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Aerospace fluid systems — Elastomer seals — Storage and shelf life

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National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Aerospace fluid systems — Elastomer seals — Storage and shelf life

Systèmes de fluides pour l'aéronautique et l'espace — Joints élastomères — Stockage et durée de conservation

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ISO 27996 was prepared by Technical Committee ISO/TC 20, *Aircraft and Space Vehicles*, Subcommittee SC 10, *Aerospace fluid systems and components*.

Introduction

In fluid power systems, power is transmitted and controlled through a fluid (liquid or gas) under pressure within an enclosed circuit. Components are designed to meet these requirements under varying conditions. Testing of components to meet performance requirements provides users a basis of assurance for determining design application and for checking component compliance with their stated requirements.

INTERNATIONAL STANDARD **ISO 27996:2009(E)**

Aerospace fluid systems — Elastomer seals — Storage and shelf life

1 Scope

This International Standard is applicable to 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.

The requirements for packaging are an integral part of the controlled storage procedure and provide a means of positive product identity from the time of manufacture to the time of assembly into a component.

This International Standard does not establish limitations or storage times for assembled components nor the operating life of these components.

The information contained in this International Standard is intended for use by those organizations that do not have specific requirements or recommendations already in place for the control of elastomeric seals and seal assemblies.

This International Standard can be specified in control, storage and procurement documents. However, when the requirements of this International Standard are in conflict with the customer's requirements or specifications, the requirements of the customer's detailed specifications take precedence.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1629, *Rubbers and lattices — Nomenclature*

ISO 5598, *Fluid power systems and components — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598 and the following apply.

3.1
date of vulcanization
date on which the elastomer product was vulcanized

NOTE Date of vulcanization is expressed in quarters (Q) of a year.

EXAMPLE 4Q08 (October to December, 2008).

3.2
elastomer
material that possesses elastic properties and has undergone vulcanization and/or conversion into a finished product

NOTE The basic building block of elastomer is the rubber polymer it contains.

3.3
end user
user carrying out the installation into a hardware component which can include an aircraft

3.4
extended storage life
period for which an elastomer seal element moulded from class III material and properly packaged can be stored after the initial storage period and the successful reinspection and testing of representative samples

3.5
hardware component
unit in which the elastomeric seal element is installed

3.6
installation date
date of the first installation into a hardware component

3.7
limited storage life
period of time during which an elastomeric seal element which has not been properly packaged by the manufacturer in an expedient manner after vulcanization can be installed without first testing for product integrity

3.8
rubbers
polymeric building blocks of an elastomer's chemical composition

NOTE Rubbers are further defined in ISO 1629.

3.9
seal
elastomeric seal configuration 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

3.10
storage life
period of time, in quarters of a year, from the date of vulcanization until installation into a hardware component

NOTE The storage life is counted from the quarter following the date of vulcanization.

3.11
storage life limit
maximum period of time, starting from the quarter following vulcanization, that an elastomeric seal element, appropriately packaged, can be stored under specific conditions, after which time it is regarded as unserviceable for the purposes for which it was originally manufactured

4 General

The life of elastomeric seal elements is reduced by the influence of environmental factors, e.g. ozone, heat and light. To extend life to the full storage life limit, the seal elements shall be properly packaged and certified as such by the manufacturer as quickly as possible following vulcanization. If the seal elements are not properly packaged and certified as such by the manufacturer, then the limited storage life requirement is followed and package labels shall indicate this.

5 Packaging

5.1 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.

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.

5.2 Packaging materials

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

Suitable materials include kraft bags (polyethylene coated kraft paper) and polyethylene bags more than 0,075 mm thick and certified to be ultraviolet (UV) resistant. Opaque packaging is preferred, but certified UV resistant materials can be used if available. Metal foil bags can be used provided they are salt free.

5.3 Labelling

Each package or container shall be labelled with the following information, which shall be visible from the outside of the package without breaking the seal:

a) manufacturer's 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 [e.g. commercial and government entity (CAGE) code; supplier number];

f) quarter and year of cure or manufacturer of the rubber component [e.g. 3Q08 (July to September 2008)];

g) manufacturer's batch number;

h) rubber class designation in accordance with ISO 1629;

i) identity of packager and package date, if different than manufacturer.

Expiration date is not required to be on the label and is added only when purchaser specifically requests the addition.

6 Storage

6.1 Temperature

The storage temperature should be in the range of 5° C to 30 °C, except when higher or lower temperatures are caused by temporary climate changes. Articles shall be stored away from direct sources of heat such as boilers, radiators and direct sunlight.

NOTE If the storage temperature is below 10 °C, it is important to take care during the handling of stored articles, as they might have stiffened and become susceptible to distortion if not handled carefully.

The temperature of articles stored below 10 °C shall be raised to approximately 20 °C throughout their mass before being installed into a component.

6.2 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 should be between 40 % and 70 %, or if polyurethanes are being stored, the relative humidity should not exceed 65 %.

6.3 Light

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

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.

6.4 Radiation

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

6.5 Atmosphere

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 vapour lamps, high voltage electrical equipment giving rise to electric sparks or silent electrical discharges. Combustion gases and organic vapour shall be excluded from storage rooms, as they may give rise to ozone via photochemical processes.

6.6 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 advise 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.

6.7 Contact with liquid and semi-solid materials

Elastomeric seals shall not be allowed to come into contact with liquid or semi-solid materials (e.g. gasoline, greases, acids, disinfectants, cleaning fluids) or their vapours 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.

6.8 Contact with metals

Certain metals and their alloys (in particular, copper, manganese, iron and cadmium) 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.

6.9 Contact with dusting powder

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

6.10 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.

NOTE Contact between elastomers and polyvinyl chloride (PVC) is not permitted.

6.11 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.

6.12 Stock rotation

Elastomeric seal stock should be rotated on the “first in, first out” (FIFO) principle, so that the most recent manufactured parts remain in inventory.

7 Recording of data during storage

A record shall be kept of the initial physical properties and the dimensional characteristics 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 user’s quality organization until such time that the stock of seals has been depleted.

In situations where limited service life seals are used, the testing results prior to installation shall also be maintained by the user’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.

8 Discarding of seals

8.1 After limited storage life has been exceeded and negative test results

Once the limited storage life requirement has been exceeded for those elastomeric seals not packaged by the manufacturer, the physical properties of the seals need to be verified. If the physical properties are found to be within ± 15 % of the original properties of the seals, the seals can be installed in the hardware component. If any of the physical properties of the seals are outside the ± 15 % window, then the seals should be removed from inventory and destroyed in accordance with internal company procedures for the destruction of such materials.

8.2 After storage life limit has been exceeded

Once the storage life limit has expired, the elastomeric seals should be removed from inventory and destroyed in accordance with internal company procedures for the destruction of such materials.

9 Storage period

9.1 Duration of storage

Unless otherwise specified in the product specification or purchase order notes, the maximum storage periods for unassembled elastomeric seal elements shall be those specified in Tables 1 and 2. This presupposes that the stored elastomers meet the current specification revisions. If they do not, there shall be a "use to depletion" comment on the current specification revision, or else they shall be discarded, since only those elastomeric seals that meet the current specification revision should be used in applications to provide the highest integrity seal for the current system requirements.

Table 1 — Limited storage life requirements

Material class	Material	Material symbol in accordance with ISO 1629	Limited storage life Quarters of a year
I	Styrene-butadiene rubber Polyester urethane, polyether urethane	SBR AU, EU	12
II	Acyrlonitrile-butadiene rubber Hydrogenated NBR Butyl, chlorobutyl, bromobutyl rubber Chloro-butadiene rubber	NBR HNBR IIR, CIIR, BIIR CR	28
III	Ethylene-propylene rubber	EPM, EPDM	40
IV	Fluorosilicone rubber Fluoro rubber Perfluoro rubber Silicone rubber Tetrafluoroethylene — propylene	FVMQ FKM FFKM VMQ, PVMQ FEPM	40

Table 2 — Storage life limits for properly packaged and stored elastomeric seals

Material class	Material	Material symbol in accordance with ISO 1629	Storage life limit Quarters of a year
I	Styrene-butadiene rubber Polyester urethane, polyether urethane	SBR AU, EU	12
II	Acyrlonitrile-butadiene rubber Hydrogenated NBR Butyl, chlorobutyl, bromobutyl rubber Chloro-butadiene rubber	NBR HNBR IIR, CIIR, BIIR CR	60
III	Ethylene-propylene rubber	EPM, EPDM	60[a]
IV	Fluorosilicone rubber Fluoro rubber Perfluoro rubber Silicone rubber Tetrafluoroethylene — propylene	FVMQ FKM FFKM VMQ, PVMQ FEPM	Unlimited

[a] The storage life of class III material can be extended for an additional 20 quarters of a year if the procedure in 9.2 is followed.

9.2 Extension of storage life for class III materials

9.2.1 General

Where it is necessary to consider extending the storage life of class III materials, the following procedure should be followed.

At or before the expiration of the storage life specified in Table 2, six to nine representative samples of the seals shall be removed from their packages and subjected to visual inspection and testing. If the samples all pass the visual inspection and testing, the storage life of the remaining seals may be extended an additional 20 quarters of a year provided they remain in their original packaging.

9.2.2 Visual inspection

Each of the samples shall be visually inspected for the following:

— permanent distortions (e.g. creases or flats);

— mechanical damage (e.g. cuts, tears, abraded areas or surface cracking);

— changes in surface condition (e.g. hardening, softening or tackiness).

9.2.3 Testing

If the samples are found to be visually acceptable, they should then be tested to ascertain that their relevant performance characteristics are within the acceptable performance characteristics for the appropriate specification to which they have been certified.

Testing to demonstrate that the product is serviceable should be carried out in accordance with the appropriate batch test requirements for the certified specification.

9.2.4 Extended storage life

If the samples pass the testing requirement, the test results shall be recorded and the shelf life extended for the remaining seals that have the same cure and batch. There shall be only one extended storage life period.

10 Identification statement

The following statement shall be used in test reports, catalogues and sales literature when electing to comply with ISO 27996:

"Storage and shelf life requirements are in accordance with ISO 27996, *Aerospace fluid systems — Elastomer seals — Storage and shelf life.*"

Bibliography

[1] ISO 2230, *Rubber products — Guidelines for storage*

[2] ISO 16031-1, *Aerospace fluid systems — O-rings, inch series: Inside diameters and cross sections, tolerances and size-identification codes — Part 1: Close tolerances for hydraulic systems*

[3] ISO 16031-2, *Aerospace fluid systems — O-rings, inch series: Inside diameters and cross sections, tolerances and size-identification codes — Part 2: Standard tolerances for non-hydraulic systems*

[4] AMS 2817, *Identification and packing, Preformed packings*

[5] ARP5316, *Storage of elastomeric seals and seal assemblies which include an elastomer element prior to hardware assembly*

[6] MIL-PRF-121G, *Barrier materials, greaseproof, waterproof, flexible, heat-sealable*

[7] MIL-PRF-131K, *Barrier materials, water vaporproof, greaseproof, flexible, heat-sealable*

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