The Challenge for Air Management Systems? Choosing the Right Lubricant

Make the Most of Lubrication

Introduction

The ever-increasing demands of manufacturers, customers and legislators mean the air management systems in modern combustion engines need to be assessed as part of a bigger picture.

New emission targets for CO_2 and nitrogen oxide (NOx) plus acoustic requirements have all significantly increased the need for measurement and control accuracy in air intake systems. At the same time, the interactions between individual components and systems in the air supply are multiplying. Taken together, these challenges are fueling the need for new solutions.

Air Management Systems and the Modern Combustion Engine

Put simply, the air management system and its components manage the flow of air into a combustion engine and the flow of exhaust gases out of it. The engine is essentially a gas-powered pump: filtered and metered air is sucked in, together with fuel. This mixture then gets compressed and ignited to hugely increase gas volume, pushing the pistons down and creating mechanical action. Finally, the exhaust—or "spent"—gas from the engine is released.

Exhaust Gas Recirculation Up Close

The purpose of exhaust gas recirculation (EGR) is to increase the engine's output performance, while improving fuel economy, lowering emissions and decreasing noise.

Repeating cycles of gas circulation at high speeds require the precise and aligned operation of the various parts of the air management system. Air is pressurized by a compressor, normally either a turbo- or a supercharger, that is used to increase air mass flow. The inlet air pressure is controlled by recirculating air around the compressor, and the air flow into the engine is controlled by a throttle device. Fuel injectors spray metered fuel directly into the engine. Some exhaust gas is recirculated to the incoming air supply for emission control, and exhaust gas flow is "managed" by various valves positioned throughout the exhaust stream.

The complexity of the engine's air management system demands that engineers and manufacturers precisely optimize the performance of both the parts and the whole system simultaneously. The combined presence of high temperature, high pressure and exhaust gases means premium materials must be used when designing the vehicle's air management system. As a result, the lubrication solutions specified for the system and its parts need to display high-temperature stability and resistance to corrosive exhaust fumes.

The Automotive Lubricant Landscape

The following review of common automotive lubricant classifications helps to give an overview of the options currently available.

Perfluoropolyethers

Perfluoropolyethers (PFPEs) are a class of synthetic lubricants that, due to their unique combination of physical and chemical properties, are used in a variety of demanding applications. PFPEs offer excellent thermal and chemical stability, low volatility and unmatched lubricity at extreme temperatures. They are the ideal choice when high performance is needed in an extreme environment. They are often also the lubricant of choice for applications requiring other properties, such as chemical inertness and extreme pressure capability. Vehicle warranties can typically be extended due to the long-lasting performance of PFPEs.

Lubricant Capability Comparison

	THERMAL STABILITY	OXIDATION STABILITY	HYDROLYTIC STABILITY	VOLATILITY	FIRE RESISTANCE	SEAL MATERIAL COMPATIBILITY	LUBRICATING ABILITY	TOXICITY
PFPE	●	●	●	●	●	●	●	●
MINERAL	◉	◉	●	◉	○	◉	◉	◉
PAO	◉	◉	●	◉	○	◉	◉	●
DIESTER	◉	◉	◉	◉	◉	○	◉	◉
POLYOL ESTER	◉	◉	◉	◉	◉	○	◉	◉
SILICONE	◉	◉	◉	◉	◉	◉	○	●

○ POOR ◉ MODERATE ◉ GOOD ● EXCELLENT

In comparison with other lubricants, PFPE lubricants stand out as high-performance solutions.

What Puts PFPEs First

Due to these unique benefits, high-performance PFPE lubricants excel in the demanding conditions of the engine's air management system. This creates a ripple effect of value. Component failures and warranty claims are reduced, vehicle life is extended, quality is improved, customer loyalty is boosted and, ultimately, profitability is increased.

Ensuring EGR Emissions Excellence

A key target for design engineers—and one that is being legislated by governments around the world—is the reduction of NOx emissions. The EGR valve reduces the formation of these emissions by recirculating some of the exhausted gas back into engine cylinders. This lowers the peak temperature inside the cylinder, thereby, reducing the rate of NOx formation.

- **WIDE OPERATING TEMPERATURE RANGE**
- **PROVEN EXTENDED BEARING LIFE**
- **LONGER WARRANTY PERIODS**
- **RESISTANCE TO AUTOMOTIVE FLUIDS**
- **MULTIPLE GRADE OPTIONS**
- **ENVIRONMENTALLY AND USER FRIENDLY**

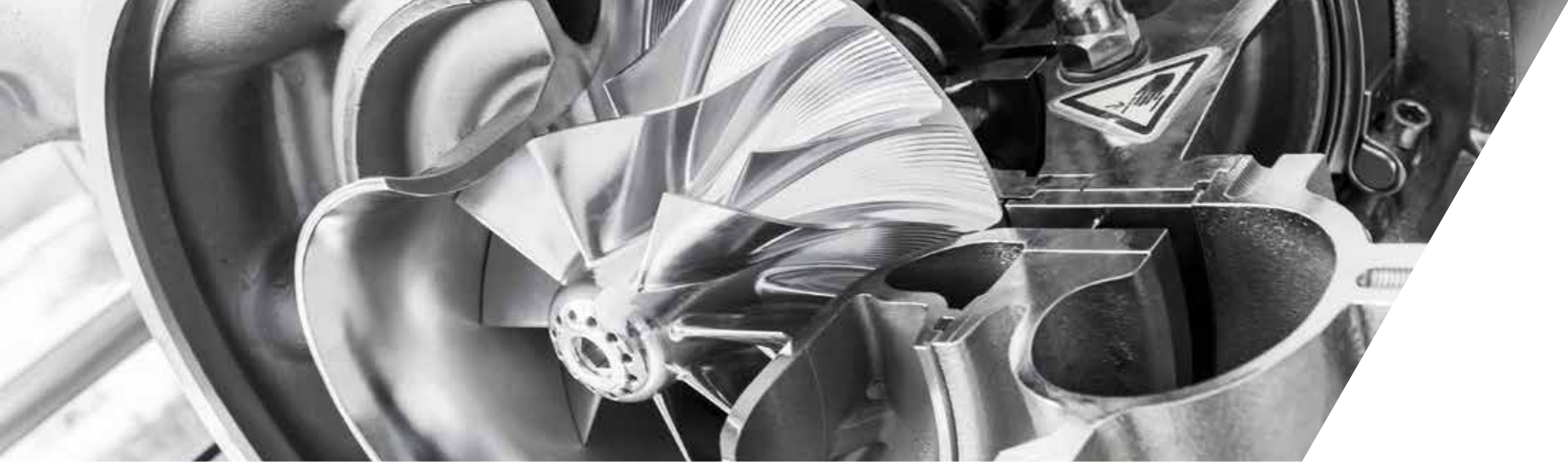
It is essential to use a reliable and durable lubricant to extend valve service life. If the valve doesn't open enough, insufficient recirculation can lead to excess pollution. However, if the valve sticks open, the temperature inside the cylinder can drop too much—decreasing engine performance and fuel mileage. Effective lubrication is once again key to ensuring optimum performance. PFPE lubricants have become an ideal choice in the industry, as they withstand the high temperatures and exhaust fumes experienced by the EGR valve.

Linear (Poppet/Stroke) Type Valve: *Convert High Speed Rotary to Low Speed Linear Motion*

High wear and fretting can be an issue in the low speed section.

The optimal lubricant can vary significantly with engine type, valve design and location in the exhaust system (high pressure versus low pressure loop with or without EGR cooler).

The lubricant solution in this application needs to withstand temperature ranges from -40 °C to 260 °C (-40 °F to 500 °F). Besides the high temperature range, the selected lubricant needs to offer full seal compatibility.



Designed to Succeed

Reliability under harsh conditions is essential for the success of the EGR valve. Performance lubrication specialists at Chemours deliver a range of high-specification grease solutions designed to improve lubricant durability, extend reliable valve service life and boost EGR valve performance.

As an example, a German manufacturer of gear-operated EGR valves chose Krytox™ Performance Lubricants to find a solution able to cope with temperatures ranging from -40 °C to 260 °C (-40 °F to 500 °F), as well as heavy vibration. Adopting a collaborative approach to the challenge, a specific Krytox™ high-temperature grease grade was chosen to fix the particular valve issue. This improved reliability and, as a result of savings on lubricants and warranty claims, contributed over €80,000 to the bottom line annually.

Flowing in the Right Direction

In conditions of extreme temperature and pressure, under severe shock loads or when exposed to harsh chemicals, there are multiple ways that PFPE lubricants can meet the demands placed on design engineers to improve engine compartment performance and reliability.

Over the last 50 years, Krytox™ Performance Lubricants from Chemours have helped customers outpace the competition by bringing customized and innovative solutions into an increasingly competitive automotive industry.

Our family of PFPE synthetic high-performance lubricants exhibits long-term wear resistance, superior lubricity, thermal stability in broad temperature ranges and chemical resistance in the most severe environments.

To explore how Krytox™ Performance Lubricants can deliver real results in automotive applications, download our eBook at krytox.com/discoverlubricants.

Krytox™ High-Performance Lubricants: Withstand the Pressures of High Expectations in the Automotive Industry

Today's technological evolution in the auto industry is possible only because engineers aren't taking any chances. They rely on the certainty long-lasting Krytox™ high-performance lubricants provide: precision formulas engineered to help drive performance by reducing component failure, extending vehicle life, and eliminating noise—even under the broadest range of temperatures and harshest conditions. For 60 years, we've considered reliability and performance non-negotiable. That's why we're the perfect partner for whatever is next. **Together, let's reconsider possible.**

Chemours is ISO 9001 and ISO 14001 certified, and select grades of Krytox™ lubricants are NSF H-1 certified.

For more information, visit **Krytox.com** or call a Krytox™ lubricant technical expert:

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Versatile attributes of Krytox™ lubricants:

Performance over a wide temperature range

Extreme heat or cold have no effect on the lubricity of these lubricants, effective from -73 °C to greater than 360 °C (-99 °F to 680 °F), depending upon operating conditions and product grade.

Chemical stability

Krytox™ lubricants withstand fuel, coolant, brake fluid, engine oil, washer solvent, and even battery acid.

Safety and low evaporation (low VOCs)

Krytox™ lubricants—within the recommended temperature ranges—experience almost zero evaporation or chemical change over the many years of a vehicle's service life.

Compatibility

Krytox™ lubricants won't harm painted surfaces, plastics, or elastomers. They are compatible with almost every material they may contact and don't migrate.

Outstanding dielectric properties

Krytox™ lubricants are good insulators and have become the lubricant of choice for electrical applications.

Krytox™ Performance Lubricants

Chemours™

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