

INCH - POUND

QQ-C-450B  
31 January 2019  
SUPERSEDING  
QQ-C-45A  
AMENDMENT 2  
6 August 2002

## FEDERAL SPECIFICATION

### COPPER-ALUMINUM ALLOY (ALUMINUM BRONZE) PLATE, SHEET, STRIP, AND BAR (COPPER ALLOY NUMBERS 606, 610, 613, 614, AND 630)

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

#### 1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers five compositions of copper aluminum alloy (aluminum bronze) flat products with slit, slit and edge rolled, sheared, sawed, or machined edges (plate, sheet, strip, and bar), but does not include flat products with finished edges.

#### 1.2 Classification.

1.2.1 Alloys. The copper-aluminum compositions covered by this specification shall be furnished in the following alloys: 606, 610, 613, 614, and 630. (see 6.2)

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

Forms:

Plate  
Sheet  
Strip  
Bar

Tempers:

Soft  
Hard

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](mailto: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 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

American Society for Quality (ASQ):

- |          |   |
|----------|---|
| ASQ Z1.4 | - Sampling Procedures and Tables for Inspection by Attribute. |
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(Copies of these documents are available from <http://asq.org> or the American Society for Quality, 644 North Plankinton Ave., Milwaukee, WI 44 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  | - Specifying the Chemical Compositions, and Selecting Sampling Practices and Quantitative Analysis Methods for Metals, Ores, and Related Materials, Standard Guide for |

(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 |
| 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)

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## 3. REQUIREMENTS

3.1 Manufacture. Material furnished under this specification shall be manufactured by hot rolling, or cold rolling and annealing, as required to meet the requirements of this specification.

3.2 Unless material in rolls or on reels or bucks is specified in the contract or order, the pinto, sheet, strip, and bar shall be furnished in flat, straight lengths (see 6.2).

3.3 Chemical composition. The material shall conform to the chemical requirements shown in Table 1.

TABLE I. Chemical composition - percent maximum unless shown as a range or minimum

Copper Alloy No.	Copper and elements with specific limits Min.	Aluminum	Iron	Manganese	Nickel	Tin	Lead	Zinc	Silicon	Phosphorus
606	99.5	4.0 - 7.0	.50	-	-	-	-	-	-	-
610	99.5	6.0 - 8.5	.50	-	-	-	.02	.02	.01	-
613	99.5	6.0 - 8.0	3.5	.50	.50	.20 - .50	-	-	-	-
614	99.5	6.0 - 8.0	1.5 - 3.5	1.0	-	-	.01	.20	-	.015
630	99.5	9.0 - 11.0	2.0 - 4.0	1.5	4.0 - 5.5	.20	.02	.30	.25	-

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3.4 Mechanical properties. The material shall conform to the properties shown in table II.

TABLE II. Mechanical properties.

Copper Alloy No.	Temper	Thickness	Width	Tensile strength, min.	Yield strength, min.	Elongation in 2 in., min
606	Hard	Inch Less than 0.0625	Inch 30 and under	Psi 60,000	Psi 24,000	Percent 8
		0.0625 to 0.50 incl.	30 and under	60,000	24,000	25
		Less than 0.0625	over 30	55,000	22,000	8
	soft	0.0625 to 0.50 incl.	Over 30	55,000	22,000	25
		Over 0.50	All	50,000	20,000	30
		All	All	45,000	17,000	40
610	Hard	Less than 0.0625	30 and under	65,000	27,000	8
		0.0625 to 0.50 incl.	30 and under	65,000	27,000	20
		Less than 0.0625	Over 30	60,000	25,000	8
	soft	0.0625 to 0.50 incl.	Over 30	60,000	25,000	20
		Over 0.50	All	55,000	22,000	25
		All	All	50,000	20,000	30
613	Hard	0.125 and less	All	85,000	55,000	30
		Over 0.125 to 0.3125 incl.	All	80,000	50,000	30
		Over 0.3125 to 0.50 incl.	All	75,000	45,000	35
	soft	Over 0.50 to 1.0 incl.	All	70,000	40,000	35
		Over 1.0	All	70,000	40,000	30
		0.50 and less	All	72,000	32,000	30
614	Hard	Over 0.50 to 2.0 incl.	All	70,000	30,000	35
		Over 2.0 to 5.0 incl.	All	65,000	28,000	35
	soft	0.50 and less	All	80,000	15,000	25
		Over 0.50 to 1 incl.	All	70,000	60,000	30
		Over 0.50 to 2 incl.	All	72,000	32,000	35
630	Hard	Over 2 to 5 incl.	All	70,000	30,000	35
		Over 5 to 10 incl.	All	65,000	28,000	35
	soft	Up to 2.0 Incl.	All	90,000	36,000	10
630	soft	Over 2.0 to 3.5 incl.	All	85,000	33,000	10
		Over 3.5 to 5.0 incl.	All	50,000	30,000	10

3.5 Residual stress. When specified in the contract or order, material shall withstand the mercurous nitrate test without cracking, when tested in accordance with 4.5.2.3.

3.6 Dimensional tolerances. Dimensional tolerances shall be in accordance with the applicable SAE-AMS2221 or SAE-AMS2222.

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<u>Dimension</u>	<u>Reference</u>
Thickness	1b (1)
Width	1b (2)
Length	1b (3)
Schedule of lengths	1a (4)
Straightness	1a (5)

3.7 Identification marking. When specified in the contract or order, item identification marking shall be in accordance with SAE-AMS-STD-185 (see 6.2).

3.8 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 of the intended parts.

#### 4. VERIFICATION

4.1 Certification of quality compliance. A certificate of quality compliance shall be prepared for each lot of material offered for acceptance (see 6.2.1). The certificate shall include actual data of specified chemical and mechanical tests. Qualitative results of nondestructive tests and other inspections or tests shall be recorded on the certificate. The certificate shall also state that each lot has been sampled, tested, and inspected in accordance with the specification and meets all specification requirements. The certificate shall be signed and dated by a responsible representative of the contractor.

4.2 Lot. Unless otherwise specified in the contract or order, a lot shall consist of 10,000 pounds or fraction thereof of material of the same heat or melt composition, form, temper, and size submitted for inspection at one time.

#### 4.3 Sampling,

4.3.1 Sampling for chemical analysis. From each lot, the number of pieces specified in Table III shall be sampled. Each example shall consist of not less than 2 ounces of clean millings, drillings, or clippings.

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TABLE III. Sampling for chemical analysis

Pounds of material in lot	Number of samples <u>1/</u>
Up to 5,000, incl.	2
5,001 to 10,000	4

1/ If the number of original bars, billets, or cakes from which the material is processed is less than the number of pieces specified for sampling, only one sample need be taken from each piece.

4.3.2 Sampling for mechanical properties. Two tension test specimens shall be taken from each lot. Each specimen shall be taken from a different piece. If the lot consists of only one piece, only one sample need be taken.

4.3.3 Sampling for mercurous nitrate test. When this test is required, one sample shall be selected from each 5,000 pounds or fraction thereof in the lot. If the lot consists of only one piece, only one sample need be taken.

4.3.4 Sampling 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 ASQ-Z1.4. Lot acceptance criteria shall be based on a single sampling plan with a zero acceptance number, and shall be examined as specified in ASQ-Z1.4.

4.4.1. Pieces selected for dimensional examination may be the same as those selected for visual examination.

4.3.4.3 When material is furnished in rolls or on reels or bucks, the sample shall be taken from within 10 feet of the outer end.

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 3.7) and workmanship (see 3.8) and shall be measured for compliance with the dimensional requirements (see 3.6) of this specification.

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4.5 Tests.4.5.1 Test specimens.

4.5.1.1 Tension test specimens. 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 sheet-type, .500 (1/2) inch wide (figure 6) 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 plate-type, 1.500 (1-1/2) inches wide (figure 6) of AS214 E 8 or the largest possible size of .500 inch diameter or .350 inch diameter (figure 8) 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 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.

4.5.1.2 Mercurous nitrate test. 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 of the test specimen shall be permitted. Preparation of the test specimens shall be in accordance with ASTM B 154.

4.5.2 Test procedures.

4.5.2.1 Chemical analysis. The samples selected in accordance with 4.3.1 shall be analyzed by ASTM E1282 to determine conformance with 3.3. A single analysis of a composite sample may be made. In case of dispute, analysis by method 111 shall be the basis for acceptance.

4.5.2.2 Tension tests. Tension tests shall be conducted in accordance with ASTM E8/E8M. The yield strength shall be determined by the extension under load method. The limiting extension shall be .005 inch per inch for all specified yield strength values.

4.5.2.3 Mercurous nitrate test. This test shall be conducted in accordance with ASTM B154.

4.6 Rejection.

4.6.1 Test failures. A lot shall be rejected for failure to meet any of the test requirements when tested in accordance with 4.5.

4.7 Retests. Retests shall be permitted in accordance with the "Rejection and Retests" provisions of ASTM E1282.

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4. 7.1 Rolls, reels, or bucks. If the sample selected for examination in accordance with 4.3.4.3 is rejected because of handling marks, an additional 20 feet shall be selected for retesting.

## 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 materiel 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. With the exception of alloy number 630, these alloys are all alpha type (a uniform solid solution of aluminum in copper). All have good corrosion resistance and are suitable for hot working. With the exception of number 630, these alloys are also suitable for cold working.

6.2 Ordering data. Purchasers should exercise any desired options offered herein and procurement documents should specify the following:

- a. Title, number, and date of this specification.
- b. Composition, form, temper and size of the material required (see 1.2).
- c. When material is required in rolls or on reels or bucks (see 3.2).
- d. When the mercurous nitrate test is required (see 3.5).
- e. Length, whether specific, or stock lengths with or without ends.
- f. When item identification marking is required (see 3.7).
- g. Maximum gross weight of containers.

6.2.1 Data requirements. When this specification is used in a procurement which incorporates a DD Form 1423 and invokes the provisions of 7-104.9(n) of the Defense Acquisition Regulations, the data requirements identified below will be developed as specified by the Data Item Description (DD Form 1664) and delivered in accordance with the approved Contract Data Requirements List (DD Form 1423) incorporated in to the contract. When the provisions of DAR 7-104.9(n) are not invoked, the procurement document will specify that the data specified below is to be delivered by the contractor (use of the DID in this case is not required). Deliverable data required by this specification is cited in the following paragraph:



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<u>PARAGRAPH</u>	<u>DATA REQUIREMENT</u>	<u>APPLICABLE DID</u>
4.1.1	Certificate of Quality Compliance	UDI-A-23264 Certification Data/ Report

(Copies of data item descriptions required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

6.2.1.1 The data requirements of 6.2.1 and any task in section 3, 4, or 5 of this specification required to be performed to meet a data requirement may be waived by the contracting / acquisition activity upon - certification by the offeror that identical data were submitted by the offeror and accepted by the Government under a previous contract for identical item acquired to this specification. This does not apply to specific data which may be required for each contract regardless of whether an identical item has been supplied previously (for example, test reports).

6.3 Subject term (key word) listing.

Cold rolling  
Hot rolling  
Mercurous nitrate

6.4 Changes from previous issues. Marginal notations identify changes with respect to the previous issue.

Custodian:  
Army - AR  
Navy - SH

Preparing Activity:  
DLA - CQ

(Project 9530-2015-001)

Review Activity:  
Army – MI  
Navy – AS

NOTE: The activities listed above were interested in this document as of the date of document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.