

in the **groove**

The world of seals and service

All Industries

Pneumatics

The perfect arrangement

Sealing solutions for pneumatic cylinders



Mobile Hydraulics

The pressure's off

New Turcon® Stepseal® V has a unique pressure relief channel



News

Busak+Shamban becomes Trelleborg Sealing Solutions

A new name with an outstanding history

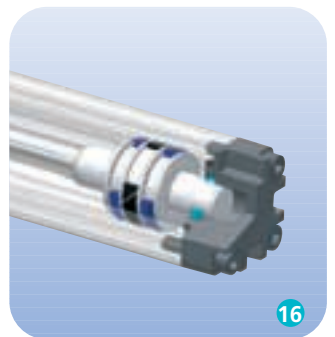
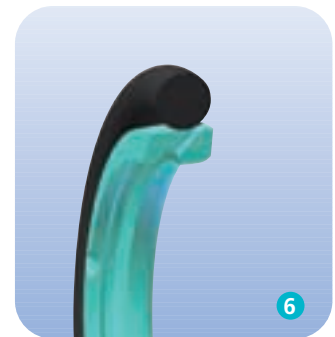


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news

Exhibiting around the world

Trelleborg Sealing Solutions is participating in a number of exhibitions worldwide. Why not come and visit us!

Offshore Europe 2007

Offshore Europe is the largest oil & gas conference and exhibition outside of North America. A truly global audience of engineers, technical specialists and industry leaders gather to source and discuss new exploration and production technology, to debate new ideas and to discover the solutions that will deliver sustainable oil & gas in the future. The show is held in Aberdeen, Scotland from **September 4th-9th**, and you will find us in **Stand 1177**.

SEMICON West 2007

SEMICON West is the largest and most comprehensive industry event in the United States, hosting more than 1,500 key players in the semiconductor, FPD, MEMS, display and microelectronics industries. The conference, held in San Francisco, California, showcases the latest products and technologies currently used in manufacturing while highlighting the technology of tomorrow. This year's show will take place from **July 17th-19th**. You'll find us in **South Hall, Booth 2612**.



MAKS 2007: International Aviation and Space Salon

The International Aviation and Space Salon, MAKS, holds the leading position in ratings for major world aviation forums. MAKS demonstrates Russian technology and domestic market openness to joint ventures with the use of foreign partners' cutting-edge advances. Held in Moscow, Russia, this year's show will take place from **August 21st-26th**.

Katowice 2007

The International Trade Fair for Mining, Power Generation and Metallurgy in Katowice, Poland is the largest European exhibition presenting the latest achievements of the heavy industry. Most companies exhibiting represent the mining and metallurgical sectors and come from all over the world. Visitors come from Europe, Ukraine, Belarus, Russia, Romania, Serbia and Montenegro, India, China, Croatia, Nigeria and South Africa. This year's event will take place from **September 11th-14th**.

Expanding to Fit

Greater capacity for production of airframe components with opening of new leading edge US manufacturing facility

Last fall, Trelleborg Sealing Solutions relocated and expanded its Apsley Street, Hudson facility to a state-of-the-art, custom-designed 29,000 square foot (2,694 square meters) plant in Northboro, Massachusetts. A part of the acquisition of Chase-Walton Elastomers, Inc. in 2005, this facility is focused on the aerospace industry. The move was necessary because of our increasing business in the airframe market.

The acquisition of Chase-Walton allowed Trelleborg Sealing Solutions to enlarge its portfolio of products, especially in the aerospace, medical technology and biotech industries. The increased manufacturing capabilities brought about by the acquisition, along with this expansion, means we can better fulfill our increasing volume of orders from our already strong customer base.

The Northboro facility employs 126 people, and the majority of these work in production. The substantial investment in the new building and equipment in Northboro supports our abilities in state-of-the-art manufacturing of high-quality precision seals and our highly-skilled



team of design, process, and quality control engineers.

"This is only the beginning," said Mark Barnes, airframe product manager for Trelleborg Sealing Solutions Americas, "The move has increased our facility's capacity by 20 percent and leaves the door open for future expansion, with 25,000 square feet of available space. We are very positive about the future growth of our new plant."

Busak+Shamban becomes Trelleborg Sealing Solutions

A new name with an outstanding history

Busak+Shamban operated as the global sales and marketing arm of Trelleborg Sealing Solutions.

To consolidate our brand strategy, Busak+Shamban is now Trelleborg Sealing Solutions, effective April 2, 2007.

Busak+Shamban has been part of Trelleborg Group, with whom we share a foundation in polymer expertise, since our acquisition in October 1, 2003. With a pedigree going back over 50 years, the marketing arm continued to operate under the existing Busak+Shamban brand, while the manufacturing facilities adopted the Trelleborg name. Effective from April 2, 2007, to consolidate the group's brand strategy, Busak+Shamban has changed our name to Trelleborg Sealing Solutions.



"The transfer will be seamless," says Claus Barsøe, President of the Trelleborg Sealing Solutions business area. "We feel this change will unify our total brand offering, emphasizing that our marketing companies and manufacturing facilities run as a cohesive unit. The quality of support and service we give to our customers will not be affected. In fact, it can only be enhanced by our future plans.

"Our business is core within the Trelleborg Group. An exciting time ahead, the name change heralds more significant investment in our business area. This will further strengthen our position as one of the world's leading developers, manufacturers and suppliers of sealing solutions to aerospace, industrial and automotive markets globally."



Fast facts about Trelleborg group

Trelleborg is a global industrial group whose leading positions are based on advanced polymer technology and in-depth applications know-how. Trelleborg develops high-performance solutions that seal, damp and protect in demanding industrial environments. The Trelleborg Group has annual sales of approximately SEK 27 billion (2.9 billion Euros, 3.8 billion US Dollars), with about 23,000 employees in 40 countries. The Group comprises four business areas: Trelleborg Engineered Systems, Trelleborg Automotive, Trelleborg Sealing Solutions and Trelleborg Wheel Systems.

www.trelleborg.com

Fast facts about Trelleborg Sealing Solutions

Trelleborg Sealing Solutions is one of the world's leading developers, manufacturers and suppliers of precision seals. We support our aerospace, industrial and automotive customers through 30 production facilities and more than 40 marketing companies globally. Within our portfolio are some of the longest established sealing brands, including Dowty, Forsheda, Palmer Chenard, Shamban, Skega and Stefa along with a large number of proprietary products and materials such as Turcon®, Zurcon®, Orkot®, Isolast®, Stepseal®, and Wills Rings®.

www.tss.trelleborg.com

US seal company HCRD acquired

Trelleborg Group, through the Trelleborg Sealing Solutions business area, has acquired the operations of precision bearing and sealing devices company Hydro-Components Research & Development Corporation (HCRD). The company employs a total of approximately 80 people and has annual sales of about SEK 50 million (over \$7 million USD). It is a privately owned company based in Streamwood, Illinois, USA.

HCRD, which manufactures high-precision components, focuses specifically on large diameter seals and bearings. These products are used primarily in applications involving heavy-duty cylinders such as shock absorbers for earth moving equipment, dumpers and diggers.

"HCRD's technology and products are at the leading edge of development in the company's area of focus and will make an extremely valuable contribution to us," says Claus Barsøe, business area president for Trelleborg Sealing Solutions. "The products fit in ideally with our current portfolio, will expand our offering and enable us to grow more rapidly in North America, within the segment for heavy duty vehicles. The acquisitions also offer distinct process and organizational synergies."

To find out more about this acquisition - take a look at HCRD's website, <http://www.hcrd.com/>.

Trelleborg Sealing Solutions

In the groove - All Industries, No. 1, 2007

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Disclaimer: The information in this magazine is intended to be for general reference purposes only and is not intended to be a specific recommendation for any individual application. The application limits for pressure, temperature, speed and media given are maximum values determined in laboratory conditions. In application, due to the interaction of operating parameters, maximum values may not be achieved. It is vital therefore, that customers satisfy themselves as to the suitability of product and material for each of their individual applications.

Any reliance on information is therefore at the user's own risk. While every effort is made to ensure the accuracy of information contained herewith, Trelleborg Sealing Solutions cannot warrant the accuracy or completeness of information.

For exceptional operating conditions, please contact your Trelleborg Sealing Solutions representative.

A problem on some tandem seal arrangements used in hydraulic cylinders is pressure build-up between the seals. Trelleborg Sealing Solutions introduces Turcon® Stepseal® V to prevent this from happening.

The pressure's off

New Turcon® Stepseal® V has a unique pressure relief channel

New solution presented at Hannover Show 2007!



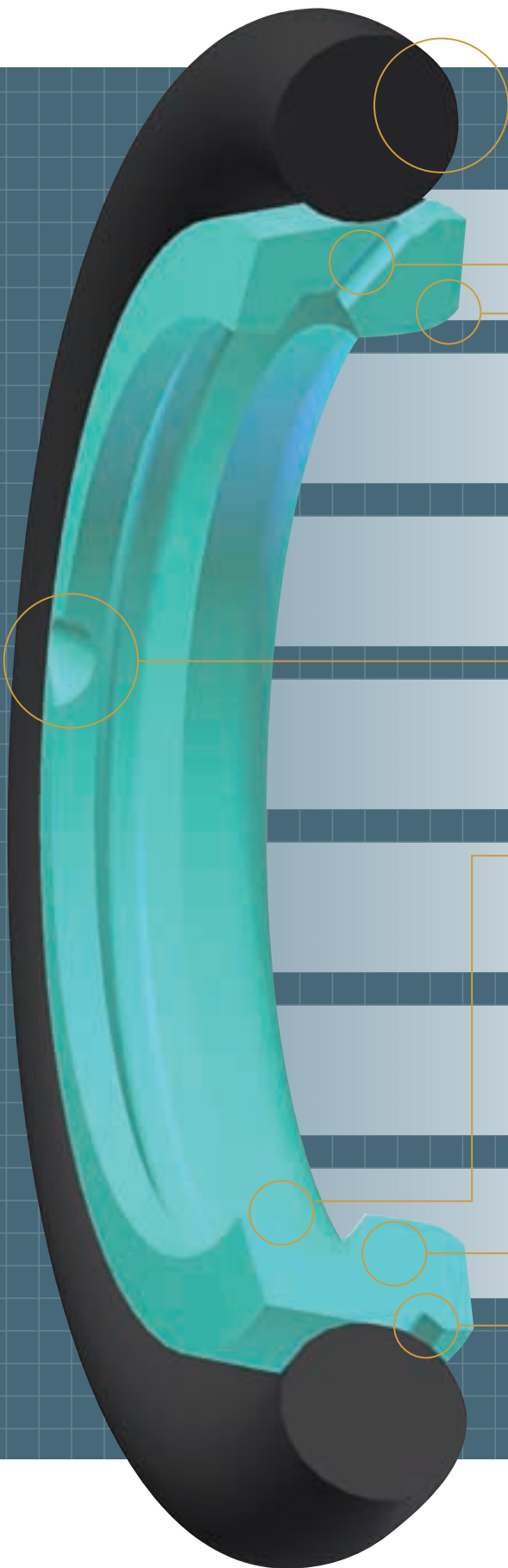
Patented technology extends seal life

Seals in tandem arrangements are commonly used in hydraulic cylinders to optimize sealing integrity. At the one side they keep lubricants in, while on the other, external media is kept out. This was first made possible with Turcon® Stepseal®. This double-acting tandem seal configuration was a major advance in fluid power technology, eliminating the build-up of disruptive intermediate pressures between seals. Always a major problem for engineers, the pressure causes loss of operating efficiency, resulting in destruction of seals and leakage.

Though configurations that use Turcon® Stepseal® are usually effective, in some designs, pressure can still build up between two seals. Based on their experience in hydraulic applications, engineers at Trelleborg Sealing Solutions looked for an even more

effective geometry for these exceptional situations. The result is Turcon® Stepseal® V, which incorporates a unique pressure relief valve. This patented technology stops any pressure from being trapped between seals, even in the most difficult arrangements.





Elastomer O-Ring

- High flexibility to satisfy hardware tolerances and movement
- Elastomer materials available to meet a wide variety of service conditions
- Pressure relief valve function

Patented hydrostatic pressure relief channel

- Prevents pressure trap between seals under all service conditions
- Prolongs life of sealing system

Contoured rear chamfer for hydrodynamic back-pumping

- Improved back-pumping of residual oil film for increased sealing efficiency
- Increased radial clearance

Notch for pressure regulation

- Ensures rapid pressure actuation and pressure balancing under all service conditions

Stabilizing edge

- Prevents seal deformation under the most demanding service conditions
- Increases assembly robustness by protecting seal face during insertion of the rod

Turcon® and Zurcon® materials

- Low friction, no stick-slip
- High sealing efficiency and long service life
- Meets demanding service conditions
- High flexibility for easy installation

Machined valve groove

- Ensures precise opening and closing of the relief channel
- Provides robust performance of the relief function independent of hardware deflection



Tough seals for tough environments

In hydraulic cylinders, used in everything from earth moving machinery to lifting platforms in the toughest working environments, the requirements for sealing are varied and difficult. The applications are dynamic, often operating at high speeds and significant pressures. A

single seal is rarely a good enough solution and in most cases a configuration of seals is required. Typically, a cylinder will include between three and five different dynamic seal and scraper types, some in tandem arrangement.

Turcon®: Exceptional material performance

Stepseal® V is manufactured from our proprietary PTFE based material, Turcon®. This offers a low coefficient of friction and performs over a wide range of operating temperatures. It has excellent wear resistance and compatibility with chemicals.

For more information on Turcon® Stepseal® V, visit

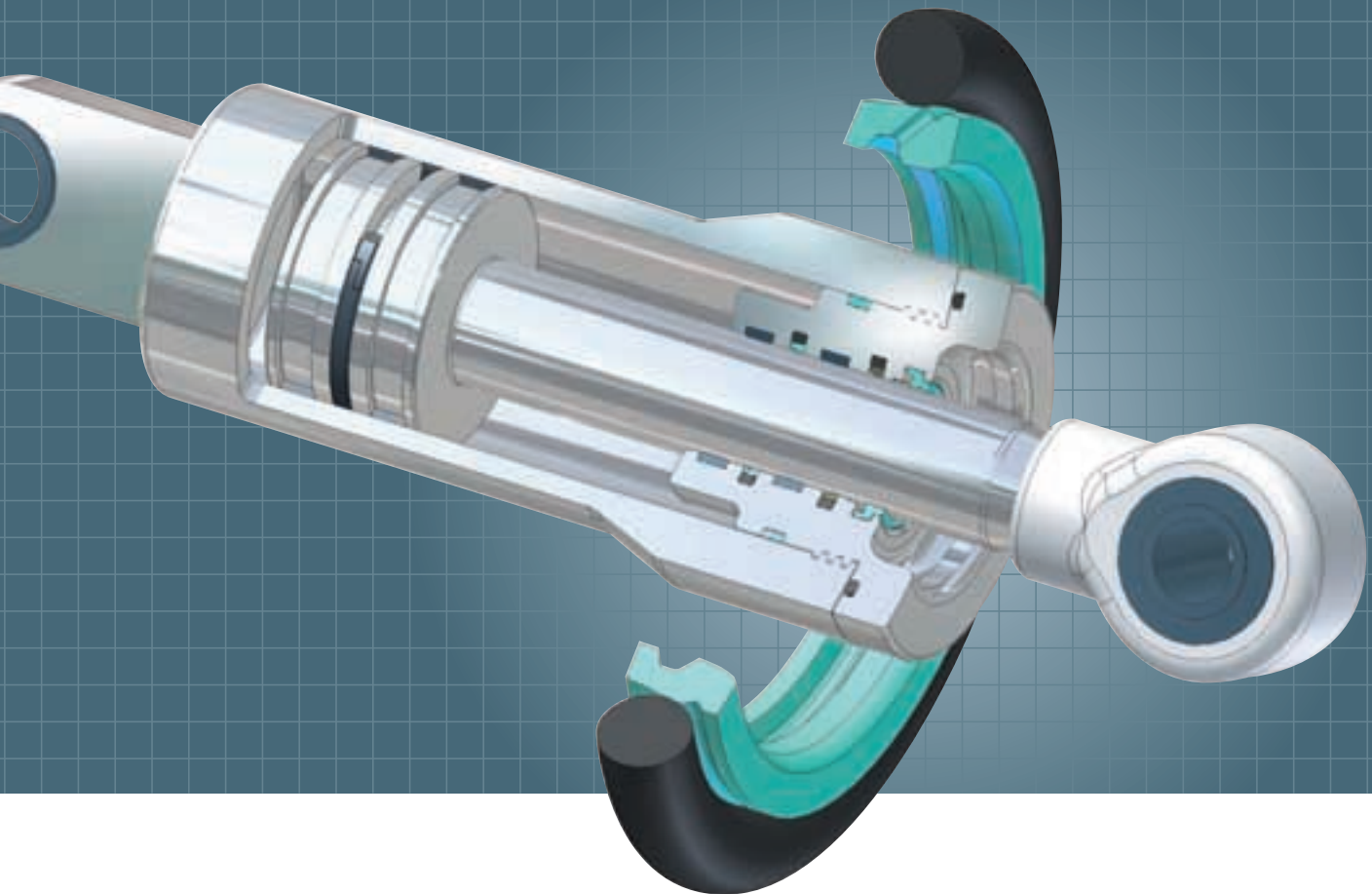
www.tss.trelleborg.com



To download the catalog, go to the Download Area.

Turcon® Stepseal® V: Advantages and benefits

- High static and dynamic sealing effect
- Very good extrusion resistance, to suit wide hardware clearances
- Low friction, increasing performance and working life
- Stick-slip-free starting, no sticking even after shut down
- High abrasion resistance, maximum operational reliability
- Excellent resistance to chemicals
- Simple installation without seal edge deformation
- Available for rod diameters up to 2600 mm (8' 6")
- Available for bore diameters up to 2700 mm (8' 10")
- Operational at pressures up to 80 MPa (800 bar, 11600 psi)
- Operational at speeds up to 15 m/s (49 ft/sec) with reciprocating movements, frequency up to 5 Hz
- Operating temperatures of -45°C to 200°C (-49°F to 392°F)
- Suited to mineral oil-based hydraulic fluids, flame retardant hydraulic fluids, environmentally safe hydraulic fluids (bio-oils), water and other media

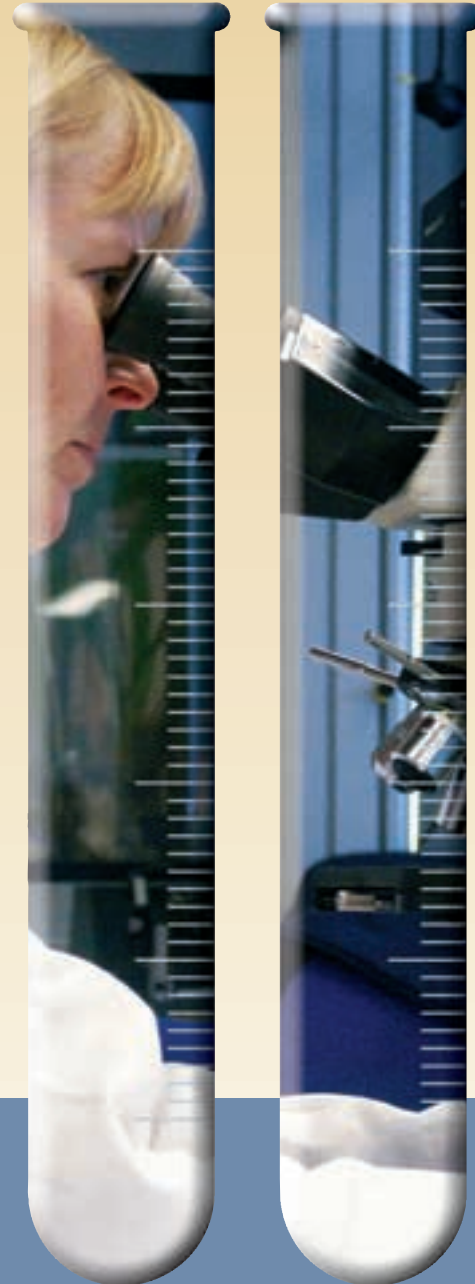


Materials Spotlight

On the outside, one seal may appear to be the same as the other. But the technology behind their material means that one type can function very differently from another. Making sure the compounds meet industry needs means that seals can be matched to a specific application, optimizing performance.

Why are more sealing materials required?

- For compatibility with new contact media
- To comply with more stringent regulations
- Provision of a solution to a customer's specific problem
- To withstand increased temperature in an application
- For improvement in performance to extend seal life



A material ma

Leading edge materials technology is fundamental to effective sealing

Systematic development of materials based on technological expertise

Trelleborg Sealing Solutions has over 2,000 proprietary compounds to our name. That's more than any other seal developer and manufacturer. Thousands of hours of research and unrivalled years of experience combine to make our sealing formulations successful.

"We invest a substantial amount of resources every year in development of new sealing materials," says Nils Kohlhase, director, research and development Europe. "Our laboratories for mixing and testing are situated globally. We gather ideas for development projects continuously through our Innovation Management Process. To do this we listen to our customers, segment experts, sales people and engineers."

New compounds reflect latest industry needs

Continuous material evolution is important as the demands of different industries are constantly changing. Even though the range from Trelleborg Sealing Solutions may appear to fulfill all requirements, new variations are necessary to meet the latest challenges.

"There are many reasons why we need to add materials. Changing market requirements are always a key focus for us," continues Kohlhase. "In the aerospace industry or the fluid power sector we may be faced with newly introduced fuels or different temperature requirements. It is possible that one of our existing compounds is suitable. If not, then priority is put on creating one that will be effective. This ensures we can continue to meet our customers' needs as quickly as possible."

Our global research and development centers are located in:

Europe Stuttgart
Helsingør
Ashchurch
Bridgewater
Malta

USA Fort Wayne

Asia Tokyo
Shanghai

Trelleborg Sealing Solutions is constantly developing new materials to meet the latest customer requirements. Here are some examples.

Turcon® M03

PTFE based material developed in response to the needs of hybrid engines. Engineered to provide excellent sealing capabilities along with extremely low gas permeation.

Zurcon® technology

A range of improved polyurethane materials has been developed to meet the demanding requirements of pneumatic applications. They give better friction characteristics and abrasion resistance.

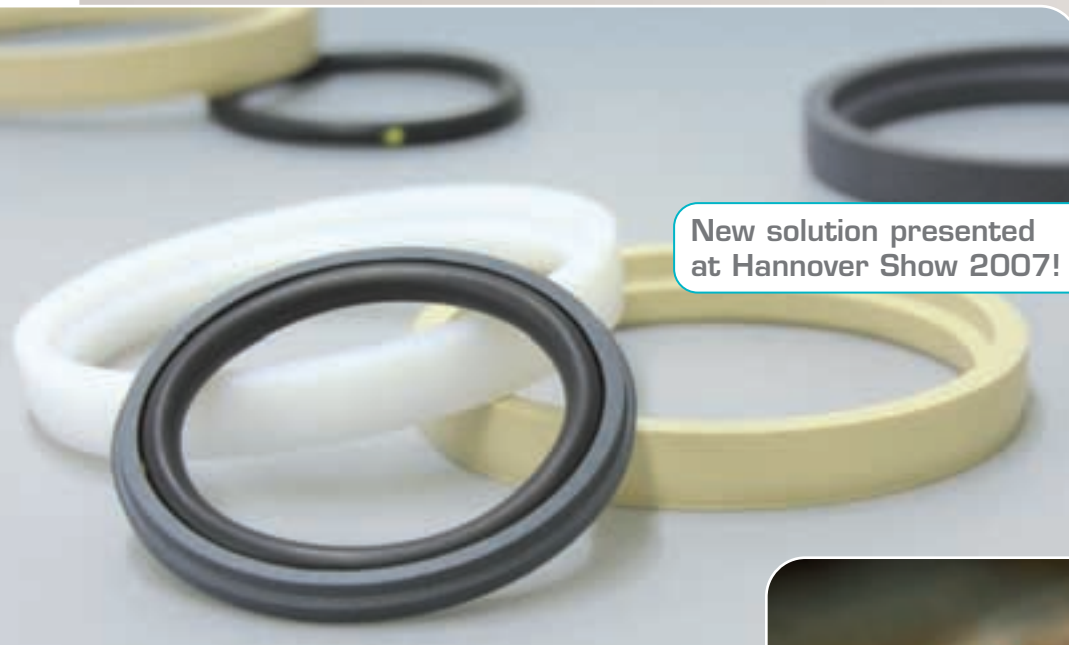
Ozone resistant NBR

These NBR compounds specifically meet the needs of fluid power customers who pre-assemble components with O-Rings in an elongated state. Superior ozone resistance prevents seals cracking.

tter

Keeping up with the grind

You can't compare the professional coffee machines manufactured by WMF to those you'll find in the average home. Their machines are engineered to brew up to 300 cups of coffee per hour. That means each component must be of the highest quality and durability. The same robustness is required from the seals that Trelleborg Sealing Solutions supplies for these appliances.



New solution presented
at Hannover Show 2007!



In WMF coffee machines, the standard non-abrasive plastic internal parts of domestic models are replaced with metal. Not only must seals be able to withstand movement against these harder counter surfaces, they must also stand up to heat, acid, pressure, cleaning media and abrasive coffee grounds.



The demands on seals in the WMF coffee machines are high. They need to have:

- **Excellent friction characteristics**
For movement against the equipment's metal counter surfaces
- **Exceptional wear resistance**
To withstand abrasion from ground coffee beans
- **Compatibility with process media**
Including acids in coffee, fats in milk and the aggressive chemicals in cleaning regimes
- **Capability to operate in pressure**
Boiling water is forced through the coffee grounds at up to 16 bar (232psi)
- **Outstanding life**
To stand up to brewing of at least 100,000 cups of coffee

To meet all these requirements a seal was specified in Turcon® MF, our proprietary PTFE based material specifically designed for food, beverage and pharmaceutical processing. A modified Stepseal® design was selected, engineered to endure this intensely dynamic environment.



Turcon® MF designed for processing needs

Based on ultra-clean technology, these compounds are manufactured from high-purity PTFE grades and additives. Their smooth finish, with high gloss and low porosity, avoids the risk of contamination buildup and reduces particle shedding. Each batch of MF material is manufactured using virgin material only and issued with a certificate of conformity.

Our range of Turcon® based PTFE materials offers:

- Temperature resistance from -253°C (-423°F) to $+260^{\circ}\text{C}$ (500°F)
- Almost universal chemical compatibility
- Outstanding low long-term compression set characteristics
- High wear resistance
- Minimal creep and permeation
- Surface finish minimizes contamination risk
- Materials perform well in a broad range of chemical media including organic and inorganic oxides, acids, alkalis, amines, esters and steam
- Materials compliant to FDA 21 CFR177.1550, 3-A, USP Class VI and sanitary standards

WMF... coffee wakes up the world

From cappuccino to latte macchiato, WMF has technologically advanced machines to make them all. The world leader in manufacturing of professional coffee makers, their equipment is heavy duty and designed to meet caterers' needs.

Making the perfect cup of coffee... 300 times per hour

In the WMF bistro range of machines, coffee is freshly ground. A piston presses these grounds into a cylinder, at the bottom of which is a metal sieve. To make the coffee, boiling water is jetted through the cylinder with a 70 mm (2.7 in) stroke of the piston at a pressure of 16 bar (232psi). The sieve then swings down and the piston pushes the used coffee grounds out of the cylinder into a collecting tray. This process is repeated for every single cup of coffee, up to 300 times per hour.

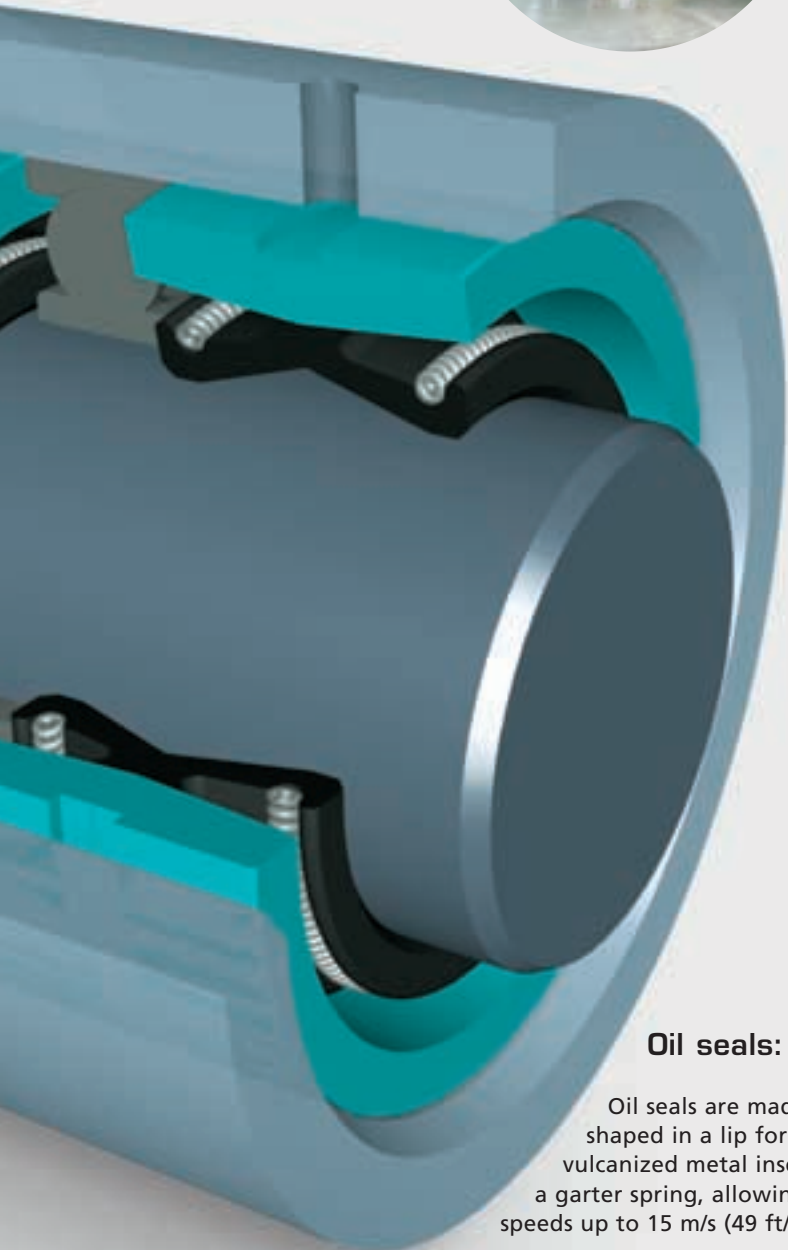
A modified Stepseal® manufactured in Turcon® MF, supplied by Trelleborg Sealing Solutions, is used for sealing this piston. It is proving to offer extended life in this harsh processing environment.

At the cutting edge

Oil seals that give superior performance



With their cut edge, oil seals manufactured by Trelleborg Sealing Solutions eliminate potential leakage problems. This gives superior performance compared with molded lips, and cost-effective supply is possible through our global production sites.



Oil seals: The facts

Oil seals are made up of an elastomeric diaphragm shaped in a lip form and reinforced with a co-vulcanized metal insert. The sealing lip is energized with a garter spring, allowing them to operate at rotating shaft speeds up to 15 m/s (49 ft/s).

A pioneer in oil seals

Trelleborg Sealing Solutions is one of the pioneers of oil seals, supplying them since the 1950s. Over the years competition grew and we saw other suppliers lowering prices by molding the lip on oil seals, removing the costly cutting operation from the manufacturing process. However, critical to the oil seal's operation, is that its lip fits as closely as possible within the sealing environment. Trelleborg Sealing Solutions was not willing to reduce the sealing integrity of our product. So we decided to find out if an oil seal with a molded lip could be as effective as one with a cut lip.

Molded lips are not as effective as cut lips

To analyze this, extensive endurance tests were undertaken by Trelleborg Sealing Solutions engineers to see if it was possible to produce a molded lip that could fulfill the performance demands for oil seals. After these,

lasting thousands of hours, they concluded that molding could not provide sufficient sealing integrity. The best method of production in the majority of cases was to continue to cut the edge, especially for standard seals.

Cost-effective supply from lower cost countries

"We would not change our manufacturing methods, if this gave inferior performance," says Frank Kleeman, product manager, oil seals, "but we still wanted to meet our key customers' expectations for cost-effective supply of these products. One advantage the Trelleborg Sealing Solutions global network gives us is that we can move manufacturing to lower cost countries within the group. We decided to do this but determined not to compromise production quality in any way. Engineers from the original manufacturing sites were involved in and oversaw the transfer process to make it seamless."

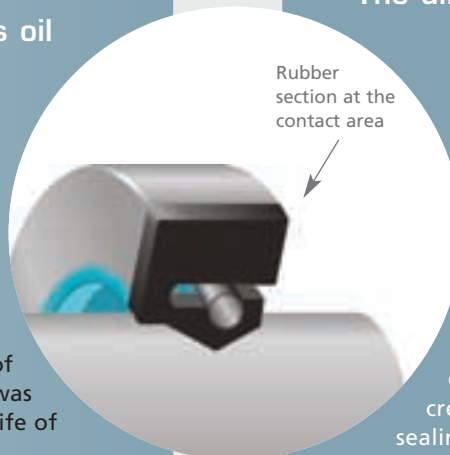
Excellent performance from a wide material range

The superior performance of the Trelleborg Sealing Solutions oil seal does not rely upon its method of production alone but also materials technology and product design. We offer a choice of more than 100 market-leading proprietary compounds specifically developed for oil seals. The materials provide excellent performance properties including exceptional dispersion and superior aging resistance in air or fluids. They are also supplied in standard designs and custom geometries. This means that sealing life can be optimized, as seal characteristics can be precisely matched to operational parameters.

The sealing lip design for Trelleborg Sealing Solutions oil seals is state-of-the-art and based on many years of experience in a wide range of application fields.

Extensive testing proves Trelleborg Sealing Solutions oil seals are superior

Tests were carried out on oil seals to ASTM and ISO standards in air, water, oil, grease and other fluids at various temperatures and time periods. Trelleborg Sealing Solutions oil seals achieved on average a 6,000 hour sealing life before reaching a specified leakage limit, with a considerable number of seals exceeding 10,000 hours. This was significantly higher than the sealing life of the majority of other products tested.



The dilemma: A molded or cut edge

The sealing edge of oil seals can either be ready molded or trimmed by mechanical cutting. The latter option requires an extra operation, which many suppliers deem too costly. Instead they rely on a molded sealing lip being sufficiently close-fitting. However, as a molded edge is rounded, it can never work as well as a cut edge. In addition, air caught in the compound during the molding process creates blisters. If one of these is near the sealing edge, it weakens the lip and is potentially an area of leakage.

For more information on rotary seals, visit

www.tss.trelleborg.com



To download the catalog, go to the Download Area. To search for specific parts, visit the Electronic Catalog.

The sealing lip design for Trelleborg Sealing Solutions oil seals is state-of-the-art and based on many years of experience in a wide range of application fields.

The perfect arrangement

Sealing solutions for pneumatic cylinders

Excellent leakage control from seals supplied by Trelleborg Sealing Solutions is expected by our customers manufacturing pneumatic cylinders. There is an amazing amount of technology behind the sealing arrangements we recommend, and they are based on years of experience and research.



New solution presented
at Hannover Show 2007!



Optimized sealing performance

So maintenance can be minimized, pneumatic cylinder manufacturers demand long life from seals. It's no easy job to provide products that can achieve this. To ensure integrity they must demonstrate excellent friction characteristics and wear resistance against their housing. A single seal is rarely sufficient and specially designed arrangements must keep lubricant within the housing, while also excluding media such as dust and dirt.

Trelleborg Sealing Solutions has been designing and developing sealing configurations for pneumatic cylinders for over 50 years. Though some of the geometries and arrangements we recommend may look complex, they are based on substantial material expertise and technology. Never relying on guesswork, product recommendations are proven in extensive long-term tests to ensure optimized performance.

FKM materials specially designed for pneumatics

Our fluoroelastomer (FKM) materials developed specifically for pneumatic applications offer a high temperature solution, operating up to 150°C (302°F). With good thermosetting behavior, they show resistance to aging and ozone. VC6B4 is FKM alone while VCBVR is an FKM and metal combination.

The pneumatic engineered plastic selection

Polyurethane and polyethylene-based materials are the usual choice for pneumatic cylinder sealing. These offer excellent friction performance, vital in these applications, in addition to almost universal chemical compatibility. All the materials developed by Trelleborg Sealing Solutions are designed to optimize these characteristics along with providing exceptional abrasion resistance.

The perfect product choice

A wide choice of seals and scrapers ensures very specific pneumatic sealing demands can be met.

ARUP

U-Shaped single-acting rod seal

AWBB

Wiper

Specially designed for guide units with linear ball bearings. Minimal pre-load avoids any negative influence on sliding behavior.

AICM

Seal

Specially designed for pneumatic cushioning where there are high pressure peaks. After change of pressure direction an integrated check valve function ensures pressure application on the full piston surface.

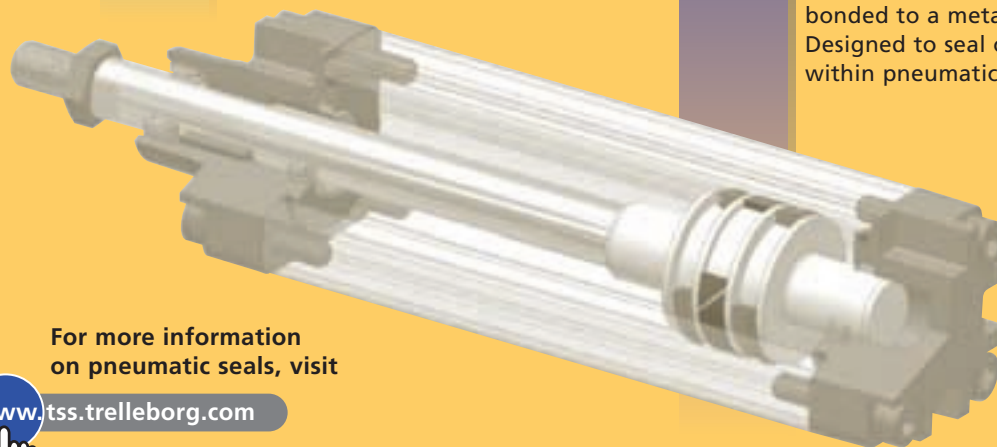
AIAS

Cushioning seal like AICM but capable of fitting into existing O-Ring grooves.

GM500

Static seal comprised of an elastomer lip bonded to a metal washer.

Designed to seal connections and couplings within pneumatic cylinders.



For more information on pneumatic seals, visit

www.tss.trelleborg.com



To download the catalog, go to the Download Area.

New Zurcon® high-performance polyurethane materials

Zurcon® Z20	94 Shore A with operating temperature up to 110°C (230°F)
Zurcon® Z22	Low temperature 94 Shore A material capable of operating down to -45°C (-49°F)
Zurcon® Z24	94 Shore A with enhanced hydrolysis resistance
Zurcon® Z30	83 Shore A with operating temperature up to 85°C (185°F)
Zurcon® Z32	83 Shore A combining low temperature operation down to -50°C (-58°F) with enhanced hydrolysis resistance
Zurcon® Z80	52 Shore D ultra high molecular weight polyethylene which gives high abrasion resistance even under poor lubrication conditions. FDA compliance makes it suitable in pharmaceutical, food and beverage processing.
WU9E1	Standard polyurethane material with fair performance level

APDE Single-acting piston seal, double-acting when used back-to-back. Suitable for cylinders with pneumatic cushioning.

APDF Standard piston seal with dimensions according to ISO 3320 that has excellent endurance test results and stick-slip characteristics. Suitable for use in end positioned damped cylinders and exhaust throttles.

APDG Similar characteristics to APDF and also ideal for small space installations.

APDS U-Shaped single-acting piston seal, double-acting when used back-to-back. Demonstrates superior friction characteristics and improved break off pressure. Recommended for return spring cylinders where better piston guidance is needed. Suitable for cylinders with pneumatic cushioning.

APMP Single-acting piston seal, double-acting when used back-to-back. Has integrated guiding element and buffer for mechanical cushioning. Suitable for short stroke cylinders or magnetic pistons.

APG Double-acting Glyd Ring® comprised of slipper seal and energizing O-Ring for piston sealing. Ideal for small space installations and suitable for cylinders with pneumatic cushioning.

ARS Combined seal and scraper. Suitable for single assembly in standard grooves in higher temperature applications.

AWNS Lip seal with sealing lip and scraper lip. Ideal for small installation spaces.

AWSD Like AWNS but with the capability of installation in small diameters.

ARAA Rod seal-scraper with integrated fixing capability.

ARAN Asymmetric lip seal with sealing lip and scraper. Excellent protection against dirt ingress. Fast installation, automatic or manual.

AWSW Single-acting scraper for use with separate rod seal. Special lip design maintains rod lubrication.

ARV Asymmetric Variseal® with spring-energized sealing and scraper lip. Suitable for high speed applications with poor lubrication. Excellent protection against dirt ingress.

ARG Double-acting Glyd Ring® rod seal comprised of a slipper seal and energizing O-Ring. Specially designed for low friction applications with small installation space.

DRV4 Static sealing element consists of two injection-molded parts. Dimensions conform to ISO 16030 and they are ideal for automatic mounting, with no installation space required.

All in vane

Trelleborg Sealing Solutions supplies advanced vane seals to a major automotive component manufacturer, ZF Sachs, for a rotary vane actuator used in their active roll stabilization system. The razor sharp edges of these stamped sintered plates ensure maximum sealing integrity between fluid chambers that control actuation.

Rotary actuators in vehicle anti-roll systems manufactured by ZF Sachs are fitted with advanced vane seals to minimize leakage

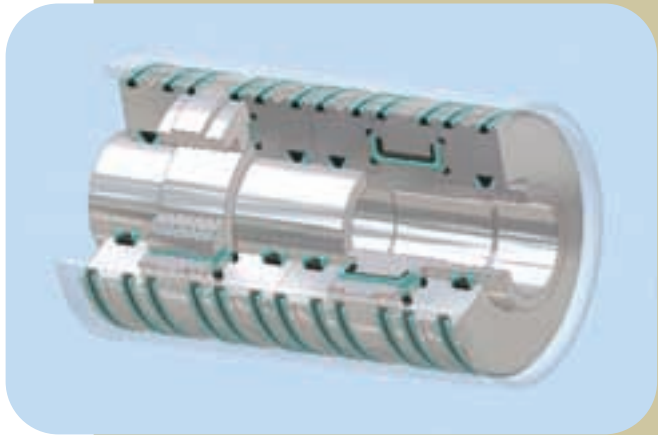
ZF Sachs, a major manufacturer of suspension systems, approached Trelleborg Sealing Solutions when they were developing their innovative active roll stabilization system. Movement was to be controlled by a rotary vane actuator, and they needed vane seals that could minimize leakage across compartments. However, they also wanted them in high volume and supplied as cost-effectively as possible.

Razor sharp vane seals proved in application

Effective sealing within rotary vane actuators is a challenge, as the shape to be sealed is rectangular and the four corners of the seals must be razor-sharp. If the seal is not perfect, liquid can leak from one working space to another, deteriorating performance of the suspension system.

The usual method of producing these rectangular seals is by milling, but this is costly and significant volumes can be difficult to achieve. So, engineers at Trelleborg Sealing Solutions decided to look for a different process to reduce production costs and increase yield. Their alternative was to stamp sintered plates of Turcon® PTFE based material to the shape of the seal. Now used for several years by ZF Sachs, sealing integrity is proven. They operate effectively at temperature extremes, ranging from - 40°C (-40°F) to well above +100°C (212°F), and at pressure exceeding 150 bar (2175 psi).

Innovative manufacturing of vane seals takes place at Trelleborg Sealing Solutions Helsingør. These products are now providing distinct cost and performance benefits to customers, extending the potential applications for rotary vane actuators in many different sectors of industry.



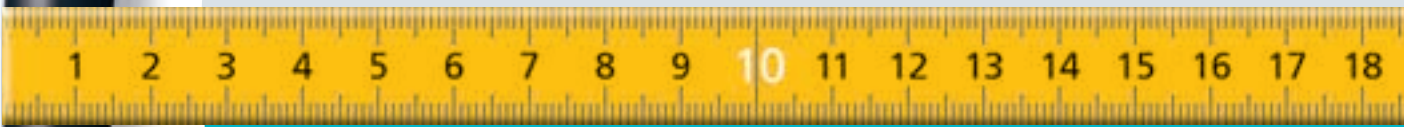
What are rotary vane actuators?

Rotary actuators are used to pivot a joint and are an alternative to conventional cylinder mounting. Unlike these, they are not limited to a 90-degree pivot but can achieve arc lengths of 180, 360, 720 degrees or more, depending on the configuration.

There are many types of rotary actuators but in a vane actuator, a rotor replaces the piston, which operates within linear hydraulic cylinders. This has one, two, three or more vanes attached to it. When differential fluid pressure is applied to the working chambers, the actuator turns.

A large step in size, a giant leap in sealing technology

Introducing Fleximold™, our new proprietary method for production of large diameter seals



Features and Benefits

- Capable of producing any diameter above 500 mm/ 20 inches
- Full visual and dimensional product integrity
- High quality, tight tolerances
- Performance capabilities matching molded O-Rings
- Elimination of leakage risks associated with spliced O-Rings
- No tooling charges for standard cross sections
- Available in Isolast® perfluoroelastomer and a wide range of other elastomers

Product availability:

- Sizes:
- Recommended for diameters > 500 mm / 20 inches
- Cross Sections:
- All standard cross sections available without purchase of dedicated tool
 - Larger and special size cross sections available upon request
 - Non-standard seal profiles available upon request

International Standard	Cross Section, mm	Reference Section, inches
Metric	3.00	0.118
JIS B 2401	3.10	0.122
Metric/JIS	3.50	0.138
AS-568	3.53	0.139
JIS B 2401	3.55	0.140
Metric	4.00	0.157
Metric	5.00	0.197
JIS B 2401	5.30	0.209
AS-568	5.34	0.210
Metric/JIS	5.70	0.224
AS-568	6.99	0.275
JIS B 2401	7.00	0.275
Metric	8.00	0.315
JIS B 2401	8.40	0.330
Metric	10.00	0.394

New solution presented
at Hannover Show 2007!



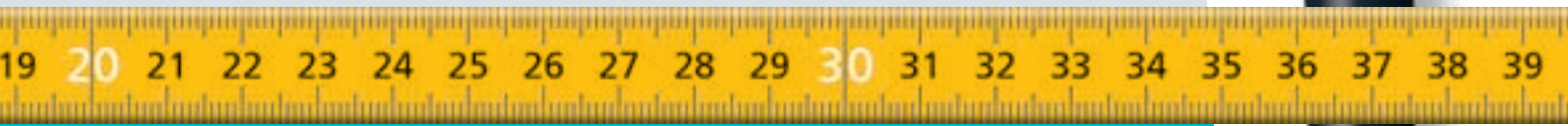
Trelleborg Sealing Solutions introduces FlexiMold™, its newly developed proprietary technology for the manufacture of high precision, large diameter O-Rings and other seal profiles.

Better quality with no tooling costs

Large O-Rings and seals are used across all process industries including Chemical and Hydrocarbon, Pharmaceutical, Food and Beverage. The conventional method of producing large diameter O-Rings and seals is by splicing extruded cord. However, inherent in this method of

fabrication is a weakness at the join, along with poor surface finish and difficulty in achieving tight tolerances. Alternatively, a dedicated tool is required with its associated high investment and long leadtime.

FlexiMold™ is a new proprietary technology specifically developed by Trelleborg Sealing Solutions for manufacture of large O-Rings and other seal profiles. With it, production of giant high quality seals is possible without the leadtime and cost associated with dedicated tooling. The FlexiMold™ process eliminates the risks associated with spliced O-Rings, ensuring the full visual, dimensional and functional integrity of a molded seal.



Materials:

- Isolast® perfluoroelastomer (FFKM)
- Resifluor™ High Performance Fluorinated Elastomers
- Fluorocarbon (FKM)
- Ethylene Propylene (EPDM)
- Acrylonitrile Butadiene Rubber (HNBR)
- FDA, USP Class IV approved compounds
- Explosive Decompression Resistant (EDR) materials

Service:

- O-Rings supplied to standards ISO 3601-1, AS568 and JIS B 2401
- Product inspected to zero defect policy
- Parts packaged and labeled individually
- Washed and packed in Class 100 Cleanroom if required
- Express delivery service available

Examples of Applications

- Flat Panel Display
- Large Cover Seals
- Vessels
- Electrolysers
- Filters
- Power Generation
- Other large processing equipment



A booster for processing

A sealing configuration manufactured in extremely cold-resistant materials by Trelleborg Sealing Solutions helps Norgren to improve the low temperature performance of their valves.

With a stroke size of only 6mm (.2in), the booster, with a nominal value of DN 25, allows a flow rate of up to 14,200 l/min (3,748 gal/min).

New solution presented
at Hannover Show 2007!



The booster as well as other seals needs to meet the standards in line with SIL according to IEC 61508.



technology

Large ball and butterfly valves are used in the chemical and process industries as well as in oil and gas production. They are usually operated by compressed air but such a large volume flow is required, that it is not possible to trigger them directly. Even a pilot valve is not sufficient to close the shut-off device quickly enough in the case of an emergency. This is why booster valves are placed between these large ball or butterfly valves and their pilot valves.

Lower temperature performance was demanded of booster valves

Norgren produces these booster valves, their 80300 line is a typical example. They need to operate at extremely low temperatures. Originally, Norgren's booster models could only withstand temperatures to -40°C (-40°F), but the market increasingly demanded even better cold resistance down to -55°C (-67°F). Responding to these demands, Norgren improved the low temperature performance of its 80300 line. In order to help do this, they have specified new booster seals from Trelleborg Sealing Solutions, made from extremely cold-resistant materials.

The sealing configuration consists of three types of seal:

- Turcon® Variseal®
- Sealing disc made of Zurcon® Z22
- O-Rings made of cold resistant NBR N7T40

Innovative seals and materials meet Norgren's requirements

All three of the seal materials selected cover a temperature range of -55°C to $+80^{\circ}\text{C}$ (-67°F to $+176^{\circ}\text{F}$). The Variseal® offers good friction performance and supports a quick response time for the booster. Its optimized design allows snap-in production for speedy assembly in the manufacturing plant or in service. Turcon® T19 with a Type H spring was specified for the Variseal®. This was so it would work effectively with its mating surfaces, be compatible with the housing made of high-grade steel and operate in the required temperature range.

About booster valves

Booster valves are poppet valves, which can increase controlled airflow by 250 to 500 times. These valves can provide up to 14,200 liter/min (3,748 gal/min) of compressed air with 0 to 1.2 MPa (0 to 174 psi) per minute respectively (based upon the nominal value DN 25).

They are used in the operation of huge shut-off devices in the chemical and process industry, as well as in petrochemical and gas manufacturing plants and machines. Norgren produces them in high-grade steel and they are validated to SIL (Safety Integrity Level) according to standard IEC 61508.



New solution presented
at Hannover Show 2007!



Both the seals, as well as the metal armature plates,
are mounted to the flying pistons and machined to
meet extremely tight tolerances.

Flying pistons make pressure constant

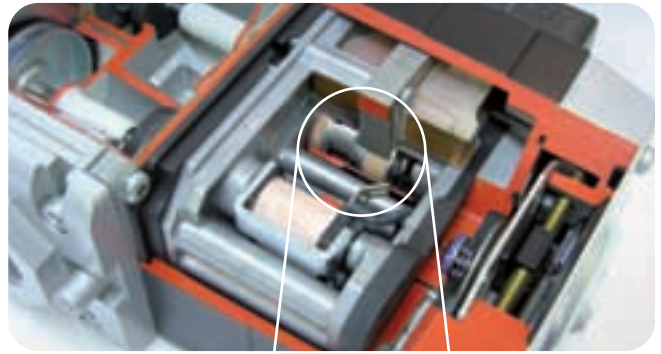
Trelleborg Sealing Solutions was involved in development of a sealing arrangement for flying pistons in the compact gas control systems manufactured by Elster Kromschröder AG. This involves a material specially engineered for the application and an innovative manufacturing process to achieve tight tolerances.

Elster Kromschröder AG safeguarding, measuring and controlling gases

Elster Kromschröder AG is a leading producer of filters, pressure regulators, valves and butterfly valves, pressure switches and combination controls. They also supply gas burners and pilot burners, as well as devices for monitoring, controlling and automation. Their high quality components,

intelligent system solutions and various services make it possible for users of their products to use natural gas economically, safely and in an environmentally-friendly way. This helps save resources in every respect, when generating and using heat for process and heating purposes.

Elster Kromschroder AG compact gas control systems contain flying pistons to regulate gas pressure. Trelleborg Sealing Solutions provided a unique custom made sealing solution for these.



Elster Kromschroder AG compact gas control systems provide the solution to the problem of varying pressure in natural gas supply networks. Gas pressure, which is produced in an armature by a linear compressor, operates the control and regulating valves and a constant initial pressure is maintained. This is crucial for steady combustion with low emissions.

Gas pressure is regulated by flying pistons in compact gas control systems oscillating at a frequency of 50 times per second

In these designs, this is achieved without the use of magnet valves, the standard option, even when there is a high inlet pressure. Instead, a flying aluminum piston oscillates between electronic magnetic Dewars to power the linear compressor. It operates like an axial piston pump, only without the piston rod, with an alternating current frequency of 50 times per second.

Within these flying aluminum pistons, sealing rings used to be stuck to the cylinder surface without any grooves for them to fit in. However, this practice was very time consuming and complicated both in the preparation of the piston cylinders as well as in the adhesion process.

Seals have to give a service life of 10 years, that means withstanding 5.4 billion movements against the piston wall

A development project between Trelleborg Sealing Solutions and Elster Kromschroder was undertaken with the objective of finding an alternative sealing arrangement for the flying piston. The seals had to be soft enough to protect the hard material coated cylinders from premature wear. At the same time, they needed to be resistant over a service life of ten years. That means capable of enduring 5.4 billion instances of friction with the piston wall.

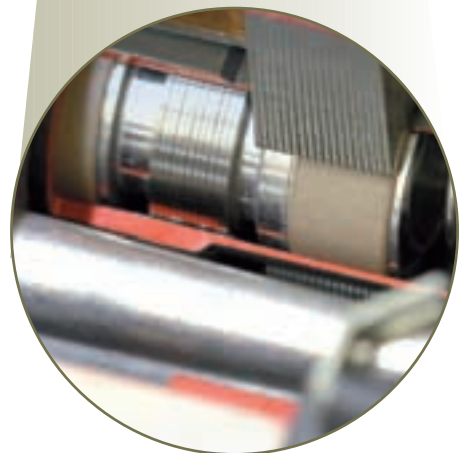
Seals for flying pistons are manufactured from a special Turcon® PTFE based compound X9820. This is an aromatic polymer incorporating a lubricant filler.

“To make sure we could provide the required seal life in this level of friction we decided to develop a material specifically for the application,” says Stephan Brändle, one of the Trelleborg Sealing Solutions sales team involved with this customer. “Based on our vast experience of compound formulation, the proposed solution was a Turcon® PTFE based material with lubrication incorporated into it.

A unique lubricated material and innovative manufacturing process provide sealing integrity

“The flying piston was redesigned to include two sealing grooves into which the Turcon® PTFE with an O-Ring energizer is fitted. An innovative manufacturing process then involves us machining metal armature plates mounted to the pistons together with the seal bearing surfaces. This ensures that the seals meet the required extremely tight tolerance of .0007in (.02mm). The machining process also balances out any measurement deviation of the cylinders.”

Elster Kromschroder AG has adopted this sealing design for its compact gas control systems. It is now proving to achieve the required integrity in this demanding dynamic environment.



In the flying piston, the bearing surface rubs the piston wall 5.4 billion times over a ten-year period, oscillating 15,768,000,000 times. That's equivalent to it traveling 113,530 kilometers (70,388 miles).

The heart of mobile

Trelleborg Sealing Solutions worked with Sauer-Danfoss to develop a custom designed sealing gasket for their new H1 range of hydrostatic pumps.



Sauer-Danfoss calls its new H1 pump line the heart of a hydraulic drive. These closed circuit variable displacement axial piston pumps are very powerful, quiet and compact. It is these attributes that make them ideal for use in mobile hydraulic engineering, especially when users increasingly demand energy efficient and low maintenance technology. Developed with the help of Finite Element Analysis (FEA), a custom designed sealing gasket from Trelleborg Sealing Solutions is contributing to the new pump range's effectiveness.

FEA was used to optimize seal performance

The "heart" is packed with high-tech components; this includes its custom designed sealing gaskets. System developers at Sauer-Danfoss worked closely with the Trelleborg Sealing Solutions team to engineer these, using advanced 3D CAD systems. The process of doing this included several steps utilizing FEA simulation to optimize the geometry of the gasket.



hydraulic systems



Seals on the Sauer-Danfoss new H1 axial piston variable displacement pumps range need to cope with pressures up to 480 bar (6,960psi) and temperatures of -40°C to $+100^{\circ}\text{C}$ (-40°F to $+212^{\circ}\text{F}$).

Advanced analysis resulted in a sealing gasket to meet the needs of Sauer-Danfoss

The result is a complex gasket with a profile that allows it to fit perfectly into its housing. With operating pressures up to 7 MPa (1,015psi) and a sealing gap of 0.3 mm (0.01in), it keeps contact pressure at a low level, provides exceptionally high wear resistance and very good media compatibility. Injection molded in polyurethane Zurcon® Z20, this material met all of the needs of Sauer-Danfoss. These were temperature resistance from -40°C to $+100^{\circ}\text{C}$ (-40°F to $+212^{\circ}\text{F}$), extrusion stability, very good media compatibility, the ability to maintain its shape and low shrinkage.

Design in a virtual environment shortened development time

FEA was an integral component of the success of this project. We were able to engineer the sealing material and develop the profile in parallel. The use of FEA analysis shortened development time and gave the flexibility to optimize the seal design in a virtual environment, helping ensure the success of the H1.

H1 – the new generation of hydrostatics

For more than 40 years, Sauer-Danfoss has been developing state-of-the-art components and systems for mobile machinery used in off-highway operations around the world. All that experience has been channeled into the new, unique H1 family of single and tandem pumps.

H1 is a range of servo-controlled hydrostatic single and tandem pumps, developed with a clear vision of tomorrow's world. It is designed for quality and reliability and offers expanded functionality, greater total efficiency and easy installation. Working quietly inside, it is at the heart of tomorrow's mobile machinery.

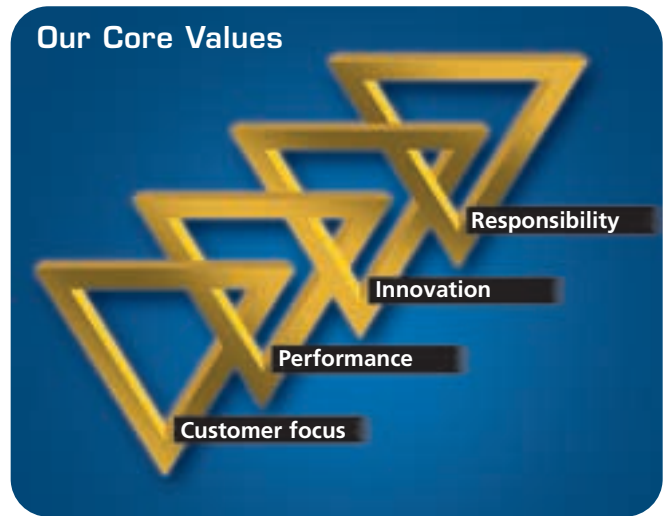
Aerospace

Customer Focus- a complete approach

Trelleborg Sealing Solutions Americas has adopted an innovative aerospace market approach based on Trelleborg core values. This means that we have been able to provide not just technical solutions to our aerospace customers, but partnerships as well. Relying on supply chain management (SCM), logistics through the Logistics Center Americas (LCA), an extensive product portfolio, multiple production facilities and outstanding customer service, this system allows us to have complete airframe capability.

Innovation- integrating supply and demand

Putting into practice the process of supply chain management has been an integral component to the success of our approach to the market. SCM involves developing, implementing and managing supply chain operations. The goal is to proactively meet customer requirements as efficiently as possible. In our current



aerospace partnerships, the effectiveness of SCM means that our customers' part stock is always taken care of. Low stock is automatically replenished, and total stock is continuously monitored.

A service approach based on Trelleborg core values

Aerospace requirements met through Supply Chain Management

Over 40,000 different seals and sealing systems are shipped from the various manufacturing sites to our central Logistics Centers in Europe, Asia and America. In addition we have completely aligned our logistical support to match changing customer needs and provide an efficient chain of delivery at economic cost.

Supply Chain Management: How does it work?

Supply Chain Management (SCM) means:

- Developing
- Implementing
- Managing

SCM involves each aspect of the supply chain, from raw components to final delivery of a finished product. The ultimate goal of SCM is to meet customers' requirements as efficiently as possible.



Responsibility- different locations, different products, one goal

The LCA is located in Fort Wayne. It works diligently to ensure that all parts, from O-Rings to back-up rings and more, are available on-demand. Adherence to specific aerospace or military specifications is strictly monitored. By working to get supply contracts with group as well as non-group suppliers, we are solidifying our product portfolio. Our locations in North America and Brazil all contribute to the success of our aerospace partnership approach, from sales, to designing and engineering, to production and delivery.

Did you know?

Trelleborg Sealing Solutions is the number one supplier of seals to the aerospace industry in Europe and number two in America.

Performance- Industry leader

Trelleborg Sealing Solutions is an industry-leading supplier to the aerospace industry, and the “not just technical solutions, but partnerships” approach only serves to further strengthen our position in the worldwide market. Additionally, our extensive range of in-house materials, products, research and development and Finite Element Analysis (FEA) capabilities ensure that the ideal solutions can be achieved for all of our customers’ applications.

Specialized manufacturing sites working together across the Americas with the LCA and the Marketing Companies to deliver products.

Trelleborg Sealing Solutions Fort Wayne
→ hydraulic seals

Trelleborg Sealing Solutions Broomfield
→ Variseal®, hydraulic seals and bearings

Trelleborg Sealing Solutions Somersworth
→ environmental, air delivery

Trelleborg Sealing Solutions Hudson
→ airframe, environmental, engine

Trelleborg Sealing Solutions Brazil
→ hydraulic seals, inventory

Trelleborg Sealing Solutions Eugene
→ composite bearings, hydraulic systems

Plus numerous third-party suppliers

A one-stop-shop for aerospace sealing

“Customers can come to one location to get every seal that they need for their project,” says Antonio Garcia, aerospace segment manager, Trelleborg Sealing Solutions Americas. That’s important, because our customers are looking for us to be a one-stop-shop. Our goal is to provide complete airframe capability.

“We rely on each of our locations in the Americas to do its part. By working together, we keep the supply chain moving and are able to meet our customers’ demands time and time again. Our SCM and logistics approach means that we operate like a well-oiled machine, while at the same time nurturing customer relationships.”



Trelleborg Sealing Solutions at a glance

- A business area of the Trelleborg Group
- Employees: 5700
- Research and Development Centers in Europe and America
- 30 manufacturing plants worldwide
- 40 Marketing Companies globally
- Quality Certifications: ISO 9001:2000 and ISO/TS 16949:2002
- In-house polytetrafluor-ethylene, polyurethane development and elastomer development
- More than 2000 material formulations
- Worldwide distribution network

Contact your local Trelleborg Sealing Solutions
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Busak+Shamban
has a new name:
Trelleborg Sealing Solutions
Quality & Service remain!


TRELLEBORG
SEALING SOLUTIONS