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MANN+HUMMEL at the IAA 2019 Frankfurt Motor Show

System solution increases system service life and efficiency of fuel cells

- **MANN+HUMMEL presents new air induction system for the cathode path of fuel cells**
- **Air induction system protects fuel cells against harmful gases, particles and water**

Ludwigsburg, September 10, 2019 – Emissions legislation is becoming stricter and accordingly also the search for alternative drives. An important concept here is the fuel cell as a supplier of energy for the electric drive. A fuel cell with a proton exchange membrane consists of electrodes, which are separated from each other by means of a semi-permeable membrane. In the fuel cell an electrochemical reaction converts hydrogen and oxygen into electrical energy. The protons are able to permeate the membrane and as a result the unit is able to generate an electric current.

A number of these electrode membrane units arranged in series form a fuel cell stack. In this process, the core components of the stacks are highly sensitive to particles, harmful gases and water present in the intake air. In order to ensure trouble-free operation and extend the lifetime of the system, the filtration of particles and the adsorption of harmful gases is therefore equally important as efficient water separation.

In addition, the proton exchange membrane requires a sufficiently high level of relative humidity in the process air to ensure that it does not dry out. Furthermore, harmful gases can cause irreversible damage to the catalytic

converter, which is coated with platinum. **These requirements are met by the air induction system newly developed by MANN+HUMMEL for the cathode path of the fuel cell.**

Adsorption of harmful substances protects catalytic converter against contamination

The ambient air sucked in, is guided through the dirty air duct fitted with a water separator to the cathode air filter where a particle filter layer separates particulate matter from the intake air. The specially-designed activated carbon layers of the filter element adsorb harmful gases such as sulfur dioxide, nitrogen oxide and ammonia and therefore protect the valuable catalytic converter of the fuel cell against contamination and an impairment of its function.

On the clean air side an air flow meter determines the mass of air which enters the system. This information is used to calculate the exact ratio of oxygen to hydrogen in order to improve the efficiency of the fuel cell stack. A resonator integrated in the clean air duct dampens undesirable flow noise.

Humidifier increases conductivity of the proton exchange membrane

In order to be able to guide sufficient air to the fuel cell, the clean air is compressed in the compressor, which in turn leads to an increase in temperature. The air is therefore cooled in the intercooler located downstream down to a temperature level, which is compatible for the fuel cell. A sufficiently high level of humidity is necessary for the efficient operation of the fuel cell. If the intake air is too dry, this will have a negative effect on the conductivity of the proton exchange membranes in the fuel cell stack.

Depending on the operating status, the humidifier therefore adds process water from the cathode air exhaust to the intake air to increase the humidity. As a result of the process, water droplets may form which are separated by a cathode water separator to protect the stack. The inlet regulating flap upstream of the stack then regulates the air flow to ensure it is ideal for the

electrochemical reaction.

Turbine water separator, coolant particle filter and ion exchange filter complete the protection of fuel cells

The water produced by the reaction is guided by an exhaust duct to the humidifier. This is where the humidity is transferred via gas-tight flat-sheet membranes to the intake air. The excess water is removed by means of a turbine water separator to protect the turbine against water impact. The turbine is used to exploit the kinetic energy still present in the system and therefore increases overall efficiency.

In addition to the air induction system, MANN+HUMMEL has also used its filtration expertise for the cooling circuit. The reaction of hydrogen and oxygen in the fuel cell generates heat, which has to be removed. The coolant particle filter removes harmful particles in the main flow from the coolant circuit and therefore protects the pump. The ion exchange filter located in the bypass flow ensures that the increased conductivity of the coolant caused by the discharge of ions from the system remains below the permissible limit.

Further information is available directly at the MANN+HUMMEL stand at the IAA 2019 Frankfurt Motor Show. You will find us in hall 8 at stand C32.

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[Press picture](#): **MANN+HUMMEL's integrated air guidance system protects fuel cells from harmful gases, particles and water.**

About MANN+HUMMEL

MANN+HUMMEL is a leading global expert for filtration solutions. The company group with its headquarters in Ludwigsburg, Germany, develops solutions for motor cars, industrial applications, clean air in interior spaces and the sustainable use of water. In 2018 the group achieved sales of approx. 4 billion euros worldwide with more than 20,000 employees at more than 80 locations. The products manufactured by the group include air cleaner systems, intake manifold systems, liquid filter systems, plastic

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components, filter media, cabin filters, industrial filters and membrane filters.

*Further information about MANN+HUMMEL is available
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