

QQ-B-639B  
 October 18, 1973  
 SUPERSEDING  
 Fed. Spec. QQ-B-639a  
 March 14, 1967

## FEDERAL SPECIFICATION

BRASS, NAVAL: FLAT PRODUCTS

(PLATE, BAR, SHEET, AND STRIP)

This specification was approved by the Commissioner, Federal Supply Service, 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 shall be furnished in the following alloys: 462, 464, 482, and 485. When the alloy is not specified, copper alloy number 464 shall be furnished.

1.2.2 Forms and tempers. The naval brass covered by this specification shall 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 shall be furnished in the half-hard temper.

### 2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issues in effect on the date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

FSC 9530, 9535

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Federal Standards

- Fed. Std. No. 123 - Marking for Domestic Shipment **(Civil Agencies)**.
- Fed. Std. No. 146 - Tolerances for Copper and Copper Base Alloy Mill Products.
- Fed. Test Method Std. No. 151 - Metals, Test Methods.
- Fed. Std. No. 185 - Identification Marking of Copper and Copper Base Alloy Mill Products.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

**(Single copies of this specification and other Federal Specifications** required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Washington, DC, Atlanta, Chicago, Kansas City, MO, Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, WA.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Specification:

- MIL-C-3993 - Copper and Copper Base Alloy Mill Products, Packaging of.

Military Standards:

- MIL-STD-101 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-129 - Marking for Shipment and Storage.

(Copies of Military Specifications and Standards required by **suppliers** in connection with specific procurement functions should be obtained from the procuring activity or as directed by the Contracting Officer.)

2.2 Other publications. The following documents 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 shall apply.

American Society for Testing and Materials (ASTM) Standards

- B 154 - Mercurous Nitrate Test for Copper and Copper Alloys
- E 8 - Tension Testing of Metallic Materials.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

### 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.

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 <sup>1/</sup>	Other elements total <sup>1/</sup>	Zinc
462	62.0 - 65.0	0.50 - 1.0	0.20 <sup>1/</sup>	0.10	0.10	Rem.
464	59.0 - 62.0	.50 - 1.0	.20 <sup>1/</sup>	.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.

<sup>1/</sup>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. <sup>1/</sup> , k.s.i.	Elongation in 4 x thickness, min., <sup>2/</sup> percent
Bar, soft	All sizes	45	16	30
Bar, half-hard	All sizes	54	25	20

<sup>1/</sup>Determined at 0.5 percent extension under load.

<sup>2/</sup>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., <sup>1</sup> / <sub>k.s.i.</sub>	Elongation in four times thickness, min., <sup>2</sup> / <sub>percent</sub>
Bar and plate, soft	0.375 and less up to 30 inches wide	52	20	30
	0.375 and less over 30 inches wide	50	20	35
	Over 0.375, all widths	50	20	35
Bar and plate, half-hard	0.375 and less up to 30 inches wide	60	35	20
	0.375 and less over 30 inches wide	57	28	30
	Over 0.375, 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

<sup>1</sup>/Determined at 0.5 percent extension under load.<sup>2</sup>/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., <sup>1</sup> / <sub>k.s.i.</sub>	Elongation in four times thickness, min., <sup>2</sup> / <sub>percent</sub>
Bar and plate, soft	0.375 and less up to 30 inches wide	52	20	30
	0.375 and less over 30 inches wide	50	20	35
	Over 0.375, all widths	50	20	35
Bar and plate, half-hard	0.375 and less up to 30 inches wide	60	35	20
	0.375 and less over 30 inches wide	57	28	30
	Over 0.375, all widths	54	25	30

<sup>1</sup>/Determined at 0.5 percent extension under load.<sup>2</sup>/In any case, a minimum gage length of 1 inch shall be used.

TABLE V. Tensile properties of copper alloy number 485

Form and temper	Thickness, inches	Tensile strength, min., k.s.i.	Yield strength, min., <sup>1/</sup> k.s.i.	Elongation in four times thickness, min., <sup>2/</sup> percent
Bar and plate, soft	0.375 and less, up to 30 inches wide	52	20	30
	0.375 and less, over 30 inches wide	50	20	35
	Over 0.375, all widths	50	20	35
Bar and plate, half-hard	0.375 and less, up to 30 inches wide	60	35	20
	0.375 and less, over 30 inches wide	57	28	30
	Over 0.375, 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

<sup>1/</sup>Determined at 0.5 percent extension under load.

<sup>2/</sup>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 4.6.3

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. The following references of Fed. Std. No. 146 shall apply.

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Dimension	Reference
Thickness	1b (1)
Width	1b (2)
Length	1b (3), 1b (4)
Straightness	1b (5)

3.8 Identification marking. When specified (see 6.2), product identification marking shall be in accordance with Fed. Std. No. 185.

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. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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 inspections set forth in the specification **where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.**

4.2 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.

4.3 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.

4.3.1 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 method 111 or 112 of Fed. Test Method Std. No. 151.

TABLE VI. Sampling for chemical analysis

Pounds of material in lot	Number of Samples <sup>1/</sup>
Up to 2500, 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 <sup>2/</sup>

<sup>1/</sup>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.

<sup>2/</sup>See 4.2b.

4.3.2 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.

4.3.3 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.

4.3.4 For visual and dimensional examination.

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

4.3.4.2 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 MIL-STD-105, inspection level II, with an acceptable quality level (AQL) of 1.5 percent defective. The samples selected for dimensional examination may be the same as those selected for visual examination, but shall be evaluated separately.

4.3.4.3 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.

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4.3.4.4 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.

#### 4.4 Examination.

4.4.1 Visual and dimensional. Pieces selected in accordance with 4.3.4 shall be visually examined to determine compliance with the requirements for identification marking (see 3.8) and workmanship (see 3.9) and shall be measured for compliance with the dimensional requirements (see 3.7).

4.4.2 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 1/32 inch by means of a straightedge and a steel scale.

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

#### 4.5 Test specimens.

4.5.1 Tension tests. Tension test specimens for sheet and strip, and for bar and plate up to 3/8 inch, inclusive, in thickness shall be machined to the form and dimensions of the standard rectangular tension test specimen of ASTM E 8. Tension test specimens for plate and bar over 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 E 8, 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 1-1/2 inches in thickness, the central axis of the test specimen shall coincide with the central axis of the material. For material over 1-1/2 inches in thickness, the central axis of the specimen shall be located midway between the center and surface of the piece.

4.5.2 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.

#### 4.6 Test procedures.

4.6.1 Chemical analysis. The samples selected in accordance with 4.3.1 shall be analyzed by the wet chemical method in accordance with method 111 of Fed. Test Method Std. No. 151 or the spectrochemical method in accordance with method 112 of Fed. Test Method Std. No. 151 to determine conformance with 3.3. A single analysis of the composite sample may be made. In case of dispute analysis by the wet method (method 111) shall be the basis for acceptance.

4.6.2 Tension tests. Specimens from samples selected in accordance with 4.3.2 shall be tested in accordance with ASTM E 8. The yield strength shall be determined by the extension under load method in accordance with ASTM E 8. The limiting extension shall be 0.005 inch per inch for all specified yield strength values.

4.6.3 Mercurous-nitrate tests. When required (see 3.5), specimens selected in accordance with 4.3.3 shall be tested in accordance with ASTM B 154.

#### 4.7 Rejection.

4.7.1 Examination defects. Any sample unit having one or more defects shall be rejected. If the number of nonconforming sample units in the sample exceeds the acceptance number specified in 4.3.4.2 for that sample size, the entire lot shall be rejected subject to the provisions of the section on "Acceptance and Rejection" of MIL-STD-105.

4.7.2 Test failures. A lot shall be rejected for failure to meet any of the test requirements when tested in accordance with 4.6, subject to the provisions of the section on "Rejection and Retests" of Fed. Test Method Std. No. 151.

### 5. PREPARATION FOR DELIVERY

#### 5.1 Packing (see 6.2 and 6.3).

5.1.1 Levels A and B. The material shall be packed in accordance with MIL-C-3993.

5.1.2 Level C. The products shall be separated by size, alloy, form, and temper and packed in accordance with the manufacturer's standard practice into containers of a type and size commonly used for the purpose, in such a manner as to insure acceptance by carrier for transportation at the lowest rate applicable and to afford maximum protection from normal hazards of transportation.

#### 5.2 Marking (see 6.2 and 6.3).

5.2.1 Civil agencies. In addition to markings required by the contract or order, shipping containers shall be marked in accordance with Fed. Std. No. 123.

5.2.2 Military agencies. In addition to markings required by the contract or order, shipping containers shall be marked in accordance with MIL-STD-129.

### 6. NOTES

#### 6.1 Intended use.

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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.

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).
- f. When the mercurous-nitrate test is not required (see 3.4).
- g. Whether finish annealing of soft material is required (see 3.6).
- h. Lengths, whether specific 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 4.2 is required.
- l. When other than two tension-test specimens for lots over 2500 pounds are required (see 4.3.2).
- m. Whether material is to be packed by level A, B, or C (see 5.1).
- n. Special marking if required (see 5.2).
- o. Maximum gross weight of containers.

6.3 The requirements for product identification marking (see 3.8) and for packing and marking for shipment (see 5.1 and 5.2) specified herein apply to direct shipment for Government activities and apply also, where specified, to contracts or orders between the manufacturer and the Government prime contractor.

#### 6.4 Definitions.

6.4.1 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 0.188 inches in thickness.

6.4.2 Plate. A flat rolled product over  $3/16$  inch (0.188 inch) in thickness and over 12 inches in width.

6.4.3 Sheet. A flat rolled product up to and including 0.188 inch in thickness and over 20 inches in width.

6.4.4 Strip. As covered by this specification, a flat product, other than flat wire, up to and including 0.188 inch in thickness, and furnished with slit, sheared, or slit and edge rolled edges in widths up to 20 inches, inclusive.

#### 6.5 General information.

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

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

6.5.3 For purposes of weight calculations, the weight per cubic inch may be taken as 0.304 pound.

6.5.4 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.

6.5.5 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.

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

6.5.7 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.

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6.6 Related specification This specification covers naval brass flat products with slit, slit and edge rolled, sheared, sawed, or machined edges. QQ-B-637 covers rod, bar, wire, shapes, forgings, and flat products with finished edges.

6.7 The term "k s.i." is defined as "thousand pounds per square inch". The term "p.s.i." is obsolete.

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

**MILITARY CUSTODIANS:**

Army - MR  
Navy - SH  
Air Force - 84

**Preparing activity:**

Army - MR

**Civil Agency Coordinating Activities:**

**Review activities:**

Army - MR, MI, MU, WC  
Navy - SH, OS, AS  
Air Force - 84  
**DSA- IS**

COMMERCE-NBS  
GSA-PCD  
HUD-TCS  
NASA-JFK  
USDA-AFS

**User activities**

Army - ME, AT  
Navy - MC, YD  
Air Force - None

Orders for this publication are to be placed with the General Services Administration, acting as an agent for the Superintendent of Documents. See section 2 of this specification to obtain extra copies and other documents referenced herein. Price 15 cents each.

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(See Instructions - Reverse Side)

1 DOCUMENT NUMBER

2 DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

b ADDRESS (Street, City, State, ZIP Code)

4 TYPE OF ORGANIZATION (Mark one)

VENDOR

USER

MANUFACTURER

OTHER (Specify)

5 PROBLEM AREAS

a. Paragraph Number and Wording

b Recommended Wording

c Reason/Rationale for Recommendation

6 REMARKS

7a NAME OF SUBMITTER (Last, First, MI) - Optional

c MAILING ADDRESS (Street, City, State, ZIP Code) - Optional

b WORK TELEPHONE NUMBER (Include Area Code) - Optional

8 DATE OF SUBMISSION (YYMMDD)

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