



# Semiconductor

SEALING SOLUTIONS



# Optimum semiconductor sealing solutions

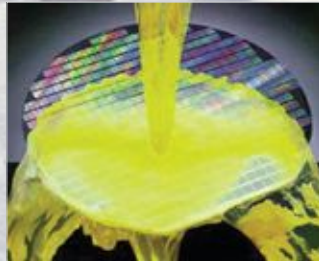
The semiconductor manufacturing process is extremely aggressive and seals are invariably housed in areas of the processing system where they need to withstand highly corrosive liquids, gases and plasmas often at elevated temperatures or in vacuum conditions. Trelleborg Sealing Solutions are a leading developer and manufacturer of high performance sealing options and we work with our customers to help them establish the optimum seal material and design to maximise the performance of semiconductor manufacturing equipment. This can result in increased service life and extended mean time between planned maintenance (MTBM) thereby reducing downtime and maximising production efficiency and yields, process reliability and minimising overall cost of ownership.

The considerable practical experience of Trelleborg Sealing Solutions in solution provision allows us to recommend the best possible option from our extensive range of innovative seal materials and products, many specifically engineered to meet the increasingly demanding requirements of the industry and to provide exceptional sealing integrity. We provide a single source for the majority of semiconductor equipment sealing requirements including the most stringent within critical manufacturing processes.

## The range of products offer:

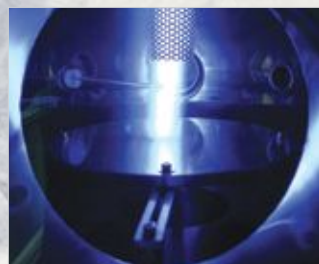
- Temperature resistance from cryogenic up to 850°C
- Almost universal chemical resistance; withstanding aggressive fluids including acids, bases, solvents amine based strippers and gases, chlorinated cleaning gases, oxygen and fluorine plasmas
- Excellent stability both thermal and when operating within a vacuum or under pressure
- Extremely low levels of ionic impurities (anionic and cationic) and TOCs (Total Organic Carbon)
- Minimal particle generation and outgassing even at elevated temperatures
- Low permeation rates
- Reduced IR absorption and weight loss
- Good mechanical performance
- Low long-term compression set
- Resistance to dry and wet process chemistry





### **Wet process applications**

Wet process sealing options combine continuous mid-range operating temperatures with excellent performance in ultra pure de-ionised water and a low level of extractable total organic carbon.



### **Aggressive plasma systems**

Seals can meet the needs of aggressive plasma applications for ultra high purity, cleanliness, reliability and long life, demonstrating minimal particulation and extremely low outgassing.



### **High temperature resistance**

The challenge of continuous high temperature operation requires highperformance materials, which minimise outgassing even when sealing aggressive chemicals and media.

# High performance elastomer sealing technology

## **Breadth of range**

Due to the breadth of range offered by Trelleborg Sealing Solutions, designers can specify seals that meet the challenge of balancing cost effectiveness with performance. Any size of O-Ring (standard or custom) is available alongside custom moulded designs and bonded products; in materials ranging from basic elastomer grades to leading edge, high specification compounds, specifically developed for semiconductor equipment applications. These innovative compounds help reduce downtime and improve production efficiency by extending seal life.

## **Advanced elastomer seals**

Fluoroelastomer (FKM) seals are ideal for downstream applications such as vacuum pumps and wet process applications where temperatures do not exceed 180°C. These materials exhibit excellent resistance to a wide range of chemicals deployed in the semiconductor industry, whilst offering high purity with low permeation and outgassing levels for vacuum applications.

## **Isolast® Fab Range™**

The ultimate in elastomer sealing is the Trelleborg Sealing Solutions Isolast® Fab Range™. These high performance Perfluoroelastomers (FFKM) are virtually inert and demonstrate almost universal chemical compatibility. Suitable for wet processing systems at elevated temperatures and in aggressive plasma applications, they are ideal as an upstream sealing solution. For thermal applications, specialist grades have been developed to operate at continuous temperatures up to 325°C.

## **Bonded to metal**

Trelleborg Sealing Solutions can effectively bond FKM and Isolast® seals to a wide variety of surfaces including stainless and mild steel, aluminium, brass and various plastics. This gives the major advantages of maximising seal integrity, eliminating contamination associated with groove voids, providing ease of assembly, reduced inventory and cost effective seal solutions.



#### **Crystal clear elastomer**

A specially developed translucent elastomer offers a sealing solution with an extremely low level of ionic impurities.



#### **Isolast® Fab Range™**

The ultimate in elastomer sealing, these virtually inert and almost universally chemical compatibility materials have been specifically designed to operate effectively in aggressive semiconductor processing systems.



#### **Seals bonded to metal**

FKM and Isolast® seals are successfully bonded to metals and plastics, maximising seal integrity, eliminating contamination associated with groove voids and providing cost effective seal solutions.



**Varilip® PDR in rotary applications**

Outstanding, high performance rotary shaft seals effectively prevent gearbox oil entering the processing system and allow the introduction of an inert gas barrier system within semiconductor processing pumps.



**Variseal® extreme sealing**

Field-proven in extreme gas and liquid handling situations, Variseal® have been used in the most demanding of semiconductor sealing applications including high vacuum and corrosive environments.



**High performance engineered thermoplastics**

These offer novel sealing and bearing solutions in proprietary materials such as HiMod® (PEEK™ or polyimide based) and Turcon® (PTFE based).



**Wills Rings® for the optimum solution**

Wills Rings® in O or C cross sections can operate in high pressure and hard vacuum situations within continuous temperatures from cryogenic up to 850C°.

# Innovative engineered sealing options



## **Varilip® PDR**

At the leading edge of sealing developments, Trelleborg Sealing Solutions provide a broad range of custom and standard options based on engineered plastic and metal technologies. Outstanding, high performance Varilip® PDR rotary shaft seals, comprise a Turcon® PTFE sealing lip retained in a crimped or clamped metal case. These multi-lip seals are ideal for use in semiconductor process pumps where they effectively prevent gearbox oil entering the processing system and allow the introduction of an inert gas barrier system. Custom designed for each application, they demonstrate low friction and wear characteristics and offer almost universal chemical compatibility over an extremely wide temperature range.

## **Variseal®**

Field-proven in extreme gas and liquid handling situations, Variseal® spring energised Turcon® PTFE seals have been used in the most demanding of semiconductor sealing applications including high vacuum and corrosive environments. With the correct selection of PTFE, filled PTFE compounds and appropriate spring material and profile, Variseal® can provide the highest level of system integrity.

## **Engineered thermoplastics**

High performance engineered thermoplastics offer novel sealing solutions in materials such as PEEK™ (Polyether Ether Ketone) and polyimide. This withstands high service temperatures, demonstrating good chemical and plasma resistance, electrostatic control and low outgassing. HiMod® wear rings and bearings for piston and rod applications have proved successful in a number of semiconductor applications which require outstanding dimensional stability and low particle shedding. Specialist Turcon® PTFE components include bellows offering a high purity and chemically compatible option to rubber joints.

## **Wills Rings®**

Wills Rings® are metallic seals providing the optimum solution in static sealing on connectors, flanges and plates for gases and liquids under extremes of temperature and pressure, from cryogenic to 850°C and hard vacuum to 1000 MPa. Wills Rings® are available in a wide range of metals, O or C cross section with either pressure filled or system pressure activation.

# Development partnerships optimise applications

Trelleborg Sealing Solutions work with semiconductor customers in development partnerships, identifying the best sealing option for specific applications from a broad choice of materials and seal profiles. Trelleborg Sealing Solutions also develop unique formulations and products specifically to meet particular industry or functional requirements, with proposed solutions proven in leading edge test facilities and backed by independent tests through internationally recognised institutes.

## High speed operation

The low surface tension of PFPE oil, typically used in semiconductor pumps and boosters, means it is difficult to maintain a meniscus of fluid, necessary for good sealing. For high speed rotary applications Trelleborg Sealing Solutions developed a Varilip® PDR with hydrodynamic sealing lip in a specially formulated grade of Turcon® PTFE, giving high integrity sealing and low level of power consumption.

## Resisting harsh chemicals

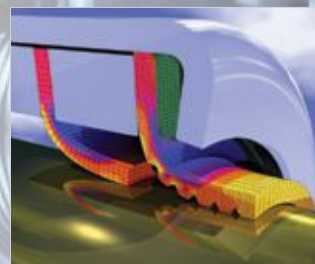
In contact with harsh chemicals, gases and plasmas in semiconductor processing systems, seals suffer degradation. Aiming at developing resistant materials, the resultant Isolast® Fab Range™ offer perfluoroelastomer seals demonstrating market leading chemical resistance. These give extended seal life, increased MTBO and equipment reliability, leading to improved production yields.

## Hard vacuum sealing

Vacuum sealing is a critical application within the semiconductor industry. In-house helium leak testing to 10-12 mbar/l/sec has been used to analyse the integrity of different sealing arrangements in vacuum conditions, enabling the development of solutions in elastomer, plastic and metal, proven to be capable of sealing extreme hard vacuums.

## Ensuring consistent purity

Trelleborg Sealing Solutions invested in a cleanroom manufacturing facility for its high performance Isolast® Fab Range™ to meet the increasing demand from semiconductor manufacturers for cleanliness and purity. This is ensured with seal production of ultra-pure polymers with high purity fillers in the specialist cleanroom, which incorporates final wash and pack in class 100 conditions and double bag packaging.



### Advanced FEA methods

FEA modeling techniques were used in conjunction with test rigs to prove the Varilip® PDR sealing solution developed for high-speed semiconductor pumps and boosters.



### Excellent chemical resistance

Seals have to withstand some of the harshest of environments in plasma applications. The Isolast® Fab Range™ has been specially designed to offer materials resistant in this environment.





**Helium testing in vacuum**

Analysis of sealing integrity in vacuum conditions is carried out on an in-house helium test rig. This has enabled development for effective solutions for hard vacuum applications.



**Clean room production**

To ensure purity in seal production, the Isolast® Fab Range™ are manufactured in clean room conditions, washed and packed to class 100 conditions and double bagged.

# Market leading global sealing capabilities

## **Total – Sealing technology**

Trelleborg Sealing Solutions is a major international sealing force, uniquely placed to offer a dedicated design and development service for sealing arrangements, from our market leading product and material portfolio; one which has provided solutions that feature in virtually every application conceivable within the aerospace, industrial, and automotive industries.

## **Global – A worldwide presence**

Globally servicing, supporting and supplying our customers, Trelleborg Sealing Solutions have an international network of over 80 facilities worldwide. They include more than 30 manufacturing sites, strategically positioned materials and development laboratories and fully resourced design and application centres, continuously succeeding in the delivery of sealing solutions to the highest standards. Facilities are certified to ISO 9001-2000, with many manufacturing sites also working to QS9000 and VDA 6.1.

## **Expertise – Our proven capabilities**

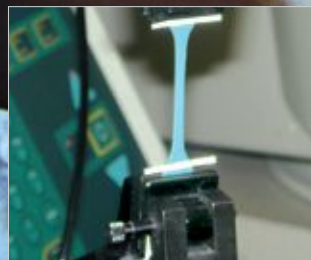
With over 50-years experience in development and application of sealing systems, Trelleborg Sealing Solutions engineering personnel contribute their knowledge of this specialised technology directly to customers. This includes project management of design, prototyping, production, test and installation using state-of-the-art design tools, fully customer-compatible CAD systems and leading edge Finite Element Analysis (FEA).

## **Innovation – In materials and supply**

Developing and formulating our materials in-house, Trelleborg Sealing Solutions have also acquired significant skills in the field of applied materials technology. Working in close cooperation with worldwide partners, we are engaged in on-going programmes of material and product development to provide customers with competitive advantage, utilising latest technologies and the resource of our material database, which includes over 2,000 proprietary compounds.

## **Commitment – To customers' needs long-term**

The aim of Trelleborg Sealing Solutions is to facilitate customers in the achievement of cost effective, durable solutions that match their specific business requirements and needs. This includes our logistical support which effectively delivers over 40,000 different seals and sealing systems to our customers worldwide. As the global sales and marketing organisation of Trelleborg Sealing Solutions, who develop, manufacture and market safety-critical polymer-based precision seals and associated systems, we have the backing of one of the world's foremost experts in polymer sealing technology.



## **Extensive test facilities**

Strategically positioned materials and development laboratories and fully resourced design and application centres, continuously succeed in the delivery of sealing solutions.



**Innovative material development**

Developing and formulating materials in-house and engaging in on-going programmes of development, Trelleborg Sealing Solutions are also skilled in the field of applied materials technology.



**Superior logistics support**

Trelleborg Sealing Solutions invested in an advanced logistical support system, which effectively delivers products to our customers worldwide.

## LOCAL CONTACTS

### EUROPE

**Austria – Vienna** (Slovenia)

+43 (0) 1 406 47 33

**Belgium - Dion-Valmont** (Luxembourg)

+32 (0) 10 22 57 50

**Bulgaria – Sofia**

(Azerbaijan, Belarus, Greece, Romania, Ukraine)

+359 (0) 2 969 95 99

**Croatia – Zagreb** (Albania, Bosnia and Herzegovina,

Macedonia, Serbia, Montenegro)

+385 (0) 1 24 56 387

**Czech Republic - Rakovnik** (Slovakia)

+420 313 529 111

**Denmark – Copenhagen**

+45 48 22 80 80

**Finland – Vantaa** (Estonia, Latvia)

+358 (0) 207 12 13 50

**France - Maisons-Laffitte**

+33 (0) 1 30 86 56 00

**Germany - Stuttgart**

+49 (0) 711 7864 0

**Hungary – Budaörs**

+36 (06) 23 50 21 21

**Italy – Livorno**

+39 0586 22 6111

**The Netherlands - Rotterdam**

+31 (0) 10 29 22 111

**Norway – Oslo**

+47 22 64 60 80

**Poland – Warsaw** (Lithuania)

+48 (0) 22 863 30 11

**Russia – Moscow**

+7 495 982 39 21

**Spain – Madrid** (Portugal)

+34 (0) 91 71057 30

**Sweden – Jönköping**

+46 (0) 36 34 15 00

**Switzerland – Crissier**

+41 (0) 21 631 41 11

**Turkey – Istanbul**

+90 216 569 73 00

**United Kingdom - Solihull** (Eire, South Africa)

+44 (0) 121 744 1221

**Aerospace Hub Europe, North**

(UK and Nordic Countries)

+44 (0) 121 744 1221

**Aerospace Hub Europe, South & West**

(Continental Europe and Middle East)

+33 (0) 1 30 86 56 00

**Automotive Hub Europe**

+49 (0) 711 7864 0

### AMERICAS

**Americas Regional**

+1 260 749 9631

**Brazil – São José dos Campos**

+55 12 3932 7600

**Canada Central – Etobicoke, ON**

+1 416 213 9444

**Canada East – Montreal, QC**

+1 514 284 1114

**Canada West – Langley, BC**

+1 604 539 0098

**Mexico - Mexico City**

+52 55 57 19 50 05

**USA, Great Lakes - Fort Wayne, IN**

+1 260 482 4050

**USA, East - Mt. Juliet, TN**

+1 615 800 8340

**USA, Midwest - Hanover Park, IL**

+1 630 539 5500

**USA, Northern California - Fresno, CA**

+1 559 449 6070

**USA, Northwest - Portland, OR**

+1 503 595 6565

**USA, Southwest - Houston, TX**

+1 713 461 3495

**Aerospace Hub Airframe**

+1 303 469 1357

**Aerospace Hub Distribution & Engineering**

+1 260 749 9631

**Aerospace Hub East**

+1 610 828 3209

**Aerospace Hub West**

+1 310 371 1025

**Automotive Hub North America**

+1 734 354 1250

**Automotive Hub South America**

+55 12 3932 7600

### ASIA PACIFIC

**Asia Pacific Regional**

+65 6 577 1778

**China – Hong Kong**

+852 2366 9165

**China – Shanghai**

+86 (0) 21 6145 1830

**India – Bangalore**

+91 (0) 80 3372 9000

**Japan – Tokyo**

+81 (0) 3 5633 8008

**Korea – Seoul**

+82 (0) 2 761 3471

**Malaysia - Kuala Lumpur**

+60 (0) 3 90549266

**Taiwan – Taichung**

+886 4 2382 8886

**Vietnam – Ho Chi Minh City**

+84 8 6288 6407

**Singapore and all other countries in South and East Asia, Australasia**

+65 6 577 1778

**Aerospace Hub China**

+86 (0) 21 6145 1830

**Aerospace Hub Singapore**

+65 6 577 1778

**Automotive Hub China**

+86 (0) 21 6145 1830

**Automotive Hub India**

+91 (0) 80 3372 9200

### AFRICA, CENTRAL ASIA AND MIDDLE EAST

**Africa & Iran** (excluding South Africa (see UK))

+41 (0) 21 631 41 11

**Central Asia** (Armenia, Georgia, Kazakhstan,

Kyrgyzstan, Tajikistan, Uzbekistan)

+7 495 982 39 21

**Middle East and Gulf Region**

+359 (0) 2 969 95 99



Trelleborg is a world leader in engineered polymer solutions that seal, damp and protect critical applications in demanding environments. Its innovative engineered solutions accelerate performance for customers in a sustainable way. The Trelleborg Group has local presence in over 40 countries around the world.

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