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SUPERSEDING
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19 June 1945

MILITARY SPECIFICATION

CIRCLES, AZIMUTH; AND CIRCLES, BEARING

This specification has been approved by the Departments of the Army, the Navy, and the Air Force

1. SCOPE

1.1 This specification covers azimuth and bearing circles for use in the accurate determination of the bearings of terrestrial objects and the azimuths of celestial bodies

2. APPLICABLE SPECIFICATIONS, STANDARDS, DRAWINGS, AND PUBLICATIONS

2.1 The following specifications, standards, and drawings of the issue in effect on date of invitation for bids form a part of this specification.

SPECIFICATIONS

FEDERAL

NN-B-601—Boxes, Wood-Cleated-Plywood, for Domestic Shipment.
NN-B-621—Boxes, Wood, Nailed and Lock-Corner
NN-B-631—Boxes, Wood, Wirebound (for Domestic Shipment).
QQ-S-781—Strapping, Flat, Steel
LLL-B-631—Boxes, Fiber Corrugated (for Domestic Shipment)

MILITARY

JAN-P-105—Packaging and Packing for Overseas Shipment—Boxes, Wood, Cleated, Plywood
JAN-P-106—Packaging and Packing for Overseas Shipment—Boxes, Wood, Nailed
MIL-B-107—Boxes, Wood, Wirebound (Overseas Type)
MIL-A-140—Adhesive, Water-Resistant, Waterproof Barrier-Material.
MIL-E-5556—Enamel; Camouflage, Quick Drying

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MIL-P-6889—Primer, Zinc Chromate, for Aircraft Use
MIL-L-7178—Lacquer, Cellulose Nitrate, Gloss, for Aircraft Use
MIL-L-10547—Liners, Case, Waterproof
MIL-M-16576—Metal, Gun Castings

NAVY DEPARTMENT

General Specifications for Inspection of Material

STANDARDS

MILITARY

MIL-STD-105—Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129—Marking of Shipments

DRAWINGS

BUREAU OF SHIPS

S2407-533000—Nameplates for Navigational Instruments
S2407-607127 and S2407-607128—Azimuth and Bearing Circle Assembly and Details, Pieces 1 Through 58 Are to Be Used
S2407-607129—Stowage Box Assembly and Details for Azimuth Circle and Bearing Circle

(Copies of specifications, standards, and drawings required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Material.

3.1.1 Prisms, lenses, and mirrors shall be of high-grade optical glass, stable, nonhygroscopic, and free from strain, striae, stones, or seeds which are visible in the field of view or which would impair optical performance.

3.1.2 **Waxes, sealing materials, and lubricants used on metal parts shall be such as not** to cause corrosive action of the optical and mechanical parts or support fungus or mite growth.

3.2 **Azimuth circle and bearing circle rings.**

3.2.1 The azimuth circle and bearing circle rings shall be made of bronze conforming to Specification MIL-M-16576. The rings shall be turned true to fit over the bezel of the 7½ inch Navy standard compass.

3.2.2 The azimuth circle ring shall be provided with prisms, vanes and mirrors, fixed at the extremities of two diameters at right angles to each other, whereby direct azimuths of terrestrial objects and direct reflected azimuths of the sun may be observed and simultaneously read from the compass card.

3.2.3 The bearing circle ring shall be provided with a sight vane and a pentagon prism and mount.

3.3 **Front vane assembly.**—The prism shall be mounted at zero (0) degree mark of the azimuth circle and bearing circle rings in order to reflect the compass card reading to the observer's eye. The prism shall also reflect the image of the horizontal wire which is located at the base of the prism box parallel to and in coincidence with the sight vane wire. The front sight vane shall be mounted on the prism box, hinged to fold toward the center of the circle, and fitted to stop at the vertical position. The black reflecting mirror shall be mounted on the prism box hinged so as to fold toward and away from the center of the circle. The spirit level shall be mounted horizontally on the prism box toward the center of the ring perpendicular to the line of sight.

3.4 **Rear vane.**—The rear sight vane shall be located at the 180° mark of the azimuth circle and the bearing circle rings diametrically opposite the front sight vane hinged to fold toward the center of the circle and fitted to stop at the vertical position.

3.5 **Mirror.**—The cylindrical plano-convex mirror shall be located at the 270° mark of the azimuth circle ring, silvered, copper plated, and painted with acid-resisting paint on the convex side to reflect the image of the sun on to the 90° prism which is located diametrically opposite.

3.6 **Prism lens and level.**—The bracket and box located at the 90° mark of the azimuth circle ring shall contain a 90° prism and lens so placed that the image of the sun, as reflected by the cylindrical plano-convex mirror, will form a narrow slit of light on the compass card. The spirit level shall be mounted horizontally on the prism box toward the center of the ring perpendicular to the reflected line of light.

3.7 **Knobs.**—Knobs shall be made of bronze conforming to Specification MIL-M-16576, and shall be located at the 45° and 225° marks of the azimuth circle ring and at the 90° and 270° marks of the bearing circle ring, for the purpose of lifting or moving the instrument in azimuth.

3.8 **Graduations.**—The inner edge of the azimuth circle and bearing circle rings shall be beveled and graduated in degrees from zero (0) degree in a counterclockwise direction through 360°. every fifth degree shall be accentuated and every tenth degree numbered, the degree marks and numbers shall be filled with a permanent white opaque material.

3.9 **Alinement.**—All parts shall be so assembled that the zero (0) degree and 180° graduations and all sighting marks will lie in a plane which will be perpendicular to the plane of the bearing rings when the azimuth circle and bearing circle rings are level and shown to be so by the spirit level. This condition shall be true for all angular settings of the vanes and mirrors. The line of sight through the sighting vanes, the reflected image from the dark mirror, and the reflected image of the zero (0) degree mark on the compass cord shall be in the same plane when the instrument rings are level and check with the spirit level attached to the pentagon prism box. The image of the sun reflected from the curved mirror shall cast a well defined pencil of light on the zero (0) degree mark of the compass card when the azimuth circle ring is level and checks with the spirit level attached to the 90° prism box.

3.10 **Balance.**—The completed azimuth circle and bearing circle rings shall be balanced and fitted with spring clips to secure the instruments firmly against the bezel of the 7½ inch

Navy standard compass or the ship's course indicators to prevent damage or loss during gun fire

3.11 **Finish.**—All exposed metal surfaces except knobs, screw heads, pins, and wire shall be given one coat of zinc chromate primer conforming to Specification MIL-P-6889 and two coats of black enamel conforming to Specification MIL-E-5556 All other parts with the exception of mirrors and prisms shall be coated with clear lacquer conforming to Specification MIL-L-7178 Bearing surfaces shall be black nickeled or bronzed without bufing such surfaces shall be smooth and free from tool marks Finishes of all metal parts shall be such as not to permit corrosive action of the optical or mechanical parts The completed instrument shall withstand the salt-spray test specified in 4 4 2 without showing harmful corrosion

3.12 **Moisture and water resistance.**—The prism boxes and mirror shall be watertight under normal service conditions tightly secured and sealed as shown on Drawings S2407-607127 and S2407-607128

3 13 **Carrying case**—The carrying case shall conform to Drawing S2407-607129

3.14 **Nameplates.**

3.14.1 *Army*—Nameplates shall be furnished as specified (see 6 1)

3.14.2 *Navy*—A suitable nonwarping, weather-resistant nameplate of plastic or metal shall be provided on the front surface of the carrying case and marked in accordance with Drawing S2407-533000

3.15 **Marking.**

3.15.1 *Army*—The marking shall be as specified (see 6.1)

3.15.2 *Navy*—The top surface of the circles in the 270 to 360° quadrant shall be engraved with the following (the zeros to be replaced by mark number and model number)

U S NAVY (TYPE) CIRCLE MK O MOD O Ⓝ 000 (YEAR OF CONTRACT)

The letter N shall be encircled by a large letter O It shall be followed by the serial numbers as furnished by the procuring activity and the year of the contract. The contractor's name shall be engraved on the top surface of the circle in the 90 to 180° quadrant.

3.16 **Workmanship.**—The workmanship shall be of the highest quality

4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1 **Inspection procedures.**—For Naval purchases, the general inspection procedures shall be in accordance with General Specifications for Inspection of Material

4.2 **Sampling for lot acceptance**

4.2.1 *Lot*—For purposes of sampling a lot shall consist of all azimuth circles or bearing circles of the same design, manufactured in accordance with the same approved drawings, and submitted for inspection at one time.

4.2.2 *Sampling for visual and dimensional inspection*—A random sample of azimuth or bearing circles shall be selected in accordance with table I from each inspection lot of material offered for Government inspection of visual and dimensional characteristics with lot acceptance based on single sampling inspection requirements in accordance with Standard MIL-STD-105

TABLE I—*Sampling for visual and dimensional inspection*

AQL (approx.) = 1.5 percent defective

Number of circles in an inspection lot	Number of circles in sample	Acceptance number (defectives)	Rejection number (defectives)
15 and under	7	0	1
16 to 40	10	0	1
41 to 110	15	0	1
111 to 300	25	1	2
301 to 500	35	1	2
501 to 800	50	2	3
801 to 1,300	75	3	4
1,301 and over	110	4	5

Note The Government inspector may institute tightened or reduced inspection in accordance with Section 9 of Standard MIL-STD-105.

4.2.3 *Sampling for salt spray test.*—Two azimuth circles or two bearing circles shall be selected by the Government inspector from each lot and subjected to the tests specified in 4.4.

4.3 **Visual and dimensional inspection.**—Each of the sample azimuth circles or bearing circles selected in accordance with table I shall

be visually and dimensionally inspected by the Government inspector to verify compliance with this specification Any circle in the sample containing one or more visual or dimensional defects shall be rejected, and if the number of defective circles in any sample exceeds the acceptance number for that sample the lot represented by the sample shall be rejected

4.4 **Lot acceptance tests**

4.4.1 *Testing of sample azimuth or bearing circles for lot acceptance* —Each of the sample circles selected in accordance with 4 2 3 shall be tested in accordance with 4 4 2 to verify compliance with this specification If either sample circle fails to meet the requirements for these characteristics, the lot represented by the sample shall be rejected

4.4.2 *Salt spray test* —The sample circles shall be subjected to salt mist for 100 hours at 94 ± 2° F using 20 percent (by weight), sodium chloride (99 5 percent sodium chloride, minimum) in distilled water, the solution having a pH value of from 6 to 7 At the completion of the test the circles shall conform to 3 11

4.5 **Additional inspection** —Where other specifications form a part of this specification, unless otherwise specified in the contract or order, sampling, inspection, and test procedures shall be conducted as required in the referenced specification

4.6 **Rejected lots.**—Rejected lots may be offered again for Government inspection provided the contractor has repaired or removed all nonconforming azimuth circles or bearing circles in the lot The Government inspector shall again select and examine samples from such resubmitted lots to verify compliance with this specification.

5. PREPARATION FOR DELIVERY

5.1 **Preservation and packaging.**

5.1.1 *Preservation* —No special cleaning or preservation will be required

5.2 **Packaging.**

5.2.1 *Unit containers* —Each circle, in its carrying case, shall be packaged individually in a fiber corrugated container conforming to Specification LLL-B-631, style RSC, with a minimum bursting strength of 275 pounds per square inch Suitable inserts of double-wall fiber corrugated material conforming to Specification LLL-B-631, designed to float the instrument within the container with not less than ½-inch clearance on all sides, top, and bottom, shall be used.

5.3 **Packing.**

5.3.1 *For domestic shipment and storage* — Unless otherwise specified in the contract or order, circles, packaged as specified in 5.2 1, shall be packed in wood-cleated-plywood, nailed wood, or wirebound wood boxes conforming to Specification NN-B-601, NN-B-621, or NN-B-631 respectively The gross weight of wood or wood cleated boxes shall not exceed approximately 200 pounds.

5.3.2 *For oversea shipment* —Circles, packaged as specified in 5 2 1 shall be packed in cleated plywood, nailed wood, or wirebound boxes conforming to Specification JAN-P-105, JAN-P-106, or MIL-B-107, respectively The containers shall be fitted with a waterproof case liner conforming to type I, grade B, class 2 of Specification MIL-L-10547 Liners shall be sealed with an adhesive conforming to Specification MIL-A-140 Seams and closures shall have strength and water resistance equal to that of the body material Shipping containers shall be closed and strapped in accordance with the applicable container specification Flat steel strapping shall conform to class A or B of Specification QQ-S-781 The gross weight of wood or wood cleated boxes shall not exceed approximately 150 pounds.

5.3.3 *For domestic or oversea shipment* — Where practicable, shipping containers of similar construction shall be of uniform size, and shall contain the same number of circles Containers shall be designed to fit the contents in a compact manner The contents shall be packed within the container in such a manner that they cannot move about after the container is closed.

5.4 **Marking.**—In addition to any special marking specified in the contract or order, shipping containers shall be marked in accordance with Standard MIL-STD-129.

6. NOTES

6.1 **Ordering data.**—Procurement documents should specify the following:

(a) Title, number, and date of this specification

(b) The nameplates and marking for Army purchases

(c) That when alterations are desired, drawings shall be submitted to the bureau or agency concerned Any work done prior to complete approval of the drawings concerned shall be at the risk of the contractor In the event of alterations the contractor shall furnish one complete set of original linen tracings to the purchaser in accordance with the purchaser's format as specified in the contract or order The cost of these tracings shall be included as a separate item in the contractor's bid

Custodians
Army—Transportation Corps
Navy—Bureau of Ships
Air Force
Other interest
Army—Sig
Navy—S