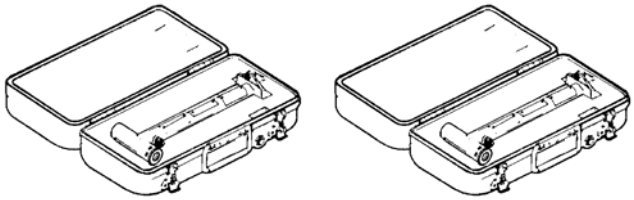
TM 9-4931-710-14&P

TECHNICAL MANUAL

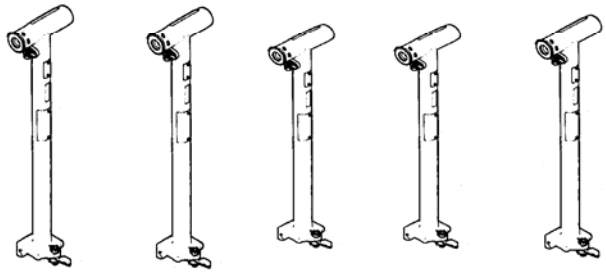
OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

(Including Repair Parts and Special Tools List)

for



M140 WITH CASE M140A1 WITH CASE



M139 M139A1 M140 M140A1 M154

ALINEMENT DEVICE: M139 (RADIOACTIVE) (4931-01-048-5834)

M139A1 (NONRADIOACTIVE) (4931-01-472-6621)

and

ALINEMENT DEVICE WITH CASE: M140 (RADIOACTIVE) (4931-01-187-9713)

M140A1 (NONRADIOACTIVE) (4931-01-472-7329)

and

ALINEMENT DEVICE WITHOUT CASE: M140 (RADIOACTIVE) (4931-00-341-5119)

M140A1 (NONRADIOACTIVE) (4931-01-472-6622)

and

ALINEMENT DEVICE WITHOUT CASE: M154 (NONRADIOACTIVE) (4931-01-516-1430)

HEADQUARTERS, DEPARTMENT OF THE ARMY

PIN: 060462-003

WARNING SUMMARY

WARNING

RADIATION  **HAZARD**

TRITIUM GAS (H_3)

This item contains radioactive material. All personnel that operate and/or maintain fire control equipment containing tritium must be aware of the following special precautions and requirements:

Immediately report any suspected lost or damaged tritium fire control equipment to your unit/mission Radiation Safety Officer (RSO). If your RSO cannot be reached, contact the TACOM-RI RSO (DSN 793-2965/6228, Commercial (309) 782-2965/6228) during regular duty hours; or call the Rock Island Police Office at DSN 793-6135 after duty hours.

Unit/mission RSO:_____Telephone:_____

A. RULES AND REGULATIONS. NRC Form 3 - Notice to Employees and Energy Reorganization Act of 1974 Section 206 must be posted and the following regulations and licenses must be available for review at a location frequented by all employees or at the installation Safety Office:

(1) 10 CFR Part 19 - Notices, Instructions and Reports to Workers; Inspections.
(2) 10 CFR Part 20 - Standards for Protection Against Radiation.
(3) 10 CFR Part 21 - Reporting of Defects and Noncompliance.
(4) NRC license and license application.

Copies may be requested or information obtained by contacting the TACOM-RI Safety Office, DSN 793-2965/6228, Commercial (309) 782-2965/6228, or by visiting TACOM-RI web site at http://tri.army.mil.

B. SAFETY PRECAUTIONS. The radioactive material used in this instrument is tritium gas (H_3) sealed in glass vials. These sources illuminate the instrumentation during night operations. Federal law prohibits tampering with or removal of the sources in the field. In the event there is no illumination, notify the local RSO or TACOM-RI RSO. If skin contact is made with any area contaminated with tritium, wash immediately with soap and water. Notification of the RSO is required.

The beta radiation emitted by tritium is a hazard only if the vial or source is broken. Tritium can be taken into the body by inhalation, ingestion, or skin absorption/injection. If the vial is broken, the tritium gas will dissipate into the surrounding air. If released into a confined space such as a storage locker, container, unventilated room, or military vehicle, the tritium will be absorbed by lungs from inhalation or by skin through contact with contaminated surfaces. However, the body naturally eliminates absorbed tritium. If exposed, notification of the RSO is required.

C. IDENTIFICATION. Instruments containing radioactive self-luminous vials are identified by means of radioactive warning label (see above). The radioactive material used in this instrument is tritium gas (H_3) sealed in glass vials. These sources illuminate the instrumentation for night operations.

WARNING SUMMARY - Continued

D. CONTROL. Federal law mandates control of this radioactive material. Tampering with or removal of the sources in the field is prohibited.

E. HAZARDS. The beta radiation emitted by tritium is a hazard only if the vial or source is broken. Tritium can be taken into the body by inhalation, ingestion, or skin absorption. If the vial is broken, the tritium gas will dissipate into the surrounding air. However, if released inside a confined space such as a storage locker, unventilated room, or military vehicle, tritium oxide will form, which is readily absorbed by lungs from air or by skin from contact with contaminated surfaces.

F. STORAGE. Federal law requires secured storage of these items. It is recommended a well-ventilated arms room or unoccupied building be used to store tritium fire control devices.

G. DISPOSAL. Non-illuminated or broken instruments will be turned into the unit/mission RSO. The unit/mission RSO will properly secure the material in an area designated for low-level radioactive waste. The unit/mission RSO must contact the Army Field Support Command for further disposition at DSN 793-0338/1883, Commercial (309) 782-0338/1883.

H. SHIPPING. Shipping of radioactive devices must be in accordance with 49 CFR, Part 173.423 or International Air Transport Association (45th ed). Broken or non-illuminated and repaired devices must be wipe tested by the unit/mission RSO prior to shipment. The unit/mission RSO or Transportation Officer (TO) will authorize the shipment. New or unused tritium devices do not require a wipe test prior to shipment if new shipping package is used. A material movement form (MMF) must accompany the shipment. The MMF can be obtained at the TACOM-RI web site: http://tri.army.mil under safety office/radiation safety/forms.

I. EMERGENCY PROCEDURES. If the tritium fire control device is not illuminated or broken, contact your unit/mission RSO immediately. If skin contact is made with any broken device or surface potentially contaminated with tritium, wash immediately with nonabrasive soap and cold water. The following acronym "**SWIMN**" will help you remember what to do if a tritium device breaks or is not illuminated:

Stop - and think.
Warn - nearby personnel of situation to exit room/vehicle/immediate area.
Isolate - use gloves (or turn plastic bag inside out over your hand) and place item in plastic bag (item 5, WP 0152 00) (if bag not immediately available, wrap in plastic). Do not handle broken tritium devices with bare hands.
Minimize - contamination by opening doors/windows/hatches to ventilate the area. Leave area if possible and wash hands and arms after handling broken items.
Notify - call the unit/mission Radiation Safety Officer (RSO).

Before any tritium-illuminated device is purged, ensure that all radioactive light sources are fully illuminated. If not fully illuminated, send to depot for maintenance.

To avoid injury to personnel and damage to equipment, ensure that tritium-illuminated counters are fully illuminated before cover of fire control device is removed.

BATTERY WARNINGS


WARNING


Lithium – Thionyl Chloride (Li-$SOCl_2$) non-rechargeable batteries present a fire, explosion, vapor, and chemical hazard. Do not recharge, disassemble, heat above 212 ºF (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).

Li-$SOCl_2$ batteries contain liquid $SOCl_2$, which fumes on contact with air. The vapor is 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 if 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 the 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 batteries.

GENERAL WARNINGS

Do not drop tank of compressed nitrogen gas. When using in confined areas, use extreme care; gas could cause asphyxiation.

Do not purge or charge a collimator that has a damaged or broken radioactive light source.

Do not disassemble the radioactive reticle assembly.

FIRST AID

For further information on first aid, see FM 4-25.11

TM 9-4931-710-14&P

CHANGE NO.

NO. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington D.C., 15 March 2005

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT
AND GENERAL SUPPORT MAINTENANCE MANUAL
(INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST)
FOR
ALINEMENT DEVICE: M139 (RADIOACTIVE) (4931-01-048-5834)
M139A1 (NONRADIOACTIVE) (4931-01-472-6621)
AND
ALINEMENT DEVICE WITH CASE: M140 (RADIOACTIVE) (4931-01-187-9713)
M140AI (NONRADIOACTIVE) (4931-01-472-7329)
AND
ALINEMENT DEVICE WITHOUT CASE: M140 (RADIOACTIVE) (4931-00-341-5119)
M140AI (NONRADIOACTIVE) (4931-01-472-6622)
AND
ALINEMENT DEVICE WITHOUT CASE: M154 (NONRADIOACTIVE) (4931-01-516-1430)

TM 9-4931-710-14&P, August 1986 is changed as follows:

1. Remove old pages and insert new pages as indicated below.

2. New or changed material is indicated by a vertical bar in the margin of the page.

3. Added or revised illustrations are indicated by miniature pointing hands in the affected areas.

4. Remove old pages and insert new pages as indicated below.

Remove pages	Insert pages
a and b	a through c(d blank)
A(B blank)	A(B blank)
i through iv	i through iv
1-1 through 1-5(1-6 blank)	1-1 through 1-5(1-6 blank)
2-1/3-1/4-1(4-2 blank)	2-1/3-1/4-1(4-2 blank)
5-1 and 5-2	5-1 and 5-2
5-5 through 5-14	5-5 through 5-14
A-1 through A-4	A-1 through A-4
B-3 and B-4	B-3 and B-4
C-1 and C-2	C-1 and C-2
C-7 and C-8	C-7 and C-8
C-9 blank(Figure C-1) through C-6-1(C-6-2 blank)	C-9 blank(Figure C-1) through C-6-1(C-6-2 blank)
D-1 through D-3 (D-4 blank)	D-1 through D-3(D-4 blank)
I-1 and I-2	I-1 and I-2
Front Cover	Front Cover

5. File this sheet in the front of the manual for reference purposes.

By Order of the Secretary of the Army:

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

Official:

SANDRA R. RILEY
Administrative Assistant to the
Secretary of the Army
0433102

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CHANGE NO.

NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington D.C., 15 September 2000

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT
AND GENERAL SUPPORT MAINTENANCE MANUAL
(INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST)
FOR
ALINEMENT DEVICE: M139 (RADIOACTIVE) (4931-01-048-5834)
M139A1 (NONRADIOACTIVE) (4931-01-472-6621)
AND
ALINEMENT DEVICE WITH CASE: M140 (RADIOACTIVE) (4931-01-187-9713)
M140A1 (NONRADIOACTIVE) (4931-01-472-7329)
AND
ALINEMENT DEVICE WITHOUT CASE: M140 (RADIOACTIVE) (4931-00-341-5119)
M140A1 (NONRADIOACTIVE) (4931-01-472-6622)

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3. Added or revised illustrations are indicated by miniature pointing hands in the affected areas.

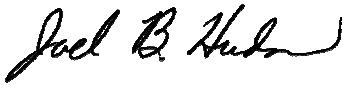
Remove pages	Insert pages
a through c (d blank)	a and b
i and ii	i and ii
1-3 through 1-5(1-6 blank)	1-3 through 1-5(1-6 blank)
5-3 through 5-6	5-3 through 5-6
5-9 through 5-12	5-9 through 5-12
5-29 and 5-30	5-29 and 5-30
B-3 through B-5(B-6 blank)	B-3 through B-5(B-6 blank)
C-9(C-10 blank)	C-9 and Figure C-1
C-1-1 through C-6-1	C-1-1 through C-6-1(C-6-2 blank)
D-1 and D-2	D-1 and D-2
I-1 and I-2	I-1 and I-2
Front Cover	Front Cover

4. File this sheet in the front of the manual for reference purposes.

By Order of the Secretary of the Army:

ERIC K. SHINSEKI
General, United States Army
Chief of Staff

Official:



JOEL B. HUDSON
Administrative Assistant to the
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CHANGE NO.

NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington D.C., 4 December 1996

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST) FOR ALINEMENT DEVICE: M139 (4931-01-048-5834) AND ALINEMENT DEVICE WITH CASE: M140 (4931-01-187-9713)

TM 9-4931-710-14&P, 15 August 1986, is changed as follows:

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Remove pages	Insert pages
a (b blank)	a through c (d blank)
i and ii	i and ii
1-3 and 1-4	1-3 and 1-4
5-7 and 5-8	5-7 and 5-8
5-13 through 5-18	5-13 through 5-18
5-23 through 5-26	5-23 through 5-26
A-3 and A-4	A-3 and A-4
B-3 through B-5 (B-6 blank)	B-3 through B-5 (B-6 blank)
C-1-1 and Figure C-2	C-1-1 and Figure C-2
C-4-1 through C-6-1	C-4-1 through C-6-1
I-1 and I-2	I-1 and I-2
D-1 and D-2	D-1 through D-3 (D-4 blank)

4. File this sheet in the front of the manual for reference purposes.

By Order of the Secretary of the Army:

DENNIS J. REIMER
General, United States Army
Chief of Staff

Official:

JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
02746

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LIST OF EFFECTIVE PAGES

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Dates of issue for original and changed pages are:

Original ..... 0 ..... 15 August 1986

Change ..... 1 ..... 4 December 1996

Change ..... 2 ..... 15 September 2000

Change ..... 3 ..... 15 March 2005

TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 82, CONSISTING OF THE FOLLOWING:

Page No.	*Change No.
Front Cover	3
a	3
b	3
c	3
d blank	3
A	3
B blank	0
i – iii	3
iv	0
1-1	3
1-2	0
1-3 – 1-5	3
1-6 blank	0
2-1 – 4-1	3
4-2 blank	0
5-1	3
5-2	0
5-3	2
5-4	0
5-5	2
5-6	3
5-7 – 5-14	3
5-15 – 5-18	1
5-19 – 5-22	0
5-23 – 5-26	1
5-27 – 5-28	0
5-29	2
5-30	0
A-1 – A-3	3
A-4	0
B-1 – B-2	0
B-3	1
B-4	3
B-5	2
B-6 blank	0
C-1	3
C-2 – C-7	0
C-8	3
C-9	0
Figure C-1	3
C-1-1	3
Figure C-2 – C-2-1	3
Figure C-3	0
C-3-1	3
Figure C-4	0
C-4-1	3
Figure C-5	0
C-5-1	3
Figure C-6	3
C-6-1	3
C-6-2 blank	0
D-1	0
D-2	3
D-3	3
D-4 blank	0
I-1 – I-2	3

*Zero in this column indicates an original page

TECHNICAL MANUAL
No. 9-4931-710-14&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 15 AUGUST 1986

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL (Including Repair Parts and Special Tools List) for ALINEMENT DEVICE: M139 (RADIOACTIVE) (4931-01-048-5834) M139A1 (NONRADIOACTIVE) (4931-01-472-6621) and ALINEMENT DEVICE WITH CASE: M140 (RADIOACTIVE) (4931-01-187-9713) M140A1 (NONRADIOACTIVE) (4931-01-472-7329) and ALINEMENT DEVICE WITHOUT CASE: M140 (RADIOACTIVE) (4931-00-341-5119) M140A1 (NONRADIOACTIVE) (4931-01-472-6622) and ALINEMENT DEVICE WITHOUT CASE: M154 (NONRADIOACTIVE) (4931-01-516-1430)

Current as of x-xxxxx-xx for Appendix C

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028-2 (Recommended Changes to Equipment Technical Publications), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is https://aeps.ria.army.mil. If you need a password, scroll down and click on "ACCESS REQUEST FORM". The DA Form 2028 is located in the ONLINE FORMS PROCESSING section of the AEPS. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or E-mail your letter, DA Form 2028, or DA Form 2028-2 direct to: Commander, U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-LC-CIP-WT, Rock Island, IL 61299-7630. The email address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

TABLE OF CONTENTS

TABLE OF CONTENTS - CONTINUED

HOW TO USE THIS MANUAL

This manual describes the operator, organizational, direct support, and general support maintenance procedures for the M139/M139A1/M140/M140A1/M154 alinement device. Before beginning any maintenance tasks on the M139/M139A1/M140/M140A1/M154 alinement device, you should become thoroughly familiar with this manual.

OVERVIEW

This manual is organized by chapters, sections, and appendixes. A summary follows.

Front cover index gives you a quick reference to sections and appendixes.

Warnings - All warnings you should observe while working on the alinement device are on the warning page and repeated where they apply.

Table of Contents - The contents of the chapters and appendixes are listed here.

Chapter 1 – This chapter contains general information about the alinement device. It also shows and describes major components and lists specific data that you will find helpful while performing tasks.

Chapter 2 - This chapter describes alinement device inspection, troubleshooting, and maintenance procedures that must be performed upon receipt of equipment.

Appendix A - This appendix lists the technical manuals and other publications that may be required while performing maintenance on the alinement device.

Appendix B - This appendix lists the spares that may be required to maintain the alinement device.

Appendix C - This appendix lists the expendable/durable supplies and materials list required to perform maintenance on the alinement device.

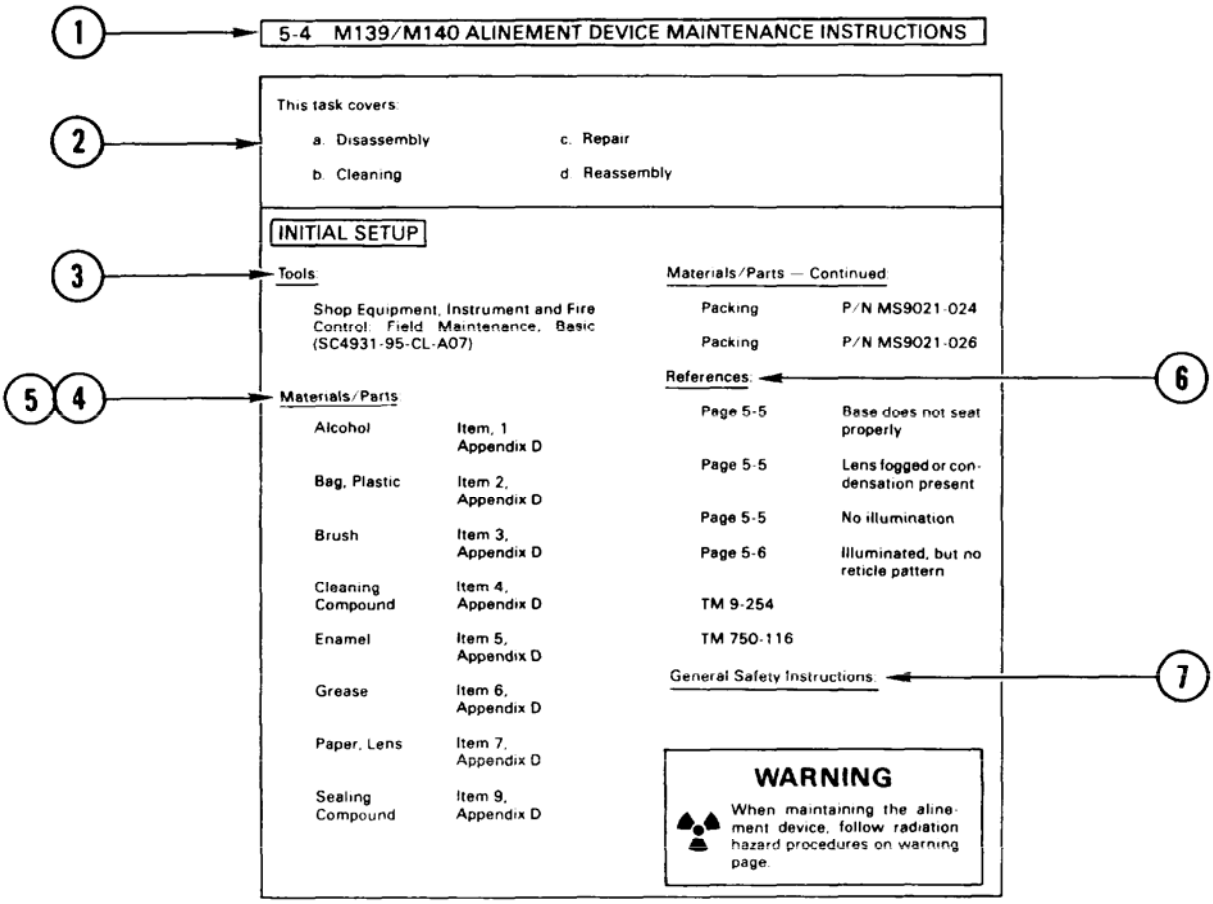
Index - The index is an alphabetical listing of the contents of this manual.

Back Cover - The inside back cover contains a metric conversion table.

USING THE MANUAL ON THE JOB

Find the task or components that needs repair by using the Index (p Index 1), then turn to the page listed for that task or component.

Read the INITIAL SETUP procedures, and gather the necessary items. Pay attention to the warnings. The INITIAL SETUP sheet is described on page iv.



1. TITLE – This is the name of the task.

2. TASKS – This lists all the tasks included in the module.

3. TOOLS – These are the tools and equipment you will need to do the task.

4. MATERIALS – These are the supplies you will need to do the task.

5. PARTS – If parts are required, they are listed here by nomenclature and either part number or national stock number

6. REFERENCES – These are troubleshooting and other technical publications that you need to help do the task

7. GENERAL SAFETY INSTRUCTIONS – These are the safety precautions that must be observed while you are doing the task.

CHAPTER 1

INTRODUCTION

CHAPTER INDEX

Section I. GENERAL INFORMATION

1-1 SCOPE

a. Type of Manual: Operator, Organizational, Direct support and General Support Maintenance.

b. Model Numbers and Equipment Names:

(1) M139/M139A1 Alinement Device

(2) M140/M140A1 Alinement Device

(3) M154 Alinement Device

c. Purpose of Equipment: Verify boresight retention of artillery pieces.

1-2 MAINTENANCE FORMS, RECORDS, AND REPORTS

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS) as contained in the Maintenance Management Update.

1-3 DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

The alinement device must be destroyed in a way that same essential parts, on like equipment, cannot be used to construct one complete unit from damaged ones (TB 43-0197).

WARNING

The radioactive material used in this equipment is tritium gas (H_3). If skin contact is made with any area contaminated with tritium, immediately wash with nonabrasive soap and water.

1-4 PREPARATION FOR STORAGE OR SHIPMENT

For information and procedures for administrative storage of equipment, refer to TM 740-90-1, Administrative Storage of Equipment. For specific procedures for radioactively illuminated fire control equipment, refer to SB 740-95-700, Storage Serviceability Standards for AMCCOM Materiel for Fire Control Items, and TB 43-0197, Instruction for Safe Handling, Maintenance, Storage, and Disposal of Radioactive Items Managed by U.S. Army Armament Materiel Readiness Command.

1-5 OFFICIAL NOMENCLATURE, NAMES, AND DESIGNATIONS

a. Nomenclature Cross-Reference List:

Common Name	Official Nomenclature
Alinement Device	M139/M139A1/M140/M140A1/M154 Alinement Device
Cap	Air Valve Cap
Lever	Manual Control Lever
Objective Cell Assembly	Optical Cell Assembly
Objective Lens	Optical Instrument Lens
Ring Retainer	Optical Element Retainer
Reticle Cell Assembly	Optical Cell Assembly
Reticle Lens	Optical Instrument Lens
Strap	Retaining Strap
Valve Stem	Purging Valve Stem

b. List of Abbreviations:

Abbreviation:	Definition
mm	Millimeter
cm	Centimeter
m	Meter
in	Inch
kg	Kilogram
lb	Pound

1-6 REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR'S)

EIR's will be prepared using SF Form 368 (Quality Deficiency Report). Instructions for preparing EIR's are provided in DA PAM 738-750, The Army Maintenance Management System. EIR's should be mailed directly to: Commander, U.S. Army Armament, Munitions, and Chemical Command, ATTN: AMSMC-QAD, Rock Island, IL 61299-6000. A reply will be furnished to you.

Section II. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

1-7 COMMON TOOLS AND EQUIPMENT

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

1-8 SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

Special tools, TMDE, and support equipment required and authorized for repair of the M139/M139A1/M140/M140A1/M154 alinement devices are listed in the Repair Parts and Special Tools List, Appendix C of this manual.

1-9 SPARES AND REPAIR PARTS

Spares and repair parts are listed and illustrated in the Repair Parts and Special Tools List, Appendix C of this manual.

Section III. EQUIPMENT DESCRIPTION AND DATA

1-10 EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

The M139 and M140 alinement devices are small and lightweight. They have a built-in radioisotopetritium (H_3) light source for both day and night operations. The M139A1, M140A1 and M154 alinement devices are small and lightweight. They are illuminated with a battery pack with an ultra low power light emitting diode (LED) with one (1) AA cell lithium battery with an on and off switch. Both alinement devices quickly clamp on to artillery piece dovetails to verify the alinement of fire control components to cannon tubes in the field. The M139 alinement device is used on M198 towed howitzer, and the M140 alinement device is used on the M102 and M119A1 towed howitzers and M109 self-propelled howitzer. The M154 Alinement device is used on the M777 towed howitzer.

1-11 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

(1) Objective Cell Assembly (1), The two viewing lenses are located in this assembly.

(2) Valve Stem (2). The valve stem is the attachment point for the nitrogen purging hose (4).

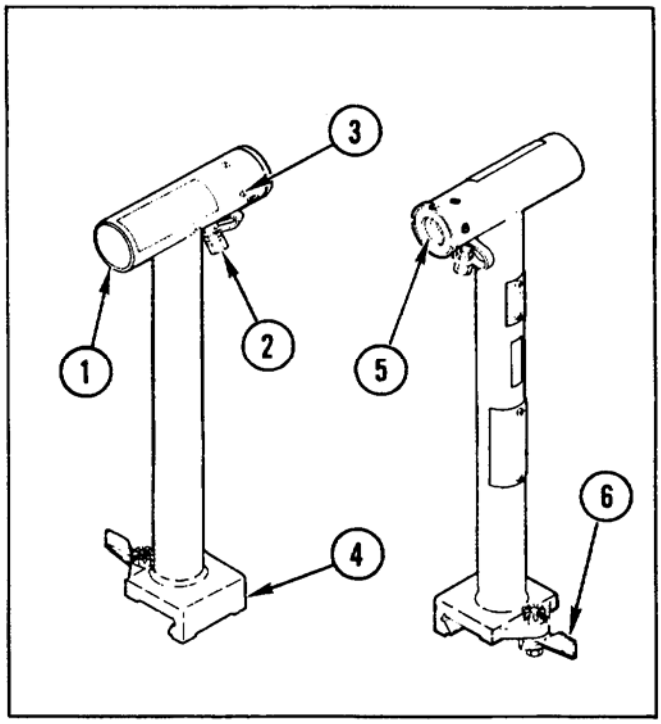
(3) Bleed Screw (3). Outlet port for purged nitrogen.

(4) Base (4). Mounting point with weapon dovetail.

(5) Reticle Cell Assembly (5). Contains the radioactive reticle and light source.

(5) Reticle Cell Assembly (5). Contains the battery pack.

(6) Lever (6). Secures alinement device to dovetail.



1-12 EQUIPMENT DATA

M139 Alinement Device:
- Length ..... 22.30 in. (56.6 cm)
- Width ..... 5.38 in. (13.7 cm)
- Weight ..... 2.96 lbs. (1.343 kg)

M139A1 Alinement Device:
- Length ..... 22.30 in. (56.6 cm)
- Width ..... 5.38 in. (13.7 cm)
- Weight ..... 3.18 lbs. (1.442 kg)

M140 Alinement Device:
- Length ..... 11.80 in. (30.0 cm)
- Width ..... 5.38 in. (13.7 cm)
- Weight ..... 1.90 lbs. (0.862 kg)

M140A1 Alinement Device:
- Length ..... 11.80 in. (30.0 cm)
- Width ..... 5.38 in. (13.7 cm)
- Weight ..... 2.11 lbs. (0.957 kg)

M154 Alinement Device:
- Length ..... 18.00 in. (cm)
- Width ..... 6.50 in. (cm)
- Weight ..... 3.80 lbs. (kg)

CHAPTER 2

OPERATING INSTRUCTIONS

GENERAL

Refer to TM 9-1015-234-10 (M102), TM 9-1015-252-10 (M119A2), TM 9-1025-211-10 (M198), TM 9-1025-215-10 (M777), TM 9-2350-311-10 (M109A2/A5), and TM 9-2350-314-10 (M109A6) for instructions on operation of alinement device.

CHAPTER 3

OPERATOR MAINTENANCE

GENERAL

Refer to TM 9-1015-234-10 (M102), TM 9-1015-252-10 (M119A2), TM 9-1025-211-10 (M198), TM 9-1025-215-10 (M777), TM 9-2350-311-10 (M109A2/A5), and TM 9-2350-314-10 (M109A6) for operator maintenance instructions for the alinement device.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE

GENERAL

Refer to TM 9-1015-234-20&P (M102), TM 9-1015-252-20&P (M119A2), TM 9-1025-211-20&P (M198), TM 9-1025-215-25&P (M777), TM 9-2350-311-20-2 (M109A2/A5), and TM 9-2350-314-20-2 (M109A6) for organizational maintenance instructions for the alinement device.

NOTE

No direct support maintenance is authorized.

CHAPTER 5

GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

CHAPTER INDEX

Section I. INSPECTION

5-1 GENERAL

a. Inspection is performed primarily to determine the following:

(1) Completeness.

(2) The nature of unserviceability.

(3) The work, repair parts, and supplies required to return the materiel to serviceability.

(4) That the work in process is being performed properly.

(5) That completed work complies fully with serviceability standards.

5-1 GENERAL - CONTINUED

b. The alinement device is considered serviceable when:

(1) It is complete and properly performs its intended function.

(2) All modification work orders (MWO'S) have been applied

(3) All defects disclosed by the inspection have been corrected.

(4) The reticle must be visible and readable at a distance of approximately 18 in. (45.7 cm), when placed in a dark area.

c. DA Form 2408-5 and DA Form 2409 list applicable MWO'S.

d. PMCS has been complied with (p 4-1)

5-2 CATEGORIES OF INSPECTION

Categories of inspection define responsibilities:

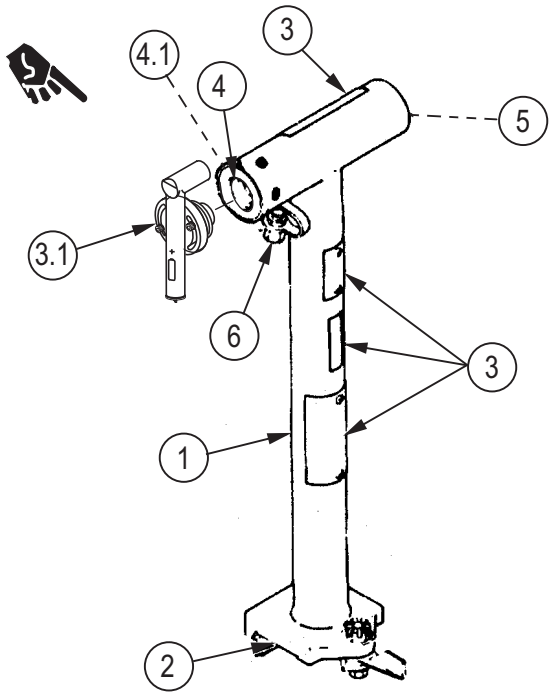
a. An initial inspection is performed immediately on receipt of the alinement device for maintenance. This inspection will determine the amount and type of work to be performed.

b. A final inspection of the alinement device is performed after repairs have been completed to ensure the item meets serviceability standards.

c. Table 5-1 lists initial inspection procedures for the alinement device. Collimation and final inspection procedures are located on page 5-18.

d. Preembarkation inspection procedures are located on page 5-30.

Table 5-1. INITIAL INSPECTION



Item No.	Item To Be Inspected	Procedures
1	ALINEMENT DEVICE	Check for completeness. Check for dents, scuff marks, and missing parts.
2	MOUNTING SURFACE	Check that mounting surface is clean and free of nicks and burrs.
3	DECALS, INSTRUCTION AND IDENTIFICATION PLATES	Check that plates are present and readable.
		Note Place instrument in a dark area, allowing eyes to adjust for approximately 15 minutes.
3.1	ILLUMINATION M139/M140 ONLY	If not illuminated, double bag the item and notify the RSO/RPO immediately.
4	CAP ASSEMBLY	Check that light is visible.
4.1	BATTERY PACK	Check that the light can be turned on and off.
5	LENS CELL	Check that cell is not cracked, chipped, scratched, or missing.
6	PURGING VALVE	Check that valve is present and complete.

Section II. TROUBLESHOOTING

5-3 GENERAL - CONTINUED

CAUTION

Before starting any maintenance procedures, check for illumination in a dark area. If not illuminated, follow the evacuation procedures on the warning page.

a. The symptom index can be used 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. Table 5-2 lists the common malfunctions which may be found during maintenance of the alinement device. Perform the tests/inspections and corrective actions in the order listed.

SYMPTOM INDEX

5-3 GENERAL - CONTINUED

Table 5-2. TROUBLESHOOTING

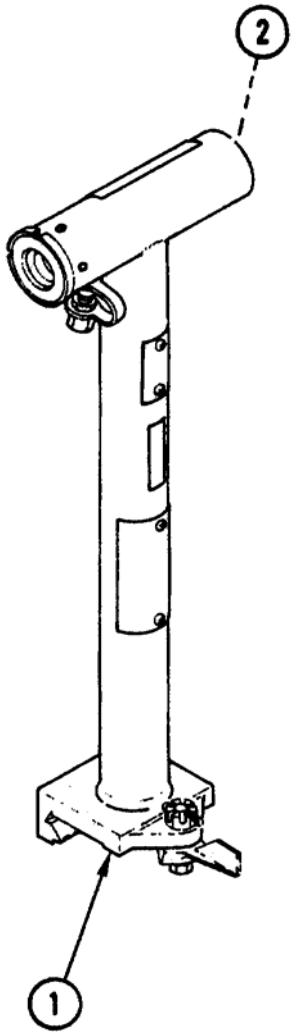
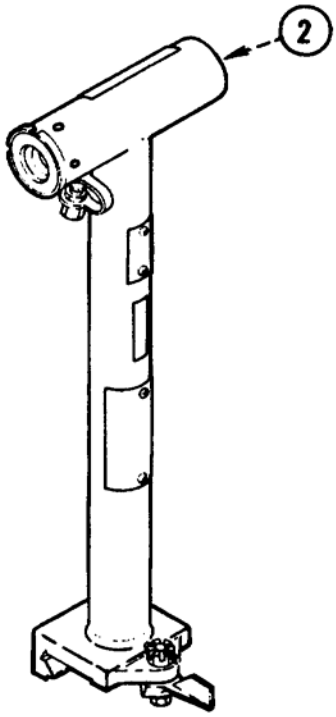
MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	LOCATION
MOUNTING SURFACE 1. BASE (1) DOES NOT SEAT PROPERLY Observe visually. a. Remove nicks and burrs with file. b. Replace lever (p 5-8). **OPTICS** 2. LENS (2) FOGGED OR CONDENSATION PRESENT Check for broken lens or damaged or missing parts. a. Replace defective objective lens (p 5-16). b. Replace damaged or defective parts (p 5-16). c. Purge and charge alinement device with nitrogen (TM 750-116). 3. NO ILLUMINATION M139/M140 **WARNING** When maintaining the alinement device, follow radiation hazard procedures on the warning page.	

Table 5-2. TROUBLESHOOTING - CONTINUED

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	LOCATION
MOUNTING SURFACE 3. NO ILLUMINATION - CONTINUED If not illuminated, double bag the item and notify the RSO/RPO immediately. M139A1/M140A1/M154 Insure the battery is installed. Replace battery. If still not illuminating change the battery pack. **NOTE** The following procedure applies to all versions of the alinement device. 4. ILLUMINATED, BUT NO RETICLE PATTERN Observe visually. a. Replace lens (2) (p 5-10 and 5-13). b. Focus lens (2) (p 5-28).	

Section III. MAINTENANCE PROCEDURES

5-4 M139/M139A1/M140/M140A1/M154 ALINEMENT DEVICE MAINTENANCE INSTRUCTIONS

This task covers:

a. Disassembly

b. Cleaning

c. Repair

d. Reassembly

INITIAL SETUP:

Tools:

Shop Equipment, Instrument and Fire Control: Field Maintenance, Basic (SC 4931-95-A07)

Shop Equipment, Instrument and Fire Control System Repair: Field maintenance (SC 5180-95-B29)

Materials/Parts:

Alcohol	Item 1, Appendix D
Bag, Plastic	Item 2, Appendix D
Brush	Item 3, Appendix D
Cleaning Compound	Item 4, Appendix D
Enamel	Item 5, Appendix D
Grease	Item 6, Appendix D
Paper, Lens	Item 7, Appendix D

Materials/Parts – Continued:

Sealing Compound	Item 8, Appendix D
Packing	P/N MS9021-024
Packing	P/N MS9021-026

References:

Page 5-5	Base does not seat properly
Page 5-5	Lens fogged or condensation present
Page 5-5	No illumination
Page 5-6	Illuminated, but no reticle pattern
TM 9-254	
TM 750-116	

General Safety Instructions:

WARNING

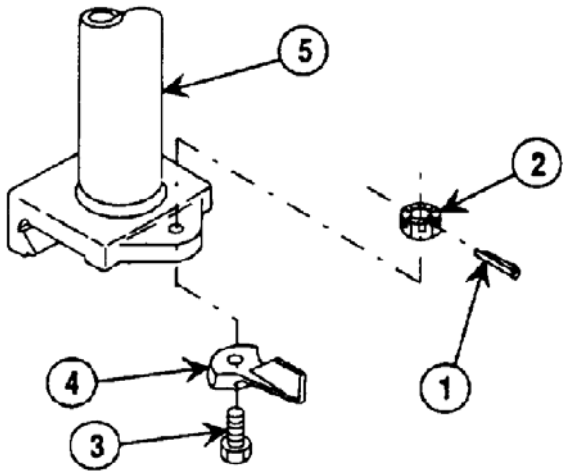
When maintaining the alinement device, follow radiation hazard procedures on warning page.

WARNING

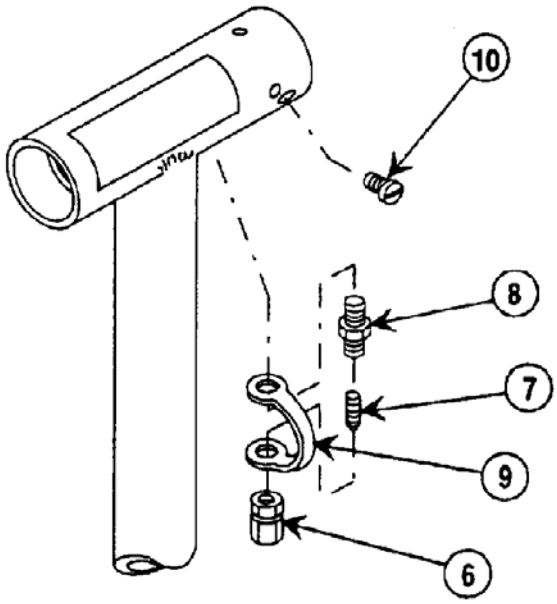
Read and follow all WARNINGS in the WARNING SUMMARY in the front of this manual. Pay careful attention to those concerning Lithium Batteries.

5-4 M139/M139A1/M140/M140A1/M154 ALINEMENT DEVICE MAINTENANCE INSTRUCTIONS-CONTINUED

DISASSEMBLY



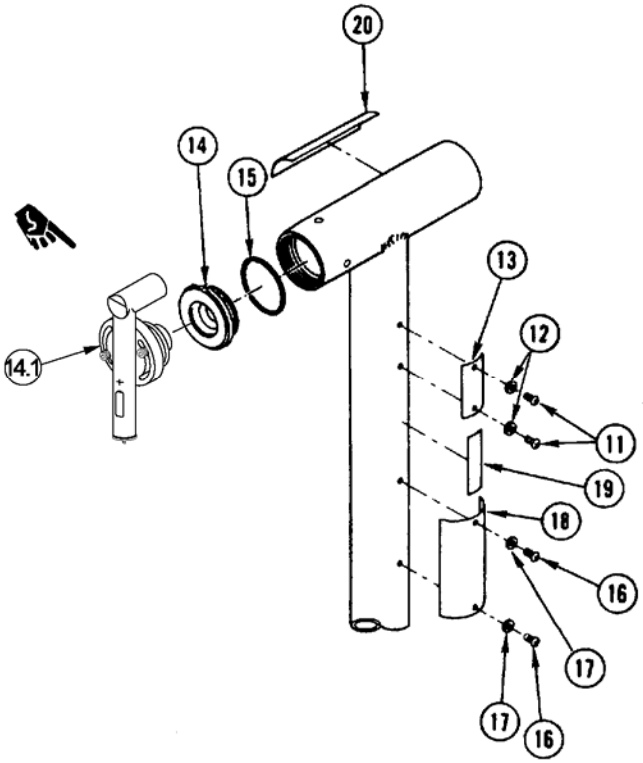
A Remove cotter pin (1), nut (2), screw (3), and lever (4) from alinement device (5).



B Remove cap (6), valve core (7), valve stem (8), strap (9), and screw (10).

5-4 M139/M139A1/M140/M140A1/M154 ALINEMENT DEVICE MAINTENANCE INSTRUCTIONS-CONTINUED

DISASSEMBLY - CONTINUED



NOTE

Authorized to use and repair tritium models but cannot procure a new one.

If tritium ID label is lost (or light source fails) or radioactive ID plate is lost or needs to be replaced, convert device to an A1 model. Remove tritium light source and replace it with ERLS light source, and new ID plate.

WARNING

- The cap assembly contains tritium gas (H3). A radiation hazard will exist if a light source is broken.
- When maintaining alinement device, follow radiation hazard procedures on warning page.

C Remove two screws (11), two washers (12), and instruction plate (13).

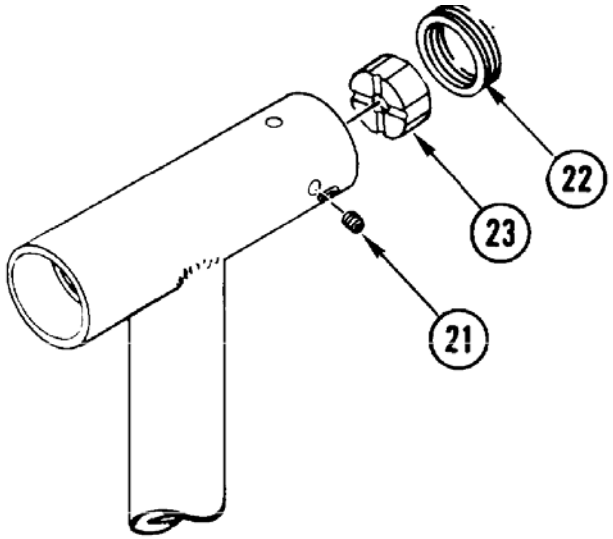
D Remove cap assembly (14 or 14.1) and packing (15) from battery pack. Discard packing.

E Remove two screws (16), two washers (17), and identification plate (18).

F Peel off instruction plate (19) and decal (20).

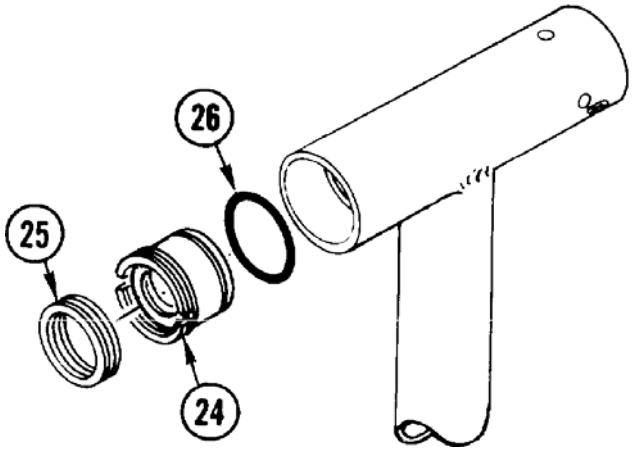
5-4 M139/M139A1/M140/M140A1/M154 ALINEMENT DEVICE MAINTENANCE INSTRUCTIONS-CONTINUED

DISASSEMBLY - CONTINUED



G Remove sealing compound from four setscrews (21).

H Remove four setscrews (21), retainer (22), and cell assembly (23). (Use tubular Spanner wrench 61/64 x 15/16.)



I Measure depth of the objective cell assembly (24) before removal and record measurement.

J Remove retainer (25), cell assembly (24), and packing. Discard packing. (Use tubular spanner wrench 1-11/64 X 1-5/32.)

CLEANING

Clean all parts per TM 9-254.

REPAIR

Repair is by replacement of authorized parts as required (Appendix B).

5-4 M139/M139A1/M140/M140A1/M154 ALINEMENT DEVICE MAINTENANCE INSTRUCTIONS-CONTINUED

REASSEMBLY

NOTE

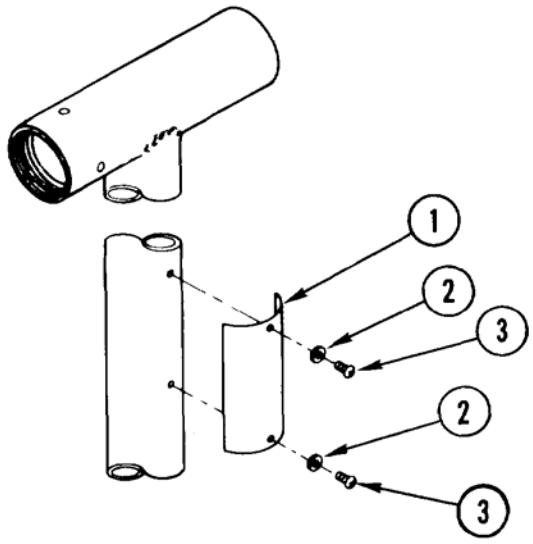
Authorized to use and repair tritium models, but cannot procure a new one except for light source and ID label. If tritium ID label is lost (or light source fails) or radioactive ID plate is lost or needs to be replaced, convert device to a A1 model. Remove tritium light source and replace it with ERLS light source, and new ID plate.

CAUTION

Stamp data on plates prior to installation. Stamping mounted plates could dent body, rendering it unserviceable.

NOTE

Transfer serial number, month and year of manufacture, and identification code of original manufacturer of alinement device to new plate, if replacement is required.



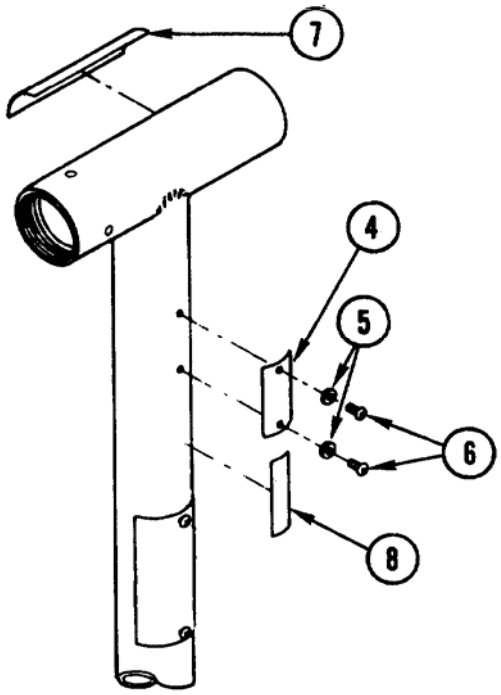
A Stamp plate (1).

B Install plate (1), two washers (2), and two screws (3).

C Cover screws (3) with sealing compound (Item 8, Appendix D).

5-4 M139/M139A1/M140/M140A1/M154 ALINEMENT DEVICE MAINTENANCE INSTRUCTIONS-CONTINUED

REASSEMBLY - CONTINUED



Note

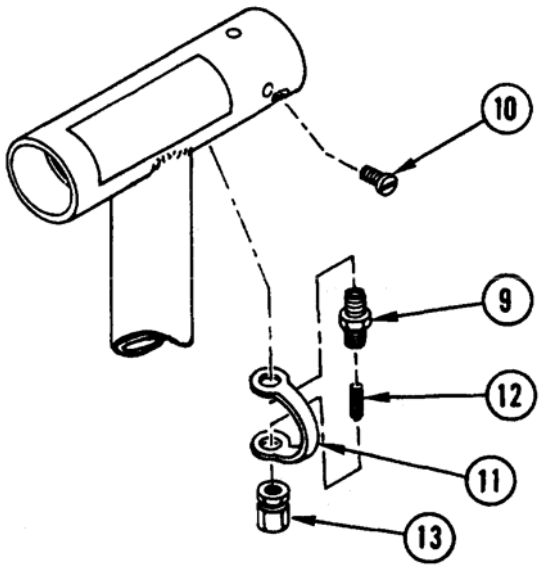
On the M139/M140 the plate must have 3.0 stamped in the curries blank. The month and year of tritium (H_3) used in the cap assembly must be stamped in the date blank. Stamped date shall be 0.063 in. (1.6 mm) high.
On the M139A1/M140A1 the plate is not necessary.

D Stamp plate (4).

E Install plate (4), two washers (5), and two screws (6).

F Install decal (7) and plate (8).

G Cover screws (6) with sealing compound (Item 8, Appendix D).



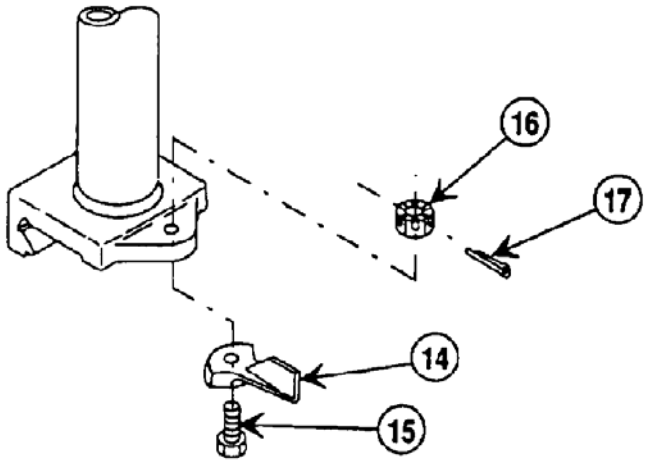
H Apply sealing compound (item 9, Appendix D) to base of valve stem (9).

I Install screw (10), strap (11), valve stem (9), valve core (12), and cap (13).

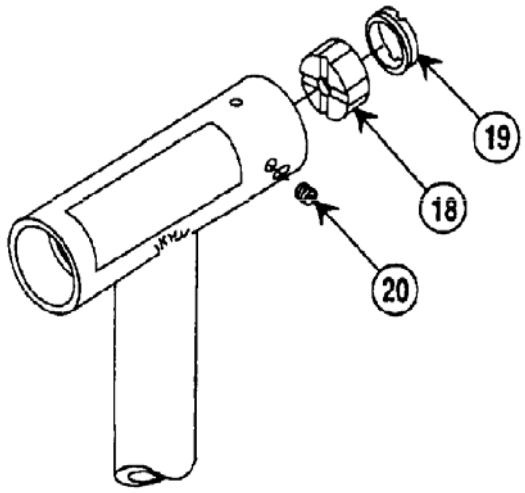
J Paint head of screw (10) and surrounding area with enamel (Item 5, Appendix D).

5-4 M139/M139A1/M140/M140A1/M154 ALINEMENT DEVICE MAINTENANCE INSTRUCTIONS-CONTINUED

REASSEMBLY - CONTINUED



K Install lever (14), screw (15), nut (16), and cotter pin (17).



Note

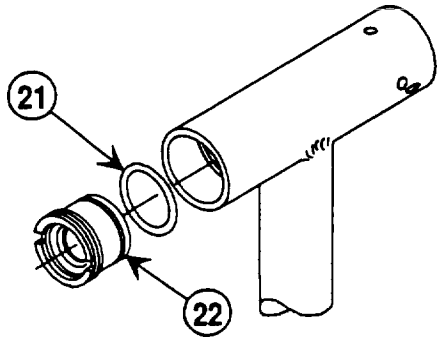
- Reticle must be installed with slotted end inward. Reticle lines should be 44 to 46 degrees from vertical center line of body.
- Cell must be tightened only enough to eliminate end play until alinement device is collimated (p 5-28).

L Install reticle cell assembly (18) and retaining ring (19).

M Install four setscrews (20). Do not tighten.

5-4 M139/M139A1/M140/M140A1/M154 ALINEMENT DEVICE MAINTENANCE INSTRUCTIONS-CONTINUED

REASSEMBLY - CONTINUED



N Coat new packing (21) with a light coat of grease (Item 6, Appendix D).

O Apply a light coat of sealing compound (Item 8, Appendix D) to threads of objective cell assembly (22).

P Install objective cell assembly (22) to the depth measured in step I, page 5-10.

5-5 RETICLE CELL ASSEMBLY MAINTENANCE INSTRUCTIONS

This task covers:

a. Disassembly

b. Cleaning

c. Repair

d. Reassembly

INITIAL SETUP:

Tools:

Shop Equipment, Instrument and Fire Control: Field Maintenance, Basic (SC 4931-95-A07)

Materials/Parts

Cleaning Compound	Item 4, Appendix D
Sealing Compound	Item 8, Appendix D

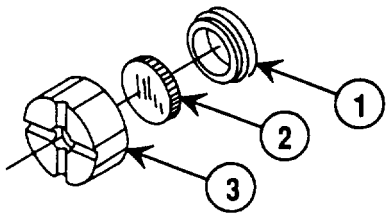
References:

TM 9-254

TM 750-116

5-5 RETICLE CELL ASSEMBLY MAINTENANCE INSTRUCTIONS-CONTINUED

DISASSEMBLY



Remove retaining ring (1) and sealing compound from reticle (2) and cell (3). Remove reticle (2) from cell (3).

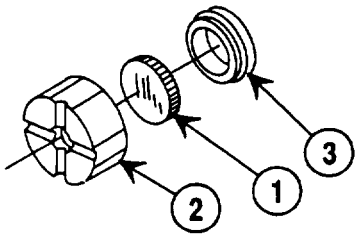
CLEANING

Clean all(parts per TM 9-254.

REPAIR

Repair is by replacement of authorized parts as required (Appendix C).

REASSEMBLY



Note

The etched face of the reticle must face slotted side of cell. Aline reticle lines 44 to 46 degrees from center lines of slots.

A Install reticle (1) in cell (2) and position the reticle to 45°.

B Apply sealing compound (Item 8, Appendix D) to three places, securing reticle (1) to cell (2).

C Install retaining ring (3) and apply sealing compound to cell (2) and retaining ring (3) in two places.

5-6 OBJECTIVE CELL ASSEMBLY MAINTENANCE INSTRUCTIONS I

This task covers:

a. Disassembly

b. Cleaning

c. Repair

d. Reassembly

INITIAL SETUP:

Tools:

Shop Equipment, Instrument and Fire Control: Field Maintenance, Basic (SC 4931-95-A07)

Materials/Pqrts:

Cleaning Compound	Item 4, Appendix D
Sealing Compound	Item 8, Appendix D

Materials/Parts--Continued

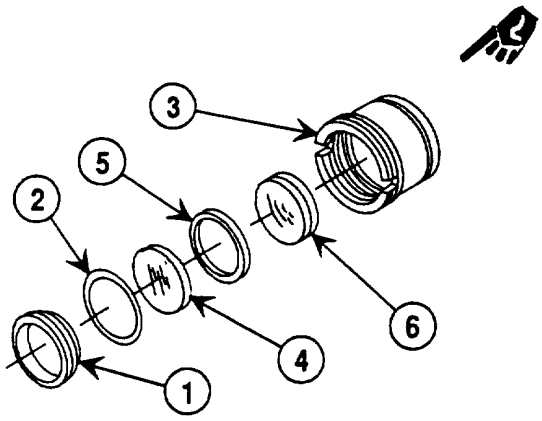
Packing	P/N 10547018-2

References:

TM 9-254

TM 750-116

DISASSEMBLY



Note

Optics sealed into the cell assembly may have to be removed using an arbor press.

A Remove retaining ring (1) and packing (2) from cell (3). Discard packing.

B Remove objective lens (4), spacer (5), and objective lens (6) from cell (3).

5-6 OBJECTIVE CELL ASSEMBLY MAINTENANCE INSTRUCTIONS-CONTINUED

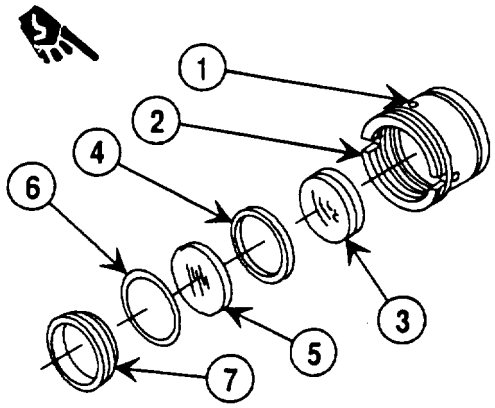
CLEANING

Clean all parts per TM 9-254.

REPAIR

Repair is by replacement of authorized parts as required (Appendix C).

REASSEMBLY



Note

If the four sealant holes have not been drilled in the cell, begin with step A. If they are present, proceed to step C.

A Drill four 1/8-in. diameter holes (1) in cell (2) 9/16 inch from the threaded end.

Note

Burrs must be removed from the inside diameter of the cell, to ensure the objective lens can be positioned properly.

B Burr four holes (1).

C Install objective lens (3) in cell (2), concave side first.

D Install spacer (4), flat side out.

E Install objective lens (5) with flat side against spacer (4).

F Spot sealing compound in four places, equally spaced, to secure objective lens (5) to inside diameter of cell (2).

G Apply a coat of grease (Item 6, Appendix D) to new packing (6). Install new packing (6) and retaining ring (7).

H Secure objective lens (3) in place by applying sealing compound to lens (3) through four holes (1).

Section IV. COLLIMATION

5-7 GENERAL

This section describes the setup and use of the collimation standard to focus and inspect the alinement device.

5-8 COLLIMATION AND INSPECTION

This task covers:

a. Setting up and adjusting the collimation standard

b. Focusing the alinement device.

INITIAL SETUP

Test Equipment:

Azimuth Test Fixture	P/N 7691596
Collimation Standard	P/N 9388622
Dial Indicator	P/N MIL-1-18422
Infinity Collimator	P/N 5549108
Mirror	P/N 10558251
V-blocks	P/N GGG-V-191

Tools:

Shop Equipment, Instrument and Fire Control: Field Maintenance, Basic (SC 4931-95-A07)

Tools - Continued:

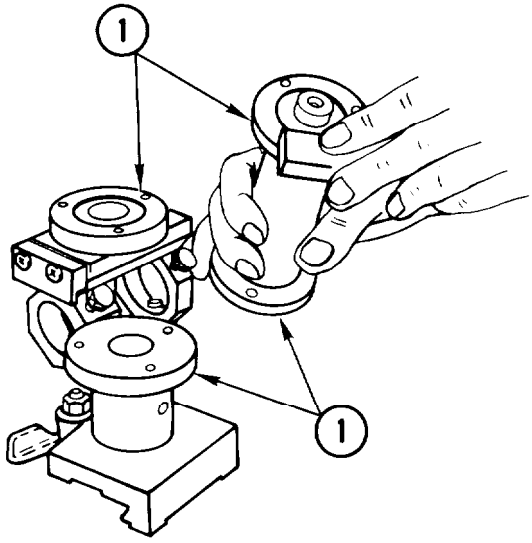
Shop Equipment, Instrument and Fire Control System Repair: Field Maintenance (SC 5180-95-B29)

Materials:

Stone	Item 9, Appendix D
Sharpening	
Masking Tape	Item 10, Appendix D

5-8 COLLIMATION AND INSPECTION — CONTINUED

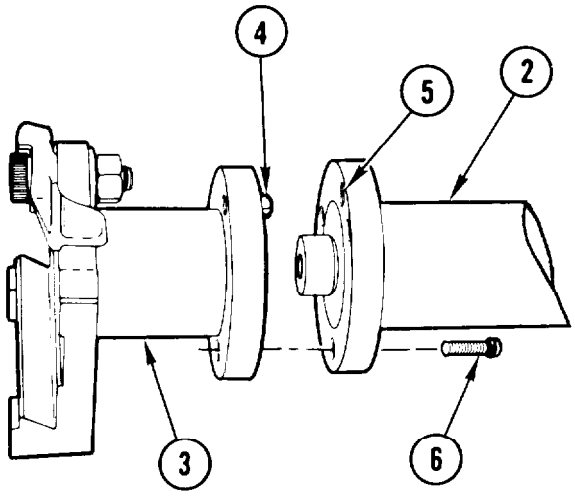
SETTING UP COLLIMATION STANDARD



CAUTION

Stone surface only enough to assure a burr-free surface.

A Using sharpening stone (Item 9, Appendix D), remove any burred or raised edges from surfaces (1).

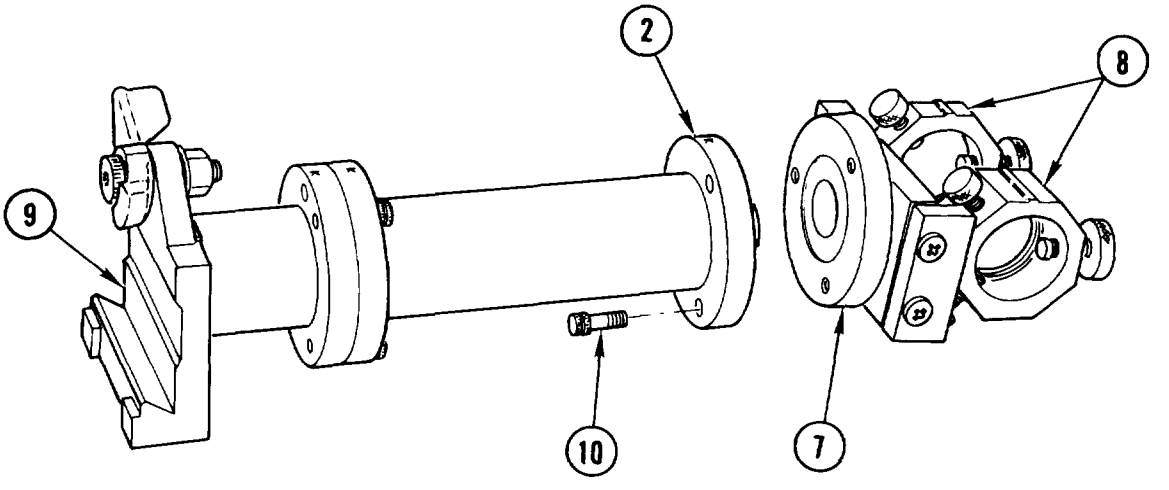


B Install collimation standard (2) to base (3) by alining pin (4) to hole (5).

C Install three screws (6) and tighten.

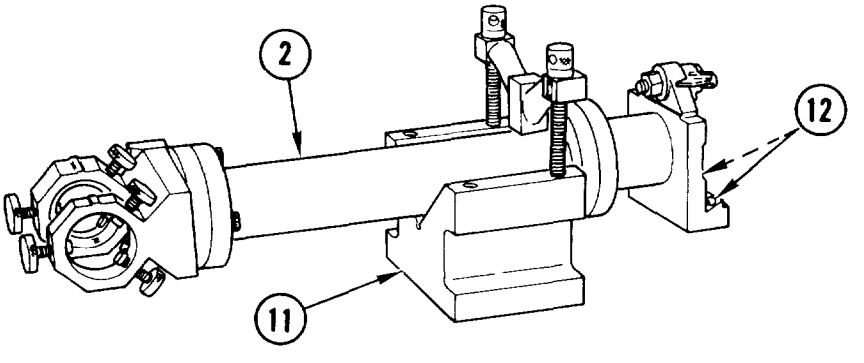
5-8 COLLIMATION AND INSPECTION — CONTINUED

SETTING UP COLLIMATION STANDARD — CONTINUED



D Install head assembly (7) to collimation standard (2). Make sure ground surfaces (8) is parallel to locating dovetail (9).

E Install three screws (10), tighten lightly.



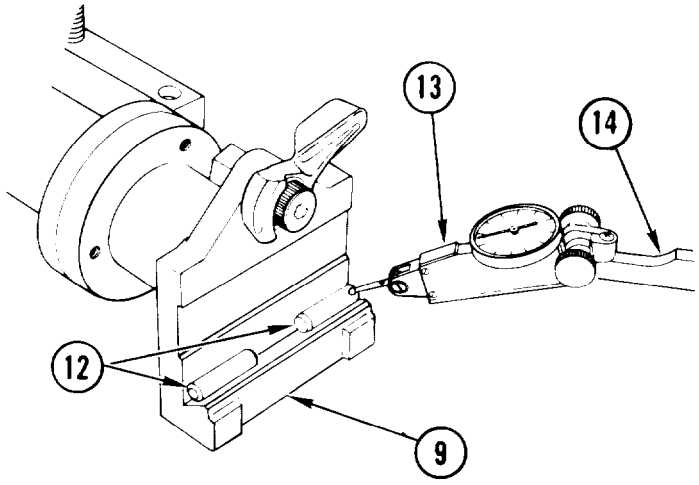
Note

- Use two V-blocks when setting up Ml 39 standard.
- Dowel pins are matched and should not be separated.

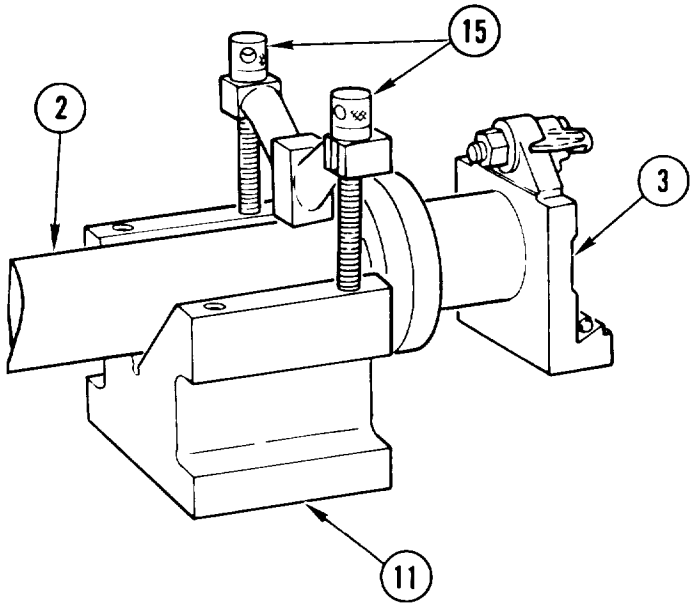
F Set collimation standard (2) on V-block(s) (11) with dovetail positioned to accept the two 1/4 in. (6.4 mm) dowel pins (12).

5-8 COLLIMATION AND INSPECTION — CONTINUED

SETTING UP COLLIMATION STANDARD — CONTINUED



G Using a 0.0001 in. (0.0025 mm) dial indicator (13), mounted on a height gage (14), indicate over top of dowel pins (12) and level dovetail (9).



Note

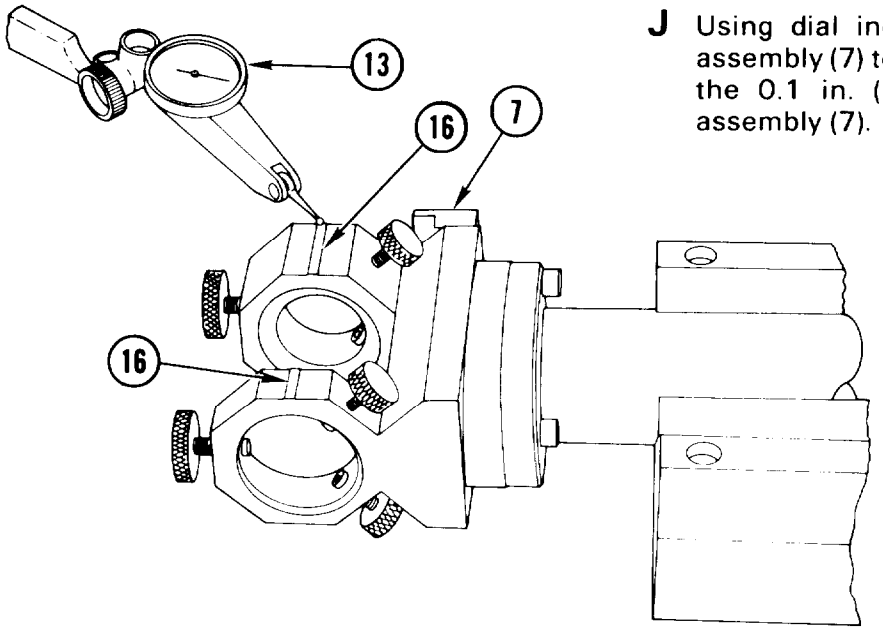
If M139 standard is being assembled, clamp only the V-block next to the base.

H Turn screws (15) to clamp collimation standard (2) in V-block (11).

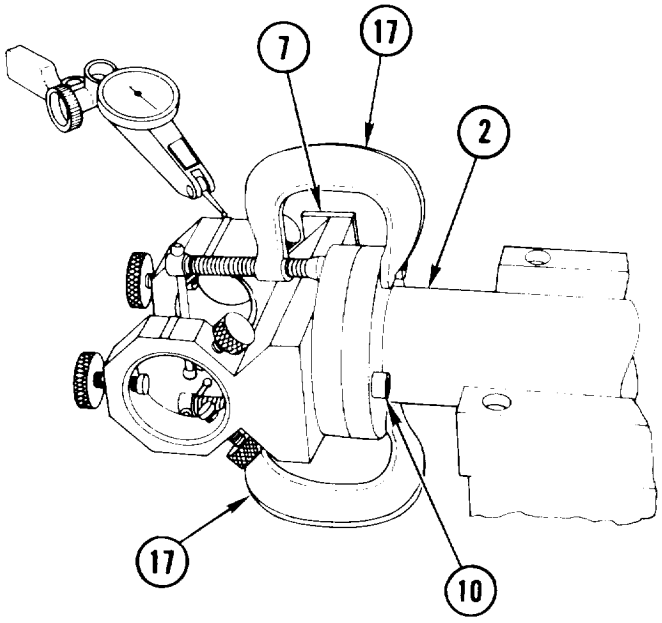
I Recheck base (3) for level. If base (3) is within 0.0002 to 0,0003 in. (0.0050 to 0.0076 mm) of level or better, leave as is. If worse, loosen screws (15) and repeat steps G and H.

5-8 COLLIMATION AND INSPECTION — CONTINUED

SETTING UP COLLIMATION STANDARD — CONTINUED



J Using dial indicator (13), level the head assembly (7) to the base by measuring over the 0.1 in. (2.5 mm) rise (16) of head assembly (7).



Note

If the base was not perfectly zero over the two pins, level the head with the same amount of offset, i.e. (base 0.0000 in. over one pin and 0.0002 in. (0.0050 mm) over the second pin). Then the head should be set the same. There is a 0.0002 in. (0.0050 mm) tolerance for parallelism between the head and the dovetail, but the closer to zero, the more accurate the collimation standard will be.

K Clamp head assembly (7) and collimation standard (2) together with two clamps (17) to hold steady.

L Recheck parallelism of standard.

M Tighten three screws (10) and remove two clamps (17).

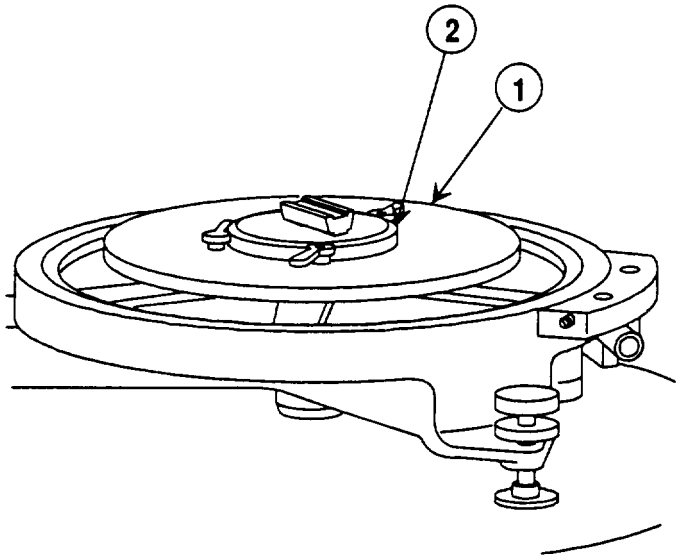
5-8 COLLIMATION AND INSPECTION - CONTINUED

SETTING UP COLLIMATION STANDARD - CONTINUED

N Recheck all levels to be sure all tolerances are within 0.0002 in. (0.0050 mm). If not, repeat steps G thru M until parallelism requirements are met.

O Remove collimation standard from V-block(s).

COLLIMATION OF AZIMUTH TEST FIXTURE



A Remove any components attached to azimuth text fixture (1).

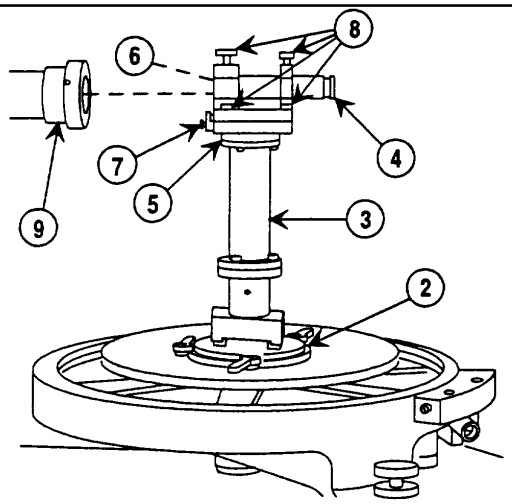
B Check for burrs and remove with sharpening stone (Item 9, Appendix D).

C Install dovetail adapter (2), part of alinement device collimation standard (P/N 9388647), onto test fixture (1).

D Level azimuth test fixture (1).

5-8 COLLIMATION AND INSPECTION - CONTINUED

COLLIMATION OF AZIMUTH TEST FIXTURE - CONTINUED



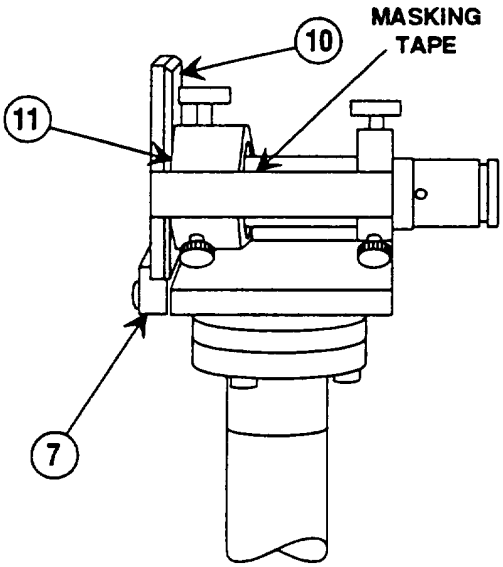
E Install collimation standard (3) to dovetail adapter (2).

F Roll test infinity collimator (4).

Note

If collimator fits loosely in head assembly, center the objective end of the collimator.

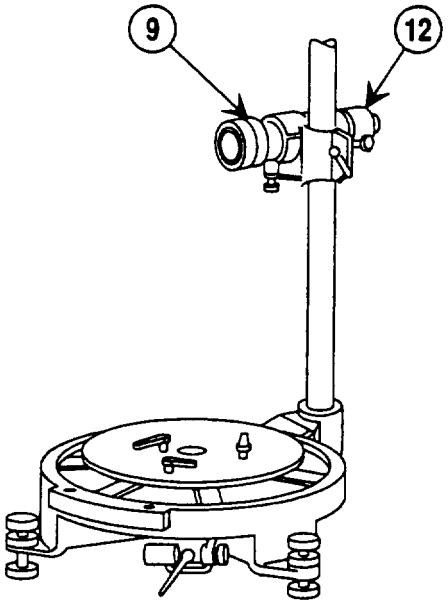
G Install infinity collimator (4) to head assembly (5). Objective end (6) should face mirror shelf (7) but not extend past ground mirror surface. Lightly tighten screws (8). Aline reticles of infinity collimator (4) and projector collimator (9).



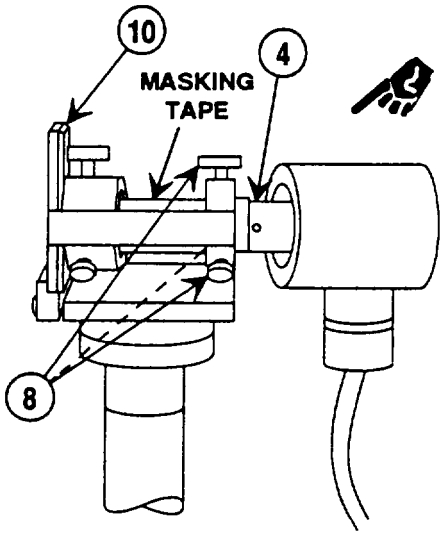
H Install front surface mirror (10) against ground surface (11) and clamped on mirror shelf (7). Secure mirror (10) with masking tape (Item 10, Appendix D).

5-8 COLLIMATION AND INSPECTION - CONTINUEDI

COLLIMATION OF AZIMUTH TEST FIXTURE - CONTINUED



I Remove lighted beam splitter (12) from collimator telescope (9).



Note

- Plumb infinity collimator prior to auto collimating.
- Make sure mirror is tightly in place.

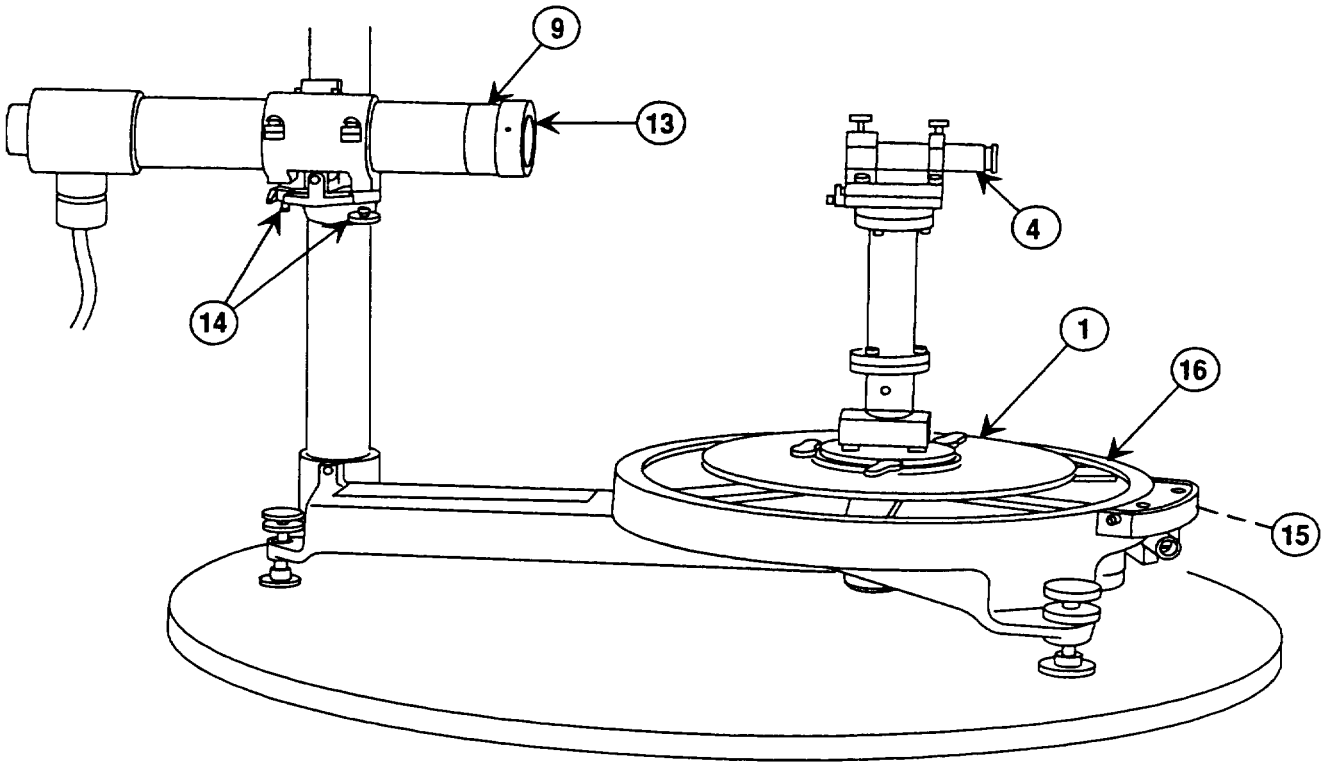
J Auto collimate the infinity collimator (4) by looking through back side of projector collimator.

K Adjust screws (8), on projector collimator and superimpose reticles.

L Remove masking tape (Item 10, Appendix D) and front surface mirror (10).

5-8 COLLIMATION AND INSPECTION - CONTINUED

COLLIMATION OF AZIMUTH TEST FIXTURE - CONTINUED



M If necessary, rotate azimuth test fixture (1) so infinity collimator (4) faces projector collimator (9).

N Raise or lower projector collimator (9) to aline with infinity collimator (4). Set projector collimator objective cell (13) to infinity.

Note

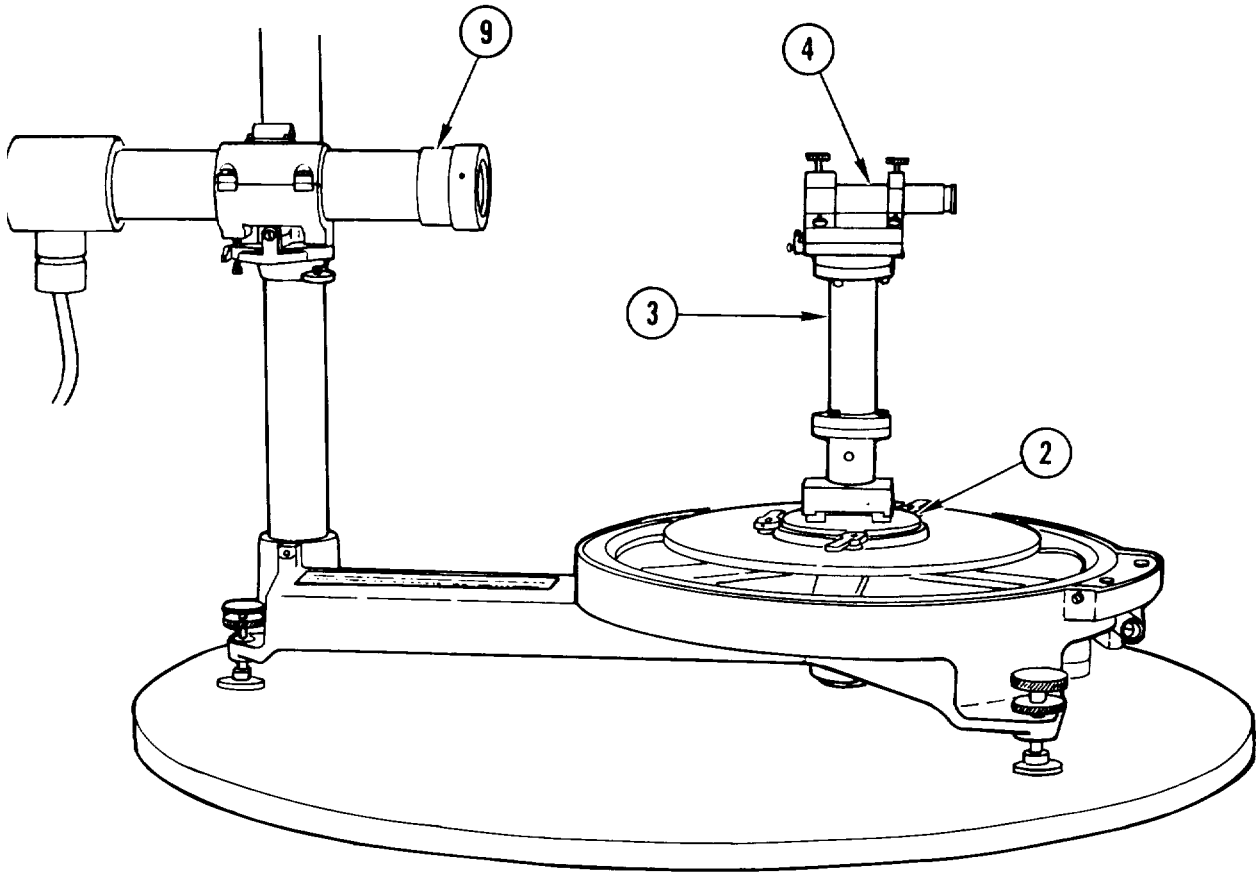
Position the projector collimator (9) so that while sighting through the infinity collimator (4), the field of view is centered on the projector collimator (9).

O Lock the azimuth test fixture (1) and height adjustment of projector collimator (9).

P Using tilt adjustment (14) on the projector collimator (9) and the fine adjustment knob (15) on the azimuth scale (16), sight through infinity collimator (4) and superimpose the two reticles.

5-8 COLLIMATION AND INSPECTION — CONTINUED

COLLIMATION OF AZIMUTH TEST FIXTURE — CONTINUED



Q Set projector collimator (9) to approximately 80 meters and recheck that the two retitles remain superimposed.

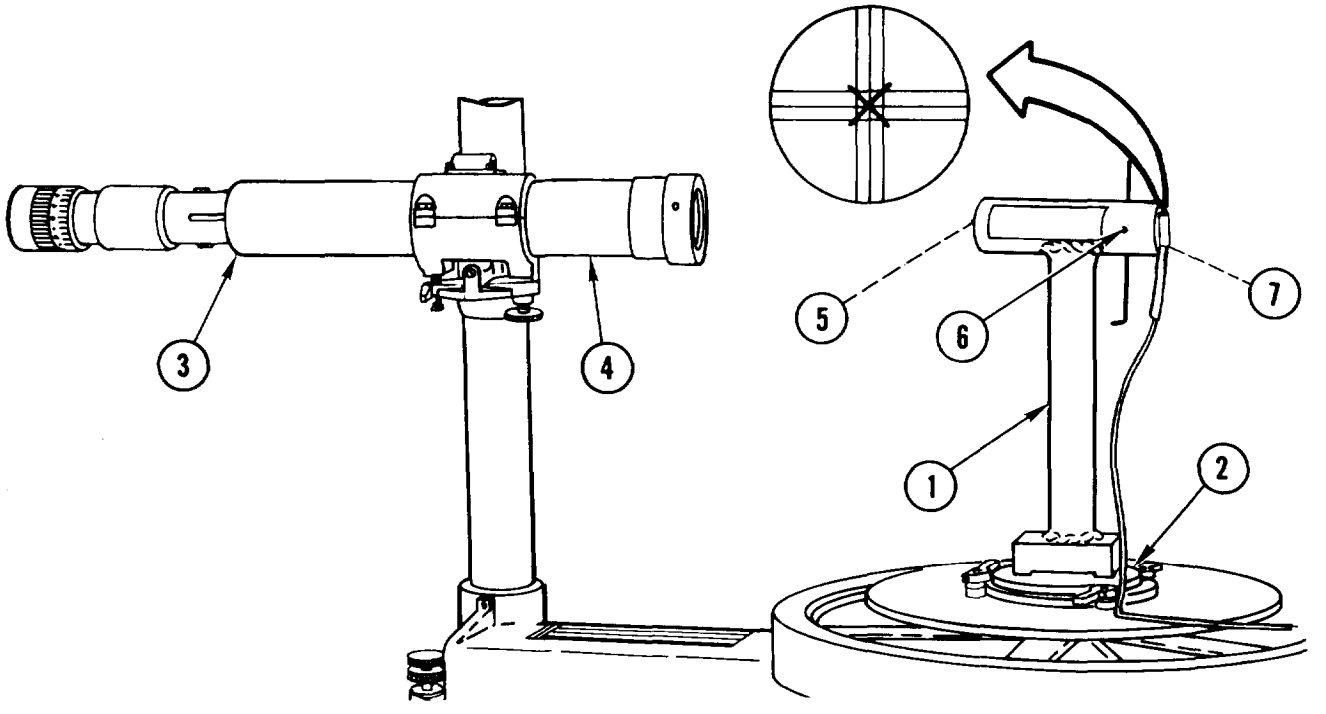
Note

It may be necessary to adjust the objective end of the infinity collimator (4) to eliminate any parallax between the two collimators. If the two retitles do not remain superimposed after elimination of parallax, it will be necessary to reautocollimate the collimation standard (3).

R Remove collimation standard (3) from dovetail adapter (2).

5-8 COLLIMATION AND INSPECTION — CONTINUED

COLLIMATION OF ALINEMENT DEVICE



W A R N I N G

The cap assembly contains tritium gas (H_3). A radiation hazard will exist if light source is broken. Follow radiation hazard procedures on warning page.

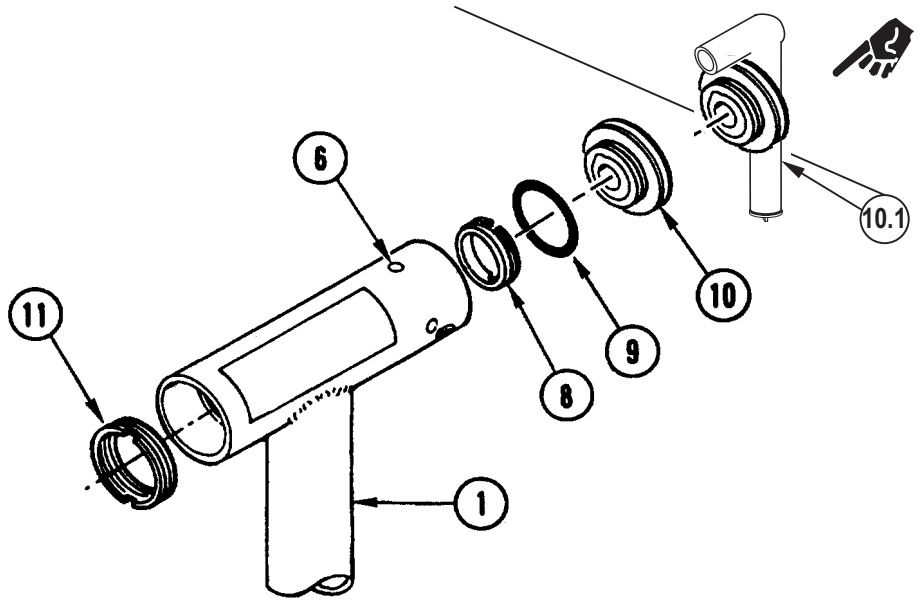
A Install alinement device (1) on dovetail adapter (2).

B While looking through the dioptometer (3), at the back of the projector collimator (4), adjust the objective cell (5), in or out, to remove parallax.

C While looking through the backside of projector collimator (4), adjust four set screws(6) until the alinement device reticle (7) becomes superimposed with the projector collimator reticle.

5-8. COLLIMATION AND INSPECTION – CONTINUED

COLLIMATION OF ALINEMENT DEVICE – CONTINUED



D Install retaining ring (8) and spot seal in two places with sealing compound (Item 8, Appendix D).

E Apply sealing compound (Item 8, Appendix D) to the top of four setscrews (6).

F Coat new packing (9) with a light coat of grease (Item 5, Appendix D).

G Install packing (9) and cap assembly (10 or 10.1) on battery pack and spot seal in two places with sealing compound (Item 8, Appendix D).

H Install retaining ring (11) and spot seal in two places with sealing compound (Item 8, Appendix D).

I Remove alinement device (1).

J Purge and charge alinement device (TM 750-116).

Section V. PREEMBARKATION INSPECTION PROCEDURES

5-9 GENERAL

a. The alinement device must be inspected for outward appearance, mechanical condition, and proper operation.

b. The alinement device must approach new equipment standards of operation and appearance. The workmanship and quality must reflect the highest standards obtainable.

5-10 SPECIFIC INSTRUCTIONS

The alinement device must conform to the following specifications for oversea shipment:

a. The lenses and reticle must be free from scratches, pits, and chips, that will affect optical performance.

b. The dovetail lever must operate smoothly.

c. The reticle must be visible and readable at a distance of approximately 18 in. (45.7 cm), when placed in a dark area.

d. General appearance and condition of alinement device.

(1) All parts must be present and free from defects.

(2) Optics shall be free of internal dirt and moisture. Presence of such contamination shall render alinement device rejected.

(3) All plates and decals shall be present and legible.

Alinement devices failing to meet requirements of the above inspections is unsatisfactory for oversea shipment.

APPENDIX A

REFERENCES

A-1 TECHNICAL MANUALS

TM 750-116 ..... General Procedures for Purging and Charging of Fire Control Instruments

TM 750-244-6..... Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use (U.S. Army Tank-Automotive Command)

TM9-1015-234-10 ..... Operator's Maintenance Manual for Howitzer, Light, Towed: 105-mm, M102 (NSN 1015-00-086-8164)

TM9-1015-252-10 ..... Operator's Maintenance Manual for Howitzer, Light, Towed: 105-mm, M119A2 (NSN 1015-01-482-4914)

TM9-1015-234-20&P..... Organizational Maintenance Manual (Including Repair Parts and Special Tools List) for Howitzer, Light, Towed: 105-mm, M102 (NSN 1015-00-086-8164)

TM9-1015-252-20&P..... Organizational Maintenance Manual (Including Repair Parts and Special Tools List) for Howitzer, Light, Towed: 105-mm, M119A2 (NSN 1015-01-482-4914)

TM9-1015-234-34P ..... Direct and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Howitzer, Light, Towed: 105-mm, M102 (NSN 1015-00-086-8164)

TM9-1015-252-34P ..... Direct and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Howitzer, Light, Towed: 105-mm, M119A2 (NSN 1015-01-482-4914)

TM9-1025-211-10 ..... Operator's Manual (crew) for Howitzer, Medium, Towed: 155-mm, M198 (NSN 1025-01-026-6648)

TM9-1025-211-20&P..... Organizational Maintenance Manual (Including Repair Parts and Special Tools List) for Howitzer, Medium, Towed, 155-mm: MI 98 (1 025-01 -026-6648)

TM9-1015 -252-34 ..... Direct and General Support Maintenance Manual for Howitzer, Medium, Towed: 155-mm, M119A2 (NSN 1015-01-482-4914)

TM9-1025 -211-34 ..... Direct and General Support Maintenance Manual for Howitzer, Medium, Towed: 155-mm, M198 (NSN1025-01-026-6648)

TM9-1025-211-34P ..... Direct and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools List) for Howitzer, Medium, Towed: 155-mm, M198 (NSN 1025-01-026-6648)

TM 9-1025-215-10 ..... Operator's Manual For Howitzer, Medium Towed: 155-mm, M777 (NSN 1025-01-445-0991) and Howitzer, Medium Towed: 155-mm, M777A1 (NSN TBD)

TM 9-1025-215-25&P..... Unit, Direct Support and General Support Maintenance Manual (Including Repair Parts and Special Tools List) for Howitzer, Medium, Towed: 155mm, M777 (NSN 1025-01-445-0991) and Howitzer, Medium, Towed: 155mm, M777A1 (NSN TBD)

A-1 TECHNICAL MANUALS – CONTINUED

TM9-2350-311-10 ... Operator's Manual For Howitzer, Medium: Self-Propelled, 155-mm, M109A2 (NSN 2350-01-031-0586), M109A3 (2350-01-031-8851), and M109A4 (2350-01-277-5770) M109A5 (NSN 2350-01-281-1719).

TM 9-2350-311-20-2 ..... Unit Maintenance Manual for Cab, Armament, Sighting Fire Control, Elevating And Traversing Systems and Associated Components, Howitzer, Medium, Self-Propelled, 155mm, M109A2 (NSN 2350-01-031-0586) (Eic: 3ez) M109A3 (NSN 2350-01-031-8851) M109A4 (NSN 2350-01-277-5770) M109A5 (NSN 2350-01-281-1719).

TM 9-2350-311-24P-2 ..... Unit, Direct Support and General Support Maintenance Repair Parts And Special Tools List (Including Depot Maintenance Repair And Special Tools) for Cab, Armament, Sighting and Fire Control Elevating and Traversing Systems, and Associated Components Howitzer Medium, Self-Propelled: 155mm, M109A2 (NSN 2350-01-031-0586) M109A3 (2350-01-031-8851) M109A4 (2350-01-277-5770) M109A5 (2350-01-281-1719)

TM9-2350-311-34P-2..... Direct and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Cab, Armament, Sighting and Fire Control, Elevating and Traversing Systems and Associated Components, Howitzer, Medium, Self-Propelled, 155-mm, M109A2 (NSN 2350-01-031-0586) and M109A3 (2350-01-031-8851)

TM 9-2350-314-10..... Howitzer, Medium, Self-Propelled: 155mm, M109A6 (NSN 2350-01-305-0028)

TM 9-2350-314-20-2 ..... Unit Maintenance Manual for Cab Systems and Components Howitzer, Medium, Self-Propelled: 155mm, M109A6 (NSN 2350-01-305-0028)

TM 9-2350-314-24P-2..... Unit, Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts) for Cab and Associated Components of Howitzer, Medium, Self-Propelled: 155mm M109A6 (NSN 2350-01-305-0028)

TM 9-2350-304-34-2 ..... Direct and General Support Maintenance Manual for Howitzer, Heavy, Self-Propelled: 8-inch, M110A2, Armament and Turret Components (2350-01-041-4590)

TM 9-254 ..... General Maintenance Procedures for Fire Control Materiel

A-2 FORMS AND PAMPHLETS

DA Form 2028 .....Recommended Changes to Publications & Blank Forms

DA Form 2028-2 .....Recommended Changes to Equipment Technical Publications

DA Form 2408-5 .....Equipment Modification Record

DA Form 2409 .....Equipment Maintenance Log

DA PAM 738-750.....The Army Maintenance Management System (TAMMS)

FM 4-25.11 .....First Aid

SF Form 368.....Quality Deficiency Report

A-3 SUPPLY CATALOGS

SC 4931 -95-A07 .....Shop Equipment, Instrument and Fire Control: Field Maintenance, Basic

SC 4931-95-J54 .....Fire Control Instrument Purging Kit

SC 51 80-95-1329 .....Shop Equipment, Instrument and Fire Control System Repair: Field Maintenance

A - 4 O T H E R

CTA 50-970 . . . . Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items)

CTA 8-100 . . . . Army Medical Department Expendable/Durable Items

SB 740-95 -700 . . . . Storage Serviceability Standards for AMCCOM Materiel for Fire Control Items

TB 43-0197 . . . . Instructions for Safe Handling, Maintenance, Storage, and Disposal of Radioactive Items Managed By U.S. Army Armament Materiel Readiness Command

APPENDIX B
MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1 GENERAL

This Maintenance Allocation Chart designates responsibility for performance of maintenance repair functions at specified maintenance levels.

a. *Section I* is a general explanation and definition of terms.

b. *Section II* shows the maintenance level responsible and estimated work measurement time for specific functions.

c. *Section III* lists common tool sets and the special tools, test and support equipment required for each maintenance function shown in Section II.

B-2 EXPLANATION OF COLUMNS IN SECTION II

a. *Column 1, Group Number.* Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. *Column 2, Component/Assembly.* Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. *Column 3, Maintenance Functions.* Column 3 lists the functions to be performed on the item listed in Column 2.

d. *Column 4, Maintenance Category.* Column 4 specifies, by the listing of a "work time" figure in the appropriate subcolumn(s), the category of maintenance authorized to perform the function listed in Column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or category of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "work time'' figures will be shown for each category. The number of man-hours specified by the "work time" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance chart. This figure does not include any time for performance of preliminary tasks listed elsewhere in the MAC, e.g., removal of engine under repair of fuel pump when the engine is listed separately in the MAC. The symbol designations for the various maintenance categories remain as follows:

B-2 EXPLANATION OF COLUMNS IN SECTION II — CONTINUED

C — Operator/Crew
O — Organizational Maintenance
F — Direct Support Maintenance
H — General Support Maintenance
D — Depot Maintenance

e. *Column 5, Tools and Equipment.* Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated functions.

f. *Column 6, Remarks.* Column 6 references any amplifying remarks.

B-3 EXPLANATION OF MAINTENANCE FUNCTIONS

a. *Inspect.* To closely and critically examine (e.g., sight, sound, or feel) an item to detect errors, flaws, wear, etc., and to determine its condition and serviceability by comparing its physical mechanical/electrical characteristics within established standards.

b. *Test.* To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. *Service.* Operations required periodically to keep an item in proper operating condition; i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. *Adjust.* To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e. *Aline.* To adjust specified variable elements of an item to bring about optimum or desired performance.

f. *Calibrate.* To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. *Install.* The act of emplacing, seating, or fixing into position an item, part or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. *Replace.* The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. *Repair.* The application of maintenance services (inspect, test, service, adjust, aline, calibrate, or replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly module (components or assembly), and item, or system.

B-3. EXPLANATION OF MAINTENANCE FUNCTIONS - CONTINUED

j. *Overhaul.* That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. *Rebuild.* Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipments/components.

Section II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	C	(4) MAINTENANCE LEVEL O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
00	M139/M139A1/M140/M140A1 /M154 Alinement Device without Case	Inspect Service Replace Repair	0.5 0.1	 0.1 0.5 0.5		 1.0			
00	M140 Alinement Device and M140A1 Alinement Device with Case	Inspect Service Replace Repair	0.5 0.1	 0.1 0.5 0.5		 1.0			
01	M139/M139A1/M140/M140A1 /M154 Alinement Device without Case Exploded View	Inspect Service Replace Repair	0.1 0.1	0.1 0.1 0.2 0.5		0.1 0.1 0.5 1.0		1,2,3, 4,5,6,7	
0101	Optical Cell Assembly	Inspect Service Replace Repair	0.1			0.1 0.1 0.5 0.5		2	
0102	Optical Cell Assembly	Inspect Service Replace Repair	0.1			0.1 0.1 0.5 0.5		2	
02	Optical Instrument Case M140A1	Inspect Replace Repair	0.1	 0.1					
0201	Instruction Plate	Inspect Replace	0.1	 0.1					

*Subcolumns are as follows:
C - - Operator/Crew O - - Organizational F - - Direct Support
H - - General Support D - - Depot

SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS

(1) REFERENCE CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER	(5) TOOL PART NUMBER
1	H	TOOL KIT, FIRE CONTROL SYSTEM, MECHANIC	4931-00-947-8243	SC5180-95-B29
2	H	SHOP EQUIPMENT, INSTRUMENT AND FIRE CONTROL: FIELD MAINTENANCE, BASIC	4931-00-754-0740	SC4931-95-CL-A07
3	H	COLLIMATION STANDARD AND STORAGE BOX ASSEMBLY	4931-01-250-1596	9388647
4	H	FIXTURE, AZIMUTH TEST	4931-00-769-1596	7691596
5	H	INDICATOR, DIAL	5210-00-273-9791	A-A-2348
6	H	MIRROR, OPTICAL INSTRUMENT	6650-01-226-0720	10558251
7	H	V-BLOCK	3460-00-517-6073	A-A-55009
8	H	PURGING KIT, FIRE CONTROL INSTRUMENT	4931-00-065-1110	SC4931-95-J54

APPENDIX C

DIRECT AND GENERAL SUPPORT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LIST (INCLUDING DEPOT MAINTENANCE REPAIR PARTS)

Section I. INTRODUCTION

C – 1 SCOPE

This RPSTL lists and authorizes spares and repair parts required for performance of general support maintenance of the M139/M139A1/M140/M14A1/M154 Alinement Devices. It authorizes the requisitioning, issue, and disposition of spares, repair parts, and special tools as indicated by the Source, Maintenance, and Recoverability (SMR) codes.

C - 2 GENERAL

In addition to Section I, Introduction, this Repair Parts and Special Tools List is divided into the following sections:

a. Section 11. Repair Parts List - A list of spares and repair parts authorized by this RPSTL for use in the performance of maintenance. The list also includes parts which must be removed for replacement of the authorized parts. Parts lists are composed of functional groups in ascending alphanumeric sequence, with the parts in each group listed in ascending figure and item number sequence. Bulk materials are listed by item name in FIG BULK at the end of the section.

b. Section III. Special Tools List - N/A

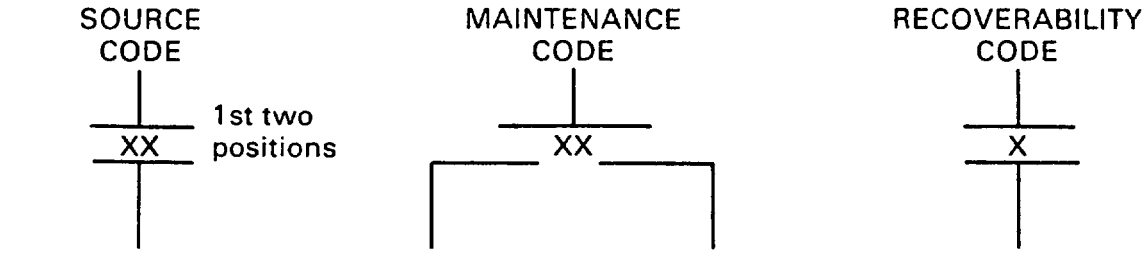
c. Section IV. National Stock Number and Part Number Index - A list, in National Identification Number (NIIN) sequence, of all National stock numbered items appearing in the listings, followed by a list in alphanumeric sequence of all part numbers appearing in the listing. National stock numbers and part numbers are cross-referenced to each illustration figure and item number appearance.

C-3 EXPLANATION OF COLUMNS (SECTION II)

a. ITEM NO. (Column (1)) - Indicates the number used to identify items called out in the illustration.

C-3 EXPLANATION OF COLUMNS (SECTION II) – CONTINUED

b. *SMR CODE (Column (2))* — The Source, Maintenance, and Recoverability (SMR) code is a 5-position code containing supply/requisitioning information, maintenance category authorization criteria, and disposition instruction, as shown in the following breakout:



* Complete Repair: Maintenance capacity, capability, and authority to perform all corrective maintenance tasks of the "Repair" function in a use/user environment in order to restore serviceability to a failed item.

(1) Source Code — The source code tells you how to get an item needed for maintenance, repair, or overhaul of an end item/equipment. Explanations of source codes follow:

CODE	EXPLANATION
PA PC** PD PE PF PG	Stocked items; use the applicable NSN to request/requisition items with these source codes. They are authorized to the category indicated by the code entered in the 3rd position of the SMR code. **NOTE: Items coded PC are subject to deterioration.
KD KF KB	Items with these codes are not to be requested/requisitioned individually. They are part of a kit which is authorized to the maintenance category indicated by the 3rd position of the SMR code. The complete kit must be requisitioned and applied.

C-3 EXPLANATION OF COLUMNS (SECTION II) — CONTINUED

CODE	EXPLANATION
MO —(Made at org. level) MF — (Made at DS level) MH — (Made at GS level) ML — (Made at Specialized Repair Act (SRA)) MD — (Made at Depot)	Items with these codes are not to be requested/requisitioned individually. They must be made from bulk material which is identified by the part number in the DESCRIPTION AND USABLE ON CODE (UOC) column and listed in the Bulk Material Group of the repair parts list in this RPSTL If the item is authorized to you by the 3rd position code of the SMR code, but the source code indicates it is made at a higher level, order the item from the higher level of maintenance.
AO — (Assembled by org. level) AF — (Assembled by DS level) AH — (Assembled by GS category) AL — (Assembled by SRA) AD — (Assembled by Depot)	Items with these codes are not to be requested/requisitioned individually. The parts that make up the assembled item must be requisitioned or fabricated and assembled at the level of maintenance indicated by the source code. If the 3rd position code of the SMR code authorizes you to replace the item, but the source code indicates the item is assembled at a higher level, order the item from the higher level of maintenance.

X A — Do not requisition an "XA''-coded item. Order its next higher assembly. (Also, refer to the NOTE below.)

XB — If an "XB" item is not available from salvage, order it using the FSCM and part number given.

XG — Installation drawing, diagram, instruction sheet, field service drawing, that is identified by manufacturer's part number,

XD — Item is not stocked. Order an "XD''-coded item through normal supply channels using the FSCM and part number given, if no NSN is available.

C-3 EXPLANATION OF COLUMNS (SECTION II) – CONTINUED

Note

Cannibalization or controlled exchange, when authorized, may be used as a source of supply for items with the above source codes, except for those source coded "XA" or those aircraft support items restricted by requirements of AR 700-42.

(2) Maintenance Code — Maintenance codes tell you the level(s) of maintenance authorized to USE and REPAIR support items. The maintenance codes are entered in the 3rd and 4th positions of the SMR Code as follows:

(a) The maintenance code entered in the 3rd position tells you the lowest maintenance level authorized to remove, replace, and use an item. The maintenance code entered in the third position will indicate authorization to one of the following levels of maintenance.

CODE	APPLICATION/EXPLANATION
C	Crew or operator maintenance done within organizational or aviation unit maintenance.
O	Organizational or aviation unit category can remove, replace, and use the item.
F	Direct support or aviation intermediate level can remove, replace, and use the item.
H	General support level can remove, replace, and use the item.
L	Specialized repair activity can remove, replace, and use the item.
D	Depot level can remove, replace, and use the item.

(b) The maintenance code entered in the 4th position tells whether or not the item is to be repaired and identifies the lowest maintenance level with the capability to do complete repair (i.e., perform all authorized repair functions). (NOTE: Some limited repair maybe done on the item at a lower level of maintenance, if authorized by the Maintenance Allocation Chart (MAC) and SMR codes.) This position will contain one of the following maintenance codes.

CODE	APPLICATION/EXPLANATION
O	Organizational or aviation unit is the lowest level that can do complete repair of the item.
F	Direct support or aviation intermediate is the lowest level that can do complete repair of the item.
H	General support is the lowest level that can do complete repair of the item.

C-3 EXPLANATION OF COLUMNS (SECTION II) — CONTINUED

L Specialized repair activity is the lowest level that can do complete repair of the item.

D Depot is the lowest level that can do complete repair of the item.

z Nonreparable. No repair is authorized.

B No repair is authorized. (No parts or special tools are authorized for the maintenance of the "8" coded item.) However, the item may be reconditioned by adjusting, lubricating, etc., at the user level.

(3) Recoverability Code — Recoverability codes are assigned to items to indicate the disposition action on unserviceable items. The recoverability code is entered in the 5th position of the SMR code as follows:

RECOVERABILITY CODES	APPLICATION/EXPLANATION
Z	Nonreparable item. When unserviceable, condemn and dispose of the item at the level of maintenance shown in 3rd position of SMR code.
o	Reparable item. When uneconomically reparable, condemn and dispose of the item at the organizational or aviation unit level
F	Reparable item. When uneconomically reparable, condemn and dispose of the item at the direct support or aviation intermediate level.
H	Reparable item. When uneconomically reparable, condemn and dispose of the item at the general support level.
D	Reparable item. When beyond lower level repair capability, return to depot. Condemnation and disposal of item not authorized below depot level.
L	Reparable item. Condemnation and disposal not authorized below Specialized Repair Activity (SRA).
A	Item requires special handling or condemnation procedures because of specific reasons (e.g., precious metal content, high dollar value, critical material). Refer to appropriate manuals/directives for specific instructions.

C-3 EXPLANATION OF COLUMNS (SECTION II)— CONTINUED

a. *FSCM (Column (3))* — The Federal Supply Code for Manufacturer (FSCM) is a 5-digit numeric code which is used to identify the manufacturer, distributor, or Government agency, etc., that supplies the item.

b. *PART NUMBER (Column (4))* — Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements to identify an item or range of items.

Note

When you use an NSN to requisition an item, the item you receive may have a different part number from the part ordered. (The parts are interchangeable.)

c. *DESCRIPTION AND USABLE ON CODE (UOC) (Column (5))* — This column includes the following information:

1. The Federal item name and, when required, a minimum description to identify the item.
2. The physical security classification of the item.
3. Items that are included in kits and sets.
4. Spare/repair parts that make up an assembled item are listed immediately following the assembled item line entry. When a separate figure lists the complete breakdown of an assembly/subassembly, a note “See figure for breakdown” in shown.
5. Part numbers for bulk materials.
6. When the item is not used with all serial numbers of the same model.
7. The usable on code, when applicable (see paragraph 5, Special Information).
8. Special Tools List section.
9. The statement “END OF FIGURE” appears just below the last item description in Column 5 for a given figure in Section II.

d. *QTY (Column (6))* — The QTY (quantity per figure column) indicates the quantity of the item used in the breakout shown on the illustration figure, which is prepared for a functional group, subfunctional group, or an assembly. A “V” appearing in this column in lieu of a quantity indicates that the quantity is variable and the quantity may vary from application to application.

C-3 EXPLANATION OF COLUMNS (SECTION II) – CONTINUED

(4) *Explanation of Columns (Section IV)*

a. *NATIONAL STOCK NUMBER (NSN) INDEX*

1. *STOCK NUMBER Column* —This column lists the NSN by National Item identification Number NllN) sequence. The NIIN consists of the last nine digits of the NSN.

NSN
(i.e., 5305-01-674-1467),
NIIN

When using this column to locate an item, ignore the first 4 digits of the NSN. However, the complete NSN should be used when ordering items by stock number.

2. *FIGURE Column* -This column lists the number of the figure where the item is identified/located. The figures are in numerical order in Section II.

3. *ITEM Column* —The item number identifies the item associated with the figure listed in the adjacent Figure column, This item is also identified by the NSN listed on the same line.

b. *PART NUMBER INDEX* — Part numbers in this index are listed by part number in ascending alpha numeric sequence (i.e., vertical arrangement of letter and number combination which places the first letter or digit of each group in order A thru Z, followed by the numbers 0 through 9 and each following letter or digit in like order).

1. *FSCM Column* —The Federal Supply Code for Manufacturer (FSCM) is a 5-digit numeric code used to identify the manufacturer, distributor, or Government agency, etc., that supplies the item.

2. *PART NUMBER Column* — Indicates the primary number used by the manufacturer (individual, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements to identify an item or range of items.

3. *STOCK NUMBER Column* — This column lists the NSN for the associated part number and manufacturer identified in the PART NUMBER and FSCM columns to the left.

4. *FIGURE Column* —This column lists the number of the figure where the item is identified/located in Section II.

5. *ITEM Column* — The item number is that number assigned to the item as it appears in the figure referenced in the adjacent figure number column.

C-3 EXPLANATION OF COLUMNS (SECTION II) - CONTINUED

(5) Special Information

a. USABLE ON CODE - The usable on code appears in the lower left corner of the Description column heading. Usable on codes are shown as "UOC: . . . . " in the Description column (justified left) on the first line after the applicable item description/nomenclature. Uncoded items are applicable to all models. Identification of the usable on codes used in the RPSTL are:

CODE	USED ON
BF4	M140A1 With Case
BF5	M140 Without Case
BF6	M140A1 Without Case
BF7	M139A1 Without Case
BN2	M154 Without Case
U09	M140 With Case
U11	M139 Without Case

b. FABRICATION INSTRUCTIONS - N/A

c. ASSEMBLY INSTRUCTION - Detailed assembly instructions for items source coded to be assembled from component spare /repair parts a refound in Chapter 2, Section III. Items that make up the assembly are listed immediately following the assembly item entry or reference is made to an applicable figure.

d. KITS - N/A

e. *INDEX NUMBERS* -This index number is a cross-reference between the National Stock Number/Part Number Index and the bulk material list in Section II.

f. *ASSOCIATED PUBLICATIONS* - N/A

g. *ILLUSTRATIONS* - LISTING - N/A

(6) How to Locate Repair Parts

a. When National Stock Number or Part Number is Not Known:

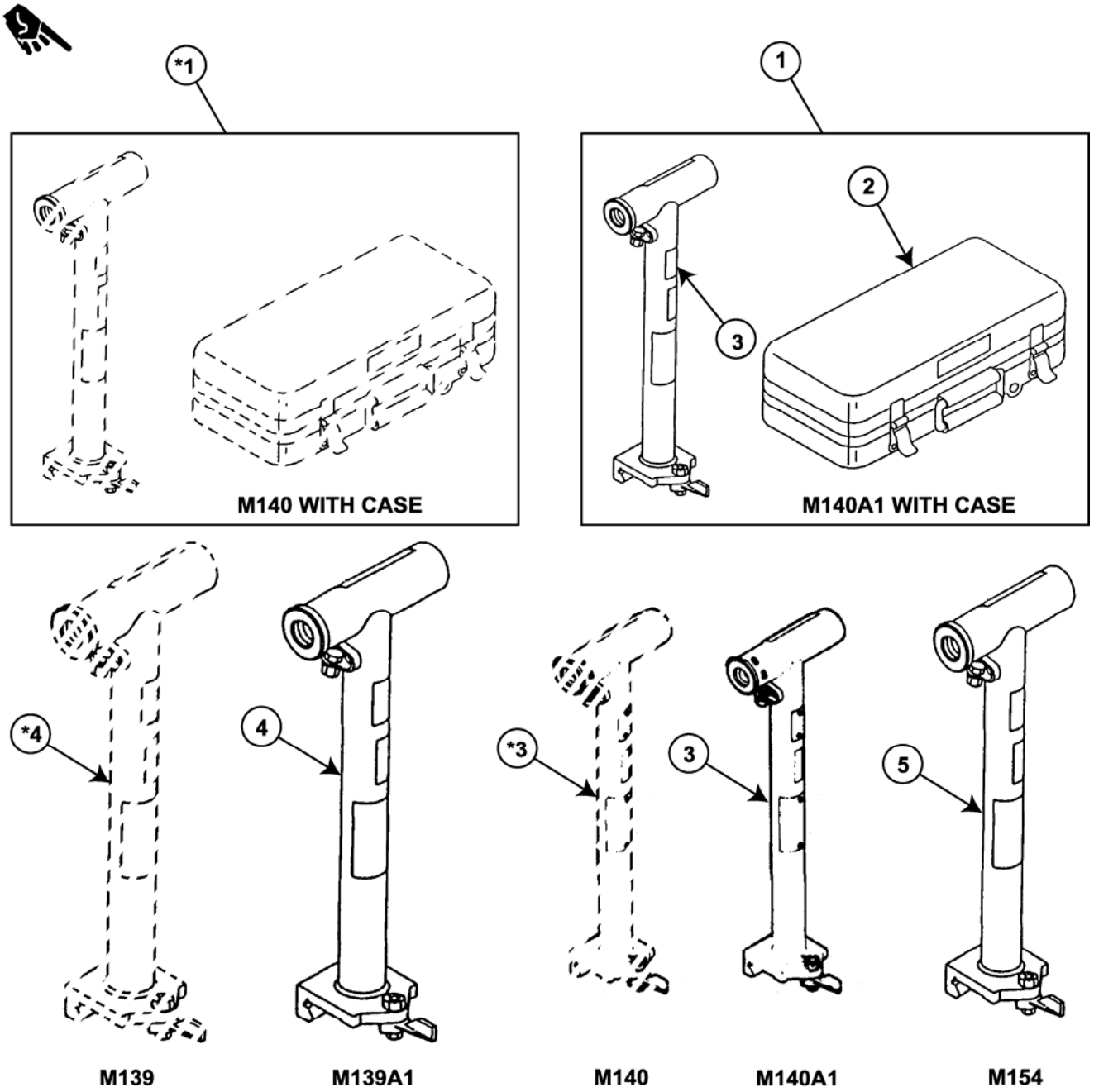
1. *First* - Using the table of contents, determine the assembly group or subassembly group to which the item belongs, This is necessary since figures are prepared for assembly groups and subassembly groups, and listings are divided into the same groups.

2. *Second*- Find the figure covering the assembly group or subassembly group to which the item belongs.

3. *Third* - Identify the item on the figure and note the item number.

4. *Fourth* - Refer to the Repair Parts List for the figure to find the part number for the item number noted on the figure.

5. *Fifth* - Refer to the Part Number Index to find the NSN, if assigned.



NOTE

*** AUTHORIZED FOR USE BUT NOT AVAILABLE FOR PROCUREMENT**

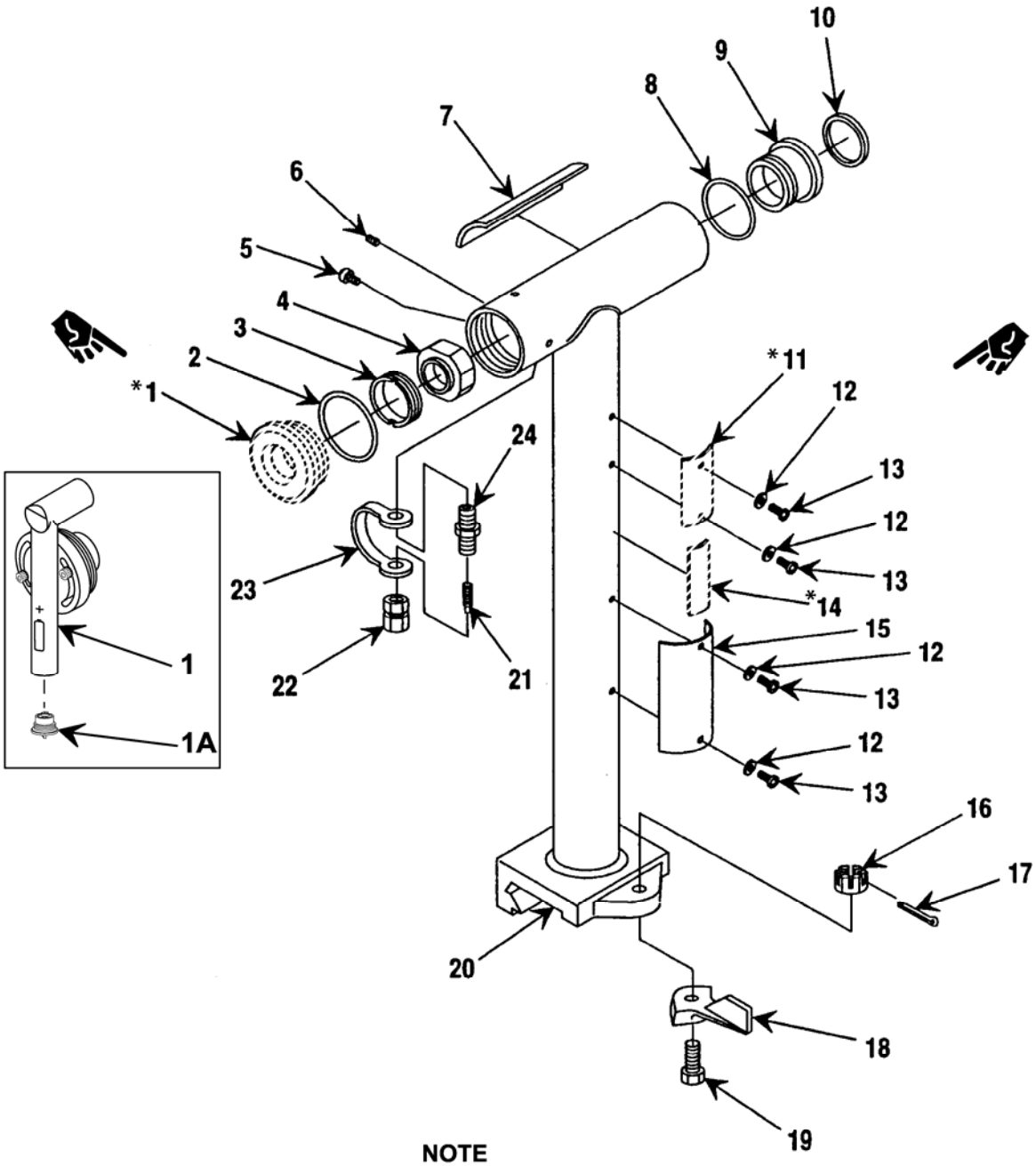
Figure C-1. M140/M140A1 Alinement Device with Case, M139, M139A1, M140, M140A1, and M154 Alinement Device without Case.

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 00: ALINEMENT DEVICE M140A1 WITH CASE 129874665 AND ALINEMENT DEVICES M139A1, 11741648-3; M140A1, 11741648-4; M154, 11741648-5 W/O CASE FIGURE C-1. ALINEMENT DEVICE M140A1 WITH CASE 129874665 AND ALINEMENT DEVICES M139A1, 11741648-3; M140A1, 11741648-4; M154, 11741648-5 W/O CASE	
*1		4931011879713			ALINEMENT DEVICE M140 WITH CASE	1
1	PAOHH	4931014727329	19200	12984665	ALINEMENT DEVICE M140A1 WITH CASE UOC: BF4	1
2	PAOZZ	1240003415127	19200	11739600	CASE, OPTICAL INSTRUMENT UOC: BF4 SEE FIG. C-5 FOR CAUTION RADIOACTIVE MATERIAL IDENTIFICATION PLATE	1
*3		4931003415119			ALINEMENT DEVICE M140 W/O CASE SEE FIG. C-2 FOR ASSEMBLY BREAKDOWN	1
3	PACHH	4931014726622	19200	11741648-4	ALINEMENT DEVICE M140A1 W/O CASE UOC: BF4, BF6 SEE FIG. C-2 FOR ASSEMBLY BREAKDOWN	1
*4		4931010485834			ALINEMENT DEVICE M139 W/O CASE SEE FIG. C-2 FOR ASSEMBLY BREAKDOWN	1
4	PACHH	4931014726621	19200	11741648-3	ALINEMENT DEVICE M139A1 W/O CASE UOC: BF7 SEE FIG. C-2 FOR ASSEMBLY BREAKDOWN	1
5	PACHH	4931015161430	19200	11741648-5	ALINEMENT DEVICE M154 W/O CASE SEE FIG. C-2 FOR ASSEMBLY BREAKDOWN	1
					END OF FIGURE	

NOTE

* ITEMS ARE AUTHORIZED FOR USE AND PARTIAL REPAIR BUT NOT AVAILABLE FOR REPLACEMENT PROCUREMENT

END OF FIGURE



NOTE

* AUTHORIZED TO USE AND REPAIR TRITIUM MODELS BUT CANNOT PROCURE A NEW ONE. IF TRITIUM ID PLATE (15) IS LOST (OR LIGHT SOURCE (1) FAILS) OR RADIOACTIVE ID PLATE (11, 14) IS LOST OR NEEDS TO BE REPLACED, CONVERT DEVICE TO AN A1 MODEL. REMOVE TRITIUM LIGHT SOURCE AND REPLACE IT WITH ERLS LIGHT SOURCE (1), AND NEW ID PLATE (15).

Figure C-2. M139/M139A1/M140/M140A1/M154 Alinement Devices (exploded view).

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 00: ALINEMENT DEVICES M139A1, 11741648-3; M140A1, 11741648-4; M154, 11741648-5	
					FIGURE C-2. ALINEMENT DEVICES EXPLODED VIEW	
*1	NON-PROCUREABLE				CAP ASSEMBLY, POTTED (RADIOACTIVE) CONVERT TO BATTERY POWERED REPLACE WITH ITEMS 1 AND 15 (A1 MODEL)	1
1	PAOOO	6695014736027	19200	12984672	LIGHT, INSTRUMENT	1
1A	PACZZ	5340014736028	19200	12984679	CAP, PROTECTIVE, DUST	1
2	PAOZZ	5331006005041	81343	AS3578-026	O-RING	1
3	PAHZZ	1240010434767	19200	10544461	RETAINER, OPTICAL ELEMENT	1
4	AHHHH		19200	10544455	CELL ASSEMBLY, OPTIC SEE FIG C-3 FOR BREAKDOWN	1
5	PAOZZ	5305009552941	19200	10555157-4	SCREW, MACHINE	1
6	PAHZZ	5305011204353	80205	MS51031-103	SETSCREW	4
7	PCOZZ	7690010437427	19200	11739593	DECAL CAUTION REMOVE AFTER BORESIGHTING	1
8	PCHZZ	5331008042748	81343	AS3578-024	O-RING	1
9	AHHHH		19200	9360371	CELL ASSEMBLY, OPTIC SEE FIG C-4 FOR BREAKDOWN	1
10	PAHZZ	1240010432204	19200	10544464	RETAINER, OPTICAL EL	1
*11	NON-PROCUREABLE				PLATE, INSTRUCTION (RADIOACTIVE) CONVERT TO BATTERY POWERED REPLACE WITH ITEMS 1 AND 15 (A1 MODEL)	1
12	PAOZZ	5310005434652	96906	MS35333-69	WASHER, LOCK	2
13	PAOZZ	5305000545636	96906	MS51957-2	SCREW, MACHINE	2
*14	NON-PROCUREABLE				PLATE, INSTRUCTION (RADIOACTIVE) CONVERT TO BATTERY POWERED REPLACE WITH ITEMS 1 AND 15 (A1 MODEL)	1
*15	NON-PROCUREABLE				PLATE, IDENTIFICATION M139 CONVERT TO BATTERY POWERED REPLACE WITH ITEMS 1 AND 15 (A1 MODEL)	1
*15	NON-PROCUREABLE				PLATE, IDENTIFICATION M140 CONVERT TO BATTERY POWERED REPLACE WITH ITEMS 1 AND 15 (A1 MODEL)	1
15	PAHZZ	9905014736025	19200	10544458-4	PLATE, IDENTIFICATION M140A1 UOC: BF6	1
15	PAHZZ	9905014738888	19200	10544458-3	PLATE, IDENTIFICATION M139A1 UOC: BF7	1
15	PAHZZ	9905015172175	19200	10544458-5	PLATE, IDENTIFICATION M154 UOC: BN2	1
16	PAOZZ	5310008942246	96906	MS35692-3	NUT, PLAIN, SLOTTED, H	1
17	PAOZZ	5315002341854	80205	MS24665-153	PIN, COTTER	1
18	PAOZZ	5340010437517	19200	10544452	LEVER, MANUAL CONTRO	1
19	PAOZZ	5305010470996	19200	10544465	SCREW, CAP, SOCKET HE	1
20	XAHZZ		19200	10544450-1	BODY M139A1 UOC: BF7	1
20	XAHZZ		19200	10544450-2	BODY M140A1 UOC: BF6	1
20	XAHZZ		19200	10544450-3	BODY M154 UOC: BN2	1
21	PAOZZ	2640000603543	96906	MS51377-2	VALVE CORE	1
22	PAOZZ	4820012350223	19200	8200055	CAP, VALVE	1
23	PAOZZ	5340004644792	19200	10516567	STRAP, RETAINING	1
24	PAOZZ	4820001141096	96906	MS51607-1	STEM, FLUID VALVE	1

END OF FIGURE

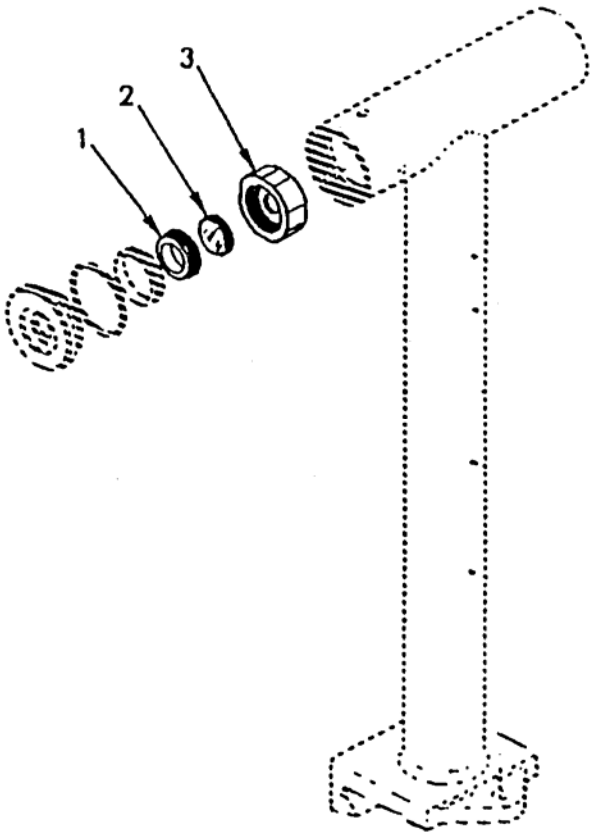


Figure C-3. Optical Cell Assembly – 10544455.

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 01: ALINEMENT DEVICES EXPLODED	
					FIGURE C-3. OPTICAL CELL ASSEMBLY P/N 10544455	
1	PAHZZ	1240012126576	19200	10544460	RETAINER, OPTICAL EL	1
2	PAHZZ	6650010439889	19200	10544459	RETICAL, OPTICAL INS	1
3	PAHZZ	1240011693255	19200	10544456	CELL, OPTICAL ELEMEN	1

END OF FIGURE

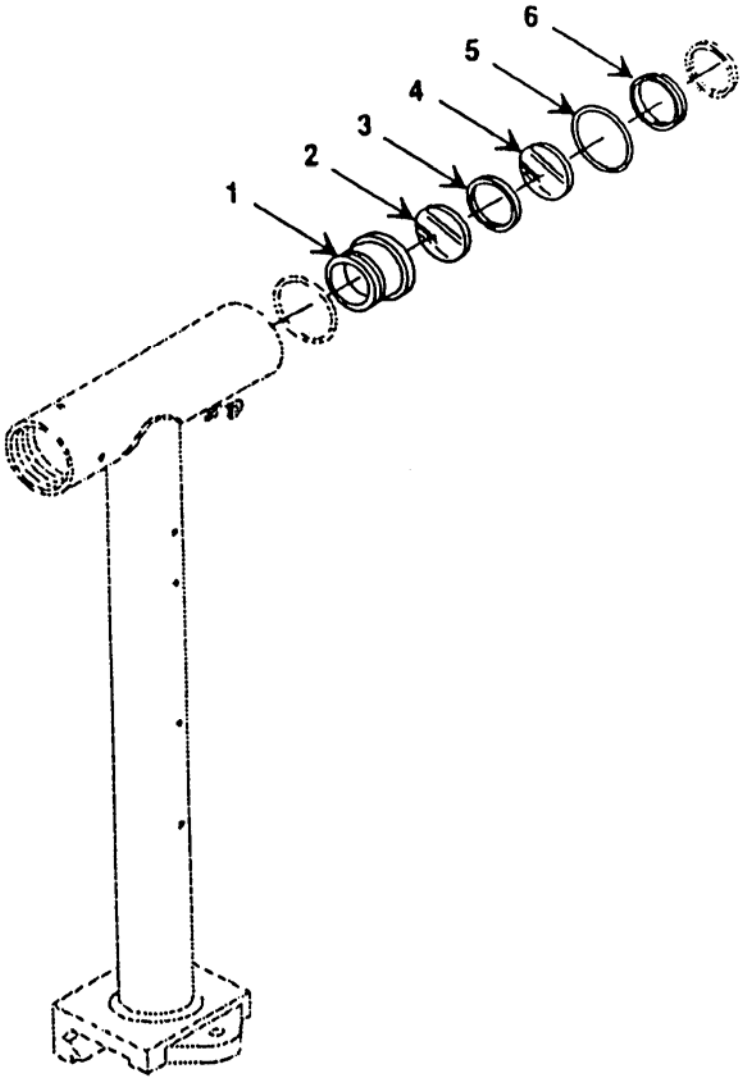


Figure C-4. Optical Cell Assembly – 9360371.

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 01: ALINEMENT DEVICES EXPLODED VIEW	
					FIGURE C-4. OPTICAL CELL ASSEMBLY P/N 9360371	
1	PAHZZ	1240012518690	19200	9360370	CELL, OPTICAL ELEMEN	1
2	PAHZZ	6650010432200	19200	10547001	LENS, OPTICAL INSTRU	1
3	PAHZZ	5365011774910	19200	10547017	SPACER, RING	1
4	PAHZZ	6650010432201	19200	10547002	LENS, OPTICAL INSTRU	1
5	PAHZZ	5331010457633	19200	10547018-2	O-RING	1
6	PAHZZ	1240012510683	19200	9360369	RETAINER, OPTICAL EL	1

END OF FIGURE

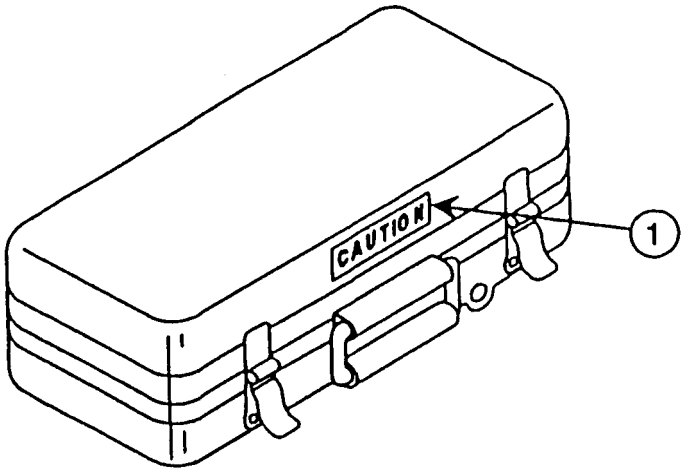


Figure C-5. Optical Instrument Case – 11739600.

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 02: CASE, OPTICAL INSTRUMENT M140A1, P/N 11739600	
1	PAOZZ	9905011463958	19204	11731008-3	PLATE, INSTRUCTION ..... (CAUTION RADIOACTIVE MATERIAL)	1

END OF FIGURE

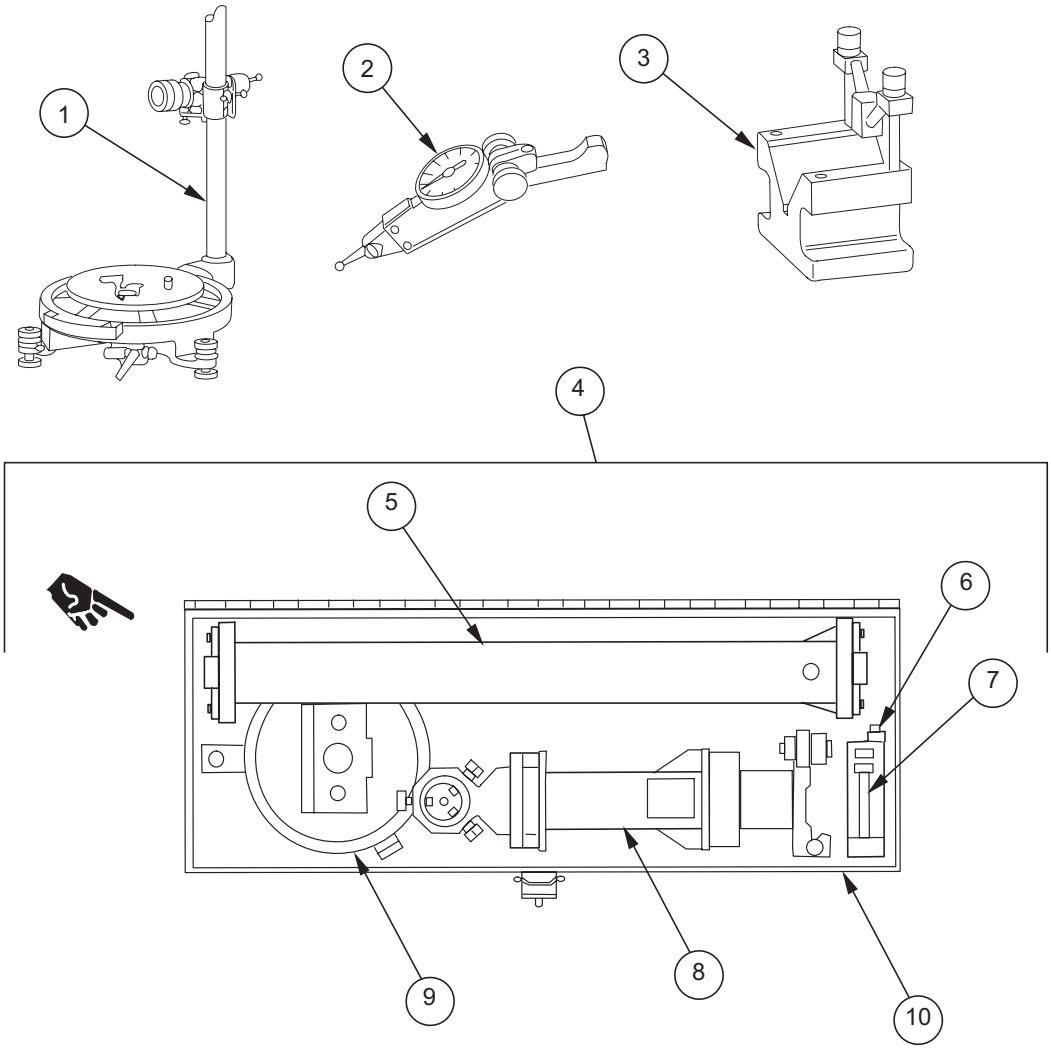


Figure C-6. Special Tools.

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					FIGURE C-6, GROUP 95: SPECIAL TOOLS	
1	PEHZA	4931007691596	19200	7691596	FIXTURE, TELESCOPE TESTING	1
2	PAFZZ	5210002739791	58536	A-A-2348	INDICATOR, DIAL	1
3	PAHZZ	3460005176073	81348	A-A-55009	V-BLOCK	1
4	PAHZZ	4931012501596	19200	9388647	COLLIMATION STANDAR D AND STORAGE BOX ASSEMBLY	1
5	XAHZZ		19200	9388615-2	SPACER	1
6	PAHZZ	5315008455110	96906	MS16555-48	PIN, STRAIGHT, HEADLESS	1
7	PAHZZ	6650012260720	19200	10558251	MIRROR, OPTICAL INSTRUMENT	1
8	XAHZZ		19200	9388622-1	COLLIMATION STANDARD	1
9	XAHZZ		19200	9388618	ADAPTER PLATE ASSEMBLY	1
10	XAHZZ		19200	9388641	STORAGE BOX	1

END OF FIGURE

APPENDIX D

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section 1. INTRODUCTION

D-1 SCOPE

This listing is for informational purposes only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items) or CTA 8-100, Army Medical Department Expendable/Durable Items.

D-2 EXPLANATION OF COLUMNS

a. Column 1 – Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material being used.

b. Column 2 – Level. This column identifies the lowest level of maintenance that requires the listed item.

H..... General Support Maintenance

c. Column 3 – National Stock Number. This item is the national stock number assigned to the item. Use it to request or requisition the item.

d. Column 4 – Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part followed by the Federal Supply Code for Manufacturer (FSCM) in parenthesis, if applicable.

e. Column 5 – Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation. If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) UNIT OF MEAS
1	H	6810-00-201-0907	ALCOHOL, DENATURED: 5 gal. can 27 CFR 21.35 (OMU53)	GL
2	H	8105-00-269-4662	BAG, PLASTIC: 20 x 25 in. (50.8 x 63.5 cm) MIL-B-117 (81349)	EA
2.1	O	8105-00-299-8532	BAG, PLASTIC: 20 x 40 in. (50.8 x 101.6 cm) 10 ea pkg A-A-1668 (58536)	EA
2.1A	O	6135-01-523-3198	BATTERY, NONRECHARGEABLE LITHIUM, SEALED (SIZE AA) (3.6 VOLT) 12984685 (19200)	EA
2.2	O	8115-00-190-5020	BOX, SHIPPING: 14 x 36 x 14 in. (35.6 x 91.4 x 35.6 cm) 10 ea pkg ASTM-D1974 (81348)	EA
3	H	7920-00-205-0565	BRUSH, DUSTING, LENS: R698 (17866)	EA
4	H	6850-00-597-9765	CLEANING COMPOUND: 6G236-6 (80063) 1 gal. can	GL
5	H	8010-00-852-9033	ENAMEL: Yellow, No. 13538 MPI 9-GLOSS (80244) 1 pt. can	PT
5.1	O	6515-01-150-2976 6515-01-150-2977 6515-01-150-2978	GLOVES, Patient exam: 100 each pkg Size Small 2D7491 (07TA6) Size Large, E-011 (07TA6) Size Medium E-012 (22353)	 PG PG PG
6	H	9150-00-935-4017	GREASE, AIRCRAFT: Instrument, TYPE I MIL-PRF-23827 (81349) 14 oz. Cartridge	CR
6.1	O	8135-00-281-3920	PAPERBOARD WRAPPING, cushioning A-A-1051(58536) 250 ft roll	FT

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) UNIT OF MEAS
7	H	6640-00-436-5000	PAPER, LENS: Tissue, sheet form type 1 NNN-P-40 (81348)	PG
8	H	8030-00-537-7925	SEALING COMPOUND: Black, semi-solid base compound with catalyst A-A-59293 (58536) 3.5 oz. box	BX
9	H		DELETED	
10	H	7510-00-266-6712	TAPE: 1-inch wide, Masking, pressure sensitive 8783476 (19203)	RL
10.1	O	7510-01-146-7767	TAPE, 1-inch wide, High Strength, 60 yd ASTM D 5486-D 5486M (81346)	RL

NATIONAL STOCK NUMBER AND PART NUMBER INDEX

NATIONAL STOCK NUMBER INDEX

STOCK NUMBER	FIG.	ITEM	STOCK NUMBER	FIG.	ITEM
5305-00-054-5636	C-2	13	4931-01-472-6622	C-1	1
2640-00-060-3543	C-2	21	9905-01-473-6025	C-2	1
4820-00-114-1096	C-2	24	6695-01-473-6027	C-2	1
5315-00-234-1854	C-2	17	5340-01-473-6028	C-2	1A
5210-00-273-9791	C-6	2	9905-01-473-8888	C-2	15
1240-00-341-5127	C-1	2	9905-01-517-2175	C-2	15
5340-00-464-4792	C-2	23			
3460-00-517-6073	C-6	3			
5310-00-543-4652	C-2	12			
5331-00-600-5041	C-2	2			
4931-00-769-1596	C-6	1			
5331-00-804-2748	C-2	8			
5315-00-845-5110	C-6	6			
5310-00-894-2246	C-2	16			
5305-00-955-2941	C-2	5			
6650-01-043-2200	C-4	2			
6650-01-043-2201	C-4	4			
1240-01-043-2204	C-2	10			
1240-01-043-4767	C-2	3			
7690-01-043-7427	C-2	7			
5340-01-043-7517	C-2	18			
6650-01-043-9889	C-3	2			
5331-01-045-7633	C-4	5			
5305-01-047-0996	C-2	19			
5305-01-120-4353	C-2	6			
9905-01-146-3958	C-5	1			
1240-01-169-3255	C-3	3			
5365-01-177-4910	C-4	3			
1240-01-212-6576	C-3	1			
4820-01-235-0223	C-2	22			
4931-01-250-1596	C-6	4			
1240-01-251-0683	C-4	6			
1240-01-251-8690	C-4	1			

NATIONAL STOCK NUMBER AND PART NUMBER INDEX

PART NUMBER INDEX

FSCM	PART NUMBER	STOCK NUMBER	FIG.	ITEM
58536	A-A-2348	5210-00-273-9791	C-6	2
81348	A-A-55009	3460-00-517-6073	C-6	3
81343	AS3578-024	5331-00-804-2748	C-2	8
81343	AS3578-026	5331-00-600-5041	C-2	2
96906	MS16555-48	5315-00-845-5110	C-6	6
80205	MS24665-153	5315-00-234-1854	C-2	17
96906	MS35333-69	5310-00-543-4652	C-2	12
96906	MS35692-3	5310-00-894-2246	C-2	16
80205	MS51031-103	5305-01-120-4353	C-2	6
96906	MS51377-2	2640-00-060-3543	C-2	21
96906	MS51607-1	4820-00-114-1096	C-2	24
96906	MS51957-2	5305-00-054-5636	C-2	13
19200	10516567	5340-00-464-4792	C-2	23
19200	10544450-1		C-2	20
19200	10544450-2		C-2	20
19200	10544450-3		C-2	20
19200	10544452	5340-01-043-7517	C-2	18
19200	10544455		C-2	4
19200	10544456	1240-01-169-3255	C-3	3
19200	10544458-3	9905-01-473-8888	C-2	15
19200	10544458-4	9905-01-473-6025	C-2	15
19200	10544458-5	9905-01-517-2175	C-2	15
19200	10544459	6650-01-043-9889	C-3	2
19200	10544460	1240-01-212-6576	C-3	1
19200	10544461	1240-01-043-4767	C-2	3
19200	10544464	1240-01-043-2204	C-2	10
19200	10544465	5305-01-047-0996	C-2	19
19200	10547001	6650-01-043-2200	C-4	2
19200	10547002	6650-01-043-2201	C-4	4
19200	10547017	5365-01-177-4910	C-4	3
19200	10547018-2	5331-01-045-7633	C-4	5
19200	10555157-4	5305-00-955-2941	C-2	5
19200	10558251	6650-01-226-0720	C-6	7
19204	11731008-3	9905-01-146-3958	C-5	1
19200	11739593	7690-01-043-7427	C-2	7
19200	11739600	1240-00-341-5127	C-1	2
19200	11741648-4	4931-01-472-6622	C-1	1
19200	12984672	6695-01-473-6027	C-2	1
19200	7691596	4931-00-769-1596	C-6	1
19200	8200055	4820-01-235-0223	C-2	22
19200	9360369	1240-01-251-0683	C-4	6
19200	9360370	1240-01-251-8690	C-4	1
19200	9360371		C-2	9
19200	9388615-2		C-6	5
19200	9388618		C-6	9
19200	9388622-1		C-6	8
19200	9388641		C-6	10
19200	9388647	4931-01-250-1596	C-6	4

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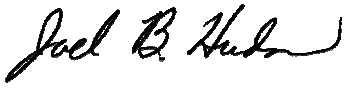
ERIC K. SHINSEKI
General, United States Army
Chief of Staff

Official:



JOEL B. HUDSON
Administrative Assistant to the
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0020809

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TM 9-XXXX-XXX-XX	Date of TM	Title of TM

PAGE NO.	PARAGRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT
3		2		Item 10. Change illustration. Reason: Tube and shown assembled on wrong side of lever cam.
109		51		Item 3. The NSN and P/N are not listed on the AMDF nor the MCRL. Request correct NSN and P/N be furnished.
2-8			2-1	Preventive Maintenance Checks and Services Item 7 under "Items to be inspected" should be changed to read as follows: Firing linkage and firing mechanism pawl.

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TM 9-4931-710-14&P	15 Aug 1986	Operator, Org, Dir Support & General Support Maint Manual for Alinement Device M139& Alinement Dev w/case M140

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THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 Lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

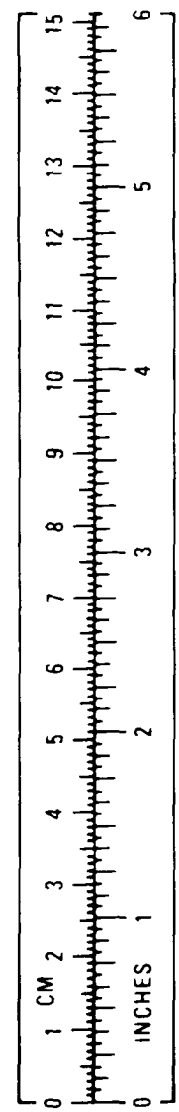
TEMPERATURE

5/9 (°F —32) = °C
212° Fahrenheit is equivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5 (°C + 32) = °F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621



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