FUEL CELL MARKET

MICROPUMP®

SUCCESS STORIES

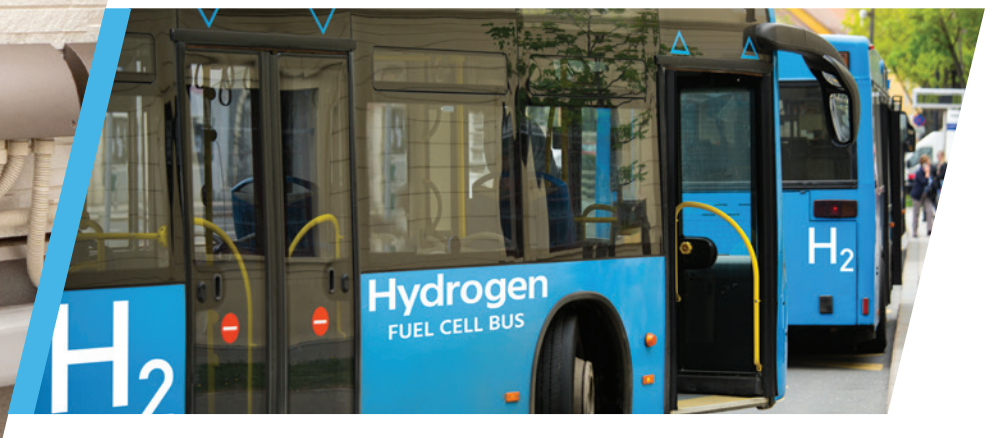
Hydrogen Reformation and Heat Recovery -
Micropump has worked with the first fuel cell company in Korea for pump solutions in the fuel processing system and fuel cell stack since 2005. Many of systems are for residential fuel cell micro-CHP systems that supply 1-3kW residential household energy and 1-10 kW back-up power systems for commercial use. Micropump pumps are used for the reformer water pump and heat recovery pump for water transfer to hot water reservoirs. Micropump GAF-T23 and GA-V21 pumps have been the customer's preferred pumps due to the constant consistent flow even with system pressure fluctuations.

Hydrogen Reformation -
Micropump worked with a Chinese transportation company developing their fuel cell powered vehicles. The vehicles provided logistics solutions primarily through hydrogen-powered fuel cell technology. Micropump pumps are utilized in the hydrogen reformation portion of the system to help to handle a methyl alcohol and water mixture. The GAF-T23 pumps with our integrated DC brushless motor were selected for the system requirements. Due to the transportation function of the system, the duty cycle and lifespan are very important for 24/7 capabilities.

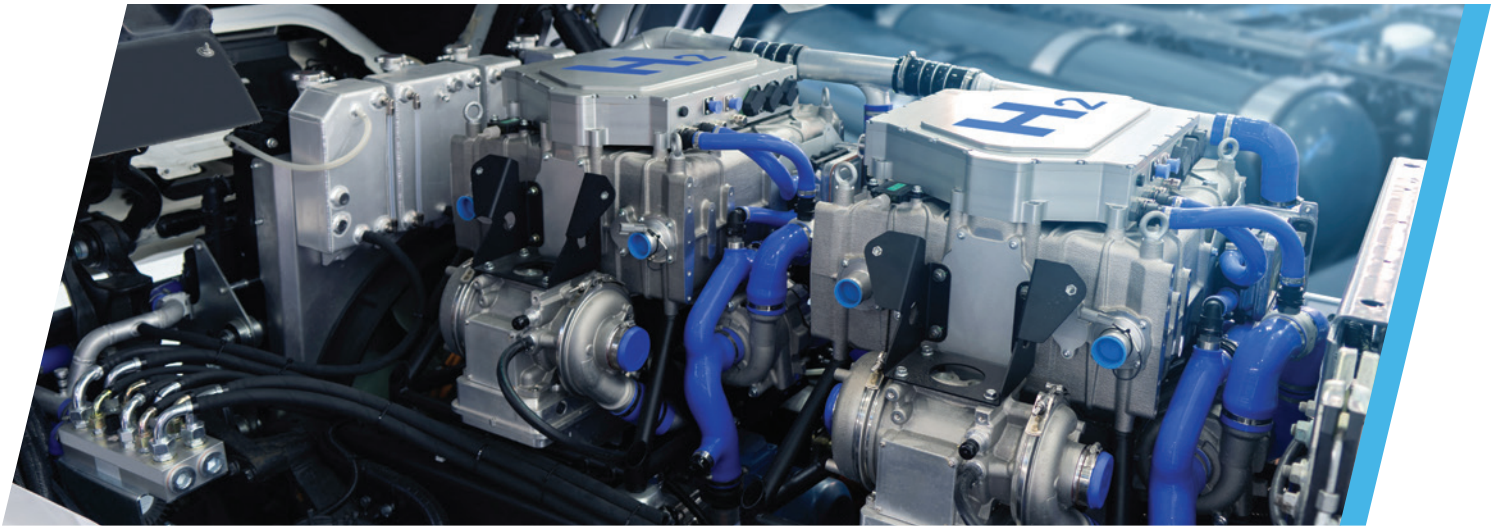
Cell membrane Hydration -
Micropump worked with a transportation manufacturer to assist with the fuel cell membrane hydration system. The Micropump pump delivers DI water into the PEM with a varying pressure of 0-25 psi depending on fuel cell power requirements. Our pumps draw water from a spray tank reservoir and pump the water through a deionizing filter into a spray-type humidifier. The DI water that is being pumped gets sprayed though a series of nozzles. The water is sprayed into the air supply in the chamber at 70° C to humidify the hydrogen before it reaches the fuel cell elements for the chemical reaction to occur. The humidification process is key to enabling the fuel cell to be successful and is challenging to make sure there is always a net positive amount of water. Micropump pumps provide highly reliable delivery to maintain accurate humidification to enable the system to operate at maximum efficiency. Micropump GJ-N25 pumps were utilized to handle temperature, pressure drops and reliable DI delivery.

Hydrogen Generation -
Micropump worked with a hydrogen generation company to assist with the conversion of fuel sources into hydrogen. The fuel reformer was a steam-based system that produced hydrogen reformate and used a membrane to produce purified hydrogen. The reformer utilized a methanol-water fuel mixture and resulting reformate would then be forced through a membrane to purify the hydrogen. The pure hydrogen produced was stored in a pressurized tank. Upon demand, hydrogen is supplied to the fuel cell stack from the pressurized tank. When pressure in the hydrogen tank drops below the set limit, the pump is turned on and the reforming process starts again.

The customer had a piston pump with the system operating at 265 psig. However, the piston pump was not a solution as pressure fluctuations were affecting the system. By utilizing a Micropump magnetic gear pump, the system could provide higher efficiencies in the steam reforming. Higher pressure also provides better utilization of the membrane. This allowed a smaller membrane, while maintaining pressure and flowrates to produce the same amount of purified hydrogen. Not only did the Micropump GA series pump optimize the system efficiency, but it also allowed for reduced cost by allowing a smaller membrane.



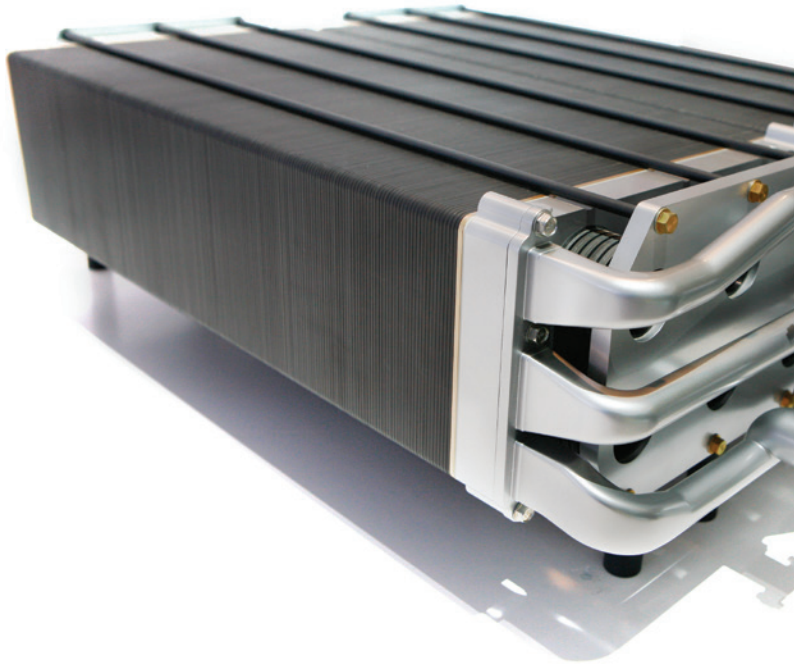
Hydrogen Generation -
Micropump worked with a fuel processor technology company for fuel processing and hydrogen purification systems for the portable power, stationary and backup power, industrial gas and transportation markets. The hydrogen generators produced highly scalable systems. Utilitizing a PEM and a methanol-water fuel mixture, the system was a more streamlined approach for purified hydrogen. Micropump delivered specially-designed GA Series pumps for the customer to operate their system at high pressures resulting in very efficient hydrogen generation.



Hydrogen Generation -

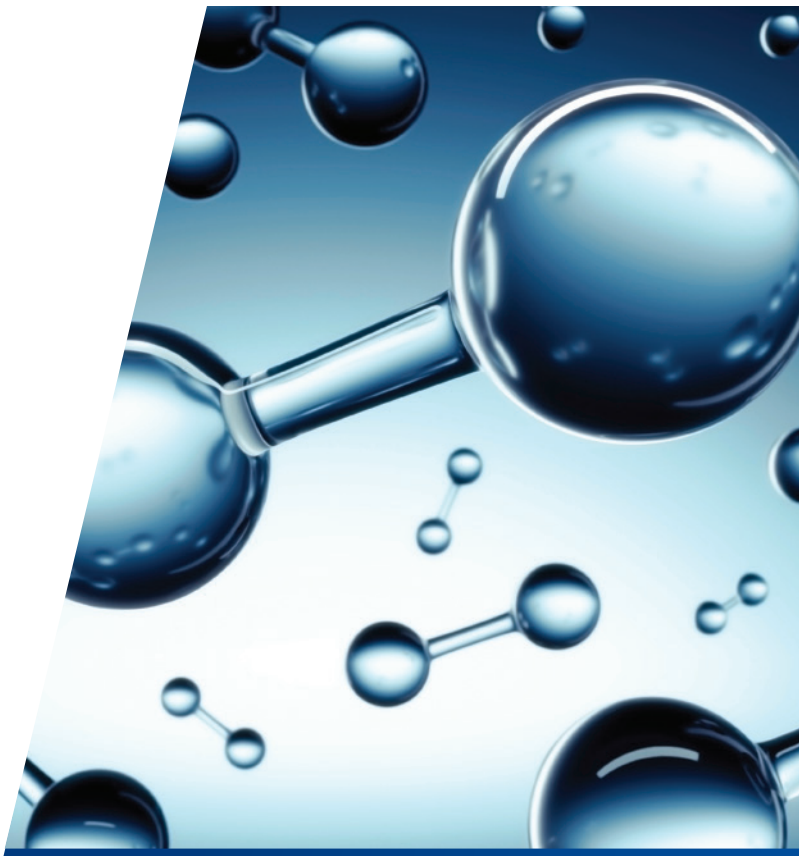
Micropump worked with a fuel processor technology company in their system to create hydrogen on-demand from liquid fuel to power backup power fuel cell systems for telecom and infrastructure networks. The fuel cell systems utilize PEM technology to convert readily-available hydrocarbon fuels into purified hydrogen for use by the fuel cell to produce electric power. The fuel cell system generates electricity by converting a methanol-water mix into hydrogen and then converting hydrogen into electricity. The fuel reformer was a steam-based system that produced hydrogen reformate and used a membrane to produce purified hydrogen. The reformer utilized a methanol-water fuel mixture and resulting reformate would then be forced through a membrane to purify the hydrogen. The pure hydrogen produced was stored in a pressurized tank. Upon demand, hydrogen is supplied to the fuel cell stack from the pressurized tank. When pressure in the hydrogen tank drops below the set limit, the pump is turned on and the reforming process starts again.

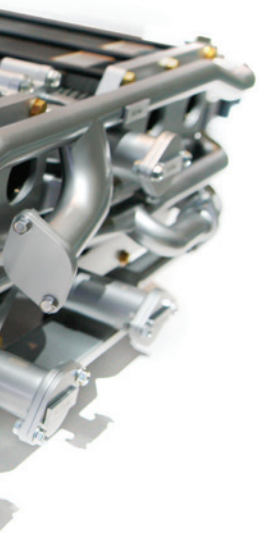
The customer had a diaphragm pump with the system operating at 170 psig. However, the piston pump was not a solution as pressure fluctuations were affecting the system. By utilizing a Micropump magnetic gear pump, the system could be operated at a higher pressure to provide higher efficiencies in the steam reforming. Higher pressure also provides better utilization of the membrane. This allowed a smaller membrane, while maintaining pressure and flowrates to produce the same amount of purified hydrogen. Not only did the Micropump GA series pump optimize the system efficiency, but it also allowed for reduced cost by allowing a smaller membrane. Additionally, the quiet operation of Micropump pumps was appreciated due to installation locations of their systems.



SOFC and CHP Coolant Circulation –
Micropump GJ and GA series pumps were part of a solution for solid oxide fuel cells (SOFC) and combined heat and power (CHP) units for a customer in England. The company developed a fuel cell module, based upon Solid Oxide Fuel Cell (SOFC) technologies, that is purposed to expand the company's core market beyond residential energy needs to include solutions that meet the demanding energy needs of businesses and infrastructures. The customer was expanding upon a compact, efficient, SOFC-based combined heat and power unit (CHP) for electrical power generation and heating.

The SOFC technology utilized requires the fuel cells to operate at substantially lower temperatures to significantly raise the efficiency of converting fuel to electricity and heat. Levels of electrical output are to be maintained in CHP units even when heat demand is modest. Micropump gear pumps are used to circulate coolant within the SOFCs and CHP units and feedback from the pump / drive units provides the essential data needed to make accurate measurements of these performance improvements. Micropump GJ Series magnetically coupled cavity plate design gear pumps as well as Micropump GA Series suction shoe design gear pumps are directly coupled to a DC brushless 24VDC motor with adjustable output speed and feedback signal of the actual motor speed.





CHP DI Water Coolant Recirculation –
Micropump suction shoe gear pumps were part of a solution for a company in England for small, efficient CHP units. The customer is committed to developing alternative solutions to address the challenges of reducing emissions, increasing fuel efficiency and improving energy security in the domestic home heating and electrical power generation market. Micropump gear pumps are used in the recirculation of de-ionized (ultra pure) water coolant within CHP units and to meter the flow of the water coolant. The smooth flow and accurate metering of the pump, equipped with a system of feedback, provides the company with essential data for evaluating the operating efficiencies and heat transfer characteristics of CHP units. Micropump GA series with brushless 24DC motors with control of the input speed and a tachometer for feedback of the actual motor speeds were supplied.

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