MIL-STD-1892(AT)
18 June 1985

MILITARY STANDARD

WELDING, ARC AND OXYFUEL GAS, PROCESS AND REQUIREMENTS FOR

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DEPARTMENT OF DEFENSE
Washington, DC 20301

Welding, Arc and Oxyfuel Gas, Process and Requirements for.

MIL-STD-1892(AT)

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FOREWORD

This Military standard establishes the requirements for arc and oxyfuel gas welding processes used to effect fusion in welded joints of gas turbine tank engine components.

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1. SCOPE

1.1 Scope. This standard covers the arc and oxyfuel gas processes and requirements for the welding of gas turbine tank engine components whereby fusion occurs in the welded joints.

1.2 Welding processes. Types of welding processes referred to herein:

Basic type	Welding process	Designation
Arc Welding	Gas (inert) tungsten arc: manual	GTAW-MA
	Gas (inert) tungsten arc: automatic	GTAW-AU
	Gas (inert) metal arc (consumable electrode)	GMAW
	Gas (inert) metal arc (consumable elctrode): automatic	GMAW-AU
	Shielded metal arc: manual	SMAW-MA
	Submerged arc	SAW
	Plasma arc	PAW
	Atomic hydrogen	AHW
Oxyfuel gas welding	Oxyacetylene welding	OAW

1.3 Classification. The five types of weld joints, namely, butt, corner, tee, lap and edge, and modifications thereof, shall be classified as follows:

Class 1 - Joints subject to high stress or fatigue loading.
Class 2 - Joints subject to intermediate stresses or fatigue loading.
Class 3 - Joints subject to intermediate stresses.
Class 4 - Joints subject to low stresses.

2. REFERENCED DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this standard to the extent specified herein.

SPECIFICATIONS
MILITARY

MIL-H-6088	- Heat Treatment of Aluminum Alloys.
MIL-M-6857	- Magnesium Alloy Castings, Heat Treatment of.
MIL-H-6875	- Heat Treatment of Steels, Aerospace Practice Process for.
MIL-F-6939	- Flux, Aluminum and Aluminum Alloys, Gas Welding.
MIL-F-6943	- Flux, Magnesium Alloy Welding.
MIL-F-18251	- Fluxes, Welding, Submerged Arc Process Carbon and Low Alloy Steel Application.

STANDARDS
MILITARY

MIL-STD-1595	- Qualification of Aircraft, Missile and Aerospace Fusion Welders.

PURCHASE DESCRIPTIONS

MIPD-T-62419	- Tests, Welding Operators Qualification.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific acquisition functions should be obtained from the acquisition authority or as directed by the contracting officer.)

(MIPD Specifications and Standards may be obtained from the US Army Tank-Automotive Command, ATTN: AMSTA-GSS, Warren, MI 48397-5000.)

2.2 Other publications. The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this standard to the extent specified herein.

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	- Standard Welding Symbols.
AWS A3.0	- Terms and Definitions.

(Copies of the above publications may be obtained from the American Welding Society, 550 N.W. LeJuene Road, P.O. Box 351040, Miami, Florida 33135.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. DEFINITIONS

3.1 Definitions. Definitions of terms relative to the equipment, processes, and procedures described in this standard can be found in the AWS A3.0 reference document.

4. GENERAL REQUIREMENTS

4.1 Certification.

4.1.1 Welding personnel. Welding shall be performed by trained personnel who have met the requirements of MIL-STD-1595 and have been qualified for the particular alloys and welding process specified on the engineering drawing.

4.1.1.1 Contractors certifications. Contractors having proficiency examinations for welding personnel (see MIPD-T-62419) which have been accepted by the acquisitioning Government activity shall not be required to use MIL-STD-1595.

4.2 Equipment.

4.2.1 Welding equipment. Welding equipment (such as welding machines, torches, regulators, heads, and filler metal feed mechanisms etc.) shall be capable of producing consistently satisfactory welds when operated by certified personnel.

4.2.2 Welding fixtures. Fixtures when required, shall be of suitable design to adequately support the assembly and preclude minimize during welding.

4.2.3 Furnaces.

4.2.3.1 Preheat facilities. Equipment shall be suitable for heating and capable of stabilizing the part at the proper preheat temperature for the base chemical composition of the material to be welded (see MIL-H-6088, MIL-M-6857, and MIL-H-6875).

4.2.3.2 Post heat and heat treat facilities. Equipment shall be suitable for heating and capable of stabilizing the part for any subsequent thermal treatment required to meet the specified requirements (see MIL-H-6088, MIL-M-6857, and MIL-H-6875).

4.2.4 Weld backing. Backing plates or bars used where full penetration welds are required and welding is performed from one side of the joint, shall be made of copper or other suitable material and may be water cooled. The mass of the product shall be sufficient to avoid melting during the first pass weld.

4.2.5 Wire brush. Brushes, either manual or power, used to clean surfaces shall have austenitic stainless steel wire bristles.

4.3 Material.

4.3.1 Shielding gases. Inert shielding gases shall be selected on the basis of the metal being welded, process being specified, influence of material thickness, and differences between manual or automated welding procedures.

4.3.2 Welding gases. Gases for welding shall be suitable for the material and process specified.

4.3.3 Fluxes. Fluxes are materials used in certain welding processes, i.e. oxyfuel gas and submerged arc welding, to produce a slag which will protect the molten metal from contaminants by providing a mechanical barrier in the weld zone. Selection of the proper flux shall be dictated by the material and process specified on the drawing. Typical welding fluxes covered by Government documents are MIL-F-6939, MIL-F-6943, and MIL-F-18251.

4.3.4 Filler metal. Welding rods, welding wire, and electrodes used in the processes specified herein shall be capable of producing satisfactory welds when used by certified personnel with proper welding equipment. The composition of the filler metal shall be compatible for the material and process specified.

5. DETAIL REQUIREMENTS

5.1 Surface preparation.

5.1.1 Parts to be welded.

5.1.1.1 Surface cleanliness. All surfaces shall be vapor degreased or solvent cleaned to remove any foreign materials (oil, grease, dirt, ink, chalk, etc.) that may be on or near the area to be welded.

5.1.1.2 Joint dressing. The edges of the weld joint surfaces shall be suitably dressed to remove all burrs, laps, tears, and any other surface irregularities. Lubricants shall not be used when dressing edges.

5.1.1.3 Joint cleaning. Immediately before welding, the weld joint surfaces shall be brushed with a clean wire brush (ref 4.2.5) to remove scale and oxides.

5.1.2 Filler metal to be used. Surface of the welding rod or welding wire shall be free of any foreign material (rust, oxides, oil, grease, moisture, etc.) that may cause weld joint defects. SMAW electrodes shall be properly dried and maintained to ensure moisture content less than 0.3% for low hydrogen electrodes.

5.1.3 Fixtures to be used. All fixtures shall be vapor degreased or by other acceptable methods to remove any foreign materials (oil, grease, rust, etc.) prior to welding.

5.2 Welding. Weld joint classification and the welding process to be employed shall be as specified in the tail of the weld symbol on the applicable engineering drawing. Weld symbols shall be in accordance with AWS A2.4. The welding process shall include but not be limited to the following requirements.

5.2.1 Joint alignment. Joint fit-up involves the positioning of the members of the joint to provide the specified dimensions and alignment. Requirements to accomplish this shall be:

a. Gap. Maximum gap shall not exceed 25 percent of the thinner member being joined.

b. Height. Maximum mismatch of the part shall not exceed 10 percent of the thickness of the thinner member.

5.2.2 Weld backing. Whenever joint design or tolerances require backing, backing plates or bars (see 4.2.4) shall be used.

5.2.3 Tack weld joints. Tack welding, depending upon the materials being joined and the thickness (mass) of each, may be performed before or after preheating. Regardless of the sequence prior to welding, all tack welds shall be examined visually for cracks. Tacks for Class 1 weldments shall be examined visually at 5x magnification.

5.2.4 Preheating. Preheating if required to make a sound weld, shall be done in proper equipment (see 4.2.3.1). The temperature used depends upon many factors, i.e. composition and mass of base materials, ambient temperature, welding process, procedure to be used, and degree of restraint in the joint. Temperature checks prior to welding if possible, shall be made on the side opposite that to which heat will be applied.

5.2.4.1 Stress relief. When stress relieving of a preheated and welded part is required immediately after welding, the weldment shall be returned to the preheat facilities until the postheat facilities are available (see 4.3.3.2).

5.2.5 Peening. Peening of weld joint shall not be permitted at any time.

5.2.6 Multiple passes. When a joint requires more than one weld (root) pass, the surface of the weld shall be cleaned prior to deposition of the subsequent (hot) pass. Methods of cleaning to remove any oxides, slag, splatter, etc. by grinding or wire brushing, will depend upon the material and process specified.

5.2.7 Final cleaning. Immediately after the post heating operation has been completed and prior to the weld joint inspection, the weld joints and surrounding area shall be cleaned to remove any oxides, slag, splatter, etc.

5.2.8 Process data. When required, welding procedures shall be established by the contractor(s) and made available to the certified welding personnel upon reasonable notification to the acquisition activity. The minimum data included shall be based on the engineering drawing specifications i.e., base composition of the materials being welded, process to be used, specific filler metal, and preheat temperature.

5.2.8.1 Monitoring.

5.2.8.1.1 Welding equipment. Welding equipment, especially the automated facilities, shall be checked periodically to determine the capability of producing satisfactory welds.

5.2.8.1.2 Furnaces. Preheat, post heat, and heat treat facilities including temperature control and recording instrumentation shall conform to the requirements of MIL-H-6088, MIL-M-6857, and MIL-H-6875.

5.2.8.1.3 Part temperature. Parts removed from the preheat facilities shall be checked at that point and during the welding cycle by contact pyrometer or temperature indicating sticks to determine heat loss within specified tolerance.

5.2.9 Test methods.

5.2.9.1 Inspection.

5.2.9.1.1 Procedure. Inspection of welded joints shall be done at a point where the entire joint is accessible for examination. It shall be performed most appropriately after the final cleaning operation (see 5.2.7).

5.2.9.1.2 Methods. Methods of weld joint inspection and the acceptance criteria by classification shall be in accordance with the cited engineering drawing inspection specifications. All weldments shall be visually inspected for cracks in the joint. There shall be no cracks allowed in any welded joint.

5.2.10 Records.

5.2.10.1 Certification. Records showing current welding certification for each person qualified in accordance with certification (see 4.1), shall be available for review at any time by the acquisition authority.

5.2.10.2 Multiple sources. Contractor(s) having more than one facility shall require certification for each entity in accordance with 4.1.

6. NOTES

6.1 Distortion. Assemblies and subassemblies that might distort beyond the engineering tolerance shall be formally submitted to the accepting agency for review and disposition.

6.2 Supersession data. This standard supersedes AVCO Lycoming Division, Stratford, Connecticut, P6200H, dated 26 April 1982.

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(Project No. THJM-A204)

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