Safety Socket

04/10/2018

RE: EASA SIB No.: 2018-04

Subject: Environmentally Assisted Cracking in certain Aluminum Alloys

The Safety Information Bulletin (SIB) states that some new 7XXX series alloys have sensitivity to a phenomenon known as Environmentally Assisted Cracking (EAC), when subjected to certain conditions in the normal operating environment. Results of further investigation are in agreement with open scientific literature, and show that an EAC phenomenon can occur only when the three following conditions are present: (1) susceptible material alloy, (2) sustained stress in the ST direction and (3) ageing in a typical environment. If one of those conditions can be eliminated, this form of EAC cracking is unlikely to occur. The affected materials did pass the "state of the art" qualification requirements for mechanical and corrosion testing, but the current industry standard of testing for stress corrosion cracking (ASTM G47) is not capable of adequately detecting the risk of this form of EAC. More specifically the subject of this SIB is EAC caused by hydrogen assisted embrittlement resulting in a decrease of toughness, but in absence of an obvious corrosion reaction. Sensitivity to this form of EAC has been confirmed for alloys 7037, 7040, 7055, 7085, 7099, and 7449.

Safety Socket has not manufactured any product using any 7XXX series alloys that have shown sensitivity to environmentally assisted cracking (EAC).

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Safety Information Bulletin

Airworthiness

SIB No.: 2018-04

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Subject: Environmentally Assisted Cracking in certain Aluminium Alloys

Ref. Publications:
None

Applicability:
Type Certificate holders, Supplemental Type Certificate holders, equipment manufacturers, maintenance organisations, production organisations and aluminium alloy producers.

Description:
EASA received reports of brittle cracking of aluminium alloy components. Additional investigation of some new generation 7xxx series alloys has shown that these have a sensitivity to a phenomenon known as environmentally assisted cracking (EAC), when subject to certain conditions in the normal operating environment. The type of EAC encountered appears to be caused by hydrogen embrittlement along the grain boundaries, leading to crack initiation and subsequent propagation. These cracks typically start from holes or other areas of stress concentration and usually propagate in a plane perpendicular to the short transverse (ST) direction. This phenomenon has been linked to the chemical composition of the alloy, notably a high zinc/magnesium ratio, combined with low copper content. Brittle fractures have been reproduced under laboratory environment and cracking has proven to be driven by time exposure (ageing) and is not fatigue related, although further crack propagation under operative loads cannot be excluded.

Results of further investigation are in agreement with open scientific literature, and show that an EAC phenomenon can occur only when the three following conditions are present: (1) susceptible material alloy, (2) sustained stress in the ST direction and (3) ageing in a typical environment. If one of those conditions can be eliminated, this form of EAC cracking is unlikely to occur. The affected materials did pass the “state of the art” qualification requirements for mechanical and corrosion testing, but the current industry standard of testing for stress corrosion cracking (ASTM G47) is not capable of adequately detecting the risk of this form of EAC (see Note 1).

Note 1: The subject of this SIB is EAC caused by hydrogen assisted embrittlement resulting in a decrease of toughness, but in absence of an obvious corrosion reaction. It is different from classical stress corrosion cracking characterised by anodic dissolution with loss of material accompanied with findings of active corrosion like pitting or attack of grain boundaries.

Sensitivity to this form of EAC has been confirmed for alloys 7037, 7040 (see Note 2), 7055, 7085, 7099, and 7449. Other alloys with similar compositions might also be affected. The material temper (i.e. the specified heat treatment and additional processing such as ageing and stress relief by stretching) and product form can also influence resistance to EAC.

Note 2: Aluminium alloy 7040 has been found sensitive to this form of EAC in T7651 temper only. Other tempers commonly used with this alloy have not shown similar issues.

Occurrences of this form of EAC cannot be excluded in service and, if not detected, could lead to crack propagation, possibly resulting in reduced structural integrity. For specific designs that have already been identified, mandatory inspections and corrective actions have been initiated and further mandatory actions for other specific designs may follow.

This SIB is issued to raise awareness, in all sectors of the industry, concerning this EAC phenomenon of these types of aluminium alloys.

Recommendation(s):

EASA recommends all affected organisations to evaluate the extent of the issue, particularly to:

- Identify components made of EAC sensitive aluminium alloys.
- Evaluate the sensitivity to and criticality of EAC in the component.
- Report these evaluation results to EASA.

In addition, EASA requests aluminium alloy producers to establish whether they supply any of the above mentioned alloys and, if so, to contact EASA and the relevant Design Approval Holder(s).

Contact(s):

For further information contact the EASA Safety Information Section, Certification Directorate.
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