

INCH-POUND

QQ-B-639C
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 SUPERSEDING
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FEDERAL SPECIFICATION

BRASS, NAVAL: FLAT PRODUCTS

This specification was approved by the Commissioner, Federal Supply Services, General Services Administration for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers four alloys of leaded and nonleaded naval brass flat products (bar, plate, sheet, and strip) with slit, slit and edge-rolled, sheared, sawed, or machined edges, but does not include flat products with finished edges (see 6.6).

1.2 Classification.

1.2.1 Alloys. The naval brass covered by this specification will be furnished in the following alloys: 462, 464, 482, and 485. When the alloy is not specified, copper alloy number 464 will be furnished.

1.2.2 Forms and tempers. The naval brass covered by this specification will be furnished in the following forms and tempers, as specified (see 6.2):

Form	Temper
Plate, sheet, and bar	Soft Half-hard
Strip	Soft Half-hard Hard

When temper is not specified, plate, bar, sheet, and strip will be furnished in the half-hard temper.

Comments, suggestions, or questions on this document should be addressed to DLA Troop Support – Industrial Hardware Division (ATTN: Code FHTE), 700 Robbins Avenue, Philadelphia, PA 19111-5096 or email trpsptspecspa@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.

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2. APPLICABLE DOCUMENTS

2.1 Other publications. The following document(s) form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal will apply:

American Society for Quality (ASQ):

- ASQ Z1.4 - Sampling Procedures and Tables for Inspection by Attribute.

(Copies of these documents are available from <http://asq.org> or the American Society for Quality, 644 North Plankinton Ave., Milwaukee, WI 53203.)

ASTM International Standards:

- ASTM B154 - Standard Test Method for Mercurous Nitrate Test for Copper Alloys
ASTM E8/E8M - Standard Test Methods for Tension Testing of Metallic Materials
ASTM E1282 - Standard Guide for Specifying the Chemical Compositions and Selecting Sampling Practices and Quantitative Analysis Methods for Metals, Ores, and Related Materials

(Copies of these documents are available from <http://www.astm.org> or the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

SAE International

- SAE-AMS-STD-185 - Identification Marking of Copper and Copper Base Alloy Mill Products (Stabilized Type)
SAE-AMS2221 - Tolerances Copper and Copper Alloy Bars and Rods
SAE-AMS2222 - Tolerances Copper and Copper Alloy Sheet, Strip, and Plate

(Copies of these documents are available from <http://sae.org> or from SAE International, 4700 Commonwealth Drive, Warrendale PA 15096-0001)

3. REQUIREMENTS

3.1 Manufacture. The material shall be manufactured by such hot or cold working followed by such annealing, and straightening as may be required to produce naval brass conforming to the requirements of this specification.

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3.2 The material shall be furnished in flat, straight lengths unless material in rolls or on reels or bucks is specified (see 6.2).

3.3 Chemical composition.

3.3.1 The material shall conform to the chemical requirements specified in table I.

TABLE I. Chemical composition, percent

Copper Alloy Number	Copper	Tin	Lead	Iron <u>1/</u>	Other elements total <u>1/</u>	Zinc
462	62.0 - 65.0	.50 - 1.0	.20 <u>1/</u>	.10	.10	Rem.
464	59.0 - 62.0	.50 - 1.0	.20 <u>1/</u>	.10	.10	Rem.
482	59.0 - 62.0	.50 - 1.0	0.4 - 1.0	.10	.10	Rem.
485	59.0 - 62.0	.50 - 1.0	1.3- 2.2	.10	.10	Rem.

1/ Maximum.

3.3.2 Analysis shall be made regularly only for the elements specifically stated in table I. If the presence of other elements is suspected, or indicated in the course of routine analysis, further analysis shall be made to determine that the total of other elements is not in excess of the limits specified.

3.4 Tensile properties. The material shall conform to the tensile properties specified in tables II, III, IV, and V for the respective tempers.

TABLE II. Tensile properties of copper alloy number 462

Form and temper	Thickness, Inches	Tensile strength, min., k.s.i.	Yield strength, min. <u>1/</u> , k.s.i	Elongation in 4 x thickness, min. <u>2/</u> , percent
Bar, soft	All sizes	45	16	30
Bar, half-hard	All sizes	54	25	20

1/ Determined at .5 percent extension under load.

2/ In any case, a minimum gage length of 1 inch shall be used.

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TABLE III. Tensile properties of copper alloy number 464

Form and temper	Thickness, Inches	Tensile strength, min., k.s.i.	Yield strength, min. <u>1</u> /, k.s.i	Elongation in 4 x thickness, min. <u>2</u> /, percent
Bar and plate, Soft	.375 and less up to 30 inches wide	52	20	30
	.375 and less over 30 inches wide	50	20	35
	Over .375, all widths	50	20	35
Bar and plate, half-hard	.375 and less up to 30 inches wide	60	35	20
	.375 and less over 30 inches wide	57	28	30
	Over .375, all widths	54	25	30
Sheet and strip, soft	All sizes	52	20	30
Sheet and strip, half-hard	All sizes	60	35	20
Strip, hard	All sizes	65	50	10

1/ Determined at .5 percent extension under load.

2/ In any case, a minimum gage length of 1 inch shall be used.

TABLE IV. Tensile properties of copper alloy number 482

Form and temper	Thickness, Inches	Tensile strength, min., k.s.i.	Yield strength, min. <u>1</u> /, k.s.i	Elongation in 4 x thickness, min. <u>2</u> /, percent
Bar and plate, Soft	.375 and less up to 30 inches wide	52	20	30
	.375 and less over 30 inches wide	50	20	35
	Over .375, all widths	50	20	35
Bar and plate, half-hard	.375 and less up to 30 inches wide	60	35	20
	.375 and less over 30 inches wide	57	28	30
	Over .375, all widths	54	25	30

1/ Determined at .5 percent extension under load.

2/ In any case, a minimum gage length of 1 inch shall be used.

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TABLE V. Tensile properties of copper alloy number 485

Form and temper	Thickness, Inches	Tensile strength, min., k.s.i.	Yield strength, min. <u>1</u> /, k.s.i	Elongation in 4 x thickness, min. <u>2</u> /, percent
Bar and plate, Soft	.375 and less up to 30 inches wide	52	20	30
	.375 and less over 30 inches wide	50	20	35
	Over .375, all widths	50	20	35
Bar and plate, half-hard	.375 and less up to 30 inches wide	60	35	20
	.375 and less over 30 inches wide	57	28	30
	Over .375, all widths	54	25	30
Sheet and strip, soft	All sizes	52	20	30
Sheet and strip, half-hard	All sizes	60	35	20
Strip, hard	All sizes	65	50	10

1/ Determined at .5 percent extension under load.

2/ In any case, a minimum gage length of 1 inch shall be used.

3.4.1 Where material is required in special forms and tempers other than those specified in tables II, III, IV, and V, the material shall be defined and specified (see 6.2).

3.5 Internal stresses. Unless otherwise specified (see 6.2), naval brass, except material of soft (finished annealed) temper, shall withstand without cracking the mercurous nitrate test specified in 4.5.3

3.6 Heat treatment. Heat treatment, if any, shall be such as to obtain mechanical properties, structure and temper required by this specification. When specified (see 6.2), soft material shall be finish annealed whether previously hot or cold rolled.

3.7 Dimensional tolerances. Dimensional tolerances shall be in accordance with the applicable AMS2221 or AMS2222.

3.8 Identification marking. When specified (see 6.2), product identification marking shall be in accordance with AMS-STD-185.

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3.9 Workmanship. Material shall be uniform in quality and temper, clean, sound, smooth, and free from foreign material, pipes, slivers, laps, cracks, seams, scale, burrs, buckles, damaged ends or edges, and other defects which, due to their nature, degree, or extent, detrimentally affect the serviceability for the intended parts. When some characteristic of workmanship is especially important to the serviceability of the intended parts, this information shall be included along with the character of the application of material in the ordering data (see 6.2).

4. VERIFICATION

4.1 Lot. Unless otherwise specified (see 6.2), a lot shall consist of material of the same alloy, form, temper, and size submitted for inspection at one time consisting of:

- a. 10,000 pounds or fraction thereof or
- b. The mixture of two or more furnace charges or crucible melts weighing not more than 70,000 pounds into a single ladle or holding furnace used to pour one or more ingots at the same time.

4.2 Sampling. Samples for the purpose of tests prescribed in this specification shall be selected in a manner as to correctly represent the material furnished and avoid needless destruction of finished material when samples representative of the material are available from other sources.

4.2.1 For chemical analysis. The number of samples specified in table VI shall be selected from different pieces in each lot. The selected pieces shall be used to prepare samples for analysis in accordance with ASTM E1282.

TABLE VI. Sampling for chemical analysis.

Pounds of material in lot	Number of samples <u>1/</u>
Up to 2)00, incl.	1
2501 to 5000, incl.	2
5001 to 7500, incl.	3
7501 to 10,000, incl.	4
10,001 to 70,000, incl.	1 <u>2/</u>

1/ If the number of original bars, billets, or cakes from which the material is processed is less than the number of samples, not more than one sample need be taken from each piece.

2/ See 4.1b.

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4.2.2 For tension test. Unless otherwise specified (see 6.2), two tension test specimens shall be taken from each lot, and each shall be selected from a different piece unless the lot consists of one piece in which case one test specimen shall be sufficient. If the lot is 2500 lbs. or less, only one tension test is required.

4.2.3 For mercurous-nitrate test. Unless otherwise specified (see 6.2), one sample for the mercurous-nitrate test shall be selected from each lot of naval brass, except material in the soft (finished annealed) temper.

4.2.4 For visual and dimensional examination.

4.2.4.1 Pieces weighing over 150 pounds. Each piece shall be examined.

4.2.4.2 Pieces weighing 150 pounds or less. From each lot of material with pieces weighing 150 pounds or less, a representative sample shall be selected in accordance with ASQC Z1.4. Lot acceptance criteria shall be based on a single sampling plan with a zero acceptance number. The samples selected for dimensional examination may be the same as those selected for visual examination, but shall be evaluated separately.

4.2.4.3 When material is furnished in rolls or on reels, or bucks, the sample for examination shall be taken from within 10 feet of the outer end. If the sample selected is rejected due to handling marks, an additional 20 feet shall be used for re-examination.

4.2.4.4 When material is, as straightened, from coils, rolls, reels, or bucks the sample for examination shall be taken from within 10 feet of the starting end of each coil, roll, reel or buck. If the sample selected is rejected due to handling marks an additional 20 feet of each coil, roll, reel or buck shall be used for re-examination.

4.3 Examination.

4.3.1 Visual and dimensional. Pieces selected in accordance with 4.2.4 shall be visually examined to determine compliance with the requirements for identification marking, (sec 3.8) and workmanship (see 3.9) and shall be measured for compliance with the dimensional requirements (see 3.7).

4.3.2 Straightness. Straightness shall be determined by placing the piece or sample unit on a level surface so that the arc or departure from straightness is horizontal. The maximum depth of arc shall be measured to the nearest .031 (1/32) inch by means of a straightedge and a steel scale.

4.3.3 Preparation for shipment. Examination or the packing and marking for shipment shall be made for conformance to the requirements of section 5.

4.4 Test Specimens.

4.4.1 Tension tests. Tension test specimens for sheet and strip, and for bar and plate up to .375 (3/8) inch, inclusive, in thickness shall be machined to the form and dimensions of the standard rectangular tension test specimen of ASTM E8/E8M. Tension test specimens for plate and bar over .375 (3/8) inch thick shall be machined to the form and dimensions of the standard rectangular or the standard round tension test specimen of ASTM E8/E8M, or tested in full section. The longitudinal axis of the specimen shall be parallel to the direction of rolling. For material up to and including 1.500 (1-1/2) inches in thickness, the central axis of the test specimen shall coincide

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with the central axis of the material. For material over 1.500 (1-1/2) inches in thickness, the central axis of the specimen shall be located midway between the center and surface of the piece.

4.4.2 Mercurous-nitrate test specimens. Where practical, the test specimen shall be the full cross-section of the material and at least 6 inches in length. For large plate, sheet, and strip, a specimen the full thickness of the material and at least 1 inch wide may be used. Sawed edges may be machined or filed, but no annealing, bending, springing, or polishing or other preparation of the test specimen shall be permitted.

4.5 Test procedures.

4.5.1 Chemical analysis. The samples selected in accordance with 4.2.1 shall be analyzed in accordance with ASTM E1282 to determine conformance with 3.3. A single analysis of the composite sample may be made.

4.5.2 Tension tests. Specimens from samples selected in accordance with 4.2.2 shall be tested in accordance with ASTM E8/E8M. The yield strength shall be determined by the extension under load method in accordance with ASTM E8/E8M. The limiting extension shall be .005 inch per Inch for all specified yield strength values.

4.5.3 Mercurous-nitrate tests. When required (see 3.5), specimens selected in accordance with 4.2.3 shall be tested in accordance with ASTM B 154.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of material is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

6.1 Intended use.

6.1.1 Copper alloy number 462 is cold workable and has the best resistance to corrosion by salt water of any of the compositions covered by this specification. It consists principally of alpha grains; has limited hot workability. It is intended for use when cold working, bending, forming, or shaping is required.

6.1.2 Copper alloy number 464 possesses excellent hot working properties with fair machinability. It consists of both alpha and beta grains; is hot workable but hardens rapidly on cold working.

6.1.3 Copper alloy number 482 possesses good hot working properties and good machinability. It consists of both alpha and beta grains; is moderately hot workable but hardens rapidly on cold working. The material is intended for use when free machining is required. Copper alloy number 482 is more machinable than copper alloy number 464.

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6.1.4 Copper alloy number 485 possesses good hot working properties, and the machinability is better than copper alloy numbers 464 and 482. It consists of both alpha and beta grains; is moderately hot workable but hardens rapidly on cold working. The material is intended for use when free machining is required and may be used for the following:

Marine hardware

Applications where a corrosion-resisting material is needed.

6.2 Ordering data. Purchasers should select the preferred options permitted herein, and include the following information in procurement documents:

- a. Title, number, and date of this specification.
- b. Alloy, form, and temper required (see 1.2).
- c. Size of material.
- d. When material is to be furnished in rolls, or on reels or bucks (see 3.2 and 3.9).
- e. Special forms and tempers required (see 3.4.1).
 - i. When the mercurous-nitrate test is not required (see 3.1).
- g. Whether finish annealing of soft material is required (see 3.6).
- h. Lengths, whether specified or stock lengths with or without ends (see 3.7).
 - i. When product identification marking is required (see 3.8).
 - j. When some characteristic of workmanship is important, the characteristic and the application of the material (see 3.9).
- K When a lot other than as specified in 4.1 is required.
- l. When other than two tension-test specimens for lots over 2500 pounds are required (see 4.2.2).
- m. Maximum gross weight of containers.

6.3 Definitions.

6.3.1 Bar. As covered by this specification, a solid rectangular section or one with two plane parallel surfaces and slit, sheared, sawed, or machined edges, up to and including 12 inches in width and over .188 inches in thickness.

6.3.2 Plate. A flat rolled product over .188 inch (3/16 inch) in thickness and over 12 inches in width.

6.3.3 Sheet. A flat rolled product up to and including .188 inch in thickness and over 20 inches in width.

6.3.4 Strip. As covered by this specification, a flat product, other than flat wire, up to and including .188 inch in thickness, and furnished with slit, sheared, or slit and edge rolled edges in widths up to 20 inches, inclusive.

6.4 General information.

6.4.1 The thickness of all flat products should be stated in decimals of an inch.

6.4.2 Plate, sheet, and strip should be ordered in as narrow widths as can be used.

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6.4.3 For purposes of weight calculations, the weight per cubic inch may be taken as .304 pound.

6.4.4 Where no description of the edge of plate, sheet, or strip is specified, the edges furnished will be the finish (slitting, shearing, sawing) most available to the producer.

6.4.5 When material is ordered in the form of plate, bar, sheet, and strip, it should be understood that these terms refer merely to the general form and dimensions of the material, and do not have any technical significance as to the method of manufacture.

6.4.6 Flat products in rolls are generally more economical than material of the same cross-section in straight or flat lengths.

6.4.7 Sheet and strip may also be furnished in longer commercial lengths in rolls or on reels or bucks. Plate or bar may be furnished in flat lengths or in rolls.

6.5 Related specification. This specification covers naval brass flat products with slit, slit and rolled, sheared, sawed, or machined edges. For specifications covering naval brass rod, bar, shapes and forgings, see ASTM B21, ASTM B124 and ASTM B285..

6.6 The term "k.s.i." defined as "Thousand pounds per inch". The term "p.s.i." is obsolete.

6.7 Metric equivalents. To obtain tensile and yield strength values in mega-Pascals (MPa), multiply the value in tables II, III, IV, and V by 6.89.

6.8 Subject term (key word) listing.

Alloy
Copper alloy
Forms

6.9 Changes from previous issues. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodian:
Army – MR
Navy – SH
Air Force - 99

Preparing Activity:
DLA - IS

(Project 9530-2015-002)

Review Activity:
Army – AT, MI
Navy – AS, MC, OS, YD
Air Force – 84

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