



AEROSPACE MATERIAL SPECIFICATION

AMS2694™**REV. D**

Issued 1980-04
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Revised 2024-06

Superseding AMS2694C

In-Process Welding of Castings

RATIONALE

AMS2694D results from a Five-Year Review and update of this specification, moving Ordering Information to the beginning, moving definitions to 2.7, replacing “purchase order, drawing, and specification” with “specified” throughout, replacing “purchaser” with “CEO” as applicable throughout, and replacing “defects” with “discontinuities” throughout.

NOTICE

ORDERING INFORMATION: The following information shall be provided to the welding processor by the purchaser:

Purchase order shall specify not less than the following:

- AMS2694D
- Filler metal to be used, if other than nominal composition (see 3.4.2)
- Limits on location, size, depth, number, and spacing of welds, if any (see 3.2)
- Post-weld heat treatment (thermal treatments required after welding), if other than 3.5.8
- Weld maps (or equivalent), when required (see 3.6.4)
- Inspection methods and frequency of examination, if different from the base material requirements (see 3.6)
- Finishing requirements, if other than specified in this specification (see 3.5.2.2.2)
- In addition, ordering documents need to state, as applicable:
 - a. If welding procedure specification (WPS) and/or procedure qualification record (PQR) of AWS D17.1, ASTM A488/A488M, or other specified standard are required
 - b. If welder qualifications are contingent upon satisfying mechanical property requirements specified in the material specification, and/or
 - c. If the processor’s procedures are subject to cognizant engineering organization (CEO) review and approval

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SAE WEB ADDRESS:

Full document details: SAE AMS2694D

For more information on this standard, visit
<https://www.sae.org/standards/content/AMS2694D>

Documents

Standard, visit Sharing Hub

Parts manufacturing operations such as heat treating, forming, and media finishing can affect the condition of the substrate for welding or, if performed after welding, could adversely affect the welded part. The sequencing of these types of operations should be specified by the cognizant engineering organization or purchaser and is not controlled by this specification.

1. SCOPE

1.1 Purpose

This specification defines the requirements for in-process correction of foundry discontinuities by manual welding of castings.

1.2 Application

This specification provides a means for cognizant engineering organizations (CEO) to specify in-process manual welding procedures and manual welder qualification methods for correction of foundry discontinuities in castings. This specification does not apply to correction of casting discontinuities detected during machining or subsequent operations, modification of a sound casting for engineering purposes (see 3.3.3.a), or fabrication performed on or with castings.

1.3 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 processor 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 +1 724-776-4970 (outside USA), www.sae.org.

AMS2175 Castings, Classification and Inspection of

AS7766 Terms Used in Aerospace Metals Specification

2.2 U.S. Government Publications

Copies of these documents are available online at <https://quicksearch.dla.mil>.

A-A-59503 Nitrogen, Technical

BB-C-101 Carbon Dioxide (CO₂): Technical and USP

BB-H-886 Hydrogen

BB-H-1168 Helium, Technical

MIL-A-18455 Argon, Technical

2.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A488/A488M Steel Castings, Welding, Qualifications of Procedures and Personnel

ASTM E1417 Liquid Penetrant Testing

ASTM E1444 Magnetic Particle Testing for Aerospace

ASTM E1742 Radiographic Examination

2.4 AWS Publications

Available from American Welding Society, 8669 NW 36 Street, #130, Miami, FL 33166-6672, Tel: 1-800-443-9353 or 305-443-9353, www.aws.org.

AWS A5.12/A5.12M Specification for Tungsten and Oxide Dispersed Tungsten Electrodes for Arc Welding and Cutting

AWS D17.1/D17.1M Specification for Fusion Welding for Aerospace Applications

AWS QC1 Specification for AWS Certification of Welding Inspectors

2.5 CGA Publications (Compressed Gas Association)

Available from CGA, 14501 George Carter Way, Suite 103, Chantilly, VA 20151, Tel: 703-788-2700, www.cganet.com.

CGA-4.3 Commodity Specification for Oxygen

CGA-5.3 Commodity Specification for Hydrogen

CGA-6.2 Commodity Specification for Carbon Dioxide

CGA-9.1 Commodity Specification for Helium

CGA-10.1 Commodity Specification for Nitrogen

CGA-11.1 Commodity Specification for Argon

2.6 ISO Publications

Available from International Organization for Standardization, ISO Central Secretariat, 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, Tel: +41 22 749 01 11, www.iso.org.

ISO 24394 Welding for aerospace applications- Qualification test for welders and welding operators - Fusion welding of metallic components.

2.7 Definitions

Terms used in AMS2694 are defined in AS7766, AWS D17.1, and as follows:

2.7.1 SPECIFIED

Requires documented instruction from the CEO through engineering drawing, purchase order, specification, or other engineering documentation.

2.7.2 NOMINAL COMPOSITION

Includes equivalent, if not identical, controls and limits on composition. An example is, but not limited to, iron levels in 357 aluminum alloys.

2.7.3 AUTOGENOUS WELD

A fusion weld made without filler metal.

3. TECHNICAL REQUIREMENTS

3.1 When performed, castings shall be welded in any as-cast or heat-treated condition appropriate to the alloy that will allow the welded casting to meet the material specification and other specified requirements (see 3.5.8 and Ordering Information). All welding shall be manual welding.

3.2 Welding shall be performed only in those areas and to the extent specified, or as otherwise agreed upon by the CEO and processor.

3.3 Correction by Welding

3.3.1 Casting nonconformances may be corrected by welding.

3.3.1.1 Examples of nonconformances allowed to be corrected by welding include cracks, handling damage, miscuts, laps, hot tears, cold shuts, cold shots, shrinkage, porosity, gas holes, inclusions, oxides, dross, and other nonmetallic material.

3.3.2 Mis-machined target points may be corrected by adding weld filler to the target point surface(s) and (re)machining (see 3.3.3.d).

3.3.3 Unless authorized by the CEO, welding shall not be used to:

- a. Correct dimensional discrepancies that are a product of the pattern or core tooling, or to modify a sound casting for engineering purposes except as noted in 3.3.1.
- b. Correct casting discontinuities detected during machining or subsequent operations.
- c. Fabricate or assemble castings or portions of castings.
- d. Weld on target points after final heat treatment and dimensional inspection.
- e. Weld broken features back onto the casting.

3.3.4 When authorized by the CEO, patches, sections, or plates of cast and wrought materials may be used to correct the conditions described in 3.3.1.