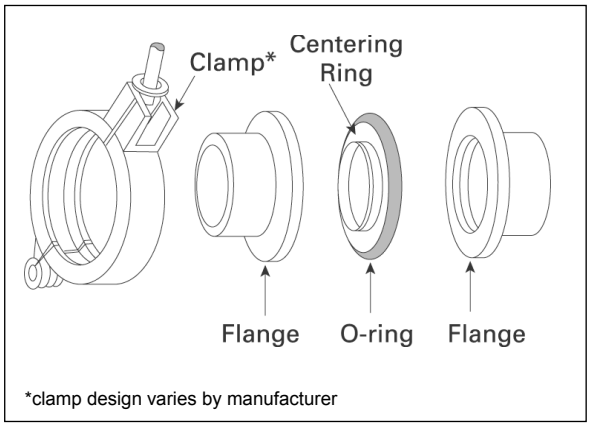
DuPont™ Kalrez®

Extended Seal Life in Semiconductor KF Flange Seals

Technical Literature—Rev. 4, July 2010



*clamp design varies by manufacturer

NW Series O-Rings for KF Flange Seals from DuPont

KF type flange seals provide an economical, convenient and simplified means of constructing vacuum systems for semiconductor applications. Despite the efficiency offered by these flanges, manufacturers may face premature seal failure and unscheduled equipment downtime when standard AS568 perfluoroelastomer O-rings are specified for high temperature service. NW series Kalrez® perfluoroelastomer O-rings from DuPont help to optimize seal life and reduce down time in semiconductor vacuum systems.

Standard AS568A O-Ring Sizes Don't Match ISO Guidelines

Dimensional specifications for NW10 to NW40 KF flange component sizes are governed by ISO standard (ref ISO 2861/1). This guideline also specifies O-ring dimensions, such as inside diameter (I.D.) and cross-sectional diameter (C.S.D.). Unfortunately, the O-ring dimensions referenced in the ISO specification are inconsistent with "off-the-shelf" O-ring sizes that are the industry standard and readily available (ref. AS568 or metric standards). As a result, many vacuum component manufacturers specify the closest AS568, 300 series O-ring for their assemblies.

"Off-the-Shelf" Sealing Options May Cause Premature Part Failure

In Table 1, the nominal dimensions for ISO 2861 O-rings and the corresponding size for AS568 O-rings are compared. The larger C.S.D. (5.33 mm vs. 5.0 mm) for the AS568 300 series O-ring is a particular concern in semiconductor wafer processes where perfluoroelastomer seals are specified for use at temperatures up to 300 °C.*

Table 1. Size Differences Between ISO 2861 O-Rings and Standard AS568 O-rings

ISO 2861 Guidelines			Typical O-ring Size Used		
O-ring/ Flange Size	I.D. (mm/in)	C.S.D. (mm/in)	AS568 Designation	I.D. (mm/in)	C.S.D. (mm/in)
NW10	15/0.590	5/0.197	312	15.24/0.600	5.33/0.210
NW16	18/0.709	5/0.197	314	18.42/0.725	5.33/0.210
NW25	28/1.102	5/0.197	320	27.94/1.100	5.33/0.210
NW40	42/1.654	5/0.197	326	40.64/1.600	5.33/0.210
NW50 to 100	(size not guidelined in ISO 2861)*		(varies by manufacturer)		

*Please contact DuPont for guidance.

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At elevated temperatures, perfluoroelastomer seal expansion is increased. In this case (see Figure 1), the strain on the larger AS568 O-ring is significantly increased which can compromise seal performance and lead to premature seal failure. Vacuum flange systems that incorporate an external, over-pressure ring accentuate this condition.

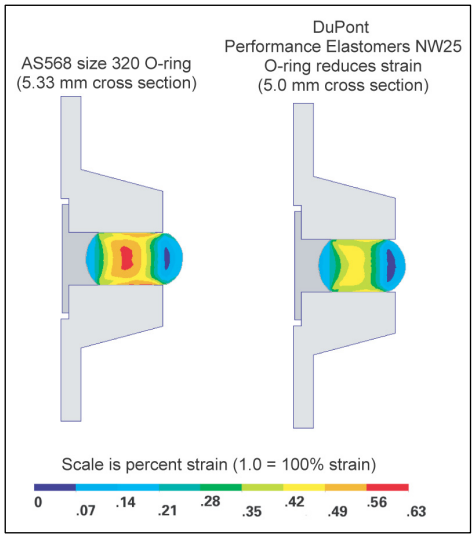
Benefits of NW Series O-Rings

- Extended seal life, particularly at elevated temperatures
- Custom O-ring solution at a standard O-ring price

DuPont Standardizes O-Ring Sizes for KF Flange Systems

In order to prolong seal life, DuPont offers a standard line of DuPont™ Kalrez® O-ring seals (NW series O-rings) consistent with ISO guidelined dimensional specifications. When process chemistry or temperature warrants the use of a perfluoroelastomer seal, no longer are component manufacturers or Fabs limited to using an inappropriately sized “off-the-shelf” O-ring or a more costly custom seal design. Special seal design considerations may be required for flange systems that incorporate an external, over-pressure ring or bulkhead clamp. In this case, contact a DuPont Applications Engineer for assistance.

Figure 1. O-ring Strain Profile Comparison for KF-25 Flange System



Sizes and Compound Availability

DuPont currently offers NW series O-rings in the most popular sizes and in a number of compounds that are specifically formulated for resistance to CVD and etch process chemistries. Some larger NW series O-rings (i.e., > NW40) are available; however, ISO 2861 does not guideline dimensional specifications for these parts. Contact a DuPont Applications Engineer for specific size availability and a compound recommendation.

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