MILITARY SPECIFICATION

MAGNESIUM-LITHIUM ALLOY PLATE, SHEET AND FORGINGS (LA141A, LS141A AND LZ145A)

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

1. SCOPE

1.1 Scope. This specification covers magnesium-lithium alloy plate, sheet and forgings (LA141A, 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 following tempers, as specified (see 6.2).

LA141A - Stabilized
LS141A - As rolled
LZ 145A - Stabilized

1.2.2 Sizes and thicknesses. The material shall be furnished in the sizes and thicknesses as specified (see 6.2).

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

STANDARDS

FEDERAL

Fed. Test Method Std. No. 151 - Metals; Test Methods
Fed. Std. No. 184 - Identification Marking of Aluminum, Magnesium and Titanium
Fed. Std. No. 245 - Tolerances for Aluminum and Magnesium Alloy Wrought Products

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 document forms 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

(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 distribution 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		
	LA141A	LS141A	LZ145A
Lithium	13.0-15.0	12.0-15.0	12.0-15.0
Zinc	-	-	4.5- 5.0
Silver	-	-	2.0- 3.0
Silicon	0.10	0.5- 0.6	1.5- 2.0
Sodium	0.005	0.005	0.005
Iron	0.005	0.005	0.005
Nickel	0.005	0.005	0.005
Copper	0.04	0.05	0.05
Aluminum	1.0- 1.5	0.05	0.05
Manganese	0.15	0.15	0.15
Magnesium	Rem.	Rem.	Rem.
Other (total)	0.30	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 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.

3.1.2 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 the material, measured in the longitudinal direction, shall be as specified in table II.

Table II. Mechanical properties[1/]

Alloy	Temper	Thickness, inch	Tensile strength, min., psi	Yield strength, (0.2% offset), min., psi	Elongation in 2 inches, min., percent
LA141A	T7[2/]	0.010-0.090	19,000	15,000	10
		0.091-0.250	19,000	14,000	10
		0.251-2.000	18,000	13,000	10
LS141A	F	0.020-2.00	18,000	13,000	30
LZ145A	T7[2/]	0.020-2.00	28,000	24,000	20

1/ The minimum mechanical properties of material in other tempers or for thicknesses not shown in table II shall be as agreed upon between the producer and procuring activity.

2/ Stabilization treatment procedures shall be approved by the procuring activity (see 6.2).

3.3 Dimensional tolerances.

3.3.1 Plate and sheet. Plate and sheet shall not vary from the specified dimensions or from true straightness of edge by an amount greater than the tolerances specified for flatness, squareness, thickness, width, length, and lateral bow in Fed. Std. No. 245 for plate, flat sheet, or coiled sheet as applicable. Tolerances for sizes of sheet and plate not covered by Fed. Std. No. 245 shall be as specified in the contract or order.

3.3.2 Forgings. The forgings shall conform to the shape and dimensions on the drawings within any variations stated therein.

3.4 Identification marking. When specified in the contract or order, item identification marking shall be in accordance with Fed. Std. No. 184. In addition to the commercial alloy designation, the number of this specification shall be applied to each item.

3.5 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.

3.6 Workmanship.

3.6.1 The material shall be uniform in quality and condition, clean, sound, smooth, commercially flat, and free from severe buckles and other injurious defects. Discolorations resulting from annealing operations, and superficial surface abrasions which are not of sufficient depth to affect adversely the static or dynamic mechanical properties or formability of the material, shall not be cause for rejection.

3.6.2 The metal shall be given such uniform treatment as the manufacturer desires to produce material that will conform to the requirements specified, applied in a manner that will produce utmost uniformity. Annealing operations shall be performed on the whole of a product, never on a part only.

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 material of the same temper and thickness, made by the same manufacturing process, submitted for inspection at one time.

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 plate, sheet or forging, 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 forwarded 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 sheet or 2,000 pounds or less of plate comprising a lot except that in no case shall less than two tension tests represent a lot. For forgings, two tension test specimens shall be selected from each lot. Each specimen shall be taken from a different piece.

4.3.3 For examination. Each plate, sheet and forging shall be carefully examined.

4.4 Examination. Each piece selected in accordance with 4.3.3 shall be examined to determine compliance with the requirements for identification marking (see 3.4) and workmanship (see 3.6) 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 requirements of ASTM E 8.

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 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 in accordance with method 111 of Fed. Test Method Std. No. 151 shall be the basis for acceptance.

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

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.

4.7 Reheat treatment. Where failure of any lot of material to meet the requirements of this specification is due to inadequate heat treatment, the material may be reheat treated, and resubmitted for test. Only two such reheat treatments will be allowed.

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 plate, sheet or forging 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 Levels A and B. The material shall be packed in accordance with MIL-STD-649.

5.2.2 Level C. 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.

5.3 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) Size and thickness (see 1.2.2).
(d) Mechanical properties for sizes or tempers not covered by table II (see 3.2).
(e) Stabilization procedures (see table II and 6.4).
(f) Tolerances for material having dimensions outside the specification limits (see 3.3).
(g) Purpose for which material is intended.
(h) Whether chrome pickled or oiled plate or sheet is desired (see 3.5).
(i) Whether material is to be packed by level A, B or C (see 5.2).
(j) 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.

Custodian:
Army - MR
Navy - AS
Air Force - 11

Review activities:
Army - MR, MI, MU, GL, WC
Navy - AS
Air Force - 84

Preparing activity:
Army - MR

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