

simrit® insight.

No 2 | 2010

The magazine for Simrit customers

Driver Comfort

Driver comfort as standard



Applications

Helping Bell Helicopter fly higher



Applications

A step change in performance



Products

Robust long-term CASCO Simmerring



Service

Quality through damage analysis

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Freudenberg Group



Dr. Jan Gupta,
Simrit

Dear Readers,

In this new issue of Simrit Insight, we will be discussing current topics for you, while at the same time having a look to the near future: Simrit will be present at the International Trade Fair for Motion, Drive and Automation India from 15 – 20 December 2010.

There is a good reason for our presence there. The Indian subcontinent is an attractive emerging market in which Simrit has been active for many years. In 2008 alone, India's GDP rose by 8.2 %, and even in the economically difficult year of 2009, it increased by 6.8 %. Accordingly, India is the most strongly expanding economy in the world after China, among others with a high demand for agricultural and construction machinery and thus for high-performance sealing and vibration control technology by Simrit. We will show you the contribution we can make to this area at MDA India.

Visit us at the Bombay Exhibition Centre, Mumbai, in Hall 1 at Stand 506 (in direct proximity to the German pavilion), where our experts will offer comprehensive information. One subject will be our comprehensive materials competence, which is also discussed in this present issue of Simrit Insight (page 18–19). This issue will introduce to you thermoplastic polyurethane (TPU), a material characterised by extreme flexibility/alternation stability, highest resistance to friction and thus a long service life. More materials innovations will be presented at HMI 2011, among them we showcase our high performance temperature materials, which offer a much increased life time. You can look forward to it. Another subject of this issue is the development partnership between us and Volvo Construction Equipment. As a globally acting technology leader for earth-moving machines, Volvo CE relies on pioneering sealing and vibration control technology manufactured by Simrit. In a joint project, our experts developed and tested a hydraulically damped cabin mount for wheel loaders for Volvo CE, aligned precisely to the customer's specific requirements (pages 6-7).

Last but not least, I wish you fun reading the new issue of Simrit Insight – and in particular enjoyable and relaxing holidays and a successful year in 2011.

Yours,
Dr. Jan Gupta

Trade fairs and events

Date	Trade fair	Place	Hall / Stand
15.12. – 18.12.2010	Motion, Drive and Automation India 2010	Mumbai	Hall 1, Stand 506
04.04. – 08.04.2011	Hannover Messe Industrie 2011	Hannover	Hall 19, Stand B26

Seminars

Date	Topic	Language	Place
17.01.2011	General sealing and vibration technology product knowledge	German	Weinheim
09.02.2011	Fluid power sealing systems in mobile hydraulics	German	Schwalmstadt
15.02.2011	Simmering product seminar	German	Weinheim
22.02.2011	Fluid power hydraulics and rotation seals in heavy machinery construction	German	Hamburg
02.03.2011	Sealing materials	German	Weinheim

For further dates, please refer to the calendar of events on www.simrit.com

Imprint

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7. Forum SAE Diesel

“Diesel – driving power for the planet” was the slogan for the 7th Forum SAE Diesel, which took place in the huge Brazilian city of Curitiba from 31 August to 1 September. For two days, directors and managers of diesel engine manufacturers in Latin America discussed economic and energy scenarios for the region aligned with the principles of sustainability. Another subject was technical trends in the different industries where diesel engines are used. Simrit provides a wide range of sealing and vibration control components for many diesel engine manufacturers around the world. Among others, we contributed with presentations on technology trends in diesel units and suggested solutions in the area of agricultural and construction machinery. Reduction of the exhaust and noise emission values, as well as continuous optimisation of fuel consumption and use of the new fuel mixtures (Agrosprit) are just a few of the technical challenges posed by diesel units. To solve these challenges perfectly, engine manufacturers and suppliers for sealing and vibration control components must cooperate closely from the outset. Events like the forum in Curitiba are therefore essential for the corresponding exchange of experience and ideas.

TechDay at Hansen Transmissions

The TechDay Simrit performed at Hansen Transmissions in Belgian Lommel was characterised by intensive exchange of opinions regarding sealing technology for wind turbines. Hansen Transmissions is one of the top players in the area of wind power gear units, supplying the largest global manufacturers of gear driven wind turbines. In addition to their European sites, the Belgians also maintain production sites in India and China, and are planning on increasing their wind power gear production capacities from 8,700 MW in financial year 2010 to 14,300 MW in financial year 2013.

For these ambitious plans, they need a technology specialist that is also globally aligned in its overall philosophy – like Simrit. Therefore, the TechDay’s interested visitors comprised not only specialists from the development departments, but also representatives of strategic procurement. Simrit presented itself as a comprehensive partner for development – from the joint search for the best material to CAE and computer simulation to the interplay of lubrication and seal (Lube&Seal range).

In addition to discussion on the seals already used by Hansen Transmissions, such as various Simmerrings and round cord rings as well as V-rings, the focus was mainly on new product developments. The Radimatic RCD PTFE labyrinth seal, the Environmatic Lipseal V-ring and the Condition Monitoring Simmering were presented. The latter also offers great cost benefits for maintenance with its integrated function monitoring.

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Wind Energy: A long term effect



Energy generated by wind power continues to increase in importance. The first global high sea wind farm was officially taken into operation in the North Sea under the name of "Alpha Ventus" in April 2010. "Alpha Ventus" consists of twelve huge wind turbines and is intended to supply power to 50,000 households. Simrit has been producing products for wind-specific applications for many years and is now well-positioned for the future with its developmental know-how. This was also obvious on the wind power trade fair Husum WindEnergy 2010.



With approximately 1000 exhibitors and about 45,000 visitors from 53 countries, the organisers of Husum WindEnergy 2010 were able to increase the number of visitors in the high two-digit range as compared to the last event in 2008. This is a clear signal: There is great support for the future development of this industry sector.

Simrit was very happy about the progress of the trade fair as well. The specialists from the sales area of Renewable Energy conducted many

specialist discussions with companies from more than 25 countries. Under the motto of "Lube&Seal for wind power", Simrit was a good (stand) neighbour of lubricant specialist Klüber Lubrication, also a member of the Freudenberg Group. A wide range of components for small and large wind power plants was presented. The Radiamatic series sealing rings, the bladder and piston accumulator and the Ventoguard 453 elastomer, which was specifically developed for pitch and yaw bearings, were particularly inter-



In brief

- Husum WindEnergy 2010 achieved an increase in the high two-digit range for exhibitors and visitors alike
- Among others, Simrit presented a new premium material for wind power plants
- Together with lubricant specialist Klüber Lubrication, Simrit presented the subject of "Lube&Seal for wind power"
- The wind power value chain also was the subject of the Simrit TechDay in Beijing



Any questions or suggestions? Please contact michael.littig@simrit.de

Full House at the Wind Power TechDay in Beijing

China is one of the global pioneers in the use of wind power. In spite of the increasing performance of Chinese wind power plant manufacturers and their components, the Chinese market with its immense size offers ample potential for manufacturers from around the world. On the Simrit TechDay in Beijing, which was held in the scope of the China Windpower 2010 trade fair, we therefore met all the important wind power players. About 60 participants from relevant companies from all over the world discussed the requirements that are now placed to sealing and vibration control components for wind power plants. Among them were representatives of international wind power plant manufacturers such as Vestas, GE Wind and Nordex, as well as representatives of Chinese companies such as Sinovel, Goldwind and Mingyang.

esting for the visitors. The Ventoguard 453 premium material is characterised, among others, by extraordinary resistance to environmental influences typical for wind power plants: Greases and other media, sea water, ozone and high mechanical strain. Ventoguard 453 is particularly characterised by its optimised compression set. This increases the long-term sealing effect and protection from grease leakage at the sealed point. Ventoguard 453's flexibility when cold is also better by at least 10 °C than that of the Simrit standard material NBR 215544. Ventoguard 453 was developed for use in extruded profiles. An expansion of the Ventoguard materials range is already being planned.



Driver comfort as standard

Low noise levels and reduced vibrations are incredibly important, particularly when working in inhospitable terrain such as quarries or major construction sites.

This is why ensuring the comfort of those who drive mobile construction machinery such as wheel loaders, bucket excavators, and dump trucks is not a luxury, but an essential part

of health protection and accident prevention. Impaired hearing is still the number one occupational disease.

Strong natural vibrations in mobile construction machinery are no less damaging to the health of those driving them. Such strong low-frequency vibrations typically occur when the bucket of a wheel loader or excava-

tor is shaken out during operation.

The big challenge facing construction machinery manufacturers and vibration control technology experts is that together, these two challenges constitute conflicting targets. Over the next two pages, we will explain how this target conflict was resolved to the benefit of drivers using one single component.

Driver comfort

How can the noise level and vibrations in mobile construction machinery be reduced simultaneously? It was a tricky target conflict, but one which Volvo Construction Equipment (Volvo CE) and Simrit resolved for Volvo's heavy wheel loader series (L180–L220). Thanks to their elegant technical solution, the series is now pioneering a unique level of drive comfort.

In its capacity as one of the world's leading technology companies for earth-moving machinery, Volvo CE has set itself the goal of always being one step ahead of market requirements. This is why the comfort of those who drive wheel loaders, bucket excavators, or dump trucks plays a key role in development. The objective is to keep noise levels at the ear of the driver as low as possible while at the same time preventing natural low-frequency vibrations in the cab mounting system. Ultimately, these are conflicting targets that can only be reached by developing new design ideas and using considerable technical expertise. Volvo CE found the ideal sealing and vibration control technology partner in Simrit, an equal partner that left nothing to be desired in terms of technical expertise and ability to innovate. In its quest to increase driver comfort for Volvo CE's wheel loader series, Simrit started with the VL Hydro Mount, a hydraulically damped stand-

ard product developed by Simrit. It then tested this mount in a joint development project and adapted it specially to meet Volvo CE's specific requirements. In a first step, Volvo CE's heavy wheel loader series (L180–L220) has been equipped with VL Hydro Mounts since March 2009.

Flexible design facilitated the optimization process

When working to improve drive comfort in machinery and equipment – not only that used in earth-moving operations, but also agricultural machinery and many high-performance machines used in difficult terrain – it is not just a question of using high-performance components, but of taking a holistic view of the entire system. According to Volvo CE, "right from the word go, the Simrit specialists considered the wheel loader as a system. Their suggestions for adapting and optimizing the cab mounting system were always

based on the system as a whole. "The flexible design of the VL Hydro Mount was a huge help in making the necessary adjustments. For example, the bucket shakeout, the viscosity of the fluid, and, consequently, the overall damping behaviour was optimized by Simrit. Just as important as the flexibility of the design was the close co-operation between the development teams at Volvo CE and Simrit. "We didn't need lengthy discussions to understand each other on a technical level," says Marc Josenhans, head of Product Marketing Vibration Control Technology; in this case, it was enough to draw a graph of the damping behaviour on the board in order to define the goal.

The Simrit specialists were responsible for the vibration control design of the hydro mount. This close co-operation was characteristic of Volvo CE and Simrit's Driver's Comfort development project from the very start. The Simrit specialists were also very heavily involved in the various tests conducted by Volvo CE. This is important, not least because Volvo CE attaches great importance not only to objective measurements, but also to the subjective assessment of the outcome by experienced test drivers. Because comfort has to be felt and experienced, the feedback provided by testers, who pinpoint the noises that have to be eliminated or damped at certain frequencies, is invaluable for the development teams at Volvo CE and Simrit.

Top service during the development process

The test drivers test the drivability of the machinery as well as its vibration behaviour in extreme situations. For

In brief



- Drive comfort in machines used in rough terrain is not a luxury, it improves health protection and accident prevention
- Simrit's VL Hydro Mount has raised the level of drive comfort in Volvo's high-performance wheel loader series
- The solution offers not only a significant improvement in comfort for the driver, it also increases productivity. This increases tonnage per hour and reduces downtimes
- Simrit was involved in this ambitious development project as the vibration control technology specialist right from the start



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Less noise and vibrations in the machines reduced the strain on the people working there.

example, the behaviour of the driver's cab is measured and assessed at high and low speeds, when driving in circles, and, above all, when driving with an extended, fully loaded bucket. In the latter case, both noises and strong, low-frequency vibrations occur and must be controlled.

"When the bucket is shaken out during operations, the cab must come to a standstill after three vibration cycles," explains Björn Tornberg, Sales Engineer, Simrit Schweden, when asked to sum up Volvo CE's ambitious objectives for this project. At the same time, both the low and the high frequencies must be brought under control. In other words, one single vibration control technology component has to fulfil a variety of tasks!

Thanks to the innovative design of its hydraulic sub-components, the VL Hydro Mount ensures much lower damping in the acoustic range in particular and, consequently, much better insulation against structure-borne noise

than comparable Hydro Mounts from other manufacturers. However, this is only from a development and production technology aspect. Another vital aspect was the help provided in integrating the component into the relevant aggregate.

"Other companies generally offer little or no help in this respect," says Tornberg, "for manufacturers like Volvo CE, it is the provision of just this kind of service during and after the development process that makes all the difference." Tornberg goes on to say that Volvo CE does not just want suppliers, it wants long-term development partners who really understand the system and with whom one can "fine-tune a variety

of aspects together." The results of the co-operation are impressive. In the Driver's Comfort project, for example, the sound pressure level in the cab emanating from the vehicle structure was reduced by over 4 db, while the damping of low-frequency vibrations that occur during operation was simultaneously increased.

The drivability of the wheel loader is not impaired by these improvements in any way; it is, in fact, significantly improved by them. In short, the new system solution not only increases comfort for the driver, but also increases productivity. In all, this means virtually no downtimes and a considerable increase in tonnage per hour.



Helping Bell Helicopter fly higher

When faced with challenging seal applications, Bell Helicopter contacts Simrit to create customised design solutions – helping raise the Aerospace Industry to new heights.



Since 1935, Bell Helicopter, originally Bell Aircraft Corp., has set the pace for the aircraft and aerospace industries by continually expanding the possibilities of vertical lift. Now known as the world's premier provider of vertical lift aircrafts, Bell Helicopter has transformed the aerospace and aircraft market in exciting and innovative ways.

Bell Helicopter: Driving aircraft innovation

Over the past 75 years, Bell Helicopter has delivered approximately 35,000 aircrafts to customers flying in more than 120 countries. A wide range of customers – from corporate users needing to fly at a moment's notice, to law enforcement and military professionals who rely on Bell aircraft for critical response needs, to the emergency medical community who cares for the critically injured and ill, to the energy/utility market and its unique requirements – call on Bell Helicopter for safe, reliable air transportation.

To answer their call, Bell Helicopter has established an unwavering dedication to innovation and forward thinking in advanced concepts that has allowed the company to be considered an industry leader and champion of firsts. For example, the company was the first to obtain certification for a commercial helicopter and is credited with the invention of the tilt rotor aircraft. These aircrafts lift like a helicopter, but fly like an airplane ... with twice the speed, three times the payload and five times the range of traditional helicopters.



Bell Helicopter is continually seeking new products and technologies that can improve the performance of its aircraft. It is the company's commitment to excellence that led them to Simrit some 15 years ago. Today, the collaboration continues, with Bell Helicopter calling on Simrit for its extreme sealing needs.

Helping Bell Helicopter go higher

More than any other industry, the aerospace market requires components and technologies that withstand a variety of intense challenges. From complex design specifications to harsh fluids to extreme environmental elements, sealing aircrafts is a precise business.

As a leader in aerospace sealing, Simrit offers the manufacturing capabilities, materials, product quality and design and testing expertise that is required to take on the most challenging of aerospace applications. So, when Bell Helicopter came to Simrit for help with a gearbox application, Simrit tapped its unparalleled expertise and capabilities to evaluate and solve the issue.

A customised combination design

Bell Helicopter was faced with a challenging gear box application where the shaft served as the mating surface

for a bearing and also functioned as the sealing surface.

Simrit proposed a combination seal design consisting of a stainless metal case housed in a ribbed rubber outer diameter with an elastomer backed PTFE insert, and a non-woven dust excluder. The assembly combined two sealing lips: an elastomer primary sealing lip with helixes and a secondary PTFE sealing lip with a spiral groove to ensure proper leakage protection. Staying true to its "solutions provider" reputation, Simrit's combination seal design resulted in improved energy efficiency within the gearbox, decreased downtime (by as much as 30 percent) and significantly reduced

maintenance costs. Simrit's design noticeably outlasted the previous seal during testing.

Simrit: A solutions provider

The combination seal design, which has evolved to meet new environmental and application factors (such as harsher temperatures and fluids), has also been used in numerous other applications across several Bell Helicopter models.

Simrit has earned the image of an extreme sealing technology specialist and Bell Helicopter frequently calls on Simrit when confronted with other tough sealing application parameters.

In brief



- When Bell Helicopter was faced with a leaking seal, it asked Simrit to design a customised solution
- Simrit's design has been incorporated into numer-

ous other Bell Helicopter applications and models



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Gold, silver and copper

Huge excavation residues are generated when mining ores and minerals. Gold, copper, bauxite or, e.g., iron ore are mixed with water and transported over large distances around the clock before they are pumped into processing plants. Weir Minerals with its high-performance pumps is globally represented in this area. Simrit sealing components – particularly diaphragms – are key elements for them.



In brief

- The reciprocating diaphragm pumps of Weir Minerals must be functional around the clock under extreme environmental conditions
- The pump's central component is a customer-specific Simrit diaphragm
- Simrit also supplies the seals for the pump's hydraulic parts



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The huge reciprocating diaphragm pumps of Weir Minerals Netherlands b.v. are used in wet, dirty and hot ambient conditions. Gold, silver, copper and aluminium are, after all, not lying in the ground ready for collection, but have to be extracted in complex processes from millions of cubic meters of excavated soil. This usually requires pumping several thousand cubic meters of viscous sludge from the respective mine into the corresponding processing plant – sometimes over distances of up to 500 km. There, the valuable mineral parts of the sludge, which may be over 200 °C hot, are separated and processed. The first reciprocating diaphragm pump developed specifically for the transport of industrial sludge was brought onto the market by Weir Minerals in 1974 under the name of GEHO.

GEHO has remained the brand name for these pumps to this day.

Diaphragm as a key component

The core of each reciprocating diaphragm pump is a diaphragm controlled by a crankshaft. The diaphragm separates the industrial sludge to be pumped off from the pump's moving parts, including the cylinder piston and cylinder rod. The diaphragm thus ensures that, for example, piston and rod do not come into contact with the industrial sludge, which might damage them. In addition to this separating function, the switching and control functions, as well as the pumping function of diaphragms are, of course, also used for the pumps. In their lab, Weir Minerals determine the viscosity and degree of friction, and thus



GEHO reciprocating diaphragm pumps transport iron ore concentrate over distances of more than 170 km in China.



Every pump is tested under realistic application conditions on the state-of-the-art test bench with the latest equipment.

the pumping capability of the industrial sludge to be pumped. The matching diaphragm is selected based on these criteria. The diaphragm therefore is a key component in the overall process and essentially determines the overall plant's productivity. This component must not fail in spite of operation around the clock, requires a long service life in spite of abrasive ambience media and high strain, and should require as little maintenance as possible.

Parameters such as long service life and low maintenance requirements brought Weir Minerals to Simrit decades ago. In joint developmental projects, we optimised the characteristics of the diaphragms used. Over the past five years, our business relationship was intensified

once more: both companies are not only technology leaders in their respective areas, they also have the same consistent service orientation.

They may produce for the global market, but both companies offer local service, always in the respective customer's language.

Diameters from 400 to 1,100 mm.

Simrit supplies customer-specific diaphragms at different diameters, precisely aligned to the respective application, for Weir Minerals' reciprocating diaphragm pumps. The range spans 400 to more than 1100 millimetres. No other diaphragm manufacturer is able to offer such a diverse range of diaphragms while also warranting the characteristics

required by Weir Minerals, such as extremely long service life.

In addition to the diaphragms, Weir Minerals procures virtually all components required for sealing the reciprocating diaphragm pump's hydraulics from Simrit. Half of these hydraulic seals are also customer-specific. The rest are standard-range products. The ore and mineral mining regions are increasingly located in areas with extreme soil and weather conditions. The temperature range goes from -40°C in Alaska and Siberia to $+40^{\circ}\text{C}$ in the tropical region, altitudes span depths of 3000 m in South Africa as well as heights of 4000 m in the Andes. With Simrit's unique materials competence, Weir Minerals is always on the safe side, no matter the challenges posed to the material.

A step change in performance

Controlled Power Technologies (CPT), have made a breakthrough in the development of a second generation stop-start system, which outperforms existing designs of modified starter motors and alternators in almost every respect.

Development partners, such as Simrit, have played an important role in helping CPT to achieve their design objectives. CPT SpeedStart® components are state of the art and have been developed specifically for this application with the assistance of market leaders in such fields as electronics and noise and vibration reduction. The design and industrialisation of the product has been very carefully refined since the SpeedStart® concept was first demonstrated, in “proof of concept” form, some seven years ago.

Reducing CO₂

The now “production ready” SpeedStart system is an advanced Integrated Starter Generator solution that offers more power, improved efficiency and greater dependability than first generation stop start systems. One of its enabling strengths is that it’s the first production design to offer full integration of both the power and control electronics, into a single electric motor assembly. Its enhanced functional availability maximises the

number of stop-start events the system allows to deliver significantly reduced fuel consumption and CO₂ emissions.

Hostile Environment

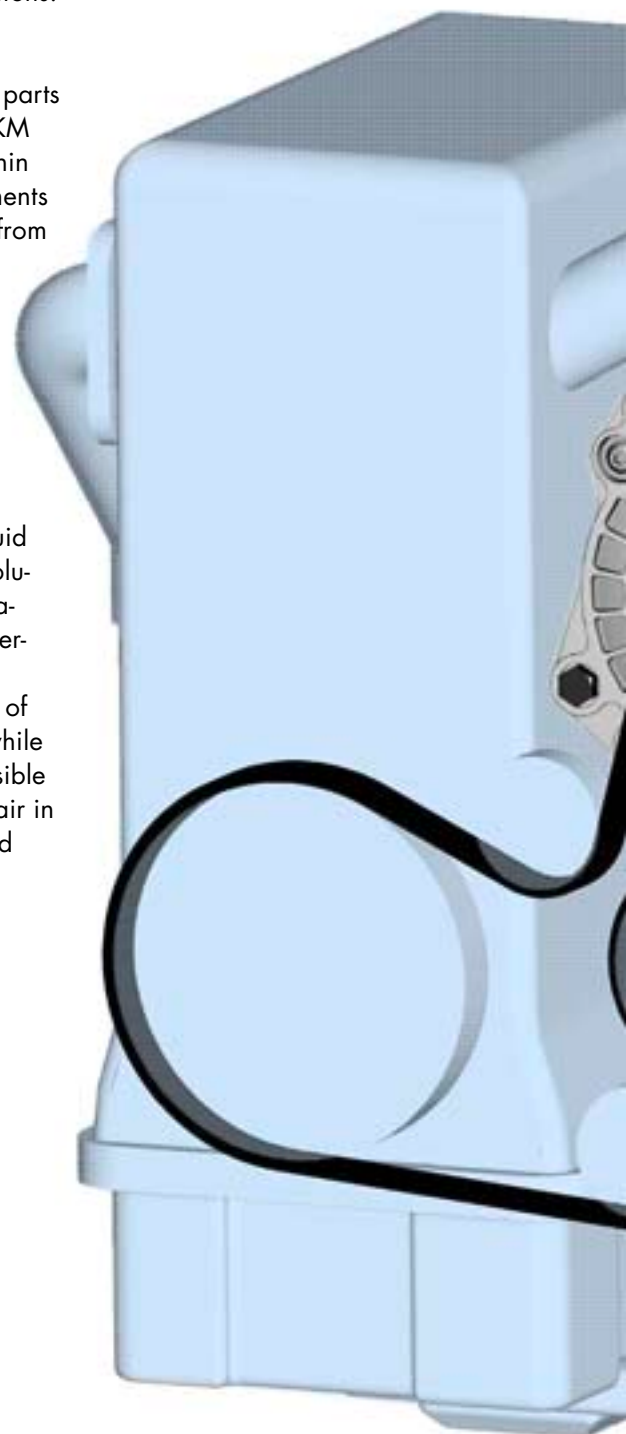
Simrit have supplied a total of 7 parts to the SpeedStart system. Two FKM O rings that seal the coolant within the system, four decoupling elements that help to attenuate any noise from the unit and a special sealing ring, a concept specifically designed for this application that both seals the coolant within the system and reduces the noise transmission. Ever increasing under hood temperatures of up to 140 °C justified the selection of an optimised liquid cooled, rather than air cooled solution, to ensure the SpeedStart machine operates in a clean and thermally stable environment. This provides for optimum robustness of the highly efficient electronics, while avoiding the increasingly impossible challenge of managing cooling air in an ever hotter and more crowded

In brief

- Speedstart® as a 2nd generation start-stop system ensures efficient use of resources and reduces CO₂-emissions
- The Speedstart® automatically reacts to driver reactions within 10 ms
- Simrit made an important contribution to this project with seven sealing and vibration-control components
- The areas of application of Speedstart® could extend to many general industry sectors, such as the agricultural and construction machinery industries



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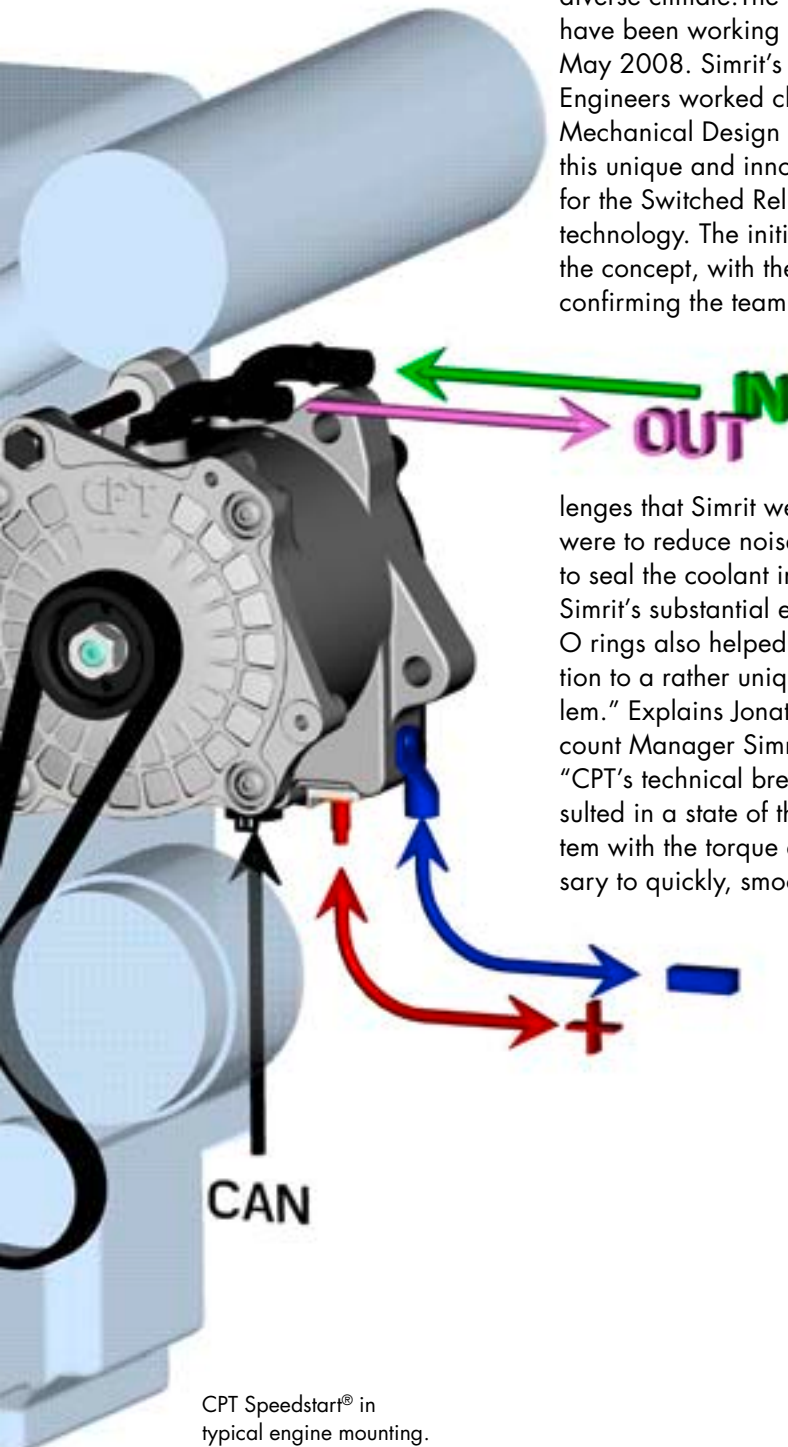




Fully integrated CPT Speedstart® machine.



The Simrit moulded part is responsible for vibration decoupling in the Speedstart® machine.



CPT Speedstart® in typical engine mounting.

engine compartment and globally diverse climate. The two companies have been working together since May 2008. Simrit's UK and German Engineers worked closely with CPT's Mechanical Design Team to develop this unique and innovative application for the Switched Reluctance motor technology. The initial design proved the concept, with the final iteration confirming the team had made another big step forward for automotive applications.

"The key challenges that Simrit were tasked with were to reduce noise emissions and to seal the coolant inside the unit. Simrit's substantial experience with O rings also helped to provide a solution to a rather unique assembly problem." Explains Jonathan Davey, Account Manager Simrit UK and Ireland. "CPT's technical breakthrough has resulted in a state of the art 12-volt system with the torque and power necessary to quickly, smoothly and more

frequently restart most modern diesel and petrol engines, while giving a class leading 'Driver Change of Mind' performance, in less than 10ms" says CPT senior manager Mike Dowsett "Unlike existing systems SpeedStart allows the vehicle to remain in gear when the engine is stopped, which is more natural to the driver and facilitates a faster restart. The highly refined system becomes almost unnoticeable to the driver and once this is achieved it creates the opportunity for car makers to offer stop-start as a standard feature on all models – thereby achieving a serious reduction in CO₂ emissions.

Noise Suppression

The advantages of the Simrit special sealing product are that it is not only a brand new innovative design offering ground breaking "from scratch" technology but that it significantly reduces noise within the system. Noise reduction is a competitive edge for CPT and a major benefit to the system. "Simrit helped us to create a step change in noise suppression" explains Mike Dowsett of CPT. In addition to this Simrit offers CPT a "one stop shop" in terms of development of sealing and vibration control technology. A total of three different solutions from just one supplier. "Whilst this technology has been initially developed for the automotive industry, the technology could be transferred across a whole range of markets potentially including some industrial and white-goods applications where volumes are already very high". Volume production for CPT SpeedStart® is expected to start in 2012 for Europe and Asia.

A robust solution

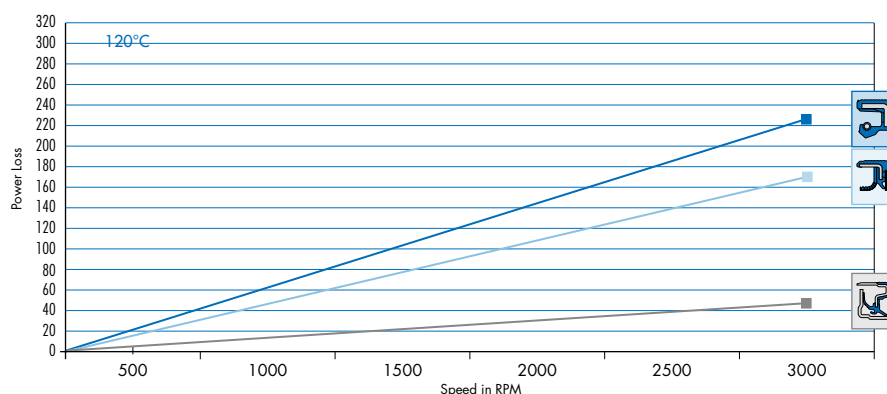
Longer service life, reduced CO₂ emissions, increased reliability and last but not least better value for money. Meeting and surpassing these customer needs often requires applying new technology to product designs in order to exceed what has previously been possible for effective lubricant retention and exclusion of environmental contamination.

The CASCO seal is, in this respect, one step ahead of all other crankshaft sealing solutions. The system is of a unitized seal design (referred to as a cassette design) integrating sealing elements and their running surface within a single cartridge. Once press-fitted into its working position it guarantees a high sealing performance even under the most arduous working conditions such as axial clearance, radial unbalance and oil ageing. The main lip is axially loaded, differentiating it from most other seal concepts. The CASCO was developed specifically to extend the seal service life under the most difficult operating conditions, whilst improving power loss by more than 60% over other crankshaft

CASCO crankshaft cassette seal has a long service potential, high reliability and helps ensure reduced CO₂ emissions.



Power Loss of Different Engine Seal Types shaft size Ø 130 and Ø 136 (ESS)



sealing solutions. Just like other cassette type seals it reduces the overall costs of the complete sealing system at the same time.

Serial production started in 2006 after a robust and comprehensive development between the Product Development Centre Simmerring Cassette and some of the biggest Original Equipment Manufacturers for Industrial Engines.

The next step for the Product Development Team for Simmerring Cassette is to apply the advantages of the CASCO also to other applications

while the material development department is aiming for an even better cost-benefit ratio.

Fully functional for more than 1.6 million kilometres

The CASCO is based on a new approach to rotating shaft sealing. The main lip of this design contacts a surface perpendicular to the shaft rather than radial on the shaft itself. The axially directed lip which has specific geometry, incorporating a hydrodynamic pumping helix feature moulded into the lip running against a metal sleeve. The sealing effect is augmented by the dynamic slinger effect of the rotating inner sleeve. One of the direct results of the low friction level is the minimal wear resulting both on the sealing lip and on its counter surface, even after more than 25,000 working hours, extending the life of this seal to more than 1,600,000 kilometers (bench-tested). Dust exclusion is ensured by a moulded rubber lip or, for more demanding applications, by a non-woven polyester ring with positive contact onto the metal sleeve, preventing dirt ingress without high wear or heat build-up (see torque chart above).



In brief

- Long service life of more than 1,609,300 km
- Extremely low torque drag even at surface speeds of up to 23 m/s
- Proprietary FKM main lip compound has very good compatibility with lubricating oils and additive packages
- Integrated wear sleeve effectively lowers the complete system cost



Any questions or suggestions?
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To the right product even faster

Innovative products are valuable to our customers not only because of the technology know-how but also because they are easy to access. Our newly designed eCatalog makes this process even faster.

Although the digital product now contains more than 45,000 components – as compared to the previous 27,000 products – the search takes no longer

than before. Quite the opposite: New search functions clearly increase efficiency for the user. For example, the new navigation with preview images makes it much easier to get an overview of the products, since images can be better and quicker to process than text.

free text search to selection by geometrical characteristics across builds to comprehensive comparison functions. The latter is important because the extensive product diversity offered by Simrit may lead to several products working for the desired function. In those cases, it is important that the individual options are presented to the user in an easy to understand fashion. Simrit's eCatalog can compare up to five items. Search is also facilitated and efficiency increased by the user not having to enter any attribute values for the products. They are automatically suggested by the eCatalog. The user only has to make a selection. The new eCatalog will become even more valuable for the daily work of distributors and direct customers. They can also check for availability and prices in connection with their product search. JavaScript is also no longer necessary, and the product database even works with Firefox.

in brief

- Product database with 45,000 components
- Many new efficient search functions (preview images, free text search, etc.)
- Extended operability for the user



Any questions or suggestions?
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Fast "Approach"

Search function efficiency increases with the option of finding the required product step by step. After all, not everyone has the item number at hand. Usually, the user has a certain idea of the required design or is looking for a Simmerring without knowing its precise designation. The new eCatalog is aligned with this kind of search. Navigation by preview images is only one of many aids. The corresponding additional aids range from

With the Product Finder, you will be sure to find what you need: The integrated characteristics search makes it possible to very quickly find the right dimension.



Up to five similar components can be compared in a table.



Figure instead of text: Find the product quickly with preview navigation.



Find the right product – then check price and availability right away! Improved efficiency for distributors and direct customers.

Quality through damage analysis

Damage cases lead to unpleasant negative headlines for the respective manufacturer, in particular where failure is connected to high costs or even physical injury. A damage analysis by independent service providers not only prevents problems with the public and customers, but can often save a lot of money as well.

They say that adversity is the school of wisdom. Of course, this is only true if the reasons for the damage case are documented, analysed and measures are defined that have a high probability of preventing new damage cases of the same type. Damage can also be avoided by performing the respective analyses preventively.

The advantages of external specialists

Examination of damage cases shows time and time again that it is often the small things that cause failure. The component that caused the damage is often quickly found. The question of what led to the impairment that caused the damage, in contrast, cannot be answered quite that easily. This then requires methodical procedure by way of a damage analysis. There are good reasons for having

such analyses performed by a service provider specialising in it – like the Freudenberg Forschungsdienste (FFD). Simrit and FFD are cooperating very closely where required. All Simrit customers can easily make use of this service and there are many reasons why they should:

- The number of the samples and examinations to be analysed can usually be reduced by the service provider's experience.
- The service provider has experience in the assessment and interpretation of the analysis results.
- Often, indicative examinations require special analysis procedures that are not available in-house.
- The external service provider approaches the task impartially.
- Own employees (e.g. product developers) are relieved.

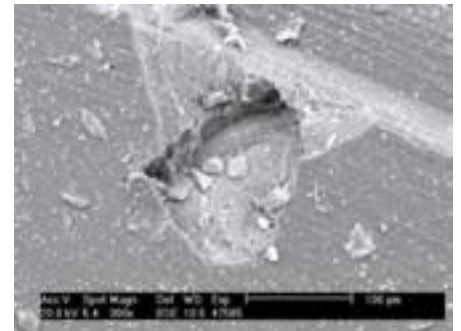


Figure 2: Illustration of broken-out particles in a seal.

important for a company to tell as early as possible whether the number of damage cases will follow curve 1 (e.g. manufacturing defects in a complete batch) or curve 2 (e.g. improper use). The result of damage analysis can be used as a basis for decision-making here.

Example 1: Complaints on seals are received after a short period of use. It is determined that particles of a non-compatible external mixture were vulcanised into the seals and breaks out of the seal after a short time (figure 2). All of the seals in question can be assigned to a materials batch that was very probably contaminated. It can be assumed that all seals in this batch will fail.

Example 2: Complaints were received for three ball bearings. The damage analysis shows that the ball bearings were not lubricated (figure 3). With the client's recorded data, it can be discounted that anymore ball bearings were delivered without lubrication. Therefore, these complaints are very probably individual cases and no further complaints will occur.

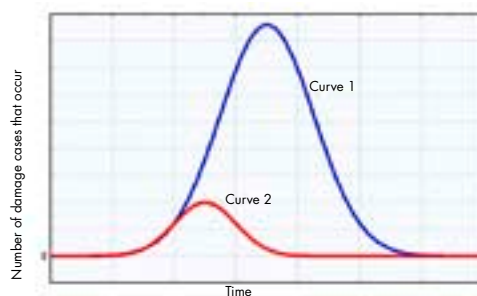


Figure 1: Appearance of defective components over time for a damage case.

Damage analyses for established components

Usually the number of failures that occur follow a Gaussian curve in damage cases where the components have been in use for a while (figure 1). It is

In brief

- The cause for functional impairment is often not clear
- Methodical procedure is essential
- External specialists have more experience and the benefit of impartiality
- Damage analysis is an important part of quality management



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Figure 3: A lack of lubrication of the ball bearings led to the damage occurrence.



After determination of the damage cause, targeted measures can be initiated or batches quarantined. Often, the analyses also lead to new insights that can be used for component improvement and new product developments.

Damage analyses in new developments

Although the requirements to quality and functionality of new products, as well as the indicativeness of calculations and simulations increase, damage cases do occur in this area as well. Often, the actual strain on a component in the actual application cannot be described in enough detail, since the conditions of use are not known precisely beforehand. Accordingly, customer-specifications are not precise enough. To avoid mistakes here, the dialogue between users and manufacturers is an essential prerequisite.

In the end, however, only application of newly constructed components will show their weaknesses and the possible effects of those weaknesses. The component and the best materials often can only be designed and selected perfectly after experience in field use

and with the – often unexpected and extraordinary – strain and constellations occurring there.

Where damage occurs in new developments, examinations therefore first target the construction and the materials used. Example 3: A nozzle is to be improved. Therefore, a new component is developed. However, the new components quickly fail and must be replaced. The damage analysis shows that wear in the form of cavitation damage occurs to the water inlet side surfaces (figure 4). The reason for this is an incorrect material selection (figure 5).

Even though damage analyses are, at times, used to assign blame, the actual objective of such analyses is always determination of the cause for failure, to remove it and to avoid similar failures in the future. Thus, the damage analysis is also an instrument for improving present products and thus an essential component of quality management.

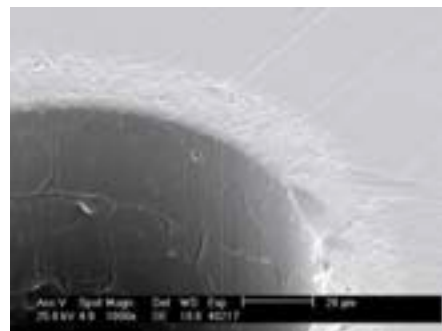


Figure 4: Proof of wear in the form of cavitation damage.

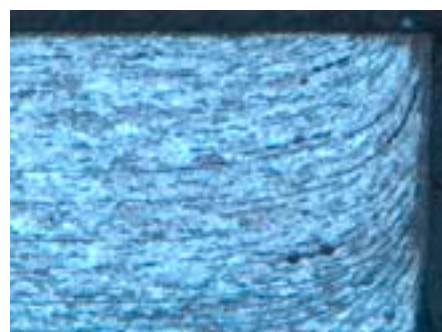


Figure 5: An incident-light microscope recording of a metallographic polish (etched) shows a damaged nozzle opening.

TPUs often outperform elastomers

The characteristics of thermoplastic polyurethanes (TPU) for sealing applications, a range of specific material composites, are often underestimated by engineers and designers. However, many TPU sealing materials developed over the past years have long been superior to traditional elastomers in applications that require high tear resistance and elasticity, and therefore extraordinary abrasion resistance. In low-temperature applications, special TPU materials are at least equal to NBR low temperature materials.

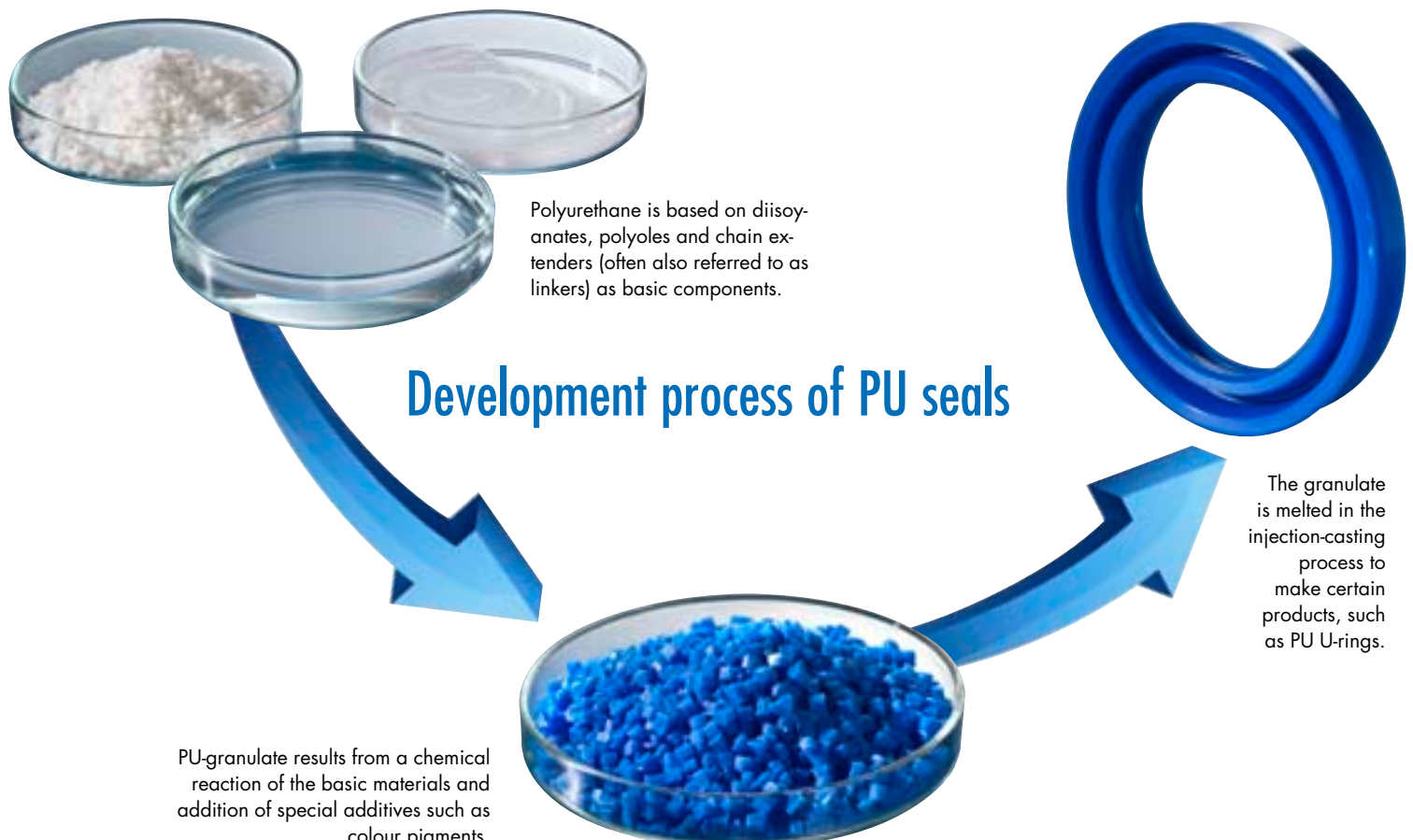
Thermoplastic urethanes are so-called block polymers, i.e. materials with molecule chains made of alternating flexible and stiff molecule parts. The flexible parts or soft segments are long-chained polyoles, usually polyether or polyester. They determine chemical resistance, low-temperature behaviour and flexibility. The stiff parts are urethanes formed from diisocyanates and short-chained dioles.

These stiff segments determine hardness, dynamic behaviour and high-temperature behaviour. In the macromolecular comparison with traditional elastomers, the soft segments in TPU materials correspond to the rubber molecules, the stiff segments to the fillers. TPU materials have the great advantage that every single molecule of the soft segment is

chemically bound to a stiff segment. TPU materials therefore offer a very high tear resistance (45 – 70 MPa) and a high tear propagation resistance (60 – 140 N/mm). They are therefore highly resistant against abrasion.

Special material composites

Very high strength and abrasion resistance are the greatest advantages



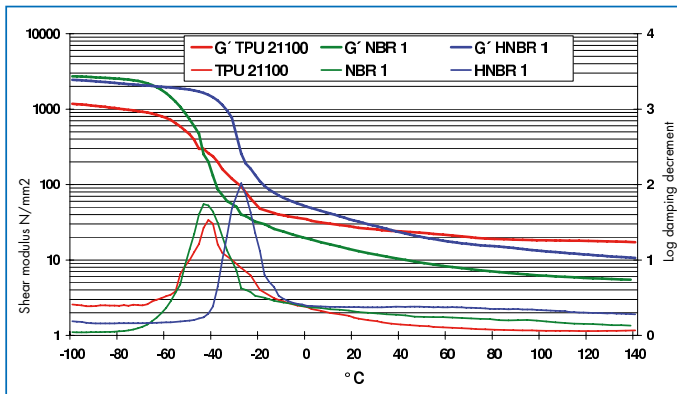


Figure 2: The low-temperature TPU 92 AU 21100 shows a much flatter shear modulus progress than a TPU standard high-performance material or low-temperature elastomers (NBR 1 and HNBR 1).

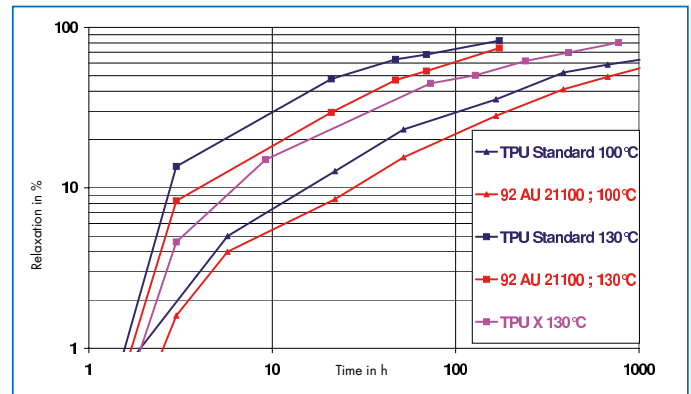


Figure 3: The material 92 AU 21100 shows better compressive strain relaxation features than the standard high-performance TPU material even at 130° C.

of the TPU-materials as compared to traditional elastomers. For hydraulic seals, TPU materials based on polycaprolactones are usually used. Many applications, however, need more than the low-temperature flexibility of these materials. Therefore, special material composites are used to decrease the glass transition (transition from elastic to inelastic) without impairing other features. For elastomers, NBR with a lower ACN content is used in such cases.

This lower ACN content as compared to NBR standard materials, however, always impairs the resistance to oils, which leads to increased swelling. Simrit's new low-temperature TPU 92 AU 21100 is a great step forwards here. It shows a much lower swelling than NBR low temperature materials, while shrinking is almost excluded. This is confirmed by several measurements performed with low-temperature fluids.

Universal use

The application features of sealing materials are mainly determined by the modulus of elasticity and the glass transition temperature. Nevertheless, flexibility and tightness of a U-ring is particularly determined by the modulus progress over temperature, rather than by single-point measurement of the glass transition temperature, even at low temperatures. The low-tempera-

ture TPU 92 AU 21100 shows a much flatter shear modulus progress than a TPU standard high-performance material. This keeps flexibility constant for longer. Both calculations and test bench measurements showed that TPU 92 AU 21100 only starts to stiffen at about 20 °C less than the TPU standard high-performance material, thus being unable to follow a rod motion quickly enough and causing a danger of leakage.

Test bench reports showed that even at normal temperature, density exceeds the values of a TPU-standard-high-performance material. The progress of the shear modulus is much flatter and more stable than the modulus curves of the NBR and

HNBR low-temperature elastomers (see figure 2). This is of enormous advantage for the geometric design of U-rings. For purely static applications, however, it must be observed that the compression set in TPU materials is never as good as in peroxide-linked NBR-materials. Compressive stress relaxation measurements, however, show that the low-temperature TPU 92 AU 21100 has better values than the TPU standard high-performance material both at 100 °C and at 130 °C (see figure 3).

Simrit's new TPU development shows even better relaxation values. Result: Designers should always also test thermoplastic polyurethanes when looking for suitable materials.

In brief



- The options offered by TPUs for sealing applications are not yet recognised completely by many designers
- TPUs have a very high tear resistance and high tear propagation resistance and are therefore very resistant to abrasion
- In the low-temperature range, the TPU 92 AU 21100 mate-

rial is superior to the corresponding NBR materials

- TPU 92 AU 21100 shows a good sealing performance of - 50 °C to +110 °C



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