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QQ-T-390A
April 17, 1972
SUPERSEDING
Fed. Spec. QQ-T-390
August 26, 1955

FEDERAL SPECIFICATION

TIN ALLOY INGOTS AND CASTINGS AND LEAD ALLOY INGOTS AND CASTINGS (ANTIFRICTION METAL) FOR BEARING APPLICATIONS

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 antifriction metal for use in bearings.

1.2 Classification.

1.2.1 Grades. The ingots and castings shall be furnished in the following grades, as specified (see 6.1 and 6.2):

Grade 1	Grade 6
Grade 2	Grade 7
Grade 3	Grade 10
Grade 4	Grade 11
Grade 5	Grade 13

1.2.2 Form and size (ingots). The ingots shall be furnished in form and size as herein specified (see 3.4).

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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 Specifications:

PPP-B-601 - Boxes, Wood, Cleated-Plywood
PPP-B-621 - Boxes, Wood, Nailed and Lock-Corner

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specification 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, DC 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, DC, Atlanta, Chicago, Kansas City, MO, Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, WA.

(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 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.)

3. REQUIREMENTS

3.1 Material. The raw material used shall be such as to produce ingots and castings conforming to the requirements of this specification.

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3.2 Manufacture.

3.2.1 Ingots. Ingots shall be made in a manner consistent with the best practice, particularly in respect to the temperature of the metal and that of the mold parts at time of pouring.

3.2.2 Castings. Castings shall be made in a manner consistent with the best practice, particularly in respect to the temperature of the metal and that of the mold parts at the time of pouring.

3.3 Chemical requirements. The chemical composition of ingots and castings shall conform to table I.

TABLE I. Chemical composition

Grade	Tin Percent	Antimony Percent	Lead Percent	Copper Percent	Iron, maximum Percent	Arsenic, maximum Percent	Zinc, maximum Percent	Aluminum, maximum Percent	Bismuth, maximum Percent	Other elements, maximum Percent
1	90.0-92.0	4.0- 5.0	0.35[1]	4.0- 5.0	0.08	0.10	0.005	0.005	0.08	0.10
2	88.0-90.0	7.0- 8.0	0.35[1]	3.0- 4.0	.08	.10	.005	.005	.08	.10
3	83.0-85.0	7.5- 8.5	0.35[1]	7.5- 8.5	.08	.10	.005	.005	.08	.10
4	80.5-82.5	12.0-14.0	0.25[1]	5.0 - 6.0	.08	.10	.005	.005	--	.10
5	61.0-63.0	9.5-10.5	24.0-26.0	2.5- 3.5	.08	.15	.005	.005	--	.30
6	4.5- 5.5	14.0-16.0	79.0-81.0	0.50[1]	.10	.20	.005	.005	--	.50
7	9.3-10.7	14.0-16.0	74.0-76.0	0.50[1]	.10	.60	.005	.005	--	.50
10	0.75-1.25	14.5-17.5[2]	78.0-83.0	0.60[1]	.10	(3)	.005	.005	--	.50
11	9.0-11.0	11.5-13.5	74.0-79.0	0.40-0.60	.10	.20	.005	.005	--	.50
13	4.0- 6.0	8.0-10.0	83.0-88.0	0.50[1]	.10	.20	.005	.005	--	.75

[1] Maximum

[2] A narrower range of antimony within the limits stated may be specified (see 6.2), but the spread shall be not less than 1.00 percent

[3] 0.80 to 1.40

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3.4 Form and size (ingots). Unless otherwise specified (see 6.2), the ingots shall be provided with a central V notch and shall have a maximum cross section of 2 1/2 inches and a maximum weight of 10 pounds.

3.5 Identification marking.

3.5.1 Ingots. Each ingot shall have cast or stamped thereon, the following information:

(a) Federal specification number.
(b) Grade number.
(c) Manufacturer's name or trade-mark.

3.5.2 Large castings. Large castings shall be marked with the pattern o mark number and, when practicable, with the lot number, in a position on the casting where they will not be machined off in manufacturing to finished dimensions.

3.5.3 Small castings. Small castings shall be properly separated by melts or lots and shall be so marked that their identity shall be clear at the point of delivery.

3.6 Workmanship. Ingots and castings shall be as uniform in quality as possible, consistent with best commercial practice.

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 facilities or any commercial laboratory acceptable to 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 that supplies and services conform to prescribed requirements.

4.1.1 Lot. For purposes of sampling, a lot shall consist of all ingots or castings from a single melt.

4.1.2 Sampling procedure.

4.1.2.1 Ingots.

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4.1.2.1.1 Chemical analysis. The sample for chemical analysis of ingots shall be obtained from representative ingots selected from each lot in accordance with table II. Saw cuts shall be made in each sample ingot to the depth and at the locations shown on figure 1. No lubricant shall be used for sawing. The sawings shall be carefully treated with a magnet to remove any particles of steel introduced in taking the sample. The material thus obtained shall be thoroughly mixed for chemical analysis.

TABLE II. Sampling procedure for chemical analysis

Pounds of metal in lot	Number of ingots to be selected for chemical analysis
500 and under	2
501 to 1000	3
1001 to 10000	5
Over 10000	10

4.1.2.1.2 Inspection. For surface inspection, representative sample ingots shall be selected from each lot in accordance with table III.

TABLE III. Sampling procedure for inspection of ingots

Number of ingots in lot	Number of ingots to be selected for inspection
1 to 6	All
7 to 10	6
11 to 15	7
16 to 25	9
26 to 40	10
Over 40	15

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4.1.2.2 Castings.

4.1.2.2.1 Chemical analysis. The sample of castings for chemical analysis shall be obtained from at least three representative castings selected from each lot. Material for analysis shall be taken from the last machine cuts made on each sample casting. Chips shall be thoroughly cleaned of lubricant and carefully treated with a magnet to remove any particles of steel introduced in taking the sample; they shall be thoroughly mixed for chemical analysis.

4.2 Inspection. Each casting offered for delivery, and each sample ingot selected in accordance with 4.1.2.1.2, shall be subjected to surface inspection to determine conformance with this specification. Inspection of castings shall include check of dimensions and testing of bond (where applicable). Each nonconforming casting shall be rejected. If any sample ingot is found to be nonconforming, the entire lot shall be rejected (see 4.4).

4.3 Lot acceptance tests.

4.3.1 Chemical analysis. The sample selected in accordance with 4.1.2.1.1 or 4.1.2.2.1 shall be subjected to chemical analysis. If the sample is found not to be in conformance with 3.3, the lot shall be rejected.

4.4 Action in case of rejection. A lot of ingots which has been rejected under the provisions of 4.2 may be resubmitted for inspection provided that the manufacturer has inspected or tested each ingot in the lot for the deficiencies noted, and has removed all nonconforming ingots.

5. PREPARATION FOR DELIVERY

5.1 Packing. Ingots and castings, segregated by grade, shall be packed for shipment as follows:

5.1.1 Level A - For overseas shipment. Ingots and castings shall be packed in cleated plywood or nailed wood boxes conforming to PPP-B-601 (overseas type) or PPP-B-621, respectively. The gross weight of the boxes shall not exceed approximately 200 pounds.

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5.1.2 Level B - For domestic shipment and storage. Ingots and castings shall be packed in cleated plywood or nailed wood boxes conforming to PPP-B-601 (domestic type), or PPP-B-621, respectively. The gross weight of the boxes shall not exceed approximately 200 pounds.

5.1.3 Level C - For domestic shipment, immediate use. The ingots and castings shall be prepared for delivery in a manner to insure carrier acceptance and safe delivery to destination at the lowest applicable rate. Ingots may be shipped in bulk in sealed cars, or in suitable containers. Castings shall be so boxed or crated as to insure safe transportation to the point of delivery.

5.1.4 The ingots and castings shall be cushioned, blocked or braced within the container in a manner to prevent damage due to dislodgement or shifting in transit.

5.2 Marking.

5.2.1 For nonmilitary agencies.

5.2.1.1 Interior containers. Packages and interior containers shall be marked with the name of the material and the name of the contractor, or with a trade-mark of such known character that the source of supply may be readily determined.

5.2.1.2 Exterior containers. Shipping containers shall be marked with the name of the item, the grade, and the quantity therein, as specified in the contract or order under which shipment is made, the name of the contractor, and the number of the contract or order.

5.2.2 For Military activities. In addition to any special marking required in the contract or order, marking for shipment shall be in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use.

6.1.1 Grade 1 ingot and casting is a medium-hard babbitt metal and may be used for aircraft engine bearings.

6.1.2 Grade 2 ingot and casting is genuine babbitt metal and may be used for all bearing surfaces requiring a hard white metal alloy and where conditions are moderately severe, such as general automotive-engine use.

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6.1.3 Grade 3 ingot and casting metal is a rather hard babbitt metal which may be used for bearings subject to moderately heavy pressures or severe reciprocating motion.

6.1.4 Grade 4 ingot and casting is a hard bearing metal which may be used for service involving very heavy pressure and high speed.

6.1.5 Grade 5 ingot and casting is one of intermediate cost and may be used for electric motor and other bearings subject to rather low pressures at high speed.

6.1.6 Grades 6, 7, 10, 11, and 13 are the most popular grades of the babbitt class known as lead-base or low-tin babbitts. They are satisfactory for most applications where the high tin or genuine babbitts (grades 1 to 5) have been used. These babbitts are not as corrosion resistant as the grades 1 to 5 and will not stand hard pounding or as heavy pressures, but they do cause less wearing of the crank shafts or other steel shafts. Thin or micro-linings instead of thick ones are recommended when practicable.

6.1.7 Grade 6 is recommended for moderate loads and speeds in engine main bearings, hoists and derrick bearings, line-shaft bearings, cam-shaft bearings, and some gasoline-engine connecting-rod bearings.

6.1.8 Grade 7 is higher in tin and is recommended for about the same uses as grade 6. It is slightly harder than grade 6.

6.1.9 Grade 10 is the lowest tin babbitt of the group but one of the most popular and is a hard arsenical babbitt. It is recommended for the same uses as grade 6, especially for steady heavy loads and for high speeds in automotive engines and all types of machinery.

6.1.10 Grade 11 is similar to grades 6 and 7 but is harder. It may be used for the same applications and heavier loads.

6.1.11 Grade 13 is recommended for railroad car and tender journal bearings, and other similar bearings.

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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) Grade required (see 1.2.1).
(c) Limits on antimony for grade 10 (if other than as specified in table I.
(d) Form and size of ingots (if other than as specified in 3.4).
(e) Whether the material shall be packed for domestic shipment, immediate use, domestic shipment and storage; or overseas shipment (see 5.1).

6.3 The data listed in table IV is approximate and is the available information on the grades in table I. It is for the guidance of users but does not form a part of this specification.

6.4 Alternate bids based on furnishing metal with a range of composition differing from the above will be considered, provided the range of composition of the metal that the bidder proposed to furnish is clearly stated and is approved by the procuring activity.

6.5 Federal specifications do not include all types, classes, grades, and sizes of the commodities indicated by the titles of the specifications, or which are commercially available, but are intended to cover the types, classes, grades, and sizes which are suitable for Federal Government requirements.

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TABLE IV. Physical properties

Grade	Brinell hardness At 20°C (68°F)	Brinell hardness At 100°C (212°F)	Melting ranges Solidus Degrees F	Melting ranges Solidus Degrees C	Melting ranges Liquidus Degrees F	Melting ranges Liquidus Degrees C	Pouring temperatures Degrees F	Pouring temperatures Degrees C
1	17.0	8.0	433	223	---	---	825	441
2	24.5	12.0	466	241	669	354	795	424
3	27.0	14.5	464	240	792	422	915	491
4	----	----	----	----	----	---	---	---
5	----	----	---	---	---	---	675	357
6	20.	9.5	459	237	522	272	645	341
7	22.5	10.5	464	240	514	268	640	338
10	25	15	---	---	---	---	---	---
11	27.5	13.6	471	244	495	257	621	327
13	----	----	469	243	491	255	615	325

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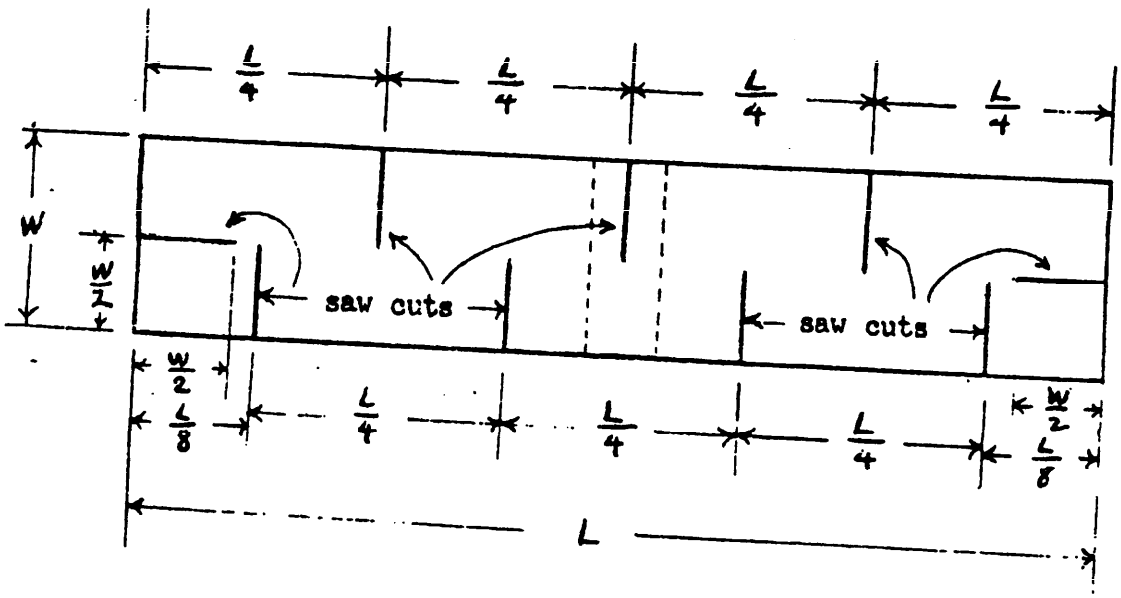

Figure 1. - Locations in ingots from which chemical samples shall be taken.

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