

FUSION ARC WELDING (GTAW)

I. SCOPE

1. Purpose. This specification covers the GTAW (Gas Tungsten Arc Welding) process requirements.
2. Applicability. This specification applies to manual and automatic fusion arc welding processes as applied to the following materials as delineated in AWS D17.1:

Carbon and low-alloy steels Groups: IA and IB

Aluminum alloys Group: IV

3. Definitions

- 3.1 SAC, as used in this specification, refers to SCOMO's Aerospace Company.
 - 3.2 Material thickness. The thinner of the weld member thicknesses being joined.
 - 3.3 Weld overlap. The protrusion of weld metal beyond the end of fusion, most commonly occur ring at the toe of the weld.
 - 3.4 Rounded indications. Indications with a length-to-width ratio not more than 3 to 1.
 - 3.5 Linear indications. Indications with a length-to-width ratio greater than 3 to 1.
 - 3.6 Aligned indications. Sequence of four or more indications touching a line parallel to the length of the weld drawn through the center of the two outer indications.
4. Welding symbols and terms shall be in accordance with AWS A2.4 and AWS A3.0, respectively.

II. APPLICABLE DOCUMENTS

AWS D17.1 - Specification for Fusion Welding for Aerospace Applications

AWS A2.4 - Standard Symbols for Welding, Brazing, and
Nondestructive Examination

AWS A3.0 - Standard Welding Terms and Definitions, Including
Terms for Adhesive Bonding, Brazing, Soldering,
Thermal Cutting, and Thermal Spraying

AWS A5.12 - Specification for Tungsten and Tungsten-Alloy Electrodes
for Arc Welding and Cutting

III. REQUIREMENTS

5. Materials

- 5.1 Shielding gases such as argon and helium used for welding, backing, and purge chambers shall be of a grade designated for welding (reference AWS D17.1).
- 5.2 Tungsten electrodes shall be any type covered by AWS A5.12 and shall have a clean or ground finish.
- 5.3 Filler wire, rod, or electrodes are added during welding, and the added material shall be per drawing requirements.

6. Equipment

- a. Welding equipment shall include applicable power sources, controls, flow meters, regulators, torches, and wire feeders to produce weldments that shall meet the requirements of this specification.
- b. Preheating and postheating furnaces shall have suitable pyrometric controls. The temperature uniformity shall be within $\pm 25^{\circ}\text{F}$.

7. Personnel Qualification

- 7.1 All welders and welding operators engaged in the welding of S.A.C. components or assemblies by any fusion arc-welding process shall be examined and qualified in accordance with AWS D17.1.
- 7.2 All personnel that perform visual and dimensional inspection of weldments shall be trained and qualified to do so. An annual eye exam shall be given to each trained and qualified inspector. The inspectors vision shall be tested at 12" minimum and must be correctable to 20/20 in one eye minimum.

8. Process Qualification

- 8.1 All production welding shall be performed in accordance with a written and qualified Welding Procedure Specification prepared by the welding supplier and approved by the Quality Department of S.A.C.

9. Procedure

- 9.1 Tack welding may be applied only for nonstructural purposes such as positioning and requirements for in-process assembly.
- 9.2 Abrasive cleaning of the weld area after tack welding is strictly prohibited due to entrapment of particles between the tacked surfaces.
- 9.3 Welding performed closely enough to soldered joints is not allowed because it may result in melting of solder.
- 9.4 All surfaces to be welded and any adjacent area that may affect weld quality (e.g., welding filler materials and fixtures) shall be free from slag, surface oxides, scale, protective finishes, oils, grease, dirt, paint, or any other contaminant.
 - 9.4.1 Mechanical or chemical methods shall be used as needed prior to welding in order to assure compliance with these requirements. Mechanical methods may include wire brushing, scraping, abrasive blasting, emery paper, or machining. Chemical methods may include alkaline cleaning, solvent wipe, or acid etching.
- 9.5 The mating edges of all weld-joint configurations shall be fitted to a tolerance that will permit joint fit-up with a maximum gap of 50 percent of the thickness of the thinnest member or 0.062 inch, whichever is smaller.
- 9.6 Weld metal may be removed for the following:
 - For fit-up of mating details or subassemblies.
 - To remove small surface discontinuities such as pits, porosity, and linear indications.
 - For blending of additional welds.
 - To bring weld reinforcement into specified limits in accordance with Table I.

10. Properties

- 10.1 Liquid penetrant, magnetic particle, radiographic, and ultrasonic inspections shall be in accordance

with S.A.C. specifications TS2309, TS2308, TS2348, and TS2321, respectively.

10.2 It is permissible to apply magnification (up to 10X) to aid visual inspection.

10.3 Acceptance criteria for visual, liquid penetrant, and magnetic particle evaluations of welds shall be in accordance with Table I.

TABLE I. VISUAL, LIQUID PENETRANT,
AND MAGNETIC PARTICLE INSPECTION
ACCEPTANCE LIMITS

Maximum allowable linear indication size	0.030 inches
Maximum allowable rounded indication size	0.33T, except not to be less than 0.030 or greater than 0.075 inch
Minimum separation, rounded and/or linear indications	0.25 inch
Through-wall indications	None Allowed
Weld overlap	None Allowed
Weld-joint mismatch	0.5T or 0.062 in., whichever is less
Weld reinforcement	1T or 0.090 in., whichever is less

TABLE II. RADIOGRAPHIC INSPECTION LIMITS

Linear indications allowable	0.005 inch
Random indications, rounded	0.3T or 0.125 inch, whichever is less
Isolated indications, rounded	0.4T or 0.250 inch, whichever is less
Aligned indications	Sum of indications less than T in 12T length or 6 inches, whichever is less
Minimum separation distance between aligned indications	6 times diameter of largest adjacent indication

11. Post Treatment

- 11.1 It is allowed making removal of unacceptable discontinuities and additional welding only if weldments and the adjacent parent metal meet the requirements of the original weldment.
- 11.2 It is allowed making of weld repairs associated with surface defects in a single location a maximum of two times.
- 11.3 When an additional welding has been performed, additional heat treatment as necessary to return the part to the heat treatment specified on the engineering drawing is required.

IV. QUALITY ASSURANCE PROVISIONS

12. Responsibility for Inspection. The supplier shall provide all samples for supplier's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to S.A.C. as required by Section VI. S.A.C. reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure processing conforms to the requirements of this specification.
13. Rejection. Welds not in compliance with this specification shall be rejected.

V. SAMPLING.

13. Each weld shall be inspected as required by this specification for compliance.

VI. REPORTS.

14. The supplier shall create a report for each lot. This report shall be made available to S.A.C. upon request.