SEALING SENSE

What should I look for when choosing a high-performance elastomer for a specific application?

Almost everyone has experienced the process of buying a car. There are many choices – new or used, economy or luxury, RWD or AWD, manufacturer's reputation and service – and the list goes on. We weigh the choice between price and longevity, cost to maintain, etc. in making our decision. The research and understanding of other's experiences, specifications and financing related to the decision can make the difference between a great experience and an expensive disappointment.

These same thoughts apply to selecting high performance elastomer seals. Elastomers are expected to have a long life cycle while providing safe and dependable service. A "lemon" breaks down, causes interruptions in our schedules and costs money to repair. Poor performing elastomers can also be poor investments, resulting in short life, leaks and unplanned downtime.

Just as automotive companies offer different product lines, so do elastomer seal manufacturers. There are low-end, economy seals and expensive luxury seals, with many types in-between. Even within the same performance categories, each seal provider offers unique combinations of polymers and other ingredients (referred to as compounds). In demanding services requiring a high performance elastomer, making the correct purchase decision is often critical for the safety of people and our environment, while providing an excellent value for the application.

Every manufacturer wants to position their products in the best possible light. Sometimes, in an effort to outperform competition, information conveyed or presented can be misleading. When choosing a high performance elastomer for a specific application, a few specific areas should be considered to help you get what you need and expect.

When purchasing a car, you would not compare the performance of an economy car to a luxury sports coupe. Similarly, elastomers recommended for one service should never be compared to those not recommended for that service. In the high performance seal arena, general-purpose compounds are used for universal fluids resistance and specialty compounds for very specific situations. Comparing one compound to another is only appropriate if they are intended for similar services.

This chart was recently presented by Company X:

Chemical Family	Company X – Compound 1	Company X - Compound 2	Company Y - Compound 3
Organic Acids	1	1	1
Inorganic Acids	1	1	1
Bases	1	2	3
Amines	1	3	4
Steam/ Hot Water	1	2	3
Ketones	1	1	1
Aldehydes	1	2	4

Table 1

The rating system was not identified, but assuming 1 means the best, you would probably conclude that Company X's Compound 1 is superior to their Compound 2 and their competitor's Compound 3.

Using actual laboratory data and specific process conditions, the comparison would have looked like Table 2 on the next page.

In this case, we added Company Y's Compound 4 because it was recommended for these types of service; Compound 3 was not recommended for hot water or amines. Specific fluids at specific temperatures are used rather than general families of chemicals. The conclusions from this data show Company X's Compounds 1 and 2 performed worse than reported in Chart 1. The duration of the tests (672 hours), temperatures and/or concentrations of fluids used likely made a difference in the results.

When choosing a seal for a specific application, look for swell data based on specific chemicals and temperatures.

Chemical	Company X - Compound 1	Company X - Compound 2	Company Y - Compound 3	Company Y - Compound 4
Nitric Acid 70% at 85°C	3	4	1	2
Ammonium hydroxide at 100°C	1	2	4	2
Ethylene diamine at 90°C	4	4	4	1
Water at 225°C	4	4	3	1
Maleic Anhydride at 100°C	3	1	1	1
Toluene Di-Isocyanate at 100°C	2	2	1	2

Table 2. Tested using ASTM D472, AS568 214 o-rings immersed for 672 hrs.
Ratings are based on the amount of volume swell: 1 = 0-10%; 2 = 10–20%; 3= 20-30%; 4 = >30% (Not recommended)

Although ASTM references 70 hours, most high performance seals are expected to run longer than a weekend, so a 672-hr duration or longer is preferable.

Although volume swell of elastomers is a popular parameter used to judge performance, there are many other aspects to consider: compression set resistance, physical properties after heat aging or exposure to the fluids, abrasion resistance, etc. The mechanical properties can and will impact performance functionality depending on your application. It's important to gather all the information pertinent to your specific needs and expectations.

When considering properties based on laboratory testing, longer test durations are generally more representative of actual use. Different conclusions may be drawn if one looks at results from 70 hours versus 672 hours. Figure 1 is an example of compression set resistance measurements taken at different points in time.

If only the 70-hr data was presented, one would conclude Compound 1 is the best choice for resisting compression set. However, given the longer-term data, Compound 2 is the better choice. In summary, remember the following when choosing a high performance elastomer seal:

- Look for test results in chemicals and at temperatures representative of your worst operating conditions.

Fluid Sealing Association

Sealing Sense is produced by the **Fluid Sealing Association** as part of our commitment to industry consensus technical education for pump users, contractors, distributors, OEMs, and reps. This month's Sealing Sense was prepared by FSA Members Kathy Roberson and John Huber. As a source of technical information on sealing systems and devices, and in cooperation with the **European Sealing Association**, the FSA also supports development of harmonized standards in all areas of fluid sealing technology. The education is provided in the public interest to enable a balanced assessment of the most effective solutions to pump technology issues on rational Total Life Cycle Cost (LCC) principles.

The **Mechanical Seal Division** of the FSA is one of five with a specific product technology focus. As part of their educational mission, they develop publications such as the *Mechanical Seal Handbook*, a primer intended to complement the more detailed manufacturer's documents produced by the member companies. Joint FSA/ESA publications such as the *Seal Forum*, a series of case studies in pump performance, are another example as is the *Life Cycle Cost Estimator*, a web-based software tool for determination of pump seal total Life Cycle Costs (LCC). More recently, the *Sealing Systems Matter* initiative has been launched. It is directed to support of the case for choosing mechanical seals that optimize life cycle cost, safety, and environmental compliance.

The following members of the **Mechanical Seal Division** sponsor this *Sealing Sense* series:

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- Make sure the tests are conducted for a time longer than a weekend (preferably greater than 500 hours).
- Make sure the method follows a known protocol, such as an ASTM method.
- Make sure you're comparing and choosing compounds targeted for your specific service.

Shopping for a high performance elastomer isn't that different from shopping for a car… except maybe not as much fun! You must understand your process conditions and the life cycle costs and set your expectations accordingly. Research your choices and understand their performance as it relates to your needs. If you practice such diligence, the elastomer you choose should provide long lasting service, just like your new vehicle!

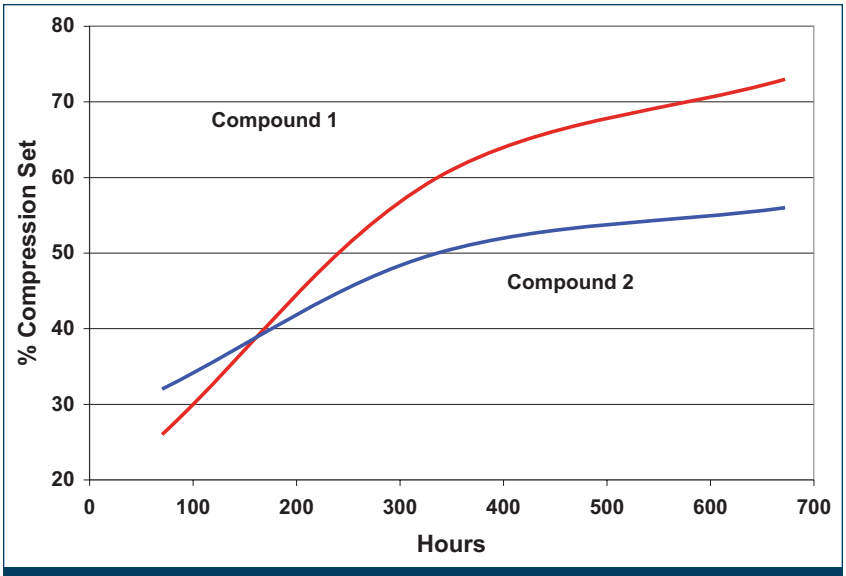

Figure 1. ASTM Method D395, 204°C, AS-568 214 O-rings

Next Month: *What are the benefits and pitfalls of graphite packing?*

We invite your questions on sealing issues and will provide best efforts answers based on FSA publications. Please direct your questions to: sealingquestions@fluidsealing.com.

P & S

Digester Recirculation

Rotamix Digester Mixing

Digester Scumbuster

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sup·port: *to provide for or maintain.* Vaughan provides the best support with fast service and immediate overnight availability from a multi-million dollar stock of all parts for all pump sizes, configurations and materials.

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