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AEROSPACE MATERIAL SPECIFICATION

AMS2668C
Superseding AMS 2668B

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SILVER BRAZING
For Flexible Metal Hose, 400°F (200°C) Max Operating Temperature

1. SCOPE:

1.1 Purpose: This specification covers the engineering requirements for producing 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 carbon or low-alloy steels.

1.2 Application: Primarily for joints requiring high strength up to 400°F (200°C).

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 SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 3410 - Flux, Silver Brazing
AMS 4770 - Brazing Filler Metal, Silver, 50Ag - 18Cd - 16.5Zn - 15.5Cu, 1160° - 1175°F (625° - 635°C) Solidus-Liquidus Range
AMS 4771 - Brazing Filler Metal, Silver, 50Ag - 16Cd - 15.5Zn - 15.5Cu - 3.0Ni, 1170° - 1270°F (630° - 690°C) Solidus-Liquidus Range

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Printed in U.S.A.

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

ASTM D1179 - Fluoride Ion in Water

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Materials:

3.1.1 Flux: Shall conform to AMS 3410 or equivalent as approved by purchaser. Ø

3.1.2 Filler Metal: Shall conform to either AMS 4770 or AMS 4771. AMS 4771 shall be used for brazing austenitic corrosion and heat resistant steels. Ø

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 (See 8.2.1).

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.

3.3.3 Joining: Shall be accomplished by electrical induction, molten filler metal, or torch heating (See 8.2.2 and 8.2.3), 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: 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.

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 are acceptable provided 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 ensure 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. Other test methods may be used when approved by purchaser.

3.4.3.1 Chlorides: Rinse the test area with 40 - 50 mL of hot (approximately 180°F (80°C)) deionized or distilled water. Collect rinse water in a 100 mL beaker and add 3 - 5 drops of concentrated nitric acid (sp gr 1.42) and 2 - 3 mL 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 mL of hot (approximately 180°F (80°C)) deionized or distilled water. Collect the rinse water in a 250 mL beaker. Using two 100 mL Nessler or equivalent color comparison tubes, pour 100 mL of the rinsings into one tube and 100 mL 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 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 for vendor's tests and shall be responsible for performing all Ø required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that processing conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to all technical Ø requirements of this specification are classified as acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests Ø 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 reapproval as in 4.4.3, and when purchaser deems confirmatory testing to be required.

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when Ø requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be not less than the following; a lot shall be all assemblies of the same part number brazed in a continuous operation and presented for vendor's inspection at one time:

4.3.1 Coverage: Three assemblies per lot.

4.3.2 Pressure Test: One assembly per lot.

4.3.3 Halide Test: As required to ensure that all assemblies are free of residual flux but not less than once each working shift.

4.4 Approval:

4.4.1 Sample assemblies brazed to the requirements of this specification and the Ø vendor's facilities and procedures shall be approved by purchaser before assemblies for production use are supplied, unless such approval be waived by purchaser. Results of tests on production assemblies shall be essentially equivalent to those on the approved samples.