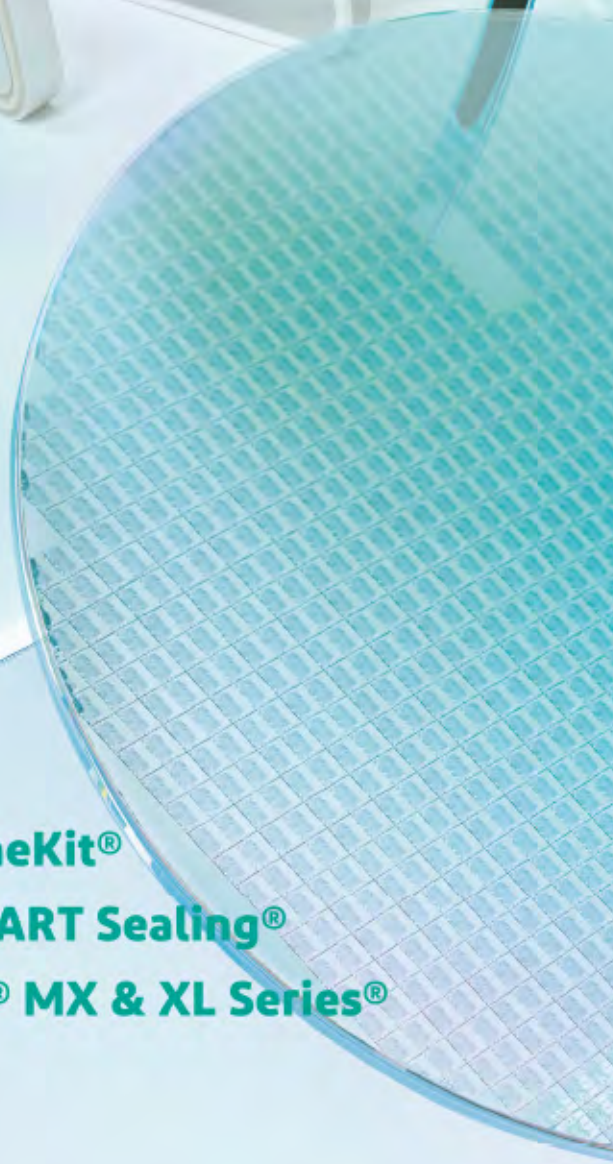
SMART Sealing®
ASNA

SEALING SOLUTIONS

Start Here



- Bonded Gates
- Case Studies
- ACE® Engineering
- ASNA BKM® Guide
- PRISM OneKit®
- ASNA SMART Sealing®
- PERFREZ® MX & XL Series®

www.asnaglobal.com
www.appliedseals.com

SMART Sealing®
ASNA

S SEALING PRODUCTS

Our semiconductor grade elastomer seals are the most high-tech sealing solutions in the global market.

M MATERIAL SCIENCE

We make seals from the most advanced compounds in the world.

A APPLICATIONS SUPPORT

We don't just provide a product, we also provide technical support to performance optimization.

R RELIABILITY

Our seals ensure long and stable process operations before maintenance.

T TECHNOLOGICAL INNOVATION

We develop tomorrow's sealing solutions today.

Table of Contents

Welcome To ASNA

ASNA (Applied Seals N.A. Inc.) is a full service, application and engineering support facility located in Fremont, CA. This site, along with the global offices that operate under its umbrella, offers the service and support imperative to handle semiconductor global requirements. Our design laboratory offers complete engineering analysis, material recommendations, and solutions to address the demands of an industry that requires unique, often daunting challenges on all aspects of sealing applications.

At ASNA, we know that harsh chemical and high temperature semiconductor processes require optimal seal performance and integrity. Our SMART Sealing® solutions are created to enable the most advanced sealing expertise possible in the global market. We take special pride in helping the industry not just with materials as impervious as possible to any process media (including those in all manufacturing process of plasma, deposition, thermal, and wet application such as: Etching, Ashing, HDPCVD, PECVD, Diffusion, LPCVD, RTP, Lamp Annealing, Wet Etching, Photoresist Stripping, Copper Plating, Cleaning, and more) but also in addressing the unique nuances of the equipment in which these processes are created.

The need to educate and thus, optimize the actual hardware (not just the process), something that has not been attempted with such focus, is the very reason ASNA has made it its mission - to raise the level of awareness and in doing so bringing attention to the gaps, the lack of SEMI standards, and the importance of defect reduction vital to the success of the application. Our work on evaluating the problem by examining both the seals (after a certain cycle or a failed seal requiring an answer for chemical, thermal or mechanical degradation) is the expertise we bring to assure optimal sealing. This includes our emphasis on tool audits of the grooves and ultimately, the application-specific parameters that will drive to truly assessing the problem and offering solutions that are based on data. The difference in this approach will always lead to providing a true scope of problem-solving with FA and FEA analyses that allow the most reliable prognosis.

Behind our application team in ASNA, our manufacturing facility is dedicated to enhancing ultraclean processing and maximizing manufacturing productivity. Applied Seals Co. Ltd. provides the next generation of advanced sealing components focused on the major 'clean' industries we call Semiconductor, Pharmaceutical as well as LED.

All of our production processes are tightly controlled. Manufacturing and packaging of fluoro-elastomer seals for highly demanding semiconductor applications are performed within Class 10,000 cleanroom environments and Class 100 packaging that includes strict adherence to cleaning procedures for reducing metal contaminants as well as organics.

This facility delivers the most reliable sealing solutions at the best possible cost of ownership (COO) and with short lead times that have often made the difference in customers whose part requirements were critical. Our products are proven to maintain high-integrity seals while withstanding the thermal variances, harsh chemicals, and ultrafine particles encountered within high-tech manufacturing equipment. Consideration is also given to provide "green" sealing products capable of being recycled.


afaq
Certificat
Certificate
N° 2010/38869.6
APPLIED SEALS CO., LTD.
MANUFACTURING OF RUBBER/PLASTIC COMPONENTS SUCH AS RINGS, OIL SEALS, GASKETS AND PACKINGS FOR THE AEROSPACE, MEDICAL, AUTOMOTIVE, MECHANICAL, HYDRAULIC/PNEUMATIC, CHEMICAL AND SEMI-CONDUCTOR INDUSTRIES.
has been assessed and found to meet the requirements of:
ISO 9001 : 2015
and is developed on the following locations:
NO. 16, LU KUNG NORTH 2ND RD., LU-KANG TOWN, CHANGHUA COUNTY, TAIWAN
2020-02-06
2023-02-05
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THEN07330-03
APPLIED SEALS CO., LTD.
Scope : MANUFACTURING OF RUBBER/PLASTIC COMPONENTS SUCH AS RINGS, OIL SEALS, GASKETS AND PACKINGS FOR THE MEDICAL DEVICE INDUSTRY.
NO. 16, LU KUNG NORTH 2ND RD., LUKANG, CHANG HUA 505, TAIWAN, R.O.C.
ISO 13485 : 2016
ORIGINAL DATE OF CERTIFICATION
31-DEC-2015
DATE OF ISSUE
24-FEB-2020
DATE OF EXPIRY
19-FEB-2023
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Trevor Wilmer
Director for Certification
ON BEHALF OF
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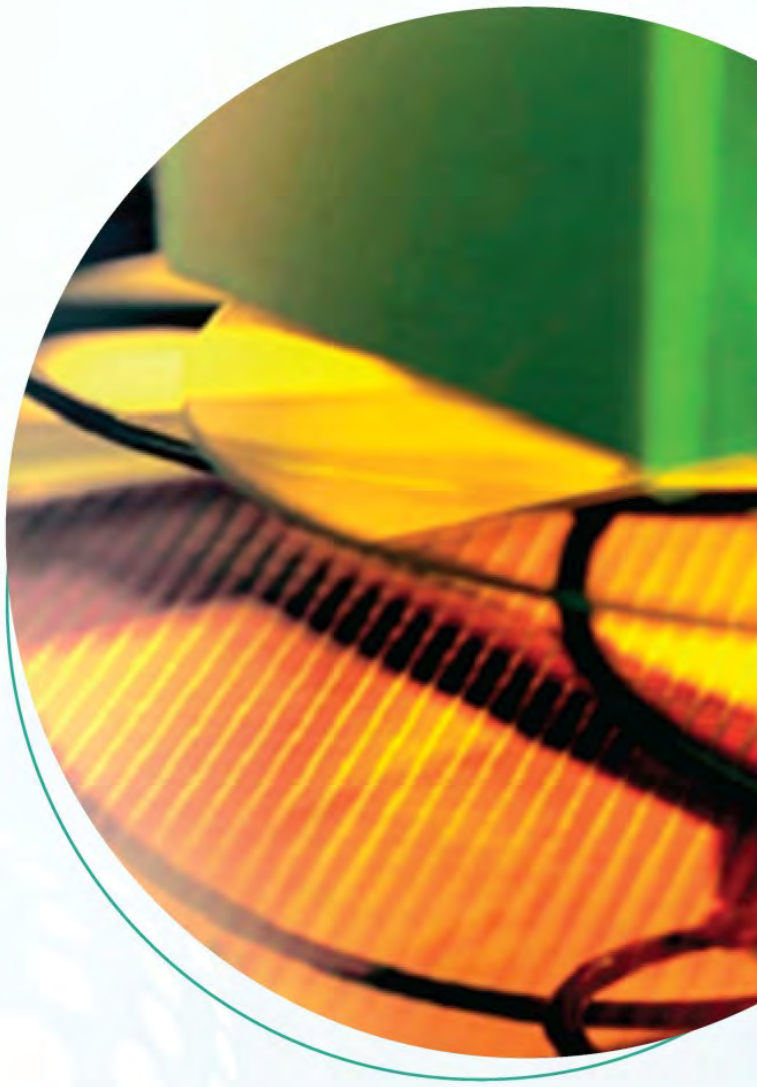
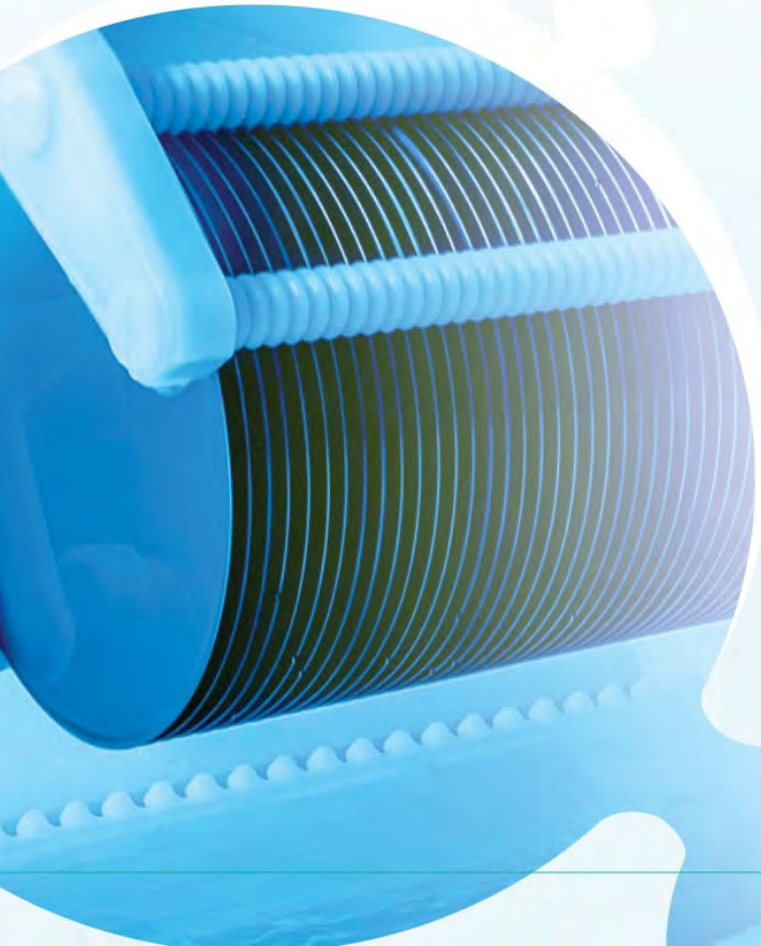
Process & Applications



Thin Film + Dry Etch

Thin Film, such as HDPCVD, PECVD, SACVD, PVD and ALD, along with Dry Etch and Ashing processes present harsh plasma and gas environments, often at elevated temperatures. Where traditional seals might break down in these conditions, ASNA next-generation compounds have excellent chemical and thermal resistance and are virtually impervious to extreme fabrication processes.



Thermal Applications

ASNA compounds are tailored to specific thermal applications and maintain integrity at elevated temperatures often found in processes such as Oxidation, Diffusion, Annealing, and RTP.

Wet Cleaning + BCD

ASNA compounds for wet cleaning are highly engineered for static, dynamic and bonded applications that require minimal metallic ion contamination.

Features & Benefits of ASNA Materials

- Designed for optimal lifetime
- Excellent plasma resistance
- Outstanding physical properties
- Ultra-high purity
- Withstands higher sealing loads
- Excellent performance in high temperature applications

High Performance O-Rings

ASNA has a great deal of experience manufacturing a full range of standard O-ring sizes including: AS-568A, JIS series, and Metric sizes. Our in-house tool makers have extensive experience in fabricating high precision standard and custom molds with a short response time to meet the most demanding applications.

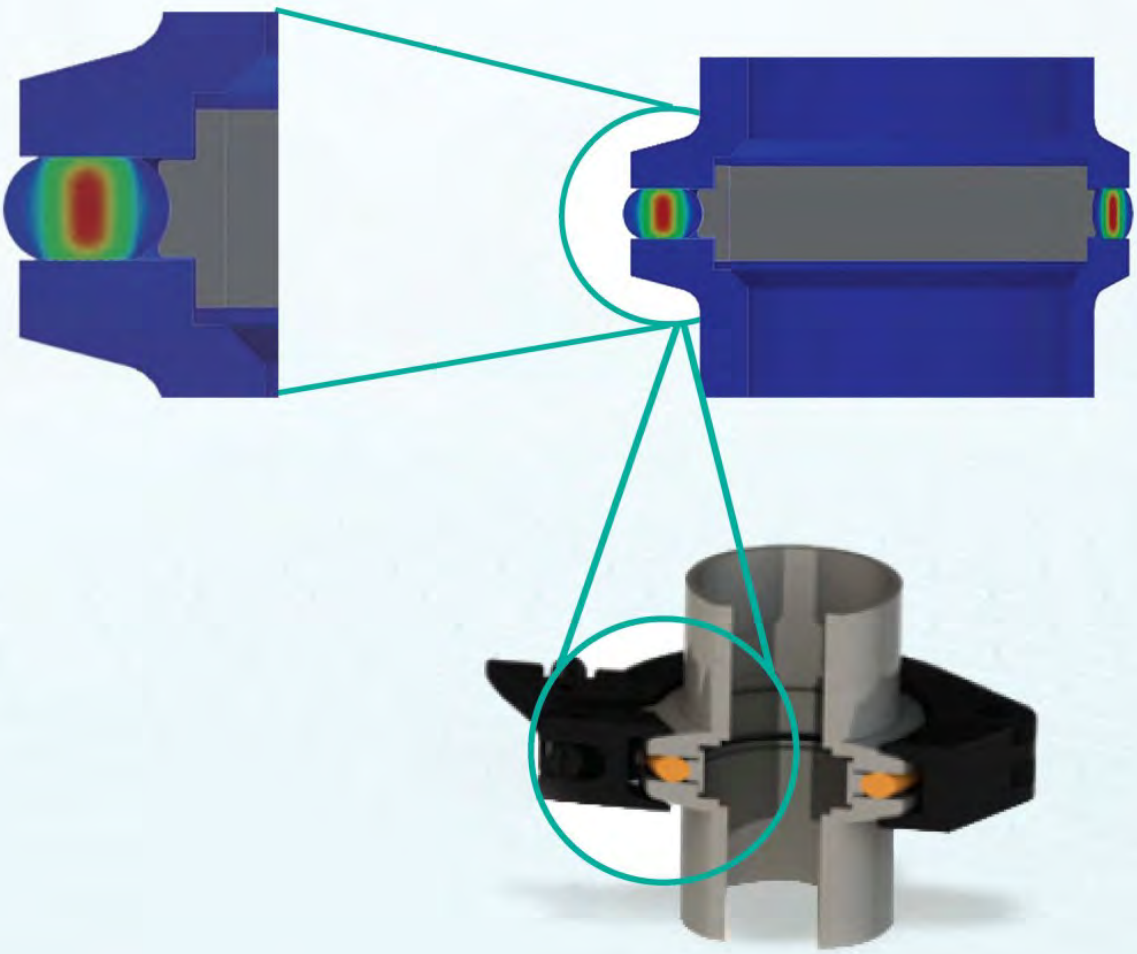
ASNA's highly integrated design and manufacturing processes are dedicated to provide our customers with standard products or custom made-to-order seals and rubber components to the highest quality standards.

Note: Products to be manufactured to ISO 3601-1 unless specified in advance.

The outstanding performance of ASNA products are built upon extensive field knowledge, in-depth material science, and sealing design expertise. Our experience coupled with a comprehensive product offering includes sealing solutions for abatement systems and forelines that offer advantages in the following:

- Optimal compound recommendations based on chemistries and temperature
- Compound attributes that offer a higher sealing retention force and resiliency
- Special shapes and sealing size recommendations to improve performance
- Improved compound mechanical strength
- Longer seal life
- Sealing consistency and reliability
- Excellent fluorine and temperature resistance
- Variety of solutions that take into account cost and performance

ASNA offers a full range of aluminum and stainless steel centering rings for NW and ISO flanges in combination with PERFREZ® compounds with an optional spacer and/or overpressure ring.



SMARTSeal PRISM OneKit® and QuikVU® Clamp

Universal Vacuum Fitting Clamp with Torque Control
Patent No.: US 11,187,358 B2

Clamp Optional

Versatile, Fully Asembled, Color-coded SubFab Seal System

SMARTSeal PRISM OneKit® Attributes

- Affordable without compromise
- Clean room assembled and stringently inspected
- Resilient to high temperatures
- Withstands amplified energies & aggressive gases
- Performs reliably, durably and consistently
- Eliminates common causes of premature failure
- Fully assembled kit reduces maintenance time
- Customizable color-coding system identifies seal assignment
- Minimized downtime

SMARTSeal PRISM oneKit®

Introducing SMARTSeal PRISM OneKit®

Why reinvent the seal?

It is widely known that, for SubFab applications, traditional FFKM seals, while great performers, are not cost effective. Neither are filler-diluted FFKMs, specialty cross-sections, re-engineered entering rings or custom shaped glands. These approaches to SubFab sealing performance limit supply options, raise potential safety concerns and add to long term costs.

There's a better path to SubFab sealing performance: SmartSeal PRISM OneKit®.

PRISM OneKit® ...One simple solution.

Commonplace today, many manufacturers change out their Viton seals to a FFKM. While seemingly innocuous or convenient, the practice is problematic.

Stretching and twisting of the seal during assembly routinely leads to leaks, compression set, potentially compromised safety and premature failure.

By contrast, the PRISM OneKit® is a complete clean room assembled and stringently inspected seal system. No assembly is required.

No compromise.

Applied Seals' new SmartSeal PRISM OneKit® yields unparalleled performance across every SubFab application. Expressly designed for SubFab manufacturing economies and exceptionally resilient to extreme operating temperatures, PRISM OneKit® handles more aggressive gases and intensive gas flows. PRISM OneKit® delivers sealing integrity without compromise. Reliability and long term SubFab durability are, at last, affordable.

Downtime mitigated.

SmartSeal PRISM OneKit® reduces maintenance time too.

Employing an innovative, systematic color-coding system, PRISM OneKit® cuts down time by identifying what seal is in use without tooling tear-down. Never again will you find yourself delayed while determining the correct seal for every process and every location.

PRISM OneKit® is ideally suited for foundry work too. And its color-coding system can be customized to fit your specific operations. PRISM OneKit® helps you make the most of your resources and delivers more uptime productivity.

ASNA QuikVU® Clamp

ASNA offers a universal clamp to fit all NW flange applications and provide enhancement to applications using PRISM seal as the OneKit. This unique clamp features a simple but efficient mechanism which not only mitigates risks, but also provides constant torque with recommended values. Four QuikVU® windows facing towards different directions allow users convenience to observe the color of inside PRISM ring regardless of how/where the clamp is installed and oriented.

How it works?

ASNA's goal is to make a clamp compact and compatible for various application conditions. This OneKit clamp is significantly different from wing-nut clamps and features the attributes below:

- Special engineered thumb nut and clamp arms which contain a spring and stopper mechanism. This allows a user to apply preset torque specifications without any wrenches.
- Preset spring compressed length design to achieve recommended torque for prevention of over-torque or under-torque issues.
- Nut notch mates with the clamp notch (Close Position) or de-mating (Open Position), the spring on the clamp functions as a constant force to keep its position as one turns the nut. The spring itself will also sustain constant force and prevent looseness from vibration, which are benefits inherited from the spring toggle clamp.

Stainless Steel and High Durability Built-to-last

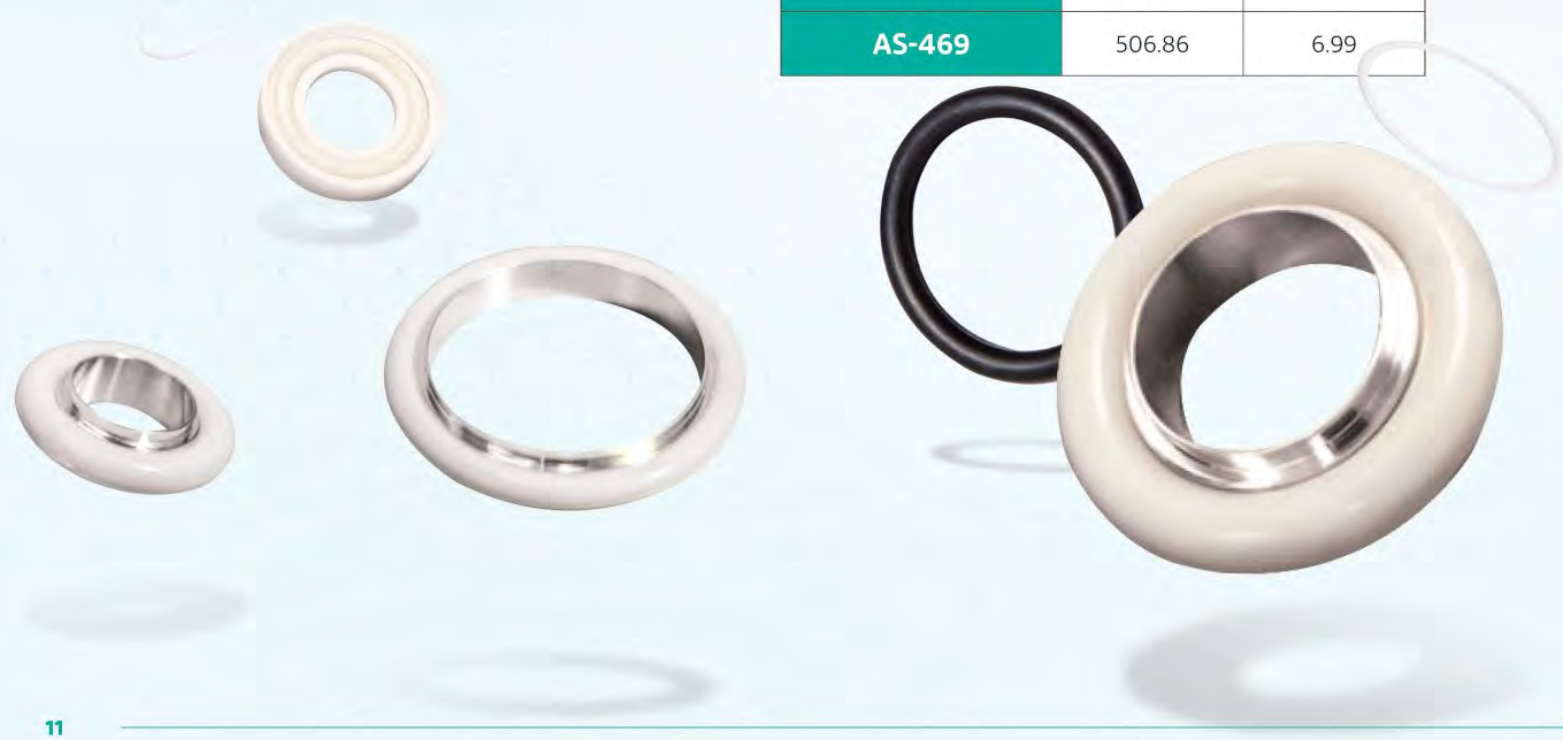
QuikVU® Windows located at both side of the clamp.

	PRISM clamp	Spring toggle clamp	Wing-nut clamp
Torque control+	●	●	●
Resistance to vibration	●	●	●
Compatibility	●	●	●
Bulk	●	●	●
Color check visibility	●	●	●
Safety vs. cost	●	●	●

● Excellent ● Good ● Poor

NW / ISO Fittings
O-Rings Sizes

NW / ISO	METRIC SIZE		AS568 SIZE		
Series	ID (mm)	CS (mm)	**Dash#**	ID (mm)	CS (mm)
NW-10	15.00	5.00	**AS-311**	13.64	5.33
NW-16	18.00	5.00	**AS-314**	18.42	5.33
NW-25	28.00	5.00	**AS-320**	27.94	5.33
NW-40	42.00	5.00	**AS-326**	40.64	5.33
NW-50	53.00	5.00	**AS-330**	53.34	5.33
ISO-63	72.00	5.00	**AS-336**	72.39	5.33
ISO-80	85.00	5.00	**AS-340**	85.09	5.33
ISO-100	104.00	5.00	**AS-346**	104.14	5.33
ISO-160	152.00	5.00	**AS-361**	151.77	5.33
ISO-200	215.00	5.00	**AS-371**	215.27	5.33
ISO-250	253.00	5.00	**AS-378**	266.07	5.33
			AS-454	316.87	6.99
			AS-461	405.26	6.99
			AS-469	506.86	6.99



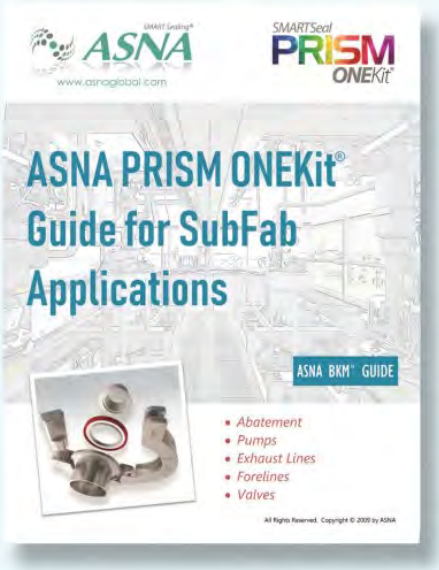
ASNA BKM®
(Best Known Method) Guides

ASNA also offers a BKM guide for NW/ISO fittings and clamps in SubFab applications, to further enhance the success with practical purpose in mind. Education and experience are the foundational pillars of this guide to assure methodologies found in the sub-fab world. In each cited case, options have been created to perform functions that were mandated years ago. ISO standards are included but, as they were originally created for non-FFKM materials, they fail to address the extremely important nuances of newer sealing materials (especially FFKM's). Issues such as improper installation, over-torque, misalignment, and easy twisting of these materials are common issues that are not addressed and have no 'common practices' to help optimize the performance of these newer generation materials. This information is not commonly cited in original specifications.

Safety is always the most critical of any requirements. This guide is focused on illustrating what should be the optimal sealing performance to maintain a safe environment while providing a superior integrated solution. ASNA is offering the 'known' pros and cons to each configuration. Along with that, an optimal solution is also created to minimize common sealing functionality issues that could lead to early leaks or unwanted downtime. PRISM OneKit® provides a sealing solution that helps enhance seal performance and reduces all common installation issues to mitigate risks that lead to catastrophic failure.

ASNA also offers data driven alternatives to what's currently deployed as nodes reach 7 nm and below. New requirements carry additional risks to any area of the fab that is not prepared, and best-known methods (BKM's) must support an ever-increasing challenge to the sub-fab space.

Please utilize this guide for purposes of additional education, increased awareness to excel in the management of this critical area, and the ultimate goal of optimal safety reliability and seal optimization for every aspect of the fabrication process.



We are available for on-site training and will make this guide available in whatever format requested. We also enhance the on-going education required so that the foundations of successful manufacturing are met and production challenges are mitigated.

For more information, please contact **engineering@asnaglobal.com.**

Successful Sealing Solutions: Engineering Methodology

Seal Solutions from Design, Prototyping, Production, Test, and Installation

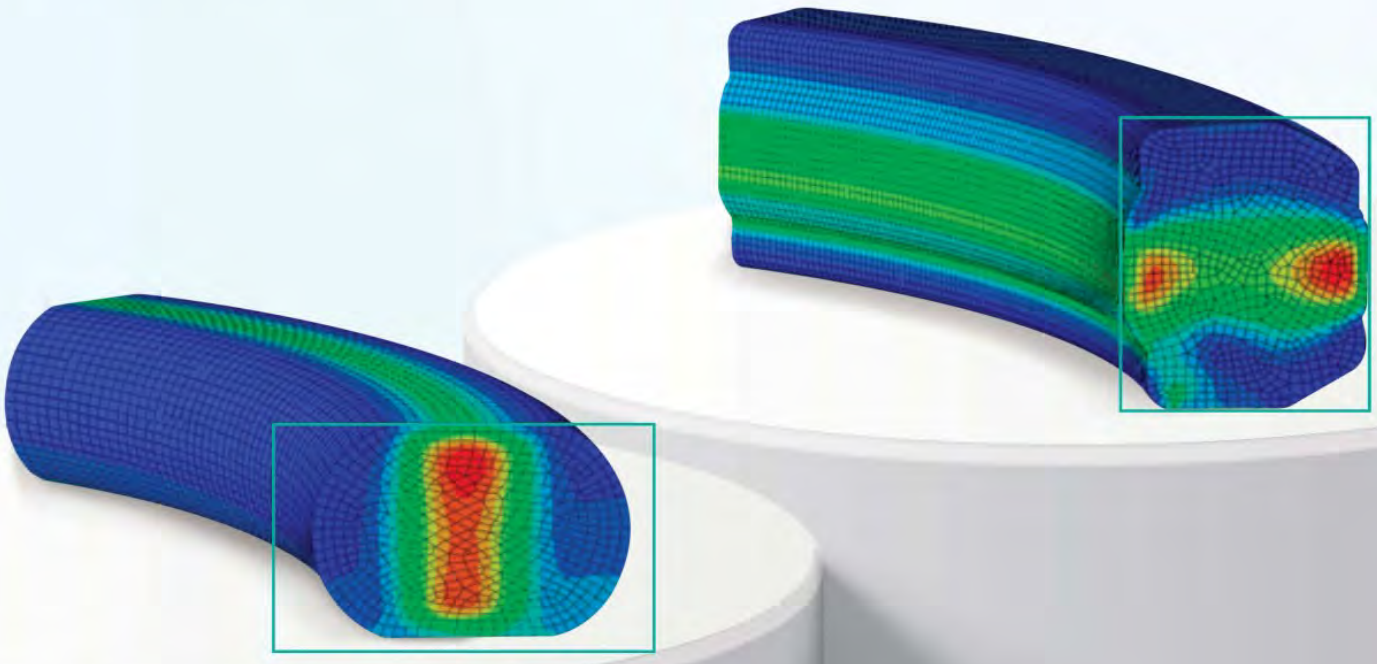
ASNA experienced engineering design team offers comprehensive product design and performance optimization and analysis services.

A failed seal often has several reasons that cause it to fail such as thermal degradation, mechanical degradation, plasma chemical attack, and inherent design flaws. Our team of ASNA engineers will investigate all of these possibilities and provide assistance in material recommendations and design upgrades along with tutorial education.

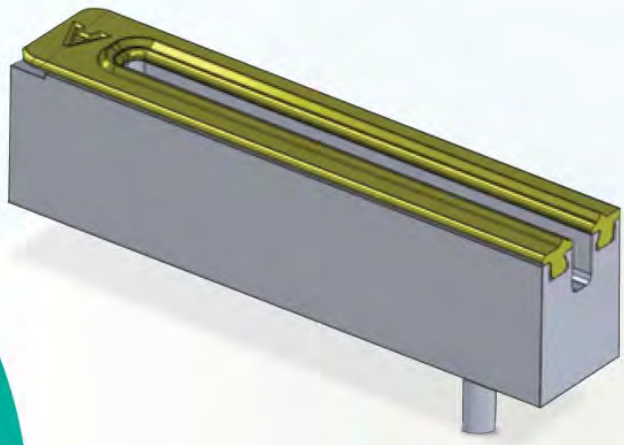
Our overall services include:

- Material recommendation: Based on chemical, mechanical, application and most importantly cost effective solutions for ROI maximization
- O-ring size nomenclature optimization AS568A, JIS B 2401 and Metric
- Maximize product sealing performance and life expectancy of the O-ring.
- Installation assistance: On-site and remote video tutorials are available.
- Tool Platform O-Ring / Seal audit: Review current usage applications efficiently and responsively.
- Groove size evaluations, design recommendations.
- Custom seal design: Designs to meet the highest industry expectation.

ASNA engineers will simulate proposed design component elements using the software SolidWorks® and ABAQUS which offer modern three dimensional Computer Aided Design (CAD) and Finite Element Analysis (FEA) capabilities.



- Today's elastomer materials have unique mechanical behavioral characteristics which are highly nonlinear and strain rate dependent. In order to accurately predict the sealing performance of these materials, ASNA has established a proprietary model for all the sealing material we have developed.
- Finite Element Analysis (FEA) has become an essential design analysis tool for us within the semiconductor industry today from tool design to magnetic multi- physics modeling.
- ASNA engineers will utilize the FEA software to perform stress and deformation analysis on all the designs we deliver to custo mers to ensure their functionality of the seal. We can enhance designs and material compound structures to extend the life of elastomer parts by optimizing the stress distribution in the elastomer part that can cause stress-induced breakdown and also chemical attack.



Customer

- **FAs help diagnose the root cause of seal failure or predict seal life.**
- **FAs provide optimal soloutions to improve seal performance.**
- **FAs grant technical insight & educational knowledge on seal material and design.**

ASNA

- **FAs present valuable field data & right track for innovation on next-Gen product.**

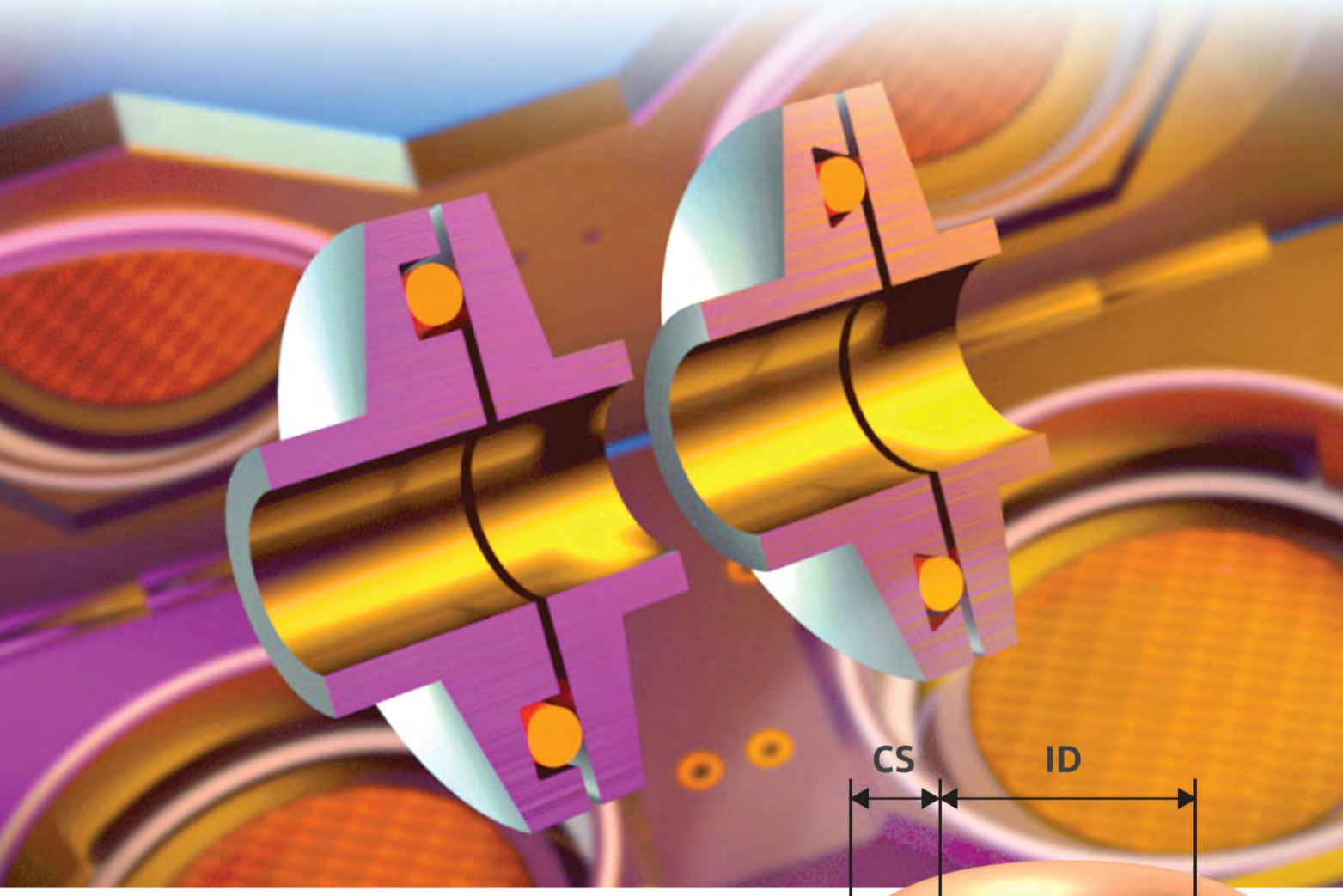
FEA also plays a key role in the failure analysis (FA) which serves great purposes for both customers and ASNA.

SMART Sealing®

ASNA

Introducing ACE® Calculated Engineering, ASNA's User-friendly Seal Engineering Tool

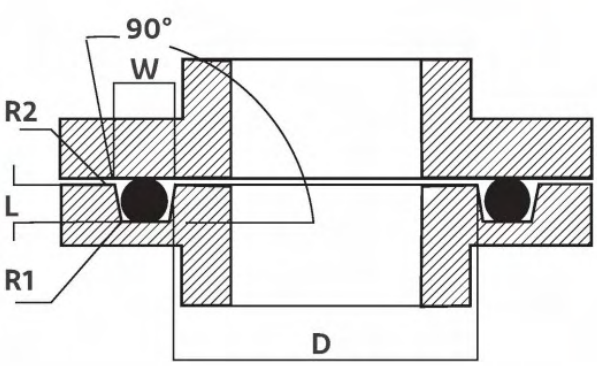
www.asna-ace.com



ACE®

ASNA Calculated Engineering

- **Seal Recommendation**
- **Groove Recommendation**
- **Design Validation**

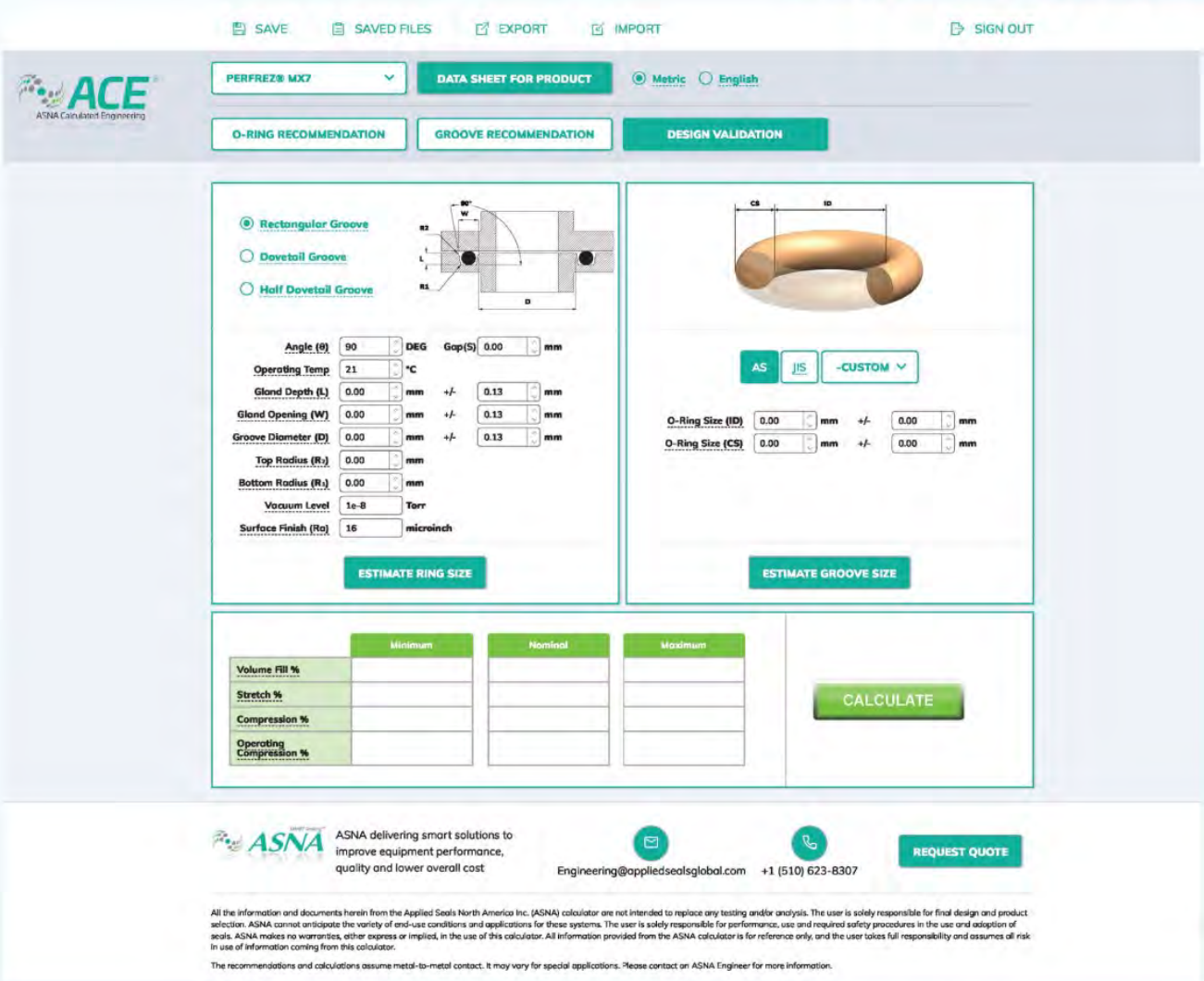


Introducing ACE®
(ASNA Calculated Engineering)

An ASNA tool created to assure the optimal conditions possible for our materials and thus, resulting in the most reliable sealing elements. The functions available in this tool will allow engineering to assure dimensions, grooves and environments are correct as well as offer optimal hardware configurations. We also feature design validation and fill in the blanks for all areas of sealing considerations. Customization is also available along with a talented team on stand-by when any and all information requires additional insight, approval as well as quotes for commercial values.

Utilization of this tool will realize more productive time and efficiency and absolute seal reliability from the start of the project and improve the lifetime of the materials and designs chosen for that purpose. Added features will continue to make our ACE® calculator the design tool of choice when working with the newest, more customized versions of materials necessary in today's harsh and complicated Semiconductor manufacturing requirements.

www.asna-ace.com



PERFREZ® Elastomers

Purity Solution for Both Static and Dynamic Applications

PERFREZ® XL15 is a translucent compound made of a semicrystalline nano-filler. This compound is developed to handle the most demanding fluorine, chlorine and oxygen plasmas as well as the most aggressive acids and solvents used in semiconductor processing. It is also recommended for extreme applications in the bio-analytical industry.

Purity Solution for Both Static and Dynamic Applications

PERFREZ® XL12 features superior physical properties with exceptionally low particle generation. XL12 offers a low Coefficient of Thermal Expansion (CTE) that mitigates risk of extrusion, while offering outstanding plasma resistance and erosion, especially with aggressive fluorine based process.

Enhanced Plasma Resistance and Physical Strength

PERFREZ® XL11 offers superior plasma resistance especially aggressive fluorine based process. It also features the excellent physical properties with low CTE that mitigate any risk of extrusion due to thermal expansion.

High Temperature Perfluoroelastomer That Combines The Benefits of Chemical Compatibility with Thermal Stability for Sub-Fab Applications

PERFREZ® 6022 is specially developed to handle aggressive oxygen and fluorine based exhaust gases while providing excellent thermal properties.

Specialty Hybrid - Ideal and Economic Solution for Better Performance

PERFREZ® 5033 solves the problem where an FKM (known as Viton® in all their many mixes and grades) cannot handle the process chemistries but a FFKM (perfluoroelastomer) is an 'overkill' solution.

High Temp. Perfluoroelastomer for Plasma Applications

PERFREZ® MX30 expands the MX series, being specially developed to handle extreme high temperatures combined with aggressive oxygen-based plasma, while generating minimal particles. MX30 features low compression set, and greater resilience against excessive stress during operation, making it exceptionally capable for challenging seal locations.

Ultra Pure FFKM for Harsh Semiconductor Applications

PERFREZ® PXC-Ultra a high purity upgrade of PXC which is also specialized for semiconductor equipment with harsh conditions, especially with stringent requirement on contamination. As effective as the original version, it also offers excellent resistance to a wide variety of chemistries including acids/bases which makes it a great alternative for wet applications, while keeping the same temperature endurance.

High Performance Seal Solution for Harsh Semiconductor Applications

PERFREZ® PXC is a specialized line of Perfluoroelastomers for semiconductor equipment wet manufacturing processes. PXC offers excellent resistance to a wide variety of chemistries including acids/bases. PXC has a maximum service temperature of 260°C.

High Temperature FFKM for Static Seal Applications

PERFREZ® MX20 is a high-performance FFKM designed to meet extreme heat requirements within the Fab and Sub-Fab. MX20 features great resilience, superior compression set, and low thermal expansion to minimize thermal degradation and seal extrusion. With its broad chemical compatibility, MX20 presents an ideal sealing solution for the harsh chemical environments found in forelines, exhausts, pumps, and valves.

Note:

Slight color variations may be observed in actual ASNA products (seals / bonded gates). Variations are considered to be normal phenomena in seal manufacturing.

Due to the curing process, small marks or dark spots may be observed in actual ASNA products. It is not indicative of foreign matter and will not impact on product performance.

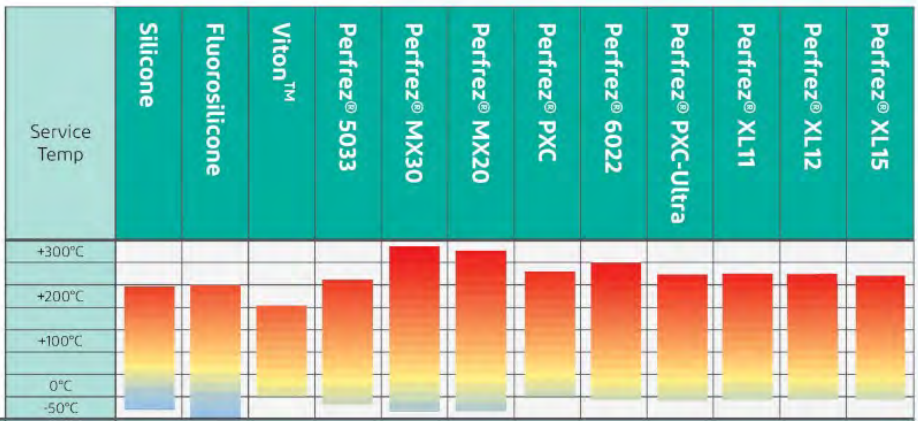
Please contact ASNA engineers if there are any questions or concerns.

PERFREZ®
faith in precision

Technical Compounds Table Information

BKM SMART Choice

- Temperature
- Chemistry
- Geometry Design
- Process Environment
- Application



Process	Chemistry	Temp(°C)	Silicone	Fluorosilicone	Viton™	Perfrez® 5033	Perfrez® MX30	Perfrez® MX20	Perfrez® PXC	Perfrez® 6022	Perfrez® PXC-Ultra	Perfrez® XL11	Perfrez® XL12	Perfrez® XL15
EPi + SiGe	$SiCl_4$, SiH_4, SiH_2Cl_2	220	▲	●	▲	●	●	●	●	●	●	●	●	●
LPCVD	NH_3, SiH_2Cl_2, TEOS, SiH_4	300	●	●	●	●	●	●	●	●	●	●	●	●
Oxidation Diffusion	N_2, O_2, HCl, H_2O	300	●	●	●	●	●	●	●	●	●	●	●	●
RTP	Ar	250	●	●	●	●	●	●	●	●	●	●	●	●
PVD	Arw	200	●	●	●	●	●	●	●	●	●	●	●	●
Metal CVD	WF_6, SiH_6, TMA, DMAH	200	●	●	●	●	●	●	●	●	●	●	●	●
PECVD	TEOS, SiH_4, NF_3, PH_3	250	●	●	▲	●	●	●	●	●	●	●	●	●
Metal Etch	BCl_3, NF_3, CHF_3, HBr	220	●	●	●	●	●	●	●	●	●	●	●	●
Poly Etch	C_2F_6, O_2, NF_3, N_2H_2, HBr	220	●	●	●	●	●	●	●	●	●	●	●	●
Dieletric Etch	C_2F_6, O_2, NF_3, CHF_3	220	●	●	●	●	●	●	●	●	●	●	●	●
Ashing	O_2, N_2O, CF_4	250	●	●	▲	●	●	●	●	●	●	●	●	●
RCA Clean	SC1, SC2, HF, SPM, UPDI	125	●	▲	▲	▲	●	●	●	●	●	●	●	●
Wet Etch	HCl, HF, HNO_2, UPDI	150	●	▲	●	●	●	●	●	●	●	●	●	●
Stripping	NMP, MEA, HDMS, DMSO	125	●	●	▲	▲	●	●	●	●	●	●	●	●
Lithography Track	TMAH, NaOH	40	●	●	●	●	●	●	●	●	●	●	●	●
CMP	UPDI, KOH, NH_3	80	●	●	▲	▲	●	●	●	●	●	●	●	●
Electrochem Cu	$CuSO_4$, UPDI	100	●	●	●	●	●	●	●	●	●	●	●	●

● Excellent ● Good ▲ Fair ● Poor

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* Viton™ is a registered trademarks of Chemours Fluoroelastomer.

CASE STUDY:
Ultra High Purity Applications

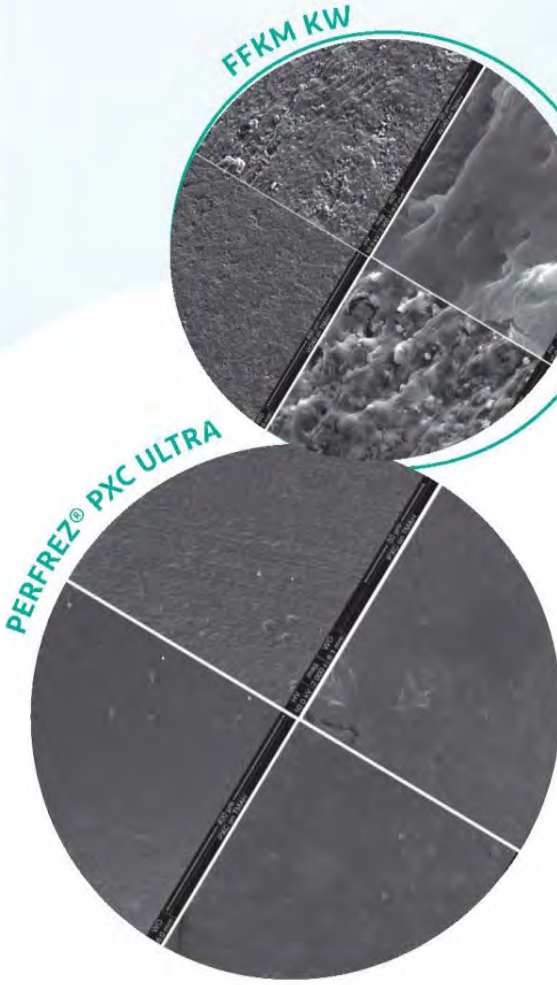
Material: PERFREZ® PXC ULTRA

- **Ultra Low Contamination Perfluoroelastomer Applicatons**

Leachable Extraction Data

2.38% Tetramethylammonium Hydroxide (TMAH) 24 hours @ ambient temperature

Element	Detection Limit	Unit	PERFREZ® PXC-Ultra	FFKM KW
Aluminum (Al)	0.1	ppb (ng/g)	3.3	77
Antimony (Sb)	0.1		*	*
Arsenic (As)	0.1		*	*
Barium (Ba)	0.1		0.3	1.5
Beryllium (Be)	0.1		*	*
Boron (B)	0.5		*	*
Cadmium (Cd)	0.1		*	*
Calcium (Ca)	0.5		*	52
Chromium (Cr)	0.1		0.4	*
Cobalt (Co)	0.1		*	*
Copper (Cu)	0.1		0.2	8.7
Copper (Cu)	0.1		*	*
Germanium (Ge)	0.1		*	*
Gold (Au)	0.5		*	*
Lead (Pb)	0.1		*	0.2
Lithium (Li)	0.1		*	*
Magnesium (Mg)	0.1		0.6	1
Manganese (Mn)	0.1		0.1	*
Molybdenum (Mo)	0.1		*	*
Nickel (Ni)	0.1		*	0.4
Potassium (K)	0.5		*	5.6
Silver (Ag)	0.5		*	*
Sodium (Na)	0.1		6.9	33
Strontium (Sr)	0.1		*	*
Tin (Sn)	0.5		*	*
Titanium (Ti)	0.5		*	0.7
Vanadium (V)	0.1		*	*
Zinc (Zn)	0.5		5	9.6
Zirconium (Zr)	0.1		*	*



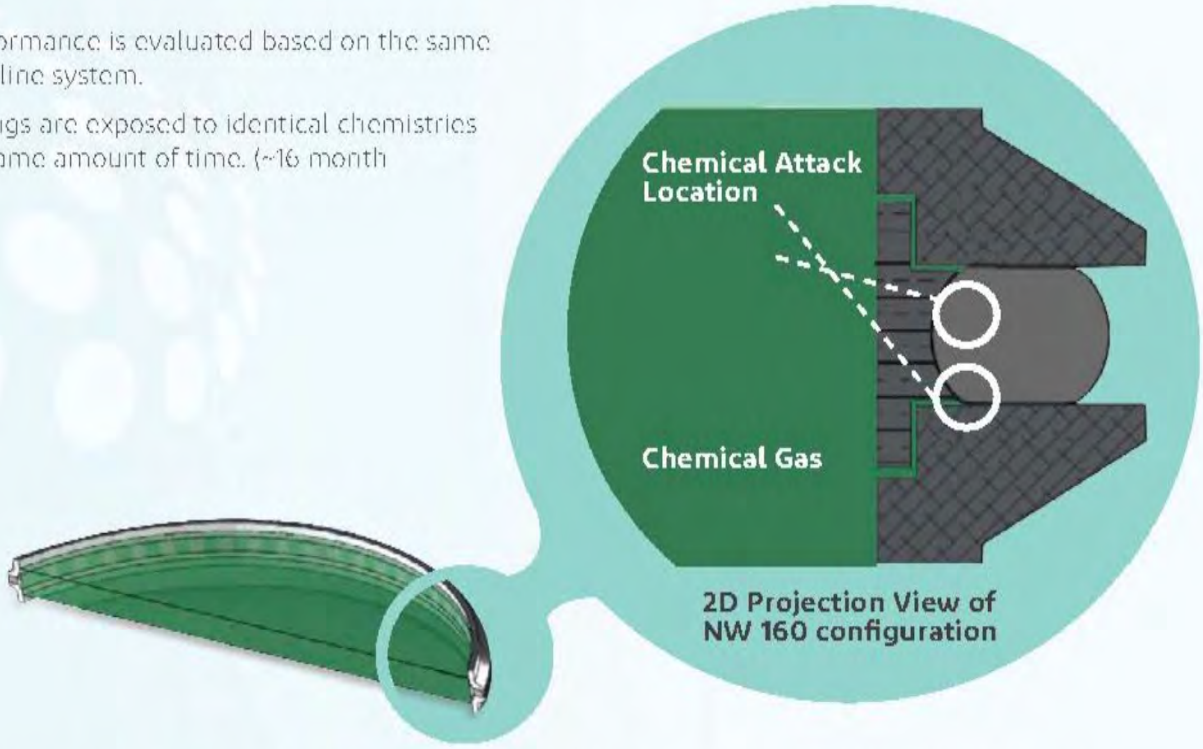
Surface Finish after 24-hour @ ambient temperatures

CASE STUDY:
Foreline NW Fittings

Material: PERFREZ® 6022

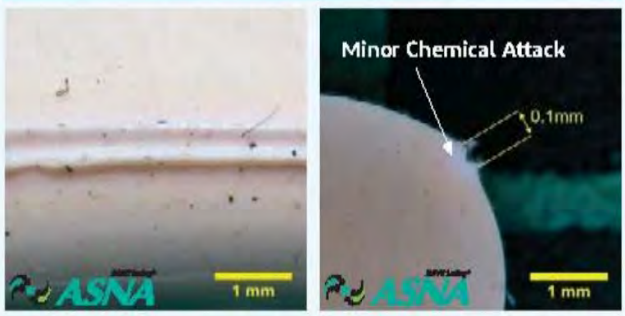
• Minimal Degradation, Extended Seal Life and Maximum Safety

- The performance is evaluated based on the same CVD foreline system.
- The O-rings are exposed to identical chemistries for the same amount of time. (~16 month

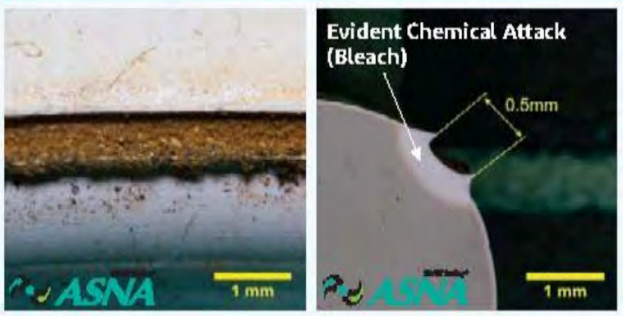


Chemical gases make way through those gaps and make contact with the seal. After a period of time, erosion will occur and leave a concave trench effect on top and bottom along the ID periphery.

PERFREZ® 6022



Comp. 8X series



PERFREZ® 6022 exhibits improved, overall minimal erosion and build-up compared to the competitor's material. In result, it provides better sealing integrity and safety of the Sub-Fab environment.

CASE STUDY:
RPC Manifold

Material: PERFREZ® PXC ULTRA

• Ultra Low Contamination Perfluoroelastomer Applicatons

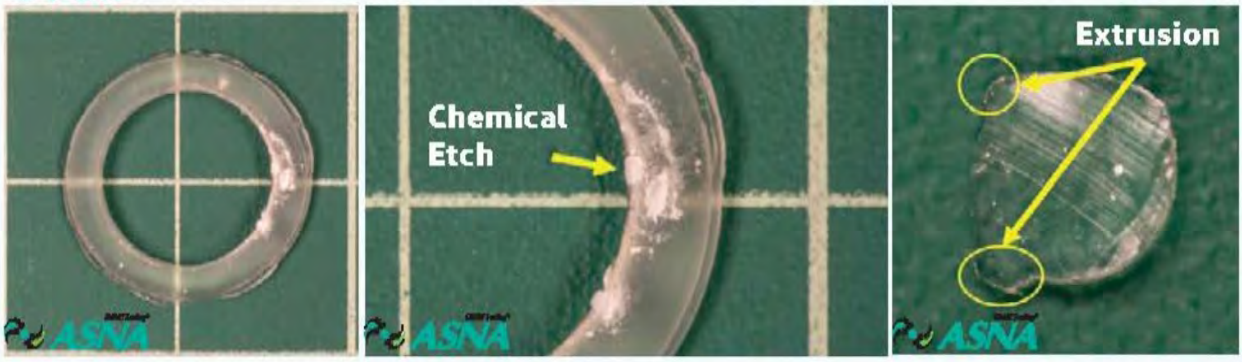
Process: PECVD
Temperature: <150°C
Chemistry: Monatomic Fluorine
Current life: Various
Desired life: 3 months to 1 year depending on the user

- Current seal materials tested at OEM showed variability and reduced sealing life.
- PERFREZ® XL12 exceeded sealing life expectations and exhibited compatibility with harsh process environment including Monatomic Fluorine.

COMPARISON BETWEEN ASNA PROPOSED AND PRODUCT ON RECORD (POR) SEAL

• ASNA Proposal

• POR



CASE STUDY:
Heater and Gas Feed Seals

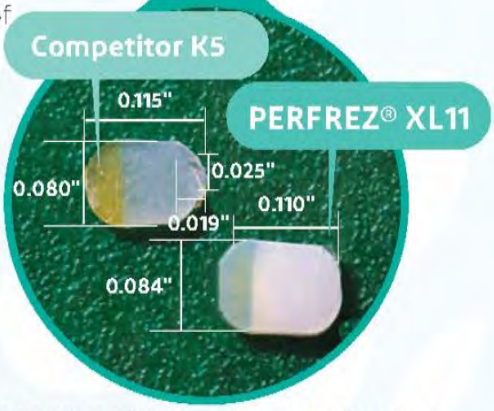
Material: PERFREZ® XL11

- **PERFREZ® XL11 Offers Excellent Chemical/ Plasma Resistance and Low CTE**

Competitor K5
(Before and after)

After use:
Competitor K5 material shows a high degree of discoloration.

PERFREZ® XL11
(Before and after)



PERFREZ® XL11 shows less chemical degradation and better compression set

- Competitor K5 exhibits pitting due to blistering from the chemical attack on the surface.
- PERFREZ® XL11 shows minor chemical degradation on the surface.
- Poor design and high CTE value lead to severe extrusion

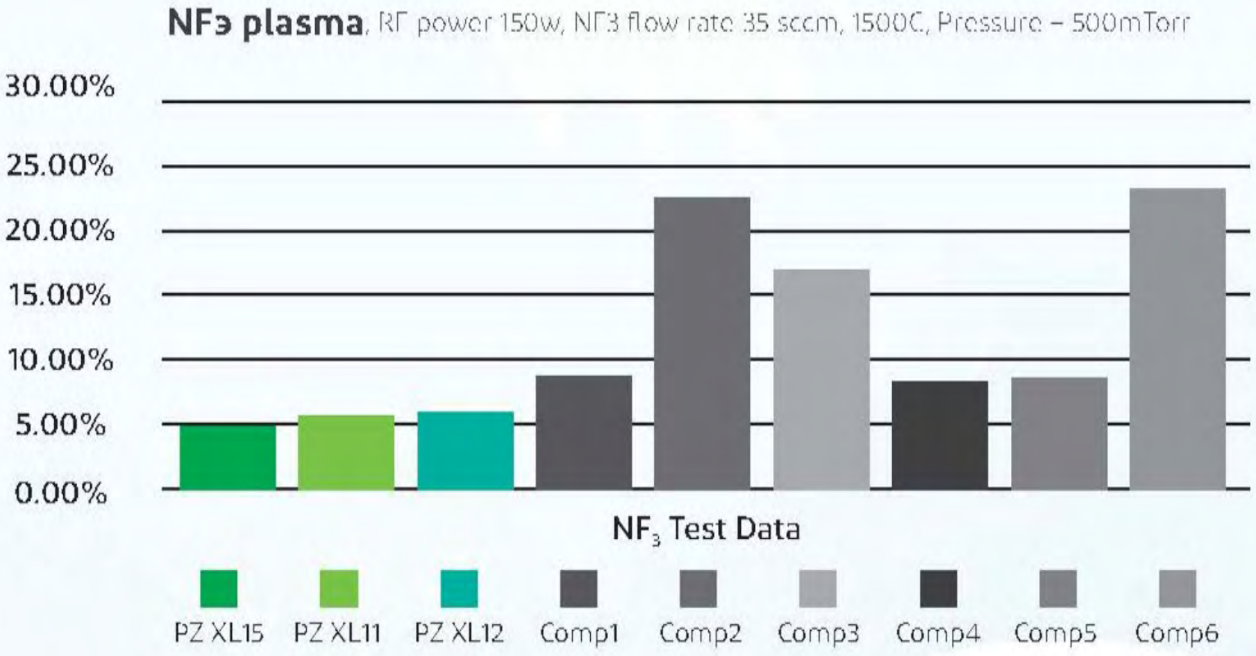
Properties	Competitor K5	PERFREZ® XL11
Hardness (Shore A)	76	85
100% Modulus, MPa	9.6	11.78
Tensile Strength, MPa	16.4	16.72
Elongation, %	193	142
CTE, µm/m-°C	421	227
Vol. ↑ in 200°C (Est.)	24%	12%

Source: Neirynck, Ya Hong, and Dalia Vernikovsky. "The Criticality of Sub Components Utilized for next Generation High Volume Manufacturing." 2017 28th Annual SEMI Advanced Semiconductor Manufacturing Conference (ASMC), May 2017, doi:10.1109/asmc.2017.7969263.

CASE STUDY:
XL Series® Data in Direct Plasma Exposure

Material: PERFREZ® XL

- **XL Series® Weight Loss in Direct Plasma Exposure**

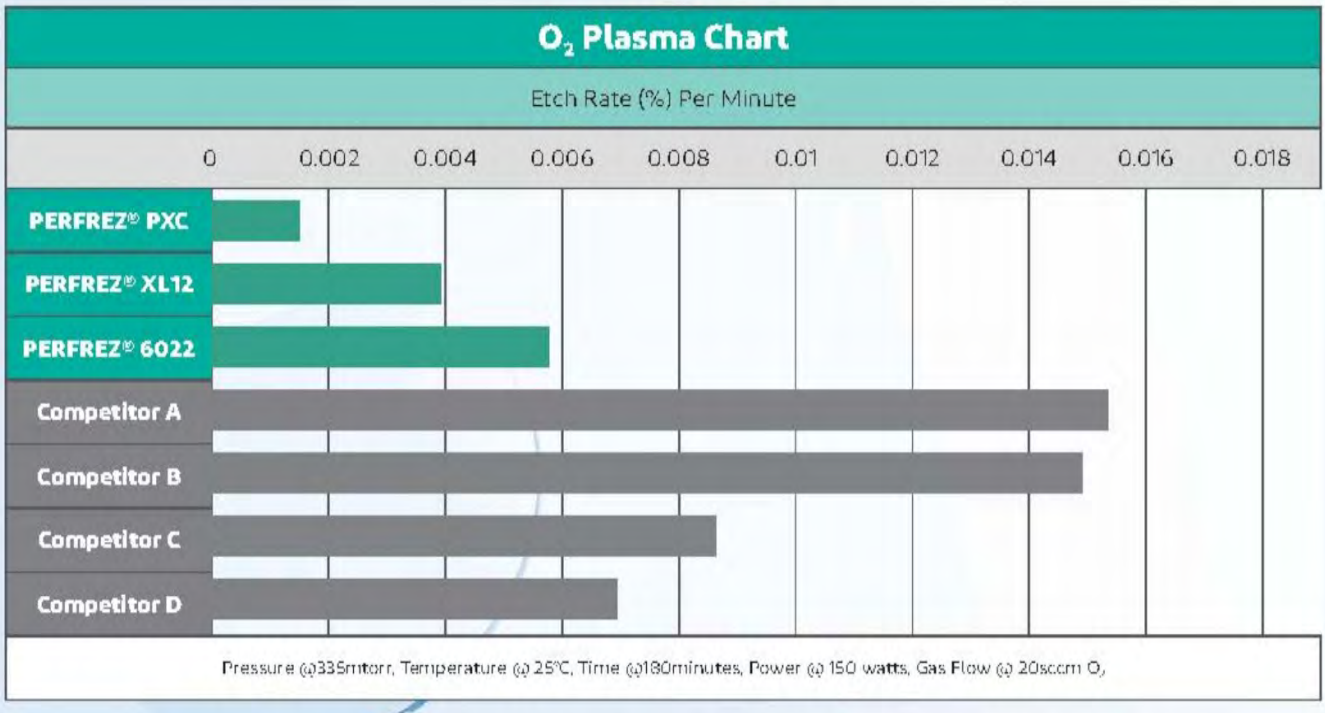


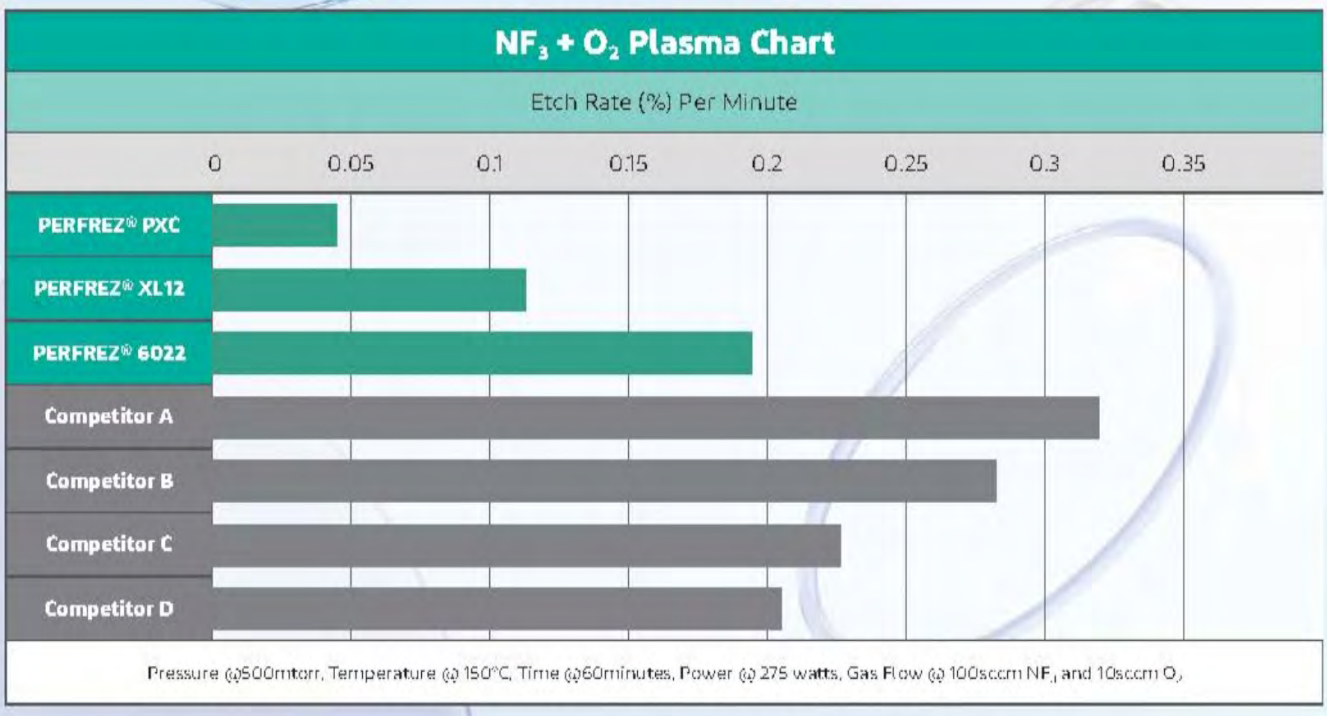
Schematic of a sample Etch Chamber
for illustration purpose only

CASE STUDY:
PERFREZ® Series Data in Direct Plasma Exposure

Material: PERFREZ® Series

- PERFREZ® Series Weight Loss in Direct Plasma Exposure





CASE STUDY:
Thin-Film Process (Memory Chips]

Material: PERFREZ® 6022

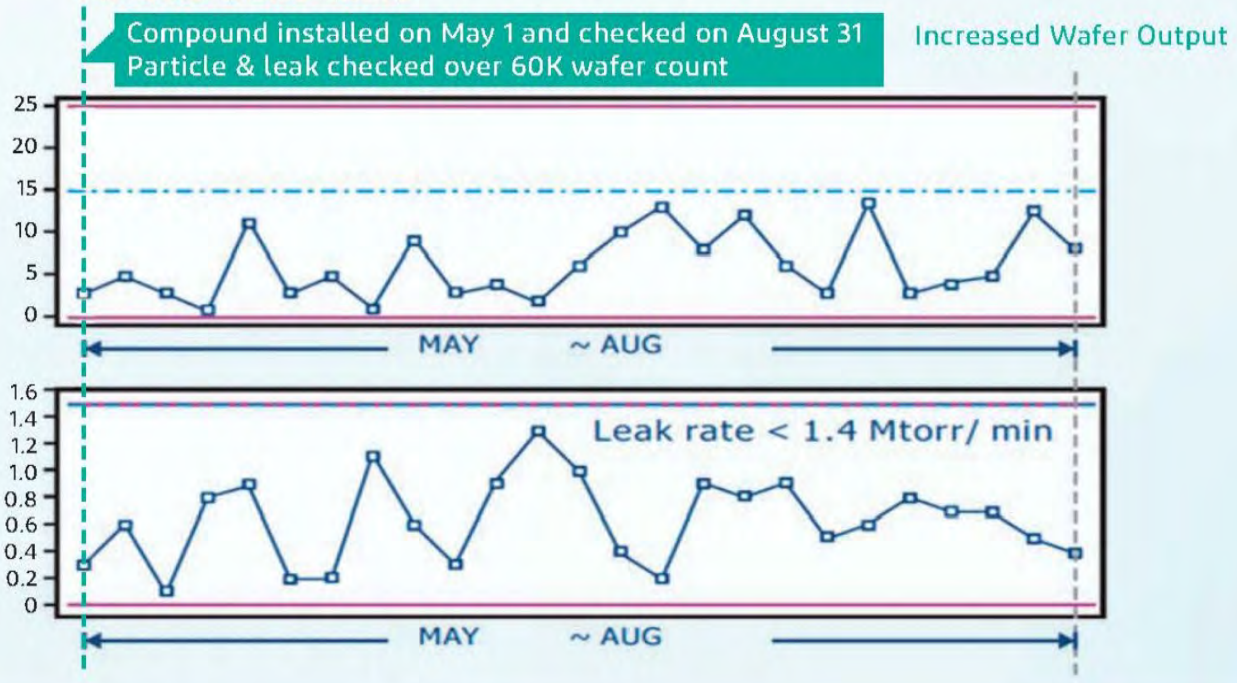
- **Improves Your Seal Life and Lowers Your Cost of Ownership**

Equipment:	300mm Producer
U-O-P:	O-ring PM kit
Process Gases/Chemical:	TEOS, SiH4, NF3, Chamber lid
RF Power:	400 Watts RF
Est. Seal Temp.:	150°C
Chamber Pressure:	10mTorr
Problem:	ncumbent parts run 20,000 pcs / wafer : Found Crack—particle generation
Spec:	0.12 μ m 25ea ↓

Incumbent Material
after 20,000 wafer counts

PERFREZ®6022
after 30,000 wafer counts

Particle trend chart



CASE STUDY:
High Purity Solution for High Temp Applications

Material: PERFREZ® MX30

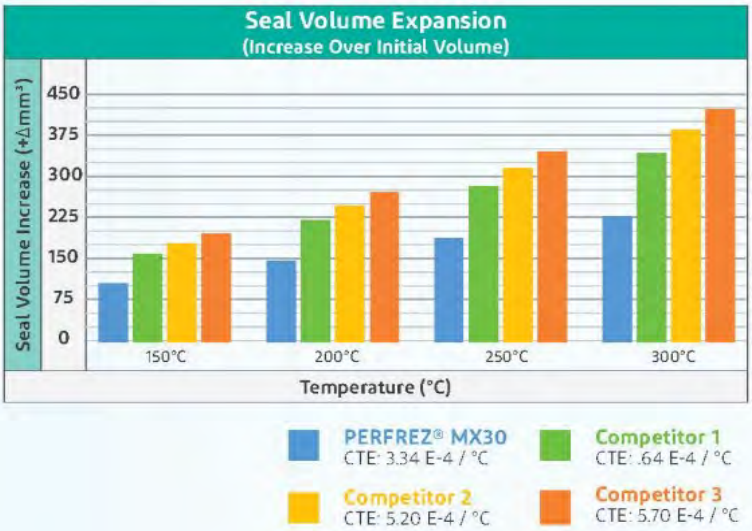
- **Maintaining Cleanliness and Process Integrity Under High Temperatures and Harsh Chemistries**

PERFREZ® MX30 expands the MX series, being specially developed to handle extreme high temperatures combined with aggressive oxygen-based plasma, while generating minimal particles.

Thermal Expansion

For AS-214 O-ring (ID 24.99 mm x CSD 3.53 mm = Initial Volume 876.88 mm³), assuming ambient temperature of 20°C, thermal expansion for different materials occurs as follows. The Coefficient of Thermal Expansion (CTE) describes each material's capacity to expand at high temperatures.

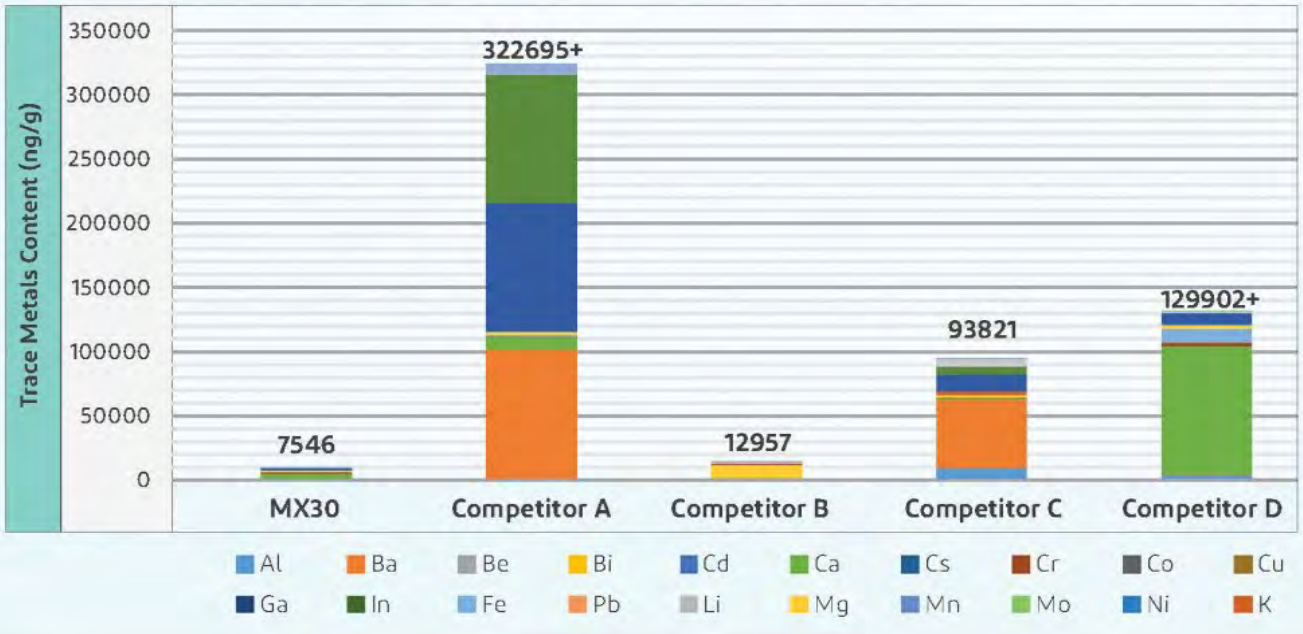
PERFREZ® MX30 features superior low CTE amongst high temperature-rated FFKMs, achieving roughly 40% lower volume expansion versus some competitor FFKMs.



ICP-MS (Ash Data)

PERFREZ® MX30 combines excellent thermal and chemical resistance with high purity, ensuring that cleanliness and process integrity will not be compromised.

PERFREZ® MX30 provides superior purity against not only industrial and Sub-Fab grade FFKMs, but also versus clean Fab-grade FFKMs as well.FFKMs as well.



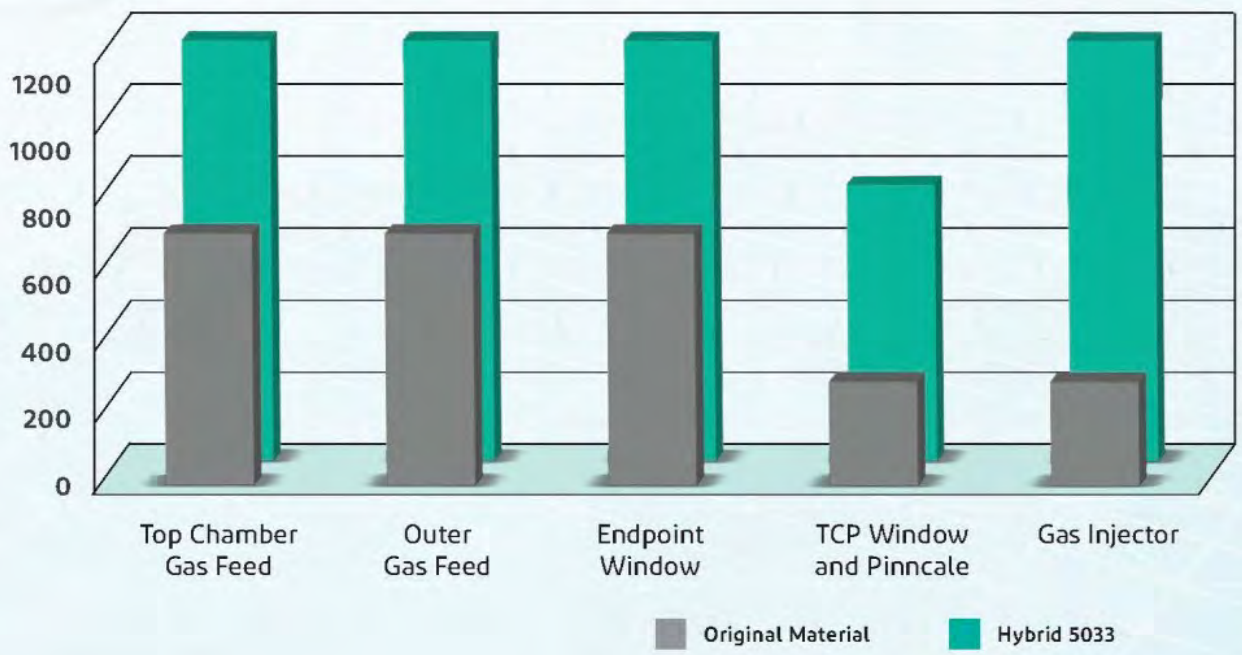
CASE STUDY:
Etch Process

Material: PERFREZ® 5033

- **Provides Economic Solutions for Better Performance**

Descriptions	Sealing Locations
O-RING, HYBRID ID 21.300" CSD 0.139"	Top Chamber Gas Feed
O-RING, HYBRID ID 1.046" CSD 0.139"	Outer Gas Feed
O-RING, HYBRID ID 1.698" CSD 0.142"	Endpoint Window
O-RING, HYBRID ID 17.955" CSD 0.139" w/ Tail	TCP Window and Pinnacle
O-RING, HYBRID ID 1.049" CSD 0.103"	Gas Injector

PERFREZ® 5033 Seal Performance vs. Incumbent Material



Bonded Gates and Custom Designs

In addition to a full series of standard O-rings, ASNA also specializes in manufacturing all kinds of custom designed products for very demanding applications. Our highly experienced R&D team is available to work with your engineering group to develop new products for your strict specifications and requirements.

Moldings to Your Requirements

Sealing elements made with PERFREZ® compounds are available for the following application categories

Static:

- Electrode seals
- Lamp seals
- Exhaust valves
- Gas inlets / outlets
- Window seals
- Center rings

Dynamic:

- Door seals
- Gate valves
- Pendulum valves
- Lip seals
- Chamber lid seals

Fittings:

- Carrier
- Wafer / FPD
- Support
- Transport
- FOUP

SMART Sealing®
ASNA

At ASNA, we know that the harsh chemical, gas, and high temperature semiconductor processes are a challenge for seal performance integrity. Our SMART sealing® solutions provide the most advanced sealing compounds in the global market, making them virtually impervious to any process media including plasma, deposition, thermal, and wet applications.

Compound	PERFREZ® 5033	PERFREZ® 6022	PERFREZ® XL12
Physical properties			
Polymer type	FKM	FFKM	FFKM
Color	Beige	Off-white	Off-white
Specific gravity [g/cm	1.96	2.21	2.05
Hardness [Shore A]	80	80	78
Mechanical properties			
Tensile Strength [MPa]	15.6	21.8	17.1
Elongation [%]	263	161	200
Modulus at 100% [MPa]	6.5	14.66	6.79
Compression set	25[2]	33[3]	27[4]
Thermal			
Service temperature [°C]	-25 to +260	-20 to +280	-20 to +260
[1] Hardness tolerance = ±5 [2] 70h at 200°C [3] 72h at 200°C [4] 72h at 175°C			

Valve description, features and intended application:

Series 021/031	Series 022/032	Series 034	
MONOVAT™ classic	MONOVAT™ direct	C-Insert	S-Insert
			
Transfer valve for load lock / process module isolation	Transfer valve for load lock / process module isolation	Designed for Producer® SE	Designed for Producer® GT retrofitable to Producer® SE
Bellow feed through	Protected bellows feed through	Shaft-sealed with intermediate pumping	Protected bellows feed through
Various gate dimensions	Various gate dimensions	DN 35x336	DN 35x336
Replaced by Series 022/032	Easy gate exchange	Replaced by S-Insert	Low particle count
-	5 million cycles maintenance free actuator	-	5 million cycles maintenance free actuator

Compound Description and Intended Applications

- **Perfrez® 5033 :** Suitable for chemistries and plasma. An upgrade option of FKM when chemical compatibility and cleaner requirements are necessary.
- **Perfrez® 6022 :** Applicable for the most arduous static and dynamic applications at temperatures above 250°C. Ultra clean compound.
- **Perfrez® XL12 :** A nano-filled material designed to meet the most rigorous defect level demands. Employed in evolving process technologies that require ultra-low metal contaminants coupled with extremely low particle generation.

Recommended minimal actuation pressures:
Minimal actuation pressures translate into less force transmitted to the actual dynamic seal. The pressure values listed in the table below are based on data gathered during compound qualification and do not consider changes to the compression set caused by use of the insert under process conditions.

Series 021/031	Displacement controlled		Independent from operational pressure, applied compound and dimension
All Apply	Bar	Psi	
	4	58-102	

Series 022/032	Size 09 32/222		Size 10 46X236		Size 12 50X336		Size 13 56X496	
Compound Type	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi
5033	4.5	65	2.5	36	3	43	3.5	51
6022	4.1	59	2	29	2	29	2	29
XL12	4.8	70	2	29	2	29	2.5	36

Preliminary values

Series 034	C-Insert		S-Insert	
Compound Type	Bar	Psi	Bar	Pai
5033	3.3	48	4.5	65
6022	3	43	4.1	59
XL12	3.5	51	4.8	70

***Other XL materials are also available, please contact ASNA engineers for more information.
Source from Kaelin. J. VAT Vakuumventile AG, MONOVAT™ Gate Spec Sheet, PERFREZ®. 290120EB. Release Date: February 2013.

CASE STUDY:
Etch Process

Material: PERFREZ® XL12

• Outperforms in NF_3 / O_2 plasma and Exceeds Performance Expectations

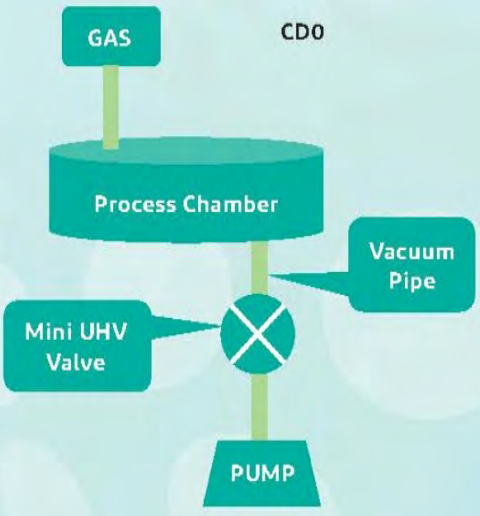
- Harsh byproducts from process attack elastomer causing leaks for Product on Record (POR) material.
- PERFREZ® XL12 tested and expectations were exceeded (36K wafers), 4X life compared to POR.

POR after 12K wafers

Material shows severe degradation

PERFREZ® XL12 after 50K wafers

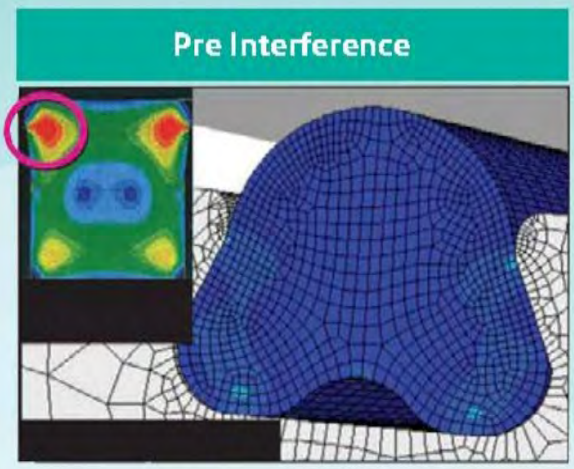
Material remains intact, smooth surface and no degradation



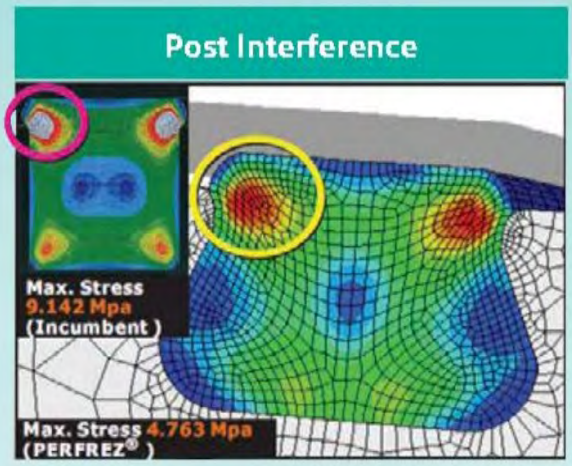
CASE STUDY:
New Generation Gate Valve Door Seal

PERFREZ® Exhibits Exceptional Seal Force Retention

Finite Element Analysis (FEA)



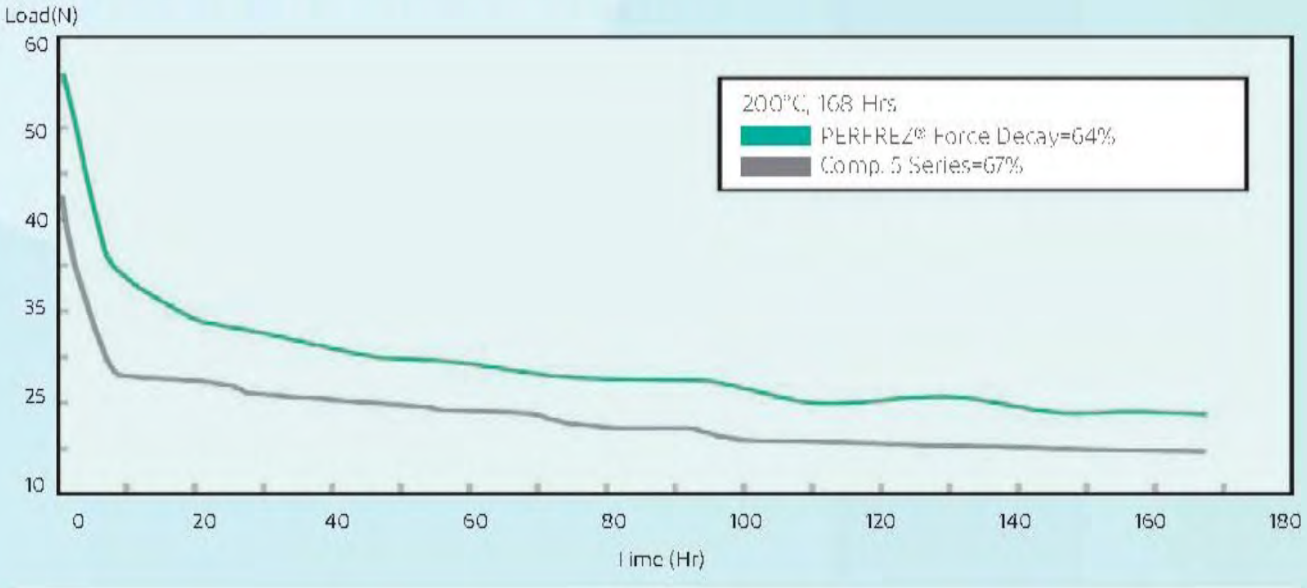
Incumbent vs. PERFREZ® material



Incumbent vs. PERFREZ® material

- **PERFREZ® designs will reduce the seal surface area subject to plasma strike. As the plasma strike surface is minimized the risk of particle generation can be significantly reduced.**

ASTM D6147 Force Retention Decay Test



PERFREZ® new technology can assist you in extending the lifetime of seals significantly.

SMART Sealing®
ASNA

ASNA AROUND THE WORLD

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Taiwan

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Boise, ID & Portland, OR

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INNODYS Ltd

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46540 Fremont Blvd., Unit 510, Fremont, CA 94538, USA
US Toll Free : 888-551-ASNA
TEL : 510-623-8307
MAIL : info@asnaglobal.com
FAX : 510-623-8723

WWW.ASNAGLOBAL.COM