Shelf Life

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DEFINITION: Shelf life is the length of time a packaged food, chemical, etc. will last without deteriorating and will function as intended. In the gasket industry, shelf life is the storage period prior to part installation, and varies primarily by elastomer type.

One thinks of shelf life in terms of the usable life of food products or medicines. These can change their effective properties over a brief period, making them either harmful or ineffective. In fact, everything has a shelf live which might be a day or many years.

DISCUSSION: I will discuss those materials and issues which would apply to us. Most often, gasket shelf life is determined by the elastomer used as the binding agent. Rubber products can remain in inventory for prolonged periods of time, especially if storage is in a remote location or on consignment. This can be important, particularly for service gaskets which may reside in stock for a long time.

Gaskets are often a composite material consisting of binders, fillers, and other additives for enhancing properties, or attached to metal components. The properties of each will change over time which can degrade due to storage conditions. The manner of packaging, storage conditions, i.e., temperature, humidity, atmosphere, will alter properties which may be critical to the function of the gasket. Some of these properties affected by this aging: flexibility, compressibility, durometer increase, dimensional change, and oxidation, among others.

Most of the available data about shelf life centers around the elastomers or binders and not composites. In composites, one must consider all materials separately to determine what each contributes.

HISTORY OF SPECIFICATIONS:
After World War II, the industry tried to establish an effort to impose age control on critical elastomer sealing devices (ANA Bulletin 438). These efforts progressed through various organizations summarized in Air Force report AFML-TR-67-235. The study concluded that the properties of elastomeric materials improved over time, making age control less restrictive. In 1994, EPRI NP-6608 concluded that with proper storage, the shelf life of elastomer seals could be 32 years. Since 1984, MIL-SD-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. Confusion still existed and the discussion regarding age control continued. Based on the data from numerous studies concerning age control and shelf life, MIL-STD-1523A was canceled in 1995. As a result of the confusion which followed and the need to address the needs of contractors and suppliers, SAE issued ARP5316. This recommended practice addresses elastomeric seal components and offers a control document for those organizations which require one. It includes recommended shelf life limits that are consistent with the data from the cumulative studies on age control. It addressed the need for traceability and proper storage of elastomeric components. It provides a reference source for quality organizations to work with.

Because it was based on the requirements of suppliers to the high-tech applications, its recommendations may be overkill for your product and customer. It should, however, be a good set of guidelines for your practices.

SAE ARP5316:
Up until this time, several standards were in play. To alleviate confusion, a standard was issued by the Aerospace Group of the SAE organization, **ARP5316, "Storage of Elastomer Seal Assemblies Which Include an Elastomer Element Prior to Hardware Assembly"**, first published in The ARP (Aerospace Recommended Practice). It addressed the general requirements for data recording procedures, packaging, and storing of elastomeric seals and seal assemblies. Although specifically designed for the aerospace application, the information is intended to be utilized by those who do not have specific requirement or recommendations already in place for the control of elastomeric seals and seal assemblies. This ARP can be specified in control, storage, and procurement documents. However, when the requirements of this document conflict with the customer's requirements or specifications, the requirements of the customer's detailed specification shall govern.

Note: This ARP is written for use by suppliers to the aerospace industry and may be too conservative for your product or industry. It is intended to be a guide, not a standard.

SUMMARY OF ARP5316:
It is recommended that each part be individually packaged in an area with less than 65% humidity. All packaging shall be free of copper naphthenates or creosote preservatives which degrade rubber. Kraft bags and polyethylene bags more than

.075 mm thick and UV resistant. Opaque packaging is preferred but certified UV resistant materials can be used.

Labeling: As required

Storage:

- Temperature less than 100°F.
- Relative humidity less than 75%, less than 65% for polyurethanes
- Light: Protected from light sources, UV light
- Radiation: protect from all ionizing radiation likely to cause damage to stored items
- Ozone: ozone is particularly deleterious to some elastomers. Do not store in areas containing devices which can be sources of ozone
- Deformation: stored free from superimposed tensions and compressive stresses
- Contact: avoid contact with other liquids or semi-solid materials, metals, dusting powder, or other elastomers
- Stock rotation: FIFO recommended

Recommended Shelf Life of Elastomers: With proper manufacturing, packaging, and storage, the maximum shelf life recommendation in ARP5316 is as follows:

• NBR	15 years
• CR Chloroprene	15 years
• FKM Fluorocarbon	unlimited
• Silicone	unlimited
• SBR sheets	3 years
• EPDM	unlimited

The above list is but a few generalized elastomers from the eight pages of variations in the ARP5316 table. If anyone is interested in the details of the ARP, a copy can be obtained from the Society of Automotive Engineers (SAE) webstore. The current standard is ARP5316D and it costs about $86.

FILLERS: Besides the elastomer or binder in the gasket, the fillers or fibers which give structure to the gasket must be considered for their effect on shelf life. The same types of storage and packaging conditions may play a role in the performance of the composite gasket.

- Shrinkage: different fillers or fibers are either inert or change dimensionally in the storage environment. Organic fibers such as cellulose or cork are notorious for having poor dimensional stability which can cause assembly problems. This can also affect the flexibility of the finished product.
- Oxidation: your product may contain steel elements as used in oil ring seals or metal in gaskets. These will oxidize over time and need to be considered in the manufacturing, packaging, and storage as ways to extend shelf life.

CONCLUSION: It is essential to remember that although a particular ingredient may have a long shelf life, packaging and storage conditions play a significant role in determining the ultimate shelf life.