SAE INTERNATIONAL

AEROSPACE STANDARD

AS5316™

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Storage of Elastomer Seals and Seal Assemblies Which Include an Elastomer Element Prior to Hardware Assembly

RATIONALE

There has been an aerospace industry need to convert ARP5316 to an Aerospace Standard because the current document has been used as a standard even though it is a Recommended Practice. This document satisifes this need.

FOREWORD

Listed below is the background information which led to the creation of this Aerospace Standard.

1. Introduction of MIL-STD-1523

Age control was imposed on elastomers used in critical sealing devices of aircraft hydraulic, lubricating, and fuel systems after World War II. Several different requirements and specifications were implemented in the years following the war until 1958 when ANA Bulletin 438 was released. This bulletin's purpose was to collect all previous requirements for age control in one document and to make it easier for various agencies and contractors to effectively implement age control. However, confusion in interpretations resulted in abuses, cost increases and inconsistently imposed exceptions.

Many other programs were then undertaken to study age control. The results of many of these were summarized in the Air Force report, AFML-TR-67-235. The conclusion of the studies summarized in this report and others that were in progress was that the overall properties of elastomeric materials were much improved over the materials initially evaluated and age control should be made less restrictive. As a result of this information, MIL-STD-1523 was released in 1973 and superseded ANA Bulletin 438. One of the basic requirements of the new document was to provide a cure date limitation of 12 quarters from cure date to acceptance of the seals by the original procuring activity, whether a government agency, a first or second contractor or an organization which assembles seal and hardware kits. In all cases, the use of cure date was intended to provide for good FIFO (First In - First Out) warehousing procedures.

On February 1, 1984, MIL-STD-1523A was issued to supersede MIL-STD-1523. This revision was targeted at eliminating the confusion in interpretation of the previous document. It also extended cure date requirements from 12 quarters to 40 quarters. MIL-STD-1523A controlled the age of elastomers only at time of acceptance by the government. This meant that the cure date of each elastomer had to be known at the time a system was accepted by the government.

Even with the clarifications of MIL-STD-1523A, confusion still existed and the discussion regarding the need for age control continued.

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2. Introduction of EPRI NP-6608

In June, 1989, Bruce Boyum and Jerral Rhoads presented an IEEE Paper: "Elastomer Shelf Life: Aged Junk or Jewels" - IEEE Transactions on Energy Conversion, Vol. 4, No. 2, pp. 191-203, June, 1989. After a detailed review of the information from previous studies and the age control documents including MIL-HDBK-695C, they concluded that age control limits were very conservative and shelf life could be extended as long as proper storage conditions were maintained.

This was followed up in May, 1994 by EPRI NP-6608, "Shelf Life of Elastomeric Components". The conclusion of this detailed study was that with proper storage, shelf life for elastomer seals could be extended to 32 years.

3. Introduction of AS1933A

Based upon the data from the numerous studies concerning age control and shelf life, MIL-STD-1523A was canceled on January 30, 1995 - without replacement but reference was made to AS1933A. This action, in essence, released aerospace elastomers from age control.

In the time since the cancellation of MIL-STD-1523A confusion has reigned. Contractors are not aware of the history of age control and still insist on it. Quality organizations are not only still insisting on age control but are now using AS1933A for seals or referring to MIL-HDBK-695C.

Some of the insistence for age control is due to the requirement that the latest revision of specifications shal be used and if age control or cure date requirements are removed, there is no traceability to specification revisions. In addition, organizations are concerned about FIFO requirements being maintained.

4. Introduction of ARP5316

To address the needs of contractors and to alleviate the confusion created by the cancellation of MIL-STD-1523A, ARP5316 was issued. This recommended practice addressed elastomeric seal components and offered a control document for those organizations which required one. It included recommended shelf life limits that were consistent with the data from the cumulative studies on age control. It addressed the need for traceability and proper storage of elastomeric components of seals. It also provided a document that addressed seals not hoses, rubber boots, etc. It provided a reference source for Quality Organizations to work with. Since it was so widely used and referenced, it is now an Aerospace Standard.

The specified storage times are based upon industry input regarding practical storage limits based upon FIFO requirements. Most users of the elastomers addressed in AS5316 will find that the times listed in the document are beyond the time periods utilized in FIFO programs. More importantly, proper storage and traceability are specified since these are the key elements in promoting long shelf life and ensuring that the elastomeric seal components meet the latest revision of a specification.

5. Introduction of MIL-HDBK-695

This document directs the reader to ARP5316 for questions concerning elastomer seal shelf life.

6. Introduction of DoD Manual 4140.27, Volumes 1 and 2

AS5316 is the key elastomer seal shelf life reference for complying with the shelf life extension policy requirements of the DoD Shelf-Life Management Program Manual, Volumes 1 and 2. Paragraph 4.3 of Volume 1 specifies remaining shelf-life requirements for shelf-life items or materiel which includes elastomer seals.

TABLE OF CONTENTS

1. SCOPE

This SAE Aerospace Standard (AS) specifies the general requirements for data recording procedures, packaging, and storing of elastomeric seals and seal assemblies which include an elastomeric element prior to the seal being assembled into hardware components.

NOTE: The requirement for packaging is an integral part of the controlled storage procedure and provides a means of positive product identity from the time of manufacture to the time of assembly into a component.

1.1 Disclaimer

As AS5316 deals solely with the life of elastomeric parts when they are being stored, this document shall not be used to justify the service life of any elastomeric component after it has been installed in any assembly, sub-assembly or any other hardware

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 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2817 Packaging and Identification, Preformed Packings

AS1933 Age Controls for Hose Containing Age-Sensitive Elastomeric Material

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D1418 Standard Practice for Rubber and Rubber Latices - Nomenclature

2.1.3 Electric Power Research Institute Publications

Available from EPRI, 3420 Hillview Avenue, Palo Alto, CA 94304, www.epri.com.

NP-6608 Shelf Life of Elastomeric Components

2.1.4 U.S. Government Publications

Copies of these documents are available online at http://quicksearch.dla.mil.

AFML-TR-67-235Literature Survey on the Effects of Long-Term Shelf Aging of Elastomer Materials

ANA Bulletin 438Age Control of Age-Sensitive Elastomeric Items

DoD Manual 4140.27:

Vol. 1 DoD Shelf-Life Management Program: Program Administration

Vol. 2 DoD Shelf-Life Management Program: Materiel Quality Control Storage Standards

MIL-HDBK-695 Rubber Products: Recommended Shelf Life

MIL-STD-1523 Age Control of Age-Sensitive Elastomeric Materials (Cancelled)

2.2 Definitions

ELASTOMER: An elastomer is a material that possesses elastic properties and has undergone vulcanization and/or conversion into a finished product.

SEAL: A seal is an elastomeric finished product or an assembly with an elastomeric element which prevents the excursion of media on one side of the product from migrating to the other side.

SERVICE LIFE: The service life of an elastomeric part is defined as the time period after installation that the seal will be required to perform the intended function.

STORAGE LIFE: The storage life is the maximum period of time, starting from the time of manufacture, that an elastomeric seal element, appropriately packaged, may be stored under specific conditions, after which time it is regarded as unserviceable for the purposes for which it was originally manufactured. The time of manufacture is the time of cure for thermoset elastomers or the time of conversion into a finished product for thermoplastic elastomers.

HARDWARE COMPONENT: A hardware component is a unit in which the elastomeric seal element is placed.

3. PACKAGING

3.1 General

Unless otherwise specified by the customer at the time of order, the elastomeric seal or seal assembly shall be packaged:

a. in individually sealed envelopes by the manufacturer, or

b. in individually sealed packets in multiple envelopes by the manufacturer provided that individually packaged elastomeric seals or assemblies can be removed without affecting the seal integrity of the other packets.

If the parts are repackaged by a distributor, the manufacturer will ship the properly identified parts to the distributor then the responsibility for the parts shifts to the distributor since the manufacturer cannot ensure that the parts will be properly packaged with minimum exposure to environmental conditions.

The packaging shall be carried out in an atmosphere in which the relative humidity is not greater than 65%. Contamination by oil, grease, etc., shall be avoided.

Seal assemblies (all components) shall be packaged in the same sealed envelope so that all elements of the assembly are present when the package is opened.

3.2 Packaging Materials

All packaging materials shall be free of copper naphthenates or creosote preservatives which can degrade rubber.

Suitable materials include Kraft bags and opaque polyethylene bags more than 0.003 inches (0.076) mm thick. Opaque packaging is required. Metal foil bags can be used provided they are salt free.

NOTE: Phosphate ester hydraulic fluids and polyol ester based gas turbine lubricants soften and compromise polyethylene bags so care shall be taken to avoid exposure of polyethylene storage bags to fluids.

3.3 Labeling

Unless otherwise directed by the customer's drawing or procurement document, each package or container shall be labeled with the following information which shall be visible from the outside of the package without breaking the seal:

a. Manufacturers' part number;

b. Specification number and Revision level;

c. Customer's part number and/or contract number (if requested);

d. Quantity in package;

e. Manufacturer's name and/or identity number (such as CAGE Code);

f. Quarter and Year of cure or manufacturer of the rubber component (e.g., July to September 1997 = 3Q97);

g. Manufacturer's batch number;

h. Rubber class designation per ASTM D1418;

i. Packager's name (if different from manufacturer) and packaged date.

The expiration date shall only be added to the label if the seal is to be purchased directly by the military procurement agencies.

AMS2817 allows individually packaged parts to be supplied to a distributor who can then allocate them to orders, if parts are purchased from the manufacturer under one contract number and then sold, without being repackaged, by the supplier to the consumer under a different contract number, the original contract number shall be crossed out and the new contract number applied in the heat seal area of the envelope. Thus cradle to grave traceability and maximum protection of the elastomer seal element is guaranteed.

4. STORAGE

4.1 Temperature

The storage temperature shall be below 100 °F (38 °C), except when higher temperatures are caused by temporary climate changes, and the seals shall be stored away from direct sources of heat such as boilers, radiators, and direct sunlight.

NOTE: If the storage temperature is below 59 °F (15 °C), care shall be exercised during the handling of stored seals as they may have stiffened and become susceptible to distortion if not handled carefully.

The temperature of the seals stored below 59 °F (15 °C) shall be raised to approximately 68 °F (20 °C) throughout their mass before being installed into a component.

4.2 Humidity

The relative humidity shall be such that given the variations of temperature in storage, condensation does not occur. In any event, if the elastomers are not stored in sealed moisture proof bags, the relative humidity of the atmosphere in storage shall be less than 75% Relative Humidity (RH), or if polyurethanes are being stored, shall be less than 65% RH.

4.3 Light

Elastomeric seals shall be protected from light sources, in particular direct sunlight or intense artificial light having an ultraviolet content. The individual opaque storage bags offer the best protection.

NOTE: It is advisable that windows of storage rooms where elastomers are stored in bulk be covered with a red or orange coating or screen.

4.4 Radiation

Precautions shall be taken to protect the stored seals from all sources of ionizing radiation likely to cause damage to stored articles.

4.5 Ozone

As ozone is particularly deleterious to some elastomeric seals, storage rooms shall not contain any equipment that is capable of generating ozone such as mercury vapor lamps, high voltage electrical equipment giving rise to electric sparks or silent electrical discharges. Combustion gases and organic vapor shall be excluded from storage rooms as they may give rise to ozone via photochemical processes.

4.6 Deformation

Elastomeric seals shall be stored free from superimposed tensions and compressive stresses or other causes of deformation. Where articles are packaged in a strain-free condition, they shall be stored in their original packaging. In case of doubt, the manufacturer's advice shall be sought.

Rings of large inside diameter shall be formed into three equal superimposed loops so as to avoid creasing or twisting.

NOTE: It is not possible to achieve this condition by forming just two loops.

4.7 Contact with Liquid and Semi-Solid Materials

Elastomeric seals shall not be allowed to come into contact with liquid or semi-solid materials (for example, gasoline, greases, acids, disinfectants, cleaning fluids) or their vapors at any time during storage unless these materials are by design an integral part of the component or the manufacturer’s packaging. When elastomeric seals are received coated with their operational media, they shall be stored in this condition.

4.8 Contact with Metals

Certain metals and their alloys (in particular, copper, manganese, and iron) are known to have deleterious effects on elastomers. Elastomeric seals shall not be stored in contact with such metals (except when bonded to them) but shall be protected by individual packaging.

4.9 Contact with Dusting Powder

Dusting powders shall only be used for the packaging of elastomeric items in order to prevent blocking. In such instances, the minimum quantity of powder to prevent adhesion shall be used.

4.10 Contact between Different Elastomers

Contact between different polymeric elastomers and elastomers of different seals shall be avoided. They shall not be packaged together in the same envelope.

4.11 Elastomeric Seals with Metal Parts Bonded to Them

The metal part of bonded elastomeric seals shall not come in contact with the elastomeric element of another seal. The bonded seal shall be individually packaged. Any preservative used on the metal shall be such that it will not affect the elastomeric element or the bond to such an extent that the seal will not comply with the product specification.

4.12 Stock Rotation

Elastomeric seal stock shall be rotated on the FIFO principle (First In - First Out) so that the most recent manufactured parts remain in inventory.

5. RECORDING OF DATA DURING STORAGE

A record shall be kept of the initial physical properties of the elastomeric seal elements placed in storage. The records shall include the actual numerical results of the physical property tests for that batch of seals and the range of properties observed during testing. This record shall be maintained by the customer's Quality Organization until such time that the stock of seals has been depleted.

In addition to the inspection and testing reports, a record shall be maintained of the label information so that all information can be cross referenced.

6. DISCARDING OF SEALS

Once the storage life has expired, the elastomeric seals shall be removed from inventory and destroyed per internal company procedures for the destruction of such materials.

7. STORAGE PERIOD

Unless otherwise specified in the Product Specification or Procurement Document notes, the maximum storage periods for unassembled elastomeric seal elements shall be those described in Tables 1, 2, and 3. This presupposes that the stored elastomers meet the current technical requirements. If they do not, they shall be discarded since only those elastomeric seals that meet the current technical requirements shall be used in applications to provide the highest integrity seal for the current system requirements.

Some of the Material Specifications listed in Tables 1 and 2 have relational Part Number Specifications associated with them. These associated Part Number Specifications are provided in Appendix A together with the applicable Material Specification.

The determination of the storage period is sometimes erroneously calculated. The correct determination of storage life is based upon determining the first quarter of storage based on all elastomeric items manufactured during any given quarter and shall not be considered one quarter old until the end of the succeeding quarter. For example, a product cured during January, February or March of any year will not be considered one quarter old until July 1 of that same year. A product cured during October, November or December of any year will not be considered one quarter old until April 1 of the following year.

Table 1 - Aerospace material specifications

Specification	Title	Polymer	Maximum Storage Life (Years)	Specification Status
AMS3200	Butadiene-Acrylonitrile (NBR) Rubber Petroleum-Base Hydraulic Fluid Resistant (55-65)	NBR	15	
AMS3201	Butadiene Acrylonitrile (NBR) Rubber, Dry Heat Resistant, 35-45	NBR	15	
AMS3202	Butadiene-Acrylonitrile (NBR) Rubber Dry Heat Resistant (55-65)	NBR	15	
AMS3205	Synthetic Rubber Low-Temperature Resistant, 45-55	CR	15	
AMS3208	Chloroprene (CR) Rubber, Weather Resistant, 45-55	CR	15	Stabilized
AMS3209	Chloroprene Rubber, Weather Resistant (65-75)	CR	15	Stabilized
AMS3210	Chloroprene Rubber, Electrical Resistant (65-75)	CR	15	
AMS3212	Acrylonitrile Butadiene (NBR) Rubber Aromatic Fuel Resistant (55-65)	NBR	15	
AMS3213	Acrylonitrile Butadiene (NBR) Rubber Aromatic Fuel Resistant (75-85)	NBR	15	
AMS3214	Acrylonitrile Butadiene (NBR) Rubber, Aromatic Fuel Resistant, 35-45	NBR	15	
AMS3215	Acrylonitrile Butadiene (NBR) Rubber Aromatic Fuel Resistant (65-75)	NBR	15	
AMS3216	Fluorocarbon (FKM) Rubber, High Temperature - Fluid Resistant Low Compression Set (70-80)	FKM	Unlimited	
AMS3218	Fluorocarbon (FKM) Rubber, High Temperature - Fluid Resistant Low Compression Set (85-95)	FKM	Unlimited	
AMS3220	Rubber, Synthetic General Purpose, Fluid Resistant, 55-65	NBR	15	
AMS3227	Acrylonitrile Butadiene (NBR) Rubber, Hot Oil and Coolant Resistant, Low Swell (55-65)	NBR	15	
AMS3228	Acrylonitrile Butadiene (NBR) Rubber, Hot Oil and Coolant Resistant, Low Swell (65-75)	NBR	15	Cancelled
AMS3229	Acrylonitrile Butadiene (NBR) Rubber, Hot Oil and Coolant Resistant, Low Swell (75-85)	NBR	15	
AMS3240	Chloroprene (CR) Rubber, Weather Resistant, 35-45	CR	15	
AMS3241	Chloroprene (CR) Rubber Weather Resistant (55-65)	CR	15	
AMS3242	Chloroprene (CR) Rubber Weather Resistant (75-85)	CR	15	
AMS3243	Chloroprene (CR) Rubber Flame Resistant (55-65)	CR	15	
AMS3304	Silicone Rubber, General Purpose (65-75)	Q	Unlimited	
AMS3305	Silicone Rubber, General Purpose (75-85)	Q	Unlimited	
AMS3306	Rubber, Silicone 1200 psi (8.27 MPa) High Modulus (55-65)	VMQ	Unlimited	Stabilized
AMS3307	Silicone (VMQ) Rubber, Low Compression Set Non-Oil Resistant (65-75)	VMQ	Unlimited	
AMS3325	Fluorosilicone (FVMQ) Rubber, Fuel & Oil Resistant (55-65)	FVMQ	Unlimited	
AMS3327	Fluorosilicone (FVMQ) Rubber, High Temperature Fuel & Oil Resistant (70-80)	FVMQ	Unlimited	
AMS3328	Fluorosilicone (FVMQ) Rubber, Fuel and Oil Resistant (35-45)	FVMQ	Unlimited	
AMS3329	Fluorosilicone (FVMQ) Rubber, Fuel and Oil Resistant, High Strength, 45-55	FVMQ	Unlimited	
AMS3330	Fluorosilicone (FVMQ) Rubber, Fuel and Oil Resistant (45-55)	FVMQ	Unlimited	

Table 1 - Aerospace material specifications (continued)

Specification	Title	Polymer	Maximum Storage Life (Years)	Specification Status
AMS3331	Fluorosilicone (FVMQ) Rubber, Fuel and Oil Resistant (65-75)	FVMQ	Unlimited	
AMS3334	Silicone Rubber, Extreme Low Temperature Resistant, 35-45	PVMQ	Unlimited	
AMS3336	Silicone (PVMQ) Rubber, Extreme Low Temperature - Resistant (55-65)	PVMQ	Unlimited	Stabilized
AMS3337	Silicone (PVMQ) Rubber, High & Extreme Low Temperature Resistant (65-75)	PVMQ	Unlimited	
AMS3338	Silicone (PVMQ) Rubber, Extreme Low Temperature Resistant (75-85)	PVMQ	Unlimited	Stabilized
AMS3345	Silicone Rubber, 1000 psi (6.90 MPa) Tensile Strength, 45-55	Q	Unlimited	
AMS3346	Silicone Rubber - 1000 psi (55-65)	Q	Unlimited	
AMS3347	Silicone Rubber - 1200 psi, High Modulus (45-55)	Q	Unlimited	
AMS3348	Silicone (VMQ) Rubber 1150 psi (7.93 MPa) Tensile Strength, High Resiliency 25-35	VMQ	Unlimited	Stabilized
AMS3349	Silicone (VMQ) Rubber, 1100 psi (7.58 MPa) Tensile Strength, High Resiliency, 65-75	VMQ	Unlimited	Stabilized
AMS3356	Silicone (VMQ) Rubber, Lubricating Oil and Compression Set Resistant, Electrical Grade (55-65)	VMQ	Unlimited	Stabilized
AMS3357	Rubber, Silicone (VMQ), Lubricating Oil and Compression Set Resistant, 65-75	VMQ	Unlimited	
AMS3382	Tetrafluoroethylene/Propylene Rubber (FEPM) Hydraulic Fluid and Synthetic Oil Resistant 70 to 80 and 85 to 95	FEPM	Unlimited	
AMS3384	Rubber, Fluorocarbon Elastomer (FKM), 70 to 80 Hardness, Low Temperature Sealing Tg -22 °F (-30 °C), For Elastomeric Shapes or Parts in Gas Turbine Engine Oil, Fuel and Hydraulic Systems.	FKM	Unlimited	
AMS7255	Rings, Sealing, Tetrafluoroethylene / Propylene Rubber (FEPM) Hydraulic Fluid and Synthetic Oil Resistance 70 to 80	FEPM	Unlimited	Stabilized
AMS7256	Rings, Sealing, Tetrafluoroethylene/Propylene Rubber (FEPM) Hydraulic Fluid and Synthetic Oil Resistance 85 to 95	FEPM	Unlimited	Stabilized
AMS7257	Rings, Sealing, Perfluorocarbon (FFKM), Rubber, High-Temperature-Fluid Resistant (70-80)	FFKM	Unlimited	
AMS7258	Rings, Sealing, Acrylonitrile Butadiene (NBR) Rubber Fuel Resistant, Low Shrinkage (65-75)	NBR	15	
AMS7259	Rings, Sealing, Fluorocarbon (FKM) Rubber High-Temperature-Fluid Resistant, Very Low Compression Set (85-95)	FKM	Unlimited	
AMS7260	Rings, Butadiene-Acrylonitrile (NBR) Rubber, Molded Fuel and Low 0-80	NBR	15	
AMS7264	Rings, Sealing, Silicone Rubber, High Temperature Resistant, Low Compression Set, 65-75	Q	Unlimited	
AMS7266	Rings, Sealing, Fluorosilicone Rubber, General Purpose, High Temperature, Fuel and Oil Resistant 65-75	FVMQ	Unlimited	
AMS7267	Rings, Sealing, Silicone (VSI) Rubber Heat Resistant, Low Compression Set (70-80)	VSI	Unlimited	

Table 1 - Aerospace material specifications (continued)

Specification	Title	Polymer	Maximum Storage Life (Years)	Specification Status
AMS7268	Rings, Sealing, Silicone Rubber, Low Compression Set, Non-Oil Resistant (65-75)	Q	Unlimited	
AMS7269	Rings, Sealing, Silicone (PVMQ) Rubber, Low Outgassing, Space and Vacuum Service (45-55)	PVMQ	Unlimited	
AMS7270	Rings, Sealing, Butadiene-Acrylonitrile (NBR) Rubber, Fuel Resistant (65-65)	NBR	15	
AMS7270	Rings, Sealing, Butadiene-Acrylonitrile (NBR) Rubber, Fuel Resistant (65-65)	NBR	15	
AMS7271	Rings, Sealing, Butadiene-Acrylonitrile (NBR) Rubber Fuel and Low Temperature Resistant (60-70)	NBR	15	
AMS7272	Rings, Sealing, Butadiene-Acrylonitrile (NBR) Rubber Synthetic Lubricant Resistant 65-75	NBR	15	
AMS7273	Rings, Sealing, Fluorosilicone (FVMQ) Rubber, High Temperature Fuel and Oil Resistant 70-80	FVMQ	Unlimited	
AMS7274	Rings, Sealing, Butadiene-Acrylonitrile (NBR) Rubber Oil Resistant (65-75)	NBR	15	
AMS7276	Rings, Sealing Fluorocarbon (FKM) Rubber High-Temperature - Fluid Resistant Very-Low Compression Set (70-80)	FKM	Unlimited	
AMS7287	Fluorocarbon Elastomer (FKM), High Temperature / HTS Oil Resistant/ Fuel Resistant Low Compression Set/ 70 to 80 Hardness, Low Temperature Tg -22 °F (-30 °C), For Seals in Oil/ Fuel/ Specific Hydraulic Systems.	FKM	Unlimited	
AMS7379	Rubber: Fluorocarbon Elastomer (FKM) 70 to 80 Hardness, Low Temperature Sealing Tg -40 °F (-40 °C) For Elastomer Seals in Aircraft Engine Oil, Fuel and Hydraulic Systems	FKM	Unlimited	
AMS-P-5315	Packing, Preformed, Hydrocarbon Fuel Resistant	NBR	15	
AMS-P-5510	Packing, Preformed, Straight Thread Tube Fitting Boss, Type Hydraulic (-65° to 160°F)	NBR	15	
AMS-P-5516	Packing, Preformed, Petroleum Hydraulic Fluid Resistant, 160°F	NBR	15	Superseded by MIL-DTL-5516
AMS-P-25732	Packaging, Preformed, Petroleum Hydraulic Fluid Resistant, Limited Service at 275°F (135°C)	NBR	15	Cancelled. Superseded by MIL-P-25732
AMS-P-83461	Packing, Preformed, Petroleum Hydraulic Fluid Resistant, Improved Performance at 275°F (135°C)	NBR	15	
AMS-R-6855	Rubber, Synthetic, Sheets, Strips, Molded or Extruded Shapes			Cancelled. Superseded by MIL-PRF-6855
	Class 1 - All Grades	NBR	15	
	Class 2 - All Grades	CR	15	
	Class 3 - All Grades	SBR	3	
	Class 4 - All Grades	CR	15	
	Class 5 - All Grades	SBR	3	
AMS-R-7362	Rubber, Synthetic, Solid, Sheet, Strip and Fabricated Parts, Synthetic Oil Resistant	NBR	15	
AMS-R-25988	Rubber, Fluorosilicone Elastomer, Oil and Fuel Resistant, Sheets, Strips, Molded Parts and Extruded Shapes	FVMQ	Unlimited	

Table 1 - Aerospace material specifications (continued)

Specification	Title	Polymer	Maximum Storage Life (Years)	Specification Status
AMS-R-83248	Rubber, Fluorocarbon Elastomer, High Temperature, Fluid, and Compression Set Resistant	FKM	Unlimited	Cancelled. Superseded by AMS3216, 3218, 7259, 7276
AMS-R-83285	Rubber, Ethylene-Propylene, General Purpose	EPDM	Unlimited	Stabilized
AMS-R-83412	Rubber, Ethylene-Propylene, Hydrazine Resistant	EPDM	Unlimited	Stabilized
AMS-R-83485	Rubber, Fluorocarbon Elastomer, Improved Performance at Low Temperature	FKM	Unlimited	Cancelled. Superseded by AMS3384 and AMS7287
NAS1613	Seal Element, Packing, Preformed, Ethylene Propylene Rubber	EPDM	Unlimited	

NOTE: Some organizations consider “Unlimited” as the equivalent of 25 years.

Table 2 - Military and Federal specifications

Specification	Title	Polymer	Maximum Storage Life (Years)	Specification Status
MIL-DTL-432	Gaskets, Nonmetallic, Synthetic Rubber	NBR	15	Inactive
MIL- DTL-81716	Packing, Preformed, Straight Thread Tube Fitting Boss, Type II Hydraulic (Minus 65°F to Plus 275°)	NBR	15	Inactive
MIL- DTL-83397	Rubber, Polyurethane, Castable, Humidity Resistant	AU or EU	5	Inactive
MIL-P-5315	Packing, preformed, hydrocarbon fuel resistant	NBR	15	Cancelled. Superseded byAMS-P-5315
MIL-P-5510	Packing, preformed, straight tube fitting boss, type 1 hydraulic (-65 deg to 160 deg F)	NBR	15	Cancelled. Superseded byAMS-P-5510
MIL-P-5516	Packing, preformed, petroleum hydraulic fluid resistant, 160 deg F	NBR	15	Revised to MIL-DTL-5516 and inactive
MIL-P-25732	Packing, preformed, petroleum hydraulic fluid	NBR	15	Inactive
MIL- PRF-2765	Rubber Sheet, Strip, Extruded, & Molded Shapes, Synthetic, Oil Resistant	NBR	15	
MIL- PRF-6855	Rubber, Synthetic, Sheets, Strips, Molded or Extruded Shapes Class 1 - All Grades Class 2 - All Grades Class 3 - All Grades Class 4 - All Grades Class 5 - All Grades	 NBR CR SBR CR SBR	 15 15 3 15 3	
MIL-R-7362	Rubber, synthetic, solid, sheet, strip and fabricated parts, synthetic oil resistant	NBR	15	Cancelled. Superseded by AMS-R-7362
MIL- DTL-25988	Rubber, fluorosilicone elastomer, oil-and-fuel-resistant, sheets, strips, molded & extruded	FVMQ	Unlimited	
MIL-R-81828	Rubber, Chlorosulfonated Polyethylene Elastomer, Sheet & Molded Shapes, Ozone Resistant	CSM	15	Cancelled
MIL-R-83248	Rubber, Fluorocarbon Elastomer, High Temperature, Fluid and Compression Set Resistant	FKM	Unlimited	Cancelled. Superseded by AMS3216, 3218, 7259, 7276
MIL-R-83285	Rubber, Ethylene-Propylene, General Purpose	EPDM	Unlimited	Cancelled. Superseded by AMS-R-83285
MIL-R-83412	Rubber, Ethylene-propylene, Hydrazine Resistant	EPDM	Unlimited	Cancelled. Superseded by AMS-R-83412

Table 2 - Military and Federal specifications (continued)

Specification	Title	Polymer	Maximum Storage Life (Years)	Specification Status
MIL-P-83461	Packing, Preformed, Petroleum Hydraulic Fluid Resistant, Improved Performance at 275°F (135°C)	NBR	15	Cancelled. Superseded by AMS-P-83461
MIL-R-83485	Rubber, fluorocarbon elastomer, improved performance at low temperatures	FKM	Unlimited	Cancelled. Superseded by AMS-R-83485
FED-ZZ-R-765	Silicone Rubber, General Purpose	Q	Unlimited	Cancelled. Superseded by A-A-59588
A-A-59588	Rubber, Silicone	Q	Unlimited	

NOTE: Some organizations consider “Unlimited” as the equivalent of 25 years.

Table 3 - Shelf life summarized by polymer type

Polymer	Maximum Storage Life (Years)
AU or EU	5
CR	15
CSM	15
EPDM	Unlimited
FEPM	Unlimited
FFKM	Unlimited
FKM	Unlimited
FVMQ	Unlimited
IIR	Unlimited
NBR	15
PVMQ	Unlimited
Q	Unlimited
SBR	3
VMQ	Unlimited

8. NOTES

8.1 Revision Indicator

A change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications nor in documents that contain editorial changes only.

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APPENDIX A

Table A1 - O-Ring part number cross over to material specification

Part Number	Part Number Specification (Superseded Specification)	Previous Part Number	Material Specification (Superseded Specification)
AA55549-XX	A-A-55549 (MS90064)	MS90064-XX	AMS3302, A-A-59588 (ZZ-R-765)
AA55801-XXXXX	A-A-55801		A-A-55801
AS3084-XX	AS3084 (Stabilized)		AMS7276 (AMS7280)
AS3085-XXX	AS3085 (Stabilized)		AMS7276 (AMS7280)
AS3208-XX	AS3208 (MIL-R-83248/1) (MS9387) (NAS1595)	M83248/1-XXX MS9387-XX NAS1595-XX	AMS7276 (MIL-R-83248, AMS-R-83248) (AMS7278) (MIL-R-25897)
AS3209-XXX	AS3209 (MIL-R-83248/1) (MS9388) (MS17413) (NAS1593)	M83248/1-XXX MS9388-XXX MS17413-XXX NAS1593-XXX	AMS7276 (MIL-R-83248, AMS-R-83248) (AMS7278) (AMS7278) (MIL-R-25897)
AS3551-XXX	AS3551(MS9241) (MS9355)	MS9241-XXX MS9355-XX	AMS7272
AS3569-XXX	AS3569 (AN123951 THRU AN124050)	AN123951 thru AN124050	AMS7270
AS3570-XXX	AS3570 (AN123851 thru AN123950)	AN123851 thru AN123950	AMS7274
AS3578-XXX	AS3578 (MS9020)	MS9020-XX	AMS7271
AS3578-XXX	AS3578 (MS9020) (MS9021)	MS9020-XX MS9021-XXX	AMS7271
AS3581-XXX	AS3581 (MIL-R-83248/2) (MS9970) (NAS1594) (NAS1596)	M83248/2-XXX MS9970-XXX NAS1594-XXX NAS1596-XX	AMS7259 (MIL-R-83248, AMS-R-83248) (AMS7279) (MIL-R-25897) (MIL-R-25897)
AS3582-XXX	AS3582 (MS9068)	MS9068-XXX	AMS3304
AS5728-XXX	AS5728		AMS7268
AS5729-XXX	AS5729	AMS-R-83248/1-XXX	AMS7379
AS6203-XX	AS6203	AMS-R-83248/1-XX	AMS7379
M25988/1-XXX	MIL-R-25988/1		MIL- DTL-25988, AMS-R-25988
M25988/2-XXX	MIL-R-25988/2		MIL- DTL-25988, AMS-R-25988
M25988/3-XXX	MIL-R-25988/3		MIL- DTL-25988, AMS-R-25988
M25988/4-XXX	MIL-R-25988/4		MIL- DTL-25988, AMS-R-25988
M83412/1-XXX	AMS-R-83412/1 (MIL-R-83412/1)		AMS-R-83412 (MIL-R-83412)

Table A1 - O-Ring part number cross over to material specification (continued)

Part Number	Part Number Specification (Superseded Specification)	Previous Part Number	Material Specification (Superseded Specification)
M83485/1	AS83485/1 (MIL-R-83485/1, AMS-R-83485/1)	M83485/1	AS83485/1 (MIL-R-83485/1, AMS-R-83485/1)
MA3352XXXXX	MA3352		AMS7276
MA3434XXXXX	MA3434		AMS7273
MA3442XXXXX	MA3442		AMS7267
MA3445XXXXX	MA3445		AMS-R-83485 (MIL-R-83485,)
MS28775-XXX	AS28775 (MS28775) (AN6227) (AN6230)	AN6227-XX AN6230-XX	MIL-P-25732 (MIL-P-5516, CLASS B) (MIL-P-5516, CLASS B)
MS28778-XX	AS28778 (AN6290)	AN6290-XX	AMS-P-5510 (MIL-P-5510)
MS28778-XX	AS28778 (MS28778)		AMS-P-5510 (MIL-P-5510)
MS28900-XX	MS28900 (Inactive)		AMS3209
MS29512-XX	AS29512 (MS29512)		AMS-P-5315 (MIL-P-5315)
MS29513-XXX	AS29513 (MS29513)		AMS-P-5315 (MIL-P-5315)
MS29561-XXX	AS29561 (MS29561)		AMS-R-7362 (MIL-R-7362)
MS3393-XX	AS33931		MIL-DTL-81716 (Inactive)
MS9385-XX	AS9385 (MS9385)		AMS7267
MS9386-XXX	AS9386 (MS9386)		AMS7267
MS9966-XX	AS9966 (MS9966)		AMS7273
MS9967-XXX	AS9967 (MS9967)		AMS7273
NAS617-XXX	NAS617		AMS-R-7362 (MIL-R-7362)
NAS1611-XXXA	NAS1611	NAS1611-XXX	NAS1613
NAS1612-XXA	NAS1612	NAS1612-XX	NAS1613
NSA 8201-X	NSA8201		NAS1613
NSA 8204-XXX	NSA8204		NAS1613
NSA8205-XXX	NSA8205		AMS3242
NSA8206-XXX	NSA8206		AMS7267

Table A2 - Non O-Ring part number cross over to material specification

Part Number	Part Number Specification (Superseded Specification)	Previous Part Number	Material Specification (Superseded Specification)
AN6225BXX	AN6225 (Inactive)	AN6225-XX	MIL-DTL-5516, CLASS A
AN6226-XX	AN6226 (Inactive)		MIL-P-25732 (MIL-P-5516, CLASS B)
AN6238-1	AN6238 (Inactive)		MIL-P-25732 (MIL-P-5516, CLASS B)
AN902BXX	AN902 (Cancelled use AS28778)	AN902-XX	MIL-P-25732 (MIL-P-5516, CLASS B)
MS27194-XX-XX	AS27194 (MS27194)		AMS-P-5315 (MIL-P-5315)
MS27195-XX-XX	AS27195 (MS27195)		AMS-R-7362 (MIL-R-7362)
MS27196-XX-XX	AS27196 (MS27196)		AMS3216 (MIL-R-83248, AMS-R-83248)
MS27197-XX-XX	AS27197 (MS27197)		AMS7268 (ZZ-R-765)
MS27198-XX-XX	AS27198 (MS27198)		MIL- DTL-25988, AMS-R-25988
MS28772-XXX	AS28772 (MS28772)		MIL-P-25732 (MIL-P-5516, Class B)