SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

AMS 2670J

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Reaffirmed 2011-04
Superseding AMS 2670H

Brazing, Copper

RATIONALE

This specification revision was issued as part of the SAE Five Year Review process.

1. SCOPE

1.1 Purpose

This specification covers the requirements for producing brazed joints using copper as the brazing filler metal.

1.2 Application

This process has been used typically for joining carbon steels, low-alloy steels, and corrosion and heat resistant steels and alloys. It is not recommended for use on parts which will operate in service over 1000 °F (538 °C) or requiring high strength joints for service over 700 °F (371 °C), but usage is not limited to such applications.

1.3 Safety - Hazardous Materials

While the materials, methods, applications, and processes described or referenced in 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.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS 2418	Plating, Copper
AMS 2424	Plating, Nickel, Low-Stressed Deposit
AMS 2635	Radiographic Inspection
AMS 3430	Brazing Filler Metal, Paste, Copper, Water Thinning
AMS 4500	Copper Sheet, Strip and Plate, Soft Annealed
AMS 4501	Copper Sheet, Strip and Plate, Oxygen Free, Light Cold Rolled

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

AMS 4701 Copper Wire, Oxygen Free, 99.95 (Cu + Ag), Annealed
AMS 4740 Copper Powder, 99.0 Cu, Minimum, As Fabricated

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B 660 Packaging/Packing of Aluminum and Magnesium Products
ASTM E 1742 Radiographic Examination

3. TECHNICAL REQUIREMENTS

3.1 Materials

3.1.1 Filler metal shall be copper conforming to AMS 4500, AMS 4501, AMS 4701, or AMS 4740, or copper paste conforming to AMS 3430. Alternatively, copper plating conforming to AMS 2418 not extending beyond the intended joint and fillet area may be used.

3.1.2 Flux

Paste or liquid flux shall not be used unless permitted by purchaser.

3.2 Equipment

Furnaces, with suitable protective atmospheres, as defined in 3.3, shall be used for brazing. Alternatively, induction heating using a protective atmosphere in a jacket surrounding the work may be used. Where brazing is concurrent with heat treatment, the pyrometry requirements of the applicable heat treatment specification shall be applicable.

3.3 Atmospheres

Brazing shall be conducted in any of the following atmospheres:

3.3.1 Argon of not less than 99.99% purity and dew point not higher than -35 °F (-37 °C).

3.3.2 Hydrogen of not less than 99.99% purity and dew point not higher than -25 °F (-32 °C). Hydrogen derived from dissociated ammonia is not permitted.

3.3.3 Any mixture of hydrogen and argon, each conforming to 3.3.1 or 3.3.2, may be used.

3.3.4 Partial vacuum not exceeding an absolute pressure of 0.020 Torr (2.7 Pa) argon conforming to 3.3.1 or hydrogen conforming to 3.3.2 may be used to suppress copper evaporation.

3.3.5 Atmosphere other than those listed in 3.3.1 to 3.3.4 may be used when authorized in writing by purchaser, provided such atmospheres will not cause scaling, carburization or decarburization, nitriding, or other undesirable surface effects, and all other technical requirements of this specification are met.

3.4 Preparation

3.4.1 Surface Condition

The surfaces to be joined shall be clean prior to assembly.

3.4.1.1 Plating

For base metals containing a specified minimum or range of aluminum and/or titanium, surfaces to be brazed and adjacent areas not exceeding 1/4 inch (6.4 mm) from the joint may be plated 0.0001 to 0.0006 inch (2.5 to 15 µm) thick, using nickel plating in accordance with AMS 2424. As an alternative copper plating in accordance with AMS 2418 may be used; when used, copper plate thickness shall be not less than 0.0001 inch (2.5 µm) but may be as thick as necessary to provide filler metal.

3.4.2 Fluxing

When use of a flux is permitted by purchaser, flux shall be applied to the joint areas of parts.

3.4.3 Assembly

3.4.3.1 Clearances

Tight or interference fit is preferred. Where not specified, joint gap shall be within the range of 0.002 inch (0.05 mm) clearance to 0.002 inch (0.05 mm) interference. For joints where copper plating is used as the source for filler metal, interference fits are required.

3.4.3.2 Fixturing

Self-fixturing is desirable. Parts shall be supported so that they will be in proper alignment after brazing. No form of welding on tube assemblies is permitted unless authorized in writing by purchaser.

3.4.3.3 Filler Metal Preplacement

Electroplated copper may be on one or both surfaces to be joined. For all other cases, filler metal shall be preplaced at only one end of the joint except as permitted in 3.4.3.3.1. For blind joints, the filler metal shall be placed at the blind end of the joint and electroplated filler metal shall not be used.

3.4.3.3.1 Shims or filler metal may be preplaced within the joint when authorized by purchaser.

3.5 Procedure

3.5.1 Joining

Parts shall be heated in equipment defined in 3.2, using an atmosphere defined in 3.3, to a selected temperature within the range 2000 to 2100 °F (1093 to 1149 °C), held at the selected temperature within ±25 °F (±14 °C) until the copper melts and flows to fill the joint.

3.5.2 Cooling

After brazing, assemblies shall be cooled so as to prevent cracks and minimize internal stress, distortion, scaling, and decarburization. Cooling from the brazing temperature to below the scaling temperature shall be done in one of the atmospheres described in 3.3. If hardening is done in conjunction with brazing, cooling procedures may be revised accordingly.

3.6 Post Treatment

3.6.1 Flux Removal

After brazing and cooling, the residues of flux, if used, shall be completely removed from the parts by a method not injurious to the specified surface finish.

3.6.2 Heat Treatment

For martensitic steels, where heat treatment is required and the normal heat treatment temperature for the base metal is less than 1980 °F (1082 °C), such heat treatment shall be conducted in a separate operation after cooling from the brazing temperature.

3.7 Rebrazing

Parts may be rebrazed a maximum of two times using the original brazing process and time and temperature cycle. Braze filler metal may be added at the original location of filler metal preplacement, or if the joint is subjected to nondestructive examination such as radiography, ultrasonic examination or proof test, to any area of the joint, provided there is evidence of satisfactory wetting and flow at that area of the joint.

3.8 Properties

Brazed parts shall conform to the following requirements:

3.8.1 Appearance

3.8.1.1 Examination of all visible joint edges shall show a complete line or fillet of copper between component parts at both ends of the joint.

3.8.1.2 Surfaces of parts shall be free from excessive filler metal that interferes with form, fit, or function.

3.8.1.3 The presence of unflowed filler metal is not acceptable.

3.8.2 Coverage

The area joined by copper shall be not less than 80% of the area of the mating portions of the assembly. Method for determination shall be as acceptable to purchaser.

3.8.3 Proof Test

When specified, any part from a lot shall pass a proof test. Standards for acceptance and method of test shall be as agreed upon by purchaser and processor.

3.9 Quality

Brazed joints, as received by purchaser, shall be sound, clean, and free from foreign materials and from imperfections detrimental to performance of the brazed joints.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The processor of brazed assemblies shall supply all samples for processor's tests and shall be responsible for the performance of all required tests. When parts are required to be tested, the parts shall be supplied by the purchaser. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that processing conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

All technical requirements are acceptance tests and shall be performed on each lot.