



Selecting the Appropriate Seal Material in Ethylene Oxide Service

Overview – Chemical Concentration Influences Seal Performance

Ethylene oxide (EO) is one of the most aggressive chemical streams that elastomer seals encounter in transportation and/or in chemical processing operations. Results from recent DuPont Performance Elastomers testing indicate that end users should take care when selecting seal materials for EO or other oxirane services. As a result of laboratory testing complemented by field analysis, DuPont Performance Elastomers has determined that the concentration of the EO can influence the seal's performance.

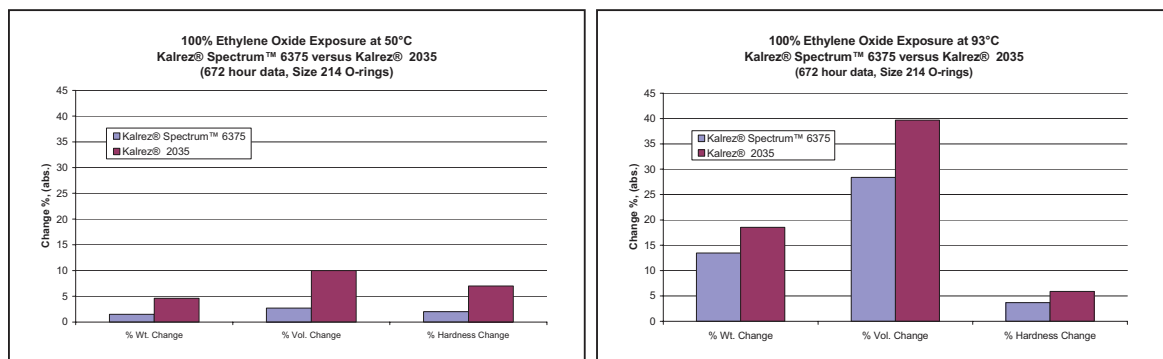
Typically 100% concentrations of EO are encountered in chemical transportation, but in chemical processing plants, EO may be diluted with water therefore reducing the concentration of EO. In transportation of 100% EO and other oxiranes, Kalrez® Spectrum™ 6375 is the suggested Kalrez® compound for use. However, in lower concentrations of EO seen in chemical processing facilities, Kalrez® 2035 is the suggested compound.

Because EO is the most aggressive in the chemical category of oxiranes, other oxiranes encountered in transportation or chemical processing, like propylene oxide (PO) and butenol oxide (BO), should have a similar but less damaging effect on elastomer seals. It is suggested that customers perform their own evaluation trials on elastomer seals, since laboratory immersion tests cannot precisely simulate customer process conditions.

Seals used in Transportation of 100% EO

In laboratory testing at both 50°C(122°F) and 93°C(200°F), Kalrez® Spectrum™ 6375 outperformed Kalrez® 2035 for EO service (Figures 1 and 2). Most transportation of EO occurs near ambient temperature, so the performance of 6375 at 50°C and 93°C offers a measure of security that 6375 retains its properties above ambient temperatures. This is particularly important in chemical processing environments.

Figures 1 and 2: In 672* hour data at both 50°C and 93°C, Kalrez® Spectrum™ 6375 is the suggested compound for 100% EO service.

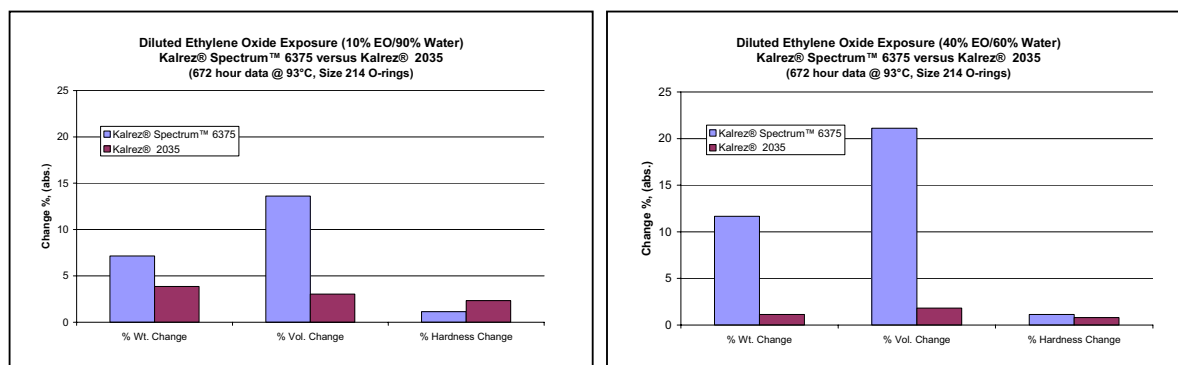


* Hardness is a percent decrease in properties. Long-term exposure (672 hours) is a more reliable predictor of long-term service than 70-hour data, the industry standard. Whenever possible, Kalrez® provides this data to better serve the industry. Test methods for Figures 1 through 4 are described on page 2.

Seals used in less than 100% EO Concentration

Unlike chemical transportation of EO where 100% EO is encountered at ambient or near ambient temperatures, mixtures of EO are used at higher temperatures and are more representative of actual plant processing conditions. Additional laboratory testing of EO combined with in-service results has shown that elastomer seals may perform differently in the presence of water. DuPont Performance Elastomers testing in diluted ratios of 10% EO / 90% water at 90°C(200°F) and 40% EO / 60% water at 90°C(200°F) suggests that Kalrez® 2035 is the compound for these types of process conditions. In cases where 100% EO is used, whether in transportation or chemical processing, Kalrez® Spectrum™ 6375 is the suggested compound.

Figures 3 and 4: In diluted concentrations of EO, Kalrez® 2035 demonstrates better physical properties than Kalrez® Spectrum™ 6375.



DuPont Performance Elastomers suggests that all elastomer seals be tested in their actual conditions to determine their suitability for service. Contact DuPont Performance Elastomers for more information about Kalrez® perfluoroelastomer parts.

Test methods for Figures 1 through 4

% Weight Change	ASTM D471
% Volume Change	ASTM D471
% Hardness Change	ASTM D2240

Properties of Kalrez® Spectrum™ 6375 and Kalrez® 2035

Kalrez® Spectrum™ 6375, designed specifically for the chemical process industry, combines the latest polymer technology with innovative curing technology. Spectrum™ 6375 is designed to provide outstanding performance in the widest possible range of chemicals. Spectrum™ 6375 is an excellent selection for use in acids, bases, amines, steam and many other aggressive chemicals. The curing system for Kalrez® Spectrum™ 6375 allows for a continuous upper service temperature of 275°C(525°F). Kalrez® Spectrum™ 6375 is a carbon-black filled compound that is well suited for applications including mechanical seals, flange seals, pump seals and in finishing equipment.

Kalrez® 2035 is a carbon-filled black compound for chemical process industry equipment, transportation and semiconductor applications. Kalrez® 2035 has excellent chemical resistance properties exhibiting low volume swell in organic acids, esters, ketones and aldehydes. This compound offers good mechanical properties with a slightly higher hardness and a maximum temperatures limit of 220°C(428°F). Kalrez® 2035 has long been a suggested compound in many EO, PO and BO services.

Typical physical properties for Kalrez® Spectrum™ 6375 and Kalrez® 2035 are shown below.

Typical Physical Properties¹	6375	2035
Hardness ² , Shore A, ±5	75	85
100% Modulus ³ , MPa (psi)	7.24(1050)	8.61(1250)
Tensile Strength at Break ³ , MPa (psi)	15.16(2200)	17.23(2500)
Elongation at Break ³ , %	160	150
Compression Set ⁴ , 70 hr at 204°C, %	30	38
Maximum Service Temperature, C°(°F)	275(527)	220(428)
Lower Service Temperature, C°(°F)	-20 (-4)	-20(-4)

¹ Not to be used for specification purposes

² ASTM D2240

³ ASTM D412, 500 mm/min (20 in/min)

⁴ ASTM 395 B, pellets

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