MILITARY SPECIFICATION

MAGNESIUM-LITHIUM ALLOY CASTINGS (LS141A and LZ145A)

1. SCOPE

1.1 Scope. This specification covers magnesium-lithium alloy castings (LS141A and LZ145A).

1.2 Classification.

1.2.1 Compositions and tempers. The material covered by this specification shall be furnished in the compositions shown in table I, and in the stabilized temper, as specified (see 6.2):

LS141A-T7
LZ145A-T7

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.

SPECIFICATION

MILITARY

MIL-M-3171 - Magnesium Alloy, Processes for Pretreatment and Prevention of Corrosion

STANDARDS

FEDERAL

Fed. Test Method Std. No. 151 - Metals; Test Methods

MILITARY

MIL-STD-129 - Marking for Shipment and Storage
MIL-STD-649 - Aluminum and Magnesium Products, Preparation for Shipment and Storage

(Copies of specifications, standards, drawings, and publications 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 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

E8 - Methods of Tension Testing of Metallic Materials
E94 - Recommended Practice for Radiographic Testing
E155-64 - Radiographs for Aluminum and Magnesium Castings
E165 - Methods for Liquid Penetrant Inspection

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

Technical societies 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 requirements. The material shall conform to the chemical requirements shown in table I.

Table I. Chemical composition, percent
(Maximum, except where a range is specified)

Element	Alloy LS141A	Alloy LZ145A
Lithium	12.0-15.0	12.0-15.0
Zinc	-	4.5-5.0
Silver	-	2.0-3.0
Silicon	0.5-0.6	1.5-2.0
Sodium	0.005	0.005
Iron	0.005	0.005
Nickel	0.005	0.005
Copper	0.05	0.05
Aluminum	0.05	0.05
Manganese	0.15	0.15
Magnesium	Rem.	Rem.
Other (total)	0.20	0.20

3.1.1 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 an amount greater than the specified limits, further analysis shall be made to determine that these elements are not present in excess of the limits specified.

3.1.2 The contractor shall furnish analysis of each melt showing the percentage of each of the elements designated in table I.

3.2 Mechanical properties. The mechanical properties of test specimens shall conform to the requirements of table II.

Table II. Mechanical properties[1]

Alloy	Temper[2]	Ultimate tensile strength min., ksi	Yield strength, min., ksi (0.2% offset)	Elongation in 2 in., min., percent
LS141A	T7	18.5	13.5	18
LZ145A	T7	28	22.5	4

[1]Properties are based on permanent mold separately cast test bars conforming to the standard specimen of figure 8 of ASTM E8.
[2]Stabilization treatment procedures shall be approved by the procuring activity (see 6.2).

3.3 Dimensional tolerances. The dimensions and tolerances shall be as specified in the drawing or contract or order and shall not vary from the dimensions so specified.

3.4 Surface imperfections. The castings shall not contain cracks, laps, or cold shuts. When specified in the contract or order, castings shall be examined for imperfections by one of the liquid penetrant methods of ASTM E165 (see 4.5.2.3).

3.5 Soundness. Radiographic standards of castings in designated areas, shall be as established by the procuring activity. The standards shall be in accordance with ASTM E155 (see 4.5.2.4 and 6.2).

3.6 Repair of castings. Castings shall not be welded, plugged or impregnated without written authorization of the procuring activity. When impregnation to prevent leakage is authorized, a written procedure of the method shall be prepared by the producer and all castings shall be identified by the symbol IMP.

3.7 Identification marking. Castings shall bear the producer's name or symbol, melt number, and part of pattern number except castings of small size. Such marking shall be done by stencilling methods or similar techniques.

3.8 Protective treatment. The material shall be acid pickled. As a final process before shipment, the material shall be either oiled or chrome pickled as specified (see 6.2). Unless otherwise specified, in the contract or order, the material shall be given a chrome pickle treatment in accordance with type I of MIL-M-3171.

3.9 Workmanship. Castings shall be clean and free of injurious defects for their intended use.

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. A lot shall consist of castings of the same part number made by the same casting process.

4.3 Sampling. Samples taken for the purpose 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 materials when samples representative of the material are available from other sources

4.3.1 For chemical analysis. A sample for chemical analysis shall be obtained from each 4,000 pounds or less of a melt of the alloy when chemical analysis is made at the time of melting. When chemical analysis is made on the finished casting, a sample for chemical analysis shall be taken from each 1,000 pounds or less of material comprising the lot. Not less than 2 ounces of the sample chips shall be used for analysis. The chips shall be fine, clean, and free from oil, dirt, grit, and foreign matter. Samples for chemical analysis shall represent the full cross section of the material. Upon approval of the procuring activity, the manufacturer's method of composition control may be used in lieu of the methods outlined above.

4.3.2 For mechanical properties. Unless otherwise specified in the contract or order, at least one tension test specimen shall be selected to represent each 1,000 pounds or less of castings comprising a lot except that in no case shall less than two tension tests represent a lot.

4.3.3. For examination. Each casting shall be visually examined.

4.3.3.1 Surface imperfections. Sampling for penetrant inspection shall be as specified by the procuring activity.

4.3.3.2 Soundness. Sampling for soundness shall be as specified by the procuring activity.

4.4 Examinations. Each piece selected in accordance with 4.3.3 shall be examined to determine compliance with the requirements for identification marking (see 3.7) and workmanship (see 3.9) and shall be measured for compliance with the dimensional requirements (see 3.3) of this specification.

4.4.1 Preparation for shipment. Examination of the preservation, packaging, 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 conform to the standard specimen of figure 8 of ASTM E8. These shall be permanent mold separately cast test bars.

4.5.2 Test procedures.

4.5.2.1 Chemical analysis. The samples selected in accordance with 4.3.1 shall be analyzed by the wet chemical method in accordance with method 111 of Fed. Test Method Std. No. 151, or the spectrochemical method in accordance with method 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, analysis by the wet method (method 111) shall be the basis for acceptance.

4.5.2.2 Tension tests. Tension tests shall be conducted in accordance with ASTM E8.

4.5.2.3 Surface imperfections. Penetrant tests shall be conducted in accordance with ASTM 165.

4.5.2.4 Radiographic inspection. Testing shall be conducted in accordance with ASTM E94.

4.6 Rejection.

4.6.1 Examination defects. Any sample unit having one or more defects shall be rejected.

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 section on"Rejection and Retests" of Fed. Test Method Std. No. 151.

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Unless otherwise specified in the contract or order, all material shall be separated by temper, size and thickness and packed in crates or boxes of the size commonly used for shipment. Individual castings which have been given a chrome pickle surface treatment shall be separated by a non-corrosive, nonhygroscopic paper to protect the finish. Oiled material shall not be required to be separated by paper.

5.2 Packing.

5.2.1 Level A. The material shall be packed 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 from normal hazards of transportation.

5.2.2 Levels B and C. The material shall be packed in accordance with MIL-STD-649.

5.3 Marking. In addition to any special marking required by the contract or order, shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. Materials covered by this specification are for use in missiles and similar applications.

6.2 Ordering data. Purchasers should exercise any desired options offered herein and procurement documents should specify the following:

(a) Title, number and date of this specification.
(b) Composition and temper (see 1.2.1).
(c) Stabilization procedures (see table II and 6.4).
(d) Radiographic standards at any particular location of the casting (see 3.5).
(e) Whether chrome pickle for oiled castings are desired (see 3.8).
(f) Sampling for penetrant inspection (see 4.3.3.1).
(g) Sampling for soundness (see 4.3.3.2).
(h) Whether material is to be packed by level A, B, or C (see 5.2).
(i) Special marking, if required (see 5.3).

6.3 The requirements for packaging (see 5.1) and for packing (see 5.2) and marking for shipment (see 5.3) specified herein apply to direct shipments for Government activities and apply also, where specified, to contracts or orders between the manufacturer and the Government prime contractor.

6.4 Stabilization. A typical stabilization treatment consists of heating at 350°F for a period of 2 to 6 hours depending on the thickness after solution treating. Solution treating consists of heating at 550°F, 1 hour per inch or 1 hour minimum (whichever is greater), followed by an air quench.

6.5 Mechanical properties. Stress levels of various sections of castings should be carefully considered before specifying the mechanical properties at any given point. Metal is cast from a single homogeneous batch of molten metal to which all alloying and processing operations have been completed.

6.5.1 The data used in table II were obtained by using separately cast test bars, using 0.505 inch diameter permanent steel molds to determine the mechanical properties.

Custodian:
Army - MR

Preparing activity:
Army - MR

Review activities:
Army - MR, MU, WC

Project No. MECA-A011

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