



Machine safety Reliable safety with AVENTICS

Interview Dr. Rolf Zöllner

AVENTICS USA 50 Years of AVENTICS Lexington

IMPRINT

Publisher: AVENTICS GmbH
Ulmer Straße 4, 30880 Laatzen, Germany

**Responsible according
to the press law:** Dr. Peter Saffe
Tel +49 511 2136-137

Editor in chief: Juliane Maxin
Tel +49 511 2136-870
juliane.maxin@aventics.com

**Deputy &
editorial staff:** Sarah Ognibeni
Tel +49 511 2136-215
sarah.ognibeni@aventics.com

Editorial staff: Torsten Kirchmann
Tel. +49 6131 6230 330
info@kirchmann-text.de

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Suggestions, praise, and criticism:
amag@aventics.com



"We are committed to making it easy to deal with us."

Paul Cleaver
CEO AVENTICS



Dear Readers,

Thank you for your feedback to the first issue of our customer magazine **A Mag**. Many of you welcomed the mix of expert opinions and practical application examples regarding everything pneumatics. The selection of industries is just as well received as the preview of the latest developments on the pneumatics market. The focus on energy efficiency received the most feedback – the topic is obviously on your mind.

This issue will focus on an important trend: machine safety. Our product portfolio encompasses a wide range of safe pneumatic and electropneumatic products. Here, AVENTICS sets benchmarks across the globe and achieves proven reliability ratings that are much higher than the market standard.

The specifications for machine safety are complex in Europe, the Americas, and Asia alike, and unfortunately they are not always clear. We want to support you by giving you access to our application experience in thousands of safe solutions. The trained AVENTICS sales team will provide you with detailed, practical and helpful consultation. Furthermore, our various print and online media information will give you additional practice-oriented support.

We have also created a brochure with safe switching examples which have been assessed by a specialized, independent institute to ensure their occupational safety.

This is only one example of how committed we are to making it easy to deal with us. Be it with helpful information, online tools for configuration, or simplified processes, such as our pneumatics material kits. On request, we will combine all pneumatic components from your project into a single order number and deliver them in a complete package worldwide – a simple, quick, reliable solution.

Have fun reading and to successful business.

Yours,
Paul Cleaver
CEO AVENTICS

CONTENTS

02

IMPRINT

03

EDITORIAL

06



Reliable safety with AVENTICS
Safe pneumatic solutions

10



Interview Dr. Rolf Zöllner
Pneumatics as safe as electrical solutions

20



High power in a small package
Polymers in pneumatics

22



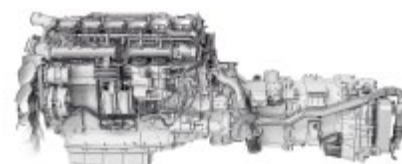
HPC inverted tooth chain
The AVENTICS "silent chain"

30



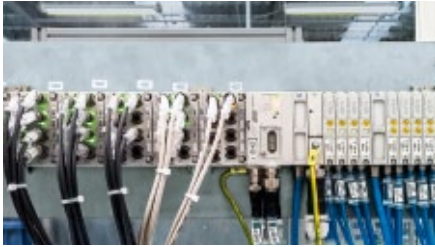
Kaleidoscope
AVENTICS news

32



India and AVENTICS
Partner Country of the Hannover Messe

14



One valve system – two signal paths
Standard-compliant safety

16



Life Sciences
Oxygen for a free life

18



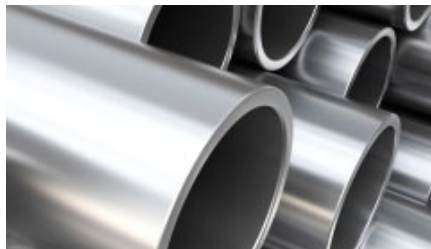
Clean under pressure
Hygienic production of wet-cured ham

24



AVENTICS USA
50 years of AVENTICS Lexington

26



Ceramic valve
Zero failures at the aluminum plant

28



Light air steers heavy steel
Modular valve panels for SMS Siemag

34

10
TIPS

Ten practical tips for pneumatics
Simple, convenient engineering

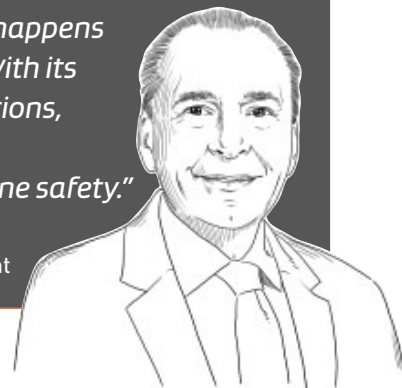
RELIABLE SAFETY WITH AVENTICS

Safe pneumatic solutions
from the experts



"Every workplace accident that happens on a machine is one too many. With its focus on safe products and solutions, AVENTICS makes an important contribution to improving machine safety."

Theo Paulus,
Vice President Research and Development



RELIABILITY WITH TOP PERFORMANCE

"Every workplace accident that happens on a machine is one too many. With its focus on safe products and solutions, AVENTICS makes an important contribution to improving machine safety," emphasizes Theo Paulus, Vice President Product Area Standard Pneumatics. "This is why AVENTICS will present a multitude of new safety products this year, providing machine manufacturers with even more expert support."

For machine manufacturers, there's no way around it: Since the launch of the Machinery Directive (2006/42/EC), only machines meeting the safety requirements set out in the directive may be commissioned in the European Union. "One major advantage: the regulation is uniform across Europe," highlights Theo Paulus. At the same time, it also sets global benchmarks the regulation serves as the foundation for other regional standards, such as Brazil's NR 12. ISO 13849 plays an important role in the implementation of the machinery directive for the assessment of technical safety measures. Typical questions that engineers ask on the topic of machine safety include: what happens when there is a power cutoff or an operator presses the emergency OFF switch on a machine? Andreas Blume, an AVENTICS machine safety specialist in Sales in Germany, knows the answer: "In these cases, we need an external mechanism to safely cut off power to cylinders, for example, so that they do not present a hazard." Pneumatic components need to execute three important safety functions: safe shutdown, safe exhaust, and safe pressure and force reduction. AVENTICS offers the right pneumatic and

electronic solutions for all three functions – available across the globe: from SV07 and SV09 double valves to ISO valves with position inquiry and maintenance units for safe exhaust to the new AV valve generation with safety-oriented electronic and mechanical components. Component function is essential when it comes to machine safety. In this area, AVENTICS is setting standards for the entire industry.

A major change compared with earlier standards: Now, engineers have to define a required performance level (PL) in a risk assessment, depending on the probability of occurrence and frequency of risks, as well as the severity of possible injuries. This PL must be achieved by means of technical safety precautions. Safe pneumatic switching processes and the reliability of the safety-relevant components contribute to these efforts. The engineer calculates and documents the PL with reliability values, such as the B10 value. In valves, this value indicates how many switching cycles it takes for 10% of components to exceed defined limits, such as switching times, leaks, or switching pressure under specific conditions. "Standard safe exhaust valves have a B10



value of 250,000. At AVENTICS, our SV07 and SV09 exhaust valves achieve 10 million and AV valves even perform up to 75 million,” Andreas Blume points out.

That’s not all: “Engineers should definitely read the fine print to see whether these values were determined precisely in accordance with ISO 19973, as at AVENTICS, or only based on the standard, as is customary for some manufacturers,” advises Sabine André, Head of Product Training for Sales and of the ICC (International Competence Center). “At the end of the day, the engineer is responsible for the calculations.” AVENTICS uploads the B10 values for all safety-relevant components in the cross-manufacturer Sistema database as a library.

EXPERTISE TRANSFORMED INTO PRACTICE

Unlike previous regulations, the machinery directive follows a systematic approach. “That’s why AVENTICS created a comprehensive catalog with safe switching examples which we supply to our customers, thereby giving them completely practical support,” underlines Sabine André.

The examples were given a positive rating by the IFA, the Institute for Occupational Safety and Health of the German Social Accident Insurance.

AVENTICS supplements this catalog with a safety brochure and

detailed information on pneumatics and machine safety on the AVENTICS homepage online. Trained sales staff is available to provide technical support.

RELIABLE VALVE ELECTRONICS

With galvanic isolation between the U_L and U_A , the AES valve electronics for the new AV valve generations meet these proven safety principles. They have two independent signal paths for safety-related tasks and other tasks. They are safeguarded against manipulation because they do not have a switch for configuration and can feature any valve to safety-zone ratio.

SAFE EXHAUST AND RELEASE

The AV series module exhausts the cylinder chambers without requiring additional energy. This means a cylinder can be moved to correct workpieces since the cylinder chambers that were under pressure are now exhausted. An application that has already come into practice is the release of trapped persons.

If a person is trapped and the cylinder cannot be moved due to power failure, the exhaust module enables the cylinder to be switched without power.

The module offers full functional integration with simple connec-



tion to the actuator. It reduces the installation space required by the cylinder significantly, lowering costs by up to 20%.

SAFE SHUTDOWN

A WIDE RANGE OF SAFE COMPONENTS
SAFE PNEUMATIC CIRCUITS ARE BASED ON
COMPONENTS DESIGNED IN ACCORDANCE WITH BASIC,
PROVEN SAFETY PRINCIPLES.

As a part of safe solutions, valves stand the test with wear-free, magnetic spool position inquiry and spring return. They also help engineers achieve the degree of diagnostic coverage for safe pneumatic circuits of 99% as defined in ISO 13849. A key feature: These valves are safeguarded against manipulation since the sensors are bonded and users cannot incorrectly mount them or change their position – in line with the poka-yoke principle.

Designation	DC range
None	$DC < 60\%$
Low	$60\% \leq DC < 90\%$
Medium	$90\% \leq DC < 99\%$
High	$99\% \leq DC$

The certified locking unit for cylinders prevents unintended movements from the home position. Another key aspect: Safety functions have to be tested at least once every eight hours. With a locking unit, this is not possible by means of a pressure switch. This is not the case with the sensor used by AVENTICS, integrated into the locking unit. It monitors the locking unit opening and closing processes and queries the clamped position. As a result, users can increase the degree of diagnostic coverage from 90% with a pressure sensor to 99% with the AVENTICS solution.

COLLABORATION WITH ROSS FOR ADDED SAFETY

In addition to the components and solutions developed in-house, AVENTICS has also entered into collaboration with ROSS CONTROLS. The company has been a leader in equipping the heavy industry worldwide with safety-relevant components for decades. "The SV07 and SV09 electro-pneumatic double valves represent a supplement to our portfolio, developed by ROSS with global certification," states product manager Wolf Gerecke. "Why should we reinvent the wheel when we can provide a proven, self-testing, redundant solution for the highest of safety requirements in collaboration?" SV07 and SV09 also execute the "safe exhaust" function if a valve malfunction occurs, for example due to contamination or wear.



"A machine is only as good as its operation and maintenance capacities."

“Build a safe machine applying proven safety principles, and document everything.”

INTERVIEW WITH DR. ROLF ZÖLLNER, RISK MANAGER AT TÜV SÜD

Dr. Rolf Zöllner studied engineering psychology and obtained his PhD in mechanical engineering from the mechanical engineering department at the Technische Universität München in Munich. After working development projects for the automotive industry, in the area of nuclear energy, and positions in information technology, he has been active as a risk manager since 2007. At TÜV SÜD, he is responsible for the machinery directive competence center and currently works in the machine safety and functional safety competence centers.

TÜV SÜD, founded in Germany over 145 years ago, has become one of the leading technical service providers across the globe. More than 20,000 employees at over 800 locations bring the company's philosophy to life: “Choose certainty. Add value.”

Dr. Zöllner, what does the subject of engineering psychology encompass?

Dr. Zöllner: *People, mechanics, and electronics coalesce here. Why is this important? Machines are never simply stand-alone: there's always a person to operate them. And the human-machine interface plays an important role in the machinery directive. A machine is only as good as its operation and maintenance capacities.*

What is your task as a risk manager?

Dr. Zöllner: *The TÜV SÜD and the machinery directive interface on many levels: On the one hand, we certify products and systems, for example in accordance with the Pressure Equipment Directive, based on our history and as an accredited body. Strictly separate, we provide consultation in interpreting directives and standards and support companies in implementing legal, standard-compliant safety. I conduct workshops and tests for companies as to how they can implement legal requirements based on existing processes and solutions and sometimes delve deep into technical details. As a technical service provider, we also assume the role of distributor. We create risk assessments and check whether the technical documentation is suitable and complete in order to meet the requirements set out in standards. In case of disputes or, in the worst case, after work accidents, we are also commissioned by courts or one of the disputing parties to determine causes and responsibilities.*

MACHINE MANUFACTURERS RESPONSIBLE FOR SUPPLIERS' CE MARK



RISK OF AN ACCIDENT RESULTING IN DEATH: TARGET OF ONE IN A MILLION

How do you proceed in such cases?

Dr. Zöllner: There is a clear chain of liability: Did the machine owner meet all responsibilities for safe operation and did the employee comply? If so, the owners have to prove to the machine manufacturer that the machine was not safe. There are then two options: If the machine manufacturer has issued a CE mark and complied with the harmonized European standards issued in the Official Journal of the European Union, the machine manufacturer is not required to make a direct move and can claim so-called "presumption of conformity" of the CE mark and EC declaration of conformity. If the machine manufacturer has issued a CE mark in accordance with other regional regulations, but not the European standards, the manufacturer has to prove that the machines correspond to European standards.

This means that not all CE marks are created equal?

Dr. Zöllner: The machinery directive has actually empowered manufacturers because they are allowed to issue CE marks under their own responsibility. In most cases, they don't need certification from an independent third-party testing institute such as TÜV SÜD. Those complying with European rules have no problems in Europe. The situation may be completely different if a company outside of Europe issues a CE mark here via a sales organization, applying only the laws in its own country. In case of doubt, it must then be proven that this CE mark corresponds to the European specifications. By the way: The machine manufacturer is responsible for making sure its suppliers' CE mark meets European laws. However, generally, it must be assumed that if there is a CE mark, the basic European requirements for health and safety have been complied with.

This means that the laws applicable worldwide still vary significantly?

Dr. Zöllner: CE is suitable as a starting point for representing regional laws such as the ASME and UL in the U.S., CCC in China, or the Russian variant of the machinery directive. The machinery directive has a fairly new, probabilistic approach for Central Europe: the risk of a malfunction, how often it can occur, and the severity of its consequences. But this isn't anything new. This approach has long been prevalent in the English-speaking world. However, the goal of the machinery directive is sometimes vague. What statistical target for accidents resulting in death should engineers aim for? In the Netherlands and the U.K., there are statutory values, but other European countries don't have set regulations. We recently assessed legally defined limits across the globe and it became apparent that the individual risk of 10^{-6} , that is one to a million, is the general aim. In other words: Using a technical system should not put you at a higher risk than you are already subject to on a standard day.

In your experience, what do machine manufacturers have to take into consideration in particular?

Dr. Zöllner: In our workshops, I always tell machine manufacturers: Define the framework conditions for using your machines exactly, meaning proper use and reasonably foreseeable misuse. An example: After darkness falls, snow groomers prepare the ski slopes. For some skiers, there's nothing better than riding right behind the snow groomer on a fresh piste, frequently resulting in accidents. To limit their liability, manufacturers have to determine and inform the operators of the snow groomers that the slope has to be empty and inaccessible to public traffic while the groomer is in use. This is considered a reasonably foreseeable and known misuse that the groomer manufacturer cannot control completely from a technical point of view.

PNEUMATIC CONTROL AS SAFE AS ELECTRIC CONTROL

How is this implemented in practice?

Dr. Zöllner: ISO 13849 Part 2 requires machine manufacturers to apply the recognized rules of good engineering practice and proven safety principles and recommends validation procedures. This includes, for example, spring return in valves for safe shutdown or the galvanic isolation of process and safety signals in valve electronics. But one aspect is frequently short-changed: Not only electric controls can be used to realize safety-related controls – pneumatics can also get the job done!

How much effort is required here for documentation?

Dr. Zöllner: The machinery directive simply states: Build a safe machine applying proven safety principles and state-of-the-art technology, and document everything. Currently, many manufacturers are introducing CE conformity processes. They are striving to adapt existing product development processes by-the-book but with minimal effort. By the way, in accordance with IEC 61508 and IEC 61511, manufacturers also have to introduce a functional safety management system. This requires them, for example, to assign organizational roles and define functional safety experts with different authorization levels. In addition, the manufacturer must also ensure that their suppliers of relevant components have also introduced this type of system.

“MISUSE IS WILLFUL IF TOOLS ARE USED IN THE PROCESS”

How do machine manufacturers handle manipulation?

Dr. Zöllner: The machine manufacturer must rule out reasonably foreseeable misuse. This specification is rather vague. But one can agree: Misuse is willful if tools are used in the process. As a machine manufacturer, I am not able to prevent these misuses, they are going to happen. What manufacturers have to consider, however, are foreseeable accidental misuses, such as poor operability or the accessibility of manual controls.

What role does operability play?

Dr. Zöllner: One extremely useful requirement of the machinery directive is that foreseeable misuses have to be considered, monitored, and controlled. A machine is only as good as I can understand, operate, and maintain it. That brings us back to the topic of engineering psychology, system ergonomics, and an anthropological machine layout.

Has the machinery directive already made machines safer?

Dr. Zöllner: The systems have become safer, partly because of raised awareness. In addition, there are more options available and the components have become safer. People tend to forget: The machinery directive doesn't only require functional safety, but also high quality. This can also be measured and evaluated thanks to reliability ratings, for example.





ONE VALVE SYSTEM – TWO SIGNAL PATHS

With common supply, section-based shut-off meets
machinery directive requirements

“Two souls, alas, are dwelling in my breast.” This quote from Goethe’s Faust may cross some engineers’ minds.

On the one hand, they want to combine all pneumatic actuators with the same compressed air supply, exhaust, and control, as far as possible. On the other hand, they have to ensure and control certain functions separately for safe shutdown in accordance with ISO 13849. Slovakian machine manufacturer SENZOR has joined the two souls in its breast: The AV valve system supports targeted, safe shutdown of individual sections in a valve unit.

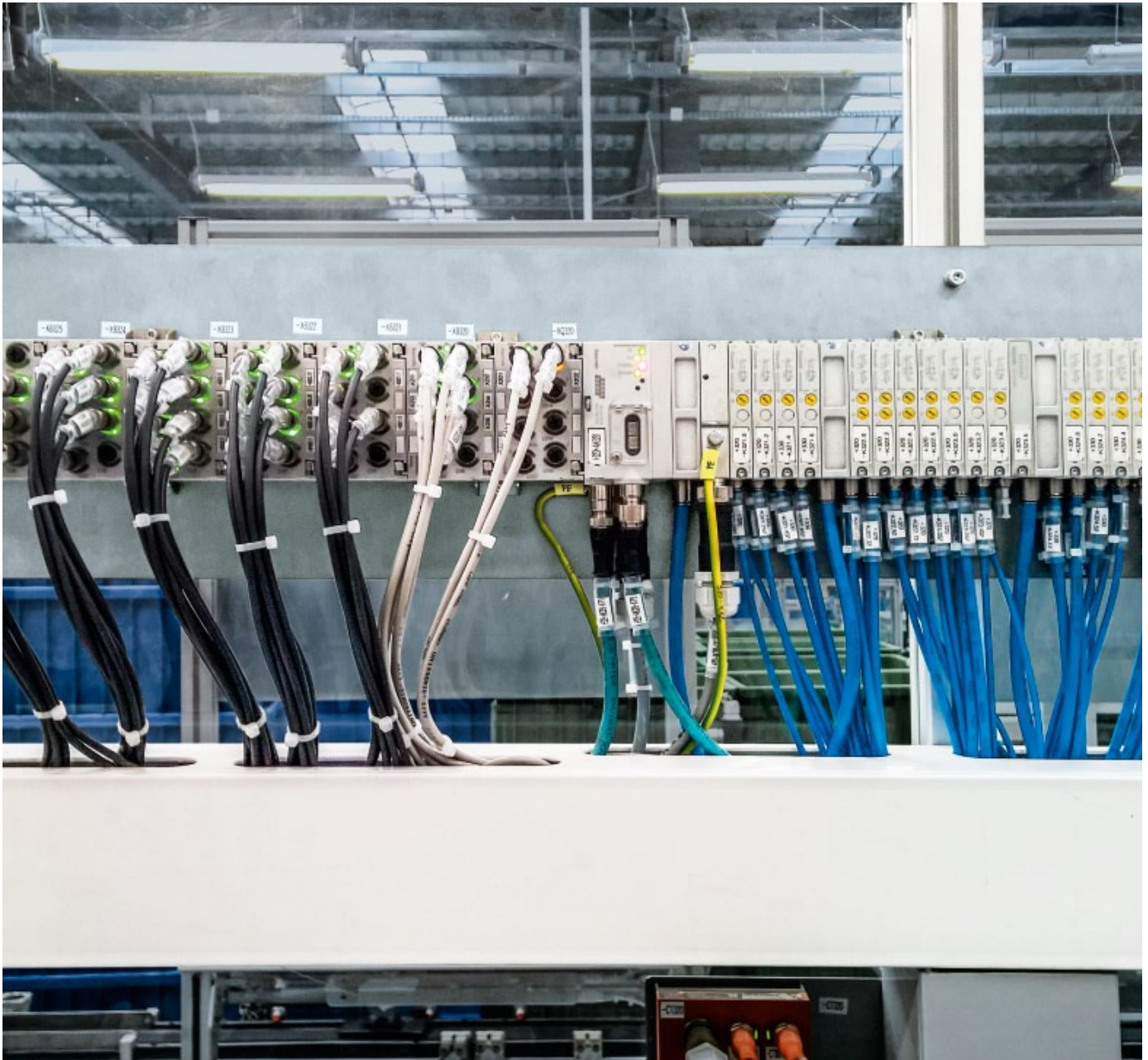
SENZOR s.r.o, in Košice, Slovakia, offers machines and assembly lines for the electrical industry. The company primarily exports to Poland, Spain, the U.K., and Russia. In a customer-specific machine, category C pneumatic controls in accordance with ISO 13849 require safe shutdown of defined functions, while other areas remain functional. This reduces downtimes for manual intervention in the machine.

The solution: the new AV valve generation from AVENTICS. In the AES valve electronics, the power supply for the actuator, U_a , and the logics, U_l , are galvanically isolated. Thanks to these independent signal paths, SENZOR can target and shut down the output for the actuator in individual valves while continuing to address the logic via the fieldbus protocol. This power supply function can be selected up to ten times with the configurator. With galvanic isolation, the AES also fulfils the requirements for the use of external power supplies and upstream safety relays.

The AES offers interfaces to all standard fieldbus and Ethernet protocols and controls up to 128 coils in one system with up to 64 valves. Additionally, it contains an extensive modular system with analog and digital I/O modules. Each AES fieldbus coupler controls up to ten I/O modules. This allows machine manufacturers to incorporate peripherals, such as sensors or single valves, and cylinder/valve units, and reduce cabling.

UP TO
64
VALVES IN ONE
VALVE SYSTEM

CONTROL UP TO
128
COILS



Targeted, safe shutdown of individual sections in a valve unit

OXYGEN FOR A FREE LIFE

Pneumatics for the life sciences industry:
robust, lightweight, and – above all – reliable

The patient's lungs are unable to inhale enough oxygen and so the patient must be provided artificial respiration permanently – just a few years ago, this diagnosis meant a lifetime spent in a hospital bed. Today, patients can take part in life thanks to portable oxygen devices.

Many of these devices feature customer-specific pneumatic valves from AVENTICS.



"Since the mid-'90s, Aventics has been a leading provider of stationary and portable oxygen devices on the American market."

Paul Gant, industry specialist for Life Sciences at AVENTICS USA



"Since the mid-'90s, Aventics has been a leading provider of stationary and portable oxygen devices on the American market," emphasizes Paul Gant, industry specialist for Life Sciences at AVENTICS USA. Back then, the first modern devices functioning without heavy oxygen tanks entered the market. They draw air from the surrounding environment and compress it. An electrically operated AVENTICS valve guides the compressed air through a special filter that extracts nitrogen, allowing the oxygen to pass. As a result, the air can be supplemented with an oxygen content of up to 95%. It then flows through a bacterial filter via a pressure reducing valve and to the patient. The pneumatic valve then controls the removal of nitrogen from the filter. This cycle repeats every few seconds.

TAILORED SOLUTIONS

"Standard products don't help device manufacturers, because they don't design their oxygen concentrators around the pneumatic valve," as Paul Gant knows from experience. "We have developed highly integrated, electrically operated solutions based on custom specifications for virtually all major manufacturers, and pre-assemble them on request." The Life Sciences specialists from AVENTICS often take miniature valves from the standard program as their starting point. A major advantage: AVENTICS is the leading technology specialist for electronics integration in pneumatics valves and can meter the air quantities very precisely. The electronics fit seamlessly into the device's control, which, for example, measures the pulse rate or the blood's oxygen saturation and calculates the required oxygen based on the figure.

RESISTANT TO CONTAMINATION

The oxygen devices including customized valves are thoroughly tested during the prototype phase to be granted market approval by the American FDA and other regional approval offices. Device failure would pose a major danger to patients. These tests showed that particles break away when cleaning the filter, which can then get into the valve. "In competitor comparisons, our valves continued to function despite this contamination, ensuring oxygen supply," Paul Gant states proudly.

AVENTICS manufactures these valves using high-performance plastics. They are resistant to chemicals, can be cleaned frequently, and are ideal for sterile environments. Another major advantage: They are very light and energy-efficient, a decisive factor for applications in devices now weighing under five kilograms.

NEW SOLUTIONS FOR LIFE SCIENCE

"In the Life Sciences sector, quality and cleanliness have top priority in production," Paul Gant stresses. AVENTICS has proven itself in this area for decades, and not only in oxygen devices. When it comes to controlling the quantity, pressure, and flow of process gases such as oxygen, or fluids used in dialysis, AVENTICS products are the ideal solution. "We are currently developing and testing new avenues for innovative diagnostic and treatment equipment, including surgical instruments for operating rooms," he announces. "Life Sciences and pneumatic solutions from AVENTICS are simply a perfect fit."

CLEAN UNDER PRESSURE

Hygienic production of wet-cured ham



Photo source: Eberhardt GmbH

Whether crispy fried at home for breakfast, on a sandwich on the go, or as a finger food at official ceremonies: Juicy wet-cured ham is a tasty cold cut popular across the globe. And the probability that the bon vivant is consuming a delicacy produced using AVENTICS products is quite high.

Curing is one of the oldest methods for conserving meat and was already established with the Sumerians and Babylonians. Curing with salt, nitrite, and spices is still the first stage in the production of wet-cured ham. The treated meat is cooked and conserved as it was hundreds of years ago. Only the formulation has changed: For some years now, the global trend is heading in the direction of so-called slicer products, hams and sausage products already sliced and packaged. This requires a uniform shape and consistency.

Butchers and industrial processors achieve this with pneumatic boiling presses from Eberhardt GmbH in Lichtenau, Germany. The company, established in 1963, is the global market leader for boiling presses and has already sold its products in 84 countries. Eberhardt's portfolio includes eight models with a filling capacity of 100 to 700 kg.

Users press and cook ham and other sausage products extremely consistently without pressure loss. This allows them to achieve a reproducible uniform shape for subsequent processing.

Operators lay the pre-treated pieces of meat lengthwise into the compartments on the boiling press and separate each layer with a stainless steel sheet. They close off the completely filled press with a cover and actuate a pneumatic valve. Compressed air at 8 bar flows into one or two bellows actuators, depending on the size, on the floor of the mobile press. They expand and press the bottom sheet on the press against the cover with up to 80 kN. This forces the meat exactly into its shape.

With a maximum stroke of 355 mm, the pressing force at the top stop reduces to 40 tons. The pneumatic valve is closed and the boiling press is moved to a heating chamber.

SAFETY MARGIN:

300%



Bellows actuator with triple safety margin

The bellows actuator keeps the products in shape over the entire cooking period. The heat also causes the pneumatic pressure to increase. Here, only AVENTICS bellows actuators offer sufficient safety margins. Burst pressure is reached at 24 bar, meaning a safety margin of 300%.

CORROSION-RESISTANT AND DURABLE

During processing, meat juices escape and drip onto the floor sheet containing the bellows actuators. After each cooking process, the presses are cleaned thoroughly with aggressive cleaning agents according to regional regulations. Liquids, cleaning chemicals, and heat form an extremely corrosive combination. Eberhardt GmbH's roots lie in stainless steel processing. The company manufactures its presses, as well as all other equipment for food processing, using this corrosion-resistant metal alone.

AVENTICS bellows actuator are the perfect fit in this environment. They are temperature-resistant up to 90°C, one version up to even 130°C. The cylinder cover is made completely of corrosion-resistant stainless steel, including the air connection. The multi-layer bellows reinforced with diamond-patterned polyester threads on the interior is made of special rubber with a much higher resistance to chemicals, including all customary cleaning agents, compared with natural rubber. This makes the bellows actuators suitable for applications in cheese production and other aggressive environments.

The service life of this material combination is much higher than that of materials used by others on the market. If necessary, operators can simply exchange the bellows themselves and continue using the stainless steel cover.



AVENTICS has driven the use of high performance plastics like no other. For over 40 years, AVENTICS products have continued to incorporate state-of-the-art technology. Today, the new AV valve generation reveals the full potential of polymers in pneumatics.

The smaller and lighter the valves, the closer they can be placed to the actuator. This reduces dead volumes and masses to be moved. The new AV valve generation is AVENTICS' major breakthrough in miniaturization. It combines advancements in plastics processing with a new design concept. A diagonal arrangement reduces the valve to the size of a business card. Compared with conventional valves, the AV series halves the installation space while maintaining the same output. The weight is also cut in half since

AV valves are 50% lighter than metal valves. In practice, engineers reach compressed air savings of up to 20%.

Compressed air savings of up to 20 percent

HIGH POWER IN A SMALL PACKAGE

Polymers in pneumatics: the key to optimized energy efficiency

High-performance plastics began their role as game-changers forty years ago. Back then, two companies independently devoted themselves to exploiting plastics for pneumatics: both former Westinghouse WABCO Steuerungstechnik in Hanover, Germany, and CPOAC in Bonneville, France – two predecessors of AVENTICS. They used ever more stable and powerful material compounds developed primarily for the automotive industry.

They began with housing made of polymers, reducing the number of individual parts and thereby the error sources and possible leaks. In the 1990s, plastic spool valves were launched and in 2001, former Rexroth Pneumatics incorporated pilot valve technology – at this point, the German and French manufacturers had merged into one company.

"Tests show that our plastic valves withstand over 120 million switching cycles, and experiences in the field have confirmed this figure."

Christophe Champouillon,
Head of Development at AVENTICS France



EXPERTISE FOR PRODUCTION

"The printing industry demanded toluol-resistant plastics while the food and beverage industry required acid resistance," Christophe Champouillon, Head of Valve Development at AVENTICS in Bonneville reminisces. Current valve generations, such as AVENTICS' Clean Line, meet these requirements. Their material has been certified by the Food and Drug Administration (FDA) and they feature NSF-H1 greases suitable for food products.

Requirements for material resistance and strength increased with success. "We performed many tests with a wide range of fiberglass and carbon-fiber-reinforced plastics," reports the engineer from Bonneville. "It turned out that carbon-fiber-reinforced plastics soften at operating temperatures over 60°C and are thus not ideal." Since then, AVENTICS has focused on fiberglass-reinforced formulations that are also suitable for higher temperatures. "In the latest AV03 generation, we increased the portion of fiberglass to 60%, while the standard ratio on the market is 30 to 50%."

The result is a higher strength that enables more sophisticated structures, and thus a significantly more compact design. But the devil is in the detail: The path from theory to series production is a long one because plastics shrink after the injection process.

"Based on our decades of experience, we developed simulation models that accurately depict this degree of shrinkage," explains Christophe Champouillon. During the development of the AV03 generation, engineers calculated 800,000 points each with different e-modules in all three directions, depending on the fiberglass orientation. These orientations were computed using a Moldflow analysis. The engineers then used supercomputers for evaluation.

The actual injection process presents another challenge. Due to the material and complex geometries, it takes place at over 1,700 bar. In addition, AVENTICS processes two components in one shot and integrates the sealing technology. "Tests show that our plastic valves withstand over 120 million switching cycles, and experiences in the field have confirmed this figure," emphasizes Christophe Champouillon.

FRICTIONLESS

&

DURABLE

&

Q U I E T

THE AVENTICS
“SILENT CHAIN”

The HPC inverted tooth chain from AVENTICS is especially low-friction and low-wear running through the two-pin rolling pivot joint, making it a “silent chain.” The two profile pins simply roll off each other without any sliding friction. The result: less maintenance and a longer service life. The drive and inverted tooth conveyor chains are particularly precise, even under difficult ambient conditions, and have long stood the test in many sectors, including the glass and automotive industries.



A tale of an inverted tooth chain: the dark profile pins ensure friction-free operation

AVENTICS USA: FLEXIBILITY AND SPEED KEY TO SUCCESS



AVENTICS USA has been active in the metallurgy, oil, and gas industries, in food production and packaging, in the rail and commercial vehicle sectors, and in health care for more than five decades. The plant in Lexington, Kentucky, is both a source of proven AVENTICS components and local success in the USA. Here, the company produces solutions tailored precisely to American requirements.

More than 600 man-years of application experience and pneumatics expertise in sales, along with a network of over 500 distributors in North America, make AVENTICS a major pneumatics specialist in the U.S. AVENTICS is known for reliable, long-lasting, high-performance products in more traditional industries such as oil, gas, and metallurgy. In the food and packaging industry, users value AVENTICS' hygienic design and technological leadership – both in implementing corrosion-free high-performance plastics and in electronics integration. AVENTICS application specialists also develop customer-specific solutions for new applications, such as in the health care industry, and pre-assemble complete modules.

SHORT CHANNELS – REGIONALITY AS THE CONCEPT OF THE FUTURE

Many components only have to travel short distances to customers, since AVENTICS has been manufacturing products in the U.S. for over 50 years. The roots of the Lexington plant date back to 1963. It was back then when WABCO erected a factory for producing pneumatic components in the second largest city in Kentucky.



CELEBRATING 50 YEARS IN LEXINGTON

In decades past, the company's name first changed from Mannesmann Rexroth to Bosch Rexroth, and now to AVENTICS. "But generally, most of our around 250 employees in the U.S. have been with us for a very long time and are top experts when it comes to pneumatics," Phil Donovan, Lexington plant manager emphasizes. "In recent years, we have established an excellent quality management system in production and the reliability ratings of our components set industry-wide standards."

DELIVERY TIME: THREE WORKDAYS

Right from the start, the employees in Lexington began producing pneumatic components and hydraulic cylinders for North America and the global market in both the metric and imperial systems. Their specialty: NFPA cylinders. They meet the standards defined by the National Fluid Power Association. Fast delivery times are a main focus. "We ensure our customers that we will ship standard cylinders within three days of

receiving the order at no surcharge," stresses Steve Lattin, project manager for NFPA. "But our customers can still custom-configure cylinders because we offer over twenty different brackets and hole sizes ranging from 1.5 to 14 inches.

The new quick ship program demonstrates once more that AVENTICS has picked up the tempo significantly as a stand-alone company. "Beyond standard components, we also deliver customer-specific electropneumatic valve systems on very short notice," underscores Phil Donovan. "This allows us to help customers significantly reduce their machine downtimes." AVENTICS delivers the orders in the U.S. directly from the plant or via the dealer network.



FROM 180 TO 0 WITH CERAMIC VALVES

Farewell to failures in aluminum production

In the U.S., it's referred to as the perfect storm: all negative circumstances and influences converge at the same time and intensify. At Noranda Aluminum in the southern state of Missouri, pneumatics faced a perfect storm.

An extremely high concentration of aluminum particles contaminating the air, 40-year-old compressed air lines, heavy humidity, and no economical option for cleaning the air. At Noranda Aluminum, the jackhammers required for aluminum production were malfunctioning several times a day on average. In aluminum production, the smelting process in so-called electrolytic cells plays a major role. A chemical process takes place within these 2 to 3 m high cells, where aluminum oxide and other raw materials are converted into liquid aluminum. During this process inside the electrolytic cells, a hard crust forms on the surface of the molten metal. This crust has to be broken periodically. At Noranda, eight cranes each equipped with a pneumatic jackhammer move in to break the crust for the 348 smelting cells.

Both the cylinder and jack hammer are powered with compressed air and require the use of a solenoid-operated directional control valve to actuate them.

DESIGNED TO RESIST CONTAMINATION

The directional valves had been a huge problem for Noranda for years, causing an average of 60 failures a month. After every valve failure, the repair team had to stop what they were doing to recover the jackhammer manually from the molten metal and then repair or replace the valve – a tremendous pool of costs – and, up to now, all their attempts to solve the problem failed.

That is, until Operations Superintendent BJ Burks decided to take a new path and tested a Ceram valve from AVENTICS. Compared with valves of other makes, Ceram valves feature completely different technology. This valve does not use a spool or a poppet, but instead uses two sliding ceramic plates placed one on top of the other to control the air flow direction. Because ceramic material is very hard, contamination has no effect on the plates. Where the plates fit together, a ceramic seal is formed thus eliminating any clearance for contamination to lodge like that found in spool or poppet valves. Contamination passes through large slots in the ceramic plates.

"Ambient conditions like those in aluminum production can be found in many other metallurgic applications. This is why more and more users are converting to Ceram valves."

Melanie Steinhoff, Mining, Metals,
Minerals Industry Manager at AVENTICS



And there are no elastomeric seals in the critical area of the Ceram valve to wear or get damaged by the contamination. This combination of ceramic plates, ceramic seal and an extra strong return spring makes for a very robust and dependable valve that will operate reliably under the most contaminated conditions. "Ambient conditions like those in aluminum production can be found in many other metallurgic applications," emphasizes Melanie Steinhoff, Mining, Metals, Minerals Industry Manager at AVENTICS. "This is why more and more users are converting to Ceram valves."

UP TO 400 MILLION CYCLES

After two weeks of trial operation without a single failure, BJ Burks made his decision: he removed the old valves on all cranes and replaced them with ceramic valves from AVENTICS. The effect was and continues to be enormous. In the first three months after the exchange, there was not a single failure. With the old valves, there would have been 180 failures in the same time period. Thanks to the Ceram valves, pneumatics at Noranda Aluminum no longer has to worry about the perfect storm.

For BJ Burks, increased availability is a major advantage that he wants to keep expanding: "We have already identified additional points in our facilities where we plan to switch to ceramic valves."



The conditions may not be as harsh but the payoff comes from the high cycle life capability of the Ceram valve. They are tested at 150 million cycles, while up to 400 million cycles are reached in practice.



LIGHT AIR STEERS HEAVY STEEL

Modular valve panels for SMS Siemag

Heavy-duty, high-strength, coiled steel strips are uncoiled in a conveyor system, rolled through various processes, and then recoiled. Pneumatic valves, tiny components compared to the enormous system, switch and decelerate the rollers and open flaps that admit process fluids.

AVENTICS has decades of expertise in the heavy industry. As a partner to companies such as SMS Siemag, the pneumatics specialist offers strong solutions – this can clearly be seen in an order that was shipped out in December 2014.

“We have fabricated and preassembled entire valve panels for a new cold rolling mill that SMS Siemag set up in China. The robust control panels consist of a basic L-profile frame equipped with series 581 ISO valves, NL maintenance units with pressure switches, and proportional valves as needed,” describes Christian Broich, the AVENTICS sales employee responsible for the German customer. SMS Siemag is one of the world’s leading suppliers of systems, machines, services, and process expertise for the steel, aluminum, and metal industry.



Hundreds of controllable
pneumatic functions

The conveyor system for metal refining contains hundreds of controllable pneumatic functions. Intelligent pneumatics from AVENTICS enables compressed air preparation, along with the monitoring and actuation of cylinders, motors, and linear drives. Pneumatics also governs braking and blowing off excess media and residual additives on descaling systems. Most of the pneumatic functions are also used in the process engineering section, for example for flap system control or acid solution regeneration. The valve panels were assembled by AVENTICS specifically for SMS Siemag.

KALEIDOSCOPE

**PNEUMATICS
MATERIAL KIT:**
A COMPLETE PACKAGE UNDER
A SINGLE ORDER NUMBER

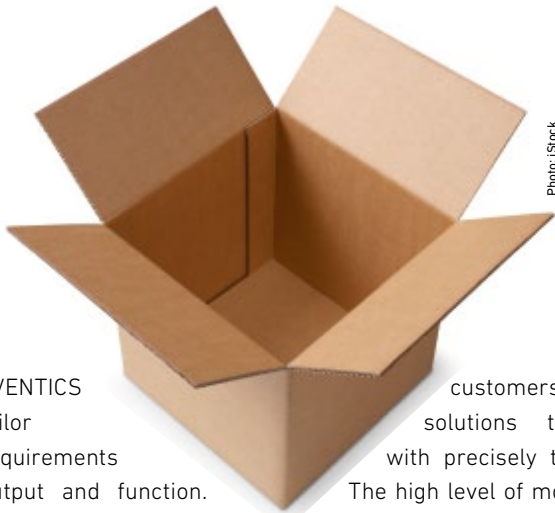


Photo: iStock

AVENTICS customers can tailor solutions to their requirements with precisely the right output and function. The high level of modularity at the component level is a given at AVENTICS and forms the foundation for custom-configured products. Now, the pneumatics company is also simplifying commercial and logistics processes for its customers. All pneumatic components for a project can be combined into a pneumatics material kit under a single order number. AVENTICS supplies this material kit as a complete package across the globe. This service speeds up the customer's processes and offers many advantages: during ordering, delivery, and even incoming control and internal logistics. That's not all: During assembly, all required components are guaranteed to be in stock and there are no downtimes due to unavailable parts. For repeat orders, the previously defined order number is used. The responsible sales employees at AVENTICS configure the individual material kit package together with the customer and check the plausibility. Then, all it takes is a click of the mouse to send the individual material or component kit on its way.



**ALWAYS
THE RIGHT
ADDRESS:
WWW.AVENTICS.COM**

With its new website, AVENTICS is setting a clear focus on e-business. "We want to make the purchasing experience even more convenient for our customers," underlines project manager Maik Kausch. The AVENTICS website features all necessary information and configurators for customers to quickly and conveniently create custom pneumatic solutions. For actual order processing, AVENTICS is now focusing more on offering services from B2C, such as express shipment, order tracking, and the display of alternative products. And AVENTICS is also present in social media such as Face-



TWEET!

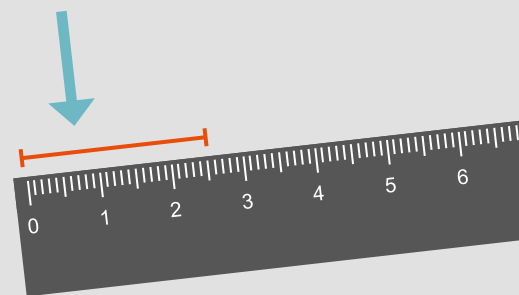
book, Twitter, and LinkedIn, maintaining the dialog with customers and providing current information and news.

MECHATRONICS AWARD FROM FRANCE



At the European Mechatronics Meeting in Annecy, France, AVENTICS was presented the "Mechatronics Award 2014" for its new PVP1 micro-solenoid pilot valve. With a length of only 25 mm, it is the smallest solenoid valve for industrial applications. "The PVP1 is the ultimate product for the factory of tomorrow," praised the expert panel. It consisted of representatives from the French trade organization ARTEMA, the "Centre technique des industries mécanique", and the technology network "Thésame". The new valve is manufactured at AVENTICS in Bonneville, France.

25 mm



2,222,222 TIMES LESS EXHAUST EMISSIONS

This production anniversary is good news for the environment. On **December 1, 2014, the 2,222,222nd EP pressure regulator rolled off the assembly line at AVENTICS.** The launch of the Euro 6 emissions standard for commercial vehicles in Europe has meant a steep increase in demand. The EP pressure regulators are primarily used in exhaust gas recirculation systems (EGR systems) in truck engines.

The valves actuate pneumatic cylinders to control the position of the exhaust gas recirculation valve. The dynamic properties of AVENTICS' electropneumatic system ensure optimized exhaust gas recirculation, even with short cycles.



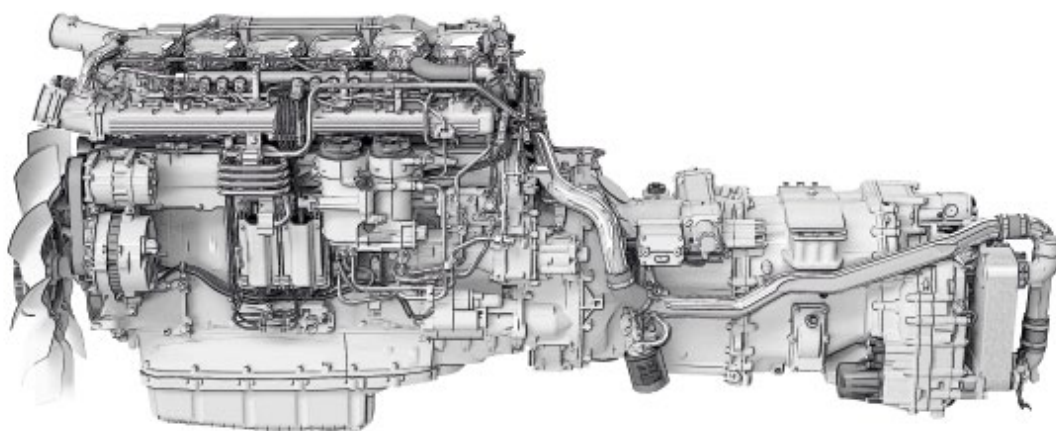
Celebratory presentation of the anniversary product; from left to right – Björn Albers, Head of Production Truck Valves, Matthias Ihmann, Plant Manager in Laatzen, Dr. Michael Beck, Head of Design Commercial Vehicles and Dr. Thomas Brückner, COO at AVENTICS

Major European truck manufacturers have long relied on the EP pressure regulator, with clientele including Mercedes-Benz, Volvo, and Renault.

"The electropneumatic pressure regulator is a benchmark on the market," Dr. Michael Beck reports proudly. The Head of Pneumatics Commercial Vehicles continues: "Since a similarly strict emissions standard is in effect in China, an engine revolution is looming on this market. We are currently working with Chinese truck producers to develop customer-specific solutions."

INDIAN TRUCK MANUFACTURERS RELY ON AVENTICS

As Partner Country to the 2015 Hannover Messe, India presents itself as a rising champion in the global economy. In recent years, India has made enormous strides in terms of industrialization, and it still has an ambitious agenda. More than 20 million passenger cars, commercial vehicles, and motorcycles were produced in India in 2013 – and AVENTICS is an active player in this market.



Tailored: components for engine, clutch,
and transmission control



"WE STARTED OUT BY APPROACHING THE MARKET LEADER FOR COMMERCIAL VEHICLES IN INDIA, TATA MOTORS, EIGHT YEARS AGO,"

recalls Dr. Michael Beck, Head of Engineering and Key Account Management Commercial Vehicles. "Three years later we had engineered a made-to-order product and for 2015 we plan to ship about 13,000 valves." Meanwhile, production is ramping up for another valve for India's "number two" in the same sector, Ashok Leyland. "We are also in the midst of negotiations with Volvo-Eicher and BharatBenz. I am optimistic that we will be successful there as well," Dr. Michael Beck says, pleased with the company's progress.

According to independent market research from the consulting firm Deloitte, the South Asian country will become the world's second largest commercial vehicle market after China, even surpassing the USA, in the next ten years. "In India as well, we are seeing a clear trend toward higher quality and more environmentally friendly commercial vehicles," Dr. Beck emphasizes. "At the same time, Indian manufacturers want to export their vehicles and our premium quality products help them in the process."

*"In India as well, we are seeing
a clear trend toward higher quality
and more environmentally friendly
commercial vehicles."*

Dr. Michael Beck, Head of Engineering
and Key Account Management
Commercial Vehicles at AVENTICS



PNEUMATICS IN PRACTICE: TEN TIPS FOR SIMPLE, CONVENIENT ENGINEERING

Efficient engineering of optimal pneumatic solutions

Rightfully, pneumatics is considered extremely simple, convenient, and flexible. Just a few tricks and engineers can save time and optimize system performance. Ten practical tips for you:

1 The correct configuration: When planning pneumatic systems, the right dimensioning plays the decisive role with regard to energy efficiency. When selecting the optimal cylinder and tubing diameter, but also suitable compressed air preparation, the online air consumption calculator provides valuable support.

2 Customized pneumatic component packages online: With online tools, such as product configurators, engineers can conveniently choose functions and create custom solution packages. Product data, including CAD models, prices, and delivery times, is available immediately.

3 Short tubing lengths: Long tubing, tubing connections, and returns cause loss of compressed air. Valves mounted on the cylinder prevent these losses. In addition, this decentralization shortens cylinder response times.

4 Needs-based degree of filtration for air preparation: A filter that is too fine decreases compressed air flow and leads to energy loss. On the other hand, a filter that is too coarse results in faster wear to the pneumatic components caused by larger particles.

5 Reduced installation effort thanks to valve systems: Pneumatic solutions featuring multiple single valves are coupled with a high amount of effort. Combination into valve systems reduces assembly effort.

6 Intelligent connection to the control: Valve systems communicate via multipole, standard fieldbus systems, or Ethernet connections to the machine control. Feedback of diagnostic and sensor data expands machine function and reduces servicing requirements.

7 Demand-based pressure: With insufficient pressure, machines are unable to reach optimal performance. On the other hand, excessive pressure wastes more energy than necessary. Manual or electropneumatic pressure regulators ensure optimal pressure.

8 Perfect level of cushioning: Individual cushioning adjustments in pneumatic cylinders often reduce system costs while extending service lives. Engineers can select smaller cylinders and shorten cycle times. This also lowers the noise level.

9 Up-to-date information on machine safety: Pneumatics offers a wide variety of products for safe solutions in line with standards, such as in explosive environments and safety-relevant functions. The latest information is always available online.

10 Benefit from specialist knowledge and application expertise: Users who aren't consistently involved in laying out pneumatic systems effectively have to begin the learning process from scratch each time. With its field representatives and in-house specialists, AVENTICS offers comprehensive consultation. They are familiar with the latest products and have realized thousands of systems – this external experience saves time and makes for optimal results.

AVENTICS^A

THE NEXT GENERATION MACHINE SAFETY



AV03/AV05 with AES



IS12-PD



SV07

Duško Marković, Technical Sales Support AVENTICS, is one of our many experts for machine safety and has many years of experience in designing pneumatic controls in line with standards.

With its focus on safe products and field-tested solutions, AVENTICS makes an important contribution to your machine safety. Your advantages: In addition to safety-related pneumatic products in certified quality – including complete documentation with reliability ratings – you can also rely on our profound application expertise.

You can find more details at:
www.aventics.com/machinesafety



AVENTICS GmbH

Ulmer Straße 4, 30880 Laatzen, Germany
www.aventics.com, info@aventics.com
Tel +49 511 2136-0



Rexroth
Pneumatics

AVENTICS GmbH
Ulmer Straße 4
30880 Laatzen, Germany
www.aventics.com
info@aventics.com

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