Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 2675D
Superseding AMS 2675C
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NICKEL ALLOY BRAZING

1. SCOPE:

1.1 Purpose: This specification covers the engineering requirements for production of brazed joints in parts made of iron, nickel, and cobalt alloys by use of nickel alloys and the properties of such joints.

1.2 Application: Primarily for use where joints having high strength and corrosion and oxidation resistance up to 1200° F (650° 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., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 4775 - Brazing Alloy, Nickel Base - 4Si - 16.5Cr - 4Fe - 3.8B

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

2.2.1 Military Standards:

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

2.3 ANSI Publications: Available from American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.

ANSI B46.1 - Surface Texture

3. TECHNICAL REQUIREMENTS:

3.1 Materials:

3.1.1 Filler Metal: Shall conform to AMS 4775, unless otherwise specified.

3.1.2 Flux: Paste or liquid fluxes shall not be used unless otherwise permitted.

3.2 Equipment: Furnaces, with suitable protective atmospheres as defined in 3.3, shall be used for brazing unless electrical induction, electrical resistance heating, or other suitable method is permitted by purchaser.

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3.3 Atmospheres: Except as specified in 3.3.1 and 3.3.2, the furnace atmosphere for brazing shall be hydrogen of not less than 99.94% purity and dew point not higher than -25° F (-32° C), determined on gas being exhausted from the furnace or retort work zone.

3.3.1 If scale and visible oxides are removed from joint surfaces prior to placing parts in the brazing furnace, one of the following atmospheres may be used; specified dew points apply to gas being exhausted from the furnace or retort work zone. .

3.3.1.1 Argon of not less than 99.99% purity and dew point not higher than -35° F (-37° C).

3.3.1.2 Mixtures of argon and hydrogen in any proportions, the hydrogen purity being as specified in 3.3, the argon purity being as specified in 3.3.1.1, and the dew point of the mixture being not higher than -35° F (-37° C).

3.3.1.3 Vacuum of 5 - 20 microns of Hg; the specified partial pressure may be maintained by back-filling with an inert atmosphere as in 3.3.1.1 or 3.3.1.2 before the furnace temperature exceeds
Ø 1600° F (0° C). When permitted by purchaser, higher vacuum (lower pressure) than 5 microns of Hg may be used.

3.3.2 Atmospheres other than those listed in 3.3 and 3.3.1 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 other technical requirements of this specification.

3.4 Preparation:

3.4.1 Surface Condition: The surfaces to be joined shall be clean prior to assembly. Surfaces shall not be highly polished. Surface texture of approximately 125 microin. (3.2 μm), determined in accordance
Ø with ANSI B46.1, is desirable, particularly when filler metal is deposited by spraying.

3.4.2 Nickel Plating: 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
Ø AMS 2403, except that plating will not be required on materials in which the specified maximum titanium content is not greater than 0.25% or the specified maximum aluminum content is not greater than 0.15% or the specified maximum sum of aluminum plus titanium contents is not greater than 0.35%; thickness of plating shall be as follows, unless otherwise specified:

3.4.2.1 Precipitation-hardenable steels and iron alloys and non-precipitation-hardenable corrosion-
Ø resistant steels stabilized with titanium shall have plating thickness of 0.0004 - 0.0006 in. (10 - 15 μm).

3.4.2.2 Precipitation-hardenable nickel alloys having less than 4.00% nominal titanium plus aluminum
Ø content shall have plating thickness of 0.0004 - 0.0006 in. (10 - 15 μm).

3.4.2.3 Precipitation-hardenable nickel alloys having nominal titanium plus aluminum content of 4.00%
Ø or greater shall have plate thickness of 0.0008 - 0.0012 in. (20 - 30 μm).

3.4.2.4 Other alloys for which plating is required shall have plating thickness of 0.0001 - 0.0003 in.
Ø (2.5 - 7.6 μm).

Ø 3.4.2.5 Nickel plating on surfaces in other than joint areas is optional and may be incomplete.

3.4.2.6 Alloys covered by 3.4.2.2 and 3.4.2.3, when brazed in vacuum, and alloys for which plating is not required by 3.4.2.1, 3.4.2.2, and 3.4.2.3 may be plated to thickness of 0.0001 - 0.0003 in.
Ø (2.5 - 7.6 μm).

3.4.3 Fluxing: When use of paste or liquid flux is permitted, flux shall be applied to the joint areas ø of parts.

3.4.4 Assembly: The parts to be joined shall be assembled so that the clearances between mating surfaces are within the specified tolerances (See 8.2). The assembly should be supported so that the parts will be in proper alignment after brazing. Sufficient filler metal shall be placed within, or in close proximity to, the joint. In the case of blind joints, the filler metal shall be preplaced within the joint.

3.5 Procedure:

3.5.1 Joining: Parts shall be heated in equipment as in 3.2 using an atmosphere as in 3.3 until the filler metal melts and the joint is formed. The brazing temperature shall be from 25° F (15° C) above ø the actual liquidus to 200° F (93° C) above the maximum liquidus for the filler metal used. After the filler metal melts, heating may be prolonged to aid diffusion but erosion of the joint shall be avoided.

3.5.2 Cooling: After brazing, assemblies shall be cooled in such a manner as to prevent cracks and minimize internal stress, distortion, scaling, and decarburization. Cooling from the brazing temperature to below the scaling temperature shall be done in one of the atmospheres described in 3.3. If hardening is to be executed in conjunction with brazing, cooling procedures may be revised accordingly.

3.6 Post Treatment:

3.6.1 Flux Removal: After brazing and cooling, residues of paste or liquid fluxes, if used, shall be removed from the parts by a method not injurious to the specified surface finish.

3.6.2 Heat Treatment: Where hardness is specified for the brazed assembly and heat treatment is is required, such heat treatment shall follow the brazing operations.

3.7 Properties:

3.7.1 Appearance: 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.

3.7.2 Coverage: Unless otherwise specified, the area joined by filler metal shall be not less than 80% of the area of the mating portions of the assembly, determined by a method agreed upon by purchaser and vendor.

3.7.3 Proof Test: When specified, any part from a lot shall pass a proof test. Method of test and ø standards for acceptance shall be as agreed upon by purchaser and vendor.

3.8 Quality:

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

3.8.2 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. Results of such tests shall be reported to the purchaser ø as required by 4.5. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to ensure that processing conforms to the requirements of this specification.