

QQ-Z-363B
May 15, 1972

SUPERSEDING
Fed. Spec. QQ-Z-363A
August 2, 1962

FEDERAL SPECIFICATION

ZINC-BASE ALLOY; DIE CASTINGS

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 zinc-base alloy die castings.

1.2 Classification.

1.2.1 Compositions. Zinc-base alloy die castings shall be of the compositions listed in table I.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issues 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. Std. No. 123 - Marking for Domestic Shipment (Civil Agencies).
Fed. Test Method Std. No. 151 - Metals; Test Methods.

(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 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, DC, Atlanta, Chicago, Kansas City, MO, Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, WA.

Area MECA

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(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.)

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) Standard:

E 8 - Tension Testing of Metallic Materials

(Applications 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 Manufacture. The die castings shall be of uniform quality and no scrap other than the sprues, gates, or rejected die castings of the particular alloy that are produced in the manufacturer's own plant shall be used. The rejected die castings used shall be free from finishes, solders, or inserts that may contaminate the alloy.

3.2 Chemical composition.

3.2.1 The chemical composition of the die castings shall be within the limits specified in table I (see 6.2).

TABLE I. Chemical composition

Element	Alloy AG40A percent	Alloy AC41A percent
Copper	0.25 max. ^{1/}	0.75 to 1.25
Aluminum	3.5 to 4.3	3.5 to 4.3
Magnesium ^{2/}	0.020 to 0.05	0.03 to 0.08
Iron, max.	0.100	0.100
Lead, max.	0.005	0.005
Cadmium, max.	0.004	0.004
Tin, max.	0.003	0.003
Zinc	Remainder	Remainder
Others	<u>3/</u>	<u>3/</u>

^{1/} For the majority of commercial applications, a copper content in the range of 0.25 to 0.75 percent will not adversely affect the serviceability of die castings and shall not serve as a basis for rejection unless so specified (see 6.2).

^{2/} Magnesium may be as low as 0.015 percent provided that the lead, cadmium and tin do not exceed 0.003, 0.003 and 0.001 percent respectively.

^{3/} Zinc-alloy die castings may contain nickel, chromium, silicon and manganese in amounts up to their solubility (0.02, 0.02, 0.035 and about 0.5 percent respectively, at the freezing temperature. Analyses are not required for these elements.

3.2.2 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 other elements are not in excess of the limits specified.

3.2.3 The contractor shall furnish an analysis of each lot showing the percentage of each of the elements specified in table I.

3.2.4 Chemical analysis of the individual lots by the contractor may be waived at the discretion of the procuring agency, provided the manufacturer's method of composition control is acceptable to the procuring agency.

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3.3 Foundry control. Unless otherwise specified (see 6.2) die castings shall be produced under foundry control approved by the procuring agency. Foundry control shall consist of examination of die castings by radiographic or other approved methods for determining internal defects until the gating and other foundry practices have been established to produce die castings meeting the quality standards furnished by the procuring agency or agreed upon by the procuring agency and contractor. When foundry practices have been so established, the production method shall not be changed without demonstration to the satisfaction of the procuring agency that the change does not adversely affect the quality of the die castings.

3.4 Soundness.

3.4.1 When specified (see 6.2) the soundness of die castings shall conform to standards furnished or approved by the procuring agency. The number and extent of blowholes, sponginess, and other defects in the die castings shall not exceed those shown by the standards, and such defects shall be substantially absent in designated areas.

3.4.1.1 The standards supplied or approved by the procuring agency for determining conformance to soundness requirements may consist of either sectionalized die castings or photographs thereof or radiographs of at least the important sections of the die castings.

3.4.2 When specified (see 6.2) the weight of each casting shall be not less than a specified minimum.

3.5 Mechanical properties, strength. When specified (see 6.2) the die castings shall withstand a specified minimum load, applied in the manner specified, without failure. Failure shall be defined as breaking, cracking or producing permanent deformation (or set) greater than a specified maximum deformation (or set).

3.6 Identification marking. Unless otherwise specified (see 6.2) each die casting shall be identified with the part number and manufacturer's name, brand, or trademark by the use of raised numerals in a location indicated on the drawing. When no location is shown on the drawing, the number shall be so located as not to be machined off in finishing to the required dimensions.

3.7 Location of ejector pinmarks and parting lines. Unless otherwise specified (see 6.2) the location of ejector pinmarks and parting lines shall be at the option of the contractor.

3.8 Dimensions. The dimensions of the die castings shall be within the dimensions and tolerances specified on the applicable drawings.

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3.9 Workmanship. The die castings shall be of uniform quality, free from injurious blowholes and porosity, hard spots, shrinkage defects, cracks, and other injurious defects which will adversely affect their serviceability, and they shall be smooth and cleaned before inspection. Porosity and other defects inherent in die castings shall not be cause for rejection provided it is demonstrated that the die castings are in accordance with the requirements and standards of the procuring agency.

3.9.1 Repair. Die castings shall not be repaired in any manner without permission of the procuring agency.

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.

4.2 Lot.

4.2.1 Inspection lot. The contractor has the option of operating on the basis of either one of the following definitions of an inspection lot.

4.2.1.1 An inspection lot shall consist of not more than 3,000 pounds of die castings of the same part number submitted for inspection at one time. However, if this method of inspection is used, the manufacturer's method of periodic composition control shall be acceptable to the procuring agency and no die castings shall be released for finishing until the composition of the representative chemical samples has been found to conform with the composition limits of this specification.

4.2.1.2 An inspection lot shall consist of the production of each die or compound die of each machine for each 24 hours during the first week of continuous operation and the production for each 48 hours thereafter of continuous operation. Any change in the machine, composition, die or continuity of operation shall be considered as the start of a new lot. Die castings inspected by this method shall be so marked or handled during the finishing operations as not to lose their identity.

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

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4.3.1 Sampling for chemical analysis. Two samples shall be taken from two representative castings from each lot. Chips shall be obtained from the entire cross-section at such points in the die casting as the procuring agency may designate, either by sawing, drilling, or milling, using clean dry tools without lubrication. The chips shall be cleaned with a magnet and analyzed separately.

4.3.2 Sampling for spectrochemical analysis. Samples for spectrochemical analysis shall conform to method 112.2 of Fed. Test Method Std. No. 151. In addition, die-cast samples, when used, shall conform to 4.3.2.1.

4.3.2.1 Die-cast samples shall weigh approximately 50 grams and shall be cast in an iron mold at the time the parts are die cast and from the molten metal supplying the machines. The mold shall be as required by the laboratory at which the spectrochemical analysis is to be performed.

4.3.2.2 If the producer's method of composition control is acceptable, sampling for check chemical analysis may be waived at the discretion of the procuring agency.

4.3.3 Sampling for soundness. Unless otherwise specified (see 6.2) the sampling for radiographic inspection or comparison with standards shall be in accordance with table II.

TABLE II. Size of radiographic inspection sample

Number of die castings in lot	Sample number of die castings	Acceptable number of defective die castings, maximum
1-5	All	0
6-100	6	0
101-500	7	0
501-2000	17	1
2001-6000	27	2
Over 6000	39	3

4.4 Examination.

4.4.1 Workmanship. Each die casting of a randomly selected sample of 35 units from each lot shall be carefully examined to determine conformance to the requirements of this specification with respect to workmanship. Failure of two or more units of the sample to comply with the specified workmanship requirements shall be cause for rejection of the lot.

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4.4.2 Dimensional. One of the first die castings made with each die shall be measured and gaged as directed by the procuring agency. Unless otherwise specified (see 6.2) at least 0.1 percent of the die castings subsequently made with the die shall be measured and gaged, if required by the procuring agency.

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

4.5 Tests.

4.5.1 Chemical analysis. The sample selected in accordance with 4.3.1 shall be analyzed in accordance with method 111.2 or 112.2 of Fed. Test Method Std. No. 151. In case of dispute, referee analysis shall be by method 111.2.

4.5.2 Foundry control. Unless otherwise specified (see 6.2) all die castings produced shall be examined radiographically until such time as the proper die casting practice necessary to produce die castings free from serious internal defects in all parts of the die castings subject to stress in service has been reached.

4.5.3 Soundness.

4.5.3.1 Unless otherwise specified (see 6.2) when soundness is required in accordance with 3.4.1, it shall be determined by radiographic examination of die castings selected in accordance with 4.3.3.

4.5.3.2 When specified (see 6.2) soundness shall be determined by comparison with sectionalized standard die castings.

4.5.3.3 When the minimum weight per casting is specified, a sufficient number of castings from each lot shall be weighed individually to satisfy the procuring agency regarding the soundness of the castings of the lot. If any of the castings so weighed fall below the specified weight, each casting of the lot shall be weighed and those weighing less than the specified weight shall be rejected.

4.5.4 Mechanical property tests. When the contract or order requires the castings to withstand a minimum nondestructive load, a random sample of 25 die castings shall be selected from each lot. Failure of one or more units of the sample to comply with the specified mechanical property tests requirements shall be cause for rejection of the lot.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Unless otherwise specified (see 6.2) commercial packages are acceptable under this specification.

5.2 Packing. Unless otherwise specified (see 6.2) the commodity shall be packed or prepared for delivery in such a manner that will insure safe delivery by common or other carriers to the point of delivery at the lowest rate.

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5.3 Marking. In addition to special marking required in the contract or order (see 6.2) the packages and shipping containers shall be marked in accordance with Fed. Std. No. 123 or MIL-STD-129 as applicable.

6. NOTES

6.1 Intended use. The zinc-base die castings covered by this specification are used for hardware of all kinds in the transportation, plumbing and electrical industry, and for instrument parts, calibrated wheels, housings, covers, frames, gears and worms, fuze parts and windshields.

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. Alloy and dimensions required. Copper content for alloy AG40A when other than given in table I (see 3.2.1).
- c. Foundry control (see 3.3 and 4.5.2).
- d. Soundness (see 3.4 and 4.5.3).
- e. Mechanical properties (see 3.5).
- f. Identification marking (see 3.6).
- g. Location of ejector pinmarks and parting lines (see 3.7).
- h. Sampling for soundness (see 4.3.3).
- i. Dimensional requirement (see 4.4.2).
- j. Special marking, if required (see 5.3).
- k. Levels of packaging and packing required (see section 5).

6.3 The use of separately die-cast test bars was omitted from this specification revision because they are considerably unreliable. Different machines and dies continue to be necessary for die castings and test bars. Comparison between static breakdown or proof test and the mechanical properties of separately die-cast test bars revealed that test bars made in a different machine in a different die had no correlation with the die casting other than a common chemical composition. In view of this, it is considered that the only practical method is to have mechanical property control based on proof testing of whole die castings.

6.4 For information only, typical separately die-cast specimen tensile and hardness properties are presented in table III. The tensile data are from tensile specimens of the form and dimensions shown in American Society for Testing and Materials Standard E 8, when cast in a die in regular production routine and conforming to the chemical composition specified in table I.

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TABLE III. Typical mechanical properties

Alloy	Tensile strength	Elongation in 2 inches	Brinell hardness number ^{1/}
	<u>psi</u>	<u>percent</u>	
AG40A	41,000	10	82
AC41A	47,000	7	91

^{1/} 500 kg load, 10 mm. ball, 30 sec.

6.5 Alloy AG40A is similar to composition AG40A in QQ-Z-363A. Alloy AC41A is similar to composition AC41A in QQ-Z-363A.

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