

simrit® insight.

No 1 | 2008

The magazine for Simrit customers

Dynamic seals

Shock absorbers from FOX



Cushioned

Greater comfort
for motorboats



Brewed

Exclusive solutions
for the perfect aroma



Sealed

The squareness
of a circle: PRW1



Trialled

Simmerrings
put to the test





Dr. Jan Gupta,
Simrit Europe

Dear Readers,

As you were able to gather from the previous editions of Simrit insight, in many industrial markets today Simrit is a development partner much sought by you, our customers. Your wishes and requirements regarding products and materials are very different from industry to industry and are becoming increasingly more specific. In order to be available in the future to customers of other industries as a competent development partner without losing the focus in our core markets, we have established three new sales areas this year that are thus specially oriented to the specific customer wishes and requirements of energy technology, aerospace and medical technology.

In the last half-year, Simrit was confronted with heavy cost rises by our raw material and energy suppliers. We were able to absorb an essential part of these costs by increasing our productivity and relocating manufacture where it was correct to do so. However we couldn't avoid a price increase for you, our customer. Unfortunately, on the basis of discussions currently taking place, we don't see any easing up for the coming year in the cost prices for oil, carbon black or energy. This is one of the drawbacks of globalisation sought by everyone or of the growth of markets such as China and India and the associated scarcity of resources. Today, it is still too early to conclusively assess the development for 2009. Nonetheless, let us jointly try to find alternative solutions on time (e.g., new materials) for your applications, in order to counteract the raw materials price development. Use and actively call on the competences of Simrit as concerns materials development, CO₂ reduction and design knowledge by means of new, innovative approaches to solutions in order to reduce the divide between raw materials price increases and market prices. You can find some successful examples in this edition of Simrit insight.

With this current edition, I hope that we can present to you an interesting mix of projects, products and materials from a wide variety of industries in which Simrit is active as a sealing specialist. At the same time, it is especially important to us that the mirror is held up to us by you again and again and that we get feedback regarding improvements to our magazine. For that reason, in this edition we are starting a reader survey. We would be happy to receive feedback from you.

Thank you for the trust in Simrit that you have shown for years.
In addition, I wish you and your company a successful 2008.

Yours, Dr. Jan Gupta
Simrit Europe

Trade fair dates

Date	Trade fair	Location	Hall / Stand
14.07. – 20.07.	Farnborough International Airshow	Farnborough – UK	Hall 4 / CC2
15.07. – 17.07.	Semicon West 2008	San Francisco – USA	North Hall / 6289

Simrit Academy dates

Date	Topic	Language	Location
02.09. – 03.09.	Hydraulic and pneumatic components	German	Weinheim

Further dates can be found in our calendar of events at www.simrit.com

Imprint

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Innovation Forum – Locally live and globally virtual

Simrit have a wide range of topics in store for the 18th Innovation Forum to be held on 6 November 2008 both live in the Weinheim Stadthalle and virtually through a WWW conference. The individual presentations can be followed over the Internet in English, French, German, Italian and Spanish. Through this virtual innovation forum a 'latitude effect' can be achieved in that people can follow the presentations live anywhere in the world. Not only that, but also firms participating virtually can save money by avoiding expensive and time consuming business trips. The forum programme is packed with technical offerings ranging from functional coatings on elastomer and miniature components and current success stories from the Simmerring world to an autonomous sensor function for rotary sealing elements. The presentations on suitable materials for air conditioners operated using CO₂ and on a new sliding bearing seal for minimising oil consumption and CO₂ emissions from units and assemblies are expected to draw great interest. From 07.07.2008 onwards, you can register online at www.simrit.com/innovationsforum.

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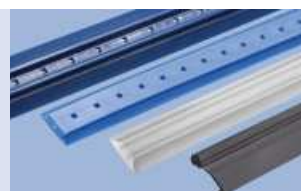
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an oil bath





Give us your opinion

Quality and customer relations are core principles of Simrit. Whoever wants to maintain quality must continually put it to the test. We want to know how we can tailor our customer magazine 'Simrit insight' even better to your wishes and needs. In this issue you will find a questionnaire which we kindly ask you to fill in and fax back to us. Simrit will select a winner of the prize, a mountainbike from Corratec – model Xvert with FOX suspension fork – from the first 200 questionnaires received. We want to ensure that Simrit insight continues to be not only long on words, but also long on topics.

Haldex announces 'Supplier of the Year'

Haldex Brakes, manufacturers of pneumatic disc brakes and brake components for heavy-duty utility vehicles, have awarded Simrit with the title of 'Supplier of the Year'. Haldex purchase custom-developed sealing components from Simrit. The products are manufactured at Simrit's Kufstein location, where expertise in this application area has been built up. The award from Haldex recognises the first-class product quality of zero ppm and on-time delivery rate of 99 per cent. In parallel to this, the price-to-performance ratio was improved for the customer. Overall Simrit fulfilled the four criteria of quality, deliverability, value and service

optimally and, as a technology leader, continue to be Haldex's preferred partner in developing new products.



Jonas Hansson of Simrit with the ranking list of seal suppliers for Haldex. Simrit are clearly number 1 in this ranking.



Mark Syer (left) and Stuart Campton are flying the Simrit colours in the UK and Ireland.

New changes for Simrit UK and Ireland

Mark Syer has joined Simrit UK as the new managing director. He has extensive experience in the sealing industry of more than 20 years and is an expert in rotary and reciprocal sealing, packings and gaskets for industries including iron and steel, power generation, semi con, pharmaceutical and oil and gas. Mark has previous sales management experience, together with business development, product development and marketing knowledge. Mark is married with two children.

Stuart Campton has taken over the responsibility of Sales Director in the UK, Ireland and Aerospace Europe. As Simrit expand upon their existing Aerospace business, Stuart will concentrate on the development of Simrit's Aerospace customers within Europe. Stuart has 18 years experience within the sealing industry covering general industry, automotive and most recently working within the aerospace sector. Stuart is also married with two children. Both experts are committed to strengthening the UK and Ireland team and providing the highest level of service to the industry.



TechDay at Honeywell

More than 20 specialists from the fields of development/design, purchasing and testing were interested listeners during the Simrit TechDay at the home automation specialist, Honeywell. Florian Türck from O-ring Materials Development and Mike Neubacher from Diaphragm Product Development demonstrated the potentials of their two product groups for the heating and sanitary areas. "For a long time now, it has not been enough to just put a seal in a valve. Instead, it's important that special regulations for the use of drinking water be observed and additional functions such as reduced friction be offered," say Purchaser Horst Högenauer and Uwe Pfeiffer, Development Director at Honeywell. In addition, intelligent solutions such as 2-component technology and nanotechnology should provide for optimised workflows and reduced costs for the customer. Talks on the two topics just mentioned were therefore a particular wish of Honeywell. Thus it was not surprising that the talk by Dr. Rolf Heldt on the topic of 2-component technology and the presentation by Dr. Birger Lange on the topic of nanotechnology, divided into the areas of friction reduction and disinfection, were found to be especially interesting.

Service Centre for „BeLux“

With the opening of a service centre in the Flemish city of Ghent, Simrit has now moved even closer to its customers in Belgium and Luxembourg. The branch directed by Joel vanden Bosch will mediate the contact of Belgian and Luxembourgian users to the various experts in Simrit's development centres all over Europe so that customer requirements can be implemented even more quickly than before.

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Sales reach record high

The Freudenberg Group, to which Simrit also belongs, achieved in fiscal year 2007 sales of 5,341.2 million euros (previous year: 5,052.8 million euros). This corresponds to a growth as compared to the previous year of 288.4 million euros, or 5.7 percent. The group's profit amounted to 275.2 million euros and was thus 25.6 percent above the previous year. The effects from acquisitions and disinvestments were on balance positive, with 32.1 million euros. In the past fiscal year, a negative influence of -122.0 million euros resulted due to conversion-related currency effects that are to be explained above all by the weak US dollar exchange rate compared to the euro. Disregarding exchange rate influences, acquisitions and disinvestments, the sales increase amounted to 378.3 million euros or 7.5 percent. Freudenberg Seals and Vibration Control Technology (Europe), the parent company of Simrit, Burgmann Industries, Freudenberg Chemical Specialties, Vibracoustic (Europe), Freudenberg Household Products and NOK-Freudenberg Group China made the greatest contribution to the sales increase. On 31 December, 2007, the group of companies employed 34,330 people, 804 more than at the same time the previous year.



FOX Racing Shox are the first address to go to for high performance shock absorbers.

Equipment for Winners

For more than 30 years, FOX Racing Shox has led the industry in the design and development of high-performance shock absorbers and racing suspension products. The company has grown from a garage-based business into a world leader of extreme performance shock absorbers serving a variety of markets, including snowmobiles, mountain bikes, motorcycles, off-road cars and trucks and ATVs.

Making tools ... not toys ... FOX designs, tests and manufactures high-performance, engineering-driven shock absorbers that have equipped vehicles and racers in every extreme sport. Its team of engineers performs rigorous tests with racers year round, collecting data about performance and product robustness. FOX's application of this

knowledge is what separates it from every other suspension company. Employing approximately 500 employees, who are never satisfied with "good enough," the company has a dedicated Continuous Improvement Team that constantly strategizes to gain manufacturing efficiency. In 2007 alone, FOX improved 91 manufacturing processes

and made 35 design changes to enhance quality and increase efficiency. FOX's suspension is an integral part of most extreme sports vehicles, as the ability of shock absorbers to take in energy allows for a smoother, more controlled ride. This increased control improves rider comfort and performance, which, in turn, allows riders to



The lip of the Samurai seal is an integral part of the suspension forks on the mountain bikes.



In brief

- Simrit helps FOX Racing Shox enter the front suspension shock absorber market without sacrificing quality for performance.
- Simrit developed a new sealing design to reduce contamination and better showcase FOX's extreme products.
- FOX could therefore enter the market successfully first time.
- The company philosophy's of FOX and Simrit complement one another perfectly with regard to customer and quality orientation.



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push their abilities to the limits. As a result, FOX-equipped vehicles and racers have stood atop podiums in every sport its vehicles compete in – from the sands of Baja to the dunes of Dakar.

Keepin' the Dirt Out

In 2000, FOX was planning to enter the front suspension mountain bike fork market. Committed to superior performance, the company wanted to enter the market with a quality, robust product that addressed design challenges and ensured rider comfort and control. One of the challenges in shock absorber design is contamination, which is

caused by dirt mixing with the oil inside the shock absorber. At the time, boots were placed over the shock absorber to reduce contamination. While this did offer some protection, time still had to be spent removing the dirt from the oil. To prevent contamination in the new FOX shock, Simrit created a customised internal sealing concept for FOX, called the "Samurai Seal." This unique seal was created using special materials and design techniques that meet the sealing requirements for all of FOX's applications. The dual-function exclusion and pressure seal works to keep out contamination, while containing the

needed fluid. A unique element of the seal is the Samurai lip, with its customized exclusion design created specially as a solution for FOX.

The new seal design allowed the company to better showcase its damping ability and technology, as it eliminated the need for the boot that previously covered the shock absorber. Additionally, the new lip reduced the time spent cleaning the shock absorber and enabled FOX's ultimate goal of entering the market with a quality, robust product that satisfied the extreme needs of the industry.

Today, the Samurai Seal is used in all of the company's shocks, helping FOX stay true to its promise of always manufacturing quality products. Working to ensure FOX keeps its promise is what Simrit does best... that is, designing products and materials to the specific requirements of its customers.



FOX supply shock absorbers for all kinds of racing machines.

Wellbeing with 2-component technology

Through their great expertise in two-component composite parts, Simrit can supply sanitary specialists Hansgrohe with precisely configured complex parts for their innovative taps for modern bathrooms. Faster manufacture and lower costs are the advantages to the customer.

For many people today wellbeing starts in the bathroom. With headquarters in the small city of Schiltach in Germany's Black Forest, the global sanitary technology firm Hansgrohe AG supplies innovative design solutions with its high-tech taps and showers for individualised bathroom atmospheres. This wellbeing starts with the shower head, with the so-called adjustment ring being an important comfort element. This ring is attached as a rotating element around the spray nozzle. Turning the ring produces various sprays: normal, soft or pulsating massage sprays. Many other spray variants are also possible.



Planning and monitoring play key roles in the cooperation between Hansgrohe and Simrit.

Hard, yet soft

The respective ring setting defines where the water should flow and where it shouldn't flow, hence where it should be 'sealed' in the truest sense of the word. Depending on the number of possible settings, five or even more seals must be positioned in the shower head. This is where Simrit come in with their materials expertise. The cooperation between Hansgrohe and Simrit began nearly 15 years ago. Initially the seals were manually positioned in the adjustment ring and it was primarily the liquid silicone expertise from Simrit that was called for. Today much more than that is involved: the expertise in materials and process technologies possessed by Simrit for so-called two-component composite parts provides a key contribution to the competitiveness of Hansgrohe in the world market for sanitary technology. The two-component technology holds great potential for economisation as it combines numerous individual steps in design, development and production. With this technology two components, usually one hard material such as a thermoplastic material and one soft material such as liquid silicone, are processed in an injection moulding process

to form a single work piece as an end product. In the case of the adjustment ring in the shower head the (grey) thermoplastic material is the support material and the (transparent green) liquid silicone is the soft part.

Joint learning process

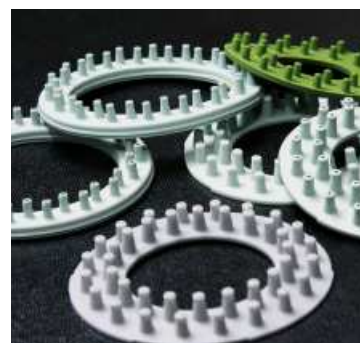
The joint learning by the engineers and technicians at Hansgrohe and the materials and process technology specialists at Simrit which lasted nearly 15 years is still far from being over, despite what has been achieved up to the present. At first single-cavity moulds were used, only to give way after a short time to multi-cavity moulds for pure silicone parts. Today we have reached the stage of using self-adhering liquid silicone for complex two-component composite parts. The spray insert was placed in the shower head manually many years ago, but in the next step of improvement of the production process this operation was automated. A short while later all silicone parts could be formed simultaneously in one and the same injection moulding process. For this the overall part had to be 2-component-capable; i.e. after injection of the liquid silicone all seals had to be filled in suc-

In brief

- Two-component technology places high demands on material and process technologies
- Joint learning by technology partners Hansgrohe and Simrit
- Low-cost manufacture through simplified assembly
- Simrit's materials expertise facilitates meeting of approval criteria in the sanitary area



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Simrit have been concentrating on the versatile material liquid silicone rubber (LSR) for over twenty years.

To produce two different water sprays a shower head needs an adjustment ring. Simrit supplies seals for the sanitary specialists Hansgrohe.

Two-component composite parts ease the production of shower heads. However, precise planning is essential.



cession. The redesign, however, could not negatively affect the function or the parts to be installed later. A filling simulation enabled an initial (positive) assessment to be made, confirming that the part could actually be manufactured in the planned manner.

Simulation and analysis on the computer

The advantages of using two-component composite parts are obvious. The

complicated seal assembly process is eliminated. Seals cannot be lost or incorrectly installed. The number of parts used is greatly reduced. All this translates into faster production and considerably lower costs.

The complex manufacturing process for products made from hard and soft composite parts in one piece necessitate the use of state-of-the-art computing technology; i.e. the behaviour of the planned part must first be simulated on the com-

puter. Through the use of FEM and mould flow analyses such as are standard at Simrit, the probability that after moulds are made functional parts can be produced with them is greater. Not least important are the special approval requirements applicable in the sanitary industry for the materials used. Certain approval criteria must be met both for thermoplastic and for elastomer materials. Simrit are ideal partners for solving these problems as well.

The means for 'good vibrations'

The challenge was clear: Volvo Penta wanted to design their dynamic D4 series speed boat engines to be as static as possible in terms of vibration. The solution was found in custom-designed conical mounts from Simrit. A mere nine months were needed from the initial meeting to mass production.

Modern recreational skippers want both performance and comfort. The boat should have a strong acceleration and a brisk cruising speed, but at the same time it should run smoothly. This represents a typical conflict of objectives. Among the world's leading manufacturers of ship engines, Volvo Penta are familiar with these requirements and take the high demands of their customers seriously. Because, for starters, higher-

power engines generate stronger vibrations, one must develop better and more novel mounts to dampen these vibrations sufficiently and keep the boat running smoothly even when driven to the extreme.

Extensive simulations

To find an optimum solution for these conflicting goals Volvo Penta got the vibration specialists from Simrit on

board. With software simulations the vibrations, smoothness of running and maximum deformation can be modelled precisely in a quasi-dry run. The results of the simulations formed the basis for discussions regarding further optimisation. The vision of a calm skipper hand and a simultaneously high acceleration of the Volvo Penta engines slowly became technical reality. After a few simulation runs the way in which

Waves yes, vibrations no: Volvo Penta can meet this challenge.



the vibrations of the Volvo Penta D4 engine could optimally and effectively be dampened and hence the recreational captain be given a super-comfortable driving feel became clear. Another very important criterion was defined to be the interchangeability of the engine mount, i.e. the ability of the mount to be installed in all ships with the same engine. After all, Volvo Penta manufactures engines for the world market, so the engine has to be able to be used in various ships.

Volvo Penta diesel engines are produced in Vara Sweden.



Customised conical mounts

The high requirements for the D4 engine project could no longer be achieved with a catalogue vibration product. In light of the installation situation, the component properties and the required lifetime as well as the test re-

sults, the team of experts from Volvo Penta and Simrit finally selected a conical mount as the optimum solution. Further adjustments were made to find the suitable Shore hardness after which followed intensive fine-tuning of the conical mount to the structural conditions. An optimally adapted mount with integrated console emerged in mid-February 2007. In the end a product combining a long life with optimum stiffness

and fitting perfectly into the available installation space had been developed jointly.

Rapid implementation

The entire project was not only technically very successful, but also implemented in a very short time. Between the start of the cooperation and the delivery of the first mass-produced parts lay a mere nine months.



A catalogue product served as the basis for the customised solution.



Volvo Penta D4: To ensure that the engine vibrations are not transmitted to the boat hull, the drive unit rests on a conical mount from Simrit.

In brief

- Mountings on speed boat engines must be as vibration-free as automobile engines are today.
- Together with specialists from Volvo Penta, Simrit carried out simulations to find the best-suited mount.
- Volvo Penta's requirements could not be met with a standard product from the catalogue.
- It took just nine months from the initial contact to the start of mass production.



Do you have any questions or suggestions? Your contact for this topic is vera.boehner@freudenberg-ds.com.



From customer relations to aroma



As suppliers to Thermoplan, one of the world's largest manufacturers of commercial automatic coffee machines, Simrit can demonstrate both their great materials expertise and their flexibility in providing customised solutions.

Automatic coffee machines for commercial use are complex machines with sophisticated mechanics and electronics. They are designed for global hotel empires such as Hilton, fast-food chains



Special valve with a magnet inside which acts as position sensor.

and special standardised coffee shops such as Starbucks. The coffee machine specialists Thermoplan grew with Starbucks. Each of the 13,500 Starbucks outlets currently in operation has at least one automatic coffee machine from the company headquartered in the central Swiss town of Weggis, and this cooperation with Starbucks has just been extended. A new generation of machines called 'Mastrena' was developed for the coffee shop chain. Of course, Thermoplan are not without competitors in this lucrative high-tech market. The Swiss do not have to go far to find them as nearly all other market participants also drive

company cars with 'CH' on the licence plates. Just like their competitors, the engineers and technicians from Weggis only build a few parts themselves. They are responsible for the overall conceptualisation of the automatic coffee machine, but there are specialised suppliers for the individual parts.

Food-grade materials

Simrit is the main parts supplier in the area of seals for Thermoplan. We are currently in the planning phase in terms of the cooperation for the 'Mastrena' machine project mentioned above. In the predecessor 'Tiger' project we have

been delivering critical seal parts that nearly all had to be composed of materials that were FDA- and NSF-approved, i.e. approved for the food industry, for several years. Most seal parts that Simrit developed for Thermoplan's Tiger project are customer-specific. The Thermoblock seal is a good example. The element must safely seal the entire pouring spout. Dead space is not permitted and the assembly must likewise be simple. Simrit use the material 70 EPDM 281 because the sealing component comes in contact with steam and cleaning agents for the machine as well as with milk. The use of conventional vulcanisation processes often fails to meet the food standards (primarily defined in the US through the FDA regulations). Thus the component, which seals the support element for the coffee pods and is made from silicone, must be vulcanised on the metal grid, but for reasons of FDA conformance only have a mechanical, not a chemical, bond.

Customised parts

Commercial automatic coffee machines such as the Tiger model naturally have integrated electric coffee mills. For this Simrit designed a decoupled gear for the mill drive. 'Our parts resist the hot and humid environment arising in the machine during brewing of the coffee particularly well and this contributed to

The sealing components in (commercial) coffee machines must all be approved for use with food. Simrit score points with Thermoplan through their great variety of materials.

us getting the go-ahead from Thermoplan,' says Steve Barrot, engineer at Simrit and technical consultant for the Thermoplan project. Design of the gear keeps the vibrations as low as possible and simultaneously ensures that the 'grain size' of the ground product remains constant. Except for some O-rings, all elements that Simrit supply for the automatic coffee machines from Thermoplan are custom-made. The range extends from simple seals for a non-return valve and a slide ring seal for installation without dead space all the way to a high-performance polyurethane machine leg and a complicated valve with an integrated magnet and fulfilling special requirements. The machine leg was designed in polyurethane because a leg made from the elastomer NBR, as is otherwise usual, often leaves ugly marks on the support surface when the machine is moved.

Doing without chemical bonding

When valves are sealed using magnets it must be ensured during manufacture



that the vulcanisation temperature is as low as possible because otherwise the magnetisation is eliminated. 'The magnet must be handled very carefully in assembly as well,' explains Steve Barrot. With this sealing component, as with the seal for the coffee pod holder, no chemical bonding is allowed. The material EPDM 281 is used for this sealing component.

The sealing components in (commercial) coffee machines must all be approved for use with food. Simrit score points with Thermoplan through their great variety of material.

+ In brief

- Thermoplan develop commercial coffee machines for large coffee shop and restaurant chains. One of their major customers is Starbucks.
- In the area of seals, Simrit are the most important parts suppliers.
- Most seals that Thermoplan purchase from Simrit are customised.
- Simrit can especially score points

with their wide range of materials as many seals come in contact with both steam and cleaning agents.



Do you have any questions or suggestions? The development manager is steve.barrot@simrit.ch

We've got the right material

Standardisation of installation spaces for hydraulic components in accordance with DIN-ISO and still a wide application range: One of the secrets behind this apparent 'squareness of the circle' is the great materials competence of Simrit.

If users of hydraulic components have to redesign the installation spaces for the sealing system accordingly when they change the application field and the environmental conditions, that takes up a great deal of time and even more money. Simrit show how this can be done more easily and economically. The solution is standardisation of the installation spaces in accordance with DIN-ISO and a pre-

cisely coordinated product programme for sealing components and guides for hydraulic cylinders. The choice of components is greatly facilitated and enables lower-cost cylinder constructions (see Simrit insight 1/2007). Using the example of the PRW1 double wiper with integrated pressure relief function for the installation space DIN-ISO 6195 type A, the variability of the standardised product range

from Simrit will be demonstrated in the following. The application diversity results from changing the material alone; the sealing component dimensions remain unchanged. In general such material alternatives are available for many series. For the PRW1 many non-standard wipers and hence expensive reconstruction efforts are unnecessary because the installation space can be retained.



The 'blue': classic

The PRW1 double wiper is used in diverse applications, the majority of which work with hydraulic oils between -30°C and $+110^{\circ}\text{C}$. Here the standard material 925 (the 'blue') is usually sufficient. This material has been on the market for decades already and has stood up to the test millions of times over. Outstanding durability and universal application possibilities characterise this mixture.



The 'red': hydrolysis-resistant material V 167

With the material V 167 (the 'red'), Simrit offer a hydrolysis-proof polyurethane. Through the simultaneous compatibility of the red polyurethane with water and hydraulic media, the material is particularly suited to tasks requiring resistance to both water and oil. This enables, for example, agricultural and forestry machinery driven with water-based media to be sealed with 'red PRW1' just as, for example, machines for mining or concrete pumping are.

The 'white': low-temperature material 21100

However, there are also applications where the 'blue' reaches its limits. Sometimes excavators, caterpillar-track snowploughs or mobile cranes have to withstand night temperatures below -40°C . Under these extreme conditions as well, immediate and full functioning of the seals is demanded. Leaks, however small, are unacceptable for both financial and ecological reasons. Here switching to the low-temperature material 21100 (the 'white') is recommended. This material retains its cold flexibility even at temperatures of -40°C and below.



In brief

- Standardisation of installation spaces for hydraulic components helps save time and money
- Simrit offer the PRW1 double wiper in various materials for diverse application areas.
- The special material properties of the PRW1 are easily identifiable through the different colours used.



Do you have any questions or suggestions? Your contact is philipp.frey@freudenberg-ds.com



Sealing profiles for rodless pneumatic cylinders made of PU precision profiles.

PU profiles for the highest requirements

Not only in pneumatic systems, but also in many other areas of automation and mechanical engineering, Simrit precision profiles made of polyurethane can be used. These are produced in a unique design process, combined with a special cutting technology.

The exceptional nature of the production process – in particular, the precision cutting process – allows sealing lips with chamfer angles of less than 30° and without radii on the tips of the lips. Such sealing lips are required, for example, on sealing profiles for rodless pneumatic cylinders, where they are used for sealing (compressed air 6 to 8 bar) of the longitudinal slit in the bore. This use also makes the highest demands regarding dimensional tolerances and surface quality. The precision also ensures that the pressure in the cylinder barrel does not drop over a longer period of time. Leakage along the slit – especially at the tips of the lips, where the sealing profile has to simultaneously act in combination with the aluminium profile and the piston seals – is reliably prevented. At the same time, the sealing profiles in the area of the slit take over the function of the counter-surface for the PU piston seals. Today, this system is used at all well-known European manufacturers of rodless cylinders. The elasticity of the polyurethane profiles in longitudinal direction would

make maintaining the required, very tight dimensional tolerances more difficult, both upon removal from the tool and also during the later precision cutting of the sealing lips. For that reason, with sealing profiles micro-cables, usually made of steel wire, are also always embedded in the PU with the aid of a bonding system. The bonding strength obtained reliably prevents unwanted axial creeping in the cylinder with later use or springing of the sealing profiles, over the entire service life, in fact. The design process used at Simrit allows

placement of the inserts with a positional accuracy of a few hundredths of a millimeter within the profile cross section. Precision profiles made of PU are also used in machine tools. Here, they have to protect, among other things, sensitive linear measurement systems, high-grade slideway guides and precise spindle drives against penetration of metal shavings or grinding dust. Due to the special hydrolysis-resistant Simrit materials the profiles offer long term resistance to cooling lubricants.



Simrit precision profiles serve as wiping seals, tension and guide elements.

In brief



- PU precision profiles meet the highest expectations regarding dimensional tolerances and surface quality.
- The materials offer long term resistance to cooling lubricants.
- The profiles are used in automation and materials handling technology as well as in the area of machine tools and in other areas of mechanical engineering.



Do you have questions or suggestions?
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Optimum friction partnership

An ideal interplay between elastomer seal, mating surface and lubricant reduces wear. Through this the costs of service and maintenance are also reduced and the lifetime extended. Simrit hence always design their sealing elements with these overall interdependencies in mind.

Dynamic seals must be able to maintain a lubricant film for as long as possible in operation and must exhibit low friction and no leaks. The interplay between friction, wear and lubrication is termed a tribological system and plays an important role in the functioning and lifetime of seals. In practice tribology deals with friction and wear and serves towards optimisation of moving mechanical systems such as gears, engines and other machine elements.

The range extends from an increase in performance and efficiency to a reduction in energy consumption through a reduction in friction and conservation of resources all the way to an increase in reliability and service life and low-

ering of service and maintenance costs. The tribological properties of elastomers (behaviour in terms of friction and wear) are influenced both by the material itself and by the condition of the mating surface, the stress condi-

tions such as temperature, speed and contact pressure and the lubricant.

The tribological system describes the interplay between friction, lubrication and wear.



In brief

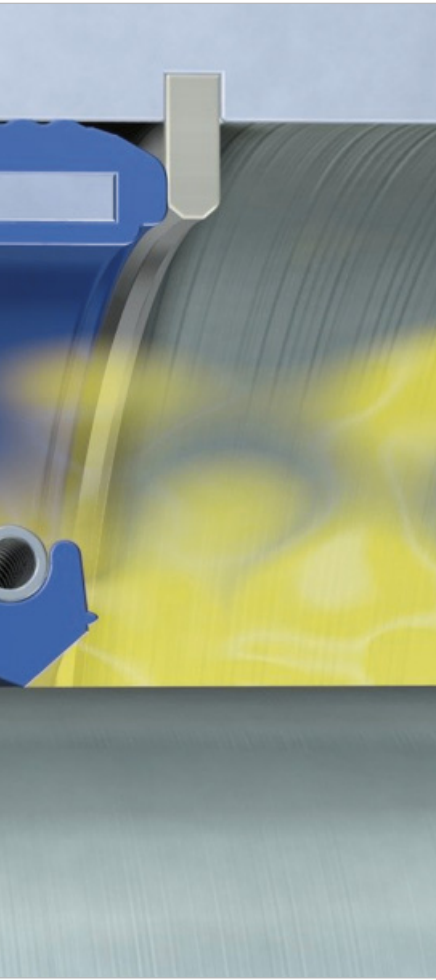
- An optimum three-part harmony of friction, lubrication and wear lowers costs of service and maintenance
- Influencing factors include the material, the temperature, contact pressure, speed and lubricant.
- Simrit can investigate the behaviour of elastomers in various conditions.
- In close cooperation with the customer, we can achieve optimum system solutions for the most diverse of requirements.



Do you have any questions or suggestions? Your contact for this topic is meike.rinnbauer@freudenberg-ds.com

Principles of friction

In order for an optimum lifetime to be achieved for the friction partners, all components of the tribological system must be coordinated. Further development of only one of these components usually does not lead to success. In general various phases of friction are distinguished (see the figures below). Due to its viscoelastic properties, the elastomer is capable of 'creeping into' the depressions in the mating surface. When the system is started not all contact areas overcome the static friction simultaneously and start moving against one another at the same time. The breakaway forces must be overcome; hence an excessively high coefficient of friction is usually observed.



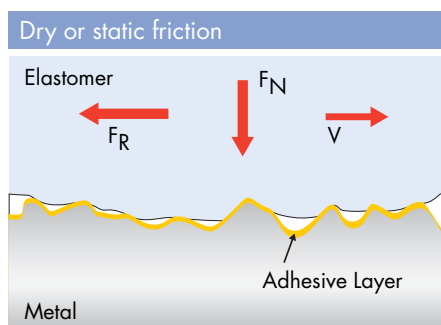
The phrase 'smooth running' is used if the complete contact surface has broken free. This run-in process is characterised by a lower coefficient of friction than the starting value. With dry friction, the sliding surfaces contact each other. Surface protrusions

are thereby flattened (erosion or wear). Depending on the composition, the elastomer contains more or less abrasive fillers which result in wear of the mating surface (e.g. contact surface of a moving seal). With unfavourable material pairs and a high surface pressure, the surfaces adhere to each other (adhesion) and mechanical interlocking results, thereby increasing wear. Dry friction occurs, for example, if no lubricant is used or if the lubricant fails. Mixed friction can occur in the case of insufficient lubrication or at the start of motion of lubricated friction pairs. In this case, the sliding surfaces contact each other only at specific points. The frictional force is lower for both mixed friction and fluid friction than for dry friction. Wear, however, is higher than for pure fluid friction. This condition is avoided wherever possible in continuous operation, although occasionally without success. If static and sliding friction alternate periodically, a so-called stick-slip effect is occurring. This transition is undesirable and is sometimes accompanied by noise, e.g. squeaking. Depending on the temperature and speed, elastomers have a greater or lesser tendency towards stick-slip. Fluid friction occurs when a continuous lubricant film forms between the sliding surfaces. Typical lubricants are oils and water, but also gases. The sliding surfaces are completely separated from one another. The friction which arises is caused by the fact that the lubricant molecules slide past each other. In order for the arising shear forces to lead

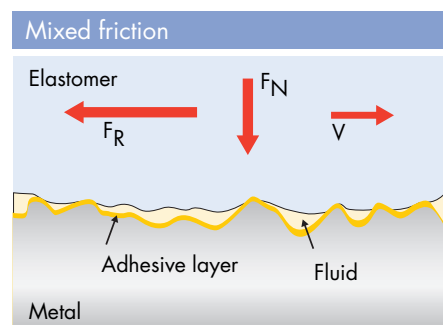
only to a moderate increase in the lubricant temperature, the generated heat must be suitably dissipated. Depending on the lubricant film thickness, the coefficients of friction can increase with increasing speed.

Interactions between the elastomer and the lubricant

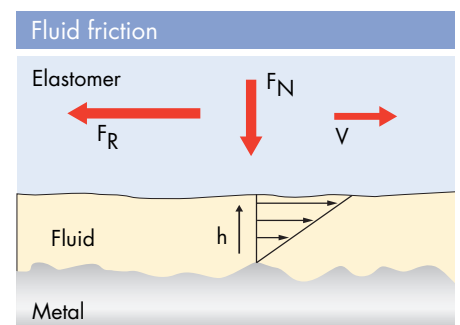
The basis for the chemical and thermal stability of elastomers is the selection of a suitable base polymer. Due to rising operating temperatures and greater lifetime requirements, synthetic lubricants with higher additive contents are increasingly being used. This can result in chemical reactions between the elastomer and the lubricant or operating media, leading to surface decomposition or changes in the properties of the material, among other things. The consequence of this for dynamic seals can be dry wear of the elastomer at the sealing edge, leading to insufficient lubrication. The resultant increase in friction causes the temperature at the sealing edge to increase. This can lead to damage of the elastomer network and hence to a reduction in lifetime. Simrit have a multitude of different friction and wear test benches available for simulating translational and rotational motions. Effects occurring in this connection, including the 'stick-slip' effect, run-in behaviour, adhesion effects and friction behaviour, can be modelled over a wide range of temperatures and speeds. This allows for precise materials characterisation as well as determination of the interactions between the seal and the lubricant.



Schematic illustration of friction: the friction force is the greatest in dry or static friction.



"Mixed" friction involves point contact of the sliding surfaces. This can occur, e.g., if lubrication is insufficient.



Fluid friction occurs when a continuous lubricant film forms between the sliding surfaces.

Simmerring® in an oil bath

Lubricants have to be adapted precisely to gear wheels and bearings as well as to Simmerrings and other sealing components. Otherwise failure is predestined. Practically all lubricant and oil manufacturers can test their lubricants on Simrit's test benches.

In the selection of a suitable material for a Simmerring, apart from the temperature range in which the sealing component should be used, the liquid or gas-forming media the material will come into contact with must always be considered. These media affect the swelling behaviour or shrinkage and the chemical stability of an elastomer and thereby the performance capabilities of a sealing component. Lubricant manufacturers face special challenges in the development of new lubricants. They must meet a large number of, in

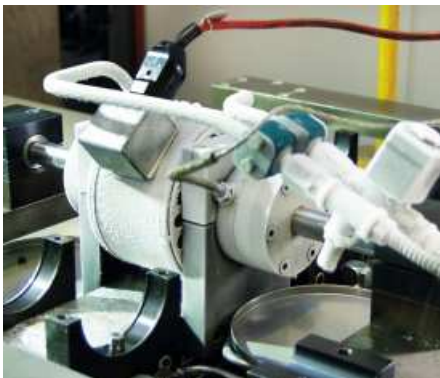
part, conflicting requirements with a lubricant formula. In view of the high costs of such a development the possibility of incompatibility between seal and lubricant only being discovered at the end must be avoided. Tests accompanying development are hence indispensable.

Defined limits for interactions

An initial indication of the compatibility of an elastomer with a lubricant is gained through a static immersion test in accordance with DIN 51517. By

means of changes in hardness, volume, tensile strength and elongation at fracture before and after immersion, the seal manufacturer can make use of its lengthy experience to draw conclusions about expected interactions or material suitability. Exceeding the following limits often signals detrimental interactions:

Change in hardness from +/- 5 Shore
 A change in volume from -2% to +5%
 Maximum change in tensile strength of -50%
 Maximum change in elongation at fracture of -60%.



Whether in a cold chamber (left) or other endurance tests, Simmerrings must withstand a lot even before they are ready for mass production.



In brief

- The compatibility of lubricants with sealing components such as Simmerrings must be tested.
- Static immersion tests in accordance with DIN 51517 provide preliminary indications of compatibility.
- The compatibility of modern gear and engine oils with Simmerrings and other sealing components can

only be determined using additional dynamic tests.

- Practically all lubricant manufacturers have their products tested for compatibility with the sealing components in Simrit's testing laboratories prior to market introduction.



Do you have any questions or suggestions? Your contact is matthias.arnold@freudenberg-ds.com.

In the selection of the material for a Simmerring the substances that it comes into contact with are decisive.

Static tests are insufficient

In the area of engines and gears ever-higher demands are being placed on the seal materials. Apart from containing a wide variety of base oils, the new synthetic oil generations have higher additive contents which serve to increase the long-term stability and function of the lubricant and to prevent corrosion, contamination and foaming. At the same time the 'additive packages' can chemically attack and destroy the seal material. Increasing temperature application ranges from -40°C to $+175^{\circ}\text{C}$, longer engine oil change intervals and the trend towards fully synthetic lubricants demand specially tested materials. Given this, it has been recognised that static material tests considered in isolation are only of limited use. Apart from static tests providing initial indications of possible interactions between the Simmerring and



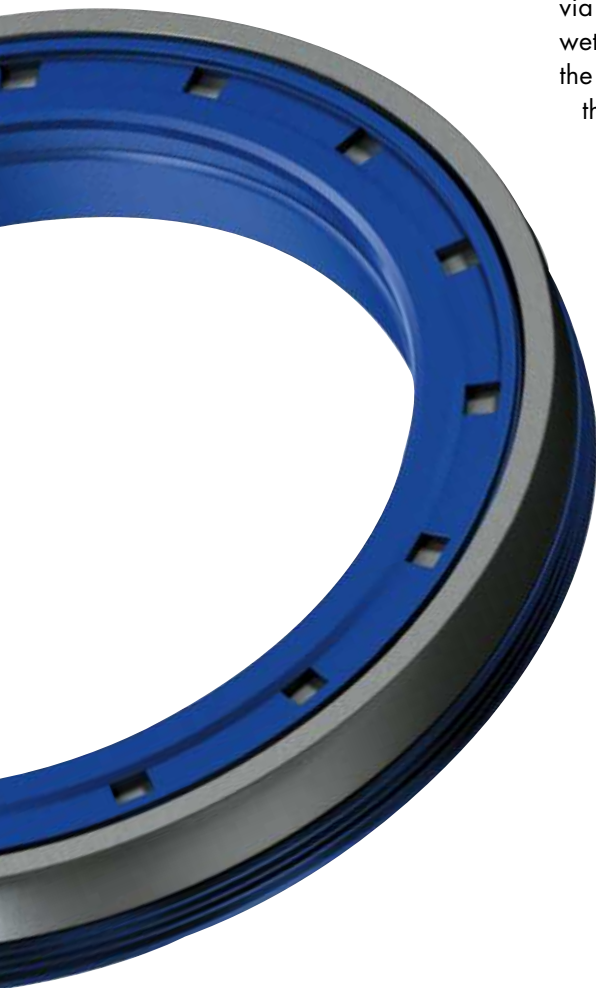
The Simmerring test fields at Simrit are equipped with many special installations, in addition to standard test benches.

the lubricant, dynamic seal investigations are hence carried out in Simrit's test laboratories. For instance, crack and blister formation on the sealing edge of a Simmerring due to lubricant incompatibility can never be simulated via a purely static test. Likewise, the wetting behaviour of the lubricant with the Simmerring can only be evaluated through a dynamic test.

Extensive testing possibilities at Simrit

In cooperation with gear and lubricant manufacturers, Simrit have established a service offer in which the functional relationships between seals

and lubricants are investigated in standardised test series. Through this Simrit's customers can be offered a coordinated 'seal plus lubricant' system. By performing tests in advance, lubricant manufacturers are able to place new, but already 'tried and tested', products on the market. Practically all lubricant and additive manufacturers make use of these testing possibilities and have the compatibility of their products with the Simmerrings tested in the test field prior to market introduction. This close cooperation with customers on the one hand and manufacturers of complementary products on the other hand is one of the quality factors of Simmerrings.



Simmerring by the book

The Simmerring was developed more than 75 years ago by Walther Simmer at Freudenberg on Bergstrasse in Weinheim, Germany. Since then the sealing component has undergone continual improvement or adaptation and optimisation for new applications. Simrit's experience with Simmerrings is unique in the world market. Now there is a first-hand compendium on the topic of the Simmerring. The book is available in English, French and German at info@simrit.com.



A greener performance

“Stihl products are often used in the natural environment. Our new, environmentally compatible components allow ecological use with optimum performance. Simrit has contributed significantly to this success with innovative seal design and unique test options. Thereby reliably ensuring our technology as well as our environmental commitment.”

*Harry Grandberg,
General Director,
Stihl, Brazil*

*Edgard Stuber,
Sales and Marketing Director,
Stihl, Brazil*



Your Technology Specialist

simrit[®]



Reader survey

Please fill out and fax
by August 1, 2008, to:

Fax +49-(0)6201 – 88 58 14

Dear reader,

Please tell us your thoughts. What do you think of simrit insight? Do you get the necessary information? Use this survey and give us your feedback. This will enable us to further optimise simrit insight and orient it to your needs and interests. For all submissions, we are raffling off an mountainbike from Corratec – model Xvert with FOX suspension fork.

1. How do you evaluate the magazine simrit insight?

	very positively		–			very negatively	
a) Overall impression	①	②	③	④	⑤		
b) Selection of topics	①	②	③	④	⑤		
c) Practical relevance	①	②	③	④	⑤		
d) Current relevance	①	②	③	④	⑤		
e) Intelligibility	①	②	③	④	⑤		
f) Length of articles	①	②	③	④	⑤		
g) Ratio image/text	①	②	③	④	⑤		
h) Graphic design/ selection of images	①	②	③	④	⑤		

2. Simrit insight is currently 20 pages long.

What do you think of this length?

Too little	①
Just right	②
Too much	③
Don't know	④

3.a How often do you receive simrit insight per year?

1–2 times	①
2–3 times	②
Don't know	③

3.b In your opinion, how often should the magazine appear in the future?

As before	①
Less frequently than before	②
More frequently than before	③
Don't know	④

4.a In the following, you will find the main topical focuses of simrit insight. Please indicate how interesting or how important these topics are for you personally.

	very interesting – completely uninteresting					very important – completely unimportant				
News	①	②	③	④	⑤	①	②	③	④	⑤
Innovations	①	②	③	④	⑤	①	②	③	④	⑤
Materials	①	②	③	④	⑤	①	②	③	④	⑤
Applications	①	②	③	④	⑤	①	②	③	④	⑤
Service	①	②	③	④	⑤	①	②	③	④	⑤
Trade fair/Academy deadlines	①	②	③	④	⑤	①	②	③	④	⑤

4.b In your opinion, which topics should be additionally or more intensively considered in simrit insight in the future?

5. How thoroughly do you read simrit insight?

Completely	①
Partially	②
Only glance through	③
Read only headings	④
Don't read at all, but keep	⑤
Put it away immediately	⑥

6.a Which sources of information do you use to inform yourself about Simrit (Internet, brochures, catalogues, etc.)?

6.b Which dialogue channels do you use for contact with Simrit (e.g., telephone, e-mail / Internet, etc.)?

7. What other remarks or suggestion do you have regarding the magazine simrit insight?



Thank you for your feedback. For the raffle, please indicate your name and e-mail address. All personal information will be handled confidentially. Raffle participation section and survey will be separated before evaluation of the survey, so that no connection between your answers and your personal information can be established. Of course, you can also answer anonymously. (Cash payment of winnings is not possible. The winner will be notified via e-mail. Legal action is excluded.) Simrit employees are excluded from winnings.

First name, last name

Company

E-mail address (for notification of winnings)