Angst+Pfister

NR. 14 2017

magazine

INTERNATIONAL ENGINEERING SOLUTIONS

ENGINEERING IN THE HIMALAYAS

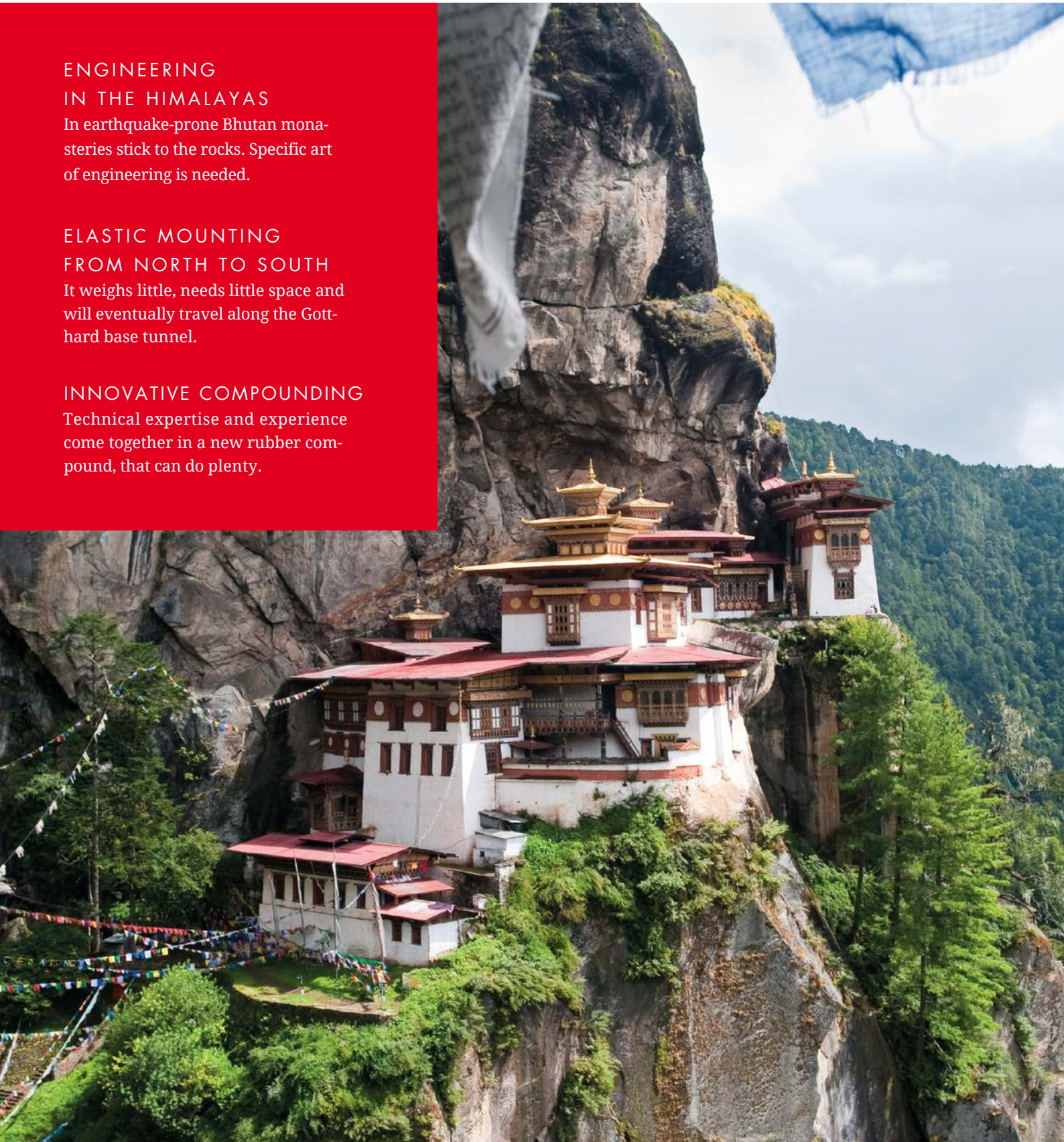
In earthquake-prone Bhutan monasteries stick to the rocks. Specific art of engineering is needed.

ELASTIC MOUNTING FROM NORTH TO SOUTH

It weighs little, needs little space and will eventually travel along the Gotthard base tunnel.

INNOVATIVE COMPOUNDING

Technical expertise and experience come together in a new rubber compound, that can do plenty.



Editorial

Dear Readers,
Dear valued Customers,

Engineers have a reputation for being rather rational people. We think that it is about time to prove the contrary. It goes without saying that we very much like to speak about the technical solutions we develop for our customers. And indeed, that these solutions allow them to shorten their development times and increase the profitability of their products is very remarkable – but there is of course more to it than that. We, the Engineering Team of Angst + Pfister, are very passionate – also when it comes to listening: We are curious about how our customers develop their innovations as well as their operating procedures, which obstacles they need to overcome and how they organise their manufacturing and logistics operations. Discussions usually reveal quite quickly where we are able to support them. And we very much like to think beyond the engineering of a single component in order to simplify its eventual assembly. Or we integrate additional functions, so that the number of parts can be reduced and the manufacturing and storage costs can be decreased. You can find proof of our passion in textual and visual form on page 4: You will be able to directly look over the shoulders of our colleagues at Laspar Angst + Pfister in Bursa, Turkey. For the design of a set of new components, the development engineers work with numerical simulation, which already saves a lot of time. And then, after only six to nine weeks, the first prototypes are available, because everything in Bursa can be found under a single roof – apart from development and prototyping, also the testing, compounding and manufacturing departments. As the right rubber compound determines the quality of performance provided by a seal or a vibration isolation, Angst + Pfister has formed a strategic alliance with TSF, the global market leader when it comes to the development and production of high-tech compounds. Read more about this strategic alliance on page 31.

We also demonstrate our passion by our readiness to invest for our customers: So that internationally operating enterprises comply with the US-American ASME Code, we have introduced the ASME Manufacturing Standard for our ASSIWELL® metal hose lines. You can read more about this on page 26.

You might also be interested in how we approached the development of a completely new vibration isolation technology for the storage converters of a high-speed train and how we succeeded in manufacturing the components in the smallest possible dimensions. Or how we deal with new European norms, such as fire prevention in rail vehicles. You can read up on all of these topics starting on page 11. If you still believe that engineers are single-minded people, then the Swiss construction engineer Andreas Galmarini will irrevocably convince you of the contrary: He – very spontaneously – packed his bags and travelled to the secluded Himalayan state of Bhutan for half a year together with his wife and three little children. His expertise was very welcome there and can now be detected underneath a historically significant tower, which had previously been destroyed by a fire. What this has to do with Angst + Pfister? The report on the reconstruction of the tower on page 22 will grant you access to another perspective on the world as it tells a story of courage and human kindness.

Enjoy reading!

Erich Schmid
Chief Technology Officer

Content

Do you have any further questions about one of the magazine topics?

Please send an e-mail to engineering@angst-pfister.com or call +41 44 306 62 57. We will contact you immediately.

Developments that bring technical and economic advantages

The development times are ambitiously short, the results are often even better than expected. This is what innovative companies want. And this is how it works for the Research & Development Centre of Laspar Angst + Pfister in Bursa, Turkey. The engineers develop solutions for antivibration and sealing technology that optimise the total cost of ownership as well as the technology.

Numerical simulation significantly reduces development time: Laspar specialists are applying their expertise daily in achieving this goal for Angst + Pfister.

Around 40 professionals work at the development centre at Bursa.

"Following the co-design phase, our colleagues in Turkey usually need no more than six to nine weeks to build the prototypes."

Erich Schmid, Chief Technology Officer, Angst + Pfister, Zurich

There is no question about it: All modern trains have floating floors to isolate vibration and absorb sound. The only imponderables for the train manufacturers are which materials and technologies to use. The development engineers from Laspar Angst + Pfister in collaboration with engineers from Stadler Bussnang AG have recently designed a new floor mount for the high-speed multiple unit train EC250, which Stadler Rail AG of Switzerland is constructing for the Swiss Federal Railways. It not only meets the latest requirements of the fire protection standard DIN EN 45 545, which defines the requirements of materials and components for rail vehicles, but also in cross-comparison the new floor bearing from Laspar Angst + Pfister is more efficient and more costeffective.*

Short development phases

"After the co-design phase, our colleagues in Turkey usually need just six to nine weeks to produce prototypes," said Erich Schmid, Chief Technology Officer for Angst + Pfister at the head office in Zurich. "We subject these to thorough tests and sometimes the customer also conducts tests at the same time," added Eray Ulugül, the CEO of Laspar Angst + Pfister in Bursa. "Over another ten to thirteen weeks, we then use the serial production tool to produce the first samples."

Practical and theoretical know-how

The reasons for the relatively short development times are as follows: The engineers in Bursa know precisely what the customers require. The 40-strong, highly qualified development works closely with Angst + Pfister's 100 application engineers, senior engineers and CAD engineers around the world.

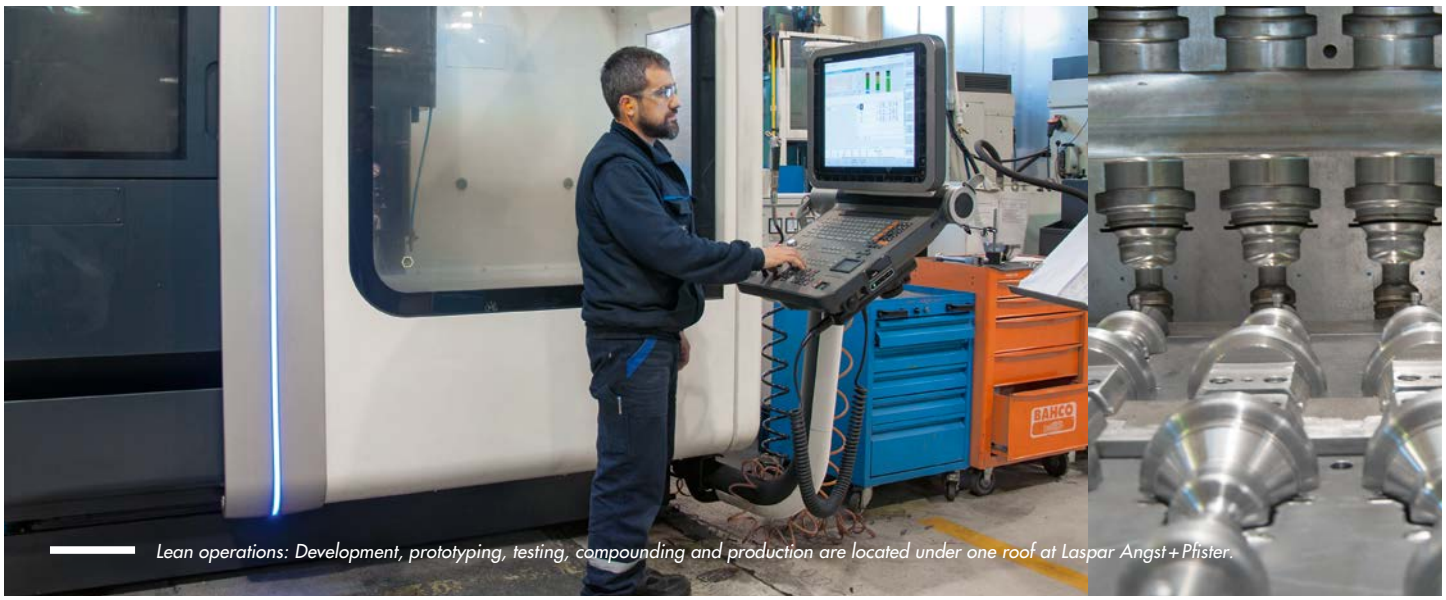
Time-saving numerical simulation

A further strength of Angst + Pfister's development team is numerical simulation: "Using the finite element method, we have been able to significantly shorten the development process," said Eray Ulugül. The specialists from Laspar Angst + Pfister are also experienced and suitably practiced in the calculation of loads to which a component is subjected throughout its lifetime.

Production under the same roof

One of the great advantages is the close proximity of the development team to production: Laspar was founded as a production company in 1982 and since then it has continued to develop further and expand. As part of the Angst + Pfister Group since 2013, Laspar Angst + Pfister now produces around 100 million antivibration and sealing components each year. The customers are leading suppliers from the automotive sector, rail sector and ship construction. Laspar Angst + Pfister is also consulted for building construction and civil engineering and, specifically, bridge construction, and also for the production of agricultural machines and the manufacture and development of electronic and household appliances.

* Read more about the high-speed multiple unit train EC250 on page 18 and the Fire Safety Standard DIN EN 45 545 on page 11.



Lean operations: Development, prototyping, testing, compounding and production are located under one roof at Laspar Angst + Pfister.

Test stations right next door

Laspar Angst + Pfister has the development expertise for customised solutions and the know-how for prototyping, initial samples and series production under one roof. "This really does allow us to keep the individual development loops and development times short in total," said Erich Schmid. The test stations for testing are also within walking distance of the offices of the development engineers who can thus accelerate their virtual engineering. "We unite all our skills on site, this gives our customers time and saves costs," commented Eray Ulugül. The development time is reduced and products enter the market quicker.

Multiple certifications

Since January 2016, the Research & Development Centre for Laspar Angst + Pfister in Bursa has been recognised by the Turkish Ministry for Science, Industry and Technology. In addition, Laspar Angst + Pfister is certified along the entire value creation chain from development to production and delivery in accordance with ISO 9001, ISO TS 16949 and ISO 14001: All processes are based on a comprehensive quality management system and the company also meets the highest standards with regard to health, safety and the environment.

Integrating functionality

The development engineers from Laspar Angst + Pfister know how to include other aspects in addition to technology in their work: For example, if an antivibration or sealing component is able to unify additional functionalities in a single unit, customers can reduce their storage and assembly costs: Instead of two or more parts, only one is needed. This reduces the total cost of ownership, which is reduced even further due to the generally long service life of the components. This integrated way of looking at things becomes apparent in all areas of Angst + Pfister: The customer benefits from distinct development competences and also from higher purchasing and production efficiency and the thoughtful logistics that offer Just-in-Time, Kanban and Supply Chain Management solutions around the world. This is the integrated, and, from a cost perspective, interesting efficiency that the market needs.

The fire safety standard EN 45 545 is also adhered to. And everything undergoes intensive testing.

"Demand for numerical simulations is constantly increasing."

Eray Ulugül, Chief Executive Officer, Laspar Angst + Pfister, Turkey

When it comes to the design, development and production of antivibration components, no one comes close to achieving the same results: Eray Ulugül heads Research and Development at Laspar Angst + Pfister in Bursa.

Mr. Ulugül, you are a professional in the field of numerical simulation. What fascinates you so much about this subject and how do the customers benefit?
Eray Ulugül: It is mainly my practical experience with the finite element method that is of benefit for our customers. Technical equipment alone is not enough, specific expertise is also needed. We have both. Using numerical simulation with internally developed guidelines and know-how, we can find the right elastomeric characteristic for optimal performance, and this enables us to achieve the required hardness and develop the best design and geometry for a component. Simulating the real-world conditions, to which a sealing or antivibration component is exposed, definitely saves time and development costs. That is why the demand for numerical simulations is increasing continuously and we are doing all we can to meet this demand.

But that is not the only way to keep development times short.
Eray Ulugül: Our other major advantage at Laspar Angst + Pfister is having everything under one roof – from development, prototyping and testing to metal preparation, compounding and production. The tool for the production of prototypes is manufactured in six to nine weeks, the tool for series production in ten to thirteen weeks. These short periods are due to the fact that our engineering unit makes full use of its proximity to the other areas of competence like mold flow simulation to design vulcanisation tools right the first time. We work hand in hand, and the effect is immediately evident to the customer.

And your test systems?
Eray Ulugül: We are well equipped to examine the rigidity of the components, to test their static and dynamic properties, their vibration absorption and their durability performance and to provide proof of their service life. The results input directly – and quickly – into additional engineering work. Our in-house rubber batch testing provides leading-edge technology to develop customised rubber recipes with an optimal vulcanisation process. This enables us to find the right rubber compound for unique applications i.e. high temperature, dynamic to static ratio and rebound value.

The right rubber compound and the right partners make the difference
The right rubber compound determines the quality of performance provided by a seal or a vibration isolation. Angst + Pfister has formed a strategic alliance with TSF, the global market leader when it comes to the development and production of high tech compounds. Read more about this strategic alliance on page 31.

This rubber compound is naturally fireproof

In April 2016, national regulations for fire safety on railway vehicles were entirely superseded by the European standard EN 45 545. Angst+Pfister forged a path for customers to follow suit by meeting the requirements of the standard: Instead of coating components, a new rubber compound was developed for vibration isolation. Siemens uses these elements to suspend bogies.

Angst+Pfister provided the specialist knowledge for the metal-jacketed bone bush for the Avenio low-floor tram, which the city of Munich reordered from Siemens.

Advanced technology on the trams: Angst+Pfister's significant input is in the form of vibration technology.

This is a very familiar scenario for Angst+Pfister and even more so for its customers. It's a win-win situation for everyone. The process takes place within the Angst+Pfister Group: In Zurich, Angst+Pfister's group engineering focus their entire efforts on the technological project; the development engineers of Laspar Angst+Pfister in Bursa, Turkey then input their expertise, which shortens the development time, by applying their numerical simulation capability and because prototype production as well as series production are carried out under the same roof. At the same time, Angst+Pfister's consulting and sales teams, such as Andreas Gogl and his team in Austria, coordinate matters and are in constant contact with Zurich, Bursa and the customer. This is the group that produces antivibration solutions and pride themselves on exceeding expectations.

Fire safety standard
EN 45 545 and further requirements

For Siemens Mobility, who design and manufacture high-speed trains, underground trains and trams, it was necessary to combine what at first glance appeared to be two contradictory requirements: Firstly, the new vibration insulation had to meet the requirements of fire safety standard EN 45 545 for the suspension of bogies. Secondly, despite integral fire retardants, the new components had to display approximately the same mechanical properties and the same static and dynamic stiffness as the old components.

Compounding specialists, too

Laspar Angst+Pfister in Bursa also specialise in compounding; the development engineers there have several different iterations of their simulation and testing methods and have developed a new rubber compound: The compound meets the parameters of the standard and is both a high-performance product and age resistant. Ultimately, a rail vehicle is designed for a long life, over ten years is the norm. The fact that the new rubber compound satisfies all requirements has been confirmed by tests in independent external laboratories.

Why not coat?

Andreas Gogl of Angst+Pfister Austria comments that a flame retardant coating of the old components would possibly have produced a similar result. However, Andreas Gogl and his team, that work together with the engineers of Siemens Austria and other customers in several Central European countries, noted that in their experience coatings can be damaged and in terms of ageing resistance cannot keep pace with rubber compounds, which have the required fire resistance already built in. "The fire safety standard EN 45 545 was indeed very challenging for the rail vehicle construction as a whole. But we managed to solve the problem – with the new rubber compound." Angst+Pfister has used the new compound to design various metal-rubber components for Siemens: for example, a primary layer spring for the Rhine-Ruhr Express running between Cologne and Dortmund, and a metal-coated bone bush for the Avenio type low-floor tram, which the city of Munich has ordered from Siemens again. >>

"The fire safety standard EN 45 545 was indeed very challenging for the rail vehicle construction as a whole. But we managed to solve the problem – with the new rubber compound."

Andreas Gogl, General Manager, Angst+Pfister Austria

A single source saves time and money

Andreas Gogl stressed the close partnership with Siemens and the matrix of skills available at Angst + Pfister: "Not only can we design the geometry of a vibration isolation system, we can also determine which rubber compound is the right one. And for our Laspar Angst + Pfister colleagues in Bursa, their development, compounding, prototyping and mass production units are just a few metres apart. This proximity and our internal cooperation allow problems to be solved in a relatively narrow time frame and in a cost-to-benefit ratio beneficial to our customer. "When customers can rely on a single source for everything, they can significantly shorten the time-to-market process, while at the same time being guaranteed an individual solution that is right, and complies with the fire safety standard EN 45 545.

160 km/h

A comfortable commute over longer distances: The Rhine-Ruhr Express between Cologne and Dortmund at 160km/h will travel faster than the regional trains.

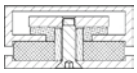
"When customers can rely on a single source for everything, they can significantly shorten the time-to-market process, while at the same time being guaranteed an individual solution that is right."

Andreas Gogl, General Manager, Angst + Pfister Austria

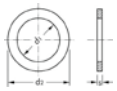
Fire safety in accordance with EN 45 545 is part of the package: Angst + Pfister designed a primary layer spring for the double-decker trains of the Rhine-Ruhr Express.

EN 45 545 Fire Protection Certificates on Angst+Pfister products

APSOvib® Antivibration Technology

Part type		Material	Hardness ShA +/–5	DIN EN 45 545
Antivibration elements for bogies (layer springs, primary buffers, round and stop buffers)		NR	50 ShA	R24: HL2
		NR(BR)	70 ShA	R24: HL3
Floor supports		CR	45 ShA	R10: HL2
		CR	49 ShA	R9: HL3, R10: HL3
		CR	70 ShA	R9: HL3, R10: HL3
		EPDM	46 ShA	R10: HL3
Floor supports – Metal Cushion		Metal Cushion		> HL3
Floor supports – PUR – metal		APSOPUR® L55 (12.5 mm)		R10: HL3

APSOseal® Sealing Technology

Part type		Production technology	Material	Type	Hardness ShA +/–5 (Density g/cm³)	DIN EN 45 545
Molded parts, molded flat gaskets, O-rings		Compression	EPDM	Compact	60 ShA	R1: HLR2
			EPDM	Compact	70 ShA	R22: HL3, R23: HL3
			VMQ	Compact	40 ShA	R22: HL3, R23: HL3
			VMQ	Compact	70 ShA	R22: HL2, R23: HL3
Flat gaskets		Punching	EPDM	Compact	70 ShA	R22: HL3, R23: HL3
			VMQ	Foam	(0.16 g/cm³)	R22: HL3, R23: HL3
			VMQ	Foam	(0.208 g/cm³)	R22: HL2, R23: HL2
			VMQ	Foam	(0.35 g/cm³)	R22: HL3, R23: HL3
			VMQ	Foam	(0.43 g/cm³)	R22: HL3, R23: HL3
			CR	Foam – closed cells	(0.195 g/cm³)	R24: HL3
Elastomeric profiles		Extrusion	EPDM	Compact	50 ShA	R22: HL2, R23: HL2, R24: HL2
			EPDM	Compact	60 ShA	R22: HL3, R23: HL3, R24: HL3
			EPDM	Compact	65 ShA	R22: HL3, R23: HL3
			EPDM	Compact	70 ShA	R22: HL3, R23: HL3
			EPDM	Compact	75 ShA	R22: HL3, R23: HL3
			EPDM	Compact	77 ShA	R22: HL3, R23: HL3
			EPDM	Foam	(0.8 g/cm³)	R22: HL2, R23: HL2
			EPDM	Foam – mixed closed and open cells	(0.8 g/cm³)	R22: HL2, R23: HL2
			VMQ	Compact	40 ShA	R22: HL3, R23: HL3
			VMQ	Compact	50 ShA	R22: HL3, R23: HL3
			VMQ	Compact	60 ShA	R22: HL3, R23: HL3
			VMQ	Compact	70 ShA	R22: HL3, R23: HL3
			VMQ	Foam – closed cells	(0.35 g/cm³)	R22: HL3, R23: HL3
			VMQ	Foam – closed cells	(0.55 g/cm³)	R22: HL3, R23: HL3

APSOfluid® Fluid Handling Technology

Part type	Product	Material	DIN EN 45 545
Industrial hoses	Conveyance hose for water	EPDM	R22: HL3 R23: HL3
	Cable protection hose	EPDM and NBR	R22: HL3 R23: HL3
	Cable protection hose	Silicon	R22: HL3 R23: HL3
	Air brake hose	CR	R22: HL3 R23: HL3
Hydraulic hoses	Hydraulic hose Type 2TE	NBR/EPDM	R22: HL3 R23: HL3
	Hydraulic hose Type 1SC	NBR/EPDM	R22: HL3 R23: HL3
	Hydraulic hose Type 2SC	NBR/EPDM	R22: HL3 R23: HL3
	Hydraulic hose Type 1SN	NBR/EPDM	R22: HL3 R23: HL3
	Hydraulic hose Type 2SN	NBR/EPDM	R22: HL3 R23: HL3
Metal hoses	ASSIWELL® metal hoses	Stainless Steel	> HL3

APSOplast® Engineering Plastics Technology

Material	Type	DIN EN 45 545
UP-HLM FR	Hand layup GRP Laminate	R1, R2, R3: HL2
UP-GRP	Pultrusion profile	R1, R2, R3: HL3 R22, R23, R24: HL3
UP-GM 203	Red/white	R1, R2, R3: HL2 R22, R23, R24: HL3
EP-GC 202	Natural, (Yellow/brown)	R7, R17: HL2 R1, R2, R3, R11, R12, R22, R23, R24: HL3
PE-UHMW FR	Black	R7: HL2 R10, R24, R26: HL3
PA 66 FR	Black	R17, R23: HL1 R24, R26: HL3
PA 6 FR	White	R22, R23, R24, R26: HL3
PA 6 FR	Extrusion profile, coloured	R22, R23, R24, R26: HL3
PC FR transp	Transparent, flame-retardant	R4: HL3

In addition to this range of products, we can supply you with special and/or customised products upon request at any time: consult us!

From two-sided expertise to top performance

Many high end cars are equipped with Sonceboz actuators. Their mechatronic drive systems and electric motors operate extremely and reliably well, even in harsh environments. Sonceboz, in turn, needs suppliers who are highly reliable when it comes to engineering, quality and logistics. One of Angst+Pfister's radial shaft seals travels the world with Sonceboz.

Radial shaft seals are vital for the actuators used on the air flaps on the radiator grille of a car. Powered air flaps are active and can improve aerodynamics by reducing air resistance. They reduce fuel consumption and lower CO_2 emissions. Sonceboz has designed actuators that are dustproof and can even withstand high-pressure water. Continuous engine vibration cannot damage them, and you could even say they are 'immune' to aggressive media such as brake fluid, engine oil, salt water and detergent.

Sonceboz's performance goes much further. With a design based on patented rotor-stator technology, the drives are remarkable for their high torque, so that even at high travelling speeds the flaps can still be controlled. At the same time, they are comparatively light and thin. Electronics and control intelligence are compactly bundled. There is always enough space for these drives, even if everything is very tightly packed in the front section of a car.

Farsighted engineering, ...

Even the radial shaft seal, which protects the drive shaft, includes attention to detail: When Angst+Pfister developed the radial shaft seal, our engineers not only worked on its design, but also on replacing FKM, which had been the choice for such seals in the past, with the high-performance and yet cost-effective HNBR. The temperature and automotive universally resistant compound underwent extensive testing to prove its full suitability. The series production tool was already available when the prototypes were made.

... above and beyond

The engineers of Angst+Pfister took it one step further, looking beyond the actual seal: aiming to enhance performance and longevity even further, they optimised the surface of the shaft that comes into direct contact with the radial shaft sealing ring together with their counterparts at Sonceboz. As a result the radial shaft is now smoother and friction is further reduced.

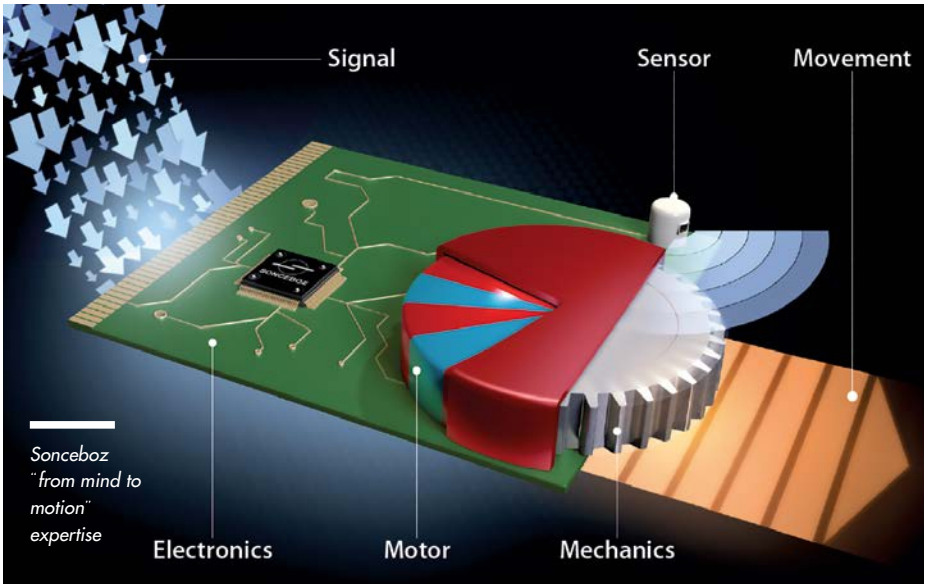
Spurring each other on

When two parties spur each other on with innovation and awareness of quality, and both are willing to go the extra mile, the result can only be a win-win situation. Rotary shaft seals affect the overall performance and service life of the actuators, and because these are produced in large numbers for the world market, Sonceboz stipulates at least two production sources: Thanks to its extensive production platform, Angst+Pfister can guarantee in-house dual sourcing at all times. Production quality is always high regardless of location. Both production partners are certified to the demanding ISO TS 16949 standard, on which the automotive industry places significant importance. By applying EDM and innovative fine tuning, Angst+Pfister and its production partners have also been able to simplify mass production. Processes are continually enhanced to always stay one step ahead.

The requirements of the customer extend to logistics: Angst+Pfister has fully aligned its production of rotary shaft seals to the rolling planning of Sonceboz; and the principle of "first in, first out" is strictly adhered to: The Sonceboz assembly robots use the seals according to date of manufacture. The manufacturing process can be traced back as far as the elastomer suppliers.

Sonceboz: This is where innovation begins.

Cooperation between Sonceboz and Angst + Pfister has been so successful over the years that the two companies often work together on innovative development projects. "We like a challenge – in engineering, quality and logistics," says Philippe Oetiker account manager for Sonceboz at Angst + Pfister. "Both parties contribute with their expertise and ensure we both grow our businesses."



Sonceboz "from mind to motion" expertise

Sonceboz smart stepper for active grille shutter

Highest Quality through Numerical Simulation and Engineering Expertise

The finite element method does the trick: The newest pressure independent valve by the Swiss company Belimo contains a membrane which was designed in no time thanks to numerical simulation. The appropriate rubber compound was determined through engineering expertise. When technology and experience come together in this way, the basis for innovation and trust is formed.

He led the project from the very beginning, built the foundations and designed each development step. And finally, he also contributed to the market launch: Andrew Jukes, senior engineer at Belimo, knows the pressure independent valve PIQCV like no one else. Since April 2015, it has been available on the market in small and medium-sized variations, the release of the large variation is to follow in 2017. Heating, ventilation, and air conditioning specialists appreciate the innovation.

If Andrew Jukes had to describe the new valve in a single sentence, he would say: “With the PIQCV, the flow rate in single zones or rooms can be controlled independently of pressure, the water quantity for heating or cooling remains accurate at all times even during partial load operations, despite pressure differences.” He would, however, like to add a few more remarks: “Energy demand is reduced, convenience increases.” And, directed specifically at HVAC specialists: “The PIQCV is counter pressure and control valve in one. A separate counter pressure valve is no longer needed. This simplifies planning and reduces material as well as installation costs.”

Fewer Design Loops

The new valve is also compact. Accordingly, the demands on the built-in membrane are high: It is intended to deliver the best possible performance in the smallest possible form. That is why Andrew Jukes turned to the engineers at Angst+Pfister for the design – and requested numerical simulation. Not only did this allow for a reliable result, but also helped to reduce the number of design loops, shorten the development time and reduce the time to money process. However, he also admits that he has ordered separate simulations for each of the three released sizes: “Releasing a product in different sizes without tests is out of question for us considering our quality standards – we wanted to be one hundred percent sure.” On the other hand, the numerical simulation resulted in pilot tools only being necessary for the production of the small and medium-sized valves. For the large valve, series production tools were used from the very beginning.

Experience as an Additional Accelerator

Security was the keyword in regard to the choice of the right EPDM compound. Here, Andrew Jukes completely relied on the experience of the sealing specialists at Angst+Pfister. “I know that I can build on their concentrated expertise.” And this expertise was even more important when the membrane had to endure temperatures of up to +120 °C as well as relatively high pressures of up to 16 bar. Furthermore, the rubber compound has to resist aggressive media, as antifreeze agents are added to water circulations in the HVAC industry. Laboratory tests, for example for determining the compression set values or the membrane’s life cycle, finally concluded that the right compound had been chosen.

The numerical simulation for the membrane has reduced development times.

Belimo's pressure-independent PIQCV valve is very compact. The membrane provides the best possible performance in the smallest possible format.

Lean, Reliable Logistics

Angst + Pfister now produces the membrane for Belimo's Italian partner, which manufactures the valves. Each batch of the EPDM compound undergoes a thermogravimetric analysis, and the documentation, proving that the right compound has been used, is reliably filed. The production volume has meanwhile increased to several ten thousand pieces per year. Belimo furthermore, sources the eight EPDM O-rings for the valves of Angst + Pfister.

"Angst + Pfister's quality standards are a perfect match for those of Belimo", concludes Andrew Jukes. What he additionally values about the collaboration is the professional exchange. "I know that I can completely trust the information I receive from the engineers at Angst + Pfister and that we can openly discuss technical challenges together." This trust extends beyond engineering and also applies to production and logistics.

Finite Element Analysis

APSOplast® PTFE N100: NSF certified for drinking water

This scenario requires the expertise and dedication of the specialists: If drinking water comes into contact with plastic, the plastic has to be approved for that purpose. APSOplast® PTFE N100 is homologated for contact with drinking water in line with NSF/ANSI 61. This new product is opening up opportunities in the food processing market for Angst+Pfister – most interestingly in the USA.

The family enterprise Unic has initiated the US-certification of APSOplast® PTFE.

It was a busy few months – but for France Laffont this was nothing new. As a Sales Application Engineer, she advises Angst + Pfister customers in the south of France and always has her hands full. This time she was having to switch mentally between France, the USA and Switzerland.

Located closely to France Laffont's office in Nice, our customer Unic has been designing, manufacturing and selling quality commercial espresso machines for use in bars and restaurants for decades. The family business with Italian roots, now run by the fourth generation, has always believed in reliability, durability and cutting-edge technology. Unic customers like to say the machines are the Rolls Royce of espresso machines.

Homologation benefits public health

Unic got the ball rolling. The seals and other PTFE components, which the company has been purchasing from Angst + Pfister for years, are certified for the European market in accordance with 2002/72/EC and 1935/2004/EC. But Unic set its sights on the US state of California, where homologation by NSF International is required. The acronym NSF once stood for the US National Sanitation Foundation, an institution that since 1990 has been independent and internationally active in public health and environment certification.

Going for certification together

France Laffont's aim is not only to answer questions and supply products, but to concentrate on the specific requirements of her customers and to find the right solution. "I work closely with Unic," she says, because ultimately it is a matter of growing both businesses, Unics's and Angst + Pfister's. France Laffont brought in her colleague Abderahmane Oubihi, who heads the plastics technology unit for Angst + Pfister in France. Similarly, Angst + Pfister's head office in Zurich was also involved. Together the experts at Angst + Pfister made sure the rolling ball gathered speed. At the instigation of Angst + Pfister, their production partners, who specialise in high-quality finished and semi-finished PTFE products, sent samples of their raw material to the NSF laboratories in the US, and a NSF representative travelled to the production partner, to audit the production of the plastic and the plastic components.

Homologation opens up new markets

Certification took just a few months, after which the specific material name came into being: APSOplast® PTFE N100. The composition of the raw material and the geometry of the components produced from it will remain the same as in the past – and this speaks for the high quality of Angst + Pfister. Homologation of production and material in accordance with NSF/ANSI 61 makes all the difference: the PTFE is now certified for contact with drinking water to NSF standards. UNIC can now take on the Californian market, also thanks to Angst + Pfister – and conquer it with their espresso machines. Abderahmane Oubihi also emphasises the considerable advantages to UNIC, and he also sees new opportunities for Angst + Pfister: "There are only a few manufacturers of PTFE that have been homologated by the NSF. With APSOplast® PTFE N100, we are now in a position to offer our customers new technological, geographical and marketing opportunities and potential in the drinking water sector, pump manufacturing and food industry. The homologation approval extends right from plastics technology through to seals and fluid technology." APSOplast® PTFE N100 is approved for contact with drinking water in warm and cold sectors up to 180 F.

The plastic components in the Unic coffee makers are now also homologated for contact with drinking water in the USA.

Thanks to APSOplast® PTFE N100, there are now new sales opportunities for Unic.

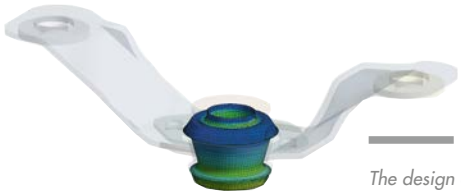
Installing power converters in high-speed trains

Coming soon, the Stadler high-speed EC250 rushes through the Gotthard base tunnel and Angst+Pfister is on board: The power converter of ABB is installed on the underside of the railcar with completely new vibration-insulating components. The mounts are designed to reduce weight and minimise size while isolating the power converter from the train and reducing downtime. Development time was also minimal.

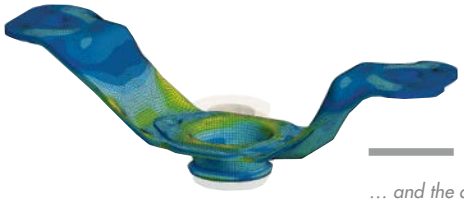
The success of a whole system often depends on seemingly minor details: In a modern rail transport vehicle, there mustn't be any noises from fans or other components transmitted into the passenger area. Consequently, these auxiliary power units have to be mechanically decoupled by using high-performance isolation elements. Which is why the engineers of ABB Switzerland turned to Angst+Pfister. The hanger elements, needed for the power converter, had to provide optimal vibration and acoustic isolation, while weighing as little as possible, and taking up as little space as possible. The specifications were crystal clear, as was the window for development of just a few weeks.

Please meet all requirements asap

As a senior engineer specialised in anti-vibration technology at Angst+Pfister, Raphael Friedli knew very well that time would be short. But he also knew that it could be done. As always: At the beginning, requirements accumulate at an alarming rate: security against tearing off, isolation frequency ratios, dynamic forces with tension loads and thrust, all make the initial specifications appear impossible to reconcile. From empirical knowledge and state-of-the art data simulation, a solution emerges which previously would hardly have been conceivable. Angst+Pfister's engineers in Zurich and their R&D engineering colleagues at Laspar Angst+Pfister in Bursa, Turkey, working with numerical simulations including finite element analysis jointly produce the perfect design. This in turn dramatically reduces production costs. It was the same for ABB as for the automotive industry: Applying the finite element method reduced the co-design process to only a few designs.



The design of vibration isolators,on which the power converter is mounted, …



… and the design of the metal bracket with which they are bolted to the undercarriage, …

… are the result of numerical simulation. The component, which is also structurally optimised, requires less material and space.

A metal bracket saving space, weight and cost

The power converter, with its twelve cast supports, sits directly on top of twelve of these antivibration insulators. These in turn are bolted to the underside of the wagon body by means of metal brackets. The bracket geometry and how it should be manufactured were also determined by numerical simulation. Previously, such parts were manufactured with the standard casting method. The brackets are produced by the deep-drawing process. This new solution allows production at much lower costs. The change in this production process, enabled by the ability of the Angst + Pfister engineers to think outside the box, resulted in a significant cost-reduction in terms of the design. The component, which also has been optimised structurally, requires less material, weighs less, and takes up less space – all vitally important considerations in the competitive world of rail vehicle construction today. A special coating renders the metal bracket corrosion-resistant, ensuring a long service life.

Engineering and manufacturing working hand in hand

ABB can also leave the production of elastomeric bearings and the metal brackets to Angst + Pfister: Engineering and production are working under one roof at Laspar Angst + Pfister in Bursa. The design engineers are working directly with the production and the local supply chain to minimise costs while ensuring quality. The tooling and prototype production is next to the R&D office to increase the speed of development and production efficiency. All of this had made it possible to deliver the pilot prototypes exactly according to schedule. The Stadler Rail EC250, or “Giruno” as the purchaser, the Swiss Federal Railways, call the trains, will soon run at up to 250 km/h between Frankfurt and Milan through the longest railway tunnel in the world. Engineering ingenuity, on a scale both large and small, has made this travel experience possible.

APSOvib®-mounts, -isolations and –brackets comply with the fire safety EU Standard 45 545 for rail vehicles.

There are twelve attachment points between the power converter and undercarriage.

How passion increases the quality of products

The most sophisticated technology is no use if its C-parts are mediocre. All strategic procurement managers know that. This, however, could be news to them: The best technology can improve, if the supplier of C-parts is a thoughtful contributor. In this interiew, Daniel Oberdanner, Head of Strategic Purchasing at Katadyn, is interviewed about professional passion and how he experiences it at Angst+Pfister: “This passion influences the quality of the product as well as operational efficiency.”

It is about life and it is about survival: Mankind needs clean water. Katadyn has been developing, producing and selling water cleaning systems and products for individual use for the past 80 years. With its water filters, its well-established water disinfectant Micropur and its desalination technology the Swiss company maintains its market share of more than 50%.

Herr Oberdanner, your business revolves completely around human health. On the part of the supplier, that presupposes technical expertise, high quality-awareness, as well as a great sense of responsibility. These are all qualities Angst + Pfister can provide. But still, that does not seem to be everything...

Daniel Oberdanner: No, that is indeed not everything! Let's start with a specific example: We had a problem with an extruded, parted off sealing in our production. Angst + Pfister analysed the production process and recommended an alternative step in the process that included a moulded seal. Not only did this solve our problem, but in addition we were also able to lower our total cost of ownership.

Through this and with other examples, Angst + Pfister has distinguished itself as a great business partner who not only accepts orders but who is proactive, committed and passionate. Their great commitment on all levels, including the management level, as well as a thorough analysis of Angst + Pfister on our part, led to us appointing them to be our main supplier of C-parts. Over the past 5 years, we almost doubled our order volume. We get solutions, which are technologically convincing, and at the same time are very attractive economically. And of course all the components coming from Angst + Pfister meet the specific drinking water regulations from around the world!

Obviously C-parts are so important to you that you treat them as if they were A-parts. For that reason, you are already including Angst + Pfister experts at the development stage of new products.

Daniel Oberdanner: There is a second reason! Development not only requires technical competency but also speed. Angst + Pfister's experts can support us twice over – on the one hand with their know-how and experience and on the other hand with their passion and commitment. We can safely assume that they are always readily available to work side by side with our developers. In this way we can save time and costs, and we can profit from their know-how at the same time.

Time as well as costs have a role in the supply chain as well. Do they show passion and commitment here as well?

Daniel Oberdanner: Our production takes place at our headquarters in Kemptthal, Switzerland as well as at our plant in Romania. Our Katadyn-Kanban-System is based on physical maps, which are then given to the purchasing department. Our warehouse is neither too large nor overfull and turnaround is quick. We call off small batch sizes at frequent intervals and our packaging sizes are in line with the assembly-U dimensions. This is a challenge, which Angst + Pfister reliably copes with. The replenishment time of seven days is also quite short. This is possible because of framework contracts which we have entered into and which reassure both sides. Logistics also works well, because Angst + Pfister's employees are highly motivated and pro-active. Incidentally, it is possible that soon all our orders will be processed electronically. We have already exchanged some ideas regarding Electronic Data Interchange (EDI).

Your personal conslusion?

Daniel Oberdanner: We depend on O-rings and moulded sealings of the highest quality. Likewise we depend on first class silicon tubes which are not only technologically perfect, but which will also remain flawless in the way they look and feel. This is exactly what Angst + Pfister provides us with, because from production through to logistics we can see their personal dedication and passion, which goes beyond the mere selling of products.

"We receive solutions that are technically convincing and at the same time very attractive economically."

Daniel Oberdanner, Head of Strategic Purchasing, Katadyn

Tower Construction in the Himalayas: Swiss Stability

This story covers more than 7000 km and takes place in two similarly small nations. For the reconstruction of a historical tower in the Himalayan kingdom of Bhutan, Angst+Pfister Switzerland has contributed the APSOPUR® damping mats for the building's vibration isolation. They will protect the building from seismic vibrations. This story, however, is also one about human courage.

The flames shot up high into the night sky across the Himalayas. On 12 June 2012, a fierce fire destroyed the Wangdue Phodrang Dzong. The firefighters were not able to save the mighty architectural complex from the 17th century, which looked down on the valley from the top of a rock spur. It was primarily built out of stone, clay and wood, and was only accessible from one side. The catastrophe had most likely been caused by a short circuit.

The Loss of a Cultural Monument

In that night, the little kingdom of Bhutan, located east of Nepal and south of Tibet, lost one of its most famous buildings: Dzongs are fortresses and Buddhist temples in one. Built in strategically crucial positions, one of its wings bears the local district administration, whereas the other holds a religious centre, usually a monastery. A high, mighty tower, the Utse, stands in the centre of each Dzong. The Wangdue Phodrang Dzong had just been registered as a UNESCO World Heritage Site by the government in March 2012.

Seismic Activity in the Himalayas

On 25 April 2015, not even three years after the catastrophic fire, a massive earthquake hits wide regions of Nepal. Strong aftershocks follow. The Nepalese government estimates the number of victims to be 8800. At that time, the Swiss engineer Andreas Galmarini is staying in Bhutan for half a year – more about this in the second text on this topic. From the capital city of Thimphu, he travels across the 3140-metre-high Dochula Pass into the Punakha Valley to visit the Wangdue Phodrang Dzong. Its reconstruction has already begun.

Evaluating the seismic activity in the Himalayan region, where two tectonic plates press against each other, encourages Andreas Galmarini in his decision: the new tower of the Wangdue Phodrang Dzong must be isolated against vibrations and must also be mounted elastically. He initiates the first technical evaluations together with his father's engineering office WaltGalmarini in Zurich.

With the Help of Friends

Father Carlo Galmarini is also getting involved and contacts Christof Domeisen, Chief Executive Officer of the Angst+Pfister Group. Both are members of the same service club. And thus the technical works gather momentum. Arno Vinzens, who specialises in vibration isolation at Angst+Pfister, selects the appropriate mats from the broad APSOPUR® selection. They have exactly the right density, which has been calculated by the engineers at WaltGalmarini to be necessary in order to protect the tower of the Wangdue Phodrang Dzong from earthquakes.

The tailor-made mats are then delivered to a steel production company in Switzerland. Here, the antivibration mats are tightened in between two steel plates, so that their entire surface can deflect. Afterwards, they are brought to Asia by ship during a three-month journey. Lorries transport them via high mountain passes and across narrow, partially unsurfaced roads, to the construction site of the Wangdue Phodrang Dzong.

A Sensational Construction Site

In February 2016 the vibration isolation is installed. Additional bearings are also mounted, where a teflon layer slides across a stainless steel sheet. The mounting as such reminds of bridge building. Andreas Galmarini travels to Bhutan again in order to supervise the process. The installation is a sensation for the workers, many of them wearing their traditional clothing, the

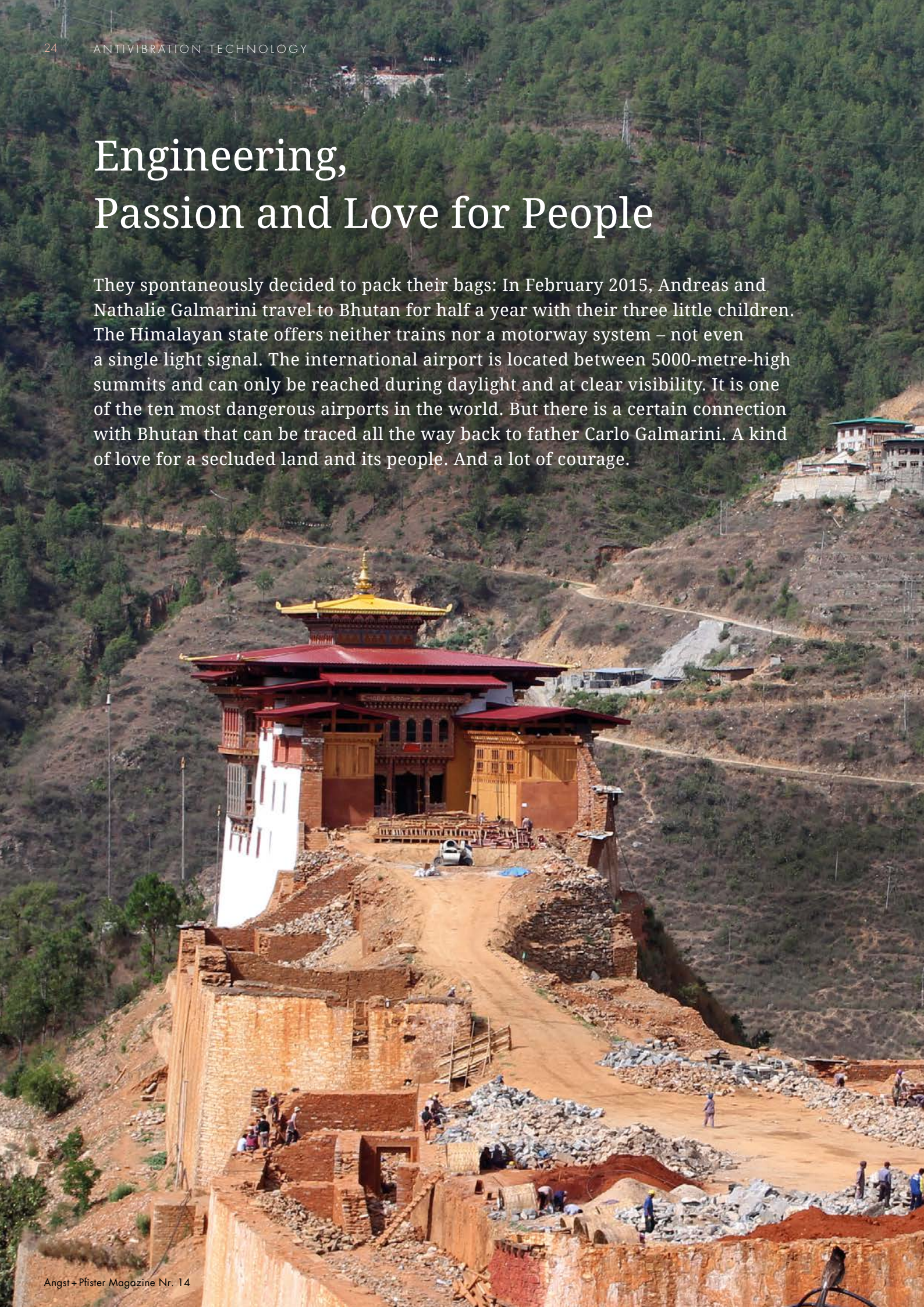
so-called Gho, as they capture the event with their smartphones. Tradition meets modernity, both in terms of isolation technology and in communication alike. Buddhist monks speak their blessings in a special ceremony. Dawa Gyaltshen, the Interior Minister of Bhutan, had already thanked Angst + Pfister for the elastomer mats in an official letter: "This type of isolation is the first of its kind in Bhutan. Your gift is a milestone for us. It will contribute to improving the construction of traditional structures in Bhutan." The APSOPUR® isolation mats now lie under the concrete base plate and the stone walls built on top of it. Their pretension will be released as soon as the four-storied tower of the new Wangdue Phodrang Dzong has been completed. As of today, the entire Wangdue Phodrang Dzong is set to be completed by 2018. >>

The Swiss construction engineer Andreas Galmarini assists in the reconstruction of a historical building in Bhutan. For the photo session he decided to wear the Gho, the traditional clothing of Bhutanese men. Jigme Choden, a construction engineer from the Bhutanese organisation for the preservation of historical buildings, who is wearing the traditional Kira in the picture, has been invited by him to do an internship in Switzerland.

Two steel plates add pretension to the insulation mats, which will protect the monument's tower from earthquakes. As soon as the four stories of the tower have been erected, the pretension will be released.

Engineering, Passion and Love for People

They spontaneously decided to pack their bags: In February 2015, Andreas and Nathalie Galmarini travel to Bhutan for half a year with their three little children. The Himalayan state offers neither trains nor a motorway system – not even a single light signal. The international airport is located between 5000-metre-high summits and can only be reached during daylight and at clear visibility. It is one of the ten most dangerous airports in the world. But there is a certain connection with Bhutan that can be traced all the way back to father Carlo Galmarini. A kind of love for a secluded land and its people. And a lot of courage.



First There Was a Wooden Bridge
After a violent storm had flushed away an important wooden bridge in Bhutan, father Carlo Galmarini was contacted by a relief organisation around ten years ago – and immediately began the planning process: He increased the span of the bridge from 35 to 55 metres in case that the river might begin to swell again. He also designed the bridge in accordance with modern state of the art engineering practices, without changing its original appearance. The current king was one of the first people to walk across the bridge for his coronation on 6 November 2008. The bridge leads to one of Bhutan's most significant monuments: The Punakha Dzong.

Kindergarten in Thimphu
Back to now: Andreas and Nathalie Galmarini live in Bhutan's capital city Thimphu, with around 100,000 inhabitants the biggest and busiest place in the country. Their six-year-old daughter and their four-year-old son go to kindergarten, the three-year-old youngest son visits a day nursery – without understanding a single word at first. Bhutan's official language is Dzongkha, but most people can also speak English. Andreas Galmarini contributes actively to the preservation of historical structures. He supervises the reconstruction of the Wangdue Phodrang Dzong. A large fire had completely destroyed it – more on this in the main text.

Vision for an Entire Region
Just like his father, Andreas Galmarini combines the traditional architecture of Bhutan with today's methods and continues to be approached for guidance by the "Division for Conservation of Heritage Sites" (DCHS) for new projects. Furthermore, he wants to tackle a much bigger task, "the realisation of a vision", as he calls it: In collaboration with the DCHS, he wants to build a laboratory at the University in Thimphu in order to conduct large-scale earthquake-related tests with stone wall structures. The research results, for which he also requires international support, could be an immense benefit for the entire Himalayan region: "Since stone walls are composed of heterogeneous materials, as it is common in the region, they behave differently from homogenous building materials", explains Andreas Galmarini. "In addition, the people of Bhutan and other Himalayan countries build with clay, and not with cement mortar. This might increase flexibility, however, clay is much less firm than modern materials, which makes it difficult to predict earthquake resistance." This is where research is needed, because "if you want to preserve the traditional construction techniques, then you have to be able to teach the population how to build traditional houses in an earthquake-proof way".

The Transfer of Knowledge
Andreas Galmarini said it quite clearly: "We want to help and foster." This includes a personal transfer of knowledge. The engineering company WaltGalmarini has invited the young construction engineer Jigme Choden of the DCHS, the state-run organisation for the preservation of historical buildings, to do a four-month internship in Switzerland. The Swiss architect Fritz Baumgartner, who has been living in Bhutan for years, is passing on his knowledge at the construction site of the Wangdue Phodrang Dzong.

The 36-year-old king of Bhutan, Jigme Khesar Namgyel Wangchuck, personally met Andreas Galmarini: In an audience, he explained how the tower of the Wangdue Phodrang Dzong will be mounted in order to be resistant to all types of tremors. The king thanked him and approved the implementation of the concept.

The historical monument of Wangdue Phodrang should, also thanks to the support from Andreas Galmarini, be restored by 2018. Then, Buddhist festivals and dances will be able to take place again as they do in other places in Bhutan.

Angst + Pfister Manufactures ASSIWELL® Hose Lines Conforming to ASME & PED Standards

Nowadays, international projects and internationally active enterprises do not only adhere to the European Pressure Equipment Directive (PED), but also to the standards set out by the American Society of Mechanical Engineers (ASME). Angst+Pfister is well-versed in both guidelines and has developed its own ASME Manufacturing Standard for the production of its hose lines.

For many European companies the "ASME World" is still largely unknown territory. The American Society of Mechanical Engineers, founded in 1880 and located in New York, unites more than 120,000 members today in the form of a professional association. The organisation establishes technical guidelines and standards and also publishes these. In the USA, many of these documents have the same significance as law and are thus binding.

One of the 37 associations of the ASME is concerned with pressure vessels and pipes. The first industrial revolution – incidentally also the time when countless organisations similar to the ASME were founded in other industrial nations – introduced new hazards: Pressurised containers could explode, and the question which soon came up was how this danger could be dealt with.

In the end, it was exactly this question that motivated several mechanical engineers to found the ASME. Too many accidents related to pressure vessels resulted in the loss of human lives – and furthermore, consumed large sums of money.

Big Differences Compared to European Pressure Directive

Today, the ASME Boiler and Pressure Vessel Code (BPVC) is still the biggest and most comprehensive of all ASME standards to this day. It regulates the development, manufacturing and maintenance, as well as the operation of pressure equipment of all types. The structure of this US-American guideline significantly sets itself apart from the European Pressure Equipment Directive (PED).

If you are used to the European approach, you will first need to accept and get familiarised with the American way of thinking. But once you have grown accustomed to the ASME system, you will be able to discover several clear benefits.

Firstly, to name just one example, much more responsibility is imposed on the manufacturer. This allows for numerous qualifications to be directly conducted by the manufacturer without the need to consult external experts as customary in the European system.

The ASME Manufacturing Standard Provides Security

In collaboration with TÜV Thüringen, Angst + Pfister has established an ASME Manufacturing Standard for the production of its ASSIWELL® hose lines. It regulates how products are to be assessed in accordance with the ASME Code, how they are to be labelled and in which ways the customer is allowed to use them.

Angst + Pfister's "ASME Manufacturing Standard" is based on a wide range of different documents and tests.

Welding Procedure: Angst + Pfister's manual as well as mechanised welding processes are qualified according to ASME Section IX and recorded in documentation (WPS, WPQ etc.)

Manufacturing Standard: This document specifies the framework conditions and forms the foundation for manufacturing.

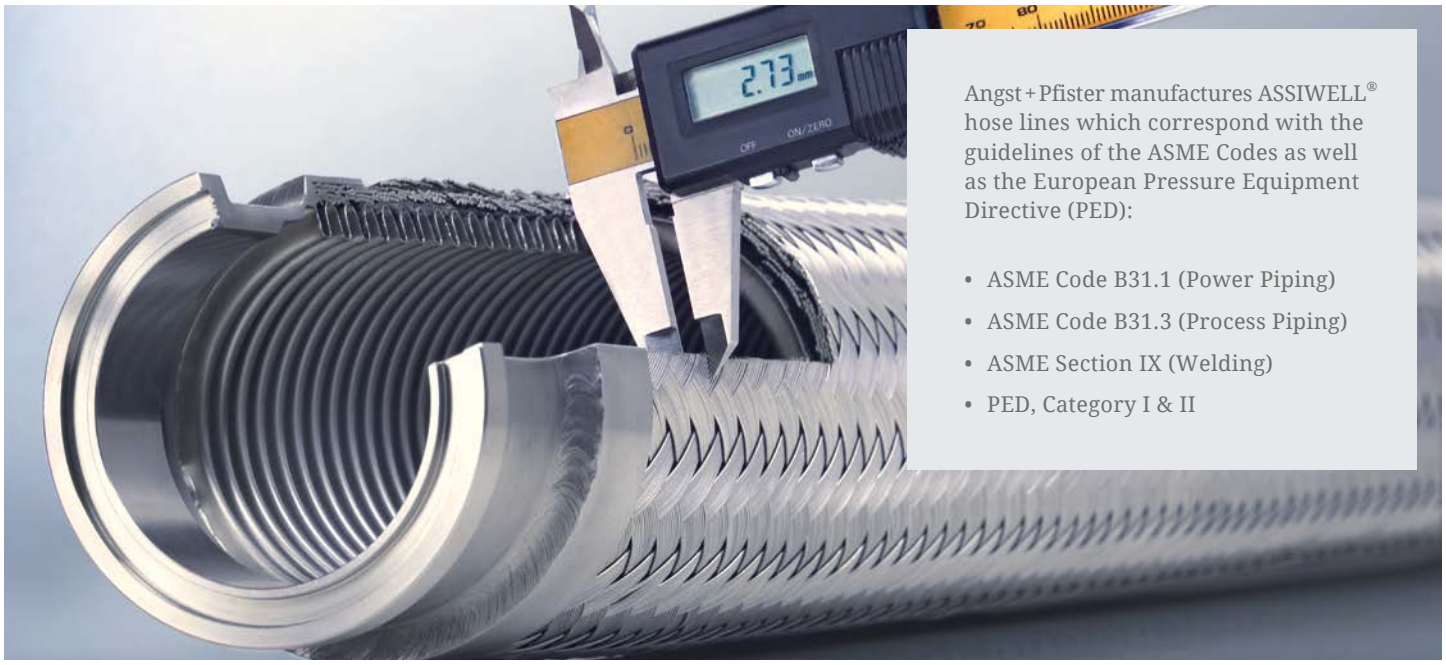
Burst Tests: All ASSIWELL® hoses which are used for facilities conforming to ASME standards undergo representative burst tests in order to receive the qualification of the pressure rating and the operating temperature. These burst tests are a follow-up to an ASME-conforming test instruction and are supervised by an ASME inspector.

Assembly Instructions / Test Instructions: These complementary files document the internal, specialist parameters established by Angst + Pfister for welding and assembling ASME-conforming ASSIWELL® metal hose lines.

ASME Standard Components: Pressure-bearing components such as pipes, flanges or pipe elbows, are used according to a standard discussed in the ASME Code.

No Additional Effort for the Customer
Angst + Pfister tests internally whether a hose line can be categorised according to the requirements. If so, a production drawing is developed. The ASME-conforming ASSIWELL® hose lines are then manufactured in accordance with the Manufacturing Standard and the complementary documentation. Angst + Pfister provides the customer with a declaration of conformity, stating that the line has been produced in accordance with ASME provisions.

ASME Standards Are Gaining more and more International Importance
The importance of the ASME Boiler and Pressure Vessel Code continues to grow. Its significance reaches beyond North America into the oil and gas industry in the Near East or into the heating, ventilating and air-conditioning systems in the Far East. Today, large international projects, as well as internationally oriented enterprises, which manufacture goods that must be globally recognised, do inevitably come into contact with ASME requirements at one point or another. Angst + Pfister is ready to support.



Angst + Pfister manufactures ASSIWELL® hose lines which correspond with the guidelines of the ASME Codes as well as the European Pressure Equipment Directive (PED):

- ASME Code B31.1 (Power Piping)
- ASME Code B31.3 (Process Piping)
- ASME Section IX (Welding)
- PED, Category I & II

Enabling Farmers to Better Till Their Land

No farmer is pleased when he can no longer properly break up the soil with his disc harrows. That, however, is about to change: Angst+Pfister has developed a special rubber compound for rubber cords, which securely maintain the disc harrows in their working position. Across Europe, enterprises manufacturing agricultural tillage equipment have expressed much interest in it.

For a year, perhaps a little longer, everything appears to be going well. The farmer attaches the harrow to his tractor and drives onto the field to cut and break up the soil. But then the disc harrows no longer firmly attach to their tracks.

Furthermore, the cutting angle and depth seem to fluctuate at random. What happened? The rubber cords inside the swivels of the arms holding the disc harrows have worn out. They are plastically deformed and no longer fulfil their function as spring joints.

"It doesn't have to be that way", says Angst + Pfister's Raphael Friedli. The Senior Engineer specialises in antivibration technology and he organises a meeting together with his colleagues at Laspar Angst + Pfister in Turkey, who are the experts when it comes to the development of new elastomer compounds. Within just a few weeks, the compounding specialists in Bursa, Turkey, create a completely new composition. Which raw rubbers and admixtures they add at which quantities for sure remains their secret. However, tests are showing that their new compound is both weather and UV resistant and that even harsh environments can do it no harm.

Significantly Increased Service Life

Even the ageing process is simulated – not only for the rubber compound, but also for comparative compounds. The new compound manages to outperform every single elastomer mixture it was compared with. In other words: Its service life is several times longer than that of the compound of the rubber cords which had been used in tillage equipment thus far.

„Unparalleled Stability"

It only takes four weeks for the prototype tool to be ready, and then a few days later the prototype of the new rubber cords becomes available as well. The first customer to build them into his disc harrows is surprised by his test results in the 1:1 environment. He calls the stability, with which the disc harrows were now working, "unparalleled". And he can also expect the rubber cords to remain in shape as spring elements for many years to come.

Customised Shapes Also Possible

Meanwhile, Angst + Pfister's rubber cords have gone into serial production. Notable manufacturers of agricultural tillage equipment from across Europe have expressed interest – countless of them have already begun using the new product. For the sake of dimensional accuracy, Angst + Pfister does not produce by extrusion but by injection moulding. This production method also allows for customised shapes which deviate from the usually round cross section. For a German manufacturer, for example, Angst + Pfister produces rubber cords with small nubs that make assembly simpler and safer.

Farmers do not need to worry anymore. And should the disc harrows ever come across a rock, they immediately move upward. The new rubber cords absorb the shock, without wearing out too quickly.

Compounding That Pushes Boundaries

It's all about the right rubber compound. But this is easier said than done. It requires specialists with not only the right technical expertise, but also with experience. They craft a fluoroelastomer that is as temperature-resistant and capable as perfluoroelastomer, but around 100 times cheaper. ABB Turbo Systems uses O-rings made out of this FKM.

ABB Turbo Systems uses O-rings made from FKM for their turbochargers.

An O-ring made out of FKM that is resistant to temperatures up to 280 °C as well as to high-performance turbine oil – that is far away from any type of standard. "But it is possible", says Giovanni Valente, Senior Engineer for Sealing Technology at Angst+Pfister. In the same breath, he points out the big cost difference between FKM and FFKM, which is normally used for high-performance components.

Recognising What Is Feasible

A fluoroelastomer compound which is almost as capable as a perfluoroelastomer compound requires quite a bit of technical expertise: first, one must listen carefully and understand exactly, down to the last detail, what the customer requires. Furthermore, experience is necessary in order to recognise what is actually feasible, even if it may seem unrealistic at first.

Laboratory and Field Tested

Together with one of Angst+Pfister's strategic production partners that specialises in compounding, Giovanni Valente has developed various new elastomer compounds. They fulfil exactly or even exceed the requirements which he had previously defined in the specification sheet. The production of the O-ring prototypes was followed by extensive high-temperature tests for various periods of time. They took around a year and a half to be completed since Giovanni Valente wanted to be 100 percent sure: "These O-rings are relatively small but strategically crucial components of the turbochargers manufactured by ABB Turbo Systems. It's quite costly when a turbocharger malfunctions." ABB develops and manufactures turbochargers for diesel and gas engines. Our products are used globally – on ships, in power plants, in locomotives as well as in big off-road vehicles.

And the successful laboratory tests were not all. In order to verify the durability of the new FKM compound under real, partly very rough conditions, a one-year-long field test was conducted with three turbines with the built-in O-ring prototypes. All results were convincing.

ABB Turbo Systems thus released the new rubber compound not just for a single application, but for an entire application field. And Giovanni Valente wrote the concluding specification sheet for this entire application field. This was the beginning of a serial production.

The right rubber compound and the right partners make the difference

The right rubber compound determines the quality of performance provided by a seal or a vibration isolation. Angst + Pfister has formed a strategic alliance with TSF, the global market leader when it comes to the development and production of high-tech compounds. Next to Angst + Pfister's existing production facility in Bursa, TSF will set up an additional production facility with initially two supermodern compounding lines. Customers will benefit from the extended expertise.

The development of raw materials forms the basis for innovative solutions, and this basis is also set to be broadened: Angst + Pfister is forming a strategic alliance with TSF S.p.A. from Italy. The alliance secures and expands the compounding capabilities of the Angst + Pfister Group and enables access to the expertise of a company which is considered one of the world leaders in this area. TSF, founded in 1984, has become a reference company for the development, production, and marketing of special rubber compounds. Products include silicones such as VMQ, fluorosilicones such as FVMQ, fluoroelastomers such as FKM, and perfluoroelastomers like FFKM, among others.

TSF invests in Turkey

As part of the strategic alliance, TSF is founding the Turkish compounding company TSF Performance Compounds Kaucuk AS and is also setting up two highly efficient compounding lines. For its part, Laspar Angst + Pfister is constructing a production facility on the property next to the plant in Bursa, which will be rented by TSF Performance. The rubber compound production will be moved to the new plant.

Gian Petro Manenti, owner and CEO of TSF, notes a trend of specialisation in compounding: "Instead of producing in-house, more and more companies receive their compounds from specialised compounding firms and also let them develop them." This is why Eray Ulugül, CEO of Laspar Angst + Pfister, is convinced that customers will benefit from the alliance, because: "We will gain additional expertise and simultaneously accelerate research and development." As soon has TSF begins the compounding process in Turkey in 2017, Laspar Angst + Pfister will move its production volume to the new company.

100,000 Times Exactly the Right Product

It doesn't always have to be a customised request. Quite often, a look at Angst + Pfister's complete product range on www.angst-pfister.com or a visit to our online shop on www.apsoparts.com can be more than worthwhile for developers and especially for purchasers.

APSOdrive® SYNCHROFLEX Polyurethane Timing Belts

For the new design of a packaging machine, our customer was in need of a powerful drive solution with an accurate high-performance toothed belt. Thanks to a close cooperation between the designers and our product application engineers, a solution was implemented with SYNCHROFLEX polyurethane timing belts from Angst + Pfister's standard range.

Application:

APSOseal® HITEC® O-rings

Sealings for drinking water pipelines do not only have to comply with specific technical requirements. The challenge lies in having a standardised product which fulfils all the approvals for different markets. HITEC® at Angst + Pfister stands for highest quality O-rings with approvals for drinking water, food, pharma and medical industries. Thus, our customers may choose from our extensive standardised range and benefit from very short delivery times.

Application:

APSOseal® Radial Shaft Seals

There are plenty of machines with shafts that require sealing in the agricultural industry. Only through a broad standardised range can a customer obtain all the required products from a single source at a short notice. Angst + Pfister offers a very wide assortment of radial shaft seals. The variety of different designs and raw materials was expanded by our newest product "Form AS" (with dust lip) in FKM. In addition, we offer APSOseal® SLEEVE (shaft protection sleeves) and APSOseal® END CAPS.

Application:

APSOPUR® Foam Damping Mats

Our customer, a leading manufacturer of railway carriages, has increasingly high requirements to improve the comfort for the passengers. Elastic mounts between the under-floor, on one hand, and covered plywood floor, on the other, make it possible to forget any unevenness in the wheels and in the tracks. To meet these high requirements, we have designed customised APSOPUR® floating floor supports, which are also fire resistant in accordance with EN 45 545 (R9 - HL3, R 10 - HL 2). The polyurethane foams are glued to aluminium strips in accordance with DIN EN 3701-2 (A2) in our plant in the Netherlands.

Application:

It doesn't always have to be a customised request. Quite often, a look at Angst + Pfister's complete product range on www.angst-pfister.com or a visit to our online shop on www.apsoparts.com can be more than worthwhile for developers and especially for buyers. Whether O-rings or hoses, cone mounts for vibration isolations, plastic profiles or toothed belts: Angst + Pfister's range includes more than 100.000 standardised products. They can be ordered online and most can be shipped immediately.Standardised products and individual consultations are not mutually exclusive. Our international team of engineers, which often conceptualises highly complex solutions for our customers, will be happy to assist if required. Countless of standardised products have emerged from Angst + Pfister's Engineering Department, so that new customers do not have to pay for the design but only for the actual product itself. Furthermore, Angst + Pfister's specialists continue to use standardised products by customising them in accordance with the buyer's specific design requirements. The uncomplicated ordering process is followed by our lean logistics. It is capable of fully adapting to the customer's supply chain which can lower costs even further.

APSOvib® Cone Mounts HD (High Deflection)

APSOvib® Cone Mounts HD (high deflection) are specifically designed to improve the interior comfort of tractors and construction machinery cabins. Thanks to the high deflection combined with a gradual damping effect, even the lowest frequencies can be absorbed. We have successfully offered our proposal for shock absorption as well as driving cabin isolation from engine vibrations to a leading manufacturer of agricultural and construction machinery.

Application:

APSOfluid® CHEMOLIT® PTFE Chemical Hose

The CHEMOLIT® PTFE chemical hose is an outstanding product in terms of its applicability. Its smooth, seamless PTFE inner layer (Teflon®) is resistant against nearly every chemical substance and is also suitable for food processing and the pharma industry due to FDA and USP class VI approvals. One of our long-term customers uses this hose for manufacturing of aromatic substances and fragrances. As the PTFE inner layer neither absorbs nor dispenses odours, it is the perfect product for its application.

Application:

APSOplast® PTFE N100

Our customer has traditional expertise in designing and manufacturing espresso machine components. Since they sell their machines on the US market, theyasked us to assist with NSF/ANSI 61 homologated components. Angst + Pfister has immediately embraced the new regulations and has started manufacturing all parts that come into contact with drinking water exclusively with APSOplast® PTFE N100, which is homologated in accordance with NSF/ANSI 61.

Application:

Logistics, quality assurance and customer focus worldwide

Our state-of-the-art logistics centre is the linchpin of Angst + Pfister's logistical services. At the roughly 23,000-square-metre logistics centre, 140,000 different stock-keeping units are warehoused and more than 1,500 separate items are reliably processed and shipped daily. Excellent C-parts management coupled with a world-spanning procurement network guarantees high product availability – even for custom items – with fast delivery times. With just-in-time, Kanban, supply management and other logistics concepts, Angst + Pfister enables customers to synchronise their incoming parts shipments to precisely match their production rhythm and to thus minimise inventory carrying costs. Our ISO 9001: 2008, ISO 14001:2004 and ISO/TS 16949:2009-certified complete quality assurance system additionally enables customers to greatly simplify their incoming goods inspection procedures.

New oxygen sensors from Pewatron for controlled atmospheres

Many industrial processes require a constant, controlled oxygen atmosphere that must be continuously monitored with sensors, as even minor fluctuations can have serious consequences.

Oxygen sensors ensure that industrial processes function correctly. During 3D printing, for example, when metals, alloys or technical ceramics are applied layer by layer, the oxygen concentration in the environment must remain absolutely constant. The same applies to cell cultures in an incubator, food preservation processes and the storage and ripening of fruits and vegetables. Oxygen sensors are also used in fire protection equipment, gas analysis mechanisms and medical oxygen concentrators.

Measurement, control and regulation by zirconium oxide sensors

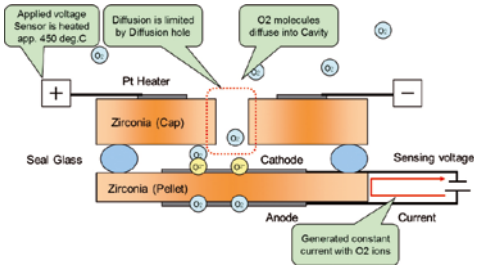
The heart of Pewatron's sensor modules is a precise, durable oxygen sensor that can be configured for just a few ppm to up to 98% oxygen concentration. Information is obtained through an electrochemical process. On a solid, ceramic electrolyte of zirconium oxide, which functions as an oxygen ion-conducting membrane, a lower or higher voltage is produced depending on the oxygen concentration in the gas being measured. The chemical information is thereby converted into an electrical signal.

A wide range of oxygen sensors and oxygen sensor modules

Pewatron offers a wide range of sensors and sensor modules with a variety of analogue and digital standard output signal formats. The FCX series oxygen sensors are available in four different measuring ranges: 0–1,000 ppm, 0–5%, 0–25% and 0–95 (98)%. In each case, the output signal is in the µA range and follows a logarithmic curve as the oxygen concentration rises. The FCX-ULL oxygen sensors measure partial oxygen pressures of 0 to 1,000 ppm pO_2. In the measurement range from 0 to 5% O_2, the new FCX-UL oxygen sensors offer very high precision for oxygen concentrations between 0 and 10,000 ppm. The FCX-UC oxygen sensors with quasilinear measurement curves determine partial oxygen pressure in the range from 0 to 25% O_2. The FCX-UWC oxygen sensors are ideal for measurements in the range from 0 to 95% O_2 – primarily in applications with high oxygen concentrations. Two module types with standardised outputs, FCX-ML and FCX-MC, are available in various configurations: as stand-alone sensors, with or without integrated sensor/flow housing on the circuit board, or with a sensor/flow housing connected to the circuit board via a cable.

Customer-specific solutions

Pewatron also offers variants customised to meet customer requirements. These are usually modules in which the sensor is connected



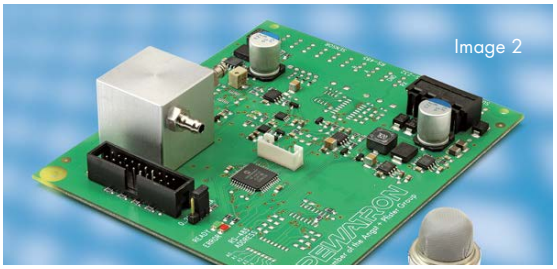
to the circuit board via a cable and which can be used up to an operating temperature of approximately 100°C. In addition, Pewatron has developed two sensor heads that can be mounted directly on the application and can withstand operating temperatures of up to 200°C.

Pewatron is continuously upgrading its sensors for applications with even more demanding requirements. Particular importance is placed on long-term stability, precision, response times and applications in the field of humidity sensors. Soon, sensor modules will be available for applications in practically every field in which controlled oxygen-containing atmospheres are required.

Image 1 — *FCX oxygen sensor and operating principle.*

Image 2 — *FCX-MC modules with standardised outputs.*

Image 3 — *Custom zirconium oxide module for use in vacuums.*



Measure with feeling: sensors from Pewatron

Pewatron AG, a wholly owned subsidiary of the Angst+Pfister Group, specialises in high-quality sensors and power supply solutions. In addition to standard products, Pewatron also offers semi-custom products and custom mass production.

For production processes in challenging environments, precision and safety are essential: in food preservation, the supply of clean energy, HVAC applications, status and function monitoring for industrial facilities, and diagnostic and therapy applications in the medical sector. Pewatron offers a wide range of own-brand sensors and products from well-known manufacturers. Pewatron also develops custom solutions to individual requirements.

Pressure, flow and force sensors
Pewatron sensor solutions measure and monitor pressure changes in the air, in liquids and in aggressive media, with models for pressures from 0 to 2000 bar, measurement cells, screw-in models and sensors for installation on circuit boards. Certain pressure sensors are premounted on customer-specific flex modules to save money and space, while configurable sensors for low pressures are installed in compact, customer-specific housings.

Gas sensors and sensor modules
When the precise composition of a gas mixture needs to be maintained for applications in the food industry, biological incubators or medical ventilation devices, errors can have devastating consequences. Pewatron offers a broad spectrum of gas sensors and gas sensor modules for the analysis of oxygen, CO_2 and combustible gases, for use in safety applications and ventilation and air conditioning technology.

Accelerometers and gyroscopes
Pewatron offers accelerometers for shock, vibration, tilt and inertial measurements, including MEMS accelerometers for navigation systems, angular rate sensors for use under high vibration loads, high-performance gyrometers with MEMS sensors rather than FOG systems, and inertial measurement units (IMUs) with combined gyrometer and accelerometer.

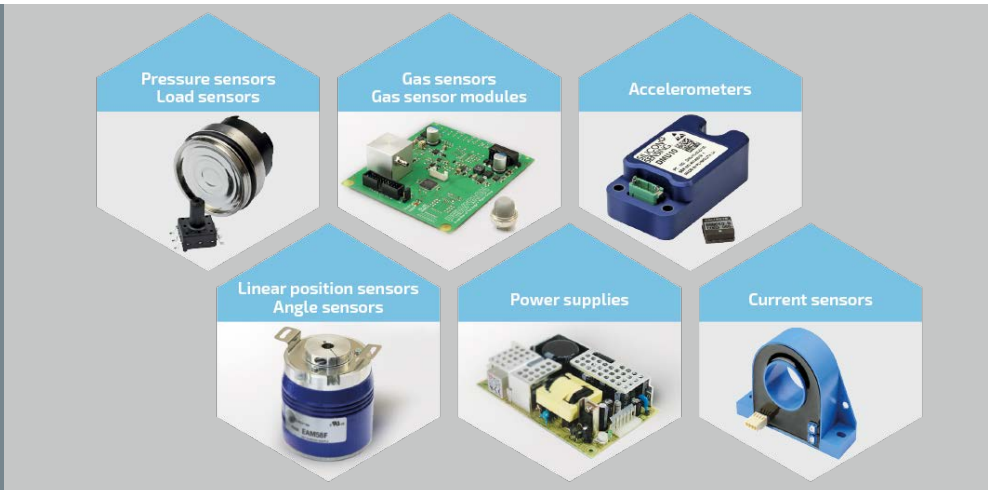
Position and angle sensors
This product range encompasses absolute sensors: potentiometers, contactless with Hall effect, and with magnetoresistive, inductive, optical or magnetic measuring principle; cost-effective kit encoders, inclinometers with one or two axles with MEMS or electrolyte technology; and cable-actuated sensors for measuring lengths of up to 50 m.

Power supplies
Pewatron offers the latest power supply units, DC/DC converters and DC/AC inverters – standard products or customer-specific solutions for industry, medical technology, household appliances, telecommunications, measurement technology, LED lighting technology and the railway industry.

Current sensors
Pewatron offers current sensors and transformers for the detection, monitoring and precise measurement of currents in energy metering and management (networking monitoring/solar/wind/hydro/fuel cells), drive technology (servomotors and DC motors), railway technology (on-board systems, track monitoring), electric mobility (charging levels, battery management systems), HVAC and industry (soldering machines, pumps, switching power supplies, USV systems and inverters).

Central Switzerland: Pewatron AG
Thurgauerstrasse 66
CH-8052 Zurich, Switzerland
Tel. + 41 44 877 35 00
info@pewatron.com
www.pewatron.com

German branch:
Pewatron AG
Neumarkter Straße 86a
DE-81673 Munich, Germany
Tel. + 49 89 260 38 47
infode@pewatron.com
www.pewatron.com

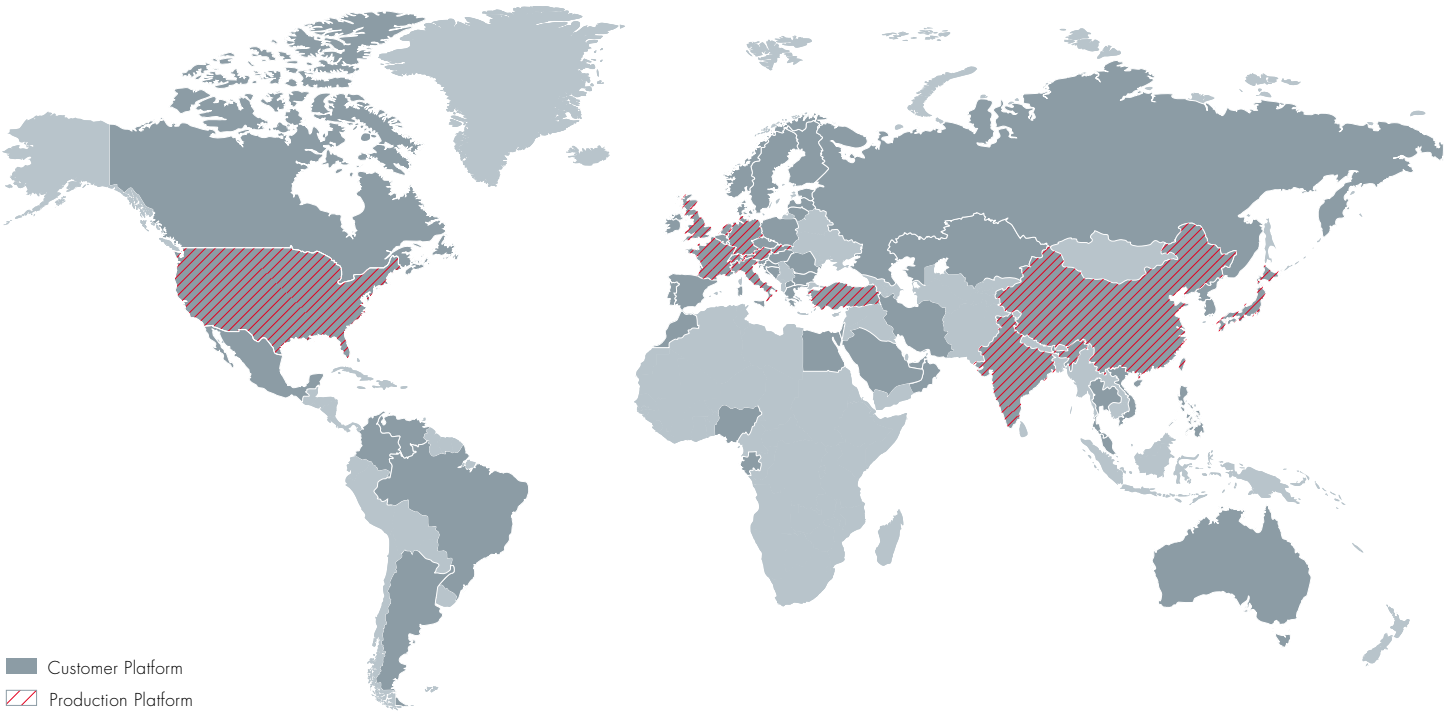


Services

The Angst+Pfister Group supplies its services to every corner of the globe. We are offering solutions tailored to the customer's specific needs with our local application specialists. We are providing engineering-lead solutions to thousands of original equipment manufacturers in over 50 countries.

Production Platform

Our global production platform spans across 15 countries. In addition to our own state-of-the-art manufacturing, we have reserved capacity with internationally renowned production partners. This allows us to always select the best production location based on our customers' quality, quantity and delivery requirements.



No matter where you are – your gateway to the products and services of Angst+Pfister:
www.angst-pfister.com

Your benefits at apsoparts.com

- Standard range of over 100,000 items
- Real-time availability display
- Online cut-to-size configurators
- Upload your own ERP order

APSOparts® serves more than 12,000 satisfied customers.

APSOparts®

the Online Shop of Angst+Pfister
www.apsoparts.com
support@apsoparts.com

0886702102 A+P Group_NP_EN_01.2017_ODW