



Sealing Solutions for Industrial Automation

EMPOWERING EFFICIENCY AND RELIABILITY IN AUTOMATION SYSTEMS



Precision Automation

The industrial automation industry uses intelligent components such as motors, actuators, sensors and computer technology to control and operate various industrial processes and machinery with minimal human intervention. It is found across a wide range of industries, including manufacturing, agriculture, energy production, logistics and healthcare.

Precision is fundamental to the effectiveness, efficiency and safety of automated systems. The ability to produce products with exact dimensions directly impacts product quality, cost, reliability and compliance with regulatory standards. It is crucial for industrial components in the motion system to be designed with this goal in mind.

High-performance sealing technology and engineered polymer solutions play a vital role in industrial automation systems. They prevent leaks, protect sensitive components and maintain low-friction operation in diverse industrial settings.

Trelleborg Sealing Solutions is a leader in advanced polymer technology for electric, pneumatic and hydraulic systems, robotics and automated manufacturing processes. Our advanced polymer components serve as the first line of defense against contamination, moisture and the harsh conditions often encountered in industrial environments. They reduce energy consumption and ensure smooth, reliable and repeatable motion to maximize equipment performance.

Custom and standard components meet application needs

Maximize system efficiency

Minimize preventative maintenance cycles

Precision motion control solutions

At Trelleborg Sealing Solutions, we play a pivotal role in advancing the industrial automation industry. We are a leading supplier of high-performance seals and engineered polymer components, offering customized solutions for a full range of industrial automation equipment.

FEATURES & BENEFITS

Wide portfolio of rotary, linear and static sealing solutions

- Low-friction polymer designs and materials boost system efficiency
- Wide range of elastomers and advanced polymers
- Robust components extend equipment service life
- Predictable wear rates simplify maintenance operations and minimize downtime
- Compliance with industry efficiency standards
- Advanced engineering and design capabilities facilitate the development of unique, custom solutions
- In-house product and materials testing facilities enable the development of new solutions
- Advanced manufacturing processes support the production of precision components with tight tolerances and of the highest quality

UNRIVALLED PRODUCT PORTFOLIO

We offer one of the most extensive ranges of rotary seals, linear seals, gaskets and custom-engineered components to match the sealing requirements of industrial automation applications.

This includes:

- Engineered performance thermoplastic components
- Stefa® radial shaft seals and cassette seals
- Turcon® polytetrafluoroethylene- (PTFE) based rotary seals
- U-Cups and other linear seals
- Static seals, including O-Rings, gaskets and FlatSeal™ flat gaskets
- Custom molded components, including multicomponent and rubber-to-metal parts

CONTACT YOUR CUSTOMER SOLUTION CENTER

Does your application have unique requirements? Is the operating environment of your application especially challenging? Reach out to your local Trelleborg Sealing Solutions Customer Solution Center for support.

www.trelleborg.com/seals/contact-form



Unrivalled Global Capabilities

We partner with major industrial automation equipment manufacturers around the globe to develop and supply innovative polymer solutions, which maximize the performance of their equipment.

We do this through:



Engineering Expertise

Our engineers design products with your application in mind. And if standard products don't meet your needs, we partner with customers locally utilizing a collaborative engineering approach from prototype development to market launch.

- Modern CAD tools (CATIA V)
- Experienced designers develop application-specific solutions
- On-site design at customer facilities
- Prototyping



R&D Capabilities

We develop and test the performance of seal designs and materials through dedicated in-house facilities to ensure our solutions meet customer requirements.

- 15 R&D centers across the globe
- World-class material and product testing equipment
- Finite element analysis (FEA) to simulate seal performance in real-world use cases



Advanced Manufacturing

Global manufacturing resources produce solutions using advanced technologies to match customer requirements. Our facilities are located in all regions across the globe to help you meet your supply chain needs.

- High-quality, precision components with tight tolerances
- Custom-molded and engineered solutions in unique and complex shapes and sizes
- Multicomponent technology strongly bonds a range of polymers into one-piece solutions



ServicePLUS Value-Added Services

Our worldwide network provides a range of supply chain services, such as rapid delivery and special kitting and packaging programs to help avoid downtime.

- Manufacturing services, including subcomponent assemblies and part identification
- Stocking and inventory management
- Repair and service packaging and kitting

Proven Performance

Our commitment to enhancing industrial automation equipment extends to optimizing energy efficiency and maximizing seal lifetime through rigorous testing and research.

Reducing power consumption and downtime for maintenance is vital to boosting the performance of motors, gearboxes, actuators and other industrial automation equipment. Motor losses, or inefficiencies, come from a variety of sources. A primary source of energy loss in automated systems is friction along the seals and bearings. This can be minimized by identifying seal designs and materials with low-friction properties. Our 15 R&D centers around the globe are equipped with state-of-the-art material and product testing equipment, allowing us to conduct comprehensive energy efficiency testing. We focus on two types of tests to understand how different components affect the overall efficiency of motion systems.

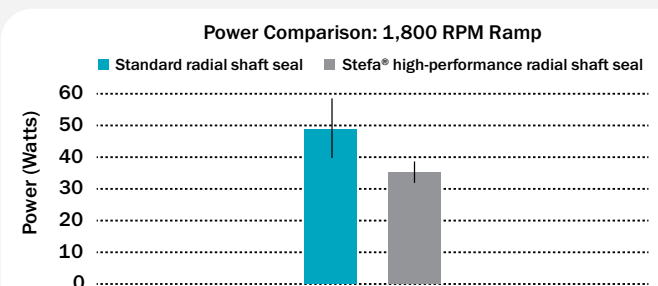


COMPARATIVE ENERGY USAGE TESTING

In our advanced test facilities, we perform rigorous comparative tests on full sealing systems and individual seal designs and materials, focusing on energy efficiency. Our tests analyze sealing integrity, under a range of operating conditions, while measuring the total power consumption in watts. This process helps us identify the most efficient full sealing solution that matches required ingress protection (IP) ratings.

LIFE CYCLE TESTING

We ensure that our solutions are designed for longevity with life cycle testing to reduce downtime and streamline maintenance operations. We account for various factors such as temperature, pressure, speed, and chemical compatibility, customizing tests to meet our customers' unique needs. By closely replicating real-world conditions, we ensure the best full sealing solution for specific environments.



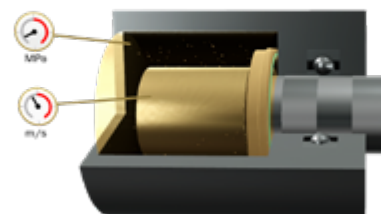
Advanced comparative testing proves our new high-performance radial shaft seal design minimizes power consumption in comparison to standard radial shaft seals.

Reducing power consumption by 15 watts with a single seal, translates to significant savings in manufacturing facilities: Medium-sized facilities can contain 1,000 motors. With 15 watt savings over 16 hours of operation per day, this adds up to 240 kilowatt-hours saved per day.

VIRTUAL SHOWROOM: PRODUCT & MATERIAL TESTING CAPABILITIES

Explore our in-house, extensive product and material testing facilities, which support the development of advanced sealing technology for today's and tomorrow's challenges.

www.trelleborg.com/seals-showroom



Automation Application Solutions

We are at the forefront of innovation in the industrial automation sector. Our high-performance solutions are instrumental in safeguarding the reliability, energy efficiency and safety of automation equipment, spanning a wide range of applications.

We are committed to adhering to industry regulations, which is evident in our close collaboration with original equipment manufacturers (OEMs). This ensures that our solutions are

precisely tailored to our customers' unique requirements, even the most challenging ones, such as weight reduction, minimizing friction and extending wear life.



ELECTRIC MOTORS

Improving Energy Efficiency

Whether utilizing AC, DC, Drum, Servo, or direct drive motors, these fundamental components contain internal mechanisms that require safeguarding against diverse environments through the use of seals capable of withstanding high RPMs. This not only minimizes friction but also enhances energy efficiency.

BACK/FRONT END COVER

Requirements:

- Protect motor components from dust and debris
- Withstand vibration

Trelleborg Solution:

O-Rings and custom-molded components are commonly used, where the motor cover meets the body. Depending on motor design, rotary seals may be required to seal along the shaft.

TERMINAL BOX

Requirements:

Prevent contamination and debris from reaching electrical wiring

Trelleborg Solution:

Depending on the hardware design, O-Rings or engineered molded parts provide effective sealing of the housing cover to protect sensitive electrical connections.

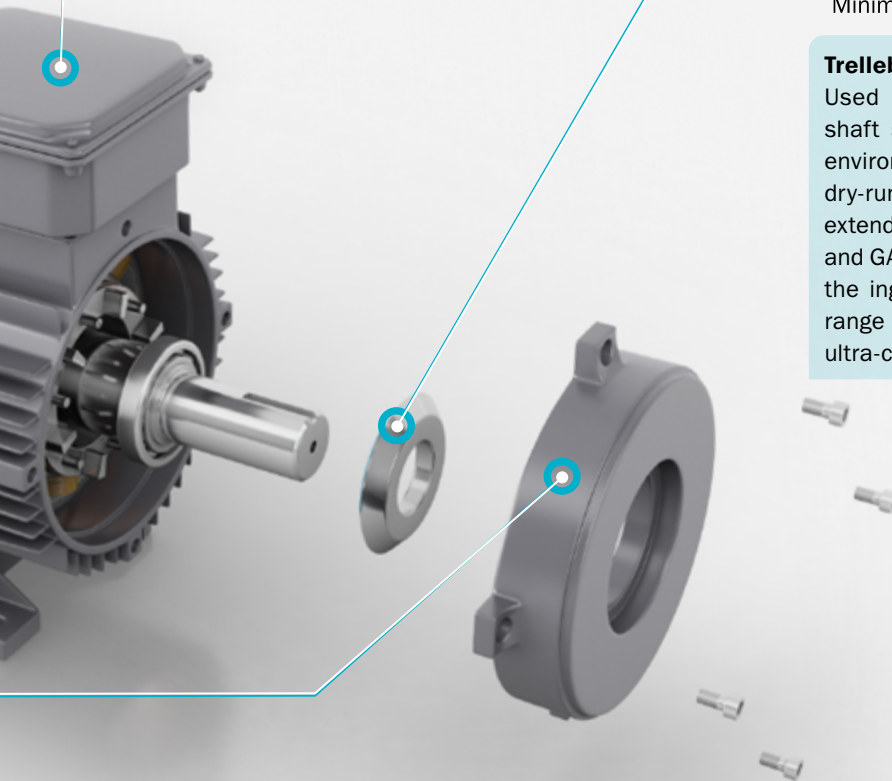
MAIN SHAFT

Requirements:

- Energy efficiency
- Protect the rotor and stator
- Prevent particle ingress
- Withstand vibration of the shaft
- Facilitate precision positioning of the shaft
- Minimize friction with little heat generation

Trelleborg Solution:

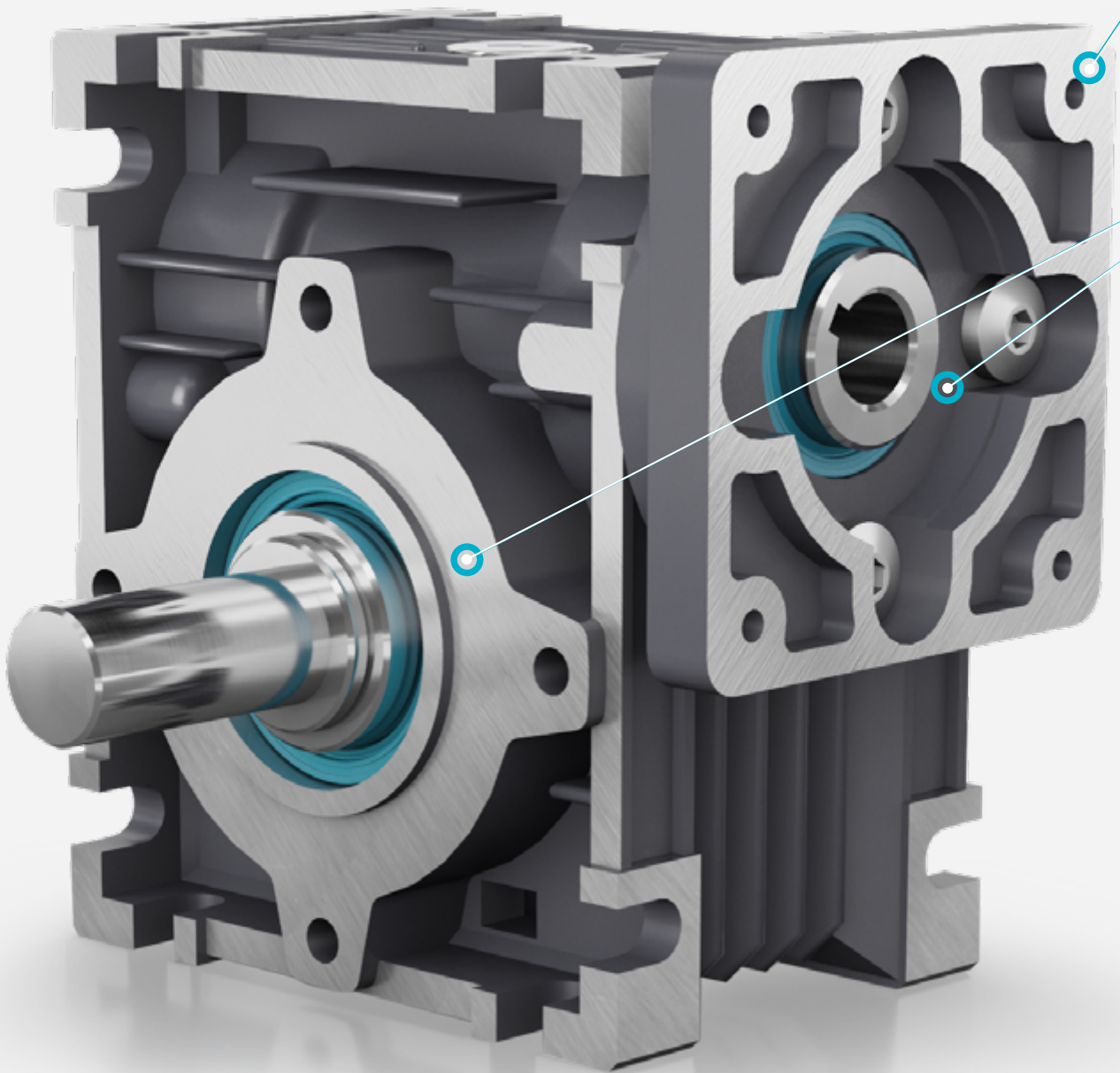
Used on the shaft, high-performance Stefa® radial shaft seals and the Turcon® Varilip® PDR for high-speed environments prevent excessive heat generation, even in dry-running environments, to increase motor efficiency and extend bearing and hardware lifetime. Our Forsheda® V-Ring and GAMMA Seal can be used as secondary seals to prevent the ingress of dirt and/or water. Our solutions cater to a range of environments from standard ingress protection to ultra-clean, washdown settings that demand IP69k ratings.



GEARBOXES AND SPEED REDUCERS

Extending application lifetime

Oil-filled gearboxes require oil seals to keep the oil in and debris out. Seals are crucial to improving gearbox performance and preventing leakage and contamination.



GEARBOX HOUSING COVER

Requirements:

- Eliminate leakage of lubricants
- Tight seal to minimize particle ingress
- Long service life

Trelleborg Solution:

Thanks to its excellent adaptability, the FlatSeal™ HMF17 offers optimum sealing performance, even in the most critical environments. It effectively seals and prevents leakage from the gearbox housing by compensating for the low-rigidity material of the housing, few and widely spaced bolts and low, uneven surface pressure.

INPUT AND OUTPUT SHAFTS

Requirements:

- Efficiency with minimal heat generation at high RPMs
- Protect against particle ingress (IP69K rating)
- Eliminate oil leakage
- Low-friction properties to enhance gearbox efficiency
- Long service life

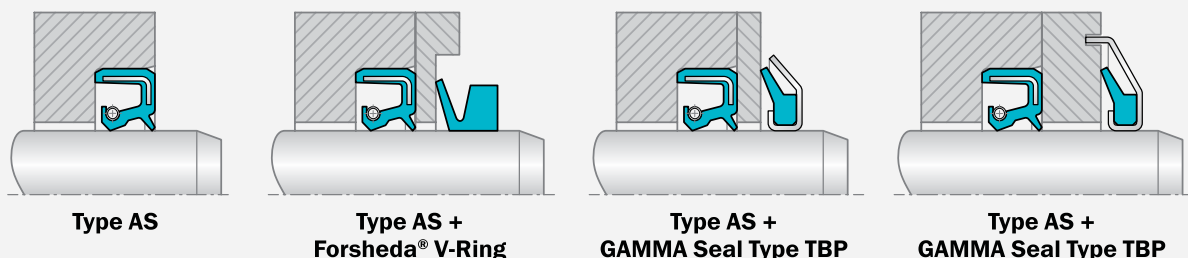
Trelleborg Solution:

Seals used on both the input and output shafts have a significant effect on thermal performance and choosing the right material for these seals can improve performance and seal life. Radial shaft seals keep the oil in and contamination out for tens of thousands of hours. Cassette seals are ideal for dirty environments and the Forsheda® V-Ring can be used as an optional secondary seal.

EFFECTIVE PROTECTION

High-performance seals play a vital role in protecting electronic devices and equipment from ingress by contaminants such as dust, water and other potentially damaging substances. Depending on the required level of ingress protection, we offer numerous sealing configurations.

Stefa® Radial Shaft Seals



Solutions for motor and gearbox applications to match increasing IP rating requirements

LINEAR ELECTRO-MECHANICAL ACTUATORS

Enabling precision actuation

Electrification is driving the adoption of electric linear actuators, enabling more efficient and precise motion control solutions, while lowering the cost of operation. Linear motion seals and scrapers facilitate high-velocity shaft speeds and clean and precise movements, even with side loads.

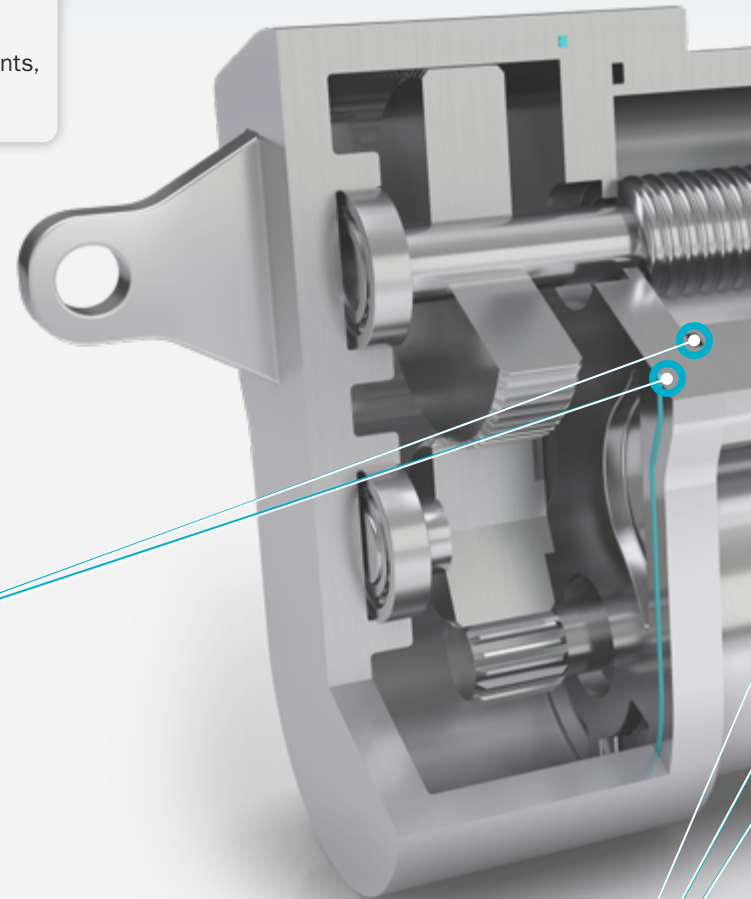
Actuator Housing

Requirements:

Prevent ingress of dust and debris
Wide-ranging chemical compatibility
Protection from electromagnetic interference (EMI) and radio frequency interference (RFI)

Trelleborg Solution:

Depending on the hardware design, O-Rings, gaskets or engineered molded parts provide effective sealing of the housing cover to ensure actuator performance.



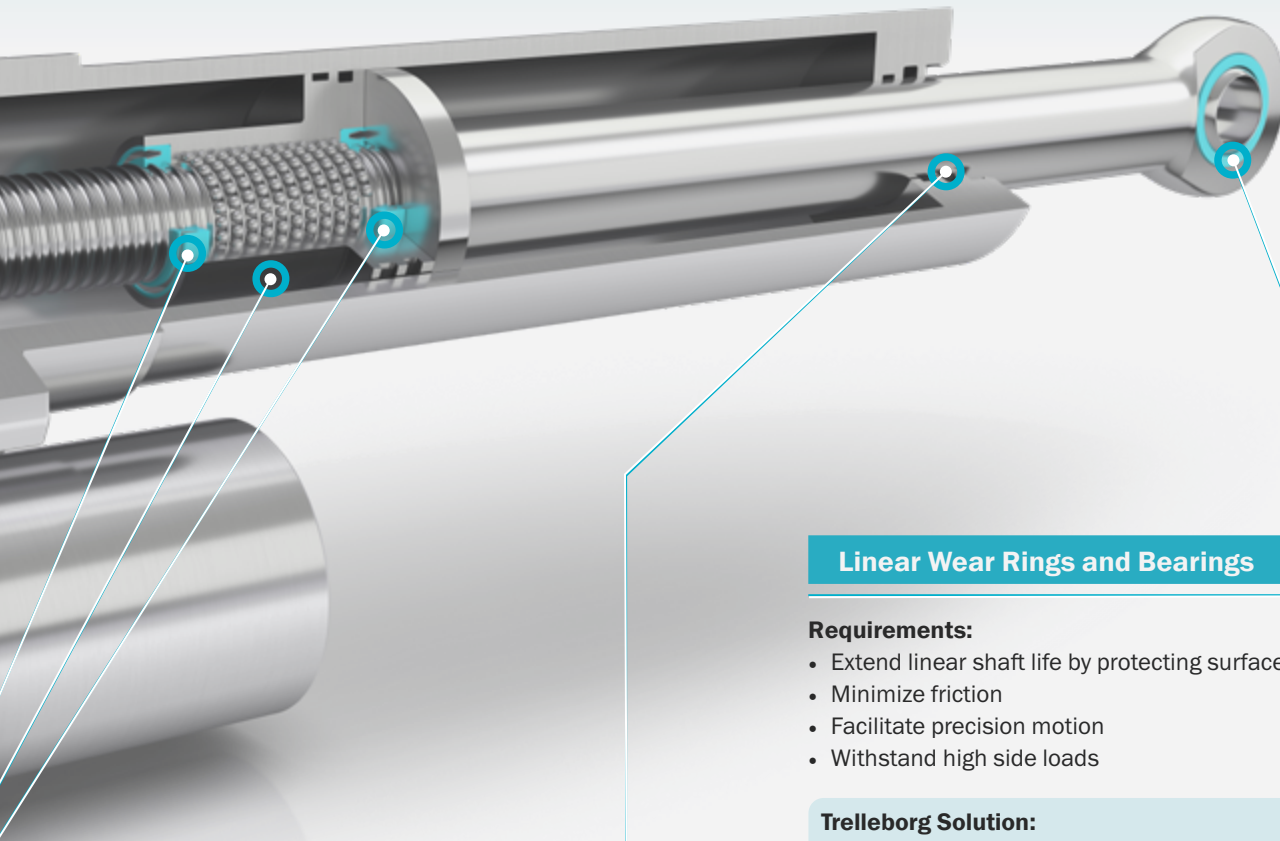
Low-Friction Motion Components

Requirements:

- Enable energy efficient operation with low-friction properties
- Facilitate smooth motion

Trelleborg Solution:

Utilizing our engineering expertise and advanced thermoplastic processing technology, we manufacture lead nuts, bearing carriers, lead screw scrapers, glides and slides, which are robust, resistant to wear and minimize friction to maximize system efficiency.



Linear Wear Rings and Bearings

Requirements:

- Extend linear shaft life by protecting surfaces from wear
- Minimize friction
- Facilitate precision motion
- Withstand high side loads

Trelleborg Solution:

HiMod® or Turcite® Slydring® wear rings and piston and rod seals, such as the Turcon® Glyd Ring® HZ provide effective sealing performance along the shaft. The Slydring® enhances stability, in particular under high side loads, and provides an additional barrier to prevent contamination.

Rod Seal

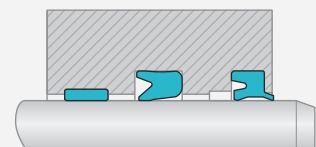
Requirements:

- Facilitate high frequency duty cycles
- Seal under high speeds with minimal heat generation
- Enable smooth, consistent motion
- Prevent particle ingress and contamination

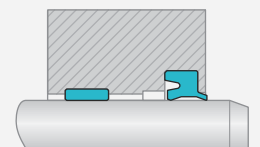
Trelleborg Solution:

Zurcon® polyurethane seals are commonly used along the shaft. The Zurcon® U-Cup RU9 serves as the primary seal and is paired with a double-acting Zurcon® Scraper DA22 for additional protection. Turcon® PTFE-based Variseal®, which offers superior low-friction properties to eliminate stick-slip, is the optimum choice for high-precision actuators.

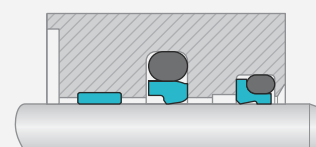
Rod Sealing Solutions



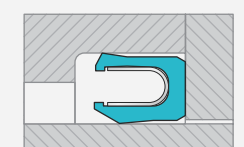
High-lubrication Slydring® wear ring, Zurcon® U-Cup RU9 and Zurcon® Scraper DA22



Low-lubrication Slydring® wear ring and Zurcon® Scraper DA22



Low-friction Slydring® wear ring, Turcon® Stepseal® 2K and Turcon® Excluder® 2



Low-friction Turcon® Variseal®

FACTORY AUTOMATION ROBOTICS

Maximizing durability, reliability and overall performance

Workhorse robots perform relentlessly, even in extreme environments. Sealing technology plays a critical role ensuring reliable and precision operation. It is vital to protect internal components, maintain efficiency and extend the operational lifespan of these machines.

Upper Arm Unit and Wrist Unit

Requirements:

- Low-friction properties to enable smooth oscillation
- Excellent sealing performance to prevent contamination and protect hardware
- Reduce wear on mating surface of seal
- Compact seal design

Trelleborg Solution:

We offer a wide range of rotary seals in different high-performance materials, including radial oil seals, Turcon® Variseal®, Forsheda® V-Ring and engineered molded parts.

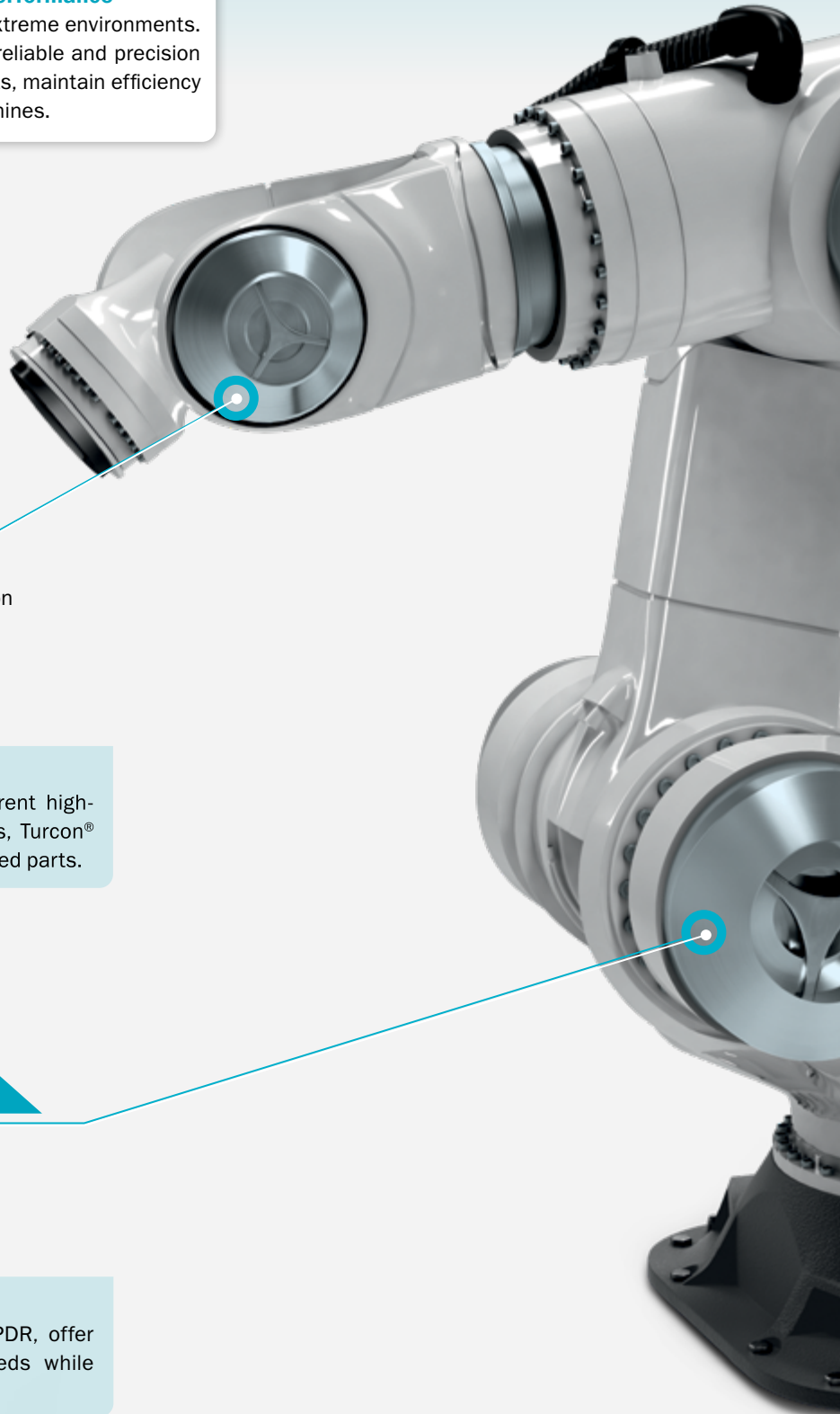
Drive Motor Unit and Reduction Gear

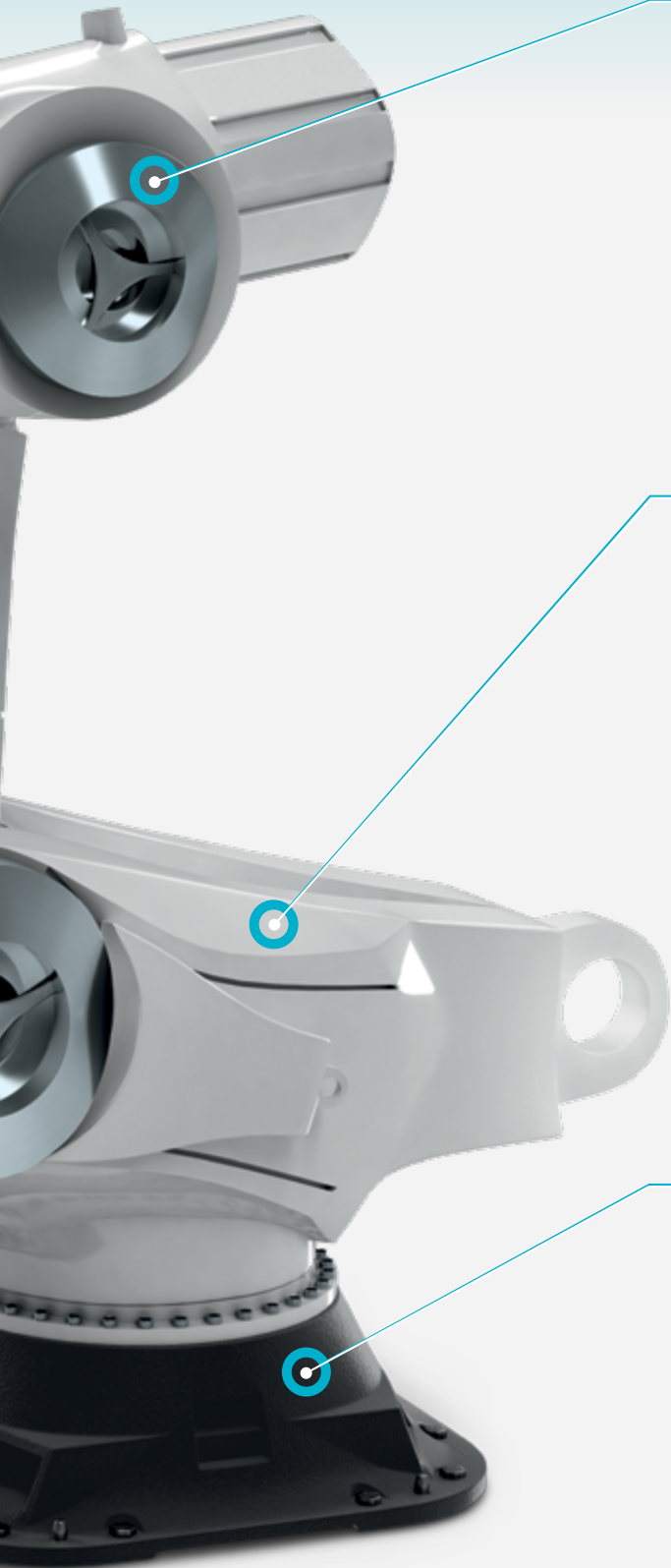
Requirements:

- Ability to perform at high shaft speeds
- Low-friction properties
- Compact seal design

Trelleborg Solution:

Rotary shaft seals, including Turcon® Varilip® PDR, offer robust performance at high input shaft speeds while minimizing friction and heat generation.





Gearbox Cover

Requirements:

- Reduce number of parts
- Eliminate contamination from grooves/voids
- Adaptable surface to effectively seal lower quality mating surfaces

Trelleborg Solution:
Elastomer-based engineered molded parts, rubber-to-metal bonded seals and the HMF FlatSeal™ offer a tight fit to protect vital components, making them ideal for gearbox lids.

Balance Cylinder

Requirements:

- Low-friction properties
- High resistance to wear and extrusion
- Compact design

Trelleborg Solution:
Our Zurcon® U-Cup RU9 offers good abrasion resistance, low compression set, high extrusion resistance and can operate in a wide range of temperatures.

Base Unit

Requirements:

- Compatibility with chemicals in the operating environment to prevent corrosion of the shaft
- Low-friction properties
- Compact design
- Easy to remove and install to simplify maintenance

Trelleborg Solution:
Our rotary seals offer effective sealing performance and a unique shaft repair kit enables rotary shaft lip seal maintenance without replacing the shaft.

LOW-FRICTION MOTION COMPONENTS

Strong, lightweight and multifunctional

Most motion systems use a variety of low-friction, polymer-based components to reduce weight, extend service life, optimize performance and boost strength.



Requirements:

- Consistent low-friction properties
- High strength with exceptional resistance to wear
- Long service life
- Protect against ingress
- Reduce downtime by extending maintenance intervals

Examples:

- Bearings and bushings
- Lead screw nuts
- Ball screw nuts
- Machine guideways
- Pillow blocks
- Linear slides

Trelleborg Solution:

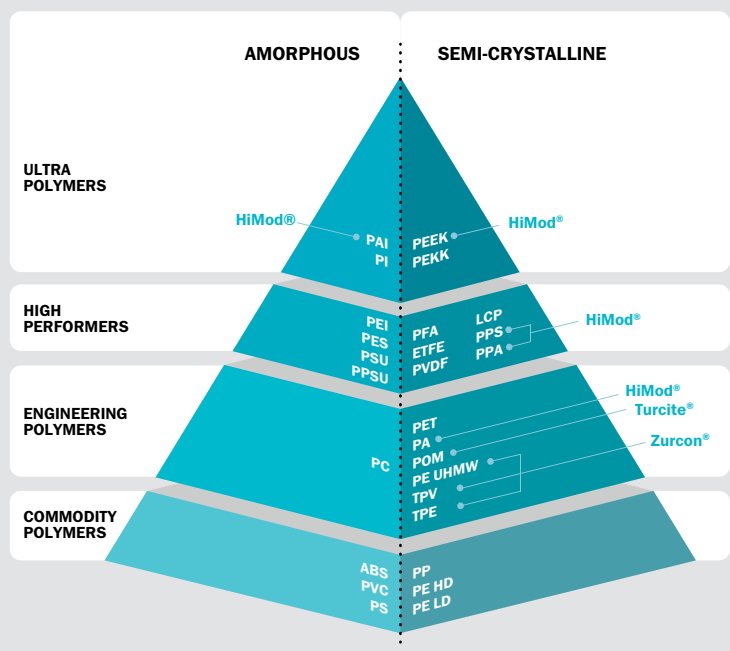
Our engineered thermoplastic solutions, including our proprietary Turcite® and HiMod® materials, are robust, resistant to wear and minimize friction to maximize system efficiency. Components can be produced in a wide range of geometries to meet unique customer requirements.

Engineered Polymer Performance Solutions

We offer custom thermoplastic materials in unique geometries to meet specific application requirements. Examples include products with enhanced corrosion and fire resistance or specialized compounds that can withstand challenging or niche conditions for longer. Our innovative manufacturing processes allow smaller and more complex shapes, facilitating reduced-size components or combining multiple functions into one product.

Learn more:

www.trelleborg.com/seals/products-and-solutions/latest-innovations/engineered-polymer-solutions





Mobile Service Robotics

Seals play a crucial role in material handling robots for warehouses, automated mobile robots (AMRs) for factory lines and automated cleaning robots by facilitating efficiency improvements which can significantly extend battery life. Precise speed control, positioning and durability are primary concerns for robots aiming to reduce labor costs and boost profits.

Trelleborg Solution:

High-performance radial shaft seals, the Turcon® Varilip® PDR and Turcon® Roto Variseal® efficiently seal rotating applications. Multicomponent technology, enabling the creation of custom one-piece solutions, is ideal when streamlining logistics processes and minimizing downtime are vital, alongside weight reduction and design considerations.

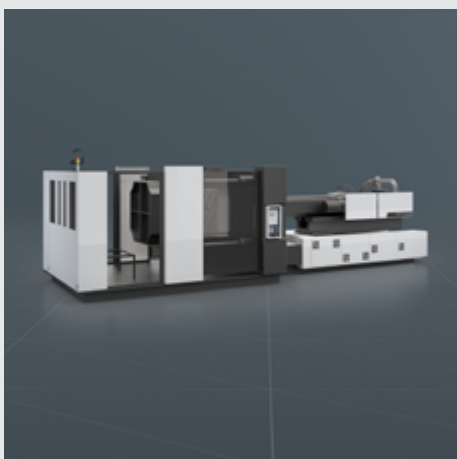


Sensors and Connectors

Often underestimated, seals are essential in sensors and connectors to maintain integrity and accurate functioning. They prevent the ingress of contaminants such as dust, moisture and chemicals that can interfere with electronic signals and degrade the performance of sensitive sensor equipment.

Trelleborg Solution:

O-Rings, gaskets and custom-engineered components in leading-edge materials demonstrate extended sealing performance and wide-ranging chemical compatibility, are capable of damping vibration and are suitable for a full range of temperatures. When required, multicomponent technology strongly bonds a range of polymers to create unique geometries and combine multiple features into a single piece.



Material Processing Equipment

Metals, paper, powders and other materials are processed in highly automated lines. In equipment such as presses and forming or molding machines, high pressures, high temperatures and vibration are common, and machinery is in continuous operation. These highly demanding environments increase the risk of premature seal and bearing failure. At the same time, sealing technology is integral to reduce energy consumption, maintain uniformity and minimize downtime.

Trelleborg Solution:

Next-generation O-Rings and our GAMMA Seal, which consists of an elastomer sealing lip with a metal carrier, demonstrate outstanding sealing performance, resistance to extrusion and wear and extended service life to reduce equipment downtime. In high-temperature environments or when chemical compatibility is critical, Turcon® Varilip® PDR is an ideal solution.

Learn more about our solutions for material processing equipment
www.trelleborg.com/seals/your-industry/machine-tools

Trelleborg is a world leader in engineered polymer solutions that protect essential applications in demanding environments. Its innovative solutions accelerate performance for customers in a sustainable way.

Trelleborg Sealing Solutions is a leading developer, manufacturer and supplier of precision seals, bearings and custom-molded polymer components. It focuses on meeting the most demanding needs of aerospace, automotive and general industrial customers with innovative solutions.

WWW.TRELLEBORG.COM/SEALS



facebook.com/TrelleborgSealingSolutions
x.com/TrelleborgSeals
youtube.com/TrelleborgSeals
linkedin.com/company/trelleborg-sealing-solutions
instagram.com/trelleborgsealingsolutions

If you'd like to talk to Trelleborg Sealing Solutions, find your local contact at: www.trelleborg.com/seals/worldwide