

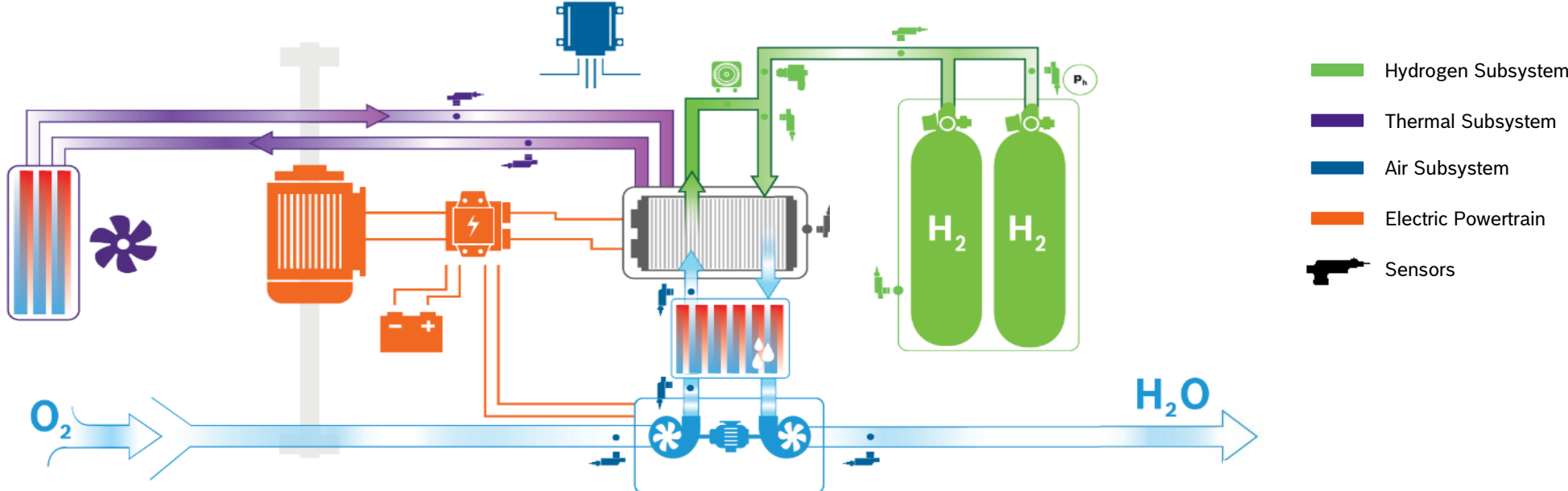


**Fuel cell components
for fuel cell-electric
vehicles**

Fuel Cell - Balance of Plant

Bosch Fuel cell components

Provided for informational purposes strictly on a non-reliance basis
 Illustrations not to scale.



- █ Hydrogen Subsystem
- █ Thermal Subsystem
- █ Air Subsystem
- █ Electric Powertrain
- Sensors

COMPONENTS						MODULES		
Hydrogen Storage System	Anode Components	Electric Air Compressor	Sensors	Bypass & Isolation Valves	PTU (incl. DC/DC)	Fuel Cell Control Units	Fuel Cell Stack	Anode Modules

Electric air compressor

Supplies the fuel cell system with oxygen

Flexible

Customer-specific aerodesign and installation position

Automotive standards

Hard- and software developed according to automotive standards

- Compact dimensions thanks to integrated power electronics
- Flexible aerodesign for adaptation to specific customer requirements for passenger cars and commercial vehicles
- Hard- and software developed according to automotive standards
- Low cost due to modular platform approach
- Oil-free to protect the stack
- Wide power range for fuel cell systems with different performances



Fuel cell power transfer unit

Delivering power from fuel cell to powertrain and fuel cell components

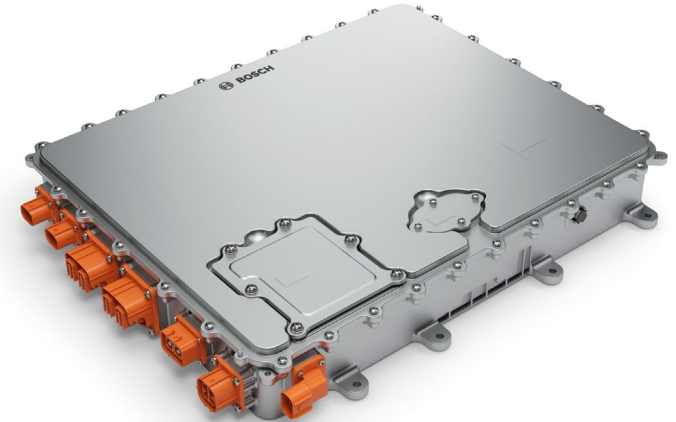
Up to
270 kW

input power @ max. 600 A

High
efficiency

Maximum Efficiency > 98,5 %

- Highly integrated interface between fuel cell system and powertrain
- Control, monitoring and protection functions for stack and fuel cell system included
- Full flexibility to mount on top or side of fuel cell stack
- Up to 5 connectors for fuel cell components



Anode recirculation blower

Anode recirculation blower for the hydrogen circuit in the anode path of a fuel cell system

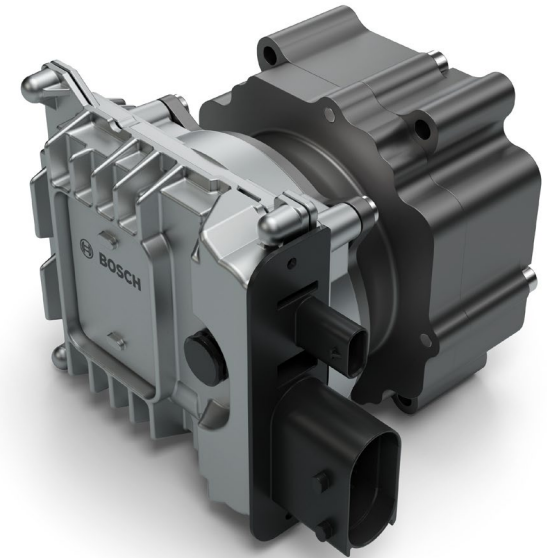
Small installation space

thanks to highly compact design and integrated electronics

Broad spectrum of applications

through functions such as conditioning/purging of the anode path

- Minimal installation space required thanks to integrated power electronics and compact design
- In combination with a jet pump, the component covers the entire requirements range with minimal power consumption
- During the start-up and shut-down process, the blower provides an additional function for conditioning or purging the stack anode path
- Broad spectrum of applications, from passenger cars to heavy-duty commercial vehicles



Hydrogen gas injector

The compact proportional valve for hydrogen gas injection

Low-noise

The hydrogen gas injector features low-noise operation

- Shut-off functionality
- Integration of a jet-pump nozzle possible
- Proportional and partially pulsed operation of the valve possible
- Use in fuel cell systems of up to 150 kW possible
- Broad spectrum of applications, from passenger cars to heavy-duty commercial vehicles

Various operating modes

are possible for the valve, including proportional and partially pulsed operation



Fuel cell anode modules

Highly integrated and compact anode modules for optimized efficiency

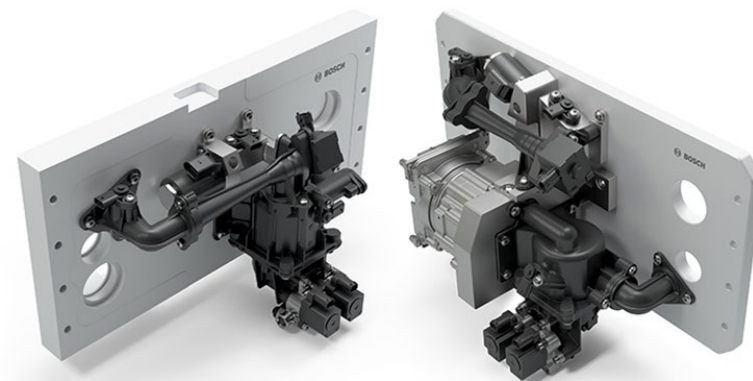
High **flexibility**

through easy customization to address a broad spectrum of vehicle applications

Optimized **hydrogen supply**

and recirculation for high stack performance

- Customized hydrogen supply and recirculation solution
- Optimized packaging with integrated interfaces
- Validated anode module subsystem
- Modular system approach to fulfill different customer requirements
- Low weight, economic plastic material



Components to regulate air volume

Humidifier/stack bypass valve and stack-isolation control valve

High
robustness

to fulfill the requirements of fuel cell vehicles

Significantly
low air leakage

Guaranteed for the product lifetime

- Stack Isolation and pressure control valves are regulating air volume and pressure on the inlet and outlet in cathode subsystem. During non-operation mode the valves are isolating the inlet and outlet path with extremely low leakage. With the volume of injected hydrogen, the valves contribute in the overall fuel cell system power control and system efficiency
- The humidifier and stack bypass valves are components to reregulate the amount of air in bypass channels
- A humidifier bypass valve is a key product to ensure right air humidity in stack and keep a maximum of efficiency of fuel cell system



Sensors for fuel cell-electric vehicles

Reliable and precise measurement of relevant parameters of the fuel cell system

Fast and precise **measurement**

of fuel cell system parameters

Own **system expertise**

from a reliable automotive supplier with many years of experience in large-scale production

- Competence from a single source
- Robust in harsh environments
- Extensive experience in the automotive sector
- Established production processes

