11. Storage and Age Control of Elastomers

Storage Life

According SAE-ARP5316 issue 1998-11, 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 purpose for which it was originally manufactured. The time of manufacture is the cure date for thermoset elastomers or the time of conversion into a finished product for the thermoplastic elastomers.

Shelf life of elastomers when stored properly is especially determined by the specific compound.
Table 3A-3 is taken from MIL-HDBK-695C and distinguishes 3 basic groups of elastomers.

The values in this chart are minimal values. In practice, longer storage periods may be used especially when 10 or 20 year categories are involved provided the parts are properly stored and periodic checks are performed. Generally, polyethylene bags stored in cardboard containers or polyethylene lined craft paper bags insure optimal storage life.

Due to major improvements in compounding technique, storage life of relatively age-sensitive elastomers in normal warehousing conditions is considerable. MIL-HDBK-695C provides guidelines for recommended shelf life for different O-ring compounds.

Table 3A-3 MIL-HDBK-695C

Type of rubber	*Common or Trade Name*	*ASTM D1418 Abbreviation*	*ASTM D2000 Abbreviation*	*MIL-STD-417 Designation*
20 YEARS OR HIGHER:				
Silicone	Silicone	Q	FE	TA
Fluorosilicone	Silastic LS	FVMQ	FK	TA
Polysulfide	Thiokol	T	BK	SA
Fluorocarbons	Fluorel, Viton®	FKM	HK	-
Polyacrylate	Acrylic	ACM, ANM	DF, DH	TB
UP TO 10 YEARS:				
Chlorosulfonated Polyethylene	Hypalon	CSM	CE	-
Isobutylene/Isoprene	Butyl	IIR	AA, BA	RS
Polychloroprene	Neoprene	CR	BC, BE	SC
Polyether Urethane	Urethane	EU	BG	-
Polypropylene oxide	Propylene oxide	GPO	-	-
Ethylene/propylene	Ethylene propylene	EPDM	BA, CA	-
Ethylene/propylenediene	Ethylene propyleneterpolymercopolymer	EPM	BA, CA	-
Epichlorohydrin	Hydrin 100	CO	-	-
UP TO 5 YEARS:				
Butadiene/acrylonitrile	Nitrile, NBR	NBR	BF, BG, BK, CH	SB
Butadiene/styrene	SBR	SBR	AA, BA	RS
Cis-polybutadiene	Butadiene	BR	AA	RN
Cis 1, 4, polyisoprene	Natural, pale crepe	NR	AA	RN
Cis 1, 4, polyisoprene	Synthetic natural	IR	AA	RN
Polyester Urethane	Urethane	AU	-	-

11. Storage and Age Control of Elastomers

Experience has demonstrated that storage conditions are much more important in determining the useful life of O-rings than is time.
SAE-ARP5316 addresses the general requirements for data recording procedures, packaging, and storing of aerospace elastomeric seals:

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

2. Humidity
The relative humidity shall be such that given the variations of temperature in storage, condensation does not occur. 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, or if polyurethanes are being stored, shall be less than 65% relative humidity.

3. Light
Elastomeric seals shall be protected from light sources, in particular direct sunlight or intense artificial light having an ultraviolet content. The individual storage bags offer the best protection as long as they are UV resistant.
Note: It is advisable that windows of storage rooms where elastomers are stored in bulk be covered with a red or orange coating.

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

5. Ozone
As ozone is particularly damaging 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 electrical 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.

6. Deformation
Elastomeric seals shall be stored free from superimposed tensile 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. O-rings of large inside diameter shall be formed into at least three superimposed loops so as to avoid creasing or twisting.
Note: It is not possible to achieve this condition by forming just two loops, three are required.

7. Contact with Liquid and Semi-Solid Materials
Elastomeric seals shall not be allowed to come in contact with liquid or semi-solid materials (for example, gasoline, greases, acids, disinfectants, and 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.

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.

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

10. Contact between Different Elastomers
Contact between different elastomers and elastomers of different seals shall be avoided.

11. Elastomeric Seals bonded to Metal Parts
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.

12. Stock Rotation
Elastomeric seal stock should be rotated on the FIFO (First In, First Out) principle.

In general Eriks recommends the following storage parameters:
- Ambient temperature (preferably not higher than 50°C (120°F).
- Dry environment and exclusion of contamination.
- Protect against direct sunlight.
- Protect against radiation.
- Protect against artificial light containing UV-radiation.
- Protect from ozone generating electrical devices.
- Store parts without tension (never hang O-rings).