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400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 2672F

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Superseding AMS 2672E

Brazing, Aluminum Torch or Furnace

1. SCOPE:

1.1 Purpose:

This specification covers the engineering requirements for producing brazed joints on aluminum and aluminum alloys by torch or furnace brazing.

1.2 Application:

This process has been used typically for joining aluminum and selected aluminum alloys.

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 canceled and no superseding document has been specified, the last published issue of that document shall apply.

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7161 FAX: (724) 776-0243
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SAE WEB ADDRESS: http://www.sae.org

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 3412	Flux, Aluminum Brazing for Torch or Furnace Brazing
AMS 4063	Aluminum Alloy, Clad One Side Sheet, 1.25Mn - 0.12Cu, (No.11-0 Brazing Sheet), Annealed
AMS 4064	Aluminum Alloy Sheet, Clad Two Sides, 1.25Mn - 0.12Cu, (No.12-0 Brazing Sheet)
AMS 4184	Filler Metal, Aluminum Brazing, 10Si - 4.0Cu (4145)
AMS 4185	Filler Metal, Aluminum Brazing, 12Si - (4047)
AMS 4255	Aluminum Alloy, Clad One Side, Sheet, 0.6Mg - 0.35Si - 0.28Cu (No. 21 Brazing Sheet) As Fabricated
AMS 4256	Aluminum Alloy Sheet, Clad Two Sides, 0.6Mg - 0.35Si - 0.28Cu (No. 22 Brazing Sheet) As Fabricated

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 1179	Fluoride Ion In Water
ASTM D 1193	Reagent Water

2.3 AWS Publications:

Available from American Welding Society, P.O. Box 351040, Miami, FL 33135-1040.

AWS B2.2 Brazing Procedures and Performance Qualification

3. TECHNICAL REQUIREMENTS:

3.1 Materials:

3.1.1 Filler Metal: Shall be aluminum brazing alloy conforming to AMS 4184 or AMS 4185.

3.1.2 Flux: Flux for torch brazing or circulating-air type furnace brazing shall conform to AMS 3412.

3.2 Equipment and Personnel:

3.2.1 Torch Method: Torches, tips, regulators, and accessory equipment shall be appropriate for the thickness of the material being brazed.

3.2.2 Furnace Method: Furnaces shall be circulating-air type, maintained within ±10 F (±6 C) degrees of a selected temperature within the range 900 to 1200 °F (482 to 649 °C) by suitable controls.

3.2.3 Personnel: Those engaged in torch brazing shall be tested periodically for proficiency in accordance with AWS B2.2 or other procedure acceptable to purchaser.

3.3 Preparation:

3.3.1 Surface Condition: The surfaces to be joined shall be clean prior to assembly. Cleaning should be by degreasing using a suitable solvent, alkaline cleaning, and deoxidizing followed by a cold and hot water rinse.

3.3.2 Fluxing: Flux shall be applied so that surfaces to be joined are sufficiently coated to ensure the specified bond between the parts after brazing; if preplaced filler metal inserts are used, they shall also be coated with flux.

3.3.3 Assembly: The parts to be joined shall be assembled so that clearances between mating surfaces are within specified tolerances. The assembly shall be supported so that the parts will be in proper alignment throughout brazing. Except when parts are fabricated from clad brazing sheet, such as AMS 4063, AMS 4064, AMS 4255, or AMS 4256, the filler metal as in 3.1.1 shall be prepositioned or fed in at one end of the joint. For a blind joint, the filler metal shall be placed at the blind end when access permits. When specified, filler metal may be placed within the joint prior to assembly for brazing. When parts are made from clad sheet, the clad surface shall be in contact with the intended mating surface.

3.3.3.1 Tack welding for fixturing shall be used only when specified or permitted by purchaser.

3.3.3.2 On closed assemblies, vent holes shall be provided as specified.

3.3.3.3 When desirable, flow of filler metal may be restricted by employing a paste compound of sodium fluoride and water.

3.4 Procedure:

3.4.1 Joining: Joining shall be effected by torch or furnace heating. Parts shall be heated rapidly until the filler metal melts and joints are formed. The temperature to which parts are heated for brazing shall be controlled so that incipient melting of the parts does not occur.

3.4.1.1 Torch Method: Parts shall be heated locally in the joint area using a reducing flame, taking care not to overheat the parent metal. Sufficient filler metal shall be introduced to the joint. Parts shall be held at heat until clean filler metal is visible at the end of the joint opposite that at which the filler metal was introduced, when joint configuration permits visual examination during brazing.

3.4.1.2 Furnace Method: Preheating to approximately 400 °F (204 °C) is recommended to remove any water from the flux or parts. The brazing time and temperature shall be such that clean filler metal is visible at the end of the joint opposite that at which the filler metal was introduced, when joint configuration permits such visual examination. The time and temperature necessary to obtain acceptable joints should be established through the use of a pilot assembly.

3.4.2 Cooling: After brazing, assemblies shall be cooled in a manner which prevents cracks and minimizes internal stress, distortion, and oxidation. If solution heat treatment is to be done in conjunction with brazing, cooling procedures may be revised accordingly.

3.5 Flux Removal:

After brazing and cooling, flux shall be removed by a method which is not injurious to the surface finish and which will not remove basis material below drawing tolerances. The test in 3.6.5 shall be used to determine the adequacy of flux removal.

3.6 Properties:

Brazed parts shall conform to the following requirements:

3.6.1 Appearance: Examination of visible joint edges shall show a complete line or ring of filler metal between component parts.

3.6.1.1 The total accumulated length of any pinholes, voids, or filler metal skips extending into the joint shall not exceed 10% of the total length of the fillet. Individual pinholes, voids, or filler metal skips shall not exceed 3/32 inch (2.4 mm).

3.6.1.2 Cracks in filler metal or adjacent parent metal are not acceptable.

3.6.1.3 Overheating, resulting in blisters on the base metal or eutectic melting is not acceptable.

3.6.1.4 Residual flux is not permissible on surfaces of the part.

3.6.2 Coverage: Unless otherwise specified, the area joined by the filler metal shall be not less than 80% of the area of the mating portions of the assembly, determined by a method agreed upon by purchaser and processor.

3.6.3 Proof Pressure Test: When specified, any part from a lot shall pass a proof test. Standards for acceptance and method of test shall be as specified by purchaser.

3.6.4 Melting or Erosion: Shall not cause thinning of the parent metal surface adjacent to the brazed joint in excess of 5% of parent metal thickness and 15% cumulative of the braze length.

3.6.5 Halide Test: Testing shall be conducted to ensure that residual flux has been removed. If the test indicates presence of flux residue, the parts shall be subjected to additional cleaning and testing until removal is complete. In case of dispute, the procedures of 3.6.5.1 and/or 3.6.5.2 shall be used.

3.6.5.1 Chlorides: Rinse the test area with 40 to 50 mL of hot [approximately 180 °F (82 °C)] ASTM D 1193, Type IV, water. Collect rinse water in a 100 mL beaker and add 3 to 5 drops of concentrated nitric acid (specific gravity 1.42) and 2 to 3 mL of 10% silver nitrate solution. Stir the contents of the beaker and allow to stand 5 to 10 minutes. A solution as clear as a blank of ASTM D 1193, Type IV, water treated in the same manner as the rinsings indicates the absence of chlorides. A white-to-gray precipitate or turbidity indicates the presence of residual flux.

3.6.5.2 Fluorides: Rinse the test area with approximately 200 mL of hot [approximately 180 °F (82 °C)] ASTM D 1193, Type IV, water. Collect the rinse water in a 200 mL beaker. Using two 100 mL Nessler, or equivalent, color comparison tubes, pour 100 mL of rinsings into one tube and 100 mL of ASTM D 1193, Type IV, water, into the other as a blank. Treat the water in the two tubes in accordance with ASTM D 1179, Method B, or use an equivalent colorimetric method. Allow the color to develop. A color in the rinse water deeper than that of the blank indicates the presence of residual flux.

3.7 Quality:

Brazed joints shall be sound, clean, and free from foreign materials and from imperfections detrimental to performance of the brazed joints. Filler metal in excess of that required for the joint is acceptable provided it does not interfere with form, fit, or function of the completed assembly.

3.7.1 The presence of unmelted filler metal in a joint is not acceptable.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The processor of brazed parts shall supply all samples for processor's tests and shall be responsible for the performance of all required tests. Parts, if required for tests, shall be supplied by purchaser. Unless otherwise specified, the processor may use his own or any other inspection facilities and services acceptable to purchaser. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the processing conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Flux removal (3.5), appearance (3.6.1) coverage (3.6.2) and quality (3.7) are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Proof pressure testing (3.6.3), when specified, and melting or erosion (3.6.4) are periodic tests and shall be performed at a frequency selected by the processor unless otherwise specified.

4.2.3 Preproduction Tests: All technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of brazed parts to a purchaser, when a change in material and/or processing requires reapproval by the cognizant engineering organization (4.4.3), and when purchaser deems confirmatory testing to be required.

4.3 Sampling and Testing:

Shall be as shown in Table 1. A lot shall be all parts of the same part number brazed in a continuous operation and presented for processor's inspection at one time.

TABLE 1 - Sampling for Acceptance Testing

Number of Parts in Lot	Quality and Appearance	Nondestructive Tests	Destructive Tests
1 to 6	all	3	0
7 to 15	all	4	0
16 to 40	all	4	0
41 to 110	all	5	1
111 to 300	all	6	2
301 to 500	all	7	3
501 to 700	all	8	5
701 to 1200	all	10	7
Over 1200	all	15	10

4.4 Approval:

4.4.1 Brazing by torch method shall be performed only by operators who have been qualified, by a procedure acceptable to purchaser, to braze the alloy specified for each part (See 3.2.3).

4.4.2 The process and control procedures, a preproduction sample brazed part, or both, whichever is specified, shall be approved by the cognizant engineering organization before production parts are supplied.

4.4.3 The processor of brazed parts shall make no significant change in brazing conditions or control factors, from those on which approval was based, unless the change is approved by the cognizant engineering organization. A significant change is one which, in the judgment of the cognizant engineering organization, could affect the properties or performance of the brazed parts.

4.4.3.1 Controls factors include, but are not limited to, the following:

Method of cleaning
Method of holding parts during brazing
Type of filler metal
Placement of filler metal
Preheat time/temperature (furnace brazing)
Braze time/temperature (furnace brazing)
Method of flux removal
Periodic test plan.