SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 6464G

Issued	JUN 1959
Revised	JAN 1992
Noncurrent	SEP 1996
Reaf. Noncur.	OCT 2001
Cancelled	SEP 2006

Superseding AMS 6464F

Welding Electrodes, Covered, Steel
1.05Mo - 0.20V (0.06 - 0.12C)

(Composition similar to UNS W10013)

RATIONALE

AMS 6464G places this specification in cancelled status.

CANCELLATION NOTICE

This specification has been declared “CANCELLED” by the Aerospace Materials Division, SAE, as of September, 2006. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications indicating that it has been “CANCELLED”.

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1. SCOPE:

1.1 Form:

This specification covers a low-alloy steel in the form of covered welding electrodes.

1.2 Application:

Primarily for use as filler metal for metal-arc welding of carbon and low-alloy steels when the deposited weld metal is required to have heat treating characteristics comparable to those of the parent metal.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 6350 Steel Sheet, Strip, and Plate, 0.95Cr - 0.20Mo (0.28 - 0.33C) (SAE 4130)

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM A 370 Mechanical Testing of Steel Products
ASTM E 350 Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

2.3 U.S. Government Publications:

Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-W-10430 Welding Rods and Electrodes, Preparation for Delivery of

2.4 AWS Publications:

Available from American Welding Society, Inc., P.O. Box 351050, Miami, FL 33135-1050.

AWS A5.5 Low-Alloy Steel Covered Arc-Welding Electrodes

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Weld metal deposited from electrodes shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 350, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Carbon	0.06	0.12
Manganese	0.35	0.70
Silicon	0.30	0.60
Phosphorus	--	0.025
Sulfur	--	0.025
Molybdenum	0.90	1.20
Vanadium	0.10	0.30
Chromium	--	0.20
Nickel	--	0.25
Copper	--	0.35

3.1.1 Weld Pads for Chemical Analysis: The referee procedure for making pads of weld metal and removing samples for chemical analysis shall be in accordance with AWS A5.5.

3.2 Type:

Electrodes shall be suitable for welding in all positions using AC or using DC straight polarity (electrode negative) or reverse polarity.

3.3 Properties:

Electrodes shall conform to the following requirements:

3.3.1 Tensile Properties: Shall be as shown in Table 2, determined in accordance with ASTM A 370 on specimens as in 4.3.1:

TABLE 2 - Minimum Tensile Properties

Requirement	Value
Tensile Strength Through Weld Zone	90% of Parent Metal
Elongation in 2 Inches (50.8 mm)	10%

3.3.2 Weldability: Electrodes shall demonstrate good weldability, shall flow smoothly and evenly under the conditions specified in 3.2, and shall produce acceptable welds, determined by a procedure acceptable to purchaser.

3.3.3 Burn-Off: The covering shall be consumed uniformly all around and shall not burn back from the core wire under proper welding conditions. Heating of the electrode during welding shall not cause injurious blistering of the covering within the range of current values recommended by the manufacturer.

3.3.4 Grip Portion and Arc Ends: A portion of the electrode 0.75 - 1.25 inches (19 - 32 mm) long on end-grip rods and 1.5 - 2.0 inches (38 - 51 mm) long on center-grip rods shall be bare to permit good electrical contact with the electrode holder. The arc end of the electrodes shall be sufficiently bare to permit easy striking of the arc but the length of this bare section, measured from the end of the electrode to the point where the full cross-section of the covering begins, shall not exceed the diameter of the bare wire and in no case shall it exceed 1/8 inch (3.2 mm).

3.3.5 Cleaning: Slag produced during welding shall be readily removable with hand tools.

3.4 Quality:

3.4.1 Core Wire: Shall be uniform in quality and condition, cylindrical, sound, and free from foreign materials and from imperfections detrimental to weld quality.

3.4.2 Covering: Shall be concentric, uniform in quality, tightly adherent, and free from abnormal scabs, blisters, pockmarks, bruises, and other surface defects and shall withstand normal handling without damage. It shall not be harmfully hygroscopic and shall not adversely affect weld quality.

3.5 Standard Size and Lengths:

The sizes and lengths in Table 3 are standard:

TABLE 3A - Size and Length, Inch/Pound Units

Nominal Diameter of Core Wire Inch	Length Inches
1/16	9
5/64, 3/32	9 or 12
1/8, 5/32, 3/16	14

TABLE 3B - Size and Length, SI Units

Nominal Diameter of Core Wire Millimeters	Length Millimeters
1.6	229
2.0, 2.4	229 or 305
3.2, 4.0, 4.8	356

3.5.1 Unless otherwise ordered, end-grip electrodes shall be supplied.

3.6 Tolerances:

Shall be as follows:

3.6.1 Electrodes shall not vary in length more than ±1/4 inch (±6.4 mm) from the length ordered.

3.6.2 Electrode core wire shall not vary in diameter more than ±0.003 inch (±0.08 mm) from the size ordered.

3.6.3 Covering shall be concentric with the core wire to the extent that the maximum core-plus-one-covering dimension shall not exceed the minimum core-plus-one-covering dimension by more than 3% of the minimum core-plus-one-covering dimension.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of electrodes shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the electrodes conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for composition (3.1), grip portion and arc ends (3.3.4), sizes (3.5), and tolerances (3.6) are acceptance tests and shall be performed on each control number of electrodes.

4.2.2 Periodic Tests: Tests for tensile properties (3.3.1), weldability (3.3.2), burn-off (3.3.3), and cleaning (3.3.5) are periodic tests 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 as agreed upon by purchaser and vendor; a control number shall be a designation indicating batch processing and core wire heat number.

4.3.1 Tensile specimens conforming to ASTM A 370, with the weld in the approximate center of the gage length and perpendicular to the longitudinal axis of the specimen, shall be cut from coupons having a single-bevel-groove, butt-joint weld, made from one side, between two pieces of AMS 6350 steel plate nominally 0.250 inch (6.35 mm) thick, one piece of which is chamfered 7/32 inch (5.6 mm) deep to a 60 degree included angle. Root opening shall be adjusted for electrode diameter to ensure 100% weld penetration. Weld metal shall be machined flush with the parent metal on both faces. Test specimens shall be hardened and tempered to a parent metal hardness of 26 - 32 HRC. Hardness shall be determined in accordance with ASTM A 370.