

# HYDROGEN REFUELLING STATIONS



The image shows a low-angle shot of a modern building with a glass facade on the left and a white facade on the right. The 'sera' logo is mounted on the white facade, featuring a stylized blue and white square icon above the word 'sera' in a bold, lowercase, sans-serif font. The sun is shining brightly from the left, creating a lens flare effect across the glass windows.

# sera

## An enterprise of the future

**sera** is one of the world's leading companies in the field of dosing and compressor technology – for over 70 years, the **sera** business group has been developing and producing solutions for applications that require precise dosing, feeding and compression of liquids and gases.

As an independent family business with headquarters in Immenhausen and subsidiaries in the UK, South Africa, Spain, Austria and Switzerland as well as over 30 strong partners representing **sera** in more than 80 countries, we guarantee professional support, advice and services on the ground across the globe.

# CLEAN. SAFE. RELIABLE.

**We create added value for people and the environment.**

**sera** has an extensive product portfolio, providing the right solutions for many of your applications worldwide. We develop, manufacture and sell high-quality gas compression and feeding products at our facilities, and offer a number of system solutions for a wide range of applications involving hydrogen.

Our customers all over the world also benefit from our comprehensive services, which include assistance with planning and commissioning systems, swift and straightforward global after-sales service, and the development of innovative technologies.



## SERVICE

Alongside innovative product and system solutions, providing an exacting and efficient service is also part of who we are. To this end, **sera** offers a wide variety of services ranging from technical support and commissioning through to maintenance and repair.

## HIGH VERTICAL INTEGRATION

Quality without compromise comes as standard at **sera**. To guarantee this, we manufacture most of our key components ourselves. High flexibility and a lower risk of losses in expertise, as well as shared production and development experience enable us to excel in delivering durable and high-quality products.

## IN-HOUSE DEVELOPMENT

With over 70 years of specialist knowledge and technological expertise, **sera** is known for reliability, flexibility and innovation. We consider it important to have a high degree of innovative strength within the company so that we can impress our customers with the best possible solutions and tailor-made products day after day.

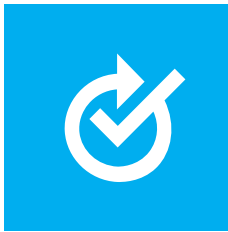
# sera HYDROGEN REFUELLING STATIONS

“Water will be the coal of the future”. Jules Verne recognised this as early as 1870, writing in his novel “The Mysterious Island” that tomorrow’s energy will be water which has been decomposed by electricity, and that its elements (hydrogen and oxygen) will provide the earth with an indefinite supply of energy.

At a time when fossil fuels are running out and environmental protection is becoming increasingly essential to our planet, **sera** GmbH has made a commitment to this very vision – which is why we have developed and launched our innovative hydrogen refuelling station as a ground-breaking step towards the preservation of our environment. Hydrogen technology: the fuel of the future.

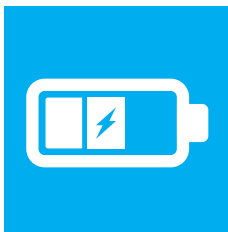


# ADVANTAGES AT A GLANCE



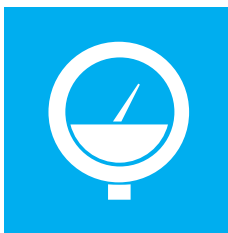
## Reliable & low maintenance

Our compressor's slow stroke puts little strain on wearing parts, giving them a long service life.



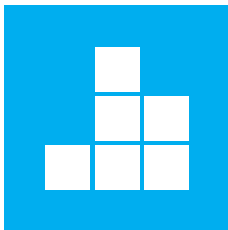
## Low energy consumption

The electrohydrostatic drive and low friction in our innovative compressor technology ensure low energy consumption.



## High flow rates

Our innovative piston compressor allows for high flow rates, which makes frequent refuelling easily achievable even with high discharge volumes.



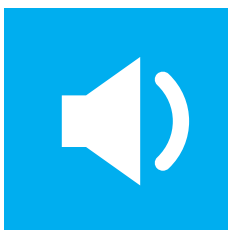
## Modular design

Thanks to standardised modules, the hydrogen refuelling station can be perfectly tailored to customer needs. Subsequent add-ons are no problem.



## Easy to service

Our system container has been designed so that every technical component is easily accessible. This lets you minimise servicing time and guarantees smoothness in use.



## Quiet operation

During development, special care was taken to keep noise emissions as low as possible so that the sera hydrogen refuelling station can also be used in noise-sensitive areas.

# MARKETS AND APPLICATIONS



## PASSENGER CARS

The first vehicles with fuel cells were tested back in 1960 as part of a demo project. Fuel-cell cars are one of just two completely emission-free propulsion alternatives on the market – the other being vehicles powered purely by electric battery – making them the perfect solution for sustainable transport, which is becoming increasingly important. In metropolitan areas in particular, fuel-cell propulsion helps to cut emissions while at the same time reducing noise pollution severalfold.



## BUSES

Vehicles with combustion engines are still used for most urban bus transport. These produce greenhouse gas emissions, particulates and especially noise. As a result, there is now a high demand for alternative, emission-free and noiseless forms of propulsion, with hydrogen drives presenting a future-proof solution. Compared to electric motors, fuel cells offer important advantages. The hydrogen refuelling process takes approximately 10 minutes, for example, while the recharge period for buses running on battery power alone is significantly longer.



## COMMERCIAL VEHICLES

At a time when diesel lorries are already banned from many German cities, HGVs powered by fuel cells are coming increasingly to the fore. Because water is the only waste product from operating a fuel cell, driving bans are no obstacle. Fuel-cell HGVs have an advantage over battery-powered HGVs, thanks in particular to their long range and faster refuelling time, which is why they have become an attractive alternative to traditional vehicles for logistics companies.

# MARKETS AND APPLICATIONS



## RAIL TRANSPORT

Around two thirds of the European rail network has already been electrified and therefore produces no emissions. On low-traffic routes, however, it is not worth installing overhead lines as this requires a high up-front investment. Fuel-cell trains offer a future-proof solution that allows emission-free travel on these routes too.



## INDUSTRIAL TRUCKS

Over 10 million industrial trucks are used around the world each day – and that number is increasing. As these are frequently operated inside buildings, conventional drive units create a local pollution problem. Long charging times mean that battery-powered vehicles are often unsuitable as an alternative. Industrial trucks powered by fuel cells can help here as they offer very short charging times. And with H<sub>2</sub> as their fuel, they produce no local emissions. This makes it possible for them to be used even indoors.



## MUNICIPAL VEHICLES

Municipal vehicles are used almost exclusively in towns and are required to make frequent stops. This produces a great deal of pollution. Sound emissions are another critical aspect, as municipal vehicles are also often used in residential areas. Municipal vehicles powered by fuel cells can solve both of these problems, enabling the vehicles to be used even during quiet hours.

# DESIGN AND MECHANICS

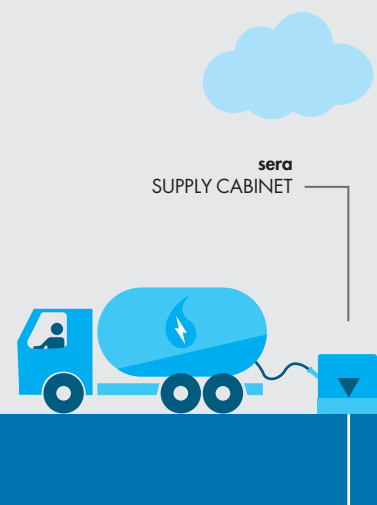
## H<sub>2</sub> SUPPLY VIA ON-SITE PRODUCTION

In this scenario, hydrogen is produced locally by an electrolyser and fed directly into the refuelling station system. The hydrogen is then compressed to the required pressure level by one of our innovative compressors. From there it goes straight on to fill the storage tanks, where it is then available for dispensing.

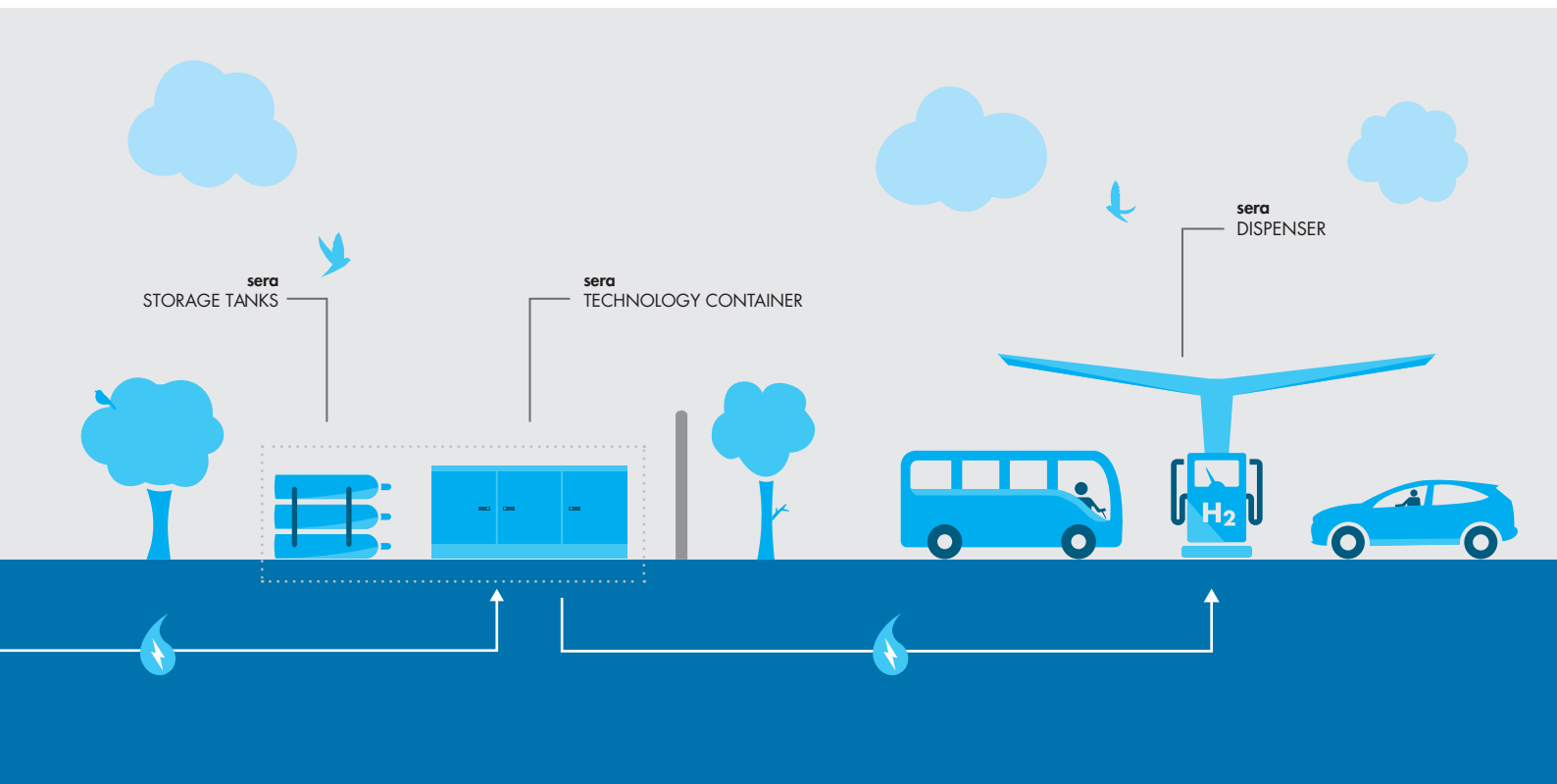
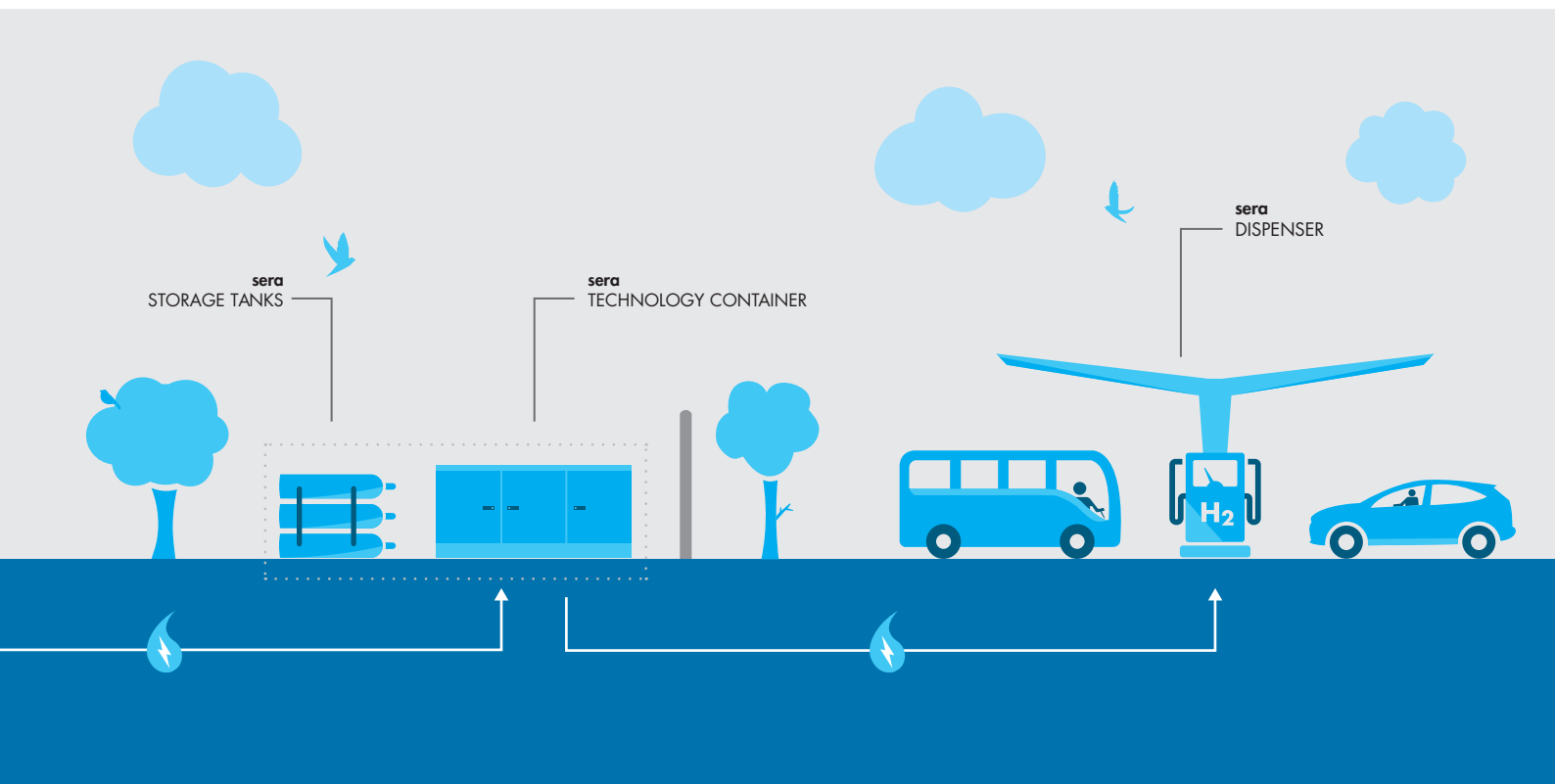


## H<sub>2</sub> SUPPLY VIA DELIVERY

One way to guarantee the supply of hydrogen at the refuelling station is to have it delivered by trailer. In this case, the hydrogen must be produced at another location before being delivered in a trailer. The tanker's driver attaches it to the **sera** supply cabinet and allows the hydrogen to flow into the storage tanks.







# TECHNOLOGY CONTAINER

The technology container is the **sera** hydrogen refuelling station's core element. Modular in design, the technology container is equipped with ultra-modern compressor systems, cooling units, valve technology and a control unit.

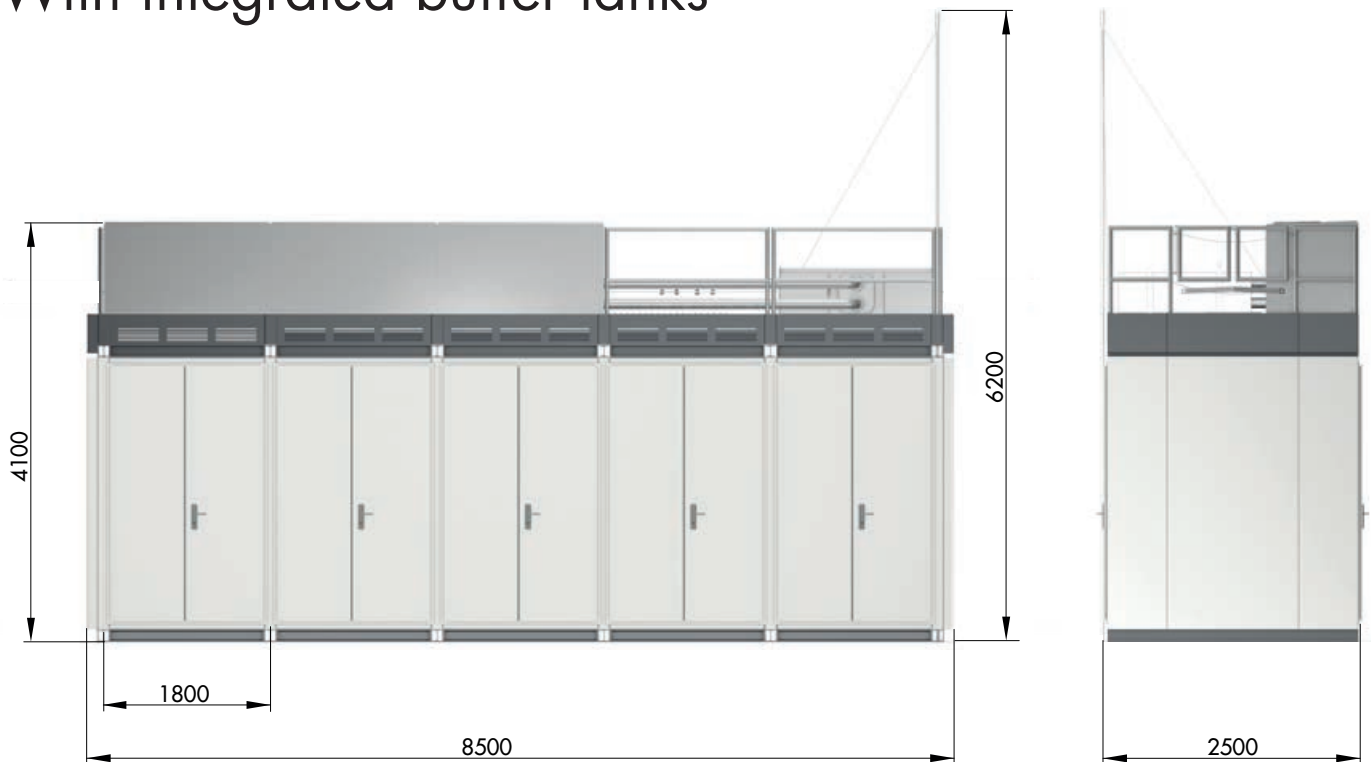
First, hydrogen is compressed to up to 900 bar using compressors, and then stored in buffer tanks until needed. The buffer tanks can be situated either inside or outside the technology container.

Another advantage is that hydrogen which is fed in from the electrolyser can be compressed directly to

the pressure level required for long-term storage in the storage tanks.

The technology container's built-in cooling unit also provides the cooling needed for refuelling a vehicle. High-pressure storage can be integrated in the **sera** technology container or located externally.

## With integrated buffer tanks



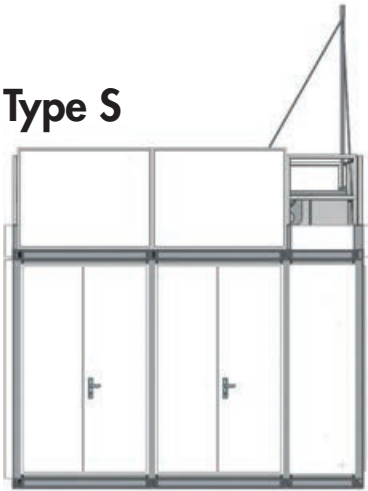
(Measurements in mm)

### Product features

- Two hydraulic piston compressors
- High-pressure storage system for refuelling at 350 bar
- High-pressure storage system for refuelling at 700 bar
- Two cooling units
- Refrigeration technology
- Two hydraulic units
- Control technology
- Control and distribution cabinet

# With external buffer tanks

## Type S



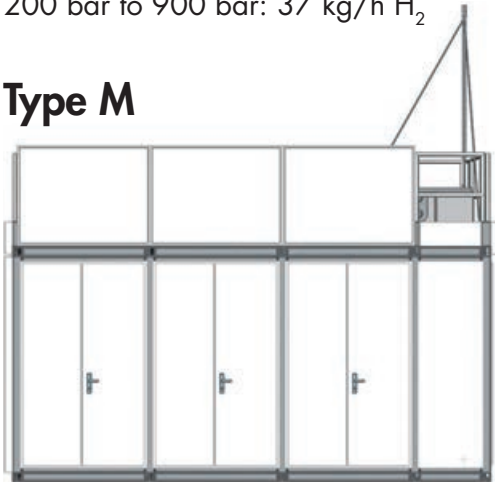
- Piston compressor
- Hydraulic unit
- Cooling unit
- Control and distribution cabinet
- Refrigeration technology
- Control technology
- Length: approx. 4500 mm

### Maximum H<sub>2</sub> flow rate\*

200 bar to 500 bar: 55 kg/h H<sub>2</sub>

200 bar to 900 bar: 37 kg/h H<sub>2</sub>

## Type M



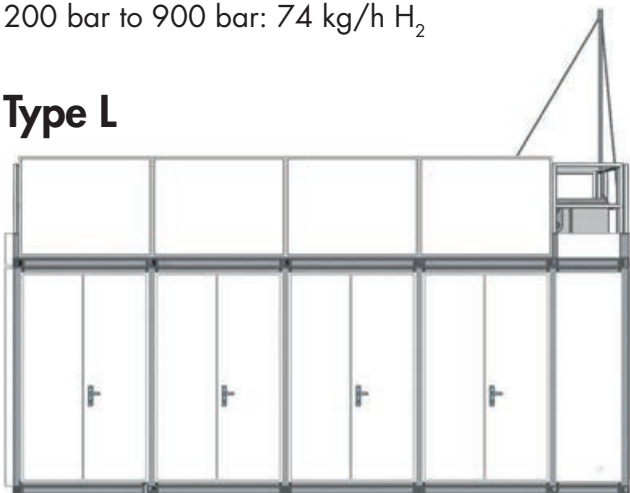
- TWO piston compressors
- TWO hydraulic units
- TWO cooling units
- Control and distribution cabinet
- Refrigeration technology
- Control technology
- Length: approx. 6300 mm

### Maximum H<sub>2</sub> flow rate\*

200 bar to 500 bar: 110 kg/h H<sub>2</sub>

200 bar to 900 bar: 74 kg/h H<sub>2</sub>

## Type L



- THREE piston compressors
- THREE hydraulic units
- THREE cooling units
- Control and distribution cabinet
- Refrigeration technology
- Control technology
- Length: approx. 7100 mm

### Maximum H<sub>2</sub> flow rate\*

200 bar to 500 bar: 165 kg/h H<sub>2</sub>

200 bar to 900 bar: 111 kg/h H<sub>2</sub>

\*depending on compressor and storage tank configuration

# DRY-RUNNING PISTON COMPRESSOR WITH ELECTRO-HYDROSTATIC DRIVE

The compressor is the “heart” of any hydrogen refuelling station.

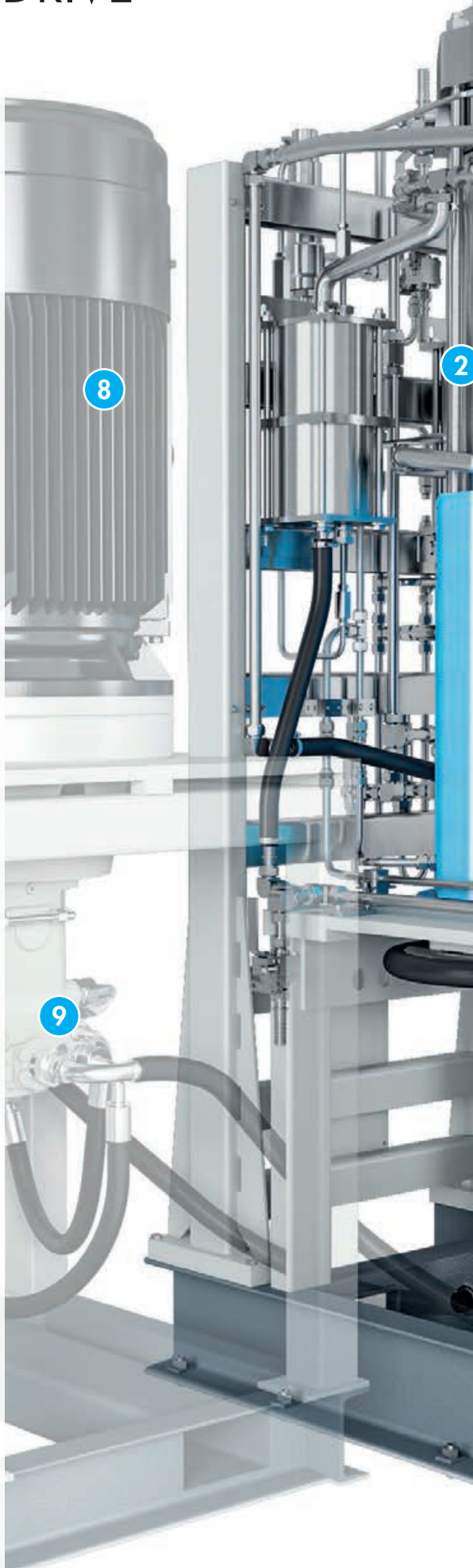
Our compressor unit consists of two coaxially arranged vertical gas cylinders, each mechanically connected to and driven by a hydraulic cylinder. The space between the gas and drive cylinders prevents the medium from becoming contaminated by hydraulic fluid.

Both drive cylinders are hydraulically coupled with each other. Contactless proximity switches are used to change the stroke direction and the hydraulic cylinders are driven by a hydraulic power unit.

Systems with a regulating pump allow infinitely variable control of changes to the number of piston strokes.

## ADVANTAGES

- OIL-FREE, SAFE COMPRESSION
- ROBUST DESIGN
- HIGH AVAILABILITY
- ENERGY-EFFICIENT DRIVE UNIT
- COMPACT FOOTPRINT
- EASY SERVICING





sera's electrohydraulically powered dry-running piston compressors work entirely without lubricants to compress particle-free gases such as hydrogen, nitrogen, helium, argon or ethylene. Thanks to the special design and arrangement of the gas piston seals and guide elements, the otherwise customary lubrication of sealing components can be completely eliminated even in high-pressure and extreme-pressure applications.

- 1 Gas valves
- 2 Tie rod
- 3 Gas piston
- 4 Spacer/lantern
- 5 Piston rod
- 6 Drive cylinder
- 7 Sensors
- 8 Electric motor
- 9 Hydraulic pump

# STORAGE TANKS

Storage tanks are necessary for keeping large stores of hydrogen on hand to allow for plenty of refuelling. Here, hydrogen is stored at high pressure and is ready when needed.

## LARGE-CAPACITY CLUSTER

A large-capacity cluster is a rack containing bottled gas. All the gas bottles in the cluster are connected to each other by pipelines and valves. This storage method is ideal if the system is to be expanded at a later date, as any number of clusters can be set up. The same method also allows very small quantities to be stored.



## TUBE STORAGE

Our tube storage facilities consist of long storage units built into a frame. Tube storage units are 6 or 12 metres long and can store large quantities of hydrogen.



# DISPENSER

The final step in hydrogen refuelling takes place at the dispenser unit. This unit incorporates a nozzle, filling hose, display and control technology. A payment terminal can be positioned separately.

Users can start their refuelling process quite conveniently via a display. A short step-by-step guide follows until the nozzle is securely attached to the filler neck of the vehicle's tank. Hydrogen cooled to as low as  $-40^{\circ}\text{C}$  then flows through the nozzle into the hydrogen tank in the vehicle.

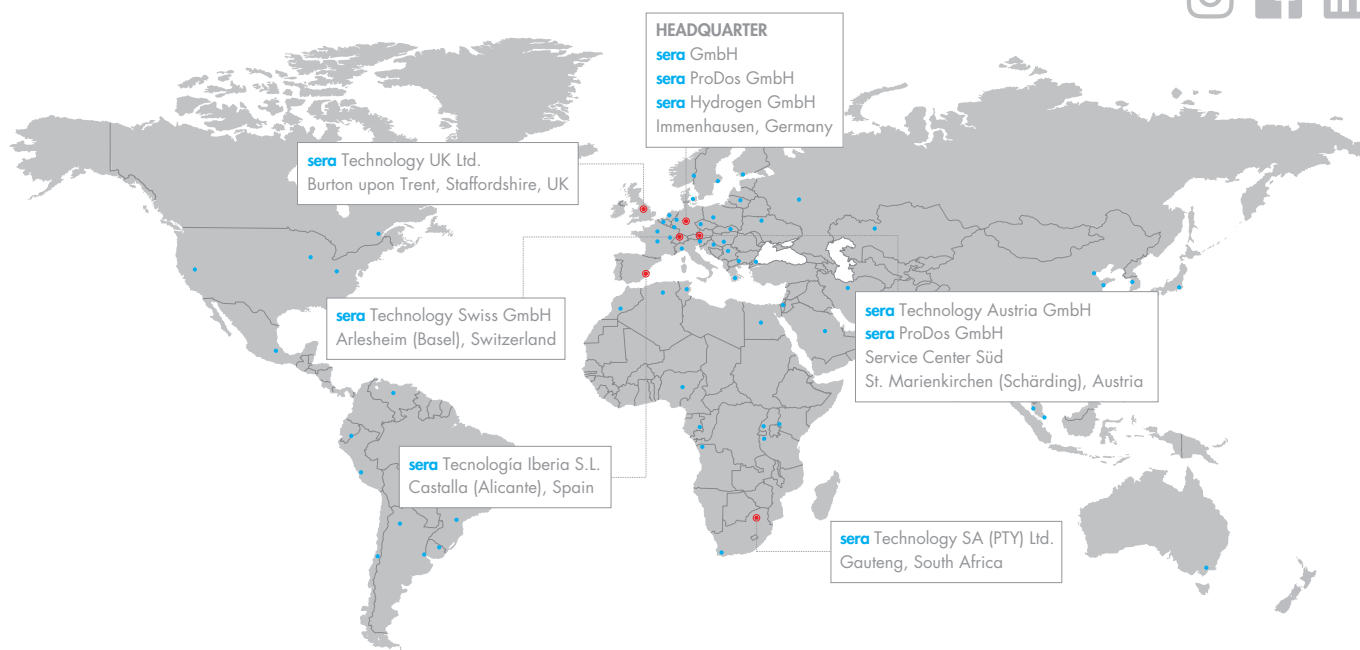
The dispenser developed by sera can refuel vehicles at 350 bar as well as 700 bar. We offer this dispenser with either one or two nozzles.



# SUPPLY CABINET

The supply cabinet allows hydrogen to be delivered by trailer and fed into the storage tanks. To do this, the delivery driver must connect the tanker to the supply cabinet. Once connected, the storage tanks can be filled by means of hydrogen overflow.





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