SAE Aerospace
An SAE International Group

# AEROSPACE RECOMMENDED PRACTICE

SAE ARP1876 REV. B

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Superseding ARP1876A

## Weldability Test for Weld Filler Metal Wire

RATIONALE

This document has been reaffirmed to comply with the SAE 5-year Review policy.

1. SCOPE:

This SAE Aerospace Recommended Practice defines a method for determining the weldability of weld filler metal in continuous coil or cut length form. It is applicable to all solid (non flux-containing) wires. It is intended as a referee method for testing weld filler metals in case of dispute between purchaser and vendor.

1.1 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

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 canceled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.org.

ASTM E 1742 Standard Practice for Radiographic Examination





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3. TEST METHODS:

3.1 Surface Cleanliness:

Wire, except aluminum and magnesium and their alloys, shall leave no more than a barely discernible trace of residue when wiped with a clean white cloth, filter paper, or tissue paper.

3.1.1 Test Method: Fold a strip of clean, white, cotton cloth around the test wire and press the cloth to the wire surface between thumb and forefinger with sufficient pressure so that a force of approximately 5 to 15 pounds (22 to 70 N) is required to pull the wire through the cloth (filter paper or tissue paper may be substituted for cloth). A length of 18 to 20 inches (457 to 508 mm) of wire should be wiped and the resulting mark compared with the standard. The test should be done with both dry cloth, and, on a separate section of test wire, a cloth dampened with a suitable solvent.

3.1.2 Test Standards:

3.1.2.1 Pencil Method: Using drafting pencil lead, grade 8H or harder (4H for aluminum or magnesium), draw the lead through dry, white cloth as in 3.1.1 for a distance of approximately 4 inches (102 mm) several times, until the indication on the cloth becomes substantially constant from wipe to wipe. Compare the final indication to that obtained in 3.1.1. The wire should not have an indication darker than that of the test standard.

3.1.2.2 Gray Scale Method: Compare the density of the indication to the Kodak Gray Scale (available from Eastman Kodak Co., Rochester, NY or its distributors). An indication darker than 0.3 (0.7 for aluminum or magnesium) indicates excessive surface contamination.

3.2 Welding:

Test welds should be made, fusion bead-on-plate style, on suitably prepared applicable base metals. Chemical cleaning or scraping are suggested as means to obtain optimum cleanliness of the base metal. Weld wire or rod should be tested in the condition that is supplied to purchaser without additional processing. The method for welding should be as fully automatic as possible.

3.2.1 Cut Lengths or Rods: A gas-tungsten-arc (GTAW) weld, bead-on-plate style, shall be made using a manual technique or automatic equipment feeding the wire, as uniformly as possible. No weld procedure is specified and selection of equipment and procedures should be at the vendor's discretion but the procedure should be such as to produce not less than 20% nor more than 60% dilution with the base metal.

3.2.1.1 Observe the weld puddle during welding. The wire should not spark or spatter; the weld puddle should be quiescent and free from slag and other debris floating on the surface. The resultant weld should be uniformly bright and shiny, with uniformly rippled or smooth surfaces, straight, and free from evidence of lack of wetting, pinholes, and surface porosity. Slag, scabs, and other surface contaminants on iron, nickel, and cobalt alloys should be limited to not more than two indications per 10 inches (254 mm) of weld, with no indication greater than 0.060 inch (1.52 mm) in diameter regardless of the bead width. There should be no slag, scabs, or other surface contaminants on other alloys.

3.2.1.2 Sufficient cut lengths should be tested to use not less than 100 inches (2540 mm) of rod, or to produce 36 inches (914 mm) of weld, excluding stops and starts. Test welds need not be one continuous length but the total, excluding stops and starts, should meet the above requirements.

3.3 Coiled Wire:

3.3.1 Coiled Wire, GTAW (TIG) Method: The test for coiled wire is the same as for cut lengths except that one continuous length of weld should be made.

3.3.2 Coiled Wire, GMAW (MIG) Method: Wire should be capable of operating with either spray transfer, plasma (transferred or nontransferred) arc, dip, pulsed, or short circuiting arc. Any one of these methods may be used at the discretion of the vendor or purchaser.

3.3.2.1 Deposit weld filler metal onto suitably cleaned compatible base metal, bead-on-plate style, using fully automatic equipment. At least 100 inches (2540 mm) of weld length should be so deposited.

3.3.2.2 Welds should be completely uniform in shape and size, with no geometric changes that can be attributed to wire wandering. Welds should be bright and shiny, and free from surface porosity and pinholes. The ripple should be uniform. For iron, nickel, and cobalt alloys, slag, scabs, and other surface contaminants should be limited to two indications in 10 inches (254 mm) of weld, with each indication less than 0.060 inch (1.52 mm) in diameter regardless of the bead width. There should be no slag, scabs, or other surface contaminants on other alloys.

3.4 Examination of Test Welds:

3.4.1 Nondestructive Examination: All test welds shall be examined by fluorescent penetrant or magnetic particle inspection procedures. Overlaps and cold shuts should be considered as evidence of inability to wet the base metal, hence, inadequate usability. Specific test methods and acceptance standards should be as agreed upon by purchaser and vendor.

3.4.2 Radiographic Examination: Should be performed in accordance with an industrially recognized procedural specification, such as ASTM E 1742. For gas-metal-arc welds (GMAW), radiography should indicate total porosity not greater than 1% of the deposited volume of metal, with no pore greater than one-half the diameter of the wire tested and no stringer or worm-like porosity. For GTAW welds, there should be no internal indications.