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

AEROSPACE MATERIAL SPECIFICATION

AMS 2664A
Superseding AMS 2664

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SILVER BRAZING
Unhardened Steels and Alloys

1. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

2. APPLICATION: Primarily for joining iron, nickel, and cobalt base alloys by the use of silver alloys where joints having high strength up to 800 F (427 C) are required.

3. PROCESS REQUIREMENTS:

3.1 Surface Condition:

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

3.1.2 Nickel Plating (Required for Induction and Furnace Brazing in Hydrogen-Containing Atmosphere Only): Unless otherwise specified, joint surfaces on parts made of any steel or alloy having a specified titanium or aluminum content, either as a maximum or a range, shall be nickel plated in accordance with the latest issue of AMS2403, except that plating will not be required on materials in which the specified maximum titanium content is not greater than 0.30% or the specified maximum aluminum content is not greater than 0.20% or the specified maximum sum of aluminum plus titanium contents is not greater than 0.40%; thickness of plating, when used, shall be 0.0001 - 0.0003 in., unless otherwise specified.

3.1.2.1 Nickel plating as in 3.1.2 may be used on steels and alloys not having a specified titanium or aluminum content when such parts are to be brazed in an atmosphere permitted in 3.6.2.

3.2 Post-Plating Diffusion Treatment: Prior to being assembled for brazing, all nickel plated parts shall be induction heated to 1825 F ± 50 (996.1 C ± 28) and held at heat for not less than 10 seconds. This requirement does not apply to parts to be furnace brazed.

3.3 Fluxing: Unless parts are to be brazed in a protective atmosphere as defined in 3.6.1, flux conforming to the latest issue of AMS 3411 shall be applied so that the surfaces to be joined are completely coated.

3.4 Assembly: The parts, after nickel plating when plating is used, shall be assembled so that the clearances between mating surfaces are within the tolerances specified on the drawing. The assembly should be supported so that the parts will be in proper alignment after brazing.

3.5 Brazing Filler Metal: Shall conform to the latest issue of the following:

3.5.1 For Brazing in Protective Atmosphere: AMS 4765.

3.5.2 For Brazing With Flux: AMS 4772.

3.6 Joining: Unless otherwise specified, joining shall be accomplished by furnace heating (See Section 5) in a protective atmosphere as defined in 3.6.2 or by induction heating with such an atmosphere surrounding the work or shall be accomplished by furnace, induction, or torch heating using flux. Parts shall be heated until the filler metal melts and the joint is formed. Further heating shall be held to a minimum. Brazing temperature shall not exceed 1950 F (1066 C).

3.6.1 When permitted by purchaser, resistance heating may be used for producing nonstructural joints, such as spacing collars on tubes, providing the heating is accomplished by passing the current through one member of the joint, so that the resistance across the joint is the source of heating, and provided that brazing is accomplished in a protective atmosphere as defined in 3.6.2.

3.6.2 Except as specified in 3.6.2.1 and 3.6.2.2, the protective atmosphere for brazing shall be hydrogen of not less than 99.94% purity and dew point not higher than -25 F (-32 C) as determined on gas being exhausted from the furnace or retort work zone.

3.6.2.1 If all scale and all visible oxides are removed from all surfaces of parts before the parts are placed in the brazing furnace, one of the following atmospheres may be used:

	Dew Point, max (See Note 2)	Purity %, min
Argon	-35 F (-37 C)	99.99
Argon + Hydrogen (See Note 1)	-35 F (-37 C)	(See Note 3)
Vacuum		5 - 20 microns Hg (See Note 4)

Note 1. Mixture may be in any proportions.

Note 2. Dew point shall be determined on gas being exhausted from the furnace or retort work zone.

Note 3. Purity of argon in the mixture shall be as specified above; purity of hydrogen shall be as specified in 3.6.2.

Note 4. When permitted by purchaser, higher vacuum (lower pressure) than 5 microns Hg may be used.

3.6.2.2 Atmospheres other than those listed in 3.6.2 and 3.6.2.1 may be used when authorized in writing by purchaser; such authorization will be granted only after demonstration, to the satisfaction of the purchaser, that use of such atmospheres will not cause scaling, carburization, nitriding, or excessive decarburization of the basis metals and will produce joints which consistently meet all requirements of this specification.

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

3.8 Flux Removal: After brazing and cooling, flux shall be removed by a method not injurious to the specified surface finish. The following test shall be used to determine that flux has been adequately removed:

3.8.1 Halide Test: Rinse test area with 40 - 50 ml of hot (approximately 180 F (82 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 halides. A white to gray precipitate or turbidity indicates presence of flux and the need for further cleaning.

4. QUALITY:

4.1 Visual examination of joints shall show a complete line or ring of filler metal between component parts at the end of the joint at which the filler metal was introduced and, when practical, shall show at least a metallic stain of filler metal at the opposite end of the joint, to indicate complete penetration of the filler metal in the joint.