AEROSPACE MATERIAL SPECIFICATION

AMS2772™	REV. G
Issued 1997-01 Revised 2016-04 Superseding AMS2772F	

Heat Treatment of Aluminum Alloy Raw Materials

RATIONALE

AMS2772G revises Equipment (4.3.1.1, 4.3.1.1.2), Uniformity of Quench (4.3.2.5, 4.3.2.5.2), and is a Five Year Review and update of this specification.

1. SCOPE

1.1 Purpose

This specification covers requirements and recommendations for the heat treatment of wrought aluminum alloy raw materials (see 8.2.1) by producers. It supersedes AMS-H-6088 and replaces MIL-H-6088.

1.1.1 Tempers

Aluminum alloy tempers are described in SAE AS1990 and ANSI H35.1.

1.1.2 Other Alloys

This specification may be used for alloys other than those specified herein providing temperatures, times, and quenchant are specified.

1.1.2.1 For those material specifications that specify proprietary heat treat and/or aging practices, all other requirements of AMS2772 apply.

1.1.3 Other Heat Treatment

1.1.3.1 Parts (See 8.2.2)

Made from wrought raw material shall be heat treated in accordance with AMS2770.

1.1.3.2 Castings and Parts Made from Castings

Are not covered by this specification; heat treatment of aluminum castings and parts made from such castings is covered by AMS2771.

1.1.3.3 Temper Conversion

Warehouses, distributors etc. shall conform to 3.8.

1.1.3.4 Procedure for Response-to-Heat-Treatment Tests

Shall conform to 3.9.

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 supplier 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.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2750	Pyrometry
AMS2770	Heat Treatment of Wrought Aluminum Alloy Parts
AMS2771	Heat Treatment of Aluminum Alloy Castings
AMS-H-6088	Heat Treatment of Aluminum Alloys
ARP1962	Training and Approval of Heat-Treating Personnel
AS1990	Aluminum Alloy Tempers

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 STP15D	Manual on Presentation of Data and Control Chart Analysis
ASTM B557	Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products
ASTM B557M	Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products (Metric)
ASTM B666/B666M	Identification Marking of Aluminum and Magnesium Products
ASTM G110	Evaluating Intergranular Corrosion Resistance of Heat Treatable Aluminum Alloys by Immersion in Sodium Chloride + Hydrogen Peroxide Solution

2.3 U.S. Government Publications

Copies of these documents are available online at http://quicksearch.dla.mil.

MIL-H-6088	Heat Treatment of Aluminum Alloys
MIL-STD-1537	Electrical Conductivity Test for Verification of Heat Treatment of Aluminum Alloys, Eddy Current Method

2.4 ANSI Publications

Copies of these documents are available online at http://webstore.ansi.org/.

ANSI H35.1 American National Standard Alloy and Temper Designation Systems for Aluminum

2.5 Battelle Publications

Available from Battelle, 505 King Ave, Columbus, OH 43201 or www.mmpds.org.

MMPDS Metallic Materials Properties Development and Standardization (MMPDS)

3. TECHNICAL REQUIREMENTS

3.1 Equipment Qualification

Before production heat treatment, each solution heat treating furnace/quench facility and each aging furnace shall be qualified by tensile and metallurgical testing (see 4.4) of heat treated samples representative of the most quench-sensitive (see 4.3.2.5.1) product to be heat treated. In addition, qualification of quench facilities shall include conformance to 4.3.

3.1.1 Sample Thickness

Tensile tests shall be representative of the thinnest and the thickest material to be heat treated; intermediate thickness samples shall be included when necessary to ensure proper production heat treatment. Thickness for metallurgical tests shall conform to 4.4.

3.1.2 Sample Locations

Samples shall be randomly positioned in simulated production loads except at least one of the tensile test samples shall be positioned at a location which exhibited a conductivity within 0.3% of the highest conductivity in a quench uniformity test.

3.1.3 Equipment Re-Qualification

Whenever any qualified equipment is changed or reworked, it shall be re-qualified unless it is known that the change or rework will not have a detrimental effect upon the properties of products. Re-qualification of quench facilities shall include conformance to 4.3.

3.2 Pyrometry

Shall conform to AMS2750 except (1) it is not applicable to furnaces used only for stress relieving or full annealing below 825 °F (441 °C), (2) recordings from instruments may be stored on magnetic or optical media providing a hard copy is producible on request, and (3) in continuous and semi- continuous furnaces, the requirements applicable to controls, instruments, and sensors in the working (soaking) zone shall also be applicable to the heating (heat-up) zone.

3.2.1 The temperature uniformity test requirements of AMS2750 shall be modified as follows:

3.2.1.1 Load Condition

Initial tests shall be performed with a typical load. Subsequent tests may be performed with any load or no load. Furnaces which have only been tested with a heavy load (in anticipation of only heat treating heavy loads) (see 8.2.9) shall not be used to heat treat light loads unless load sensors and recording instruments are employed to (1) preclude any portion of the load exceeding the maximum specified temperature on heat-up and (2) ensure soaking within the specified range for the required time.

3.2.1.2 Load Sensors

When all production loads are heavy (see 8.2.9) and a temperature uniformity test load is heavy, load sensors may be used in lieu of uniformity test sensors.

3.2.1.3 Loaded Furnaces

During the heat-up portion of uniformity tests performed on a loaded batch furnace and during the period that a load is in the heating (heat-up) zone(s) of continuous and semi-continuous furnaces, the temperature of the heating medium may exceed the maximum of the range being tested providing that the metal temperature does not exceed that maximum.

3.2.1.4 Uniformity Requirements

During the test period, the temperature of all working and test sensors in the working (soaking) zone shall be within the following allowable ranges (these ranges supersede the ± temperature tolerances specified in AMS2750):

3.2.1.4.1 50 °F (28 °C) range for furnaces used only for full annealing at 825 °F (441 °C) and higher. Annealing temperatures shall be controlled so as to preclude any material exceeding the lowest solution heat treating temperature for the alloy being annealed.

3.2.1.4.1.1 For furnaces used only for full annealing below 825 °F (441 °C) and for stress relieving, there are no temperature uniformity requirements.

3.2.1.4.2 30 °F (17 °C) range for furnaces used only for solution heat treatment of those 6xxx alloys for which Table 1 specifies a range of 30 °F (17 °C) degrees or more.

3.2.1.4.3 20 °F (11 °C) range for furnaces used for solution heat treatment of 6xxx alloys for which Table 1 specifies a range of less than 30 °F (17 °C).

3.2.1.4.4 20 °F (11 °C) range for furnaces used for solution heat treatment of other alloys except 10 °F (6 °C) range for furnaces used for solution heat treatment of 8090 sheet.

3.2.1.4.5 20 °F (11 °C) range for furnaces used for aging treatments.

3.2.1.4.6 20 °F (11 °C) range for furnaces used for processing to the -O1 temper.

3.3 Heating Media for Solution Heat Treatment

Shall be air, protective atmosphere, combusted gases, molten salt bath, or fluidized bed. However, no protective atmosphere, combusted gas or fluidized bed environment shall be used unless it has been shown by test (in accordance with 4.4.1.1), on the alloy/form to be heat treated, to yield product which is free from heat treat induced porosity. Composition of salt baths and fluidized beds shall be maintained to prevent attack of the product.

3.4 Preparation for Heat Treatment

3.4.1 Cleanliness

Prior to heat treating, product shall be free from surface contaminants which could have a detrimental effect on the material.