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**SUPERSEDING**
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# MILITARY STANDARD

# DIP BRAZING OF ALUMINUM ALLOYS


AREA THJM

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## APPENDIX

# DIP BRAZING OF ALUMINUM ALLOYS

## 1. SCOPE

1.1 This standard covers the manufacturing requirements for the joining of aluminum alloys by dip brazing, employing an aluminum base filler metal and a flux bath.

## 2. REFERENCED DOCUMENTS

2.1 The following specifications, of the issue in effect on date of invitation for bids, shall form a part of this standard to the extent specified herein.

### SPECIFICATIONS

FEDERAL

QQ-A-601 — Aluminum Alloy Sand Castings

QQ-B-655 — Brazing Alloys

MILITARY

MIL-H-6088 — Heat Treatment of Aluminum Alloys

(Copies of specifications, standards, and drawings required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

## 3. DEFINITIONS (Not applicable).

## 4. GENERAL REQUIREMENTS (Not applicable).

## 5. DETAIL REQUIREMENTS

5.1 Material.

5.1.1 *Filler metal.* Unless otherwise specified, filler metal shall conform to QQ-B-655, alloy FS-BA1Si-2, FS-BA1Si-3, FS-BA1Si-4 or FS-BA1Si-5.

5.2 Preparation of parts.

5.2.1 *Cleaning.* The mating surfaces and adjacent areas of all parts to be joined and the filler metal shall be thoroughly cleaned to remove all oil, grease, paint, dirt, scale, or foreign substances that might interfere with the bonding action of the filler metal. Cleaning shall always precede chemical dipping.

5.2.1.1 *Chemical dipping.* Parts shall be dipped and rinsed as follows:

(a) Immerse parts in 5 percent sodium hydroxide solution at 140° to 160° F for 10 to 60 seconds.

(b) Rinse in cold water.

(c) Immerse parts in 50 percent solution of nitric acid at room temperature for 30 to 60 seconds.

(d) Rinse in cold water.

(e) Rinse in hot water.

(f) Force dry.

Spinning or forced air methods following the hot water rinse is desirable to obtain the required results. Storage of cleaned and dipped parts for longer than 4 hours may result in the accumulation of an oil film and the build-up of oxides which will interfere with satisfactory brazing.

5.2.2 *Fit.* The clearance between mating surfaces of parts being brazed shall be 0.002 inch to 0.010 inch for laps less than 1/4 inch long. Longer laps may require clearances up to 0.025 inch. These clearances should be maintained at brazing temperature. Therefore, the expansion rates of the parts should be considered.

5.2.3 *Assembly.* Parts to be brazed may be assembled in fixtures and the filler metal preplaced. The volume of brazing alloy should be sufficient to form required fillets. Consideration should be given to methods of assembly such as light press fits, staking, swaging, crimping, tack welding, etc., which will eliminate the use of fixtures. A stop-off paste may be used to restrict the flow of filler metal.

**5.3 Procedure and methods.**

5.3.1 *Preheating.* The assembly shall be placed in a clean furnace and preheated to temperatures between 900° and 1050° F., depending upon the filler metal used. Furnaces shall be of suitable design and construction for the purpose, and shall provide uniform temperatures within the working zone. Automatic temperature-controlling and recording devices, preferably of the potentiometer type, shall be provided to satisfactorily control furnace temperatures. Temperature variations within the working zones shall not be greater than ± 10° F. from the control point.

5.3.2 *Brazing.* The assembly shall be removed from the preheat furnace and immediately dipped into the flux bath capable of producing filler metal flow at a uniform rate so as not to disturb the position of the preplaced filler metal. Brazing times are dependent upon the shape and cross-section of the assembly; the usual times vary between 30 seconds and 3 minutes. Brazing is complete when the filler metal has flowed evenly into the joints, and at this point the assembly shall be removed slowly from the bath at a rate that will not cause loss of the molten filler metal. The composition and quantity of brazing flux should be adjusted periodically.

**5.4 Post-brazing treatment.**

5.4.1 *Hot water rinse.* The assembly shall be cooled in air to approximately 600° to 700° F. (Parts subject to distortion may be cooled to a lower temperature.) The assembly shall then be immersed immediately in hot water at 180° to 212° F. for approximately 2 minutes to remove the heavy flux scale. The part then shall be immediately removed from the fixture and placed in a second bath of water held at 180° to 212° F. The part shall be left in this bath until no flux residue is visually apparent. Since the flux is corrosive, provision shall be made to continuously circulate fresh water in the rinse tanks.

5.4.2 *Final cleaning.* Parts shall be given a final cleaning immediately after the hot water rinse. The time interval between hot water rinsing and final cleaning shall be kept to a minimum especially during humid weather conditions:

(1) Soak for approximately 5 minutes in a 15 percent nitric acid solution, maintained at room temperature, or other suitable solution, to remove all traces of flux particles.

(2) Cold water rinse.

(3) Forced air or spin dry.

# APPENDIX A

## ALUMINUM ALLOYS

This process is intended for the brazing of wrought aluminum alloys 1100, 3003, 5052, 6053, 6061, 6063, 6066, and 6951, and cast aluminum alloy of the composition corresponding to QQ-A-601, alloy 613 (Tenzaloy).

# APPENDIX B

## HEAT TREATING ALUMINUM ALLOYS AFTER BRAZING

After brazing, all wrought aluminum alloys are in the annealed condition ("O" temper). When it is desired to heat treat heat-treatable alloys to the "T6 temper, brazed parts should be heat treated and aged. When required, such heat treatment and aging should be in accordance with MIL-H-6088.

Notice: Copies of this standard for military use may be obtained as indicated in the foreward to, or the general provisions of, the Index of Military Specifications and Standards.

Notice: The title and identifying symbol should be stipulated when requesting copies of military standards.

**Custodian:**

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