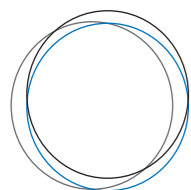




Less Downtime,
MORE RELIABILITY.

Freudenberg
Sealing Technologies



EVERYTHING ON THE MOVE

The shift in emphasis seems unstoppable. Primarily development in Asia will drive the global growth that experts expect in the truck and bus market. The share for **Asian countries is already nearly 50 percent** and China has been the global market leader since 2009. But the requirements for customers in “emerging markets” are different from those in the classic industrial countries. Emissions legislation has become a driving factor in most countries and drives strategies that vary from region to region.

Truck and bus customers agree on one thing throughout the world: Tough competition in the transportation sector is

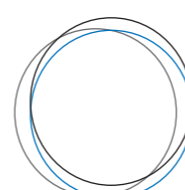
increasingly shifting TCO (total cost of ownership) to center stage. The issue involves more than just purchase price. Efficiency and uncompromising reliability are the keys to low TCO. To a sealing manufacturer such as Freudenberg Sealing Technologies, this means a number of things: **reductions in friction and weight, support for innovative technologies and, at the same time, unfailing durability and robustness** – because there is nothing more costly than downtime.

A reliable partner with unmatched global materials expertise, FST is your best guarantee for success around the world.

SUSTAINABILITY AS A GLOBAL TREND – WITH A VARIETY OF SOLUTIONS

Technological demands are increasing everywhere. The reduction of fine soot particulates and nitrogen oxide emissions is becoming a global challenge that no truck or bus manufacturer can ignore. The pollutant level of modern trucks has actually fallen dramatically in recent years, but there is still a great deal to do. Increasingly short cycles for new limits, even in the “emerging markets”, require new solutions that vary from region to region.

Diversification remains a distinctive characteristic of the global commercial vehicle business. While the requirements of premium and low-cost markets may differ sharply from one another, reliability and efficiency are becoming increasingly important in purchasing decisions around the globe. In this respect, customers in developing countries differ very little from those in established markets. Diversity also characterizes the development of powertrain concepts. Distinctive regional considerations determine whether the focus is on **exhaust gas after-treatment, electrification, hybridization** or increased use of alternative fuels such as **LNG** or **CNG**. So it’s good to be able to rely on a global player that, with more than 1,600 specific mixtures, has the right answer to all sealing questions.



LOW FRICTION – MAXIMUM DURABILITY

It might seem like squaring the circle, but it’s all in a day’s work for Freudenberg Sealing Technologies: achieving reliable sealing with minimum friction. Both are equally important when it comes to keeping the maintenance costs for heavy commercial vehicles as low as possible. Less friction leads to lower operating costs. And absolute reliability and durability extends operating cycles. This does not just cut inspection and maintenance costs, it prevents breakdowns as well.



CASCO

The **CASCO** is a perfect example of the combination of outstanding sealing characteristics, friction optimization and maximum durability. At the crankshaft output on the casing, the axially positioned seal lip provides reliable protection not only from oil leakage, but also from contaminants and extreme environmental factors. A test covering 1.6 million kilometers demonstrated that the **60-percent decrease in friction¹** delivered a reduction in fuel consumption. In a heavy truck driven 200,000 kilometers a year, CASCO saves up to 225 liters² of diesel fuel.



MILEMAKER

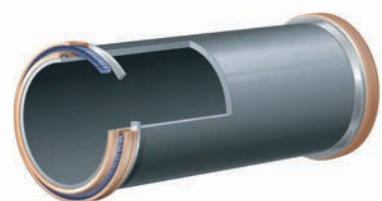
MileMaker also combines long service life with excellent friction characteristics and significant savings potential. Wheel and axle hubs in light and heavy trucks are typical applications for cassette sealing rings. With friction reduced by more than 50 percent, a semi truck equipped with MileMaker can **save more than 1,000 liters of fuel²**. At the same time, MileMaker still seals reliably at high temperatures and protects the hubs from the penetration of dirt and moisture.

¹ Compared to a conventional PTFE or spring-loaded seal lip
² Internal calculations



SAFE AND COMFORTABLE – FOR LIFE

The highest quality standards, an excellent command of processes and a zero-defect philosophy are a matter of life and death in brake development. Functional reliability is an absolute must – so that even heavyweights come to a stop without fail. With its state-of-the-art analysis and calculation methods, Freudenberg Sealing Technologies is a valued development partner for seals in pneumatic brake systems. Diaphragm accumulators for chassis applications are another core competence. The necessary hydraulic energy is stored in a diaphragm accumulator and made available very quickly when needed, thus enabling the use of hydraulic pumps with a relatively low volumetric flow. Energy consumption is reduced thanks to a more compact overall design.



PLUG & SEALS

Ingeniously simple solutions do not merely save time and money during installation. Where previously a separate O-ring was used to seal water or oil circuits in metal pipes, patented **Plug & Seals** now solve several problems at once. The self-sealing plug connectors can be installed mechanically without distortion. This reduces production costs, while easing maintenance and repair work. Plug & Seals from Freudenberg Sealing Technologies are also significantly more resistant to high pressures, contribute to acoustic and mechanical decoupling and are substantially better at compensating axial tolerances. But the main thing is that Plug & Seals last much longer and thus make a key contribution to lower maintenance costs. Furthermore, with integrated pressure and temperature sensors, they offer further potential for optimized engine and transmission control.

LESS WEIGHT – MORE FREEDOM

Substituting plastic for metal, a feature of many products from Schneegans-Freudenberg, not only offers weight savings of up to 50 percent, 3D formed all-plastic pipes – e.g. for oil dipsticks or oil filler necks – also allow free-form geometries that could not be achieved with metal tubes. As a result, optimum use is made of packaging space around the engine. Plastic components also offer greater potential for the integration of additional functions or parts, such as local reinforcement or retaining brackets.



MODULE WITH INTEGRATED SEAL

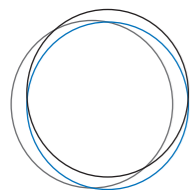
Lightweight design combined with high resilience – these are the key benefits of housing covers made of plastic. They also allow the integration of additional parts and functions. The innovative 2K module features **a silicon seal integrated into the cover**, as well as a friction-optimized PTFE seal.

A MATCH FOR ALL PRESSURES

Increasingly stringent emissions limits require a broad range of measures – from fuel injection to exhaust after-treatment.

The piston rods in today's high-pressure injection pumps move at a frequency of more than 200 Hertz. This calls for an extremely wear- and heat-resistant seal. The **Duo Forseal** can take these stresses – even after more than a billion strokes. As a result, high-pressure pumps can function

efficiently and remain trouble-free during the long service life of a commercial vehicle. The **BlueSeal** is also suited to use in high-pressure pumps. This patented radial shaft seal technology offers weight savings of 25 percent compared to a conventional seal, and it requires only half as much installation space. The additional metal carrier has been shown to be mechanically resistant to high pressures, while the PTFE material of the seal lip stands up to aggressive substances.



HIGH TECH FOR LOW EMISSIONS

Selective catalytic reduction (SCR) is a prerequisite for achieving the Euro 6 exhaust standard. The injection of AdBlue® decreases critical nitrogen oxide values in the exhaust. This liquid urea solution cannot be sealed with conventional materials. In addition to membranes and specially configured O-rings, our **AdBlue® portfolio** includes extremely compact Plug & Seal components for the inflow and outflow lines of SCR pumps. Their elastomers, in varying degrees of hardness, are suited to **temperature applications as low as -52° C**, enabling us to offer the right seal concept for all SCR applications.



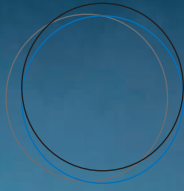
VALVE-STEM SEALS WITH BACK-PRESSURE SEALING LIP

New engine generations are improving their emissions performance with particulate filters and increasing their braking power with retarders. At the same time, their specific power is rising thanks to new turbocharger technology and "downsizing". All these measures increase the pressure levels in the intake and exhaust tract. But high exhaust back pressure can cause the seal lip in conventional valve stem seals to lift up. That enables combustion exhaust gases to penetrate into the valve guide – so-called blow-by – causing the lubricating film to break down. The new generation of **valve-stem seals with back-pressure sealing lip** is designed to prevent this blow-by effect and to guarantee optimal sealing performance and thus the full power output of the engine.

Multipole encoders provide precise data on rotational speed and rotation angle that are indispensable for engine control systems designed to reduce emissions. Alongside their application in crankshafts, Freudenberg Sealing Technologies has also developed radial and axial encoders for the chassis and transmission management. In a new development, this compact signal supplier is now able to determine the angular position of the camshaft. Its high signal precision makes it possible to optimize fuel injection based on timing and quantity, increasing efficiency while simultaneously reducing emissions.

PORTFOLIO

	ENGINE & CHARGING	FUEL & EXHAUST AFTERTREATMENT	TRANSMISSION	DRIVELINE & AXLE	STEERING & SUSPENSION	SAFETY SYSTEMS	CLIMATE SYSTEMS	ELECTRIFICATION
ROTATING APPLICATIONS								
Reduced Friction Radial Shaft Seals	✓	✓	✓	✓	✓	✓	✓	✓
Cassette Seals	✓		✓	✓				✓
Multipole Encoders	✓		✓	✓	✓	✓		✓
Thermoplastic Seal Rings & Thrust Washers	✓		✓		✓			
High Pressure Diesel Pump Seals		✓						
Shaft Boots				✓				
RECIPROCATING APPLICATIONS								
Valve Stem Seals	✓							
Forseal & Duo Forseal	✓	✓	✓					
PTFE Piston Seals			✓		✓		✓	
PTFE Slide Seals	✓		✓					
Diaphragms	✓	✓	✓			✓		
Solenoid Plungers	✓	✓	✓		✓	✓		
Bonded Piston Seals			✓					
Hydraulic Accumulators			✓		✓			
Damper Seals					✓			
Banded Piston Seals					✓			
Composite Valves Seals						✓		
STATIC APPLICATIONS								
Elastomeric Gaskets	✓	✓	✓	✓	✓	✓	✓	✓
Stamped Exhaust System Gaskets	✓	✓	✓	✓				
Plug & Seals	✓	✓	✓	✓			✓	✓
Offset Seals	✓	✓	✓					✓
2K Cover Modules with Sealing Elements	✓	✓	✓	✓	✓	✓	✓	✓
Plastic Dipsticks Tube Assemblies	✓		✓					
Complex Plastic Modules	✓	✓	✓	✓	✓	✓	✓	✓
O-Rings with Coatings	✓	✓	✓	✓	✓	✓	✓	✓
Wet Cylinder Liners	✓							
USIT Rings	✓		✓	✓			✓	✓
Seals for CNG/LPG Systems		✓						
Overpressure Relief Valve								✓
Boots & Bellows				✓	✓	✓		
Covers & Sealing Plugs	✓		✓	✓				✓



GLOBAL PROBLEM-SOLVER FOR SEALING ISSUES

As a global player and leader in sealing technology, we anticipate trends and developments which are the key to developing new markets, as well as safeguarding established markets. The result is a comprehensive product portfolio suited to many areas of application. But that's not all: **Our mission is to be a problem-solver for all aspects of friction reduction and sealing technology.** Use our materials expertise and innovative power to help achieve your objectives for growth and emissions reduction.



Freudenberg Sealing Technologies

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