

AEROSPACE RECOMMENDED PRACTICE

ARP7500™

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Minimization of High Temperature Oxidation,
Aluminum Alloy Heat Treatment

RATIONALE

ARP7500 is a new recommended practice which provides recommendations for minimizing high temperature oxidation (HTO) during the heat treatment of aluminum alloy products and parts.

ARP7500 has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

1.1 Purpose

This recommended practice provides recommendations for minimizing high temperature oxidation (HTO) during the heat treatment of aluminum alloy products and parts. HTO leads to deterioration of properties.

1.1.1 Product refers to as-produced raw materials from mills and foundries.

1.2 The recommendations reflect those fabricating procedures which have been found to be most effective in minimizing HTO in aluminum alloy products and parts.

1.3 This ARP provides general guidelines. For further information, refer to ASM International, Handbook 4E.

2. APPLICABLE DOCUMENTS

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 ASM International

Available from ASM International, 9639 Kinsman Road, Materials Park, OH 44073-0002, Tel: 440-338-5151 (inside USA and Canada) or +1 440-462-0292 (outside USA), www.asminternational.org.

ASM Handbook Volume 4E Heat Treating of Nonferrous Alloys

3. GENERAL

Aluminum alloys may have HTO occur at subsurface defects when heated above 550 °F (300 °C) in the presence of water vapor (see 4.2). The thermally induced dissociation of water into elemental hydrogen and oxygen may diffuse into the aluminum. The interaction of hydrogen with subsurface defects may exacerbate this phenomenon forming blisters (i.e., subsurface porosity). The blisters may be detected by visual inspection, metallographic, and/or nondestructive inspection techniques (see 3.3). The 2000 and 7000 series alloys are the most susceptible to HTO. Figure 1 shows a metallographic cross section with a blister present.

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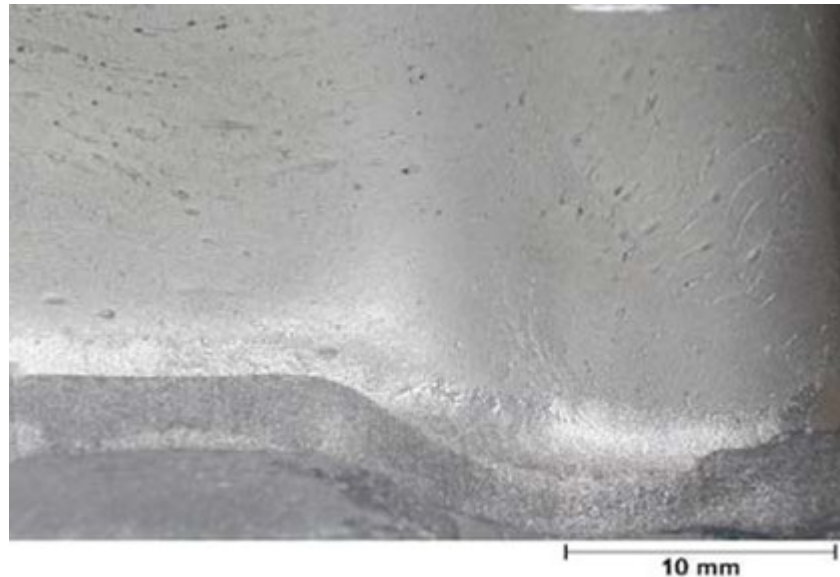


Figure 1 - Metallographic cross section showing a blister

3.1 Recommended Practices for Use Prior to Product and Parts Entering a Furnace to Assist in Avoiding HTO

These practices can be used singularly or in combination:

- Prior to heat treatment, parts should be machined to reduce sites that may exacerbate this phenomena during heat treatment.
- Prior to heat treatment, parts should be machined to visually assist detection of HTO after heat treatment.
- Prior to solution heat treatment and/or annealing, parts and product should be free from water, lubricants, oils, halogen compounds, sulfur compounds, and other foreign matter.
- Surfaces of fixtures, racks, etc., should be clean and free of dirt, water, oil, grease, paint, ink, crayon markings, die pick-up, and other foreign material.
- Racks should have drain holes for post quench water drainage.
- Part and product spacing in the furnace should be sufficient to allow for water drainage.
- After cleaning and prior to solution heat treatment in air furnaces, personnel handling parts and product should wear clean gloves that ensure no handling residue is left on parts or product.
- Anodizing (see 4.3) or Alcladding should be used prior to solution heat treating and/or annealing as a protective coating during heat treatment and removed after heat treatment. Coatings used in heat treatment should not be considered capable for design corrosion intent.
- Inert gases such as nitrogen or argon should be used to periodically purge the furnace prior to solution heat treatment and/or annealing.