SAE Aerospace
An SAE International Group

AEROSPACE INFORMATION REPORT

SAE AIR4150A

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Superseded by ARP4150

Inspection of Inservice Airborne Accumulators for Corrosion and Damage

RATIONALE

Upon performing a five year review of ARP4150, it was decided that the document should be updated. This review revealed that an earlier version of this information was available in AIR4150. It was determined that when ARP4150 was produced all the important information from AIR4150 was included. It appears that AIR4150 was forgotten about. During the SAE meeting committee A-6A1 voted to cancel AIR 4150 as being superseded by ARP4150.

CANCELLATION NOTICE

This document has been declared "CANCELLED" as of January 2009 and has been superseded by ARP4150. By this action, this document will remain listed in the Numerical Section of the Aerospace Standards Index noting that it is superseded by ARP4150.

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FOREWORD

Accumulators are designed for infinite service life, however, under certain environmental conditions the surface protection system can deteriorate and allow corrosion, which in turn can lead to early stress corrosion type failures. Since the accumulator is gas charged, the results of such failure can be extremely violent. Failure of an accumulator can result in aircraft structural damage and may result in injury to nearby personnel. At the present time there is no in-service inspection criterion or life limit for these units.

1. SCOPE:

   This SAE Aerospace Information Report (AIR) is intended for use as a guide in determining the condition of in-service accumulators. A minimum inspection program is recommended to determine the existence of corrosion or damage.

2. REFERENCES:

   There are no referenced publications specified herein.

3. REVIEW:

   Since accumulators are structurally designed for unlimited life, many units will last for the total airplane service life. There are, however, certain conditions that can lead to early failures. The most obvious of these are as follows:

3.1 Fluid traps in the end caps or under the mounting clamps can retain moisture which will adversely act on the corrosion protective system. The rate of corrosion will be greater on some installations than others due to their more severe operating environment. Installations exposed to moist salty air, waste water, or corrosive cleaning solvents will lose their protective finish much faster than those operating under clean dry conditions.

3.2 The inadvertent use of moist nitrogen or air to service the accumulator can cause loss of the internal corrosion protection system. Some configurations, such as those with permanently closed air chambers are extra susceptible to this problem since the air chambers are not necessarily inspected during normal refurbishment activities. It is recommended that high purity, cryogenically pumped, industrial grade nitrogen be used to reduce the chance of introducing moisture into the accumulator.

3.3 Damage Caused During Normal Maintenance:

3.3.1 Damage to the protective coating will allow corrosion pitting, which will allow early failure due to stress corrosion action.

3.3.2 Nicks or scratches can induce high localized stress levels which will appreciably reduce the structural life.

3.4 Improperly Designed or Manufactured Parts:

3.4.1 Sharp internal corners from improper machining cause high stress concentrations and reduce life.

3.4.2 Deficient plating/coating processes allow early corrosion pitting which in turn allows failures due to stress corrosion.

3.4.3 Improper material heat treatment can reduce the material fatigue life.

4. INSPECTION:

A general inspection program should be established to determine the service life probability for each particular accumulator installation. The inspection period may be determined from a sampling program over different in-service periods. The inspection program should be aimed at determining problems related to corrosion, since structural problems related to heat treatment or built in stress risers will not be apparent at the normal maintenance levels. In order to be effective the program should consist of the following steps:

4.1 A program should be set up to require the inspection for corrosion of all units returned for servicing. In addition the parts should be inspected for unusual nicks, scratches, or manufacturing tool marks in excess of drawing requirement, that could be a source of stress risers. As a minimum this inspection should consist of using a bright light and a low power (approximately 2 to 3 power) magnifying glass to detect corrosion on the pressure shell and end cap portions of the assembly. A manual or instruction should be prepared for an inspection "How to". In some cases more sophisticated equipment will be required to inspect hard to get at areas.

4.1 (Continued):

Figure 1 shows some typical areas of concern on two common accumulator end cap configurations. Moisture can enter the areas around the highly stressed thread, lock ring, and end cap areas and cause corrosion.

It is good practice to inspect the interior surfaces of the gas charge chamber. This chamber is normally charged with noncorrosive dry nitrogen, however, experience has shown that the inadvertent use of moist air can cause extensive corrosion damage.

4.2 When corrosion is found, corrective action must be taken. When a mild case of corrosion exists as defined by light surface discoloration without pitting, all signs of discoloration should be removed and the affected surface protected prior to reassembly. Heavier indications of corrosion involving surface pitting should be inspected for indication of stress corrosion cracks. Nondestructive inspection is recommended; i.e., magnetic particle inspection or fluorescent inspection per MIL-I-6866. Discard the parts which show crack indications. Further use of the remaining parts normally require removal of the corrosion, blending out of the pits, and restoration of the corrosion protective coating to the original state. Since many accumulators are standard off the shelf items it is often more cost-effective to replace these assemblies rather than to rework the defective part.

NOTE: Contact the manufacturer for dress-out limits, finishes, and possible stress relief requirements. Any rework that is beyond overhaul manual/design limits requires approval of the applicable government agencies or the airworthiness authorities.

4.3 A program should be initiated to record and track corrosion problems discovered during the inspection. Proper recordings and tracking will make it possible to separate the repetitive from the one of a kind problems and take proper fleet wide corrective action where required. Installations found to be prone to corrosion should be subject to repetitive inspections aimed at time intervals based upon the severity of the problem at finding and correcting the overall fleet problems.

If it is determined that a fleet wide problem exists, a plan should be set up to methodically inspect all field units within a reasonable period of time. The surest method of inspection is to disassemble the unit and proceed with a visual inspection. Sometimes, however, an alternate method of in place inspection can be developed which can both expedite the program and reduce inspection costs. One method that has been used successfully is to use an ultrasonic transducer installed in a lucite wedge shaped to the accumulator contour. This tool is calibrated to a standard and will pick up defects in installed equipment. See Figure 2.

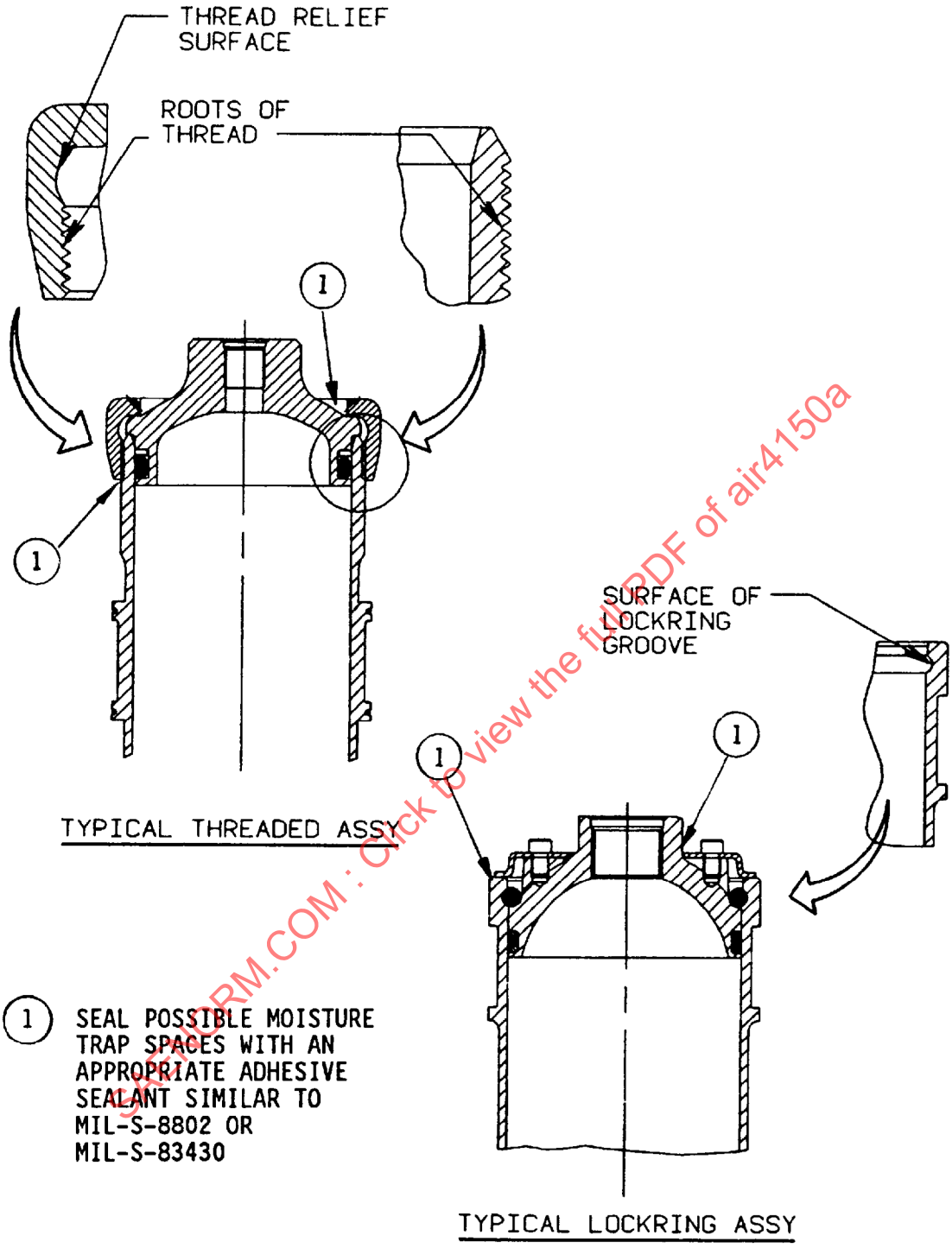

FIGURE 1 - Critical Stress/Corrosion Areas
Typical End Cap Configurations