SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS2667 | REV. G

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Superseding AMS2667F

Brazing, Silver For Small Pressurized Fittings

RATIONALE

AMS2667G results from a five year review and update of this specification.

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 supplied.

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

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
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http://www.sae.org/technical/standards/AMS2667G

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. 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.

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 (690 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

2.2 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 D 1179 Fluoride Ion in Water

ASTM D 1193 Reagent Water

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 purchaser.

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 resisting 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 purchaser 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 purchaser.

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. The tests of 3.4.3 shall be used to determine that flux has been adequately removed.

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 by purchaser, any part from a lot shall pass a proof test. Where a proof test procedure is not specified, the proof pressure of production parts shall be 75% of the average burst pressure of not less than three preproduction samples or as specified by purchaser. Proof pressure testing may be done pneumatically or hydrostatically at room temperature.

3.4.2.2 Burst Pressure Tests

When specified by purchaser, 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 by purchaser. Leak tests shall be done pneumatically with the assembly held under still, clear water for not less than five 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 D 1193, Type IV, water. Collect rinse water in a 100 mL beaker and add 3 to 5 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 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.

3.4.3.2 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 250 mL beaker. Use approximately 200 mL of ASTM D 1193, Type IV, water as a comparison sample. Test both samples in accordance with ASTM D 1179. 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 processor's tests and shall be responsible for the performance of all required tests. Parts, if required for tests, shall be supplied by 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, except burst pressure tests, 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, when a change in material and/or processing requires approval by the cognizant engineering organization (See 4.4.2), and when purchaser deems confirmatory testing to be required.

4.3 Sampling and Testing

Shall be not less than shown in Table 1, with samples selected randomly from the lot, unless another sampling plan is specified by purchaser. A lot shall be all assemblies of the same part number, brazed by the same operator in the same shift, and presented for processor's inspection at one time.