

MIL-C-17850A(GL)

29 March 1983

SUPERSEDING

MIL-C-17850 (WEP)

15 January 1954

## MILITARY SPECIFICATION

## COMPASS, MAGNETIC, CARD, POCKET, TYPE MC-1

This specification is approved for use by the Natick Research and Development Laboratories, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

## 1. SCOPE

1.1 Scope. This document covers certain design requirements and all performance requirements of a small, portable, magnetic, card type compass.

1.2 Classification. Magnetic compasses covered by this document shall be designated type MC-1.

## 2. APPLICABLE DOCUMENTS

2.1 Government documents. Unless otherwise specified, the following documents of the issue in effect or date of invitation for bids or request for proposal, form a part of this document to the extent specified herein.

## SPECIFICATIONS

## FEDERAL

A-A-1249	- Paper, Wrapping, Tissue
QQ-N-290	- Nickel Plating (Electrodeposited)
QQ-P-416	- Plating, Cadmium (Electrodeposited)
PPP-B-566	- Boxes, Folding, Paperboard
PPP-B-636	- Boxes Snipping, Fiberboard

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U.S. Army Natick Research and Development Laboratories, Natick, MA 01760 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 6605

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MILITARY

- MIL-P-116 - Preservation, Methods of
- MIL-F-495 - Black Chemical Finish for Copper Alloys
- MIL-A-8625 - Anodic Coatings, for Aluminum and Aluminum Alloys

STANDARDS

FEDERAL

- FED-STD-595 - Colors

MILITARY

- MIL-STD-129 - Marking for Shipment and Storage
- MIL-STD-130 - Identification Marking of U.S. Military Property
- MIL-STD-889 - Dissimilar Metals
- MIL-STD-1188 - Commercial Packaging of Supplies and Equipment
- MS-33558 - Numerals and Letters, Aircraft Instrument Dial, Standard Form of

2.2 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document shall take precedence.

3. REQUIREMENTS

3.1 First article. When specified, a sample shall be subjected to first article inspection (see 4.3, 6.2, and 6.3).

3.2 Materials. Materials shall conform to the requirements specified herein and in the subsidiary documents applicable thereto (see 6.4).

3.2.1 Non-magnetic materials. Non-magnetic materials shall be used for all parts of the compass except where magnetic materials are essential.

3.2.2 Fungus-proof materials. Materials which are not nutrients for fungi shall be used to the greatest extent practicable. Materials which support fungi shall be treated with a suitable, permanent fungicidal agent.

3.2.3 Corrosion resistant metals. Metals shall be of the corrosion-resisting type or suitably protected to resist corrosion in salt spray.

3.2.4 Dissimilar metals. Unless suitably protected against electrolytic corrosion, dissimilar metals shall not be used in contact with each other. Dissimilar metals are defined in MIL-STD-889.

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3.3 Design and construction. The general outline and dimensions of the compass shall conform to figure 1. The lanyard rings shown in figure 1 shall normally be spring loaded in the flush position but may be swung out to accept the securing lanyard. Compasses shall be constructed to withstand the normal strain of jars, vibration and such other conditions as are incident to shipping, storage, and service, without failure. Attachment of compass card, damping cup, and pivot post shall be by mechanical means and not totally dependent on glue or adhesive.

3.3.1 Case.

3.3.1.1 Optical properties. The clear portion of the case shall be made of transparent plastic, uniform in texture and free from flaws which will affect the legibility of the card markings when the compass is observed under normal operating conditions.

3.3.1.2 Resistance to static charge. Material of the case shall not build up a charge of static electricity great enough to cause the compass to malfunction.

3.3.1.3 Condensation. The interior of the case shall be free of visible frost when the compass is thermally stabilized at  $-25^{\circ}\text{F}$ .

3.3.1.4 Leak tightness. The case shall not leak when tested as specified in 4.4.4.

3.3.1.5 Flootation. The compass shall float in water.

3.3.1.6 Cleanliness. The interior of the case shall be free of visible foreign matter.

3.3.2 Lubber line. The lubber line, 0.015 inches wide, shall be marked on the inside of the top and on two sides of the transparent case with lusterless white, color 37875 of FED-STD-595.

3.3.3 Sighting slot. A vee-shaped sighting slot, in the plane of the lubber line shall be engraved or molded in the bottom of the case. Two vee-shaped sighting slots shall be provided in the beaded rim at the top of the case, one at each end of the lubber line.

3.3.4 Jewel mount. A spring mounted, glass, vee bearing jewel shall be provided. The mount shall be designed so that the card pivot cannot, under any circumstances, cause the jewel to bottom.

3.3.5 Magnets. The card magnets shall be Alnico V or equivalent magnetic material and shall be suitably heat-treated, magnetized to saturation, and aged to insure optimum performance.

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3.3.6 Damping cup. The damping cup shall be made of high conductivity copper.

3.3.7 Card. The card shall be self-seating and made of aluminum or aluminum alloy. The weight of the card shall not exceed 4 grams. The junction between the card and any metal support shall be adequately protected to prevent electrolytic corrosion. The card magnets shall be set so that their axes are parallel to each other and parallel to a plane through the north (0-degree) and south (180 degree) points of the card.

3.3.8 Pivot. The card pivot shall be tipped with osmium or other suitable material, such as N-100 stainless steel, as may be approved by the contracting activity. The design of the compass shall be such as to protect the pivot from coming in contact with any part of the compass except the jewel.

3.3.9 Weight. The weight of the compass shall not exceed 0.10 pounds.

3.3.10 Marking of card. The card shall be marked as shown in figure 2. The form of the letters and numerals shall conform to MS 33558.

3.4 Performance.

3.4.1 Shock resistance. The operation of the compass shall not be impaired by shock when tested as specified in 4.4.4.

3.4.2 Compass error. The error in magnetic azimuth, including that caused by pivot friction shall not be more than 2 degrees when tested as specified in 4.4.4.

3.4.3 Freedom of rotation (level). The compass card and magnetic assembly shall rotate freely when tested as specified in 4.4.4.

3.4.4 Freedom of rotation (tilted). The compass card and magnet assembly shall remain free when the compass case is tilted 15 degrees from the horizontal axis when tested as specified in 4.4.4.

3.4.5 Card balance. The card shall be balanced so that it is horizontal within 2 degrees in a vertical field of 0.30 oersted, tilts  $2.5 \pm 1.5$  degrees to the south in a magnetic field of zero oersted and tilts  $2.5 \pm 1.5$  degrees to the north in a vertical field of 0.60 oersted.

3.4.6 Damping. The rotation of the card shall be damped so that excessive overswing is prevented when tested as specified in 4.4.4.

3.4.7 Vibration resistance.

3.4.7.1 Vibration error. The reading of the compass card shall not vary more than 5 degrees when subjected to the test specified in 4.4.4.

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3.4.7.2 Vibration failure. The compass shall not be adversely affected by extended vibration when tested as specified in 4.4.4.

3.4.8 High temperature operation. The operation of the compass shall not be adversely affected by a temperature of 50°C when tested as specified in 4.4.4.

3.4.9 Low temperature operation. The operation of the compass shall not be adversely affected by a temperature of minus 30°C when tested as specified in 4.4.4.

4.4.10 Temperature stability. The performance of the compass shall not be adversely affected by storage at temperatures from 70°C to minus 55°C when tested as specified in 4.4.4.

3.4.11 Finish.

3.4.11.1 Aluminum alloy parts. Aluminum alloy parts shall, when practical, be covered with an anodic film in accordance with MIL-A-8625.

3.4.11.2 Brass and steel parts. Brass and steel parts shall, when practical, be cadmium or nickel plated in accordance with QQ-P-416 or QQ-N-290 as appropriate. As an alternate on brass parts, black chemical finish conforming to MIL-F-495 may be used.

3.4.12 Marking for identification. In accordance with MIL-STD-130, each compass shall be legibly and permanently marked with the following information in such a manner as not to impair the readability of the compass:

U.S.  
Compass, Magnetic, Card, Pocket Type MC-1  
Stock Number  
Manufacturer's Part No.  
Contract No. or Order No.  
Manufacturer's Name or Trademark

3.4.13 Operating instructions. The contractor shall furnish a set of operating instructions and a description of the compass, including a cross section drawing, with each compass. The instructions shall be printed on 8-1/2 by 11 inch paper and shall be submitted to NLABS for approval prior to printing.

3.4.14 Workmanship. All details of workmanship shall be in accordance with high-grade instrument manufacturing practice.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspection set forth in the document where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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4.2 Classification of inspection. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

4.3 First article inspection. When a first article is required (see 6.2), it shall be examined for the defects specified in table I and tested for the characteristics specified in table II. The presence of any defect or failure to pass any test shall be cause for rejection of the first article.

4.4 Quality conformance inspection. Unless otherwise specified, sampling for inspection shall be performed in accordance with MIL-STD-105.

4.4.1 Component and material inspection. In accordance with 4.1, components and materials shall be inspected in accordance with all the requirements of referenced documents unless otherwise excluded, amended, modified, or qualified in this document or applicable procurement document.

4.4.1.1 Certification. Components and materials shall be accepted on the basis of the contractor's certificate of compliance with the requirements of 3.2.1, 3.2.2, 3.2.3 and 3.2.4.

4.4.2 End item visual examination. The end item shall be examined for the defects listed in table I. The lot size shall be expressed in units of one compass. The sample unit shall be one compass. The inspection level shall be II and the acceptable quality level (AQL), expressed in terms of defects per hundred units, shall be 2.5.

TABLE I. Visual defects

Examine	Defect
Case	Not transparent Not uniform in texture Contains flaws, dirt Causes distortion Vees not provided, not sharp Lubber line off center, not well defined Sighting slot not sharp, misaligned Lanyard rings not held in flush position
Card	Letters or numerals not clear and sharp Arrow not clear, not centered on north Graduations not sharp Colors not uniform, do not match standard

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4.4.3 End item dimensional examination. The end item shall be examined for conformance to the dimensions specified. Any dimension deviating from the specified requirement shall be classified as a defect. The lot size shall be expressed in units of one compass. The sample unit shall be one compass. The inspection level shall be S-3 and the AQL, expressed in terms of defects per hundred units, shall be 4.0.

4.4.4 End item testing. The compass shall be tested as specified in table II. The lot size shall be expressed in units of one compass. The sample unit shall be one compass. The inspection level shall be II and the AQL expressed in terms of defects per hundred units, shall be 4.0.

TABLE II. End item tests

Characteristics	Requirement paragraph	Test method paragraph
Resistance to electrostatic charge	3.3.1.2	4.5.3
Condensation	3.3.1.3	4.5.4
Leak tightness	3.3.1.4	4.5.5
Flotation	3.3.1.5	4.5.2
Shock resistance	3.4.1	4.5.6
Compass error	3.4.2	4.5.7
Freedom of rotation (level)	3.4.3	4.5.8
Freedom of rotation (tilted)	3.4.4	4.5.9
Card balance	3.4.5	4.5.10
Damping ability	3.4.6	4.5.11
Vibration error	3.4.7.1	4.5.12
Vibration failure	3.4.7.1	4.5.13
High temperature operation	3.4.8	4.5.14
Low temperature operation	3.4.9	4.5.15
Temperature stability	3.4.10	4.5.16

If first article testing is not required, one representative compass shall be required to pass the tests specified in 4.5.2, 4.5.3, 4.5.4, 4.5.6, 4.5.11, 4.5.14, 4.5.15 and 4.5.16 before sampling under MIL-STD-105 can begin. If the representative unit passes the tests specified in 4.5.2, 4.5.3, 4.5.4, 4.5.6, 4.5.11, 4.5.14, 4.5.15 and 4.5.16, subsequent lots, produced without design, material, or manufacturing changes, may be accepted without repetition of those tests, providing all other requirements are met.

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4.4.5 Packaging inspection. An examination shall be made to determine that preservation, packing and marking requirements comply with section 5 requirements. Defects shall be scored as specified in table III. The sample unit shall be one shipping container fully packaged with the exception that it need not be closed. Examination of closure defects listed in table III shall be made on shipping containers fully packaged. The lot size shall be the number of containers in the inspection lot. The inspection level shall be S-2 and the AQL expressed in terms of defects per hundred units shall be 4.0.

TABLE III. Packaging defects

Examine	Defect
Markings	Omitted; incorrect; illegible, of improper size, location, sequence, or method of application.
Workmanship	Inadequate application of components, such as incomplete closure of container flaps, inadequate stapling, loose strapping, or improper taping. Bulged or distorted container.
Materials	Any component missing, damaged, or not as specified.
Content	Number of compasses per container not as specified.

4.5 Methods of inspection.4.5.1 Test conditions.

4.5.1.1 Atmospheric and magnetic. Unless otherwise specified, all tests required by this document shall be made at standard atmospheric pressure and temperature and, for tests specified in 4.5.7, 4.5.8, and 4.5.11, in a magnetic field having a horizontal component of approximately 0.18 oersted.

4.5.1.2 Vibratory. Whenever a vibration stand is specified it shall consist of a device which will vibrate at any desired frequency between 500 and 2000 cycles per minute and shall subject the instrument to vibration such that a point on the vibrator stand will describe, in a plane inclined 45 degrees to the horizontal plane, a circle of the diameter specified herein.

4.5.1.3 Tapping. Unless otherwise specified, the compass shall be tested in normal operating position and shall be lightly tapped before a test reading is taken.



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4.5.2 Floatation test. Place the compass in distilled water at room temperature to determine compliance with the requirements of 3.3.15. If no portion of the compass remains above the surface of the water after a period of 1 minute it shall have failed the test.

4.5.3 Resistance to static charges test. Secure the compass on a horizontal surface with the lubber-line aligned with the N-S axis of the card. Briskly rub the surface of the case with a clean, dry cotton cloth for a period of 15 seconds. Failure of the card to read within  $3^\circ$  of north, 15 seconds after the rubbing operation is completed shall constitute failure of the test.

4.5.4 Condensation test. The compass shall be placed within a test chamber and cooled to the temperature specified in 3.3.1.3. While at this temperature it shall be determined by a visual examination with the unaided eye that the interior of the case is free of frost. Any evidence of frost inside the case shall constitute failure of the test.

4.5.5 Resistance to leakage test. The compass shall be immersed in water so that the uppermost part is  $2 \pm 1$  inches below the surface. The absolute pressure of the air above the water shall be reduced to 5.5 inches of mercury (absolute) and maintained until air bubbles substantially cease to be given off by the water. The reduced pressure shall be maintained for an additional period of 15 minutes. The formation of bubbles from air leaving the compass shall constitute failure of the test.

4.5.6 Shock resistance test. The compass shall be subjected to a drop test of 5 feet onto a hardwood surface. Any damage to the mechanism of the compass after it has been dropped four times shall constitute failure of the test.

4.5.7 Compass error test. The compass shall be mounted on a turntable and the lubber line aligned with the magnetic N-S axis. The compass error shall not exceed 2 degrees when determined for 0, 90, 180, and 270 degrees setting of the turntable. Any larger error shall constitute failure of this test. During this test the compass shall not be tapped or vibrated.

4.5.8 Freedom of rotation test (level). The compass case shall be secured on a level surface. The card shall be magnetically deflected 30 degrees from its equilibrium position, held long enough to come to rest, then released. The time for the card to pass through an angle of 25 degrees shall be noted. The test shall be repeated with the card deflected 30 degrees to the other side of its equilibrium position. The average time shall be the average of the two readings. Any average time greater than 1.25 seconds shall constitute failure of this test.

4.5.9 Freedom of rotation test (tilted). In a magnetic field having a vertical component of 0.30 oersted, the compass case shall be tilted 15 degrees and rotated about a vertical axis through 360 degrees. The card shall remain horizontal and shall not at any time, be deflected more than 5 degrees from its equilibrium position. Any excess deflection shall constitute failure of this test.

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4.5.10 Card balance test. The balance of the compass card shall be determined under the conditions specified in 3.4.5. Any tilt in excess of the specified angles shall constitute failure of this test.

4.5.11 Damping test. The card shall be magnetically deflected 30 degrees from its equilibrium position then released and the swing of the card beyond the equilibrium position noted. This test shall be repeated with deflection 30 degrees in the opposite direction. The average of the two determinations shall be the overswing and shall not exceed 8 degrees. Any excess shall constitute failure of this test.

4.5.12 Vibration error test. The compass shall be mounted on a vibration stand and subjected to a vibration as specified herein with a circle diameter between .009 and .011 inch at frequencies varying from 500 to 2000 cycles per minute. Any difference between the card reading observed before vibration and during vibration in excess of 5 degrees shall constitute failure of this test.

4.5.13 Vibration failure test. The compass shall be subjected to vibration as described in the vibration error test except that it shall be subjected to a frequency of 1800 cycles per minute for a period of 5 hours. At the completion of this vibration the compass card shall be deflected 5 degrees from its equilibrium position, released, allowed to come to rest, and read without tapping. The test shall be repeated, deflecting the card 5 degrees in the opposite direction and releasing. The difference between the two equilibrium readings shall be noted. Any difference in excess of 2 degrees shall constitute failure of this test. The compass shall not be tapped during this test.

4.5.14 High temperature operation test. The compass shall be subjected to a temperature of +50°C for 4 hours and, while at this temperature, the compass shall be subjected to and meet the requirements of the freedom of rotation test. Any damage to the compass which could affect subsequent operation shall be cause for rejection.

4.5.15 Low temperature operation test. The compass shall be subjected to a temperature of -30°C for a period of 4 hours. While at this temperature, the compass shall be subjected to and meet the requirements of the freedom of rotation test. Failure to meet those requirements shall constitute failure of the test.

4.5.16 Temperature stability test.

4.5.16.1 High temperature storage. The compass shall be subjected to a temperature of 70°C for four hours. After one hour at room temperature it shall pass the freedom of rotation test.

4.5.16.2 Low temperature test. The compass shall be subjected to a temperature of -55°C for four hours. After one hour at room temperature it shall pass the freedom of rotation test.

## 5. PACKAGING

5.1 Preservation. Preservation shall be level A.

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5.1.1 Level A. Each compass shall be individually cleaned and dried in accordance with MIL-P-116, methods C-1 and D-4. Each compass shall be snugly wrapped in a neutral tissue conforming to type II of A-A-1249 and the operating instruction sheet shall be wrapped around it. Each wrapped compass shall be inserted within a kraft lined chipboard folding box conforming to variety 1, style II, type D, class a, notched tucks of PPP-B-566. Approximate inside dimensions shall be 2 inches in length, 1-1/2 inches in width and 3 inches in depth.

5.2 Packing. Packing shall be level A, B, or Commercial as specified (see 6.2).

5.2.1 Level A packing. Three hundred compasses, preserved as specified in 5.1.1, shall be placed within a fiberboard box conforming to style RSC, type CF, (variety SW), class weather-resistant, grade V3s of PPP-B-636. The approximate inside dimensions of the box shall be 20 inches in length, 15 inches in width and 15 inches in depth. Each shipping container shall be closed in accordance with method III, waterproofed in accordance with method V, and reinforced as specified in the appendix of PPP-B-636 except that the inspection shall be in accordance with 4.4.5.

5.2.2 Level F packing. Three hundred compasses, preserved as specified in 5.1.1, shall be placed within a fiberboard box conforming to style RSC, type CF, (variety SW), class domestic, grade 275 of PPP-B-636. The approximate inside dimensions of the box shall be 20 inches in length, 15 inches in width and 15 inches in depth. Each shipping container shall be closed in accordance with method II as specified in the appendix of PPP-B-636, except that the inspection shall be in accordance with 4.4.5.

5.2.2.1 Weather-resistant fiberboard containers. When specified (see 6.2), the shipping container shall be a grade V3c, V3s or V4s fiberboard box fabricated in accordance with PPP-B-636 and closed in accordance with method III as specified in the appendix of PPP-B-636, except that the inspection shall be in accordance with 4.4.5.

5.2.3 Commercial packing. Compasses, preserved as specified in 5.1.1, shall be packed in accordance with MIL-STD-1188.

5.3 Marking. In addition to any special marking required by the contract or purchase order, unit packs and shipping containers shall be marked in accordance with MIL-STD-129 or MIL-STD-1188, as applicable.

## 6. NOTES

6.1 Intended use. The compass is intended for emergency use on life rafts or in remote areas.

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6.2 Ordering data. Acquisition documents should specify the following:

- (a) Title, number, and date of this document.
- (b) When a first article is required (see 3.1, 4.3 and 6.3).
- (c) Selection of the applicable levels of packing (see 5.2).
- (d) When weather-resistant fiberboard containers are required (see 5.2.2.1).

6.3 First article. When a first article is required, it shall be inspected and approved under the appropriate provisions of DAR 7-104.55. The first article should be a preproduction sample. The first article should consist of one unit. The contracting officer should include specific instructions in all acquisition documents regarding arrangements for inspection and approval of the first article.

6.4 Recycled material. It is encouraged that recycled material be used when practical as long as it meets the requirements of the document (see 3.2).

6.5 Changes from previous issue. Asterisks are not used in this revision to identify the changes with respect to the previous issue, due to the extensiveness of the changes.

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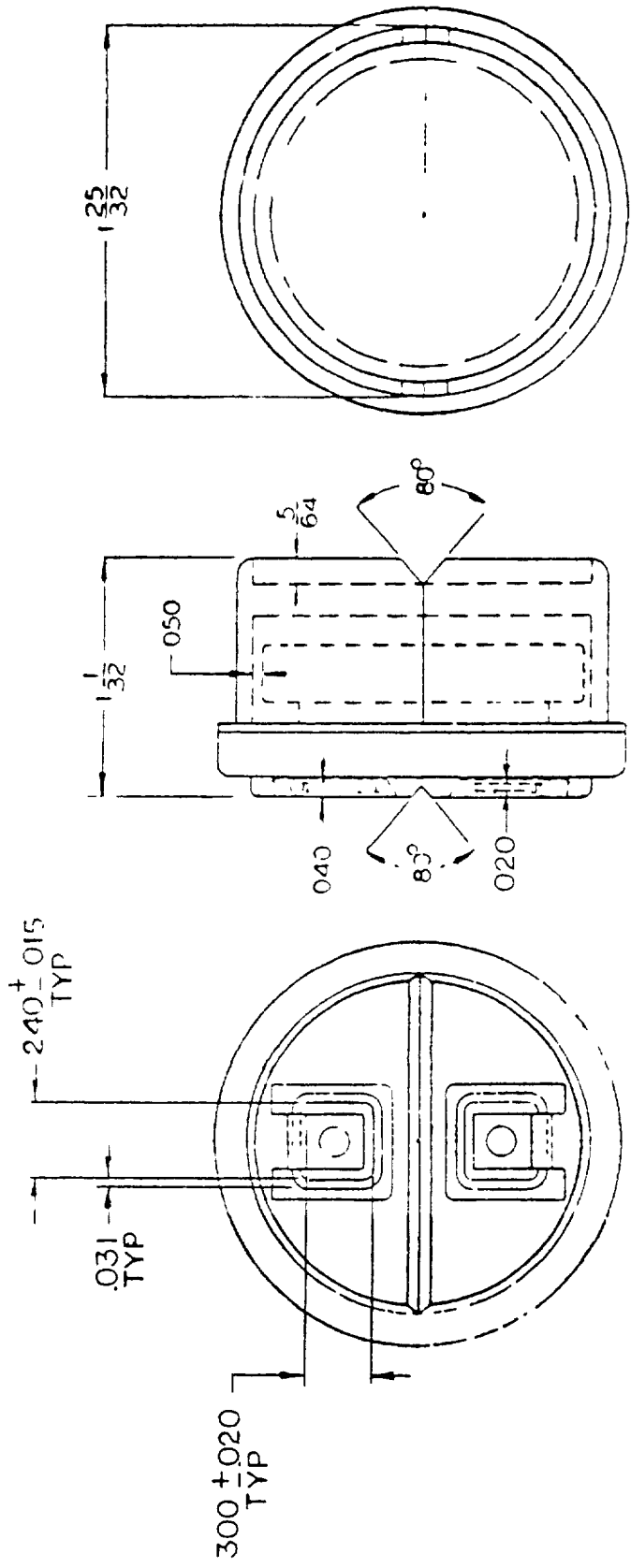
Review activity

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Project No. 6605-A325

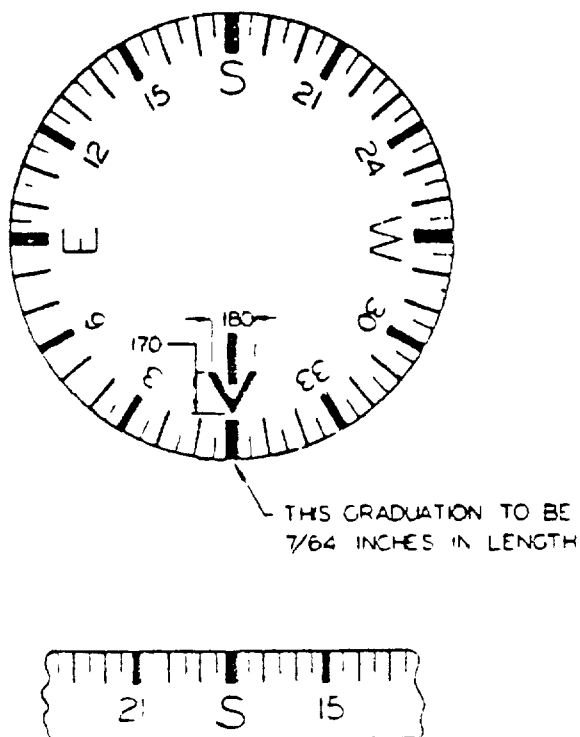


DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED

TOLERANCES FRACTIONS  $\frac{1}{64}$ , DECIMALS .005, ANGLES  $\frac{1^\circ}{2}$

FIGURE 1 COMPASS - MAGNETIC, CARD, POCKET, TYPE MC-1

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Marking	Height or Length $\pm .005$		Width of Line or Graduation	Finish
	Top of Card	Side of Card		
Letters N, E, S, W	-----	0.125	0.015	Lusterless White Color 57575 of FED-STD-595  or  photo etched to expose lusterless aluminum markings
Letters E, S, W	0.125	-----	0.015	
30° Graduations	0.156	0.094	0.020	
Graduations at E, S, W	0.156	0.094	0.040	
Arrow	0.375	-----	0.040	
10° Graduations	0.156	0.094	0.015	
5° Graduations	0.109	0.062	0.010	
Numerals 3, 6, 12, 15, 21, 24, 30, 33	0.080	0.080	0.010	
CARD BACKGROUND				Lusterless Black Color 37038 of FED-STD-595

Fig. 2 - Compass card markings.

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**NOTE** This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

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DEPARTMENT OF THE ARMY



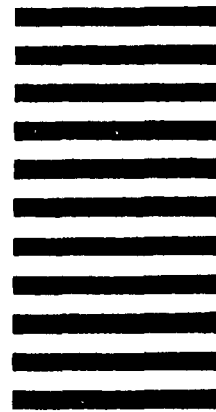
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## STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

*(See Instructions - Reverse Side)*

1 DOCUMENT NUMBER MIL-C-17850A (GL)		2 DOCUMENT TITLE COMPASS, MAGNETIC, CARD, POCKET, TYPE MC-1	
3a. NAME OF SUBMITTING ORGANIZATION		4 TYPE OF ORGANIZATION <i>(Mark one)</i> <input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER <i>(Specify)</i> _____	
b ADDRESS <i>(Street, City, State, ZIP Code)</i>			
5 PROBLEM AREAS			
a Paragraph Number and Wording			
b Recommended Wording			
c Reason/Rationale for Recommendation			
6 REMARKS			
7a NAME OF SUBMITTER <i>(Last, First, MI)</i> - Optional		b WORK TELEPHONE NUMBER <i>(Include Area Code)</i> - Optional	
c. MAILING ADDRESS <i>(Street, City, State, ZIP Code)</i> - Optional		8 DATE OF SUBMISSION (YYMMDD)	