



AEROSPACE MATERIAL SPECIFICATION	AMS2670™	REV. K
	Issued 1947-12 Reaffirmed 2016-12 Revised 2022-06	
Superseding AMS2670J		
Brazing, Copper		

RATIONALE

AMS2670K results from a Five-Year Review and update of this specification with vacuum partial pressure clarified (3.3.4) and electro plated filler metal anti-tarnish compound being prohibited (3.4.1.1).

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

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<https://www.sae.org/standards/content/AMS2670K/>

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2418	Plating, Copper
AMS2424	Plating, Nickel, Low-Stressed Deposit
AMS2635	Radiographic Inspection
AMS3430	Brazing Filler Metal, Paste, Copper, Water Thinning
AMS4500	Copper, Sheet, Strip and Plate, Soft Annealed
AMS4501	Copper Sheet, Strip, and Plate, Oxygen-Free, Light Cold Rolled
AMS4701	Copper Wire, Oxygen-Free, 99.95(Cu+Ag), Annealed
AMS4740	Copper Powder, 99.0 Cu, Minimum, As Fabricated
AS7766	Terms Used in Aerospace Metals Specifications

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 B660	Packaging/Packing of Aluminum and Magnesium Products
ASTM E1742	Radiographic Examination

3. TECHNICAL REQUIREMENTS

3.1 Materials

3.1.1 Filler metal shall be copper conforming to AMS4500, AMS4501, AMS4701, or AMS4740, or copper paste conforming to AMS3430. Alternatively, copper plating conforming to AMS2418 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 cognizant engineering organization.

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 Vacuum furnaces shall initially achieve a partial pressure of not higher than 20 microns and then backfilled with either hydrogen conforming to 3.3.2 or argon conforming to 3.3.1 to achieve a maximum partial pressure of 1000 microns 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 cognizant engineering organization, 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 AMS2424. As an alternative, copper plating in accordance with AMS2418 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. Post plating anti-tarnish compounds are not allowed.

3.4.2 Fluxing

When use of a flux is permitted by the cognizant engineering organization, 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 the cognizant engineering organization.

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 the cognizant engineering organization.

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 rebraced 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 the cognizant engineering organization.

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 the cognizant engineering organization 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.

4.2.2 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 and when purchaser deems confirmatory testing to be required.

4.3 Sampling and Testing

Sampling and testing shall be not less than the following: a lot shall be all assemblies of the same part number brazed in the same equipment without breakdown of setup and presented for processor's inspection at one time.

4.3.1 Visual

Each assembly.

4.3.2 Coverage

4.3.2.1 When coverage is determined destructively by tear test or metallographic examination, test frequency shall be not less than one part per lot or one part per 100 parts brazed, whichever is more frequent.

4.3.2.2 When coverage is determined non-destructively, as for example, by radiography in accordance with AMS2635 or ASTM E1742 or ultrasonic inspection of the joints in accordance with a procedure specified by the cognizant engineering organization; test frequency shall be agreed upon by purchaser and processor. Failure of any part shall be cause for 100% inspection of the lot.

4.3.2.3 Examination for braze internal coverage may be waived when parts are proof tested in accordance with 3.8.3 and 4.3.3.

4.3.3 Proof Test

When a proof test is required, any part shall pass a proof test. Standards for acceptance and method of test shall be as agreed upon by the cognizant engineering organization and processor. Failure of any part to pass proof test requirements shall be cause for 100% testing of the lot.

4.3.4 For preproduction testing, at least one joint shall be destructively examined for braze coverage and for evidence of surface contamination due to carburization, decarburizing, nitriding, or other deleterious effects.

4.4 Approval

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