

WW-T-791A  
12 July 1971  
 SUPERSEDING  
 Fed. Spec. WW-T-791  
 21 July 1931

## FEDERAL SPECIFICATION

### TUBE, BRASS, SEAMLESS

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

## 1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers four types of seamless brass tubing.

1.2 Classification. Tubing shall be of the following types and grades (see 6.5).

Type I	-	Maximum nominal working pressure 100 psi
Type II	-	Maximum nominal working pressure 200 psi
Type III	-	Maximum nominal working pressure 300 psi
Type IV	-	Maximum nominal working pressure 450 psi

Grade A	-	(83-86 percent copper)
Grade B	-	(65-68 percent copper)
Grade C	-	(59-63 percent copper)

## 2. APPLICABLE DOCUMENTS

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

### Federal Standards:

Fed. Standard No. 123	Marking for Domestic Shipment (Civilian Agencies).
Fed. Standard No. 146	Tolerance for Copper and Copper Base Mill Products.
Fed. Standard No. 185	Continuous Identification Marking of Copper and Copper Base Alloy Mill Products.
Fed. Test Method Standard No. 151	Metals; Test Method.

(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

WW-T-791A

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, D. C., Atlanta, Chicago, Kansas City, Mo., Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, Washington.)

(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 Standard:

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.

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

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

WW-T-791A

### 3. REQUIREMENTS

3.1 Chemical composition. The chemical composition shall be as specified in table I, as applicable.

Table I. Chemical composition.

Grade	Copper (Percent)	Zinc (Percent)	Lead (Percent)	Iron (Percent)
A	83.0-86.0	Remainder	0.06 max. <sup>1/</sup>	0.05 max.
B	65.0-68.0	Remainder	0.20-0.8 <sup>1/</sup>	0.07 max.
C	59.0-63.0	Remainder	0.30 max.	0.07 max.

<sup>1/</sup> For tubes over 5" OD, the lead may be less than 20%.

3.2 Temper and finish. Unless otherwise specified (see 6.2), tubing shall be semiannealed. Fully annealed tubing shall be acid cleaned.

#### 3.3 Mechanical properties.

3.3.1 Tensile strength. Unless otherwise specified, Grade A tubing shall have a minimum tensile strength of 35,000 psi and minimum elongation of 30 percent in 8 inches. The test shall be performed in accordance with 4.4.2.

3.3.2 Mercurous nitrate test. Tubing shall withstand the mercurous nitrate test as specified in 4.4.3.

3.3.3 Flattening. Tubing shall withstand flattening and shall develop no flaws when tested as specified in 4.4.4.

3.3.4 Bending test. Tubing shall show no signs of fracture on the outer surface when tested as specified in 4.4.5.

3.3.5 Flanging test. When specified Grade A tubing shall withstand the flanging test as specified in 4.4.6.

3.3.6 Hydrostatic test. When specified, the tubing shall withstand the hydrostatic test as specified in 4.4.7. Tubing shall develop no cracks or flaws as a result of the test performed.

WW-T-791A

### 3.4 Dimensions, weight, and permissible variations.

3.4.1 Diameter and wall thickness. The size of tubing required shall be designated by its actual outside diameter and the wall thickness as specified (see 6.2). The walls of the tubing at any point shall be not less than the thickness specified in tables II, III or IV. Unless otherwise specified in the contract or order, the standard dimensions and weights shall be as specified in tables II through V.

Table II. Standard dimensions and weights - Type I.

Outside diameter (inches)	Thickness (inch, minimum)	Inside diameter (inches)	Nominal weight per foot of length (pounds)		Minimum test pressure (psi)
			Grade A	Grades B & C	
1.900 <sup>1/2</sup> / <sub>1</sub>	-	-	-	-	-
2.375 <sup>1</sup> / <sub>1</sub>	-	-	-	-	-
2.875	.065	2.745	2.176	2.114	300
3.500	.065	3.370	2.660	2.584	250
4.000	.065	3.870	3.047	2.960	200
4.500	.065	4.370	3.434	3.336	200
5.563	.068	5.427	4.451	4.325	150
6.625	.081	6.463	6.315	6.135	150
8.625	.105	8.145	10.657	10.354	150
10.750	.131	10.488	16.573	16.101	150

<sup>1/</sup> For this size in Type I use Type II.

3.4.2 Outside diameter tolerance. The permissible variations in average outside diameter of brass tubing shall conform to the tolerances shown in table VI.

3.4.3 Length tolerance. When tubing is ordered to exact length, the length tolerances of Federal Standard No. 146 for round seamless tubing shall apply. For specific and stock lengths with ends, the schedule of lengths of Federal Standard No. 146 for round seamless tubing shall apply.

WW-T-791A

Table III. Standard dimensions and weights - Type II.

Outside diameter (inches)	Thickness (inch, minimum)	Inside diameter (inches)	Nominal weight per foot of length (pounds)		Minimum test pressure (psi)
			Grade A	Grade B & C	
1.900	0.065	1.770	1.421	1.380	400
2.375	.065	2.245	1.789	1.738	300
2.875	.068	2.739	2.274	2.209	300
3.500	.083	3.334	3.378	3.282	300
4.000	.095	3.810	4.420	4.294	300
4.500	.107	4.286	5.600	5.440	300
5.563	.132	5.299	8.540	8.297	300
6.625	.158	6.309	12.172	11.826	300
8.625	.205	8.215	20.563	19.977	300
10.750	.256	10.238	32.004	31.093	300

Table IV. Standard dimensions and weights - Type III.

Outside diameter (inches)	Thickness (inch, minimum)	Inside diameter (inches)	Nominal weight per foot of length (pounds)		Minimum test pressure (psi)
			Grade A	Grade B & C	
0.405 <sup>1/</sup>	--	--	--	--	--
0.540 <sup>1/</sup>	--	--	--	--	--
0.675 <sup>1/</sup>	--	--	--	--	--
0.840 <sup>1/</sup>	--	--	--	--	--
1.050 <sup>1/</sup>	--	--	--	--	--
1.315	0.065	1.185	0.968	0.940	700
1.660	.065	1.530	1.235	1.200	500
1.900	.066	1.768	1.442	1.401	500
2.375	.083	2.209	2.266	2.202	500
2.875	.100	2.675	3.306	3.212	500
3.500	.122	3.256	4.910	4.770	500
4.000	.140	3.720	6.436	6.254	500
4.500	.157	4.186	8.123	7.891	500
5.563	.194	5.175	12.408	12.055	500
6.625	.231	6.163	17.596	17.094	500
8.625	.301	8.023	29.848	28.998	500
10.750	.375	10.000	46.349	45.030	400

<sup>1/</sup> For this size in Type III use Type IV.

WW-T-791A

Table V. Standard dimensions and weights - Type IV.

Outside diameter (inches)	Thickness (inch, minimum)	Inside diameter (inches)	Nominal Weight Per foot of length (pounds)		Minimum test pressure (psi)
			Grade A	Grade B & C	
0.405	0.062	0.281	0.253	.246	1,000
0.540	.065	.410	.368	.357	1,000
0.675	.065	.545	.472	.459	1,000
0.840	.065	.710	.600	.583	1,000
1.050	.065	.920	.763	.741	800
1.315	.066	1.183	.982	.954	700
1.660	.084	1.492	1.577	1.532	800
1.900	.096	1.709	2.053	1.995	800
2.375	.120	2.135	3.224	3.132	700
2.875	.145	2.585	4.716	4.581	700
3.500	.177	3.146	7.006	6.807	700
4.000	.202	3.596	9.139	8.879	700
4.500	.228	4.044	11.603	11.273	700
5.563	.281	5.001	17.681	17.178	700
6.625	.335	5.955	25.102	24.387	700
8.625	.436	7.753	42.534	41.323	700
10.750	.544	9.662	66.142	64.259	700

Table VI. Permissible variations in average outside diameter.

Outside diameter	Tolerance Inch
0.50 inch and less	+0.0020
Over 0.50 inch to 0.75, inclusive	+ .0025
Over 0.75 inch to 1.00 inch, inclusive	+ .0030
Over 1.00 inch to 1.25 inches, inclusive	+ .0035
Over 1.25 inches to 1.50 inches, inclusive	+ .0040
Over 1.50 inches to 1.75 inches, inclusive	+ .0045
Over 1.75 inches to 2 inches, inclusive	+ .0050
Over 2 inches	1/

1/ +0.25 percent of outside diameter.

WW-T-791A

3.4.4 Weight tolerances. The maximum tolerance permitted for overweight for any lot of tubing shall be 10 percent. For purposes of calculation, the densities of the grades shall be as follows:

Grade A	0.316 lbs/cubic inch
Grade B	0.307 lbs/cubic inch
Grade C	0.303 lbs/cubic inch

3.5 Threading. Unless otherwise specified, the ends of the tubing shall not be threaded. Tubing may be ordered with special threads, the details of which shall be specified by the procuring activity.

3.6 Identification marking. Identification marking shall be in accordance with Federal Standard No. 185 and shall include the number of this specification. (See 6.2 and 6.3)

3.7 Workmanship. The tubing shall be clean, smooth, round, straight (when applicable), of proper dimensions, and free from all defects of a nature that would interfere with normal applications including grooving, indentations, cracks, and flaws.

#### 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, the supplier may utilize 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 Inspection lot. An inspection lot shall consist of 1,000 tubes or of 5,000 lbs whichever constitutes the greater weight of tubes of the same size, alloy, class and temper. (See 4.5.1)

#### 4.3 Examination.

4.3.1 Examination of product. Samples selected in accordance with table VII shall be examined for conformance to dimensions and weights, tolerance, identification marking, and preparation for delivery requirements.

WW-T-791A

Table VII. Sampling plan for examination of product.

Lot size	Sample size	Acceptance No.
1 to 110	5	0
111 to 500	7	0
501 to 800	10	0
801 to 1200	15	0
Over 1200	25	0

4.3.2 Examination of preparation for delivery. Prior to shipment, examination shall be made of the preservation, packaging, packing and marking for shipment to determine compliance with section 5.

#### 4.4 Test methods.

4.4.1 Chemical analysis. Analysis shall be made in accordance with method 111 or 112 of Federal Test Method Standard No. 151. In case of dispute, method 111 shall be the basis for acceptance.

4.4.2 Tension test. The tension test shall be made on Grade A tubing 2 inches inside diameter and over. One specimen from each tubing selected shall be tested to represent the lot. If from 2 to 6 inches inside diameter, the test specimens shall be cut longitudinally; if over 6 inches inside diameter, they shall be cut circumferentially. The test specimens shall be heated to a cherry red and straightened when hot, then annealed and machined to the dimensions of a plate-type standard specimen with 8 inch gage length, as required in ASTM E 8, Figure VI. For thicknesses up to and including 1/4 inch, the width of the narrow part of the test specimen shall be about 1 1/2 inches. For the thicker pieces the width shall be such as to give a cross section of about half a square inch, but the breadth shall not in any case be less than the thickness. The surfaces shall not be machined but shall be left in their original condition.

4.4.3 Mercurous nitrate test. For this test a full section test specimen 6 inches in length shall be taken for each tube selected for the test. The tube shall be subjected to mercurous nitrate test procedures as outlined in ASTM B 154.

4.4.4 Flattening test. For all tubing under 2 inches in outside diameter, the length of tubing selected for test remaining after cracking (mercurous nitrate test) test shall be flattened on different elements throughout its



WW-T-791A

length so that a gage set at three times the thickness of the metal shall pass over the tube freely throughout the flattened part, except at such points where changes in the elements of flattening take place. The tubing shall be rotated approximately 90° between each successive flattening element. For tubing 2 inches and over in outside diameter, a section 4 inches long shall be flattened so that a gage set at three times the wall thickness shall pass over the tubing freely throughout the flattened part.

**4.4.5 Bending test.** When tubing 2 inches and under in diameter is ordered fully annealed, full sections of tubing shall withstand bending 180° around a diameter of one and one-half times the inside diameter of the tubing without cracking on the outside bent portion. Flattening of pipe due to bending is permitted.

**4.4.5.1** A strip not over 1-1/2 inches wide shall be taken from each tube selected for test of Grade A tubing, and after annealing shall stand bending flat on itself without showing signs of fracture on the outer surface. The ends of the specimens used in this test shall stand hammering down hot and cold to a knife-edge without showing signs of cracks.

**4.4.6 Flanging test** A specimen shall be taken from each tubing selected for test of Grade A tubing and shall stand flanging cold, after annealing. The width of the flange, measured from the outside of the tubing, shall be one-fourth of the inside diameter of the tubing.

**4.4.7 Hydrostatic pressure test.** Hydrostatic test pressure shall be calculated according to the following formula for thin, hollow cylinders but in no case shall a test pressure of over 1,000 psi be used:

$$P = \frac{2ts}{D-0.8t}$$

Where P = safe internal pressure

D = inside diameter, in inches

S = allowable unit stress of the material, 7,000 psi

t = wall thickness, in inches.

**4.4.7.1** Every tube shall be perfectly tight under pressure and show no signs of bulging, cracks, flaws and porous places. The test pressures for specified sizes of tubing are listed in table II through V.

**4.5 Rejection and retest.** If any specimen fails to conform to the requirements of this specification, it shall be cause for rejection of the material represented by the specimen subject to the retest provisions of

WW-T-791A

Federal Test Method Standard No. 151. Results of all tests shall be reported.

4.5.1 All tubing shall be surface inspected for defects. In the event of failure of 10 percent of any lot for inspection to pass the surface inspection and gaging tests that lot shall be rejected (see 4.2).

## 5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Preservation and packaging shall be level A or C as specified.

5.1.1 Level A. Preservation and packaging shall be in accordance with MIL-C-3993.

5.1.2 Level C. The tubing shall be cleaned, preserved and packaged in a manner that will afford protection against corrosion, deterioration, mechanical and/or physical damage during shipment from the supply source to the first receiving activity. The supplier may use his own practice providing it fulfills these requirements.

5.2 Packing. Tubing shall be packed for shipment in accordance with levels A or C as specified.

5.2.1 Level A. Material shall be packed in accordance with MIL-C-3993.

5.2.2 Level C. The tubes shall be separated by size, composition and temper and packed in accordance with the manufacturer's commercial 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 for normal hazards of transportation.

## 5.3 Marking.

5.3.1 Civil agencies. In addition to any special marking required by the contract or order, shipping containers shall be marked in accordance with Federal Standard No. 123.

5.3.2 Military agencies. In addition to any special marking required by the contract or order, shipping containers shall be marked in accordance with MIL-STD-129, and as follows: Federal Stock Number (FSN), Manufacturer's Designation and Type/Grade designations.

WW-T-791A

## 6. NOTES

6.1 Intended use. The tubing procurable to this specification is intended for use where a material with special resistance to corrosion by salt water, salt air, or gases is required; for freshwater service where corrosive conditions are more severe than ordinary and for ordinary freshwater service. When tubing is required for instrument making or similar uses and the dimensions or tolerances in this specification are not suitable, the special dimensions or tolerances desired should be stated in the invitation for bids.

6.2 Ordering data. Procurement documents should specify:

- (a) WW-T-791A; Tube, Brass, Seamless
- (b) Grade and type.
- (c) Outside diameter and wall thickness.
- (d) Temper
- (e) Length, whether specific or mill lengths.
- (f) Tensile properties when required (see 3.3.1).
- (g) Hydrostatic pressure test, when required (see 3.3.6)
- (h) Whether material is to be packed to Level A or C (see 5.2).
- (i) Marking required (see 5.3).
- (j) Item identification marking when required (see 3.6).
- (k) Maximum gross weight of container.

6.3 The requirements for item identification marking (see 3.6) and for packing (see 5.2) and marking for shipment (see 5.3) specified herein apply to direct shipment for Government activities and apply also, when specified to contracts or orders between the manufacturer and the Government prime contractor.

6.4 Tubing should be purchased on a footage basis (per foot of length) in preference to weight.

6.5 Supersession data. The relationship between the types and grades of the superseded and those of this specification are shown in table VIII. Included are the alloy designations used in the copper industry.

Table VIII. Designation comparison.

WW-T-791	WW-T-791A	Industry
Type A	Type I	Class 100
Type B	Type II	Class 200
Type C	Type III	Class 300
Type D	Type IV	Class 450

(continued)

WW-T-791A

Table VIII. continued

WW-T-791	WW-T-791A	Industry
Grade 1	Grade A	Alloy 230
Grade 2	Grade B	Alloy 330
Grade 3	Grade C	Alloy 280

Custodians:

Army - MR  
 Navy - AS  
 Air Force - 11

Preparing activity:

Air Force - 11

Project No. 4710-0130

Review activities:

Army - ME  
 Navy - AS  
 Air Force - 82

User activity:

Army - CE

SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 22-R255
<b>INSTRUCTIONS:</b> This sheet is to be filled out by personnel, either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity. Comments and suggestions submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or serve to amend contractual requirements.		
SPECIFICATION		
ORGANIZATION		
CITY AND STATE	CONTRACT NUMBER	
MATERIAL PROCURED UNDER A <input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? A. GIVE PARAGRAPH NUMBER AND WORDING.		
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES		
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
3. IS THE SPECIFICATION RESTRICTIVE? <input type="checkbox"/> YES <input type="checkbox"/> NO (If "yes", in what way?)		
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)		
SUBMITTED BY (Printed or typed name and activity - Optional)		DATE

DD FORM 1426  
1 JAN 66

REPLACES EDITION OF 1 OCT 64 WHICH MAY BE USED.

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