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Age Control of Age Sensitive Elastomeric Materials

(R) FOREWORD

MIL-STD-1523A, "Age Controls of Age-Sensitive Elastomeric Materiel", requiring maximum ages of age sensitive elastomeric items for use in military aircraft and missiles and for space vehicles at the time of acceptance, was canceled on 30 January 1995. U.S. military specifications for nitrile rubber O-rings such as MIL-P-5315, MIL-P-5510, MIL-P-25732, and MIL-P-83461 which were formerly controlled by MIL-STD-1523A are now released from age control.

Certain hoses containing nitrile rubber continue to be age controlled by AS1933A, "Age Controls for Hose Containing Age-Sensitive Elastomeric Material". The following text is unchanged from the 1975 revision (except where indicated) and is republished for historical purposes.

1. SCOPE:

This SAE Aerospace Information Report (AIR) summarizes data and background relative to age control of specific classes of those nitrile type synthetic elastomers used in sealing devices which are resistant to petroleum base hydraulic fluids, lubricating oils, and aircraft fuels. This includes, but is not limited to, those nitrile (NBR or BUNA-N) elastomers previously covered by Section I of MIL-STD-1523.

1.1 Purpose:

To provide users with appropriate references and information correlating past need and use of age controls with current needs and to provide summary guidelines for consideration when future use of age controls is required or contemplated.

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2. REFERENCES:

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AS1933A Age Controls for Hose Containing Age-Sensitive Elastomeric Material

2.2 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-1523

2.3 Other Publications:

ANA 438

3. BACKGROUND:

3.1 ANA Bulletin 438:

After World War II, particular concern was expressed relative to the apparent aging characteristics of the then recently developed BUNA-N and nitrile/neoprene blended elastomers being used in critical sealing devices of aircraft hydraulic, lubricating, and fuel systems.

These early compounds apparently possessed poor ozone and weather resistance characteristics and were soon classified as “age sensitive”. As a result, age controls were established on these materials, initially in various general coverage government documents; when this proved unwieldy, all requirements were collected in 1958 and published in a single document, ANA Bulletin 438. Unfortunately, subsequent interpretations of this document by various agencies and contractors resulted in additions and variations in its implementation with subsequent confusion, abuses, and cost increases being incurred during enforcement of these variations.

3.2 MIL-STD-1523:

At the same time age controls leading to ANA 438 were being promulgated, at least ten programs were initiated relative to evaluation of long term aging of elastomeric materials. Results of these evaluations have been summarized in an excellent Air Force report AFMA-TR-67-235. The tests indicated that, while certain mechanical properties did undergo some change with time (i.e., increases in hardness, tensile, and modulus with a corresponding decrease in ultimate elongation), these property changes tended to level off after 4 or 5 years. Further, the changes that did occur were not of sufficient magnitude to result in seal failure.

3.2 (Continued):

In addition to the above test programs, a large amount of performance data for “old” components containing “over-age” elastomeric seals has also been generated over the years that further indicate elastomers are less affected by aging than originally expected. Several of the more widely publicized studies involved the analysis of equipment removed from two aircraft that had crashed during WW II, one in the Libyan desert and the other on the Arctic ice cap. Functional tests performed on assemblies and mechanical property data on O-rings from these aircraft indicated that the elastomeric seals were in remarkably good condition when tested and that most of these old units functioned within their original specification limits. As the elastomeric parts removed from these two planes had probably been cured in 1941 or 1942, these materials represented the state of the art for very early nitrile or nitrile-neoprene blended compounds.

In view of the above results and the fact that overall properties of current nitrile materials are much improved over those evaluated, it was concluded that the then current age controls should be reconsidered and made less restrictive. Accordingly, MIL-STD-1523 was promulgated and when released in 1973, superseded ANA Bulletin 438. Among other considerations, this document basically provides for a cure date limitation of twelve quarters from cure date to acceptance of the seals or bulk hose by the original procuring activity, whether a government agency, a first or second tier subcontractor or kitter. In all cases, continued use of cure dates is intended to provide for good first-in/first-out warehousing procedures.

3.3 (R) MIL-STD-1523A:

MIL-STD-1523A was issued 1 February 1984, superseding MIL-STD-1523. This somewhat alleviated the burden imposed by the earlier versions. Limitation of time from cure date to acceptance was extended from 12 quarters to 40 quarters.

In both ANA Bulletin 438c and MIL-STD-1523, ages were controlled as the items moved through the development and production cycles. Acceptance for the government was done by procuring activities at intermediate stages as well as acceptance by the government of the completed system. Later acceptances depended upon previous age requirements having been met. O-rings were not controlled after installation. Both versions required that the history of an elastomeric item be known at installation. Therefore, not all elastomeric items already installed in an assembly or subassembly at acquisition were automatically acceptable for critical programs, i.e., for the acquisition of space vehicles, military aircraft, and missiles. The history of each elastomeric item had to be known at the time it was installed and its age had to fall within the limit given in the table of each version.

In MIL-STD-1523A the ages of both O-rings and hoses were controlled only at time of acceptance by the government. The limits were meant to apply to items installed in a system to be accepted by the government. Since the only age control was at acceptance, the cure date of each item had to be known at that time.

The main reasons for changes from MIL-STD-1523 to MIL-STD-1523A were:

3.3 (Continued):

a. At the limits given in MIL-STD-1523, government inspectors were requiring the discarding of unused material. This culling and discarding increased costs and delayed ongoing programs. Therefore, a time longer than most development programs was specified to allow uninterrupted pursuit of a program.

b. To assign age control responsibility to the prime contractor, who had to see that the age limits in MIL-STD-1523A fit into the missile, military aircraft, or space vehicle development program completion or production delivery schedule.

c. Systems already accepted by the government were removed from control of the document. The elastomeric items for such systems were to be controlled by their managers in accordance with system needs and constraints.

d. Specifying age limits for intermediate stages of a program as was done in MIL-STD-1523 were not consistent with the then DoD standardization policy that documents give minimum performance requirements and not detailed methods.

4. SUMMARY GUIDELINES (OBSOLETE MIL-STD-1523):

In conclusion and as a result of study and evaluation of the above and related data by both consumers and producers, the following points are offered as a guide for use in justifying or otherwise considering future requirements for age controls where needed under MIL-STD-1523.

4.1 The general and detailed requirements of MIL-STD-1523 provide:

4.1.1 The necessary parameters needed for future procurement programs involving age controls of those “age sensitive” elastomers included therein.

4.1.2 A cure date based on which good supply and warehousing procedures may be established.

4.1.3 An effective reference for use on contractual specifications and/or drawings.

4.1.4 An appropriate description of environmental limits for proper long term storage of items made from subject elastomers.

4.1.5 The reference document and authority for discontinuing use of, and deleting reference to, the now obsolete ANA Bulletin 438 at the earliest practicable date.