

Modules and Solutions for a Clean Future.

It is highly efficient, extensively free of pollutants and absolutely silent. Thanks to these properties, fuel cell technology is regarded as a major source of hope in the search for alternative, future-oriented energy supply and drive concepts. The principle behind this is impressively simple: the direct conversion of chemically stored energy—for example that of hydrogen—to electricity. A fascinating idea. And one pointing the way ahead. But intensive research and development efforts are still needed from the production of the substance, which only occurs in molecular form in nature, through to the production of affordable, series-production fuel cell systems. Bürkert provides components which are crucial in the advanced development of both processes.

A rule of thumb applies in the language of engineers: the quality of fuel cell technology is proportional to the quality of its components. In fact, the peripherals are coming more and more to the fore among experts—with control and regulating system modules as well as intelligent process-related coupling of these components. This is the field where Bürkert has been active for over 60 years. As one of the few providers who can cover the entire process chain involving measuring, controlling and regulation.

It is no wonder then, that the Bürkert product range includes precisely those components which are optimal for use in fuel cell technology: certified modules with low power consumption, a wide temperature range, chemically resistant properties and a very good price-performance ratio. Or the extensively proven, highly-precise mass flow controller technology that is flexible in use.

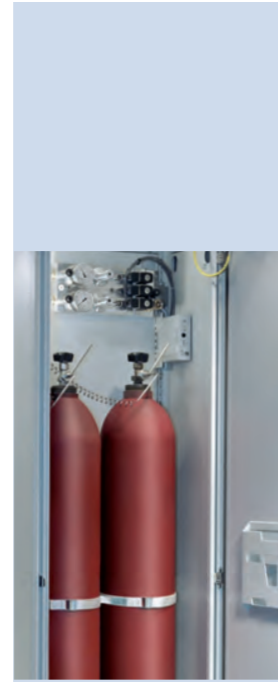
Reliability is achieved through a high level of production competence at Bürkert—you can obtain plastic injection molding technology, coil production or prototypes and tools from a single source with Bürkert. And thanks to our system houses, we are always close to you when it comes to the development of highly specific, individual solutions. At the same time, individual does not always have to be expensive, as we can realize your individual solution at an affordable price in our production facilities if you order above a certain quantity.

Areas of use for Bürkert products in PEMFC application environments:

- Stationary power generators and/or heating power
- APU (Auxiliary Power Units)
- Uninterruptible power supply (UPS)
- Service vehicles such as fork-lift trucks, buses etc.
- Reformer systems
- PSA plants
- Hydrogen generators
- Fuel cell test benches

Bürkert's product spectrum for fuel cell applications:

- Solenoid valves
- Flow sensors
- Pressure sensors
- Solenoid control valves
- Mass flow controllers
- Process valves
- Integrated peripheral modules for control of the process media



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New Energy: Valves and System Solutions for Fuel Cell Technology (PEMFC)



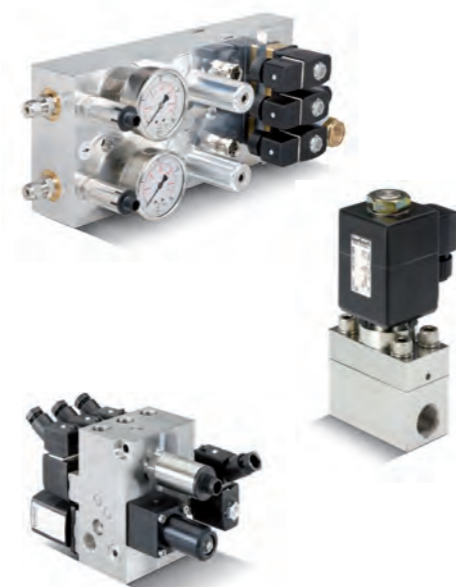
Hydrogen Peripherals

Integrated system solutions: In order to ensure the hydrogen supply, components are needed, which reliably reduce the high pressure and keep the supply stable. High pressure and medium pressure regulators reduce to the required low pressure, while pressure sensors and switches monitor the gas storages and communicate via a signal to the superordinate control panel. Further necessary components are safety and check valves, as well as solenoid valves which contribute to the automation level of the hydrogen supply, shut off very tightly and respond highly dynamically. To keep the handling expense as low as possible, Bürkert offers highly-integrated modules designed in line with customer requirements, both fluidic as well as mechanical and electronic.

Medium: Dry hydrogen

Bürkert components:

- High-pressure regulators for pressure up reduction (high pressure to 300 bar and medium pressure up to 10 bar)
- Medium-pressure regulators for pressure reduction (medium pressure up to 10 bar and low pressure up to 0.5 bar)
- NC shut-off valves with approval
- High-pressure sensor/switch
- Safety valve for pressure relief



Anode Peripherals

Efficient solenoid valves: Media such as reformat gas or humidified hydrogen must be shut off or controlled in the direct environment of the anode. The fuel must be supplied to or removed from the fuel cell stack. This occurs with or without water separation and with or without recirculation. In line with the system, anode residual gas is fed back, while nitrogen contents are decreased. Solenoid valves that are resistant to high temperatures and combustion gases humidified with pure steam are necessary for all these tasks. Taking safety reasons into account, bipolar valves offer significantly lower electrical switching capacities (efficiency contribution), while solenoid control valves provide the option of reliable and efficient pressure control.

Media typ.: Humid hydrogen, humid reformat gas

Bürkert components:

- Shut-off valves for controlling, resistant to deionized pure steam, or water, low-power, medium-separated
- Pressure sensors/switches
- Pressure regulators for low pressure
- Solenoid control valves
- Safety valve
- Hydrogen flow meter



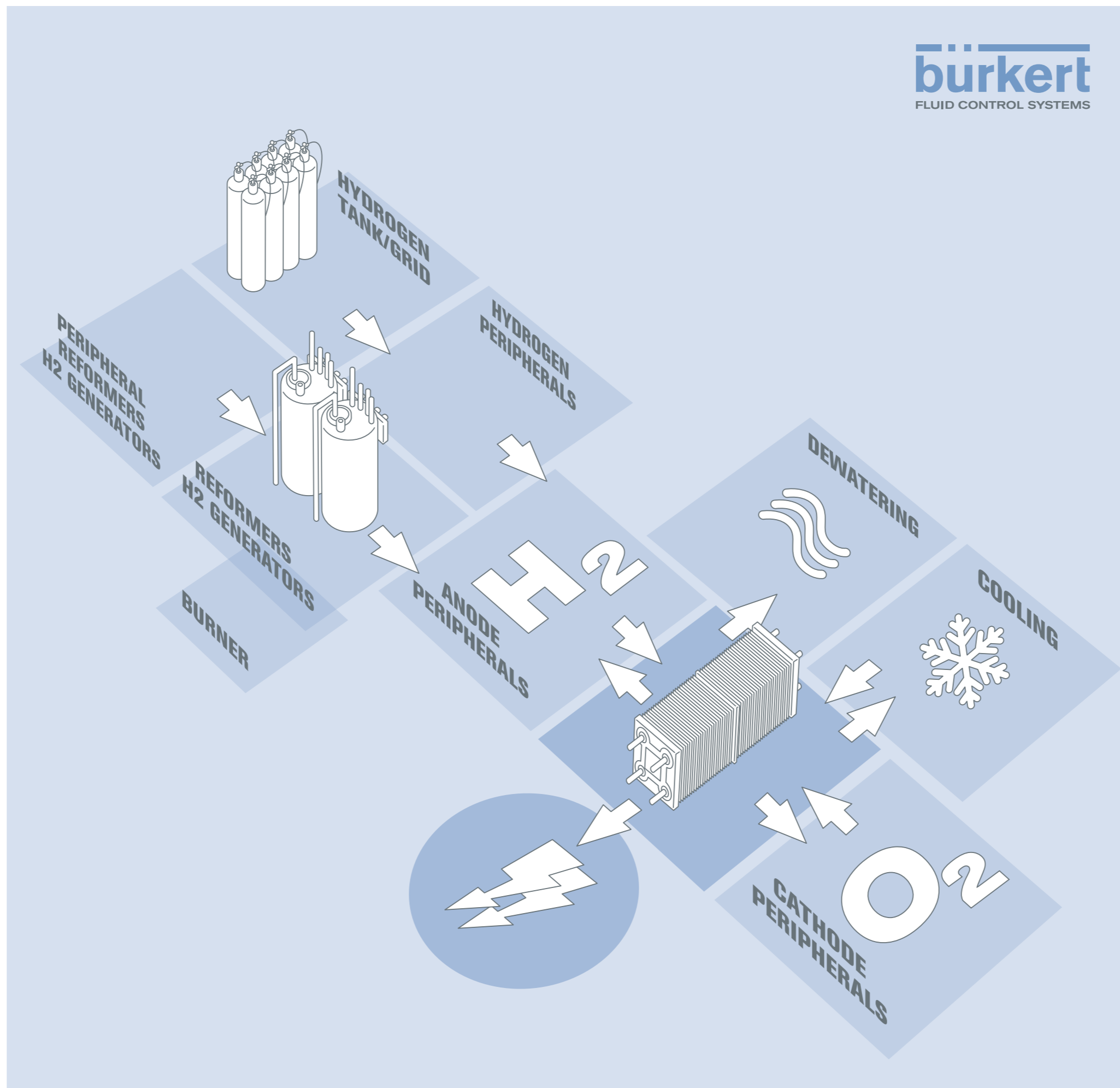
Peripheral Reformers/H₂ Generators

Resistant and certified: If no hydrogen infrastructure is available, other fuels need to be reformed or hydrogen has to be produced using known gas technology. Fuels such as natural gas, diesel or LPG are available in typical applications. Reformation produces a gas rich in hydrogen (reformat), which is then cleaned of undesired components. Compact shut-off and solenoid control valves are able to secure or shut off the fuels. Other solenoid valves, on the other hand, are able to meet the requirements of DI water and ensure a long life. Greater flow rates in hydrogen generators are controlled with pneumatically operated process valves, available from DN 15 to DN 100. These valves are distinguished by maximum life time and leak tightness, while their actuating air can be controlled either with Bürkert control heads or valve islands.

Media typ.: Natural gas, diesel, LPG, DI water, air, municipal water

Bürkert components:

- NC shut-off valves with approval/ dual valves
- Shut-off valves for controlling, resistant to DI pure steam or water
- Gas flow meters
- Water flow meters
- Water shut-off valve, small size
- Process valves



Media typ.: Humid cathode air, DI water (drainage)

Bürkert components:

- Shut-off valves for controlling, resistant to pure steam and water, low-power
- Pressure sensors
- Air flow meters

Cathode Peripherals/ Drainage

Cathode valves: The range of atmospheric oxygen capacity over many fuel cell systems is very large. On the cathode side too, components have to be resistant to media humidified with pure steam. The temperature range exceeds normal requirements. The solution: motorized seat valves DN 8 to DN 25 or optionally with ball cock, which also feature very low power consumption. Valves such as those of the Types 211, 6126, 6128, 6606 and 6608 are optimal for the task of draining the pure water resulting in the process.

Cooling

Media typ.: Water with glycol, water

Bürkert components:

- De-aeration valve (customer specific)
- Liquid flow meter
- Pressure sensor
- Control valve (motorized)
- Temperature sensor/controller



Compact cooling water controls: The modular concept behind our control electronics module of the Type 8611 enables customer-specific complete solutions that are fixed and tested. It has been designed for installation in system blocks which are also equipped with other Bürkert products. The flow sensor Type 8012 comes with a magnetic measuring principle integrated in a paddle wheel, while the sensor electronics can be integrated in the control electronics and an actuator (Bürkert solenoid control valves) operated directly by the control electronics. System solutions enable cost optimization and compact designs. The system solution shown controls a temperature-guided flow of cooling water. Other available sensor measuring technologies are ultrasonic and MID (magnetic-inductive).

Test Stand Equipment

Media typ.: Hydrogen, oxygen, air, DI water, methanol

Bürkert components:

- Mass flow controller, mass flow meter
- Pressure sensor/controller
- NC shut-off valve (solenoid and air operated)
- Flow sensors
- Liquid flow controller, liquid flow meter
- Temperature sensor/controller
- Proportional valves



Testing of fuel cells: Like many other major aggregates, fuel cells also have to be tested regarding the performance data to be complied with. For the application field of fuel cell testing technology, Bürkert provides a wide product spectrum, from three-way solenoid valves of Type 330 through to mass flow controllers of Type 8626. Mass flow controllers realize the gas supply, while pressure sensors with controllers and solenoid control valves make up pressure control loops. The liquid flow controller of Type 8718 controls the water dosing for the humidifier or the methanol dosing for testing DMFC systems as well. Air operated process valves or even corresponding thermal flow meters are used for large flow ranges (air, hydrogen).