

(R) In-Process Welding of Castings

RATIONALE

AMS 2694B results from a Five Year Review and update of 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 purchasers 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, or for 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 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 2175 Classification and Inspection of Castings

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2.2 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 A 488/A 488M	Steel Castings, Welding, Qualifications of Procedures and Personnel
ASTM E 1417	Liquid Penetrant Examination
ASTM E 1444	Magnetic Particle Examination
ASTM E 1742	Radiographic Examination

2.3 AWS Specifications

Available from American Welding Society, 550 NW LeJeune Road, Miami, FL 33126, Tel: 1-800-443-9353, www.aws.org.

AWS D17.1 Specification for Fusion Welding for Aerospace Applications

3. TECHNICAL REQUIREMENTS

3.1 When performed, castings shall be welded in any condition appropriate to the alloy that will allow the welded casting to meet the specified requirements. All welding shall be manual welding.

3.2 Welding shall be performed only in those areas and to the extent shown on the casting drawing, purchaser specifications, or as otherwise agreed upon by purchaser and supplier (See 8.2.1).

3.3 Correction by Welding

3.3.1 Casting discontinuities of all types (See 3.5.2.2) may be corrected by welding.

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

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

- 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,
- Correct casting discontinuities detected during machining or subsequent operations,
- Fabricate or assemble castings or portions of castings.

3.4 Materials and Equipment:

3.4.1 Gases for welding, backing, and chambers shall be in conformance with AWS D17.1.

3.4.2 Unless otherwise specified or authorized by purchaser (See 8.2.2), welding filler metal shall be the same nominal composition as the casting composition (See 8.2.3 and 8.3). Welding filler metal shall be identified and stored in accordance with AWS D17.1 and the applicable welding filler metal specification.

3.4.3 Equipment shall be maintained and calibrated as required to facilitate meeting specified requirements. Equipment, includes, but is not limited to power sources, controls, flow meters, regulators, and torches. Calibration shall be in accordance with AWS D17.1.

3.5 Welding Procedure

3.5.1 Welding shall be accomplished in accordance with written work instructions. These instructions shall include, but are not limited to welding process, alloy type and preweld heat treatment condition, preweld conditioning, welding filler metal, preheat and/or post-heat temperature as applicable, control of rewelding, and subsequent processing including post-weld thermal treatment. Supplemental instructions for each purchaser or casting part number shall be established as required to control purchaser or casting specific items such as cleaning, inspection, weld zone locations and allowances, thermal treatments, and special qualification procedures.

3.5.2 Preparation, Welding and Finishing

3.5.2.1 Casting discontinuities to be corrected shall be removed by a method that does not damage the base metal. The prepared area shall be smoothly contoured prior to welding.

3.5.2.2 The area shall be examined, prior to welding, to ensure that the discontinuity has been removed or reduced to the extent required. The method of examination shall be any combination of visual and nondestructive inspections used to determine final acceptance of the weld. Cracks, laps, hot tears, cold shuts, cold shots, and other linear discontinuities shall be removed completely, unless otherwise authorized by purchaser. Other discontinuities such as shrinkage, porosity, gas holes, inclusions, dross, and other nonmetallic material shall be removed to the extent necessary to comply with 3.1.

3.5.2.2.1 When authorized by purchaser, surface-contained gas holes, pits, HIP sinks, porosity, cold shuts, and cold shots may be reworked using autogenous welding, with or without the addition of filler material.

3.5.2.3 The preparation practices and precautionary measures for preweld cleaning shall be in accordance with AWS D17.1.

3.5.3 Castings may be preheated or preweld-stress-relieved in accordance with the weld procedure as required to provide good weld quality.

3.5.4 Welding shall be accomplished by manual gas-tungsten-arc welding (GTAW), unless use of another manual process such as plasma arc welding (PAW), gas metal arc welding (GMAW), or shielded metal arc welding (SMAW) is authorized by purchaser. Weld shielding shall be in accordance with D17.1.

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

3.5.6 Welding shall be performed by welders qualified in accordance with 3.8.

3.5.7 Welded areas shall be blended to conform to drawing requirements. Root weld reinforcement, penetration, and drop-through in inaccessible areas shall be blended in accordance with purchaser requirements. Unless otherwise specified by purchaser, the perimeter of the weld shall be blended flush with the parent metal (See 8.5).

3.5.8 Identification

3.5.8.1 Welded areas shall remain traceable to their location on the castings until inspection is completed (See 3.6).

3.5.8.2 When specified, welded castings shall be marked with a symbol of the type, method, and in the place specified by the purchaser.

3.5.8.3 Traceability of welder personnel and lot number of filler material shall be maintained by the supplier through shop traveler, weld map, or other record suitable to satisfy purchaser requirements, and as necessary to demonstrate continuing proficiency or qualification status.