QQ-C-465A
March 8, 1974
SUPERSEDING
Fed. Spec. QQ-C-465
February 16, 1967

FEDERAL SPECIFICATION

COPPER-ALUMINUM ALLOYS (ALUMINUM BRONZE) (COPPER ALLOY NUMBERS 606, 614, 630, and 642); ROD, FLAT PRODUCTS WITH FINISHED EDGES (FLAT WIRE, STRIP, AND BAR), SHAPES, AND FORGINGS

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 copper-aluminum rod, flat products with finished edges (flat wire, strip, and bar), shapes, and forgings (see 6.1).

1.2 Classification.

1.2.1 Compositions, forms, and tempers. Material covered by this specification shall be furnished in the alloys shown in table I and in the following forms and tempers, as specified (see 6.2).

Forms and tempers:

Rod - Drawn, hot rolled, forged, extruded, annealed or stress relieved.
Bar - Drawn, hot rolled, forged, extruded, annealed or stress relieved.
Flat wire and strip - Hard or annealed.
Shapes - As extruded or annealed.
Forgings - Annealed.
Forging stock - As extruded.

1.2.2 Finish. When specified (see 6.2), round rod $\frac{1}{2}$ inch and over in diameter shall be furnished as standard shafting with or without piston finish. Also, when specified (see 6.2), round rod 1 inch and over in diameter shall be furnished as special shafting with or without piston finish.

FSC 9525, 9530, 9535, 9540, FORG

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.

Federal Standards:

Fed. Std. No. 123 - Marking for Domestic Shipment (Civilian 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 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 product 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, D.C., Atlanta, Chicago, Kansas City, Mo., Ft. Worth, Denver, San Francisco, Los Angeles, and Seattle, Wash.

(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-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.

(Copies of Military Specifications and Standards required by contractors 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. Materials covered by this specification shall be manufactured by such hot or cold working followed by such annealing as may be required to meet the requirements of this specification.

3.2 Chemical composition. The material shall conform to the chemical requirements specified in table I.

Table I. Chemical composition, percent[1/]

Copper Alloy Number	Copper	Lead	Aluminum	Iron	Nickel	Silicon	Arsenic	Manganese	Phosphorous	Tin	Zinc	Sum of named elements, min.
606	92.0-96.0	---	4.0-7.0	0.50	---	---	---	---	---	---	---	99.5
614	88.0-92.5	0.01	6.0-8.0	1.5-3.5	---	---	---	1.0	0.015	---	0.20	99.5
630	78.0 85.0	---	9.0-11.0	2.0-4.0	4.0-5.5	0.25	---	1.5	---	0.20	.30	99.5
642	80.0-93.0	0.05	6.3-7.6	0.30	0.25	1.5-2.2	0.15	0.10	---	.20	.50	99.5

1/ Maximum, unless shown as a range or minimum.

3.2.1 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 these other elements is not in excess of 0.50 percent.

3.3 Mechanical properties.

3.3.1 Unless otherwise specified (see 6.2), the material shall meet the tensile property requirements specified in table II.

Table II. Tensile Properties

Copper alloy number	Form, temper and diameter or distance between parallel surfaces, inches	Tensile strength, k.s.i., min.	Yield strength[1], k.s.i., min.	Elongation in 2 inches or 4 times diameter or thickness[2], percent, min.
606 and 614	Rod, stress relieved:			
	0.5 and less	80	40	30
	Over 0.5 - 1.0, incl.	75	35	30
	Over 1.0 - 2.0, incl.	70	32	30
	Over 2.0 - 3.0, incl.	70	30	30
606	Flat wire and strip:			
	Hard	60	24	25[3]
	Annealed	45	17	40
614	Flat wire and strip:			
	Hard:			
	0.125 and less, thickness	85	55	30[3]
	Over 0.125 - 0.188, incl., thick.	80	50	30
	Annealed:			
	0.125 and less, thickness	75	42	30
	Over 0.125 - 0.188, incl., thick.	72	38	32
630	Rod and bar, annealed:			
	0.50 - 1.0, incl.	100	50	5
	Over 1.0 - 2.0, incl.	90	45	6
	Over 2.0 - 4.0, incl.	85	42.5	10
	Over 4.0	80	40	12
	High strength rounds only, annealed:			
	1 and less	110	68	10
	Over 1.0 - 2.0, incl.	110	60	10
	Over 2.0 - 3.0, incl.	105	55	10
	Over 3.0 - 5.0, incl.	100	50	10
	Shapes, as extruded or annealed	85	42.5	10
	Forgings, annealed	85	42.5	10
	Forging stock, as extruded	--	--	--
642	Rod and bar; annealed or stress relieved:			
	0.50 and less	80	40	15
	Over 0.50 - 1.0, incl.	75	37.5	15
	Over 1.0 - 3.0, incl.	72	35	20
	Over 3.0	70	30	15
	Rod or bar, hot rolled or forged and turned or as extruded:			
	Over 3[4]	70	30	15
	Shapes, as extruded or annealed	70	30	15
	Forgings, annealed	70	--	15
	Forging stock, as extruded	--	--	--

1/ Yield strength taken at 0.5 percent extension under load.
2/ In any case, a gage length of at least 1 inch shall be used.
3/ For thicknesses less than 1/16 inch, a minimum elongation of 8 percent in 2 inches will be permitted.
4/ Extruded and turned rod shall be acceptable when all requirements of hot rolled or forged and turned rod are met.

3.3.2 When specified (see 6.2), drawn rod and bar of alloy number 642 shall meet the mechanical properties specified in table III.

Table III. Special mechanical properties for alloy number 642 rod and bar (see 3.3.2)

Temper and diameter or distance between parallel surfaces, inches	Tensile strength, min., k.s.i.	Yield strength min.,1/ k.s.i.	Elongation in 4 times diameter or thickness, min.2/, percent
Cold worked and stress relieved:			
0.50 and less	85	45	15
Over 0.50 - 1.0, incl.	85	44	15
Over 1.0 - 2.0, incl.	78	42	20
Over 2.0 - 3.0, incl.	75	37	20
Over 3.0 - 4.0, incl.	70	30	15
Over 4.0	70	25	15

1/ Yield strength taken at 0.5 percent extension under load.
2/ In any case, a gage length of at least 1 inch shall be used.

3.4 Hot forging. Forging stock shall withstand the test specified in 4.6.3 without cracking.

3.5 Internal stresses. When specified (see 6.2), rod, bar, shapes, drawn strip, and forgings shall withstand without cracking the mercurous-nitrate test specified in 4.6.4.

3.6 Shafting.

3.6.1 Standard shafting. When specified (see 6.2), round rod $\frac{1}{2}$ inch and over in diameter shall be furnished as standard shafting.

3.6.2 Special shafting. When specified (see 6.2), round rod 1 inch and over in diameter shall be furnished as special shafting.

3.6.3 Piston finish. When specified (see 6.2), standard or special shafting shall be furnished with piston finish, a special surface produced by grinding.

3.7 Dimensional tolerances.

3.7.1 Forgings. All forgings shall conform to the size and shape, as specified (see 6.2). When dimensional tolerances are not included in the contract or order, forgings measured on their diameters or betweel parallel surfaces shall not vary from the specified dimensions by more than plus or minus 3/32 inch on smooth forged, or plus or minus 1/32 inch on rough machined forgings.

3.7.2 Bar and rod, hot rolled or forged. Bar and rod, hot rolled or forged, over 3 inches in diameter or distance between parallel surfaces, shall not vary from the specified dimension by more than the following tolerances. Rod (rounds) shall be rough turned with tolerances of plus or minus 1/32 inch. Other tolerances shall be in accordance with commercial hot rolled tolerances.

3.7.3 Other forms. The following references to Fed. Std. No. 146 shall apply.

Form and dimension	Reference
Flat products with finished edges (bar, flat wire, and strip):	
Thickness	2b(1)
Width	2b(2)
Length	2b(3)
Schedule of lengths	2b(4)
Straightness	2b(5)
Standard edge contours	2b(6)
Bar and rod; as extruded:	
Diameter or thickness	5b(1)
Straightness and length	5b(2)
Rod, cold drawn:	
Diameter or thickness	11b(1) 1/
Length	11b(2)
Schedule of lengths	11b(3)
Straightness	11b(4)
Rod, hot rolled:	
Diameter	13b(1)
Length and straightness	13b(2)
Rod, piston finish:	
Diameter	14a(1)
Length	14a(2)
Straightness	14a(3)
Rod, shafting, standard:	
Diameter	14b(1)
Length	14b(2)
Straightness	14b(3)
Rod, shafting, special:	
Diameter	14b(1)
Length	14b(2)
Straightness	Tables IV and V 2/
Shapes, cold drawn or cold rolled	15a
Shapes, as extruded	16

1/ When hexagons are ordered for the manufacture of nuts and bolts, tolerances shall be all minus double the specified values.
2/ This specification.

3.7.3.1 Straightness of special shafting. When checked at the mill, the permissible variations in straightness of rod for special shafting as determined by the departure from straightness (throw in one revolution) (see 4.4.1.1.2) shall be as shown in table IV. All rod for special shafting shall be checked for straightness when supported on rollers at quarter points, and also on rollers at the end of the rod in lengths as shown in table IV.

Table IV. Permissible variations in straightness of rod for special shafting

Span, feet	Rods supported at ends			Rods supported at quarter points		
	At first quarter point, inch	At center, inch	At third quarter point, inch	At first end, inch	At center, inch	At second end, inch
6	0.004	0.006	0.004	--	--	--
8	.006	.010	.006	0.006	0.004	0.006
10	.012	.016	.012	.012	.006	.012
12	.018	.024	.018	.018	.006	.018
14	.024	.032	.024	.024	.008	.024
16	.030	.042	.030	.030	.012	.030
18	.040	.054	.040	.040	.014	.040
20	.048	.066	.048	.048	.016	.048
22	--	--	--	.060	.020	.060
24	--	--	--	.072	.024	.072
26	--	--	--	.084	.028	.084
28	--	--	--	.096	.032	.096
30	--	--	--	.112	.038	.112

3.7.3.2 The maximum permissible length of span to be used to determine conformance with table IV shall be as shown in table V.

Table V. Maximum permissible length of span for the determination of conformance with table IV

Diameter of rod, inches	Allowable length of rod when supported at the end, 1/ feet
1	9
1-1/8	10
1-1/4	10
1-3/8	11
1-1/2	11
1-5/8	12
1-3/4	12
2	13
2-1/4	14
2-3/8	14
2-1/2	15
2-3/4	15
3	16
3-1/2	17
4	19
4-1/2	20
5	21

1/ With the rod supported at the first and third quarter points, the allowable length shall be twice the value given.

3.8 Identification marking. When specified (see 6.2), product identification marking shall be in accordance with Fed. Std. 185 (see 6.3).

3.9 Workmanship. The material shall be uniform in quality and temper, clean, sound, smooth and free from foreign material, pipes, slivers, laps, cracks, twists, 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.

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 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 purposes 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. Samples for chemical analysis

Pounds of material in lot	Number of samples 1/
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 2/

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 4.2b.

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 hot forging and mercurous-nitrate tests. Unless otherwise specified (see 6.2), one sample for the hot forging test, and one sample, when required, for the mercurous-nitrate test shall be selected for each test from the lot. Each sample need not be taken from a different piece.

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.

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).

4.4.1.1 Straightness.

4.4.1.1.1 Bar, rod (except shafting), flat wire and strip. 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.

4.4.1.1.2 Rod for standard shafting. The departure from straightness of rod for standard shafting shall be determined in accordance with reference 14b(3) of Fed. Std. No. 146.

4.4.1.1.3 Rod for special shafting. Straightness of rod for special shafting shall be determined as specified in 4.4.1.1.2 except that rod shall be supported as indicated in 3.7.3.1.

4.4.2 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.

4.5.1.1 Rod and bar. Tension test specimens for rod and bar shall be tested in full size when practicable and the elongation measured in a gage length of four times the diameter of round specimens and of four times the minimum distance across flats of specimens other than round except the gage length shall be not less than 1 inch. When a machined specimen becomes necessary, enough metal may be removed from the gage section to meet the limitations of the testing machine, or the specimens may be machined to form and dimensions in accordance with the standard round tension test specimen of ASTM E 8. When this specimen is used, the elongation shall be measured in a gage length of 2 inches.

4.5.1.1.1 For bar and rod, $1\frac{1}{2}$ inches or less in diameter or minimum thickness, the axis of the test specimen shall coincide with the central axis of the piece. For bar and rod over $1\frac{1}{2}$ inches in diameter or minimum thickness, when a machined specimen is used, the axis shall be located midway between the center and the surface of the piece. The longitudinal axis of the tension specimen shall be parallel to the direction of rolling or drawing.

4.5.1.2 Strip and flat wire. Tension test specimens for strip and flat wire shall be tested in full size when practicable or shall be machined to the form and dimensions of the standard rectangular tension test specimen of ASTM E 8. The longitudinal axis of the tension test specimen shall be parallel to the direction of rolling or drawing.

4.5.1.3 Shapes and forgings. The tension test specimens shall be as specified (see 6.2).

4.5.2 Hot forging test. The specimen shall represent the full cross section of the sample unit.

4.5.3 Mercurous-nitrate test. Where practicable, the test specimen shall be of the full cross-section of the material and at least 6 inches in length. Sawed edges may be machined or filed, but no annealing, bending, springing, 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 3.2. A single analysis of a 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 Hot forging test. The specimens selected in accordance with 4.3.3 for the hot forging test shall be heated to a suitable forging temperature, hammered hot to a fine point and examined for compliance with 3.4.

4.6.4 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 6.3).

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. Aluminum bronze possesses greater resistance to corrosion than manganese bronze and may be used where greater strength and resistance to corrosion are required. It also may be readily forged. It is intended for uses as follows: Bar and rod requiring great strength and where subjected

to corrosive action, valve stems, propeller blade bolts, worm wheels, engine valve seats, air pumps and condenser bolts, and purposes requiring great strength with bearing qualities, such as slide liners.

6.1.1 Copper alloy No. 606. This composition has both hot and cold working properties and is used for bolts, tie rods, and forgings.

6.1.2 Copper alloy No. 614. This is an alpha structure alloy suitable for both hot and cold working and is used where high strength is required.

6.1.3 Copper alloy No. 630. This is alpha plus beta structure alloy having good hot working properties. It is a high-strength alloy which can be heat treated. The material is suitable for large shafts and structural parts where wear and corrosion resistance are necessary. For the Department of the Navy (other than SHIPS), heat-treated forgings should be procured in accordance with composition 2 of MIL-B-16166. For the Department of the Navy (SHIPS), heat-treated forgings should be procured in accordance with MIL-B-24059.

6.1.4 Copper alloy No. 642. This covers several alpha or alpha plus beta structure alloys having good hot working properties. This composition is used for gears, bushings, spindles, cams, and other small wear and corrosion resisting parts. For the Department of the Navy (other than SHIPS), heat-treated forgings of this composition should be procured in accordance with composition 1 of MIL-B-16166. For the Department of the Navy (SHIPS), heat-treated forgings should be procured in accordance with either composition 1 of MIL-B-16166 or MIL-B-24059.

6.1.5 Shafting. Standard shafting as covered by this specification is suitable for most shafting applications and for applications other than shafting. Special shafting should be used only in limited propulsion shafting applications.

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, temper, and finish (see 1.2.1 and 1.2.2).
c. When special mechanical properties are required (see 3.3.1).
d. When the special mechanical properties of table III are required for drawn rod or bar of copper alloy No. 642 (see 3.3.2).
e. Mercurous-nitrate test, if required (see 3.5).
f. When standard or special shafting is required (see 3.6.1 and 3.6.2).
g. When piston finish for shafting is required (see 3.6.3).
h. Lengths required (see 3.7).
i. Straightness requirements, if required (see 3.7).
j. Corners, and edges required if other than square (see 3.7).
k. Size and shape of forgings (see 3.7.1).
l. When special dimensional tolerances for forgings are required (see 3.7.1).

m. If bars or rods are intended for forgings (see 3.7.2).
n. When special identification marking is required (see 3.8).
o. When a lot other than as specified in 4.2 is required.
p. When other than two tension test specimens for lots over 2,500 pounds are required (see 4.3.2).
q. When other than one sample for the hot forging and mercurous-nitrate test (when required) are required (see 4.3.3.2).
r. Size and location of tension test specimens for shapes and forgings (see 4.5.1.3).
s. Whether material is to be packed by level A, B, or C (see 5.1).
t. Special marking, when required (see 5.2).
u. Maximum gross weight of containers.

6.3 The requirements for product identification marking (see 3.8) and for packing and marking for shipment (see section 5) 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. A solid rectangular (including square) section, or one with two plane parallel surfaces and round or other simple regularly shaped edges, up to and including 12 inches in width and over 0.188 inch in thickness.

6.4.2 Rod. A round, hexagonal, or octagonal solid section furnished in straight lengths.

6.4.3 Shape. A solid section other than rectangular, square, or standard rod and wire sections, furnished in straight lengths.

6.4.4 Strip. A flat product, other than flat wire, up to and including 0.188 inch in thickness and furnished with finished drawn or rolled edges in widths over $1\frac{1}{4}$ to 12 inches, inclusive.

6.4.5 Flat wire. A flat product (rectangular, including square) up to and including 0.188 inch in thickness and up to and including $1\frac{1}{4}$ inches in width with all surfaces rolled or drawn without previous slitting, shearing, or sawing. It may be furnished in straight lengths or on spools, reels or bucks.

6.4.6 Shafting.

6.4.6.1 Standard shafting. Round rods $\frac{1}{2}$ inch and over in diameter having standard shafting straightness and special diameter tolerances furnished with or without piston finish.

6.4.6.2 Special shafting. Round rods 1 inch or over in diameter, with special diameter and straightness tolerances furnished with or without piston finish.

6.5 Forging stock. Forging stock purchased under this specification should not be required to meet any mechanical properties other than those specified under this specification for forgings. Where mechanical properties other than those required by this specification are needed, it may be necessary to specify closer chemical composition ranges for consistent and efficient production of aluminum bronze forgings that are heat treated to special mechanical properties.

6.6 The chemical composition and mechanical properties of the alloys covered by this specification are approximately equivalent to ASTM alloys as follows:

Copper Alloy No.	ASTM B 150 Alloy	ASTM B 169 Alloy
606	---	606
614	614	614
630	630	---
642	642	---

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 k.s.i. values in tables II and III by 6.89.

MILITARY CUSTODIANS:

Army - MR
Navy - AS
Air Force - 11

Review activities:

Army - MR, MU, WC, MI
Navy - AS, SH
Air Force - 11
DSA - IS

User activities:

Army - ME
Navy - OS
Air Force - None

Preparing activity:

Army - MR

CIVIL AGENCY COORDINATING ACTIVITIES:

NASA - MSF
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