



AEROSPACE MATERIAL SPECIFICATION

AMS2667™**REV. H**

Issued 1956-07
Reaffirmed 2018-08
Revised 2023-05

Superseding AMS2667G

Brazing, Silver,
for Small Pressurized Fittings

RATIONALE

AMS2667H results from a Five-Year Review and update of this specification with the addition of Ordering Information, added testing for residual flux (3.3.5), and reworded Proof Test for clarity (3.4.2.1).

NOTICE

ORDERING INFORMATION: The following information shall be provided to the plating processor by the purchaser.

1. Purchase order shall specify not less than the following:

- AMS2667H
- Quantity of pieces to be brazed
- Type or maximum service temperature (1.3)
- Maximum operating pressure (1.3.2)
- Material types of components being joined
- Applicable CEO engineering drawings
- Optional: Proof test and procedure (3.4.2.1)
- Optional: Burst test (3.4.2.2)

2. Parts manufacturing operations such as heat treating, forming, joining, and media finishing can affect the condition of the substrate for brazing or, if performed after brazing, could adversely affect the brazed part. The sequencing of these types of operations should be specified by the cognizant engineering organization or purchaser and is not controlled by this specification.

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For more information on this standard, visit
<https://www.sae.org/standards/content/AMS2667H>

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1. SCOPE

1.1 Purpose

This specification covers requirements for producing brazed joints in parts fabricated from corrosion- and heat-resistant steels, carbon or low-alloy steels, or copper alloys, and the properties of such joints.

1.2 Application

This process has been used typically for producing joints brazed between flexible metal hose, pressure fillings, pipe and tube joints, and similar parts, such as bellows and rigid end fittings where one end of the joint is not accessible for inspection, but usage is not limited to such applications.

1.3 Classification

The brazing procedure is classified by the maximum service temperature as follows:

Type 1: 600 °F (316 °C) service temperature

Type 2: 400 °F (204 °C) service temperature

Type 3: 800 °F (427 °C) service temperature

1.3.1 If a Type is not specified, Type 1 shall be used.

1.3.2 Maximum operating pressures will vary with part geometry and should be specified by the purchaser.

1.4 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.

1.5 Warning

Numerous scientific studies have determined that cadmium, which is used in some brazing alloys, presents a health hazard to persons who are exposed to it.

2. REFERENCES

2.1 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.

2.1.1 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.

AMS3410 Flux, Silver Brazing

AMS3411 Flux, Silver Brazing, High Temperature

AMS4768 Silver Alloy, Brazing Filler Metal, 35Ag - 26Cu - 21Zn - 18Cd, 1125 to 1295 °F (607 to 702 °C) Solidus-Liquidus Range

AMS4769	Silver Alloy, Brazing Filler Metal, 45Ag - 24Cd - 16Zn - 15Cu, 1125 to 1145 °F (607 to 618 °C) Solidus-Liquidus Range
AMS4770	Silver Alloy Brazing Filler Metal, 50Ag - 18Cd - 16.5Zn - 15.5Cu, 1160 to 1175 °F (627 to 635 °C) Solidus-Liquidus Range
AMS4771	Silver Alloy, Brazing Filler Metal, 50Ag - 16Cd - 15.5Zn - 15.5Cu - 3.0Ni, 1170 to 1270 °F (632 to 688 °C) Solidus-Liquidus Range
AMS4772	Silver Alloy, Brazing Filler Metal, 54Ag - 40Cu - 5.0Zn - 1.0Ni, 1325 to 1575 °F (718 to 857 °C) Solidus-Liquidus Range
AMS4773	Silver Alloy, Brazing Filler Metal, 60Ag - 30Cu - 10Sn, 1115 to 1325 °F (602 to 718 °C) Solidus-Liquidus Range
AMS4774	Silver Alloy Brazing Filler Metal, 63Ag - 28.5Cu - 6.0Sn - 2.5Ni, 1275 to 1475 °F (691 to 802 °C) Solidus-Liquidus Range
AMS4788	Silver Alloy Brazing Filler Metal, 50Ag - 28Zn - 20Cu - 2.0Ni, 1220 to 1305 °F (660 to 707 °C) Solidus-Liquidus Range

2.1.2 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 D1179 Fluoride Ion in Water

ASTM D1193 Reagent Water

2.2 Definitions

Terms used in AMS are defined in AS7766.

3. TECHNICAL REQUIREMENTS

3.1 Materials

3.1.1 Flux

For Types 1 and 2 brazed joints, flux shall conform to AMS3410. For Type 3, flux shall conform to AMS3411. Other fluxes may be used if approved by the cognizant engineering organization.

3.1.2 Filler Metal

3.1.2.1 Type 1

Filler metal shall conform to AMS4768 or AMS4771. AMS4771 shall be used for brazing austenitic corrosion- and heat-resistant steels.

3.1.2.2 Type 2

Filler metal shall conform to AMS4769, AMS4770, or AMS4771. For austenitic corrosion-resistant steels, AMS4771 shall be used.

3.1.2.3 Type 3

Filler metal shall conform to AMS4772.

3.1.2.4 For Type 1 and Type 2 processing, where the cognizant engineering organization specifies or permits the use of cadmium-free filler metal, AMS4773 or AMS4788 may be used, except that AMS4788 shall be used for corrosion- and heat-resistant steels. For Type 3 processing, cadmium-free AMS4774 may be used when specified by the cognizant engineering organization.

3.2 Preparation

The surfaces to be joined shall be clean prior to assembly. Surfaces shall not be polished.

3.3 Procedure

3.3.1 Fluxing

Flux, as specified in 3.1.1, shall be applied so that the surfaces to be joined are completely coated.

3.3.1.1 Flux should not be used on hose covered with wire braid or wire cloth because of the wicking action of the cloth or braid and the resulting difficulty of removal. Where this is unavoidable by part design, fluxes used shall be free from chlorides and fluorides.

3.3.2 Assembly

The parts shall be assembled so that the clearances between mating surfaces will produce optimum coverage by filler metal without appreciable running on surfaces outside the boundaries of the joint area. Optimum joint clearances for silver brazing are in the range of 0.001 to 0.004 inch (0.025 to 0.10 mm). Sufficient filler metal shall be placed within, or in close proximity to, the joint. The assembly should be supported so that the parts will be in proper alignment after brazing.

3.3.3 Joining

Shall be accomplished by electrical induction, resistance, or neutral flame torch heating, unless a specific method of heating is specified. The method of heating for brazing should be selected to avoid damaging previously applied supplementary coatings, e.g., hose assemblies having silver plated coupling nuts should not be brazed by immersion in molten filler metal. Parts shall be heated until the filler metal melts, and the joint is formed. Further heating shall be held to a minimum. Overheating shall be avoided.

3.3.4 Cooling

After brazing, but prior to handling, assemblies shall be cooled for sufficient time to allow the filler metal to solidify and in such a manner as to prevent cracks and minimize internal stress, distortion, and scaling.

3.3.5 Flux Removal

After brazing and cooling, flux shall be removed by a method not injurious to the specified surface finish. If the flux contains halides, tests shall be performed to ensure that residual flux has been removed (see 3.4.3).

3.4 Properties

Brazed parts shall conform to the following requirements:

3.4.1 Coverage

Visual examination of joints shall show an adequate fillet of filler metal at the end of the joint at which the filler metal was introduced. Surface and subsurface voids in the brazed joint are acceptable provided pressure and leak test requirements are met.

3.4.1.1 Parts shall be visibly free from flux residue.

3.4.1.2 The presence of unflowed filler metal is unacceptable.

3.4.2 Tests

3.4.2.1 Proof Tests

When specified, any part from a lot shall pass a proof test. When specified and a procedure for the proof test has not been provided, the proof pressure shall be 75% of the average burst pressure of not less than three preproduction samples. Proof pressure testing may be done pneumatically or hydrostatically at room temperature. The number of parts to be tested and the test frequency shall be specified.

3.4.2.2 Burst Pressure Tests

When specified, any part from a lot shall pass a burst pressure test. The burst pressure shall be the maximum pressure sustained without noticeable leakage.

3.4.2.3 Leak Tests

Any part from a lot shall sustain an internal pressure of not less than 90% of the proof pressure without leakage, unless another leak test pressure is specified. Leak tests shall be done pneumatically with the assembly held under still, clear water for not less than 5 minutes.

3.4.3 Halide Tests

Test shall be conducted on brazed assemblies to ensure that residual halide-containing flux has been removed. If the flux is known not to contain chlorides, tests for chloride need not be made; if the flux is known not to contain fluorides, the test for fluorides need not be made. If tests indicate the presence of halides, parts shall be subjected to additional cleaning and testing procedures until removal is complete. Test methods are not specified. Commercial chemicals are available for simple qualitative analysis for fluorides. However, in case of dispute, the following test methods shall apply:

3.4.3.1 Chlorides

Rinse the test area with 40 to 50 mL of hot (approximately 180 °F [82 °C]) ASTM D1193, Type IV, water. Collect rinse water in a 100 mL beaker and add three to five drops of concentrated nitric acid (sp gr 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 D1193, 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.

3.4.3.2 Fluorides

Rinse the test area with approximately 200 mL of hot (approximately 180 °F [82 °C]) ASTM D1193, Type IV, water. Collect the rinse water in a 250 mL beaker. Use approximately 200 mL of ASTM D1193, Type IV, water as a comparison sample. Test both samples in accordance with ASTM D1179. A higher concentration of fluoride in the rinse water than in the comparison sample indicates the presence of fluoride containing residual flux.

3.5 Quality

3.5.1 Brazed joints shall be sound, clean, and free from foreign materials and from imperfections detrimental to usage of the brazed joints.

3.5.2 Surfaces of assemblies shall be free from pitting and burning and from excessive filler metal that interferes with form, fit, or function.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

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