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21 June 1971
SUPERSEDING
MIL-C-21768
4 October 1962

MILITARY SPECIFICATION

COPPER ALLOY NUMBERS 210 (GILDING, 95%) AND 220 (COMMERCIAL BRONZE, 90%) SHEET AND STRIP

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers copper alloy numbers 210 and 220 in sheet and strip form.

1.2 Classification.

1.2.1 Temper. Copper alloy numbers 210 and 220 shall be furnished in the following tempers, as specified (see 6.2):

Annealed
Cold rolled:
- Quarter hard
- Half hard
- Three-quarter hard
- Hard
- Extra hard
- Spring
- Extra spring

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.

SPECIFICATIONS
MILITARY
MIL-C-3993 - Copper and Copper-base Alloy Mill Products, Packaging of

/FSC 9535/

STANDARDS

FEDERAL

Fed. Std. No. 146 - Tolerance 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

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes

MIL-STD-129 - Marking for Shipment and Storage

(Copies of 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 otherwise indicated, 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 Tension Testing of Metallic Materials

E 112 - Estimating the Average Grain Size of Metals

(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 Chemical composition

3.1.1 The material shall conform to the chemical requirements specified in table I.

Table I - Chemical composition

Copper alloy number	Copper, percent	Lead, max., percent	Iron, max., percent	Zinc, percent	Total other elements, max., percent
210	94.0-96.0	0.03	0.05	Remainder	0.10
220	89.0-91.0	.05	.05	Remainder	.10 1/

1/ If the presence of bismuth is suspect during analysis, further analysis shall be made, and if bismuth is found in excess of 0.006 percent, the lot shall be rejected.

3.1.2 Analysis shall be made regularly only for the elements specifically mentioned in table I. If, however, 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.

3.2 Tensile properties (rolled tempers only). Material in the rolled tempers shall conform to the tensile properties shown in table II.

Table II. Tensile properties, rolled tempers

Copper alloy number	Temper	Tensile strength, psi	
		Minimum	Maximum
210	Quarter-hard	37,000	47,000
	Half-hard	42,000	52,000
	Three-quarter hard	46,000	56,000
	Hard	50,000	59,000
	Extra hard	56,000	64,000
	Spring	60,000	68,000
	Extra spring	61,000	69,000
220	Quarter-hard	40,000	50,000
	Half-hard	47,000	57,000
	Three-quarter hard	52,000	62,000
	Hard	57,000	66,000
	Extra hard	64,000	72,000
	Spring	69,000	77,000
	Extra spring	72,000	80,000

3.3 Grain size requirements. Material in the annealed temper shall conform to the grain size requirements shown in table III.

Table III. Grain size requirements

Grain size, millimeter		
Nominal	Minimum	Maximum
0.050	0.035	0.090
.035	.025	.050
.025	.015	.035
.015	1/	.025

1/Although no minimum grain size is required, the material shall be fully recrystallized.

3.4 Dimensional tolerances. The following references of Fed. Std. No. 146 shall apply:

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

3.5 Identification marking. Product identification marking, when specified, shall be in accordance with Fed. Std. No. 185 (see 6.2 and 6.3).

3.6 Workmanship. The metal shall be free from oil, grease, oxidation, laminations, double metal, scale, chips, dirt or grit, dented or bent edges, pipes, slivers, laps, cracks, deep scratches, wrinkles, and other defects which will render the metal unsuitable for the purpose intended. The metal shall be clean and free from acid.

3.6.1 The metal shall be uniform in composition, anneal or temper, and free from kinks and warps.

3.6.2 Sheet and strip, when ordered for either shallow or deep cupping, shall not have directional properties which result in the formation of ears when the material is cupped.

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

4.3 Sampling. Samples taken for the purpose of the tests prescribed in this specification shall be selected in a manner that will represent correctly the material furnished and avoid needless destruction of finished material when samples representative of the material are available from other sources.

4.3.1 Sampling for chemical analysis. The number of samples specified in table IV shall be selected from different pieces in each lot. From each sample, 2 square inches, or not less than 2 ounces of clean millings, drillings, or clippings shall be obtained.

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

4.3.2 Sampling for tension test. Unless otherwise specified in the contract or order, 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.

4.3.3 Sampling for grain size determination. Unless otherwise specified in the contract or order, at least four sample pieces shall be selected from each lot for the test specified in 4.5.2.3 unless the lot is represented by less than four pieces. Not more than one sample shall be taken from the same piece.

4.3.4 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, sample pieces shall be selected as specified in 4.3.4.1 and 4.3.4.2.

4.3.4.1 Visual examination. From each lot of material composed of pieces weighing 150 pounds or less, a random sample shall be selected in accordance with MIL-STD-105, Inspection Level II, with an acceptance quality level (AQL) of 1.5 percent, and shall be visually examined as specified in 4.4.2.1.

4.3.4.2 Dimensional examination. From each lot of material composed of pieces weighing 150 pounds or less, a random sample shall be selected in accordance with MIL-STD-105, Inspection Level II, with an acceptance quality level (AQL) of 1.5 percent and shall be measured as specified in 4.4.2.2. The samples 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 for examination shall be taken from within 10 feet of the outer end. If the sample is rejected for handling marks, an additional 20 feet shall be examined.

4.4 Examination.

4.4.1 Pieces weighing over 150 pounds. Each piece in the lot shall be visually examined to determine compliance with the requirements for identification marking (see 3.5) and workmanship (see 3.6) and shall be measured for compliance with the dimensional requirements (see 3.4) of this specification. Straightness of each piece shall be determined as specified in 4.4.3.

4.4.2 Pieces weighing 150 pounds and under.

4.4.2.1 Visual. Each sample unit selected in accordance with 4.3.4.1 shall be visually examined to determine compliance with the requirements for identification marking (see 3.5) and workmanship (see 3.6).

4.4.2.2 Dimensional. Each sample unit selected in accordance with 4.3.4.2 shall be measured to determine compliance with the dimensional requirements (see 3.4) of this specification. Straightness of each sample unit shall be determined as specified in 4.4.3.

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

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

4.5 Tests.

4.5.1 Tension test specimens. Tension test specimens shall be prepared in accordance with ASTM E 8. The longitudinal axis of the specimen shall be parallel to the direction of rolling or drawing.

4.5.2 Test procedures.

4.5.2.1 Chemical analysis. The samples selected in accordance with 4.3.1 shall be analyzed in accordance with method 111 or 112 of Fed. Test Method Std. 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 method 111 shall be the basis for acceptance.

4.5.2.2 Tension tests. All tension tests shall be conducted in accordance with ASTM E 8.

4.5.2.3 Grain size determination. Grain size shall be determined in accordance with ASTM E 112.

4.6 Rejection.

4.6.1 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 MIL-STD-105 for that sample size, the entire lot shall be rejected subject to the provisions on "Disposition of Nonconforming Product" of MIL-STD-105.

4.6.2 Test failures. A lot shall be rejected for failure to meet any of the test requirements when tested in accordance with 4.5, subject to the provisions of the General Section 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 product shall be separated by size, alloy, and temper, and packed for shipment in compliance with common carrier regulations applicable to that mode of transportation to insure safe delivery at destination at lowest transportation costs without assessment of penalty charges for improper packing.

5.2 Marking. In addition to any special marking required in the contract or order (see 6.2), marking for shipment shall be in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. Material covered by this specification is used in primer and detonator cups for artillery ammunition and bombs and other applications such as nameplates and screws.

6.2 Ordering data. Procurement documents should specify the following:

a. Title, number and date of this specification.
b. Alloy, temper, and size required (see 1.2).
c. Lengths, whether specific or stock lengths with or without ends (see 3.4).
d. When tolerances are required all plus or all minus (see 3.4).
e. When identification marking in accordance with Fed. Std. 185 is required (see 3.5)
f. Nature of application of the material, such as spinning or cupping (see 3.6).
g. When a lot size other than 10,000 pounds is required (see 4.2).
h. Whether material is to be packed by Level A, B, or C (see 5.1).
i. Maximum gross weight of containers with contents.
j. Special marking, if required (see 5.2)

6.3 The requirements for item identification marking (see 3.5) 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 Definition of forms.

6.4.1 Sheet. Sheet, as covered by this specification, is a flat product up to and including 0.188 inch in thickness, and generally furnished with slit, slit and edge rolled, sheared, sawed, or machined edges in widths over 20 inches.

6.4.2 Strip. Strip, as covered by this specification, is a flat product, other than flat wire, up to and including 0.188 inch in thickness, and generally furnished with slit, slit and edge rolled, sheared, sawed, or machined edges in widths over 1-1/4 inch to 20 inches, inclusive.

6.5 The approximate Rockwell hardness for material in the rolled tempers is shown in table V for information only.

Table V. Approximate Rockwell hardness of rolled tempers

Copper alloy number	Temper	B scale[a] 0.020 to 0.036 in. thick, incl. Min.	Max.	Over 0.036 in. thick Min.	Max.	Superficial 30-T scale[b] 0.012 to 0.028 in. thick, incl. Min.	Max.	Over 0.028 in. thick Min.	Max.
210	Quarter-hard	20	48	24	52	34	51	37	54
	Half-hard	40	56	44	60	46	57	48	59
	Three-quarter hard	50	61	53	64	52	60	54	62
	Hard	57	64	60	67	57	62	59	64
	Extra hard	64	70	66	72	62	66	63	67
	Spring	68	73	70	75	64	68	65	69
	Extra spring	69	74	71	76	65	69	66	70
220	Quarter-hard	27	52	31	56	38	53	41	56
	Half-hard	50	63	53	66	52	61	54	63
	Three-quarter hard	59	68	62	71	58	64	60	66
	Hard	65	72	68	75	62	66	64	68
	Extra hard	72	77	74	79	67	71	68	72
	Spring	76	79	78	81	70	72	71	73
	Extra spring	78	81	80	83	71	73	72	74

[a] Applies to metal 0.020 inch in thickness and over.

[b] Applies to metal 0.012 inch in thickness and over.

6.6 The former names for the material covered by this specification are as follows:

Copper alloy number	Former commercial name	Former specification name
210	Gilding, 95%	Gilding metal (95/5 brass)
220	Commercial bronze, 90%	Gilding metal (90/10 brass)

Custodians:

Army - MR
Navy - SH
Air Force - 84

Review activities:

Army - MU, GL
Navy - AS
Air Force - 85
DSA - IS

User activities:

Army - EL

Preparing activity:
Army - MR
Project No. 9535-0131

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(See Instructions – Reverse Side)

1. DOCUMENT NUMBER

2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION *(Mark one)*

- ☐ VENDOR
- ☐ USER
- ☐ MANUFACTURER
- ☐ OTHER *(Specify)*. _____

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

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

b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional

c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional

8. DATE OF SUBMISSION *(YYMMDD)*

DD FORM 82 MAR 1426

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