



AEROSPACE MATERIAL SPECIFICATION

AMS2728™**REV. C**

Issued 1988-01
Revised 2012-09
Reaffirmed 2019-04

Superseding AMS2728B

Heat Treatment of Wrought Copper Beryllium Alloy Parts

RATIONALE

AMS2728C results from a Limited Scope Ballot to correct errors present in revision B (3.1.2.2, 3.1.5.1, 3.3.6, 3.3.7, 4.2.2).

1. SCOPE

1.1 Purpose

This specification establishes the requirements for heat treatment of wrought copper beryllium parts (See 1.2.2 and 8.2.1) by users or by their vendors or subcontractors.

1.2 Application

This specification is applicable to parts made from the following alloys: UNS C17000, UNS C17200, UNS C17300, UNS C17500, and UNS C17510 (See 8.4).

1.2.1 The heat treat parameters (temperatures, soaking times, cooling rates, etc.) used by material producers and forge shops for qualification of response to heat treatment of their products shall conform to the requirements of this specification.

1.2.2 Heat treatment of raw material by producers or forge shops shall be in accordance with the material procurement specification.

1.3 While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The vendor may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2019 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
<http://www.sae.org>

SAE WEB ADDRESS:

Full document details: SAE AMS2728C

SAE values your input. To provide feedback on this Technical Report, please visit <http://standards.sae.org/AMS2728C>

Documents
Document Sharing Hub

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS2750	Pyrometry
AMS2769	Heat Treatment of Parts in Vacuum
ARP1917	Clarification of Terms Used in Aerospace Metals Specifications
ARP1962	Training and Approval of Heat-Treating Personnel

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM E 3	Preparation of Metallographic Specimens
ASTM E 8/E 8M	Tension Testing of Metallic Materials
ASTM E 10	Brinell Hardness of Metallic Materials
ASTM E 18	Rockwell Hardness of Metallic Materials
ASTM E 384	Knoop and Vickers Hardness of Materials

3. TECHNICAL REQUIREMENTS

3.1 Equipment

3.1.1 Pyrometry

Shall conform to AMS2750.

3.1.2 Furnaces

3.1.2.1 Solution heat treating furnaces shall be a minimum of Class 2 (± 10 °F or ± 6 °C)

3.1.2.2 Precipitation hardening furnaces shall be a minimum of Class 2 (± 10 °F or ± 6 °C)

3.1.2.3 Stress Relieving furnaces shall be a minimum of Class 5 (± 25 °F or ± 14 °C)

3.1.2.4 Vacuum furnaces used to perform processes in this specification shall be in accordance with AMS2769.

3.1.3 Heating Media

High temperature furnaces with or without controlled atmosphere are acceptable for solution heat treating. Salt baths shall not be used for solution treatments. A muffle furnace shall be used for solution treating in fuel fired furnaces with an air atmosphere. Circulating atmosphere type furnaces, with or without controlled atmospheres, and salt bath type furnaces are acceptable for precipitation hardening. Still air oven type furnaces are not permitted for age hardening.

3.1.4 Racks and Fixtures

Shall not cause contamination of product and shall not reduce the heating, cooling, or quenching rates to less than required for correct heat treating. Design and construction shall preclude entrapment of quenchant and minimize deformation or other damage to product.

3.1.5 Quenching Equipment

3.1.5.1 Equipment shall be provided for quenching in water and for measuring and recording water temperature. Provisions shall be made for mechanical or hydraulic agitation of the quenching medium and/or agitation of the product and for cooling of the water as necessary to conform with 3.1.5.3.

3.1.5.2 Air agitation shall not be used.

3.1.5.3 Quench tanks shall be located in proximity to solution heat treating furnaces so that the quench delay times listed in Table 2 can be achieved. The delay time is measured from the time the furnace door starts to open until complete immersion of the load in quenchant.

3.1.5.4 The quenchant volume shall be sufficient to prevent the quench tank temperature from rising to a temperature greater than the limit established in 3.2.2.

3.1.6 Cleaning Equipment

Equipment shall be provided to clean parts before heat treatment and to remove salt from parts heated in salt baths.

3.2 Heating and Cooling Environment

3.2.1 Atmospheres

Shall be controlled so as not to react with the parts being heat treated. Materials that could attack or contaminate shall not contact parts.

3.2.1.1 Solution Treating Atmosphere

Parts shall be solution treated in either air or protective atmospheres. Acceptable protective atmospheres are exothermic, argon, helium, nitrogen, hydrogen, blends of these gases, and vacuum (See 3.2.1.1.2). Endothermic atmosphere is not acceptable. To minimize discoloration an air atmosphere should be avoided.

3.2.1.1.1 Unless specifically informed that the part will be machined all over, the heat treating processor shall heat treat the parts as if some surfaces will not have subsequent metal removal and, therefore, when solution heat treating, shall heat treat using protective atmosphere.

3.2.1.1.2 Vacuum

Is permitted for UNS C17000, UNS C17200, and UNS C17300 at 1450 °F (790 °C), but is not permitted for UNS C17500 and UNS C17510 at 1700 °F (925 °C).

3.2.1.2 Age Hardening Atmosphere

Parts shall be aged in air or protective atmospheres. Acceptable protective atmospheres for age hardening are the same as for solution treating (3.2.1.1), and neutral salt bath.

3.2.2 Quenching Media

Cold water baths shall be used. The water temperature shall not exceed 130 °F (46 °C) during operating use.

3.3 General Procedures

3.3.1 Cleaning

Parts shall be cleaned before heat treatment operations. Parts aged in salt shall be cleaned after heat treatment to remove salt residue.

3.3.2 Discoloration Protection

Parts shall be protected from discoloration by keeping dry before and after processing.

3.3.3 Racking and Spacing

Parts shall be racked and supported, or otherwise oriented, to ensure access of the heating, cooling, and quenching media to all surfaces of every part. Racking orientation shall include measures to minimize part distortion or damage during the heating and quenching process.

3.3.4 Loading

Parts shall not be loaded into a furnace with the temperature higher than the set temperature.

3.3.4.1 When load thermocouples are required, the cognizant engineering organization shall determine the number, location, and method of attachment.

3.3.5 Soaking

Heating shall be controlled in such a manner that either the heating medium or the part temperature, as applicable, is maintained at the set temperature and for the soak time specified herein. Soaking shall commence when all control, indicating, and recording thermocouples reach the specified set temperature or, if load thermocouples are used, when the part temperature reaches the minimum of the furnace uniformity tolerance at the set temperature. The determination of the commencement of soak time based on using either load or control thermocouples on a job shall not be changed once established, unless approval by the cognizant quality assurance agency is granted for changing the method, i.e., either from a load thermocouple to the control thermocouple or vice versa.

3.3.6 Solution Heat Treat (Solution Annealing)

Shall be accomplished by heating to and soaking at the following temperatures for the time specified in Table 1:

Alloy No. UNS C17000, UNS C17200, and UNS C17300: 1450 °F ± 10°F (790 °C ± 6°C)

Alloy No. UNS C17500, UNS C17510: 1700 °F ± 10°F (925 °C ± 6°C)

The solution heat treat condition is designated as TB00 (formerly Condition A).

3.3.6.1 Quench

Shall be accomplished in cold water (See 3.2.2) within the quench delay times listed in Table 2.