

in the groove

General Edition

The world of seals and service



Aerospace

Aerospace Special






Off-Highway

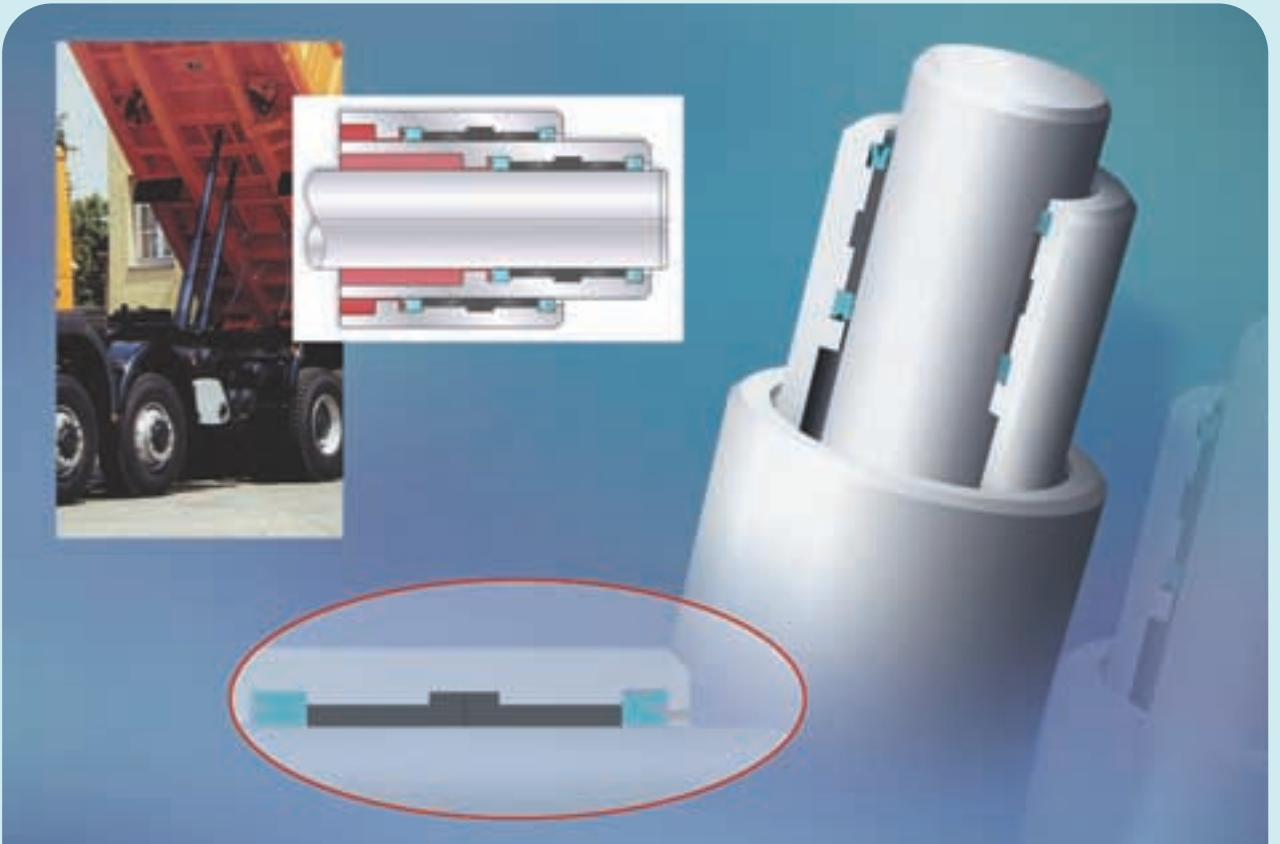
Busak+Shamban seals selected by world-leading tractor manufacturer

Marine

Orkot® bearings from Busak+Shamban fitted on boats leading Volvo Ocean Race

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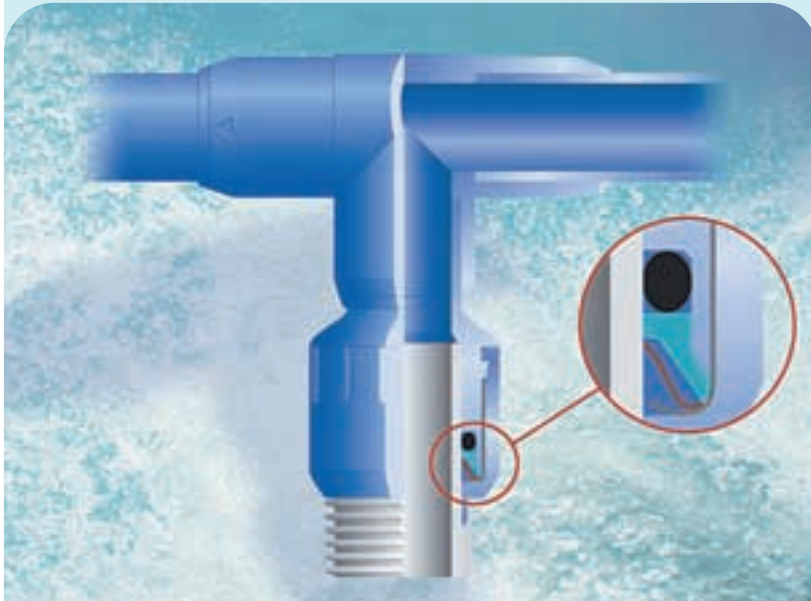
A money saving tip

The telescopic cylinders that control tipper trucks operate with three, four, five or more steps and are of a compact design. Wall thickness of the cylinders is therefore thin and they have a short guiding length with the guiding achieved either by nitrating the machined steel rod or by installation of Wear Rings.

Always wanting to face up to a challenge we decided to try and find the optimum sealing and Wear Ring arrangement for telescopic cylinders which control tipper trucks.

The perfect design needed to fit into an extremely narrow installation space and to work at a pressure of 21MPa (3045 psi, 210 bar). It had to retain integrity at temperatures from -40°C (-40°F) up to +110°C (230°F), operate at speeds reaching 0.5 m/sec (20 inch/sec) and be resistant to mineral oil based hydraulic fluids and bio oils. Excellent static and dynamic sealing had to be maintained, even when the cylinders were subject to severe vibration caused by the truck driving on rough surfaces.

Busak+Shamban engineers came up with numerous proposals, which they tested in a virtual environment using computer simulation techniques, including advanced FEA modeling. The optimum design proved to be a combination of seal, scraper and Wear Ring specific to these telescopic applications. The unique Wear Ring of HiMOD® HM061, an engineered thermoplastic in a special L-shape, met all performance requirements and allowed the dimension of the steel tube to be reduced, lowering overall manufacturing costs.



Keep it watertight

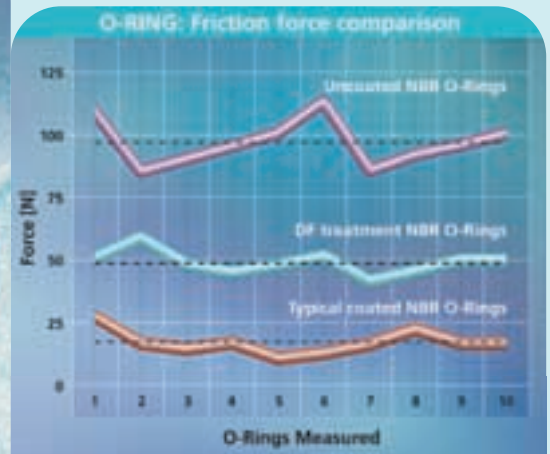
Drinking water is a precious commodity. Making sure as little as possible is lost is important, and domestic water pipes must be guaranteed watertight for 50 years. Key to achieving this is effective sealing.

Sealing requirements are demanding, as most new pipes are plastic and increasingly quick fit connections are used to speed fitment. When you consider still 70% of the world's population does not have access to clean drinking water, installation of water systems as quickly as possible, that are virtually leak free, is a major priority. And when most of those systems are required in the developing world, minimizing cost is vital.

Sealing material development for water system applications has therefore focused not just on performance but also on making cost of production as low as possible. Which means to meet cost criteria, O-Rings need to be produced by injection molding.

To make injection molding of O-Rings possible, softeners are usually added to the elastomer to give better flow of material into the injection tool. The resulting better fill increases seal output and makes production costs lower. But, softener may migrate into plastic components such as pipes and quick connectors. This can lead to cracks in the plastic parts, which is not acceptable.

Busak+Shamban has solved this problem. We now have a broad range of materials available that balance the use of softeners with material performance. They also meet approvals to various international standards, making them universally compliant globally.



Smooth operators

Automotive door mechanisms, storage compartments and interior features with movement need to operate smoothly. To achieve this, O-Rings are used in the components, to act as a damper, stopping the component snapping back after use.

The friction characteristics of a standard elastomer O-Ring are not good enough and parts tend to stick so O-Rings are coated or treated to improve friction properties. Sometimes though, these are too good and the components still snap back into place.

Busak+Shamban has a leading position in surface coating and treatment technology for seals, identifying many formulations to enhance the performance of our seals. One of these, DF surface modification, proved to have the ideal performance characteristics.

In this particular application, the higher coefficient of friction of the DF treatment compared to a coating, proved an advantage, giving it the best possible degree of friction reduction to allow a controlled smooth movement. Also, no deterioration of operation was likely over time, as there was no coating layer to be rubbed from the surface.

Busak+Shamban O-Rings with DF treatment are now successfully acting as dampers on release mechanisms on major car models worldwide.



Keeping artificial limbs leak free

The technology behind the design and manufacture of artificial limbs has come a long way since they were made of wood. The prosthetics produced by Chas A Blatchford, who manufactures the world leading ENDOLITE range of artificial limb components, include an advanced mix of microprocessors, hydraulics, stabilizing units and wireless programming. This helps them as closely as possible reproduce the performance of the amputee's lost limb. It is thinking technology that responds to the wearer's natural rhythm and the cadence of their walking style, blurring the boundary between real and artificial.

Seals are used within the hydraulic system of the artificial limb. They have a joint function, sealing hydraulic fluid within the unit and acting as a damper on the movement of the prosthesis. Effective leak-free sealing is vital in these components; the last thing that a user wants is hydraulic fluid leaking from their artificial limb.

Chas A Blatchford investigated a number of alternative sealing options. Working closely with Busak+Shamban engineers, a sealing arrangement was designed incorporating a combination of Glydring® and Turcon® Stepseal®, the Turcon® material having the optimum friction characteristics to enhance limb movement and demonstrate extended life.

The seals underwent long-term tests both on rigs and in components fitted on patients. The Glydring® and Turcon® Stepseal® are now the standard seals on Endolite Adaptive and IP+ products.

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Survival of the fittest: Turcon® Stepseal® 2K proves the theory of evolution

Developing a hydraulic cylinder sealing arrangement with certainty of performance over a wide range of applications has provided a long term engineering challenge. The first breakthrough was in the 1970s when Busak+Shamban, with the Turcon® Stepseal®, revolutionized fluid sealing in cylinder applications. Through ongoing research and development, the Stepseal® has been further refined and improved, with the latest version, Turcon® Stepseal® 2K, achieving new levels in cylinder sealing performance.

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 seals must keep lubricants within the cylinder chamber and, at the same time, keep abrasive media out. 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 configuration will comprise of between three to five different dynamic seal and scraper types.

A sealing system was born

Busak+Shamban changed the thinking behind the sealing of hydraulic cylinders. After its introduction of the Turcon® Stepseal® in 1972, it quickly became a first choice for rod and single acting cylinder sealing for design engineers from major cylinder manufacturers world-wide.

With the Turcon® Stepseal®, it was possible for the first time to arrange several seals, one behind the other, to create a static and dynamic sealing arrangement. This double-acting tandem seal configuration was a major advance in fluid power technology,

eliminating the build up of disruptive intermediate pressures between seals. This had always been a major problem for engineers and had caused a loss of operating efficiency, seal destruction and leakage.

The new seal was developed from a proprietary PTFE-based material, Turcon®, which offers a low co-efficient of friction and performs over a wide range of operating temperatures. This resulted in greatly improved wear resistance compared with materials previously used. In the 1980s, Busak+Shamban introduced the Turcon® Stepseal® K, which provided improved long term sealing performance.

Stepseal® 2K - the next generation

Busak+Shamban was unwilling to accept that the basic Stepseal® design was the optimal solution for fluid sealing. Significant research and development resources were invested in developing its efficiency and application capability. This was partly driven by cylinder manufacturers changing the tolerance requirements between the rod and cylinder walls, along with the use of alternative hydraulic fluids and increasing temperatures

Turcon® Stepseal® 2K advantages for piston and rod sealing:

- High static and dynamic sealing effect
- High 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
- High 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

and pressures. The resulting product was the Turcon® Stepseal® 2K.

The Turcon® Stepseal® 2K enhances sealing efficiency. Better extrusion resistance gives superior leakage control and allows larger hardware tolerances, making cylinder production more economic. It also is more uniform, showing low friction characteristics throughout an extended life and even during the run in period, when friction forces can have the greatest effect on hydraulic seals.

The Turcon® Stepseal® 2K is available in nine different compounds, offering unsurpassed sealing security when used with all lubricating and non-lubricating hydraulic fluids, including zinc-free oils and water-based hydraulic fluids. They can also be matched to specific mating surfaces and media. They are suitable for gas applications, and seals can be specified to meet the precise degree of extrusion and abrasion tolerance required for an application.

Download catalog under
Service/Download Area at


www.busakshamban.com



(available in English and
German)



The optimum patented profile of Turcon® Stepseal® 2K was the result of significant research and development.



Marine

Orkot[®] bearings from Busak+Shamban fitted on boats leading Volvo Ocean Race

The high point of ocean sailing, the Volvo Ocean Race started in Vigo, Spain on November 15, 2005 and will finish in Gothenburg, Sweden in July 2006 after the teams touch four continents and circumnavigate 32,000 miles of the globe. Orkot[®] TLM Marine, a highly specialized composite material from Busak+Shamban, is on board the boats for team ABN AMRO.



The Volvo 70s, a new class of boat developed for the race, are the Formula One boats of the seas. All aspects of the design and materials used for the Volvo 70s are considered by every team to have optimal speed potential, stability, maneuverability and sailing creativity.

Team ABN AMRO has two boats designed by Juan Kouyoumdjian. The design includes twin rudders for added security in case of breakage or collision with a floating object, with twin foils used to increase control when the keel is canted. Being retractable, unimpaired movement of the foils is essential. That is what led the boat designers to the Orkot® TLM Marine material, a highly specialized composite material from Busak+Shamban, which was specifically developed for marine applications.

Designing for perfect movement, perfect performance

In conjunction with Busak+Shamban engineers in the Netherlands, developers of the Volvo 70s yacht for Team ABN AMRO selected Orkot® TLM Marine composite for a critical application. Bearing pads enable the foil boards to extend, retract and tilt in perfect movement. Orkot® TLM Marine material was selected for the bearing pads because of its capability to withstand side and edge loads, its proven resistance to seawater and its ability to operate without lubrication.

These inherent characteristics have been used by marine engineers for many years, and Orkot® Marine Bearings composites are used in applications throughout boat building, related maritime and offshore sectors, including sub-sea applications.



Juan Kouyoumdjian, Team ABN AMRO

Being manufactured from a unique composition of reinforced woven fabric and solid lubricants within a thermosetting resin matrix, Orkot® Marine Bearings composites are able to cope with extremes in temperature.

By selecting this design configuration, hopefully Team ABN AMRO will achieve the best sailing speed and stability in all sea conditions.



Klaas Pilon, General Manager, Busak+Shamban Netherlands

Helping ABN AMRO ONE rule the waves was an interesting excursion for Busak+Shamban Netherlands. Says general manager (and avid yachtsman) Klaas Pilon: "We provide our customers with a one-stop-shop for all their sealing and bearing needs. With the Trelleborg Group behind us, we can provide any solution they require, whether from our virtually unlimited catalog of ready-made parts or in the shape of custom-made parts. We've got it or we can make it."

Trelleborg Sealing Solutions is one of the leading producers of

precision seals for the industrial, automotive and aerospace markets, and its marketing organization Busak+Shamban makes sure that supply and demand meet each other.

In the Netherlands, with its rich maritime tradition, that means that many of those seals and bearings end up in the marine industry. There they ensure a smooth, environmentally sound and cost-efficient operation of some of the largest floating constructions in the world. And some of the fastest, too.

Find out more about the Volvo 70s Team ABN AMRO and their progress in the Volvo Ocean Race at:

www.volvoceanrace.org



Aerospace Special



The sky's no limit

Interview with Claus Barsøe,
President Trelleborg Sealing Solutions



Though Trelleborg Sealing Solutions may seem a new name in the supply of aircraft seals, it is not. Its pedigree goes back over 50 years and the names Dowty, Impervia and Shamban give a clue to that history. These pioneers of the aerospace industry are now united within the group.

Leading supplier of sealing solutions

"We are the leading supplier of sealing solutions to aircraft manufacturers", said Claus Barsøe, President Trelleborg Sealing Solutions. "We have successfully supplied seals to the majority of platforms; from Douglas and Boeing in the 1950s to the latest aircrafts, including the Joint Strike Fighter and Airbus A380. Trelleborg Sealing Solutions is responsible for manufacturing, while Busak+Shamban, which retains the respected

Shamban name, is our global sales and marketing organization.

"Our parent, Trelleborg AB, sees the aerospace group as a key part of its growth strategy, and manufacturing units dedicated to this sector are enjoying significant investment to maintain and improve our position as technological pioneers within our field of expertise; expanding the product range to enhance our ability to be a total solution provider."

A completely integrated global supplier

"Production of aircraft components takes place in America, Denmark, France, Sweden and the UK. Since Trelleborg AB acquired the sealing business we have undertaken a major restructuring program to strengthen and realign ourselves to meet the challenge of ever changing market demands. This has meant developing our organization from a number of strong, but individually operating entities, to a completely integrated global supplier. This reflects the way our customers operate, where we see a trend for design and development to take place in one or two countries, purchase decisions to be made elsewhere and final build to be perhaps in a different continent."

Busak+Shamban has aerospace specialists located in each one of their 40 marketing companies worldwide. Experience is seamlessly exchanged through a sophisticated engineering network, which utilizes the skills and testing resources of focused research and development facilities."

Innovative manufacturing methods continuously developed

Claus Barsøe continues, "We are committed to providing our key customers with leading-edge solutions and R&D concentrates on examining factors important to the aircraft designer. This includes the effects of high frequency vibration, extremes of temperature, severe pressures, environmental conditions and resistance to aggressive media used in hydraulic systems like phosphate ester fluid and synthetic hydrocarbon based oils.

"Innovative manufacturing methods are continuously developed to match increasingly demanding performance criteria. This is in addition to constant material and seal enhancements that have generated an unrivalled range of proprietary compounds and patented products."

Customers rely on our experience in sealing solutions

Busak+Shamban works in partnership with their key customers and the relationship is not just limited to simply supplying a seal for an application. Claus Barsøe confirms this. "We aim to understand all our customers' needs, from their desire for involvement at concept stage to special requirements for delivery. We have always been involved in the early development of aircraft but our input is becoming ever greater, customers relying on our experience in providing sealing solutions. They are more than happy to use our computer modeling and in-house test capabilities to ensure sealing integrity.

"Our support continues right up to aircraft build and into aftermarket support. To ease our customers' assembly and help reduce stock levels, we combine efficient and timely product supply from our global logistics centers with direct line feed and kitting at our production plants."

Service is of paramount importance

"We have achieved our unparalleled market position by providing the ultimate in customer support to our customers; service is of paramount importance to us", emphasized Barsøe. "Whether delivering innovative inflatable canopy seals, a Variseal® of a few millimeters in diameter, airframe seals in hundreds or O-Rings in thousands, the same dedication is committed to ensuring satisfactory supply. Every aerospace application is important to us, whether it is a simple standard part used as a static seal on a commercial aircraft or a critical custom designed part on the Mars Lander.

"Busak+Shamban has been involved in the aerospace industry for the last 50 years and we intend to be at the forefront of aerospace sealing technology for the next 50 years...at least."



Whether a Variseal® is only 3mm or 2.5 meters (1/8 inch or 8 feet) in diameter it



provides the same level of sealing integrity.

The sky's no limit; Busak+Shamban products even reached Mars when custom designs were used on the Mars Lander.



Manufactured to standard or custom design, airframe seals are hand-fabricated with absolute attention to detail.





Sealing solutions 'On board the A380'

To realize their ambitious performance targets, Airbus Industries (Europe) worked with system suppliers who could employ new technology to enable them to meet their objectives. Busak+Shamban contributed with innovative sealing concepts.

Seals withstand high pressures in hydraulic cylinders

The take-off weight of the A380 with full fuel tanks can be over 500 tonnes (551 tons). To lift this load, but to avoid increasing weight and size of the hydraulic actuators, Airbus increased the hydraulic pressure from 3,000 PSI, the norm for commercial aircraft, to 5,000 PSI. This enables relatively small hydraulic cylinders to generate the larger forces required to retract and extend the undercarriage, as well as to adjust the rudders and flaps. Significant experience with high-pressure sealing, gained from years of work on military high performance jet Fly-by-wire flight controls, allowed us to offer a solution to meet these pressure parameters. It also achieved stringent requirements for sealing security, maintained long-term strength, could operate in temperature extremes and provided resistance to a wide range of aggressive media.

Resistance to extreme temperatures vital in engine sealing

Though two propulsion units, with a total thrust of 227 kN (51,075 pounds), were

sufficient for the Airbus A320; four propulsion units are needed to generate the 1244 kN thrust required to lift the 550-seater A380. Newly developed Rolls Royce Trent 900 jet engines were chosen for the task. The seals for the turbine blades presented specific challenges with their requirements to operate over a wide range of extreme temperatures and the necessity to seal lubricant into the engine, while excluding external media. The Busak+Shamban innovative design for this application used composite construction materials, the fiber-reinforced sealing systems effectively providing optimum sealing in their harsh operational environment.

Sealing for airflow optimization

When sealing airfoil surface areas, unique silicone profile seals play a part in airflow optimization of the flaps and fairings. These seals offer improved aerodynamics and thus, noise reduction and decreased fuel consumption.

Fire seals withstand flame temperatures of



Trelleborg Sealing Solutions Cadley Hill has developed a technology for fire seals that is leading within its class. In both single and twin-wall construction they provide very low surface friction and electrical conductivity. They are successfully being used on Trent (500, 700, 800) V2500, EFA, Nimrod and M346 aircraft platforms.

Fire seals need to conform to ISO 2685 performance standards and must withstand flame temperatures of 1100° C (2012°F), for 15 minutes. Busak+Shamban fire seals

are compliant with international standards, and tests have proved a number of the new seals to be capable of withstanding this temperature extreme for a period of 30 minutes, twice the required time!

They also include a patented 'split-seal' option to facilitate retrofitting, without the need to dismantle any part of the aircraft frame. This means it is economic to upgrade to a fire seal, with all the benefits of operational safety.

Materials: the technology behind the seal

Busak+Shamban is continuously developing new materials to meet the specific needs of the industries we serve. Extensive investment is made into research and development to ensure we are at the forefront of the technology behind the seal. Here we detail just three of the many proprietary compounds we can offer to the aerospace industry.

Download complete
Aerospace Catalog under
Service/Download Area at

www.busakshamban.com



Isolast® advanced perfluoroelastomer

Isolast® is the Busak+Shamban brand for their range of perfluoroelastomer materials which offer the most advanced elastomer sealing option available.

Being virtually inert and demonstrating almost universal chemical compatibility, the definition of a perfluoroelastomer is quite broad and polymer architecture of different compounds can vary substantially. With this in mind, the Isolast® range has been engineered to fulfill specific industry requirements. Isolast® has been approved by several Aero Engine manufacturers who benefit from its unique properties. Specialized

grades are available, which operate at continuous temperatures up to 325°C (617°F). These are ideal for situations when seals will be subject to elevated temperatures and at the same time potentially in contact with aggressive media. A typical example would be the high temperature lubrication systems in aero engines. The fact that they can be molded to custom geometries or bonded to metal gives the material an added benefit in such environments.

Turcon® M30 - High Pressure, Non-Abrasive

Turcon® M30 is a PTFE based non-abrasive material for high pressure applications, developed to offer sealing

security over the increased component life of flight controls on new generation of civil aircraft such as A380 and the B787.

An optimum compound crystalline form gives this material a dense and homogeneous structure while aromatic polymer fillers mean it has high temperature resistance. The use of non-abrasive filler materials stops abrasion of mating surfaces under high loading conditions providing it with excellent friction characteristics, making it perfect for low-lubrication environments. All this leads to increased wear resistance, improved leakage control and better stability in-service. Ultimately, that means superior reliability and enhanced operational efficiency.

As with all Turcon® materials, the M30 is virtually universally compatible with all currently used aircraft fluids.

Ultra-Low Temperature FKM Turel® LTFE

The Turel® LTFE range of proprietary fluorocarbon elastomer (FKM) based materials provides certainty of sealing at temperatures as low as -40°C (-40°F). Available at 75 and 90 IRHD hardness, the compounds demonstrate exceptional characteristics to meet the most demanding of aerospace sealing requirements.

Laboratory testing has shown that the materials perform well at 10°C (50°F) lower than the next best low temperature FKM material and at least 20°C (68°F) lower than any 'standard' FKM material. At the other end of the temperature scale, they have equally as good or slightly improved properties to other FKM materials at 200°C (392°F).

In addition, immersion tests prove that Turel® LTFE is resistant to a wider spectrum of aircraft fluids than other materials, with an acceptable resistance to Skydrol 500B. These materials are ideal for sealing in any components that are subject to and are required to operate at extremely low temperatures, such as landing gear.



The perfect match for hydraulic sealing

Robinson Helicopter of Torrance, California is one of the world's foremost manufacturers of civilian helicopters. Not only do Robinson's aircraft offer excellent value for the money, their hydraulic control systems are also leak free - thanks to seals from Busak+Shamban.

The vision of company founder Frank Robinson was to create a small, low-cost, reliable helicopter. Robinson Helicopter has steadily carved out an impressive position in its market. In 2005, it manufactured 806 civilian helicopters, more than any other company in a single year.

Just as customers seek reliable helicopters, the helicopter maker seeks reliable parts. And for hydraulic seals, Robinson found the perfect match in Busak+Shamban.

Busak+Shamban worked with Robinson to find the best piston seals for the three servos powering the hydraulically boosted controls of their R44 helicopter.

At the piston rod, Robinson uses Busak+Shamban Excluder®, its Plus Seal® II seal and Slydring®. At the input valve, a low-friction seal in proprietary Turcon® PTFE based material, prevents feedback to the pilot.

See us at air shows globally!

In May, Busak+Shamban exhibited at the Berlin Air Show. With record attendance there, we enjoyed one of our best ever shows, generating lots of interest in our products and service.

This year and next, Busak+Shamban will continue to present their aerospace capabilities around the world. Why not visit us at the following events:

Farnborough International Airshow, UK
Boeing All Model Fleet Conference, USA
Aero-Engine Expo, London, UK
Paris Air Show, France

17 to 23 July 2006
26 to 27 September 2006
27 to 28 September 2006
18 to 24 June 2007



Uniquely secure

Inflatable cockpit seals; an innovative technology

At service ceilings of up to 15,000 meters, maximum speeds of 2,000 kilometers per hour, rates of climb of 12,000 meters per minute* and under extreme pressures, the seal on the jet fighter cockpit presents the ultimate sealing challenge. Even a pinprick in the seal between the cockpit and the plane could put the pilot's life at risk. The manufacture of cockpit seals

by Busak+Shamban associated manufacturing company Trelleborg Sealing Solutions Cadley Hill is a feat of engineering. These are high technology products yet still hand fabricated in tools the full size and shape of the jet fighter cockpit. The inflatable seals are built up layer by layer, cured within the tool, then tested at line side.

Adrian Roberts, Product Manager for Trelleborg Sealing Solutions Cadley Hill says, "We lead the market in development and manufacture of one piece inflatable cockpit seals. We have produced these for the Tornado, M346 and Eurofighter Typhoon to name but a few."

*48,000 feet; 1,200 miles per hour; 40,000 feet per minute



How the cockpit seal works

The cockpit seal is fitted to the edge of the canopy. When the canopy is closed the seal is inflated, filling the gap between the plane's cockpit and its canopy, ensuring total sealing integrity.

For more information on our aerospace capabilities and for your local contacts go to





Busak+Shamban signed a four-year agreement with leading international tractor manufacturer Fendt to supply special high pressure rotary seals for their innovative Vario range of tractors.

Busak+Shamban seals selected by

world-leading tractor manufacturer

Fendt is a major brand of the AGCO Corporation, one of the largest tractor manufacturers in the world. Fendt has been receiving praise for its new Vario tractors which range from 950HP (70kw) to 310HP (221kw).

Designed for agricultural, forestry and public works, the Vario tractor contains a hydraulic gearbox with a stepless drive unit. Within this hydraulic assembly, a high-performance pump

drives two adjustable hydro motors on a single shaft. In one set of gears, there are between six and nine seals of two different diameters, with a rotary seal consisting of three individual components - a PTFE antifriction ring, two thrust rings, and a pre-tensioning element.

Fendt began product development for this innovative gearbox design in 1990. In the early planning stages, several seal manufacturers were involved, with each trying

Off-Highway

to offer a rotary sealing configuration that would work at elevated temperatures, low idling speeds and high pressure. After a number of developmental stages, Busak+Shamban was selected to take its sealing design to production.

The Research and Development Center in Stuttgart became involved in the process, and the use of specially-formulated high-performance plastics solved the problem of failures due to high temperature with the configuration meeting requirements for seal performance. This helped Fendt launch a top-notch product. The partnership between Fendt and Busak+Shamban was, and still is, considered to be an integral part of the product's success. From applications

engineering, customer service and sales support, the partnership between the two companies helped to move the product from its concept in 1990 to its market launch in 2005.

"Busak+Shamban is a very cooperative and customer-oriented company to work with," said Dr. Johann Weixler, Purchasing Manager, AGCO GmbH. "We are building a successful future through innovative product development."

With the Vario tractor range now in full production in the world market, Busak+Shamban is continuing to supply batch sizes that match Fendt's demanding line side deadlines.

"Busak+Shamban is a very cooperative and customer-oriented company to work with"

Dr. Johann Weixler



Dr. Johann Weixler, Purchasing Manager, AGCO GmbH



Inside the gearbox

At the heart of the drive chain is the variable control gearbox. Called the Vario CVT, this transmission control system offers infinite speeds within two ranges, helping to deliver optimum drive performance. The engineering development challenge involved providing advanced rotary sealing for the Vario CVT gearbox arrangement. Seal performance requirements included a capability of optimum performance at

pressures up to 500 bar (7250 psi) with temperatures to 130°C (266°F) within a sealed-for-life unit. Situated within swiveling rotary units, the back-up ring version was required for installation within closed grooves and for high-volume production line assembly. Busak+Shamban developed a special, high-performance plastic to meet these demanding performance requirements.



Peter Schellenberg (left) and Sebastian Reiner, Busak+Shamban Germany, serving AGCO as a team.

“We worked together with Fendt in a very agreeable manner, despite the requirements placed on us by the market”

Peter Schellenberg

Team approach provides the key

Peter Schellenberg, head of mobile hydraulics at Busak+Shamban Germany, led a team that worked in partnership with AGCO’s Fendt division.

“From the product-development stage through to the manufacturing process, we worked together with Fendt in a very agreeable manner, despite the requirements placed on us by the market,” says Schellenberg. “At the heart of this process is a commitment to interdisciplinary teamwork. This enables us to continue to present solutions for the lifetime of the product, which elicit from the customer not merely satisfaction, but enthusiasm.”

At Fendt, purchasing manager Johann Weixler has signed a four-year contract for the supply of seals.

During a conversation with Schellenberg and Busak+Shamban area sales manager Sebastian Reiner, Weixler expressed his appreciation for the essential role Busak+Shamban played in helping to reach a new level of reliability in the Vario range. “There isn’t just one kind of supplier - there are those who supply small parts, those who produce components, and then there are development partners,” he says. “Busak+Shamban is one of the latter. It is a very cooperative and customer - oriented company to work with. We are building a successful future through innovative product development.”

Saving the Environment,



one seal at a time



Wind power installed in Europe is saving over 50 million tons of CO₂ a year and is on track to deliver one-third of the European Union's Kyoto commitment by 2010. Busak+Shamban developed a sealing system for the hydraulic cylinder used to change the angle of the rotor blade of wind generators.

Busak+Shamban, in partnership with a leader in the engineering of wind power technology, was inspired by the associated technology to create several innovative solutions in hydraulic sealing. The company developed a new sealing system comprised of seals, wipers and bearings for this application.

Capturing the wind

Technological improvements in wind turbine engineering continue at a dizzying pace. What was once considered the world's largest wind power plant has now been surpassed by an even larger one. Masts are becoming higher and now exceed 120 meters (394 feet) and at the same time, rotor diameter is increasing.

Depending on the wind direction and wind force, the azimuth, or the alignment of the rotor and the pitch

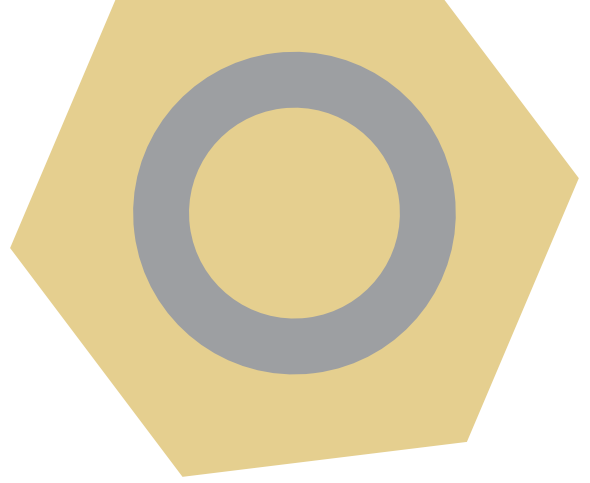
angle of the rotor blade, must be adjusted. The movement is carried out through the use of hydraulic cylinders within the safety-critical pitch system, an adjustment mechanism that employs quite advanced engineering technology.

Designing a system for continuous use

For each rotor blade, there is a hydraulic cylinder that adjusts the angle of the blade. The blade rotates 10 to 20 times per minute, relative to the wind force. Busak+Shamban was commissioned to provide a sealing solution for this mechanism and developed new seals, wipers and bearings for the hydraulic drive piston rods and cylinders. A Turcon® Stepseal® 2K, manufactured from the high-performance seal material Turcon® T29, was used in tandem with an Excluder® 5 from

Turcon® T40 material. Bearings produced from C320 material and piston seals produced in the Glyd Ring® Hz system and Turcon® T29 materials were also used.

The sealing and bearing system in the wind generator is in constant use and under constant pressure. At high wind speeds, any failure of pitch adjustment could have serious consequences, as highlighted in the "Failure Mode and Effects Analysis" (FMEA) testing recently carried out by a European wind power plant developer and the Allianz Technology Centre in Munich, Germany. The analysis, undertaken on a major installation, provided information relating to optimum operational performance values and safety and included the Busak+Shamban sealing configuration as part of the study.



Let's stick together

Isolast® perfluoroelastomer proprietary technology to bond to metal

One of the main reasons engineers specify a perfluoroelastomer seal for an application is because of its almost universal chemical resistance. This, perhaps the material's most important advantage, can also be a disadvantage. When, for space saving or performance reasons, a sealing device with a rubber lip, pad or membrane bonded to a metal component is required, then perfluoroelastomer is a problem - it just won't stick easily.

Finding a solution to a sealing challenge

As perfluoroelastomer is chemically inert, conventional glue bonding of perfluoroelastomer to metal will not give the sealing integrity needed for critical medical, pharmaceutical, food and beverage applications.

Engineers responsible for the development of Isolast®, the Busak+Shamban high performance perfluoroelastomer, set for themselves the challenge of finding a solution;

to develop a method of bonding perfluoroelastomer to a metal substrate.

Bond integrity proven

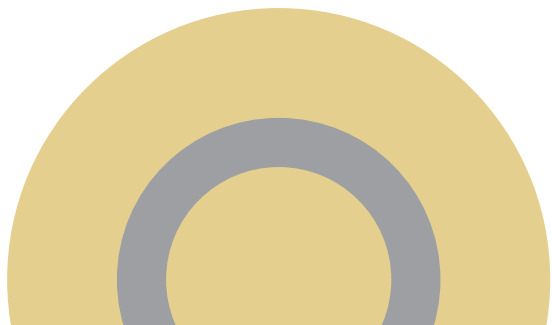
Busak+Shamban undertook lengthy research to find an innovative method of bonding Isolast® to metal. They found when testing their proposed solution that the bonding action achieved did not affect the physical performance properties or the general chemical resistance of the perfluoroelastomer. In fact, both laboratory and field-testing showed bond integrity to be greater than the tensile strength of the perfluoroelastomer itself. In addition, immersion tests in a range of chemicals, including acetic acid, Methyl Ether Ketone (MEK) and sulfuric acid at elevated temperatures, showed the bond to be resistant to chemical attack. The bond strength was equally as high, following immersion, as it was before the soak tests began.

Isolast® has now been successfully bonded to a wide range of surfaces including stainless and mild steel, aluminum and brass.

Savings of up to 50%

Ursula Porelle, Product Manager for Isolast Seals, told us "In cases where space is at a premium, a bonded seal is often the preferred option. Our new bonding technology now makes it possible to use Isolast® in these designs."

There are other benefits from bonding Isolast® to metal. These include fewer parts to be handled and stored, a smaller overall component and resulting from that, increased speed and process reliability in assembly. That means we can help our customers save money. In one application, an Isolast® bonded seal offered a full 50% cost saving when replacing a conventional 3-piece seal arrangement. And although the seal was smaller, the design achieved improved sealing performance.



FDA / USP Class VI approved Isolast®

Medical, pharmaceutical, food and beverage industries demand FDA / USP Class VI approved materials. The Isolast® grades J9515 (black) and J9516 (white), bonded to stainless steel, are being used by a number of companies in these sectors. The bonded design eliminates the problems associated with groove voids, meaning bacterial build up and subsequent contamination is eliminated. In addition, Isolast® and its bond stand up to the severe cleaning fluids required within CIP and SIP processes.

Isolast® seal manufacturing

Manufacturing of Isolast® seals currently takes place in Busak+Shamban associated manufacturing companies in the UK and USA.

The Isolast® range of advanced perfluoroelastomer materials is available for supply as O-Rings, V Rings, gaskets, custom molded and bonded designs. We offer anything from micro O-Rings in high volume to an individually made seal, several meters in diameter. Cleanroom facilities give the capability of supplying product washed and packed to class 100 standards.

Download Isolast® brochures under Service/Download Area at

www.busakshamban.com



Gaining the seals of approval

Busak+Shamban has a range of seal materials that comply to Norsok M-710 standard

Busak+Shamban has been a leading supplier of sealing solutions to the oil and gas industry for over 25 years. To support their customers supplying the Norwegian oil and gas industry in gaining Norsok approval for their assemblies, Busak+Shamban has had a number of sealing materials tested to Norsok standards.

We can now offer the largest range of sealing materials with certificates of compliance to Norsok M-710, available from any seal developer and manufacturer. And most of these are already proven and in long-term use in many demanding exploration, offshore and onshore production, upstream and downstream environments.

Bill Allan, Busak+Shamban Oil and Gas Segment Manager said, "We are thrilled to have been so successful in these tests. The availability of compliant materials will make it easier for existing and new customers to achieve full approval for their assemblies from Norsok."

The sealing materials are available in a range of seal types. The PTFE based materials are commonly used in the industry in the form of Turcon® Variseal®, back up rings and support rings.

Details of tests:

A number of grades of Busak+Shamban polymers were involved in rigorous independent tests, undertaken and supervised by MERL - materials engineering research laboratory, a respected independent laboratory in the United Kingdom. The main focus of the testing was to predict service life of the materials within an offshore working environment, as specified in Norsok M-710 standard, Annex C. Ideally materials should exceed expected well production lifetime of an oil and gas facility of 30 years.

Thermoplastic sealing compounds, PTFE based grades and PEEK based materials, were immersed in a sour (2% H₂S) multi-phase fluid at +200°C to +220°C (+392°F to +428°F), for periods of 7 to 70 days. After saturation in this liquid the mechanical properties, including tensile strength, elongation Young's modulus and volume changes, were measured. These results were used to predict aging and estimated service life of the materials.

Summary of results:

All 11 thermoplastic materials tested met Norsok acceptance criteria, showing them to have good chemical stability. Changes in tensile strength remained well within the Norsok acceptance range for thermoplastics and all easily exceeded the 30 year expected well production lifetime.



MERL report relating to NORSOK M-710 standards for Busak+Shamban materials.



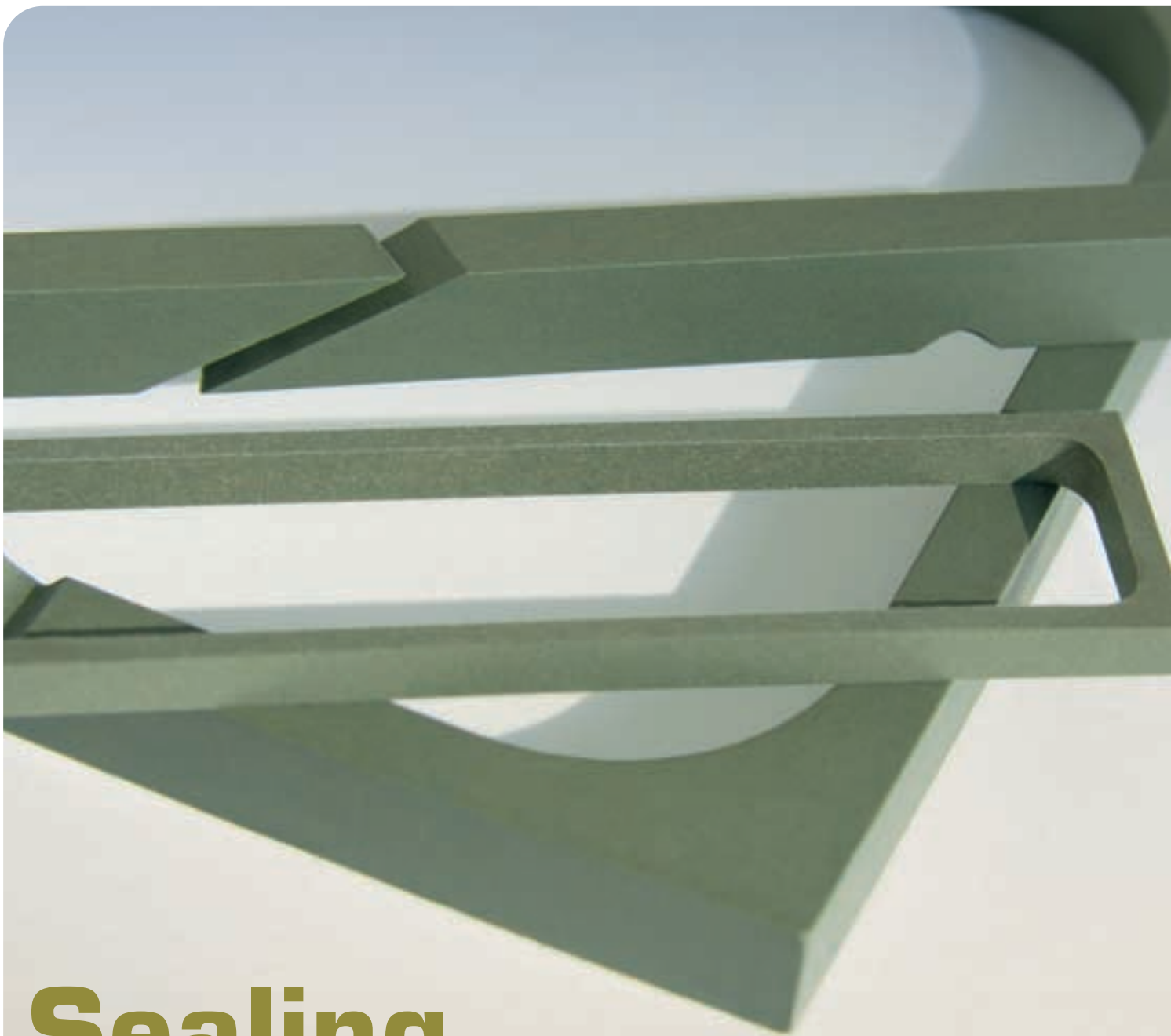
The NORSOK Standards

The Norwegian petroleum industry has developed the NORSOK standards to ensure safety, add value to and improve cost effectiveness of petroleum industry developments and operations.

Usually the NORSOK standards are based on recognized international standards with modifications to specifically meet the needs of the Norwegian petroleum industry. One of the objectives of these standards is to contribute Norwegian knowledge to improve international standards.

Different from previous approvals, is that all individual components within an assembly must meet and be approved to NORSOK standards, rather than just the complete assembly.

The preparation and publication of the NORSOK standards is supported by OLF (The Norwegian Oil Industry Association) and TBL (Federation of Norwegian Manufacturing Industries). NORSOK standards are managed and issued by Standards Norway.



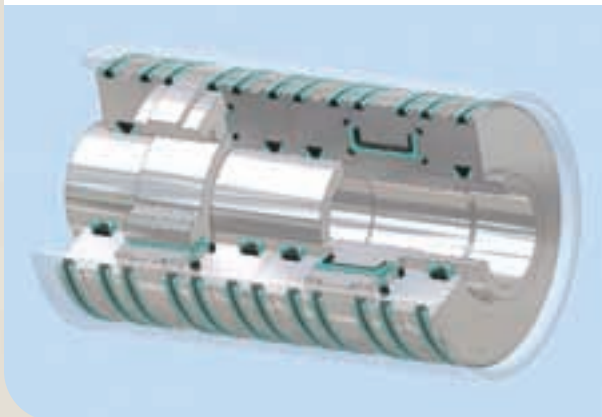
Sealing in the right 'vane'

The vane sealing challenge

The majority of rotary vane actuators are designed with one or two vanes, but versions are available with three or more vanes. In a two vane rotary actuator, the piston, which operates within linear hydraulic cylinders, is replaced by a rotor with two vanes attached. When fluid pressure is applied to two of the four working chambers, the actuator turns, necessitating perfect sealing to prevent leakage across the chambers. This type of seal is called a 'vane seal'.

Effective sealing is a challenge, as the shape to be sealed is rectangular and the four corners of the rectangular seals must be razor-sharp. If the surface is not perfectly sealed, sealing integrity may be compromised and liquid could leak from one working space to another.

3D model showing vane seals in typical rotary vane actuator application.



Innovative manufacturing for cost-effective production

It was thought the only effective method of producing the sharp edged rectangular seals required for rotary vane actuators was through a high-cost milling process. Associated manufacturing company of Busak+Shamban, Trelleborg Sealing Solutions Helsingør, Denmark proposed an alternative to reduce production costs and increase yield. This was to stamp sintered PTFE plates to the shape of the seal. Following unsuccessful attempts to achieve this by one of Europe's leading stamping companies, Trelleborg Sealing Solutions Helsingør decided to try themselves. They succeeded, and vane seals with razor sharp edges are now being produced using Busak+Shamban proprietary Turcon® PTFE based material. With this high performance compound, sealing integrity is ensured at both room temperature and extremes, ranging from -40°C (-40°F) to well above +100°C (212°F), and at pressure exceeding 150 bar (2175 psi). This innovation is now providing distinct cost and performance benefits to customers, extending the potential applications for rotary vane actuators in many different sectors of industry.

Stainless steel tube bending for marine and architectural fittings, a typical machine tool application using rotary vane actuators with vane seals.



Online sealing – so much more

Check out www.busakshamban.com

The best sealing solution resource on-line

Powerful electronic catalog

Innovative interactive quote facility

When we set out to redesign our website, we wanted to have the best sealing solutions resource on-line. We believe we have achieved this with the new look www.busakshamban.com. Available in 20 different country-specific versions in 18 different languages, it will make the job of engineers specifying seals easier, worldwide.

Our powerful electronic catalog allows you to search for seals by item number or by their properties, such as type of seal, installation dimensions or approvals. You can even compare one seal to another, to find the best product to suit your needs.

Once you know the product you require, then request a quotation on-line. A simple-to-use service lets you load up a shopping cart and send it through to your local marketing company for quotation. You are guaranteed a rapid response, making the whole process of specifying and ordering seals easier and quicker than ever!

What does the website offer:

Powerful electronic catalog – With innovative interactive quote facility

O-Ring calculator – Save time and energy

Versatile CAD service – Makes drawing production easier

In depth product detail – Industry leading catalogs on-line for download



than just a website!

Versatile CAD service makes drawing production easier

The CAD download facility has major benefits for engineers specifying seals, providing thousands of drawings from a wide seal range. Believed to be the most advanced and easy to use service of its kind, it provides the option of two or three dimensional files, in a range of formats to suit most commonly used CAD systems. File format and preferred method of delivery can be specified. Unique to this program is a 'Direct 2 CAD' facility. With this, seal profiles can be directly imported into the user's drawing, without the requirement to download or save the drawing to the desktop.

Save time and energy with our O-Ring calculator

Available on-line is a free-of-charge program for calculating O-Ring specifications and housing designs. The calculator has unique functions and is remarkably easy to use. It includes a sizing capability, recommendations on design parameters and complete measurements. Results and comments may be printed, saved on-line or as a PDF. Using a great deal of 'sealing expertise', the calculator even takes into account compression, seal expansion and groove fill.

In depth product detail

The Busak+Shamban catalogs have always been recognized as industry leading. On our product pages you can access information on sealing elements and link through to detailed catalog information. You can also view and download full versions of related literature, go to relevant news articles and CAD seal profiles.



Member area

By registering as a member you can access all the advanced services on the website. Register now and make sure you are getting the best from the Busak+Shamban website.



Busak+Shamban at a glance

- Part of Trelleborg Sealing Solutions, a business area of the Trelleborg Group
- Employees: 5700 (Trelleborg Sealing Solutions)
- Research and Development Centers in Europe and America
- Over 30 manufacturing plants worldwide
- 40 Marketing Companies worldwide
- Quality Certifications: ISO 9001, QS 9000, VDA 6.1
- In-house polytetrafluor-ethylene, polyurethane development and elastomer development
- More than 2000 material formulations
- Worldwide distribution network

Contact your local Busak+Shamban Marketing Company at:

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