MIL-B-16541B(WP)
3 December 1964
Superseding
MIL-B-16541A(Wep)
29 May 1961

MILITARY SPECIFICATION

BRONZE, VALVE: CASTINGS

This specification has been approved by the Bureau of Naval Weapons, Department of the Navy.

1. SCOPE

* 1.1 Scope - This specification covers one grade of valve bronze (copper-tin-zinc-lead) castings produced by static mold, centrifugal mold or continuous processes, and furnished in the "as cast" condition.

2. APPLICABLE DOCUMENTS

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

FSC MECA

SPECIFICATIONS

Military

MIL-C-3993 Copper and Copper-Base Alloy Mill Products; Packaging of

STANDARDS

Federal

FED-STD-151 Metals, Test Methods

Military

MIL-STD-23 Nondestructive Testing Symbols

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

MIL-STD-129 Marking for Shipment and Storage

MIL-STD-271 Nondestructive Testing Requirements for Metals

PUBLICATION

BUREAU OF SHIPS

NAVSHIPS-250-537-1 or 2 - Radiographic Standards for Bronze Castings

* (When requesting any of the applicable documents, refer to both title and number. Copies of this specification and other unclassified specifications and drawings required by contractors in connection with specific procurement functions should be obtained upon application to the Commanding Officer, Naval Supply Depot (Code CDS), 5801 Tabor Avenue, Philadelphia, Pennsylvania 19111. All other documents should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Chemical requirements - Castings shall conform to the chemical composition requirements of Table I.

Table I. Chemical requirements

Copper	Tin	Zinc	Lead	Iron (max.)	Nickel (max.)	Phosphorus (max.)
Percent	Percent	Percent	Percent	Percent	Percent	Percent
86.0-89.0	5.5-6.5	3.0-5.0	1.0-2.0	0.25	1.00	0.05

* 3.1.1 The analysis shall represent the average composition of the metal cast at the beginning, and the metal cast at the finish of production of the lot of castings.

3.2 Mechanical properties - Mechanical properties of these castings shall conform to those specified in Table II.

Table II. - Mechanical properties

Tensile strength per square inch (min.)	Elongation in 2 inches (min.)
Pounds	Percent
34,000	22.0

3.3 Production control and soundness -

* 3.3.1 Foundry control - When specified (see 6.2), castings shall be produced under foundry control approved by the procuring activity. Foundry control shall consist of the examination of castings by radiographic or other methods specified by the procuring activity until the gating, pouring and other foundry practices have been established to produce castings meeting the quality standards agreed upon by the procuring activity and the contractor. When the foundry practices have been so established, the practices shall not be changed without demonstrating to the satisfaction of the procuring activity that the change does not adversely affect the quality of the castings.

* 3.3.2 Soundness - When specified (see 6.2), the soundness of the castings shall meet standards agreed upon by the procuring activity and the manufacturer. The areas of the castings subject to the soundness requirements shall be as specified (see 6.2) and the number and extent of sponginess, blow-holes and other defects in such areas shall not be greater than indicated by the standard.

3.3.3 Nondestructive testing - Radiographic and other nondestructive tests used for foundry control methods and determinations of soundness shall conform to MIL-STD-271. Radiographic examination of castings will not be required unless specified in the contract or order (see 6.2), on the drawings, or in the applicable specifications listed in the contract or order.

3.4 Pressure - Castings shall meet such pressure requirements as may be specified in the contract or order (see 6.2).

3.5 Dimensions -

3.5.1 The responsibility for furnishing castings that can be laid out and machined to the finished dimensions, within the specified tolerances, as shown on the blueprints or drawings, and that will conform to such gages as may be specified in individual cases, shall rest with the contractor. Sufficient stock shall be allowed for shrinkage and, where required, for finishing, but castings of excessive size or weight shall not be furnished.

3.5.2 Cast-to-size parts shall conform to dimensions and tolerances specified, and shall not be warped or distorted in such a manner as to adversely affect the appearance or serviceability.

3.6 Repairing of defective castings -

* 3.6.1 Castings shall not be welded, plugged, burned in or otherwise repaired without permission from the procuring activity. Such permission shall be given only when the defects are small and do not adversely affect the strength, use, or machinability of the castings.

* 3.6.2 Each repair shall be encircled with a ring of white paint prior to shipment.

* 3.7 Cleaning - Castings shall be smooth and well cleaned by sand-blasting, tumbling, chipping, or other process approved by the Government.

3.8 Identification marking - When castings are of sufficient size, each casting shall be marked with the following data:

(a) Manufacturer's name or trade-mark.
(b) Heat, melt or lot number.
(c) Pattern or drawing number.

3.8.1 When castings are so small that individual marking is impracticable, castings of the same lot or melt and pattern, shall be wired together and placed in a container, or otherwise segregated and a metal tag containing the data required in 3.8 attached thereto.

3.8.2 Impression stamping - When impression stamping is used for identification marking, the markings shall be located in areas of low stress as referred to in the blueprint or drawing. Markings should be in locations which will not be machined off.

* 3.9 Workmanship - Castings shall be of the highest grade of workmanship, and of uniform quality and condition. Castings shall be free of blowholes, porosity, shrinkage, oxides, cold-shuts, hard spots, laps, cracks or other injurious defects that inspection may detect or that are revealed by subsequent manufacturing operations.

4. QUALITY ASSURANCE PROVISIONS

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 supplies and services conform to prescribed requirements.

* 4.2 Lot - A lot shall consist of all castings of the same size and shape, and shall be further limited by the applicable provisions of 4.2.1 or 4.2.2.

* 4.2.1 Static and centrifugal castings - A lot shall consist of all castings produced from the same melt or the same pouring of a furnace, or the same ladle when two or more furnace or crucible melts are used to charge a ladle for pouring castings. In no case shall a lot exceed 2000 pounds of rough castings.

* 4.2.2 Continuous cast - A lot shall consist of not more than 2000 pounds of rough castings cut from continuous cast stock which was produced during continuous operation of one casting machine, except that when the cast stock is produced continuously by one casting machine from alloy ingots of known composition, a lot shall then consist of not more than 4000 pounds of rough castings cut from this stock material.

4.3 Inspection - Acceptance inspection shall consist of:

(a) Visual examination
(b) Acceptance tests.

4.4 Sampling -

* 4.4.1 Sampling for visual examination - A random sample of castings shall be selected from each lot in accordance with Standard MIL-STD-105, Inspection Level III, Acceptable Quality Level (AQL) 1.5 percent defective, and shall be surface inspected to determine conformance with workmanship, cleaning and identification marking requirements of this specification. Lots exceeding the allowable sample defective shall be rejected. Rejected lots shall receive 100% inspection for removal of all defective castings.

* 4.4.1.1 Sampling for dimensional inspection - A sample shall be selected at random from each inspection lot in accordance with MIL-STD-105, Inspection Level I, Acceptable Quality Level (AQL) 0.0 percent defective, and inspected for dimensional requirements to show that they can be properly machined to the required finished dimensions specified.

4.4.2 Sampling for acceptance testing -

* 4.4.2.1 Chemical and spectrochemical analysis - The sample for chemical analysis using Method 111.1 of FED Test Method Standard No. 151 shall consist of a thorough mixture of equal portions of drillings taken from a casting or a test coupon produced at the beginning, and from a casting or a test coupon produced at the end of each lot. At least two (2) ounces of fine drillings shall be taken from each casting or coupon, from sound metal below the surface, and free from oil, dirt and foreign matter. For spectrochemical analysis, using Method 112.1 of FED Test Method Std. No. 151, samples or test specimens shallbe as specified therein, providing that the beginning and ending of production of the lot shall be represented by such samplesor test specimens (see 3.1.1).

* 4.4.2.2 Coupons for tension tests - A minimum of two (2) tension tests per lot of castings is required. The casting of additional coupons for replacement testing (see 4.5.2.3) is not specified, but is recommended. The responsibility for providing them shall rest with the contractor. The test coupons shall represent as closely as practicable the solidification and cooling rate of the castings. When chill castings are specified, the test coupons shall be similarly chill cast, but the chilling or quenching of test coupons representing unquenched or non-chilled castings is prohibited.

* 4.4.2.2.1 Static mold castings -

* 4.4.2.2.1.1 Separately cast coupons (test bars) - Unless otherwise specified, two separately cast test coupons shall be poured with each lot, one at the beginning and one at the end of pouring the castings of each lot. Test coupons shall be cast in the form and dimensions illustrated by Figure 11, 12a or 12b of Method 211.1 of FED Test Method Std. No. 151. The coupons shall be drawn from the mold when properly cooled and properly marked for identification.

* 4.4.2.2.1.2 Attached coupons - When specified in the contract or order (see 6.2), or if the manufacturer desires and the procedure is satisfactory to the Government, test coupons shall be attached to individual castings as follows:

(a) Each casting weighing 250 pounds or more shall have at least one test coupon cast with it, and attached thereto. The first and the last casting poured in each lot shall be so identified. Large or heavy castings, representing a single lot of metal, shall have at least two (2) test coupons cast with it, and attached thereto.

(b) If the castings weigh less than 250 pounds, at least one cast test coupon shall be attached to the first and last castings poured in each lot, and shall be so identified.

In either case (a) or (b), a minimum of two (2) test coupons shall represent each lot of castings, one taken at the beginning and one at the ending of pouring. The location and type of attached coupons shall be as specified or as approved by the procuring agency (see 6.2).

* 4.4.2.2.2 Centrifugal mold castings - The mold may be designed so as to provide an attached coupon to every casting or only when desired. When it is not practicable to provide for castings with attached coupons, at least two (2) representative castings shall be taken for test coupons from each lot of castings poured. When it is not practicable to use castings as test coupons, at least two (2) separately cast test coupons shall be poured. In all cases, two (2) test coupons are required, representing metal poured at the beginning, and at the ending of each lot of castings. The location and design of attached coupons or the design of separately cast test coupons shall be as specified, or otherwise approved by the procuring activity (see 6.2).

* 4.4.2.2.3 Continuous cast - Unless otherwise specified, tension test coupons shall be taken from the continuous cast stock material. At least two(2) test coupons shall be taken for each lot of castings produced, one from stock material adjacent to the first casting, and one from stock material adjacent to the last casting produced in each lot.

* 4.4.2.2.4 Chill-mold castings - Test coupons representing castings poured in chill molds shall be cast in molds of the same material and conditions as used for the castings. Test coupons representing castings poured in non-chill molds shall not be cast in chill molds.

* 4.4.2.2.5 Sample castings - When the manufacturer so desires, castings in the lot may be used as test coupons. The two or more castings selected shall represent the first and the last metal cast in each lot, and so identified.

* 4.4.2.3 Sampling for non-destructive testing - When a soundness requirement is specified, sampling shall be accomplished as specified by the procuring activity, (see 6.2).

4.5 Tests -

* 4.5.1 Chemical analysis - The samples, obtained in accordance with 4.4.2.1 shall be analyzed by either or a combination of parts of Method 111.1 and Method 112.1 of FED Test Method Std. No. 151 for determination of chemical composition.

The chemical report shall conform to requirements of paragraph 3.1.1. All lots of castings that fail to conform to the chemical requirements of Table I shall be rejected. Individual castings, when so analyzed, shall likewise conform with these requirements or be rejected (see 3.1).

4.5.2 Tension test -

* 4.5.2.1 Preparation of tensile specimens - Test coupons obtained in accordance with paragraph 4.4.2.2. shall be used to prepare Type R1 tensile specimens as specified in Method 211.1 of FED Test Method Std. No. 151, unless otherwise advised by the Government.

* 4.5.2.2 Test procedure - Tension testing shall be performed in accordance with Method 211.1 of FED Test Method Std. No. 151, for compliance with the mechanical property requirements of Table II. If either of the two (2) specimens representing a lot of castings fails to conform with these requirements, the lot of castings shall be rejected, except as provided in paragraph 4.5.2.3. Individual castings, when so tested, shall likewise conform with these requirements or be rejected (see 3.2).

* 4.5.2.3 Retests - If a tensile specimen fails to meet the requirements of Table II, replacement specimens are permissable when in accordance with replacement provisions outlined in the General Section of FED Test Method Std. No. 151. An acceptable replacement coupon must possess the same representation as the discarded test specimen with respect to lot number and location in the lot as the beginning or the ending of production of the lot. It may be, for example, an extra coupon taken from the same mold or casting, or from an adjacent or neighboring mold or casting.

* 4.5.3 Radiographic examination - When radiographic examination is required (see 6.2), it shall be conducted in accordance with Standard MIL-STD-271, and the radiographic quality classification which is assigned in accordance with NAVSHIPS-250-537-1 or 2, shall be specified in the applicable specifications, contract or order, or drawings approved by the procuring activity.

* 4.5.3.1 The procurement activity may require radiographic examination of additional areas to investigate the extent of defects revealed by original radiographic examination, by surface inspection, by machining, or by pressure and other tests. Tension test specimens sectioned through areas of allowable radiographic soundness divisions may also be required. Such tension specimens will be tested for information only and shall not be cause for rejection of the casting or lot.

* 4.5.3.2 Failure of castings to meet radiographic requirements as specified shall be cause for rejection of the castings or the lot so represented.

4.5.3.3 Castings from rejected lots may, at the option of the supplier, be individually examined radiographically to remove all defective castings from rejected lots, and resubmit the reworked lots for acceptance.

4.5.3.4 Marking of drawings - When radiographic examination is required, all drawings detailing radiographic examination of castings shall be submitted to the contracting agency for approval. Contractors are required to submit drawings showing the proper radiographic markings, in accordance with Military Standard MIL-STD-23, including the extent, location, and classification assigned. Other pertinent information, such as section thickness, design pressures and temperatures, should be included on the drawings submitted. The type or format of the drawings shall conform to the applicable specification or master drawing system as specified in the contract or order.

* 4.6 Inspection of shipment - Prior to shipment, each lot of castings shall be examined to determine compliance with the requirements of section 5.

5. PREPARATION FOR DELIVERY

* 5.1 Packaging - The bronze valve castings shall be packaged Level A or C as specified (see 6.2) in accordance with the appropriate level of Specification MIL-C-3993.

* 5.2 Packing - The bronze valve castings shall be packed Level A, B or C as specified (see 6.2) in accordance with the appropriate level of Specification MIL-C-3993.

* 5.2.1 Level C - Castings that require overpacking by the carrier shall be packed in exterior type shipping containers in a manner that will insure safe transportation at the lowest rate to the point of delivery, and shall meet as a minimum, the requirements of the rules and regulations applicable to the mode of transportation selected.

5.3 Marking -

* 5.3.1 Unless otherwise specified in the contract or order, each bundle, shipping container, and unpacked casting shall be marked with the name of the material; pattern or mold number as specified on the drawings; this specification number; the gross weight and quantity; the name of the contractor; the number of the contract or order.

5.3.2 In addition to the marking specified in 5.3.1 and special markings required in the contract or order, marking of the shipping containers shall be in accordance with Standard MIL-STD-129.

6. NOTES

6.1 Intended use - This material is a high grade valve bronze suitable for use in valves, manifolds, and cocks. This bronze is machineable and resistant to corrosion.

* 6.2 Ordering data - Procurement documents should specify the following:

(a) Title number and date of this specification.
(b) Whether foundry control is required (see 3.3.1).
(c) Whether nondestructive tests are required (see 3.3.2, 3.3.3, 4.4.2.3 and 4.5.3).
(d) Whether pressure tests are required (see 3.4).
(e) Pattern and drawing number.
(f) Whether pattern is to be furnished

(g) Whether attached test coupons are required (see 4.4.2.2.1.2 and 4.4.2.2.2).
(h) Level of packing required (see 5.1).
(i) Quantity of castings required.

* 6.3 Radiographic standards for bronze castings are available at the Department of Commerce, Office of Technical Services, Washington 25, D. C.

6.4 The contractor may be required to replace castings in which injurious defects are revealed by manufacturing operations performed subsequent to acceptance, without expense to the Government.

* 6.5 The outside margins of this specification have been marked "(*)" to indicate where changes (deletions, additions, etc.) from the previous issue have been made. This has been done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content as written irrespective of the marginal notations and relationship to the last previous issue.

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