



AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N. Y. 10001

AMS 2669B
Superseding AMS 2669A

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SILVER BRAZING

For Flexible Metal Hose, 800 F (427 C) Max Operating Temperature

1. SCOPE:

1.1 Purpose: This specification covers the engineering requirements for production of brazed joints between flexible metal hose, and similar parts such as bellows, and rigid end fittings and the properties of such joints. Parts are usually made of austenitic corrosion and heat resistant steels but may be of carbon or low-alloy steels.

1.2 Application: Primarily where joints having high strength up to 800 F (427 C) are required.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., Two Pennsylvania Plaza, New York, New York 10001.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

AMS 3411 - Flux, Silver Brazing, High Temperature

AMS 4772 - Brazing Filler Metal, Silver, 54Ag - 40Cu - 5.0Zn - 1.0Ni

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

ASTM D1179 - Fluoride Ion in Industrial Water and Industrial Waste Water

3. TECHNICAL REQUIREMENTS:

3.1 Materials:

3.1.1 Flux: Shall conform to AMS 3411.

3.1.2 Filler Metal: Shall conform to AMS 4772.

3.2 Preparation:

3.2.1 Surface Condition: The surfaces to be joined shall be clean prior to assembly. Surfaces shall not be highly 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.

3.3.2 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. 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.

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3.3.3 **Joining:** Shall be accomplished by electrical induction, molten filler metal, or torch heating, unless a specific method of heating is specified. 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:**

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.

3.4.2 **Pressure Test:** When a pressure test is specified on the drawing or is agreed upon by purchaser and vendor, any assembly from a lot shall pass that test. Voids in the brazed joint will not be cause for rejection if the pressure test requirement is met.

3.4.3 **Halide Tests:** The following tests shall be conducted on hose, bellows, and tube assemblies, and on other assemblies when specified, to assure that residual flux has been removed. If the flux is known not to contain chlorides, the test for chlorides need not be made and if the flux is known not to contain fluorides, the test for fluorides need not be made. If the washings indicate the presence of either chlorides or fluorides, assemblies shall be subjected to additional cleaning and testing operations until removal is complete.

3.4.3.1 **Chlorides:** Rinse the test area with 40 - 50 cm³ of hot (approximately 180 F (82 C)) deionized or distilled water. Collect rinse water in a 100 cm³ beaker and add 3 - 5 drops of concentrated nitric acid (sp gr 1.42) and 2 - 3 cm³ of 10% silver nitrate solution. Stir the contents of the beaker and allow to stand 5 - 10 minutes. A solution as clear as a blank of deionized or distilled 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 cm³ of hot (approximately 180 F (82 C)) deionized or distilled water. Collect the rinse water in a 250 cm³ beaker. Using two 100 cm³ or equivalent color comparison tubes, pour 100 cm³ of the rinsings into one tube and 100 cm³ of deionized or distilled water into the other as a blank. Treat the water in the two tubes in accordance with ASTM D1179, or use an equivalent (See 8.2) colorimetric method, and allow the color to develop. A color in the washings deeper than that of the blank indicates the presence of residual flux.

3.5 **Quality:**

3.5.1 Brazed joints shall be sound, clean, and free from foreign materials and from imperfections detrimental to performance of assemblies.

3.5.2 Surfaces of assemblies shall be free from pitting, burning, and excessive filler metal.

4. **QUALITY ASSURANCE PROVISIONS:**

4.1 **Responsibility for Inspection:** The vendor of brazed assemblies shall supply all samples and shall be responsible for performing all required tests. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to assure that processing conforms to the requirements of this specification.

4.2 **Classification of Tests:** Tests to determine conformance to all technical requirements of this specification are classified as acceptance or routine control tests.