

Elastomer Cure Dates, Shelf Life and Service Life Explained

We are often asked what the shelf life is for a particular elastomer (NBR, FKM, and VMQ typically). If you "google" the question several inconsistent answers are provided. NBR can be 3-5 years; 5-10 years; 5 years etc. Why isn't there a consistent answer for a simple question? Before we answer that question and pose several other questions routinely asked, let's examine some definitions.

Cure Date – Curing is the heat-induced process whereby the long chains of the rubber molecules become cross-linked by a vulcanizing agent to form three-dimensional elastic structures. The **Cure Date** is the date that the rubber is fully molded in this process.

Shelf(Storage) Life – the maximum period of time, from cure date, to the date an elastomeric product is used as a component part in assemblies, sub-assemblies, and systems. During the shelf life time the stored elastomeric product is expected to retain its characteristics, as originally specified.

Service Life – is its expected lifetime, or the acceptable period of use in service. It is the time that any manufactured item can be expected to be 'serviceable' or supported by its [manufacturer](#). Since elastomers are used in many products, the service life would be dependent on the product manufactured. There are several primary factors that influence the service life of an elastomer in a finished product: heat, corrosion, wear and cracking.

There are several standards for defining the shelf life of an elastomer. The standard used by the manufacturer is mostly dependent on where the product is manufactured, or what market the product will be used. These standards include:

ASTM D1418	American Society of Testing & Materials: Standard Practice for Rubber Materials
DIN 7716	German National Standard: Requirements for Storage, Cleaning & Maintenance for Rubber Products
BS 3F68:1977	British Standards: Storage and Shelf Life of O-Ring Elastomeric Materials
ISO 2230	International Standards Organization: Rubber Products – Guide to Storage
DIN 9088	German Standard: Aerospace – Storage of Rubber Products
MIL-HDBK-695C	Military Standard: Guidelines for Recommended Shelf Life of Rubber Compounds
SAE ARP5316	Society of Aerospace Engineers: Storage of Elastomer Seals and Seal Assemblies

Q. With all of these standards why does the standard usually publish a range for a shelf life, such as 5-10 years?

A. As they age, rubber seals and molded products can undergo changes in physical properties and become unusable due to excessive hardening, softening, cracking, crazing, or other surface degradations. These changes may be the result of one particular factor or a combination of factors, such as the action of oxygen, ozone, light, heat, humidity, oils, water, or other solvents. The detrimental effects of these factors can, however, be minimized by proper storage conditions. There are three important factors involved in the determining the shelf life of rubber products: (1) the initial quality level of the rubber; (2) the quality assurance provisions of the specifications under which the product was procured; and (3) the age resistance of

the rubber. The age resistance of the raw material may not always correspond to the age resistance of the finished product. These factors also assume that the product was packaged and stored in order to minimize deterioration due to such factors as temperature, humidity, ozone, sunlight, oils, solvents, corrosive liquids and fumes, insects and rodents.

More specific accepted criteria for storage of elastomers are as follows: *Temperature*(below 100 deg F(preferably 40-80 deg F)); *Humidity*(less than 75% in a dry environment and avoiding condensation); *Light*(protect from direct sunlight and avoid artificial light with an ultraviolet content); *Ozone*(storage areas should not contain mercury vapor, high voltage electrical equipment, and/or combustion gases); *Deformation*(Finished product should be free from superimposed tensile and compressive stresses or other causes of deformation); *Liquid/Semi Liquids*(elastomeric product should not be allowed to come in contact during storage with gasoline, greases, acids or cleaning fluids or their vapors, unless the finished product is coated with this material, as specified); *Metals*(certain metals(copper, manganese and iron) are known to have a deleterious effect on elastomers and should not be stored in contact, but shall be protected by individual packaging); *Dusting Powder*(dusting powder should only be used to prevent sticking and only the minimum amount should be used); and *Different Elastomers*(contact with between different elastomers should be avoided and bonded seals should be individually packed).

The range is therefore dependent on the storage environment of the elastomer/finished product.

Q. Is the shelf life different between the raw material and the finished product?

A. The shelf life for an elastomer starts with the Cure Date of the elastomer. For a thermoplastic elastomer the Shelf Life starts at the time of conversion into a finished product. Example: If the elastomer is stored properly for two years and is then used in the manufacture of a finished product and then stored, the Shelf Life is still recorded from the Cure Date. Once the elastomer finished product is used in an application, the Shelf Life no longer applies.

Q. In the absence of a cure date or published shelf life, how does one determine if the finished product is usable?

A. If your finished elastomer product has been in storage for a period of time, a visual inspection is one method of determining if the product is still usable. Obviously, a laboratory analysis would be a more thorough and comprehensive method. For a visual inspection look for discoloration, tearing, scratched, imperfections in the rubber, splits in the rubber, hardening or cracked surfaces, bubbling/blisters more than likely due to heat, foreign material damage, and rust(spring, or if the elastomer is bonded to a metal case).

SAE Aerospace ARP5316 provides a comprehensive listing of common elastomers and their maximum storage life. http://www.anchorrubber.com/pdf/ARP_5316.pdf

For questions on this topic please contact our sales engineer, Annie Maloney Colonial Seal Company 800 564-2201.