SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

AMS 4396E

Issued JUL 1963
Revised JUL 2007

Superseding AMS 4396D

Magnesium Alloy Welding Wire
3.2 Rare Earths - 2.5Zn - 0.72Zr (EZ33A)

(Composition similar to UNS M12331)

RATIONALE

AMS 4396E results from a Five Year Review and update of this specification. The title has been changed to from 3.2 Ce to 3.2 Rare Earths. The Composition table has been changed from Cerium [total rare earths] to Total Rare Earths.

1. SCOPE

1.1 Form

This specification covers a magnesium alloy in the form of welding wire.

1.2 Application

This wire has been used typically as filler metal for gas-metal-arc and gas-tungsten-arc welding of magnesium alloys of similar composition, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS 2355	Quality Assurance Sampling and Testing, Aluminum and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged or Flash Welded Rings
AMS 2813	Packaging of Welding Wire, Standard Method
AMS 4383	Magnesium Alloy Sheet and Plate, 2.0Th - 0.78Mn Solution Heat Treated, Cold Worked and Precipitation Heat Treated
AMS 4384	Magnesium Alloy Sheet and Plate, 3.2Th - 0.70Zr (HK31A-0), Annealed Recrystallized
AMS 4385	Magnesium Alloy, Sheet and Plate, 3.2Th - 0.70Zr Cold Rolled and Partially Annealed
ARP1876	Weldability Test for Weld Filler Metal Wire
ARP4926	Alloy Verification and Chemical Composition Inspection of Welding Wire

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS 2355:

TABLE 1 - COMPOSITION

Element	min	max
Total Rare Earths (3.1.1)	2.5	4.0
Zinc	2.0	3.1
Zirconium, total	0.45	1.0
Zirconium, soluble (3.1.2), (3.1.3)	0.45	--
Other Elements, total (3.1.3)	--	0.30
Magnesium	remainder	

3.1.1 Total Rare Earths (TRE) are principally a mixture of Cerium, Lanthanum, Neodymium and Praseodymium. The Cerium content shall not be less than 45% of TRE

3.1.2 Soluble zirconium is that portion of zirconium which is soluble in 1:4 hydrochloric acid held below its boiling point.

3.1.3 Determination not required for routine acceptance.

3.1.4 Chemical analysis of initial ingot, bar, or rod stock is acceptable provided the processes used for manufacture and cleaning are controlled to ensure conformance to composition requirements, and the facility employs procedures to ensure traceability of wire to the originally analyzed ingot.

3.2 Condition

Wire for cut lengths shall be extruded and for spooled wire shall be extruded and sized. Drawn wire may be supplied if acceptable to purchaser.

3.3 Fabrication

3.3.1 Butt welding is permissible provided both ends to be joined are identified by chemical analysis or the repair is made at the wire processing station. The butt weld shall not interfere with uniform, uninterrupted feeding of the wire in machine welding equipment.

3.3.2 Oxides, dirt, and extruding compounds shall be removed by cleaning processes which will neither result in pitting nor cause gas absorption by the wire or deposition of substances harmful to welding operations.

3.4 Properties

Wire shall conform to the following requirements:

3.4.1 Weldability

Melted wire shall flow smoothly and evenly and shall produce, on panels of AMS 4383, AMS 4384, or AMS 4385 magnesium alloy, a pool of molten metal of uniform appearance and form. Welding of parts by a qualified welding operator shall produce a weld bead of uniform appearance and form, free from oxide, excessive or unacceptable porosity, entrapped slag, and other defects. ARP1876 may be used to resolve disputes.

3.5 Quality

Wire, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to welding operations, operation of welding equipment, or properties of the deposited weld metal.

3.6 Sizes and Tolerances

Wire shall be supplied in the sizes and to the tolerances shown in 3.6.1 and 3.6.2.

3.6.1 Diameter

Shall conform to the tolerances shown in Table 2.

TABLE 2A - TOLERANCES, INCH-POUND UNITS

Form	Nominal Diameter Inch	Tolerance, Inch plus	Tolerance, Inch minus
Cut Lengths	0.062 to 0.250, incl	0.007	0.007
Spools	0.040 to 0.125, incl	0.003	0.004
	Over 0.125 to 0.187, incl	0.007	0.007

TABLE 2B - TOLERANCES, SI UNITS

Form	Nominal Diameter Millimeters	Tolerance, Millimeter plus	Tolerance, Millimeter minus
Cut Lengths	1.57 to 6.35, incl	0.18	0.18
Spools	1.00 to 3.17, incl	0.076	0.10
	Over 3.17 to 4.75, incl	0.18	0.18

3.6.2 Length

Cut lengths shall be furnished in 36-inch (914-mm) lengths and shall not vary more than +0, -1/2 inch (-12 mm).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The vendor of wire shall supply all samples for vendor's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the wire conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Composition (3.1) and sizes and tolerances (3.6) are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests

Weldability (3.4.1) is a periodic test and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing

Shall be in accordance with AMS 2355.

4.4 Reports

The vendor of wire shall furnish with each shipment a report stating that the wire conforms to the composition and other technical requirements of this specification. This report shall include the purchase order number, lot number, AMS 4396E, nominal size, and quantity.