TM 9-1290-333-15

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, FIELD AND DEPOT MAINTENANCE MANUAL

COMPASS, MAGNETIC, UNMOUNTED: M2

This copy is a reprint which includes current pages from Changes 1 through 4.

HEADQUARTERS, DEPARTMENT OF THE ARMY

7 NOVEMBER 1963

CHANGE

No. 4

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 11 September 1985

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT MAINTENANCE MANUAL
(Including Repair Parts and Special Tools List)
COMPASS, MAGNETIC, UNMOUNTED: M2 (1290-930-4260)

TM 9-1290-333-15, 7 November 1963, is changed as follows:

Page 6, para 11c. When closing the M2 Compass, make sure that the rear sight is folded into the plane of the rearsight holder. If the rear sight is not in this position during closing, mirror damage will occur.

Page 7, Table I, Point of Inspection: (Magnetic Needle). Figure number 5 is rescinded.

Page 7, Table I, Accepted Standards: (Magnetic Needle). Paragraph is superseded as follows: Place the compass on a level non-metalic surface, with the cover open. Once the magnetic needle has stabilized, note the position of the magnetic needle with respect to the azimuth scale. With a piece of metal, pull the needle off a minimum of 100 mils. The needle should stabilize at the same reading as before ± 10 mils. Watch for any sudden stoppage of magnetic needle during this check.

Page 7, Table I, under Point of Inspection. Add Needle Lifting (Locking) Pin.

Page 7, Table I, Accepted Standards: (Needle Lifting (Locking) Pin). Add, Press the Needle Lifting (Locking) Pin down until its end is flush with the compass body. Note, whether or not the magnetic needle is lifted off the pivot point and is pressed flush against the glass face of the compass.

Page 13, Table II, Malfunction. Needle lifting lever fails to lock, is changed to read "Needle lifting lever fails to lift."

Page 13, Table II, Malfunction. Add, Cannot read azimuth scale or see sight picture through mirror.

Page 13, Table II, probable Cause. Add, Mirror cracked, broken or deteriorated.

Page 13, Table II, Corrective Action. Add, Obtain new compass.

Page 13, para 28b is superseded as follows: b. Turn in unserviceable compasses through direct support unit for property disposal.

Page 18, Column (2). Federal Stock No. 1290-560-6596 is superseded by "NSN 1290-00-930-4260."

Page 18, Column (3). Part Number (8293421) is superseded by "(10547166)".

Page 18, Column (2). Federal Stock No. 1290-654-5048 is superseded by "NSN 6605-00-946-8757."

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

DONALD J. DELANDRO
Brigadier General. United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-41, Operator, Organizational, Direct and General Support Maintenance requirements for Compass, Magnetic, M2.

TM 9-1290-333-15
C 3

Change No. 3

HEADQUARTERS,
DEPARTMENT OF THE ARMY
Washington, DC, *20 May 1974*

Operator, Organizational, Direct Support, General Support and Depot Maintenance Manual (Including Repair Parts and Special Tools List)

Operator, Organizational, Direct Support, General Support and Depot Maintenance Manual (Including Repair Parts and Special Tools List) COMPASS, MAGNETIC, UNMOUNTED: M2 (1290-560-6596).

TM 9-1290-333-15, 7 November 1963, is changed as follows:
The title is changed to read as shown above.

Page 2, Content. Change Appendix II to read as follows:

Appendix II. Basic Issue Items List, Items Troop Installed or Authorized, Organizational, Direct Support, General Support, Depot Maintenance Repair Parts and Special Tools List

Page 13, paragraph 28. Subparagraph *b* is added as follows:

b. Return all unserviceable compasses through supply channels to Commander, Frankford Arsenal, ATTN: SARFA-MAM, Philadelphia, PA 19137 for maintenance engineering evaluation.

Page 17. APPENDIX II title is changed to read as follows:

Basic Issue Items List, Items Troop Installed or Authorized, Organizational, Direct Support, General Support, Depot Maintenance Repair Parts and Special Tools List

Paragraph 1 is superseded as follows:

1. General

This appendix list the basic issue items; items troop installed or authorized; repair parts; special tool lists and is divided into the following sections.

a. Basic Issue Items List, Section II. A list of items which accompany the Compass and is required by the operator/crew for installation, operation or maintenance.

b. Items Troop Installed or Authorized List, Section III. Not applicable.

c. Repair Parts List, Section IV. Not applicable.

d. Special Tools List, Section V. A list of special tools, test and support equipment authorized for the performance of maintenance at the DS/GS levels.

Paragraph 3. Subparagraph *a*1 is added immediately below the paragraph title.

*a*1. *Illustrations.* This column is divided as follows:

(1) *Figure number.* Not applicable.
(2) *Item number.* Not applicable.

Subparagraph *f*. Deleted.

Page 18, Chart is superseded as follows

Section II. BASIC ISSUE ITEMS LIST

(1) Illustration		(2) Federal stock number	(3) Description	(4) Qty furn with equip
(a) Fig No.	(b) Item No.		Part Number & FSCM — Usable on Code	
		1290-946-8757	CASE, UNMOUNTED, MAGNETIC COMPASS (PLASTIC) 10543560 (19200)	1

Section V. SPECIAL TOOLS LIST

(1) Source Maintenance and Recoverability Code				(2) Federal Stock Number	(3) Description	(4) Unit of issue	(5) Quantity incorporated in unit	(7) 15-Day maintenance allowance per 100 equipments 3rd Echelon	(8) 15 Day Maintenance Allowance per 100 Equip		(9) Depot Maintenance Codes per 100 Equipments 4th Echelon
(a) Material Code	(b) Source	(c) Maintenance Level	(d) Recoverability						(a) 3rd Echelon Direct Support	(b) 4th Echelon General Support	
9	P	C		1290-946-8757	CASE, UNMOUNTED, MAGNETIC COMPASS (PLASTIC) 10543560 (19200)	1	-	-	0.1	0.1	10

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:

VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-41 (qty rqr block No. 18) Operator's Maintenance requirements for Compass, Magnetic.

Change No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., *24 April 1978*

Operator, Organizational, Direct Support, General Support and Depot Maintenance Manual (Including Repair Parts and Special Tools List)
COMPASS, MAGNETIC, UNMOUNTED: M2 (1290-930-4260)

TM 9-1290-333-15, 7 November 1963 is changed as follows:
Title is changed as shown above.
Page 18. Chart is superseded as follows:

(1) Source, maintenance and recoverability code				(2)	(3)	(4)	(5)	(6)	(7)	(8) 15-Day maintenance allowances per 100 equipment		(9)
(a) Material code	(b) Source	(c) Maintenance level	(d) Recoverability	Federal Stock No	Description	Unit of issue	Quantity incorporated in unit	Allowance per major item or combination (1st echelon)	15-Day maintenance allowance per 100 equipment (2d echelon)	(a) 3d echelon (direct support)	(b) 4th echelon (general support)	Depot maintenance guide per 100 equipment (5th echelon)
					Section A. Basic Issue Items							
9	P	C		1290-946-8757	CASE, UNMOUNTED, MAGNETIC COMPASS (PLASTIC) 10543560	1		1				
					Section B. ORGANIZATIONAL DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT REPAIR PARTS AND SPECIAL TOOL LIST							
					REPAIR PARTS							
					None authorized							
					Tools and Equipment							
9	P	C		1290-946-8757	CASE, UNMOUNTED, MAGNETIC COMPASS (PLASTIC) 10543560	1				0.1	0.1	10

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:

VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-41 (qty rqr block no. 18) Operator Maintenance requirements for Compass, Magnetic.

CHANGES
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *28 December 1966*

Operator, Organizational, Direct Support, General Support, and Depot Maintenance Manual (Including Repair Parts and Special Tool Lists)

COMPASS, MAGNETIC, UNMOUNTED: M2 (1290-560-6596)

TM 9-1290-333-15, 7 November 1963, is changed as follows:

Change the title to read as shown above.

Change the references "field and depot maintenance" to "direct support, general support and depot maintenance," respectively, wherever they appear throughout the manual.

Page 3.

1. Scope

* * * * * * *

e. (Superseded) Use DA Form 2028 (Recommended Changes to DA Publications) to report errors, omissions, and recommendations for improvement in this manual direct to Commanding Officer, Frankford Arsenal, ATTN: AMSWE-SMF-W3100, Philadelphia, Pa. 19137.

Page 13.

28. Maintenance

* * * * * * *

b. (Rescinded) Return all unserviceable * * * maintenance engineering evaluation.

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:
KENNETH G. WICKHAM,
Major General, United States Army.
The Adjutant General.

Distribution:
To be distributed in accordance with DA Form 12-41 (Unclas) requirements for Organizational Maintenance applicable to the Compass, Magnetic.

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, FIELD AND DEPOT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST) FOR COMPASS, MAGNETIC, UNMOUNTED: M2

Headquarters, Department of the Amy, Washington 25, D.C.

7 November 1963

***This manual supersedes SB 9-208, 28 June 1962; TM 9-6605200-12P, 6 March 1959; and that portion of TM 9-575, 20 October 1948, and TM 9-1530, 21 March 1950, pertaining to Compass M2.**

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual contains instructions for operation, organizational, field, and depot maintenance of compass, magnetic, unmounted: M2.

b. Appendix I contains a list of current references, including supply and technical manuals, forms, and other available publications applicable to compass M2.

c. Appendix II contains a basic issue item list required for stockage by first echelon maintenance and includes those components, with quantities thereof, constituting the major item. It also lists first echelon equipment and spare parts all of which constitute the major end item for issue to users. The list also includes maintenance parts and equipment, with quantities thereof, required for organizational, field and depot maintenance of the major end item and its equipment.

d. Appendix III contains a maintenance allocation chart which lists maintenance responsibilities allocated to each echelon of maintenance.

e. This first edition is being published in advance of complete technical review. The direct reporting of errors, omissions, and recommendations for improving this equipment -manual by the individual user is authorized and encouraged. DA Form 2028 will be used for reporting these improvements. This form may be completed using pencil, pen or typewriter. DA Forms 2028 will be completed in triplicate and forwarded by the individual using the manual. The original and one copy will be forwarded direct to the Commanding Officer, Frankford Arsenal, ATTN: SMUFA-3100, Philadelphia, Pennsylvania 19137. one information copy will be provided to the individual's immediate superior.

2. Maintenance Allocation

The maintenance of compass M2 does not require the use of tools and will be performed as reflected in the maintenance allocation chart (app. III).

3. Form, Records, and Reports

a. General. Responsibility for the proper execution of forms, records, and reports rests upon the commanding officers of all units maintaining this equipment. However, the value of accurate records must be fully appreciated by all persons responsible for their compilation, maintenance, and use. Records, reports, and authorized forms are normally utilized to indicate the type, quantity, and condition of materiel to be inspected or replaced. Properly executed forms convey authorization and serve as records for replacement of materiel in the hands of troops.

b. Authorized Forms. The forms generally applicable to units operating or maintaining this materiel are listed in appendix I. For instructions on the use of these forms refer to TM 38-750, FM 9-3 and FM 9-4, For a listing of all forms, refer to DA Pam 310-2.

c. Field Reports of Accidents. The reports necessary to comply with. the requirements of the Army safety program are prescribed in detail in AR. 385-40. These reports are required whenever accidents involving injury to personnel or damage to materiel occur.

d. Equipment Improvements Recommendations. Deficiencies detected in the equipment or materials should be reported using the Equipment Improvement Recommendation section of DA Form 2407.

Section II. DESCRIPTION AND DATA

4. Description

a. General. Unmounted magnetic compass M2 (figs. 1 and 2) is a multiple purpose instrument applicable to obtaining clinometer, angle of site, and azimuth readings. The body of the compass is dustproof and moisture proof, and is made of nonmagnetic material except for the magnetic needle and its pivot. When the cover is closed, the magnetic needle is automatically lifted from its pivot to protect the pivot point and jewel bearing. The jewel bearing is agate. The compass is provided with an angle of site scale and an azimuth scale. The azimuth scale may be rotated approximately 1,800 mils. The compass is equipped with circular and tubular levels. In place of a telescope, the compass employs front and rear leaf sights in conjunction with a mirror in the cover for sighting and reading the angles. The instrument has an azimuth scale adjuster for orienting the azimuth scale to the local magnetic declination, so that grid or Y azimuths may be read direct.

b. Angle of Sight Mechanism and Related Parts. Rotation of the level lever (fig. 6) causes tie elevation level and elevation scale index to rotate as a unit. The index clamps against the bottom piece to prevent the mechanism from moving unless actuated by the level lever.

c. Magnetic Needle and Lifting Mechanism. The magnetic needle provides a magnetic north direction for orienting purposes. The needle is delicately bahmced and jewel mounted, on a pivot, to rotate freely. The magnetic needle reading is

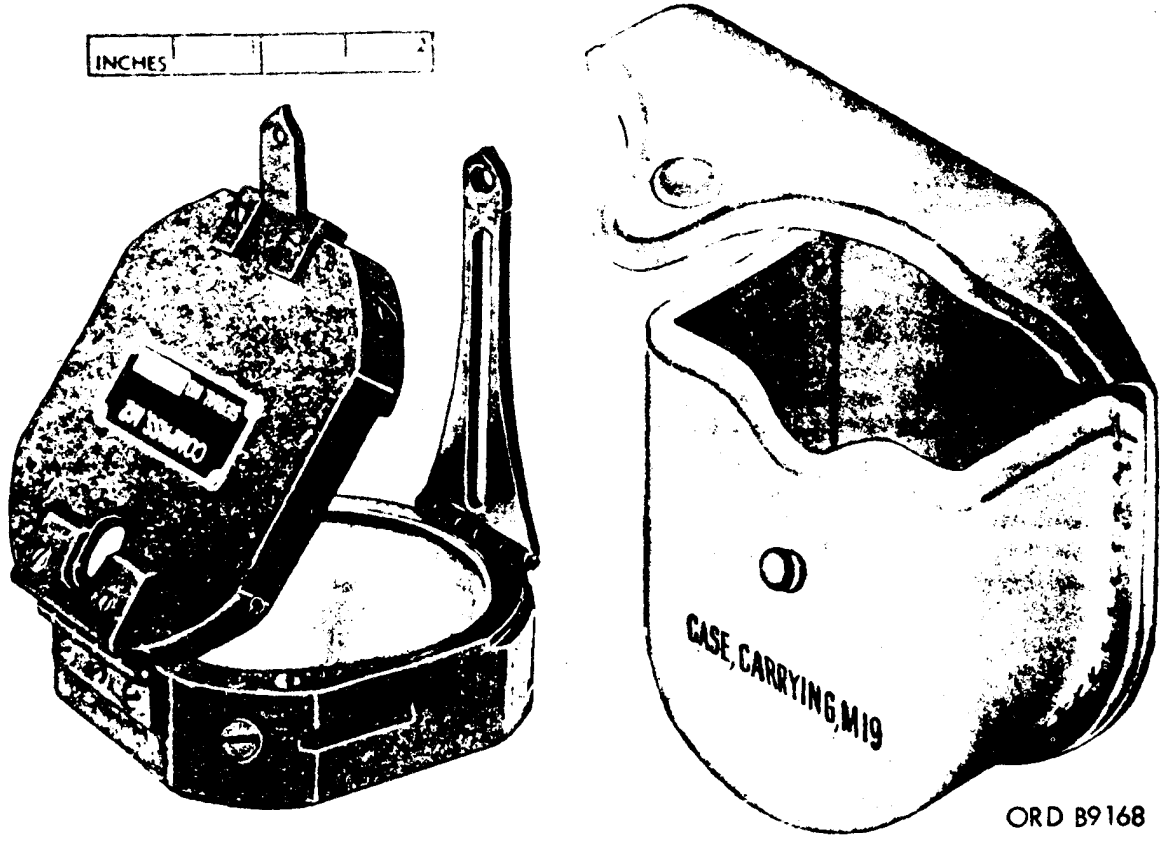

Figure 1. Compass M2 and carrying case M19.

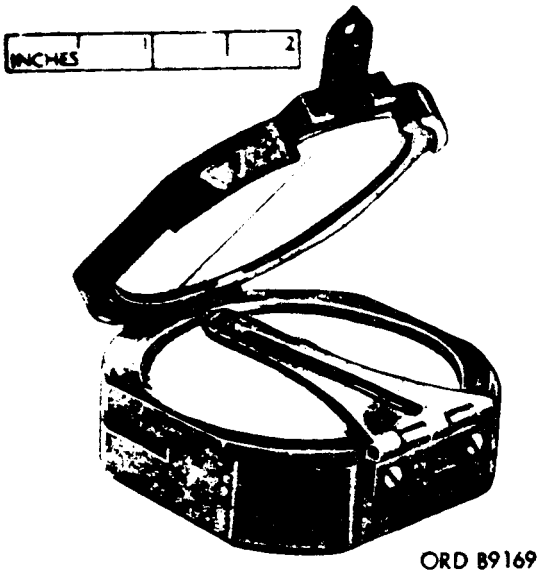

Figure 2. Compass M2.

taken when the bubble is centered in the circular level. The lifting mechanism includes a needle lifting (locking) pin (fig. 5) and a needle lifting lever. The lower end of the pin engages the lever and the upper end projects slightly above the body of the compass to engage the cover when it is closed, thereby automatically lifting the needle from its pivot and holding it firmly against the glass window.

d. Azimuth Scale Adjuster Assembly and Azimuth Scale. The azimuth scale adjuster assembly rotates the azimuth scale to introduce the declination constant. Two teeth of the adjuster engage teeth on the under side of the azimuth scale, so that turning of the adjuster with a screwdriver States the azimuth scale approximately 1,800 mils. The scale is read against a fixed index under t the rear sight hinge .

e. Front and Rear Sight Assemblies.

(1) The front sight (fig. 5) is hinged to a bracket on the cover of the compass and folds against the top surface of the cover.

(2) The rear sight (fig. 6) is hinged tc a rear sight holder which in turn is hinged to a bracket. The bracket is secured to the body of the compass so as to permit folding the sight against the window inside the cover when the instrument is not in use.

5. Characteristics

Angle of site scale . . . . . 1,200-0-1,200 roils
Azimuth scale . . . . . 0-6,400 roils
Dimensions closed . . . . . 2-3/4 in. x 1-1/8 in.
Weight . . . .8 oz.

6. Equipment Issued With Compass M2

Leather carrying case M19 (fig. 1) is the only piece of equipment issued with the compass M2. The case consists of a three-piece assembly into which the compass fits and has a flap or cover which is an integral part of the back piece. This bends over the case and is fastened to the front with a snap button. The loop of the carrying case is riveted to the back side of the case (not shown in the illustration indicated).

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIEL

7. General

a. When a new, used, or reconditioned compass M2 is first received by the using organization it is the responsibility of the officer in charge to determine whether the materiel is in condition to perform its function.

b. Make a record of any missing parts or equipment and of any malfunctions. Correct any deficiencies as quickly as possible.

8. Duties

The organizational mechanic performs the inspection to determine whether the materiel is in condition to perform its assigned mission. It is the duty of the operator to assist the organizational mechanic in the performance of these services.

9. Services

Upon receipt of materiel, the operations described in a through d below shall be performed to place the compass into operating condition.

a. Open the sealed container and remove the contents consisting of compass M2, carrying case M19 and TM 9-1290-333-15.

b. Open and close the cover to determine if the hinge friction is uniform throughout its full movement.

c. Unfold and fold the sights. The sights and arm hinges shall have friction comparable to that of the cover.

d. The mirror and window should be firm enough to resist turning in their seats under medium thumb pressure.

Note. Stow TM 9-1290-333-15 inside container with compass M2 when not in use.

Section II. OPERATION UNDER USUAL CONDITIONS

10. General

This section contains instructions for the proper case of the materiel and preparation for operation. Every organization equipped with this compass must thoroughly train its personnel in the procedures for its operation.

11. Care in Handling

a. Compass M2 will not stand rough handling or abuse. Inaccuracy or breakage will result from mistreatment. Any instrument that is functioning inaccurately or that contains damaged parts must be brought to the attention of organizational maintenance personnel for disposition.

b. Men not in use, keep the compass within the carrying case so that it is protected from dust and moisture.

12. Preporation for Use

a. Setting Up.

(1) Remove carrying case M19 with compass M2 from stowed position.

(2) Remove compass from carrying case.

b. Inspection.

(1) General. Whenever inaccuracies, maladjustments, or other conditions affecting serviceability are disclosed by the inspection prescribed in table I, the necessary corrective action should be taken if the maintenance required is within the scope of the using organization. If the maintenance required is beyond the scope of the using organization, the condition should be referred to the organiza-

tional maintenance personnel for disposition in accordance with the maintenance allocation chart (app. III).

(2) *Procedure*. Visually examine the Compass and carrying case for completeness and general appearante. Inspect the compass and carrying case as outlined in table I.

Table I. Operator's inspection Chart for Compass M2 and Carrying Case M19

Point of Inspection	Fig no.	Accepted standard
		Compass M2
Azimuth scale adjuster assy	3	Rotate the azimuth scale adjuster with a screwdriver, alternately in one direction and then another, until the stops are reached. The scale shall move freely 800 mils in either direction from zero without binding or excessive looseness.
Angle of sight level lever	6	Operate the level lever to determine if there is sufficient friction to hold the elevation scale index at any setting on the scale.
Magnetic needle	5	Press the needle lifting (locking) pin down until its end is flush with the compass body. Note the position of the magnetic needle with respect to the azimuth scale. Gently shake the compass while holding the needle lifting (locking) pin in this position. There shall be no noticeable movement of, the needle.
Alinement of sights	4	Open the cover to an angle of approximately 60° with the face of the compass. Move the front and rear sights so that the tips make contact with each other to assure that both sights are in alinement, and then move the tip of the rear sight along the etched line of the mirror. The tip and line should not be misalined more than the width of the line to the left or right.
		Carrying Case M19
Snap button	1	One snap button shall be secured in the carrying case and shall properly hold the cover flap in a secure and closed position.
Loop	1	The loop of the carrying case is secured by rivets to the back side (not shown in the illustration indicated). It shall be securely fastened to the case.

13. Operation

a. Setting Up. The compass should be held as rigidly as possibie to obtain the most accurate readings. The use of a sitting or prone position, a rest for the hands or elbows, or a solid support for the compass will help to eliminate unintentional movement of the instrument. The time of oscillation of the needle can be shortened by partially depressing the needle lifting locking pin, or by using the average position of the needle in its swing. When sighting, hold hands rigid and turn the body.

Caution: When measuring angles in azimuth, no magnetic materials should be in dose proximity to the compass during the procedure.

b. Orientation. Allowance for declination constant can be made in the compass by shifting the azimuth scale, using the azimuth scale adjuster (fig. 3). The slotted head of the adjuster can be turned with a suitable screwdriver.

c. Measuring Azimuth Angles. To read the azimuth scale by reflection, hold the compass in both hands at eye level with arms braced against body and with the rear sight nearest the eyes. Place the cover at an angle of approximately 45° to the face of the compass (fig. 4) so that the scale reflection can be readily viewed in the mirror. Level the instrument by viewing the circular level in the mirror, sight on the desired object through the window, and read the azimuth indicated on the reflected azimuth scale by the south-seeking

(black) end of the compass needle. The instrument can be sighted by any of the methods below.

(1) Raise the rear sight holder approximately perpendicular to the face of the compass. Sight on the object through the opening in the rear sight holder (fig. 5) and through the window in the cover. Keep the compass level and raise or lower the eye along the opening in the rear sight holder until the black center line of the window bisects the object and the opening in the rear sight.

(2) Fold the rear sight holder (fig. 4) out parallel with the face of the compass, with the rear sight perpendicular to its holder. Sight through or over the rear sight and view the object through the window in the cover. If the object sighted is at a lower elevation than the compass, raise the rear sight holder as needed. The compass is correctly sighted when the compass is level and the operator sees the black center line of the window bisecting the rear sight and the object sighted.

(3) Raise the front sight and the extended rear sight assembly perpendicular to the face of the compass. Sight over the tips of the rear and front sights. If the object is above the line of sighting, fold the rear sight toward the eye as needed. The instrument is correctly alined when, with the level centered, the operator sees the tips of the sights and the center of the object sighted in coincidence.

d. Reading Azimuth Scale Directly. Hold the compass in both hands at about waist level, braced against the body, with the rear sight away from the body. Open the cover until the mirror affords a clear image of the object sighted. Raise the rear sight sssembly until it is approximately perpendicular to the face of tie compass. Level the instrument by means of the circular level. Holding arms rigid with the instrument level, turn body until the center line on the mirror bisects the opening in the rear sight holder and the reflection of the object sighted then read the azimuth indicated on the azimuth scale by the north-seeking (white) end of the compass needle.

e. Measuring Angle of Site. Hold the opened compass in a vertical plane with the rear sight (fig. 6) toward the body and the angle of site level lever to the right. Open the cover to an angle of approximately 45° to the face of the compass. Fold the rear sight holder out parallel to the face of the compass with the rear sight perpendicular to the holder. Look through the rear sight and raise or lower the instrument until the center line of the window bisects the opening in the rear sight and

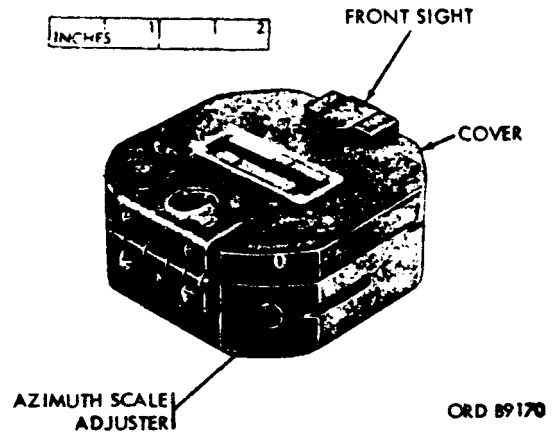

Figure 3. Compass M2.

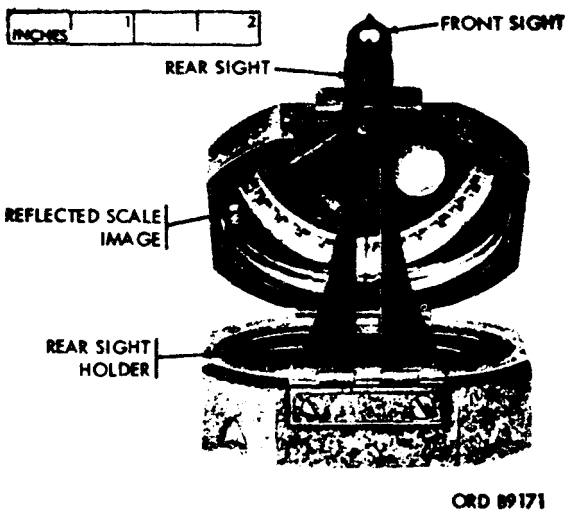

Figure 4. Compass M2 observer's view, azimuth.

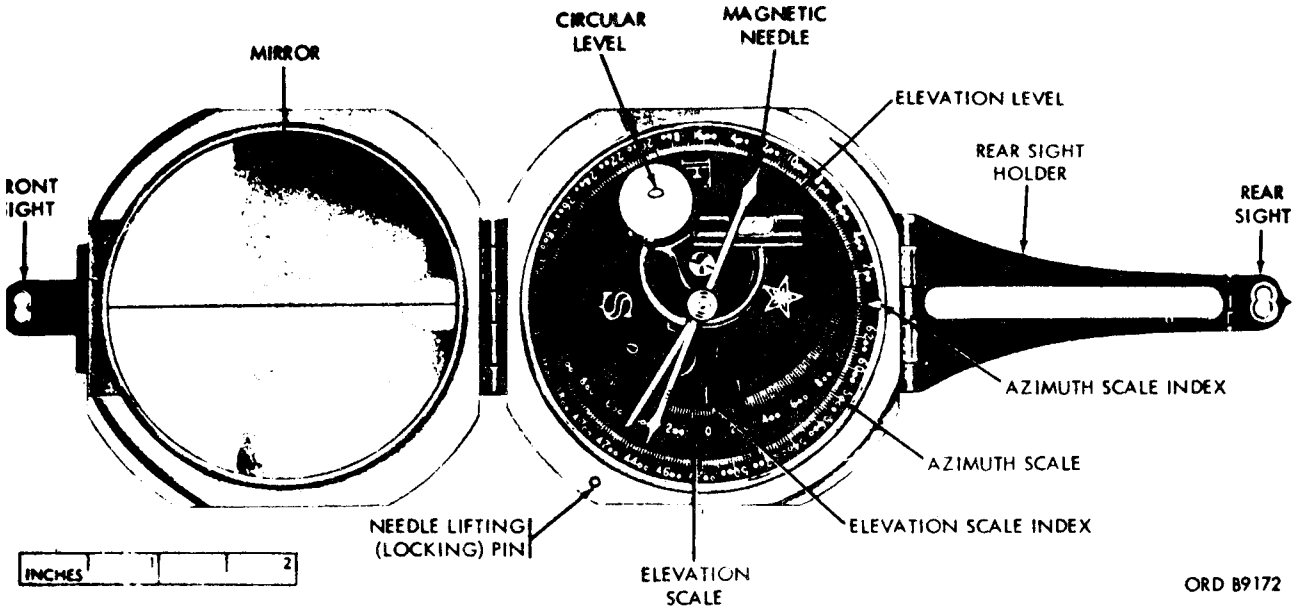

Figure 5. Compass M2.

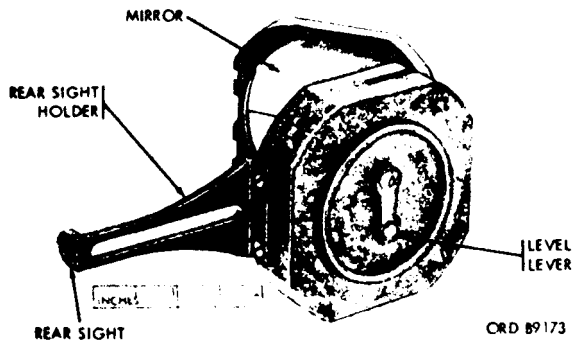

Figure 6. Compass M2-bottom view.

the object sighted; then level the tubular level reflected in the mirror, by means of the lever. Read the angle of site opposite the index. Care must be exercised to maintain the compass in a vertical plane to obtain accurate readings.

f. Measuring Gun Elevation. Open the cover and rear sight holder so that they are parallel with the face of the compass. Place the left side of the opened compass on the leveling plates of the breech ring or on a level portion of the piece which is parallel to the bore, center the bubble of the elevation level, and read the angle of elevation.

Section III. OPERATION UNDER UNUSUAL CONDITIONS

14. General

In addition to the normal operating procedures for usual conditions described in section II, special instructions for operating under unusual conditions are contained herein. In addition to the normal preventive-maintenance services (pars. 20 through 24), special care in cleaning and handling must be observed where extremes of temperature and atmospheric conditions are present.

15. Operation in Extreme Cold

a. In temperatures below freezing it is necessary that the moving parts be kept absolutely free from moisture.

b. Never breathe on glass in cold weather. This will serve only to aggravate conditions already present and, in extreme cases, may even break the glass.

c. Do not bring any materiel indoors unless it is absolutely necessary. It is best to leave it outdoors, but covered to

protect it from the. Snowtight lockers which stay at outdoor temperatures are recommended as a place for keeping the compass. If it is necessary to bring instruments from low temperatures to room temperatures, "anticondensation" containers should be used. These containers can be specially made boxes or any other fairly airtight containers with heat-conducting walls. Keep them outside 80 they will remain at prevailing temperatures until it is desired to bring the instrument indoors; then put the instrument into the container, close the top, bring it indoors and let it come to room temperature. When the instrument is at room temperature, the container can be opened and the instrument removed without condensation forming on it. If anticondensation chambers are not used and instruments are brought into a heated room, condensation will occur and the instrument will have to be wiped thorughly dry. Use only lens tissue paper for drying glass.

d. Use a dry cloth for cleaning. A water are damped cloth will either freeze to the mirror or it will leave a film of ice and make it inoperable.

e. Do not permit the accumulation of snow or ice on the compass. When not in use, always keep the compass inside carrying case M19 to prevent such accumulation.

f. Never apply heat from strongly concentrated sources directly to an extremely cold compass. Sudden changes in temperature may cause breakage of the component parts of the compass.

16. Operation Under Dusty or Sandy Conditions

Under extremely dusty or sandy conditions, extra care must be exercised when cleaning the compass so that scratching or marring of the mirror does not occur. Shake all dust and sand from the carrying case.

CHAPTER 3

MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, TOOLS, AND EQUIPMENT FOR OPERATION AND ORGANIZATIONAL MAINTENANCE

17. Repair Parts

No repair parts are supplied to the using organization for replacement on the compass M2.

18. Common or Special Tads

No common or special took are required.

19. Equipment

Carrying Case M19 is equipment required and authorized for Compass M2.

Section II. PREVENTIVE-MAINTENANCE SERVICES

20. General

Preventive maintenance is the systematic care, inspection, and servicing of equipment to maintain it in serviceable condition, prevent breakdowns, and assure maximum operational readiness. First echelon preventive maintenance is accomplished by the equipment operator. The operator's role in the performance of preventive-maintenance service is: To perform the daily service each day the equipment is operated.

21. Responsibility

Operators and crew are personally responsible for assigned equipment. Squad, section, and platoon leaders are charged with supervisory responsibility for equipment pertaining to their commands. Unit and organizational commanders are required to insure that equipment issued or assigned to their commands are properly maintained in a serviceable condition, and that they are properly cared for and used.

22. General Procedures for All Services and Inspections

a. The following general procedures apply to first-echelon preventive-maintenance services and all inspections, and are just as important as the specific procedures.

b. Inspections to see if items are in good condition, correctly assembled or stowed, secure, not. excessively worn, apply to most items in the preventive-maintenance and inspection procedures. Any or all of these checks that are pertinent to any item will be performed automatically, as general procedures, in addition to any specific procedures given.

(1) Inspection for "good condition" is usually an external visual inspection to determine whether the unit is damaged beyond safe or serviceable limits. Good condition is explained further as meaning: not bent or twisted, not chafed or burred, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut, not deterioratad.

(2) Inspection of a unit to see that it is "correctly assembled" or stowed is usually a visual inspection to see if the unit is in its, normal position in the equipment and if all its parts are present and in their correct relative position.

(3) By "excessively worn" is meant worn beyond serviceable limits or to a point likely to result in failure if the unit is not replaced before the next scheduled inspection It

includes illegibility as applied to markings, data and caution plates, and printed matter.

(4) Such expression as "replace if necessaary" is not used in the specific procedures. It is understood that whenever inspection reveals the need of replacement, the necessary action will be taken.

23. Preventive-Maintenance by Operator(s)

a. Purpose. To assure maximum operational readiness, it is necessary that the equipment be systematically inspected at intervals every day it is operated, so defects may be discovered and corrected before they result in serious damage or failure. Certain scheduled maintenance services will be performed at these designated intervals. Any deficiencies discovered that c a n n o t be corrected by the operator, will be reported on DA Form 2404.

b. Daily Preventive-Maintenance Service. Each piece of equipment will be inspected each day that it is operated. This service is divided into three parts, as indicated in (1) through (3) below.

(1) ***Before-operation service.*** This is a brief service to ascertain that the equipment is ready for operation it is mainly a check to see if conditions affecting the item's readiness have changed since the last-operation service.

(2) *During-operation service.* This service consists of detecting unsatisfactory performance.

(3) *After-operation service.* This is the basic daily service for the equipment. It consists of correcting, insofar as possible, any operating deficiencies. Thus the equipment is prepared to operate upon a moment's notice.

c. Fire-Control Instruments.

(1) *General precautions in cleaning.*

(a) Under no circumstances use polishing liquids, pastes, or abrasives for polishing window or mirror. To remove dust use only clean lens tissue paper.

(b) Do not touch the mirror or window with the bare fingers. To r e m o ve fingerprinta, oil, or grease from glass, apply alcohol with lens tissue paper, and wipe gently with c 1 e a n lens tissue paper. If alcohol is not available and the temperature is above freezing, breathe heavily upon glass and wipe off with clean lens tissue paper. Repeat this operation until clean.

Caution: The compass is sealed to withstand dust, dampness,and variations of atmospheric conditions; however, the compass is not protected to resist steam, air or water under high pressure.

(2) *Care in handling fire-control equipment.*

(a) The compass M2 is, in general, suitably designed for functional purposes. It will not, however, stand rough handling or abuse. Inaccuracy or malfunctioning will result from mistreatment.

(b) Unnecessary turning of screws or other parts not incident to the use of the compass is forbidden.

(c) Keep the compass as clean and dry as possible. If the compass is wet, dry it carefully before placing it in its carrying case.

(d) When not in use, keep the compass in its carrying case.

(e) Keep the exposed surfaces of the mirror and window dry to prevent scratching of the glass.

24. Specific Procedures For First Echelon

There are no specific procedures for first echelon, daily or weekly periodic maintenance checks or services.

Section III. TROUBLESHOOTING

25. Scope

Troubleshooting is a systematic isolation of defective components by means of symptoms, test for determining the defective component, plus remedies. The test and remedies provided in this section are governed by the scope of the organizational level of maintenance.

26. Procedure

The troubleshooting procedure described in table II is one of determining, upon occurrence of malfunctions noted, the probable cause, then taking the necessary corrective action, which includes notifying maintenance personnel if the tests and remedies are beyond the scope of the using organization.

Table II. Troubleshooting

Malfunction	Probable cause	Corrective action
Sights and mirror are out of alinement	Front or rear sights are bent	Obtain new compass
Azimuth scale adjuster does not rotate	Pin teeth of the adjuster are broken or bent	Obtain new compass
Sluggish needle movement	Broken jewel, bent or broken needle pivot	Obtain new compass
Needle lifting lever fails to lock	Lifting lever is bent or broken	Obtain new compass
Level vials do not function	Broken or cracked vials	Obtain new compass

Section IV. REPAIR OF COMPASS M2 AND CARRYING CASE M19

27. General

Repair of compass M2 and/or carrying case M19 is not authorized.

28. Maintenance

a. When compasses become unserviceable, obtain a replacement on a direct exchange basis from the supporting maintenance unit.

b. Return all unserviceable compasses through supply channels to Commanding Officer, Frankford Arsenal, ATTN: SMUFA-3300, Philadelphia, Pennsylvania, 19137 for maintenance engineering evaluation.

c. If carrying case M19 becomes worn, damaged. or destroyed in such a manner as to render it an inadequate protection for compass M2, it should be replaced as authorized in appendix III.

29. Final Inspection,

Final inspection of compass M2 and carrying case M19 will consist primarily of a visual inspection of the materiel by organizational, field, or depot maintenance personnel.

a. Good Condition. When it has been determined that the materiel is in good condition (par. 8) it shall be stowed or placed in storage.

b. Excessively Worn. When it has been determined that the materiel is excessively worn (par. 12) it shall be replaced in accordance with appendix III.

CHAPTER 4

DOMESTIC SHIPMENT, LIMITED STORAGE, AND DEMOLITION TO PREVENT ENEMY USE

Section I. DOMESTIC SHIPMENT AND LIMITED STORAGE

30. Shipping Instructions

When shipping the compass M2, carrying case M19, and the technical manual TM 9-1290-333-15, the officer in charge of preparing shipments will be responsible for compass M2 being shipped in a serviceable condition, properly packard and packed including the preparation of Army shipping documents.

31. Processing ond Packaging

For instructions for processing and packaging compass M2, carrying case M19, and TM 9-1290-333-15 refer to TM 9-200 (boxed materiel).

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

32. General

Destruction of compass M2 when subject to capture or abandonment in the combat zone will be undertaken by the using arm only when, in the judgment of the unit commander concerned, such action is necessary in accordance with orders of or po1icy established by the Army commander.

33. Destruction By Disposal

Adequate destruction of the materiel requires that it be destroyed to the extent that the enemy cannot restore it to usable condition in the combat zone either by repair or by cannibalization. If evacuation of personnel is made, all materiel should be carried with them. If evacuation is not possible, all materiel should be thoroughly smashed with an ax or sledge.

APPENDIX I

REFERENCES

1. Publication Indexes

The following publication indexes should he consulted frequently for latest changes or revisions of references given in the appendix and for new publications relating to materiel covered in this manual.

Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings. DA Pam 108-1

Military Publications:

Index of Administrative Publications. . . . . ..DA Pam 310-1

Index of Blank Forms . . . . . DA Pam 310-2

Index of Doctrinal, Training and Organizational Publications. . . . . DA Pam 310-3

Index of Graphic Training Aids and Devices . . . . . .DA Pam 310-5

Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders. DA Pam 310-4

2. Supply Manuals

The following supply manual of the Department of the Army pertain to this materiel:

Destruction to Prevent Enemy Use.

Ammunition and Explosives (Class 1375 Explosives, Solid Propellants and Explosive Devices). SM 9-5-1375

3. Forms

The following forms pertain to this materiel:

DA Form 9-1, Materiel Inspection Tag
DA Form 9-79, Parts Requisition
DA Form 9-80, Job Order File
DA Form 828, Job Time Ticket - Individual
DA Form 829, Rejection Memorandum
DA Form 1296, Stock Accounting Record
DA Form 1297, Title Insert (Formal Accountability)
DA Form 1546, Request for Issue or Turn-In
DA Form 2028, Recommended Changes to DA Technical Manual Parts List or Supply Manual 7, 8, or 9
DA Form 2402, Exchange Tag
DA Form 2404, Equipment Inspection and Maintenance Work-Sheet
DA Form 2405, Maintenance Request Register
DA Form 2407, Maintenance Request
DD Form 6, Report of Damaged or Improper Shipment
DD Form 250, Materiel Inspection and Receiving Report

4. Other Publications

a. Camouflage.

Camouflage, Basic Principles and Field Camouflage . . . . . FM 5-20

b. Decontamination.

Chemical, Biological, and Radiological Decontamination . . . . . TM 3-220

c. Destruction to Prevent Enemy Use.

Explosives and Demolitions . . . . . FM 5-25
Ordnance Ammunition Service. . . . . FM 9-5
Ordnance Service in the Field. . . . . FM 9-1
Safety: Regulations for Firing Ammunition for Training, Target Practice, and Combat. AR 385-63 AFR 50-13

d. General.

Dictionary of United States Army Term . . . . . AR 320-5
Logistics (General):
Malfunctions Involving Ammunition and Explosives . . . . . AR 700-1300-8
Military Symbols . . . . . FM 21-30 AFM 55-3
Military Terms, Abbreviations, and Symbols:
Authorized Abbreviations and Brevity Codes . . . . . AR 320-50
Military Training . . . . . FM 21-5
Ordnance Direct Support Service . . . . . FM 9-3
Ordnance General and Depot Support Service . . . . . FM 9-4
Safety: Accident Reporting and Records . . . . . AR 385-40
Shop Mathematics . . . . . TM 9-2820
Techniques of Military Instruction . . . . . FM 21-6
The Army Equipment Record System and Procedures. . . . . TM 38-750

e. Maintenance.

Maintenance of Supplies and Equipment:
Cleaning of Ordnance Materiel.. . . . . TM 9-208-1
Command Maintenance Inspections . . . . . AR 750-8
General Maintenance Procedures For Fire Control Materiel. . . . . TM 9-254
Organization, Policies, and Responsibilities for Maintenance Operation. AR 750-5
Technical Procedures: Elementary Optics and Application to Fire Control Instruments. TM 9-258

f. Operations.

Operation and Maintenance of Ordnance Materiel in Extreme Cold Weather, 0° to -65° F. TM 9-207
Ordnance Corp. Equipment Data Sheets . . . . . TM 9-500
Special Operations: Northern Operations . . . . . FM 31-71

g. Shipment and Storage.

General Packaging Instructions for Ordnance General Supplies . . . . . TM 9-200
Instruction Guide: Ordnance Preservation, Packing, Packaging, Storage and Shipping. TM 9-1005
Issue of Supplies and Equipment: Preparation Processing, and Documentation for Requisitioning, Shipping, and Receiving. AR 725-5
Logistics (General): Preservation, Packaging and Packing , ... AR 700-15
Logistics (General): Report of Damaged or Improper Shipment . . . . . AR 700-58
Marking and Packing of. Supplies and Eqiupment: Marking of Supplies for Shipment. AR 746-80
Paper, Lens, Tissue, Antitarnish, Wrapping MIL-P-13988
Preservation, Methods of.... . . . . MIL-P-116C
Protection of Ordnance General Supplies in Open Storage . . . . . TB ORD 379
Standards for Oversea Shipment and Domestic Issue of Ordnance Materiel Other Than Ammunition and Army Aircraft. TB ORD 385
Storage of Supplies and Equipment Storage and Materiels Handling . . . . TM 743-200-1

APPENDIX II

BASIC ISSUE ITEMS, ORGANIZATIONAL, FIELD AND DEPOT REPAIR PARTS AND SPECIAL TOOLS LISTS

Section I. PREFACE

1. General

This appendix is a list of basic issue tems, organizational, field and depot items required and/or authorized for compass magnetic, unmounted: M2.

2. Requisitions Notes

Items listed and indicated by an asterisk nay be requisitioned if required.

3. Explanation of Columns

a. Source, Maintenance, and Recoverability Code (col. 1).

(1) Materiel code *(col. 1a).* This column indicates the materiel code, assigned to the listed item. Materiel codes of items in this list are:

Code	*Type materiel*
9	Ordnance Materiel
12	Adjutant General

(2) *Source (col. 1b).* This column indicates the selection status and source for the listed item. Source code used in this list is:

Code	*Explanation*
P	Requisition from the depot system of the responsible material code (applies to high mortality parts).

(3) *Maintenance level (col. 1c).* This column indicates the lowest maintenance echelon authorized for the listed item. Maintenance level code used in this list is:

Code	*Explanation*
O	Organizational maintenance (1st and 2nd echelons)

(4) *Recoverability (co., 1d).* When no code is indicated, the item is expendable and not recoverable.

b. Federal StockNumber (col. 2). This column indicades the Federal stock number which has been assigned by the Cataloging Division, Defense Loisgtics Services Center.

c. Description (col. 3). This column indicates the Federal item name (shown in capital letters) and any additional description required for supply operations. The materiel code or manufacter's part number is also included for reference.

d. Unit of Issue (col. 4). This column indicates the quqntity to be requisitioned

e. Quantity Incorporated in Unit (col. 5). This column indicates the quantity of the listed item autiorized for stockage to constitute the prescribed load.

f. Column 6. This column indicates the allowance per major item or combination (lst echelon).

g. Column 7. This column indicates the 15-day maintenance alowance per 100 equipments (2nd echelon).

h. Column 8. This column indicates the M-day maintenance allowances per 100 equipments. (a) 3rd echelon (direct support) (b) 4th echelon (general support).

i. Column 9. This column indicates depot maintenance guide per 100 equipments (5th echelon).

4. Abbreviations and Symbols

a. Abbreviations.

Abbreviation	*Explanation*
w/e	with equipment

b. Symbols. None.

(1) Source, maintenance, and recoverability code				(2)	(3)	(4)	(5)	(6)	(7)	(8) 15-Day maintenance allowances per 100 equipments		(9)
(a) Materiel code	(b) Source	(c) Maintenance level	(d) Recoverability	Federal stock No.	Description	Unit of issue	Quantity incorporated in unit	Allowance per major item or combination (1st Echelon)	15-Day maintenance allowances per 100 equipments (2nd Echelon)	(a) 3rd Echelon (direct support)	(b) 4th Echelon (general support)	Depot maintenance guide per 100 equipments (5th Echelon)
					Section A — Basic Issue Items, Organizational, Field and Depot Repair Parts and Special End Item							
9	P	O	---	1290-560-6596	COMPASS, MAGNETIC, UNMOUNTED: M2, w/e (8293421).	1						
					Component of End Item							
			---	----------	COMPASS, MAGNETIC, UNMOUNTED: M2 (8565186).	1	----	1				
					REPAIR PARTS							
					None authorized							
					Tools and Equipment							
9	P	O	---	1290-654-5048	CASE: CARRYING, M19 (6582645).	1	----	1				
					MATERIEL ISSUED BY OTHER TECHNICAL SERVICES							
					The following items are issued by the Adjutant General's Office in accordance with distribution formula and AR 310-1. Additional copies, when required, will be requisitioned from the Adjutant General's Office.							
12	---	---	---	----------	TECHNICAL MANUAL, TM 9-1290-335-15	1	----	1				
					Section B — Organizational, Field and Depot Repair Parts And Special Tool List							
					REPAIR PARTS							
					None authorized							
					Tools and Equipment							
9	P	O	---	1290-654-5048	CASE: CARRYING, M19 (6582645).	1	----	----	----	0.1	0.1	10

APPENDIX III

MAINTENANCE ALLOCATION CHART

SERVICE — To clean, preserve, and maintain.

INSPECT — To verify serviceability and detect inaccuracies or failure by scrutiny, and to determine that materiel is not worn, torn, sorat.shed, broken, or otherwise destroyed and unfit for use.

REPLACE — To furnish usable material.

SYMBOL "X" — The symbol X placed in the appropriate column indicates the echelon responsible for performing that pacticular maintenance operation, but does not necessarily indicate that repair parts will be stocked at that level. Echelons higher than the echelon marked by X are authorized to perform the indicated operation.

(1) Group number	(2) Component and related operations	(3) Echelons 1st	2nd	3rd	4th	5th	(4) Tools required	(5) Remarks
	Compass M2							
	Service	x						
	Inspect	x						
	Replace			X				
	Carrying Case M19							
	Service	x						
	Inspect	x						
	Replace			X				

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NG: State AG (3); Units same as Active Army except one (1) copy to each unit.
USAR: Same as Active Army except one (1) copy to each unit.
For explanation of abbreviations used, see AR 320-50.

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THE METRIC SYSTEM AND EQUIVALENTS

'NEAR MEASURE

. 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

'VEIGHTS

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

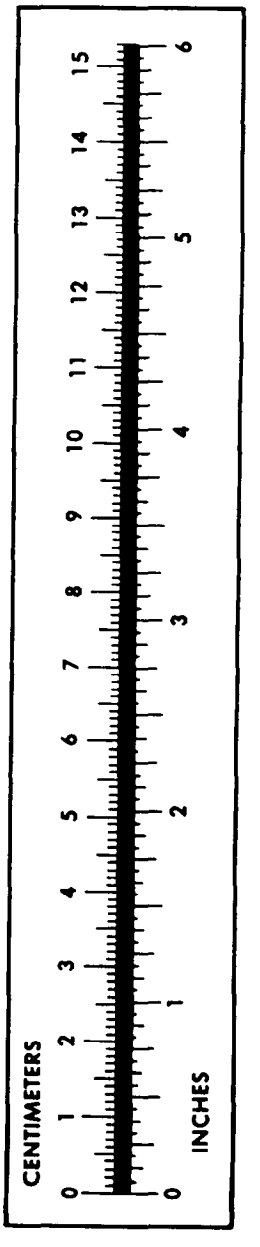
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 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
ıts	Liters	0.473
arts	Liters	0.946
allons	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
ers	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
lometers per Liter	Miles per Gallon	2.354
meters per Hour	Miles per Hour	0.621



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