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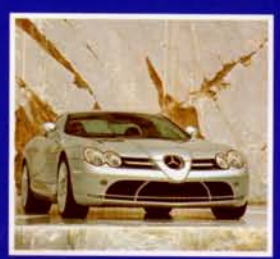
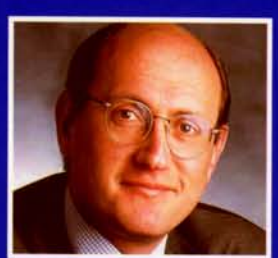
Materials
New Materials for Particulate Filters

Innovative Structural Adhesives

R&D
High-Tech: The Mercedes-Benz SLR McLaren



Interview
Pierre Lévi, Chief Executive Officer Faurecia



Magazine of FISITA – the world body for automotive engineers

Trends in Vehicle Air Conditioning And Cooling

The Renaissance of CO_2: Greenhouse Potential 1,300 Times Lower

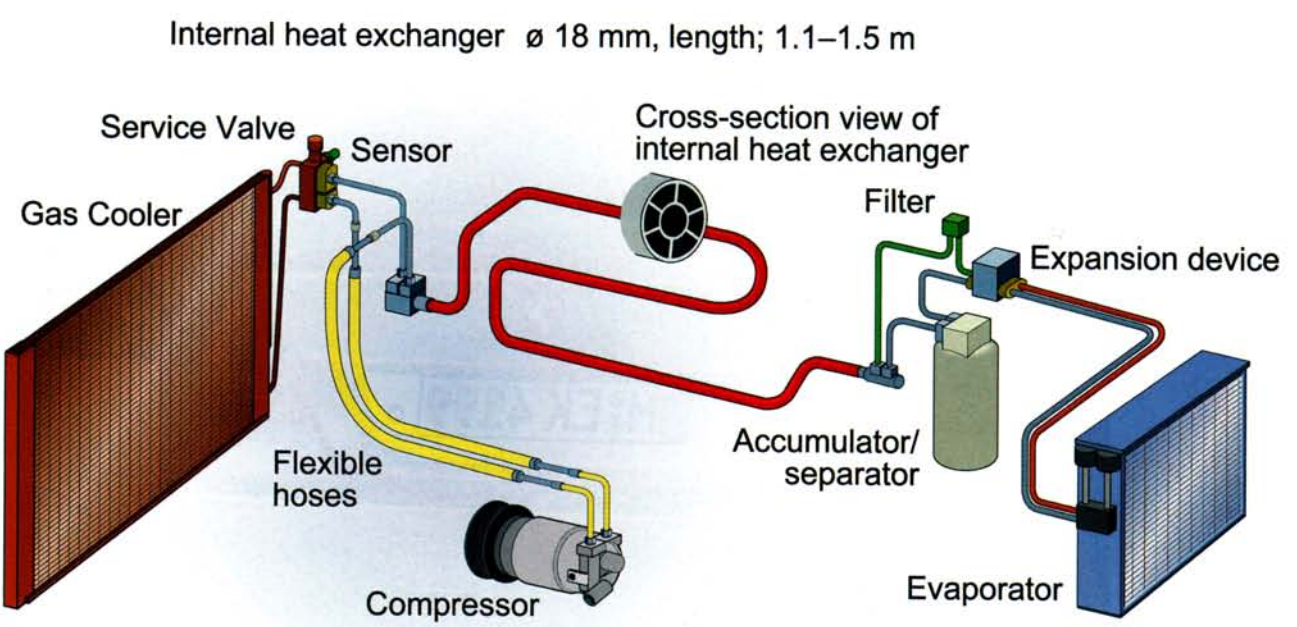
Saving 40% of the current emission

At the 7th Technical Symposium of Behr GmbH & Co. KG, the spotlight was on an almost forgotten coolant, just one of several innovations on show. Until the 1930s, vehicle air conditioning systems primarily used CO_2 as a coolant. Now, Behr has "rediscovered" it as a substitute for R134a. The automotive supplier has also developed new concepts for engine cooling, such as a controlled intercooler system or an optimised cooling fan for commercial vehicles.

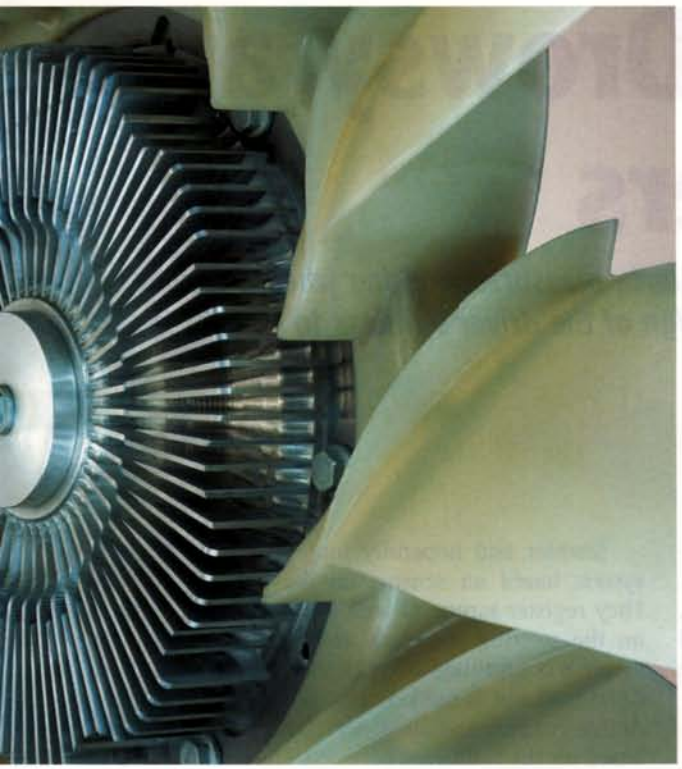
"The greenhouse potential of CO_2 is 1,300 times lower than that of R134a," said Dipl.-Ing. Hans Kampf, Head of the Product Line Systems for the Product Area Air Conditioning. "What is more, the atmospheric gas can easily be produced naturally or as a by-product of industrial processes." This means that its use in air conditioning systems is merely a case of "interim storage" and therefore has a neutral influence on the environment without causing any additional greenhouse effect. Hans Kampf estimates that a worldwide implementation of CO_2 air conditioning systems could save about 40 % of the current emissions of conventional vehicles.

Ingenious CO_2 Air Conditioning System

Since CO_2 has different material properties from R134a in terms of density and pressure, the developers were faced with the task of adapting all of the components of the cooling system to use CO2. Furthermore, two completely new parts had to be developed: a gas cooler that replaces the condenser and an internal heat exchanger integrated into the coolant circuit to increase the performance and efficiency of the system. In order to guarantee the required heat absorption during evaporation, the CO_2 can also be cooled. For this purpose, Behr employs an internal heat exchanger that uses CO_2 that has been cooled to approximately 0 °C from the evaporator. The improved cooling dynamics ensure that a pleasant temperature is achieved very quickly, even if the vehicle interior was very hot. A further advantage of CO_2 over R134a is its higher density, which means that lower volume flow rates are needed to achieve the same cooling performance. Another benefit is that the compressor displacement



The functional diagram shows the components of the high-performance, environmentally friendly CO_2 air conditioning system, including the two new parts: the gas cooler and the internal heat exchanger.



Never too hot: Behr's new cooling fan with a viscous coupling will allow heavy trucks to develop their full engine power.

can be reduced by more than 80 %. The smaller dimensions mean that the fuel-consuming mass of the system remains constant, in spite of the thicker walls that are required due to the higher system pressure. The new CO_2 air conditioning system, which is more efficient and offers better fuel economy than conventional systems, is expected to be launched in 2006.

Innovations in Engine Cooling

There are also innovations in the field of engine cooling. Intercooling, for example, increases an engine's power out put and life expectancy, while at the same time reducing fuel consumption. Furthermore, new indirect intercooling achieves a noticeable reduction in particulate and NO_x emissions. The state-of-the-art process also uses the engine coolant to control the temperature of the charge air and the engine process air. In diesel engines, cooled exhaust gas recirculation drastically reduces NO_x emissions. A variable bypass at the exhaust cooler minimises unwanted CO and HC emissions during the critical cold start phase. Improved exhaust coolers have also been specially developed for commercial vehicles. For GDI (gasoline direct injection) engines, Behr prefers to use NO_x trap catalytic converters combined with an exhaust cooler especially for lean burn operation. The cooler extends the working range of the catalytic converter, protects it against irreversible damage due to overheating and increases engine output. Not least, the new cooling fan for heavy trucks allows the previous upper limit for acceptable engine output to be exceeded. In the meantime, Behr is also testing corresponding improvements in cooling efficiency in passenger cars. (mm)