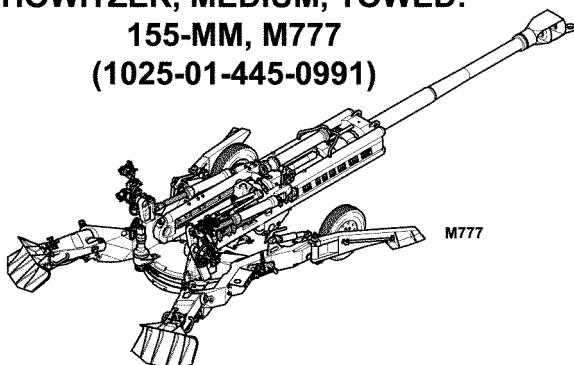


MARINE CORPS TM-10407A-OR/1 ARMY TM 9-1025-215-10

**TECHNICAL MANUAL
OPERATOR'S MANUAL
FOR
HOWITZER, MEDIUM, TOWED:
155-MM, M777
(1025-01-445-0991)**



**HOWITZER, MEDIUM, TOWED:
155-MM, M777A1
(1025-99-411-1447)(EIC:3ET)
155-MM, M777A2
(NSN TBD) (EIC:TBD)**



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TM 9-10407A-10/1/TM 9-1025-215-10 dated 30 June 2006 superseded

TM 9-10407A-10/1/TM 9-1025-215-10 dated 30 April 2005, including all changes.

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**HEADQUARTERS, DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. MARINE CORPS**

JUNE 2006

OPERATOR'S MANUAL
FOR
HOWITZER, MEDIUM, TOWED: 155-MM, M777
(1025-01-445-0991)
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(EIC:3ET)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help to improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028 (Recommended Changes to Publications and Blank Forms), through the internet, on the Army Electronic Product Support (AEPS) website. The internet address is <http://aepls.ria.army.mil>. If you need a password, scroll down and click on "ACCESS REQUEST FORM". The DA Form 2028 is located in the ONLINE FORMS PROCESSING section of the AEPS. Fill out the form and click SUBMIT. Using the form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax, or E-mail your letter or DA Form 2028 direct to: AMSTA-LC-CI Tech Pubs, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The E-mail address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726. Marine Corps users submit NAVMC 10772 to: Commander, Marine Corps Logistics Bases (Code 850), Albany, GA 31704-5000. Marine Corps units should also respond to MARCORSYSCOM Attn: (CBG) with a copy of NAVMC 10722 or via Naval message.

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- Notes: • The portion of the text affected by the changes is indicated by a vertical line in the outer margin of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.
- The USMC changed the title of this manual from TM-10407A-10/1 to TM-10407A-OR/1 in keeping with the ROM. This is applicable throughout the manual. Page headers will be changed in the next revision.

Date of issue for original and changed pages are:

Original.....030 June 2006

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 719, CONSISTING OF THE FOLLOWING:

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ARMY TM 9-1025-215-10**

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RECORD OF CHANGES

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HOW TO USE THIS MANUAL

GENERAL

- a. Whenever the masculine gender (i.e., crewmen) is used in this manual, it includes both masculine and feminine genders.
- b. The text is keyed to the illustrations by numbered callouts. When an item is called out in a procedure, a number in parentheses in the text corresponds with a circled number on the illustration.
- c. The preventative maintenance checks and services table (Para 2-17) includes equipment serviceability criteria. The information normally found in the For readiness reporting ... column is in the Procedures column.
- d. Procedures for unmodified howitzers, where applicable, are provided before procedures for modified howitzers.

INDEXES

- a. **Front Cover Index.** A page reference index of often used portions of the manual.
- b. **Table of Contents.** Lists all chapters and their sections, appendixes, and alphabetical index in order and gives page references to where they begin.
- c. **Chapter Indexes.** All chapters contain indexes with page references.
- d. **Section Indexes.** Lists each paragraph contained in the section and page reference to the first page of the paragraph.
- e. **Symptom Index.** This quick guide to troubleshooting lists common malfunctions in alphabetical order with a page reference to the test or inspection and corrective action.
- f. **Alphabetical Index.** At the back of the book, tells you where in the manual to find a particular subject.

NOMENCLATURE CROSS-REFERENCE LIST

Throughout this manual, most items are referred to by their official nomenclature. On page 1-2, the items referred to by their common names are listed alphabetically and are followed by their official nomenclature.

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WARNING SUMMARY

HAZARDOUS MATERIAL WARNING ICON DEFINITIONS:



FIRE - flame shows that a material may ignite and cause burns.



EXPLOSION - rapidly expanding signal shows that material may explode if subjected to high temperature, sources of ignition or high pressure.



VAPOR - human figure in a cloud shows that material vapors present a danger to life or health.



CHEMICAL - drops of liquid on hands show that material will cause burns or irritation.

BATTERY WARNINGS



WARNING

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



TDC0450

Lithium Batteries

Lithium – Thionyl Chloride (Li-SOCl₂) non-rechargeable batteries present a fire, explosion and vapor hazard. Do not recharge, disassemble, heat above 212° F (100° C), incinerate, puncture, crush, short circuit the terminals, or expose contents to water. If they are abused the high energy level can result in extreme heat or fire.

If battery enclosure shows signs of overheating or becomes hot to the touch, immediately turn off equipment (use ON/OFF switch if supplied, or turn off by unscrewing/removing the battery caps). When removing batteries wear protective equipment.

Li-SOCl₂ batteries contain liquid SOCl₂, which fumes on contact with air. The fumes or vapors are highly toxic, and the liquid is highly corrosive. Therefore, if you smell a sharp suffocating odor or hear a hissing sound, immediately turn off the equipment (use ON/OFF switch supplied, or turn off by unscrewing/removing the battery caps) and leave the area until odor dissipates.

NOTE

Personnel can detect the smell of 1 ppm while concentrations of 10 ppm are dangerous. Once the odor has dissipated, always handle leaking batteries with personal protective equipment meeting ANSI or NIOSH/MSHA requirements.

Use only appropriate batteries for each particular item. Consult technical manual for the correct battery. Never mix rechargeable batteries with non-rechargeable batteries to prevent damage and potential injury. Never short-circuit the terminals. Pay careful attention to the polarity diagram on battery enclosure. Do not install batteries backwards or severe equipment damage may result.

Use only class 'D' fire extinguisher to extinguish battery fires.

**WARNING SUMMARY
(cont)**

Storage and Shipping

Store batteries in original packaging until ready for use. Examine packages/batteries for bulging, cracking, or signs of leakage before putting the batteries into equipment. Remove any damaged batteries from service and dispose of in accordance with local regulations.

NOTE

When handling batteries that show signs of leaking, bulging, swelling, or deformity, personal protective equipment meeting ANSI or NIOSH/MSH requirements must be used.

Store in cool, dry, well-ventilated areas separated from other combustibles and hazardous materials. Storage of batteries over 100° F (38° C) will cause rapid loss of power.

Do not accumulate or store waste batteries for disposal for more than 90 days.

Do not mix hazardous and non-hazardous waste in the same package.

Do not package any battery if it is hot/warm. Package batteries only when they are cool to the touch.

Batteries for disposal shall be collected, transported and disposed of in a manner that will prevent short-circuit (isolate by taping metal poles/terminals), compacting or mutilation to destroy their physical integrity.

Non-usable batteries shall be disposed of in accordance with local regulations. Contact your local environmental office for instructions. Li-SOCl₂ batteries are classified as hazardous waste.

NOTE

A flashing LED light indicates a low battery condition on the M137A2 Pantel (counter box) and the M1A2 collimator. The LED may continue to flash for up to 12 hours. Replace the batteries as soon as possible after encountering this condition.

1.5V alkaline or NiCad batteries may be used in place of 3.6V Lithium – Thionyl Chloride (Li-SOCl₂) batteries for **emergency short-term use only**. Using 1.5V batteries will severely reduce the battery life and they will not work below 32° F (0° C).

ANTENNA

Remain at least 2 feet from radiating antennas of howitzer mounted radios. Antennas can radiate harmful levels of radio frequency.

MERCURY

Thermal warning device contains 0.367 lb (0.166kg) of mercury. Exposure to mercury can cause burns to the skin, eyes and respiratory tract. May be fatal if swallowed or inhaled. Seek emergency assistance immediately. Call HAZMAT personnel for disposal of mercury IAW state/local requirements.

**WARNING SUMMARY
(cont)**



AMMUNITION



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

HEARING PROTECTION

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 e-a-r type (plastic roll) preferred. The effects of blast can be reduced by moving farther to the rear of the weapon. For this reason, all crew members 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.

Properly worn foam earplugs provide adequate protection when firing all existing propellant charges, including M203 series and MACS charges, at all quadrant elevations according to the guidelines in the chart on Para 2-33.

HOWITZER

General

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

Make sure personnel are clear of path of recoil. Loss of nitrogen pressure can allow cannon tube assembly to fall out of battery.

To prevent injury from air pressure, never disconnect airline assemblies before closing prime mover cutout cock (M939 series only).

When howitzer is in the raised position and not connected to the prime mover, howitzer brakes will be applied. Howitzer brakes will be disengaged when howitzer is in the lowered position.

Prior to loading howitzer for actual firing, all personnel must be familiar with prescribed actions in the event of a misfire (Para 2-55 to 2-58) and ensure prefiring checks (Para 2-32) are performed.

When firing howitzer at night, personnel should avoid direct viewing of muzzle flash from their howitzer, or adjacent howitzer, when firing top zones. Temporary flash blindness can be caused by intense muzzle flash, resulting in potential reduction of crew efficiency.

Stickers may occur when firing charge 2, (M3 series propellants). When stickers occur, the projectile lodges in cannon tube and hot gasses under pressure are trapped in the chamber. Removal of the primer is dangerous, as it will be expelled rearward when released. Do not stand behind the breech when removing the primer; the expelled primer may cause injury to personnel standing in its path or ricochet. To prevent injury to personnel, ensure personnel are clear of the PFM when expelling primer.

In case of a MISFIRE/HANGFIRE, follow the misfire procedures prescribed in Para 2-55 thru 2-58. When breech is opened, to remove the 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 (EOD).

WARNING SUMMARY
(cont)

Upon receipt of new issue, overhauled or repaired recoil or scavenge system first round must be fired with a 25ft lanyard.

Before attempting to speedshift, be sure howitzer is free of all ammunition.

Handbrakes are to remain locked if the howitzer is on any degree of an incline and are not to be released until the lunette is on the prime mover pintle. Release of handbrakes while howitzer is on an incline may allow the howitzer to roll causing injury to personnel and/or damage to equipment.

Personnel should stay clear of area between prime mover and howitzer.

Two crewmen are required to remove or install a wheel assembly. Use care to avoid injury.

For safety precautions, prior to beginning any painting operations refer to TM 43-0139. Improper application or removal of CARC paint can be extremely hazardous to your health.

Do not force primer into primer chamber. If primer will not go in, chamber is probably dirty. Forcing primer into primer chamber may cause primer to prematurely ignite powder charge which will cause the howitzer to recoil prematurely and cause serious injury to crew.

Lanyards will not be shortened or injury to personnel may result.

If nitrogen pressure is below 362 psi (25 bar), or above 522 psi (36 bar) the cannon assembly could slide out of battery and cause severe personal injury. Make sure personnel are clear of recoil path.

When moving howitzer with third wheel installed, ensure personnel are standing clear from rear of howitzer, failure to do so may cause injury to personnel and/or damage to equipment.

DFCS

Raising or lowering the Under Cradle Electronics Assembly should be done in accordance with the specified procedures. Because of the weight, any necessary manual adjustments of the assembly (to insert retaining pins) should be done by two personnel to minimize risk of personnel injury or equipment damage.

The surface of the PCCM can become hot enough to cause skin burns. Allow the PCCM to cool down before attempting remove/handle this unit.

SINCGARS antenna and antenna cable/connectors (See WARNING text in Chapter 2).

Power [W3] and CSD [W16] cables present Trip/Fall hazards. Use care when placing and walking around the cables.

Risk of electrical shock due to exposed voltage (200VDC) on printed wiring board portion of [W23] cable attached to rear of CLA divider assembly. Turn off system power before removing any hardware/LRUs from the CLA.

Wire rope isolators may retain NBC and/or decontamination agents. Special cleaning procedures or replacement may be required if satisfactory cleaning cannot be achieved.

Even with the PCCM power switch in the OFF position there is a small power draw by the PCCM. Minor arcing may occur during removal/installation of the [W5] or [W17] cables.

**WARNING SUMMARY
(cont)**

If operating M777A1 and M777A2 howitzer, ensure CLA door is closed and secure and padlock is removed before firing. Failure to do so may cause injury to personnel and/or damage to equipment.

During system initialization, selection of inappropriate spheroid/datum values may result in targeting errors. Any changes to the currently loaded spheroid/datum values should be verified by the SC, before completing initialization.

Antenna shaft should be removed for all transport conditions where the DFCS does not have to remain operational during transport.

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

Do not fire M4A2 propelling charge in any M777/M777A1/M777A2 unless the two M2 flash reducers are inserted behind the forward increment of the M4A2 when firing charge 4W, 5W, 6W and 7W. Flash reducers should be tied to the front of the M4A2 charge, under the cloth tie-straps, when firing charge 3W.

FIRST AID

For further information on first aid refer to: FM 4-25.11 (Army)/MRCP 3-02G (Marine Corps), and Battle Skills Training Handbook, Book 2, Pvt. - L/Cpl. (Marine Corps).

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CHAPTER 1

INTRODUCTION

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Section I. GENERAL INFORMATION

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1-1 SCOPE

This manual tells the howitzer crew how to operate and maintain the howitzer in the field. It also includes training procedures.

- a. **Type of Manual.** Operator's Manual.
- b. **Model Number and Equipment Name.** Howitzer, Medium, Towed 155mm, M777/M777A1/M777A2.
- c. **Purpose of Equipment.** To provide artillery fire in support of ground-gaining troops.
- d. **Special Inclusions in Manual.** This manual includes section drill procedures as detailed in Section IV.

1-2 MAINTENANCE FORMS AND RECORDS

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS). Marine Corps personnel will use TM 4700-15/1, Equipment Record Procedures.

1-3 HAND RECEIPT (HR) MANUALS

This manual has a companion document with a TM number followed by "HR" (which stands for Hand Receipt). The TM 9-1025-215-10-HR consists of pre-printed hand receipts (DA Form 2062) that list end item related equipment (i.e. COEI, BII and AAL) that must be accounted for. As an aid to property accountability, additional - HR manuals may be requisitioned from the following source in accordance with procedures in Chapter 3, AR 25-30:

1-3 HAND RECEIPT (HR) MANUALS (cont)

Commander
US Army Publications Distribution
Center-St. Louis
ATTN: SFIS-APC-S-OC
1655 Woodson Road
St. Louis, MO 63114-6181

1-4 REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS

If your howitzer needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on a SF 368 (Product Quality Deficiency Report). Mail it to us at: ATTN: AMSTA-AR-QAW-C, TACOM-ARDEC, 1 Rock Island Arsenal, Rock Island, IL 61299-7300 (FAX: Commercial (309) 782-6653, DSN 793-6653 (E-mail: qawqdrs@ria.army.mil. Marine Corps users submit a Product Quality Deficiency Report (SF 368) in accordance with MCO 4855. -10, Product Quality Deficiency, and TM 4700-15/1, Equipment Record Procedures, to: Commanding General, ATTN: Code (808-1), Marine Corps Logistics Base, 814 Radford Blvd, Albany, GA 31704-1128. We'll send you a reply.

1-5 CORROSION PREVENTION AND CONTROL

a. Corrosion Prevention and Control (CPC) of service materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in future items.

b. While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of these materials may be a corrosion problem. If a corrosion problem is identified, it can be reported using SF 368, Product Quality Deficiency Report. Use of key words such as "corrosion", "rust", "deterioration," or "cracking" will assure that the information is identified as a CPC problem. Submit the form to: ATTN: AMSTA-AR-QAW-C, TACOM-ARDEC, 1 Rock Island Arsenal, Rock Island, IL 61299-7300 (FAX: commercial (309) 782-6653, DSN 793-6653 (E-mail: qawqdrs@ria.army.mil. Marine Corps users submit a Product Quality Deficiency Report (SF 368) to: Commanding General, ATTN: Code (808-1), Marine Corps Logistics Base, 814 Radford Blvd, Albany, GA 31704-1128.

1-6 NOMENCLATURE CROSS-REFERENCE LIST

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

HOWITZER COMMON NAMES	OFFICIAL NOMENCLATURE
Breech lever	Breech operating valve lever
Breech crank locking pin.....	Quick release pin
Cannon tube.....	Ordnance
Emergency airline assembly	Emergency hose assembly
Equilibrator	Balancer
Equilibrator and lines.....	Balancer and pipework
Equilibrator Indicator	Balancer adjusting indicator
Firing lever	Remote firing lever
Firing mech	M51 firing mechanism
FM wrench	Firing mechanism wrench
Handbrakes.....	Left and right manual brake assemblies
Loading tray lever.....	Loading tray control valve lever
Obturator.....	Bolt vent axial
Oil index pin	Tell-tale rod
Pantel.....	M137A2 panoramic telescope

PFM lever.....	PFM manual handle
Round roller.....	Rear projectile roller
Recoil accumulator	Recuperator
Recoil cylinders.....	Buffer cylinders
Recoil yoke.....	Buffer yoke
Scavenge isolator valve.....	Scavenge system isolator valve
Service airline assembly.....	Service hose airline
Suspension lever.....	Suspension operating valve lever
Travel locks.....	Elevation travel locks
Trunnion pump.....	Trunnion pump adaptor
Wheel locking lever.....	Wheel axle arm locking plunger

1-7 LIST OF ABBREVIATIONS/ACRONYMS

a. The following alphabetical list gives definitions for the abbreviations and acronyms used for the howitzer.

AAL	Additional Authorization List
ADAM.....	Area Denial Artillery Munition
AG	Assistant Gunner
ASP	Ammunition Supply Point
ATC.....	Ammunition Team Chief
AZ.....	Azimuth
BE	Base Ejection
BII	Basic Issue Items
CA	Canada
CASP	Chemical Ammunition Supply Point
CCW	Counterclock Wise
CHG	Charge
CLGP	Cannon Launched, Guided Projectile
CLP	Cleaner, Lubricant and Preservative
COEI	Components of End Item
CP	Concrete-Piercing
CPC	Corrosion Prevention and Control
CTA.....	Complete Table of Allowances
CW	Clockwise
D.....	Driver
DA	Denmark
DAP	Distant Aiming Point
DF	Deflection
DLY	Delay
DODIC	Department of Defense Identification Code
DP	Dual Purpose
DS	Direct Support
ECCM	Electronic Counter Counter Measures
EFC	Equivalent Full Charge
EIRs	Equipment Reporting Improved Recommendations
EL.....	Elevation
EOD	Explosive Ordnance Disposal
EPIAFS*	Enhanced Portable Inductive Artillery Fuze Setter
ERLS.....	Elimination Radioactive Light Source
ET.....	Electronic Time
FAPP.....	Field Artillery Projectile Pallet
FAST	Fast Azimuth Shift Tool
FDC.....	Fire Direction Center
FMTV	Family of Medium Tactical Vehicles
* (Future Upgrade)	

1-7 LIST OF ABBREVIATIONS/ACRONYMS (cont)

FPF	Final Protective Fire
FR	France
FRBC	Flexible Rotating Band Cover
FZ	Fuze
G	Gunner
GB	Nerve Agent, Non-Persistent
GB	Green Bag
GE	Germany
GMD	Grease Molybdenum Disulphide
GR	Greece
H	Mustard Gas
HC	White Smoke Canisters
HD	Distilled Mustard Gas
HE	High Explosive
HEAT	High-Explosive, Anti-Tank
HERA	High Explosive, Rocket Assisted
HP	High Pressure
ICM	Improved Conventional Munitions
IT	Italy
LAW	Lubricant All Weather
LCD	Liquid Crystal Display
LED	Liquid Emitting Diode
LP	Low Pressure
LPRS	Loose Projectile Restraint System
MACS	Modular Artillery Charge System
MOFA	Multi-Option Fuze Artillery
MOUT	Military Operations Urban Terrain
MT	Mechanical Time
MTSQ	Mechanical Time and Super Quick
MTVR	Medium Tactical Vehicle Replacement
MVS	Muzzle Velocity System
NATO	North Atlantic Treaty Organization
NBC	Nuclear Biological Chemicals
NL	Netherlands
NO	Norway
OFC	Optical Fire Control
PD	Point Detonating
PFM	Primer Feed Mechanism
PIAFS	Portable Inductive Artillery Fuze Setter
PIK*	Portable Integration Kit
PMCS	Preventative Maintenance Checks and Services
POC	Platoon Operations Command
RAAMS	Remote Anti-Armor Mine System
RAP	Rocket Assisted Projectile
RB	Red Bag
RF	Radio Frequency
RPM	Revolutions Per Minute
S&A	Safe & Arming Mechanism
SADARM	Sense and Destroy Armor Munition
SC	Section Chief
SOP	Standing Operating Procedure
SQ	Super Quick
TI	Time
TNT	Trinitrotoluene Nitrate Toluene
* (Future Upgrade)	

TWD	Thermal Warning Device
UK	United Kingdom
USMC	United States Marine Corps
VHF	Very High Frequency
VT	Variable Time
VX	Nerve Agent Persistent
WB	White Bag
WP	White Phosphorous
W/SUPPL.CHG	With Supplementary Charge

b. The following alphabetical list gives definitions for the abbreviations and acronyms used for the Digital Fire Control System (DFCS) system.

AGD	Assistant Gunners Display
AMP	Radio Amplifier
ANT	Radio Antenna
BAT	Battery
BIT	Built in Test
BTT	Battery Temperature Sensor
CLA	Communication Location Assembly
CLE	Communication Location Enclosure
CSD	Chief of Section Display
DAGR*	Defense Advanced GPS Receiver
DFCS	Digital Fire Control System
GND	Gunners Display
GPS	Global Positioning System
INU	Inertial Navigation Unit
LCD	Liquid Crystal Display
MSC	Mission Computer
PCCM	Power Conditioning and Control Module
PWR	Power
PWS	Power
RPS	Radio Power Supply
RTA	Radio Transceiver
SOC	State Of Charge
SINCGARS	Single Channel Ground and Airborne Radio System
VMS	Vehicle Motion Sensor

* Future Upgrade.

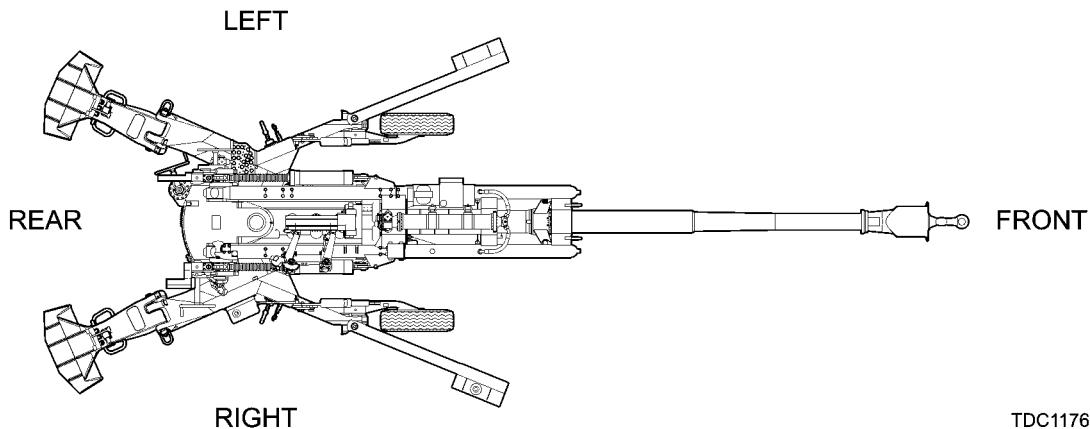
1-8 GLOSSARY

The following is an alphabetical listing of terms with definitions used in this manual. These terms need explanation and are not defined within the text.

- a. **Front of Howitzer.** The muzzle end of the howitzer.
- b. **Howitzer Section.** Those personnel specified by the current table of organization and equipment that make up the howitzer section.
- c. **Left Side of Howitzer.** At a person's left-hand side when standing at the breech end of the howitzer, facing toward the cannon muzzle.
- d. **Rear of Howitzer.** The breech end of the howitzer.

1-8 GLOSSARY (cont)

- e. **Right Side of Howitzer.** At a person's right-hand side when standing at the breech end of the howitzer, facing toward the cannon muzzle.



TDC1176

1-9 WARRANTY INFORMATION

Not Applicable

Section II. EQUIPMENT DESCRIPTION

Section Index

Paragraph		Page
1-10	Equipment Characteristics, Capabilities, and Features.....	1-6
1-11	Location and Description of Major Components	1-7
1-12	Modification and System Improvement Package	1-16
1-13	Data Plates	1-16
1-14	M777A1/M777A2 Howitzer DFCS Cable Routing Identification.....	1-21
1-15	Equipment Data.....	1-24

1-10 EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

- a. The howitzer provides general support field artillery firing for light divisions by providing non-nuclear firing.
- b. The howitzer is an extended range weapon that can be towed by any four-wheel drive vehicle over 2.5 tons. The howitzer is also transportable by rotary and fixed wing aircraft. The body has trails, spades, and stabilizers that can be folded for transportation and storage.
- c. The Optical Fire Control (OFC) equipment may be used by one or two crewmen for direct or indirect fire. The Gunner on the left side controls left and right (traversing) settings and the Assistant Gunner on the right side controls elevation and depression settings. The equipment can also be operated by a Gunner on the left side controlling both traversing and elevation settings.
- d. All vials, reticles, and counters on the OFC and accessory equipment are illuminated by battery powered Light Emitting Diodes (LED) and Elimination Radioactive Light Source (ERLS).

e. The Digital Fire Control System (DFCS) is a computer based indirect fire control system for the M777A1 and M777A2 howitzer. DFCS provides:

- Gun location.
- Pointing.
- Navigation.
- Digital communications.
- Emplacement/displacement aid capability.

f. The howitzer has a low profile, may be emplaced rapidly, and has a 6400-mil speed shift capability.

1-11 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

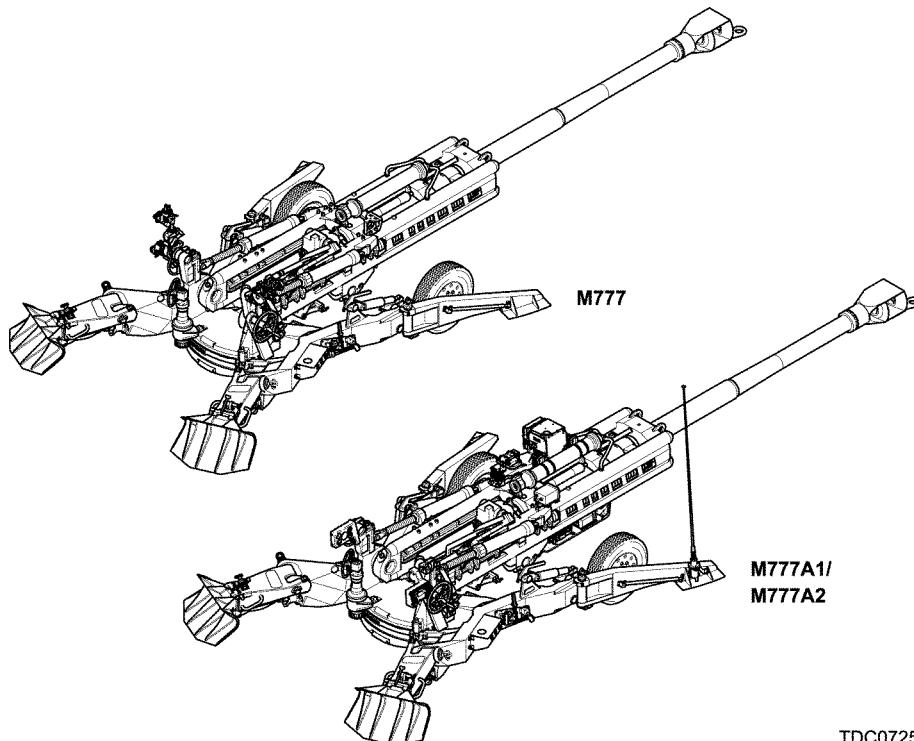
a. Differences between models:

(1) M777 howitzer uses OFC equipment.

(2) M777A1 howitzer has DFCS mounted and uses DFCS Block 1 software with Gun Display Unit (GDU) protocol.

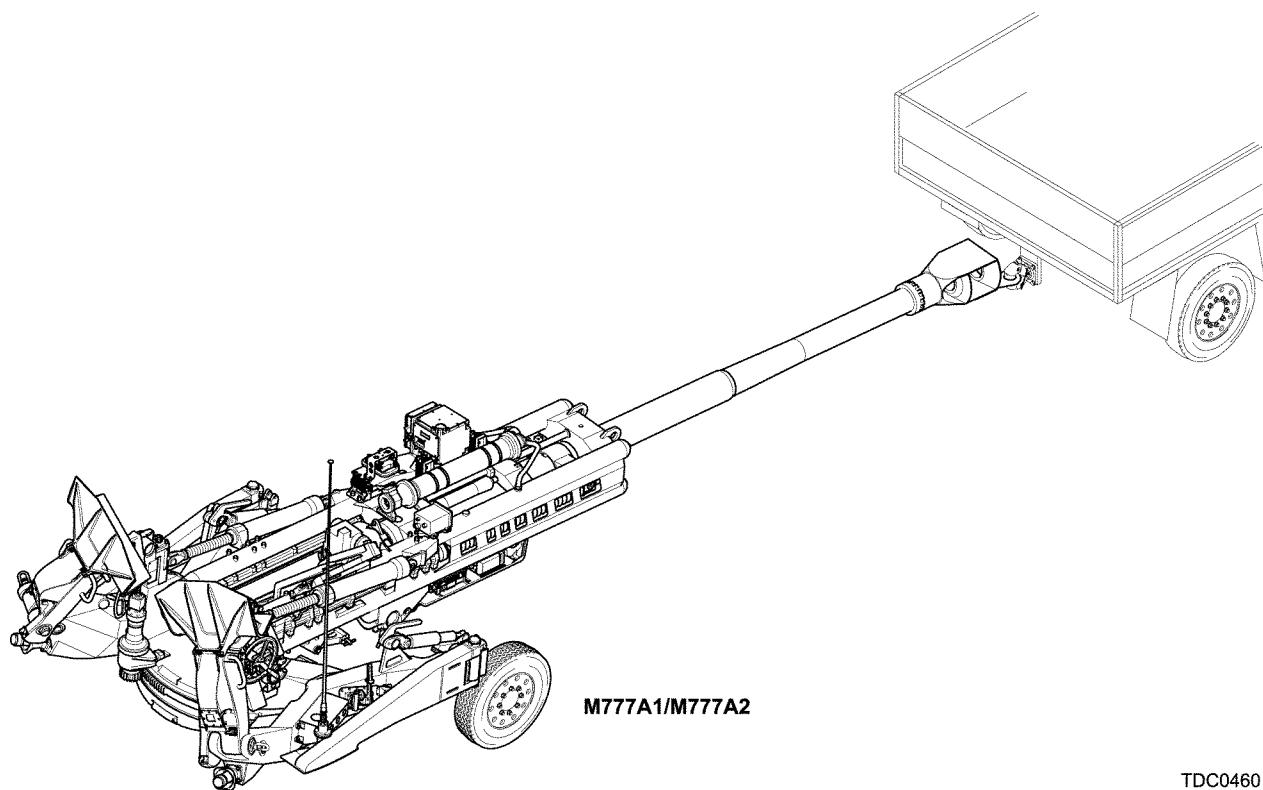
(3) M777A2 howitzer has DFCS mounted and uses DFCS Block1a software with Joint Variable Message Format (JVMF) protocol. The Enhanced Portable Inductive Artillery Fuze Setter (EPIAFS) Platform Integration Kit (PIK) and setter mounted to an M777A2 howitzer makes the howitzer Excalibur capable and the user can set Excalibur projectiles and inductive fuzes through the DFCS. However, EPIAFS is not required, and may not be mounted, on the M777A2.

b. **Howitzer Positions.** The firing and towed positions respectively, for the howitzer, are illustrated as follows:



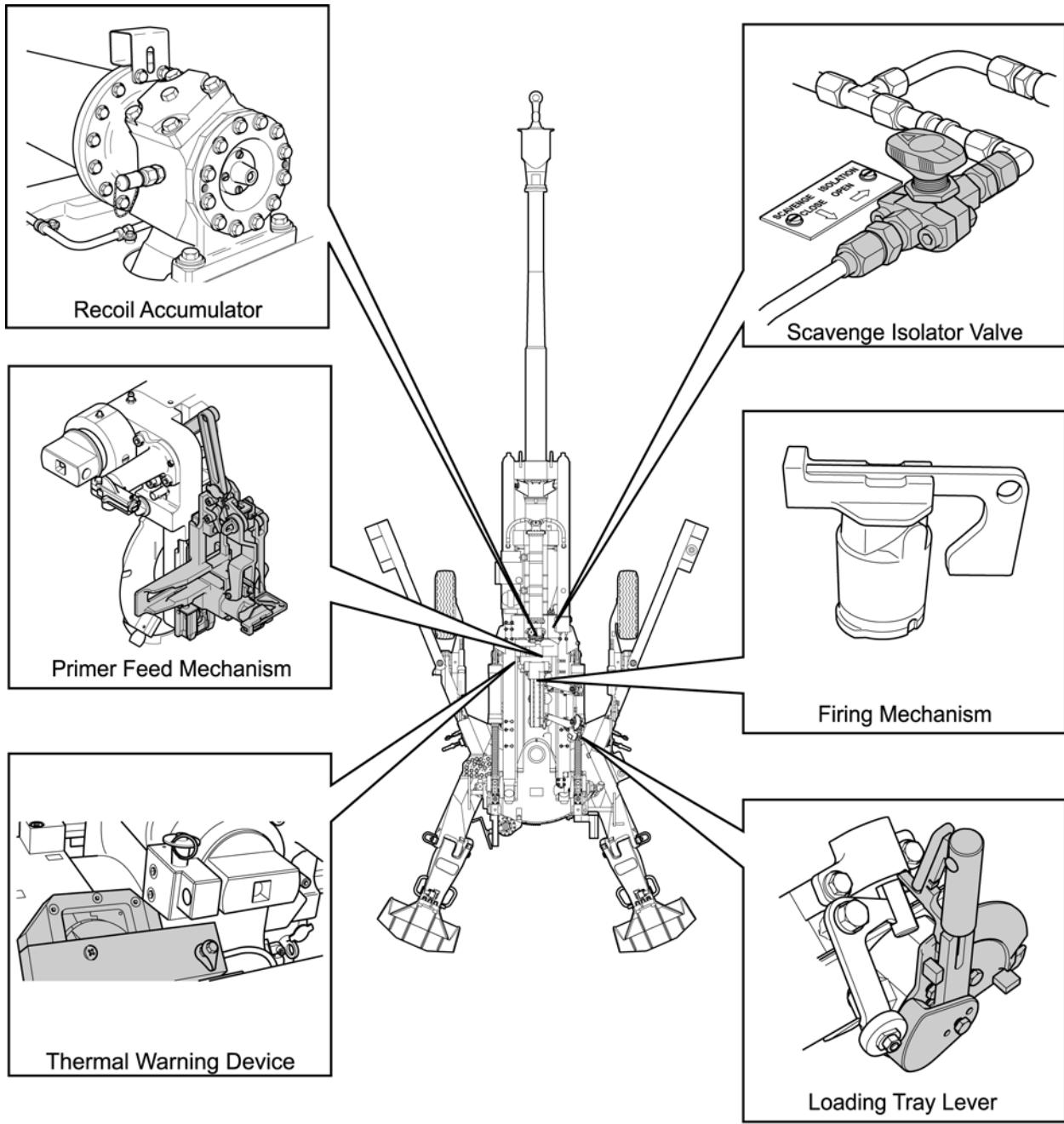
FIRING POSITION

1-11 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (cont)



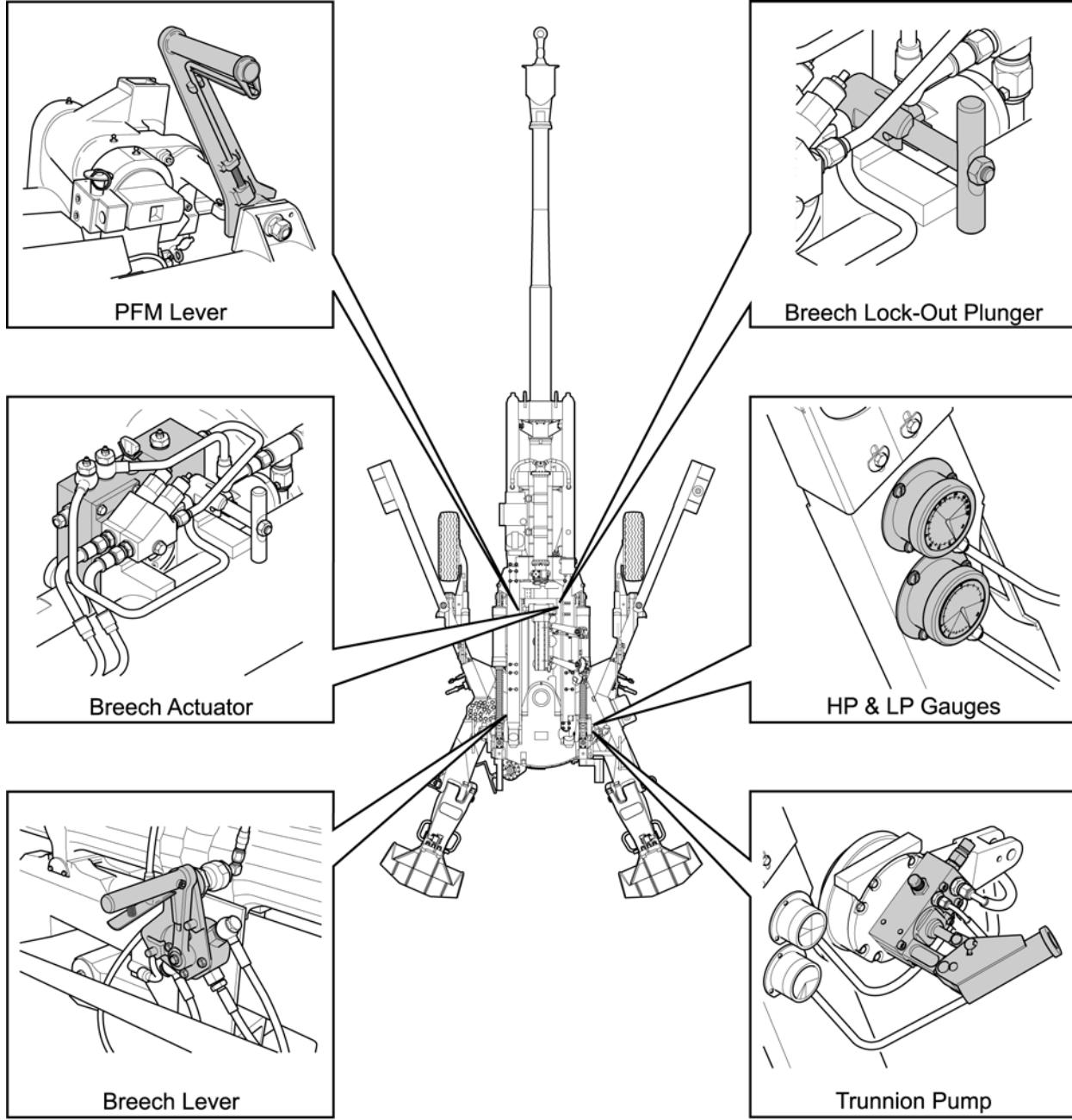
TOWED POSITION

c. **Howitzer Components.** Familiarize yourself with the components of the howitzer as detailed in the following illustrations: (See Chapter 2, Section I, for description of Controls and Indicators).

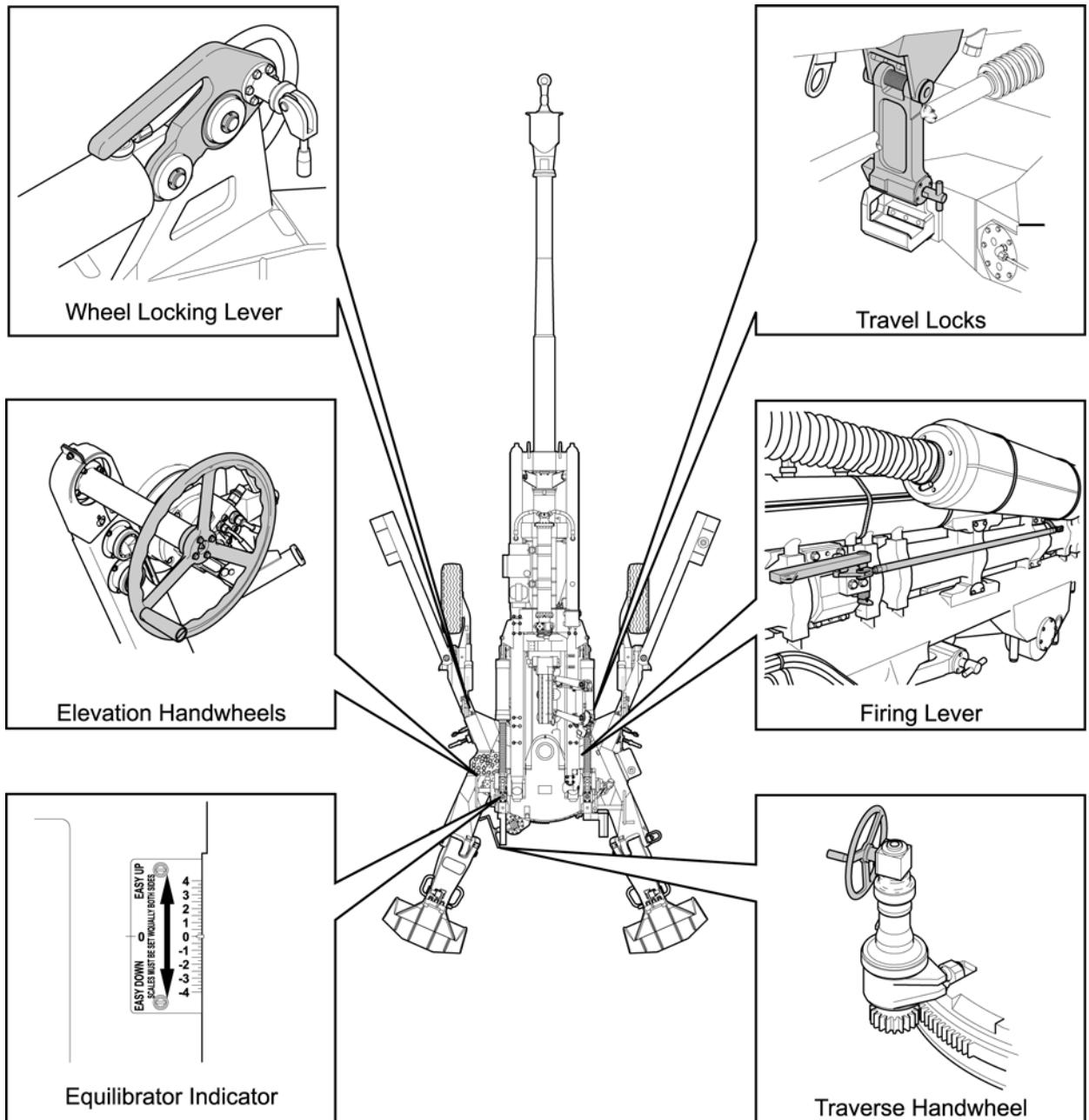


TDC1177

1-11 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (cont)

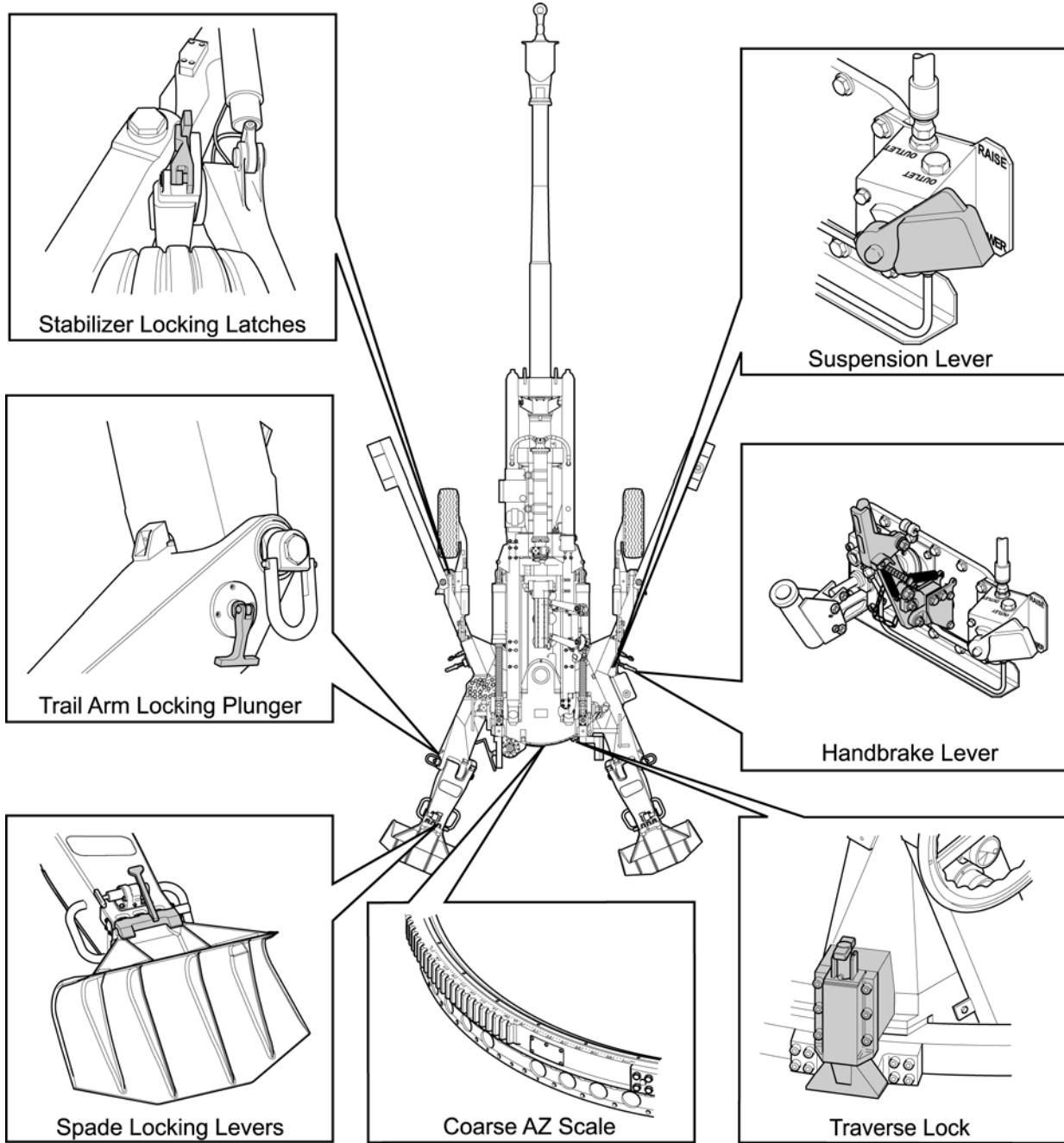


TDC1178



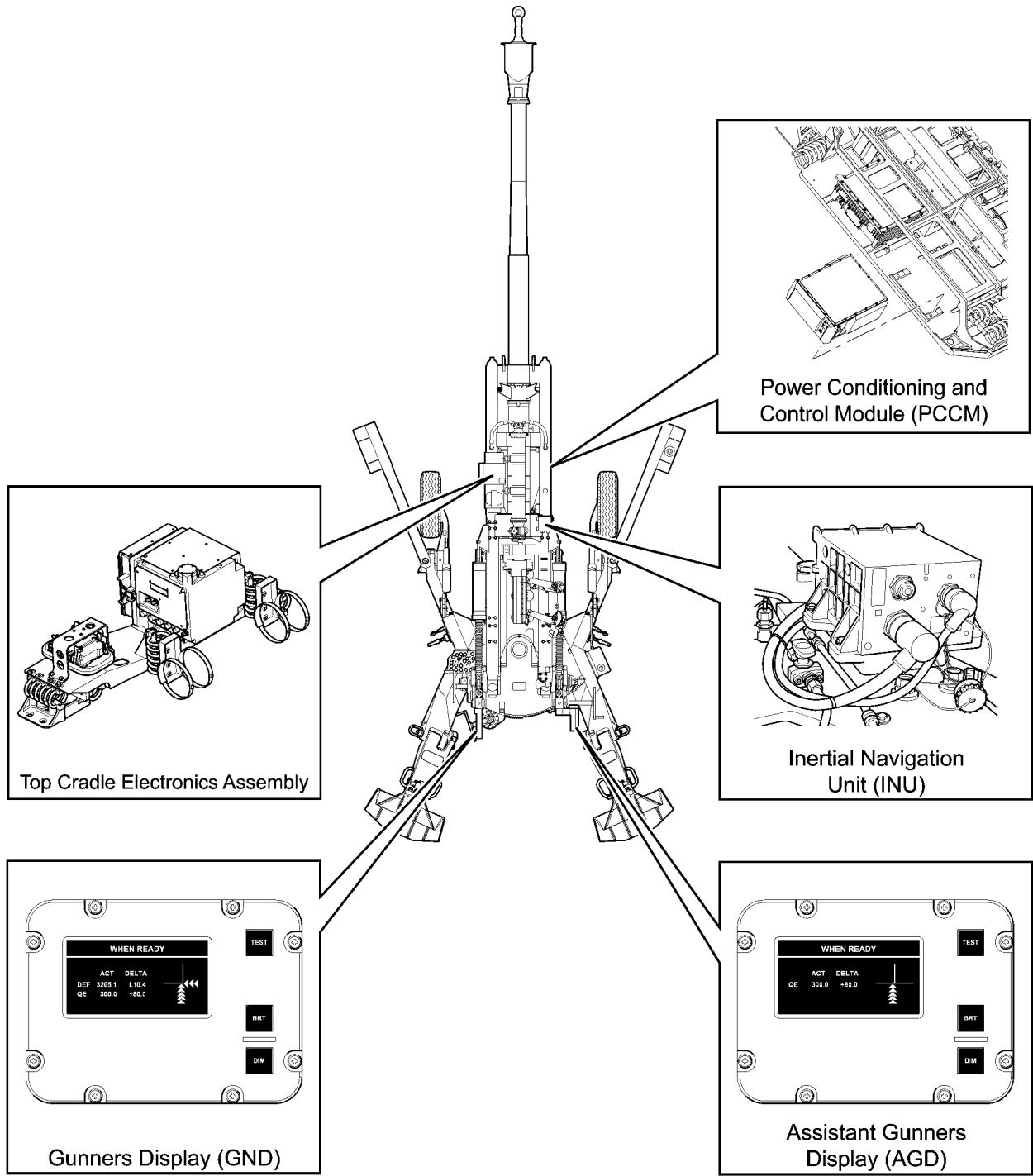
TDC1179

1-11 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (cont)



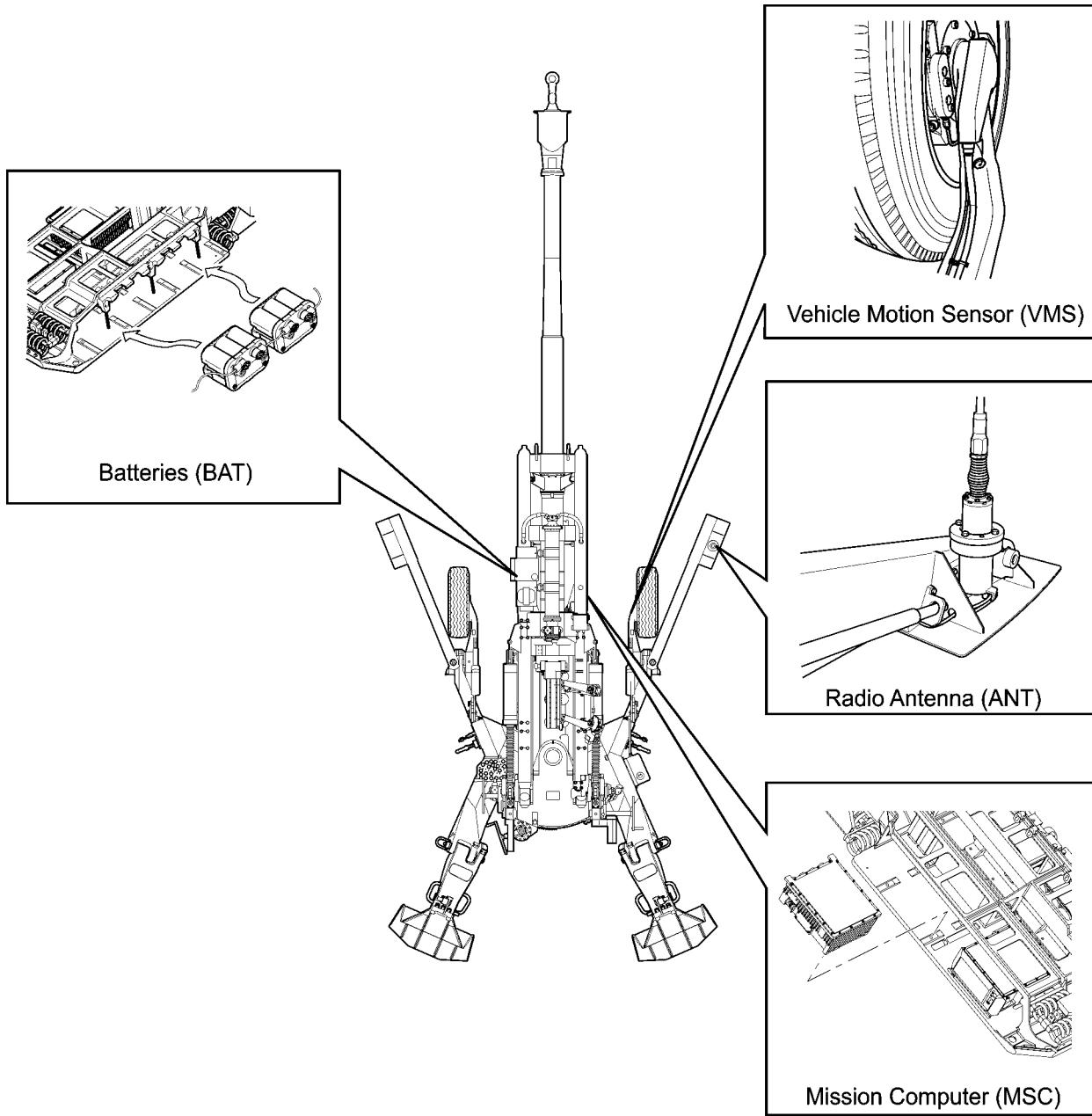
TDC1175

d. **DFCS Components.** Familiarize yourself with the components of the DFCS as detailed in the following illustrations: (See Chapter 2, Section I, for description of Controls and Indicators).



TDC1180

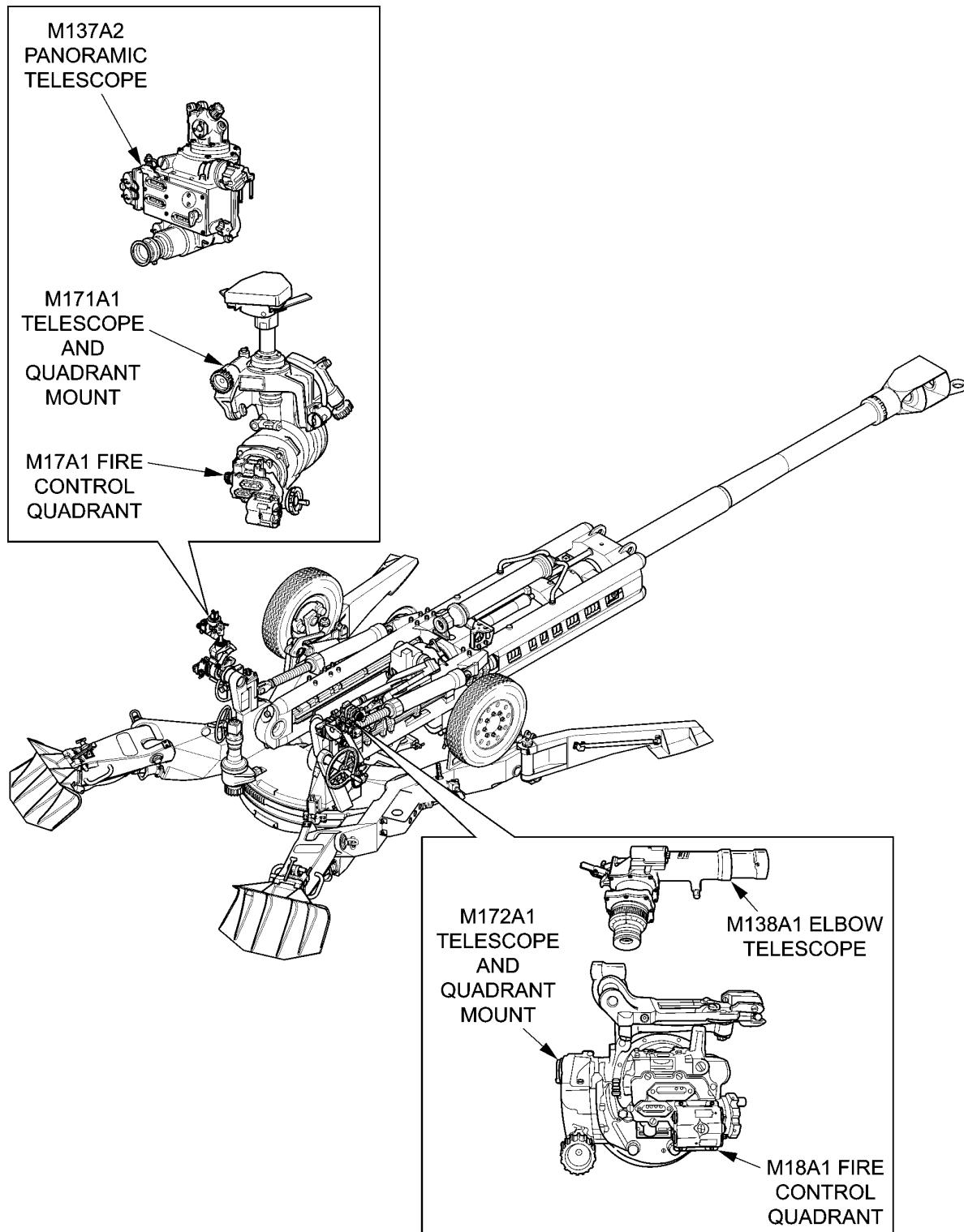
1-11 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (cont)



TDC1181

1-11 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (cont)

e. **OFC Components.** Familiarize yourself with the components of the OFC as detailed in the following illustrations:



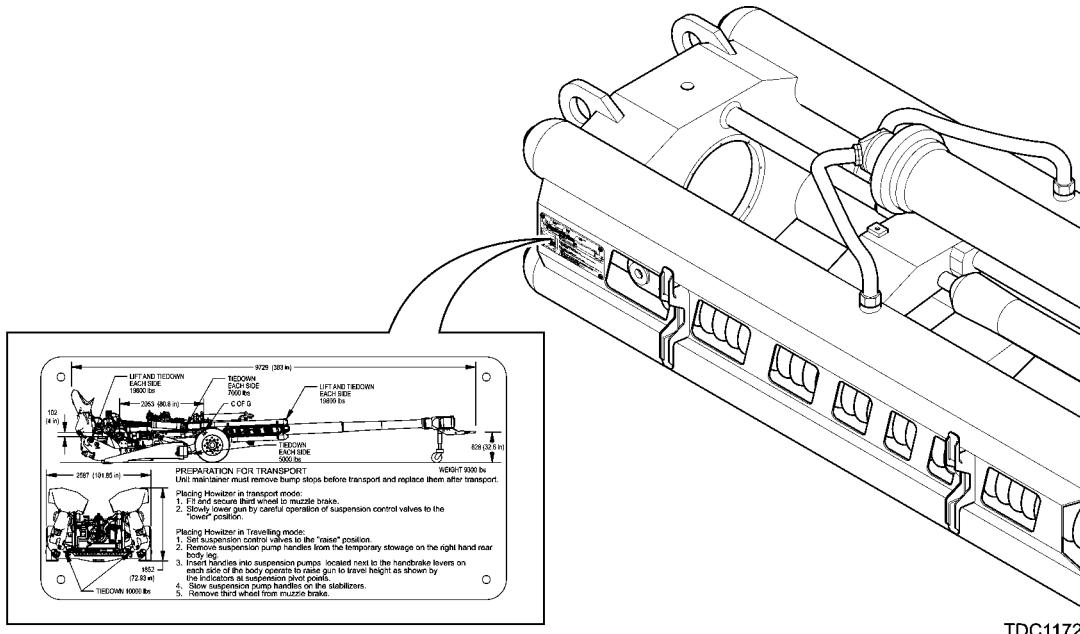
TDC0466

1-12 MODIFICATION AND SYSTEM IMPROVEMENT PACKAGE

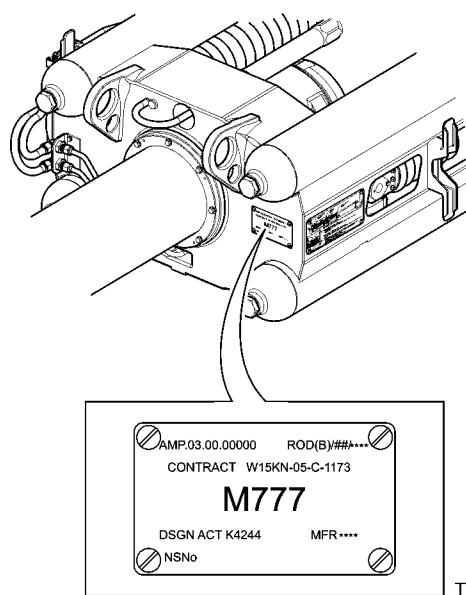
Not Applicable

1-13 DATA PLATES

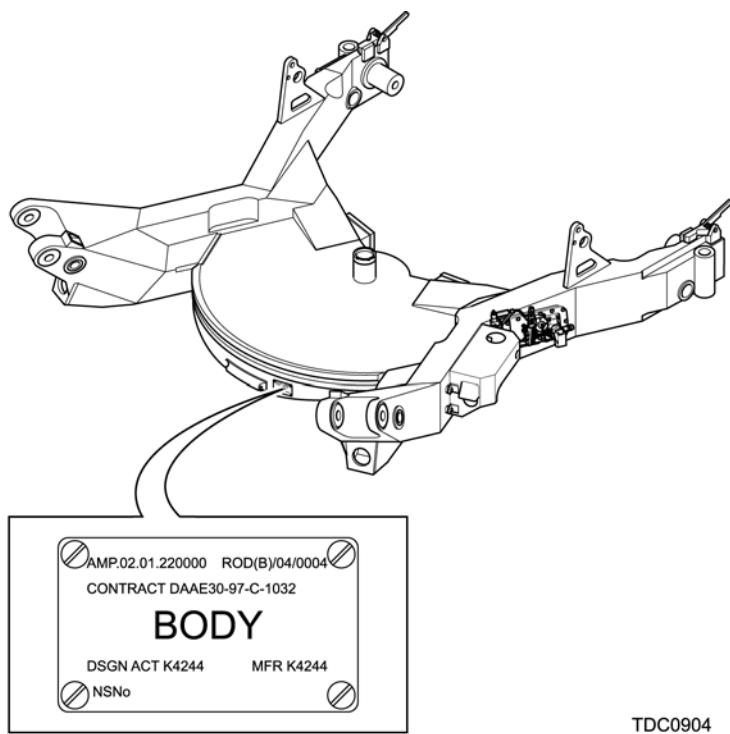
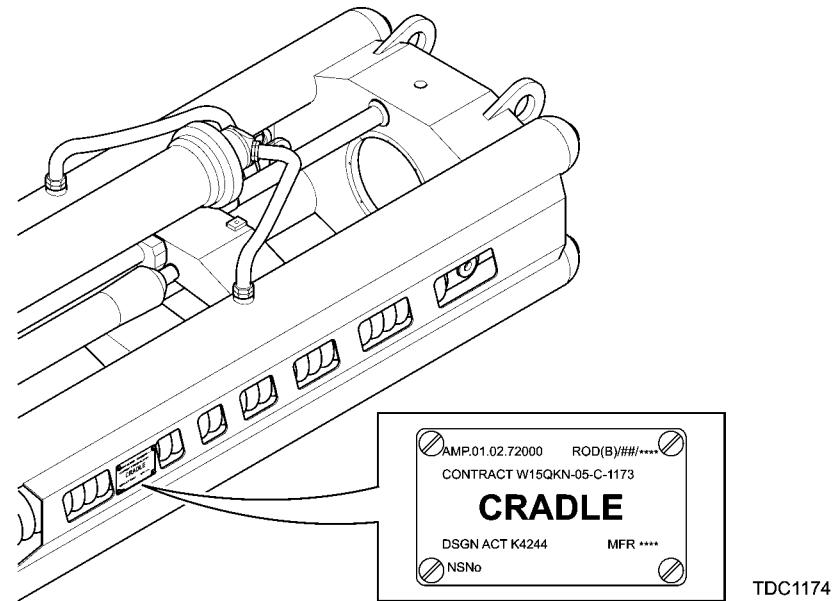
- For location of data plates, refer to the following illustrations:



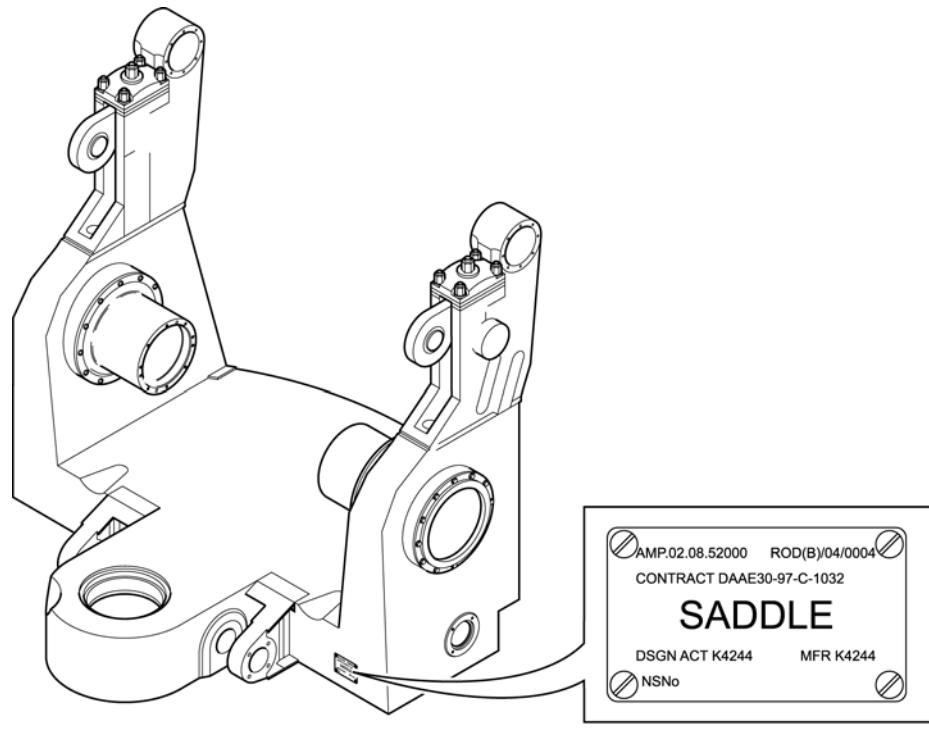
TDC1172



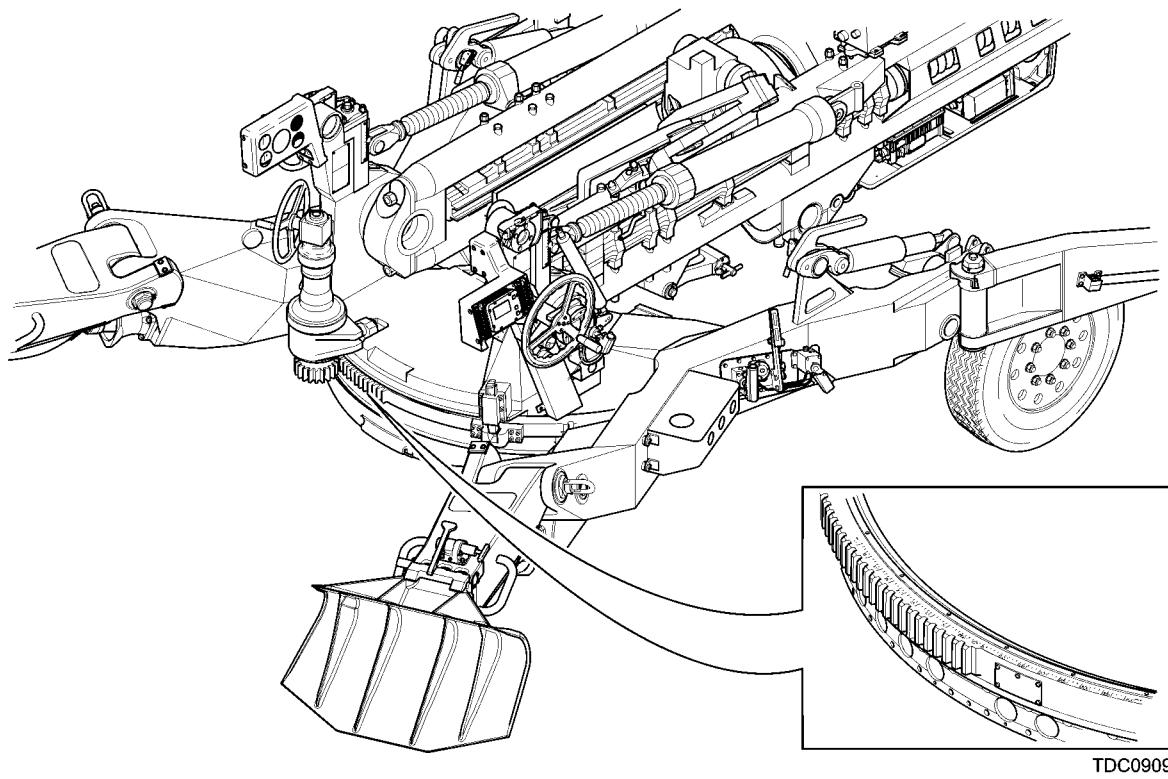
TDC1173

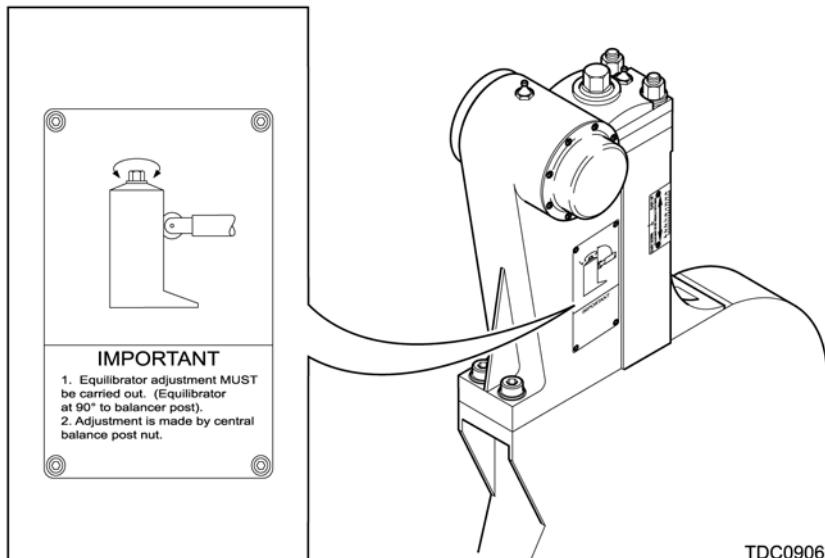


1-13 DATA PLATES (cont)

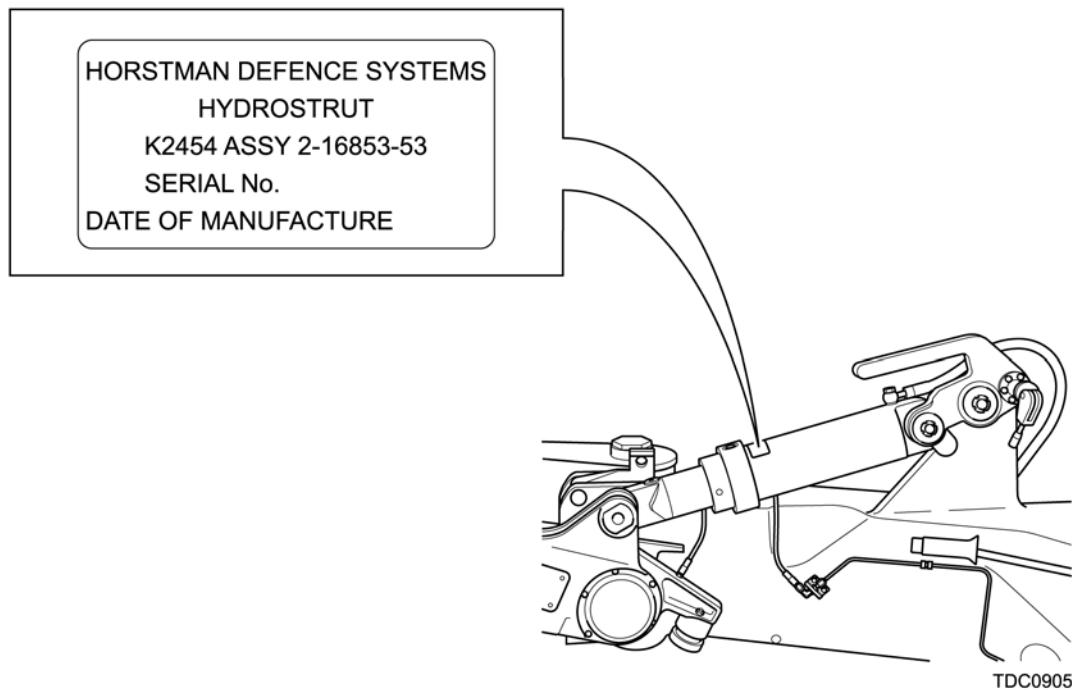


TDC0908



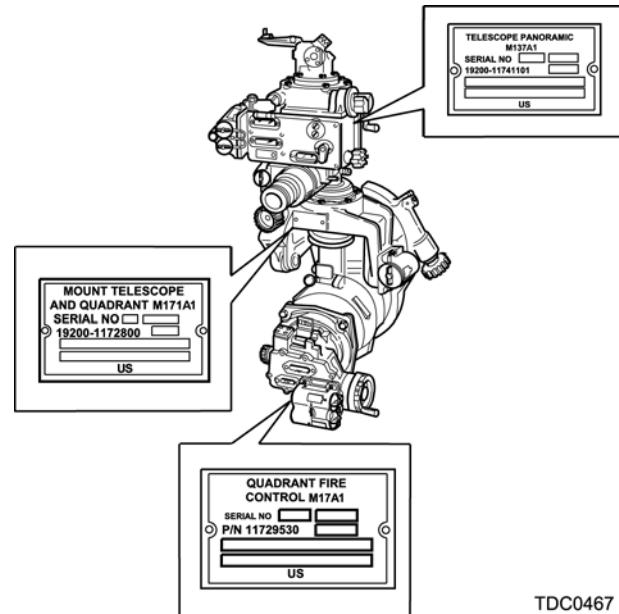


TDC0906

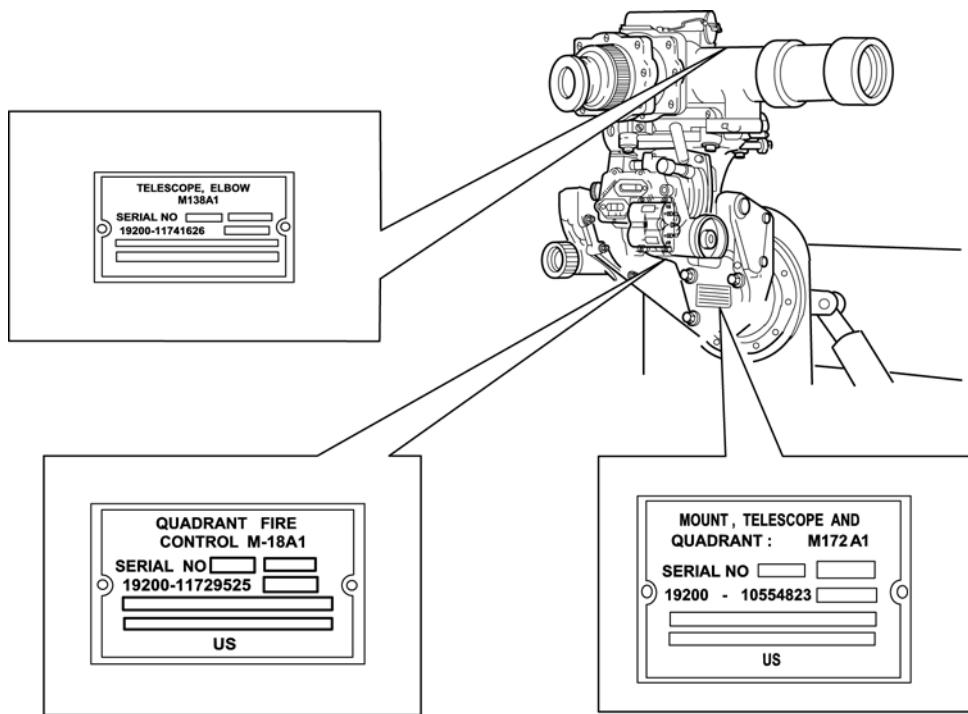


TDC0905

1-13 DATA PLATES (cont)



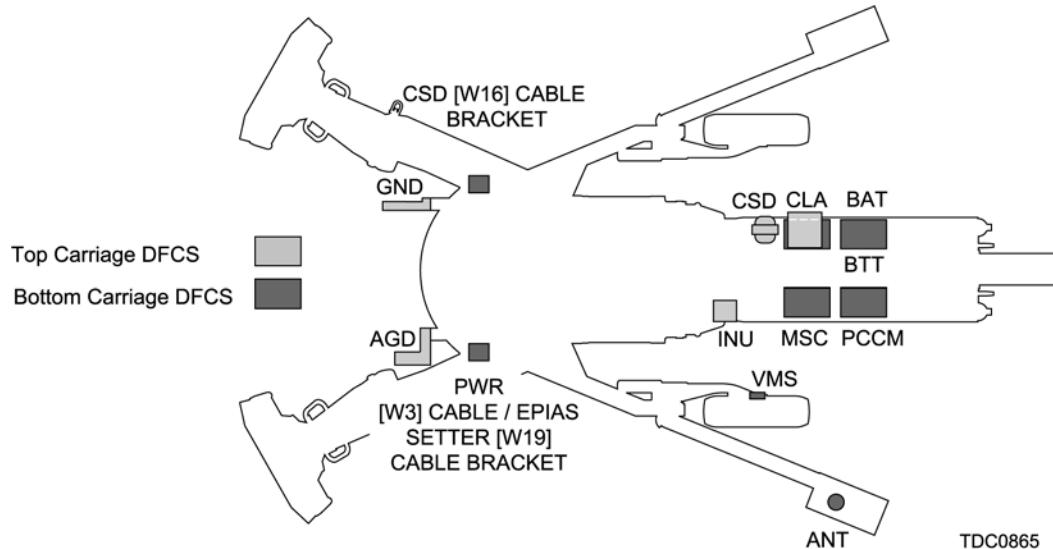
TDC0467



TDC0468

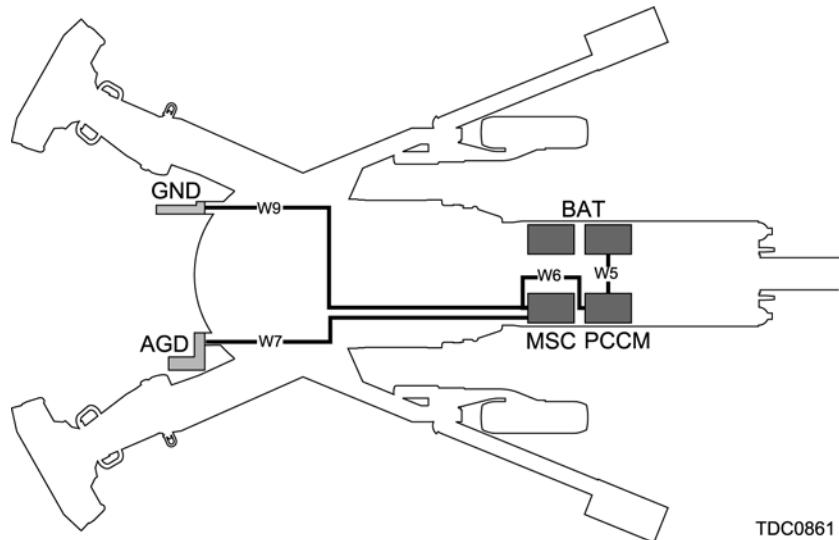
1-14 M777A1 AND M777A2 HOWITZER DFCS CABLE ROUTING IDENTIFICATION

a. For identification and location of top and bottom carriage M777A1 and M777A2 howitzer DFCS, refer to the following illustration:



b. For identification and location of M777A1 and M777A2 howitzer DFCS cable routing, refer to the following illustrations:

- (1) [W5] cable – BAT to PCCM.
- (2) [W6] cable – MSC to PCCM.
- (3) [W7] cable – AGD to MSC.
- (4) [W9] cable – GND to MSC.



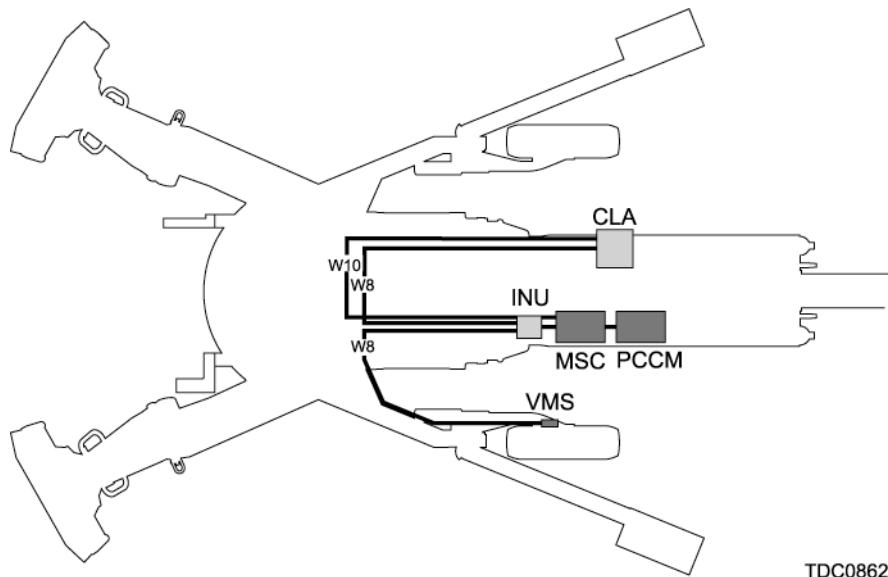
1-14 M777A1 AND M777A2 HOWITZER DFCS CABLE ROUTING IDENTIFICATION (cont)

- (5) [W8] cable – INU/VMS and CLA/MVS to PCCM/MSC.

NOTE

[W8] cable from CLA to MVS is for future applications.

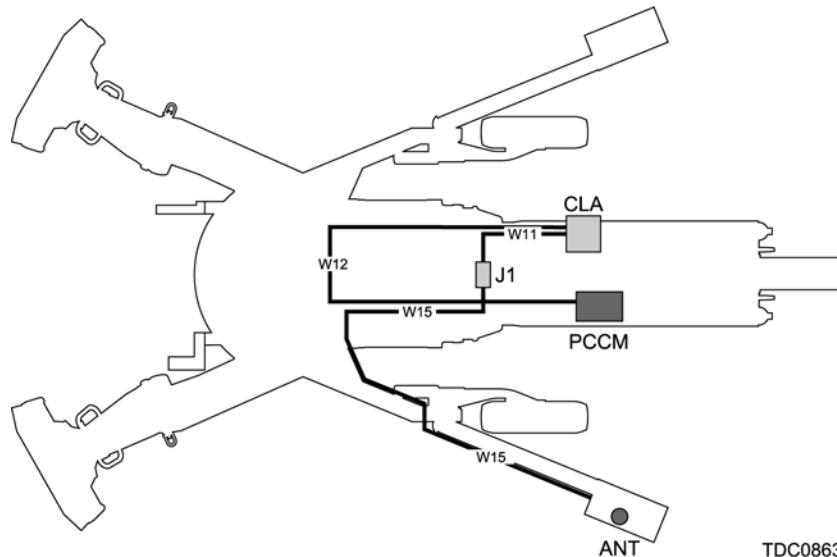
- (6) [W10] cable – CLA to MSC.



TDC0862

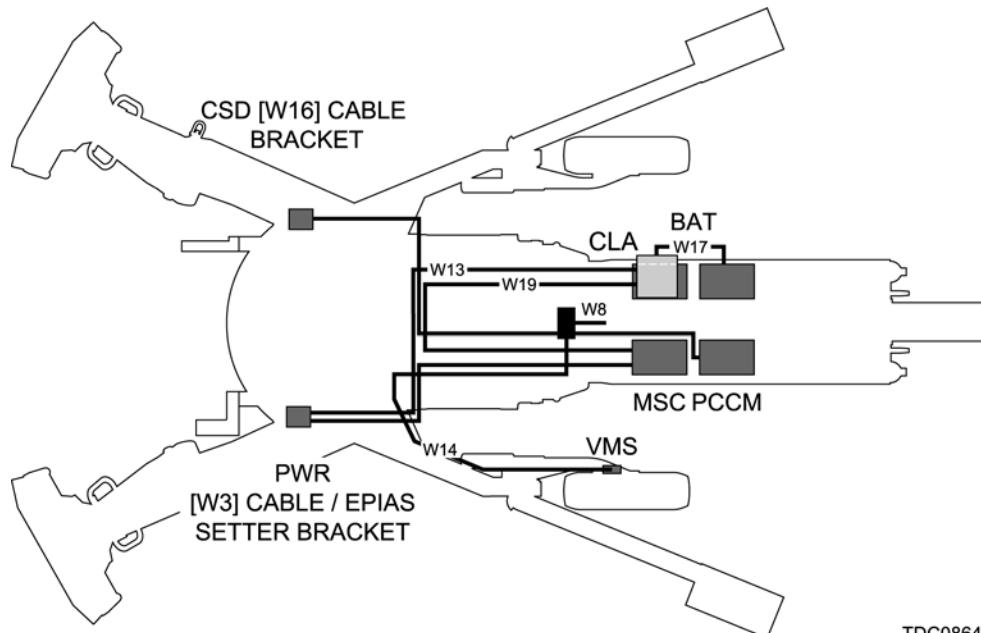
- (7) [W11] cable – CLA to [W15] cable [J1] socket connection and ANT.

- (8) [W12] cable – CLA to PCCM.

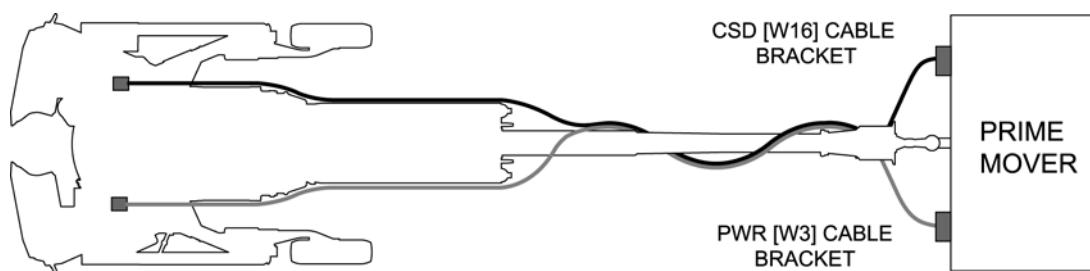


TDC0863

- (9) [W14] cable – VMS to [W8] cable [J1] socket connection.
- (10) [W17] cable – AFT BAT to FWD BAT.
- (11) [W4] cable – CSD [W16] CABLE BRACKET to MSC.
- (12) [W20] cable – PWR [W3] CABLE BRACKET to PCCM.
- (13) [W19] cable – EPIAFS [W13] CABLE BRACKET to MSC.



- (14) [W16] and [W3] cables – CSD [W16] and PWR [W3] CABLES to PM.



TDC0910

1-15 EQUIPMENT DATA

a. Howitzer Performance Data

Brakes:

Parking..... Manually operated
Service..... Air/Oil power

Breech life Original and five tubes

Breech type Screw block, interrupted thread

Dimensions (travel conditions):

Ground clearance at rear of body..... 2 ft 3 in (0.66 m)

Height at spades:

Towed position 7 ft 2 $\frac{2}{3}$ in (2.65 m)

Length:

Firing position 35 ft (10.21 m) (center traverse) 35 ft 4 in (10.83 m) (maximum traverse)

Towed position 31 ft 2 $\frac{1}{4}$ in (9.51 m)

Tread (center-to-center) 7 ft 6 $\frac{1}{2}$ in (2.30 m)

Width:

Firing position 12 ft 2 $\frac{1}{2}$ in (3.72 m)

Towed position 8 ft 6 in (2.59 m)

EFC rating TM 9-1000-202-14

<u>Zone</u>	<u>EFC</u>
8-S	1.000
8	0.500
7 Red	0.250
7 White	0.150
3-6 White	0.050
1-5 Green	0.050
M231	1
M231	2
M232/M232A1	3
M232/M232A1	4
M232/M232A1	5

Handwheel load:

Elevating..... 265 in-lb (30 N-m)

Traversing..... 106 in-lb (12 N-m)

Length of recoil (maximum) ... 55 in (1385 mm) charge 8S (M203A1), 55.9 in (1420 mm) max metal-to-metal

Lunette load 60 lb (27.21 kg) at a height of 2ft 7 $\frac{1}{2}$ in (0.80 m)

Maximum ranges:

M3 propelling charge 2 thru 5..... 3 to 5.9miles (5000 to 9900m)

M4 propelling charge 3 thru 6..... 2.55 to 7.64miles (4100 to 12300m)

M4 propelling charge 7 white..... 5.8 to 9.2miles (9300 to 14800m)

M203 propelling charge 8 (RAP rd, M549A1) 18.6miles (30000m)

M231 (MACS zones 1 and 2)..... 2.80 to 7.39miles (4500 to 11900m)

M232/M232A1 (MACS zone 5)..... 18.6miles (30000m)

M119 Series propellants 11.8 to 14.91miles (18000 to 24000m)

Maximum terrain slope..... 10-degree cant

Maximum towing speeds:

Cross country	Up to 15 mph (24 kph)
Improved roads.....	Up to 45 mph (74 kph)
Secondary roads	Up to 30 mph (50 kph)

Mils of movement per turn of handwheel:

Elevating.....	Approximately 10 mils
Traversing.....	Approximately 10 mils

Muzzle brake..... Double baffle

On-Carriage elevating range..... -43 mils (-2.5 deg) to +1275 mils (72 deg)

Primer feed mechanism Magazine feed; loads, fires and extracts primers

Prime mover:

MTVR	Refer to Marine Corps TM 10629-10
FMTV.....	Refer to US Army TM 9-2320-366-20-5
M939 Series	Refer to US Army TM 9-2320-272-10

Rate of fire:

Maximum	4 rounds/minute for 2 minutes
Sustained.....	2 rounds/minute (determined by the Thermal Warning Device (TWD))

Recoil mechanism..... Hydro-pneumatic, constant, dependant

Speed shift range 6400 mils (360 deg)

Tires (radial):

Pressure.....	100 psi (690kPa)
Size	245 x 70 x 19.5
Load range	H

Traversing range..... 400 mils (22.5 deg) left and 400 mils (22.5 deg) right of center

Trident bar weight 58 lb (26.308 kg)

Tube life Based on wear factor (pullover gage reading) (Refer to TM 9-1000-202-14)

M777 howitzer weight (without basic issue items)..... 9277 lb (4208 kg)

M777A1 and M777A2 howitzer weight (without basic issue items)..... 9840 lb (4463 kg)

b. Optical Fire Control (OFC) Equipment Performance Data

M17A1 Fire Control Quadrant:

Correction	± 95 mils (± 5 deg)
Elevation.....	-280 to 1275 mils (-16 to 72 deg)
Least increment reading (counters).....	1 mil (0.05 deg)
Weight.....	7.50 lb (3.40 kg)

M18A1 Fire Control Quadrant:

Correction	± 95 mils (± 5 deg)
Elevation.....	-280 to 1275 mils (-16 to 72 deg)
Least increment reading (counters).....	1 mil (0.05 deg)
Weight.....	7.50 lb (3.40 kg)

1-15 EQUIPMENT DATA (cont)

b. Optical Fire Control (OFC) Equipment Performance Data (cont)

M171A1 Telescope and Quadrant Mount:

Cross level adjustment:

Left	178 mils (10 deg)
Right.....	178 mils (10 deg)
Elevation	-270 to 1333 mils (-15 to 75 deg)

Pitch level adjustment:

Aft.....	178 mils (10 deg)
Fore.....	178 mils (10 deg)

Weight:

Adapter assembly	3.25 lb (1.47 kg)
Mount	75 lb (34.02 kg)
Optical instrument support.....	2 lb (0.91 kg)

M172A1 Telescope and Quadrant Mount:

Boresighting:

Azimuth	±18 mils (± 1.01 deg)
Elevation	±18 mils (± 1.01 deg)
Cross level adjustment.....	± 604 mils (±34 deg)

Weight:

Adapter assembly	4.75 lb (2.15 kg)
Mount	27.50 lb (12.47 kg)

M137A2 Panoramic Telescope (Pantel):

Field of view.....	178 mils (10 deg)
Movement:	
Azimuth counter	(increasing clockwise) 6400 mils (360 deg)
Deflection counter	6400 mils (360 deg)
Correction counter.....	±95 mils (± 5 deg)
Elevation.....	±300 mils (± 17 deg)
Least increment reading (Azimuth)	0.25 mils (0.01 deg)
Power.....	4X
Weight.....	19 lb (8.62 kg)

M138A1 Elbow Telescope:

Elevation.....	60 mils (3 deg)
Field of View	142 mils (8 deg)
Power	8X
Weight.....	8 lb (3.63 kg)

M154 Alignment Device: (ERLS Battery Powered LED Light Source)

Batteries:	
Quantity/Cell Size	1 each/size "AA"
Voltage	3 volts (each)
Weight.....	2.22 lb (1.0 kg)

M1A2 Collimator with case: (ERLS Battery Powered LED Light Source)

Batteries:	
Quantity/Cell Size	2 each/size "C"
Voltage	3 volts (each)
Weight.....	31 lbs (14 kg)

M1A1 Gunners Quadrant with case: (not illuminated – no light source)

Least increment reading	0.1 mil
Weight.....	3.63 lb (1.65 kg)

c. Digital Fire Control System (DFCS) Performance Data

Mission Computer (MSC):

Weight.....	17.50 lb (7.94 kg)
Height	5.12 in. (13.02 cm)
Length.....	9.35 in. (23.33 cm)
Width.....	11.50 in. (29.21 cm)
Input Voltage	28v DC (from PCCM)

Power Conditioning and Control Module (PCCM):

Weight.....	24.52 lb (11.12 kg)
Height	5.75 in. (14.61 cm)
Length.....	14.0 in. (35.56 cm)
Width.....	9.5 in. (24.1 cm)
Input Voltage	28v DC (from BAT)

Battery (BAT) (per battery):

Weight.....	44.14 lb (20.02 kg)
Height	6.34 in. (16.25 cm)
Length.....	9.75 in. (25.00 cm)
Width.....	6.34 in. (16.25 cm)

Vehicle Motion Sensor (VMS):

Weight.....	0.99 lb (0.45 kg)
Height	10.14 in. (26.0 cm)
Length.....	6.65 in. (17.06 cm)
Width.....	9.56 in. (24.50 cm)
Input Voltage	5v DC (from INU)

Inertial Navigation Unit (INU):

Weight.....	13.01 lb (5.90 kg)
Height	5.50 in. (13.97 cm)
Length.....	9.96 in. (25.30 cm)
Width.....	9.25 in. (23.50 cm)
Input Voltage	28v DC (from PCCM)

INU Mount:

Weight.....	4.7 lb (2.13 kg)
Height	1.46 in. (3.75 cm)
Length.....	10.02 in. (25.7 cm)
Width.....	9.36 in. (24.0 cm)

Gunners Display (GND):

Weight.....	3.0 lb (1.36 kg)
Height	4.68 in. (12.0 cm)
Length.....	6.40 in. (16.40 cm)
Width.....	2.34 in. (6.0 cm)
Input Voltage	28v DC (from MSC)

1-15 EQUIPMENT DATA (cont)

c. Digital Fire Control System (DFCS) Performance Data (cont)

GND Mount:

Weight.....	6.7 lb (3.04 kg)
Height	12.87 in. (33.0 cm)
Length.....	17.32 in. (44.4 cm)
Width.....	4.45 in. (11.4 cm)

Assistant Gunners Display (AGD):

Weight.....	3.0 lb (1.36 kg)
Height	4.68 in. (12.0 cm)
Length.....	6.40 in. (16.40 cm)
Width.....	2.34 in. (6.0 cm)
Input Voltage.....	28v DC (from MSC)

AGD Mount:

Weight.....	9.15 lb (4.15 kg)
Height	11.47 in. (29.4 cm)
Length.....	13.81 in. (35.4 cm)
Width.....	11.90 in. (30.5 cm)

Chief of Section Display (CSD):

Weight.....	6.02 lb (2.81 kg)
Height	7.29 in. (18.50 cm)
Length.....	11.2 in. (28.44 cm)
Width.....	7.23 in. (10.75 cm)
Input Voltage.....	28v DC (from PCCM)

Radio Antenna (ANT):

Weight.....	11.6 lb. (5.26 kg)
Height	109.45 in (278.00 cm)
Base Diameter.....	5.00 in (12.7 cm)

ANT Mount:

Weight.....	2.65 lb (1.20 kg)
Height	7.49 in. (19.2 cm)
Length.....	6.36 in. (16.3 cm)
Width.....	3.5 in. (8.97 cm)

Receiver/Transmitter Assembly (RTA):

Weight (without battery).....	5.55 lb (2.52 kg)
Height	3.2 in. (8.2 cm)
Length.....	10.1 in. (25.9 cm)
Width.....	5.3 in. (13.6 cm)
Input Voltage.....	9 to 32v DC

Radio Amplifier (AMP):

Weight.....	6.8 lb (3.1 kg)
Height	5.3 in. (13.4 cm)
Length.....	12.1 in. (30.7 cm)
Width.....	2.7 in. (6.9 cm)
Input Voltage.....	9 to 32v DC

Communication Location Assembly (CLA) (Fully populated):

Weight.....	61.07 lb (27.7 kg)
Height	14 in. (35.6 cm)
Length.....	15.9 in. (40.6 cm)
Width.....	15.3 in. (38.9 cm)
Input Voltage	28v DC (from PCCM)

Communication Location Enclosure (CLE):

Weight.....	40.63 lb (18.43 kg)
Height	14 in. (35.6 cm)
Length.....	15.9 in. (40.6 cm)
Width.....	15.3 in. (38.9 cm)
Input Voltage	28v DC (from PCCM)

Top Cradle Electronics Assembly Mount:

Weight.....	39.93 lb (18.11 kg)
Height	12.87 in. (33.0 cm)
Length.....	53.24 in. (136.5 cm)
Width.....	14.98 in. (38.4 cm)

Under Cradle Electronics Assembly Mount:

Weight.....	115.85 lb (52.55 kg)
Height	11.64 in. (29.85 cm)
Length.....	55.89 in. (143.3 cm)
Width.....	29.48 in. (75.6 cm)

Defense Advanced GPS Receiver (DAGR) (w/batteries installed):

Weight.....	2 lb (0.9 kg)
Height	1.5 in. (3.8 cm)
Length.....	6.25 in. (15.9 cm)
Width.....	3.1 in. (7.9 cm)
Input Voltage	12v or 24v DC

Enhanced Portable Inductive Artillery Fuze Setter (EPIAFS) Platform Integration Kit (PIK) (If Present)

Weight.....	3.5 lb (1.6 kg)
Height	2.6 in. (6.6 cm)
Length.....	10 in. (25.4 cm)
Width.....	5.5 in. (14.0 cm)
Input Voltage	24v DC

CSD Stow Bracket:

Weight.....	2.95 lb (1.34 kg)
Height	4.91 in. (12.6 cm)
Length.....	4.91 in. (12.6 cm)
Width.....	2.77 in. (7.1 cm)

Power Connection Bracket:

Weight.....	0.47 lb (0.21 kg)
Height	4.91 in. (12.6 cm)
Length.....	4.91 in. (12.6 cm)
Width.....	2.77 in. (7.1 cm)

Data Cable Connector Bracket:

Weight.....	0.23 lb (0.10 kg)
Height	3.55 in. (9.1 cm)
Length.....	3.55 in. (9.1 cm)
Width.....	2.77 in. (7.1 cm)

Section III. TECHNICAL PRINCIPLES OF OPERATION

Section Index

Paragraph		Page
1-16	Principles of Operation	1-30

1-16 PRINCIPLES OF OPERATION

- a. The howitzer is a lightweight, split trail weapon.
- b. For firing, the wheels may be raised clear of the ground with the body and stabilizers supporting the weapon.
- c. For large shifts in direction, a hydraulically operated suspension system quickly lifts the weapon clear of the ground, rotates or shifts the weapon to the new direction, and then lowers it back onto the ground.
- d. The traversing and elevating mechanisms are manually operated.
- e. The two pneumatic equilibrator cylinders are charged with compressed nitrogen gas.
- f. The recoil mechanism is a hydro pneumatic constant dependant type with a variable recoil length.
- g. The cannon is equipped with a muzzle brake to reduce recoil.
- h. The breech mechanism assembly is hydraulically operated, and the weapon is manually loaded.
- i. The weapon is equipped with an air-over oil power brake system.

Section IV. SECTION DRILLS

Section Index

Paragraph		Page
1-17	General.....	1-30
1-18	Instructions	1-30
1-19	Execution of Command to Fall In	1-31
1-20	Execution of Command to Change Posts	1-31
1-21	Execution of Command to Change Posts (Entire Section)	1-32
1-22	Execution of Command to Count Off	1-32
1-23	Execution of Command to Mount.....	1-32
1-24	Execution of Command to Dismount.....	1-33
1-25	Execution of Command to Post.....	1-33
1-26	Break Periods During Training, or Firing.....	1-34
1-27	Reduced Crew Drill.....	1-34

1-17 GENERAL

The purpose of section drill is to improve the howitzer section through execution of assigned tasks and cross training of section personnel.

1-18 INSTRUCTIONS

- a. Section drill must be conducted in silence, except for commands and reports. The section must be drilled until reaction to commands is quick, automatic and correct.

b. Battery Staff will supervise section drill. Errors will be corrected immediately.

c. Duties should be rotated during training so that each crewman of the section can perform all duties within the section. Battery leadership should also take part in section drill so that they can perform with a howitzer section, if required.

d. If the number of personnel falls below the 10-man crew, the reduced crew drill will be used (Para 1-27).

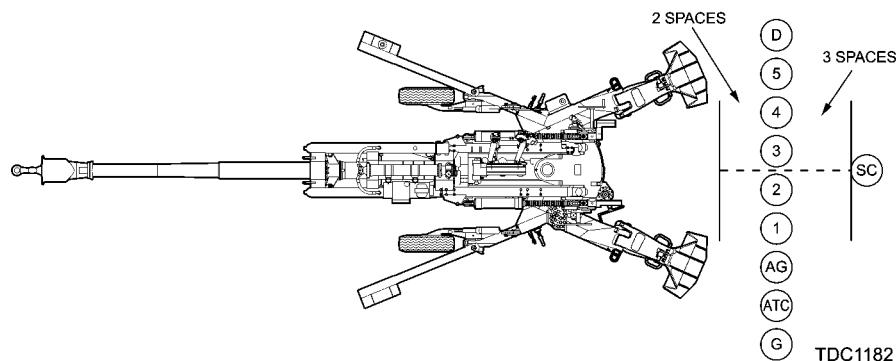
1-19 EXECUTION OF COMMAND TO FALL IN

a. To Fall In. The SC takes his assigned post. The preparatory command may indicate the place and direction in which the section is to form. At the first formation for a drill or exercise, the preparatory command, HOWITZER SECTION, precedes the command. The commands are 1. FALL IN or 2. IN FRONT (REAR) OF YOUR PIECE, FALL IN.

NOTE

The formation for REAR OF YOUR PIECE is illustrated.

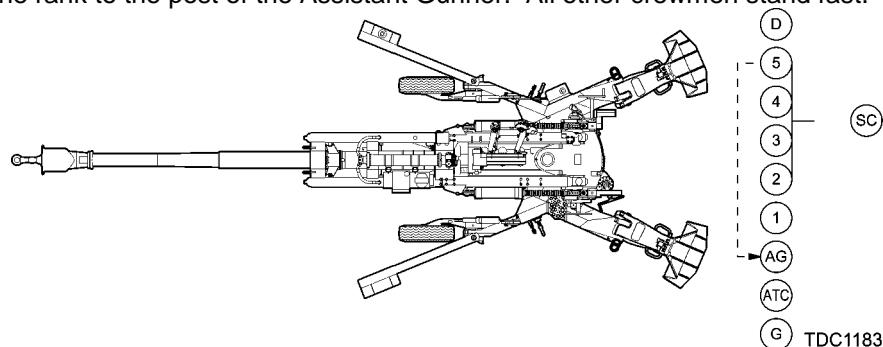
b. At the command, the section moves at double time and forms a single rank, at close intervals, guiding on the Gunner. The numbered Cannoneers should be in order between the Assistant Gunner and the Driver of the prime mover. The section stands at attention, centered on and facing the SC at a distance of three paces.



1-20 EXECUTION OF COMMAND TO CHANGE POSTS

a. To Change Posts. To have the Assistant Gunner and numbered Cannoneers change posts, the commands is 1. CHANGE POSTS, 2. MARCH.

b. At the command, the Assistant Gunner and numbered Cannoneers, except for ATC, take two steps left, taking the position of the next higher numbered Cannoneer. At the same time, Cannoneer No. 5 moves at double time to the rear of the rank to the post of the Assistant Gunner. All other crewmen stand fast.



1-21 EXECUTION OF COMMAND TO CHANGE POSTS (ENTIRE SECTION)

a. To have the entire section change posts, the command is 1. SECTION CHANGE POSTS, 2. MARCH.

b. At the command, all crewmen of the section take two steps left, except for the crewman on the extreme left, that crewman moves at double time to the rear of the rank and takes the post of the Gunner.

1-22 EXECUTION OF COMMAND TO COUNT OFF

a. To Count Off. The command is COUNT OFF.

b. All crewmen in rank, except the Gunner, execute eyes right.

c. The section counts off in sequence, GUNNER, ATC, A-GUNNER, CANNONEERS NOS. 1 - 5, DRIVER. Each crewman calls out and turns head smartly to the front.

1-23 EXECUTION OF COMMAND TO MOUNT

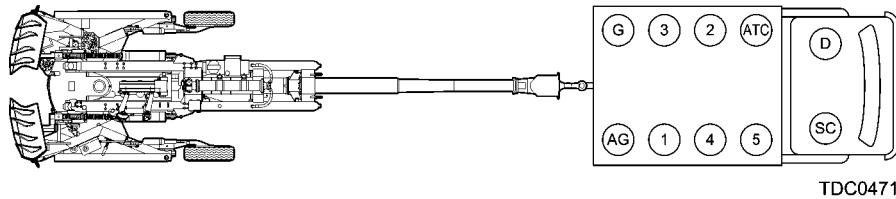
a. To Mount. To mount, the commands are 1. MOUNT or 2. PREPARE TO MOUNT, MOUNT. If any of the crewmen of the section are to remain dismounted, their designations are announced with the command, STAND FAST, given between the preparatory command and the command of execution; for example, 1. PREPARE TO MOUNT; DRIVER STAND FAST, 2. MOUNT.

b. At the command, MOUNT, the section crewmen take positions as illustrated.

c. At the command of execution, the Driver and SC take their positions at the rear of the prime mover, on the left and right, respectively, where they can observe and assist in loading.

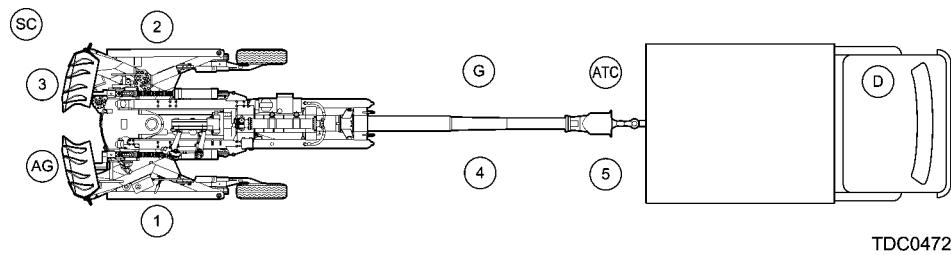
d. The two columns mount in order from front to rear and take seats as shown. Each Cannoneer is assisted in mounting by the person directly behind (or in front in the case of the last Cannoneer in the column) to ensure promptness and prevent injury.

e. Before mounting, the SC and Driver check that the howitzer is properly coupled, to the prime mover, with the brakes engaged, the crewmen are aboard, and the tailgate and safety straps are secure.



1-24 EXECUTION OF COMMAND TO DISMOUNT

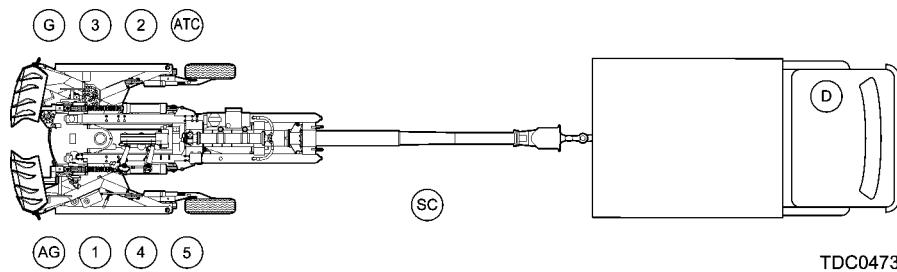
- a. To Dismount. The commands are 1. DISMOUNT or, 2. PREPARE TO DISMOUNT, DISMOUNT.
- b. At the preparatory command, the personnel in the prime mover dismount from rear of the prime mover.
- c. All crewmen of the section assume positions from which they can dismount properly.
- d. At the command of execution, they dismount, and at double time, take the posts illustrated.



TDC0472

1-25 EXECUTION OF COMMAND TO POST

- a. To Post. The command is CANNONEERS, POST. This general command applies whether the section is in, or out of ranks, at a halt, or marching.
- b. At the command, the section moves at double time and takes the positions shown. The section then stands at attention.



TDC0473

1-26 BREAK PERIODS DURING TRAINING OR FIRING

- a. At Drill. When it is required to give personnel a rest from drill or to relieve them temporarily from formation or posts, the command, FALL OUT, is given. The command may be given at any time and means that the section is to remain in the drill area.
- b. When Firing. When firing has been suspended temporarily, but the section is to remain in the vicinity of the prime mover, the command, FALL OUT, is given. Crewmen stand clear of the howitzer, so that settings remain undisturbed. During these periods, the SC may direct the crewman to improve their position, to replenish ammunition, or to do other necessary work.

1-27 REDUCED CREW DRILL

NOTE

Procedures for operating with reduced crew have been standardized under the Department of the Army Standardization Program.

- a. It is normal to expect howitzer crews to be reduced to less than the prescribed TOE strength due to illness, casualties, battery tasking, and the need to rest personnel. To meet the need of these occasions and the need to maintain operations of the section in as orderly a manner as possible, the duties of the individuals of the section have been combined as shown in.

FIRING

9-MAN	8-MAN	7-MAN
SC	SC	SC
G/ATC	G/ATC	G/ATC
AG	AG/1	AG/1
1	2	2
2	3	3
3	4	4/5
4	5	D
5	D	
D		

EMPLACEMENT/DISPLACEMENT

9-MAN	8-MAN	7-MAN
SC	SC	SC
G	G	G
ATC	ATC	ATC
AG	AG/1	AG/1
1	2	2/3
2	3	4/5
3	4/5	D
4/5	D	
D		

- b. The SC will assign duties to the crewmembers when the number of available personnel falls below the level shown above.

CHAPTER 2

OPERATING INSTRUCTIONS

Section Index

		Page
Section I.	Description and Use of Operator's Controls and Indicators	2-1
Section II.	Preventative Maintenance Checks and Services (PMCS)	2-32
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Section IV.	Operation Under Unusual Conditions.....	2-192
Section V.	Misfire and Check Firing Procedures.....	2-201
Section VI.	Operation of Auxiliary Equipment.....	2-219
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Section I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS

Paragraph		Page
2-1	General.....	2-1
2-2	Cannon Controls and Indicators.....	2-1
2-3	Recoil Mechanism Controls and Indicators	2-3
2-4	Carriage Controls and Indicators.....	2-3
2-5	Top Carriage Controls and Indicators	2-6
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2-10	M138A1 Elbow Telescope Controls and Indicators.....	2-16
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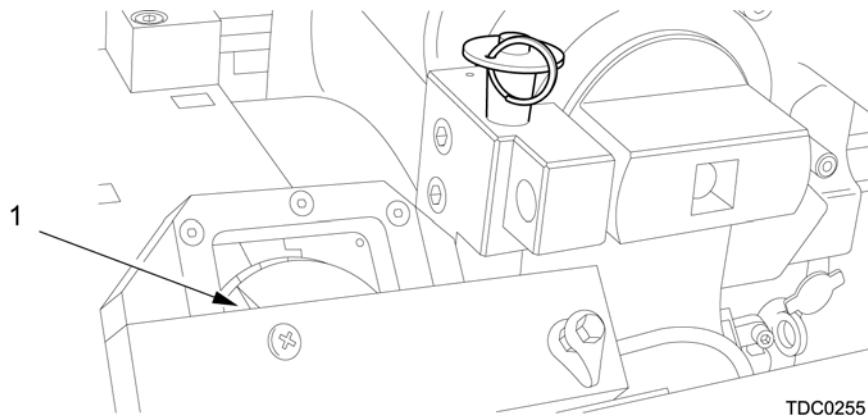
2-1 GENERAL

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 2-43 through 2-47 for misfire and check firing procedures.

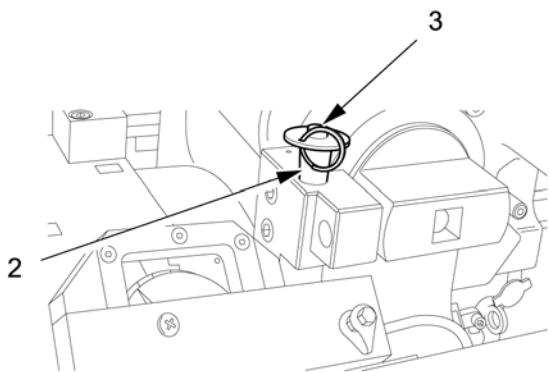
2-2 CANNON CONTROLS AND INDICATORS (cont)



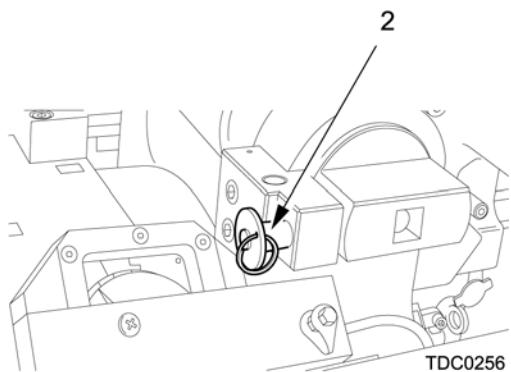
b. **Breech Crank Locking Pin (2)** is located on the left side of the breech ring. It is used during misfire and sticker procedures.

- (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

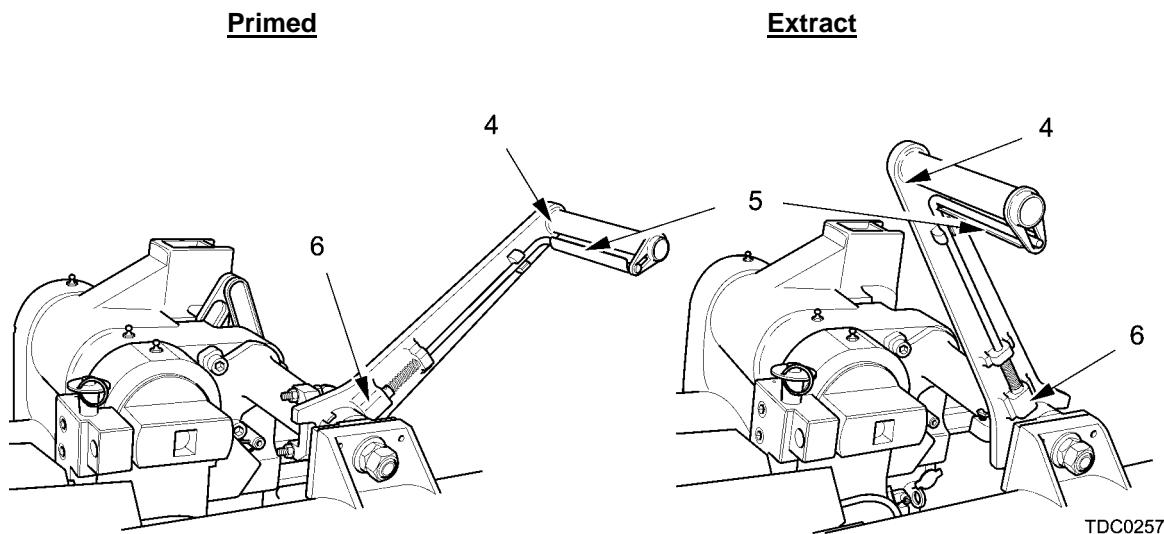


Engage



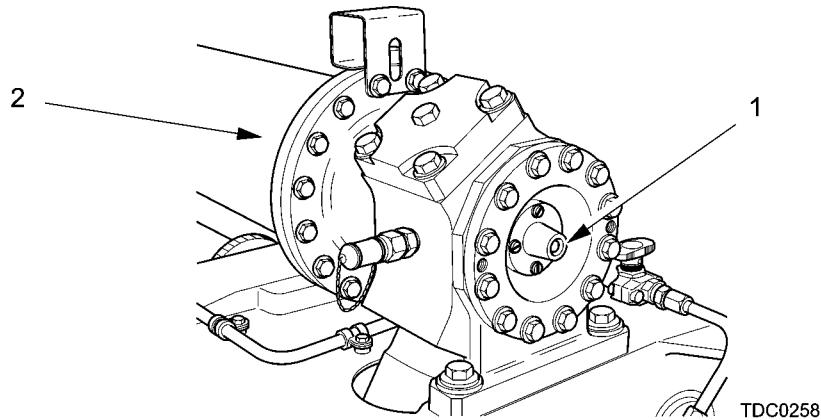
c. **Primer Feed Mechanism (PFM) Lever (4)** is located on the top left cradle tube. It is used for loading and extracting primers during fire mission cycles.

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



2-3 RECOIL MECHANISM CONTROLS AND INDICATORS

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

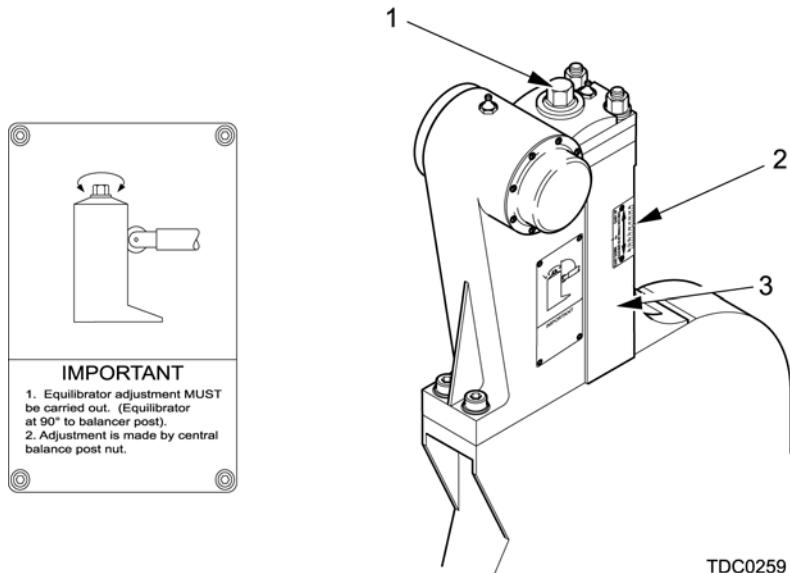


2-4 CARRIAGE CONTROLS AND INDICATORS

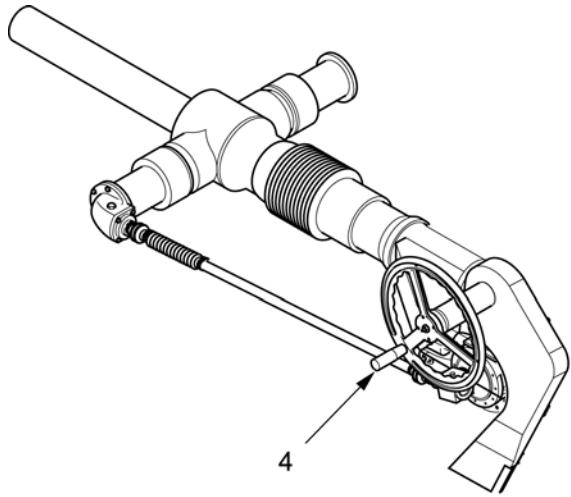
- Equilibrator Adjustment Screws (1) and Indicator (2)** are located on each equilibrator post (3). Use to adjust equilibrators during minor temperature changes, correcting for unequal force required to turn elevation handwheel during elevation or depression of cannon tube.

(1) Difficult to Elevate or Depress. Using 17mm socket and wrench, adjust equilibrator screw (1) CW or CCW (adjust indicator (2) at $\frac{1}{2}$ 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.

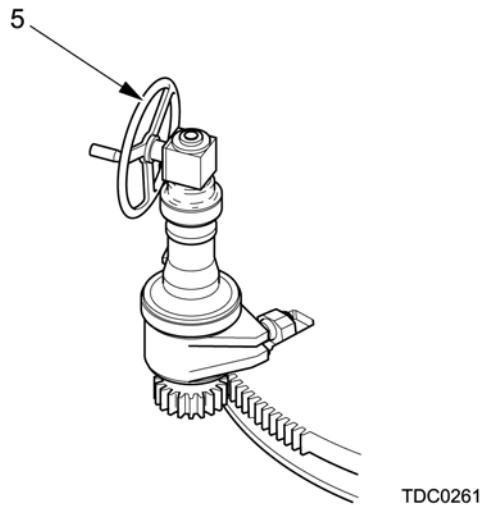
2-4 CARRIAGE CONTROLS AND INDICATORS (cont)



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. Turning handwheel CW moves cannon to the right; turning handwheel CCW moves cannon left. One complete turn of the handwheel is approximately 10 mils (0.5 deg).



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).

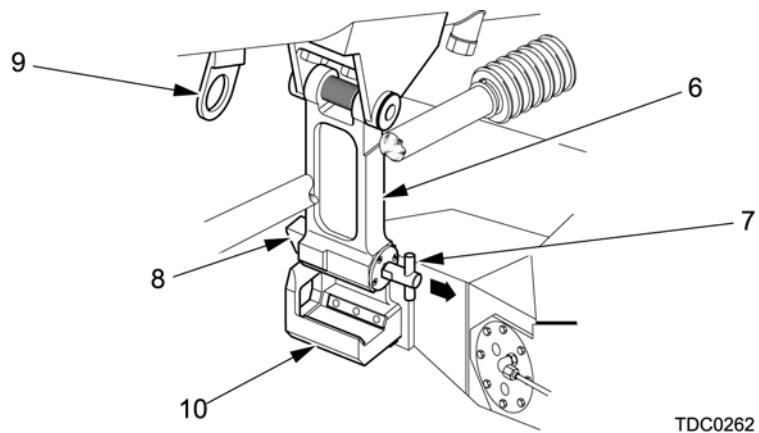
CAUTION

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

NOTE

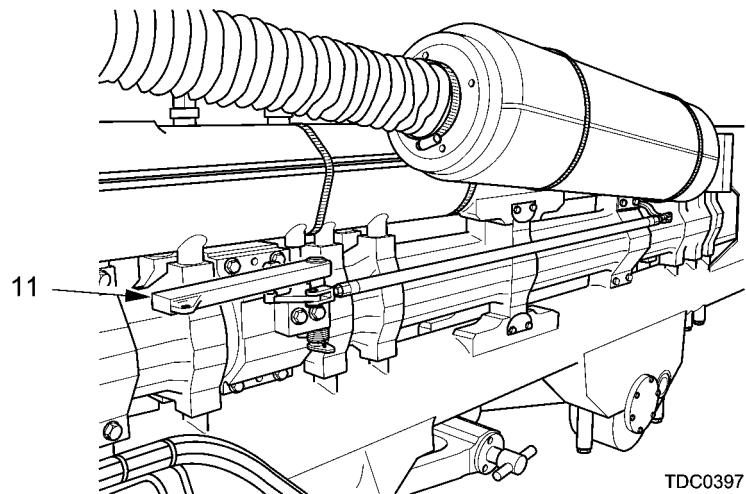
Travel locks will be held in the vertical position under spring tension.

(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.

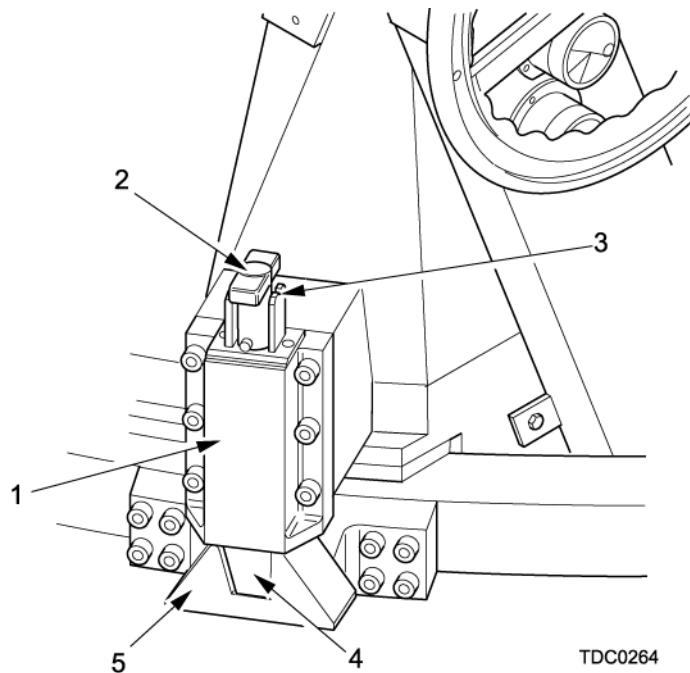


2-5 TOP CARRIAGE CONTROLS AND INDICATORS

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.

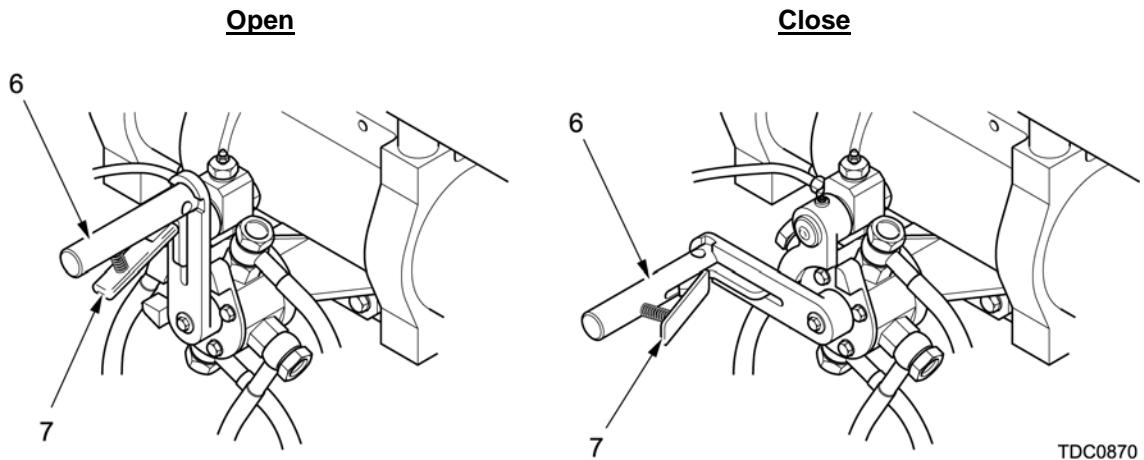
(2) To engage lock (1), raise and turn tee-handle (2) and lower into lock. Traverse howitzer until plunger (4) engages bracket (5).



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 lock (7) together and pull the lever rearward to the OPEN position.

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

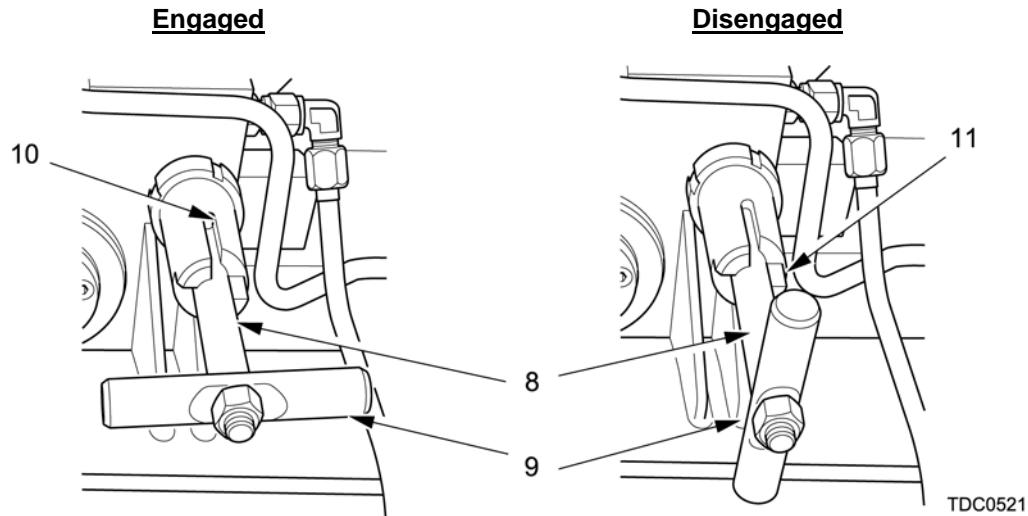


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c. **Breech Lock Out Plunger (8)** is provided for maintenance purposes and can only be engaged when the breech is open.

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

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



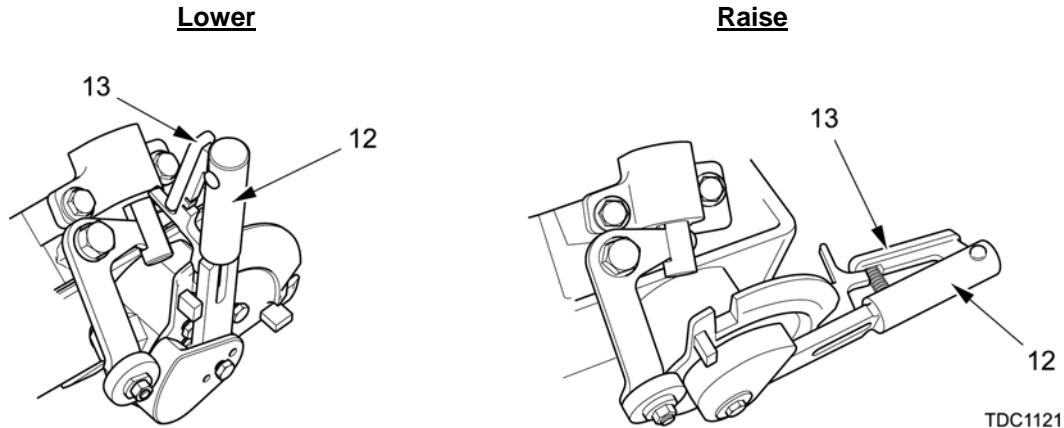
TDC0521

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 lock (13) together and move lever to the LOWER position.

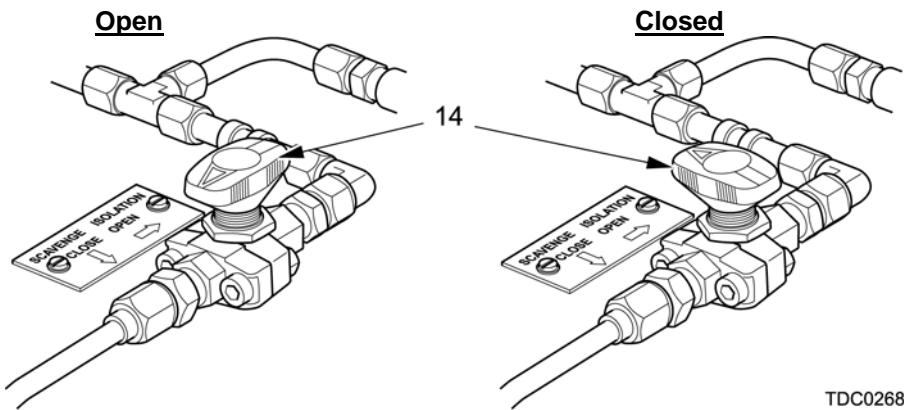
(2) To raise the tray, squeeze lever (12) and lock (13) together and move lever to the RAISE position.



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.

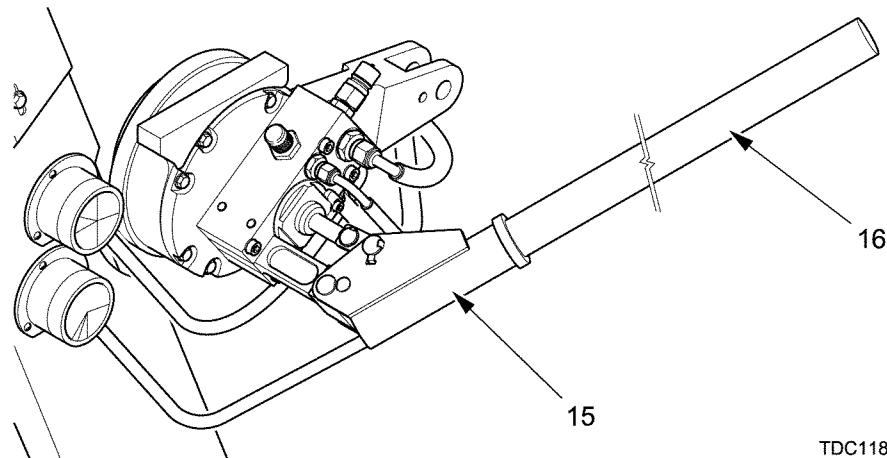
(1) To open the scavenge system from the closed position, turn valve (14) CW to the OPEN position.

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



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

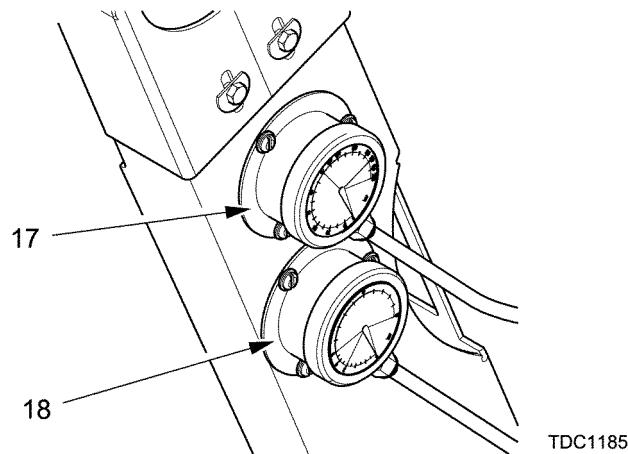
(1) To operate the pump (15), insert pump handle (16) into the pump adaptor. Pump on handle until the system is pressurized to 1761psi (120 bar).



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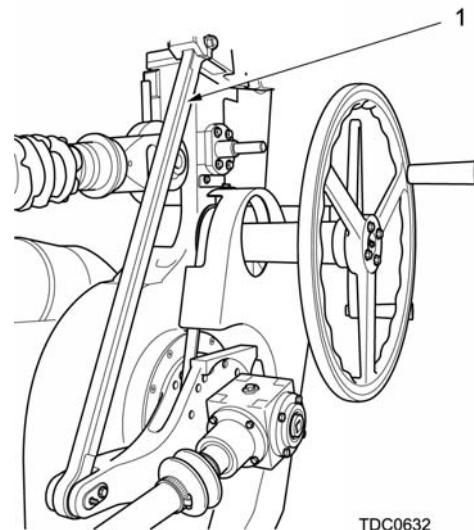
g. **High Pressure (HP) and Low Pressure (LP) Gauges** are located on the right saddle post.

- (1) The HP gauge (17) indicates scavenge system pressure.
- (2) The LP gauge (18) indicates exhaust cylinder pressure.



TDC1185

h. **Sight Linkage (1)** synchronises movements of the false trunnion and true trunnion.



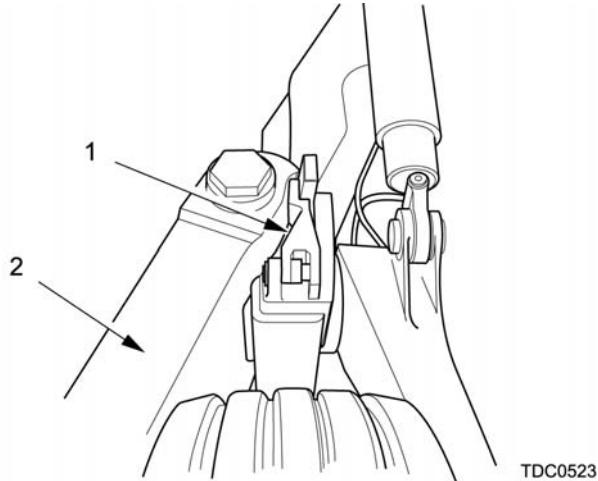
TDC0632

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.

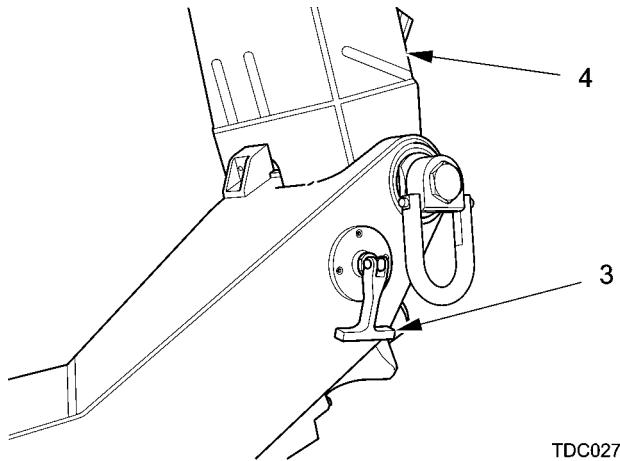
(2) To stow stabilizers (2) into the towed position, raise latch (1) and swing stabilizer rearward, ensuring latch re-engages.



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 firing position.

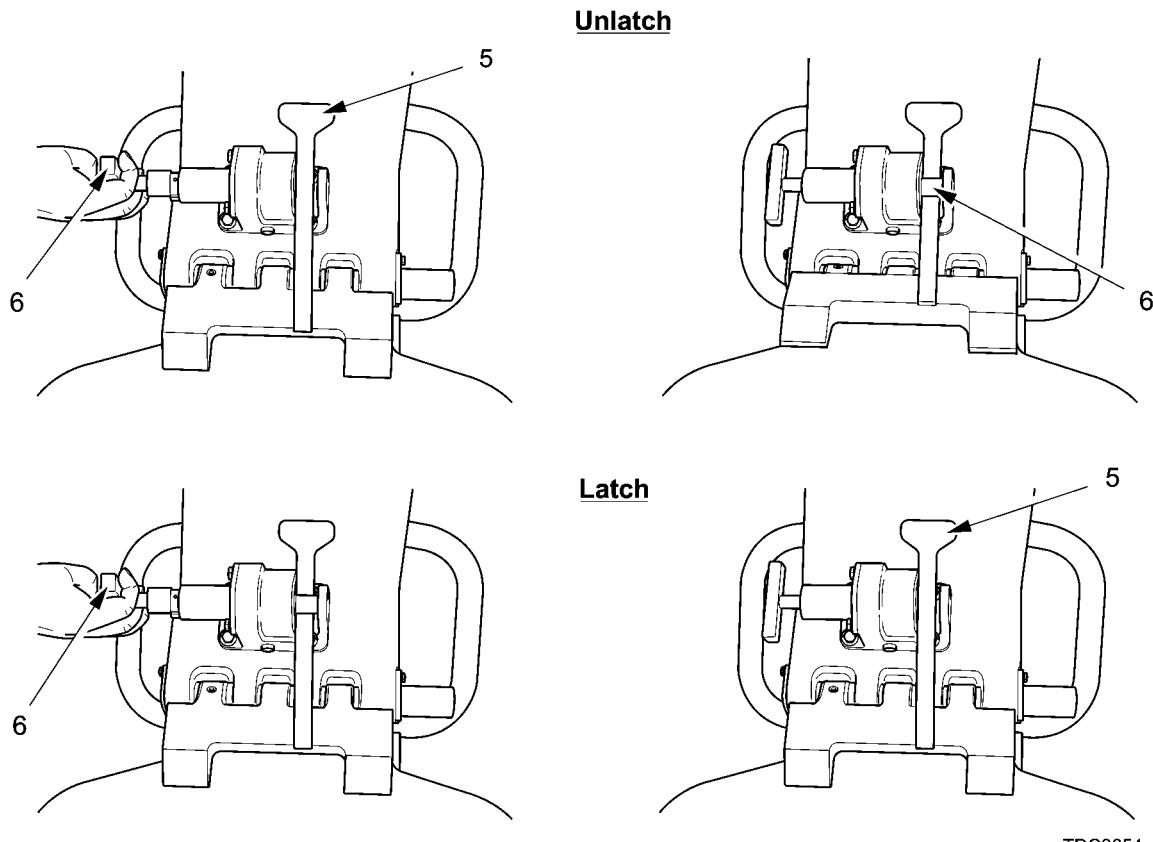
(2) To engage locking plunger (3), allow plunger to return to the engaged position. Ensure locking plunger is engaged.



c. **Spade Locking Levers (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 lever (5) down to the open position, allow plunger to return over the lever. Ensure plunger is engaged.

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



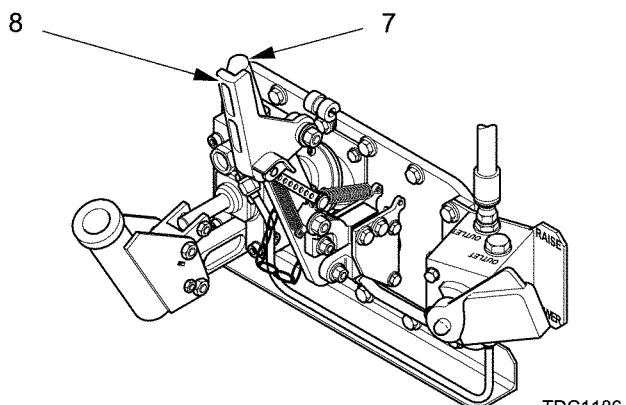
TDC0654

d. Handbrakes (7) 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 (7) out.
- (2) To release handbrake, squeeze lever (7) and lock (8) together and push lever in fully.



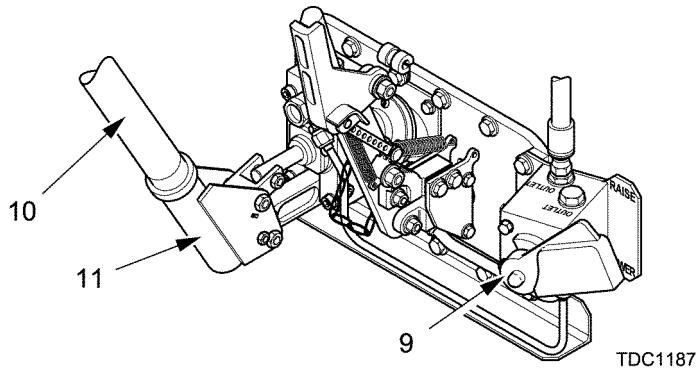
TDC1186

2-6 BOTTOM CARRIAGE CONTROLS AND INDICATORS (cont)

e. **Suspension Levers (9)** are located on either side of the body, and are used when raising or lowering the howitzer.

(1) To lower the howitzer, move lever (9) to the LOWER position.

(2) To raise the howitzer, move lever (9) to the RAISE position. Install pump handle (10) into pump adaptor (11) and pump on handle until the howitzer is raised.



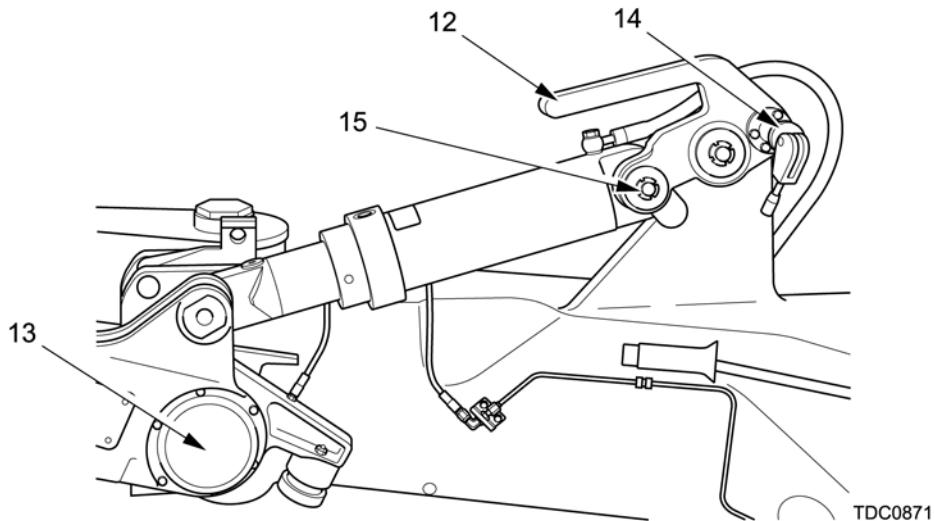
f. **Wheel Locking Levers (12)** are located on either side of the howitzer, and are used when raising and lowering the wheel assembly.

NOTE

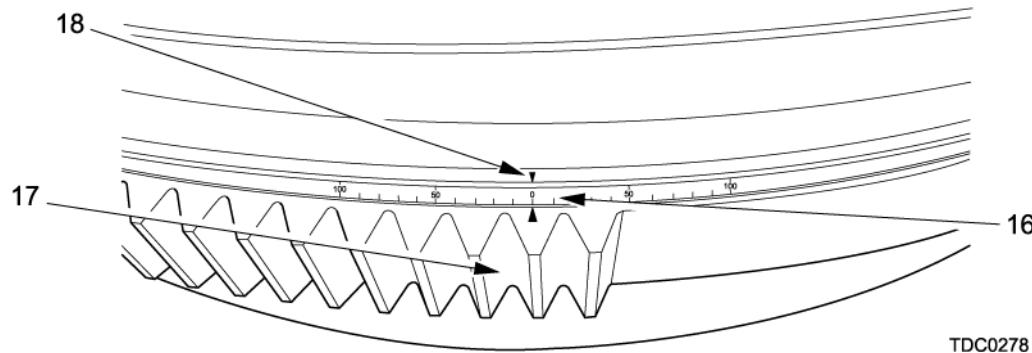
Excessive force is not required to disengage hydrostrut lock.

(1) To raise the wheel arm assembly (13) onto the body, rotate wheel locking plunger (14) up and pull lever (12) upwards until hydrostrut lock (15) is disengaged. Lift wheel arm assembly onto body.

(2) To lower the wheel arm assembly (13) onto the ground, rotate wheel locking plunger (14) up and push wheel arm assembly forward. Push lever (12) downwards until hydrostrut lock (15) is engaged. Ensure plunger is engaged.



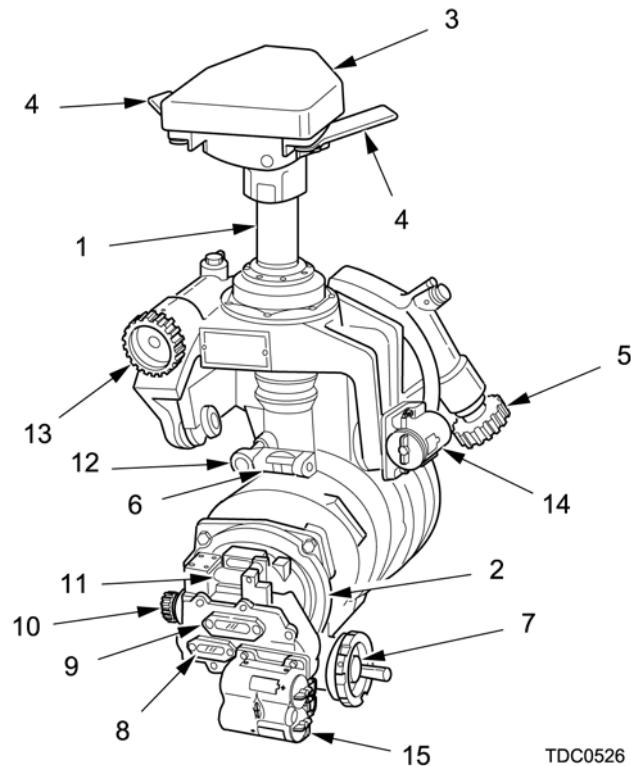
g. **Coarse Azimuth Scale (16)** is located above the traverse rack (17), and indicates saddle and top carriage traverse angle in mils. The azimuth scale is read in conjunction with a scribe line on the saddle (18).



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.

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

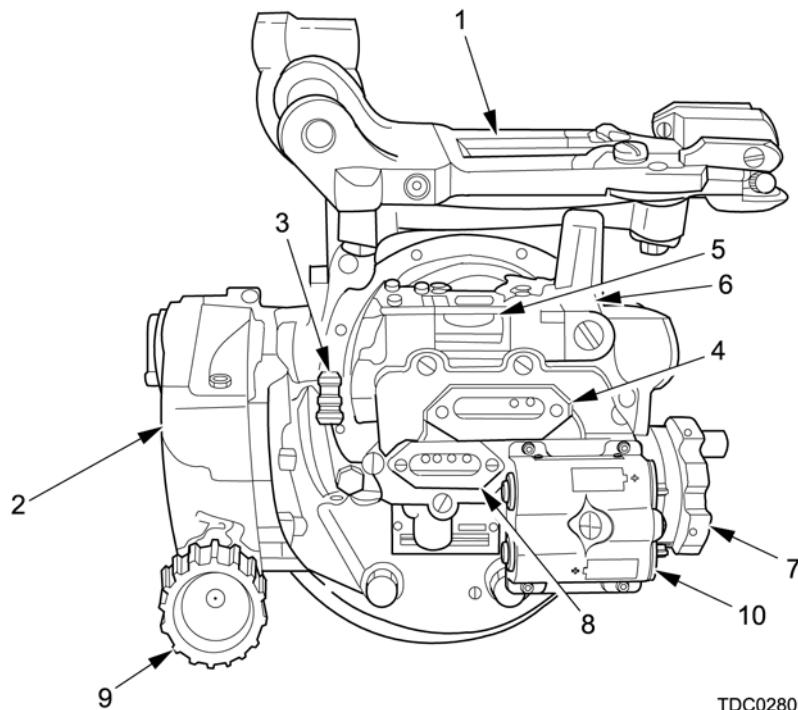


TDC0526

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).

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



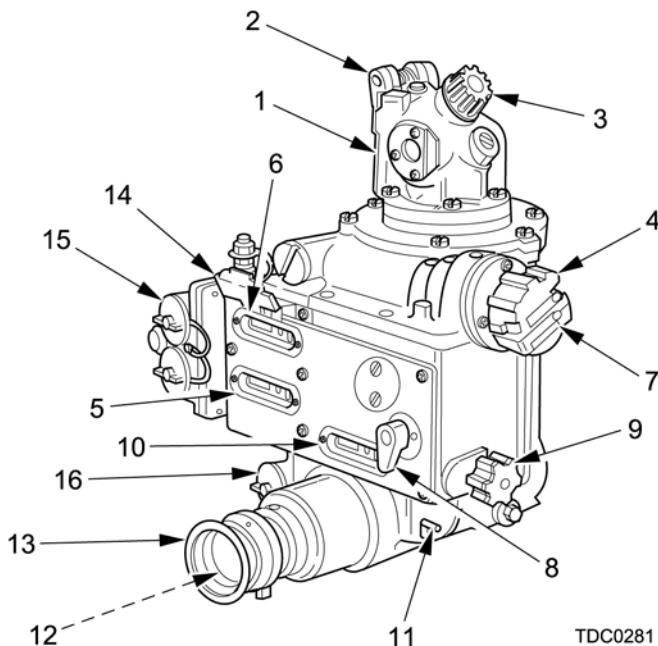
TDC0280

2-9 PANTEL CONTROLS AND INDICATORS

- a. **Pantel (1)** provides direction for 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 to the DIRECT position, the azimuth counter (6) will move in 5 mil increments.
- f. **Deflection Knob (8)** when pushed to the RELEASE position, 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.

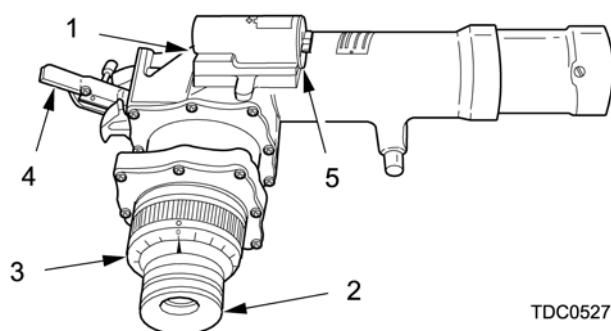
2-9 PANTEL CONTROLS AND INDICATORS (cont)

- I. 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. Eyesight (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.



2-11 DIGITAL FIRE CONTROL SYSTEM (DFCS) OPERATING MODES

The DFCS functions are performed during two operating modes. These modes are Normal Operations and Maintenance.

a. **Normal operation mode.** In the normal operation mode there are four submodes: initialization, travel, fire mission, and maintenance. This mode is designed to operate, monitor performance, and track hardware and software configuration of the DFCS.

b. **Maintenance mode.** This mode is designed to be used by the crew and maintainer to do initial troubleshooting of a failure in the DFCS, expedite repair, and view detailed hardware and software configuration information.

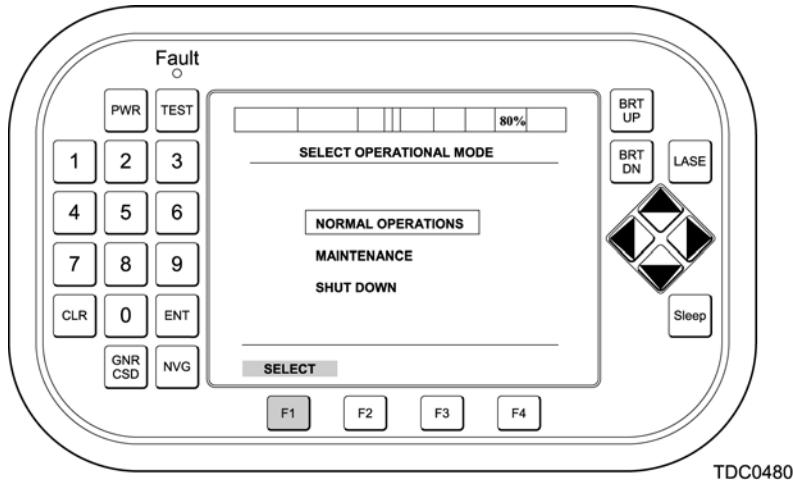
2-12 DFCS CONTROLS AND INDICATORS

a. CHIEF OF SECTION DISPLAY (CSD) CONTROLS AND INDICATORS

The CSD is a handheld, or vehicle mounted control display, which provides an interface between the DFCS and SC.

- (1) **PWR** removes power to the CSD only.
- (2) **TEST** momentary action switch provides a means to test function of display screen.
- (3) **Numeric Key Pad (0 thru 9)** allows operator to enter numeric values.
- (4) **CLR** clears an entry from the display and returns entry point to previous operation.
- (5) **ENT** key function to enter data into the MSC database.
- (6) **GNR/CSD** (not currently used).
- (7) **NVG** sets the screen brightness for use with night vision goggles.
- (8) **BRT UP** each press of the button increases the brightness of the display by one level.
- (9) **BRT DN** each press of the button decreases the brightness of the display by one level.
- (10) **LASE** not used for DFCS Block 1. **RING** Key for DFCS Block 1a.
- (11) **CURSOR KEYS** allows the operator to move the cursor on the screen in order to make a menu selection.
- (12) **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.
- (13) **F1 – F4 Keys**, set of function keys used to select commands that appear above the keys depending on the screen being displayed.
- (14) **FAULT LED** (not currently used).

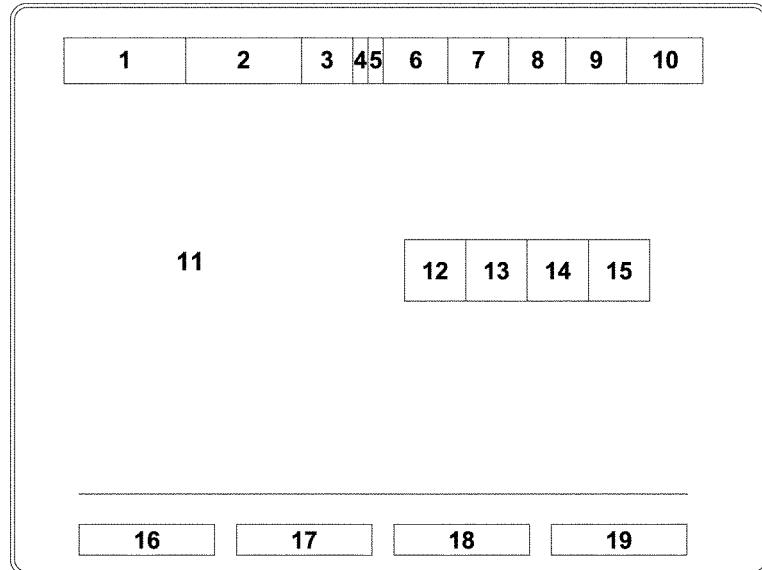
2-12 DFCS CONTROLS AND INDICATORS (cont)



TDC0480

b. CSD DISPLAY LAYOUT

The display layout is functionally divided into 4 areas of 16 fields as illustrated below.



TDC1273

(1) **DFCS System Information Area (Fields 1 through 10)** The DFCS system information line is divided into 10 fields that provide system status as described below.

- (a) **Field 1. OPERATIONAL MODE** – The following data will appear in this field:
- **NORMAL** – Indicates that the normal operational mode was selected.
 - **MAINT** – Indicates that the internal test mode was selected.
 - **Blank** – Indicates that the software configuration data table is invalid.

(b) **Field 2. FIRE MISSION INDICATOR** – This field will appear as follows in highest to lowest priority order:

- **CHKFIRE** – Indicates that a checkfire status exists on the DFCS. This message will appear in inverse video.
- **FIREMSN** – Indicates that the DFCS is performing a fire mission. This message will appear in inverse video.
- **(Blank)** – Indicates that none of the above conditions apply.

(c) **Field 3. MOVE ORDER INDICATOR** – The field will appear as follows:

- **MO** – Indicates that the DFCS has an active move order. This indicator will appear in inverse video.
- **(Blank)** – Indicates that there is no move order active.

(d) **Field 4. RESERVED FOR FUTURE UPGRADE**

(e) **Field 5. RESERVED FOR FUTURE UPGRADE**

(f) **Field 6. ALIGN TIME TO GO INDICATOR** – Following are the data that will appear in this field, in highest to lowest priority order:

- **ZPT** – Indicates that the Navigation Device requires a Zero Velocity Update.
- **CMD** – Indicates that the DFCS has initiated a command sequence with the Navigation Device and the command sequence has not yet been completed.
- **POS** – Indicates that the Navigation Device requires a position update.
- **nnn** – This three digit number indicates the number of seconds remaining before navigation alignment is complete.
- **(Blank)** – Indicates the DFCS is not undergoing a navigation alignment and does not require any information.

(g) **Field 7. FUNCTION STATUS** – The following data will appear in this field when in normal operational mode:

- **N** – Navigation function not available or non-operational.
- **A** – GPS Aiding function not available or non-operational.
- **C** – Communications function not available or non-operational.
- **(Blank)** – The absence of a letter indicates that the associated function is available.

(h) **Field 8. LAY STATUS** – This three (3) character field indicates whether the tube is in the lay position.

- **LAY (normal video)** – Indicates the tube is not within the lay window.
- **LAY (reverse video)** – Indicates the tube is within the lay window.
- **(Blank)** – When not in a fire mission.

(i) **Field 9. DC STATUS** – This four (4) character field indicates the current charge of the batteries if on DC power.

- **NNN%** – Percentage of battery life left.
- **(Blank)** – Indicates external power source is being used.

(j) **Field 10. POWER SOURCE** – This field indicates what type of power source is currently in use. The following data will appear in this field:

- **AC** – Alternating Current
- **DC** – Direct Current

(2) **Main Display Area (Field 11)** – This area contains the menu, information, and data entry fields required for operating the DFCS. The specific data shown in this field is dependent on the functions being performed by the DFCS.

2-12 DFCS CONTROLS AND INDICATORS (cont)

(3) **Additional Status Area (Fields 12-15)** – This area is displayed when performing a fire mission or when the system is in Section In Order but not accessing any setup and information displays. This area is only defined for normal operational mode. The Additional Status Area information line is divided into several Fields dedicated to particular types of system status as illustrated below.

The data contained in each field is as follows:

(a) **Field 12. MISSION PRIORITY** – This field provides an indication of the current priority of the fire mission. The following data will appear in this field:

- **FPP** - Indicates that the mission is a Final Protective Fire mission.
- **PRI** - Indicates that the mission is a Priority Fire Mission
- **(Blank)** - Indicates that the mission is a Normal mission.

(b) **Field 13. MISSION URGENCY** – This field provides an indication of the current mission urgency status for the DFCS. The following data will appear in this field:

- **DC** – Indicates that the fire mission has an associated danger close status.
- **TOT** – Indicates that the fire mission is a time on target fire mission.
- **(Blank)** – Indicates that the DFCS has normal urgency for this mission.

(c) **Field 14. RESERVED FOR FUTURE UPGRADE**

(d) **Field 15. RESERVED FOR FUTURE UPGRADE**

(4) **Function Key Labels Area (Fields 16-19)** – The data contained in each field varies with the particular menu displayed in the Main Display Area.

(a) **Error and Alert Usage** - The function key label area is also used for short error and alert messages. When used in this fashion the following gives the layout of the field:

Message prompt area	ACK
---------------------	-----

The data contained in the message prompt area varies with the particular message to be displayed.

(b) **Confirmation Usage** - The function key label area is also used for confirmation prompting. When used in this fashion the following gives the layout of the area:

Confirm prompt area	YES	NO
---------------------	-----	----

The data contained in the confirm prompt area varies with the particular prompt to be displayed.

(5) **Data Entry Methods** - There are four (4) basic methods of data entry used by the DFCS. They are: Cursor Selection Entry, Numeric Entry, Toggle Selection Entry and Function Label Entry.

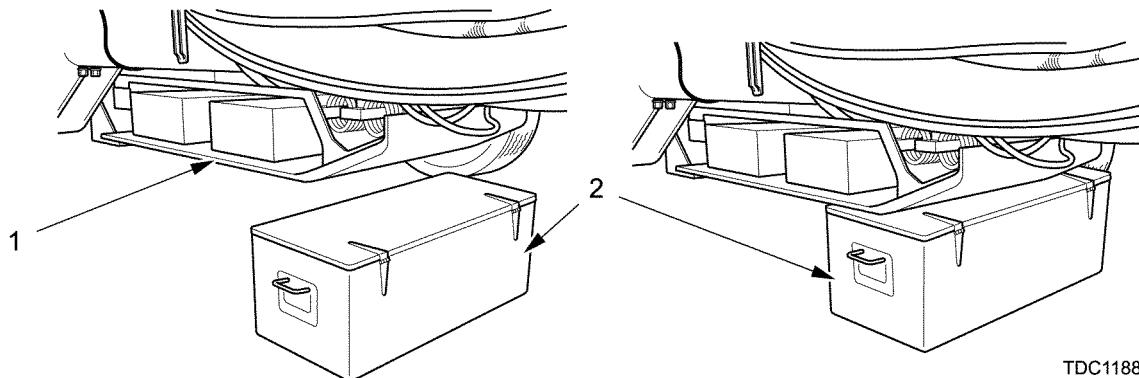
c. UNDER CRADLE ELECTRONIC ASSEMBLY CONTROLS AND INDICATORS

The **Under Cradle Electronic Assembly (1)** is located and mounted to the underside of the cradle assembly. Provides housing for the following DFCS LRUs; MSC, PCCM, BAT and BTT.

(1) To Lower the Under Cradle Electronic Assembly

(a) Place a suitable support (2) (dunnage, section chest, wood or other expedient material) on the ground, underneath and, at the front of the under cradle electronic assembly (1).

(b) Depress howitzer until the under cradle electronic assembly (1) is resting on the support (2).

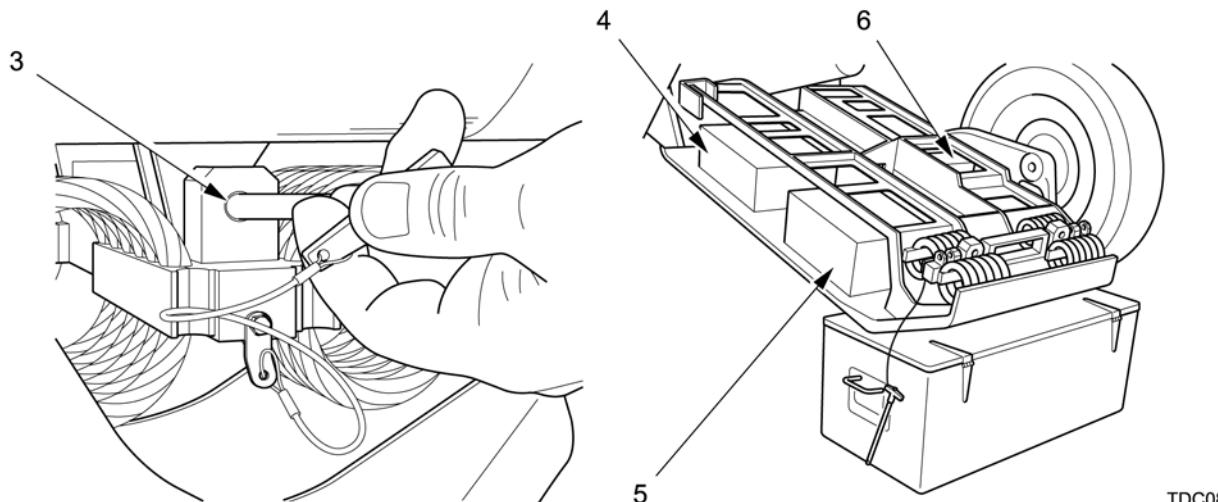


(c) Remove quick release pin (3) by depressing button and pull pin outwards.

CAUTION

When elevating howitzer, ensure under cradle electronic assembly is properly supported. Failure to do so may damage equipment.

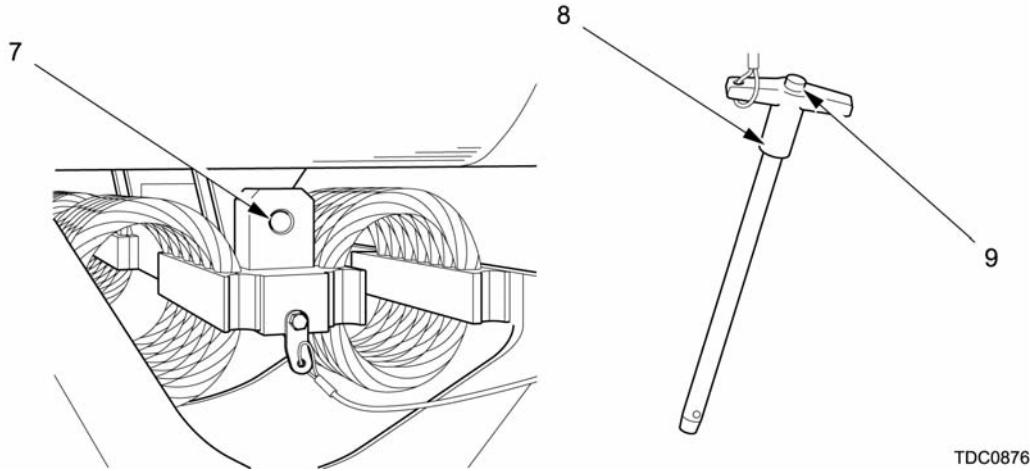
(d) Elevate howitzer until access to the MSC (4), PCCM (5), and BAT (6) can be obtained.



2-12 DFCS CONTROLS AND INDICATORS (cont)

(2) To Raise the Under Cradle Electronic Assembly

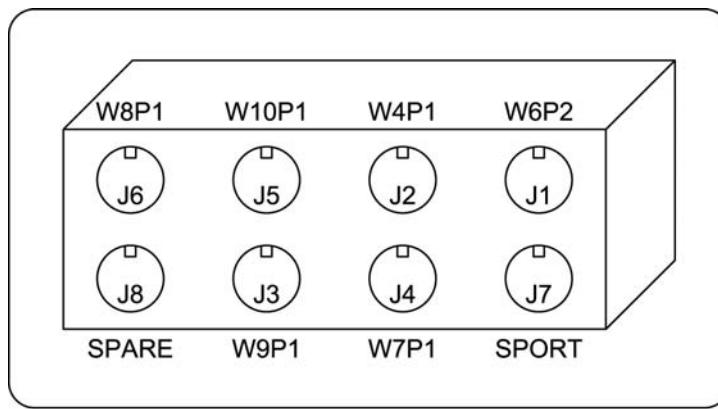
(a) Depress howitzer until quick release holes (7) are aligned, insert quick release pin (8) by depressing button (9), ensure pin is engaged.



TDC0876

NOTE

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



TDC1109

d. MISSION COMPUTER (MSC) CONTROLS AND INDICATORS

The **MSC** is located under the cradle assembly and is mounted to the under cradle electronics assembly. It provides an interface between all DFCS components. Displays operator information at the CSD, GND and AGD units.

(1) **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.

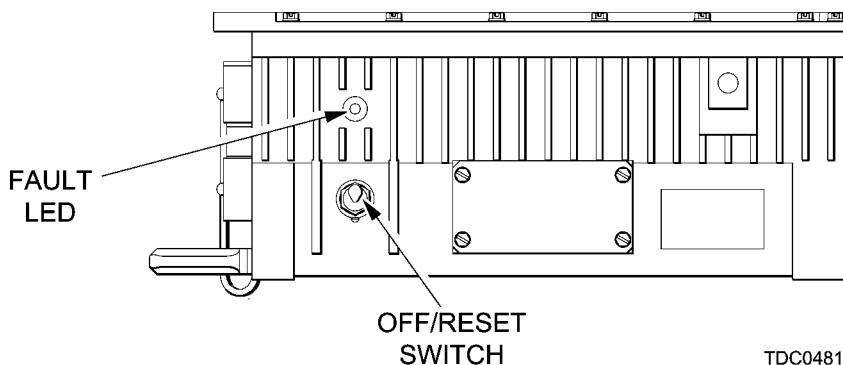
NOTES

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 on the CSD that an abnormal power down had previously occurred.

To apply power to the MSC from an OFF state, turn the PCCM function control switch to ON.

- (2) **FAULT LED** is located on the side of the MSC enclosure and will illuminate AMBER during MSC boot-up. 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. POWER CONDITIONING AND CONTROL MODULE (PCCM) CONTROLS AND INDICATORS

The **PCCM** is located under the cradle assembly and is mounted to the under cradle electronics assembly and regulates onboard and/or external power for the DFCS components.

- (1) **Function Control Switch** is a four-position rotary switch providing the following positions:

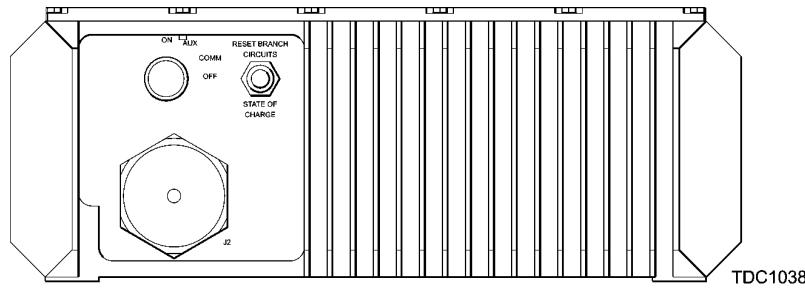
- (a) **OFF** position removes power from the DFCS. To move into the OFF position or to move into any other position from OFF position, the knob must be pulled out and rotated.
- (b) **COMM** position applies power only to the CLA to enable SINCGARS communication independent of remainder of DFCS.
- (c) **AUX** position applies power to the J4 connector port and CLA.
- (d) **ON** position distributes/controls power to the remainder of the DFCS components.

NOTE

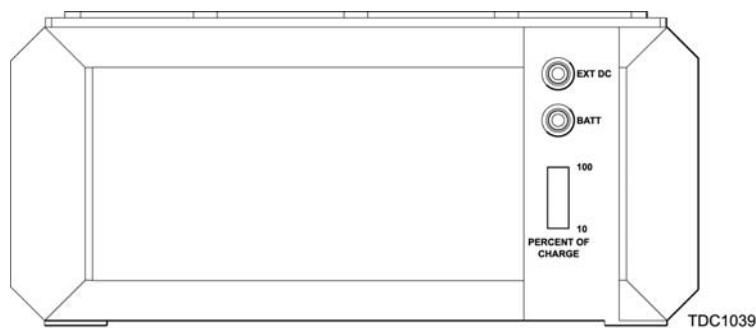
The DFCS must be booted up and operating in order to obtain an accurate SOC reading. In order to read SOC on the PCCM, the Function Control Switch must be in the COMM, AUX or ON position.

- (2) **RESET BRANCH CIRCUITS STATE OF CHARGE** a momentary toggle switch resets the PCCM circuit breakers (up position) turns on SOC display (down position).

2-12 DFCS CONTROLS AND INDICATORS (cont)



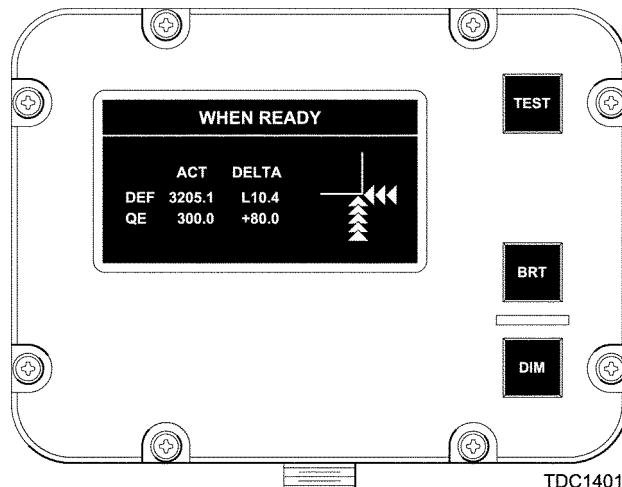
- (3) EXT DC LED indicator, when lit indicates prime mover is source of power.
- (4) BATT LED indicator, when lit indicates DFCS batteries are source of power.
- (5) PERCENT OF CHARGE 10 TO 100 indicates percentage of charge remaining in batteries.



f. GUNNER (GND) AND ASSISTANT GUNNERS DISPLAYS (AGD) CONTROLS AND INDICATORS

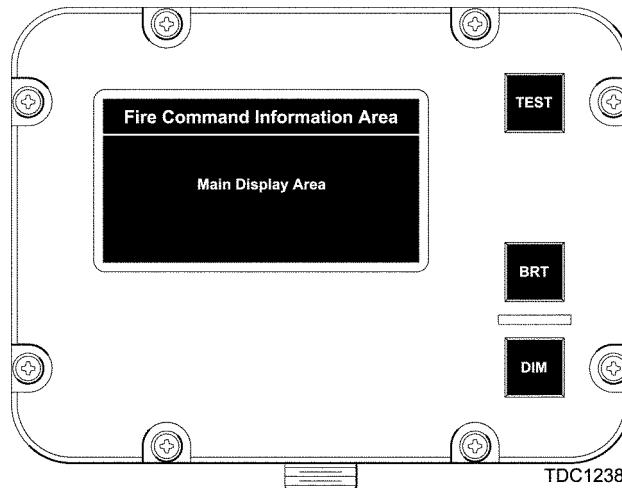
The **GND** and **AGD** displays commands for laying the howitzer. Located and mounted to the left and right sight posts.

- (1) TEST momentary action switch provides a means to display a series of test patterns on the screen.
- (2) BRT each press of the button increases the brightness of the display by one level.
- (3) DIM each press of the button decreases the brightness of the display by one level.



g. GND DISPLAY LAYOUT

The display layout is functionally divided into two (2) main areas as illustrated below.

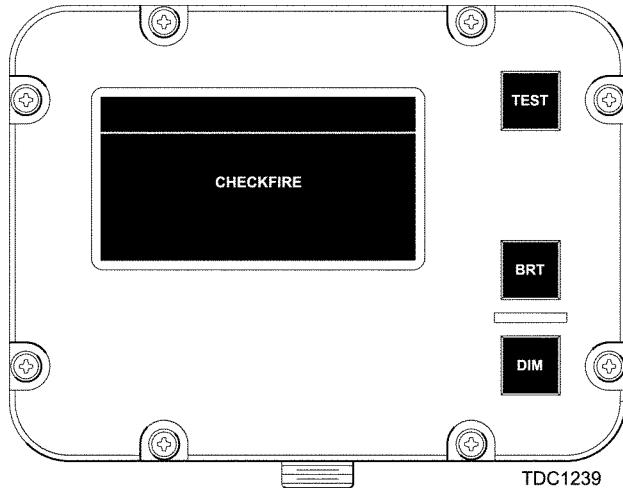


(1) Fire Command Information Area The top line of the display is reserved for Fire Command Information. The follow information may appear in this area:

- (a) **DO NOT LOAD** – DNL method of control received in the fire mission message.
- (b) **AT MY COMMAND** – AMC method of control received in the fire mission message.
- (c) **WHEN READY**
 - FIRE command message received from the FDC and the fire mission is an AMC or FPF DNL mission.
 - WR method of control received in the fire mission message.
- (d) **CONTINUOUS** – Continuous Fire Interval received in the fire mission message.
- (e) **MANUAL** – “USE ALL” previously selected by operator on Fire Command Screen of CSD.
- (f) **CEASELOAD** – CEASELOAD message was received from FDC and a fire mission is active.
- (g) **TOT** – TOT received in the fire mission message.
- (h) **CHECKFIRE** – Checkfire By Target Number or Checkfire All received from an FDC.

(2) Main Display Area The main display area contains numerical and graphical gun pointing information indicating the magnitude and direction of the delta-motions required to lay the gun on the commanded Gun Orders. This area will also display critical Mission Commands, such as **END OF MISSION**, **CEASE LOADING**, and **CHECKFIRE**, using large characters, as illustrated in the following example.

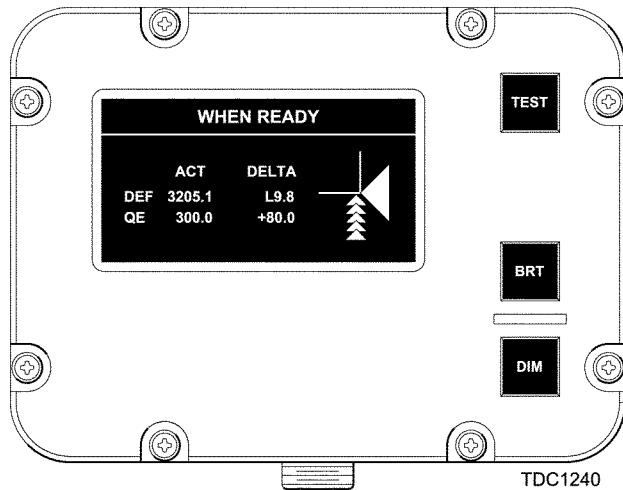
2-12 DFCS CONTROLS AND INDICATORS (cont)



(3) Fire Mission Pointing Information Display Layout

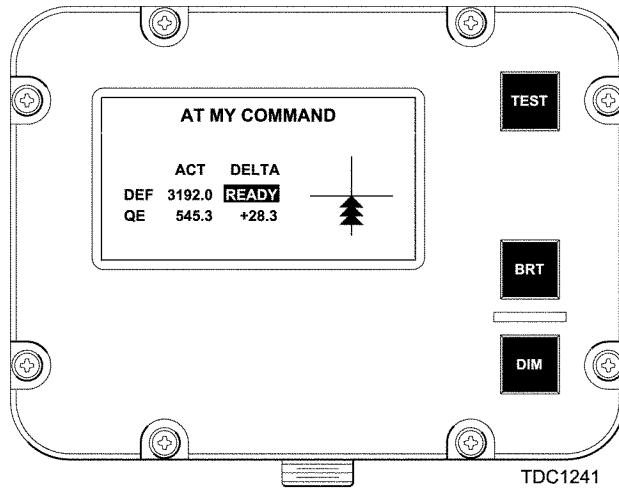
The fire mission pointing display will appear as illustrated in the examples below.

- (a) Two sizes of triangles will be used to graphically represent direction and number of mils in tens of mils. Small and Large triangles will not be mixed on any one axis of the cruciform. Each small Triangle will correspond to a delta of 10 mils between actual and commanded values such that five each may fit on any one arm of the cruciform. The resolution of the small triangles will always round up to the nearest ten mils (+28.3 equals three triangles). When the delta is less than 10 mils the small triangle will be replaced by a large triangle.

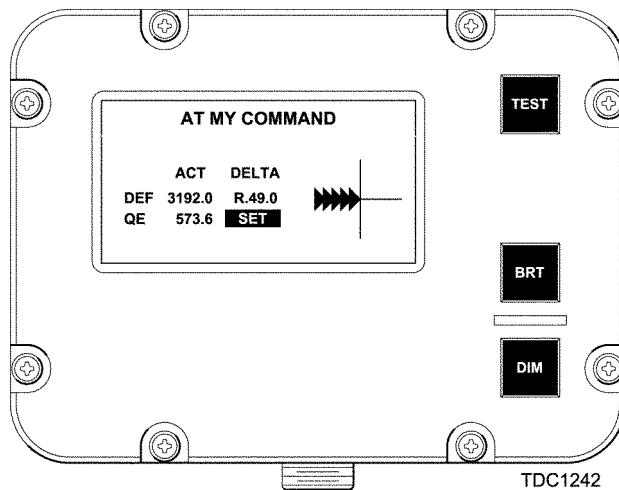


- (b) Actual Deflection will be displayed to the nearest 0.1 mil, and leading zeros will be suppressed.
- (c) Delta Deflection will be displayed with the letters 'L' or 'R' in large characters in front of the numeric data to indicate which direction to turn the weapon.
- (d) Actual Quadrant Elevation will be displayed to the nearest 0.1 mil and leading zeros will be suppressed.
- (e) Delta Quadrant Elevation will be displayed with the plus sign (+) or minus sign (-) in front of the numeric data to indicate which direction to turn the weapon.

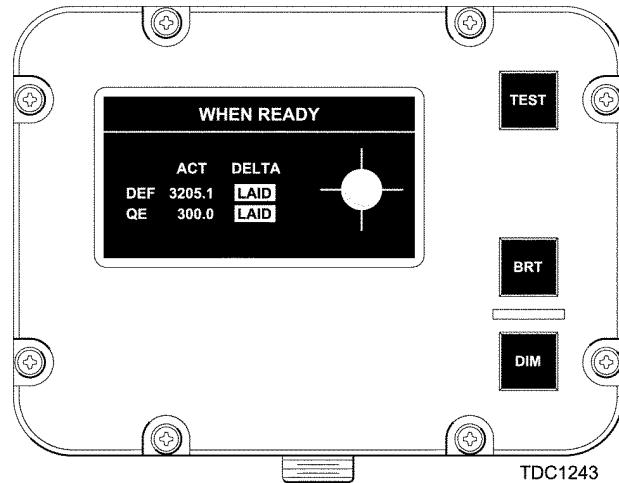
(f) When the deflection delta is less than or equal to 0.5 mil, the indicator READY will appear in inverse font/background color, and replace the numeric data.



(g) When the Quadrant Elevation delta is less than or equal to 0.5 mil, the indicator SET will appear in inverse font/background color, and replace the numeric data.



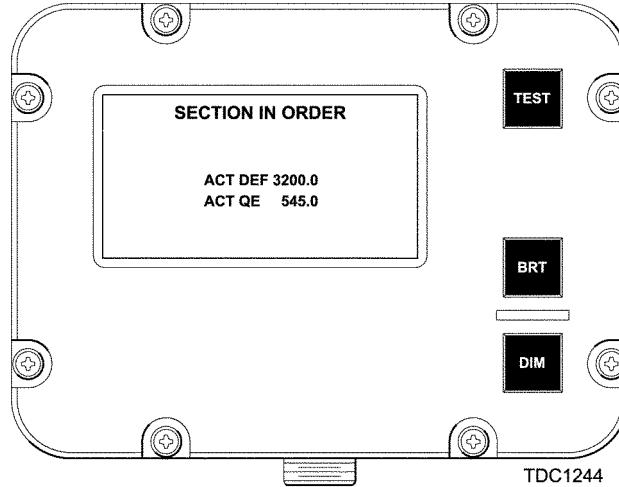
(h) When both the Deflection delta and the Quadrant Elevation delta are less than or equal to 0.5 mil, a circle will be drawn at the center of the cruciform and the indicator LAID will appear to indicate the weapon is in the laid position.



2-12 DFCS CONTROLS AND INDICATORS (cont)

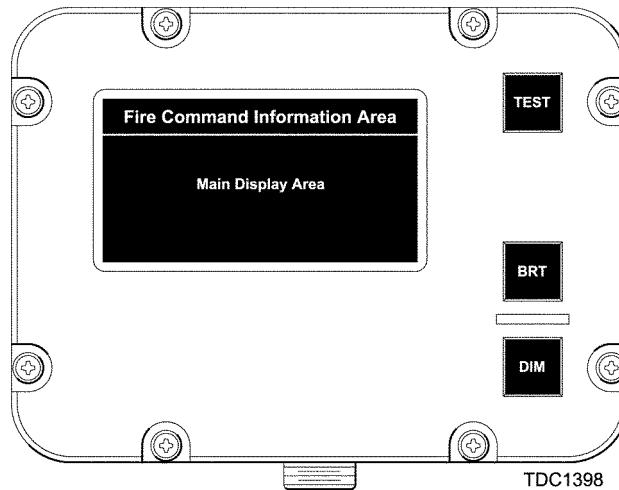
(4) Gun Pointing Information Display Layout

The gun pointing display will be used for pointing the gun tube for non fire-mission operations, such as **SECTION IN ORDER**. The display will indicate the current position of the gun tube in deflection or azimuth, as set by the mission computer, and quadrant elevation, each to the nearest 0.1 mil.



h. AGD DISPLAY LAYOUT

The display layout is functionally divided into two (2) main areas as illustrated below.

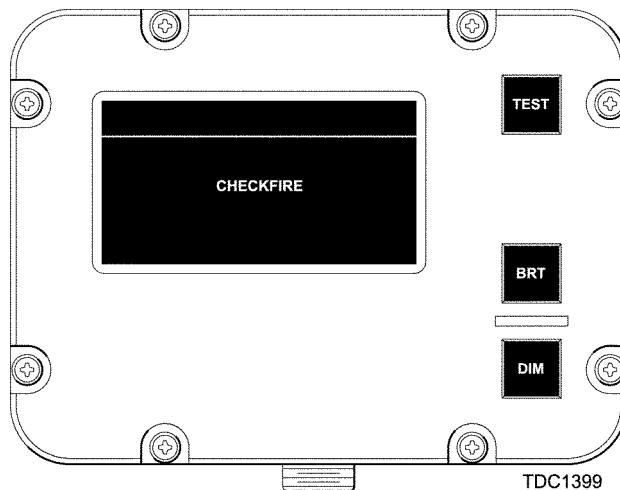


(1) Fire Command Information Area

The top line of the display is reserved for DFCS Fire Command Information; **DO NOT LOAD, AT MY COMMAND, WHEN READY, FIRE**, and also in combination with Final Protective Fire (FPF).

(2) Main Display Area

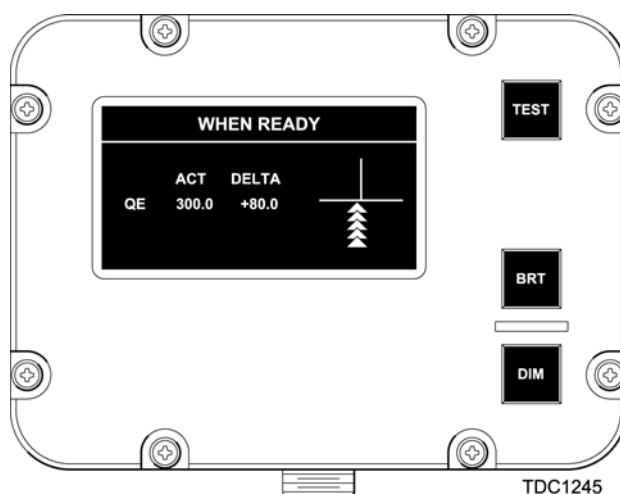
The main display area contains numerical and graphical gun pointing information indicating the magnitude and direction of the delta-motions required to lay the gun on the commanded Gun Orders. This area will also display critical Mission Commands, such as **END OF MISSION**, **CEASE LOADING**, and **CHECKFIRE**, using large characters, as illustrated in the following example.



(3) Fire Mission Pointing Information Display Layout

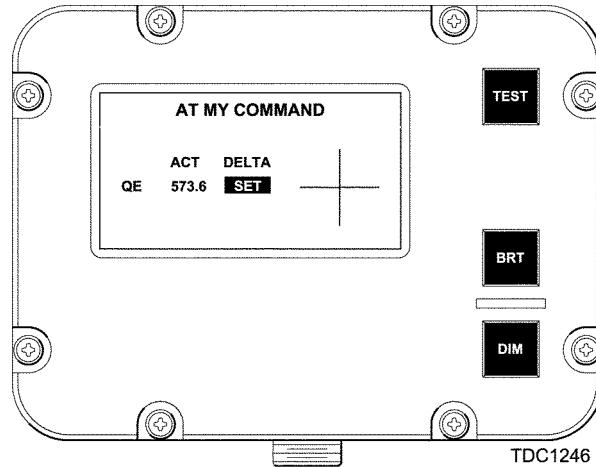
The fire mission pointing display will appear as illustrated in the examples below.

- (a) Two sizes of triangles will be used to graphically represent direction and number of mils in tens of mils. Small and Large triangles will not be mixed on any one axis of the cruciform. Each small Triangle will correspond to a delta of 10 mils between actual and commanded quadrant elevation value such that five each may fit on the elevation arm of the cruciform. The resolution of the small triangles will always round up to the next ten mils (+21.3 would equal three triangles pointing up). When the delta is less than 10 mils the small triangle will be replaced by a large triangle.
- (b) Actual Quadrant Elevation will be displayed to the nearest 0.1 mil and leading zeros will be suppressed.
- (c) Delta Quadrant Elevation will be displayed with the plus sign (+) or minus sign (-) in front of the numeric data to indicate whether to elevate or depress the weapon.

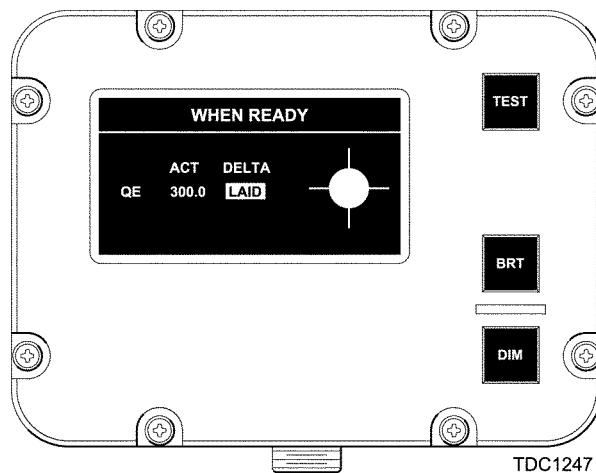


- (d) When the Quadrant Elevation delta is less than or equal to 0.5 mil, the indicator SET will appear in inverse font/background color, and replace the numeric data.

2-12 DFCS CONTROLS AND INDICATORS (cont)

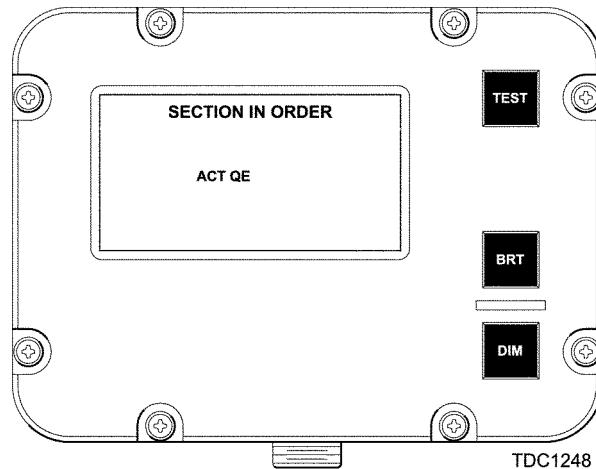


(e) When both the Deflection delta and the Quadrant Elevation delta are less than or equal to 0.5 mil, a circle will be drawn at the center of the cruciform to indicate the weapon is in the laid position.



(4) Gun Pointing Information Display Layout

The gun pointing display will be used for pointing the gun tube for non fire-mission operations, such as SECTION IN ORDER. The display will indicate the current position of the gun tube in quadrant elevation, as set by the mission computer to the nearest 0.1 mil.



h. COMMUNICATIONS LOCATION ASSEMBLY (CLA) CONTROLS AND INDICATORS

The **CLA (1)** is located on the left side of the cradle assembly and mounted on the top cradle electronics assembly. The CLA contains the CLE (2), RTA (3), AMP (4), DAGR (5), GPS antenna (6), RPS (7), and EPIAFS PIK (14).

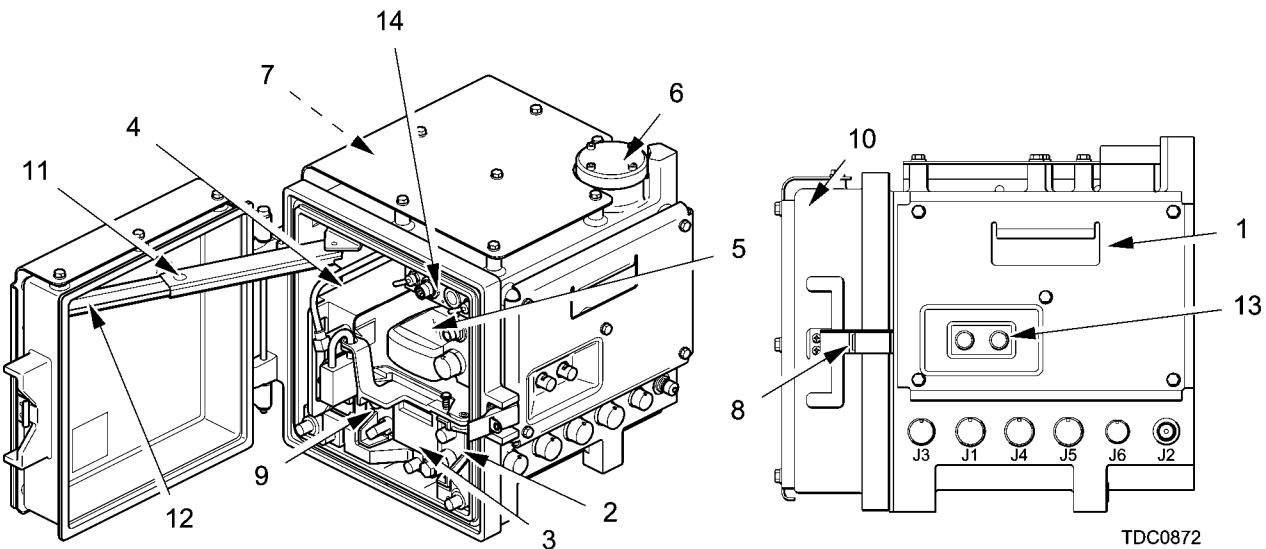
- (1) **PADLOCKS** provide external and internal security for door latch (8) and extractor bar (9).
- (2) **DOOR LATCH (8)** is used to close and secure outer door (10).
- (3) **EXTRACTOR BAR (9)** provides internal security for RTA (3).
- (4) **DOOR STAY RELEASE BUTTON (11)** releases door stay (12) from the locked (open) position.
- (5) **LANDLINE BINDING POSTS (13)** connect CLA (1) to hardware landline communications.

NOTES

The PIK is not required for routine M777A1 or M777A2 missions and may or may not be present. The PIK is required for Excalibur missions and setting inductive fuzes via DFCS mission.

Refer to:

- TM 11-5820-890-10-8 for description and operation of SINCGARS RT-1532E (RTA) and RF Power Amplifier (AMP).
- TM 11-5820-1172-13 for description and operation of DAGR.
- TM 9-1290-211-12&P for description and operation of the EPIAFS.



Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

Paragraph	Page
2-13 PMCS Procedures.....	2-32

2-13 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. Routinely, units perform daily BEFORE and AFTER procedures in conjunction with crew rest (e.g., the AFTER procedures will be performed at the end of the day prior to crew rest; the BEFORE procedure will be performed after crew rest and prior to the start of the current day's activities). 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 fully performing its primary mission. However, if deemed safe by your supervisor, the system can be capable of being operated for a limited amount of time or in a degraded mode until maintenance can be performed. If you identify any of the faults listed in this column, consult your supervisor for direction.

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.

CAUTION

Equipment operation is allowed with leaks (Class I, II or III), provided ample fluid exists or can be maintained in the system. When in doubt, consult your supervisor for direction. Class I, II or III leaks should be repaired as soon as the mission dictates.

f. Equipment does not perform. If equipment does not perform as required, refer to Chapter 3, Section II 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/M777A1/M777A2 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).	Howitzer has not been borescoped/pullover gauged in accordance with instructions.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			WARNINGS	
2	Before and After	RECOIL SYSTEM	<p>SC</p> <p>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:</p> <p>(1) Howitzer has been deployed to a temperature change of $\pm 40^{\circ}\text{F}$ (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.</p>	Nitrogen pressure is below 362 psi (25 bar) or above 522 psi (36 bar).
3	Before and After	RECOIL SYSTEM AND LINES	<p>Cannoneers Nos. 1 and 2</p> <p>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 parts are damaged, notify unit maintenance.</p> <p>b. Check for oil leakage. If oil leaks are present, notify unit maintenance.</p> <p>c. Check oil index pin is flush. If pin is not flush, notify unit maintenance.</p>	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/M777A1/M777A2 HOWITZER (cont)

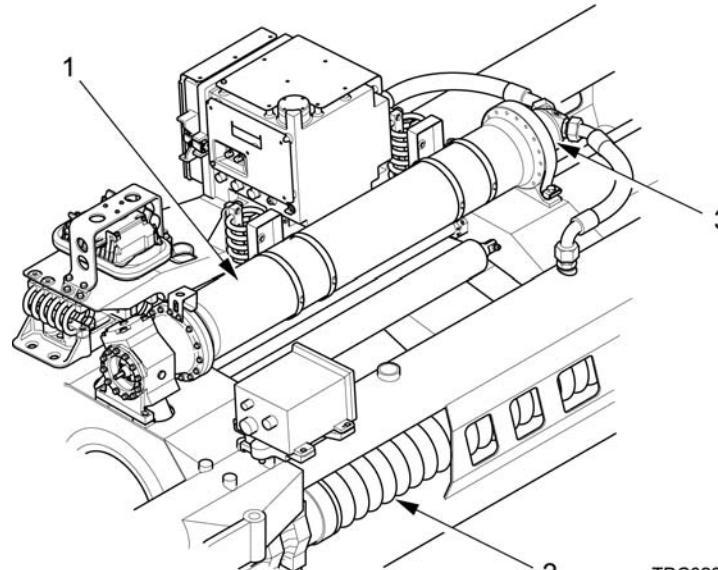
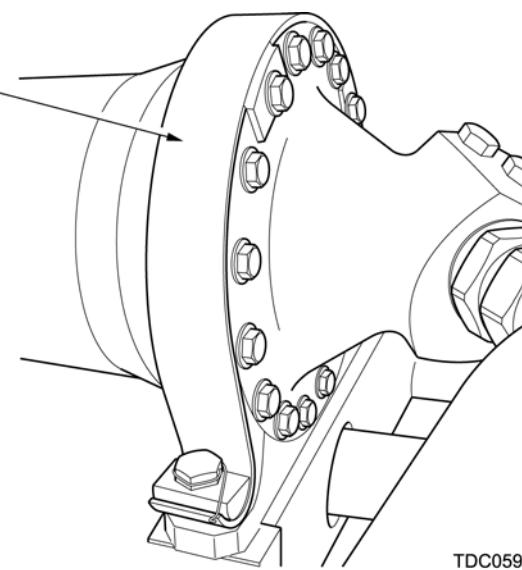
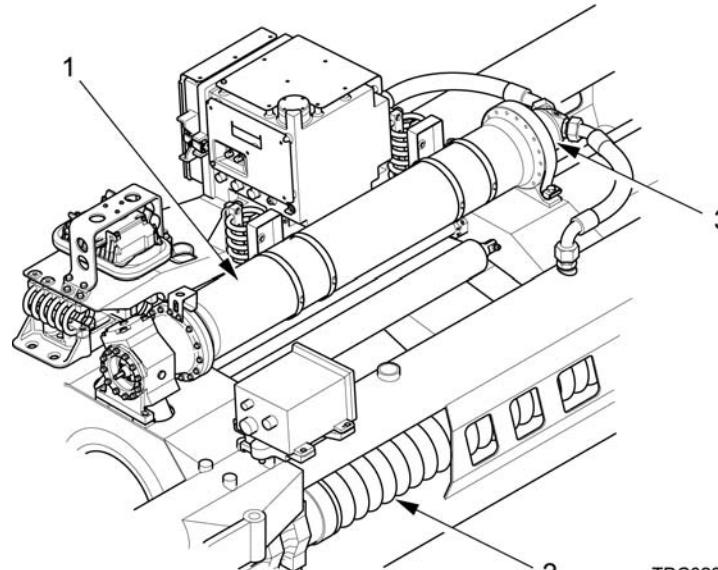
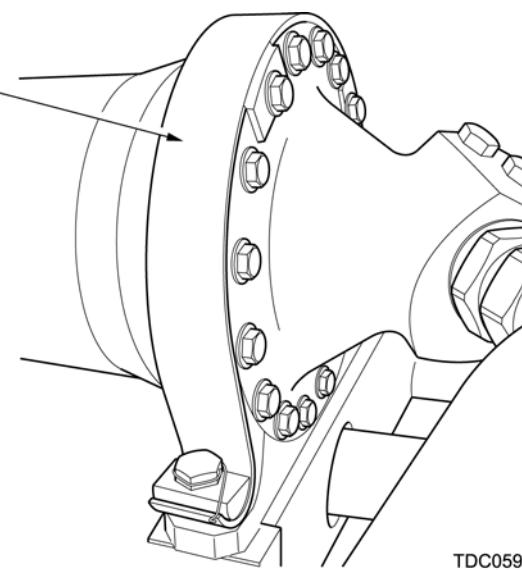
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			 <p>1. Gun tube assembly 2. Recoil system components 3. Mounting hardware</p> <p>d. Check recoil accumulator retaining strap (4) for loose nuts/bolts missing or damaged parts. If nuts/bolts are loose, missing, not lockwired, or parts are damaged, notify unit maintenance.</p>  <p>4. Recoil accumulator retaining strap</p>	 <p>1. Gun tube assembly 2. Recoil system components 3. Mounting hardware</p> <p>d. Check recoil accumulator retaining strap (4) for loose nuts/bolts missing or damaged parts. If nuts/bolts are loose, missing, not lockwired, or parts are damaged, notify unit maintenance.</p>  <p>4. Recoil accumulator retaining strap</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

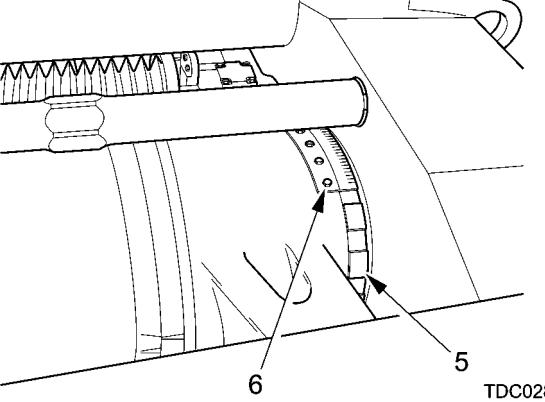
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			<p>e. Check recoil yoke thrust collar (5) and locking tab (6) for positive locking. If not locked, notify unit maintenance.</p> <p>f. Check recoil cylinders and bellows for damage, tears, and wear. If parts are damaged, torn or worn, notify unit maintenance.</p> <p>g. Check recoil cylinders and bellows for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, not lock wired, or parts are damaged, notify unit maintenance.</p> 	Thrust collar and locking tab not locked.
4	Before and After	SCAVENGE SYSTEM AND LINES	<p>Cannoneer No. 2</p> <p>a. Check scavenge manifold (1), piston (2), pressure (3) and exhaust cylinders (4), and lines for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>	<p>UPON RECEIPT OF NEW ISSUE, OVERHAULED OR REPAIRED RECOIL OR SCAVENGE SYSTEM FIRST ROUND MUST BE FIRED WITH A 25FT LANYARD.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

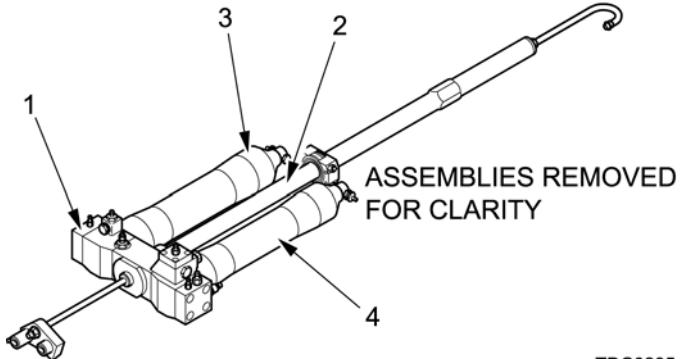
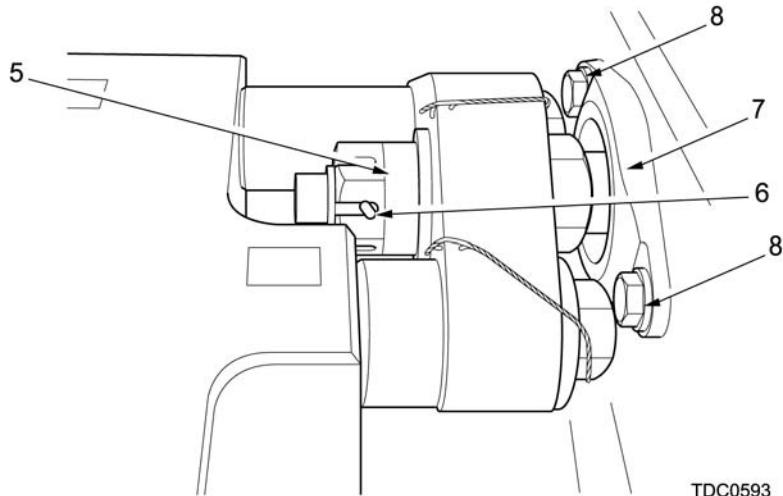
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			 <p>TDC0285</p> <p>b. Check scavenge rod-end nut (5), cotter pin (6), retaining plate (7) and two tab washers (8) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, not lock wired, or parts are damaged, notify unit maintenance.</p>  <p>TDC0593</p> <p>c. Check scavenge key washer (9), tab washer (10) and locking collar (11) for loose, missing or damaged parts. If parts are loose, missing, or parts are damaged, notify unit maintenance.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

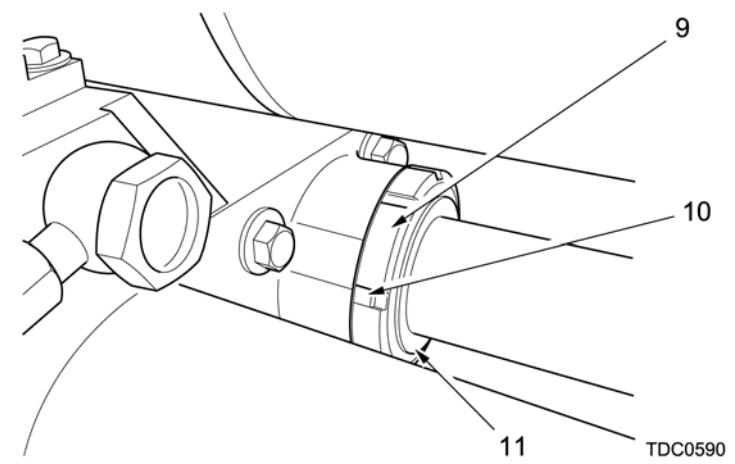
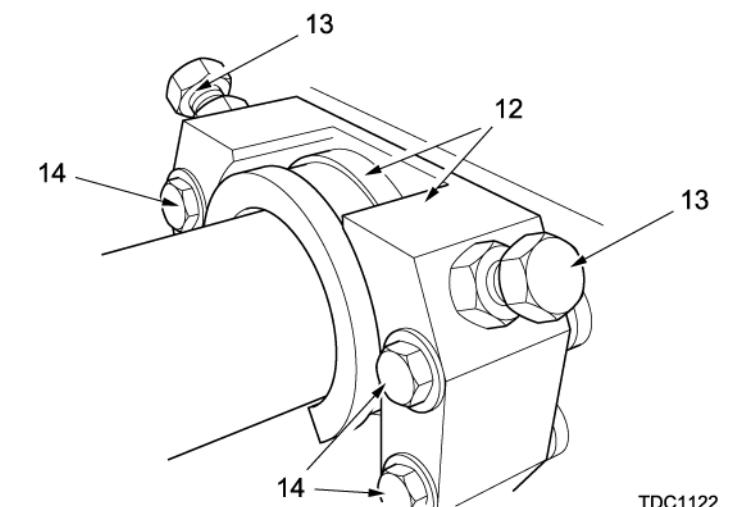
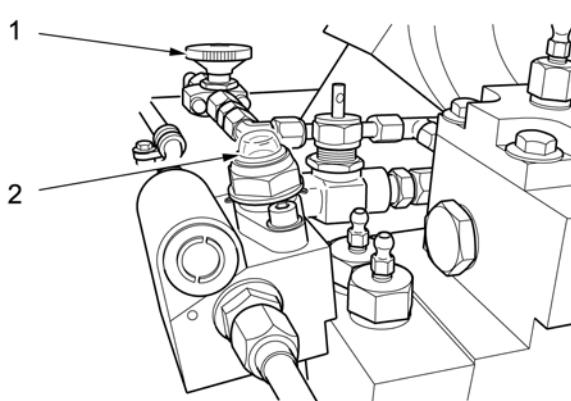
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			 <p>d. Check scavenge doughnut and collar (12), setscrews (13) and mounting bolts (14) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>  <p>e. Check for oil leakage. If oil leaks are present, notify unit maintenance. If leakage is a Class III.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
5	Before and After	SCAVENGE ISOLATOR VALVE AND FILTER	<p style="text-align: center;">WARNING</p> <p>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.</p> <p>Cannoneer No. 1</p> <p>a. Check scavenge isolator valve (1) and filter (2) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, not lockwired, or parts are damaged, notify unit maintenance.</p> <p>b. Check for oil leakage. If oil leaks are present, notify unit maintenance.</p> <p>c. Check isolator valve for smooth operation, if sticking or binding occurs, notify unit maintenance.</p>  <p>INU AND MOUNT REMOVED FOR CLARITY</p>	Scavenge isolator valve lockwire missing. If leakage is a Class III.

TDC0594

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 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	<p>Cannoneer No. 1</p> <p>a. Check trunnion pump and lines for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>b. Check for oil leakage. If oil leaks are present, notify unit maintenance.</p> <p>c. Check pump for smooth operation, if binding and/or jerky, notify unit maintenance.</p>	If leakage is a Class III.
7	Before and After	HIGH AND LOW PRESSURE GAUGES	<p>Cannoneer No. 1</p> <p>a. Check high and low pressure gauges for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>b. Check gauges for damage. If damaged notify unit maintenance.</p> <p>c. Check gauges for oil leaks. If oil leaks present notify unit maintenance.</p> <p>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.</p> <p>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.</p> <p>f. Check lines for oil leakage. If oil leaks are present, notify unit maintenance.</p>	If leakage is a Class III. If high pressure gauge is reading below 1160 psi (80 bar). If low pressure gauge is reading below 44 psi (3 bar). If leakage is a Class III.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

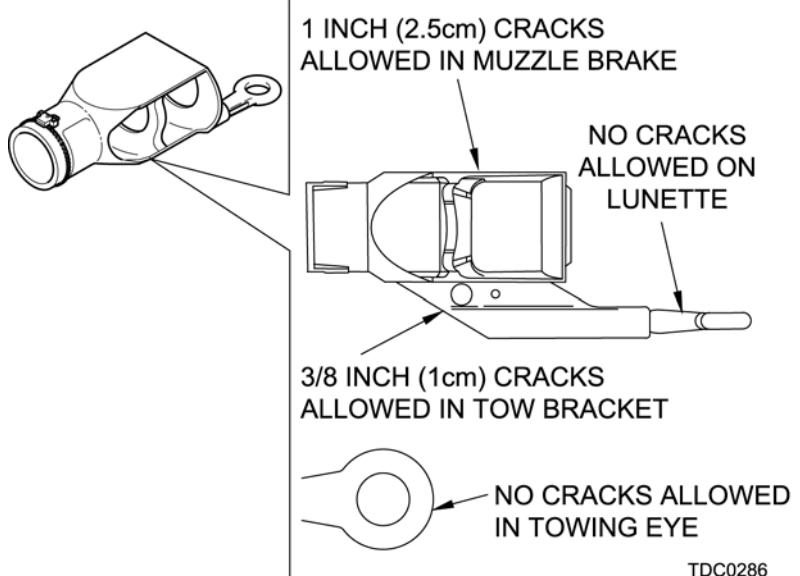
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
8	Before and After	MUZZLE BRAKE ASSEMBLY	<p>Cannoneer No. 4</p> <p>a. Inspect muzzle brake assembly for cracks over 1in (2.54cm) long. If cracks appear over 1in (2.54cm) long, notify unit maintenance.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

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

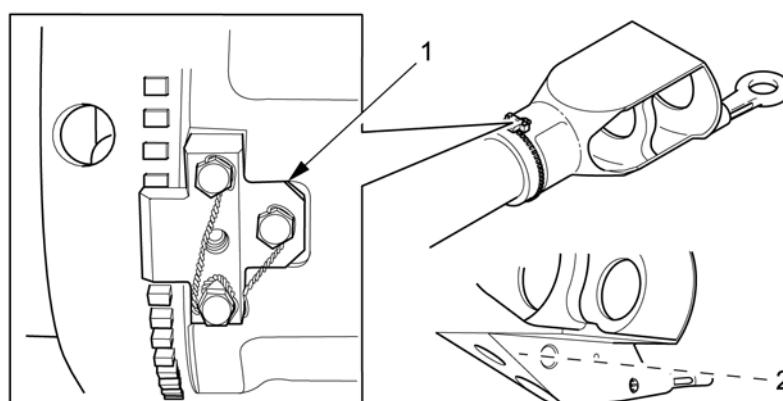
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			 <p style="text-align: right;">TDC0287</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> WARNING </div> <p>ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.</p>	
9	Before and After	BREECH LEVER AND LINES	<p>Cannoneer No. 2</p> <ul style="list-style-type: none"> a. Check breech lever and lines for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or 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 binding occurs, notify unit maintenance. <div style="border: 1px solid black; padding: 5px; text-align: center;"> WARNING </div> <p>THE BREECH LOCK-OUT 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.</p>	If leakage is a Class III.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 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	<p>Cannoneer No. 2</p> <p>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 handfile.</p> <p>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, remove burrs with hand file.</p> <p>c. Inspect breechblock detent plunger (5) for smooth operation, distortion and wear. If worn, notify unit maintenance.</p> <p>d. Unit maintenance should also be notified for replacement of detent plunger, when cannon tube is replaced (as recorded on DA FORM 2408-4/Weapon Record Book NAVMAC 10558/10558a).</p> <p>e. Check catches (6) for loose bolts and missing or damaged parts. If bolts are loose, missing, not lock wired or parts are damaged, notify unit maintenance.</p> <p>f. Check breech roller cam (7) for loose or missing screws. If loose or missing, notify unit maintenance.</p>	<p>Roller is broken.</p> <p>Breechblock will not close completely (witness marks do not align) breech is seized.</p>
			<p>NOTE</p> <p>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.</p> <p>g. Using multi-tool cross tip screwdriver head, test and inspect obturator pad (8) (Para 3-7 f.), for damage and wear. If obturator fails test and inspection, replace obturator pad and notify unit maintenance.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

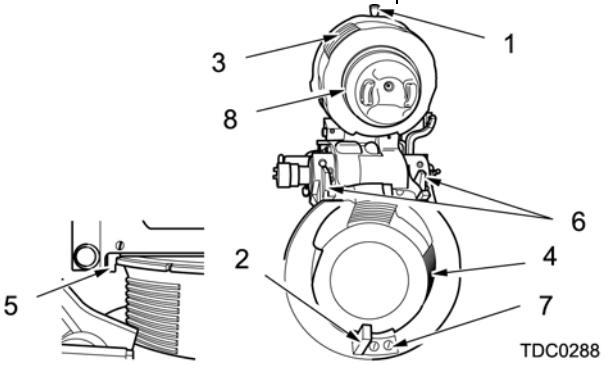
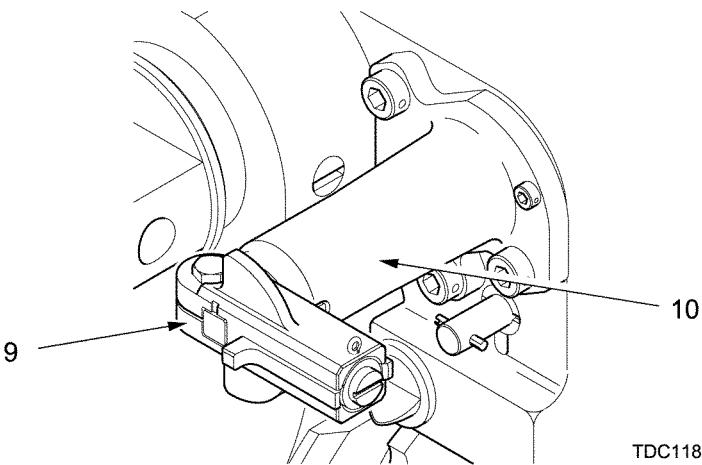
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			<p>NOTE If steel mesh is visible but not torn, obturator pad is still serviceable.</p> <p>h. Check obturator pad for damage or wear, if steel mesh is visible and torn, replace.</p>  <p>i. Check dog 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 handfile.</p> <p>j. Check drive shaft housing (10) for loose nuts and bolts, missing or damaged parts. If loose, missing, not lock wired, or parts are damaged, notify unit maintenance.</p> 	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

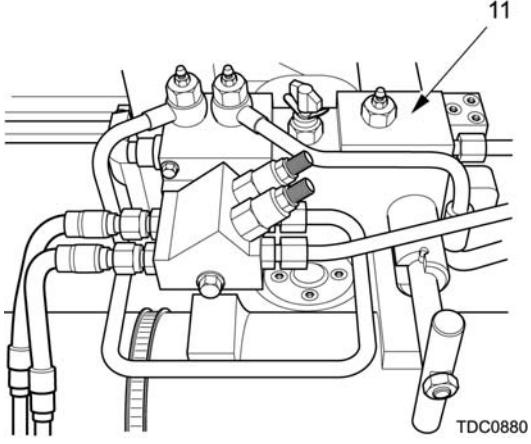
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			<p>k. Check actuator housing (11) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>l. Check for oil leakage. If oil leaks are present, notify unit maintenance.</p>  <p style="text-align: right;">TDC0880</p> <p>m. 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.</p> <p>n. Check pin for corrosion, nicks, or burrs. If required, remove corrosion with crocus cloth (item 11, appx D). Remove nicks and burrs with a handfile.</p> <p style="text-align: right;">TDC0954</p>	If leakage is a Class III.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

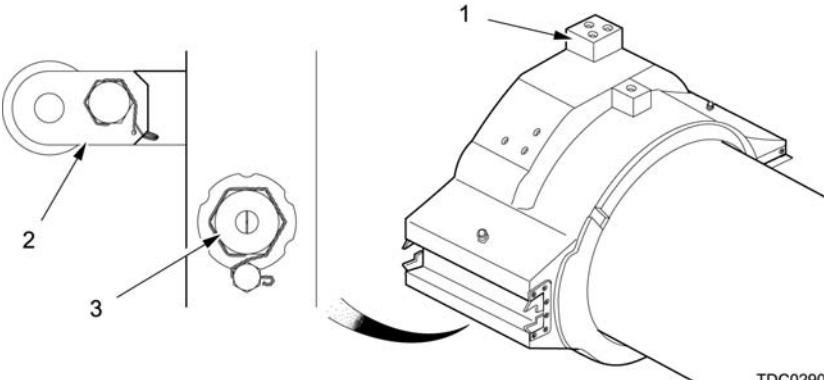
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
11	Before and After	BREECH COLLAR ASSEMBLY	<p style="text-align: center;">WARNING</p> <p>THE BREECH LOCK-OUT PLUNGER MUST BE ENGAGED PRIOR TO PERFORMING ANY MAINTENANCE TASKS THAT REQUIRE THE BREECH TO BE OPEN. FAILURE TO ENGAGE THE PLUNGER COULD RESULT IN ACCIDENTAL BREECH CLOSURE. THIS COULD RESULT IN SEVERE CRUSHING INJURIES TO PERSONNEL.</p> <p>Cannoneer No 2</p> <p>a. Inspect the stop (1) for loose or missing bolts. If loose or missing, notify unit maintenance.</p> <p>b. Inspect breech collar key (2) and tube locking key (3) for loose, missing, or broken bolt and lockwire. If lockwire is missing or a bolt is loose, missing or broken, notify unit maintenance.</p>  <p style="text-align: right;">TDC0290</p> <p style="text-align: center;">WARNING</p> <p>THE BREECH LOCK-OUT 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.</p>	Breech collar/key/bolt/lockwire missing.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

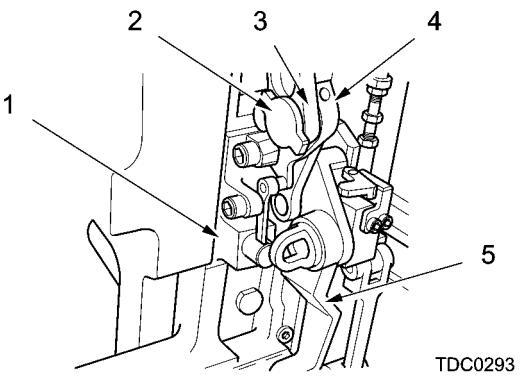
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
12	Before and After	PFM TRAY ASSEMBLY	<p>Cannoneer No. 2</p> <p>a. Check PFM (1) for loose bolts and missing or damaged parts. If bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>b. Check connect link (2), quick release (3) and drive link (4) assemblies for secure attachment, if unable to secure, notify unit maintenance.</p> <p>NOTE If Injector Arm Assembly fails to operate correctly, refer to Chapter 3, Section II under Troubleshooting Procedures, and carryout INJECTOR ARM ASSEMBLY WILL NOT FUNCTION CORRECTLY steps.</p> <p>c. Check injector arm assembly (5) for missing or damaged parts. If parts missing or damaged, notify unit maintenance.</p>  <p>TDC0293</p> <p>d. Inspect magazines (Para 3-8) for damaged parts. If damaged, notify unit maintenance.</p> <p>e. Check firing mechanism (Para 3-7 l.) for damaged parts. If damaged, replace firing mechanism and notify unit maintenance.</p> <p>f. Inspect firing pin (Para 3-7 c.) (6), spring (7) and retainer (8) for damage or broken parts.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

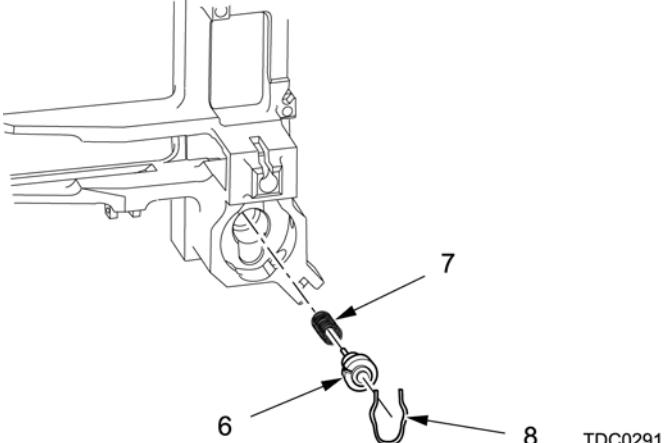
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			<p>g. Remove corrosion and small burrs from the tray sub-assembly rails that mate with the body assembly with crocus cloth (Item 11, appx D) and a small handfile.</p> 	
13	Before and After	PFM LEVER	<p>Cannoneer No. 2</p> <p>NOTE If PFM fails to operate correctly, refer to Chapter 3, Section II under Troubleshooting Procedures, and carryout PFM TRAY WILL NOT FUNCTION CORRECTLY steps.</p> <p>a. Check PFM lever (1) for smooth operation, loose nut/bolts and missing, or damaged parts. If nuts/bolts are loose, missing or damaged, notify unit maintenance.</p> <p>b. Operate PFM lever (1), ensure locking mechanism (2) engages in PRIMED (3) and EXTRACT (4) position. Ensure locking plunger is not deformed and or broken, if deformed or broken notify unit maintenance.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

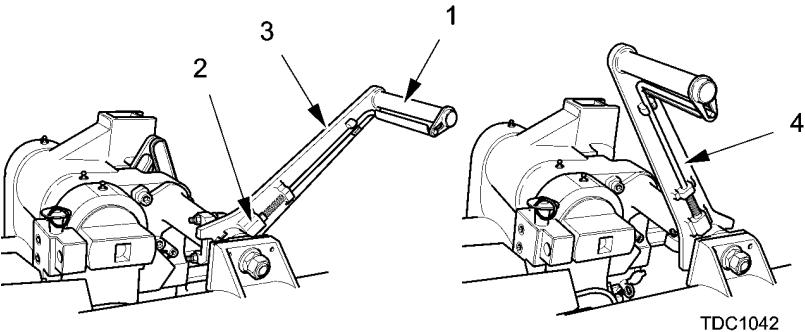
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			 WARNING <p>ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.</p>	
14	Before and After	TWD	<p>Cannoneer No. 2</p> <ul style="list-style-type: none"> a. Inspect for moisture inside TWD (fogging of window) (1), if moisture present notify unit maintenance. b. Check TWD for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance. <p>NOTE If TWD is inoperable, refer to cannon tube temperature definitions in Misfire/Hangfire procedures (Para 2-42 to 2-47) to determine cannon tube temperatures.</p> <ul style="list-style-type: none"> c. Check operation of TWD. Indicator should show approximate outside temperature before firing. 	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

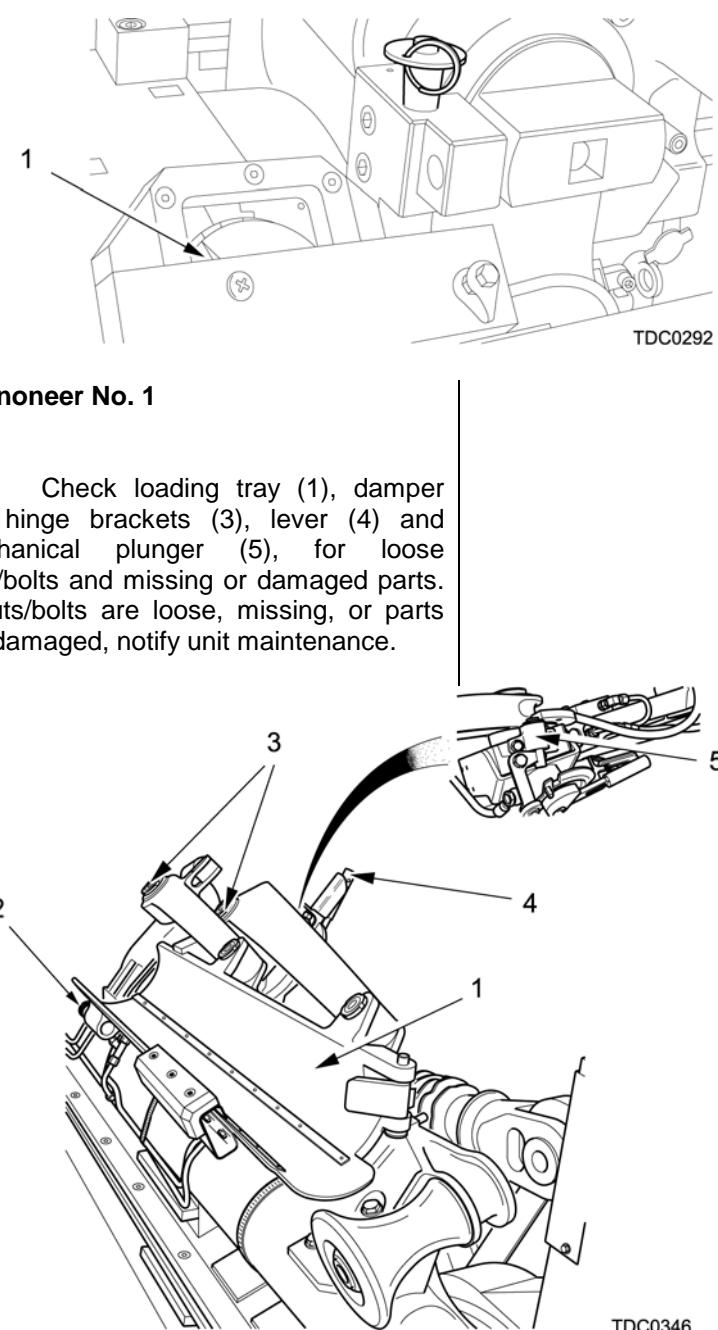
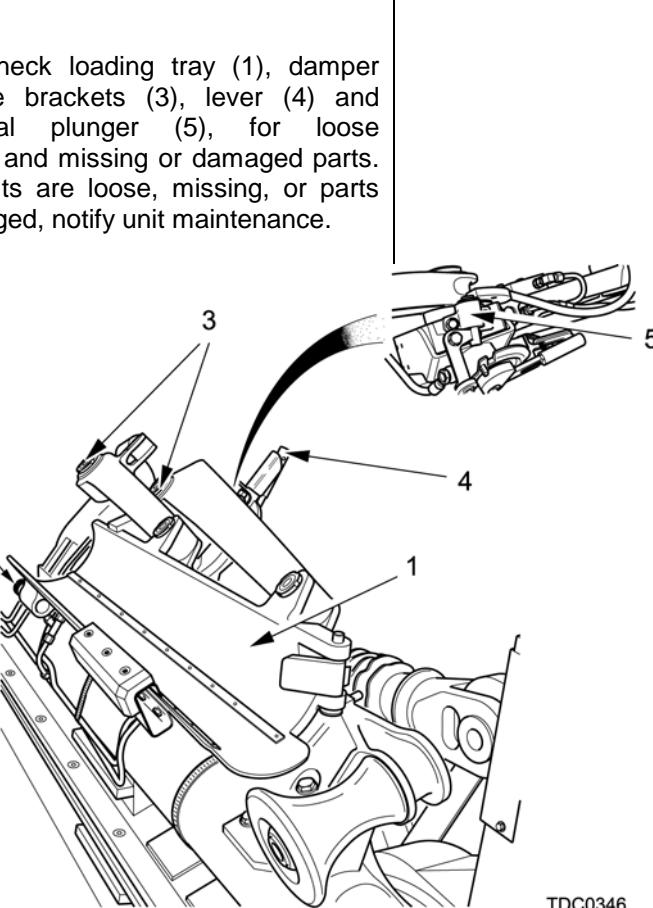
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
15	Before and After	LOADING TRAY AND LINES	<p>Cannoneer No. 1</p> <p>a. Check loading tray (1), damper (2), hinge brackets (3), lever (4) and mechanical plunger (5), for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>  <p>TDC0292</p> <p>b. Check MACS spring clip (6), for loose nuts/bolts and missing, or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>  <p>TDC0346</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

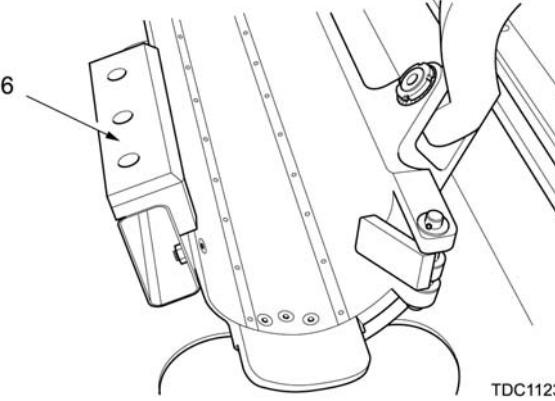
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
16	Before and After	EQUILIBRATOR SYSTEM	 <p>TDC1123</p> <p>c. Check for oil leakage. If oil leaks are present, notify unit maintenance.</p> <p>d. Check loading tray lever for smooth operation, if binding occurs, notify unit maintenance.</p> <p>e. Check damper and actuator for oil leakage. If oil leaks are present, notify unit maintenance.</p> <p>f. Check round catch and roller for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>g. Check round catch and roller for smooth operation, if defective, notify unit maintenance.</p> <p>SC</p> <p>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:</p> <ul style="list-style-type: none"> (1) Howitzer has been deployed to a temperature change of $\pm 40^{\circ}\text{F}$ (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. 	<p>If leakage is a Class III.</p> <p>If leakage is a Class III.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
17	Before and After	EQUILIBRATOR SYSTEM AND LINES	<p>Gunner and Assistant Gunner</p> <p>a. Check equilibrator cylinders and lines for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>b. Check cylinder, cylinder-retaining straps and insulation cover for damage, cracks, and wear. If damaged, cracked or worn, notify unit maintenance.</p> <p>c. Check handwheels for smooth operation, if unable to elevate /depress howitzer, or unable to adjust, notify unit maintenance.</p>	Unable to elevate/depress, or adjust howitzer.
18	Before and After	EQUILIBRATOR INDICATOR	<p>Gunner and Assistant Gunner</p> <p>a. Check equilibrator indicators and bracket pins for loose screws and missing or damaged parts. If screws are loose, missing, or if parts are damaged, notify unit maintenance.</p> <p>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.</p>	Bracket pins damaged. Unable to adjust equilibrator.
19	Before and After	ELEVATION SYSTEM	Gunner and Assistant Gunner	

NOTE

If Elevation Handwheel fails to operate correctly, refer to Chapter 3, Section II under Troubleshooting Procedures, and carryout HOWITZER WILL NOT, OR IS DIFFICULT, TO ELEVATE OR DEPRESS steps.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

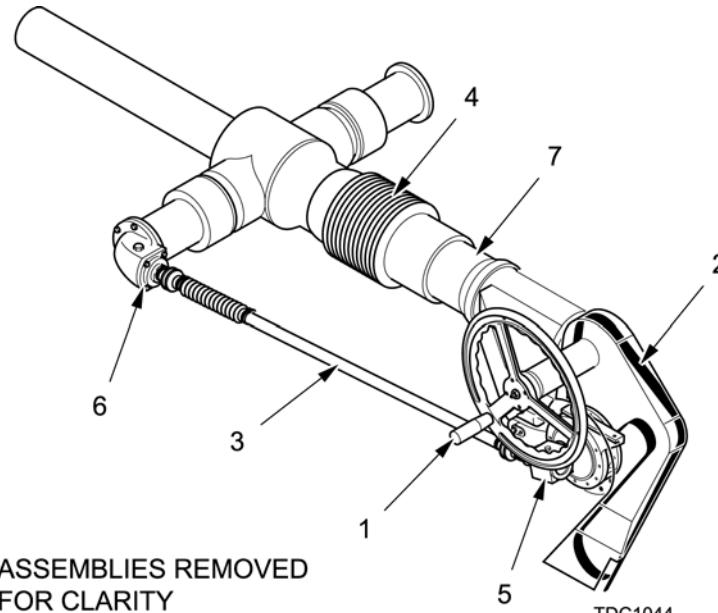
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			<p>a. Check elevation handwheel (1), drive belt (2) drive shaft (3), roll screw bellow (4) and mitred (5), intermediate (6), and resilient (7) gearboxes for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>  <p>ASSEMBLIES REMOVED FOR CLARITY</p> <p>TDC1044</p> <p>b. Inspect charge plate, elevation indicator plate (8), for damage, legibility and cleanliness. If plate is damaged or not legible, notify unit maintenance. Clean with a clean wiping rag (item 30, appx D).</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
20	Before and After	TRAVEL LOCKS	<p>Gunner and Assistant Gunner</p> <p>NOTE In case of emergency, howitzer may travel with only one Travel Lock (Refer to Para 2-67).</p> <p>a. Check travel locks (1) and stops (2) for loose nuts/bolts and missing, or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>b. Check for smooth operation, if unable to engage or disengage, notify unit maintenance.</p>	<p>Travel locks will not engage or disengage.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
21	Before and After	TRAVERSE SYSTEM	<p>Gunner</p> <p>a. Check traverse handwheel, coarse azimuth scale, gear rack, pinion and mesh adjuster for loose nuts/bolts and missing, or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>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.</p>	
22	Before and After	TRAVERSE LOCK	<p>Gunner and Assistant Gunner</p> <p>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.</p> <p>b. Check traverse lock, for smooth operation, if unable to engage or disengage, notify unit maintenance.</p>	Traverse lock will not engage or disengage.
23	Before and After	CRADLE ASSEMBLY	<p>Cannoneers Nos. 3 and 4</p> <p>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, not lock wired, or parts are damaged, notify unit maintenance.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

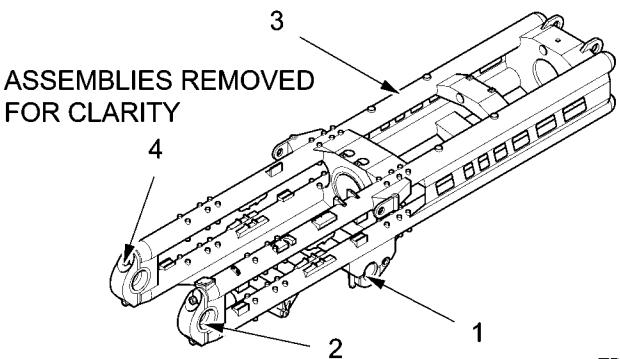
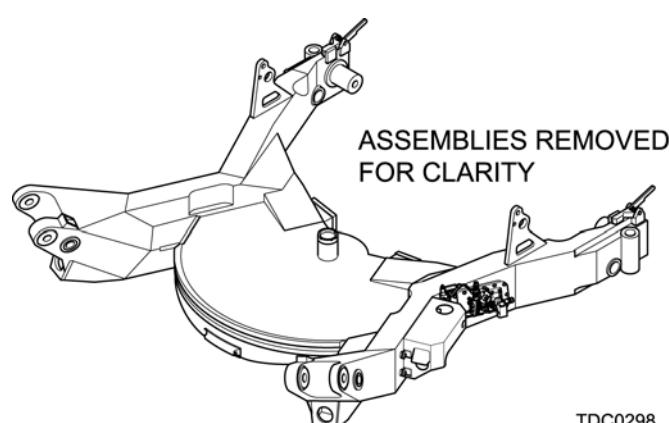
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
24	Before and After	BODY ASSEMBLY	<p>Cannoneers Nos. 3 and 4</p> <p>Check body assembly for missing, broken or damaged parts. If missing or parts are damaged, notify unit maintenance.</p>  <p>ASSEMBLIES REMOVED FOR CLARITY</p> <p>1</p> <p>2</p> <p>3</p> <p>4</p>	TDC0297
25	Before and After	SADDLE ASSEMBLY	<p>Cannoneers Nos. 3 and 4</p> <p>Check saddle assembly for missing, broken, or damaged parts. If parts are missing, broken or damaged, notify unit maintenance.</p>  <p>ASSEMBLIES REMOVED FOR CLARITY</p>	TDC0298

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

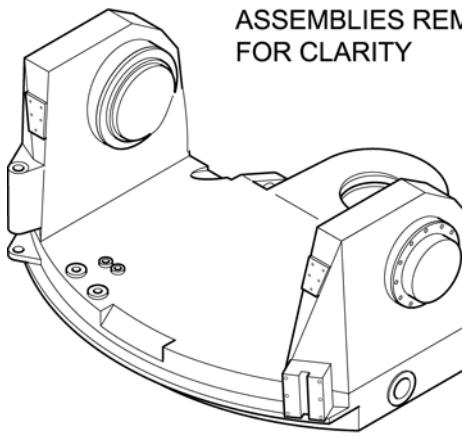
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
26	Before and After	STABILIZERS	<p>Cannoneers Nos. 3 and 4</p> <p>a. Check stabilizers (1), bump stops (2), alignment brackets (3), stops (4), and spring retainer pin (5) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>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.</p>	 <p>ASSEMBLIES REMOVED FOR CLARITY</p> <p>TDC0919</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

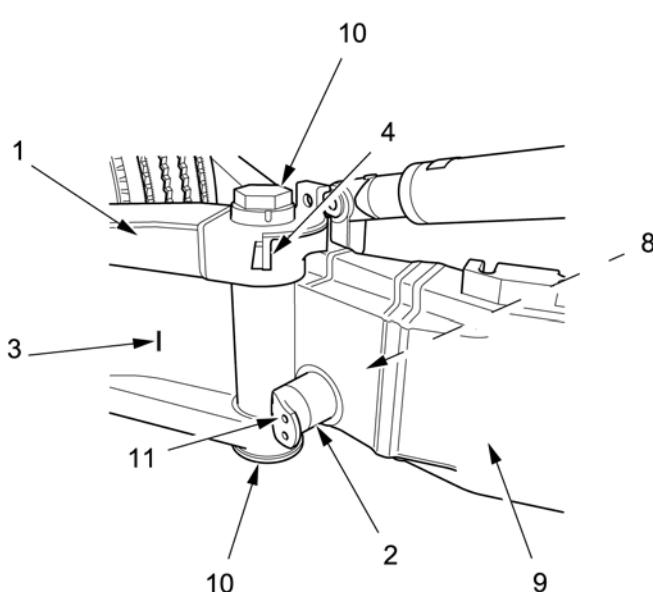
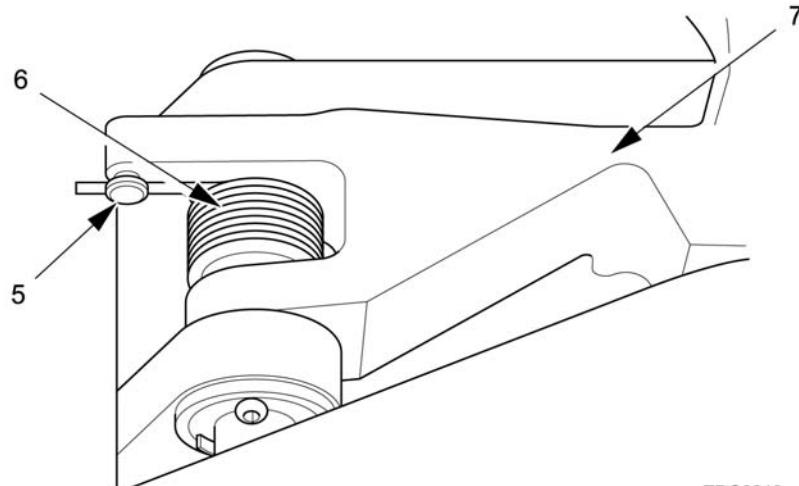
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			 <p>TDC0300</p> <p>c. Check retaining spring (6) for smooth operation, move locking latch (7) to the open and closed position, if binding or excessive wear/play is present, notify unit maintenance.</p>	
			 <p>TDC0819</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

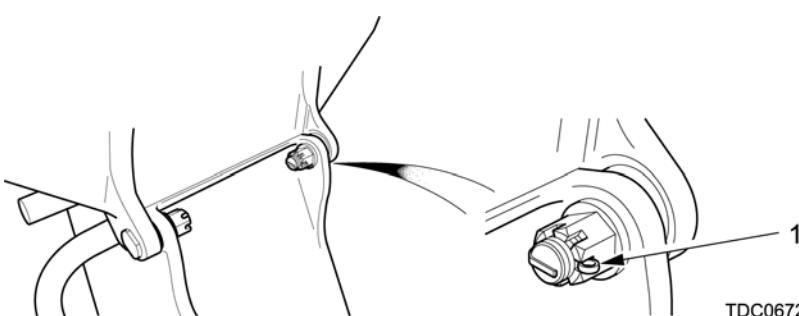
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
27	Before and After	TRAIL ARM AND SPADE ASSEMBLIES	<p style="text-align: center;">CAUTION</p> <p>Do not attempt to lower howitzer if bump stop end plate is NOT in contact with the howitzer body.</p> <p>d. Deploy stabilizers into firing position and check that bump stop end plates (8) contact howitzer body (9), if no contact, notify unit maintenance.</p> <p>e. Check for smooth operation of stabilizer (1), hinge pin (10), locking latch (7), bump stop (2), and bump stop bracket (11). If binding, or excessive wear/play is present, notify unit maintenance.</p> <p>Cannoneer No. 5 and ATC</p> <p>a. Check trail arms, spades, levers and spade cotter pins (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>  <p style="text-align: right;">TDC0672</p> <p style="text-align: center;">WARNING</p> <p>TO PREVENT INJURY TO PERSONNEL, MOVEMENT OF TRAIL ARM MUST BE SUPPORTED BY A MINIMUM OF TWO PERSONNEL.</p>	Bump stop end plate fails to contact howitzer body.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
28	Before and After	SPADE DAMPER ASSEMBLIES	<p>b. Check spades for gouges, dents and/or damage. If gouges, dents and/or damage is present, notify unit maintenance.</p> <p>c. Check spades for any cracks beginning to extend 2 inches into blade, from blade perimeter. If cracks are found, notify unit maintenance.</p> <p>d. Check smooth operation of trail arm, spade assemblies, locking plungers and handles. If binding or excessive wear/play is present, notify unit maintenance.</p> <p>Cannoneer No. 5 and ATC</p> <p>a. Check spade damper assemblies, for loose bolts and missing or damaged parts. If bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>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 parts are damaged, notify unit maintenance.</p>	<p>Spades fail inspection.</p> <p>Cracks in spade exceed 3 inches in length.</p>

NOTE

If spade dampers fail to operate correctly, refer to Section VII Operation Under Degraded Conditions, and carryout, Spade Damper Failure Procedures (Para 2-62), 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/M777A1/M777A2 HOWITZER (cont)

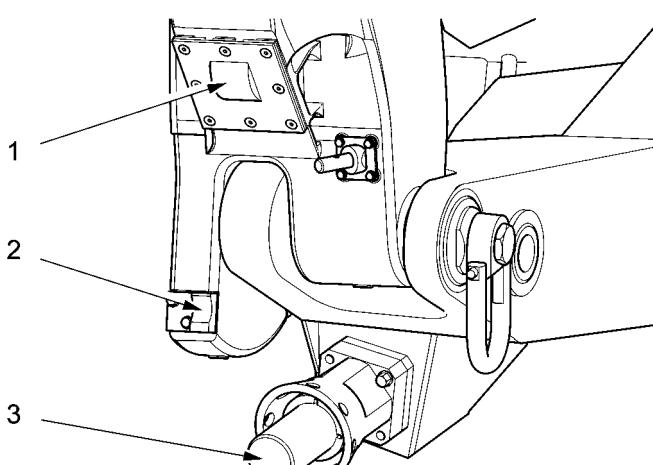
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
29	Before and After	SUSPENSION SYSTEM	<p>Cannoneers Nos. 1 and 2</p> <p>a. Check suspension pump (1), for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>b. Check for oil leakage. If oil leaks are present, notify unit maintenance.</p> <p>c. Check suspension pump (1) and lever (2) for smooth operation, if binding or excessive wear/play is present, notify unit maintenance.</p> <p>d. Check oil fluid level (3) (wheel in stowed position), if oil low, notify unit maintenance.</p>  <p style="text-align: right;">TDC1190</p>	<p>If leakage is a Class III.</p> <p>Unable to pressurize or raise/lower howitzer.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

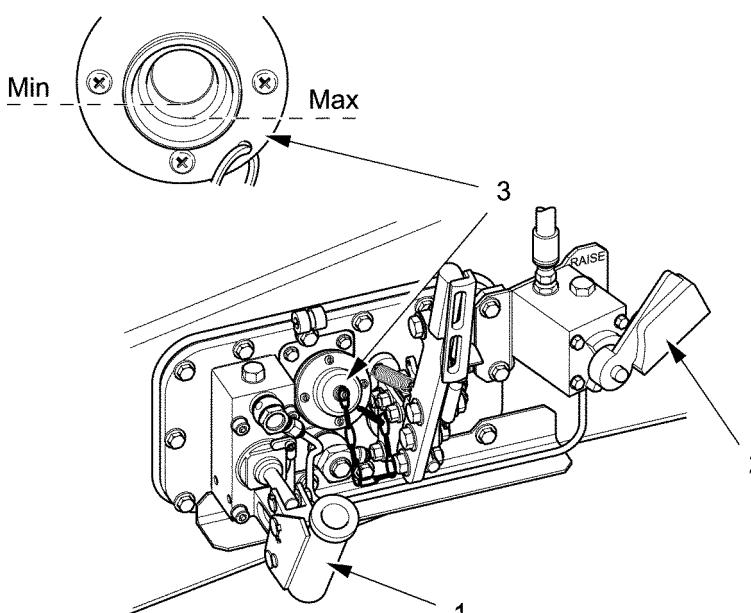
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			 <p>TDC1191</p> <p>e. Check wheel assembly pad (4), for cracks, dry rot and gouges. If cracked, dry rot or gouges are present, notify unit maintenance.</p>	
			<p>NOTE</p> <p>If Suspension System fails to operate correctly, refer to Chapter 3, Section II under Troubleshooting Procedures, and carryout SUSPENSION WILL NOT RAISE, OR FULLY RAISE, HOWITZER steps.</p> <p>f. Check hydro-strut (5) for smooth operation, if binding or wear/play of hydro-strut, plunger (6) and/or wheel locking lever (7) is present, notify unit maintenance.</p>	Unable to raise/lower howitzer.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

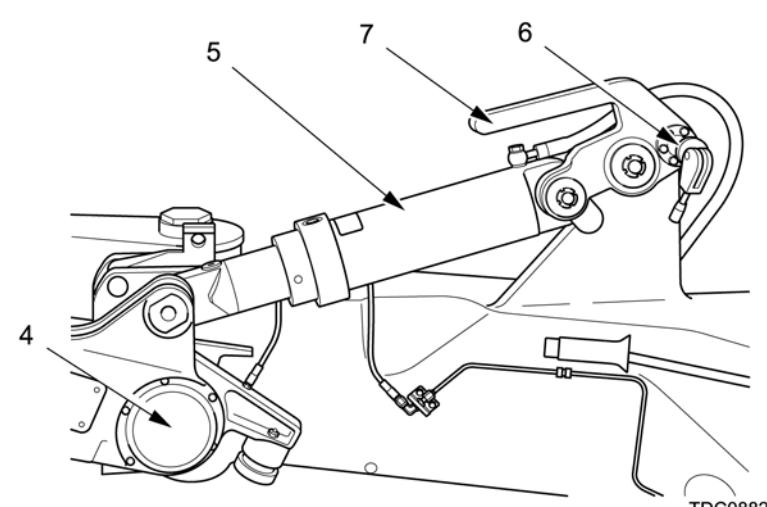
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
30	Before and After	WHEEL AND HANDBRAKE ASSEMBLIES	 <p>Cannoneers Nos. 1 and 2</p> <p>CAUTION</p> <p>Use only authorized tires when towing the howitzer. Never re-inflate a tire that has been run flat without first having the wheel and tire disassembled and inspected by unit maintenance.</p> <ul style="list-style-type: none"> a. Check wheel nuts (1). If loose, tighten and notify unit maintenance to torque wheel nuts. 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 1-15). 	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

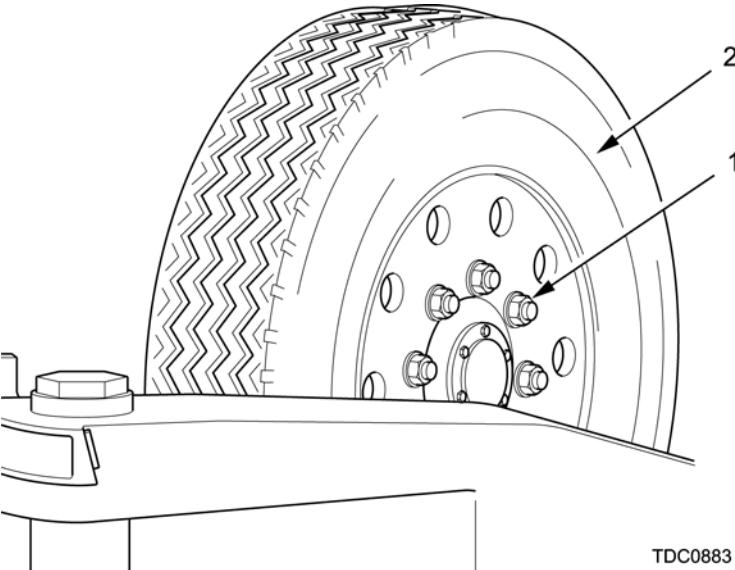
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			 <p>TDC0883</p> <p>f. Check handbrake assemblies (3), for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>g. Check handbrakes (3) for smooth operation, if binding or wear/play of handbrakes is present, notify unit maintenance.</p>	
			<p>NOTE</p> <p>If Handbrakes fail to operate correctly, refer to Chapter 3, Section II under Troubleshooting Procedures, and carryout BRAKE DOES NOT OPERATE WHEN HANDBRAKE IS ENGAGED steps.</p> <p>h. Check operation of handbrakes. Apply handbrakes, try to rotate wheels, if wheels rotate, notify unit maintenance.</p>	Wheels rotate, when handbrakes are applied.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

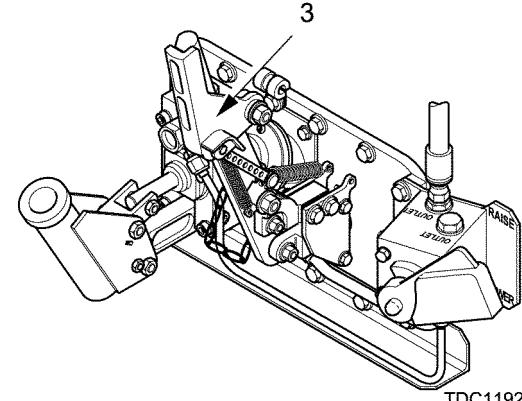
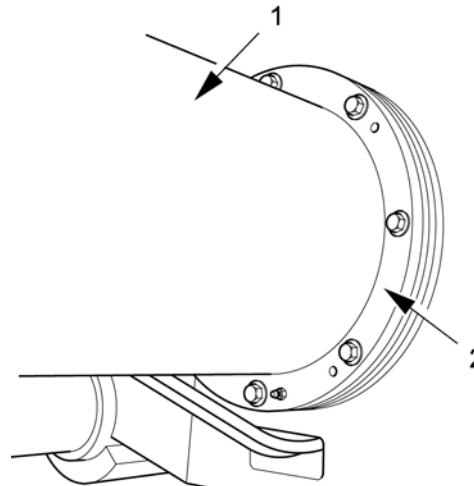
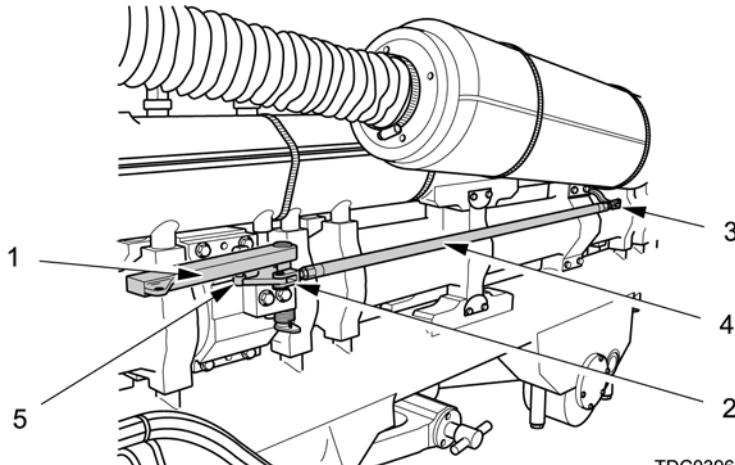
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
31	Before and After	CANNON TUBE, CHASE BEARING	<p>Cannoneer No. 2</p> <p>a. Check cannon tube bearing surface (1) for corrosion and pitting, if corrosion or pitting present, clean with CLP and crocus cloth (item 11, appx D), wipe dry with a clean wiping rag (item 30, appx D), apply WTR (item 16, appx D) to exposed areas (Chap 3, Sect I NOTE 2).</p> <p>b. Check chase bearing (2) for loose bolts and missing or damaged parts. If bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> 	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
32	Before and After	FIRING LEVER AND LINKAGE	<p>Cannoneer No. 1</p> <p>NOTE If Firing Lever fails to operate correctly, refer to Chapter 3, Section II under Troubleshooting Procedures, and carryout FIRING LEVER FAILS TO OPERATE steps.</p> <p>a. Check firing lever (1), linkage (2), connector link (3) and push rod (4) for loose nuts, cotter pins and missing or damaged parts. If nuts, cotter pins are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>b. Check for smooth operation, if firing linkage does not re-cock notify unit maintenance.</p> <p>c. Check roller (5) for smooth operation. If binding occurs notify unit maintenance.</p>  <p style="text-align: right;">TDC0396</p>	

NOTE
To carryout the air brake system check, howitzer must be connected to the prime mover.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
33	Before and After	AIR BRAKE SYSTEM	<p>SC</p> <p>a. Check air brake system for loose bolts and missing or damaged parts. If bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>b. Check for oil leakage. If oil leaks are present, notify unit maintenance.</p> <p>c. Check emergency, service airline and couplings for defects, dry rot or cracks, if any present, notify unit maintenance.</p>	If leakage is a Class II.
34	Before and After	AIR/OIL INTENSIFIER	<p>SC and Driver</p> <p>a. Check air/oil intensifier (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>b. Check for oil leakage. If oil leaks are present, notify unit maintenance.</p> <p>c. Check brake fluid level (2).</p> <p>d. Check operation of brakes, if gauges remain in red, notify unit maintenance.</p> <p>e. Check that needle moves to green area once prime mover brakes are released.</p>	If leakage is a Class II. Gauges remain in red area. Needle does not move to green area.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

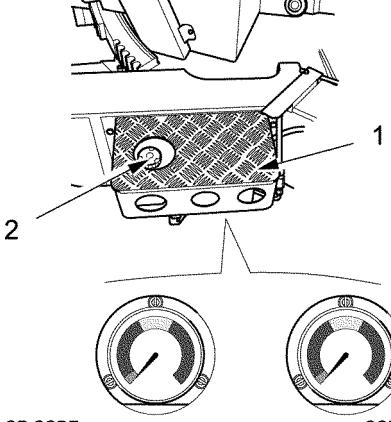
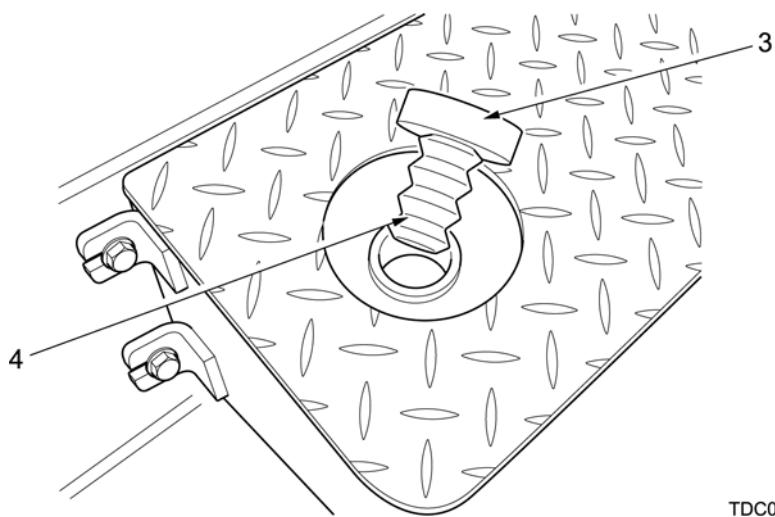
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:																								
			 <p style="text-align: center;">COLOR CODE</p> <table> <tbody> <tr> <td>GREEN</td> <td>0 - 200 PSI</td> <td>[Solid Gray]</td> <td>GREEN</td> <td>0 - 10 PSI</td> <td>[Solid Gray]</td> </tr> <tr> <td>RED</td> <td>200 - 1600</td> <td>[Solid Black]</td> <td>RED</td> <td>10 - 80</td> <td>[Solid Black]</td> </tr> <tr> <td>YELLOW</td> <td>1600 - 2400 PSI</td> <td>[Hatched]</td> <td>YELLOW</td> <td>80 - 120 PSI</td> <td>[Hatched]</td> </tr> <tr> <td>RED</td> <td>2400 - 4000 PSI</td> <td>[Solid Black]</td> <td>RED</td> <td>120 - 200 PSI</td> <td>[Solid Black]</td> </tr> </tbody> </table> <p style="text-align: right;">TDC0306</p> <p>f. Check breather cap (3) and bellow (4) for loose, missing or damaged parts. If parts loose, missing or damaged, notify unit maintenance.</p>	GREEN	0 - 200 PSI	[Solid Gray]	GREEN	0 - 10 PSI	[Solid Gray]	RED	200 - 1600	[Solid Black]	RED	10 - 80	[Solid Black]	YELLOW	1600 - 2400 PSI	[Hatched]	YELLOW	80 - 120 PSI	[Hatched]	RED	2400 - 4000 PSI	[Solid Black]	RED	120 - 200 PSI	[Solid Black]	
GREEN	0 - 200 PSI	[Solid Gray]	GREEN	0 - 10 PSI	[Solid Gray]																							
RED	200 - 1600	[Solid Black]	RED	10 - 80	[Solid Black]																							
YELLOW	1600 - 2400 PSI	[Hatched]	YELLOW	80 - 120 PSI	[Hatched]																							
RED	2400 - 4000 PSI	[Solid Black]	RED	120 - 200 PSI	[Solid Black]																							
			 <p style="text-align: right;">TDC0597</p>																									

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			<p style="text-align: center;">WARNING Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.</p>	 
35	Before and After	M171A1 TELESCOPE AND QUADRANT MOUNT AND M17A1 FIRE CONTROL QUADRANT	<p>Gunner</p> <p>a. Check that lock wire is present, and mounting bolts are not loose, if loose notify unit maintenance.</p> <p>b. Check level vials (1) and counters (2) and (3) for illumination.</p> <p>c. 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 9, appx D). Wipe dry.</p> <p>d. Check for smooth operation of control knobs by turning pitch level control knob (4) and cross level control knob (5).</p> <p>e. 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.</p>	<p>Lockwire is missing or mounting bolts are loose.</p> <p>Level vials and counters are not illuminated or level vials are broken.</p> <p>Control knobs do not operate.</p> <p>Correction counter turns when elevation counter turns and M17A1 quadrant is non-operational.</p> <p>Elevation counter does not move in 1-mil increments or the elevation counter is not accurate, and M17A1 quadrant is non-operational.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

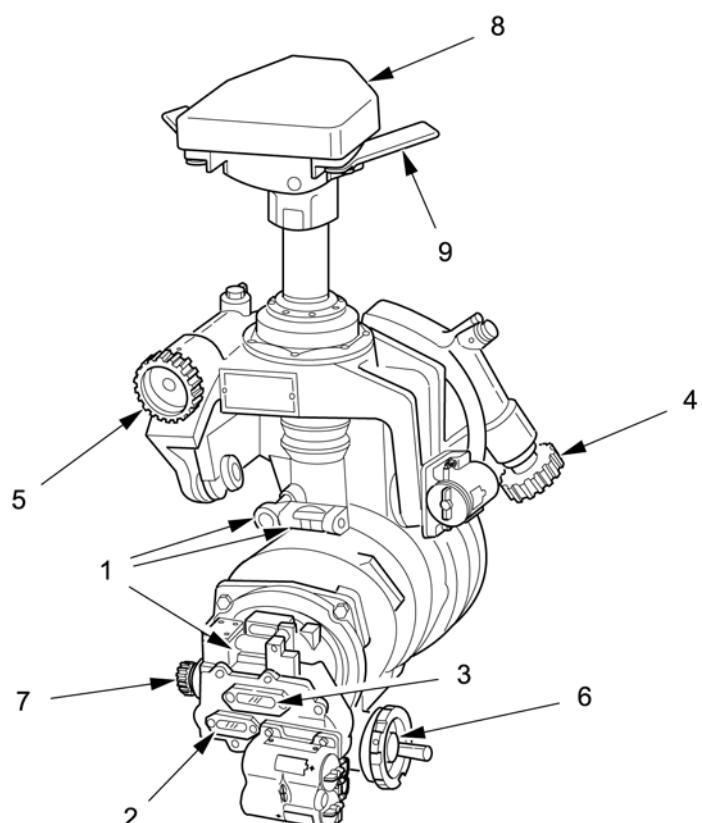
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			<p>f. M171A1 mount must have a cover (8). Mounting surface must be free of nicks or burrs. Clean surface with crocus cloth (item 11, appx D), and wipe dry.</p> <p>g. Check for presence of latches (9).</p>	One or more latches missing.
36	Before and After	PANTEL	<p>Gunner</p> <p>a. All knobs (1), (2), (3) and (4) should turn freely. Check for rust. Clean with a clean wiping rag (item 30, appx D) moistened with cleaning compound (item 9, appx D). Wipe dry.</p> 	TDC0955 Knobs do not turn.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			<p>b. Check counters (5), (6) and (7) and reticles (8) for illumination.</p> <p>(1) Press red power switch (9) on counter box battery enclosure (10). Wait 3 seconds and recheck.</p>	<p>Reticles or counters are not illuminated.</p> <p>Counters are not illuminated.</p>
			<p>(2) Install new batteries in battery enclosure on counterbox and telescope elbow then recheck.</p> <p>c. Install Pantel on mount and check for tight mounting.</p> <p>d. Turn azimuth knob (2). Deflection counter (5) and azimuth counter (6) should turn; correction counter (7) should not turn.</p> <p>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.</p> <p>f. Check reticle image.</p> <p>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.</p> <p>h. Check Pantel with M154 alignment device. If Pantel cannot be aligned to $4800 \text{ mils} \pm 0.5\text{-mil}$ tolerance, notify unit maintenance.</p>	<p>Reticles or counters are not illuminated.</p> <p>Pantel cannot be secured to mount.</p> <p>Counters will not turn or correction counter turns.</p> <p>Gunners aid knob will not move in one direction or in 1-mil, increments.</p> <p>Deflection counter does not change by amount of correction applied.</p> <p>Azimuth and/or deflection counter move more than 1/4 –mil.</p> <p>Reticle image is not clearly visible.</p> <p>Deflection counter turns.</p> <p>Pantel cannot be aligned $4800 \text{ mils} \pm 0.5\text{-mil}$ tolerance.</p>



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



TDC0450

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
37	Before and After	M172A1 TELESCOPE AND QUADRANT MOUNT AND M18A1 FIRE CONTROL QUADRANT	<p style="text-align: right;">TDC1111</p> <p>Assistant Gunner</p>	  <p>WARNING Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.</p>   <p>TDC0450</p> <p>a. Check that lock wire is present, and mounting bolts are not loose, if loose notify unit maintenance.</p> <p>b. Check level vials (1) and counters (2) and (3) for illumination by turning battery enclosure switch ON.</p> <p>Lockwire is missing or mounting bolts are loose.</p> <p>Level vials or counters will not illuminate if level vials are broken.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

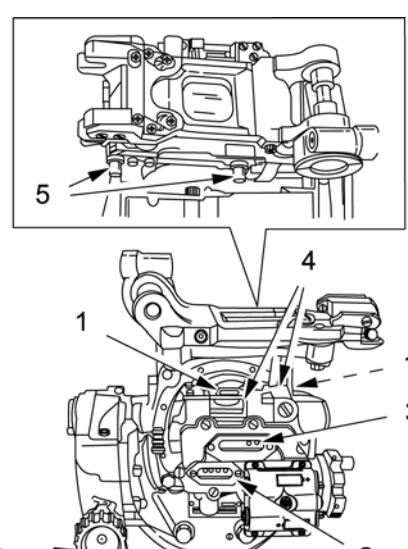
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			<p>c. Check that level vial covers (4) move freely. Markings on level vials must be clear, and bubble must be present. Wipe level vials (1) and gunner's quadrant seats (5) clean with cheesecloth (item 12, appx D) moisten with lens cleaning compound (item 9, appx D). Wipe dry.</p> <p>d. Turn cross level control knob (6). Check for binding.</p>	<p>Bubble is missing from one or more level vials.</p> <p>Cross level control knob does not operate and M18A1 fire control quadrant is inoperable.</p> 
			<p>e. Turn elevation control knob (7). Elevation control counter (2) should turn, and elevation correction counter (3) should not turn.</p> <p>f. 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.</p>	<p>Correction counter turns when elevation control knob is turned and M18A1 quadrant is non-operational.</p> <p>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.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

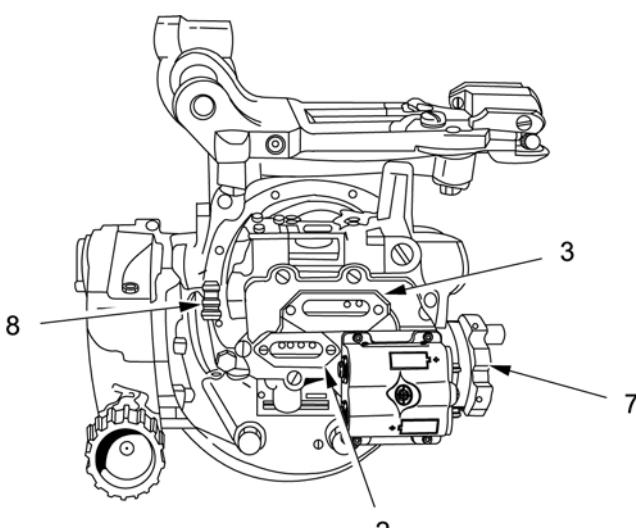
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			<p>g. Telescope mounting surface must not be nicked or burred. Clean surface with crocus cloth (item 11, appx D).</p>  <p>TDC0310</p>	
38	Before and After	M138A1 ELBOW TELESCOPE	<p>WARNING Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.</p> <p>Assistant Gunner</p> <p>a. Check reticle for illumination.</p> <p>(1) Replace battery and recheck.</p> <p>(2) If still not illuminated after replacing battery, notify unit maintenance.</p> <p>b. Check optics. Diopter scale should turn freely and allow individual focus. No inside moisture is allowed.</p> <p>c. Mount M138A1 elbow telescope and check for secure mounting.</p>	<p>Reticle is not illuminated.</p> <p>If reticle will not illuminate.</p> <p>Optics fogged or will not focus.</p> <p>If M138A1 elbow telescope cannot be mounted securely.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

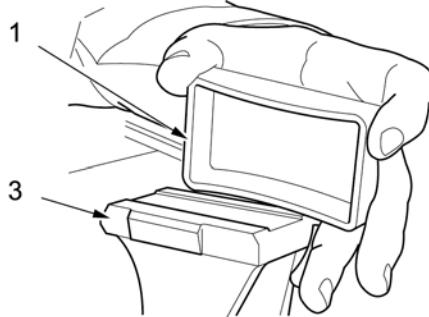
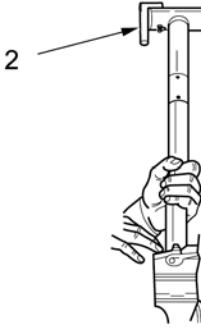
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
39	Before and After	M154 ALIGNMENT DEVICE	<p>Assistant Gunner</p> <p>a. Check for illumination.</p>	If reticle will not illuminate.
40	Before and After	M1A2 COLLIMATOR	<p>WARNING Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.</p> <p>(1) Replace battery and recheck.</p> <p>(2) If still not illuminated after replacing battery, notify unit maintenance.</p> <p>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.</p>   <p>Cannoneer No. 3</p> <p>a. Check to ensure collimator three locking knobs (1) operate smoothly and lock.</p> <p>b. Check to ensure azimuth adjustment knob (2) operates smoothly.</p> <p>c. Check level vial (3) to ensure markings are clear and bubble is present.</p>	If reticle will not illuminate. Surface has nick and/or burrs. Mounting not tight.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

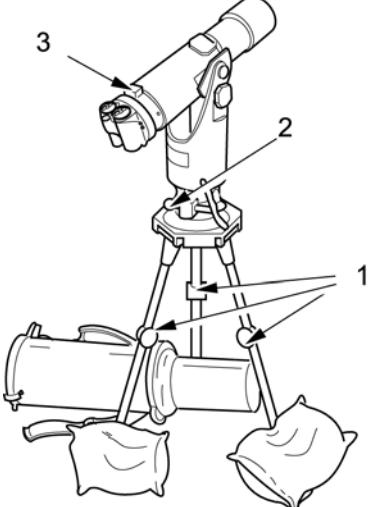
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			<p>d. Check for dirt or moisture on internal optics.</p> <p>e. Check reticle image for illumination.</p> <p>(1) Press red power ON/OFF switch on battery enclosure. Wait three seconds and recheck.</p>	<p>Dirt or moisture on internal optics.</p> <p>Not illuminated.</p> <p>Not illuminated.</p>
41	Before and After	M1A1 GUNNER'S QUADRANT	<p>WARNING Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.</p> <p>(2) Install new batteries in battery enclosure then recheck.</p> <p>f. Check for damage. If damaged notify unit maintenance. If not damaged, clean and mount.</p>  <p>TDC0312</p> <p>SC</p> <p>a. Check gunners quadrant level vial (1) for cracks, and markings.</p>	<p>Not illuminated.</p> <p>Collimator is damaged and aiming posts are not available.</p> <p>Level vial is cracked and markings are not visible.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

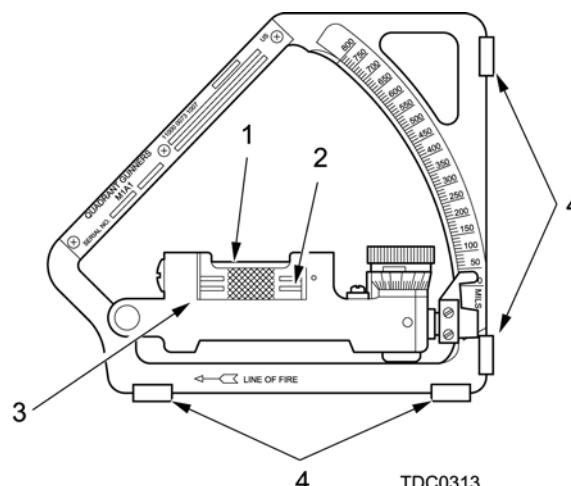
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			<p>b. Check level vial cover (2) and quadrant arm (3) for smooth operation.</p> <p>c. Check shoes (4) for burrs wear and damage. If shoes are burred, worn or damaged, notify unit maintenance.</p>	<p>Quadrant arm does not move freely.</p> <p>Shoes are burred or worn.</p>
42	Before and After	DFCS CABLES	<p>All</p> <p>a. Check all DFCS cables (See Chapter 1, Para 1-14 for cable routing information) and connectors for wear and damage, if cuts, gouges are present, notify unit maintenance.</p> <p>b. Check cable plug and jack connectors, ensure red line is covered, if not, tighten connector, if unable to tighten, remove and inspect for damage, if damaged, notify unit maintenance.</p> <p>c. Check cable routing for missing/damaged cable ties, if missing/damaged, replace.</p> <p>d. Notify unit maintenance if cable and/or cable connector, dust caps are missing or unserviceable.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
43	Before and After	CSD	<p>SC</p> <p>a. Check CSD (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <div style="border: 1px solid black; padding: 2px; text-align: center;"> CAUTION </div> <p>The display screen on the CSD has a specialized surface coating that can be easily damaged. Do not touch and do not attempt to clean displays unless specified cleaning solutions, brush and soft cloth are available.</p> <p>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.</p> <p>(1) Clean exterior surfaces of CSD with a clean cheesecloth, (item 12, appx D) dampened with warm water.</p> <p>(2) Gently clean the display surface with a clean brush, dusting lens 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.</p> <p>(3) To remove any remaining fragments of dirt or fingerprints, apply a small amount of cleaning compound, optical lens (item 9 appx D) onto clean cheesecloth (item 12, appx D). Gently clean the display surface without scratching the display surface.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

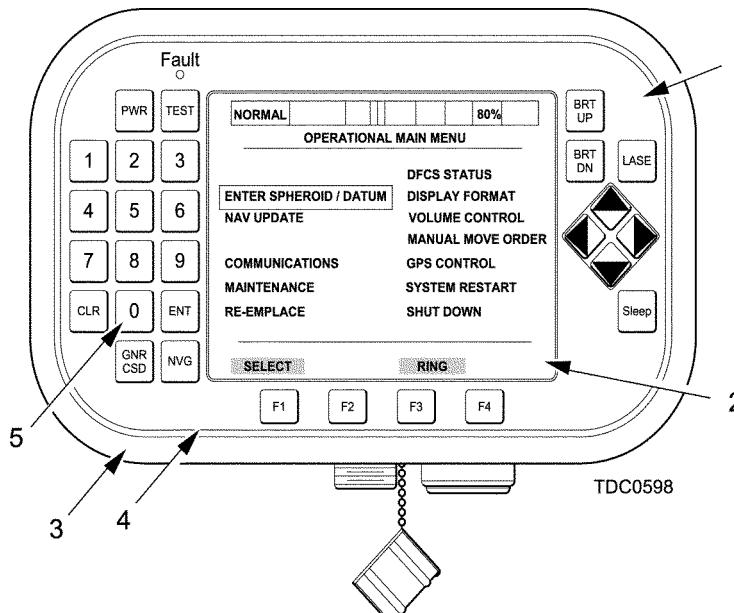
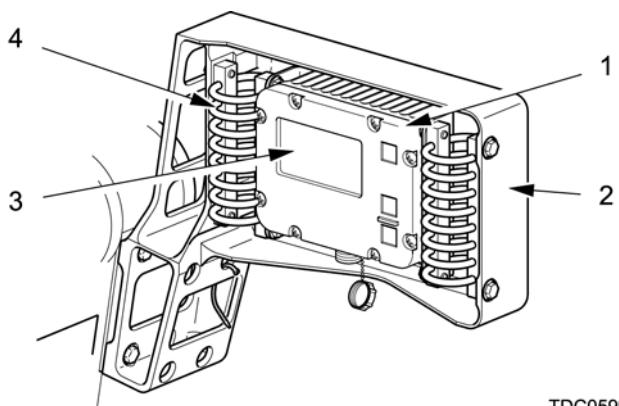
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
44	Before and After	GND AND MOUNT	<p>c. Check rubber bumper attachment (3) around bezel (4) for loose screws/washers and missing or damaged parts. If screws/washers are loose, missing, tighten or notify unit maintenance. If rubber bumper is damaged, replace bumper (Para 3-13).</p> <p>d. Check keys (5) for wear and damage, if worn or damaged, notify unit maintenance.</p>  <p>Gunner</p> <p>a. Check GND (1) and mount (2) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>	<p>CAUTION</p> <p>The display screen on the GND has a specialized surface coating that can be easily damaged. Do not touch and do not attempt to clean displays unless specified cleaning solutions, brush and soft cloth are available.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
			<p>b. Clean display glass (3) and perform external physical inspection of display surface of the screen for condition of display glass.</p> <p>(1) Clean exterior surfaces of GND with a clean cheesecloth, (item 12, appx D) dampened with warm water.</p> <p>(2) Gently clean the display surface with a clean brush, dusting lens 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.</p> <p>(3) To remove any remaining fragments of dirt or fingerprints, apply a small amount of cleaning compound, optical lens (item 9, appx D) onto clean cheesecloth (item 12, appx D). Gently clean the display surface without scratching the display surface.</p> <p>c. Check shock isolators (4) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>	



TDC0599

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

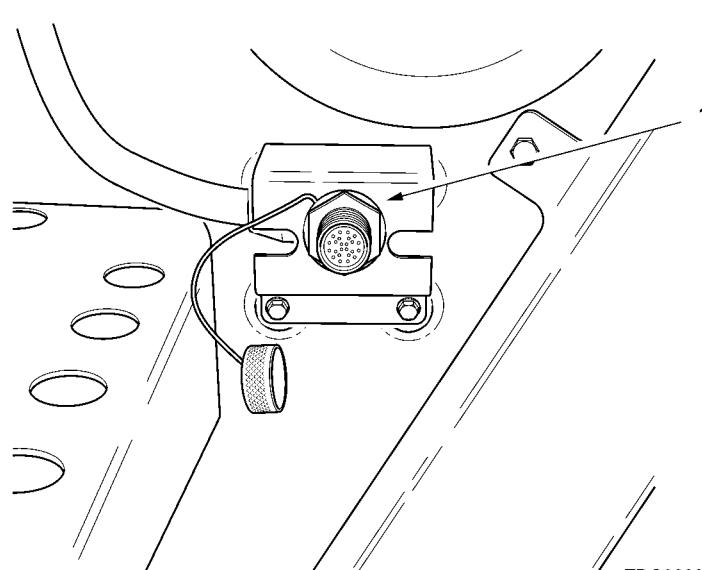
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
45	Before and After	CSD CABLE CONNECTION BRACKET	<p>Gunner</p> <p>Check CSD cable connection bracket (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are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

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

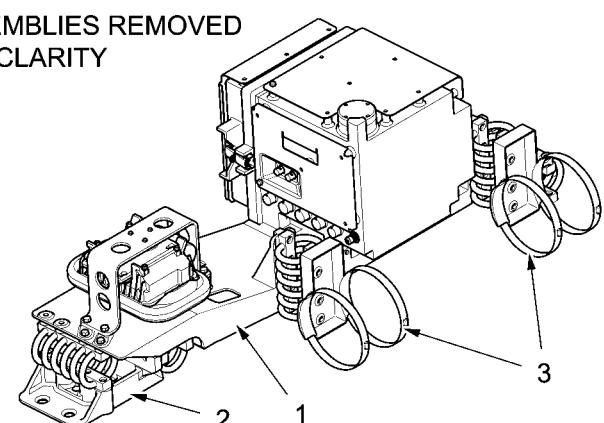
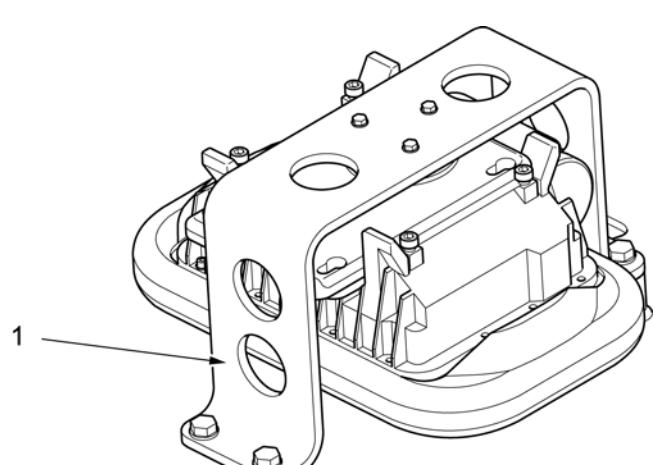
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
47	Before and After	CSD STOWAGE BRACKET	<p>ASSEMBLIES REMOVED FOR CLARITY</p>  <p>TDC0601</p> <p>Cannoneer No. 2</p> <p>Check stowage bracket (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>  <p>TDC0602</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
48	Before and After	CLA	<p>Cannoneer No. 2</p> <p>a. Check CLA (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>b. Check door latch (2) for secure attachment, and correct operation, if unable to secure latch, notify unit maintenance.</p> <p>c. Check CLA for cracks and damage, if cracked or damaged, notify unit maintenance.</p> <p>d. Check PIK (3) RTA (4), AMP (5), DAGR (6) and GPS antenna (7) and interconnect cable between RTA and AMP for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>e. Turn PCCM Function Control Switch to COMM. Remove DAGR from CLA and check DAGR memory battery status. If low, notify unit maintenance for replacement. Turn PCCM Function Control Switch to OFF when task is complete.</p>	TDC0620

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

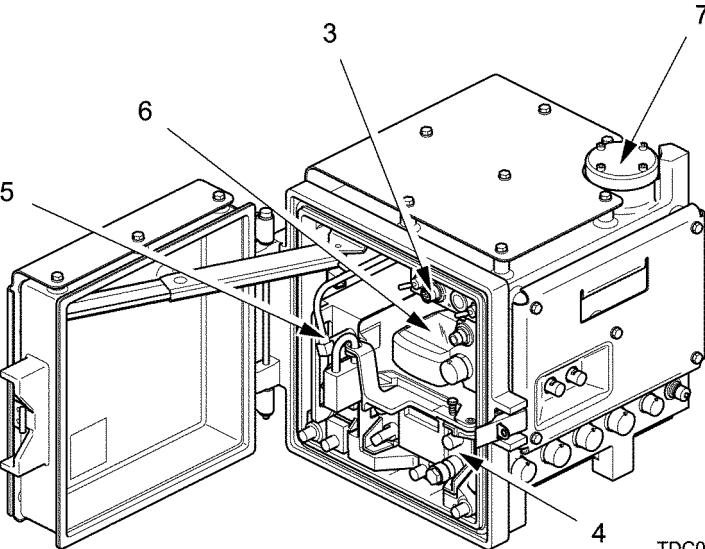
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
49	Before and After	UNDER CRADLE ELECTRONIC ASSEMBLY	 <p>Cannoneer No. 3</p> <p>WARNING</p> <p>HEAVYWEIGHT:- ENSURE UNDER CRADLE ELECTRONIC ASSEMBLY IS SUPPORTED BY A MINIMUM OF TWO PERSONNEL PRIOR TO ELEVATING THE HOWITZER. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.</p> <p>a. Lower under cradle electronics assembly (1) (Para 2-12c) and check for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>b. Check cable plug and jack connectors, ensure red line is covered, if not, tighten connector, if unable to tighten, remove and inspect for damage, if damaged, notify unit maintenance.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

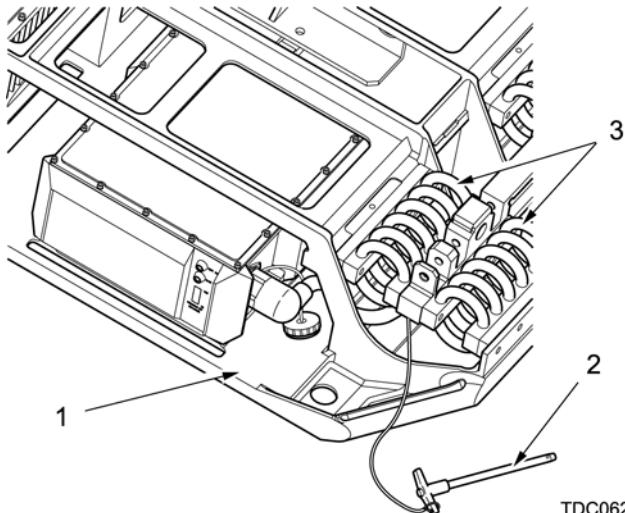
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
50	Before and After	BAT	<p>Cannoneer No. 3</p> <p>c. Check quick-disconnect pins (2) for smooth operation. Check pins for corrosion, nicks, or burrs. If required remove corrosion with crocus cloth (item 11, appx D). Remove nicks and burrs with hand file.</p> <p>d. Check front and rear shock 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.</p> <p>e. Check smooth operation of under cradle electronic assembly, if binding or excessive wear/play is present, notify unit maintenance.</p>  <p style="text-align: right;">TDC0623</p>	
			<p>WARNING</p> <p>Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.</p> <p>a. Check BAT (1) are secure and check for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>     <p style="text-align: right;">TDC0450</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

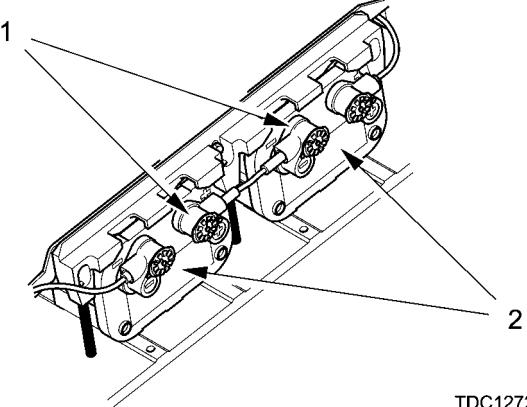
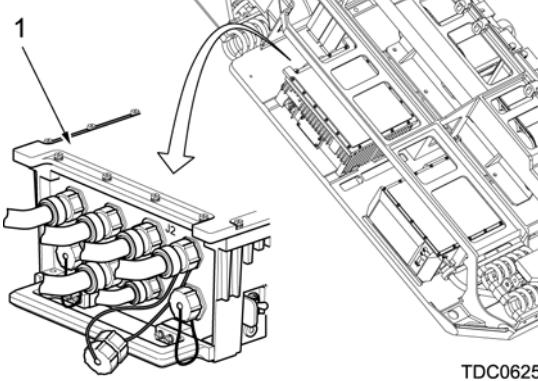
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
51	Before and After	MSC	<p>b. Check battery terminal caps (2) for secure attachment if missing, notify unit maintenance.</p>  <p>TDC1272</p> <p>Cannoneer No. 4</p> <p>Check MSC (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>	
52	Before and After	PCCM	 <p>Cannoneer No. 4</p> <p>a. Check underside of under cradle electronic assembly and PCCM (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>	TDC0625

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

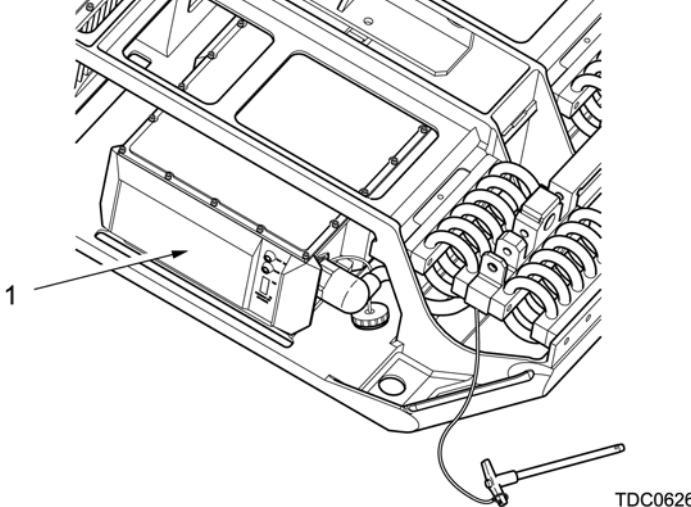
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
53	Before a and After	ANT AND MOUNT	<p>NOTE The DFCS must be booted up and operating in order to obtain an accurate SOC reading.</p> <p>b. Check SOC indicator by turning Function Control Switch to COMM and pressing toggle switch to check for illumination, if no illumination, notify unit maintenance.</p> <p>c. Raise under cradle electronics assembly (1) (Para 2-12c) and check for smooth operation, if binding occurs, notify unit maintenance.</p>  <p>TDC0626</p> <p>Cannoneer No. 4</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> WARNINGS </div> <p>DO NOT TOUCH ANTENNA. ANTENNAS CAN RADIATE HARMFUL LEVELS OF RADIO FREQUENCY. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL.</p> <p>BEFORE CHECKING ANTENNA AND MOUNT, ENSURE PCCM IS SWITCHED OFF. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

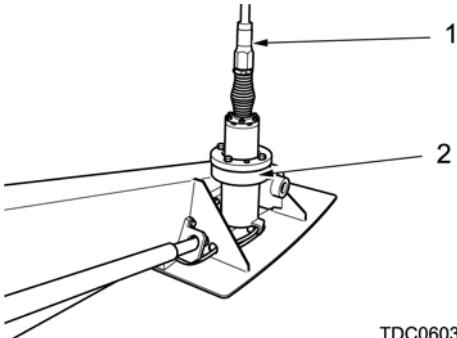
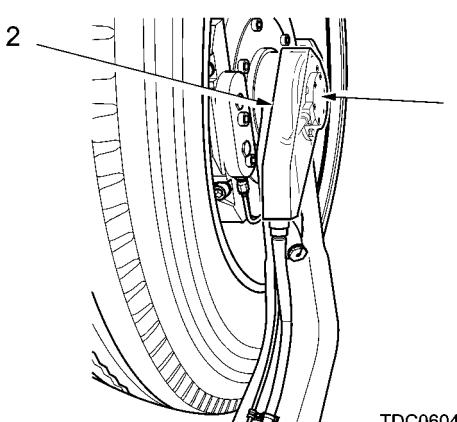
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
54	Before and After	VMS	<p>Check ANT (1) and mount (2) for loose bolts and missing or damaged parts. If bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>  <p>TDC0603</p> <p>Cannoneer No. 1</p> <ul style="list-style-type: none"> a. Check VMS (1) for loose bolts and missing or damaged parts. If bolts are loose, missing, or 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 parts are damaged, notify unit maintenance. c. Check cable guard for cracks and damage, if cracked or damaged, notify unit maintenance.  <p>TDC0604</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

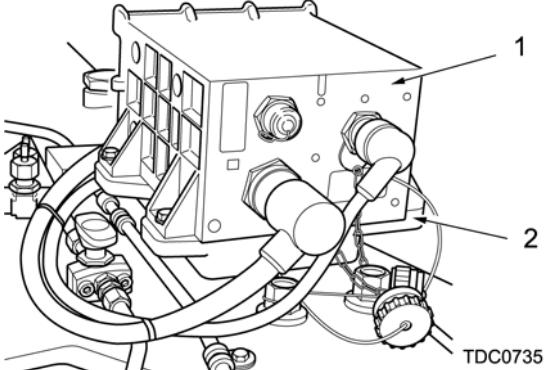
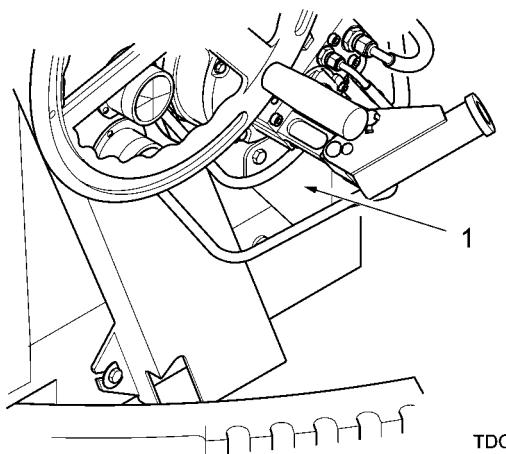
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
55	Before and After	INU AND MOUNT	<p>Cannoneer No. 1</p> <p>Check INU (1) and mount (2) for loose bolts and missing or damaged parts. If bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> 	
56	Before and After	POWER CABLE CONNECTION BRACKET	<p>Assistant Gunner</p> <p>Check power cable connection bracket (1) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> 	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
57	Before and After	AGD AND MOUNT	<p>Assistant Gunner</p> <p>a. Check AGD (1) and mount (2) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p> <p style="text-align: center;">CAUTION</p> <p>The display screen on the AGD has a specialized surface coating that can be easily damaged. Do not touch and do not attempt to clean displays unless specified cleaning solutions, brush and soft cloth are available.</p> <p>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.</p> <p>(1) Clean exterior surfaces of AGD with clean cheesecloth (item 12, appx D) dampened with warm water.</p> <p>(2) Gently clean the display surface with a clean brush, dusting lens 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.</p> <p>(3) To remove any remaining fragments of dirt or fingerprints, apply a small amount of cleaning compound, optical lens (item 9, appx D) onto clean cheesecloth (item 12, appx D). Gently clean the display surface without scratching the display surface.</p> <p>c. Check shock isolators (4) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

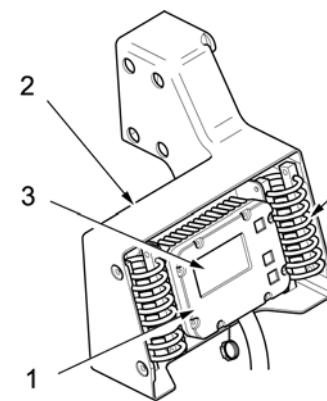
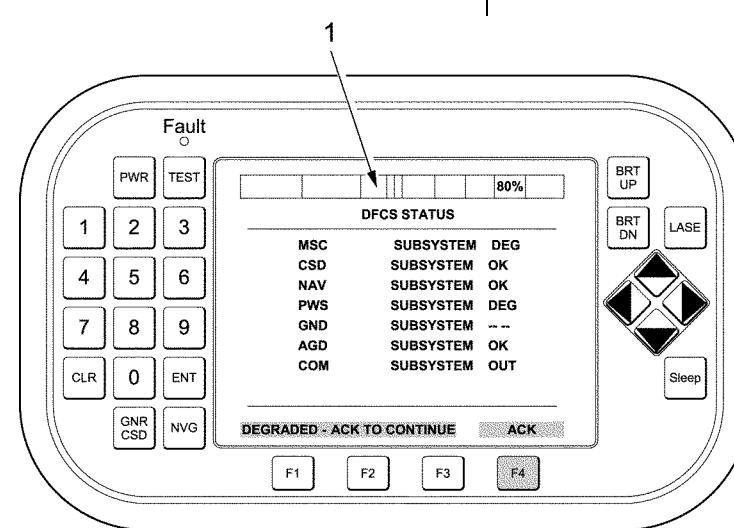
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:																					
58	Before and After	DFCS Built-In-Test (BIT)	<p>SC</p>  <p>TDC0629</p> <p>NOTE If using DFCS Block 1a and EPIAFS PIK is installed, connect EPIAFS Setter prior to initialization. Remove and stow after complete.</p> <p>a. Perform Initialization procedure for DFCS Block 1 (Para 2-74 steps 1 thru 10) or Perform Initialization procedure for DFCS Block 1a (Para 2-69, steps 1 thru 10). b. Note <u>DFCS STATUS</u> screen (1) for any --, DEG, or OUT messages for DFCS Block 1 or DISCONNECTED, DEGRADED or OUT for DFCS Block 1a.</p>  <p>1</p> <p>Fault</p> <p>PWR TEST</p> <p>1 2 3</p> <p>4 5 6</p> <p>7 8 9</p> <p>CLR 0 ENT</p> <p>CNR CSD NVG</p> <p>DFCS STATUS</p> <table border="1"> <thead> <tr> <th>MSC</th> <th>SUBSYSTEM</th> <th>DEG</th> </tr> </thead> <tbody> <tr> <td>CSD</td> <td>SUBSYSTEM</td> <td>OK</td> </tr> <tr> <td>NAV</td> <td>SUBSYSTEM</td> <td>OK</td> </tr> <tr> <td>PWS</td> <td>SUBSYSTEM</td> <td>DEG</td> </tr> <tr> <td>GND</td> <td>SUBSYSTEM</td> <td>--</td> </tr> <tr> <td>AGD</td> <td>SUBSYSTEM</td> <td>OK</td> </tr> <tr> <td>COM</td> <td>SUBSYSTEM</td> <td>OUT</td> </tr> </tbody> </table> <p>DEGRADED ACK TO CONTINUE ACK</p> <p>F1 F2 F3 F4</p> <p>BRT UP BRT DN LASE</p> <p>Sleep</p> <p>TDC0957</p>	MSC	SUBSYSTEM	DEG	CSD	SUBSYSTEM	OK	NAV	SUBSYSTEM	OK	PWS	SUBSYSTEM	DEG	GND	SUBSYSTEM	--	AGD	SUBSYSTEM	OK	COM	SUBSYSTEM	OUT	
MSC	SUBSYSTEM	DEG																							
CSD	SUBSYSTEM	OK																							
NAV	SUBSYSTEM	OK																							
PWS	SUBSYSTEM	DEG																							
GND	SUBSYSTEM	--																							
AGD	SUBSYSTEM	OK																							
COM	SUBSYSTEM	OUT																							

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

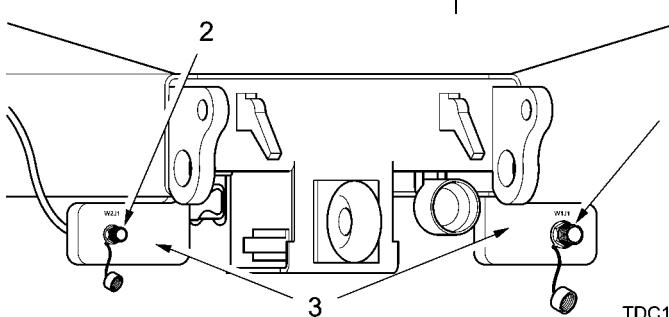
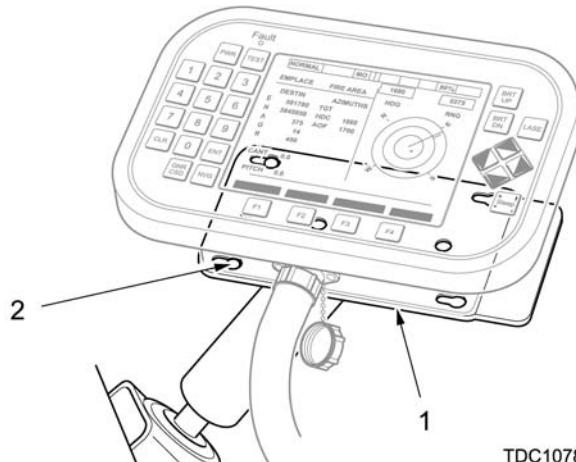
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
59	Before and After	PRIME MOVER POWER AND CSD CONNECTORS	<p>(1) If MSC, CSD, or NAV is OUT or if system does not have power, the DFCS is not operational.</p> <p>(2) If all subsystems report OK, continue PMCS and select <u>NORMAL OPERATIONS</u> or <u>SHUT DOWN</u> under <u>SELECT OPERATIONAL MODE</u>.</p> <p>NOTE If any subsystem continues to report --, DEG, or OUT (in DFCS Block 1) or DISCONNECTED, DEGRADED, or OUT (in DFCS Block 1a), refer to Chap 3, Sect II for Troubleshooting procedures on the DFCS.</p> <p>(3) If any subsystem reports --, DEG, or OUT, note the subsystem, ACK the message to continue, select <u>SHUT DOWN</u> under <u>SELECT OPERATIONAL MODE</u> to perform a normal system shutdown for DFCS Block 1 or DISCONNECTED, DEGRADED or OUT for DFCS Block 1a.</p> <p>Driver and Cannoneer No. 4</p> <p>Check power (1), CSD connectors (2) and brackets (3) for loose, and missing or damaged parts. If loose, missing, or parts are damaged, notify unit maintenance.</p> 	<p>Batteries do not charge or PCCM does not provide power to the system.</p> <p>System fails to boot, MSC BIT light remains lit, or MSC is OUT.</p> <p>CSD does not function or CSD is out.</p> <p>NAV is out.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
60	Before and After	PRIME MOVER NATO CONNECTOR	<p>Driver</p> <p>Check NATO connector, and circuit breaker for loose, missing or damaged parts. If loose, missing, or parts are damaged, notify unit maintenance.</p>	
61	Before and After	PRIME MOVER CSD MOUNT	<p>Driver</p> <p>a. Check prime mover CSD mount (1), spring lock tension (2) for loose, missing or damaged parts. If loose, missing, or parts are damaged, notify unit maintenance.</p> <p>b. Check operation of mount, install CSD to mount, if unable to secure to mount, notify unit maintenance.</p>	Unable to secure CSD to mount.



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NOTE

The crew will make any possible field expedient repairs to restore full mission capable status to the limit of their skills, materials, and tools available.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
62	During	RECOIL ACCUMULATOR AND LINES	<p>Cannoneer No. 2</p> <p>a. Check recoil accumulator and lines for oil leakage. If oil leaks are present, notify unit maintenance.</p> <p>b. Check to see if oil index pin is flush. If not flush, notify unit maintenance.</p>	If leakage is a Class III. If oil index pin is showing red indicator line.
63	During	RECOIL CYLINDERS	<p>Cannoneers Nos. 1 and 2</p> <p>Check recoil cylinders for oil leakage. If oil leaks are present, notify unit maintenance.</p>	If leakage is a Class III.
64	During	CRADLE ASSEMBLY	<p>Cannoneers Nos. 1 and 2</p> <p>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, not lock wired, or parts are damaged, notify unit maintenance.</p>	
65	During	BODY ASSEMBLY	<p>Gunner and Assistant Gunner</p> <p>Check body assembly for missing, broken or damaged parts. If missing or parts are damaged, notify unit maintenance.</p>	
66	During	PFM LEVER AND ASSEMBLY	<p>Cannoneer No. 2</p> <p>NOTE If PFM lever fails to operate correctly, refer to Section VII Operation Under Degraded Conditions, and carryout, PFM Lever Failure Procedures (Para 2-59), and notify unit maintenance.</p> <p>a. Check PFM lever, detent, and assembly for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>	

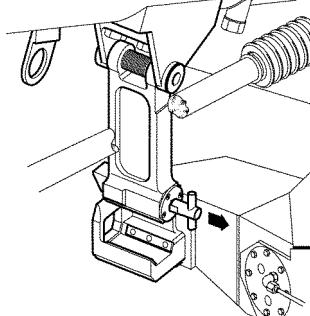
Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
67	During	TWD	<p>b. Operate lever, 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.</p> <p>Cannoneer No. 2</p> <p>Inspect for moisture inside TWD (fogging of window). If moisture present, notify unit maintenance.</p>	
68	During	SCAVENGE SYSTEM	<p>Cannoneer No. 1</p> <p>Check scavenge pump, pressure and exhaust cylinders, manifold, isolator valve and lines for oil leakage. If oil leaks are present, notify unit maintenance.</p>	If leakage is a Class III.
69	During	BREECH MECHANISM	<p>Cannoneer No. 2</p> <p>a. Check breech lever, actuator and lines for oil leakage. If oil leaks are present, notify unit maintenance.</p> <p>b. Inspect magazines (Para 3-8) for damaged parts. If damaged, replace magazine and notify unit maintenance.</p> <p>c. Check firing mechanism (Para 3-7 I.) for loose, missing or damaged parts. If loose, missing, or parts are damaged, replace firing mechanism and notify unit maintenance.</p>	If leakage is a Class III.
70	During	LOADING TRAY SYSTEM	<p>Cannoneer No. 1</p> <p>a. Check loading tray, lever, damper, hinge brackets and lines for oil leakage. If oil leaks are present, notify unit maintenance.</p> <p>b. Check mechanical interlock, damper for smooth operation, if binding occurs, notify unit maintenance.</p>	If leakage is a Class III.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
71	During	FIRING LEVER AND LINKAGE	<p>Cannoneer No. 1</p> <p>a. Check firing lever (1), linkage (2), connector link (3) and push rod (4) for loose nuts, cotter pins and missing or damaged parts. If nuts, cotter pins are loose, missing, or parts are damaged, notify unit maintenance.</p> <p>b. Check for smooth operation, if firing linkage does not re-cock notify unit maintenance.</p> <p>c. Check roller (5) for smooth operation. If binding occurs notify unit maintenance.</p>	
72	During	TRUNNION PUMP	<p>Cannoneer No. 1</p> <p>Check trunnion pump for oil leakage. If oil leaks are present, notify unit maintenance.</p>	If leakage is a Class III.
73	During	TRAVERSE SYSTEM	<p>Gunner</p> <p>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 parts are damaged, notify unit maintenance.</p> <p>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.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
74	During	ELEVATION SYSTEM	<p>Assistant Gunner</p> <p>Check elevation handwheel (1), drive belt (2), drive shaft (3), roll screw bellow (4) and mitred (5), intermediate (6), resilient (7) gearboxes for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>	
74.1	During	ELEVATION TRAVEL LOCKS	<p>Gunner and Assistant Gunner</p> <p>If unable to engage one travel lock, refer to Section VII, Operation Under Degraded Conditions and carryout Travel Lock Failure Procedures (para 2-67) and Notify Unit Maintenance.</p>  <p>TDC1233</p>	
75	During	PANTEL	<p>Gunner</p> <p>a. Check counters and reticles for illumination.</p> <p>(1) Press red power ON/OFF switch on battery enclosure. Wait three seconds and recheck.</p>	<p>Reticles or counters are not illuminated.</p> <p>Not illuminated.</p>



WARNING

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



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(2) Install new batteries in battery enclosure then recheck.

Not illuminated.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
76	During	M1A2 COLLIMATOR	<p>Cannoneer No. 3</p> <p>a. Check reticles for illumination.</p> <p>(1) Press red power ON/OFF switch on battery enclosure. Wait 3 seconds and recheck.</p>	<p>Reticles are not illuminated.</p> <p>Not illuminated.</p>
			 <p>WARNING Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.</p>	
77	During	M138A1 ELBOW TELESCOPE	<p>(2) Install new batteries in battery enclosure then recheck.</p> <p>Assistant Gunner</p> <p>a. Check reticles for illumination.</p>	<p>Not illuminated.</p> <p>Reticles or counters are not illuminated.</p>
78	During	M172A1 TELESCOPE AND QUADRANT MOUNT AND M18A1 FIRE CONTROL QUADRANTS	<p>Assistant Gunner</p> <p>a. Check that lockwire is present and mounting bolts are not loose if loose, notify unit maintenance</p> <p>b. Check level vials and counters and reticles for illumination.</p> <p>(1) Press red power ON/OFF switch on battery enclosure. Wait 3 seconds and recheck.</p>	<p>Lockwire is missing or mounting bolts are loose.</p> <p>Reticles or counters are not illuminated.</p> <p>Not illuminated.</p>
			 <p>WARNING Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.</p>	
			 <p>(2) Install new batteries in battery enclosure then recheck.</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
79	During	M171A1 TELESCOPE AND QUADRANT MOUNT AND M17A1 FIRE CONTROL QUADRANT	<p>Gunner</p> <p>a. Check that lockwire is present and mounting bolts are not loose if loose, notify unit maintenance</p> <p>b. Check level vials and reticles for illumination.</p> <p>(1) Press red power ON/OFF switch on battery enclosure. Wait 3 seconds and recheck.</p>	Lockwire is missing or mounting bolts are loose. Reticles or counters are not illuminated. Not illuminated.
80	Weekly	M171A1 TELESCOPE AND QUADRANT MOUNT AND M17A1 FIRE CONTROL QUADRANT	<p>Gunner</p> <p>(2) Install new batteries in battery enclosure then recheck.</p> <p>a. Check that lock wire (1) is present, and mounting bolts (2) are not loose, if loose notify unit maintenance.</p> <p>b. Check all counters (3) and vials (4) for illumination.</p>	Not illuminated. Lockwire is missing or mounting bolts are loose. Counters or vials broken will not illuminate.



WARNING

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



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WARNING

Read and follow all warnings in WARNING SUMMARY.
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- b. Check all counters (3) and vials (4) for illumination.

Counters or vials broken will not illuminate.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

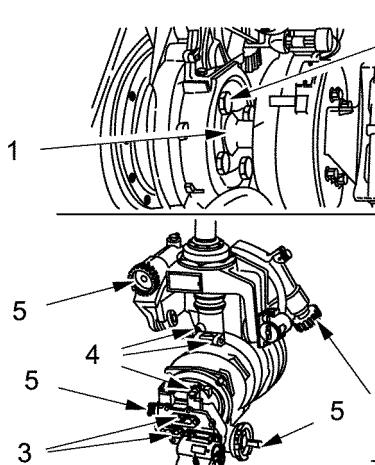
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
81	Weekly	M172A1 TELESCOPE AND QUADRANT MOUNT AND M18A1 FIRE CONTROL QUADRANT	<p>(1) Replace battery and recheck.</p> <p>(2) If still not illuminated after replacing battery, notify unit maintenance.</p> <p>c. Check smooth operation by turning all knobs (5).</p>  <p>Assistant Gunner</p> <p>TDC0314</p>	<p>If reticle will not illuminate.</p> <p>Knobs will not operate.</p> <p>Lockwire is missing or mounting bolts are loose.</p>
			<p>a. Check that lock wire (1) is present, and mounting bolts (2) are not loose, if loose notify unit maintenance.</p> <p>b. Check all counters (3) and vials (4) for illumination.</p>	  <p>WARNING Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.</p>   <p>TDC0450</p> <p>Counters or vials broken/will not illuminate.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

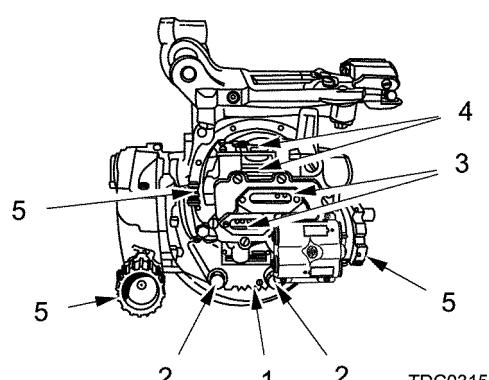
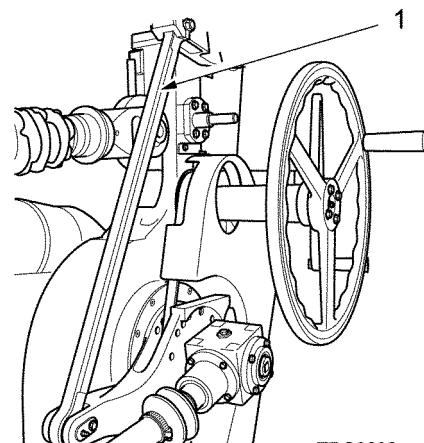
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
82	Weekly	SIGHT LINKAGE	<p>(1) Replace battery and recheck.</p> <p>(2) If still not illuminated after replacing battery, notify unit maintenance.</p> <p>c. Check smooth operation by turning all knobs (5), if binding occurs, notify unit maintenance.</p>  <p>TDC0315</p> <p>Gunner</p> <p>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.</p>  <p>TDC0632</p>	<p>If reticle will not illuminate.</p> <p>Knobs will not operate.</p> <p>Loose or missing nuts/bolts.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
83	Weekly	PANTEL	<p>Gunner</p> <p>a. All knobs should turn freely. Check for rust. Clean with a clean wiping rag (item 30, appx D) moistened with cleaning compound (item 9, appx D). Wipe dry.</p> <p>b. Check counters and reticles for illumination.</p> <p>(1) Press red power ON/OFF switch on battery enclosure. Wait three seconds and recheck.</p>	Knobs do not turn. Reticles or counters are not illuminated. Not illuminated.
84	Weekly	M1A2 COLLIMATOR	<p>(2) Install new batteries in battery enclosure then recheck.</p> <p>Cannoneer No. 3</p> <p>a. All knobs should turn freely. Check for rust. Clean with a clean wiping rag (item 30, appx D) moistened with cleaning compound (item 9, appx D). Wipe dry.</p> <p>b. Check reticles for illumination.</p> <p>(1) Press red power ON/OFF switch on battery enclosure. Wait 3 seconds and recheck.</p>	Not illuminated. Knobs do not turn. Reticles are not illuminated. Not illuminated.
			<p>WARNING Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries.</p>	    <small>TDC0450</small>
			<p>(2) Install new batteries in battery enclosure then recheck.</p>	Not illuminated.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
85	Weekly	M138A1 ELBOW TELESCOPE	<p>Assistant Gunner</p> <p>a. All knobs should turn freely. Check for rust. Clean with a clean wiping rag (item 30, appx D) moistened with cleaning compound (item 9, appx D). Wipe dry.</p> <p>b. Check reticles for illumination.</p>	Knobs do not turn. Reticles are not illuminated.
86	Weekly	M154 ALIGNMENT DEVICE	<p>Cannoneer No. 3</p> <p>a. Check reticle for illumination.</p> <p>(1) Press red power ON/OFF switch on battery enclosure. Wait three seconds and recheck.</p>	Reticle is not illuminated. Not illuminated.



WARNING

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



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87	Weekly	M1A1 GUNNERS QUADRANT	<p>(2) Install new batteries in battery enclosure then recheck.</p> <p>Gunner</p> <p>a. Check gunners quadrant level vial for cracks and markings.</p> <p>b. Check level vial cover and quadrant arm for smooth operation.</p> <p>c. Check shoes for burrs wear and damage. If shoes are burred, worn or damaged, notify unit maintenance.</p>	Not illuminated. Level vial is cracked and markings not visible. If quadrant arm does not move freely. If shoes are burred, worn or damaged.
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Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
88	Weekly	BAT	Cannoneer No. 3	
			  <div style="background-color: #e0e0e0; padding: 5px; margin-top: 10px;"> WARNING Read and follow all warnings in WARNING SUMMARY. Pay careful attention to those about batteries. </div>  	
89	Weekly	WHEELS AND TIRES	<p>Check BAT terminals for corrosion. If corroded, remove corrosion with wire brush.</p> <p>Cannoneers Nos. 1 and 2</p> <p>a. Check the wheel nuts. If loose, have unit maintenance torque to 369 ft-lb (500 N-m).</p> <p>b. Check wheels for dents or cracks. Notify unit maintenance.</p>	
90	Weekly	BRAKE FLUID	<p>Assistant Gunner</p> <p>Check brake fluid level, if level is low notify unit maintenance.</p>	If brake fluid level is low.
91	Weekly	SUSPENSION SYSTEM	Cannoneers Nos. 1 and 2	
			WARNINGS	
			<p>BEFORE OPERATING THE SUSPENSION LEVERS, ENSURE THAT ALL PERSONNEL ARE STANDING CLEAR OF HOWITZER.</p> <p>PERSONNEL SUPPORTING THE WEIGHT OF THE CANNON ASSEMBLY MUST BE WARNED BEFORE LOWERING THE HOWITZER.</p>	
			<p>Operate suspension levers and lower weapon onto ground to check for proper operation of the suspension system and hydrostruts.</p>	<p>Suspension lever and hydrostruts do not operate.</p>

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
92	Weekly	SCAVENGE SYSTEM	<p>Cannoneers Nos. 1 and 2</p> <p>a. Operate scavenge system, using pump handle, charge system to required pressure 1740 psi (120 bar) and check operation of trunnion adaptor.</p> <div style="text-align: center; border: 1px solid black; padding: 5px; margin-top: 10px;"> WARNING </div> <p>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.</p> <p>NOTE If breech and/or loading tray fail to operate correctly, refer to Chapter 3, Section II under Troubleshooting Procedures, and carryout BREECH WILL NOT OPEN/CLOSE and/or LOADING TRAY WILL NOT LOWER AND/OR RAISE steps.</p> <p>b. Check scavenge system by completing a loading cycle, open breech, lower and raise loading tray, close breech.</p> <div style="text-align: center; border: 1px solid black; padding: 5px; margin-top: 10px;"> WARNING </div> <p>MAKE SURE ALL PERSONNEL ARE CLEAR OF CANNON RECOIL PATH. LOSS OF NITROGEN PRESSURE CAN ALLOW CANNON TO FALL OUT OF BATTERY.</p>	Scavenge system will not pressurize to 1740 psi (120 bar).
93	Weekly	RECOIL SYSTEM	<p>SC</p> <p>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:</p>	Nitrogen pressure is below 362 psi (25 bar) or above 522 psi (36 bar).

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 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 $\pm 40^{\circ}\text{F}$ (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.		
94	Weekly	RECOIL SYSTEM	Cannoneer No. 2 Check oil index pin is flush. If pin is not flush, notify unit maintenance.	If oil index pin is showing red indicator line.
95	Weekly	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 $\pm 40^{\circ}\text{F}$ (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.	
96	Weekly	THIRD WHEEL ASSEMBLY	Cannoneer No. 5 a. Check third wheel assembly (1), adjustment bolt (2) and securing pins (3) for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance. b. Check for smooth operation, if binding occurs or jerky movement, notify unit maintenance.	Wheel will not operate.

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

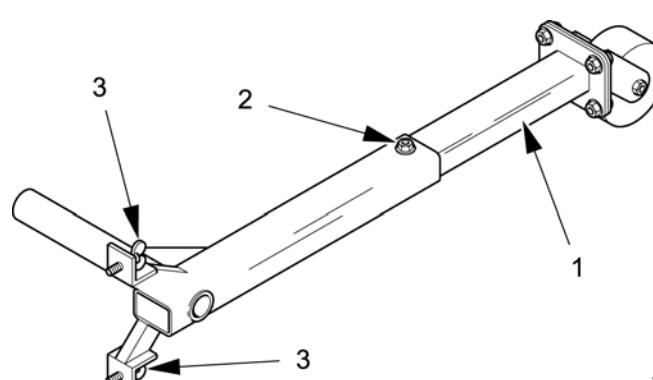
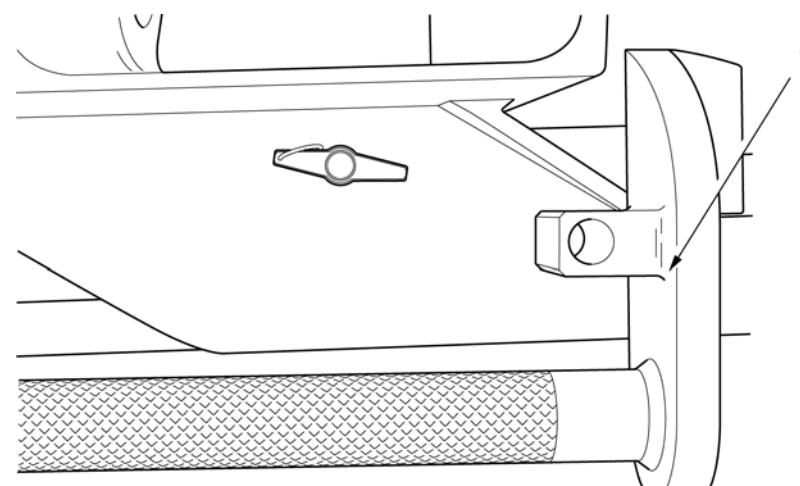
Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
97	Weekly	TRIDENT BAR ASSEMBLY	<p>Cannoneer No. 5</p> <p>Check trident bar assembly (1) for loose and missing or damaged parts. If loose, missing, or parts are damaged, notify unit maintenance.</p>  <p style="text-align: right;">TDC0886</p>  <p style="text-align: right;">TDC1066</p>	

Table 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES FOR M777/M777A1/M777A2 HOWITZER (cont)

Item No.	Interval	Location Item to Check/Service	Crew member Procedure	Not Fully Mission Capable If:
98	Weekly	SADDLE ASSEMBLY	<p>Cannoneers Nos. 3 and 4</p> <p>Check saddle assembly for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>	
99	Weekly	BODY ASSEMBLY	<p>Gunner and Assistant Gunner</p> <p>Check body assembly for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>	
100	Weekly	CRADLE ASSEMBLY	<p>Cannoneer Nos. 1 and 2</p> <p>Check cradle assembly for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or parts are damaged, notify unit maintenance.</p>	
101	Weekly	DFCS	SC, Gunner and Assistant Gunner	
<p>NOTE</p> <p>The DFCS must be booted up and operating in order to obtain an accurate SOC reading.</p>				
			<ul style="list-style-type: none"> a. Check SOC indicator by turning Function Control Switch to COMM and pressing toggle switch to check for illumination, if no illumination, notify unit maintenance. b. Perform DFCS confidence checks (Para 3-23 to 3-29). 	

Section III. OPERATION UNDER USUAL CONDITIONS

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2-17	Laying the Howitzer using M2 Aiming Circle	2-134
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2-19	Emplacing the M1A2 Aiming Posts	2-138
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2-22	Checking Alignment of Pantel, using M154 Alignment Device	2-141
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2-14 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 Gunner's 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.
 - (4) Assistant Gunner, assists the Gunner and, in an emergency, acts as the Gunner. The Assistant Gunner's specific duties are described in this manual.

2-14 GENERAL (cont)

- (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 Table of Organization and Equipment (TOE) and Appendix B of this manual.
- c. If using the M777A1 or M777A2 for any paragraph covered in this section, first initialize the DFCS (Para 2-74 for DFCS Block 1 and Para 2-69 for DFCS Block 1a).

2-15 EMPLACING THE HOWITZER

WARNING

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

CAUTION

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

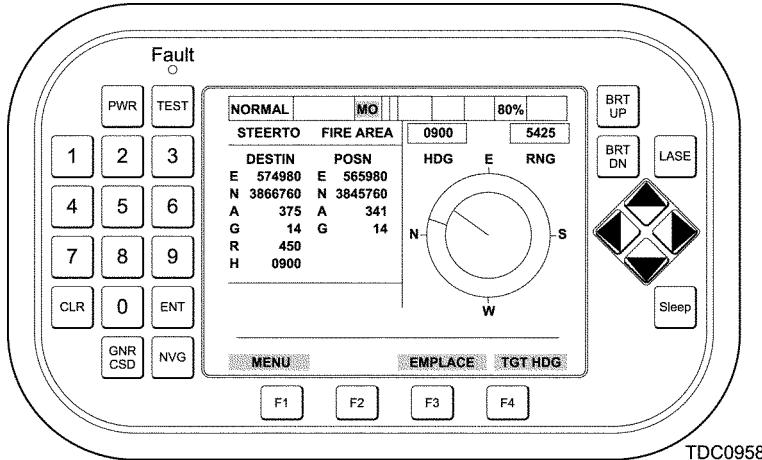
When using only OFC equipment, SC is to ensure that the DFCS CSD [W16] and power [W3] cables are disconnected and removed from the howitzer and stowed on the prime mover. Failure to do so may damage cables.

NOTES

SC supervises the occupation of the firing section position. The Driver should drive the prime mover onto the firing position facing the Azimuth Of Fire (AOF).

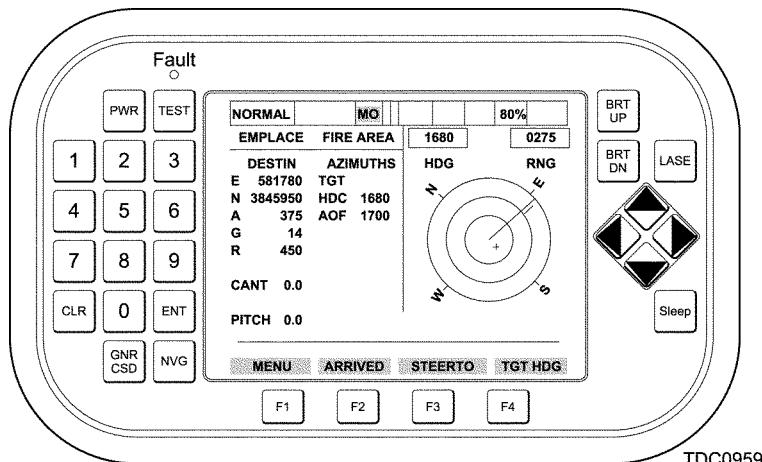
If emplacing M777 howitzer carryout step 1, if emplacing M777A1 or M777A2 howitzer, carryout steps 2 and 3. Steps 4 thru 6 are applicable to all howitzers.

- 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 (for DFCS Block I see Para 2-76, Movement Procedures) (for DFCS Block Ia see Para 2-70, Movement Procedures). SC carryout the following:



TDC0958

- (a) SC, using EMPLACE/FIRE AREA screen on the CSD, directs Driver onto AOF by aligning howitzer heading indicator to the AOF indicator. When both headings are aligned the SC commands HALT.



TDC0959

CAUTION

Ensure CSD is powered down before disconnecting CSD cable [W2]. Failure to do so may damage equipment.

NOTE

CSD [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 CSD [W2 or W16] cable and re-powering the CSD.

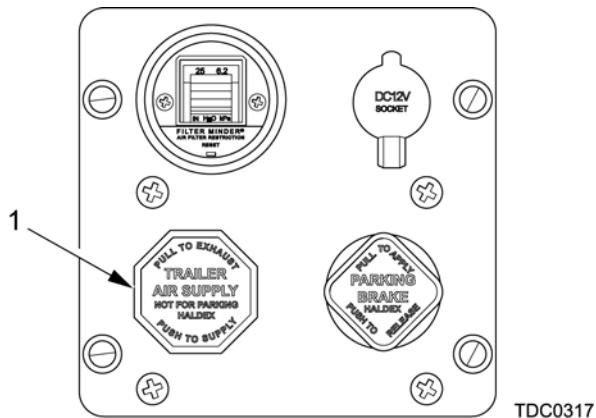
2-15 EMPLACING THE HOWITZER (cont)

- 3 SC presses PWR key on the CSD for three seconds and release (CSD should power off, if not repeat), disconnect CSD [W2] cable and removes CSD from vehicle mount, SC commands DISMOUNT.
- 4 Upon hearing command, section exits through rear of prime mover.

NOTE

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

- 5 Driver exhausts air supply to the howitzer by pulling trailer air supply button (1) outwards.

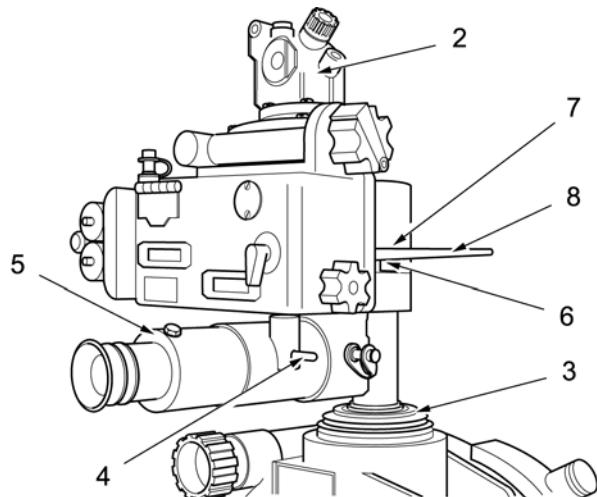


- 6 SC commands PREPARE FOR ACTION.

NOTE

If emplacing M777 howitzer carryout steps 7 thru 11, if emplacing M777A1 or M777A2 howitzer, carryout steps 12 and 13. Steps 14 thru 19 are applicable to all howitzers.

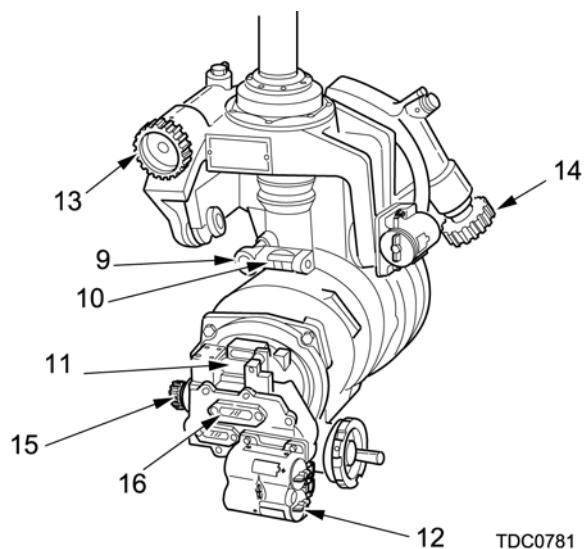
- 7 Gunner mounts the howitzer and removes sight cover.
- 8 Cannoneer No. 3 receives M1A2 collimator and Pantel from Cannoneer No. 2.
- 9 Cannoneer No. 3 hands Pantel to Gunner, then places M1A2 collimator to side of howitzer.
- 10 Gunner installs Pantel (2) to M171A1 telescope and quadrant mount (3) as follows:
 - (a) Depress locking pin (4) of eyepiece (5). Swing eyepiece and lock in position, approximately 90° to Pantel (2).
 - (b) Align pins (6) and keyways (7) and seat Pantel (2) onto M171A1 telescope and quadrant mount (3).
 - (c) Engage two latches (8) to secure Pantel (2) onto M171A1 telescope and quadrant mount (3).



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 (9), pitch level vial (10), and elevation level vial (11).
- (b) Turn M17A1 fire control quadrant battery enclosure switch (12) to ON.
- (c) Turn cross level control knob (13) to center bubble in cross level vial (9).
- (d) Turn pitch level control knob (14) to center bubble in pitch level vial (10).
- (e) Turn elevation correction knob (15) to zero elevation correction counter (16).



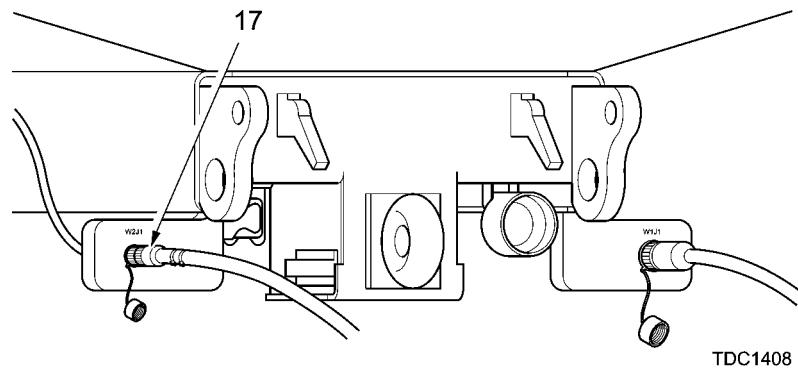
TDC0781

2-15 EMPLACING THE HOWITZER (cont)

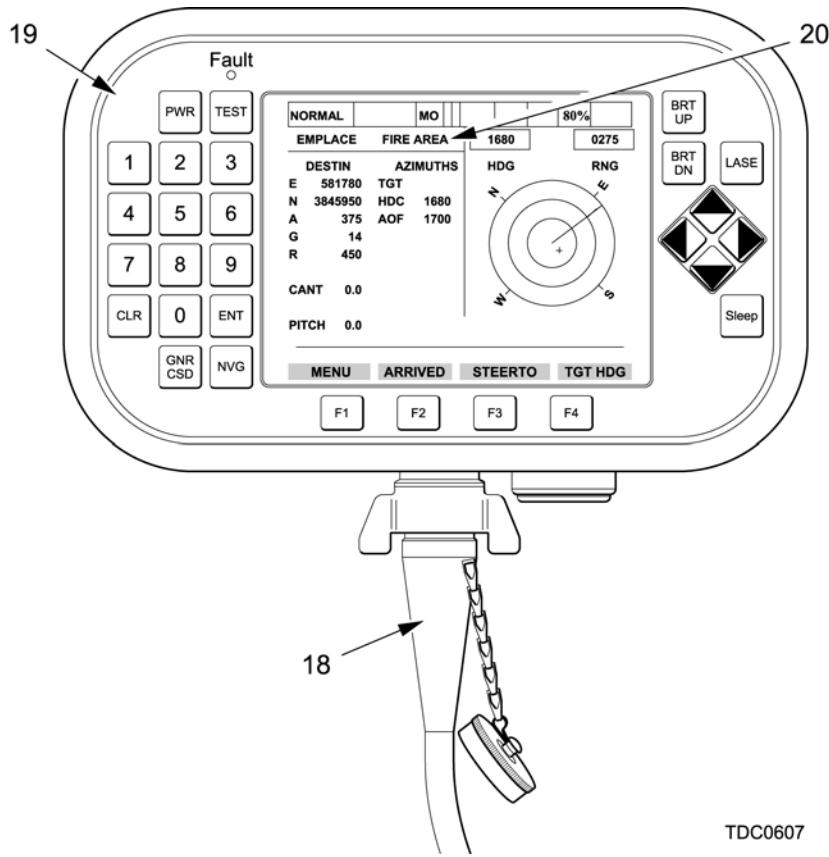
NOTE

If GND screen is not displaying data, SC will lay the howitzer using data displayed on CSD screen.

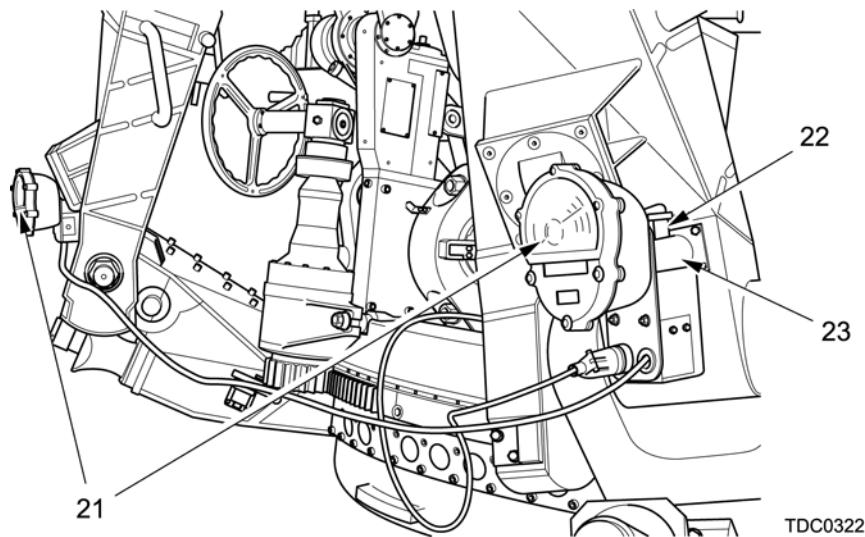
- 12 Gunner disconnects CSD [W16] cable (17) and unwraps cable from cannon tube, hands cable to SC. Gunner mounts howitzer and removes GND cover.



- 13 SC connects CSD [W16] cable (18) to CSD (19), and observes display screen (20) (EMPLACE FIRE AREA/POINT screen should be displayed).



- 14 Assistant Gunner receives sight box from Cannoneer No. 1 and places box to side of howitzer.
- 15 Assistant Gunner and Cannoneer No. 3 remove howitzer taillights (21), by pulling quick release pin (22) out, remove taillights from brackets (23).



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.

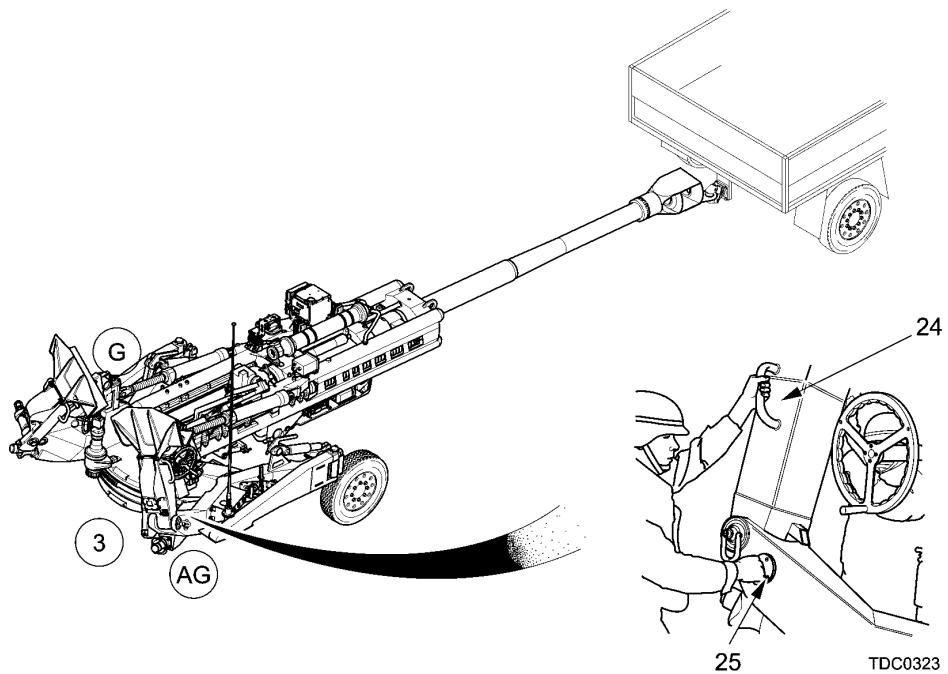
NOTES

When operating in arctic, and/or hard ground conditions (Para 2-34) (e.g., rock, motor pool, etc), the SC may order trail arms to remain in the stowed position.

During Position Improvement, trail arms will be lowered by available cannoneers, to firing position.

- 16 Assistant Gunner and Cannoneer No. 3 deploy trail arms (24), by pulling trail arm locking plunger (25) out, lower trail arm until plunger engages.

2-15 EMPLACING THE HOWITZER (cont)

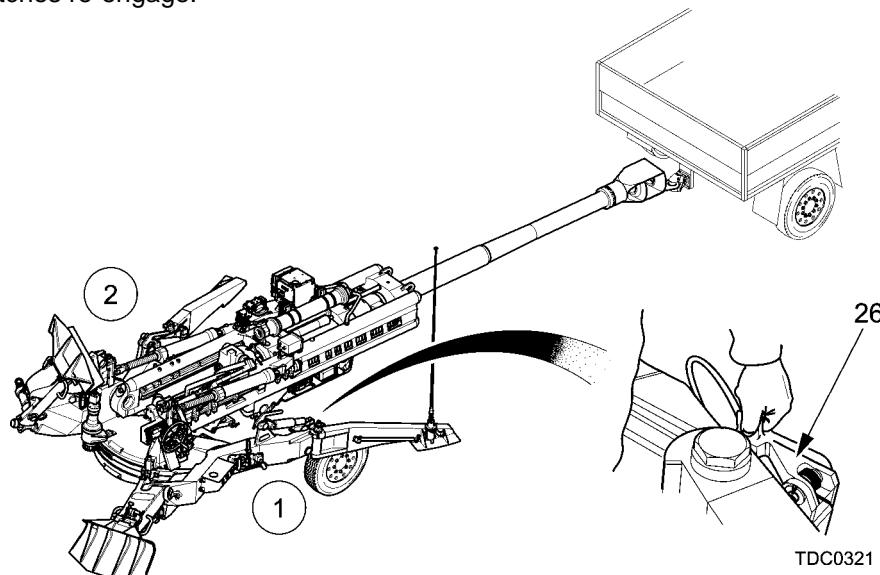


WARNINGS

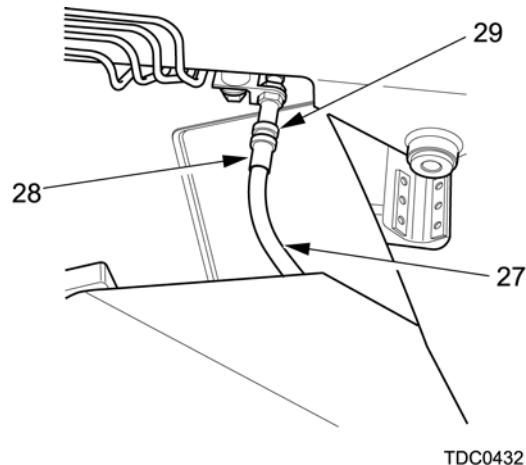
DO NOT TOUCH ANTENNA. ANTENNAS CAN RADIATE HARMFUL LEVELS OF RADIO FREQUENCY. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL.

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

- 17 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 (26), swing stabilizers outwards to the firing position, ensure latches re-engage.



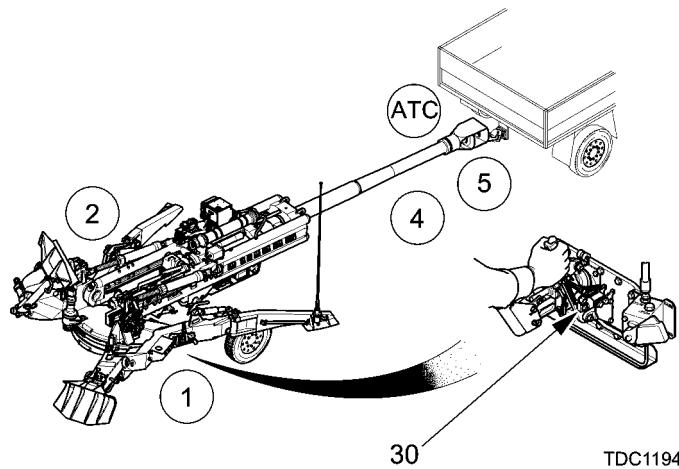
- 18 Cannoneer No. 1 removes quick disconnect airline (27), by disconnecting coupling (28) from howitzer connector (29) and stows airline into bracket.



CAUTION

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

- 19 Cannoneers Nos. 1 and 2 apply handbrakes (30).



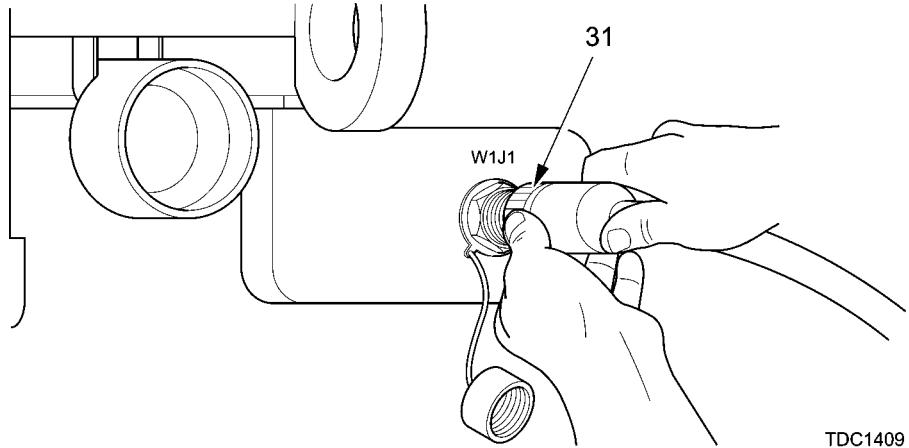
NOTES

If emplacing M777A1 or M777A2 howitzer, carryout step 20. Steps 21 thru 26 are applicable to all howitzers.

If power [W3] cable is not connected to the prime mover connector, proceed to step 21.

2-15 EMPLACING THE HOWITZER (cont)

- 20 Cannoneer No. 4 disconnects power [W3] cable (31) and unwraps from cannon tube.



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.

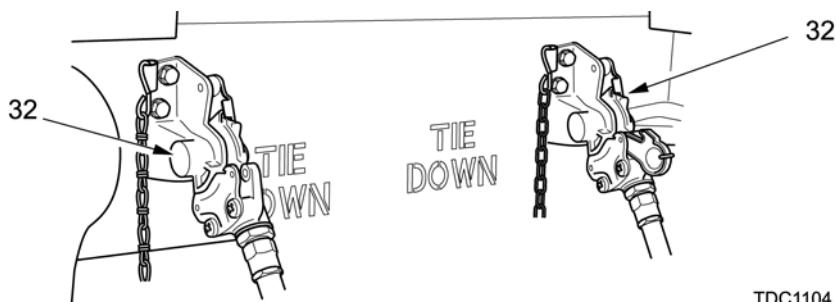
Prime mover vehicles MTVR and FMTV M939 series have opposite coupling connections.

- MTVR – service connection (left side), emergency connection (right side).
- FMTV – M939 series service connection (right side), emergency connection (left side).

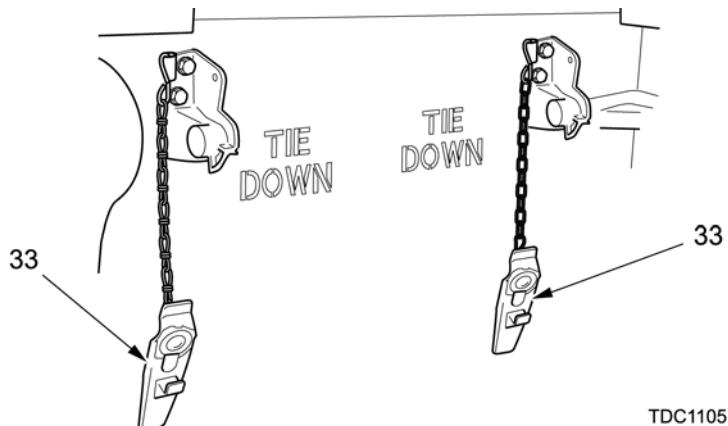
NOTE

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

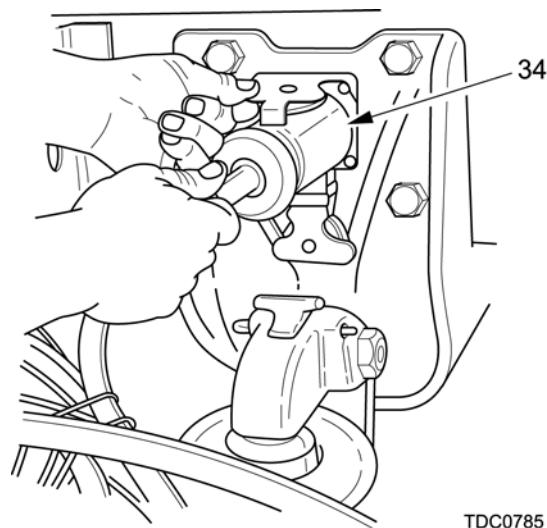
- 21 ATC and Cannoneer No. 5 disconnect emergency and service airlines (32) from the prime mover and stow onto muzzle brake.



- 22 ATC and Cannoneer No. 5 reconnect service and emergency dummy couplings (33).



- 23 ATC disconnects howitzer taillight cable (34) and stows onto muzzle brake.

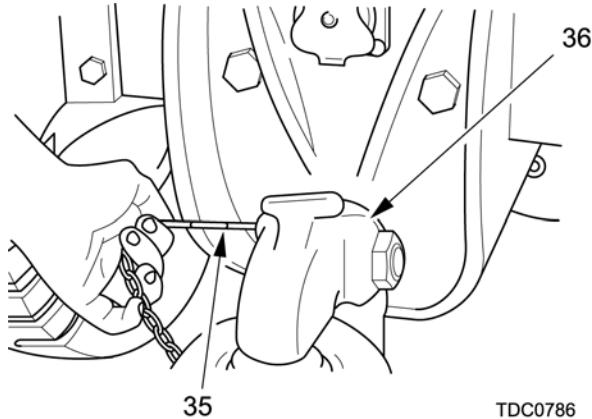


WARNING

DUE TO HOWITZERS CENTER OF GRAVITY, ENSURE PERSONNEL ARE SUPPORTING TRIDENT BAR BEFORE UNLATCHING FROM PRIME MOVER PINTLE. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

2-15 EMPLACING THE HOWITZER (cont)

- 24 ATC removes muzzle plug from cannon tube and places onto prime mover. ATC removes cotter pin (35) and unlatches pintle (36) on prime mover.



TDC0786

- 25 ATC and Cannoneer No 5 lift lunette clear of pintle using trident bar and support howitzer.
26 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.

CAUTIONS

Suspension levers must be operated simultaneously. The howitzer cannot be lowered until the following steps have been completed:

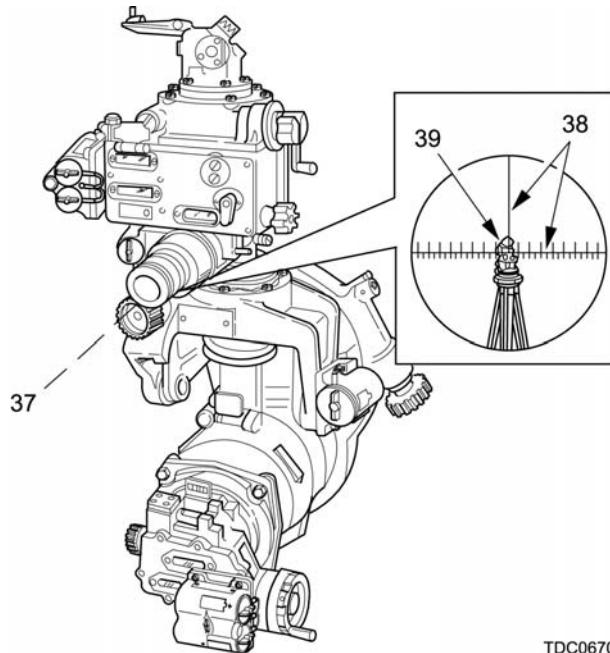
- Handbrakes are applied.
- Lunette assembly is unhooked from the prime mover.
- Cannon assembly is supported by a minimum of two personnel.
- Stabilizers have been deployed into the firing position.

NOTES

If crosshairs are not within \pm 10 mils, Gunner commands "MUZZLE LEFT/RIGHT" until crosshairs are within \pm 10 mils, Gunner then commands "READY DROP".

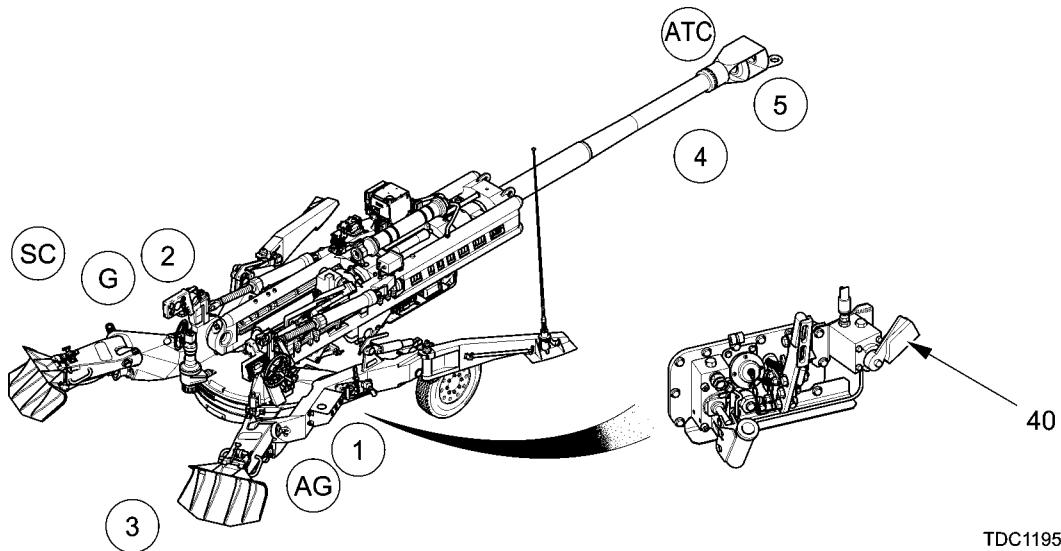
If emplacing M777 howitzer carryout step 27, if emplacing M777A1 or M777A2 howitzer, carryout step 28. Steps 29 thru 32 are applicable to all howitzers.

- 27 Gunner looking through Pintel eyepiece (37) ensures crosshairs (38) are within \pm 10 mils of aiming circle reflector (39), Gunner commands READY DROP.



TDC0670

- 28 Gunner commands READY DROP, when AOF and ACTL AZ on the GND display screen are reading within 10 mils.
- 29 ATC and Cannoneer No. 5 raise cannon tube, Cannoneers Nos. 1 and 2, drop howitzer by moving suspension levers (40) to the LOWER position, and release handbrakes.



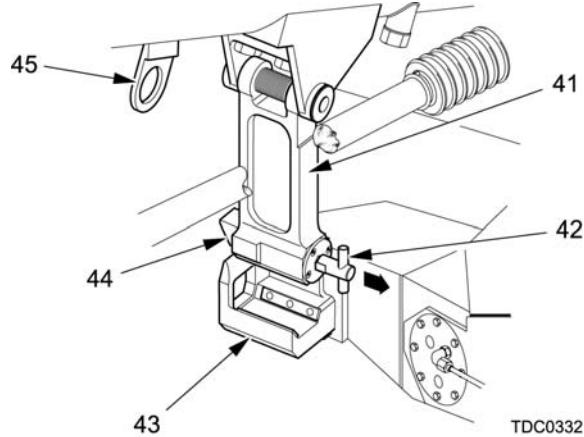
TDC1195

NOTE

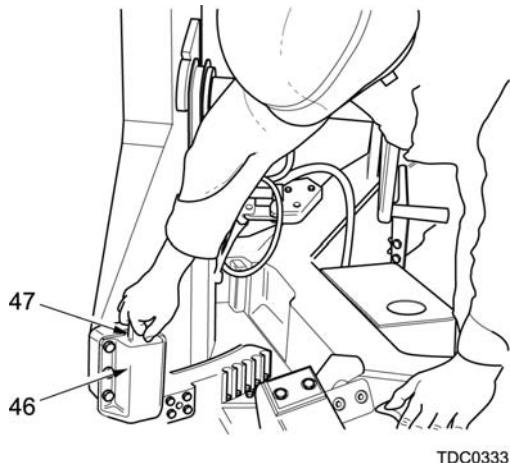
When howitzer is lowered, SC presses "ARRIVED" key on the CSD. For DFCS Block 1, report to FDC the SPHEROID, DATUM, EASTINGS, NORTHINGS, ALTITUDE, and GZ as displayed on the "POSITION DATA FOR FDC" screen.

2-15 EMPLACING THE HOWITZER (cont)

- 30 Cannoneers Nos. 1 and 2 disengage travel locks (41) by pulling tee-handle (42) out. Assistant Gunner elevates cannon tube until clear of locking brackets (43).
- 31 Cannoneers Nos. 1 and 2 raise travel locks (41) and engage plungers (44) into stowage bracket (45).



- 32 Gunner and Assistant Gunner disengage traverse lock (46) by raising and turning handle 90° CW and lowering into the slot (47).

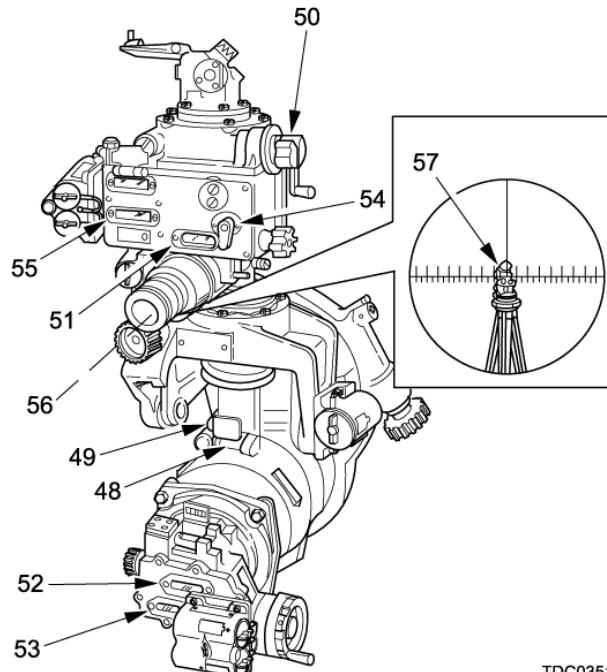


NOTE

If emplacing M777 howitzer carryout steps 33 and 34. Steps 35 thru 37 are applicable to all howitzers.

- 33 Gunner checks to ensure that:
 - (a) Bubbles in pitch level vial (48) and cross level vial (49) on the M171A1 telescope and quadrant mount are centered.
 - (b) Azimuth knob bar (50) reads INDIRECT.
 - (c) Correction counter (51) on the Pantel is set at zero.
 - (d) Elevation correction counter (52) on M17A1 fire control quadrant is set to zero.

- (e) Elevation counter (53) on M17A1 fire control quadrant is set at zero (or another elevation dictated by unit SOP).
 - (f) Gunner engages the deflection knob (54), sets the deflection counter (55) at 3200, and then disengages deflection knob.
- 34 Gunner looking through Pantel eyepiece (56), traverses howitzer until crosshairs are centered on the aiming circle reflector (57) (Para 2-17 for Laying the Howitzer using the Aiming Circle).



TDC0351

WARNING

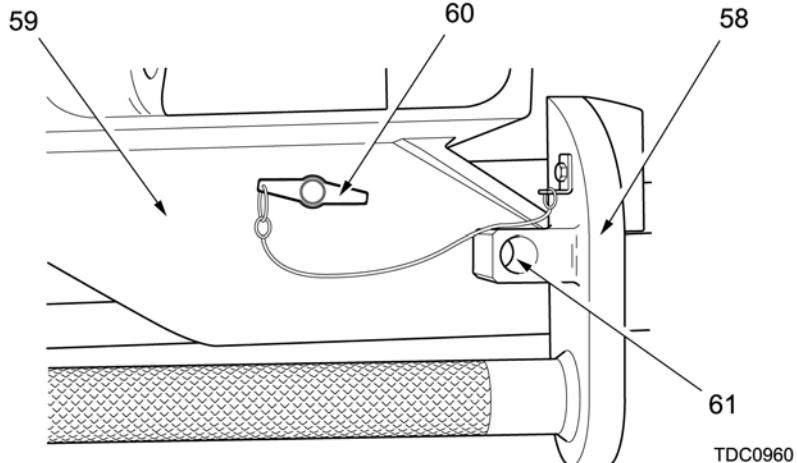
ENSURE TRIDENT BAR IS REMOVED FROM LUNETTE ASSEMBLY BEFORE FIRING THE HOWITZER, FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

CAUTION

When trident bar is removed from the lunette assembly, ensure quick release pin is stowed. Failure to do so will damage equipment.

2-15 EMPLACING THE HOWITZER (cont)

- 35 Cannoneer No. 5 removes trident bar (58), from lunette assembly (59), by disengaging quick release pin (60), slide trident bar out of adaptor. Ensure quick release pin is stowed in bracket (61).



WARNINGS

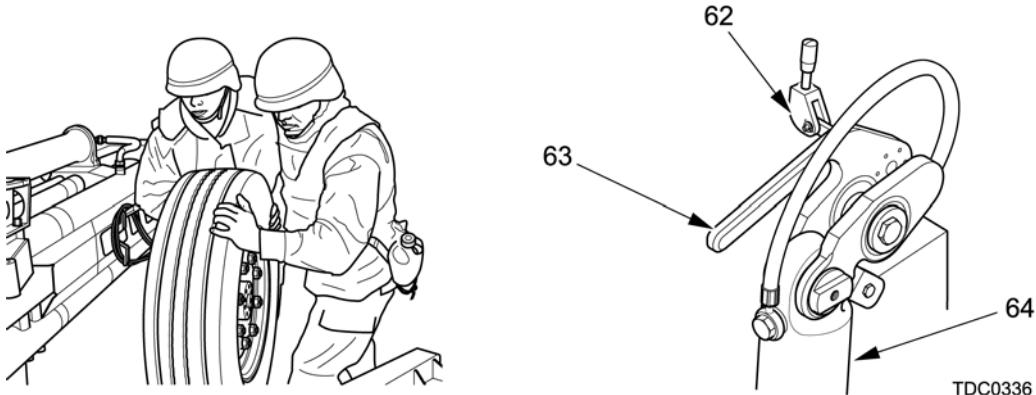
ENSURE THAT HANDBRAKES ARE APPLIED BEFORE ATTEMPTING TO MOVE WHEEL ASSEMBLY ONTO THE BODY; FAILURE TO APPLY HANDBRAKES MAY RESULT IN INJURY TO PERSONNEL.

TWO PERSONNEL MUST BE USED WHEN LIFTING WHEEL ARM ASSEMBLY. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL.

NOTE

Step 36 only applies when local SOP's decide wheel arm assemblies are to be raised during fire missions/deployment operations.

- 36 ATC and Cannoneers Nos. 1, 2 and 5 deploy wheel arm assemblies into raised position, by rotating wheel locking plunger (62) upwards and pull wheel locking lever (63) up until hydrostrut lock (64) disengages. Lift wheel arm assembly onto body, push down on lever until plunger is engaged.



- 37 Cannoneer No. 3 guides prime mover to rear of howitzer.

NOTE

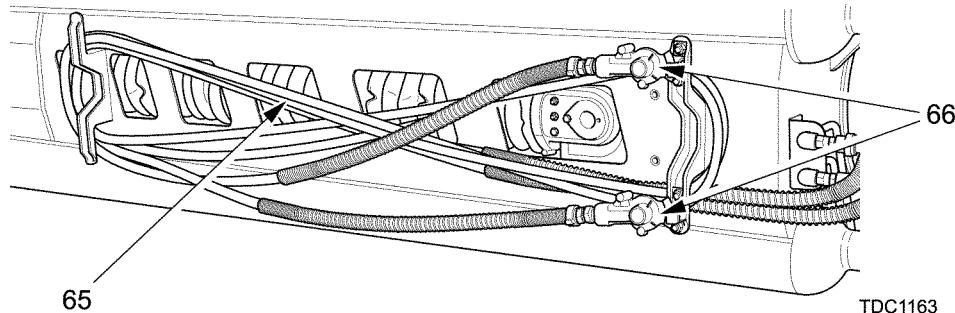
If emplacing M777A1 or M777A2 howitzer carryout step 38. Steps 39 thru 44 are applicable to all howitzers.

- 38 Cannoneer No. 4 hands power [W3] cable to Cannoneer No. 3, who connects cable to prime mover power connector. Driver installs power [W3] and CSD [W16] dust caps to prime mover connectors.
- 39 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.

- 40 Cannoneer No. 4, stows service and emergency airlines (65) onto cradle bracket (66).



TDC1163

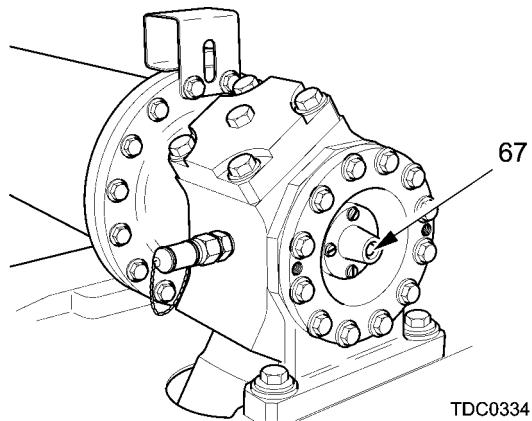
CAUTION

Do not fire howitzer if red indicator is visible on recoil accumulator oil index pin. Failure to do so will damage equipment. Immediately notify unit maintenance.

NOTE

If recoil accumulator oil index pin is not flush (slightly indented or red indicator not visible), continue with operations and notify unit maintenance.

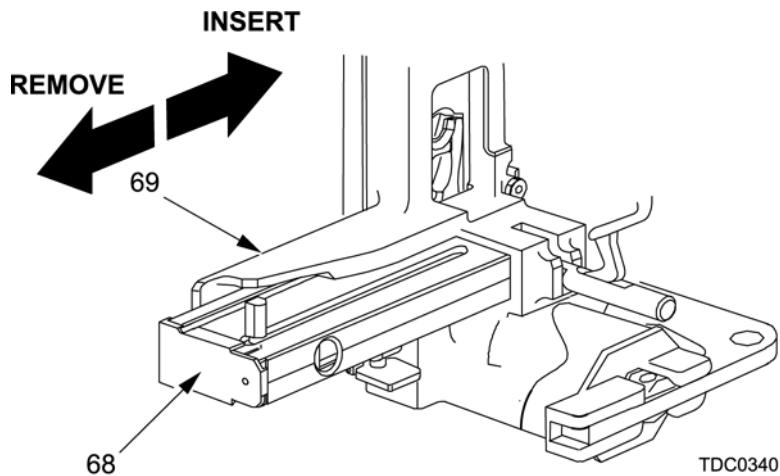
- 41 Cannoneer No. 2 removes PFM cover, and checks recoil accumulator oil index pin (67) is flush.



TDC0334

2-15 EMPLACING THE HOWITZER (cont)

- 42 Cannoneers Nos. 1 and 2 open the breech (Para 2-16).
- 43 Cannoneer No. 2 installs magazine (68) into tray assembly (69). Ensure magazine is locked.



CAUTION

Spades must be dug in to a minimum of 3 inches (7.62 cm). Soil must not be removed from rear of spade.

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

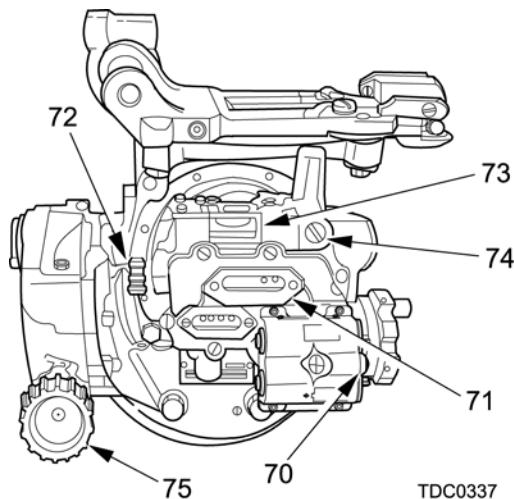
NOTE

If emplacing M777A1 or M777A2 howitzer, carryout step 45, if emplacing M777 howitzer, carryout steps 46 and 47.

- 45 Assistant Gunner removes AGD cover.
- 46 Assistant Gunner removes cover from M172A1 telescope and quadrant mount and M18A1 fire control quadrant and levels mount as follows:
 - (a) Turn M18A1 fire control quadrant battery enclosure switch (70) to ON.
 - (b) Zero elevation correction counter (71) by turning elevation correction knob (72).
 - (c) Roll back protective covers on elevation level vial (73) and cross level vial (74).
 - (d) To center bubble in cross level vial (74), turn cross level control knob (75).

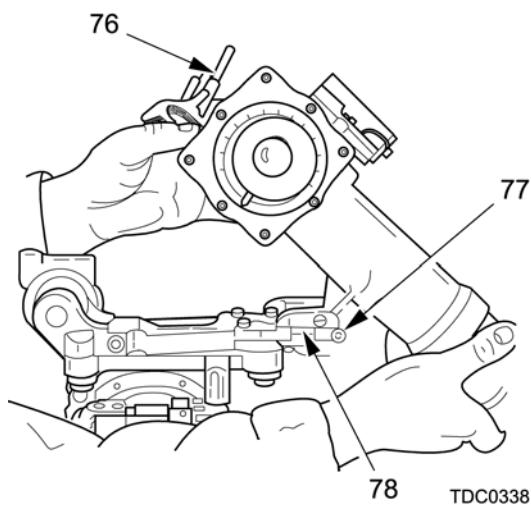
NOTE

Each time M777 howitzer is traversed, elevated, or depressed, M172A1 telescope and quadrant mount must be checked to make sure it is level.



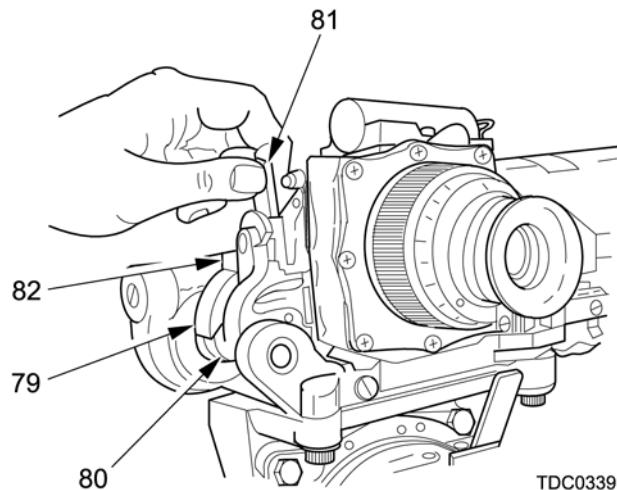
47 Assistant Gunner removes M138A1 elbow telescope from the sight box and installs as follows:

- (a) Turn lock release lever (76) to the left, move locking latch (77) to the open position.
- (b) Insert telescope T-rod (78) into keyway on M172A1 telescope and quadrant mount with eyepiece end raised.



2-15 EMPLACING THE HOWITZER (cont)

- (c) Lower eyepiece end of telescope until latch assembly (79) engages mount shaft (80).
- (d) Pull locking latch (81) up to a vertical position and turn lock-release lever (82) CW until snug.



2-16 BREECH OPERATING MECHANISM

Open Breech (system not charged):

NOTE

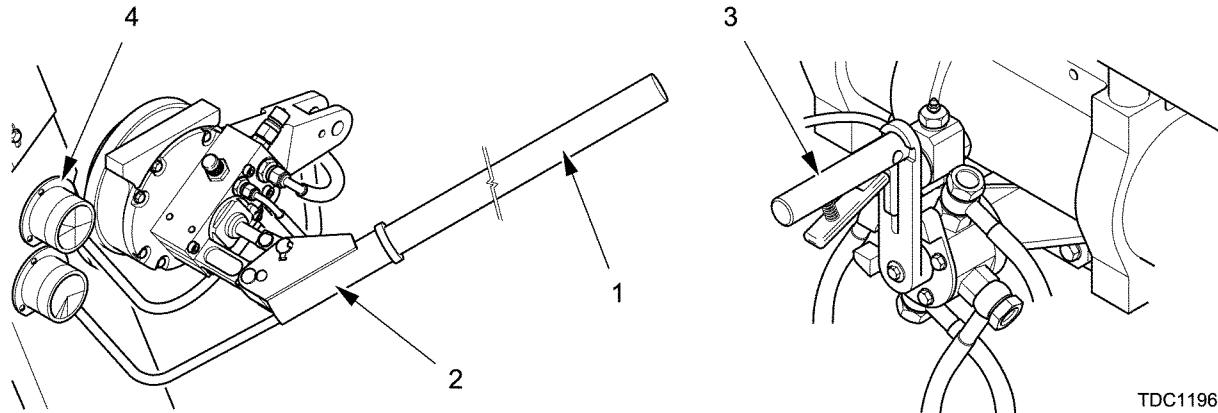
The breech assembly can only be operated when the loading tray is stowed.

- 1 Cannoneer No. 1 installs pump handle (1) into trunnion adaptor (2).
- 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 (HP) gauge (4) reads in the green sector 1762psi (120 bar). Ensure that the final stroke of the adaptor is inboard, remove 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.



TDC1196

NOTE

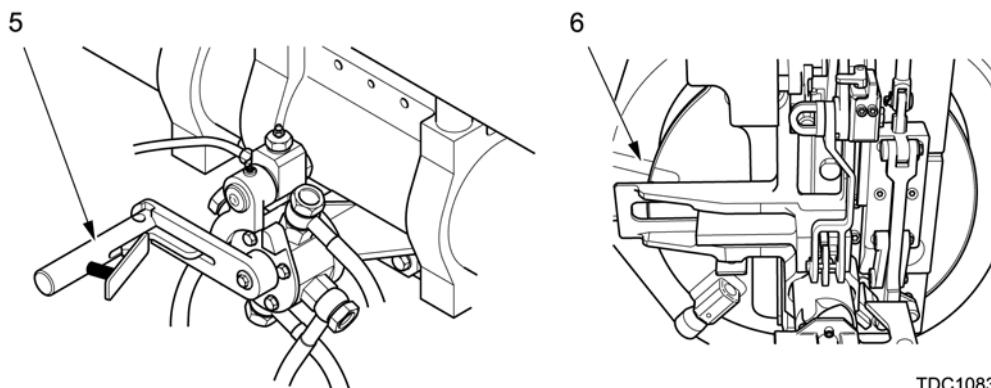
After the first round has been fired, the breech and loading tray assembly can be operated hydraulically by using the breech and loading tray levers.

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.

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



TDC1083

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.

2-16 BREECH OPERATING MECHANISM (cont)

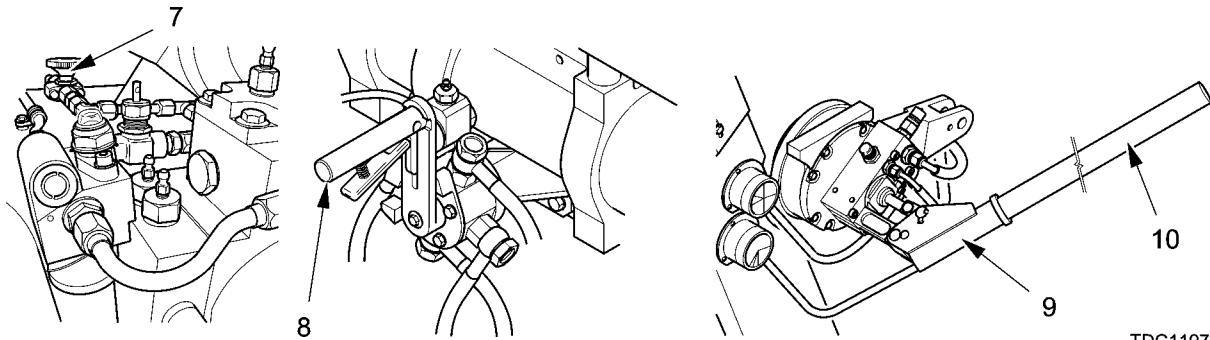
Open Breech (manually) (cont):

- 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 handle (9) until breech is fully open. Remove handle (10) and stow.

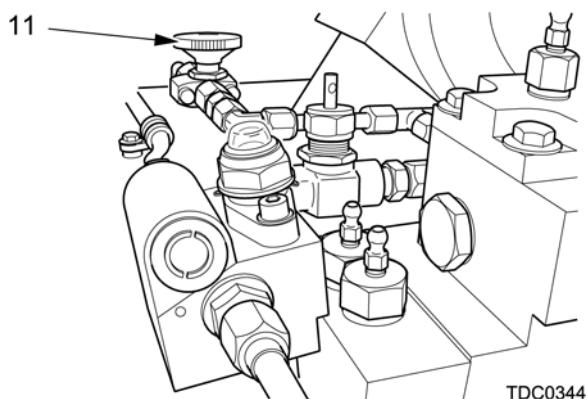


Close Breech (manually):

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.

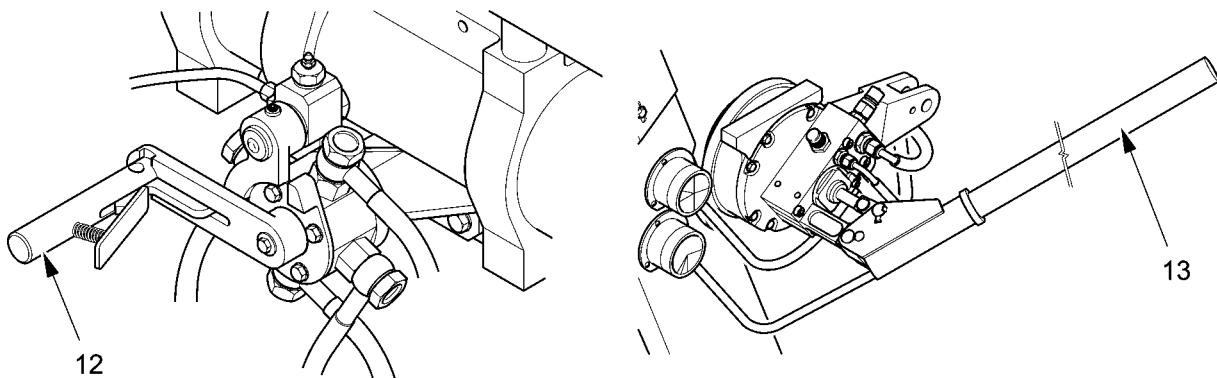
- 1 Cannoneer No. 1 closes scavenge isolator valve (11).



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.



TDC1198

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

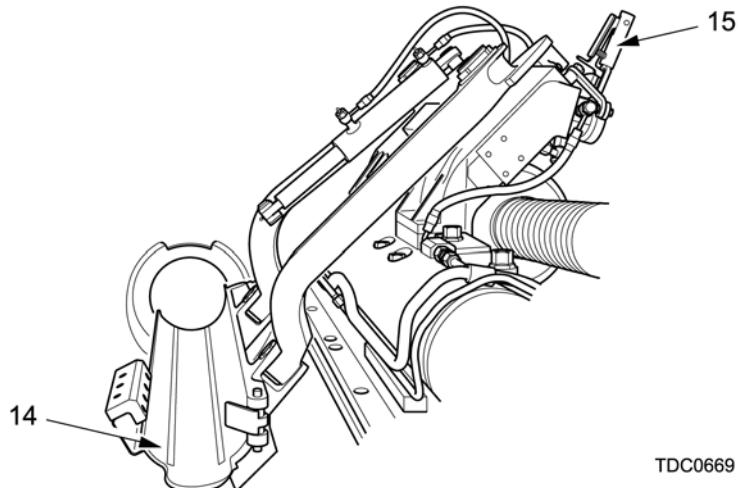
ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.

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.

2-16 BREECH OPERATING MECHANISM (cont)

Lower/Raise Loading Tray (system not charged) (cont):

- 2 To raise/lower loading tray (14), move loading tray lever (15) to the LOWER/RAISE position.



Lower Loading Tray (manually):

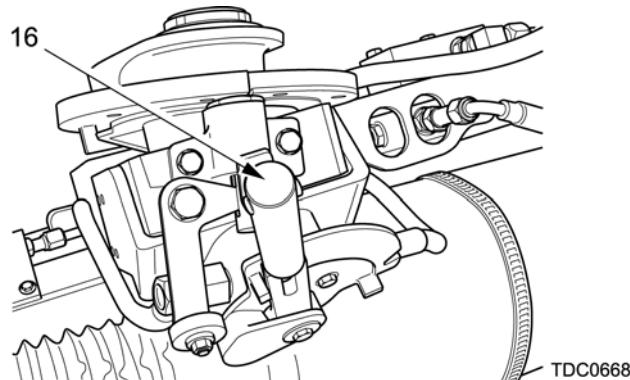
- 1 Open breech (manually).

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 To lower loading tray move loading tray lever (16) to the LOWER position.
- 3 Operate trunnion pump handle until loading tray is fully lowered. Removes handle and stow.

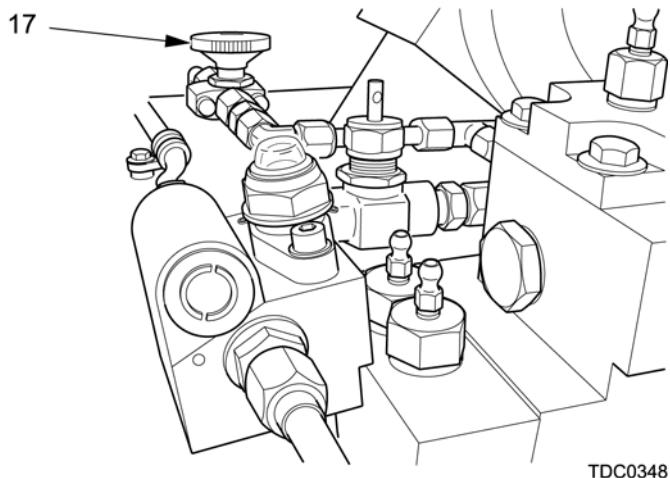


Raise Loading Tray (manually):

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 Close scavenge isolator valve (17).



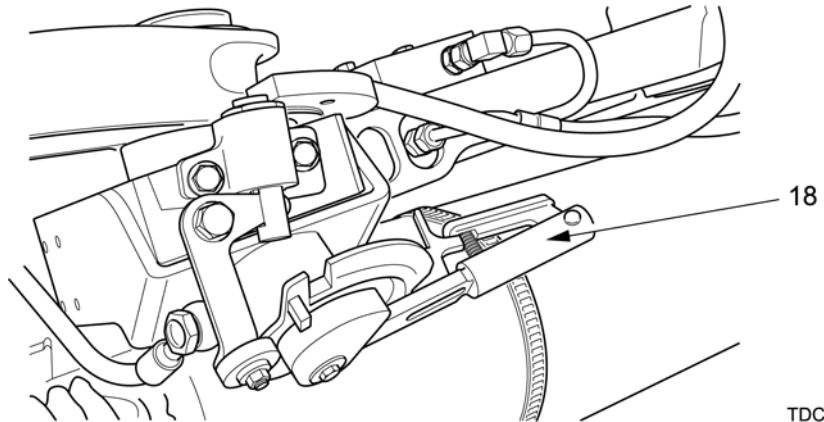
TDC0348

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 RAISE position.

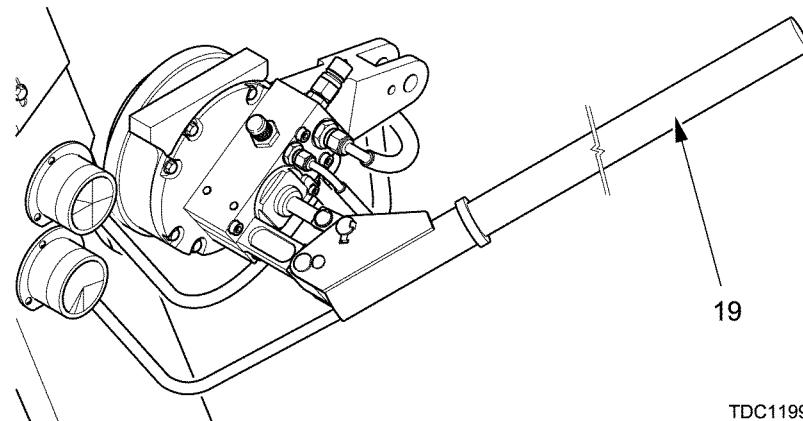


TDC0667

2-16 BREECH OPERATING MECHANISM (cont)

Raise Loading Tray (manually) (cont):

- 3 Operate trunnion pump handle (19) until loading tray is fully raised, ensure loading tray mechanical interlock is engaged. Remove handle and stow.



TDC1199

2-17 LAYING THE HOWITZER USING M2 AIMING CIRCLE



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



TDC0450

NOTE

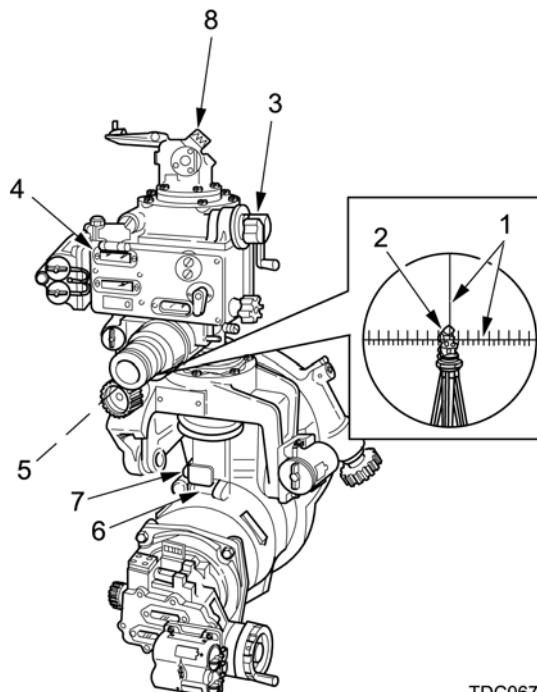
Lay the howitzer under the direction of the Aiming Circle Operator when he announces: BATTERY ADJUST, AIMING POINT THIS INSTRUMENT.

- 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 (1) 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 M1A2 collimator.



TDC0671

2-18 EMPLACING THE M1A2 COLLIMATOR



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



TDC0450

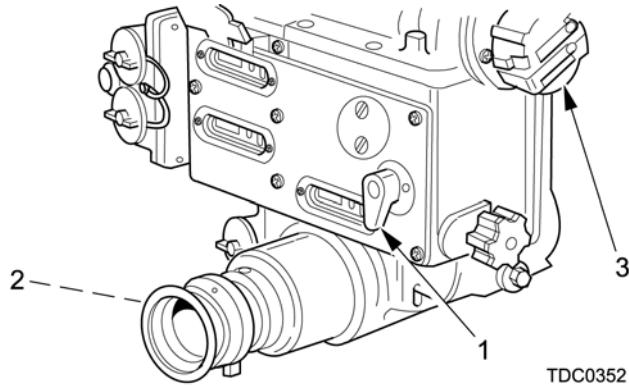
NOTES

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 10 and 13yds (9 and 12m). The M1A2 collimator should not be emplaced more than 4.4yds (4m) above or below the Pantel.

2-18 EMPLACING THE M1A2 COLLIMATOR (cont)

- 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.

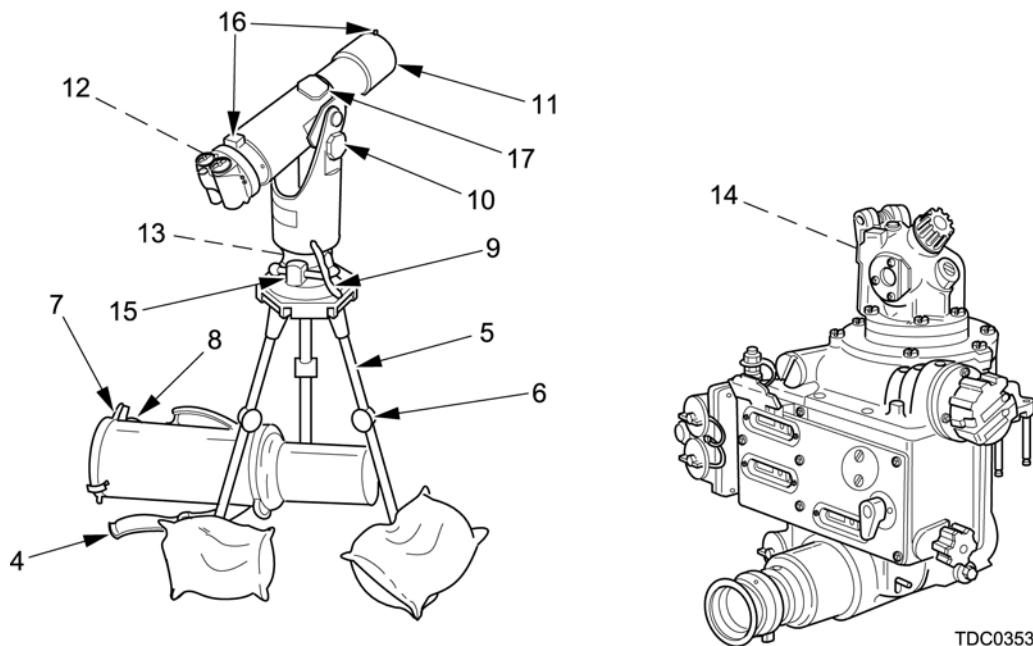


- 2 Under directions from the Gunner, Cannoneer No. 3 emplaces M1A2 collimator as follows:
- Unfastens strap (4) holding legs.
 - Extends legs (5) as necessary. Lock by tightening locking knobs (6).
 - Rotate legs (5) to the down position. Point one leg toward the Pantel. Set each leg firmly into the ground and place a sandbag on each leg.
 - Release latches (7) holding cover (8). Remove cover from collimator (11) and place between legs with closed end toward muzzle.
 - Unfasten strap (9). Loosen elevation clamping knob (10) and rotate collimator (11) to a horizontal position.
 - Turn M1A2 battery enclosure switch (12) to ON.
 - Ensure azimuth adjustment is in the center of traversing capabilities by operating azimuth adjustment knob (13). Turn 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.

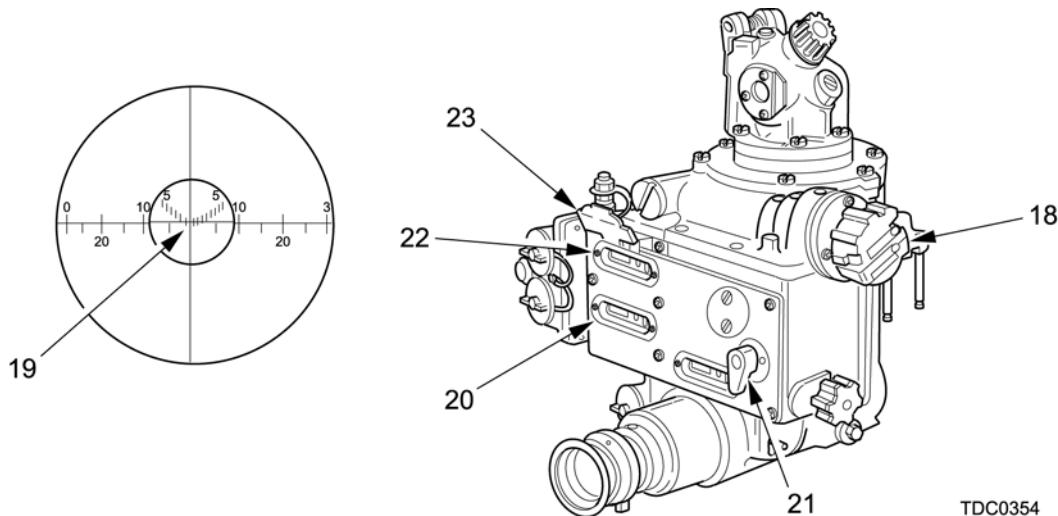
- Loosen azimuth clamping knob (15). Sighting down front and rear sights (16) rough lay on Pantel objective lens (14). Tighten azimuth clamping knob. Adjust collimator elevation as required and tighten elevation clamping knob (10).
- Loosen cross-level clamping knob (17). Rotate collimator (11) until 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 collimator azimuth adjustment knob (13) until Pantel crosshairs are centered with collimator reticle center (19), and announces to Cannoneer No. 3. SET.
 - 4** With 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.



2-19 EMPLACING THE M1A2 AIMING POSTS

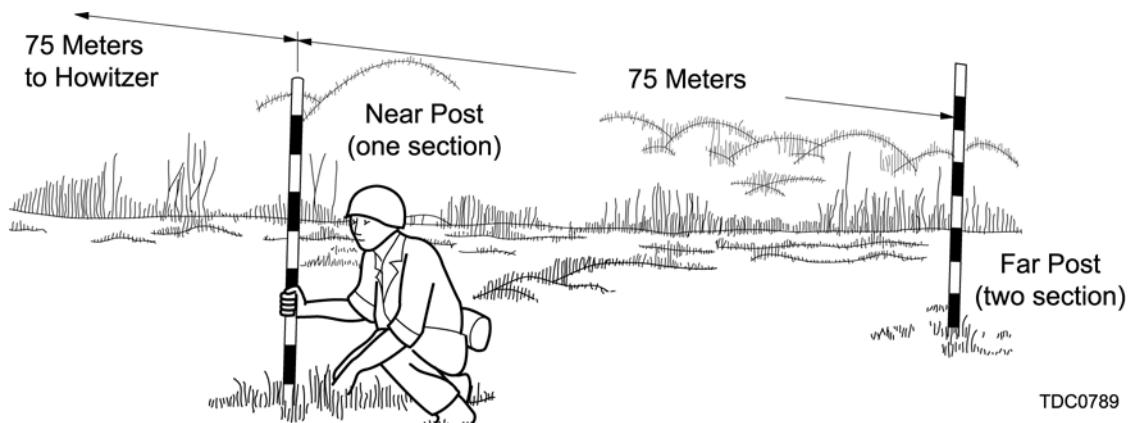
NOTE

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.
- 2 Cannoneers Nos. 4 and 5 emplace 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) Cannoneers Nos. 4 and 5 assemble M1A2 aiming posts.
- 3 Cannoneers Nos. 4 and 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. Cannoneers Nos. 4 and 5 return to the near aiming post and position it by observing hand signals from 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 Cannoneers Nos. 4 and 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 Cannoneers Nos. 4 and 5 to come in.

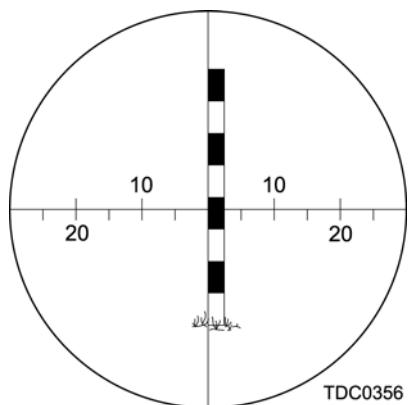
NOTE

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



TDC0789

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



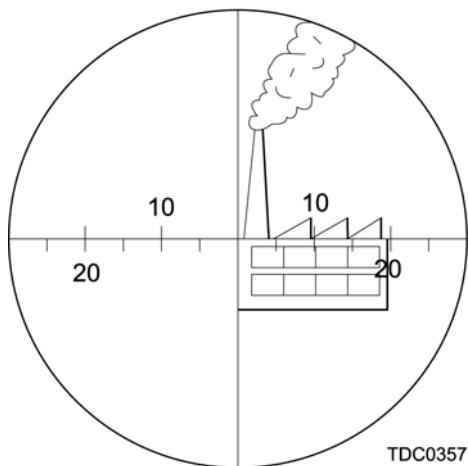
2-20 ESTABLISHING ALTERNATE AIMING POINTS

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.

2-20 ESTABLISHING ALTERNATE AIMING POINTS (cont)

Distant Aiming Point (DAP) (cont)



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 Sets deflection counter back to 3200 by turning the azimuth knob.
- 2 Pushes deflection knob to the left (release position).
- 3 Opens azimuth counter door, turns azimuth knob until azimuth counter shows value he has on his gunners reference card for the aiming point he wishes to use.
- 4 Closes azimuth counter door and pushes deflection knob to the right (engage).
- 5 Set deflection given in the fire mission, on deflection counter, using azimuth knob.
- 6 Sighting through eyepiece, traverse howitzer until proper sight picture is obtained.
- 7 Levels M171A1 telescope and quadrant mount and rechecks sight picture (see Laying for Direction and Elevation During Indirect Fire Missions, Para 2-29).
- 8 Fire according to the command.

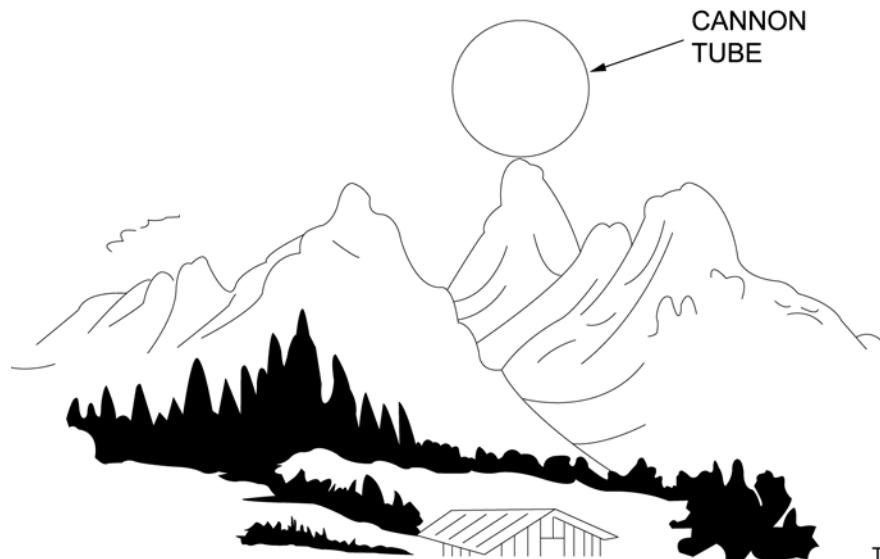
2-21 MEASURE SIGHT-TO-CREST

- 1 SC sights along the bottom edge of the bore and directs 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 Assistant Gunner to MEASURE THE QUADRANT.

- 3 Assistant Gunner centers cross level bubbles by turning cross level control knob, centers elevation level bubble by turning elevation control knob, and reports 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 gunner's quadrant on the M172A1 telescope and quadrant mount quad seats, with the LINE-OF-FIRE arrow pointing toward the muzzle, then moving radial arm index up or down and turning micrometer knob until the bubble centers.



TDC0709

2-22 CHECKING ALIGNMENT OF PANTEL USING M154 ALIGNMENT DEVICE

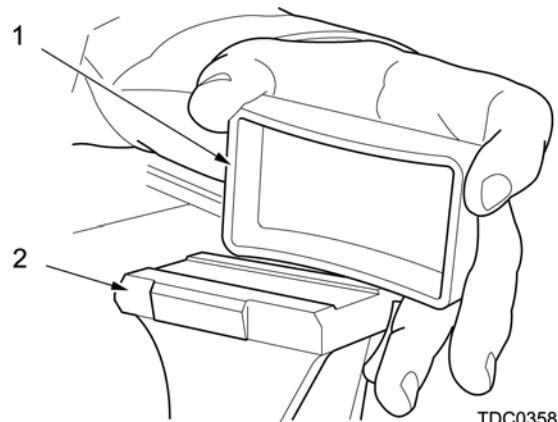


WARNING
Read and follow all warnings in WARNING SUMMARY.
Pay careful attention to those about batteries.



TDC0450

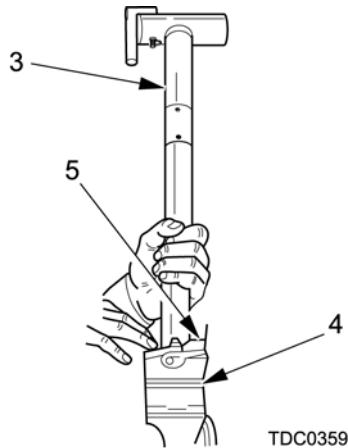
- 1 Assistant Gunner removes protective cover (1) from dovetail (2) on right trunnion and ensures dovetail is clean by wiping with a clean wiping rag (item 30, appx D).



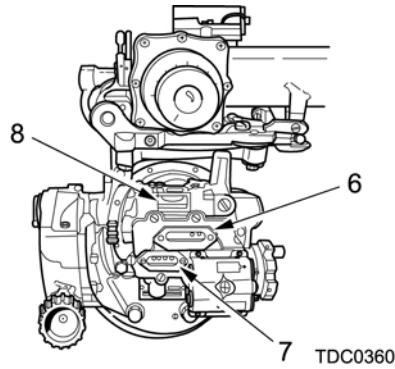
TDC0358

2-22 CHECKING ALIGNMENT OF PANTEL USING M154 ALIGNMENT DEVICE (cont)

- 2 Assistant Gunner removes M154 alignment device (3) from carrying case and installs battery, ensures mating surface (4) is clean by wiping with a clean wiping rag (item 30, appx 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 mating surface of alignment device fits dovetail. Assistant Gunner turns alignment device latch (5) to lock device in place.

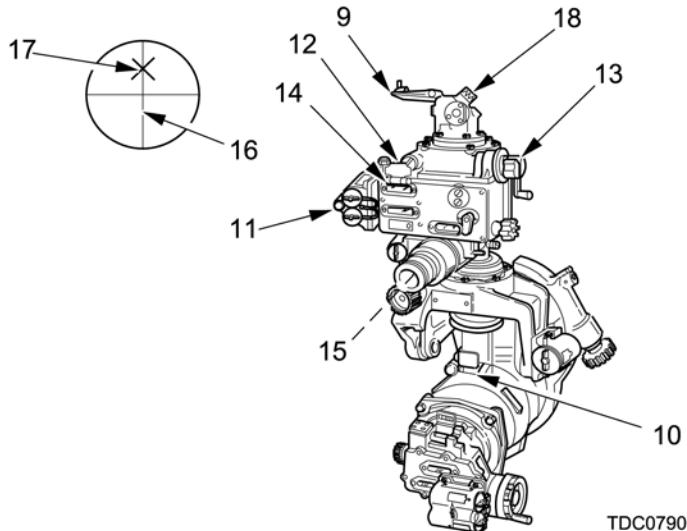


- 4 Assistant Gunner sets M18A1 fire control quadrant elevation correction counter (6) to 00 and elevation counter (7) to 0000. Assistant Gunner levels cannon tube by turning elevating handwheel until bubble in elevation vial (8) centers. If 0000 mils elevation cannot be achieved due to terrain restrictions, elevate cannon to 0100 mils and verify boresight with standard angle method, para 2-26.



- 5 Gunner levels M171A1 telescope and quadrant mount and closes parallax shield (9). After leveling mount, Gunner ensures 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). Vertical Pantel crosshair (16) should align with crosshair (17) of alignment device.

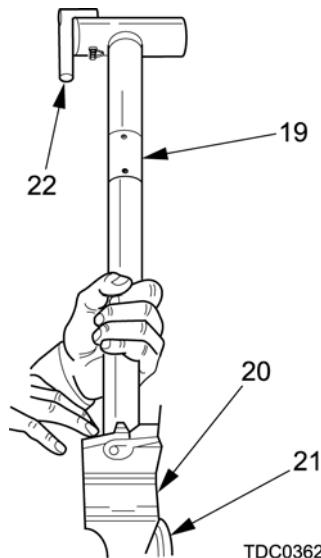
- 8 If Pantel crosshair (16) does not align with alignment device crosshairs (17) when azimuth counter (14) reads 4800 mil \pm 0.5, Assistant Gunner proceeds as follows:
- Remove alignment device (19) from dovetail (20).
 - Reclean mounting surfaces (21) and reinstall alignment device (19). If Pantel crosshair aligns, alignment checks are completed. If alignment is not obtained, perform alignment device comparison test (Para 3-22).
- 9 Gunner opens 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).

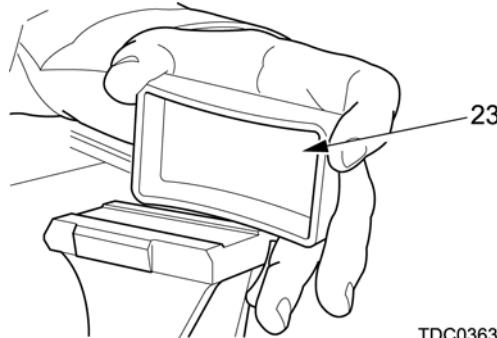


2-22 CHECKING ALIGNMENT OF PANTEL USING M154 ALIGNMENT DEVICE (cont)

CAUTION

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

- 11 Assistant Gunner installs trunnion dovetail protective cover (23), and moves sight case to Gunners side of howitzer.



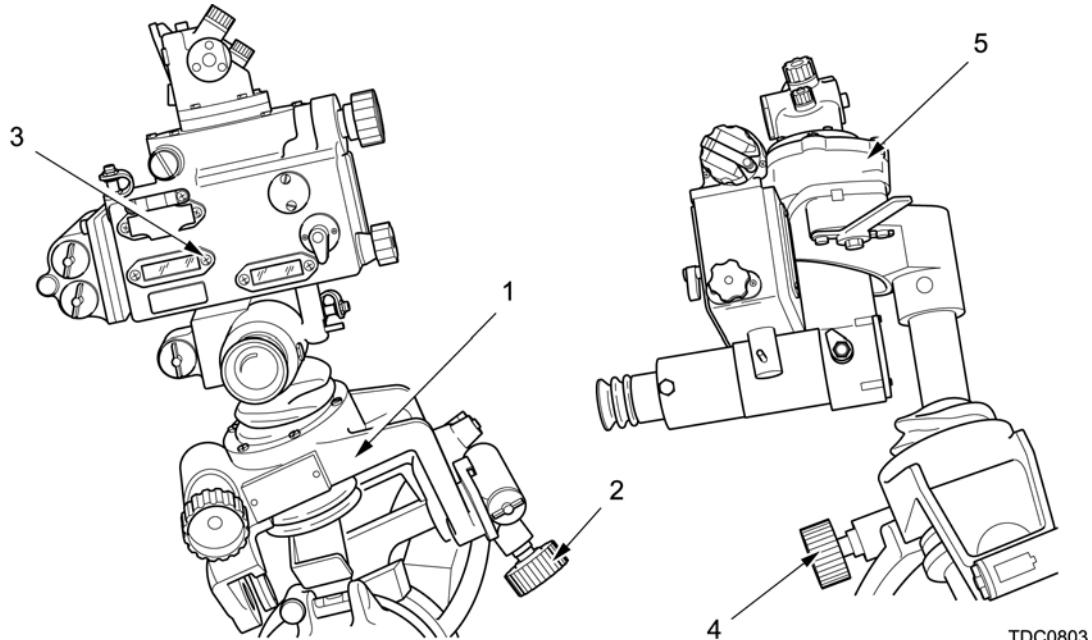
TDC0363

2-23 CHECKING STANDARD ANGLE

NOTE

Before carrying out the standard angle procedure, cannon tube must be at 0000 or 0100 mils elevation.

- 1 To check howitzer standard angle, carryout the following:
 - (a) Using M171A1 telescope and quadrant mount (1) pitch level control knob (2), position Pantel fully forward (3).
 - (b) Using cross level control knob (4), position Pantel fully outwards (5).

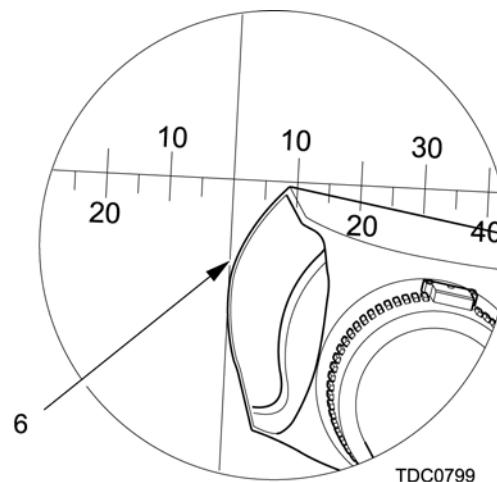


TDC0803

NOTE

If required, adjust Pantel crosshair; turn elevation knob.

- (c) Sighting through Pantel eyepiece, align vertical crosshair (6) on the left edge of the muzzle brake.



- (d) Read standard angle on the azimuth counter, if angle is not within ± 0.5 mil of the established angle, verify boresight of Pantel using DAP (Para 2-25) or Standard Angle (Para 2-26).
- (e) Gunner verifies boresight of Pantel with M154 alignment device (Para 2-22).
- (f) Repeat steps (a) thru (d), if standard and established angles are not within ± 0.5 mil, notify unit maintenance.

2-24 BORESIGHTING M138A1 ELBOW TELESCOPE, USING DISTANT AIMING POINT



WARNING

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



TDC0450

NOTE

Boresighting 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.

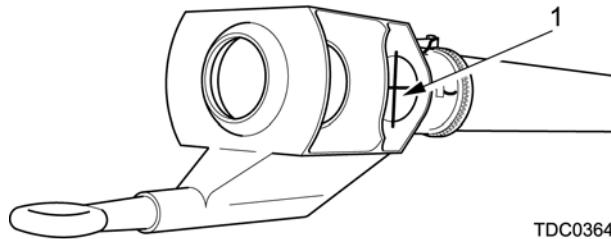
2-24 BORESIGHTING M138A1 ELBOW TELESCOPE, USING DISTANT AIMING POINT (cont)

NOTES

Ensure muzzle boresight disc mating surfaces and end of cannon tube are clean and free of debris before installing disc. Clean with a clean wiping rag (item 30, appx D).

Muzzle crosshairs may be used in lieu of muzzle boresight disc.

- 2** Assistant Gunner installs muzzle boresight disc (1) to cannon tube. Ensure disc is secure.

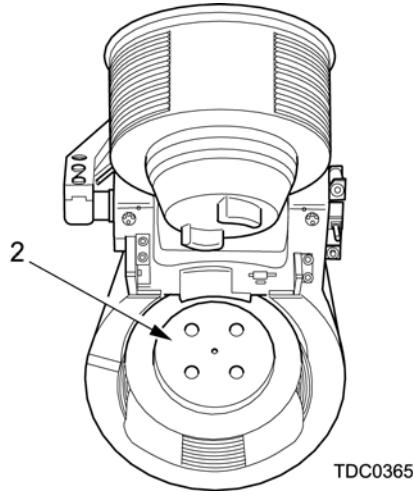


TDC0364

WARNING

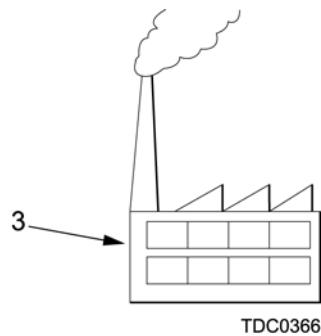
BEFORE INSTALLING BREECH BORESIGHT DISC, ENSURE SCAVENGE ISOLATOR VALVE IS IN THE CLOSED POSITION AND THE BREECH LOCKING PLUNGER IS ENGAGED. FAILURE TO DO SO MAY CAUSE INADVERTANT BREECH MOTION, CAUSING SEVERE CRUSHING INJURIES TO PERSONNEL.

- 3** Cannoneers Nos. 1 and 2 manually open breech (Para 2-16), Cannoneer No. 1 engages breech lock-out plunger, Cannoneer No. 2 installs breech boresight disc (2).

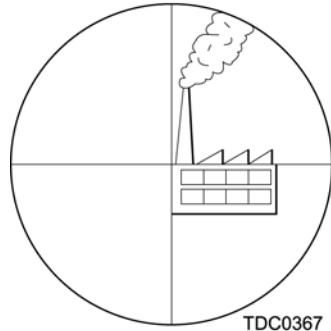


TDC0365

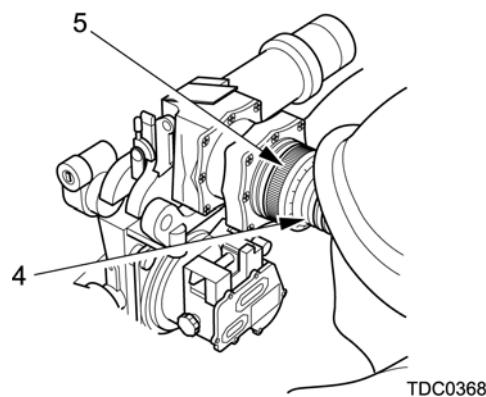
- 4** SC selects a DAP (3) with a well-defined vertical and horizontal axis, ideally at least 1500 meters from the howitzer. If such an aiming point is not available, the SC boresights at engagement range for direct fire.



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

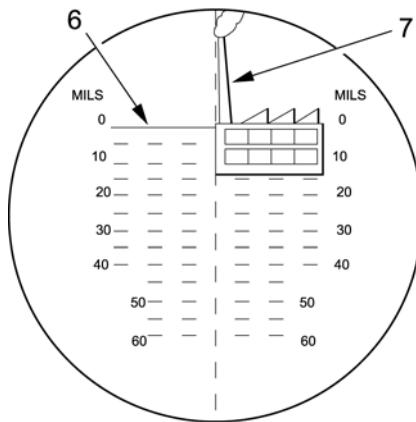


- 6 Assistant Gunner looking through eyepiece (4) adjusts diopter scale (5). Using a calibrated gunners quadrant and the quadrant seats on the M172A1 telescope and quadrant mount, measures the elevation to the DAP and elevates the muzzle 2.3 mils. Checks cross-level of M172A1 telescope and quadrant mount and adjusts if necessary.



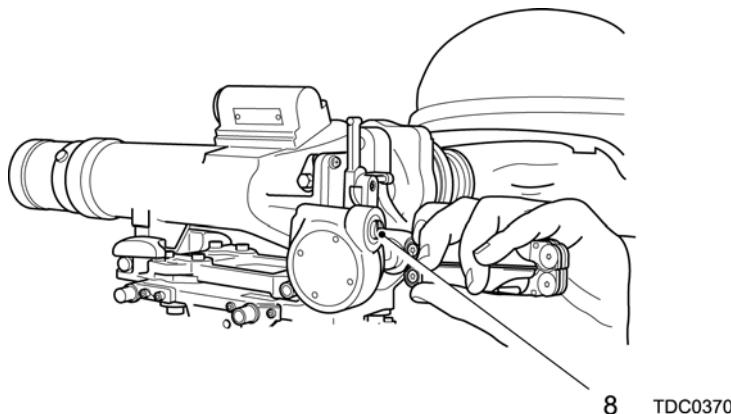
2-24 BORESIGHTING M138A1 ELBOW TELESCOPE, USING DISTANT AIMING POINT (cont)

- 7 Assistant Gunner sights through eyepiece. If elevation line (6) is aligned with DAP (7), M138A1 elbow telescope is in boresight.



TDC0369

- 8 If elevation line is not aligned with DAP, Assistant Gunner turns elevation adjusting screw (8). If the elevation line is misaligned by more than 0.5 mils, repeat steps 1 thru 7, prior to adjustment.



8 TDC0370

- 9 The vertical reticle line 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 muzzle boresight disc from cannon tube, Cannoneer No. 2 removes breech boresight disc, Cannoneer No. 1 disengages breech lock-out plunger.

2-25 BORESIGHTING PANTEL USING DISTANCE AIMING POINT

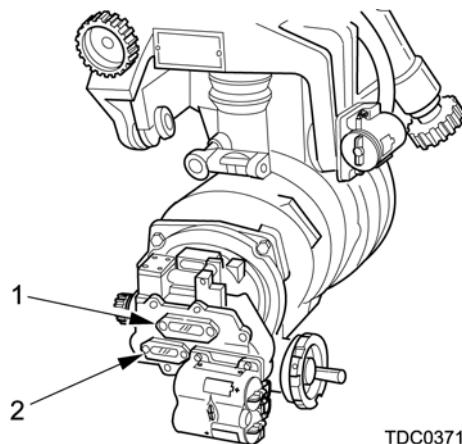
NOTES

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 3-22 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 3-17 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 90 mils cant. If trunnions are not within 90 mils cant, level trunnions (Para 3-18).

- 1 Emplace howitzer into firing position (Para 2-15).
- 2 Gunner sets elevation correction counter (1) and elevation counter (2) to read 0.00 mils. Gunner selects a sharply defined DAP, at least 1500 meters from the howitzer.

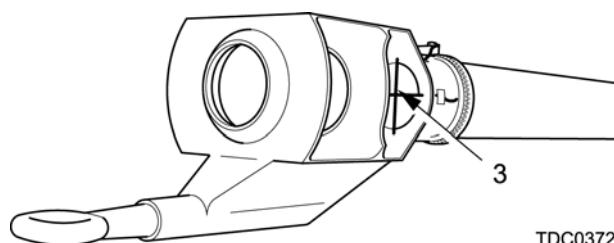


NOTES

Ensure muzzle boresight disc mating surfaces and end of cannon tube are clean and free of debris before installing disc. Clean with a clean wiping rag (item 30, appx D).

Muzzle crosshairs may be used in lieu of muzzle boresight disc.

- 3 Assistant Gunner installs muzzle boresight disc (3) to cannon tube. Ensure disc is secure.

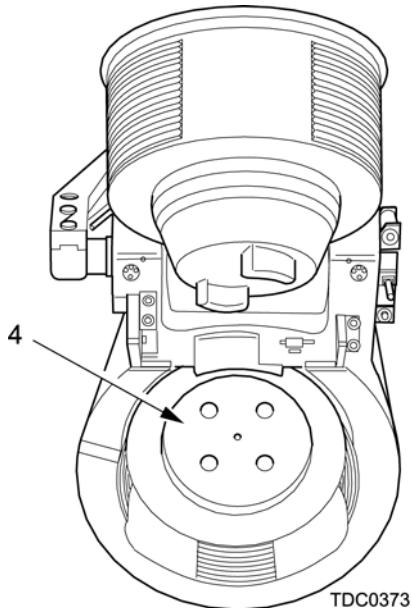


2-25 BORESIGHTING PANTEL USING DISTANCE AIMING POINT (cont)

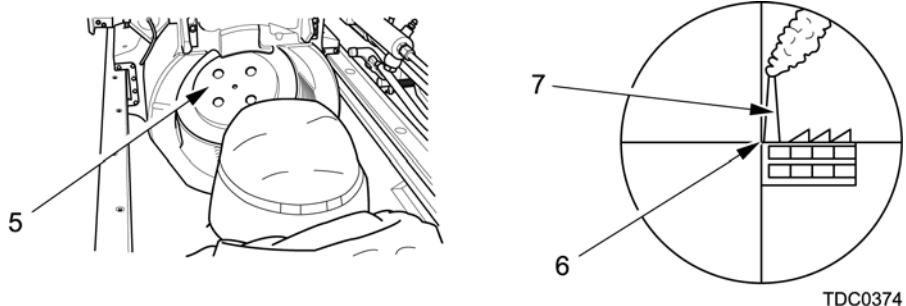
WARNING

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

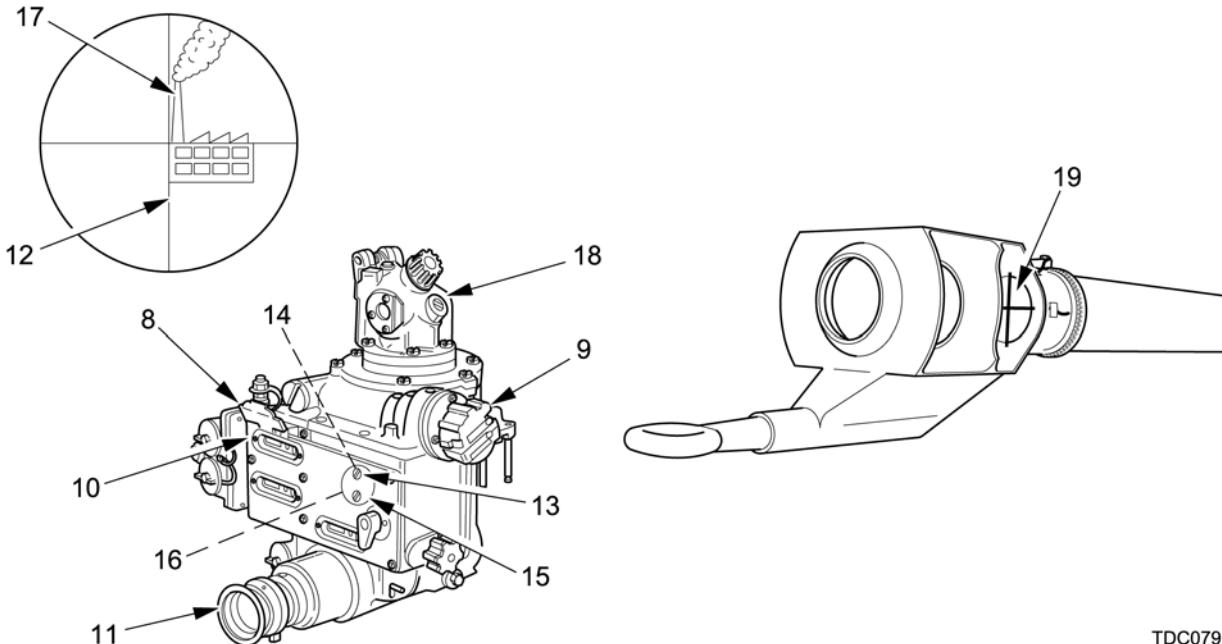
- 4 Cannoneers Nos. 1 and 2 manually open breech (Para 2-16), Cannoneer No. 1 engages breech lock-out plunger, Cannoneer No. 2 installs breech boresight disc (2).



- 5 While looking through breech boresight disc, (5) Cannoneer No. 1 directs Gunner to elevate, depress, or traverse cannon tube, until muzzle boresight cross hairs (6) are aligned on left edge of DAP (7).
- 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, carryout the Level Trunnions procedure (Para 3-18).
- 7 Gunner levels M171A1 telescope and quadrant mount. Repeat steps 6 and 7, as necessary, to ensure trunnions are level and muzzle boresight cross hairs (6) are aligned with DAP (7). If gunners quadrant reading exceeds 90 mils cant, carry out the Level Trunnions procedure (Para 3-18).



- 8 Gunner lifts azimuth counter door (8) and turns azimuth knob (9) until a reading of 3200 mils is obtained on azimuth counter (10).
- 9 Gunner looks through eyepiece (11). Vertical Pantel crosshair (12) 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 (13) and two lock-washers (14), but do not remove from cover (15).
- 11 Remove cover (15).
- 12 Turn slotted eccentric (16) CW approximately $\frac{1}{4}$ turn to disengage azimuth counter (10).
- 13 Turn azimuth knob (9) CW to align vertical Pantel cross hair (12) with left edge of DAP (17).
- 14 Turn slotted eccentric (16) CCW to engage azimuth counter (10).
- 15 Using azimuth knob (9), turn head (18) CCW at least 80 mils.
- 16 Look through the eyepiece (11) and use azimuth knob (9) to align vertical Pantel crosshair (12) on left edge of DAP (final movement in a CW direction).
- 17 With vertical Pantel crosshair (12) on the left edge of DAP, azimuth counter (10) reading should be 3200 mils. If it is not, notify unit maintenance for repair of Pantel. If reading is 3200 mils, howitzer is boresighted.
- 18 Install cover and tighten two setscrews (13) with two lockwashers (14) to secure.
- 19 Assistant Gunner removes muzzle boresight disc (19) from cannon tube, Cannoneer No. 2 removes breech boresight disc, Cannoneer No. 1 disengages breech lock-out plunger.



TDC0791

NOTE

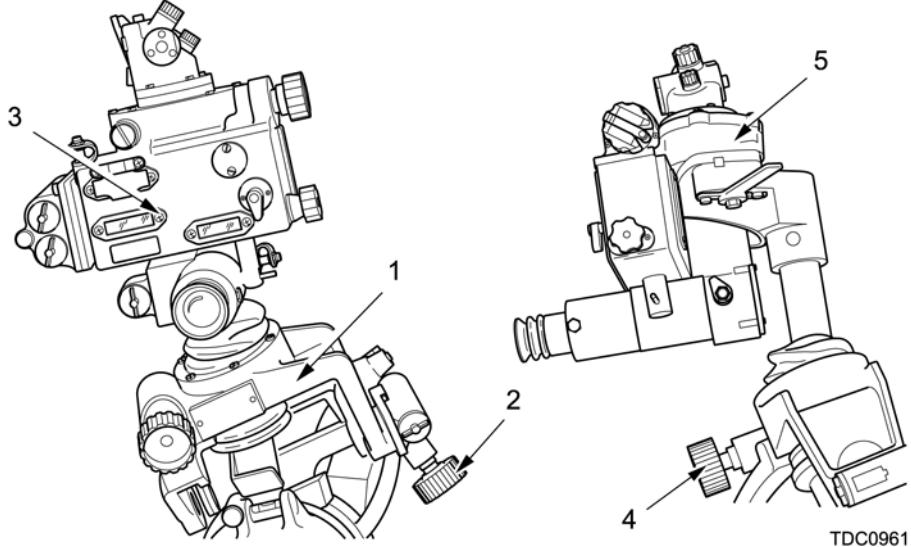
If misalignment of Pantel and M154 alignment device persists, notify unit maintenance.

2-26 BORESIGHTING PANTEL USING STANDARD ANGLE

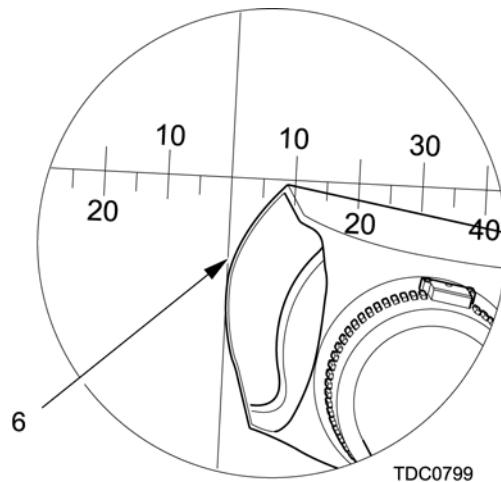
NOTE

Before carrying out the standard angle procedure, cannon tube must be at 0000 or 0100 mils elevation.

- 1 To check Pantel boresight using standard angle, carryout the following:
 - (a) Using M171A1 telescope and quadrant mount (1) pitch level control knob (2), position Pantel fully forward (3).
 - (b) Using cross level control knob (4), position Pantel fully outwards (5).



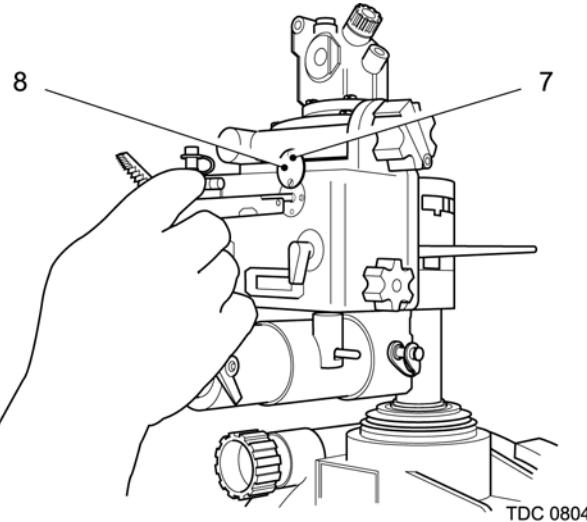
- (c) Using a gunners quadrant, check trunnion level by placing quadrant on cant leveling pads. If gunners quadrant is within 90 mils, proceed to step (d), if quadrant exceeds 90 mils, carryout Level Trunnions procedure (Para 3-18).
- (d) Sighting through Pantel eyepiece, align vertical crosshair (6) on left edge of the muzzle brake.



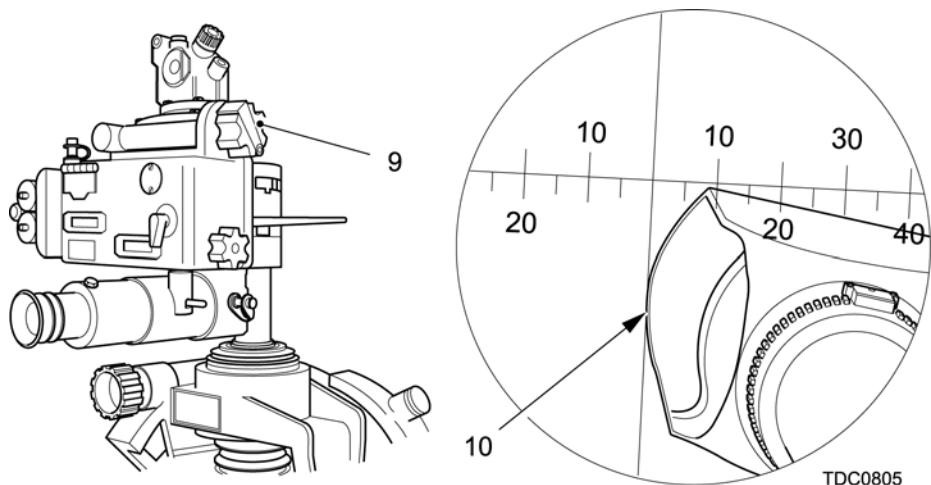
TDC0799

- (e) Read standard angle on the azimuth counter, if angle is within ± 0.5 mil of the established angle, howitzer is in boresight, if not, carryout steps 2 thru 9.

- 2 Set established angle on the azimuth counter.
- 3 Loosen two setscrews and two lockwashers (7), but do not remove from cover (8).
- 4 Remove cover (8), turn slotted eccentric CW approximately $\frac{1}{4}$ turn to disengage azimuth counter.



- 5 Turn azimuth knob (9) to align Pantel vertical crosshair (10) with left edge of muzzle brake.
- 6 Turn slotted eccentric (11) CCW to engage azimuth counter.
- 7 Using azimuth knob turn Pantel head at 80 mils.
- 8 Looking through Pantel eyepiece and using azimuth knob align vertical crosshair onto the left edge of the muzzle brake.



- (a) Read standard angle on the azimuth counter, if angle is within ± 0.5 mil of the established angle, howitzer is in boresight, if not, notify unit maintenance.
- 9 Install cover and tighten two setscrews with two lockwashers to secure.
- 10 Verify standard angle with M154 alignment device, if angle is within ± 0.5 mil of the established angle, howitzer is in boresight, if not, notify unit maintenance.

2-27 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 2-44.
+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 2-45.
+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 2-46.
Above +350°F (+177°C)/Red	Hot	Fire combat emergency missions only. In case of misfire or check fire, go to Para 2-47.

NOTE

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

2-28 PREFIRING CHECKS

WARNING

BEFORE FIRING THE HOWITZER THE FOLLOWING CONDITIONS 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) Bore is clear.
- (b) Howitzer has five points of contact with the ground.
- (c) Breech and PFM witness marks are aligned.
- (d) Oil index pin is flush.

- 2 Driver makes the following prefiring checks:
 - (a) Looks through cannon tube (1) to ensure no foreign matter is present.



2-29 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING INDIRECT FIRE MISSIONS

NOTES

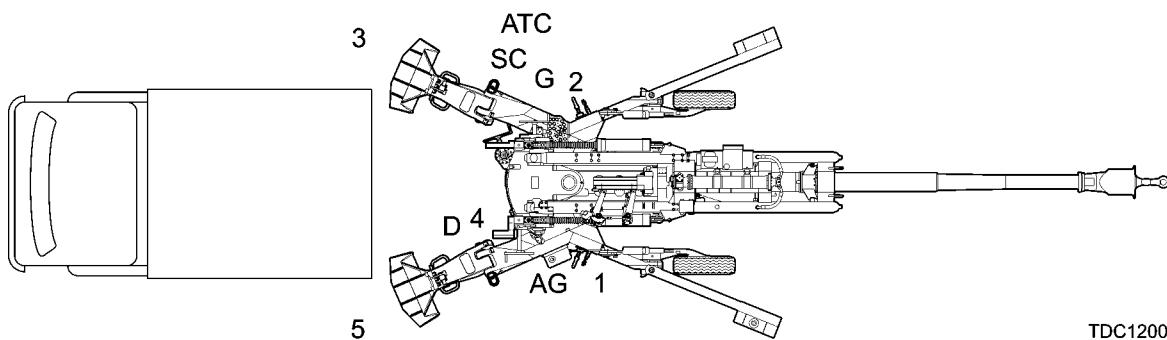
Procedures for firing drills have been standardized under Department of the Army Standardization Program.

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.

NOTE

Prior to loading howitzer for actual firing, all personnel must be familiar with prescribed actions in the event of a misfire (Para 2-43 to 2-47) and ensure that prefiring checks (Para 2-28) 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).

2-29 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING INDIRECT FIRE MISSIONS (cont)

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 2-16).



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



TDC0450

- 6** Gunner lays for direction as follows:

NOTE

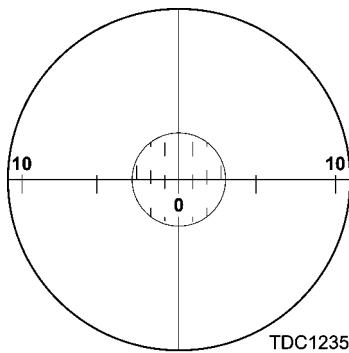
If laying for direction and quadrant for M777A1 or M777A2, use Para 2-76 for DFCS Block 1, and Para 2-70 for DFCS Block 1a. If M1A2 collimator is used, Gunner performs the following:

- (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.

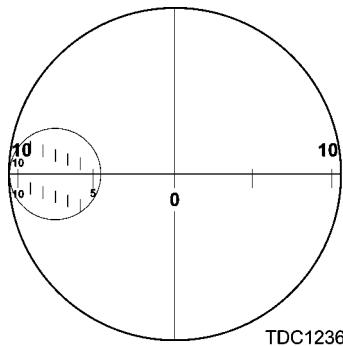
NOTE

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

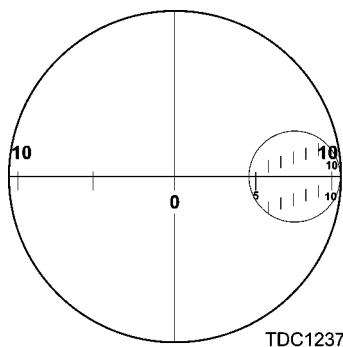
- (b) While sighting through eyepiece, Gunner traverses howitzer until a proper sight picture on collimator is obtained.
- (c) Gunner then levels M171A1 telescope and quadrant mount and rechecks sight picture.
- (d) If the howitzer has not been displaced, the sight picture appears as shown.



- (e) If the howitzer has experienced right displacement (collimator reticle pattern slopes upwards to the left), Gunner traverses the howitzer until the left portion of the Pantel reticle is matched with the collimator reticle.



- (f) If the howitzer has experienced left displacement (collimator reticle pattern slopes upwards to the right), Gunner traverses the howitzer until right portion of the Pantel reticle is matched with the collimator reticle.



NOTE

If laying for direction and quadrant for M777A1 or M777A2 howitzer, use Para 2-76 for DFCS Block 1, and Para 2-70 for DFCS Block 1a. If aiming posts are used, Gunner performs the following:

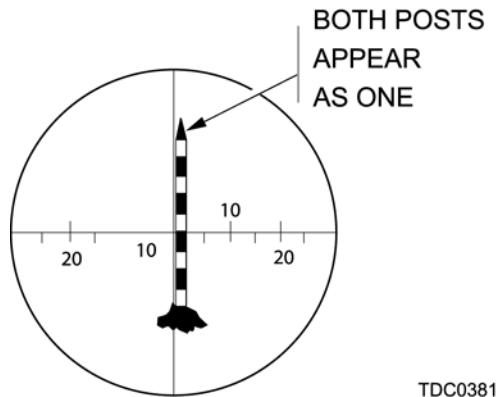
- (g) On the command, DEFLECTION (SO MUCH), Gunner turns the azimuth knob until the deflection appears in deflection counter; he then reads the setting to SC.
- (h) While sighting through eyepiece, Gunner traverses howitzer until a proper sight picture on aiming post is obtained.
- (i) Gunner then levels 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.

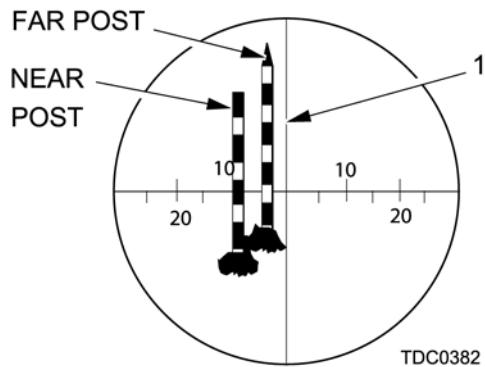
- (j) If the howitzer has experienced no displacement, the sight picture will be displayed as shown.

2-29 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING INDIRECT FIRE MISSIONS (cont)



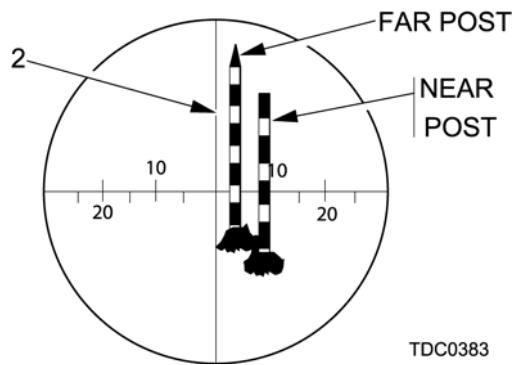
TDC0381

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



TDC0382

- (l) If the howitzer has experienced left displacement (the far aiming post is to the left of the near aiming post), Gunner traverses the howitzer 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.



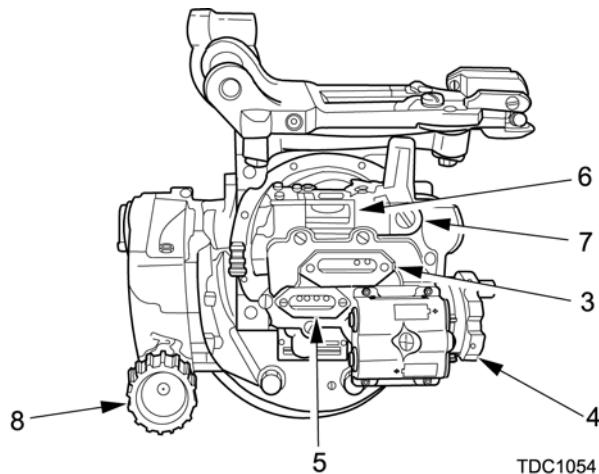
TDC0383

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:

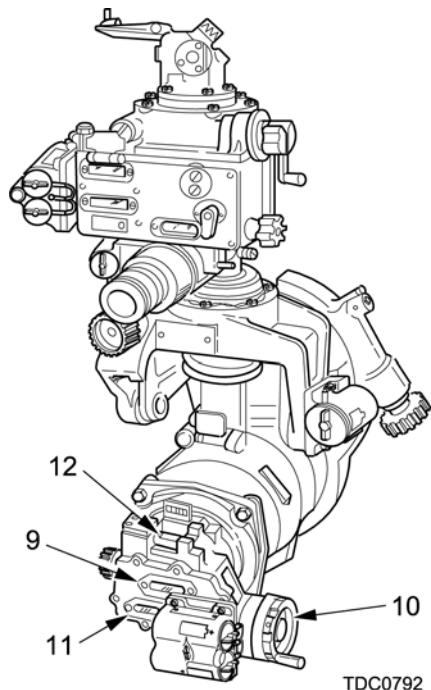
- (a) On the command, QUADRANT (SO MUCH), ensures elevation correction counter (3) reads 00 and rotates elevation control knob (4) until announced quadrant appears in the elevation counter (5). He then reads the setting to SC.
- (b) Elevates or depresses the cannon tube until the elevation level vial (6) centers. Centers the bubble in the cross level vial (7), by turning the cross level control knob (8). Rechecks and adjusts both bubbles (if necessary), and announces QUADRANT (SO MUCH) SET to SC.
- (c) Gunner's quadrant can also be used to lay for quadrant. SC sets announced quadrant on the gunner's quadrant using radial arm index and micrometer knob. He places and holds the gunner's quadrant firmly on the M18A1 fire control quadrant seats with LINE-OF-FIRE arrow pointing toward muzzle. SC directs Assistant Gunner to elevate or depress, until the bubble is centered.



- 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), 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) Elevates or depresses cannon tube until bubble centers in elevation level vial (12).
- (c) Rechecks M171A1 telescope and quadrant mount pitch and cross level vials, Pantel sight pictures, and adjusts as necessary. Announces QUADRANT (SO MUCH) SET to SC.

2-29 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING INDIRECT FIRE MISSIONS (cont)

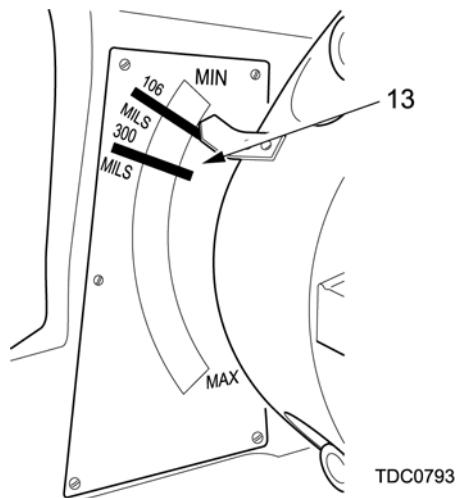


WARNING

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), when using propellant series M119, M203, MACS Zones 4 and 5. Ensure indicator is not below 300 mil line.



WARNING

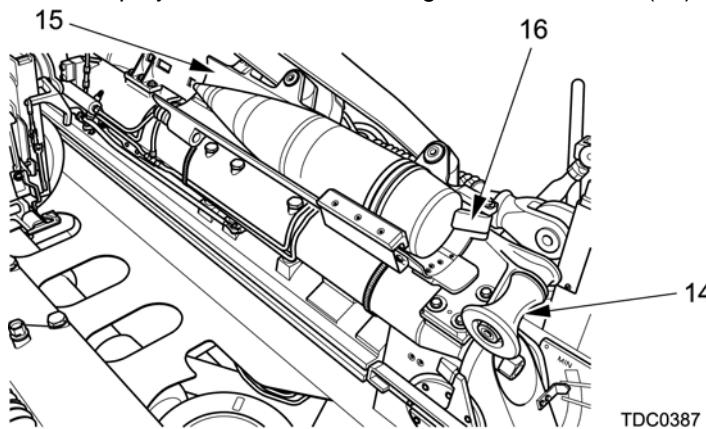
FIRING A PROJECTILE WITH AN OBSTRUCTION IN THE CANNON TUBE CAN CAUSE AN IN-BORE EXPLOSION. THIS COULD RESULT IN DESTRUCTION OF THE HOWITZER AND SEVERE INJURIES OR DEATH TO PERSONNEL.

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

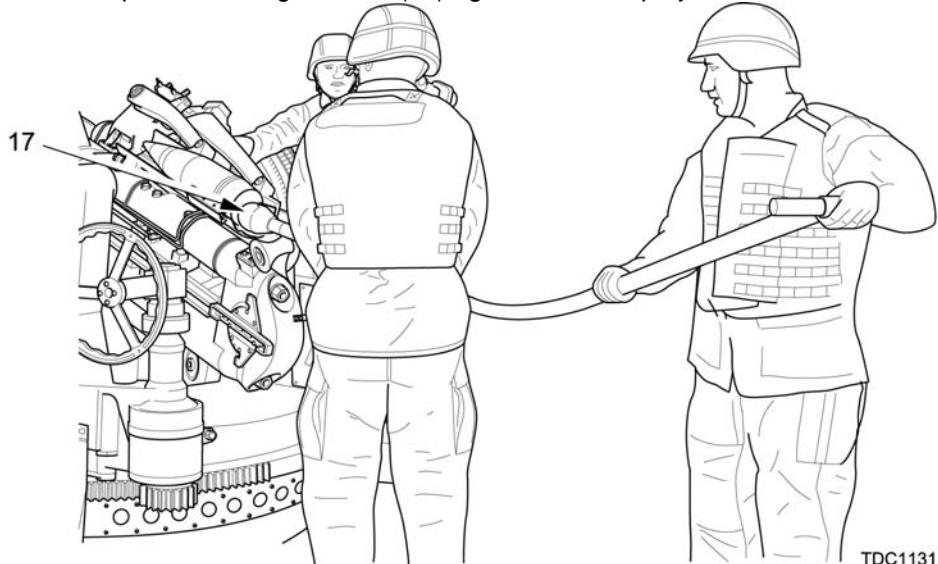
WARNING

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).

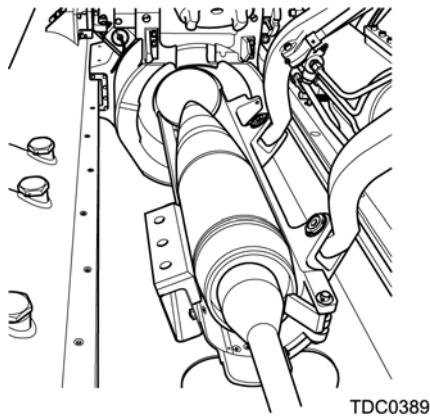


- 12 Cannoneer No. 4 places loading rammer (17) against base of projectile.



2-29 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING INDIRECT FIRE MISSIONS (cont)

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



- 14 Cannoneer No 4 and Driver push projectile past Swiss groove.
15 Upon the command, READY, RAM from Cannoneer No. 4, using loading rammer, the projectile is rammed into place by Cannoneer No. 4 and Driver.
16 Cannoneer No. 4 withdraws loading rammer.

WARNINGS

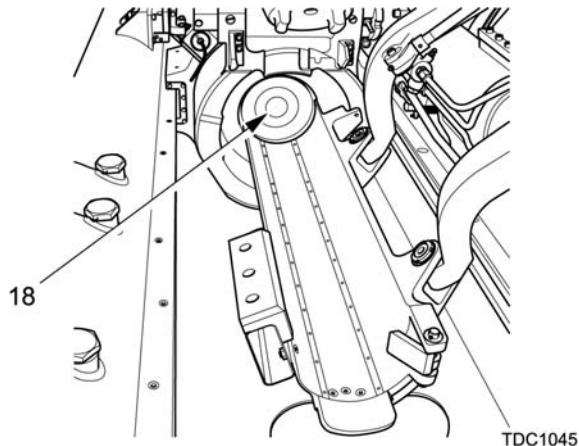
DO NOT LEAVE A PROPELLED CHARGE IN THE CHAMBER LONGER THAN NECESSARY BEFORE FIRING. TEMPERATURE CHANGES AFFECT PERFORMANCE CHARACTERISTICS OF A POWDER CHARGE. THOSE CHANGES OCCUR RAPIDLY IN A HOT CHAMBER.

BE AWARE OF INCREASED HEIGHT FROM THE GROUND WHEN USING LOADING STEP DURING LOADING PROCEDURES. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL.

NOTE

Use loading 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 charge and announces, CHARGE (SUCH AND SUCH) to SC. Cannoneer No. 2 places charge onto loading tray.
18 Cannoneer No. 2 slides charge (18) into 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 groove.



- 19 Cannoneer No. 2 announces, I SEE RED, CLEAR and gives a verbal and visual signal (hands above head) to Cannoneer No. 1.

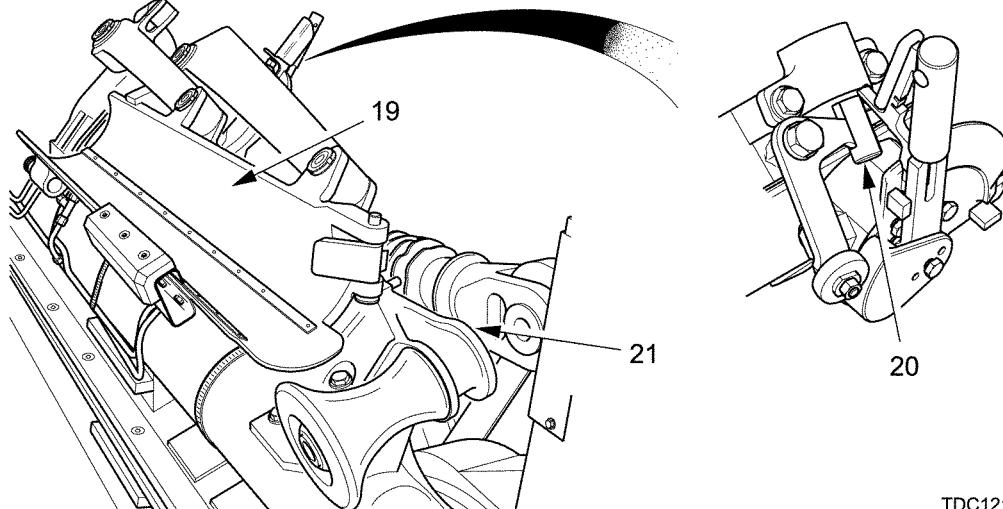
WARNINGS

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 PLUNGER IS 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) is engaged and that there is no gap between the loading tray and tray stop (21).

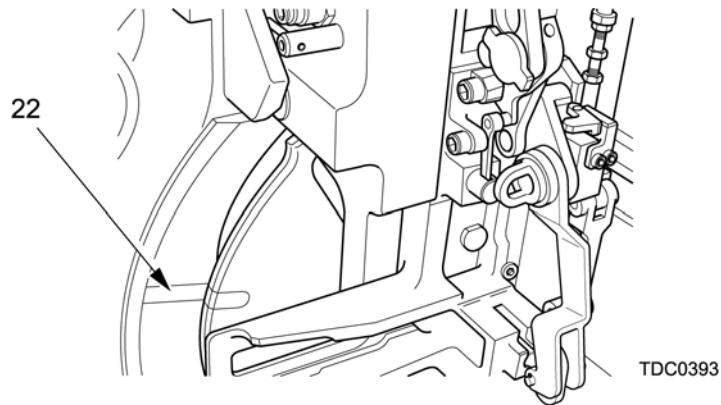


2-29 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING INDIRECT FIRE MISSIONS (cont)

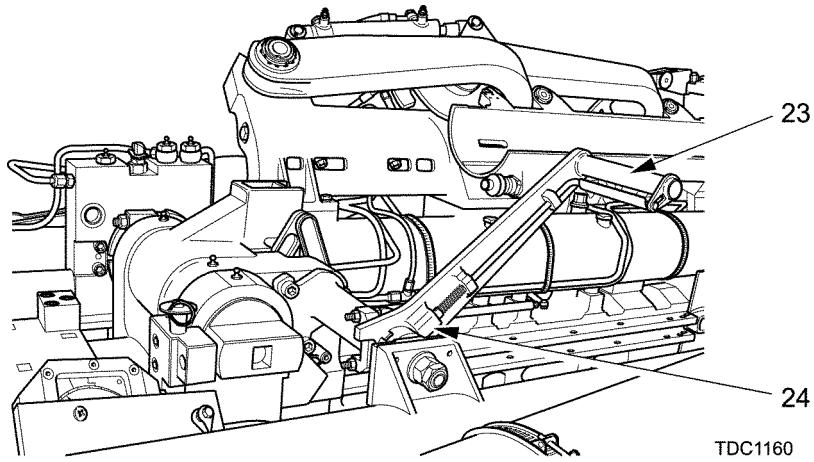
WARNING

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

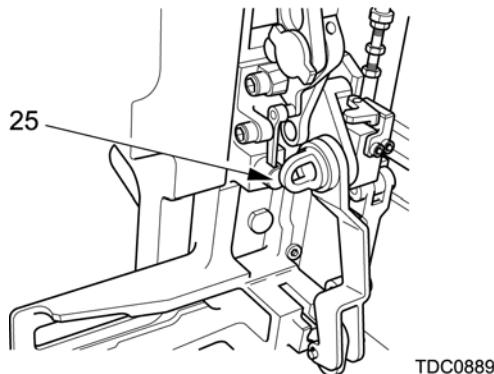
- 21** Cannoneer No. 2 closes breech (Para 2-16), and ensures witness marks (22) are aligned and announces WITNESS MARKS ALIGNED.



- 22** Cannoneer No. 2 loads a primer by moving PFM lever (23) to the PRIMED position; ensuring detent (24) is engaged.



- 23 Cannoneer No. 2 ensures PFM (25) witness marks are aligned, then announces PRIMED.



WARNINGS

STAND CLEAR OF SPADES AND STABILIZERS.

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

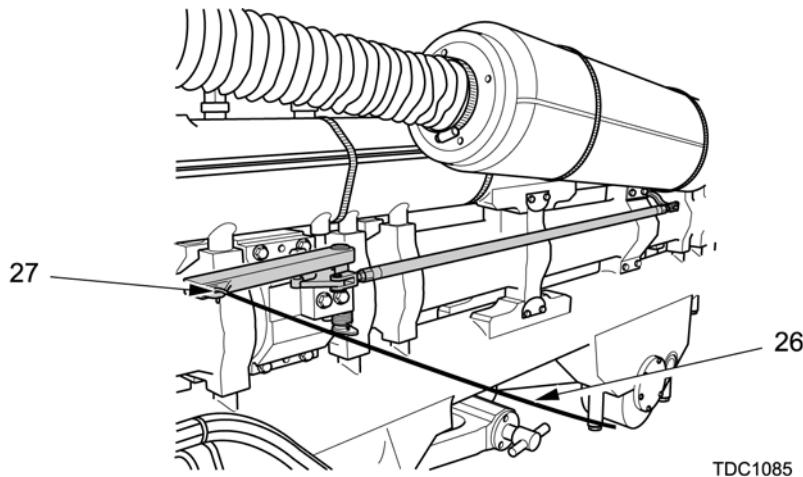
THE LANYARD WILL NOT BE ATTACHED UNTIL THE COMMAND; STAND BY IS ANNOUNCED BY SC.

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

IF OPERATING M777A1 OR M777A2 HOWITZER, ENSURE CLA DOOR IS CLOSED AND SECURE AND PADLOCK IS REMOVED BEFORE FIRING. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

- 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 ensures firing lever has re-cocked, then attaches lanyard (26) by inserting S-hook through hole in firing lever (27).

2-29 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.

M777/M777E1 Operations Point Value Per Round, Weapon Separation Distances, & 140dB Contour Distances for Hearing Protection Requirements

Propelling Charge/Zone Groupings	SANR (Point Value Per Round)** 1000 Points Total Accumulation Allowed	Separation Distance* (meters)	Distance to 140 dB Contour (hearing protection required inside contour) (meters)
M3A1 Zones 3 thru 5 and M4A2 Zones 3 thru 5	500 (2)	40	310
M4A2 Zones 6 and 7	250 (4)	54	420
M119 Series	1000 (1)	64	525
M203 Series	143 (7)	74	660
M231 Zone 1	500 (2)	40	235
M231 Zone 2	1000 (1)	40	235
M232/M232E1 Zone 3	250 (4)	54	465
M232/M232E1 Zone 4	125 (8)	64	509
M232/M232E1 Zone 5	77 (13)	74	611

SANR = allowed number of rounds per day using single hearing protection

* (based on minimum SANR of 2000)

** (based on approved crew positions)

WARNINGS

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

ENSURE TRIDENT BAR IS REMOVED FROM LUNETTE ASSEMBLY BEFORE FIRING THE HOWITZER, FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

CAUTION

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

NOTES

When Assistant Gunner has announced SET, Gunner has announced READY, 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/or linkage, immediately carryout the degraded firing procedure (Para 2-58). If faulty or broken remote firing linkage, notify unit maintenance.

Unnecessary tension on the lanyard will cause the firing lever not to re-cock inadvertently causing a misfire.

2-29 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING INDIRECT FIRE MISSIONS (cont)

WARNING

UPON RECEIPT OF NEW ISSUE, OVERHAULED OR REPAIRED RECOIL OR SCAVENGE SYSTEM FIRST ROUND MUST BE FIRED WITH A 25FT LANYARD.

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

NOTE

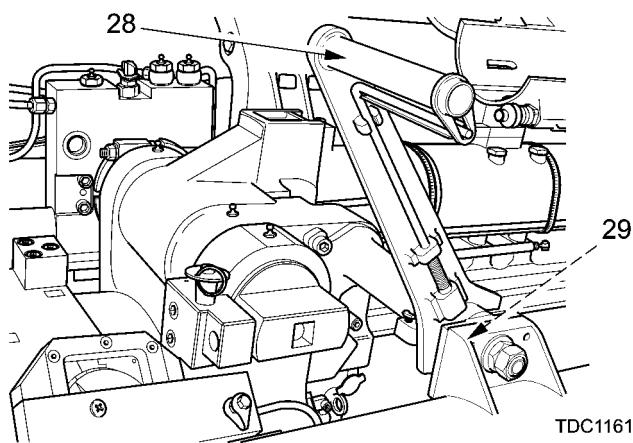
In case of a failure to fire, refer to misfire and checkfiring procedures (Para 2-43 to 2-47). Use the misfire and check firing procedure that corresponds to the cannon tube temperature.

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

NOTE

Primer vent hole will be cleaned and lubricated with CLP (Item 7, appx D) after each fire mission or primer magazine change

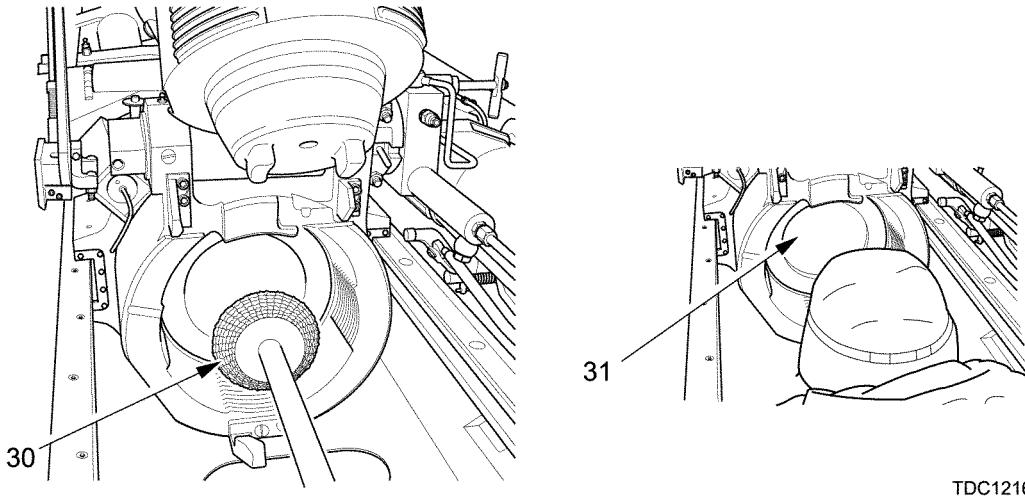
- 28** Cannoneer No. 2 extracts primer by moving PFM lever (28) to the EXTRACT position; ensuring detent (29) is engaged.



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 2-16).
- 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.



TDC1216

- 32 Sequence is repeated until mission is completed.

WARNING

IF OPERATING M777A1 OR M777A2 HOWITZER, ENSURE CLA DOOR IS CLOSED AND SECURE AND PADLOCK IS REMOVED BEFORE FIRING. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

- 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 4513.

2-30 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING DIRECT FIRE MISSIONS

WARNINGS

STAND CLEAR OF SPADES.

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.

IF OPERATING M777A1 OR M777A2 HOWITZER, ENSURE CLA DOOR IS CLOSED AND SECURE AND PADLOCK IS REMOVED BEFORE FIRING. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

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

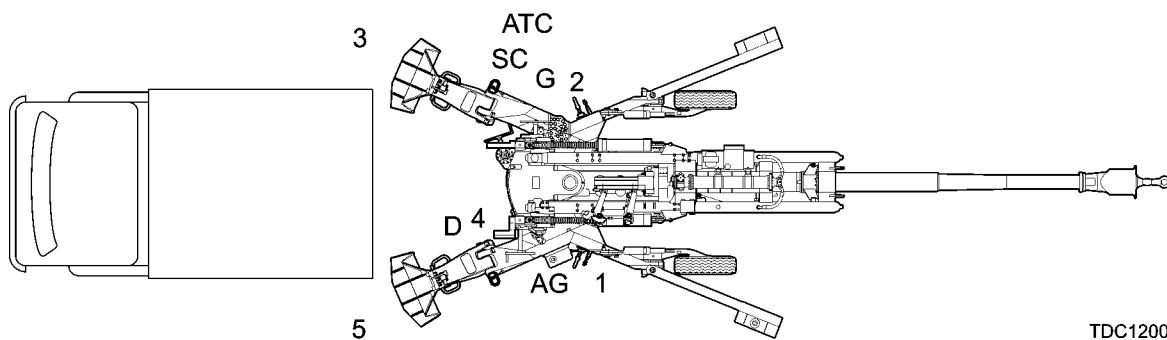
Before firing the howitzer during direct fire missions, ensure that the spades are dug into the ground to a minimum depth of 6 inches (15.24cm).

NOTE

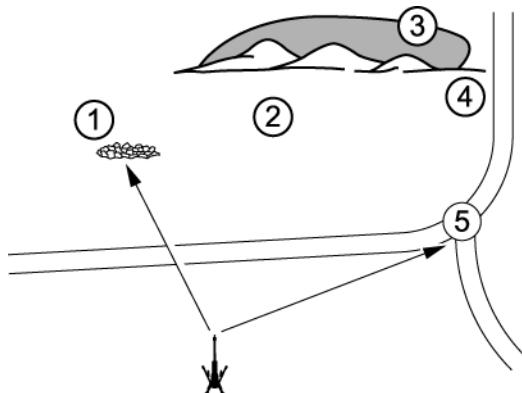
Procedures for firing drills have been standardized under the Department of the Army Standardization Program. The following procedures are for two-persons. For one-person, one-sight operations, the Gunner assumes duties of the Assistant Gunner and performs them on the left side of the howitzer.

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.



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	SWEET 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.

M777 and M777A1 DIRECT FIRE RANGE PLATE					
M107 Projectile					
Charge M4A2 Zone 7		Charge M232 Zone 3		Charge M232A1 Zone 3	
Range (meters)	Elevation (mils)	Range (meters)	Elevation (mils)	Range (meters)	Elevation (mils)
400	6	400	7	400	6
600	9	600	10	600	9
800	13	800	14	800	12
1000	16	1000	17	1000	16
1200	20	1200	21	1200	19
1400	24	1400	25	1400	22
1600	28	1600	29	1600	26

TDC1230

2-30 LAYING FOR DIRECTION AND ELEVATION AND LOADING AND FIRING DURING DIRECT FIRE MISSIONS (cont)

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 kph).....5 mils

6 to 10 mph (9.65 to 16.09 kph).....10 mils

11 to 15 mph (17.69 to 24.13 kph).....15 mils

- 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.



TDC0450

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

NOTE

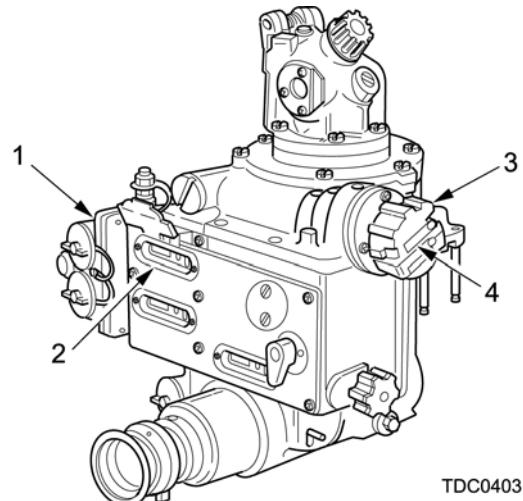
To eliminate backlash when laying for direction and elevation, make sure the last motion of all control and leveling knobs are in a CW direction.

- 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 howitzer. 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.

2-31 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.

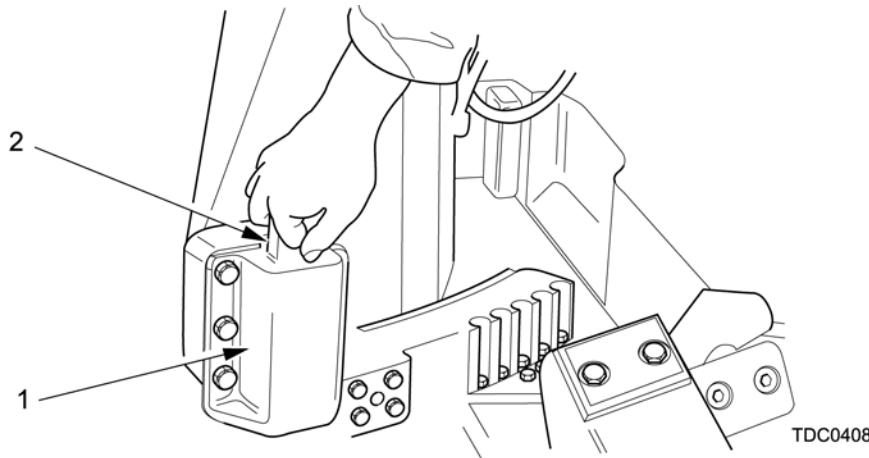
IF OPERATING M777A1 OR M777A2 HOWITZER, ENSURE CLA DOOR IS CLOSED AND SECURE AND PADLOCK IS REMOVED BEFORE MOVING. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

NOTES

Special Instructions AZ may be received either by voice and/or digitally (Optics/DFCS). The following steps 1 thru 18 are applicable for all howitzers.

If shifting aiming points see Para 2-20.

- 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.



NOTE

SC will determine if the prime mover is to be repositioned and/or power [W3] cable is to be disconnected.

- 2 Driver ensures bore is clear of ammunition and announces BORE CLEAR. Gunner announces MUZZLE RIGHT or MUZZLE LEFT as required.

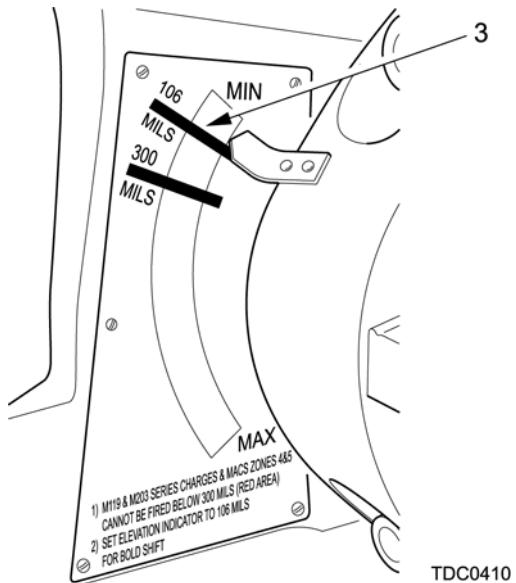
CAUTION

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.

NOTE

If directed by the SC, disconnect power [W3] cable from prime mover.

- 3 Assistant Gunner elevates/depresses cannon tube until charge plate elevation indicator (3) is set at 106-mil line.



- 4 Cannoneer No. 4 inserts FAST bar into lunette assembly and supports cannon tube. ATC records fire mission on DA-2408-4 or NAVMC 4513 form, then moves to muzzle brake and supports cannon tube.

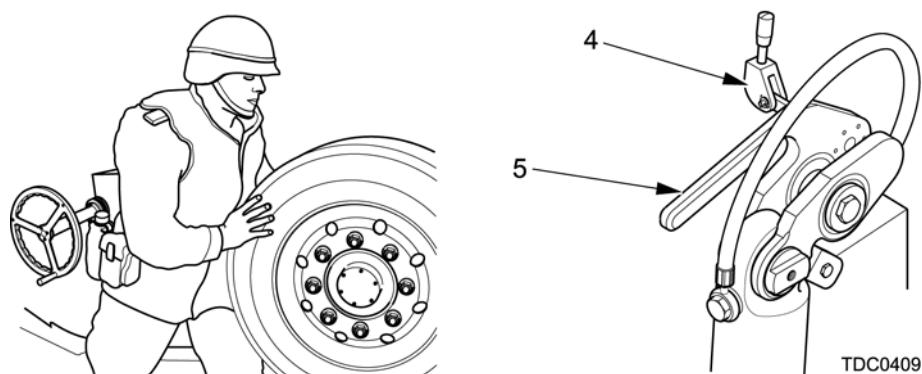
CAUTION

Before operating suspension system ensure wheel locking levers and wheel locking plungers are engaged. Failure to do so will damage lock stops.

NOTE

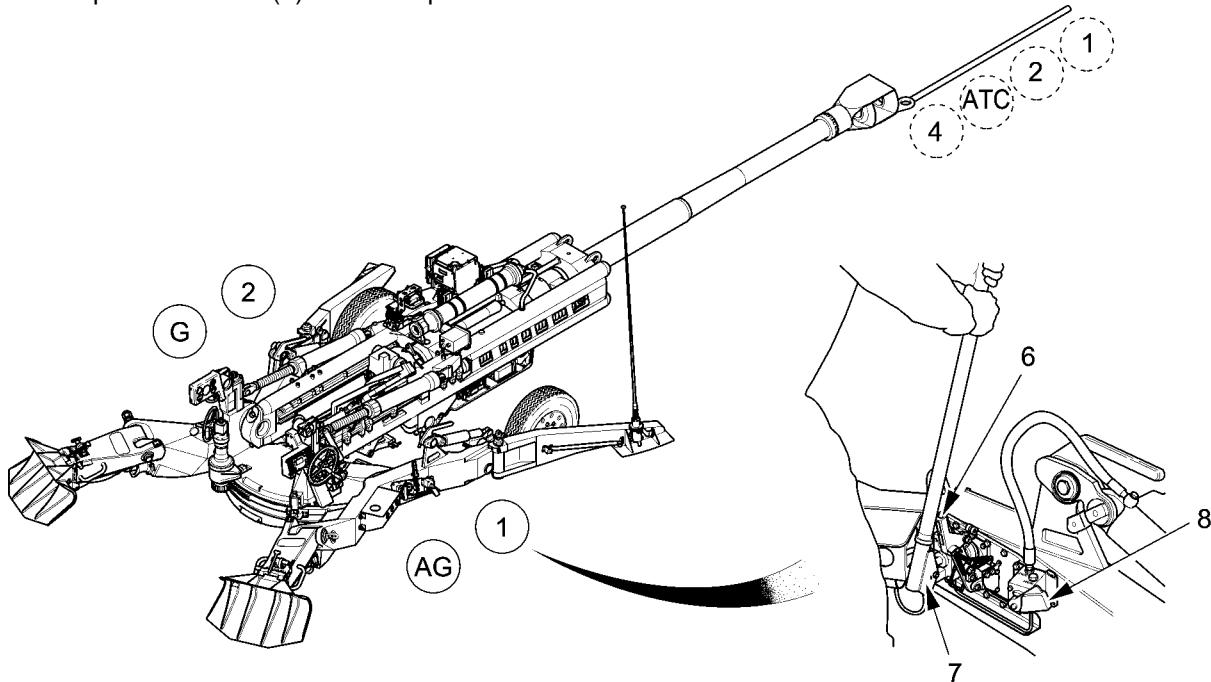
Step 5 only applies when local SOP's decide wheel assemblies have been raised during fire missions/deployment operations.

- 5 Cannoneers Nos. 1 and 2 deploy wheel arm assemblies, by rotating wheel locking plunger (4) up and push wheels forward. Push down on wheel locking levers (5) and ensure plungers are engaged.



2-31 TRAVERSING BEYOND CARRIAGE TRAVERSE LIMITS (SPEED SHIFT) (cont)

- 6 Cannoneers Nos. 1 and 2 engage handbrakes (6) insert pump handles into adaptors (7) and set suspension levers (8) to RAISE position.

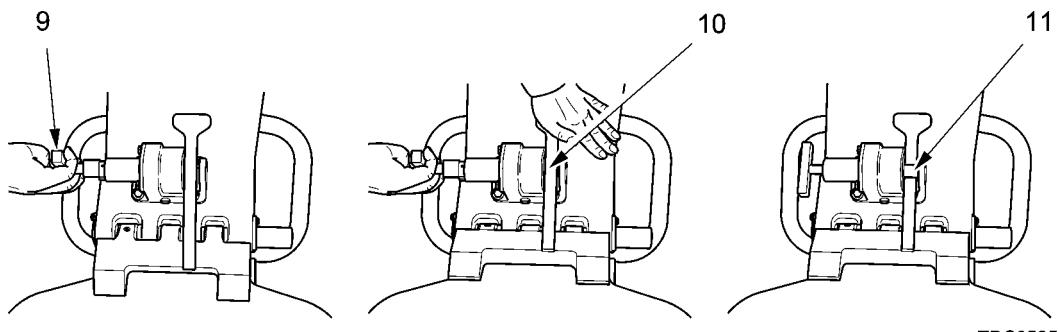


TDC1201

NOTE

If required remove soil from spade locking levers.

- 7 Cannoneers Nos. 3 and 5 unlatch spades by pulling spade locking plunger (9) out and push spade locking lever (10) down, allow plunger (11) to return over lever. Ensure plunger is engaged.



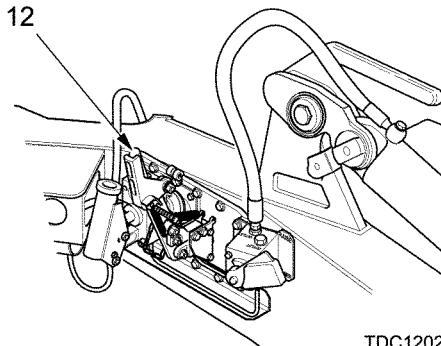
TDC0525

CAUTION

Howitzer body, spades and stabilizers must be clear of the ground before shifting howitzer.

- 8 Cannoneers Nos. 1 and 2 raise howitzer, by pumping handles until SC commands STOP.

- 9 Cannoneer No. 1 releases handbrake (12). Cannoneers Nos. 1 and 2 move to muzzle brake and support cannon tube.

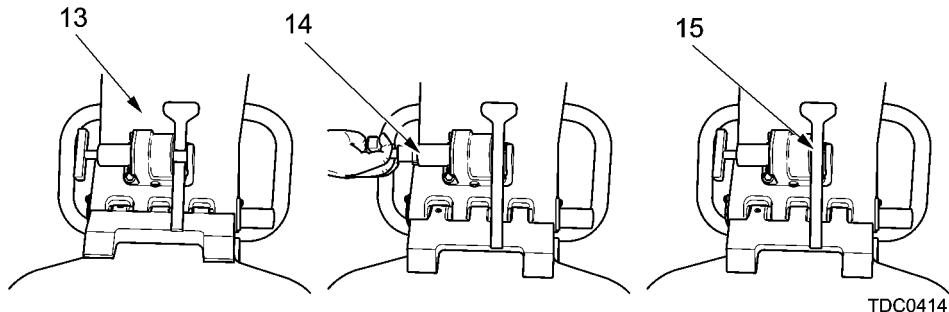


TDC1202

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.

- 10 Cannoneers Nos. 3 and 5 relatch spades (13), by pulling spade locking plunger (14) out and turn 90° CCW. Ensure spade locking lever (15) is engaged.



TDC0414

WARNING

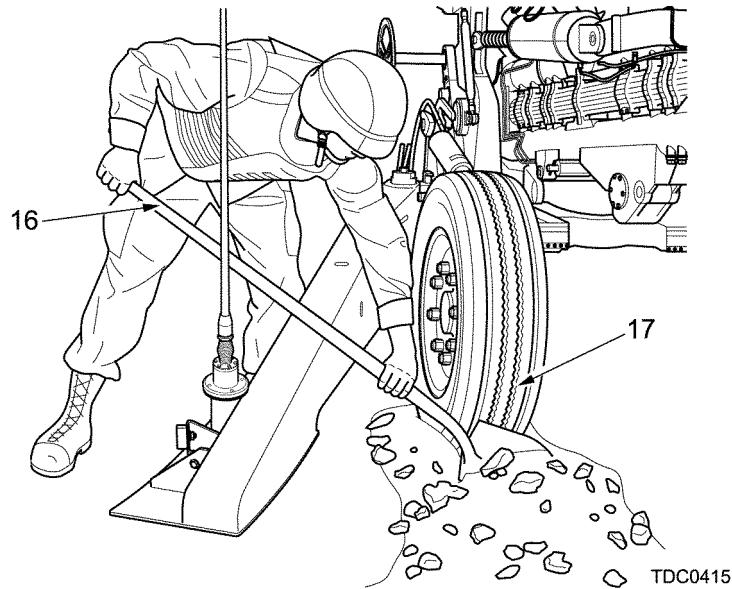
WHEN CLEARING A PATH FOR THE ROLLING WHEEL, PERSONNEL MUST NOT STAND BETWEEN THE CRADLE ASSEMBLY AND STABILIZER ARM. A TRIP HAZARD CAN OCCUR, CAUSING SEVERE CRUSHING INJURIES TO PERSONNEL.

NOTE

Certain terrain conditions may be necessary to clear a path in front of or behind the rolling wheel.

2-31 TRAVERSING BEYOND CARRIAGE TRAVERSE LIMITS (SPEED SHIFT) (cont)

- 11 If SC commands CLEAR ROLLING WHEEL, Cannoneer No. 5 takes shovel (16) and clears a path in front of or behind the rolling wheel (17).



- 12 Assistant Gunner, Cannoneers Nos. 3 and 5 move SL-3/BII gear.
- 13 Gunner commands SHIFT, ATC and Cannoneers Nos. 1, 2 and 4 move muzzle in direction indicated by Gunner. When Pantel vertical hairline is aligned or close to aiming point, or when CSD screen displays matching CMD and ACTL figures, Gunner commands STOP.
- 14 Assistant Gunner moves to and applies handbrake. Commands HANDBRAKE LOCKED.
- 15 Cannoneers No. 1 and 2 move to suspension lever, once handbrake is applied.

WARNINGS

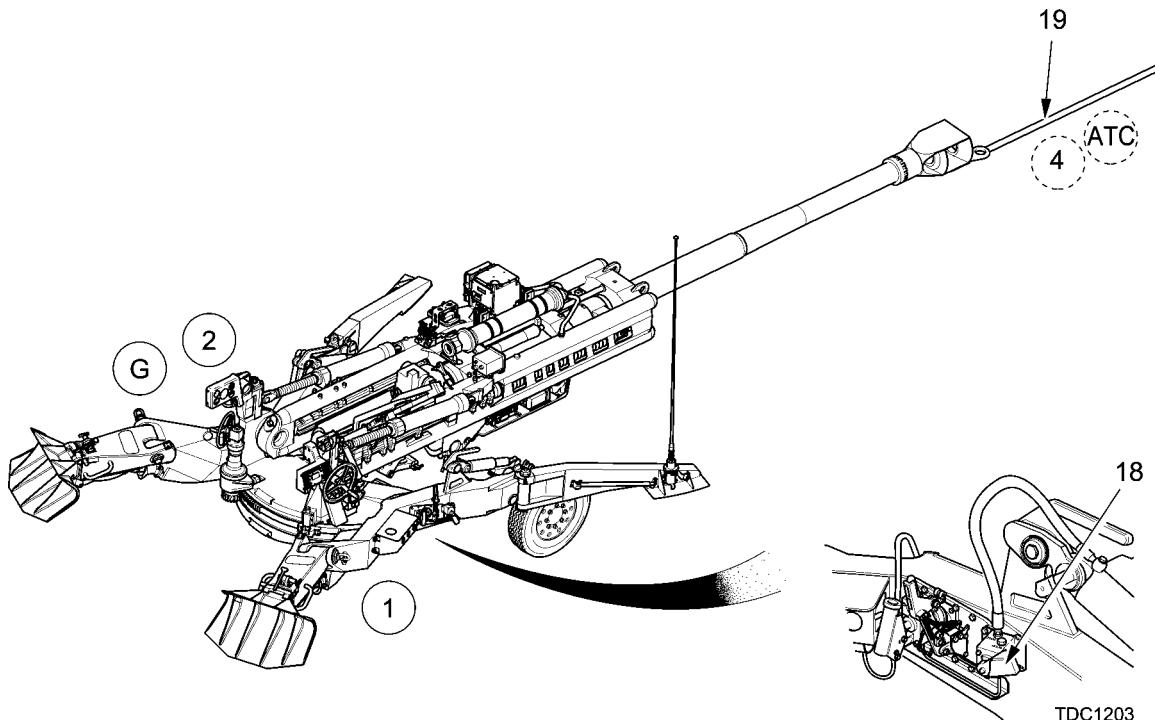
BEFORE OPERATING SUSPENSION LEVERS, ENSURE THAT ALL PERSONNEL ARE STANDING CLEAR OF HOWITZER.

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

NOTE

When operating in arctic, and/or hard ground conditions (Para 2-34) (e.g., rock, motor pool, etc), the SC may order trail arms to remain in the stowed position.

- 16 Gunner commands READY DROP, Cannoneers Nos. 1 and 2 lower howitzer by moving suspension levers (18) to the LOWER position. ATC and Cannoneer No. 4 raise FAST bar (19).



- 17 Cannoneer No. 4 removes FAST bar from the muzzle brake.

- 18 All emplace howitzer (Para 2-15).

2-32 PREPARATION OF HOWITZER FOR TOWING

WARNINGS

HANDBRAKES ARE TO REMAIN APPLIED IF HOWITZER IS ON ANY DEGREE OF INCLINE AND ARE NOT TO BE RELEASED UNTIL 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 [W16] CABLE. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

IF OPERATING M777A1 OR M777A2 HOWITZER, ENSURE CLA DOOR IS CLOSED AND SECURE AND PADLOCK IS REMOVED BEFORE TOWING. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

2-32 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 wheel lugnuts are present and tight. Check hubs and brakes for overheating by sight and smell. If hubs and brakes are too hot, allow to cool before continuing.

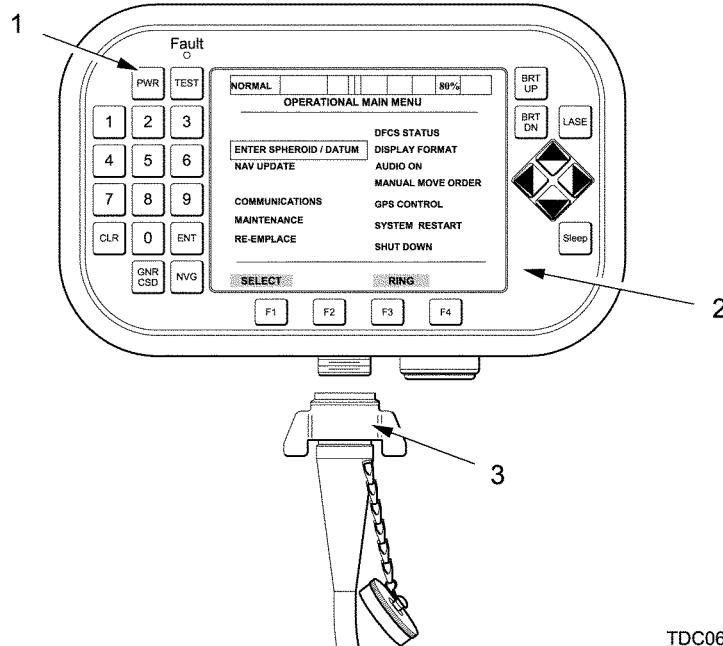
Before disconnecting data [W16] cable from CSD, ensure PWR key has been depressed and CSD is switched off. Failure to do so could result in loss of screen information.

NOTES

Data [W16] cable MUST be fully disconnected from the CSD. The CSD CANNOT be re-powered by depressing '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.

If displacing M777A1 or M777A2 howitzer carryout step 1, steps 2 thru 9 are applicable to all howitzers.

- 1 SC commands MARCH ORDER, presses PWR key (1) on CSD (2) for 3 seconds and release (CSD should power off, if not, repeat), disconnect data [W16] cable (3) from CSD. Driver disconnects power [W3] cable from prime mover.



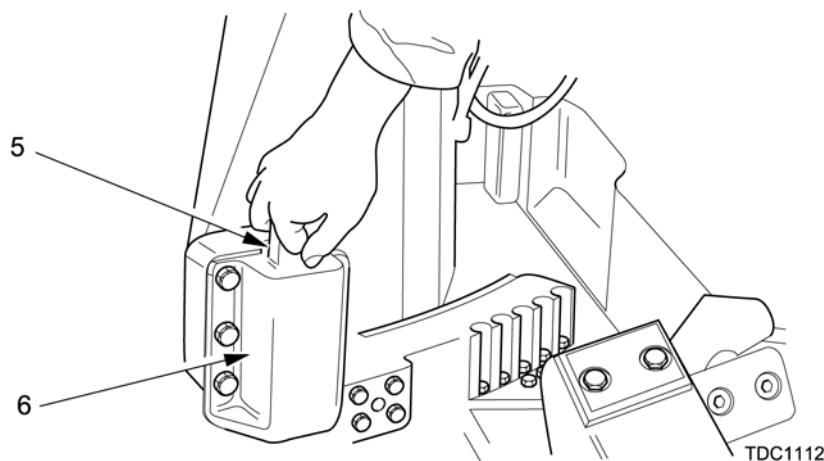
TDC0642

- 2 Driver ensures bore is clear of ammunition and announces BORE CLEAR.

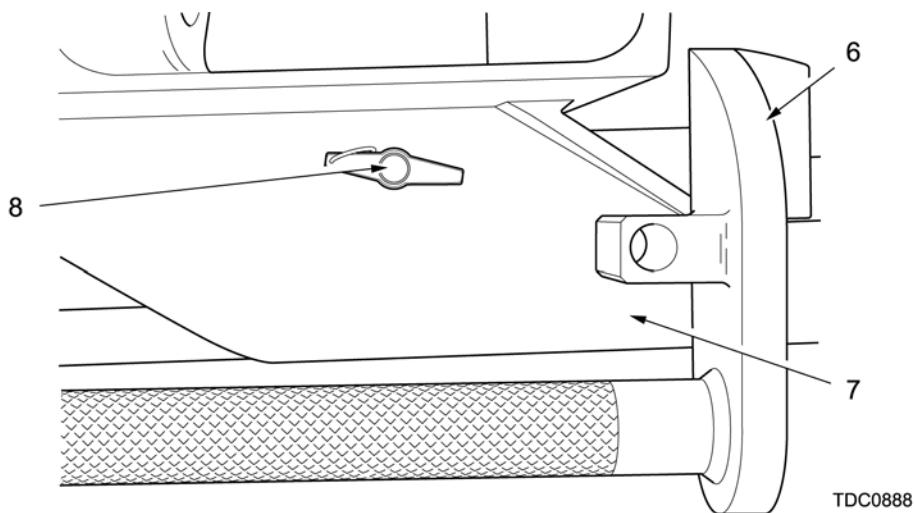
WARNING

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 prime mover.
- 5 Gunner traverses cannon tube to center of traverse and Assistant Gunner engages traverse lock (4), ensure plunger (5) is engaged.



- 6 Cannoneer No. 3 inserts trident bar (6) into lunette assembly (7), ensure quick release pin (8) is engaged.



CAUTION

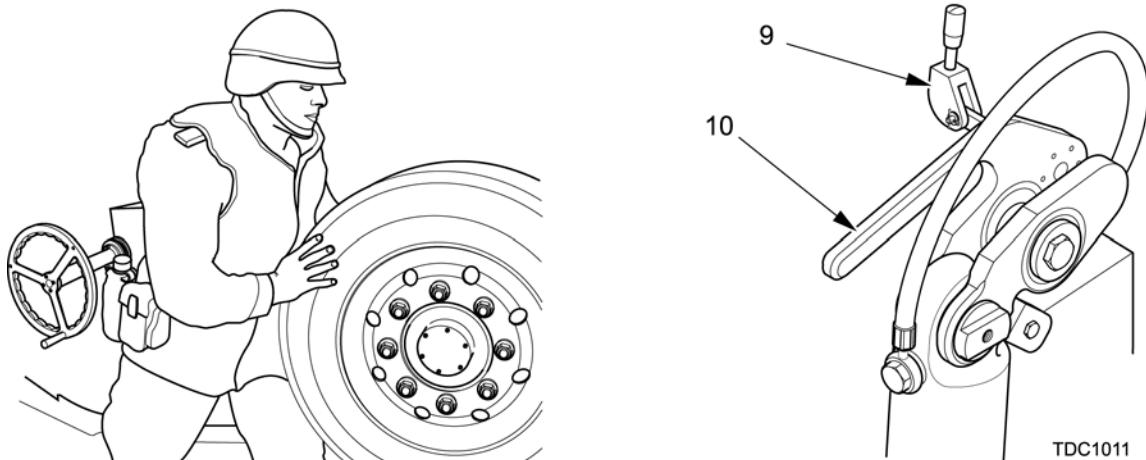
Before operating suspension system, ensure wheel locking lever and wheel locking plungers are engaged. Failure to do so will damage the lock stops.

2-32 PREPARATION OF HOWITZER FOR TOWING (cont)

NOTE

Step 7 only applies when local SOP's decide wheel assemblies have been raised during fire missions/deployment operations.

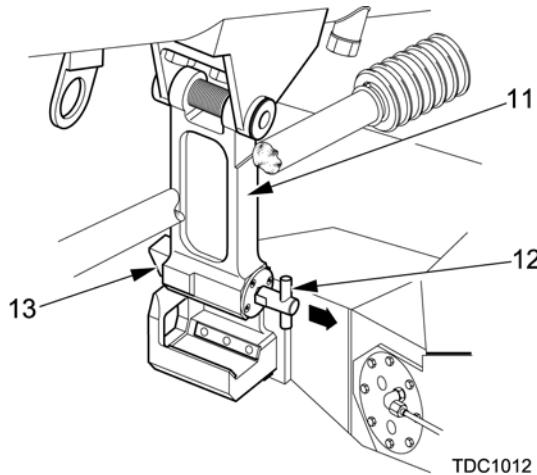
- 7 Cannoneers Nos. 1 and 2 deploy wheel arm assemblies, by rotating wheel locking plunger (10) down and push wheels forward. Push down on wheel locking levers (9) and ensure plungers are engaged.



CAUTION

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

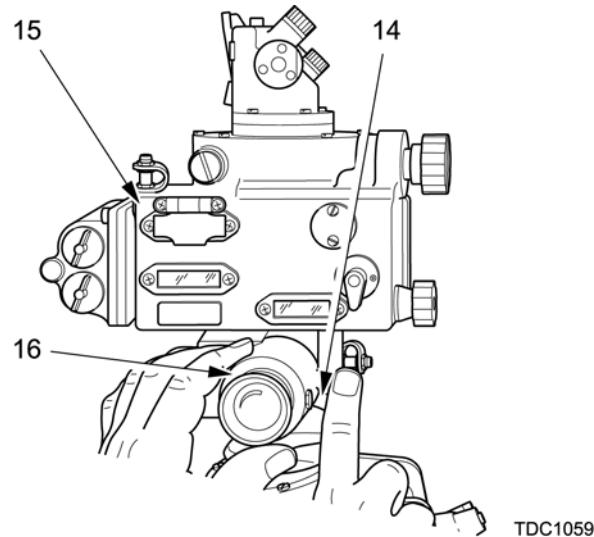
- 8 Cannoneers Nos. 1 and 2 engage travel locks (11) by pulling out tee-handle (12), and allowing link (13) to drop.
- 9 Assistant Gunner depresses cannon tube and engages travel locks (11).



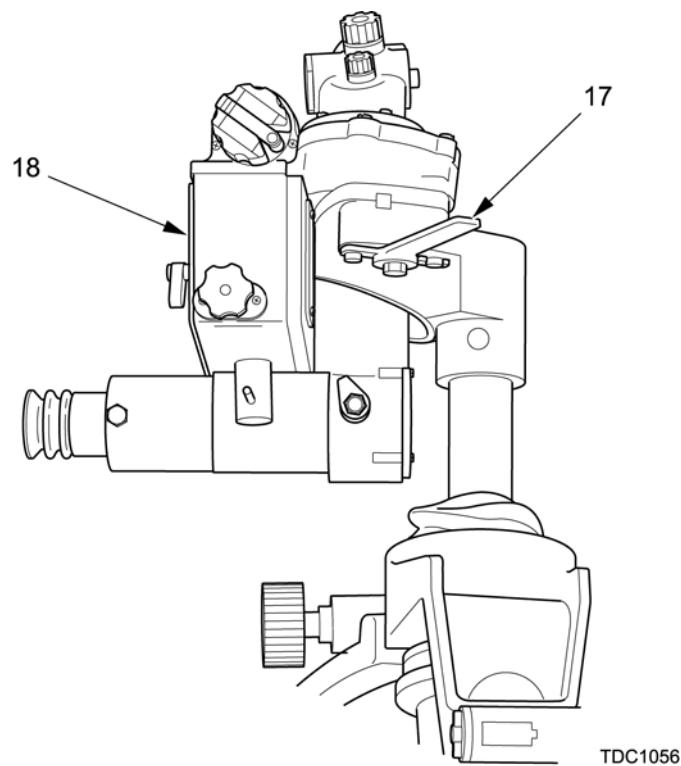
NOTE

If preparing an M777 howitzer for towing carryout steps 10 thru 16. Steps 17 thru 22 are applicable to all howitzers.

- 10 Gunner releases locking pin (14) on Pantel (15) and moves elbow (16) with eyepiece to the stowed position, approximately 90° to the Pantel.

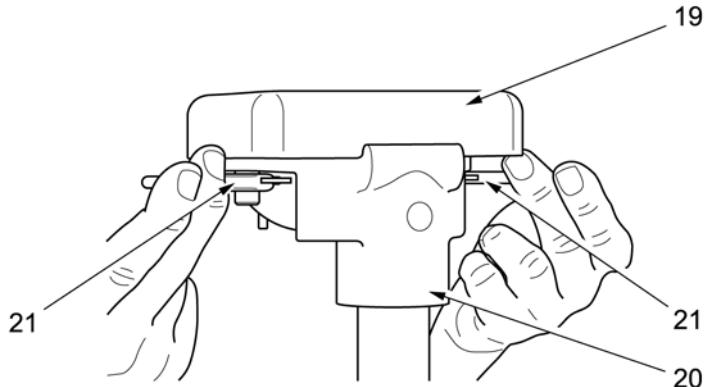


- 11 Gunner unlocks two latches (17), removes Pantel (18), and secures in the sight box.



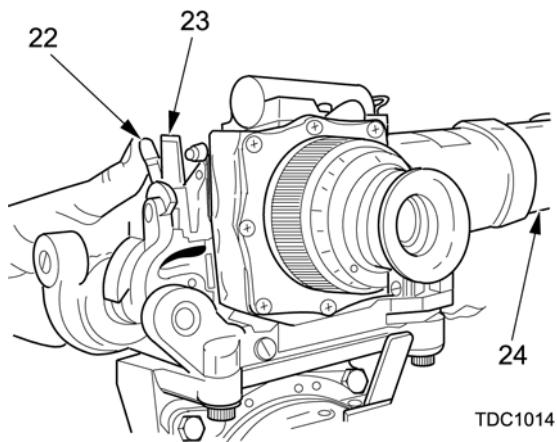
2-32 PREPARATION OF HOWITZER FOR TOWING (cont)

- 12** Gunner places protective cover (19) on M171A1 telescope and quadrant mount (20) and locks two latches (21), rotate protective covers on the cross level vial, and elevation level vial to the closed position.



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- 13** Gunner places cover over M171A1 telescope and quadrant mount and secures with drawstring provided.
- 14** Assistant Gunner rotates lock-release lever (22) CCW and pulls locking latch (23) down, removes M138A1 elbow telescope (24), replaces protective cover assembly, and gives M138A1 elbow telescope to Gunner, who secures in the sight box.



TDC1014

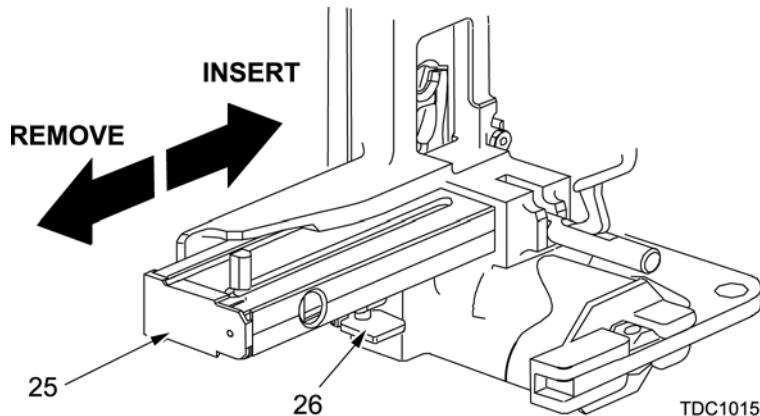
- 15** Gunner ensures all OFC equipment is properly placed within the sight box and is securely latched.

- 16 Assistant Gunner rotates 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 AND CLEARING PROCEDURES ON PRIMER FEED MECHANISM.

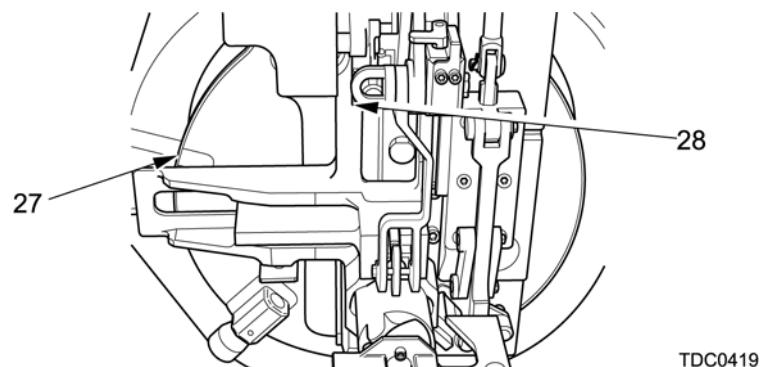
- 17 Cannoneer No. 2 removes magazine assembly (25), by pressing release lever (26) and slide magazine out of tray. Ensure primer vent hole is clear.



WARNING

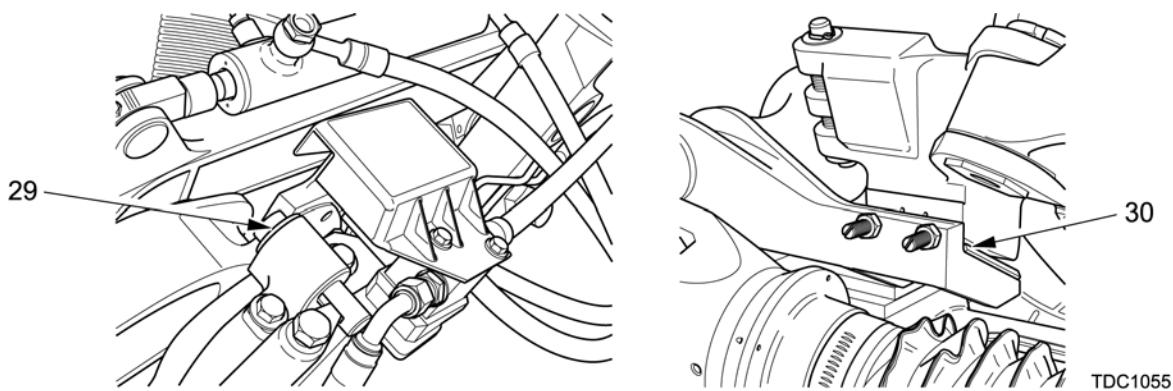
ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.

- 18 Cannoneer No. 2 closes breechblock assembly (Para 2-16), ensures breechblock (27) and PFM (28) witness marks are aligned, and installs PFM cover.



2-32 PREPARATION OF HOWITZER FOR TOWING (cont)

- 19** Cannoneer No. 1 ensures loading tray mechanical interlock plunger (29) is engaged and there is no gap between the loading tray and tray stop (30).



NOTE

If required remove soil from spade locking latches.

- 20** ATC and Cannoneer No. 5 unlatch spades.
- 21** Cannoneer No. 4 places taillight cable onto rear of cradle and passes cable to Cannoneer No. 1.
- 22** Cannoneer No. 1 places taillight cable to side of howitzer, Cannoneer No. 4, wraps cable around cannon tube and places cable connector on top of muzzle brake.

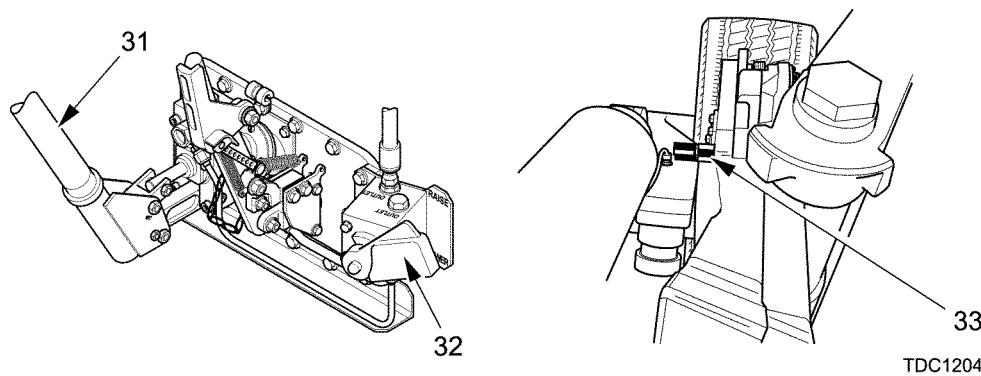
WARNING

DUE TO HOWITZERS CENTER OF GRAVITY, ENSURE PERSONNEL ARE SUPPORTING TRIDENT BAR BEFORE RAISING HOWITZER. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

NOTE

If preparing an M777A1 or M777A2 howitzer for towing carryout step 23. Steps 24 thru 39 are applicable to all howitzers.

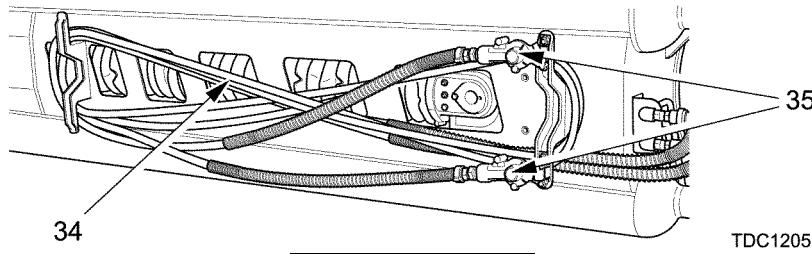
- 23** Gunner and Assistant Gunner install GND/AGD covers, move to muzzle brake and support cannon tube.
- 24** Cannoneers Nos. 1 and 2 insert pump handles into adaptors (31) set suspension levers (32) to RAISE position, engage handbrakes, raise howitzer, by pumping handles until ride height indicator (33) is level.



NOTE

If brake system on howitzer is serviceable, airlines may not be attached during **TACTICAL** and/or **FIELD** environments or as directed by **UNIT SOP**.

- 25** Cannoneer No. 4 removes airlines (34) from cradle bracket (35) and wraps airlines around cannon tube and places airlines on top of muzzle brake.



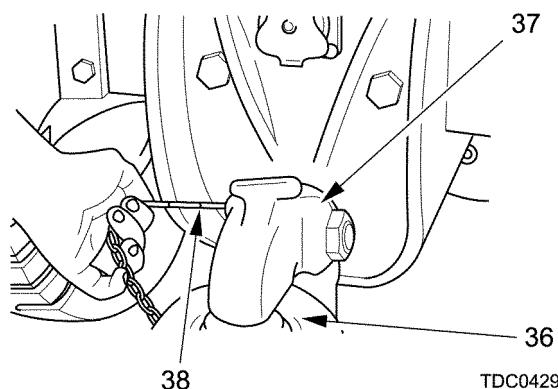
WARNING

WHEN HANDBRAKE IS RELEASED HOWITZER MAY MOVE DUE TO TERRAIN.

NOTE

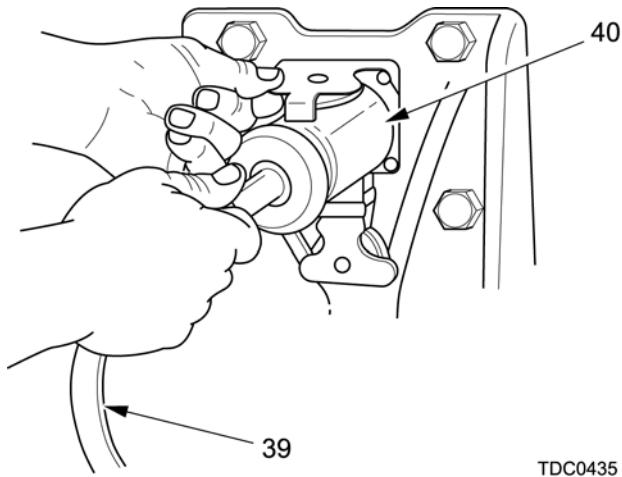
Cannoneer No 1, handbrake may be released to assist in lifting lunette assembly onto prime mover pintle

- 26** Cannoneer No. 3 directs Driver to back prime mover to howitzer.
- 27** Gunner installs muzzle plug into front of the muzzle brake.
- 28** Gunner and Assistant Gunner lift lunette assembly (36) onto prime mover pintle (37), Gunner latches pintle and secures with cotter pin (38).



2-32 PREPARATION OF HOWITZER FOR TOWING (cont)

- 29 Gunner connects taillight cable (39) to prime mover socket (40).



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CAUTION

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

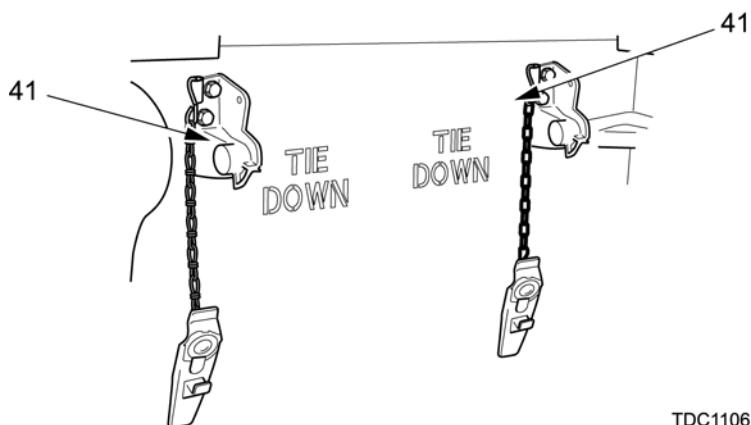
Prime mover vehicles MTVR and FMTV M939 series have opposite coupling connections.

- MTVR – service connection (left side), emergency connection (right side).
- FMTV – M939 series service connection (right side), emergency connection (left side).

NOTE

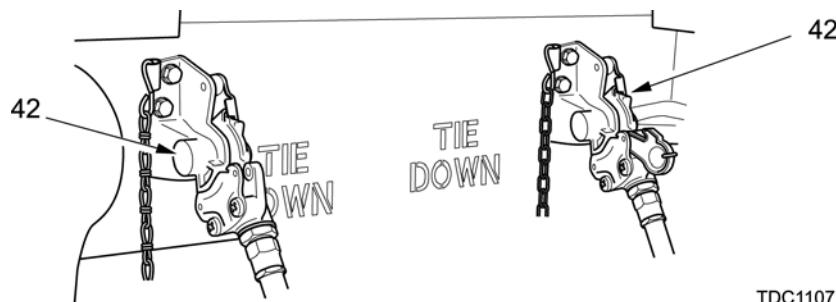
Airline couplings should be color-coded the same as the prime mover.

- 30 Gunner and Assistant Gunner disconnect emergency and service dummy couplings (41) from prime mover.



TDC1106

- 31 Gunner and Assistant Gunner connect emergency and service airlines (42) to the prime mover, then mounts prime mover.



TDC1107

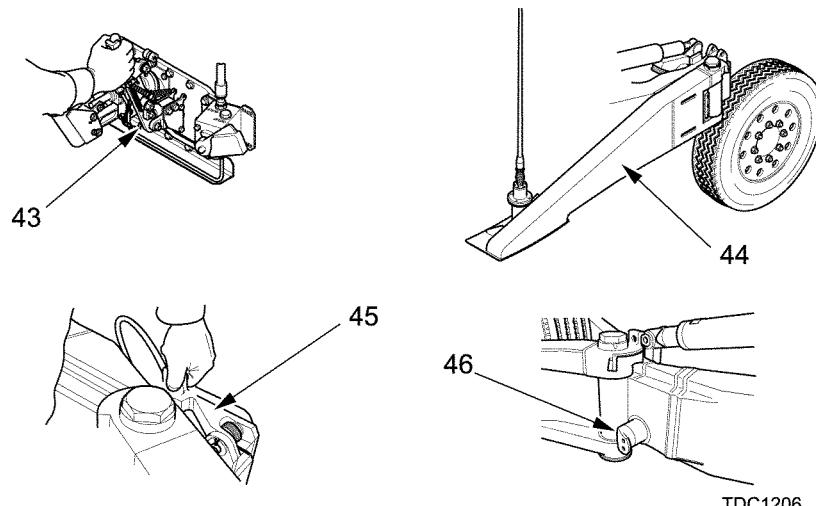
- 32 Driver turns on air supply.

WARNINGS

WHEN STOWING STABILIZERS INTO TRAVEL POSITION, ALL PERSONNEL MUST STAY CLEAR OF HOWITZER.

ENSURE STABILIZER SPRING CLIP IS ATTACHED AND INSTALLED CORRECTLY UNDER THE PIN. FAILURE TO DO SO MAY ALLOW STABILIZER TO SWING OUT DURING TRAVELING, CAUSING INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

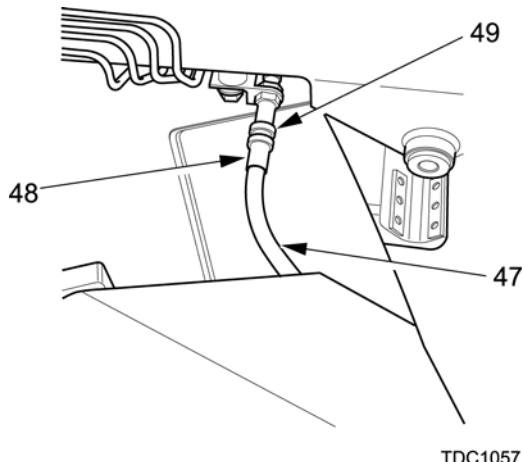
- 33 Cannoneers Nos. 1 and 2 release handbrakes (43).
- 34 Cannoneers Nos. 1 and 2 (if necessary) adjust ride height indicator, remove handles and stow.
- 35 Cannoneers Nos. 1 and 2 stow stabilizers (44), ensure locking latch (45) is engaged and suspension bump stops (46) are fully extended.



TDC1206

2-32 PREPARATION OF HOWITZER FOR TOWING (cont)

- 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.

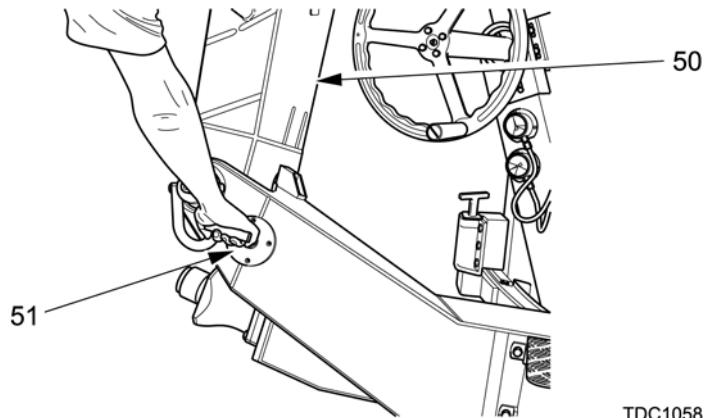
- 37 ATC and Cannoneer No. 5 relatch spades.

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.

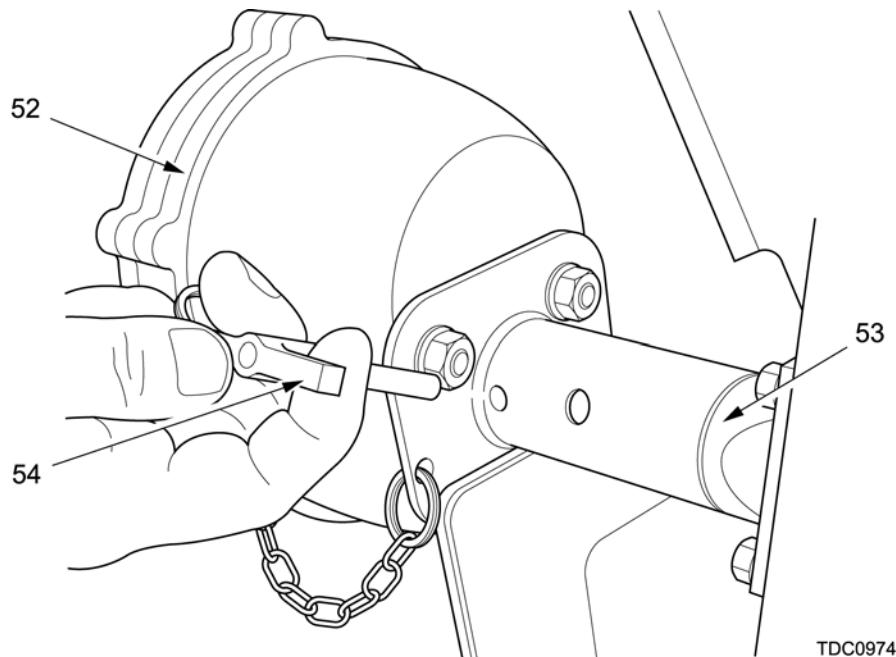
- 38 ATC and Cannoneer No. 5 stow trail arms (50), by pulling locking plunger (51) out, raise trail arm and push locking plunger in. Ensure locking plunger is engaged.



NOTE

Ensure taillight bracket with connector is installed on right trail arm.

- 39 ATC and Cannoneer No. 5 install taillights (52) onto trail arms, by pushing taillight onto bracket (53), insert quick release pin (54). Ensure pin is engaged.

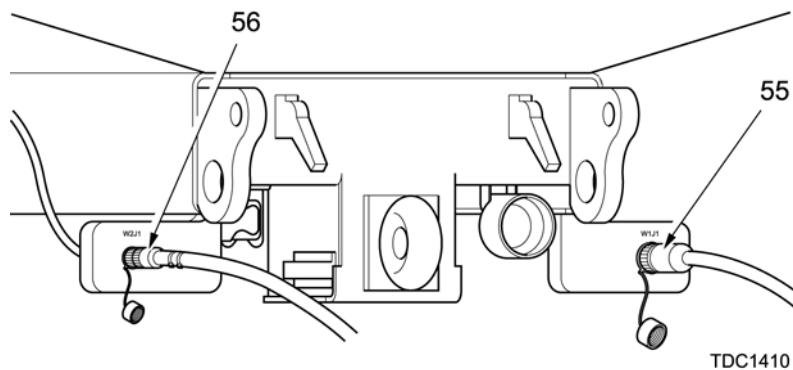


NOTES

If SOC is 50% or more and/or directed by UNIT SOP, **DO NOT** connect power [W3] cable to prime mover during short **TACTICAL** and/or **FIELD** maneuvers.

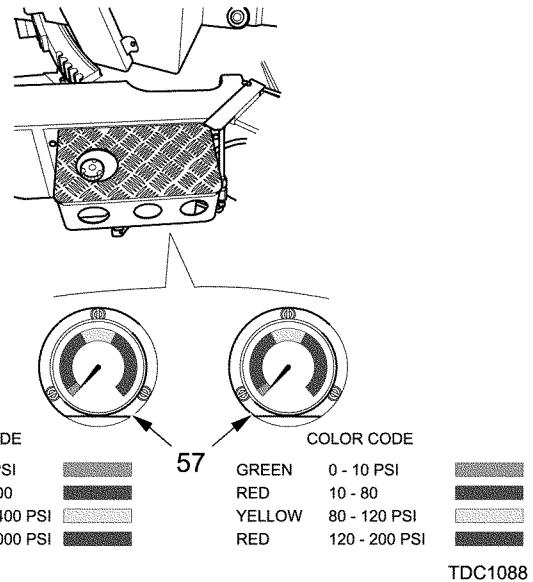
If preparing an M777A1 or M777A2 howitzer for towing carryout step 40. Steps 41 thru 45 are applicable to all howitzers.

- 40 Cannoneers Nos. 1 and 2 connect power [W3] (55) and CSD [W16] (56) cables to prime mover sockets. Cannoneers Nos. 1 and 2 mount prime mover.



2-32 PREPARATION OF HOWITZER FOR TOWING (cont)

- 41 ATC and Cannoneer No.5 recover and stow M1A2 collimator and remainder of SL-3/BII gear onto prime mover, then mount prime mover.
- 42 Cannoneers Nos. 3 and 4 recover aiming posts and stow onto prime mover, then mount prime mover.
- 43 Driver applies brake on prime mover; SC checks air/oil intensifier gauges (57) and ensures gauges read in the yellow sector.
- 44 Driver releases brake on prime mover, SC checks air/oil intensifier gauges (57) and ensures gauges read in the green sector.



- 45 Driver applies brake on prime mover; SC checks brake taillights, then mounts prime mover.

NOTE

If preparing M777A1 or M777A2 howitzer for towing carryout step 46.

- 46 SC installs CSD into prime mover mount, connects CSD [W2] cable to CSD connector.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

Paragraph		Page
2-33	General.....	2-193
2-34	Extreme Cold Weather Conditions.....	2-193
2-35	Extreme Hot Weather Conditions.....	2-194
2-36	Operation in Hot, Damp and Salty Atmosphere	2-195
2-37	Unusual Terrain Conditions.....	2-196
2-38	Fording Operations.....	2-196
2-39	DFCS Battery Operations.....	2-198
2-40	Shipboard, Landing Craft Air Cushions (LCAC), Landing Craft Utility (LCU), and Airborne (Ship to Shore) Operations	2-200

2-33 GENERAL

This section contains special instructions for operating and servicing the howitzer 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.

2-34 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.

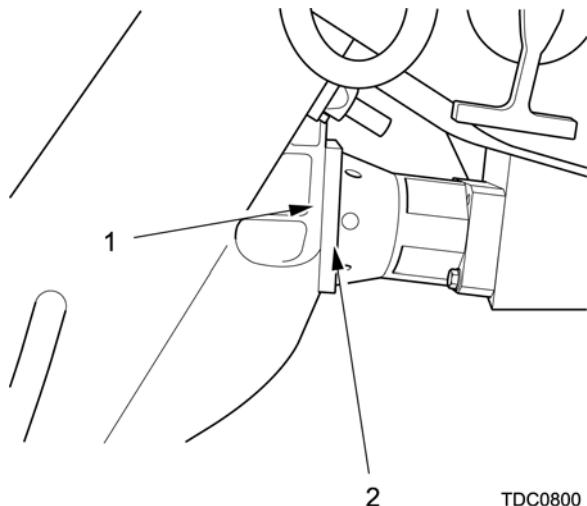
CAUTION

It is important that 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 spade damper (1) and trail arm striker plate (2) have achieved full contact.



TDC0800

2-34 EXTREME COLD WEATHER CONDITIONS (cont)

- d. **Tires.** Tires should be inflated to their respective pressure (Para 1-15).
- e. **OFC Equipment.**
 - (1) When not in use, keep OFC 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 30, appx D) and dry lens paper (item 27, 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.
- f. **DFCS Equipment.**
 - (1) When not in use, keep DFCS equipment covered using covers provided.
 - (2) Do not let snow or ice accumulate on DFCS equipment.
 - (3) Use only clean wiping rags (item 30, appx D) when cleaning DFCS components. Use camel hair lens brush or clean cheesecloth (item 12, appx D) for cleaning CSD, GND and AGD display screens.
 - (4) Key pads on the CSD, GND and AGD may operate or function sluggishly. The operator should not use excessive force.
 - (5) Do not expose CSD, GND and AGD to sudden changes in temperature by moving them from very cold to warm or warm to cold areas. Display screens may fracture.

2-35 EXTREME HOT WEATHER CONDITIONS

a. General problems.

(1) In hot climates, the film of oil necessary for operation and preservation will quickly dissipate. 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 corrosion. 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 PREMATURE MALFUNCTIONS.

(2) Whenever practicable, store white phosphorous-loaded smoke projectiles at temperatures below the melting point (+111.4°F (+44.11°C)) 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 1-15).

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 (Para 2-4 a.) to develop equal handwheel loads while elevating and depressing. If equilibrators cannot be manually adjusted properly, notify unit maintenance.

2-36 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 howitzer 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 howitzer 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 a 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 30, appx D). Do not rub deposits.

2-37 UNUSUAL TERRAIN CONDITIONS

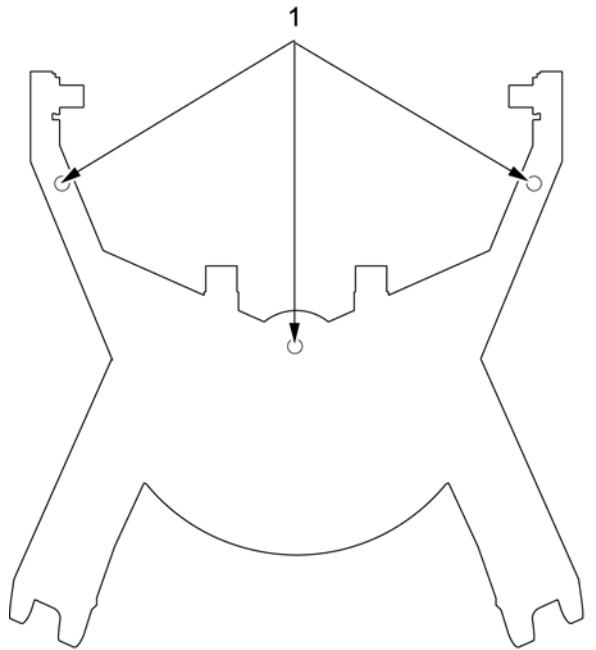
a. **Soft or Rough Terrain.** When traveling on soft or rough terrain, such as mud, sand, or snow, use care when backing howitzer when attached to prime mover.

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.

2-38 FORDING OPERATIONS

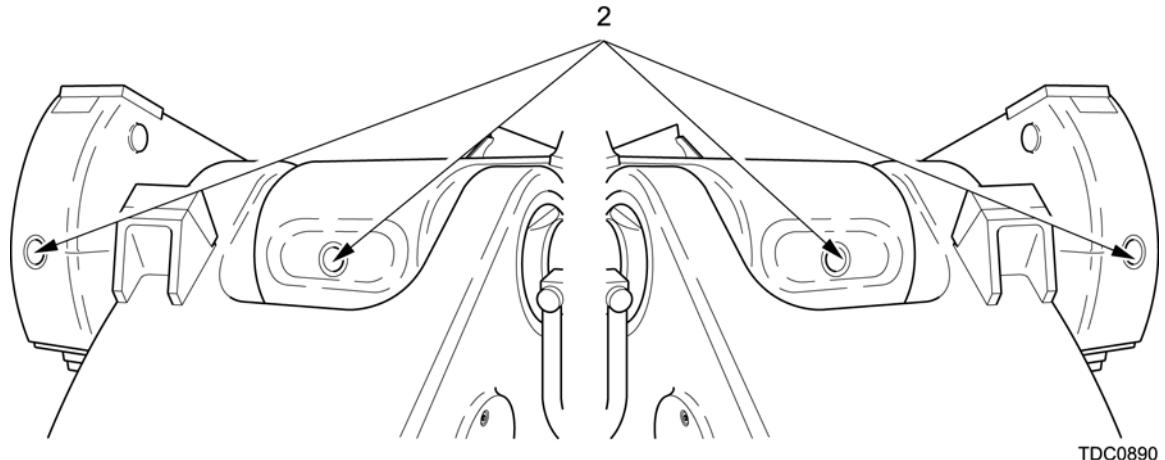
a. **Before-Fording Operations.** Before carrying out fording operations, ensure the following steps are carried out:

- (1) Apply a thin coat of WTR (item 16, appx D) to the DFCS battery terminals.
- (2) Ensure all DFCS cable connections and sockets are secure.
- (3) Ensure all howitzer body drain plugs (1) are present.

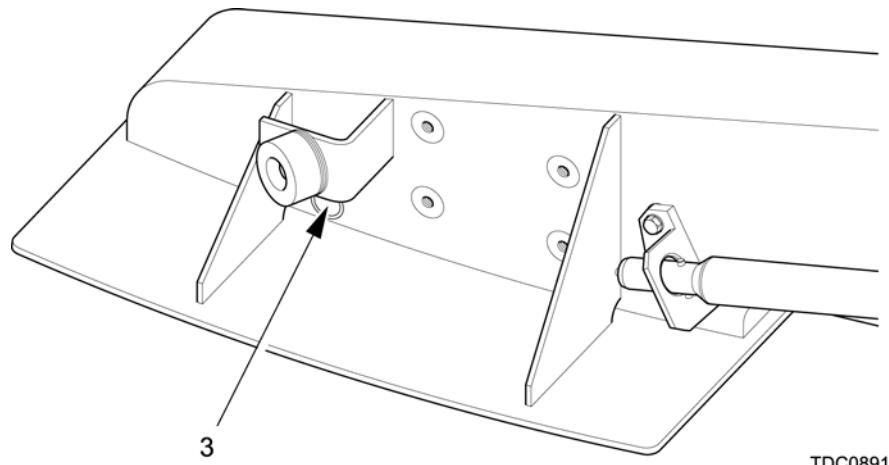


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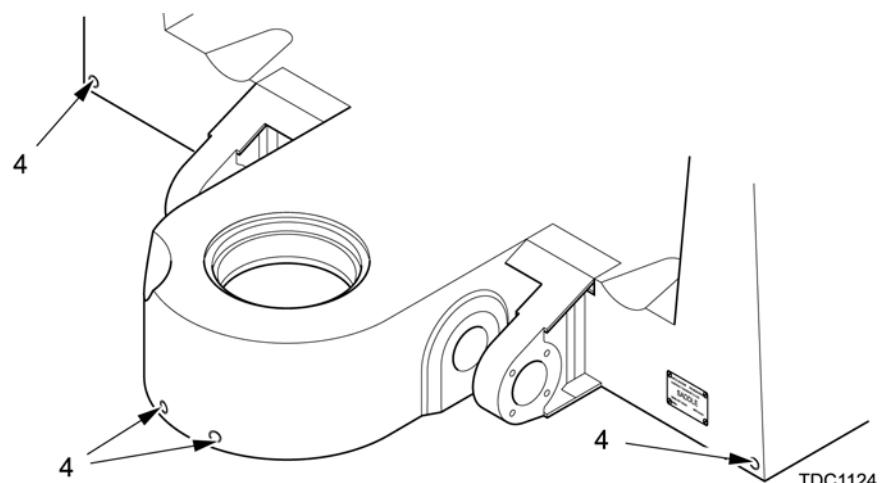
(4) Ensure trail arms drain plugs (2) are present.



(5) Ensure stabilizer drain plugs (3) are present.



(6) Ensure saddle drain plugs (4) are present.



(7) Ensure muzzle plug is installed.

2-38 FORDING OPERATIONS (cont)

b. After-Fording Operations. Immediately after howitzer 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, 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) Remove WTR from DFCS battery terminals and wipe dry with clean wiping rag (item 30, appx D).

(4) 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.

(5) Remove all howitzers drain plugs and drain any moisture.

2-39 DFCS 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.

(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.

DFCS 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)

Ambient Temp ° C / ° F	Allowable Operating Time: Without External Power (minutes)	Minimum Allowable Battery State of Charge	Required Recharge Time (hours)
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% SOC. 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 SOC at current level.

For extreme cold weather conditions, it is recommended that a spare set of fully charged batteries be maintained for back-up during extended periods of operations without prime mover power.

c. Storage.

(1) Do not leave batteries on the howitzer, 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 -13°F (-25°C), 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 PCCM uses a battery-unique charging profile that optimizes the charging voltage and current based on the measured open-circuit voltage for the batteries. This charging profile consists of four stages:

2-39 DFCS BATTERY OPERATIONS (cont)

- (a) **Trickle Mode** is used to initiate battery charging in extremely discharged batteries (10% or less).
- (b) **Bulk Mode** is used for most of the battery charging process and puts the largest amount of power back into the batteries.
- (c) **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.
- (d) **Float Mode** once charging is complete, the PCCM enters float mode, which is used solely to maintain the charge already in the batteries.

NOTE

Batteries must be at room temperature.

- (3) When charging 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 OVERRIDE LOWBAT PWROFF warning displayed on the CSD should only be overridden 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 OVERRIDE 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.

2-40 SHIPBOARD, LANDING CRAFT AIR CUSHION (LCAC), LANDING CRAFT UTILITY (LCU) AND AIRBORNE (SHIP TO SHORE) OPERATIONS

- 1 Configure DAGR prior to installing into the CLE, and perform DAGR initialization procedures (Refer to TM 11-5820-1172-13) and set accuracy to a Figure of Merritt 1 (FOM1).



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



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- 2 Once DAGR initialization is complete, remove internal batteries and secure DAGR into the CLE. Turn PCCM function control switch to the COMM position.
- 3 Switch on DAGR and SINCGARS radio, configure radio (Refer to TM 11-5820-890-10-8) and perform communications checks with FDC.
- 4 Perform DFCS initialization procedures, Block 1 (Para 2-74, steps 1-4 only) or Block 1a (Para 2-69, steps 1-4 only).

- 5 Press PWR key on CSD for three seconds and release (CSD should power off, if not repeat), disconnect CSD [W16] cable.
- 6 Conduct movement operations IAW METT-T and unit SOP.
- 7 Upon arriving at destination, connect CSD [W16] cable to the CSD.
- 8 Once SELECT OPERATIONAL MODE screen is displayed, select NORMAL OPERATIONS, press SELECT F1 key continue initialization procedures, Block 1 (Para 2-74, steps 1-4 only) or Block 1a (Para 2-69, steps 1-4 only).
- 9 Upon completion of initialization procedures report position to FDC and continue mission as required.

Section V. MISFIRE AND CHECK FIRING PROCEDURES

Paragraph		Page
2-41	General Precautions.....	2-201
2-42	Definitions.....	2-201
2-43	Misfire and Check Firing Preventive or Corrective Procedures	2-202
2-44	Misfire Procedure for Cold Tube	2-204
2-45	Misfire Procedure for Warm Tube.....	2-205
2-46	Special Misfire Procedure for Warm Tube in Hot Weather.....	2-206
2-47	Misfire Procedures for Hot Tube	2-207
2-48	Unloading a Sticker Round.....	2-208
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2-41 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 (Para 2-27 and Para 2-42), for definitions.

2-42 DEFINITIONS

- 1 **Check firing.** A check firing is a command given by anyone observing an unsafe act or condition.
- 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.

2-42 DEFINITIONS (cont)

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 2-48).
- 5 **Cookoff.** The premature functioning of the propelling charge or projectile when it is initiated by the heat of the cannon assembly.
- 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 howitzer 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 °F (+ 38 °C) during the day.

2-43 MISFIRE AND CHECK FIRING PREVENTIVE OR CORRECTIVE PROCEDURES

WARNINGS

IN THE EVENT OF A FAILURE TO FIRE, KEEP THE HOWITZER 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 2-44 TO 2-47).

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 howitzer may unexpectedly fire. All personnel should stay clear of the recoiling parts and muzzle. The howitzer should be kept trained on the target until the projectile has been removed from the howitzer.
- 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 2-44). 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 2-45 (in hot weather follow procedures on Para 2-46).
- 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 2-47.

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 firing mechanism is at fault. Replace firing mechanism and notify unit maintenance.

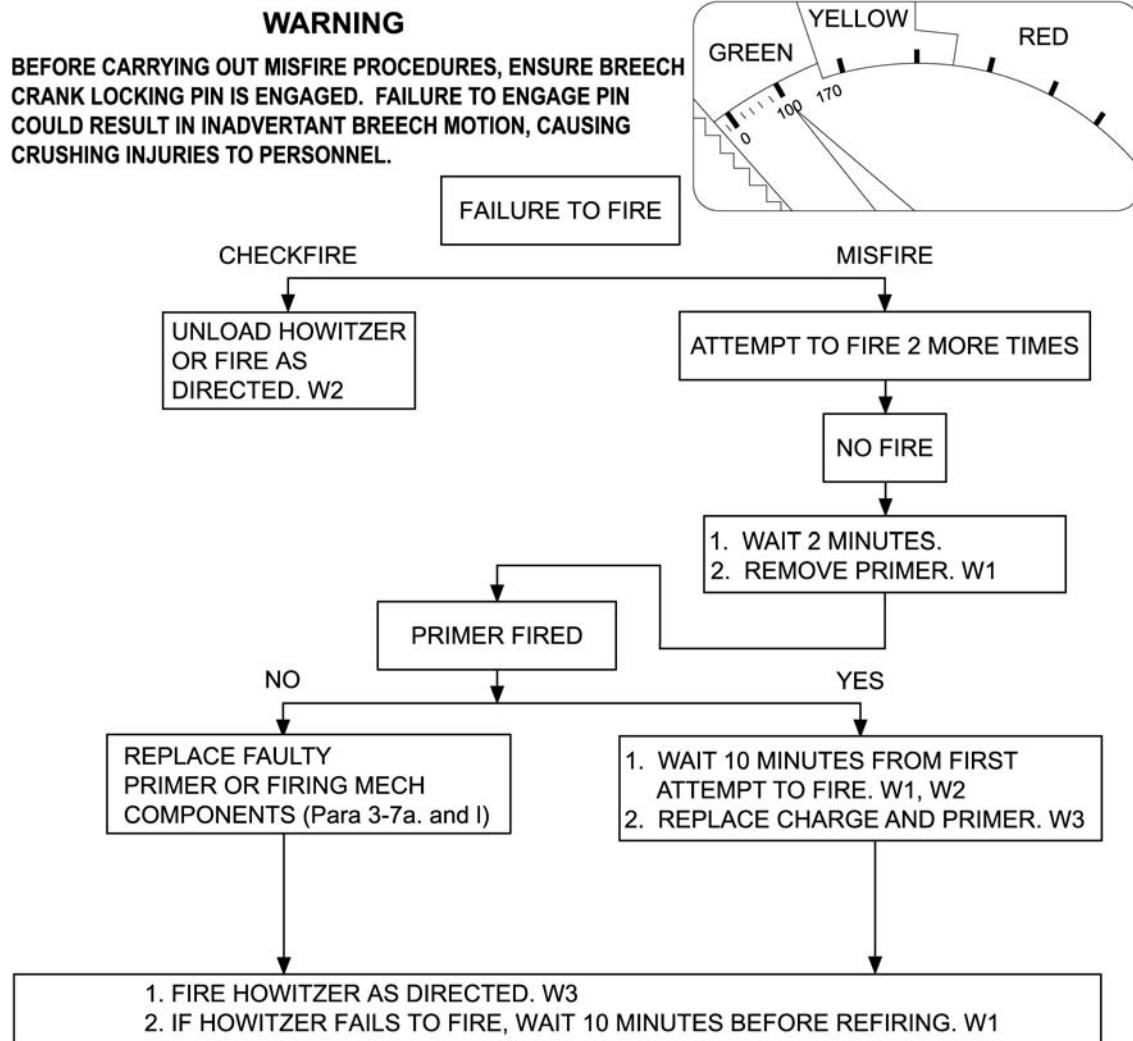
WARNINGS

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.

2-44 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



TDC0437

WARNINGS

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 AMMUNITION. SEPARATE, MARK UNSERVICABLE.

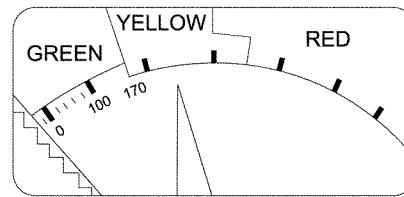
NOTE

See Para 2-48 for use of bell rammer.

2-45 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

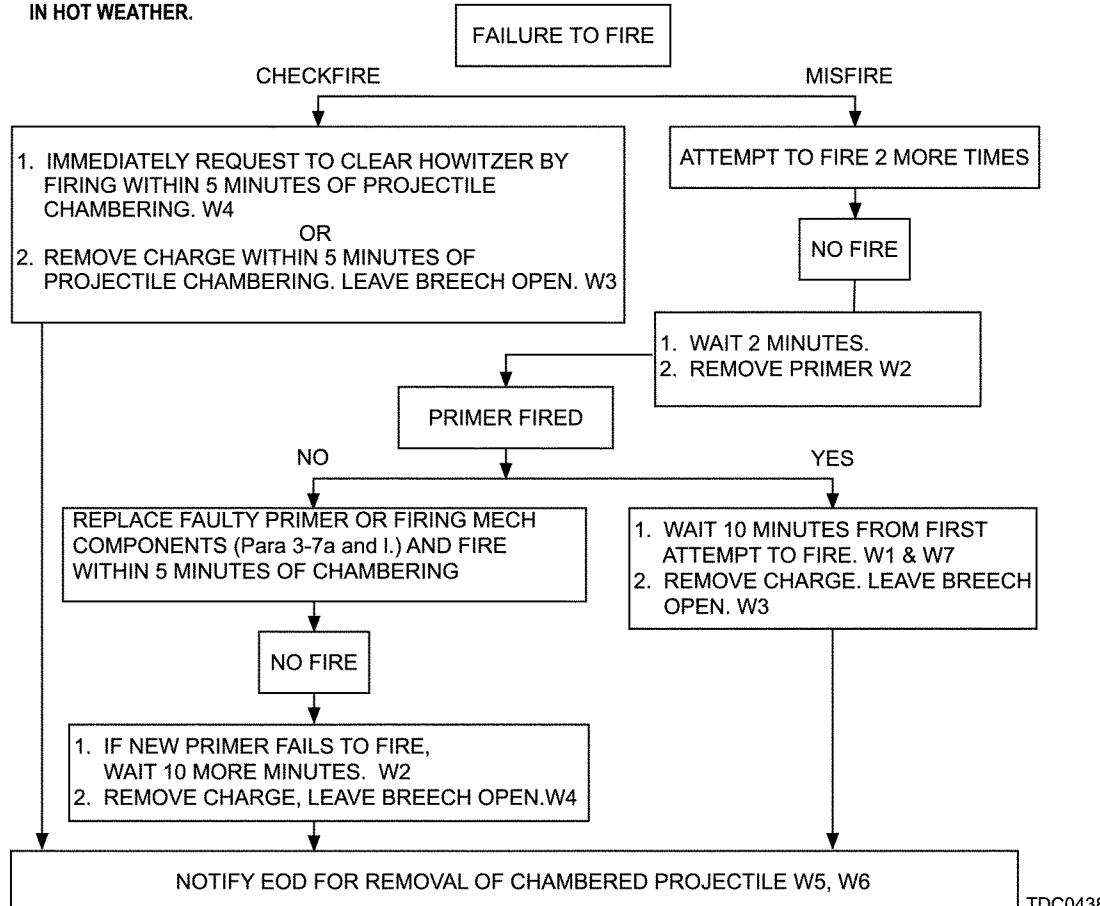
WARNING

BEFORE CARRYING OUT MISFIRE PROCEDURES, ENSURE BREECH CRANK LOCKING PIN IS ENGAGED. FAILURE TO ENGAGE PIN COULD RESULT IN INADVERTENT 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.



TDC0438

WARNINGS

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.

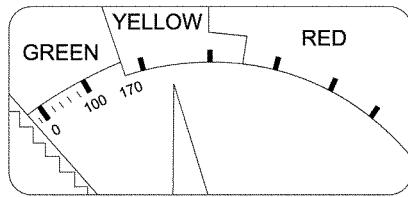
W6-NEVER FIRE A PROJECTILE OR CHARGE THAT HAS BEEN ALLOWED TO COOL IN A HEATED TUBE, SEPARATE, MARK UNSERVICABLE.

W7-IF SMOKE/SPARKS ARE COMING FROM CHAMBER AREA, DO NOT REMOVE CHARGE OR CLOSE BREECH, EVACUATE AREA, NOTIFY EOD.

**2-46 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**

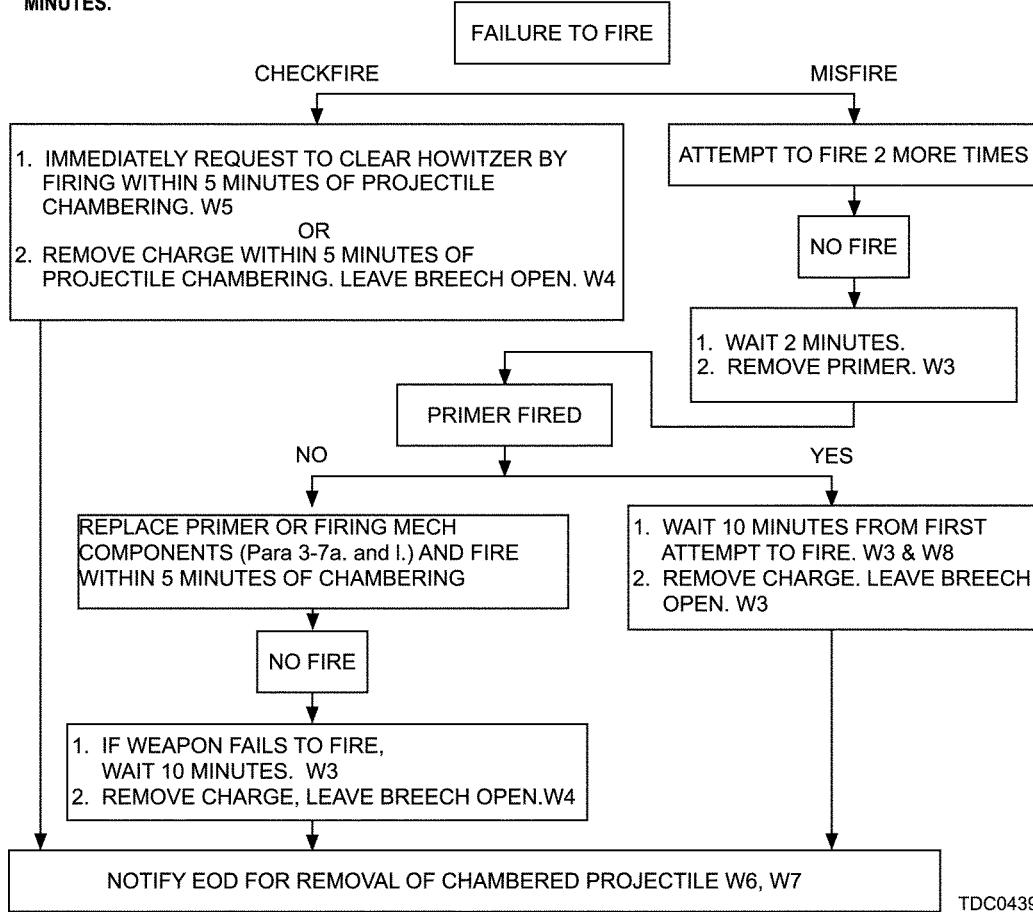
WARNING

BEFORE CARRYING OUT MISFIRE PROCEDURES, ENSURE BREECH CRANK 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.



TDC0439

WARNINGS

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.

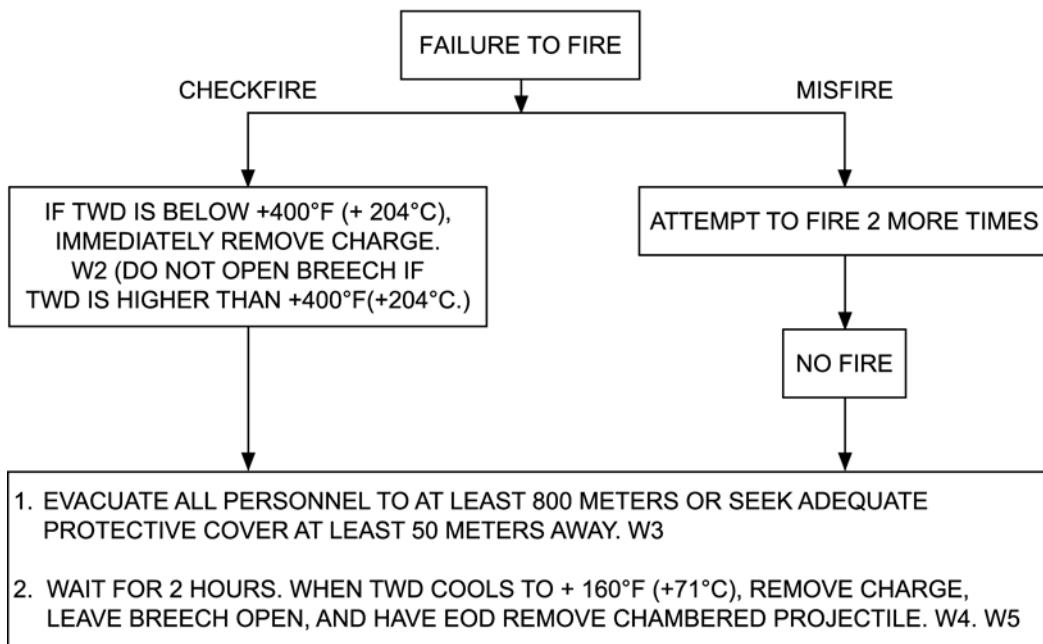
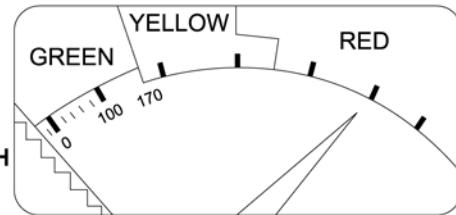
2-47 MISFIRE PROCEDURES FOR HOT TUBE (TWD RED READING) ABOVE +350°F (+177°C). TWD RED READING ABOVE +300°F (+149°C) IN HOT WEATHER, OR USE HOT TUBE DEFINITION IF TWD IS NOT WORKING

WARNING

DO NOT FIRE IN A HOT TUBE EXCEPT IN A COMBAT SITUATION.

DO NOT TAKE CORRECTIVE ACTION EXCEPT AS STATED BELOW.

BEFORE CARRYING OUT MISFIRE PROCEDURES, ENSURE BREECH CRANK LOCKING PIN IS ENGAGED. FAILURE TO ENGAGE PIN COULD RESULT IN INADVERTANT BREECH MOTION, CAUSING CRUSHING INJURIES TO PERSONNEL.



TDC0440

WARNINGS

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 AMMUNITION. SEPARATE, MARK UNSERVICABLE.

W5-NEVER FIRE A PROJECTILE, CHARGE OR PRIMER THAT HAS BEEN ALLOWED TO COOL IN A HEATED TUBE. SEPARATE, MARK UNSERVICABLE.

2-48 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 HOWITZER 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 2-49).

ALL NON-ESSENTIAL PERSONNEL ARE TO MOVE TO THE SAFE AREA FROM THE PRIMER RICOCHET 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.

WARNING

ENGAGEMENT AND DISENGAGEMENT OF THE BREECH CRANK LOCKING PIN IS TO BE PERFORMED AS A ONE HANDED OPERATION.

INADVERTANT BREECH MOTION COULD RESULT IN SEVERE CRUSHING INJURIES TO PERSONNEL.

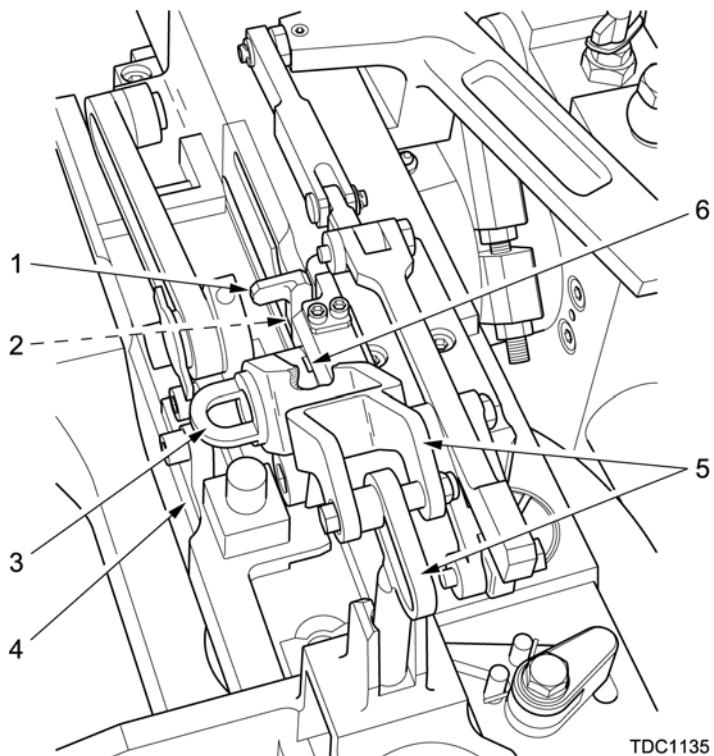
- 2 Cannoneer No. 2 installs breech crank locking pin.

WARNING

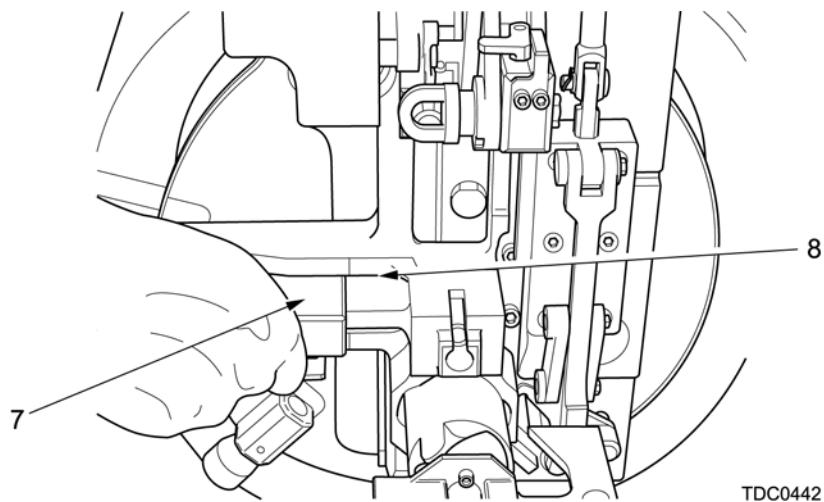
DO NOT ATTEMPT TO FUNCTION THE PFM LEVER UNTIL THE MAGAZINE ASSEMBLY HAS BEEN REMOVED. ATTEMPTING TO VENT A STICKER WITH THE MAGAZINE IN PLACE MAY RESULT IN DETONATION OF THE PRIMERS IN THE MAGAZINE, AS HOT GAS IS VENTED OUT OF THE SPINDLE (PRIMER) HOLE FROM THE CHAMBER.

3 Cannoneer No. 2 removes injector arm assembly as follows:

- (a) Push and rotate knob (1) 90° CCW, until knob is on knob stop (2).
- (b) Rotate locking shaft (3) 90° and remove from tray assembly (4).
- (c) Remove injector arm assembly (5) from slots on follower (6).
- (d) Re-install locking shaft (3) by rotating 90° until engaged. Rotate knob (1) CW until engaged.



4 Cannoneer No. 2 removes magazine assembly and inserts primer stop (7) into tray assembly (8).



2-48 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 and stows.
- 6 Cannoneers Nos. 1 and 2 open breech (2-16).

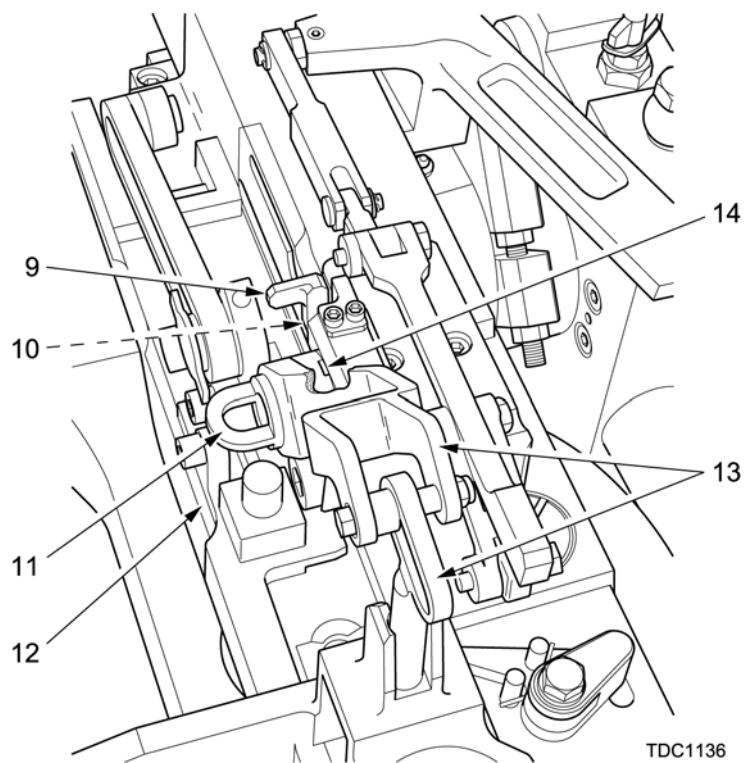
WARNING

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 lock-out plunger.
- 8 Cannoneer No. 2 removes primer stop.
- 9 Cannoneer No. 2 installs injector arm assembly as follows:
 - (a) Push and rotate knob (9) 90° CW until on knob stop (10).
 - (b) Rotate locking shaft (11) 90° 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) Insert locking shaft (11) into tray assembly. Rotate knob CCW until engaged. Ensure locking shaft is engaged.

NOTE

Ensure all parts are locked and engaged.



- 10 Cannoneer No. 2 inserts magazine assembly into tray assembly. Swabs breech to remove any residue from the breech chamber.
- 11 Cannoneer No. 1 disengages breech lock-out plunger.
- 12 Cannoneer No. 1 opens scavenge isolator valve.

CAUTION

Check with local SOP before firing sticker rounds.

NOTE

No significant range loss is expected.

- 13 Fire with Charge 5 or higher with proper authority

2-49 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 2-43 TO 2-47.

FOR EXTRACTION OF M712 PROJECTILE (COPPERHEAD), SEE CHAPTER 4 TO THIS TM.

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.

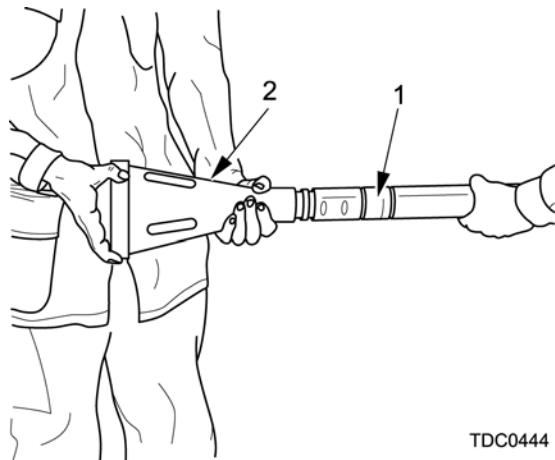
WARNING

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 (1) to bell rammer (2).



TDC0444

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 (Para 2-16).

WARNING

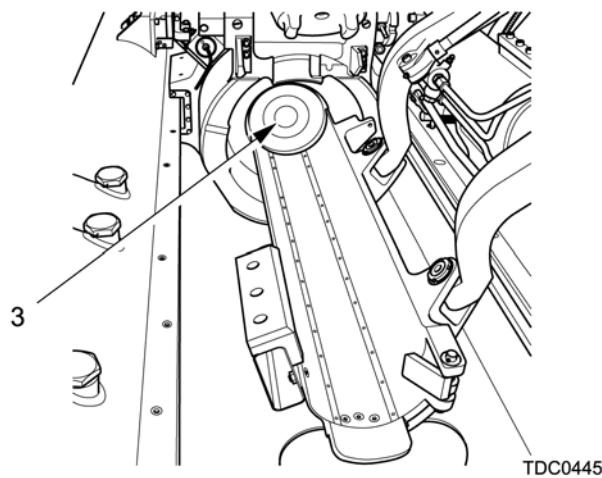
ENSURE BREECH LOCK-OUT PLUNGER IS ENGAGED PRIOR TO PERFORMING ANY MAINTENANCE TASKS. FAILURE TO ENGAGE PLUNGER COULD RESULT IN ACCIDENTAL BREECH CLOSURE, CAUSING SEVERE CRUSHING INJURIES TO PERSONNEL.

- 6 Cannoneer No. 1 engages breech lock-out plunger and lowers loading tray.

NOTE

If MACS charge loaded, see Para 2-50 for removing.

- 7 Cannoneer No. 2 removes propellant charge (3) from chamber and hands it to Cannoneer No. 3.

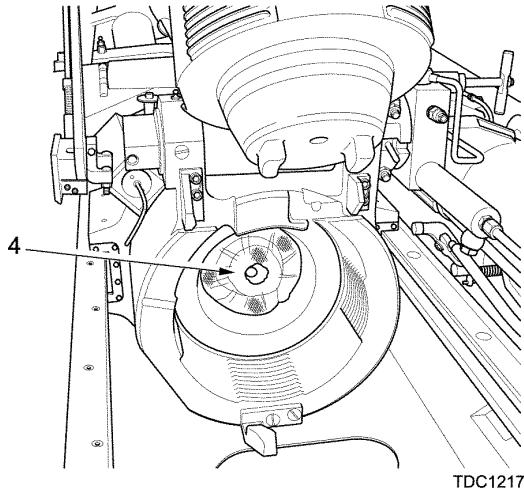


NOTE

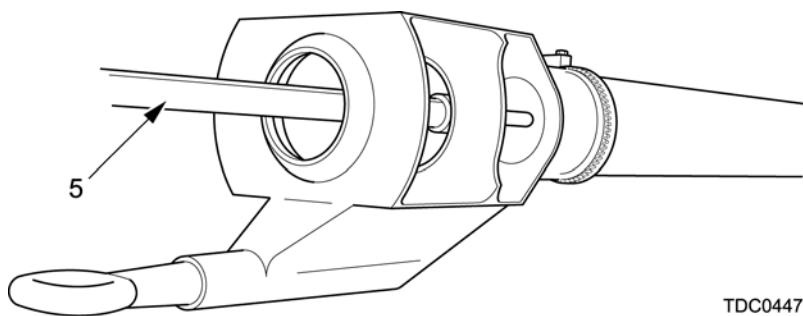
Chamber swab or clean dry rags may be used.

2-49 UNLOADING AN UNFIRED ROUND (cont)

- 8 Cannoneer No. 2 places chamber swab or clean dry rags (4) into the chamber.
- 9 Cannoneer No. 1 raises loading tray.



- 10 Cannoneer No. 1 disengages breech lock-out plunger.
- 11 Cannoneers Nos. 1 and 2 close breech (Para 2-16).
- 12 ATC and Cannoneers Nos. 3, 4 and 5, insert bell rammer (5) into cannon tube (muzzle end), and push carefully until it encloses fuze, and comes into contact with ogive of projectile.
- 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 (Para 2-16).

WARNING

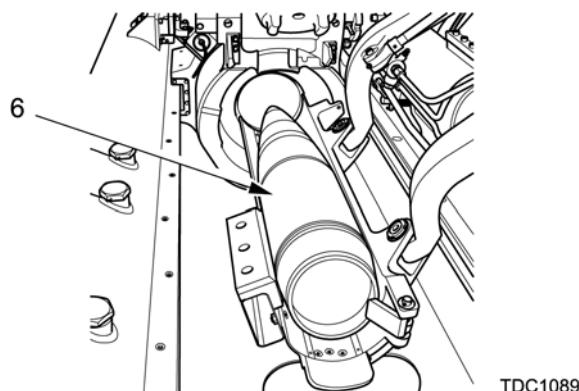
ENSURE BREECH LOCK-OUT PLUNGER IS ENGAGED PRIOR TO PERFORMING ANY MAINTENANCE TASKS. FAILURE TO ENGAGE PLUNGER COULD RESULT IN ACCIDENTAL BREECH CLOSURE, CAUSING SEVERE CRUSHING INJURIES TO PERSONNEL.

- 16 Cannoneer No. 1 engages breech lock-out plunger and lowers loading tray.
- 17 Cannoneer No. 2 removes chamber swab or clean dry rags (item 30, appx D) from chamber.

NOTE

Base of projectile may have to be lifted clear of Swiss groove.

- 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.

2-50 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 2-16).

2-50 UNLOADING PROCEDURES FOR MACS PROPELLING CHARGE ONLY (cont)

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.

- 5** Cannoneer No. 1 engages breech lock-out 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 howitzer elevate cannon tube as needed to get 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 (Para 2-49) after MACS has been removed.

2-51 REMOVING RUPTURED PRIMER CASING

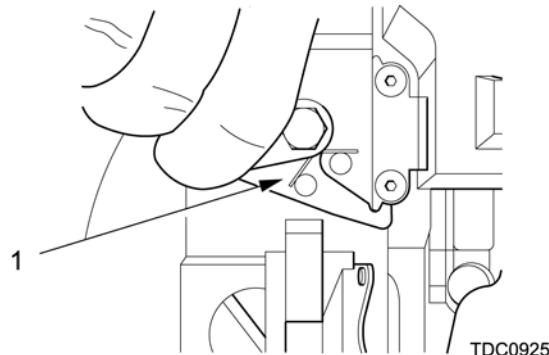
- 1** In the advent of a primer casing becoming ruptured, Cannoneers Nos. 1 and 2 carryout the following:

- (a) Open breech (Para 2-16).

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.

- (b) Engage breech lock-out plunger.
- (c) Unlock PFM tray latch (1).

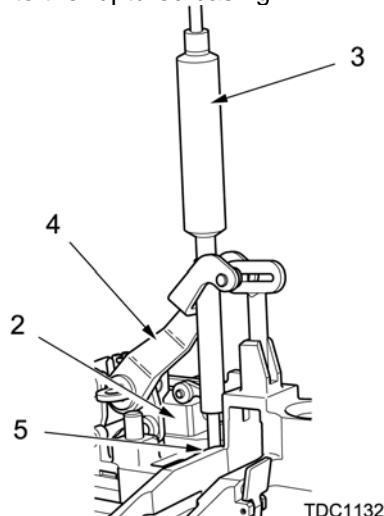


- (d) Slide PFM tray (2) forward, using primer extractor tool (3), insert tool through injector arm assembly (4) and into the primer vent hole (5).

CAUTION

When inserting the primer extractor tool, take care not to damage the primer vent hole.

- (e) Insert primer extractor tool (3) into the ruptured casing, use controlled movements, slowly turn tool until the tap screws into the ruptured casing.

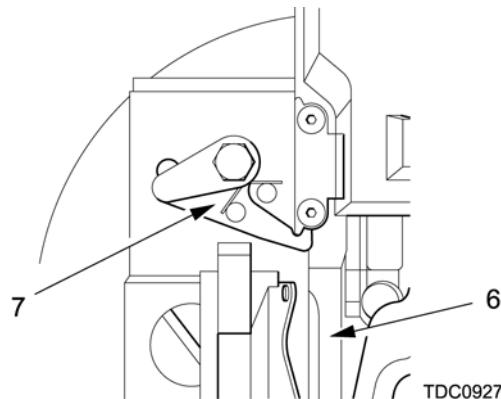


- (f) Using slide hammer handle and with a quick upward motion remove primer extractor tool and ruptured casing from the primer vent hole.

NOTE

When ruptured primer is removed from primer vent hole. Clean vent hole using hand reamer and primer brush. Inspect vent hole for cleanliness and damage, if damaged, notify unit maintenance.

- (g) Slide PFM tray (6) rearwards until tray latch (7) engages into PFM tray.



- (h) Disengage breech lock-out plunger.
(i) Close breech (Para 2-16).

2-52 REMOVING JAMMED PRIMER CASING

NOTE

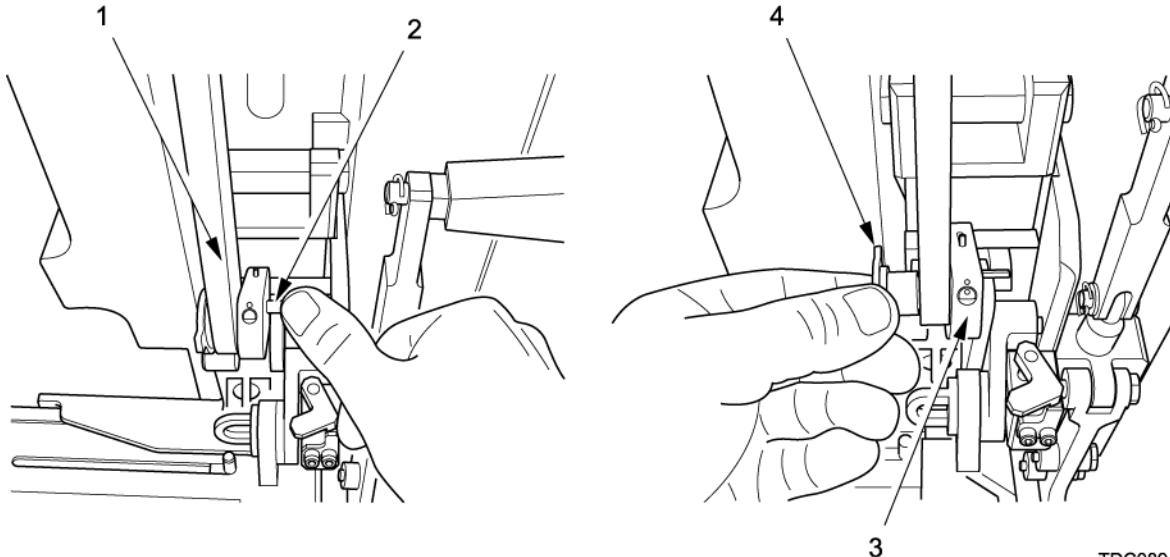
The following procedure is for removing a jammed primer; it may also be used for removing damaged primers.

- 1 In the advent of a primer casing becoming jammed and/or damaged, Cannoneers Nos. 1 and 2 carryout the following:

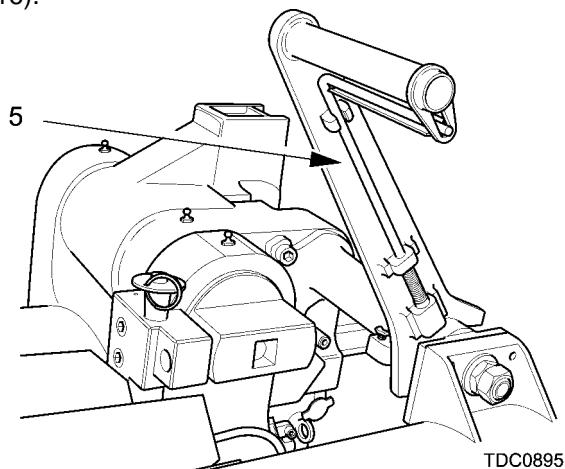
NOTE

When removing connector it may have tension on it from the quick disconnect link, it may be necessary to move PFM lever slightly towards the extract position to release the tension so that the connector can be removed.

- (a) Disconnect quick disconnect link (1) by pushing down detent pin (2) on drive link assembly (3). Remove connector (4).
- (b) Move quick disconnect link (1) up and out of the way. Reinstall connector (4) ensure connector is engaged.



- (c) Move PFM lever (5) to the extract position.
- (d) Open breech (Para 2-16).



NOTE

It may not be possible to move PFM tray to the extract position due to primer being jammed.

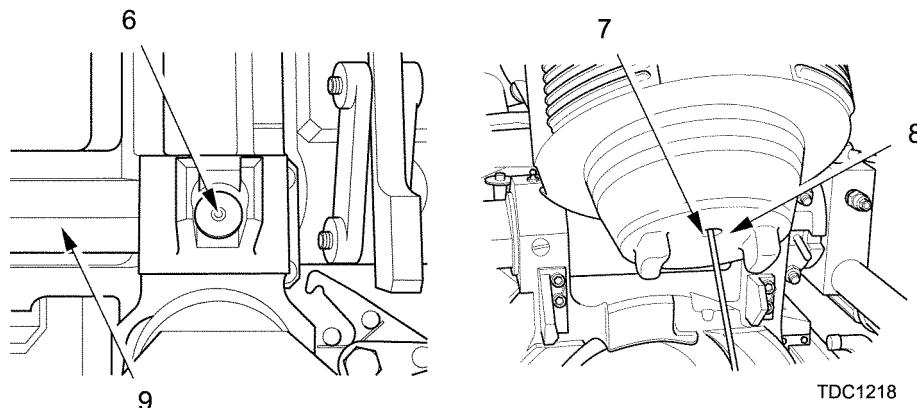
- (e) Remove injector arm assembly (Para 3-7 b.).

NOTES

It may not be possible to remove the magazine due to the primer being jammed.

When extracting jammed primer, it may be necessary to pull back on the magazine pull to release tension on the magazine pull and finger assembly.

- (f) Remove primer (6), by inserting vent reamer tool (7) from bottom of spindle assembly (8) and push primer into magazine (9).



TDC1218

- (g) Remove magazine and inspect primer vent hole for cleanliness or ruptured primer casing.
- (h) Remove damaged primer from the magazine.
- (i) If primer vent hole is dirty, clean with CLP (item 7, appx D), hand reamer and primer brush, if a ruptured primer exists refer to Para 2-51 removing ruptured primer casing.
- (j) Install injector arm assembly (Para 3-7 k.), quick disconnect link and magazine, carry out mission as directed by FDC.

Section VI. OPERATION OF AUXILIARY EQUIPMENT

Paragraph		Page
2-53	Operating M94 Muzzle Velocity System (MVS).....	2-219
2-54	Operating SINCGARS RT-1532E (RTA).....	2-220
2-55	Operating Radio Amplifier (AMP)	2-220
2-56	Operating Defense Advanced Global Positioning System Receiver (DAGR)	2-220
2-57	Operating Enhanced Portable Inductive Artillery Fuze Setter (EPAIFS)	2-220

2-53 OPERATING M94 MUZZLE VELOCITY SYSTEM (MVS)

NOTE

M94 MVS mounting bracket mounted on top cradle electronic assembly is for installation of the M94 MVS bracket assembly. Instructions for operation of the M94 MVS are in TM 9-1290-364-14&P.

2-54 OPERATING SINCgars RT-1532E (RTA)

NOTE

RTA mounting bracket mounted within the CLE for installation of RTA bracket assembly. Instructions for operation of the RTA are in TM 11-5820-890-10-8.

2-55 OPERATING RADIO AMPLIFIER (AMP)

NOTE

AMP mounting bracket mounted within the CLE is for installation of AMP bracket assembly. Instructions for operation of the AMP are in TM 11-5820-890-10-8.

2-56 OPERATING DEFENSE ADVANCED GLOBAL POSITIONING SYSTEM RECEIVER (DAGR)

NOTE

DAGR mounting bracket mounted within the CLE is for installation of DAGR. Instructions for operation of the PLGR are in TM 11-5820-890-11-8.

2-57 OPERATING ENHANCED PORTABLE INDUCTIVE ARTILLERY FUZE SETTER (EPIAFS)

NOTE

The EPIAFS Platform Integration Kit (PIK) mounting bracket mounted within the CLE is for installation of PIK. The EPIAFS Setter cable W13 connects to the connector bracket located on the Assistant Gunner's trunnion. Instructions for operation of the EPIAFS are in TM 9-1290-211-12&P.

Section VII. OPERATION UNDER DEGRADED CONDITIONS

Paragraph		Page
2-58	Firing Lever or Linkage Failure Procedure	2-220
2-59	PFM Lever Failure Procedure	2-221
2-60	Injector Arm Assembly Failure Procedure (Single Shot Mode)	2-225
2-61	Dog Coupler Failure Procedure.....	2-226
2-62	Spade Damper Failure Procedure.....	2-229
2-63	Loading and Firing the Howitzer Under Hydraulic Failure Procedure	2-229
2-64	Elevation Drive Belt Failure Procedure.....	2-235
2-65	Wheel Arm Assembly Hydrostrut Failure Procedure.....	2-236
2-66	DFCS Degraded Condition.....	2-237
2-67	Travel Lock Failure Procedure	2-238

2-58 FIRING LEVER OR LINKAGE FAILURE PROCEDURES

NOTE

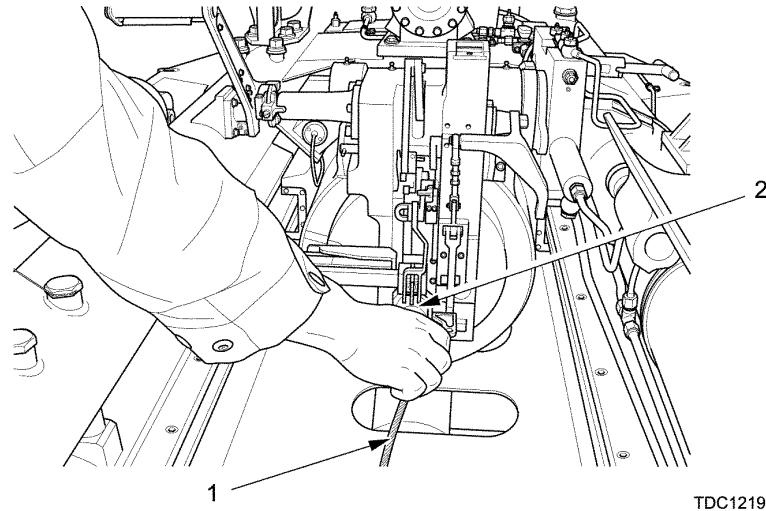
Continue laying for direction and elevation and loading and firing during indirect/direct fire missions (Para 2-29/30). Once fire mission is complete or as time permits, notify unit maintenance.

- 1 In the advent of Firing Lever or Linkage Failure, carry out the following:
 - (a) Cannoneer No. 1 unhooks 6-foot lanyard from 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 firing mech lever (2).

WARNING

ENSURE ALL PERSONNEL ARE STANDING CLEAR OF RECOILING PARTS.

- (d) SC commands, FIRE, and pulls lanyard (1) with a steady pull.



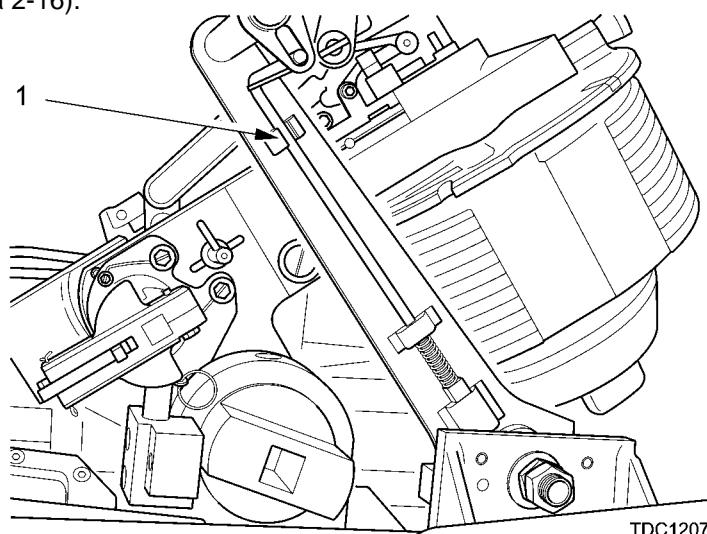
- (e) When cannon assembly returns to the in-battery position, Cannoneer No. 2 removes lanyard from firing mech lever.

2-59 PFM LEVER FAILURE PROCEDURE

NOTE

Continue laying for direction and elevation and loading and firing during indirect/direct fire missions (Para 2-29/30). Once fire mission is complete or as time permits, notify unit maintenance.

- 1 In the advent of PFM Lever Failure, Cannoneers Nos. 1 and 2 carryout the following:
 - (a) Move PFM lever (1) forward to the EXTRACT position.
 - (b) Open breech (Para 2-16).



2-59 PFM LEVER FAILURE PROCEDURE (cont)

WARNING

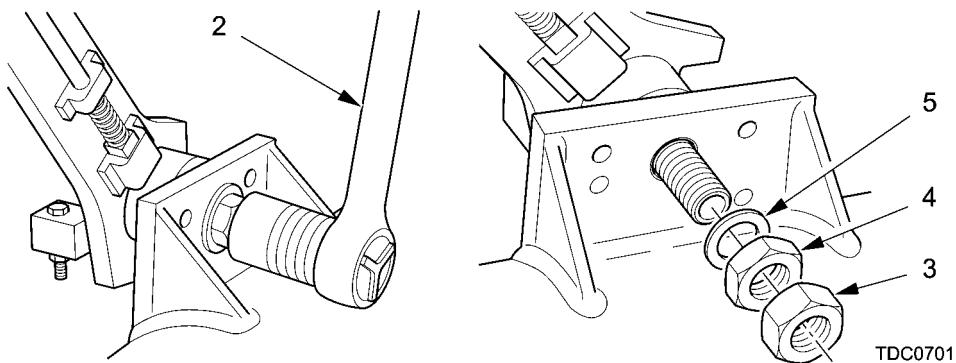
ENSURE BREECH LOCK-OUT PLUNGER IS ENGAGED PRIOR TO PERFORMING ANY MAINTENANCE TASKS. FAILURE TO ENGAGE PLUNGER COULD RESULT IN ACCIDENTAL BREECH CLOSURE, CAUSING SEVERE CRUSHING INJURIES TO PERSONNEL.

- (c) Engage breech lock-out plunger.

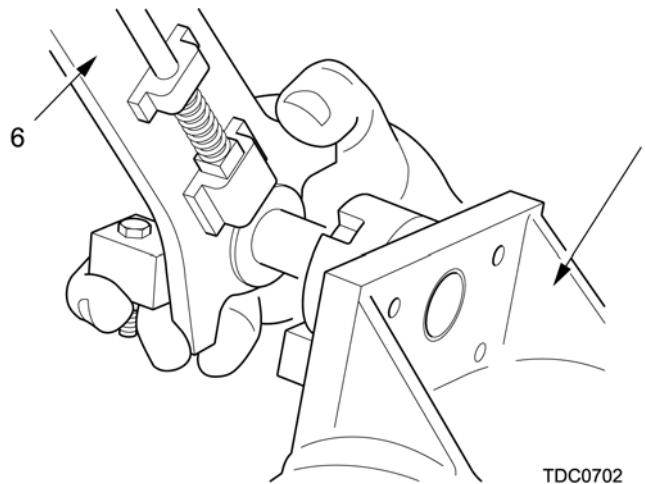
NOTE

For some howitzers, a split cotter pin will be required to be removed.

- (d) Using 24mm socket and $\frac{1}{2}$ in ratchet (2), remove locking nut (3), nut (4) and washer (5).



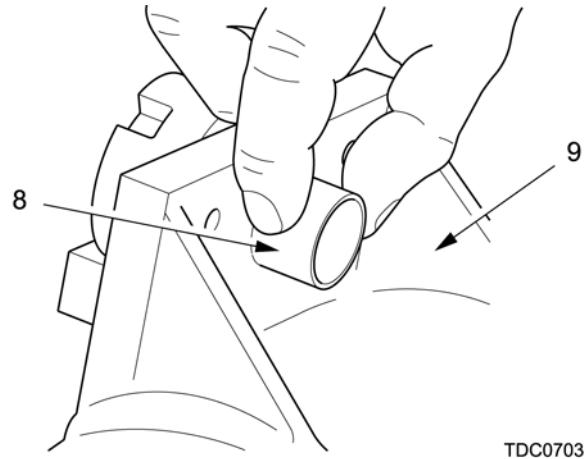
- (e) Remove PFM lever (6) from PFM bracket (7).



WARNING

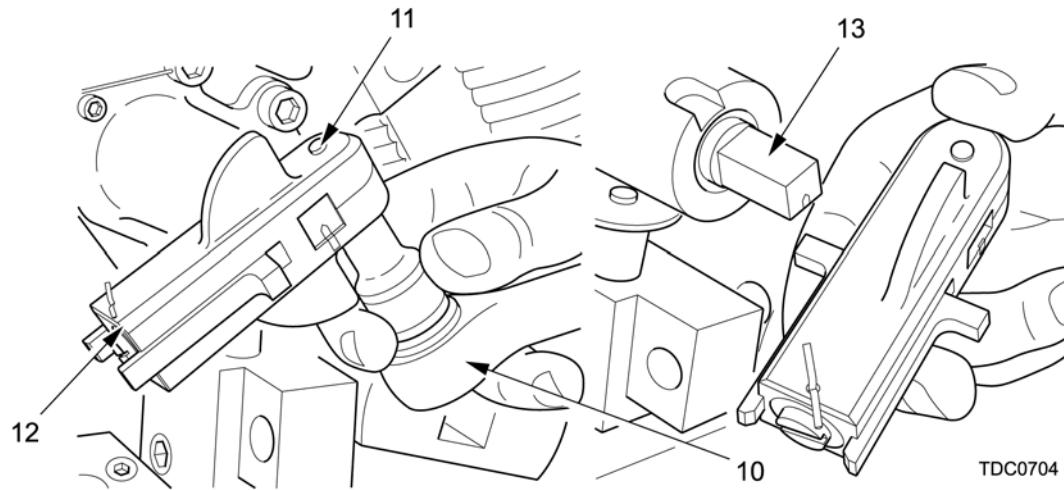
ENSURE BUSHING IS REMOVED BEFORE FIRING THE HOWITZER; FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

- (f) Remove bushing (8) from PFM bracket (9).



TDC0703

- (g) Using 11mm socket and $\frac{1}{2}$ in ratchet (10), loosen bolt (11), until dog coupler (12) can be removed from drive shaft (13).



TDC0704

- (h) Disengage breech lock-out plunger.

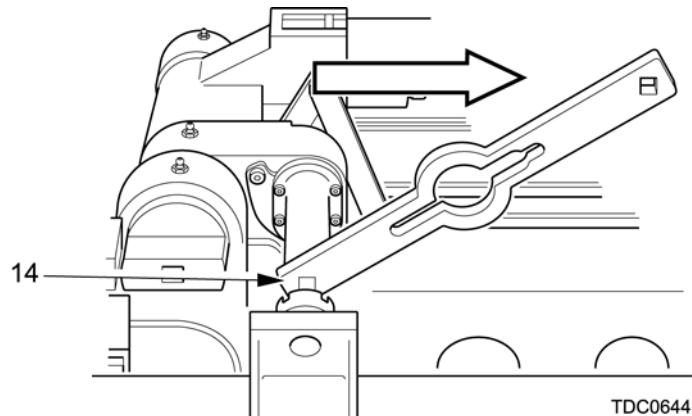
- (i) Close breech (Para 2-16).

NOTE

To continue firing cycle on the howitzer, using the FM wrench, carryout steps 2 thru 6.

2-59 PFM LEVER FAILURE PROCEDURE (cont)

- 2** Install FM wrench (14) onto drive shaft, ensure witness marks are aligned, move wrench rearwards to PRIMED position.

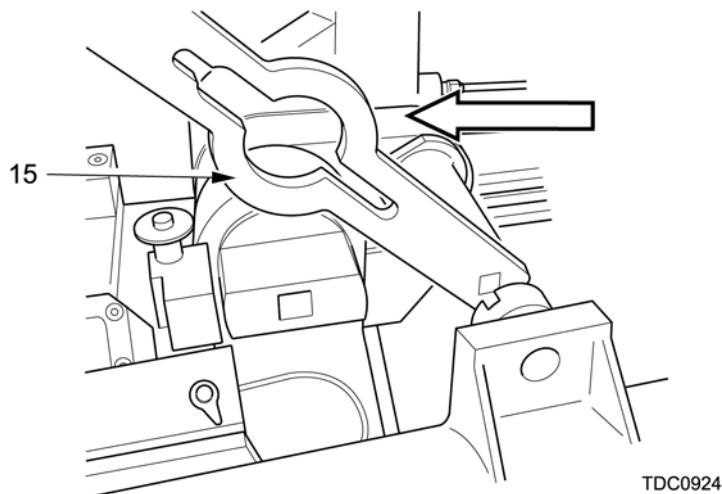


TDC0644

WARNING

ENSURE FM WRENCH IS REMOVED BEFORE FIRING HOWITZER; FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

- 3** Remove FM wrench from drive shaft.
- 4** Install FM wrench (15) onto drive shaft, ensure witness marks are aligned, and move wrench forward to the EXTRACT position.



TDC0924

WARNING

ENSURE FM WRENCH IS REMOVED BEFORE OPENING OR CLOSING THE BREECH; FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

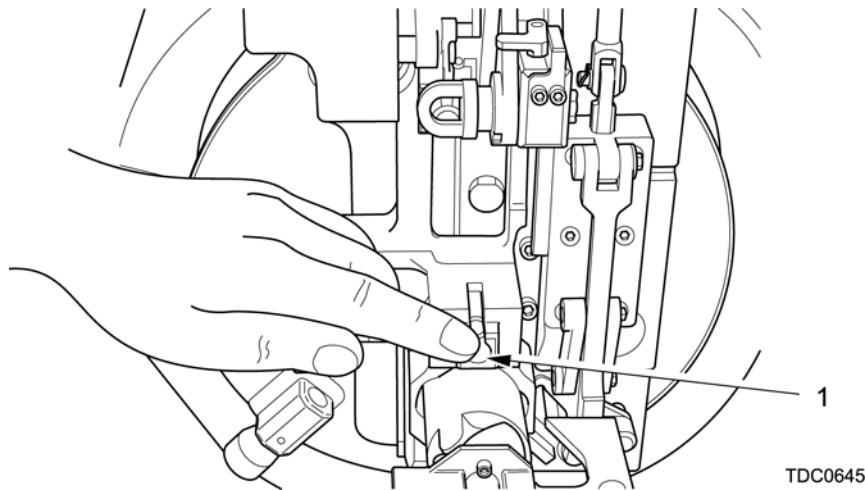
- 5 Remove FM wrench from drive shaft.
- 6 Open breech (Para 2-16).
- 7 Repeat steps 2 thru 6 until the fire mission is completed.

2-60 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 2-29/30). Once fire mission is complete or as time permits, notify unit maintenance.

- 1 In the advent of Injector Arm Assembly Failure, Cannoneer No. 2 carries out the following:
 - (a) Remove magazine (Para 2-32, step 17).
 - (b) Remove injector arm assembly (Para 3-7b.).
 - (c) Manually inserts primer (1) into PFM vent hole, using finger, keep primer in position.

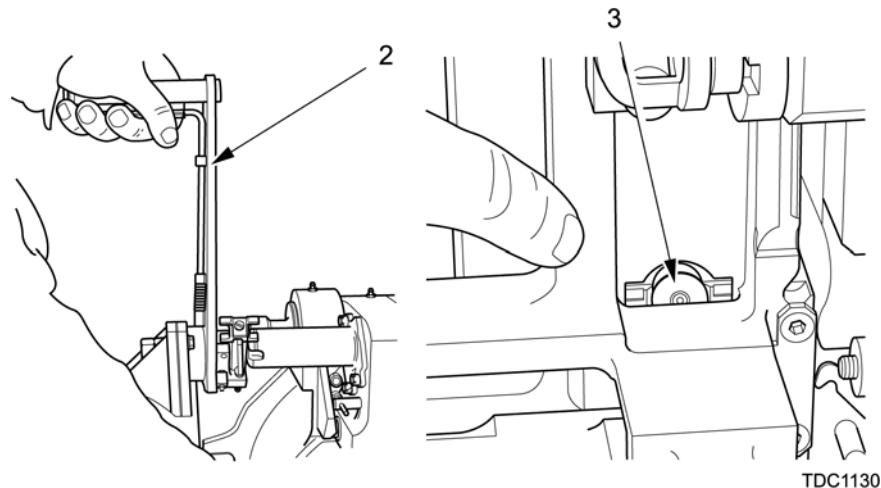


WARNING

TAKE CARE MOVING PFM LEVER WHEN APPLYING FINGER PRESSURE TO PRIMER. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL.

2-60 INJECTOR ARM ASSEMBLY FAILURE PROCEDURE (SINGLE SHOT MODE) (cont)

- (d) Raise PFM lever (2) until PFM rests over primer (3), by moving lever slowly to the PRIMED position. When PFM begins to move over the primer, remove finger.
- (e) Continue moving PFM lever (2) to the PRIMED position. Ensuring witness marks are aligned.

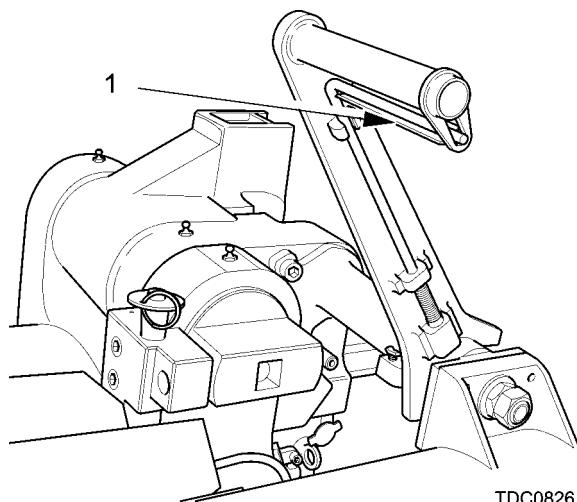


2-61 DOG COUPLER FAILURE PROCEDURE

NOTE

Continue laying for direction and elevation and loading and firing during indirect/direct fire missions (Para 2-29/30). Once fire mission is complete or as time permits, notify unit maintenance.

- 1 In the advent of Dog Coupler Failure, Cannoneer No. 2 carries out the following:
 - (a) Move PFM lever (1) forward to the EXTRACT position.



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) Close scavenge isolator valve.
- (c) Manually open breech (Para 2-16).

WARNING

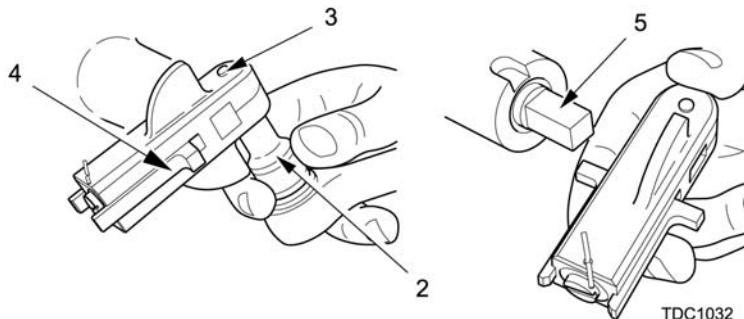
ENSURE BREECH LOCK-OUT PLUNGER IS ENGAGED PRIOR TO PERFORMING ANY MAINTENANCE TASKS. FAILURE TO ENGAGE PLUNGER COULD RESULT IN ACCIDENTAL BREECH CLOSURE, CAUSING SEVERE CRUSHING INJURIES TO PERSONNEL.

- (d) Engage breech lockout plunger.

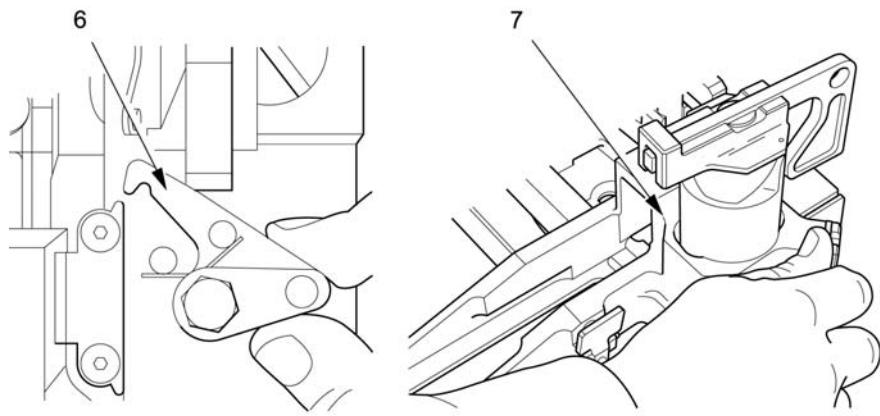
NOTE

When dog coupler has been removed, inspect for missing and/or damage parts, if parts missing and/or damaged, notify unit maintenance.

- (e) Using 11mm socket and $\frac{1}{2}$ in. ratchet (2), loosen bolt (3), until dog coupler (4) can be removed from drive shaft (5).

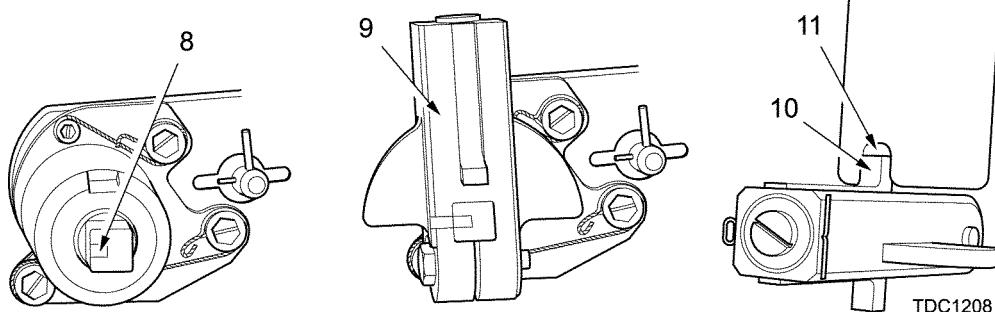


- (f) Disengage tray latch (6) and slide PFM tray (7) fully forward to the primed position.

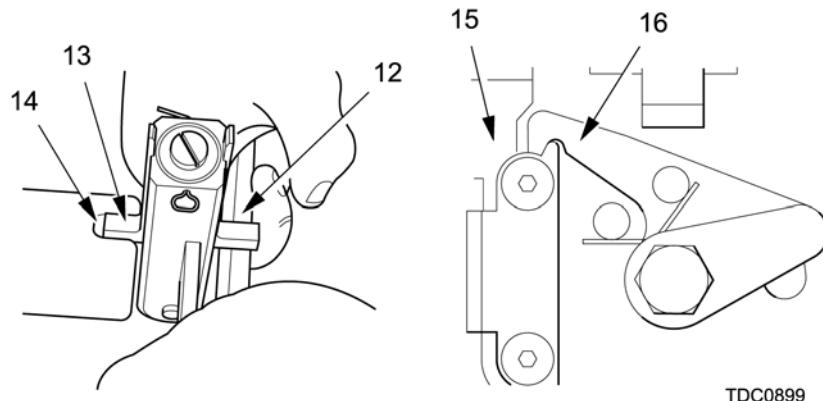


2-61 DOG COUPLER FAILURE PROCEDURE (cont)

- (g) Drive shaft witness marks (8) should be in the primed position (horizontal). Slide 2nd dog coupler (9) onto drive shaft. Ensure drive shaft and dog coupler witness marks are aligned.
- (h) Dog coupler plunger (10) will now be positioned in the housing slot (11).



- (i) Using 12" adjustable wrench (12) lift dog coupler plunger (13) until clear of housing slot (14). Move PFM tray (15) fully rearwards to the extract position. Ensure tray latch (16) engages.

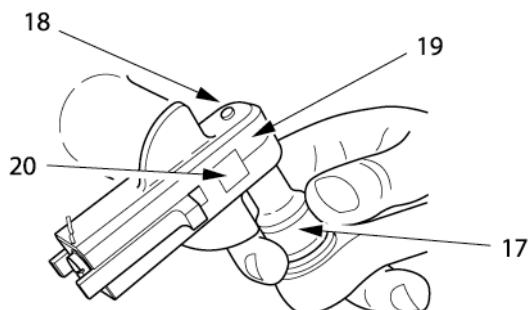


TDC0899

CAUTION

Do not over tighten bolt, damage to dog coupler will result.

- (j) Using 11mm socket and ½ in. ratchet (17), tighten bolt (18), until dog coupler (19) is secured on drive shaft (20).



TDC1128

- (k) Disengage breech lockout plunger.

- (l) Manually close breech (Para 2-16).
- (m) Open scavenge system.

2-62 SPADE DAMPER FAILURE PROCEDURE

NOTES

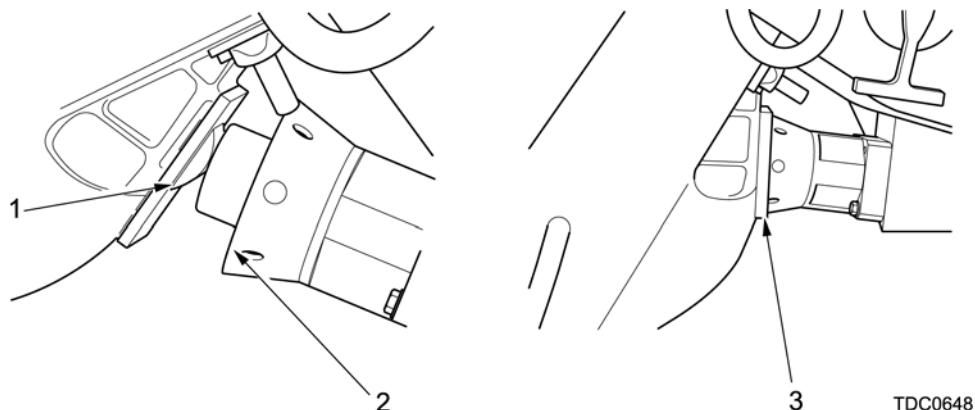
In most cases spade damper failure may not be observed until the howitzer has been displaced.

- 1 In the advent of Spade Damper Failure, carryout the following:
 - (a) All emplace howitzer (Para 2-15).

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) Dig spades in until trail arm striker plate (1) and spade damper (2) have achieved full contact (3).



TDC0648

2-63 LOADING AND FIRING THE HOWITZER UNDER HYDRAULIC FAILURE PROCEDURE

WARNING

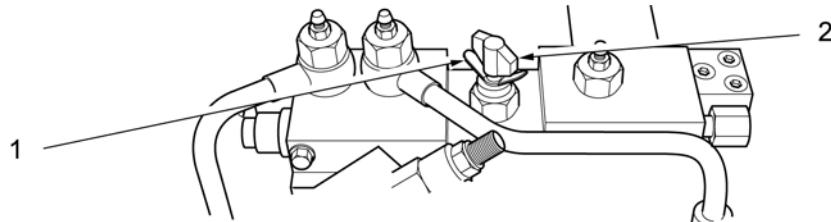
THE FOLLOWING PROCEDURE IS ONLY TO BE CONDUCTED IN A COMBAT EMERGENCY.

Open Breech Under Hydraulic Failure

- 1 In the advent of a scavenge hydraulic failure, to open breech, carryout the following:
 - (a) Cannoneer No. 2 extracts primer (if required).
 - (b) Cannoneer No. 1 unlocks bypass valve locking tab (1) by turning CCW, then fully opens bypass valve (2) by turning valve CCW.

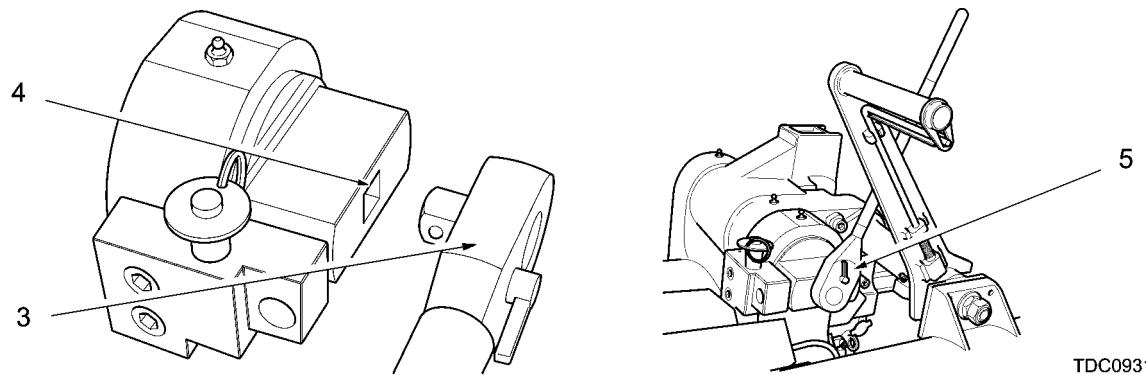
2-63 LOADING AND FIRING THE HOWITZER UNDER HYDRAULIC FAILURE PROCEDURE (cont)

Open Breech Under Hydraulic Failure (cont)



TDC1030

- (c) Cannoneer No. 2 inserts $\frac{3}{4}$ in ratchet (3) into breech crank (4) and moves ratchet CW to the rearwards position (5).



TDC0931

WARNINGS

IF HOWITZER HAS RECENTLY FIRED, THE BREECH MECHANISM ASSEMBLY MAY BE HOT TO TOUCH, ENSURE GLOVES ARE WORN WHEN HANDLING BREECH. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL.

DO NOT RELEASE 3/4 INCH RATCHET UNTIL BREECHBLOCK IS SUPPORTED. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL.

HEAVY WEIGHT. TAKE CARE WHEN SUPPORTING BREECHBLOCK, CARRIER AND PFM ASSEMBLY. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL.

WHEN SUPPORTING BREECHBLOCK, ENSURE BODY IS CLEAR OF PATH OF MOVING BREECH. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL.

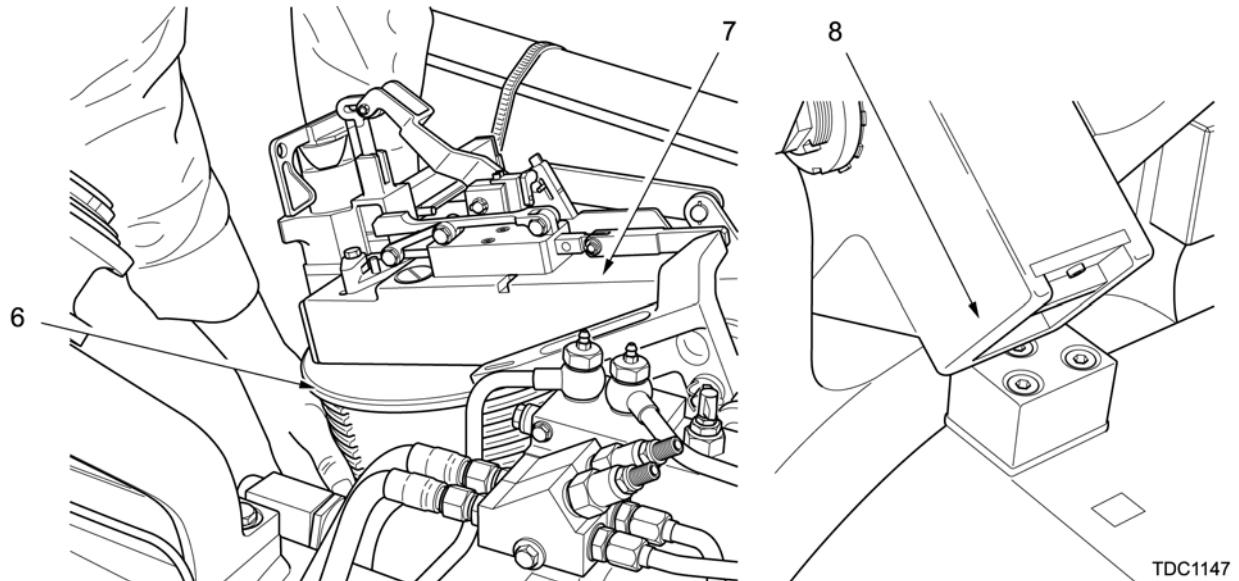
Open Breech Under Hydraulic Failure (cont)

- (d) Cannoneer No. 2 using $\frac{3}{4}$ in ratchet, unlocks breech, by moving ratchet CCW (forward). Cannoneer No. 4 positions himself to the rear of the breech (inside cradle).

WARNING

BEFORE REMOVING 3/4 INCH RATCHET, ENSURE BREECHBLOCK IS SUPPORTED. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL.

- (e) Cannoneer No. 2 using $\frac{3}{4}$ in. ratchet, partially opens breech, by moving ratchet CW (rearward), then CCW (forward). Cannoneer No. 4 supports breech, Cannoneer No. 2 removes ratchet.
- (f) Cannoneer No. 4 lifts breechblock (6) until carrier (7) is resting on carrier stop (8).



WARNING

THE BREECH MUST BE HELD IN THE FULLY OPEN POSITION UNTIL BREECH LOCK-OUT PLUNGER IS ENGAGED. FAILURE TO ENGAGE PLUNGER COULD RESULT IN INADVERTENT BREECH MOTION. THIS COULD RESULT IN SEVERE CRUSHING INJURIES TO PERSONNEL.

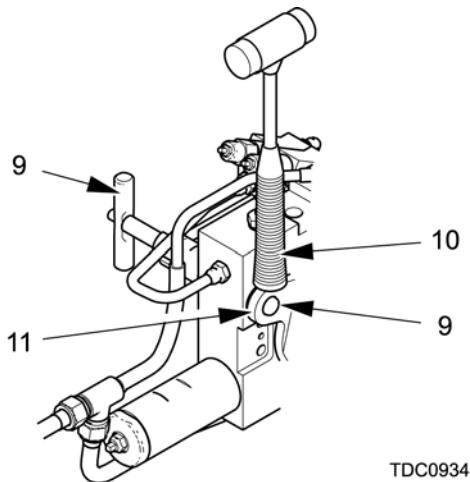
NOTE

Due to the breech being opened without hydraulic pressure, the rotary actuator will be misaligned and the breech lock-out plunger cannot be engaged.

- (g) Cannoneer No. 4 supports breech in the fully open position.

2-63 LOADING AND FIRING THE HOWITZER UNDER HYDRAULIC FAILURE PROCEDURE (cont)

- (h) Cannoneer No. 1 engages breech lock-out plunger (9) by using soft face hammer handle (10), applies downward pressure to rotary actuator (11) until actuator is aligned and breech lock-out plunger is engaged.



TDC0934

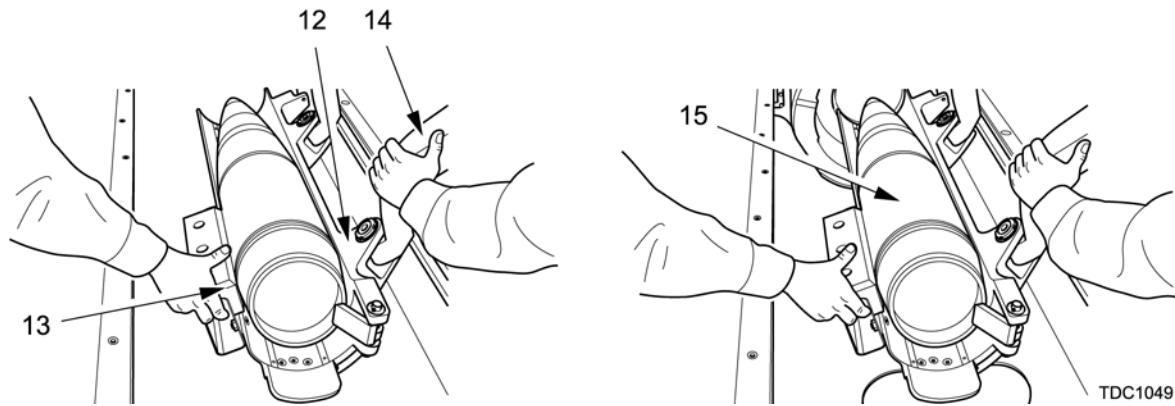
Load Howitzer Under Hydraulic Failure

NOTES

Load howitzer, Para 2-29, steps 10 and 11. Loading tray will be operated manually.

When moving loading tray lever to "LOWER" position, weight of projectile will cause tray to lower.

- 1 Cannoneers Nos. 1 and 2 manually move loading tray (12) to the breech assembly, by pushing (forward) on MACS clip (13) and tray arm (14) until tray is in the loading position (15).



NOTE

Load howitzer, Para 2-29, steps 12 thru 19.

- 2 Cannoneer No. 1 moves loading tray lever to "RAISE" position.

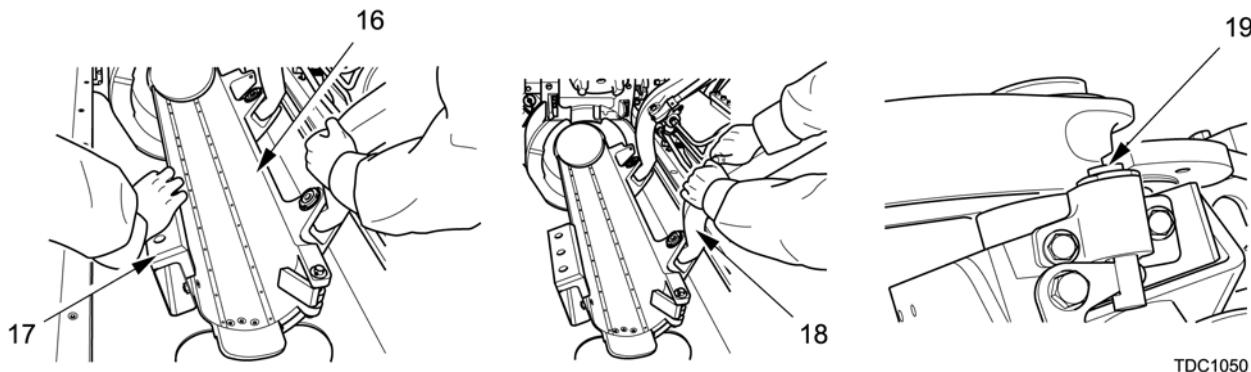
WARNING

WHEN MANUALLY LIFTING LOADING TRAY TO THE STOWED POSITION, ENSURE HANDS ARE CLEAR OF AREA BETWEEN TRAY ARM AND LOADING TRAY. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL.

NOTE

At the midway point of lifting loading tray to the stowed position, Cannoneer No. 2 releases MACS clip and allows Cannoneer No. 1 to raise and stow loading tray.

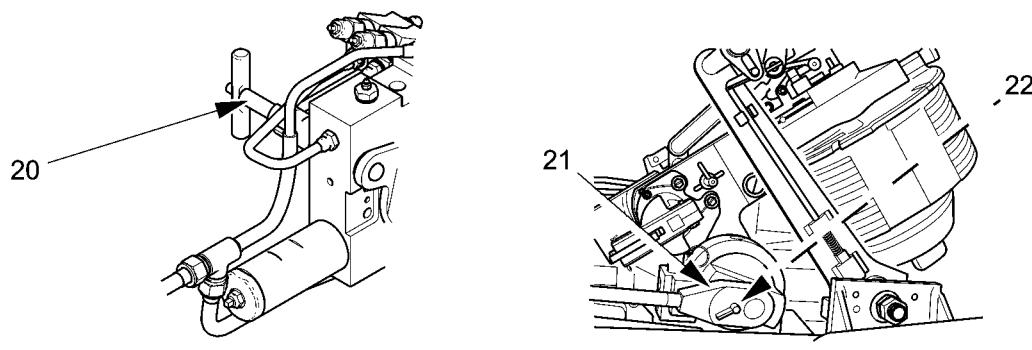
- (a) Cannoneers Nos. 1 and 2 manually lift loading tray (16) to the stowed position, by pulling up (rearwards) on MACS clip (17) and tray arm (18), ensuring mechanical interlock plunger (19) is engaged and that there is no gap between the loading tray and tray stop.



TDC1050

Close Breech Under Hydraulic Failure

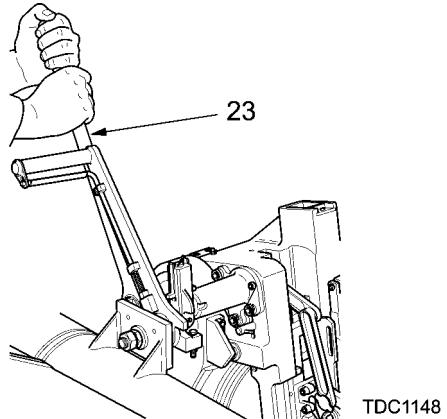
- 1 In the advent of a scavenge hydraulic failure, to close the breech, carryout the following:
- (a) Cannoneers Nos. 1 and 2 disengage breech lock-out plunger (20), by inserting $\frac{3}{4}$ in ratchet (21), into breech crank (22), apply downward pressure on ratchet, until plunger can be disengaged. Cannoneer No. 1 ensures breech lock-out plunger is disengaged.



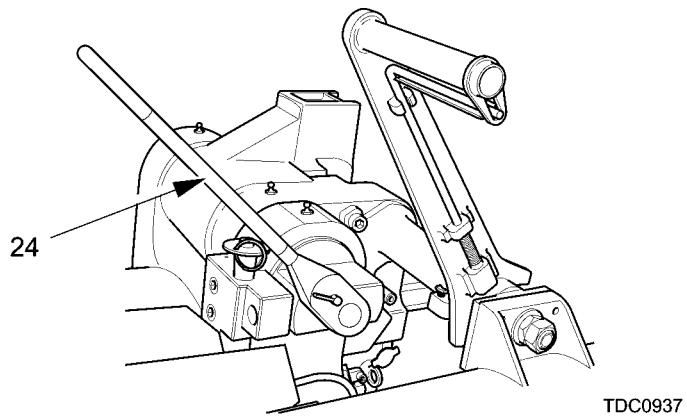
TDC1209

2-63 LOADING AND FIRING THE HOWITZER UNDER HYDRAULIC FAILURE PROCEDURE (cont)

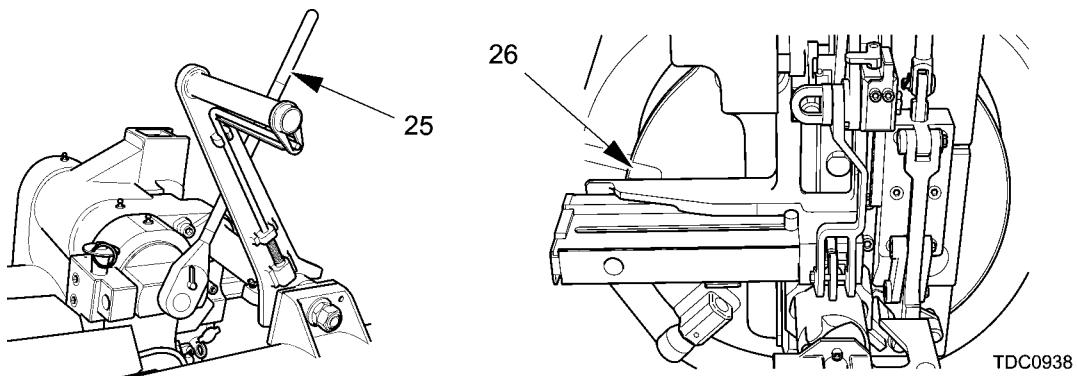
- (b) Cannoneer No. 2 lowers breech under control by rotating $\frac{3}{4}$ in ratchet (23) CW to the rear position and stops prior to breechblock threads engaging breechring threads.



- (c) Cannoneer No. 2 repositions $\frac{3}{4}$ in ratchet (24) into the forward position.



- (d) Cannoneer No. 2 slightly opens breech and releases $\frac{3}{4}$ in ratchet (25) allowing the breechblock to close and start to rotate.
- (e) Cannoneer No. 2 fully closes breech by using $\frac{3}{4}$ in ratchet (25) until witness marks (26) are aligned. Cannoneer No. 2 ensures witness marks are aligned.



Close Breech Under Hydraulic Failure (cont)

WARNING

BEFORE FIRING THE HOWITZER, ENSURE 3/4 INCH RATCHET IS REMOVED FROM BREECH CRANK. FAILURE TO REMOVE RATCHET WILL RESULT IN INJURIES TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

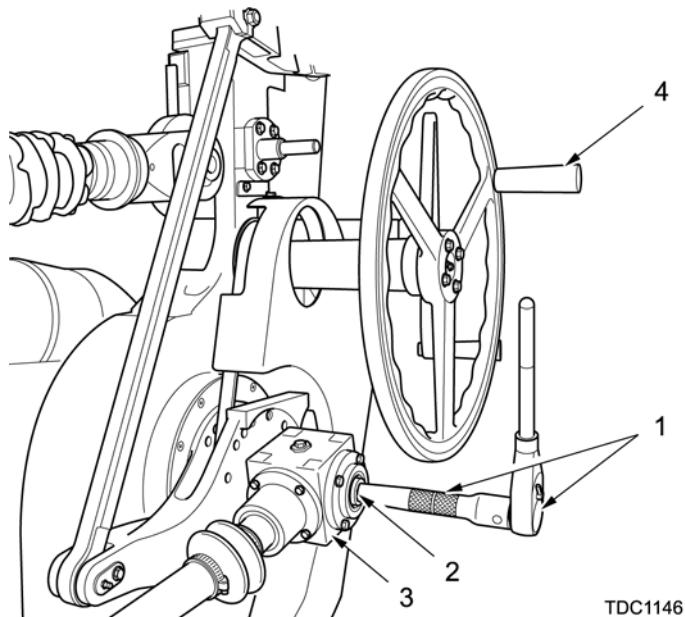
- (f) Cannoneer No. 2 removes $\frac{3}{4}$ in ratchet from breech crank.
- (g) Cannoneer No. 1 fully closes bypass valve by turning valve CW, then locks bypass valve locking tab by turning CW.
- (h) Fire howitzer as directed by FDC.

2-64 ELEVATION DRIVE BELT FAILURE PROCEDURE

NOTE

Continue laying for direction and elevation and loading and firing during indirect/direct fire missions (Para 2-29/30). Once fire mission is complete or as time permits, notify unit maintenance.

- 1 In the event of an Elevation Drive Belt Failure, Gunner carries out the following:
 - (a) Using $\frac{1}{2}$ in ratchet and 5 in extension (1), elevate/depress howitzer, by inserting ratchet and extension into socket (2) on gearbox (3).
 - (b) Hold handwheel handle (4) clear of $\frac{1}{2}$ in. ratchet (1), rotate $\frac{1}{2}$ in ratchet CW or CCW until howitzer is at the required elevation.



TDC1146

2-65 WHEEL ARM ASSEMBLY HYDROSTRUT FAILURE PROCEDURE

NOTE

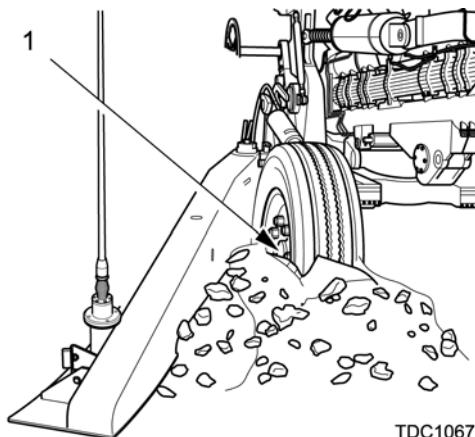
Continue laying for direction and elevation and loading and firing during indirect/direct fire missions (Para 2-29/30). Once fire mission is complete or as time permits, notify unit maintenance.

- 1 In the event of a Wheel Arm Assembly Hydrostrut Failure, carryout the following:

NOTE

Depth and size of hole must be sufficient for wheel arm assembly and tire to be level or below center line of wheel.

- (a) Using shovels/mattocks, dig a hole on both sides of the howitzer, lower wheel arm assembly into hole, ensure wheel center line (1) is level or below ground.



- (b) Engage traverse and travel locks.
- (c) Engage handbrakes.
- (d) Attach howitzer to prime mover.

CAUTION

Before pulling howitzer forward, ensure stabilizers are clear of debris. Failure to do so could damage equipment.

- (e) Driver under control, moves prime mover and howitzer forward.
- (f) When howitzer is sufficiently raised from the ground, Driver halts prime mover and applies brakes. Stow stabilizers into the traveling position and ensure bump stops are engaged.

2-65 WHEEL ARM ASSEMBLY HYDROSTRUT FAILURE PROCEDURE (cont)

WARNING

WHEN RELEASING HANDBRAKES, ENSURE PERSONNEL ARE STANDING CLEAR OF HOWITZER. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL.

- (g) Release handbrakes. Driver releases brakes and reverses prime mover until howitzer is resting on its bump stops.

CAUTION

When towing howitzer under wheel arm assembly hydrostrut failure conditions, howitzer will not have suspension and will be resting on its bump stops, ensure howitzer is towed at reduced towing restrictions. Failure to do so will cause damage to equipment.

Towing restrictions under wheel arm assembly hydrostrut failure are limited to: 3 mph (5 kph) maximum over cross-country roads, 9.5 mph (15 kph) maximum over secondary roads, and 18.5 mph (30 kph) maximum over improved roads.

2-66 DFCS DEGRADED CONDITION

Critical Mode

- 1 When performing howitzer operations, PMCS and/or corrective maintenance on the DFCS, if DFCS will not boot or if MSC, PCCM, INU and/or CSD become non-operational (OUT indicated on DFCS system status screen), the DFCS status is "OUT". This is identified as a critical mode, and the crew should carryout the following:

NOTE

If MSC, PCCM, INU and/or CSD become non-operational during missions, immediately revert to degraded operations, continue to lay howitzer for direction and elevation using OFC equipment.

- (a) SC commands DFCS OUT, Gunner removes Pantel from telescope case, and installs onto M171A1 telescope and quadrant mount (Para 2-15, steps 10 and 11), Gunner (if required) continues to lay howitzer for direction and elevation (Para 2-29/30).

- 2 Carryout laying the howitzer for direction and elevation using Table 1 listed below:

Table 1 – DFCS Critical Mode

DFCS Condition/Indication	Operator Action
DFCS Inoperable	Install and continue mission using OFC equipment.
CSD OUT	
NAV OUT	
MSC OUT/ Not Operational	

2-66 DFCS DEGRADED CONDITION (cont)

Degraded BIT Mode

NOTES

"Degraded" BIT results, e.g., **NAV, CSD or MSC - DEGRADED**, displayed on CSD screen or loss of AGD or GND (**-- or OUT**) constitute a degraded mode within the DFCS, but still allow DFCS to be mission capable.

If "Degraded" BIT results or AGD/GND (**-- or OUT**) results are displayed on CSD screen during missions, continue to lay howitzer for direction and elevation under the following conditions:

- 3 Carryout laying the howitzer for direction and elevation using Table 2 listed below:

Table 2 – DFCS Degraded BIT Mode

DFCS Condition/Indication	Operator Action
GND OUT/DISCONNECTED (--)	Continue mission using CSD and AGD, notify unit maintenance.
AGD OUT/DISCONNECTED (--)	Continue mission using CSD, GND and M18A1 fire control quadrant, notify unit maintenance.
GND and AGD OUT/DISCONNECTED (--)	Continue mission using CSD and M18A1 fire control quadrant, notify unit maintenance.
MSC Degraded (DEG)	Use voice radio or landline communications to contact FDC and enter mission data manually on the CSD.
NAV Degraded (DEG)	Continue mission and notify unit maintenance. Perform ZUPT as required.
COMM OUT	Use voice radio or landline communications to contact FDC and enter mission data manually on the CSD.
RTA Inoperable	Use landline communications to contact FDC and enter mission data manually on the CSD.

2-67 TRAVEL LOCK FAILURE PROCEDURE

CAUTION

Towing must be carried out Slowly and Carefully. Failure to do so may damage equipment.

NOTE

In case of emergency, howitzer may be towed with one travel lock.

- 1 Set the howitzer in the towing position.
- 2 Ensure the operational travel lock is engaged.
- 3 Apply strapping and wooden supports between the cradle and body to ensure the two units will remain secure during towing operation.
- 4 Ensure the traverse lock bolt is engaged.

Section VIII. DFCS BLOCK IA OPERATION

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2-69	Initialization Procedures	2-248
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2-68 DFCS BLOCK 1A LIST OF ABBREVIATIONS/ACRONYMS AND MESSAGES/ALERTS

a. Alphabetical list of abbreviations and acronyms used for DFCS Block 1a.

A	GPS Aiding not available
ALT	Altitude
ACK	Acknowledge
ACT	Actual
ACT DEF	Actual Deflection
ACTL	Actual
ACT QE	Actual Quadrant Elevation
AF	Adjust Fire
AGD	Assistant Gunners Display
AMC	At My Command
AOF	Azimuth of Fire
AUX	Auxiliary
AZ	Azimuth
BRT	Brightness
CBLS	Cables
CHG	Charge
CHKFIRE	Checkfire
CLR	Clear
CMD	Command
COM	Communication (TACLINK)
COMMS	Communication
CRS-AZ	Course Azimuth
CSD	Chief of Section Display
DAGR	Defense Advanced GPS Receiver
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
GNR	Gunner
GPS	Global Positioning System
H	Heading

2-68 DFCS BLOCK 1A LIST OF ABBREVIATIONS/ACRONYMS AND MESSAGES/ALERTS (cont)

a. Alphabetical list of abbreviations and acronyms used for DFCS Block 1a. (cont)

HDG	Heading
INIT POINT	Initialization Point
LOG POINT	Logistic Point
MO	Move Order
MSC	Mission Computer
MSN NO.....	Mission Number
N	NAV unavailable
N	North/Northings
NAV	Navigation Subsystem
NVG	Night Vision Goggles
OBIT	Operational-BIT
OIBIT	Operated-Initiated-BIT
OL	Orientation Line
POSN.....	Position
PROP.....	Propellant
PSP	Power Conditioning and Control Module
PWR	Power
PWS	Power Subsystem
PUBIT.....	Power-Up-BIT
QE	Quadrant Elevation
QUAD.....	Quadrant
RNDS.....	Rounds
RNG	Range
RPS	Radio Power Supply
RTA	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

b. The following list provides the messages and alerts used in DFCS Block 1a in alphabetic order by priority.

DFCS BLOCK 1A MESSAGES/ALERTS

PRIORITY	MESSAGE/ALERT	DESCRIPTION	RESPONSE
1	CHECKFIRE	Displayed when either Check Fire By Target for an active fire mission or Check Fire All has been received from the FDC.	ACK
2	ABNORMAL POWER DOWN	The last power down was uncontrolled.	ACK
2	AGD DISCONNECTED	A cable loopback check has determined that the AGD is disconnected. This shall appear only once per disconnect.	ACK
2	AGD OUT	A failure has been declared in the Operational BIT for the AGD that results in the AGD being declared OUT.	ACK

DFCS BLOCK 1A MESSAGES/ALERTS

PRIORITY	MESSAGE/ALERT	DESCRIPTION	RESPONSE
2	BATTERY LOW	The life left in the battery has been determined to be less than 60 minutes based on the state of charge and temperature read from the PCCM during the Operational BIT. This message will appear every 10 minutes whenever there is less than 60 minutes left.	ACK
2	COM DISCONNECTED	A cable loopback check has determined that the CLA is disconnected. This shall appear only once per disconnect.	ACK
2	COM OUT	A failure has been declared in the Operational BIT for the COM that results in the COM being declared OUT.	ACK
2	CSD DEGRADED	A failure has been declared in the Operational BIT for the CSD that results in the CSD being declared DEGRADED.	ACK
2	CSD OUT	A failure has been declared in the Operational BIT for the CSD that results in the CSD being declared OUT.	ACK
2	CSD OUT SHUTTING DWN	A failure has been declared in the Operational BIT for the CSD External Video Sync test.	ACK
2	DEGRADED - ACK TO CONTINUE	One or more of the subsystems is declared DEGRADED, OUT or Disconnected.	ACK
2	FIRE CONTROL ALIGN REQUIRED	The MSC and PNS stored values for the Bore sight offsets differ when checked at start up. This message shall also be displayed if NAV declared OUT during start up.	ACK
2	FIRE MISSION RECEIVED	Displayed when Fire Mission has been received digitally and was not automatically rejected or an update to the current Fire Mission has been received.	ACK
2	FPF/PRI MISSION UPDATED	Displayed upon receiving, updating, or deleting a stored FPF or Priority Target except when an active fire mission exists.	ACK
2	FZ EXPIRED CALL FDC	The M982 Series Timer has reached zero minutes.	ACK
2	FZ EXPIRES 1 MIN CALL FDC	The M982 Series Timer has reached 1 minute.	ACK
2	GND DISCONNECTED	A cable loopback check has determined that the GND is disconnected. This shall appear only once per disconnect.	ACK
2	GND OUT	A failure has been declared in the Operational BIT for the GND that results in the GND being declared OUT.	ACK
2	GPS UNKEYED	Displayed when the INU has indicated that the GPS is unkeyed.	ACK

2-68 DFCS BLOCK 1A LIST OF ABBREVIATIONS/ACRONYMS AND MESSAGES/ALERTS (cont)

DFCS BLOCK 1A MESSAGES/ALERTS

PRIORITY	MESSAGE/ALERT	DESCRIPTION	RESPONSE
2	GZ CHANGED CALL FDC	Displayed when moving and the INU has indicated that the howitzer has transitioned from one grid zone to another and communications are out.	ACK
2	IFS DEGRADED	A failure has been declared in the Operational BIT for the IFS that results in the IFS being declared DEGRADED. Can be called for GPS, MAINT, or LOBAT.	ACK
2	IFS DISCONNECTED	A cable loopback check has determined that the IFS is disconnected. This shall appear only once per disconnect.	ACK
2	IFS OUT	A failure has been declared in the Operational BIT for the IFS that result in the IFS being declared OUT or the EPIAFS message returning EPIAFS Status Message is not received within 5 consecutive attempts to communicate with EPIAFS	ACK
2	MESSAGES HAVE BEEN LOST	There are more than three unviewed messages in the received message queue.	ACK
2	MSC DEGRADED	A failure has been declared in the Operational BIT for the MSC that results in the MSC being declared DEGRADED.	ACK
2	MSC OUT	A failure has been declared in the Operational BIT for the MSC that results in the MSC being declared OUT.	ACK
2	NAV DEGRADED	A failure has been declared in the Operational BIT for the NAV that results in the NAV being declared DEGRADED.	ACK
2	NAV OUT	A failure has been declared in the Operational BIT for the NAV that results in the NAV being declared OUT.	ACK
2	NAV POS UPDATE NO LONGER REQ	Displayed when the INU has indicated that the position update is now complete.	ACK
2	NAV POS UPDATE REQUIRED	Displayed when the INU has indicated that a position update is required.	ACK
2	NET BUSY CHECKFIRE	The operator has initiated a check fire and a communications network channel cannot be acquired.	RETRY NO RETRY
2	NET BUSY MTO DENY	The operator has initiated an abort fire mission and a communications network channel cannot be acquired.	RETRY NO RETRY
2	NET BUSY READY	The operator has indicated ready during an AMC fire mission and a communications network channel cannot be acquired.	RETRY NO RETRY

DFCS BLOCK 1A MESSAGES/ALERTS

PRIORITY	MESSAGE/ALERT	DESCRIPTION	RESPONSE
2	NET BUSY READY - NL	The operator has indicated ready during a PGM DNL fire mission and a communications network channel cannot be acquired.	RETRY NO RETRY
2	NET BUSY REQ INIT	The operator has initiated a request for initialization data and a communications network channel cannot be acquired.	RETRY NO RETRY
2	NET BUSY REQ VEH STS	The operator has initiated a request for vehicle status and a communications network channel cannot be acquired.	RETRY NO RETRY
2	NET BUSY ROUND COMP	The operator has indicated the last round of a multi round fire mission has been fired and a communications network channel cannot be acquired.	RETRY NO RETRY
2	NET BUSY SHOT	The operator has indicated the first round of a fire mission has been fired and a communications network channel cannot be acquired.	RETRY NO RETRY
2	NET BUSY SITE DATA	The operator has initiated a send site data and a communications network channel cannot be acquired.	RETRY NO RETRY
2	NET BUSY UTE - BAT	The DFCS has initiated either a UTE or BAT message and a communications network channel cannot be acquired.	RETRY NO RETRY
2	NET BUSY VEH STS	The operator has initiated a send vehicle status and a communications network channel cannot be acquired.	RETRY NO RETRY
2	NETBUSY REQ SITEDATA	The operator has initiated a request for site data and a communications network channel cannot be acquired.	RETRY NO RETRY
2	NO ACK CHECKFIRE	The operator has initiated a check fire and the FDC software did not acknowledge the receipt of the message.	RETRY NO RETRY
2	NO ACK MTO DENY	The operator has initiated an abort fire mission and the FDC software did not acknowledge the receipt of the message.	RETRY NO RETRY
2	NO ACK READY	The operator has indicated ready during an AMC fire mission and the FDC software did not acknowledge the receipt of the message.	RETRY NO RETRY
2	NO ACK READY - NL	The operator has indicated ready during a PGM DNL fire mission and the FDC software did not acknowledge the receipt of the message.	RETRY NO RETRY
2	NO ACK REQ INIT	The operator has initiated a request for initialization data and the FDC software did not acknowledge the receipt of the message.	RETRY NO RETRY
2	NO ACK REQ SITE DATA	The operator has initiated a request for site data and the FDC software did not acknowledge the receipt of the message.	RETRY NO RETRY

2-68 DFCS BLOCK 1A LIST OF ABBREVIATIONS/ACRONYMS AND MESSAGES/ALERTS (cont)

DFCS BLOCK 1A MESSAGES/ALERTS

PRIORITY	MESSAGE/ALERT	DESCRIPTION	RESPONSE
2	NO ACK REQ VEH STS	The operator has initiated a request for vehicle status and the FDC software did not acknowledge the receipt of the message.	RETRY NO RETRY
2	NO ACK ROUND COMP	The operator has indicated the last round of a multi round fire mission has been fired and the FDC software did not acknowledge the receipt of the message.	RETRY NO RETRY
2	NO ACK SHOT	The operator has indicated the first round of a fire mission has been fired and the FDC software did not acknowledge the receipt of the message.	RETRY NO RETRY
2	NO ACK SITE DATA	The operator has initiated a send site data and the FDC software did not acknowledge the receipt of the message.	RETRY NO RETRY
2	NO ACK UTE - BAT	The DFCS has initiated either a UTE or BAT message and the FDC software did not acknowledge the receipt of the message.	RETRY NO RETRY
2	NO ACK VEH STS	The operator has initiated a send vehicle status and the FDC software did not acknowledge the receipt of the message.	RETRY NO RETRY
2	OKAY TO SHOOT OR MOVE	Displayed one time every power cycle when the PNS reports it has transitioned from alignment mode to survey mode and the DFCS has been initialized (all astericks cleared).	ACK
2	OVERIDE LOBAT PWROFF	The life left in the battery has been determined to be less than 10 minutes based on the state of charge and temperature read from the PCCM during the Operational BIT.	YES NO
2	PNS DISCONNECTED	A cable loopback check has determined that the INU is disconnected. This shall appear only once per disconnect.	ACK
2	PROP TEMP UPDATE REQUIRED	The UPDATE ALERT TIME counter has reached zero.	ACK
2	RESET COMMS COMPLETE	System has determined COMMS has been reset.	ACK
2	SEND RING?	The operator pressed the LASE key on the CSD for 1.5 seconds.	YES NO
2	SET FUZE MANUALLY	Displayed once during any given IFS OUT cycle and when the IFS has been determined OUT and the Fire mission fuze can be set manually.	ACK

DFCS BLOCK 1A MESSAGES/ALERTS

PRIORITY	MESSAGE/ALERT	DESCRIPTION	RESPONSE
2	ZEROIZE GPS COMPLETE	The EPIAFS message Auto-return Zeroize Crypto Key Status is received with a success status for the GPS.	ACK
2	ZEROIZE GPS FAILED	The EPIAFS message Auto-return Zeroize Crypto Key Status is received with a failed status for the GPS.	ACK
2	ZEROIZE IFS COMPLETE	The EPIAFS message Auto-return Zeroize Crypto Key Status is received with a success status for the IFS.	ACK
2	ZEROIZE IFS FAILED	The EPIAFS message Auto-return Zeroize Crypto Key Status is received with a failed status for the IFS.	ACK
2	ZEROIZE NO RESPONSE	The EPIAFS message Auto-return Zeroize Crypto Key Status is not received within 20 seconds.	ACK
2	ZUPT NO LONGER REQUIRED	Displayed when the INU has indicated that the ZUPT is now complete.	ACK
2	ZUPT REQUIRED	Displayed when the INU has indicated that a ZUPT is required.	ACK
3	ABORT ARE YOU SURE?	The Operator selected Abort from the Fire Mission screen.	YES NO
3	CHANGE COMM CONFIG?	The Operator selected COMMUNICATION CONFIGURATION from the Network Setup screen.	YES NO
3	CHANGE HEMISPHERE?	The Operator selected CHANGE HEMISPHERE in the NAV Update or Manual Move Order screen.	YES NO
3	CHANGE TO 2 WIRE?	The Operator selected DEVICE and the current setting is SINCGARS.	YES NO
3	CHANGE TO AZIMUTH?	The Operator selected DISPLAY TUBE and DEFLECTION shall be as currently set	YES NO
3	CHANGE TO BACKUP?	The Operator selected CONTROL from the Network Address Setup screen.	YES NO
3	CHANGE TO DEFLECTION	The Operator selected DISPLAY TUBE and AZIMUTH is currently set.	YES NO
3	CHANGE TO PRIMARY?	The Operator selected CONTROL from the Network Address Setup screen.	YES NO
3	CHANGE TO SINCGARS?	The Operator selected DEVICE and the current setting is 2 WIRE.	YES NO
3	CHG TO DBL BLK MODE?	The Operator selected BLOCK MODE SELECTION from the Network Setup screen and the current setting is SINGLE.	YES NO
3	CHG TO SGL BLK MODE?	The Operator selected BLOCK MODE SELECTION from the Network Setup screen and the current setting is DOUBLE.	YES NO
3	CHKFIRE ARE YOU SURE	The Operator selected SEND CHECKFIRE from the Operational Main Menu or Fire Mission screen.	YES NO

2-68 DFCS BLOCK 1A LIST OF ABBREVIATIONS/ACRONYMS AND MESSAGES/ALERTS (cont)

DFCS BLOCK 1A MESSAGES/ALERTS

PRIORITY	MESSAGE/ALERT	DESCRIPTION	RESPONSE
3	CLEAR *ASTERISKS* TO CONTINUE	The Operator pressed USE ALL and all asterisks have not been cleared.	ACK
3	CONFIRM POSN UPDATE?	The Operator entered a position and the horizontal or vertical distance between the entered position update and the current position is greater than 100 meters.	YES NO
3	CONFIRM RANGE?	The Operator has pressed USE ALL and the NAV is not OUT in the Manual Move Order screen.	YES NO
3	DELETE ADDRESS?	The Operator has placed the cursor box around an address to be deleted and pressed the DELETE key in the Network Address Setup screen.	YES NO
3	DESTINATION NOT VALID	The position entered by the Operator is not valid as indicated by Range being greater than 350,000 meters.	ACK
3	DISABLE RELAYER?	The Operator selected INTRANET RELAYER from the Network Setup screen and the current setting is ENABLED.	YES NO
3	DUPLICATE VALUE - REENTER	The Operator entered a duplicate URN address or RANK in the Network Address Setup screen.	ACK
3	ENABLE RELAYER?	The Operator selected INTRANET RELAYER from the Network Setup screen and the current setting is DISABLED.	YES NO
3	EOM ARE YOU SURE?	The Operator selected EOM from the Fire Mission screen.	YES NO
3	ERROR-LEFT AND RIGHT EQUAL	The SITE data segment being entered results in the LEFT and RIGHT fields being equal and "ENTER" is pressed by operator.	ACK
3	ERROR-SEGMENT OVERLAP	The SITE data segment being input overlaps a segment previously input and "ENTER" is pressed by operator.	ACK
3	GET INIT DATA?	The Operator selected GET INIT DATA from FDC Data Transfer screen.	YES NO
3	GET PIECE STATUS?	The Operator selected GET PIECE STATUS from FDC Data Transfer screen.	YES NO
3	GET SITE DATA?	The Operator selected GET SITE DATA from FDC Data Transfer screen.	YES NO
3	GPS/POSN UPDT DISAGREE	The Operator entered a position with GPS Aiding available and the position entered is greater than 10 meters from the GPS position.	ACK
3	INCOMPLETE ADDRESS "XXXXXXX"	The Operator has pressed USE ALL and the URN or the RANK are not complete in the Network Address Setup screen.	ACK

DFCS BLOCK 1A MESSAGES/ALERTS

PRIORITY	MESSAGE/ALERT	DESCRIPTION	RESPONSE
3	INVALID DTG VALUE	The Operator entered an invalid DTG.	ACK
3	MAINT ARE YOU SURE?	The Operator selected MAINTENANCE from the Operational Mode Select screen.	YES NO
3	NOT SUPPORTED BY THIS HARDWARE	The Operator selected USE NET BUSY DETECT from the Network Setup screen.	ACK
3	NUMBER OF STATIONS SET TO "XX"	The RANK entered exceeds the NUMBER OF STATIONS value entered on the Network Setup screen.	ACK
3	PERFORM SETTER CHECK	The Operator selected PERFORM SETTER CHECK from the IFS Setup/Info Screen.	YES NO
3	POSITION NOT VALID	The Operator entered a position that is not convertible to its natural Grid Zone.	ACK
3	RESET ARE YOU SURE?	The Operator selected RESET COMMS from the Operational Main Menu screen.	YES NO
3	RESTRT ARE YOU SURE?	The Operator has selected SYSTEM RESTART from the Operational Main Menu or Maintenance Menu screen.	YES NO
3	SEND PIECE STATUS?	The Operator selected SEND PIECE STATUS from FDC Data Transfer screen.	YES NO
3	SEND SITE DATA?	The Operator selected SEND SITE DATA from FDC Data Transfer screen.	YES NO
3	SHTDWN ARE YOU SURE?	The Operator selected shutdown from the Operational Mode Select, Operational Main Menu, or Maintenance Menu screen.	YES NO
3	TURN NET BUSY OFF?	The Operator selected NET BUSY SENSE OVERRIDE from the Network Setup screen and the current setting is ON.	YES NO
3	TURN NET BUSY ON?	The Operator selected NET BUSY SENSE OVERRIDE from the Network Setup screen and the current setting is OFF.	YES NO
3	USE NET BUSY DETECT?	The Operator selected USE NET BUSY DETECT from the Network Setup screen.	YES NO
3	VALUE TOO BIG	A numeric field has been entered by the operator with a value that is larger than the upper limit for acceptable range.	ACK
3	VALUE TOO SMALL	A numeric field has been entered by the operator with a value that is smaller than the lower limit for acceptable range.	ACK
3	ZEROIZE ARE YOU SURE	The Operator selected ZEROIZE IFS from the Operational Main Menu Screen.	YES NO

2-69 INITIALIZATION PROCEDURES



WARNING

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



TDC0450

NOTES

Before initializing the DFCS, ensure the following are completed:

- Howitzer left wheel is within 1 yard (1m) of the 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 (1m) of SCP.
- 2 Turn PCCM (1) on by, pulling out and rotating the functional control switch (2) counter clock wise to the ON position.

NOTES

DAGR internal power batteries are not required while using external power, but may remain installed when using external power. If batteries are removed, the battery pack should remain installed to seal the battery compartment. The memory battery should always remain installed.

If the DFCS system requires an external power source and/or batteries require charging (PCCM state of charge indicator is showing below 50%), 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:

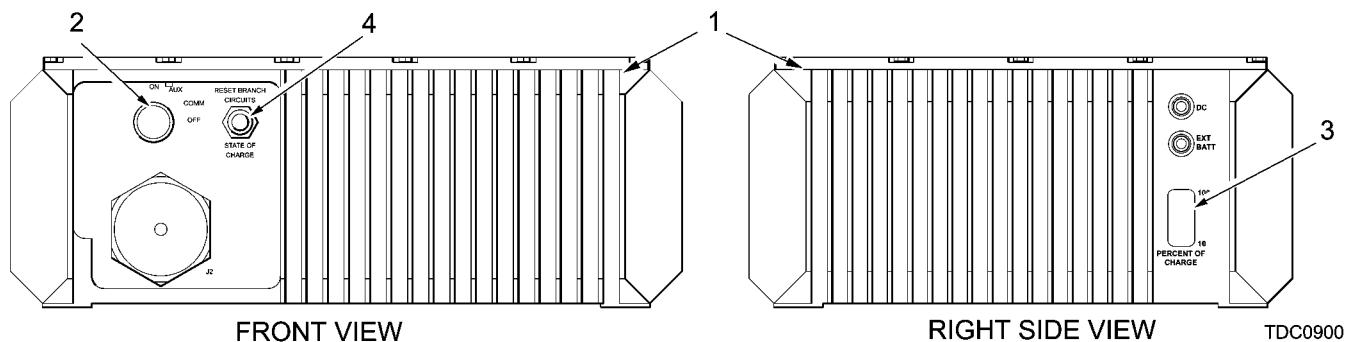
Incorrect rpm may not provide the sufficient power to charge the DFCS batteries.

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

If there is no reading on the State Of Charge (SOC) indicator (3), reset RESET BRANCH CIRCUITS/STATE OF CHARGE on front of PCCM. If no power indicated on PCCM, see Chap 3, Sect II (Troubleshooting).

If the SOC indicator is 50% or more, continue with initialization procedure, if indicator is below 50%, connect power [W3] cable and charge batteries (startup prime mover engine).

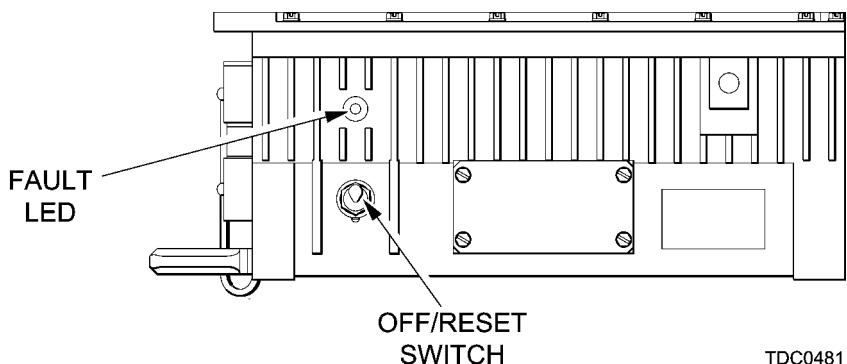
- 3 Press RESET BRANCH CIRCUITS/STATE OF CHARGE (4) and check SOC indicator (3).



NOTE

During initialization process, FAULT LED (5) will be illuminated. Upon completion of initialization process (approximately 90 seconds), if no faults are detected, FAULT LED will extinguish.

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



NOTES

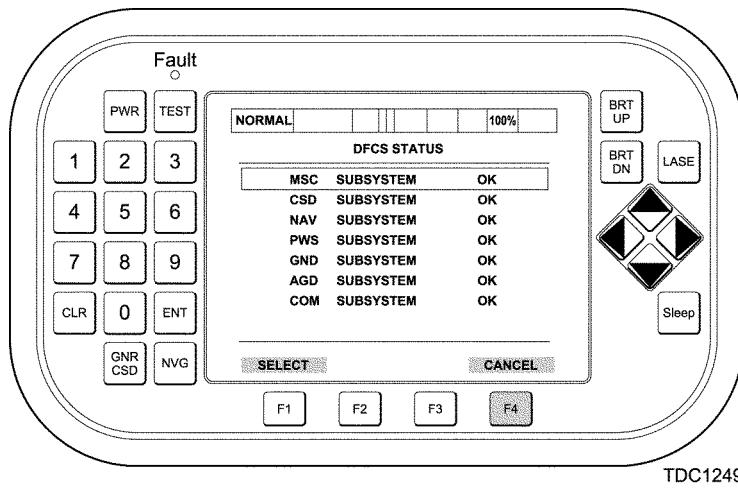
DFCS will power up and automatically perform its Built-In-Test (BIT). On completion of the BIT the CSD screen will display DFCS STATUS.

DISCONNECTED may appear on NAV, GND, AGD and COM status lines indicating the subsystem is not connected.

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

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

2-69 INITIALIZATION PROCEDURES (cont.).

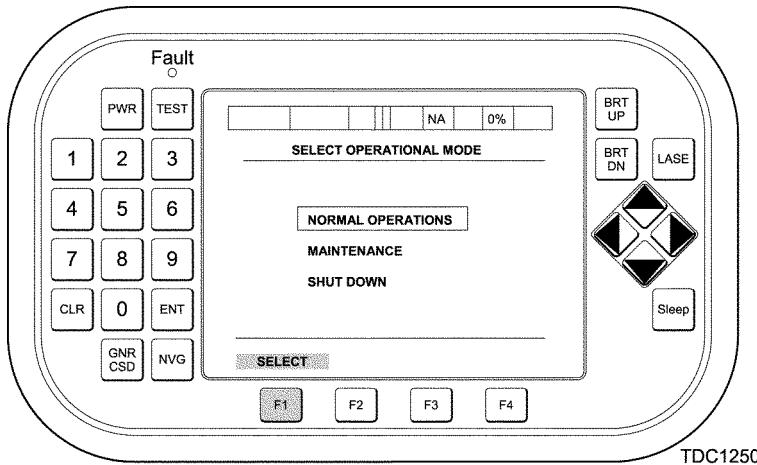


TDC1249

NOTE

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

- 5 Select NORMAL OPERATIONS and press SELECT F1 key.



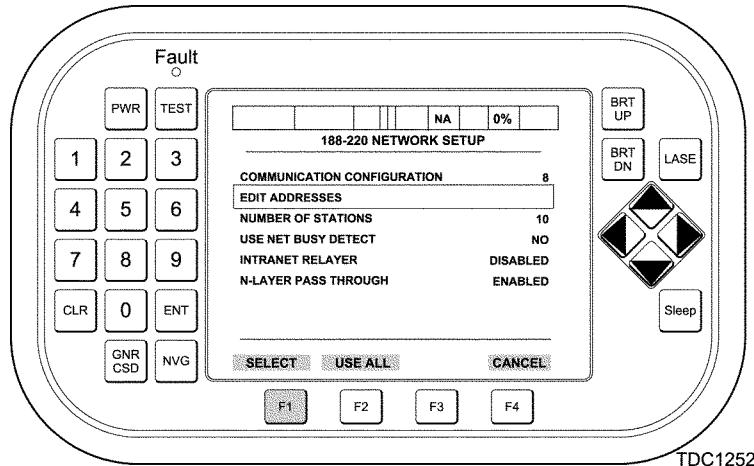
TDC1250

NOTES

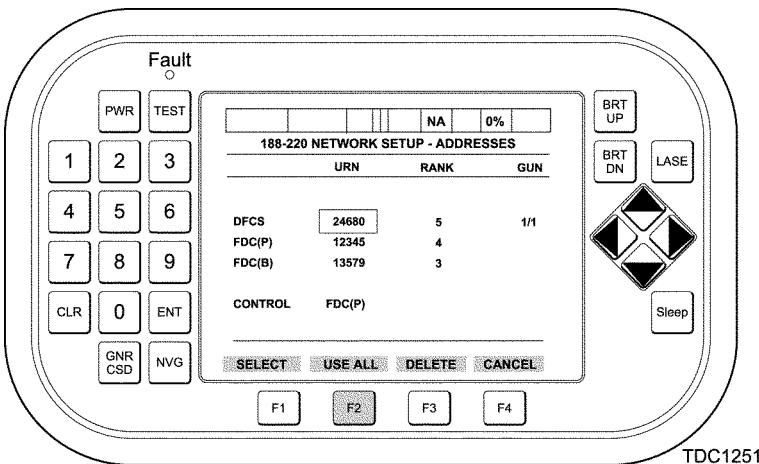
NETWORK SETUP will be displayed. This allows the SC to verify his means of communicating with the FDC.

If the Communications Configuration, Edit Addresses, Number of Stations, Use Net Busy Detect, and Intranet Relayer are correct go to step 16. If Communications Configuration, Edit Addresses, Number of Stations, Use Net Busy Detect, and Intranet Relayer is not correct go to step 6.

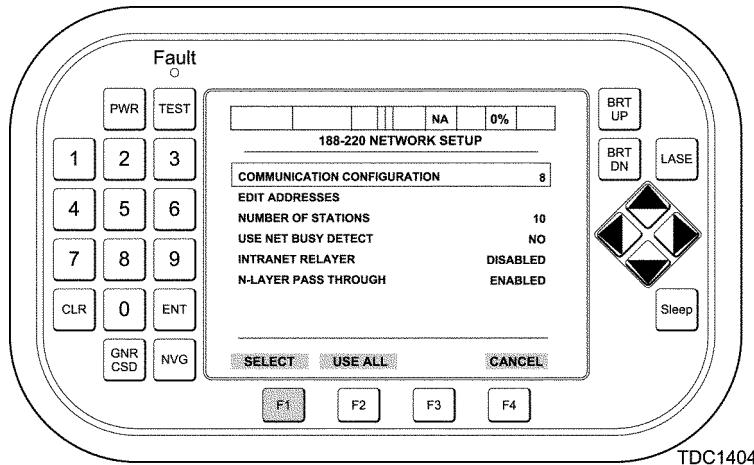
- 6 Select **EDIT ADDRESSES**, press **SELECT F1** key.



- 7 Enter INFORMATION PROVIDED BY FDC, when complete press **USE ALL F2** key.

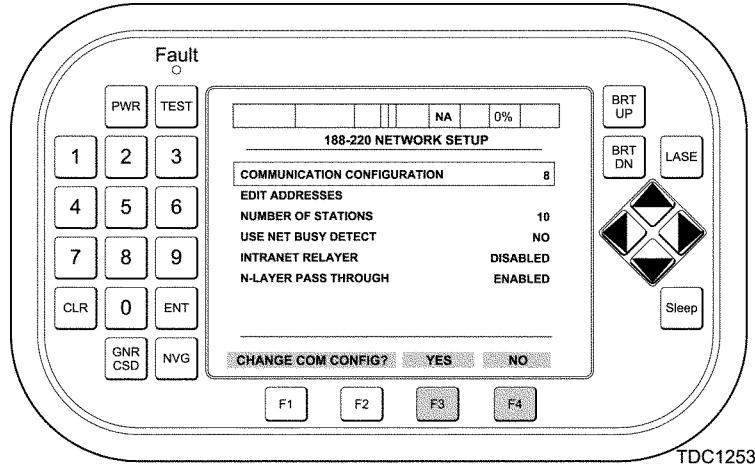


- 8 Select **COMMUNICATION CONFIGURATION**, press **SELECT F1** key.



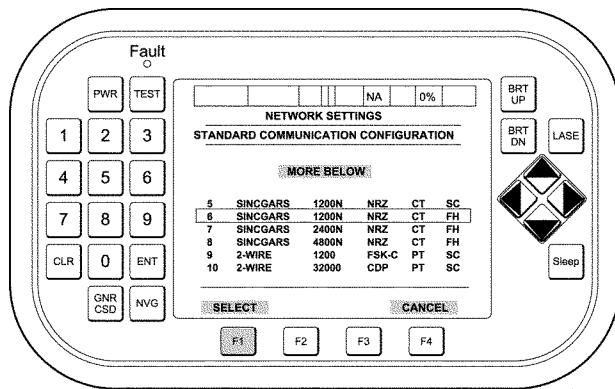
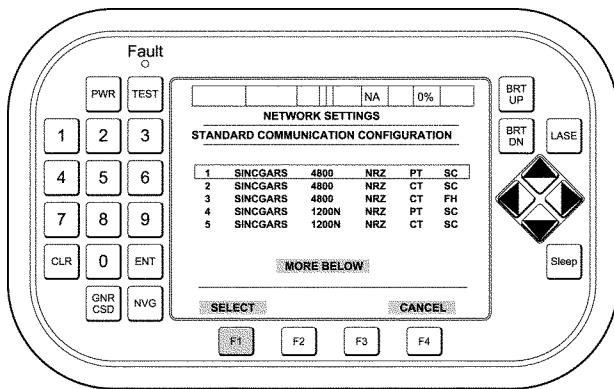
2-69 INITIALIZATION PROCEDURES (cont).

- 9** "CHANGE COMM CONFIG?", press YES F3 key or NO F4 key.



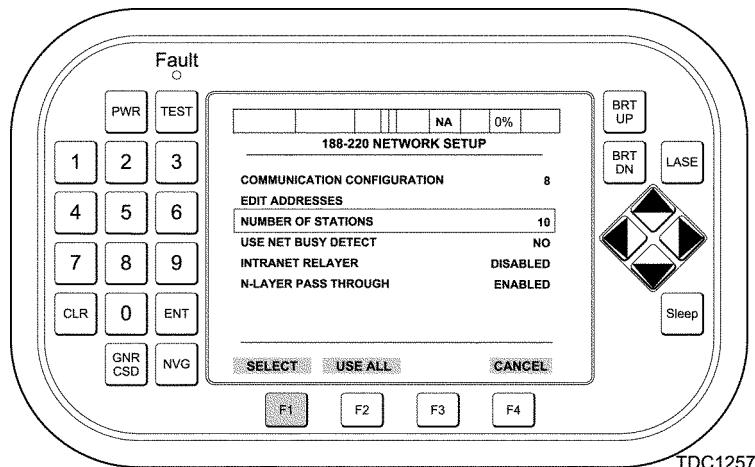
TDC1253

- 10** Select NETWORK SETTINGS based on information provided by FDC, press SELECT F1 key.



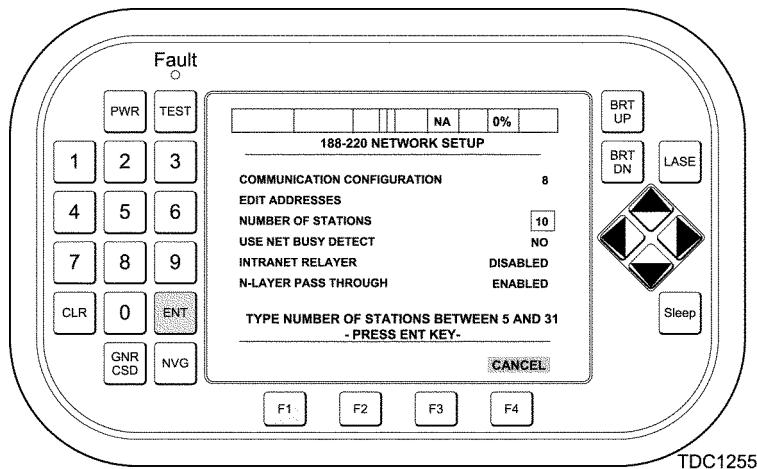
TDC1254

- 11** Select NUMBER OF STATIONS, press SELECT F1 key.



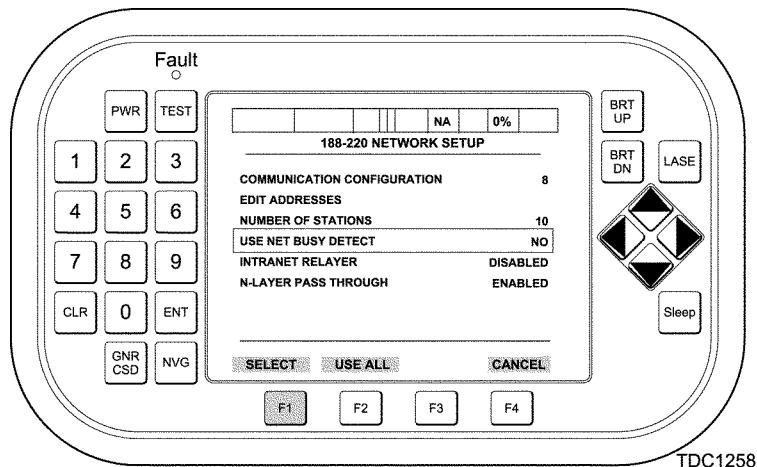
TDC1257

- 12 Type Station Number provided by FDC, press ENT key.



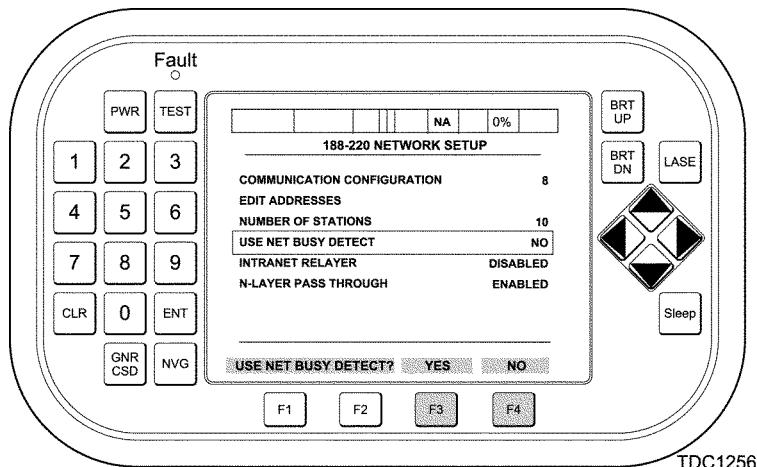
TDC1255

- 13 Select USE NET BUSY DETECT, press SELECT F1 key.



TDC1258

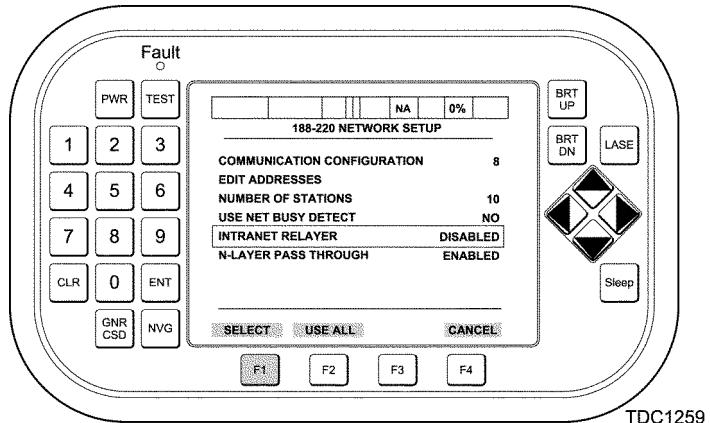
- 14 "USE NET BUSY DETECT?", press YES F3 key or NO F4 key.



TDC1256

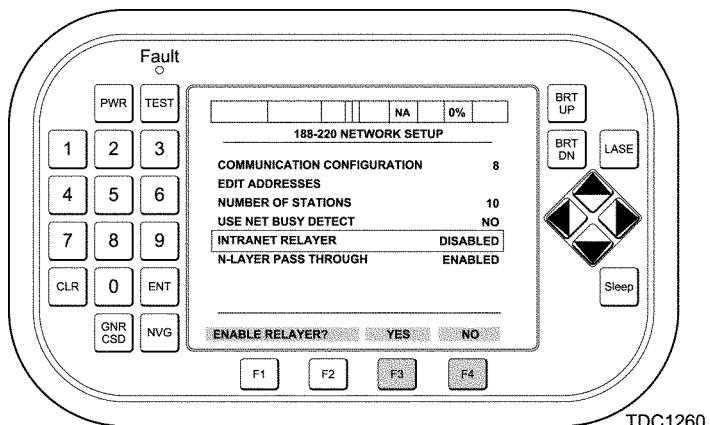
2-69 INITIALIZATION PROCEDURES (cont.).

- 15 Select **INTRANET RELAYER**, press **SELECT F1** key.



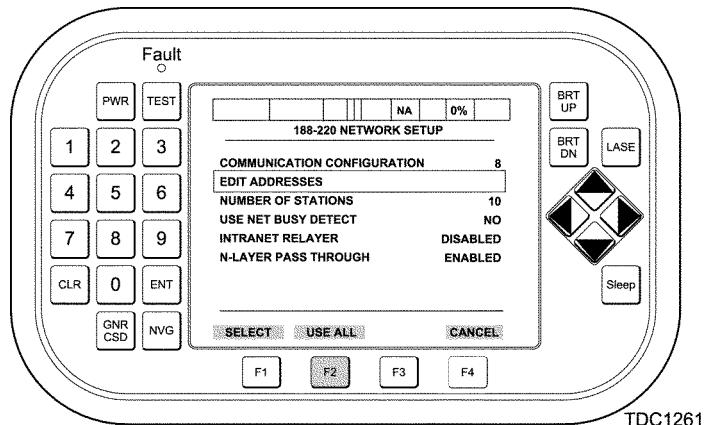
TDC1259

- 16 "ENABLE RELAYER?", press **YES F3** key or **NO F4** key.



TDC1260

- 17 Verify communication data is correct, press **USE ALL F2** key.

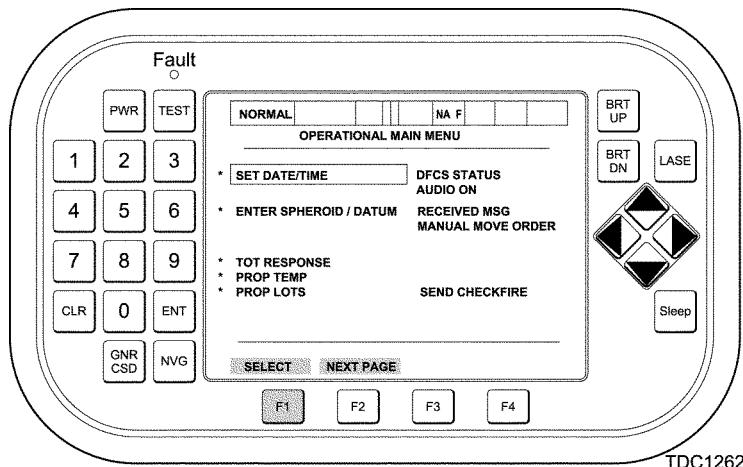


TDC1261

NOTE

Asterisk (*) indicates required item to be completed before the system shall be considered initialized. Asterisk (*) shall be removed after the operator verifies/changes data in the sub screen and then returns to the operational main menu.

- 18 Select ***SET DATE/TIME** and press **SELECT F1** key.

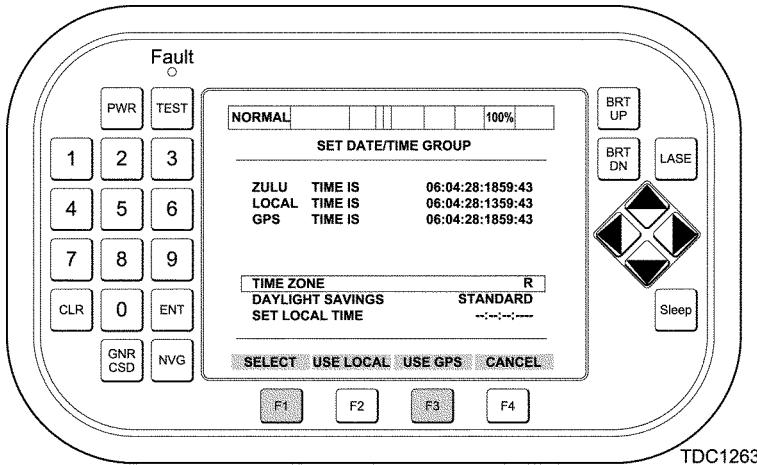


TDC1262

NOTE

If directed to Use GPS Time, press **USE GPS F3** key. This action will complete all SET DATE/TIME activities. Complete Step 19 and then proceed to step 25.

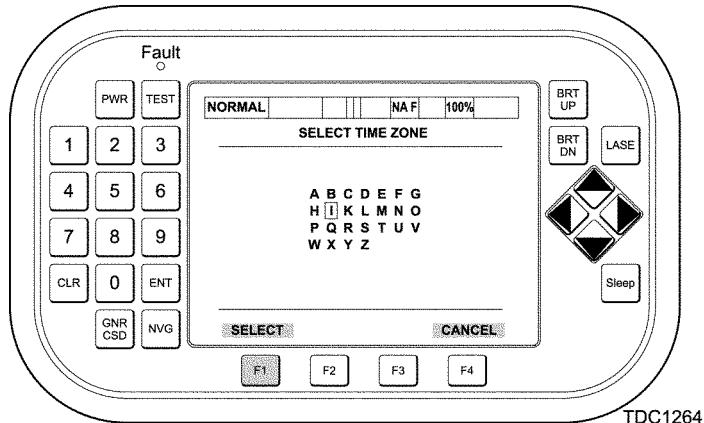
- 19 If directed by FDC, press **USE GPS F3** key, otherwise select **TIME ZONE** and press **SELECT F1** key.



TDC1263

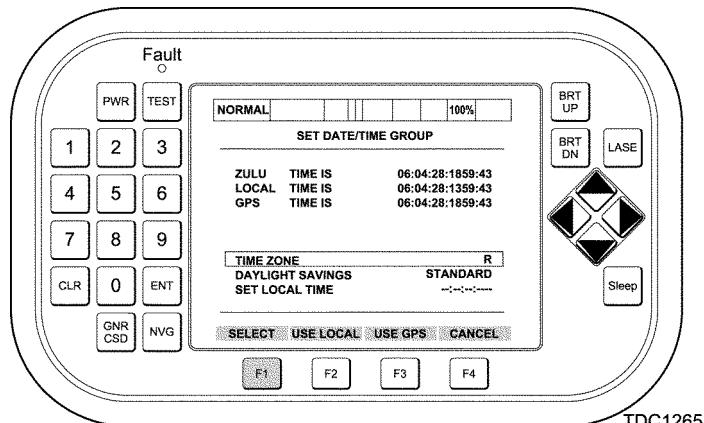
2-69 INITIALIZATION PROCEDURES (cont.).

- 20 Select TIME ZONE IDENTIFIER, press SELECT F1 key.



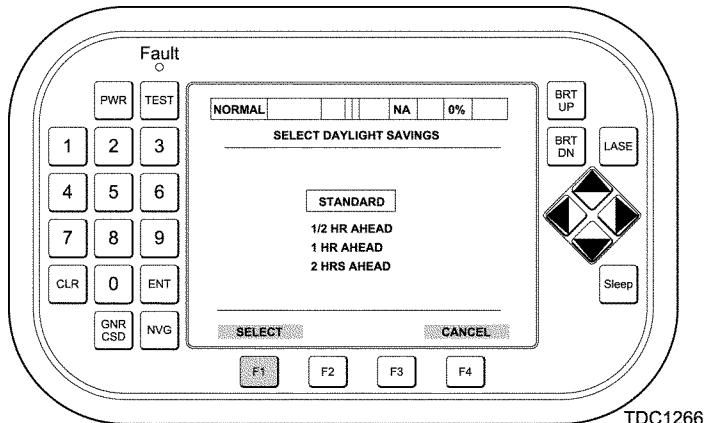
TDC1264

- 21 Select DAYLIGHT SAVINGS and press SELECT F1 key.



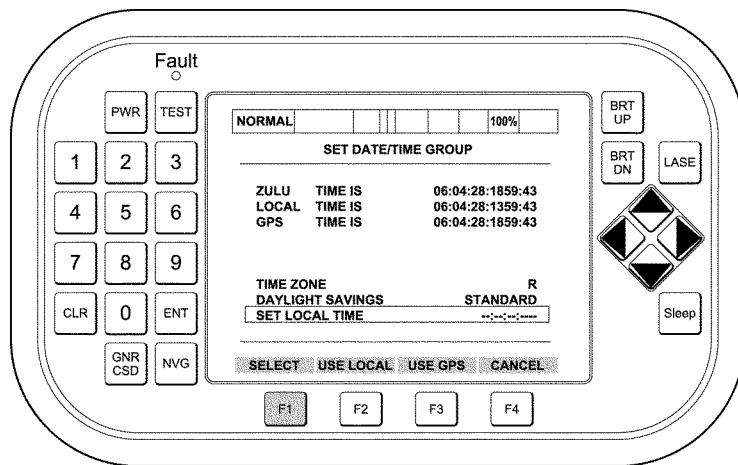
TDC1265

- 22 Select the appropriate item based on information provided by FDC, press SELECT F1 key.



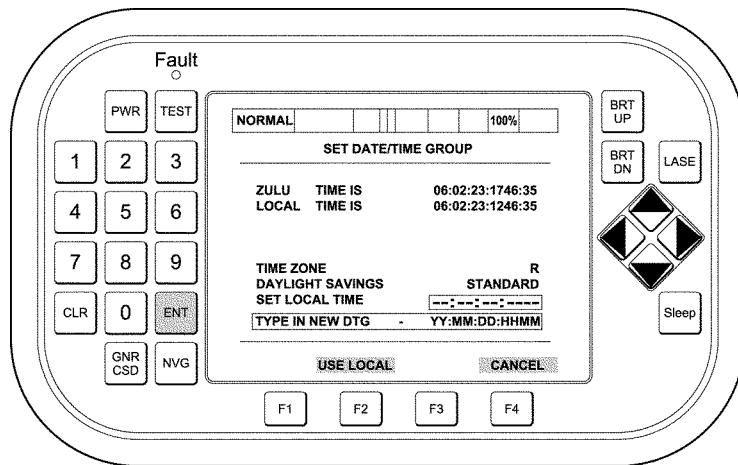
TDC1266

- 23 Select **SET LOCAL TIME**, press **SELECT F1** key.



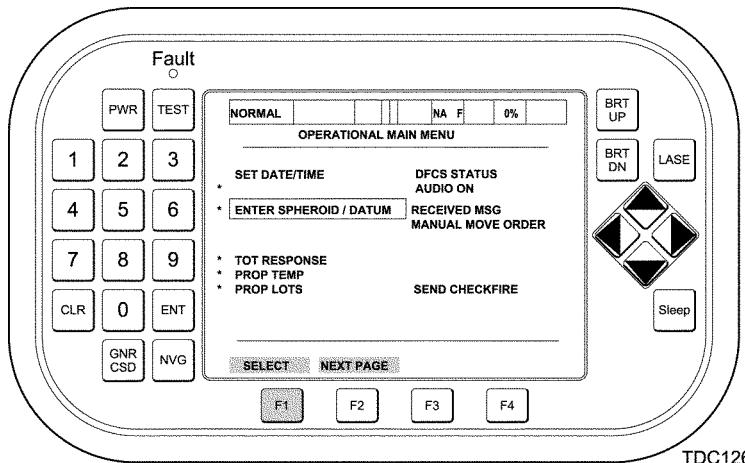
TDC1267

- 24 Type in new Date Time Group, press **ENT** key.



TDC1268

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



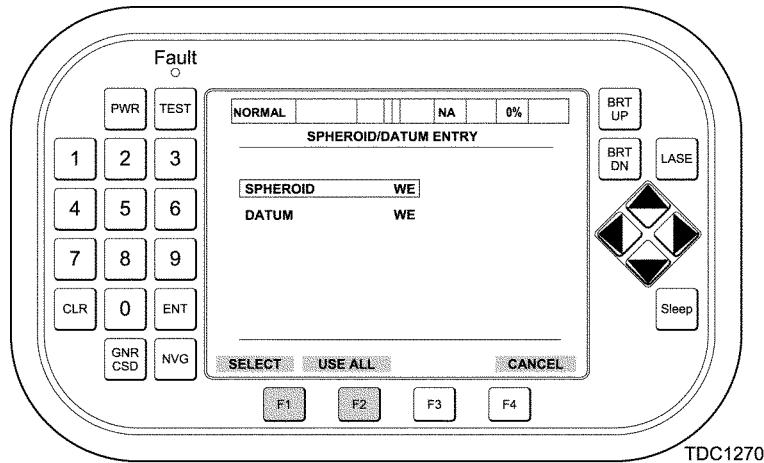
TDC1269

2-69 INITIALIZATION PROCEDURES (cont).

NOTE

If **SPHEROID WE** and **DATUM WE** are used, after verification proceed to Step 35. Steps 27-34 are only for User Defined SPHERIOD/DATUM entry.

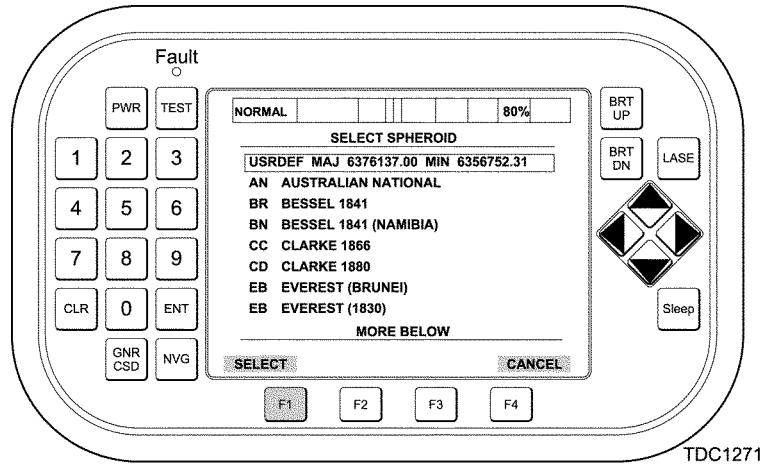
- 26** Verify spheroid and datum, press **USE ALL F2** key or select **SPHEROID** and press **SELECT F1** key for User Defined SPHEROID/DATUM entry.



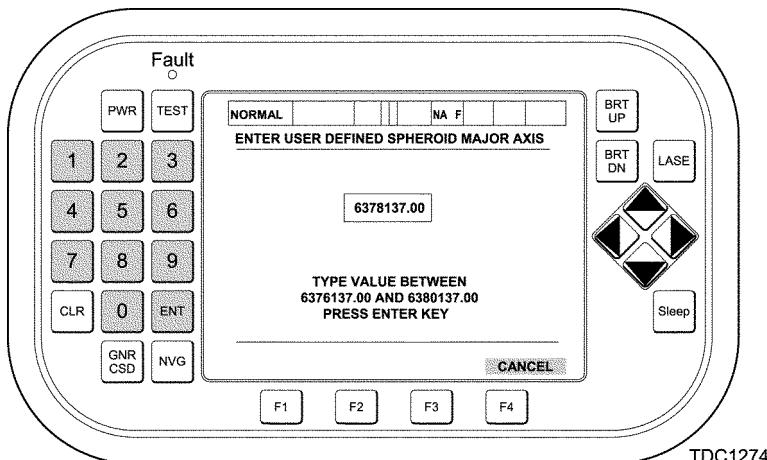
NOTE

The FDC will provide a Spheroid and Datum that is not listed on the **SELECT SPHEROID** or **SELECT DATUM** screens.

- 27** Select **USRDEF MAJ number MIN number**, press **SELECT F1** key.

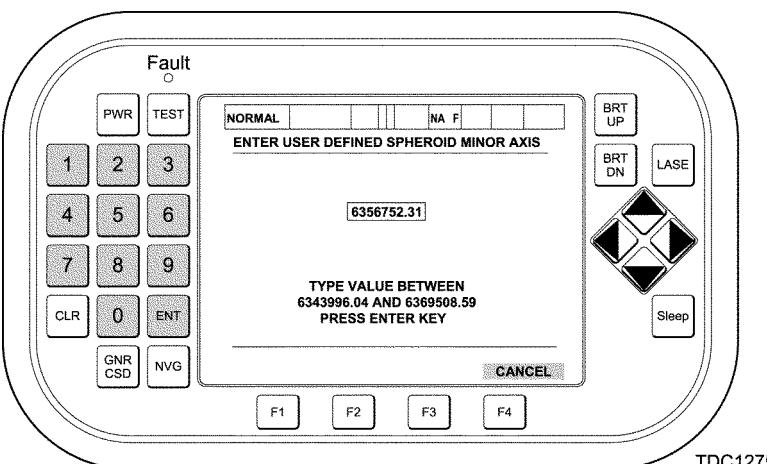


- 28 Enter user defined Spheroid Major Axis, press ENT key.



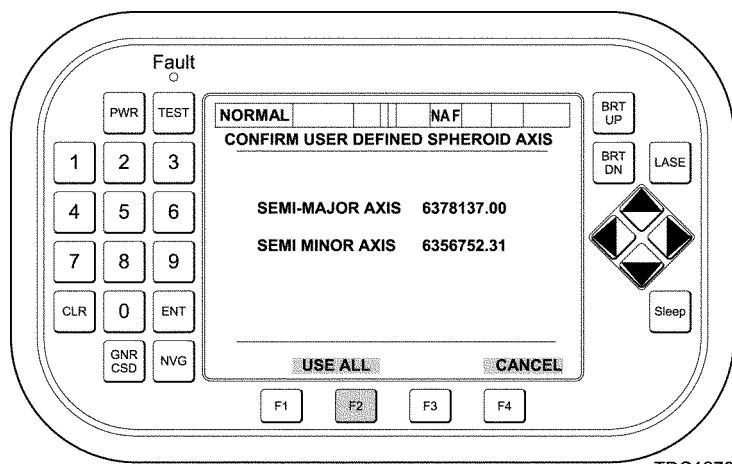
TDC1274

- 29 Enter user defined Spheroid Minor Axis, press ENT key.



TDC1275

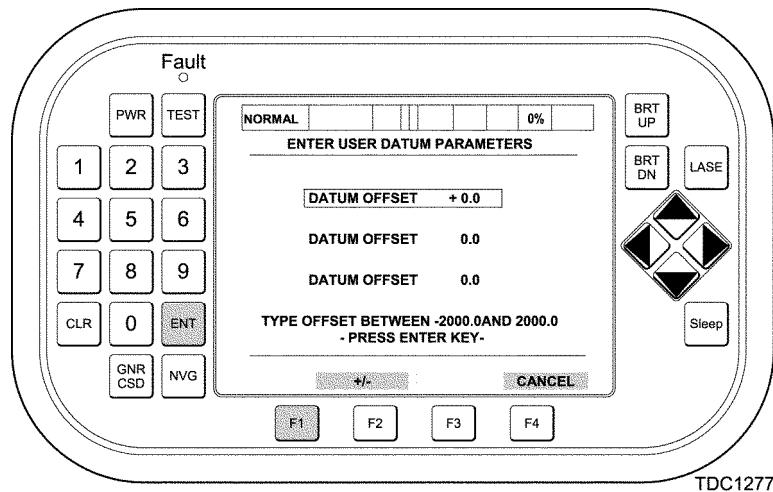
- 30 Confirm user defined Spheroid Axis by pressing USE ALL F2 key.



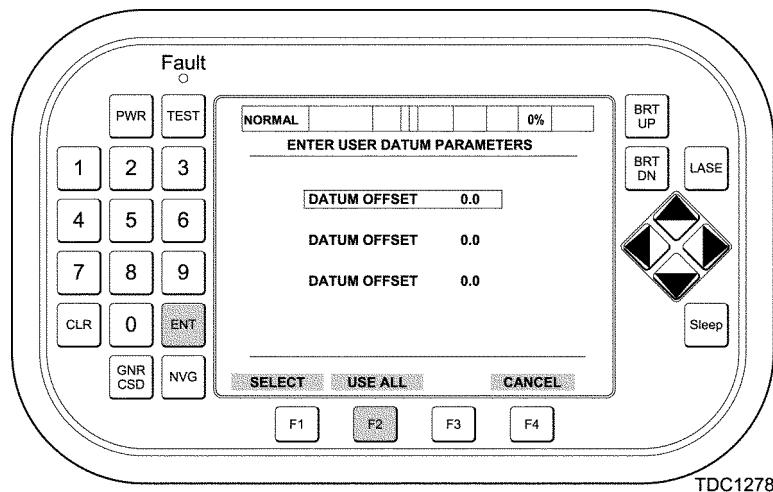
TDC1276

2-69 INITIALIZATION PROCEDURES (cont.).

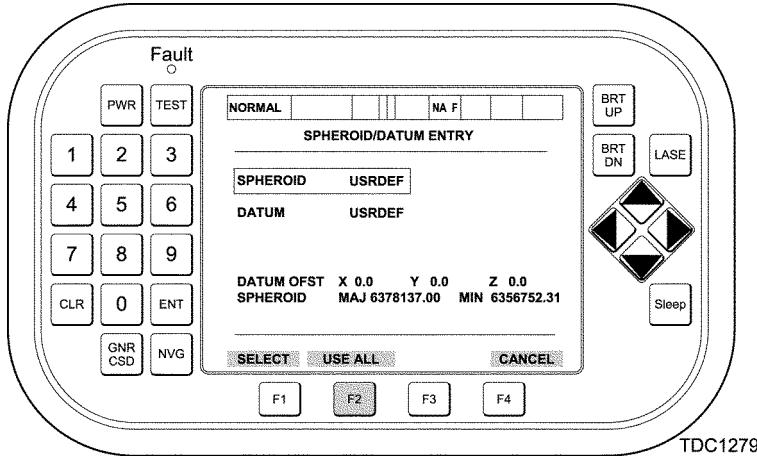
- 31 Select **DATUM**, press **SELECT F1** key. Select **USRDEF**, press **SELECT F1** key.
- 32 Select **DATUM X OFFSET**, press **SELECT F1** key, enter the offset value and press **ENT** key. Repeat for **DATUM Y OFFSET** and **DATUM Z OFFSET**.



- 33 Verify ENTER USER DATUM PARAMETERS data is correct, press **USE ALL F2** key.



- 34 Verify SPHEROID/DATUM ENTRY data is correct, press USE ALL F2 key. The screen will automatically transition to the NAVIGATION SUBSYSTEM UPDATE screen.



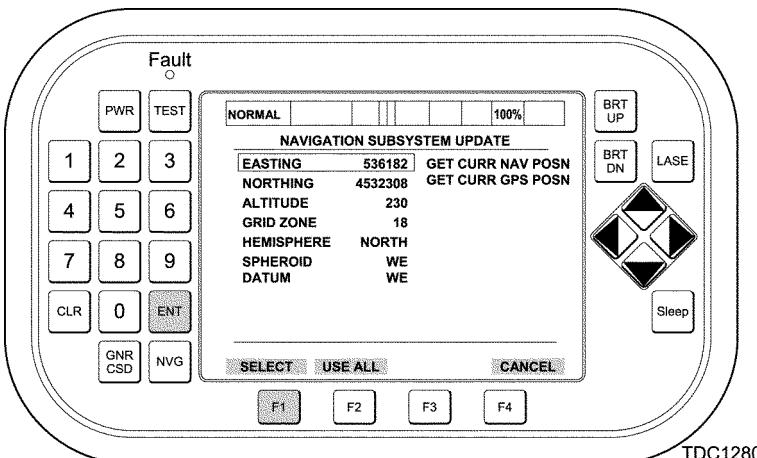
TDC1279

NOTES

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

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

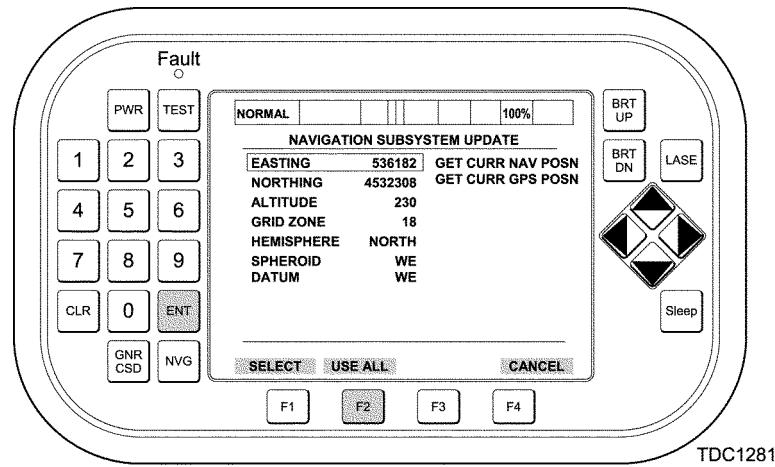
- 35 Select EASTING, press SELECT F1 key, enter data, and press ENT key. Repeat for NORTHING, ALTITUDE, HEMISPHERE, and GRID ZONE.



TDC1280

2-69 INITIALIZATION PROCEDURES (cont).

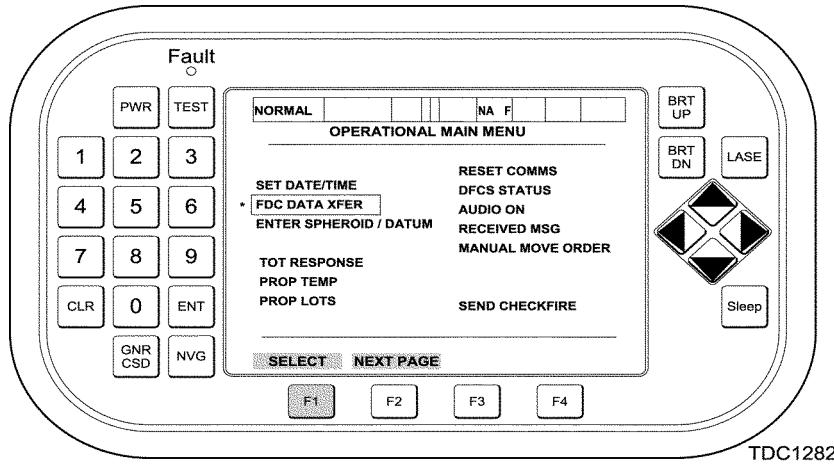
- 36 Verify data on the NAVIGATION SUBSYSTEM UPDATE screen, press **USE ALL F2** key. System will start alignment.



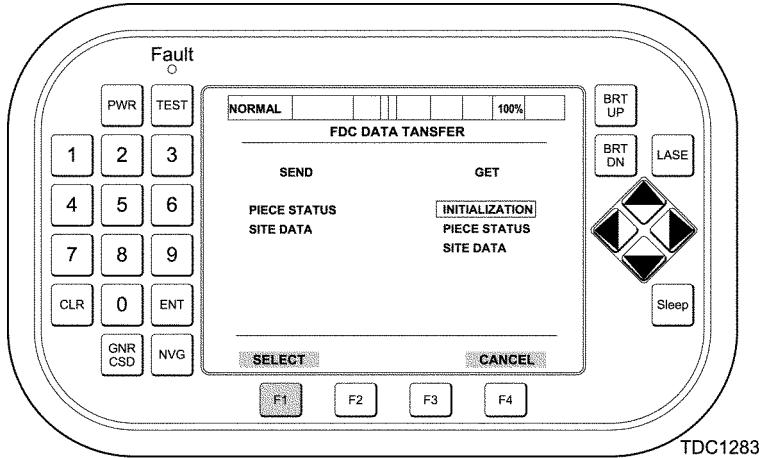
NOTE

Upon completion of alignment, the DFCS screen will automatically transition to the OPERATIONAL MAIN MENU Screen.

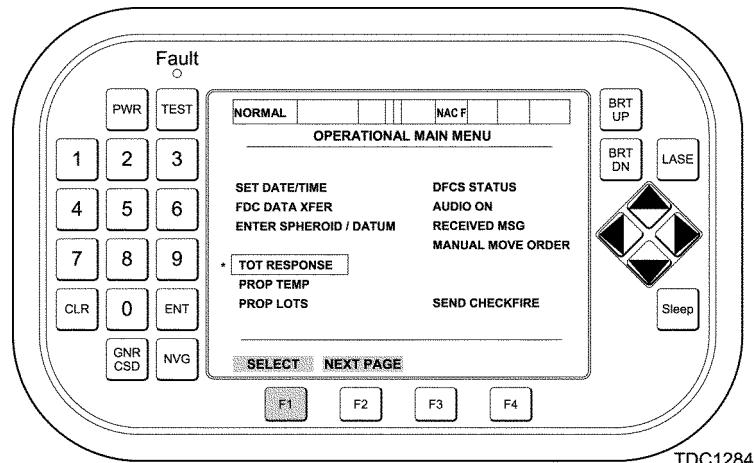
- 37 Select ***FDC DATA XFER** and press **SELECT F1** key.



- 38 Select the appropriate FDC DATA TRANSFER topic as directed by FDC, press **SELECT F1** key.

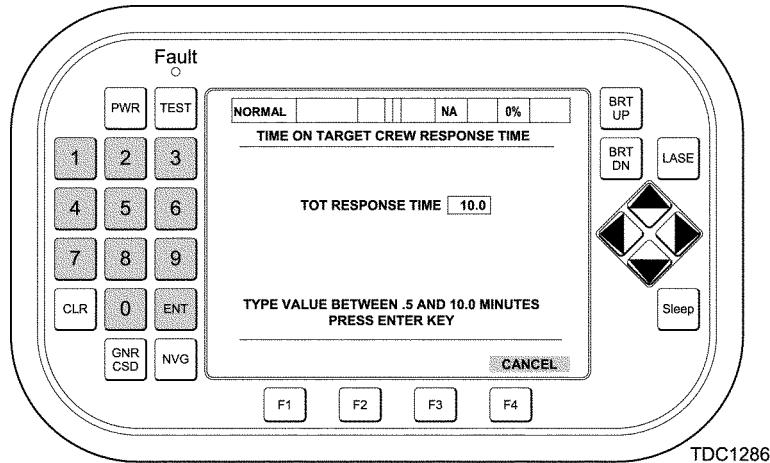


- 39 To transition from the FDC Data Transfer screen to the OPERATIONAL MAIN MENU screen, press **CANCEL F4** key.
- 40 At the OPERATIONAL MAIN MENU screen, select ***TOT RESPONSE** and press **SELECT F1** key.



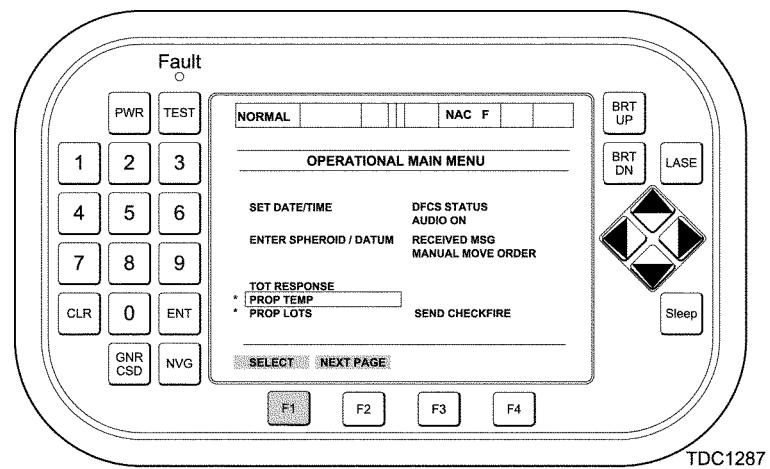
2-69 INITIALIZATION PROCEDURES (cont)

- 41 Type in a TOT RESPONSE TIME as directed by FDC, press **ENT** key. Screen will automatically transition to OPERATIONAL MAIN MENU.



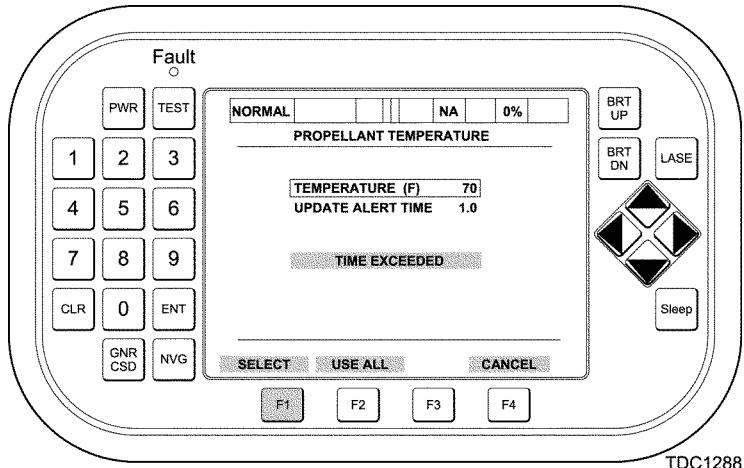
TDC1286

- 42 Select ***PROP TEMP**, press **SELECT F1** key.



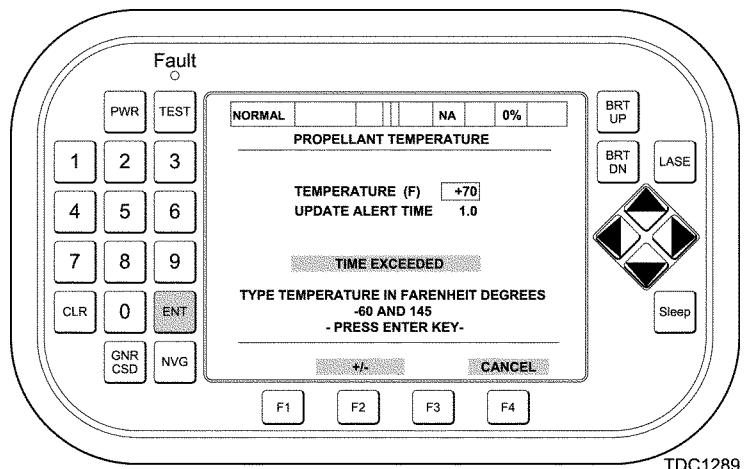
TDC1287

- 43 Select TEMPERATURE (F) nn, press SELECT F1 key.



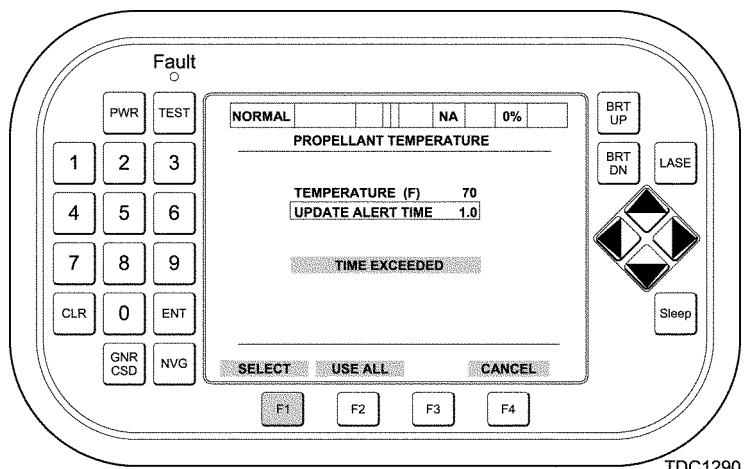
TDC1288

- 44 Type Temperature in Fahrenheit Degrees (-60 to +145), press ENT key.



TDC1289

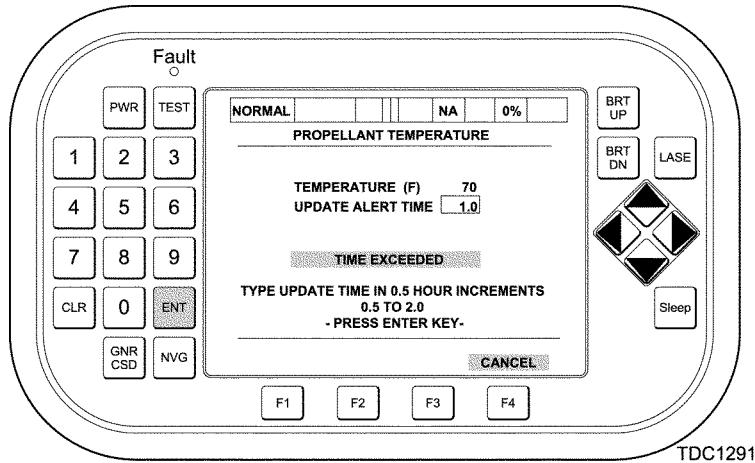
- 45 Select UPDATE ALERT TIME, press SELECT F1 key.



TDC1290

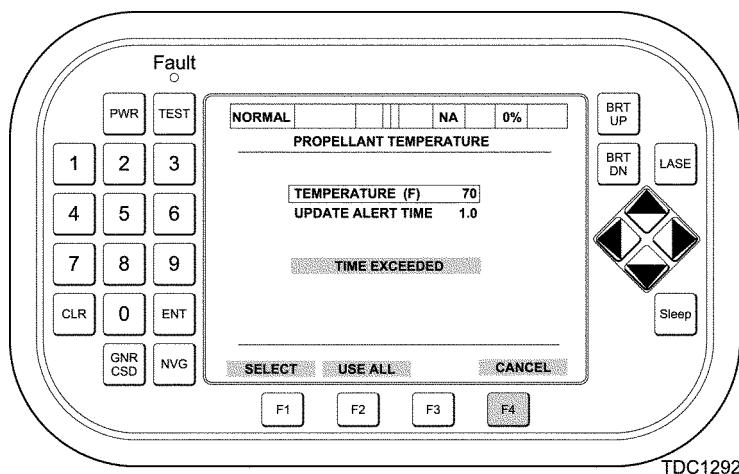
2-69 INITIALIZATION PROCEDURES (cont).

- 46 Type Update Time in 0.5 hour increments (0.5 to 2.0), press **ENT** key. Screen will automatically transition to the previous screen.



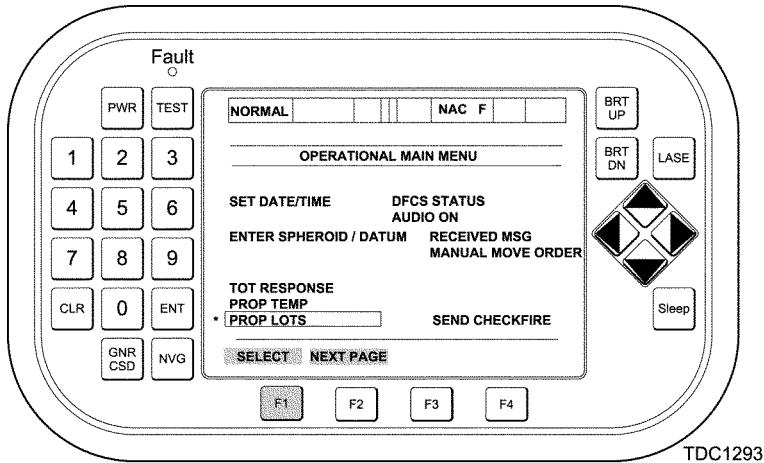
TDC1291

- 47 To transition to the OPERATIONAL MAIN MENU screen, press **CANCEL** **F4** key



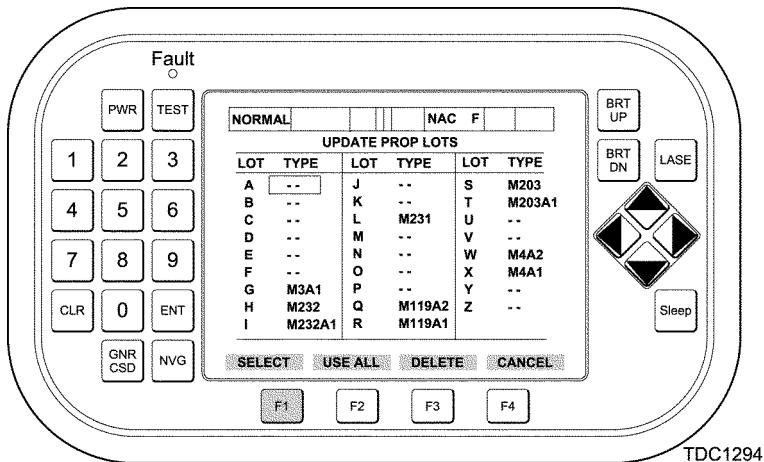
TDC1292

- 48 Select *PROP LOTS, press SELECT F1 key.



TDC1293

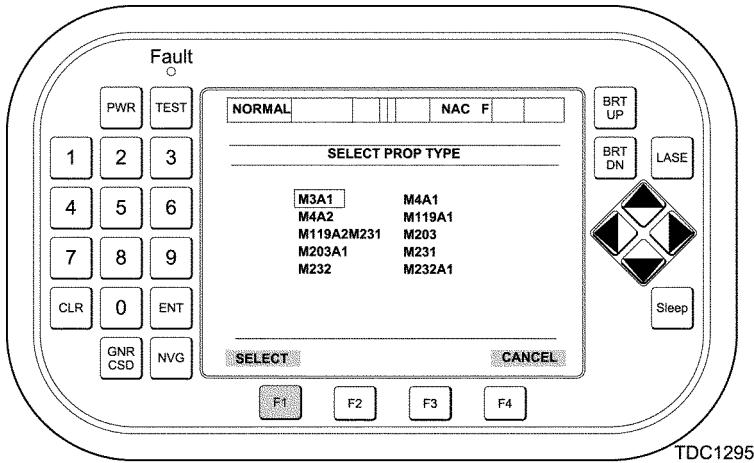
- 49 Select LOT DESIGNATOR based on information provided by FDC, press SELECT F1 key.



TDC1294

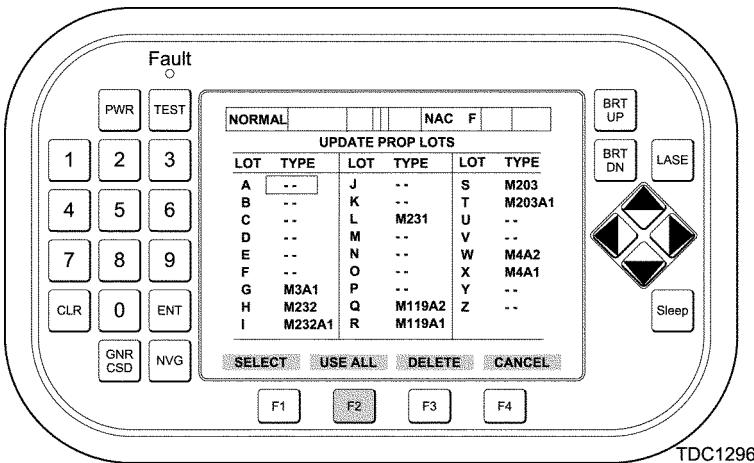
2-69 INITIALIZATION PROCEDURES (cont).

- 50 Select PROPELLANT TYPE based on information provided by FDC, press **SELECT F1** key.



TDC1295

- 51 Verify PROP LOT data is correct, press **USE ALL F2** key. Screen will automatically transition to the OPERATIONAL MAIN MENU.



TDC1296

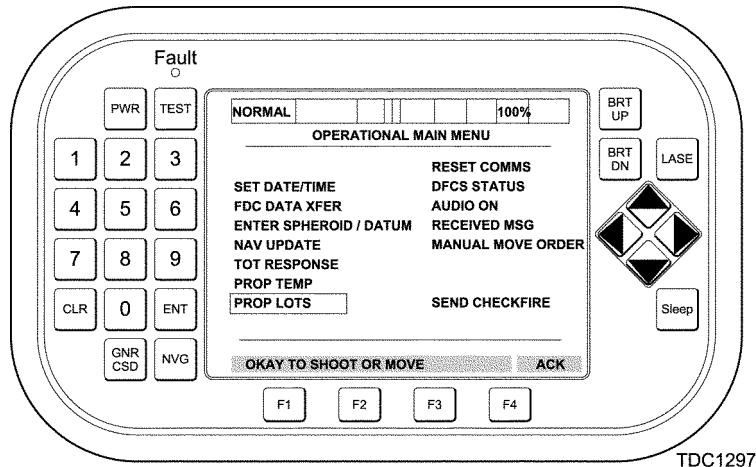
- 52 Verify PROP LOT data is correct, press **USE ALL F2** key. Screen will automatically transition to the OPERATIONAL MAIN MENU. Initialization of the DFCS is now complete.

2-70 MOVEMENT PROCEDURES

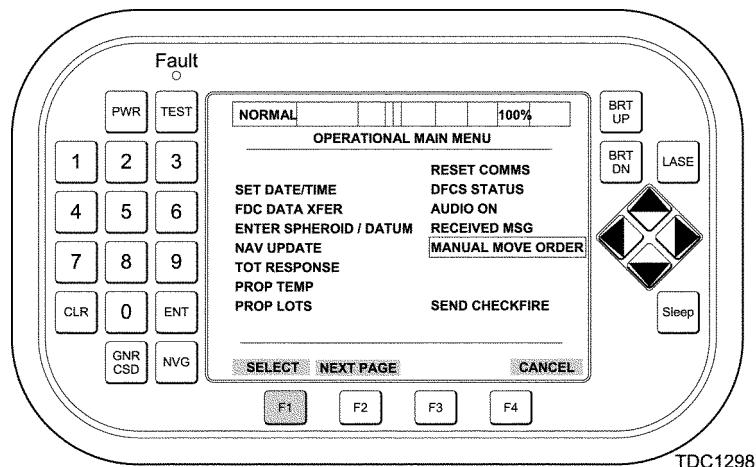
a. Move to a Fire Area/Point/Log/Init Point

NOTE

Once the DFCS has completed alignment count-down and all asterisk removed, an "OK TO SHOOT OR MOVE" alert will appear. SC can enter a move order that will allow the howitzer to move to a firing point/area and prepare for fire missions.



- 1 Select **MANUAL MOVE ORDER**, press **SELECT F1** key.



NOTES

If altitude is negative, enter value, select **± F2** key, press **ENT** key.

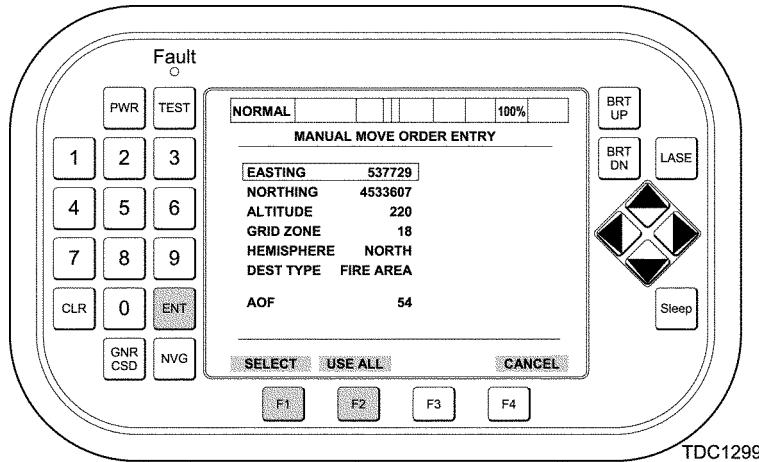
FIRE COMMANDS not available if:

- Moving.
- Destination is to a Initialization or Logistic Point.
- NAV is OUT, position data sent to INU and INU is aligning.

2-70 MOVEMENT PROCEDURES (cont)

a. Move to a Fire Area/Point/Log/Init Point (cont)

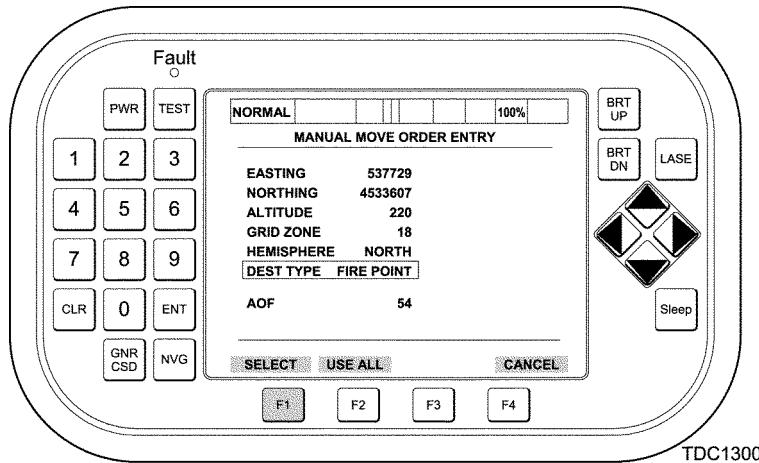
- 2 Select **EASTING**, press **SELECT F1** key, enter data, and press **ENT** key. Repeat with **NORTHING**, **ALTITUDE**, and **GRID ZONE**.



NOTE

Last entered **DEST TYPE** will be displayed. If 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.

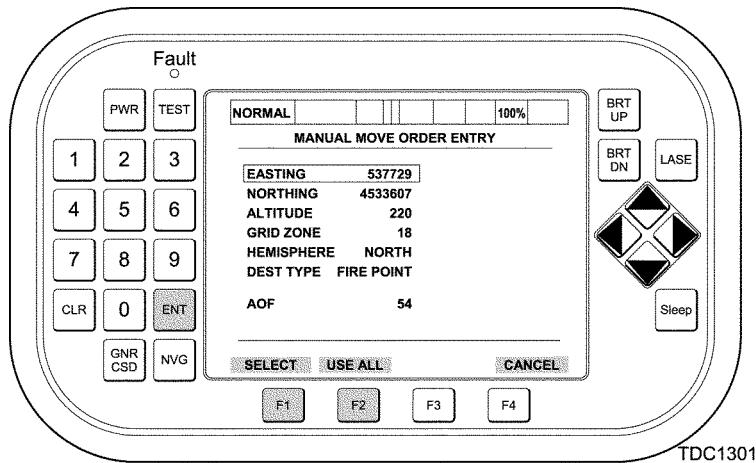


NOTE

A **RADIUS** must be entered if **FIRE AREA** is selected. 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.



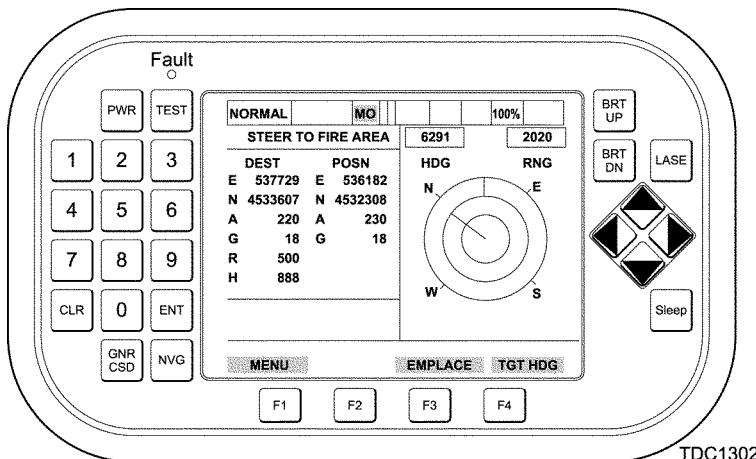
TDC1301

NOTES

STEER TO SCREEN will be displayed when INU detects movement.

During a move to designated Fire Area/Fire Point see paragraph 2-70b to conduct EMERGENCY FIRE MISSION (HIP SHOOT).

- 8 Move to designated area, Steer-To Graphics will automatically transition to Emplace Screen once howitzer enters into designated radius (Emplacement Area).

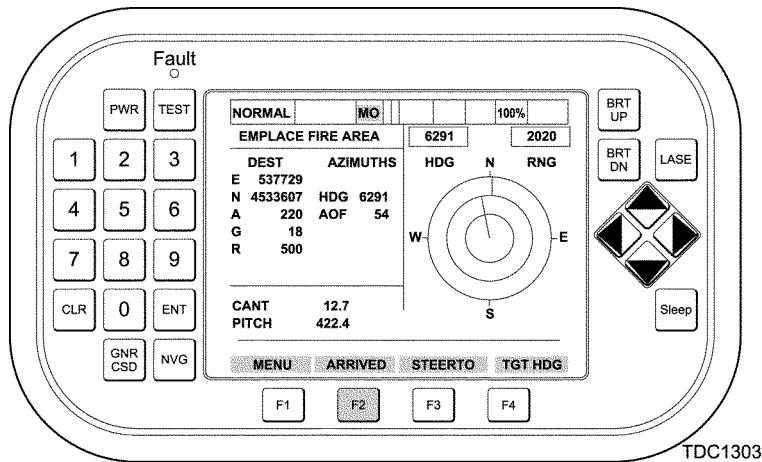


TDC1302

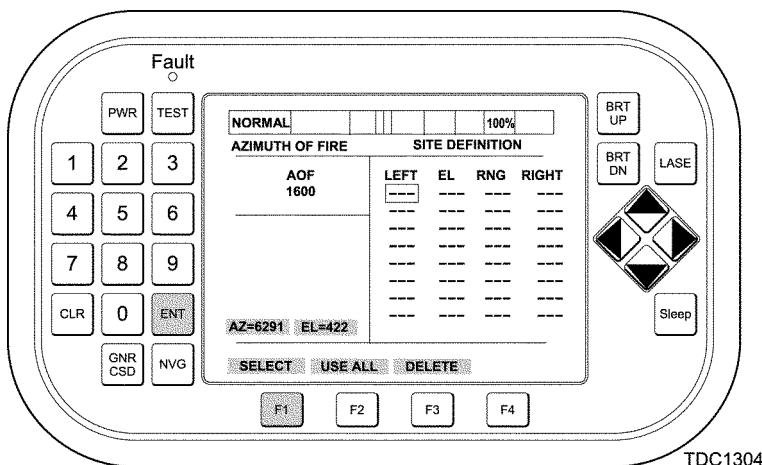
2-70 MOVEMENT PROCEDURES (cont)

a. Move to a Fire Area/Point/Log/Init Point (cont)

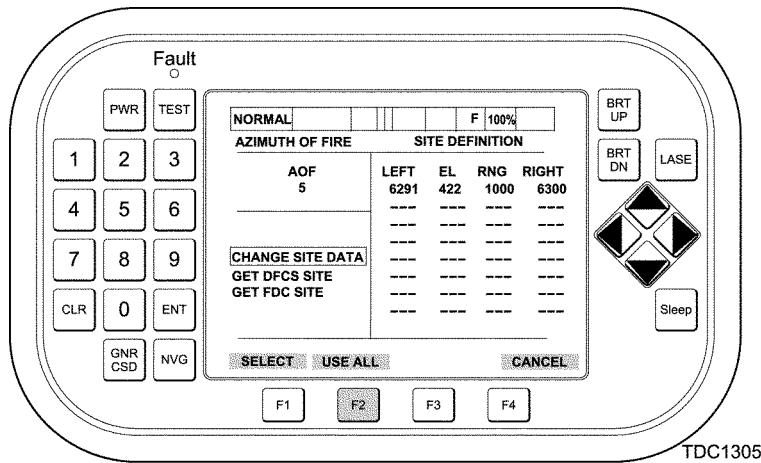
- 9 The AGD and GND will automatically display emplacement data once the howitzer enters the emplacement area. At Fire Point/Fire Area SC will select appropriate position to emplace. Select ARRIVED, press SELECT F2 key.



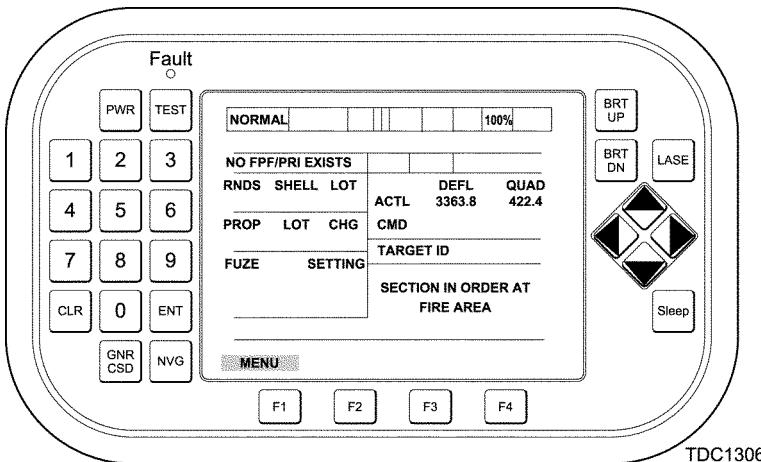
- 10 After the screen transitions to SITE DEFINITION, select LEFT, press SELECT F1 key, enter data, and press ENT key. Repeat for EL, RNG, and RIGHT.



- 11 Verify SITE data, press USE ALL F2 key.



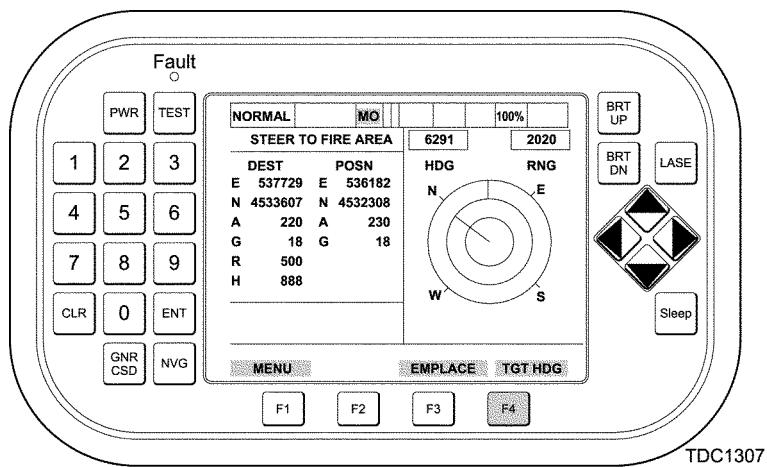
- 12** Upon entering Site Data at Fire Point/Fire Area, CSD will automatically transition to the Section In Order screen. The DFCS is now ready to receive and process Fire Missions.



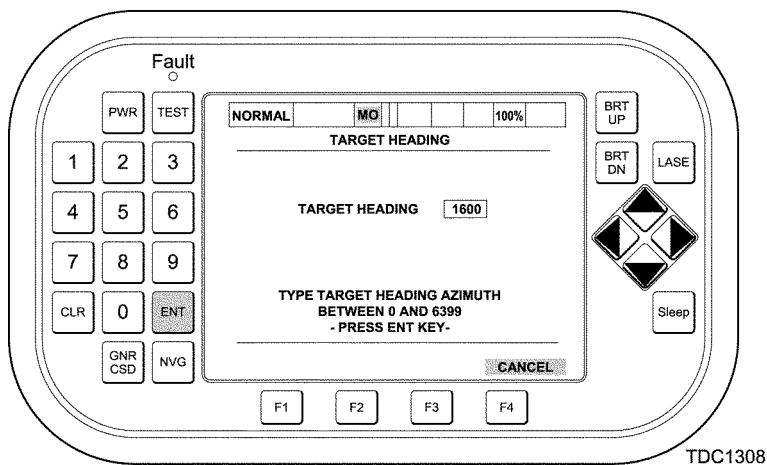
2-70 MOVEMENT PROCEDURES (cont)

b. Conduct EMERGENCY FIRE MISSION during a Move to a Fire Area/Point

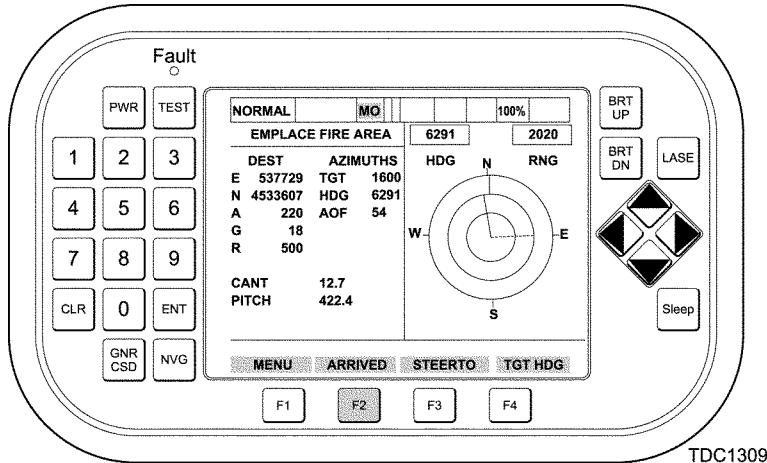
- 1 During a move to designated area, the DFCS will allow the SC to enter a Target Heading (Azimuth of Fire for emergency mission) without interfering with original MOVE ORDER, press TGT HDG F4 key.



- 2 Type Target Heading Azimuth received by voice communications, press ENT key.

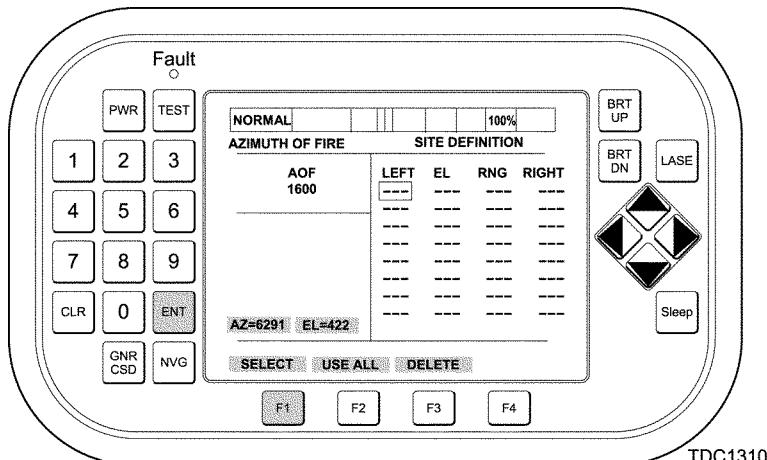


- 3 Find a suitable location to emplace the howitzer. Using the Dotted line on the CSD, ensure the howitzer is aligned on the TGT HDG, press ARRIVED F2 key.



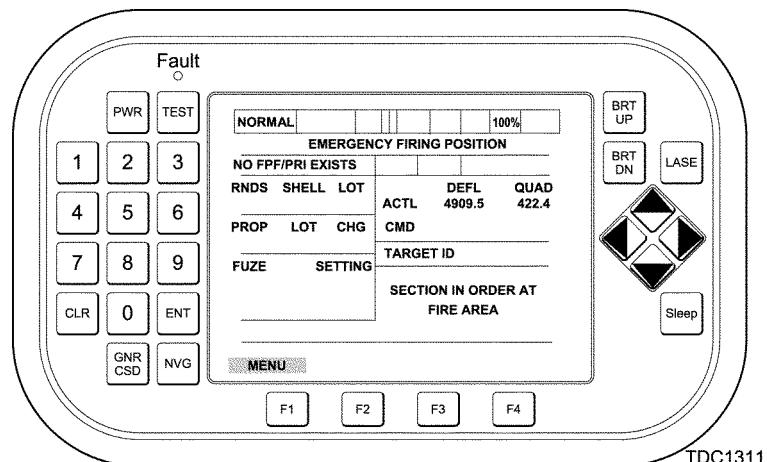
TDC1309

- 4 Select SITE DEFINITION, press SELECT F1 key. Enter LEFT, EL, RNG, AND RIGHT, press ENT key. Select LEFT, press ENT key. Repeat for EL, RNG, and RIGHT.



TDC1310

- 5 Upon entering Site Data at Emergency Fire Area, CSD will automatically transition to the Section In Order screen. The DFCS is now ready to receive and process Fire Missions.



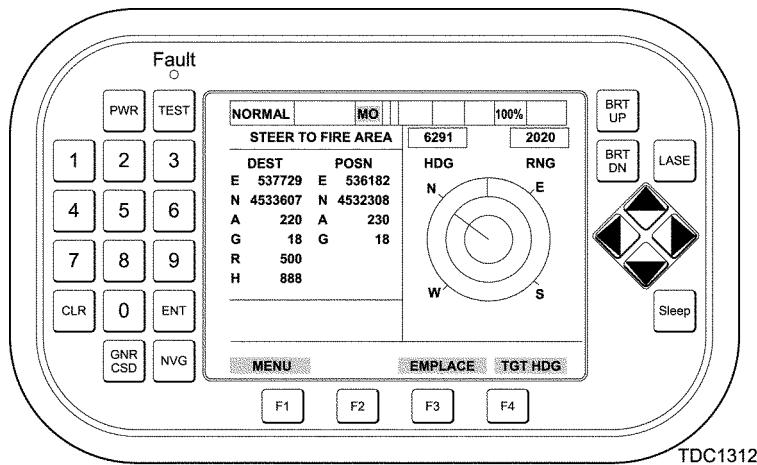
TDC1311

2-70 MOVEMENT PROCEDURES (cont)

b. Conduct EMERGENCY FIRE MISSION during a Move to a Fire Area/Point (cont)

NOTE

Upon completion of the Emergency Fire Mission, prepare the howitzer for towing. STEER TO SCREEN will display last entered Manual Move Order when INU detects movement.



TDC1312

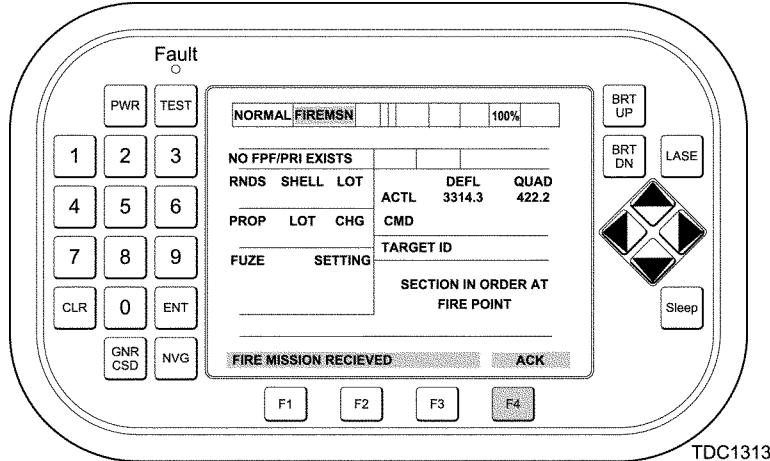
2-71 FIRE MISSION PROCEDURES

a. Digital Fire Mission – Fire When Ready

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.

- Upon receipt of a digital fire mission from the FDC, an audible alert on the CSD and a message prompting the SC to acknowledge will occur. When **FIRE MISSION RECEIVED** message is displayed, press **F4** key to acknowledge.



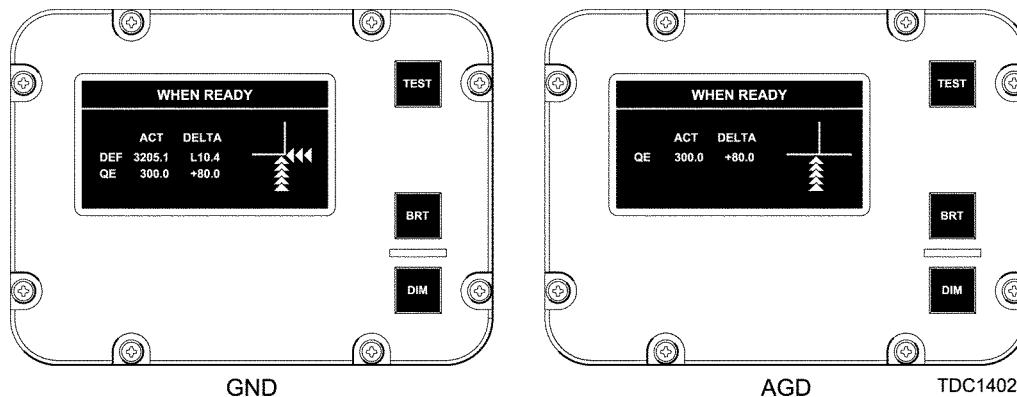
TDC1313

- 2 SC announces FIRE MISSION to the crew. FIRE MSN will display initial fire commands.

NOTES

Howitzer is laid on commanded firing data, GND and AGD will display graphic arrows indicating to the Gunner and Assistant Gunner the amount the cannon tube must move to achieve the lay data. A numeric delta also appears on the screen indicating the direction and amount to achieve the lay data.

When data is within 10 mils of commanded data, small arrowheads will change to one large arrowhead. When commanded data has been achieved the large arrowhead will change to a solid circle (ball shape) in the middle of the graphic crosshairs.

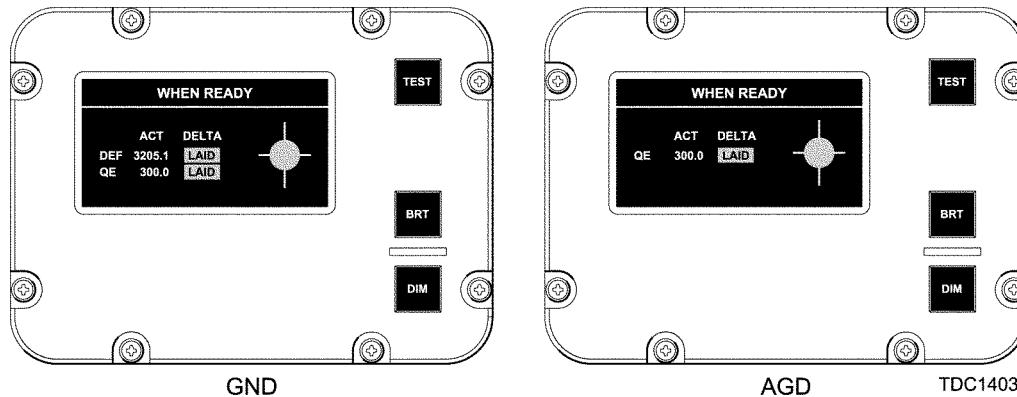


CAUTIONS

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.

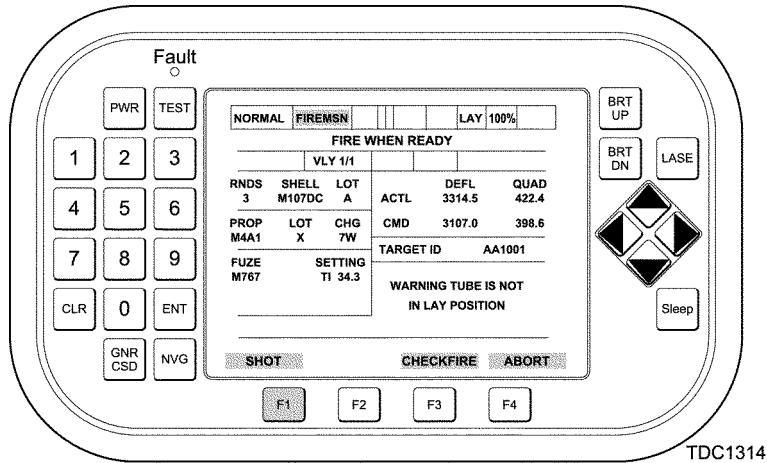
- 3 Gunner and Assistant Gunner elevate/depress/traverse cannon tube until ACT DEF and QE data are set on the howitzer. AGD will display SET in the delta column and a solid circle in the middle of the crosshairs indicating the actual data is within 0.5 mils of the commanded quadrant. Once both the deflection and quadrant is achieved, SET and READY will be replaced with LAID and the solid circle in the middle of the graphic crosshairs.



2-71 FIRE MISSION PROCEDURES (cont)

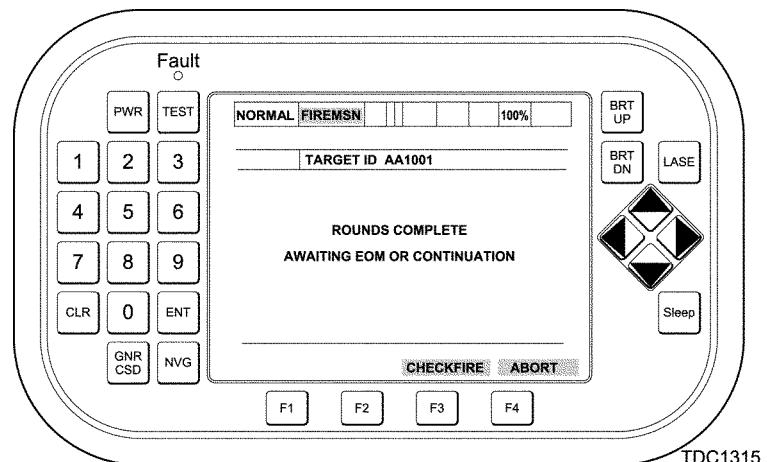
a. Digital Fire Mission – Fire When Ready (cont)

- 4 The SC verifies mandatory safety checks and presses SHOT F1 key on the FIRE MSN screen.



TDC1314

- 5 After all rounds have been fired, ROUNDS COMPLETE will be displayed. This will remain displayed until mission is ended or another FIRE MSN appears indicating mission has been updated.

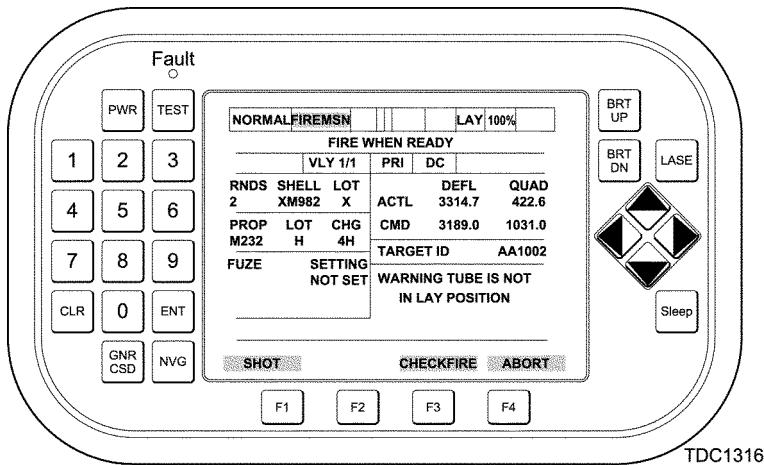


TDC1315

- 6 FIRE MSN will be displayed with SHOT CHECKFIRE ABORT keys again available.

NOTE

The subsequent data procedures are the same as steps 2 through 5 above.

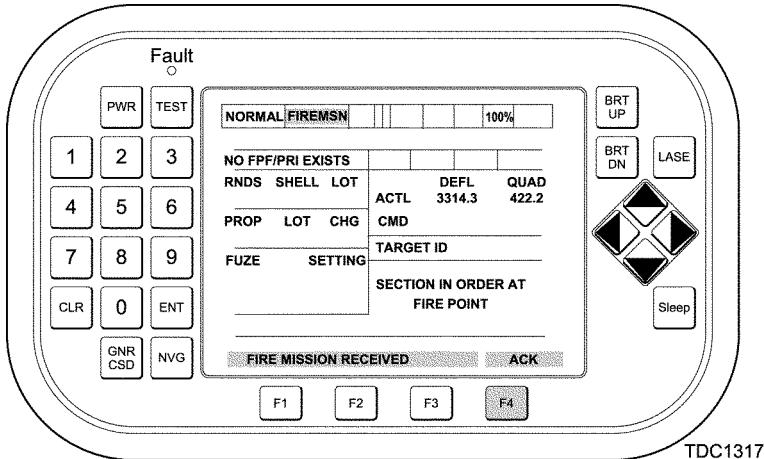


TDC1316

NOTE

If adjusting rounds, the steps above are repeated. When FFE phase begins, a new FIRE MSN screen will be displayed with "FIRE MISSION RECEIVED, ACK" message displayed. GUN number and RNDS will change from 1 to the number of rounds required in FFE.

- 7 When updated FIRE MSN is displayed, press ACK F4 key to acknowledge message.



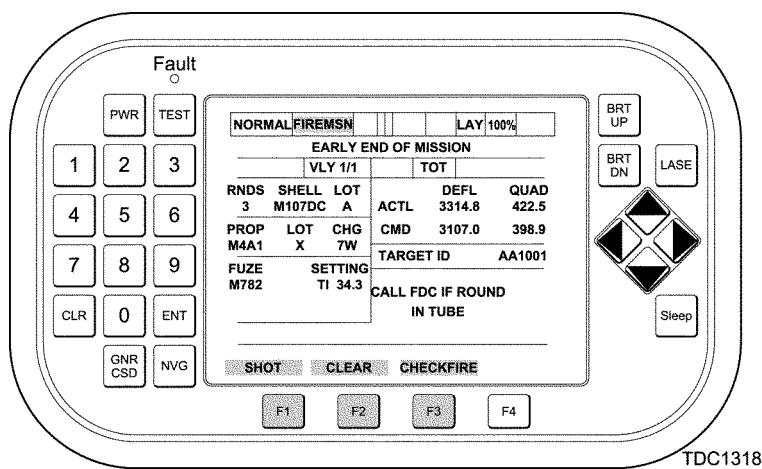
TDC1317

2-71 FIRE MISSION PROCEDURES (cont)

a. Digital Fire Mission – Fire When Ready (cont)

NOTE

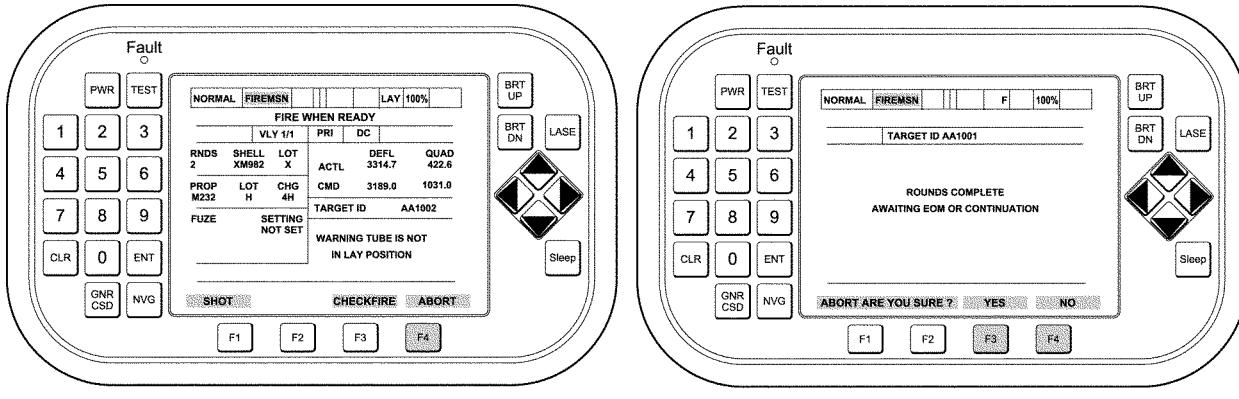
FDC has the ability to send an EARLY END OF MISSION at anytime during a Fire Mission. SC must call FDC if there is a round in the tube and the SC presses **SHOT F1** or **CLEAR F2** or **CHECKFIRE F3** depending on the situation.



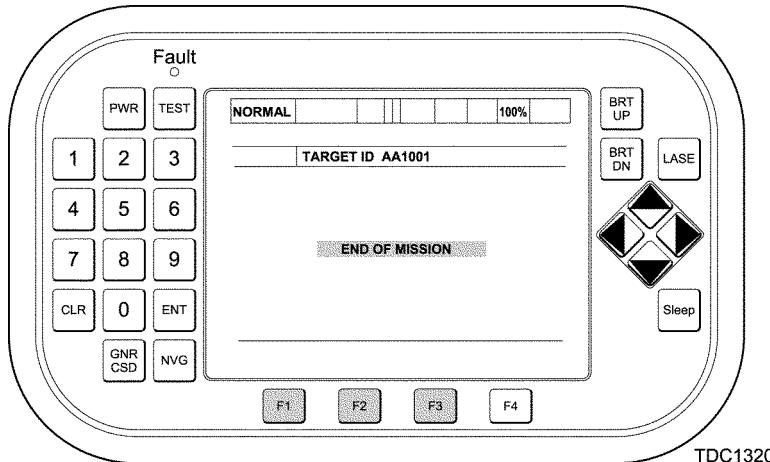
NOTE

The SC has the ability to ABORT a Fire Mission. SC must call FDC if there is a round in the tube and the SC presses **ABORT F4**.

When **ABORT ARE YOU SURE? YES NO** is displayed, press **YES F3** key to transition to Section In Order or **NO F4** to cancel ABORT.



- 8 When the FDC transmits EOM, or the SC presses **SHOT F1** or **CLEAR F2** on the EARLY END OF MISSION screen, or the SC presses **YES F3** on the ABORT screen, the END OF MISSION screen will be displayed. This will display for approximately 3 seconds and transitions to the SECTION IN ORDER screen.



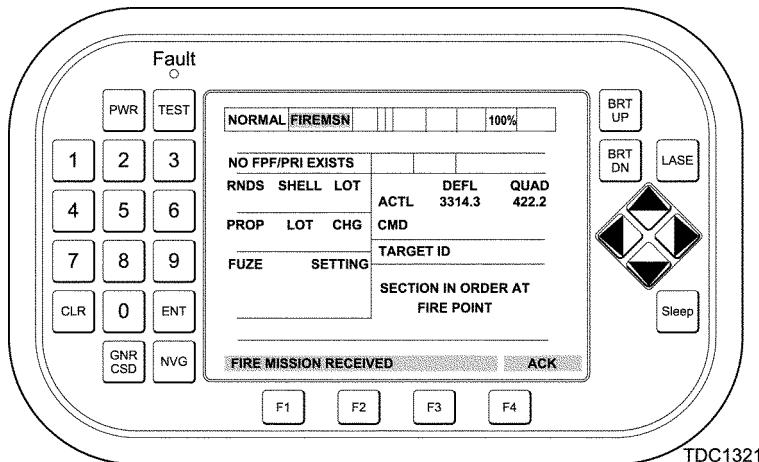
TDC1320

b. **Digital Fire Mission – Do Not Load**

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.

- 1 SC announces FIRE MISSION to the crew.



TDC1321

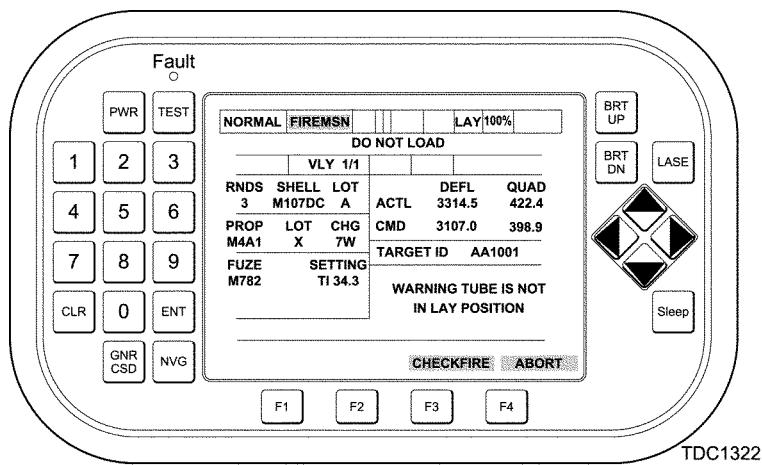
NOTE

Instructions at the top of the screen display will provide the method of fire and control. In this mission the method of fire is DO NOT LOAD. Screen will display FFE data.

2-71 FIRE MISSION PROCEDURES (cont)

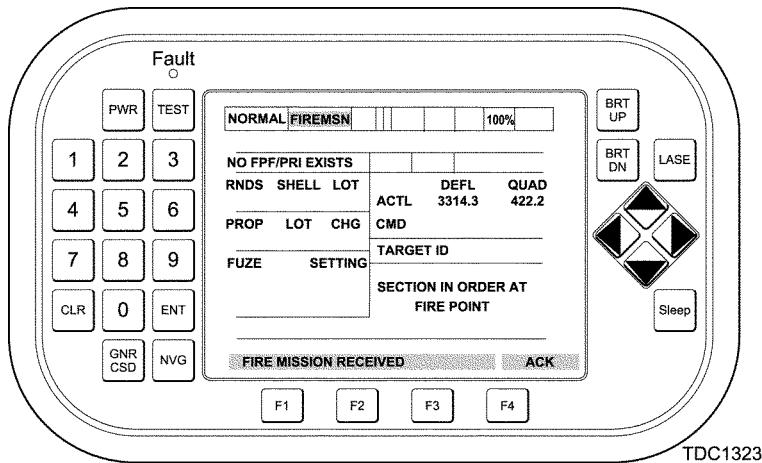
b. Digital Fire Mission – Do Not Load (cont)

- 2** Howitzer is laid on commanded firing data; ATC will record the data and section will prepare the ammunition for the FFE phase.



TDC1322

- 3** When FFE Phase begins, a new FIRE MSN screen will be displayed with “FIRE MISSION RECEIVED, ACK” message displayed.



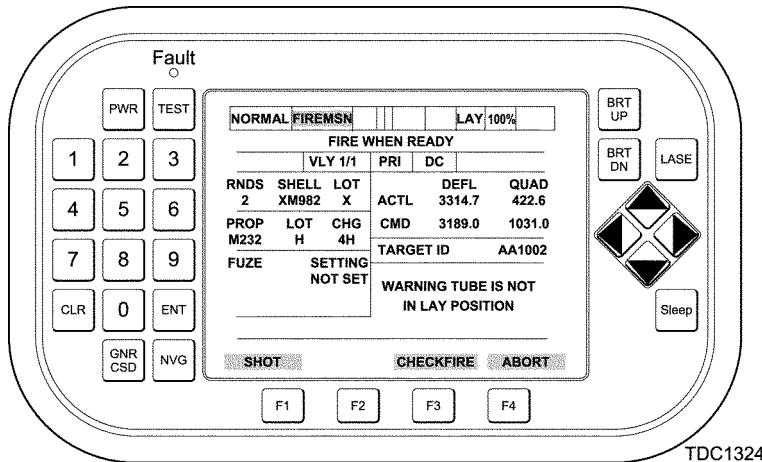
TDC1323

4

FIRE MSN will be displayed with SHOT CHECKFIRE ABORT keys again available.

NOTE

After the first round has been fired, the subsequent data procedures are the same as para 2-71a, steps 2 through 4 above. After all rounds have been fired, the subsequent data procedures are the same as para 2-71a, steps 5 through 8 above.



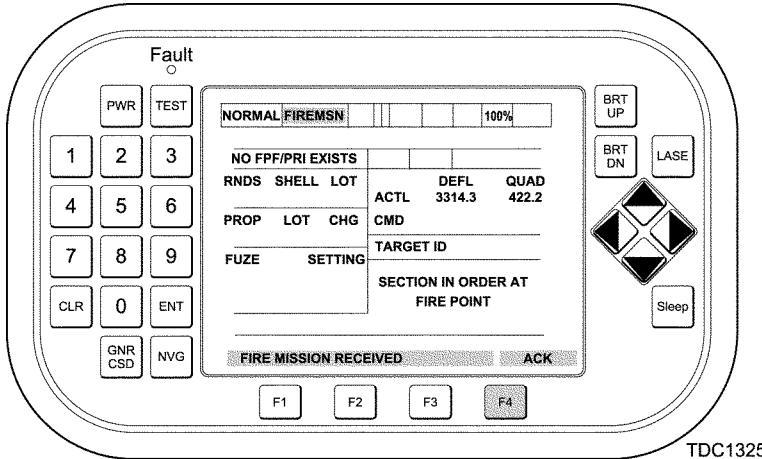
TDC1324

c. **Digital Fire Mission – At My Command**

- Upon receipt of a digital fire mission from the FDC, an audible alert on the CSD and a message prompting the SC to acknowledge will occur. When "FIRE MISSION RECEIVED, ACK" message is displayed, press F4 key to acknowledge.

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.

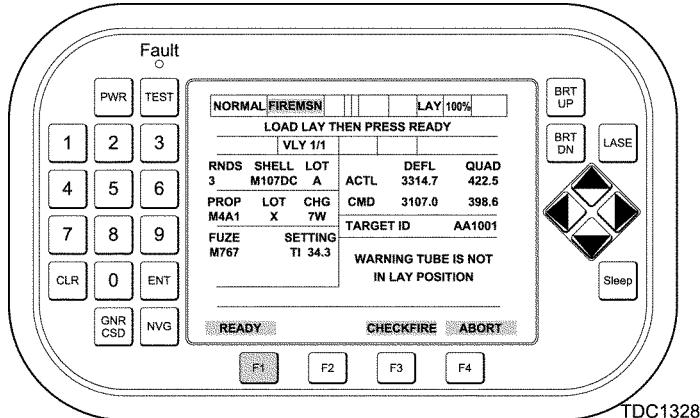


TDC1325

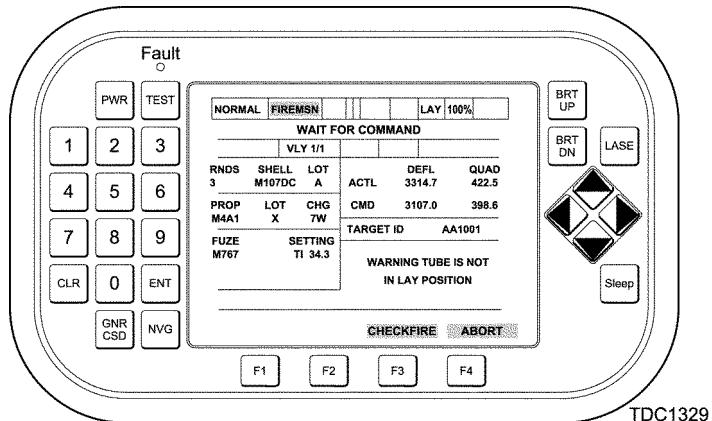
2-71 FIRE MISSION PROCEDURES (cont)

c. Digital Fire Mission – At My Command (cont)

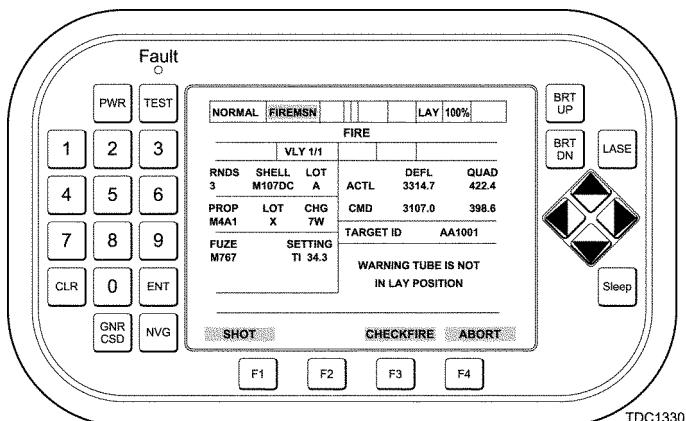
- 2 SC announces FIRE MISSION to the crew. FIRE MSN screen will display initial fire commands. In this mission the method of fire is AT MY COMMAND. Howitzer is loaded and laid on commanded firing data; ATC will record the data and SC will press READY F1.



- 3 SC announces WAIT FOR COMMAND to the crew.



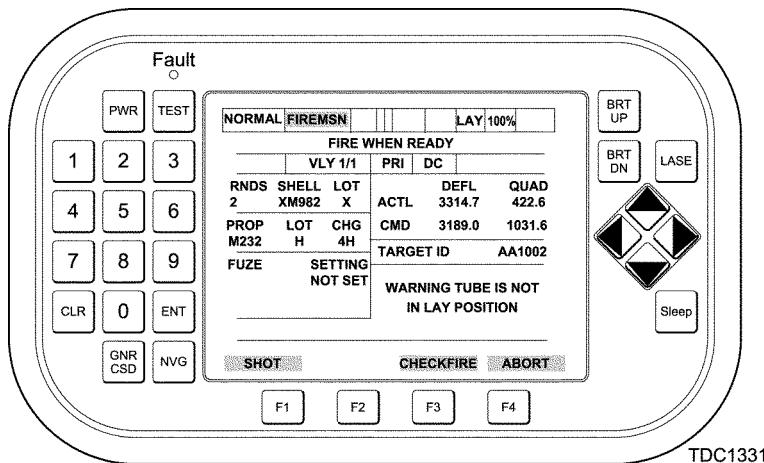
- 4 SC announces FIRE to the crew.



- 5 FIRE MSN will be displayed with SHOT CHECKFIRE ABORT keys again available.

NOTE

After the first round has been fired, the subsequent data procedures are the same as para 2-71a, steps 2 through 4 above. After all rounds have been fired, the subsequent data procedures are the same as para 2-71a, steps 5 through 8 above.



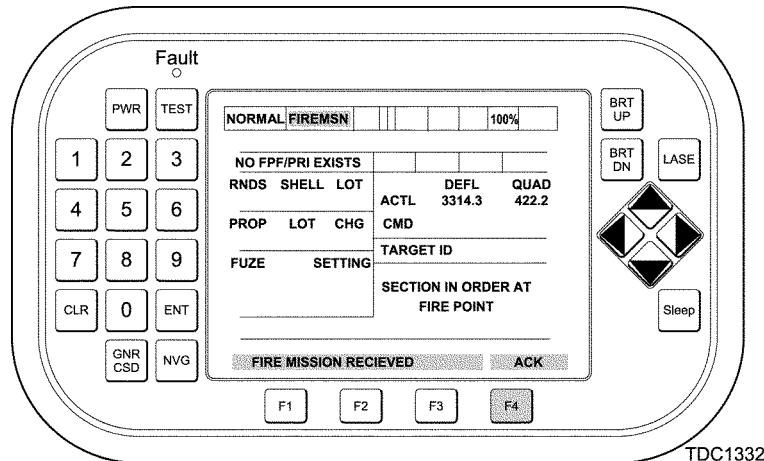
TDC1331

d. Digital Fire Mission – Time on Target

- 1 Upon receipt of a digital fire mission from the FDC, an audible alert on the CSD and a message prompting the SC to acknowledge will occur. When "FIRE MISSION RECEIVED" message is displayed, press F4 key to acknowledge.

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.

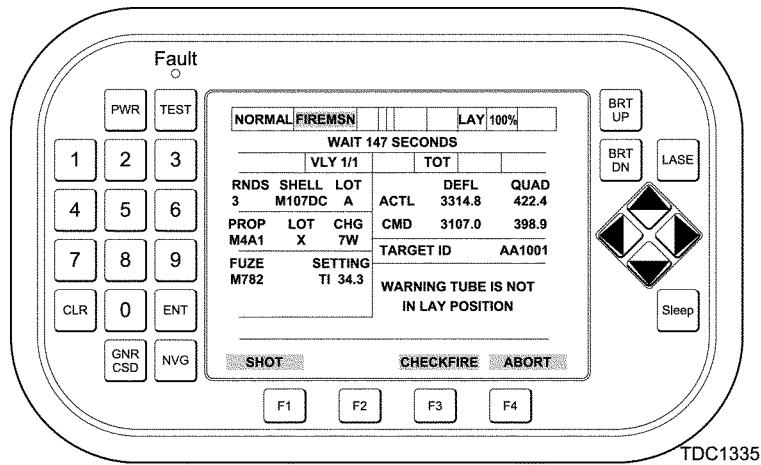


TDC1332

2-71 FIRE MISSION PROCEDURES (cont)

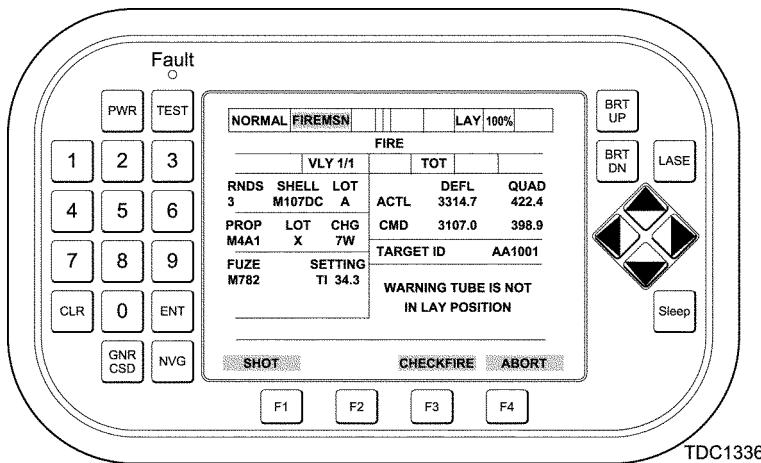
d. Digital Fire Mission – Time on Target (cont)

- 2 SC announces FIRE MISSION to the crew. FIRE MSN screen will display initial fire commands. In this mission the method of fire is TIME ON TARGET. Howitzer is loaded and laid on commanded firing data; ATC will record the data.



TDC1335

- 3 SC announces FIRE to the crew.

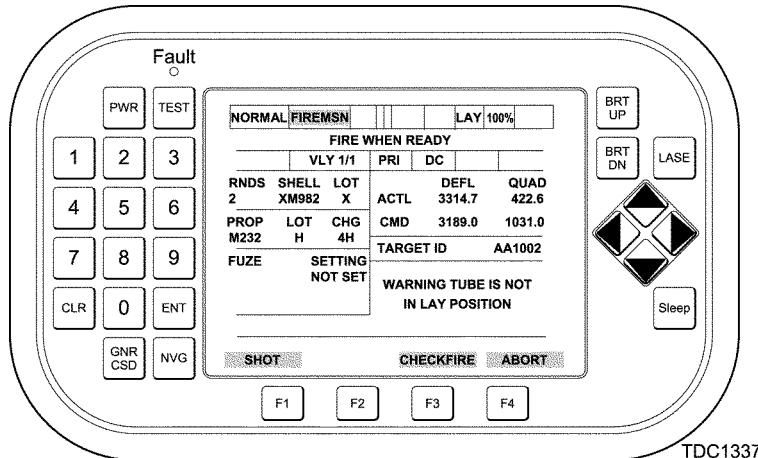


TDC1336

- 4 FIRE MSN will be displayed with SHOT CHECKFIRE ABORT keys again available.

NOTE

After the first round has been fired, the subsequent data procedures are the same as para 2-71a steps 2 through 4 above. After all rounds have been fired, the subsequent data procedures are the same as para 2-71a steps 5 through 8 above.



TDC1337

e. Digital Fire Mission – Priority Target (FPF).

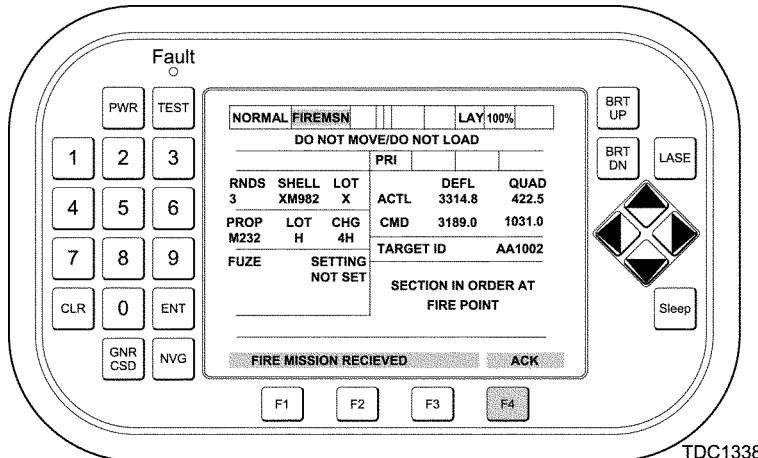
NOTES

FPF will continue until the section has expended all ammunition and the SC has informed the FDC. The FDC will transmit FPF END OF MISSION message that will be displayed on the FIRE MSN screen.

FPF data may be received with DO NOT LOAD command or by voice from the FDC.

Whatever screen is displayed upon receipt of a fire mission, a FIRE MISSION RECEIVED, ACK message will be displayed along with an audio alert.

- 1 Upon receipt of a digital fire mission from the FDC, an audible alert on the CSD and a message prompting the SC to acknowledge will occur. When “FIRE MISSION RECEIVED” message is displayed, press F4 key to acknowledge.

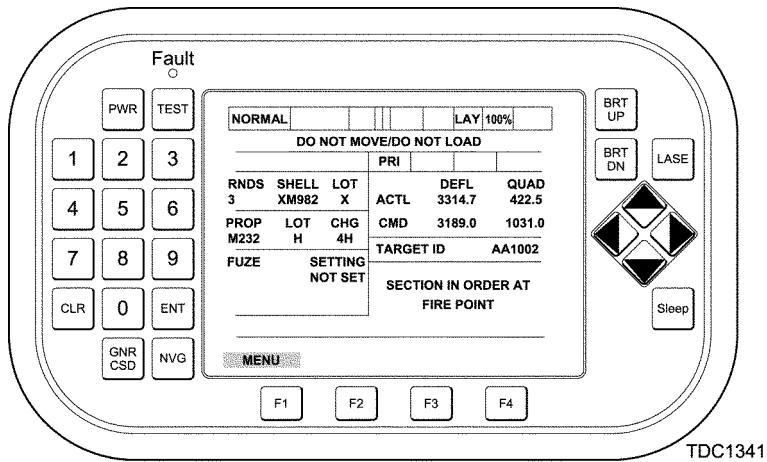


TDC1338

2-71 FIRE MISSION PROCEDURES (cont)

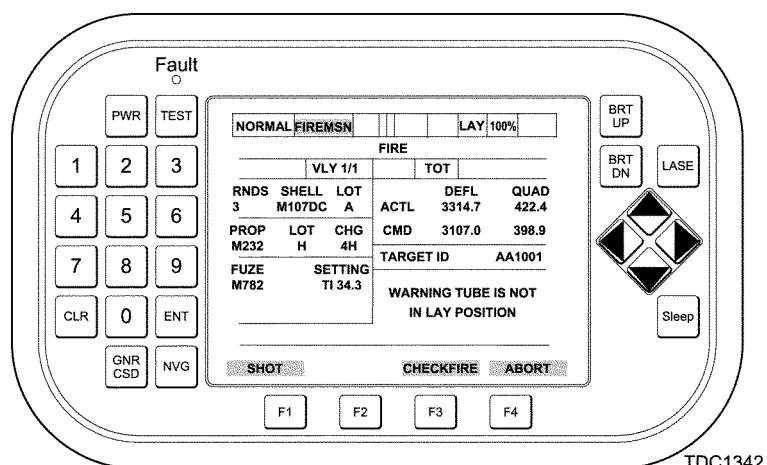
e. Digital Fire Mission – Priority Target (FPF) (cont)

- 2 SC announces FIRE MISSION to the crew. FIRE MSN screen will display initial fire commands. In this mission the method of fire is PRIORITY TARGET (Stored Target). Howitzer is laid on commanded firing data; ATC will record the data and ammunition will be prepares.



TDC1341

- 3 FDC will send the command to fire the Priority Target, SC announces FIRE to the crew.



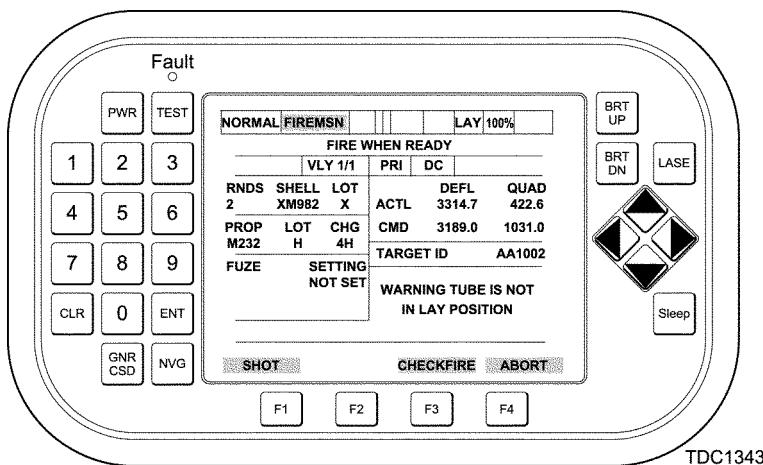
TDC1342

4

FIRE MSN will be displayed with SHOT CHECKFIRE ABORT keys again available.

NOTE

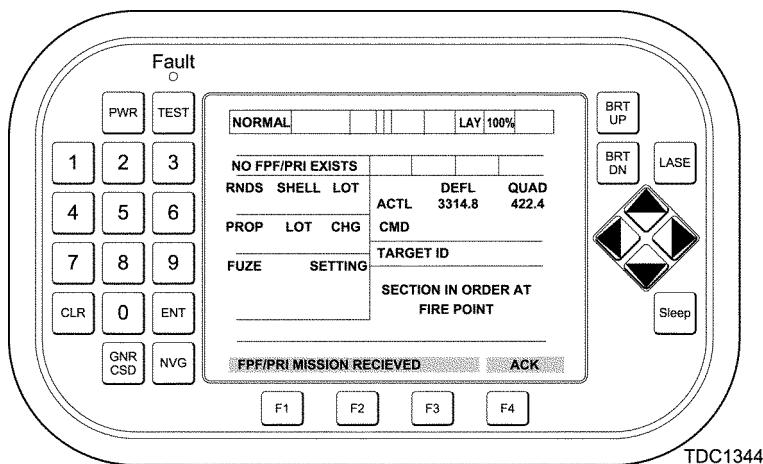
After the first round has been fired, the subsequent data procedures are the same as para 2-71a, steps 2 through 4 above. After all rounds have been fired, the subsequent data procedures are the same as para 2-71a, steps 5 through 8 above.



TDC1343

5

If there is a change to the Priority Target, the SC announces FIRE MISSION to the crew. FIRE MSN screen will display initial fire commands. In this mission the method of fire is PRIORITY TARGET (Stored Target). Howitzer is laid on commanded firing data; ATC will record the data and ammunition will be prepared.

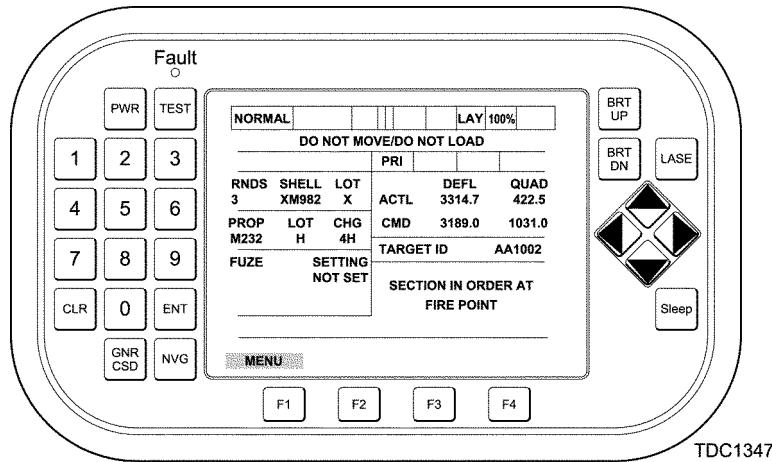


TDC1344

2-71 FIRE MISSION PROCEDURES (cont)

e. Digital Fire Mission – Priority Target (FPF) (cont)

- 6 FIRE MSN screen will display initial fire commands. In this mission the method of fire is PRIORITY TARGET (Stored Target). Howitzer is laid on commanded firing data; ATC will record the data and ammunition will be prepared.



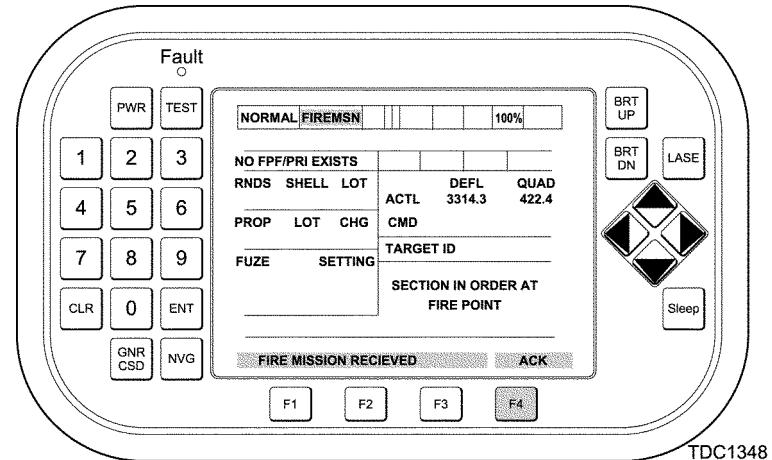
TDC1347

f. Excalibur Fire Mission – Fire When Ready

- 1 Upon receipt of a digital fire mission from the FDC, an audible alert on the CSD and a message prompting the SC to acknowledge will occur. When "FIRE MISSION RECEIVED" message is displayed, press F4 key to acknowledge.

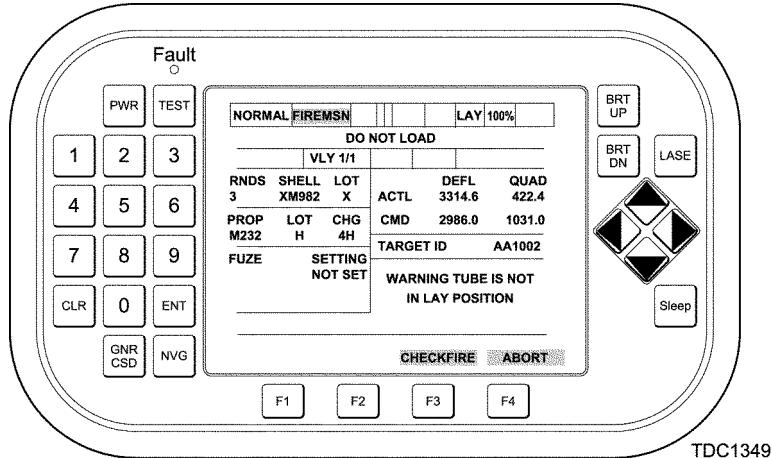
NOTE

Whatever screen is displayed upon receipt of a fire mission, a "FIRE MISSION RECEIVED" ACK message will be displayed along with an audio alert.



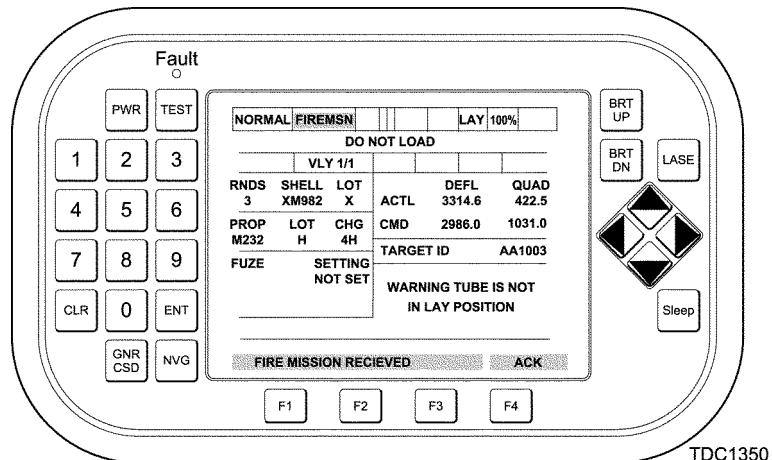
TDC1348

- 2 SC announces FIRE MISSION to the crew. FIRE MSN screen will display initial fire commands. In this mission the method of fire is Excalibur DO NOT LOAD. Howitzer is laid on commanded firing data; ATC will record the data and ammunition will be prepared.



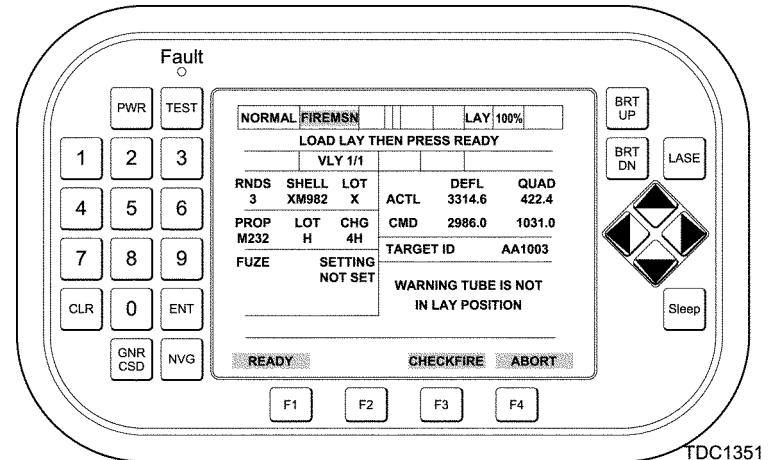
TDC1349

- 3 A new FIRE MSN screen will be displayed with "FIRE MISSION RECEIVED", ACK message displayed.



TDC1350

- 4 Set the Excalibur with the EPIAFS. When completed the Fuze Mode and Expiration Time will be displayed in the FUZE area on the CSD.

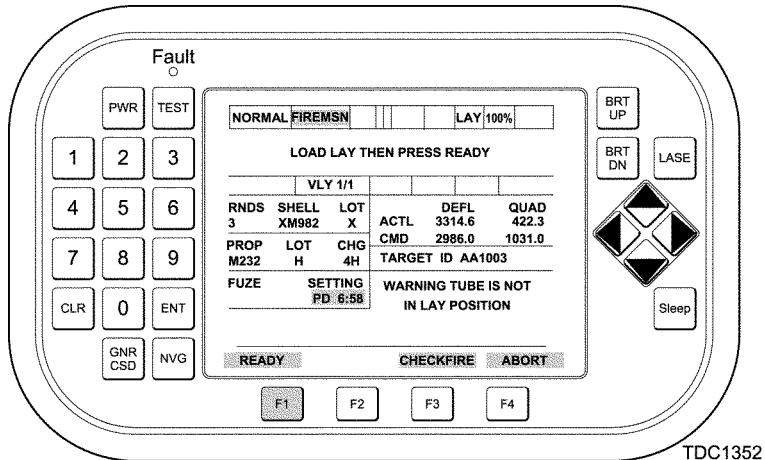


TDC1351

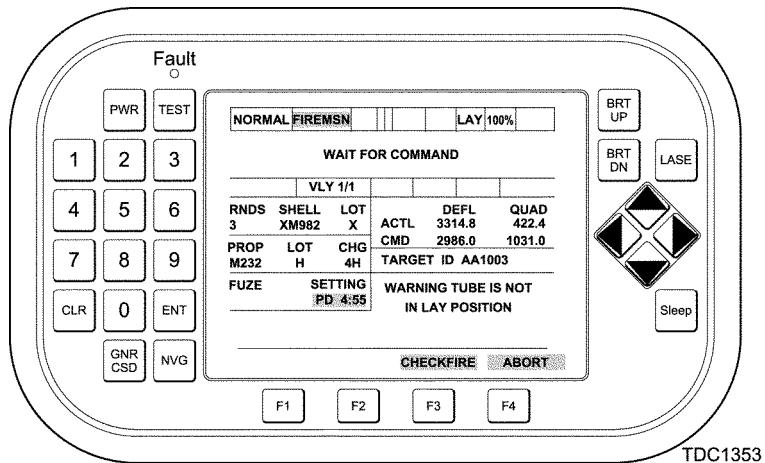
2-71 FIRE MISSION PROCEDURES (cont)

f. Excalibur Fire Mission – Fire When Ready (cont)

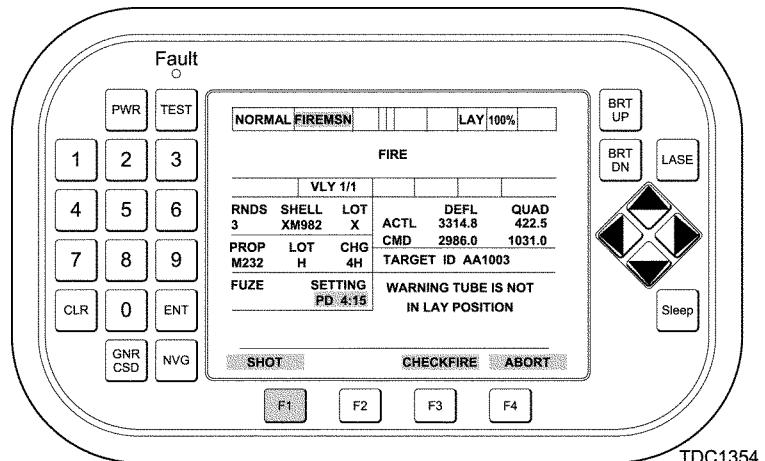
- 5 Load and Lay the howitzer, press READY F1.



- 6 Wait for command to fire from FDC.

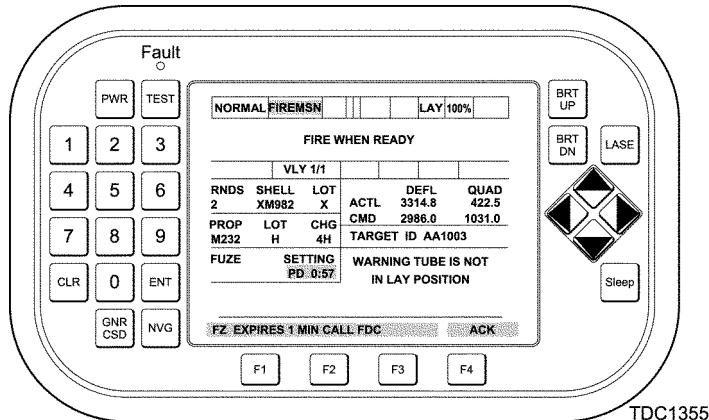


- 7 Fire the Excalibur, press SHOT F1.



NOTE

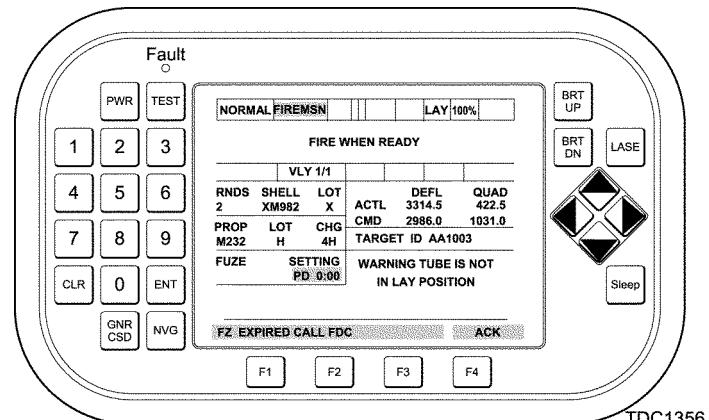
If Excalibur expiration time drops below one minute, the DFCS will present both an audible alarm and visual alert. "FZ EXPIRES 1 MIN CALL FDC, ACK".



TDC1355

NOTE

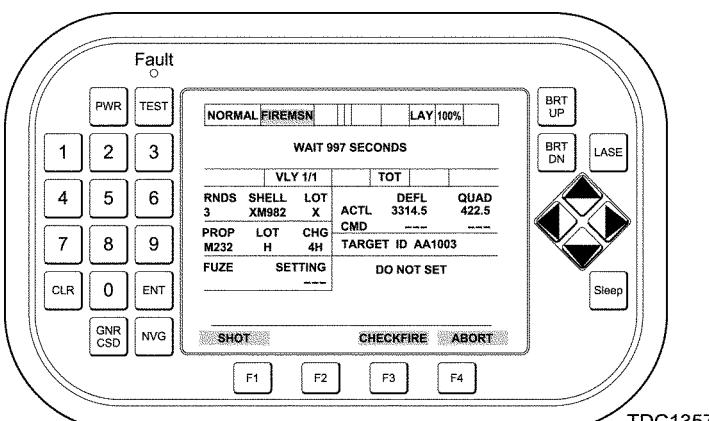
If Excalibur expiration time drops to zero, the DFCS will present both an audible alarm and visual alert. "FZ EXPIRED CALL FDC, ACK".



TDC1356

NOTE

If FDC sends an Excalibur Fire Mission with a expiration time greater than 420 seconds, the following screen will appear.

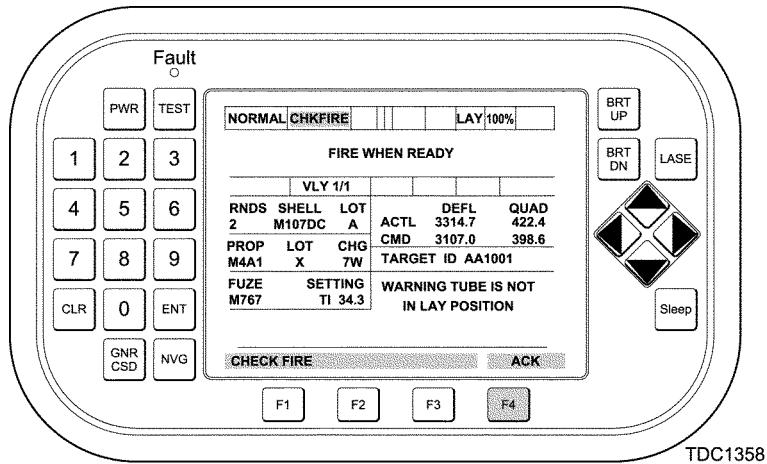


TDC1357

2-71 FIRE MISSION PROCEDURES (cont)

g. CHECK FIRE

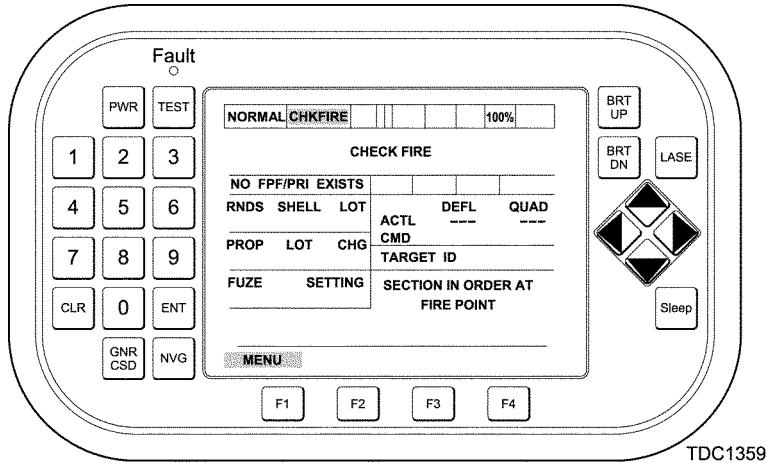
- 1 Upon receipt of a digital "CHECKFIRE" from the FDC, an audible alert on the CSD and a message prompting the SC to acknowledge will occur. When "CHECKFIRE" ACK message is displayed, press F4 key to acknowledge.

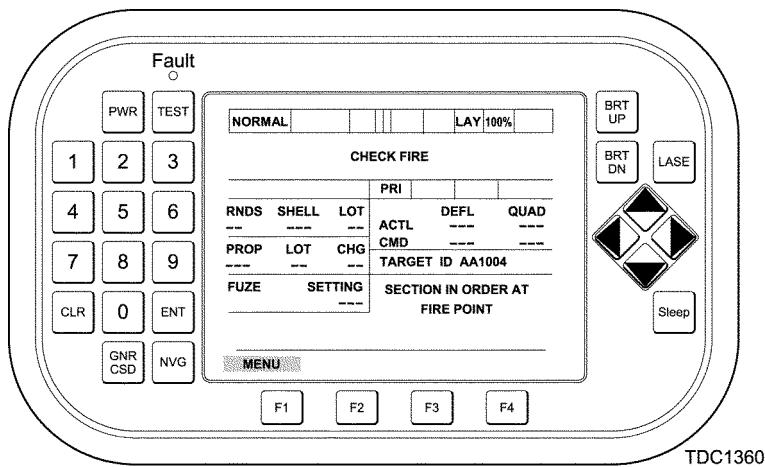


NOTE

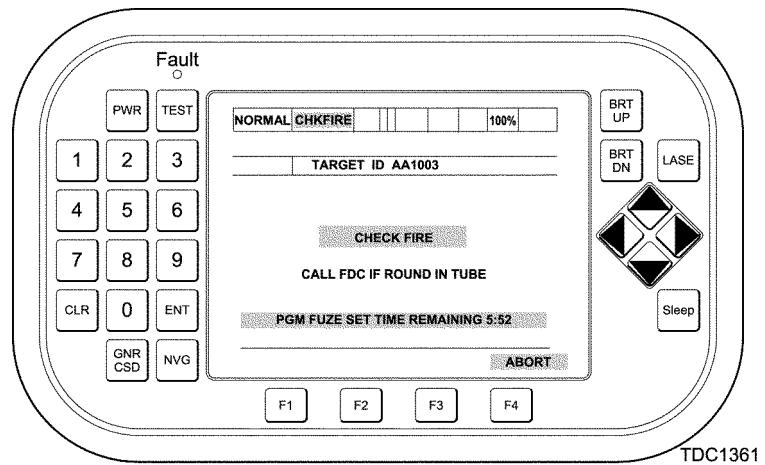
Whatever screen is displayed upon receipt of a Check Fire, a "CHECKFIRE" ACK message will be displayed along with an audio alert. The type of "CHECKFIRE" screen displayed is dependent on several factors, the type of Fire Mission, the type of Target, initiated by FDC, initiated by the SC, or Excalibur. Below are several examples of check fire screens that may appear,

- 2 SC announces "CHECKFIRE" to the crew. In all cases SC should follow directions on the screen.

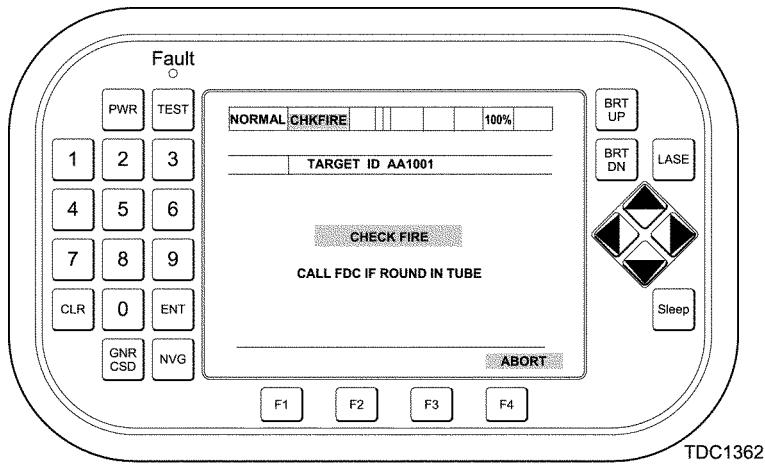




TDC1360



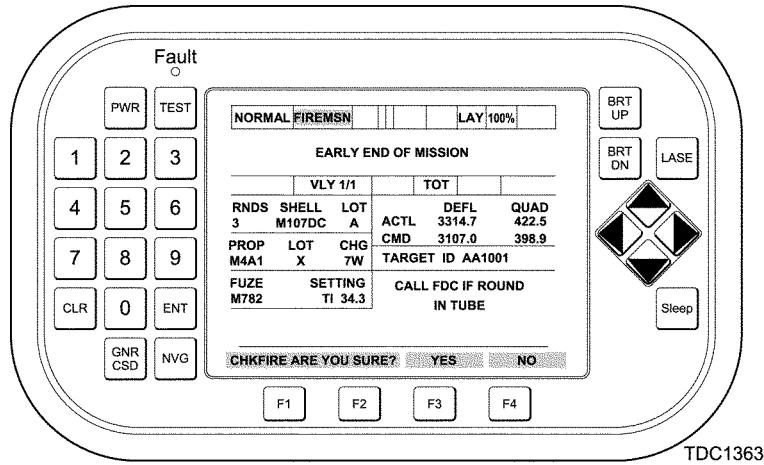
TDC1361



TDC1362

2-71 FIRE MISSION PROCEDURES (cont)

g. CHECK FIRE (cont)



TDC1363

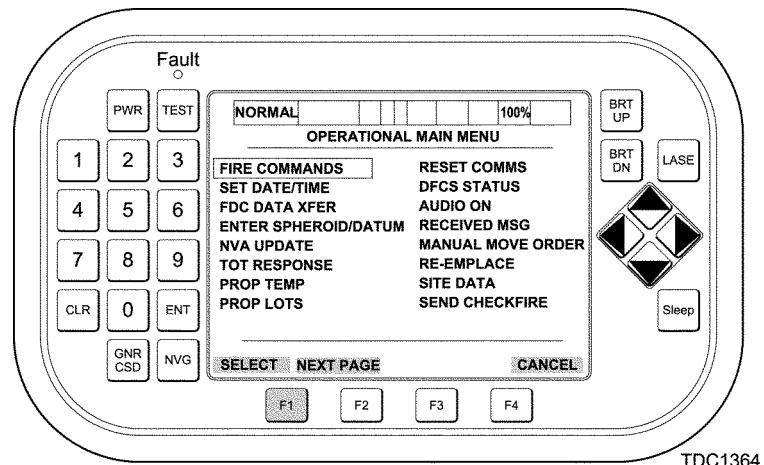
h. Manual Fire Mission.

NOTES

Manual Fire Mission is used when 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.

In a manual fire mission, only DF and QE will be displayed on the CSD.

- Select FIRE COMMANDS and press F1 key.

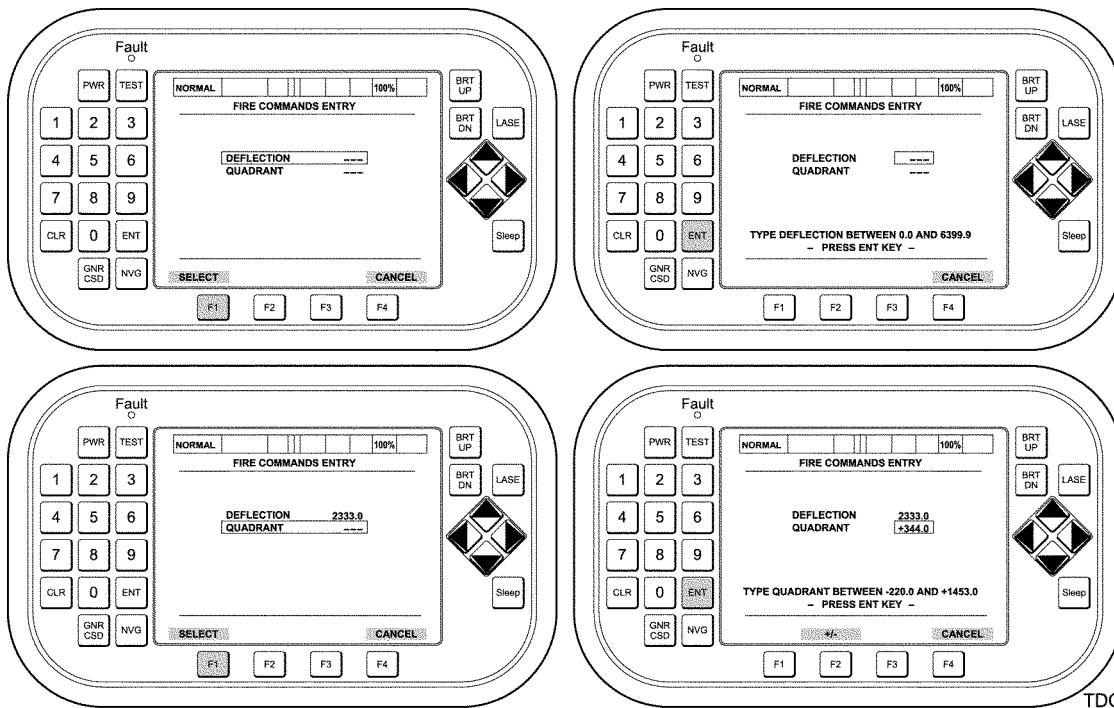


TDC1364

NOTE

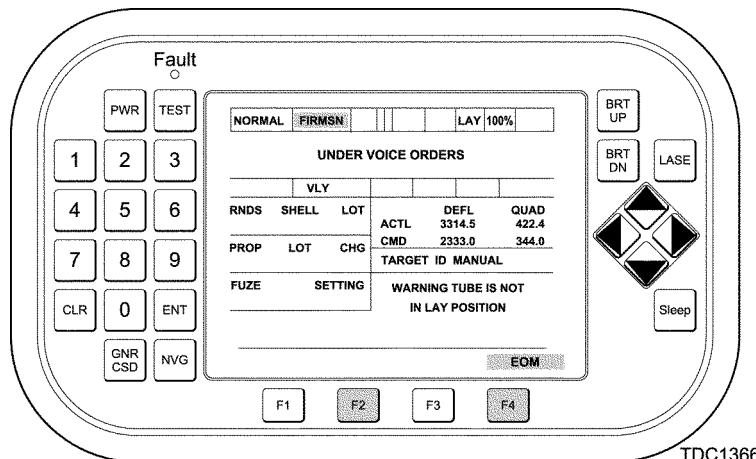
"+/-" appears on the FIRE COMMANDS ENTRY when QUADRANT is selected. A negative number can be entered for those quadrants less than 0 (zero) using F2 key.

- 2 The FIRE COMMAND ENTRY screen will be displayed. Select DEFLECTION, press SELECT F1 key, enter data, and press ENT key. Repeat for QUADRANT.



TDC1365

- 3 Verify DEFLECTION and QUADRANT data, press USE ALL F2 key. On completion of fire mission, press EOM F4 key.

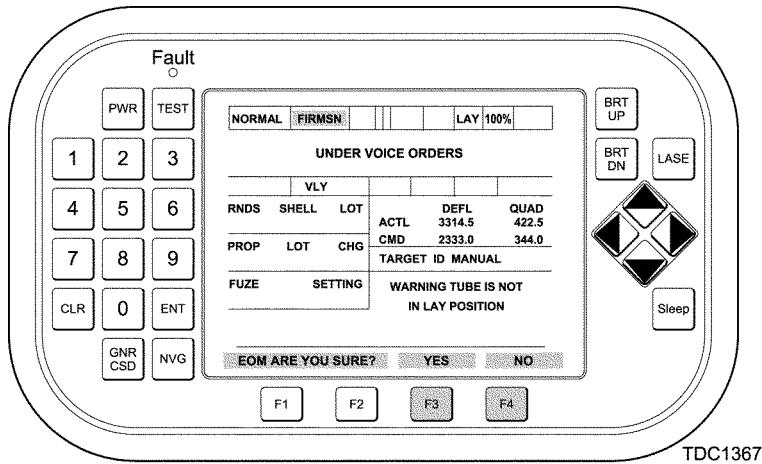


TDC1366

2-71 FIRE MISSION PROCEDURES (cont)

h. Manual Fire Mission. (cont)

- 4 At prompt to "EOM ARE YOU SURE?" press YES F3 key TO TRANSITION TO Section In Order screen. press NO F4 key to remain Under Voice Orders.



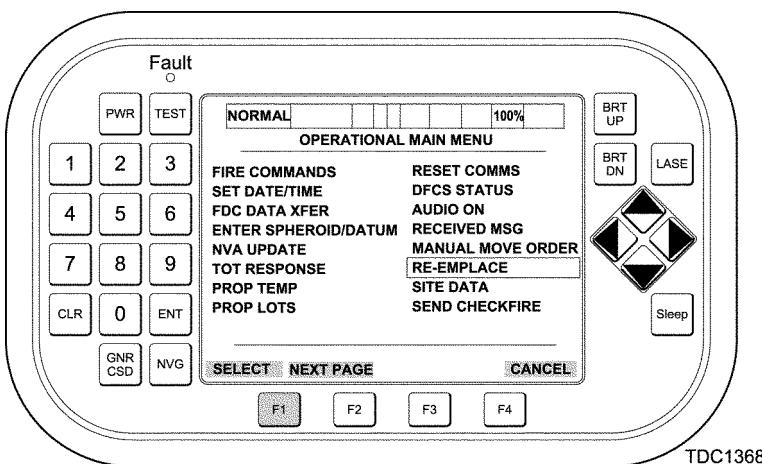
2-72 SPECIAL PROCEDURES

a. Emplace Howitzer Using DFCS

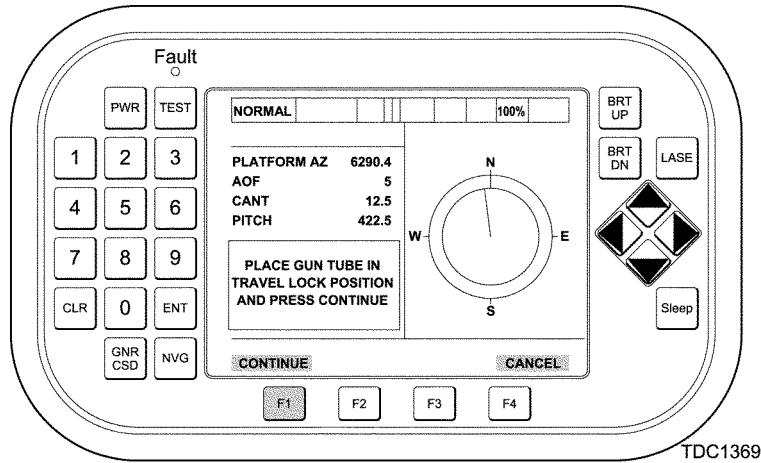
NOTE

At Fire Point/Fire Area, due to displacement during live fire, the SC may be required to re-emplace the howitzer back on the original azimuth of fire

- 1 SC transitions from current screen to OPERATIONAL MAIN MENU by pressing MENU F1 key.
- 2 Select RE-EMPLACE, press SELECT F1 key.



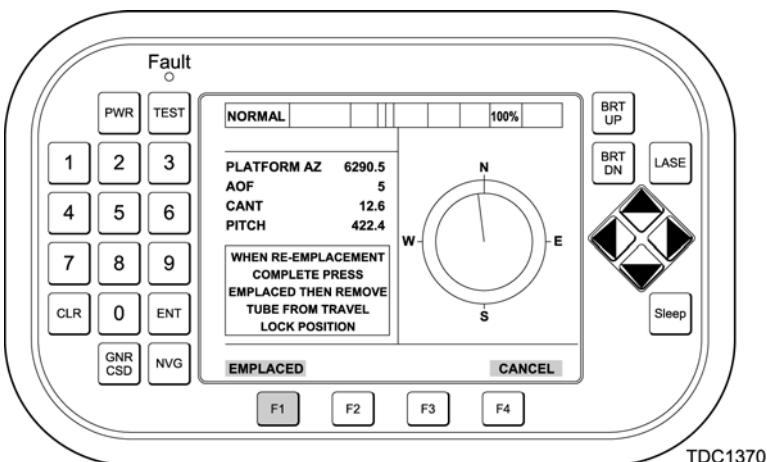
- 3 Verify **RE-EMPLACE**, ensure traverse lock is engaged. PLACE GUN TUBE IN TRAVEL LOCK POSITION AND PRESS CONTINUE will be displayed, press **CONTINUE F1** key.



- 4 When howitzer is parallel to the AOF, press **EMPLACED F1** key.

NOTE

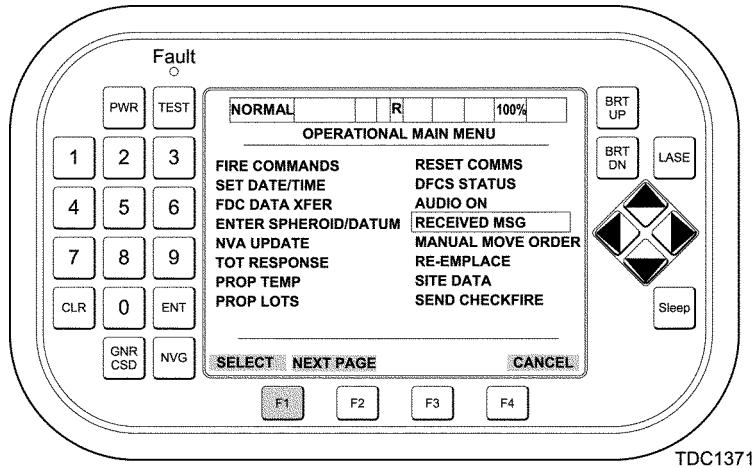
It is recommended that position data be recorded by the ATC in the event of an unexpected surge or loss of power. Confirm current position, when **EMPLACE F1** is selected data will be sent to the FDC



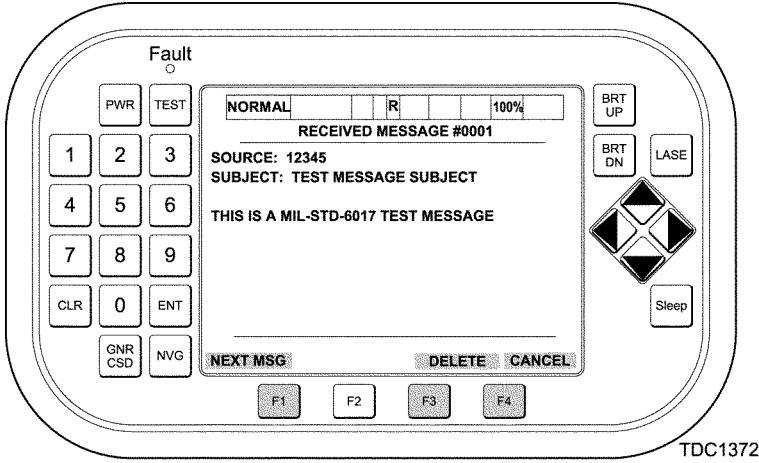
2-72 SPECIAL PROCEDURES (cont)

b. Received Messages

- 1 SC transitions from current screen to OPERATIONAL MAIN MENU by pressing **MENU F1** key.
- 2 Select **RECEIVED MSG**, press **SELECT F1** key.



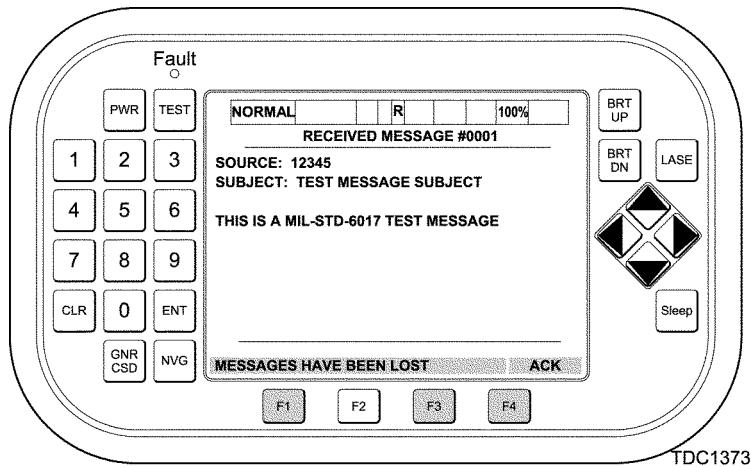
- 3 Press **NEXT MSG F1** key to view additional messages, Press **DELETE F3** key to remove messages from system, press **CANCEL F4** key to return to Operational Main Menu.



NOTE

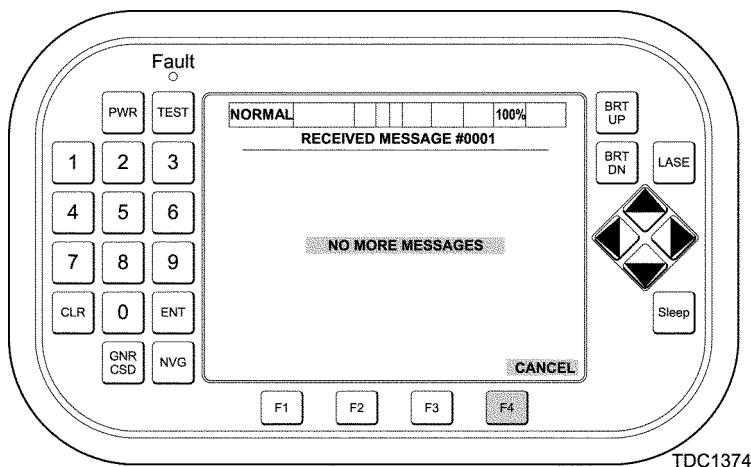
If too many messages accumulate, they will be lost in order of first in and first out.

- 4 When "MESSAGES HAVE BEEN LOST" ACK message is displayed, press F4 key to acknowledge.



TDC1373

- 5 NO MORE MESSAGES screen is displayed when the final message has been deleted, press CANCEL F4 key to return to Operational Main Menu.



TDC1374

c. Audio ON/OFF

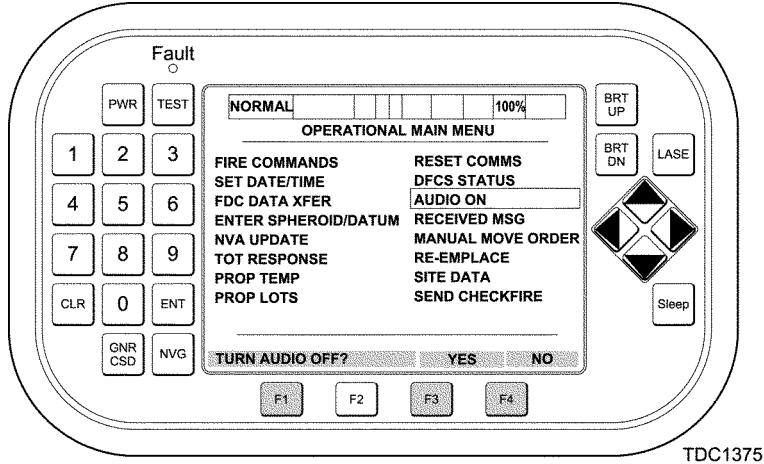
- 1 SC transitions from current screen to OPERATIONAL MAIN MENU by pressing MENU F1 key. Select AUDIO ON, press SELECT F1 key.

2-72 SPECIAL PROCEDURES (cont)

NOTE

The volume for the CSD buzzer is controlled by rotating the exterior cover plate.

- 2 When TURN AUDIO OFF YES NO message is displayed, press YES F3 or NO F4 key to acknowledge.

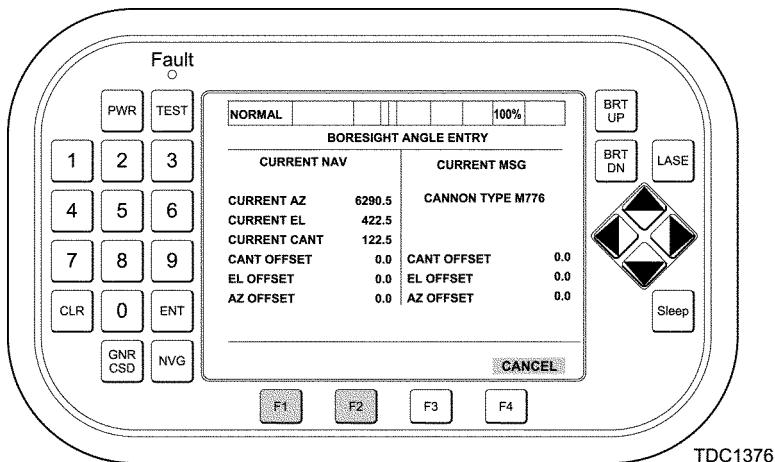


d. Boresight Angle Entry-Normal Operations

- 1 SC transitions from current screen to OPERATIONAL MAIN MENU by pressing **MENU F1** key.
- 2 Press **NEXT PAGE F2** key.
- 3 Select **MAINTENANCE**, press **SELECT F1** key.
- 4 Select **BORESIGHT ENTRY**, press **SELECT F1** key.

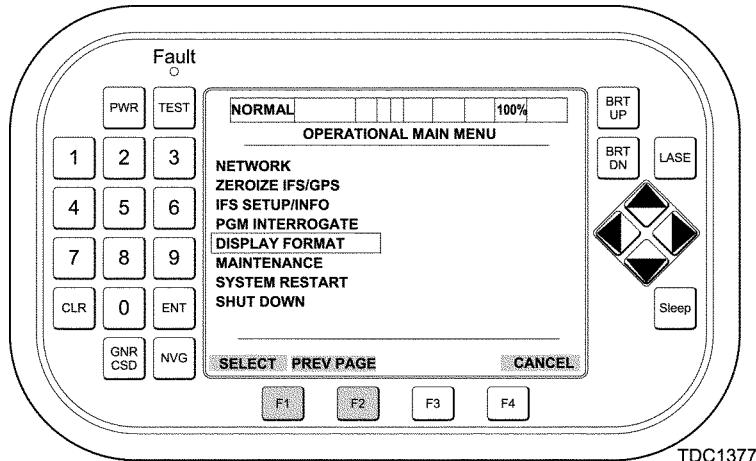
NOTE

In NORMAL OPERATIONAL MODE the BORESIGHT ANGLE ENTRY screen is read-only. To change the BORESIGHT OFFSETS, MAINTENANCE MODE must be entered from the OPERATIONAL MODE SELECT screen during boot-up. Only authorized Maintenance Personnel should reset the Boresight Offsets.

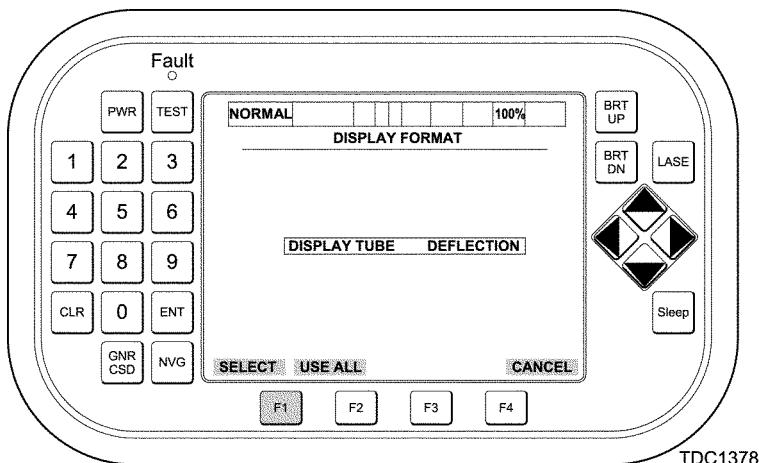


e. **Display Format**

- 1 SC transitions from current screen to OPERATIONAL MAIN MENU by pressing **MENU F1** key.
- 2 Press **NEXT PAGE F2** key.
- 3 Select **DISPLAY FORMAT**, press **SELECT F1** key.



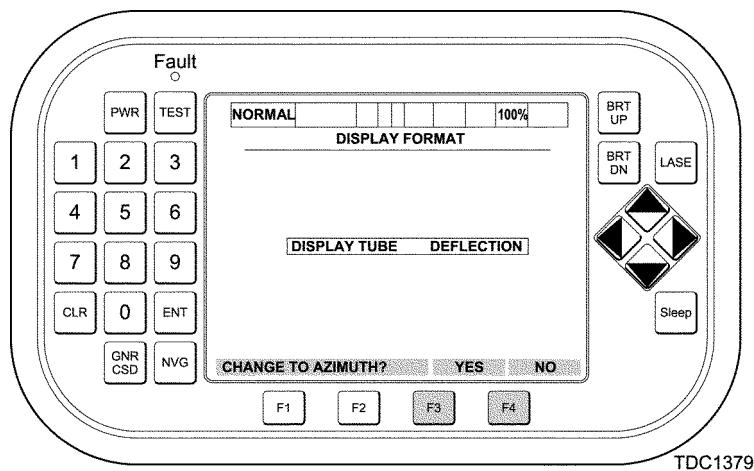
- 4 To change display format to AZIMUTH, select **DISPLAY TUBE DEFLECTION**, press **SELECT F1** key.



2-72 SPECIAL PROCEDURES (cont)

e. Display Format (cont)

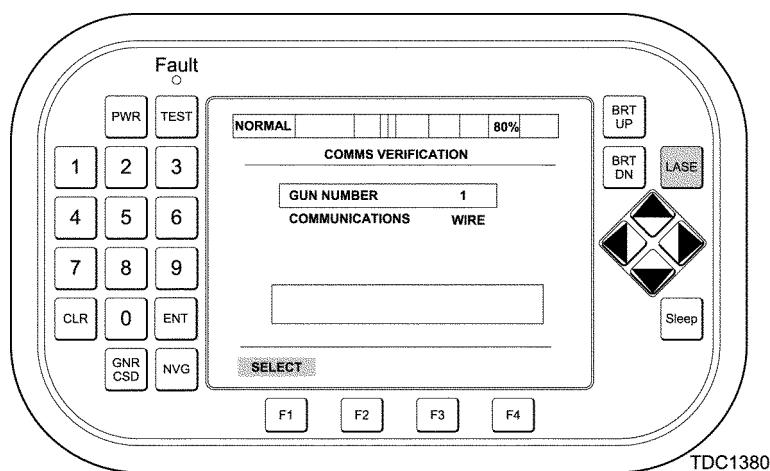
- 5 When **CHANGE TO AZIMUTH? YES NO** message is displayed, press **F3** key to change format or **F4** key to retain current format.



TDC1379

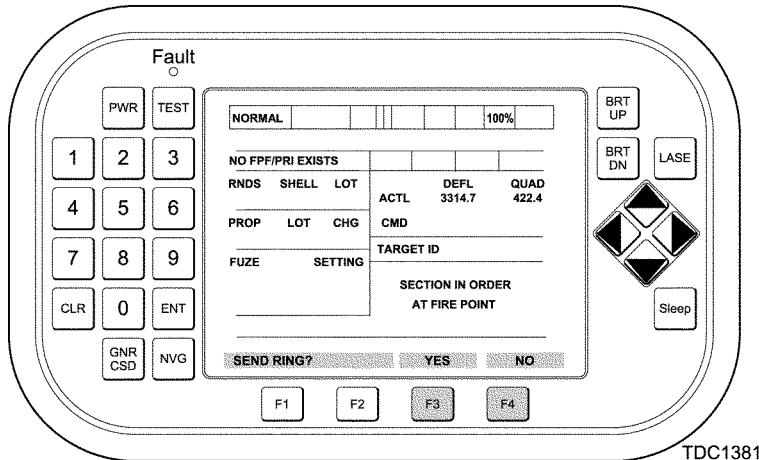
f. Send Ring

- 1 To request Voice Communications with FDC, press **LASE** key.



TDC1380

- 2 When **SEND RING YES NO** message is displayed, press **YES F3** or **NO F4** key to acknowledge.



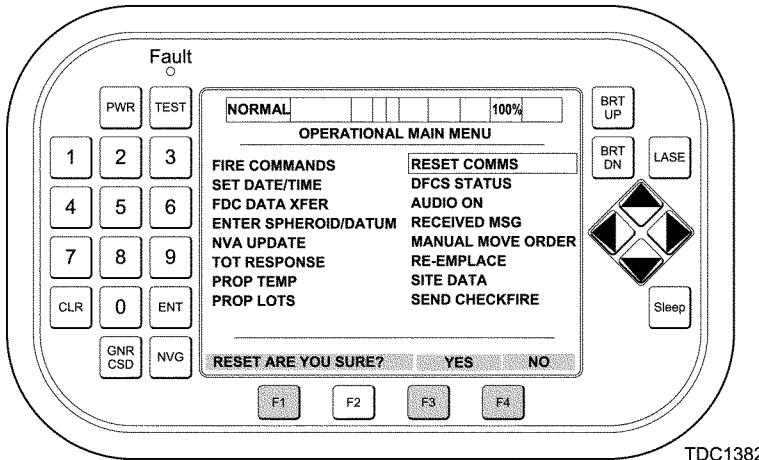
TDC1381

g. Reset Communications

- 1 SC transitions from current screen to **OPERATIONAL MAIN MENU** by pressing **MENU F1** key. Select **RESET COMMS**, press **SELECT F1** key.
- 2 When **RESET COMMS YES NO** message is displayed, press **YES F3** or **NO F4** key to acknowledge.

NOTE

The **RESET COMMS** function automatically resets the communications device located inside of the MSC. When selected, the **RESET COMMS** menu item will disappear until the task has been completed.

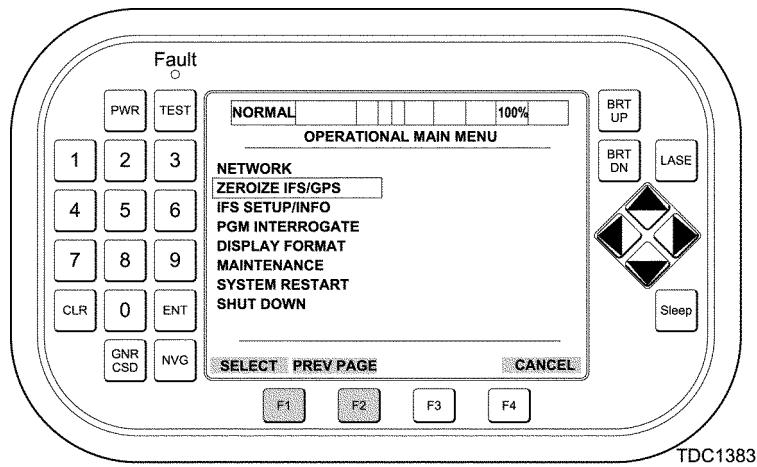


TDC1382

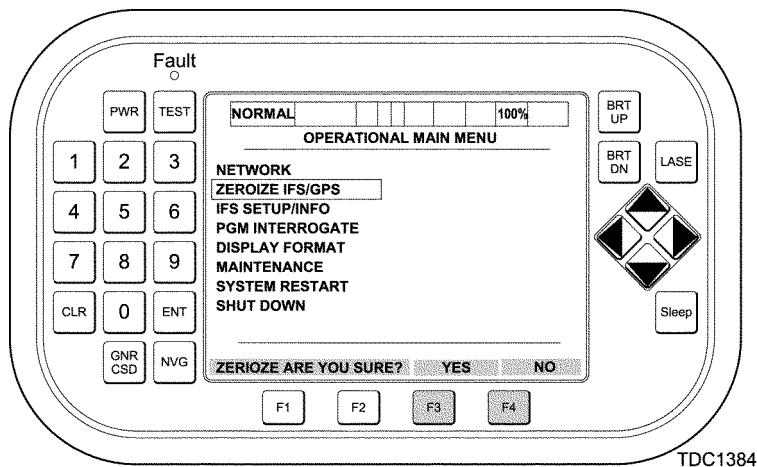
2-72 SPECIAL PROCEDURES (cont)

h. Zeroize IFS/GPS

- 1 SC transitions from current screen to OPERATIONAL MAIN MENU by pressing **MENU F1** key.
- 2 Press **NEXT PAGE F2** key.
- 3 Select **ZEROIZE IFS/GPS**, press **SELECT F1** key.

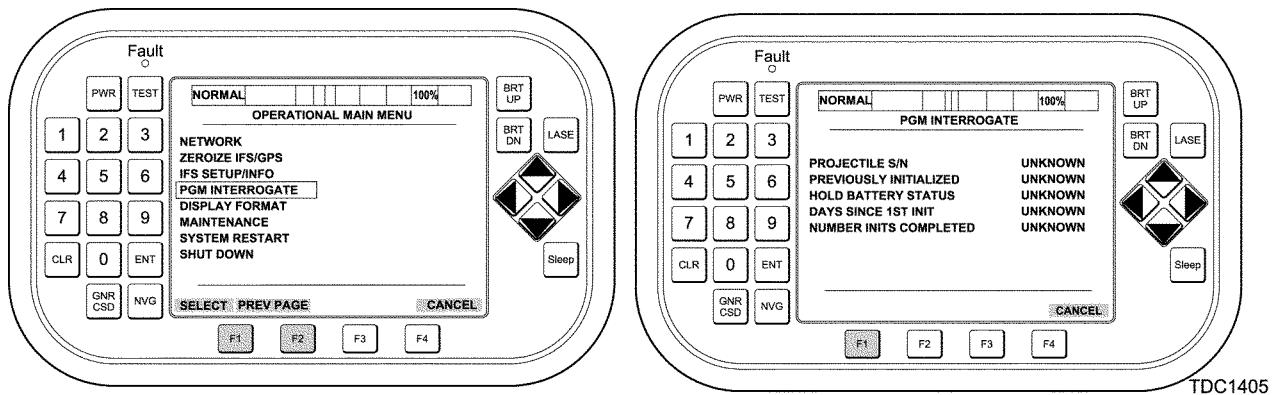


- 4 When "ZEROIZE ARE YOU SURE" YES NO message is displayed, press **YES F3** acknowledge or **NO F4** key to cancel.



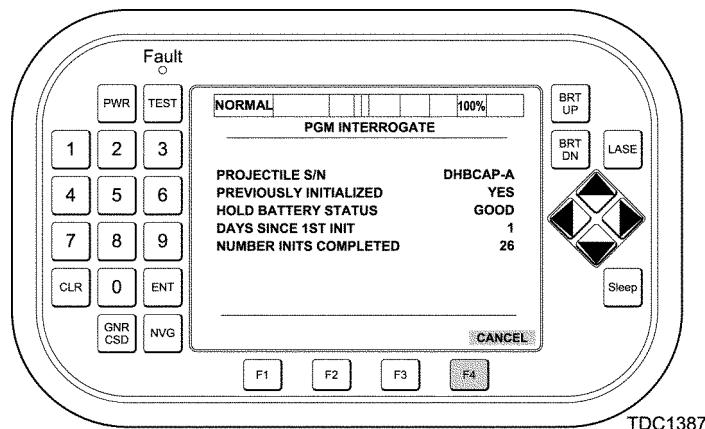
i. **PGM Interrogate**

- 1 SC transitions from current screen to OPERATIONAL MAIN MENU by pressing **MENU F1** key.
- 2 Press **NEXT PAGE F2** key.
- 3 Position the EPIAFS wand over the nose cone of the PGM (Excalibur). Select **PGM INTERROGATE**, press **SELECT F1** key. There will be a delay in transition to the next screen while the DFCS interrogates the PGM.



TDC1405

- 4 Upon completion of interrogation, the display will automatically transition to the screen below. Press **CANCEL F4** key to return to Operational Main Menu.

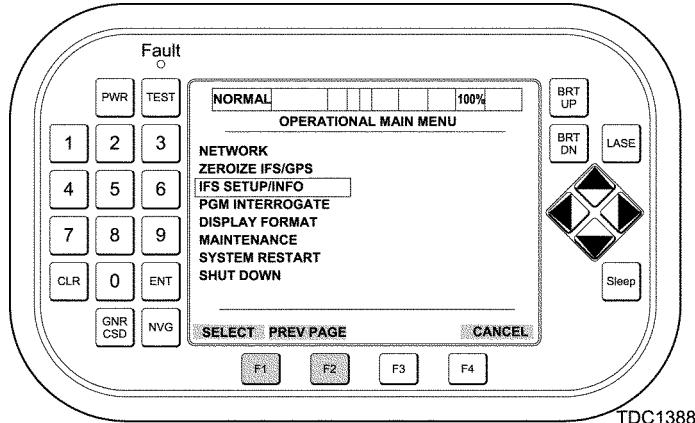


TDC1387

2-72 SPECIAL PROCEDURES (cont)

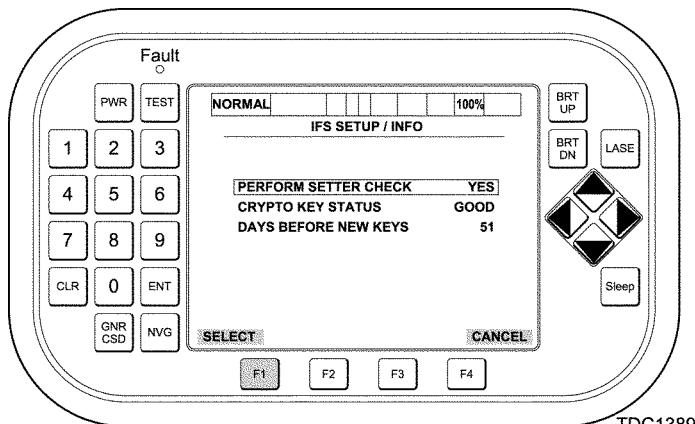
j. IFS Set up/Information

- 1 SC transitions from current screen to **OPERATIONAL MAIN MENU** by pressing **MENU F1** key.
- 2 Press **NEXT PAGE F2** key.
- 3 Select **IFS SETUP/INFO**, press **SELECT F1** key.



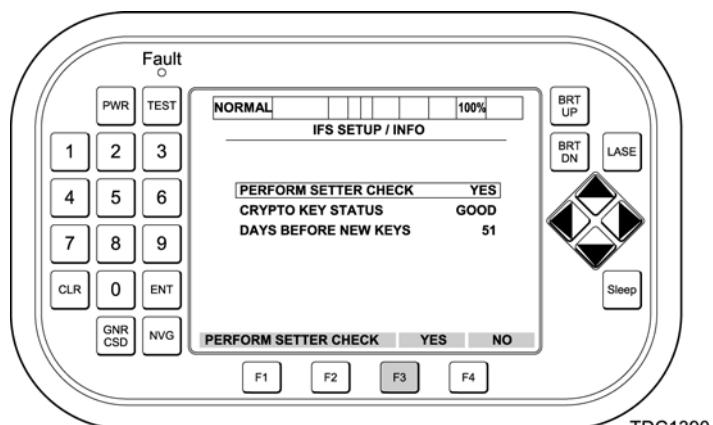
TDC1388

- 4 Select **PERFORM SETTER CHECK YES**, press **SELECT F1** key.



TDC1389

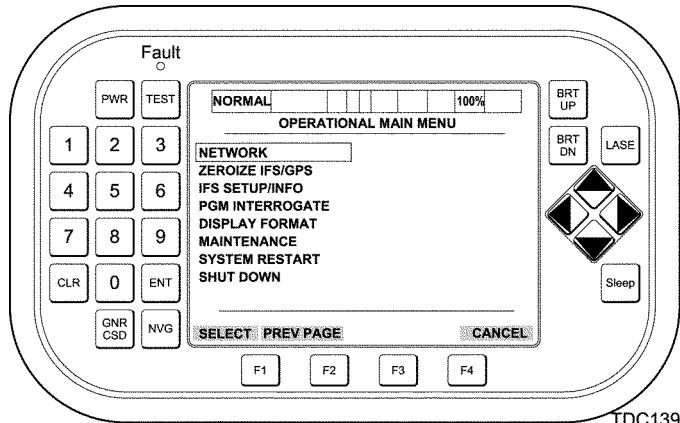
- 5 “**PERFORM SETTER CHECK**” **YES NO** message is displayed, press **YES F3**.



TDC1390

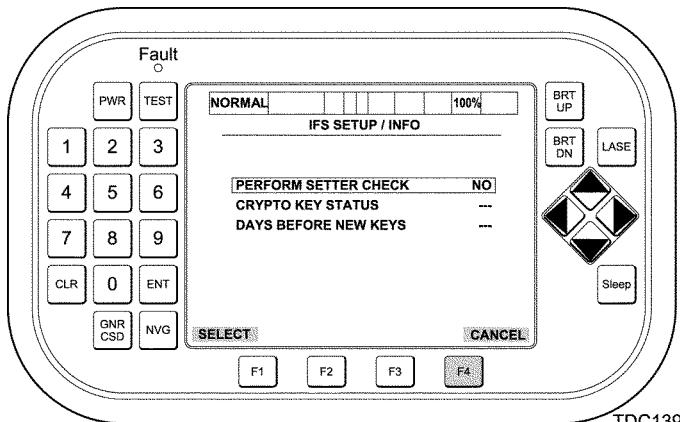
NOTE

This function allows the DFCS to monitor the status of the Inductive Fuze Setter System (IFS). In this mode the Zeroize the IFS/GPS and PGM Interrogate is enabled.



TDC1391

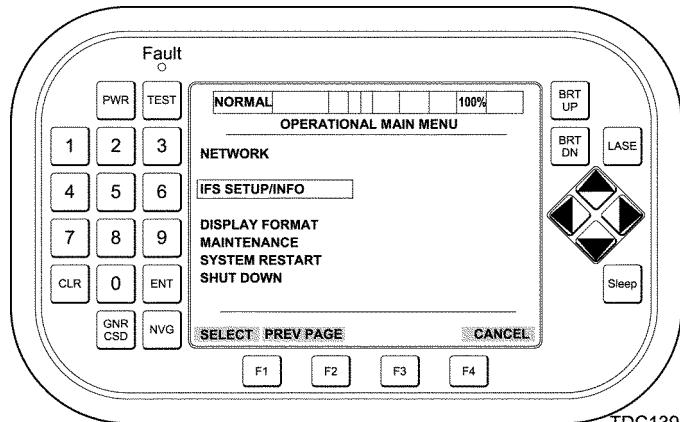
- 6 “PERFORM SETTER CHECK” YES NO message is displayed, press NO F4.



TDC1392

NOTE

This function will not allow the DFCS to monitor the status of the Inductive Fuze Setter System (IFS). It should only be used when components of the IFS will not be connected to the DFCS. In this mode the Zeroize the IFS/GPS and PGM Interrogate is disabled.



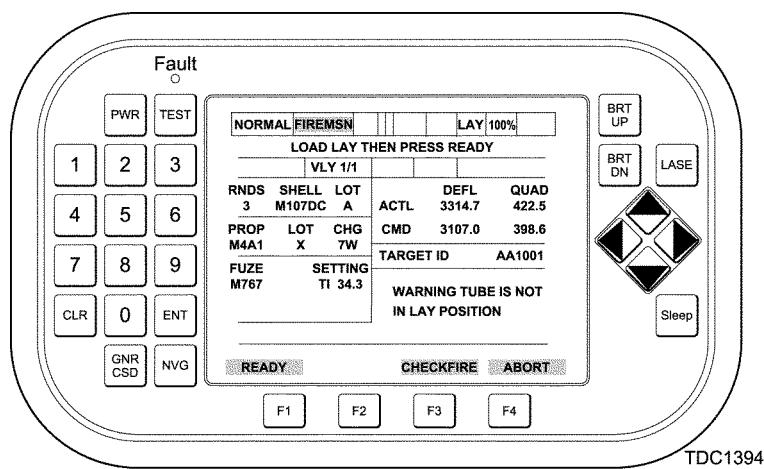
TDC1393

2-72 SPECIAL PROCEDURES (cont)

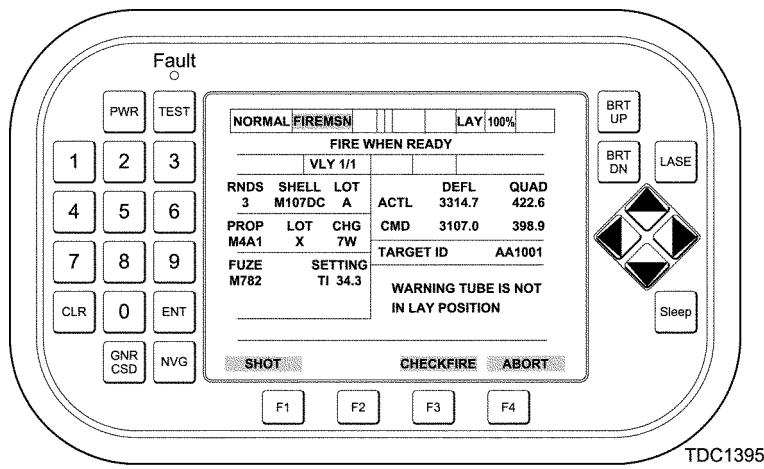
k Monitor Inductively Set Fuze Operations:

NOTE

With the Inductive Fuze Setter System (IFS) integrated onto the M777A2, the crew can remotely set inductive fuzes while the SC monitor the status of the fuze setting operation on the CSD.

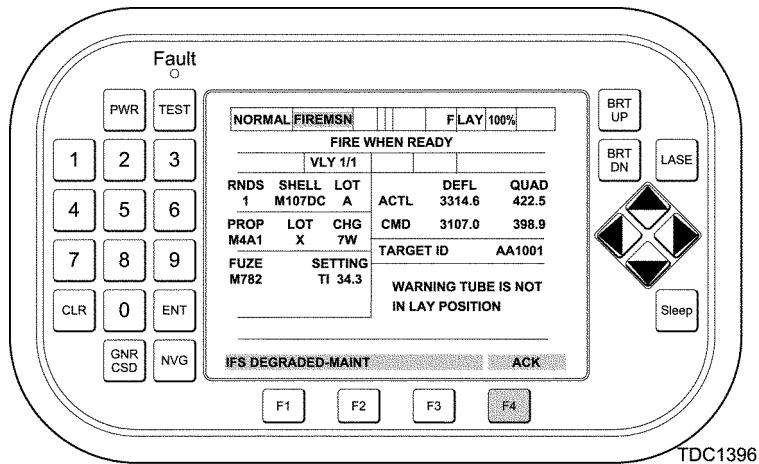


TDC1394



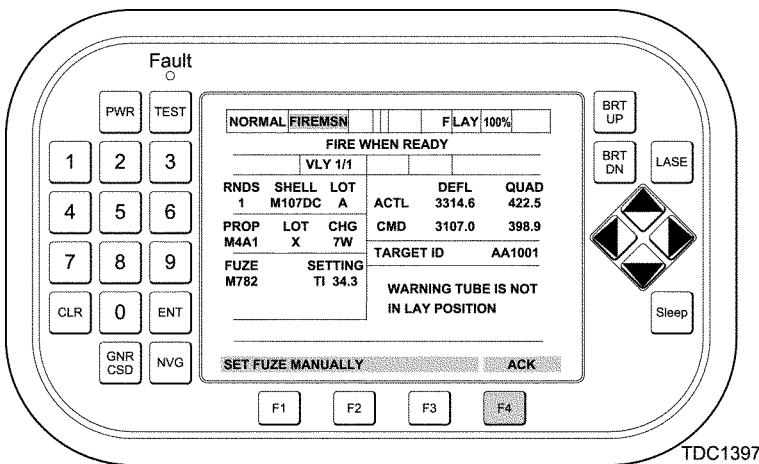
TDC1395

- 1 If the IFS fails during a fire mission, the "IFS DEGRADED-MAINT" ACK message is displayed, press F4 to acknowledge.



TDC1396

- 2 "SET FUZE MANUALLY" ACK message is displayed, press F4 to acknowledge.



TDC1397

Section IX. DFCS BLOCK 1 OPERATION

Paragraph		Page
2-73	DFCS Block 1 List of Abbreviations/Acronyms	2-312
2-74	Initialization Procedures Using Stored Spheroid/Datum Entries	2-313
2-75	Initialization Procedures Using User Defined Spheroid/Datum Entries.....	2-319
2-76	Movement Procedures	2-327
2-77	Fire Mission Procedures.....	2-328
2-78	Special Orders Procedures	2-336
2-79	Re-emplace Howitzer Using DFCS	2-339

2-73 DFCS BLOCK 1 LIST OF ABBREVIATIONS/ACRONYMS

The following alphabetical list gives definitions for the abbreviations and acronyms used for the DFCS.

A	GPS Aiding not available
ALT	Altitude
ACK	Acknowledge
ACT	Actual
ACT DEF	Actual Deflection
ACTL	Actual
ACT QE	Actual Quadrant Elevation
AF	Adjust Fire
AGD	Assistant Gunners Display
AMC	At My Command
AOF	Azimuth of Fire
AUX	Auxiliary
AZ	Azimuth
BRT	Brightness
CBLS	Cables
CHG	Charge
CHKFIRE	Checkfire
CLR	Clear
CMD	Command
COM	Communication (TACLINK)
COMMS	Communication
CRS-AZ	Course Azimuth
CSD	Chief of Section Display
DAGR	Defense Advanced GPS Receiver
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
PPF	Final Protective Fire
GND	Gunners Display
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	NAV unavailable
N	North/Northings
NAV	Navigation Subsystem
NVG	Night Vision Goggles
OBIT	Operational-BIT
OIBIT	Operated-Initiated-BIT
OL	Orientation Line
POSN.....	Position
PROP.....	Propellant
PSP	Power Conditioning and Control Module
PWR	Power
PWS	Power Subsystem
PUBIT	Power-Up-BIT
QE	Quadrant Elevation
QUAD.....	Quadrant
RNDS.....	Rounds
RNG	Range
RPS	Radio Power Supply
RTA	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

2-74 INITIALIZATION PROCEDURES USING STORED SPHEROID/DATUM ENTRIES



WARNING

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



TDC0450

NOTES

Before initializing the DFCS, ensure the following are completed:

- Howitzer left wheel is within 1 yard (1m) of the SCP.
- Travel and traverse locks are engaged.
- Radio antenna is properly mounted.

2-74 INITIALIZATION PROCEDURES USING STORED SPHEROID/DATUM ENTRIES (cont).

- 1 SC directs Driver, and places the howitzers left wheel within 1 yard (1m) of SCP.
- 2 Turn PCCM (1) on by, pulling out and rotating the functional control switch (2) counter clock wise to the ON position.

NOTES

DAGR internal power batteries are not required while using external power, but may remain installed when using external power. If batteries are removed, the battery pack should remain installed to seal the battery compartment. The memory battery should always remain installed.

If the DFCS system requires an external power source and/or batteries require charging (PCCM state of charge indicator is showing below 50%), 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:

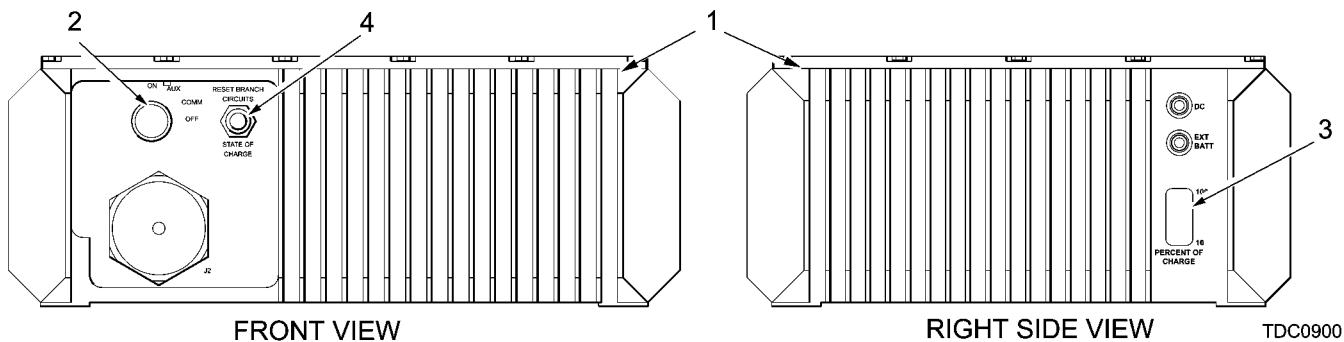
Incorrect rpm may not provide the sufficient power to charge the DFCS batteries.

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

If there is no reading on the State Of Charge (SOC) indicator (3), reset RESET BRANCH CIRCUITS/STATE OF CHARGE on front of PCCM. If no power indicated on PCCM, see Chap 3, Sect II (Troubleshooting).

If the SOC indicator is 50% or more, continue with initialization procedure, if indicator is below 50%, connect power [W3] cable and charge batteries (startup prime mover engine).

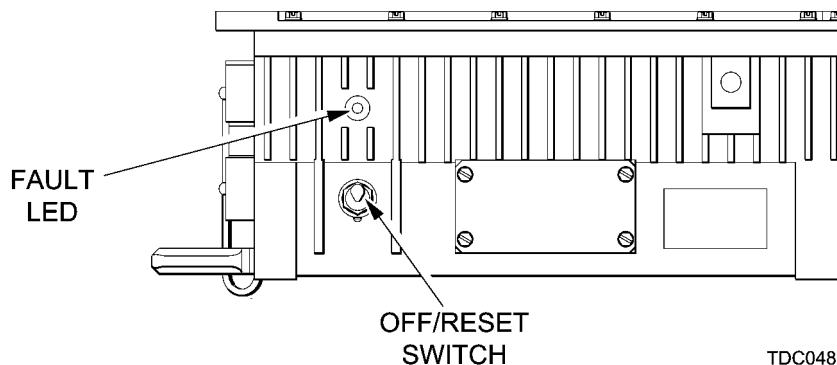
- 3 Press RESET BRANCH CIRCUITS/STATE OF CHARGE (4) and check SOC indicator (3).



NOTE

During initialization process, FAULT LED (5) will be illuminated. Upon completion of initialization process (approximately 90 seconds), if no faults are detected, FAULT LED will extinguish.

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



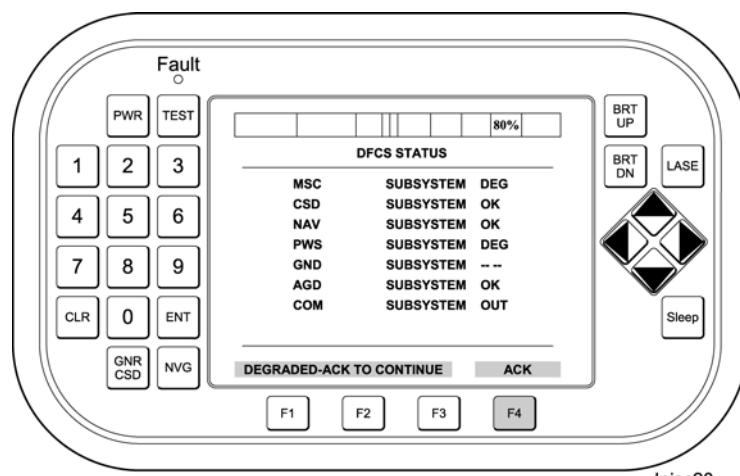
NOTES

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

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

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

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

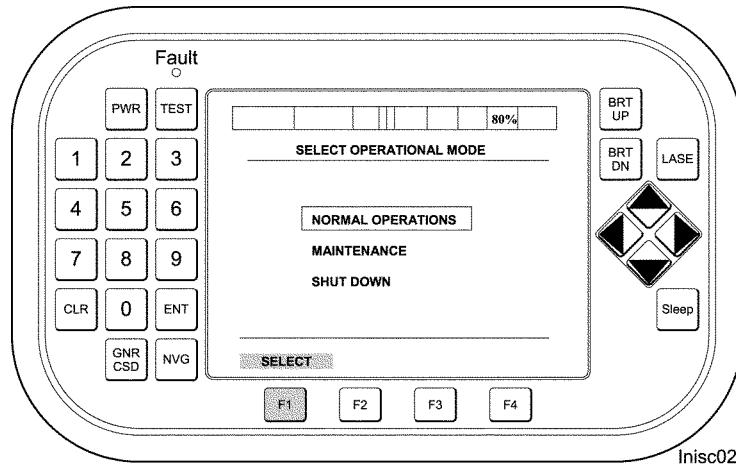


2-74 INITIALIZATION PROCEDURES USING STORED SPHEROID/DATUM ENTRIES (cont).

NOTE

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

- 5** Select **NORMAL OPERATIONS** and press **SELECT F1** key.

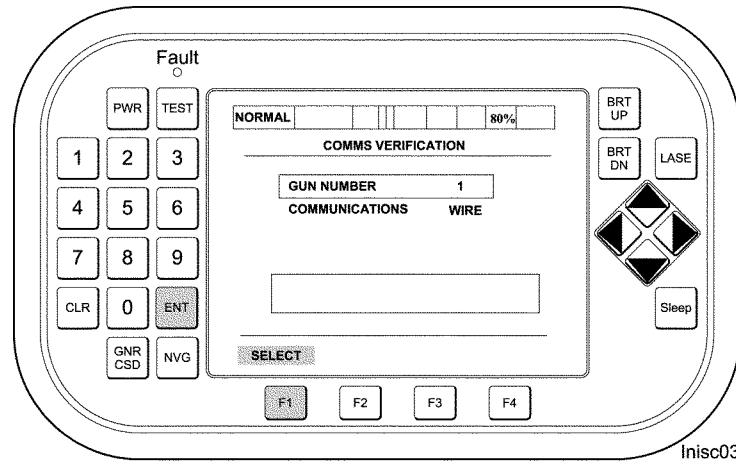


NOTES

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

If **GUN NUMBER** and **COMMUNICATIONS** are correct go to step 8. If **GUN NUMBER** is correct and **COMMUNICATIONS** is not correct, go to step 7.

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

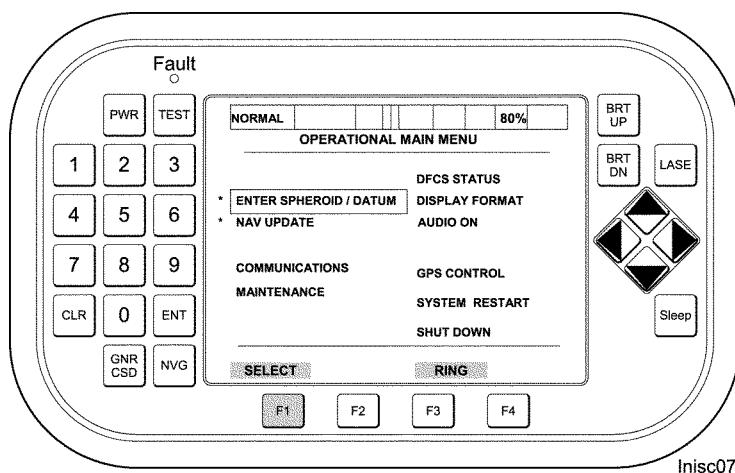


- 7 Select **COMMUNICATIONS** and press **SELECT F1** key. **CHANGE TO RADIO**, **YES**, **NO**. Press **YES F3** key.
- 8 Verify gun number and communication data is correct, press **USE ALL F2** key.

NOTE

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

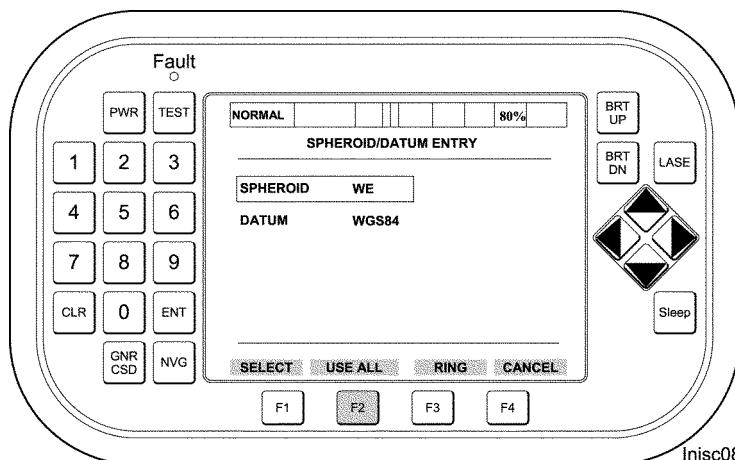
- 9 Select ***ENTER SPHEROID/DATUM** and press **SELECT F1** key.



NOTE

If spheroid and datum is other than WE, and WGS84 (see Para 2-75).

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



2-74 INITIALIZATION PROCEDURES USING STORED SPHEROID/DATUM ENTRIES (cont).

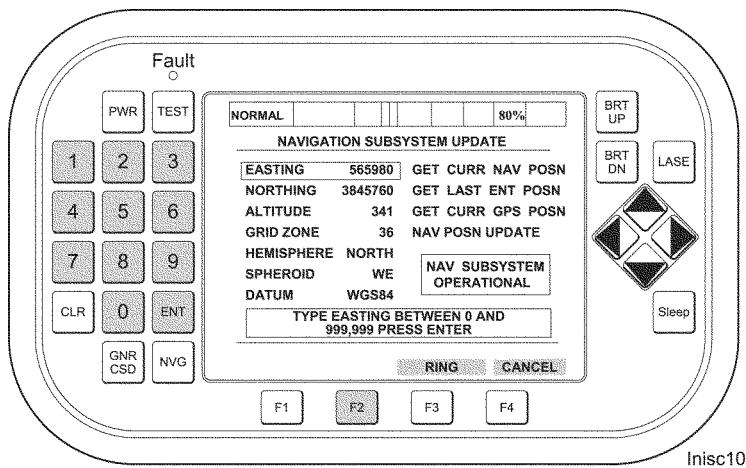
- 11 Select **NAV UPDATE**, press **SELECT F1** key.

NOTES

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

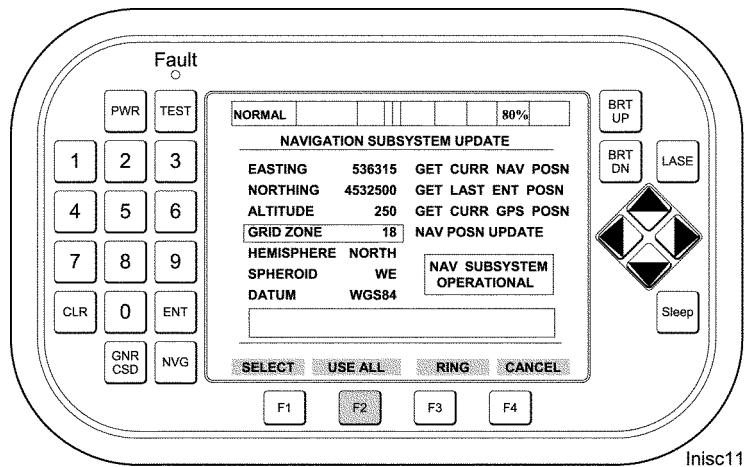
If **HEMISPHERE** needs to be changed, CHANGE HEMISPHERE MESSAGE will be displayed. **YES/NO** selections will allow change of the hemisphere from NORTH to SOUTH and vice versa.

- 12 In sequence, select **EASTING**, **NORTHING**, **ALTITUDE**, **HEMISPHERE**, and **GRID ZONE**. After each selection, press **SELECT F1** key, enter data, and press **ENT** key.



Inisc10

- 13 Verify data on the **NAVIGATION SUBSYSTEM UPDATE**, press **USE ALL F2** key. System will start alignment.



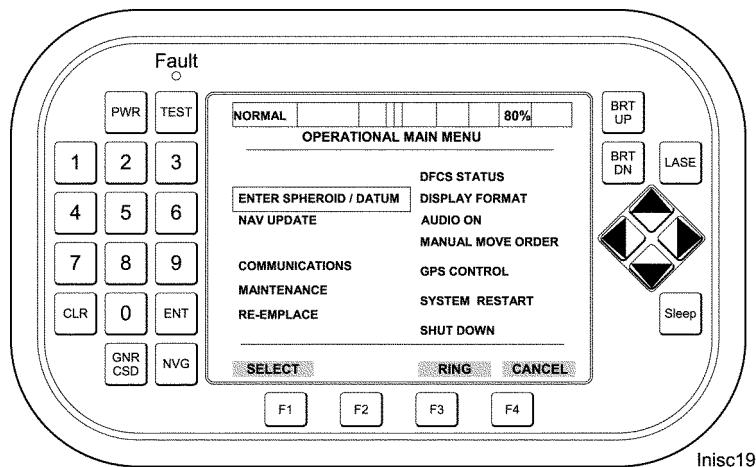
Inisc11

- 14 At the completion of alignment, press CANCEL F4 key, SECTION IN ORDER AT INITIALIZATION POINT will be displayed.

NOTE

SC can enter a move order that will allow the howitzer to move to a firing point/area and prepare for fire missions.

- 15 Press MENU F1 key, the OPERATIONAL MAIN MENU will be displayed. DFCS is now initialized.



Insc19

2-75 INITIALIZATION PROCEDURES USING USER DEFINED SPHEROID/DATUM ENTRIES

NOTES

Before initializing the DFCS, ensure the following are completed:

- Howitzer left wheel is within 1 yard (1m) of the 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 (1m) of SCP.
- 2 Turn PCCM (1) on by, pulling out and rotating the functional control switch (2) counter clock wise to the ON position.

2-75 INITIALIZATION PROCEDURES USING USER DEFINED SPHEROID/DATUM ENTRIES (cont)

NOTES

DAGR internal power batteries are not required while using external power, but may remain installed when using external power. If batteries are removed, the battery pack should remain installed to seal the battery compartment. The memory battery should always remain installed.

If the DFCS system requires an external power source and/or batteries require charging (PCCM state of charge indicator is showing below 50%), 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:

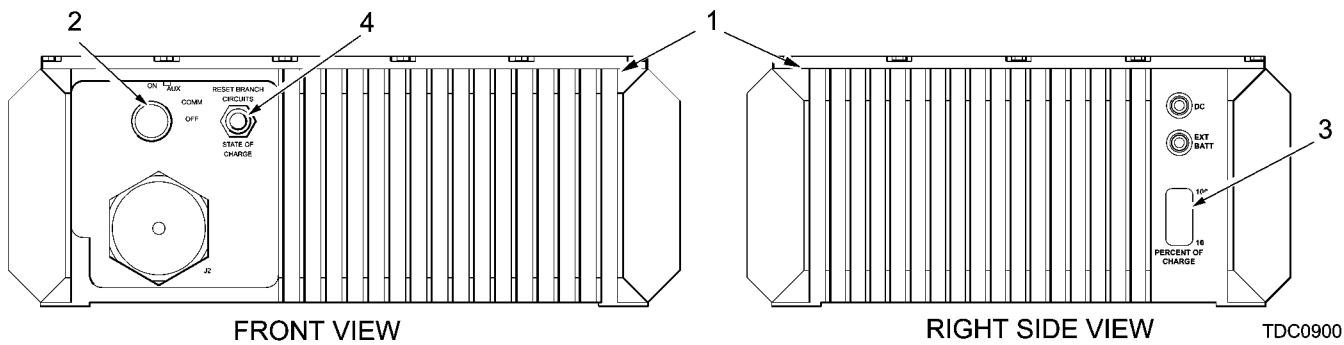
Incorrect rpm may not provide the sufficient power to charge the DFCS batteries.

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

If there is no reading on the State Of Charge (SOC) indicator (3), reset RESET BRANCH CIRCUITS/STATE OF CHARGE on front of PCCM. If no power indicated on PCCM, see Chap 3, Sect II (Troubleshooting).

If the SOC indicator is 50% or more, continue with initialization procedure, if indicator is below 50%, connect power [W3] cable and charge batteries (startup prime mover engine).

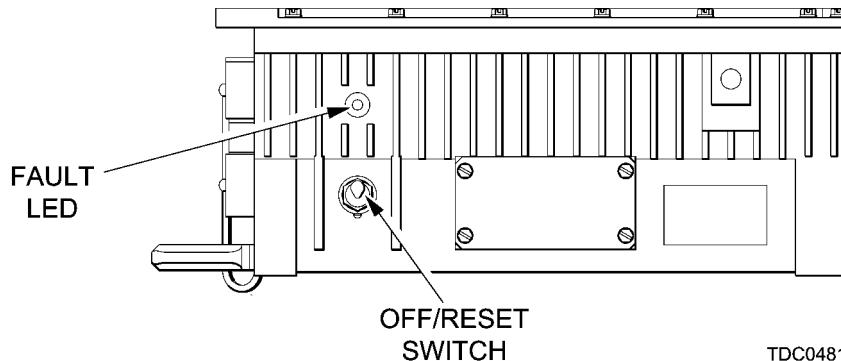
- 3 Press RESET BRANCH CIRCUITS/STATE OF CHARGE (4) and check SOC indicator (3).



NOTE

During initialization process, FAULT LED (5) will be illuminated. Upon completion of initialization process (approximately 90 seconds), if no faults are detected, FAULT LED will extinguish.

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



TDC0481

NOTES

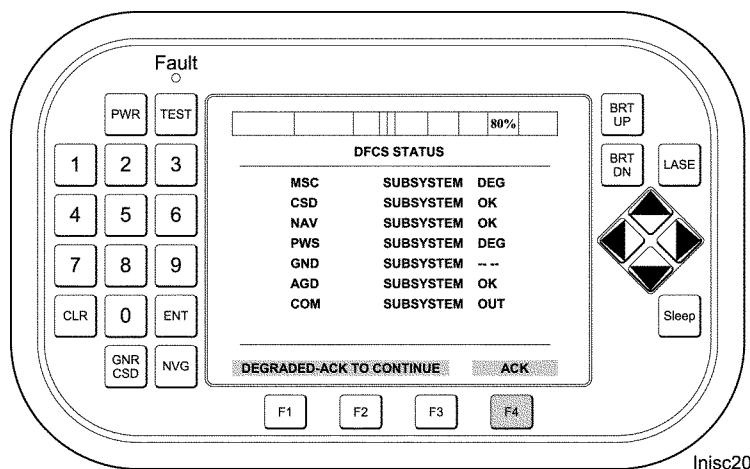
DFCS will power up and automatically perform its Built-In-Test (BIT). On completion of the BIT the CSD screen will display DFCS STATUS.

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

In the event of a failure during system startup, message **DEGRADED-ACK TO CONTINUE** will be displayed (only for certain subsystems) on the bottom line of the Electro Luminescent (EL) panel. To continue, press **F4** key under **ACK**. This

action will transition the **DFCS STATUS** screen to **SELECT OPERATIONAL MODE** screen.

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

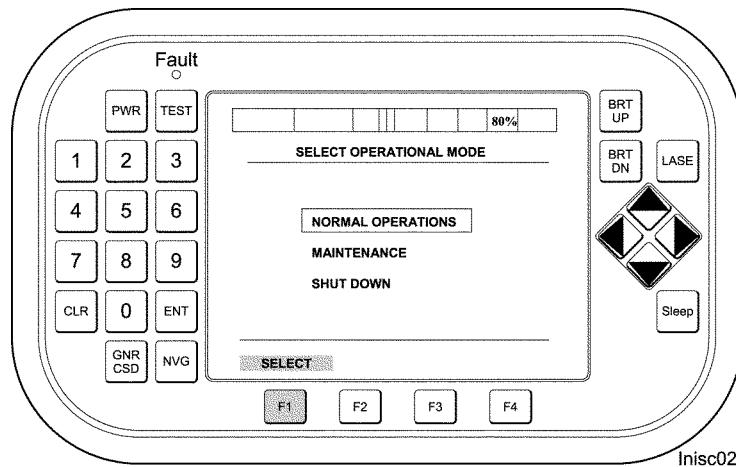


NOTE

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

2-75 INITIALIZATION PROCEDURES USING USER DEFINED SPHEROID/DATUM ENTRIES (cont).

- 5** Select **NORMAL OPERATIONS** and press **SELECT F1** key.



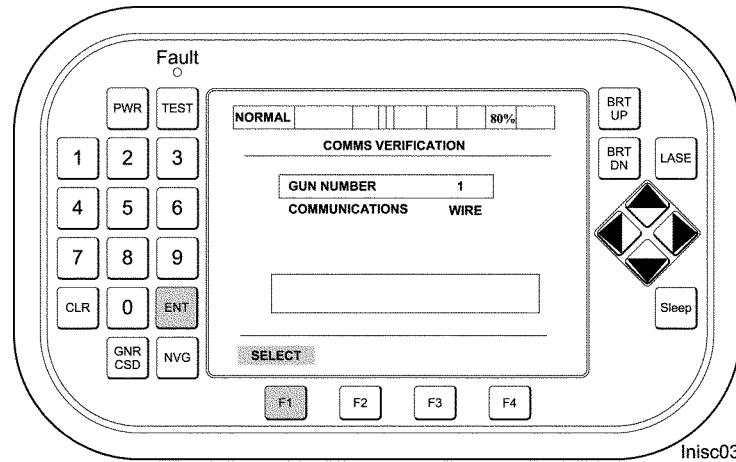
Inisc02

NOTES

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

If GUN NUMBER and COMMUNICATIONS are correct go to step 8. If GUN NUMBER is correct and COMMUNICATIONS is not correct, go to step 7.

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



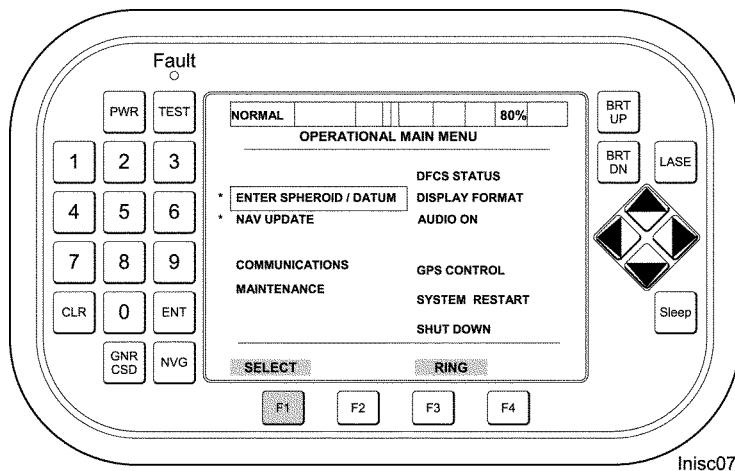
Inisc03

- 7 Select **COMMUNICATIONS** and press **SELECT F1** key. **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**. Asterisks indicate these two entries are required to be completed.

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

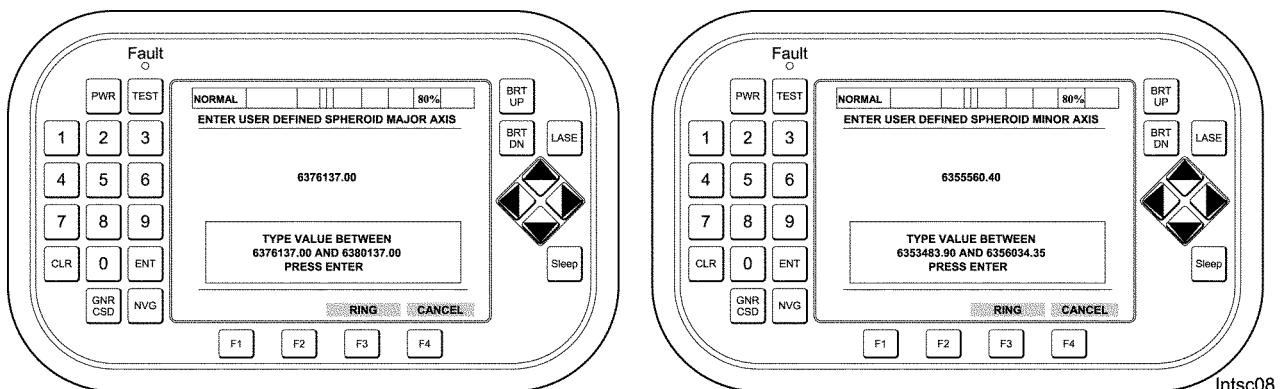


Insc07

NOTE

The FDC will provide a spheroid and datum that is not **WE/WGS84** or listed on the **SELECT SPHEROID** or **SELECT DATUM** screens.

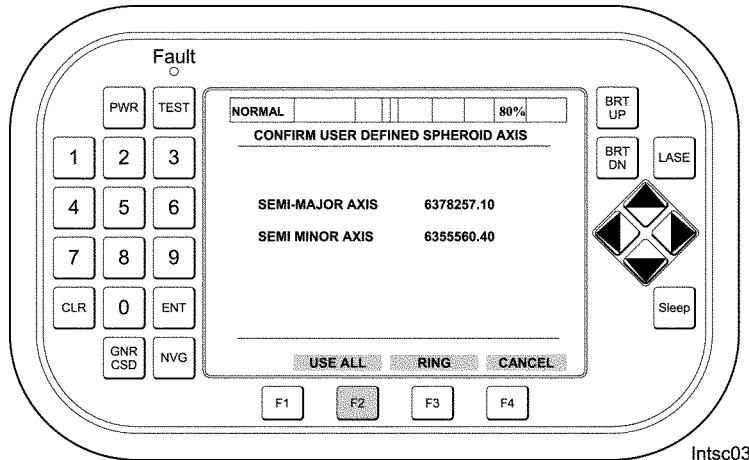
- 10 When **SELECT SPHEROID** is displayed, select **USRDEF** with a MAJ and MIN, press **SELECT F1** key.
- 11 **ENTER USER DEFINED SPHEROID MAJOR AXIS**, press **ENT** key.



Insc08

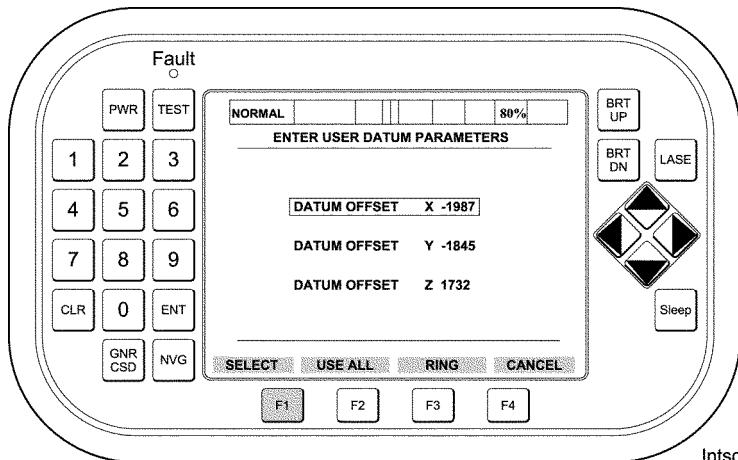
2-75 INITIALIZATION PROCEDURES USING USER DEFINED SPHEROID/DATUM ENTRIES (cont.).

- 12 CONFIRM USER DEFINED SPHEROID AXIS, press USE ALL F2 key.



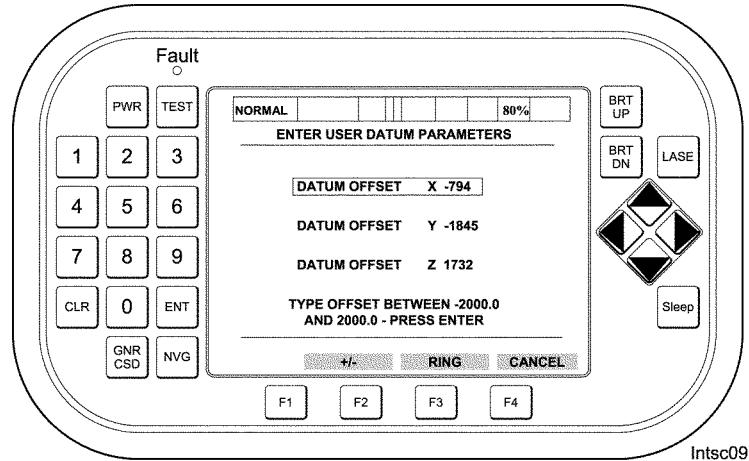
Intsc03

- 13 Select DATUM, press SELECT F1 key. Select USRDEF, press SELECT F1 key.



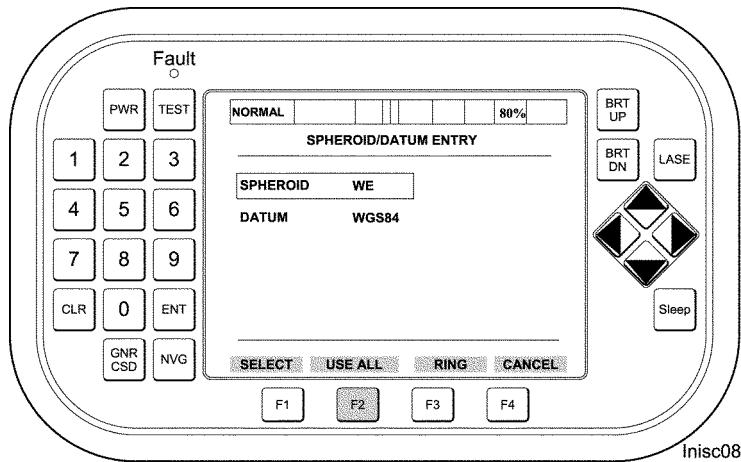
Intsc05

- 14 To enter datum offsets, press SELECT F1 key, enter the offset values and press ENT key.



Intsc09

- 15 VERIFY DATA, PRESS USE ALL F2 KEY.



Inisc08

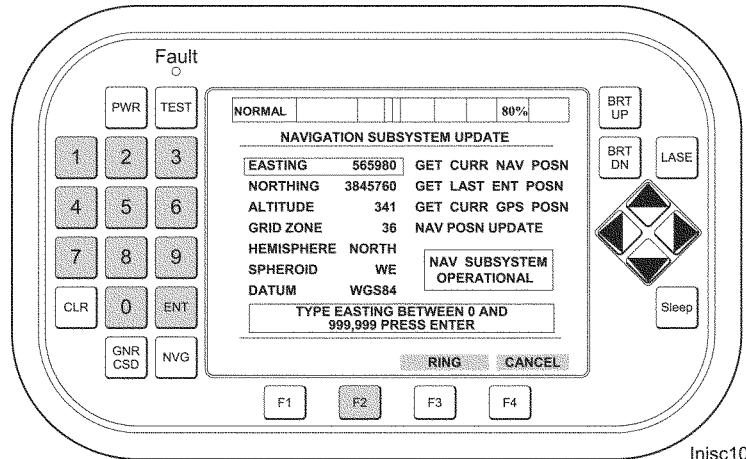
- 16 Select NAV UPDATE, press SELECT F1 key.

NOTES

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

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

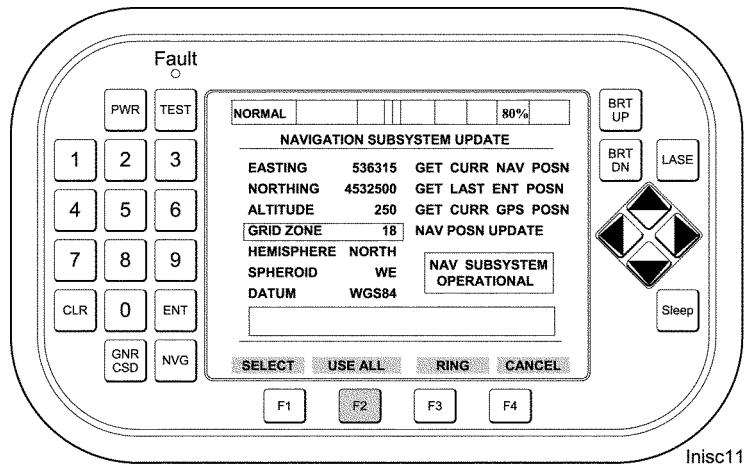
- 17 In sequence, select EASTING, NORTHING, ALTITUDE, HEMISPHERE, and GRID ZONE. After each selection, press SELECT F1 key, enter data, and press ENT key.



Inisc10

2-75 INITIALIZATION PROCEDURES USING USER DEFINED SPHEROID/DATUM ENTRIES (cont).

- 18 Verify data on the NAVIGATION SUBSYSTEM UPDATE, press **USE ALL F2** key. System will start alignment.



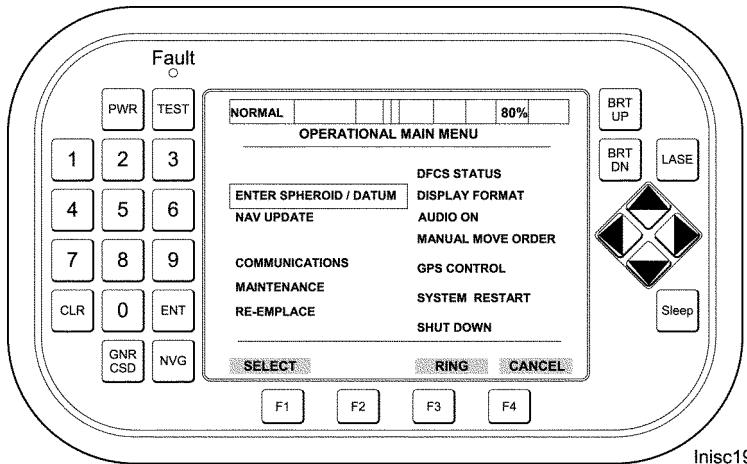
Inisc11

- 19 At the completion of alignment, press **CANCEL F4** key, SECTION IN ORDER AT INITIALIZATION POINT will be displayed.

NOTE

SC can enter a move order that will allow the howitzer to move to a firing point/area and prepare for fire missions.

- 20 Press **MENU F1** key, the OPERATIONAL MAIN MENU will be displayed. DFCS is now initialized.

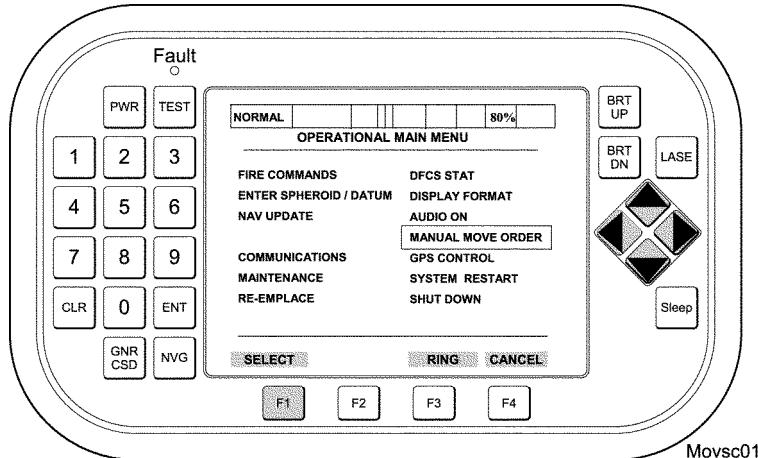


Inisc19

2-76 MOVEMENT PROCEDURES

a. Move to a Fire Area/Point/Log/Init Point

- Select **MANUAL MOVE ORDERS**, press **SELECT F1** key.



Movsc01

NOTES

If altitude is negative, enter value, select **± F2** key, press **ENT** key.

FIRE COMMANDS not available if:

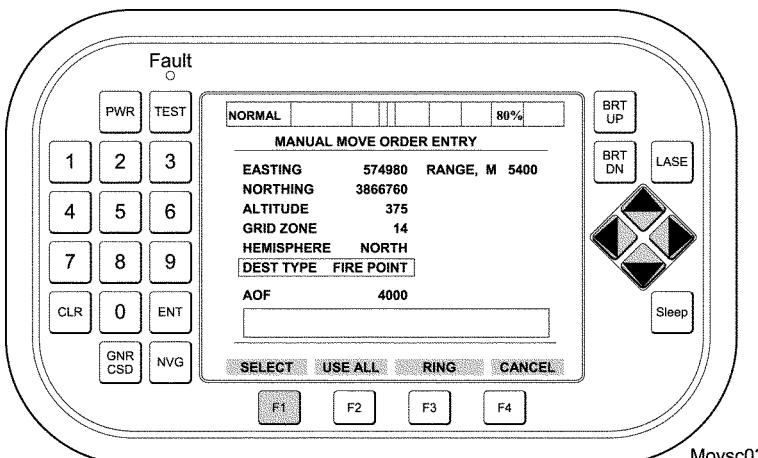
- Moving.
- Destination is to a Initialization or Logistic Point.
- NAV is OUT, position data sent to INU and INU is aligning.

- In sequence, select **EASTING**, **NORTHING**, **ALTITUDE**, **HEMISPHERE**, and **GRID ZONE**. After each selection, press **SELECT F1** key, enter data, and press **ENT** key.

NOTE

Last entered **DEST TYPE** will be displayed. If destination type is different, go to step 3, if not, press **USE ALL F2** key and proceed to step 4.

- Select **DEST TYPE**, press **SELECT F1** key.



Movsc03

2-76 MOVEMENT PROCEDURES (cont)

NOTE

Selecting **FIRE AREA** requires a **RADIUS** to be entered; default value is 750 meters. If selecting any **DEST TYPE** other than **FIRE AREA**, proceed to step 7.

- 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.

NOTE

STEER TO SCREEN will be displayed when INU detects movement.

- 7 Verify move data, press **USE ALL F2** key. Move to designated area, emplace howitzer (Para 2-15).

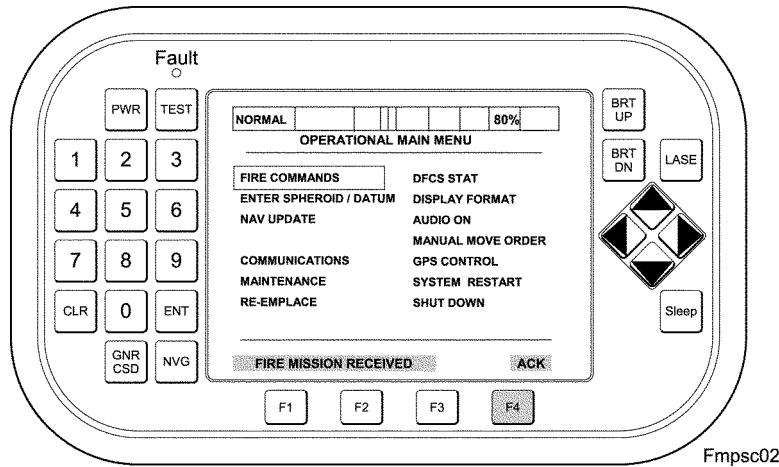
2-77 FIRE MISSION PROCEDURES

- a. **Digital Fire Mission – Fire When Ready/At My Command.**

- 1 Upon receipt of a digital fire mission from the FDC, an audible alert on the CSD and a message prompting the SC to acknowledge will occur. When **FIRE MISSION RECEIVED** message is displayed, press **F4** key to acknowledge.

NOTE

Any screen can be displayed during non-fire mission operations. In this example, the OPERATIONAL MAIN MENU is displayed



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 howitzer. 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.

NOTES

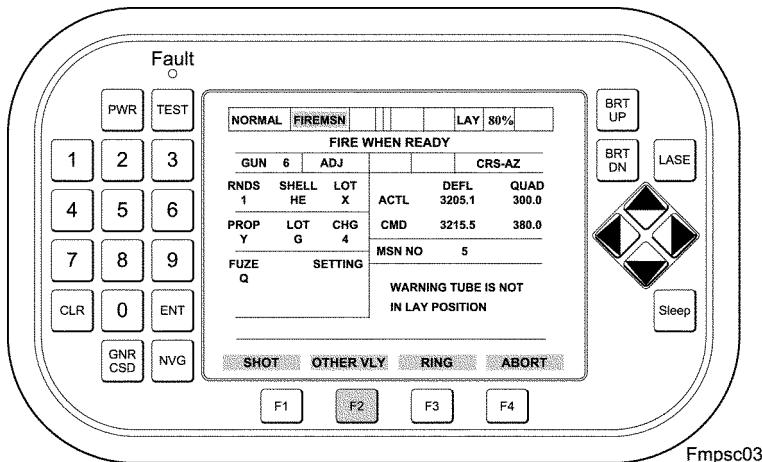
FIRE MSN will display initial fire commands; the SC of the adjusting section will announce fire commands to the crew.

F2 key on the FIRE MSN 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.

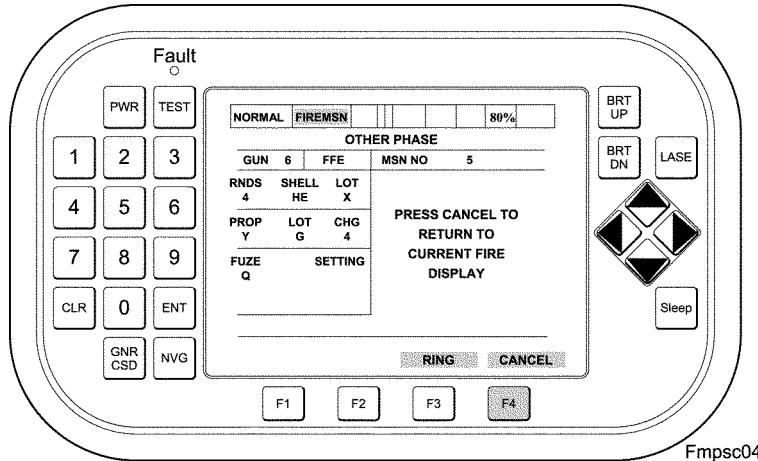
Adjusting howitzer will have ADJ in the space to the right of the GUN number. The number of rounds (RNDS) will be 1 during the adjustment phase.

- 3 The SC of the adjusting howitzer can see the additional data by pressing the OTHER VLY F2 key.



Fmpsc03

- 4 OTHER PHASE screen will display FFE data. This will allow the section to prepare the ammunition for the FFE phase.



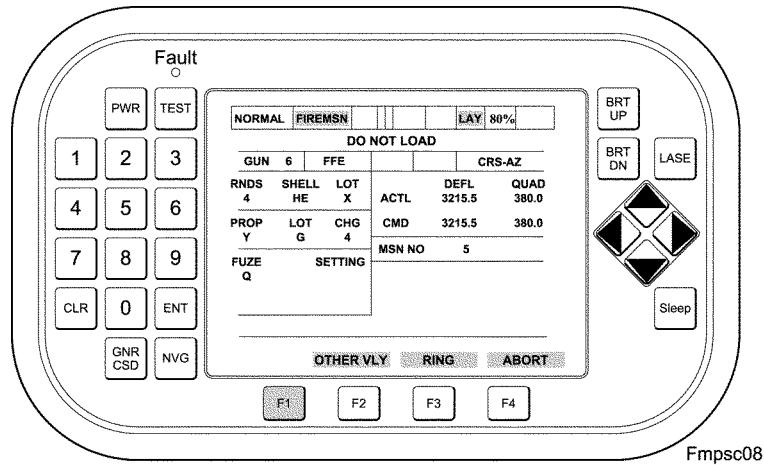
Fmpsc04

2-77 FIRE MISSION PROCEDURES (cont)

a. Digital Fire Mission – Fire When Ready/At My Command (cont).

5 ATC will record the data and press CANCEL F4 key returning display to the FIRE MSN.

6 Non-adjusting howitzers CSD will display a FIRE MSN with a DO NOT LOAD method of fire. FFE will be displayed to the right of the GUN number. Number of rounds in FFE will be displayed under RNDS label.

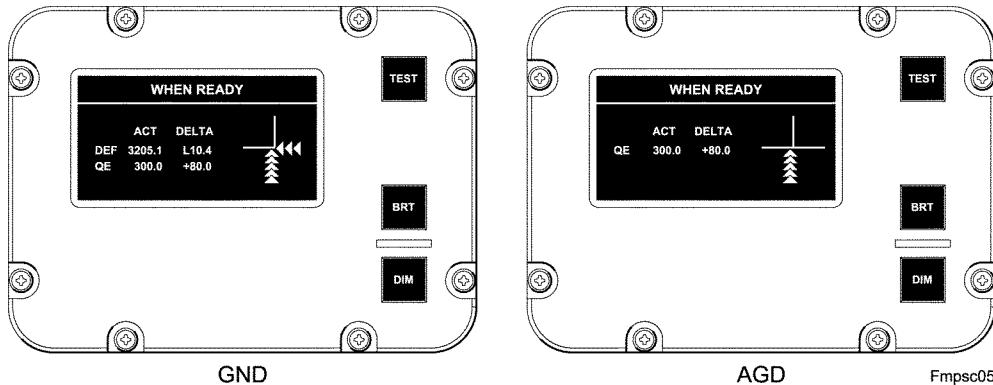


Fmpsc08

NOTES

Howitzer is laid on commanded firing data, GND and AGD will display graphic arrows indicating to the Gunner and Assistant Gunner the amount the cannon tube must move to achieve the lay data. A numeric delta also appears on the screen indicating the direction and amount to achieve the lay data.

When data is within 10 mils of commanded data, small arrowheads will change to one large arrowhead. When commanded data has been achieved the large arrowhead will change to a solid circle (ball shape) in the middle of the graphic crosshairs.



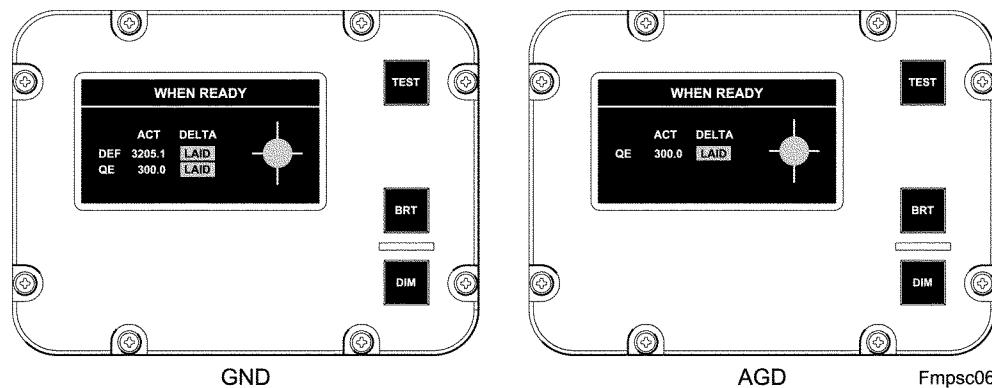
Fmpsc05

CAUTIONS

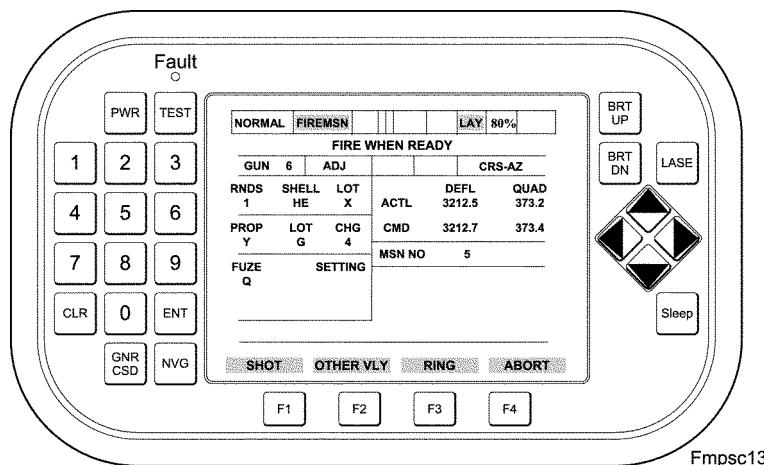
Following safety checks are mandatory for all fire missions:

- 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.

- 7 Gunner and Assistant Gunner elevate/depress/traverse cannon tube until ACT DEF and QE data are set on the howitzer. AGD will display 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. Once both the deflection and quadrant is achieved, SET and READY will be replaced with **LAID** and the solid circle in the middle of the graphic crosshairs.

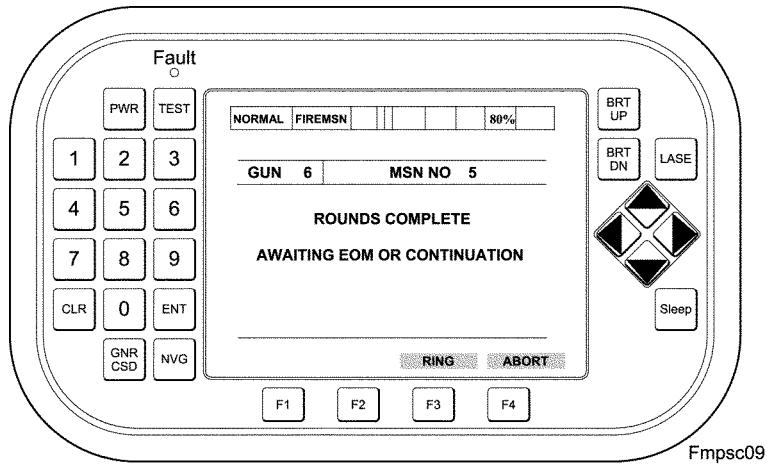


- 8 The SC verifies mandatory safety checks and presses **SHOT F1** key on the **FIRE MSN** screen.



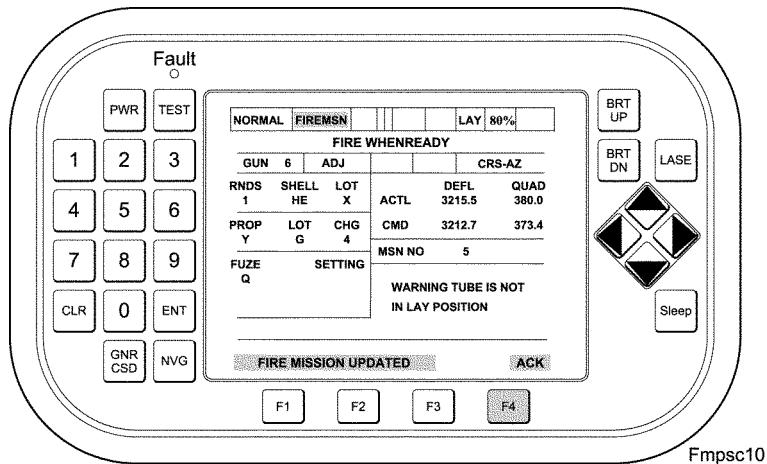
2-77 FIRE MISSION PROCEDURES (cont)

- a. **Digital Fire Mission – Fire When Ready/At My Command (cont).**
- 9 After the round has been fired, **ROUNDS COMPLETE** will be displayed. This will remain displayed until mission is ended or another **FIRE MSN** appears indicating mission has been updated.



Fmpsc09

- 10 If there is subsequent adjustment data, an audio alert will sound and **FIRE MSN UPDATED** will be displayed, press ACK **F4** key to acknowledge.

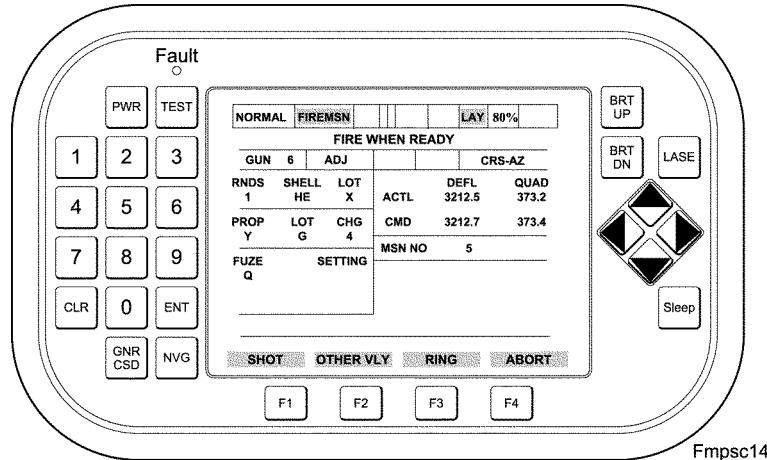


Fmpsc10

- 11 **FIRE MSN** will be displayed with **SHOT** and **OTHER VLY** keys again available.

NOTE

The subsequent data procedures are the same as steps 6 through 10 above.

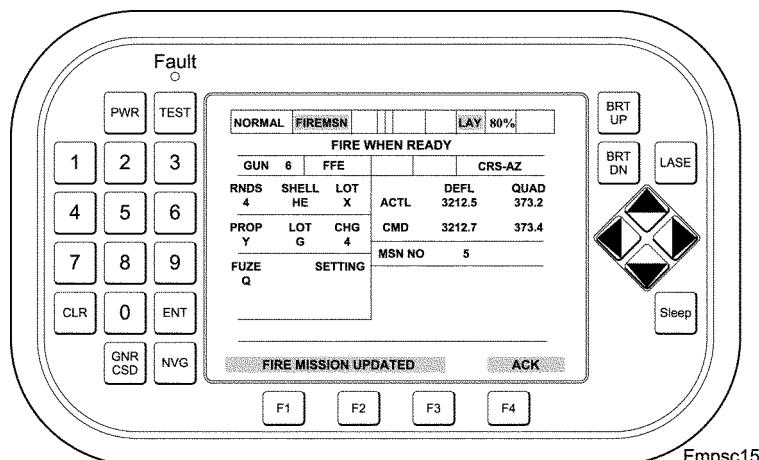


Fmpsc14

NOTE

If subsequent adjusting rounds, the steps above are repeated. When FFE phase begins, a new FIRE MSN screen will be displayed with FIRE MSN UPDATED, ACK message displayed. FFE will be displayed in the space to the right of the GUN number and RNDS will change from 1 to the number of rounds required in FFE.

- 12 When updated FIRE MSN is displayed, press ACK F4 key to acknowledge message.

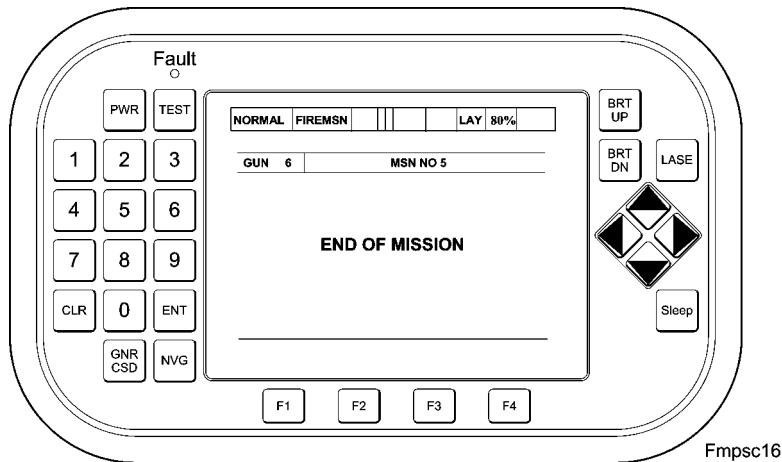


Fmpsc15

2-77 FIRE MISSION PROCEDURES (cont)

a. Digital Fire Mission – Fire When Ready/At My Command (cont).

- 13 When the **FIRE MSN** is displayed again, **SHOT F1** key will be active.
- 14 The Gunner and Assistant Gunner lay the howitzer using the aid of the GND and AGD as described in step 7. Once the howitzer is laid the SC commands fire and presses **SHOT F1** key. As each round in **FFE** is fired, the ATC presses the **SHOT** key. When the FFE is expended, the ROUNDS COMPLETE screen will be displayed.
- 15 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

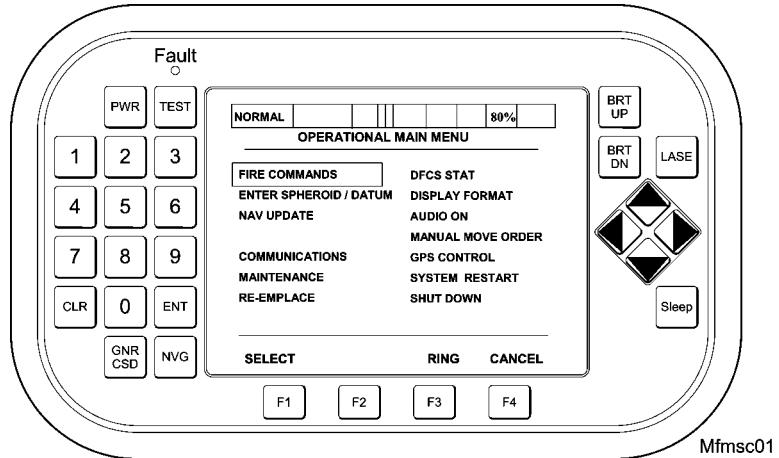
b. Manual Fire Mission.

NOTES

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.

In a manual fire mission, only DF and QE will be displayed on the CSD.

- 1 Select **FIRE COMMANDS** and press **F1** key.

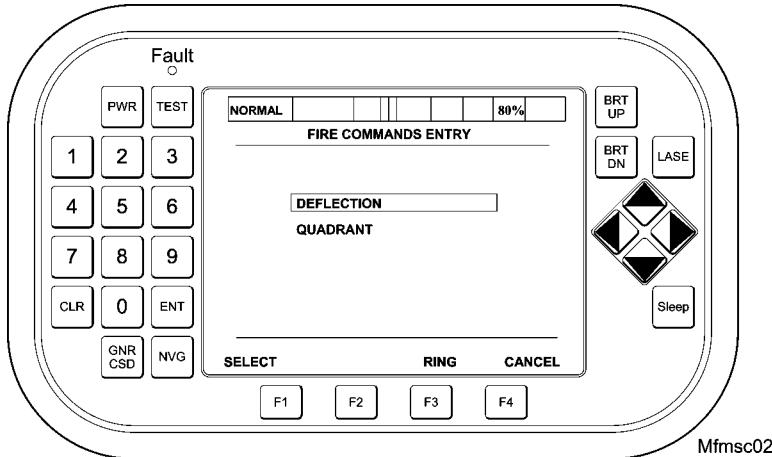


Mfmsc01

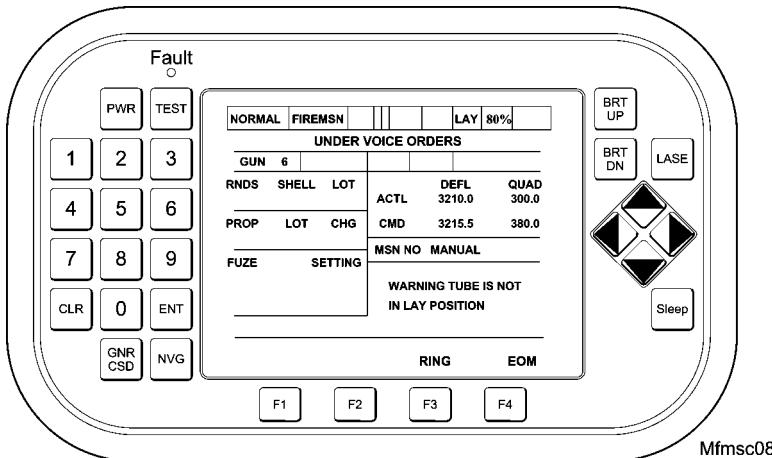
NOTE

"+/-" appears on the **FIRE COMMANDS ENTRY** when **QUADRANT** is selected 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 **DEFLECTION** and **QUADRANT**, press **SELECT F1** key. Enter data, press **ENT** key.



- 3 Verify DEFLECTION and QUADRANT data, press **USE ALL F2** key.



- 4 On completion of fire mission, press **EOM F4** key.
- 5 At prompt to **PRESS CLEAR**, press **CLEAR F2** key.

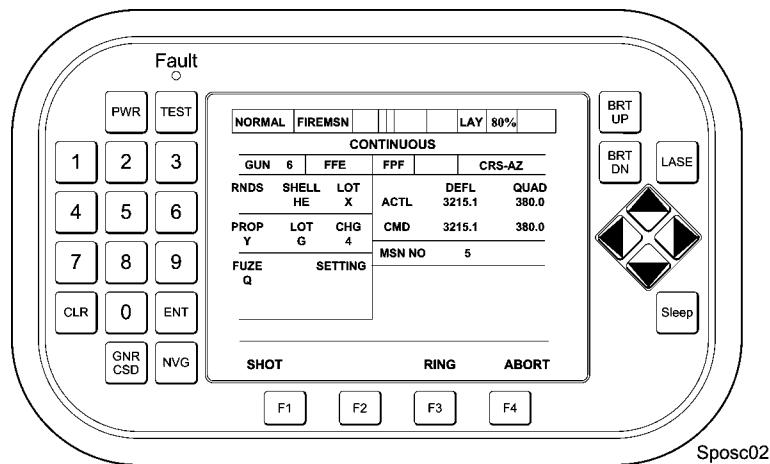
2-78 SPECIAL ORDERS PROCEDURES

a. Final Protective Fire (FPF).

NOTES

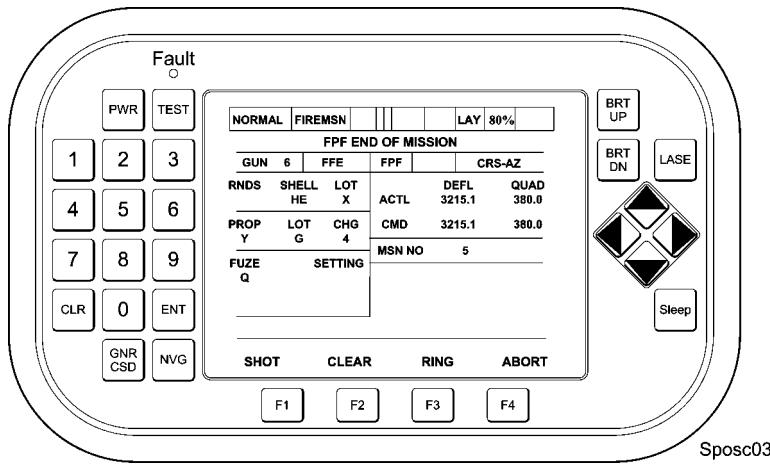
FPF will continue until the section has expended all ammunition and the SC has informed the FDC. The FDC will transmit FPF END OF MISSION message that will be displayed on the FIRE MSN screen.

FPF data may be received with DO NOT LOAD command or by voice from the FDC.



Sposc02

Execution of Fire When Ready FPF mission is the same as explained in Para 2-77. FIRE MSN will be displayed.



Sposc03

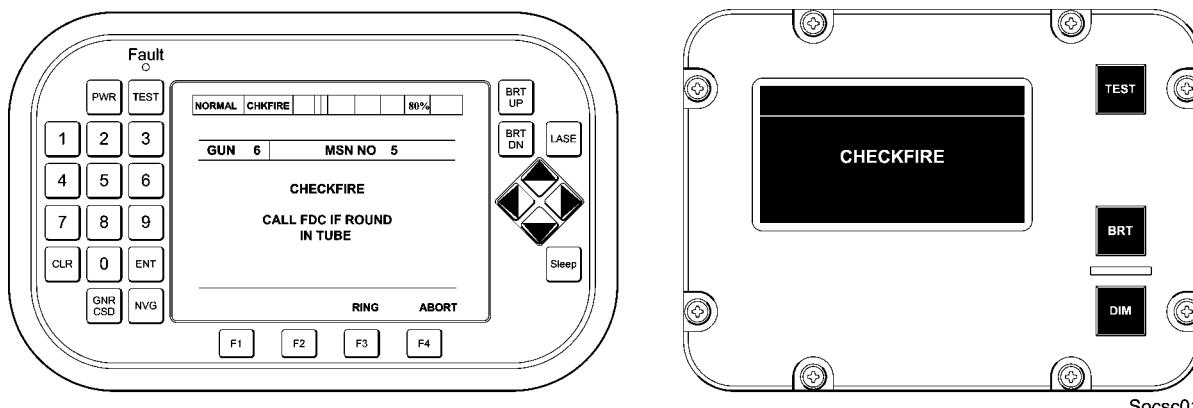
b. Checkfire

NOTES

During a fire mission **CHECKFIRE** may appear on the CSD/GND/AGD display screens at any time.

CHECKFIRE can only be cancelled by the FDC.

If the command **CHECKFIRE**, CALL FDC IF ROUND IN TUBE is displayed, notify the FDC.



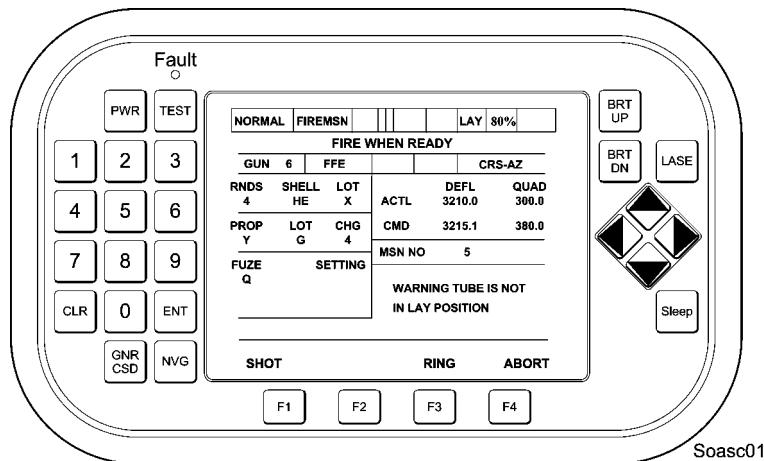
Socsc01

c. Abort

NOTE

SC maybe directed to abort the current mission.

- 1 Press **ABORT F4** key.

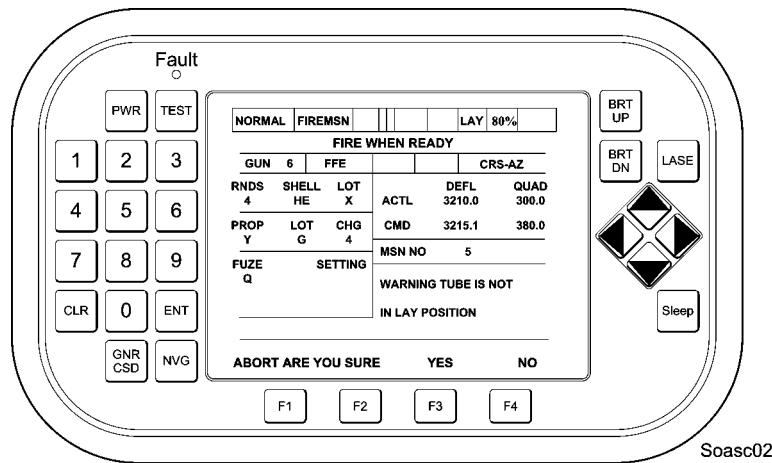


Soasc01

2-78 SPECIAL ORDERS PROCEDURES (cont)

c. Abort (cont)

- 2 ABORT ARE YOU SURE? will be displayed, press YES F3 key. Press CLEAR F2 key.



d. Shutdown

CAUTIONS

Shutting down DFCS should be performed ONLY from the 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 "Shutdown Procedure", ensure PCCM 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.

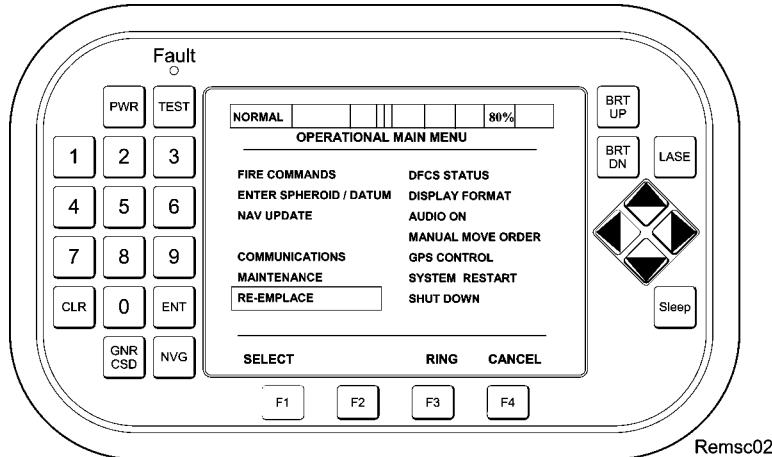
NOTE

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 turn off power from the DFCS.

- 2 Rotate and pull out PCCM function control switch CW to the OFF position.

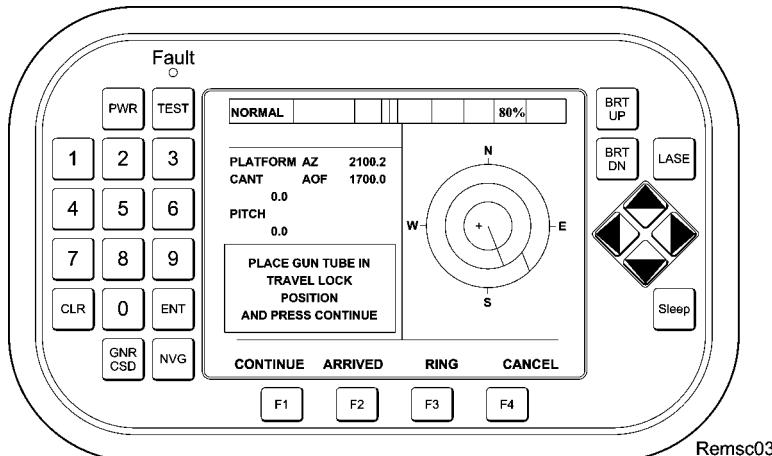
2-79 RE-EMPLACE HOWITZER USING DFCS

- 1 SC transitions from current screen to OPERATIONAL MAIN MENU by pressing **MENU F1** key.
- 2 Select **RE-EMPLACE**, press **SELECT F1** key.



Remsc02

- 3 Verify **RE-EMPLACE**, ensure traverse lock is engaged. **PLACE GUN TUBE IN TRAVEL LOCK POSITION AND PRESS CONTINUE** will be displayed, press **CONTINUE F1** key.



Remsc03

- 4 When howitzer is parallel to the AOF, press **EMPLACED F1** key.

NOTE

It is recommended that position data be recorded by the ATC in the event of an unexpected surge or loss of power.

- 5 Confirm current position and send to the FDC, **CALL FDC WITH POSITION DATA THEN PRESS CANCEL**. Once data has been verified by the FDC, press **CANCEL F4** key.

CHAPTER 3

MAINTENANCE INSTRUCTIONS

Section Index

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Section	II. Troubleshooting Procedures.....	3-19
Section	III. Maintenance Procedures.....	3-76
Section	IV. Cannon Maintenance Procedures	3-76
Section	V. Carriage Maintenance Procedures.....	3-110
Section	VI. Optical Fire Control Equipment Maintenance Procedures	3-120
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Section I. LUBRICATION INSTRUCTIONS

Section Index

Paragraph		Page
3-1	General.....	3-1

3-1 GENERAL

NOTE

Lubrication instructions in this section are mandatory.

- a. Intervals based on normal operations. You should lube more during constant use and lube less during inactive periods. Relubricate after washing, fording (fresh or salt water) or contact with saltwater spray. Clean fittings before lubricating. Clean parts with cleaning compound. Dry before lubricating. DO NOT over lubricate; wipe off excess lubricant.
- b. Dotted lines indicate lubrication points on both sides of the equipment. The level of maintenance responsible for each lube instruction is shown, and this section is divided into three sections based on lubrication intervals (DAILY, WEEKLY, and MONTHLY). An overall view showing lubrication points precedes each set of detailed notes for each interval.
- c. Daily lubing means once each day after howitzer has been fired.

KEY

MAINTENANCE LEVEL

C Operator/Crew WTR



LUBRICATION POINTS



CLP
(As directed in procedure)

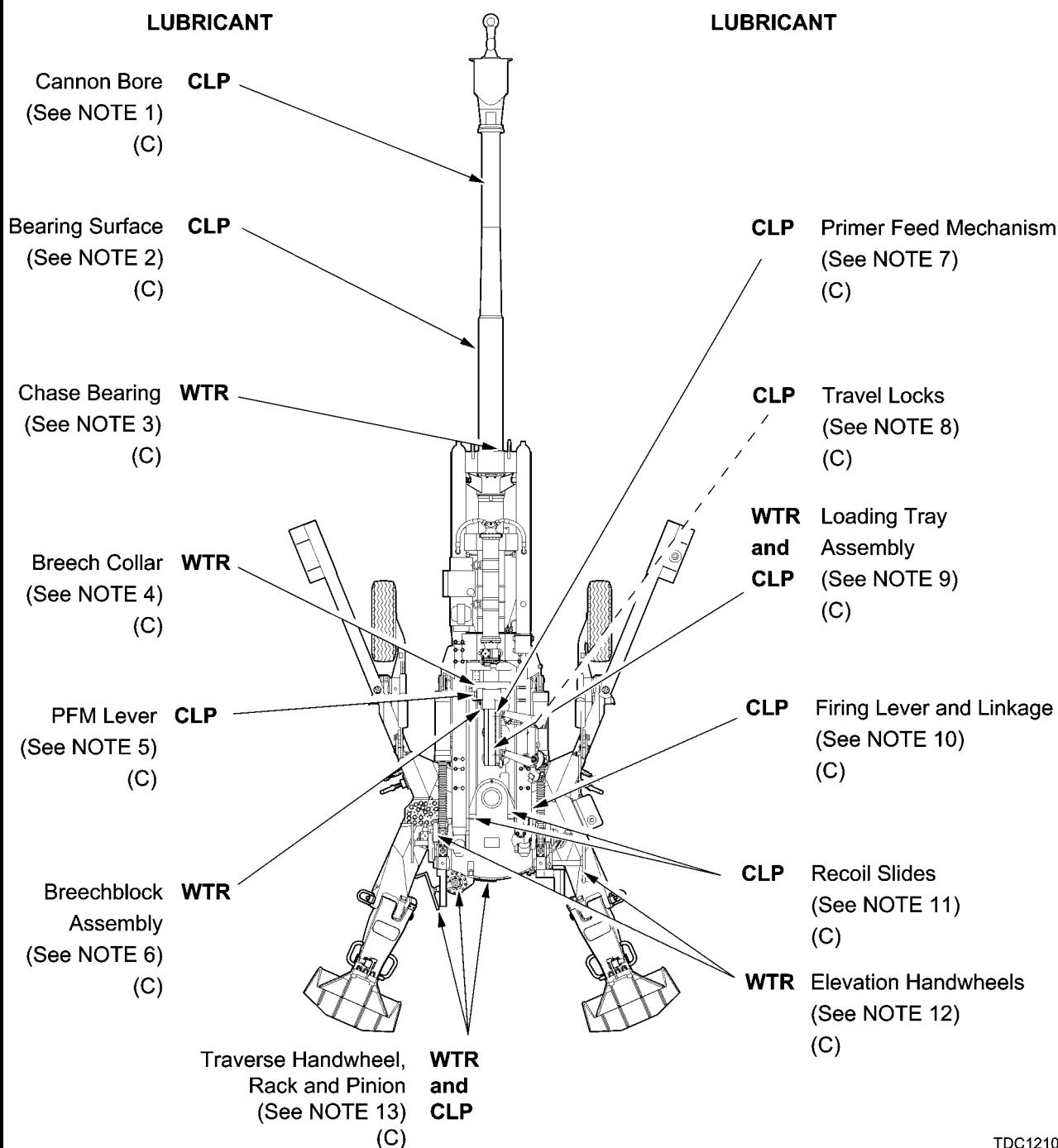
TDC0079

CLP Cleaner, Lubricant and Preservative, MIL-L-63460.

WTR Grease, Aircraft, General Purpose, Wide Temperature Range, MIL-PRF-81322.

LAW Lubricant, All Weather, MIL-L-14107 (Only to be used in sub-zero temperatures).

DAILY



DAILY NOTES

NOTE 1

CANNON BORE (C)

ON DAY OF FIRING

NOTES

The nylon bore brush is flexible enough that a scrubbing action (back and forth motion) can be used to clean the cannon tube. Work on short sections of the cannon tube (approx 2 ft (0.6m)) starting at the muzzle and working toward the breech.

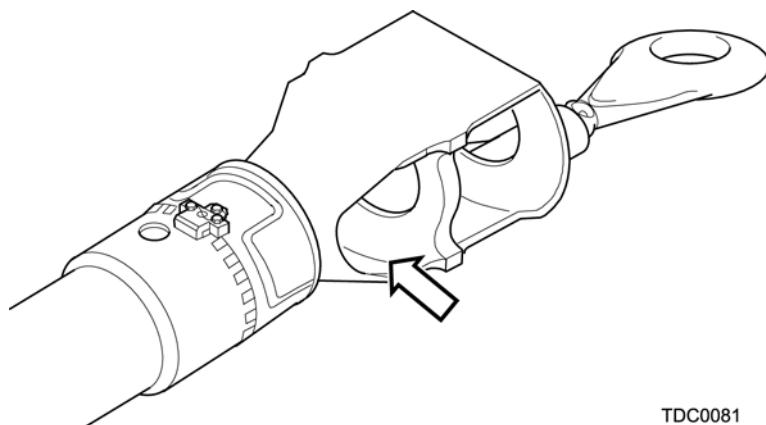
For non-firing periods, the cannon tube and breech mechanism are cleaned and lubricated on a weekly basis.

Attach bore brush assembly to cleaning staff sections. Inspect breech and cannon tube and clear obstructions.

Apply CLP (item 7, appx D) to bore brush and thoroughly wet punch cannon bore three times. Wrap clean wiping rags (item 30, appx D) around bore brush and dry punch the bore twice. Wrap clean wiping rags round bore brush, soak with CLP, and punch bore one time.

ON DAY AFTER FIRING

Wrap bore brush with clean wiping rags (item 30, appx D) and dry punch tube once back and once forward. Wrap bore brush with clean wiping rags and applies CLP (item 7, appx D) and wet punch the entire tube once back and once forward. Repeat last step with more CLP.



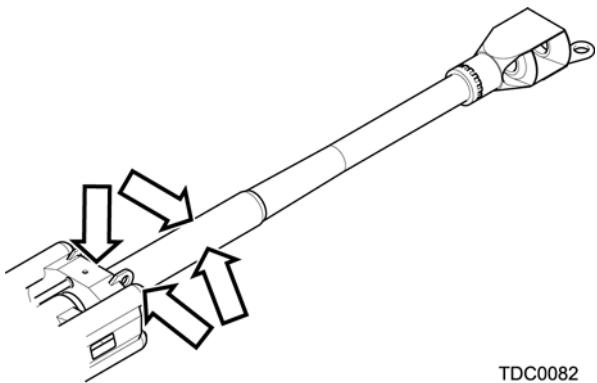
TDC0081

DAILY NOTES (cont)

NOTE 2

BEARING SURFACE (C)

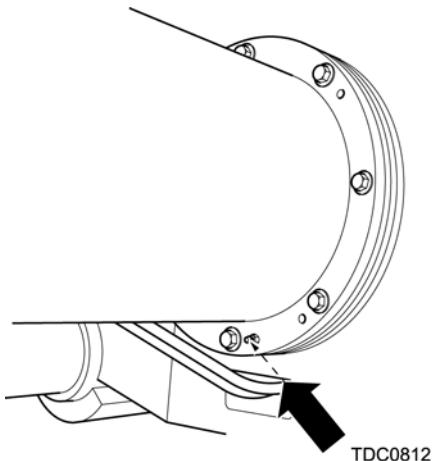
Wipe bearing surface with a clean wiping rag
(item 30, appx D).



TDC0082

NOTE 3

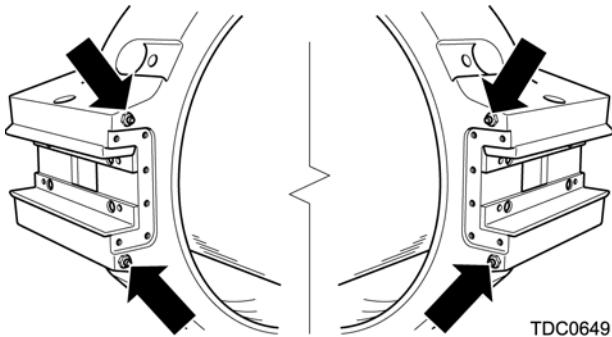
CHASE BEARING (C)



TDC0812

NOTE 4

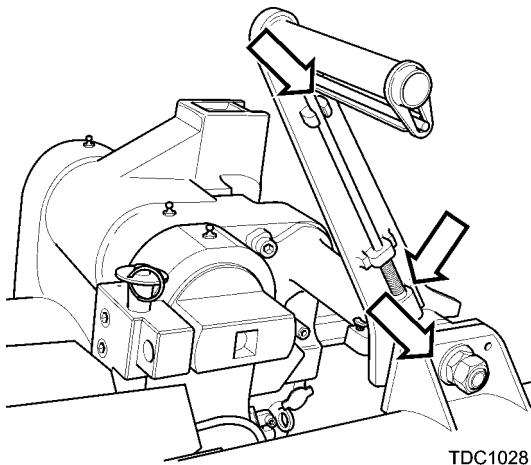
BREECH COLLAR (C)



TDC0649

NOTE 5

PFM LEVER (C)



TDC1028

DAILY NOTES (cont)

NOTE 6

BREECHBLOCK ASSEMBLY (C)

BEFORE FIRING

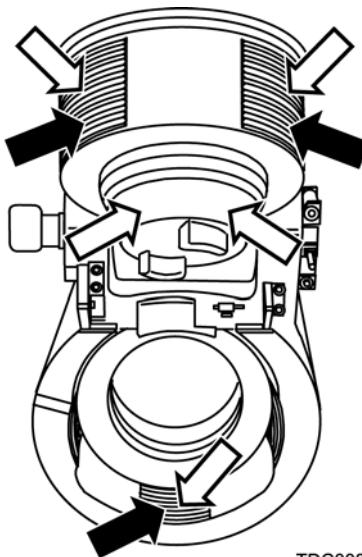
Clean breechblock assembly with CLP (item 7, appx D) and a crocus cloth (item 11, appx D); wipe off excess CLP with a clean wiping rag (item 30, appx D). Apply a light coat of WTR (item 16, appx D) to breechblock threads.

AFTER FIRING

Clean breechblock assembly with CLP (item 7, appx D), and wipe dry with a clean wiping rag (item 30, appx D). Apply WTR (item 16, appx D) to threads of breechblock and breechrings assemblies.

Clean spindle with CLP (item 7, appx D) and a crocus cloth (item 11, appx D); wipe off excess CLP with a clean wiping rag (item 30, appx D).

Clean obturator pad with pad scouring (item 23, appx D) and clean water, wipe with a clean wiping rag (item 30, appx D).



TDC0086

DAILY NOTES (cont)

NOTE 7

PRIMER FEED MECHANISM (C)

PFM TRAY and PFM BODY ASSEMBLIES

AFTER FIRING

Remove PFM and breech components in the following order:

Injector arm assembly (Para 3-7b).
Firing pin (Para 3-7c).
PFM tray assembly (Para 3-7d).
PFM body assembly (Para 3-7e).
Spindle assembly (Para 3-7f).

Service and inspect PFM and breech by, applying CLP (item 7, appx D) to PFM and breech components. Let soak for 15 minutes and wipe dry with clean wiping rag (item 30, appx D). Apply a light coat of CLP to all components.

Install breech and PFM in the following order:

Spindle assembly (Para 3-7h).
PFM body assembly (Para 3-7i).
PFM tray assembly (Para 3-7j).
Injector arm assembly (Para 3-7k).

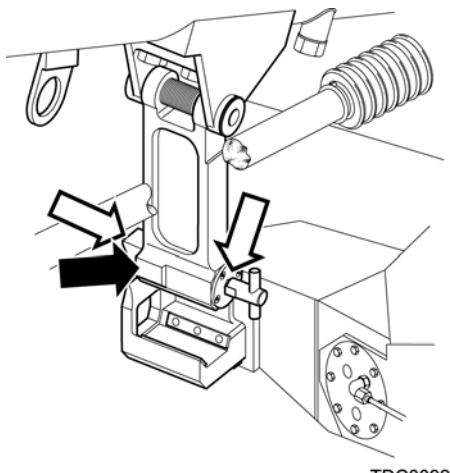
Clean PFM tray and PFM body assemblies with CLP (item 7, appx D), and wipe dry with a clean wiping rag (item 30, appx D).

DAILY NOTES (cont)

NOTE 8

TRAVEL LOCKS (C)

Clean and lubricate travel locks with CLP (item 7, appx D); wipe off excess CLP with a clean wiping rag (item 30, appx D).



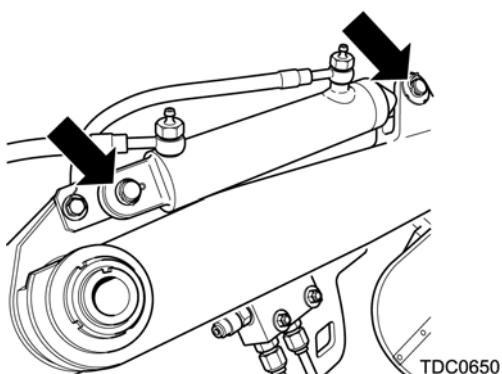
TDC0092

NOTE 9

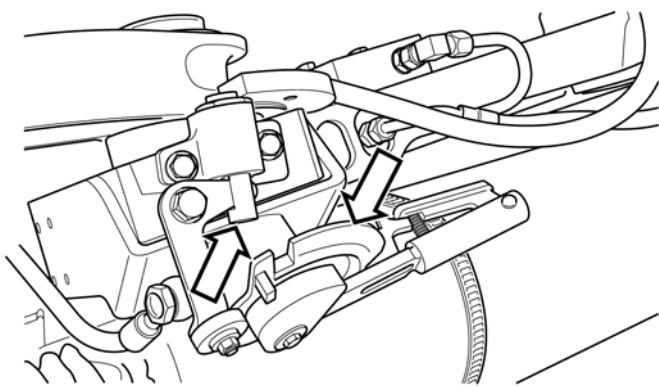
LOADING TRAY ASSEMBLY (C)

DAY AFTER FIRING

Clean loading tray interlock plunger with CLP (item 7, appx D) and crocus cloth (item 11, appx D) and wipe dry with clean wiping rag (item 30, appx D).



TDC0650



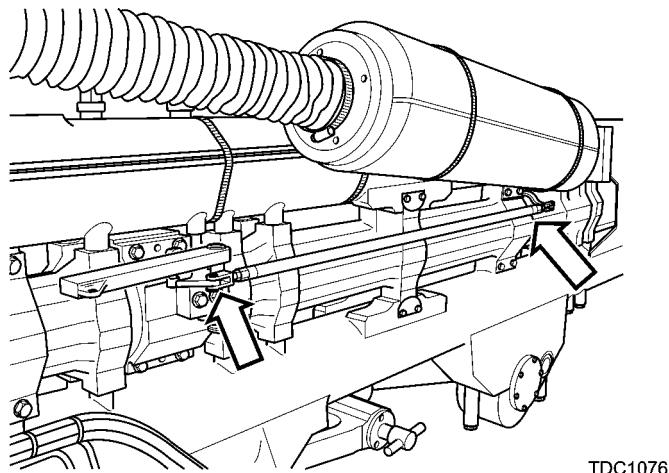
TDC0813

DAILY NOTES (cont)

NOTE 10

FIRING LEVER AND LINKAGE

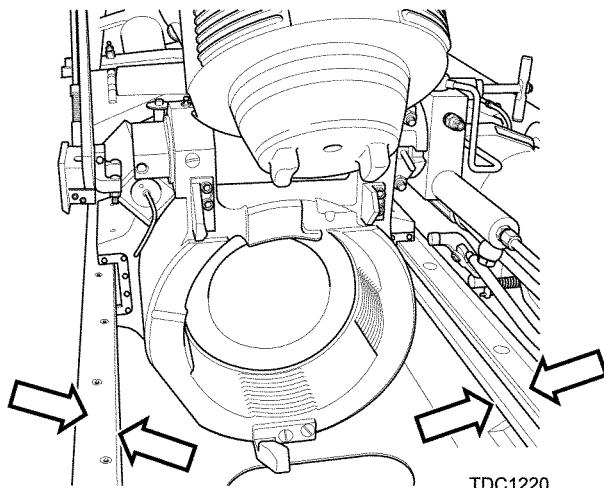
Clean and lubricate firing lever and linkage with CLP (item 7, appx D); wipe off excess CLP with a clean wiping rag (item 30, appx D).



NOTE 11

RECOIL SLIDES (C)

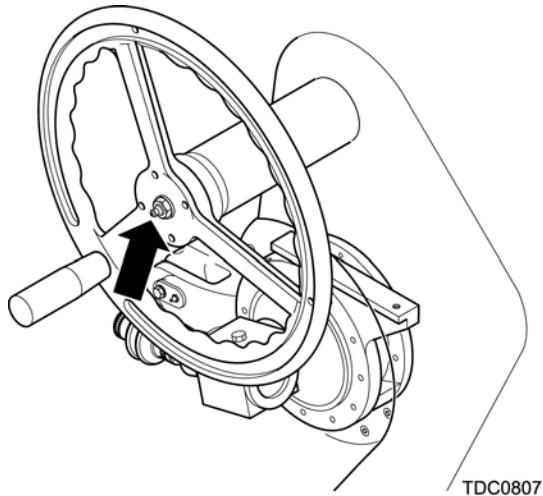
Clean top and bottom of recoil slides with CLP (item 7, appx D) and crocus cloth (item 11, appx D) and wipe dry with clean wiping rag (item 30, appx D).



DAILY NOTES (cont)

NOTE 12

ELEVATION HANDWHEELS (C)

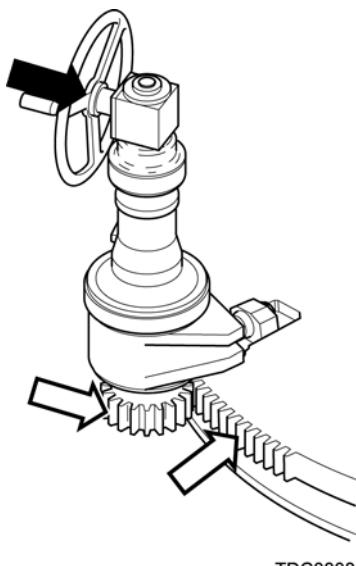


NOTE 13

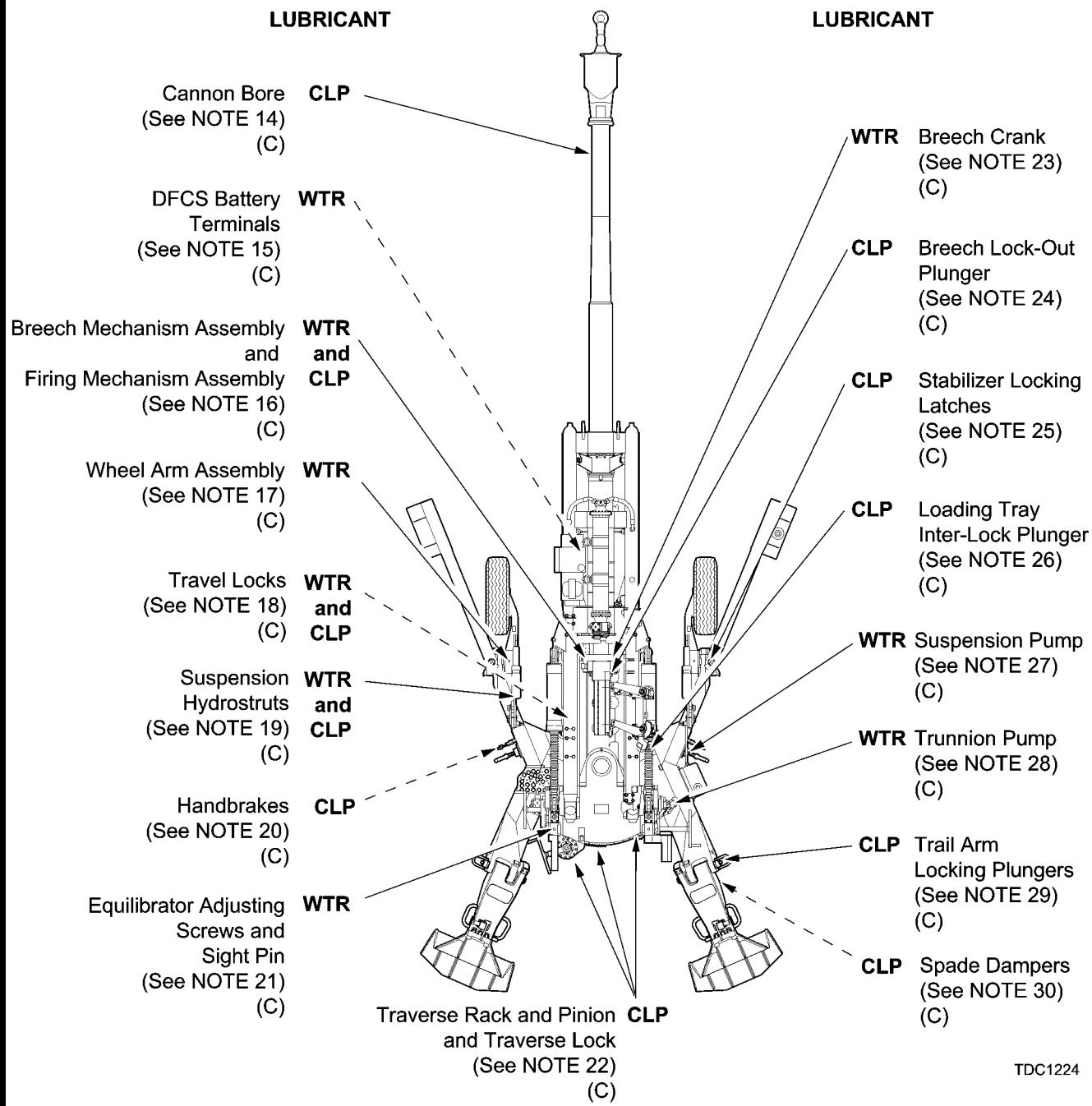
TRAVERSE HANDWHEEL, RACK AND PINION (C)

BEFORE/AFTER FIRING

Clean traverse rack and pinion with CLP (item 7, appx D) and crocus cloth (item 11, appx D); wipe dry with clean wiping rag (item 30, appx D).



WEEKLY



TDC1224

WEEKLY NOTES

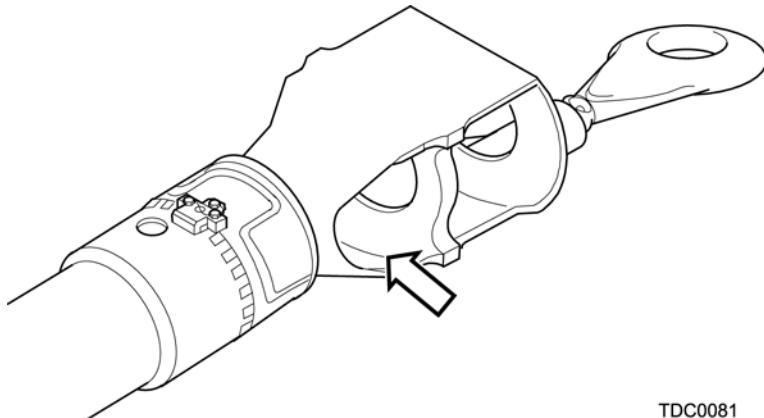
NOTE 14

CANNON BORE (C)

When howitzer is not being fired, clean cannon bore with CLP (item 7, appx D), wipe dry with clean wiping rag (item 30, appx D), re-oil with CLP, and install muzzle plug.

OR

Inspect cannon bore and bearing surface for cleanliness and corrosion. If required, dry punch bore with clean wiping rag (item 30, appx D), then wet punch bore with clean wiping rags soaked with CLP (item 7, appx D).



TDC0081

NOTE 15

DFCS BATTERY TERMINALS (C)



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

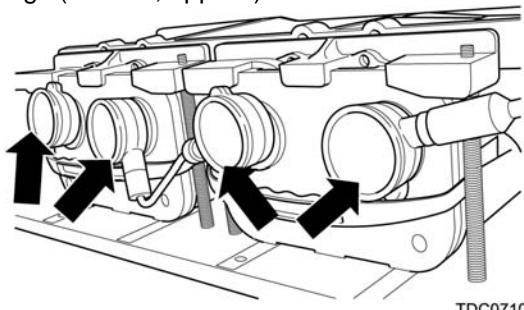


TDC0450

NOTE

WTR only to be applied to the DFCS battery terminals during fording operations (Para 2-38).

Remove BAT terminal covers; inspect terminals for cleanliness and corrosion. If required clean and wipe dry terminals with clean wiping rags (item 30, appx D).



TDC0710

WEEKLY NOTES (cont)

NOTE 16

**BREECH MECHANISM ASSEMBLY (C)
AND
FIRING MECHANISM ASSEMBLY(C)**

Remove, disassemble, service/ inspect and assemble magazine assembly (Para 3-8).

Remove, disassemble, service/ inspect, assemble and install firing mechanism (Para 3-7a and I.).

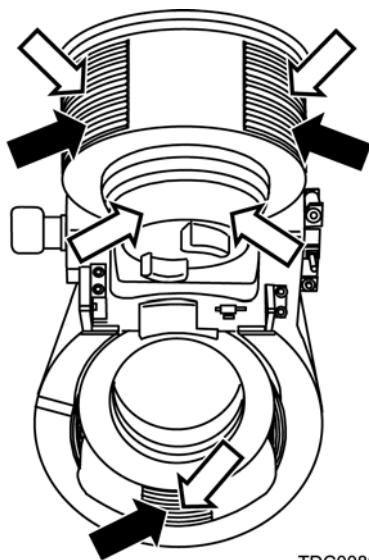
Remove, service/ inspect, and install injector arm assembly (Para 3-7b and k.).

Remove, disassemble, service/ inspect, assemble and install firing pin (Para 3-7c.).

Remove, disassemble, service/inspect, assemble and install PFM body and tray assemblies (Para 3-7d. and e. and i. and j.) from breech carrier, clean with CLP (item 7, appx D), and wipe dry with a clean wiping rag (item 30, appx D).

Separate, service/inspect connect breechblock and carrier assemblies (Para 3-7g.).

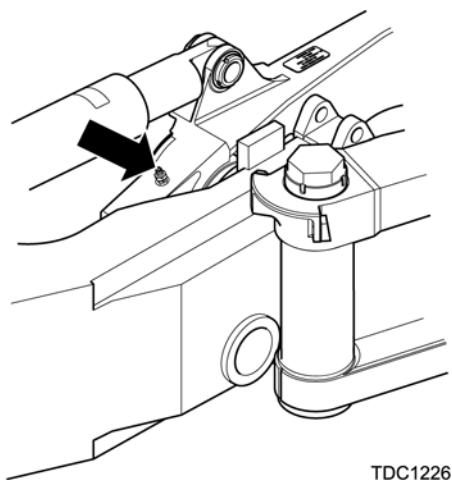
Clean breech mechanism assembly with CLP (item 7, appx D), and wipe dry with clean wiping rag (item 30, appx D). Apply WTR (item 16, appx D) to threads of breechblock and breechring assemblies.



WEEKLY NOTES (cont)

NOTE 17

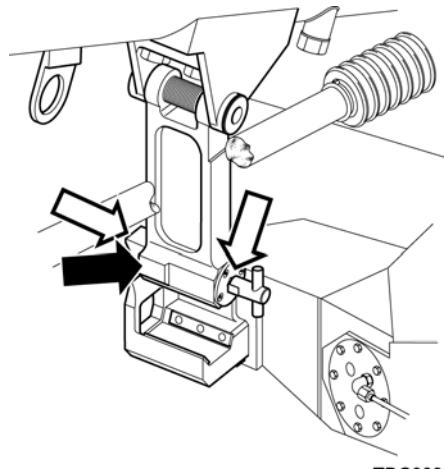
WHEEL ARM ASSEMBLY (C)



NOTE 18

TRAVEL LOCKS (C)

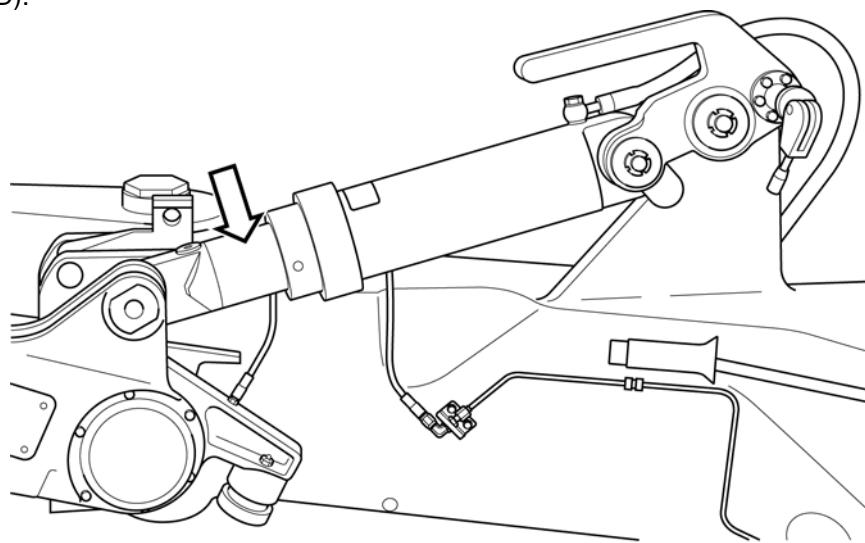
Clean and lubricate travel locks with CLP (item 7, appx D); wipe off excess CLP with a clean wiping rag (item 30, appx D). Apply WTR (item 16, appx D) to plunger.



NOTE 19

SUSPENSION HYDROSTRUTS (C)

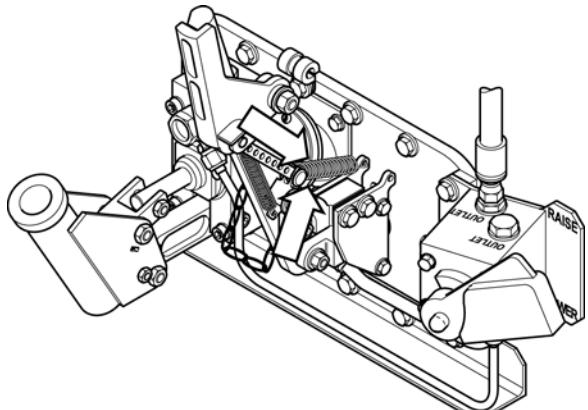
Clean and lubricate suspension hydrostruts with CLP (item 7, appx D); wipe off excess CLP with a clean wiping rag (item 30, appx D).



WEEKLY NOTES (cont)

NOTE 20

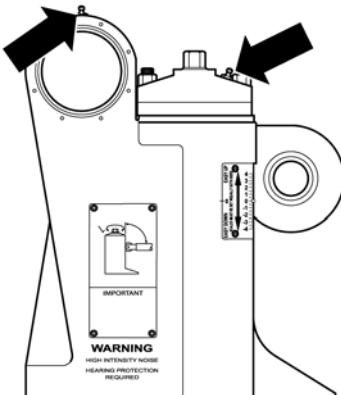
HANDBRAKES (C)



TDC1211

NOTE 21

EQUILIBRATOR ADJUSTING SCREWS AND SIGHT PIN (C)

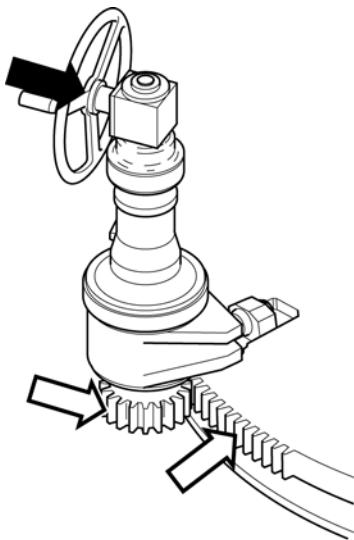


TDC0095

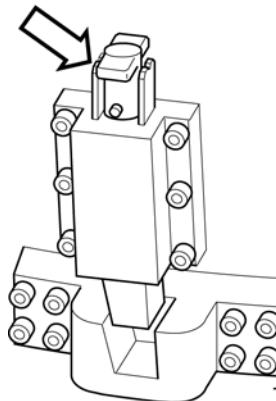
NOTE 22

TRAVERSE RACK AND PINION AND TRAVERSE LOCK (C)

Clean traverse rack and pinion with CLP (item 7, appx D) and a crocus cloth (item 11, appx D); wipe dry with a clean wiping rag (item 30, appx D).



TDC0808

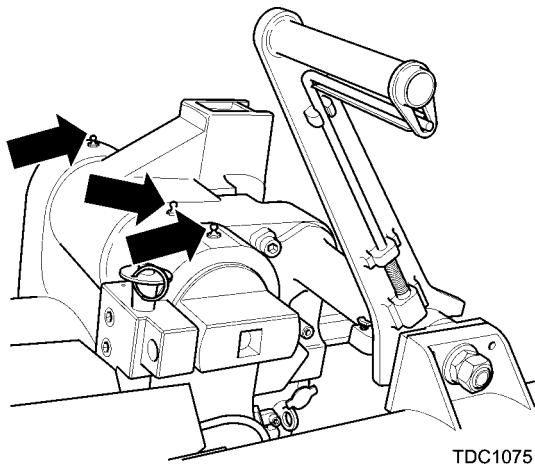


TDC0815

WEEKLY NOTES (cont)

NOTE 23

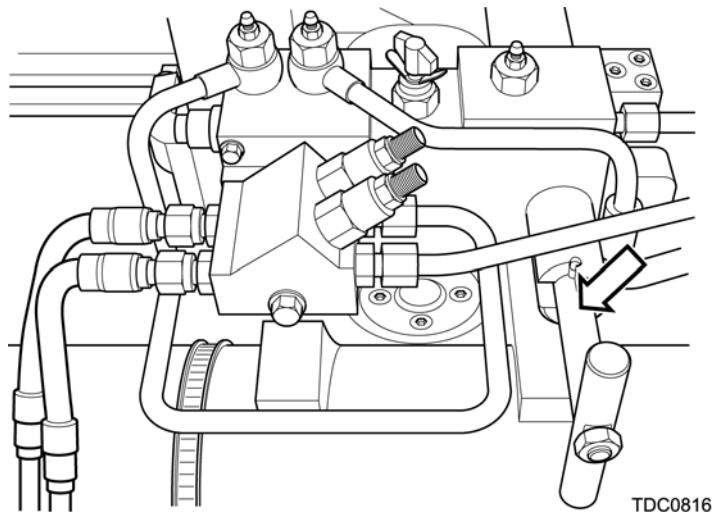
BREECH CRANK (C)



NOTE 24

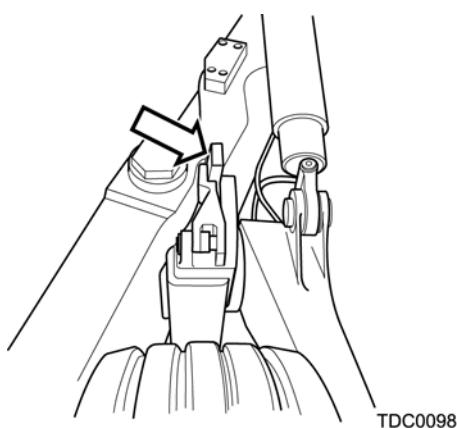
BREECH LOCK-OUT PLUNGER (C)

Wipe clean with a clean wiping rag (item 30, appx D).



NOTE 25

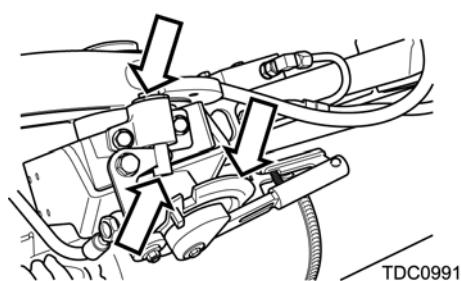
STABILIZER LOCKING LATCHES (C)



NOTE 26

LOADING TRAY INTER-LOCK PLUNGER (C)

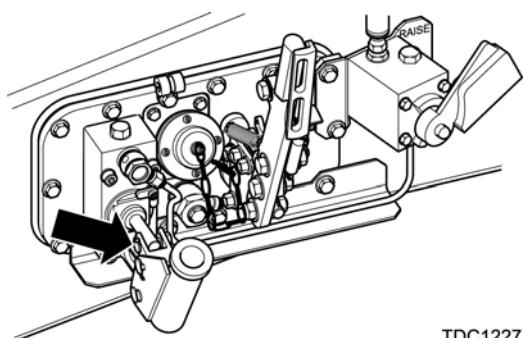
Clean loading tray interlock plunger with CLP (item 7, appx D) and crocus cloth (item 11, appx D) and wipe dry with clean wiping rag (item 30, appx D).



WEEKLY NOTES (cont)

NOTE 27

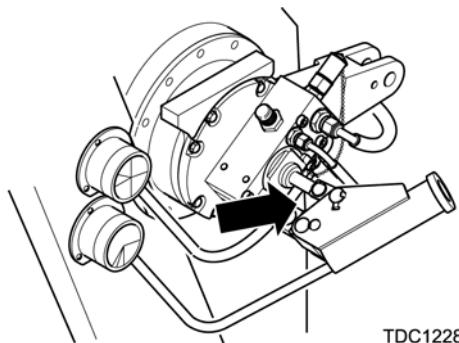
SUSPENSION PUMP (C)



TDC1227

NOTE 28

TRUNNION PUMP (C)

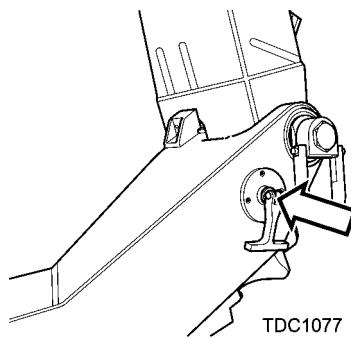


TDC1228

NOTE 29

TRAIL ARM LOCKING PLUNGERS (C)

Clean trail arm locking plunger with CLP (item 7, appx D); wipe off excess CLP with a clean wiping rag (item 30, appx D).



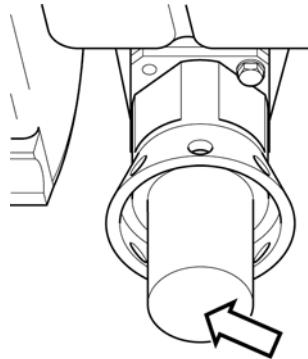
TDC1077

NOTE 30

SPADE DAMPERS (C)

Clean spade dampers with CLP (item 7, appx D) and a crocus cloth (item 11, appx D); wipe off excess CLP with a clean wiping rag (item 30, appx D).

Clean piston with CLP (item 7, appx D) and a crocus cloth (item 11, appx D); wipe off excess CLP with a clean wiping rag (item 30, appx D).



TDC1151

MONTHLY

LUBRICANT

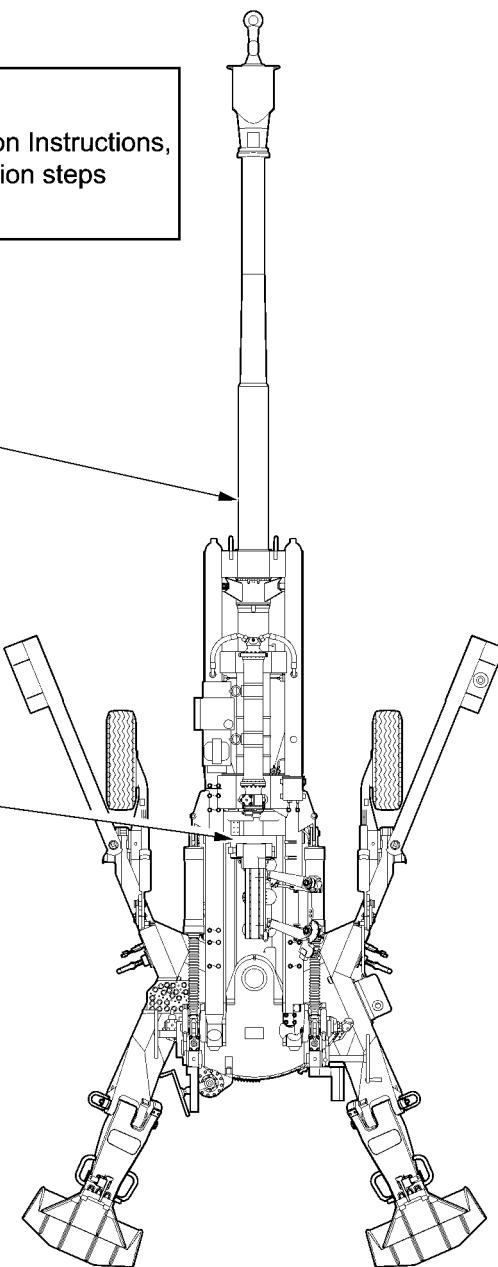
LUBRICANT

NOTE

When performing Monthly Lubrication Instructions,
ensure all Daily and Weekly lubrication steps
have been completed beforehand.

Cannon Tube WTR
(See NOTE 28) and
 (C) CLP

Breech Mechanism WTR
Assembly
(See NOTE 29)
(C)



TDC1212

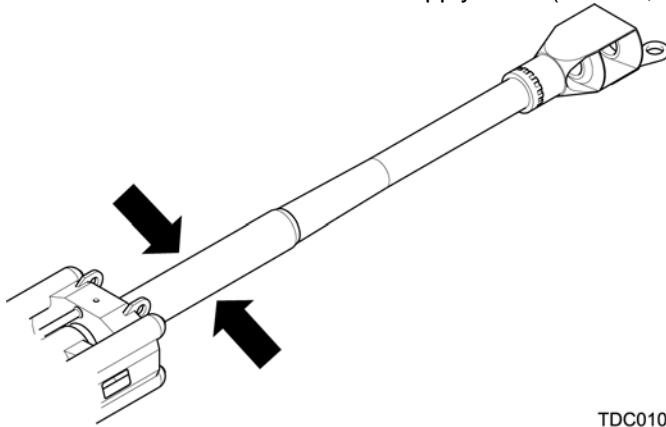
MONTHLY NOTES

NOTE 28

CANNON TUBE (C)

Inspect cannon tube for presence of dark film lubricant. If loose or flaking, clean only affected areas with CLP (item 7, appx D) and a crocus cloth (item 11, appx D), wipe off excess CLP with a clean wiping rag (item 30, appx D). Apply WTR (item 16, appx D) to exposed areas where dry film lubricant was removed or missing.

Remove any corrosion on slide surface of cannon tube and apply WTR (item 16, appx D) to bare area.



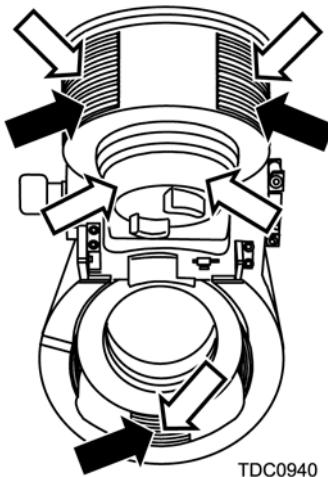
TDC0103

NOTE 29

BREECH MECHANISM ASSEMBLY (C)

Remove, service/inspect, and install PFM body and tray assemblies (Paras 3-7 d. and e, and i. and j.) from breech carrier, clean with CLP (item 7, appx D), and wipe dry with a clean wiping rag (item 30, appx D).

Clean breech mechanism assembly with CLP (item 7, appx D), and wipe dry with a clean wiping rag (item 30, appx D). Lube with CLP. Apply WTR (item 16, appx D) to threads of breechblock and breechrings assemblies.



TDC0940

Section II. TROUBLESHOOTING PROCEDURES

Section Index

Paragraph		Page
3-2	Introductory Information	3-19
3-3	Symptom Index	3-20
3-4	Troubleshooting Procedures	3-22

3-2 INTRODUCTORY INFORMATION

- a. Use Symptom Index (Para 3-3) as a quick guide to troubleshooting. Common malfunctions are listed in alphabetical order with a page number reference to the troubleshooting table where a test or inspection and corrective action are provided.
- b. Troubleshooting Procedures (Para 3-4) lists possible malfunctions, which you may find during operation or maintenance of the howitzer or its components. Perform the tests/inspections and corrective actions in the order listed.
- c. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective action, notify your SC.
- d. This section contains information on corrective actions used to return the howitzer to normal operation. This section cannot list all malfunctions that may occur, or all tests, inspections and corrective actions. If a malfunction is not listed, or is not corrected by corrective actions, notify unit maintenance.
- e. Crewmembers should report all malfunctions to the SC. This information aids on-board test equipment to accurately predict and determine faults. The BIT automatically tests DFCS. It predicts and determines failures of system components. System component failures are displayed on the CSD, GND and AGD screens.
- f. Troubleshooting the howitzer requires crewmembers to perform unscheduled and scheduled maintenance procedures and to monitor system functions at all times. Troubleshooting is conducted both during operations and during preparation for operations.
- g. With all automatic weapons system operations, attention to detail is imperative for personnel safety. All maintenance checks, services, and tests should be performed only when safety is not in jeopardy. Before performing troubleshooting tasks, carefully read the operating instructions and follow all notes, cautions, and warnings.
- h. DFCS has three levels of Built-In-Test (BIT) available to identify faults:
 - (1) **Power-Up-BIT (PUBIT)** is a self-test of the DFCS that is conducted when DFCS power mode switch on the PSP is turned ON or to COMM.
 - (2) **Operational-BIT (OBIT)** is an automated process of periodically assessing the status of DFCS.
 - (3) **Operator-Initiated-BIT (OIBIT)** is a semi-automated process to assess the status of DFCS.

3-3 SYMPTOM INDEX

CANNON

BREECH LEVER IN THE OPEN POSITION, BREECH WILL NOT OPEN	3-22
BREECH LEVER IN THE CLOSED POSITION, BREECH WILL NOT CLOSE.....	3-24
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PFM TRAY DROPS DURING FIRING	3-28
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PRIMER CASES DO NOT FEED PROPERLY.....	3-32
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FIRING LEVER FAILS TO OPERATE.....	3-33

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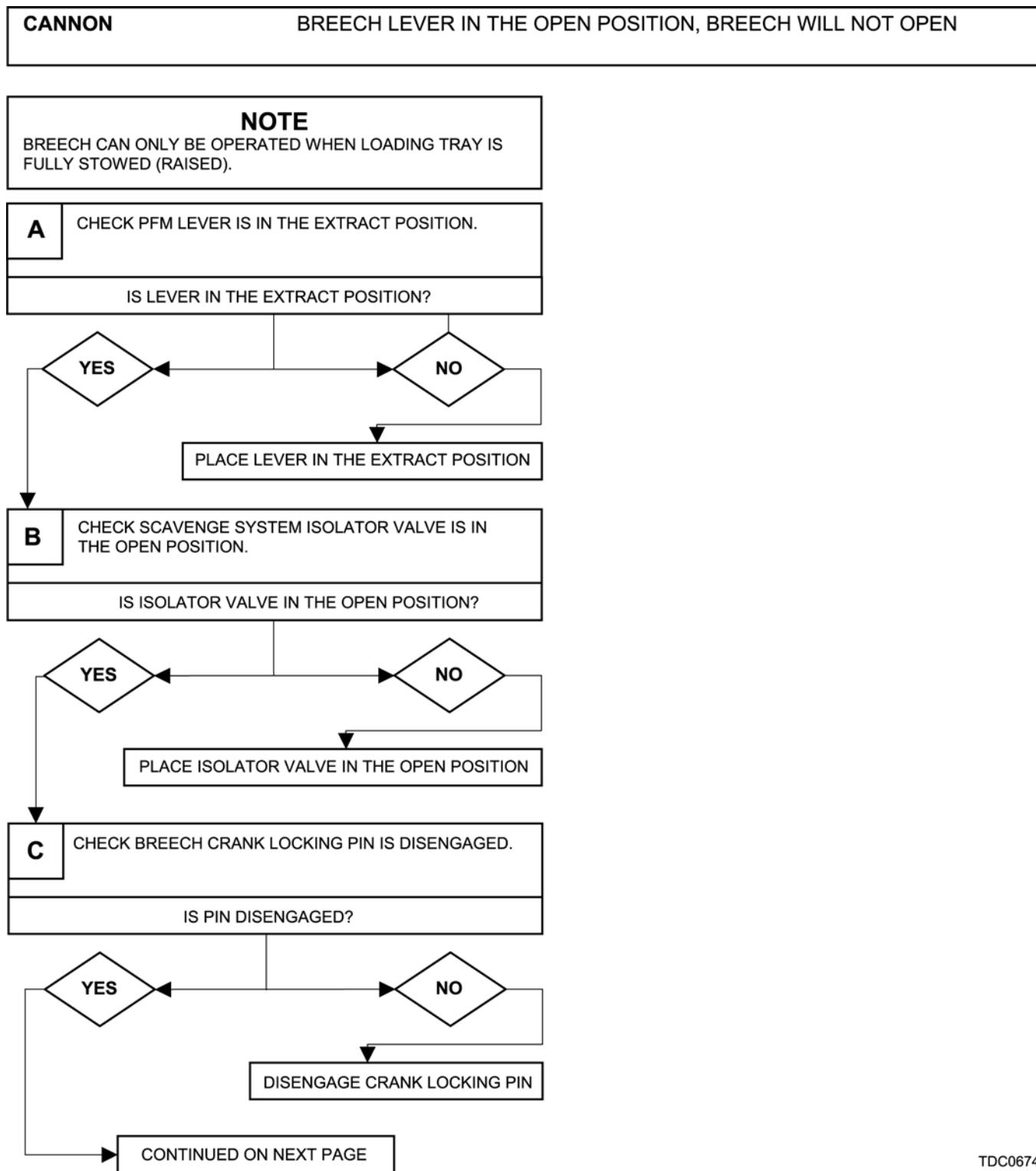
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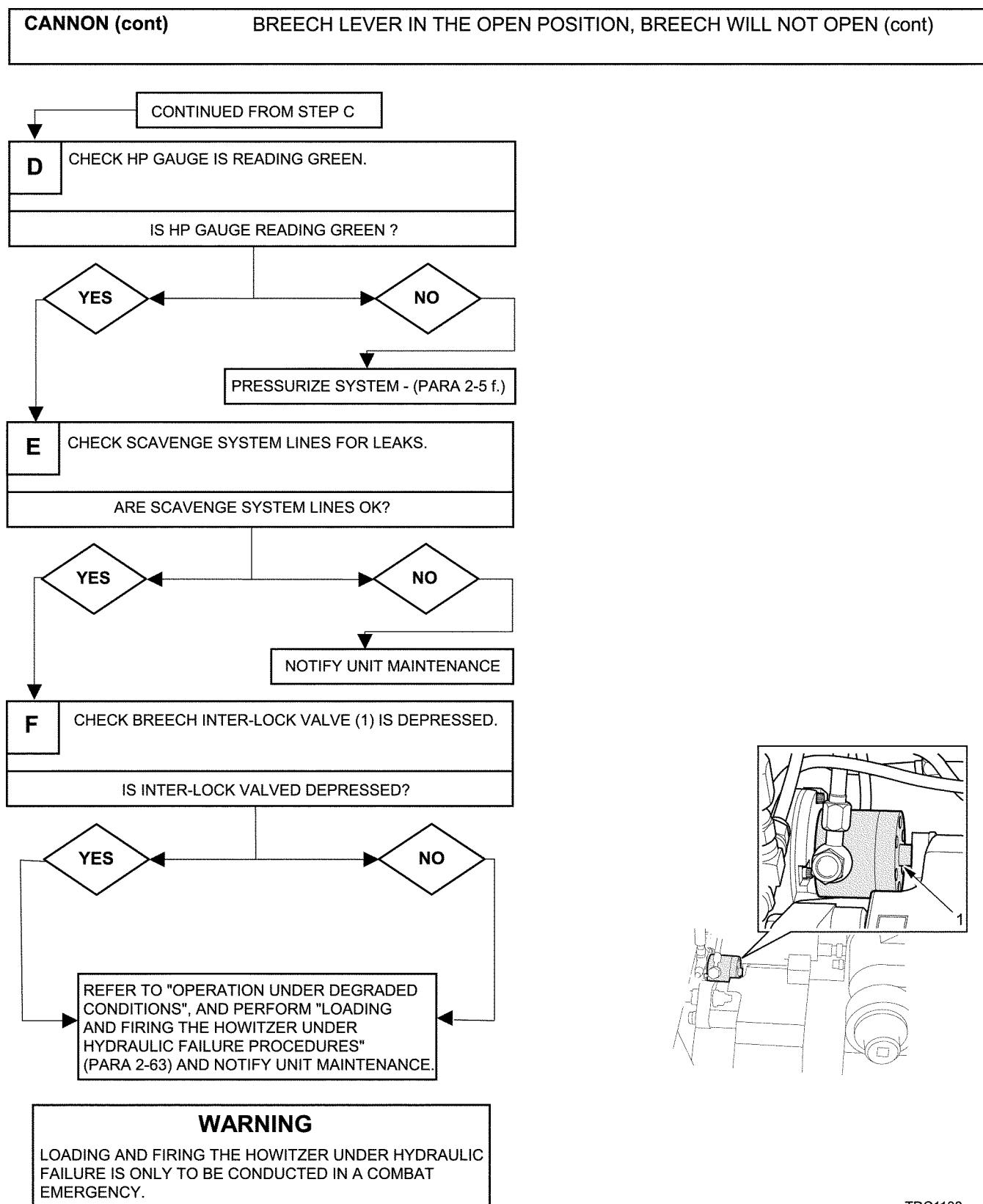
3-4 TROUBLESHOOTING PROCEDURES

Table 3-1 Troubleshooting



TDC0674

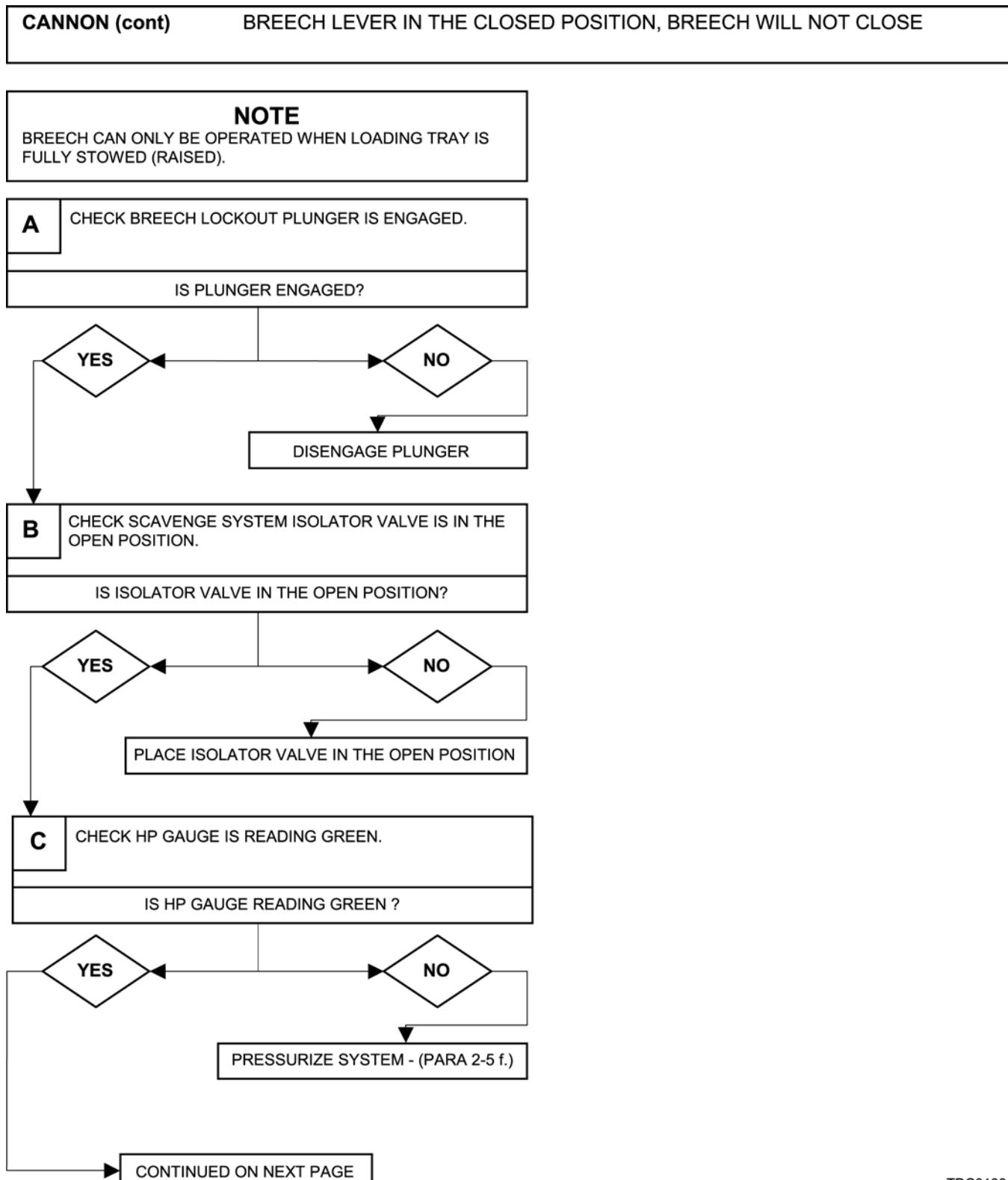
Table 3-1 Troubleshooting (cont)



TDC1133

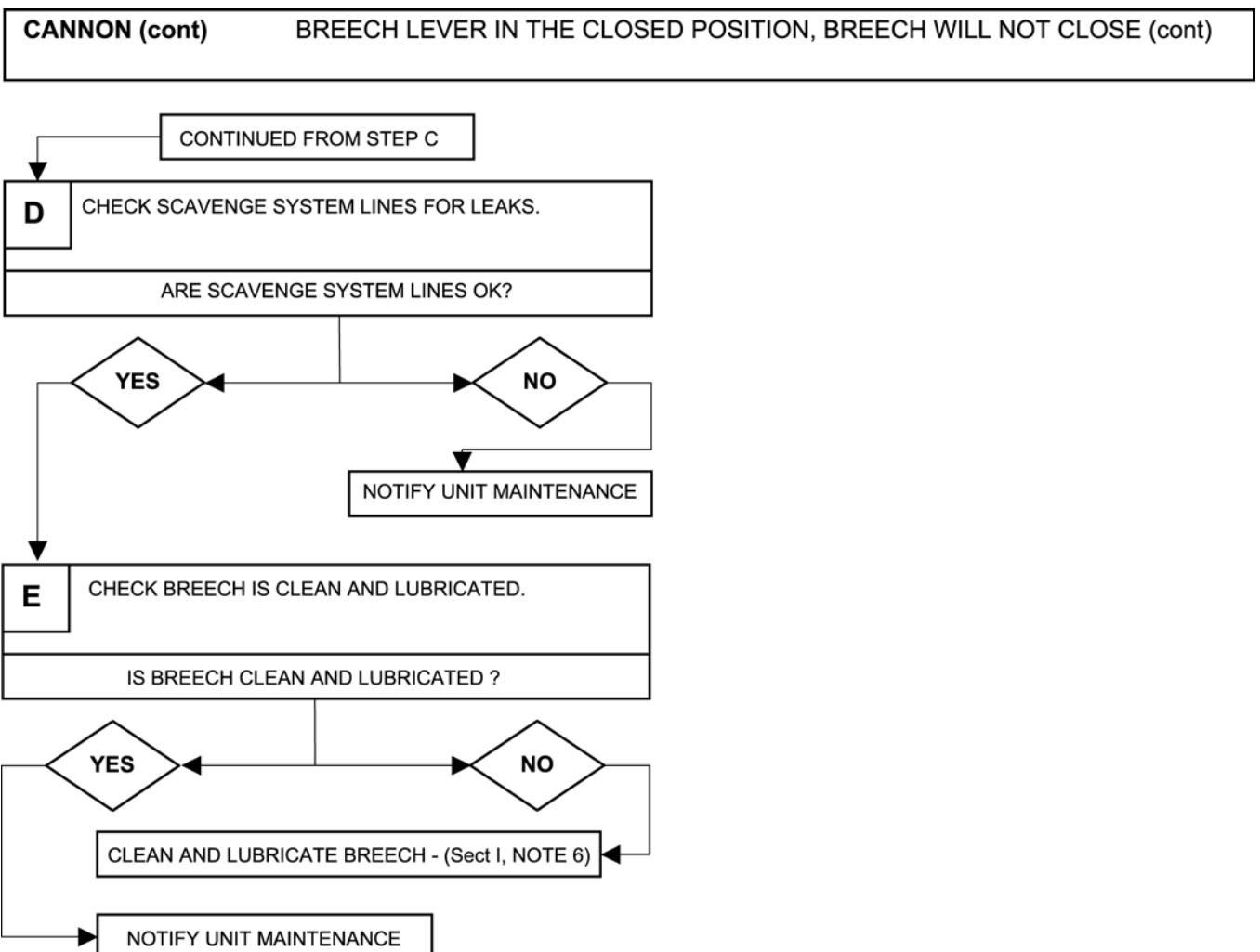
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC0106

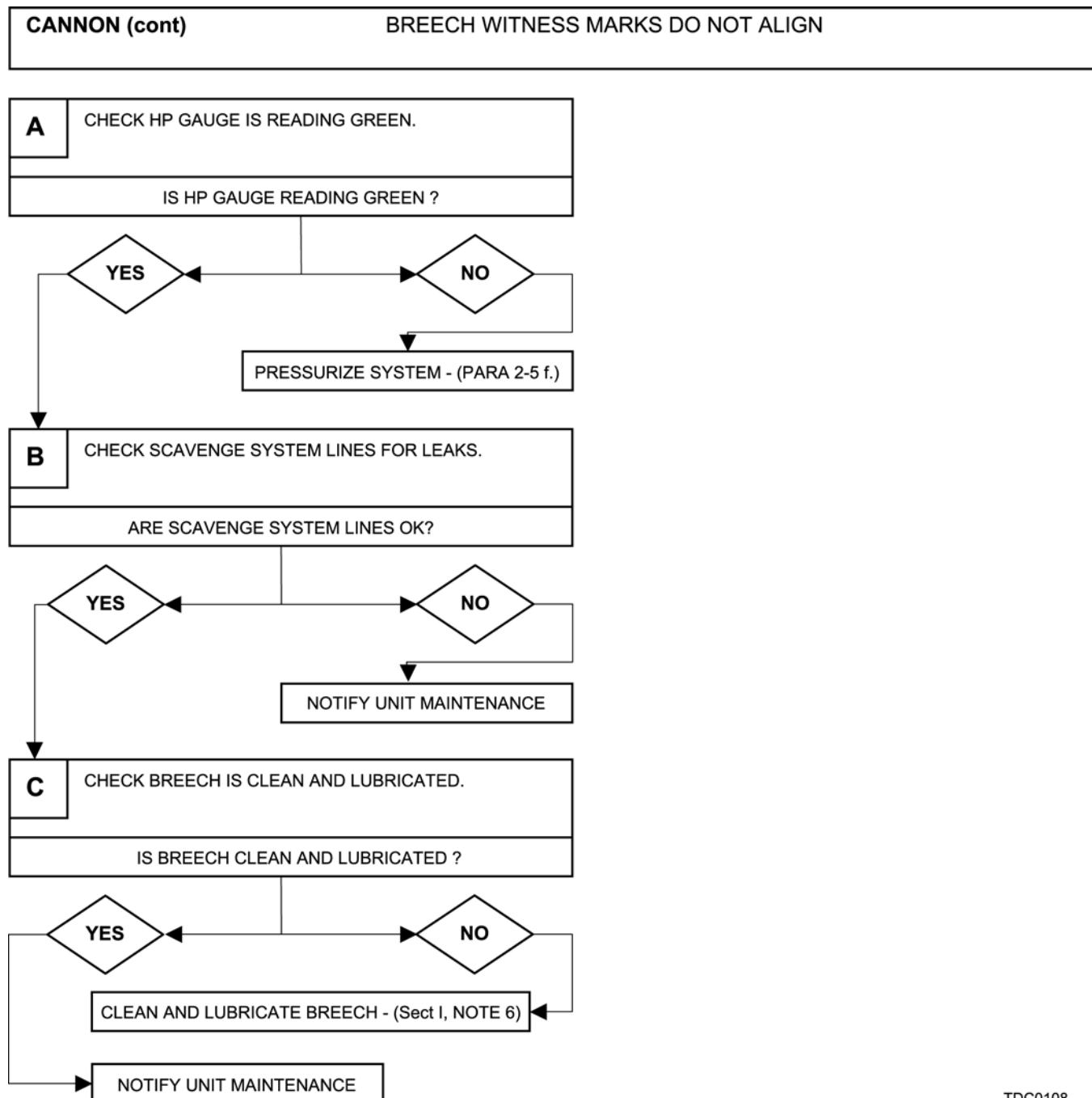
Table 3-1 Troubleshooting (cont)



TDC0107

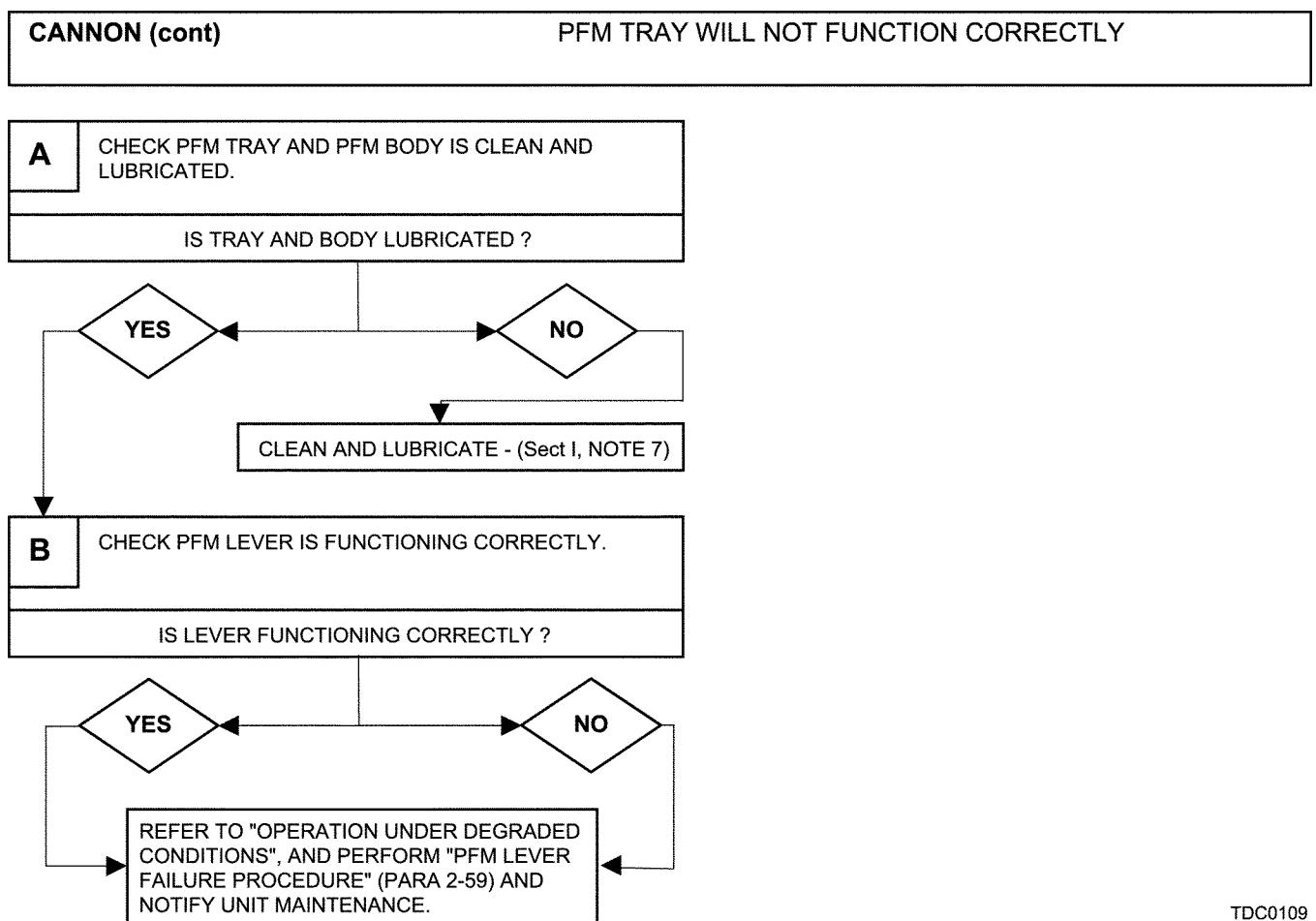
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC0108

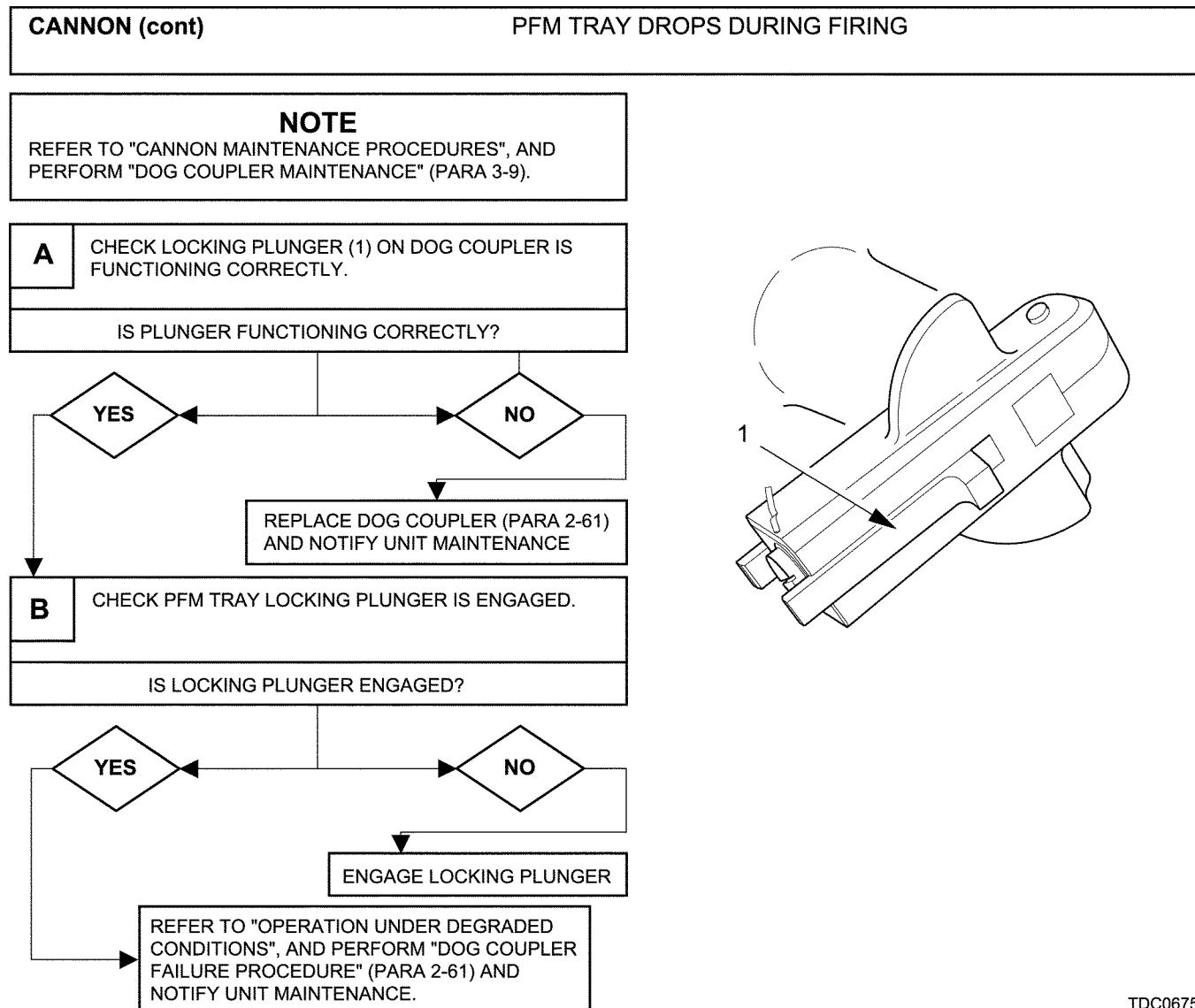
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TDC0109

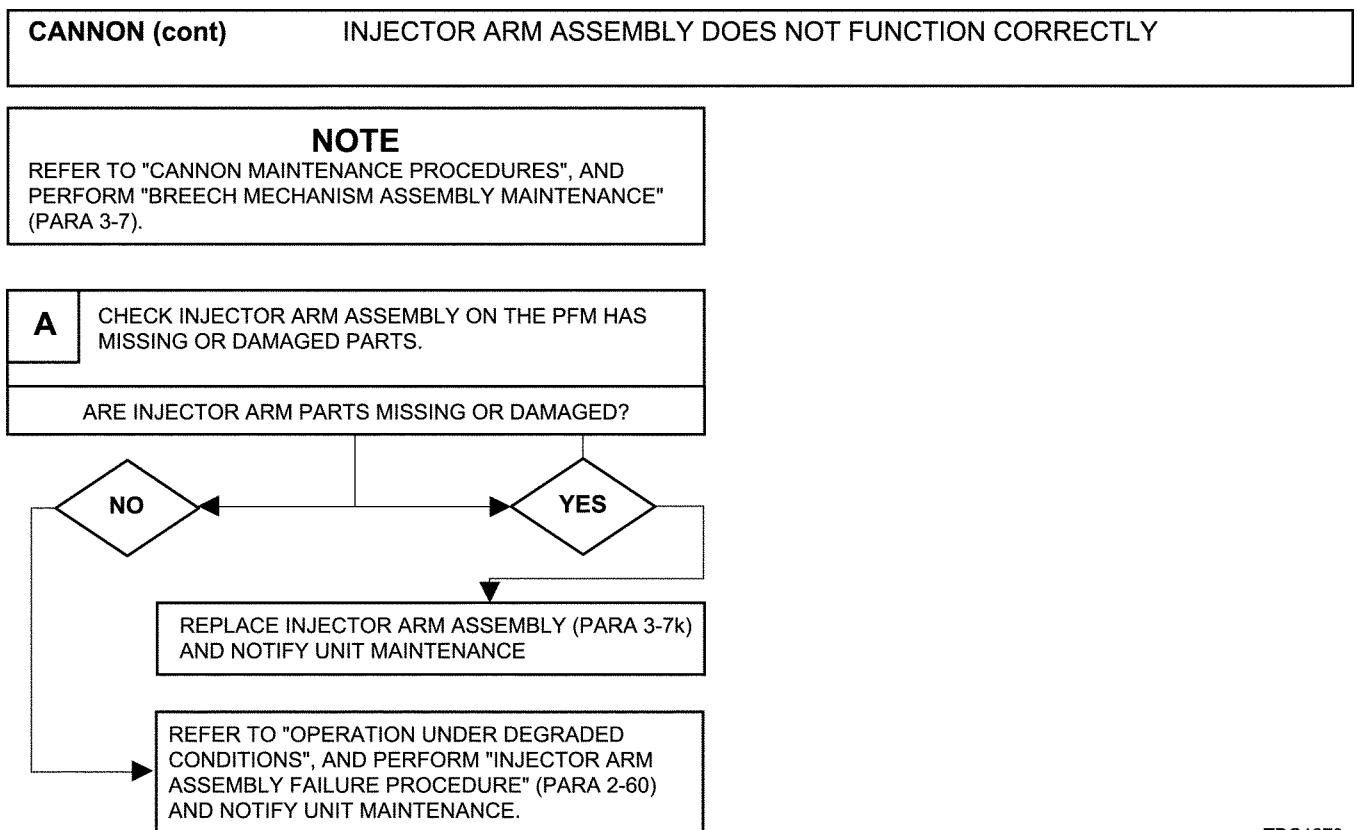
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC0675

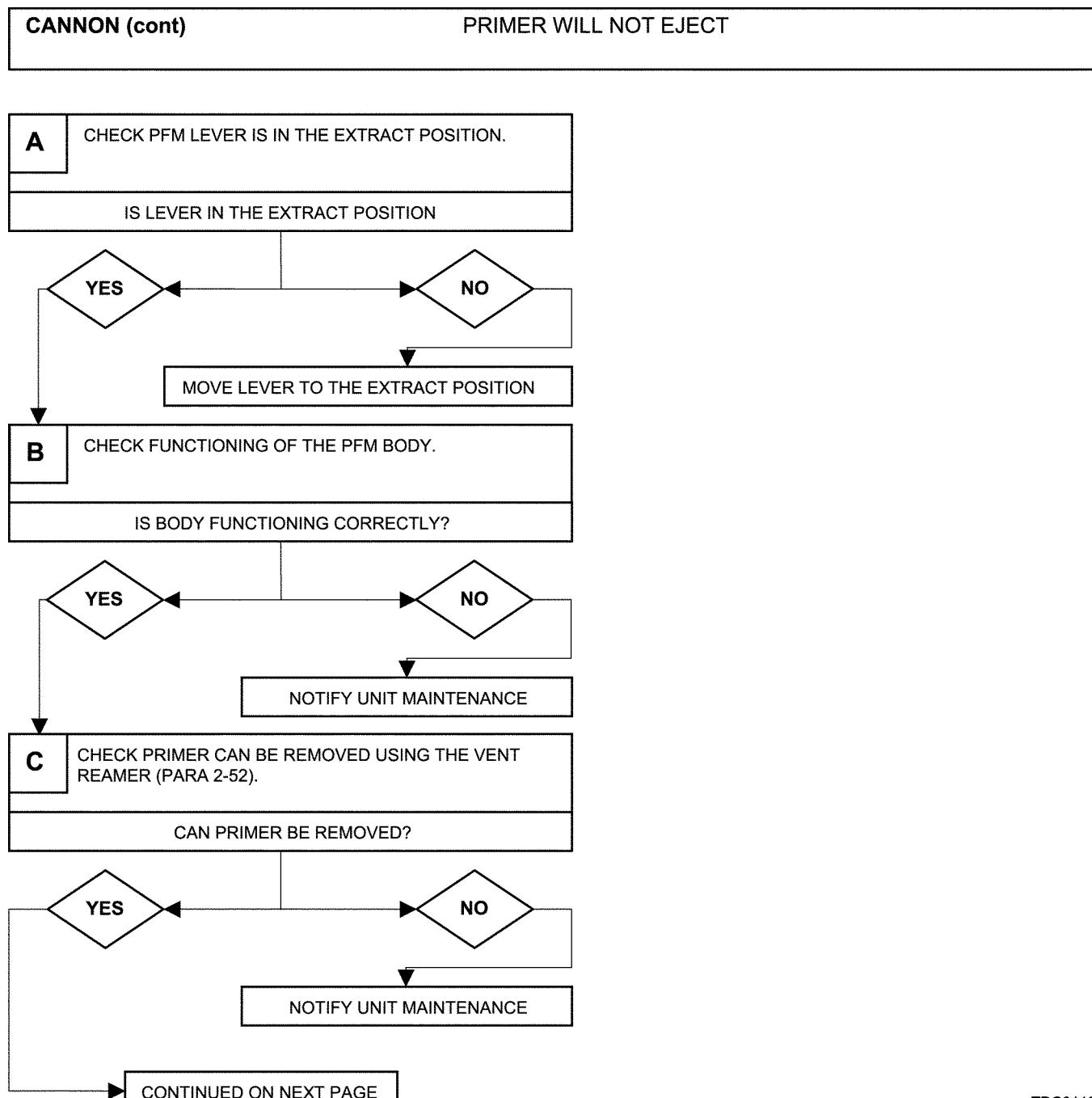
Table 3-1 Troubleshooting (cont)



TDC1073

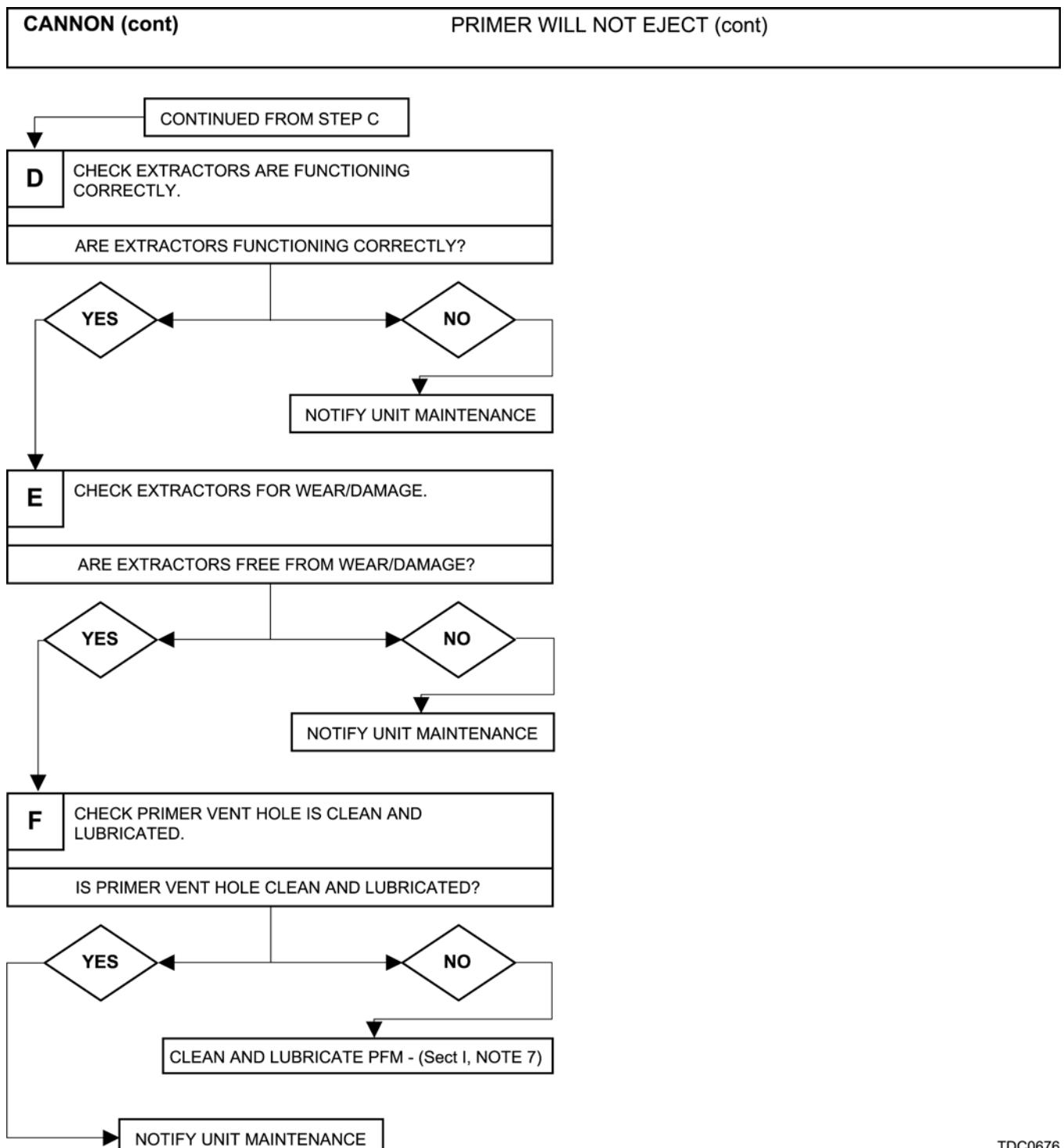
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC0110

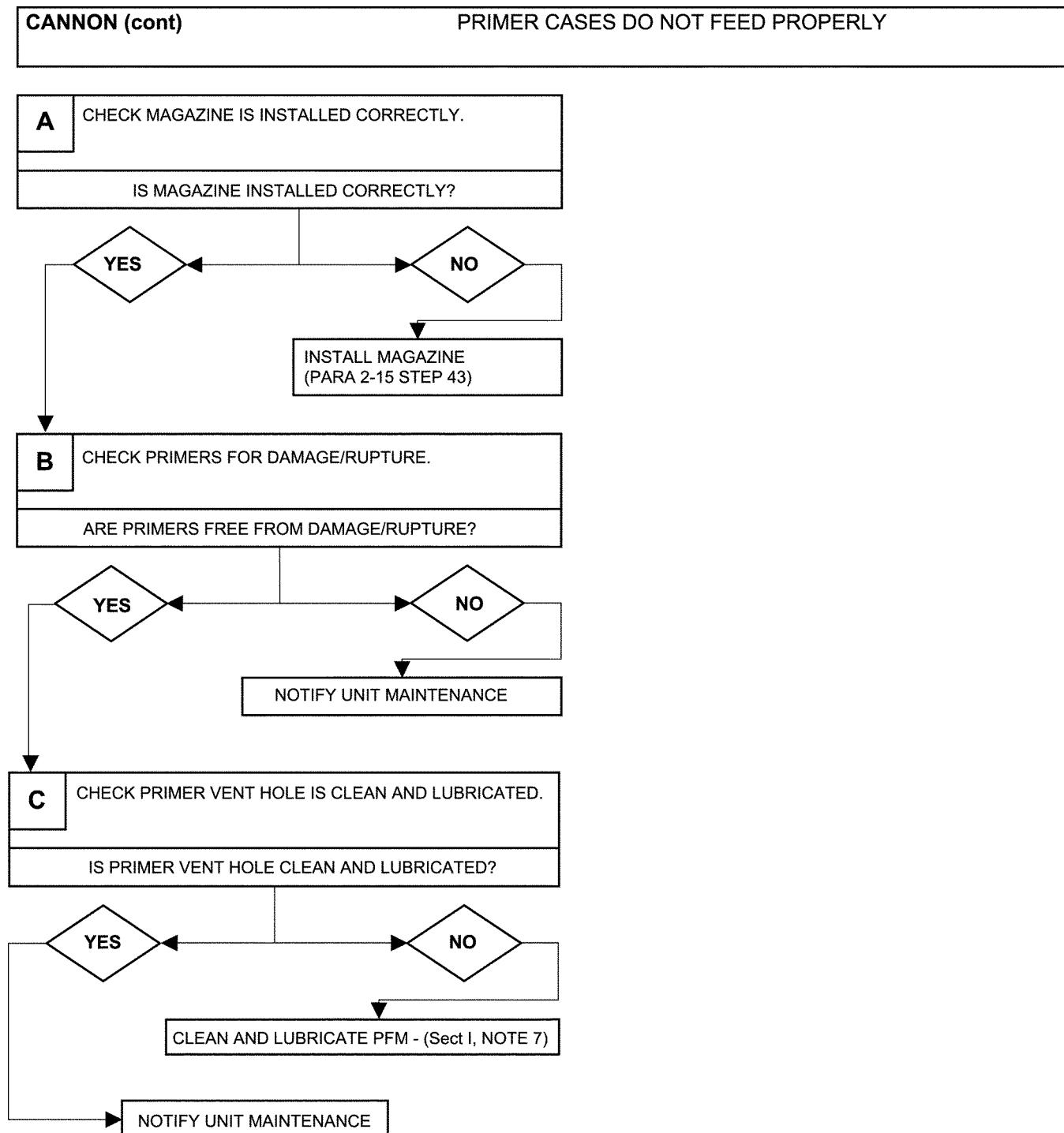
Table 3-1 Troubleshooting (cont)



TDC0676

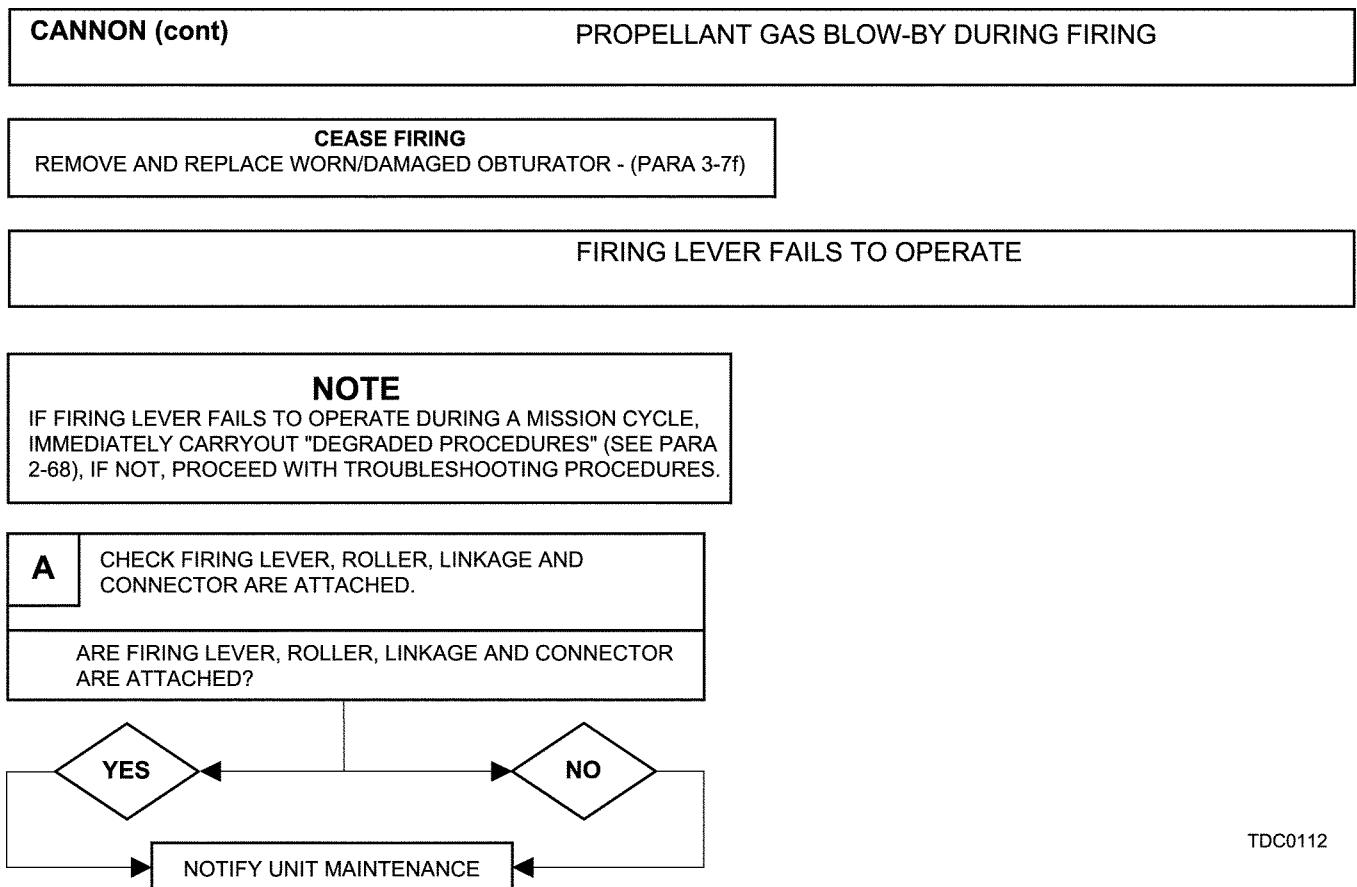
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



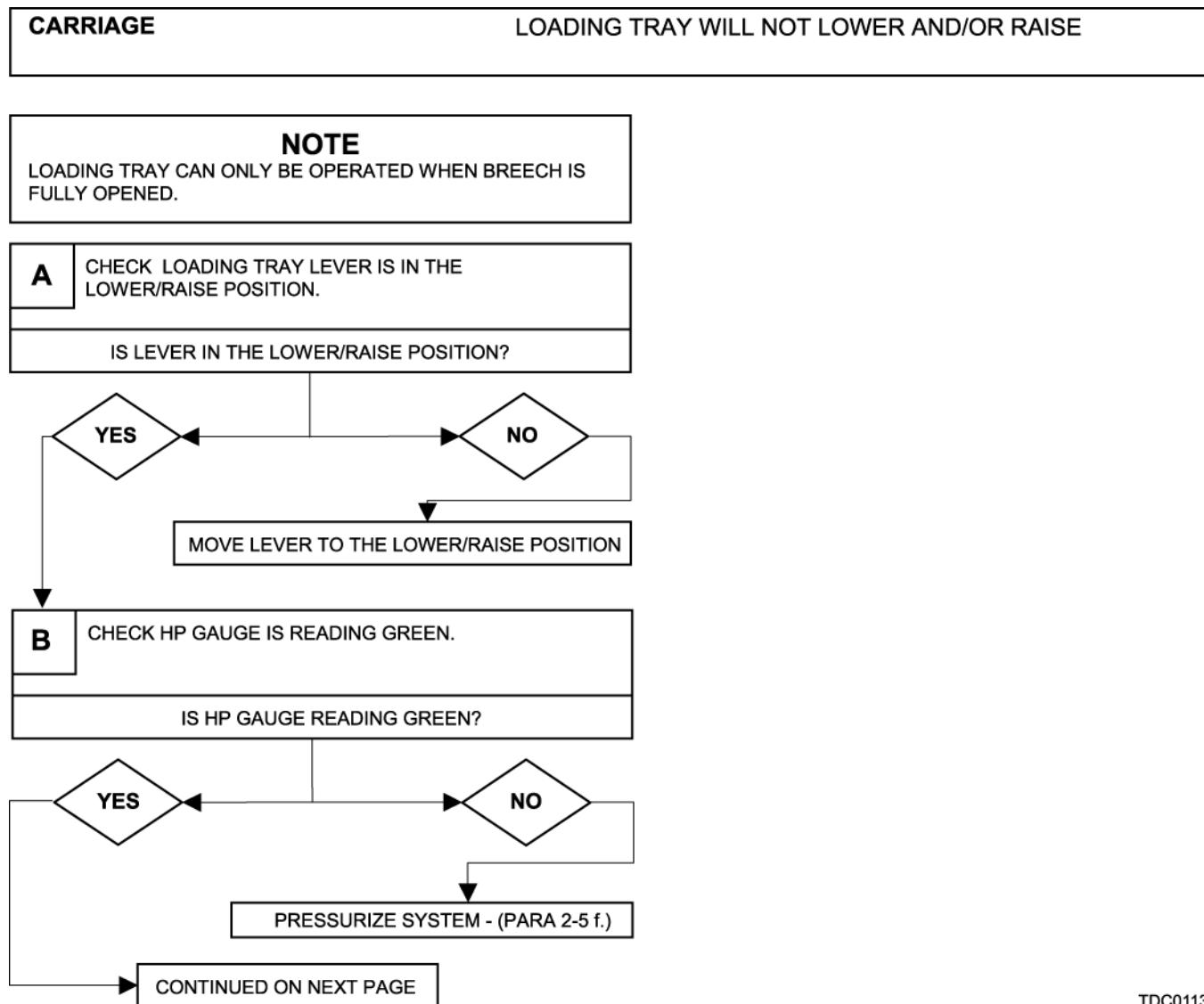
TDC0111

Table 3-1 Troubleshooting (cont)



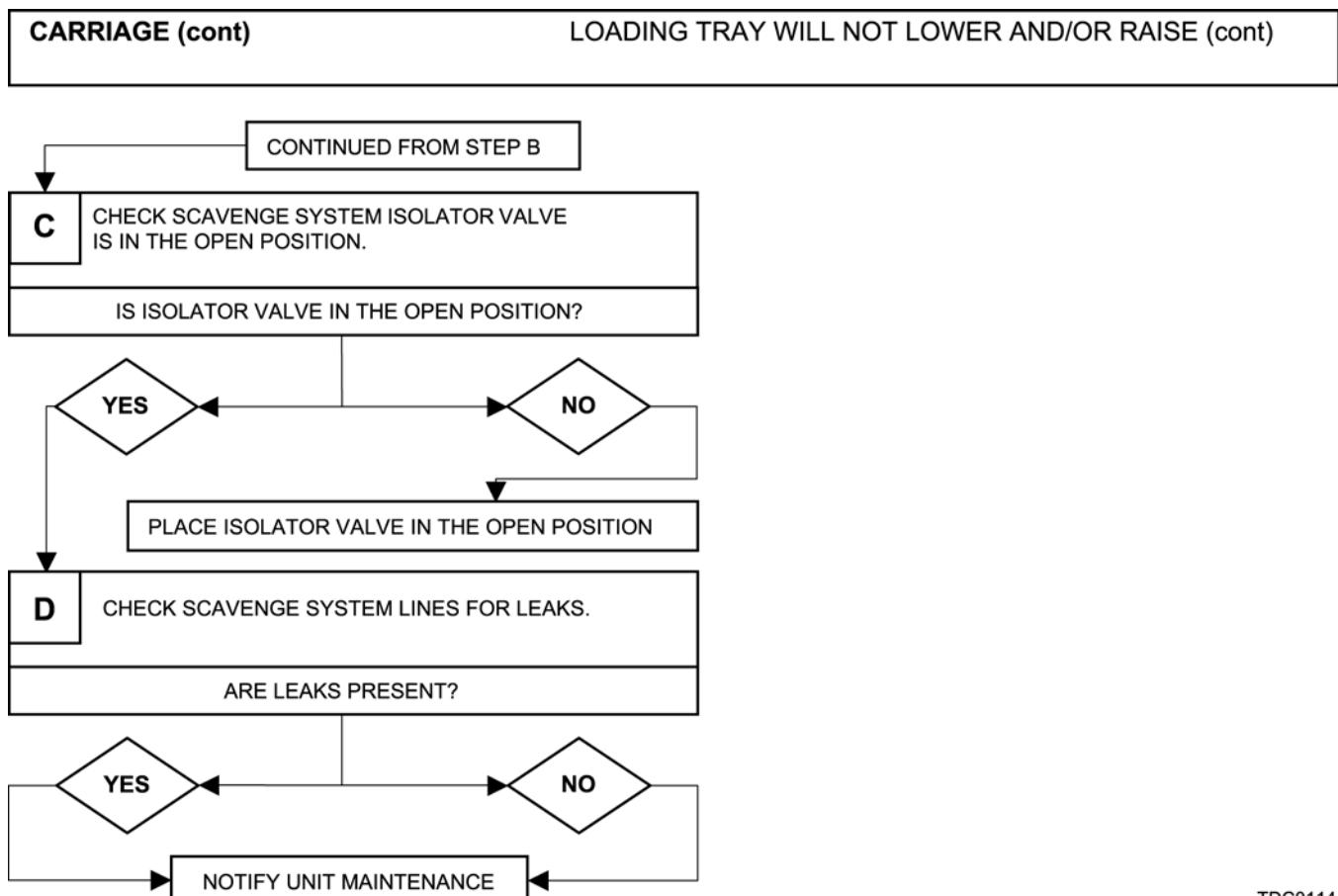
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC0113

Table 3-1 Troubleshooting (cont)



TDC0114

3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)

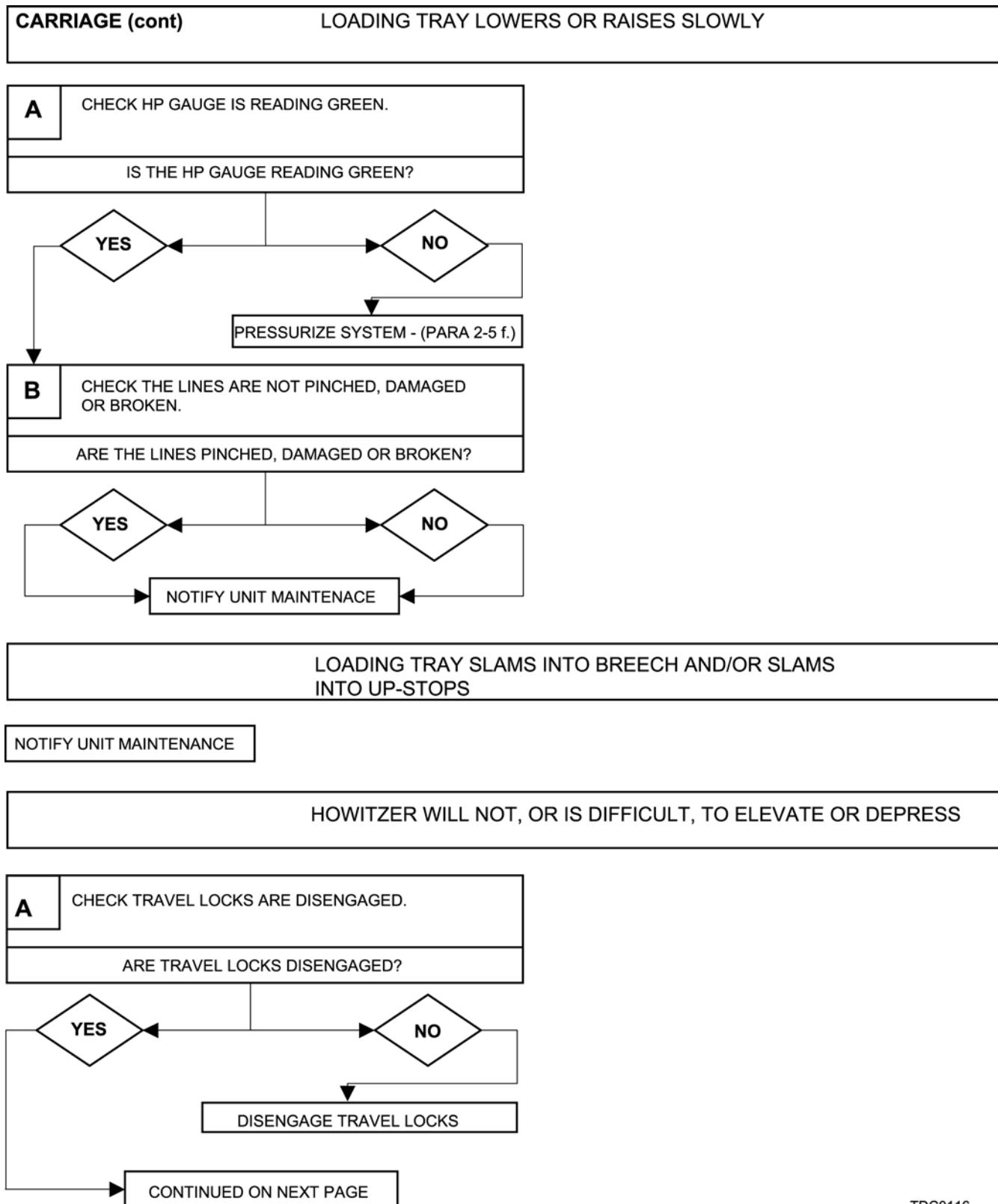
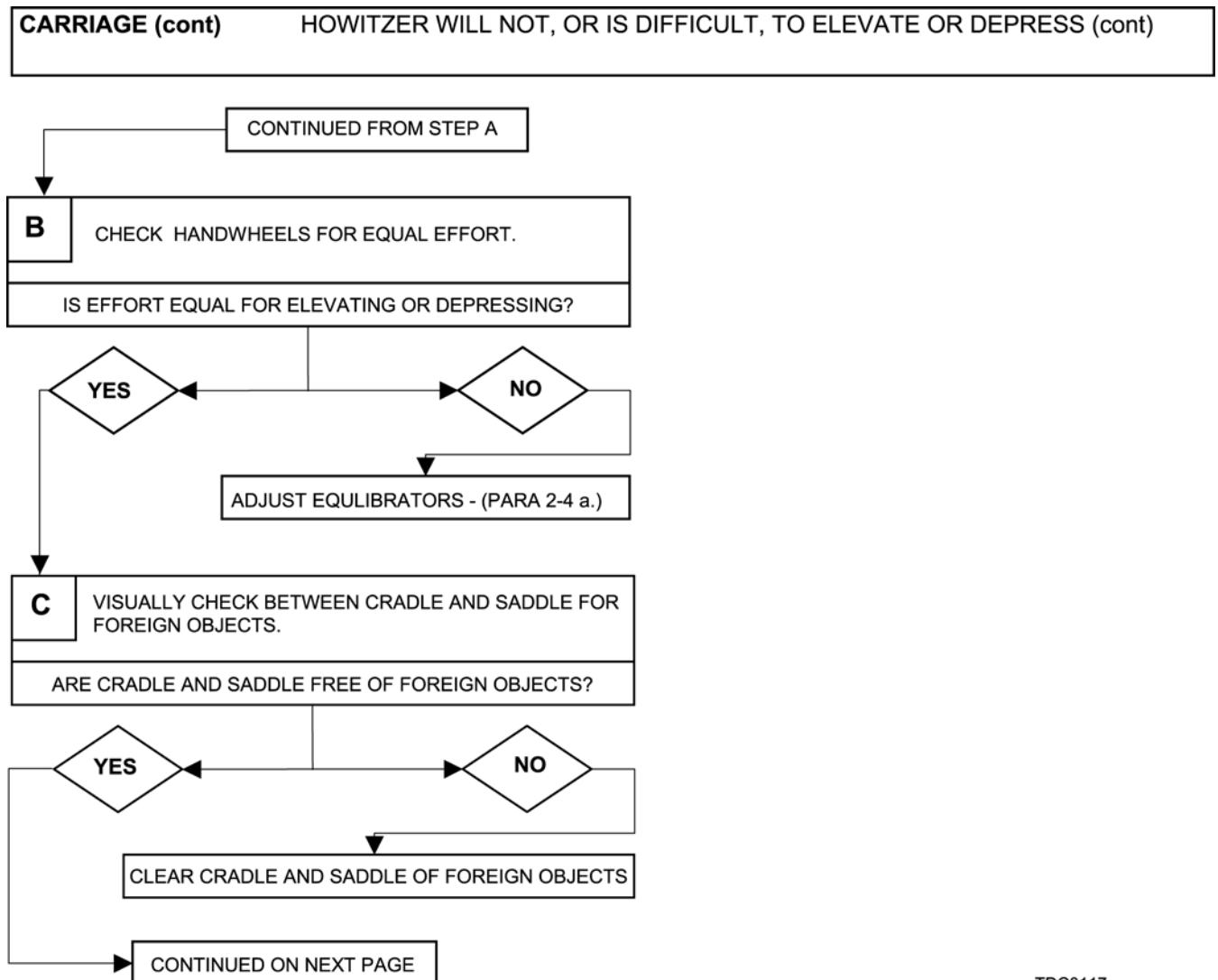


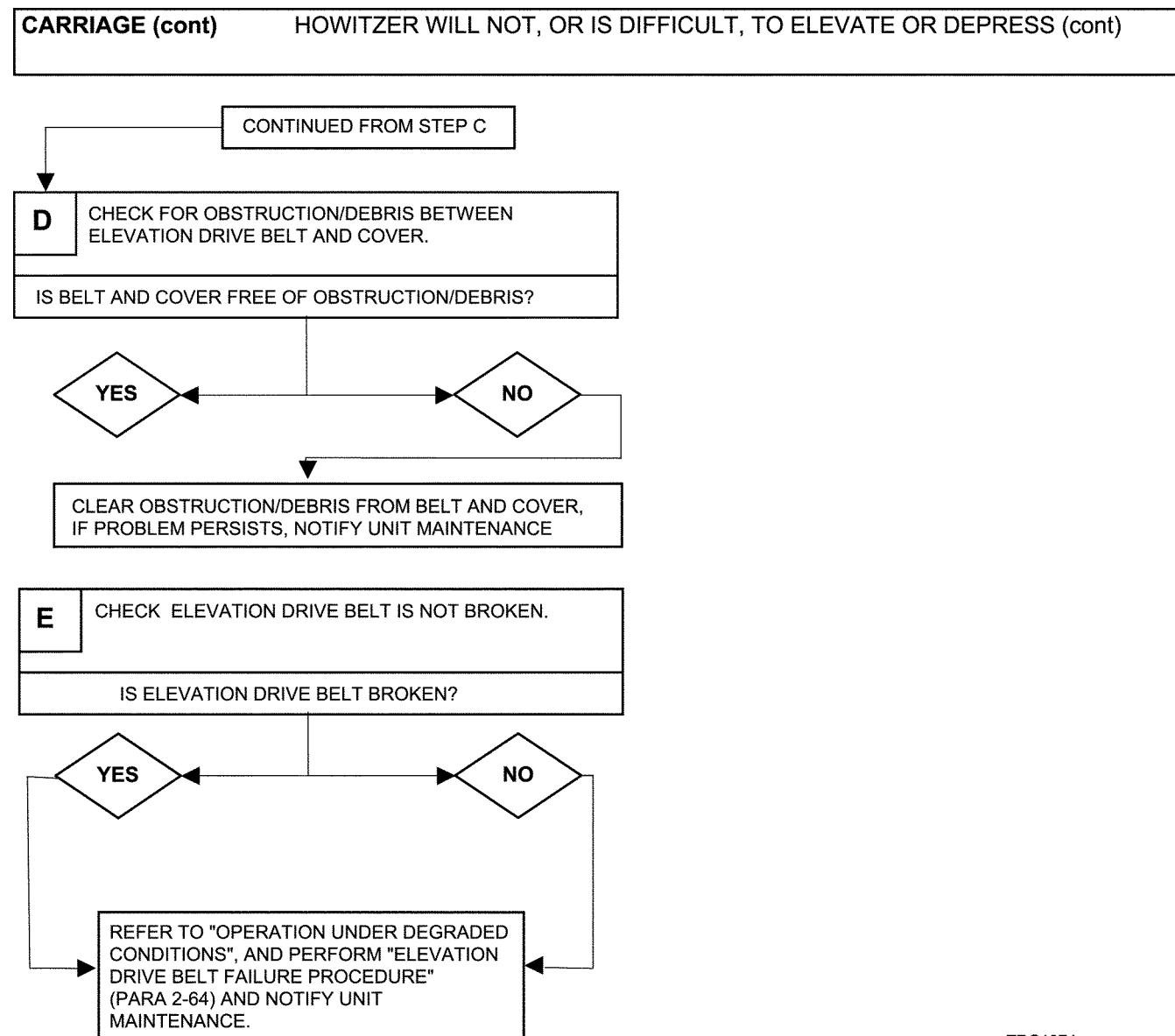
Table 3-1 Troubleshooting (cont)



TDC0117

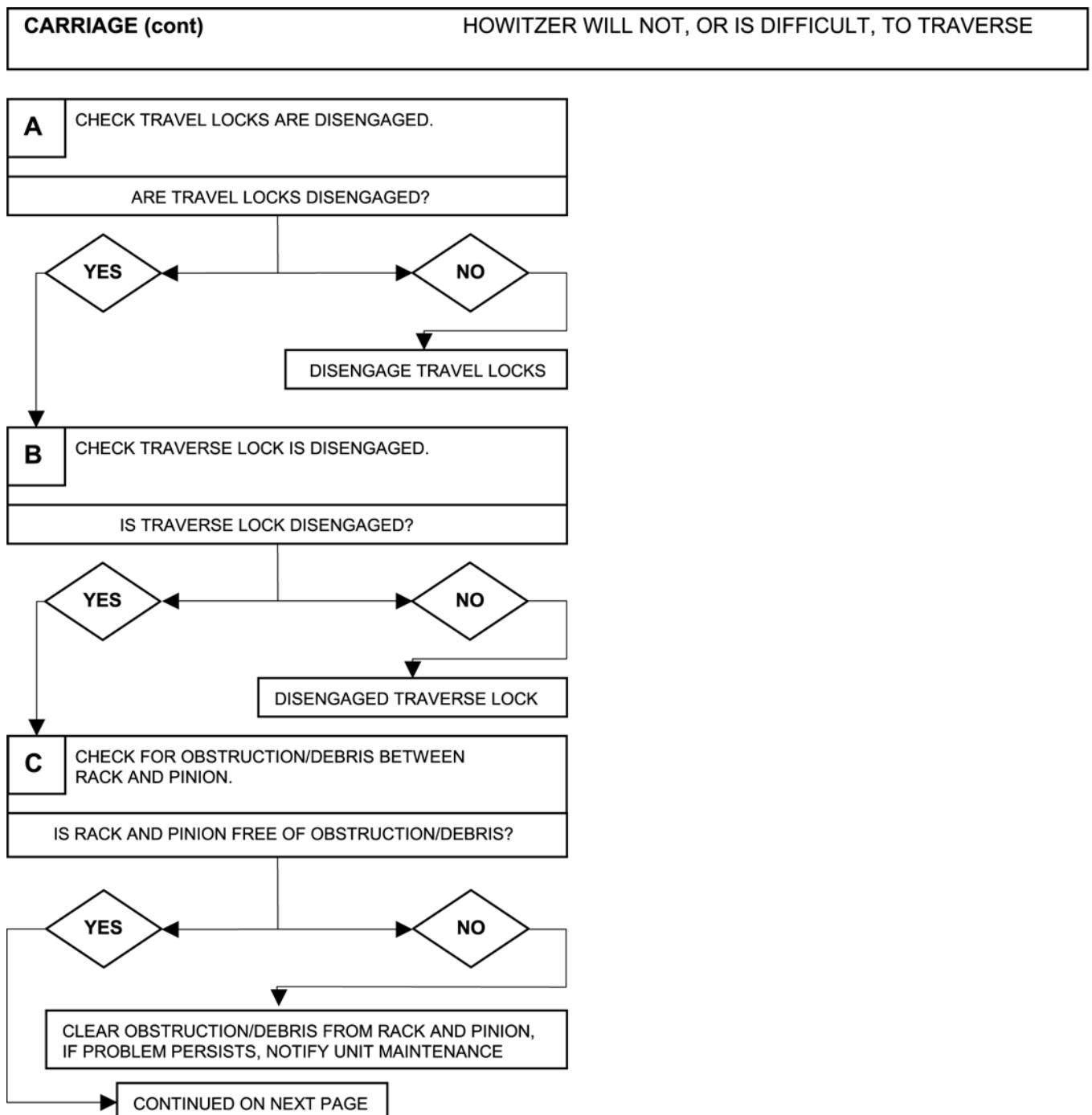
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC1074

Table 3-1 Troubleshooting (cont)



TDC0133

3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)

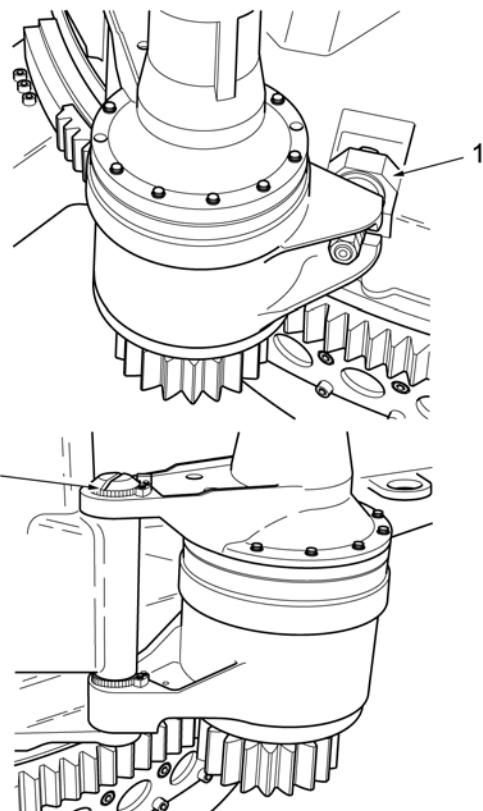
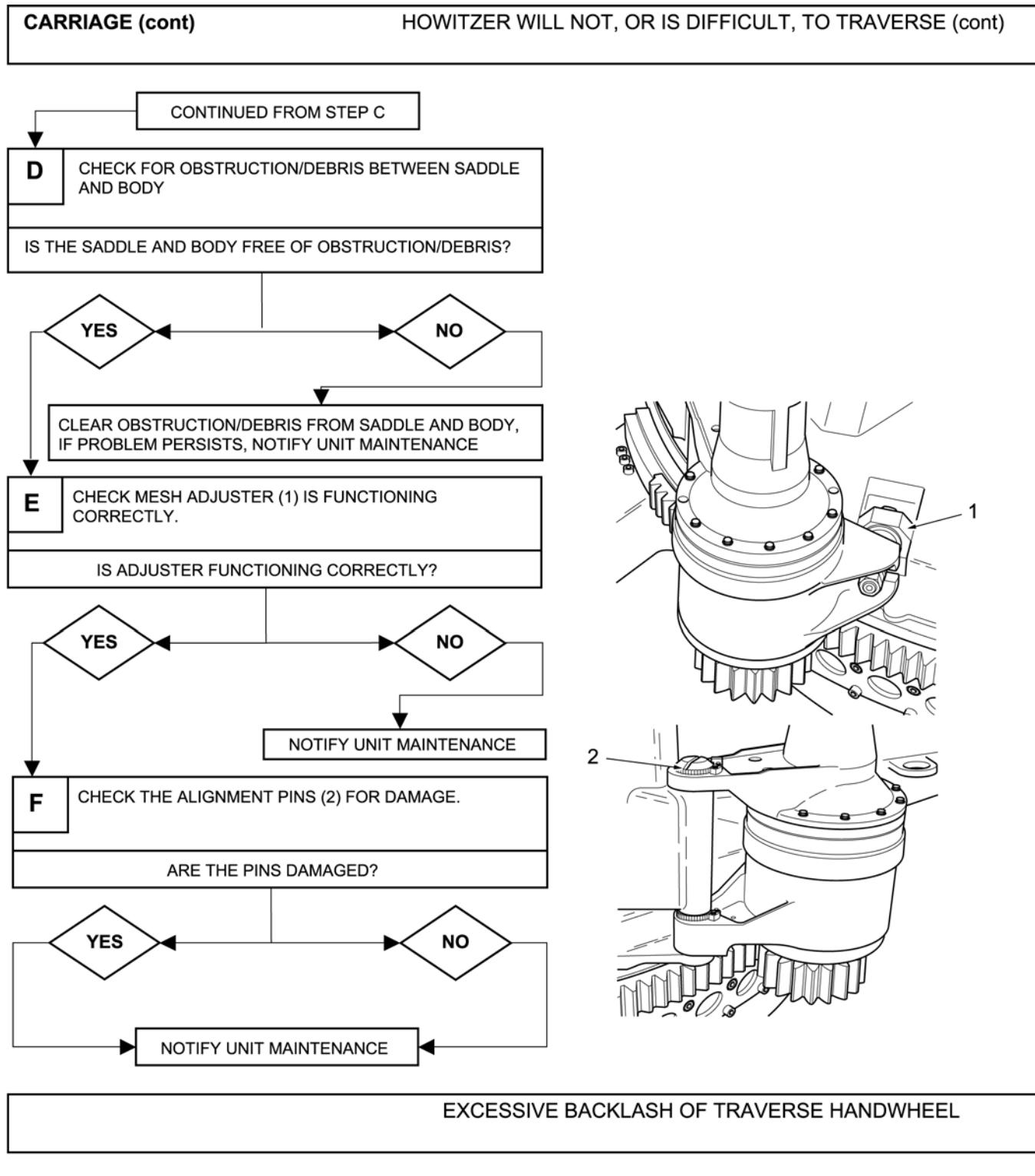
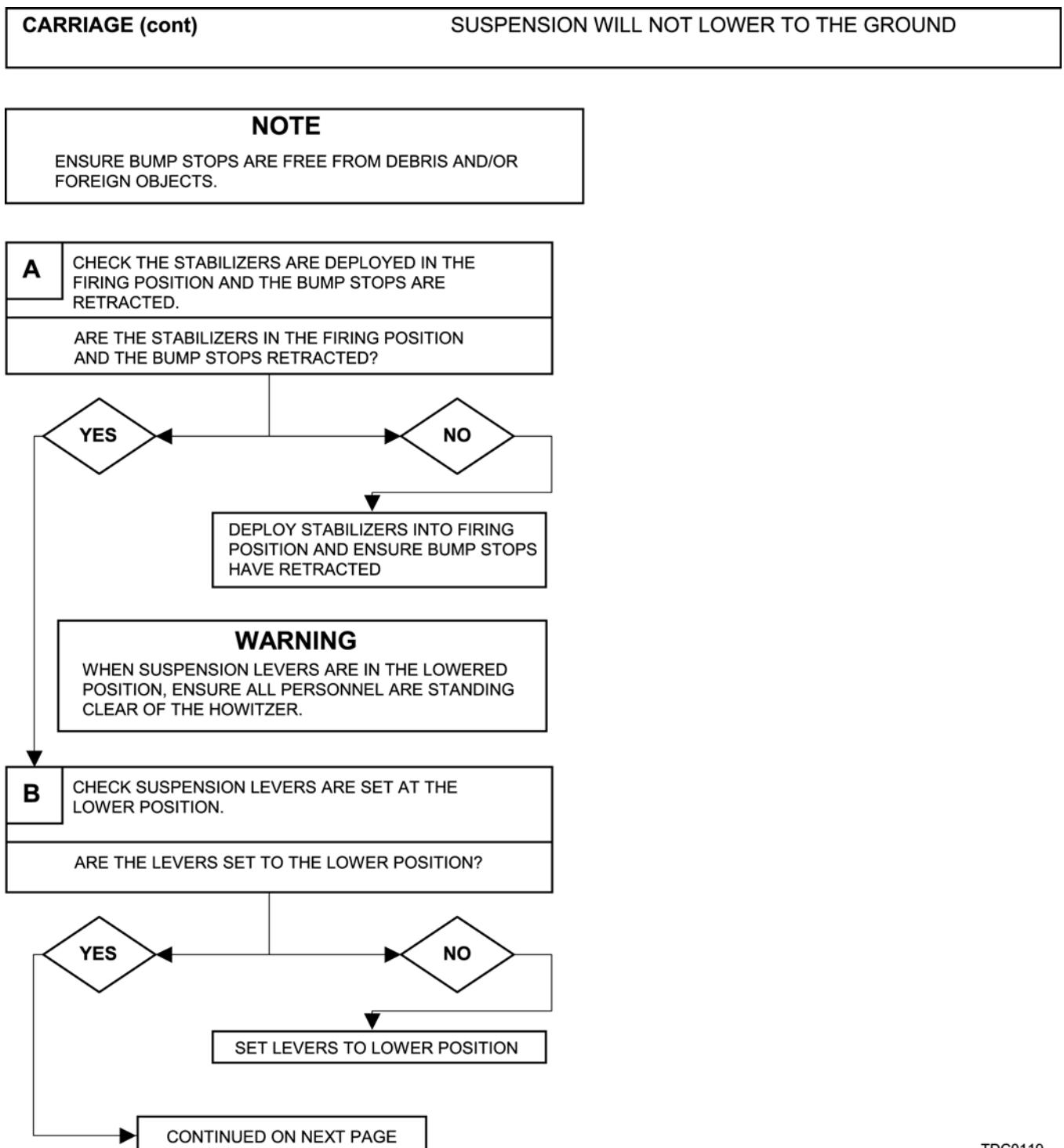


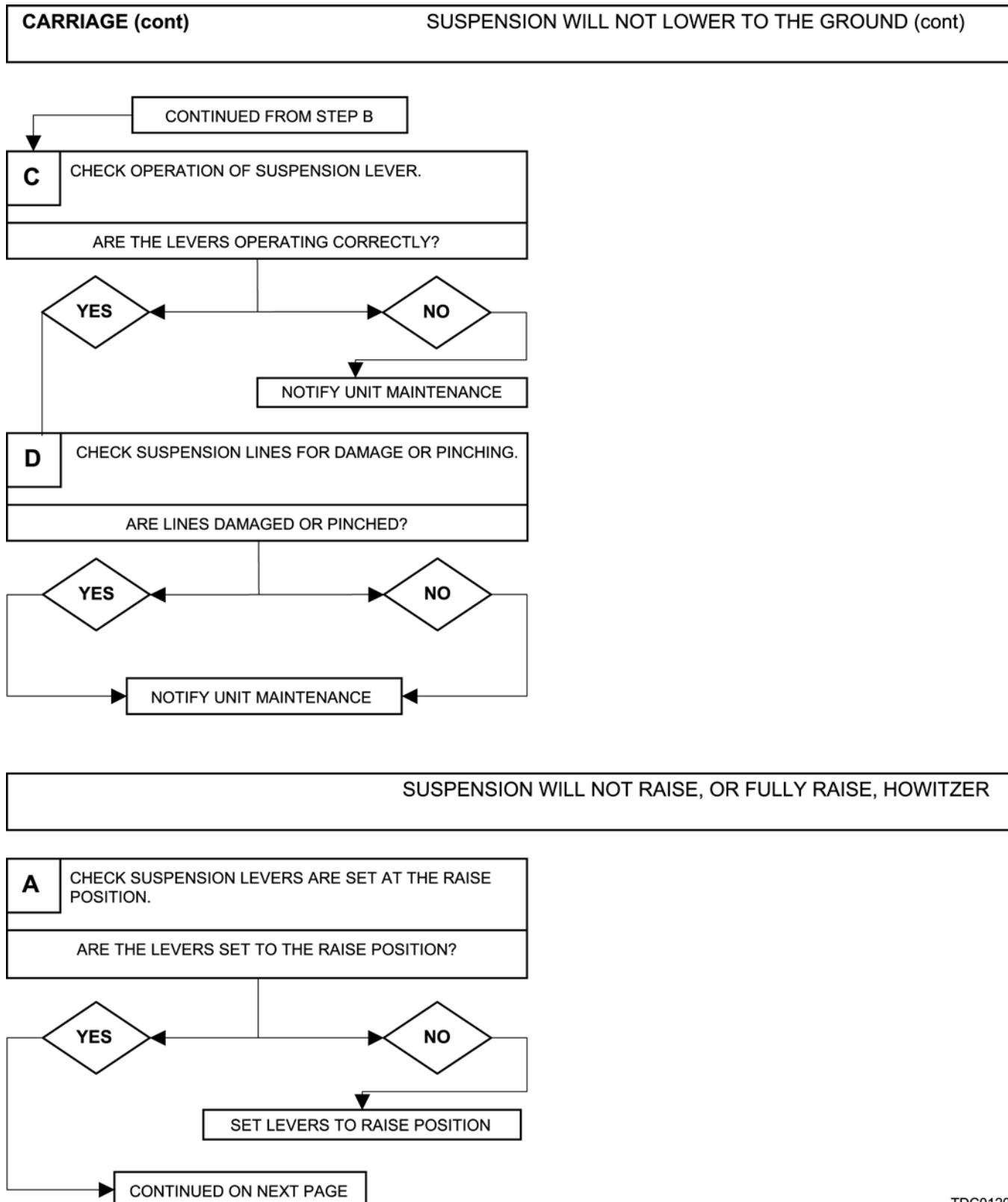
Table 3-1 Troubleshooting (cont)



TDC0119

3-4 TROUBLESHOOTING PROCEDURES (cont)

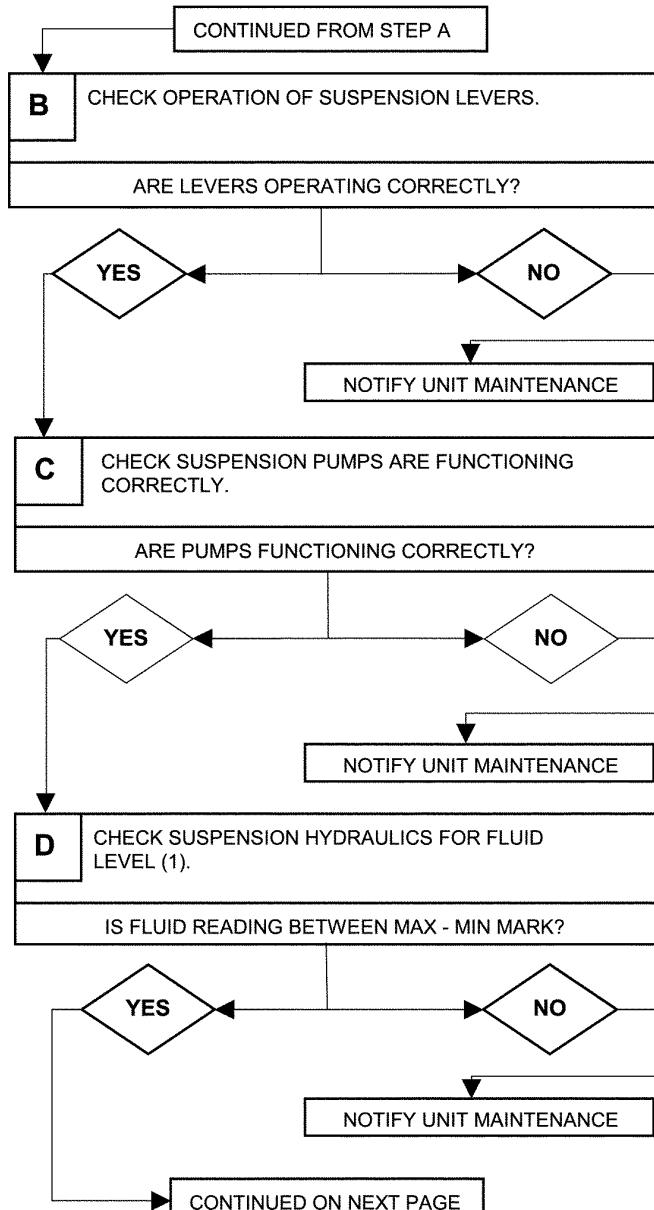
Table 3-1 Troubleshooting (cont)



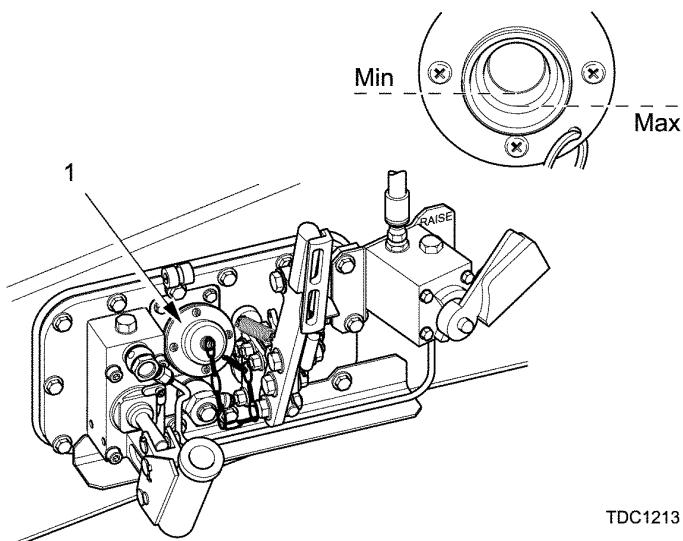
TDC0120

Table 3-1 Troubleshooting (cont)

CARRIAGE (cont)	SUSPENSION WILL NOT RAISE, OR FULLY RAISE, HOWITZER (cont)
-----------------	--



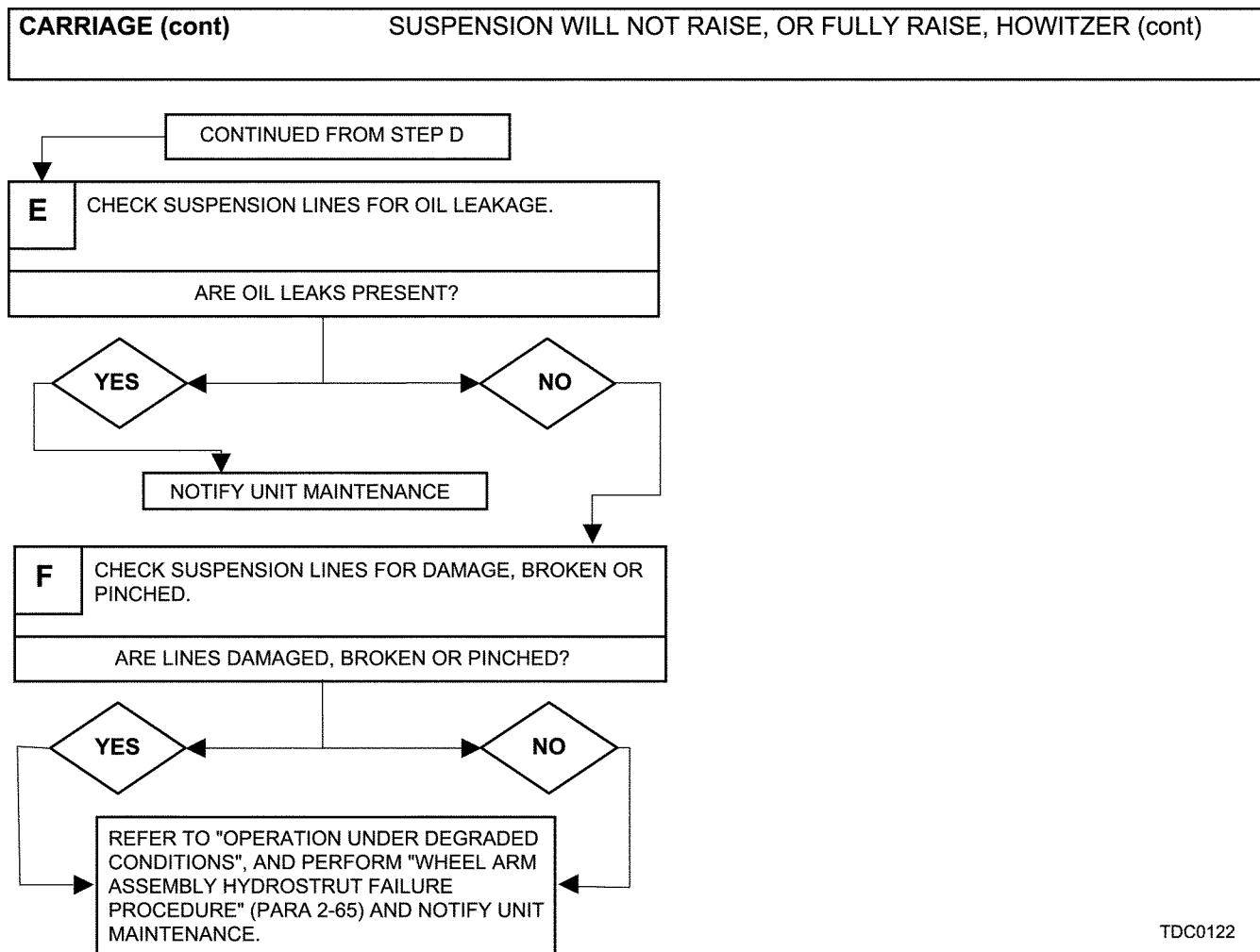
NOTE
WHEEL ARM ASSEMBLIES MUST BE IN THE RAISED POSITION,
BEFORE CHECKING FLUID LEVEL.



TDC1213

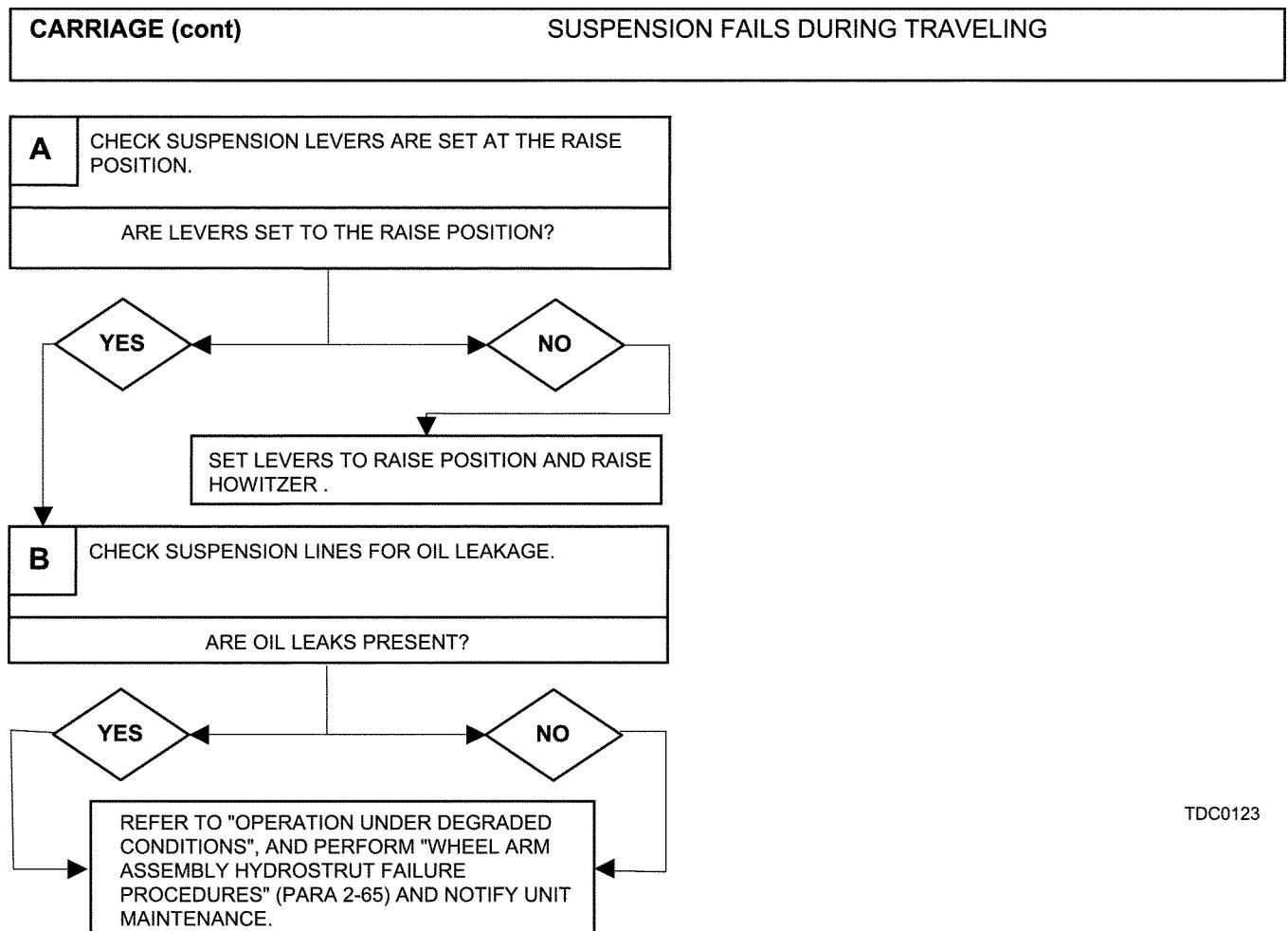
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



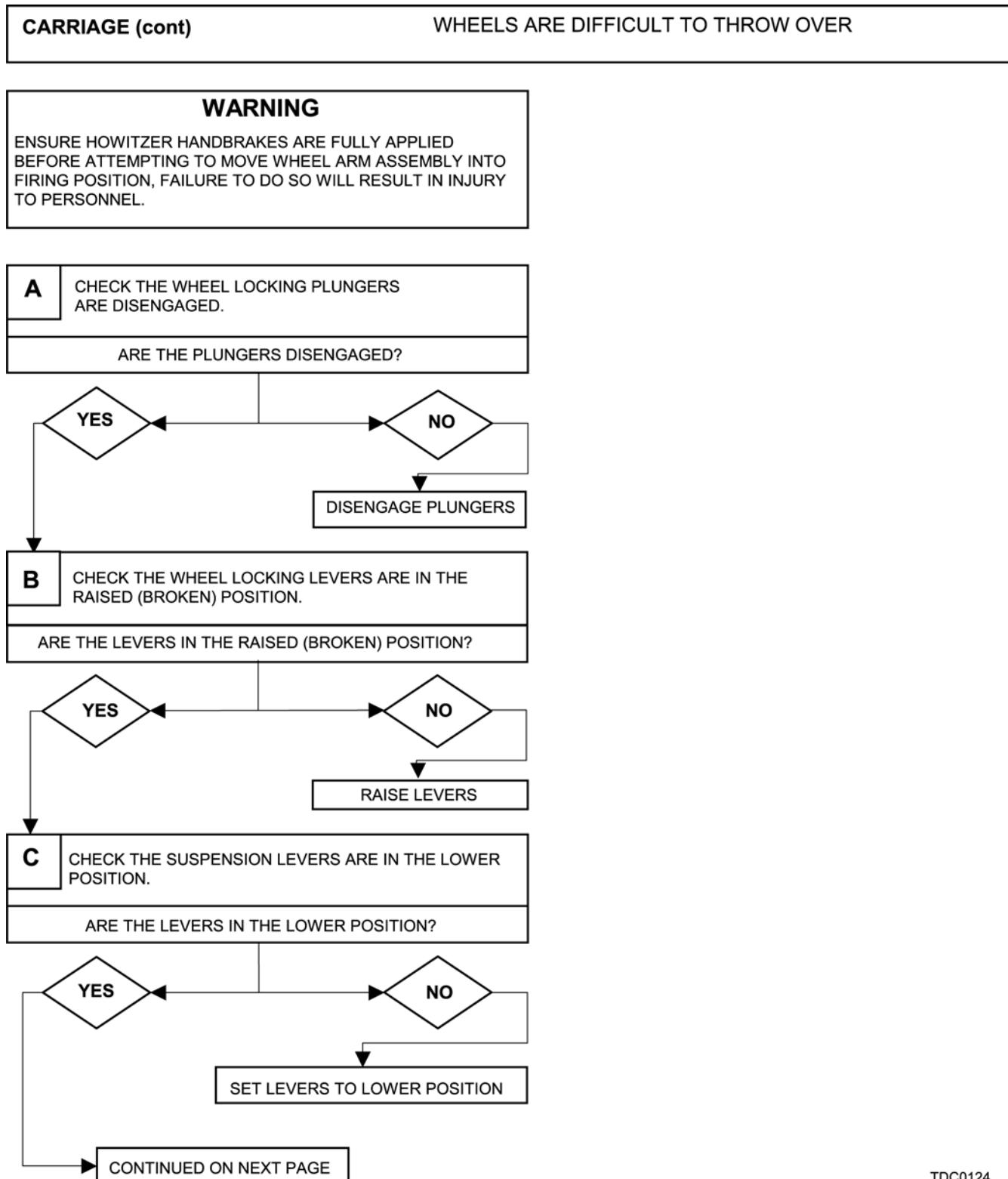
TDC0122

Table 3-1 Troubleshooting (cont)



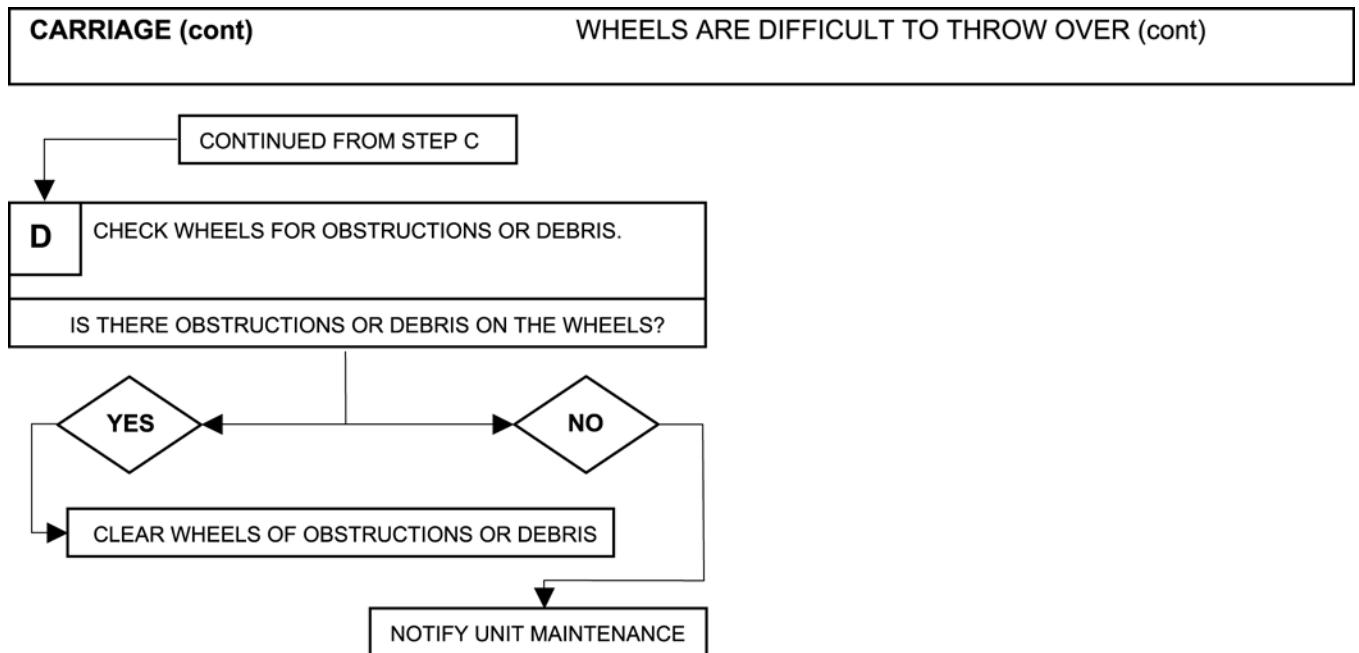
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC0124

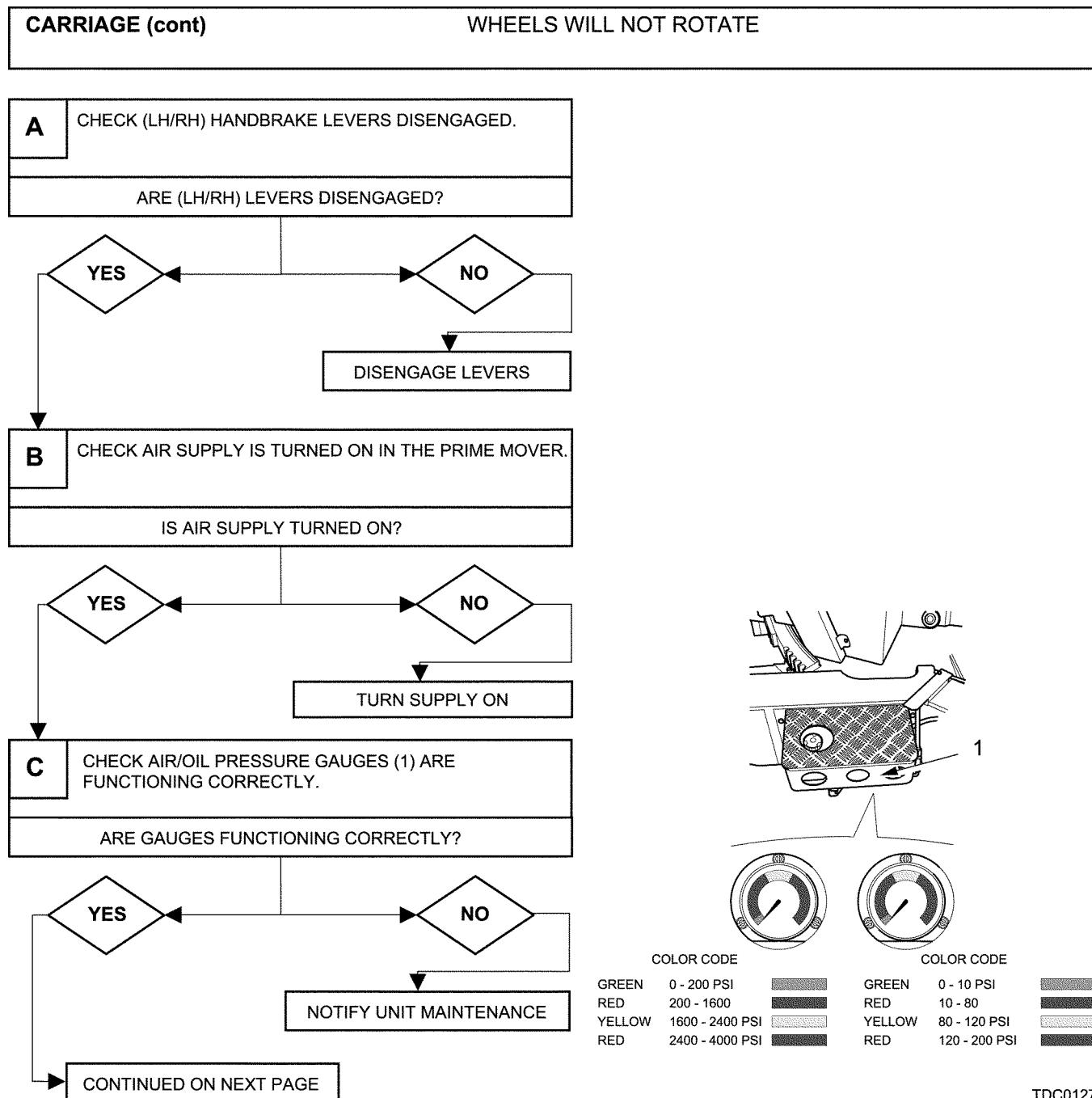
Table 3-1 Troubleshooting (cont)



TDC1035

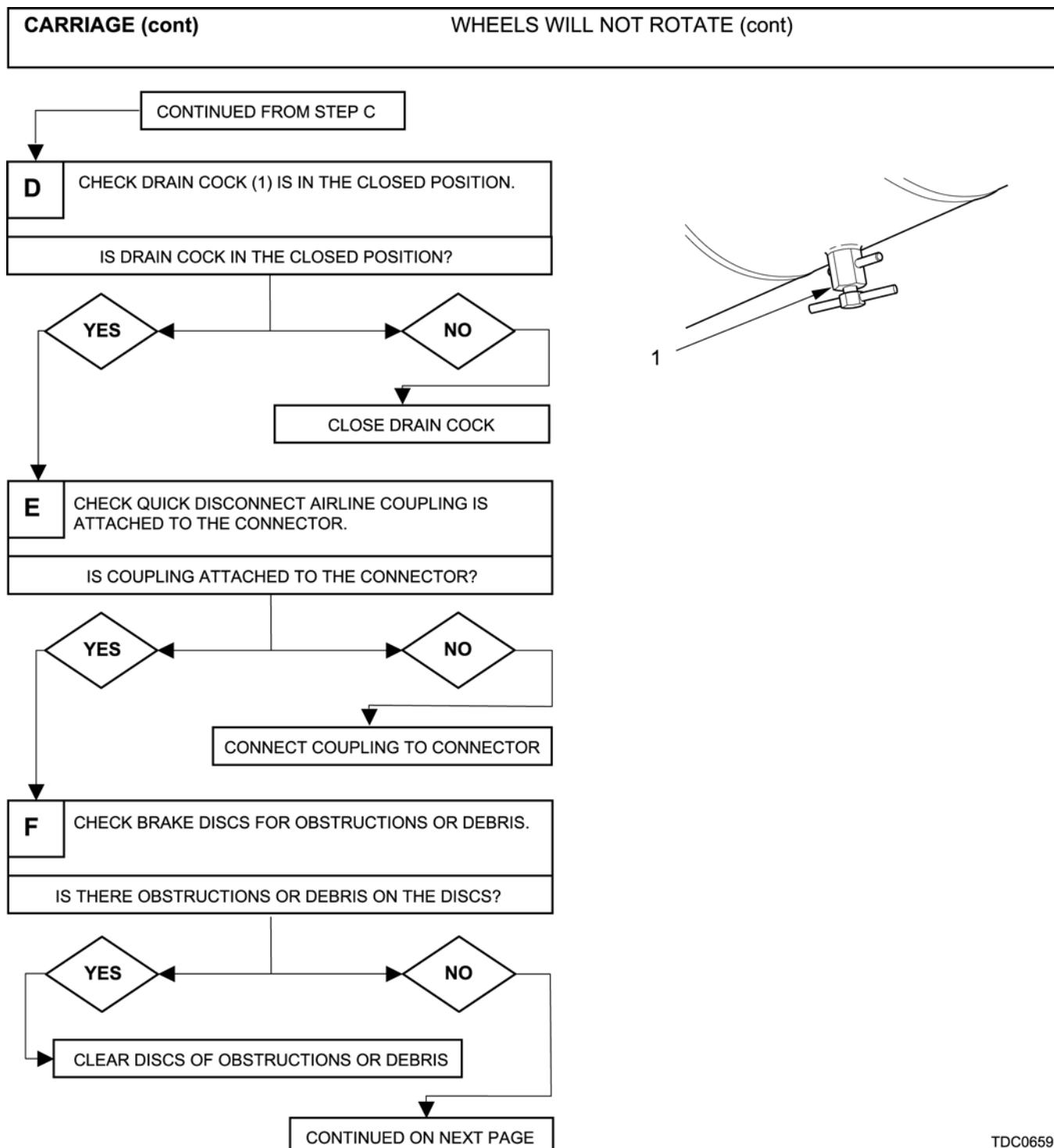
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC0127

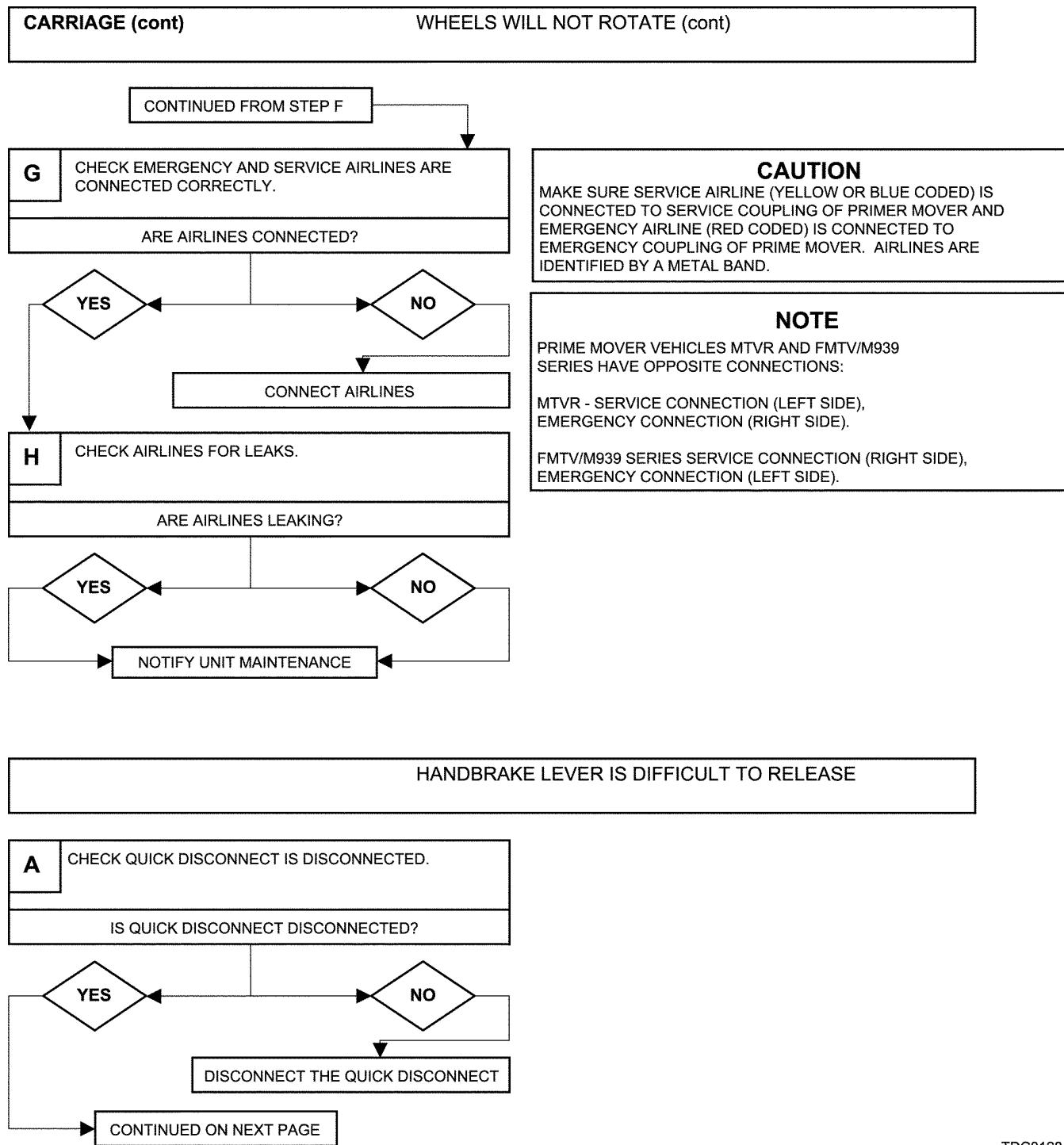
Table 3-1 Troubleshooting (cont)



TDC0659

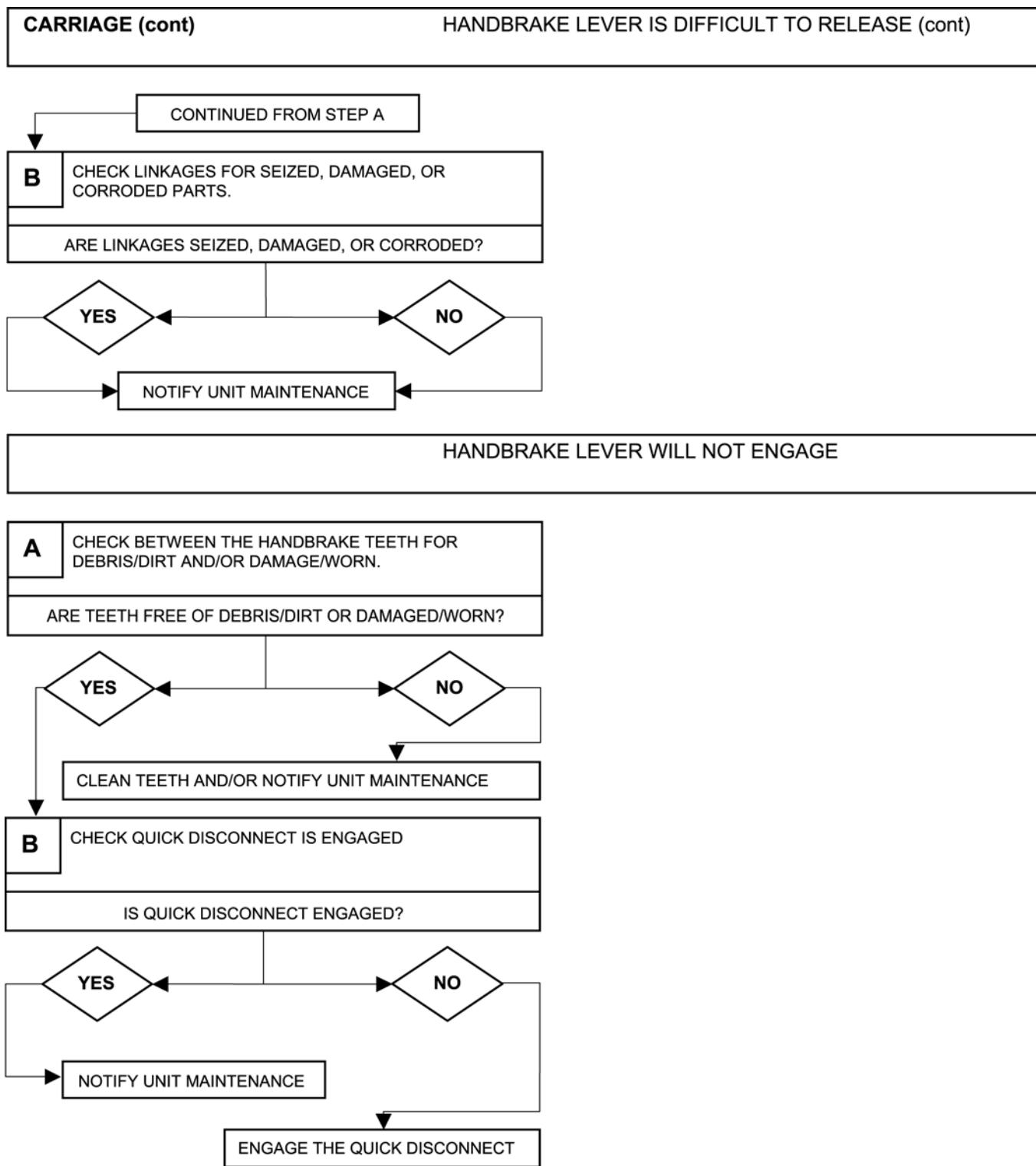
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC0128

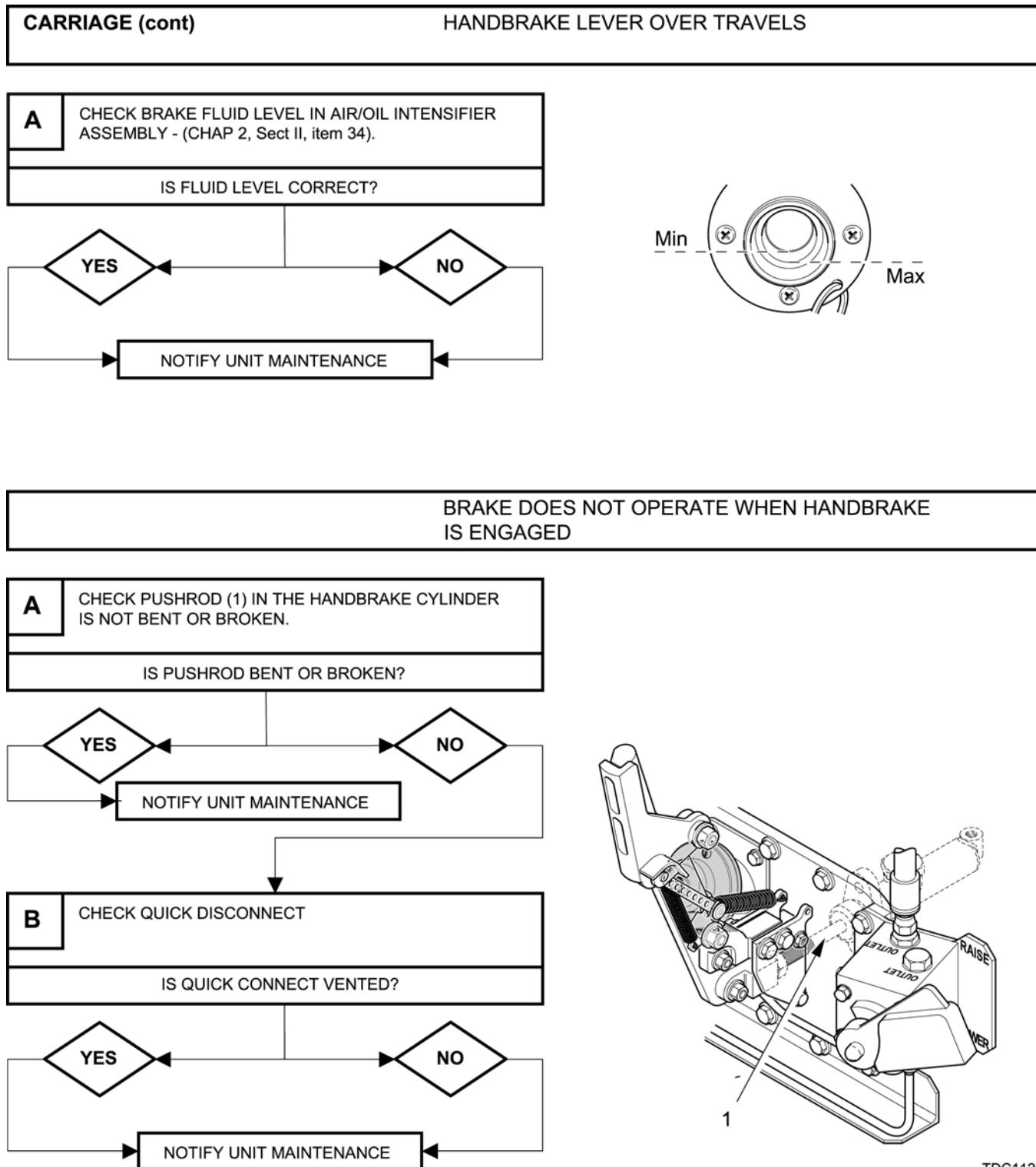
Table 3-1 Troubleshooting (cont)



TDC0129A

3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC1126

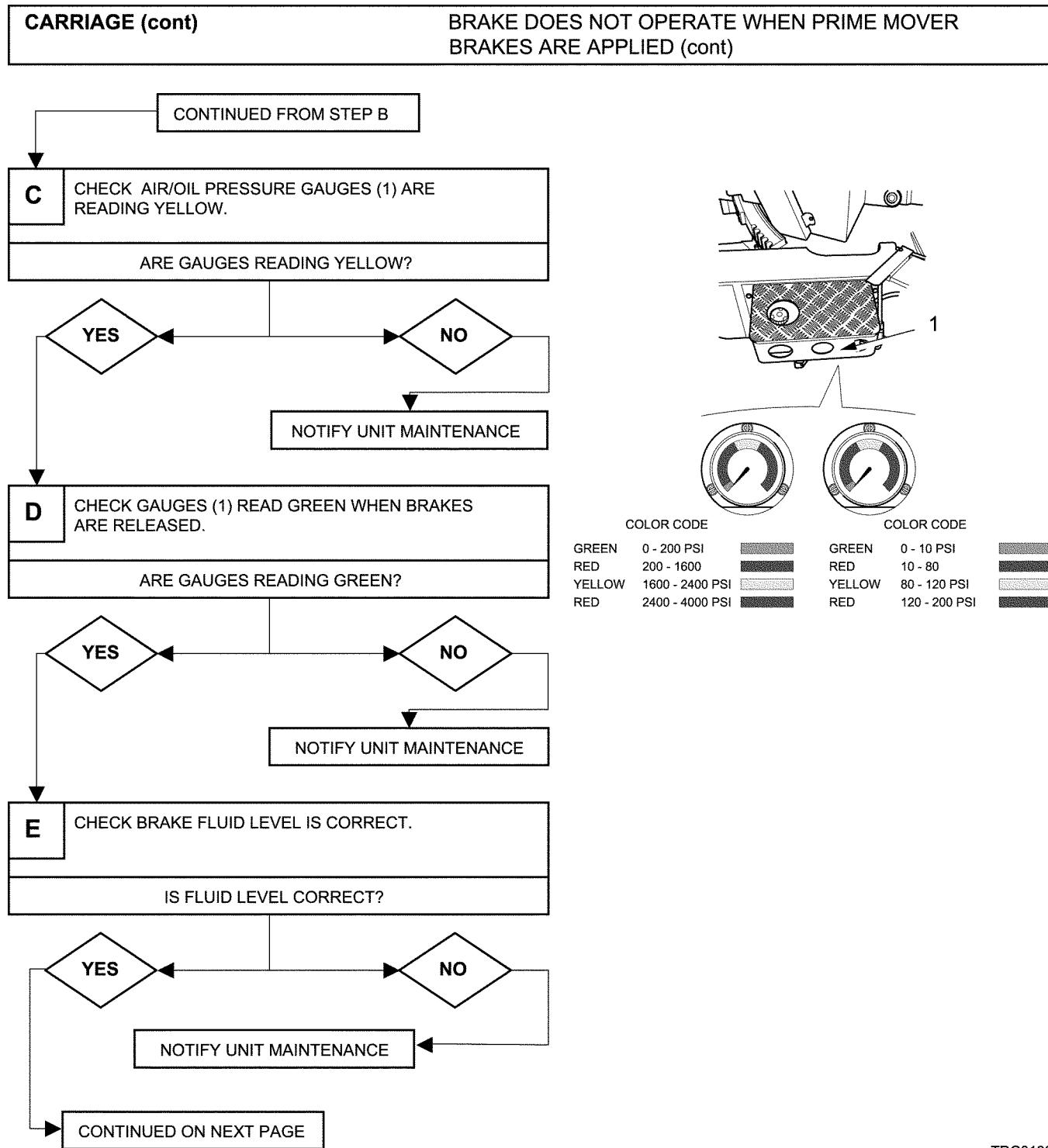
Table 3-1 Troubleshooting (cont)

CARRIAGE (cont)	BRAKE DOES NOT OPERATE WHEN PRIME MOVER BRAKES ARE APPLIED
WARNING	
PERSONNEL SHOULD STAY CLEAR OF AREA BETWEEN PRIME MOVER AND HOWITZER.	
CAUTION	
MAKE SURE SERVICE AIRLINE (YELLOW OR BLUE CODED) IS CONNECTED TO SERVICE COUPLING OF PRIMER MOVER AND EMERGENCY AIRLINE (RED CODED) IS CONNECTED TO EMERGENCY COUPLING OF PRIME MOVER. AIRLINES ARE IDENTIFIED BY A METAL BAND.	
NOTE	
PRIME MOVER VEHICLES MTVR AND FMTV /M939 SERIES HAVE OPPOSITE CONNECTIONS:	
MTVR - SERVICE CONNECTION (LEFT SIDE), EMERGENCY CONNECTION (RIGHT SIDE).	
FMTV/M939 SERIES SERVICE CONNECTION (RIGHT SIDE), EMERGENCY CONNECTION (LEFT SIDE).	
A	CHECK TO SEE IF THE SERVICE AND EMERGENCY AIRLINES ARE CORRECTLY CONNECTED TO THE PRIME MOVER.
ARE AIRLINES CONNECTED CORRECTLY?	
<pre> graph TD A[ARE AIRLINES CONNECTED CORRECTLY?] -- YES --> B A -- NO --> Connect[CONNECT AIR LINES] </pre>	
B	CHECK AIR SUPPLY ON THE PRIME MOVER IS ON.
IS AIR SUPPLY ON?	
<pre> graph TD B[IS AIR SUPPLY ON?] -- YES --> Next B -- NO --> Turn[TURN AIR SUPPLY ON] </pre>	
<pre> graph TD Turn --> Continue[CONTINUED ON NEXT PAGE] </pre>	

TDC0131

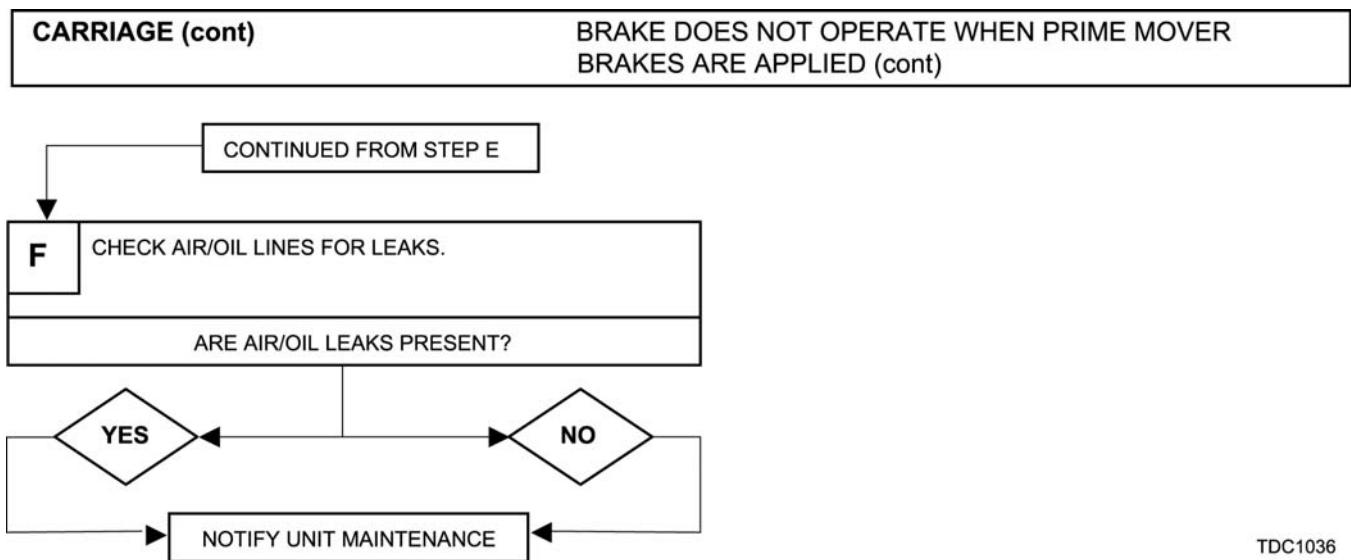
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC0132

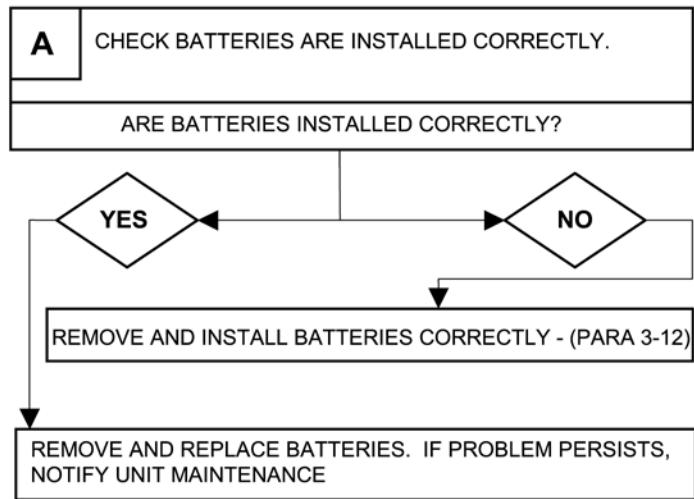
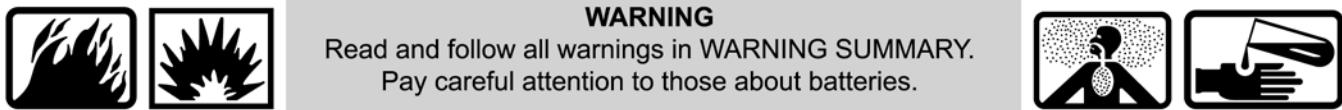
Table 3-1 Troubleshooting (cont)



3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)

FIRE CONTROL EQUIPMENT	MOISTURE IN FIRE CONTROL EQUIPMENT
NOTIFY UNIT MAINTENANCE	
	COUNTERS, LEVEL VIALS, OR RETICLES, NOT ILLUMINATED, WILL NOT ILLUMINATE, OR INTERMITTENT



TDC0135

Table 3-1 Troubleshooting (cont)

FIRE CONTROL EQUIPMENT (cont)

FIRE CONTROL KNOBS DO NOT TURN FREELY

NOTIFY UNIT MAINTENANCE

COUNTER DIALS, RETICLES, OR LEVEL VIALS, ARE BROKEN

NOTIFY UNIT MAINTENANCE

FITTED PARTS OF FIRE CONTROL EQUIPMENT ARE LOOSE

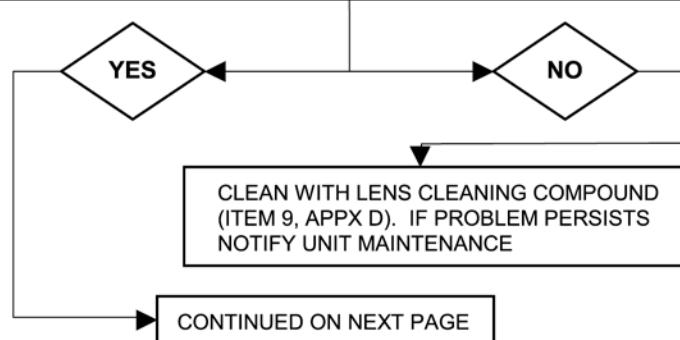
NOTIFY UNIT MAINTENANCE

M1A2 COLLIMATOR RETICLE IMAGE IS NOT SHARP

A

CHECK PANTEL IS PROVIDING A CLEAR IMAGE AND IS NOT DIRTY, WET, OR FOGGED.

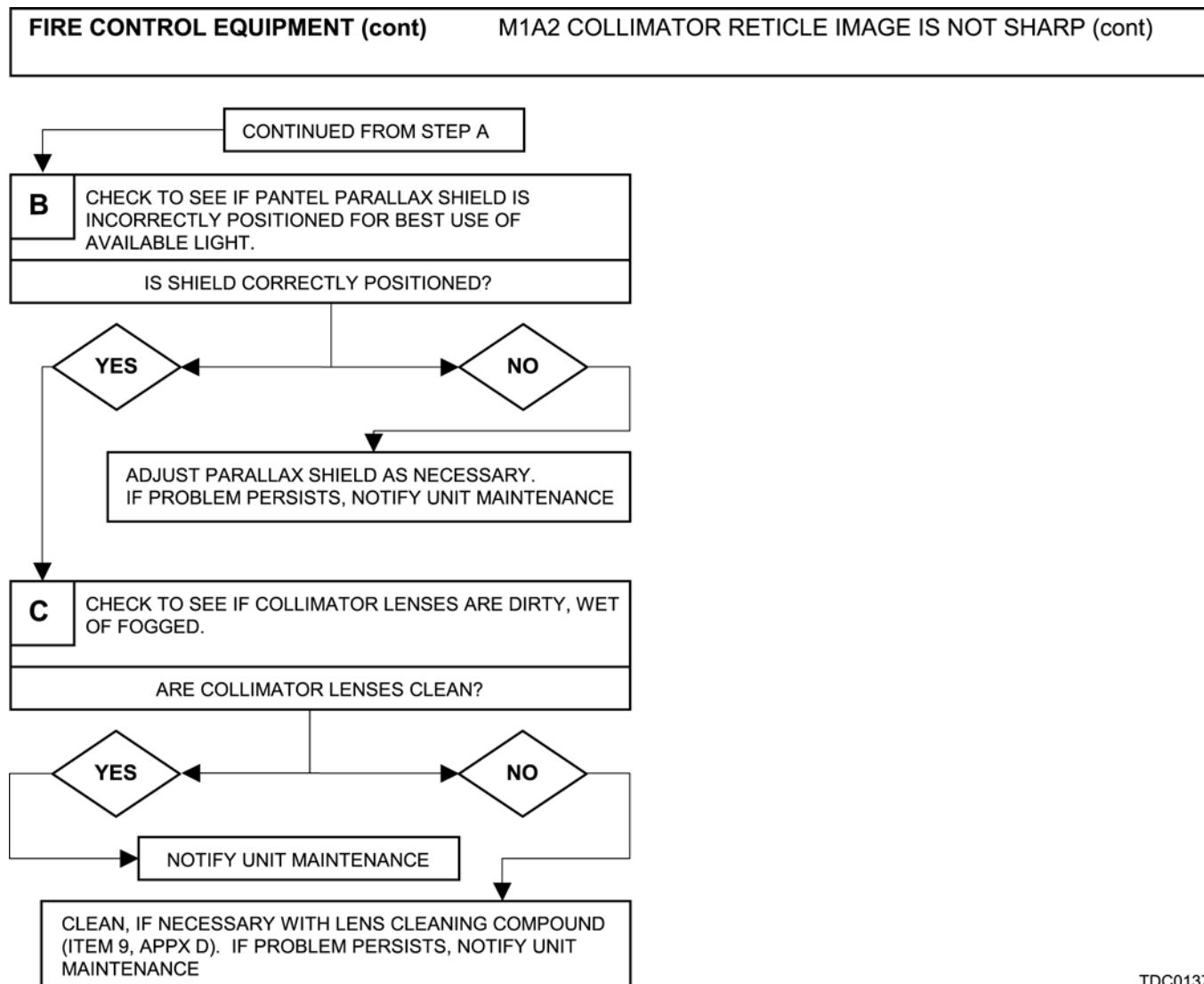
IS PANTEL PROVIDING A CLEAR IMAGE AND IS CLEAN?



TDC0136

3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC0137

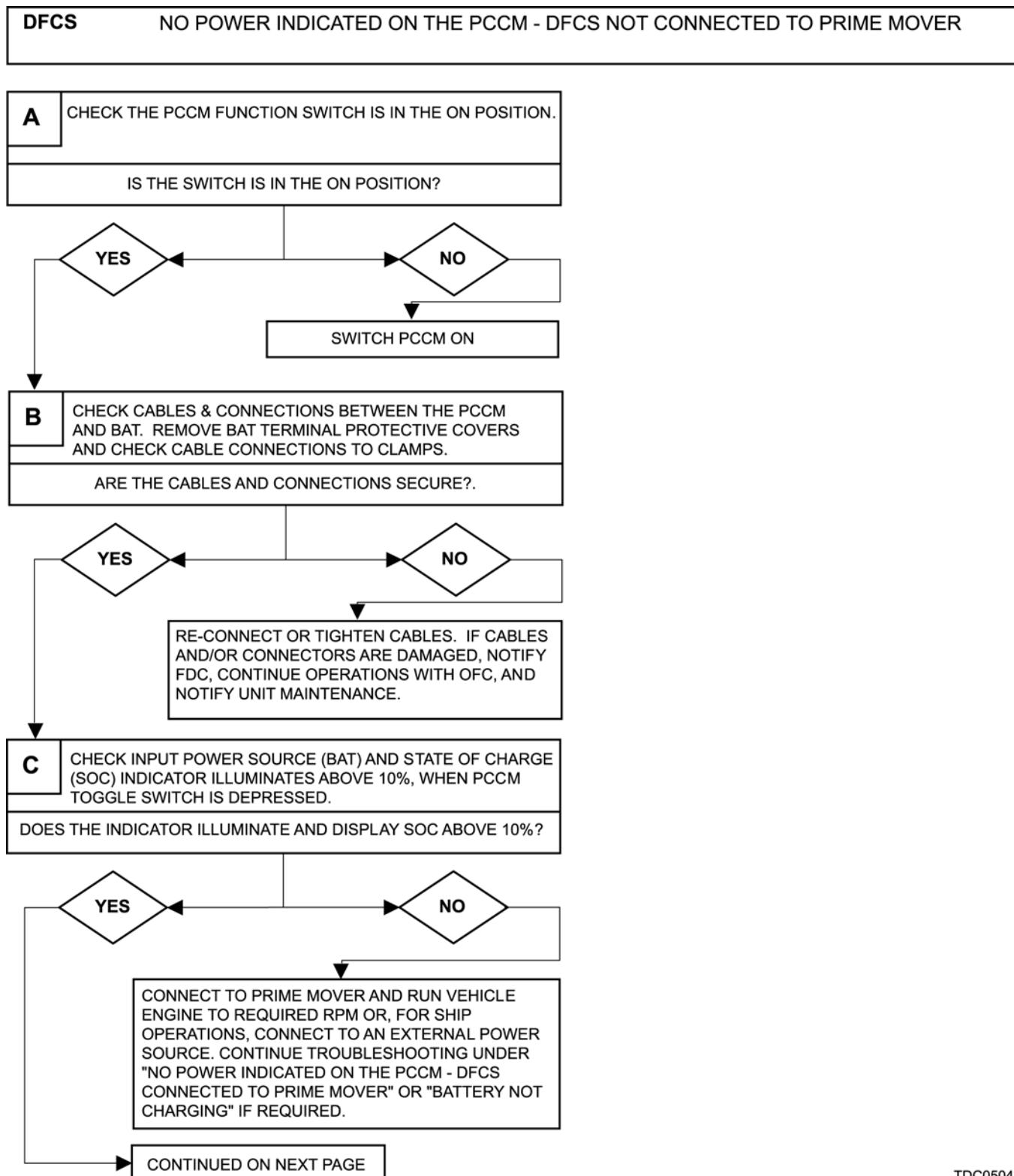
Table 3-1 Troubleshooting (cont)

RECOIL MECHANISM	EXCESSIVE RECOIL OF CANNON ASSEMBLY
CEASE FIRING NOTIFY UNIT MAINTENANCE	CANNON ASSEMBLY HAS JERKY RECOIL
CEASE FIRING NOTIFY UNIT MAINTENANCE	CANNON ASSEMBLY SLAMS INTO BATTERY
CEASE FIRING NOTIFY UNIT MAINTENANCE	CANNON ASSEMBLY DOES NOT RETURN TO BATTERY
CEASE FIRING NOTIFY UNIT MAINTENANCE	

TDC0139

3-4 TROUBLESHOOTING PROCEDURES (cont)

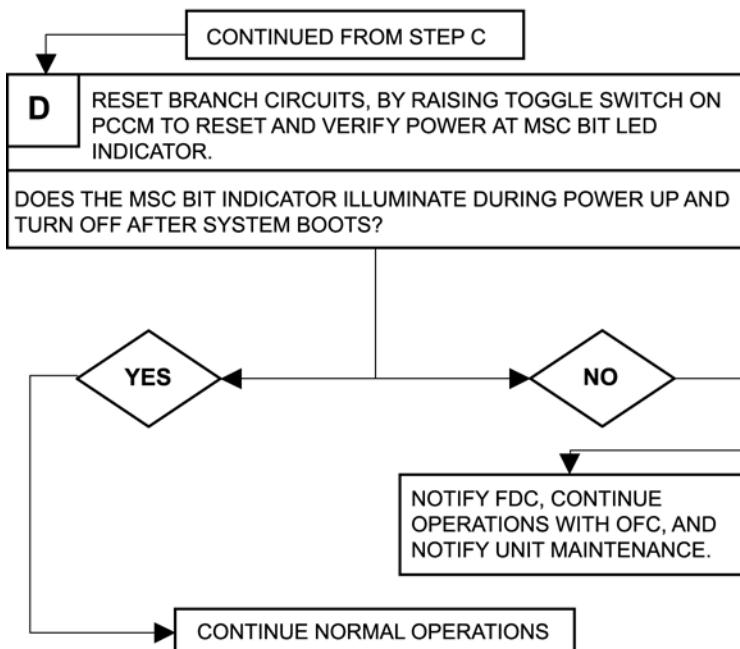
Table 3-1 Troubleshooting (cont)



TDC0504

Table 3-1 Troubleshooting (cont)

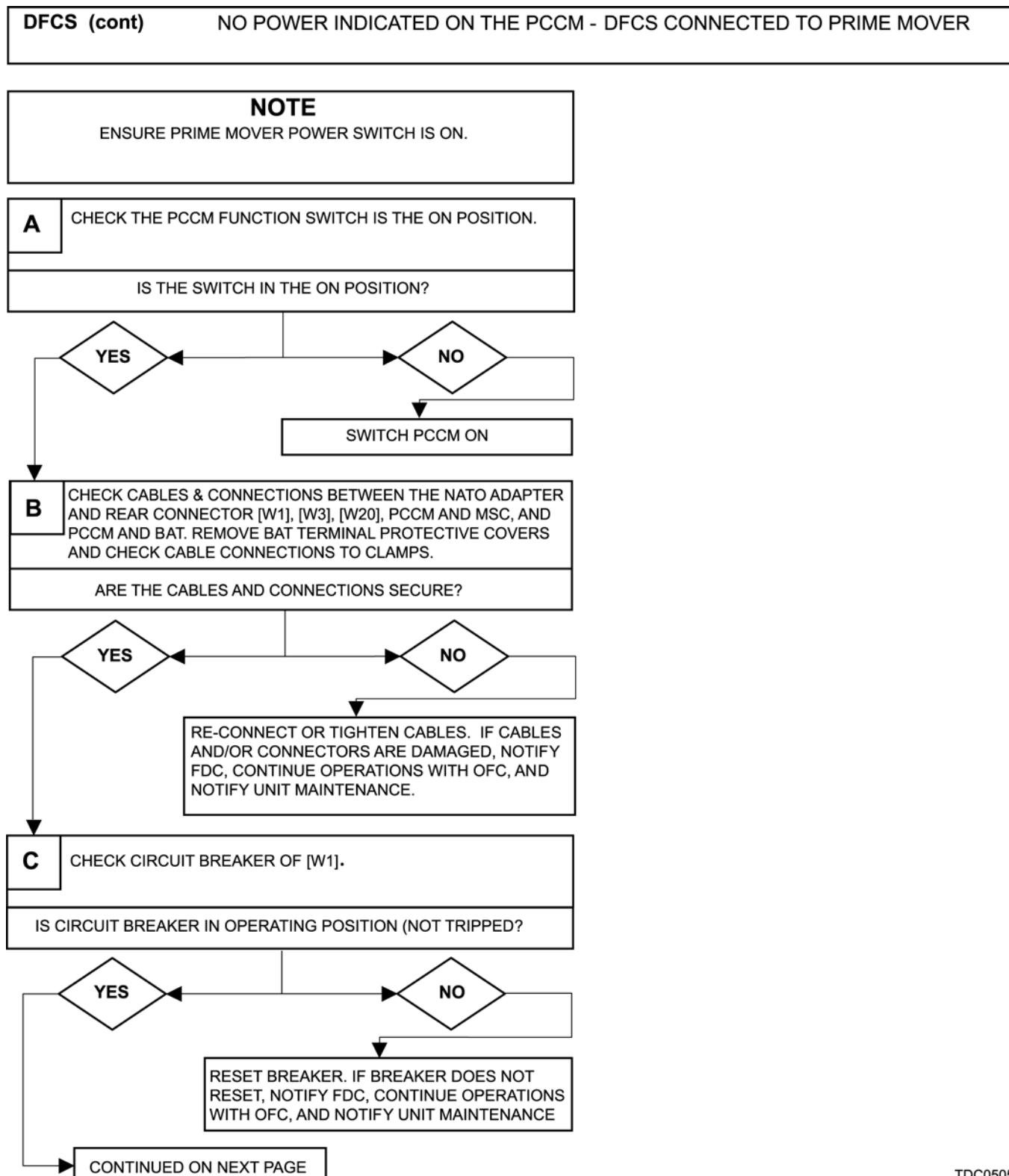
DFCS (cont) NO POWER INDICATED ON THE PCCM - DFCS NOT CONNECTED TO PRIME MOVER (cont)



TDC0637

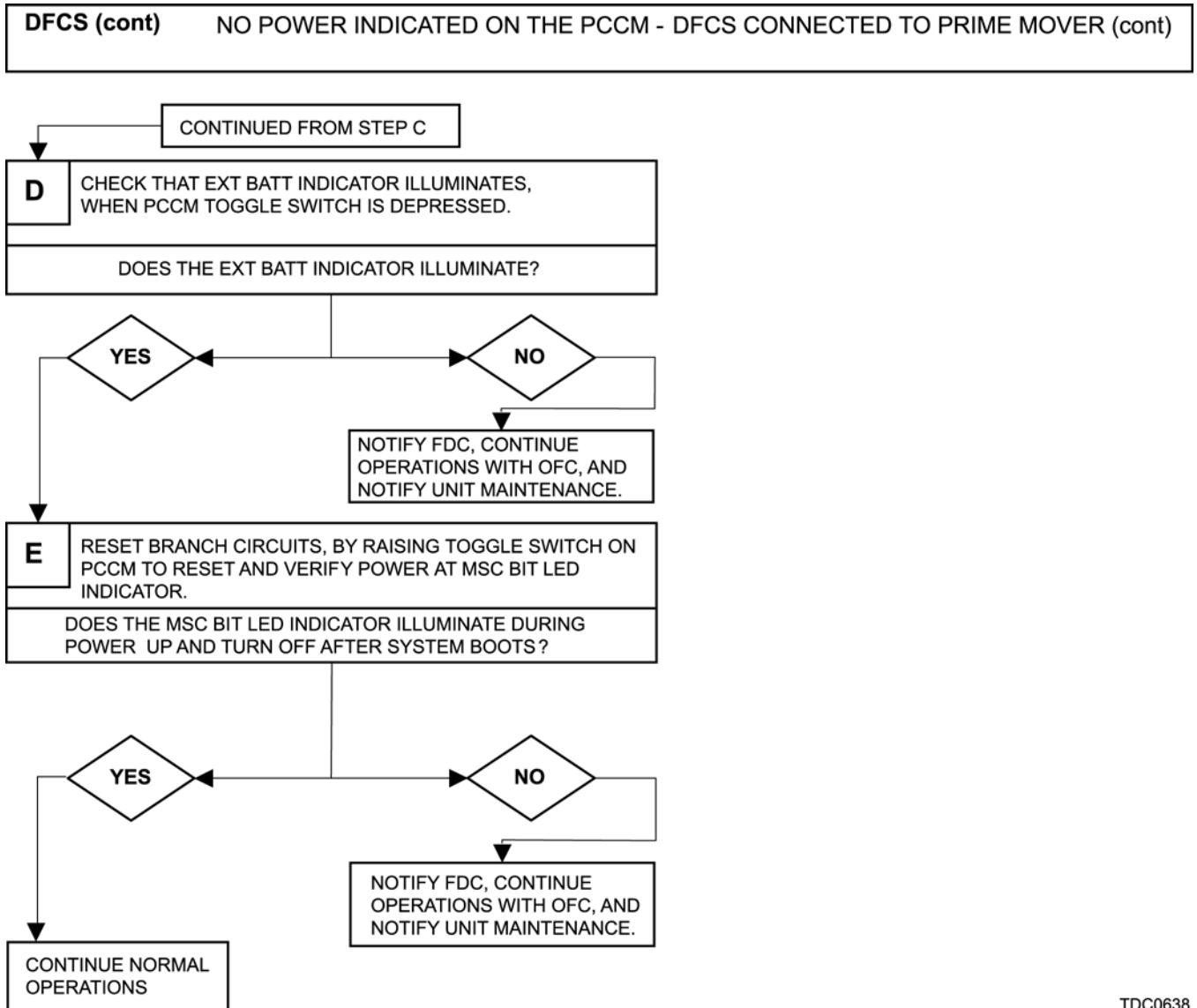
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC0505

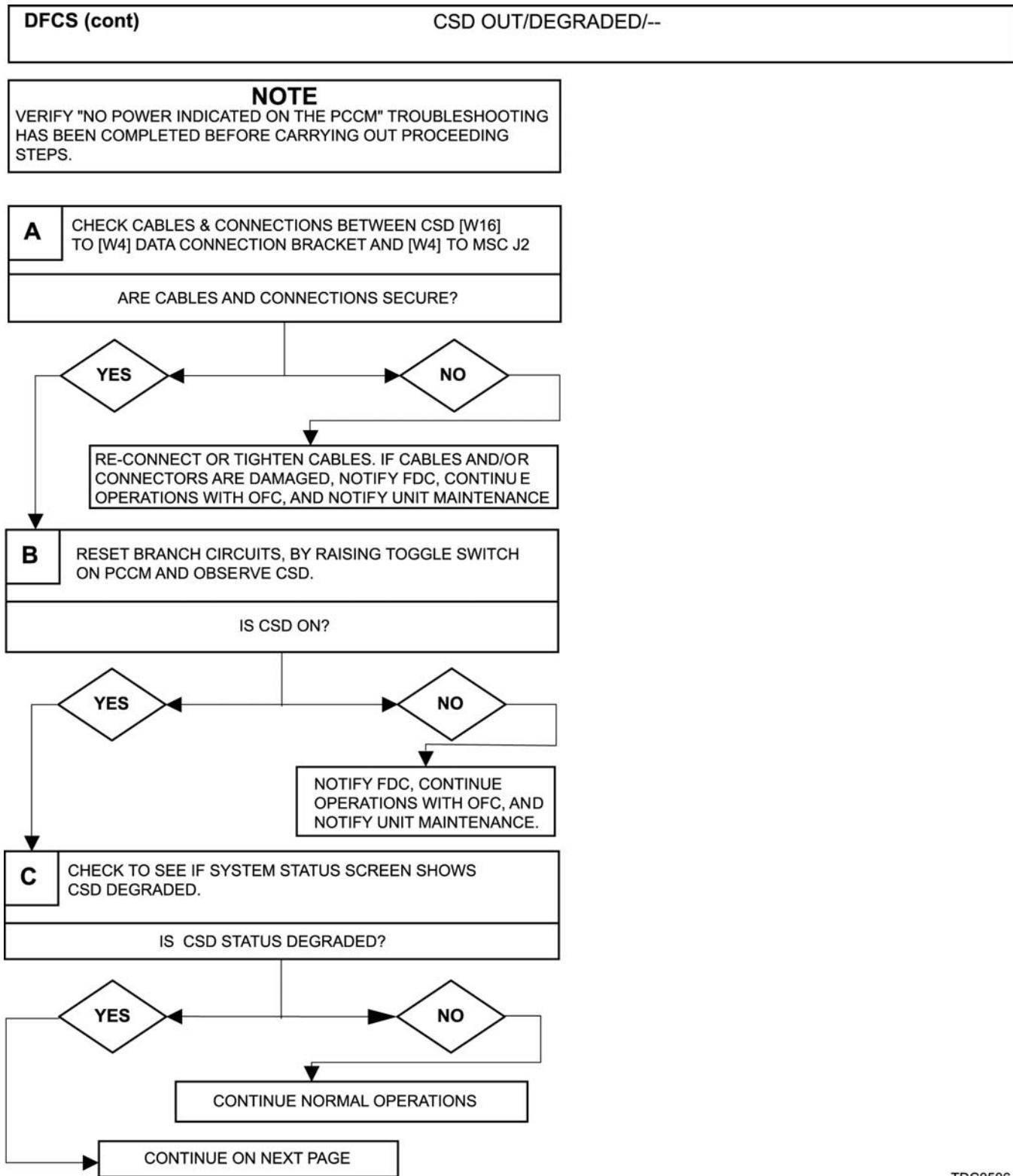
Table 3-1 Troubleshooting (cont)



TDC0638

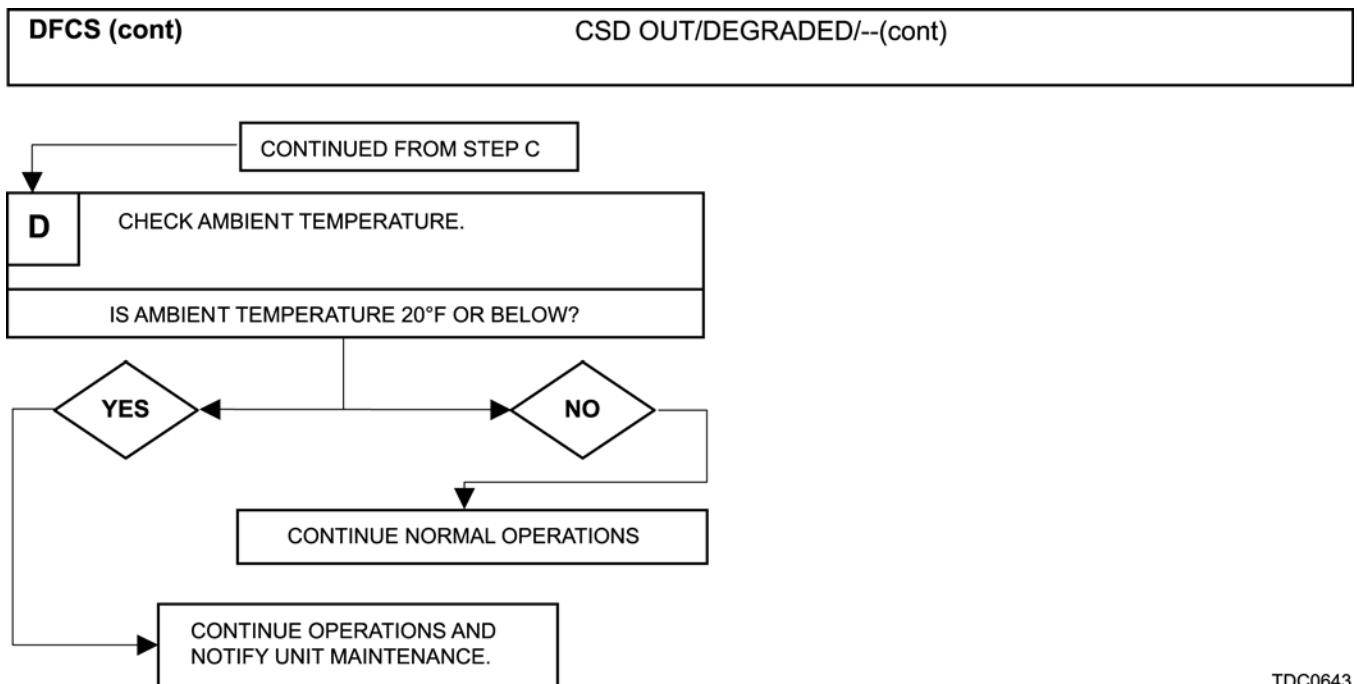
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC0506

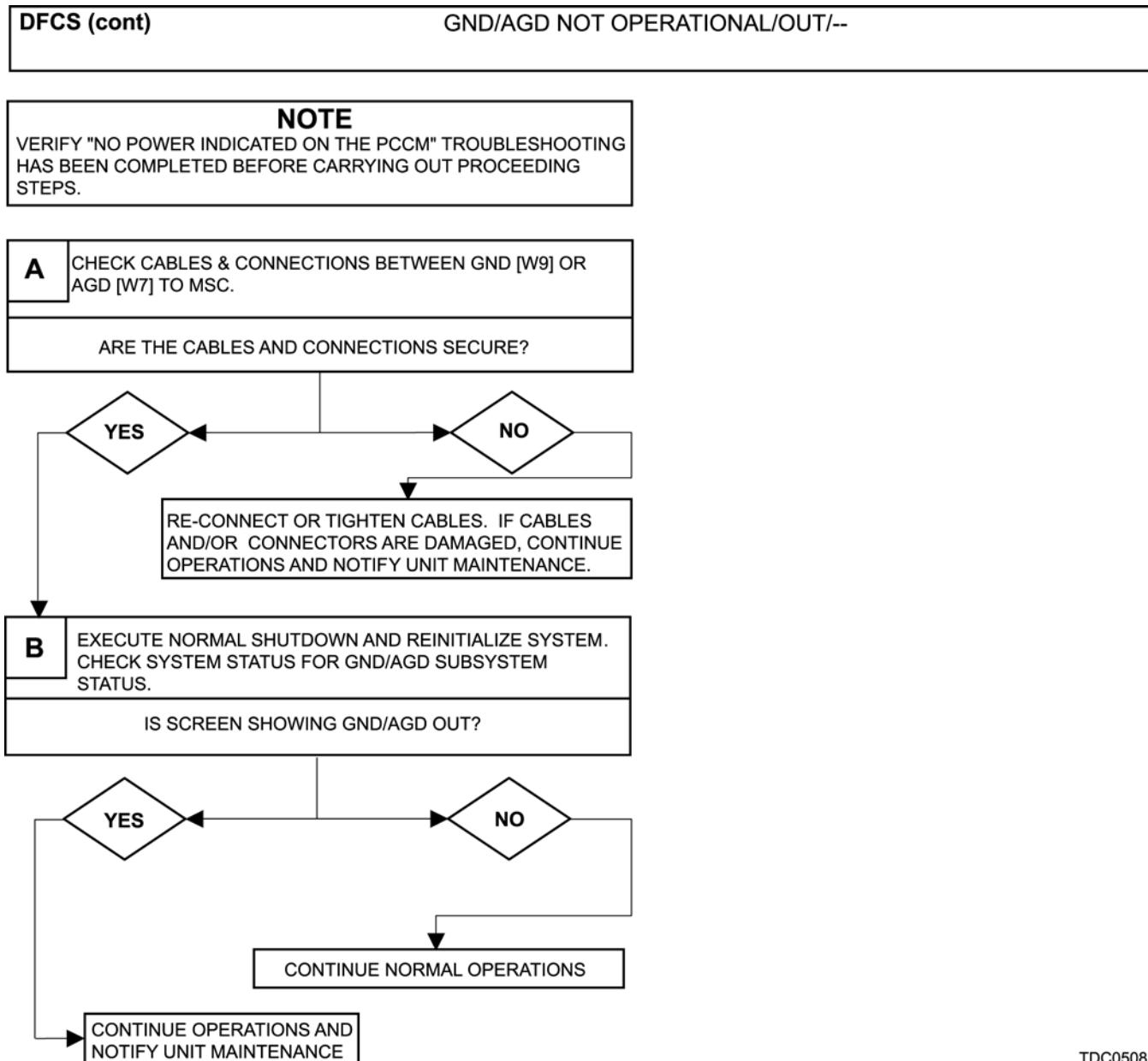
Table 3-1 Troubleshooting (cont)



TDC0643

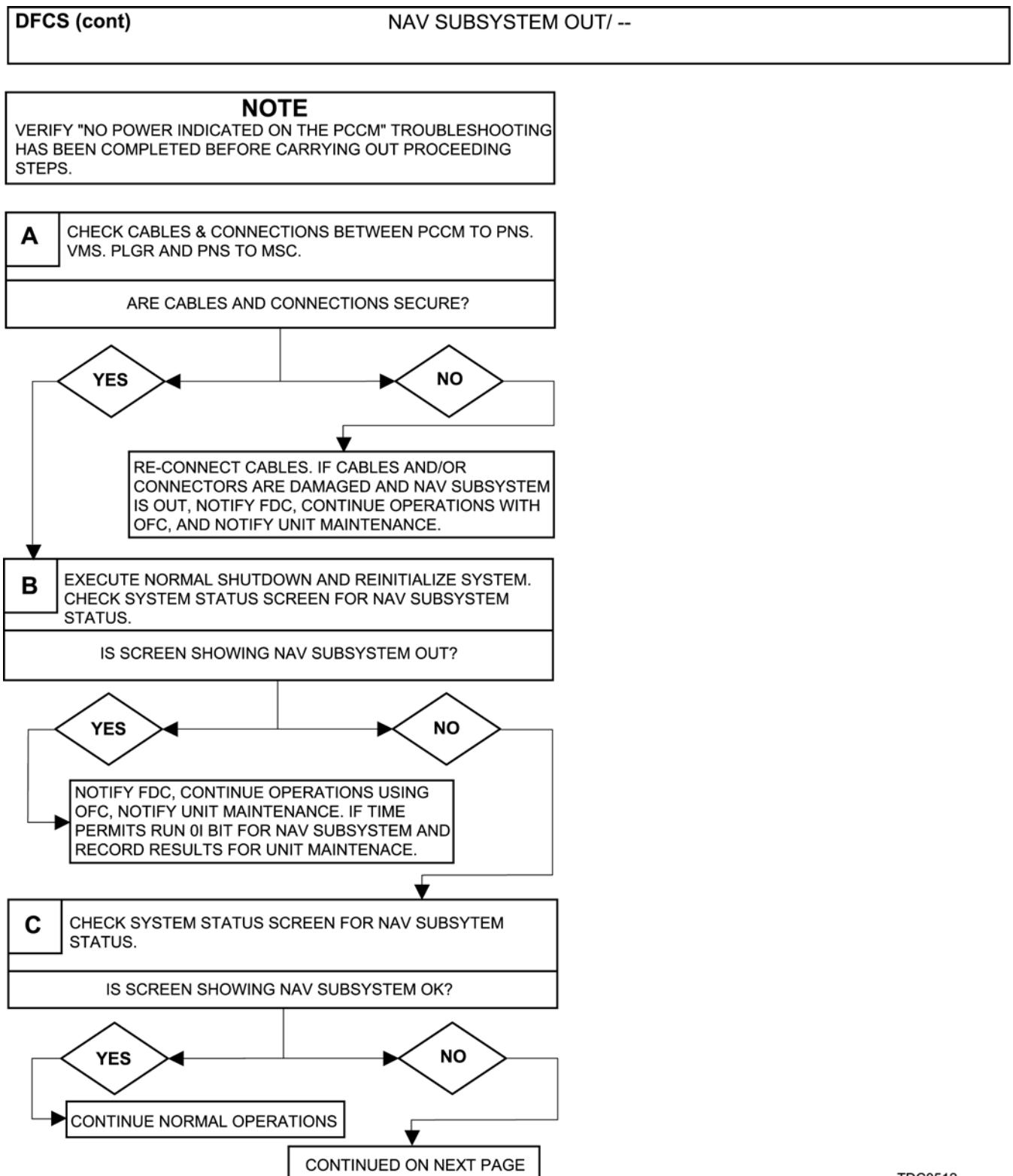
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC0508

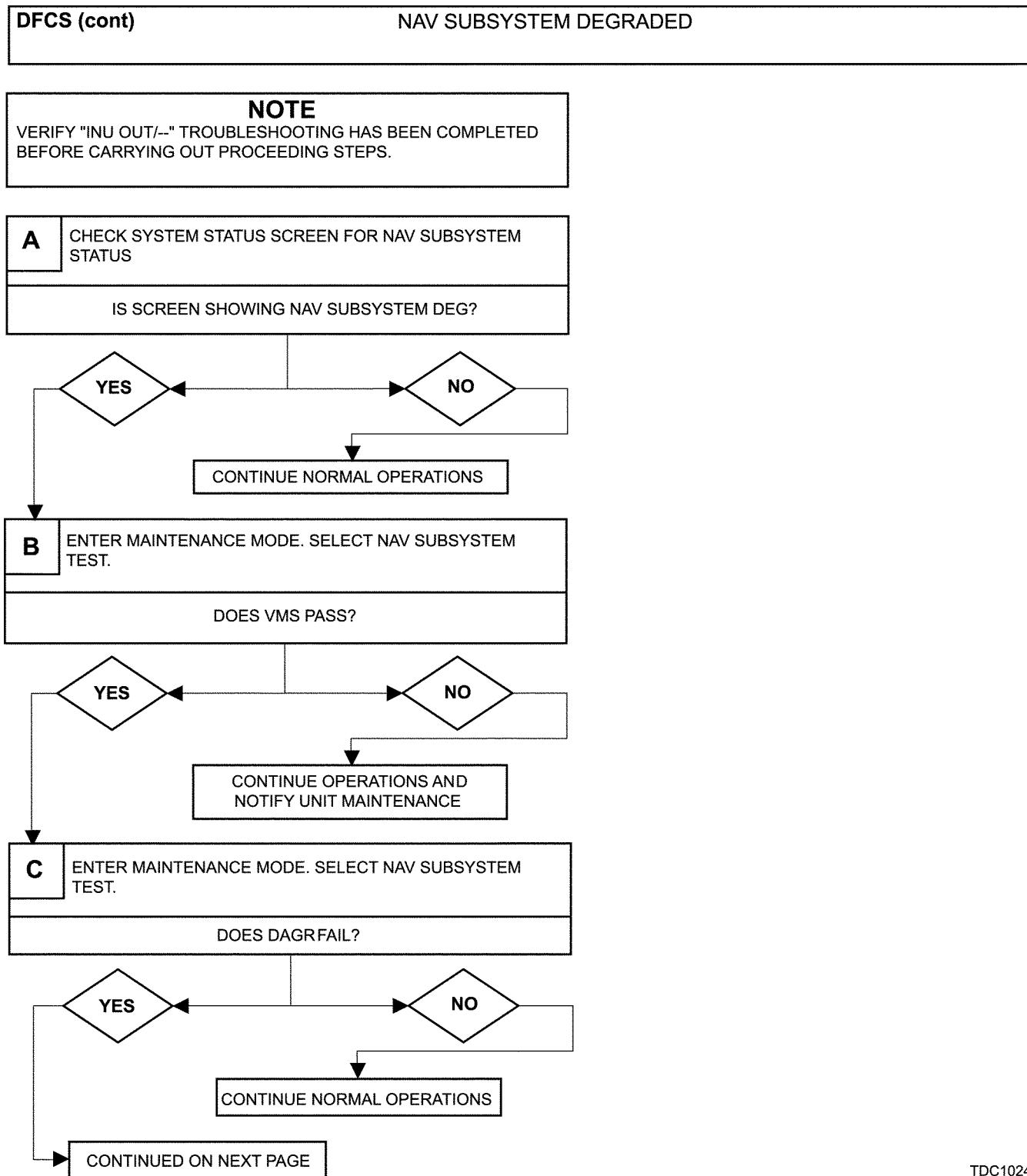
Table 3-1 Troubleshooting (cont)



TDC0512

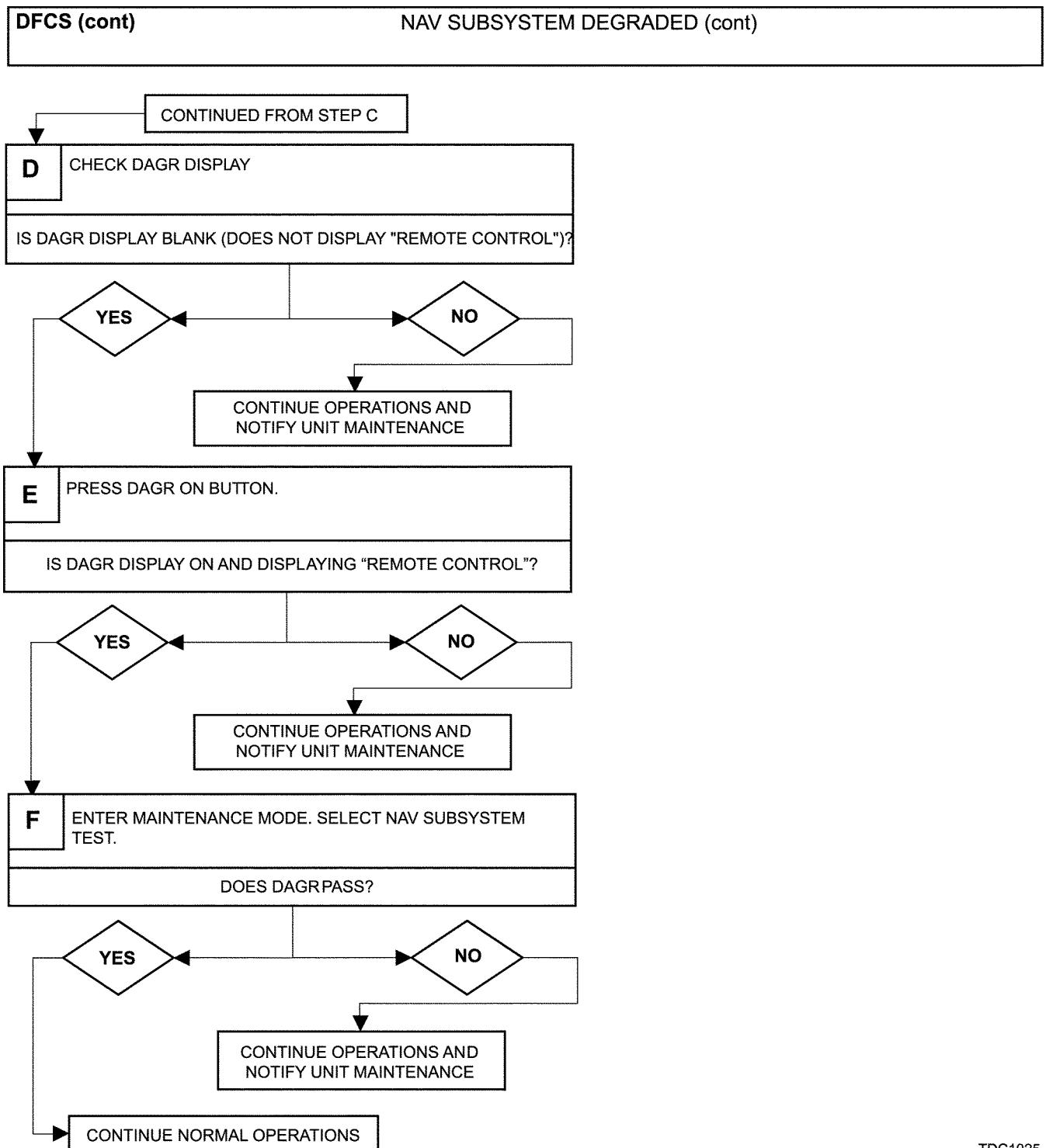
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC1024

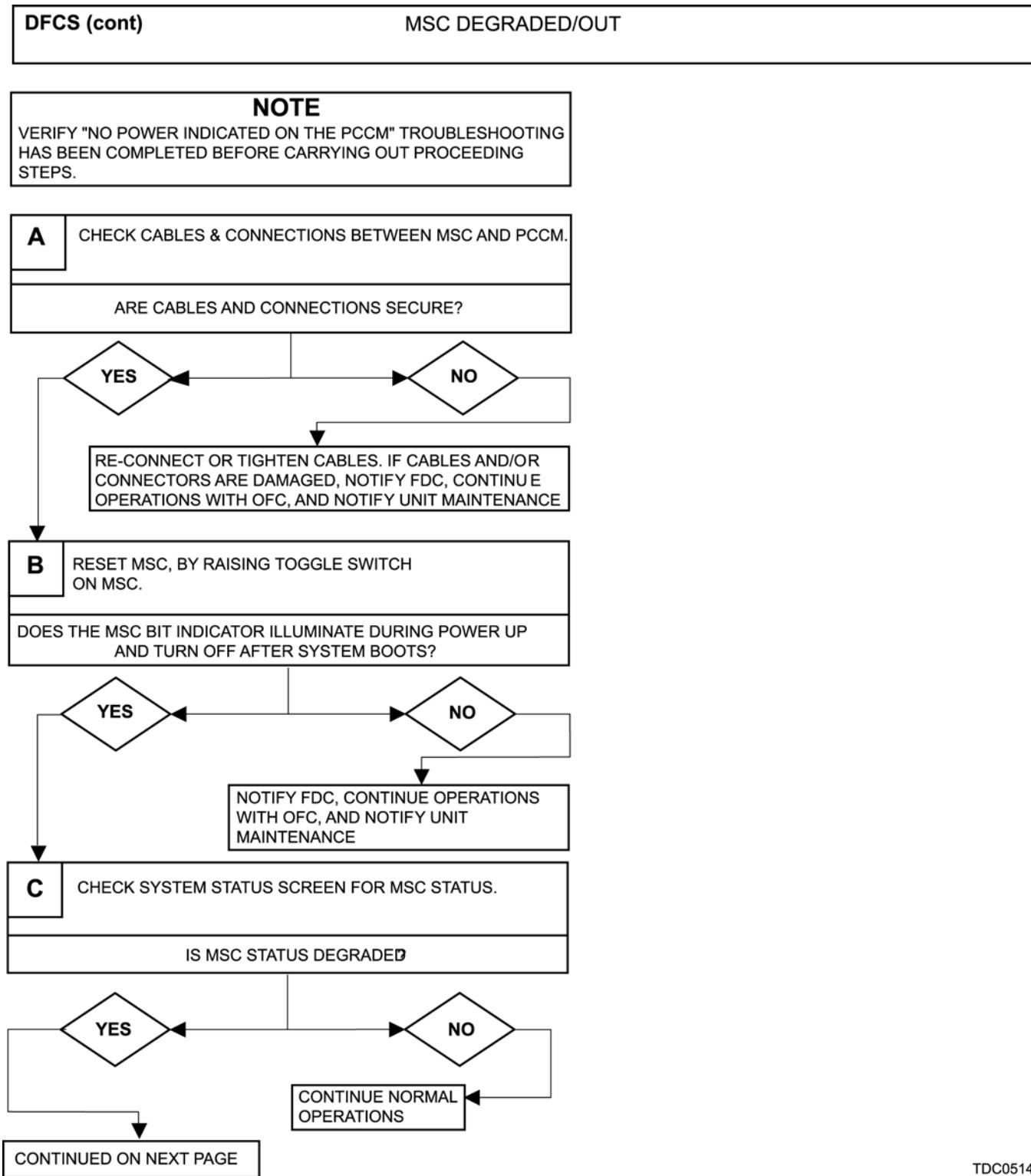
Table 3-1 Troubleshooting (cont)



TDC1025

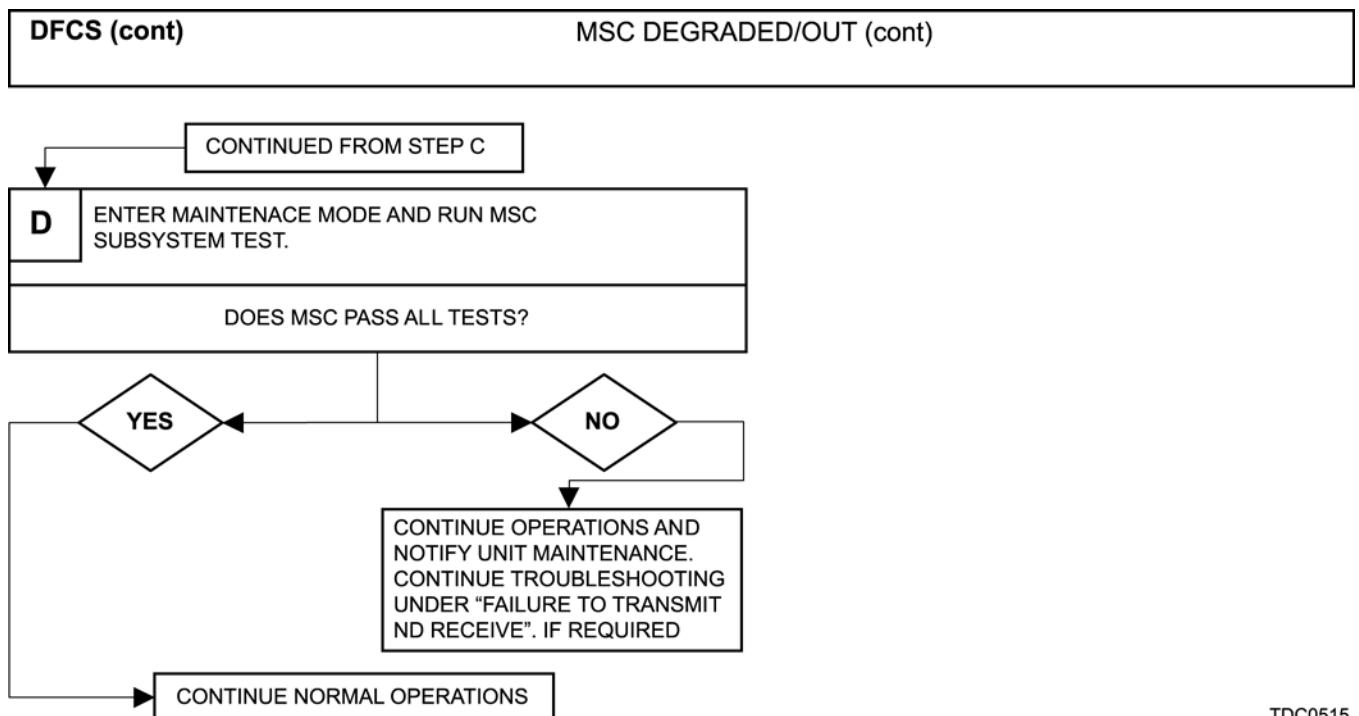
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC0514

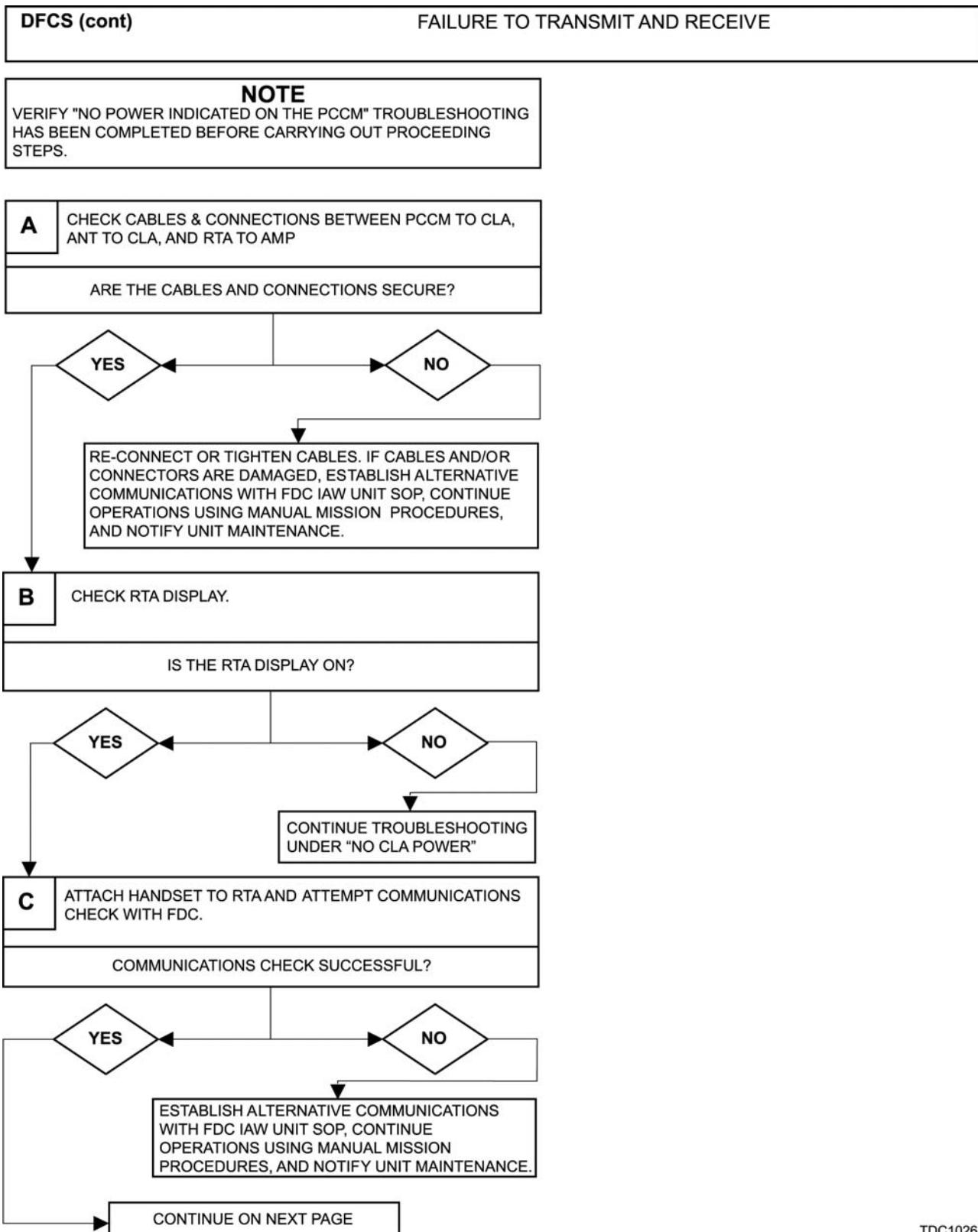
Table 3-1 Troubleshooting (cont)



TDC0515

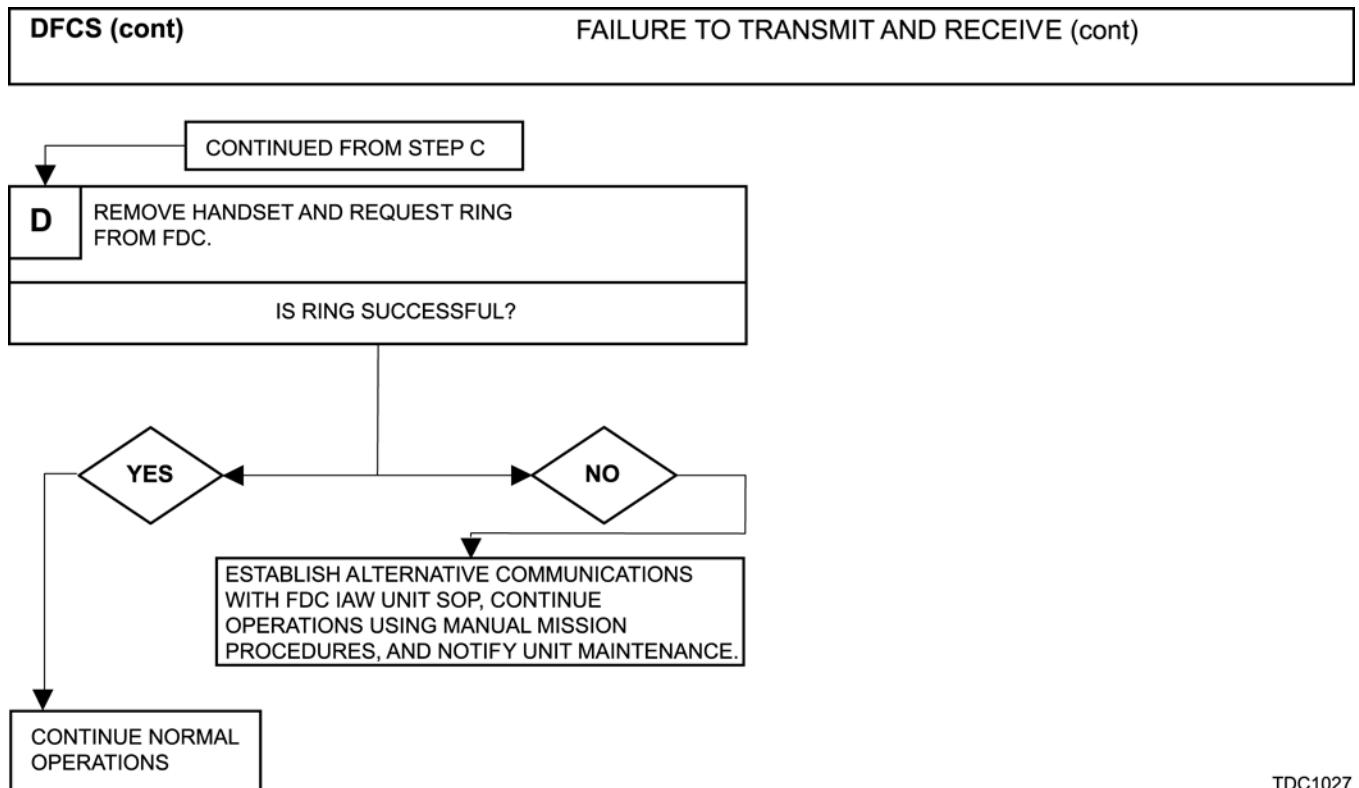
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC1026

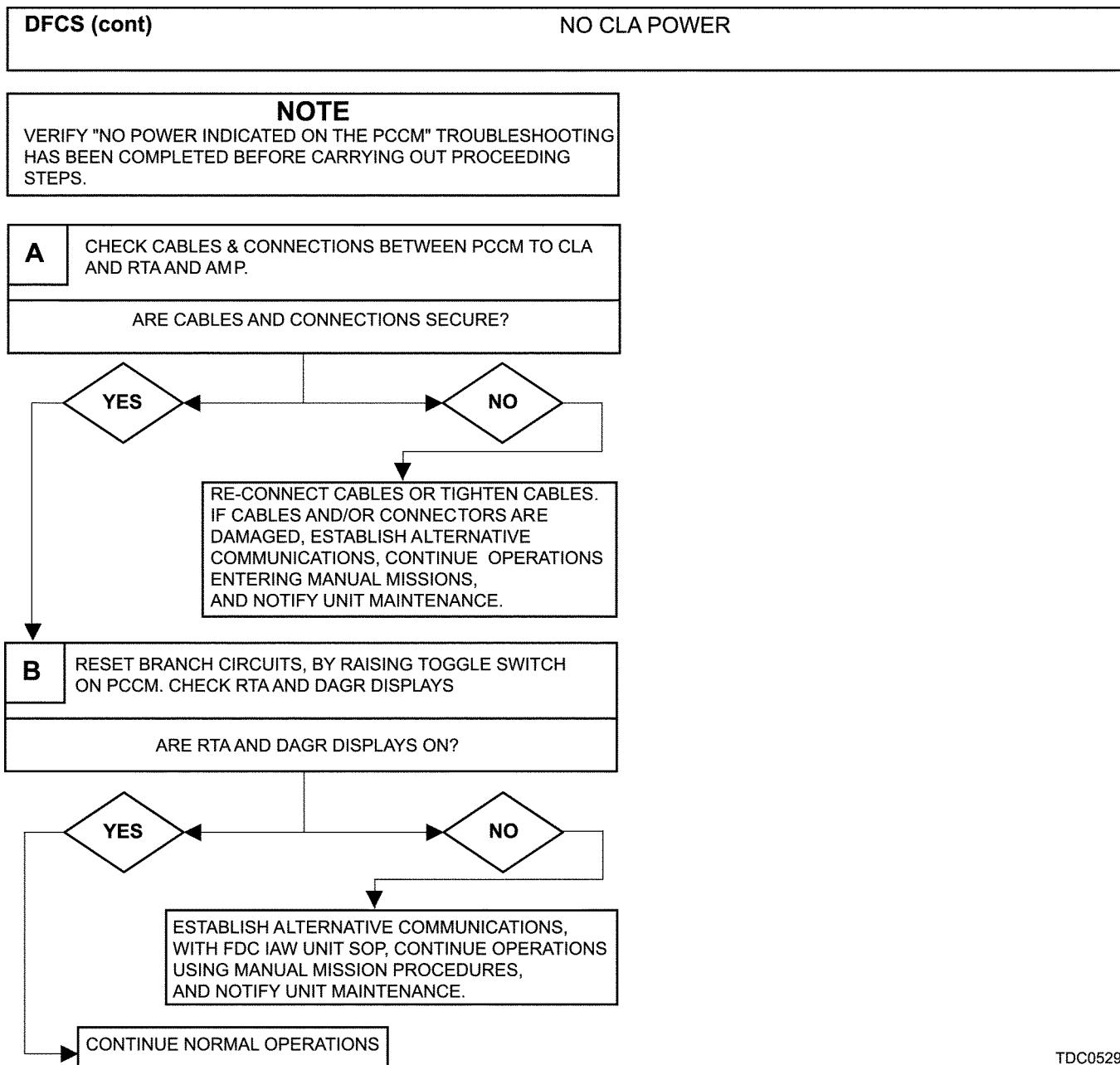
Table 3-1 Troubleshooting (cont)



TDC1027

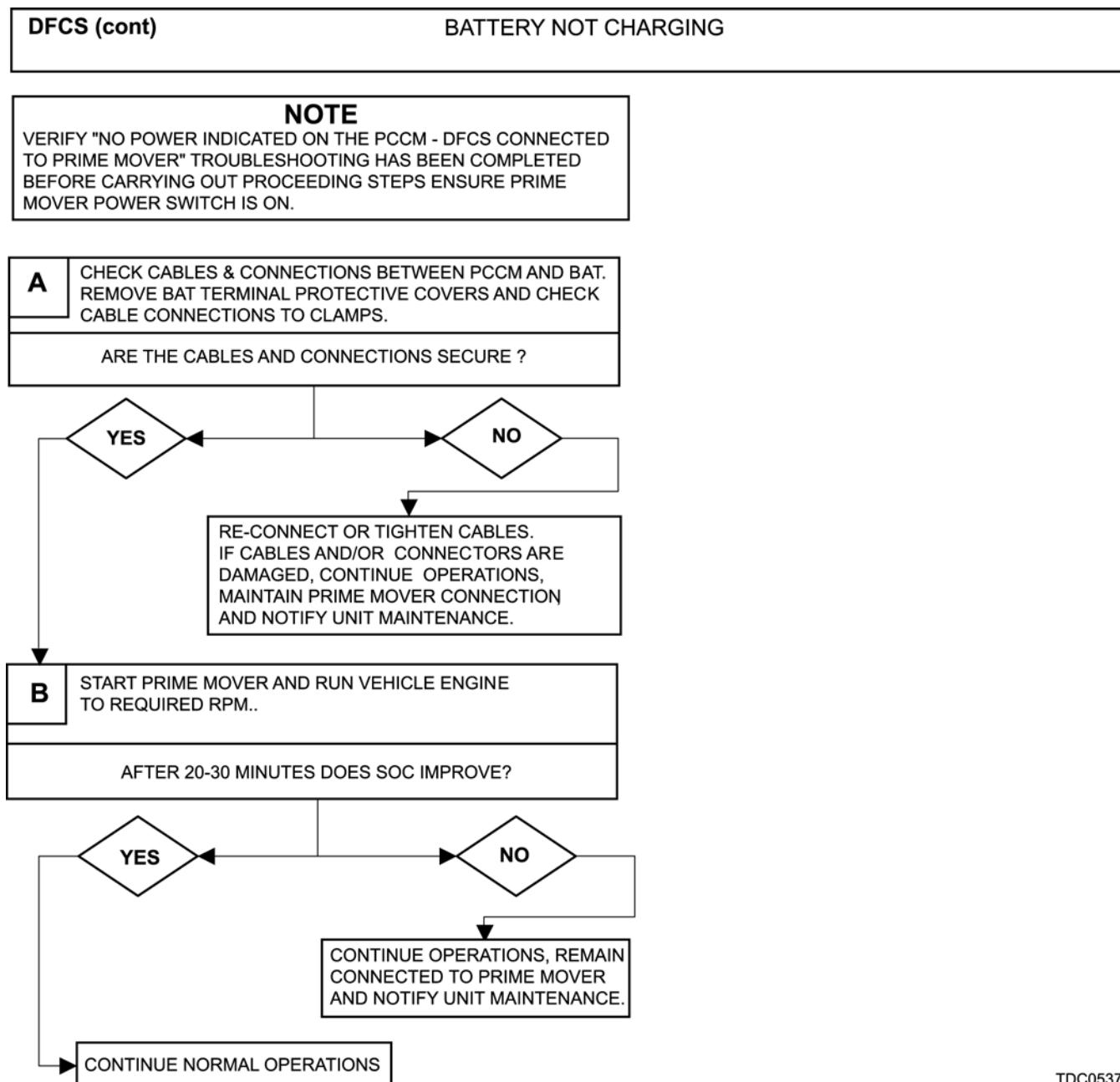
3-4 TROUBLESHOOTING PROCEDURES (cont)

Table 3-1 Troubleshooting (cont)



TDC0529

Table 3-1 Troubleshooting (cont)



TDC0537

Section III. MAINTENANCE PROCEDURES

Section Index

Paragraph		Page
3-5	General.....	3-76

3-5 GENERAL

- a. **Responsibility.** The crew, supervised by the SC, is responsible for corrective maintenance of the howitzer.

WARNING

BEFORE CARRYING OUT CORRECTIVE MAINTENANCE, ENSURE HOWITZER IS NOT LOADED.

- b. **Repairs.** Repairs will be limited to those listed in this manual.
- c. **Tools.** Appendix B lists tools required to maintain the howitzer.
- d. **Inspection and Services.** Inspect and service according to the following maintenance procedures. PMCS (Chapter 2, Section II) table lists the tasks, which affect operational readiness; perform these tests in the interval indicated. In addition to PMCS tasks, these procedures include other inspections and services, which do not affect operational readiness, but keep the howitzer in working order.

Section IV. CANNON MAINTENANCE PROCEDURES

Section Index

Paragraph		Page
3-6	Cannon Maintenance	3-77
3-7	Breech Mechanism Assembly Maintenance	3-78
3-8	Magazine Assembly Maintenance	3-103
3-9	Dog Coupler Maintenance	3-108

3-6 CANNON MAINTENANCE

WARNINGS

VERIFY HOWITZER IS NOT LOADED. PERFORMING MAINTENANCE ON A LOADED HOWITZER COULD RESULT IN SERIOUS INJURY OR DEATH TO PERSONNEL.

KEEP OUT OF PATH OF RECOILING PARTS. SEVERE CRUSHING INJURIES OR DEATH COULD RESULT.

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

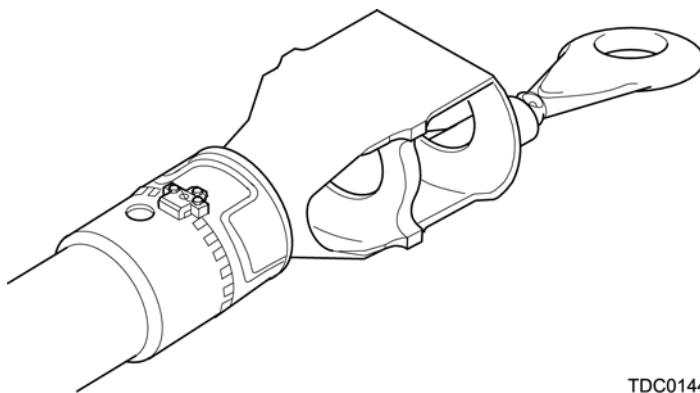
ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.

INSPECTION

NOTE

For nonfiring periods clean and lubricate cannon tube and breech mechanism assembly weekly (see Sect I, NOTES 14 and 16).

Inspect Cannon tube for moisture, rust, corrosion, foreign matter, and presence of solid film lubricant. Clean and lubricate (see Sect I, NOTE 1).



TDC0144

3-7 BREECH MECHANISM ASSEMBLY MAINTENANCE

NOTE

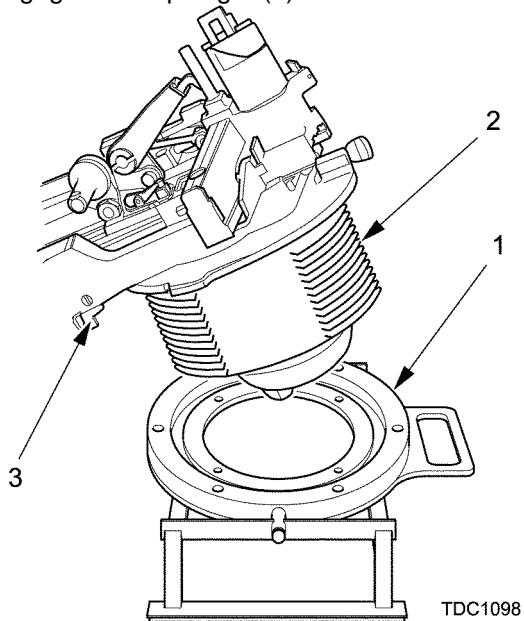
Disassemble/assemble for cleaning and inspection only. Crew is authorized to replace firing mech.

- 1 Close scavenge isolator valve.
- 2 Manually open breech mechanism (Para 2-16).

WARNING

BREECHBLOCK MUST BE RESTING ON BREECH STOOL BEFORE THE SPINDLE IS REMOVED. FAILURE TO USE BREECH STOOL COULD RESULT IN SERIOUS INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

- 3 Place breech stool (1) onto recoil slides. Move breech stool (1) forward until it is centered under breechblock assembly (2).
- 4 Manually lower breechblock assembly (2) onto center of breech stool (1), ensuring breechblock assembly does not engage detent plunger (3).

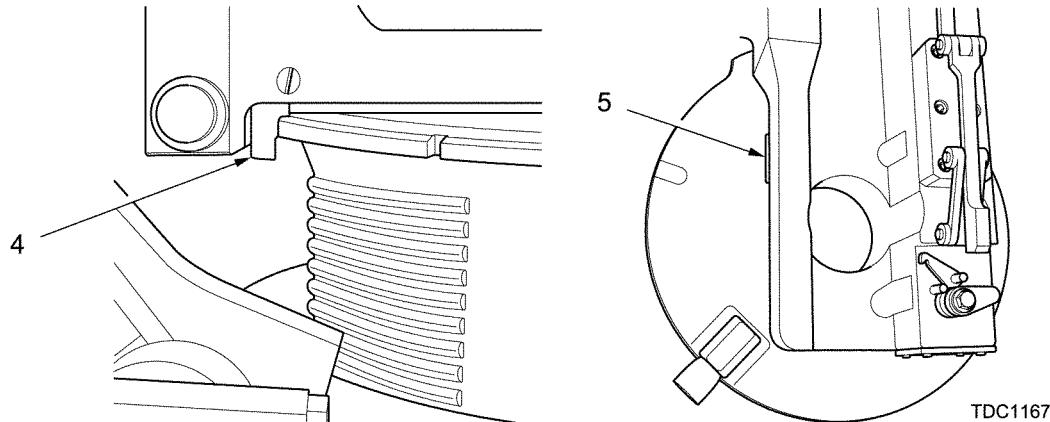


WARNINGS

TAKE CARE WHEN ROTATING BREECHBLOCK WHEN APPLYING FINGER PRESSURE TO DETENT PLUNGER. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL.

BREECHBLOCK IS HELD IN THE CARRIER BY THE SPINDLE. BREECHBLOCK WILL DROP OUT OF THE CARRIER WHEN THE SPINDLE IS REMOVED

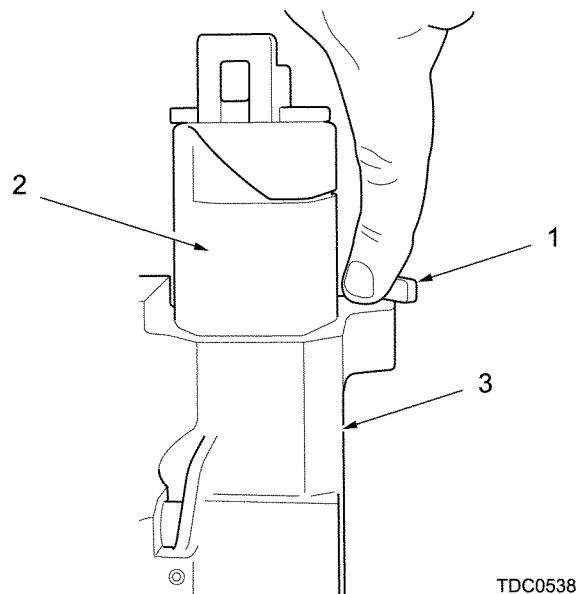
- 5 Depress breechblock detent plunger (4). With plunger depressed, using trunnion pump handle manually rotate breechblock CW to the fully closed position (until witness mark (5) on the breechblock is aligned with carrier).



a. Firing Mech

REMOVAL

Depress block plunger (1) and rotate firing mech (2) CW until lugs disengage from cutouts in tray assembly (3). Lift firing mech out of the tray assembly. To perform firing mech maintenance see para 3-7, I.



b. Injector Arm Removal

REMOVAL

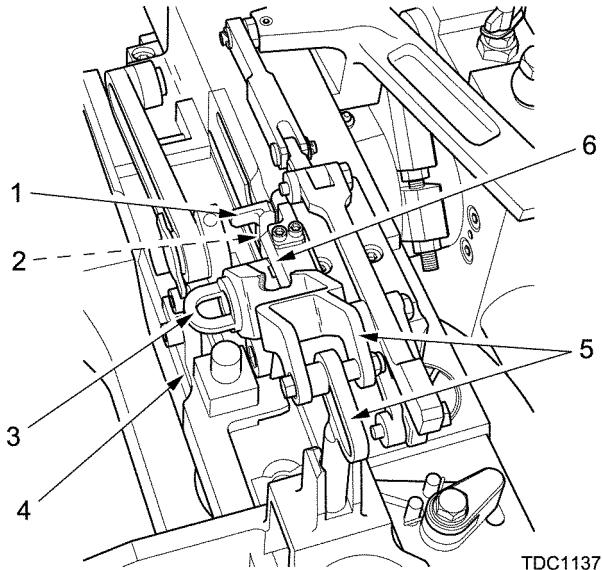
- 1 Push and rotate knob (1), 90° CCW, until knob is on knob stop (2).
- 2 Rotate locking shaft (3) 90° and remove from tray assembly (4).
- 3 Remove injector arm assembly (5) from slots on follower (6).

3-7 BREECH MECHANISM ASSEMBLY MAINTENANCE (cont)

b. Injector Arm Removal (cont)

REMOVAL (cont)

- 4 Re-install locking shaft (3) by rotating 90° until engaged. Rotate knob (1) CW until engaged.



SERVICE AND INSPECTION

- 1 Clean and remove corrosion from injector arm assembly with CLP (item 7, appx D) and crocus cloth (item 11, appx D), remove excess CLP with clean wiping rag (item 30, appx D).
- 2 If burring has occurred, notify unit maintenance.

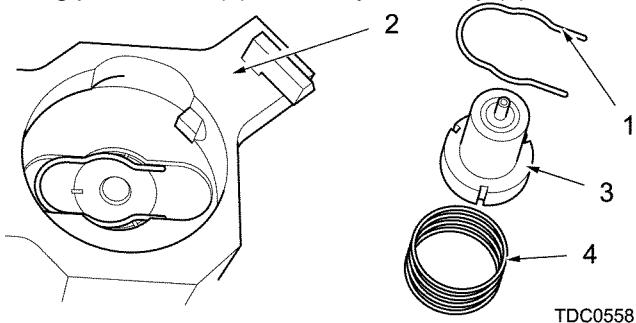
c. Firing Pin

REMOVAL

WARNING

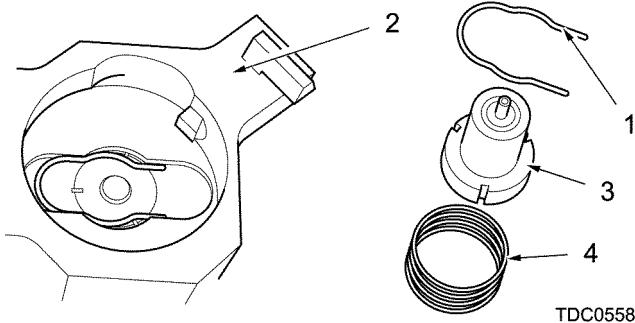
FIRING PIN RETAINER AND FIRING PIN ARE UNDER COMPRESSION.
FAILURE TO FOLLOW THIS WARNING COULD RESULT IN INJURY TO
PERSONNEL.

Using multi-tool, pry firing pin retainer (1), from tray assembly (2). Remove firing pin (3) and spring (4).



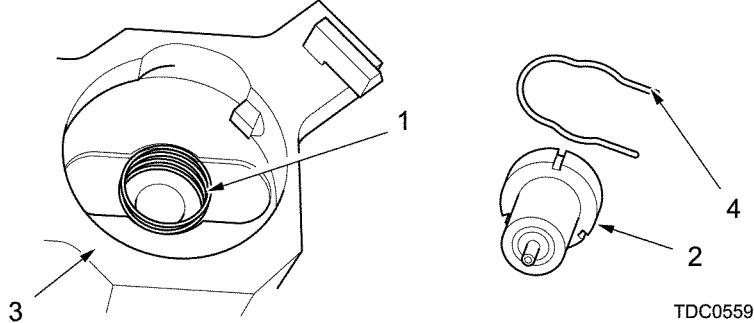
SERVICE AND INSPECTION

- 1 Clean and remove corrosion from firing pin, retainer, spring and cavity with CLP (item 7, appx D) and crocus cloth (item 11, appx D), remove excess CLP with clean wiping rag (item 30, appx D).
- 2 If burring has occurred in cavity, remove burrs using hand file.
- 3 Replace firing pin (3) if the tip is deformed, bent or broken.
- 4 Replace retainer (1) if it is kinked or otherwise deformed.
- 5 Replace spring (4) if it is kinked or broken.



INSTALLATION

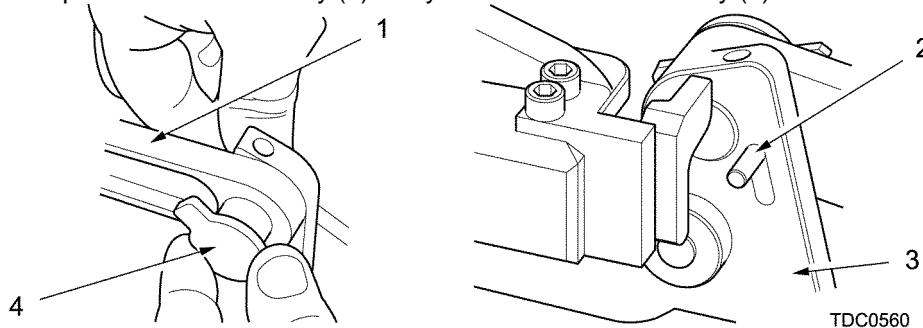
Insert spring (1) and firing pin (2) into firing pin cavity of the tray assembly (3). Using multi-tool, push firing pin retainer (4) into groove. Push firing pin to verify that it moves freely.



d. PFM Tray Assembly

REMOVAL

- 1 Disengage quick release assembly (1) by pushing pin (2) on drive link assembly (3) rearwards. Remove connector link (4).
- 2 Rotate quick release assembly (1) away from drive link assembly (3). Re-install connector link (4).

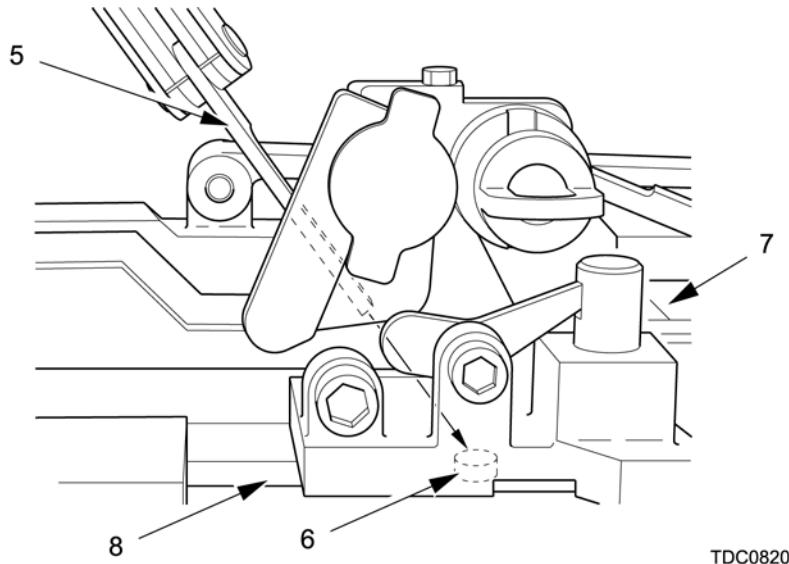


3-7 BREECH MECHANISM ASSEMBLY MAINTENANCE (cont)

d. PFM Tray Assembly (cont)

REMOVAL (cont)

- 3 Using multi-tool (5) depress locking plunger (6) and slide tray assembly (7) from body assembly (8).



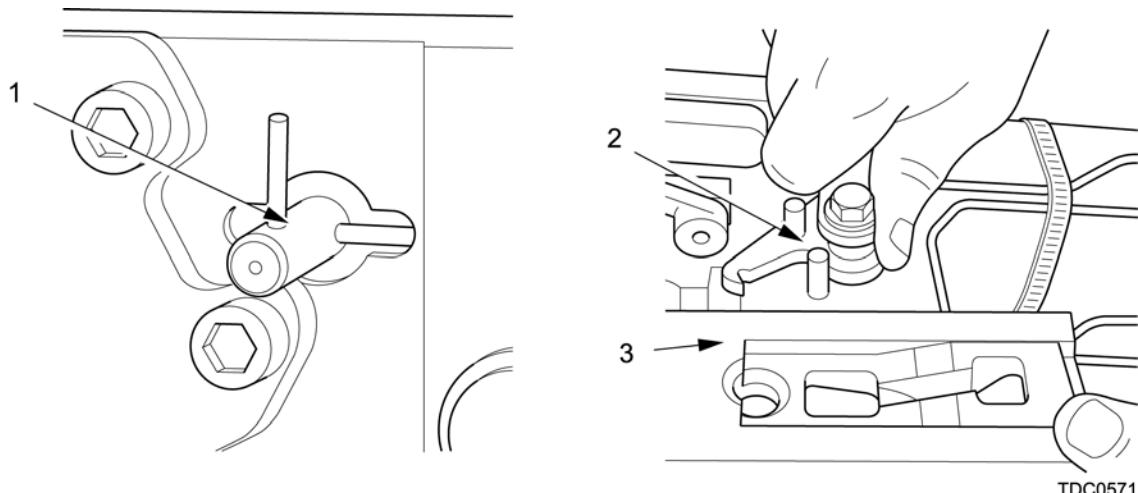
SERVICE AND INSPECTION

Clean and remove corrosion and small burrs from rails with CLP (item 7, appx D), crocus cloth (item 11, appx D) and hand file. Remove excess CLP with clean wiping rag (item 30, appx D).

e. PFM Body Assembly

REMOVAL

Pull primer feed lock (1) out and rotate 90° CCW. Lift and slide body assembly (3) rearward, rotate tray latch (2) CW, and lift body assembly out of the carrier assembly.



SERVICE AND INSPECTION

Clean and remove corrosion and small burrs from guides with CLP (item 7, appx D), crocus cloth (item 11, appx D) and hand file. Remove excess CLP with clean wiping rag (item 30, appx D).

f. Spindle Assembly

REMOVAL

WARNINGS

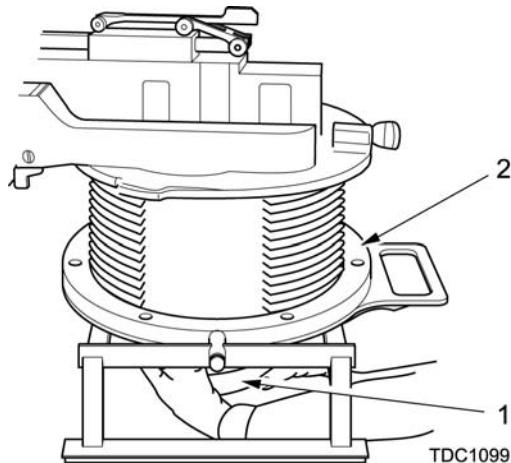
WHEN DISENGAGING SPINDLE FROM CARRIER, SPINDLE MAY DROP SUDDENLY CAUSING INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

DO NOT RAISE BREECHBLOCK ASSEMBLY FROM BREECH STOOL WHEN SPINDLE ASSEMBLY IS REMOVED. FAILURE TO DO SO MAY CAUSE SEVERE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

NOTE

Ensure disk is removed from breechblock assembly.

Rotate spindle assembly (1) CCW and lower spindle through hole in the center of the breech stool (2). Set spindle on a clean level surface. Ensure disk is removed from breechblock.

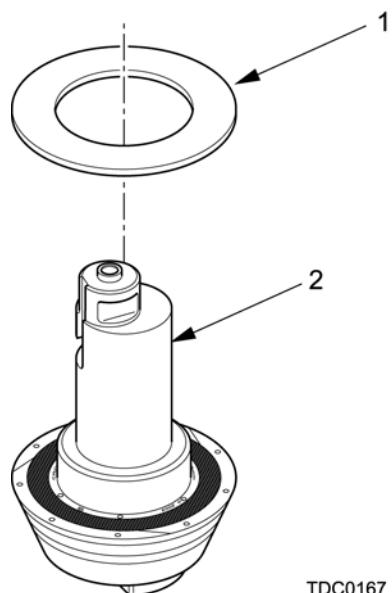


3-7 BREECH MECHANISM ASSEMBLY MAINTENANCE (cont)

f. Spindle Assembly (cont)

DISASSEMBLE

- 1 Remove disk (1) from spindle assembly (2).

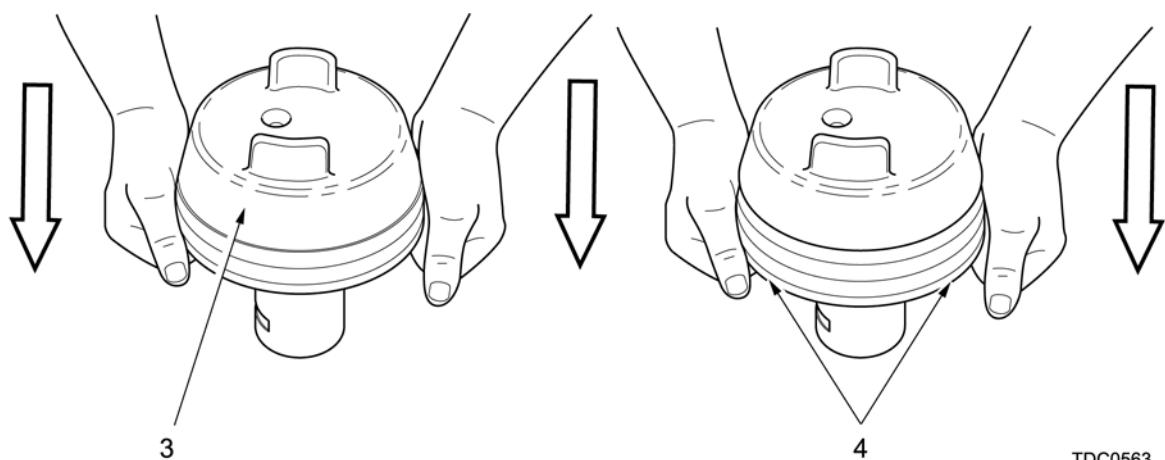


TDC0167

CAUTION

Care should be taken when removing obturator pad.

- 2 With spindle (3) on a firm flat surface, remove obturator pad by applying downward and equal pressure to opposite sides of obturator (4).



TDC0563

SERVICE AND INSPECTION

CAUTION

Do not clean obturator pad with CLP, or expose pad to high water pressure.
Damage may occur to pad.

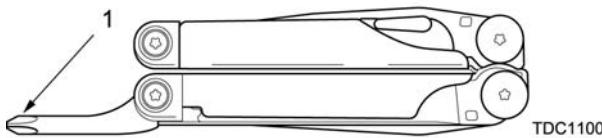
- 1 Using a scouring pad (item 23, appx D), clean obturator pad with water. Dry pad with clean wiping rag (item 30, appx D).
- 2 Using multi-tool cross tip screwdriver (1), inspect obturator pad as follows:

NOTE

Two types of obturator pad are used; a non-mesh type and a mesh type. If using non-mesh type, proceed to step (a), if using mesh type, proceed to step (b).

(a) Non Mesh Type

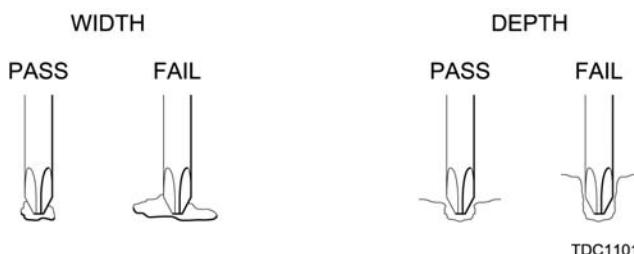
- (1) Using multi-tool cross tip screwdriver (1), test and inspect obturator pad for damage and/or wear. If obturator fails width and/or depth area test and inspection, replace obturator pad and notify unit maintenance.



NOTE

If width and/or depth of the gouge area exceed width and/or depth area on multi-tool cross tip screwdriver , replace obturator.

- (2) Inspect obturator pad for gouges. If gouges present, place multi-tool cross tip screwdriver, in split ring area and check width and depth of gouge area.



(b) Mesh Type

NOTE

If steel mesh is visible but not torn, obturator pad is still serviceable.

- (1) Check obturator pad for damage or wear, if steel mesh is visible and torn, replace.
- (2) Clean and remove corrosion from spindle assembly and disk with CLP (item 7, appx D), crocus cloth (item 11, appx D), remove excess CLP with a clean wiping rag (item 30, appx D). Apply light coat of CLP (item 7, appx D) on spindle.
- (3) If cracks, pitting, burrs are present or any evidence of blowby (erosion into the steel), notify unit maintenance.

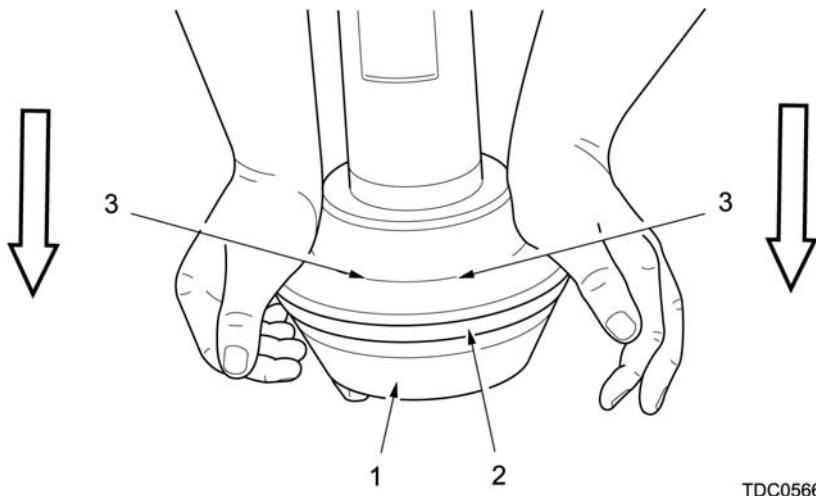
3-7 BREECH MECHANISM ASSEMBLY MAINTENANCE (cont)

ASSEMBLE

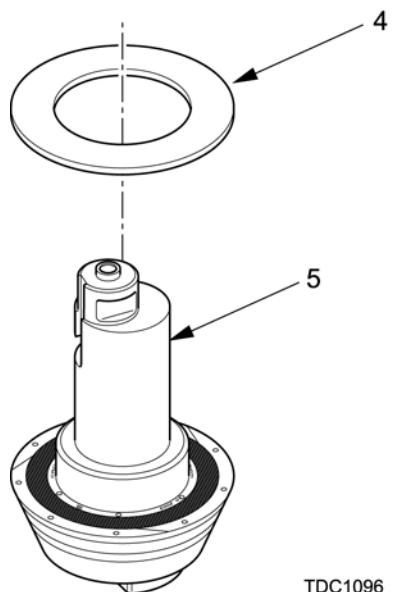
CAUTION

Care should be taken when installing obturator pad.

- With spindle (1) on a firm flat surface, install obturator pad (2) by applying downward and equal pressure on opposite sides of obturator (3).



- Install disk (4) onto the spindle assembly (5).



NOTE

If conducting daily maintenance on breechblock assembly see para 3-7g

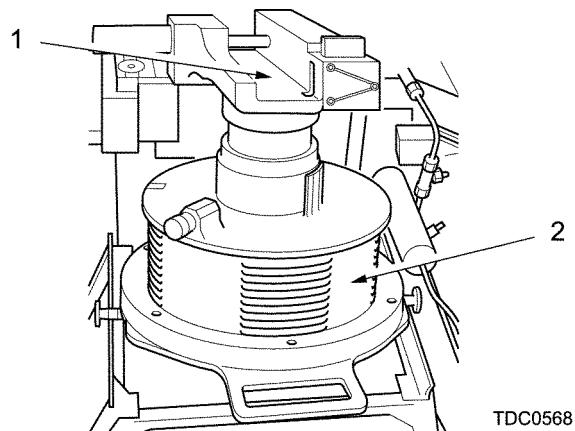
g. Separating Breechblock and Carrier Assemblies

REMOVAL

WARNING

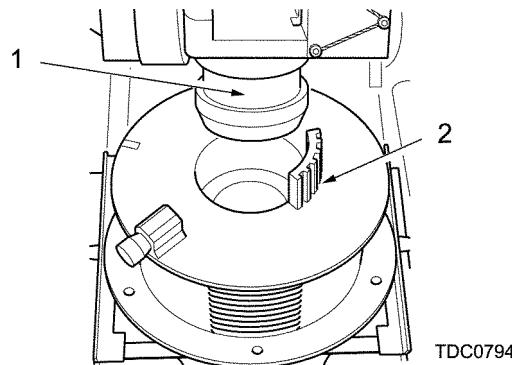
TAKE CARE WHEN SEPARATING CARRIER AND BREECHBLOCK ASSEMBLIES, ONCE CARRIER IS CLEAR OF BREECHBLOCK, THE CARRIER MAY SUDDENLY SPRING UPWARDS TO THE FULLY OPEN POSITION. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL.

- 1 Separate carrier (1) and breechblock (2) assemblies, by moving breech lever to the OPEN position. Pump back and forth on trunnion pump handle until carrier is raised to the fully open position (carrier will separate from breechblock).



SERVICE AND INSPECTION

- 1 Remove existing grease with a clean wiping rag (item 30, appx D).
- 2 Inspect carrier breechblock boss (1) and breechblock gear (2) for corrosion, pitting or burrs.
- 3 If corrosion is present, clean with CLP (item 7, appx D) and crocus cloth (item 11, appx D). Wipe dry with a clean wiping rag (item 30, appx D).
- 4 If burrs are present, remove with hand file.
- 6 Apply a thick coat of WTR (item 16, appx D) to breechblock boss (1) and gear (2).



3-7 BREECH MECHANISM ASSEMBLY MAINTENANCE (cont)

g. Separating Breechblock and Carrier Assemblies (cont)

INSTALLATION

NOTE

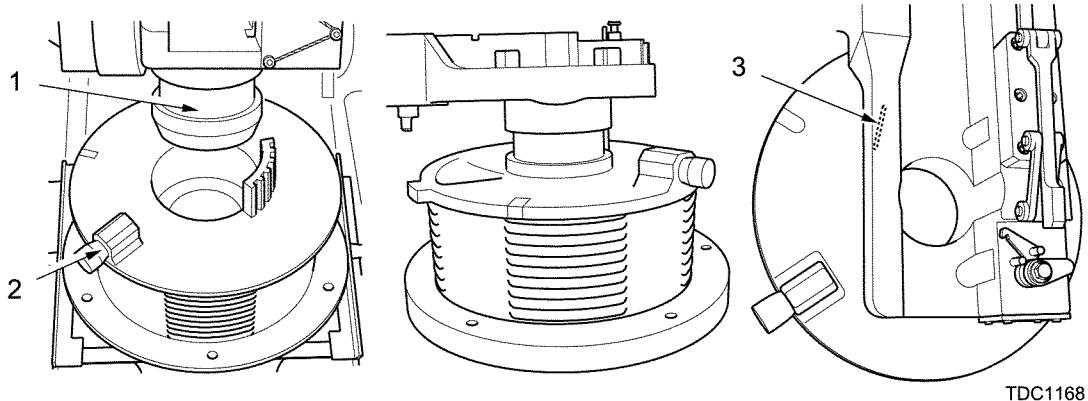
Ensure breechblock witness mark aligns with carrier.

- 1 Lower carrier (1) into breechblock (2), by moving breech lever to the CLOSE position. Insert pump handle into trunnion pump adaptor, pump back and forth on handle and carefully lower carrier into breechblock. Ensure breechblock maintains same angle as carrier when being lowered.
- 2 Lower carrier (1) into breechblock (2) until breechblock gear and carrier rack gear are engaged.

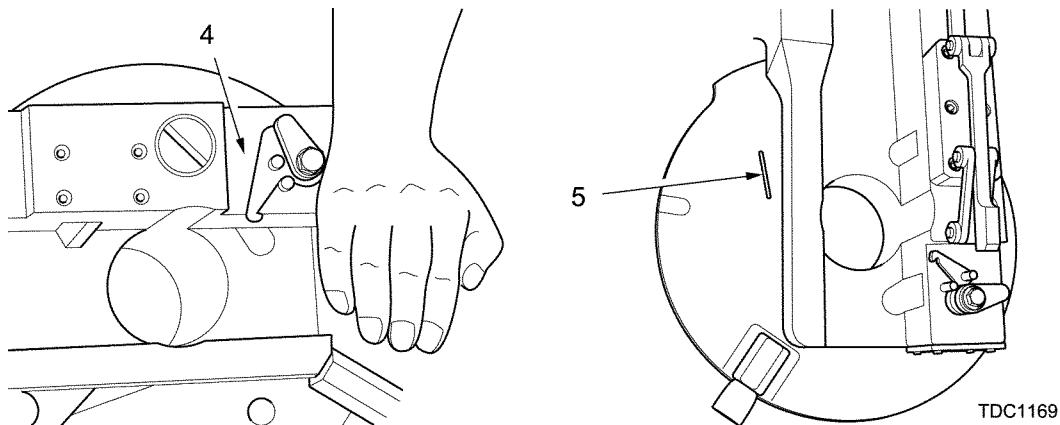
NOTE

When carrier assembly is at stops the gearing is aligned (witness mark will not be aligned). Breechblock witness marks will be offset to the right.

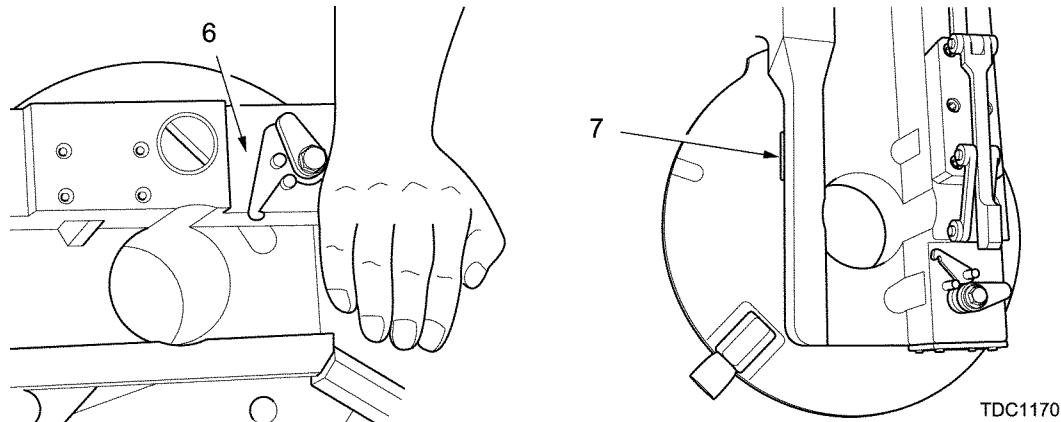
- 3 Continue to lower carrier (1) until carrier stops (witness mark (3) will be misaligned CW).



- 4 Move breech lever to the OPEN position, while applying downward pressure on carrier (4), slowly open breech until an audible click is heard or witness mark (5) is visibly offset.



- 5 Move breech lever to the CLOSE position, while applying downward pressure on the carrier (6), close breech until carrier is fully seated on the breechblock and witness mark (7) is aligned.



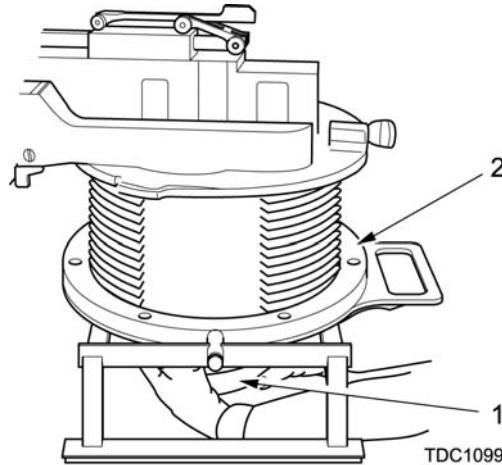
h. Spindle Assembly

INSTALLATION

NOTE

Apply light coat of WTR (item 16, appx D) grease to top of disk before installation.

Raise spindle assembly (1) through hole in center of breech stool (2) and install spindle into the breechblock assembly. Rotate spindle CW to lock into the breechblock.



i. PFM Body Assembly

INSTALLATION

NOTES

To install PFM body assembly, it may be necessary to apply upward pressure to the spindle assembly.

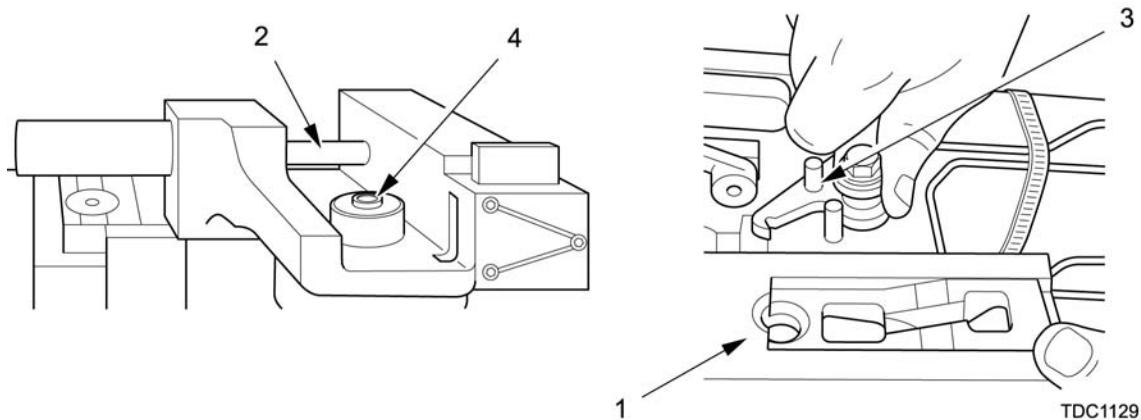
Verify slots are completely engaged into primer feed lock.

3-7 BREECH MECHANISM ASSEMBLY MAINTENANCE (cont)

i. PFM Body Assembly (cont)

INSTALLATION (cont)

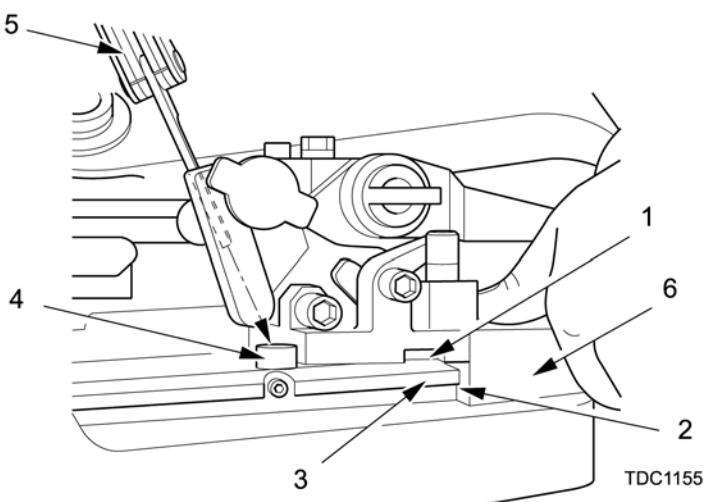
Install PFM body assembly (1) into lock (2), rotating PFM tray latch (3) CW to the unlocked position, lower body onto spindle assembly (4) move body slightly rearwards, allowing body to engage spindle, and release latch, move body forward until fully engaged. Rotate lock CCW until engaged.



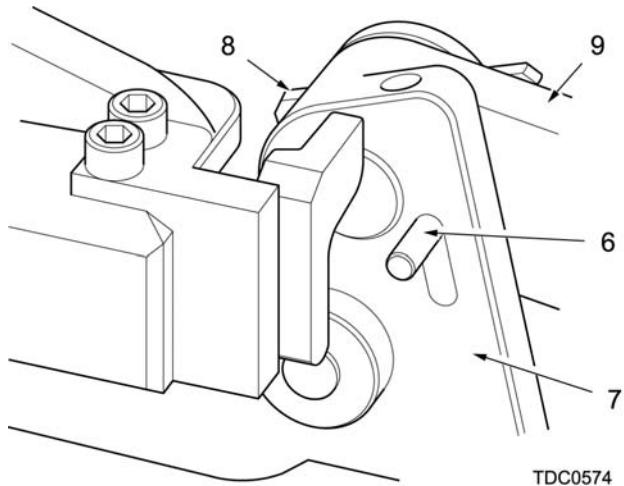
j. PFM Tray Assembly

INSTALLATION

- 1 Compress tray-locking plunger (1), align PFM tray assembly guides (2) with rails of PFM body assembly (3). Slide tray assembly forward until tray rests against locking plunger (4).
- 2 Using multi-tool (5) depress locking plunger (4) and push PFM tray assembly (6) forward. Ensure plunger is engaged.



- 3 Depress pin (6) on drive link assembly (7) and remove connector link (8). Rotate quick release assembly (9) towards drive link assembly, install connector link and release pin, and ensure connector is engaged.



k. Injector Arm Assembly

INSTALLATION

- 1 Push and rotate knob (1) 90° CW until on knob stop (2).
- 2 Rotate locking shaft (3) 90° and remove from PFM tray assembly (4).
- 3 Insert injector arm assembly (5) into PFM tray assembly (4) and rotate injector arm (6) to engage slots (7) on the follower.
- 4 Insert locking shaft (3) into PFM tray assembly (4). Rotate knob (1) CCW until engaged. Ensure locking shaft is engaged.

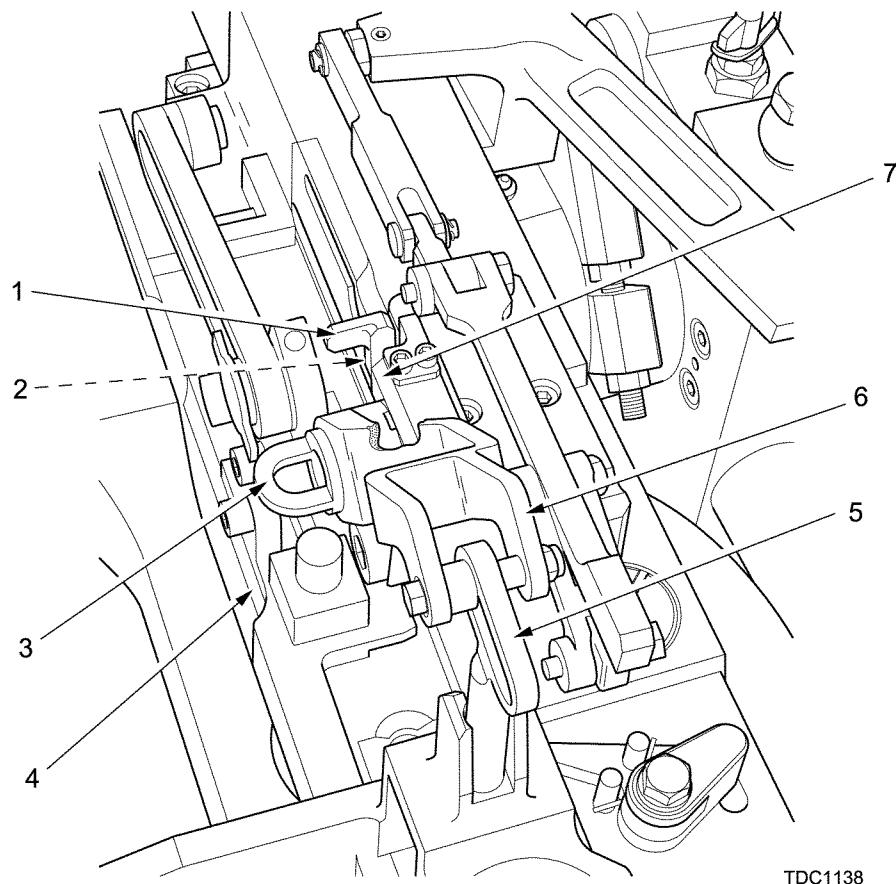
NOTE

Ensure all parts are locked and engaged.

3-7 BREECH MECHANISM ASSEMBLY MAINTENANCE (cont)

k. Injector Arm Assembly (cont)

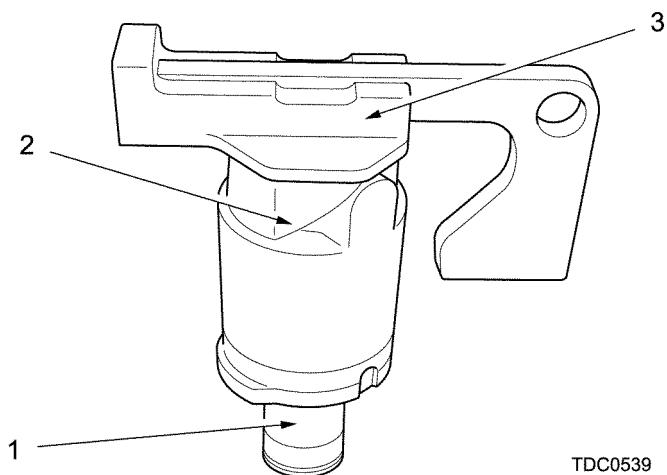
INSTALLATION (cont)



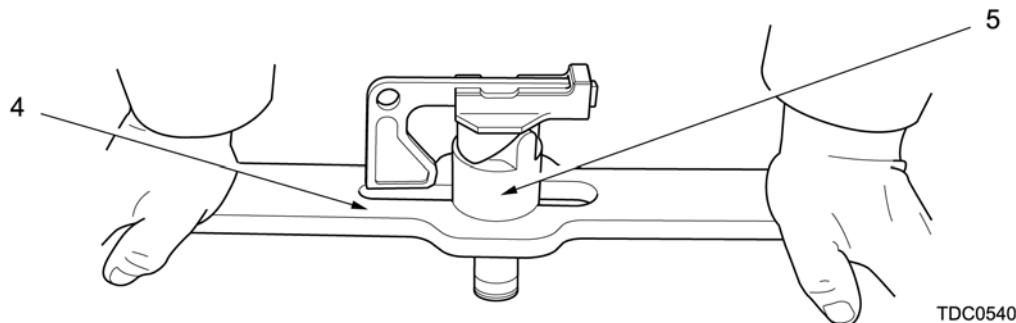
I. Firing Mech

DISASSEMBLE

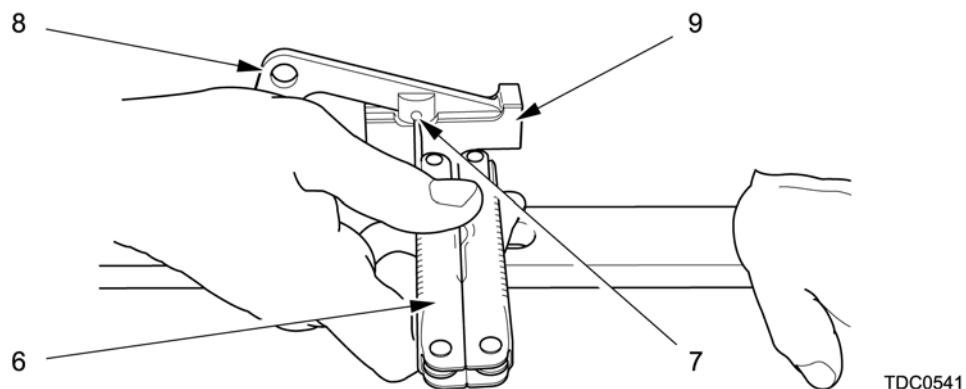
- 1 Place 24 mm socket (1) on a firm hard surface, place firing mech (2) on top of socket with follower (3) end up.



- 2 Place FM wrench (4) onto case (5). Using wrench, depress assembly.



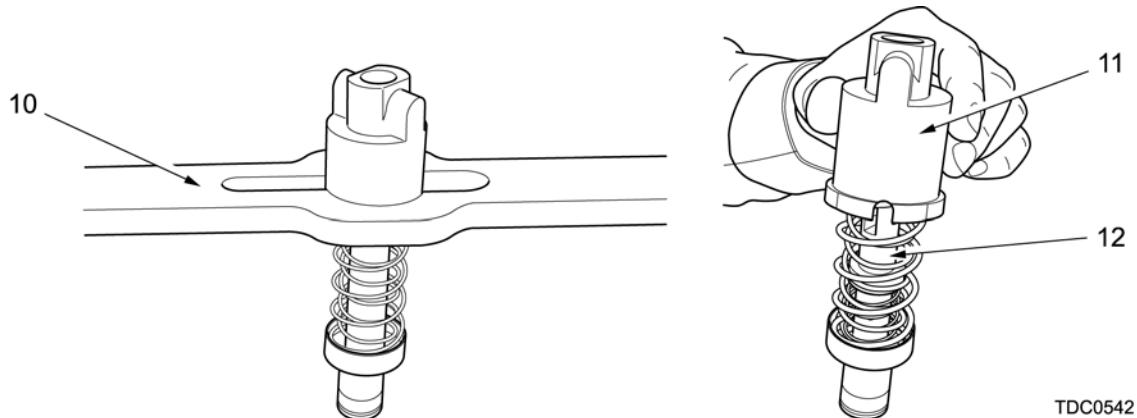
- 3 Using multi-tool (6), remove pin (7), lanyard lever (8) and follower (9).



WARNING

FIRING MECH IS UNDER PRESSURE. WHEN REMOVING PIN, ENSURE PRESSURE IS APPLIED TO FM WRENCH. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL.

- 4 Under control allow case and springs to expand.
- 5 Remove FM wrench (10) from case (11) then remove case from cup and yoke springs (12).

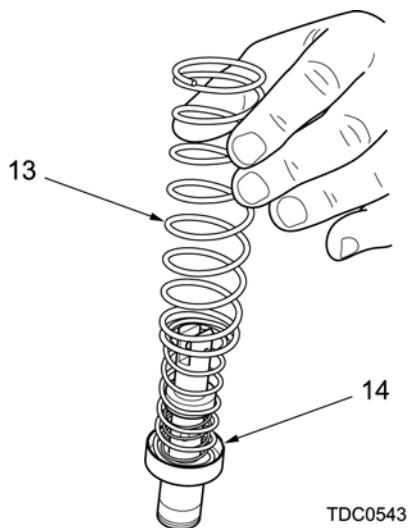


3-7 BREECH MECHANISM ASSEMBLY MAINTENANCE (cont)

I. Firing Mech (cont)

DISASSEMBLE (cont)

- 6 Remove cup and yoke springs (13) from yoke assembly (14).

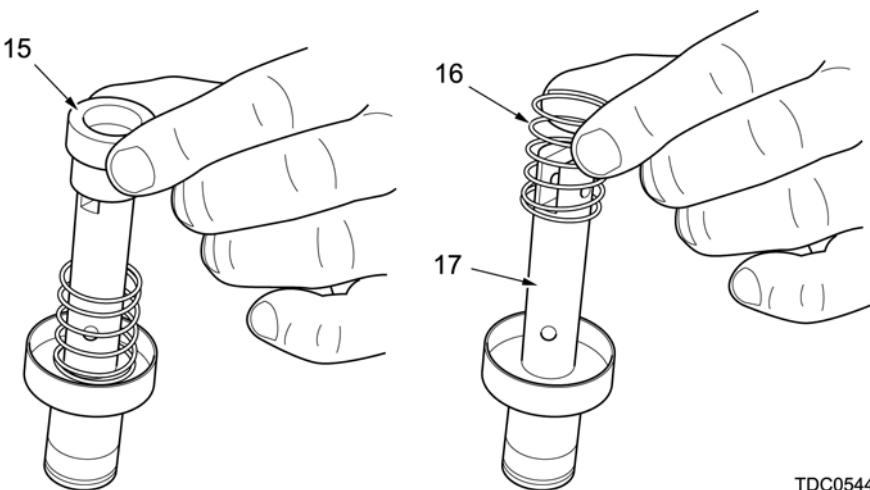


TDC0543

NOTE

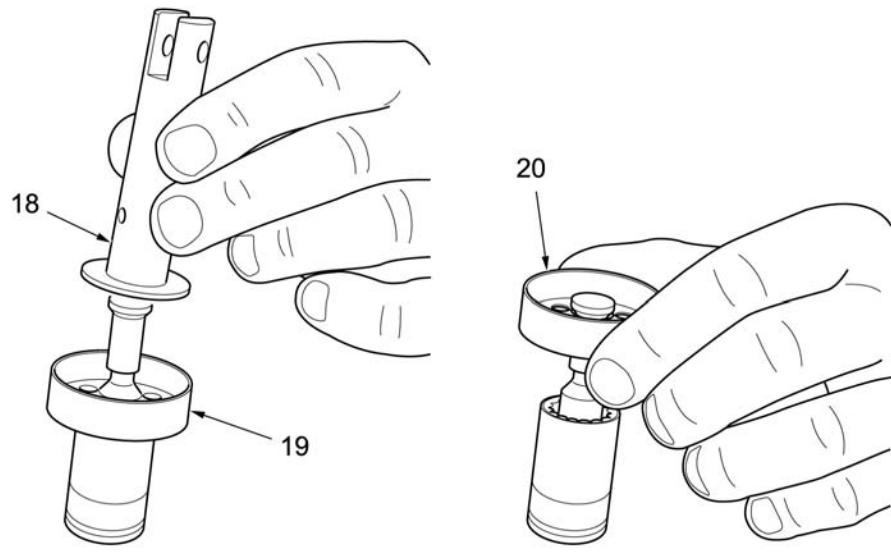
Take care when removing sleeve and sleeve spring from yoke, balls are loose and may detach from yoke assembly.

- 7 Remove sleeve (15) and sleeve spring (16) from yoke (17).

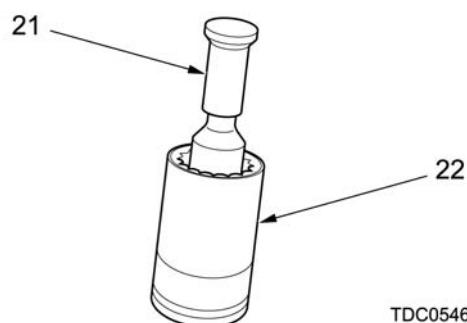


TDC0544

- 8 Lift and remove yoke (18) from firing hammer (19). Carefully remove three balls from the yoke.
- 9 Remove cup (20) from firing hammer (19).



- 10 Remove firing hammer (21) from 24mm socket (22).



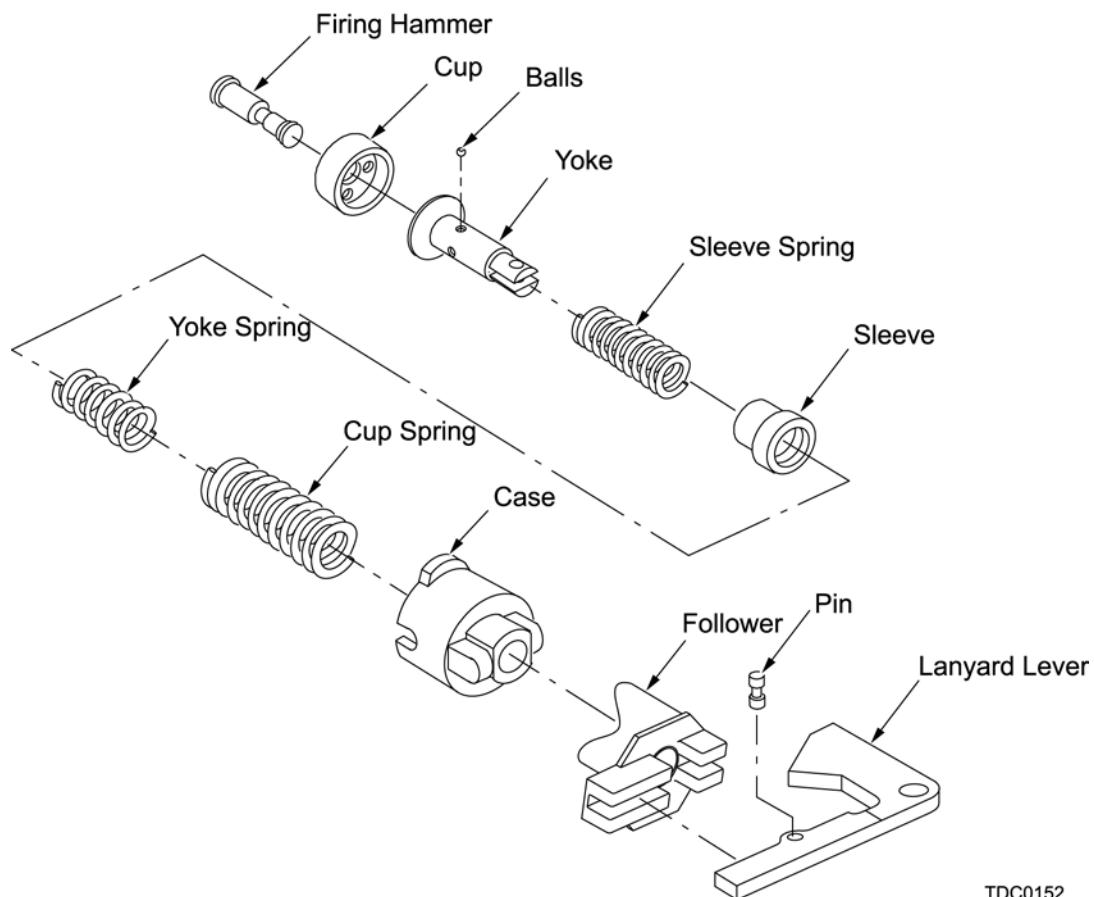
SERVICE AND INSPECTION

- 1 Clean and lubricate all parts with CLP (item 7, appx D) (Sect I, NOTE 7).
- 2 Remove corrosion, burrs from firing mech with CLP (item 7, appx D), hand file and crocus cloth (item 11, appx D), remove excess CLP with clean wiping rag (item 30, appx D).

3-7 BREECH MECHANISM ASSEMBLY MAINTENANCE (cont)

I. Firing Mech (cont)

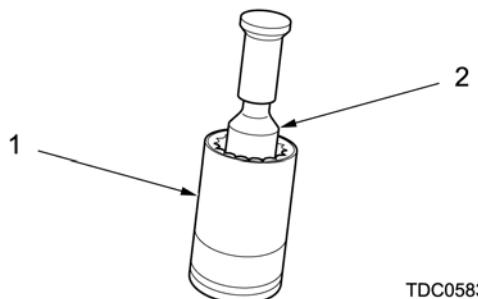
SERVICE AND INSPECTION (cont)



TDC0152

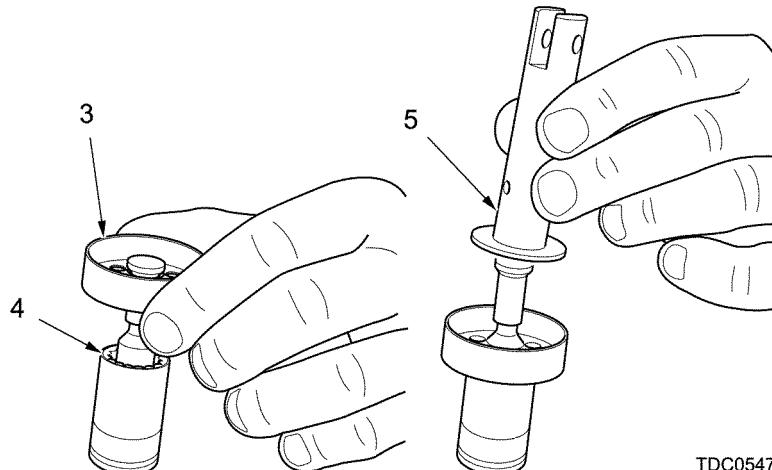
ASSEMBLE

- 1 Place 24 mm socket (1) on a firm hard surface put firing hammer (2) inside socket.



TDC0583

- 2 Place cup (3) onto firing hammer (4), then slide yoke (5) onto hammer until seated.

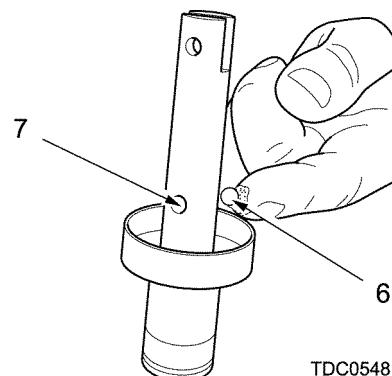


TDC0547

NOTE

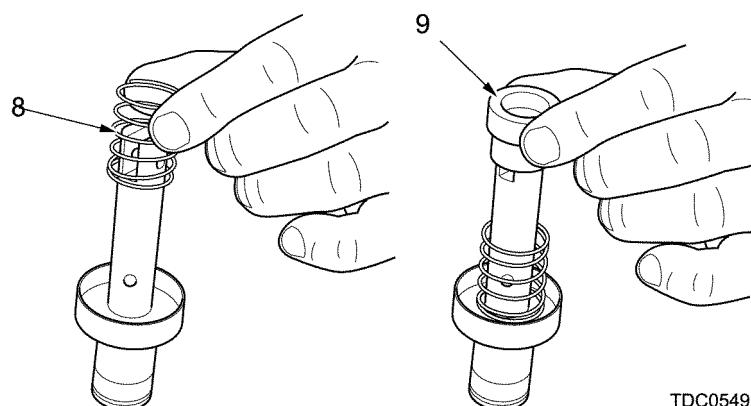
Use WTR (item 16, appx D) grease to hold balls into yoke holes.

- 3 Apply WTR (item 16, appx D) grease to three balls (6) and install balls into yoke holes (7).



TDC0548

- 4 Slide sleeve spring (8) and sleeve (9) onto firing hammer.



TDC0549

NOTE

When removing yoke assembly from 24 mm socket, ensure pressure is applied to sleeve spring and sleeve.

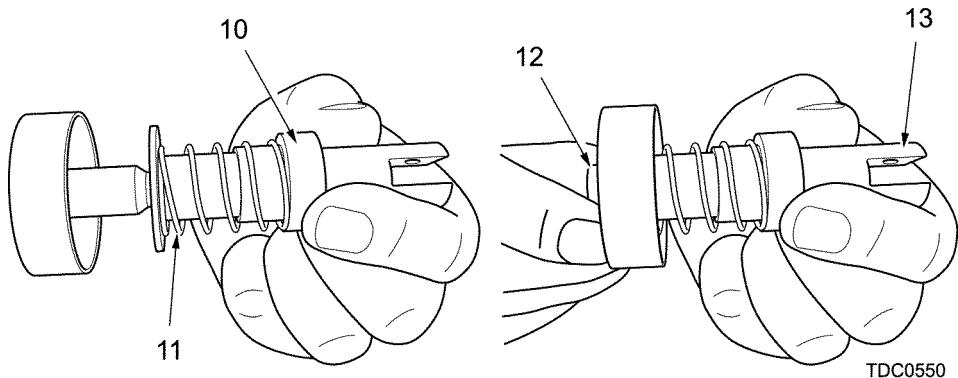
- 5 Hold sleeve (10) and sleeve spring (11) and remove assembly from 24mm socket.

3-7 BREECH MECHANISM ASSEMBLY MAINTENANCE (cont)

I. Firing Mech (cont)

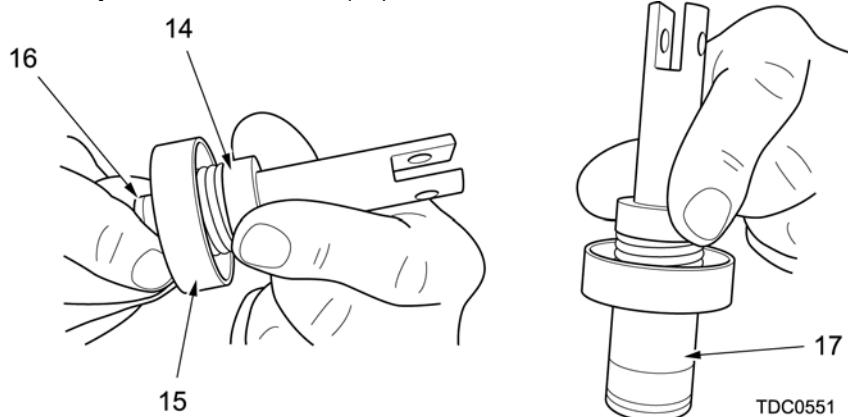
ASSEMBLE (cont)

- 6** Slide firing hammer (12) into yoke (13) (towards sleeve), until balls fall into hammer groove.



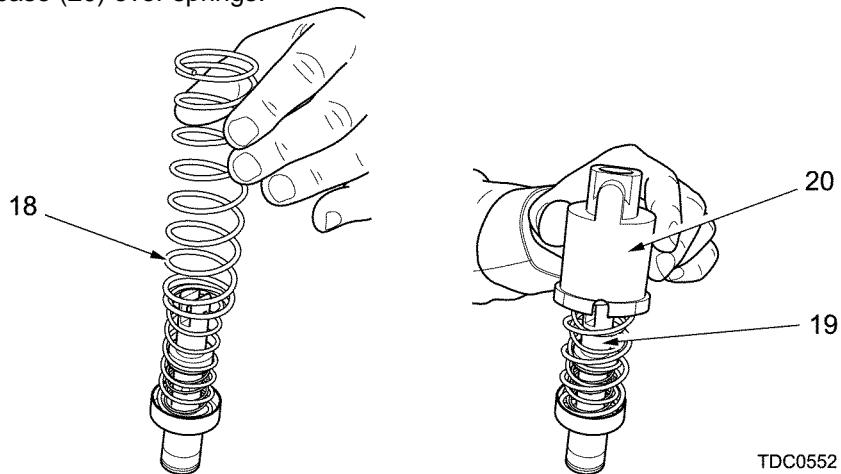
- 7** Fully compress sleeve and sleeve spring (14) towards cup (15), then pull firing hammer (16) outwards. Ensure sleeve and sleeve spring are locked.

- 8** Place assembly onto 24mm socket (17).

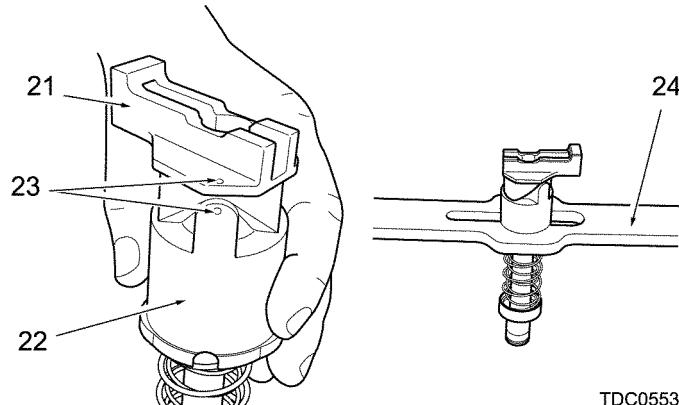


- 9** Slide yoke and cup springs (18) onto yoke (19).

- 10** Place case (20) over springs.



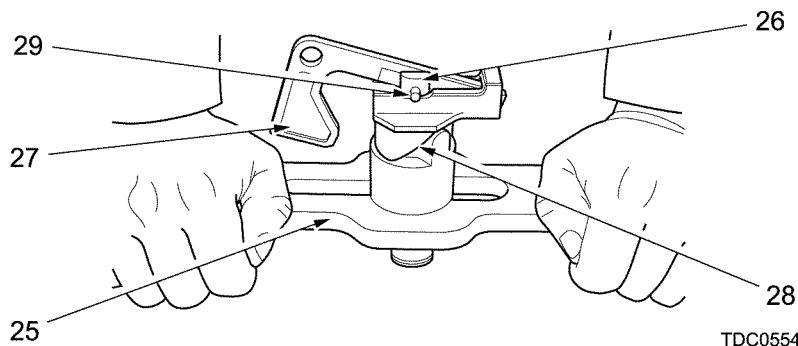
- 11 Place follower (21) over case (22), ensuring witness marks (23) are aligned.
- 12 Slide FM wrench (24) onto case (22).



WARNING

WHEN INSERTING PIN, ENSURE CONTINUOUS PRESSURE IS APPLIED TO FM WRENCH UNTIL PIN IS INSTALLED. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL.

- 13 Using FM wrench (25) compress springs until yoke hole (26) is visible.
- 14 Install lanyard lever (27) into follower (28) and yoke, and align holes.
- 15 Install pin (29) into yoke hole (26). Ensure pin is secure.
- 16 Carefully release pressure and remove FM wrench from firing mech.



m. Firing Mech

FUNCTIONAL TEST

WARNING

KEEP HANDS AWAY FROM BOTTOM OF FIRING MECH WHEN CARRYING OUT THE FUNCTIONAL TEST; FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL.

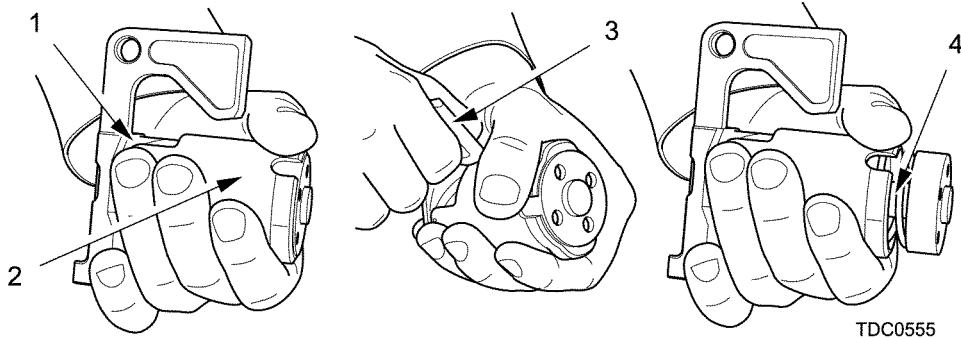
- 1 Hold firing mech (1) by the case (2), pull lanyard lever (3) (an audible click should be heard) until firing hammer and cup have recessed case.

3-7 BREECH MECHANISM ASSEMBLY MAINTENANCE (cont)

m. Firing Mech (cont)

FUNCTIONAL TEST (cont)

- 2 Push cup and hammer (4) back into case, ensuring firing mech re-cocks. Repeat test (if necessary).



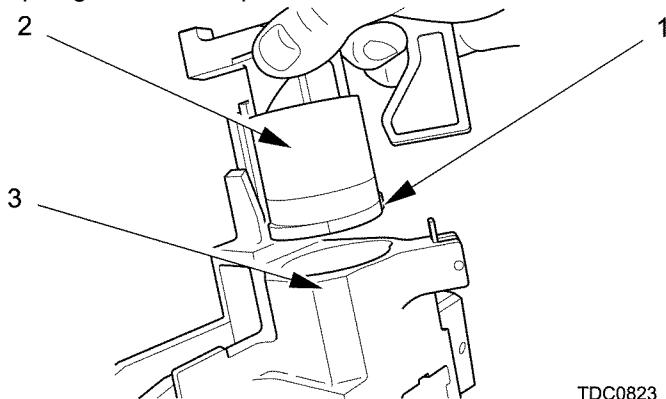
NOTE

If functional test fails, repeat disassembly and assembly (Para 3-7l.) steps. If firing mech fails functional test, notify unit maintenance.

n. Firing Mech

INSTALLATION

Align lugs (1) on firing mech (2) with cut-outs on tray assembly (3). Apply pressure turn firing mech CCW until the block plunger clicks into place.



o. Breech Mechanism

FUNCTIONAL TEST

Open Breech (manually):

WARNING

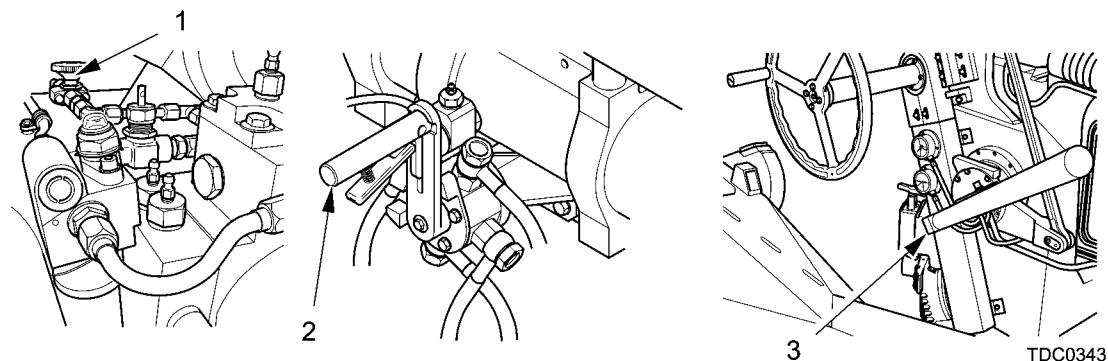
THE SCAVENGE ISOLATOR VALVE MUST BE CLOSED WHEN WORKING AROUND THE BREECH. FAILURE TO CLOSE THE VALVE COULD RESULT IN INADVERTENT BREECH MOTION. THIS COULD RESULT IN SEVERE CRUSHING INJURIES TO PERSONNEL

- 1 Cannoneer No 1 ensures scavenge isolator valve (1) is closed.

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.

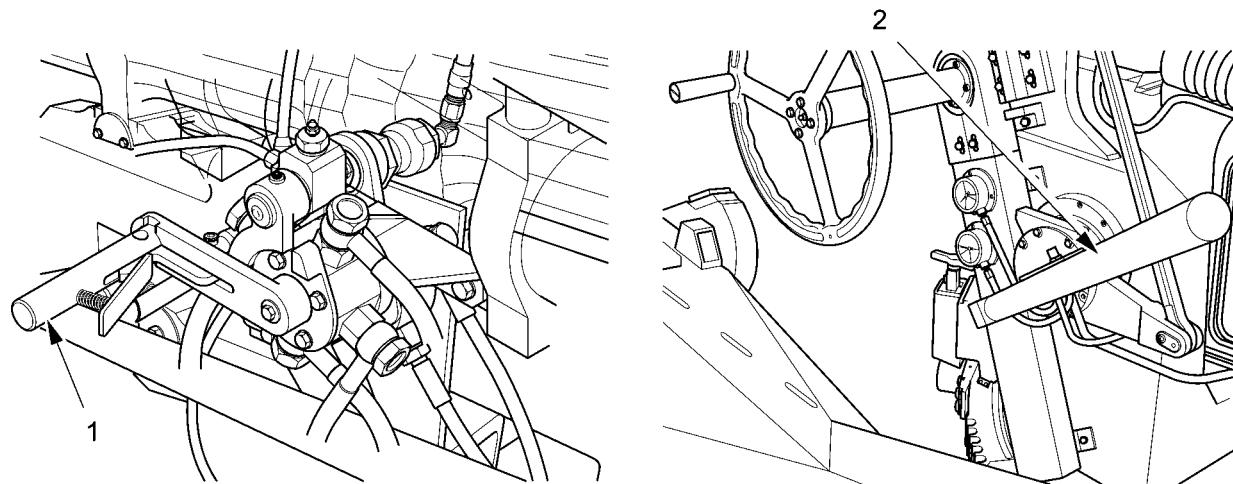
- 2 Cannoneer No 2 moves breech lever (2) to OPEN position.
- 3 Cannoneer No 1 operates trunnion pump handle (3) until breech is fully open.



- 4 Cannoneer No 4 removes breechstool from recoil slides

Close Breech (manually):

- 1 Cannoneer No 2 moves breech lever (1) to the CLOSE position.
- 2 Cannoneer No 1 operates trunnion pump handle (2) until breech is fully closed and witness marks are aligned. Remove handle and stow



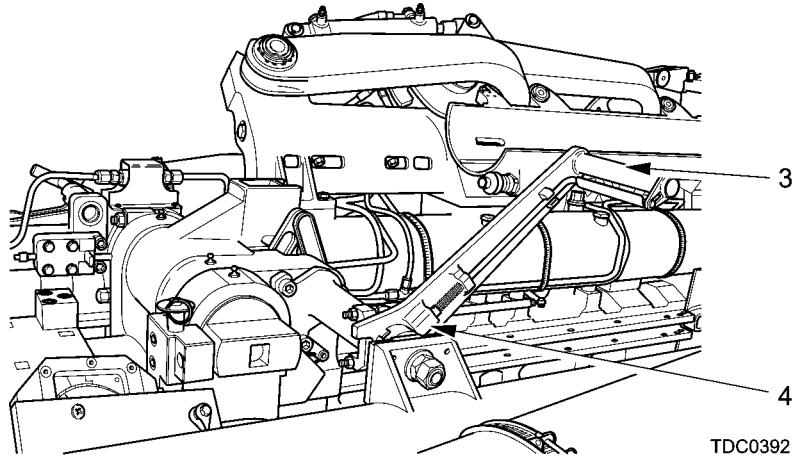
3-7 BREECH MECHANISM ASSEMBLY MAINTENANCE (cont)

o. Breech Mechanism Test (cont)

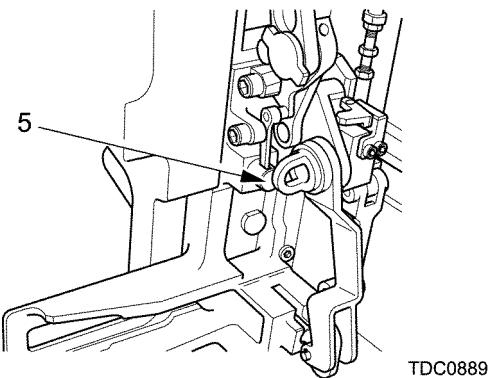
FUNCTIONAL TEST (cont)

Open Breech (manually): (cont)

- 3 Cannoneer No 2 moves PFM lever (3) to the primed position; ensuring detent (4) is engaged.

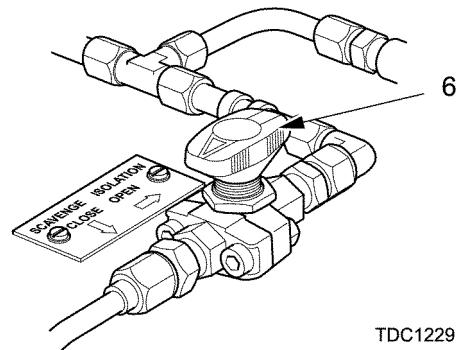


- 4 Cannoneer No 2 ensures PFM (5) witness marks are aligned, then pronounces PRIMED.



- 5 Cannoneer No 1 opens scavenge isolator valve (6).

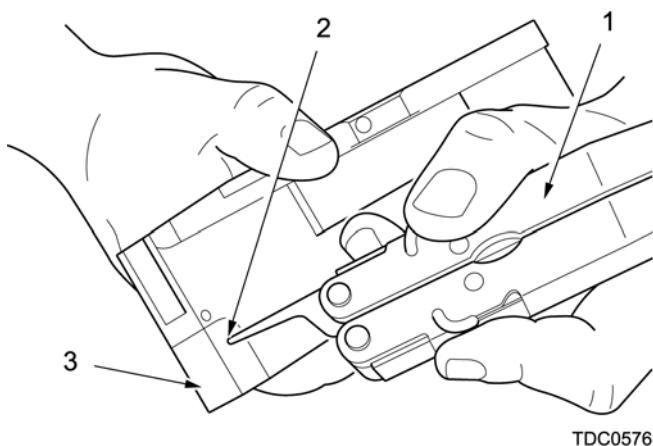
Open



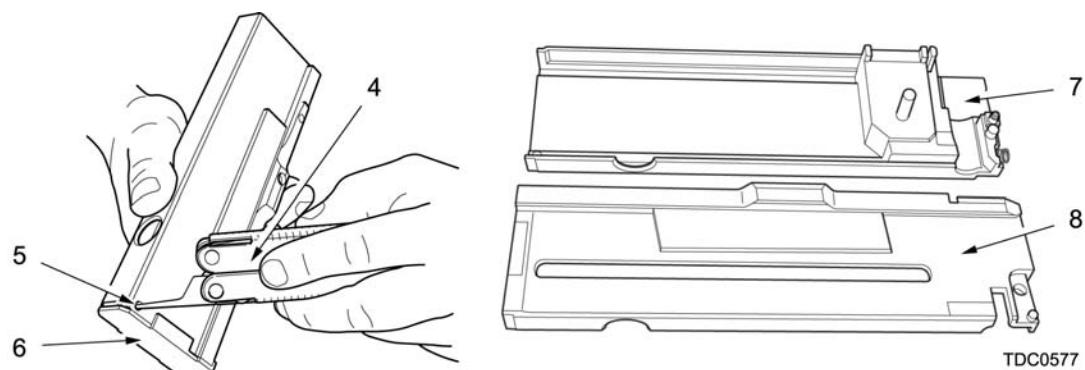
3-8 MAGAZINE ASSEMBLY MAINTENANCE

DISASSEMBLE

- 1 Using multi-tool (1) depress plunger (2) and rotate clip (3) to disengage it from magazine assembly. Remove clip.



- 2 Using multi-tool (4) depress plunger (5) and remove end plate assembly (6).
- 3 Place magazine assembly (7) (bottom half down) on solid surface and remove top half magazine assembly (8).



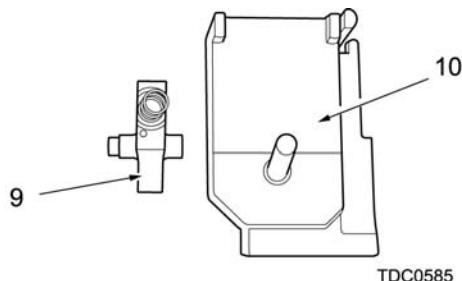
3-8 MAGAZINE ASSEMBLY MAINTENANCE (cont)

DISASSEMBLE (cont)

CAUTION

Use care to avoid pulling off spring on finger assembly during handling.

- 4 Remove finger assembly (9) and pusher assembly (10).



SERVICE AND INSPECTION

CAUTION

Do not clean nylon spools and negator spring on pusher assembly with CLP (item 7, appx D). Damage may occur to pusher assembly.

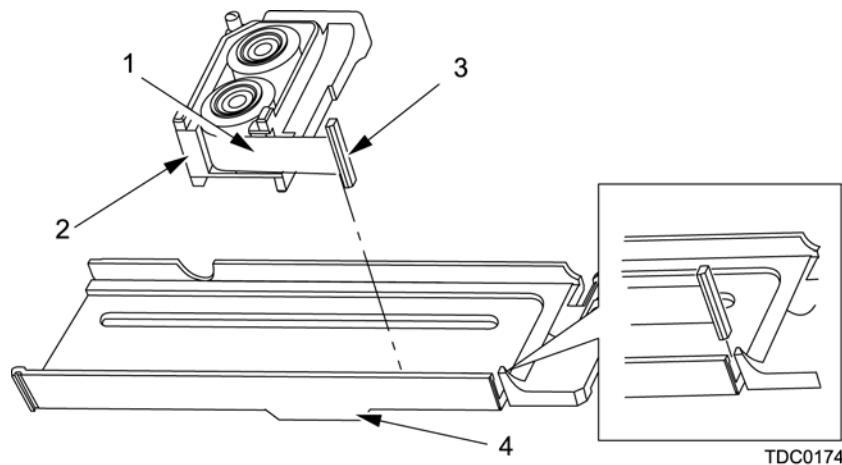
- 1 Clean, brush and remove corrosion from magazine assembly with CLP (item 7, appx D), crocus cloth (item 11, appx D) and all purpose brush. Remove excess CLP with a clean wiping rag (item 30, appx D).
- 2 Wipe nylon spools and negator spring on pusher assembly with a clean wiping rag (item 30, appx D).
- 3 If parts are corroded, pitted, cracked, worn or deformed, notify unit maintenance.
- 4 Ensure clip and end plate plungers operate correctly, by depressing plungers using forefinger and thumb. If plungers do not return, notify unit maintenance.

ASSEMBLE

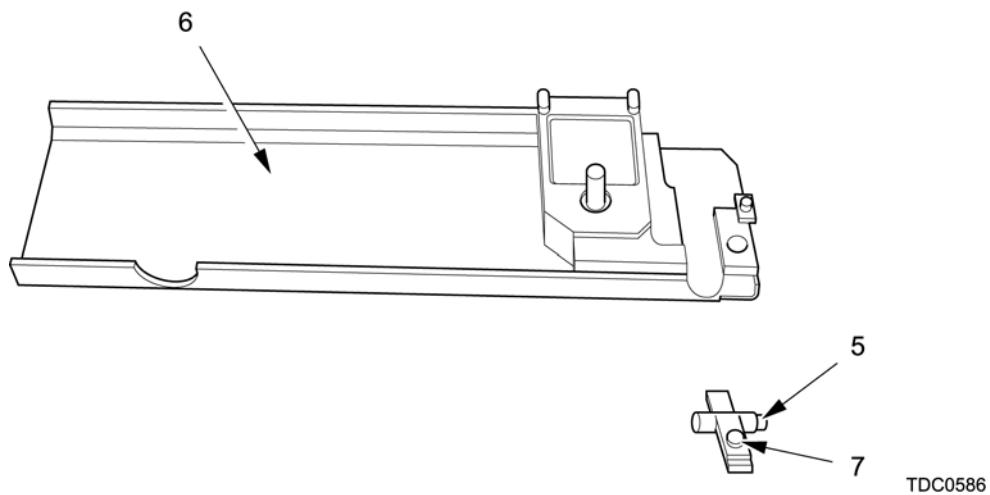
NOTE

Negator spring is under tension.

- 1 Pull negator spring (1) out of pusher assembly (2) (approximately $\frac{1}{4}$ in), align hook (3) on negator spring with slot in magazine top half (4) and insert pusher assembly into magazine top half assembly.



- 2 Install finger assembly (5) into the magazine top half assembly (6) with plunger (7) pointing away from the magazine top half assembly.



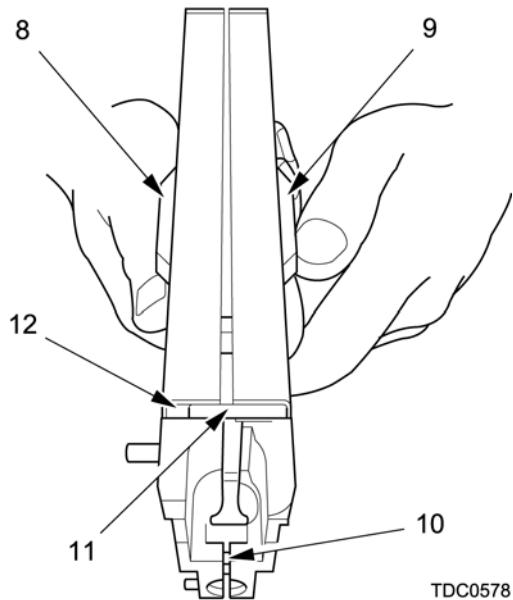
CAUTION

When assembling top and bottom half of magazine DO NOT apply excessive force, damage to hook and negator spring will result.

3-8 MAGAZINE ASSEMBLY MAINTENANCE (cont)

ASSEMBLE (cont)

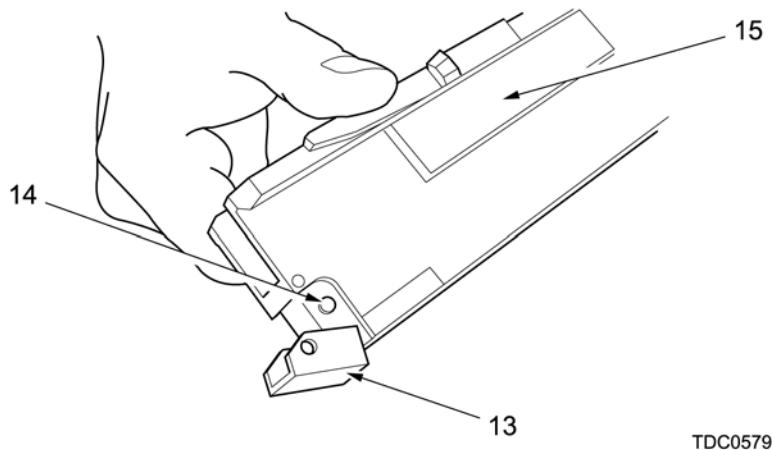
- 3 Attach magazine bottom half (8) to magazine top half (9). Ensure locating pin (10) engages matching hole in magazine top half and hook (11) on negator spring is in slot (12) on both magazine halves.



CAUTION

Use care to avoid pulling off the spring during handling.

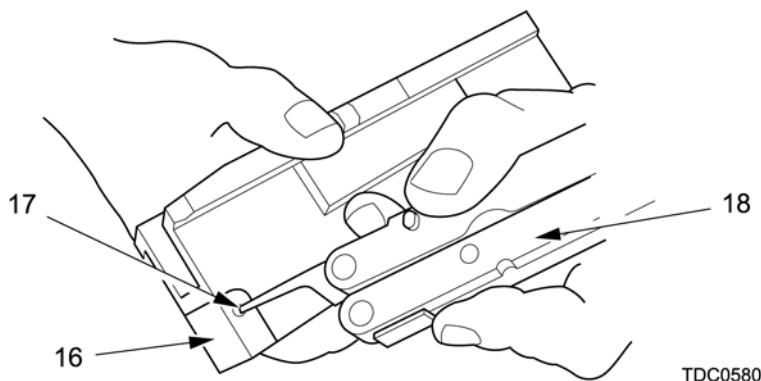
- 4 Position clip (13) until it engages pin (14) on magazine top half (15).



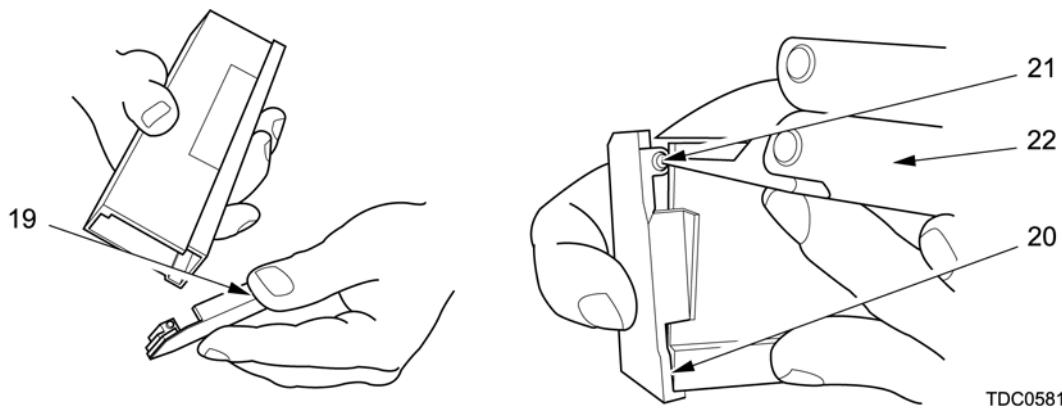
CAUTION

The ears on the clip should be on the outside of the two magazine halves. Do not force clip. If clip does not fit over magazine halves, they are not assembled correctly.

- 5 Rotate clip (16) until it contacts plunger (17) of finger assembly. Using multi-tool (18) depress plunger and rotate clip until plunger locks.



- 6 Position lip on end plate (19), engaging slots (20) on bottom of magazine assembly and rotate end plate until it contacts plunger (21).
- 7 Using multi-tool (22) depress plunger (21) and push end plate (19) until plunger locks.

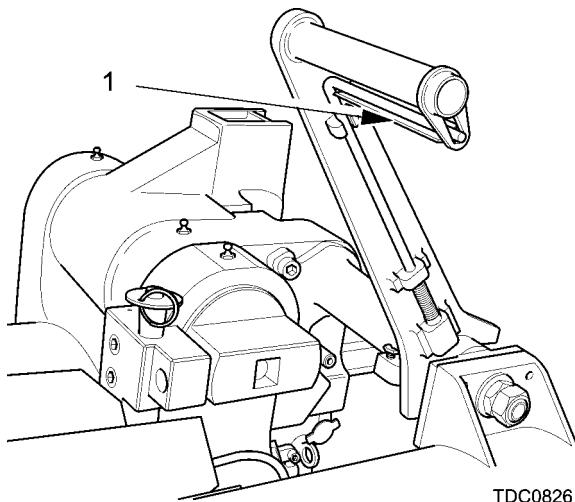


- 8 Retract pull and release. Pusher should move freely.

3-9 DOG COUPLER MAINTENANCE

REMOVAL

- 1 Move PFM lever (1) forward to the EXTRACT position.



WARNING

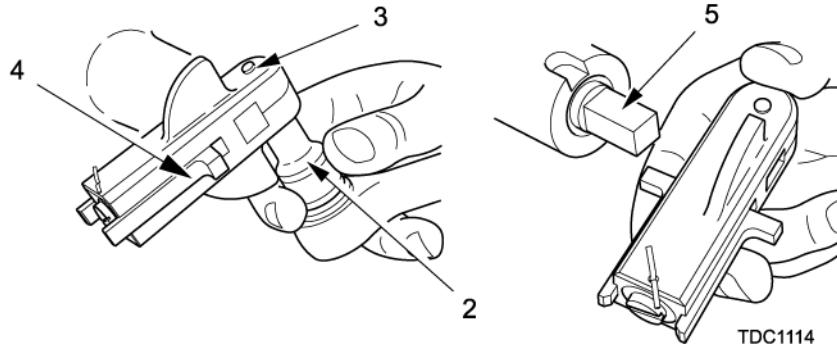
ENSURE BREECH AND LOADING TRAY LEVERS REFLECT THE CORRECT POSITION OF THEIR COMPONENTS TO PREVENT UNEXPECTED BREECH AND LOADING TRAY MOTION AND POSSIBLE CRUSHING INJURIES TO PERSONNEL.

- 2 Close scavenge isolator valve.
- 3 Manually open breech (Para 2-16).

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.

- 4 Engage breech lockout plunger.
- 5 Using 11mm socket and $\frac{1}{2}$ in ratchet (2), loosen bolt (3), until dog coupler (4) can be removed from the drive shaft (5).



SERVICE AND INSPECTION

Clean and remove corrosion and small burrs from dog coupler with CLP (item 7, appx D), crocus cloth (item 11, appx D) and hand file. Remove excess CLP with clean wiping rag (item 30, appx D).

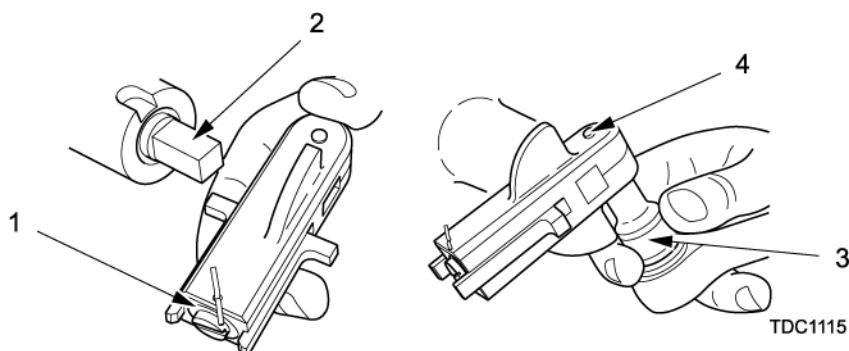
INSTALLATION

- 1 Slide dog coupler (1) onto drive shaft (2).

CAUTION

Do not over tighten bolt, damage to dog coupler will result.

- 2 Using 11mm socket and $\frac{1}{2}$ in ratchet (3), tighten bolt (4), until dog coupler (1) is secured onto drive shaft (2).



- 3 Disengage breech lockout plunger.
- 4 Manually close breech (Para 2-16).
- 5 Open scavenge system.

Section V. CARRIAGE MAINTENANCE PROCEDURES

Section Index

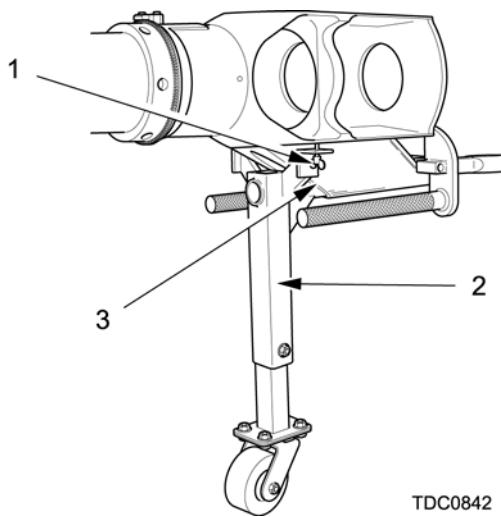
Paragraph		Page
3-10	Top Carriage Maintenance.....	3-110
3-11	Bottom Carriage Maintenance.....	3-115

3-10 TOP CARRIAGE MAINTENANCE

a. Third Wheel Assembly

REMOVAL

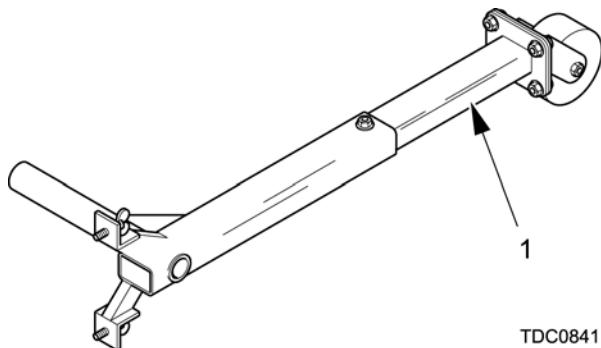
Turn securing bolts (1) CCW; remove third wheel assembly (2) from muzzle brake rear slot (3).



TDC0842

SERVICE AND INSPECTION

- 1 Check third wheel assembly (1) for any unusual or excessive damage due to improper adjustments, worn or loose parts, lack of lubricant, foreign matter, or moisture.
- 2 Clean and lubricate all parts with CLP (item 7, appx D).
- 3 Remove corrosion, burrs from third wheel assembly (1) with CLP (item 7, appx D), handfile and crocus cloth (item 11, appx D), remove excess CLP with clean wiping rag (item 30, appx D).



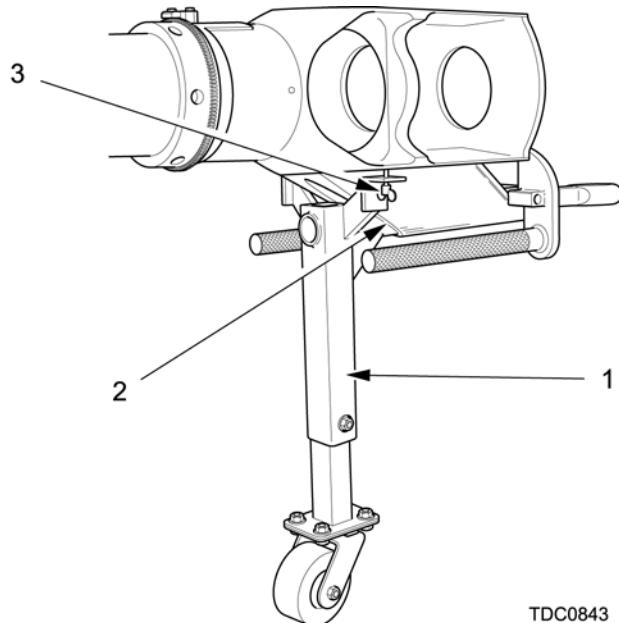
TDC0841

WARNING

BEFORE MOVING HOWITZER WITH THIRD WHEEL ASSEMBLY INSTALLED,
ENSURE SECURING BOLTS ARE ENGAGED; FAILURE TO DO SO MAY
CAUSE WHEEL TO BECOME DISENGAGED DURING MOVEMENT, CAUSING
INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

INSTALLATION

Install third wheel assembly (1) into muzzle brake rear slot (2), turn securing bolts (3) CW until engaged, ensure third wheel is secure to muzzle brake.



b. Trident Bar Assembly

REMOVAL

CAUTION

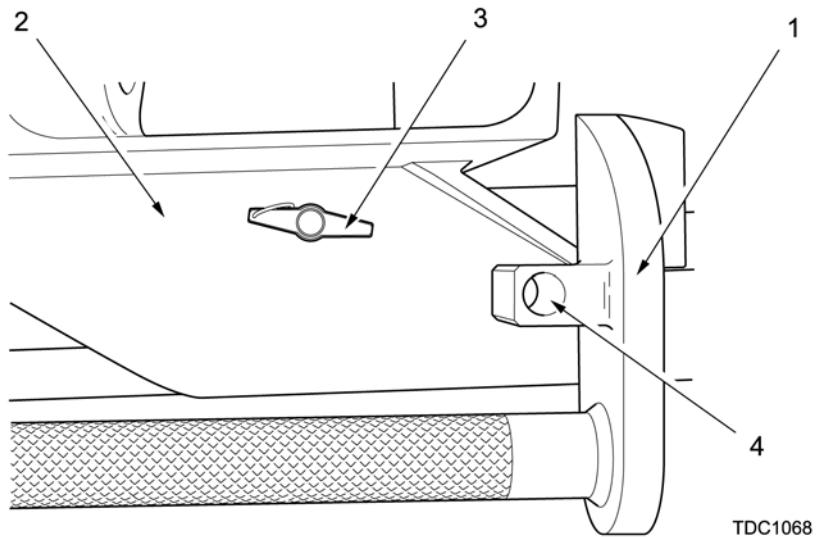
When trident bar is removed from lunette assembly, ensure quick release pin is stowed. Failure to do so will damage equipment.

Remove trident bar (1) from lunette assembly (2), by disengaging quick release pin (3), slide trident bar out of adaptor. Ensure quick release pin is stowed in bracket (4).

3-10 TOP CARRIAGE MAINTENANCE (cont)

b. Trident Bar Assembly (cont)

REMOVAL (cont)



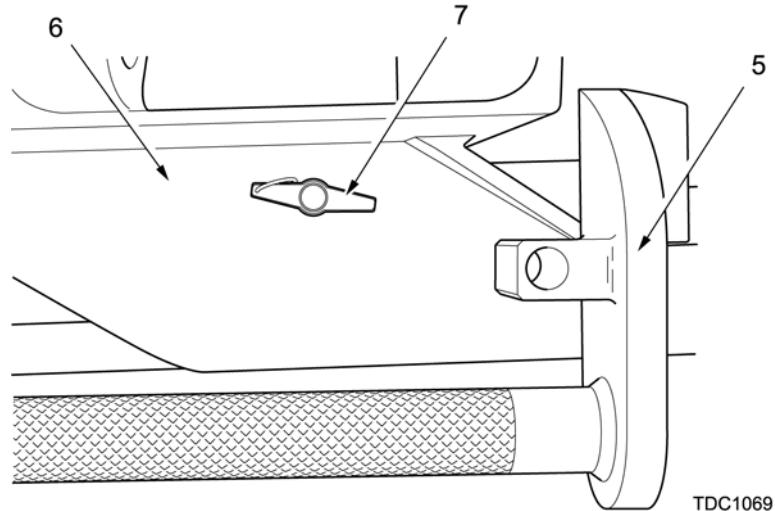
TDC1068

SERVICE AND INSPECTION

- 1 Check trident bar assembly for any unusual or excessive damage due to improper use, worn or loose parts.
- 2 Clean and lubricate all parts with CLP (item 7, appx D).
- 3 Remove corrosion, burrs from trident bar assembly (1) with CLP (item 7, appx D), handfile and crocus cloth (item 11, appx D), remove excess CLP with clean wiping rag (item 30, appx D).

INSTALLATION

Install trident bar assembly (5) into the lunette assembly (6), ensure quick release pin (7) is engaged.



TDC1069

c. Safety Strap Assembly (US Army Only)

REMOVAL

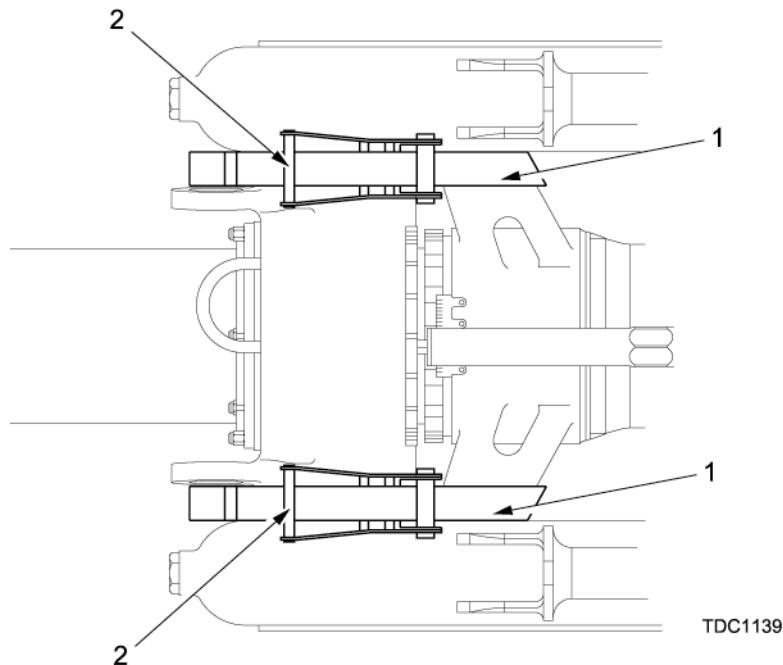
WARNING

SAFETY STRAP ASSEMBLY MUST BE REMOVED PRIOR TO FIRING.
FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL AND/OR
DAMAGE TO EQUIPMENT.

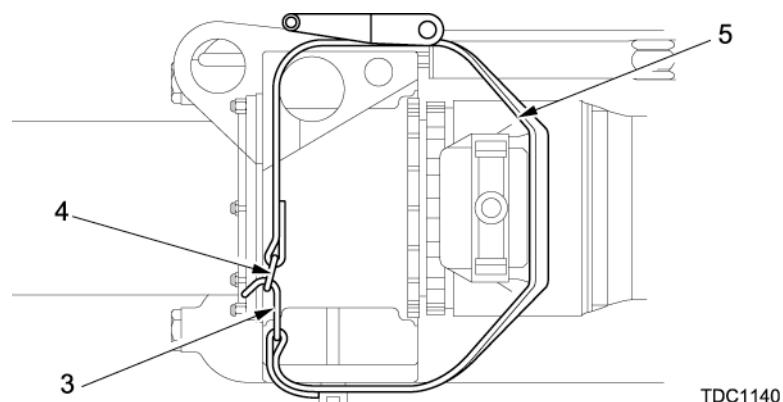
NOTE

Safety strap assembly can be removed from either side of cradle front bridge piece and recoil yoke.

- 1 Loosen tension on safety strap assembly (1) by adjusting ratchet (2) until strap is loose.



- 2 Disconnect hook (3) from eye (4) on strap (5).



3-10 TOP CARRIAGE MAINTENANCE (cont)

c. Safety Strap Assembly (cont)

REMOVAL (cont)

CAUTION

When removing safety strap assembly, ensure strap does not snag on airlines or any other equipment. Failure to do so may cause damage to equipment.

- 3 Remove safety strap assembly from howitzer, ensure strap does not snag on airlines or any other equipment.

SERVICE AND INSPECTION

- 1 Check safety strap assembly for any unusual or excessive damage due to improper use, worn or loose parts.
- 2 Check strap for cuts or abrasions on the webbing and that it is serviceable.
- 3 Clean all parts with a clean wiping rag (item 30, appx D).

INSTALLATION

CAUTION

Safety strap assembly must only be installed when howitzer is in battery. Ensure safety strap is serviceable before use.

- 1 Check safety strap assembly (1) to ensure there are no cuts or abrasions on the webbing and that it is serviceable.

NOTE

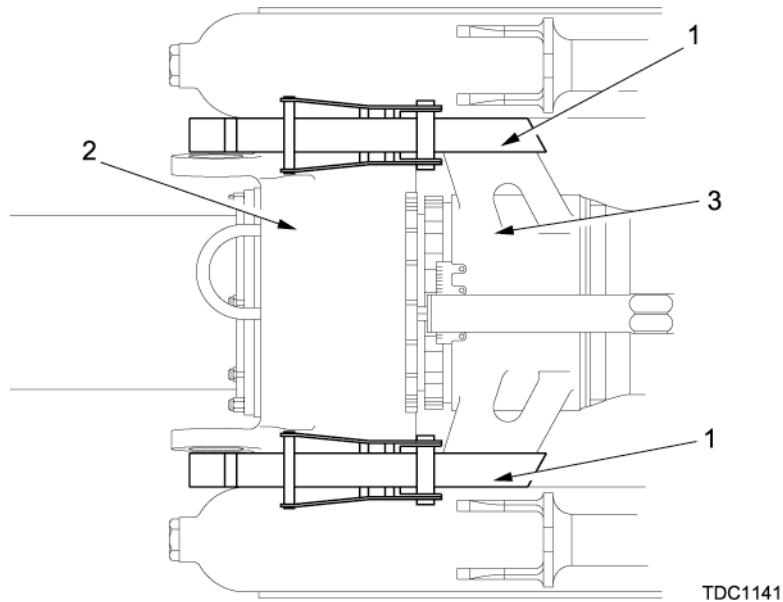
Safety strap assembly can be installed from either side of cradle front bridge piece and recoil yoke.

- 2 Lay safety strap assembly (1) in position across the bridge piece (2) and recoil yoke (3). Ensure webbing is not twisted.

CAUTION

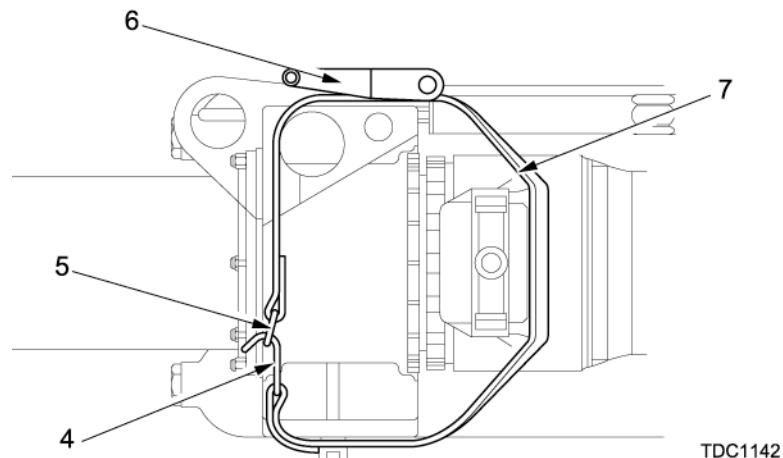
When installing safety strap assembly, ensure strap does not snag on airlines or any other equipment. Failure to do so may cause damage to equipment.

- 3 Install safety strap assembly (1) by wrapping strap around the front bridge piece (2) and recoil yoke (3). Ensure strap does not snag on airlines or any other equipment.



TDC1141

- 4 Connect hook (4) with eye (5) and adjust ratchet (6) until strap (7) is tensioned.



TDC1142

3-11 BOTTOM CARRIAGE MAINTENANCE

a. Wheel Assembly Maintenance

REMOVAL

- 1 Apply handbrake on both wheels.

WARNING

TWO PERSONNEL MUST BE USED WHEN LIFTING WHEEL AND TIRE ASSEMBLY. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL.

- 2 Using wooden support (1), (or other expedient material), place onto hydrostrut (2). Raise wheel arm assembly (3), until support is secure between hydrostrut and arm assembly.

3-11 BOTTOM CARRIAGE MAINTENANCE (cont)

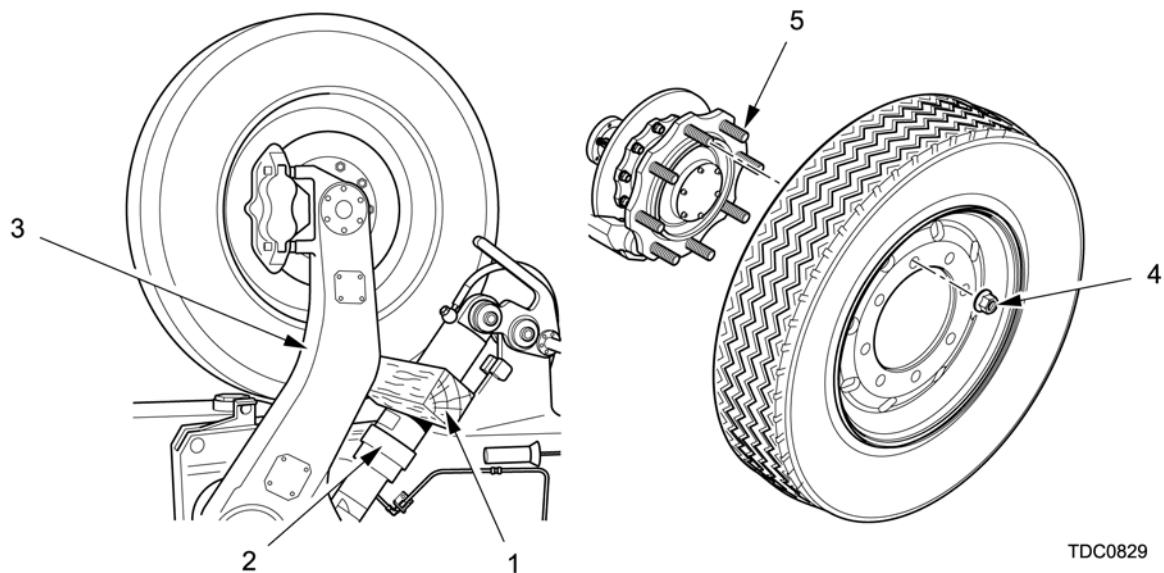
a. Wheel Assembly Maintenance (cont)

REMOVAL (cont)

WARNING

TWO PERSONNEL MUST BE USED WHEN LIFTING WHEEL AND TIRE ASSEMBLY. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL.

- 3 Using 33 mm socket and $\frac{3}{4}$ in. ratchet, remove 8 wheel nuts (4) from wheel studs (5) and remove wheel and tire assembly.



SERVICE AND INSPECTION

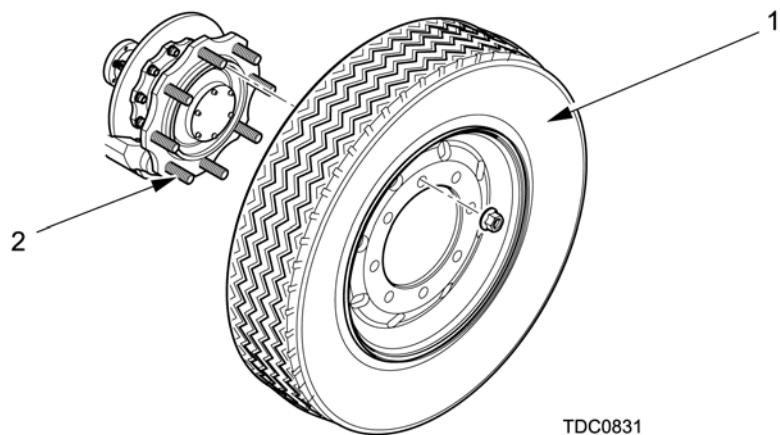
- 1 Using clean wiping rag (item 30, appx D) and CLP (item 7, appx D), clean all components.
- 2 Inspect all components for wear and damage. Replace as necessary.

INSTALLATION

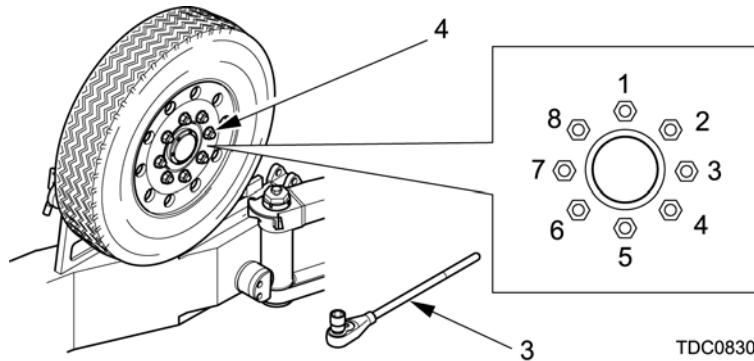
WARNING

TWO PERSONNEL MUST BE USED WHEN LIFTING WHEEL AND TIRE ASSEMBLY. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL.

- 1 Install wheel and tire assembly (1) onto studs (2).



- 2 Using 33 mm socket and $\frac{3}{4}$ in. ratchet (3), tighten lugnuts (4) as tight as possible in a crisscross pattern; i.e., 1 and 5, 7 and 3, 8 and 4, 6 and 2.



WARNING

TWO PERSONNEL MUST BE USED WHEN LIFTING WHEEL AND TIRE ASSEMBLY. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL.

- 3 Lower wheel arm to the ground and remove wooden support.

NOTE

Notify unit maintenance as soon as possible to torque lugnuts.

b. Tire Assembly Maintenance (USMC Only)

REMOVAL

WARNING

TWO PERSONNEL MUST BE USED WHEN LIFTING WHEEL AND TIRE ASSEMBLY. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL.

- 1 Place wheel (1) and tire (2) on a flat surface and remove valve dust cap (3). Using valve core tool, fully deflate tire by opening valve core (4). Turn wheel over to allow work on the back of wheel.
- 2 Using bead breaker, unseat back tire bead (5) from rim of wheel (1).

3-11 BOTTOM CARRIAGE MAINTENANCE (cont)

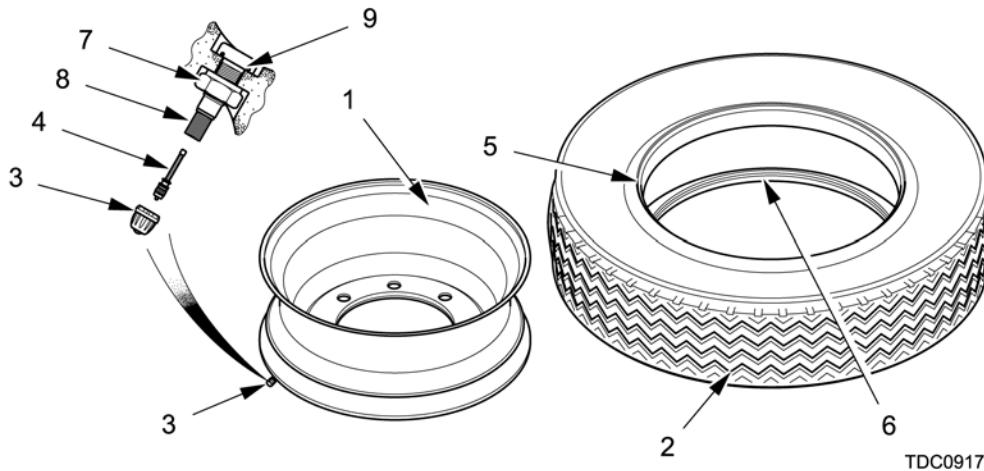
c. Tire Assembly Maintenance (USMC Only)

REMOVAL (cont)

NOTE

Apply soapy water to rim/bead of the tire to aid removal.

- 3 Turn wheel (1) and tire (2) over to allow work on the front side of wheel. Using the bead breaker, unseat the front tire bead (6) from wheel rim (1).
- 4 Using tire irons, lever front tire bead (6) over the back rim of wheel (1). Using tire irons lever back tire bead (5) over the back rim of wheel (1). Discard tire (2).
- 5 Using a 16 mm socket and $\frac{1}{2}$ in. ratchet, remove valve body locknut (7).
- 6 Using a softheaded hammer, remove valve body (8) together with seal (9) and valve core (4) from wheel (1). Discard seal and valve core.



SERVICE AND INSPECTION

- 1 Remove all traces of old tire from wheel.
- 2 Using clean wiping rag (item 30, appx D) and CLP (item 7, appx D), clean all components.
- 3 Inspect all wheel components for wear and damage. Replace as necessary.

INSTALLATION

WARNING

TWO PERSONNEL MUST BE USED WHEN LIFTING WHEEL AND TIRE ASSEMBLY. FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL.

- 1 Install valve body (1) and new seal (2) ensuring it is correctly seated within the wheel rim (3). Do not insert the valve core (4) at this stage.
- 2 Using a 16 mm socket and $\frac{1}{2}$ in. ratchet, install the valve body locknut (5).

NOTE

Apply water to rim/bead of the tire to aid installation.

- 3 Using tire irons, install new tire (6) onto rim of wheel (3), start with the tire bead in central well of wheel to allow opposite part of the bead to be stretched over the rim. Lubricate tire beads (7) with water.

WARNING

DO NOT EXCEED RECOMMENDED TIRE PRESSURE. FAILURE TO DO SO MAY CAUSE SERIOUS INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

- 4 Inflate tire (6) to 100 psi (6.9 bar).
- 5 Using soapy water, check for leaks from tire (6) and seal between tire beads (8) and (7) and rim of wheel (3). Deflate tire.

NOTE

If there is a leak from the tire then replace tire. If there is a leak from the seal between tire beads and the rim then remove tire and check that rim is in a serviceable condition.

- 6 Using the valve core tool, install new valve core (4) into valve body (1).

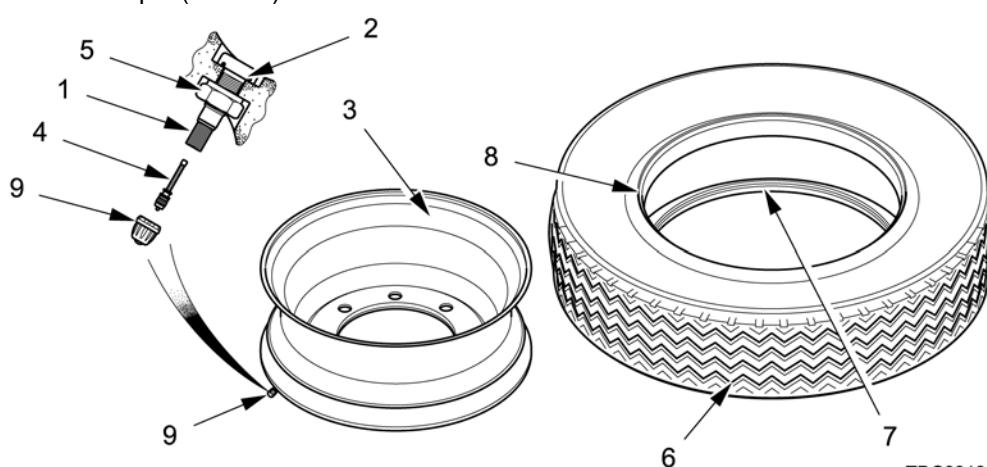
WARNING

DO NOT EXCEED RECOMMENDED TIRE PRESSURE. FAILURE TO DO SO MAY CAUSE SERIOUS INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

- 7 Inflate tire (6) to 100 psi (6.9 bar).
- 8 Using soapy water, check for leaks from valve core (4). Install dust cap (9).

NOTE

If there is a leak from the valve core, deflate tire and replace valve core. Inflate tire to 100 psi (6.9 bar).



Section VI. OPTICAL FIRE CONTROL EQUIPMENT MAINTENANCE PROCEDURES

Section Index

Paragraph		Page
3-12	Optical Fire Control (OFC) Equipment Battery Maintenance Procedures.....	3-120

3-12 OPTICAL FIRE CONTROL (OFC) EQUIPMENT BATTERY MAINTENANCE PROCEDURES



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



TDC0450

REMOVAL

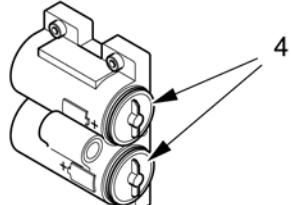
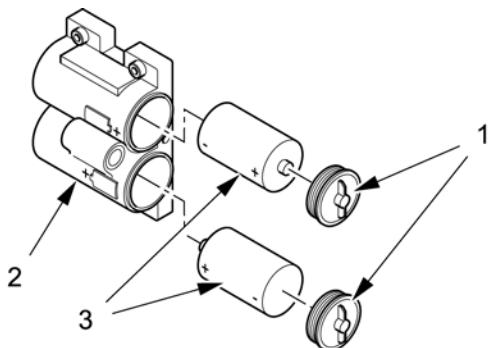
- 1 Check for broken, damaged, or missing parts.
- 2 Check for illumination.
- 3 Repair is by replacement of authorized parts.
- 4 Replace battery if required:
 - (a) Unscrew cap (1) from body (2).
 - (b) Remove batteries (3). If battery will not slide out, reverse battery cap (1) and use embedded magnet (4).

INSTALLATION

CAUTION

Pay careful attention to polarity diagram on battery enclosure. Do not install batteries backwards or severe equipment damage may result.

- 1 Install new batteries making sure battery is inserted properly in accordance with diagram on battery enclosure.
- 2 Install cap (1) and tighten with fingers only.



TDC0587

Section VII. DFCS MAINTENANCE PROCEDURES

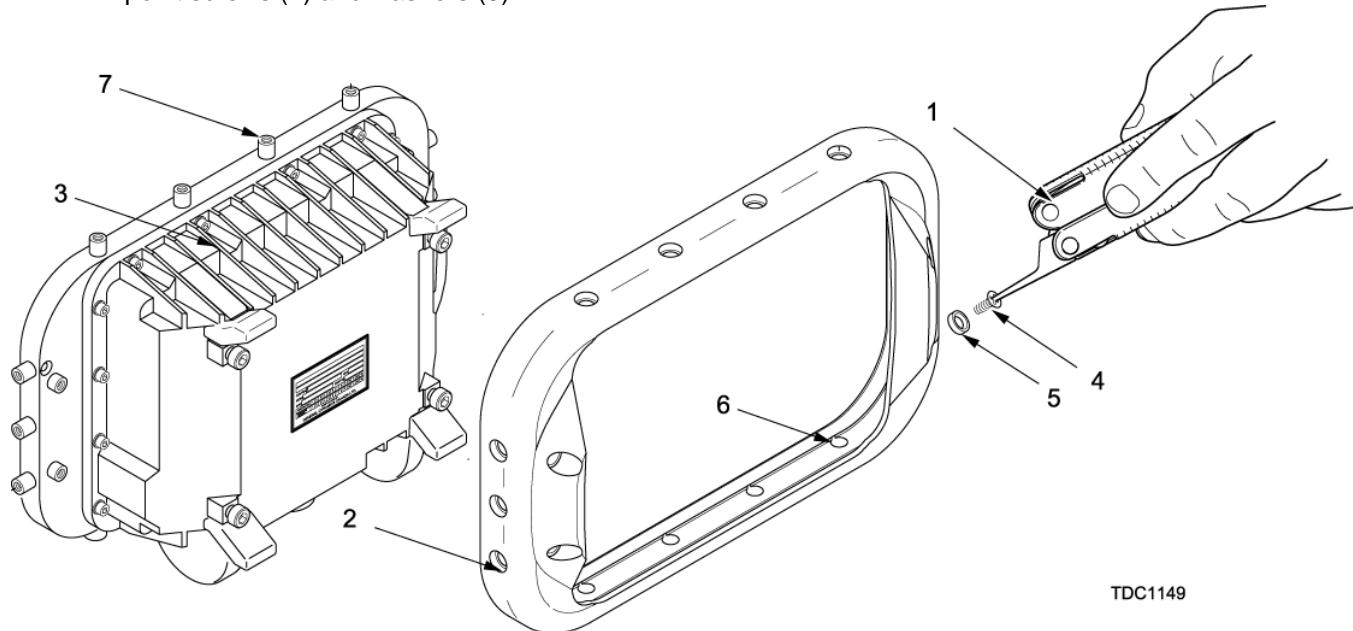
Section Index

Paragraph		Page
3-13	Chief of Section (CSD) Maintenance Procedures.....	3-121

3-13 CHIEF OF SECTION (CSD) MAINTENANCE PROCEDURES

REMOVAL OF CSD RUBBER BUMPER

Using multi-tool cross tip screwdriver (1) remove rubber bumper (2) from CSD (3) by, removing 18 cross point screws (4) and washers (5).



TDC1149

SERVICE AND INSPECTION

CAUTION

Do not clean CSD and/or rubber bumper with CLP, or expose CSD to high water pressure. Damage may occur to equipment.

- 1 Clean display glass with a clean, cheesecloth, (item 12, appx D) and perform external physical inspection of display surface of screen for condition of display glass.
- 2 Gently clean display surface with a clean brush, dusting lens or clean cheesecloth, (item 12, appx D). Apply light pressure to remove dust without scratching display surface.
- 3 Clean exterior surfaces of CSD with a clean cheesecloth, (item 12, appx D) dampened with warm water.
- 4 If display glass is scratched and degrades video image beyond readability, notify unit maintenance.

INSTALLATION OF CSD RUBBER BUMPER

- 1 Install new rubber bumper (2) around CSD (3) and align holes (6) on bumper with CSD sockets (7).
- 2 Using multi-tool cross tip screwdriver (1), install and tighten 18 cross point screws (4) and washers (5) securing rubber bumper (2) to CSD (3).

Section VIII. MAINTENANCE OF AUXILIARY EQUIPMENT

Section Index

Paragraph		Page
3-14	Vehicular Taillight Maintenance.....	3-122

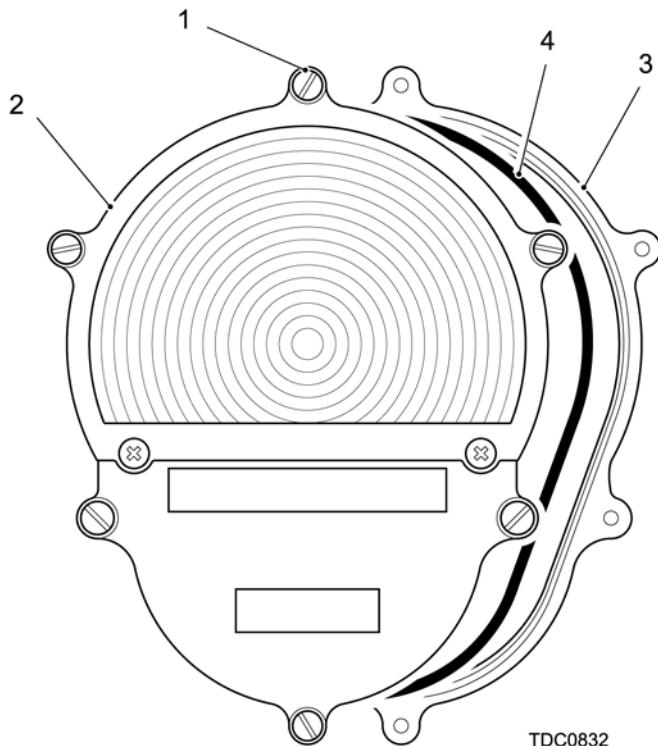
3-14 VEHICULAR TAILLIGHT MAINTENANCE

DISASSEMBLE

NOTE

Screws are retained in the taillight lens cover.

Using multi-tool flat tip screwdriver, loosen six screws (1) sufficiently to remove lens cover (2) from taillight casing (3).



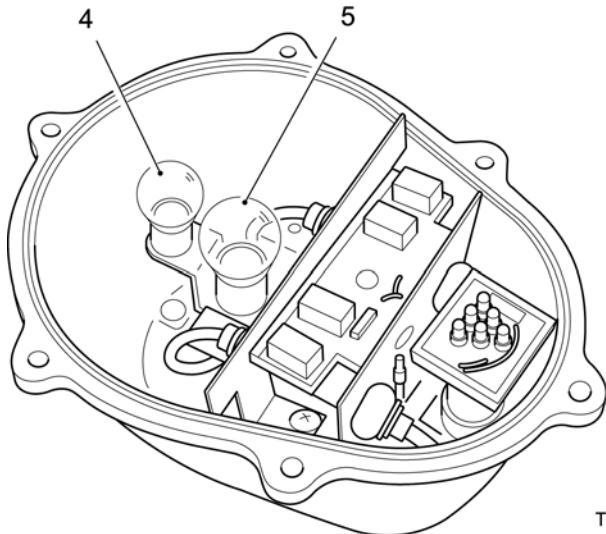
TDC0832

NOTE

The lighting assembly consists of two bulbs. All have bayonet type fixings.

REMOVAL

Remove bulbs (4) and (5) by pressing into socket and rotating CCW.



TDC1070

SERVICE AND INSPECTION

CAUTION

Do not clean taillight lens and cover with CLP, or expose taillight lens and cover to high water pressure. Damage may occur to equipment.

- 1 Check taillight assembly for loose nuts/bolts and missing or damaged parts. If nuts/bolts are loose, missing, or if parts are damaged, notify unit maintenance.
- 2 Clean lens surface with a clean brush, dusting lens or clean cheesecloth, (item 12, appx D). Apply light pressure to remove dust and other particles without scratching lens surface.
- 3 Clean exterior surfaces of lens and cover with a clean cheesecloth, (item 12, appx D) dampened with warm water, and perform external physical inspection of surface of lens.

INSTALLATION

Install two bulbs (4) and (5) into their respective sockets and secure by pressing in and rotating CW until secure.

ASSEMBLE

Assemble lens cover (2) to taillight assembly (3). Using multi-tool flat tip screwdriver, secure with six screws (1).

TEST

Connect taillight assembly to Howitzer. Connect taillight to prime mover and check operation of lights. If lights fail to operate notify unit maintenance.

Section IX. FIRE CONTROL ALIGNMENT TESTS AND MEASUREMENTS

Section Index

Paragraph		Page
3-15	Purpose	3-124
3-16	Frequency.....	3-124
3-17	Test of M1A1 Gunners Quadrant.....	3-124
3-18	Leveling Trunnions	3-138
3-19	Testing M17A1 and M18A1 Fire Control Quadrants	3-139
3-20	Reliability Test of Pantel.....	3-144
3-21	Alignment Test of M171A1 Telescope and Quadrant Mount and Pantel	3-145
3-22	M154 Alignment Device Comparison Test.....	3-147

3-15 PURPOSE

Fire control alignment tests and measurements determine if on-carriage fire control, gunners quadrant, and alignment device, are in correct adjustment. Send equipment that fails these tests to unit maintenance.

3-16 FREQUENCY

Recommended intervals for the following tests are:

- a. Once each year if howitzer is used for nonfiring training.
- b. Once every 3 months if howitzer is fired.
- c. As soon as possible after extensive use.
- d. Following accidents.
- e. After traveling over extremely rough terrain.
- f. When fire control mounts have been replaced.
- g. Whenever the howitzer fires inaccurately for no apparent reason.
- h. After replacement of cannon tube.
- i. After 3rd echelon (DS) maintenance.

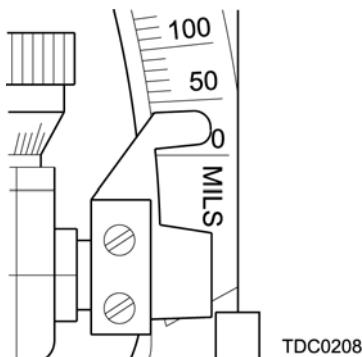
3-17 TEST OF M1A1 GUNNERS QUADRANT

NOTE

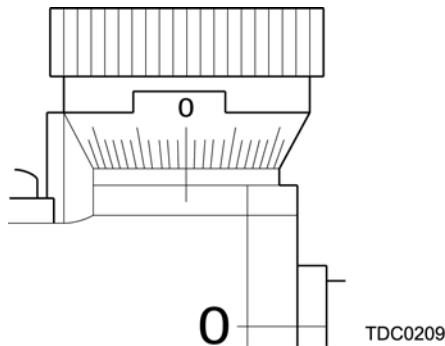
Before testing gunners quadrant inspect quadrant shoes and seats for dirt or defects.

MICROMETER TEST

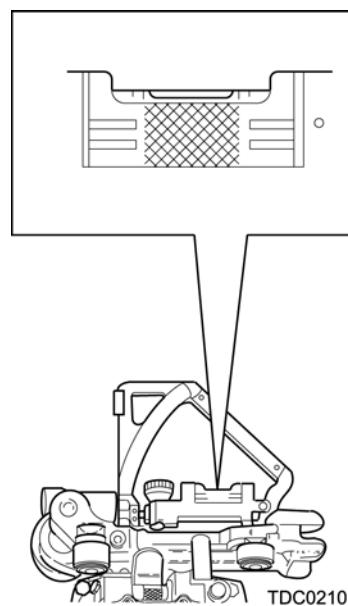
- 1 Set index at +10.



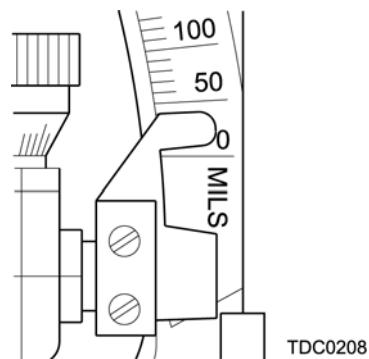
- 2 Zero micrometer.



- 3 Point gunners quadrant to muzzle end of cannon tube and elevate cannon to center bubble.



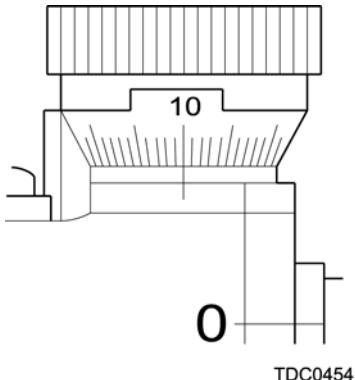
- 4 Set index at 0.



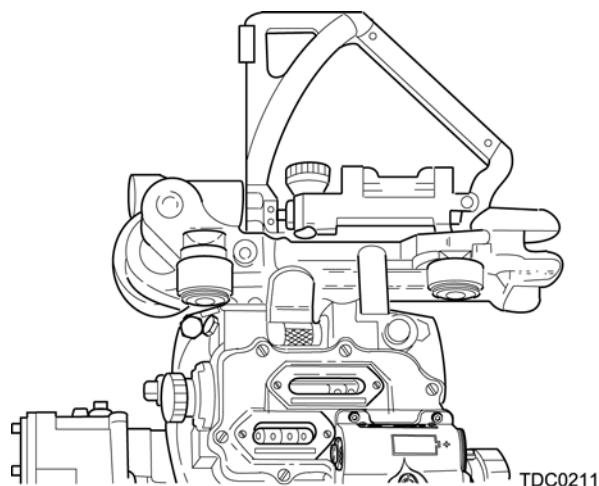
3-17 TEST OF M1A1 GUNNERS QUADRANT (cont)

MICROMETER TEST (cont)

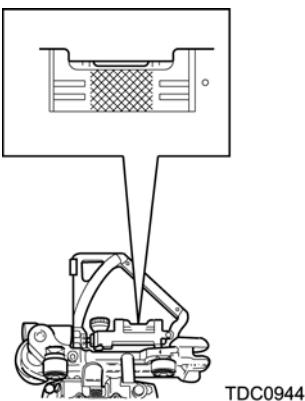
- 5** Set micrometer at 10.



- 6** Point gunners quadrant to muzzle end of cannon tube.



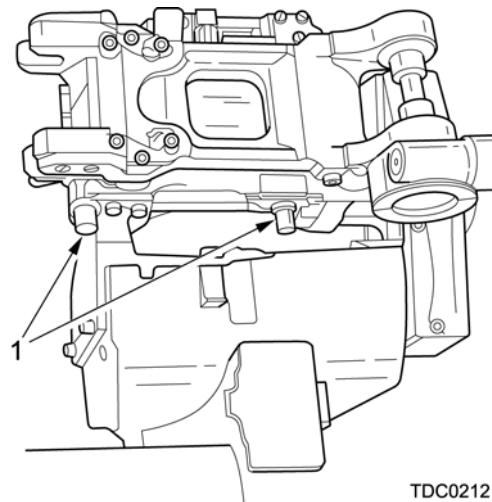
- 7** Bubble should re-center.



- 8** If bubble does not re-center, micrometer is in error. Send gunners quadrant to unit maintenance.

END-FOR-END TEST

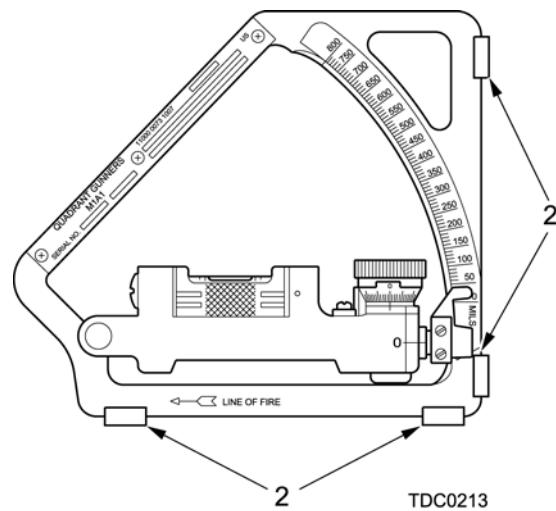
- 1 Inspect elevation quadrant seats (1).



NOTE

Maximum allowance tolerances are ± 0.4 mil.

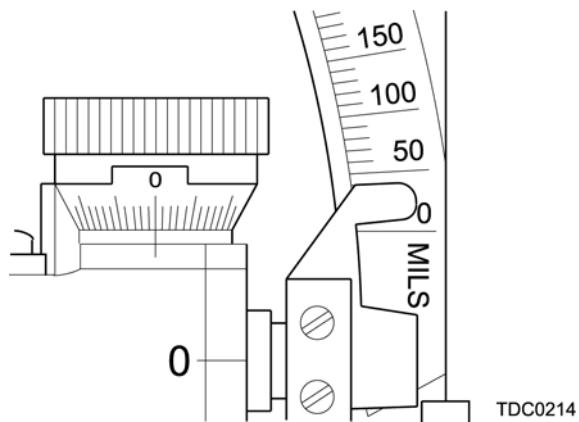
- 2 Inspect gunners quadrant shoes (2).



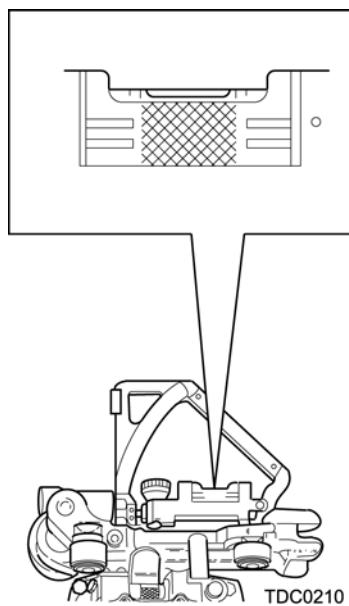
3-17 TEST OF M1A1 GUNNERS QUADRANT (cont)

END-FOR-END TEST (cont)

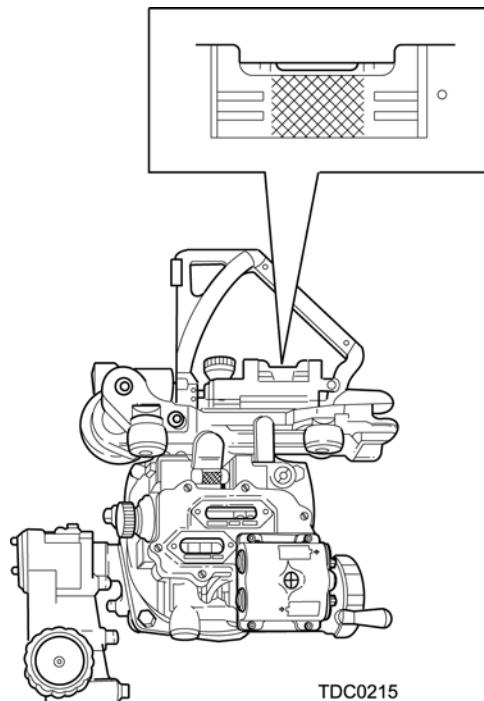
- 3** Zero scales.



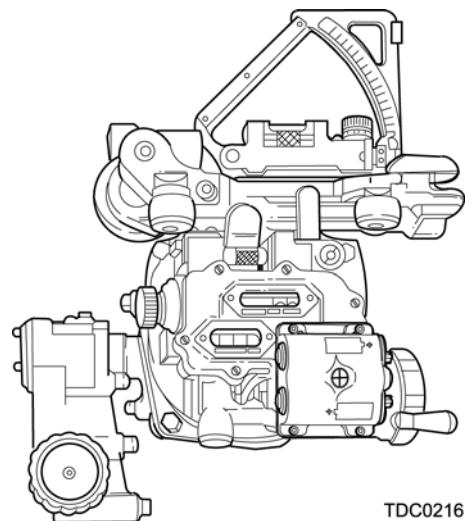
- 4** Point gunners quadrant toward muzzle end of cannon tube.



- 5 Elevate cannon tube to center bubble.



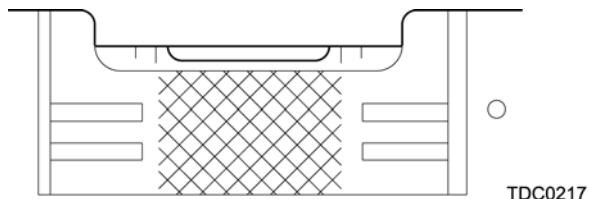
- 6 Reverse direction of gunners quadrant.



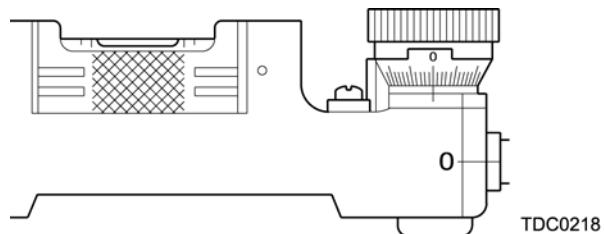
3-17 TEST OF M1A1 GUNNERS QUADRANT (cont)

END-FOR-END TEST (cont)

- 7** If bubble centers, test is complete. If bubble does not center, go to step 8.

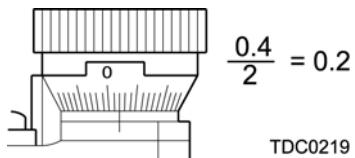


- 8** Center bubble with micrometer knob. If bubble centers, go to step 9. If it does not, go to step 15.



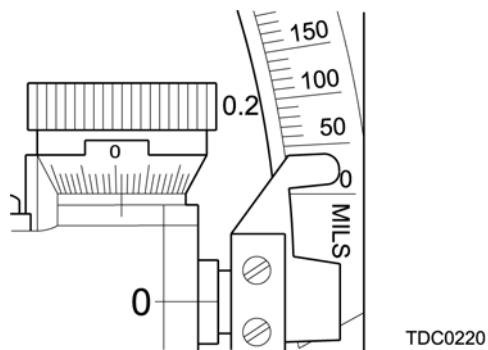
POSITIVE CORRECTION

- 9** Divide micrometer reading by 2.

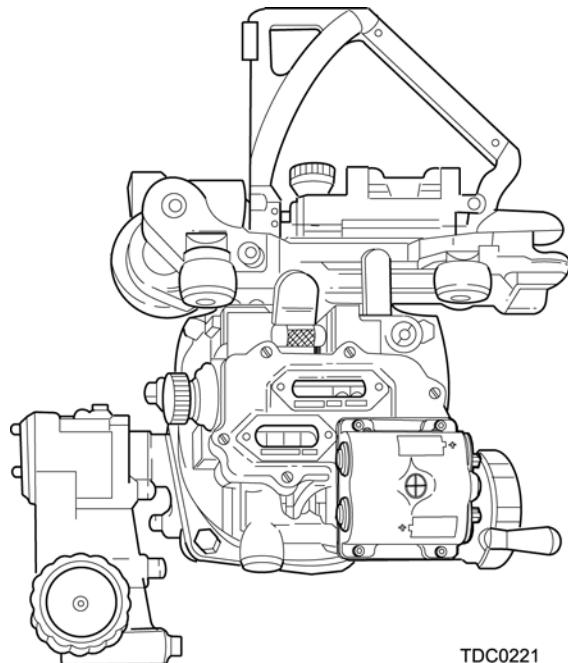


NOTE
Each short line on micrometer scale equals 0.2 mil.

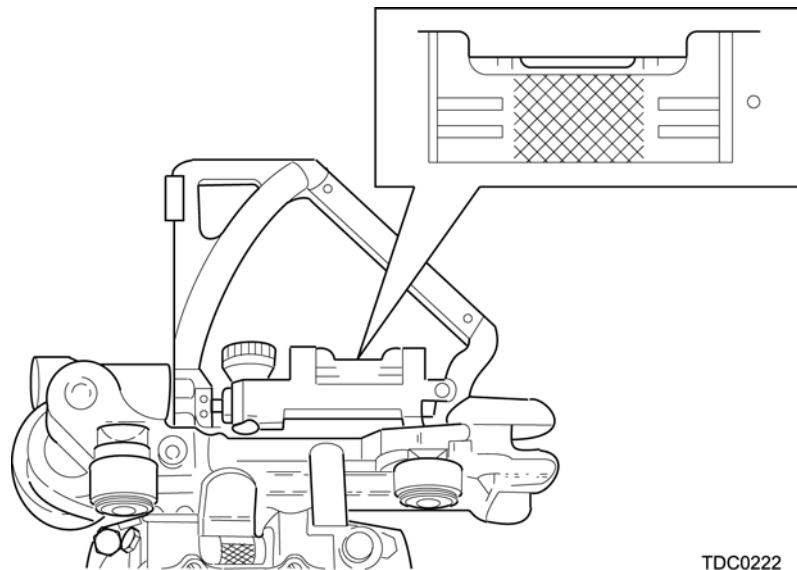
- 10** Put result on micrometer scale.



11 Point gunners quadrant toward muzzle end of cannon tube.



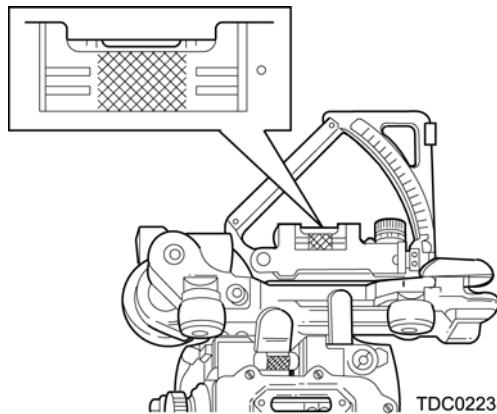
12 Elevate cannon tube to center bubble.



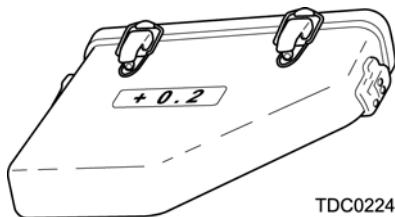
3-17 TEST OF M1A1 GUNNERS QUADRANT (cont)

END-FOR-END TEST (cont)

- 13** Reverse direction of gunners quadrant. Bubble should center.



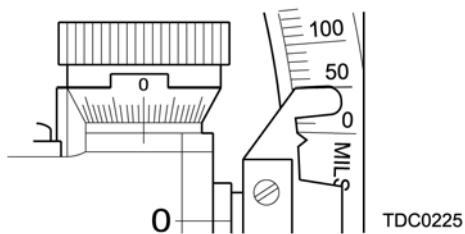
- 14** Record end-for-end correction on carrying case.



NEGATIVE CORRECTION

- 15** Set index at -10.

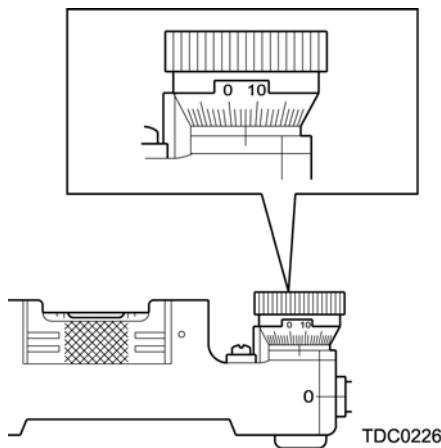
NEGATIVE CORRECTION
(Bubble did not center at step 8.)



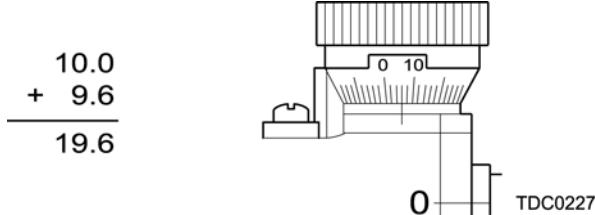
NOTE

If bubble did not center at step 8, the following tests should be made:

16 Center bubble with micrometer knob.



17 Add 10 to micrometer reading.

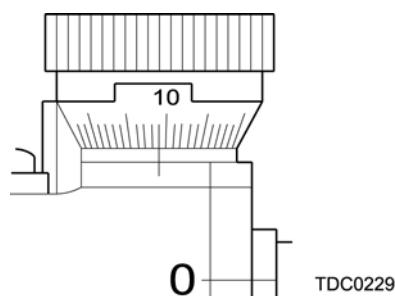


18 Divide sum by 2.

$$\frac{19.6}{2} = 9.8$$

TDC0228

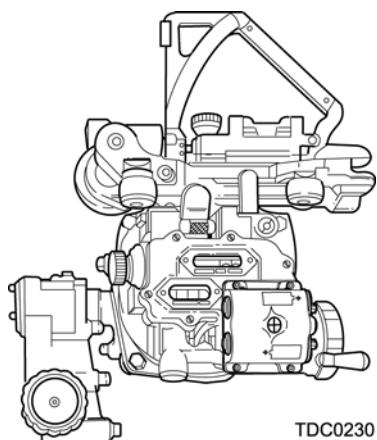
19 Place answer on micrometer scale.



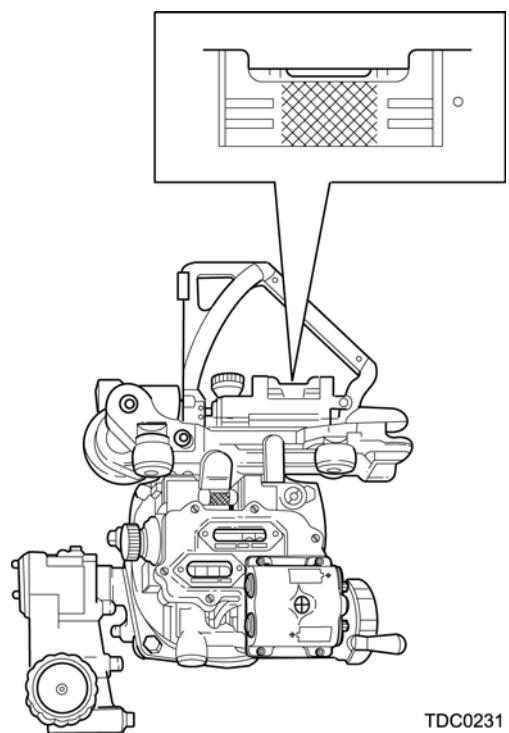
3-17 TEST OF M1A1 GUNNERS QUADRANT (cont)

END-FOR-END TEST (cont)

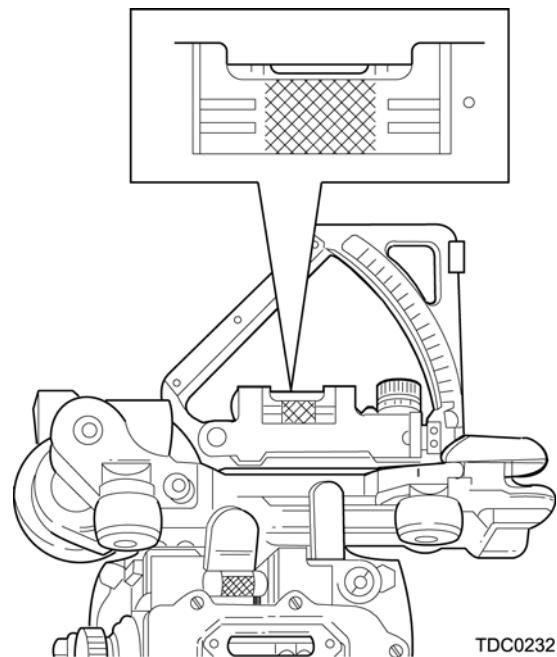
- 20** Point gunners quadrant toward muzzle end of cannon tube.



- 21** Elevate cannon tube to center bubble.



- 22** Reverse direction of gunners quadrant. Bubble should center.

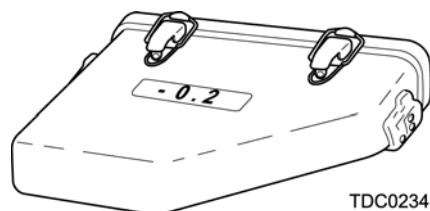


23 Subtract micrometer reading from 10.

$$\begin{array}{r} 10.0 \\ - 9.8 \\ \hline - 0.2 \end{array}$$

TDC0233

24 Record end-for-end correction.



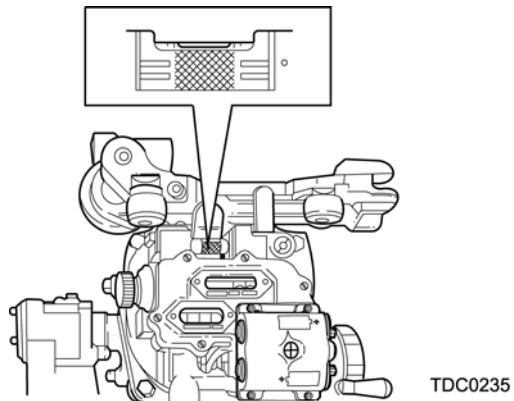
3-17 TEST OF M1A1 GUNNERS QUADRANT (cont)

VERTICAL SHOE TEST

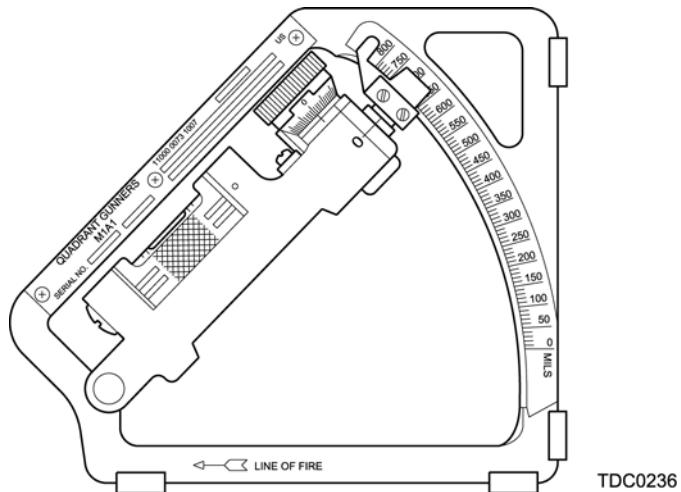
WARNING

MAKE SURE ALL PERSONNEL ARE CLEAR OF CANNON RECOIL PATH.
LOSS OF NITROGEN PRESSURE CAN ALLOW CANNON TO FALL OUT OF
BATTERY.

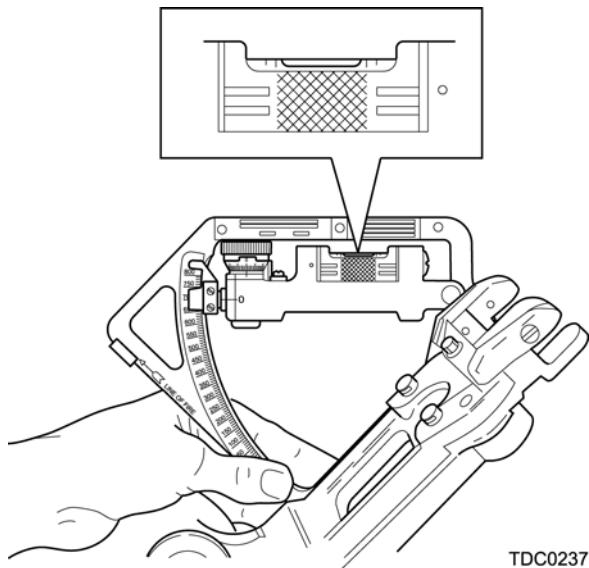
- 1 On high angle 800-1600 mil scale, set M18A1 quadrant to 800 mils, elevate cannon until elevation level bubble is centered, and cross level M18A1 quadrant as required.



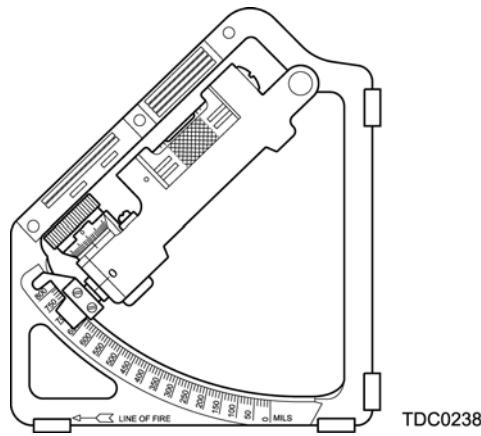
- 2 Set 800 mils on gunners quadrant 0-800 mil coarse scale. If there is a correction factor for the horizontal shoes, set corresponding micrometer scale to correction factor; otherwise, set micrometer scale to 0.



- 3 Set gunners quadrant on M172A1 telescope and quadrant mount quadrant seats, with gunners quadrant LINE OF FIRE arrow toward muzzle end of cannon tube. If gunners quadrant level bubble is not centered, elevate or depress cannon until the bubble is centered.



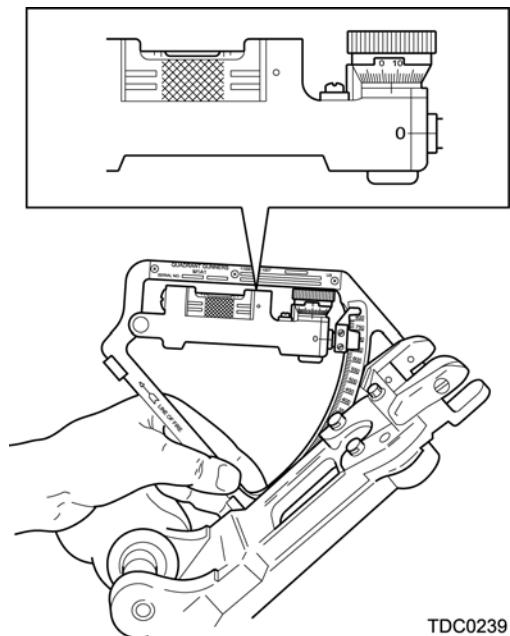
- 4 Remove gunners quadrant from M172A1 telescope and quadrant mount.
- 5 Set 800 mils on gunners quadrant 800-1600 mil coarse scale.



- 6 Place gunners quadrant vertical shoes on M172A1 telescope and quadrant mount quadrant seats, with gunners quadrant LINE-OF-FIRE arrow toward muzzle end of cannon tube.
- 7 Center level bubble on gunners quadrant with micrometer knob. Gunners quadrant should read 800 mils ± 0.4 mil.
- 8 If gunners quadrant reading deviates more than ± 0.4 mil, the gunners quadrant is defective, notify unit maintenance.

3-17 TEST OF M1A1 GUNNERS QUADRANT (cont)

VERTICAL SHOE TEST (cont)



3-18 LEVELING TRUNNIONS

NOTE

When leveling trunnions in the motor pool, it is not necessary to deploy spades.

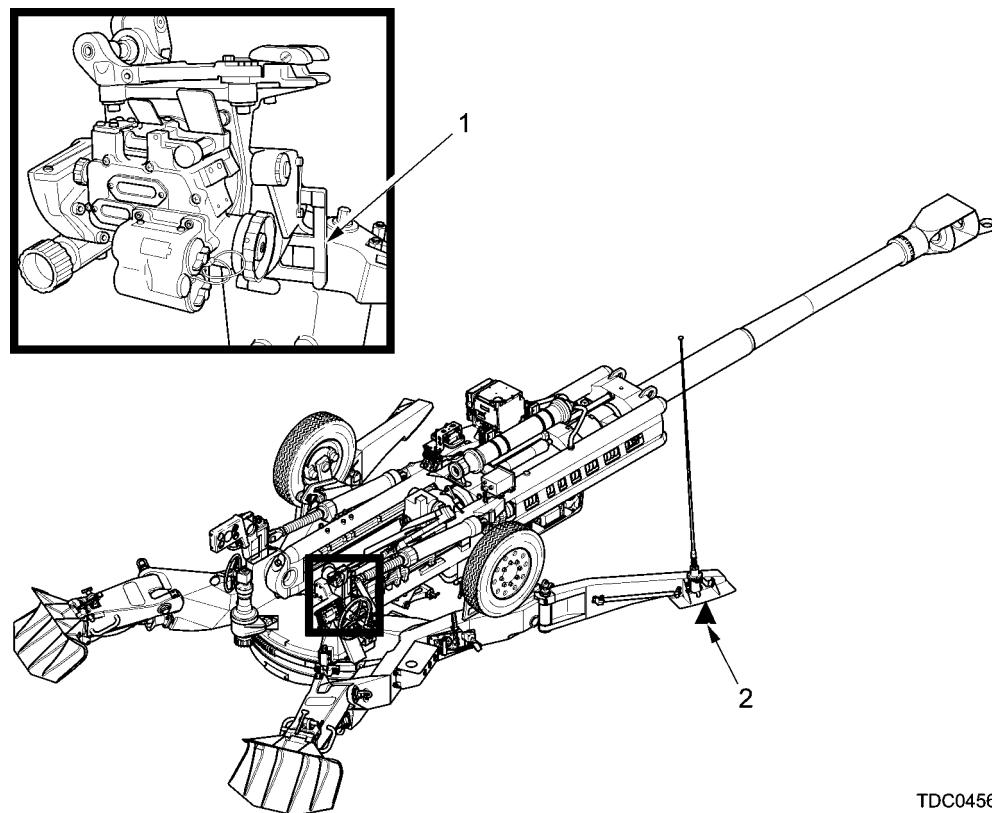
- 1 Emplace howitzer (Para 2-15) on a hard surface, such as concrete or asphalt, if possible; if not, place on solid ground. If spades are deployed, they do not need to be dug in.
- 2 Set cannon tube to zero mils.
- 3 Set a pretested gunners quadrant on the direct side adapter plate (1) with any correction applied. Observe and record position of quadrant bubble.

NOTES

Depending which side the gunners quadrant bubble is displaced (left or right), will determine which side of howitzer to raise. If bubble is displaced right, then raise left side of howitzer and vice versa.

If suspension system fails, use jack mechanical leveling to raise howitzer and insert shims under the stabilizer.

- 4 Using pump handle raise howitzer on whichever side is necessary to center gunners quadrant bubble. Insert maximum possible shims under stabilizer foot (2), using suspension lever, lower howitzer.
- 5 Repeat step 4 until gunners quadrant bubble remains centered. Trunnions are now level.



TDC0456

3-19 TESTING M17A1 AND M18A1 FIRE CONTROL QUADRANTS



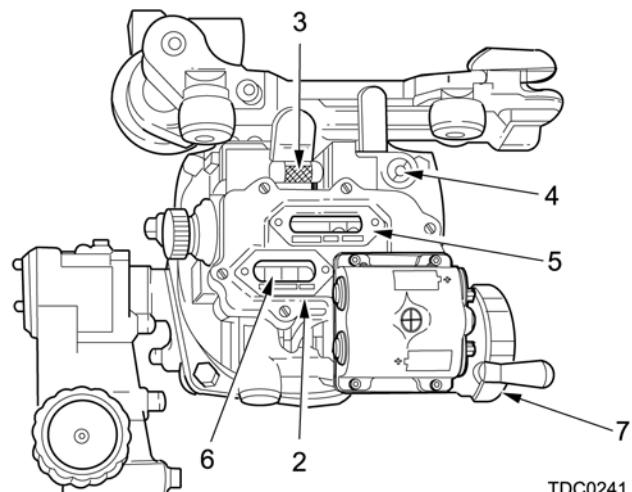
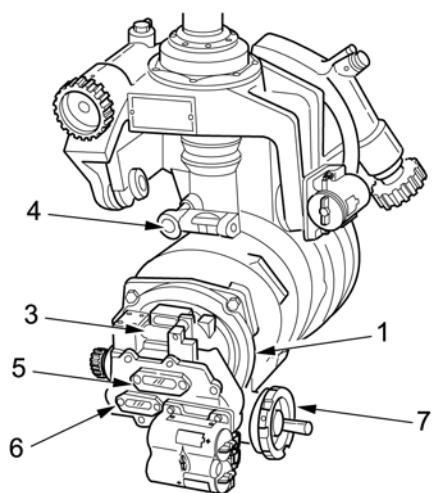
WARNING
Read and follow all warnings in WARNING SUMMARY.
Pay careful attention to those about batteries.



TDC0450

- 1 Before starting, make sure there are no obvious defects on M17A1 fire control quadrant (1) or M18A1 fire control quadrant (2). Check M17A1 and M18A1 fire control quadrants for looseness or wobble in their mounting on the trunnions. Also check the markings on the elevation level vials (3) and cross level vials (4) are legible and are illuminated when battery enclosure switch is turned to ON.
- 2 Emplace howitzer (Para 2-15) on a hard surface, such as concrete or asphalt, if possible. Spades must be in the firing position, but do not need to be dug in. Trunnions must be level.
- 3 Set M17A1 and M18A1 fire control quadrant elevation correction counters (5) to 00, and set elevation counters (6) to 0000. To eliminate backlash, rotate elevation control knob (7) with the last motion in a CW direction.

3-19 TESTING M17A1 AND M18A1 FIRE CONTROL QUADRANTS (cont)

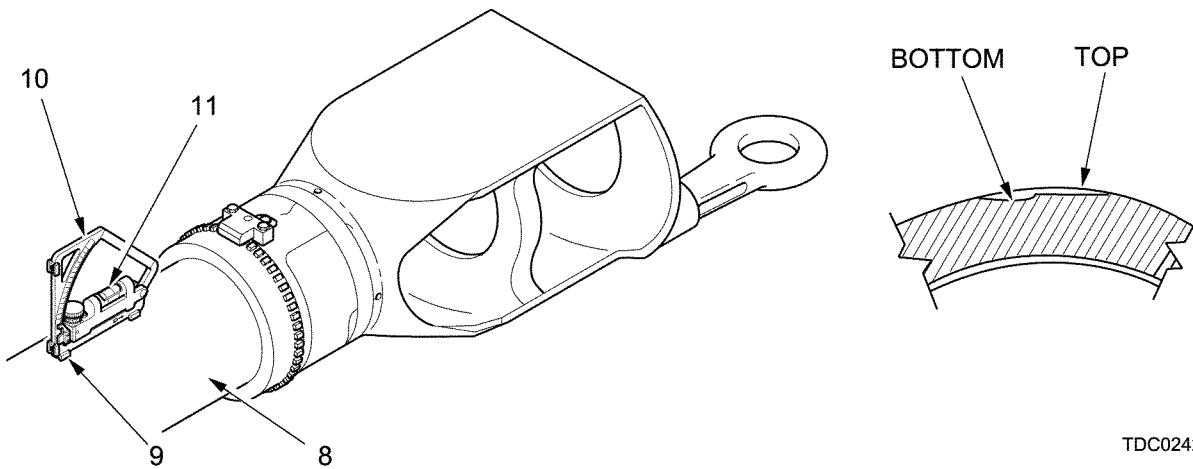


- 4 Depress cannon tube (8) to 0 mils, using M17A1 fire control quadrant (1).
- 5 Ensure cannon tube leveling pads (9) are clean.

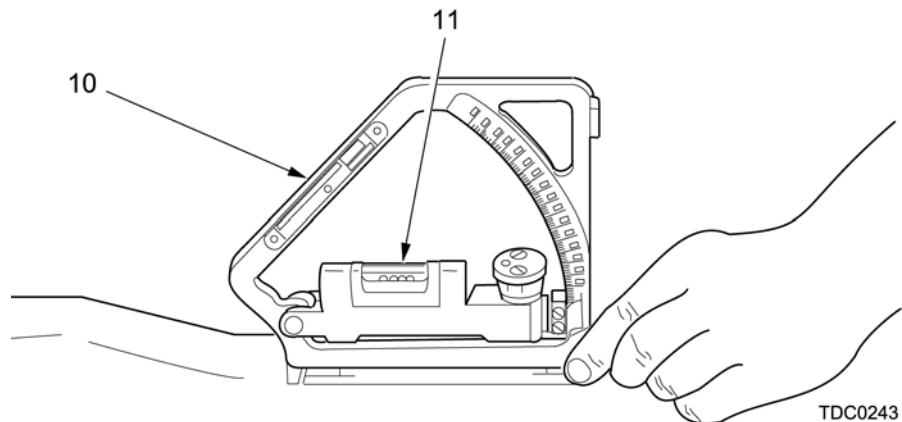
NOTE

Place gunners quadrant on the top surface of the cannon tube leveling pad; use of the bottom surface may lead to erroneous readings.

- 6 Place gunners quadrant (10), with corrections applied, on cannon leveling pads (9), aligning with edge of top surface as shown, with LINE-OF-FIRE arrow pointed toward muzzle end of cannon tube.
- 7 Elevate cannon tube (8) with elevating handwheel until gunners quadrant bubble (11) centers.



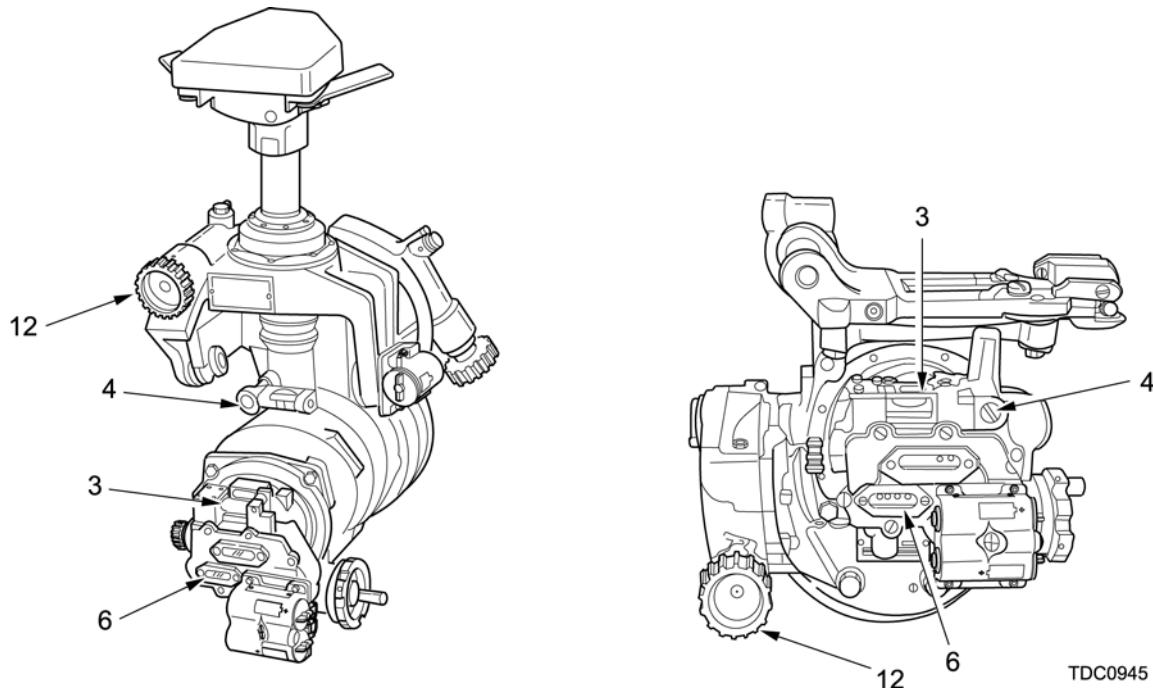
- 8 Rotate gunner's quadrant (10) end-for-end. Gunner's quadrant bubble (11) should re-center. If gunner's quadrant bubble does not re-center, verify gunner's quadrant correction factor and repeat steps 5 thru 7.



NOTE

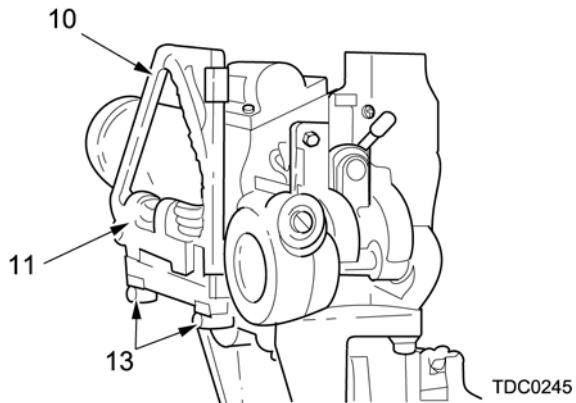
To eliminate backlash during leveling, last motion of pitch/elevation and cross level control knobs will be in a CW direction.

- 9 Level M17A1 and M18A1 fire control quadrants by turning cross level control knobs (12) until cross level vials (4) center. With elevation counters (6) set at 0000, bubbles in elevation level vials (3) should be centered. If bubbles in elevation vials are not centered, either counters, or level vials, are out of adjustment. Notify unit maintenance.



- 10 With bubbles in each elevation level vial and cross level vial still centered, place gunners quadrant (10) on quadrant seats (13) with LINE-OF-FIRE arrow towards the muzzle.
- 11 Center gunners quadrant bubble (11) and record reading. Quadrant seats (13) are out of adjustment if reading changes over 1 mil. Notify unit maintenance.

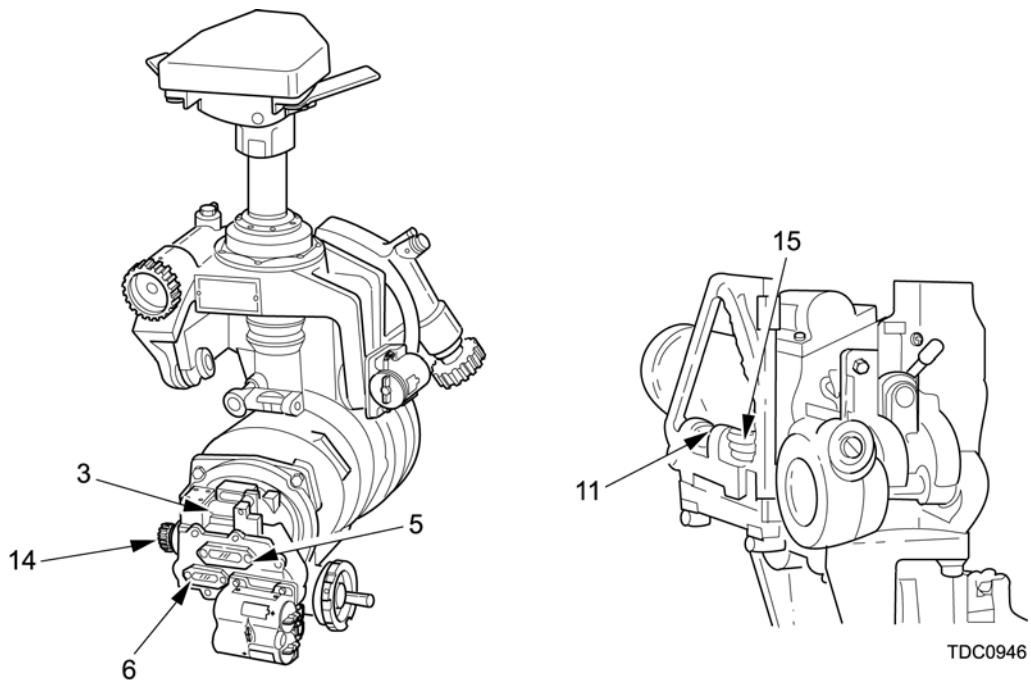
3-19 TESTING M17A1 AND M18A1 FIRE CONTROL QUADRANTS (cont)



NOTE

Do not forget the gunners quadrant correction factor when taking these readings.

- 12 Using elevation correction knobs (14), insert a + 5 mil correction in both elevation correction counters (5). Reading in each elevation counter (6) should now read 9995. Set each elevation counter back to zero. Elevate cannon tube until bubble in elevation level vial (3) of M18A1 fire control quadrant centers. Center gunners quadrant bubble (11). Micrometer (15) should show an increase of 5 mils. When bubble in M18A1 fire control quadrant elevation level vial is centered, bubble in M17A1 fire control quadrant elevation level vial (3) should center ± 1 graduation.



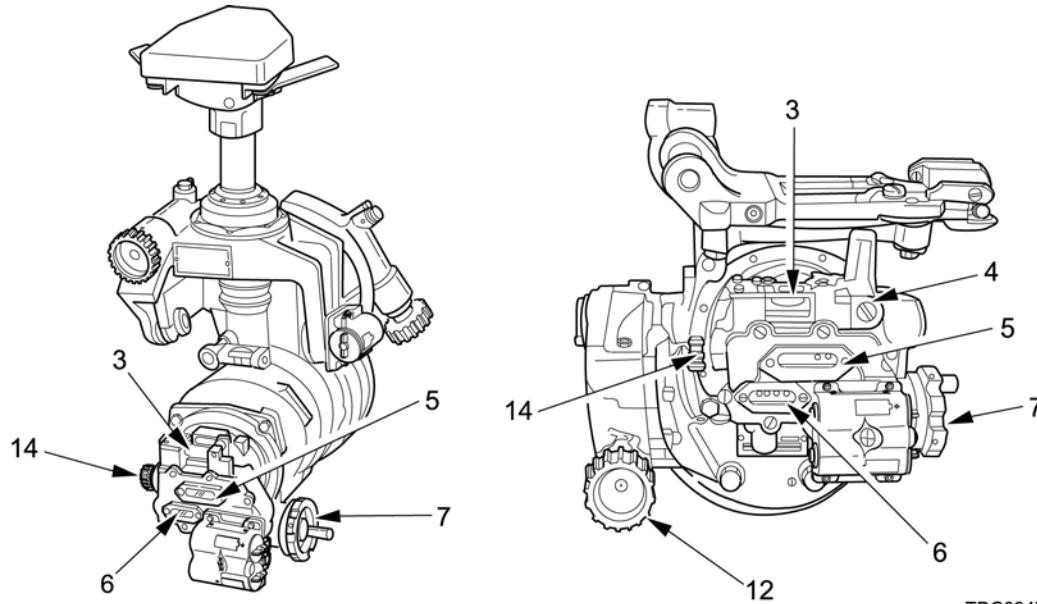
- 13 Set elevation counter (6) and elevation correction counter (5) on each fire control quadrant back to zero.

- 14 Insert corrections 10 mils at a time, up to 50 mils, on each elevation correction counter (5) and observe the following:
 - (a) Reading in each elevation counter (6) should have decreased by the amount of correction applied within ± 0.5 mil.
 - (b) Bubble in each elevation level vial (3) should still be centered. If either M17A1 or M18A1 fire control quadrant does not perform properly, it is defective. Notify unit maintenance.
- 15 Return each elevation correction counter (5) to zero, using elevation correction knobs (14).
- 16 Set 400 mils on each elevation counter (6), using the elevation control knobs (7).

WARNING

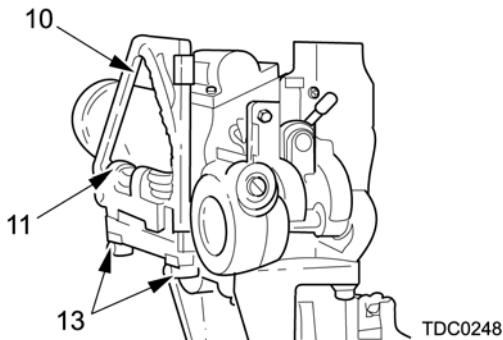
MAKE SURE ALL PERSONNEL ARE CLEAR OF CANNON RECOIL PATH.
LOSS OF NITROGEN PRESSURE CAN ALLOW CANNON TO FALL OUT OF
BATTERY.

- 17 Using elevating handwheel, elevate cannon tube to center bubble in elevation level vial (3) on M18A1 fire control quadrant. Center bubble in cross level vial (4) using cross level control knob (12). When bubble in M18A1 fire control quadrant elevation level vial is centered, bubble in M17A1 fire control quadrant elevation level vial (3) should center within ± 1 graduation.



- 18 Place 400 mils \pm any correction factor on gunners quadrant (10). Set gunners quadrant with LINE-OF-FIRE arrow towards muzzle on quadrant seats (13). Gunners quadrant bubble (11) should center within ± 1 mil. If not, M18A1 fire control quadrant is defective. Notify unit maintenance.
- 19 Repeat steps 15 thru 17 at 900 mils. M17A1 and M18A1 fire control quadrant tests are now completed.

3-19 TESTING M17A1 AND M18A1 FIRE CONTROL QUADRANTS (cont)



3-20 RELIABILITY TEST OF PANTEL



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



TDC0450

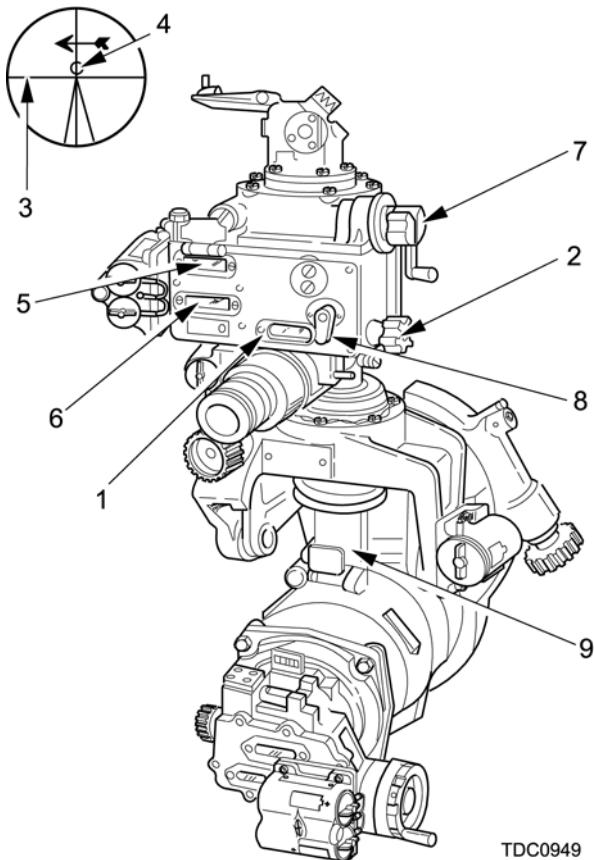
- 1 Turn M17A1 fire control quadrant and Pantel battery enclosure switches to ON.
- 2 Level cannon tube using M17A1 fire control quadrant. Set Pantel correction counter (1) to zero using gunners aid knob (2).
- 3 Level M17A1 telescope and quadrant mount (9).
- 4 Sighting through Pantel, align crosshairs (3) on a sharply defined aiming point (4) at least 50 to 100 meters away (if less than 50 meters distance, use parallax shield.). Be careful not to move crosshairs. Record reading from azimuth counter (5) and deflection counter (6).

NOTE

To eliminate backlash by making last movement of Pantel head from left to right

- 5 Using azimuth knob (7), rotate Pantel head through two complete CW revolutions, and re-align crosshairs on aiming point. Record readings from azimuth counter (5) and deflection counter (6). Be sure last motion is from left to right.
- 6 Compare azimuth and deflection counter readings obtained in steps (3) and (4). If difference between counter readings is greater than 1 mil, Pantel is defective. Notify unit maintenance.
- 7 Repeat steps (4) and (5) by rotating Pantel head CCW. Be sure last motion is from right to left.
- 8 Using gunners aid knob (2), insert corrections 1 mil at a time, up to 50 mils, on correction counter (1) and observe the following:
 - (a) Crosshairs (3) should not move from aiming point (4).
 - (b) Reading on azimuth counter (5) should not change.
 - (c) Reading from the deflection counter (6) should change by the amount of correction applied.
- 9 Repeat step (8), applying corrections in opposite direction. If Pantel does not perform as stated in step (8), it is defective. Notify unit maintenance.
- 10 Disengage deflection clutch (8). Turn azimuth knob (7). Deflection counter (6) should not move.

- 11 Engage deflection clutch (8).



3-21 ALIGNMENT TEST OF M171A1 TELESCOPE AND QUADRANT MOUNT AND PANTEL



WARNING

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



TDC0450

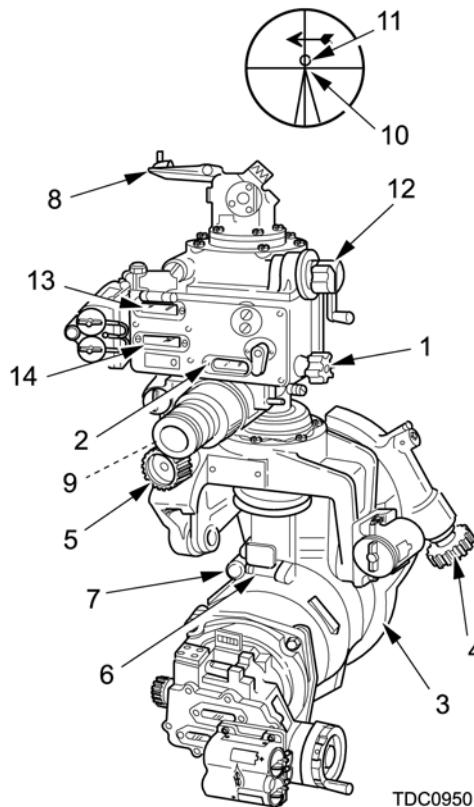
- 1 Turn M18A1 fire control quadrant and Pantel battery enclosure switches to ON.
 - 2 Elevate cannon tube to 0 mils using M18A1 fire control quadrant.
- NOTE**
Do not disturb traverse or move howitzer for any reason when conducting this test.
- 3 Use correction knob (1) to set correction counter (2) on Pantel to zero.
 - 4 Carefully level M171A1 telescope and quadrant mount (3) by turning pitch level control knob (4) and cross level control knob (5), until bubbles in pitch level vial (6) and cross level vial (7) center.
 - 5 Select an aiming point as far away as possible, to left side of howitzer, so that it will be visible during steps 6, 8, and 11.

3-21 ALIGNMENT TEST OF M171A1 TELESCOPE AND QUADRANT MOUNT AND PANTEL (cont)

NOTE

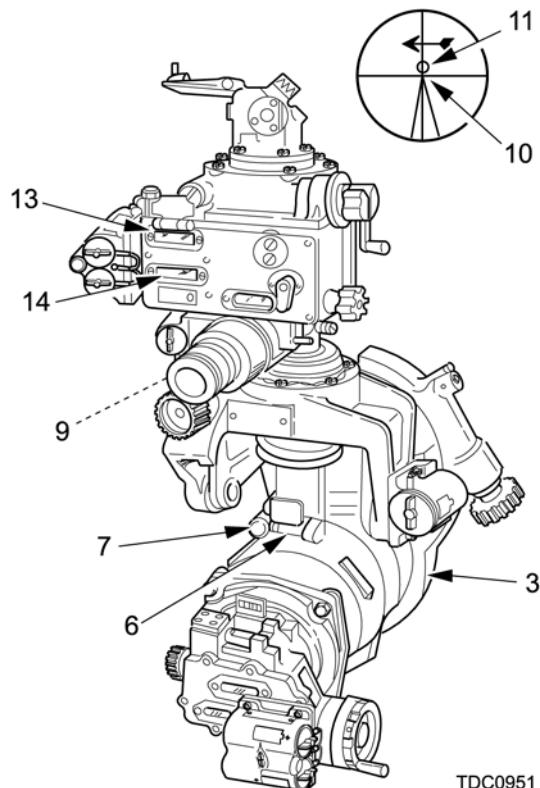
To eliminate backlash by making last movement of Pantel head from left to right

- 6 Close parallax shield (8) and, with bubbles in pitch level vial (6) and cross level vial (7) still centered, sight through eyepiece (9) and align telescope crosshairs (10) on a sharply defined aiming point (11), by turning azimuth knob (12). Record readings from azimuth counter (13) and deflection counter (14).



- 7 Slowly elevate cannon tube to 400 mils, and re-center bubbles in pitch level vial (6) and cross level vial (7) on M171A1 telescope and quadrant mount (3).
- 8 Sighting through eyepiece (9), realign crosshairs (10) on aiming point (11). Record readings from azimuth counter (13) and deflection counter (14).
- 9 Compare readings from azimuth counter (13) and deflection counter (14) recorded in steps 6 and 8. If difference between readings is greater than 1 mil, M171A1 telescope and quadrant mount is defective. Notify unit maintenance.
- 10 Slowly elevate cannon tube to 900 mils and re-center bubbles in pitch level vial (6) and cross level vial (7).
- 11 Sighting through eyepiece (9), realign crosshairs (10) on same aiming point (11). Record readings of azimuth counter (13) and deflection counter (14).

- 12 Compare readings of azimuth counter (13) and deflection counter (14) recorded in steps 6 and 11. If difference between counter readings is greater than 3 mils at 401 to 900 mils elevation, M171A1 telescope and quadrant mount is defective. Notify unit maintenance.



3-22 M154 ALIGNMENT DEVICE COMPARISON TEST



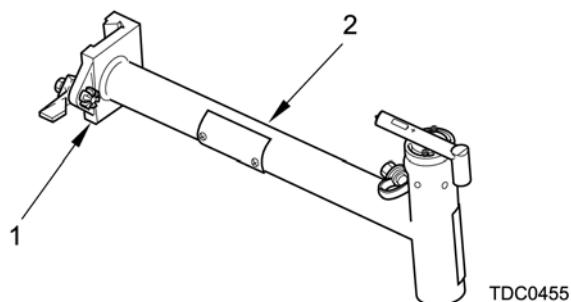
WARNING

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



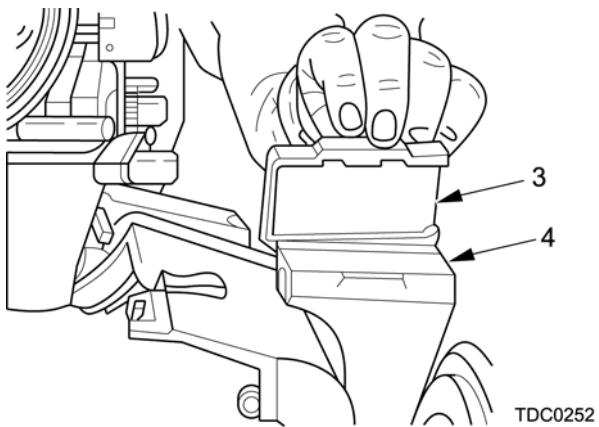
TDC0450

- 1 Get two additional M154 alignment devices from other howitzer sections. Install batteries.
- 2 Inspect mating surfaces (1) of M154 alignment device (2) for nicks, burrs, and dirt. If dirty, clean with a clean wiping rag (item 30, appx D). If mating surfaces (1) are burred, notify unit maintenance. If mating surfaces are not burred, continue with test.



3-22 M154 ALIGNMENT DEVICE COMPARISON TEST (cont)

- 3 Remove protective cover (3) from dovetail (4) and check surface as you did for M154 alignment device in step 2. Wipe dovetail clean with a clean wiping rag (item 30, appx D). Notify unit maintenance to remove any nicks or burrs.

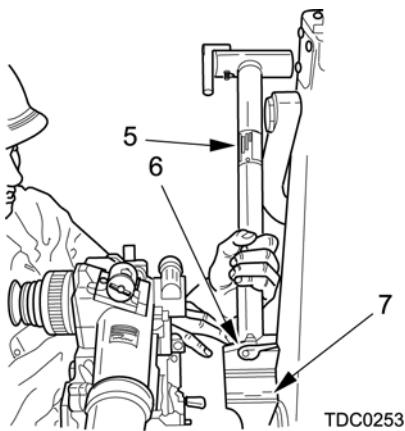


TDC0252

- 4 Turn M18A1 fire control quadrant battery enclosure switch to ON, and level cannon tube using M18A1 fire control quadrant.
- 5 Install M154 alignment device (5) and turn light switch to ON. Make sure mating surface (6) matches with dovetail (7).
- 6 Level M171A1 telescope and quadrant mount.

NOTE

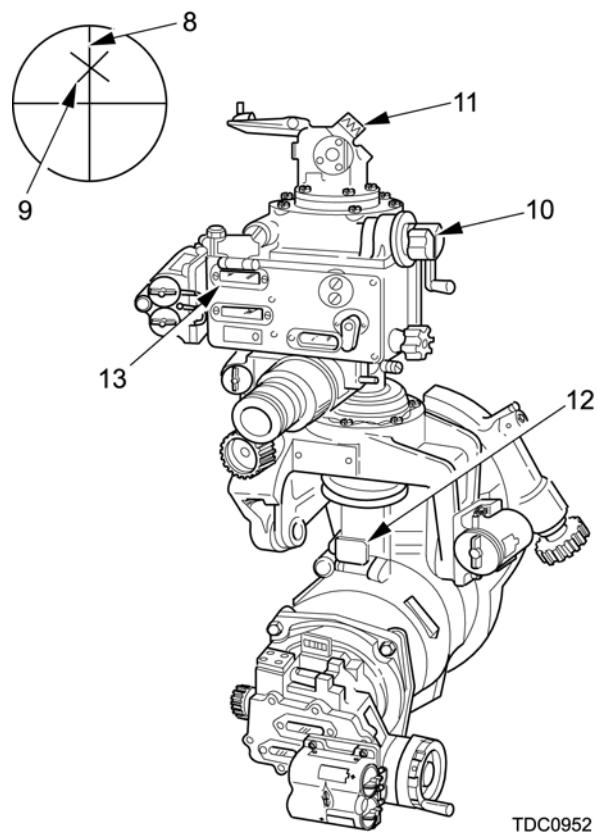
After leveling M171A1 telescope and quadrant mount, be careful not to disturb the pitch level setting.



TDC0253

- 7 Turn Pantel battery enclosure switch to ON and align crosshairs (8) of Pantel with crosshairs (9) of M154 alignment device, by turning azimuth knob (10). Center crosshairs for elevation; turn elevation knob (11). Last movement of azimuth knob should be left to right.

- 8 With Pantel and M154 alignment device crosshairs aligned, bubble centered in pitch level vial (12) of M171A1 telescope and quadrant mount, and cannon tube at zero elevation, record reading of Pantel azimuth counter (13).
- 9 Remove M154 alignment device and install a second M154 alignment device. Make sure dovetail and mating surfaces match. Turn light switch to ON.
- 10 Repeat steps 7 and 8 with a second and third M154 alignment device.
- 11 Compare three azimuth counter readings. If readings from M154 alignment devices fall within ± 0.5 mil of each other, M154 alignment devices are serviceable. Any M154 alignment device exceeds ± 0.5 mil tolerance is defective. SC, boresights Pantel using DAP (Para 2-24). If alignment problem persists, notify unit maintenance.
- 12 Remove and store M154 alignment device.
- 13 M154 alignment device comparison test is complete.



TDC0952

Section X. DFCS USER CONFIDENCE CHECKS

Section Index

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3-26	Verification of Direction Using Aiming Circle and OS/EOL.....	3-152
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3-23 PURPOSE

- a. For M777A1 and M777A2 howitzer, user confidence checks accurate location AND pointing data.
- b. They are quickly executed checks that can be completed as part of preparation for operations in the motor pool, tactical assembly area, forward assembly area, or firing location. They should also be conducted at command discretion if howitzer appears to be firing inaccurately, or data between howitzers is significantly different.

3-24 VERIFICATION OF DIRECTION USING A DISTANT AIMING POINT (DAP)

- a. This is to give the section and leadership confidence that the DFCS is providing accurate aiming data.
- b. This test can be performed at a firing point or fire area. To perform this test, a DAP at least 1500 meters away is required.
 - 1 Traverse cannon tube until ACTL DEFL displays 3200 deflections on CSD (SECTION IN ORDER) screen (this is center of sector or base azimuth).
 - 2 Check boresight of Pantel with M154 alignment device.
 - 3 Select a DAP at least 1500 meters away.
 - 4 Using azimuth knob, align vertical hairline of Pantel on DAP. Level pitch and cross level bubbles and check alignment.
 - 5 Engage deflection knob, set azimuth counter at 3200.
 - 6 Using muzzle and breech boresight discs, align cannon tube on DAP.
 - 7 Level pitch and cross level bubbles on Pantel mount. Using azimuth knob, align vertical hairline of Pantel on DAP. Record Pantel deflection reading from reset counter.

NOTE

Azimuth counter must read 3200.

- 8 Center elevation level vial on M171A1 telescope and quadrant mount. Record M171A1 fire control quadrant reading.
- 9 Read and record ACTL deflection (DEFL) and QE obtained on CSD screen.

- 10 Compare deflections and quadrants obtained in steps 7 thru 9. Tolerance between readings is +/- 2 mils for both deflection and quadrant.
- 11 If DFCS and Pantel agree within tolerance, test is complete.
- 12 If DFCS and Pantel do not agree within tolerance, notify unit maintenance.

3-25 VERIFICATION OF DIRECTION USING AIMING CIRCLE ORIENTED TO GRID AZIMUTH

- a. This procedure provides an independent method of verifying lay and boresight of DFCS when a SCP is not available.
- b. If survey data is not available and hasty survey is not possible, the next best method of orienting the aiming circle is to use the magnetic needle (See FM 6-50, Chapter 4 for orienting the M1A2 aiming circle).
- c. Both DFCS and Pantel can be checked for boresight alignment using M1A2 aiming circle set up using Grid Azimuth method.
- d. This test can be performed at a firing point or fire area.

DFCS Boresight Alignment Check

- 1 Set up M1A2 aiming circle 10 to 15 meters in front of cannon tube (See FM 6-50, Chapter 4 for orienting the M1A2 aiming circle).
- 2 Check boresight of Pantel with M154 alignment device.
- 3 Install muzzle and breech boresight discs.
- 4 Traverse and elevate cannon tube until aiming circle operator can see his reticle, muzzle and breech boresight discs lined up.
- 5 Measure QE by placing gunner's quadrant on the breech seats.
- 6 If azimuth of M1A2 aiming circle and output from CSD is within +/- 2 mils, and QE from gunner's quadrant within +/- 1 mil, DFCS boresight alignment is complete.
- 7 If azimuth is +/- 2 mils or +/- 1 mil in elevation, perform an orderly shutdown of DFCS (Para 2-39d.), then initialize DFCS (Para 2-36) and repeat steps 1 thru 5 two additional times. If azimuth is within 2 mils and 1 mil QE on two consecutive attempts alignment is complete.
- 8 If DFCS boresight alignment check is greater than +/- 2 mils for azimuth and greater than +/- 1 mil for QE, notify unit maintenance.

Pantel Boresight Alignment Verification.

- 1 Ensure steps 1 and 4 above has been performed.
- 2 Using azimuth knob, align vertical hairline of Pantel on M1A2 aiming circle.
- 3 Aiming circle operator resets upper motion to 3200. Realign reticle on muzzle and breech boresight discs using lower motion.
- 4 If deflection reading from Pantel is 2 mils greater, reading from the aiming circle, Pantel is out of tolerance and FCAT must be performed.

3-26 VERIFICATION OF DIRECTION USING AN AIMING CIRCLE OS/EOL

- a. This procedure provides an independent method of verifying lay and boresight of DFCS. It requires access to an M1A2 aiming circle and survey data.
- b. If survey data is available, the best method of orienting M1A2 aiming circle is to use the Orienting Angle method. You can check both DFCS and Pantel for boresight alignment using an M1A2 aiming circle set up using the orienting angle method.
- c. This test can be performed at a fire point or fire area.

DFCS Boresight Alignment Check.

- 1 Set up M1A2 aiming circle 10 to 15 meters in front of cannon tube (See FM 6-50, Chapter 4 for orienting the M1A2 aiming circle).
- 2 Check boresight of Pantel with M154 alignment device.
- 3 Install muzzle and breech boresight discs.
- 4 Traverse and elevate cannon tube so aiming circle operator can see his reticle, muzzle and breech boresight discs lined up.
- 5 Measure QE by placing gunner's quadrant on breech seats.
- 6 If azimuth of M1A2 aiming circle and output from CSD is within +/- 2 mils, and QE from gunner's quadrant within +/- 1 mil, DFCS boresight alignment is complete.
- 7 If azimuth is +/- 2 mils or +/- 1 mil in elevation, perform an orderly shutdown of DFCS (Para 2-78d.), initialize DFCS (Para 2-69.) and repeat steps 1 thru 5 two additional times. If azimuth is within 2 mils and 1 mil QE on two consecutive attempts, alignment is complete.
- 8 If DFCS boresight alignment check is greater than +/- 2 mils for azimuth and greater than +/- 1 mil for QE, notify unit maintenance.

Pantel Boresight Alignment Verification.

- 1 Ensure steps 1 and 4 above have been performed.
- 2 Using azimuth knob, align vertical hairline of Pantel on the M1A2 aiming circle.
- 3 Aiming circle operator resets upper motion to 3200. Realign reticle on muzzle and breech boresight discs using lower motion.
- 4 If deflection reading from Pantel is +/- 2 mils reading from the M1A2 aiming circle, Pantel is out of tolerance and FCAT must be performed.

3-27 TESTING THE ACCURACY OF THE DFCS ELEVATION

- a. This procedure provides an independent method of verifying QE of the DFCS. Check DFCS and gunner's quadrant for a match in QE.
- b. Before performing this test, ensure cannon tube is properly equilibrated to prevent tube elevation drift.
- c. This test can be performed at a firing point or fire area.
 - 1 Level the cannon tube using a pretested gunner's quadrant.

- 2 Read and record ACTL QE on CSD screen. Gunners quadrant and ACTL QE displayed on CSD should be +/- 1 mil tolerance. If ACTL QE is outside tolerance, notify unit maintenance.
- 3 Set scale on gunners quadrant to 100 mils (applied gunners quadrant correction).
- 4 Place gunners quadrant on breech seats. Elevate cannon tube until bubble is centered.
- 5 Read and record ACTL QE on CSD screen. Compare reading with gunners quadrant. Readings should agree within +/- 1 mils.
- 6 Repeat steps 4 thru 6, adding 300 mils elevation each time, until maximum elevation is reached. Decrease elevation in 300 mil increments and repeat measurements.
- 7 Compare all differences to tolerance of +/- 1 mils. If reading at any elevation exceeds tolerance, notify unit maintenance.

3-28 VERIFICATION OF WALKOFF USING M172A1 TELESCOPE AND QUADRANT PADS

- a. This test is performed at the same time as the OFC walk off is tested.
- b. As part of OFC checks the howitzer has been set onto level trunnions as measured by gunners quadrant against M172A1 telescope and quadrant mount cant pads.
 - 1 Elevate cannon tube through range 0 to 1275 mils QE.
 - 2 Every 200 mils record INU azimuth on CSD screen.
 - 3 If recorded azimuth is +/- 3 mils from starting (0 mil QE) azimuth the system has failed to meet tolerance, notify unit maintenance.

3-29 VERIFICATION OF POSITION USING SURVEY POINTS

- a. To perform position test, two SCPs about 3-4 km apart are required, with an accuracy of 1:1000 or better.
 - 1 Initialize DFCS (Para 2-36.) with howitzer left wheel within one meter of the 1st SCP. Ensure easting, northing, altitude match data posted on survey marker.
 - 2 Receive a manual move order from the FDC (destination INIT POINT) to 2nd SCP.
 - 3 Move to 2nd SCP without stopping.
 - 4 Upon arrival at 2nd SCP, position howitzer with left wheel within one meter of SCP.
 - 5 With STEER TO screen displayed, read and record DFCS position data under POSN (Easting, northing, altitude) and range to destination (RNG) in the upper right hand corner of screen. Subtract POSN altitude from DESTN altitude.
 - 6 Compare data obtained in step 5 with following tolerances:

3-29 VERIFICATION OF POSITION USING SURVEY POINTS (cont)

- (a) Range 26 meters or less.
 - (b) Altitude difference +/- 26 meters.
- 7 If DFCS data is within tolerance, but POSN easting, northing, and altitude do not match SCP data, conduct a NAV POSN UPDATE.
 - 8 If DFCS data is within tolerance, position test is complete.
 - 9 If DFCS data is out of tolerance verify DESN easting, northing, altitude matches the data on SCP. If they do not match, record SCP data for later use.
 - 10 Press ARRIVED key. Select NAV POSN UPDATE from SETUP and INFORMATION menu to enter the SCP data. Do a NAV POSN UPDATE, press USE ALL key.
 - 11 Receive a manual move order to the 1st SCP.
 - 12 Move to 1st SCP without stopping.
 - 13 Repeat steps 4 thru 6 at the 1st SCP. Record data and note whether DFCS is within tolerance.
 - 14 Press ARRIVED key. Select NAV update from SETUP and INFORMATION menu to enter SCP data. Do a NAV position update, press USE ALL key.

NOTE

If a surveyed azimuth to a DAP will be used for a direction test at the 2nd SCP, manual move order entered should include azimuth to DAP. When entering manual move order, first enter azimuth to DAP as AOF, position howitzer at 2nd SCP with howitzer heading aligned with center of sector, ensure cannon tube is pointing toward DAP.

- 15 Receive a manual move order from FDC to 2nd SCP.
- 16 Move to 2nd SCP without stopping.
- 17 Repeat steps 4 thru 6 at 2nd SCP. Record data and note whether DFCS is out of tolerance.
- 18 If DFCS is out of tolerance two out of three trials, notify unit maintenance.
- 19 If DFCS is in tolerance two out of three trials, press ARRIVED key. Select NAV UPDATE from SETUP and INFORMATION menu, enter 2nd SCP data. Perform NAV POSN UPDATE, press USE ALL key. Proceed to chosen method for testing direction.

CHAPTER 4

AMMUNITION

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Section I. GENERAL INFORMATION

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4-1 GENERAL

a. Ammunition for M776 cannon is the separate loading type. The loading of each complete round into the cannon requires three separate operations: loading the fuzed projectile, the propelling charge, and the primer.

b. These components are shipped separately; therefore, the cannon crew must know how to store, unpack, inspect, prepare, and load each complete round every time the howitzer is fired.

(1) SC supervises the loading and preparation duties performed by Cannoneers.

(2) SC must also see that the Cannoneers and Driver are cross-trained in the specific duties of the care, handling, unpacking, inspection, preparation, and loading of the ammunition components in order to sustain a 24-hour operation or to operate with a reduced crew.

c. It is planned that future ammunition for all new 155mm weapons will be interchangeable. This will enable projectiles and propelling charges of one NATO nation to be fired from the 155mm weapons of all others. Current items of interchangeability are contained in Chapter 5.

WARNING

UNTIL SAFETY AND RELIABILITY TESTING IS COMPLETED, THE USE OF AMMUNITION OTHER THAN PRESCRIBED IN THIS MANUAL IS PROHIBITED.

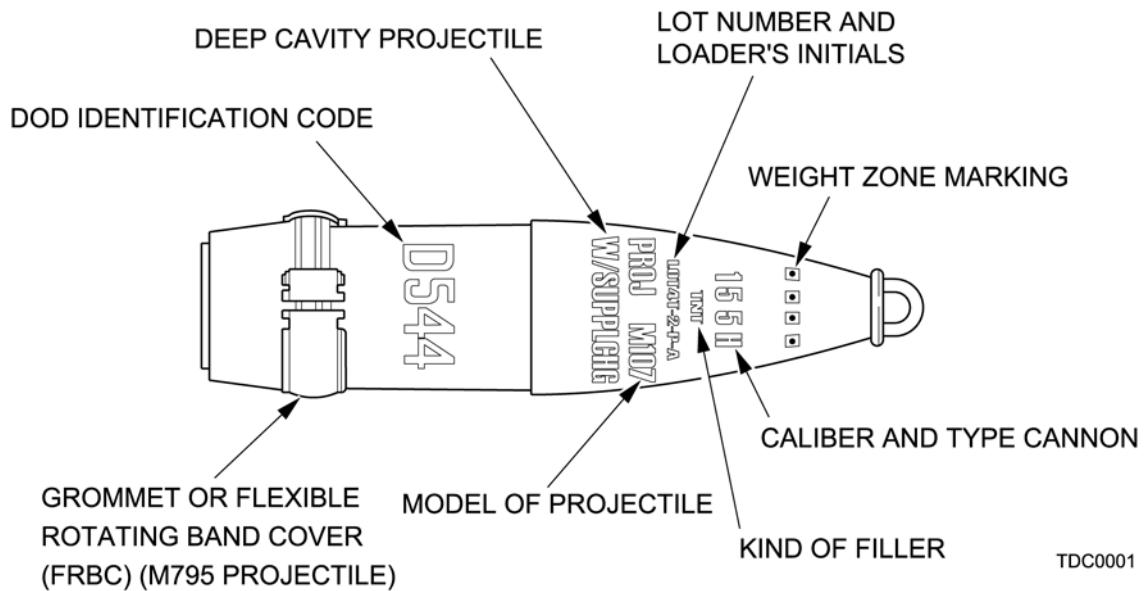
d. Full details of all current 155mm munitions are contained in "155mm ARTILLERY WEAPON SYSTEMS REFERENCE DATA BOOK".

e. Refer to paragraph 4-32 for information on the Loose Projectile Restraint System (LPRS). The LPRS is a divider rack for securing loose unfuzed projectiles for transportation in field artillery companion vehicle.

4-2 IDENTIFICATION

Important information is stenciled on each projectile. New and old projectile colorings and markings are listed on Table 4-1. Knowing the color coding and the meaning of the markings will aid in rapid selection of the required projectile when firing. Know the ammunition!

MARKING OF THE 155-MM HE PROJECTILE



PROJECTILE, 155MM HERA, M549

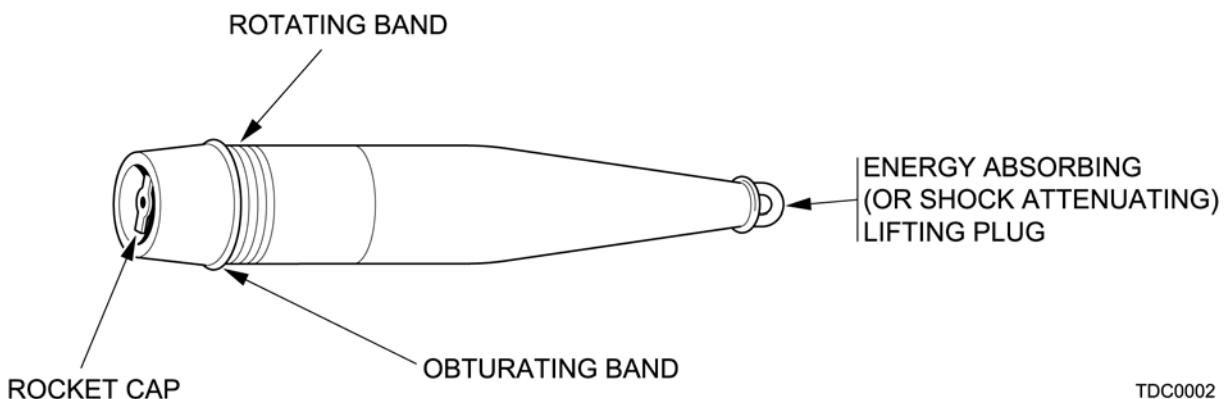


Table 4-1. Model Numbers and Color Coding of Projectiles

Model Number and Type of Projectile	New Manufacture			Old Manufacture		
	Color of Projectile	No./Color of Bands	Marking	Color of Projectile	No./Color of Bands	Marking
M107, HE, comp B and TNT filler w/and w/o suppl charge	Olive Drab	None	Yellow	Olive Drab	None	Yellow
M110, Agent (H, HD), w/burster	Gray	2/Green 1/Yellow ¹	Green	Gray	2/Green	Green
M110A1 M110A2, Smoke (WP)	Light Green	1/Yellow	Red	Gray	1/Yellow	Yellow
M116A1, Smoke BE, (HC)	Light Green	None	Black	Not Applicable		
M449, M449A1, HE, ICM	Olive Drab	Diamonds ²	Yellow	Olive Drab	None	Yellow
M483A1, HE, ICM	Olive Drab	Diamonds ²	Yellow	Not Applicable		
M485A1, M485A2, illuminating	Olive Drab	1/White	White	Olive Drab	None	White
M549, M549A1, HERA	Olive Drab	None	Yellow	Not Applicable		
M692, HE (ADAM)	Olive Drab	Triangles ³	(L) Yellow	Not Applicable		
M712, HEAT (Copperhead)	Black (except window area of cone)	None	Yellow	Not Applicable		

¹ Renovated or newly manufactured (post 1976) projectiles will be marked with one green band and, if burstered, one yellow band.

² Row of yellow diamonds between nose and bourrelet of projectile.

³ Yellow triangles between nose and bourrelet of projectile with letters S or L painted inside the triangle.

4-2 IDENTIFICATION (cont)

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

Model Number and Type of Projectile	New Manufacture			Old Manufacture		
	Color of Projectile	No./Color of Bands	Marking	Color of Projectile	No./Color of Bands	Marking
M718/ M718A1, AT (RAAMS)	Olive Drab	Triangles ³	(L) Yellow	Not Applicable		
M731, HE (ADAM)	Olive Drab	Triangles ³	(S) Yellow	Not Applicable		
M741/ M741A1, AT (RAAMS)	Olive Drab	Triangles ³	(S) Yellow	Not Applicable		
M795, HE	Olive Drab	None	Yellow	Not Applicable		
M804, Practice	Blue	1/Brown	White	Not Applicable		
M804A1, Practice	Blue	1/Yellow	White	Not Applicable		
M823, training (Copperhead)	Bronze	None	Black	Not Applicable		
M825, M825A1 Smoke (WP)	Light Green	1/Yellow	Red	Not Applicable		
M864, HE, ICM, DP extended range	Olive Drab	Diamonds ²	Yellow	Not Applicable		
M898, HE (SADARM)						
M982						

²Row of yellow diamonds between nose and bourrelet of projectile.

³Yellow triangles between nose and bourrelet of projectile with letters S or L painted inside the triangle.

4-3 AUTHORIZED PROJECTILES

WARNING

UNAUTHORIZED ASSEMBLY AND USE OF PROJECTILES AND PROPELLING CHARGES ARE EXTREMELY DANGEROUS. MAKE SURE PROJECTILES ARE MARKED 155H (NOT G).

- a. Projectile and fuze combinations for authorized rounds are given in Table 4-2.

Table 4-2. Authorized Projectile and Fuze Combinations

Projectiles	Fuze										
	PD		MT	MTSQ		PROX		ET		MOFA	
MK 399 ⁵ MOD 1	M557/M572	M739 Series	M565	M564	M577 Series	M582 Series	M728 ²	M732 Series	M762 Series	M767 Series	M782
HE, M107 (Deep Cavity)	X	X	X		X		X	P	X	X	X
HE, M107 (Normal Cavity)	X	X	X		X		X		X	X	X
Agent, H, HD, M110		X	X		X		X			X	X
SMOKE, WP, M110 Series		X	X		X		X			X	X
SMOKE, HC, BE, M116A1				X		X			X		
HE, M449 Series				X		X			X		
HE, M483A1						X ¹			X ¹		
Illuminating, M485 Series				X		X			X		
HERA, M549/M549A1 ⁴	X	X	X				X		X ³	X	X

WARNING

THE M728 PROXIMITY FUZE SHALL NOT BE USED WITH M203 SERIES PROPELLING CHARGE. PREMATURE MALFUNCTION COULD RESULT.

¹The M483A1/M864 projectile may be used for self-registration (as a spotting round) by replacing the expulsion charge assembly with a projectile spotting charge added to M577 series or M762 series fuzes.

²The letter P shows compatibility for proximity fuzes that require removal of the supplementary charge to make room for the long intrusion fuze.

³Only the M732A2 fuze may be used for this combination.

⁴M549/M549A1 projectile may break-up upon impact with urban structures and bunkers rendering it an ineffective penetrator of these targets.

⁵Refer to the description of the MK399 MOD 1 fuze in paragraph 4-4b for expected performance against MOUT targets.

4-3 AUTHORIZED PROJECTILES (cont)

Table 4-2. Authorized Projectile and Fuze Combinations (cont)

Projectiles	Fuze										
	PD		MT	MTSQ		PROX		ET		MOFA	
MK 399 MOD 1	M557/M572	M739 Series	M565	M564	M577 Series	M582 Series	M728	M732 Series	M762 Series	M767 Series	M782
HE, M692/M731 (ADAM)					X				X		
AT, M718, M718A1, M741, M741A1 (RAAM)					X				X		
HE, M795	X	X	X			X		X		X	X
PRACTICE, M804		X	X		X		X		X		X
PRACTICE, M804A1		X	X		X		X			X	X
SMOKE, WP, M825/M825A1					X				X		
HE, M864					X ¹				X ¹		
HE, M898 (SADARM)					X ⁶						

WARNING

ONLY THOSE ITEMS LISTED ARE AUTHORIZED. FIRING OF UNAUTHORIZED PROPELLING CHARGE, PROJECTILE, OR FUZE COMBINATIONS CAN RESULT IN CRITICAL MALFUNCTIONS. CHARGE 1 (M3 SERIES GB) WILL NOT BE FIRED IN THE M776 CANNON. CHARGE 2 (GB) MAY BE USED WITH ANY M100 SERIES PROJECTILE, M449, M804, M804A1 AND M485 PROJECTILE; HOWEVER, STICKERS MAY OCCASIONALLY BE ENCOUNTERED. ALL OTHER PROJECTILES, EXCEPT THE M795, USE MINIMUM CHARGE 3 (GB) OR CHARGE 3 (WB). M795 USES MINIMUM CHARGE 3 (GB) OR CHARGE 4 (WB). FIRING BELOW THESE CHARGES MAY RESULT IN STICKERS.

¹The M483A1/M864 projectile may be used for self-registration (as a spotting round) by replacing the expulsion charge assembly with a projectile spotting charge added to M577 series or M762 series fuzes.

⁵Refer to the description of the MK399 MOD 1 fuze in paragraph 4-4b for expected performance against MOUT targets.

⁶Use only M577A1 Fuzes DODIC NAIO, NSN 1390-01-462-0661, Lot #HAT 90M033-011 with Projectile, 155mm: HE M898 (SADARM). M577A1 Fuzes are marked "M898 SADARM Compatible".

b. Authorized projectile and propelling charge combinations are given in Table 4-3:

Table 4-3. Authorized Projectile and Propelling Charge Combinations

	Propelling Charge														Fire Warning			
	(GB) M3A1					(WB) M4A1 and M4A2				M119A2 and M119A1	M203 and M203A1	M231 ³		M232 ³ Series				
	Charge					Charge				Charge	Charge	Charge	Charge	Charge				
Projectiles	1	2	3	4	5	3	4	5	6	7	7, 8 ¹	8	1	2	3	4	5	
M107, HE	No ²	No ²	x	x	x	x	x	x	x	x	x	No	x	x	x	x	No	
M110 agent (H, HD)	No ²	No ²	x	x	x	x	x	x	x	x	x	No	x	x	x	x	No	M110 agent burster loaded with tetrytol cannot be stored/fired at temperatures exceeding +125°F (+52°C).
M110 , M110A1 , M110A2 , smoke (WP)	No ²	No ²	x	x	x	x	x	x	x	x	x	No	x	x	x	x	No	M110 (M110E1) burster loaded with tetrytol cannot be stored/fired at temperatures exceeding +125°F (+52°C).

¹M119A2 charge 7 is equivalent to M119A1 charge 8. Refer to firing tables for small differences in velocity, which affect range.

²Charge 1 and charge 2 must not be fired in the M776 cannon because of stickers (bag charges only)

³Do not load or fire M231 charges with M232 series charges. Critical malfunction could result.

NOTES

PRIMERS M82 and DM191A1 are the authorized primers and can be used with the M776 cannon.

M203 series charge 8 is not equivalent to M119A1 charge 8/M119A2 charge 7.

M232 series charge 5 is equivalent to M203 series charge 8.

4-3 AUTHORIZED PROJECTILES (cont)

Table 4-3. Authorized Projectile and Propelling Charge Combinations (cont)

Projectiles	Propelling Charge															Fire Warning		
	(GB) M3A1					(WB) M4A1 and M4A2				M119A2 and M119A1		M203 and M203A1		M231 ³		M232 ³ Series		
	Charge				Charge				Charge	Charge	Charge	Charge	Charge	Charge	Charge			
Projectiles	1	2	3	4	5	3	4	5	6	7	7, 8 ¹	8	1	2	3	4	5	
M116A1, Smoke, BE, HC	No ²	No ²	x	x	x	x	x	x	x	x	x	No	x	x	x	x	No	Do not fire WP projectiles known to have been stored other than base down. Firing of such projectiles could contribute to in-bore explosions or close-in premature malfunctions.
M449, M449A1, HE, ICM	No ²	No ²	x	x	x	No	x	x	x	x	x	No	x	x	x	x	No	

¹M119A2 charge 7 is equivalent to M119A1 charge 8. Refer to firing tables for small differences in velocity, which affect range.

²Charge 1 and charge 2 must not be fired in the M776 cannon because of stickers (bag charges only).

³Do not load or fire M231 charges with M232 series charges. Critical malfunction could result.

NOTES

PRIMERS M82 and DM191A1 are the authorized primers and can be used with the M776 cannon.

M203 series charge 8 is not equivalent to M119A1 charge 8/M119A2 charge 7.

M232 series charge 5 is equivalent to M203 series charge 8.

Table 4-3. Authorized Projectile and Propelling Charge Combinations (cont)

	Propelling Charge															Fire Warning	
	(GB) M3A1					(WB) M4A1 and M4A2				M119A2 and M119A1		M203 and M203A1		M231 ³		M232 ³ Series	
	Charge					Charge				Charge	Charge	Charge	Charge	Charge	Charge		
Projectiles	1	2	3	4	5	3	4	5	6	7	7, 8 ¹	8	1	2	3	4	5
M483A1, HE, ICM	No ²	No ²	x	x	x	x	x	x	x	x	x	No	x	x	x	x	No
M485A1, M485A2, Illuminating	No ²	No ²	x	x	x	x	x	x	x	x	x	No	x	x	x	x	No
M549 ⁴ , HERA5	No ²	No ²	No	No	No	No	No	No	No	x	x	No	No	No	x	x	No
M549A1 ⁴ , HERA5	No ²	No ²	No	No	No	No	No	No	No	x	x	x	No	No	x	x	x

¹M119A2 charge 7 is equivalent to M119A1 charge 8. Refer to firing tables for small differences in velocity, which affect range.

²Charge 1 and charge 2 must not be fired in the M776 cannon because of stickers (bag charges only).

³Do not load or fire M231 charges with M232 series charges. Critical malfunction could result.

⁴Do not fire the M549/M549A1 projectiles if the obturating band is missing or broken. If band is displaced and can be repositioned and remain in the groove, the projectile can be fired.

NOTES

PRIMERS M82 and DM191A1 are the authorized primers and can be used with the M776 cannon.

M203 series charge 8 is not equivalent to M119A1 charge 8/M119A2 charge 7.

M232 series charge 5 is equivalent to M203 series charge 8.

4-3 AUTHORIZED PROJECTILES (cont)

Table 4-3. Authorized Projectile and Propelling Charge Combinations (cont)

Projectiles	Propelling Charge															Fire Warning	
	(GB) M3A1					(WB) M4A1 and M4A2				M119A2 and M119A1		M203 and M203A1		M231 ³		M232 ³ Series	
	Charge				Charge				Charge	Charge	Charge	Charge	Charge	Charge	Charge		
Projectiles	1	2	3	4	5	3	4	5	6	7	7, 8 ¹	8	1	2	3	4	5
M692, HE (ADAM)	No ²	No ²	x	x	x	x	x	x	x	x	x	No	x	x	x	x	No
M712, HEAT (Copper head)	No ²	No ²	No	x	x	No	x	x	x	x	x	No	x	x	x	x	No
M718, M718A1, AT (RAAMS)	No ²	No ²	x	x	x	x	x	x	x	x	x	No	x	x	x	x	No
M731, HE (ADAM)	No ²	No ²	x	x	x	x	x	x	x	x	x	No	x	x	x	x	No
M741, M741A1, AT (RAAMS)	No ²	No ²	x	x	x	x	x	x	x	x	x	No	x	x	x	x	No

¹M119A2 charge 7 is equivalent to M119A1 charge 8. Refer to firing tables for small differences in velocity, which affect range.

²Charge 1 and charge 2 must not be fired in the M776 cannon because of stickers (bag charges only).

³Do not load or fire M231 charges with M232 series charges. Critical malfunction could result.

NOTES

PRIMERS M82 and DM191A1 are the authorized primers and can be used with the M776 cannon.

M203 series charge 8 is not equivalent to M119A1 charge 8/M119A2 charge 7.

M232 series charge 5 is equivalent to M203 series charge 8.

Table 4-3. Authorized Projectile and Propelling Charge Combinations (cont)

	Propelling Charge															Fire Warning			
	(GB) M3A1					(WB) M4A1 and M4A2				M119A2 and M119A1		M203 and M203A1		M231 ³		M232 ³ Series			
	Charge					Charge				Charge	Charge	Charge	Charge	Charge	Charge				
Projectiles	1	2	3	4	5	3	4	5	6	7	7, 8 ¹	8	1	2	3	4	5		
M795, HE	No ²	No ²	x	x	x	No	x	x	x	x	x	x	x	x	x	x	x		
M804, practice	No ²	No ²	x	x	x	x	x	x	x	x	x	No	x	x	x	x	No		
M825 (WP) ⁵	No ²	No ²	x	x	x	x	x	x	x	x	x	No	No	No	No	No	No		
M825A1 (WP) SMOKE	No ²	No ²	x	x	x	x	x	x	x	x	x	x	x	x	x	x	No		

¹M119A2 charge 7 is equivalent to M119A1 charge 8. Refer to firing tables for small differences in velocity, which affect range.

²Charge 1 and charge 2 must not be fired in the M776 cannon because of stickers (bag charges only).

³Do not load or fire M231 charges with M232 series charges. Critical malfunction could result.

⁵M825 projectiles (manufactured Jan 85-May 86) fired at temperatures above +110°F (+43°C) (WP liquefied) have resulted in flight instability and short rounds. This instability does not occur below +110°F (+43°C) (WP solid).

NOTES

PRIMERS M82 and DM191A1 are the authorized primers and can be used with the M776 cannon.

M203 series charge 8 is not equivalent to M119A1 charge 8/M119A2 charge 7.

M232 series charge 5 is equivalent to M203 series charge 8.

4-3 AUTHORIZED PROJECTILES (cont)

Table 4-3. Authorized Projectile and Propelling Charge Combinations (cont)

Projectiles	Propelling Charge															Fire Warning			
	(GB) M3A1					(WB) M4A1 and M4A2				M119A2 and M119A1		M203 and M203A1		M231 ³		M232 ³ Series			
	Charge					Charge				Charge	Charge	Charge	Charge	Charge	Charge				
Projectiles	1	2	3	4	5	3	4	5	6	7	7, 8 ¹	8	1	2	3	4	5		
M864, HE, ICM, extended range	No ²	No ²	No	No	No	No	No	No	No	x	x	x	No	No	x	x	x	The M864 shall be fired to achieve ranges beyond capabilities of the M483A1 projectile or when the M483A1 is not available.	
HE, M898 (SADARM)	No	No ²	x	x	x	x	x	x	x	x	x	x	x	x	x	x	No	Do not fire with M232 series (MACS) 5 ⁶ .	

¹ M119A2 charge 7 is equivalent to M119A1 charge 8. Refer to firing tables for small differences in velocity, which affect range.

² Charge 1 and charge 2 must not be fired in the M776 cannon because of stickers (bag charges only).

³ Do not load or fire M231 charges with M232 series charges. Critical malfunction could result.

⁶ Do not fire M232 series charge 5 in M777/M777A1/M777A2 howitzer. Safety Testing was not performed.

NOTES

PRIMERS M82 and DM191A1 are the authorized primers and can be used with the M776 cannon.

M203 series charge 8 is not equivalent to M119A1 charge 8/M119A2 charge 7.

M232 series charge 5 is equivalent to M203 series charge 8.

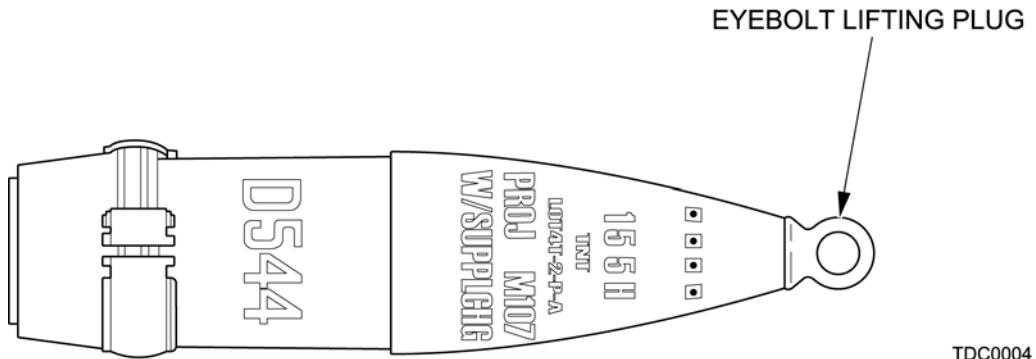
c. Projectiles of current manufacture with deep fuze cavities and supplementary charges of TNT are suitable for use with the long intrusion (M728) or the short intrusion (M732 series) proximity fuzes. The supplementary charge must be removed when the long intrusion proximity fuze is used; it must remain in place whenever any other authorized fuze is used.

d. Deep-cavity projectiles are identified by the words, W/SUPPL CHG, marked on the projectile. Weight zones are indicated on projectiles by one or more squares of the same color as the markings. Four squares indicate normal weight for which no weight corrections are necessary when computing firing data. There may also be punch marks in the center of squares for night identification of weight zones by touch.

e. The authorized projectiles and their characteristics are as follows:

(1) **Projectile, 155-mm, HE, M107.** This HE projectile is used primarily for blast, fragmentation and mining. This deep or shallow-cavity projectile consists of a steel case loaded with TNT or composition B. A point detonating, time, or proximity fuze may be used. The M107 projectile weighs approximately 95.0 lbs (43.09 kg).

M107 PROJECTILE



WARNING

SINCE THE BURSTER IN (H) MUSTARD GAS OR (HD) DISTILLED MUSTARD GAS AMMUNITION IS LOADED WITH TETRYTOL, DO NOT STORE OR FIRE AT TEMPERATURES EXCEEDING +125°F (+52°C). TEMPERATURES ABOVE +125°F (+52°C) WILL CAUSE THE TETRYTOL TO MELT AND/OR SEEP, CAUSING PREMATURE FUNCTIONING.

4-3 AUTHORIZED PROJECTILES (cont)

(2) **Projectile, 155-mm, Agent, H or HD, M110.** This projectile produces a toxic effect on personnel and is also used to contaminate habitable areas. This 93.0 lbs (42.18 kg) projectile is filled with mustard gas (H) or distilled mustard gas (HD) and has a burster charge.

WARNINGS

THE FILLER IN WHITE PHOSPHOROUS SMOKE PROJECTILES MELTS AT +111.4°F (+44.1°C) AND CREATES VOIDS INSIDE THE PROJECTILE. THE WHITE PHOSPHOROUS PROJECTILES MUST BE STORED BASE DOWN SO THAT ANY VOIDS ARE IN THE NOSE OF THE PROJECTILE. DO NOT FIRE WHITE PHOSPHOROUS PROJECTILES, WHICH ARE KNOWN TO HAVE BEEN STORED IN OTHER THAN BASE DOWN POSITION. FIRING OF SUCH PROJECTILES COULD CONTRIBUTE TO IN-BORE EXPLOSIONS OR CLOSE-IN PREMATURE MALFUNCTIONS.

SINCE THE BURSTER IN THE M110 PROJECTILES IS LOADED WITH TETRYTOL, DO NOT STORE OR FIRE AT TEMPERATURES ABOVE +125°F (+52°C). TEMPERATURES ABOVE +125°F (+52°C) WILL CAUSE THE TETRYTOL TO MELT AND/OR SEEP, CAUSING PREMATURE FUNCTIONING. PRIOR TO FIRING, INSPECT FUZE WELL CUP FOR DENTS IN BOTTOM SURFACE. IF DENTS ARE FOUND OR THE FUZE IS HARD TO SEAT, DO NOT USE THE ROUND.

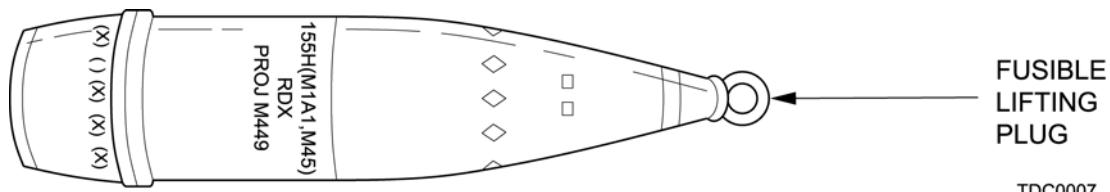
(3) **Projectile, 155-mm, Smoke, WP, M110.** The M110 White Phosphorous (WP) smoke projectiles have a slight burning effect, but are used primarily to produce screening smoke. The projectiles are similar to the M110 gas projectile and have the same characteristics as the M107 HE projectile. Each projectile weighs approximately 98 lbs (44.45 kg).

(4) **Projectiles, 155-mm, Smoke, WP, M110A1 and M110A2.** These projectiles are similar to the M110 WP projectiles, except that the burster is loaded with composite B5. These projectiles may be stored and transported at temperatures up to +145°F (+63°C). Inspection of the fuze well cup is required before firing.

(5) **Projectile, 155-mm, Smoke, HC, M116A1.** The M116A1 projectile is a BE type similar to the M116 and M116B1 with the exception that it uses the M565 MT and M577 series MTSQ or M762 ET fuzes, and that it has improved M1 and M2 HC (white) smoke canisters.

(6) **Projectile, 155-mm, ICM, M449 Series.** These projectiles are Improved Conventional Munitions (ICM) used primarily against personnel. The cargo consists of 60 M43 grenades, which are ejected in flight. The fuze, having been set to function at a predetermined time, initiates the expulsion charge, ejecting the entire cargo from the rear of the projectile. The projectile spins centrifugally and disperses the grenades from the projectile line-of-flight. Upon impact with the target area, an expulsion charge is initiated which propels a high explosive filled sphere upward 4 to 6 ft (1.22 to 1.83 m) above the impact area. The elevated sphere is detonated, sending high-velocity fragments in a spherical pattern. Each projectile weighs approximately 95 lbs (43.09 kg).

M449 SERIES PROJECTILE



WARNING

THE M483A1 PROJECTILE WILL NOT BE FIRED BELOW CHARGE 3 IN THE M777/M777A1/M777A2 HOWITZER. FIRING BELOW CHARGE 3 MAY RESULT IN STICKERS.

NOTE

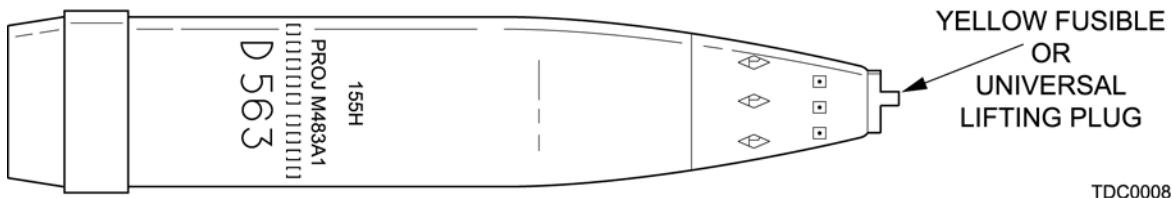
The M483A1 projectile or other projectiles using the M483A1 carrier may not be fired without the obturating band. Reposition band if it is dislodged.

(7) Projectile, 155-mm, ICM, M483A1. The dual-purpose ICM projectile is effective against personnel and light materiel targets. These BE type projectiles consist of a steel body containing an expelling charge and 88 shaped charge grenade sub-missiles. This projectile weighs approximately 103 lbs (46.72 kg) and uses M577 series MTSQ or M762 ET fuze. It can be used in the fire-for-effect mode or the self-registration mode.

(a) In the fire-for-effect mode, the expelling charge ejects the 88 sub-missiles from the projectile during flight and they actuate on ground or target impact. A shaped charged jet is expelled downward while the body bursts into a large number of high-velocity fragments. The jet is capable of penetrating approximately 2.75 in (6.98 cm) of homogenous armor plate. Anti-personnel effects are obtained by fragmentation of the body.

(b) In the self-registration mode, the expelling charge is removed, and a projectile spotting charge is attached to the time fuze and installed in the projectile. The spotting charge will cause the projectile to detonate all 88 grenades inside the projectile, causing high fragmentation in the same manner as a standard high-explosive projectile. This permits observation of projectile in relation to target. See paragraph 4-12 for additional information on special preparation of the M483A1 projectile for use in the self-registration mode.

M483A1 PROJECTILE



NOTE

The M864 is for extended range only. Use the M483A1 projectile through the M119A2 charge (Zone 7) where applicable. The M864 shall be fired to achieve ranges beyond the capabilities of the M483A1 projectile or when the M483A1 is not available.

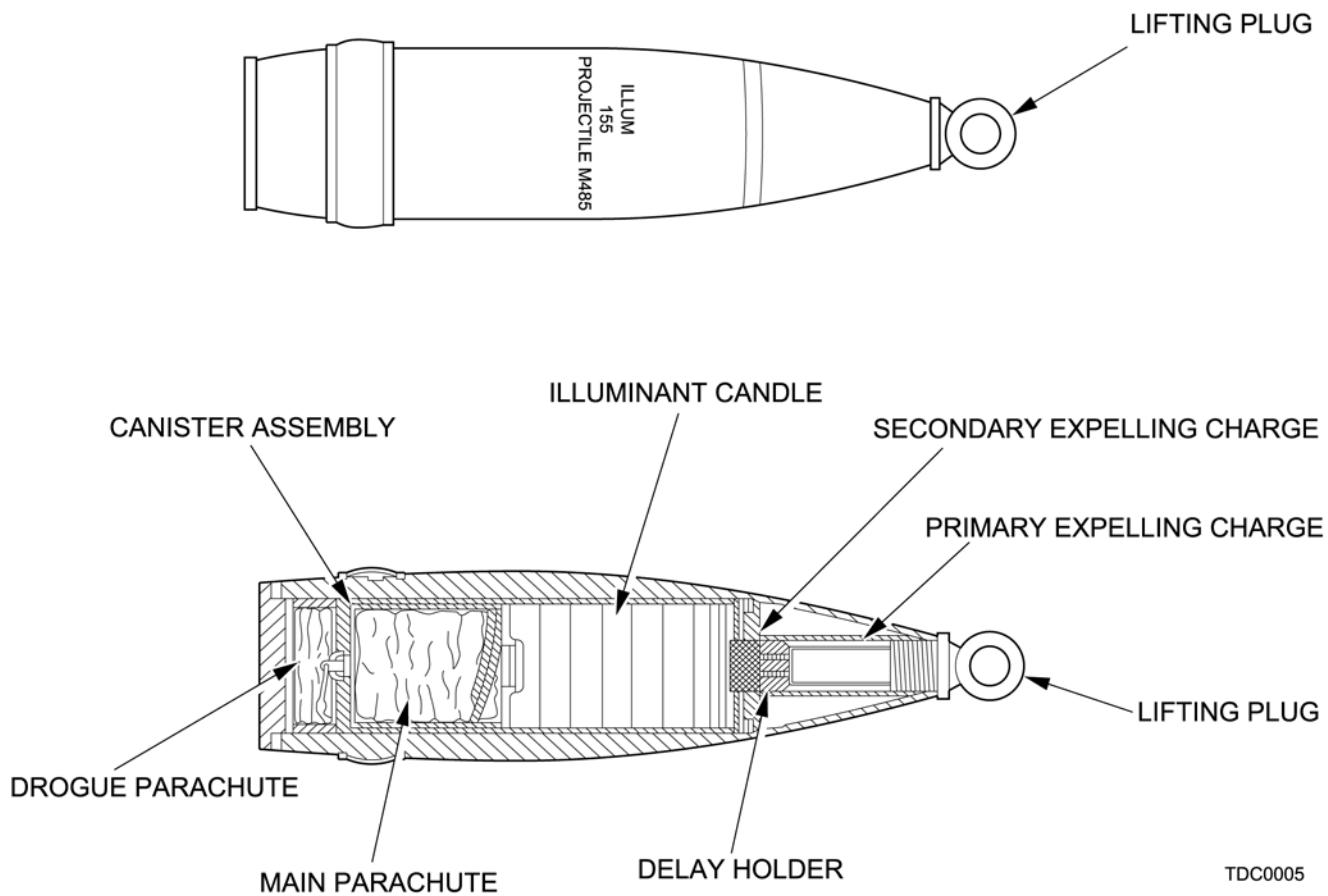
4-3 AUTHORIZED PROJECTILES (cont)

WARNING

THE M485A1 AND M485A2 PROJECTILES CAN BE FIRED WITH CHARGE 2 (M3 GB) THRU 8 (M119 SERIES CHARGES) INCLUSIVE. THESE PROJECTILES ARE NOT RELIABLE WHEN FIRED AT CHARGES 6, 7, AND 8 WITH FUZE SETTINGS OF 10 SECONDS OR LESS.

(8) **Projectiles, 155-mm, Illuminating, M485A1 and M485A2.** These projectiles are used for battlefield illumination. Each projectile has a hollow steel body containing a primary expelling charge, a canister assembly, and a drogue parachute. The canister assembly contains a secondary expelling charge, a delay holder, a light producing chemical, and the main parachute.

PROJECTILE, 155 MILLIMETER: ILLUM, M485 SERIES



(9) **Projectiles, 155-mm, HE, Rocket Assist, M549 and M549A1.** This is a high fragmentation projectile containing a rocket motor. The protective rocket cap must be removed from the projectile before firing to increase the range over that attainable ballistically. The M549 differs from the M549A1 only in type of explosive filler. The M549 is loaded with composite B, and the M549A1 is loaded with TNT.

WARNINGS

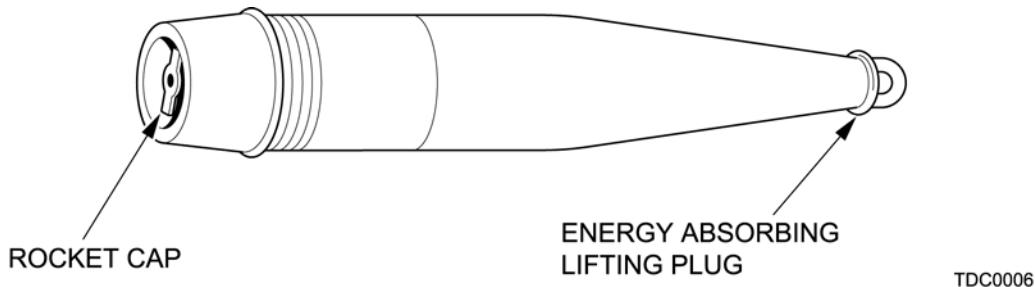
STANDARD PROCEDURES PROHIBIT FIRING THE M549/M549A1 IN THE ROCKET OFF MODE EXCEPT IN COMBAT EMERGENCIES. REMOVE ROCKET CAP BEFORE LOADING TO ACTIVATE THE ROCKET.

A 6000-METER SAFETY ZONE IS REQUIRED **SHORT** OF THE TARGET BECAUSE OF THE POSSIBILITY OF ROCKET MOTOR NON-IGNITION.

IF FIRED ROCKET OFF DUE TO EMERGENCY SITUATION, A 6000 METER RANGE IS REQUIRED **BEYOND** THE TARGET BECAUSE OF THE POSSIBILITY OF ROCKET MOTOR IGNITION.

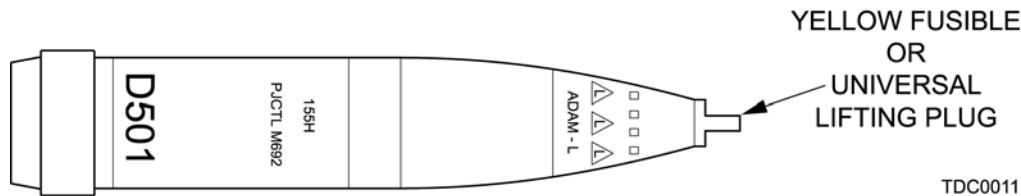
(a) The M549/M549A1 projectiles have the energy-absorbing lifting plug designed to protect the projectile fuze area against accidental damage. The new plug has an oversized 3.75 in. (9.53 cm) flange. If this lifting plug is broken at the neck area, the threaded portion of the plug will remain in the projectile and the projectile cannot be fuzed. No attempt should be made to extract any portion of a broken plug from a projectile; the projectile is not to be used and should be returned to supply point.

M549 OR M549A1 PROJECTILE



(10) **Projectile, 155-mm, HE, M692.** This HE projectile is known as the Area Denial Artillery Munition (ADAM). It is painted olive drab with yellow markings. The most significant marking on the ogive is the letter 'L' appearing in the triangles, and in later production 'ADAM-L' on the ogive, indicating a long self-destruct time of the antipersonnel mine sub-munitions. The M692 is a BE type projectile and uses the M577 series MTSQ or M762 ET fuze.

M692 PROJECTILE



4-3 AUTHORIZED PROJECTILES (cont)

(11) Projectile, 155-mm, HEAT, M712. This projectile is a cannon-launched guided projectile. It is a High-Explosive Anti-Tank (HEAT) projectile loaded with 14.75 lbs (6.69 kg) of composition B. It is guided to its target by a laser beam directed on the target from a laser designator. The projectile has five time and code switches set by the crew prior to firing. The warhead section of the projectile contains its own base-detonating fuze (M740). The projectile is 54 in. (137.16 cm) long and weighs 138 lbs (62.60 kg). Details on use of M712 projectile begin on Chapter 4, Section IV.

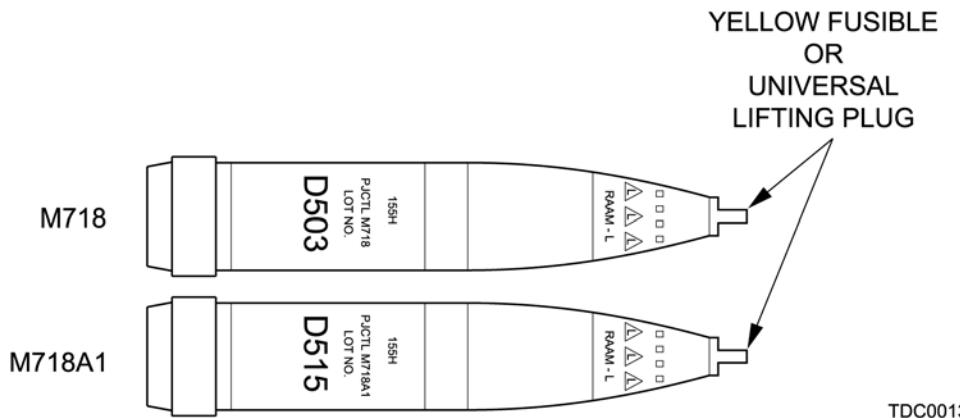
M712 HEAT PROJECTILE



TDC0015

(12) Projectile, 155-mm, AT, Remote Anti-Armor Mine System, M718/M718A1. This projectile is used to deliver high-explosive antitank mines in front of enemy armored forces to deny/delay access to a particular area for a specific time period. This projectile is from the family of scatterable mines known as the Remote Anti-Armor Mine System (RAAMS). It is painted olive drab with yellow markings. The most significant markings are the row of yellow triangles between the nose and the bourrelet which contain the letter 'L' and 'RAAM-L' on the ogive that indicates the LONG self-destruct time for the submunition. This is a BE type projectile and uses the M577 series MTSQ or M762 ET fuze. The M718A1 projectile contains internal changes to the submunitions and has a new DODIC (D515); however, the projectile is handled and fired the same as the basic model.

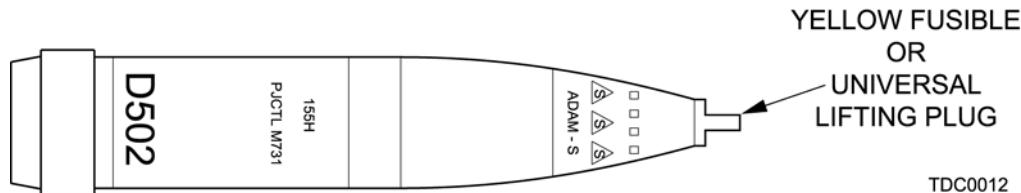
M718/M718A1 PROJECTILE



TDC0013

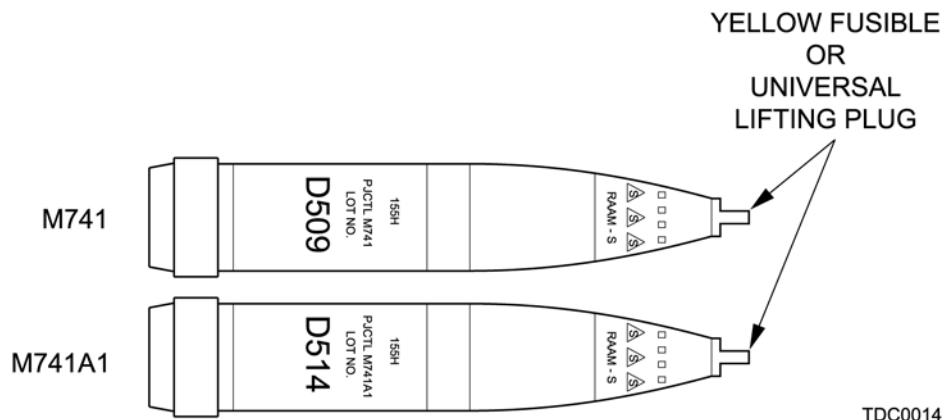
(13) Projectile, 155-mm, HE, M731. This projectile is like the M692 projectile, except the letter 'S' appears within the yellow triangles, indicating short self-destruct time of mine sub munitions. This base-ejection type projectile uses the M577 series MTSQ or M762 ET fuze.

M731 PROJECTILE



(14) Projectile, 155-mm, AT, Remote Anti-Armor Mine System, M741/M741A1. This projectile is also known as the RAAMS round, and it is exactly like the M718 above except the letter 'S' painted in the yellow triangles and 'RAAMS-S' on the ogive are different to indicate a SHORT self-destruct time. This is a base-ejection type projectile and uses M 577 series MTSQ or M762 ET fuze. The M741A1 projectile contains internal changes to the sub munitions and has a new DODIC (D514); however, the projectile is handled and fired the same as the basic model.

M741/M741A1 PROJECTILE



WARNINGS

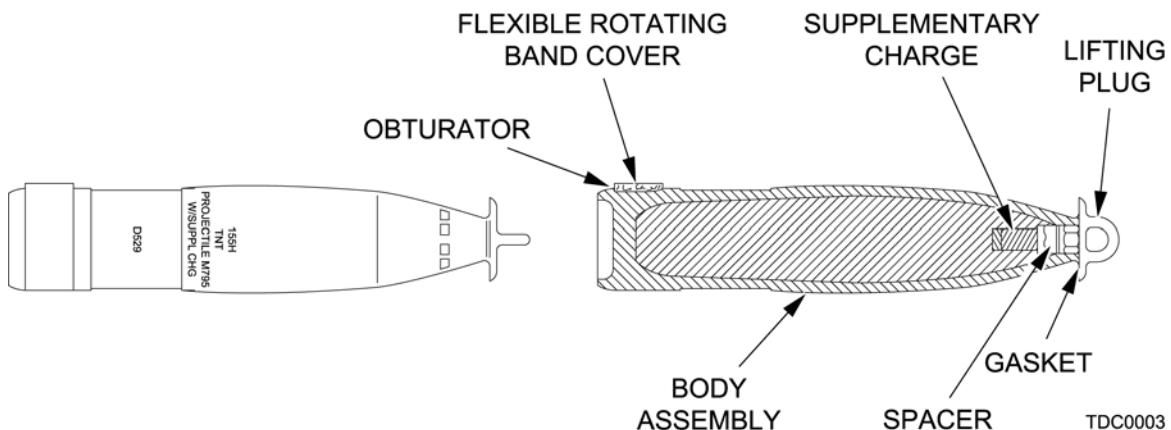
THE M795 PROJECTILE WILL NOT BE FIRED AT CHARGE 3 (WHITE BAG (WB)). FIRING AT CHARGE 3 WB MAY RESULT IN STICKERS.

THE M795 IS NOT TO BE FIRED IF THE OBTURATOR IS MISSING OR BROKEN AS ROTATING BAND FAILURE AND SHORT ROUND MAY RESULT. IF THE BAND IS DISPLACED AND CAN BE REPOSITIONED AND REMAIN IN THE GROOVE, THE PROJECTILE CAN BE FIRED.

4-3 AUTHORIZED PROJECTILES (cont)

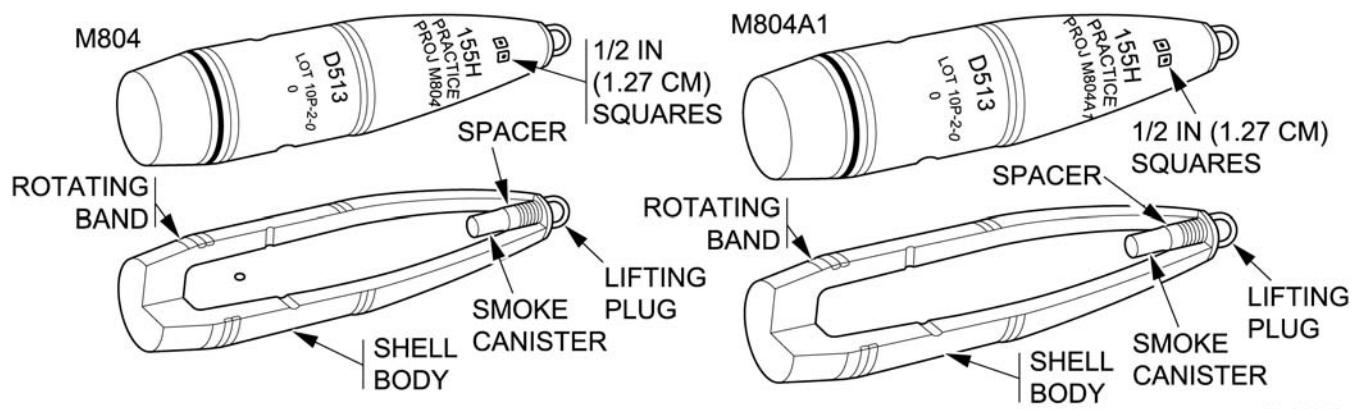
(15) **Projectile, 155-mm, HE, M795.** This high explosive (HE), shallow cavity projectile is used as a registration round for the M483A1 family of cargo munitions. It is also used for harassment and interdiction (H & I), fragmentation, mining, and blast effect. The M795 consists of 23.8 lbs (10.8 kg) of TNT explosive loaded into a 78.1 lbs (35.5 kg) body assembly. A welded rotating band encircles the high fragmentation steel HF-1 body near its base.

M795 HE PROJECTILE



(16) **Projectile, M804/M804A1, Practice.** The M804/M804A1 projectile is used in place of the M107 HE projectile in training exercises. The M804/M804A1 contains a small smoke canister in the fuze well, which provides flash and smoke for visual determination of functioning. The M804/M804A1 is similar in weight and external configuration to the M107 HE projectile and can be used in training without the blast and fragmentation, which accompany functioning of an M107 HE projectile. The body of the M804 contains four holes, 90° apart, which serve to disperse smoke on functioning. The M804A1 does not contain any holes and has a larger smoke canister. Both projectile models are handled and fired in the same way.

M804/M804A1 PROJECTILE



WARNINGS

THE M823 PROJECTILE MUST NOT BE FIRED. SUCH FIRING COULD BE A HAZARD TO PERSONNEL FORWARD OF THE HOWITZER.

(17) **Projectile, 155-mm, Training, M823 (Copperhead).** This projectile is designed to train 155-mm howitzer crews in the handling and setting of the M712 projectile. It simulates the M712 in weight, center of gravity, and external appearance. It contains code and time switches, which are set to simulate prefiring activity by the crew. It is shipped and stored in the same container as the M712, color coded bronze for easy identification. Details on use of M823 projectile begin on Chapter 4, Section IV.

M823 PROJECTILE



TDC0016

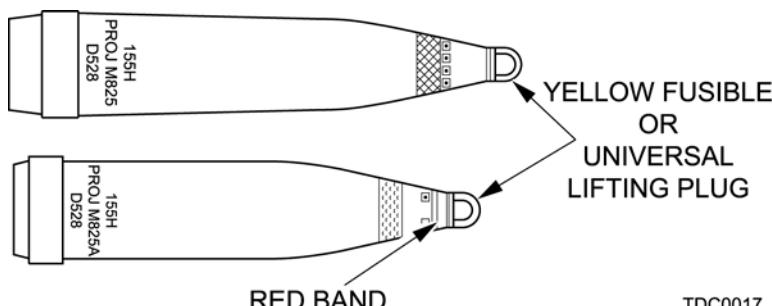
WARNINGS

WHITE PHOSPHOROUS IMPREGNATED FELT WEDGES FROM THE M825/M825A1 ARE NOT TOTALLY CONSUMED WHEN THE WHITE PHOSPHOROUS BURNS. WHEN THE UNBURNED FELT WEDGES ARE CRUSHED OR MOVED, RESIDUAL WHITE PHOSPHOROUS WILL REIGNITE, POSING A BURN HAZARD. PERSONNEL SHOULD NOT CONTACT OR MOVE THE UNBURNED FELT WEDGES.

THE M825/M825A1 IS NOT TO BE FIRED IF THE OBTURATOR IS MISSING OR BROKEN AS ROTATING BAND FAILURE AND SHORT ROUND MAY RESULT. IF THE BAND IS DISPLACED AND CAN BE REPOSITIONED AND REMAIN IN THE GROOVE, THE PROJECTILE CAN BE FIRED.

(18) **Projectile, 155-mm, Smoke, WP, M825/M825A1.** The M825 projectile consists of a modified M483A1 projectile carrier with a payload of WP impregnated felt wedges. In-flight fuze functioning ejects a canister. A burster inside the canister scatters burning wedges over the target area producing obscuring smoke. This projectile uses the M577 series MTSQ or M762 ET fuze. The M825A1 projectile contains an improved payload and a new base, which have corrected the M825 flight instability. The restrictions imposed on the M825 do not apply to the M825A1.

M825/M825A1 SMOKE PROJECTILE



TDC0017

4-3 AUTHORIZED PROJECTILES (cont)

WARNINGS

A 5000-METER SAFETY ZONE IS REQUIRED SHORT OF THE TARGET BECAUSE OF THE POSSIBILITY OF THE BASE BURNER ASSEMBLY NON-IGNITION.

THE M864 IS NOT TO BE FIRED IF THE OBTURATOR IS MISSING OR BROKEN BECAUSE IT MAY RESULT IN A SHORT ROUND. IF THE OBTURATOR BAND IS DISPLACED AND CAN BE REPOSITIONED AND REMAIN IN THE GROOVE, THE PROJECTILE CAN BE FIRED.

FOR M864 PROJECTILES MARKED WITH THREE SOLID WHITE CIRCLES 120° APART ON THE OGIVE (ABOVE THE WEIGHT ZONE MARKINGS), AVOID HAZARDS RESULTING FROM GAPS AT THE BASE TO BODY JOINT AND FROM SEPARATION OF THE BASE FROM THE BODY BY FOLLOWING THESE SAFETY PROCEDURES:

- PROJECTILES ARE TO REMAIN PALLETIZED AS LONG AS POSSIBLE PRIOR TO USE.
- DO NOT TRANSPORT PROJECTILES AS LOOSE CARGO.
- DO NOT FIRE PROJECTILES RECEIVED WITHOUT GROMMETS OR WITH EVIDENCE OF DENTS, FLATTENING, OR GOUGES TO THE LIFTING PLUG, GROMMET, ROTATING BAND OR BOATTAIL AREA.
- DO NOT FIRE PROJECTILES, WHICH HAVE BEEN DROPPED LOOSE.
- ANY BASE SEPARATIONS SHOULD BE HANDLED BY EXPLOSIVE ORDNANCE DISPOSAL PERSONNEL.

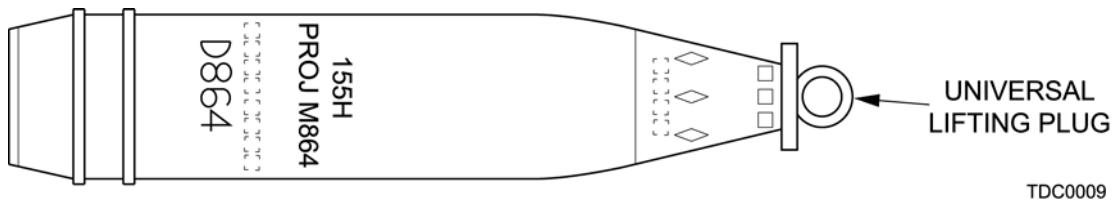
IN THESE SPECIALLY MARKED M864 ROUNDS, A GAP AT THE BASE TO BODY JOINT OF THE PROJECTILE MAY LEAD TO HOT PROPELLANT GASES ENTERING THE ROUND DURING FIRING AND CAUSING AN INBORE EXPLOSION. GAPS ARE NOT DETECTABLE WITH A VISUAL EXAMINATION DUE TO THE PRESENCE OF THE OBTURATOR OVER THE BASE TO BODY JOINT. IN ADDITION, A SEPARATION OF THE BASE FROM THE BODY OF THE PROJECTILE WILL EXPOSE M42 AND M46 GRENADES. ARMING COULD OCCUR AND RESULT IN DEATH AND/OR INJURY.

(19) Projectile 155-mm Extended Range, DP, M864.

(a) This is an extended range dual-purpose, ICM projectile. The M864 is modeled after the M483A1 projectile with the addition of a base burner unit at the projectile's base. The propellant in the base burner ignites upon firing of the projectile, producing gases which reduce the drag on the projectile and extend its range.

(b) This is a base-ejection type projectile with a steel body. The expulsion charge contains 105 grams of M10 propellant. There are 72 shaped charge grenades consisting of 48 M42 grenades and 24 M46 grenades. They are effective against personnel and light materiel targets. This projectile weighs approximately 102 lbs (46.27 kg) and uses the M577 series MTSQ or M762 ET fuze. It can be used in the fire-for-effect mode or the self-registration mode. See para 4-12 e (2) for additional information on special preparation of the M864 projectile for use in self-registration mode.

M864 PROJECTILE



4-4 AUTHORIZED FUZES

a. Paragraphs b. thru k describes the fuzes to be used with this howitzer. They are in model number sequence. For additional information and more detailed descriptions and functioning of the authorized fuzes, see TM 43-0001-28.

WARNINGS

THE FIRING OF A FIELD ARTILLERY ROUND WITHOUT A FUZE OR WITH AN UNAUTHORIZED FUZE IS STRICTLY PROHIBITED AS AN INBORE EXPLOSION MAY RESULT.

IF A PROJECTILE FIRED WITH AN MK399, MOD 1 FUZE IMPACTS A SUBSTANTIAL OBJECT (EITHER INTENTIONALLY OR UNINTENTIONALLY), A HIGH-ORDER EXPLOSIVE FUNCTION MAY RESULT EVEN WHEN THE OBJECT IS LOCATED INSIDE THE 400-CALIBER (203 FEET FOR 155MM WEAPON SYSTEMS) MINIMUM ARMING DISTANCE FROM THE HOWITZER.

b. **Fuze, PD, MK399, MOD 1.** The MK399 MOD 1 MOUT fuze is primarily for use against urban structures (buildings) and other hard targets such as bunkers. Its primary design is for penetration of wood, brick or concrete and function inside the target. It therefore is delivered to the field set in the DLY (delay) mode to accomplish this task. The fuze has a setscrew that can be turned by a flathead screwdriver or M18 fuze wrench to select PD or delay (DLY) function. When set PD, the fuze functions superquick, which is more effective in destroying walls or urban targets and bunkers, can provide a conventional PD fuze role against personnel, and is useful for spotting purposes. The fuze is assembled with a booster pellet and set on the DLY mark for shipping. This fuze is rain sensitive.

4-4 AUTHORIZED FUZES (cont)

Table 4-3.1 Summary Matrix of Expected Performance Against MOUT Targets.

Obliquity Angle \Rightarrow	Wood Frame				Single Brick				Triple Brick				Reinforced Concrete			
	0°	30°	45°	60°	0°	30°	45°	60°	0°	30°	45°	60°	0°	30°	45°	60°
155mm M107/M795 low zone	M ¹	M ¹	M ¹	M ¹	G	G	G	G	G	G	M ³	M ³	G	G	M ³	M ³
155mm M107/M795 mid zone	G	G	G	G	G	G	G	G	G	G	M ³	M ³	G	G	M ³	M ³
155mm M107/M795 high zone	G	G	G	G	G	G	G	G	M ²	M ²	G	G	M ²	M ²	G	G
155mm M549A1					P ¹	P ¹	P ¹									

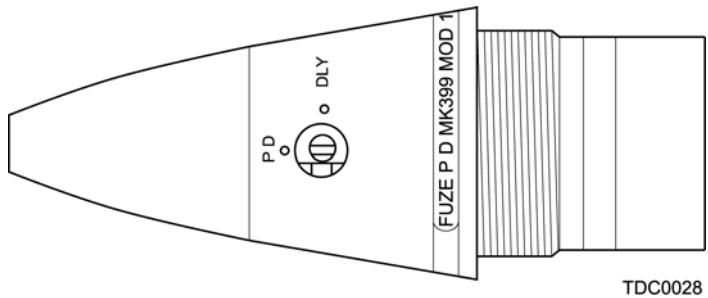
G – good
M – marginal
P – poor, not recommended

NOTE

Always be prepared to use multiple rounds to defeat targets.

Obliquity angle 0° = perpendicular to target wall.

MOUT PD FUZE, MK399 MOD 1



TDC0028

M¹ – for lighter wood frame construction, at low zone, insufficient impact force may result in duds.

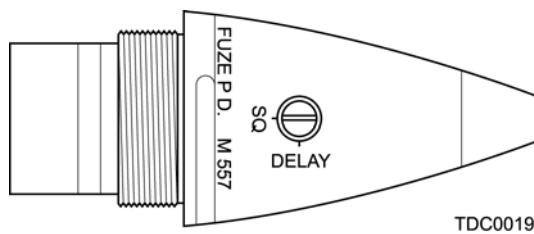
M² – perpendicular and near perpendicular impacts against harder targets at high zone can result in functions on the wall before penetration.

M³ – at low and mid zones impact angles at and beyond 45 degrees can result in duds.

P¹ – RAP rounds not recommended against MOUT targets, projectile may break-up upon impact.

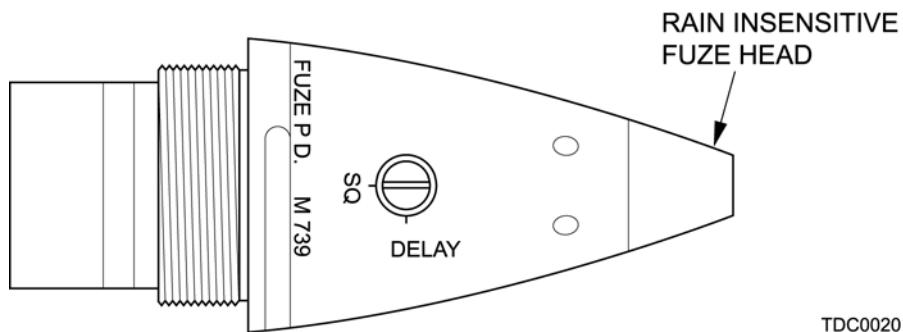
c. Fuze, Point-Detonating (PD), M557. The M557 has a selective SQ DLY setscrew. It is packed set for SQ and has a booster attached. Premature functioning can occur when fuzes are fired in heavy precipitation, i.e., heavy rainfall, sleet, snow, or hail.

M557 PD FUZE



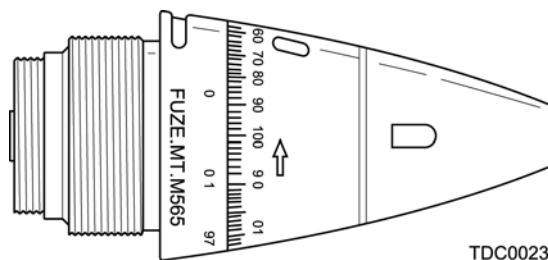
d. Fuze, PD, M739 and M739A1. These fuzes are the latest improved versions of the selective impact fuze. These fuzes have solid aluminum bodies with threaded bases. The fuzes contain a rain-insensitive screen so that the fuzes can be fired through a heavy rainstorm without premature functioning of the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

M739 OR M739A1 FUZE



e. Fuze, Mechanical Time (MT), M565. The M565 MT type is similar to the M564 MTSQ fuze, except that the M565 fuze does not contain the PD assembly or the booster assembly. The M565 fuze can be set from 2 to 100 seconds. Like the M564 fuze, the M565 fuze has a vernier scale to assure a setting accuracy of 0.1 second. The fuze is used with BE projectiles only.

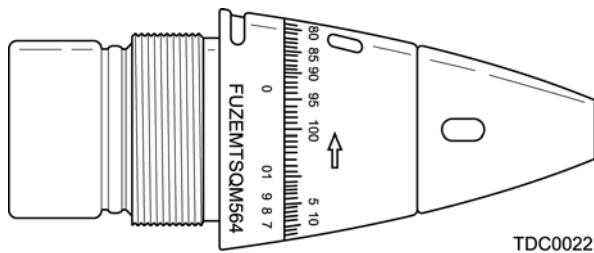
M565 FUZE



4-4 AUTHORIZED FUZES (cont)

f. **Fuze, MTSQ, M564.** This fuze is an improvement over the older MTSQ fuzes, because it provides a longer timing mechanism (100 seconds) for functioning at longer ranges. The date of manufacture is stamped on the fuze body before the lot number. Fuzes manufactured through 1969 must be set on 90 seconds if SQ (impact) action is desired. Setting of these fuzes between S and 2 seconds may result in functioning after approximately 2 seconds. Fuzes manufactured from 1970 on may be set as shipped on S for SQ (impact) functioning. Premature functioning of this fuze may occur downrange when the fuze is fired in heavy precipitation, i.e., heavy rainfall, sleet, snow, or hail.

M564 FUZE



g. **Fuzes, MTSQ, M577 Series and M582 Series.**

WARNING

THE M577 AND M582 SERIES FUZES, WHEN SET FOR A TIME OF LESS THAN 4 SECONDS, WILL ALLOW THE ROTOR TO RELEASE ALMOST IMMEDIATELY, FULLY ARMING THE FUZE, WHICH ENABLES THE FUZE TO EXPLODE AT THE SET TIME. ANY TIME SETTING OF LESS THAN 2 SECONDS IS A DANGER TO CREW AND SHOULD NOT FIRE UNLESS FIRING "KILLER JUNIOR".

(1) These fuzes have a 200-second MT mechanism with three movable digital dials similar to a speedometer. Each fuze has a window through which the dials are viewed. The dials permit setting of the fuze to the nearest tenth of a second. The M577A1 and M582A1 MTSQ fuzes contain a different mechanism for PD action. Externally the major difference is the configuration of the wrench slots. The M577A1 and M582A1 fuzes are handled, set, and fired the same as the basic models. Early manufactured basic and A1 fuzes have black (paint finish) ogives while the later produced A1 fuze has a gold (chromate finish) ogive.

(a) The dial closest to the fuze nose indicates the time in hundreds of seconds. (The triangle (◀) position is a nontime setting).

(b) The second dial indicates time in tens of seconds.

(c) The third dial indicates the nearest second and also tenths of seconds by using the scale on the right edge of the dial.

(2) These fuzes can be set with the M35 fuze setter or a flat-tip screwdriver. The time-setting key is located on the end of the fuze nose. The desired time is set under the hairline. Detailed setting instructions are outlined in paragraph 4-14.

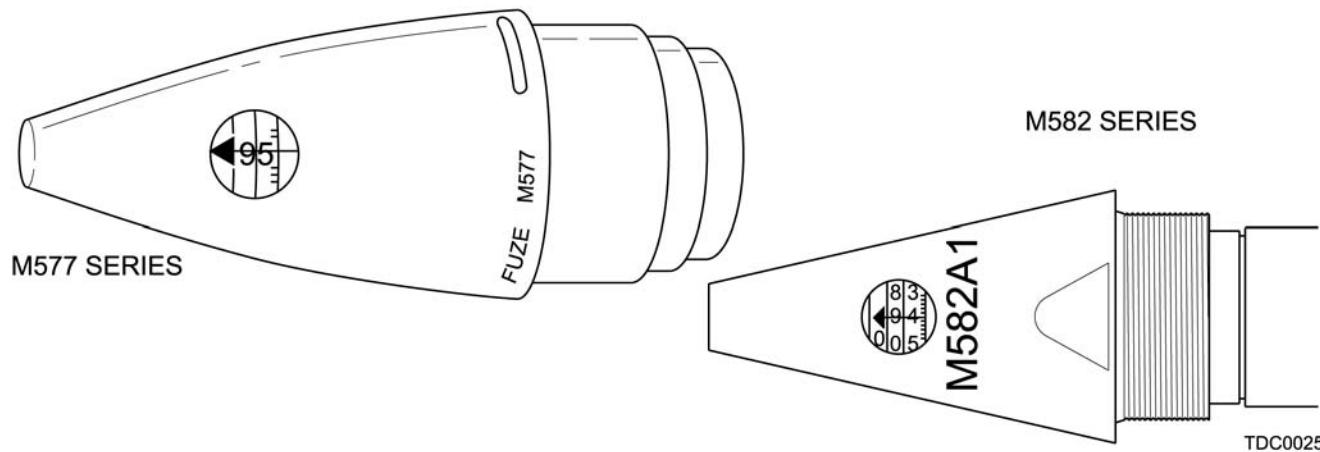
(3) The M577 series does not contain a booster and is used with BE projectiles. The M582 series fuze is fitted with a booster for firing with burster-type and high explosive projectiles. In order to minimize identification problems, current production of the M582A1 fuzes contain a white stencil "M582A1" below the window in the fuze body.

(4) The fuzes are not sensitive to rain.

(5) The M577 series fuze can be used with a spotting charge when firing the M483A1 and M864 projectiles in the self-registration mode.

(6) If M577 series/M582 series fuzes are set for TI and the timing mechanism fails, the fuze may or may not function on impact.

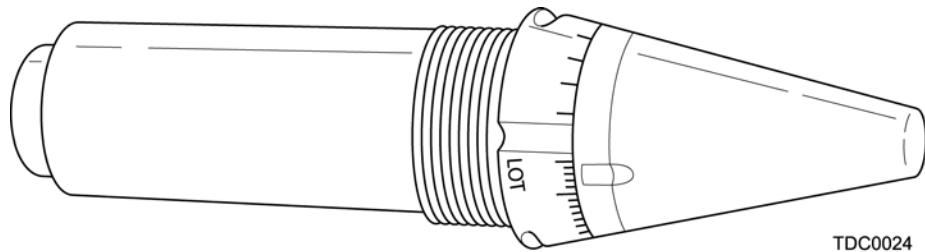
M577 SERIES OR M582 SERIES FUZE



THE M728 SERIES FUZES ARE NOT TO BE USED WITH THE M203/M203A1 PROPELLING CHARGE. PREMATURE MALFUNCTION COULD RESULT.

h. Fuze, Proximity, Variable Time (VT), M728 Series. These proximity VT fuzes are used with deep-cavity projectiles and are essentially self-powered radios and transmitting units. The fuzes can be set from 5 to 100 seconds. The nose of M728 fuze has been painted (black) to reduce static electricity.

M728 SERIES FUZE



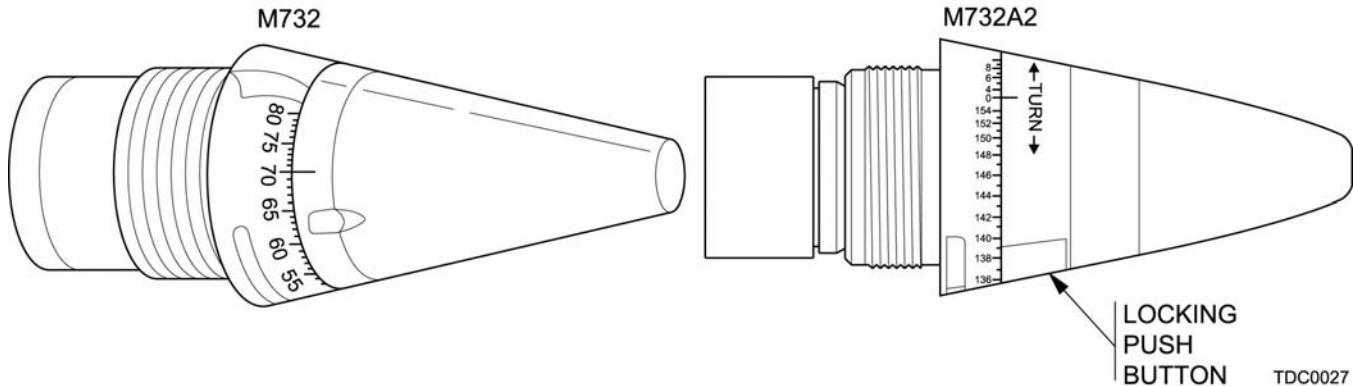
i. Fuze, Proximity, VT, M732 series. These proximity VT fuzes are short-intrusion fuzes of the same overall length as the standard impact or MT fuze. The supplementary charge must be left in the fuze well for proper functioning of this fuze. The M732 fuze has a time ring that can be set from 0 to 150 seconds. The M732A2 fuze can be set from 4 to 156 seconds. TI settings are used to arm these fuzes 3 to 5 seconds prior to set time for proximity function. The fuzes can also function PD as an option or proximity mode back-up and are always armed for PD at 400 calibers. The M732A2 was especially designed for compatibility with rocket-assisted rounds. The M732A2 is set by simultaneously depressing two pushbuttons in the ogive and rotating the setting ring to the desired position. When the pushbuttons are released, the setting ring is locked into position.

4-4 AUTHORIZED FUZES (cont)

NOTE

The PD setting of the M732 series VT fuzes, when fired into soft impact areas, will produce less lethality than the SQ setting of the M739 series PD fuze.

M732 SERIES FUZE



j. Fuzes, Electronic Time (ET), M762 and M767 Series.

(1) These fuzes are powered by a reserve lithium battery. The battery is activated manually by rotating the ogive or using the M1155 PIAF fuze setter, see paragraph 4-14.h. An electronic subassembly contains integrated circuits that provides controls and logic for 199.9 seconds ET and transmits a fire pulse signal for TI function. A Liquid Crystal Display (LCD) provides a visual readout of the fuze setting, as follows:

- (a) The column closest to the base end indicates time in hundreds of seconds (the triangle (◀ position is a nontime setting).
- (b) The second column away from base end indicates time in tens of seconds.
- (c) The third column away from base end indicates time in seconds.
- (d) The fourth column (closest to nose end) indicates time in tenths of seconds.

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

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

(4) These fuze bodies are anodized gold. The rear portion of the ogive is coated with a gold phosphate finish. The forward portion of the ogive is brown plastic for the basic fuzes and black plastic for the M762A1 and M767A1 fuzes. The nose cap is unpainted bronze for the basic fuzes and stainless steel for the M762A1/M767A1.

(5) The M762 fuze does not contain a booster and is used with BE projectiles. The M767 series fuze is fitted with a booster for firing with burster-type and HE projectiles.

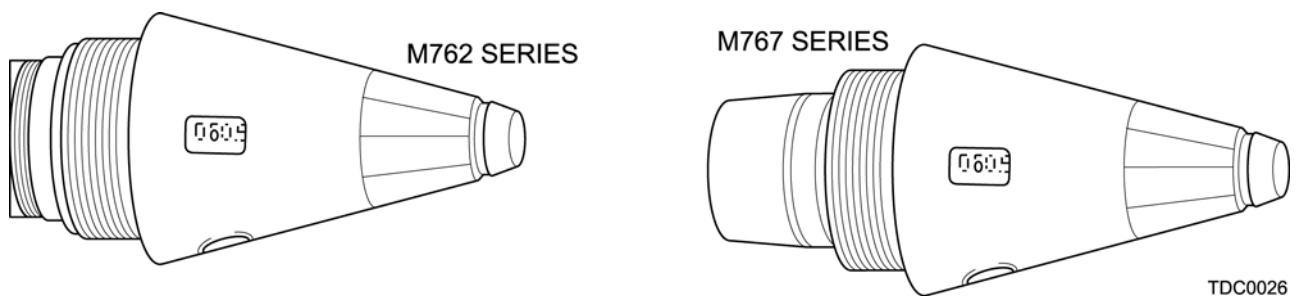
(6) The M762 series fuze can be used with a special spotting charge when firing the M483A1 and M864 projectiles in the self-registration mode. See paragraph 4-12.

- (7) If these fuzes fail in the time mode, there is no PD backup.
- (8) The fuzes are not sensitive to rain.

NOTE

Once activated, the M762 and M767 cannot be turned off, therefore, the fuzes have approximately 15 days service life before the battery runs down and the LCD goes blank.

M762 AND M767 FUZES



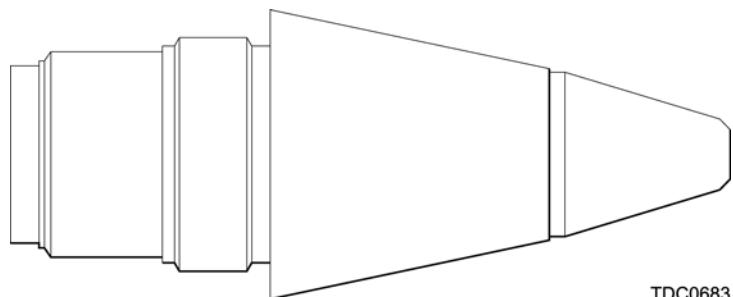
TDC0026

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

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

(2) These fuzes are set by a M1155 PIAFS (refer to TM 9-1290-210-12&P). The setting can be changed as many times as required. This fuze is not sensitive to rain.

M782 MOFA FUZE



TDC0683

4-5 PROPELLING CHARGES

- a. The following are authorized propelling charges:

WARNING

SOME PROPELLING CHARGES MAY HAVE PRIMER MK2A4 PACKED INSIDE THE CONTAINER. THIS PRIMER IS NOT AUTHORIZED FOR FIRING IN THE M776 CANNON. DO NOT FIRE THE MK2A4 IN THIS CANNON. TURN THEM INTO THE AMMUNITION SUPPLY POINT.

- ALLOWABLE NUMBER OF ROUNDS PER 24-HOUR PERIOD-BY CHARGE (WITH HEARING PROTECTION).

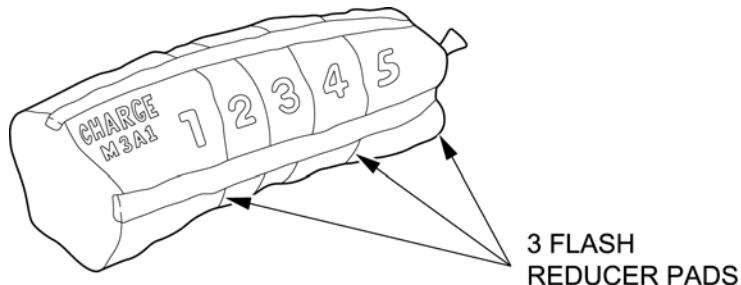
M203	SERIES – 12
M119	SERIES – 32
M4	SERIES – 144
M3	SERIES – 1000

NOTE

These recommended limits are mutually exclusive; e.g., 12 rounds M203 series, or 32 rounds M119 series, or 144 rounds M4 series, or 1000 rounds M3 series per 24 hour continuous time period.

- b. **Propelling Charge, M3A1.** This is a Green Bag (GB) charge divided into a base and four increments for firing in charges 1 thru 5. It has a flash reducer pad assembled in front of the base charge with similar 1 oz (28.35 g) pads assembled in front of increments 4 and 5. The increment bags are tied together by cloth straps. A clean-burning igniter charge in a red cloth bag is sewn to the rear of the base section.

M3A1 PROPELLING CHARGE (GREEN BAG)



TDC0029

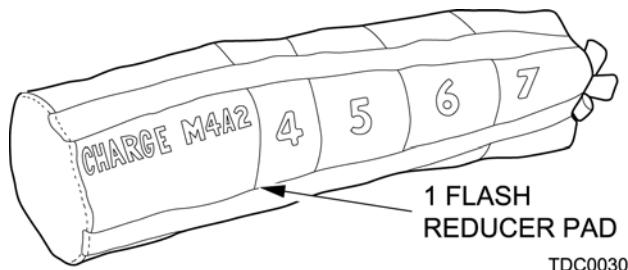
WARNING

DO NOT FIRE M4A2 PROPELLING CHARGE, IN ANY M777/M777A1/M777A2 UNLESS TWO ADDITIONAL M2 FLASH REDUCERS ARE INSERTED BEHIND THE FORWARD INCREMENT OF THE M4A2 WHEN FIRING CHARGE 4W, 5W, 6W AND 7W. FLASH REDUCERS SHOULD BE TIED TO THE FRONT OF THE M4A2 CHARGE, UNDER THE CLOTH TIE-STRAPS, WHEN FIRING CHARGE 3W.

- c. **Propelling Charge, M4A2.** This is a White Bag (WB) charge consisting of a base charge and four increments for firing in charges 3 thru 7. The increments are tied together by cloth straps. A clean-burning igniter charge in a red cloth bag is sewn to the rear of the base section. It has a flash reducer pad assembled in front of the base charge.

M4A2 PROPELLING CHARGE (WHITE BAG)

d. **Propelling Charge, M4A1.** The M4A1 propelling charge is identical to the M4A2 propelling charge, except that it does not contain a flash reducer, and the base igniter contains black powder instead of a clean-burning igniter charge. The M2 flash reducer may be used with this charge and is a separate item of issue.

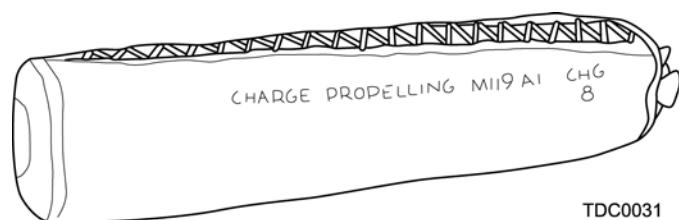


WARNING

A CENTRAL IGNITION CORE IN M119A1, AND M203 CHARGES EXTENDS THROUGH THE CENTER OF THE CHARGE FOR ALMOST IT'S ENTIRE LENGTH. THE M119A1, AND M203 CHARGES MUST BE STORED AND TRANSPORTED IN A HORIZONTAL POSITION SO THAT ANY POSSIBILITY OF DAMAGE TO THE CORE IN THE FORM OF CRACKS OR SPLITS IS ELIMINATED. THE M119 CHARGE IS NOT TO BE USED WHEN FIRING M549/M549A1 PROJECTILES.

e. **Propelling Charge, M119A1.** This charge is identical in appearance to the M119 propelling charge. It is a single charge 8. It contains some design improvements including a modified flash reducer, the modified flash reducer allows firing of this charge with the M549 and M 549A1 projectiles. A pull strap has also been added to the M119A1 charge, which provides easier removal from the metal container. This pull strap must be removed from the charge before loading into the weapon tube.

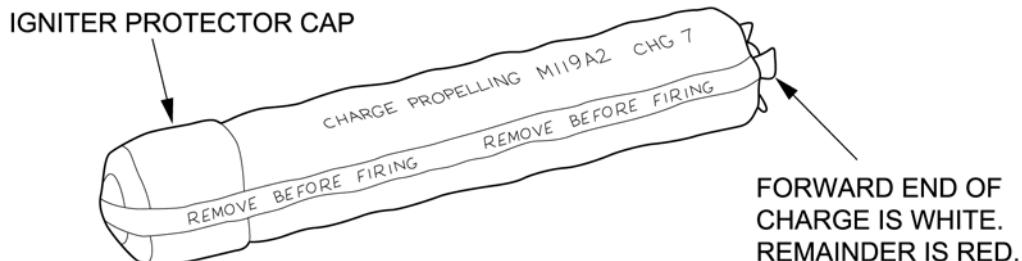
M119A1 PROPELLING CHARGE (WHITE BAG)



f. **Propelling Charge, M119A2.** This charge differs in appearance from the M119A1 in that it has no lacing jacket and the charge bag is red. It is a base ignited zone 7 charge with an igniter pad sewn on the base and a flash reducer, which lines the side of the charge. Like the M119A1, it can be fired with the M549/M549A1 projectile. The igniter protector cap and tie strap must be removed prior to firing the charge. The M119A2 zone 7 is equivalent to the M119A1 zone 8 charge.

4-5 PROPELLENG CHARGES (cont)

M119A2 PROPELLENG CHARGE



TDC0032

WARNINGS

WHEN FIRING THE M203 CHARGE (RED BAG) OR M203A1 CHARGE, THE FOLLOWING RESTRICTIONS MUST BE OBSERVED:

- FOAM EARPLUGS MUST BE PROPERLY WORN.
- NO MORE THAN 12 ROUNDS SHOULD BE FIRED IN A GIVEN 24 HOUR PERIOD BY ANY ONE CREW OR ONE INDIVIDUAL CREW MEMBER, IF MORE THAN 12 M203 SERIES CHARGES ARE FIRED, ALL PERSONNEL MUST STAND 25 FEET (7.62 M) OR MORE BEHIND REAR OF CANNON AND A 25-FOOT (7.62-M) LANYARD MUST BE USED.
- ALLOWABLE NUMBER OF ROUNDS PER 24-HOUR PERIOD-BY CHARGE (WITH HEARING PROTECTION).

M203 SERIES – 12
M119 SERIES – 32
M4 SERIES – 144
M3 SERIES – 1000

NOTE

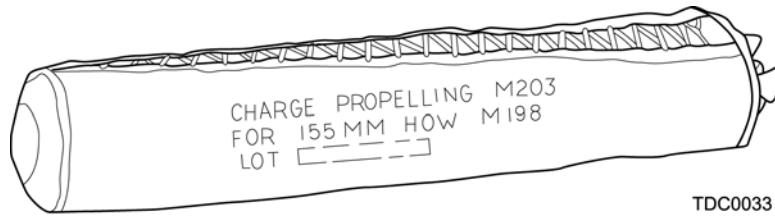
These recommended limits are mutually exclusive; e.g., 12 rounds M203 series, or 32 rounds M119 series, or 144 rounds M4 series, or 1000 rounds M3 series per 24 hour continuous time period.

g. Propelling Charge, M203. The M203 propelling charge is a charge 8 propelling charge developed for extended range in long-tube (M776) 155-mm howitzers. This red bag charge consists of one increment with an igniter bag sewn on its base, a central core igniter extending through the center of the charge, and a flash reducer in front of the charge. The entire length of the charge is encased in a tight-fitting lacing jacket for added strength and stability.

NOTE

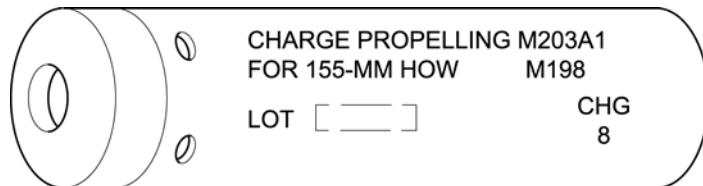
Early production of M203 charges are marked charge 8S (i.e., super). Later production M203 charges are marked charge 8. The charges are ballistically equivalent and should be identified as charge 8 red bag.

M203 PROPELLING CHARGE (RED BAG)



h. Propelling Charge, M203A1. The M203A1 propelling charge like the M203 is a charge 8 propelling charge developed for extended range in long-tube (M776) 155-mm howitzers. This charge consists of one increment of stick propellant and a base igniter pad encased in a full length rigid combustible cartridge case. The charge also contains a wear reducing additive and a lead foil decoppering agent. The M203A1 charge 8 is ballistically equivalent to the M203 red bag charge 8.

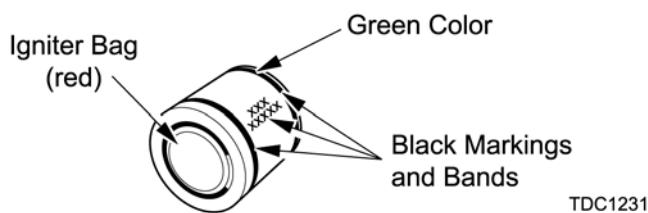
M203A1 PROPELLING CHARGE



M231 PROPELLING CHARGE: MACS (Modular Artillery Charge System)

i. Propelling Charge, M231. The M231 propelling charge is comprised of a green-colored, coated, nitrocellulose-based combustible case with black markings and black bands. This charge is bi-directional (can be loaded in either direction). The M231 is fired in increments of 1 or 2 for charges 1 and 2.

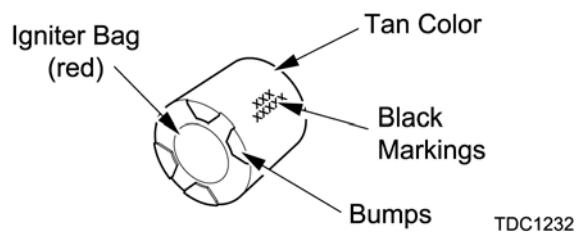
M231 PROPELLING CHARGE



4-5 PROPELLING CHARGES (cont)

j. **Propelling Charge, M232/M232A1.** The M232/M232A1 propelling charge is comprised of a tan-colored, coated, nitrocellulose-based combustible case with black markings. This charge is bi-directional (can be loaded in either direction). Each end has four raised 1/8 in. bumps. The M232/M232A1 is fired in increments of 3 through 5 for charges 3 through 5.

M232/M232A1 PROPELLING CHARGE



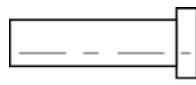
4-6 PRIMER, M82

WARNING

THE M82 AND DM191A1 ARE THE ONLY PRIMERS (SEE CHAPTER 5) AUTHORIZED FOR FIRING IN M776 CANNON. DO NOT FIRE THE MK2A4 IN THIS CANNON. TURN THEM INTO THE AMMUNITION SUPPLY POINT.

a. **The M82 primer,** which is loaded separately from the projectile, is inserted into the primer chamber. When the cannon is fired, the firing pin strikes the primer, which in turn ignites the charge, propelling the projectile forward.

PRIMER, M82



4-7 FLASH REDUCER, M2 (T2)

a. The M2 (T2) flash reducer pads serve to limit breech flashback, as well as muzzle flash and blast overpressure. This flash reducer consists of a red cotton cloth bag 4 in. (10.16 cm) square, containing black powder and potassium sulfate or potassium nitrate. The M2 flash reducer, which is a separate item of issue, may be used with the M4A1 propelling charge if flash reduction is desired. In preparing an M4A1 white bag propelling charge for firing, one flash reducer is added in front of the base charge and one in front of each increment used.

M2 (T2) FLASH REDUCER



TDC0037

Section II. PREPARATION FOR FIRING

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4-9	Grommets
4-10	Flexible Rotating Band Cover (FRBC)
4-11	Field Artillery Projectile Pallet (FAPP)
4-12	Preparation for Firing
4-13	Fuzes
4-14	Fuze Setting
4-15	Propelling Charge Preparation
4-16	Loading and Firing
4-17	After Firing
4-18	Ammunition Prepared for Firing, but not Fired.....

4-8 GENERAL

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

WARNING

TO ENSURE THAT THE PROJECTILE UPPER TEMPERATURE LIMIT STAYS BELOW +125 °F (+ 52 °C), THE PROJECTILE MUST BE KEPT UNDER SHADE WHEN THE TEMPERATURE IS EXPECTED TO EXCEED + 100 °F (+ 38 °C) DURING THE DAY.

- (1) Lower limit is -40°F (-40°C).
- (2) Upper limit is + 125°F (+52°C).

4-8 GENERAL (cont)

b. Temperature Checks Procedures for MACS, M231 and M232/M232A1.

NOTE

Temperature will be taken using the standard issue M1A1 powder thermometer. The operating temperature of MACS is -50°F through +120°F.

- (1) Lift the edge of the red seal on either end of the increment and peel the seal back.

WARNING

DO NOT JAB THE ROUND END IGNITER BAG WITH THERMOMETER OR ANY OTHER OBJECT THAT MAY BE USED TO BREAK THROUGH THE EDGE OF THE RED SEAL. BLACK POWDER IS IMPACT SENSITIVE AND FORCEFUL IMPACT OF THE BAG MAY CAUSE AN ACCIDENTAL IGNITION.

NOTE

Do not puncture the combustible case since this makes the increment defective.

- (2) Lift the edge of the igniter bag and insert the powder thermometer under the cloth igniter bag and down along the inside of the center core.

- (3) The thermometer must stay in the increment until the temperature stabilizes.

c. Packing and Unpacking Ammunition Components. Retain packing materials for repackaging, as required.

WARNING

THE M82 AND DM191A1 (SEE CHAPTER 5) ARE THE ONLY AUTHORIZED PRIMERS TO BE USED IN THE M776 CANNON. DO NOT USE THE MK2A4 IN THIS CANNON TUBE. THE PROPELLANT MAY NOT IGNITE.

- (1) The M3 series propelling charges are packed two per metal container, with or without the MK2A4 primer. The M4 series, M119A1, M119A2, M203 and M203A1 propelling charges are packed one per metal container.

- (2) The M231 is packed with four increments (two per extraction sleeve) in each metal container and the M232/M232A1 is packed with five per metal container. Increments in extraction sleeves that are not full will be combined to reduce the number of partially loaded containers. These increments will be repacked into their correct type of extraction sleeve and the repacked sleeves returned to their correct container (correct type and lot number) using the following procedures:

NOTE

Unused MACS increments should not be destroyed. They should be repacked, and either fired or turned back in.

- (a) Place one of the end cushions into the end of the extraction sleeve and lock in place using the velcro strap.

- (b) Slide the correct amount of charges (two for the M231 and five for the M232/M232A1) into the open end of the extraction sleeve.

(c) Slide the separators between the charges, making sure they slide all the way in. The bumps on the M232/M232A1 must be aligned for the separators to slide all the way in.

(d) Place second cushion into the open end of the sleeve and lock in place using the second velcro strap.

(e) Slide extraction sleeve with charges into the container and close.

(f) Mark partially loaded containers to that they are not turned in as empty.

(3) The M82 primers are packed one per waterproof bag. Primers are ready for firing when unpacked and should be protected from blows that might cause accidental functioning.

(4) The M2 (T2) flash reducers are packed 200 per metal container (four containers, 800 flash reducers per wooden box).

(5) Fuze are generally packed in metal boxes. The metal boxes are then packed in wooden boxes.

(6) Refer to paragraph 4-24 Unpacking and Inspection procedures for the M712 Copperhead (HEAT) and M823 Training Projectiles.

d. **Procedures.** Inspect ammunition components and verify item identification.

WARNING

INSPECT YOUR AMMUNITION; FAILURE TO ACCOMPLISH REQUIRED INSPECTIONS COULD RESULT IN UNNECESSARY MALFUNCTIONS.

CAUTION

Do not use axes, crowbars, etc., which may damage ammunition or packaging.

(1) Unpack ammunition and perform inspections indicated in paragraph 4-24.

(2) Return all defective ammunition to Ammunition Supply Point (ASP).

4-9 GROMMETS

Plastic Grommets. Provide protection to projectile rotating bands and obturators. One kind of grommet consists of glass filament, wound and impregnated with polyester. Another kind of grommet is made of polycarbonate. In order to remove the polycarbonate grommet from the projectile, the grommet fastener has to be pulled outward to release the tension, which holds the grommet around the projectile body. When installing the polycarbonate grommet, slide the grommet over the projectile until it rests on the rotating band area, then close and push the fastener until it locks.

4-10 FLEXIBLE ROTATING BAND COVER (FRBC)

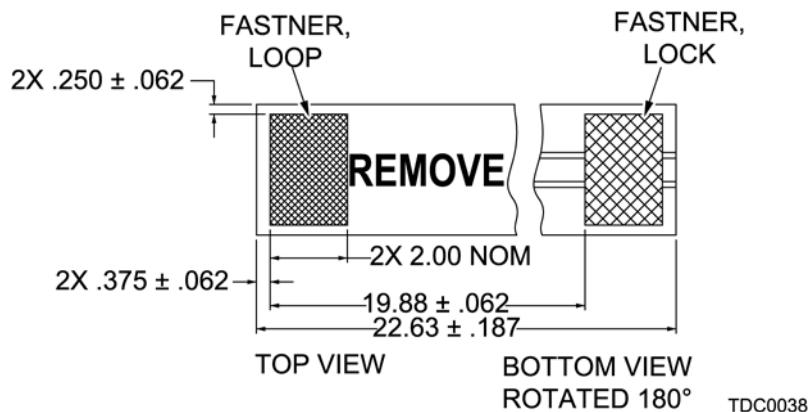
a. **General.** The FRBC, as well as the grommet, is used to protect the rotating band of artillery projectiles for corrosion, dirt, and damage during transportation, handling, and storage. The FRBC can be discarded or replaced in the event of NBC contamination. The FRBC consists of a cloth band with hook and loop attachable ends. Once the FRBC is wrapped around the projectile rotating band, the two ends are pulled until it is tight against the rotating band. The FRBC is then closed by pressing the loop end against the hook end of the fastener with the words "REMOVE BEFORE FIRING" visible in the upright position.

4-10 FLEXIBLE ROTATING BAND COVER (FRBC) (cont)

b. **Replacement.** The FRBC should be replaced if any of the following situations occur:

- (1) The FRBC does not stay on firmly with sufficient resistance to opening.
- (2) The FRBC exhibits cuts that expose the rotating band.
- (3) The FRBC marking is unreadable due to age and wear.

FLEXIBLE ROTATING BAND COVER



TDC0038

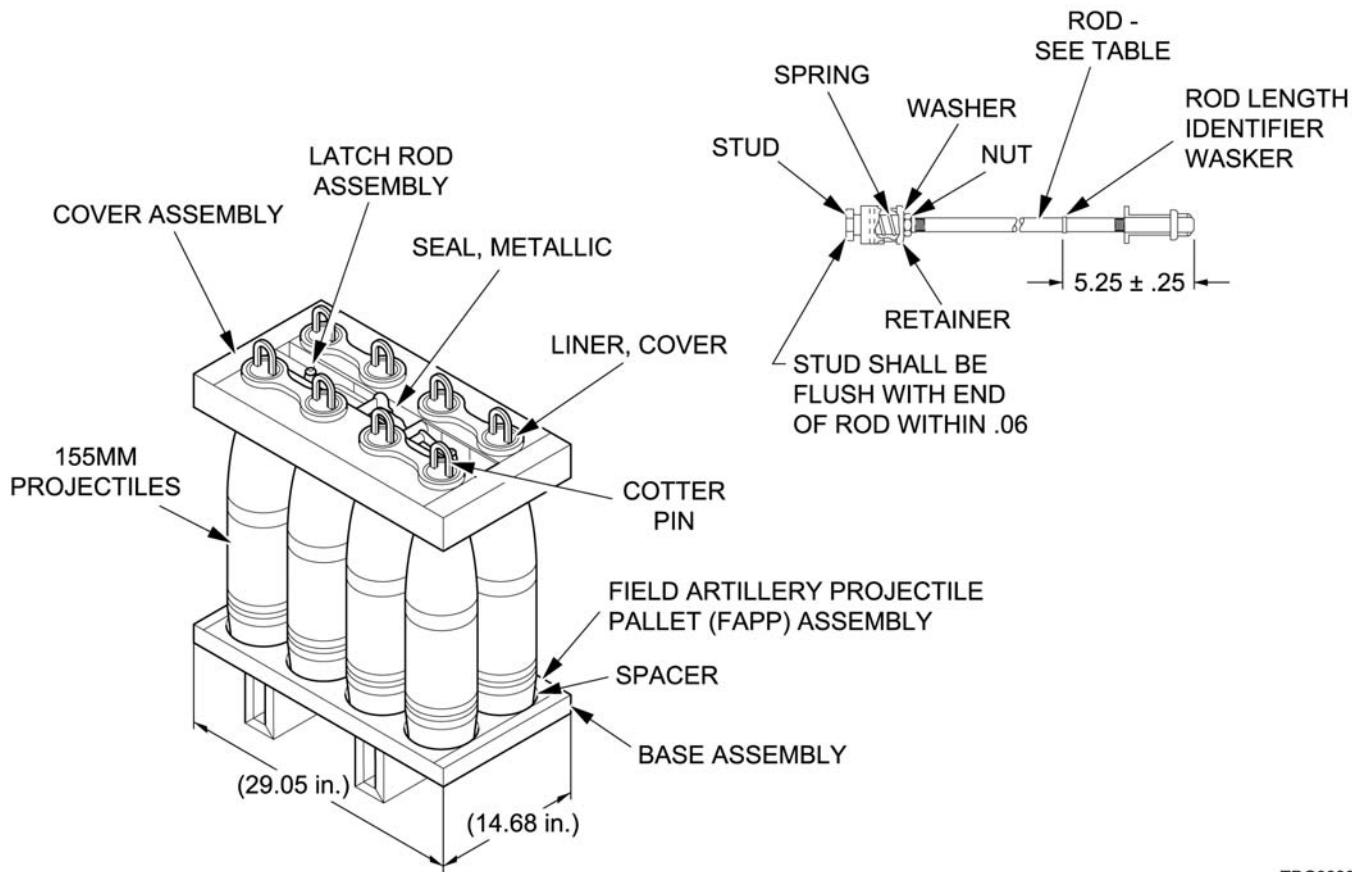
4-11 FIELD ARTILLERY PROJECTILE PALLET (FAPP)

a. **General.** The FAPP is a NBC decontaminable, non-flammable, reusable metal pallet. It allows for easy repalletization in the field with no special tools required. The FAPP consists of a steel pallet base, steel pallet cover, and two adjustable rods that hold the cover to the base. The two adjustable rods hold the FAPP securely without any banding needed. There are plastic spacers under the base of the projectile and on top of the lifting plug to prevent abrasion. The FAPP holds up to eight 155-mm projectiles, with a minimum of two projectiles, and it accommodates both plastic grommet and the FRBC for rotating band protection. Before loading the FAPP with projectiles, the latch rods must be assembled to the pallet base. The center of the pallet is loaded first to avoid tipping. Once the FAPP is loaded, the pallet cover with the handles in open position is placed over the projectiles. The pallet cover is then closed by pushing the handles down into the locked position.

b. **Instructions.** Complete instructions for assembling, loading, and unloading the FAPP are found in TM 9-1300-251-20&P and TM 9-1300-251-34&P.

PROJECTILE	ROD LENGTH	BASE SPACES
M107, M110 SERIES, M449 SERIES, M485A1, M804 SERIES	24.5 in. (62.2 cm)	5.5 in. (14.0 cm) wide –Green
M795	30 in. (76.2 cm)	5.9 in. (15.0 cm) wide – Black
M549 SERIES	31.5 in. (80.0 cm)	5.5 in. (14.0 cm) wide – Green
M483A1, M692, M718, M731, M741, M864, M898	32 in. (81.3 cm)	5.9 in. (15.0 cm) wide – Black

FIELD ARTILLERY PROJECTILE PALLET



TDC0039

4-12 PREPARATION FOR FIRING

a. Preparation for firing. Preparing the four components of a complete 155-mm round for firing requires efficient teamwork among the Cannoneers. They must quickly and accurately select, unpack, inspect, and prepare the correct primer, propellant, projectile, and fuze from the fire commands received by the howitzer section. The SC must thoroughly cross-train the entire crew so that any crewman can perform any or all of the duties required of any other members.

b. Primer, M82. Do not open moisture protective bag until ready to load into magazine.

c. Conventional Propelling Charges. Propelling charges come packed in hermetically sealed metal containers. There is one complete charge in each container of the M4 series, M119 series, and the, M203 series propellants. The M3 series GB charges are packed with two complete charges in each metal container. Check for the following when preparing the propellant for firing:

(1) Select the right charge announced in the fire command.

(2) Unpack the charge from the metal container, and inspect the charge for torn cloth, loose powder grains, or discoloration of the cloth bags.

(3) For M203A1 propelling charge only, pull pull-straps until the buttons on the base igniter assembly clear the mouth of the container. Grasp charge around the buttons and pull charge out of the container supporting it along its length to avoid dropping the charge. Charges which have severely crushed or distorted cases and/or contain missing or broken propellant are not to be fired.

4-12 PREPARATION FOR FIRING (cont)

(4) Remove the igniter cap and inspect the red igniter pad; the pad should not be torn or wet. The igniter powder grains are highly hygroscopic (will absorb moisture). The grains could stick together, which could cause misfires. The igniter powder grains should move freely inside the pad to show that they are not stuck together.

(5) Check the smell of the powder charge and its container. There should not be a sour, acid smell as this indicates the charge was previously wet. There should be a sweet, ether-like smell, indicating that the charge is fresh.

(6) Remove any excess powder increments (those increments with a higher number than called for in the fire command), and retighten the tie straps so that all powder increments are secure, with the highest numbered charge (per fire command) on top.

(7) Place the unused powder increments in a secure container and dispose of them later by burning under the supervision of an officer.

d. **Modular Artillery Charge System (MACS).** The MACS propelling charges are combustible case type charges that are packed in hermetically sealed metal containers. The M231 MACS is packed with four modules (two per extraction sleeve) in each metal container. The M232/M232A1 MACS is packed with five modules in each metal container. Check for the following when preparing the propellant for firing.

(1) Select the right charge announced in the fire command.

(2) Unpack the charges from the metal container by pulling on the velcro strap removing the sleeve with the MACS enclosed from the container. Remove separator assembly by pulling on the connecting strap. Open the velcro strap and remove end cushions from either end of sleeves. Push the needed amount of MACS from the opposite end of the sleeve through the now open end of the sleeve. Charges that are severely crushed, distorted, or broken are not to be fired.

(3) Check the red mylar seals on the end of the charges. If the seal is torn, punctured or missing, inspect the igniter bag. The pad should not be torn or wet. The igniter powder grains are highly hygroscopic (will absorb moisture); the grains will stick together, which could cause misfires. The igniter powder grains should move freely inside the pad to show that they are not stuck together.

(4) Unused MACS charges are repacked for later use.

e. **Projectile.** Projectiles for this howitzer normally come packed eight to the pallet, with the top and bottom of the wood pallets banded together or metal pallets (FAPP) secured together with adjustable rods. Each projectile has a lifting plug and a grommet or FRBC attached for protection during handling and shipping activities. See paragraph 4-32 for the LPRS, which is an optional system for securing, unfuzed projectiles for transportation.

WARNING

DO NOT REMOVE THE GROMMET OR FLEXIBLE ROTATING BAND COVER FROM THE PROJECTILE UNTIL IT IS READY TO BE FIRED. IF THE GROMMET OR FRBC HAS BEEN REMOVED AND THE PROJECTILE IS NOT FIRED, THE GROMMET OR FLEXIBLE ROTATING BAND COVER SHOULD BE REPLACED. HANDLING OR TRANSPORTING PROJECTILES WITHOUT A GROMMET OR FLEXIBLE ROTATING BAND COVER IS LIKELY TO CAUSE DAMAGE TO THE OBTURATOR BAND AS WELL AS TO THE ROTATING BAND.

NOTE

These procedures apply to all projectiles, except for the M483A1 and M864 projectiles when fired in the self-registration mode.

(1) Preparation of projectiles. Select the right projectile announced in the fire commands and prepare it for firing as follows:

(a) Inspect and clean projectile.

1. Verify that the projectile is the type designated by the fire commands.

NOTE

A projectile with a burred rotating band will be put aside until the burrs can be removed with a file.

2. Remove the grommet or FRBC and examine the rotating band to ensure that it is free from all dirt and burrs.

3. Remove the eyebolt lifting plug and gasket and examine the fuze well for leaks or damage to the filler. If any HE filler residue clings to the threads of the fuze well, the round is rejected and another one is used to complete the fire mission.

WARNING

DIRT OR GREASE LEFT ON THE PROJECTILE ROTATING BAND COULD CAUSE FAILURE OF THE PROJECTILE TO SEAT PROPERLY IN THE FORCING CONE. FIRING AN UNSEATED PROJECTILE COULD RESULT IN AN INBORE EXPLOSION CAUSING DEATH OR INJURY.

NOTE

Any sand, dirt, oil, or grease left on the projectile will cause wear, scratches, or gouges in the bore.

4. Examine the entire projectile for defects and check to see that the projectile is not damaged or corroded and is free of dirt, grease, sand, and oil. Slight rust on the projectile is acceptable.

(b) Hold the projectile upright for fuzing and fuze setting.

(2) Special preparation of the M483A1 and M864 projectiles for use in the self-registration mode. When the command for use of the M483A1 or M864 ICM projectile includes the self-registration mode, the expulsion charge inside the nose of the projectile must be removed and a projectile spotting charge threaded on to the fuze as follows:

(a) Remove the fusible or universal lifting plug (1) with attached gasket. When the lifting plug is removed, the compressed coiled pull-wire (2) on the bagged expulsion charge assembly (3) will expand and protrude beyond the fuze well of the projectile ogive. If the projectile is assembled with the cylindrical plastic expulsion charge assembly (4), the tab (5) will pop up.

(b) Remove the bagged expulsion charge assembly (3 or 4) by grasping and firmly pulling the pull-wire (2) or tab (5). Set charge assembly aside for disposal. Visually inspect the fuze well (6) for loose grains of propellant or other foreign material. Remove any loose material.

4-12 PREPARATION FOR FIRING (cont)

WARNING

WHEN ASSEMBLING THE PROJECTILE SPOTTING CHARGE (7) ON TO REAR OF THE M577 SERIES FUZE OR M762 FUZE (8) ENSURE THAT SHOULDER OF PROJECTILE SPOTTING CHARGE IS SEATED SQUARELY AGAINST SHOULDER OF FUZE. AN IMPROPERLY SEATED CHARGE COULD CAUSE A MALFUNCTION.

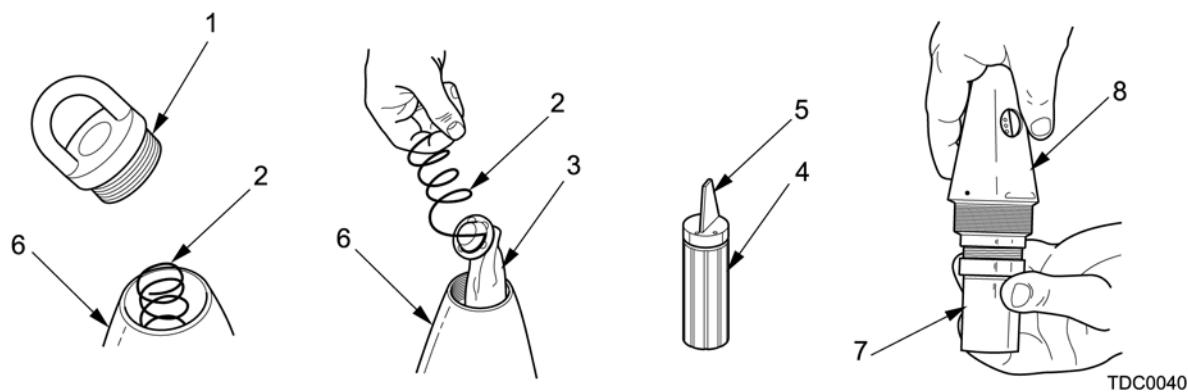
CAUTION

When assembling projectile spotting charge to fuze, take care to avoid damaging threads. If binding occurs, remove spotting charge and inspect charge and fuze threads for damage. If damage has occurred notify EOD.

(c) Obtain an M577 series fuze or an M762 fuze (8) and a projectile spotting charge (7). (1320-00-171-0760 D003).

(d) If firing the M483A1 or M864 projectile in the self-registration mode, screw the projectile spotting charge (7) hand tight onto the M577 series fuze or M762 fuze (8) (left-hand thread).

EXPULSION CHARGE ASSEMBLY – REMOVAL



4-13 FUZES

a. **General.** The four basic types of fuzes are: PD, MT, ET and VT fuzes. On the command, FUZE (type of fuze), Cannoneer No. 5 must select the right type, unpack, inspect, and install it in the projectile, and set it as commanded (TI, SQ, DLY).

b. **Lifting Plug Removal.**

WARNING

DO NOT USE A PROJECTILE WITH EXPLOSIVE ON THE THREADS OR EVIDENCE OF EXPLOSIVE POWDER SEEPAGE. IT COULD CAUSE DETONATION OF THE PROJECTILE IF FIRED.

(1) Remove plug and inspect the filler beneath the plug.

(2) Inspect the cavity and projectile threads for damage. Remove loose material from cavity If any high explosive is found stuck to the threaded portion of the projectile throat, do not fire.

WARNINGS

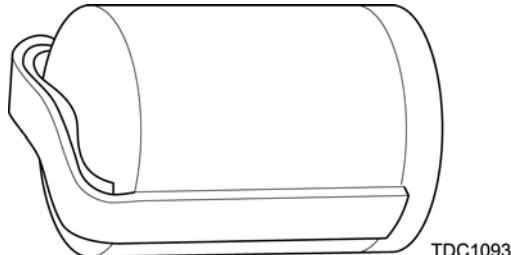
DO NOT USE THE M549/M549A1 PROJECTILE IF THE LIFTING PLUG HAS BEEN BROKEN. DO NOT ATTEMPT TO EXTRACT ANY PORTION OF THE PLUG FROM THE FUZE WELL OF THE PROJECTILE. RETURN PROJECTILE TO THE AMMUNITION SUPPLY POINT.

DO NOT FIRE POINT-DETONATING, MECHANICAL TIME AND SUPERQUICK, ELECTRONIC TIME, OR THE SHORT INTRUSION VARIABLE TIME FUZES IN A DEEP-CAVITY PROJECTILE WITHOUT THE SUPPLEMENTARY CHARGE AS AN INBORE EXPLOSION MAY RESULT.

DO NOT ATTEMPT TO REMOVE SUPPLEMENTARY CHARGE BY ANY MEANS OTHER THAN THE LIFTING LOOP. USE OF SCREWDRIVERS OR OTHER TOOLS TO REMOVE THE CHARGE BY FORCE IS DANGEROUS.

c. **Supplementary Charge.** For the long intrusion proximity fuze firings, remove supplementary charge by means of its lifting loop. If the charge cannot be removed by its lifting loop, either fire with a short intrusion VT, PD, ET, or MTSQ fuze or dispose of the round.

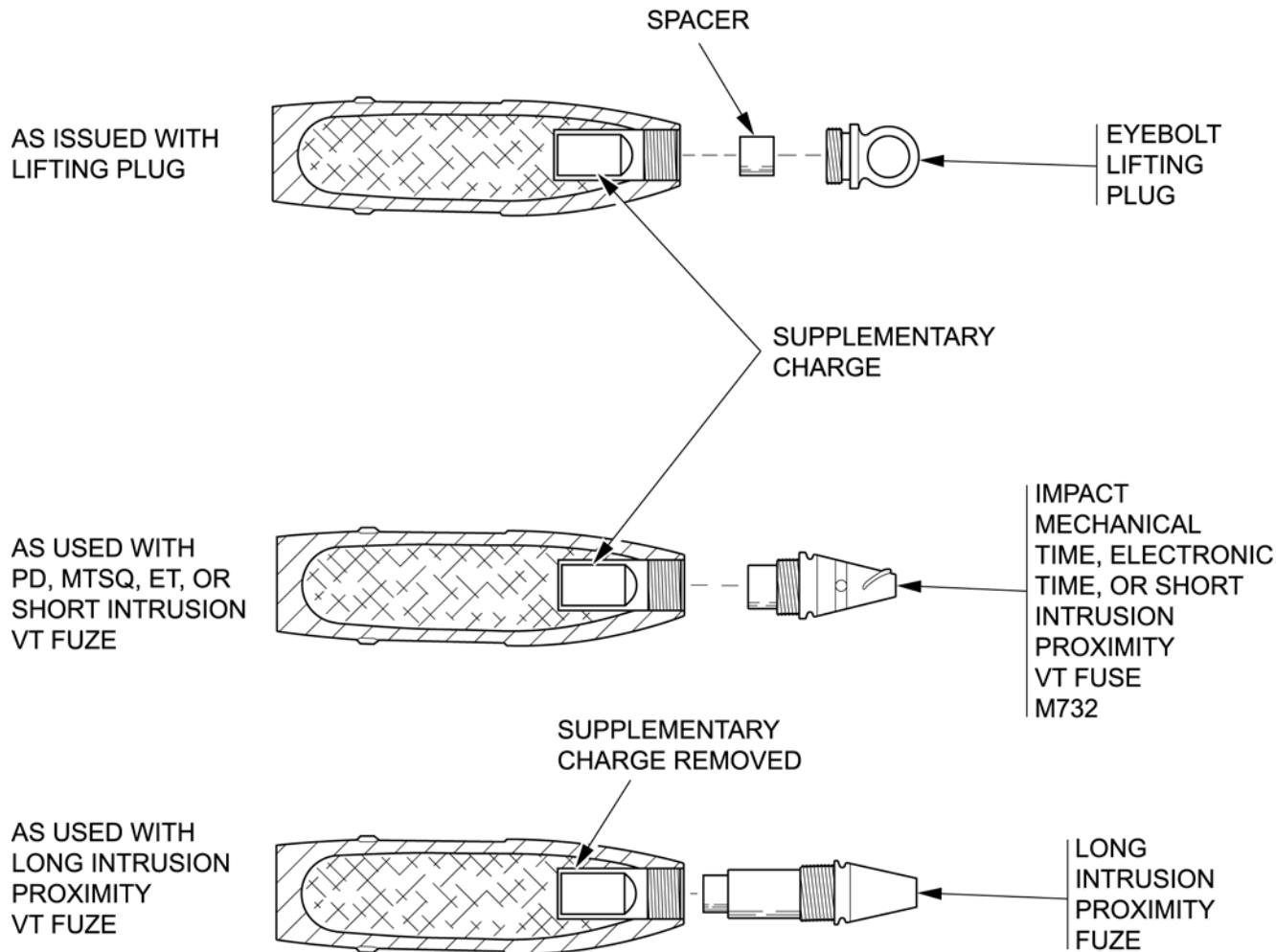
SUPPLEMENTARY CHARGE



TDC1093

4-13 FUZES (cont)

TYPICAL DEEP-CAVITY PROJECTILES



TDC1092

d. Fuze Assembly. The following procedures apply to all fuzes. Sub paragraph (2) contains special instructions for the M577 series fuzes.

- (1) Assembly of fuze to projectile.

WARNING

WHEN TIGHTENING FUZE TO PROJECTILE, DO NOT HAMMER ON FUZE SETTER WRENCH OR USE EXTENSION HANDLE ON FUZE SETTER WRENCH. DO NOT STAKE FUZE TO PROJECTILE UNDER ANY CIRCUMSTANCES. SHOCKS TRANSMITTED TO A FUZE DURING ASSEMBLY MAY CAUSE A MALFUNCTION.

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

WARNING

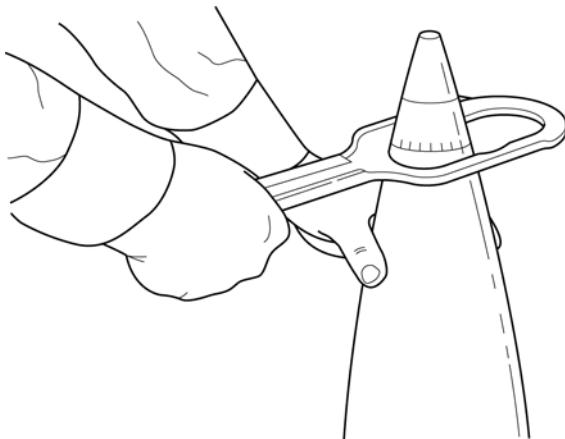
PROJECTILES FIRED WITH AN IMPROPERLY SEATED FUZE MAY FUNCTION PREMATURELY.

NOTE

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

(b) After assembling fuze by hand, back fuze off $\frac{1}{4}$ turn. Using the M18 fuze setter wrench, tighten fuze to projectile with a sharp snap of the wrench so that the fuze shoulder is seated firmly against the projectile nose.

FUZE ASSEMBLY



TDC0042

(2) Special preparation for the M577 Series fuze. Inspect the fuze setting. The fuze will be considered unserviceable if the setting is not between \blacktriangleleft 93.5 and \blacktriangleleft 95.5, the fuze shows signs of damage, or the window is blackened or sooty inside.

WARNING

WHEN SCREWING THE PROJECTILE SPOTTING CHARGE ON TO THE REAR OF THE M577 SERIES FUZE, ENSURE THAT THE SHOULDER OF THE PROJECTILE SPOTTING CHARGE IS SEATED SQUARELY AGAINST THE SHOULDER OF THE FUZE. AN IMPROPERLY SEATED CHARGE COULD CAUSE A MALFUNCTION.

4-13 FUZES (cont)

CAUTION

When assembling projectile spotting charge to a fuze, take care to avoid damaging threads. If binding occurs, consider the charge unserviceable and report it for disposal. If binding has occurred, re-inspect the fuze and ensure it is still serviceable.

4-14 FUZE SETTING

- a. The following procedures apply to all authorized fuzes. Fuze-setting tools and procedures are listed in Table 4-4.

Table 4-4. Fuze-Setting Tools and Procedures.

Fuze										
MOFA	PD			MT		Prox	ET			
M782	M557	M739 Series	MK399 MOD1	M565	M564	M577/ M582 Series	M732/ M728/ M514	M762/ M767 Series	Setter	Procedure Number/ Page Number
	X	X	X						Fuze-setter wrench,M18	1/4-48
							X		M27	2/4-41
				X	X				M34	3/4-42
						X			M35	4/4-45
								X	By hand or M1155	6/4-48
X									M1155	7/4-8.1

b. Procedure Number 1, Fuzes M557, M739 series, and MK399 MOD 1.

NOTE

PD fuzes with SQ or DLY functioning are shipped for SQ action. The MK399 MOD 1 MOUT fuze is shipped set on DLY mark.

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

(2) To set fuzes for DLY action, use screwdriver end of the M18 fuze-setter wrench or similar tool and turn slot $\frac{1}{4}$ turn to align with index mark indicating DELAY (or DLY on MK399 MOD 1 fuze).

FUZE SETTING PROCEDURE



TDC0043

c. Procedure Number 2, Fuze M728 and M732 series.

CAUTION

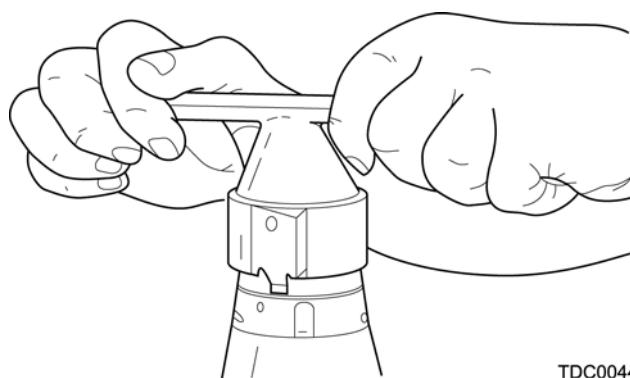
Plastic nose cones rotate with index mark. Damage to plastic will produce duds. However, since there is no backlash, fuze setting can be accomplished or changed one or more turns with no harmful effect. If CCW rotation is used, be sure that the fuze has not come loose from the projectile.

NOTE

M728 fuzes are shipped with the index mark on the nose cone set at 10 seconds.
M732 fuze is shipped with the index mark aligned with PD.

- (1) The fuze is set when the index line at base of nose cone is aligned with the time, in seconds, engraved on base of fuze.

FUZE SETTING PROCEDURE



TDC0044

4-14 FUZE SETTING (cont)

NOTE

Rotation of the M732 fuze nose cone has been experienced at top zones (not a safety hazard). If this occurs when M732 is set on time for proximity function, PD function might occur instead. In such instances, set the fuze to a time of 10 seconds less than the time of flight for proximity function. If this occurs when M732 fuze is set on PD mark proximity functioning may occur instead of impact functioning. In such instances, set the fuze to a time equal to the time of flight plus 10 seconds for impact function. The PD setting of the M732 series VT fuze when fired into soft impact areas will be less deadly than the superquick (SQ) setting of the M739 series PD fuze.

(2) To set fuze for proximity action, rotate nose cone with the M27 fuze setter, normally in clockwise direction while looking down on the nose of the fuze, until the index mark coincides with the announced time. The fuze setting can be changed one or more times with no harmful effects.

(3) For impact functioning of the M728 fuzes, set fuzes to 90 seconds (100 second line for flight time exceeding 85 seconds). The M732 series fuze remains set on PD for impact function.

WARNING

DO NOT FIRE PROJECTILE UNLESS FUZE IS FULLY SEATED. INBORE EXPLOSION MAY RESULT.

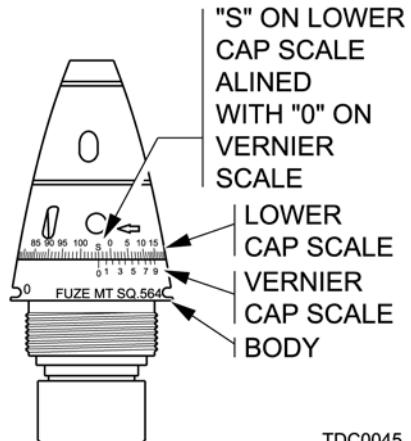
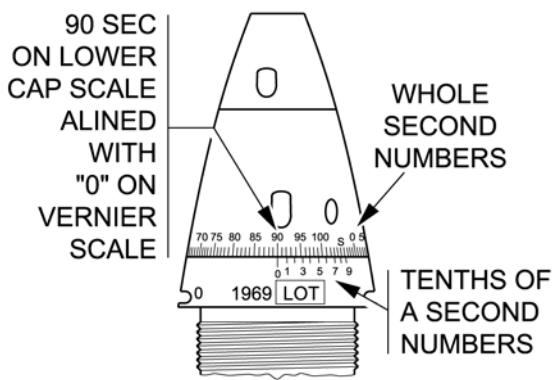
(4) Firing temperature limits for M728 and M732 proximity fuzes are -40°, to - 140°F (-40° to +60°C) and 0° to + 120°F (-18° to +49°C) for M514 series fuzes.

NOTE

Do not attempt to set the fuze until just before firing.

d. **Procedure Number 3, Fuze, M565 and M564.** The following procedures include instructions for setting the fuze for SQ (impact) action and airburst (time) and for meeting safety requirements. If the M564 fuze is to be fired for SQ action (impact) only, first check the year of manufacture stamped on the fuze body, then follow instructions below, as appropriate.

FUZE SETTING PROCEDURE



TDC0045

WARNING

TO AVOID ACCIDENTAL FUNCTIONING OF POINT DETONATING ELEMENT IN M564 FUZE, DO NOT DROP, ROLL, OR STRIKE THE FUZE UNDER ANY CIRCUMSTANCES (PACKAGED, UNPACKAGED, OR ASSEMBLED TO THE PROJECTILE).

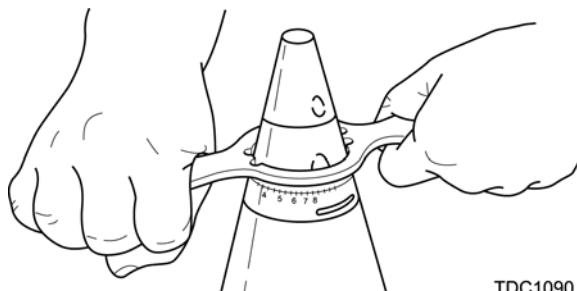
NOTE

Do not attempt to set fuze until just before firing.

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

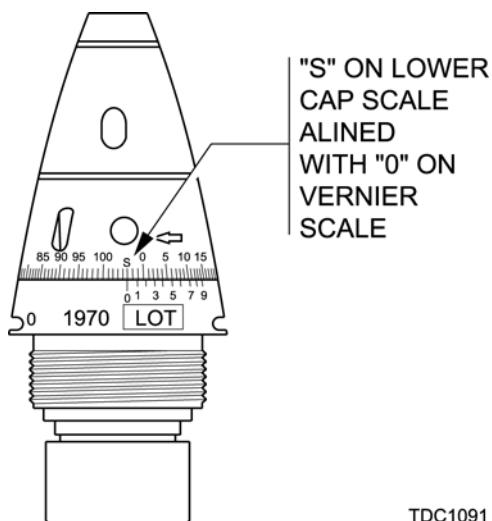
(a) M564 fuzes manufactured prior to January 1970. Use M34 fuze setter to rotate the lower cap in the direction of the arrow (CW) from shipping "S" position until the 90-second position on the lower cap scale is aligned with the "O" on the vernier scale.

FUZE SETTING PROCEDURE



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

FUZE SETTING PROCEDURE



4-14 FUZE SETTING (cont)

(2) Setting M564 and M565 fuzes for airburst (time).

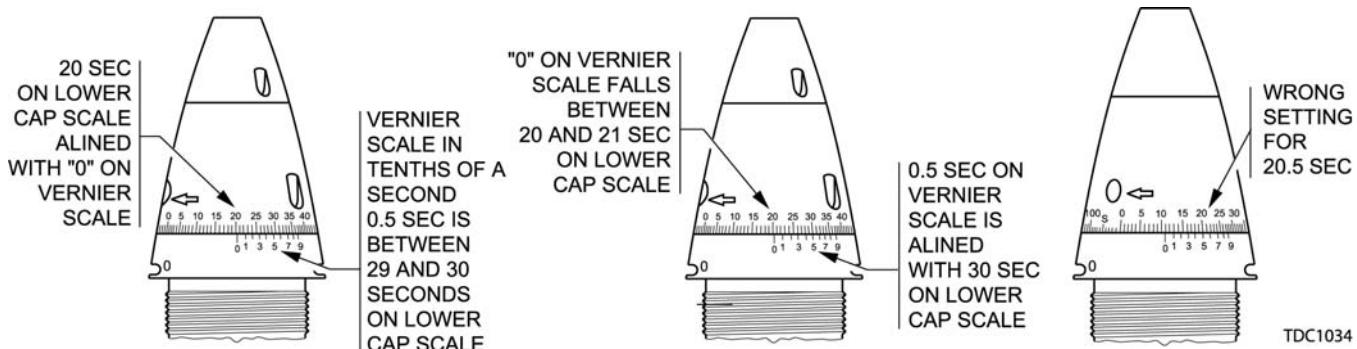
WARNING

INCORRECT SETTINGS OF MT AND MTSQ FUZES CAN AND HAVE RESULTED IN DOWN-RANGE PREMATURE MALFUNCTIONS. THE SAFETY OF PERSONNEL LOCATED DOWN-RANGE OF A WEAPON FIRING MT AND MTSQ FUZES (BETWEEN THE WEAPON AND INTENDED TARGET) IS IN THE HANDS OF THE GUN CREW PERSONNEL ASSIGNED THE JOB OF SETTING THE FUZES.

(a) To set the M564 and M565 fuzes for a whole-second time setting, use the M34 fuze setter to rotate the lower cap in the direction of the arrow (CW) until the desired whole number of seconds (e.g., 20.0 seconds) on the lower cap scale is aligned with the "O" mark engraved on the vernier scale.

(b) To set the M564 and M565 fuzes for a tenth of a second (e.g., 20.5 seconds), use the M34 fuze setter to set the fuze for the whole seconds on the lower cap scale. (In this case, the whole is 20 seconds.) Next, find the desired tenth of a second mark on the vernier scale.

FUZE SETTING PROCEDURE



(c) Continue to slightly rotate the lower cap in the direction of the arrow (CW) until the adjacent upper right graduation on the lower cap scale is aligned with the desired tenth of a second mark on the vernier scale. (The 0.5-second mark is now aligned with the 30-second mark on the lower scale).

NOTES

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

An incorrect fuze setting for 20.5 seconds is shown above. If a fuze is set in this way for 20.5 seconds firing, the fuze is actually set on and will function at 10.5 seconds. This would cause the fuze to function earlier than desired.

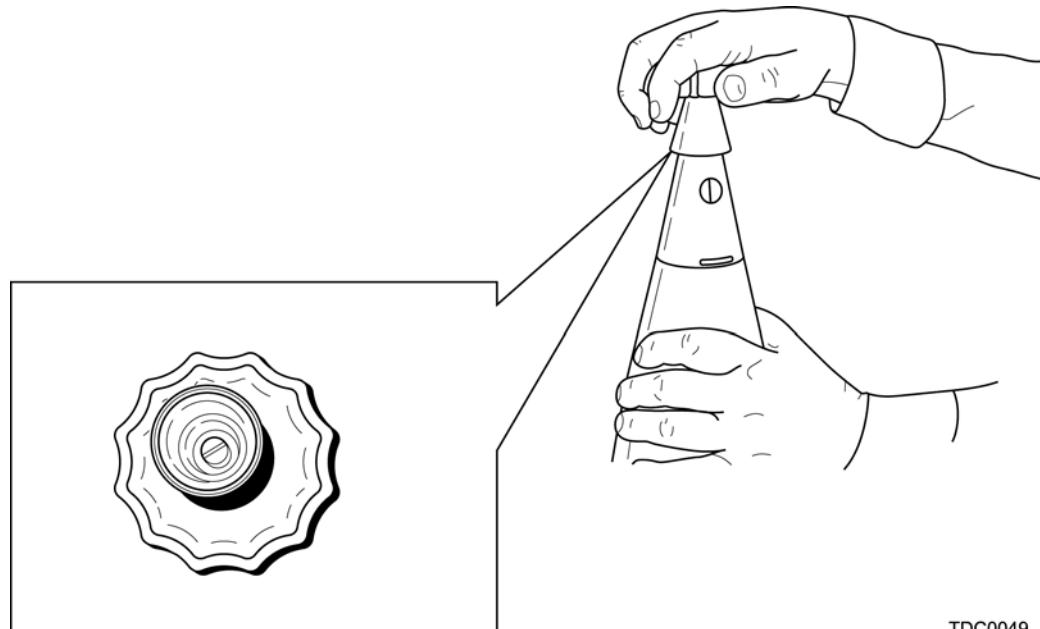
Do not attempt to set the fuze until just before firing.

(3) **Resetting fuze.** If you miss the setting, use the M34 fuze setter (1) and turn the lower cap in the opposite direction (CCW) 2 or 3 seconds below the desired setting. Then rotate the lower cap in the direction of the arrow (CW) and set the fuze on the correct time. This can also be done by turning the lower cap in the direction of the arrow (CW) all the way around (additional turn) to obtain the desired setting. Always make the final setting from low to high numbers.

(4) **Fuzes not fired.** If the fuze is prepared for firing but not fired, reset the fuze, using M34 fuze setter, by turning the lower cap in the direction of the arrow (CW) until the "S" mark on the fuze lower cap scale is in line with the "O" mark on the vernier scale.

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

FUZE SETTING PROCEDURE



TDC0049

e. **Procedure Number 4, Fuzes M577 Series and M582 Series.** The slotted setting key on the nose of the fuze is used for setting the fuze in the following steps.

(1) Press the open end of the M35 fuze setter against the setting key.

(2) Turn the knob handle of the fuze setter **CCW**, as viewed from the nose end, until the fuze-setter blade engages fuze-setting key slot. The hairline in the window is used for all settings.

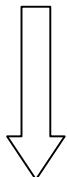
NOTE

The M577 series or M582 series fuze is set to the desired time by rotating the fuze setter in a **CCW** direction. To return to shipping and storage setting, the fuze setter must be rotated in a **CW** direction.

4-14 FUZE SETTING (cont)

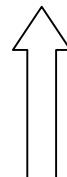
COUNTER

CLOCKWISE (CCW)



SHIPPING AND STORAGE	
SETTING (\blacktriangleleft 93.5 TO \blacktriangleleft 95.5)	1/4 TURN
PD SETTING (\blacktriangleleft 98)	1/4 TURN
000 SECONDS	1/4 TURN
200 SECONDS	20 TURNS

CLOCKWISE (CW)

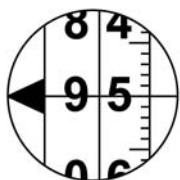


CAUTION

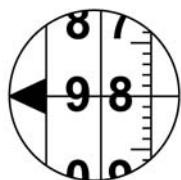
Do not attempt to set these fuzes below \blacktriangleleft 93.5 when setting them in the CW direction or above 200 seconds when setting them in the CCW direction. The settings of 000 and/or 200 are not authorized service settings.

- (3) When setting the fuze (SQ), start with the shipping and storage position (safe) (\blacktriangleleft 93.5 to \blacktriangleleft 95.5); then turn CCW to \blacktriangleleft 98.0 for PD action under the hairline window.

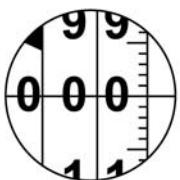
FUZE-SETTING SEQUENCE



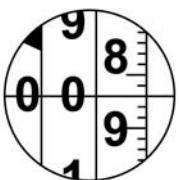
A STORE (SAFE)



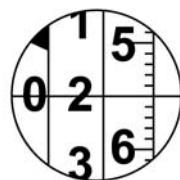
B PD



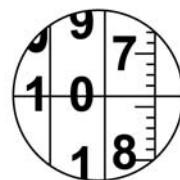
C 000.0



D 8.7



E 25.5



F 107.4

TDC0050

- (4) To set the fuze for MT action, turn the fuze setter CCW from safe position (\blacktriangleleft 93.5 to \blacktriangleleft 95.5) past PD (\blacktriangleleft 98.0), until the triangle (\blacktriangleleft) moves off the hairline. This action occurs near a 000 setting. Continue to turn the fuze setter CCW until the desired time appears under the hairline. Maintain a very light turning force against the fuze setter while reading the setting. The sequence is illustrated above for settings of 8.7, 25.5, and 107.4.

- (5) To set a lower time on a fuze already set, reseat fuze setter and turn CW (numbers get smaller) to a setting at least 1 second lower than the required setting (for example, at least 24.5 for 25.5). Reverse direction to CCW (numbers get larger.), and set required time under the hairline.

- (6) To return fuze to the shipping and storage (safe) position, turn the fuze setter CW (numbers get smaller) until: 000 is passed, and continue to turn until setter stops turning freely. This point should be past the PD setting (\blacktriangleleft 98.0) and between \blacktriangleleft 95.5 and \blacktriangleleft 93.5. Notice that the triangle has reappeared in the window. Do not apply excessive force on the fuze setter after it has stopped turning and the setting is between \blacktriangleleft 95.5 and \blacktriangleleft 93.5. Return the fuze to the reusable fuze container. The fuze is considered unserviceable after being out of the container for more than 30 days.

- (7) For special preparation for M577 series fuze, perform the following procedure. Inspect the fuze setting, consider the fuze unserviceable if the setting is not between \blacktriangleleft 93.5 and \blacktriangleleft 95.5, the fuze shows signs of damage, or the window is blackened or sooty inside.

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

f. **Procedure Number 5, Fuze M762 and M767.** Set these fuzes with M1155 PIAF fuze setter (see paragraph h.), by hand, or remotely by a howitzer equipped with auto-set fire control system, as follows:

CAUTION

Do not activate these fuzes unless they will be fired within 15 days. Once activated, these fuzes have a service life of approximately 15 days before the battery runs down. Check if LCD is active to determine if fuze is still settable.

(1) Setting by hand:

CAUTION

If the LCD display is blank or shows other displays than indicated after completing steps (a) and (b), the fuze is considered unserviceable and should not be fired.

NOTE

The M762 or M767 fuze ogive will rotate only CW (as viewed from nose end). If a desired digit was passed, continue rotating CW until the desired digit appears again. The ogives of the M762A1 and M767A1 can be rotated bi-directionally to provide quicker manual setting.

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

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

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

NOTE

The hundreds of seconds column can display 0, 1 or **◀** (blank space for the M762A1 or M767A1) while the tens of seconds, seconds, and tenths of seconds columns each can display 0 through 9.

(d) Each column is set independently. Depress and release the selector button as required to move the cursor to the desired column. At the desired column, keep the selector button depressed and rotate the ogive to select the desired digit or **◀**. Release the selector button and depress again to move cursor to the next column to continue setting.

(e) For M762 or M767 PD, set the fuze to **◀ 98.0**. Any other setting will result in a dud.

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

4-14 FUZE SETTING (cont)

(g) The following are examples of fuze settings.

M762A1/M767A1	M762/M767PD				
<u>Pd</u>	<u>098.0</u>	<u>000.8</u>	<u>007.3</u>	<u>040.1</u>	<u>169.0</u>
	0.8 SECONDS	7.3 SECONDS	40.1 SECONDS	169 SECONDS	TDC0051

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

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

(2) Auto setting is accomplished via an inductive data link between the fuze and a howitzer equipped with an auto-set fire control system. The desired fuze setting is input in the setter console and the transmit button is depressed. The fuze will be remotely activated and set and the console will display the actual fuze setting as a safety feature.

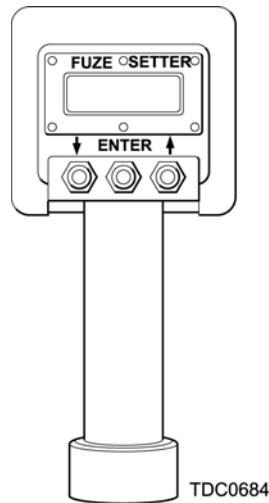
(3) To return fuze to the shipping and storage configuration, reset the fuze to \blacktriangleleft 88.8. These fuzes should be segregated and used first in subsequent firings.

(4) Firing temperature limits for M762 and M767 ET series fuzes are -45°F to +145°F (-43°C to +63°C).

g. **Procedure Number 6, Fuze M782.** This fuze cannot be set by hand but can only be set inductively by the M1155 PIAFS.

h. **M1155 PIAFS.** Is a lightweight, hand-held device consisting of a cylindrical handle that houses two 'D' cell batteries that power the device, and a base with a fuze seating area in the back and a display window and control buttons on the front. Under the display window are three buttons, and between the buttons and the display window are three indicators or labels for the buttons. The right button is the \uparrow button, the center button below the word **ENTER** is the ENTER button, and the left button is the \downarrow button. The \uparrow and \downarrow button will scroll the cursor, which is the arrow (\rightarrow) to the left of the items in the menu, up or down in the display window.

(1) The M1155 PIAFS is designed to permit artillery units to set M762, M767, and M782 series artillery fuzes, and will decrease the time needed to set these fuzes and reduce time setting errors on fuzes equipped with inductive setting features. The M1155 PIAFS seats on compatible fuzes and sets the fuzes to their required operational parameters by electrical induction. Once the M1155 PIAFS is set to the correct fuze, mode and time, it is placed on the fuze to be set and the ENTER button is pressed. The display should then read "FUZE SET – OK".

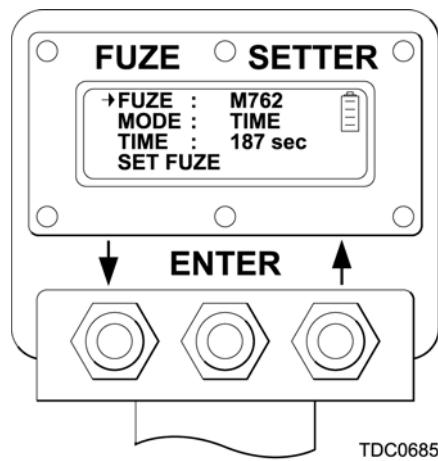


NOTE

When the setter is first initialized it displays the Fuze Menu. Afterwards it remembers where it was last and displays the Fuze Setting Menu with the last fuze set.

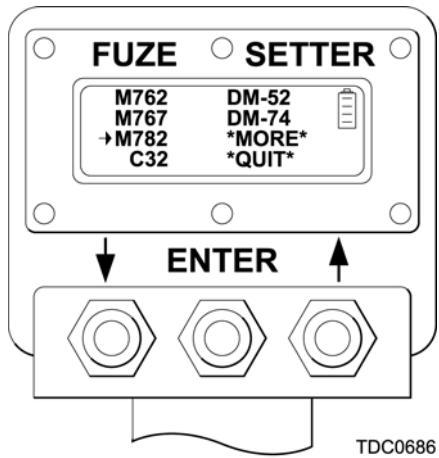
(2) Setting for PD mode:

- (a)** Press the ENTER button to turn on the setter. The last used fuze setting menu will be displayed.



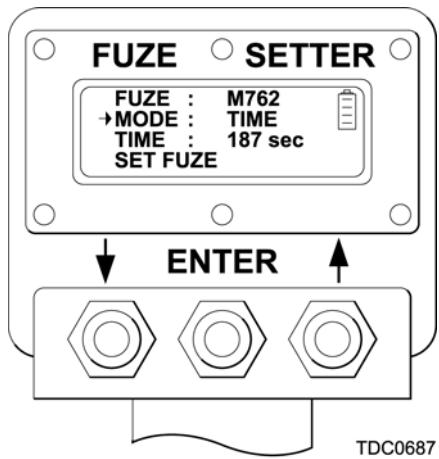
- (b)** Press the ↑ button or ↓ button if necessary to move the cursor (→) to align with **FUZE** and then press the ENTER button. The Fuze Menu appears.

4-14 FUZE SETTING (cont)



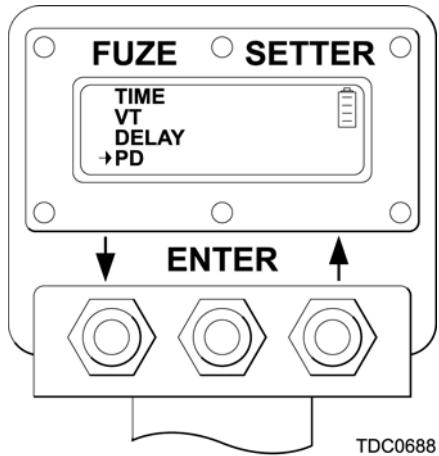
(c) Press the ↑ button or ↓ button as necessary to move the cursor (→) to align with **M782** and press the ENTER button. The Fuze Setting Menu appears with the cursor aligned with **MODE**.

FUZE SETTING MENU



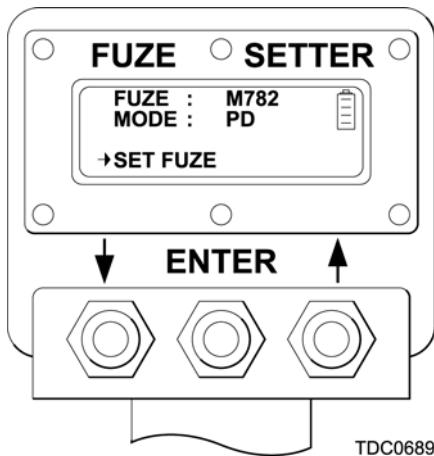
(d) Press the ENTER button. The Mode Menu for the M782 fuze appears.

MODE MENU (FOR THE M782 FUZE)



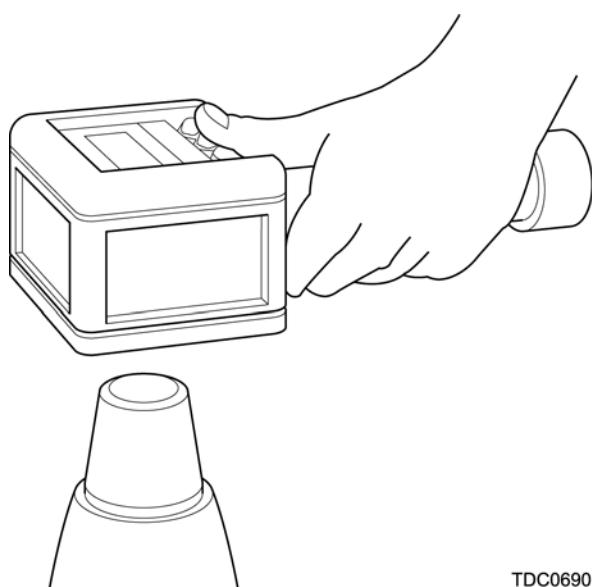
(e) Press the ↑ button or ↓ button as necessary to move the cursor (→) to align with **PD** and press the ENTER button. The Fuze Setting Menu appears with the cursor aligned with **SET FUZE**.

FUZE SETTING MENU



(f) Place the setter on the fuze and press the ENTER button.

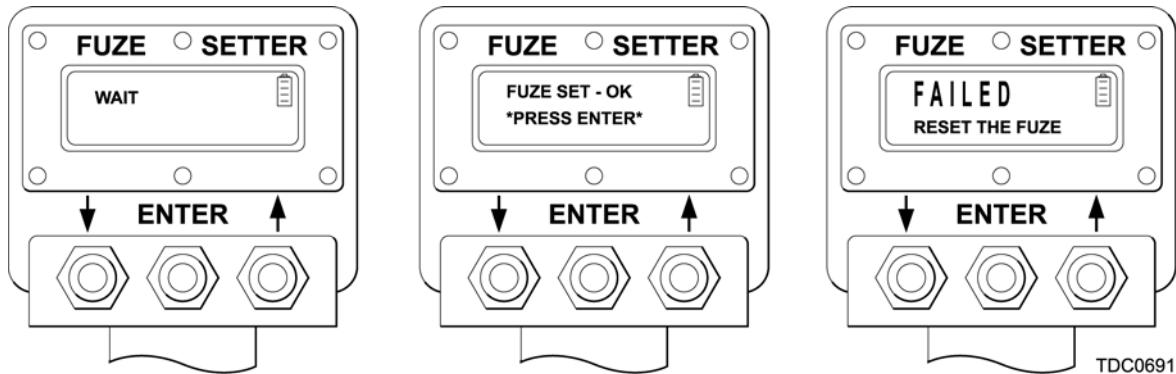
PLACING THE FUZE SETTER



(g) The setter will attempt to set the fuze. After the **WAIT** message is briefly displayed, either the **FUZE SET – OK** message will be displayed, which means that the fuze has been set, or the **FAILED** message will be displayed, which means the fuze has not been set. If the **FAILED** message appears, try setting another fuze. If both fuzes do not accept the setting then replace the fuze setter and retry setting the fuzes.

4-14 FUZE SETTING (cont)

SETTING THE FUZE

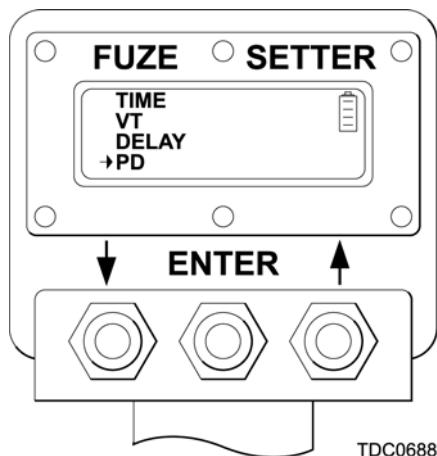


(3) Setting for DLY mode:

NOTE

The setting procedures for the DLY mode are the same as those for PD mode except at step e. the cursor (→) is to be aligned with **DELAY** instead of **PD**.

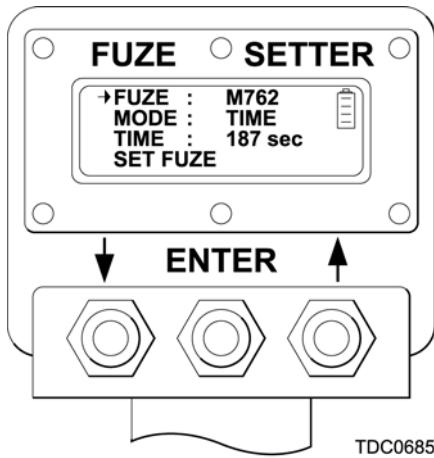
MODE MENU (FOR THE M782 FUZE)



(4) Setting for VT mode:

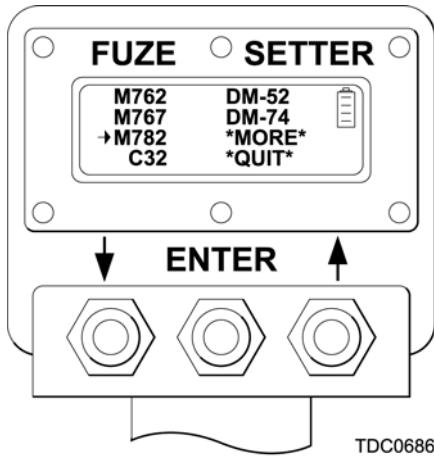
- (a) Press the ENTER button to turn on the setter. The last used fuze setting menu will be displayed.

FUZE SETTING MENU



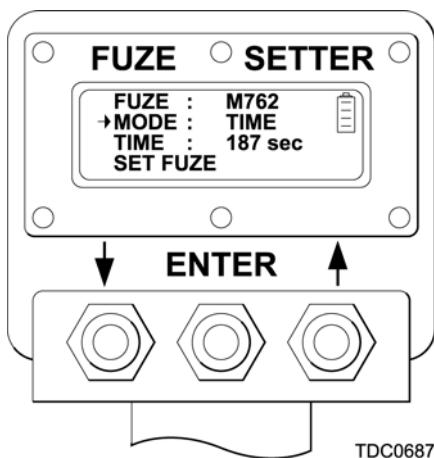
(b) Press the ↑ button or ↓ button if necessary to move the cursor (→) to align with **FUZE** and then press the ENTER button. The Fuze Menu appears.

FUZE MENU



(c) Press the ↑ button or ↓ button as necessary to move the cursor (→) to align with **M782** and press the ENTER button. The Fuze Setting Menu appears with the cursor aligned with **MODE**.

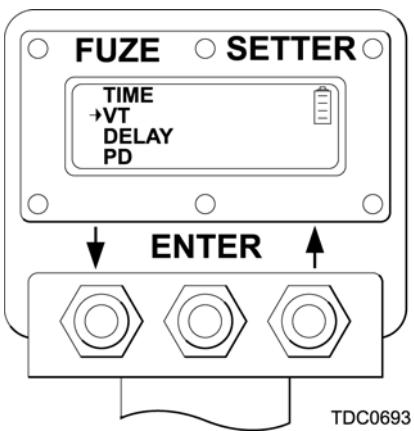
FUZE SETTING MENU



4-14 FUZE SETTING (cont)

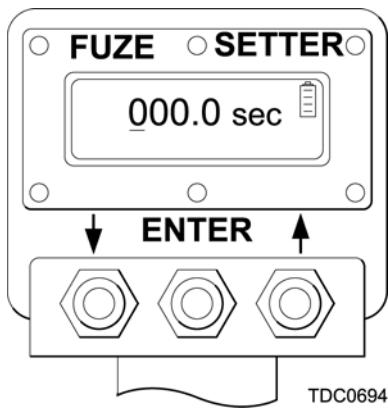
(d) Press the ENTER button. The Mode Menu for the M782 fuze appears.

MODE MENU (FOR THE M782 FUZE)



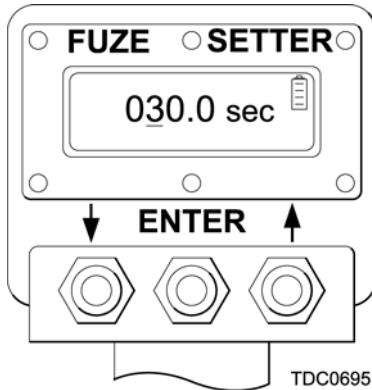
(e) Press the ↑ button or ↓ button as necessary to move the cursor (→) to align with VT and press the ENTER button. The Time Menu appears with a line under the hundreds-of-seconds position.

VARIABLE TIME MENU (FOR THE M782 FUZE)



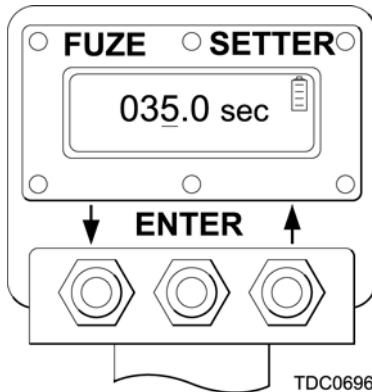
(f) Press the ↑ button or ↓ button to toggle between 0 and 1 for the hundreds-of-seconds digit and press the ENTER button. The underline will move to the tens-of-seconds position.

VARIABLE TIME MENU (FOR THE M782 FUZE)



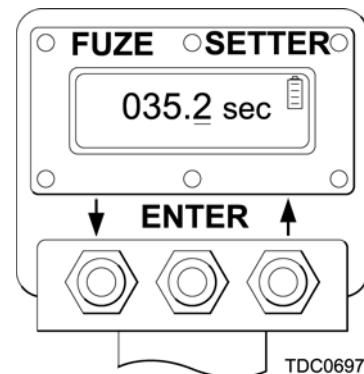
(g) Press the ↑ button or ↓ button or choose the desired number between **0** and **9** for the tens-of-seconds digit and press the ENTER button. The underline will move to the seconds position.

VARIABLE TIME MENU (FOR THE M782 FUZE)



(h) Press the ↑ button or ↓ button to choose the desired number between **0** and **9** for the seconds digit and press the ENTER button. The underline will move to the tenths-of-seconds position.

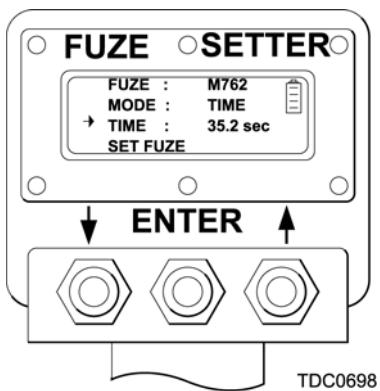
VARIABLE TIME MENU (FOR THE M782 FUZE)



4-14 FUZE SETTING (cont)

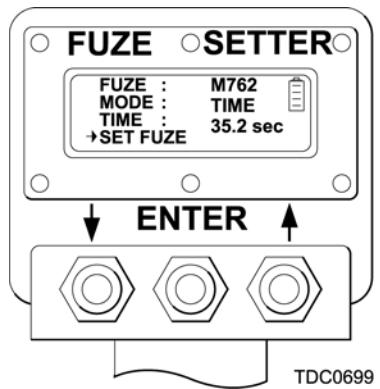
(i) Press the ↑ button or ↓ button to choose the desired number between **0** and **9** for the tenths-of-seconds digit and press the ENTER button. The Fuze Setting Menu appears with the cursor (→) aligned with **TIME** showing the set time.

FUZE SETTING MENU



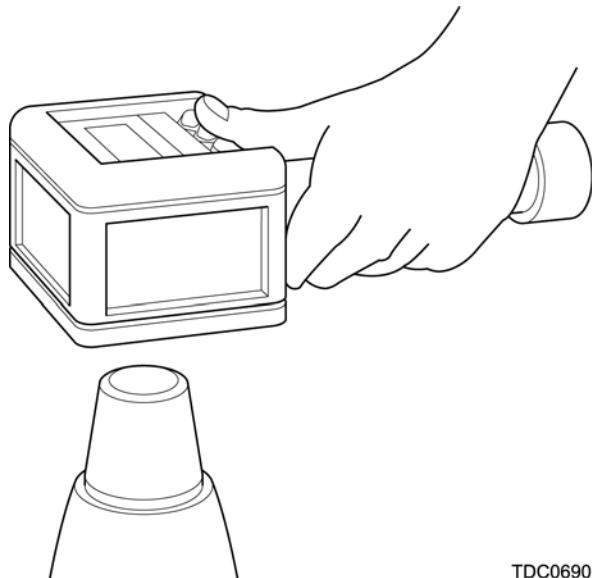
(j) Press the ↓ button to move the cursor (→) to align with **SET FUZE**.

FUZE SETTING MENU



(k) Place setter on the fuze and press the ENTER button.

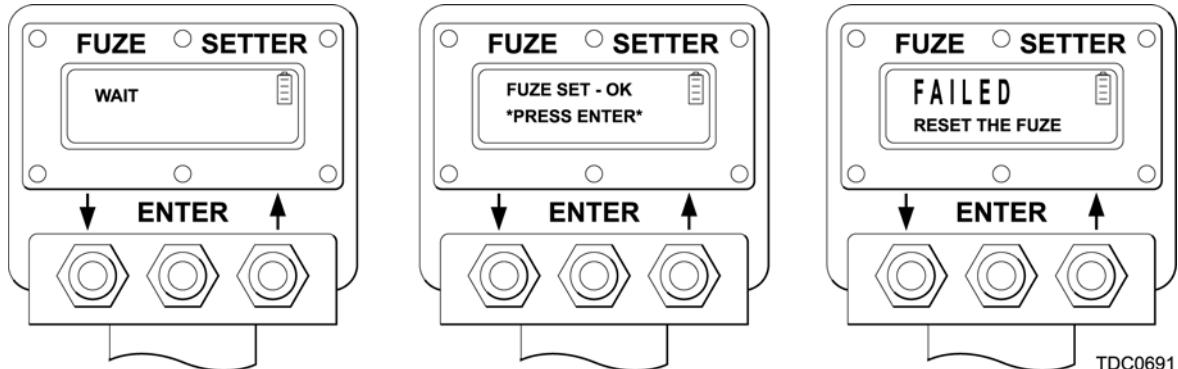
PLACING THE FUZE SETTER



TDC0690

(I) The setter will attempt to set the fuze. After the **WAIT** message is briefly displayed, either the **FUZE SET - OK** message will be displayed, which means that the fuze has been set, or the **FAILED** message will be displayed, which means the fuze has not been set. If the **FAILED** message appears, try setting another fuze. If both fuzes do not accept the setting then replace the fuze setter and retry setting the fuzes.

SETTING THE FUZE



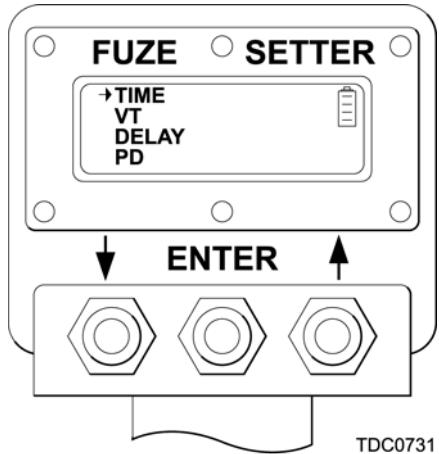
(5) Setting for TI mode:

NOTE

The setting procedures for the TI mode are the same as those for VT mode except at step e. the cursor (→) is to be aligned with **TIME** instead of **VT**.

4-14 FUZE SETTING (cont)

MODE MENU (FOR THE M782 FUZE)



- (6) Firing temperature for the M782 fuze is -45°F to +145°F (-43°C to +63°).

4-15 PROPELLING CHARGE PREPARATION

WARNING

UNDER NO CIRCUMSTANCES WILL GREEN BAG AND WHITE BAG CHARGES BE ASSEMBLED TOGETHER FOR FIRING. CRITICAL MALFUNCTION COULD RESULT.

- a. **Propelling Charges, M3 Series and M4 Series.** M4A2 and M4A1 WB charges can be expected to perform within design limits at charges 5 through 7. However, large dispersions may result when these charges are fired at charges 3 and 4. It is recommended that M3A1 GB charges be used instead of WB charges at charges 3 and 4. If GB charges are not available, use WB charges, although range dispersions may result.

- (1) If required, remove excess increments from charge, and retighten excess strap by twisting and securing ends under straps.

NOTE

Using the M2 flash reducer to reduce muzzle flash is optional, except when TB 9-1300-385-1 or TB 9-1300-385-2 restricts a specific propelling charge lot to use only with flash reducer. The M4A2 propelling charge has a flash reducer assembled in front of the base charge (increment number 3) at the time of manufacture and does not require use of the M2 flash reducer.

- (2) In preparing the M4 or M4A1 WB charge, one M2 flash reducer should be added in front of each increment used. Untie the charge and insert the proper number of M2 flash reducers (i.e., one flash reducer added in front of the base charge and each increment used). Then retie with two interlapping square knots.

- b. **Propelling Charges, M119A1, and M119A2.** The M119 and M119A1 are a one-increment, charge 8 white bag propelling charges and are shipped ready for firing. After unpacking and inspection, the only preparation required is removal of the igniter protector cap. This charge is not used in lieu of charge 7, M4 series white bag. M119A2 is a one-increment, charge 7, red bag, propellant charge, shipped ready for firing. The M119A2 charge 7 is equivalent to M119/M119A1 white bag charge 8 except for small difference in velocity.

c. **Propelling Charge, M203 and M203A1.** The M203 series is a one-increment, charge 8 propelling charge for the M776 cannon. After unpacking and inspection, the only preparation required is removal of the igniter protector cap.

d. **Propelling Charge, M231 or M232/M232A1 (MACS).** The M231 contains four charges (two per extraction sleeve) in each metal container and the M232/M232A1 contains five charges per metal container. There is no other preparation needed after unpacking and inspecting the MACS.

4-16 LOADING AND FIRING

WARNINGS

OBSERVE ALL PRECAUTIONS IN FM 6-40, AR 385-63, AND FM 6-50 PARTICULARLY LIMITATIONS REGARDING OVERHEAD FIRE IN TRAINING AND COMBAT.

DO NOT FIRE M110 SERIES WHITE PHOSPHOROUS PROJECTILES WHICH ARE KNOWN TO HAVE BEEN STORED IN OTHER THAN THE BASE DOWN POSITION. FIRING OF SUCH PROJECTILES COULD CONTRIBUTE TO INBORE EXPLOSIONS OR CLOSE-IN PREMATURE MALFUNCTIONS.

DO NOT LOAD OR FIRE ARTILLERY AMMUNITION WITHOUT THE AUTHORIZED FUZE. FIRING OF ROUNDS WITHOUT FUZES OR WITH UNAUTHORIZED FUZES COULD RESULT IN IN-BORE PREMATURES AND OTHER HAZARDOUS CONDITIONS.

DO NOT LOAD OR FIRE ROUND IF THE FUZE IS NOT FULLY SEATED.

FIRING OF THE M557, M572, AND M564 FUZES DURING HEAVY PRECIPITATION (HEAVY RAINFALL, SLEET, SNOW, OR HAIL) MAY RESULT IN OCCASIONAL DOWN-RANGE PREMATURES. THE AMOUNT OF PRECIPITATION NECESSARY TO CAUSE FUNCTIONING IS COMPARABLE TO THE HEAVY DOWNPOUR, WHICH OCCURS DURING A SUMMER THUNDERSTORM.

DO NOT FIRE PROXIMITY-FUZED AMMUNITION AT TARGETS CLOSER THAN 820 YARDS (750 METERS) TO FRIENDLY TROOPS.

FIRING THE M100 SERIES, M449, M485, OR M804 AND M804A1 PROJECTILES AT CHARGE 2 MAY OCCASIONALLY RESULT IN STICKERS.

DO NOT ASSEMBLE M3 SERIES GREEN BAG CHARGES WITH M4 SERIES WHITE BAG CHARGES. CRITICAL MALFUNCTION COULD RESULT.

DO NOT LOAD OR FIRE M231 CHARGES WITH M232/M232A1 CHARGES. CRITICAL MALFUNCTION COULD RESULT. DO NOT LOAD OR FIRE MORE THAN TWO M231 CHARGES OR LESS THAN THREE M232/M232A1 CHARGES.

4-16 LOADING AND FIRING (cont)

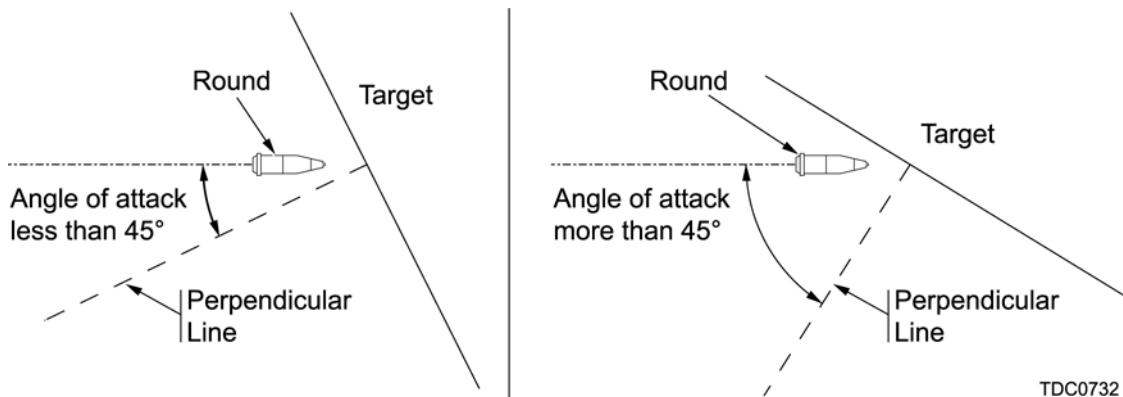
WARNINGS

DO NOT FIRE M549/M549A1 PROJECTILES IF OBTURATING BAND IS MISSING OR BROKEN. SEPARATION OF THE PROJECTILE AND ROCKET MOTOR MAY OCCUR. (IF THE BAND IS DISPLACED AND CAN BE REPOSITIONED AND REMAIN IN THE GROOVE, PROJECTILE CAN BE FIRED).

MK 399 MOD 1 FUZES SET IN DELAY MODE PERFORM MORE EFFECTIVELY IF THE ANGLE OF ATTACK (THE ANGLE BETWEEN THE ROUND AND THE PERPENDICULAR LINE OF THE TARGET) IS LESS THAN 45 DEGREES. ANGLES OF ATTACK HIGHER THAN 45 DEGREES WILL RESULT IN DECREASED EFFECTIVENESS AND INCREASE THE LIKELIHOOD OF UNEXPLODED ORDNANCE IN THE BATTLEFIELD.

IF A PROJECTILE FIRED WITH MK 399 MOD 1 FUZE IMPACTS A SUBSTANTIAL OBJECT, A HIGH ORDER DETONATION MAY OCCUR EVEN IF THE OBJECT IS WITHIN THE 400 CALIBER MINIMUM ARMING DISTANCE, WHICH COULD RESULT IN DAMAGE TO THE WEAPON AND/OR DEATH OR SERIOUS INJURY TO UNPROTECTED CREW MEMBERS.

DO NOT FIRE M864 PROJECTILE IF THE OUTER WEATHER SEAL IS DAMAGED (PUNCTURED, TORN, OR PEELING) TO THE EXTENT THAT MOISTURE CAN ENTER THE BASE BURNER ASSEMBLY. A LOSS IN RANGE (SHORT ROUND) MAY RESULT. RETURN PROJECTILE TO SUPPLY POINT.



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WARNINGS

FOR M864 PROJECTILES MARKED WITH THREE SOLID WHITE CIRCLES 120° DEGREES APART ON THE OGIVE (ABOVE THE WEIGHT ZONE MARKINGS), OBSERVE THE FOLLOWING WARNINGS:

- DO NOT FIRE THE M864 IF IT HAS BEEN DROPPED OR IF IT SHOWS EVIDENCE OF DENTS, FLATTENING, OR GOUGES TO THE LIFTING PLUG, GROMMET, ROTATING BAND, OR BOATAIL AREA.
- DO NOT FIRE THE M864 IF IT HAS BEEN DELIVERED WITHOUT THE GROMMET.
- IF DURING HANDLING AND OR LOADING THE M864 BASE SEPARATES, CALL EXPLOSIVE ORDNANCE DISPOSAL (EOD) PERSONNEL.

DO NOT FIRE THE M864 IF THE OBTURATOR IS MISSING OR BROKEN BECAUSE IT MAY RESULT IN A SHORT ROUND. IF THE BAND IS DISPLACED AND CAN BE REPOSITIONED AND REMAIN IN THE GROOVE, THE PROJECTILE CAN BE FIRED.

- a. Make sure the round is clean and the fuze is present and fully seated.

WARNING

FIRING A ROUND WITH AN OBSTRUCTION IN THE CANNON TUBE CAN CAUSE AN IN-BORE EXPLOSION.

- b. Make sure there are no obstructions in the cannon tube.
- c. Check the firing mech to see that the primer expended in previous firing has been removed.
- d. Remove grommet or FRBC cover from projectile.

WARNING

NEVER LOAD A PROPELLING CHARGE INTO THE CHAMBER BY INCREMENTS. ONLY FULLY ASSEMBLED CHARGES WILL BE USED, CRITICAL MALFUNCTION COULD RESULT.

- e. Load fuzed projectile into cannon and ram it solidly into the forcing cone of the cannon tube. Round must remain wedged into the forcing cone at all angles of elevation.
- f. Remove the igniter protective cap from the propelling charge and load the propelling charge into the cannon chamber with igniter end (red bag) toward the breechblock assembly.

4-16 LOADING AND FIRING (cont)

WARNING

NEVER CLOSE THE BREECHBLOCK ASSEMBLY UNLESS YOU CAN SEE THE RED IGNITER BAG ON THE BASE OF THE PROPELLING CHARGE. MISFIRES, HANGFIRES, ERRATIC PERFORMANCE, OR OTHER CRITICAL MALFUNCTION COULD RESULT.

- g. Close breechblock assembly.

WARNING

DON'T FORCE PRIMER INTO PRIMER CHAMBER. IF PRIMER WILL NOT GO IN, CHAMBER IS PROBABLY DIRTY. FORCING PRIMER INTO PRIMER CHAMBER MAY CAUSE PRIMER TO PREMATURELY IGNITE POWDER CHARGE, WHICH WILL CAUSE THE HOWITZER TO RECOIL PREMATURELY AND CAUSE SERIOUS INJURY TO CREW.

- h. Insert primer using PFM, cycle to firing position and fire on command of the SC.

4-17 AFTER FIRING

- a. Open the breechblock assembly and secure in the fully open position.
- b. Swab face of spindle assembly and powder chamber after each round, making sure that all burning fragments of powder charge are removed from powder chamber. Look through the cannon tube. If the cannon tube is clear, announce, BORE CLEAR.
- c. All ammunition fired must be recorded on DA form 2408-4, by charge number, type, and total number of each fired.

4-18 AMMUNITION PREPARED FOR FIRING, BUT NOT FIRED

WARNING

THE PROJECTILES AND FUZES THAT HAVE BEEN RAMMED AND THEN REMOVED FROM THE CANNON TUBE WILL NOT BE RELOADED OR FIRED, WITH THE EXCEPTION OF M712 COPPERHEAD EXTRACTED FROM A COLD CANNON TUBE. MARK UNSERVICEABLE AND RETURN TO AMMUNITION SUPPLY POINT.

- a. Using applicable fuze setter and procedure (Para 4-14), reset the fuzes of the projectiles prepared for firing but not rammed. Reset TI fuzes to safe; reset VT fuzes to initial setting at which they were shipped; reset PD fuzes to SQ or PD. All M762 and M767 ET fuzes that have activated and not fired should be reset to ▲ 88.8, segregated, and used first in subsequent firings. When the battery runs down on an activated M762/M767 fuze, the LCD goes blank. These fuzes are unserviceable and should be packed separately, marked unserviceable, and turned in to the ASP. To determine if an M762/M767 fuze has been activated and run down, gently attempt to turn the ogive CW by hand without depressing the selector button. If the ogive turns easily, the fuze has been activated; a fuze that has not been activated should resist the applied torque. Replace safety wires in those fuzes so furnished.

- b. Disassemble fuze from projectile and repack in original packing. When a long intrusion proximity fuze is removed from the projectile, replace the supplementary charge in the projectile before assembling the spacer and the correct type of lifting plug.

NOTE

Be sure the correct type of lifting plug is used. (For example, energy-absorbing or shock-attenuating lifting plug for M549 series projectiles, yellow fusible or universal lifting plug for M483 series projectiles, and standard eyebolt lifting plugs for other projectiles).

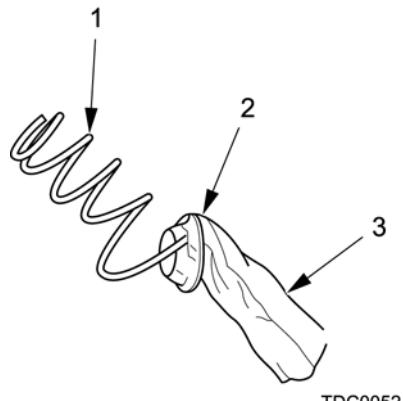
- c. Replace grommet or FRBC over rotating band.
- d. Restore propelling charges to original condition. Make sure all zones (increments) are present, tied, in proper order, in good condition, of the proper lot number, and that igniter caps are replaced.
- e. Replace fuzes, primers, and flash reducers in original packing.
- f. Make sure the lot number of the ammunition corresponds with the lot number on the container.
- g. If rocket cap was removed from the M549/M549A1 HERA projectile, replace cap and tighten hand tight.
- h. Return all projectiles to shaded and protected storage regardless of weather.
- i. Special instructions for the M483A1 and M864 ICM projectile are as follows:

WARNING

USE NO OTHER LIFTING PLUG EXCEPT THE FUSIBLE OR UNIVERSAL PLUG REMOVED FROM THIS PROJECTILE, BECAUSE IT IS DESIGNED FOR SAFE RELEASE OF PRESSURE INSIDE THE PROJECTILE IN CASE OF FIRE DURING STORAGE OR SHIPPING ACTIONS.

- (1) Wind the pull-wire (1) under four tabs (2) on the cover of the expulsion charge assembly (3) (1 1/2 turns for proper engagement).

EXPULSION CHARGE ASSEMBLY-INSTALLATION



TDC0052

Section III. MAINTENANCE

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4-19 HANDLING

WARNING

KEEP FIRE AND FLAMMABLE MATERIALS OUT OF THE AMMUNITION AREA. THERE WILL BE NO SMOKING IN THE VICINITY OF AMMUNITION.

SHIELD ALL AMMUNITION FROM HIGH TEMPERATURES (EG. DIRECT RAYS OF THE SUN).

WHEN THE OUTSIDE TEMPERATURE IS EXPECTED TO REACH +100°F (+38°C), FAILURE TO SHADE THE PROJECTILES COULD RESULT IN DAMAGE TO MATERIEL AND LOSS OF LIFE.

- a. Do not expose ammunition and components containing explosives to extreme temperatures. Do not expose to direct sunlight, flame, or other sources of heat.
- b. Do not expose unpacked propelling charges and fuzes to rain, excessive humidity, or ground moisture.
- c. Protect the rotating band and the obturator band by keeping the grommet or FRBC on the projectile while it is being handled and transported.
- d. Prevent rough handling of projectile and fuzes. Do not strike projectiles together and do not offload ammunition by dropping projectile on projectile.
- e. Protect fuzes, primers, and flash reducers at all times from foreign matter and impact. A drop of 4 ft (1.22 m) may cause the electrolyte vial in a VT fuze battery to break, thus causing a dud.
- f. Do not disassemble fuzes.

4-20 CARE

- a. Ammunition is packed to withstand conditions ordinarily encountered in the field. Keep packing boxes from becoming broken or damaged.
- b. Since ammunition is impaired by moisture, frost, extreme temperatures, and foreign matter (mud, oil, etc.), observe the following:
 - (1) Do not break the moisture-resistant seal on the container until ammunition is to be used.
 - (2) Shield all ammunition from high temperatures (e.g., the direct rays of the sun). When covering projectiles to provide this shield, cover with a tarpaulin. Ensure 18 in. (46 cm) of air space over and 6 in. (15 cm) of air space on the sides to allow free air flow necessary to keep projectiles cooler in hot weather.

- (3) Refer to paragraph 4-30 for information regarding maintenance of the M712 Copperhead (HEAT) projectile.

4-21 MAINTENANCE

WARNING

ALTERATION OF AMMUNITION OR COMPONENTS IS PROHIBITED.
UNAUTHORIZED MODIFICATION OF AMMUNITION COULD CAUSE CRITICAL MALFUNCTION.

NOTE

Proper performance of ammunition maintenance procedures when ammunition is received by using units assures that ammunition on hand is kept ready for use.

a. General.

- (1) Inspect ammunition packaging daily. Open boxes or containers, which show evidence of contamination or deterioration and inspect ammunition. Do not open sealed boxes or containers unless defective ammunition is suspected.

NOTE

Procedures for preparing the M712 projectile (Copperhead) for firing begin in paragraph 4-25 as well as the care, maintenance, inspection, unpackaging and repackaging of this projectile.

- (2) Inspect unpackaged ammunition and explosive components daily.

- (3) Wipe off wet or dirty ammunition at once. Remove light corrosion. Do not polish ammunition to make it look better.

- (4) Consider ammunition unserviceable if it has severe rust or propellant contamination, particularly moisture. Do not use except in an emergency.

- (5) When repackaging ammunition, put it back into the original containers. If other packing material must be used, the old markings should be transferred to the new containers.

- (6) See paragraph 4-32 for the LPRS, which is an optional system for securing loose unfuzed projectiles for transportation.

b. Projectiles.

- (1) Visually inspect projectiles for the following defects:

- (a) Projectiles without grommets or FRBCs installed; if either is missing, replace immediately.
- (b) Distorted, out of round, or damaged body.
- (c) Dirt or other foreign material.
- (d) Seepage of explosive filler.
- (e) Rust through projectile baseplate.

4-21 MAINTENANCE (cont)

- (2) Clean dirt or foreign material from projectile by wiping with a clean damp rag (item 28, Appx D).
 - (3) Return defective projectiles to ASP.
 - (4) Inspect the M549/M549A1 projectile for the following:
 - (a) Missing or broken obturating bands. The projectile cannot be used if the obturating band is broken or missing. Return projectile to the ASP.
 - (b) Broken energy-absorbing lifting plugs. When the lifting plug is broken, the threaded area will remain in the projectile. Do not attempt to extract any portion of the broken plug. Return projectile to the ASP.
 - (5) The M483A1 projectile cannot be used if the obturating band is missing or broken. Return projectile to the ASP.
 - (6) Inspect the M864 projectile for the following:
 - (a) Missing or broken obturating bands, the projectile cannot be used if the obturating band is broken or missing. Return projectile to the ASP.
 - (b) Damaged (torn, punctured or peeling) weather seal, the projectile cannot be used if the weather seal is damaged. Return projectile to the ASP.
 - (7) Inspect specially marked M864 projectiles with three solid white circles 120° degrees apart on the ogive (above the weight zone markings) for the following:
 - (a) Projectiles that have not been palletized. Projectiles that have been transported as loose cargo. These conditions can cause gaps or separation at the base to body joint resulting in a hazard. Return projectile to the ASP.
 - (b) Projectiles showing dents, flattening, or gouges to the lifting plug, grommet, rotating band, or boatail area. These conditions can cause gaps or separation at the base to body joint resulting in a hazard. Return projectile to the ASP.
- c. Propelling Charge, M3 and M4 Series.**
- (1) Visually inspect propelling charges for the following defects:
 - (a) Loose tie straps, allowing separation of the charge into increments.
 - (b) Missing increment, extra increment, or incorrect sequencing (order) of increments.
 - (c) Increment bags torn or damaged to the extent that black powder or propellant spills out.
 - (d) Wet propelling charge.
 - (e) Missing or damaged red igniter pad on base of charge.
 - (2) Charges requiring retying may be retied as follows:
 - (a) Assemble increments in correct order.
 - (b) Tie the four tie straps over top of charge.

(3) Return all defective charges to the ASP.

d. Propelling Charges M119A1, M119A2, M203, M203A1, M231 and M232/M232A1.

(1) Visually inspect propelling charges M119A1, M119A2, M203, M203A1, M231 and M232/M232A1 for the following defects:

NOTE

Flash reducer is sewn into sides of charge bag on M119A2 charge.

- (a) Missing flash reducer.
 - (b) Charge bag ripped or damaged to the extent that propellant can escape.
 - (c) Black powder leaking from base igniter pad.
 - (d) Base igniter pad not centered with respect to outer diameter of charge, both ends for the M231 and M232/M232A1 charges.
 - (e) Evidence of broken or damaged central igniter tube (M119A1, M203 and M231 and M232/M232A1 only).
 - (f) Combustible case for M231 and M232/M232A1 charges with cut or puncture through case wall.
 - (g) Combustible case for M231 and M232/M232A1 charges with uneven cap (crooked, tilted or slanted).
 - (h) Combustible case for M231 and M232/M232A1 charges that cannot be replaced into its sleeve due to exterior damage.
 - (i) Tie straps not tight over forward end of charge.
 - (j) Lacing jacket not secure on charge (M119A1, and M203 only).
 - (k) Cord missing or broken on lacing jacket (M119A1, and M203 only).
 - (l) Crushed or distorted cases or with missing/broken propellant in M203A1 charges.
- (2) If tie straps are loose, retighten the straps at the forward end of the charge.
- (3) Return all defective charges to the ASP.

e. Fuzes.

(1) Inspect fuzes for the following defects:

- (a) Damage to body or threads.
 - (b) Loose components.
- (2) Return defective fuzes to ASP.

f. Ammunition or Components of Ammunition Prepared for Firing but Not Rammed.

(1) Return such ammunition to the original condition and packing. Mark appropriately, and use first in subsequent firings to keep stocks of open packings to a minimum.

4-21 MAINTENANCE (cont)

(2) Replace the grommet or FRBC in those projectiles that were not fired.

(3) Reassemble the supplementary charge and the correct type of lifting plug (with gasket and spacer) to the projectile to restore it to its original condition. Return fuzes to original condition. Return fuzes to original packing. In reassembling the components, make certain the supplementary charge is properly inserted (felt pad end innermost).

(4) Remove the projectile spotting charge from the M577 series or M762 fuze and replace the expulsion charge assembly and fusible or universal lifting plug with gasket to the M483A1 or M864 projectiles. Replace rocket cap in M549 and M549A1 projectiles.

(5) Reassemble propelling charges prepared for firing and not used. Replace in original containers as follows:

(a) If increment was removed, reinstall and retie.

(b) Replace igniter protective cap.

(c) Repack charge in container (igniter end first), and close and secure container.

(d) Mark container appropriately, and use charge first in subsequent firings.

g. Unserviceable Ammunition.

(1) Conspicuously mark unserviceable ammunition or explosive components "UNSERVICEABLE" and return to ASP personnel for disposition.

(2) Repackage ammunition in original containers. If original container is unsuitable, use available material and transfer all markings. All layers of packing must be conspicuously marked "UNSERVICEABLE".

h. Excess Explosive Components.

(1) Pack supplementary charges removed from projectiles prior to assembling long intrusion proximity fuzes in containers from which proximity fuzes were removed.

(2) Properly mark container and return it to ASP for disposition.

(3) Destroy any unused powder increments or expelling charges left over after round has been fired by burning them in a safe place.

i. Destroying Powder Increments.

NOTE

Unused MACS increments should not be destroyed. They should be repacked, and either fired or turned back in.

(1) Locate proper burning area. Area should be 200 ft (60.96 m) from any combustible material.

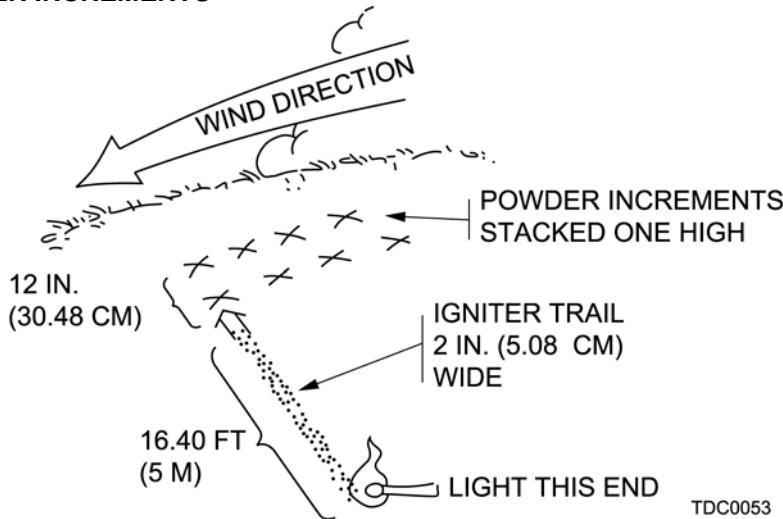
(2) Ensure proper firefighting equipment and personnel are present.

(3) Lay out powder increments parallel to wind direction in 12 in. (30.48 cm) wide column.

(4) Lay out an igniter trail at the downwind end of the line of increments by opening one powder bag and making a trail of powder at 90° to the powder increments. The igniter trail should be approximately 16.40 ft (5 m) long and 2 in. (5.08 cm) wide. See diagram below.

- (5) Light the end of the igniter trail, then move away from the powder increments.
- (6) While powder is burning, be alert for sparks or burning fragments caught by the wind.
- (7) When powder is through burning, be sure all flames are extinguished and no smoldering ashes remain "**BE SURE ASHES ARE COMPLETELY BURNED**".

DESTROYING POWDER INCREMENTS



j. Destroying MACS Charge Increments.

- (1) Locate proper burning area. Area should be 164 ft (50 m) from any combustible material.
- (2) Ensure proper firefighting equipment and personnel are present.
- (3) Prepare MACS propelling charge increments for field destruction:
 - (a) Peel off both red Mylar covers, exposing igniter end bags.
 - (b) Remove igniter bags from charge increment (locate ribbon tying bags together and cut, taking care not to cut into bags).
 - (c) Use one charge increment to make igniter trail. If one increment is cracked, break it open and use propellant to make igniter trail.
 - (d) If no charge increments are cracked, roll one charge increment on the ground, exerting a downward pressure on the joint of the case of the body. This should break the joint and the exposed propellant can be poured out and used to make the igniter trail.

4-21 MAINTENANCE (cont)

(4) Lay out MACS propelling charge increments parallel to wind direction in 12 in. (30.48 cm) wide column (columns of two increments) and lay the removed igniter bag components among the increments.

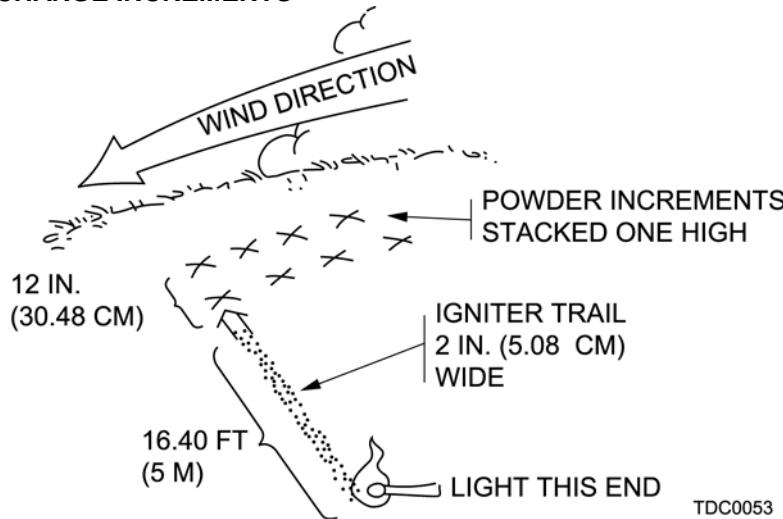
(5) Lay out an igniter trail at the downwind end of the line of increments by either breaking open one increment or by using a cracked or broken increment and making a trail of propellant at 90 degrees to the increments. The igniter trail should be approximately 16.40 ft (5 m) long and 2 in. (5.08 cm) wide. See diagram below.

(6) Light the end of the igniter trail, then move away from the MACS propelling charge increments.

(7) While increments are burning, be alert for sparks or burning fragments caught by the wind.

(8) When increments are through burning, be sure all flames are extinguished and no smoldering ashes remain "**BE SURE ASHES ARE COMPLETELY BURNED**".

DESTROYING MACS CHARGE INCREMENTS



4-22 STORAGE

WARNING

AMMUNITION EXPOSED DIRECTLY TO SUNLIGHT, OR IN UNVENTILATED CONTAINERS, ENCLOSURES, SHELTERS, FREIGHT CARS, CLOSED VEHICLES, AND SIMILAR STRUCTURES EXPOSED TO DIRECT SUNLIGHT MAY REACH TEMPERATURES EXCEEDING UPPER STORAGE LIMITS. AVOID EXPOSURE OF AMMUNITION COMPONENTS TO DIRECT SUNLIGHT. DO NOT STORE AMMUNITION ASSEMBLED WITH TETRYTOL-LOADED BURSTERS (I.E., PROJECTILES, 155-MM- SMOKE, WHITE PHOSPHOROUS, M110; GAS, AND HAND HD, PERSISTENT, M110) AT TEMPERATURES EXCEEDING +125°F (+52°C).

a. Temperature Limits.

- (1) Except as otherwise specified, observe the following limits:
 - (a) Lower limit is -80°F (-62°C) for period of not more than 3 days.
 - (b) Upper limit is +160°F (+71°C) for periods of not more than 4 hours per day.

WARNING

DO NOT FIRE SMOKE, WHITE PHOSPHOROUS M110 ROUNDS, WHICH ARE KNOWN TO HAVE BEEN STORED IN OTHER THAN BASE DOWN POSITION. FIRING OF SUCH PROJECTILES COULD CONTRIBUTE TO INBORE EXPLOSIONS OR CLOSE-IN PREMATURE MALFUNCTIONS.

(2) Store or transport projectiles containing WP at a temperature below the melting point of the WP filler (+111.4°F (+44°C)). If this is not practicable, store or transport such projectiles on their bases so that, should the WP filler melt, it will resolidify with the void in the nose of the projectile. This restriction does not apply to the M825/M825A1 WP projectiles.

(3) Protect proximity fuzes and proximity rounds from long exposure in high humidity. Store M728 in temperatures between -65°F (-54°C) to +145°F (+63°C); store M732 series fuze in temperatures between -60°F (-51°C) and +160°F (+71°C); and store M514 series fuze in temperatures between -30°F (-34°C) and +130°F (+54°C).

WARNING

DO NOT STORE AMMUNITION UNDER TREES OR NEAR TALL BUILDINGS THAT ATTRACT LIGHTNING. WHEN AMMUNITION MUST BE STORED IN THE OPEN, SELECT A STORAGE SITE FREE OF POWER LINES, ELECTRIC CABLES, AND FLAMMABLE MATERIALS. SITES SHOULD NOT BE ADJACENT TO RESERVOIRS, WATER MAINS, ETC. DO NOT STORE AMMUNITION NEAR A LARGE CONCENTRATION OF PERSONNEL.

b. **Sites.** Store ammunition in the firing area so that it is protected against accidental explosions. Sites should be level and well drained.

c. **Provisions.**

NOTE

A hardstand of blacktop or gravel and sand is preferable to excessive use of spacing material.

(1) Use heavy, well supported dunnage to keep bottom tier of stack off the ground and to prevent it from sinking into the ground.

(2) Allow at least 6 in. (15.24 cm) of space beneath the pile for air circulation. Dig trenches to prevent water from flowing under pile.

(3) Provide nonflammable covers (e.g., tarpaulin) for all ammunition. Maintain air space of approximately 18 in. (45.72 cm) between cover and ammunition. Keep cover at least 6 in. (15.24 cm) from pile on ends and sides for air circulation.

4-22 STORAGE (cont)

(4) Store M110 series and WP projectile rounds nose up; this does not apply to the M825 WP projectile.

(5) Store ammunition and primer containers with the top side up. Labels or markings on boxes and containers indicate which side should be up.

SECTION IV. M712 HEAT, CANNON-LAUNCHED, GUIDED PROJECTILE AND M823 TRAINING PROJECTILE (COPPERHEAD)

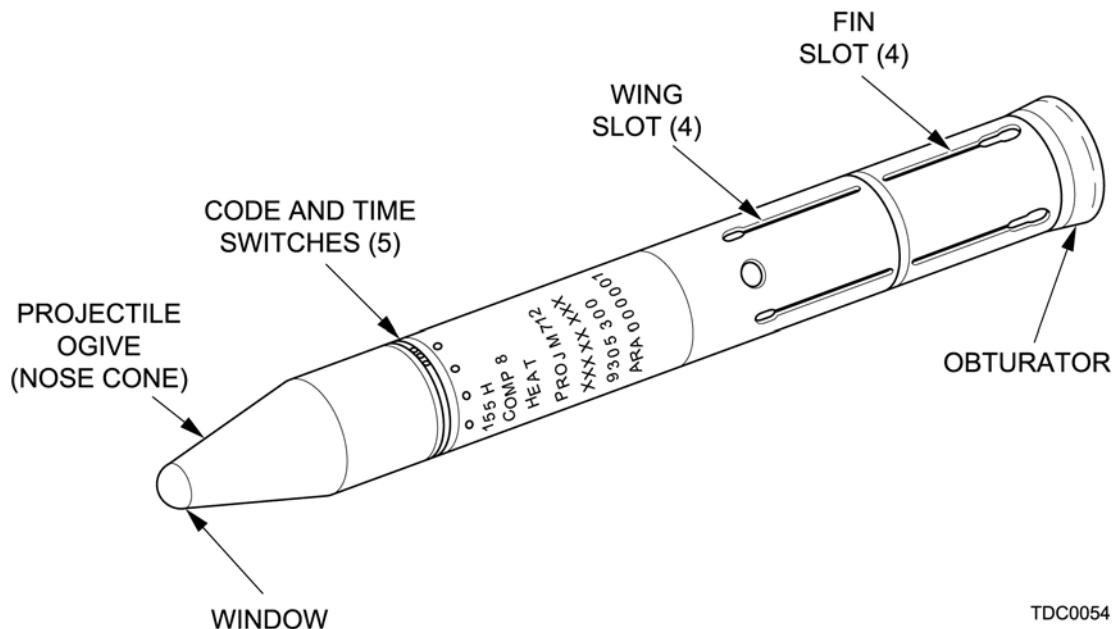
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4-23 DESCRIPTION

a. **M712 Cannon-Launched, Guided Projectile** is a terminally guided system launched from the M777/M777A1/M777A2 howitzer into a ballistic trajectory. During flight, the target is illuminated by a laser beam from a laser designator. An onboard computer continuously refines the terminal trajectory and provides guidance to the control surfaces, causing the round to home in on stationary or moving hard-point targets. The M712 projectile is fired in the same manner as conventional projectiles.

M712 PROJECTILE



TDC0054

WARNING

THE M823 TRAINING PROJECTILE MUST NOT BE FIRED. SUCH FIRING COULD BE A HAZARD TO PERSONNEL FORWARD OF THE HOWITZER.

b. The training round for M712 projectile is M823 projectile. The M823 projectile is designed to train 155mm howitzer crews in the handling and setting of the M712 projectile. It simulates the M712 in weight, center of gravity, and external appearance. It contains code and time switches, which are set to simulate prefiring activity by the crew; however, it does not have the wings or fins. It is shipped and stored in the same container as the M712 projectile and color-coded for easy identification. The containers for both the M712 and M823 projectiles are forest green. Marking for the M712 is yellow; for the M823 it is white. Bronze patches at container ends also identify the M823 projectile inside.

4-24 UNPACKING AND INSPECTION

WARNING

IF EXUDED COMPOSITION B IS OBSERVED ON THE PROJECTILE OR IN THE CONTAINER DURING THE UNPACKING AND INSPECTION OPERATIONS, MOVE THE PROJECTILE TO A SAFE AREA AND NOTIFY EOD FOR DISPOSAL.

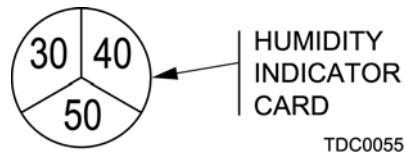
NOTE

Unless the unpackaged M712 projectile is to be fired immediately, it must be protected from the elements (by means of protective bag) as described below. Do not let an unpackaged M712 projectile sit out unprotected.

a. Unpackaging.

(1) A humidity indicator is located in the aft end of the container. The indicator card is the pie-sector type (the M823 training round has a card that resembles the card for the M712 projectile, but 'DUMMY CARD' is printed on its face. These procedures apply only to the M712 projectile).

HUMIDITY INDICATOR



(2) Open only those containers whose humidity indicator card shows under 40 percent relative humidity (40 percent sector must be colored blue, 30 percent sector may be blue or pink), and only when a fire mission is planned or anticipated. If the 40 percent humidity section is pink, turn complete item in to ASP. Keep all packaging materials in the container. A protective bag is provided inside each container. When mission requirements dictate a need, the M712 projectile may be removed from the shipping and storage container and placed in the protective bag. The protective bag will protect the round against direct effects of water, sunlight, dirt, and debris. However, it will not protect the round from the elements for more than 30 days at a time. Repackage unfired projectiles within 30 days and turn in to ASP. Projectiles must be repackaged for vehicular transportation. Unpackage the M712 projectile from its container as follows:

4-24 UNPACKING AND INSPECTION (cont)

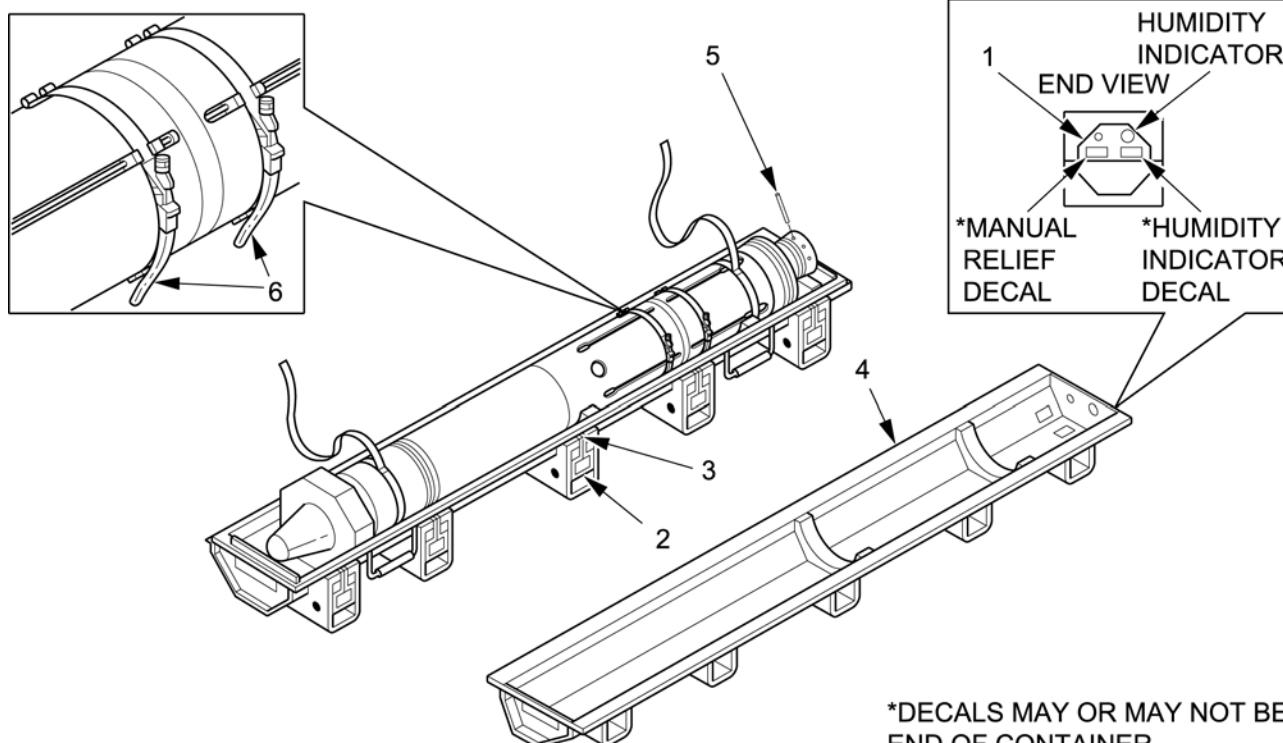
UNPACKING

CAUTION

Before unpackaging round from container, make a quick visual inspection of projectile for obvious damage or other conditions that would prevent use. If projectile appears unusable, replace container cover, close latches, and return to ASP.

- (3) Using a screwdriver or equivalent tool, break and remove metallic seal wires (if present) located on center latch on both sides of container.
- (4) Depress manual relief valve (1).
- (5) Release container latches (2), starting at the manual relief valve (aft) end, in pairs. Pull latch handles all the way up, remove barrel nut (T-bolt) (3) from recess in cover, and then push down all the way.
- (6) Separate cover (4) from container body and place upside down on ground alongside body.
- (7) Partially pull torquing rod (5) from rear end of tension mechanism.
- (8) Turn torquing rod CCW to release tension, and then spin tension mechanism by hand until it stops.
- (9) Open stainless steel fin and wing preload bands (6), remove and place in container.

SEPARATING COVERS



*DECALS MAY OR MAY NOT BE ON
END OF CONTAINER

TDC0056

CAUTION

Do not let the projectile touch the ground or lay in water. Projectile may be placed on a tarpaulin or may be put down across the top of the open container. Water, dirt, or other materials entering projectile through wing/fin slots may cause projectile to fail during flight. Do not touch or grasp ogive when handling and loading projectile.

(10) Carefully remove projectile (1) from container by lifting it up and to the rear, using lifting straps (2) provided on the projectile.

(11) Place the projectile on a clean, dry surface. The projectile should be shielded from direct sunlight, rain, dirt, and other debris.

(12) Remove lifting straps (2), and place them in the container.

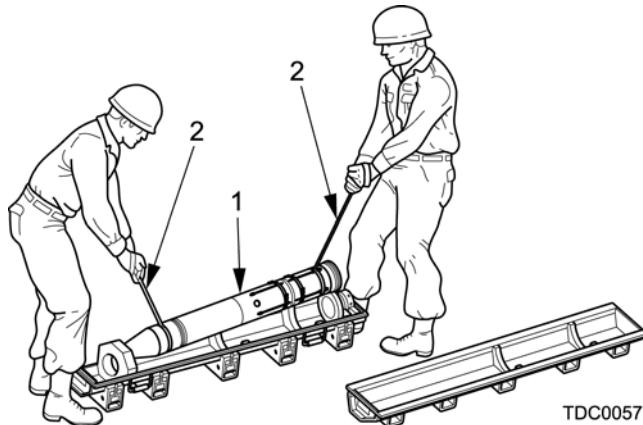
(13) Spin tension mechanism several turns CW by hand to avoid interference of torquing rod with cover when container is closed.

(14) Replace cover on container body.

(15) Starting on the end opposite the humidity indicator, straddle container, place T-bolts in cover recesses, and close corresponding left and right side latches at the same time, in pairs, until all 10 latches are closed.

(16) Keep the container and all packing materials for reuse or return complete container to ASP. Covers and bodies of containers form a set. Do not separate or mix covers and bodies.

PROJECTILE REMOVAL



TDC0057

b. **Inspection of M712 Projectile.** Perform the following inspection immediately after the projectile is unpackaged from its container. If a projectile is found to be unserviceable, as a result of damage or other defects, as described below, repackage the projectile in its original container, and return to ASP. Attach a tag describing the defects.

(1) Inspect the window area of the nose cone to make sure that it is clean and that there are no cracks, fogging, indications of moisture on the inside of the window, or other damage. Clean a dirty window, using a clean wiping rag (item 30, Appx D). Reject a projectile as unserviceable for any of the following reasons:

(a) Window cannot be properly cleaned.

4-24 UNPACKING AND INSPECTION (cont)

(b) Window shows signs of fogging or has moisture on the inside.

(c) Window is cracked, broken, or badly gouged.

(2) Inspect code and time switches to make sure that they are free of dirt and that all numbers and index marks are legible. Remove dirt, using a clean wiping rag (item 30, Appx D). Reject a projectile as unserviceable for any of the following reasons:

(a) Missing or broken switch dials.

(b) Switch dials cannot be properly cleaned to make numbers and index marks legible.

(c) Switches cannot be rotated freely when the firing codes are being set into projectile. Turn switches, using a screwdriver or the tang end of the M18 fuze-setter wrench, to check switches turn. A click should occur at each number.

(3) Reject a projectile as unserviceable if the obturator has a crack or large gouge.

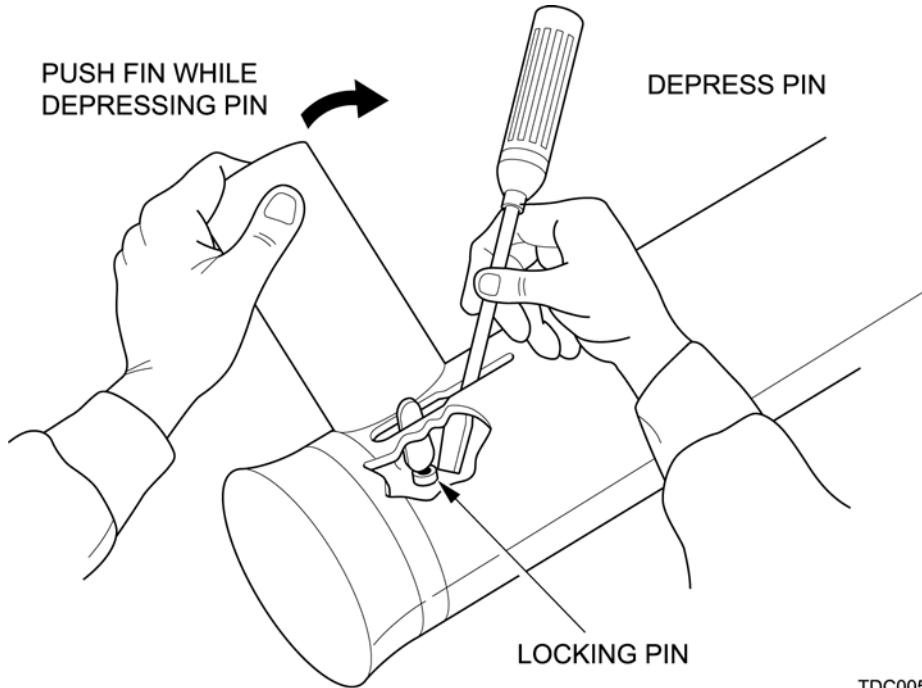
(4) Inspect wing and fin slots to make sure there is no dirt, debris, or other foreign matter in the slots. Reject as unserviceable if foreign material cannot be removed.

(5) Inspect fins to make sure that they are not in extended position. If they are, perform either (a) or (b) below to relatch fins. Reject projectile as unserviceable if fins cannot be relatched.

(a) If fin is only part way out, gently push fin back into its slot until it locks in place.

(b) If fin is locked in extended position, insert a small screwdriver, knife blade, or similar tool to fin slot as shown. Depress locking pin with tool, and push fin forward at the same time to lock fin in retracted position.

FIN INSPECTION



TDC0058

(6) Inspect the overall projectile to make sure that there is no caked-on dirt, excessive corrosion, loose or missing items, such as screws or access covers or other damage. Remove dirt, minor corrosion, and foreign matter using a clean, soft cloth or tissue (item 12, Appx D). Inspect for loose or missing screws. If any splice screw or access cover screw is loose, attempt to make it finger tight, turning by hand. Reject a projectile as unserviceable if there is excessive corrosion or screws missing on access cover. Minor corrosion, minor gouges, burrs on metal projectile body, and/or missing splice screws are acceptable. Screws slightly above flush are acceptable after tightening.

c. **Inspection of M823 Projectile.** Since the M823 projectile will be reused many times, it will be rejected only for the following reasons.

- (1) Nose cone is cracked or broken.
- (2) One or more switches cannot be rotated or will not stay set to a number.
- (3) Severe damage to projectile body which could prevent it from being rammed or extracted and cause damage to the interior of the gun tube.
- (4) Badly damaged or worn obturator, which results in fall back.
- (5) Damaged base which prevents proper extraction.

4-25 PREPARATION FOR FIRING

WARNINGS

FORCING CONE IN THE CANNON TUBE MUST BE FREE OF OIL AND GREASE BEFORE RAMMING. OIL OR GREASE MAY PERMIT PROJECTILE FALBACK.

AFTER EXTRACTING AN M712 PROJECTILE FROM A HOT CANNON TUBE FORCING CONE MUST BE CLEANED OF MELTED PLASTIC. FAILURE TO DO SO MAY RESULT IN PROJECTILE FALBACK. CLEANING MAY BE ACCOMPLISHED BY FIRING A DIFFERENT 155MM ROUND IF MISSION REQUIREMENTS PERMIT OR FIRING A PROPELLING CHARGE ALONE

NOTE

For training purposes, the M823 training projectile will be used instead of the M712 projectile. All operational procedures, which apply to the M712, also apply to the M823 projectile. However, no live propelling charges are to be used with the M823 training round.

- a. Unpackage and inspect M712 or M823 projectile (Para. 4-24).
- b. Make sure that the extractor assembly is set up and ready for use as described in paragraph 4-28.

4-25 PREPARATION FOR FIRING (cont)

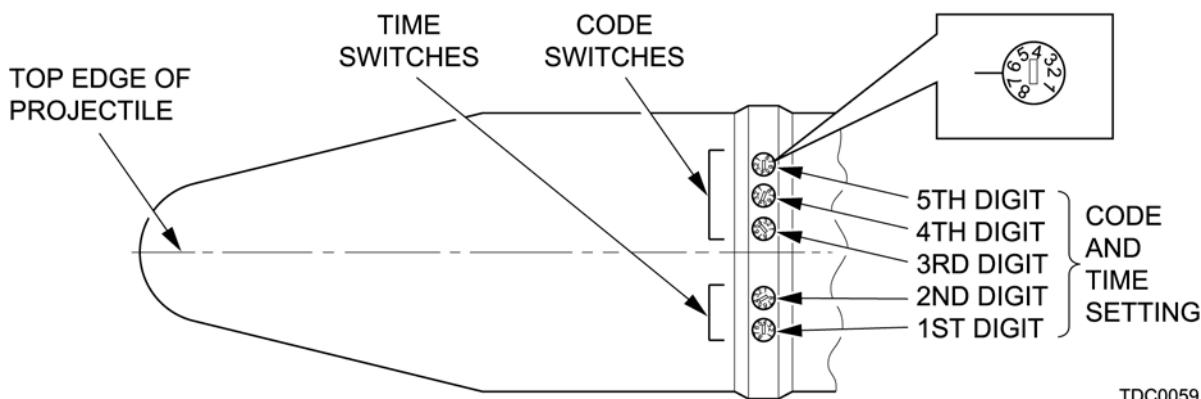
NOTES

Be sure to set switches in correct sequence. Always set first switch on left (looking from base of projectile toward nose) first, then the next switch to the right, etc., until all five switches have been set.

A noticeable click should occur at each number on the switch. This click may be heard and /or felt.

- (1) Rotate switch at least one complete turn, either CW or CCW.
- (2) Continue turning switch past correct number and toward the next adjacent number (but stop before reaching next number).
- (3) Turn switch back the other way and set on correct number. Be sure that number on switch is centered on scribe line.

PREPARATION FOR FIRING



c. After unpackaging the round, set the code and time switches, using a screwdriver or the tang end of the M18 fuze-setter wrench. The fire direction center announces this setting in the fire command, in the same place as they usually send 'time' for time of VT fuzes. This switch setting will always have five numbers. Switches will be set from left to right as seen when facing the nose of the projectile from the base of the round. The switches are circular dials that can be rotated CW or CCW as many times as required, without damaging the switches. The appropriate number on the switch must be centered on the scribe line.

d. Set the elevation of the cannon tube between 250-500mils for loading the projectile.

WARNING

THE M712 PROJECTILE IS NOT ADAPTABLE FOR USE WITH THE CURRENT LOADING TRAY. DAMAGE TO PROJECTILE OR INJURY TO PERSONNEL COULD OCCUR.

e. Carry the prepared projectile to the howitzer. Recheck the nose window and obturator cleanliness. If necessary, they are wiped clean, using a clean wiping rag (item 30, Appx D).

f. Visually recheck code and time switches. If numbers are not centered on scribe lines or correct numbers have not been set, set them now following procedures in paragraph c (above). Verify that the steel fin and wing retainer clamps have been removed. If the clamps have not been removed, remove before ramming the round.

4-26 LOADING M712 AND M823 PROJECTILES

- a. When loading projectiles M712 and M823, carryout the following:

WARNING

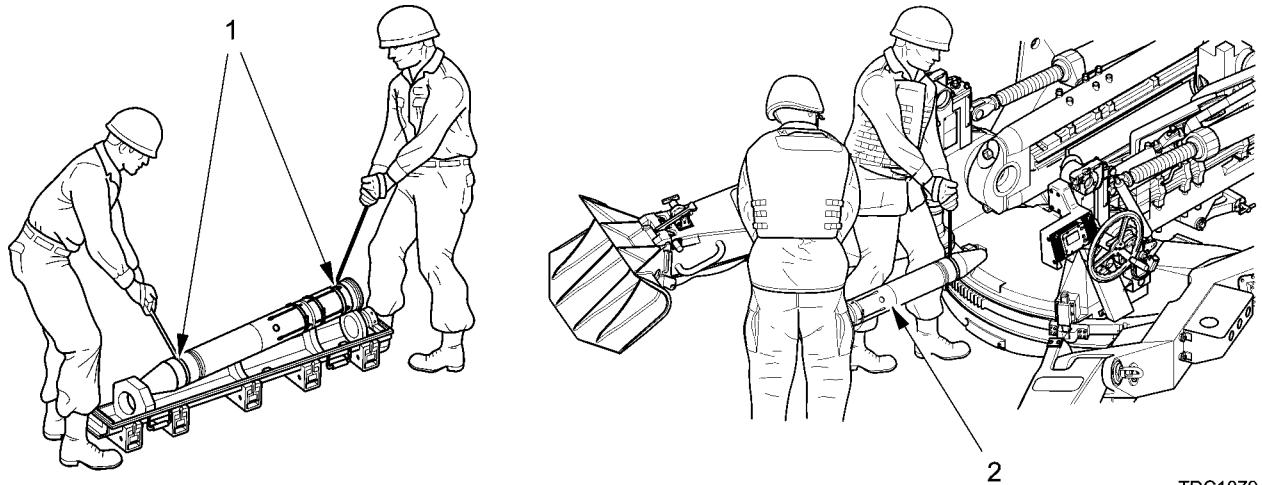
LOADING PROCEDURES FOR PROJECTILES M712 AND M823 MUST BE CARRIED OUT AT AN ELEVATION OF 200 MILS, FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL AND/OR DAMAGE EQUIPMENT.

NOTE

Before lifting projectile M712 or M823, ensure breech is in the open position and the loading tray is in the lowered position (Para 2-16).

- (1) Unpack and prepare projectile M712 or M823 (Para 4-24).
- (2) Using lifting straps (1), lift and carry projectile (2) to the howitzer.

LOADING M712 OR M823 PROJECTILE



TDC1079

WARNINGS

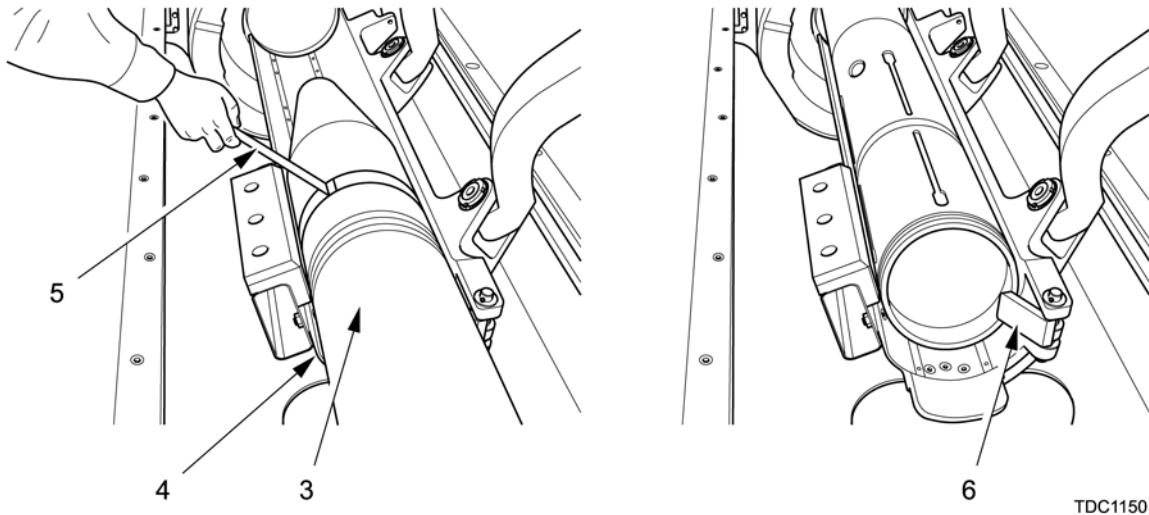
WHEN MOVING PROJECTILE M712 OR M823 TO THE LOADING TRAY, ENSURE CARE IS TAKEN WHEN USING LIFTING STRAPS, FAILURE TO DO SO WILL CAUSE INJURY TO PERSONNEL AND/OR DAMAGE EQUIPMENT.

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.

4-26 LOADING M712 AND M823 PROJECTILES (cont)

(3) Under control, place projectile (3) onto loading tray (4), remove lifting straps (5), ensure that base of projectile is forward and against round catch (6).

LOADING M712 OR M823 PROJECTILE



- b. Carry out remainder of the loading process as per this manual (Para 2-33).

4-27 MISFIRE AND CHECK FIRING PROCEDURES

The precautions and actions associated with misfires and checkfires are the same for the M712 or M823 projectile as for other projectiles in this manual.

4-28 OPERATION OF EXTRACTOR TOOL ASSEMBLY FOR PROJECTILES M712 AND M823

a. **General.** The extractor assembly is used to remove the M712 or M823 projectile from the weapon. The following procedures include setting up the extractor assembly in preparation for use and breakdown procedures for stowage.

- b. **Setup for Use.**

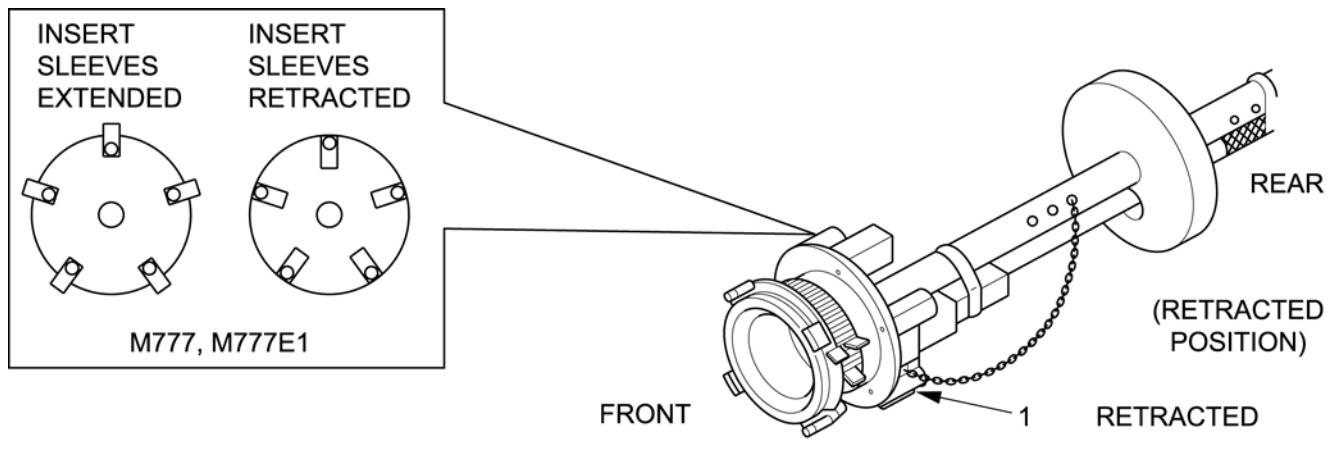
- (1) Get extractor assembly from wooden packing box.

NOTE

The 16 in. socket wrench extension will initially be found in the SL-3/BII gear. This extension should be relocated into the box containing the extractor and retained there.

- (2) Inspect to make sure that the five insert sleeves (1) in the extractor assembly are retracted for use with an M777/M777A1/M777A2 howitzer as shown.

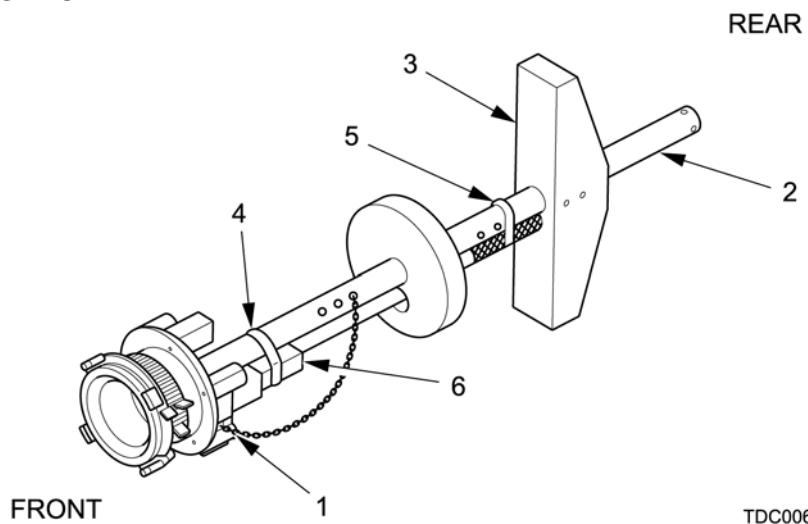
EXTRACTOR TOOL SET UP



TDC0060

- (3) While standing at the rear, loosen drive nut (2) CW to farthest white mark.
- (4) Move brace (3) back.
- (5) Loosen two strap assemblies (4 and 5).
- (6) Remove ratchet (6).
- (7) Disengage locking pin (7).

EXTRACTOR TOOL SET UP



TDC0061

- (8) Extend telescoping solid shaft (1) and hollow shaft (2) until hole (3) in solid shaft (1) aligns with farthest hole in hollow shaft (2).
- (9) Move alignment support (4) forward, midway between locking pin chain screw (5) and two holes (3) and (6), at end of the hollow shaft (2).
- (10) Guide the locking pin (7) through the slot in alignment support (4).

4-28 OPERATION OF EXTRACTOR TOOL ASSEMBLY FOR PROJECTILES M712 AND M823 (cont)

(11) Insert locking pin (7) completely through both shafts (1) and (2), as shown.

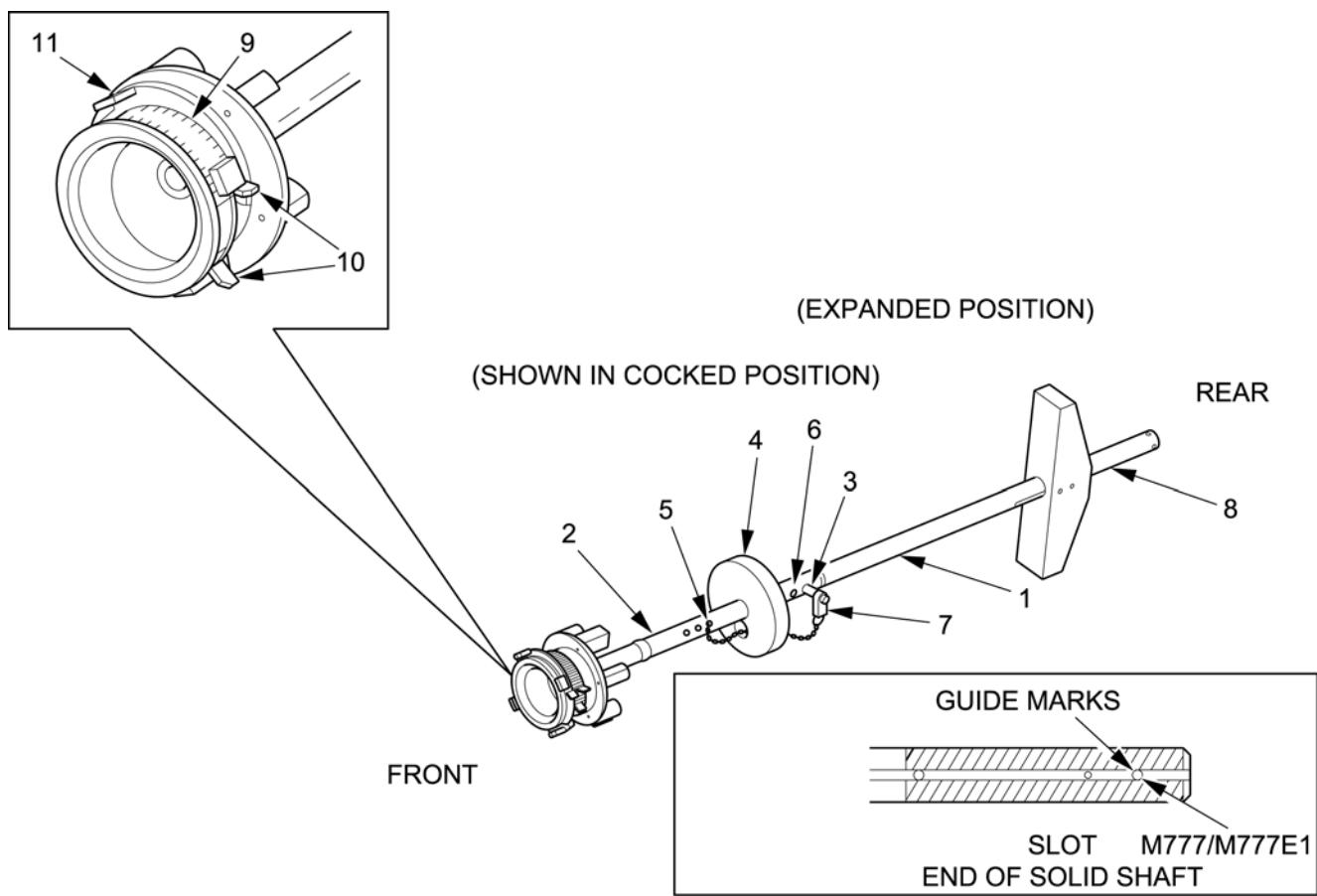
(12) Turn drive nut (8) CCW until forward edge aligns with guide mark (white) on solid shaft (1). Use rear mark for M777/M777A1/M777A2 howitzer.

(13) Cock extractor assembly as follows:

(a) Compress expansion ring (9) by squeezing tabs (10) together.

(b) Align cutout in retaining ring (11) with tabs (10) on expansion ring (9), and slide retaining ring forward over expansion ring.

EXTRACTOR TOOL SET UP



TDC1031

c. **Setup for Use Under Conditions of Poor Visibility.** If the extractor assembly is being expanded under conditions of poor visibility, the alignment hole and shaft detent may be used as described below.

(1) Disengage locking pin (1), and pull solid shaft (2) from hollow shaft (3).

(2) Move alignment support (4) forward of the two holes (5) and (6), in hollow shaft (3).

(3) Guide locking pin (1) through the slot in alignment support (4).

(4) Insert locking pin (1) in the alignment hole (6) (second hole from end of hollow shaft).

(5) Insert solid shaft (2) in hollow shaft (3), and rotate until alignment detent in end of solid shaft rests against locking pin (1).

(6) While holding both shafts, to prevent them from turning or sliding, remove locking pin (1) from alignment hole (6); and insert locking pin completely through farthest hole (5) to lock both shafts in extended position.

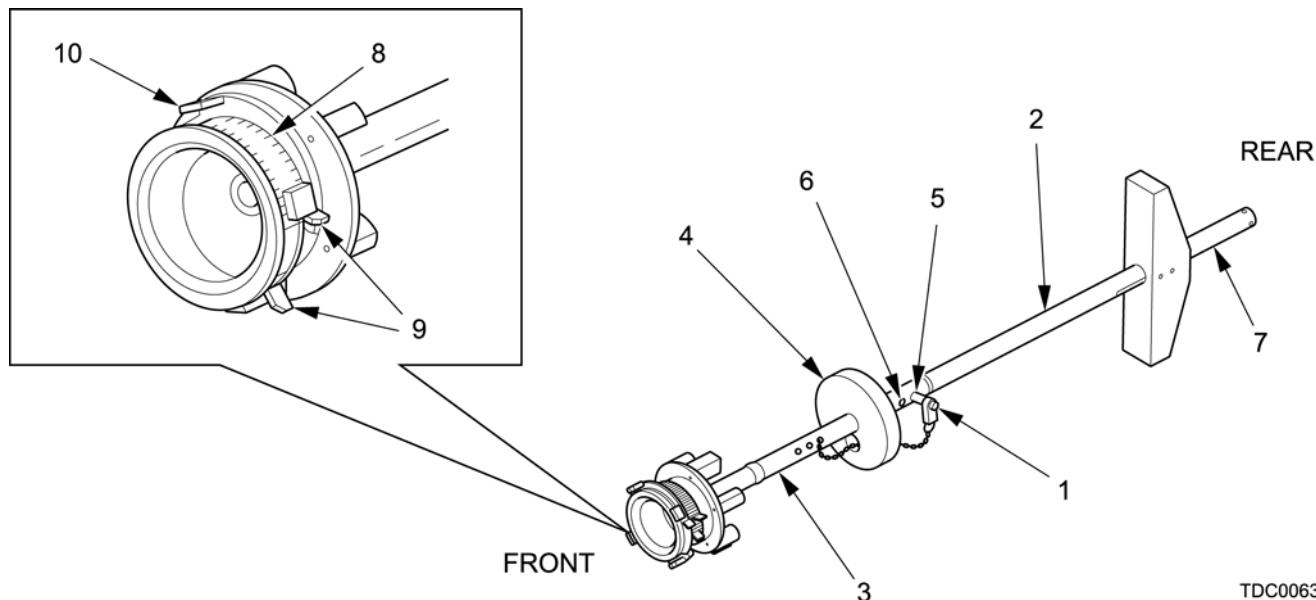
(7) Turn drive nut (7) CCW until forward edge aligns with guide mark (white) on solid shaft (2). Use rear mark for M777/M777A1/M777A2 howitzer.

(8) Cock extractor assembly as follows:

(a) Compress expansion ring (8) by squeezing tabs (9) together.

(b) Align cutout in retaining ring (10) with tabs (9) on expansion ring (8), and slide retaining ring forward over expansion ring.

EXTRACTOR TOOL SET UP



TDC0063

d. Breakdown for Stowage.

(1) Disengage locking pin (1), and compress telescoping solid shaft (2) and hollow shaft (3) to retracted position.

(2) Guide locking pin (1) through slot in alignment support (4).

(3) Insert locking pin (1) completely through solid shaft (2) and hollow shaft (3).

(4) Remove ratchet (5) and extension, and guide ratchet handle through the slot in alignment support (4).

(5) Strap ratchet (5) to hollow shaft (3), using the strap assemblies (6) and (7) provided.

(6) Slide brace (8) forward until it touches end of ratchet handle. Turn drive nut (9) CCW until brace (8) is held firmly against ratchet handle.

4-28 OPERATION OF EXTRACTOR TOOL ASSEMBLY FOR PROJECTILES M712 AND M823 (cont)

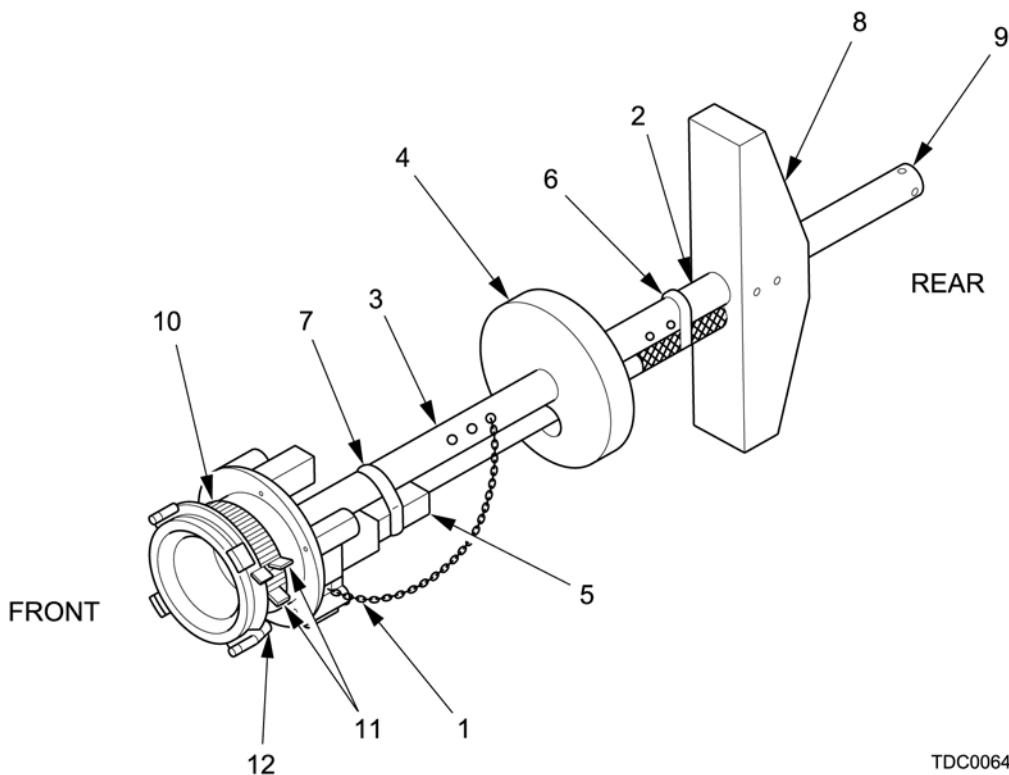
(7) Check to see if extractor is cocked. If it is not cocked, perform the following:

(a) Compress expansion ring (10) by squeezing tabs (11) together.

(b) Align cutout in retaining ring (12) with tabs (11) on expansion ring (10), and slide retaining ring (12) over expansion ring (10).

(8) Stow assembly and extension in wooden packing box.

EXTRACTOR TOOL BREAKDOWN FOR STOWAGE



4-29 UNLOADING M712 OR M823 PROJECTILES

CAUTION

Do not use bell rammer to unload M712 or M823 projectile.

a. Removal of Primer and Propelling Charge.

- (1) Remove primer by moving PFM lever to the EXTRACT position. Remove magazine assembly.
- (2) Elevate/depress cannon tube to approximately 300 mils.

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.

- (3) Close scavenge isolator valve.

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) Move breech lever to the OPEN position. Operate trunnion pump handle until breech is fully open. Remove pump handle and stow.

NOTE

If MACS charge loaded, see Para 2-50 for removing.

- (5) Remove propellant charge from chamber.

b. **Unloading M712 and M823 Projectile.** Unload M712 or M823 projectile following the steps listed below.

- (1) Obtain extractor assembly.

(2) Check to see if extractor assembly is cocked. If expansion ring is cocked, proceed to (3) below; otherwise, cock extractor assembly as follows:

- (a) Compress expansion ring by squeezing tabs together.

(b) Align cutout in retaining ring with tabs on expansion ring, and slide retaining ring forward over expansion ring.

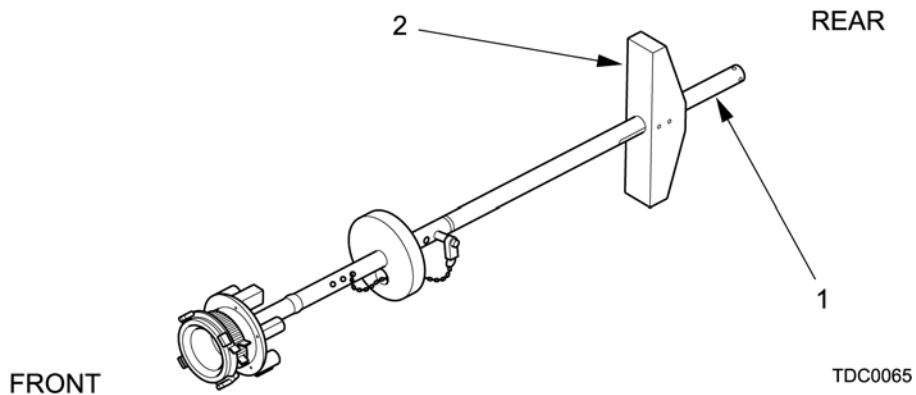
(3) Insert extractor assembly through breech ring assembly until forward end makes contact with base of projectile. Push extractor assembly firmly against projectile until expansion ring is seated in the base of the projectile. Pull on extractor assembly to make sure that it is engaged with projectile. If extractor assembly did not engage, remove it from cannon tube and repeat procedures in steps (2) (a) and (b), and this step.

(4) Turn extractor drive nut (1) CCW by hand until brace (2) touches and is centered across face of breech ring assembly.

4-29 UNLOADING M712 OR M823 PROJECTILES (cont)

b. Unloading M712 and M823 Projectile (cont).

EXTRACTOR ASSEMBLY



TDC0065

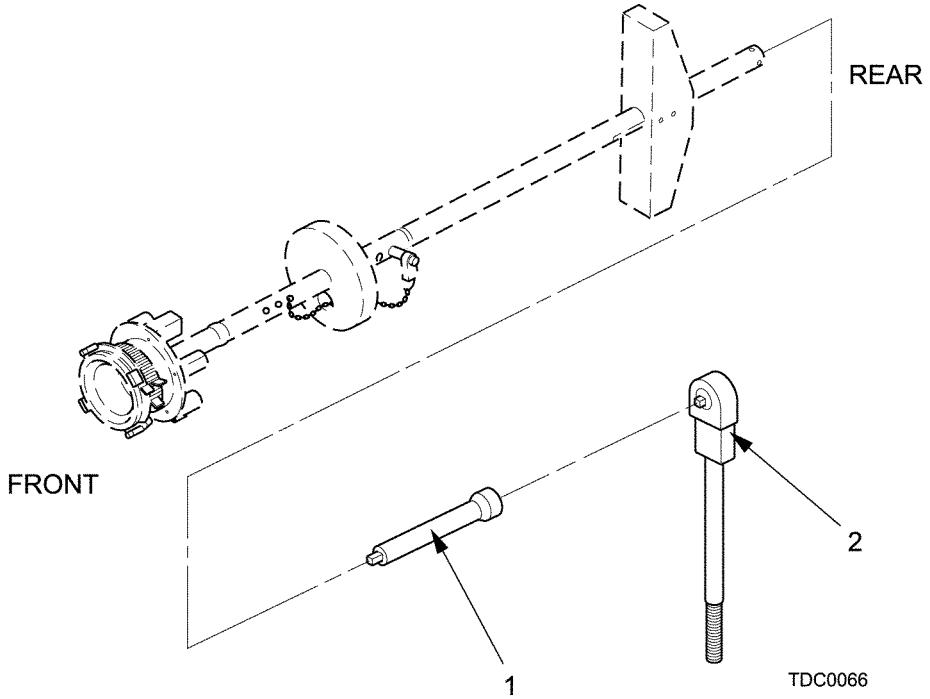
(5) Insert socket wrench extension (1) into ratchet (2). Connect ratchet to end of drive nut. Set ratchet to OFF, and turn ratchet CCW until projectile is pulled free of forcing cone. Remove ratchet and wrench extension from drive nut.

(6) Let projectile and extractor assembly slide slowly out of gun tube until base of projectile has passed through breech ring assembly. Projectile will have to be raised slightly to pass obturator over Swiss groove.

(7) Release extractor assembly by squeezing tabs on expansion ring.

(8) Remove the projectile from howitzer, being careful not to strike plastic nose cone, and repackaging the projectile. If the projectile has been unloaded from a hot gun tube, remove it to a safe distance from personnel, and notify EOD for disposal.

PROJECTILE REMOVAL



TDC0066

4-30 AMMUNITION PREPARED FOR FIRING, BUT NOT FIRED

a. **General.** M712 projectiles that have been unpackaged (in accordance with paragraph 4-24) but not fired will be repackaged as soon as possible and returned to ASP for further disposition. Long exposure of the projectile to sunlight and other elements may cause it to fail. Code and time switch settings made during preparation need not be reset. A projectile that has been unloaded from a weapon as a result of a misfire or checkfire will be repackaged as described below.

NOTE

An M712 projectile, which has been rammed and extracted from a cold tube, may be used.

b. **Repackaging Projectile.** Repackage the M712 projectile as follows:

(1) Using a clean wiping rag (item 30, Appx D), wipe all loose dirt and moisture from projectile.

(2) Locate original container. If container has become unserviceable, replace it. If original container cannot be found or has been replaced for unserviceability, make sure that markings on replacement container match markings on projectile. If not, return to ASP for remarking.

(3) Install projectile into container as follows:

(a) Check red decals, stamp, or stencil (if present) at nose end of container halves to assure numbers on decals match.

(b) Open container, and remove lifting straps. Also remove fin and wing preload bands.

CAUTION

Make sure that all four fins and wing preload bands securely engage fin and wings.

(c) Install fin and wing preload bands (1) on projectile.

(d) Install lifting straps (2) on projectile.

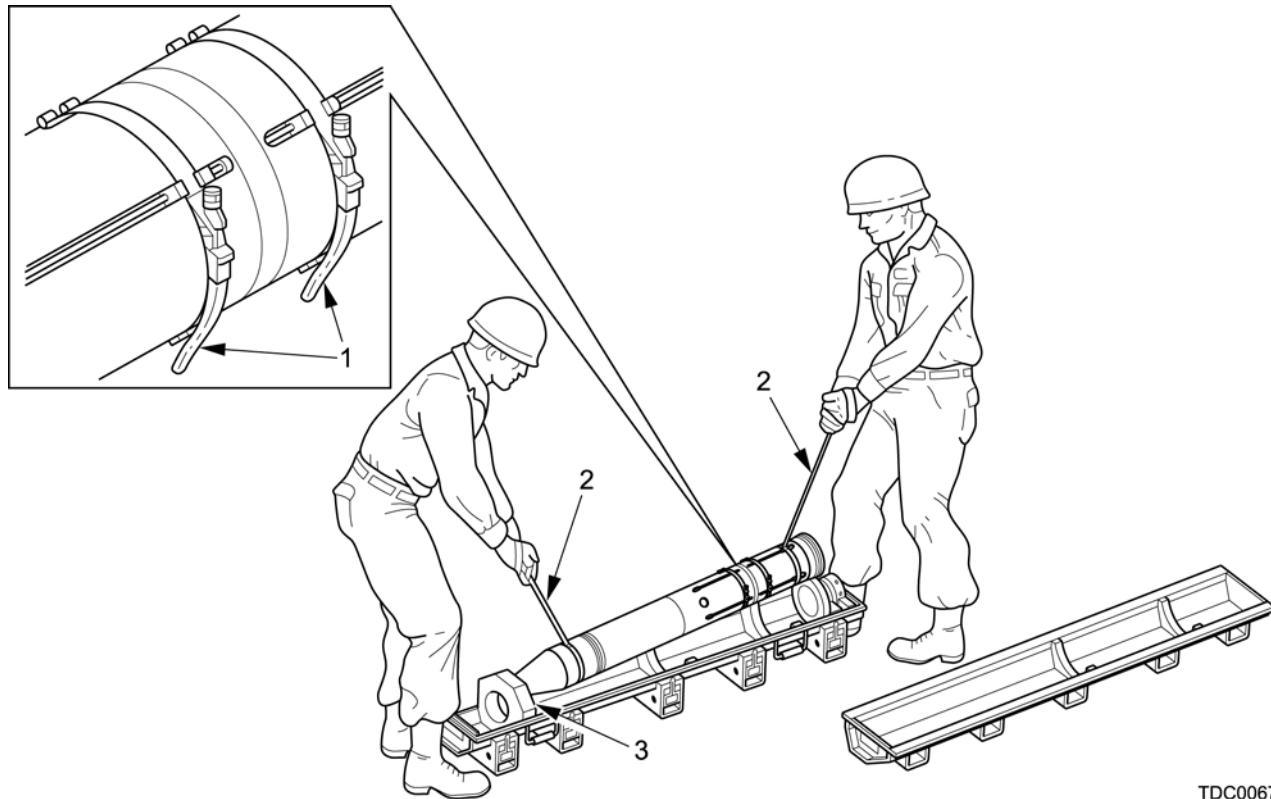
(e) Spin tension mechanism CCW by hand until it stops.

(f) Lift projectile, and position over opened container.

(g) Carefully lower projectile, guiding nose cone into retainer (3) in the container.

4-30 AMMUNITION PREPARED FOR FIRING, BUT NOT FIRED (cont)

REPACKING PROJECTILE



TDC0067

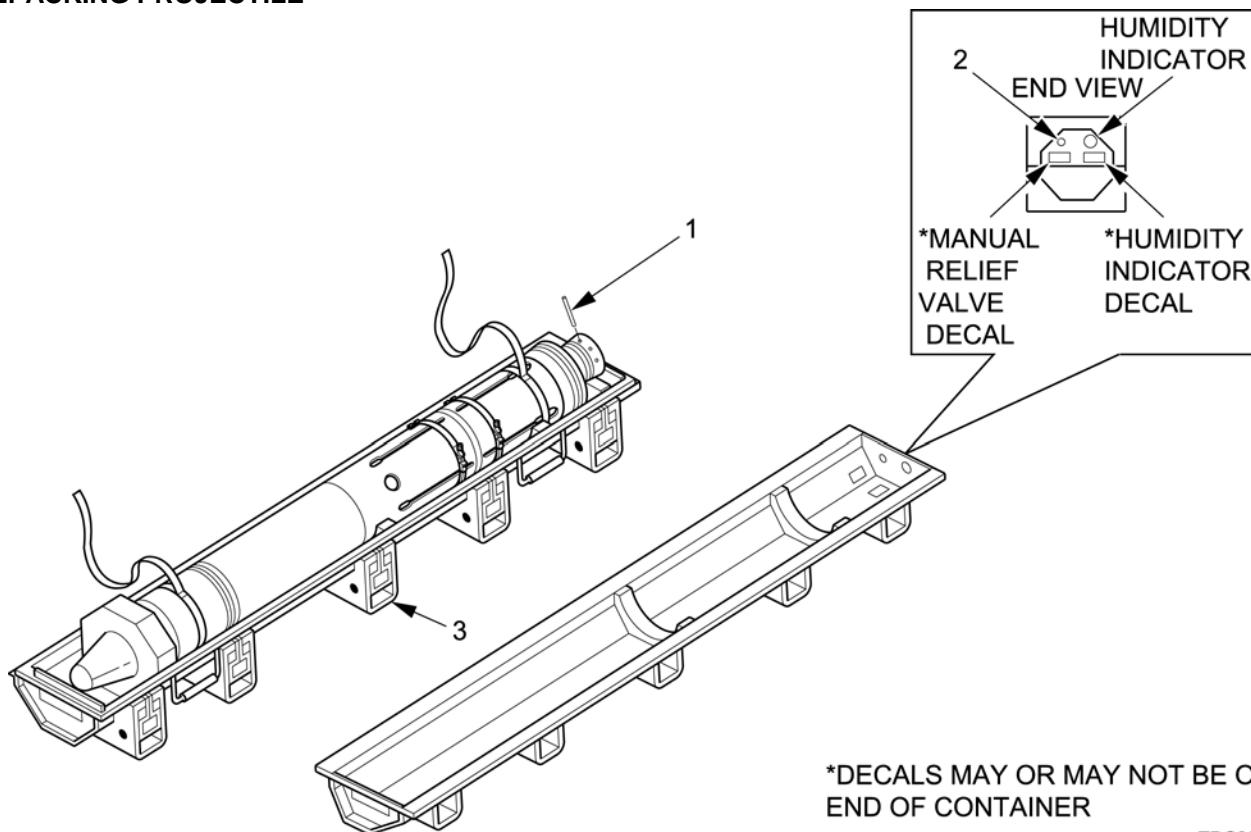
(h) Using torquing rod (1), turn tension mechanism clockwise as far as possible to snug projectile into the retainer ring. Position rod in holes so thread is horizontal (or as close as possible). This is required toward interference with the cover stops inside the cover.

(i) Be sure that desiccant and protective bag are placed inside container.

(j) Place container cover on container body in such a manner that the inside cradles are aligned and the manual relief valve (2) and the humidity indicator card are at the rear end of the container.

(k) Starting on the end opposite the humidity indicator card, straddle container, place T-bolts in cover recesses, and close corresponding left and right side latches (3) at the same time in pairs.

REPACKING PROJECTILE



TDC0068

4-31 M712 PROJECTILE MAINTENANCE

Humidity indicators on package M712 projectiles must be monitored for humidity every 90 days, as a minimum. If relative humidity in the container is 40 percent or greater (40 percent sector of humidity indicator card is not blue), follow instructions in Para 4-24.

SECTION V. HANDLING

Section Index

Paragraph	Page
4-32	Loose Projectile Restraint System (LPRS) 4-95

4-32 LOOSE PROJECTILE RESTRAINT SYSTEM (LPRS)

NOTE

When using the LPRS, ensure proper spacing is used.

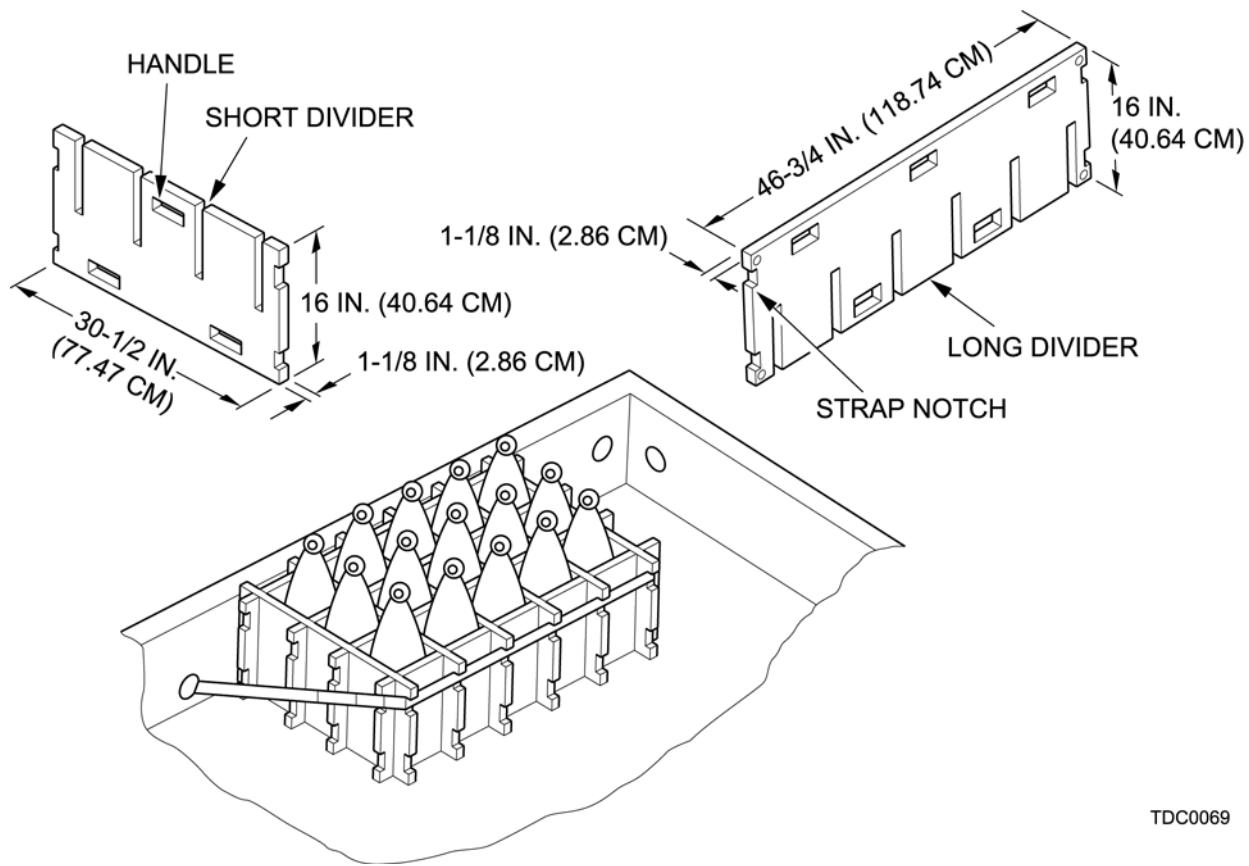
a. General. The LPRS is a divider rack that provides a fast, simple method of securing 'loose' unfuzed projectiles for transportation in a field artillery companion vehicle. The rack restrains projectiles from excessive longitudinal and lateral movement and from contact with other projectiles. The rack is easily assembled using a quantity of short and/or long plastic dividers that fit together. Projectiles are then placed vertically in the rack, with the base of each projectile resting on the floor of the vehicle. The assembly is then secured to the sidewall of the vehicle by means of cargo tiedown straps. After use, the rack may be disassembled and stored for reuse.

4-32 LOOSE PROJECTILE RESTRAINT SYSTEM (LPRS) (cont)

b. **Use of LPRS.** Use of LPRS is optional. (item 34/35, appx D), Expendable/ Durable Supplies and Materials List, lists LPRS components.

c. **Instructions.** Complete instructions for use of the LPRS are found in TM 9-2590-210-10. Loose Projectile Restraint System (LPRS) for use with Field Artillery Companion Vehicles.

LOOSE PROJECTILE RESTRAINT SYSTEM



CHAPTER 5

FOREIGN AMMUNITION

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Section I. NATO AMMUNITION

Section Index

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5-2	Authorized Projectiles.....	5-2
5-3	Authorized Fuze.....	5-6
5-4	Authorized Propelling Charges.....	5-7

5-1 GENERAL

a. Agreements between the United States and NATO allies have established the inter-operability of weapon systems and ammunition of the nations. The agreements enable the safe and effective firing of major types of ammunition of the same size from the same compatible size and type of the NATO armies.

b. The following pages cover only authorized German (GE), United Kingdom (UK), Canadian (CA), Netherlands (NL), French (FR), Norwegian (NO), Italian (IT), Danish (DA), Greek (GR) or Belgian (BE) 155-mm components. If a munitions item has not yet been authorized, it is because either it has not yet been determined to be safe to fire, or it has been determined that the munitions item cannot be safely fired from the US weapons system.

WARNINGS

ONLY UNDER EMERGENCY COMBAT CONDITIONS ZONE 1 OF THE M3A1 AND DM62 PROPELLING CHARGE BE FIRED FROM THE M776 CANNON TUBE OF THE M777 HOWITZER.

DO NOT MIX US, GE, UK, CA, NL, FR, NO, IT, DA, GR, OR BE COMPONENTS (I.E., PROJECTILE, PROPELLING CHARGE, FLASH REDUCER, FUZE). FIRE ONLY ALL COMPONENTS FROM ONE NATION, EXCEPT GE PRIMER DM191A1, AND PROJECTILE DM702/DM702A1. GE MUST USE DM191A1 WHEN FIRING US, GE, UK, CA, NL, NO, IT, DA, GR, OR BE 155-MM MUNITIONS. US MUST USE US FUZE, CHARGE AND PRIMER WHEN FIRING THE GE DM702/DM702A1 PROJECTILE.

NOTE

At the conclusion of any training exercise, ammunition drawn from a NATO nation and not fired should be returned to the troops of the NATO nation from whom it was obtained.

5-2 AUTHORIZED PROJECTILES

- a. The following GE munitions are authorized for use in howitzer:

Projectile	155-mm, HE, DM21 (TNT loaded only), DM702/DM702A1 SMArt
Charge, propelling.....	Green bag, DM62, zones 1-5
Charge propelling.....	White bag, DM42B1, zones 3-7
Fuze	Point-detonating, DM211
Primer.....	Use only US M82, do not use GE DM191A1 primer

- b. The following UK munitions are authorized for use in howitzer:

Projectile	155-mm, HE, M107 (TNT loaded only)
Charge, propelling.....	Green bag, M3A1, zones 1-5
Charge propelling.....	White bag, M4A2, zones 3-7
Fuze	Point-detonating, M557, L85A2
Primer.....	M82

- c. The following CA munitions are authorized for use in howitzer:

Projectile	155-mm, HE, M107
Charge, propelling.....	M3 ¹ , M3A1, M4A1 ¹ , M4A2
Fuze	Point-detonating, M557, M564
.....	Proximity, M514A1
Primer.....	M82

- d. The following NL munitions are authorized for use in howitzer:

Projectile	155-mm, HE, M107, M107C1 ² , (TNT-loaded only)
Charge, propelling	M3C1 ² , M4C3 ² , M4A1 ¹
Fuze	Point-detonating, M557, M557C1 ²
Primer	M82, M82C1 ²

- e. The following FR munitions are authorized for use in howitzer:

Projectile	155-mm, HE, M107
Charge, propelling.....	Green bag, M3 ¹ , zones 1-5
Charge, propelling.....	White bag, M4A1 ¹ , zones 5-7
Fuze	Point-detonating, M557
Primer.....	Use US M82 only, not MK2A4

NOTE

FR troops must use MK2A4 primer in FR F3 AMSP weapon.

¹ These charges do not have flash reducers.

² NL Manufacture.

f. The following NO munitions are authorized for use in howitzer:

WARNINGS

DO NOT FIRE M107 PROJECTILES WHEN LOT NUMBER START WITH RA.

INTERCHANGE FIRINGS WILL BE WITH TNT-LOADED M107 PROJECTILES ONLY.

Projectile	155-mm, HE, M107 (TNT-loaded only)
Charge, propelling.....	Green bag, M3A1, zones 1-5
Charge, propelling.....	White bag, NM23 (same as US M4A2), zones 3-7
Fuze	Point-detonating, M557
Primer	M82

NOTE

Except as noted above, preparation for firing GE, UK, CA, NL, FR, NO, IT, DA, GR, and BE munitions in US weapons system (preparation for firing, precautions during firing, misfire procedures, etc are contained in Chapters 2 and 4 of this manual.

g. The following IT munitions are authorized for use in howitzer:

Projectile	155-mm, HE, M107 (TNT-loaded only)
Charge, propelling.....	Green bag, M3A1, zones 1-5
Charge, propelling.....	White bag, M4A2, zones 3-7
Fuze	Point-detonating, M557, MTSQ, M564
Primer	M82

h. The following DA munitions are authorized for use in howitzer:

Projectile	155-mm, HE, M107 (TNT-loaded only)
Charge, propelling.....	Green bag, M3 ¹ , M3A1 zones 1-5
Charge, propelling.....	White bag, M4A1 ¹ , M4A2, zones 3-7
Fuze	Point-detonating, M557C1, MTSQ, M564
Primer	M82

i. The following GR munitions are authorized for use in howitzer:

Projectile	155-mm, HE, M107, M107B2 (TNT-loaded only)
Charge, propelling.....	Green bag, M3 ¹ , M3A1 zones 1-5
Charge, propelling.....	White bag, M4A1 ¹ , M4A2, zones 3-7
Fuze	Point-detonating, M557, MTSQ, M564
Prime.....	M82

¹These charges do not have flash reducers.

5-2 AUTHORIZED PROJECTILES (cont)

- j. The following BE munitions are authorized for use in howitzer:

Projectile	155-mm, HE, M107, (TNT-loaded only)
Charge, propelling.....	Green bag, M3A1 zones 1-5
Charge, propelling.....	White bag, M4A2, zones 3-7
Fuze	Point-detonating, M557, MTSQ, M564
Primer.....	M82

- k. The following US munitions are authorized for use in GE M109, UK M109, NL M109, FR F3 AM, and NO M109G CA M109 and M114 series weapon systems:

NOTE

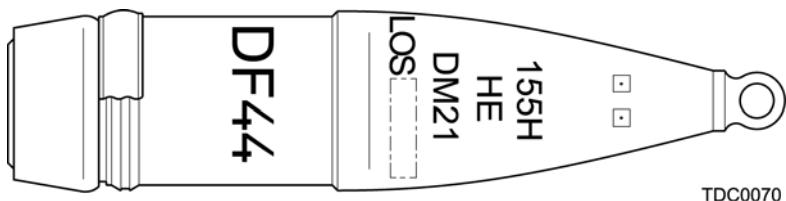
During training exercises, give either TNT or Comp B-loaded 155-mm, HE, M107 projectiles to UK, NL, and FR troops.

Projectile	155-mm, HE, M107
Charge, propelling.....	Green bag, M3A1 zones 1-5
Charge, propelling.....	White bag, M4A2, zones 3-7
Primer.....	M82 (GE use DM191A1; FR F3 AM use MK244)

- I. The authorized projectiles and their characteristics are as follows:

(1) **Projectile, 155-mm, HE, DM21 (GE).** This HE projectile is used for blast effect, fragmentation and mining. The projectile is a hollow steel shell filled with TNT. PD fuze is used with this projectile. A supplementary charge of 0.3 lb (0.136 kg) TNT is sealed in an aluminum container placed in the fuze cavity of the projectile. The projectile weighs approximately 92.0 lb (41.7 kg).

DM21 PROJECTILE

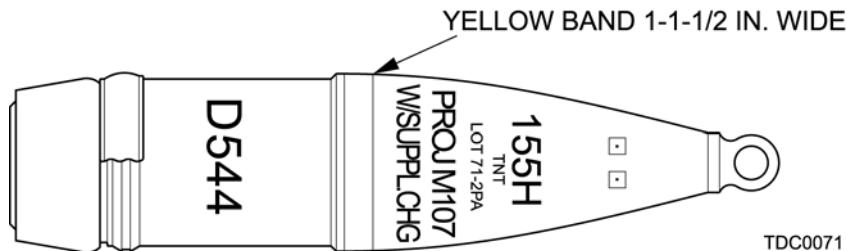


(2) **Projectile, 155-mm, HE, M107 (Normal and Deep Cavity) (UK, CA, and NL).** This HE projectile is used for blast effect, fragmentation, and mining. The projectile is a hollow steel shell filled with TNT. PD fuze is used with this projectile. A supplementary charge of 0.3 lb (0.136 kg) TNT is sealed in an aluminum container placed in the fuze cavity of this projectile. The projectile weighs approximately 92.3 lbs (41.9 kg).

NOTE

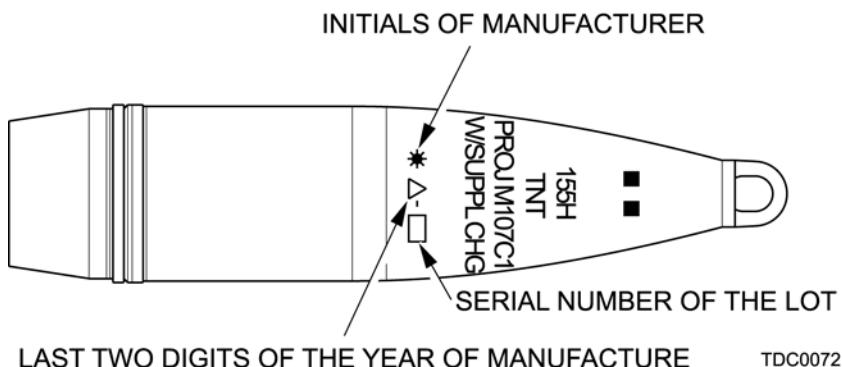
With the exception of a yellow hazard band around the body of renovated projectiles, these UK munitions are identical to US munitions.

M107 PROJECTILE



(3) **Projectile, 155-mm, HE, M107C1 (NL).** This HE projectile is used for blast effect, fragmentation, and mining. The projectile is a hollow steel shell filled with TNT. PD, time, or VT (deep cavity only) fuzes may be used. The projectile weighs approximately 92.3 lb (41.9 kg).

M107C1 PROJECTILE



(4) **Projectile, 155-mm, SMArt, DM702/DM702A1 (GE).** This projectile is a 155-mm fire-and-forget, top attack, counter-fire munition. There are two sensor fuzed munitions (SFM) packaged in the projectile. The SFM are ejected out the base of the projectile using a fuze initiated expulsion charge located in the forward end of the round. Millimeter-wave radar and infrared sensors locate targets and provide countermeasure resistance. The warhead is an explosively formed penetrator designed for top-attack of the self-propelled howitzers and armored combat vehicles. Firing solution for the DM702/DM702A1 exist in AFATAD.

NOTE

The SMArt, DM702/DM702A1 projectiles come pre-fuzed with DM52 fuze . The DM52 fuze must be replaced with the M762 Series fuze prior to firing. The DM52 fuze removed from the DM702/DM702A1 should be packed in a M2A1 container and sent back to ASP for destruction.

Characteristics: Number of Submunitions: 2

Submunitions Footprint radius: DM702 70m, DM702A1 105m

Optimal altitude: DM702 100m, DM702A1 150m

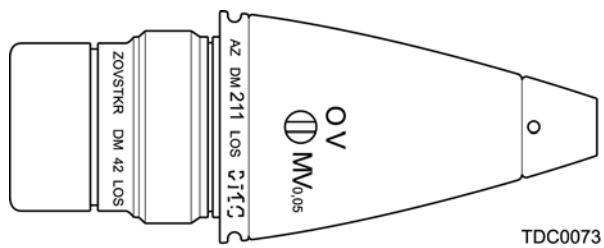
DM702/DM702A1



5-3 AUTHORIZED FUZES

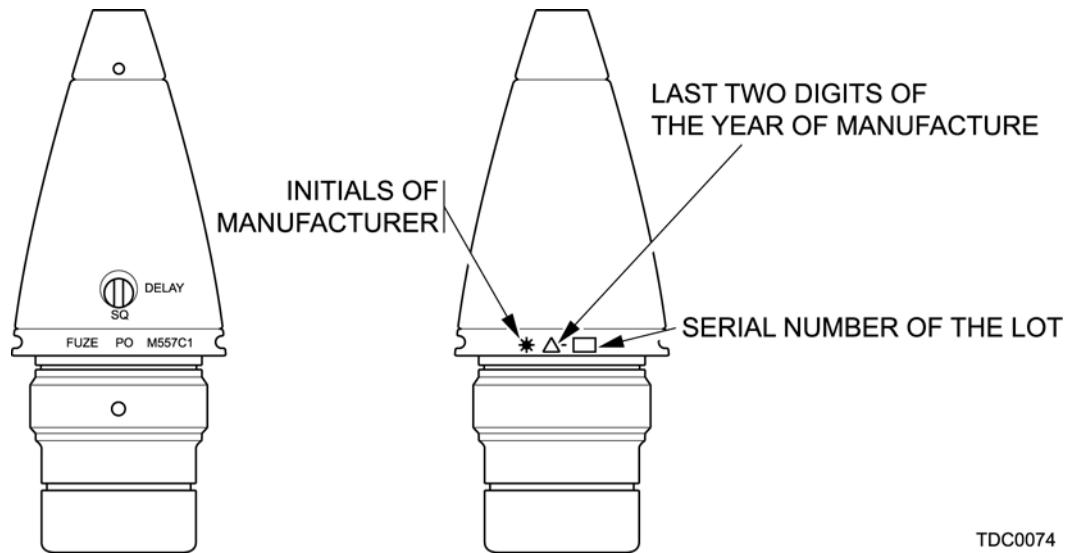
a. **Fuze, PD, DM211 (GE and NO).** The DM211 fuze has a SQ element in the head consisting of a firing pin, firing pin support, and detonator. The fuze body contains a DLY plunger assembly and a selective device for SQ or DLY action. The DM211 fuze is similar to the US fuze M557.

DM211 FUZE



b. **Fuze, PD, M557C1 (NL).** The M557C1 fuze is a selective SQ or 0.05-second DLY impact fuze. The M557C1 fuze is a US M557 fuze with a booster M125C1 of IT manufacture. This booster is the same design as the US M125A1 except that it is fitted with a setback pin, which locks one of the spin locks.

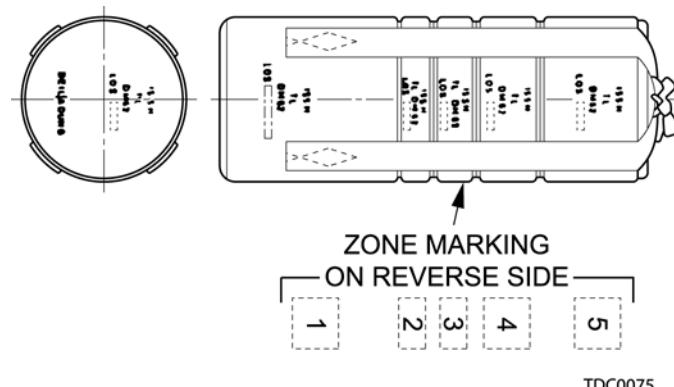
M557C1 FUZE



5-4 AUTHORIZED PROPELLING CHARGES

a. **Propelling Charge, DM62 (GE).** This is a green bag charge consisting of a base charge and four unequal increments loaded in cloth bags for firing in zones 1 thru 5. The bags are fastened together with four cloth straps sewn to the base and tied on top of increment no. 5. The clean burning igniter in a red or brown cloth bag is sewn to the rear of the base charge.

DM62 PROPELLING CHARGE

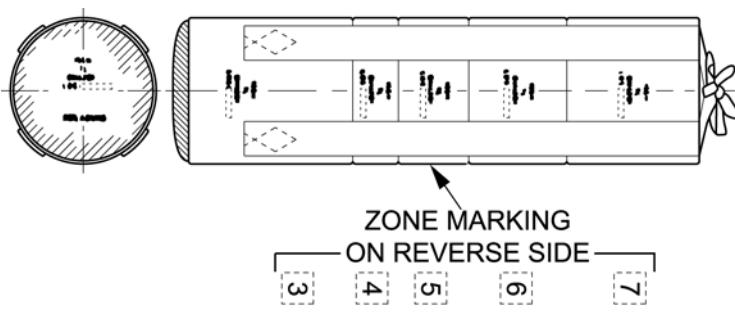


b. **Propelling Charge, DM42B1 (GE).** This is a white bag charge consisting of a base charge and four unequal increments loaded in cloth bags for firing in zones 3 thru 7. The increments are connected by four cloth tapes sewn to the base and tied on top of increment no. 7. The clean burning igniter in a red or brown cloth bag is sewn to the bottom of the base charge. A flash reducer pad is assembled at the front end of the base charge.

NOTE

Lot number of assembled propellant charge is shown on the base charge and all supplemental charges.

DM42B1 PROPELLING CHARGE



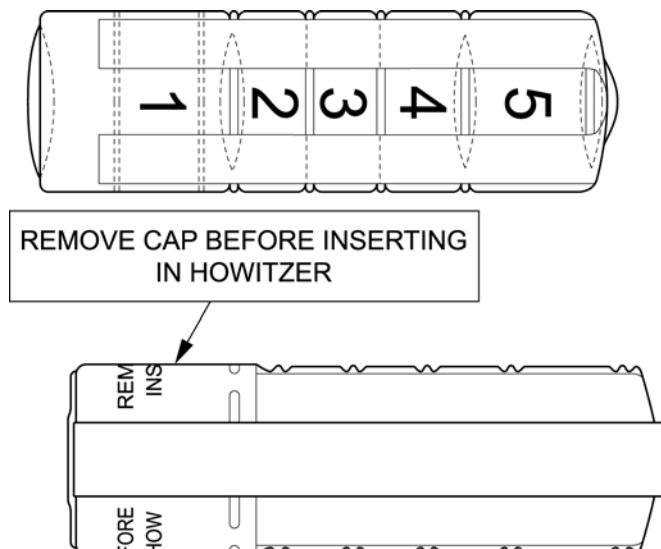
5-4 AUTHORIZED PROPELLING CHARGES (cont)

c. **Propelling Charge, M3C1 (NL).** This is a green bag charge consisting of a base charge and four unequal increments loaded in cloth bags for firing in zones 1 thru 5. The bags are fastened together with four cloth straps sewn to the base and tied on top of increment no. 5. It has a flash reducer pad in front of the base charge and two flash reducer pads in front of increments no. 4 and 5. The clean burning igniter in a red cloth bag is sewn to the rear of the base charge.

NOTE

Lot number of assembled propellant charge is shown on the base charge and all supplemental charges.

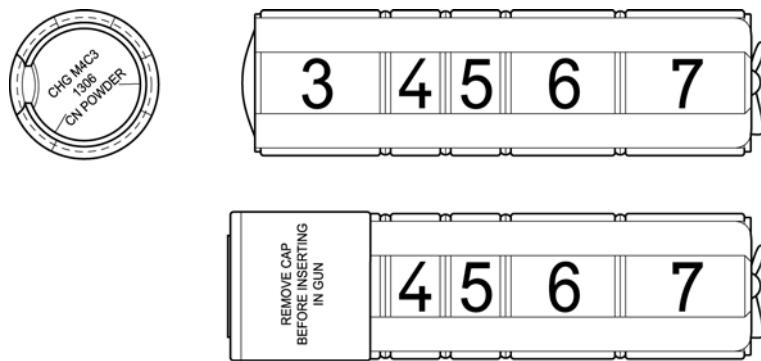
M3C1 PROPELLING CHARGE



TDC0077

d. **Propelling Charge, M4C3 (NL).** This is a white bag charge consisting of a base charge and four unequal increments loaded into cloth bags for firing in zones 3 thru 7. The increments are connected by four cloth tapes sewn to the base and tied on top of increment no. 7. The clean burning igniter in a red cloth bag is sewn to the bottom of the base charge (increment no. 3). A flash reducer pad is assembled at the front of the base charge (increment no.3).

M4C3 PROPELLING CHARGE



TDC0078

CHAPTER 6

DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

Section Index

Paragraph		Page
6-1	General.....	6-1
6-2	Destruction of Optical Fire Control (OFC) and Digital Fire Control System (DFCS) Equipment	6-2
6-3	Destruction of Cannon Tube and Top Carriage Assembly.....	6-2
6-4	Destruction of Pneumatic Tires	6-4

6-1 GENERAL

a. If subject to capture or abandonment in the combat zone, the howitzer will be destroyed only when, in the judgment of the unit commander, such action is necessary in accordance with orders or policy of the commander.

b. The information, which follows, is for guidance only. Certain procedures require the use of demolition charges and incendiary grenades, which may not be authorized items for the using organization. The issue of these and related materiel's and the conditions under which the howitzer will be destroyed are command decisions, according to the tactical situation. Destruction of essential parts, followed by burning, will usually be enough to make the materiel useless. Selection of the particular method of destruction requires imagination and resourcefulness, in using the facilities at hand under existing conditions. Time is critical. The most applicable means of destruction are as follows:

- (1) **Mechanical.** Requires axe, pick mattock, sledge, crow bar or similar implement.
- (2) **Demolition.** Requires suitable explosives and ammunition.
- (3) **Burning.** Requires gasoline, oil, incendiary grenades, or other flammables.
- (4) **Gunfire.** Includes artillery, machine guns, rifles using rifle grenades, and launchers using anti-tank rockets. Under some circumstances, hand grenades may be used.

c. If the howitzer is to be destroyed, the materiel must be so badly damaged that it cannot be restored to a suitable condition in the combat zone, either by repair, or cannibalization. Adequate destruction requires that all parts essential to the operation of the materiel, including essential spare parts, be destroyed or damaged beyond repair. However, when lack of time and personnel prevents destruction of all parts, priority is given to the destruction of those parts most difficult to replace. Equally important, the same essential parts must be destroyed on all like materiel, so that the enemy cannot construct one complete unit from several damaged ones.

d. If destruction is ordered, these procedures should be followed:

- (1) Select a point of destruction that will cause the greatest obstruction to enemy movement and also prevent hazard to friendly troops from fragments or ricocheting projectiles.
- (2) Observe appropriate safety precautions.

6-2 DESTRUCTION OF OPTICAL FIRE CONTROL (OFC) AND DIGITAL FIRE CONTROL SYSTEM (DFCS) EQUIPMENT

All OFC/DFCS equipment, especially such items as CSD, telescopes, gunners quadrants, binoculars and similar items, is costly, difficult to replace, yet relatively light. It should be conserved and evacuated whenever practicable. If evacuation is impracticable, the equipment should be destroyed completely. The preferred means of destruction of OFC/DFCS equipment is by demolition, burning, or gunfire. If by demolition, miscellaneous fire control components may be placed on or near auxiliary charges. Small charges should be placed at the main fire control attachment points. If the tactical situation mandates mechanical destruction, primary attention should be given to lenses, display screens, control knobs, mounting surfaces, and counters. Firing tables and other flammable items will be burned.

6-3 DESTRUCTION OF CANNON TUBE AND TOP CARRIAGE ASSEMBLY

a. If time permits, personnel and materiel's are available; the destruction of the complete howitzer should be accomplished by means of demolition materiel's, burning or gunfire. If time, personnel or materiel's are limited, priority should be given to the destruction of the cannon tube. Pneumatic tires should be destroyed as described in paragraph 6-4.

b. Method No. 1 Destruction with Demolition Charges.

(1) For simultaneous detonation, prepare and place demolition charges (1lb (0.45kg)) TNT blocks (or equivalent with the necessary detonating cord) as indicated below:

Charge	Location of Charge
2-lb (0.91-kg).....	Insert charge into cannon tube
2-lb (0.91-kg).....	Place next to recoil accumulator
2-lb (0.91-kg).....	Place charge on carriage next to left wheel and wheel axle arm
2-lb (0.91-kg).....	Place charge on carriage next to right wheel and wheel axle arm

(2) Connect the charge for simultaneous detonation with detonating cord.

(3) Detonate the charges. For complete details on the use of demolition materiel's and methods of priming and detonating demolition charges, refer to TM 750-244-7. Training and careful planning are essential. The danger zone is approximately 273 yds (250 m).

Elapsed time: About 10 minutes.

c. Method No. 2 Destruction by Burning.

WARNING

DO NOT STRIKE EQUILIBRATOR, RECOIL SYSTEM, OR SCAVENGE SYSTEM AS THEY COULD EXPLODE AND INJURE PERSONNEL.

(1) With combustible materiel's:

(a) Using an axe, pick mattock, sledge, or similar implement, smash the brake lines, hydraulic lines, OFC/DFCS equipment handwheels, and elevation gearboxes.

(b) Destruction of essential parts, followed by burning in an intense fire, will usually make the cannon tube and top carriage useless. Since the cannon tube and top carriage are almost entirely metal, enough quantities of combustibles should be used to ensure a very hot fire.

(c) If explosive ammunition is available, place the unpacked ammunition on and above the cannon tube and top carriage.

(d) Pour gasoline or oil over the combustible materiel.

WARNING

COVER MUST BE TAKEN WITHOUT DELAY, SINCE THE FIRE MAY CAUSE AN EARLY EXPLOSION OF THE EXPLOSIVE AMMUNITION. IF EXPLOSIVE AMMUNITION IS PRESENT, THE DANGER AREA IS 273 YARDS (250 METERS).

(e) Ignite by means of an incendiary grenade fired from a safe distance, by a burst from a flame-thrower, by a combustible train of a suitable length, or by other appropriate means. Take cover immediately.

Elapsed time: About 6 minutes.

(2) With incendiary grenades – If large quantities of combustibles are not available, use incendiary grenades as follows:

WARNINGS

EACH ROLL OF TIME BLASTING FUZE MUST BE TESTED SHORTLY BEFORE USE. THE RATE OF BURNING WILL VARY FOR THE SAME OR DIFFERENT ROLL UNDER DIFFERENT ATMOSPHERIC AND/OR CLIMATIC CONDITIONS, FROM A BURNING TIME OF 30 SECONDS OR LESS PER FOOT TO 45 SECONDS OR MORE PER FOOT.

TIME BLASTING FUZES SHALL BE OF SUFFICIENT LENGTH TO ALLOW PERSONNEL ENOUGH TIME TO SAFELY LEAVE THE HOWITZER AFTER IGNITING THE FUZES.

(a) Insert two incendiary grenades end-to-end in the muzzle brake of the cannon tube. The two grenades will be ignited by means of a third grenade fitted with a length of blasting time fuze. The metal from the grenades will fuse with the tube.

(b) Place the fourth and fifth grenades on the carriage; the first next to the left wheel and wheel axle arm and the second next to the right wheel and wheel arm axle. A sixth grenade fitted with a length of time blasting fuze will ignite the two grenades.

(c) Place a seventh grenade next to the recoil accumulator. An eighth grenade fitted with a length of time blasting fuze will ignite this grenade.

Elapsed time: About 5 minutes.

6-3 DESTRUCTION OF CANNON TUBE AND TOP CARRIAGE ASSEMBLY (cont)

d. Method No 3. Destruction by Gunfire.

WARNING

FIRING ARTILLERY AT RANGES OF 421 YARDS (460 METERS) OR LESS SHOULD BE FROM COVER. FIRING RIFLE GRENADES OR ANTI-TANK ROCKETS SHOULD BE FROM COVER.

(1) This method cannot be relied upon to destroy the same parts of all cannons and carriages or to produce the same degree of destruction. Fire on the cannons and carriages, using nearby artillery, machine guns, rifles using rifle grenades, or launchers using anti-tank rockets. Although one well placed direct hit may render the cannon tube and top carriage temporarily useless, several hits are usually required for complete destruction.

Elapsed time: about 5 minutes.

6-4 DESTRUCTION OF PNEUMATIC TIRES

a. An attempt must always be made to destroy pneumatic tires, even if time will not permit destruction of the remainder of the bottom carriage. Destroy tires with incendiary grenades in conjunction with the destruction of the howitzer.

b. Method No 1. Destruction by Incendiary Grenades.

WARNING

DO NOT USE WHITE PHOSPHOROUS (WP) GRENADES TO DESTROY THE TIRES. WP GRENADES BURST AND THROW BURNING WHITE PHOSPHOROUS PARTICLES AS FAR AS 27 YARDS (30 METERS).

(1) Ignite an incendiary grenade under each tire.

(2) When this method is combined with the destruction of materiel by means of demolition materiels, the detonation of demolition charges should be delayed until the incendiary fires are well started to avoid the possibility of the flames being extinguished by the blast of the explosion.

Elapsed time: About 2 minutes.

c. Method No 2. Destruction by Slashing.

WARNING

BEFORE ATTEMPTING TO SLASH TIRE, DEFLATE TIRE, AS A BLOWOUT MAY OCCUR, CAUSING POSSIBLE INJURY TO PERSONNEL.

(1) Wherever practicable, deflate the tires before slashing.

Elapsed time: about 3 minutes.

APPENDIX A REFERENCES

A-1. SCOPE

This appendix lists all forms, field manuals, technical manuals, technical bulletins, and miscellaneous publications referenced in this manual.

A-2. FORMS

Equipment Inspection and Maintenance Worksheet.....	DA Form 2404
Hand Receipt/Annex Number.....	DA Form 2062
Product Quality Deficiency Report.....	SF 368
Recorder Data.....	DA Form 4513
Recommended Changes to Equipment Technical Manuals	DA Form 2028-2
Recommended Changes to Publications and Blank Forms	DA Form 2028
Weapon Record Book.....	DA Form 2408-4
Weapon Record Book	NAVMC 10558/10558a
Recommended Changes to Publications.....	NAVMC 10772

A-3. FIELD MANUALS

Basic Cold Weather Manual.....	FM 31-70
Field Artillery Cannon Battery.....	FM 3-09.50
First Aid.....	FM 4-25.11/MRCP 3-02G
Northern Operations.....	FM 31-71
Operation and Maintenance of Ordnance Materiel in Cold Weather (0° to -65°F).....	FM 9-207

A-4. TECHNICAL MANUALS

Extractor Assembly for Projectile, 155 mm, M712 Cannon Launched	TM 3-1320-242-10
Fuze Setter Portable Inductive Artillery	TM 9-1290-210-12&P
Hand Receipt Manual Covering Components of End Item (COEI), Basic Issue Items (BII), and Additional Authorization List (AAL), for Howitzer, Medium, Towed: 155 MM, M777/M777A1/M777A2	TM 9-1025-215-10-HR

A-4. TECHNICAL MANUALS (cont)

Marine Corps Equipment Record Procedures.....	TM 4700-15/1
Operator's Manual: Operating M94 Muzzle Velocity System.....	TM 9-1290-364-14&P
Operator's Manual: Operating Precision Lightweight Global Positioning System Receiver AN/PNS-11	TM 11-5825-291-13
Operator's Manual: Operating SINCGARS RT-1532E (RTA).....	TM 11-5820-890-10-8
Operator's Organizational, Direct Support, and General Support Maintenance Manual for Evaluation of Cannon Tubes.....	TM 9-1000-202-14
Painting Instructions for Army Material.....	TM 43-0139
Procedures for Destruction of Equipment in Federal Supply Classifications 1000, 1005, 1015, 1020, 1025, 1030, 1055, 1090, and 1095, To Prevent Enemy Use.....	TM 750-244-7

A-5. TECHNICAL BULLETINS

Battery Disposition and Disposal	TB 43-0134
Munitions: Permanently Suspended as Restricted	TB 9-1300-385-2
Munitions: Suspended or Restricted	TB 9-1300-385-1

A-6. MISCELLANEOUS PUBLICATIONS

Battle Skills Training Handbook	Book 2, Pvt. – L/Cpl. (Marine Corps)
Notices, Instructions and Reports to Workers; Inspections	10CFR Part 19
Standards for Protection Against Radiation	10CFR Part 20
The Army Integrated Publishing and Printing Program	AR 25-30
The Army Maintenance Management System (TAMMS)	DA PAM 738-750

APPENDIX B
COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS

Section Index

	Page
Section I. Introduction.....	B-1
Section II. Components of End Item (COEI)	B-2
Section III. Basic Issue Items (BII)	B-4

Section I. INTRODUCTION

B-1. SCOPE

This work package lists COEI and BII for the M777/M777A1/M777A2 Howitzer to help you inventory items required for safe and efficient operation of the equipment.

B-2. GENERAL

The COEI and BII information is divided into the following lists:

a. Components of End Item (COEI). This list is for informational purposes only and is not authority to requisition replacements. These items are part of the M777/M777A1/M777A2 Howitzer. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Items of COEI are removed and separately packaged for transportation or shipment only when necessary. Illustrations are furnished to help you find and identify the items.

b. Basic Issue Items (BII). These essential items are required to place the M777/M777A1/M777A2 Howitzer in operation, operate it, and to do emergency repairs. Although shipped separately packaged, BII must be with the M777/M777A1/M777A2 Howitzer during operation and when it is transferred between property accounts. Listing these items is your authority to request/requisition them for replacement based on authorization of the end item by the TOE/MTOE. Illustrations are furnished to help you find and identify the items.

B-3. EXPLANATION OF ENTRIES IN THE COEI AND BII LIST

a. Column (1)–Illus Number. Gives you the number and the item illustrated.

b. Column (2)–National Stock Number (NSN). Identifies the stock number of the item to be used requisitioning purposes.

c. Column (3)–Description, Part Number/(CAGEC). Identifies the Federal item name (in all capital letters) followed by a minimum description when needed. The stowage location of COEI and BII is also included in this entry. The last line below the description is the CAGEC (Commercial and Government Entity Code) (in parentheses) and the part number.

d. Column (4)–Usable On Code. When applicable, gives you a code if the item you need is not the same for different models of equipment. These codes are identified below:

Code Used on

AAA Model M777

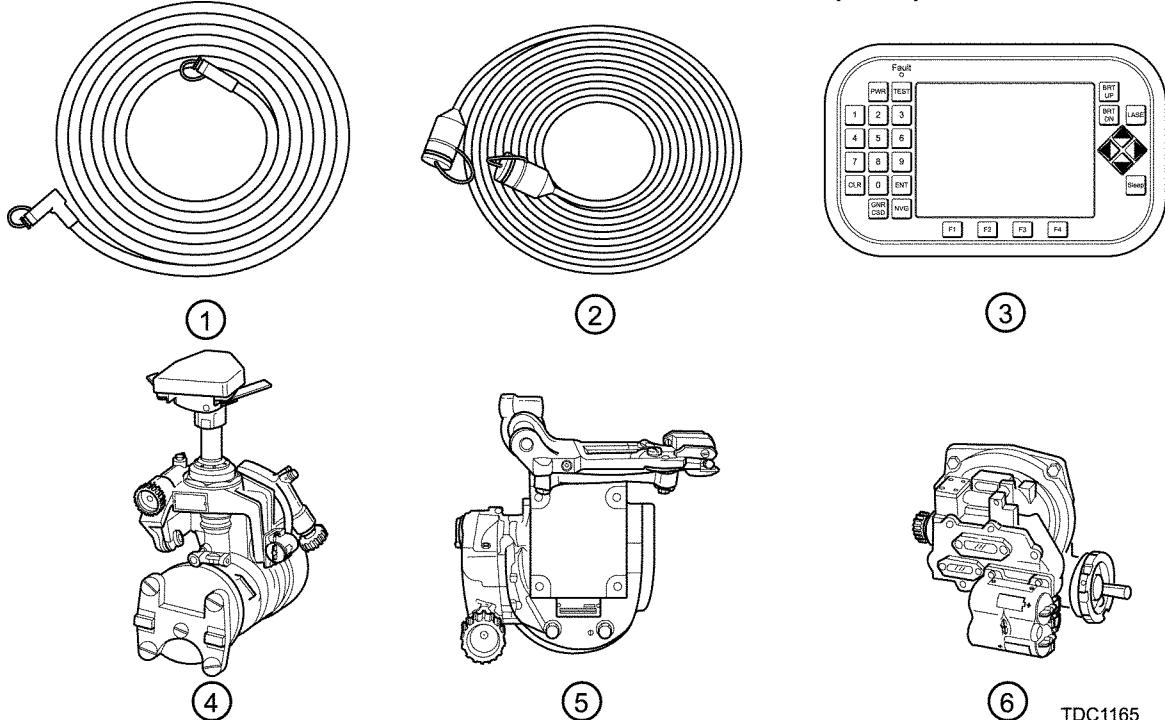
XXX Model M777A1

XXX Model M777A2

e. **Column (4)–Unit of Issue (U/I).** Indicates the physical measurement or count of the item as issued per the National Stock Number.

f. **Column (5)–Qty Rqr.** Indicates the quantity required.

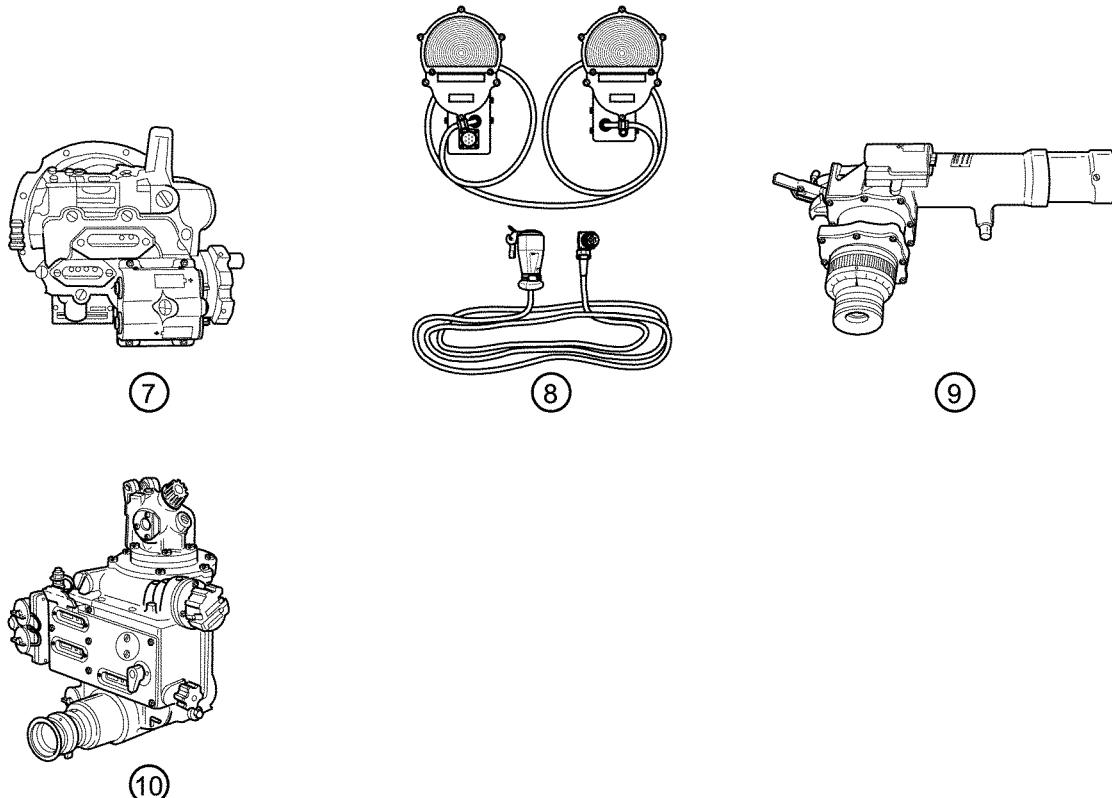
Section II. COMPONENTS OF END ITEM (COEI)



TDC1165

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
1	GD	CABLE, DATA [W16] 35 FT 10059052 (05606) (M777A1 Only)		EA	1
2	GD	CABLE, POWER [W3] 35 FT 10059039 (05606) (M777A1 Only)		EA	1
3	GD	CHIEF OF SECTION, DISPLAY (CSD) XXXXXX (05606) (M777A1 Only)		EA	1
4	1240-01-517-2171	MOUNT, TELESCOPE AND QUADRANT, M172A1 13005089 (19200)		EA	1
5	1240-01-515-8265	MOUNT, TELESCOPE AND QUADRANT, M171A1 13005103 (19200)		EA	1
6	1290-01-515-8260	QUADRANT, FIRE CONTROL, M17A1 13005101 (19200)		EA	1

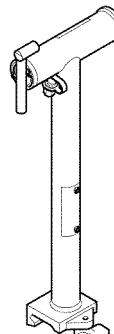
Section II. COMPONENTS OF END ITEM (COEI) (cont)



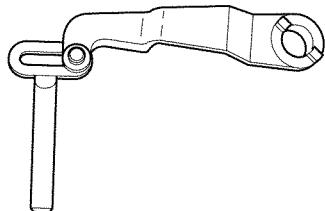
TDC1166

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
7	1290-01-515-8262	QUADRANT, FIRE CONTROL, M18A1 13005102 (19200)		EA	1
8	6620-99-186-9260 TBD	TAILLIGHT VEHICULAR with CABLE AM-00-04-23000 (K4244) (Incandescent) TAILLIGHT VEHICULAR with CABLE (TBD) (TBD) (LED)		EA	1
9	1240-01-515-8264	TELESCOPE, ELBOW, M138A1 13005104 (19200)		EA	1
10	1240-01-038-0531	TELESCOPE, PANORAMIC, M137A2 11741101 (19200)		EA	1

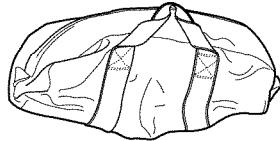
Section III. BASIC ISSUE ITEMS (BII)



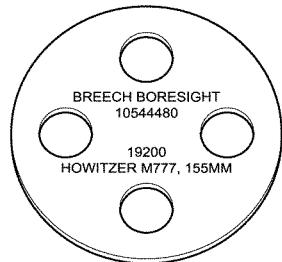
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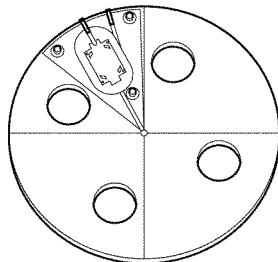
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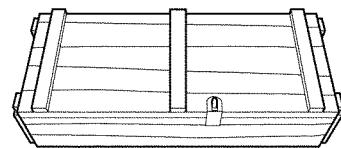
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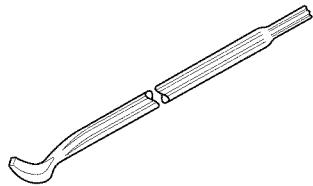


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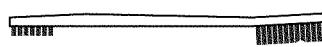
Bii01

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
1	4931-01-516-1430	ALIGNMENT DEVICE, M154, 117416485 (19200)		EA	1
2	3040-01-527-9729	ARM, INJECTOR, ASSEMBLY (On- Board Spare) 11581651 (1NUW7)		EA	1
3	5140-00-473-6256	BAG, TOOL KIT (SMALL) MIL-B-43663 (81349)		EA	1
4	4933-01-152-2902	BORESIGHT, DEVICE (BREECH) 10544480 (19200)		EA	1
5	4933-01-539-4510	BORESIGHT, DEVICE (MUZZLE) 13006503 (19200) (M777A1 Only)		EA	1
6	1025-01-174-3990	BOX PACKING, EXTRACT TOOL ASSEMBLY 9331729 (19200)		EA	1

Section III. BASIC ISSUE ITEMS (BII) (cont)



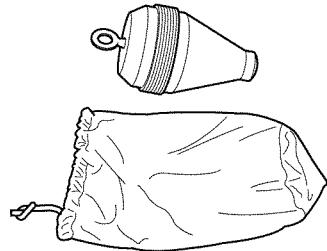
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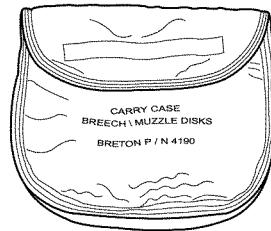
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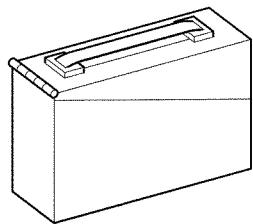


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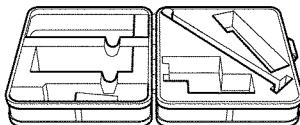
Bii02

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
7	5120-00-580-8924	BREAKER, BEAD (USMC Only) GGG-T-350TY4 (80244)		EA	1
8	1005-00-494-6602	BRUSH, ALL PURPOSE 8448462 (19204)		EA	1
9	7920-00-205-0565	BRUSH, DUSTING, LENS 15311 (99592)		EA	1
10	1025-01-196-2176	BRUSH and BAG ASSEMBLY 155-110-401 (27412)		EA	1
11	4933-00-730-7183	BRUSH, CLEAN, PRIMER 7307183 (19206)		EA	1
12	1240-01-539-3409	CASE, BORESIGHT, MUZZLE AND BREECH 13006511 (19200) (M777A1 Only)		EA	1

Section III. BASIC ISSUE ITEMS (BII) (cont)



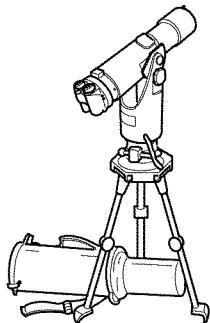
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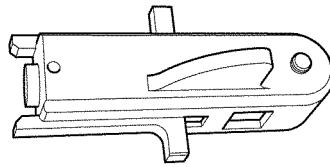
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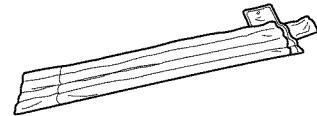
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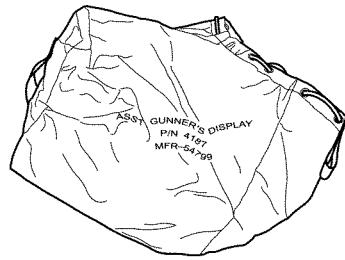


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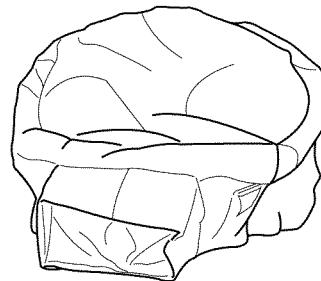
Bii03

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
13	2540-01-538-6663	CASE, FIRING MECHANISM 13006465 (19200)		EA	1
14	1240-01-040-6977	CASE, TELESCOPE 11746386 (19200)		EA	1
15	4933-00-601-9667	CLEANING TOOL, VENT 6019667 (19206)		EA	1
16	1240-01-465-5452	COLLIMATOR, INFINITY, AIMING M1A2 12984644 (19200)		EA	1
17	5340-01-531-3270	COUPLER, DOG (On-Board Spare) 11581695 (1NUW7)		EA	1
18	1290-00-653-7993	COVER, AIMING POST, M401 6537993 (19200)		EA	2

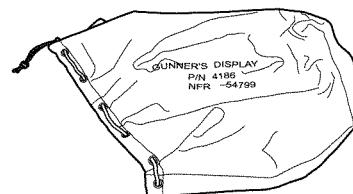
Section III. BASIC ISSUE ITEMS (BII) (cont)



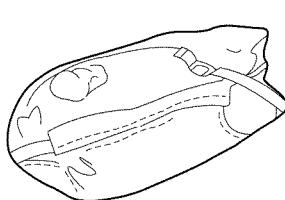
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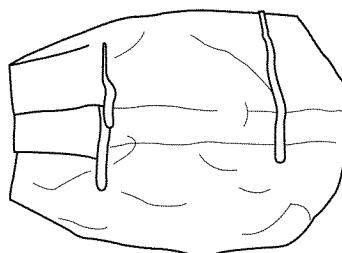
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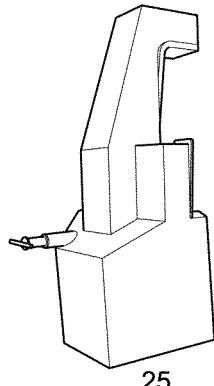


24

Bii04

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
19	7045-01-539-3413	COVER, ASSISTANT GUNNERS DISPLAY 13013455 (19200) (M777A1 Only)		EA	1
20	1025-01-529-4351	COVER, BREECH 13006423 (19200)		EA	1
21	7045-01-539-3412	COVER, GUNNERS DISPLAY 13013267 (19200) (M777A1 Only)		EA	1
22	1240-01-042-7989	COVER, FIRE CONTROL 11729566 (19200)		EA	2
23	1025-01-529-4353	COVER, MUZZLE BRAKE 13006434 (19200)		EA	1
24	5340-01-517-9272	COVER, PANTHER MOUNT (PLASTIC) PN13005042 (19200)		EA	1

Section III. BASIC ISSUE ITEMS (BII) (cont)



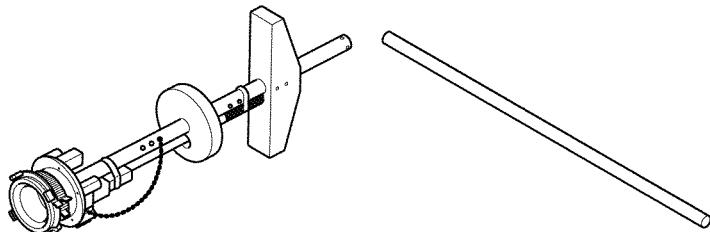
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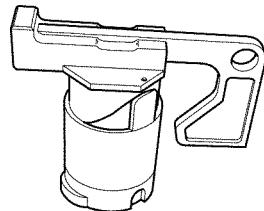
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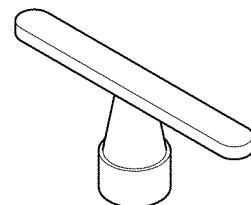
Bii05

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
25	1025-01-536-7954	COVER, PRIMER FEED MECHANISM 13006406 (19200)		EA	1
26	5120-00-227-8079	EXTENSION, SOCKET WRENCH L122 (C7127)		EA	1
27	5120-00-243-7326	EXTENSION, SOCKET WRENCH 1/2 IN DR 5 IN 41B311200 (80372)		EA	1
28	1025-01-082-3586	EXTRACTOR TOOL ASSEMBLY, PROJECTILE 9305465 (19200)		EA	1
29	5340-01-529-5079	FAST BAR 13006403 (19200) Consisting of: END CAP 13013463 (19200) FILE, TAPER SAW		EA	1
30	TBD	4229A11		EA	1

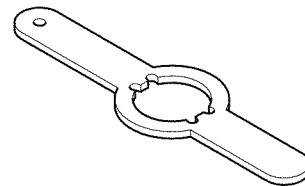
Section III. BASIC ISSUE ITEMS (BII) (cont)



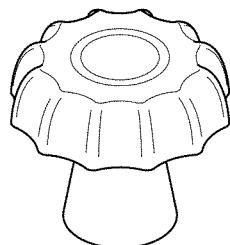
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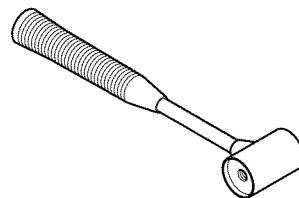
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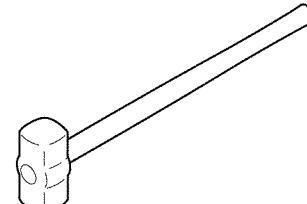
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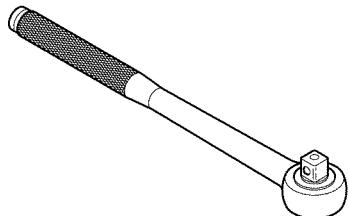


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Bii06

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
31	1025-01-528-4241	FIRING MECHANISM (M51) (On-Board Spare) 11581582 (1NUW7)		EA	1
32	1290-00-764-7761	FUZE SETTER, M27 7647761 (19200)		EA	1
33	1290-00-078-4367	FUZE SETTER, M34 11747300 (19200)		EA	1
34	1290-00-201-3507	FUZE SETTER, M35 11729019 (19200)		EA	1
35	5120-01-434-9524	HAMMER, HAND SOFT FACE 69-013 (08292)		EA	1
36	5120-00-265-7462	HAMMER, HAND, 6 LB 41796 (90172)		EA	1

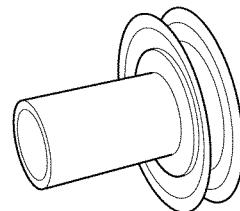
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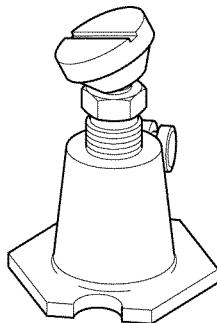
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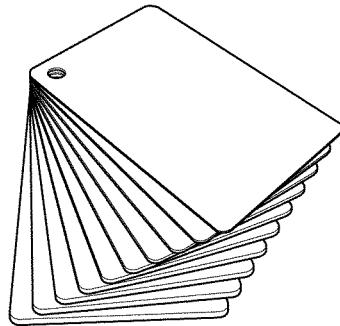
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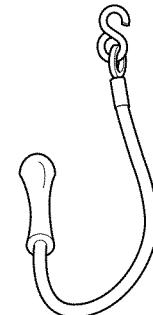
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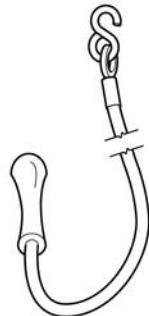


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Bii07

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
37	5120-00-230-6385	HANDLE SOCKET WRENCH RATCHET 1/2 IN DR S10 (27239)		EA	1
38	5120-00-288-6574	HANDLE, MATTOCK-PICK 11677021 (19207)		EA	2
39	1030-00-859-4511	HOLDER, CHAMBER SWAB 8765688 (19206)		EA	1
40	3640-01-534-2845	JACK, MECHANICAL, LEVELING 3P (OGZAO)		EA	1
41	5365-01-529-4352	KIT, SHIM, LEVELING, TRUNNION 12999487 (19200)		EA	1
42	1095-00-600-6780	LANYARD, FIRING (6-FT LENGTH) 6006780 (19206)		EA	1

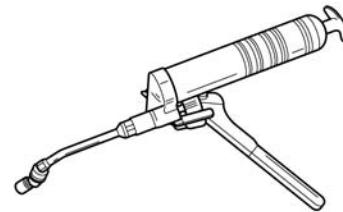
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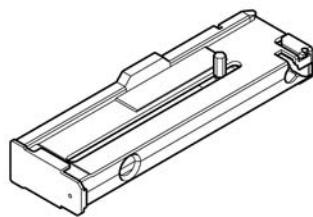
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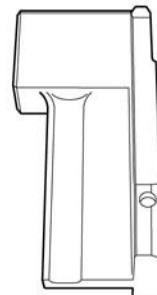
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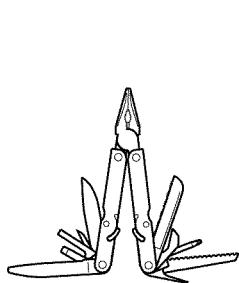


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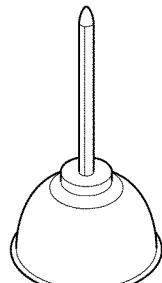
Bii08

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
43	1095-01-129-4672	LANYARD, FIRING (25-FT LENGTH) 11579739 (19206)		EA	1
44	1290-01-487-6058	LIGHT, AIM POST M14A1 SLB10525 (11934)		EA	4
45	4930-00-253-2478	LUBRICATING, GUN HAND 1142 (1PL57)		EA	1
46	1025-01-528-4226	MAGAZINE PRIMER, ASSEMBLY 11581587 (1NUW7)		EA	3
47	1025-01-531-1670	MAGAZINE PRIMER, STOP 11581643 (1NUW7)		EA	1
48	5120-00-243-2395	MATTOCK 10501971 (56161)		EA	2

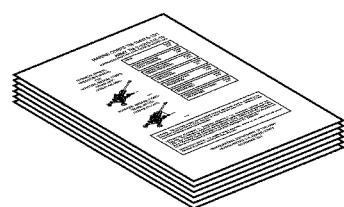
Section III. BASIC ISSUE ITEMS (BII) (cont)



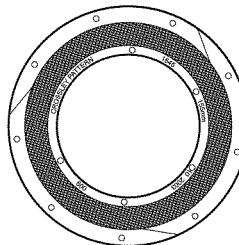
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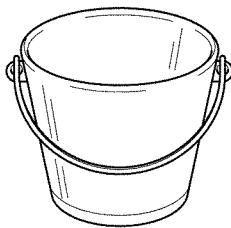
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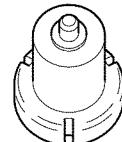
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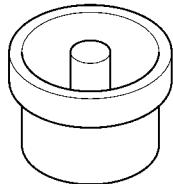


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Bii09

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
49	5110-01-425-7570	MULTI-TOOL (LEATHERMAN) 63010201 (OCAD1)		EA	1
50	4930-00-537-8977	OILER, HAND GGG0591 (81348)		EA	1
51	TM9-1025-215-10	OPERATOR MANUAL, TM		EA	1
52	1025-01-535-6284	PAD, OBTURATOR (CROSSLEY) (On-Board Spare) 11581699 (1 NUW7)		EA	1
53	7240-00-160-0455	PAIL, UTILITY (GALVANISED) RR-P-35 (81348)		EA	1
54	1025-01-525-6436	PIN, FIRING (On-Board Spare) 11581545 (1NUW7)		EA	2

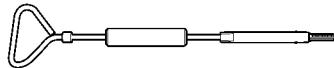
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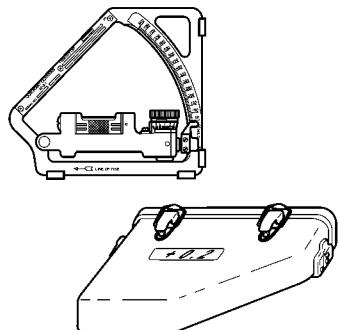
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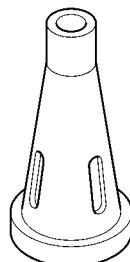
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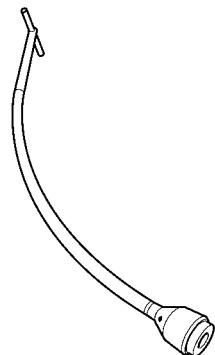
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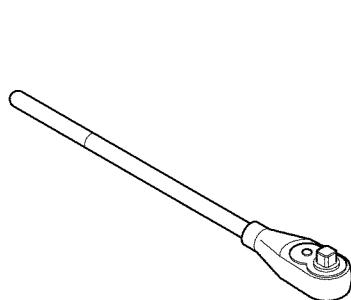


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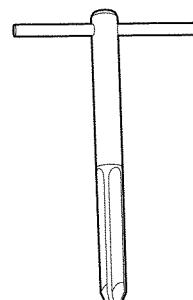
Bii10

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
55	1025-00-566-3789	PLUG, MUZZLE 7309257 (19206)		EA	1
56	1290-00-535-7617	POST, AIM, M1A2 7687114 (19200)		EA	4
57	1025-01-530-5873	PRIMER, EXTRACTOR, RUPTURED 11581663 (INUW7)		EA	1
58	1290-00-891-9999	QUADRANT, FIRE CONTROL, GUN M1A2 7197156 (19200)		EA	1
59	1025-00-860-5443	RAMMER, ARTILLERY (BELL TYPE) 8767210 (19206)		EA	1
60	1025-01-529-5078	RAMMER, SHELL ASSEMBLY 13006407 (19200), Consisting of:		EA	1
	1025-01-529-4360	HANDLE ASSEMBLY 13006408 (19200)		EA	1
	1025-01-529-5078	RAMMER, HEAD 13006418 (19200)		EA	1
	3040-01-531-1671	SHAFT, CURVED 13006416 (19200)		EA	1

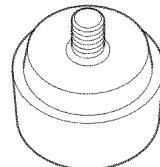
Section III. BASIC ISSUE ITEMS (BII) (cont)



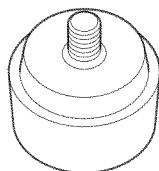
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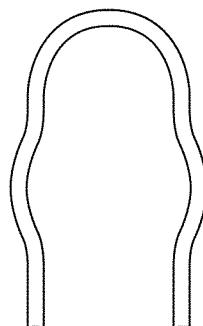
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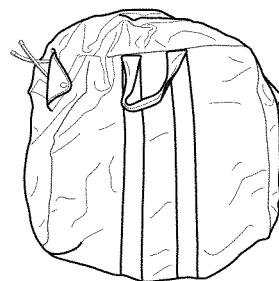
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Bii11

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
61	5120-01-335-1318	RATCHET, HEAD 3/4 IN DR L872 (55719)		EA	1
62	5110-01-026-5253	REAMER, HAND 11578743 (19206)		EA	1
63	5120-01-435-0661	REPLACEMENT RUBBER, MED TIP 69158 (08292)		EA	1
64	5120-01-435-0665	REPLACEMENT RUBBER, PL HARD TIP 69152 (08292)		EA	1
65	5340-01-368-9993	RETAINER, FIRING PIN (On-Board Spare) 11580634 (19206)		EA	1
66	8460-00-606-8366	SECTION, BIG BAG MIL-K-41835 (81349)		EA	1

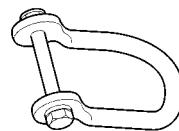
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Information

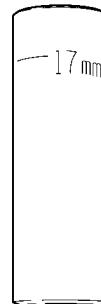
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Bii12

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
67	5430-00-158-3805	SERIES 200 LOCKS. AA59487-2S (58536) (M777A1 Only)		EA	2
68	1670-01-162-2372	SHACKLE, TIEDOWN 11-1-2801 (81337)		EA	2
69	7045-01-539-4512	SHADE, SUN, GND and AGD 13013271 (19200) (M777A1 Only)		EA	2
70	5120-00-188-8450	SHOVEL, HAND LONG HANDLE 1550000 (94536)		EA	4
71	5130-01-112-0552	SOCKET, EQUILIBRATOR ADJ 17mm 1/2 IN DR B107.33M (05047)		EA	1
72	5120-01-430-7959	SOCKET, 11mm 1/2 IN DR 12311 (08292)		EA	1

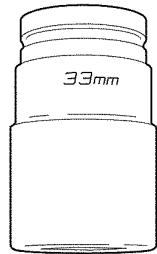
Section III. BASIC ISSUE ITEMS (BII) (cont)



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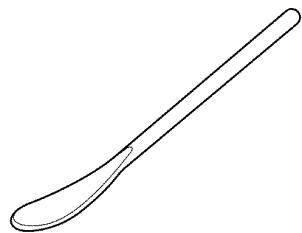
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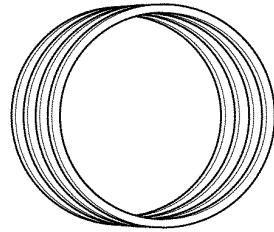
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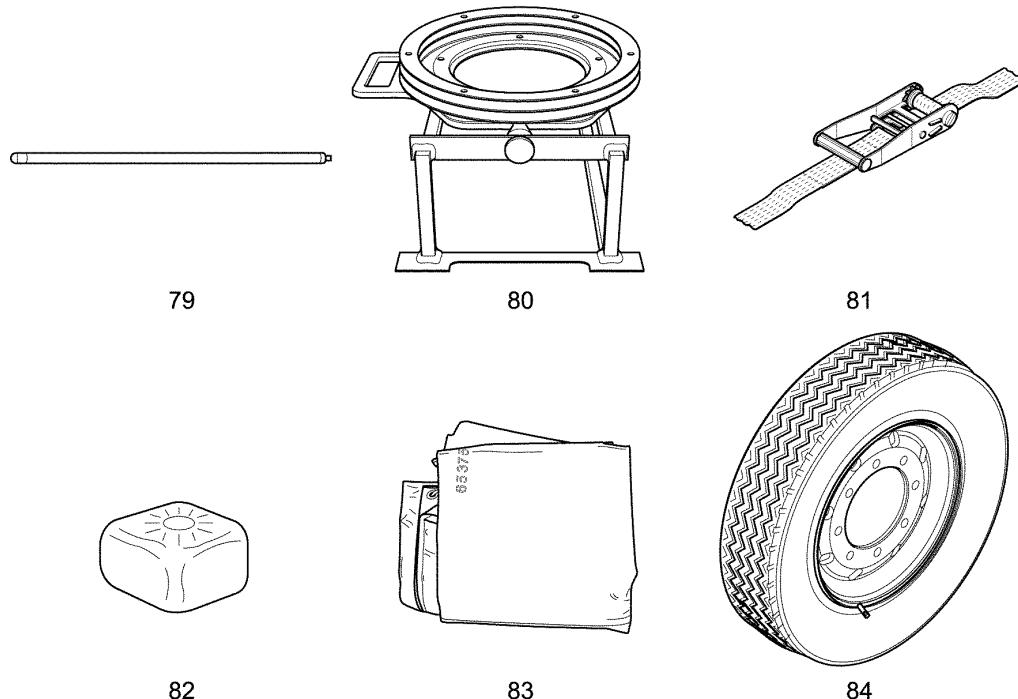


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Bii13

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
73	5120-01-398-7939	SOCKET, 16mm 1/2 IN DR 9-44266 (53800)		EA	1
74	5120-01-430-7680	SOCKET, 24mm 1/2 IN DR 12324 (08292)		EA	1
75	5130-01-355-1874	SOCKET, 33mm A/F SIMM332 (55719)		EA	1
76	TBD 6130-01-521-1386 6130-01-521-1329	SOLAR/AC CHARGER (M777A1/M77A2 Only) 735 x 676 (00NQ8) SOLAR CHARGER/AC CHARGER (M77A1/M777A2 Only) W/O CASE, WITH SOLAR PANEL 735 x 661 (00NQ8) SOLAR CHARGER/AC CHARGER (M77A1/M777A2 Only) W/O CASE, W/O SOLAR PANEL 735 x 667 (00NQ8)		EA	1
77	5120-00-277-4071	SPOON, TIRE (USMC Only) GGG-T-350 TY3SZ2 (80244)		EA	2
78	5360-01-029-7115	SPRING, FIRING PIN (On-Board Spare) 11578914 (19206)		EA	1

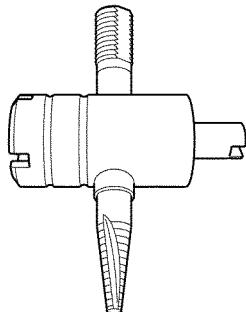
Section III. BASIC ISSUE ITEMS (BII) (cont)



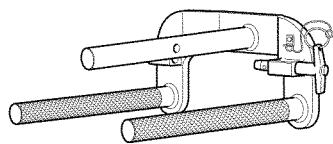
Bii14

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
79	1025-00-563-7232	STAFF SECT, CLEAN 4 FT 7309228 (19206)		EA	7
80	1025-01-529-4358	STOOL, BREECH 13006382 (19200)		EA	1
81	5340-01-535-1890	STRAP, SAFETY (US Army Only) 13006460 (19200)		EA	2
82	1025-01-232-6822	SWAB, CHAMBER 11579875 (19206)		EA	1
83	2540-00-653-7589	TARPAULIN 6537589 (19207)		EA	2
84	N/A 2530-01-526-1595 2610-01-526-1619 TBD	TIRE WHEEL ASSEMBLY, SPARE 2-16853-52 (K2454) (USMC Only) Consists of the following components: WHEEL 764550 (17621) TIRE 67113 (121195) VALVE STEM 40117 (62161)		EA	1 1 1 1

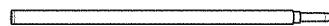
Section III. BASIC ISSUE ITEMS (BII) (cont)



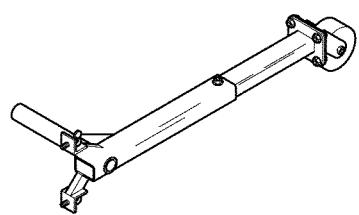
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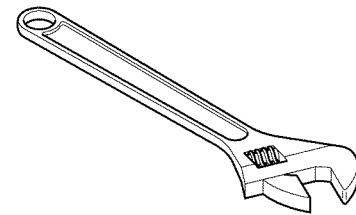
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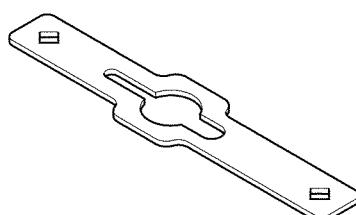
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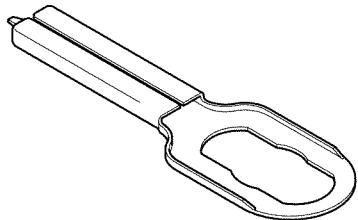


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Bii15

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
85	5120-00-541-4687	TOOL, VALVE CORE (USMC Only) 2668 (27783)		EA	1
86	1090-01-536-6493	TRIDENT BAR 13006374 (19200)		EA	1
87	5340-99-160-5106	TUBE, PUMP HANDLE AMP-02-14-29000 (K4244)		EA	2
88	1025-01-537-3762	WHEEL, THIRD FOR MUZZLE BRAKE 12999476 (19200)		EA	1
89	5120-00-264-3796	WRENCH, ADJUSTABLE 12 IN ADHI2 (55719)		EA	1
90	5120-01-537-2582	WRENCH, FIRING MECHANISM 11581486 (1NUW7)		EA	1

Section III. BASIC ISSUE ITEMS (BII) (cont)



91

Bii16

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) U/I	(6) Qty Rqr
91	4933-00-723-1161	WRENCH, FUZE-SETTER, COMB, M18 7231161 (19206)		EA	1

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APPENDIX C
ADDITIONAL AUTHORIZATION LIST

Section Index

	Page
Section I. Introduction.....	C-1
Section II. Additional Authorization List	C-2

Section I. INTRODUCTION

C-1. SCOPE

This work package lists additional items you are authorized for the support of the M777/M777A1/M777A2 Howitzer.

C-2. GENERAL

This list identifies items that do not have to accompany the M777/M777A1/M777A2 Howitzer and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.

C-3. EXPLANATION OF ENTRIES IN THE AAL

- a. **Column (2)–National Stock Number (NSN).** Identifies the stock number of the item to be used requisitioning purposes.
- b. **Column (3)–Description, Part Number/(CAGEC).** Identifies the Federal item name (in all capital letters) followed by a minimum description when needed. The last line below the description is the part number and the Commercial and Government Entity Code (CAGEC) (in parentheses).
- c. **Column (4)–Usable On Code.** When applicable, gives you a code if the item you need is not the same for different models of equipment. These codes are identified below:

Code Used on

AAA Model M777
XXX Model M777A1
XXX Model M777A2

- d. **Column (4)–Unit of Issue (U/I).** Indicates the physical measurement or count of the item as issued per the National Stock Number.
- e. **Column (5)–Qty Recm.** Indicates the quantity recommended.

Section II. ADDITIONAL AUTHORIZATION LIST

(1) National Stock Number (NSN)	(2) Description, Part Number/(CAGEC)	(3) U/I	(4) Qty Rqr
7920-00-291-5815	BRUSH, WIRE SCRATCH 7920-00-291-5815 (83421)	EA	1
5140-00-653-4198	CHEST, TOOL BOX 6534198 (19204)	EA	1
TBD	DFCS NATO ADAPTOR	EA	1
5110-00-156-0054	FILE, HAND A-A-2313 (58536)	EA	1
5110-00-263-0349	HANDLE, FILE, WOOD NN-H-00106 (81348)	EA	1
1025-01-210-3688	LUNETTE HITCH ASSEMBLY 12009299 (19200)	EA	1
8345-00-174-6865	MARKER, PANEL, SIGNAL MII-P-40061 (81349)	EA	3
5120-00-223-7397	PLIERS, SLIP-JOINT GGG-P-471 (81348)	EA	1
5120-00-278-1283	SCREWDRIVER, FLAT-TIP GGG-S-121 (81348)	EA	1
6685-00-344-4603	THERMOMETER, SELF-INDICATING BIMETALLIC MIL-T-3618C (81349)	EA	1
N/A	TIRE WHEEL ASSEMBLY, SPARE+RUNFLAT ASO 199 (62161) (US ARMY Only) Consists of the following components:	EA	1
2530-01-535-9265	WHEEL, SPLIT RIM 13006467 (19200)	EA	1

(1) National Stock Number (NSN)	(2) Description, Part Number/(CAGEC)	(3) U/I	(4) Qty Rqr
2610-01-526-1619	TIRE 67113 (12195)	EA	1
2640-01-537-1405	RUN-FLAT 13006469 (19200)	EA	1
2640-01-537-1407	VALVE STEM 13006493 (19200)	EA	1
NOTE: US Army units are also authorized to use TIRE WHEEL ASSEMBLY, SPARE, P/N 2-16853-52 (K2454) on M777A1 in pairs. Mixing of runflat and non-runflat tires is not authorized.			

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APPENDIX D
EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section Index

	Page
Section I. Introduction.....	D-1
Section II. Expendable/Durable Supplies and Materials List.....	D-2

Section I. INTRODUCTION

D-1. SCOPE

This work package lists expendable and durable items that you will need to operate and maintain the M777/M777A1/M777A2 Howitzer. This list is for information only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items), or CTA 50-909, Field and Garrison Furnishings and Equipment or CTA 8-100, Army Medical Department Expendable/Durable Items.

D-2. EXPLANATION OF ENTRIES IN THE EXPENDABLE/DURABLE ITEMS LIST

The following provides an explanation of columns found in the tabular listing.

- a. Column (1)–Item No.** This number is assigned to the entry in the list and is referenced in the narrative instructions to identify the item (e.g., Use brake fluid (Expendable/Durable Items List).).
- b. Column (2)–Level.** This entry identifies the lowest level of maintenance that requires the listed item.

C – Operator/Crew

- c. Column (3)–National Stock Number (NSN).** This is the NSN assigned to the item which you can use to requisition it.
- d. Column (4)–Item Name, Description, Part Number/(CAGEC).** This column provides the other information you need to identify the item. The last line below the description is the part number and the Commercial and Government Entity Codes (CAGEC) (in parentheses).
- e. Column (5)–Unit of Issue (U/I).** Shows the physical measurement or count of an item, such as gallon, dozen, gross, etc.

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National Stock Number (NSN)	(4) Description	(5) U/I
1	C	8105-00-269-4662	BAG, PLASTIC: waterproof and greaseproof MIL-B-117 (81349) 20 x 25, std pkg 25	EA
2	C	6135-00-835-7210	BATTERY (1) Non rechargeable 1.5 V No. BA-30 type, pkg of 12 MIL-B-49030/1 (81349)	EA
3	C	6135-01-301-8776	BATTERY, LITHIUM (Li-SOCl ₂) Size "AA" TL-2100/S (4J947)	EA
4	C	6135-01-456-2924	BATTERY, LITHIUM (Li-SOCl ₂) Size "C" TL-2200/S (4J947)	EA
5	C	6135-01-499-6293	BATTERY, LITHIUM (Li-SOCl ₂) (small 2) Size "C" TL-5920 (4J947) (Quantity Of 40 per box)	EA
6	C	9150-01-102-9455	BRAKE FLUID, SILCONE, AUTOMOTIVE: (BFS) MIL-PRF-46176 (81348) 1-gal. (3.79-l) plastic container	CN CN
7	C	9150-01-053-6688 9150-01-054-6453	CLEANER, LUBRICANT AND PRESERVATIVE: grade 2 (CLP) MIL-L-63460 (81349) 1-gal. (3.79-l) bottle 1-pt. (0.47-l) can	GL CN
8	C	6850-00-597-9765	CLEANING COMPOUND: liquid form 6G236-6 (81349) 1-gal (3.79-l) container	GL
9	C	6850-00-227-1887	CLEANING COMPOUND, OPTICAL LENS A-A-59199 (58536) 1 qt. (0.95 l)	QT
10	C	7930-01-064-5179	CLEANER, PLASTIC and GLASS (18598) MS-260 15oz can	EA

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (cont)

(1) Item Number	(2) Level	(3) National Stock Number (NSN)	(4) Description	(5) U/I
11	C	5350-00-268-3116 5350-00-221-0872	CLOTH, ABRASIVE: crocus ANSI B74.18 (80204) 2 wide x 50 yd (45.72m) 9 x 11 sh, 50 sh sleeves	EA EA
12	C	8305-00-222-2423	CLOTH, CHEESECLOTH: cotton CCC-C-440 (81348)	YD
13	C	1025-01-311-3770	CLOTH, CLEANING, SLEEVE: 155/203-140 (65983) box of 30 sleeves	BX
14	C	4020-00-242-4072	CORD, FIBROUS: 0.045 diam, natural 8851560 (19200)	LB
15	C	8135-00-052-9070	CUSHIONING MATERIAL type 1, class II MIL-P-26514 (81349) 48 x 24 x 4	SH
16	C	9150-00-944-8953 9150-00-181-7724	GREASE, AIRCRAFT: general purpose (GPG) wide temperature range (WTR) MIL-PRF-81322 (81349) (1.75lb) 8 oz (226.8 g)	TU
17	C	6240-00-044-6914	LAMP INCANDESCENT MS354478-1683 (01084)	EA
18	C	6240-00-019-3093	LAMP INCANDESCENT S-623 (58815)	EA
19	C	9150-00-292-9689 9150-00-292-9687	LUBRICANT, ALL WEATHER (only to be used in sub-zero temperatures) (LAW) MIL-PRF-14107 (81349) 1-qt (0.95-l) container 1-gal (3.79-l) container	CN CN
20	C	9150-00-935-9807 9150-00-935-9808	HYDRAULIC FLUID, PETROLEUM BASE PRESERVATIVE: (OHT) MIL-PRF-6083 (81349) 1-qt (0.95-l) container 1-gal (3.79-l) container	CN CN

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (cont)

(1) Item Number	(2) Level	(3) National Stock Number (NSN)	(4) Description	(5) U/I
21	C	1025-01-196-2172	KIT, ARTILLERY CLEANING SK1-84JS (59678)	EA
22	C	8010-01-070-0922	LACQUER, ACRYLIC: camouflage, Lusterless, type II MIL-L-52909 (81348) 1-pt (0.47-l) can	CN
23	C	7920-00-753-5242	PAD, SCOURING SCOTCHBRITE - 96 (27293)	EA
24	C	8010-01-141-2419	PAINT, BLACK (CARC) MIL-C-46168 (81349)	KT
25	C	8010-01-160-6744	PAINT, BROWN (CARC) MIL-C-46168 (81349)	KT
26	C	8010-01-160-6741	PAINT, GREEN (CARC) MIL-C-46168 (81349)	KT
27	C	6640-00-663-0832	PAPER, LENS: tissue sheet, type 1 NNNP40 (81348)	EA
28	C	8010-01-416-6556	PRIMER COATING MIL-PRF-23377 (81349)	KT
29	C	8010-01-193-0516	PRIMER COATING (CARC) MIL-P-53022 (81349)	KT
30	C	7920-00-205-1711	RAG, WIPING: cotton 7920-00-205-1711 (64067) 50 lb (22.68 kg)	BE
31	C	8010-00-181-7568	REMOVER, PAINT (CARC) MIL-R-81294 TYC1CL1 (80244)	GL
32	C	8520-00-228-0598	SOAP, TOILET: liquid P-S-624 (81348) 6 gal (22.71 l)	CN

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (cont)

(1) Item Number	(2) Level	(3) National Stock Number (NSN)	(4) Description	(5) U/I
33	C		TIES, CABLE WRAP NOTE Items 34 thru 36 are applicable to the Loose Projectile Restraint System (LRPS) only.	CN
34	C	2590-01-223-2945	DIVIDER, AMMUNITION (SHORT: (LPRS)), 155mm AC200000402 (28620)	EA
35	C	2590-01-223-2944	DIVIDER, AMMUNITION (LONG: (LPRS)), 155mm AC200000403 (28620)	EA
36	C	2590-01-223-2949	RACK, AMMUNITION, STOWAGE 15 round, (LPRS), 155mm AC200000400 (28620)	EA
37	C	5340-00-980-9277	STRAP, WEBBING: 1.75 IN. W 10900880 (19207)	EA
38	C	3990-01-204-3009	STRAP, WEBBING MIL-PRF-71224-1 (OKHZ6)	EA
39	C	1670-00-725-1437	TIE DOWN, CARGO, AIRCRAFT: nylon, 1.719 in. w, type CGU1B MIL-T-27260 (81349)	EA

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

E-1. SCOPE

This appendix shows the locations for stowage of equipment and material required to be carried on the howitzer.

E-2. GENERAL

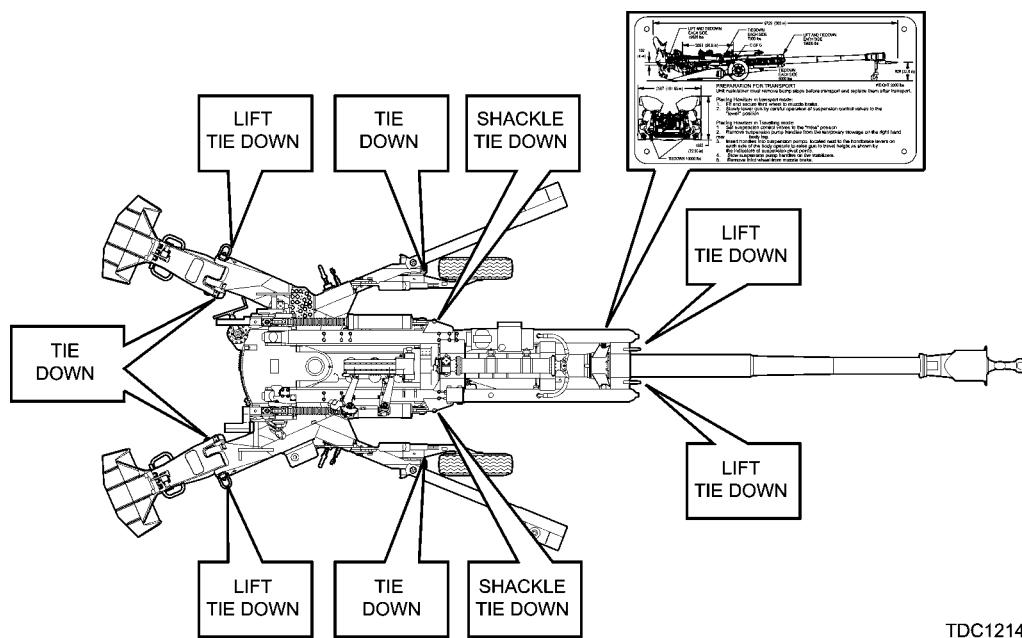
Locations of COEI, which remain attached to the howitzer during operation and storage, are shown on pages B-2. Other COEI and BII mounted or stowed on the howitzer are shown in this appendix. Items not shown are stowed in the prime mover or the ammunition truck. Additional authorization list items are stowed at the discretion of the SC.

STOWAGE AND SIGN GUIDE

NOTES

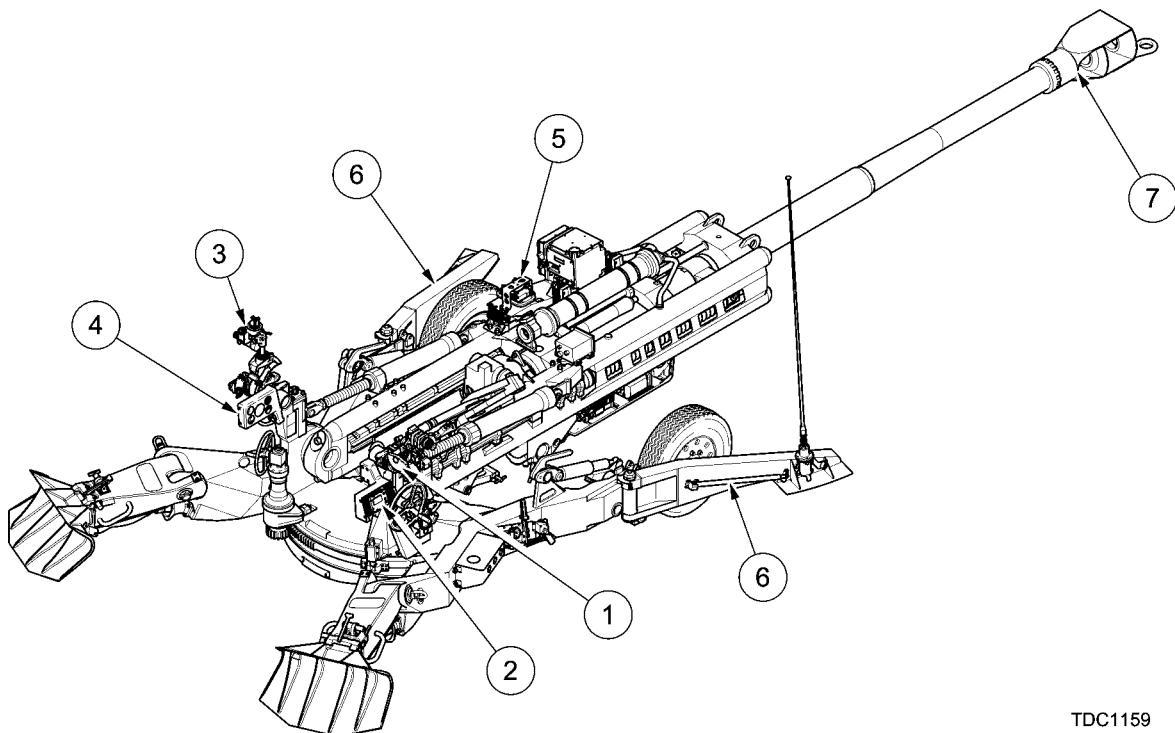
Shackle tie-downs are mandatory for all internal air transportation.

Shackle tie-downs may be used for all other modes of transportation.



TOP VIEW

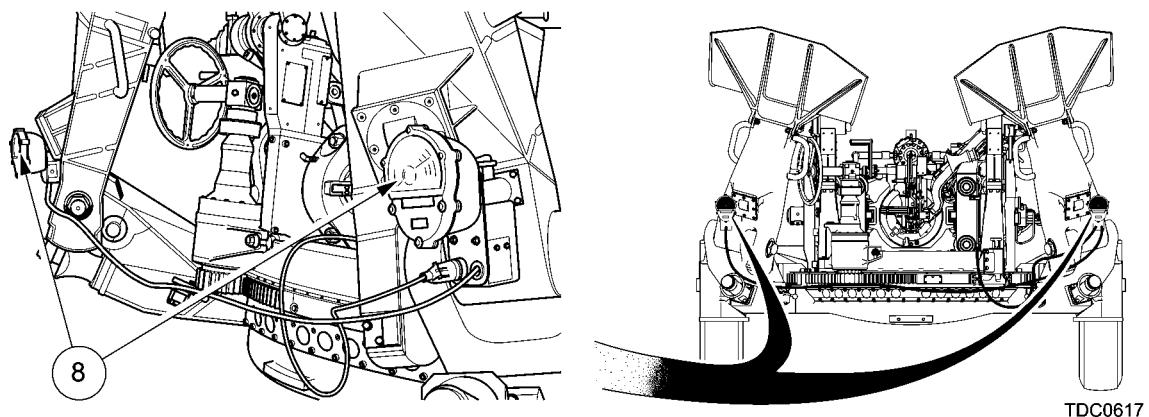
STOWAGE AND SIGN GUIDE (cont)



RIGHT SIDE VIEW

NO.	STOWAGE PLAN
	ITEM
1	M172A1 Telescope and Quadrant Mount M18A1 Fire Control Quadrant and Cover
2	AGD and Cover
3	M171A1 Telescope and Quadrant Mount M17A1 Fire Control Quadrant and Cover
4	GND and Cover
5	CSD Stowage Bracket
6	Pump Handles
7	Muzzle Plug

STOWAGE AND SIGN GUIDE (cont)



REAR VIEW

NO.	STOWAGE PLAN
	ITEM
8	Vehicle Taillight Special Purpose Cable Assembly

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APPENDIX F TRANSPORTABILITY INSTRUCTIONS

1. General

a. The Army's intended prime mover is the FMTV and the USMC's intended prime mover is the MTVR. The M939 series prime mover may also serve as a temporary prime mover pending full fielding of the newer vehicles.

b. The howitzer will be transported primarily by Navy ships and commercial roll on/roll off transport-type ships. The howitzer will also be transported by US Air Force aircraft, commercial rail cars, and helicopter External Air Transportability (EAT) assets. The theater of operation for the howitzer is world-wide.

c. The purpose of the transportability instruction is to provide the crew with the procedures for preparing the howitzer for transportation by, air, rail or sea.

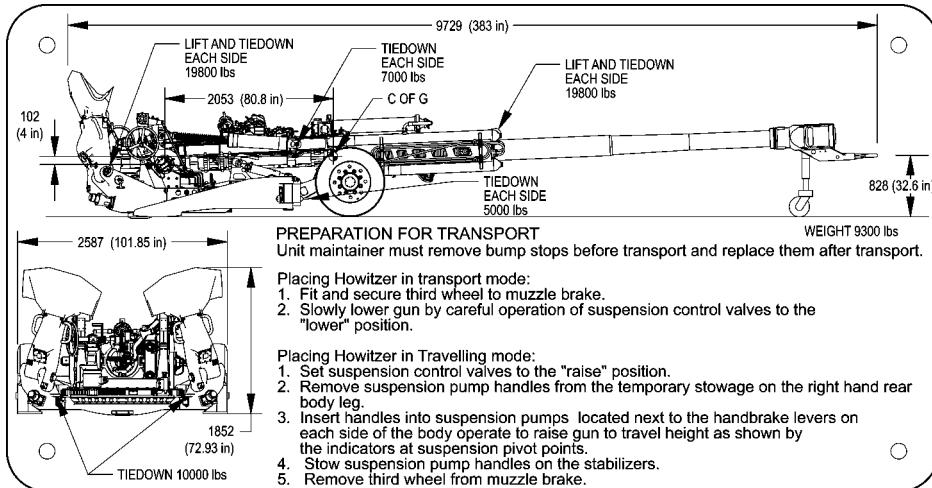
d. The following documents provide additional information for Transportability Instructions.

- (1) DI-PACK-80880A.
- (2) MIL-STD-810E.
- (3) MIL-STD-814, Requirements for Tiedown, Suspension and Extraction Positions on Military Materiel for Airdrop.
- (4) MIL-STD-209J, Slinging and Tiedown Provisions for Lifting and Tying Down Military Equipment.
- (5) MIL-STD-1791, Designing for Internal Aerial Delivery in Fixed Wing Aircraft.
- (6) MIL-STD-1366C, Transportability Criteria.
- (7) MIL-STD-913A, Requirements for the Certification of Externally Transported Military Equipment by Department of Defense Rotary Wing aircraft.
- (8) TP-94-01.
- (9) MTMCTEA REF, 94-70-1 Transportability and Deployability for better strategic Mobility.
- (10) American Association of Railroads (AAR) Clearance Diagram.
- (11) Gabarit Internationale de Chargement (GIC) Clearance Diagram.

2. Crew Preparations

a. Transport by Truck, Semi-Trailer or Rail.

Transportability Data Plate Information



TDC1221

Loading Procedure using Prime Mover or Forklift

- (1) Remove bumpstops (notify unit maintenance). Transport bumpstops with howitzer.
- (2) Remove pump handles.
- (3) Attach pump handles to trail arms using cargo straps (duct tape may also be used).
- (4) Install trident bar.
- (5) Use prime mover or forklift to maneuver onto transport.

WARNING

TAKE CARE WHEN LOADING HOWITZER ONTO TRANSPORT PLATFORM, SUSPENSION SYSTEM IS ACTIVE, WHICH MAY CAUSE SUDDEN HOWITZER MOVEMENT. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

- (6) Once howitzer is in position on the transport platform, engage handbrakes. Disconnect howitzer from prime mover or forklift.
- (7) Two crewmembers support the howitzer at the muzzle brake, using the trident bar.
- (8) Install howitzer 3rd wheel (Para 3-10) and extend wheel to the 3rd hole and secure with bolt provided. Align wheel to roll in the direction of the cannon.
- (9) Under control, lower howitzer onto platform, by moving suspension levers to the "LOWER" position.
- (10) Return suspension levers to "RAISE" position once howitzer is completely lowered.
- (11) Secure howitzer to platform (Appendix E).
- (12) Deleted.

2. **Crew Preparations (cont)**

a. **Transport by Truck, Semi-Trailer or Rail (cont).**

Offloading Procedure using Prime Mover or Forklift

- (1) Two crew members support the howitzer at the muzzle brake, using the trident bar.
- (2) Remove pump handles from trail arms and insert into pump adaptors.
- (3) Under control slowly raise howitzer to its ride height.
- (4) Attach howitzer to prime mover or forklift.
- (5) Remove 3rd wheel (Para 3-10) and disengage handbrakes.
- (6) Use prime mover or forklift to maneuver howitzer off transport.
- (7) Install bump stops (notify unit maintenance).

Loading Procedure using Overhead Crane

- (1) Remove bumpstops (notify unit maintenance). Transport bumpstops with howitzer.
- (2) Remove pump handles.
- (3) Attach pump handles to trail arms using cargo straps (duct tape may also be used).
- (4) Install howitzer 3rd wheel (Para 3-10) and extend wheel to the 3rd hole and secure with bolt provided. Align wheel to roll in the direction of the cannon.
- (5) Place howitzer in Firing Position with trails raised and locked, wheels down suspension levers at "LOWER" position.
- (6) Attach suitable lifting straps to the front cradle and outer trail lifting provisions.
- (7) Attach a guide rope to the lunette.
- (8) Slowly raise howitzer off ground using overhead crane.
- (9) Place stabilizers in stowed position.
- (10) Carefully place howitzer on transport platform using crane and guide rope.
- (11) Engage handbrakes. Set suspension levers at "RAISE" position.
- (12) Remove lifting straps and guide rope.
- (13) Secure howitzer to platform (Appendix E).

Offloading Procedure using Overhead Crane

- (1) Remove tie down chains and/or straps.
- (2) Attach suitable lifting straps to the front cradle and outer trail lifting provisions.
- (3) Attach a guide rope to the towing eye.
- (4) Set suspension levers at "LOWER" position.
- (5) Slowly raise howitzer off transport platform using overhead crane.
- (6) Deploy stabilizers before setting howitzer on ground.
- (7) Carefully place howitzer on ground using crane and guide rope.
- (8) Remove lifting straps and guide rope.
- (9) Install bump stops (notify unit maintenance).

b. **Marine Landing Craft (Larger than an LCM – 8).**

- (1) Roll-On/Roll-Off (RORO) vessels (LOTS, LASH Lighters, FSS, LOLO, SEABEE Barges, LCM, LSV, LCU).
 - (a) If required for maneuverability or repositioning within the landing craft, install the howitzer 3rd wheel.

2. **Crew Preparations (cont)**

c. **Air Transportation.**

(1) Fixed Wing Aircraft (C-5, C-17, C-130, C-141).

(a) DFCS Batteries.

- (i) USAF Air Mobility Command special handling section has determined that the DFCS batteries (Optima Battery P/N TBD) is classified as a non-spillable battery and has exemption from UN2800 classification (Batteries, wet, non-spillable) in accordance with 49 CFR173.159 (d). Based on these findings the batteries are exempt from the provisions of Air Force Interservice Manual 24-204, para A12.5
- (ii) The DFCS batteries are exempt from Air Force Interservice Manual 24-204, para A13.7 and can be transported installed on the howitzer.
- (iii) The following steps will be performed in preparation for air transport:
 - Check battery mounting to ensure batteries are securely fastened to the undercradle electronics assembly.
 - Check the battery terminal housing assembly to support the requirement of short circuit protection in the event of freight shifting.

(b) C-130 aircraft require spades to be removed from the trail arm.

Spade Removal Procedures

WARNING

HEAVY WEIGHT. A MINIMUM OF TWO PERSONNEL ARE REQUIRED TO SUPPORT THE WEIGHT OF THE SPADE.

NOTE

The procedure described below applies to both the LH and RH spades

- (i) Place trail arm (1) in the stowed position and ensure trail arm locking plunger is engaged (Para 2-6).
- (ii) Using multi-tool, remove two cotter pins (2).
- (iii) Using ratchet $\frac{1}{2}$ in drive, 24 mm socket and 12 in. adjustable wrench, remove two slotted nuts (3).
- (iv) Remove two flat washers (4) and two pivot pins (5).

2. Crew Preparations (cont)

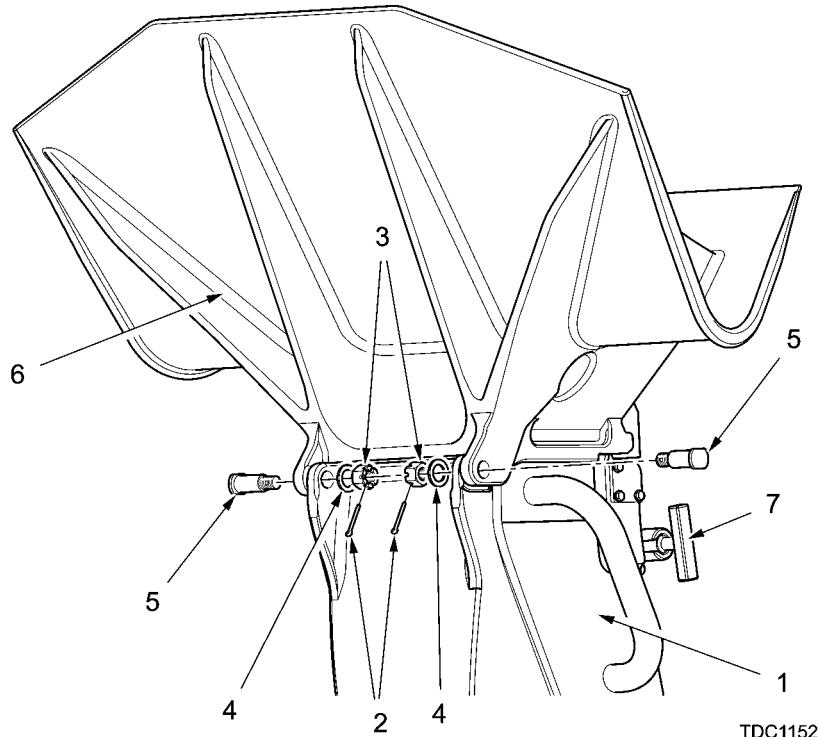
c. Air Transportation (cont).

Spade Removal Procedures (cont)

WARNING

HEAVY WEIGHT. A MINIMUM OF TWO PERSONNEL ARE REQUIRED TO SUPPORT THE WEIGHT OF THE SPADE. ENSURE PERSONNEL ARE STANDING CLEAR OF SPADES WHEN LOWERING. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

- (v) While supporting spade (6), disengage spade locking plunger (7) (Para 2-6). Lift spade clear of trail arm (1) and stow.



Spade Installation Procedures

WARNING

HEAVY WEIGHT. A MINIMUM OF TWO PERSONNEL ARE REQUIRED TO SUPPORT THE WEIGHT OF THE SPADE. ENSURE PERSONNEL ARE STANDING CLEAR OF SPADES WHEN INSTALLING. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

2. **Crew Preparations (cont)**

c. **Air Transportation (cont).**

Spade Installation Procedures (cont)

- (i) Install spade (1) onto trail arm assembly (2).
- (ii) Engage spade locking lever (Para 2-6).
- (iii) Install two pivot pins (3) and two washers (4).
- (iv) While holding pivot pins (3), install slotted nuts (5).
- (v) Using ratchet $\frac{1}{2}$ in. drive, 24 mm socket, and 12 in. adjustable wrench, tighten slotted nuts (5) until slot is aligned with hole in pivot pin (3).

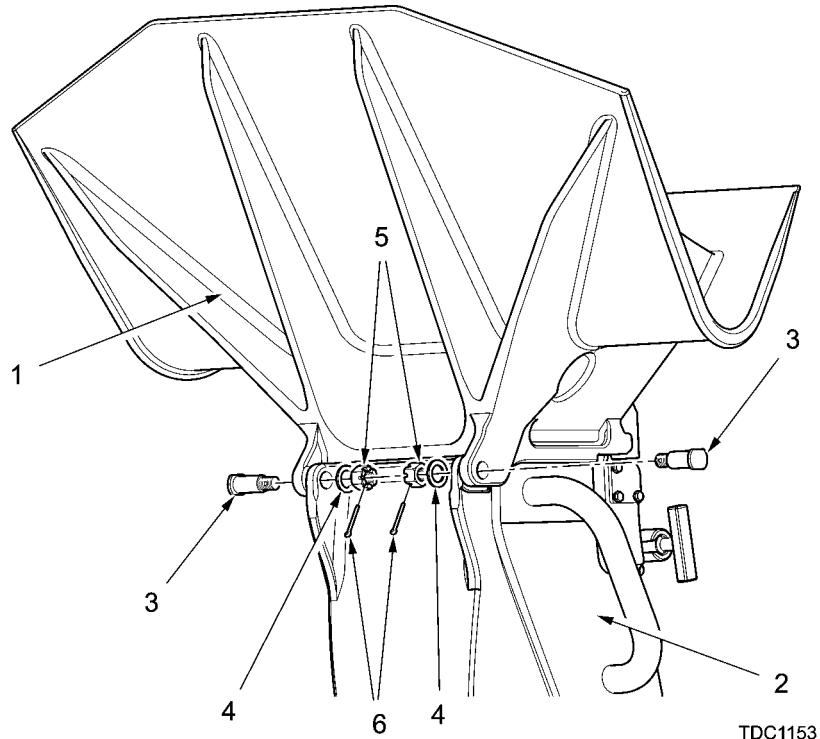
NOTE

Notify Unit Maintenance to replace cotter pins (6).

WARNING

HEAVY WEIGHT. A MINIMUM OF TWO PERSONNEL ARE REQUIRED TO SUPPORT THE WEIGHT OF THE SPADE. ENSURE PERSONNEL ARE STANDING CLEAR WHILE SPADES ARE BEING LOWERED. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

- (vi) Check spade operation.



2. **Crew Preparations (cont)**

c. **Air Transportation (cont).**

Spade Installation Procedures (cont)

(c) If required for maneuverability or repositioning within the aircraft, install the howitzer 3rd wheel.

(2) Rotary Wing Aircraft (CH-47D, CH-53D, CH-53E, MV-22).

- (a) Spades, trail arms and stabilizers to be deployed in the firing position.
- (b) Wheel assemblies to be in the travel (lowered) position.
- (c) Suspension levers in the LOWER position.
- (d) Traverse and travel locks engaged.

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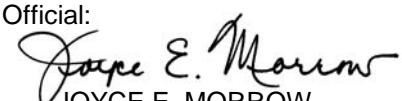


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Joint Program Manager
Lightweight 155mm Howitzer
Marine Corps Systems Command

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