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

AEROSPACE MATERIAL SPECIFICATION

AMS 2670E
Superseding 2670D
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COPPER FURNACE BRAZING
Carbon and Low Alloy Steels

1. SCOPE:

1.1 Purpose: This specification covers the engineering requirements for production of brazed joints using metallic copper as the brazing filler metal.

1.2 Application: For joining carbon and low-alloy steels. Not recommended for use on parts which will operate at over 1000°F (538°C) or on parts where high strength joints are required at temperatures over 700°F (371°C).

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue shall apply.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, Pennsylvania 15096.

2.1.1 Aerospace Material Specifications:

AMS 3430 - Paste, Copper Brazing, Water Thinning
AMS 4500 - Copper Sheet and Strip, Soft Annealed
AMS 4501 - Copper Sheet, Strip, and Plate, Oxygen-Free, Light Cold Rolled Temper
AMS 4701 - Copper Wire, Annealed

3. TECHNICAL REQUIREMENTS:

3.1 Materials:

3.1.1 Filler Metal: Shall be copper conforming to AMS 4500, 4501, or AMS 4701. When permitted by purchaser, a suitable copper paste such as AMS 3430 or copper applied by electroplating may be used.

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

3.2 Equipment: Furnaces with suitable protective atmosphere as defined in 3.3 shall be used for brazing. Alternatively, induction heating, using a protective atmosphere in a jacket surrounding the work, may be used.

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 the gas being exhausted from the furnace or retort work zone.

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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 Ø an inert atmosphere as in 3.3.1.1 or 3.3.1.2 before the furnace temperature exceeds 1600°F (871°C).

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.

Ø 3.4.2 Fluxing: When use of flux is permitted, flux shall be applied to the joint areas of parts.

3.4.3 Assembly: The parts to be joined shall be assembled so that the clearances between mating surfaces are within the specified tolerances. The assembly should be supported so that the parts will be in proper Ø alignment after brazing. Sufficient copper shall be placed within, or in close proximity to the joint. In the case of blind joints, the copper shall be preplaced within the joint; in such cases use of AMS 3430 or other suitable copper paste or copper applied by electroplating is permitted.

3.5 Procedure:

3.5.1 Joining: Parts shall be heated in equipment defined in 3.2 using an atmosphere defined in 3.3 at a temperature between 2000°F (1093.3°C) and 2150°F (1176.7°C). Parts shall be heated until the copper melts and the joint is formed. Further heating shall be held to a minimum.

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 required, such heat treatment shall follow the brazing operation.

3.7 Properties:

3.7.1 Appearance: Visual examination of joints shall show a complete line or ring of copper between component parts at the end of the joint at which the copper was introduced and, when practical, shall show at least a metallic stain of copper at the opposite end of the joint to indicate complete penetration of the copper through the joint.

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3.7.2 Coverage: Unless otherwise specified, the area joined by copper 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.

3.7.2.1 Surfaces of parts shall be free of excessive copper.

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

3.8 Quality: Brazed joints shall be sound, clean, and free from imperfections detrimental to performance of assemblies.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of brazed assemblies shall supply all samples and shall be Ø 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 Ø are classified as acceptance or routine control tests.

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

Ø 4.3.1 Coverage: Three assemblies per lot.

Ø 4.3.2 Proof Test: One assembly per lot, when specified.

4.4 Approval:

4.4.1 Sample assemblies brazed to this specification and the vendor's facilities and procedures shall be Ø approved by purchaser before parts for production use are supplied, unless such approval be waived.

4.4.2 Vendor shall use filler metal placement, type of equipment, environment, brazing process and cycle, and methods of inspection for production parts which are essentially the same as those used on the Ø approved sample parts. If any changes are necessary in type of equipment, processes, procedures, or methods of inspection, vendor shall submit for reapproval a statement of the proposed changes in processing and, when requested, sample revised parts. No production parts fabricated by the revised procedure shall be shipped prior to receipt of reapproval.

4.5 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, Ø disposition of the parts may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the parts represented and no additional testing shall be permitted.

Ø 5. PREPARATION FOR DELIVERY: Not applicable.

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

7. REJECTIONS: Parts not brazed in accordance with this specification or with authorized modifications will be subject to rejection.

8. NOTES:

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