

Modularity and functional integration in the engine periphery of commercial vehicles

Hannover, September 2014 – The use of identical components and modular solutions makes it possible to implement engine-specific requirements for peripheral systems, such as oil or fuel management, at significantly lower cost. The required additional functions of a module are also easier to integrate. For this reason, MAHLE is increasingly pursuing a modular systems approach for commercial vehicles.

Today, automobile manufacturers are increasingly turning to cross-platform modular systems. Such strategies of identical components and modular design offer great potential for serving global markets efficiently in high quantities. For this reason, modular systems with a high degree of functional integration also provide numerous advantages for diverse subsystems. All of MAHLE's current commercial vehicle applications have highly integrated functionality and—depending on the application—use customer-specific modular solutions. To be able to provide even more cost-effective solutions in the future, MAHLE is pursuing the advanced approach of a standardized, modular filter system.

Cylinder head cover module and oil separator

Cylinder head covers remain an important design element. Customer-specific surface graining, paintwork, or design elements often live up to these requirements. Besides the appearance, functionality is increasingly required to go beyond the actual sealing function.

MAHLE has developed cylinder head cover modules with integrated oil separation for a commercial vehicle engine platform that allows ultrahigh separation levels and a modular concept for use in four- and six-cylinder engines. This is now the second generation of impactor separators from MAHLE for oil

separation. In this instance, the oil separator being a modular system, it can be adapted to the boundary conditions of the various engines so that it can be used in almost all engine variants with just a few minor modifications.

In addition to a uniform oil separator system, additional functions such as pressure regulation, clean gas supply, and part of the compression intake line have been integrated in the cylinder head cover modules. This eliminates the need for additional hoses. High-pressure oil valves have also been successfully integrated in a plastic cover, thus demonstrating that plastics allow functional integration in addition to economic efficiency. MAHLE has introduced the new production process of hot-gas welding, which allows these high-precision, durable components to be produced.

Fuel filter modules

With the use of common rail injection systems in commercial vehicle engines, the fuel filter modules must meet the highest requirements with regard to particle and water separation as well as the filtration of residual contamination. Here, the modular concept is even more critical as the trend toward so-called world engines is spreading. This approach involves the use of one engine platform with various design variants for all markets. As a result, modern engines are becoming more widespread in regions with varying fuel qualities—for instance with a higher water content. As a high degree of water separation is required in order to protect the fuel system components, regardless of service life, dirt content, or fuel quality, MAHLE has developed a solution with the active prefilter module that achieves a separation level of up to 98 percent in normal operation.

The modern MAHLE fuel filter module for heavy commercial vehicles is characterized by a very high level of functional integration. Valves for regulating the pressure and quantity have been integrated here in addition to particle and water separation, the fuel cooler, the prefilter for protecting the mechanical low-pressure pump, and the pressure sensor on the

dirty side. Also included are a manual priming pump, a valve for initial filling by the customer, two nonreturn valves in the form of tank connectors, and a manual water disposal system. The difference between the diverse module variants is primarily limited to their varying connections and water disposal systems. The water disposal system is thus optionally offered with or without water level sensor and the water reservoir is available in different variants.

In addition to being highly flexible, the modular system of the fuel filter module has extremely small package requirements and its design is optimized for strength and weight.

Oil filter modules

The development and production of complex oil filter modules has long been one of MAHLE's core competences. Besides filtration and cooling of lubricating oil, additional functions can be integrated into the overall system of "oil management."

Thanks to the integration and use of state-of-the-art materials—especially of high-performance plastics—significant cost and weight savings can be achieved. Modern long-life filter elements play an indispensable role in extending service intervals.

The MAHLE oil cooler module for heavy commercial vehicle applications has a high degree of functional integration on both the oil and coolant sides, which also results in minimal package requirements. In addition to the coolant and oil thermostats, the coolant pump is also integrated in the module. The module also serves as a support for the bracket of the charge air pipe. By changing the position of internal interfaces, the plastic content has been increased considerably. The innovative pressure die-cast design helps to reduce the internal interfaces. Together, these measures lead to substantial weight and cost reductions.

In addition to highly functionally integrated oil coolant modules, MAHLE has developed an oil filter module system for off-highway applications that maximizes the use of identical components. The current oil filter modules combine all-plastic oil

filters, oil coolers, and other functions. The high-performance plastics used reduce the weight of the module substantially. This reduction of interfaces to the engine block results in improved quality and decreased costs.

Outlook

Current commercial vehicle systems from MAHLE already have a high level of functional integration with minimal package requirements and weight, as well as optimal functionality under all operating conditions. The strategies of identical components and modular design have already been implemented in MAHLE systems and will be pursued even more closely in the future.

A modular filter system from MAHLE is currently being developed as a new solution for customer-independent applications, using as many identical components as possible for commercial vehicle applications. With standardized internal interfaces within the complete module, it will be significantly easier to integrate individual components into the module in the future, so that a greater focus can be placed on customer-specific interfaces. The modular system means higher numbers built, thus reducing tooling, development, and manufacturing costs. This will also make the product more interesting in the future for commercial vehicle customers with small-quantity projects.

About MAHLE

With its three business units Engine Systems and Components, Filtration and Engine Peripherals, as well as Thermal Management, MAHLE ranks among the top three automotive systems suppliers worldwide. All of the group's nonautomotive activities are combined in the Industry business unit with products from the application areas of large engines, filtration, and thermal management for industrial purposes. The Aftermarket business unit serves the independent parts market with MAHLE products in OE quality.

MAHLE has a local presence in all major world markets. In 2014, some 64,000 employees at over 140 production locations and ten major research and development centers are expected to generate sales of around ten billion euros.

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