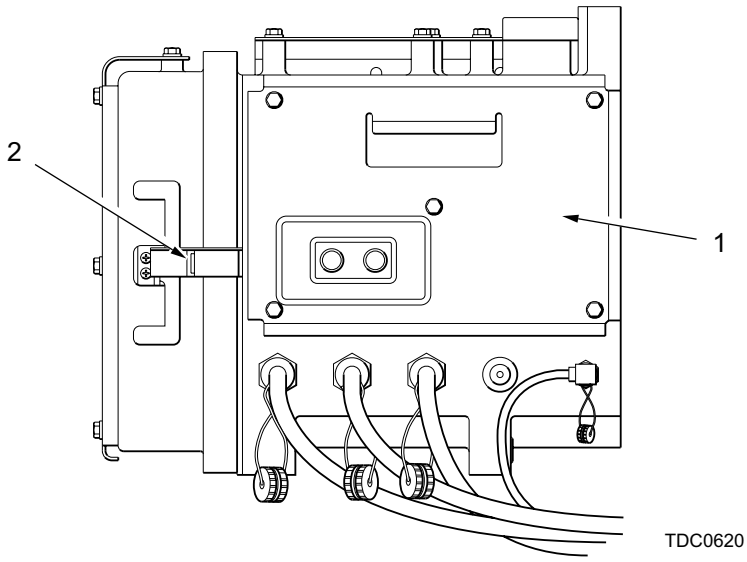
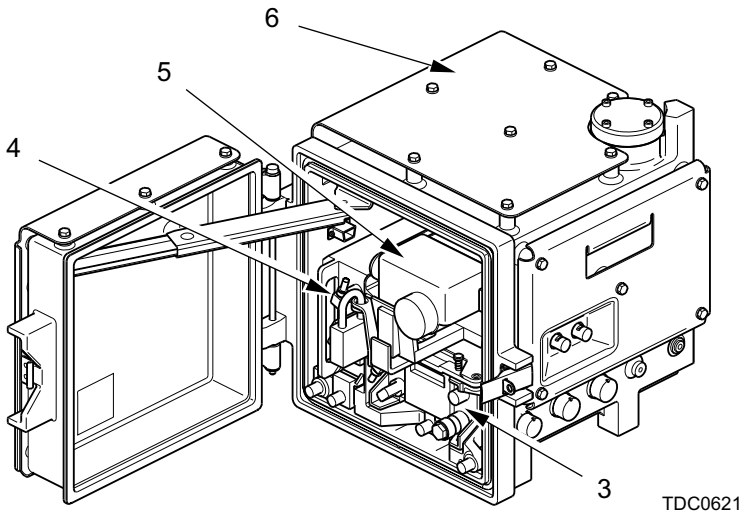
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
49	**Before and After**	**COMMUNICATION LOCATION ASSEMBLY (CLA)**	**Cannoneer No. 2** a. Check CLA (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance. b. Check door latch (2) for secure attachment, and correct operation, if unable to secure latch, notify unit maintenance.  c. Check RTA (3), AMP (4), PLGR (5) and PLA (6) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance. d. Check for cracks and damage, if cracked or damaged, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
				
50	**Before and After**	**UNDER CRADLE ELECTRONIC ASSEMBLY**	**Cannoneer No. 3** a. Lower under cradle electronics assembly (1) and check for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance. b. Check quick-disconnect pins (2) for smooth operation. Check pins corrosion, nicks, or burrs. If required remove corrosion with crocus cloth (item 11, appx D). Remove nicks and burrs with hand file. c. Check front and rear isolators (3) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.	

WARNING

TO PREVENT INJURY TO PERSONNEL, MOVEMENT OF UNDER CRADLE ELECTRONIC ASSEMBLY MUST BE SUPPORTED BY A MINIMUM OF TWO PERSONNEL.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			d. Check smooth operation of under cradle electronic assembly, if binding or excessive wear/play is present, notify unit maintenance.	
51	**Before and After**	**BATTERIES (BAT)**	**Cannoneer No. 3**	
			WARNING Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.	
			a. Check BAT (1) are secure and check for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance. b. Check battery terminal covers (2) for secure attachment if missing, notify unit maintenance.	

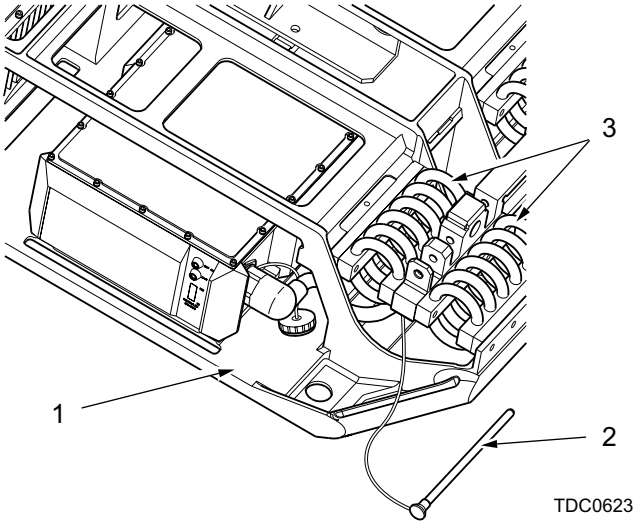


Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

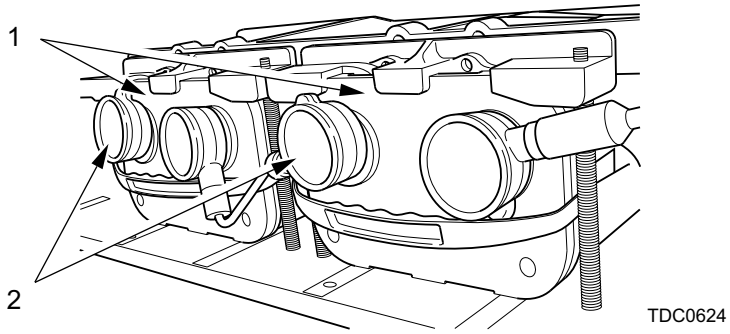
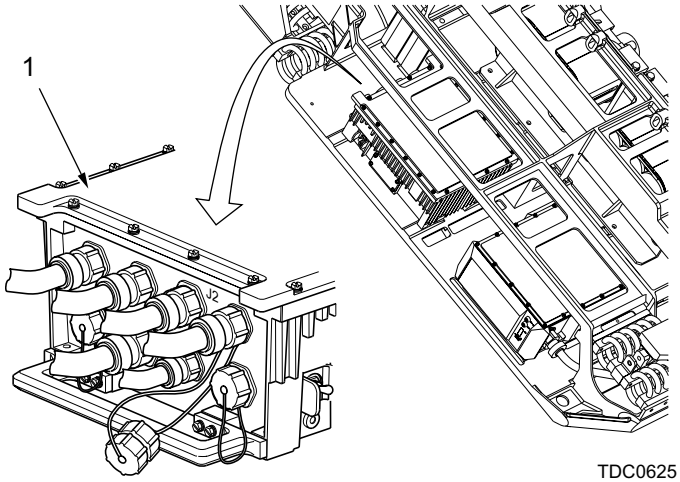
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			 TDC0624	
52	**Before and After**	**MISSION COMPUTER (MSC)**	**Cannoneer No. 4** Check underside of under cradle electronic assembly and MSC (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.  TDC0625	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

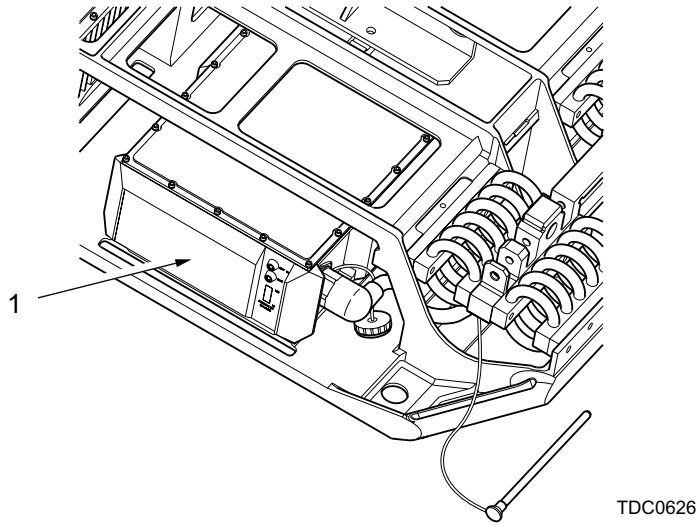
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
53	**Before and After**	**POWER CONDITIONING AND CONTROL UNIT (PSP)**	**Cannoneer No. 4** a. Check underside of under cradle electronic assembly and PSP (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance. b. Check state of charge before connecting to prime mover. c. Check state of charge. If SOC does not increase above 10% after 30 minutes of charging, notify unit maintenance.	Batteries fail to charge.
				
54	**Before and After**	**RADIO ANTENNA (ANT) AND MOUNT**	**Cannoneer No. 4** Check ANT (1) and mount (2) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

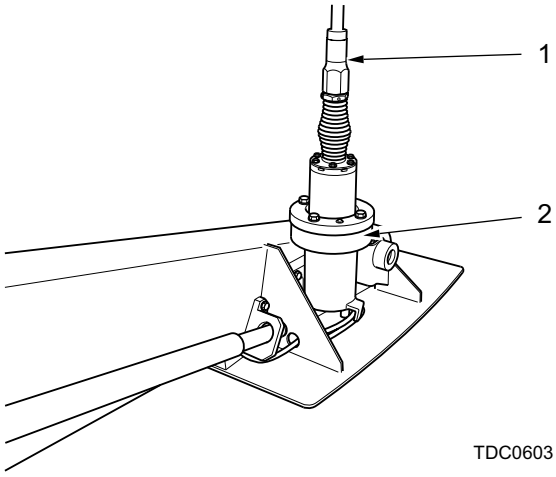
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
				
55	**Before and After**	**VEHICLE MOTION SENSOR (VMS)**	**Cannoneer No. 1** a. Check VMS (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance. b. Check cable guard (2) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance. c. Check cable guard for cracks and damage, if cracked or damaged, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

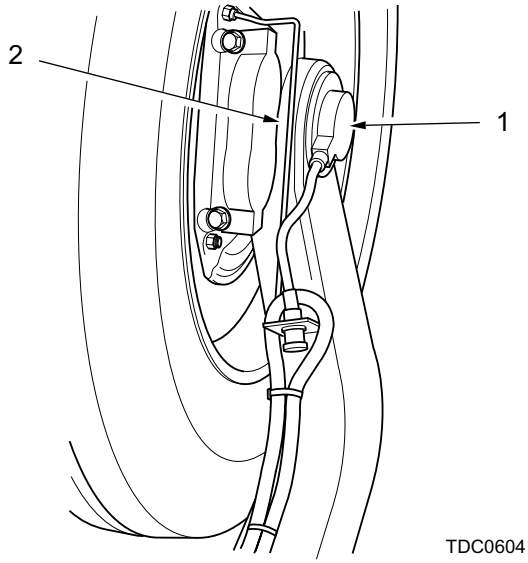
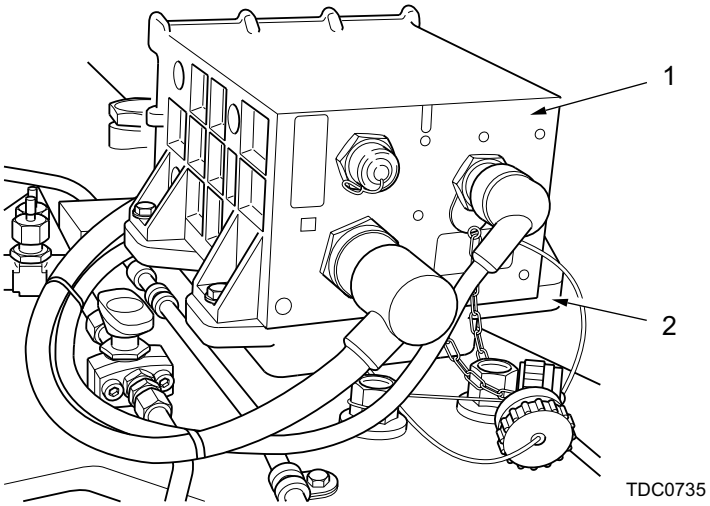
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
				
56	**Before and After**	**POSITION NAVIGATION SYSTEM (PNS) AND MOUNT**	**Cannoneer No. 1** Check PNS (1) and mount (2) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance. 	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

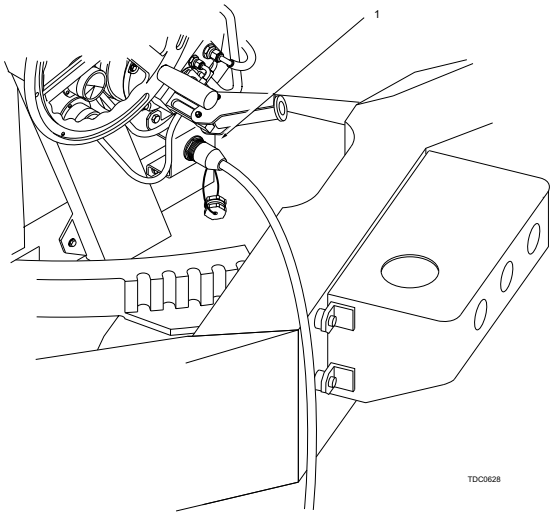
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
57	**Before and After**	**POWER CABLE CONNECTION BRACKET**	**Assistant Gunner** Check power cable connection bracket (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.  	
58	**Before and After**	**ASSISTANT GUNNERS DISPLAY (AGD) AND MOUNT**	**Assistant Gunner** a. Check AGD (1) and mount (2) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance. b. Clean display glass (3) with a, clean cheesecloth, (item 12, appx D) and perform external physical inspection of display surface of the screen for condition of display glass. (1) Clean exterior surfaces of AGD with a clean cheesecloth (item 12, appx D) dampened with warm water.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

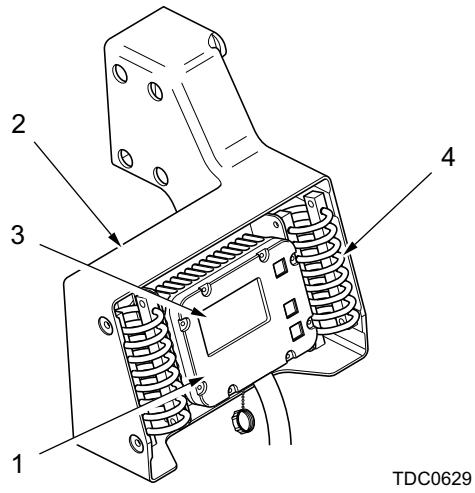
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			(2) Gently clean the display surface with a clean camel hair lens brush (AA List) or clean cheesecloth (item 12, appx D). Apply light pressure to remove dust and other particles without scratching the display surface. If the display surface is still not clean, blow on the display surface to remove any dust or other particles. (3) To remove any remaining fragments of dirt or fingerprints, apply a small amount of non-ammonia, isopropanol or ethanol based, mild, non-abrasive detergent onto a clean cheesecloth (item 12, appx D). Gently clean the display surface without scratching the display surface. (4) If display glass is scratched and degrades video image beyond readability, notify unit maintenance. c. Check isolators (4) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.  	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
59	**Before and After**	**DFCS Built-In-Test (BIT)**	**SC** a. Perform Initialization procedure (Para 2-39, steps 1 thru 10). b. Note DFCS STATUS screen (1) for any – –, DEG, or OUT messages. (1) If all subsystems report OK, continue PMCS with Item No. 60, and select NORMAL OPERATIONS or SHUT DOWN under SELECT OPERATIONAL MODE. (2) If any subsystem reports – –, DEG, or OUT, note the subsystem, ACK the message to continue, select SHUT DOWN under SELECT OPERATIONAL MODE to perform a normal system shutdown, and continue with Item No. 43c. c. Check that cables are serviceable and connectors tight to subsystem(s) that reported – –, DEG, or OUT. d. Re-initialize the system (Para 2-40). (1) If all subsystems report OK, continue PMCS with Item No. 60, and select NORMAL OPERATIONS or SHUT DOWN under SELECT OPERATIONAL MODE. (2) If any subsystem continue report – –, DEG, or OUT, ACK the messages to continue, select MAINTENANCE under SELECT OPERATIONAL MODE, and continue with Item No. 43e.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

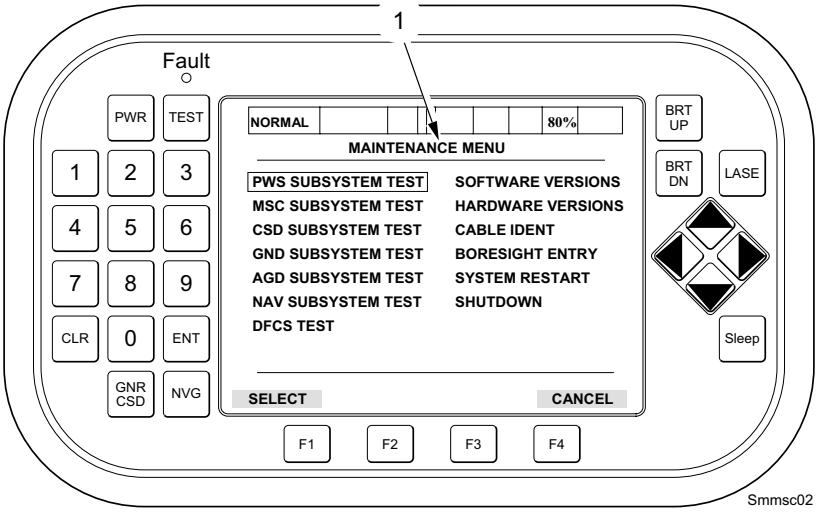
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
				
			e. Run Operator Initiated BIT for the following:	
			(1) PWS Subsystem Test.	Batteries do not charge or PSP does not provide power to the system.
			(2) MSC Subsystem Test.	System fails to boot, MSC BIT light remains lit, or MSC is OUT.
			(3) CSD Subsystem Test.	CSD does not function or CSD is OUT.
			(4) GND Subsystem Test.	
			(5) AGD Subsystem Test.	
			(6) NAV Subsystem Test.	NAV is OUT.
			f. Select SHUTDOWN to perform a normal system shutdown.	
			g. Notify unit maintenance of all failures. If MSC, CSD, or NAV is OUT or if system does not have power, the DFCS is not operational.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

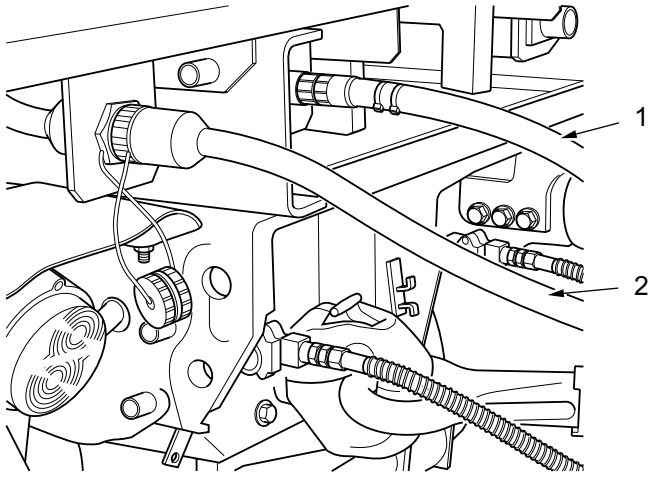
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
60	**Before and After**	**PRIME MOVER POWER AND DATA SOCKETS**	**Driver and Cannoneer No. 4** Check power cable (1), data cable (2) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.  TDC0605	
61	**Before and After**	**PRIME MOVER NATO CABLE AND SOCKET**	**Driver** Check NATO socket (1), cables [W2] (2) and circuit breaker (3) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

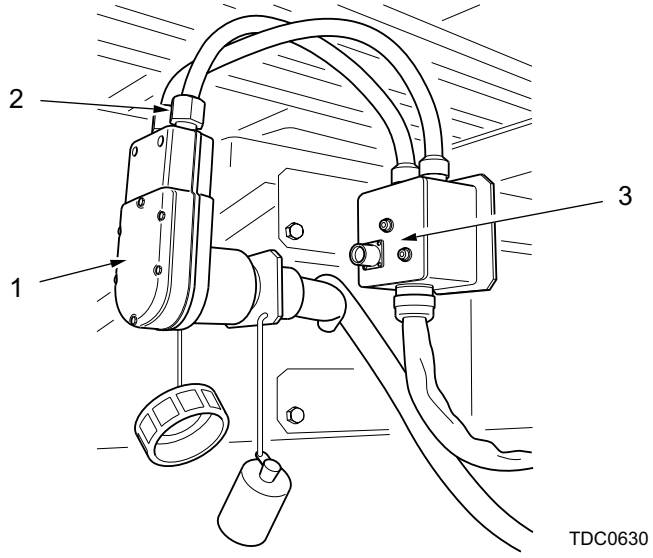
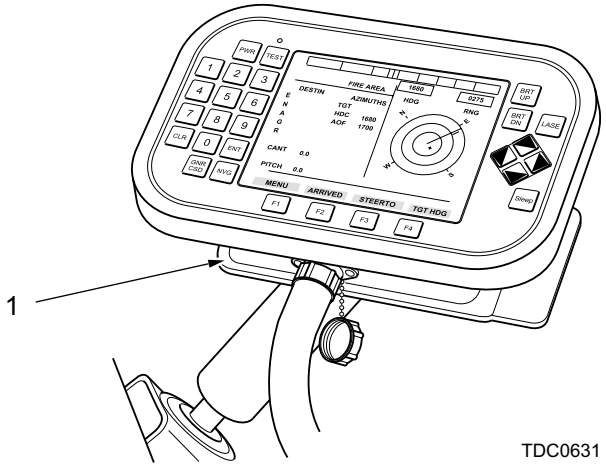
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			 TDC0630	
62	**Before and After**	**PRIME MOVER CSD MOUNT**	**Driver** Check prime mover CSD mount (1), for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.  TDC0631	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
63	**During**	**RECOIL ACCUMULATOR AND LINES**	**Cannoneer No. 2**	
			a. Check recoil accumulator and lines for oil leakage. If oil leaks are present, notify unit maintenance.	If leakage is a Class III.
			b. Check to see if oil index pin is flush. If not flush, notify unit maintenance.	If oil index pin is showing red indicator line.
64	**During**	**RECOIL CYLINDERS**	**Cannoneers Nos. 1 and 2**	
			Check recoil cylinders for oil leakage. If oil leaks are present, notify unit maintenance.	If leakage is a Class III.
65	**During**	**CRADLE ASSEMBLY**	**Cannoneers Nos. 1 and 2**	
			a. Check elevation, and main trunnions, tubes, end caps and lines for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged or lock wire missing, notify unit maintenance.	
			b. Check cradle tube insulation covers and retaining straps for damage and wear. If damaged or worn, notify unit maintenance.	
66	**During**	**PFM MANUAL HANDLE**	**Cannoneer No. 2**	
			NOTE If PFM manual fails handle to operate correctly, refer to Section VII Operation Under Degraded Conditions, and carryout, PFM Manual Handle Failure Procedures (Para 2-72), and notify unit maintenance.	
			a. Check PFM manual handle, detent, lever for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			b. Operate manual handle, ensure locking mechanism engages in PRIMED and EXTRACT position. Ensure locking plunger is not deformed and or broken, if deformed or broken notify unit maintenance.	
67	**During**	**THERMAL WARNING DEVICE (TWD)**	**Cannoneer No. 2** Inspect for moisture inside TWD (fogging of window). If moisture present, notify unit maintenance.	
68	**During**	**SCAVENGE SYSTEM**	**Cannoneer No. 1** Check scavenge pump, pressure and exhaust cylinders, manifold, isolator valve and lines for oil leakage. If oil leaks are present, notify unit maintenance.	If leakage is a Class III.
69	**During**	**BREECH MECHANISM**	**Cannoneer No. 2** a. Check breech lever, actuator and lines for oil leakage. If oil leaks are present, notify unit maintenance. b. Inspect magazines (Para 3-8) for damaged parts. If damaged, replace magazine and notify unit maintenance. c. Check M54 firing mechanism (Para 3-7 a.) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, replace M54 firing mechanism and notify unit maintenance.	If leakage is a Class III.
70	**During**	**LOADING TRAY SYSTEM**	**Cannoneer No. 1** a. Check loading tray, lever, damper, hinge brackets and lines for oil leakage. If oil leaks are present, notify unit maintenance.	If leakage is a Class III.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			b. Check mechanical interlock for smooth operation.	
71	**During**	**TRUNNION PUMP**	**Cannoneer No. 1**	
			Check trunnion pump for oil leakage. If oil leaks are present, notify unit maintenance.	If leakage is a Class III.
72	**During**	**SUSPENSION SYSTEM**	**Cannoneers Nos. 1 and 2**	
			Check suspension levers and adaptors for oil leakage. If oil leaks are present, notify unit maintenance.	If leakage is a Class III.
73	**During**	**PANTEL**	**Gunner**	
			a. Check counters and reticles for illumination.	Reticles or counters are not illuminated.
			(1) Press red power on/off switch on battery enclosure. Wait three seconds and recheck.	Not illuminated.
		**WARNING** Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.		
			(2) Install new batteries in battery enclosure then recheck.	Not illuminated.
74	**During**	**M1A2 COLLIMATOR**	**Cannoneer No. 3**	
			a. Check counters and reticles for illumination.	Reticles or counters are not illuminated.
			(1) Press red power on/off switch on battery enclosure. Wait three seconds and recheck.	Not illuminated.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
		**WARNING** Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.		
			(2) Install new batteries in battery enclosure then recheck.	Not illuminated.
75	During	**M138A1 ELBOW TELESCOPE**	**Cannoneer No. 2**	
			a. Check reticles for illumination.	Reticles or counters are not illuminated.
			(1) Press red power on/off switch on battery enclosure. Wait three seconds and recheck.	Not illuminated.
76	During	**M17A1 and M18A1 FIRE CONTROL QUADRANT**	**Cannoneer No. 2**	
			a. Check level vials and counters and reticles for illumination.	Reticles or counters are not illuminated.
			(1) Press red power on/off switch on battery enclosure. Wait three seconds and recheck.	Not illuminated.
		**WARNING** Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.		
			(2) Install new batteries in battery enclosure then recheck.	Not illuminated.
77	During	**M171A1 TELESCOPE AND QUADRANT MOUNT AND M17A1 FIRE CONTROL QUADRANT**	**Gunner**	
			a. Check level vials and reticles for illumination.	Reticles or counters are not illuminated.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			(1) Press red power on/off switch on battery enclosure. Wait three seconds and recheck.	Not illuminated.
		**WARNING** Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.		
			(2) Install new batteries in battery enclosure then recheck.	Not illuminated.
78	**Weekly**	**M171A1 TELESCOPE AND QUADRANT MOUNT AND M17A1 FIRE CONTROL QUADRANT**	**Gunner**	
			a. Check that lock wire (1) is present, and mounting bolts (2) are not loose.	Lockwire is missing or mounting bolts are loose.
		**WARNING** Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.		
			b. Check all counters (3) and vials (4) for illumination.	Counters or vials broken will not illuminate.
			(1) Replace battery and recheck.	If reticle will not illuminate.
			(2) If still not illuminated after replacing battery, notify unit maintenance.	
			c. Check smooth operation by turning all knobs.	Knobs will not operate.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

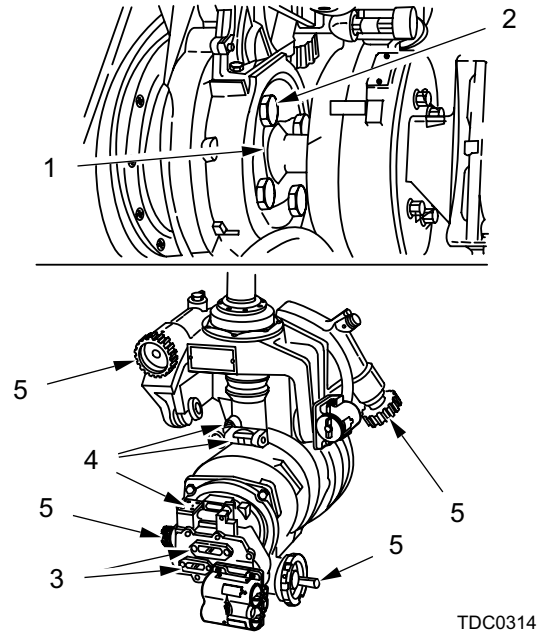
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
				
79	Weekly	**M172A1 TELESCOPE AND QUADRANT MOUNT AND M18A1 FIRE CONTROL QUADRANT**	**Assistant Gunner** a. Check that lock wire (1) is present.	Lockwire is missing.
			WARNING Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.	
			b. Check all counters (2) and vials (3) for illumination.	Counters or vials broken/will not illuminate.
			(1) Replace battery and recheck.	If reticle will not illuminate.
			(2) If still not illuminated after replacing battery, notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

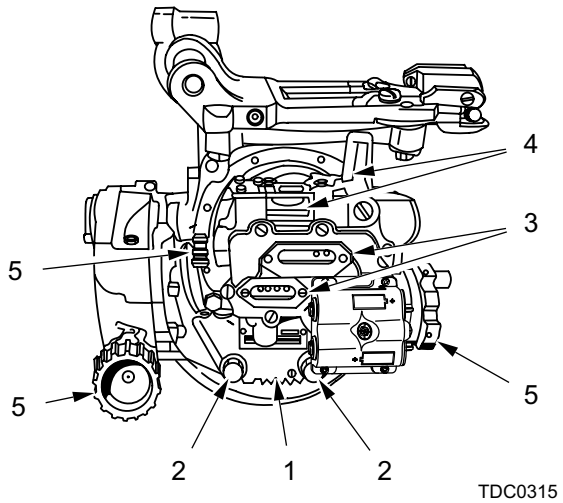
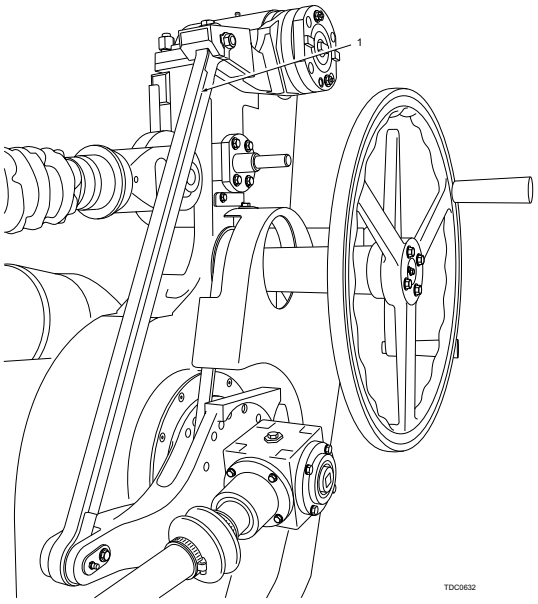
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			c. Check smooth operation by turning all knobs.	Knobs will not operate.
				
80	**Weekly**	**SIGHT LINKAGE**	**Gunner** a. Check sight linkage (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.	Loose or missing nuts/bolts.
				

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
81	**Weekly**	**PANTEL**	**Gunner**	
			a. Check counters and reticles for illumination.	Reticles or counters are not illuminated.
			(1) Press red power on/off switch on battery enclosure. Wait three seconds and recheck.	Not illuminated.
		**WARNING** Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.		
			(2) Install new batteries in battery enclosure then recheck.	Not illuminated.
82	**Weekly**	**M1A2 COLLIMATOR**	**Cannoneer No. 3**	
			a. Check counters and reticles for illumination.	Reticles or counters are not illuminated.
			(1) Press red power on/off switch on battery enclosure. Wait three seconds and recheck.	Not illuminated.
		**WARNING** Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.		
			(2) Install new batteries in battery enclosure then recheck.	Not illuminated.
83	**Weekly**	**M138A1 ELBOW TELESCOPE**	**Assistant Gunner**	
			a. Check reticles for illumination.	Reticles or counters are not illuminated.
84	**Weekly**	**M154 ALIGNMENT DEVICE**	**Cannoneer No. 3**	
			a. Check counters and reticles for illumination.	Reticles or counters are not illuminated.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			(1) Press red power on/off switch on battery enclosure. Wait three seconds and recheck.	Not illuminated.
		**WARNING** Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.		
			(2) Install new batteries in battery enclosure then recheck.	Not illuminated.
85	**Weekly**	**M1A1 GUNNERS QUADRANT**	**Gunner**	
			a. Check gunners quadrant level vial for cracks and markings.	Level vial is cracked and markings not visible.
			b. Check level vial cover and quadrant arm for smooth operation.	If quadrant arm does not move freely.
			c. Check shoes for burrs wear and damage. If shoes are burred, worn or damaged, notify unit maintenance.	If shoes are burred, worn or damaged.
86	**Weekly**	**BATTERIES (BAT)**	**Cannoneer No. 3**	
		**WARNING** Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.		
			Check BAT terminals for corrosion. Apply grease to BAT terminals.	BAT terminals are corroded.
87	**Weekly**	**WHEELS AND TIRES**	**Cannoneers Nos. 1 and 2**	
			a. Check the wheel nuts. If loose, have unit maintenance torque to 369 ft-lb (500 N-m).	
			b. Check wheels for dents or cracks. Notify unit maintenance.	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
88	**Weekly**	**BRAKE FLUID**	**Assistant Gunner** Check brake fluid level.	
89	**Weekly**	**SUSPENSION SYSTEM**	**Cannoneers Nos. 1 and 2** Operate suspension levers and lower weapon onto ground to check for proper operation of the suspension system and wheel hydrostrut.	Suspension lever or wheel hydrostrut does not operate.
90	**Weekly**	**SCAVENGE SYSTEM**	**Cannoneers Nos. 1 and 2** a. Operate scavenge system, using pump handle, charge system to required pressure 120 bar (1740 psi) and check operation of trunnion adaptor.	Scavenge system will not pressurize to 120 bar (1740 psi).
			WARNING ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.	
			b. Check scavenge system by completing a loading cycle, open breech, lower and raise loading tray, close breech.	Breech will not open/close, loading tray will not lower/raise under scavenge system pressure.
			WARNING MAKE SURE ALL PERSONNEL ARE CLEAR OF CANNON RECOIL PATH. LOSS OF NITROGEN PRESSURE CAN ALLOW CANNON TO FALL OUT OF BATTERY.	
91	**Weekly**	**RECOIL SYSTEM**	**SC** Notify unit maintenance to check the nitrogen pressure of the recoil accumulator before firing the howitzer, or when any of the following conditions are met:	Nitrogen pressure is below 329 psi (23 bar).

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777E1 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
	(1) Howitzer has been deployed to a temperature change of ± 40°F (22° C). (2) Temperature change of 40ºF (22ºC) or more. (3) Howitzer has not been fired within a week. (4) Nitrogen pressure has not been checked within a month.			
92	**Weekly**	**RECOIL SYSTEM**	**Cannoneer No. 2** Check oil index pin is flush. If oil index pin is not flush, notify unit maintenance.	If oil index pin is showing red indicator line.

Section III. OPERATION UNDER USUAL CONDITIONS

2-23 GENERAL

a. The personnel of the howitzer section consist of the following:

(1) Section Chief (SC), whose duties and responsibilities are the following:

(a) Training and efficiency of personnel.

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

(c) Observance of safety precautions.

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

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

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

(g) Policing the section area.

(2) Gunner (G) assists the SC in carrying out the duties specified in sub-paragraph (1). The Gunners specific duties are described in this manual.

(3) Ammunition Team Chief (ATC), leads and directs the handling of ammunition and assists SC in the supervision of the howitzer section, the ATC also performs duties as listed in this manual and other duties as directed.

2-23 GENERAL (cont)

(4) Assistant Gunner (AG), assists the Gunner and, in an emergency, acts as the Gunner. The Assistant Gunner's specific duties are described in this manual.

(5) Cannoneers Nos. 1 to 5 perform duties as listed in this manual and other duties as directed by SC.

(6) Driver (D), whose primary duty is to drive the prime mover of the section, and undertake maintenance and other duties as described by this manual, or directed by SC.

b. Section equipment is listed in the appropriate Tables of Organization and Equipment (TOE's) and Appendix B of this manual.

2-24 EMPLACING THE HOWITZER

WARNING

TO PREVENT INJURY TO PERSONNEL - CARE SHOULD BE TAKEN WHEN DISMOUNTING FROM PRIME MOVER.

CAUTION

Do not open tailgate on primer mover when howitzer is attached, damage may occur to the muzzle brake and lunette assembly.

NOTES

SC supervises the occupation of the firing section position. The Driver should drive the prime mover onto the firing position facing the line of fire.

When only using OFCS, SC is to ensure that the DFCS data [W16] and power [W3] cables are disconnected and removed from the howitzer and stowed on the prime mover.

If emplacing M777 howitzer carryout step 1, if emplacing M777E1 howitzer, carryout steps 2 and 3. Steps 4 thru 6 are applicable to both howitzers.

1 Ground guide announces initial DF to Gunner, who applies DF to Pantel.

2 When STEER TO SCREEN is replaced with EMPLACE FIRE AREA/POINT screen on the CSD (Para 2-41a, Emplacement at a Fire Area/Point/Log/Init Point), SC directs Driver to a suitable firing area/point, and commands HALT.

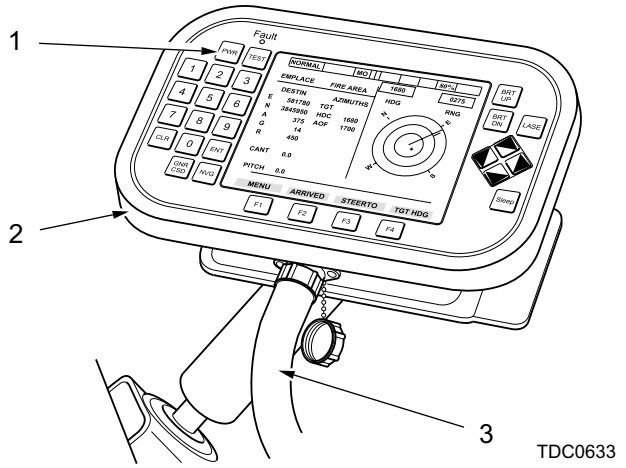
WARNING

ENSURE CSD IS POWERED DOWN BEFORE DISCONNECTING DATA CABLE [W2]. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

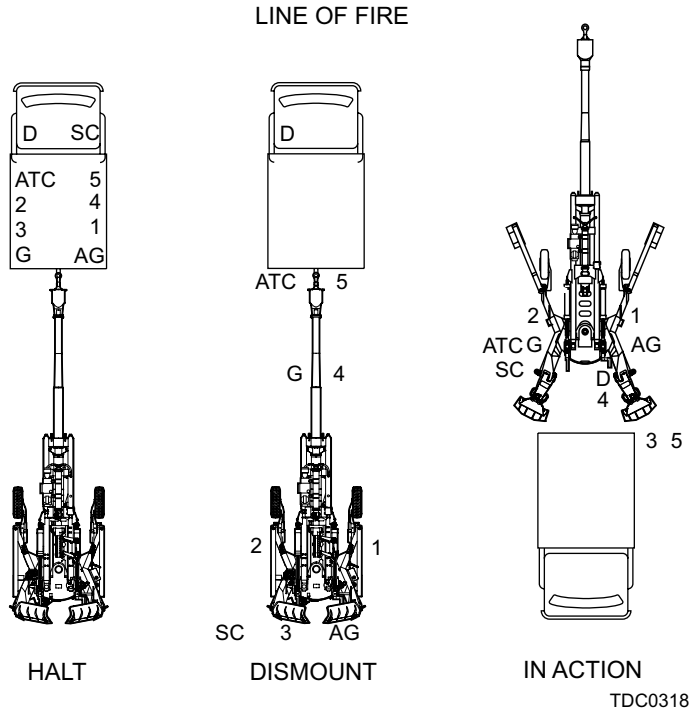
NOTE

Data [W2] cable MUST be fully disconnected from the CSD. The CSD CANNOT be re-powered by hitting the 'PWR' button. It should be considered an OFF button and not an ON button. Wait for a minimum of 2 seconds before reconnecting data [W2 or W16] cable and re-powering the CSD.

3 SC presses PWR key (1) on the CSD (2) for three seconds and release (CSD should power off, if not repeat), disconnect data [W2] cable (3) and removes CSD from vehicle mount, SC commands DISMOUNT.



4 Upon hearing command, section exits through rear of prime mover. All section members take positions as illustrated.

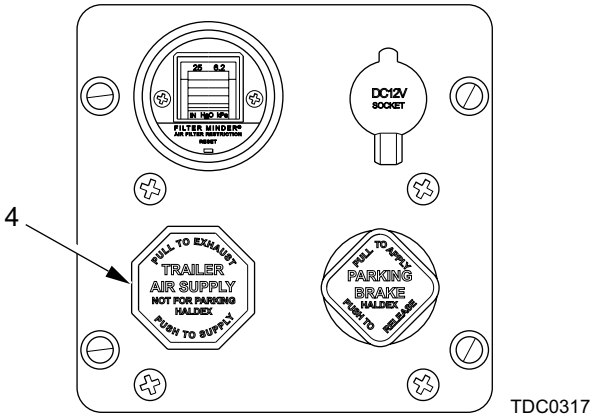


NOTE

In these drills, left and right are as seen from the rear of the howitzer.

2-24 EMPLACING THE HOWITZER (cont)

5 Driver exhausts air supply to the howitzer by pulling trailer air supply button (4) outwards.



TDC0317

6 SC commands PREPARE FOR ACTION.

NOTE

If emplacing M777 howitzer carryout steps 7 thru 11, if emplacing the M777E1 howitzer, carryout steps 12, thru 14. Steps 15 thru 19 are applicable to both howitzers.

7 Gunner mounts the howitzer and removes sight cover.

8 Cannoneer No. 3 receives the M1A2 collimator and Pantel from Cannoneer No. 2.

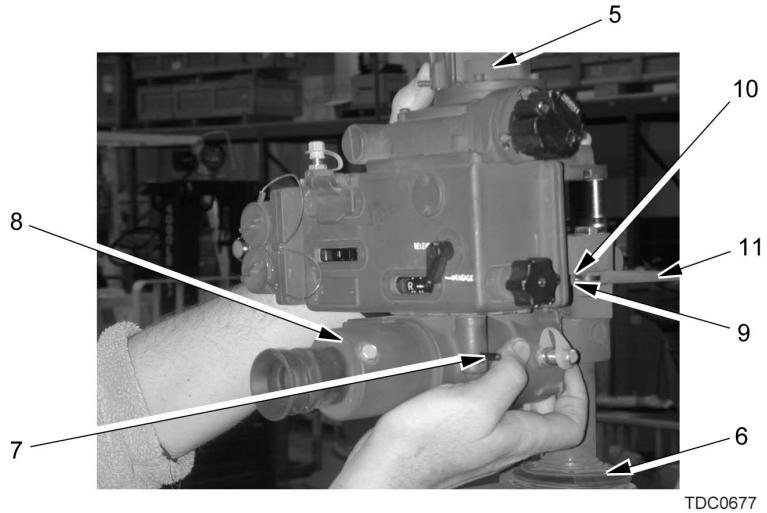
9 Cannoneer No. 3 hands Pantel to Gunner, then places M1A2 collimator to side of howitzer.

10 Gunner installs Pantel (5) to M171A1 telescope and quadrant mount (6) as follows:

(a) Depress locking pin (7) of eyepiece (8). Swing eyepiece and lock in position, approximately 90° to Pantel.

(b) Align pins (9) and keyways (10) and seat Pantel onto M171A1 telescope and quadrant mount.

(c) Engage two latches (11) to secure Pantel onto M171A1 telescope and quadrant mount.



TDC0677

11 Gunner levels M171A1 telescope and quadrant mount and M17A1 fire control quadrant as follows:

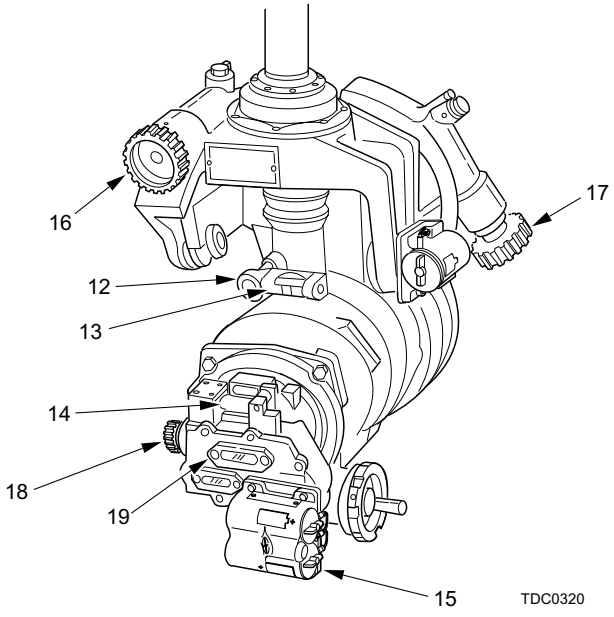
(a) Roll back the protective covers on the cross level vial (12), pitch level vial (13), and elevation level vial (14).

(b) Turn M17A1 fire control quadrant battery enclosure switch (15) to ON.

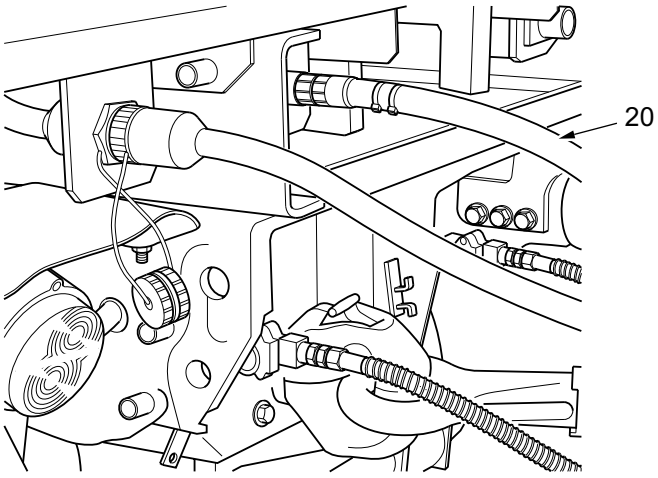
(c) Turn cross level control knob (16) to center bubble in cross level vial (12).

(d) Turn pitch level control knob (17) to center bubble in pitch level vial (13).

(e) Turn elevation correction knob (18) to zero elevation correction counter (19).

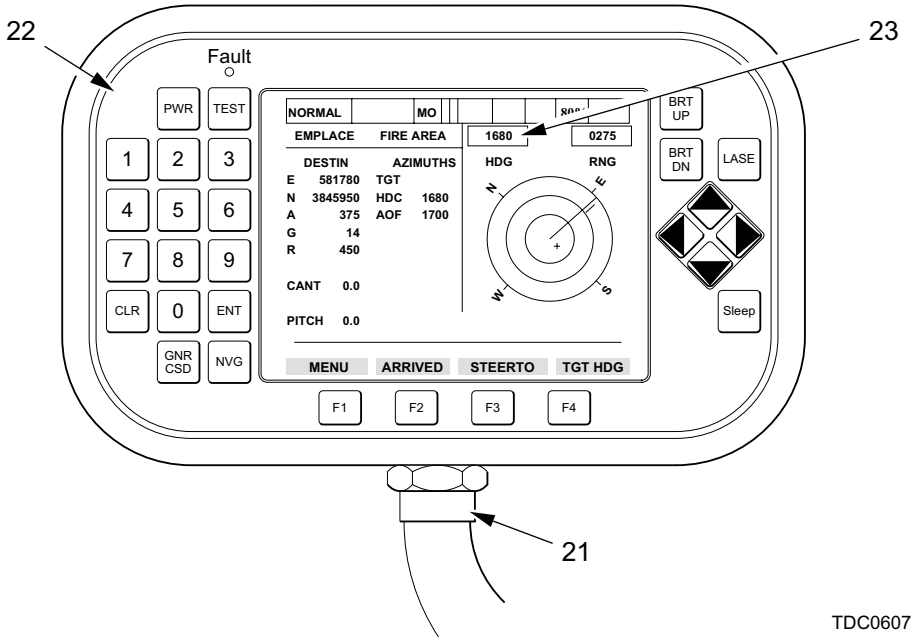


12 Gunner disconnects data [W16] cable (20) and unwraps cable from cannon tube and hands cable to SC. Gunner mounts howitzer and removes GND cover.



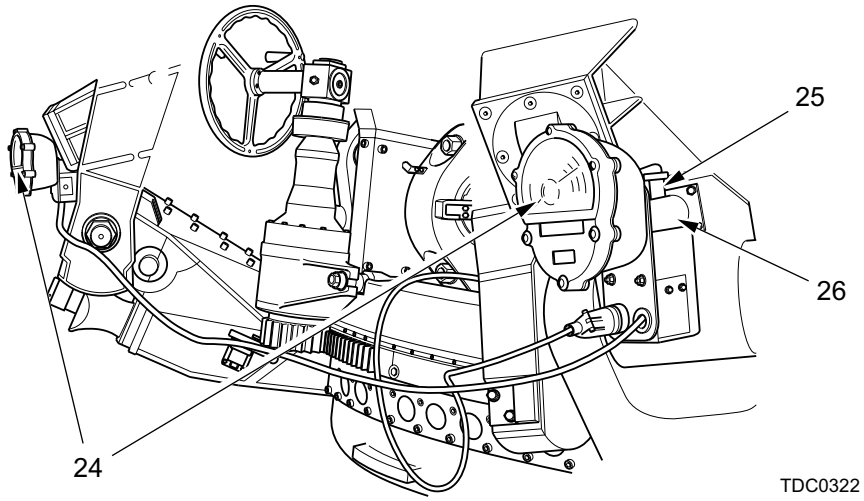
2-24 EMPLACING THE HOWITZER (cont)

13 SC connects data [W16] cable (21) to CSD (22), and observes display screen (23) (EMPLACE FIRE AREA/POINT screen should be displayed).



TDC0607

14 Assistant Gunner and Cannoneer No.3 remove howitzer taillights (24), by lifting spring plunger (25) up and removing taillights from brackets (26).



TDC0322

WARNINGS

WHEN DEPLOYING TRAIL ARMS INTO FIRING POSITION, ENSURE PERSONNEL ARE STANDING CLEAR.

TO PREVENT INJURY, MOVEMENT OF TRAIL ARM MUST BE SUPPORTED BY A MINIMUM OF TWO PERSONNEL.

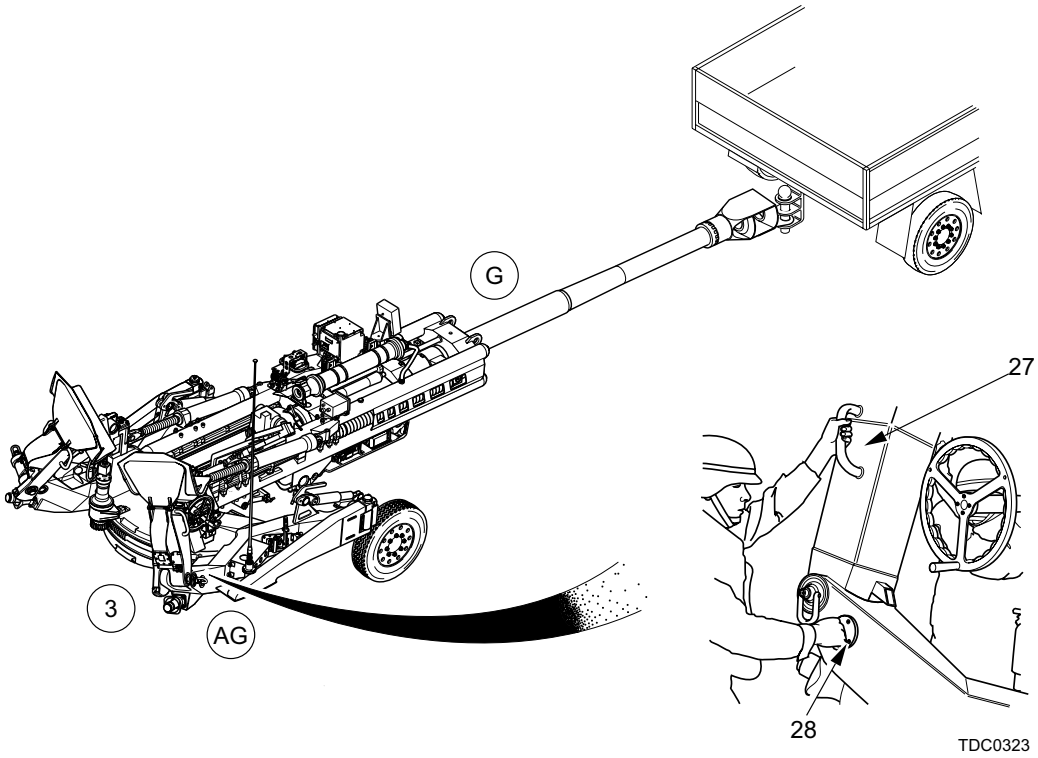
CAUTION

When deploying trail arms into the firing position, ensure trail arm locking plungers are engaged. Failure to do so will cause damage to equipment.

NOTE

When operating in arctic, and/or hard ground conditions (Para 2-46) (e.g., rock, motor pool, etc), the SC may order trail arms to remain in the stowed position.

15 Assistant Gunner and Cannoneer No. 3 deploy trail arms (27), by pulling trail arm locking plunger (28) out, lower trail arm until plunger engages.

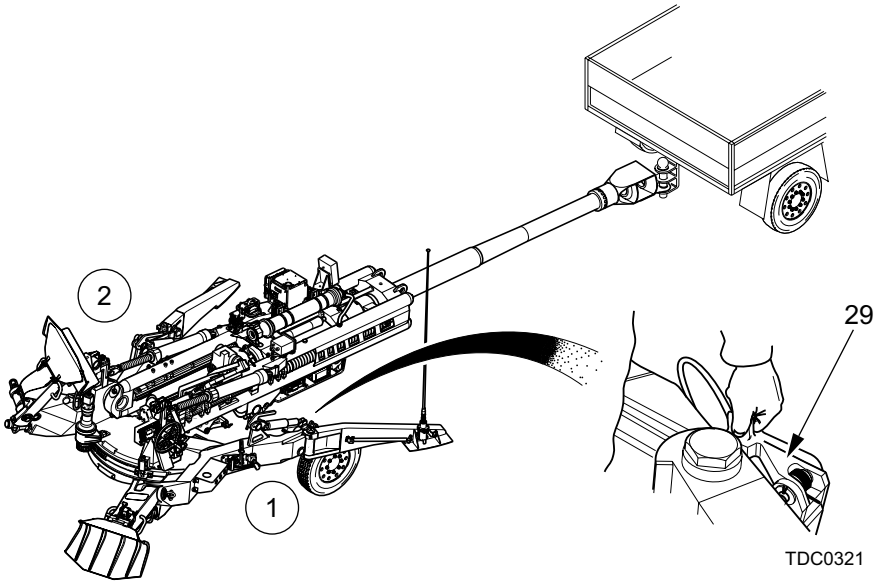


WARNING

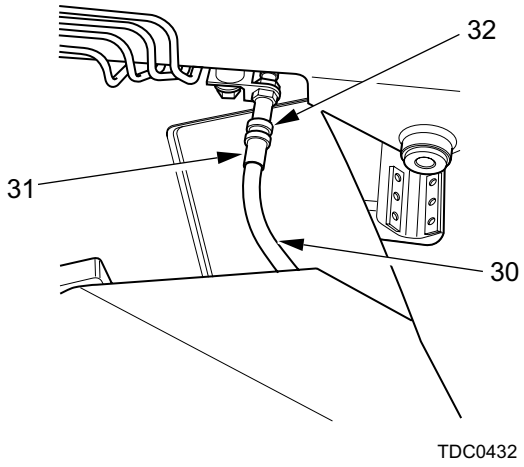
WHEN DEPLOYING STABILIZERS INTO FIRING POSITION, ENSURE PERSONNEL ARE STANDING CLEAR.

16 Cannoneer No. 2 places ammo can at side of howitzer. Cannoneers Nos. 1 and 2 deploy stabilizers into firing position, by raising stabilizer locking latches (29), swing stabilizers outwards to the firing position, ensure latches re-engage.

2-24 EMPLACING THE HOWITZER (cont)



17 Cannoneer No. 1 removes airline (30), by disconnecting coupling (31) from howitzer connecter (32) and stows airline into bracket.



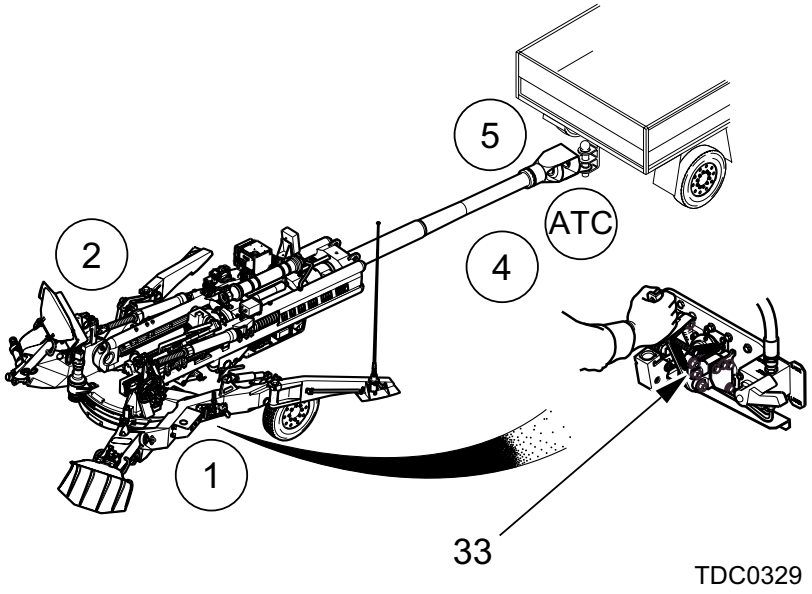
WARNING

HANDBRAKES MUST BE SET IN GARRISON AS WELL AS DURING FIELD EMPLACEMENT.

CAUTION

Care must be taken when operating handbrakes. Do not force the lever. Forcing lever will damage equipment.

18 Cannoneers Nos. 1 and 2 apply handbrakes (33).

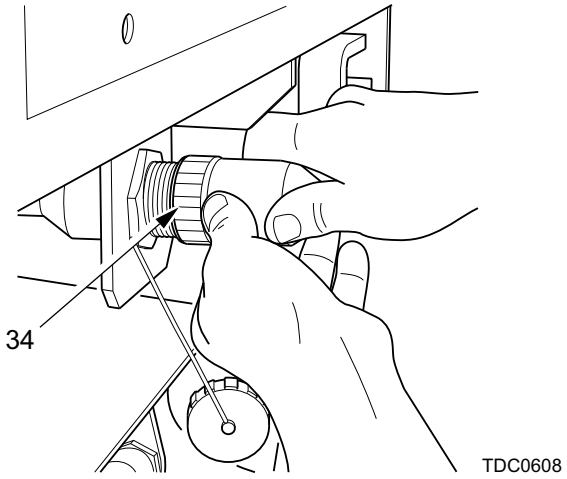


NOTES

If emplacing M777E1 howitzer, carryout step 19. Steps 20 thru 25 are applicable to both howitzers.

If power [W3] cable is not connected to the prime mover socket, proceed to step 20.

19 Cannoneer No. 4 disconnects power [W3] cable (34) and unwraps from cannon tube.



2-24 EMPLACING THE HOWITZER (cont)

CAUTIONS

Make sure service airline (yellow or blue coded) is connected to service coupling of prime mover and emergency airline (red coded) is connected to emergency coupling of prime mover. Airlines are identified by a metal band.

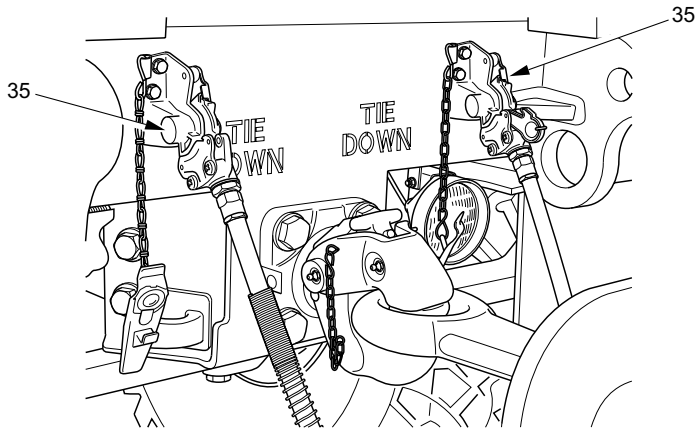
Prime mover vehicles MTVR (USMC) and FMTV (US Army) have opposite coupling connections e.g.

- MTVR – (USMC) service connection (left side), emergency connection (right side).
- FMTV – (US Army) service connection (right side), emergency connection (left side).

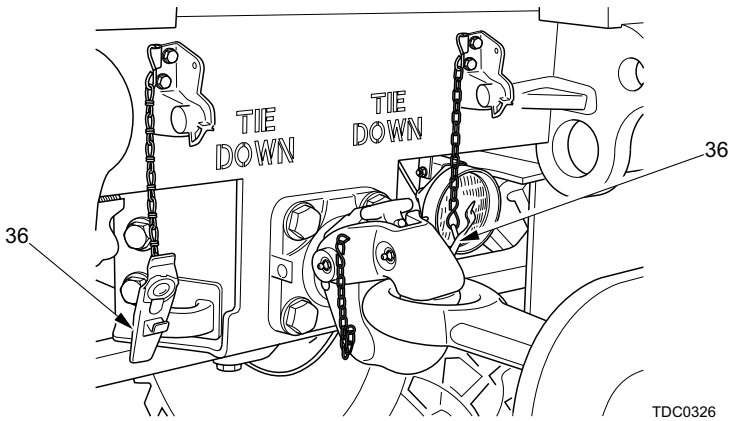
NOTE

The airline couplings should be color-coded the same as the prime mover. Yellow or blue for service and red for emergency.

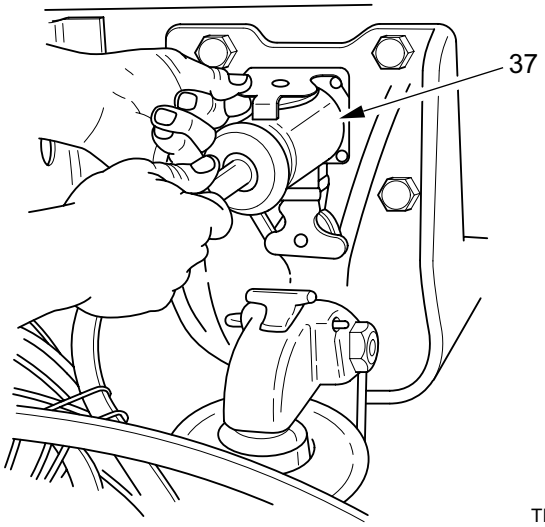
20 ATC and Cannoneer No. 5 disconnect emergency and service airlines (35) from the prime mover and stow onto muzzle brake.



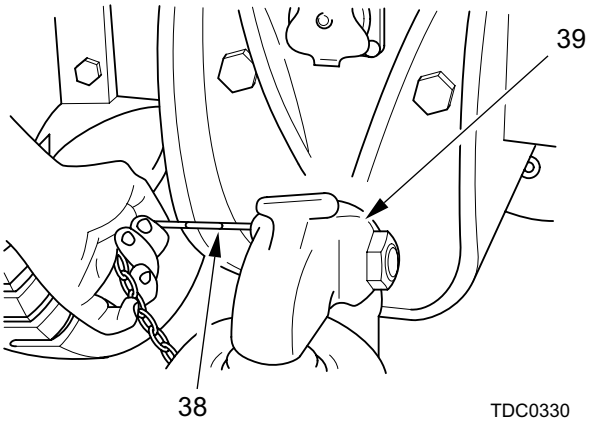
21 ATC and Cannoneer No. 5 reconnect service and emergency dummy couplings (36).



22 Cannoneer No. 5 disconnects howitzer taillight cable (37) and stows onto muzzle brake.



23 ATC removes cotter pin (38) and unlatches pintle (39) on prime mover.



24 ATC and Cannoneer No 5 lift lunette clear of pintle using trident bar and support howitzer.

25 SC commands Driver to move prime mover to rear of howitzer.

WARNINGS

BEFORE OPERATING THE SUSPENSION LEVERS, ENSURE THAT ALL PERSONNEL ARE STANDING CLEAR OF HOWITZER.

PERSONNEL SUPPORTING THE WEIGHT OF THE CANNON ASSEMBLY MUST BE WARNED BEFORE LOWERING THE HOWITZER.

2-24 EMPLACING THE HOWITZER (cont)

CAUTION

Suspension levers must be operated simultaneously.

The howitzer cannot be lowered until the following steps have been completed:

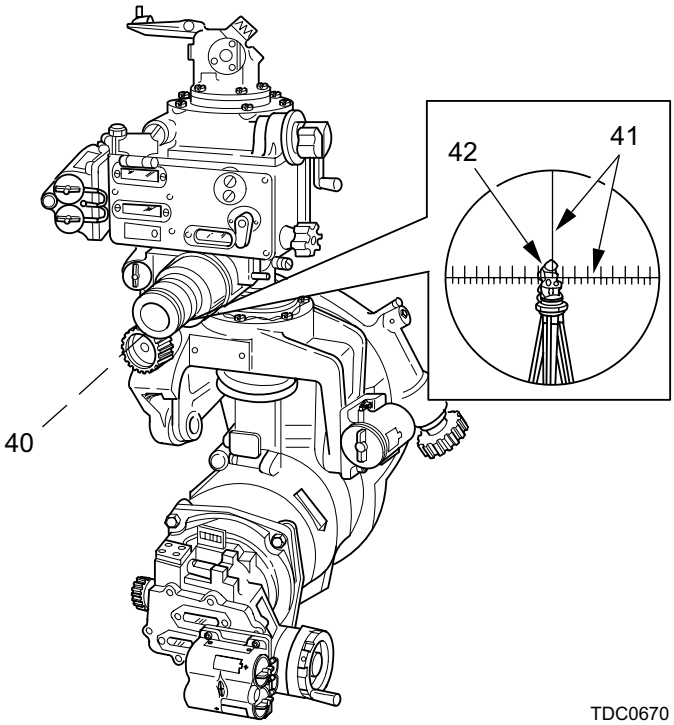
- Handbrakes are applied.
- Lunette assembly is unhooked from the prime mover.
- Cannon assembly is supported by a minimum of two personnel.
- Stabilizer and trail arms have been deployed into the firing position.

NOTES

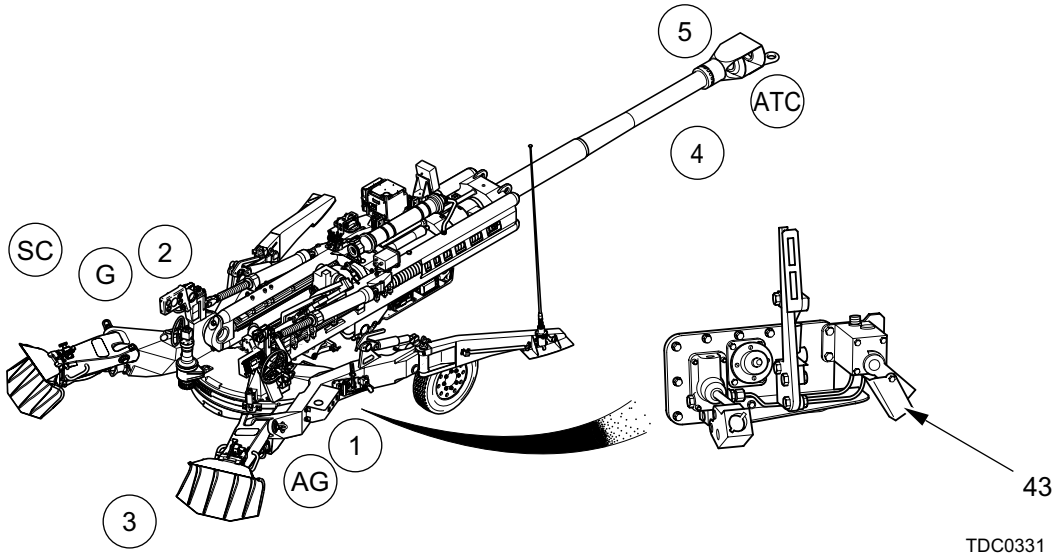
If crosshairs are not within ± 10 mils, Gunner commands ' MUZZLE LEFT/RIGHT' until crosshairs are within ± 10 mils, Gunner then commands 'DROP HOWITZER"

If emplacing M777 howitzer carryout step 26, if emplacing the M7777E1 howitzer, carryout step 27. Steps 28 thru 31 is applicable to both howitzers.

26 Gunner looking through the Pantel eyepiece (40) ensures crosshairs (41) are within ± 10 mils of the aiming circle reflector (42), Gunner commands DROP HOWITZER.



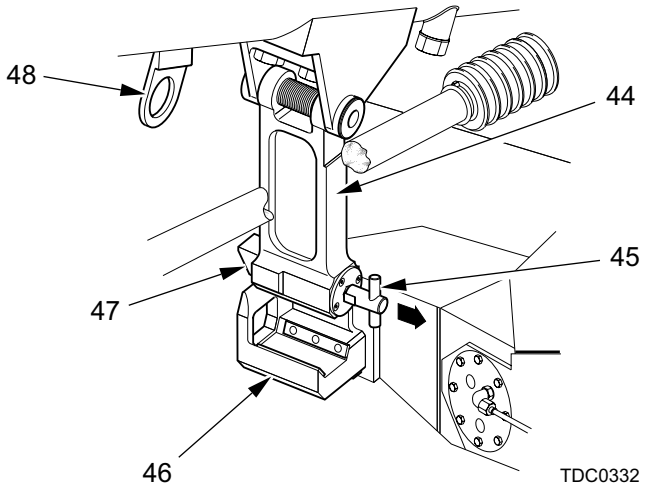
27 Gunner commands DROP HOWITZER, when CMD and ACTL AZ are reading within 10 mils ATC and Cannoneer No. 5 raise cannon tube, Cannoneers Nos.1 and 2, lower howitzer by moving suspension levers (43) to the LOWER position.



NOTE
Once howitzer is lowered SC may press “ARRIVED” key on CSD.

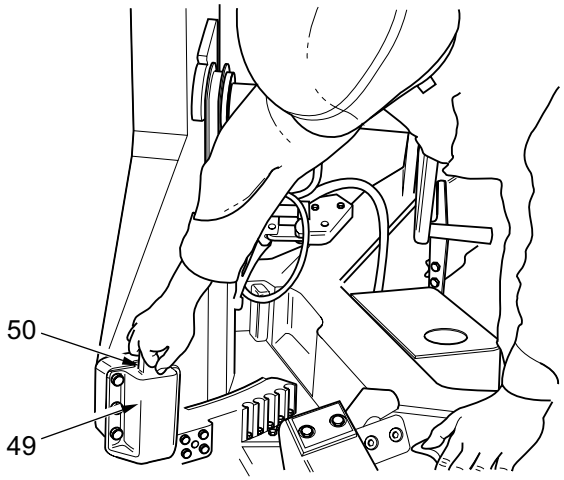
28 Cannoneers Nos. 1 and 2 disengage travel locks (44) by pulling tee-handle (45) out. Assistant Gunner elevates cannon tube until clear of locking brackets (46).

29 Cannoneers Nos. 1 and 2 raise travel locks (44) and engage plungers (47) into stowage bracket (48).



2-24 EMPLACING THE HOWITZER (cont)

30 Gunner and Assistant Gunner disengage traverse lock (49) by raising and turning handle 90° CW and lowering into the slot (50).



NOTE

If emplacing M777 howitzer carryout steps 31 and 32. Steps 33 thru 36 are applicable to both howitzers.

31 Gunner checks to ensure that:

(a) Bubbles in pitch level vial (51) and cross level vial (52) on the M171A1 telescope and quadrant mount are centred.

(b) Azimuth knob bar (53) reads INDIRECT.

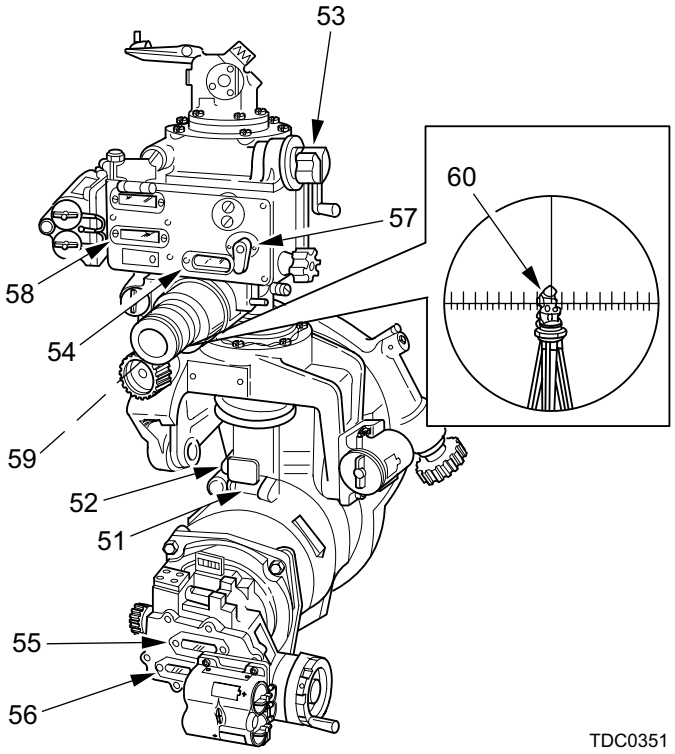
(c) Correction counter (54) on the Pantel is set at zero.

(d) Elevation correction counter (55) on M17 fire control quadrant is set zero.

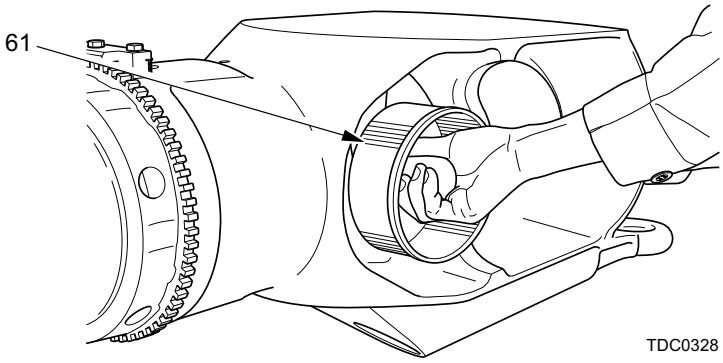
(e) Elevation counter (56) on M17 fire control quadrant

(f) Gunner engages the deflection knob (57), sets the deflection counter (58) at 3200, and then releases defection knob.

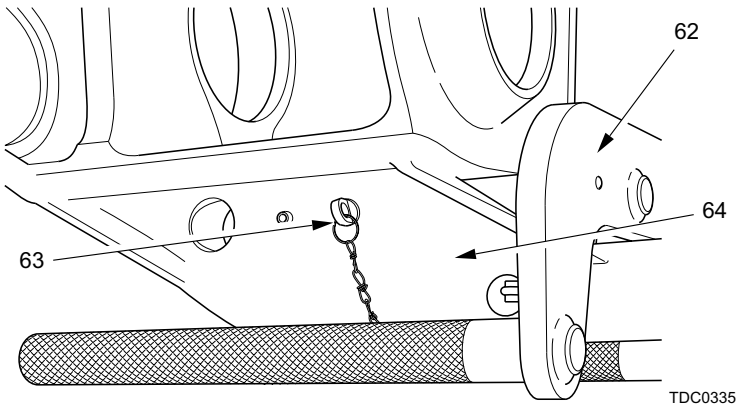
32 Gunner looking through Pantel eyepiece (59), traverses howitzer until crosshairs are centred on the aiming circle reflector (60) (see Para 2-26 for Laying the Howitzer using the Aiming Circle).



33 ATC removes muzzle plug (61) from cannon tube and stows onto prime mover.



34 Cannoneer No. 5 removes trident bar (62), by disengaging quick release pin (63) from lunette assembly (64), slide trident bar out of adaptor.



2-24 EMPLACING THE HOWITZER (cont)

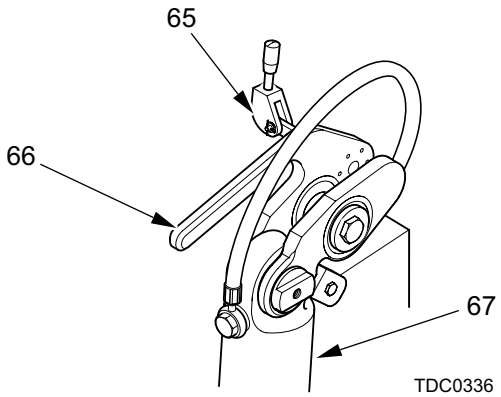
WARNINGS

ENSURE THAT HANDBRAKES ARE APPLIED BEFORE ATTEMPTING TO MOVE WHEEL ASSEMBLY ONTO THE BODY; FAILURE TO APPLY HANDBRAKES MAY RESULT IN INJURY TO PERSONNEL.

TWO PERSONNEL MUST BE USED WHEN LIFTING WHEEL ASSEMBLY.

NOTE
Step 35 only applies when local SOP's decide wheel assemblies are to be raised during fire missions/deployment operations.

35 ATC and Cannoneers Nos. 1, 2 and 5 deploy wheel assemblies into raised position, by pulling wheel locking lever (65) out and lift crank handle (66) up until hydrostrut (67) lock disengages. Lift wheel assembly onto body. Ensure crank handle is engaged.



36 Cannoneer No. 3 guides prime mover to rear of howitzer.

NOTE
If emplacing M777 howitzer carryout step 37. Steps 38 thru 42 are applicable to both howitzers.

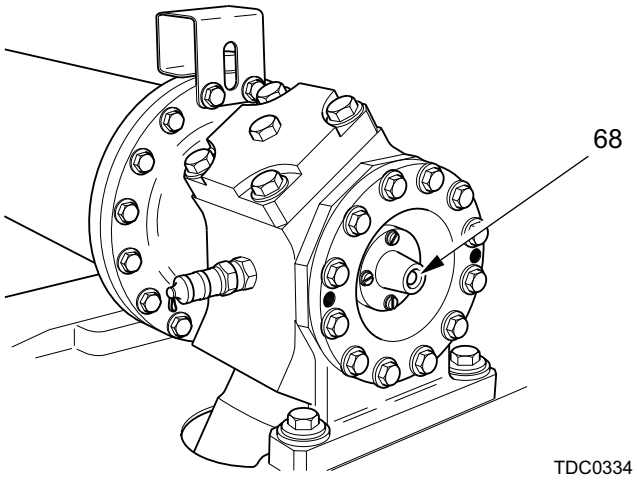
37 Cannoneer No. 4 hands power [W3] cable to Cannoneer No. 3, who connects cable to prime mover power socket. Cannoneer No. 3 mounts prime mover and hands SL-3/BII gear to Driver.

WARNING

BEFORE FIRING HOWITZER, ENSURE THAT AIRLINES ARE STOWED ONTO THE CRADLE BRACKETS. FAILURE TO STOW AIRLINES WILL CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

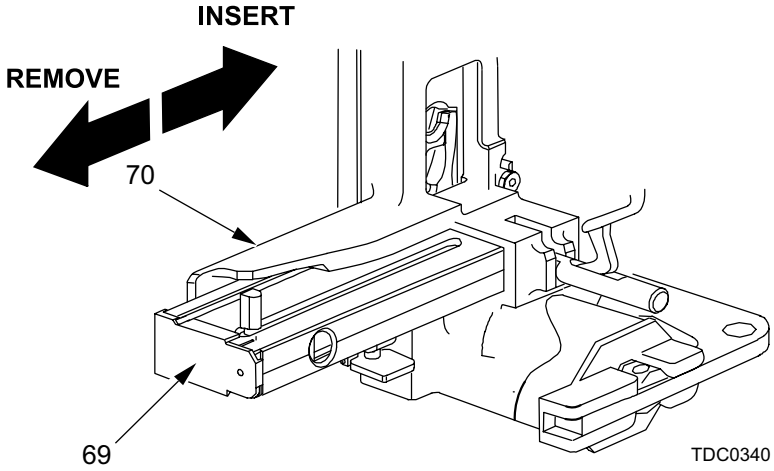
38 Cannoneer No. 4, stows service and emergency brakelines onto cradle bracket.

39 Cannoneer No. 2 removes breech cover, and checks recoil accumulator oil index pin (68) is flush.



40 Cannoneers Nos. 1 and 2 open the breech (Para 2-25 a).

41 Cannoneer No. 2 installs magazine (69) into tray assembly (70). Ensure magazine is locked.



CAUTION

Spades must be dug into a minimum of 3 inches (7.5cm). Soil must not be removed from rear of spade.

42 ATC and Cannoneers Nos. 1, 2 and 5 dig in spades (if required).

NOTE

If emplacing M7777E1 howitzer carryout step 43, if emplacing the M777 howitzer, carryout steps 44 thru 47.

43 Assistant Gunner removes AGD cover.

44 Assistant Gunner receives telescope case from Cannoneer No. 2, and deploys case to the right side of the howitzer, removes cover from M172A1 telescope and quadrant mount and M18A1 fire control quadrant.

2-24 EMPLACING THE HOWITZER (cont)

45 Assistant Gunner levels M172A1 telescope and quadrant mount as follows:

(a) Turn M18A1 fire control quadrant battery enclosure switch (71) to ON.

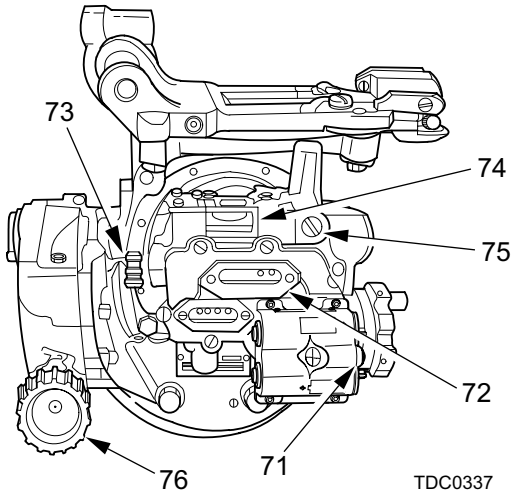
(b) Zero elevation correction counter (72) by turning elevation correction knob (73).

(c) Roll back protective covers on elevation level vial (74) and cross level vial (75).

(d) To center bubble in cross level vial (75), turn cross level control knob (76).

NOTE

Each time howitzer is traversed, elevated, or depressed, M172A1 telescope and quadrant mount must be checked to make sure it is level.

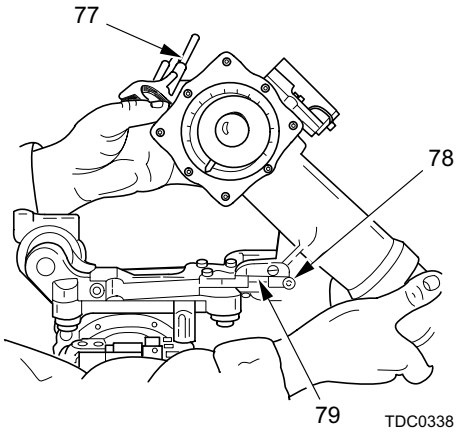


46 Assistant Gunner removes M138A1 elbow telescope from the fire control equipment carrying case.

47 Assistant Gunner installs M138A1 elbow telescope as follows:

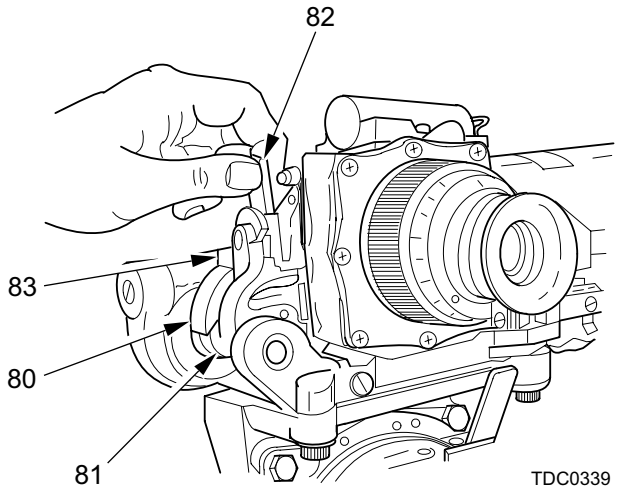
(a) Turn lock release lever (77) to the left, move locking latch (78) to the open position.

(b) Insert telescope T-rod (79) into keyway on M172A1 telescope and quadrant mount with eyepiece end raised.



(c) Lower eyepiece end of telescope until latch assembly (80) engages mount shaft (81).

(d) Pull locking latch (82) up to a vertical position and turn lock-release lever (83) CW until snug.



2-25 BREECH OPERATING MECHANISM

Open Breech (system not charged):

NOTE

The breech assembly can only be operated when the loading tray is stowed.

1 Cannoneer No. 1 installs pump handle (1) into trunnion adaptor (2), ensuring that the bayonet fitting is engaged.

2 Cannoneer No. 2 checks that the breech lever (3) is in the CLOSED position.

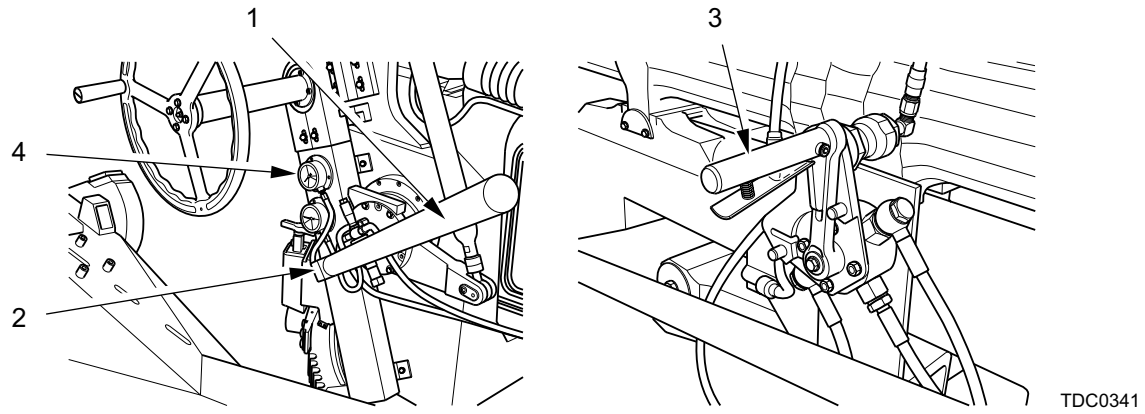
3 Cannoneer No. 1 operates pump handle (1) until high pressure gauge (4) reads in the green sector 1762psi (120 bar). Ensure that the final stroke of the adaptor is inboard, remove pump handle and stow. Cannoneer No. 1 announces CHARGED.

WARNING

ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.

4 Cannoneer No. 2 moves breech lever (3) to the OPEN position.

2-25 BREECH OPERATING MECHANISM (cont)



NOTE

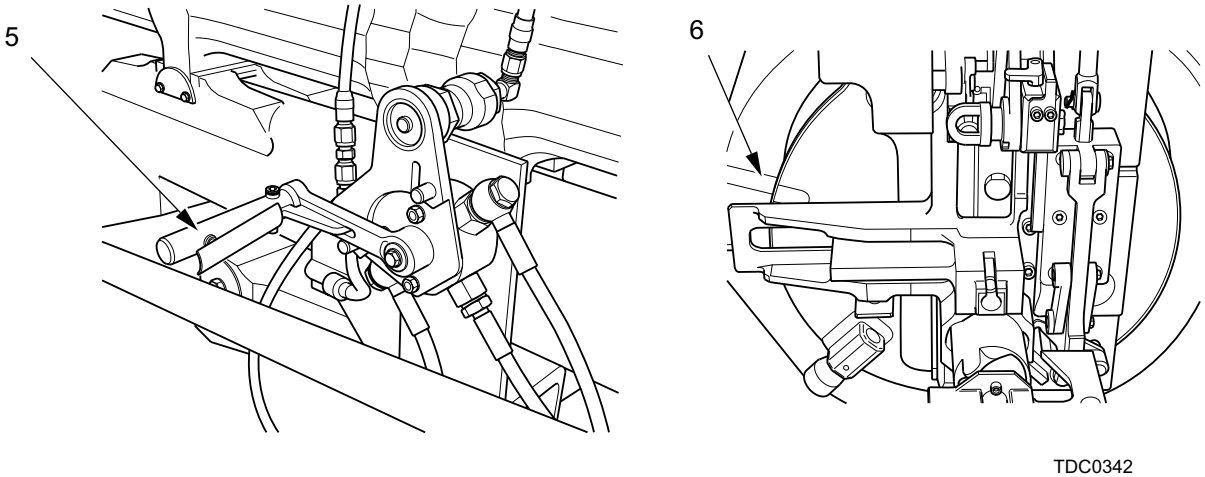
After the first round has been fired, the breech and loading tray assembly can be operated hydraulically by using the breech and loading tray levers.

Close Breech:

WARNING

ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.

1 Cannoneer No. 2 moves breech lever (5) to CLOSE position, and checks that breech witness marks (6) are aligned.



Open Breech (manually):

WARNING

THE SCAVENGE ISOLATOR VALVE MUST BE CLOSED WHEN WORKING AROUND THE BREECH. FAILURE TO CLOSE THE VALVE COULD RESULT IN INADVERTENT BREECH MOTION. THIS COULD RESULT IN SEVERE CRUSHING INJURIES TO PERSONNEL.

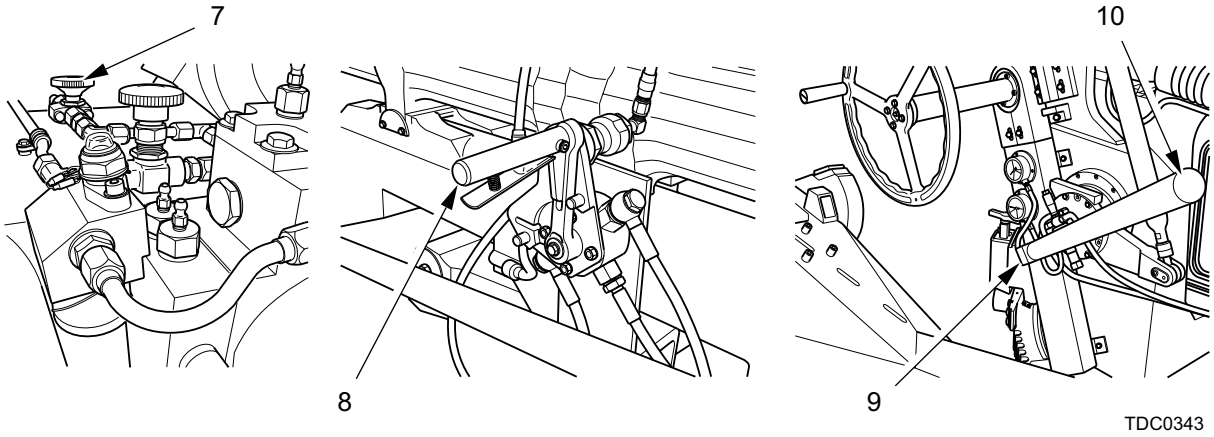
1 Cannoneer No. 1 closes scavenge isolator valve (7).

WARNING

ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.

2 Cannoneer No. 2 moves breech lever (8) to the OPEN position.

3 Cannoneer No. 1 operates trunnion pump (9) until breech is fully open. Remove pump handle (10) and stow.



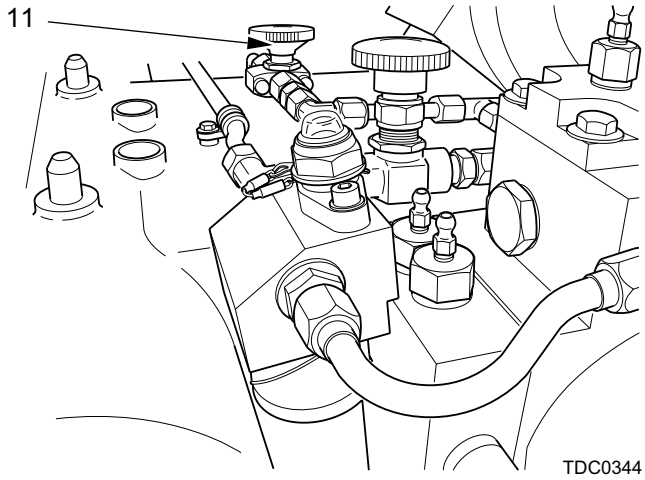
Close Breech (manually):

WARNING

THE SCAVENGE ISOLATOR VALVE MUST BE CLOSED WHEN WORKING AROUND THE BREECH. FAILURE TO CLOSE THE VALVE COULD RESULT IN INADVERTENT BREECH MOTION. THIS COULD RESULT IN SEVERE CRUSHING INJURIES TO PERSONNEL.

2-25 BREECH OPERATING MECHANISM (cont)

1 Cannoneer No. 1 closes scavenge isolator valve (11).

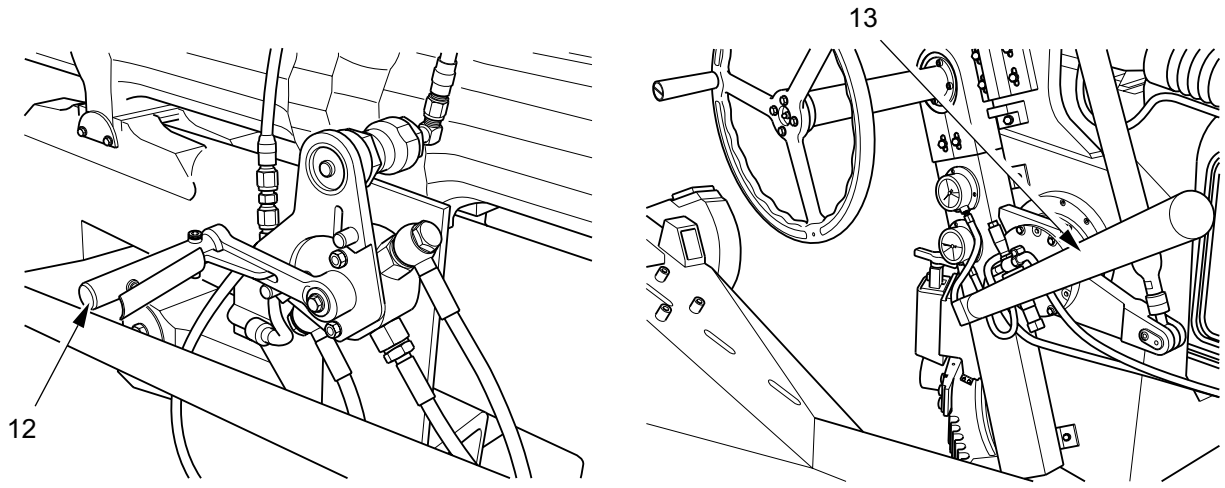


WARNING

ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.

2 Cannoneer No. 2 moves breech lever (12) to the CLOSE position.

3 Cannoneer No. 1 operates trunnion pump handle (13) until breech is fully closed and witness marks are aligned. Remove handle and stow.



Lower/Raise Loading Tray (system not charged):

NOTE
The loading tray can only be operated when the breech is open.

1 Open breech (system not charged).

WARNINGS

ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.

DO NOT RAISE THE LOADING TRAY WITH A PROJECTILE EMPLACED ON THE TRAY. FAILURE TO DO SO WILL RESULT IN INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

2 To raise/lower loading tray (14), move loading tray lever (15) to the DOWN/UP position.

Lower Loading Tray (manually):

1 Open breech (manually).

WARNINGS

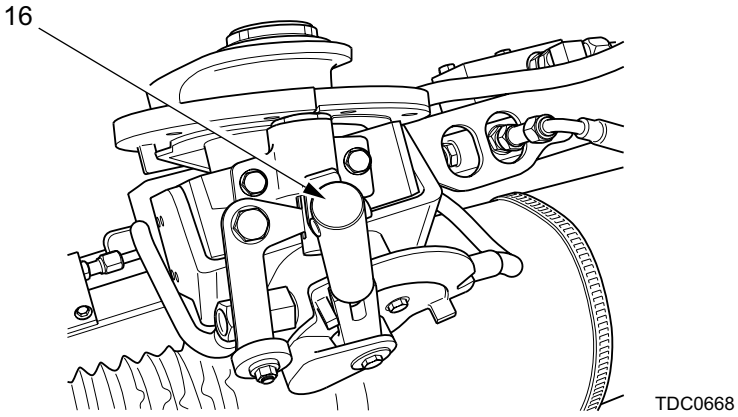
ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.

DO NOT RAISE THE LOADING TRAY WITH A PROJECTILE EMPLACED ON THE TRAY. FAILURE TO DO SO WILL RESULT IN INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

2-25 BREECH OPERATING MECHANISM (cont)

2 To lower loading tray move loading tray lever (16) to the DOWN position.

3 Operates trunnion pump until loading tray is fully lowered. Removes pump handle and stow.

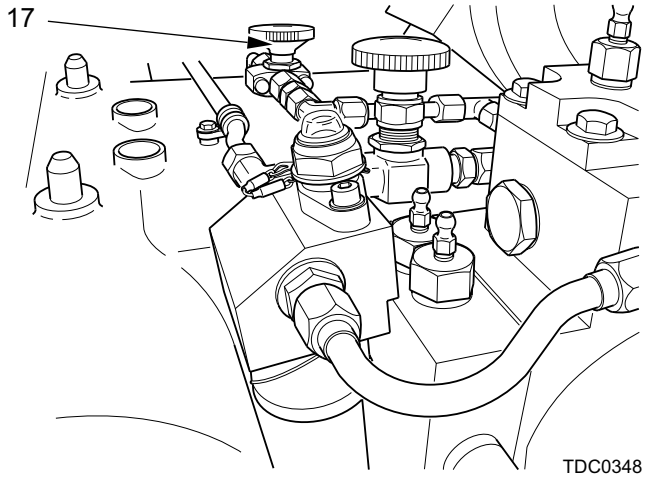


WARNING

THE SCAVENGE ISOLATOR VALVE MUST BE CLOSED WHEN WORKING AROUND THE BREECH. FAILURE TO CLOSE THE VALVE COULD RESULT IN INADVERTENT BREECH MOTION. THIS COULD RESULT IN SEVERE CRUSHING INJURIES TO PERSONNEL.

Raise Loading Tray (manually):

1 Close scavenge isolator valve (17).



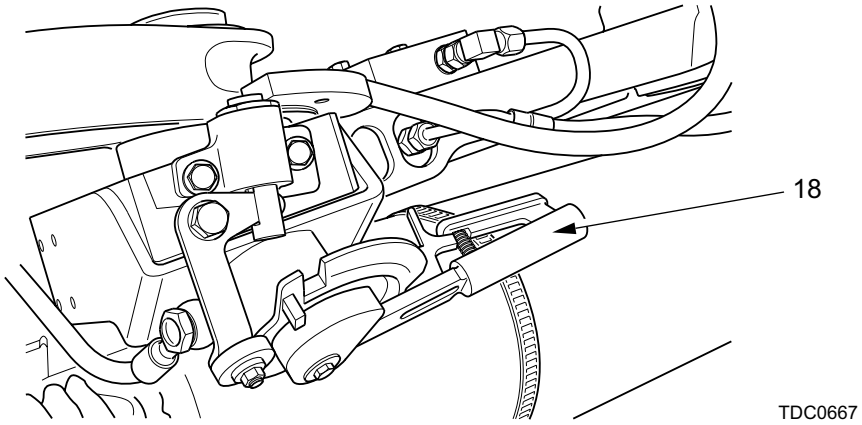
Raise/Lower Loading Tray (manually) (cont):

WARNINGS

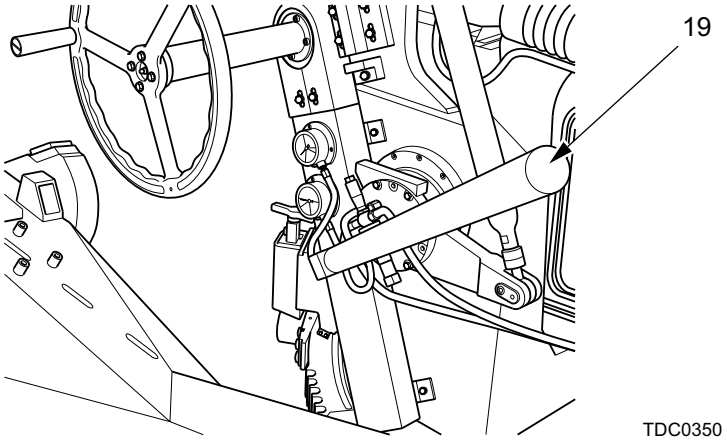
ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.

DO NOT RAISE THE LOADING TRAY WITH A PROJECTILE EMPLACED ON THE TRAY. FAILURE TO DO SO WILL RESULT IN INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

2 To raise loading tray move loading tray lever (18) to the UP position.



3 Operate pump handle (19) until loading tray is fully raised. Remove handle and stow.



2-26 LAYING THE HOWITZER USING M2 AIMING CIRCLE

WARNING
Read and follow all warnings in WARNING SUMMARY.
Pay careful attention to those about batteries.

NOTE
Lay the howitzer under the direction of the Aiming Circle Operator when he announces: BATTERY ADJUST, AIMING POINT THIS INSTRUMENT.

1 When Pantel crosshairs (1) are aligned on reflector (2) of aiming circle, Gunner announces to the Aiming Circle Operator, NUMBER (SO-AND-SO), AIMING POINT IDENTIFIED.

2 The Aiming Circle Operator determines the aiming circle reading to Pantel and announces, NUMBER (SO-AND-SO), DEFLECTION (SO MUCH).

3 Upon announcement of the azimuth, Gunner repeats the deflection reading to the Aiming Circle Operator by announcing, NUMBER (SO-AND-SO), DEFLECTION (SO MUCH), (SO MANY) mils and turns azimuth knob (3) until the announced azimuth appears on the azimuth counter (4).

4 Operating traverse handwheel and sighting through eyepiece (5), Gunner traverses howitzer until Pantel crosshairs (11) are centered on reflector (2) of aiming circle, with bubbles centered in pitch level vial (6) and cross level vial (7). Horizontal crosshair alignment is obtained by turning elevation knob (8).

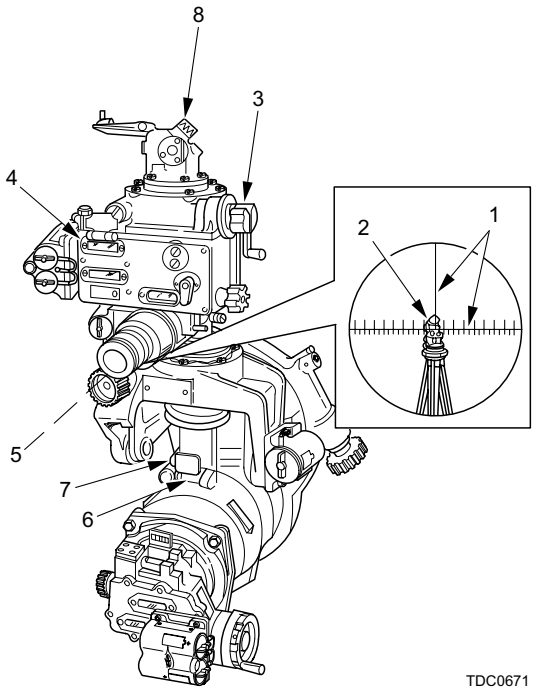
5 Gunner announces to the Aiming Circle Operator, NUMBER (SO-AND-SO), READY FOR RECHECK.

6 Aiming Circle Operator determines a new aiming circle reading to Pantel and announces, NUMBER (SO-AND-SO), DEFLECTION (SO MUCH).

7 Gunner and Aiming Circle Operator repeat steps 2 to 6 above until the difference between the announced aiming circle reading to Pantel, and the reading on the azimuth counter (4) (step 3.) is 0 mils. When the difference announced by Gunner in step 3 is 0 mils, Aiming Circle Operator announces, NUMBER (SO-AND-SO) IS LAID.

NOTE
Position of Pantel and cannon tube must not be disturbed until M1A2 collimator and/or aiming posts have been emplaced.

8 Upon the command, LAID, Gunner records reading on azimuth counter (4). Gunner then lays the collimator.



2-27 EMPLACING THE M1A2 COLLIMATOR

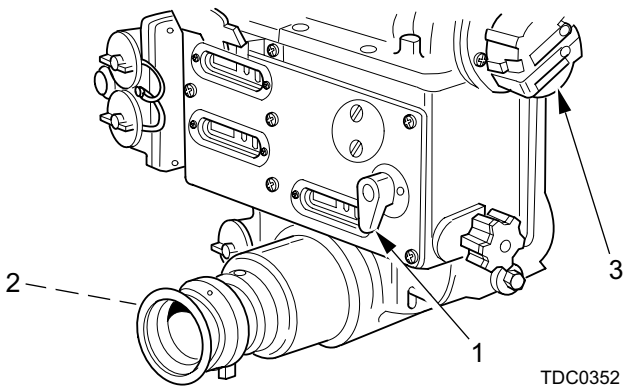
WARNING
Read and follow all warnings in WARNING SUMMARY.
Pay careful attention to those about batteries.

NOTES

M1A2 collimator is emplaced immediately after laying operations.

The M1A2 collimator is the primary reference aiming point for the M777 howitzer. The collimator is normally placed on the left rear side of the weapon to facilitate its maximum use. Emplaced distances away from weapon will vary due to type of terrain but must be between 9 and 12 meters. The M1A2 collimator should not be emplaced more than 4 meters above or below the Pantel telescope.

1 With deflection counter set at 3200 mils, Gunner disengages deflection knob (1) and then sights through eyepiece (2). Gunner turns azimuth knob (3) until a convenient place to locate collimator is sighted.



2-27 EMPLACING THE M1A2 COLLIMATOR (cont)

2 Under directions from the Gunner, Cannoneer No. 3 emplaces M1A2 collimator as follows:

(a) Unfastens strap (4) holding legs.

(b) Extends legs (5) as necessary. Lock by tightening locking knobs (6).

(c) Rotate legs (5) to the down position. Point one leg toward the Pantel. Set each leg firmly into the ground and place a sandbag on each leg.

(d) Release latches (7) holding cover (8). Remove cover from collimator and place between collimator legs with closed end toward muzzle.

(e) Unfasten strap (9). Loosen elevation clamping knob (10) and rotate collimator (11) to a horizontal position.

(f) Turn M1A2 battery enclosure switch (12) to ON.

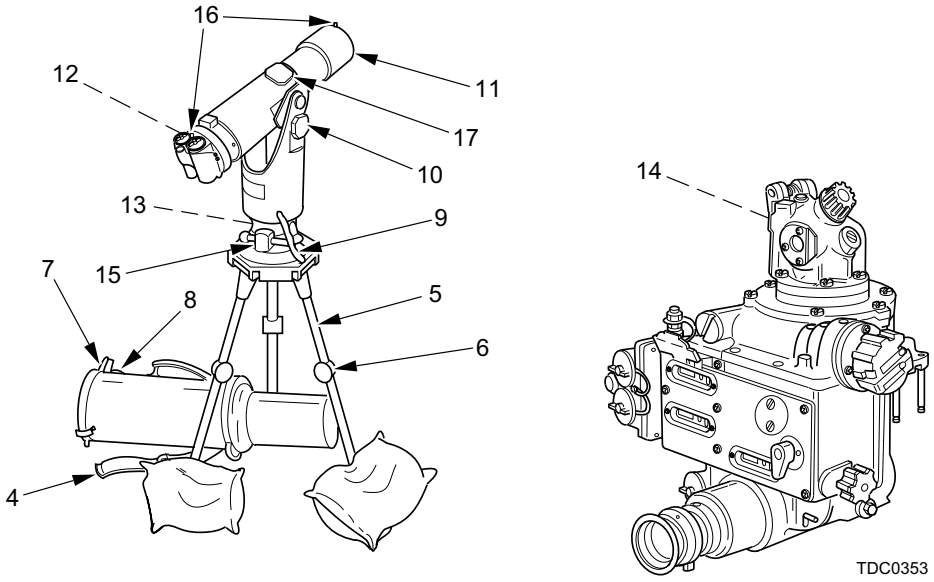
(g) Ensure azimuth adjustment is in the center of traversing capabilities by operating azimuth adjustment knob (13). Turn azimuth adjustment knob all the way to the right and turn back six half turns.

NOTE

During night operation, Pantel objective lens (14) may not be visible from M1A2 collimator. To increase visibility, use of a red lens flashlight may be placed on Pantel eyepiece.

(h) Loosen azimuth clamping knob (15). Sighting down front and rear sights (16) rough lay on Pantel objective lens (14). Tighten azimuth clamping knob (15). Adjust collimator elevation as required and tighten elevation clamping knob (10).

(i) Loosen cross-level clamping knob (17). Rotate M1A2 collimator (11) until the bubble of cross level vial (12) centers. Tighten cross-level clamping knob.



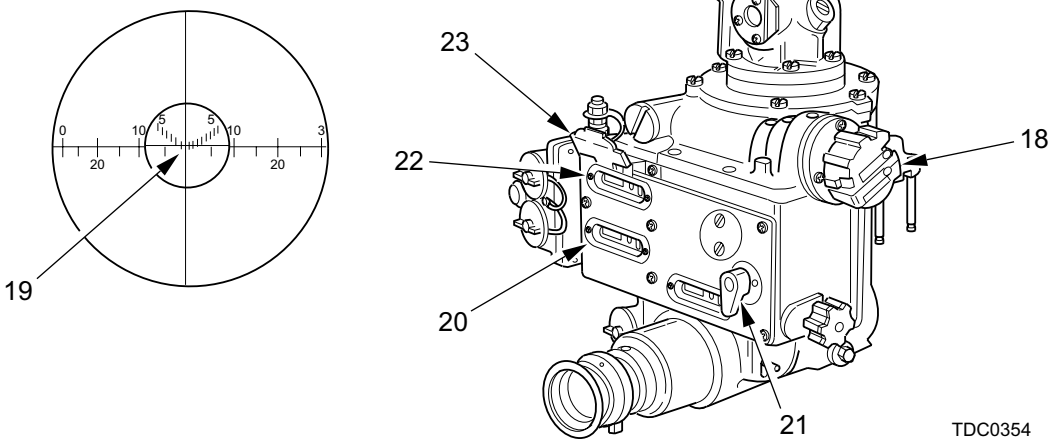
NOTE

To ensure accurate laying and referring, the Gunner, when sighting through Pantel, should view a minimum of 7 mils of M1A2 collimator reticle area.

3 Sighting through Pantel, Gunner turns azimuth knob (18), commands Cannoneer No. 3 to turn M1A2 collimator azimuth adjustment knob (13) until Pantel crosshairs are centered with collimator reticle center (19), and announces to Cannoneer No. 3. SET.

4 With M1A2 collimator emplaced, Gunner engages deflection counter (20) on Pantel by turning deflection knob (21) CCW to the ENGAGE position.

5 Gunner records the value appearing on azimuth counter (22) and closes azimuth counter door (23) on Pantel.



2-28 EMPLACING THE M1A2 AIMING POSTS

NOTE

The M1A2 aiming posts are the alternative aiming reference for the M777 howitzer and are emplaced, time permitting, immediately after the M1A2 collimator is emplaced.

1 With howitzer laid on initial azimuth of fire, the Gunner checks to ensure that:

(a) Pantel pitch and cross-level vial bubbles are centered.

(b) Pantel correction counter is set at zero.

NOTE

Six aiming posts are used for each howitzer. To ensure equal spacing of the aiming posts, the same Cannoneers should pace the distance from howitzer.

2 ATC and Cannoneer No. 5 emplaces the aiming posts as follows:

(a) Cannoneer No. 5 removes aiming post cover and aiming posts from back of the prime mover.

(b) Cannoneer No. 5 removes aiming posts from cover.

(c) ATC and Cannoneer No. 5 assemble M1A2 aiming posts.

2-28 EMPLACING THE M1A2 AIMING POSTS (cont)

NOTE

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

(d) At night, remove M14A2 aiming post lights from storage chest, install batteries, and install on aiming posts.

3 ATC and Cannoneer No. 5 run out approximately 75 meters with both aiming posts and sticks the near post (short post) in the ground. They continue an additional 75 meters, stop and face the Gunner, and emplace the far aiming post (long post) aligned with the body. ATC and Cannoneer No. 5 return to the near aiming post and position it by observing hand signals from the Gunner.

4 Sighting through Pantel. Gunner rotates the azimuth knob until proper site picture is obtained on the far aiming post. By extending his left hand above his head (right hand if posts are to rear of howitzer) and having ATC and Cannoneer No. 5 move the post as directed by the following movements:

(a) Move aiming post left or right as directed by direction of hand movement**.**

(b) Up and down movement represents emplace.

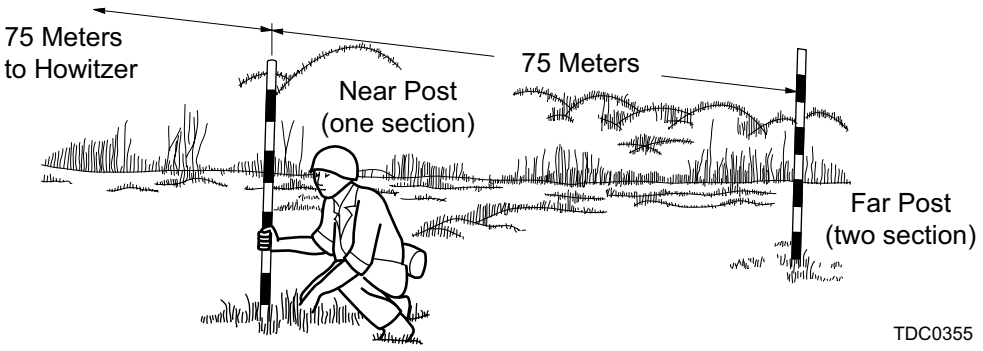
(c) Clenched fist represents stop**.**

(d) Tapping on top of helmet and moving hand (left or right) represents movement of top of aiming post.

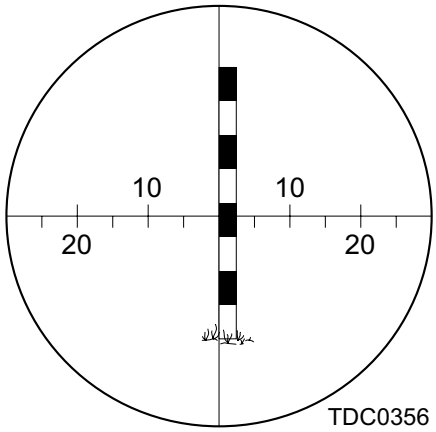
(e) Hand waved in a circular motion means for ATC and Cannoneer to come in.

NOTE

At night, this method can be used with a flashlight in the on/off mode.



5 After aiming posts are emplaced, sight picture should be as illustrated (no displacement), Gunner then records the value indicated on azimuth counter.

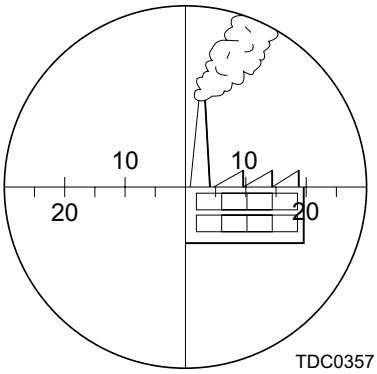


2-29 ESTABLISHING ALTERNATIVE AIMING POINTS

Distant Aiming Point (DAP).

1 Sighting through the Pantel, Gunner rotates the azimuth knob until proper sight picture is obtained on a DAP.

2 Gunner records the value appearing on azimuth counter on the gunners reference card to the nearest quarter (0.25) mil.



Switching Aiming Points. In the event that Gunner needs to switch aiming points any time after he has established one, i.e. switch from the collimator to the aiming post, or switch from the aiming post to the DAP, Gunner on his new aiming point performs the following steps:

NOTE

In a fire mission, follow steps 1 through 7. If not, follow steps 1 through 4. These steps will place the Gunner on his new aiming point.

1 Gunner sets the deflection counter back to 3200 by turning the azimuth knob.

2 Gunner then pushes the deflection knob to the left (release position).

3 Gunner opens azimuth counter door, turns the azimuth knob until the azimuth counter shows the value he has on his gunners reference card for the aiming point he wishes to use.

4 Close azimuth counter door and pushes the deflection knob to the right (engage).

5 Gunner will set the defection given in the fire mission, on the deflection counter, using the azimuth knob.

2-29 ESTABLISHING ALTERNATIVE AIMING POINTS (cont)

6 While sighting through eyepiece, Gunner traverses weapon until proper sight picture is obtained.

7 Gunner then levels M171A1 telescope and quadrant mount and rechecks sight picture (see Laying for Direction and Elevation During Indirect Fire Missions, Para 2-36).

8 Fire according to the command.

2-30 MEASURE SIGHT-TO-CREST

1 SC sights along the bottom edge of the bore and directs the Gunner to traverse left or right, and Assistant Gunner to elevate or depress the cannon tube, until the bottom edge of the bore clears the highest crest in the field of fire.

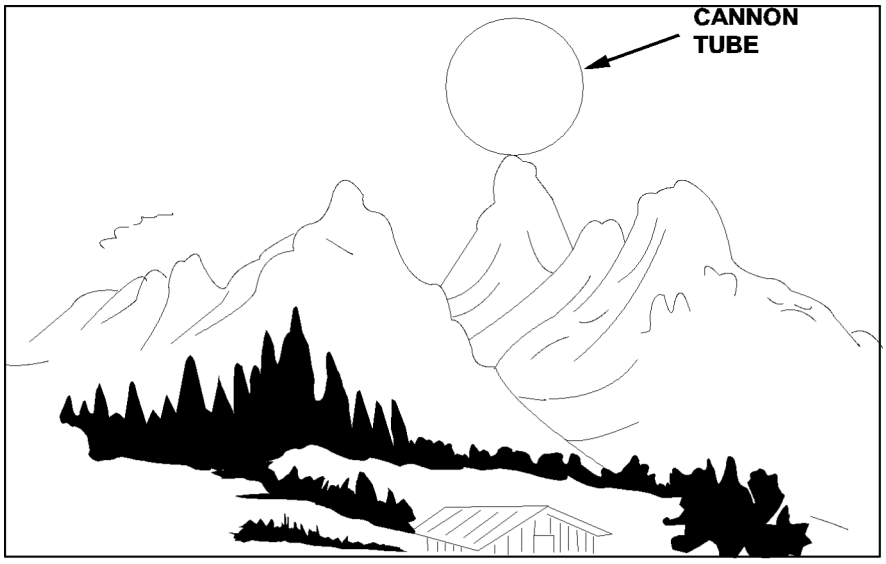
2 SC directs the Assistant Gunner to MEASURE THE QUADRANT.

3 Assistant Gunner centers the cross level bubbles by turning the cross level control knob, centers the elevation level bubble by turning the elevation control knob, and reports the reading that appears on the elevation counter.

4 SC: determine range-to-crest to the nearest 100 meters (FM 6-50) and report site-to-crest and range-to-crest to executive officer. Record site-to-crest and range-to-crest.

NOTE

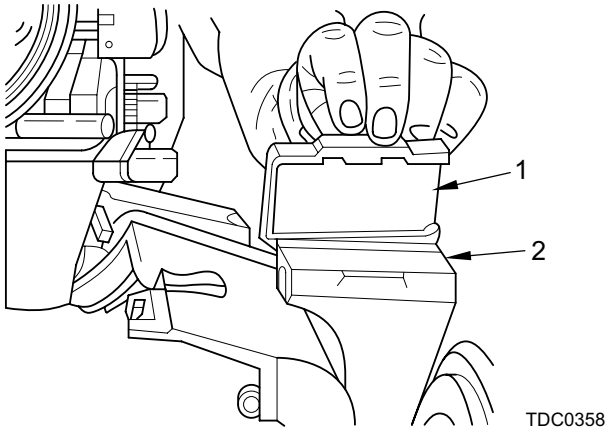
The sight to crest can also be measured using gunner's quadrant by placing the gunner's quadrant on the M172A1 telescope and quadrant mount quad seats, with the LINE-OF-FIRE arrow pointing toward the muzzle of the Howitzer, then moving radial arm index up or down and turning the micrometer knob until the bubble centers.



2-31 CHECKING ALIGNMENT OF PANTEL USING M154 ALIGNMENT DEVICE

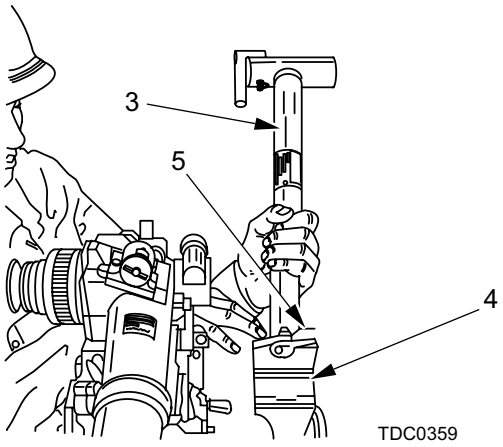
WARNING
Read and follow all warnings in WARNING SUMMARY.
Pay careful attention to those about batteries.

1 Assistant Gunner removes protective cover (1) from dovetail (2) on right trunnion and ensures dovetail is clean by wiping with a clean wiping rag (item 29, appx D).



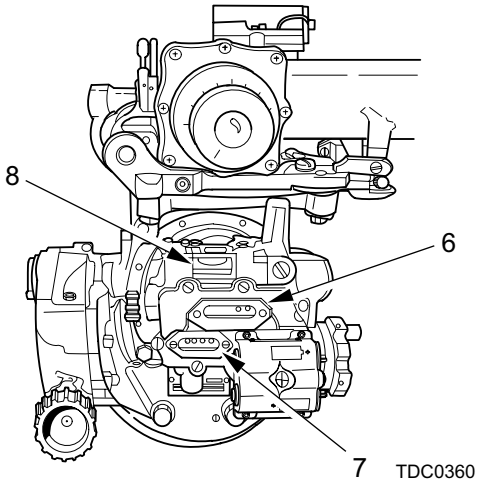
2 Assistant Gunner removes M154 alignment device (3) from carrying case installs battery in alignment device, and ensures mating surface (4) is clean by wiping mating surface with a clean wiping rag (item 29, app D). Removes protective plastic caps from head of alignment device and stores in carrying case.

3 Assistant Gunner mates alignment device (3) to dovetail of mounting bracket, ensuring that the mating surface of alignment device fits dovetail. Assistant Gunner then turns alignment device latch (5) to lock device in place.



4 Assistant Gunner sets M18A1 fire control quadrant elevation correction counter (6) at 00 and elevation counter (7) at 0000. Assistant Gunner levels cannon tube by turning elevating handwheel until bubble in elevation vial (8) centers.

2-31 CHECKING ALIGNMENT OF PANTEL USING M154 ALIGNMENT DEVICE (cont)



5 Gunner levels M171A1 telescope and quadrant mount and closes parallax shield (9). After leveling mount, Gunner ensures that bubble in pitch level vial (10) remains centered until alignment check of Pantel is complete.

6 Gunner turns Pantel battery enclosure switch (11) to ON, lifts azimuth counter door (12) and turns azimuth knob (13) until a 4800-mil reading is obtained on azimuth counter (14).

7 Gunner sights through eyepiece (15). The vertical Pantel crosshair (16) should align with crosshair (17) of alignment device.

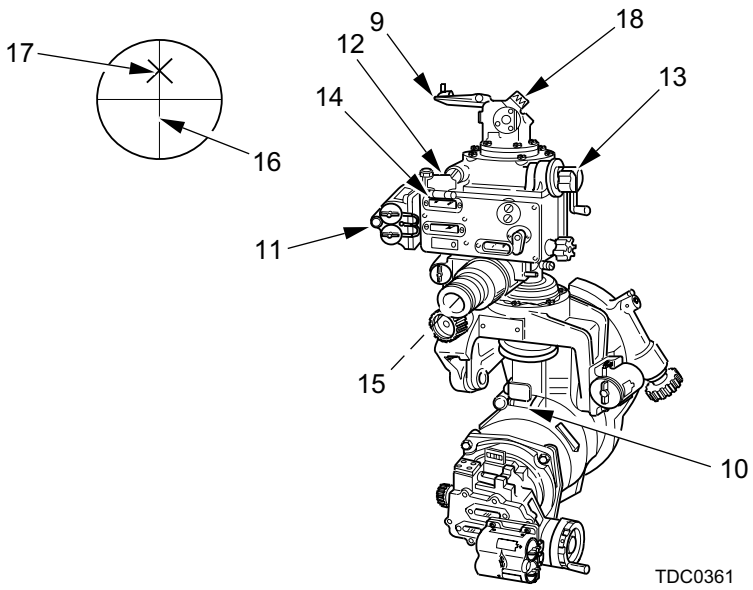
NOTE
To center crosshair for elevation; turn elevation knob (18).

8 If Pantel crosshair (16) does not align with alignment device crosshairs (17) when azimuth counter (14) reads 4800 mil ± 0.5, Assistant Gunner proceeds as follows:

(a) Remove alignment device (19) from dovetail (20).

(b) Reclean mounting surfaces (21) and reinstall alignment device (19). If Pantel crosshair aligns, alignment checks are completed. If alignment is not obtained, perform alignment device comparison test (Para 3-21).

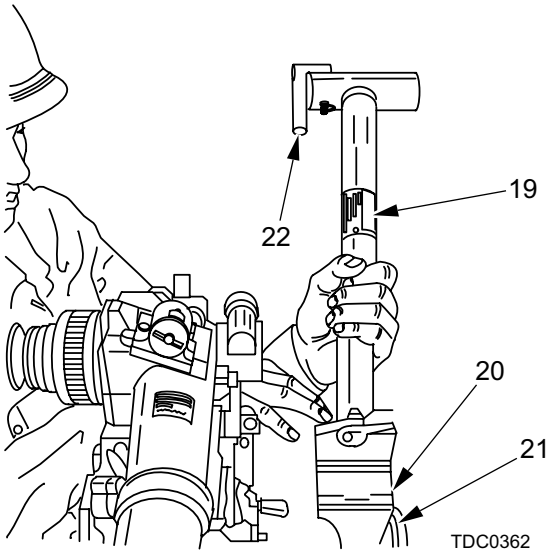
9 Gunner opens the parallax shield (9) and closes azimuth counter door (12).



CAUTION

Failure to remove alignment device during firing may damage device.

10 Assistant Gunner turns battery enclosure switch (22) to OFF, removes and stores alignment device (remove batteries).

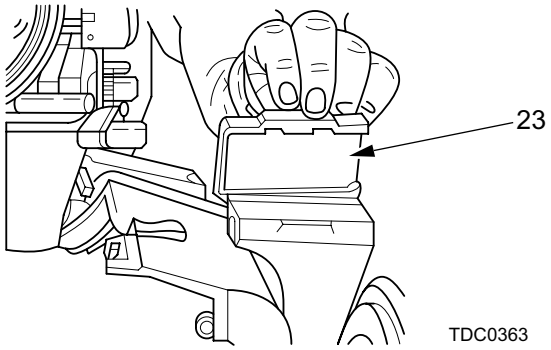


CAUTION

Failure to install protective cover on dovetail may result in damage to the dovetail.

2-31 CHECKING ALIGNMENT OF PANTEL USING M154 ALIGNMENT DEVICE (cont)

11 Assistant Gunner installs trunnion dovetail protective cover (23).



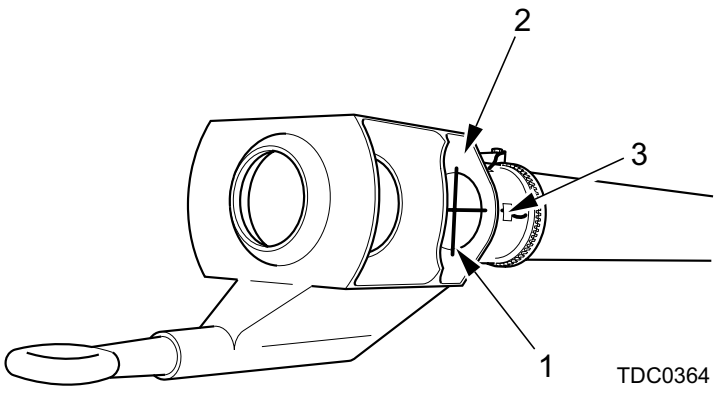
2-32 BORESIGHTING M138A1 ELBOW TELESCOPE, USING DISTANT AIMING POINT

WARNING
Read and follow all warnings in WARNING SUMMARY.
Pay careful attention to those about batteries.

NOTE
Bore sighting the M138A1 elbow telescope is not mandatory when occupying a new position, but it should be done as soon as time permits. The M138A1 elbow telescope and the M172A1 telescope and quadrant mount reduce the need to boresight after installing and removing the telescope. Boresight M138A1 elbow telescope by the DAP method.

1 Assistant Gunner cross-levels M172A1 telescope and quadrant mount by centering bubble in cross level vial on M18A1 fire control quadrant.

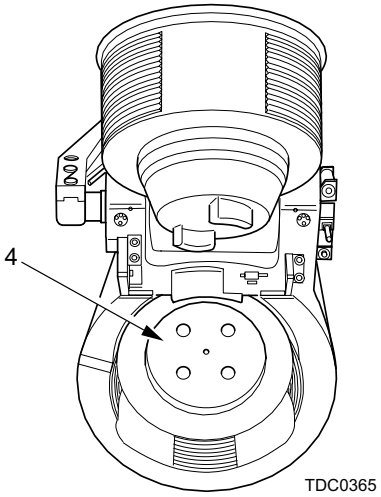
2 Assistant Gunner stretches a piece of cord fibrous (item 14, appx D) (1) tightly through drilled holes in muzzle brake (3), over witness marks, and fastens it in place, forming muzzle boresights (2).



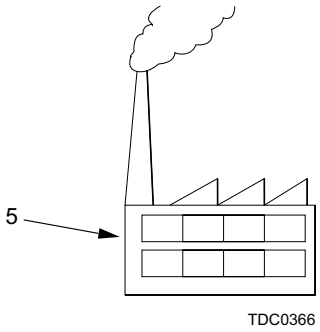
WARNING

BEFORE INSTALLING BREECH BORESIGHT DISK, ENSURE SCAVENGE ISOLATOR VALVE IS IN CLOSED POSITION AND THE BREECH LOCKING PLUNGER IS ENGAGED. FAILURE TO DO SO MAY CAUSE INADVERTANT BREECH MOTION, CAUSING SEVERE CRUSHING INJURIES TO PERSONNEL.

3 Cannoneer No. 2 opens breech and installs breech boresight disk (4).

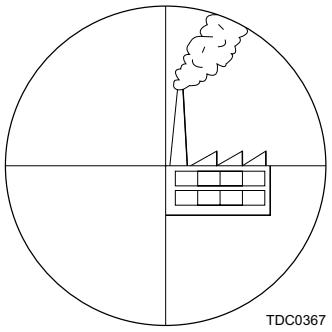


4 SC selects a DAP (5) with a well-defined vertical and horizontal axis, ideally at least 1500 meters from the weapon. If such an aiming point is not available, the SC boresights at engagement range for direct fire.

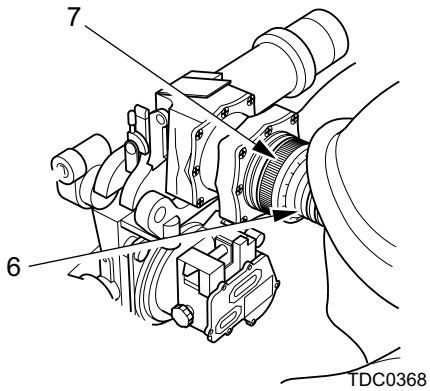


5 SC, looking through breech boresight disk, directs the elevation; depression, or traversing of cannon tube, until muzzle boresights are aligned on DAP.

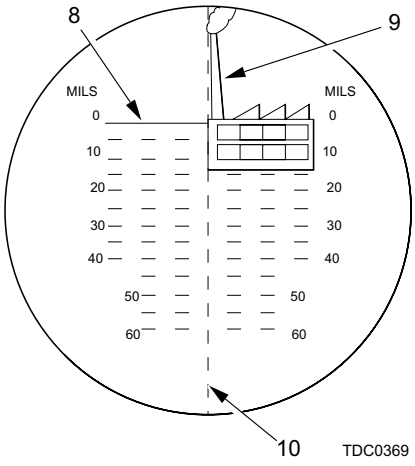
2-32 BORESIGHTING M138A1 ELBOW TELESCOPE, USING DISTANT AIMING POINT (cont)



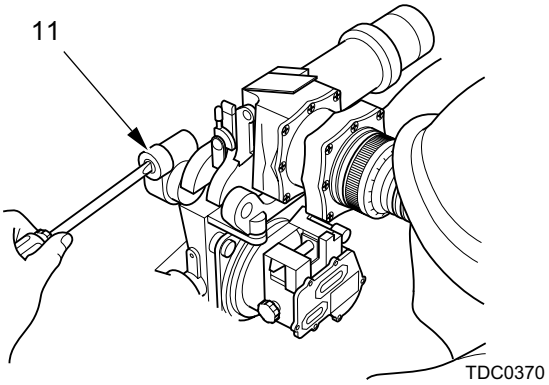
6 Assistant Gunner looking through eyepiece (6) adjusts diopter scale (7). Using a calibrated gunners quadrant and the quadrant seats on the M172A1 telescope and quadrant mount, Assistant Gunner measures the elevation to the DAP and elevates the muzzle 2.3 mils. Assistant Gunner checks cross-level of M172A1 telescope and quadrant mount and adjusts if necessary.



7 Assistant Gunner sights through eyepiece. If elevation line (8) is aligned with DAP (9), M138A1 elbow telescope is in boresight.



8 If elevation line is not aligned with DAP, Assistant Gunner turns elevation adjusting screw (11). If the elevation line is misaligned by more than 0. 5 mils, repeat steps 1 thru 7, prior to adjustment.



9 The vertical reticle line (10) should be on DAP. If the line is not in alignment, repeat steps 1 thru 7. If azimuth correction is still required, notify unit maintenance.

10 Assistant Gunner removes cord from muzzle brake; Cannoneer No. 2 removes breech boresight disk.

2-33 BORESIGHTING PANTEL USING DISTANCE AIMING POINT

NOTES

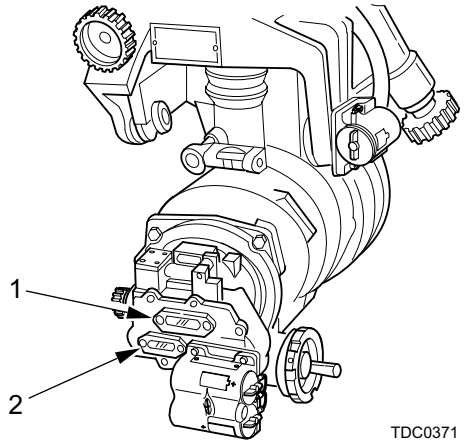
The following procedure must be performed by the SC; only after comparison tests of three M154 alignment devices have been performed, eliminating the alignment device as the cause for misalignment. (See Para 3-21 for details of M154 alignment device comparison test).

High angle shoes on gunners quadrant must be tested for accuracy prior to checking trunnion level (see Para 3-16 Test of Gunners Quadrant).

DAP must be a minimum of 1500 meters from the howitzer and the howitzer should be aligned with the DAP prior to checking trunnion level within 178 mils cant. If trunnions are not within 178 mils cant, level trunnions (Para 3-17).

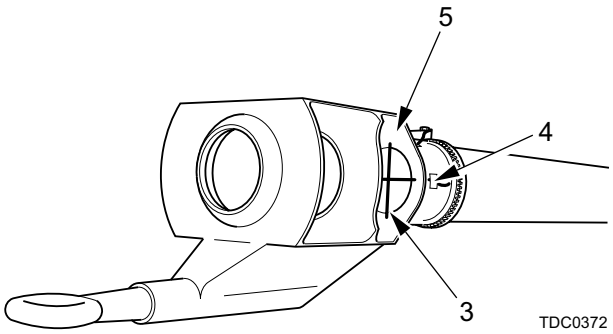
1 Emplace howitzer into firing position (Para 2-24).

2 Gunner sets elevation correction counter (1) and elevation counter (2) to read 0.00 mils. Gunner then selects a sharply defined DAP, at least 1500 meters from the howitzer.



2-33 BORESIGHTING PANTEL USING DISTANCE AIMING POINT (cont)

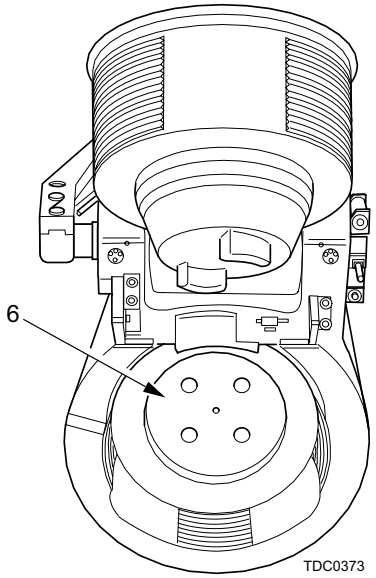
3 Assistant Gunner stretches a piece of cord (3) tightly through drilled holes of the muzzle brake (4), ensuring cord is over witness marks. He then fastens the cord in place, forming muzzle boresights (5) cross hairs.



WARNING

BEFORE INSTALLING BREECH BORESIGHT DISK, ENSURE SCAVENGE ISOLATOR VALVE IS IN CLOSED POSITION AND THE BREECH LOCKING PLUNGER IS ENGAGED. FAILURE TO DO SO MAY CAUSE INADVERTANT BREECH MOTION, CAUSING SEVERE CRUSHING INJURIES TO PERSONNEL.

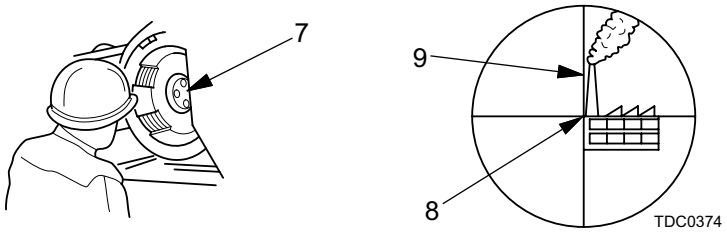
4 Cannoneer No. 2 opens breech and inserts breech boresight disk (6).



5 While looking through breech boresight disk, (7) Cannoneer No. 1 directs Gunner to elevate, depress, or traverse cannon tube, until muzzle boresight cross hairs (8) are aligned on left edge of DAP (9).

6 Assistant Gunner checks trunnion level with a gunners quadrant placed on adaptor assembly quadrant pads. If the gunners quadrant reading exceeds 90 mils cant, carry out the Level Trunnions procedure (Para 3-17).

7 Gunner levels the M171A1 telescope and quadrant mount. Repeat Steps 6 and 7, as necessary, to ensure trunnions are level and muzzle boresight cross hairs (8) are aligned with DAP (9). If the gunners quadrant reading exceeds 90 mils cant, carry out the Level Trunnions procedure (Para 3-17).



8 Gunner lifts azimuth counter door (10) and turns azimuth knob (11) until a reading of 3200 mils is obtained on azimuth counter (12).

9 Gunner looks through eyepiece (13). The vertical Pantel crosshair (14) should be on the left edge of the same aiming point as the vertical muzzle boresight. If they are on the same point, the howitzer is in boresight. If they are not, proceed to step 10.

10 Loosen two setscrews (15) and two lock-washers (16), but do not remove from cover (17).

11 Remove cover.

12 Turn slotted eccentric (18) CW approximately ¼ turn to disengage azimuth counter (12).

13 Turn azimuth knob (11) CW to align vertical Pantel cross hair (5) with left edge of DAP (19).

14 Turn slotted eccentric (18) CCW to engage azimuth counter (12).

15 Using azimuth knob (11), turn head (20) CCW at least 80 mils.

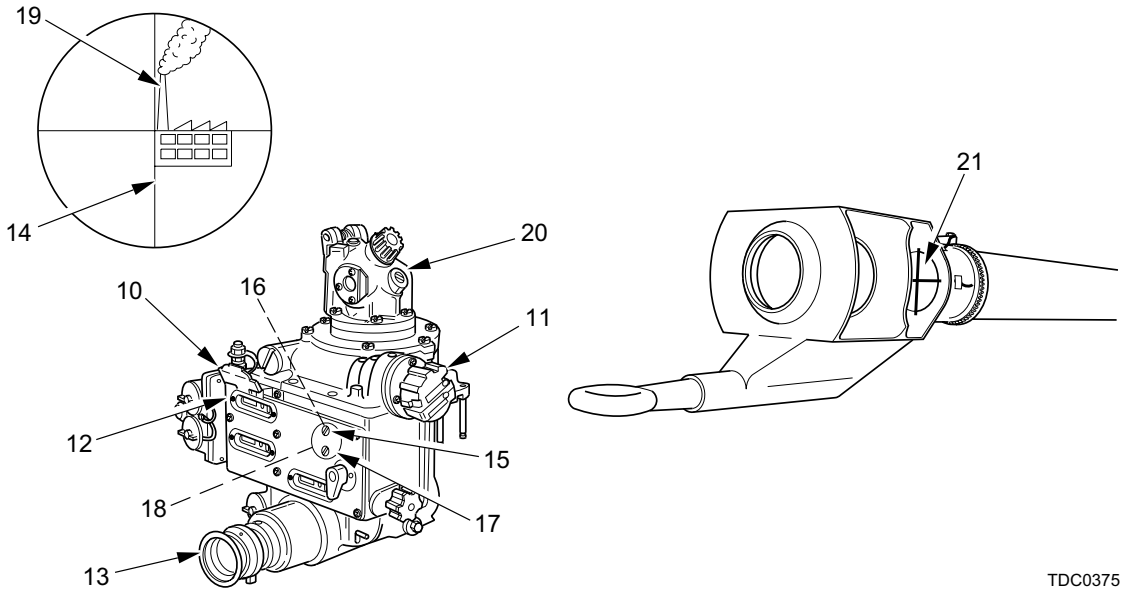
16 Look through the eyepiece (13) and use azimuth knob (11) to align vertical Pantel crosshair (14) on left edge of DAP (final movement in a CW direction).

17 With vertical Pantel crosshair (14) on the left edge of DAP, azimuth counter (12) reading should be 3200 mils. If it is not, notify unit maintenance for repair of Pantel. If reading is 3200 mils, weapon is boresighted.

18 Install cover and tighten two setscrews (15) with two lockwashers (16) to secure.

19 Remove muzzle boresight crosshairs (21) and breech boresight disk.

2-33 BORESIGHTING PANTEL USING DISTANCE AIMING POINT (cont)



NOTE

If misalignment of Pantel and M154 alignment device persists, notify unit maintenance.

2-34 USING THE THERMAL WARNING DEVICE

NOTE

The TWD shows the temperature of the cannon tube so that proper action may be taken in the event of a misfire or checkfire. Use the chart below as a guide.

Temperature/Color Code	Tube Condition	Crew Must Do The Following
0° to +170°F (-18° to +77°C)/Green	Cold	In case of misfire or checkfire, go to Para 2-59.
+170° to +350°F (+77° to +177°C)/Yellow	Warm	Notify Fire Direction Center (FDC) that cannon tube is warm. In case of misfire or checkfire, go to Para 2-60.
+170° to +300°F (+77° to +149°C)/Yellow	Warm/Hot Weather	Notify FDC that cannon tube is warm under hot weather conditions. In case of misfire or check fire, go to Para 2-61.
Above +350°F (+177°C)/Red	Hot	Fire combat emergency missions only. In case of misfire or check fire, go to Para 2-62.

NOTE

Hot weather is any weather in which the outside temperature is expected to exceed 100°F (38°C) during the day.

2-35 PREFIRING CHECKS

WARNING

BEFORE FIRING THE HOWITZER THE FOLLOWING CONDITIIONS MUST APPLY. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

NOTE

After a move, make the following checks before firing the first round.

1 SC ensures the following prefiring checks are complete:

(a) The bore is clear.

(b) The howitzer has five points of contact with the ground.

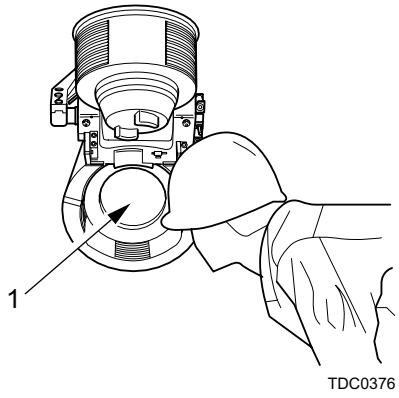
(c) Breech and PFM witness marks are aligned.

(d) Oil index pin is flush.

(e) Spade damper levers are in the NORMAL position.

2 Driver makes the following prefiring checks:

a. Driver looks through cannon tube (1) to ensure no foreign matter is present.



2-36 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING INDIRECT FIRE MISSIONS

NOTES

Procedures for firing drills have been standardized under Department of the Army Standardization Program.

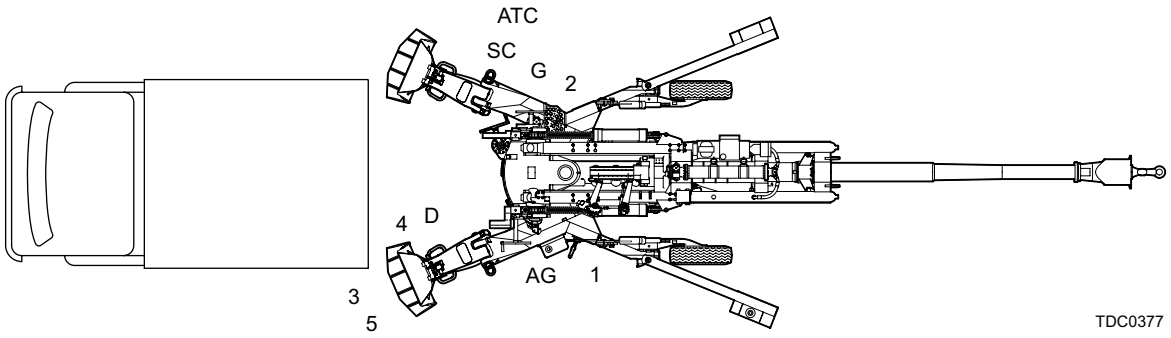
To eliminate backlash when laying for direction and elevation, make sure the last motion of all control and leveling knobs is in a CW direction.

1 At the command, FIRE MISSION, from SC, the section takes up positions as shown. SC then relays the fire mission to the crew.

2-36 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING INDIRECT FIRE MISSIONS (cont)

NOTE

Prior to loading howitzer for actual firing, all personnel must be familiar with prescribed actions in the event of a misfire (Para 2-59 to 2-62) and ensure that prefiring checks (Para 2-35) are performed.



2 Cannoneer No. 5 repeats PROJECTILE, and selects and prepares projectile. (For preparation of M712 projectile (Copperhead), (Para 4-3).

3 Cannoneer No. 3 repeats PROPELLING CHARGE, and selects and prepares propelling charge (Para 4-5).

4 Cannoneer No. 5 repeats FUZE, and selects and prepares fuze (Para 4-4).

WARNING

ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.

5 Cannoneer No. 2 opens breech (Para 2-25).

WARNING
Read and follow all warnings in WARNING SUMMARY.
Pay careful attention to those about batteries.

6 Gunner lays for direction as follows:

NOTE

If laying for direction and quadrant for M777E1 howitzer, (Para 2-41 (digital/manual)). If M1A2 collimator is used, Gunner performs the following:

(a) On the command, DEFLECTION (SO MUCH), Gunner turns azimuth knob until deflection appears in deflection counter. He then reads the setting to the SC.

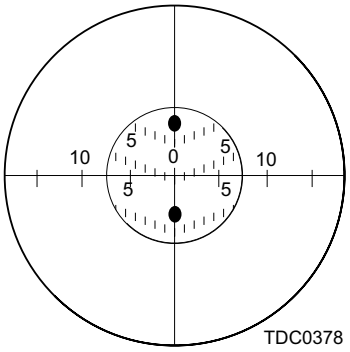
NOTE

Each time howitzer is traversed; or cannon tube elevated, or depressed, level M171A1 telescope and quadrant mount.

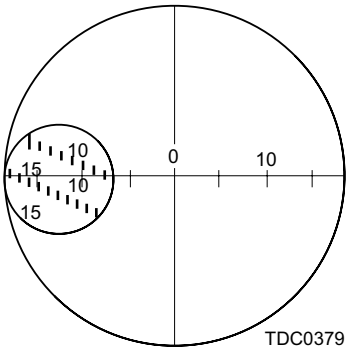
(b) While sighting through eyepiece, Gunner traverses weapon until a proper sight picture on collimator is obtained.

(c) Gunner then levels M171A1 telescope and quadrant mount and rechecks sight picture.

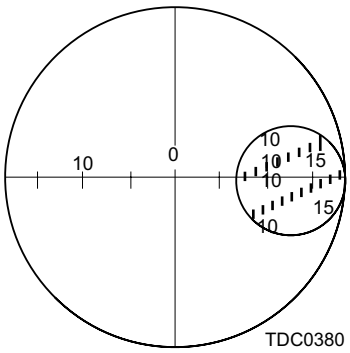
(d) If the weapon has not been displaced, the sight picture appears as shown.



(e) If the weapon has experienced right displacement (collimator reticle pattern slopes upwards to the left), Gunner traverses the weapon until the left portion of the Pantel reticle is matched with the collimator reticle. For example, 10- and 15- mil marks are aligned as shown.



(f) If the weapon has experienced left displacement (collimator reticle pattern slopes upwards to the right), Gunner traverses the weapon until right portion of the Pantel reticle is matched with the collimator reticle. For example, 10- and 15- mil marks are aligned as shown.



2-36 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING INDIRECT FIRE MISSIONS (cont)

NOTE

If laying for direction and quadrant for M777E1 howitzer, (Para 2-41 (digital/manual)). If aiming posts are used, Gunner performs the following:

(g) On the command, DEFLECTION (SO MUCH), Gunner turns the azimuth knob until the deflection appears in deflection counter; he then reads the setting to SC.

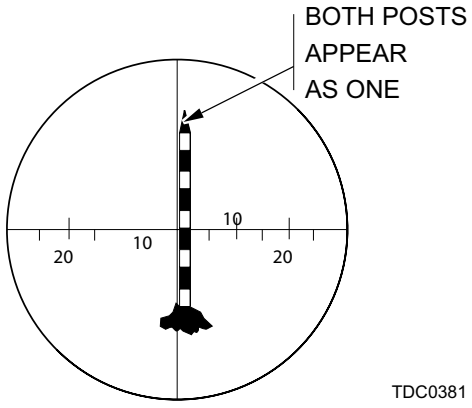
(h) While sighting through eyepiece, Gunner traverses weapon until a proper sight picture on aiming post is obtained.

(i) Gunner then levels the M171A1 telescope and quadrant mount and rechecks sight picture.

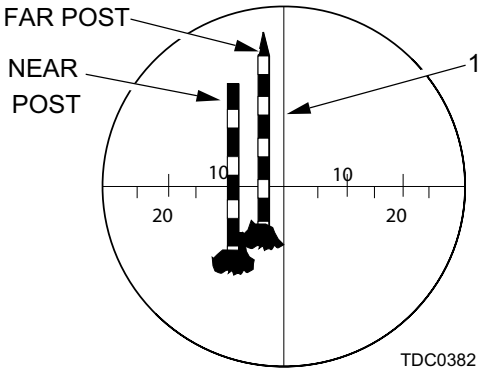
NOTE

At night aiming posts are identified as near or far by the color of the aiming post lights. Unit SOP will dictate which color goes on which aiming post.

(j) If the weapon has experienced no displacement, the sight picture will be displayed as shown.

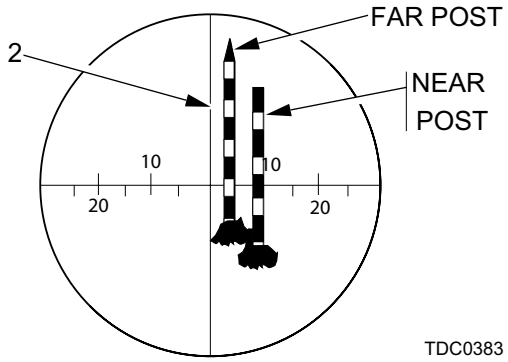


(k) If the weapon has experienced right displacement (the far aiming post is to the right of the near aiming post), the Gunner traverses the weapon until the far aiming post is exactly halfway between the near aiming post and the Pantel vertical reticle line, (1).



(l) If the weapon has experienced left displacement (the far aiming post is to the left of the near aiming post), the Gunner traverses the weapon until the far aiming post is exactly halfway between the near aiming post and the Pantel vertical reticle line (2).

(m) Gunner then relevels M171A1 telescope and quadrant mount (if necessary), rechecks and adjusts sight picture (if necessary), by traversing, and announces READY to SC.



NOTE

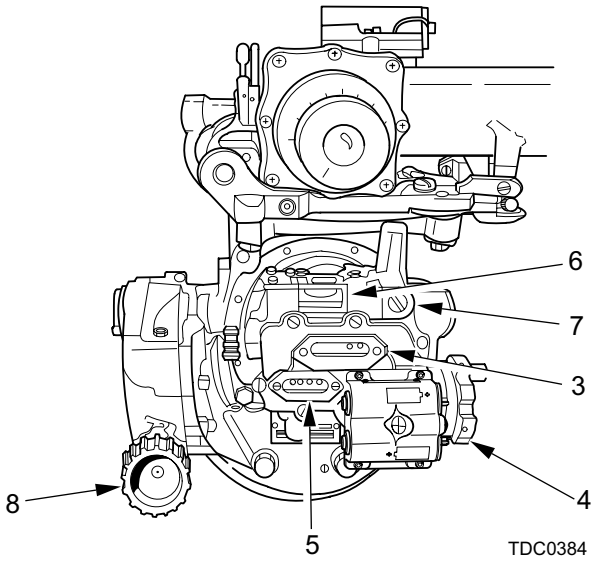
During normal operation, Assistant Gunner lays the howitzer for elevation using the M18A1 fire control quadrant. However, during one-man indirect fire operations, Gunner lays the howitzer for elevation using the M17A1 fire control quadrant.

7 Using the M18A1 fire control quadrant, Assistant Gunner lays the howitzer for elevation as follows:

(a) On the command, QUADRANT (SO MUCH), Assistant Gunner ensures elevation correction counter (3) reads 00 and rotates elevation control knob (4) until announced quadrant appears in the elevation counter (5). He then reads the setting to SC.

(b) Assistant Gunner elevates or depresses the cannon tube until the elevation level vial (6) centers. Assistant Gunner centers the bubble in the cross level vial (7), by turning the cross level control knob (8). Assistant Gunner rechecks and adjusts both bubbles (if necessary), and announces QUADRANT (SO MUCH) SET to SC.

(c) The gunner's quadrant can also be used to lay for quadrant. SC sets the announced quadrant on the gunner's quadrant using the radial arm index and micrometer knob. He places and holds the gunner's quadrant firmly on the M18A1 fire control quadrant seats with the LINE-OF-FIRE arrow pointing toward muzzle. SC directs Assistant Gunner to elevate or depress, until the bubble is centered.



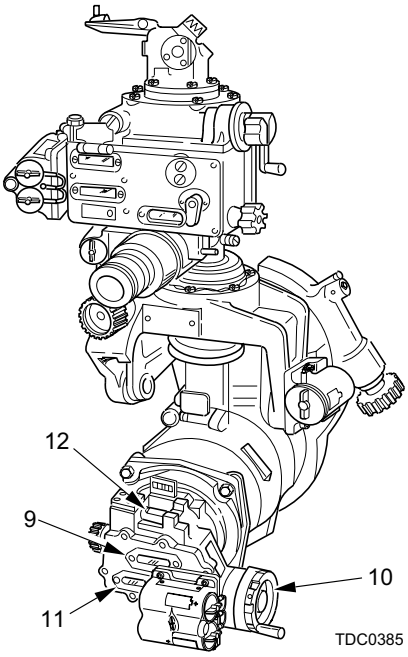
2-36 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING INDIRECT FIRE MISSIONS (cont)

8 Using the M17A1 fire control quadrant (during one-man indirect fire operations), Gunner lays the howitzer for elevation as follows:

(a) On the command, QUADRANT (SO MUCH), Gunner ensures elevation correction counter (9) reads 00 and rotates elevation control knob (10) until announced quadrant appears in elevation counter (11). He then reads the setting to SC.

(b) Gunner elevates or depresses cannon tube until bubble centers in elevation level vial (12).

(c) Gunner rechecks the M171A1 telescope and quadrant mount pitch and cross level vials, Pantel sight pictures, and adjusts as necessary. Gunner then announces QUADRANT (SO MUCH) READY to SC.

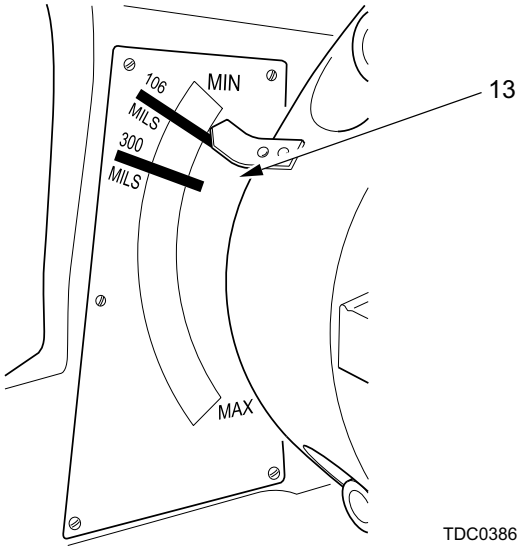


WARNING

DO NOT LOAD OR FIRE HOWITZER IF CHARGE PLATE ELEVATION INDICATOR IS READING 300 MILS OR IN THE RED AREA WHEN USING THE FOLLOWING PROPELLANT SERIES:

- M119 SERIES.
- M203 SERIES.
- MACS ZONES 4 AND 5.

9 SC checks charge plate elevation indicator (13).



WARNING

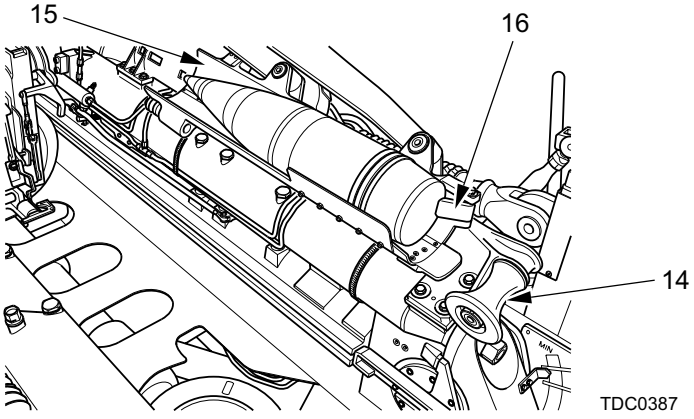
FIRING A PROJECTILE WITH AN OBSTRUCTION IN THE CANNON TUBE CAN CAUSE AN IN-BORE EXPLOSION. THIS COULD RESULT IN DESTRUCTION OF THE HOWITZER AND SEVERE INJURIES OR DEATH TO PERSONNEL.

10 Driver ensures that there are no obstructions in the cannon tube, and announces BORE CLEAR.

WARNING

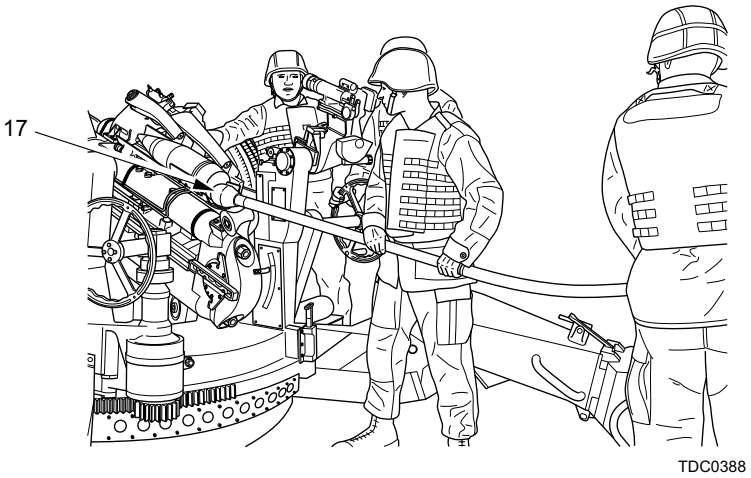
WHEN PLACING PROJECTILE ON LOADING TRAY ASSEMBLY, ENSURE THAT THE BASE OF PROJECTILE IS AGAINST ROUND CATCH. FAILURE TO DO SO MAY RESULT IN PROJECTILE SLIDING REARWARDS, CAUSING INJURY TO PERSONNEL.

11 Cannoneer No. 4 places projectile on round roller (14) and slides projectile forward onto loading tray (15), ensuring that base of projectile is forward and against round catch (16).

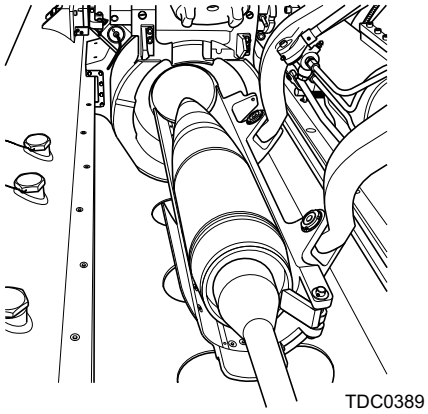


2-36 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING INDIRECT FIRE MISSIONS (cont)

12 Cannoneer No. 4 places loading rammer (17) against base of projectile.



13 Upon the command READY, DROP, from Cannoneer No. 4, Cannoneer No. 1 lowers loading tray.



14 Cannoneer No 4 and Driver push projectile into breech chamber.

15 Upon the command, READY, RAM, from Cannoneer No. 4, the projectile is rammed into place by Cannoneer No. 4 and Driver, using loading rammer.

16 Cannoneer No. 4 withdraws loading rammer.

WARNINGS

DO NOT LEAVE A PROPELLING CHARGE IN THE CHAMBER LONGER THAN NECESSARY BEFORE FIRING. TEMPERATURE CHANGES AFFECT PERFORMANCE CHARACTERISTICS OF A POWDER CHARGE. THOSE CHANGES OCCUR RAPIDLY IN A HOT CHAMBER.

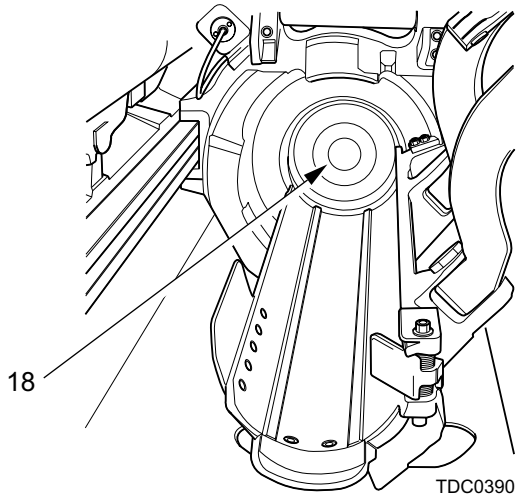
BE AWARE OF INCREASED HEIGHT FROM THE GROUND WHEN USING STEP DURING LOADING PROCEDURES.

NOTE

Use step to gain access to the breech assembly during loading procedures.

17 Cannoneer No. 3 hands prepared propelling charge to Cannoneer No. 2 who checks the charge and then announces CHARGE (SUCH AND SUCH) to the SC. Cannoneer No. 2 then places charge onto the loading tray.

18 Cannoneer No. 2 slides the charge (18) into the chamber with red igniter base to the rear (except for the MACS charge, which may be loaded in any direction). The propelling charge is pushed in until the base is approximately 3 in (7.62 cm) from rear face of cannon tube into Swiss notch recess.



19 Cannoneer No. 2 announces, I SEE RED and gives a verbal and visual signal to Cannoneer No. 1.

WARNINGS

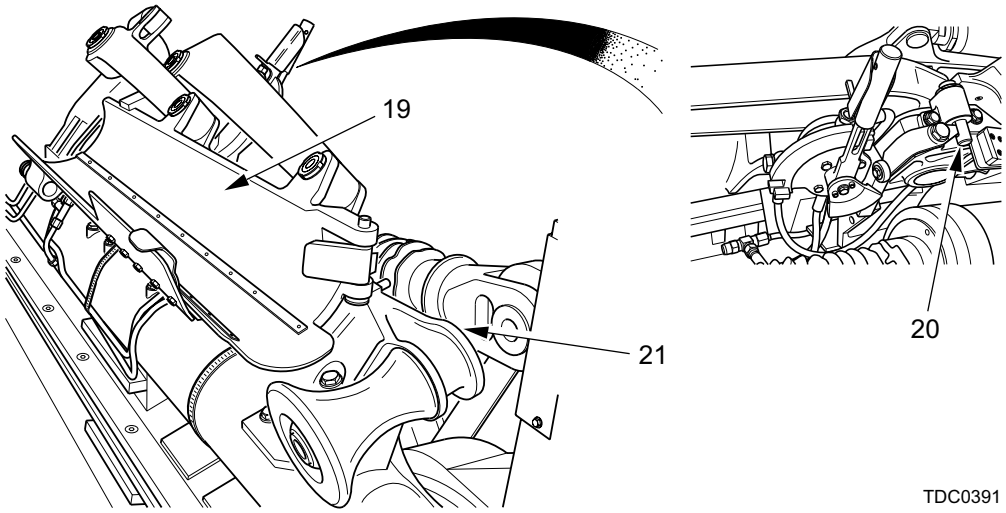
ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.

DO NOT RAISE THE LOADING TRAY WITH A PROJECTILE PLACED ON THE TRAY. FAILURE TO DO SO WILL RESULT IN INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

BEFORE FIRING THE HOWITZER, ENSURE THE LOADING TRAY IS RETRACTED AND CHECK THAT THE MECHANICAL INTERLOCK PLUNGERS ARE ENGAGED AND THERE IS NO GAP BETWEEN THE LOADING TRAY AND TRAY STOP. FAILURE TO DO SO COULD RESULT IN INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

20 Cannoneer No. 1 raises loading tray (19), ensuring the mechanical interlock plunger (20) are engaged and that there is no gap between the loading tray and tray stop (21).

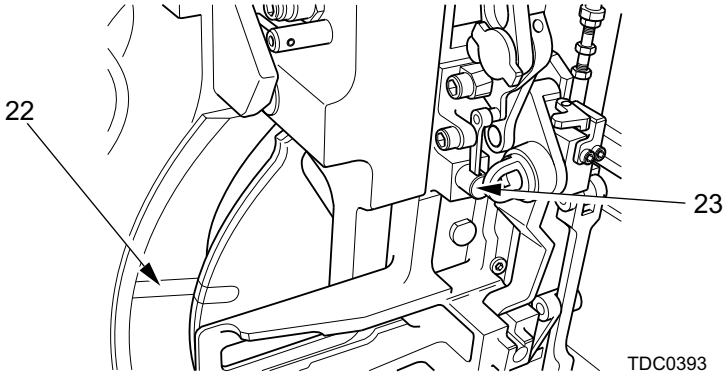
2-36 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING INDIRECT FIRE MISSIONS (cont)



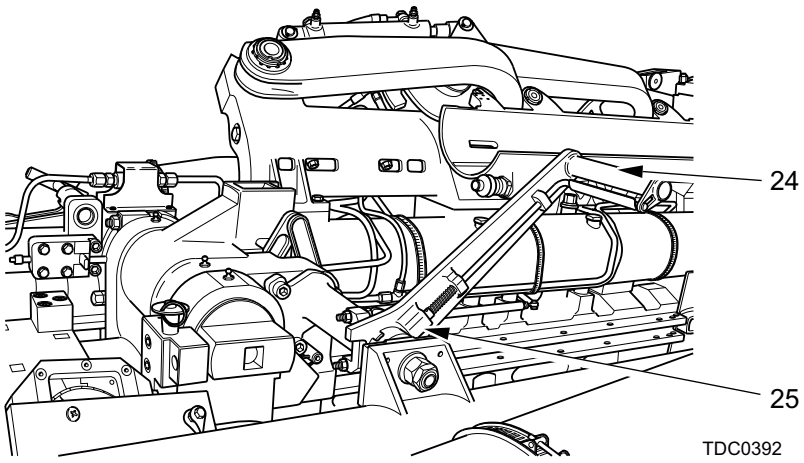
WARNING

DO NOT CLOSE BREECHBLOCK IF THE POWDER CHARGE RED IGNITER BASE CANNOT BE SEEN. A POSSIBLE HANG FIRE MAY OCCUR IF THE RED IGITER PAD IS INSTALLED TOWARD THE MUZZLE BRAKE.

21 Cannoneer No. 2 closes breechblock assembly (Para 2-25), and ensures witness marks (22) are aligned and announces WITNESS MARKS ALIGNED.



22 Cannoneer No. 2 loads a primer by moving PFM manual handle (24) to the PRIMED position; ensuring detent (25) is engaged.



23 Cannoneer No. 2 ensures the PFM (23) witness marks are aligned, then announces PRIMED.

WARNINGS

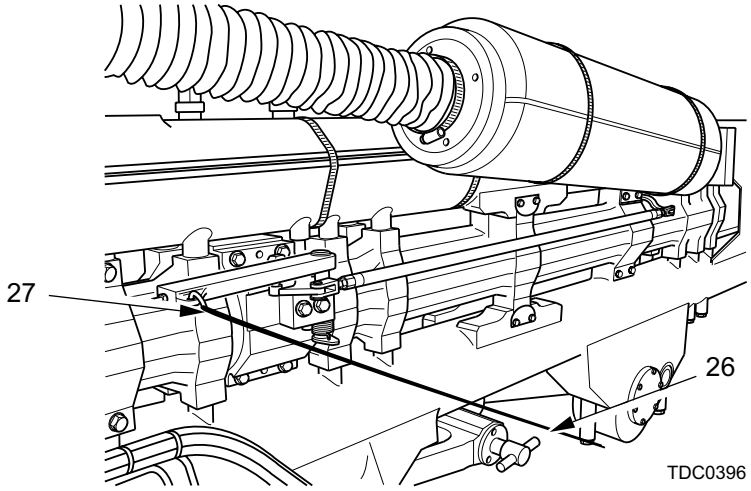
THE LANYARD WILL NOT BE SHORTENED BECAUSE INJURY TO PERSONNEL MAY RESULT.

THE LANYARD WILL NOT BE ATTACHED UNTIL THE COMMAND; STAND BY IS ANNOUNCED BY SC.

SC MUST ENSURE THAT ALL PERSONNEL ARE CLEAR OF THE PATH OF RECOIL.

24 After Assistant Gunner announces SET, Gunner announces READY, and Cannoneer No. 2 announces PRIMED. SC will command, STAND BY.

25 After STAND BY, Cannoneer No. 1 attaches lanyard (26) by inserting S-hook through hole in firing lever (27).



2-36 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING INDIRECT FIRE MISSIONS (cont)

WARNINGS

WHEN FIRING, PERSONNEL IN THE AREA MUST STAY CLEAR OF THE RECOIL PATH.

WHEN FIRING HOWITZER AT NIGHT, PERSONNEL SHOULD AVOID DIRECT VIEWING OF MUZZLE FLASH FROM THEIR HOWITZER OR ADJACENT HOWITZERS. WHEN FIRING TOP ZONES TEMPORARY FLASH BLINDNESS CAN BE CAUSED BY INTENSE MUZZLE FLASH, RESULTING IN POTENTIAL REDUCTION OF CREW EFFECIENCY.

THE HOWITZER CAN GENERATE BLAST OVERPRESSURE, WHICH MAY DAMAGE HEARING, OR CAUSE INJURY TO LUNGS OR SINUSES, IF PROPER PROTECTIVE MEASURES ARE NOT FOLLOWED. SUPERVISED WEARING OF EARPLUGS IS REQUIRED AT ALL TIMES, WITH THE E-A-R TYPE (PLASTIC ROLL) PREFERRED. THE EFFECTS OF BLAST CAN BE REDUCED BY MOVING FURTHER TO THE REAR OF THE HOWITZER. FOR THIS REASON ALL CREW MEMBERS NOT REQUIRED TO FIRE THE WEAPON SHOULD MOVE AWAY AS FAR TO THE REAR AS PRACTICABLE. ANY CREWMAN WHO EXPERIENCES SUCH PROBLEMS AS SHORTNESS OF BREATH, OR BLEEDING FROM NOSE, OR MOUTH, MUST BE IMMEDIATELY TRANSPORTED TO A MEDICAL FACILITY FOR EVALUATION.

THE DEGREE OF HEARING PROTECTION REQUIRED IS BASED ON PROPELLING CHARGE USED AND NUMBER OF ROUNDS FIRED DAILY BY THE CREW. FOR TRAINING MISSIONS, EARPLUGS PROVIDE ADEQUATE PROTECTION IF M4A2 (WB), ZONE 6, OR LOWER CHARGES ARE USED. WHEN FIRING HIGHER ZONES, CONSULT THE FOLLOWING TABLE.

PROPERLY WORN FOAM EARPLUGS PROVIDE ADEQUATE PROTECTION WHEN FIRING ALL EXISTING PROPELLANT CHARGES, INCLUDING M203 SERIES, AT ALL QUADRANT ELEVATIONS, ACCORDING TO THE GUIDELINES IN THE FOLLOWING TABLE.

Hazard Assessment Point Values for the, 155mm, Towed Howitzer

	Areas						
Charge/Zone	1	2	3	4	5	6	7
M203	5.24	3.79	1.11	3.01	1.44	0.51	0.18
M119	4.65*	3.36*	0.98*	1.34*	0.64*	0.23*	0.1*
M4A2	1.14*	0.27	0.1	1.12*	0.54*	0.19*	0.1*
M3A1	0.34*	0.15	0.1	0.35*	0.17*	0.1*	0.1*
M232/5	1.60	1.60	0.94	1.43	0.36	0.30	0.19
M232/4	1.40	1.40	0.31	0.79	0.27	0.20	0.15
M232/3	0.80	0.80	0.23	0.54	0.22	0.15	0.11
M231/2	3.22	3.22	0.14	0.15	0.10	0.10	0.10
M231/1	0.95	0.95	0.10	0.30	0.10	0.10	0.10

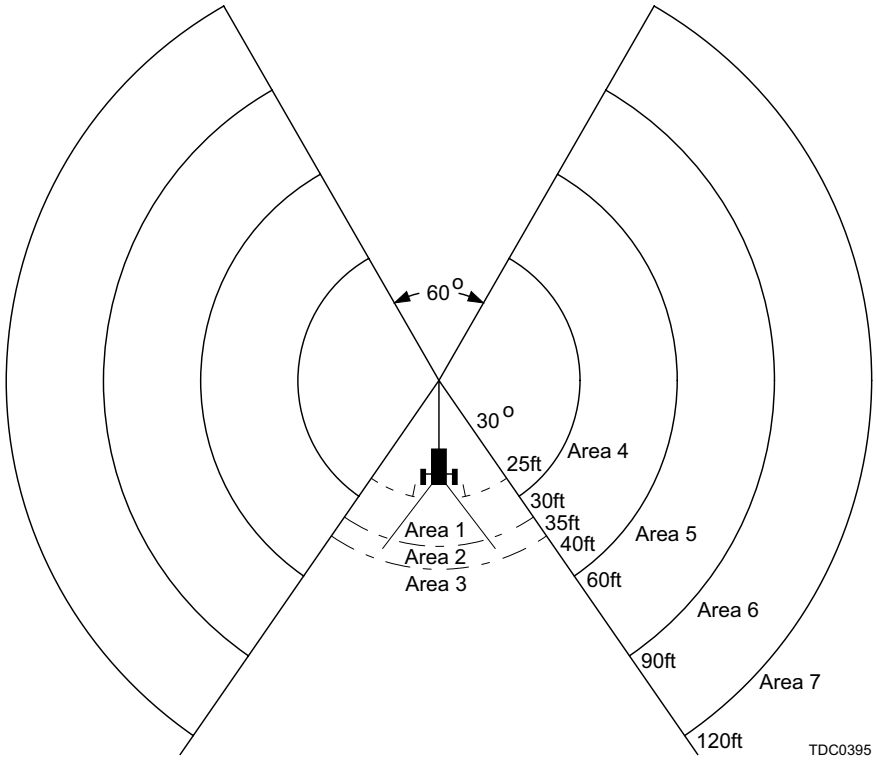
NOTES

These point values are based on the use of approved single hearing protection.

Exposure of any personnel must not exceed 1000 points in a 24-hour period. In battery formation, points from the firing of adjacent howitzers must be included. (See illustration below for definition of areas).

The areas must be rotated as the azimuth is changed. Point values less than 0.1 have been set to 0.1. Areas not defined in this table have unknown hazard due to lack of data.

*Point values extrapolated and scaled from M203 data.



WARNINGS

BEFORE FIRING HOWITZER, ENSURE THAT BRAKELINES ARE CORRECTLY STOWED ON THE CRADLE BRACKETS PROVIDED. FAILURE TO DO SO MAY RESULT IN INJURY TO PERSONNEL.

BEFORE FIRING HOWITZER, ENSURE SPADE DAMPER LEVERS ARE DEPLOYED IN THE NORMAL POSITION. UNDESIRABLE DISPLACEMENT MAY OCCUR, CAUSING INJURY TO PERSONNEL AND INACCURATE FIRING.

2-36 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING INDIRECT FIRE MISSIONS (cont)

CAUTION

Before firing howitzer, ensure spade dampers are in contact with the body end stops. Failure to do so could damage equipment.

NOTES

When Gunner has announced READY, Assistant Gunner has announced SET, and Cannoneer No. 2 has announced PRIMED, SC may command, FIRE, unless restricted by the fire command.

If the howitzer fails to fire due to a faulty or broken firing lever and linkage, immediately carry out the degraded firing procedure (Para 2-71). Notify faulty or broken remote firing linkage to unit maintenance.

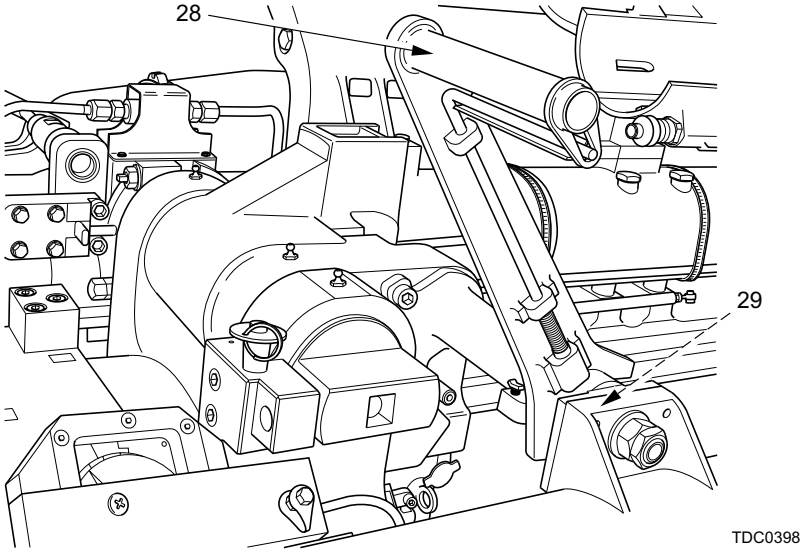
26 When the SC commands, FIRE, Cannoneer No. 1 pulls lanyard with a steady pull.

NOTE

In case of a failure to fire, refer to misfire and check firing procedures (Para 2-59 to 2-62). Use the misfire and check firing procedure that corresponds to the cannon tube temperature.

27 When cannon assembly returns to the in-battery position, Cannoneer No. 1 unhooks the lanyard from remote firing lever.

28 Cannoneer No. 2 extracts primer by moving PFM manual handle (28) to the EXTRACT position; ensuring detent (29) is engaged.



WARNING

ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.

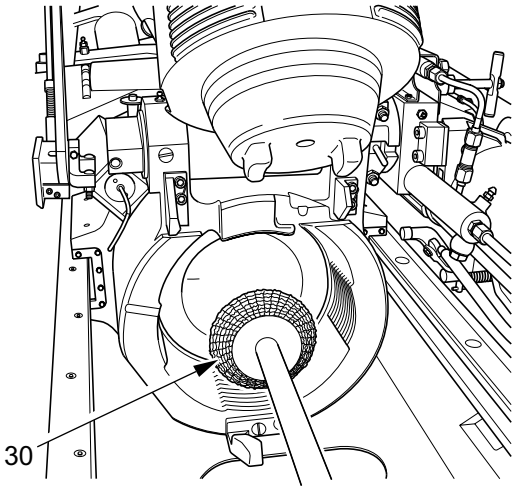
29 Cannoneer No. 2 opens breech (Para 2-25).

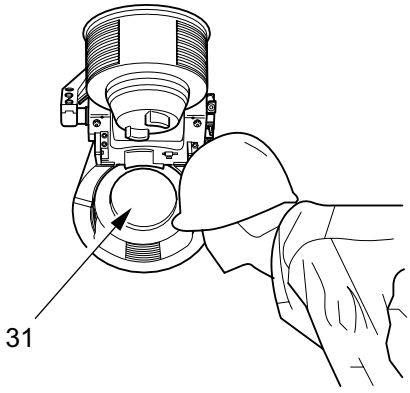
WARNING

THE BREECH LOCKOUT PLUNGER MUST BE ENGAGED PRIOR TO PERFORMING ANY MAINTENANCE TASKS THAT REQUIRE THE BREECH TO BE OPEN. FAILURE TO ENGAGE THE PLUNGER COULD RESULT IN ACCIDENTAL BREECH CLOSURE, WHICH COULD RESULT IN SEVERE CRUSHING INJURIES TO PERSONNEL.

30 Cannoneer no. 2 swabs powder chamber, spindle assembly, and gas check seat using chamber swab (30).

31 Driver inspects cannon tube (31); and announces, BORE CLEAR.





TDC0399

32 Sequence is repeated until mission is completed.

33 ATC records all ammunition fired by charge number, type, and total number of each fired, and entered on DA FORM 2408-4 or NAVMC 10558/10558A.

2-37 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING DIRECT FIRE MISSIONS

WARNINGS

DIRECT FIRE ON TARGETS CLOSER THAN 800 METERS FROM THE HOWITZER DURING COMBAT SITUATIONS ONLY. LETHAL FRAGMENTS CAN TRAVEL UP TO 600 METERS FROM POINT OF BURST.

THE ONE-PERSON SIGHT SYSTEM SHOULD ONLY BE USED WHEN THE TARGET AND THE HOWITZER ARE AT THE SAME ELEVATION, WITH NO MASK (SIGHT-TO-CREST) OBSTACLES IN BETWEEN. FIRING AT TARGETS ABOVE OR BELOW THE HOWITZER POSITION REQUIRES ADJUSTMENTS TO THE QUADRANTS LISTED ON THE RANGE CHART. ADJUSTMENTS MUST BE COMPUTED BY THE FIRE DIRECTION CENTER (FDC) IN ACCORDANCE WITH FM 6-40, PARAGRAPH 8-4. FOR THIS REASON, THE PRIMARY MEANS OF DIRECT FIRE WILL BE THE TWO-PERSON TWO-SIGHT METHOD.

CAUTION

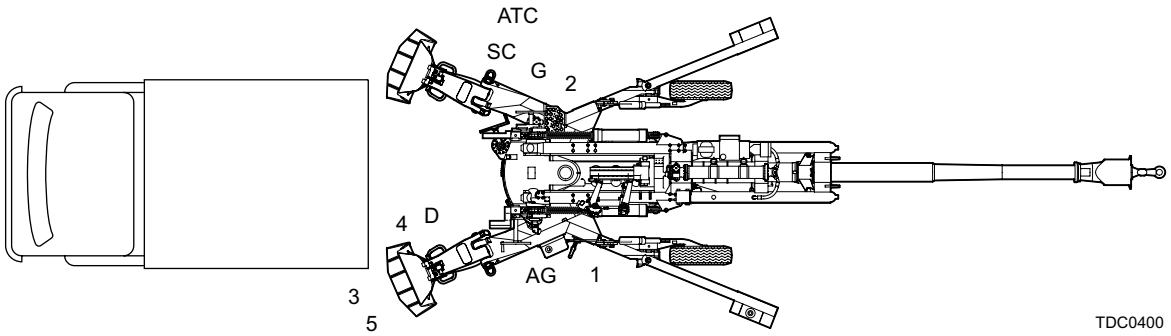
Before firing the howitzer during direct fire missions, ensure that the spades are dug into the ground to a minimum depth of 6 inches.

NOTE

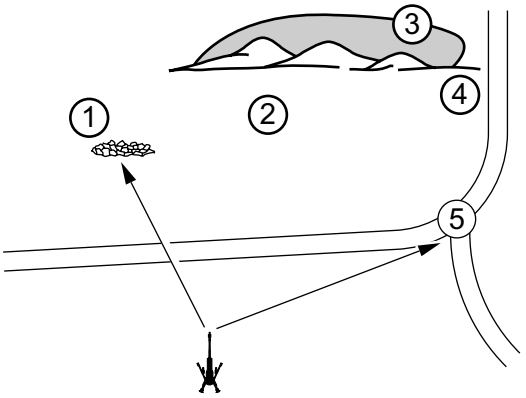
Procedures for firing drills have been standardized under the Department of the Army Standardization Program. The following procedures are for two-persons. For one-person, one-sight operations, the Gunner assumes duties of the Assistant Gunner and performs them on the left side of the howitzer.

Duties of the SC. Upon receipt of the order to fire direct fire, SC does the following:

1 Commands the section to take positions as illustrated.



2 Announces target to section, i.e., TARGET, ROCK PILE.



NO.	SHELL	CHG	FZ	TI	DF	QE	RANGE	DESCRIPTION	RMK
1	HE	7	Q		3800	4	250	ROCK PILE	
2	HE	5GB	Q		3015	6	150	TREE	
3	1CM	1	T1	2.0	2800	1000	500	DEAD SPACE	SWEEP 200 m
4	HE	1	T1	2.0	2447	30	400	HEDGE ROW	KJ
5	HE WP	1	T1	2.0	1831	30	400	RD JCT	KJ

TDC0401

3 Determines quadrant of target from range card, i.e., 4 mils. If range card is not prepared, quadrant may be obtained from direct fire range plate.

DIRECT FIRE RANGE PLATE
M777/M777E1 155MM H0WITZER

M795 HE PROJECTILE		M107 HE PROJECTILE	
M203 PC (RB)		M119A1 PC (WB)	
RANGE (METERS)	ELEV (MILS)	RANGE (METERS)	ELEV (MILS)
400 -		400 -	4
600 -		600 -	7
800 -		800 -	9
1000 -		1000 -	11
1200 -		1200 -	14
1400 -		1400 -	16

L15 HE PROJECTILE		M107 HE PROJECTILE	
M203 PC (RB)		M4A2 PC (WB)	
RANGE (METERS)	ELEV (MILS)	RANGE (METERS)	ELEV (MILS)
400 -		400 -	6
600 -		600 -	10
800 -		800 -	13
1000 -		1000 -	16
1200 -		1200 -	20
1400 -		1400 -	24

PLATE DIRECT FIRE P/N 12008973

TDC0402

NOTE
The M795 HE projectile and L15 projectile are not available.

4 Determines and announces lead, in mils, by estimating speed of target for particular projectile and charge. Approximate leads are as follows:

0 to 5 mph (0 to 8.05 km/hr)…….. 5 mils

6 to 10 mph (9.65 to 16.09 km/hr)…….. 10 mils

11 to 15 mph (17.69 to 24.13 km/hr)…….. 15 mils

2-37 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING DIRECT FIRE MISSIONS (cont)

5 Gives the fire command as follows:

(a) TARGET (DESCRIPTION/LOCATION)

(b) SHELL (TYPE)

(c) CHARGE (TYPE)

(d) FUZE (TYPE)

(e) LEAD (LEFT OR RIGHT SO MUCH)

(f) RANGE (SO MUCH)

(g) FIRE AT WILL (unless otherwise notified)

6 Gives the following subsequent commands based on observed effect:

(a) CHANGE IN LEAD (LEFT OR RIGHT SO MUCH)

(b) CHANGE IN QUADRANT (ADD OR DROP)

WARNING
Read and follow all warnings in WARNING SUMMARY.
Pay careful attention to those about batteries.

Duties of Assistant Gunner. The Assistant Gunner lays the howitzer for elevation as follows:

NOTE
To eliminate backlash when laying for direction and elevation, make sure the last motion of all control and leveling knobs are in a CW direction.

1 Cross level M172A1 telescope and quadrant mount by centering bubble in cross level vial.

2 Using direct fire range plate, determines elevation based on announced range, charge, and projectile and elevates or depresses cannon tube to keep appropriate mil line of elbow telescope on center mass of target, then announce, SET.

3 Continues to announce, SET, as long as target is being tracked.

4 For subsequent rounds, changes the mil line based on commands from SC.

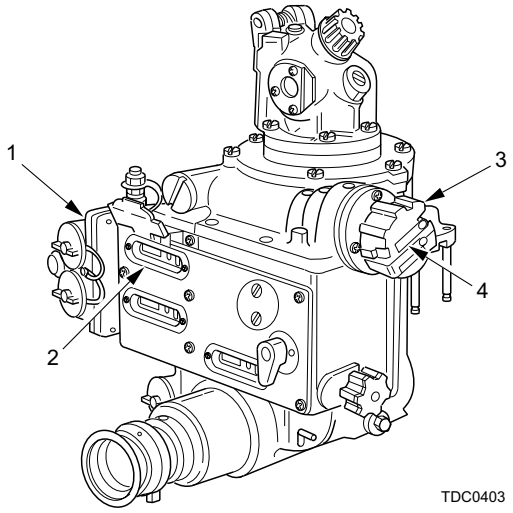
Duties of the Gunner. The Gunner lays the howitzer for direction as follows:

NOTE
To eliminate backlash when laying for direction and elevation, make sure the last motion of all control and leveling knobs are in a CW direction.

1 Cross levels M171A1 telescope and quadrant mount by centering bubble in cross level vial.

NOTE
Central laying is the preferred method for direct fire.

2 Opens azimuth counter door (1), sets azimuth counter (2) to 3200 by turning azimuth knob (3), and turns azimuth bar knob (4) to DIRECT.



3 Tracks target (if moving) by traversing weapon. If a lead is announced by SC, it can be applied with azimuth knob (3). With azimuth bar knob (4) on DIRECT, azimuth counter (2) will click every 5 mils. The lead can also be applied with reticle lead. The Gunner should use appropriate mil line of reticle pattern to obtain desired lead.

4 When proper sight picture exists and Cannoneer No. 2 announces, PRIMED, the Assistant Gunner announces, SET continuously, until Gunner commands, FIRE.

Duties of Remainder of Section. Performs duties as indirect fire until, END OF MISSION or CHECK FIRING is commanded by SC.

2-38 DISPLAY SCREEN LIST OF ABBREVIATIONS/ACRONYMS

The following alphabetical list gives definitions for the abbreviations and acronyms used for the CSD/GND/AGD

A .....Altitude
ACK ..... Acknowledge
ACT .....Actual
ACT DEF.....Actual Deflection
ACTL .....Actual
ACT QE.....Actual Quadrant Elevation
AF ..... Adjust Fire
AGD .....Assistant Gunners Display Unit
AMC .....At My Command
AOF ..... Azimuth of Fire
AUX ..... Auxiliary
AZ .....Azimuth
BRT .....Brightness
C ..... Cant
CBLS ..... Cables
CHG .....Charge
CHKFIRE ..... Checkfire
CLR ..... Clear

2-38 DISPLAY SCREEN LIST OF ABBREVIATIONS/ACRONYMS (cont)

CMD ..... Command
COM ..... Communication
COMM ..... Communication
CRS-AZ ..... Crest Azimuth
CSD ..... Section Chiefs Display Unit
CURR ..... Current
DEF ..... Deflection
DEFL ..... Deflection
DEG ..... Degraded
DELTA ..... Difference in Deflection and Quadrant from Actual
DESTN ..... Destination
DEST TYPE ..... Destination Type
DIST ..... Distance
DN ..... Down
E ..... East/Eastings
EL ..... Electro Luminesant
EOM ..... End of Mission
ENT ..... Enter
FDC ..... Fire Direction Center
FFE ..... Fire For Effect
FIREMSN ..... Fire Mission
FPF ..... Final Protective Fire
GND ..... Gunners Display Unit
GNR ..... Gunner
GPS ..... Global Positioning System
H ..... Heading
HDG ..... Heading
INIT POINT ..... Initialization Point
LOG POINT ..... Logistic Point
MO ..... Move Order
MSC ..... Mission Computer
MSN NO ..... Mission Number
N ..... North/Northings
NAV ..... Navigation
NVG ..... Navigation
OBIT ..... Operational-BIT
OIBIT ..... Operated-Initiated-BIT
OL ..... Orientation Line
POSN ..... Position
PROP ..... Propellant
PUBIT ..... Power-Up-BIT
PWR ..... Power
PWS ..... Power
QE ..... Quadrant Elevation
QUAD ..... Quadrant
RNDS ..... Rounds
RNG ..... Range
RPS ..... Radio Power Supply
RT ..... Receiver-Transmitter
S ..... South
SCP ..... Survey Control Point
SHTDWN ..... Shutdown
TEMP ..... Temperature
TGT ..... Target
TGT HDG ..... Target Heading

TRAV ..... Traverse
USRDEF ..... User Defined
VLY ..... Volley
W ..... West

2-39 INITIALIZATION PROCEDURES

WARNING
Read and follow all warnings in WARNING SUMMARY.
Pay careful attention to those about batteries.

a. Initialize the DFCS (using stored spheroid/datum entries)

WARNING

WHEN OPERATING THE PLGR ON EXTERNAL POWER WITH BA-5800 LITHIUM BATTERY INSTALLED, THE BATTERY MAY EXPLODE. ENSURE THAT BATTERY IS REMOVED BEFORE CONNECTING POWER TO THE CABLE; THIS WILL HELP PREVENT DEATH OR SERIOUS INJURY.

NOTES

Before carrying out initializing of the DFCS, ensure the following:

- Left wheel is within 1 yard (0.9 m) of the Survey Control Point (SCP).
- Travel and traverse locks are engaged.
- Radio antenna is properly mounted.

1 SC directs driver, and places the howitzers left wheel within 1 yard (0.9 m) of SCP.

2 Turn PSP (1) on by, rotating the functional control switch (2) CCW to the ON position.

NOTES

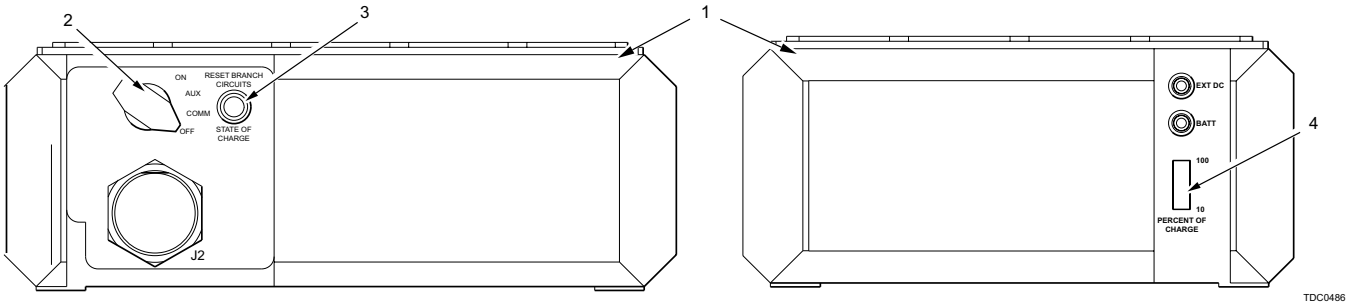
If there is no reading on the state of charge indicator (4), reset RESET BRANCH CIRCUITS/STATE OF CHARGE button on front of PSP. If no power indicated on PSP, see Chap 3, Sect II (Troubleshooting).

If the SOC indicator is 10 percent or more, continue with initialization procedure, if indicator is below 10 percent, charge batteries (startup prime mover engine).

3 Press RESET BRANCH CIRCUITS/STATE OF CHARGE BUTTON (3) and check SOC indicator (4).

2-39 INITIALIZATION PROCEDURES (cont)

a. Initialize the DFCS (using stored spheroid/datum entries) (cont)



FRONT VIEW

RIGHT SIDE VIEW

CAUTION

Disconnect power [W3] cable from prime mover when engine is not running, failure to do so will cause vehicle batteries to discharge. If the DFCS system requires an external power source and/or batteries require charging (PSP state of charge indicator is showing below 10 percent), connect power [W3] cable to prime mover and start up the engine so that the system/batteries can be charged. To provide the necessary DFCS power requirements, ensure the prime mover revolutions per minute (rpm) vehicle counter is set to the following rpm:

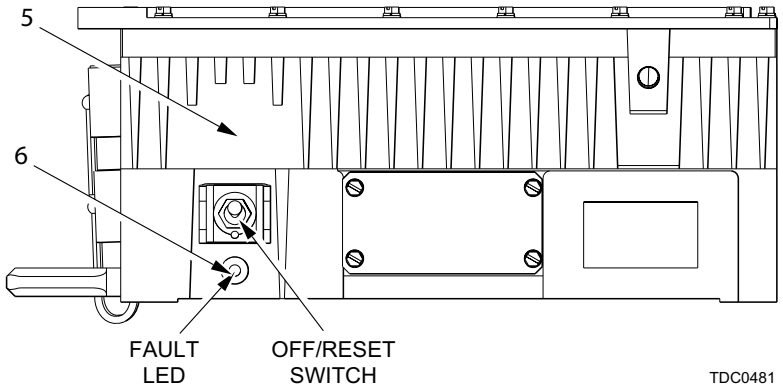
- MTVR – 733 rpm.
- FMTV – 700 rpm.
- M939 – 841 rpm.

Failure to set the correct rpm will not provide the correct power output needed to charge the DFCS batteries.

NOTE

During the initialization process, the FAULT LED (6) will be illuminated. Upon completion of the initialization process (approximately 90 seconds), if no faults are detected, the FAULT LED will extinguish.

4 The MSC (5) FAULT LED (6) should be illuminated at this time.



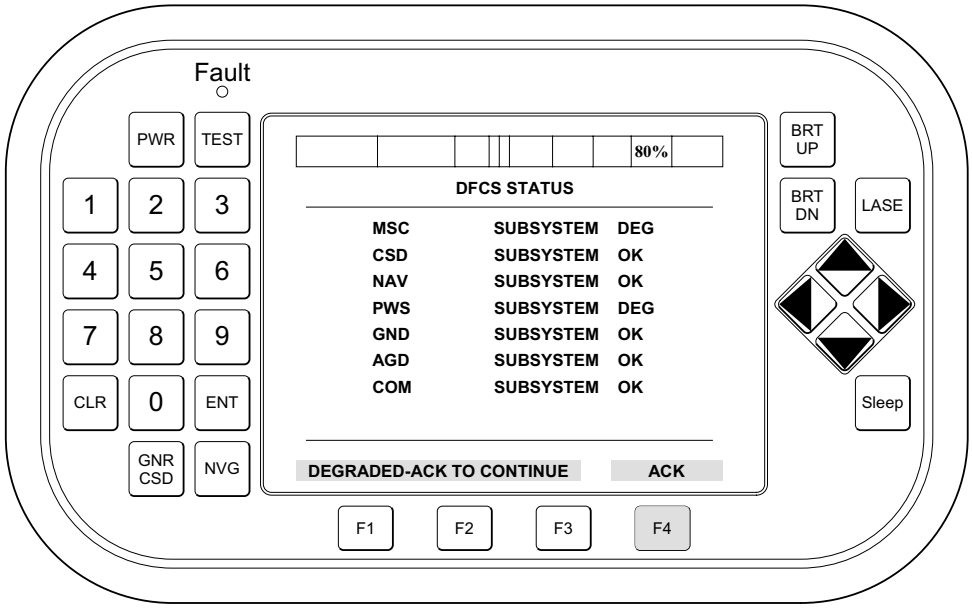
NOTES

DFCS will power up and automatically perform its Built-In-Test (BIT). On completion of the BIT the CSD screen will display the DFCS STATUS.

The - - appears on the NAV, GND, AGD and COM status lines indicating that the subsystems are not connected.

In the event of a failure during system startup, the message DEGRADED-ACK TO CONTINUE will be displayed (only for certain subsystems) on the bottom line of the Electro Luminesant (EL) Panel. To continue, press F4 key under ACK. This action will transition the DFCS STATUS screen to the SELECT OPERATIONAL MODE screen.

If all subsystems conditions indicate "OK", upon completion of BIT all function key labels will be blank and the DFCS STATUS screen will automatically transition to SELECT OPERATIONAL MODE screen after approximately 3 seconds.



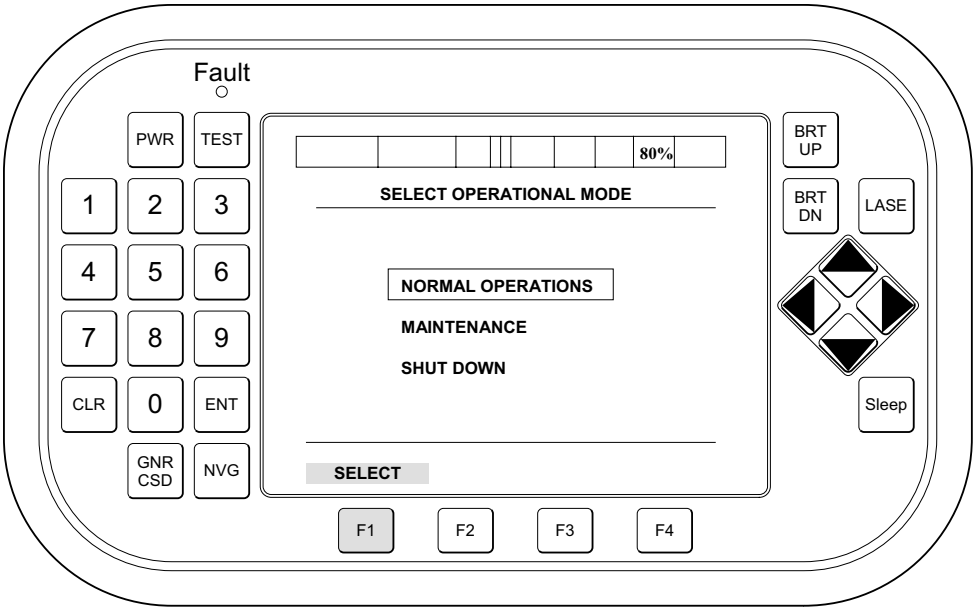
NOTE

The SELECT OPERATIONAL MODE has three menu items that allows the SC to select NORMAL OPERATIONS, enter the MAINTENACE mode or SHUTDOWN the system before preceding any further in the initialization process.

5 Select NORMAL OPERATIONS and press SELECT F1 key.

2-39 INITIALIZATION PROCEDURES (cont)

a. Initialize the DFCS (using stored spheroid/datum entries) (cont)

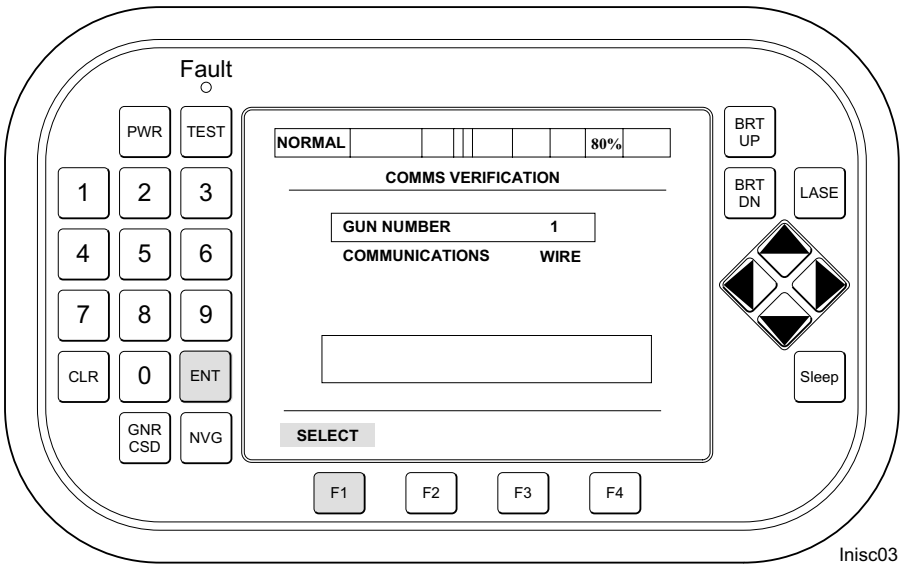


NOTES

The COMMS VERIFICATION will be displayed. This allows the SC to verify his assigned gun number and means of communicating with the FDC.

If the GUN NUMBER and COMMUNICATIONS are correct go to step 17. If the GUN NUMBER is correct and the COMMUNICATIONS is not correct, go to step 16.

6 Select GUN NUMBER, press SELECT F1 key. Enter GUN NUMBER between 1 and 12 and press ENT key.



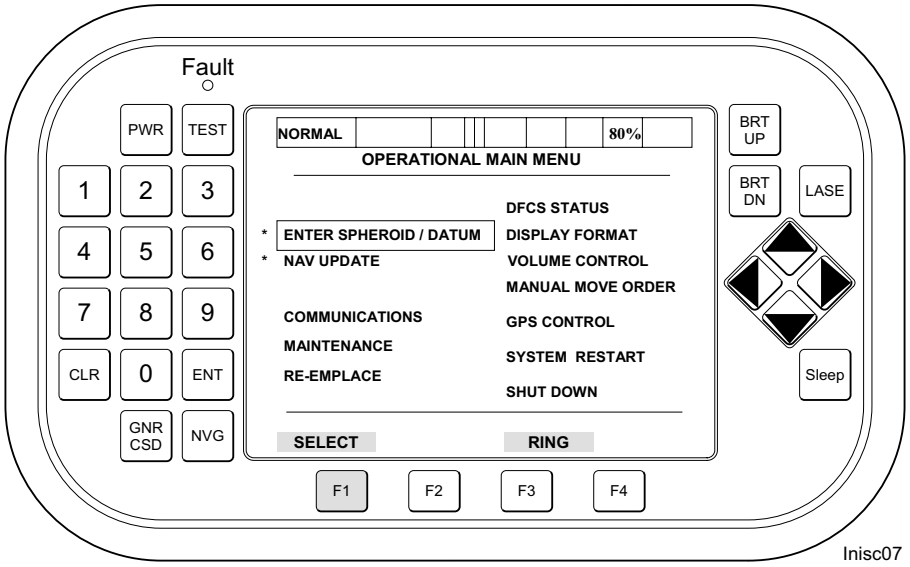
7 Select COMMUNICATIONS and press SELECT F1. CHANGE TO RADIO, YES, NO. Press YES F3 key.

8 Verify gun number and communication data is correct, press USE ALL F2 key.

NOTE

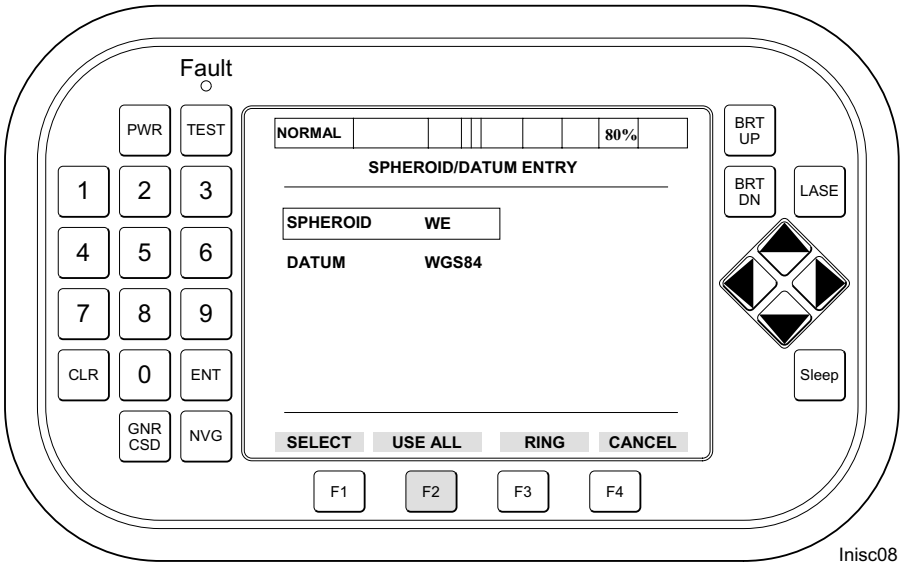
An asterisk (*) will appear next to ENTER SPHEROID/DATUM and NAV UPDATE. The asterisks indicate these two entries are required to be completed.

9 Select *ENTER SPHEROID/DATUM and press SELECT F1 key.



Inisc07

10 Verify spheroid and datum, press USE ALL F2 key.



Inisc08

NOTE

If spheroid and datum is other than WE and WGS84, proceed to step 11.

2-39 INITIALIZATION PROCEDURES (cont)

a. Initialize the DFCS (using stored spheroid/datum entries) (cont)

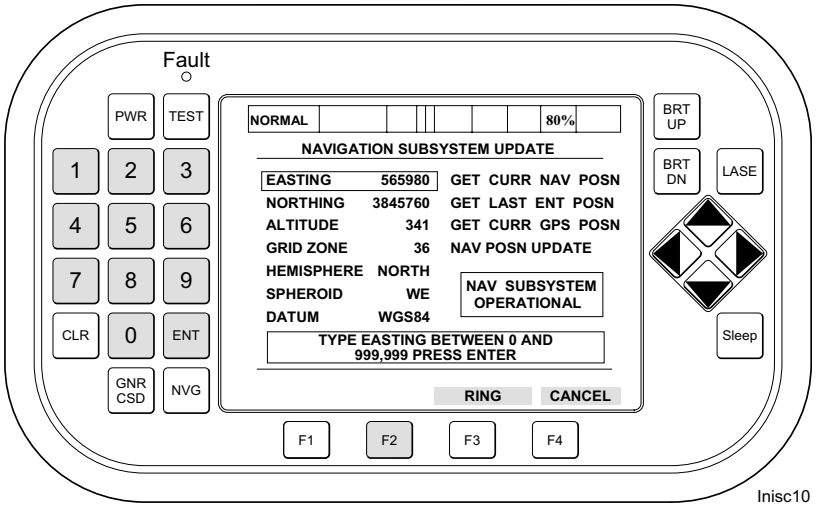
11 Select NAV UPDATE, press SELECT F1 key.

NOTES

When the ALTITUDE is selected, the F2 key position will be populated with a (+/-) sign allowing entry of a negative number. The process for entering a negative altitude is to enter the value, press +/- F2 key and press ENT key.

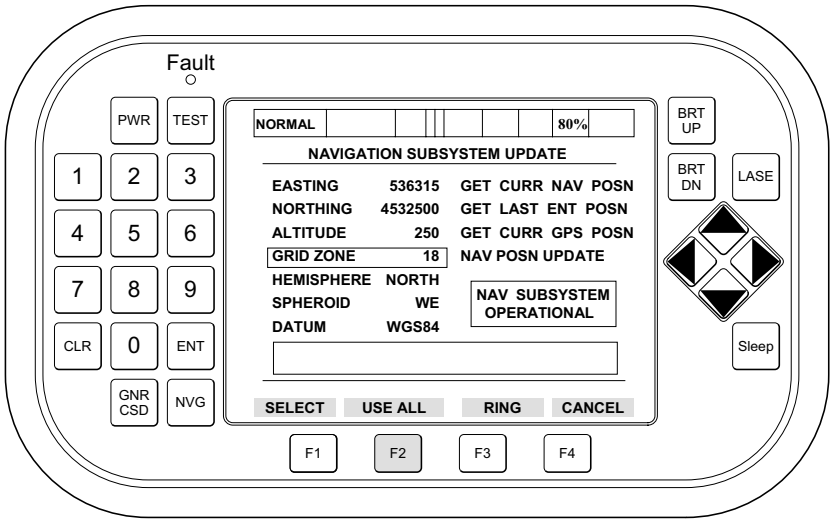
If the HEMISPHERE needs to be changed, the NAVIGATION SUBSYSTEM UPDATE will be displayed. The YES/NO selections will allow change of the hemisphere from NORTH to SOUTH and vice versa.

12 Select EASTING, NORTHING, ALTITUDE, GRID ZONE and HEMISPHERE, press SELECT F1 key. Enter data, press ENT key.



Inisc10

13 Verify data on the NAVIGATION SUBSYSTEM UPDATE, press USE ALL F2 key.



14 The POSITION DATA FOR FDC will display the data entered on the NAVIGATION SUBSYSTEM UPDATE.

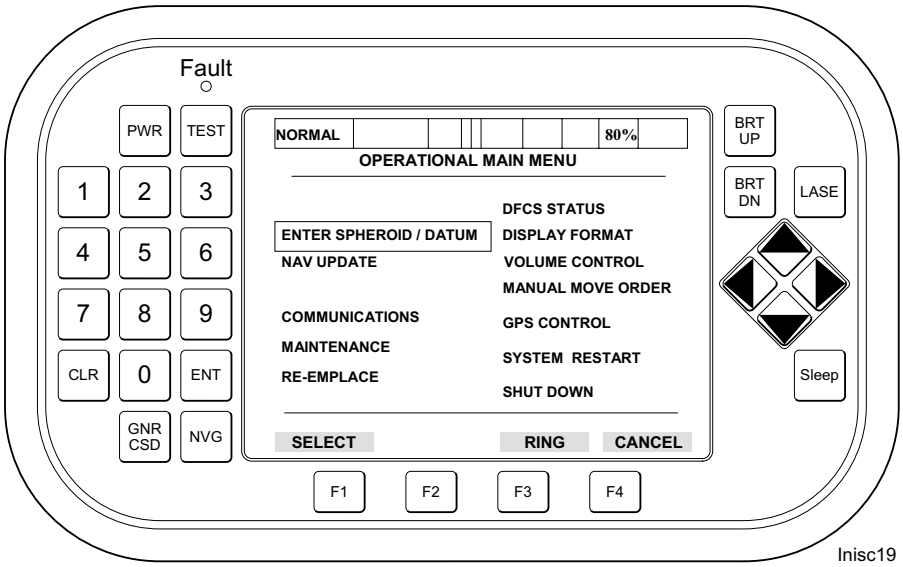
15 After SC calls the FDC with the position data, press CANCEL F4 key.

16 The SECTION IN ORDER AT INITIALIZATION POINT will be displayed.

NOTE

At this point the SC can enter a move order that will allow the howitzer to move to a firing point/area and prepare to fire missions.

17 Press MENU F1 key, the OPERATIONAL MAIN MENU will be displayed.



b. Shutdown

CAUTIONS

Shutting down of the DFCS should be performed ONLY from CSD, with an orderly shutdown procedure as described below. Failure to do so, may result in DFCS boot-up or other operational problems

On completion of the "Shutdown Procedure", ensure the PSP function control switch is set to the OFF position. Failure to do so will cause the DFCS batteries to discharge.

1 Select SHUTDOWN, press SELECT F1 key. SHTDWN ARE YOU SURE?, press YES F3 key.

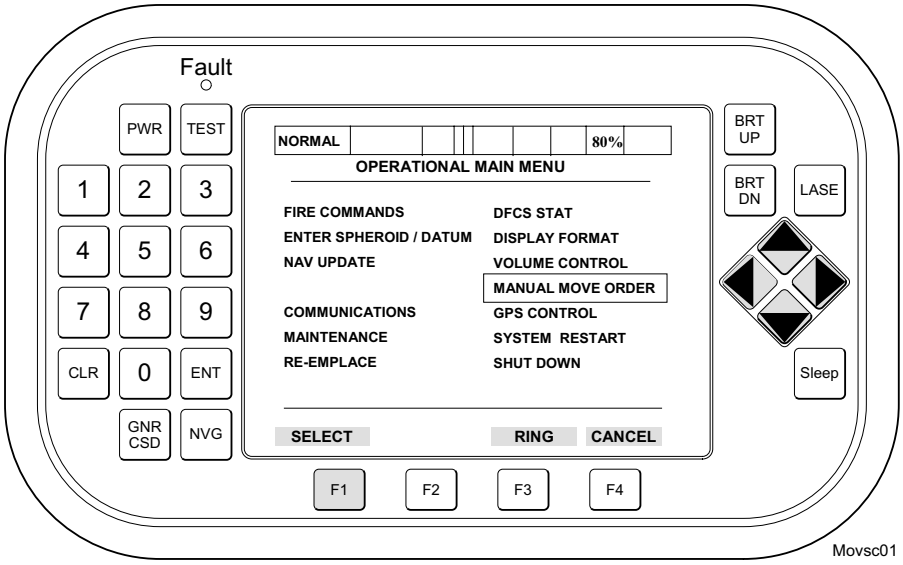
2 After YES is selected, the system will write unsaved data to files and perform an orderly shutdown. When the system is ready to be turned off, a screen will appear notifying the operator it is safe to remove power from the DFCS.

3 Rotate PSP function control switch CW to the OFF position.

2-40 MOVEMENT PROCEDURES

a. Move to a Fire Area/Point/Log/Init Point)

1 Select MANUAL MOVE ORDERS, press SELECT F1 key.



Movsc01

NOTE

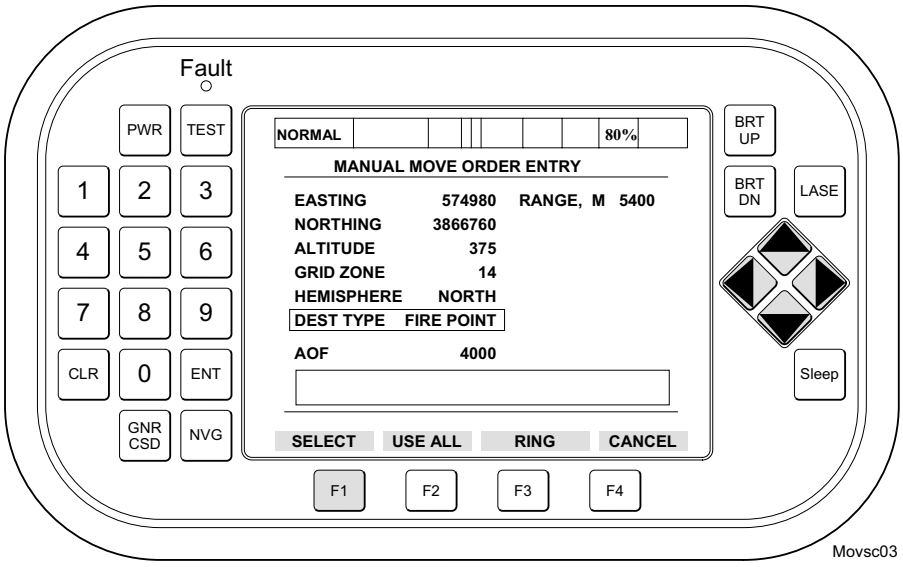
If altitude is negative, enter value, select the ± F2 key, then press ENT key.

2 Select EASTING, NORTHING, ALTITUDE and GRID ZONE, press SELECT F1 key. Enter data, press ENT key.

NOTE

The last entered DEST TYPE will be displayed. If the destination type is different go to step 3, if not, press USE ALL F2 key and proceed to step 4.

3 Select DEST TYPE, press SELECT F1 key.



Movsc03

NOTE

When selecting FIRE AREA a RADIUS must be entered; the default value is 750 meters.

4 Select FIRE AREA, press SELECT F1 key.

5 Enter RADIUS, press ENT key.

6 Select AOF, press SELECT F1 key. Enter AOF, press ENT key.

7 Verify move data, press USE ALL F2 key. Move to designated area, emplace howitzer (Para 2-25).

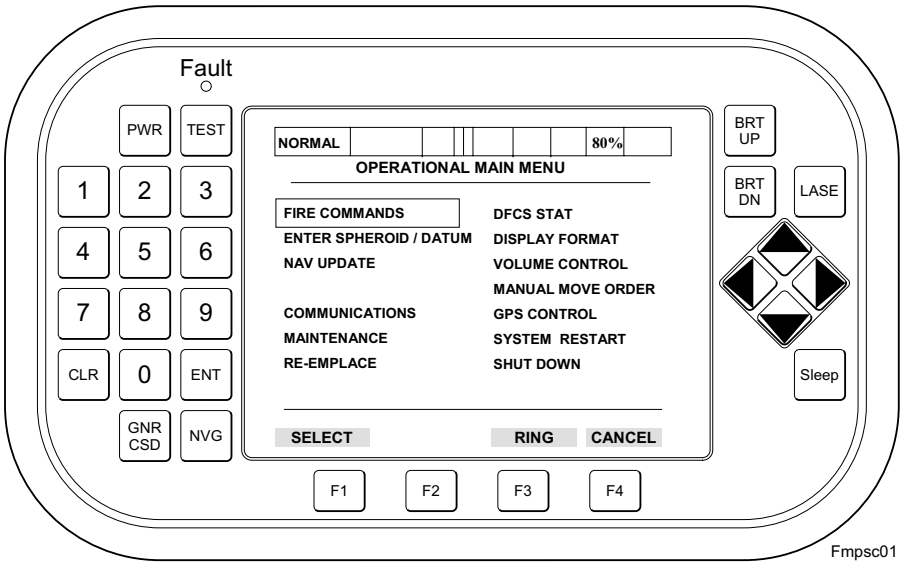
2-41 FIRE MISSION PROCEDURES

a. Digital Fire Mission – Fire When Ready

1 When a digital fire mission is received from the FDC, an audible alert on the CSD and a message requiring the SC to acknowledge the alert.

NOTE

Any screen can be displayed during non-fire mission operations. In this example, the OPERATIONAL MAIN MENU is displayed



Fmpsc01

NOTE

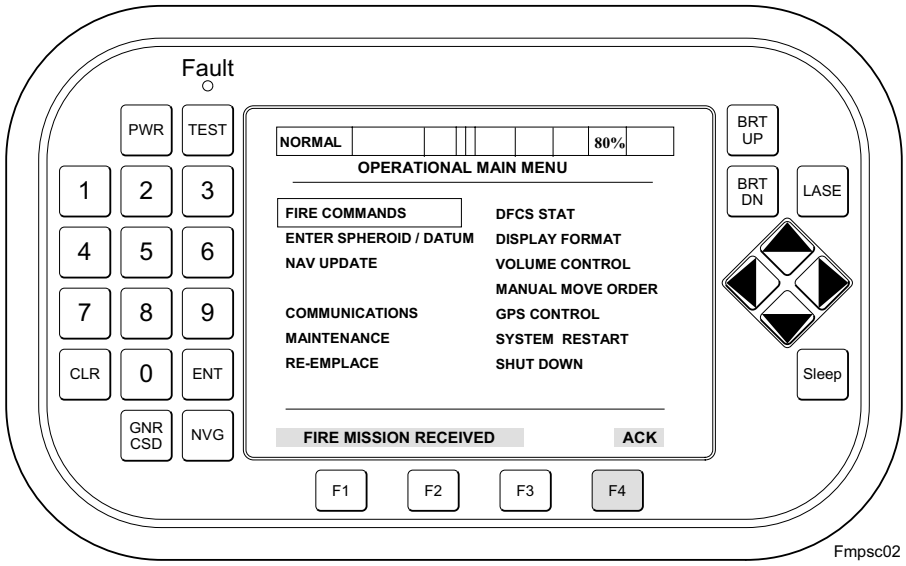
Whatever screen is displayed upon receipt of a fire mission, a FIRE MISSION RECEIVED, ACK message will be displayed along with an audio alert. The firing data will indicate which section will be the adjusting piece. The remainder of the howitzers will receive their FFE data with a DO NOT LOAD method of fire displayed.

2 SC announces FIRE MISSION to the crew.

3 When the FIRE MISSION RECEIVED message is displayed, press F4 key to acknowledge.

2-41 FIRE MISSION PROCEDURES (cont)

a. Digital Fire Mission – Fire When Ready (cont)



Fmpsc02

NOTES

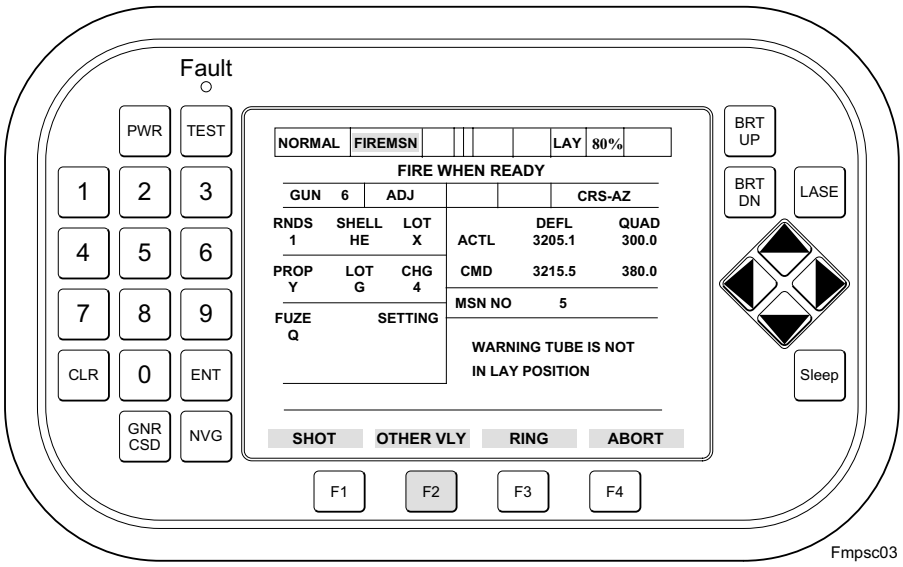
The FIRE MISSION will display initial fire orders; the SC of the adjusting section will announce fire commands to the crew.

The F2 key on the FIRE MISSION will display OTHER VLY indicating there is additional data (e.g. FFE) as part of the mission.

Instructions at the top of the screen display will provide the method of fire and control. In this mission the method of fire is FIRE WHEN READY.

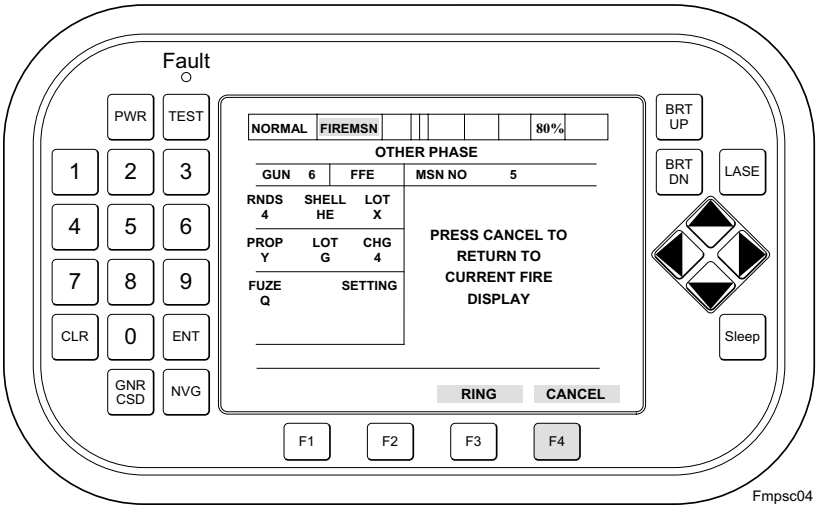
The adjusting howitzer will have ADJ in the space to the right of the GUN number. The number of rounds (RNDS) will be 1 during the adjustment phase.

4 The SC of the adjusting howitzer can see the additional data by pressing the OTHER VLY F2 key.



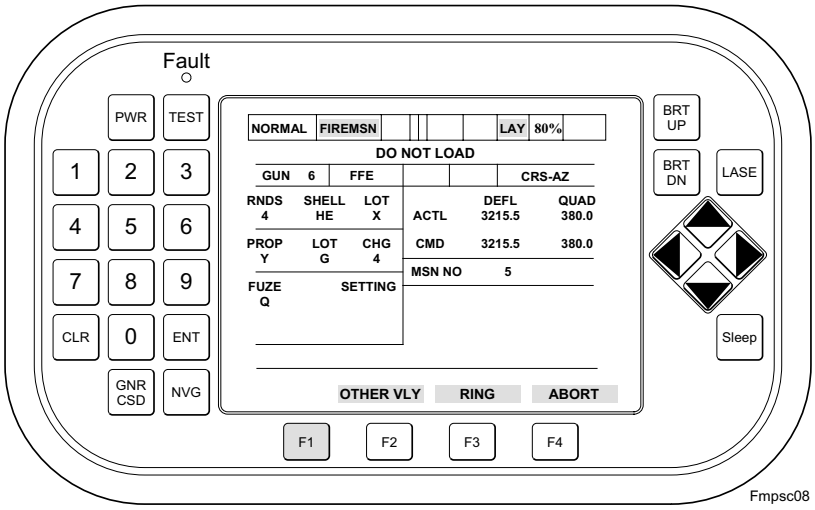
Fmpsc03

5 The OTHER PHASE screen will display the FFE data. This will allow the section to prepare the ammunition for the FFE phase.



6 The SC/ATC will record the data and press CANCEL F4 key returning the display to the FIRE MISSION.

7 The non-adjusting platoon/battery gun's CSD will display a FIRE MISSION with a DO NOT LOAD method of fire. FFE will be displayed to the right of the GUN number. The number of rounds in FFE will be displayed under the RNDS label.



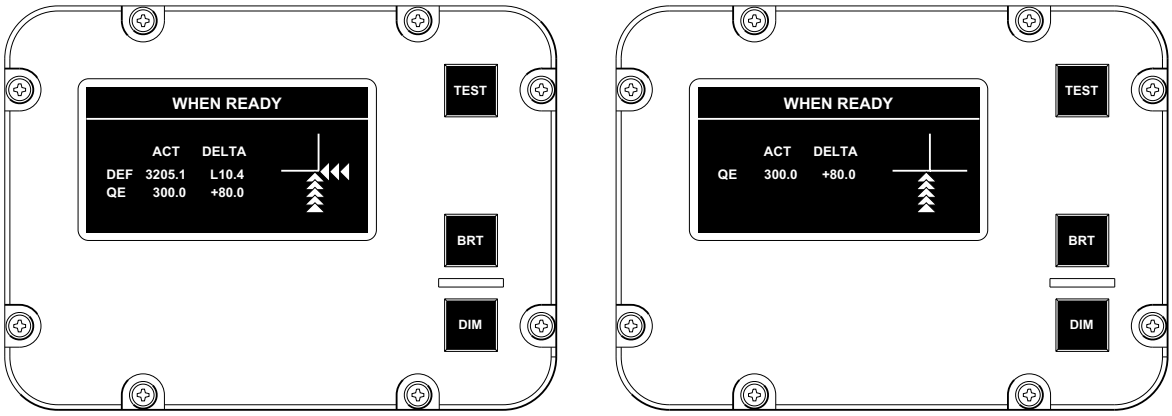
NOTES

As the howitzer is laid on the commanded firing data, the GND and AGD will display graphic arrows indicating to the Gunner and Assistant Gunner the magnitude the tube must move to achieve the lay data. A numeric delta also appears on the screen indicating the direction and magnitude to achieve the lay data.

When the data is within 10 mils of the commanded data, the small arrowheads will change to one large arrowhead. When the commanded data has been achieved the large arrowhead will change to a solid circle (ball shape) in the middle of the graphic crosshairs.

2-41 FIRE MISSION PROCEDURES (cont)

a. Digital Fire Mission – Fire When Ready (cont)



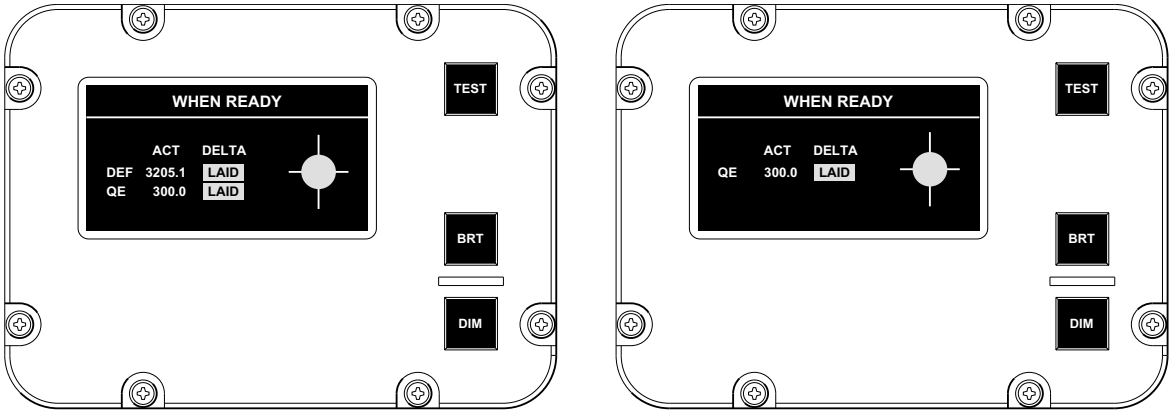
GND AGD Fmpsc05

CAUTION

The following safety checks are mandatory for all fire missions:

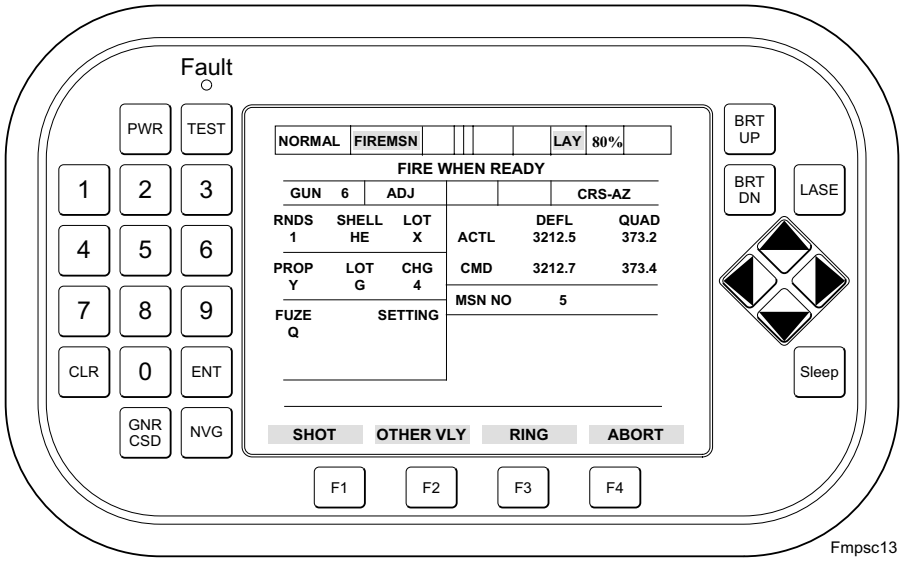
- Verify LAID is displayed on the GND and AGD units with a circle (ball shape) in the center of the crosshairs.
- WARNING TUBE NOT IN LAY POSITION is not displayed on the CSD screen.
- Verify LAY is displayed on the CSD and is inverse video.

8 The Gunner and Assistant Gunner elevate/depress and/or traverse cannon tube until the ACT DEF and QE data are set on the howitzer. The AGD will display the word SET in the delta column and a solid circle in the middle of the crosshairs indicating the actual data is within 0.5 mils of the commanded quadrant. The word SET will also appear on the GND if the deflection has not yet been achieved. If the commanded deflection has been achieved prior to the quadrant, the word READY will be displayed on the GND in the delta column. Once both the deflection and quadrant is achieved, the words SET and READY will be replaced with the word LAID and the solid circle in the middle of the graphic crosshairs.



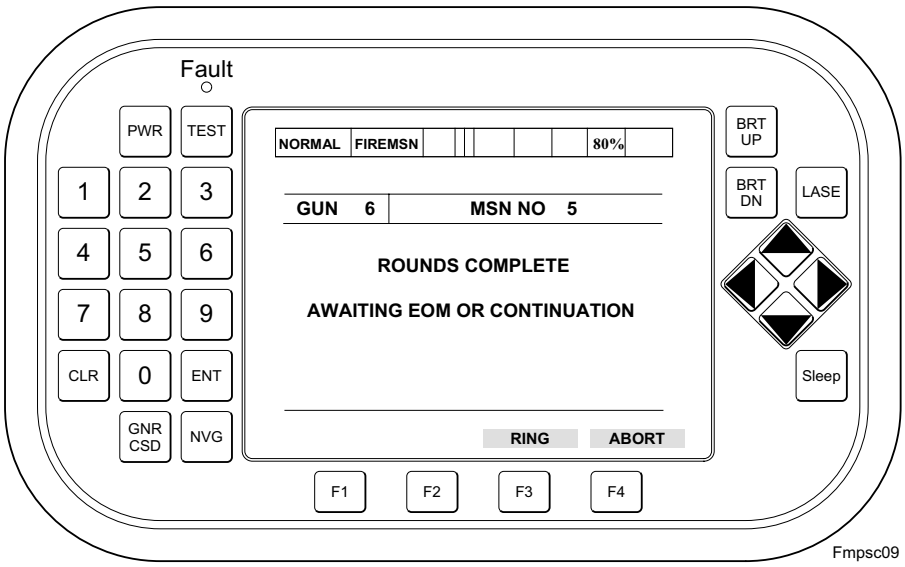
GND AGD Fmpsc06

9 The SC verifies mandatory safety checks and presses SHOT F1 key on the FIRE MISSION screen.



Fmpsc13

10 After the round has been fired, the ROUNDS COMPLETE will be displayed. This will remain displayed until the mission is ended or another FIRE MISSION appears indicating the mission has been updated.

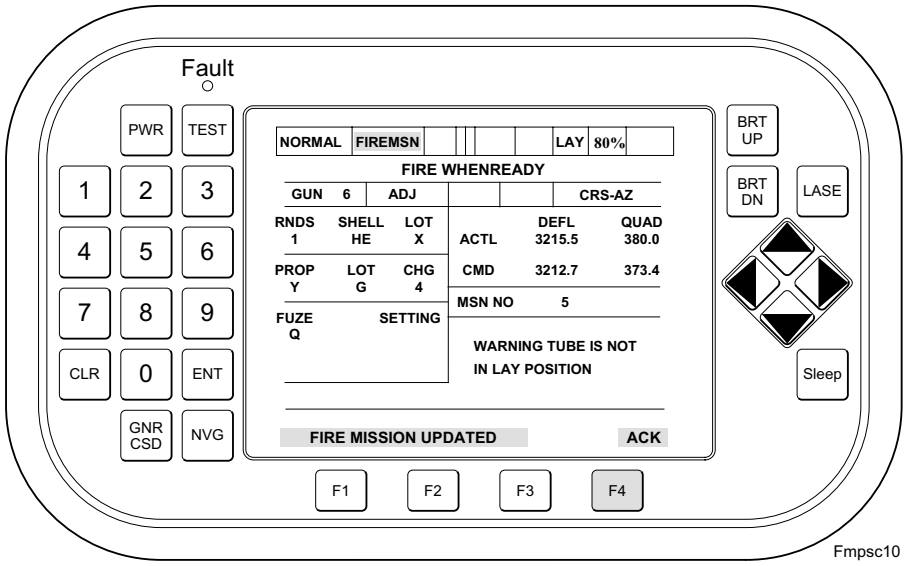


Fmpsc09

11 If there is subsequent adjustment data, an audio alert will sound and FIRE MISSION UPDATED will be displayed, press ACK F4 key to acknowledge.

2-41 FIRE MISSION PROCEDURES (cont)

a. Digital Fire Mission – Fire When Ready (cont)

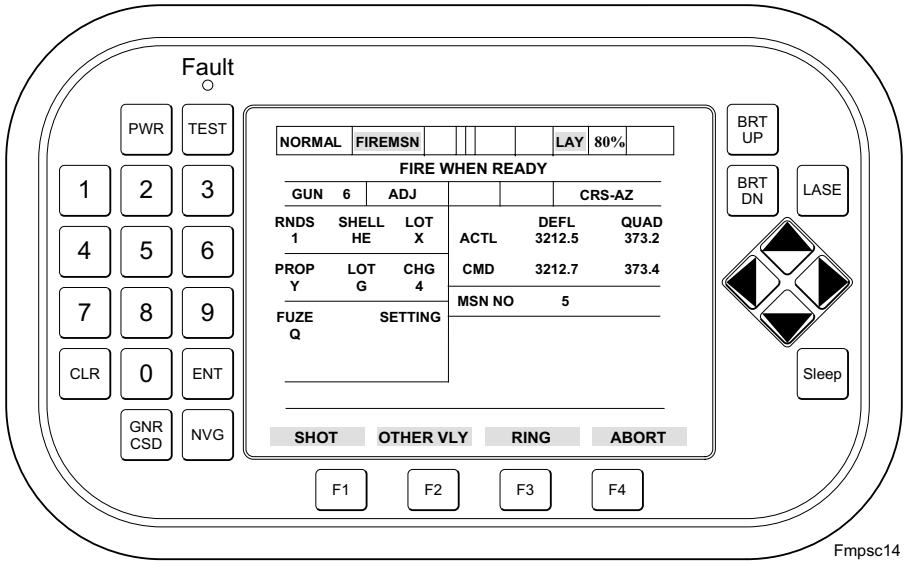


Fmpsc10

12 The FIRE MISSION will be displayed with the SHOT and OTHER VLY keys again available.

NOTE

The subsequent data procedures are the same as steps 6 through 10 above.

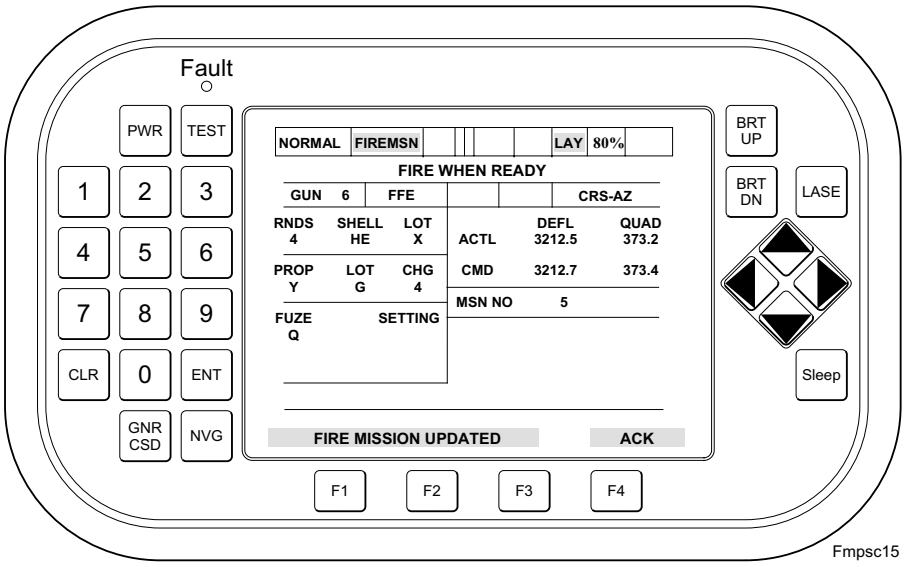


Fmpsc14

NOTE

If there are subsequent adjusting rounds, the steps above are repeated. When the FFE phase begins, a new FIRE MISSION screen will be displayed with the FIRE MISSION UPDATED, ACK message displayed. FFE will be displayed in the space to the right of the GUN number and the RNDS will change from one to the number of rounds required in FFE.

13 When the updated FIRE MISSION is displayed, press ACK F4 key to acknowledge the message.

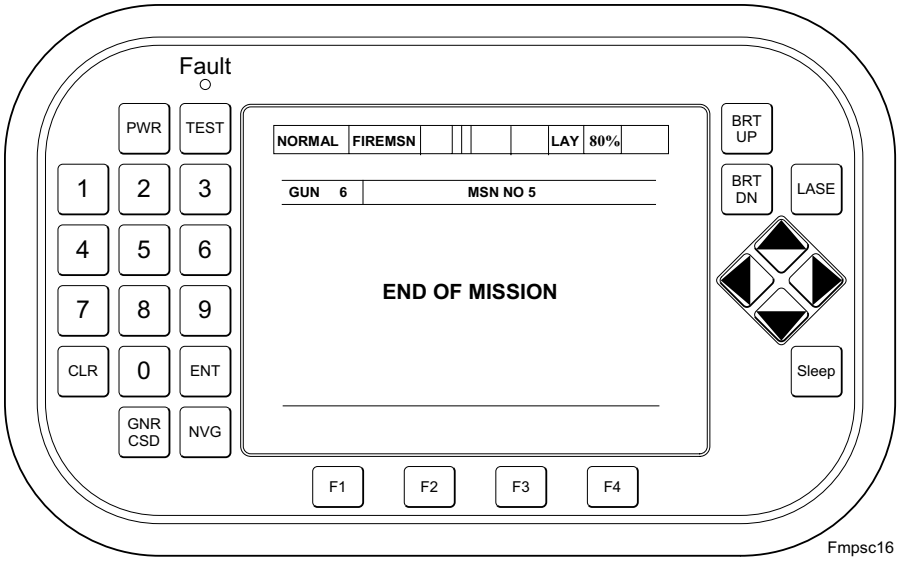


Fmpsc15

14 When the FIRE MISSION is displayed again, SHOT F1 key will be active.

15 The Gunner and Assistant Gunner lay the howitzer using the aid of the GND and AGD as described in step __. Once the howitzer is laid the SC commands fire and presses SHOT F1 key. As each round in FFE is fired, the SC presses the SHOT key. When the FFE are expended, the ROUNDS COMPLETE screen will be displayed.

16 When the FDC transmits EOM, the END OF MISSION will be displayed. This will display for approximately 3 seconds and transitions to the SECTION IN ORDER.



Fmpsc16

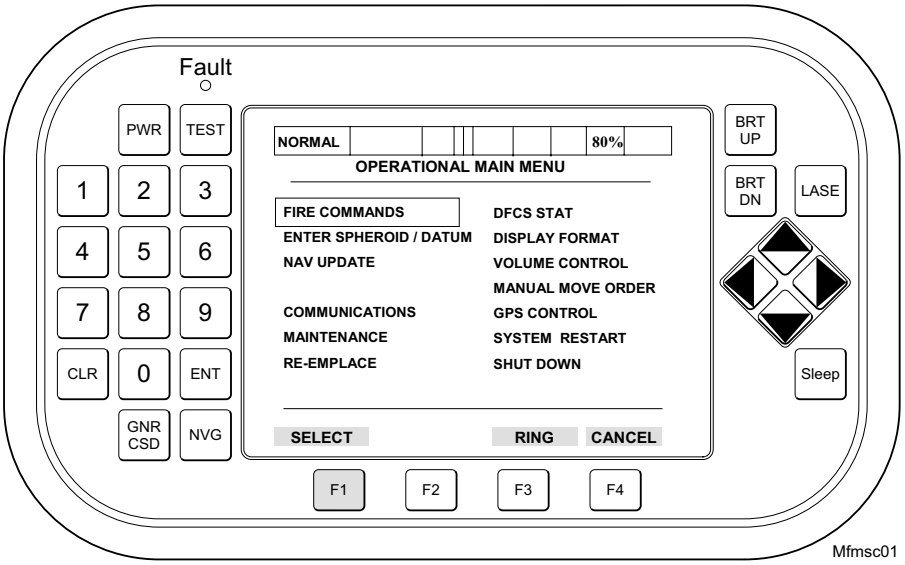
2-41 FIRE MISSION PROCEDURES (cont)

b. Manual Fire Mission

NOTE

The DFCS communications are OUT. The manual procedures for a fire mission are the same as a digital fire mission, except a manual entry is required.

1 Select FIRE COMMANDS and press F1 key.

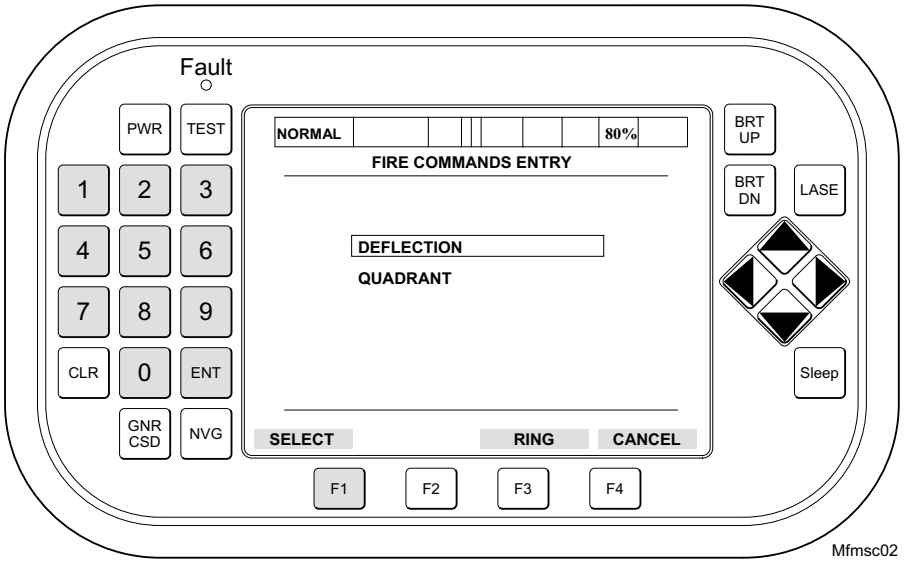


Mfmsc01

NOTE

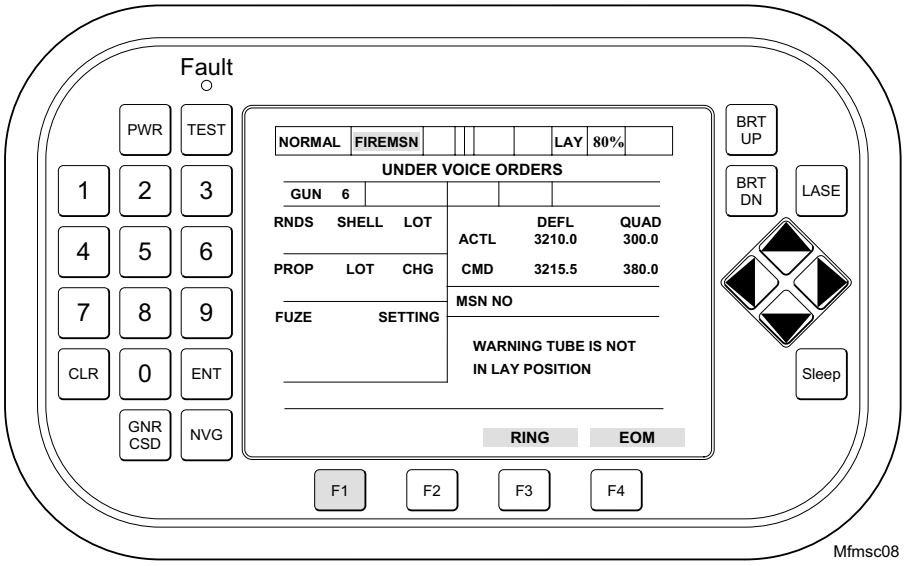
A "+/-" appears on the FIRE COMMANDS ENTRY when QUADRANT is selected so a negative number can be entered for those quadrants less than 0 (zero) using F2 key.

2 The FIRE COMMAND ENTRY will be displayed. Select DEFELECTION and QUADRANT, press SELECT F1 key. Enter data, press ENT key.



Mfmsc02

3 Verify DEFLECTION and QUADRANT data, press USE ALL F2 key.



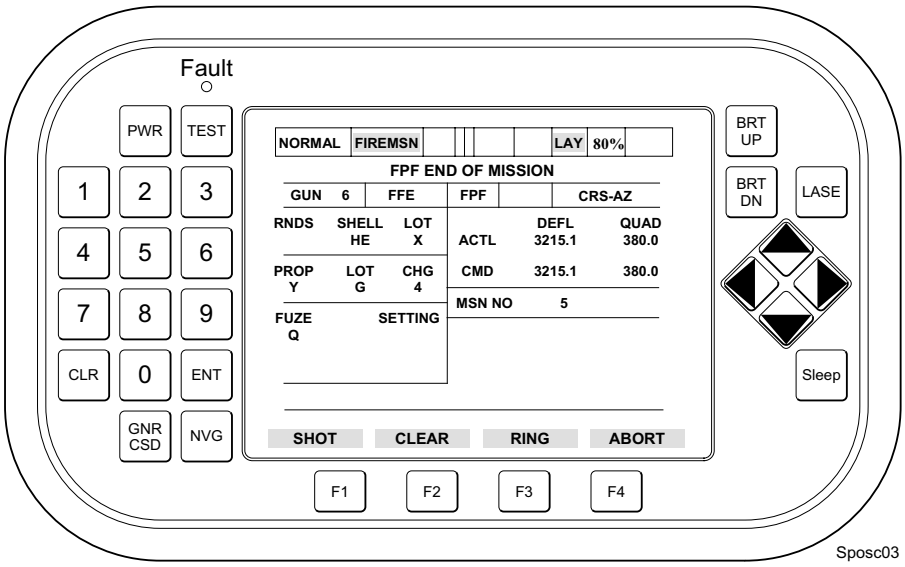
Mfmsc08

4 SC commands FIRE, and presses SHOT F1 key.

5 On completion of fire mission, press EOM F4 key.

2-42 SPECIAL ORDERS PROCEDURES

a. Final Protective Fire (FPF)

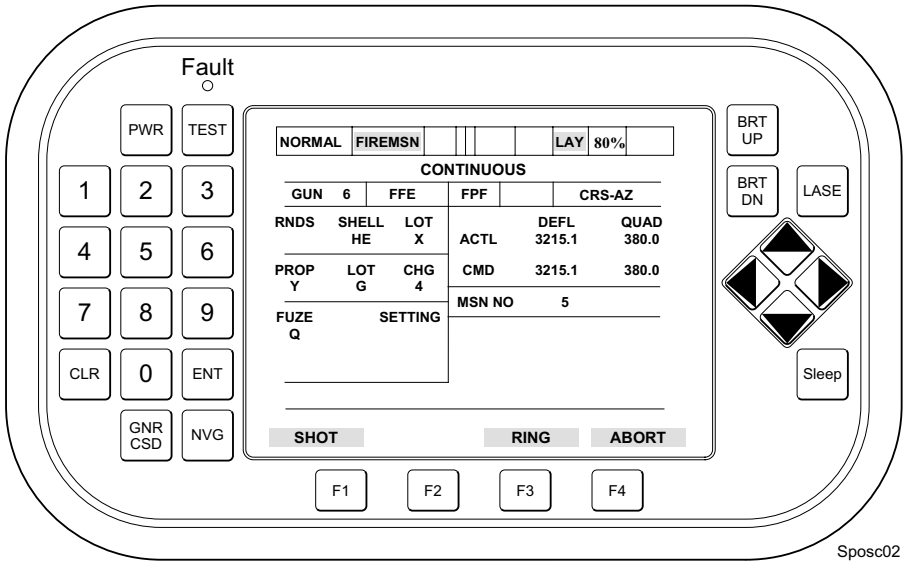


Sposc03

2-42 SPECIAL ORDERS PROCEDURES (cont)

a. Final Protective Fire (FPF) (cont)

1 The execution of a Fire When Ready FPF mission is the same as explained in Para 2-41. The FIRE MISSION will be displayed.

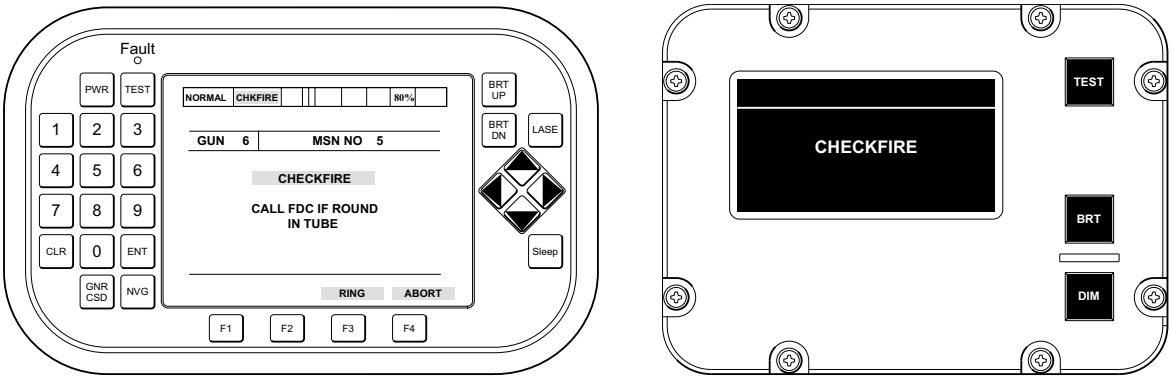


Sposc02

b. Checkfire

NOTE
During a fire mission CHECKFIRE may appear on the CSD/GND/AGD display screens at any time.

1 If the command CHECKFIRE CALL FDC IF ROUND IN TUBE is displayed during, notify the FDC.

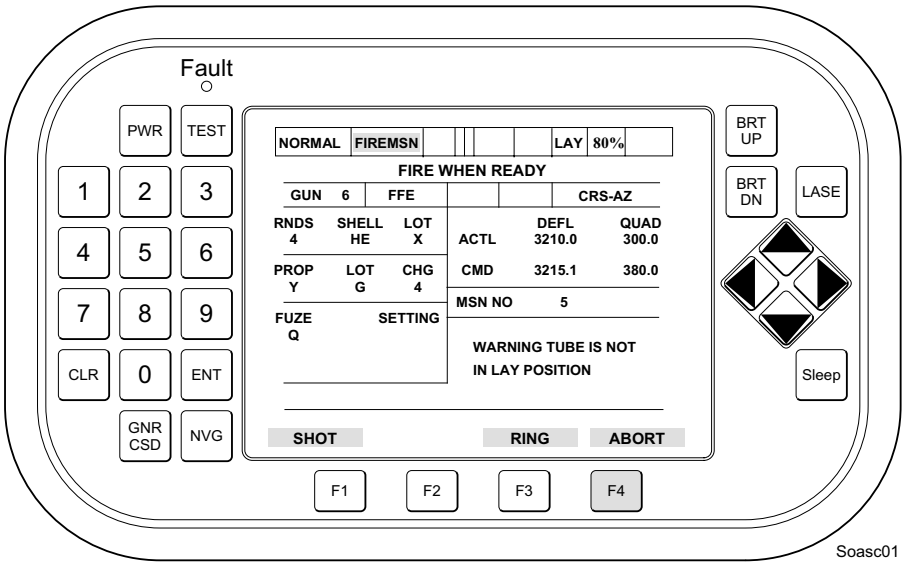


Socsc01

c. Abort

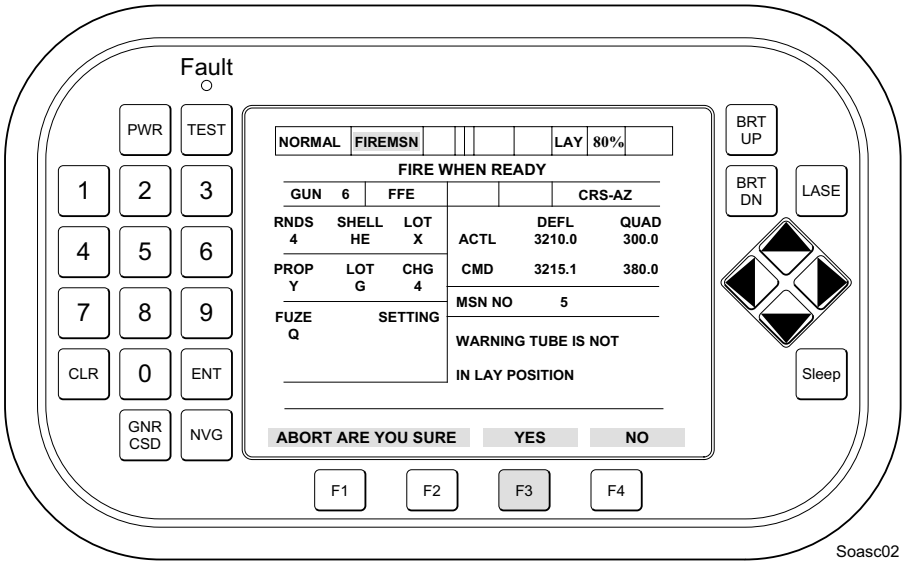
NOTE
SC maybe directed to abort the current mission.

1 Press the ABORT F4 key.



Soasc01

2 ABORT ARE YOU SURE? will be displayed, press YES F3 key.



Soasc02

2-43 TRAVERSING BEYOND CARRIAGE TRAVERSE LIMITS (SPEED SHIFT)

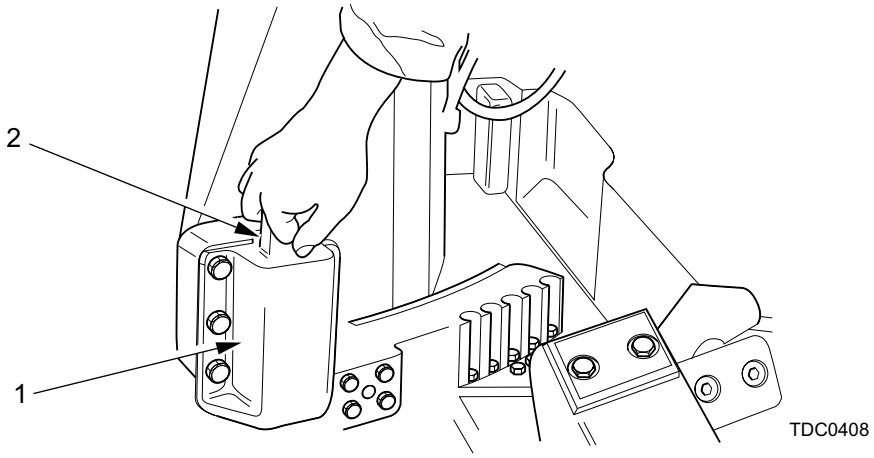
WARNINGS

TRAVERSE LOCK MUST BE ENGAGED BEFORE HOWITZER CAN BE SHIFTED. FAILURE TO ENGAGE TRAVERSE LOCK COULD RESULT IN INJURY TO PERSONNEL, AND/OR DAMAGE TO EQUIPMENT.

BEFORE ATTEMPTING TO SPEEDSHIFT, ENSURE HOWITZER IS FREE OF ALL AMMUNITION AND SL-3/BII GEAR.

1 Upon receipt of the command DEFLECTION (SUCH-AND-SUCH), Gunner determines the deflection to be out of normal traverse limits. Gunner traverses tube to center of traverse and Assistant Gunner engages traverse lock (1), allow plunger (2) to engage under spring pressure.

2-43 TRAVERSING BEYOND CARRIAGE TRAVERSE LIMITS (SPEED SHIFT) (cont)



NOTE

SC will determine if the prime mover is to be repositioned and/or power [W3] cable is to be disconnected.

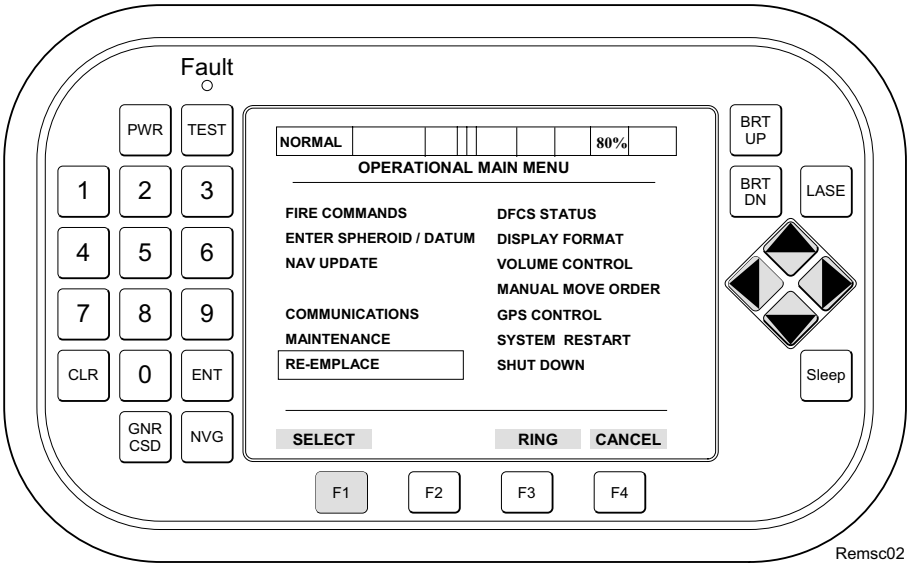
2 Gunner announces MUZZLE RIGHT or MUZZLE LEFT as required.

3 As directed by SC, Driver repositions prime mover.

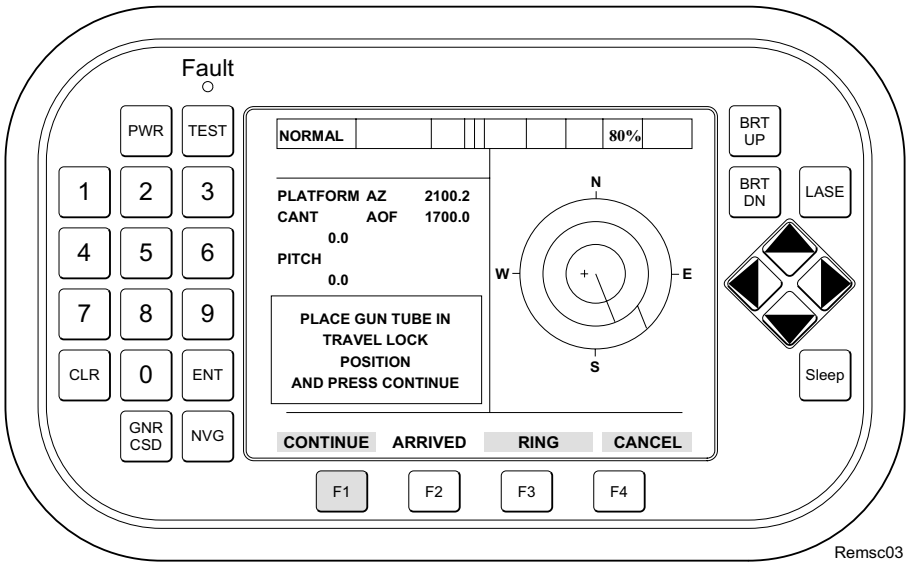
4 Upon receipt of the command DEFLECTION (SUCH-AND-SUCH), Driver ensures bore is clear of ammunition and announces BORE CLEAR.

5 SC transitions from the current screen to the OPERATIONAL MAIN MENU by pressing MENU F1 key.

6 Select RE-EMPLACE, press SELECT F1 key.



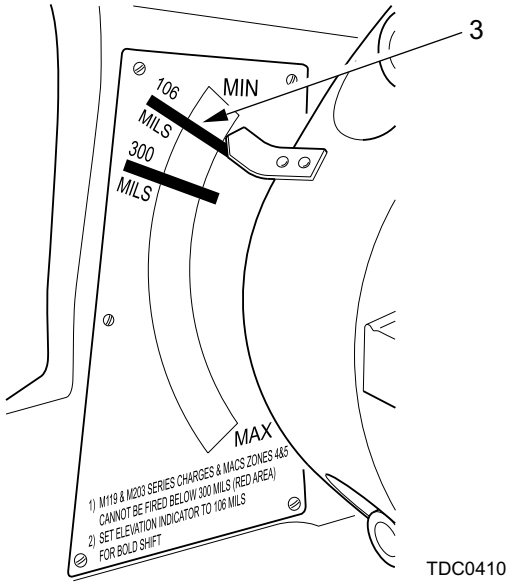
7 Verify RE-EMPLACE and ensure howitzer is in traverse lock. PLACE GUN TUBE IN TRAVEL LOCK POSITION AND PRESS CONTINUE will be displayed, press CONTINUE F1 key.



CAUTION

Before moving howitzer, ensure charge plate elevation indicator is set to the 106-mil line (Speed Shift elevation). Failure to do so will cause damage to the elevation gearing.

8 Assistant Gunner elevates or depresses cannon tube until the charge plate elevation indicator (3) is set at the 106-mil line.



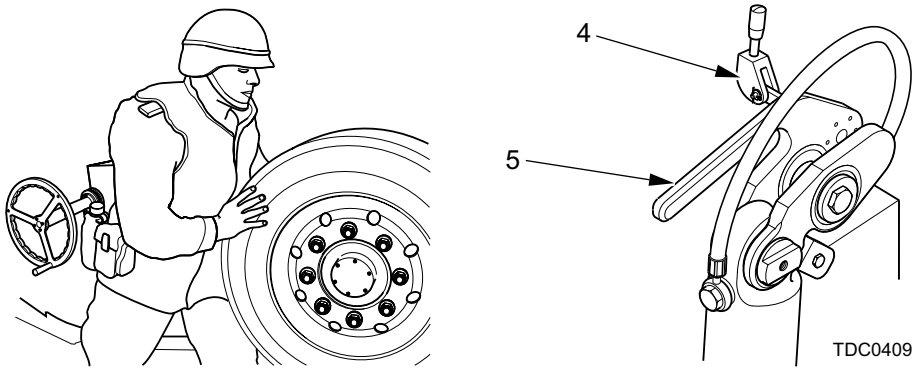
9 Cannoneer No. 4 inserts FAST bar into lunette assembly and supports cannon tube. ATC records fire mission on DA-4513 form, then moves to FAST bar and supports cannon tube.

2-43 TRAVERSING BEYOND CARRIAGE TRAVERSE LIMITS (SPEED SHIFT) (cont)

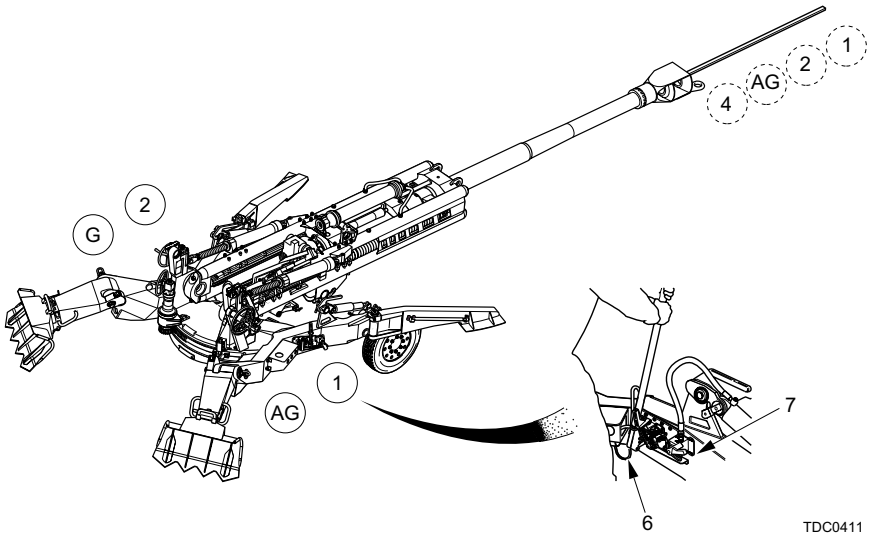
CAUTION

Before operating the suspension system ensure wheel crank handles and locking levers are engaged. Failure to do so will damage the crank lock stops.

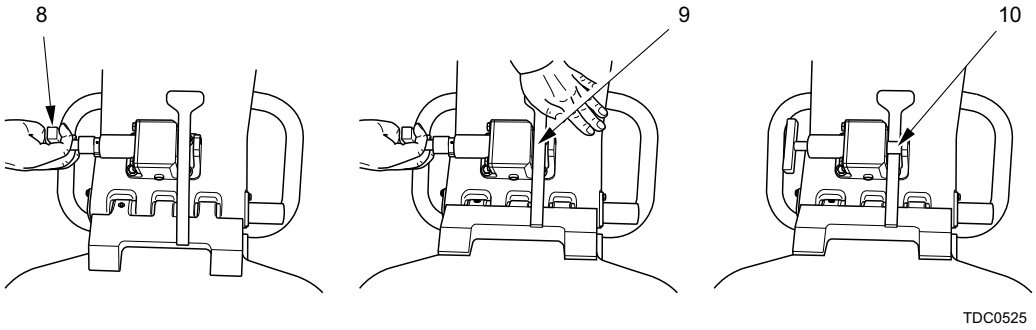
10 Cannoneers Nos. 1 and 2 throw wheels down and engage wheel-locking levers (4). Ensure crank handles (5) are locked and levers are engaged.



11 Cannoneers Nos. 1 and 2 insert pump handles into adaptors (6) and set suspension levers (7) to RAISE position.



12 Cannoneers Nos. 3 and 5 unlatch spades by pulling spade locking plunger (8) out and push spade locking latch (9) down, allow plunger (10) to return over the latch. Ensure plunger is engaged.

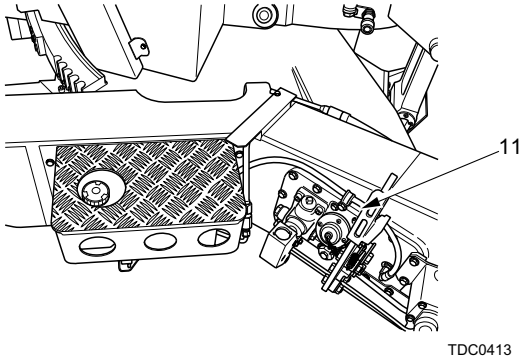


CAUTION

Howitzer body, spades and stabilizers must be clear of the ground before shifting howitzer.

13 Cannoneers Nos. 1 and 2 raise howitzer, by pumping handles until SC commands STOP.

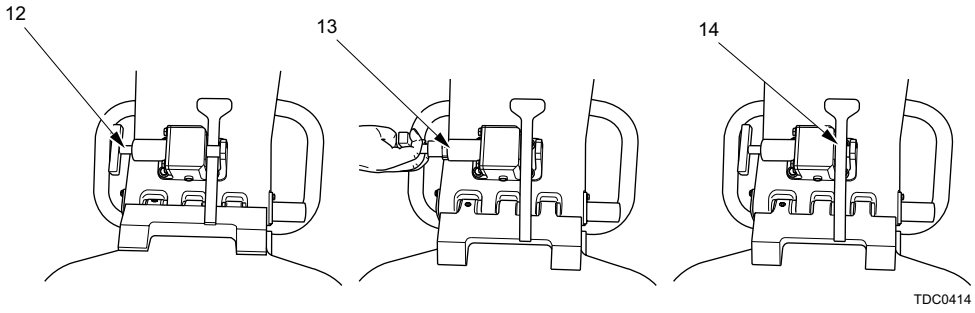
14 Cannoneer No. 1 releases handbrake (11). Cannoneers Nos. 1 and 2 support cannon tube.



WARNING

WHEN RELATCHING SPADES TO THE TRAIL ARMS, ALL PERSONNEL MUST STAY CLEAR OF MOVING SPADE. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL.

15 Cannoneers Nos. 3 and 5 relatch spades, by pulling spade locking plunger (12) out and turn (13) 90° CCW. Ensure spade locking latch is engaged.



2-43 TRAVERSING BEYOND CARRIAGE TRAVERSE LIMITS (SPEED SHIFT) (cont)

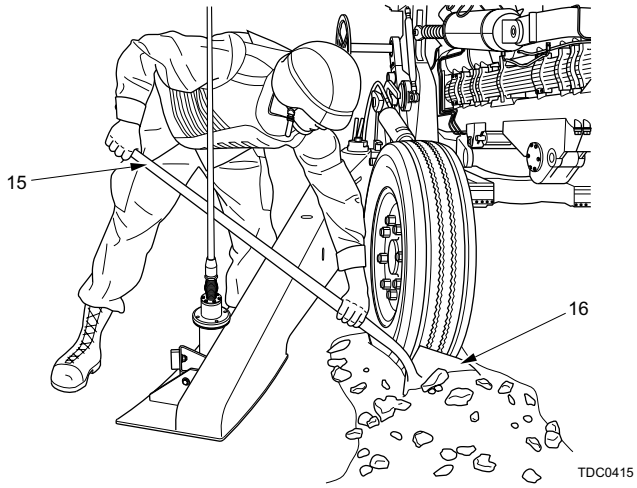
WARNING

WHEN CLEARING A PATH FOR THE ROLLING WHEEL, PERSONNEL MUST NOT STAND BETWEEN THE CRADLE ASSEMBLY AND STABILIZER ARM. A TRIP HAZARD CAN OCCUR, CAUSING SEVERE CRUSHING INJURIES TO PERSONNEL.

NOTE

Certain terrain conditions may deem it necessary to clear a path in front of the rolling wheel.

16 If SC commands CLEAR ROLLING WHEEL, Cannoneer No. 5 takes shovel (15) and clears a path in front of the rolling wheel (16).



17 Assistant Gunner, Cannoneers Nos. 3 and 5 move SL-3/BII gear.

18 Gunner commands SHIFT, ATC and Cannoneers Nos. 1, 2 and 4 move muzzle in direction indicated by the Gunner. When Pantel vertical hairline is aligned or close to aiming point, or when the CSD screen displays matching CMD and ACTL figures, Gunner commands STOP.

19 Cannoneer No. 1 moves to and applies handbrake.

20 Cannoneers No. 2 moves to suspension lever, once handbrake is applied.

WARNINGS

BEFORE OPERATING SUSPENSION LEVERS, ENSURE THAT ALL PERSONNEL ARE STANDING CLEAR OF HOWITZER.

PERSONNEL SUPPORTING THE WEIGHT OF THE CANNON ASSEMBLY MUST BE WARNED BEFORE LOWERING THE HOWITZER.

NOTE

If traversing beyond carriage traverse limits (SPEEDSHIFT) using M777 howitzer carryout step 22, if using M777E1 howitzer go to step 23, steps 24 and 25 are applicable to both howitzers.

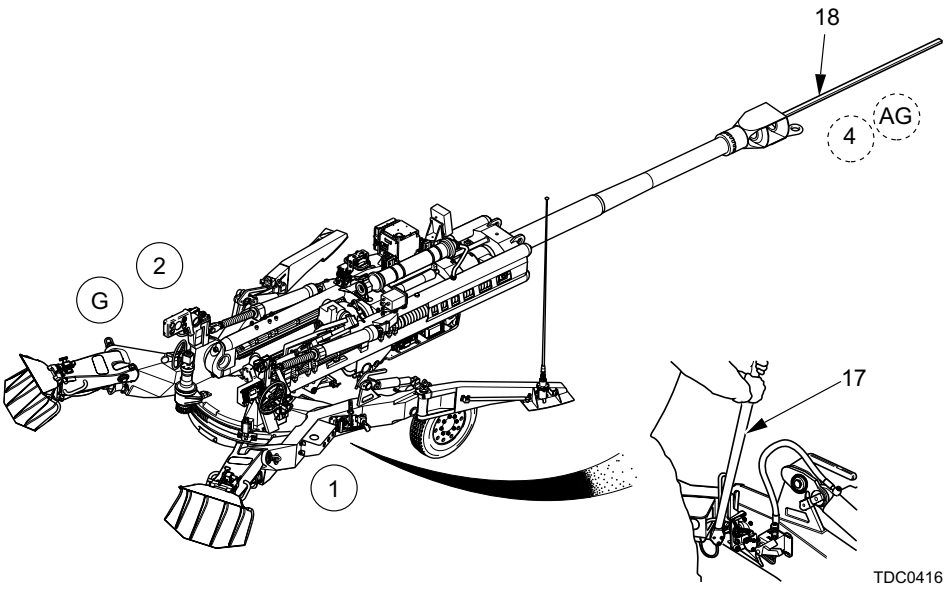
21 Gunner commands DROP HOWITZER, Cannoneers Nos. 1 and 2 lower howitzer by moving suspension levers (17) to the LOWER position. ATC and Cannoneer No. 4 raise the FAST bar (18).

22 When howitzer is parallel to the AOF, press EMPLACED F1 key.

NOTE

It is recommended that the position data be recorded by the ATC in the event of an unexpected surge or loss of power.

23 Confirm current position and report new position to the FDC, CALL FDC WITH POSITION DATA THEN PRESS CANCEL. Once the data has been verified by the FDC, press CANCEL F4 key.



24 Cannoneer No. 4 removes FAST bar from the muzzle brake.

25 All emplace weapon.

2-44 PREPARATION OF HOWITZER FOR TOWING

WARNINGS

HANDBRAKES ARE TO REMAIN APPLIED IF THE HOWITZER IS ON ANY DEGREE OF INCLINE AND ARE NOT TO BE RELEASED UNTIL THE LUNETTE IS ATTACHED TO THE PRIME MOVER. RELEASE OF HANDBRAKES WHILE HOWITZER IS ON AN INCLINE MAY ALLOW HOWITZER TO MOVE, CAUSING INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

ENSURE CSD IS POWERED DOWN BEFORE DISCONNECTING DATA CABLE [W2]. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

2-44 PREPARATION OF HOWITZER FOR TOWING (cont)

CAUTIONS

Towing restrictions are limited to: 15 mph (25 kph) maximum over cross-country roads, 30 mph (48 kph) maximum over secondary roads, and 45 mph (72 kph) maximum over improved roads.

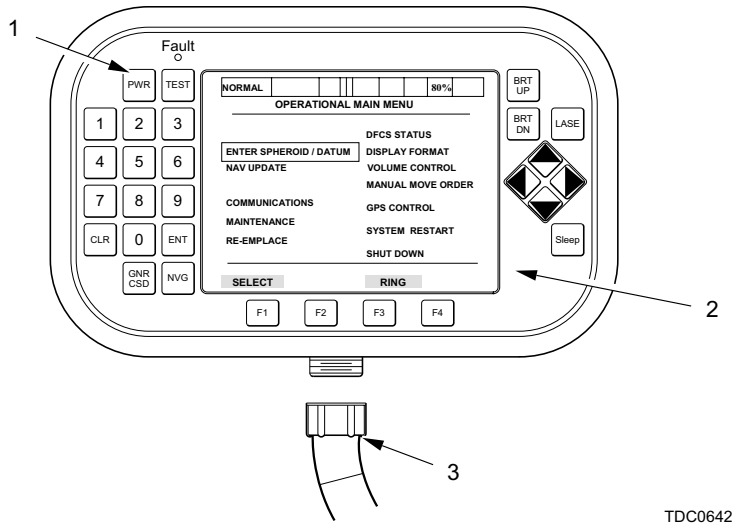
During scheduled stops, check that wheel lugnuts are present. Check the hubs and brakes for overheating by sight and smell. If hubs and brakes are too hot, let them cool before continuing.

Before disconnecting data cable [W16] from CSD, ensure PWR key has been depressed and the CSD is switched off. Failure to do so could result in loss of screen information.

NOTE

Data [W16] cable MUST be fully disconnected from the CSD. The CSD CANNOT be re-powered by hitting the 'PWR' button. It should be considered an OFF button and not an ON button. Wait for a minimum of 2 seconds before reconnecting data [W2 or W16] cable and re-powering the CSD.

1 SC presses PWR key (1) on the CSD (2) for three seconds and release (CSD should power off, if not repeat), disconnect data [W16] cable (3) from CSD.



2 Driver ensures bore is clear of ammunition and announces BORE CLEAR. Driver disconnects power [W3] cable from prime mover.

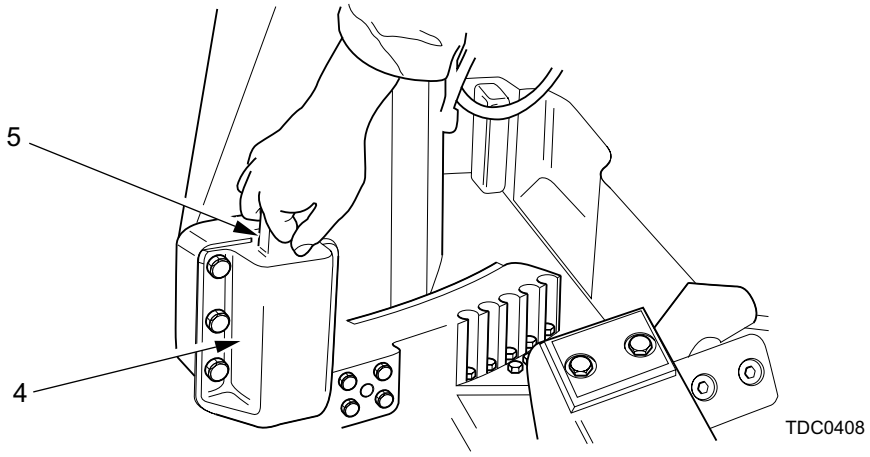
WARNING

PERSONNEL SHOULD STAY CLEAR OF AREA BETWEEN PRIME MOVER AND HOWITZER.

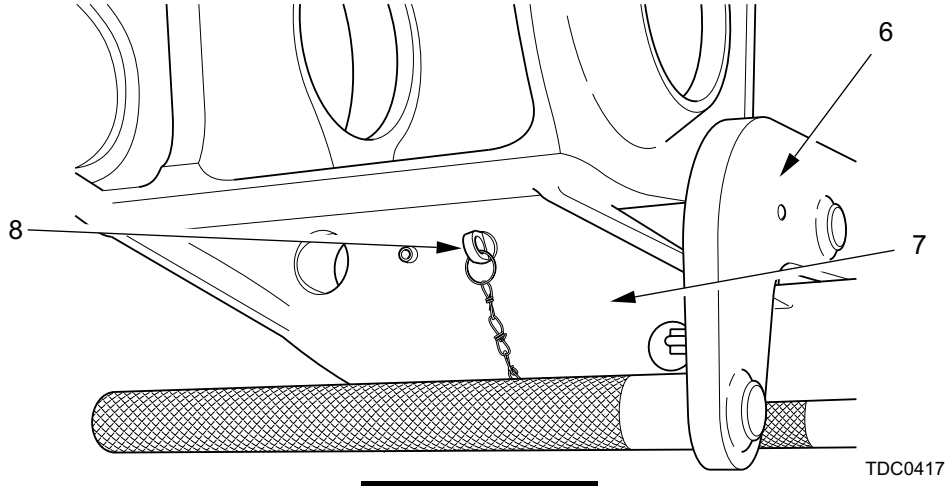
3 SC directs Driver to move prime mover to front of howitzer.

4 Cannoneer No. 4 places rammer staff and FAST bar onto the prime mover.

5 Gunner traverses tube to center of traverse and Assistant Gunner engages traverse lock (4), allow plunger (5) to engage under spring pressure.



6 Gunner installs GND cover, then moves to muzzle brake and inserts trident bar (6) into the lunette assembly (7), ensure quick release pin (8) is secure. Supports cannon tube.

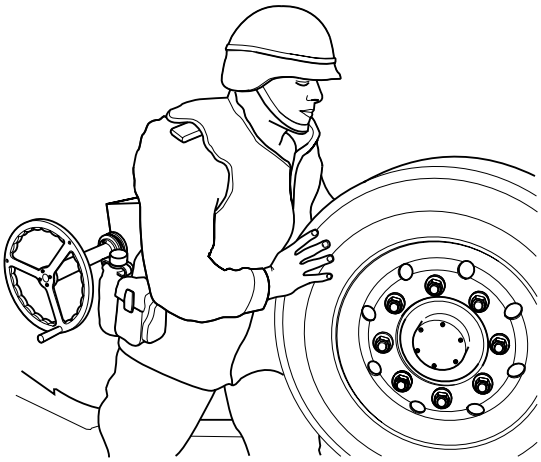


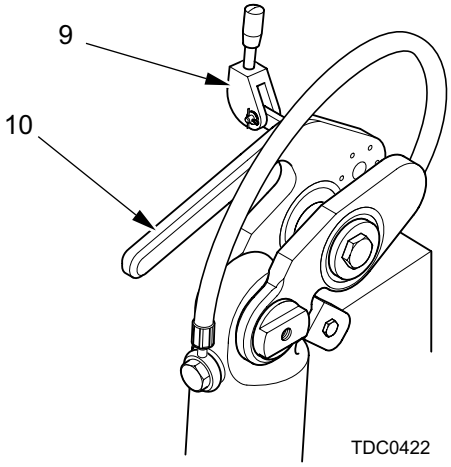
CAUTION

Before operating the suspension system ensure wheel crank handles and locking levers are engaged. Failure to do so will damage the crank lock stops.

7 Cannoneers Nos. 1 and 2 throw wheels down and engage wheel locking levers (9). Ensure wheel crank handles (10) are locked and levers are engaged.

2-44 PREPARATION OF HOWITZER FOR TOWING (cont)



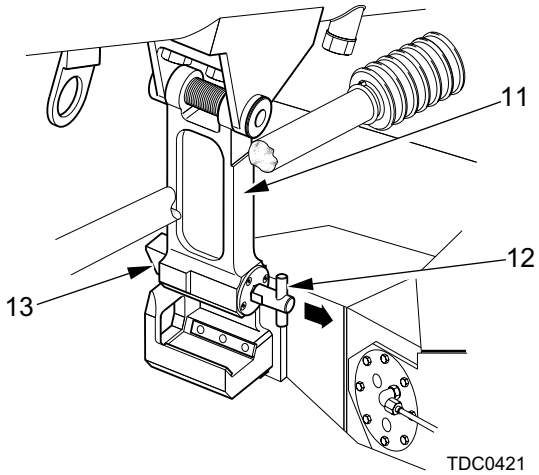


CAUTION

Before engaging travel locks, ensure traverse lock is engaged. Failure to engage traverse lock will damage equipment.

8 Cannoneers Nos. 1 and 2 engage travel locks (11) by pulling out tee-handle (12), and allowing link (13) to drop.

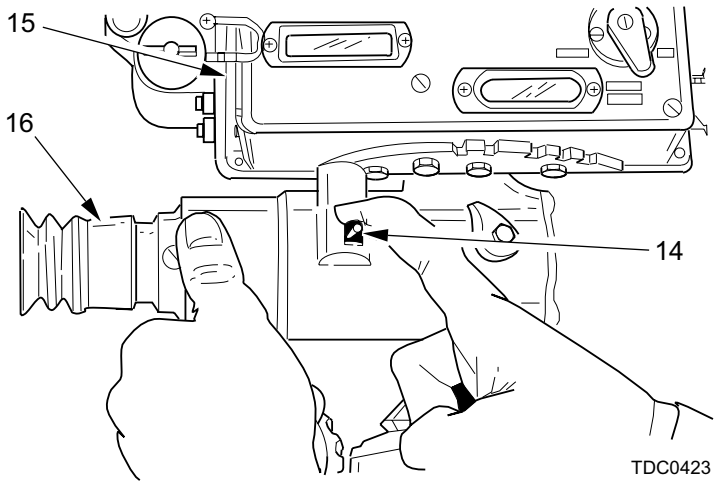
9 Assistant Gunner depresses cannon tube and engages travel locks (11).



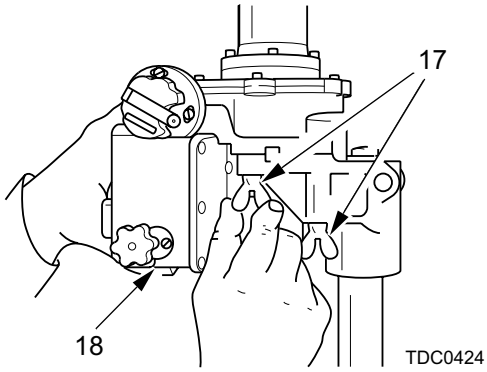
NOTE

If preparing an M777 for towing carryout steps 10 thru 17. Steps 18 thru 46 are applicable to both howitzers.

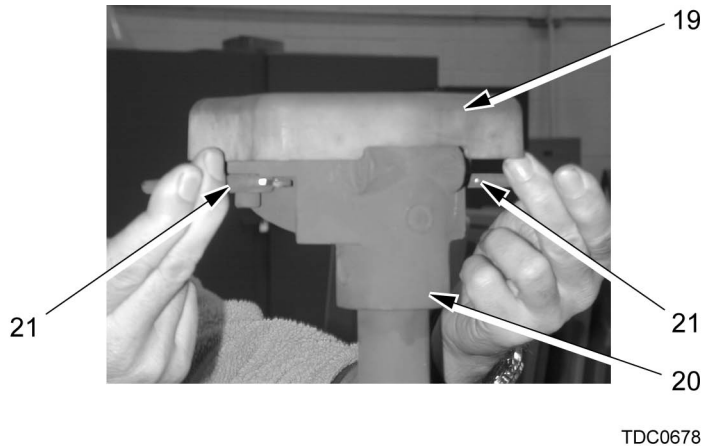
10 Gunner releases locking pin (14) on Pantel (15) and moves elbow (16) with eyepiece to the stowed position.



11 Gunner unlocks two latches (17), removes Pantel (18), and secures in the telescope case.



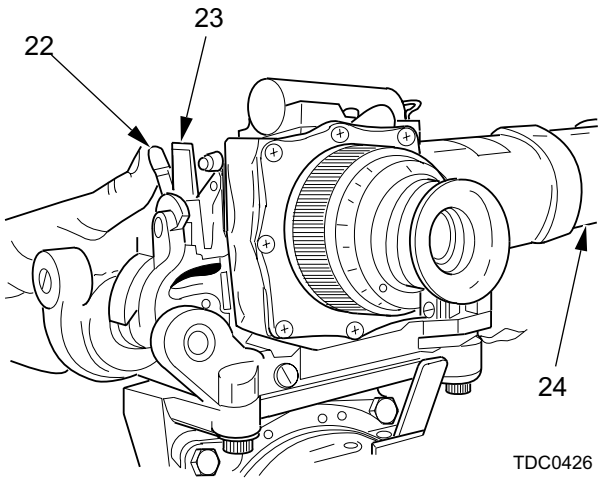
12 Gunner places protective cover (19) on M171A1 telescope and quadrant mount (20) and locks two latches (21), then rotate the protective covers on the cross level vial, and elevation level vial to the closed position.



13 Gunner places cover over M171A1 telescope and quadrant mount and secures with the drawstring provided.

2-44 PREPARATION OF HOWITZER FOR TOWING (cont)

14 Assistant Gunner rotates lock-release lever (22) CCW and pulls locking latch (23) down, removes M138A1 elbow telescope (24), replaces the protective cover assembly, and gives M138A1 elbow telescope to Gunner, who secures in the telescope case.



15 Gunner ensures that all OFC is properly placed within the OFC carrying case and is securely latched.

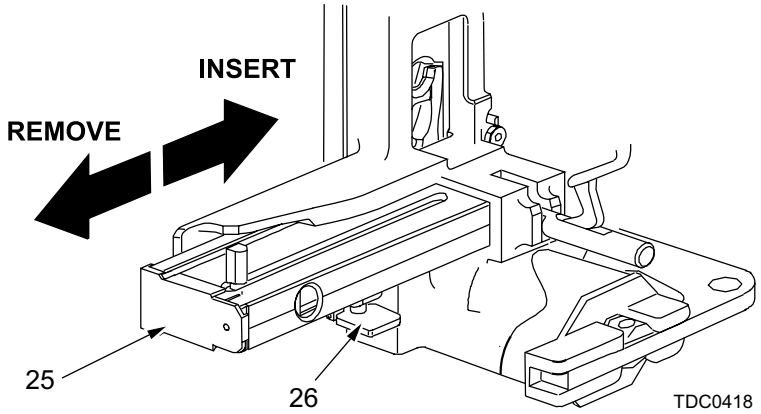
16 Gunner recovers M1A2 collimator and telescope case and stow onto prime mover.

17 Assistant Gunner rotates the protective covers on the elevation and cross level vials to the closed position on the M172A1 telescope and quadrant mount. Assistant Gunner places cover and secures it with drawstrings provided.

WARNING

REMOVE MAGAZINE ASSEMBLY BEFORE CARRYING OUT UNLOADING/CLEARING PROCEDURES ON PRIMER FEED MECHANISM.

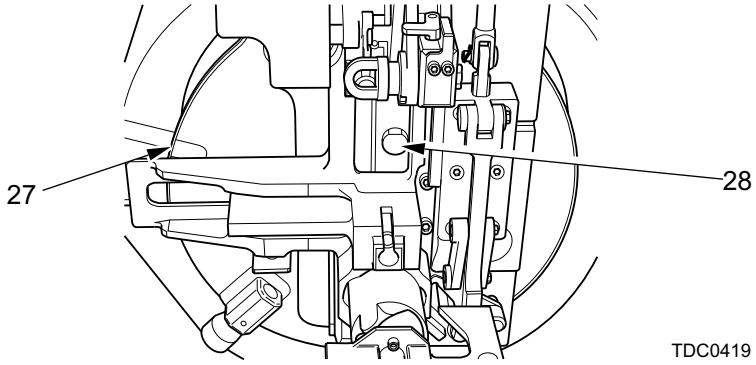
18 Cannoneer No. 2 removes magazine assembly (25), by pressing release lever (26) and slide magazine out of tray. Ensure primer vent hole is clear.



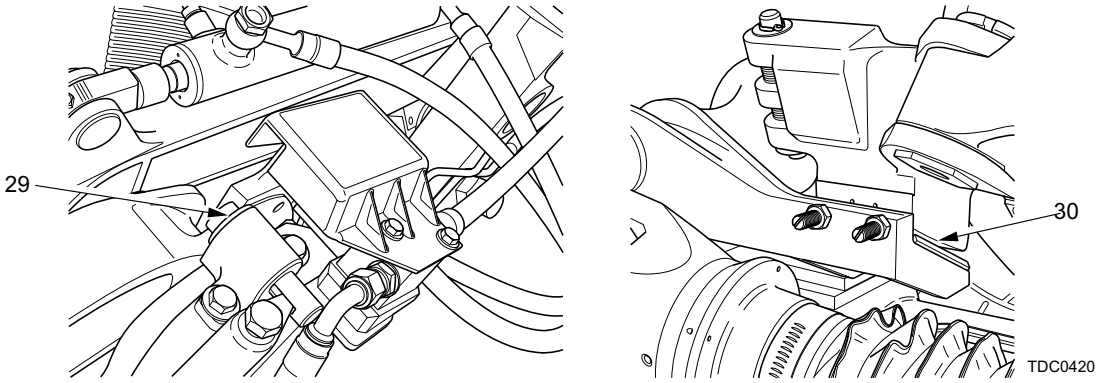
WARNING

ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.

19 Cannoneer No. 2 closes breechblock assembly (Para 2-25.), ensures breechblock (27) and PFM (28) witness marks are aligned, then installs breech cover.



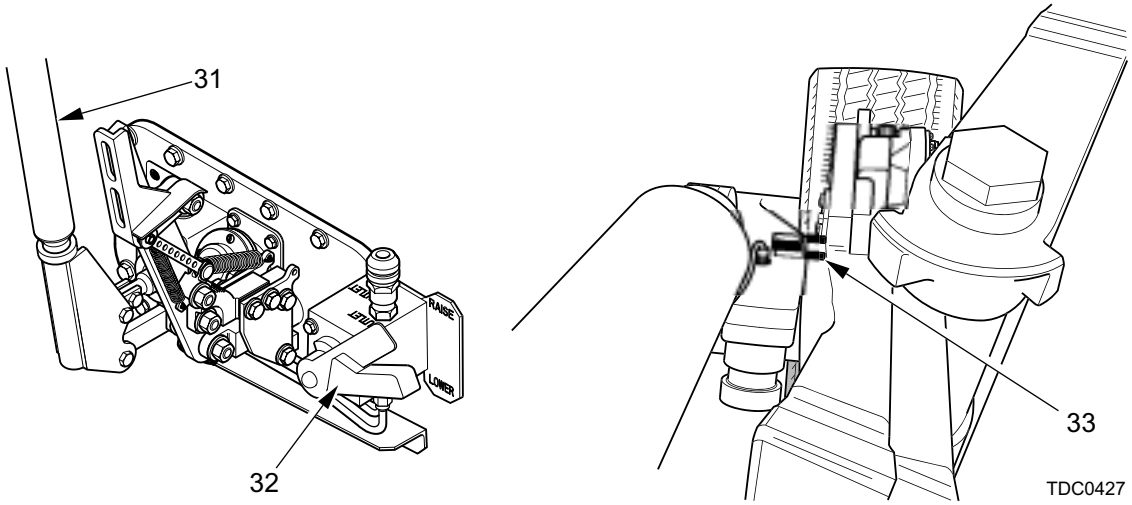
20 Cannoneer No. 1 ensures that the loading tray mechanical interlock plunger (29) is engaged and that there is no gap between the loading tray and tray stop (30).



21 ATC and Cannoneer No. 5 unlatch spades.

22 Cannoneers Nos. 1 and 2 insert pump handles into adaptors (31) and set suspension levers (32) to RAISE position, raise howitzer, by pumping handles until ride height indicator (33) is level.

2-44 PREPARATION OF HOWITZER FOR TOWING (cont)

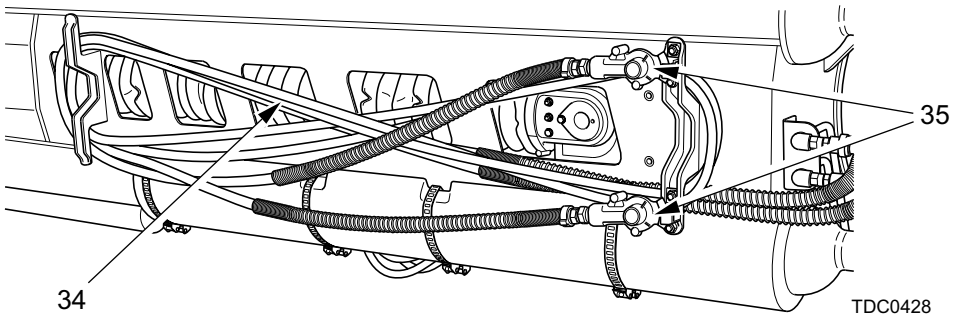


23 Cannoneer No. 4 places taillight cable onto rear of cradle and passes cable to Cannoneer No. 1.

NOTE

If the brake system on the howitzer is serviceable, the airlines may not be attached during **TACTICAL** and/or **FIELD** environments or as directed by **UNIT SOP**.

24 Cannoneer No. 4 removes airlines (34) from cradle bracket (35) and wraps lines around cannon tube and places airlines on top of muzzle brake.

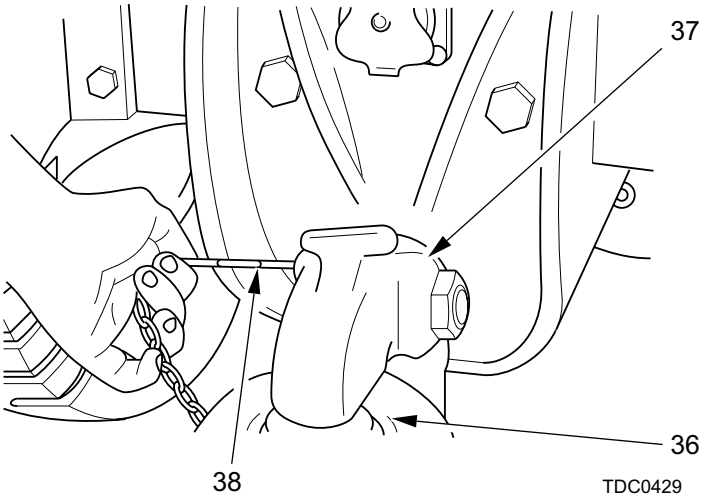


25 Assistant Gunner installs AGD cover, moves to muzzle brake and supports cannon tube.

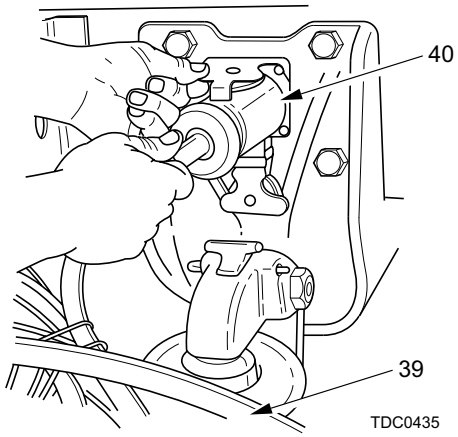
26 Cannoneer No. 3 retrieve muzzle plug from prime mover and installs into front of the muzzle brake.

27 Cannoneer No. 3 directs Driver to back prime mover to howitzer.

28 Gunner and Assistant Gunner lift towing eye (36) onto prime mover pintle (37), latch pintle and secures with cotter pin (38).



29 Gunner connects taillight cable (39) to prime mover socket (40).



CAUTIONS

Make sure service airline (yellow or blue coded) is connected to service coupling of prime mover and emergency brakeline (red coded) is connected to emergency coupling of prime mover. Brakelines are identified by a metal band.

Prime mover vehicles MTVR (USMC) and FMTV (US Army) have opposite coupling connections e.g.

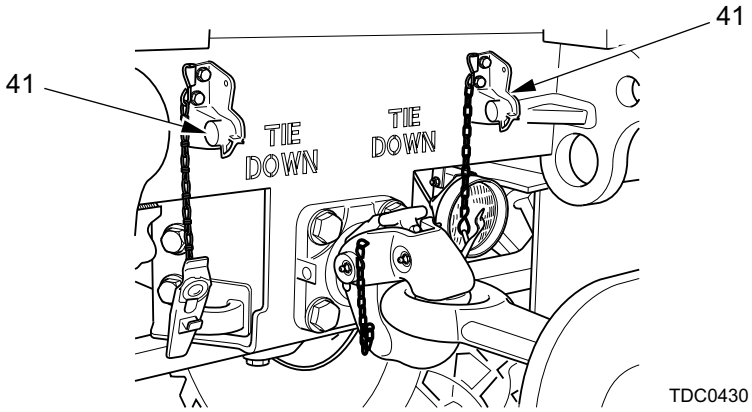
- MTVR – (USMC) service connection (left side), emergency connection (right side).
- FMTV – (US Army) service connection (right side), emergency connection (left side).

NOTE

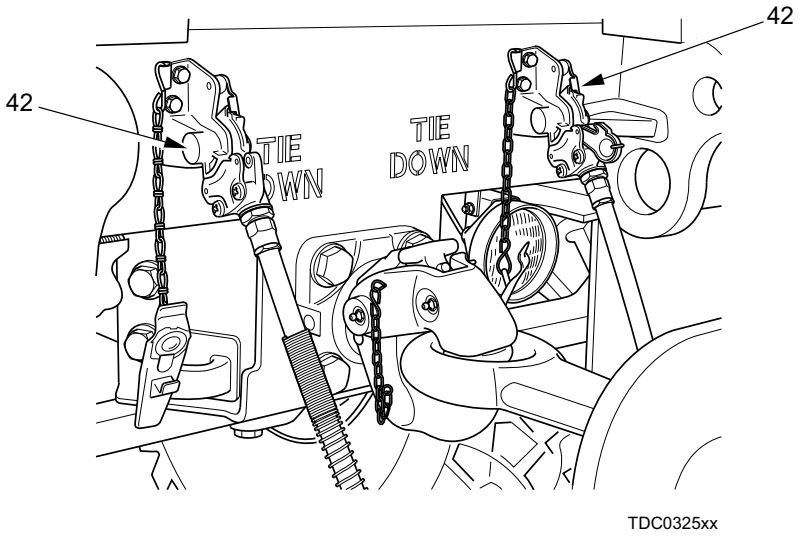
The airline couplings should be color-coded the same as the prime mover. Yellow for service and red for emergency.

2-44 PREPARATION OF HOWITZER FOR TOWING (cont)

30 Gunner and Assistant Gunner disconnect emergency and service dummy couplings (41) from prime mover.



31 Gunner and Assistant Gunner connect emergency and service airlines (42) to the prime mover.



32 Driver turns on air supply.

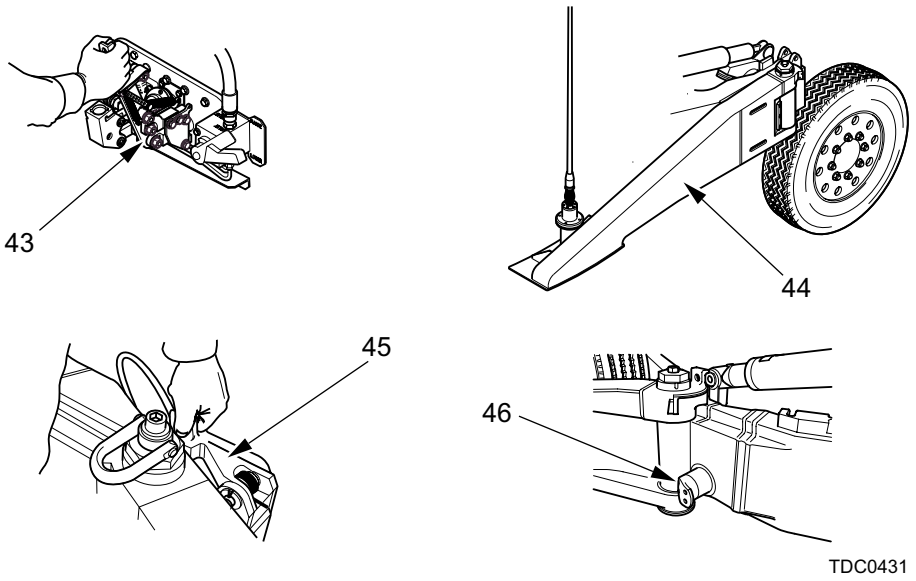
WARNING

WHEN STOWING STABILIZERS INTO TRAVEL POSITION, ALL PERSONNEL MUST STAY CLEAR OF HOWITZER.

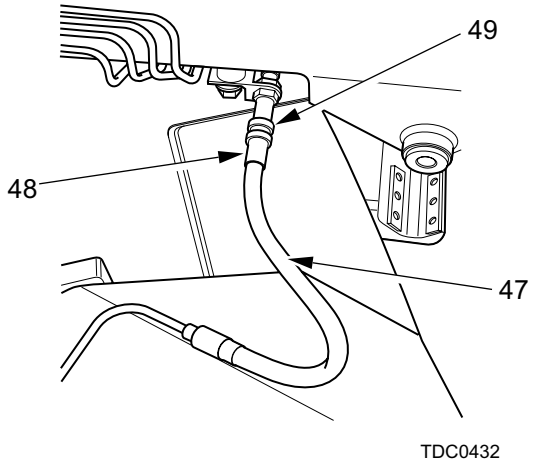
33 Cannoneers Nos. 1 and 2 release handbrakes (43).

34 Cannoneers Nos. 1 and 2 (if necessary) fine adjust ride height indicator, remove handles and stow.

35 Cannoneers Nos. 1 and 2 stow stabilizers (44), ensure locking latches (45) are engaged and suspension bump stops (46) are fully extended.



36 Cannoneer No. 1 installs quick disconnect airline (47) by, connecting coupling (48) to connector (49).



WARNING

WHEN RELATCHING SPADES, PERSONNEL MUST STAY CLEAR. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL.

37 ATC and Cannoneer No. 5 relatch spades.

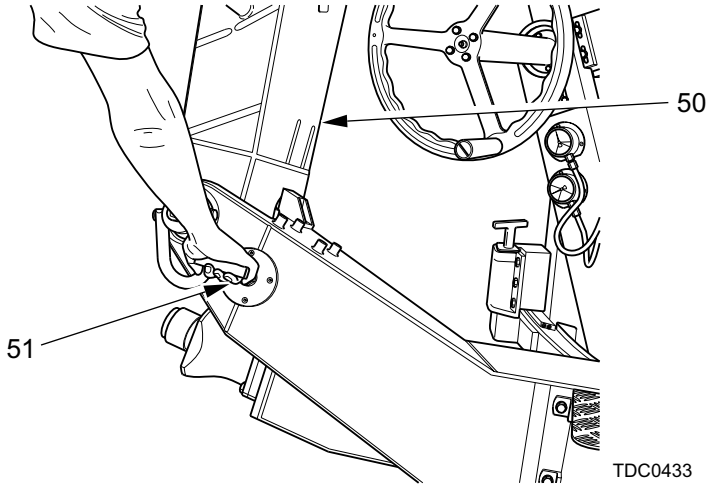
2-44 PREPARATION OF HOWITZER FOR TOWING (cont)

WARNINGS

TO PREVENT INJURY TO PERSONNEL, STOWING TRAIL ARM MUST BE SUPPORTED BY A MINIMUM OF TWO PERSONNEL.

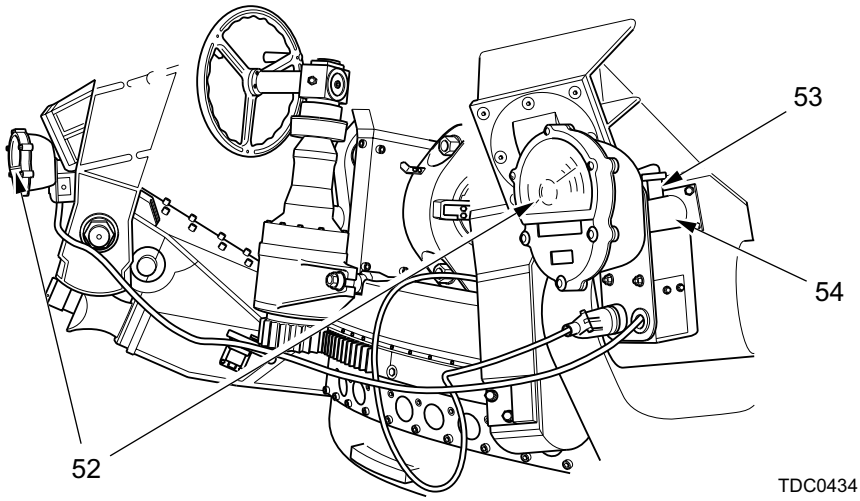
ENSURE TRAIL ARM LOCKING PLUNGERS ARE ENGAGED WHEN STOWING TRAIL ARMS. FAILURE TO DO SO WILL ALLOW TRAIL ARMS TO DROP CAUSING CRUSHING INJURIES TO PERSONNEL.

38 ATC and Cannoneer No. 5 stow trail arms (50), by pulling locking plunger (51) out, raise trail arm and push locking plunger in. Ensure locking plunger is engaged.



NOTE
Ensure taillight bracket with connector is installed on right trail arms.

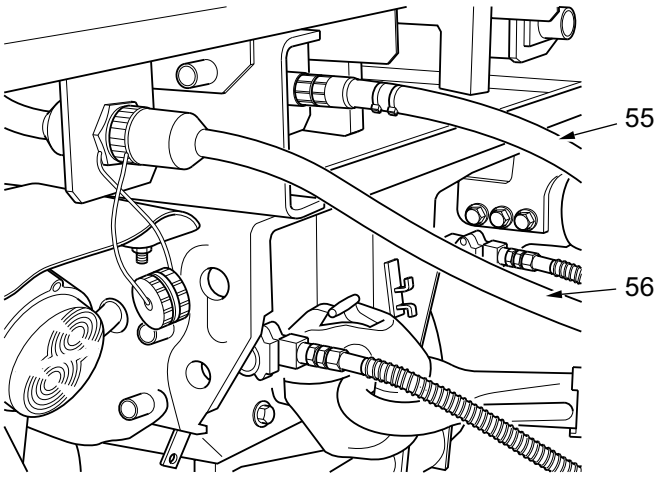
39 ATC and Cannoneer No. 5 install tail lights (52) onto trail arms, by lifting spring plunger (53) up, push tail light onto bracket (54), release plunger. Ensure plunger is engaged.



NOTE

If SOC is 50% or more and when directed by UNIT SOP, do not connect power [W3] cable to prime mover during short **TACTICAL** and/or **FIELD** manoeuvres.

40 Cannoneers Nos. 1 and 2 recover and connect data [W16] (55) and power [W3] (56) cable to prime mover sockets.



41 Gunner then mounts prime mover.

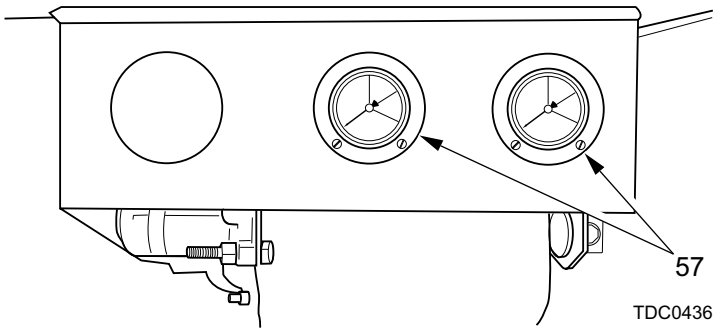
42 ATC and Cannoneer No.5 recover and stow remainder of SL-3/BII gear onto prime mover.

43 Cannoneers Nos. 3 and 4 recover aiming posts and stow onto prime mover, then mount prime mover.

44 ATC and Cannoneer No. 5 recover M1A2 collimator and sandbags and stow onto prime mover, then mount prime mover.

45 Driver applies brake on prime mover; SC checks air/oil intensifier gauges (57) and ensures gauges read in the green sector.

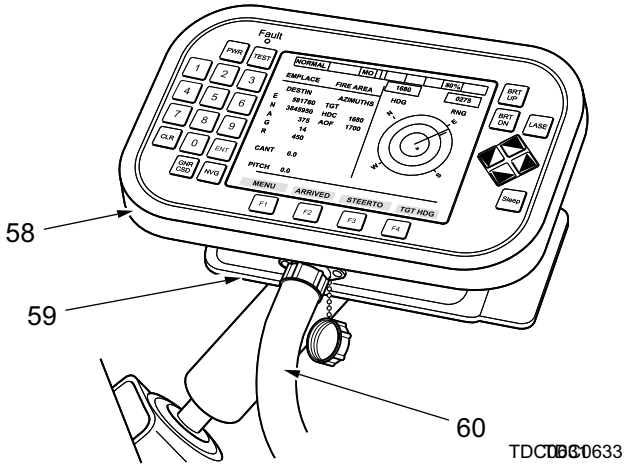
46 Driver releases brake on prime mover, SC checks air/oil intensifier gauges (57) and ensures gauges read zero.



47 Driver applies brake on prime mover; SC checks brake taillights, then mounts prime mover.

48 SC installs CSD (58) into prime mover mount (59), connects data cable [W2] (60) to CSD.

2-44 PREPARATION OF HOWITZER FOR TOWING (cont)



Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2-45 GENERAL

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

2-46 EXTREME COLD WEATHER CONDITIONS

WARNING

DO NOT GRASP METAL PARTS, SUCH AS KNOBS, LEVERS, AND COVERS ETC, WITH BARE HANDS.

a. General Problems.

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

CAUTION

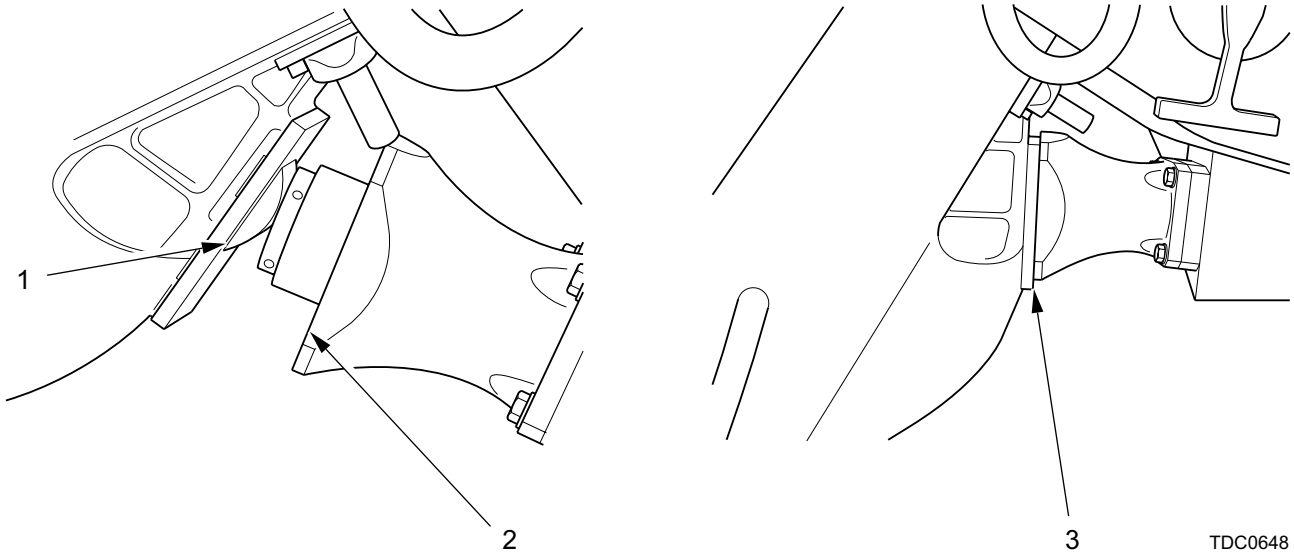
It is important that the approved practices and precautions be followed. FM 9-207 contains general cold weather information applicable to the howitzer. It must be considered an essential part of this manual.

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

b. Equilibrators. Extreme cold temperatures will cause a corresponding decrease of nitrogen pressure in the equilibrators, making it difficult to elevate the cannon tube. Manually adjust the equilibrators (Para 2-4 a.) to develop equal handwheel loads while elevating and depressing. If equilibrators cannot be adjusted properly, notify unit maintenance.

c. Trail Arm and Spades. When operating in arctic, and/or hard ground conditions, dig spades in until trail arm striker plate (1) and spade damper (2) have achieved full contact (3).

2-46 EXTREME COLD WEATHER CONDITIONS (cont)



d. Tires. Tires should be inflated to their respective pressure (Para 1-14a).

e. Fire Control Equipment.

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

(2) Do not let snow or ice accumulate on equipment. Keep moving parts free of moisture.

(3) Use only clean wiping rags (item 29, appx D) and dry lens paper (item 26, appx D) for cleaning.

(4) 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 movement beyond their stops.

(5) Do not expose Pantel, M138A1 elbow telescope, or M154 alignment device to sudden changes in temperature by moving them from very cold to warm or warm to cold areas. Lenses, windows, or prisms may fracture.

2-47 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.

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. All lubrication instructions are mandatory.

WARNING

DO NOT FIRE WP PROJECTILES, WHICH ARE KNOWN TO HAVE BEEN STORED IN OTHER THAN A BASE DOWN POSITION. FIRING OF SUCH PROJECTILES COULD CONTRIBUTE TO INBORE OR CLOSE-IN PERMATURE MALFUNCTIONS.

(2) Whenever practicable, store white phosphorous-loaded smoke projectiles at temperatures below the melting point (+111.4ºF (+44.11ºC)) of the white phosphorous filler. If not practicable, white phosphorous projectiles 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. Prematures 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 Para 4-22 for precautions in handling ammunition in high temperatures.

c. Tires. Cover tires with available materials to protect them from the direct rays of the sun, to keep from overinflating, and to keep the rubber from deteriorating. Inflate tires to their respective pressures at ambient temperature (Para 1-14a).

d. Equilibrators. Extreme hot temperatures will cause a corresponding increase in nitrogen pressure in the equilibrators, making it difficult to depress the cannon tube. Manually adjust the equilibrators to develop equal handwheel loads while elevating and depressing. If equilibrators cannot be manually adjusted properly, notify unit maintenance.

2-48 OPERATION IN HOT, DAMP AND SALTY ATMOSPHERE

a. Inspect material daily when it is being operated in hot, damp and salty areas.

b. When the weapon is active, clean and lubricate the bore and exposed metal surfaces daily. Lubrication instructions are in Chapter 3, Section I of this TM. All lubrication instructions are mandatory.

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 as firing conditions permit.

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

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

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

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

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

i. Salt deposits are especially harmful to optical surfaces. Loosen deposits by sponging with a clean wiping rag (item 29, appx D). Do not rub deposits.

2-49 UNUSUAL TERRAIN CONDITIONS

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

b. Sand, Dust, and Dirt. Inspect and lubricate the material, except exposed lubricated parts, frequently when operating in sandy or unusually dusty areas. Be careful to keep sand and dust out of mechanisms and oil receptacles when inspecting and lubricating, and when making adjustments and repairs. Keep all covers in place as much 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 recoil rails and any other exposed lubricated parts, situation permitting. Sand and dirt on lubricants will form an abrasive, which will cause rapid wear. Dry surfaces wear less than do surfaces coated with lubricant contaminated with sand or dirt. Clean and lubricate all exposed parts after the action is over. Lubrication instructions are in Chapter 3, Section I of this TM. All lubrication instructions are mandatory.

2-50 FORDING OPERATIONS

After-Fording Operations. Immediately after weapon is towed from the water, if tactical situation permits, perform the following services:

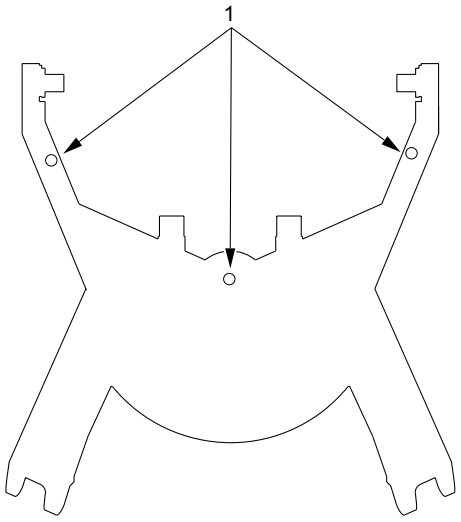
(1) Notify unit maintenance to remove the wheels with hubs and thoroughly clean with cleaning compound (item 8, appx D) and dry all working parts of the handbrakes and wheel bearings, and lubricate the handbrakes. Lubrication instructions are in Chapter 3, Section I of this TM. All lubrication instructions are mandatory.

(2) Empty any water from the material and clean and dry, and apply the proper lubricant to all exposed unpainted surfaces, paying special attention to the bore and chamber, the recoil rails, and the equilibrator rods.

Notify unit maintenance for necessary disassembly, cleaning, and lubrication. Lubrication instructions are in Chapter 3, Section I of this TM. All lubrication instructions are mandatory.

(3) Saltwater immersion greatly increases rusting and corrosion, especially on unpainted surfaces. Remove all traces of saltwater and salt deposits from every part of the cannon and carriage. Apply CLP (item 7, appx D) and notify unit maintenance so that the cannon and carriage are disassembled, cleaned, and lubricated as soon as possible. Lubrication instructions are in Chapter 3, Section I of this TM. All lubrication instructions are mandatory.

(4) Three drain holes (1), are located on the body, which enables water/salt water to drain from the body. Ensure drain holes are clean and free of debris.



TDC0182

2-51 M777E1 BATTERY OPERATIONS

a. The purpose of this information is to provide:

(1) System operating guidelines for battery power management during Cold Weather operations with and without Prime Mover power.

(2) Measures that should be taken to prevent short and long term battery damage.

b. General Power Management Guidelines

(1) The following table provides a summary of system power capacity and battery recharge characteristics and recommended operating limitations that should be observed under various temperature ranges.

System Battery Discharge/Recharge Data

Ambient Temp °C / °F	Allowable Operating Time: Without External Power (minutes)	Minimum Allowable Battery State of Charge	Required Recharge Time (hours)
158°F (70°C) to 50°F (10°C)	328 to 306	10%	4 to 5
48°F (9°C) to 14°F (-10°C)	146 to 129	50%	6 (Full recharge not achievable)
12°F (-11°C) to -31°F (-35°C)	10	50%	Little or no recharge possible
-33°F (-36°C) to -58°F (-50°C)	10 to 0	50%	Little or no recharge possible

CAUTIONS

The following operating procedures should be observed during extreme cold weather conditions:

When operating below **32°F (0°C),** system batteries should not be allowed to discharge below 50% state of charge. Batteries may be damaged by repeated discharge below 50% at these temperatures.

Recharging batteries below **32°F (0°C)** will take considerably longer than at room temperature and will not achieve full battery charge. Room temperature recharge is recommended, but may require additional time to bring batteries up to room temperature.

At temperatures below **14°F (–10°C),** little or no battery recharge is achievable. External prime mover power will allow continued system operation, but will only maintain battery state of charge at current level.

For extreme cold weather conditions, it is recommended that a spare set of fully charged batteries be maintained for swap-out during extended periods of operations without prime mover power.

2-51 M777E1 BATTERY OPERATIONS (cont)

c. Storage

(1) Do not leave batteries on the weapon, or stored as spares, in cold weather, without power connected to maintain their charge.

(2) The self discharge rate of batteries increases at cold temperatures. A set of batteries stored in temperatures below -13ºF (-25ºC), can completely discharge in eight hours, if external power is not applied.

d. Additional Information

(1) When charging batteries indoors, a car-type battery charger that provides 28VDC at a minimum of 10A can be used. This type of charger will recover charge quickly, but will not fully charge a battery set.

(2) The PSP uses a battery-unique charging profile that optimizes the charging voltage and current based on the measured open-circuit voltage for the Optima batteries. This charging profile consists four stages: Trickle mode, Bulk mode, Peaking mode, and Float mode. Trickle mode is used to initiate battery charging in extremely discharged batteries (10% or less). Bulk mode is used for most of the battery charging process and puts the largest amount of power back into the batteries. Peaking mode begins close to the last 10% of charging. This mode is used to put the last possible amount of charge in the batteries by using the maximum charging current. Once charging is complete, the PSP enters Float mode, which is used solely to maintain the charge already in the batteries.

(3) When charging at room temperature (Note: batteries must be at room temperature) the following general guideline applies:

(a) The first 90% of recharge, is completed in 1 to 1.5 hours

(b) The remaining 10% requires an additional 2 to 2.5 hours

CAUTIONS

The OVRIDE LOWBAT PWROFF warning displayed on the CSD should only be overridden only under Emergency conditions.

Overriding this warning will provide a short duration of additional operating time for extreme Battlefield conditions, but operating beyond this warning may cause irreversible damage to the batteries.

If the OVRIDE LOWBAT PWROFF warning is overridden, attempt normal shutdown and power OFF the system immediately after the mission is complete, to prevent damage to the batteries.

2-52 SHIPBOARD OPERATIONS

Awaiting Information

2-53 LANDING CRAFT AIR CUSHION (LCAC) AND LANDING CRAFT UTILITY (LCU) OPERATIONS

Awaiting Information

2-54 AIRBORNE (SHIP TO SHORE) OPERATIONS

Awaiting Information

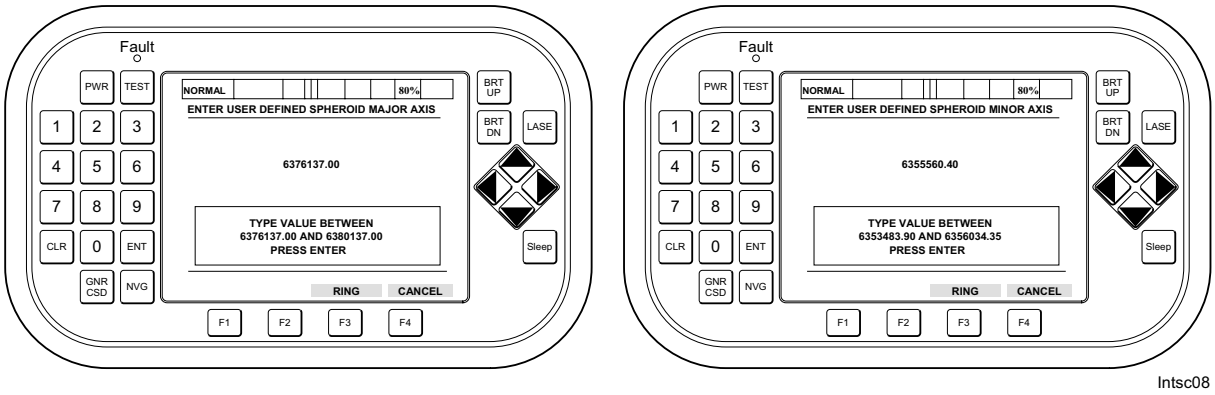
2-55 SPHEROID DATUM SETUP

NOTE

The FDC may provide a spheroid and datum that is not WE/WGS84 or listed on the SELECT SPHEROID or SELECT DATUM screens. The following procedures explain the steps involved with entering a USRDEF spheroid and datum. Steps 1- 19 in paragraph 2-39a and step 1 in paragraph 2-39b are the same.

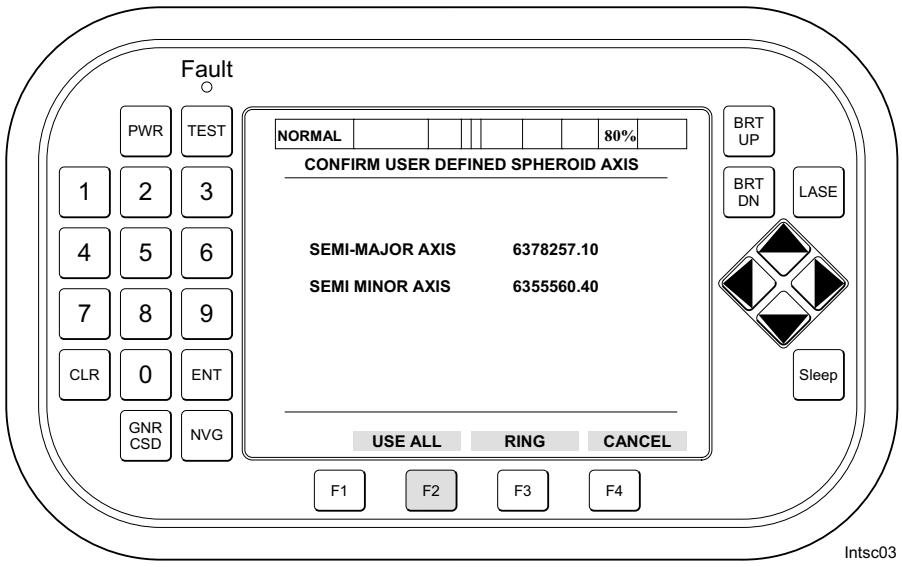
1 When the SELECT SPHEROID is displayed, select USRDEF with a MAJ and MIN, press SELECT F1 key.

2 ENTER USER DEFINED SPHEROID MAJOR AXIS, press ENT key.



Intsc08

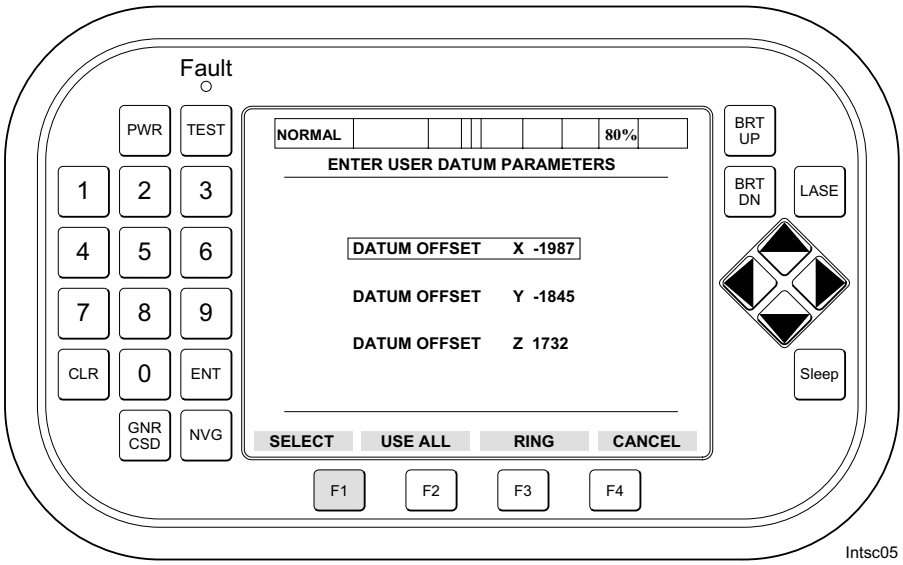
3 CONFIRM USER DEFINED SPHEROID AXIS, press USE ALL F2 key.



Intsc03

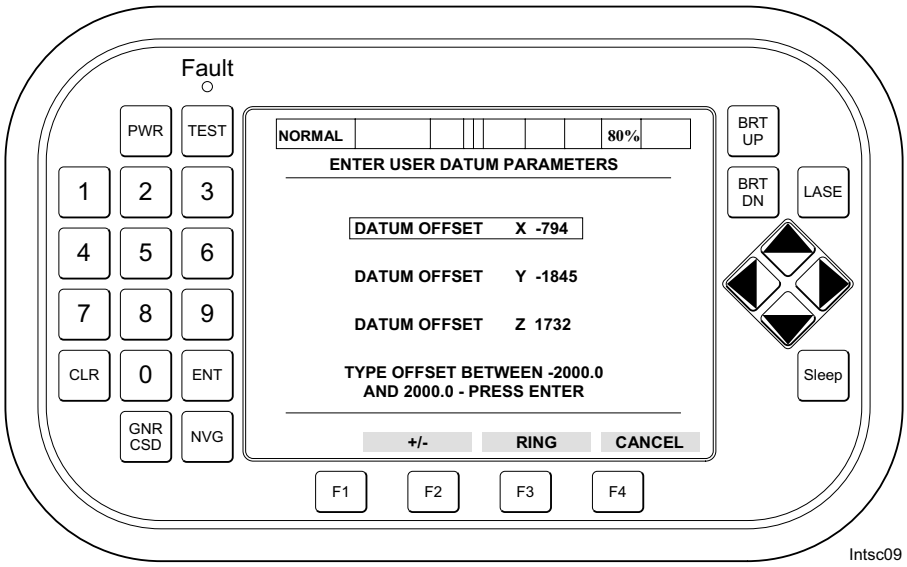
2-55 SPHEROID DATUM SETUP (cont)

4 Select DATUM, press SELECT F1 key. Select USRDEF, press SELECT F1 key.



Intsc05

5 To enter datum offsets, press SELECT F1 key, enter the offset values and press ENT key.



Intsc09

6 Verify data, press USE ALL F2 key.

Section V. MISFIRE AND CHECK FIRING PROCEDURES

2-56 GENERAL PRECAUTIONS

Conditions described below are rarely encountered with a properly maintained howitzer, and when authorized and properly maintained ammunition is fired. To avoid injury to personnel, and damage to equipment, these conditions must be understood. To determine tube temperature, and which action to take, refer to Para 2-2 a. for instructions on using the TWD, and Para 2-57, for definitions.

2-57 DEFINITIONS

1 Checkfire. A checkfire is a command normally given by the executive officer. In an emergency, the command may be given by anyone who interrupts a fire mission.

2 Misfire. A misfire is a failure of a round to fire after initiating action is taken. This may be due to the failure in functioning of the primer, igniter, propelling charge, or firing mechanism. A misfire in itself is not dangerous; it cannot be immediately distinguished from a hangfire. Therefore, misfires must be treated as delayed firings until determined otherwise.

3. Hangfire. A hangfire is a delay in the functioning of the primer, igniter, or propelling charge. The delay, although unpredictable ranges from a fraction of second to several minutes. A hangfire cannot be distinguished immediately from a misfire.

WARNINGS

DO NOT STAND BEHIND BREECH WHEN REMOVING THE PRIMER. DO NOT GRASP THE FIRING MECHANISM BLOCK ASSEMBLY SO THAT YOUR HAND IS EXPOSED TO BEING HIT BY THE EXPELLED PRIMER.

STICKERS MAY OCCUR WHEN FIRING CHARGE 2. WHEN A STICKER DOES OCCUR, HOT GASSES UNDER PRESSURE ARE TRAPPED IN THE CHAMBER. REMOVAL OF THE PRIMER IS DANGEROUS, AS IT WILL BE SHOOTING REARWARD WHEN RELEASED. THE EXPELLED PRIMER MAY CAUSE INJURY TO PERSONNEL STANDING IN ITS PATH OR RICOCHET.

4 Sticker. A sticker is a projectile that has lodged in the tube after being fired. Stickers result from insufficient chamber pressure. Either fire out with Charge 5 or higher or notify EOD. If a sticker round is encountered, follow the procedures for unloading a sticker round (Para 2-63).

5 Cookoff. The functioning of the propelling charge or projectile when it is initiated by the heat of the breech chamber.

2-57 DEFINITIONS (cont)

6 Cold tube. Any tube that has, or has not, exceeded the rates of fire, and does not cause water from a wet swab to boil, fry or steam off, when placed just forward of the gas check seat.

7 Hot Tube. Any tube that has, or has not, exceeded the rates of fire, but does cause water from a wet swab to boil, fry, or steam off, when placed just forward of the gas check seat.

8 Hot Weapon. A hot weapon is one in which the tube and breech have been brought to a sufficiently high temperature by previous firings, so that they can transmit, in several minutes time, enough heat to the round to activate its explosive components.

9 Hot Weather. Hot weather is any weather in which the outside temperature is expected to exceed + 100 ^{o}F (+ 38 ^{o} C) during the day.

2-58 MISFIRE AND CHECK FIRING PREVENTIVE OR CORRECTIVE PROCEDURES

WARNINGS

IN THE EVENT OF A FAILURE TO FIRE, KEEP THE WEAPON TRAINED ON THE TARGET. WHEN FIRING IS INTERRUPTED, PROMPTLY REMOVE THE PROJECTILE FROM THE CHAMBER IF TIME ALLOWS AS INDICATED BY THE THERMAL WARNING DEVICE (PARA 2-59 TO 2-62).

IN CASE OF A MISFIRE/HANGFIRE, FOLLOW THE MISFIRE PROCEDURES FOR TUBE TEMPERATURE. WHEN BREECH IS OPENED, TO REMOVE THE POWDER CHARGE AND PRIMER, IF SMOKE/SPARKS ARE COMING FROM THE CHAMBER AREA, DO NOT ATTEMPT TO REMOVE THE CHARGE OR CLOSE THE BREECH, IMMEDIATELY EVACUATE THE AREA AND NOTIFY EXPLOSIVE ORDNANCE DISPOSAL.

1 General. Misfires and check firing are not dangerous in themselves; however, two conditions hazardous to crew and equipment can develop if the proper corrective procedures are not followed.

a. In case of a checkfire or a misfire, the weapon may unexpectedly fire. All personnel should stay clear of the recoiling parts and muzzle. The weapon should be kept trained on the target until the projectile has been removed from the weapon.

b. If a charge, or projectile is chambered in a hot tube following failure to fire, the possibility of a cookoff exists.

2 Misfire and Check Firing Procedures.

a. Failure to fire with a cold tube (green range on TWD). When indicator is in the green zone (below +170°F (+77°C)), there are no restrictions with respect to misfire instructions, and normal cold tube misfire procedures apply (Para 2-59). In this region, there is little danger of a cookoff.

b. Failure to fire with a warm tube (yellow range on TWD). The warm tube has two upper boundaries. When there is failure to fire, use +350°F (+177°C) as the upper boundary (in hot weather use +300°F (+149°C)). For misfires occurring when the indicator is in the yellow zone, follow procedures in Para 2-60 (in hot weather follow procedures on Para 2-61).

c. Failure to fire with a hot tube (red range on the TWD). If the indicator reaches the red zone, the howitzer should be used in combat emergency only. There is an immediate danger of cookoff if a misfire occurs. Follow procedures in Para 2-62.

3 **Inspection of Primer after Removal**. After a primer has been removed, it should be inspected to determine whether the primer or the firing mechanism caused the misfire. If the primer has been dented and not fired, the primer is at fault. If the primer has not been dented, the M54 firing mechanism is at fault. Replace M54 firing mechanism and notify unit maintenance.

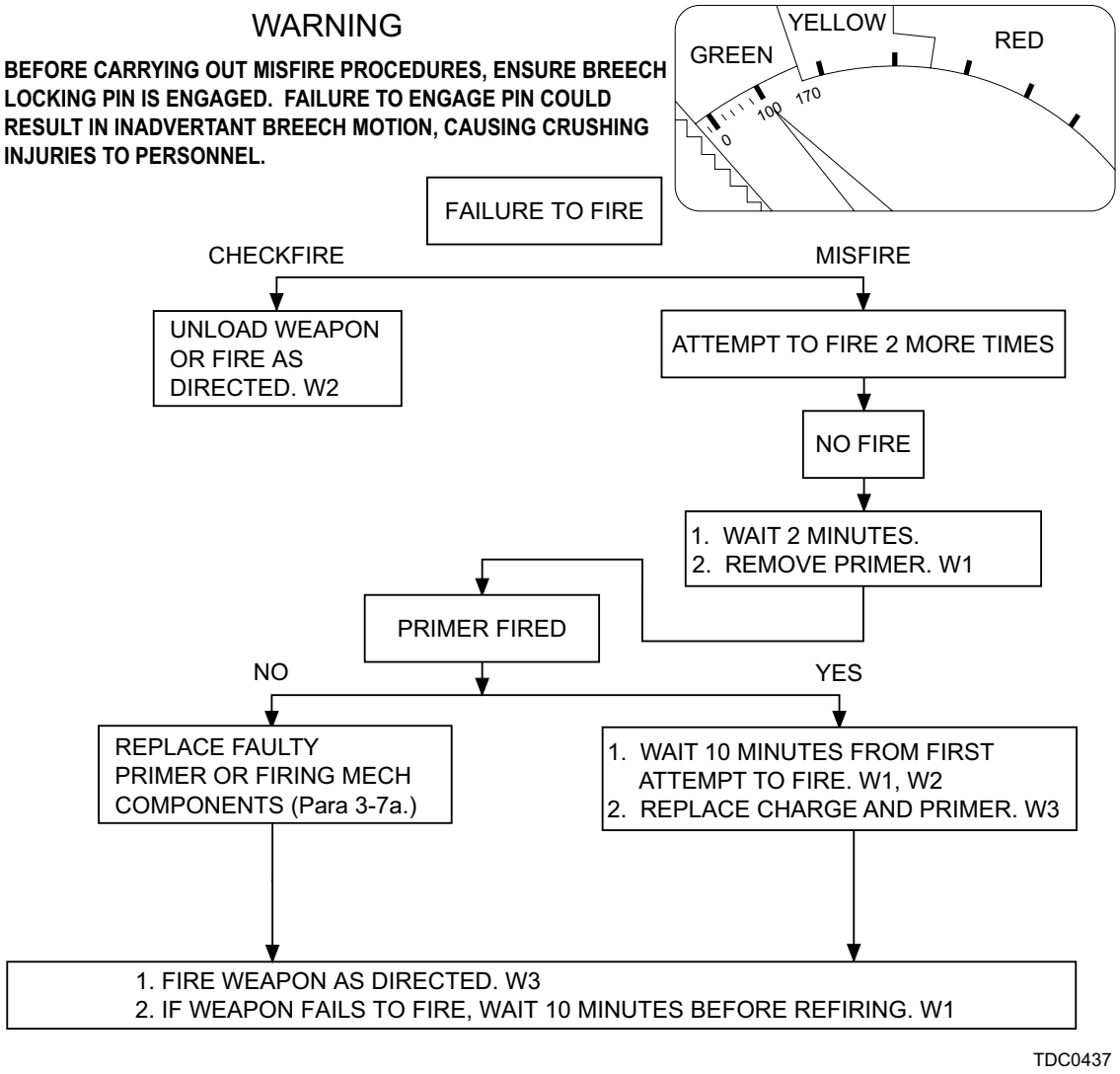
WARNINGS

PROJECTILES AND FUZES THAT HAVE BEEN RAMMED AND THEN REMOVED FROM THE TUBE MUST NOT BE REUSED. UNLOADING MAY HAVE CREATED SOME NON-STANDARD CONDITIONS. THEY MUST BE TURNED OVER TO AUTHORIZED PERSONNEL FOR DESTRUCTION OR DEMILITARIZATION. ONLY AN M712 COPPERHEAD PROJECTILE THAT HAS BEEN RAMMED AND EXTRACTED FROM A COLD TUBE MAY BE REUSED.

IN THE EVENT OF FAILURE OF THE THERMAL WARNING DEVICE, USE THE DEFINITIONS OF COLD TUBE AND HOT TUBE FOR THE MISFIRE/HANGFIRE PROCEDURES.

4 **Notification of EOD Personnel**. If a projectile cannot be cleared from the howitzer within the specified time, EOD personnel must be notified to remove the stuck projectile.

2-59 MISFIRE PROCEDURE FOR COLD TUBE (TWD GREEN READING) -0° TO +170°F (-17° TO +77°C), OR USE COLD TUBE DEFINITION IF TWD IS NOT WORKING



WARNING

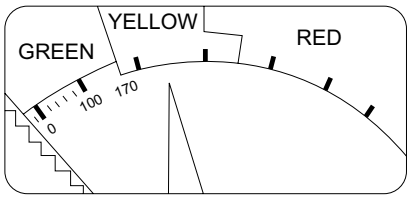
W1-HANGFIRE POSSIBLE; STAND CLEAR OF RECOILING PARTS.
W2-IF SMOKE/SPARKS ARE COMING FROM CHAMBER AREA, DO NOT REMOVE CHARGE OR CLOSE BREECH, EVACUATE AREA, NOTIFY EOD.
W3-DO NOT FIRE UNLOADED PRIMER, CHARGE, OR PROJECTILE. SEPARATE, MARK UNSERVICABLE.

NOTE
See Para 2-64 for use of bell rammer.

2-60 MISFIRE PROCEDURE FOR WARM TUBE (TWD YELLOW READING) +170° TO +350°F (+77° TO +177°C), OR HOT TUBE DEFINITION IF TWD IS NOT WORKING

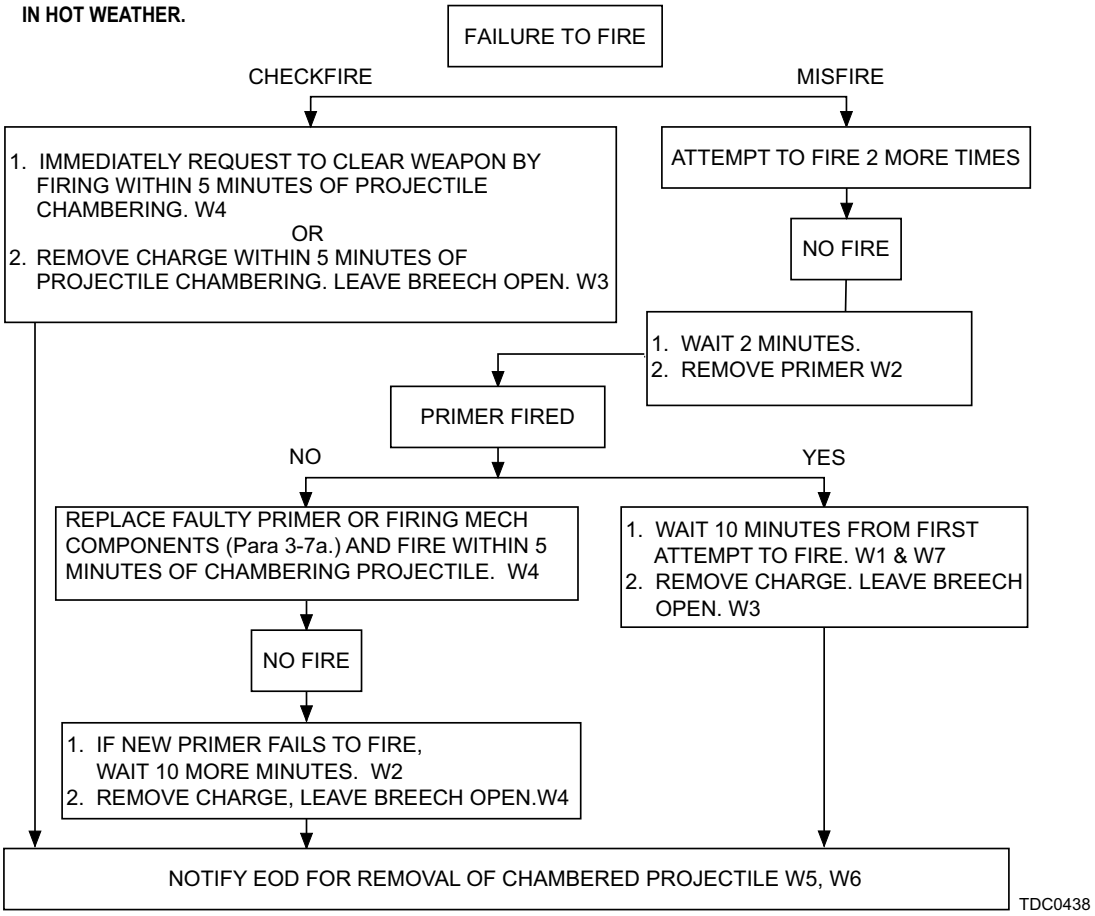
WARNING

BEFORE CARRYING OUT MISFIRE PROCEDURES, ENSURE BREECH LOCKING PIN IS ENGAGED. FAILURE TO ENGAGE PIN COULD RESULT IN INADVERTANT BREECH MOTION, CAUSING CRUSHING INJURIES TO PERSONNEL.



CAUTION

DO NOT FIRE PROJECTILE CHAMBERED FOR MORE THAN 5 MINUTES. USE SPECIAL WARM TUBE MISFIRE PROCEDURES IN HOT WEATHER.



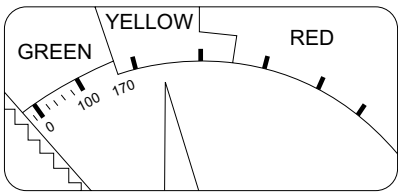
WARNING

W1-WEATHER IS CONSIDERED HOT IF OUTSIDE TEMPERATURE IS EXPECTED TO REACH +100°F (+38°C) DURING THE DAY.
W2-HANGFIRE POSSIBLE; STAND CLEAR OF RECOILING PARTS.
W3-DO NOT FIRE, UNLOADED AMMUNITION, SEPARATE, MARK UNSERVICABLE.
W4-A HEATED PROJECTILE MAY CAUSE AN INBORE EXPLOSION IF FIRED AFTER 5 MINUTES.
W5-WAIT UNTIL TWD FALLS BELOW +160°F (+71°C), BEFORE PERMITTING EOD TO REMOVE PROJECTILE.
W6-NEVER FIRE A PROJECTILE OR CHARGE THAT HAS BEEN ALLOWED TO COOL IN A HEATED TUBE, SEPARATE, MARK UNSERVICABLE.
W7-IF SMOKE/SPARKS ARE COMING FROM CHAMBER AREA, DO NOT REMOVE CHARGE OR CLOSE BREECH, EVACUATE AREA, NOTIFY EOD.

2-61 SPECIAL MISFIRE PROCEDURE FOR WARM TUBE IN HOT WEATHER (TWD YELLOW READING) +170°F TO 300° (+77° TO +149°C). OR USE HOT TUBE DEFINITION IF TWD IS NOT WORKING

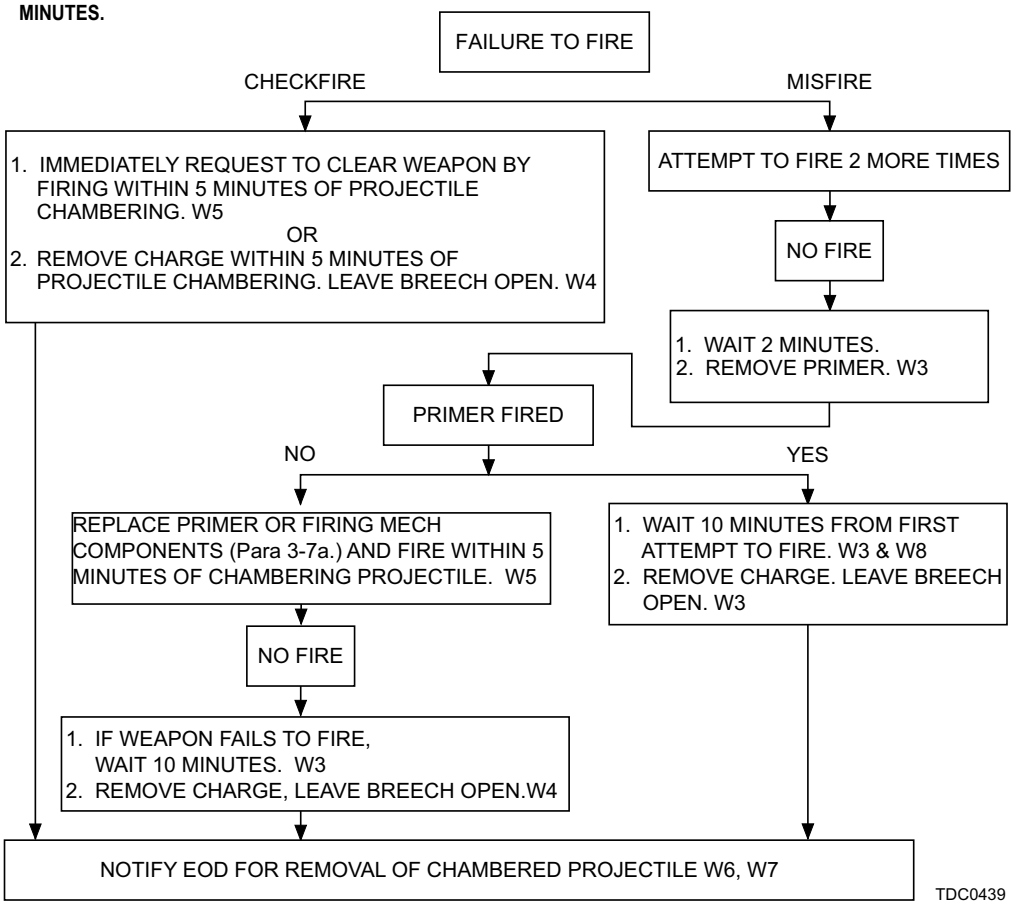
WARNING

BEFORE CARRYING OUT MISFIRE PROCEDURES, ENSURE BREECH LOCKING PIN IS ENGAGED. FAILURE TO ENGAGE PIN COULD RESULT IN INADVERTANT BREECH MOTION, CAUSING CRUSHING INJURIES TO PERSONNEL.



CAUTION

DO NOT FIRE PROJECTILE CHAMBERED FOR MORE THAN 5 MINUTES.



WARNING

W1-IF PROJECTILES ARE NOT PROPERLY SHADED, TREAT A WARM TUBE AS A HOT TUBE.
W2-WEATHER IS CONSIDERED HOT IF OUTSIDE TEMPERATURE IS EXPECTED TO REACH +100°F (+38°C) DURING THE DAY.
W3-HANGFIRE POSSIBLE; STAND CLEAR OF RECOILING PARTS.
W4-DO NOT FIRE UNLOADED AMMUNITION. SEPARATE, MARK UNSERVICABLE.
W5-A HEATED PROJECTILE MAY CAUSE AN INBORE EXPLOSION IF FIRED AFTER 5 MINUTES.
W6-WAIT UNTIL TWD FALLS BELOW +160°F (+71°C) BEFORE PERMITTING EOD TO REMOVE PROJECTILE.
W7-NEVER FIRE A PROJECTILE CHARGE THAT HAS BEEN ALLOWED TO COOL IN A HEATED TUBE. SEPARATE, MARK UNSERVICABLE.
W8-IF SMOKE/SPARKS ARE COMING FROM CHAMBER AREA, DO NOT REMOVE CHARGE OR CLOSE BREECH, EVACUATE AREA, NOTIFY EOD.

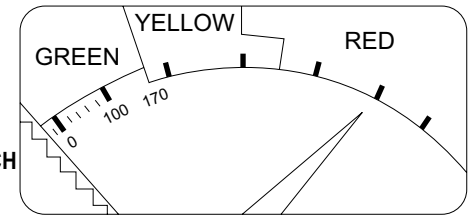
2-62 MISFIRE PROCEDURES FOR HOT TUBE (TWD RED READING) ABOVE +350°F (+177°C). TWD RED READING ABOVE +300°F (+149°C) IN HOT WEATHER, OR USE HOT TUBE DEFINITION IF TWD IS NOT WORKING

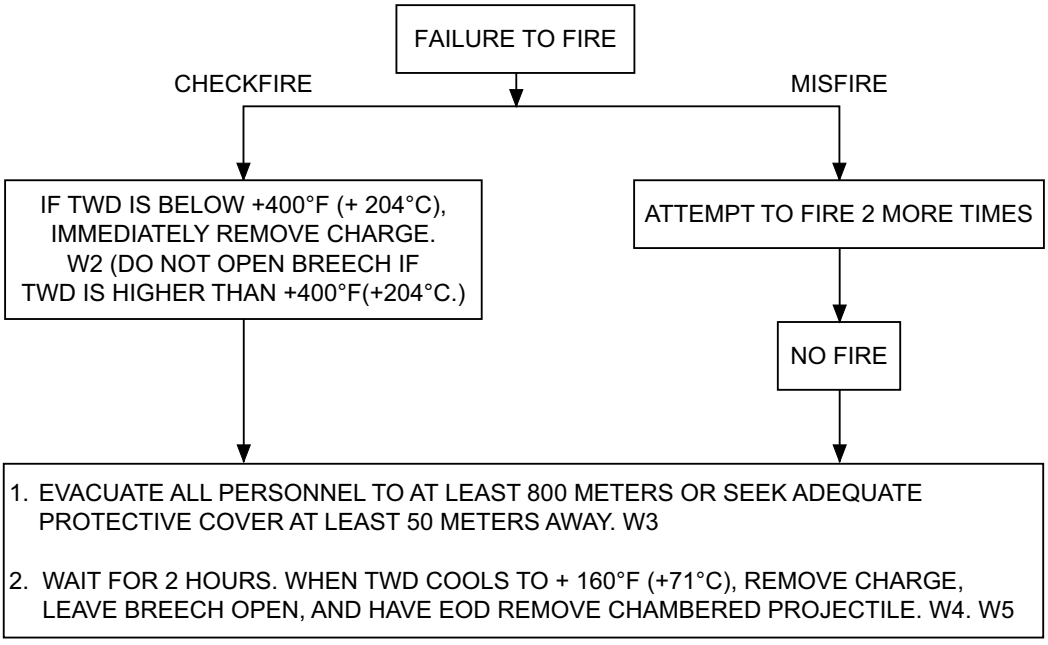
WARNING

DO NOT FIRE IN AHOT TUBE EXCEPT IN A COMBAT SITUATION.

DO NOT TAKE CORRECTIVE ACTION EXCEPT AS STATED BELOW.

BEFORE CARRYING OUT MISFIRE PROCEDURES, ENSURE BREECH LOCKING PIN IS ENGAGED. FAILURE TO ENGAGE PIN COULD RESULT IN INADVERTANT BREECH MOTION, CAUSING CRUSHING INJURIES TO PERSONNEL.





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WARNING

W1-WEATHER IS CONSIDERED HOT IF OUTSIDE TEMPERATURE IS EXPECTED TO REACH +100°F (+38°C) DURING THE DAY.
W2-CHARGE COOKOFF POSSIBLE AFTER 1 MINUTE.
W3-DO NOT TAKE COVER IMMEDIATELY TO REAR OF HOWITZER.
W4-DO NOT FIRE UNLOADED PRIMER AND CHARGE, SEPARATE, MARK UNSERVICABLE.
W5-NEVER FIRE A PROJECTILE, CHARGE OR PRIMER THAT HAS BEEN ALLOWED TO COOL IN A HEATED TUBE. SEPARATE, MARK UNSERVICABLE.

2-63 UNLOADING A STICKER ROUND

WARNINGS

STICKERS MAY OCCUR WHEN FIRING CHARGE 2. WHEN A STICKER DOES OCCUR, HOT GASSES UNDER PRESSURE ARE TRAPPED IN THE CHAMBER. REMOVAL OF THE PRIMER IS DANGEROUS, AS IT WILL BE SHOOTING REARWARD WHEN RELEASED. THE EXPELLED PRIMER MAY CAUSE INJURY TO PERSONNEL STANDING IN ITS PATH OR RICOCHET.

DO NOT STAND IN THE PATH OF RECOIL, WHILE PERFORMING THIS PROCEDURE.

LEAVE WEAPON TRAINED ON TARGET

WAIT TWO MINUTES BEFORE ATTEMPTING TO REMOVE PRIMER.

MAKE ALL ATTEMPTS TO FIRE THE PROJECTILE ONCE LOADED. HOWEVER, IF FOR ANY REASON AN UNFIRED PROJECTILE MUST BE REMOVED, SEE UNLOADING AN UNFIRED ROUND (PARA 2-64).

ALL NON-ESSENTIAL PERSONNEL ARE TO MOVE TO THE SAFE AREA FROM THE PRIMER RICOCHETE PATH.

ENSURE SCAVENGE ISOLATOR VALVE IS CLOSED WHEN WORKING AROUND THE BREECH. FAILURE TO CLOSE THE VALVE COULD RESULT IN INADVERTENT BREECH MOTION. THIS COULD RESULT IN SEVERE CRUSHING INJURIES TO PERSONNEL.

1 Cannoneer No. 1 closes scavenge isolator valve.

WARNINGS

ENGAGEMENT AND DISENGAGEMENT OF THE BREECH LOCKING PIN IS TO BE PERFORMED AS A ONE HANDED OPERATION.

INADVERTANT BREECH MOTION COULD RESULT IN SEVERE CRUSHING INJURIES TO PERSONNEL.

2 Cannoneer No. 2 installs breech crank locking pin.

WARNING

DO NOT ATTEMPT TO FUNCTION THE PFM LEVER UNTIL THE MAGAZINE ASSEMBLY HAS BEEN REMOVED. ATTEMPTING TO VENT A STICKER WITH THE MAGAZINE IN PLACE MAY RESULT IN DETONATION OF THE PRIMERS IN THE MAGAZINE, AS HOT GAS IS VENTED OUT OF THE SPINDLE (PRIMER) HOLE FROM THE CHAMBER.

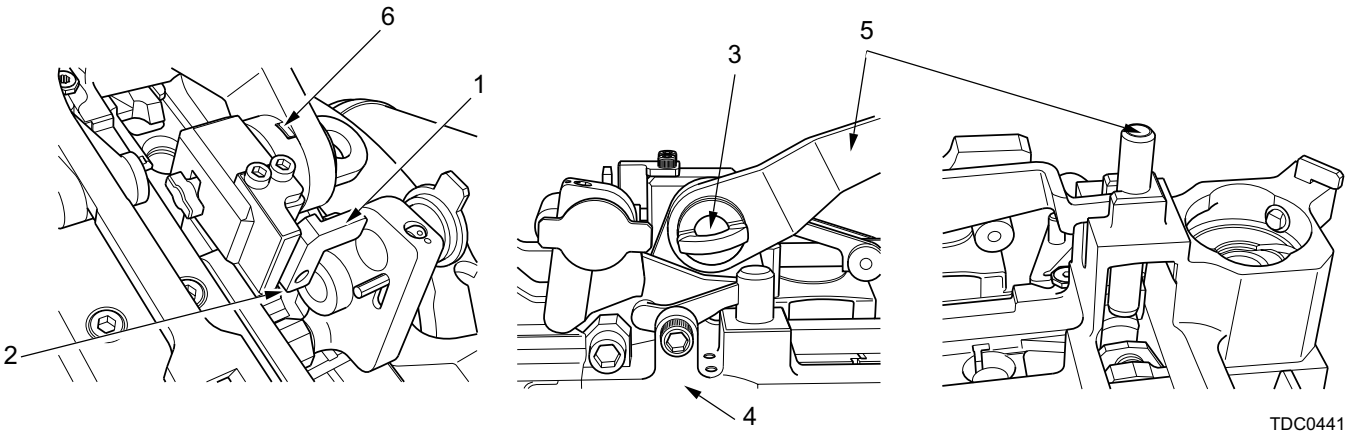
3 Cannoneer No. 2 removes injector arm assembly as follows:

a. Lift and rotate knob (1) 90º CW, until knob is on knob stop (2).

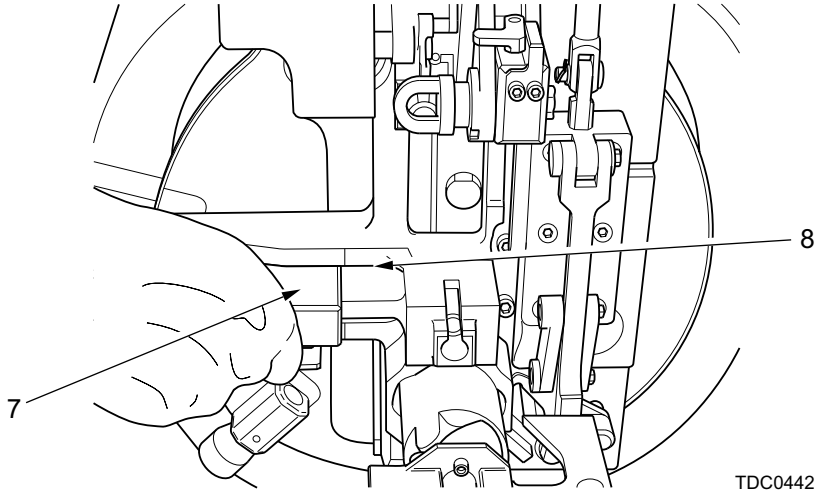
b. Rotate locking shaft (3) 90º and remove from tray assembly (4).

c. Disengage injector arm assembly (5) from slots on follower (6) and remove injector assembly.

d. Re-install locking shaft (3) by rotating 90º and rotate knob (1) 90º CCW until engaged.



4 Cannoneer No. 2 removes magazine assembly and inserts primer stop (7) into tray assembly (8).



2-63 UNLOADING A STICKER ROUND (cont)

WARNINGS

WHEN STICKERS OCCUR, THE PROJECTILE LODGES IN THE TUBE AND HOT GASSES UNDER HIGH PRESSURE ARE TRAPPED IN THE CHAMBER. REMOVAL OF THE PRIMER IS DANGEROUS, AS IT WILL BE SHOOTING REARWARD FROM THE PRIMER HOLE WHEN RELEASED.

THE PRIMER MAY ALSO RICOCHET. DO NOT STAND BEHIND THE BREECH WHEN REMOVING THE PRIMER; THE VELOCITY OF THE EXPELLED PRIMER MAY CAUSE INJURY TO PERSONNEL STANDING IN ITS PATH.

VENTING PROPELLANT GASSES WILL ALSO EXIT THE OPEN PRIMER HOLE IN THE PRIMER FEED MECHANISM'S TRAY UNDER EXTREME PRESSURE IMMEDIATELY AFTER THE PRIMER CARTRIDGE IS REMOVED. DO NOT PLACE BODY PARTS BEHIND THE BREECH OR IN THE EJECTION PATH OF THE PRIMER, WHEN MOVING THE PRIMER FEED MECHANISM TRAY TO THE EJECT POSITION.

WHEN THE PRIMER IS EXTRACTED, THE GAS PRESSURE WILL VENT SAFELY. KEEP HANDS AND ALL PERSONNEL CLEAR OF THE BREECH AS THE PRIMER AND HOT GASSES WILL BE EXPELLED OUT OF THE PRIMER HOLE WITH CONSIDERABLE FORCE.

5 Cannoneer No. 2 extracts primer and removes breech crank locking pin.

6 Cannoneers Nos. 1 and 2 open breech.

WARNING

ENSURE BREECH LOCK-OUT PLUNGER IS ENGAGED PRIOR TO PERFORMING ANY MAINTENANCE TASKS. FAILURE TO ENGAGE PLUNGER COULD RESULT IN ACCIDENTAL BREECH CLOSURE, CAUSING SEVERE CRUSHING INJURIES TO PERSONNEL.

7 Cannoneer No. 1 engages breech lockout plunger.

8 Cannoneer No. 2 removes primer stop.

9 Cannoneer No. 2 installs the injector arm assembly as follows:

a. Push and rotate knob (9) 90º CW until knob is on knob stop (10).

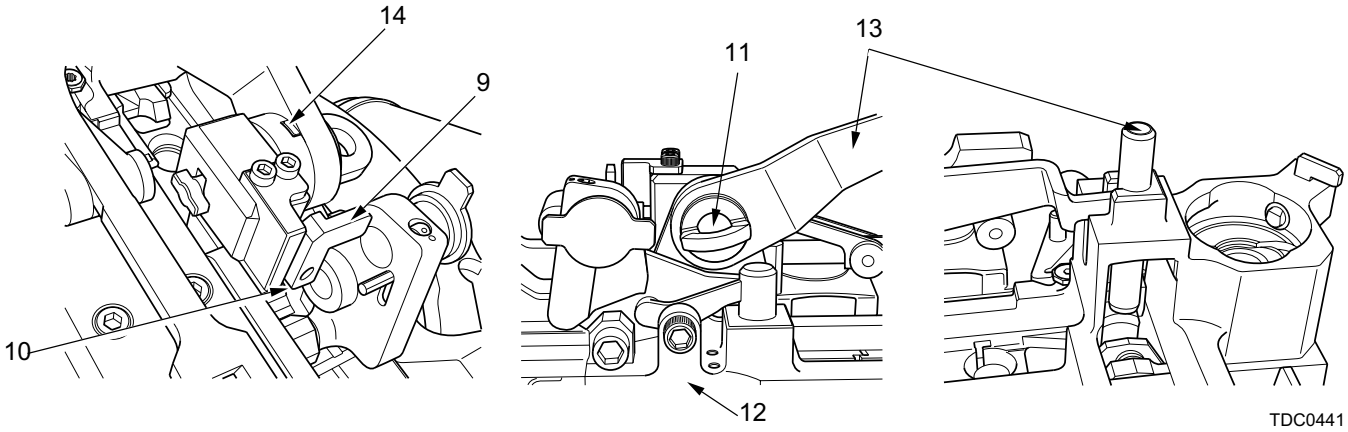
b. Rotate locking shaft (11) 90º and remove from tray assembly (12).

c. Insert injector arm assembly (13) into tray assembly (12) and rotate injector arm assembly (13) to engage slots (14) on the follower.

d. Rotate locking shaft (11) 90º and install into tray assembly (12).

e. Rotate knob (9) 90º CCW until engaged.

NOTE
Ensure all parts are locked and engaged.



10 Cannoneer No. 2 inserts magazine assembly and swabs the breech to remove any residue from the breech chamber.

11 Cannoneer No. 1 disengages breech lock-out plunger.

12 Cannoneers Nos. 1 and 2 close breech.

13 Cannoneer No. 1 opens scavenge isolator valve.

14 Cannoneer No. 2 loads primer and ensures that breech and PFM witness marks are aligned, and announces PRIMED.

15 When Cannoneer No. 2 has announced, PRIMED, SC may command, FIRE, unless restricted by the fire command.

CAUTION

Check with local SOP before firing sticker rounds.

16 Fire with proper authority.

2-64 UNLOADING AN UNFIRED ROUND

WARNINGS

A COMPLETE PROJECTILE, ONCE LOADED, SHOULD BE FIRED. HOWEVER, IF AN UNFIRED PROJECTILE IS TO BE REMOVED, PROCEED AS FOLLOWS:

FOR MISFIRE AND CHECK FIRING, REFER PARA 2-59 TO 2-62.

FOR EXTRACTION OF M712 PROJECTILE (COPPERHEAD), SEE CHAPTER 4 TO THIS TM.

2-64 UNLOADING AN UNFIRED ROUND (cont)

NOTE

The following unloading procedures do not apply to the MACS propelling charge.

1 Cannoneer No. 2 extracts primer.

2 Assistant Gunner levels cannon tube.

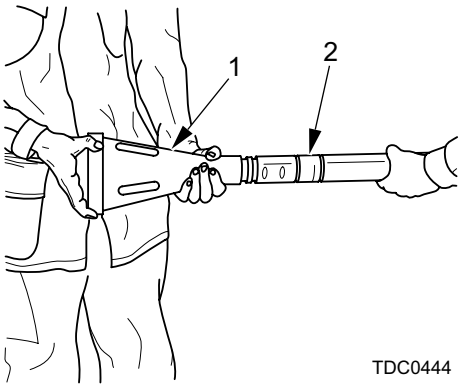
WARNING

ENSURE THAT ARTILLERY RAMMER (8767210) IS USED.

NOTE

The FAST bar may be used as one of the staff sections; this will eliminate the need to disassemble the chamber swab or rammer staff.

3 ATC and Cannoneers Nos. 3, 4 and 5 assembles at least seven sections of rammer staff (2) to bell rammer (1).



WARNING

ENSURE SCAVENGE ISOLATOR VALVE IS CLOSED WHEN WORKING AROUND THE BREECH. FAILURE TO CLOSE THE VALVE COULD RESULT IN INADVERTENT BREECH MOTION. THIS COULD RESULT IN SEVERE CRUSHING INJURIES TO PERSONNEL.

4 Cannoneer No. 1 closes scavenge isolator valve.

5 Cannoneers Nos. 1 and 2 open breech.

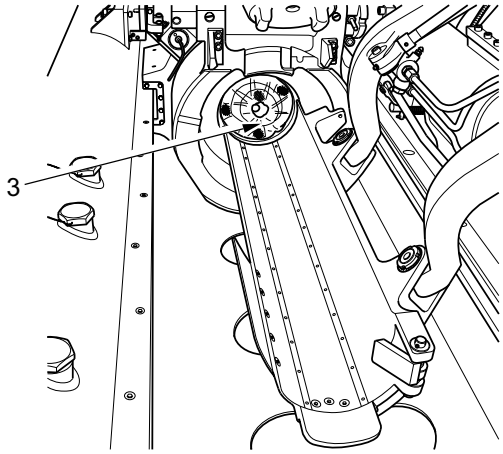
WARNING

ENSURE BREECH LOCKOUT PLUNGER IS ENGAGED PRIOR TO PERFORMING ANY MAINTENANCE TASKS. FAILURE TO ENGAGE PLUNGER COULD RESULT IN ACCIDENTAL BREECH CLOSURE, CAUSING SEVERE CRUSHING INJURIES TO PERSONNEL.

6 Cannoneer No. 1 engages breech lockout plunger and lowers loading tray.

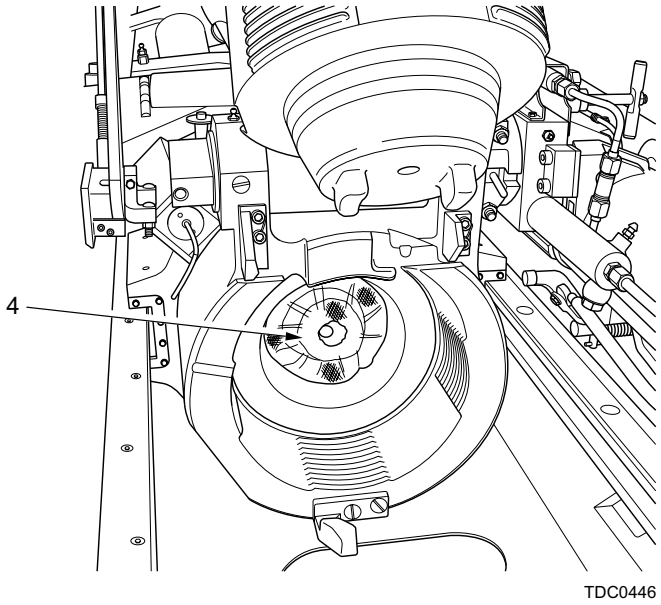
NOTE
If MACS charge loaded, see Para 2-65 for removing.

7 Cannoneer No. 2 removes propellant charge (3) from chamber and hands it to Cannoneer No. 3.



8 Cannoneer No. 2 places chamber swab (4) into the chamber.

9 Cannoneer No. 1 raises loading tray.



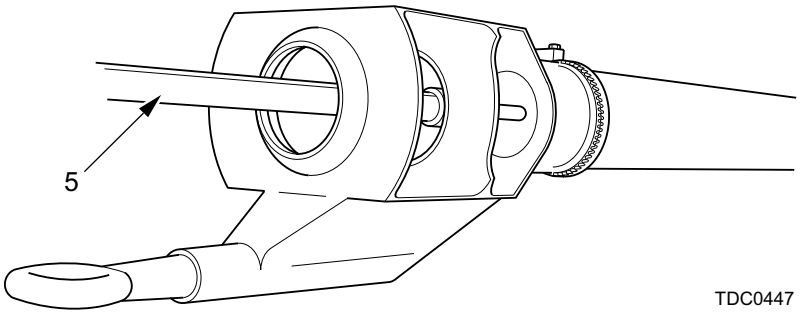
10 Cannoneer No. 1 disengages breech lockout plunger.

11 Cannoneers Nos. 1 and 2 close breech.

12 ATC and Cannoneers Nos. 3, 4 and 5, insert bell rammer end of rammer staff (5) into cannon tube (muzzle end), and push carefully until it encloses fuze, and comes into contact with ogive of projectile.

2-64 UNLOADING AN UNFIRED ROUND (cont)

13 ATC and Cannoneers Nos. 3, 4 and 5, push or, if necessary, tap rammer staff until projectile is dislodged from its seat.



NOTE
If projectile cannot be removed notify EOD.

14 ATC, and Cannoneers Nos. 3, 4 and 5 push projectile into chamber.

15 Cannoneers Nos. 1 and 2 open breech.

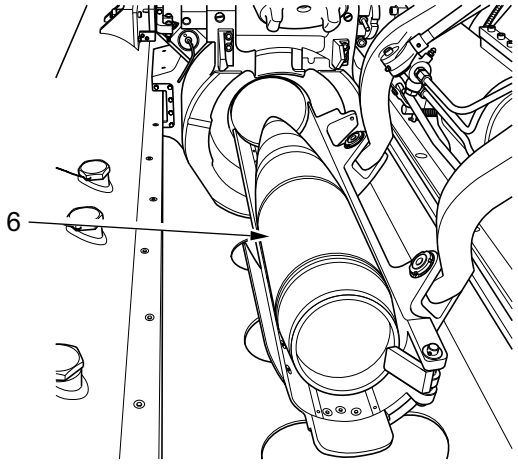
WARNING

ENSURE BREECH LOCKOUT PLUNGER IS ENGAGED PRIOR TO PERFORMING ANY MAINTENANCE TASKS. FAILURE TO ENGAGE PLUNGER COULD RESULT IN ACCIDENTAL BREECH CLOSURE, CAUSING SEVERE CRUSHING INJURIES TO PERSONNEL.

16 Cannoneer No. 1 engages breech lockout plunger and lowers loading tray.

17 Cannoneer No. 2 removes chamber swab from the chamber.

18 ATC and Cannoneers Nos. 3, 4 and 5, push projectile (6) onto loading tray.



19 Cannoneer No. 1 raises loading tray.

20 Cannoneer No. 4 removes projectile from loading tray and isolates projectile for inspection by EOD.

21 ATC and Cannoneers Nos. 3 and 5 remove rammer staff sections from cannon tube and stow.

2-65 UNLOADING PROCEDURES FOR MACS PROPELLING CHARGE ONLY

1 Cannoneer No. 2 extracts primer.

2 Assistant Gunner levels cannon tube.

WARNING

ENSURE SCAVENGE ISOLATOR VALVE IS CLOSED WHEN WORKING AROUND THE BREECH. FAILURE TO CLOSE THE VALVE COULD RESULT IN INADVERTENT BREECH MOTION. THIS COULD RESULT IN SEVERE CRUSHING INJURIES TO PERSONNEL.

3 Cannoneer No. 1 closes scavenge isolator valve.

4 Cannoneers Nos. 1 and 2 open breech (Para 2-25).

WARNING

ENSURE BREECH LOCKOUT PLUNGER IS ENGAGED PRIOR TO PERFORMING ANY MAINTENANCE TASKS. FAILURE TO ENGAGE PLUNGER COULD RESULT IN ACCIDENTAL BREECH CLOSURE, CAUSING SEVERE CRUSHING INJURIES TO PERSONNEL.

5 Cannoneer No. 1 engages breech lockout plunger and lowers loading tray.

NOTE
MACS increments must be removed one at a time.

6 Cannoneer No. 2 unloads MACS increments as follows:

a. Lift increment out of Swiss notch by using the thin black charge separator as a tool. Slide the separator along the increment then under to lift it up and out of the Swiss notch.

b. If MACS charge 2 or higher was loaded into the weapon then elevate the cannon tube as needed to get the increments to slide back into the Swiss notch. Repeat step (a) above for each increment.

7 Follow instruction in previous section for unloading the projectile after MACS has been removed.

2-66 REMOVING RUPTURED PRIMER CASING

1 In the advent of a primer casing becoming ruptured, Cannoneers Nos. 1 and 2 carryout the following:

WARNINGS

THE SCAVENGE ISOLATOR VALVE MUST BE CLOSED WHEN WORKING AROUND THE BREECH. FAILURE TO CLOSE THE VALVE COULD RESULT IN INADVERTENT BREECH MOTION. THIS COULD RESULT IN SEVERE CRUSHING INJURIES TO PERSONNEL.

ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.

(a) Close scavenge isolator valve.

(b) Manually open breech (Para 2-25).

WARNING

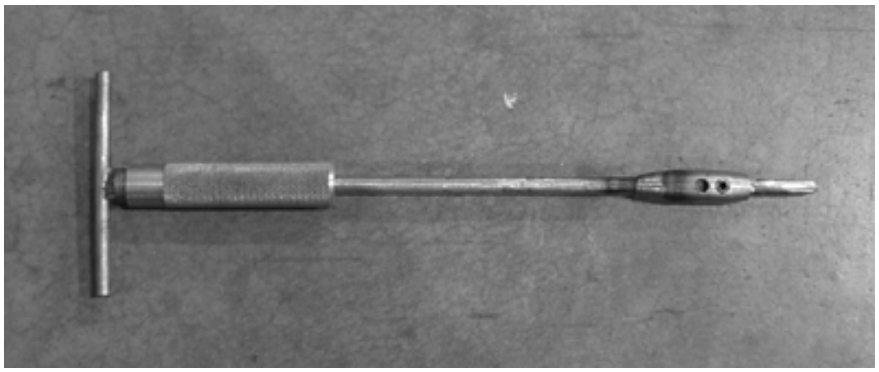
ENSURE BREECH LOCK-OUT PLUNGER IS ENGAGED PRIOR TO PERFORMING ANY MAINTENANCE TASKS. FAILURE TO ENGAGE PLUNGER COULD RESULT IN ACCIDENTAL BREECH CLOSURE, CAUSING SEVERE CRUSHING INJURIES TO PERSONNEL.

(c) Engage breech lockout plunger.

NOTE

When ruptured primer is removed from the breechblock vent hole. Inspect vent hole for cleanliness and damage. If vent hole is dirty, clean with cleaner vent hole tool, if damaged, notify unit maintenance.

(d) Using primer extractor ruptured tool (1), insert tool into ruptured primer casing. Pull upwards on tool until primer is free from the breechblock vent hole.



(e) Disengage breech lockout plunger.

(f) Close breech manually (Para 2-25).

Section VI. OPERATION OF AUXILIARY EQUIPMENT

2-67 OPERATING M94 MUZZLE VELOCITY SYSTEM (MVS)

NOTE

The M94 MVS mounting bracket mounted on the top cradle electronic assembly is for installation of the M94 MVS bracket assembly. Instructions for the operation of the M94 MVS are in TM 9-1290-364-14&P.

2-68 OPERATING SINCGARS RT-1532E (RTA)

NOTE

The RTA mounting bracket mounted within the CLE for installation of the RTA bracket assembly. Instructions for the operation of the RTA are in TM 11-5820-890-10-8.

2-69 OPERATING RADIO AMPLIFIER (AMP)

NOTE

The AMP mounting bracket mounted within the CLE is for installation of the AMP bracket assembly. Instructions for the operation of the AMP are in TM 11-5820-890-10-8.

2-70 OPERATING PRECISION LIGHTWEIGHT GLOBAL POSITIONING SATELLITE RECEIVER AN/PNS-11 (PLGR)

NOTE

The PLGR mounting bracket mounted within the CLE is for installation of the PLGR bracket assembly. Instructions for the operation of the PLGR are in TM 11-5825-291-13.

Section VII. OPERATION UNDER DEGRADED CONDITIONS

2-71 FIRING LEVER OR LINKAGE FAILURE PROCEDURES

NOTE

Continue laying for direction and elevation and loading and firing during indirect/direct fire missions (Para 2-36/37). Once fire mission is complete or at a suitable time, notify unit maintenance.

1 In the advent of Firing Lever or Linkage Failure, carry out the following:

(a) Cannoneer No. 1 unhooks 6-foot lanyard from the firing lever.

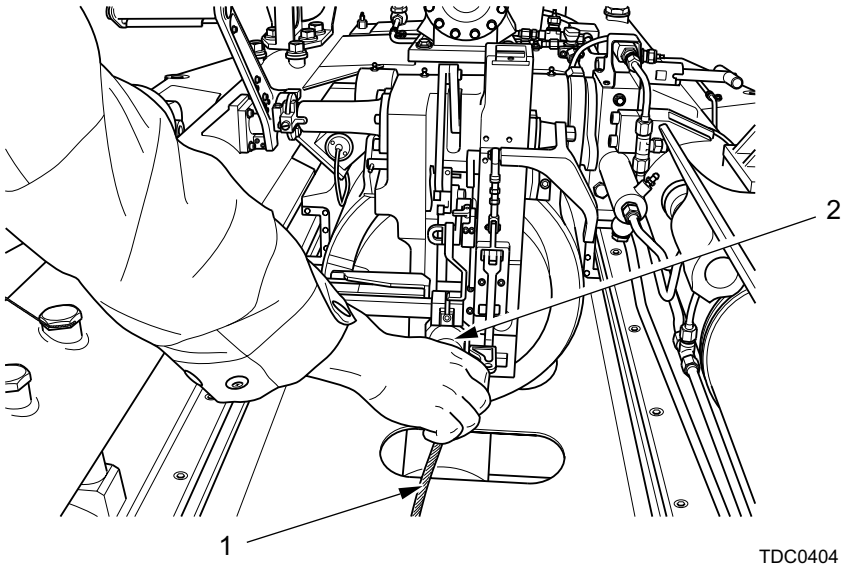
(b) Cannoneer No. 2 hands 25-foot lanyard to SC.

(c) SC hands lanyard to Cannoneer No. 2 and commands, STAND BY, Cannoneer No. 2 attaches lanyard (1) to the M54 firing mechanism lever (2).

WARNING

ENSURE ALL PERSONNEL ARE STANDING CLEAR OF RECOILING PARTS.

(d) SC commands, FIRE, and pulls lanyard (1) with a steady pull.



(e) When cannon assembly returns to the in-battery position, Cannoneer No. 2 removes lanyard from M54 firing mechanism lever.

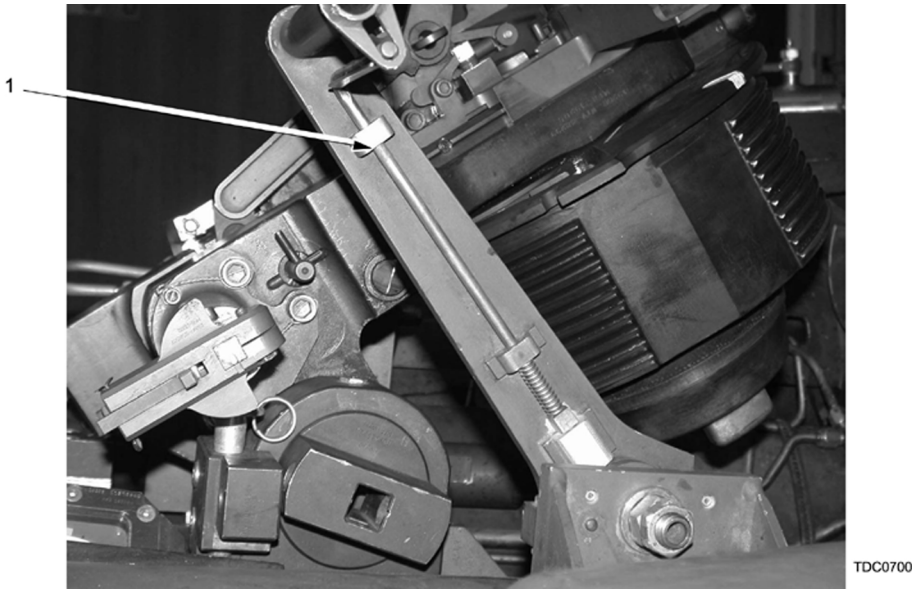
2-72 PFM MANUAL HANDLE FAILURE PROCEDURE

NOTE

Continue laying for direction and elevation and loading and firing during indirect/direct fire missions (Para 2-36/37). Once fire mission is complete or as time permits, notify unit maintenance.

1 In the advent of PFM Manual Handle Failure, Cannoneers Nos. 1 and 2 carryout the following:

(a) Move PFM manual handle (1) forward to the EXTRACT position.



WARNINGS

THE SCAVENGE ISOLATOR VALVE MUST BE CLOSED WHEN WORKING AROUND THE BREECH. FAILURE TO CLOSE THE VALVE COULD RESULT IN INADVERTENT BREECH MOTION. THIS COULD RESULT IN SEVERE CRUSHING INJURIES TO PERSONNEL.

ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.

(b) Close scavenge isolator valve.

(c) Open breech manually (Para 2-25).

WARNING

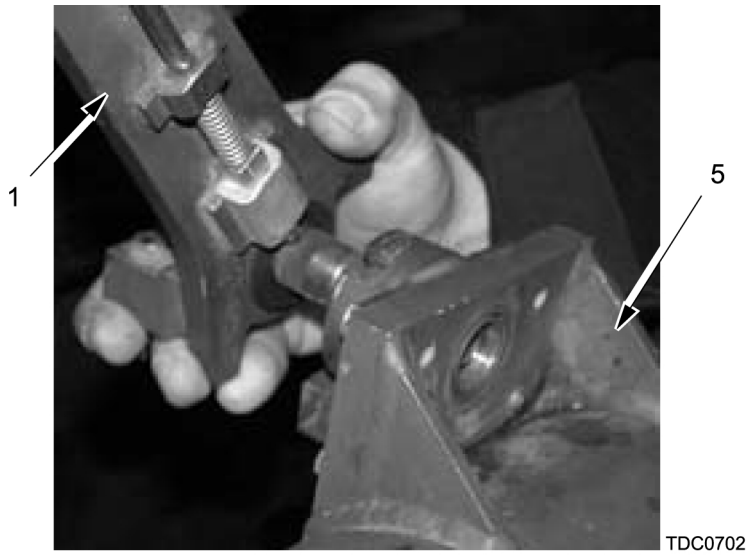
ENSURE BREECH LOCK-OUT PLUNGER IS ENGAGED PRIOR TO PERFORMING ANY MAINTENANCE TASKS. FAILURE TO ENGAGE PLUNGER COULD RESULT IN ACCIDENTAL BREECH CLOSURE, CAUSING SEVERE CRUSHING INJURIES TO PERSONNEL.

2-72 PFM MANUAL HANDLE FAILURE PROCEDURE (cont)

(d) Engage breech lockout plunger.

(e) Using 24mm socket and 1/2 in ratchet, remove locking nut (2), nut (3) and washer (4).

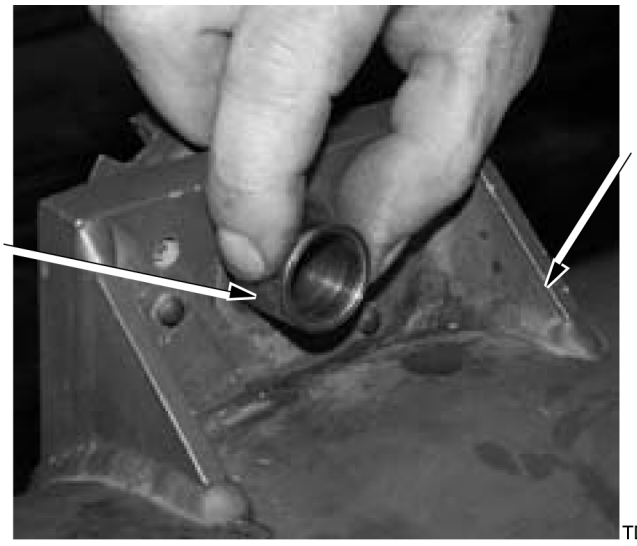
(f) Remove PFM manual handle (1) from PFM bracket (5).



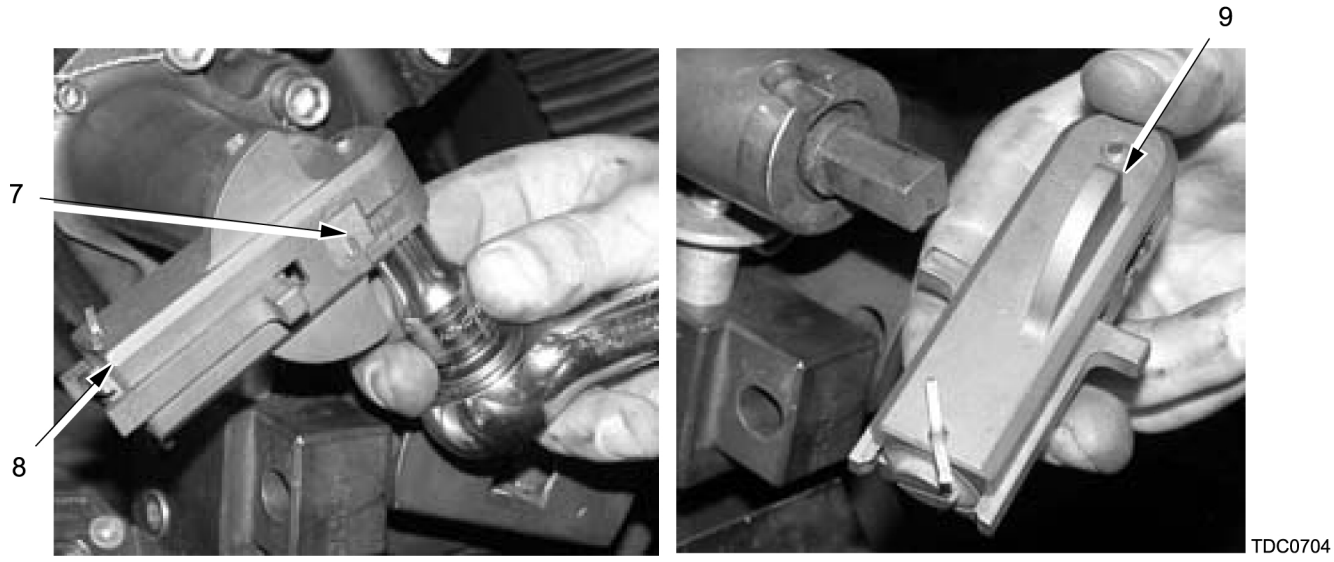
WARNING

ENSURE BUSHING IS REMOVED BEFORE FIRING THE HOWITZER; FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

(g) Remove bushing (6) from the PFM bracket (5).



(h) Using 11mm socket and 1/2 in ratchet, loosen dog coupler bolt (7), until dog coupler (8) can be removed from the drive shaft (9).



(i) Disengage breech lockout plunger.

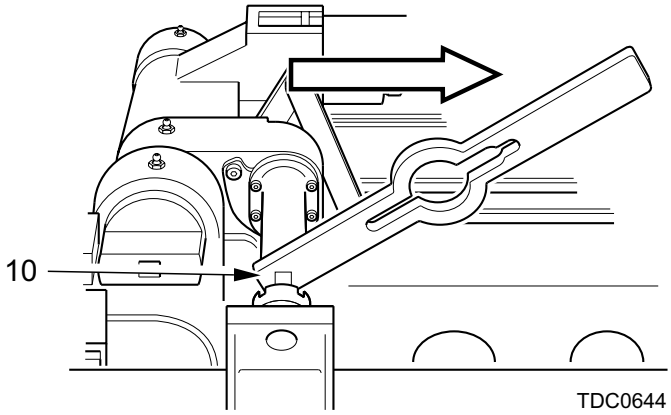
(j) Close breech manually (Para 2-25).

NOTE

To continue the firing cycle on the howitzer, using the firing mechanism wrench, carryout steps 2 thru 6.

2 Install firing mechanism wrench (10) onto the drive shaft, and move wrench rearwards to the PRIMED position.

2-72 PFM MANUAL HANDLE FAILURE PROCEDURE (cont)



WARNING

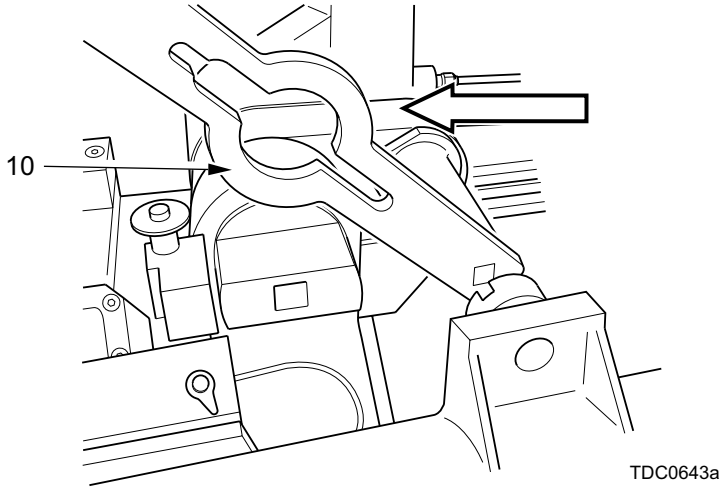
ENSURE THAT THE FIRING MECHANISM WRENCH IS REMOVED BEFORE FIRING THE HOWITZER; FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

3 Remove firing mechanism wrench from drive shaft.

NOTE

Once howitzer has fired and returned to the in-battery position, proceed with steps 4 thru 6.

4 Install firing mechanism wrench (10) onto drive shaft and move wrench forward to the EXTRACT position.



WARNING

ENSURE FIRING MECHANISM WRENCH IS REMOVED BEFORE OPENING OR CLOSING THE BREECH; FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

5 Remove firing mechanism wrench from drive shaft.

6 Open breech manually (Para 2-25).

7 Repeat steps 2 thru 6 until the fire mission is completed.

2-73 INJECTOR ARM ASSEMBLY FAILURE PROCEDURE (SINGLE SHOT MODE)

NOTE

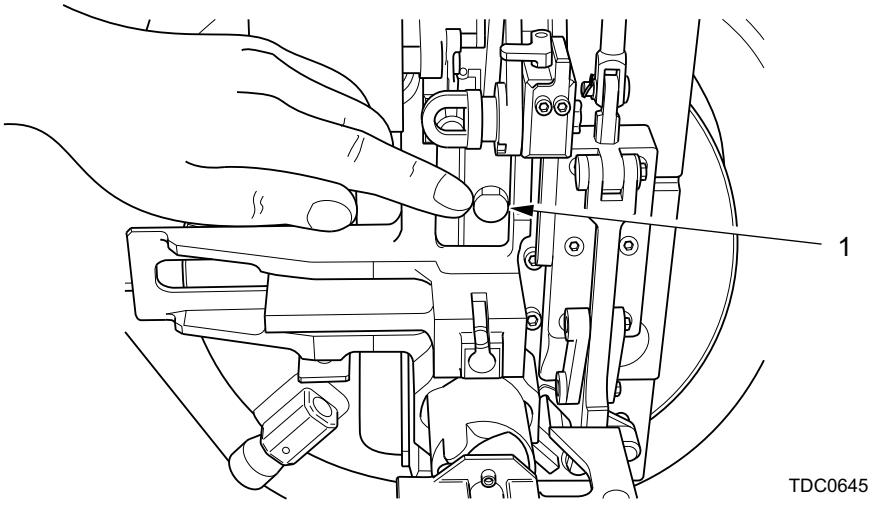
Continue laying for direction and elevation and loading and firing during indirect/direct fire missions (Para 2-36/37). Once fire mission is complete or at a suitable time, notify unit maintenance.

1 In the advent of Injector Arm Assembly Failure, carryout the following:

(a) Cannoneer No. 2 removes magazine (Para 2-44, step 18).

(b) Cannoneer No. 2 removes injector arm assembly (Para 3-7c.).

(c) Cannoneer No. 2 manually inserts primer (1) into PFM vent hole, keeping primer in position.



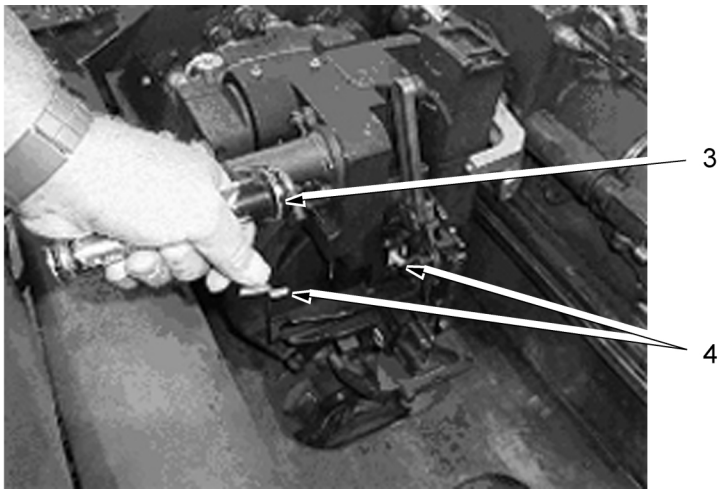
WARNING

TAKE CARE WHEN MOVING PFM MANUAL HANDLE WHEN APPLYING FINGER PRESSURE TO PRIMER. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL.

(d) Cannoneer No. 2 raises PFM manual (2) handle to rest over the primer, by moving handle slowly to the PRIMED position. When PFM tray begins to move over the primer, Cannoneer No. 2 removes finger from primer.

2-73 INJECTOR ARM FAILURE PROCEDURE (SINGLE SHOT MODE) (cont)

(e) Cannoneer No. 2 continues moving PFM manual handle (3) to the PRIMED position. Ensuring witness marks (4) are aligned.



2-74 SPADE DAMPER FAILURE PROCEDURE

NOTES

In most cases spade damper failure may not be observed until the howitzer has been displaced.

If spade damper failure occurs, the howitzer will remain fully mission capable, however in a degraded mode.

1 In the advent of Spade Damper Failure, carryout the following:

(a) Emplace howitzer (Para 2-24).

WARNING

BEFORE FIRING HOWITZER, ENSURE TRAIL ARM STRIKER PLATE AND SPADE DAMPER HAVE FULL CONTACT. UNDESIRABLE DISPLACEMENT MAY OCCUR, CAUSING INJURY TO PERSONNEL AND INACCURATE FIRING.

(b) ATC and Cannoneers Nos. 1, 2 and 5 dig spades in until trail arm striker plate (1) and spade damper (2) have achieved full contact (3).