TAKING HYDROGEN INTO THE FUTURE

TOTAL SYSTEM SOLUTIONS FOR H2 APPLICATIONS.

Parker

HYDROGEN FOR TOMORROW & BEYOND

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THE GROWING IMPORTANCE OF HYDROGEN

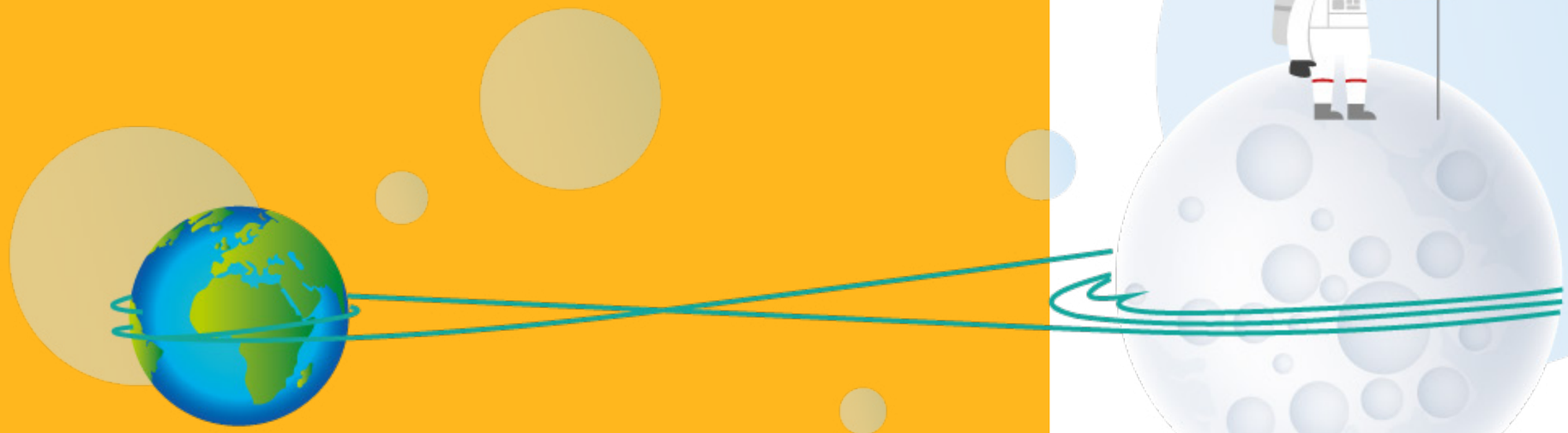
The world is currently pursuing all possible means to reduce planet-warming emissions from carbon-producing fuels. Hydrogen plays a critical role in creating alternative systems that provide the carbon-free energy required for a sustainable future.

As the world becomes more reliant on renewable resources, hydrogen will need to be cost-efficiently transported and stored to deliver energy at the right time and place to meet demands. Electrochemical conversion via fuel cells will become commonplace as hydrogen is used more frequently to decarbonize industry, mobility, transportation, and heating.

As a result of this, hydrogen will undoubtedly be developed as a zero-carbon energy carrier and become one of the most important globally traded commodities. Consequently, the ability to quickly produce hydrogen generation and storage systems that are safe, efficient, and affordable, will become increasingly important across the globe.

This is where Parker's unrivaled expertise in motion and control technologies and hydrogen components and sub-systems can help. In partnership with Parker, hydrogen system designers and engineers can build the hydrogen engineering of tomorrow, today. In a safer, faster, and more economical way. From initial blueprint designs right through to the completed system.

WHY TRUST PARKER FOR YOUR H_2 NEEDS?



PARKER'S H2 CREDENTIALS

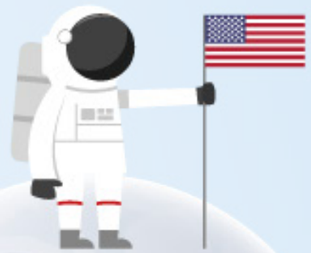
Few component suppliers have Parker's pedigree when it comes to motion and control technology and hydrogen systems.

We have over 100 years of experience in various engineering fields and our involvement with hydrogen and the supply of components for such systems goes back a long way, over 50 years in fact

It all started with a significant contribution to one of the most ambitious hydrogen-dependent engineering projects of the past, which led to one of the greatest achievements in the history of man...

ONE SMALL STEP FOR PARKER...

On July 16, 1969, NASA's Apollo 11 launched from the Kennedy Space Centre, Cape Canaveral. Onboard were Neil Armstrong, Buzz Aldrin, and Michael Collins on the culmination of a decades-long mission to put a man on the moon and bring him back again. From blast-off, to the historic first step on the moon, and the return journey to Earth - Parker provided engineering and system contributions, including those around H2 and O2 for the onboard fuel cells systems, to make this incredible mission possible and successful.



Many Apollo fluid systems relied on specially designed Parker seals and fittings to prevent leaks that could cause mission delays - or worse. Parker ball valves, stop valves, check valves, shut-off valves, seals and O-rings, tubing, and fittings, all contributed to the operation of the fuel cell reactant supply modules and oxygen and hydrogen modules of the Saturn 5.

CLICK BELOW TO SEE THE 21 PARKER COMPONENTS USED IN APOLLO 11

LEARN MORE

...ONE GIANT LEAP FOR PARKER'S H2 PARTNERS

Parker's work with NASA continued for many years right up to the Space Shuttle program. With such a long-standing and high-profile relationship like this, our expertise with hydrogen has grown exponentially over the years.

Today, we have an established product range and the engineering experience that gives us a clear advantage when it comes to providing hydrogen designers with components and system solutions for hydrogen-based applications in areas that include transport, power generation (industrial/domestic), maritime, storage and distribution.

Couple this with a worldwide presence of more than 300 production plants and 50,000 employees across 45 countries, manufacturing hundreds of thousand product lines, and it's easy to see why Parker can provide a 'one-stop-shop' when it comes to supplying components for a variety of H2 applications.

Whether it's advising on initial system designs; supplying fully compatible products that have been thoroughly tested in the most extreme conditions; or working in partnership to design new products or adapt existing technology for specific needs - Parker should become one of your first ports of call when it comes to hydrogen.

OUR KEY HYDROGEN SECTORS

AT WORK, IN EVERY AREA HYDROGEN WORKS IN

Parker has many years of experience providing motion and control solutions to a wide selection of global industries. These range from transport and power generation (both industrial and domestic) to maritime and aerospace through to storage and distribution.

Many of the technologies and solutions we have developed for these industries are compatible with H2 application requirements or can be customized to become fit-for-purpose.

The four key hydrogen areas that Parker can provide advice and components for are:

PRODUCTION

The colorless gas hydrogen can be produced in several ways: from fossil fuels (hydrogen-carbon molecules), from biomass resources (hydrogen-oxygen-carbon molecules), or from water (hydrogen-oxygen molecule).

Whatever method is used the resulting colorless H2 is attributed with a color code that defines the type of hydrogen it is, and the technology used to produce it.

Parker can provide a large range of components for use in gas or liquid preparation and electrolyzers that are critical to the production of hydrogen.

STORAGE AND DISTRIBUTION

For hydrogen to help meet the ambitious targets for greenhouse gas emission reduction in the 2035-2050 timeframe, distribution and the related technologies used in this area, are a key component.

Parker can supply components for the main distribution methods currently used including pipelines and gas tube trailers, gas along with liquid by road, and gas/liquid by ship - which both utilize transportation via conversion of H2 to ammonia, methanol, and other carriers and then back to H2 at the destination. Also aligned to this is bulk storage.

POWER GENERATION

On the road to 'net zero', hydrogen will play an increasingly important role in reaching a fully decarbonized power sector with its increasing use as a fuel, particularly in gas turbines.

Hydrogen will provide the potential for flexible power generation, helping to balance a more variable, renewables-based electricity grid.

Together with electrification, hydrogen will also provide a viable alternative to the natural gas-based domestic heating sector.

Many components required by the 'power generation' sector fall under Parker's core product expertise and have been proven to be reliable over many years.

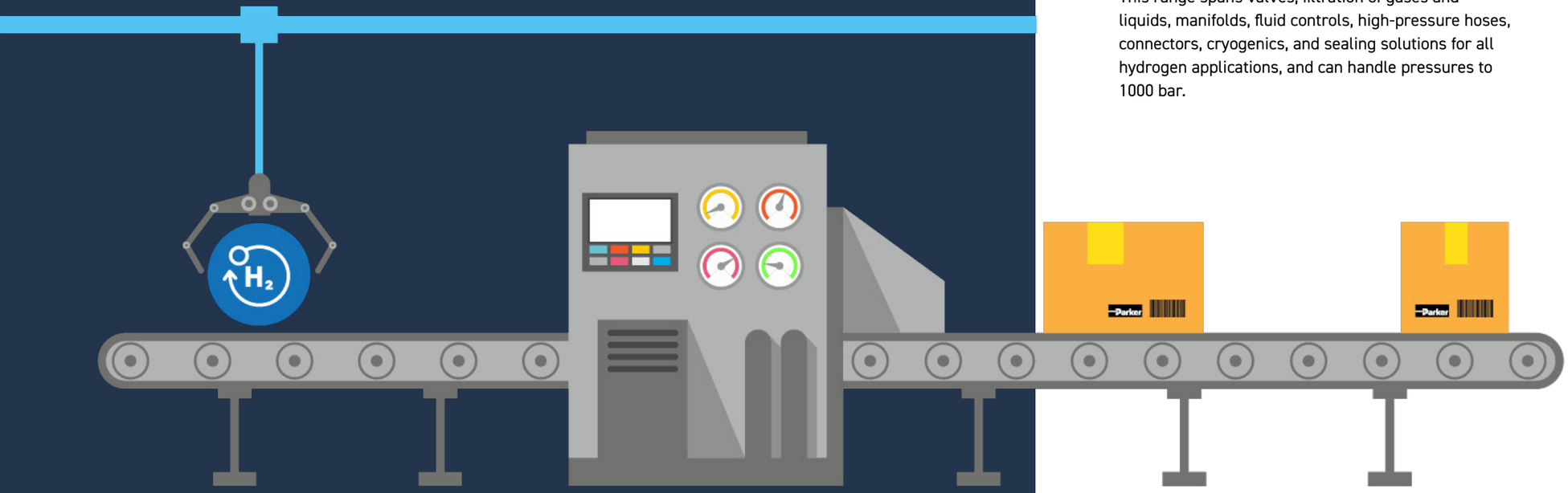
TRANSPORTATION

Hydrogen will also become increasingly fundamental in achieving the full decarbonization of transport.

Areas of 'heavy' transport that batteries cannot fully accommodate - like HGVs, buses, shipping, and aviation - are the main areas where hydrogen can play a significant role in decarbonizing.

Parker already works with many partners in the transportation sector and provides components for onboard hydrogen-powered vehicles for pressures from 30 to 1000 bar (435 to 14,503 psi).

COMPLETE COMPONENT COMPATIBILITY



PARKER H2 PRODUCTS

Hydrogen is a key component for businesses looking to reduce emissions. However, creating viable H2 applications is not without its challenges.

- Designing projects can be complex
- Hydrogen systems have specific intricacies
- High-pressure operation is required
- Freezing vent lines are common
- Metal embrittlement is a concern
- Converting prototype designs into smaller commercial footprints is demanding

Parker's H2 range includes products suited to very high pressures and low temperatures, as well as compliant products and hydrogen service testing options.

All components are fully compatible with each other to provide the H2 system designer with a comprehensive choice of products that have been designed to work together to create the best possible solutions.

This range spans valves, filtration of gases and liquids, manifolds, fluid controls, high-pressure hoses, connectors, cryogenics, and sealing solutions for all hydrogen applications, and can handle pressures to 1000 bar.

PARKER'S H2 RANGE IS:

- Suitable for high pressure and low temperatures
- Available and supported globally
- Customizable to enable the design and manufacture of custom products and subsystems
- Backed-up by application and design engineer expertise
- Manufactured to ISO quality for reliability
- Ever expanding

OUR H2 RANGE SPANS:

- Valves
- Heat Exchangers/air cooler plants
- Pumps
- Electrical motors and Invertors
- Filtration – water, alkaline, air, and other media
- Manifolds systems
- Fluid and gas control
- Hoses – rubber, thermoplastic, and stainless steel
- Connectors - fittings and instrumentation
- Small and large bore tube or pipe (non-weld systems)
- Cryogenic controls
- Sealing solutions for all hydrogen applications
- Power supply units
- Air preparation and nitrogen generation (air separation)
- Water preparation and reverse osmosis
- Sensors

HYDROGEN APPLICATIONS COVERED:

- Media preparation – air, alkaline, water
- Electrolysis systems (componentry and control)
- Compressors
- Stationary and on the move Storage
- Dispensers
- Vehicles and mobility
- Fuel Cells
- Infrastructure

DECARBONIZING ONE MOLECULE AT A TIME

SUSTAINABILITY

Like many businesses, Parker is committed to achieving carbon-neutral operations.

Analysts estimate that clean hydrogen could meet 24% of world energy demand by 2050, with annual sales in the range of €630 billion.

To transform hydrogen's potential for the decarbonization of industry, transport, and power generation into reality, the ability to be innovative in creating hydrogen systems is required along with components and products that can bring these innovations safely online. Parker is committed to helping to achieve this and is constantly reviewing its H2 range's ability to do this.

24% by 2050

Analysts estimate that clean hydrogen could meet 24% of world energy demand by 2050.

Hydrogen is the most abundant element in the universe, though it is not found naturally on its own as a single element and must be extracted or separated from other sources.

Like electricity, hydrogen can be produced from sustainable domestic and renewable energy resources, such as wind, wave, or solar-powered electrolysis, which enhances long-term energy security and contributes significantly to helping to achieve net-zero.

Both hydrogen and electricity can be generated from greenhouse gas-neutral sources, addressing climate change and urban air quality problems, particularly those associated with transport emissions.

Many millions of metric tons of hydrogen are produced annually, and hydrogen is being increasingly viewed as an essential decarbonization option around the world for a wide range of sectors. These encompass transportation, goods and people movement, power generation, energy storage, natural gas blending, marine propulsion, aviation, heating, steelmaking, and other industrial applications.

billion €630

Estimated annual sales in Hydrogen by 2050.

Parker has invaluable experience in all these sectors and can pass on our knowledge of H2 sub-system component design, engineering applications, and hydrogen compatible products to help businesses and manufacturers hit their own carbon reduction goals by implementing sustainable hydrogen solutions.

WORKING WITH YOU TOWARDS A VIABLE H2 FUTURE

As a leader in motion and control technologies, Parker's broad array of solutions makes us one of the best companies to service the H2 sector.

We have over 50 years of experience in working with hydrogen and have worked globally with businesses and organizations of all sizes on H2 projects.

Not only can we supply a complete range of compatible components and products for H2 projects, systems, and applications, but we can also supply products at any stage, and are willing to collaborate openly on potential H2 projects to create new solutions.

HELP WITH YOUR HYDROGEN REQUIREMENTS

Whatever stage of development you are at on your Hydrogen system call Parker to discuss your requirements and find out how we can help with your H2 project.

PARKER HANNIFIN IS A MEMBER OF THE

Hydrogen Council

a global CEO-led initiative of leading companies with a united vision and long-term ambition: for hydrogen to foster the clean energy transition for a better, more resilient future.

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