

The Magazine from Trelleborg Sealing Solutions

in the groove

The world of seals and service



Get *in the groove*
for your iPad

CHEMICAL TRANSPORT

A 'No Stop' Solution

Compatibility is key to making sure vital chemicals are transported effectively by rail and road.

FLUID POWER

Solutions for Fluid Power

Delivering the power to hydraulics.



HEALTHCARE & MEDICAL

One is Better than Many

Multicomponent solutions in liquid silicone rubber.



CONTENTS



**COVER
STORY**

CHEMICAL TRANSPORT

A 'No Stop' Solution

Two new materials reduce downtime when transporting chemicals.

**PAGE
28**

FLUID POWER

Sealing Solutions for Fluid Power

Products and solutions to deliver the power required in fluid power applications.



**PAGE
50**



HEALTHCARE & MEDICAL

When One is Better than Many

Utilizing multicomponent solutions to fit multiple functions into small spaces.

**PAGE
42**

04 News**LITERATURE UPDATE****06 Hot Off the Press**

Discover Trelleborg Sealing Solutions publications to keep ahead of new products and developments.

DIGITAL INNOVATION**08 Digital Update**

The latest digital tools and services for engineers.

CORPORATE RESPONSIBILITY**12 High Hopes**

See how Trelleborg responsibly sources the rubber for its global operations.

**MARINE****16 Better than Bronze**

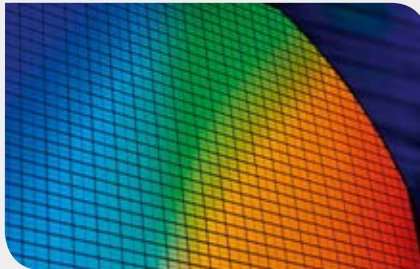
Orkot® TLM Marine replaces bronze on ships' rudders.

GUEST COLUMN**18 A Road Map for Fluid Power**

Eric Lanke, President and CEO of the National Fluid Power Association, discusses the Technology Roadmap and where the industry is heading in 2020.

SEMICONDUCTOR**22 The Fab Four**

New Isolast® compounds to optimize semiconductor development and manufacturing.

**ROBOTICS****33 Industry Focus: Robotics**

The past, present and future of industrial robotics.

VIRTUAL TOUR**37 VIP Access**

An enhanced virtual reality tour lets you visit Trelleborg facilities from anywhere in the world.

eMOBILITY**40 Moving with eMobility**

Find out how Trelleborg solutions optimize eMobility applications.

COGNITIVE SEALING**45 Future Sensing**

Using IoT and AI to reduce downtime.

**VIRTUAL CONFERENCE****48 Shaping (Y)our Future Together**

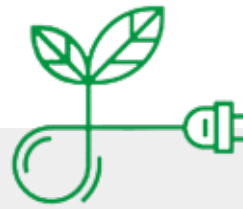
A virtual conference brings experts together to discuss technology and upcoming disruptive developments.

MATERIALS**54 Material Updates**

The latest materials to enhance efficiency and performance in your applications.

Gone green

All Trelleborg sites in the UK are now powered by 100% renewable energy, helping to save energy and reduce Trelleborg's climate impact.



PARTNERSHIP

A Partner to AGCO

AGCO, one of the world's largest manufacturers of agricultural machinery and equipment with brands such as Challenger, Fendt, GSI, Massey Ferguson and Valtra, has awarded Trelleborg Sealing Solutions partner level supplier status at its first EME Virtual Supplier Event.

Trelleborg Sealing Solutions supplies AGCO with products such as special rotary seals for transmissions and tire pressure control systems. Partner status is the highest level a supplier can achieve at AGCO. In addition to quality, the supplier's reliability, service orientation and innovative strength are decisive for the award.

Konstantin Meier-Kulenkampff, Vice President Purchasing & Materials, AGCO International GmbH, says: "I would like to thank Trelleborg Sealing Solutions for the outstanding performance and our excellent cooperation over the past years. Together we have brought AGCO to the forefront and together we aim to maintain or even extend our innovative lead."



Another business area of Trelleborg Group, Trelleborg Wheel Systems has had AGCO partner level status since 2018. When giving the award, the machine manufacturer particularly praised the high level of innovation of Trelleborg's tire business area.

SEALS-SHOP

Chemical Transportation Seals-Shop Launch

The Chemical Transportation Seals-Shop, an e-commerce site that simplifies the procurement process for Trelleborg's US-based Chemical Transportation customers, launched on July 27, 2020.

The Seals-Shop delivers 24/7 access to online ordering of repair kits for valves and other components critical to the function of tank cars, trucks and ISO containers used for chemical transport. The site also provides customers with access to online invoice payment, complete order history, order shipment tracking, product search functionality and more.

Development is underway to expand the Seals-Shop to include product lines for other industries, such as Fluid Power and Food, Beverage and Water.



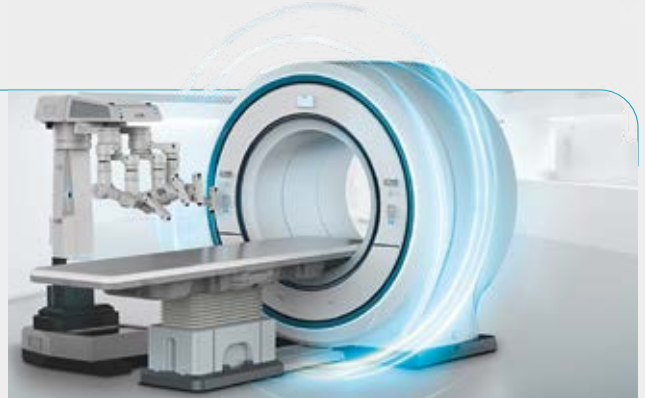
Shop online for seals now:
www.chemtransportsealshop.com

NEW HEADQUARTERS

Trelleborg Healthcare & Medical Establishes Global Headquarters

In July of 2020, Trelleborg Healthcare & Medical moved into its new global headquarters, located in the US in St. Louis Park, Minnesota.

Trelleborg's wide range of healthcare and medical device capabilities includes silicone molding, silicone extrusion, silicone sheeting, silicone dipping, device assembly, process seals and tubing, drug eluting combination product manufacturing and more.



Establishing a new global headquarters for the Healthcare & Medical Business Unit is just one of the many steps being taken to harmonize the customer-first approach.

DIGITAL SERVICE

Virtual Ontario Hard Hat Open House

On July 30, 2020, the new US-based Ontario, California, facility, consisting of an Aerospace Hub, ServicePLUS Center and the Trelleborg Sealing Solutions West Warehouse, hosted a virtual Hard Hat Open House to welcome customers into the new space.

The event included a combination of on-site and off-site live streaming video, as well as a pre-recorded video of the New Berlin ServicePLUS Center in Wisconsin, US. At more than double the size of the previous space, the new facility provides room for growth and an opportunity to expand the services Trelleborg Sealing Solutions provides to customers in the region.



Carlos Nunez films Tim Poplin and Mark Barnes demonstrating Aerospace parts during the Hard Hat Open House.

IMPRINT

Trelleborg Sealing Solutions

in the groove, Edition 40, 99GBK9MAGEE0120

© 2020 Trelleborg Group. All rights reserved.

* All trademarks are the property of Trelleborg Group.

The turquoise color is a registered trademark of the Trelleborg Group. At time of publication the information contained in this literature is believed to be correct and accurate.

EDITORIAL TEAM: Meghan Cloud Braunger, Matthias Engler, Donna Guinivan, Lara Haas, Whitney Killip, Mike O'Brien, Tobias Schmid, Jan Sklucky, Amy Swab, Robert Zahiri

RESPONSIBLE UNDER GERMAN PRESS LAW: Tobias Schmid

GRAPHIC ARTS: team:orange, Esslingen, Germany

PRINTING: W. Kohlhammer, Stuttgart, Germany

IMAGES:

p. 01 ©www.istockphoto.com/af_istocker

p. 04 AGCO Fendt

p. 04 Dabarti CGI/shutterstock.com

p. 01;05;06;07;08;09;10;11 Trelleborg Sealing Solutions

p. 08;09;10;11 ©www.istockphoto.com/

Best Content Production Group

p. 03;12;13;14;15 Rosman Jahja

p. 12;13;14;15 Gettyimages

p. 16;17; Ian Geraint Jones/shutterstock.com

p. 17;18;19;20;21;22;23 Trelleborg Sealing Solutions

p. 03;22;23; Rainer Plendl/shutterstock.com

p. 22;23; fotografos/shutterstock.com

p. 24 Gorodenkoff/shutterstock.com

p. 25 MS Mikel/shutterstock.com

p. 26;27 Anusorn Nakdee/shutterstock.com

p. 28;29;30;31;32;35;36 Trelleborg Sealing Solutions

p. 01;02;28;29 ©www.istockphoto.com/af_istocker

p. 29 © Adobe Stock / 2dmolier

p. 32;55 Tobias Arhelger/shutterstock.com

p. 33 asharkyu/shutterstock.com

p. 34;35 ©www.istockphoto.com/ipopba

p. 36 ©www.istockphoto.com/3alexnd

p. 36 ©www.istockphoto.com

p. 37;38;39;40;41;42;43;44 Trelleborg Sealing Solutions

p. 45;46;47;48;49 Trelleborg Sealing Solutions

p. 50;51;52;53;54;55 Trelleborg Sealing Solutions

p. 54-55 Eduard Muzhevskiy /shutterstock.com

Hot Off the Press

Find out about the latest literature from Trelleborg Sealing Solutions

Sealing Solutions for Fluid Power Applications



A new brochure has been released to complement the Fluid Power focus within Trelleborg Sealing Solutions. A wide variety of products and materials are collected in one place to give a detailed overview of the products and solutions available to optimize performance in fluid power applications.



Find out more about our Fluid Power focus on page 50 of this issue of *in the groove!*

Seal-Glide® : Reducing Friction with Nanoscale Treatments



Specially developed to improve on the benefits of PTFE-based coatings, Seal-Glide® significantly reduces friction during assembly and operation. Applicable to a wide variety of materials, from silicones to standard elastomers and plastics, the new surface treatment can deliver advanced static and dynamic frictional performance, reduced stick-slip behavior and simplified assembly.

A medical-grade version of the treatment is also available, offering compliance and approval with EC 1935-2004 and biocompatibility regulations set out in DIN EN ISO 10993-5, for use within healthcare, medical, food and beverage applications. The clean process involved reduces maintenance requirements and enhances safety.



MORE INFORMATION



To view all Trelleborg Sealing Solutions catalogs, brochures and flyers, go to

www.tss.trelleborg.com/literature

O-Rings and Back-up Rings Catalog Updated for 2020



The versatile O-Ring is available in a wide selection of materials and designs, offering consistent and reliable sealing in thousands of applications. Our O-Ring and Back-up Ring catalog has been updated with the latest developments to ensure customers can always find the best solution.

Key updates:

– Materials section improvements:

- Revised general fields of application
- New tables listing special requirements – authorities and approvals
- Updated tables of preferred materials

– Surface quality acceptance criteria aligned with latest ISO 3601-3 updates

– Over 200 minor improvements!

– Products

- Complete revised chapter for FEP/PFA encapsulated O-Rings
- Integration of a new chapter for special oversized O-Rings

New Turcon® Variseal® Catalog



Turcon® Variseal® is a spring-energized, single-acting seal for dynamic and static working conditions. Its special seal profile and choice of proprietary Turcon® or Zurcon® materials offer low friction performance at high speeds, pressures and temperatures for many different applications.

The new edition of the catalog has updated material and certification information, reworked ordering examples for Turcon® Variseal® M2 and minor changes and corrections to size ranges.



Digital Update

Check out our
latest digital
resources



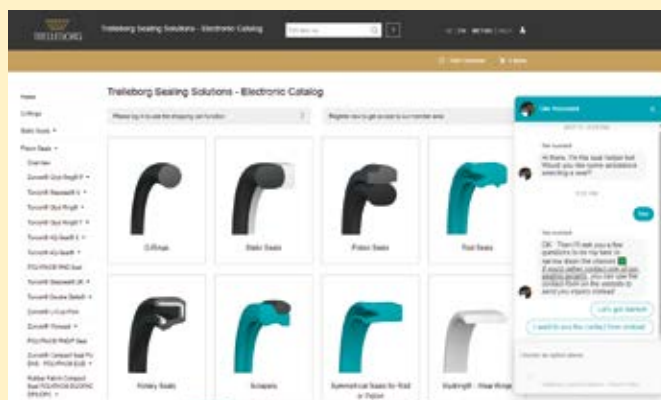
e-Catalog Helper

Assistance is at hand to find the right product!

To simplify searching through and finding standard products and solutions, Trelleborg Sealing Solutions has developed a useful chatbot helper that appears on e-Catalog pages. Answer some simple questions about your application and requirements, and it will provide you with part numbers for products that fulfill your needs.

While the chatbot is already very popular, Trelleborg Sealing Solutions is planning new features to make it even more useful and user friendly:

- Provides a simple and user-friendly way to quickly find the products you need.
- Contains all the products featured in the e-Catalog.
- Guides users with simple questions based on performance values and seal characteristics to find appropriate seal types.
- If any questions or concepts are not understood, then handy links to e-Learning sections are available.
- Provides specific part numbers, which can then be sent through the e-Catalog RFQ function for quick ordering.
- Can be restarted as many times as desired to find multiple seals, bearings and wipers. Use it for as many products as required.
- If the user has further questions or requires a custom product, a contact form is provided for further assistance



OUR VIRTUAL TOUR HAS BEEN UPDATED!

Turn to page 37 for more details



or scan the QR Code



Visit the e-Catalog:
<https://www.tss.trelleborg.com/ecatalog/>

App Updates

Trelleborg Sealing Solutions is constantly working to improve and update their apps to keep ahead of engineer's needs, aiming to make their lives easier.

A P P



Hydraulic System Calculator App

The Hydraulic System Calculator has already helped engineers calculate key values needed when working with hydraulic cylinders thousands of times. Use it to quickly calculate cylinder displacement, flow rates, electric motor power and total efficiency, with values all in compliance with ISO 3320, ISO 3321 and ISO 4393.



An intuitive tool, it can be used for single- and double-acting cylinders, in multiple different units and all the formulas used can be reviewed within the app.

Latest updates at a glance:

- Includes calculations for motors, pumps and piping in a hydraulic system.
- Enables calculation of flow rates, pressures, displacements, speeds, torques and power for motors
- Calculate displacement, flow rate, electric motor power and total efficiency for pumps
- Quickly find out the pressure drop around an orifice
- Piping parameters like velocity, cross-sectional area and Reynolds number can be calculated using absolute or kinematic viscosity



Aerospace Groove Selector

The Aerospace Groove Selector helps users to find the sizes of grooves and gaps, covering the most important SAE aerospace groove standards for hydraulic systems.

Updates include:

- Two new SAE standards, AS4088 & AS4382
- Allows larger cross-sectioned O-Rings, more stable and efficient scrapers and zero width Back-up Rings
- Enhanced and intuitive navigation and user interface
- Easier to change between units
- In-app messaging added



ISO Fits & Tolerances

Easily determine the type of fits using tolerances according to DIN ISO 286. Upon entering the nominal diameter, the tool calculates lower and upper limit deviations and minimum and maximum interferences depending on the selected tolerance classes for bore and shaft.

Updates include:

- Redesigned user interface for easy selection with minimal navigation for a better user experience
- Store favorites and view usage history to find previously run calculations
- Dutch and Spanish language support now available in Android version



New Webinars and Technical Articles Available!



MORE INFORMATION

To get access to technical articles, webinars and whitepapers on sealing technology, visit the Technical Library from Trelleborg Sealing Solutions under "Tools & Resources" at www.tss.trelleborg.com or scan the QR code.



WEBINAR



Airframe Manufacturing Capabilities (webinar)

Join Richard Furlong, Director Global Operations Airframe Seals and Matt Keen, Product Manager Airframe Seals for an overview of airframe and

engine manufacturing capabilities within Trelleborg Sealing Solutions. Learn about the materials and techniques used, the range of finishing options available and understand the pros and cons of each method.



Ultra High Temp Seal (webinar)

The Ultra High Temp (UHT) Seal is the latest addition to Trelleborg's airframe and engine sealing portfolio, designed and tested on the

latest generation of aircraft and engines.

Quinn Collett, General Manager, Airframe Seals Sales and Marketing, George Ngugi, Development and Qualification Engineer for Trelleborg Sealing Solutions Aerospace and Michael Haley, Product Manager in Northborough, Massachusetts, USA will show you how to achieve better performance with lighter weight and a lower system cost.



Applying Advanced Extrusion Technologies for Medical Device Design (webinar)

Designing smaller and more intricate medical devices with increasingly stringent national and international regulations can

be challenging. Medical device manufacturers are looking to advanced extruded products in high consistency rubber (HCR) silicone. Dan Sanchez, Product Manager, gives an overview of the trends in medical device design and shows the value of using extruded silicone products in medical devices.



When One is Better than Many (technical article)

Ursula Nollenberger, Product Line Director for LSR Components and Healthcare & Medical, details the use of silicone multicomponent solutions to combine many functions into a single component. With medical devices

becoming smaller and more sophisticated, these manufacturing techniques and materials provide designers with the latitude and flexibility to improve application performance.



Charging into the Future (technical article)

Harlan Hart, Technical Manager for e-Mobility at Trelleborg Sealing Solutions, describes two new seals for e-Mobility applications, noticeably extending the distances traveled by electric vehicles between charges. HiSpin® PDR RT and HiSpin® HS40 have been

developed especially for these types of applications, undergoing significant testing to prove their performance in application.



Website Updates

The industry sections of the Trelleborg Sealing Solutions website have been undergoing a redesign from the ground up to better serve our customers and accurately display the full range of products and solutions.

All the following web sections have been updated with new content, including films and animations, new products and detailed technical information. Get rapid access to the most relevant tools and literature at the click of a button. With experts on hand to answer queries, customers can be sure to find a wealth of information to ensure they're using the correct seal to improve efficiency and performance.

Fluid Power

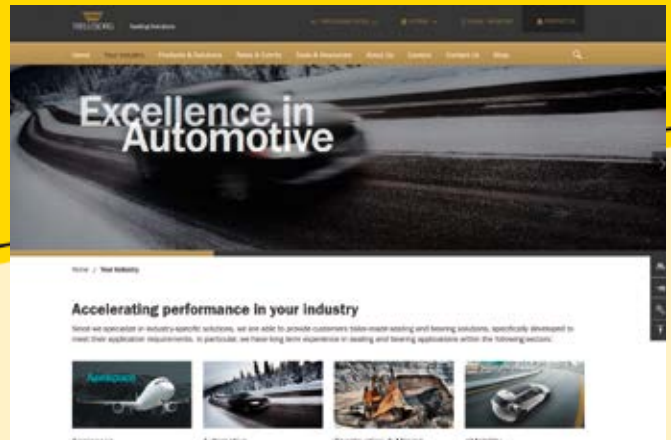
Hydraulic applications are challenging for seals. Not only must the hydraulic seals prevent leakage of fluid from the cylinder, but they must also withstand high pressures, extreme temperatures and transverse forces within the application.

Find out about tools, literature and products that make specifying seals for hydraulic applications quicker and easier. Read about the latest concepts in Lubrication Management or take an e-Learning module on Hydraulic Seals to learn how to specify seals or brush up on your knowledge.

e-Mobility

By 2030, electric cars are expected to see an unprecedented rise to make up 40% of the total global vehicle population, while 60% of bikes, 50% of motorcycles and 30% of the world's buses will also be electrically powered. Mobility is a central topic of the future and one focus is on e-Mobility.

Whether for aircraft, automobiles or bikes, Trelleborg Sealing Solutions guides you to the most useful products for improving performance, such as the HiSpin® PDR RT and the HiSpin® HS40 that withstand high rotational speeds.



Find out more at www.tss.trelleborg.com under "Your Industry".

Material Handling

Material handling equipment works hard and long to deliver goods when and where they are needed. Vehicles and equipment have become indispensable in a number of working environments. Productivity and safety are crucial and sealing solutions must be long-lasting and ensure continuous, efficient operation.

Quickly access tools like the Sealing Solutions Configurator, Hydraulic System Calculator and CAD Service to easily make calculations for appropriate seals. Better understand the sealing requirements by enrolling in handy e-Learning modules or see where seals fit into a forklift and how they contribute to improved performance.

Semiconductor

As trends promising huge growth in semiconductor use, such as Artificial Intelligence (AI), 5G, machine learning, and high-performance computing, drive semiconductor manufacturers' innovation, accelerating time to market while reducing total cost of ownership is becoming critical.

With ever increasing requirements for miniaturization and cleanliness, high-performance seals from Trelleborg Sealing Solutions come to the fore, guaranteeing cleanliness, chemical resistance, and extension of the uptime cycle for maximum yield.

Use the new website to find an expert with whom you can discuss your application requirements or learn about the Isolast® PureFab™ range of materials specifically designed for high temperatures and dry and wet process chemistries, lowering total cost of ownership.

High Hopes

Ever wondered how the natural rubber in your seals is produced? Rosman Jahja, who is VP of Corporate Responsibility at Trelleborg Group, took a tour of SAPH. One of the largest production facilities in Africa, Rosman went there to understand the production process and find out how its owner contributes to the local community.



IN SHORT

- 1 SAPH, based in the Ivory Coast, is an important supplier of rubber to Trelleborg.
- 2 The production of rubber involves stages such as washing, mixing, cutting and drying.
- 3 Initiatives, such as water recycling, are in place to reduce damage to the environment.
- 4 Employees get many benefits, including free water and electricity, schools, and education.

SAPH Quality Manager Etienne Bertrand (left) with Henriette Gomis-Billon, who is responsible for sustainability and communication for the SIFCA Group, the main owner of SAPH.



THOUGH SYNTHETIC RUBBER DOMINATES THE MARKET, almost half the rubber used by the manufacturing industry is natural. While Thailand and Indonesia are the two biggest producers of natural rubber, the third country on the list in terms of net exports is the Ivory Coast.

Harvesting rubber

SAPH, is an important supplier of natural rubber to Trelleborg. Its natural rubber producer in Bongo, in the southeast of the Ivory Coast, is the largest in Africa and capable of producing 56,000 tonnes of natural rubber per year.

Rubber can be harvested every month of the year except January and February. Siphoned off from the *Hevea Brasiliensis* tree, the raw materials are collected in a cup, where they coagulate to form what is known in the industry as a “cup lump”. The color of the cup lump changes depending on how much time it spends drying out in the sun, becoming more yellowish-brown with increased exposure and oxidation.

SAPH Quality Manager, Etienne Bertrand, says: “The first step we take with a batch is quality control – to check that the raw material contains enough usable rubber. After that comes the washing, mixing, cutting and drying process.”

“The first step we take with a batch is quality control – to check that the raw material contains enough usable rubber.”

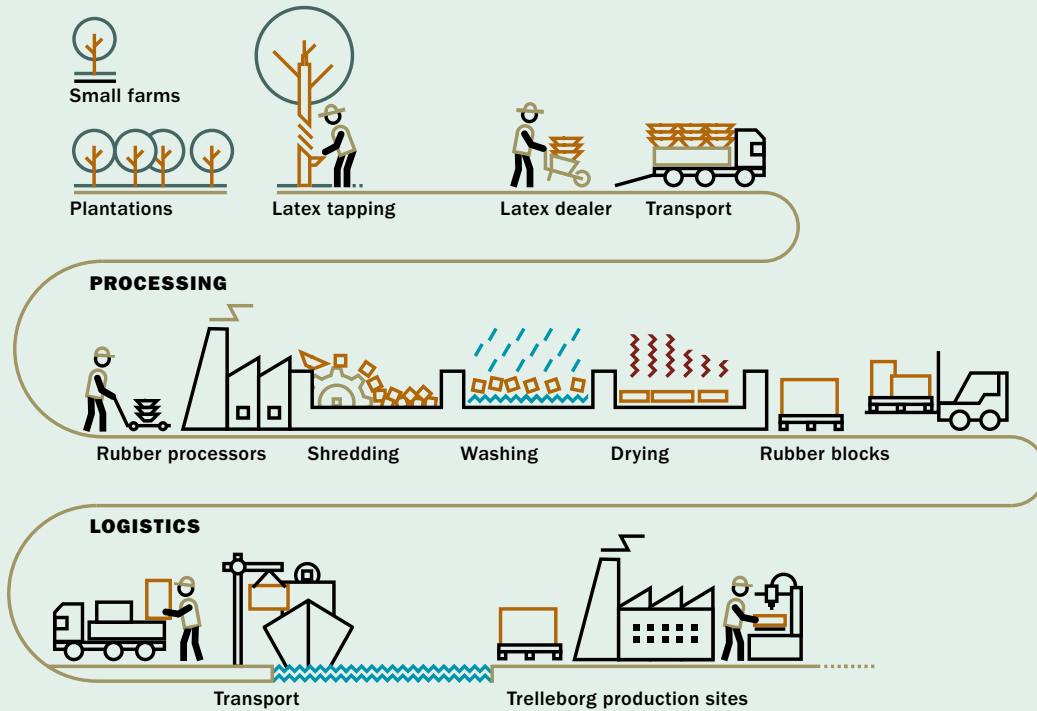
ETIENNE BERTRAND,
SAPH Quality Manager

Improving safety and caring for the environment

Among the most striking features of the facility are the prominent graffiti-like reminders on the walls to wear safety equipment including helmets, boots, visors and, if necessary, ear protection. The reminders are clearly being taken seriously; the accident rate has decreased in the past few years, with only 13 recorded in 2017, which is comparable to any similar industrial production facility in Europe.

The initial washing phase involves the use of a great deal of water in large tubs. The facility has recently invested in a comprehensive water cleaning site, where the aim is to recycle the water. The recycling process has not yet been perfected, but it has reached a level where the purified water can be used for the first step of the industrial process for things like watering plants. →

Production of natural rubber



Mass production

Having been dried, a finished bale of yellow-brown natural rubber weighs 35 kg. Wrapped in plastic sacks, 36 bales are then stacked on a pallet. Around 2,000 tonnes of natural rubber of varying degrees of quality are stored on pallets in the large warehouse at the end of the production chain. Every pallet is inspected at the internal laboratory where obligatory tests are carried out to ensure quality and detect any impurities. The test results are saved so that batches can be tracked and cross-checked.

On the plantation, the high-tempo tapping work is in full swing. A tapper has less than 20 seconds per tree to make the right cut and empty the cup to collect the rubber. Everyone has gone on a 21-day course to learn how to make the optimal cut.

Worker benefits

Supporting its workforce is vital to SAPH. Employees enjoy many benefits such as the opportunity to live in the nearby villages that the company has built, which are directly connected to the factory.

They also have free access to water and electricity in their living quarters, daycare facilities and places at locally run primary schools for their smaller children, and – not least – basic insurance and health care.

The significant fixed costs involved in taking proper care of the workforce fall under the heading Corporate Social Responsibility (CSR). It is perhaps mainly this aspect of comprehensive social responsibility that differentiates a manufacturing facility of this size in this part of Africa from any in Western Europe or North America.

Henriette Gomis-Billon, who is responsible for sustainability and communication for the SIFCA Group, the main owner of SAPH, says: “There really is no alternative. We have to take on a great deal of responsibility, otherwise it would be impossible to run an operation as large as ours, with almost 1,300 employees.”

Corporate responsibility

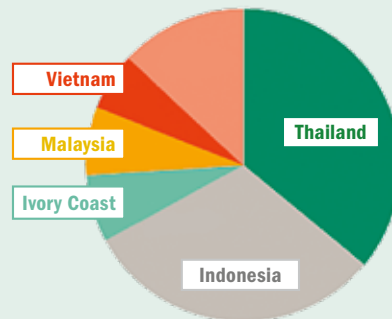
Another positive result of SAPH’s CSR efforts is that the villages neighboring the ones owned by the company also benefit. They can also use the health center and receive advice and help from doctors and nurses, for example during childbirth. In general, the quality of equipment here is higher than at the equivalent state-owned health facilities. Many other services that the state would usually provide are taken care of by the large rubber producer in this region – and access is not limited to those living in the company’s villages.



“There really is no alternative. We have to take on a great deal of responsibility, otherwise it would be impossible to run an operation as large as ours, with almost 1,300 employees.”

HENRIETTE GOMIS-BILLON,
Responsible for sustainability and communication for the SIFCA Group


The five countries that exported the most natural rubber in 2017



- 1. Thailand:**
USD 6 billion (36.2%)
- 2. Indonesia:**
USD 5.1 billion (30.7%)
- 3. Ivory Coast:**
USD 1.1 billion (6.7%)
- 4. Malaysia:**
USD 1.1 billion (6.6%)
- 5. Vietnam:**
USD 1 billion (6.1%)



In the areas just outside these villages, SAPH provides support to high schools in the form of materials and the construction of new buildings. The company also builds school canteens with support from local women’s groups for food supply and preparation, using the motto “a hungry belly has no ears.”

An entire ecosystem has sprung up around the facility in Bongo. And the operation has given independent rubber farmers a chance to earn an income that is better than if they were growing cacao, which you can only harvest twice a year. 

Better than Bronze

By Donna Guinivan

Can composites perform better than bronze? Comparative tests against our Orkot® bearing materials prove that they can.

ORKOT® TLM MARINE is a proven material for use as bearings on ships' rudders and a popular alternative to bronze.

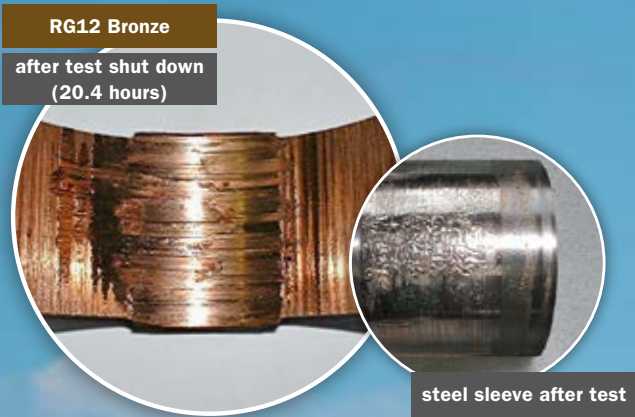
"Though Orkot® TLM Marine is well-established and a leading composite option in marine applications, we wanted to prove once and for all that it was a suitable and superior replacement for bronze bearings, especially when not lubricated," says Shanul Haque, Products and Innovations Manager at the Trelleborg Sealing Solutions facility in Rotherham, England, where Orkot® materials are fabricated.

Tests destroy bronze bearing

Tests were undertaken in water with no lubrication with continuous shaft motion for a targeted length of 100 hours.

Shanul continues, "The results undisputedly showed the supremacy of Orkot® TLM Marine as a bearing material in rudder applications without lubrication. The bearing in RG12 bronze was completely worn away after just 20.4 hours."

The Orkot® composite bearing demonstrated lower friction with less stress on adjoining hardware, which means lower wear and longer product life. It also produced an even, consistent wear surface due to the compliant nature of the material. The bronze bearing, being harder, had uneven edge loading causing high wear and surface break down.



A layer of bronze has fused to the sleeve and destroyed the surface finish



No damage has been caused to the sleeve. The scar on the sleeve was already present from previous tests.




ABOUT ORKOT® TLM MARINE

Orkot® TLM Marine is an advanced polymer reinforced with solid lubricants. The material has exceptional wear resistance and virtually no swell in water, providing dimensional stability and tolerating edge loading and misalignment even with the heaviest loads. Where there are extended periods without lubrication, Orkot® TLM Marine proves especially effective.

Real benefits

“Orkot® TLM Marine offers real benefits to ship operators. The extended life of Orkot® over bronze bearings means a longer interval between planned maintenance, significantly reducing total cost of ownership for the ship operators. The bearings are also easy to install with alignment to the shaft being less critical to avoid edge loading.

“And importantly, as the composite bearings so successfully operate in non-lubricated conditions, they are better for the environment and fish-friendly,” concludes Shanul. 

Test Program

The purpose of these tests was to compare RG12, a bronze commonly used in rudder applications, and Orkot® TLM Marine.

The test parameters:	
Surface Pressure	10 N/mm ²
Shaft Speed	1 m/min
Angle of Reciprocation	± 15°
Shaft Motion	Continuous
Lubrication	Water
Sleeve Material	316 Stainless Steel
Surface Roughness Sleeve	0.6µm
Test Duration	100 Hours

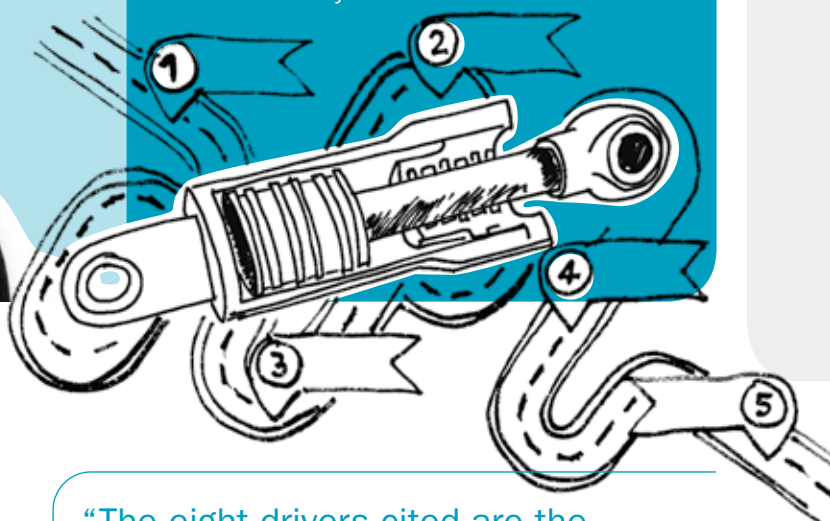
The test results:	RG12 Bronze	Orkot® TLM Marine
	Duration (Hours)	Failed after 20.4
Average Coefficient of Friction	0.343	0.151
Peak Coefficient of Friction	0.621	0.299
Average Bearing Temp. (°C)	24.3	20.4
Average Room Temp. (°C)	20.5	19.6
Specific wear rate	Completely Worn Away	6.184 x 10 ⁻¹⁵ m ³ /Nm
Wear rate, depth per second	Completely Worn Away	1.031 x 10 ⁻⁹ m/sec



ERIC LANKE,
President and CEO of the
National Fluid Power Association

A Road Map for Fluid Power

Eric Lanke, President and CEO of the National Fluid Power Association, talks to *In the Groove* about what the association's Technology Roadmap means for the fluid power industry for 2020 and beyond.



ITG: The NFPA published its first Technology Roadmap in 2009. Can you describe how this roadmap has evolved over the last decade?

EL: Our Technology Roadmap is intended to identify the research and development objectives that the fluid power industry should pursue to help ensure that its products continue to meet the needs of its diverse customer base. An update is published every other year and, since its inception, we have dramatically increased the number of customer voices that are part of the Roadmap's development process. Today's Roadmap is much more focused on the actual needs expressed by those customers.

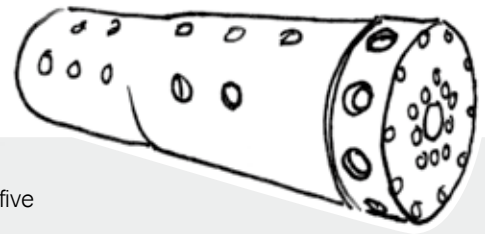
ITG: About which aspects of the 2019 Roadmap are you most optimistic?

EL: The 2019 Roadmap shows strong alignment between fluid power and many of the primary needs of our customers. For example, when looking for technologies that can help

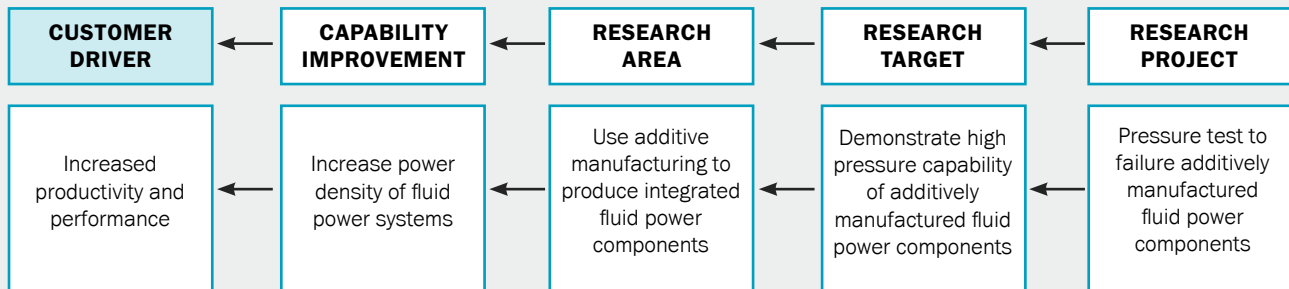
“The eight drivers cited are the eight most important things that fluid power customers are trying to deliver to their own customers – the buyers of their machines.”

increase productivity or performance, lower the capital or operating costs, or increase the power density of machines, customers frequently choose fluid power as a primary technology. In some of the other areas of need, fluid power finds itself more frequently competing with other technologies. However, the Roadmap lays out several research and development objectives that the industry is readily adopting in order to improve its competitive position in those spaces.

ITG: When looking at the Roadmap Committee's ranking of the eight Customer Drivers, autonomous operation and greater integration of technology are two areas that were given relatively low importance. Based on the emphasis on IoT in so many markets, is this surprising to you?



ROADMAP ELEMENTS The 2019 NFPA Technology Roadmap is comprised of five primary elements, each connected to the next in an interdependent chain.



1. CUSTOMER DRIVERS are the business or technology objectives of fluid power customers. They help them serve the needs of their own customers and are not necessarily connected to their use of fluid power.

2. CAPABILITY IMPROVEMENTS describe the ways in which fluid power systems must improve if they are to meet or better meet the customer needs described by the Customer Drivers.

3. RESEARCH AREAS are the broad areas of pre competitive investigation that could assist in bringing about the Capability Improvements.

4. RESEARCH TARGETS are the objectives that quantify or otherwise describe successful strategies for pursuing the Research Areas.

5. RESEARCH PROJECTS specifically address and attempt to achieve the Research Targets.



EL: The eight drivers cited are the eight most important things that fluid power customers are trying to deliver to their own customers – the buyers of their machines. And while IoT is clearly making dramatic in-roads into the marketplace, the pre-eminent concerns remain the needs for machines to deliver increased availability and uptime, increased productivity and performance, and lower capital and operating costs.

I think it is interesting to note that IoT, while obviously a technology that can facilitate autonomous operation and the greater integration of technologies, can also be applied to the more “bread and butter” concerns of uptime, performance, and cost.

It is similar to what we heard discussed in many of our road mapping sessions – the Internet of Things is not a customer driver in and of itself. IoT is a technological strategy for addressing the needs expressed by many of the Customer Drivers. →

CUSTOMER DRIVERS

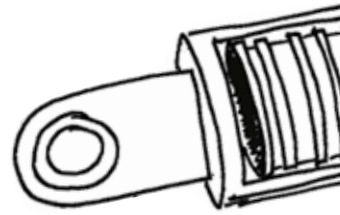
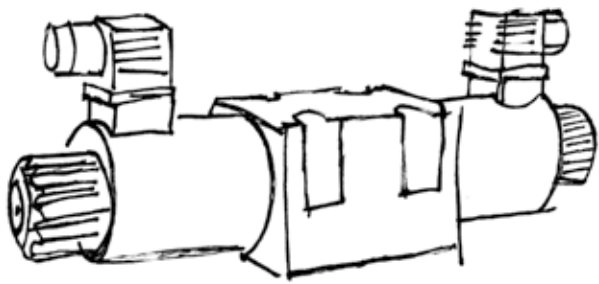
Fluid power's machine builders want to provide their customers with machines that offer:

- Increased availability and up-time¹
- Lower capital and operating costs²
- Increased productivity and performance
- Autonomous operation
- Compliance with safety regulations and machine directives³
- Easier and more predictable maintenance
- Greater integration of technologies, including data acquisition, utilization and ownership
- Weight reductions and increased power density

¹ “Increased energy efficiency” and “Component interchangeability” were both discussed as possible Customer Drivers but were ultimately seen as ways to provide customers with “Increased availability and up-time.”

² “Increased energy efficiency” and “Manufacturing close to the customer” were both discussed as possible Customer Drivers but were ultimately seen as ways to provide customers with “Lower capital and operating costs.”

³ “Lower environmental impact” was discussed as a possible Customer Driver but was ultimately seen as a way to provide customers with “Compliance with safety regulations and machine directives.”



ITG: The Roadmap also provides a gap analysis that compares the importance of Customer Drivers and fluid power's ability to meet the need expressed by that driver. Weight reduction and increased power density is the one area where fluid power's ability to meet the need exceeds the importance to customer markets. Why do you feel that's the case?

EL: Power density has traditionally been one of fluid power's strongest attributes. Compared to other technology options, the power-to-weight ratio that hydraulics and pneumatics offer is unmatched. I think the gap analysis in the Roadmap reflects this strength. Especially in the mobile equipment markets, fluid power currently provides more than enough power density to meet the needs of those customers.

ITG: Based on the analysis, where do you believe the greatest unmet needs are? Who is addressing them? What innovations do you expect to see as a result?

EL: The largest gaps between Customer Drivers and fluid power's current ability to meet them were in relation to the autonomous operation of and the integration of technologies on the customer's machines. To address these gaps, the Roadmap

recommends improvements to fluid power control systems and to fluid power's ability to monitor, gather, and use data from its own systems in ways that add value for our customers.

Since the most recent Roadmap was published, in August 2019, NFPA has been focused on highlighting the latest innovations in these spaces at a series of regional conferences and through its new Fluid Power Forum podcast.

Several presentations and episodes have already focused on the use of IoT technologies in fluid power systems – from real-time condition monitoring to adaptive control environments. Others have and will be focusing on innovative control systems in real fluid power applications, especially in the realm of automating hydraulic functions on mobile machines. Over the next few years I believe we will see some remarkable advancements in these areas.

ITG: One of the main Capability Improvements highlighted in the plan was to Improve fluid power control systems (including through electrification). What makes improving this capability achievable, and how does it help customers?

EL: Electrification is often described as a major disruptor in the fluid power industry, but it really depends on what you mean by "electrification." Industrial hydraulic systems have always been "electrified" in the sense that it is an electric motor that generally serves as the prime mover in those systems. The new trend, driven mostly by environmental concerns, has to do with "electrifying" mobile machines – which either means replacing the internal combustion engine with an electric motor for the machine's propulsion while keeping hydraulics for its actuated work functions, or replacing both the internal combustion engine and the hydraulic system for entirely electro-mechanical solutions.

The Capability Improvement in question incorporates the research and development needs associated with this and other changing environments. Most notably, it focuses on the development of novel control architectures and algorithms that will allow hydraulics to flourish in this evolving hybridization of technologies on mobile machines. Some of these new control systems can likely be imported or adapted from best practices in industrial hydraulic applications, but some will need to be created for the unique demands and realities of the mobile environment.

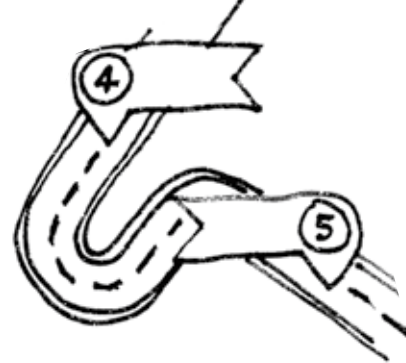
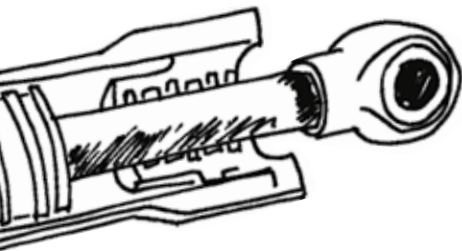
HOW DOES ARTIFICIAL INTELLIGENCE INFLUENCE FLUID POWER SYSTEMS?



Trelleborg Sealing Solutions presented on this subject at a recent Fluid Power Industrial Consortium.



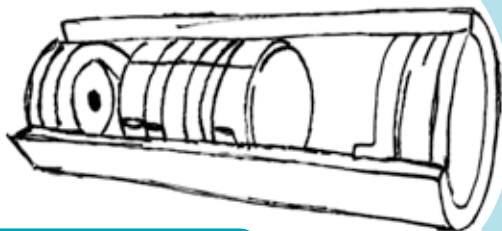
To find out more, go to:
<https://www.tss.trelleborg.com/cognitive-sealing>



In terms of serving the needs of customers, successfully hybridizing hydraulic work functions with electric propulsion on mobile machines can give those customers the best of both worlds – lowering the environmental impact while maintaining the needed power density that hydraulics offers.

ITG: How do you anticipate the next NFPA Roadmap will differ from this current version?

EL: It is extremely difficult to predict the future, but one area we would like to improve upon is to include even more customers in the road mapping process. Those who participated in developing the current Roadmap were pivotal in creating a document with a lot of utility, both for them, and for their fluid power suppliers. Because fluid power serves such a diverse customer market base, we would like to include an even greater diversity of customers in future Roadmaps. Our process is open to all who are interested in participating. ▽



BIOGRAPHY

Eric Lanke

Eric Lanke is the President and CEO of the National Fluid Power Association, a trade association of more than 330 organizations serving the hydraulic and pneumatic industries.

He is responsible for setting NFPA's strategic direction, and overseeing the programs and communications needed to achieve its objectives. He also serves as the President and CEO of the NFPA Education and Technology Foundation, an affiliated charitable organization that supports outreach, education and research programs in fluid power.



Want to contribute to the next NFPA Roadmap? Contact Eric Lanke via email: elanke@nfpa.com

MORE INFORMATION

Check out the Fluid Power Forum podcasts



Visit the Fluid Power Forum Podcast to hear episodes on the innovative technologies in fluid power systems and more:
<http://fluidpowerforward.libsyn.com>

ABOUT THE NFPA

Founded in 1953, the National Fluid Power Association (NFPA) focuses exclusively on fluid power technology with members representing the entire fluid power supply chain.

Headquartered in Milwaukee, Wisconsin in the US, the NFPA began with 35 fluid power companies at the inaugural meeting on May 1, 1953. Its membership has now grown to over 340 companies with an ever-growing impact toward ensuring fluid power is a customer's technology of choice.



To learn more about the NFPA, and to download the complete 2019 Technology Roadmap, visit:
<https://www.nfpa.com/home/workforce/Fluid-Power-Industry-Roadmap.htm>
or scan the QR code.

The NFPA and Trelleborg Sealing Solutions

As a Supplier Member of the NFPA, Trelleborg Sealing Solutions donates to the organization's PASCAL society and actively participates in several committees, including the:

- Supplier Leadership Council
- Future Leaders
- Education Committee
- FAMTEM hubs
- Fluid Power Challenge

The Fab Four

JPF10



JPF20



JPF30



JPF21



Sealing in semiconductor processes is challenging, and this rapidly evolving industry is becoming ever more demanding. Listening to the voice of the customer and to address the requirements of critical front-end processes, a major R&D investment has resulted in four new cutting-edge Isolast® materials with market-leading properties that answer all semiconductor fab requirements.

By Donna Guinivan

**DR. MURAT GULCUR,
MATERIAL DEVELOPMENT
MANAGER FOR
SEMICONDUCTOR,**

gives us information about the booming semiconductor sector and introduces the new Isolast® PureFab™ range.



SEMICONDUCTORS ARE INTEGRAL TO ALMOST ALL THE ELECTRICAL AND ELECTRONIC EQUIPMENT that we use

in our daily lives. They are fundamental to our computers and mobile phones, but they are also behind other less obvious applications, such as the advanced functions in our cars and even creating shopping lists from our fridge.

Growing market

The history of these little pieces of magic dates to 1947, when a group of engineers at Bell Labs in the US, made the first transistor. The original integrated circuit (IC), which consists of numerous transistors on a single 'chip' of silicon, was made by Texas Instruments in 1958. In 1960, the first metal oxide semiconductor (MOS) was produced by engineer Jack Kilby.

In just 60 years, the semiconductor industry has grown to a power house that will generate, according to Statista, just over 433 billion US dollars in sales worldwide in 2020.¹ Stimulated by the booming innovations in Artificial Intelligence in all sectors, as well as 5G, autonomous driving, the Internet of Things and Big Data, by 2022, PricewaterhouseCoopers predicts that the market will be worth 575 billion US dollars.² Fortune Business Insights projects it to reach over 730 billion US dollars by 2026, exhibiting a compound annual growth rate of 5.2% from 2019.³ →

Check out the new semiconductor section of our website at:

<https://www.tss.trelleborg.com/en/your-industry/semiconductor>





SEMICONDUCTOR DEVELOPMENT AND MANUFACTURING SOLUTIONS

The state-of-the-art manufacturing techniques and facilities of Trelleborg Sealing Solutions help make product designs a reality.

We've invested in the latest manufacturing technologies to provide the most advanced solutions, which bring optimized product designs to the semiconductor market.

Decades of experience have led us to develop new and improve existing methods for producing innovative and reliable products. In particular, these include leading-edge micro-molding technology, cleanrooms and our unique FlexiMold™ process.

Continual miniaturization

The technology behind semiconductors has evolved significantly over time, particularly around their miniaturization. In 1965, Gordon Moore, co-founder of Intel, said that the number of transistors that would fit on a given area of silicon would double every two years. A few years later he revised his statement, which is now known as "Moore's law", and said that the number of transistors per integrated chip would double every 18-24 months; an astonishing prediction that has so far proved right.

In the very first integrated circuit, there were only 16-transistor chips with a feature size of 40 micrometers (40,000 nm), about half the width of a human hair. On today's ICs there are billions of them, which are smaller than 10 nm, or a hundred millionth of a millimeter.

Microchips are manufactured in semiconductor fabs, which are essentially giant cleanrooms with extremely expensive specialized production equipment. Much of this equipment relies on critical sealing that can stand up to the particularly harsh conditions of fab processing. It is paramount that seals do not shed particulates or generate gases during operation, as this would cause damage to minute electronic components, so called killer defects.

Extending the life of seals is key to lengthening planned maintenance intervals. This can reduce total cost of ownership in semiconductor fabs, but even more importantly, optimize wafer output. Every second counts on these high-

volume production lines, and emergency downtime must be avoided.

Challenging requirements in difficult sealing environments

The manufacturing process behind semiconductors has been down to the nanoscale for some time and is now pushing the boundaries of physics, with the most advanced technology node as of today down to 5 nm, just above the width of a hemoglobin molecule, with 3 nm on the horizon. At this scale, purity, cleanliness, and minimum contamination are vital to microchip manufacturing, as transistors continue to be miniaturized and each wafer is packed with hundreds of billions of them.

Particles that cannot be seen by the naked eye can lead to defects on wafers. Spotting the source of contamination and cleaning the wafers can cause significant loss of time at the front-end of the semiconductor manufacturing process. Moreover, metallic impurities in parts per billion (one billionth of a gram) can change the electrical properties of a wafer and therefore cause dysfunctional microchips.

Another factor that increases the challenge in semiconductor sealing, is that, unlike other industries, such as aerospace and oil & gas, there are no standards for sealing that are widely used. This is mainly because each chip manufacturing fab has its own process conditions and gasses optimized for its own products. Requirements for sealing materials are therefore very different and there is no 'one size fits all' solution.

FFKM becomes the only solution

Extreme temperatures and chemicals used in harsher processes mean only perfluoroelastomer (FFKM) can stand up to process environments. FFKMs have the elasticity of an elastomer and very similar chemical resistance to a Polytetrafluoroethylene (PTFE) material.

We've always had a strong range of semiconductor options in our Isolast® PureFab™ FFKM range. Recently we decided to expand our offering and have developed four market leading materials that are completely in line with today's and more importantly, the developing needs of tomorrow's fabs.

The new leading-edge materials address the requirements of some of the most difficult sealing environments created by semiconductor manufacturing processes, whether it is in plasma, extreme high temperatures or the destructive chemicals in wet processes. Sealing in plasma processes was a particular challenge when it came to material development.

Plasma resistance

Plasma is an ionized gas consisting of positive ions, radicals and free electrons in proportions resulting in no overall electric charge, typically at low pressures, as in the upper atmosphere, stars, and fluorescent lamps. It is widely used in semiconductor processes for etching or activation of chemicals.

FFKM base polymers are fully organic, and therefore their plasma resistance is very low. To improve this, a lower erosion ingredient - usually fillers - is blended into the FFKM formulation; filler particles shield the polymer matrix from plasma exposure, hence improving the plasma resistance of the material.

Various types of fillers can be used in FFKM formulations. Each one of them has some advantages and disadvantages over the others, therefore it is crucial to select the correct sealing material for each specific semiconductor process.

Fully organic solutions

Organic fillers provide higher purity and better particle performance and therefore less contamination. The FFKM polymer and organic fillers form gaseous molecules when they are exposed to plasma. These gaseous substances can be pumped away by a vacuum, meaning these materials provide a very clean processing environment.

Part of our development process for the new semiconductor materials focused on trying to engineer a material that operates effectively in plasma using organic fillers. This resulted in Isolast® PureFab™ JPF10, which is one of the best performing fully organic materials on the market. It provides the sealing characteristics required by the highly demanding semiconductor processes to manufacture the most advanced microchips.

The benefit of a fully organic composition is that the material has an unrivalled low level of particle generation and excellent outgassing performance, increasing process yields and lowering the total cost of ownership of semiconductor processes. It offers excellent high temperature sealing performance and purity.

In some highly critical semiconductor processes, the requirements of a sealing material can be even more stringent. For example, if a process node is below 10 nm even higher purity may be needed if the elastomer part is in close proximity →

OUR SEMICONDUCTOR MISSION

At Trelleborg Sealing Solutions, we support our customers in the global semiconductor industry with innovative solutions designed to accelerate their business by maximizing yield and minimizing overall cost of ownership.

We do this by forming lasting partnerships with customers to design, prototype, manufacture & deliver unique, high-performance engineered polymer solutions for the most demanding semiconductor applications.

We combine cutting edge, high purity materials with established advanced engineering capabilities to deliver superior performance & service for our customers.



1 <https://www.statista.com/statistics/266973/global-semiconductor-sales-since-1988/>

2 <https://www.pwc.com/gx/en/industries/tmt/publications/global-tmt-semiconductor-report-2019.html>

3 <https://www.globenewswire.com/news-release/2020/03/02/1993314/0/en/Semiconductor-Market-to-Reach-USD-730-29-billion-by-2026-Growing-Adoption-of-Electronics-to-Augment-Growth-states-Fortune-Business-Insights.html>

→ Find out more about these new leading-edge materials by going to www.tss.trelleborg.com and downloading our flyers on these innovative compounds.

to the wafers. To maintain volume wafer output, a specially formulated ultra-pure FFKM translucent material without any filler may be required.

In these situations, Isolast® PureFab™ JPF30 can meet extreme purity requirements while offering unrivalled high temperature performance and sealing integrity compared to other translucent FFKM materials in the market.

Inorganic Solutions

Inorganic fillers can be mineral- or synthetic-based and these provide excellent plasma resistance compared to organic fillers, as they have strong crystal structures.

However, if the wrong type of filler or material is specified for a particular semiconductor application, it can cause more damage than the benefit provided. For instance, using coarse particle size fillers or an excessive amount in the formulation, can cause particulation when exposed to plasma even though

ABOUT ISOLAST® PUREFAB™

Isolast® PureFab™ is the Trelleborg Sealing Solutions brand for its proprietary range of semiconductor materials, which provides extreme purity and performance. The compounds undergo significant testing to prove their properties. Additionally, all parts are manufactured, cleaned, and packaged in cleanrooms to avoid contamination by particles from the outside world.

The Fab Four

1 ISOLAST® PUREFAB™ JPF10

A fully organic formulation for use in the most critical semiconductor processes. The material offers extremely low trace metal content and excellent vacuum integrity under aggressive process conditions and temperatures over +300 °C / +573 °F, as well as outstanding plasma resistance in a wide range of process gasses including NF3. Low particle generation and excellent outgassing performance means Isolast® PureFab™ JPF10 can increase process yields and lower the total cost of ownership of semiconductor processes.

Applications

- Deposition processes: PECVD, HDPCVD, PEALD
- Etch processes: ALE, dry etch
- Chamber lid seals
- Gas inlet seals
- Bonded slit valve doors

2 ISOLAST® PUREFAB™ JPF20

A perfluoroelastomer compound with excellent resistance to oxygen and fluorine-based plasmas, exhibiting perfect performance in both radical and ion rich plasmas. With an advanced and superior nanoparticle filler system, Isolast® PureFab™ JPF20 provides the ultimate plasma resistance, while minimizing particle generation.

Applications

- Etch processes: dry etch, ALE, dielectric etch
- Chamber lid seals
- Plasma showerhead and delivery tube seals
- Bonded slit valve doors

the plasma resistance will be high. Therefore, the amount and the particle size of the fillers in the FFKM formulation must be engineered carefully.

Isolast® PureFab™ JPF20 incorporates an advanced nanoparticle filler. And due to this, the filler has a very high surface area. This means the amount of fillers in the material is significantly lower than competitive compounds, providing excellent plasma resistance with minimum particulation without compromising the overall purity of the material.

Another fully synthetic filler system is used in Isolast® PureFab™ JPF21 to offer outstanding high temperature performance up to +320 °C / +593 °F and minimum particulation upon exposure to fluorine-based plasmas.

Plasma resistance versus purity

Selecting the correct sealing material for semiconductor applications is very important to achieve the optimum balance between extending the life of the seal and the chances of contamination. As they are exposed to process chemicals, the seals used in semiconductor tools wear over time and it is critical that wafers are not exposed to the contamination produced by worn elastomeric seals.

There is inevitably a compromise between the plasma resistance and purity between different types of materials. However, Isolast® PureFab™ materials are developed to


provide both excellent plasma resistance and purity, maximizing the potential for semiconductor manufacturing.

Innovation for the future

All the 'Fab four' materials were proven in long-term testing in our state-of-the-art laboratories across the globe. Dedicated testing to advance semiconductor material development, included plasma erosion tests in the most common process gasses, long-term mechanical tests, and purity tests including trace metal analysis and outgassing.

In order to raise the bar of the current sealing standards and specifications for semiconductor materials, the results were benchmarked against all major competitive materials to demonstrate superior performance and reduce risks for our customers during new material qualification.

And we won't stop there. We're working with our partner fabs and original equipment manufacturers to keep up to date with changing requirements. Innovation is a core strength of the semiconductor team at Trelleborg Sealing Solutions. For example, vertical integration of our in-house material compounding, manufacturing and design ensures a complete control of the entire process.

We're already working on the next generation Isolast® PureFab™ materials, which will provide "smart" properties to address the most challenging semiconductor sealing issues. 

3 ISOLAST® PUREFAB™ JPF21

A versatile perfluoroelastomer for etch, deposition and thermal processes. It exhibits a superior high temperature capability, which has continuous stability up to +320 °C/ +608 °F with excursions to +327 °C/ +620 °F.

Applications

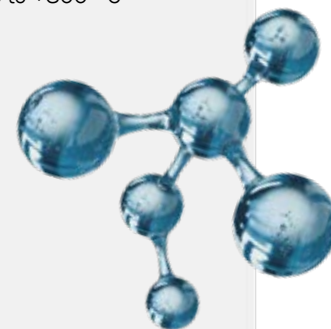
- Etch processes: Dielectric etch
- Deposition processes: ALD, PEALD, SACVD
- Thermal processes: Oxidation, diffusion, RTP
- Chamber lid seals
- Plasma showerhead and delivery tube seals
- Bonded slit valve doors

4 ISOLAST® PUREFAB™ JPF30

A high purity, translucent FFKM compound designed for the most critical semiconductor applications. The material offers a market leading compression set performance and unrivalled thermal stability compared to other unfilled-translucent FFKM materials. This means that Isolast® PureFab™ JPF30 provides long-term, robust sealing integrity at temperatures up to +300 °C / 572 °F.

Applications

- Etch processes: ALE, dry etch, ashing, stripping
- Chamber lid seals
- Gas inlet seals
- Bonded slit valve doors



A 'No Stop' Solution

By rail and road, chemicals are transported across the length and breadth of the US, Europe and Asia. Equipment owners and shippers strive for maximum uptime, and that means seals within valves need to achieve long life despite the media carried being potentially quickly destructive to them. Now, two sealing compounds from Trelleborg Sealing Solutions are proven to make the goals of owners and shippers possible.

By Donna Guinivan

Bottom Outlet Valve (Ball)

Bottom outlet ball valves are attached to the bottom of general purpose tank cars and are used to unload the contents of the tank. These valves are typically operated with a handle that allows for 90 degree (open/closed) rotation.



Pressure Relief Valve

Located on top of tank cars, the Pressure Relief Valve relieves excess internal tank pressure at a specified setting to prevent damage to the tank, other components and personnel.



Angle Transfer Valve

Top transfer ball valves are situated at the top of pressure tank cars and are used for loading and unloading of the contents in the tank as well as to allow air flow into and out of the tank.



COVER STORY

CHEMICAL TRANSPORTATION involves the carrying of media by rail, in ISO tank containers, trucks and Intermediate Bulk Containers (IBC). According to the Association of American Railroads, chemical, petroleum and petroleum product freight accounted for around 20 percent of total North American rail carloads during 2019, equating to just over 68,700 carloads on average per week.¹

Though traditionally, chemical transportation has been strongest in terms of shipments in the North

American region, it is now becoming a global phenomenon. This is partly driven by conversion of shipments transported in drums or chemical tankers to tank containers and considerably, by the growth of transport by tank containers in China.

In 2018, the global fleet of tank containers reached a record high in terms of number of containers operating globally, as well as the overall percentage increase in the global fleet. →

¹ <https://www.aar.org/data-center/rail-traffic-data/>

Universal compatibility in all environments

Prior to transportation, chemicals are pumped into and out of tanks, and within the tanks' valves there are numerous seals. Intrinsicly, the type of chemicals transported will potentially cause sealing materials to prematurely deteriorate with some media being extremely destructive. Zero-leakage is mandatory to avoid any pollution and meet strict regulations.

Thijs Menzel, Segment Director, Chemical Transportation, says, "To make transportation as effective and economical as possible for the carrier, the ideal is that the same valve can be used in the tank whatever the media transported. Irrespective of conditions, seals must provide long life so that downtime, maintenance and valve replacement is minimized.

"To make transportation as effective and economical as possible for the carrier, the ideal is that the same valve can be used in the tank whatever the media transported."

THIJS MENZEL,

Segment Director, Chemical Transportation

"This avoids rework to swap-out the seals in the valves. Though the seals themselves would be relatively low in value, the labor to bring the tank into the shop and perform maintenance, and the lost up-time during maintenance and while waiting for an inspector to sign off on work done, can be costly. Consequently, fewer seal changes can significantly lower the total cost of ownership for an equipment owner or shipper.

"Sealing materials in the valve in the tank must, therefore, be resistant to the maximum number of chemicals that could potentially be transported in the tanks. Add to this challenge the environmental conditions that freight may be exposed to; traveling across deserts in extreme heat or over ice fields at low temperatures, for instance. This makes universal sealing across the full range of chemicals potentially transported, an almost unsurmountable task."



Material characteristics and advantages

About Isolast® J9503 and Isolast® J9567

- Both Isolast® J9503 and Isolast® J9567 offer universal chemical compatibility at acceptable levels within chemicals commonly transported
- Isolast® J9503 provides the best volume change results in the most challenging media, including Ethylenediamine and Glacial Acetic Acid
- Operating temperatures
 - Isolast® J9503 -25 °C to +225 °C / -13 °C to +437 °F
 - Isolast® J9567 -10 °C to +225 °C/+14 °F to +437 °F
- Excellent long-term compression set properties
- Exceptional hysteresis properties
- Superior extrusion resistance
- High resilience and dynamic recovery

Advantages:

- Best and broadest chemical resistance to chemical transportation media providing universal chemical compatibility to chemicals commonly transported
- Optimum seal reliability in both extreme hot and cold environments
- Extended service life
- Minimized total cost of ownership

Harsher media transported

These requirements mean that for transportation of certain commodities, the only possible type of sealing material that can be used is Perfluoroelastomer (FFKM), which exhibits the sealing qualities of an elastomer combined with the chemical resistance of a Polytetrafluoroethylene (PTFE). However, not all FFKMs are made equally. Special properties are needed to stand up to the harshest of chemicals likely to be transported.

This mentions a trend toward transportation of harsher media, not just as a single medium, but as cocktails of chemicals. Again, this means that a sealing material that is as universally compatible as possible is a paramount requirement for owners and shippers.

“A particular example is MTBE, an additive for diesel fuel or ethanol that is a denaturant, which is extremely destructive to sealing materials,” says Thijs. “MTBE prevents ethanol from being consumed as an alcohol, allowing it to be de-taxed by the US Government.

“Also, under the Sulphur 2020 initiative, higher-grade diesel is replacing previously prevalent bunker fuel, and this has MTBE in it. Both of these factors are increasing the number of shipments of ethanol and diesel with added MTBE.”

Testing proves performance

Isolast® J9503 and Isolast® J9567 are existing advanced proprietary FFKM compounds in the Trelleborg Sealing Solutions material portfolio. Based on experience in other segments and with their outstanding media compatibility and sealing performance, we believed that these materials could effectively endure the rigorous conditions faced in chemical transportation over the broadest range of media.

To prove this, Trelleborg Sealing Solutions subjected Isolast® J9503 and Isolast® J9567, as well as three competitive FFKM materials, to an extensive testing program involving the sixteen chemicals most transported. →



- Acetone** – Organic compound that is commonly used as a solvent
- Ammonium Hydroxide** – Solution of ammonia in water that is used as a cleanser and in manufacturing of plastics, rubber, fertilizer and textiles
- Butyraldehyde** – An organic compound that is used in production of plasticizers
- Diethyl Ether** – An ether used as an inhalation anesthetic, non-polar solvent and refrigerant
- Ethanol** – A simple alcohol used in a variety of products and processes
- Ethyl Acetate** – Acetate used in glues, nail polish removers and in the decaffeination process of tea and coffee
- Ethylenediamine*** – Organic compound commonly used as a building block in chemical synthesis
- Ethylene Glycol** – Organic compound used as a raw material in the manufacture of polyester fibers and antifreeze
- Glacial Acetic Acid*** – A water-free acetic acid and a precursor to polyvinyl acetate and cellulose acetate
- Mobil Jet 11** – High performance aircraft-type gas turbine lubricant formulated with a combination of a highly stable synthetic base fluid and a unique chemical additive package
- Methyl tert-butyl ether (MTBE)*** – Organic compound used as a blending component to oxygenate and raise the octane of gasoline
- Nitric Acid** – Mineral acid commonly used as a strong oxidizing agent
- Sodium Hydroxide** – A caustic base and alkali that is used in many industries
- Sulfuric Acid** – Mineral acid commonly used in manufacturing and processing
- Toluene** – Aromatic hydrocarbon used as a solvent in various products, such as paint thinner or contact cement
- Urea** – An organic compound that is an important material in chemicals

* These chemicals tend to be the most destructive to sealing materials.

The tests focused on key criteria effecting sealing performance and the life of the seal, one of the most important being volume change. The smaller the volume change, the better the long-term sealing performance.

In most media, both Isolast® J9503 and Isolast® J9567 exhibited a volume change of less than 5%, a level that is deemed to have little or minor effect on sealing performance. In the media that is most destructive to seals, Isolast® J9503 and Isolast® J9567 performed exceptionally well.

Compression set was also a focus for testing. At +100 °C and +150 °C/ +212 °F and +302 °F, both Isolast® J9567 and Isolast® J9503 performed significantly better than competitive materials. Even at +200 °C/ +392 °F, which is beyond the normal operating temperatures in chemical transportation, Isolast® J9503 performed better than all the competitive materials and Isolast® J9567 better than two of the three.

“Isolast® J9503 is set to be the gold standard for most of the harsher chemical transportation applications in low temperatures,” continues Thijs. “However, if a shipper solely or primarily transports specific chemicals, Isolast® J9567 could provide market-leading chemical compatibility at a more cost-effective level.

“It’s very much horses for courses. To find the optimum material for chemical transportation applications, it is important to consult with a seal supplier that can lend its expertise to specifying the seal type and material that will provide the longest life and best performance, whatever the transportation requirements.”

Service matters

Supplying to the chemical transportation industry is not just about the seals themselves and their chemical compatibility. Service is a critical factor.

“Downtime needs to be avoided,” concludes Thijs. “When equipment requires repair, commodities aren’t moving, and the equipment owner and shipper is losing money. At Trelleborg Sealing Solutions, we offer rapid replacement of seals with short lead times, so that transportation equipment is back on the rails or road as quickly as possible.”

SUCCESSFUL TEST RESULTS FOR ISOLAST® MATERIALS

Trelleborg Sealing Solutions testing focused on key criteria effecting sealing performance and the life of the seal, the most important being volume change. The lower this is, the better the long-term sealing performance.

Superior performance

In all media, both Isolast® J9503 and Isolast® J9567 had a volume change of less than 10%; a level that is deemed to have at its maximum, only a moderate effect on sealing performance. In 12 out of 16 media for both Isolast® J9503 and Isolast® J9567, the volume change was below 5%; a level that is deemed to have little or minor effect on sealing performance.

The Isolast® compounds were back-to-back tested against three competitive products. Two of these competitive compounds displayed a volume change in one of the media above 20%, meaning the material would not be recommended for use in that media.

All testing was conducted against ISO 1817 standards. Hardness and volume change were monitored for an extended period, of 2000 hrs. This testing regime far exceeded the standard requirement, which monitors physical changes in the material over a limited seven-day period.

Significantly better in destructive media

Both Isolast® J9503 and Isolast® J9567 performed exceptionally well in the media that is most destructive to seals—Ethylenediamine and Glacial Acetic Acid. In fact, Isolast® J9503 exhibited the best volume change performance of all materials tested in both chemicals. Two of the competitive materials failed in either Ethylenediamine or Glacial Acetic Acid, rendering both materials incapable of delivering fully universal compatibility with all chemicals potentially transported.



Industry Focus: Robotics

By Jan Sklucky



IN SHORT

- 1** Industrial robotics have replaced humans in hazardous and repetitive work since the 1930s.
- 2** Robotics can create jobs and move people toward more important and higher-level tasks that add value.
- 3** The robotics market is showing solid and consistent growth, with the largest market in Asia.
- 4** Automated Guided Vehicles (AGVs) are being replaced with Autonomous Mobile Robotics (AMRs) as Manufacturing Execution Systems (MES) become more popular.



Industrial robotics can make work safer for people and help to automate dangerous and repetitive work.

An exploration of the history of industrial robotics and future trends

WHEN YOU THINK OF ROBOTS, what first comes to mind? Perhaps Arnold Schwarzenegger's portrayal of a humanoid assassin from the future in Terminator, or Baymax, the friendly healthcare assistant from Big Hero 6?

Robots have alternately been viewed with both fascination and fear by humans, as seen in the many different visions of robots featured in popular culture, through comics, films and books. Regardless of any perceptions of robots, they are both visibly - and invisibly - playing a more prevalent role in our lives.

The beginning of industrial robotics

The earliest industrial robots were produced in the United States in the 1930s. These were modeled on the human arm, designed to have similar types of movement to imitate pushing, pulling, lifting and pressing. Programming was difficult and time consuming, but made repetitive work considered unpleasant for human workers safer, quicker and easier.


The first true industrial robot, similar in appearance to those that we think of today, was 'Unimate' - a portmanteau of 'Universal Automation'. Digitally reprogrammable and capable of dexterous manipulation, the robotic arm was intended to replace humans in repetitive and hazardous

tasks. Though originally created in the 1950s, they weren't widely implemented until the patent was acquired in the 60s by Joseph Engleberger, often considered the 'father of robotics'. In 1961, these were installed in a General Motors manufacturing facility to move hot die-cast metals and weld car components together, changing the face of automotive manufacturing forever.

The Unimate company had very little competition until the 1970s, when the market was shaken up by several large Japanese conglomerates manufacturing similarly styled robots. This enthusiasm rapidly spread to Europe, leading to the first commercially available micro-processor-controlled robot. By the end of the '70s, the industry was booming, and US competitors and start-ups began to enter the market.

The perils and the positives

The term 'Robot' is from the Czech word for 'forced labor', originally used in a play by Karel Čapek about a mechanical workforce that rebelled against their human creators. Perhaps justifiably, many workers have a fear of automation, and the loss of jobs that can come with it. "But actually, we needn't consider robots in this way," says Yusuke Takita, Team Leader, Marketing Department at Trelleborg Sealing Solutions in Japan. "They can create more jobs and move people away from repetitive or hazardous tasks to more important and higher-level jobs that truly add value."



“Use of robots can advance humanity as a whole, especially when working alongside them.”

YUSUKE TAKITA,

*Team Leader, Marketing Department at
Trelleborg Sealing Solutions in Japan*

Humankind already makes good use of robots to operate in hostile environments. The industrial arms mentioned previously can handle high temperatures and poisonous atmospheres, but as a more extreme example, consider the Exploration Rovers that traversed the surface of Mars to provide scientists with valuable data about the planet. “Use of robots can advance humanity as a whole, especially when working alongside them. And, as costs fall, more menial tasks can be further automated,” says Yusuke.

From healthcare facilities to factories, many tasks could be seen as consuming too much time for a fully qualified worker or doctor. With increased focus over the past decade on increasing efficiency and optimization, freeing people for more important work is crucial. Simple tasks could be performed by a robot that would previously be considered too expensive, with machines designed to reduce repetitive strain injuries or to lift and transport heavy loads, further reducing the harmful impacts that work can have on humans.

WHAT ARE MANUFACTURING EXECUTION SYSTEMS?

Manufacturing execution systems (MES) are computerized systems used in manufacturing to track and document the transformation of raw materials to finished goods. MES provide information that helps manufacturing decision makers understand how current conditions on the plant floor can be optimized to improve production output. MES work in real time to enable the control of multiple elements of the production process (e.g., inputs, personnel, machines and support services).

Source: Wikipedia

Expanding market

Though the market this year shows signs of slowing down due to COVID-19, positive growth is expected in the long-term. In 2010, at least 120,000 robots were installed in factories. Five years later, 254,000 units began their diligent work in production lines across the world. The latest reports state that in 2018, more than 400,000 robots were installed across the globe, estimated at a worth of \$16.5 billion, with the entire industry growing by 6% and further growth expected in coming years.

Even now, 60 years later, the automotive industry is the largest purchaser of industrial robotics. “Thirty percent of industrial robots are being sold to automotive companies. Investments in new modern production methods and increased production capacity in emerging markets have increased demand,” says Yusuke. “But the electronics market is definitely competing for the number one spot now.” →



From working on machinery to operating on people, robots can offer many benefits to society.

“We’re also expecting to see further movement from automation to autonomy” continues Yusuke. “Automated Guided Vehicles, which rely on something like lines, wires or magnets to navigate are more often being replaced by Autonomous Mobile Robotics.”


Unlike AGVs, AMRs don’t require supporting infrastructure and are being frequently implemented for picking optimization and fleet management. They need just ‘start’ and ‘finish’ locations and can safely navigate around obstacles, choosing the most efficient alternate route.

Globally, Asia is the largest market for industrial robotics. “Two out of every three new robots in 2018 were installed in Asia,” comments Yusuke. And, when looking at the figures, it’s hard not to notice that five countries stand out. “China, Japan, the US, the Republic of Korea and Germany actually account for 74% of global robot sales.” says Yusuke.

2020 and beyond

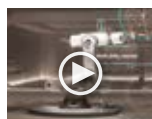
As Industry 4.0 encourages manufacturing trends that incorporate more automation and data-driven approaches (the so-called ‘fourth industrial revolution’), the robotics industry is the natural forerunner for many of these systems.

“We’re seeing increased desire for complete autonomy using Artificial Intelligence (AI), not just in production, but ordering and transporting, now termed Manufacturing Execution Systems, which tie in with Enterprise Resource Planning (ERP),” says Yusuke. “The robots are fully integrated into the system and improve all the time as more and better data is available and more connectivity is possible. Demand for trainable AIs and upscaling of existing systems is also increasing as companies explore this exciting new field. Much of Trelleborg’s focus is in the already huge industrial robotics market, where we can add value to new applications requiring precise motion with advanced specifications.

As costs come down, more personal-use robots are entering the market with interesting new purposes. In the not-so-distant future, you could have a robot ‘coach’ that analyses your form while weight-lifting or playing sports and tells you how to correct your posture and form, while another robot teaches your children in school. “Healthcare and Medical can certainly gain from recent technological innovations. AI-based, data-driven diagnostic systems, personalized medicine and assistants for the disabled are more than possible now,” finishes Yusuke. 

MORE INFORMATION

Find out more about how Trelleborg Sealing Solutions supports the robotics industry.



Watch the film:
Sealing Solutions for Robotics Applications at
www.tss.trelleborg.com/films



Read the brochure
www.tss.trelleborg.com/literature

VIP Access



Get a behind-the-scenes look at how Trelleborg Sealing Solutions operates.

By Jan Sklucky

The blending of digital and offline is revolutionizing how business is carried out in all industries and market segments. A rush to innovate and take advantage of newly developed technologies draws together the best of both worlds, offering unique and futuristic experiences that exceed the capabilities of a purely digital or purely concrete experience. Trelleborg Sealing Solutions has been involved in creating and using digital tools as soon as the concepts were possible, and in 2019 launched its ground-breaking and industry-leading Virtual Tour.

Removing restrictions

Any tour has restrictions on where you can go, such as hazardous or dangerous areas and active production floors. Trelleborg Sealing Solutions thought that using new digital platforms, it could allow its visitors access that wouldn't usually be possible.

"We wanted to find new ways to really show our customers how we work and what we're doing, with a deep dive behind-the-scenes of our facilities," says Konrad Saur, Vice President - Innovation & Technology at Trelleborg Sealing Solutions. "Some areas are just not accessible during tours, and perhaps there are particular reasons a customer can't get to a facility physically. It's not necessarily a replacement for a site visit, but certainly an enhancement - permitting access beyond what's usually possible," →

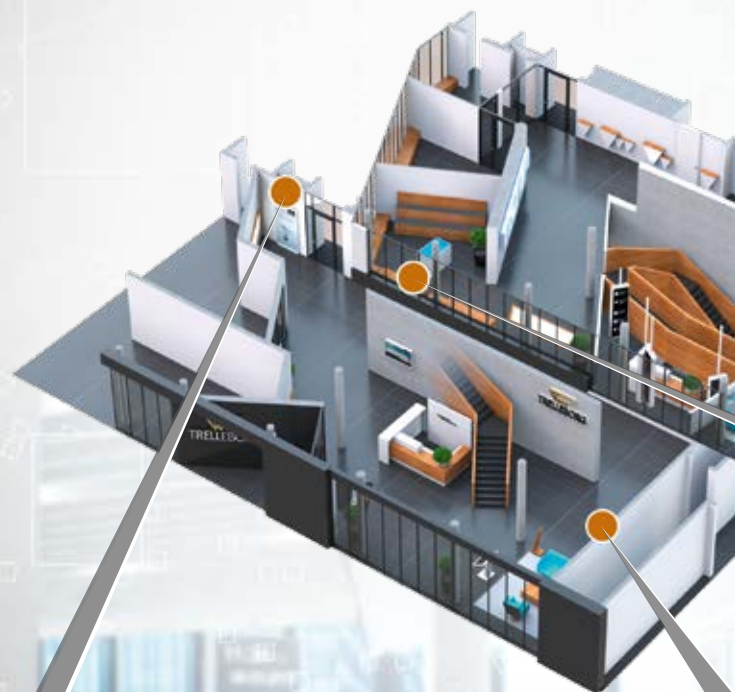
Personalized experience

Visitors are guided around the facility by a 'digital moderator', a chaperone to help you to build your own personalized tour, focusing on what you want to see or interact with in a 360° virtual environment enriched with additional digital content. For the most important topics, extra help is needed to explain the subject clearly.

"Our experts feature prominently throughout the tour, speaking on a wide range of topics and offering their unique insights. These focus on our innovations and where we can apply our expertise as a company. If a customer is interested, extra webinars are available for even more detail on selected topics.

And, if any questions remain, customers can live chat with experts who are on hand to answer any other queries – a feature completely unique to this kind of platform," says Holger Baur Director European Marketing & Communications at Trelleborg Sealing Solutions.

Trelleborg Sealing Solutions has a lot to show, with a huge breadth of products and knowledge in many applications, and the tour provides a unique way to get up-close in an interesting fashion. Taking the tour allows you to not just see innovative products and materials but go inside state-of-the-art R&D laboratories and Trelleborg facilities.



Window Into the Future



Automotive and e-Mobility

Rotary sealing in the latest automotive and e-Mobility applications requires materials and designs that withstand increasingly high speeds. Explore Trelleborg's Liquid Silicone Rubber (LSR) components and capabilities. Then see how Trelleborg can support electric vehicles with high speed rotary seals to achieve longer ranges with lower energy consumption.

TAKE THE TOUR

Experience Trelleborg's facilities and capabilities in 360°. Visit www.tss-virtualtour.com to take the tour now! Simply sign up with your company email to get instant access.





Off-Highway & Agricultural

Watch a webinar on the innovative Cassette Seal CSL 1500 that improves service life. See up close how Turcon® Roto L revolutionizes sealing of Central Tire Inflation Systems (CTIS), only operating when its needed to reduce friction, energy and fuel consumption. Finally, get an overview of the latest industry trends with our expert Clarissa Maier in a discussion with Dr. Gesine Herzberger.



Stein Am Rhein

The center of silicone excellence for Trelleborg Sealing Solutions opens its doors for you to explore this high tech, precision manufacturing facility. Learn about what goes into the tool and mold designs that manufacture products with complex geometries, and see automated multicomponent injection molding in action!



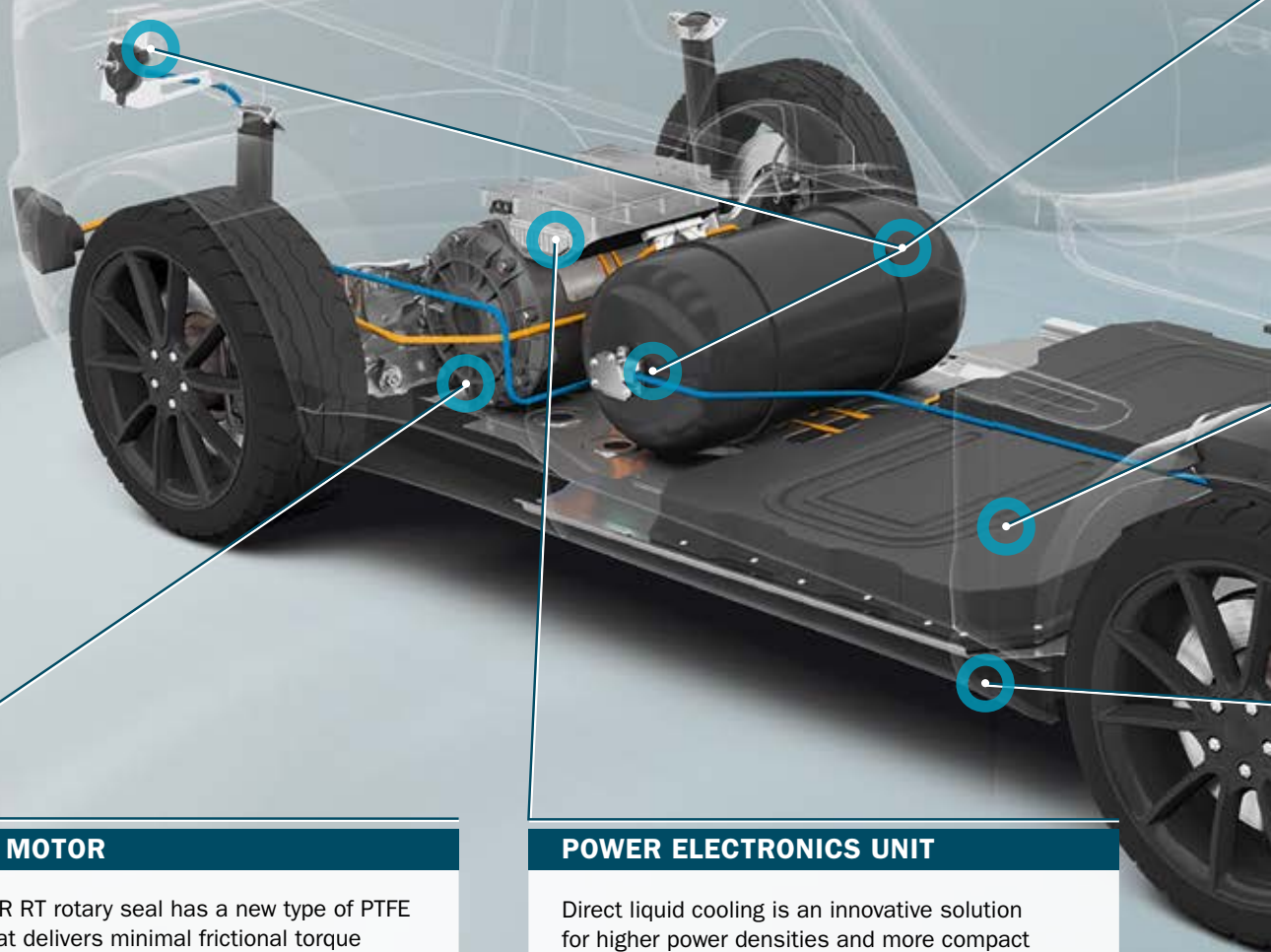
Fluid Power

Find out about cutting-edge research into counter surfaces and coating processes, and get a primer on the revolutionary field of Lubrication Management, rethinking sealing concepts as a whole. This time, Dr. Gesine Herzberger has a conversation on the latest industry trends and topics with Dr. Ing Mandy Wilke, Senior Manager Global Technical Management at Trelleborg Sealing Solutions.



Moving with eMobility

Trelleborg Sealing Solutions continues to support the growing global eMobility market as an advanced sealing solution supplier. By combining cutting-edge R&D and modern digital processes, development times are reduced, leading to higher performance at a lower total cost.



ELECTRIC MOTOR

A HiSpin™ PDR RT rotary seal has a new type of PTFE sealing lip that delivers minimal frictional torque with high static and dynamic tightness. Sealing is independent of the direction of travel at high speeds of more than 60 m/s /134 mph, while combining grounding into the same product through innovative conductive materials.

POWER ELECTRONICS UNIT

Direct liquid cooling is an innovative solution for higher power densities and more compact modules. Pressure activated profile seals guarantee safe and efficient sealing for the power electronics. A narrow seal design increases the cooling surface, giving increased performance.

HYDROGEN SYSTEM

Many applications within the fuel cell system require gas tightness at low temperatures and high pressures. Newly-developed PU and FKM materials, specially formulated for these applications, combined with our established seal designs provide the ideal solutions. These low temperature compounds solve known issues with the typical glass transition point shift.

SENSORS

Multifunctional components combine sealing and housing functions, reduce critical interfaces and lower total system cost. Multicomponent parts can be manufactured from different material combinations, such as LSR, PA66, steel, PPA, EPDM, and many more.

BATTERY BOX

Seals for battery housing and service lids

The high-voltage battery needs special protection. Trelleborg offers individualized sealing solutions to fit many different lid and battery case geometries. These enable inexpensive and fully automated assembly and simplify disassembly when the battery is serviced.

- For aluminum, steel and plastic housings
- Tightness according to IPX9K and IPX7, and flammability compliant with UL94 V0 and HB
- Special seal design enables thin-walled lid and reduces number of screws required

Seals for high voltage connectors

Special products provide tolerance compensation between plastic and metal housing, combining two or three dissimilar materials, including rubbers, metals and plastics, tailored to the application. Seals produced comply with flammability requirements UL94 V0 & HB and provide electrical insulation.

THERMAL MANAGEMENT

Thermal management is essential for sensitive electric systems. Heat dissipation and protection from cold temperatures is a challenge when controlling liquid flow paths. Trelleborg Sealing Solutions offers individualized solutions for critical sealing of three-, four- or five-way thermal management control valves, coolant proportional valves and electric coolant pumps. Multicomponent solutions make assembly easier, reduce installation space and deliver low torque, long-life sealing with during dynamic movement of ball valves.

When One is Better than Many

By Donna Guinivan

SILICONE: IDEAL FOR MEDICAL DEVICES

Silicone is ideal for medical devices and equipment, not only because it is inert, biostable and biocompatible with favorable physical and haptic attributes, but also because it can be processed in a multitude of ways.

This encompasses methods, such as, extrusion, molding, casting, coating, and immersion; on its own or in combination with other materials and substrates, including API (Active Pharmaceutical Ingredients).



As medical devices become ever more sophisticated and smaller in size, the challenge for the component manufacturer is how to fit multiple functions into a limited space. Multicomponent LSR technology offers a solution to this that, in addition, provides designers with the latitude and flexibility to enhance their applications. Ursula Nollenberger, Product Line Director - LSR Components and Healthcare & Medical takes you through the process.



ONE OF THE PRIMARY ADVANTAGES OF multicomponent liquid silicone rubber (LSR) technology for medical devices is that complex geometries can be created. These can combine multiple separate elements that would have been assembled into a single component.

Eliminating assembly

The cost and risk associated with assemblies, such as potential leak paths or undesirable spaces for bacterial growth, are therefore eliminated. The technology also provides the developer with the ability to create considerably more robust and cost-effective solutions that are of higher integrity and which can fit into a smaller design envelope.

In addition, assemblies can be value engineered, something that offers tangible benefits to the device manufacturer in terms of improved performance, prevention of contamination, the opportunity for automating a customer's production lines, elimination of risk of misassembly, lower inventories and ultimately, reduced total cost of ownership.

Involvement from concept stage

For new multicomponent LSR applications, most customers involve us as early as possible in the development process; from the concept stage so applications can be optimized for market and manufacturing. Trelleborg Healthcare & Medical provides customers with access to specialists in product design and functional modeling, material selection, as well as manufacturing, quality, and validation engineering, to help accelerate time to market.

Part functionality and maximizing performance of an application are primary considerations in the design, but also, right from the earliest point possible, Design for Manufacturing (DfM) considerations should be included along with solutions for automation, creation of flash-less parts, waste-free production, in-process quality checks, batch by cavity and packaging. This and short cycle times, makes the production of

ABOUT MULTICOMPONENT LSR TECHNOLOGY

Multicomponent LSR technology is the simultaneous injection of Liquid Silicone Rubber in combination with engineered plastics and potentially other substrates. In what is also commonly referred to as 2K, 2shot, 2C LSR, multicomponent injection molding, or co-injection, it is used to develop innovative solutions, combining two or more individual materials into one fully bonded component in hard-soft and soft-soft combinations. This is challenging due to the differing process requirements of LSR and other substrates.

extremely complex multicomponent LSR components possible in the high volumes needed for medical devices, which at full series demand could reach tens of millions.

Automation and quality

At Trelleborg's multicomponent LSR facilities, automation is taken to the ultimate level of process efficiency and quality consistency. Most parts are untouched by human hands until packaged, all in a 24/7 fully automated operation.

For medical devices quality is paramount, and the holy grail of quality is to ensure quality in process rather than have post-production quality checks. Depending on customer requirements, this can be in an 'uncontrolled' or controlled environment of class 100,000, ISO 8 or class 10,000, ISO 7 cleanrooms. →



Quality is equally considered in the holistic approach, with certified quality systems and process controls built into the production process based on a mindset of producing 100% good quality. The ability to segregate suspect product effectively with minimal disruption in the case of a quality concern, is key to a high-volume, fast-paced production process. In-line quality checks are electronically recorded allowing full traceability, with products separated by cavity. Any issue can therefore be isolated to just a small number of components and delivered quality from the production line can be checked for that batch in detail.

Good manufacturing practice

Fundamental to the disciplines of any high-quality manufacturer involved in supplying 'clean' product, whether from within or outside a classified cleanroom, is a Good Manufacturing Practice (GMP) discipline firmly rooted in the facility's quality systems. Industry guidelines provide minimum requirements that a manufacturer must meet to assure that products are of high quality and do not pose any risk to the consumer or public.

It is therefore critical for any manufacturer to apply due diligence in the establishment of GMP standards so that they are appropriately set to the specific application concerns and risks of parts produced. Standards, for example relating to medical devices, may vary depending on whether production relates to a low risk Class 1 device or a long-term implant.

“At Trelleborg’s multicomponent LSR facilities, automation is taken to the ultimate level of process efficiency and quality consistency.”

URSULA NOLLENBERGER,
*Product Line Director - LSR
Components and Healthcare
& Medical*



The future

In summary, Trelleborg Healthcare & Medical, through its leading edge multicomponent LSR technology and holistic approach to design and manufacturing can provide medical device manufacturers with real benefits, especially in terms of miniaturization of devices and their integrity. As medical applications become ever more sophisticated and smaller, multicomponent LSR components will play a significant part in the future of medical devices. 



Future Sensing

Are IoT and Artificial Intelligence just hype? For Trelleborg Sealing Solutions, they're a reality as we work on actual projects that are already bringing benefits to our customers. One of these was a three-way collaboration between Trelleborg Sealing Solutions, Vapo and Ampelmann. Here we talk to some of the people involved.

By Donna Guinivan

A three-way partnership is showing how big data can work to develop next generation solutions. Domenico Tucci (DT) interviews Vapo Hydraulics and Ampelmann Operations



Views from Ampelmann Operations

Ampelmann has an established presence in every major oil & gas and offshore wind market. Jochem Pieterse (JP), Head of Reliability at Ampelmann Operations, talks about the project.

DT: Can you tell us what Ampelmann does?

JP: At Ampelmann we have a solution for safe transfer of people and cargo to offshore structures; a typical assignment for helicopters and crew transport vessels, for instance.

DT: It was certainly a fascinating project for me. It was the first time that I have encountered this type of application. On the gangways that you provide you have cylinders, which are fitted with numerous sensors gathering data on how these cylinders are operating. That's the data that you've supplied to us. Our engineers and our data scientists worked with your team. What were you hoping to achieve?

JP: We have data available from all sensors in our systems, and this is mainly used to operate them. In the project, we wanted to use this data for other applications, such as the prediction of failures and the condition monitoring of critical components.

DT: What about initial results?

JP: In terms of results so far, we have some good first algorithms that need to be statistically proven, as well as some key sensor data that was missing from the data sets. These can now be added to new cylinders to give a more comprehensive field of data sets.

DT: I think that both companies have learned from this project and I am looking forward to what we are able to achieve now that we have made changes to the way data is being collected. Hopefully, we will be able to help optimize the performance of your cylinders and predict any possible problems going forward.



What Vapo Hydraulics had to say

Vapo Hydraulics has been involved in custom-hydraulics since 1974 in several industries. Wouter Vullers (WV) is the Commercial Director at Vapo Hydraulics NV.

DT: What trends are you seeing in the hydraulics market currently?

WV: We see more and more customers are interested in adding sensors to their hydraulic equipment. This is not only in offshore environments, but also on dredging equipment and civil works, like bridges, as well as on industrial equipment, for example presses.

These sensors can not only be used in normal operating conditions to monitor capacity, speed or force control, but also to collect and analyze data to prevent certain failure modes.

This helps customers avoid significant costs associated with downtime, as well the replacement or repair of key components.

DT: What are the sort of conditions that you are seeing our seals and bearings facing within hydraulic environments?

WV: In the offshore environment they face extreme temperatures and need to survive in saltwater. They are also subjected to a dynamic load spectrum that influences both seals and bearings.

DT: Putting the collective minds together of the engineers, data scientists and IoT specialists of Vapor Hydraulics, Amplemann Operations, and Trelleborg Sealing Solutions, we've managed to deliver value. Would you agree with that statement?

WV: This three-way open communication gave us all a chance to bring our experts to the table to create and stimulate us to move to the next level of root cause analysis.

For our company, this helps us to develop new products and update existing ones, so we can support the customer to produce a better product in the future.

MORE ABOUT COGNITIVE SEALING



Go to our web page dedicated to Cognitive Sealing at www.tss.trelleborg.com/cognitive-sealing to find out more.

Here you can find the interviews with Vapo Hydraulics and Ampelmann Operations, a video on Cognitive Sealing, as well as a Tech Talk and podcast by the Trelleborg Sealing Solutions manager for digital transformation, Johannes Kunze von Bischhoffshausen.



Strengthening the Weakest Link

As IoT and big data can offer significant benefits in terms of improving product performance, lowering total cost of ownership and extending application life, it is becoming an area of focus in almost all industries. This includes the off-highway industry. Johannes Kunze von Bischoffshausen, the Trelleborg Sealing Solutions manager for digital transformation, tells us more.

Keeping equipment available

In the off-highway industry, keeping equipment availability as high as possible is crucial. Planned downtime needs to be kept to a minimum and unplanned downtime should be avoided. Therefore, predictive maintenance is one of the big value drivers in the digitization of this industry. Maintenance must not be too late, as this incurs extremely high costs in downtime, nor too early, to reduce maintenance costs overall.

Even though we at Trelleborg provide the best sealing solutions possible for even the harshest of off-highway applications, the seal is still often the weakest link in a hydraulic system. In the Cognitive Sealing approach, we use artificial intelligence to calculate a health score by analyzing sensor data that is captured around the sealing system.

A health score

This is done using artificial neuro-networks, an advanced technique used in autonomous driving, for instance. This is needed as you cannot simply look at one sensor signal but must combine the data from different sensors, such as temperature, pressure, and cylinder movement. An algorithm then calculates the health score for the sealing system.

We are currently focusing the Cognitive Sealing approach on those industries and applications in which there is a very high cost of downtime and maintenance. In off-highway applications, most maintenance happens on a fixed maintenance cycle and generally the seals are changed in this cycle.

Automation driving need for intelligent systems

However, there is one big trend in the off-highway industry which makes management of the sealing system and monitoring seal health much more important, and that is automation. This is being brought into equipment for mining and excavators, for instance. Without a driver, you need another way to monitor the system with better remote monitoring.

This is an extract from a podcast produced by OEM off-highway magazine.

WATCH THE PODCAST IN FULL

Dr.-Ing. Johannes Kunze von Bischoffshausen joined the July 22 OEM Off-Highway video podcast to discuss how Trelleborg uses artificial intelligence to improve predictive maintenance to help prevent unplanned downtime in heavy equipment. Interest in this topic is fueled by growth in the autonomous equipment market. To view the podcast, follow the link below www.tss.trelleborg.com/cognitive-sealing



Shaping (Y)our Future Together



Virtual Conference 2020

Today, virtually is the way we are communicating, and Trelleborg Sealing Solutions in Germany set a milestone by holding our first virtual conference.

The conference, with the slogan 'Shaping (y)our future together', took place on July 8 and around 500 attendees experienced digitally how technology, society and the economy will be shaped in the coming years by disruptive developments and opportunities in supercomputing, e-Mobility, platform companies and artificial intelligence.



Watch the virtual conference

Recordings of the German event are available at www.tss-virtualconference.com

Following the success of this conference another Virtual Conference is planned for Europe.





Jürgen Bosch (BU President Global Aerospace & Marketing Europe, Trelleborg Sealing Solutions) and Christoph Ulusoy (CIO, Ionity) in the panel "World electrified – The future of electrification"



Prof. Dr. Konrad Saur (Vice President Innovation & Technology, Trelleborg Sealing Solutions) and Björn Knoop (Management of Sustainability, fritz-kola) in the panel about "Engineering a more sustainable environment"



Illustrator Andreas Gartner in action.



Tech-moderator Sarah Yvonee Elsser behind-the-scenes



Keynote speakers included:

Entrepreneur and technology pioneer **Karl-Heinz Land** introduced key sustainability concepts.



Expert on supercomputers at the University of Stuttgart and head of its high-performance computing center, **Prof. Dr. Michael M. Resch**, outlined how machine learning can accelerate the search for new solutions.



Chair of Production Engineering of E-Mobility Components at the RWTH Aachen University and one of the founders of Street-Scooter, **Prof. Dr. Achim Kampker**, discussed electrification.

Sealing Solutions for Fluid Power Applications

Lubrication and sealing are critical areas for the performance of any fluid power application. Therefore, the sealing products that are used within the application are essential for conveying the performance and power required, whether moving earth or manufacturing products.

By Jan Sklucky



BEYOND THE RAW FRICTION PERFORMANCE, seals are expected to prevent leakage, withstand high and low temperatures and pressures, and absorb forces within cylinders. This combination of requirements is challenging for seals and generally necessitates a complex arrangement of products, including wipers and bearings, all working together in tandem.

Trelleborg Sealing Solutions is more than a simple seal supplier. The company partners with customers across the globe to help them achieve their goals. Its expertise and unique approach to sealing enables it to provide components that are reliable, long-lasting and capable of operating within demanding and harsh operating conditions. To better represent today's offering, a new website with films, detailed information, access to digital tools, and cutting-edge webinars relevant to fluid power has now been launched. The website has been designed to contain a wealth of information that is useful to an engineer when specifying solutions for hydraulic arrangements, all in one place.

Working with Trelleborg

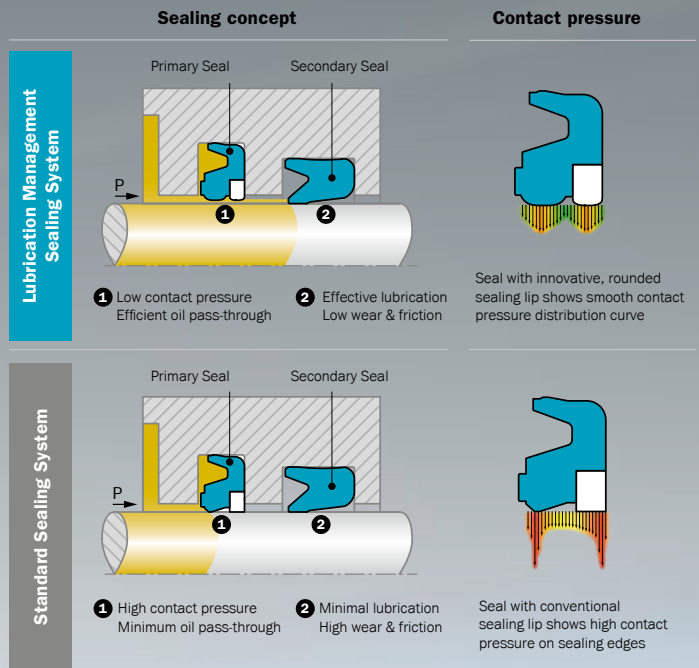
Engineering and Development

Trelleborg Sealing Solutions can operate as a partner for your operations, aiming to improve both applications and business processes. Collaboration between teams at an early stage can ensure that the correct products and solutions are chosen and maximum performance is achieved. Nine R&D facilities globally develop new materials and solutions with engineering teams in your local language to provide support and expertise when implementing them.

Though Trelleborg Sealing Solutions offers one of the broadest ranges of products on the market, custom solutions can be developed on request. World-class analytical testing laboratories, combined with advanced manufacturing and design processes, such as FEA modeling and rapid prototyping, ensure that you can have confidence in any bespoke components. →

LUBRICATION MANAGEMENT

Effective lubrication within a sealing system is more than choosing the correct lubricant. By expertly managing the lubrication conditions between all elements of the arrangement, the load on each element can be reduced and the system life increased. Lubrication management as a field, takes a holistic approach to the sealing system, aiming to understand the relationships between the components, surfaces, fluids and friction. Through modifications to the seal design and surfaces, friction properties can be significantly lowered to enhance application performance and extend seal life.



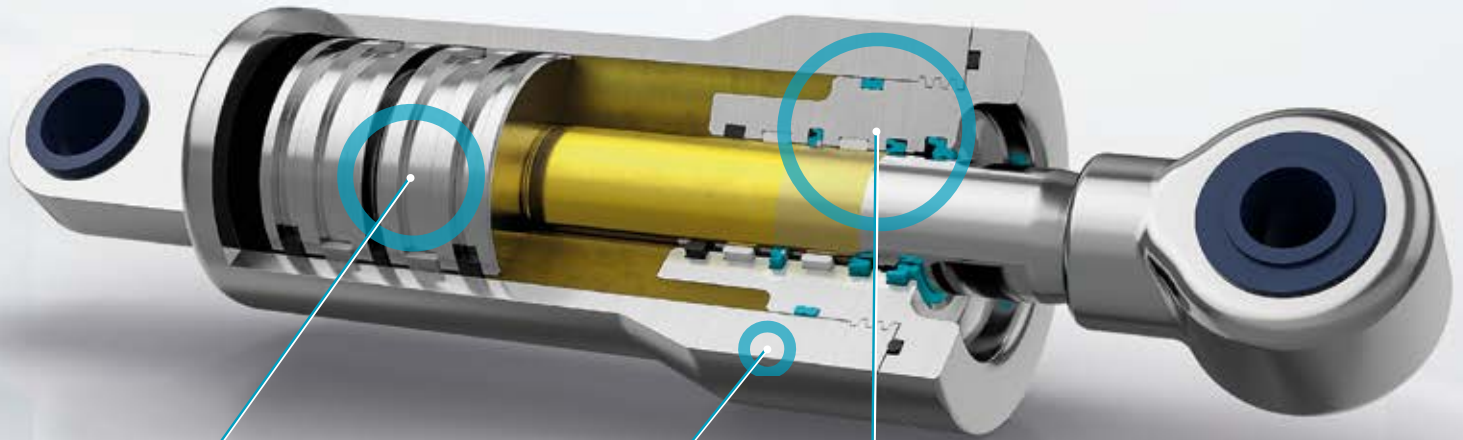
READ THE BROCHURE

Scan the QR Code to download the **Sealing Solutions for Fluid Power Applications** brochure, featuring key products and solutions for hydraulic cylinders and pumps.



SEALING SOLUTIONS FOR CYLINDERS

Hydraulic cylinders can feature a complex arrangements of solutions, engineered to work together for optimal performance. Each element within the system plays an important role, whether preventing fluid from spilling out, preventing ingress of external contaminants or stopping contact where undesirable.



PISTON SEALS AND WEAR RINGS

Fluid needs to be inhibited from flowing across internal components.

HOUSING - STATIC SEALS

Fluid must be contained within the hydraulic system and environmental contamination prevented.

ROD SEALS, WEAR RINGS AND SCRAPERS

Leakage of fluid from within the cylinder to the outside needs to be stopped as does ingress of external contamination. Transverse forces should be absorbed and metal-to-metal contact avoided.

Material Selection

Trelleborg's material expertise is key to effective operation of seals. Backed by the polymer expertise of Trelleborg Group, and supported by an international network of engineering and R&D, the material portfolio offers an extensive selection of materials to meet any requirements.

TURCON® – Outstanding Friction Characteristics

Turcon® is the Trelleborg Sealing Solutions range of proprietary materials based on premium-grade Polytetrafluoroethylene (PTFE). The materials demonstrate low friction, with minimized wear in dynamic and high-speed applications. They are compatible with virtually all media, even at elevated temperatures, and are resistant to aging.

TURCITE® – Stick-Slip Free Operation

Turcite® material gives outstanding friction behavior, good load capacity, stick-slip free operation and good resistance to high temperatures and chemicals.

ZURCON® – Exceptional Wear Resistance

Zurcon® engineered polyurethane-based materials exhibit outstanding friction characteristics, making them ideal for reciprocating, very slow rotating and oscillating situations where high wear resistance is required.

ORKOT® – Advanced Composite Polymers

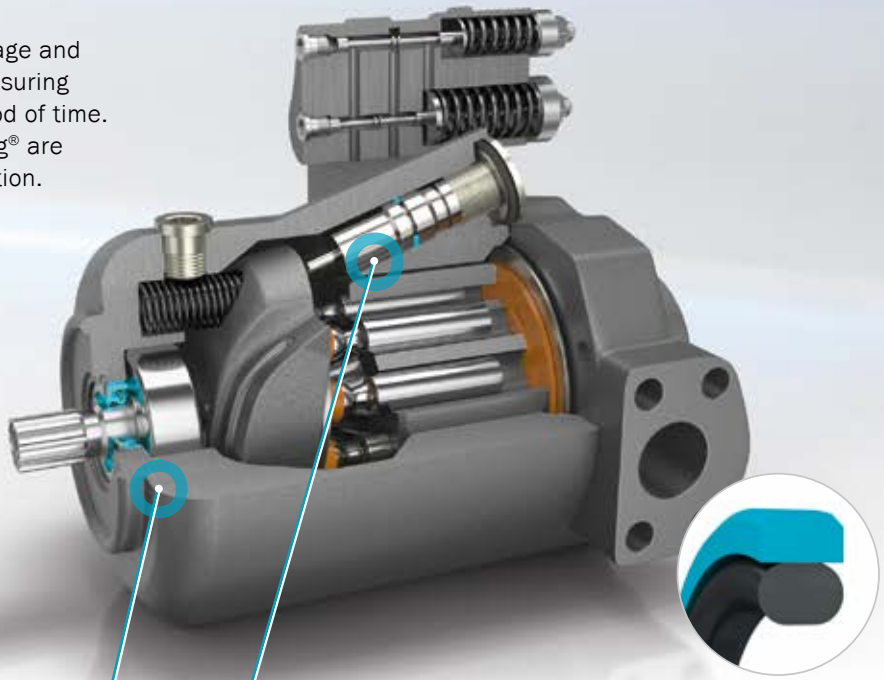
Orkot® bearing materials are thermoset composites incorporating advanced polymer technologies. These consist of technical fabrics impregnated with thermosetting resins, evenly dispersed solid lubricants and further additives to ensure optimum performance.

HIMOD® – Economical Solution for Medium Loads

HiMod® provides an economical solution for applications with medium transverse loads, while giving good wear and compression properties.

SEALING SOLUTIONS FOR PUMPS

Pump applications must prevent leakage and contamination of the system, while ensuring low friction and wear over a long period of time. Radial Oil Seals and Turcon® Glyd Ring® are ideal products for this kind of application.



DRIVE SHAFT

Radial Oil Seals prevent leakage from the drive shaft during pump operating cycles and excludes ingress of contamination with an externally facing dustlip.

POSITIONING PISTON

Turcon® Glyd Ring®: A low friction, abrasion-resistant seal, such as the Turcon® Glyd® Ring, allows the positioning cylinder to function reliably as needed over a long period of time.

ServicePLUS

To allow you to better focus on your core business, Trelleborg Sealing Solutions has developed a ‘total solution’ program to simplify the workflow in every part of your value chain. Whether supplying ready-to-use components pre-assembled or packaging and handling seals in a way that works for you, ServicePLUS offers solutions to simplify, speed-up and solve challenges in your manufacturing process.

Advanced Delivery

Automated Kanban process with SealScan app for iOS. Vendor and stock level management by Trelleborg.

Assembly

“Ready-to-use” assembled components delivered directly to your production line.

Special Handling

Services to optimize the identification, handling and mounting of seals.

QuickSeal

Expedited sealing solutions for punctual deliveries.

SELECTED TOOLS FOR DESIGN ENGINEERS

Trelleborg Sealing Solutions has an extensive offering of digital tools and services to make specifying seals easy. Use the hydraulic system calculator to quickly get relevant dimensions and automatic calculations to determine housings and hardware, or benefit from our CAD service to access drawings and designs at the click of a button.



To find our complete range of tools and apps for engineers, visit www.tss.trelleborg.com or scan the QR code.

Mechanical Design Assistance	Standards. Conversions and Norms	Learning and Knowledge	Product Selection
<ul style="list-style-type: none"> Hydraulic System Calculator Area & Volume Calculator Mechanical Engineering Calculator Fluid Mechanics Calculator CAD Service 	<ul style="list-style-type: none"> ISO Fits & Tolerances Unit & Hardness Converter 	<ul style="list-style-type: none"> Installation Instructions e-Learning on Sealing Technology 	<ul style="list-style-type: none"> Electronic Catalog Sealing Solutions Configurator

● Website Tools & Services

● Mobile Apps

Material Updates

Learn about new materials from Trelleborg Sealing Solutions that help to improve application performance and improve efficiency.

HMF48 – Improved Flat Gasket Material for Food Contact Applications

A NEW FLAT GASKET MATERIAL AIMS TO IMPROVE PROCESSING OF FOOD AND BEVERAGES.

As with many industries, modern food and beverage applications are placing higher demands on seals. Though regulations for food contact materials define approved ingredients and migration limit values to determine safety, manufacturers are still looking for ways to improve the performance in application.

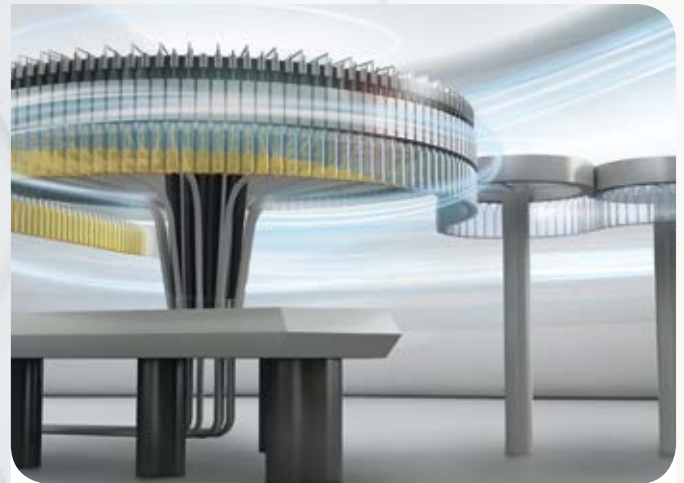
“We have been working with our customers and seeking out new solutions to help them meet their challenging requirements, and critically, we are applying our breadth of experience in materials and seal design”, says Rudolf Hawellek, Senior Specialist in Food Contact Materials at Trelleborg Sealing Solutions.

The materials used for seals place limits on the temperatures and chemicals used within the system. “These applications require high mechanical resistance, but also extensive chemical resistance and resilience to high temperatures, whether in processing or in cleaning regimes” says Rudolf.

Formulated from virgin polytetrafluoroethylene (PTFE) and enhanced with high-quality approved fillers, the new HMF48 material offers a ‘universal’ solution for food and beverage processing.

“HMF48 is an ideal material for flat gaskets. We’ve been making this kind of seal for decades, but this new material is adding to the number of applications that can be improved,” says Rudolf.

Flat gasket designs are extremely mechanically stable to start with, and the materials used resist the temperatures and chemicals used. With a pure white appearance without any coloring, frequently specified for food applications, the new material enhances the temperature range from -210 °C to +260 °C/-346 °F to +500 °F and offers pressure resistance from vacuum up to 83 bar, and all-round process chemical resistance.



Quick Facts about HMF48

- Carries all global certifications, including FDA, EU and Chinese GB guidelines
- All around material, with chemical and temperature resistance
- Universal applicability enables standardization of many different types of seals
- Large variety of thickness and sheet formats allows simple and inexpensive production of almost any seal geometry
- Gaskets characteristics in accordance with DIN EN 13555, allowing design of permanent tight flange connections
- Availability of all important gasket constants allows safe seal designs and calculation
- Unlimited shelf life

Trelleborg material formulation experts spent time perfecting the composition of fillers. “Extensive internal testing and iterative development allowed us to develop this new compound. Over other materials, we’ve stopped cold flow and reduced hot creep. It’s blow-out proof, in accordance with VDI guideline 2200, and has excellent leakage properties, meeting the German Clean Air Act requirements,” says Rudolf.

As with other food contact materials, different regulations from around the world must be met, especially for manufacturers who produce food and beverages for multiple countries.

“This material can be used globally, it’s fully approved with EU, FDA and Chinese GB guidelines, amongst others,” says Rudolf, “but crucially, its all-encompassing field of application permits standardization of many different types of seals allowing safe seal designs and consistent calculations.”

Electrically conductive materials: Turcon® MC1 and MC2



COMPLETELY UNIQUE TO THE MARKET, TWO NEW ELECTRICALLY CONDUCTIVE MATERIALS ALLOW NEW DYNAMIC APPLICATIONS.

Sealing materials are finding innovative new uses in high-tech applications. Virgin PTFE is an excellent insulator, with resistivity around 2×10^{17} Ohm-cm. Previously, only by inserting carbon fillers up to a threshold point and interconnected within the PTFE matrix, could any electrical productivity be added.

In most cases, the conductivity was discovered by accident, but these new materials have been deliberately engineered and optimized to offer this functionality.

“Conductive elastomers are available, but these are primarily only for static applications, while the conductive, injection-moldable plastic materials that exist have low flexibility and are less suited for sealing purposes and for installation in closed grooves,” says Soeren Roepstorff, Development Manager at Trelleborg’s manufacturing facility in Helsingør, Denmark, where the new compounds were developed.

For spring and elastomer-energized dynamic applications, this conductivity was nearly impossible. But these new compounds open up exciting fields and applications that were not previously possible.

“Now seals and bearings can provide a reliable electrical connection between the moving parts,” says Soeren. “There has been a strong demand for drive electrification, and new opportunities within eMobility, sensing and IoT applications that these new materials can take advantage of and provide engineers with opportunities in grounding or transmitting signals through the seals themselves.”

Consider an aircraft generating static through flying, or charges between gaps in components causing sparks. These compounds allow safe and efficient dissipation of this charge. Further still, with high-tech applications, rather than using additional circuitry, sensors can send signals directly through the seals, enabling more compact and complex systems.

A dedicated test rig was designed for testing Turcon® MC1 and MC2 to simulate real life conditions. Results showed negligible dry-contact resistance even with low contact pressure and system fluids. The low resistance shown proved its conductivity.

“Turcon® MC1 and Turcon® MC2 meet our customers’ demands for conductive plastic sealing materials that will work effectively and reliably as seals and bearings in dynamic applications. With them, designers can take advantage of using a range of advanced PTFE-based sealing geometries and all the benefits that they offer in applications that require electrical conductivity through a hydraulic system or electric motor, for instance,” finishes Soeren.

Also featured in this issue:



Find out more about Trelleborg’s material expertise in different industries.

- **NEW ISOLAST® J9503 AND J9567 COMPOUNDS** for Chemical Transport on page 28.
- **EXTENDED ISOLAST® PUREFAB RANGE** for Semiconductor on page 22.

ServicePLUS

THE PLUS FOR YOUR BUSINESS



When you partner with Trelleborg Sealing Solutions through our ServicePLUS program, you can focus on your core business while we focus on ensuring all of your value chain needs are covered. We concentrate on business activities, which typically offer the largest resource saving opportunities.

Find out what ServicePLUS can do for your business at
www.tss.trelleborg.com/ServicePLUS