

QQ-B-728

December 6, 1961

SUPERSEDING

Fed. Spec. QQ-M-80

December 30, 1955

FEDERAL SPECIFICATION**BRONZE MANGANESE; ROD,
SHAPES, FORGINGS, AND FLAT PRODUCTS
(FLAT WIRE, STRIP, SHEET, BAR, AND PLATE)**

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 wrought manganese bronze which may be used where superior strength and corrosion resistance is required such as valve stems, propeller-blade bolts, air pumps, condenser bolts, gears, bearings, and similar items and may be used in lieu of Naval brass where higher strength is required.

1.2 Classification.

1.2.1 Classes. Manganese bronze shall be of the following classes, as specified (see 6.1):

Class A.

Class B.

1.2.2 Forms and tempers. Manganese bronze shall be of the following forms and tempers, as specified (see 6.1):

Forms:

Rod

Shapes

Forgings

Flat products with finished edges (flat wire, strip, and bar)

Flat products with slit and edge-rolled, sheared, sawed, or machined edges (strip, sheet, and plate)

Tempers:

Soft

Half-hard

Hard

1.2.3 When the class of manganese bronze is not specified, class A shall be furnished. When temper is not specified, rod, and flat products (strip, sheet, bar, and plate) shall be furnished in the half-hard temper; however, when the material is forging stock, wrought-material produced by any process may be furnished. Round rods $\frac{1}{2}$ inch and over in diameter may be furnished as standard shafting, with or without piston finish.

2. APPLICABLE SPECIFICATIONS, STANDARDS, AND OTHER PUBLICATIONS

2.1 Specifications and standards. The following specification and standards, of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein.

Federal Standards:

Fed. Std. No. 102—Preservation, Packaging and Packing Levels.

Fed. Std. No. 146—Tolerances for Copper and Copper Base Alloy Mill Products.

Fed. Test Method Standard 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

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TABLE I.—Chemical composition

Class	Copper	Tin	Iron	Manganese	Aluminum	Lead (maximum)	Zinc	Other impurities
A	Percent 57 to 60	Percent 0.5 to 1.5	Percent 0.8 to 2.0	Percent 0.05 to 0.50	Percent 0.25	Percent 0.20	Percent Remainder	Percent 0.10
B	63 to 68	0.5	2.0 to 4.0	2.5 to 5.0	3.0 to 6.0	20	Remainder	.10

¹ Maximum.

the Index of Federal Specifications, Standards, and Handbooks 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 25, D. C.

(Single copies of this specification and other product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Atlanta, Chicago, Kansas City, Mo., Dallas, Denver, San Francisco, Los Angeles, Seattle, and Washington, D. C.

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

Military Specifications:

MIL-C-3993—Copper and Copper-Base Alloy Mill Products Preparation for Shipment and Storage of.

(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.)

3. REQUIREMENTS

3.1 Chemical composition. The material shall conform to the requirements composition shown in table I.

3.2 Mechanical properties.

3.2.1 Tensile properties. Rod, shapes, forgings, and flat products (flat wire, strip, sheet, bar, and plate) shall conform to the mechanical requirements shown in tables II and III.

3.2.2 Where material is required in special forms and tempers other than those specified in tables II and III, the material shall be defined and specified (see 6.1).

3.3 Internal stresses. When specified, flat products (see 6.1) shall be supplied free from internal stresses insofar as can be determined by the mercurous-nitrate test (see 4.7.3). Unless otherwise specified, rods, shapes, and forgings shall be free from internal stresses as determined by the mercurous nitrate test (see 4.7.3).

3.4 Processing. Classes A and B manganese bronze shall be furnished either hot or cold finished, as specified (see 6.1).

3.5 Standard shafting. When specified (see 6.1), round rods $\frac{1}{2}$ inch and over in diameter shall be furnished as standard shafting having standard shafting straightness and special roundness tolerances.

3.6 Forgings.

3.6.1 Dimensions. All forgings shall conform to the sizes and shapes as specified (see 6.1).

3.6.2 Permissible variations. When dimensional tolerances are not included in the contract or order, open die forgings measured on their diameters or between parallel faces shall not vary from the specified dimensions by more than plus and minus $\frac{3}{32}$ inch, on smooth forgings, or plus and minus $\frac{1}{16}$ inch, on rough machined forgings.

3.7 Piston finish. When specified (see 6.1), standard shafting shall be furnished with piston finish, a special surface produced by grinding.

3.8 Tolerance. Tolerance shall not exceed that specified in the following sections of Federal Standard No. 146.

Flat Products with Finished Edges, Cold Drawn or Cold Rolled.

Length Tolerances (Nonrefractory Alloys).

TABLE II.—Mechanical properties of manganese bronze bars, forgings, rods, and shapes, classes A and B

Form	Temper	Diameter or distance between parallel faces	Tensile strength (minimum)	Yield strength (minimum)	Elongation in 2 inches or 4 X diameter or thickness (minimum)	
		<i>Inches</i>	<i>P.s.i.</i>	<i>P.s.i.</i>		
Bars and rods	Soft	Class A				
		All sizes	55,000	22,000	20	
		Up to 1.000	72,000	26,000	13	
	Half-hard	1.001 to 2.500	70,000	25,000	15	
		2.501 and over	65,000	23,000	17	
	Hard (rods only)	Up to 1.000	80,000	50,000	8	
1.001 to 1.500		76,000	52,000	10		
1.501 to 2.500		73,000	48,000	12		
Shapes	Soft	2.501 and over	68,000	45,000	16	
		All sizes	55,000	22,000	20	
		.....	60,000	25,000	18	
Forgings	Soft	Class B				
		All sizes	85,000	45,000	10	20
		All sizes	105,000	60,000	7	12
	Half-hard	All sizes	115,000	68,000	5	10
		.....	85,000	45,000	10	20
		.....	93,000	50,000	7	15
Hard	.....	100,000	55,000	5	15	

TABLE III.—Mechanical properties of manganese bronze plates, sheets, strips, and flat wire, class A

Temper, thickness, and width	Tensile strength (minimum)	Yield strength (minimum)	Elongation in 2 inches (minimum)
<i>Inches</i>	<i>P.s.i.</i>	<i>P.s.i.</i>	<i>Percent</i>
Temper: Soft			
0.5 and less thick, up to 20 wide, incl.	57,000	22,000	20
0.5 and less thick, over 20 wide, incl.	56,000	22,000	25
Temper: Hard-hard			
0.5 and less thick, up to 20 wide, incl.	60,000	24,000	18
0.5 and less thick, over 20 wide, incl., and over 0.5 thick	52,000	22,000	22

Schedule of Lengths (Nonrefractory Alloys).
Straightness Tolerances (Nonrefractory Alloys).

Standard Edge Contours (Nonrefractory Alloys).

Thickness Tolerances (Refractory Alloys).

Width Tolerances (Refractory Alloys).

Flat Products with Unfinished Edges, Cold Rolled.

Width Tolerances (Nonrefractory Alloys).

Length Tolerances (Nonrefractory Alloys).

Schedule of Lengths (Nonrefractory Alloys).
Straightness Tolerances (Nonrefractory Alloys).

Thickness Tolerances (Refractory Alloys).

Rod, Special Products.

Diameter Tolerances (Piston Finish Rod).

Straightness Tolerances (Shafting Rod).

Rod, Cold Drawn.

Diameter Tolerances (Refractory Alloys).

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Straightness Tolerances (Refractory Alloys).

Rod, Hot Rolled, Round.

Diameter Tolerances (Nonrefractory Alloys).

Bar, as Extruded.

Tolerance on Diameter or Distance Between Parallel Surfaces (Nonrefractory Alloys).

Tolerance on Diameter or Distance Between Parallel Surfaces (Refractory Alloys).

3.8.1 Length. Bar, rod, and shapes shall be furnished in straight lengths, except that class A rods up to $\frac{3}{4}$ inch in diameter or distance between parallel faces may be supplied in coils, if specified (see 6.1). Flat wire may be furnished either in straight lengths or in coils or on spools, reels, or bucks.

3.8.2 Unless otherwise specified (see 6.2), flat wire, finished edge strip, bar, and shapes shall be furnished with either square or rounded corners at the option of the manufacturer.

3.9 Corners and edges. Plate, sheet, and strip shall have corners and edges conforming to good commercial practice.

3.10 Class A material may be furnished in rolls, or in flat lengths as required (see 6.1). Rolls shall consist of a length of a flat-rolled product wound into a cylindrical spiral.

3.11 Other tolerances. Length tolerances for hot-finished bar and rod shall be as specified in 3.8.2. No other tolerances are established for hot-finished bar and rod.

3.12 The permissible variations for extruded shapes shall be as specified (see 6.1).

3.13 If, for special purposes, tolerances are required all plus or all minus, it shall be so specified, and the tolerance permitted shall be doubled (see 6.1).

3.14 Identification marking. Product identification marking, when specified (see 6.1), shall be in accordance with Federal Standard No. 185.

3.15 Workmanship. Rod, shapes, and all flat products shall be uniform in quality and

temper, and shall be sound, clean, smooth, and free from injurious defects including foreign material, pipes, silvers, laps, cracks, seams, scale, burrs, buckles, and damaged ends, corners, or edges.

4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1 The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. 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.

4.1.1 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 class, form, temper, and size submitted for delivery at one time.

4.2 Samples for chemical analysis. The inspector shall select from different representative pieces in each lot the number of samples for chemical analysis as specified in table IV. From each sample, not less than 2 ounces of clean millings, drillings, or clippings shall be obtained, placed in separate containers, and forwarded to a laboratory designated by the bureau or agency concerned for analysis. A single analysis of a composite sample may be made.

TABLE IV.—Sampling for chemical analysis

Pounds of material in lot	Number of samples ¹
Up to 5,000	2
5,001 to 10,000	4

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

4.3 Samples for mechanical tests. Unless otherwise specified in the contract or order, two tension test specimens shall be taken from each lot and each shall be selected from different pieces.

4.4 Samples for mercurous-nitrate test. Unless otherwise specified in the contract or order, one mercurous-nitrate test specimen shall be taken from each lot.

4.5 Sampling for visual and dimensional examination. If the weight of each piece is more than 150 pounds, every piece shall be examined. If the weight of each piece is not over 150 pounds, the inspector shall select sample pieces as specified in 4.5.1 and 4.5.2.

4.5.1 Visual examination. From each lot material containing individual pieces weighing 150 pounds or less, a representative sample of material shall be selected by the inspector in accordance with table V and shall be visually examined as specified in 4.6.2.1.

4.5.2 Dimensional examination. From each lot of material containing individual pieces weighing 150 pounds or less, a representative sample of material shall be selected by the inspector in accordance with table V and shall be measured as specified in 4.6.2.2. The samples selected for dimensional examination may be the same as those selected for visual examination.

TABLE V.—Sampling for visual and dimensional examination AQL (approx.) = 1.5 percent defective

Number of pieces in lot	Number of pieces required for sampling of 4.5.1 and 4.5.2
Up to 180	Inspection Level III MIL-STD-105
181 to 500	Inspection Level II MIL-STD-105
501 and over	Inspection Level I MIL-STD-105

4.5.3 Flat wire, strip, and sheet in coils, on reels or bucks. For flat wire, strip, and sheet in coils, on reels or bucks, the portion for examination shall be an area representing the outer wrap of the material up to 10 feet.

4.6 Visual and dimensional examination.

4.6.1 Pieces weighing over 150 pounds. For pieces weighing over 150 pounds, each piece shall be visually and dimensionally examined and the straightness of each piece shall be determined as specified in 4.6.3.

4.6.2 Pieces weighing 150 pounds, and under.

4.6.2.1 Visual. Each of the sample pieces selected in accordance with 4.5.1 shall be visually examined to determine compliance with this specification.

4.6.2.2 Dimensional. Each of the sample pieces selected in accordance with 4.5.2 shall be measured to determine compliance with this specification.

4.6.2.3 Any nonconforming piece in each sample shall be rejected and if the number of nonconforming pieces in the sample exceeds the acceptance number specified in table V for that sample, the entire lot shall be rejected.

4.6.3 Straightness.

4.6.3.1 Material other than rods for shafting Straightness shall be determined by placing the piece 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 $\frac{1}{32}$ inch by means of a straight edge and a steel scale.

4.6.3.2 Rods for shafting. Straightness shall be determined as follows: Support the rod at two points on freely rotating supports with the distance between supports one-half the length of the piece to be measured. Each unsupported end will have a length of one-quarter of the total rod length, and the portion between supports one-half of that length. Departure from straightness shall be measured at each end and at the center by means of a dial gauge mounted on a suitable movable block. Set the gauge successively at the three points to be measured and rotate the rod slowly and carefully to avoid vibration.

4.6.4 Flat wire, strip, and sheet in coils, on reels, or bucks. If the sample coil, reel, or buck

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is rejected due to handling marks, an additional 20 feet shall be selected for examination.

4.7 Test procedures.

4.7.1 Chemical analysis. The sample selected and forwarded in accordance with 4.2 shall be analyzed by the wet chemical method in accordance with method 111 of Federal Test Method Standard No. 151 or spectrographic method in accordance with method 112 of Federal Test Method Standard No. 151 to determine conformance with 3.1. A single analysis of a composite sample may be made. In case of dispute, the analysis by the wet method shall be the basis for acceptance.

4.7.2 Tension tests. Each of the specimens selected in accordance with 4.3 shall be subjected, in the presence of the inspector, to the tension test as follows:

4.7.2.1 Rod, shapes, forgings, and all flat products 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 that the gage length shall be not less than 2 inches. 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 specimen may be machined to the form and dimensions in accordance with type R1 of method 211 of Federal Test Method Standard No. 151. When a type R1 specimen is used, the elongation shall be measured in a gage length of 1 inch.

4.7.2.2 For rod, shapes, forgings, and all flat products up to 1½ inches in diameter or minimum thickness, the axis of the test specimen shall coincide with the central axis of the piece. For material 1½ inches and over in diameter or minimum thickness, when a machined specimen is used, the axis shall be located midway between the center and the rolled or drawn surface of the piece.

4.7.2.3 For plate, sheet, and strip not over 0.750 inch thick, the test specimen shall be ma-

chined to the form and dimensions of type F2 of method 211 of Federal Test Method Standard No. 151. For plate over 0.750 inch thick, the test specimen shall be machined to the form and dimensions of type F1 of method 211 of Federal Test Method Standard No. 151 or in full section.

4.7.2.4 The longitudinal axis of tension test specimens shall be parallel to the direction of rolling or drawing.

4.7.2.5 Test methods. All tension tests shall be conducted in accordance with method 211 of Federal Test Method Standard No. 151.

4.7.2.5.1 Yield strength. The yield strength shall be determined by the extension-under-load method of method 211 of Federal Test Method Standard No. 151. The limiting extension shall be 0.005 inch-per-inch for all specified strength values.

4.7.3 Mercurous-nitrate test. The sample selected in accordance with 4.4 shall be subjected to the stress test as specified in method 831 of Federal Test Method Standard No. 151. Where practicable, the test specimens shall be the full cross-section size of the material at least 6 inches in length. For large rods, bars, and plates, or wide sheets and strips, the specimens shall include a cross-sectional area at least 1 inch wide. The sawed edges may be removed by machining or smoothed with a file, but the specimens shall receive no annealing, bending, springing, polishing, or other preparation preliminary to this test.

4.8 Rejection and retests.

4.8.1 Rejection. If a test specimen fails to meet any of this specification, the lot represented by the specimen shall be rejected.

4.8.2 Retests. Retests will be permitted in accordance with Federal Test Method Standard No. 151.

5. PREPARATION FOR DELIVERY

(For civil agencies, Federal Standard No. 102 should be referred to for definitions and appli-

cations of the various levels of packaging protection for supplies and equipment.)

5.1 The material shall be prepared for delivery for the adequate level of shipment as specified in the contract or order (see 6.1) in accordance with Military Specification MIL-P-3993.

5.2 Marking.

5.2.1 *Civil agencies.* Marking for shipment shall be as specified in the contract or order.

5.2.2 *Military agencies.* In addition to any special marking required in the contract or order, marking of the shipping containers shall be in accordance with Military Standard MIL-STD-129.

6. NOTES

6.1 **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) Classes, forms and tempers (see 1.2).
- (c) Special forms and tempers required (see 3.2.2).
- (d) When standard shafting is required (see 3.5).
- (e) Sizes and shapes of forgings (see 3.8.1).
- (f) Whether material should be hot or cold finished (see 3.4).
- (g) When standard shafting should be furnished with piston finish (see 3.7).
- (h) When class A rod up to $\frac{3}{4}$ inch in diameter or distance between parallel faces may be supplied in coils (see 3.8.1).
- (i) Tolerance in accordance with Federal Standard No. 146 (see 3.8).
- (j) Whether class A material is to be furnished in rolls, flat plates, sheets, or strips (see 3.10).

(k) Permissible variations for extruded shapes (see 3.12).

(l) When tolerances are required all plus or all minus (see 3.13).

(m) Level of shipment required (see 5.1).

(n) Whether marking is required (see 3.14).

6.2 General information.

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

6.2.2 Plates, sheets, and strips should be ordered in as narrow width as can be used.

6.2.3 For purposes of weight calculations, the weight per cubic inch may be taken as 0.302 pound for class A and 0.266 pound for class B.

6.2.4 Rods up to $\frac{3}{4}$ inch in coils are generally furnished at a lower price than in straight lengths.

6.2.5 Round, hexagonal, and octagonal sections are classed as "rods." Square and rectangular sections are classed as "bars." The term "shape" should be defined as a section produced by extruding, rolling, drawing, or forming, or a combination thereof, not specifically classified as "flat rolled or drawn product and rod."

6.2.6 The size limitations for flat products shown in table VI should apply.

6.3 **Trade name.** The described manganese bronze is also called commercially "high strength yellow brass."

TABLE VI.—Size limitations for flat material

Form	Thickness	Width
	<i>Inch</i>	<i>Inches</i>
Bar	Over 0.188	Over 12, incl.
Plate	Over 0.188	Over 12
Sheet	Up to 0.188, incl.	Over 20
Strip with finished edges	Up to 0.188, incl.	Over 1 $\frac{1}{4}$ to 12, incl.
Strip with slit, etc., edges	Up to 0.188, incl.	Up to 20, incl.
Flat wire	Up to 0.188, incl.	Up to 1 $\frac{1}{4}$, incl.

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