SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE RECOMMENDED PRACTICE

Submitted for recognition as an American National Standard

SAE ARP823 REV. D

Issued 1964-01
Revised 1997-03
Reaffirmed 1994-07

Superseding ARP823C

Minimizing Stress-Corrosion Cracking in Wrought Heat-Treatable Aluminum Alloy Products

FOREWORD

Changes in the revision are format/editorial only.

1. SCOPE:

1.1 The purpose of this recommended practice is to provide the aerospace industry with recommendations concerning minimizing stress-corrosion cracking (SCC) in wrought high-strength aluminum alloy products.

1.2 The detailed recommendations are based on practical engineering experience and reflect those design practices and fabricating procedures which have been found to be most effective in minimizing stress-corrosion cracking in wrought high-strength aluminum alloy products.

1.3 This ARP provides general guidelines. For further information see references in 4.3.

2. REFERENCES:

2.1 Applicable Documents:

The following publications form a part of this document 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.

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

ASTM G 64 Classification of Resistance to Stress-Corrosion Cracking of High-Strength Aluminum Alloys (Volume 03.02 of the ASTM 1986 Book of Standards)

QUESTIONS REGARDING THIS DOCUMENT: **(724) 772-8510** **FAX: (724) 776-0243**
TO PLACE A DOCUMENT ORDER: **(724) 776-4970** **FAX: (724) 776-0790**
SAE WEB ADDRESS **http://www.sae.org**

2.1.2 NASA Publications: Available from NASA, Documentation, Marshall Space Flight Center, AL 35812.

MSFC-SPEC-522A Design Criteria for Controlling Stress Corrosion Cracking, issued 1977 November 18 by George C. Marshall Space Flight Center

2.1.3 U.S. Government Publications: Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-HDBK-5, Chapter 3 Aerospace Vehicle Structures, Metallic Materials and Elements for
MIL-STD-1568 Materials and Processes for Corrosion Prevention and Control in Aerospace Weapons Systems

2.1.4 Other Publications:

NBS Monograph 156, “Stress Corrosion Cracking Control Measures”, by B. F. Brown, Chapter 4 on Aluminum Alloys, 1977 June

3. GENERAL:

Stress-corrosion cracking failures of wrought, high-strength aluminum alloy parts have been attributed to the following combination of factors:

a. Presence of a sustained surface tensile stress developed as a result of assembly stresses and/or residual stresses due to heat treatment, forming, or service stresses acting in a direction perpendicular to the plane of predominant grain flow.

b. Presence of a corrosive environment, which need not be severe (atmospheric water vapor may be sufficient), and

c. Existence, in the product, of a metallurgical condition which makes the product susceptible to stress-corrosion cracking.

3.1 Al-Cu-Mg alloys of the 2xxx series, 5xxx alloys with magnesium greater than 3%, Al-Zn-Mg and Al-Zn-Mg-Cu alloys of the 7xxx series are most susceptible to stress-corrosion cracking especially in the short-transverse direction. The alloy-temper combinations of particular concern are:

2011-T3x
2011-T4x
2014-T3x
2014-T4x
2014-T6x
2017-T4x
2018-T6x
2024-T3x
2024-T36x

3.1 (Continued):

2024-T4x
2024-T6x
2219-T31x
2219-T37x
2618-T61
7001-T6x
7075-T6x
7079-T6x
7079-T611x
7175-T66
7178-T66

3.1.1 In addition, control of the fabrication process is important for the avoidance of stress-corrosion cracking susceptibility in some 2xxx alloys in the T8x tempers.

4. RECOMMENDATIONS:

4.1 General:

Applied stresses in the short-transverse direction should be minimized. Besides material susceptibility, residual forming stresses, stresses from machining, and stresses from assembly or misfit of parts can contribute to stress-corrosion cracking. Such stresses should not be overlooked in the design phase.

- Use alloys and tempers resistant to SCC.

- Use stress-relieved parts.

- Perform severe forming on product in the annealed condition, followed by heat treatment, if required.

- Perform forming and straightening on newly quenched product to lessen forming stresses.

- Avoid fitup stresses by careful attention to tolerances. Misaligned parts should not be forced into place.

- Where surface tensile stresses cannot be avoided, consider techniques like shot peening, surface rolling, or thermal stress relief to reduce undesirable stresses. When using thermal treatments for stress relief, consideration also needs to be given to the effect of time at elevated temperature on the properties of the product.

- Heat treat weldments after welding. To avoid stress-corrosion cracking while the product is in the W temper, parts should be stored in a dry environment for as short a time as possible before artificial aging.