NOTICE OF CHANGE

INCH-POUND

MIL-STD-1881(AT)
Notice 1
13 May 1991

MILITARY STANDARD

BRAZING SILVER, GENERAL PROCESS FOR

TO ALL HOLDERS OF MIL-STD-1881(AT):

1. THE FOLLOWING PAGES OF MIL-STD-1881(AT), HAVE BEEN REVISED AND SUPERSEDE THE PAGES LISTED.

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
1	13 May 1983	1	Reprinted without change
2	13 May 1991	2	13 May 1983
2a	13 May 1991		NEW PAGE
5	13 May 1991	5	13 May 1983
5a	13 May 1991		NEW PAGE
6	13 May 1991	6	13 May 1983
6a	13 May 1991		NEW PAGE
7	13 May 1991	7	13 May 1983
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2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

3. Holders of MIL-STD-1881(AT) will verify that page changes and additions indicated above have been entered. This notice page will be retained as a check sheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained be stocking points until the military standard is completely revised or canceled.

AMSC N/A FSC THJM

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

4. Changes from previous issue. The margins of this standard are marked with vertical lines to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

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Preparing activity:
Army - AT

(Project THJM-A300)

1. SCOPE

1.1 Purpose. The procedures covered by this standard are intended to insure silver brazing operations meet prescribed requirements.

1.2 Scope. This standard covers three brazing processes using silver brazing alloy.

1.2.1 Classification. Braze joints shall be butt and lap joints classified as follows:

Class 1 - Joints subjected to high stresses or fatigue loading.
Class 2 - Joints subjected to intermediate stresses.
Class 3 - Joints subjected to low stresses.

1.2.2 Type. The types of brazing process designated on the engineering drawing shall be in accordance with the following:

Type	Description
Torch Brazing	TB
Induction Brazing	IB
Furnace Brazing	FB

2. APPLICABLE DOCUMENTS

2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks from a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS
MILITARY

MIL-H-6875	- Heat Treatment of Steels.
MIL-T-81533	- 1-1-1, Trichloroethane (Methyl Chloroform Inhibited, Vapor Degreasing).

STANDARDS
MILITARY

MIL-STD-248	- Welding and Brazing Procedure and Performance.
MIL-STD-865	- Coating, Metallic, Electrodeposited, Process for.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Printing Services Office, Standardization Documents Order Desk, Bldg 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

M1PD-STD-40002	- General Heat Treatment.
M1PD-STD-40003	- Metal Texturing, Process for (Liquid Honing).
M1PD-N-62425	- Nickel Plating, Process for.

(Copies of M1PD specifications and standards may be obtained from the U.S. Army Tank-Automotive Command, ATTN: AMSTA-GDS, Warren, MI 48397-5000).

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)
SAE Standards and Recommended Practices

AMS 5510	- Steel Sheet, Strip, and Plate, Corrosion and Heat Resistant (UNS S32100).
AMS 5525	- Plate, Sheet and Strip, Corrosion and Heat Resistant (UNS K66286).
AMS 5597	- Plate, Sheet and Strip, Corrosion and Heat Resistant (UNS N07718).

(Application for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Avenue, Warrendale, PA 15096).

AMERICAN WELDING SOCIETY

AWS A2.4	- Welding Symbols.
AWS A3.0	- Welding Terms and Definitions (including Brazing).

(Applications for copies should be addressed to the American Welding Society, 2501 Northwest 7th Street, Miami, FL 33125.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

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4. GENERAL REQUIREMENTS

4.1 Equipment.

4.1.1 Brazing furnace. The brazing furnace shall be suitable for the intended purpose and capable of meeting the following conditions:

a. The furnace atmosphere shall be controllable to prevent decarburization or oxidation of carbon or low alloy steels and to prevent casing, carburizing, or nitriding of corrosion and heat resisting steels.
b. Uniform heating and cooling of the work load.
c. Uniform temperature in all areas of the work zone in accordance with MIL-H-6875.

4.1.2 Temperature measuring instrumentation and controls. All brazing-heat treat furnaces shall be equipped with temperature controllers and recording instruments.

4.1.3 Fixtures. Brazing fixtures shall be made of non-gassing heat resistant materials, be capable of maintaining proper braze clearance, have dimensional stability, and shall have compatible coefficients of expansion with parts being joined.

4.1.4 Brazing equipment. Brazing equipment other than furnaces (induction coils, transformers, control panels, torches, regulators, etc), shall be suitable for the intended purpose and be capable of consistently reproducing quality brazements.

4.1.5 Braze alloy paste applicators. Braze alloy applicators shall be capable of dispensing the required size and amount of braze alloy paste. The materials of the applicators shall be not detrimental to the alloy paste used and may be of tube, bulb, cartridge, or air gun type.

4.1.6 Abrasive blast equipment. An air pressure source providing 40 pound-force per square inch (psi) minimum of clean, dry filtered air shall be required for both wet and dry abrasive blast operations.

4.2 Material.

4.2.1 Braze alloy. The braze alloy powder, paste, wire, or preform shall conform to the requirements of the specification specified on the engineering drawing.

4.2.2 Fluxes. The fluxes shall be capable of dissolving any oxides and prevent the additional formation of oxides on the filler metal and base material during the heating. Fluxes may be in the form of powder, paste, vapor gas, or coating on the filler metal.

4.2.3 Vapor degreaser solvent. Stabilized 1-1-1 trichloroethane MIL-T-81533 or equivalent type solvent.

4.2.4 Abrasive wheels. Silicon carbide impregnated cloth wheels.

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4.2.5 Wire brush. The wire brush shall have austenitic stainless steel bristlen.

4.2.6 Cleaning solvent. Acetone, methyl ethyl ketone (MEK) or isopropyl or methyl alcohol of commercial grade.

4.2.7 Abrasive for abrasive blast.

4.2.7.1 Dry. Silicon carbide, 325 mesh or equivalent.

4.2.7.2 Wet abrasive slurry. The wet abrasive slurry shall be in accordance with M1PD-STD-40003.

Note: Aluminum oxide grit shall be not considered an equivalent material.

4.2.8 Heat shields. Heat shields shall be made from AMS 5510 metal or fiber-frax cloth.

4.3 Required procedures and operations.

4.3.1 Cleaning. Part surfaces shall be thoroughly cleaned using appropriate solvents (ref. 4.2.6).

4.3.2 Preparation of parts. All surfaces to be brazed shall be prepared by one or more of the following methods.

4.3.2.1 Polishing. Mating surfaces shall be prepared for brazing by polishing with a silicon carbide impregnated cloth wheel or wire brush (ref. 4.2.4 and 4.2.5).

Note: Polishing is not applicable to plated or otherwise specially prepared surfaces.

4.3.2.2 Vapor degrease. When required to maintain cleanliness, parts and fixtures to be placed in brazing furnace shall be vapor degreased (ref. 4.2.3).

4.3.2.3 Abrasive blast (mechanical cleaning). All surfaces to be brazed shall be either dry or wet abrasive blasted as follows:

a. Dry abrasive blast. Dry abrasive blasting shall be accomplished using the specified material and air pressure (ref. 4.1.6 and 4.2.7.1).

Note: After dry abrasive blasting, parts shall be handled in a manner which will prevent contamination of the part surface.

b. Wet abrasive blast. Wet abrasive blasting shall be performed in accordance with M1PD-STD-40003 (ref. 4.2.7.2) with the exception of the final operation of slushing in protective oil.

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4.3.2.4 Final wipe. Wet abrasive blasted parts shall have the areas to be braze wiped with a clean, lint free wiper and wet with a suitable solvent (ref. 4.2.6).

4.3.2.5 Stress relief. Details which have been formed, pierced, or punched in the area to be brazed and are made of the following materials, shall be stress relieved in accordance with M1PD-STD-40002 as specified herein:

a. AMS 5510 (321) - M1PD-STD-40002(L1)
b. AMS 5525 (A286) - M1PD-STD-40002(L5)
c. AMS 5597 (718) - M1PD-STD-40002(L7S)

Note: Stress relief must be performed before nickel plate is applied (see 4.3.2.6).

4.3.2.6 Nickel plate. Nickel plate shall be required on the braze joint area of stainless or corrosion resistant steels and superalloy parts having the equal or larger percentage by weight of the following alloying elements:

a. Titanium - 0.70 percent.
b. Aluminum - 0.40 percent.
c. Titanium plus aluminum - 0.70 percent.

4.3.2.6.1 Application. Nickel plate 0.4 to 0.8 mil (0.010 to 0.020 mm) thick shall be applied in accordance with the requirements of M1PD-STD-865 or M1PD-N-62425 and the following:

a. The nickel plate shall extend approximately 0.1 inch minimum beyond the braze joint areas indicated by the braze symbol on the engineering drawing unless part geometry does not permit this allowance.
b. The nickel plate shall be applied to each joint surface or surfaces immediately before the braze cycle, and to the required braze joint surface or surfaces for each subsequent braze cycles.

Note: The nickel plating does not apply to rebraze cycles.

4.3.2.7 Cleaning. The nickel plated braze joint surface shall be thoroughly wiped with a suitable solvent (ref 4.2.6).

4.3.2.8 Assembly. The detail parts shall be assembled in the position specified on the assembly drawing.

4.3.2.8.1 Braze joint clearance. The optimum joint clearance between mating surfaces shall be 0.001 to 0.005 inch with the following exceptions:

a. When one of the mating surfaces is knurled (0.003 to 0.005 inch deep), a minimum gap clearance is not required.
b. Isolated areas of the braze gap may have clearances up to 0.010 inch.

4.3.3 Brazing. The required class and type of braze process (ref. 1.2.1 and 1.2.2) shall be as specified in the tail of the brazing symbol on the engineering drawing. Braze symbols shall be interpreted in accordance with AWS A2.4.

4.3.3.1 Flux. The surface to be brazed shall be completely covered with flux when required.

4.3.3.2 Torch braze. Parts shall be preheated by torch to bring the joint area to the flow temperature of the braze alloy. The braze alloy shall be introduced at one edge of the joint or in a groove provided for the purpose and shall flow by capillary action to fill the braze joint area.

4.3.3.3 Induction braze. The fluxed details and braze alloy shall be assembled in the induction brazing unit and the joint area shall be induction heated to the braze alloy flow temperature. The braze joint may be supplementary face fed provided the braze alloy in the joint has reached its flow temperature and melted.

4.3.3.4 Furnace braze. The fixtured assemblies and braze alloy shall be induction heated to the temperature required to produce good flow of the braze alloy. Suitable protective atmospheres shall be used to prevent scaling or degradation of the braze alloy or base material.

4.3.3.5 Multiple cycles. Application of braze alloy and the braze cycle shall be repeated as required for assemblies requiring more than one braze cycle to complete the assembly operation.

4.3.4 Post braze cleaning. Post braze cleaning shall be performed to remove all residual flux from assembly. If rinsing in hot water 180°F (82°C) minimum does not remove flux, a cleaning procedure approved by the acquisition activity may be used.

4.3.5 Post braze treatments. All post braze heat treatments shall require approval by the acquisition activity prior to use.

5. DETAIL REQUIREMENTS

5.1 Approvals. The equipment (see 4.1) and basic heat treat and brazing procedures shall be approved by the acquisition activity and shall be subject to periodic review (see MIL-STD-248).

Note: If a supplier has more than one facility, each facility and brazing personnel shall require separate approval for any given part configuration.

5.1.1 Work instruction submittal. When specified on the purchase order, specific process procedures and the revision or change of such work instructions shall be submitted to the acquisition activity for review prior to use. The acquisition activity reserves the right to disapprove any work instruction and change or revision submitted for review.

5.1.2 Reports. Unless otherwise specified, the supplier shall furnish three copies of a certificate with each shipment. The certificate shall state the following:

a. Purchase order number.
b. Part number and revision letter.
c. Quantity.
d. Brazing heat (lot) number.
e. Conformance to this standard, latest revision.

5.2 Monitoring equipment.

5.2.1 Accuracy of furnace control instruments. The accuracy of temperature measuring and controlling instruments shall be checked in accordance with the requirements of MIL-H-6875.

5.3 Certification.

5.3.1 Operators. Torch braze operators shall be qualified by a procedure acceptable to the acquisition activity (see MIL-STD-248). If the brazing operator does not show a continuous record of satisfactory brazing, certification shall be necessary every six months.

5.3.2 Process technique. When specified on the purchase order, initial substantiation tests shall be conducted using this process procedure (equipment, heat treatment, brazing process, etc) to determine conformance to the engineering drawing requirements for each part configuration.

5.4 Test methods.

5.4.1 Inspection. The method of braze inspection and acceptance levels shall be in accordance with the applicable inspection specifications cited on the engineering drawing.

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