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Superseding AMS-H-7199

Heat Treatment of Wrought Copper-Beryllium Alloys, Process for
(Copper Alloys: Numbers C17000, C17200, C17300, C17500, and C17510)

RATIONALE

AMS-H-7199A stabilizes this document because AMS2728 contains technically equivalent requirements and is the document which will be maintained in the future by SAE AMS Committee D.

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AMS2728 Heat Treatment of Wrought Copper Beryllium Alloy Parts

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Under Department of Defense policies and procedures, any qualification requirements and associated qualified products lists are mandatory for DOD contracts. Any requirement relating to qualified products lists (QPL's) has not been adopted by SAE and is not part of this technical report.

1. SCOPE:

- 1.1 This specification presents requirements for the heat treatment of parts and components fabricated from wrought (plate, sheet, strip, bar, rod, wire extrusions and tube and forgings) copper alloys, numbers C17000, C17200, C17300, C17500, and C17510 (see 6.7). This specification also covers "bright hardening".

2. APPLICABLE DOCUMENTS:

The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

2.1 U. S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

FED-STD-151 Metals, Test Methods

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 8 Methods of Tension Testing of Metallic Materials.

3. REQUIREMENTS:

3.1 Permissible furnace types (see 6.1):

- 3.1.1 Solution heat treating furnace: Acceptable furnaces for solution heat treating of copper-beryllium products include those heated by electricity, gas or oil. They may be batch, continuous or induction types, using either vacuum, controlled gas atmosphere or air (static or circulating) in a chamber or muffle. Molten salt baths shall not be used because of the susceptibility of copper-beryllium alloys to corrosive attack by molten salts at solution heat treatment temperatures. Air atmosphere furnaces shall not be used when the loss of material due to excessive scaling is detrimental to the finished part.
- 3.1.2 Precipitation hardening (aging) furnaces: Aging or precipitation heat treatment furnaces shall be of the controlled gas atmosphere, vacuum or neutral salt-bath types. Air chamber furnaces are permissibly only when bright lustre parts are not required, or when subsequent brightening operations used to remove oxides, stains and tarnish are not detrimental to the finished parts. Forced circulating air is then recommended.
- 3.1.2.1 Bright hardening: An acceptable precipitation process known as "bright hardening" utilizes a controlled non-oxidizing and non-combustible gas atmosphere in a chamber-type furnace. (The material must be clean and bright prior to hardening - the process maintains the bright luster.) (see 6.5.4.4).

3.1.3 Furnace temperature uniformity: When equipped with satisfactory temperature-control devices, the design and construction of furnaces used for heat treating copper-beryllium products shall be such that, with a normal charge, the maximum temperature limit herein specified shall at no time during heating-up and holding be exceeded at any point in the working zone. Furthermore, the minimum temperature limit herein specified shall not be violated at any point in the working zone during the holding portion of the treatment cycle.

3.2 Furnace instruments:

3.2.1 Heat-control and measuring equipment: A sufficient number of suitable automatic temperature-control devices, and also temperature-recording instruments shall be provided for all heat treating furnaces to assure adequate control and measurement of temperatures through-out the furnace working zone. Temperature recording instruments shall be of the potentiometer type, and shall be adjusted to ± 5 F degrees of the true temperature, by applying corrections established by calibrated equipment in 4.2.2. If corrections greater than ± 5 F degrees are indicated, the source of the error shall be determined and adjustments shall be made so that the readings represent a true temperature within ± 5 F degrees or less.

3.2.2 Thermocouples shall be enclosed within suitable protecting tubes to prevent contact with furnace atmosphere or molten salt.

3.3 Quenching equipment for solution heat treatment:

3.3.1 Water baths: Cold water quenching baths of adequate size and design for the work load shall be used. The water temperature shall not exceed 95°F during operating use. Forced circulation may be needed to achieve this control. Alternate quenchants may be used providing their equivalence with respect to mechanical properties and residual stress of parts is substantiated.

3.3.2 Location of quenching equipment: To facilitate a very rapid transfer of the load from the solution treatment furnace into the water bath, the location of the bath and related equipment shall be such that a satisfactory quench of the material is obtained (see 3.7.2.2.4).

3.3.3 Quenching trays: Small parts should preferably be dumped directly into cold water; however, they may be quenched while in racks, baskets, trays or other containers, provided that the container construction will permit water to simultaneously reach all parts of the charge.

3.4 Salt bath equipment:

3.4.1 Rinse tanks: When molten salt baths are used, rinse tanks or sprays shall be provided for removing all salt from the parts. Rinse tanks shall be provided with sufficient inflow of fresh water to prevent concentration of dissolved salts.

3.4.2 Neutralizing bath: When required by 3.7.2.3.4 a neutralizing bath such as tri-sodium phosphate or other process - equipment for complete removal of active salt residues shall be provided.