

VOSS

Customized fluid and thermal management systems for hydrogen and fuel cell technologies.



www.voss.net

THAT'S WHO WE ARE.

FLUID MANAGEMENT FOR VEHICLE AND MACHINE CONSTRUCTION

As a larger medium-sized group of companies, VOSS develops and produces line and connection systems for the automotive industry and mechanical engineering. The success of the VOSS Group is based on great customer proximity, committed employees, innovative products and the demand for permanent top quality for customers with the highest requirements.

With strategic corporate development, a responsible awareness of people, the environment and the region, VOSS has evolved over the past 90 years to an internationally successful group of companies.

VOSS in figures

54

sales partners in
56 countries

6.500

employees

>50.000

marketable
articles

16

international subsidiaries



COMPETENCE FOR HIGH- AND LOW-PRESSURE

OUR SYSTEM COMPETENCE. YOUR ADDED VALUE.

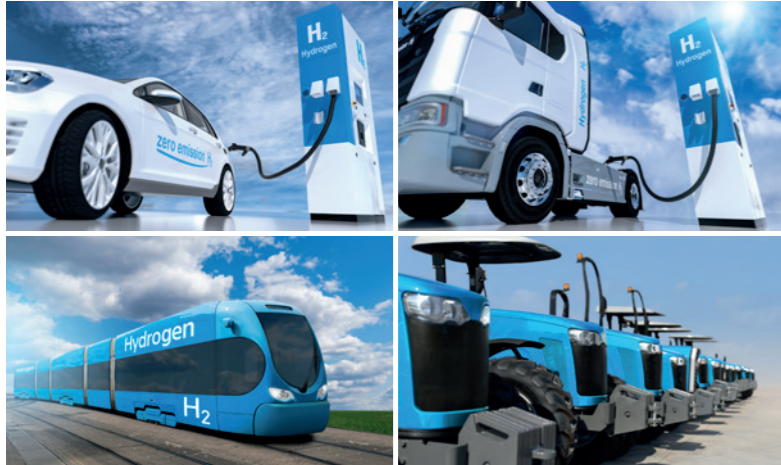
Our competences are the development and production of customer-specific system solutions for the fluid management of mobile as well as stationary applications. In doing so, we serve the entire spectrum along the hydrogen value chain. From the high-pressure range, such as in the production, storage or transport of hydrogen, via the low-pressure range in the fuel cell to the thermal management of the cooling circuits, VOSS designs solutions tailored to customized requirements.

Our extensive product portfolio includes installation space-optimized line and connection technology as well as supplementary system components such as valves, sensors or manifolds. Depending on the purpose, these are optimized directly for hydrogen applications. In this way, customers and users benefit from the system competence of the entire VOSS Group. This includes not only our innovative product solutions but also our comprehensive services:

- Vehicle analysis and benchmarking
- Innovative product and system development
- Continuous accompanying simulations and FE analysis
- Own test vehicle fleet for field tests under real conditions
- Rapid prototyping and pre-series production
- Validations and tests during the entire product development process
- In-house toolmaking
- Worldwide standardized production and assembly processes
- Intelligent logistics concepts
- First installation advice & service also after series production
- Extensive theoretical and practical training
- Worldwide availability of our products & services
- Comprehensive certifications and compliance with the highest quality standards

HIGH-PRESSURE APPLICATIONS

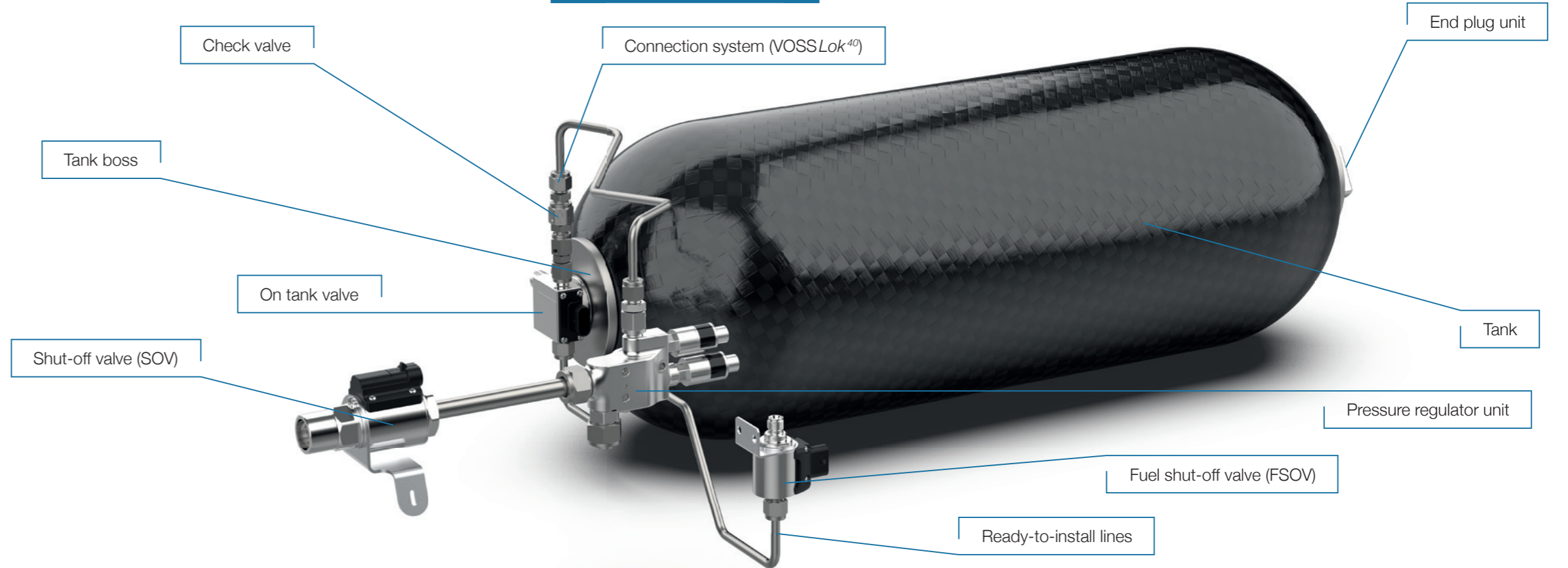
Mobile applications



Stationary applications

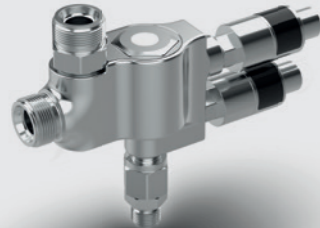


VOSS SOLUTIONS



COMPONENTS FOR HIGH-PRESSURE APPLICATIONS

Pressure regulator unit



Installation space-optimized, mechanical pressure regulator for hydrogen applications with integrated pressure relief valve and sensors

- Realization of different output pressures of the control unit and activation pressures of the pressure relief valve
- High-pressure side:
 - Sensor working range: 0-1000 bar
 - Nominal pressure: 700 bar/15 °C (maximum working pressure 875 bar/85 °C)
 - Port: VOSS*Lok*⁴⁰ MM06 (metallic sealing)

- Low-pressure side with pressure relief valve:
 - Sensor working range: 0-25 bar
 - Nominal pressure: 8 bar +/-1 bar (7 bar to 18 bar possible)
 - Port: VOSS*Lok*⁴⁰ MM12 (metallic sealing)
 - Set pressure relief device on venting side PRV: 11 +/-1 bar (9 bar to 20 bar possible)
- Temperature range: -40 °C to +85 °C
- Mass flow: 0-3 g/s (0-2 g/s, p<30 bar)
- Weight: ca. 360 g
- Dimensions: 126 x 30 x 97 mm

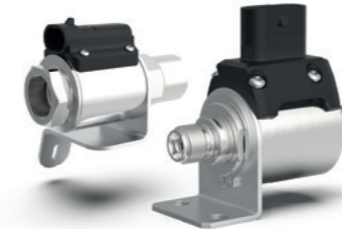
On tank valve



Extremely light and compact interface between vessel and tube system for refueling and withdrawal the hydrogen

- Consisting of various safety-related valve types and a filter system
- For the application of gaseous hydrogen
- Nominal pressure: 700 bar/15 °C (maximum working pressure: 875 bar/85 °C)
- Temperature range: -40 °C to +85 °C
- Supply voltage: 12 -4/+5 V

- Mass flow:
 - Fueling: max. 60 g/s
 - Defueling: 0-3 g/s (p>35 bar), 0-2 g/s (p>20 bar)
- Weight: ca. 640 g
- Dimensions: 125 x 69 x 61 mm
- Interface for high-pressure connection: 2x VOSS*Lok*⁴⁰ MM06 studs (metallic sealing)
- Other connection systems possible on request



Shut-off valves for high- and low-pressure

Safety valves with low power consumption for the entire hydrogen system

- Low-pressure shut-off valve (SOV) for shutting off the line system between the pressure regulator and the fuel cell for nominal pressure 5 bar to 30 bar
 - Weight: ca. 200 g (depending on variant)
 - Dimensions: ca. 75 x 38 x 60 mm (depending on variant)

- High-pressure shut-off valve (FSOV) for safe refueling with nominal pressure 700 bar
 - Weight: ca. 210 g (depending on variant)
 - Dimensions: ca. 66 x 30 x 60 mm (depending on variant)
- Temperature range: -40 °C to +85 °C
- Supply voltage: 12 -4/+5 V
- Port: VOSS*Lok*⁴⁰ or customized on request

Check valves

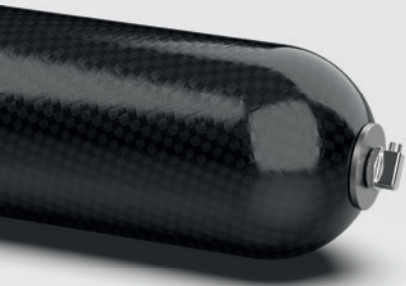


Customized check valves for controlled flow in the hydrogen system

- Different sizes and designs available (inline and screw-in version)
- Nominal pressure: 700 bar/15 °C (maximum working pressure: 875 bar/85 °C)

- Temperature range: -40 °C to +85 °C
- Opening pressure < 1 bar (customized on request)
- Weight: ca. 50 g (depending on variant)
- Dimensions: ca. 40 x 20 mm (depending on variant)
- Port: VOSS*Lok*⁴⁰ MM06, also possible in other connection sizes

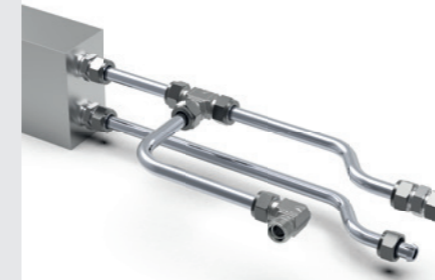
COMPONENTS FOR HIGH-PRESSURE APPLICATIONS



Tank boss

Weight-reduced connection system (boss) for Type IV and V hydrogen pressure tanks

- Can be integrated directly into pressure tanks
- Weight reduction due to reduced neck diameter
- Optimized integration of VOSS on tank valve + VOSSLok⁴⁰
- Nominal pressure: 700 bar/15°C (maximum working pressure: 875 bar/85 °C)
- Temperature range: -40 °C to +85 °C
- Neck diameter: up to 54 mm (customer-specific on request)
- Material: aluminum or stainless steel



Ready-to-install lines

Customized, ready-to-install tube systems specially developed for hydrogen systems

- Bended stainless steel tubes with perfectly matched individual components
- Special materials on request
- End facing machining for different connection systems, e.g. VOSSLok⁴⁰
- Completely pre-assembled modules
- Integration of flex lines on request
- Different cleanliness standards according to customer requirements
- On request, with 100% inspection of tube geometry and tightness



End plug unit

End plug unit for hydrogen tanks with integrated thermal safety relief valve (TPRD) and tube connection for vent line

- Individual alignment for line connection possible
- Nominal pressure: 700 bar/15 °C (maximum working pressure: 875 bar/85 °C)
- Temperature pressure relief device: 110 ±5 °C
- Temperature range: -40 °C to +85 °C
- Weight: ca. 520 g
- Dimensions: 81 x 53 mm



Connection system - VOSSLok⁴⁰

Tube forming system for a safe and easy handling of connections in hydrogen applications

- Approved according to EC79 / EU No 406/2010
- Additionally approved in several prototypes, field tests, pre-series and also series of renowned OEMs
- Very simple and process-reliable pre-assembly and final assembly
- Reduction of leak paths thanks to high finish quality of the forming
- High precision sealing even with volatile media (e.g. hydrogen) and at very high system pressures (700 bar), but also for low-pressure applications - one system for all requirements
- For metric and imperial tube dimensions
- Fast and more process-reliable forming process
- Also applicable for CNG, LNG, LPG and various other industrial gases

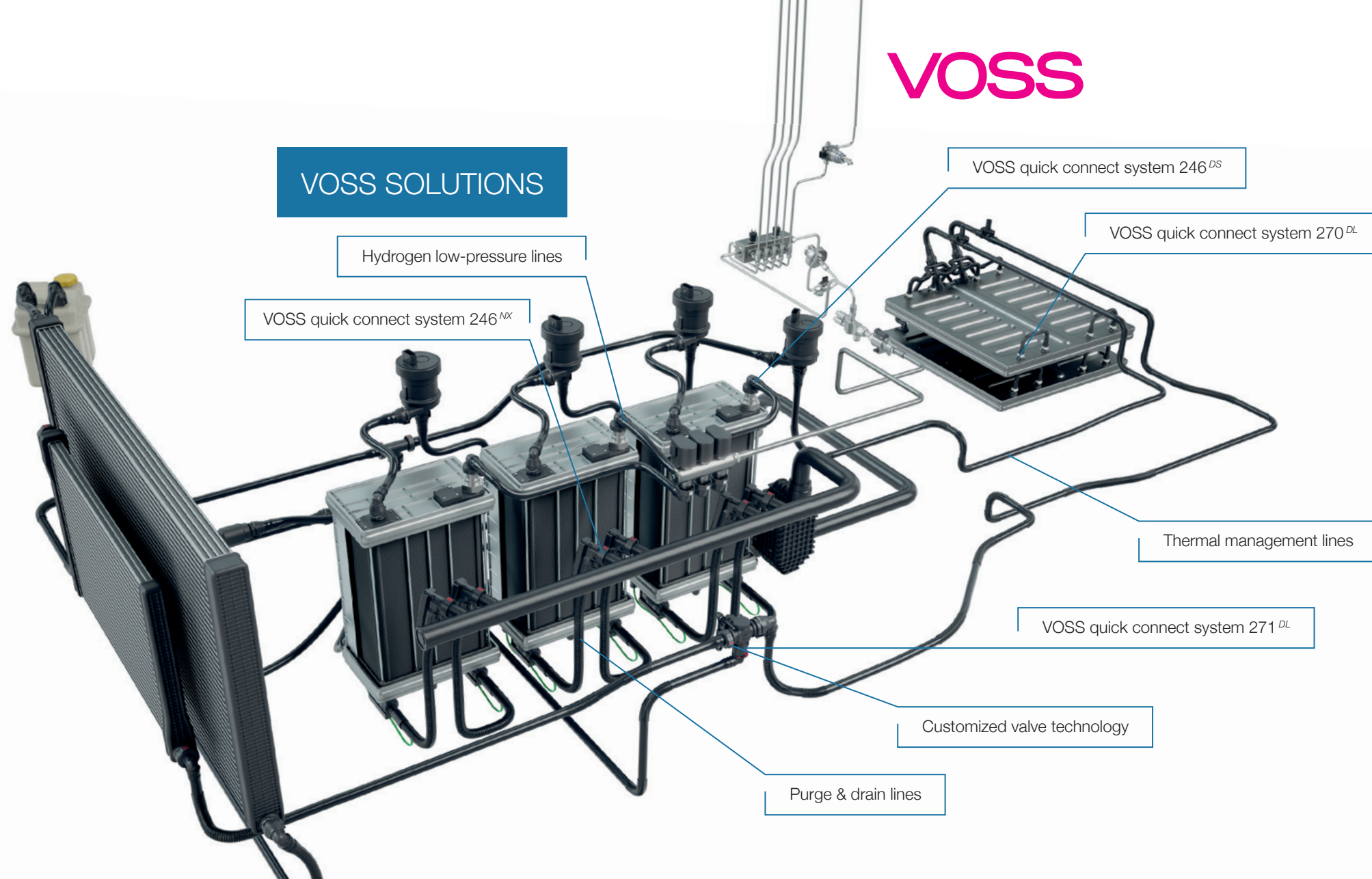
LOW-PRESSURE APPLICATIONS

Alternative drives for mobile applications



VOSS SOLUTIONS

VOSS



COMPONENTS FOR LOW-PRESSURE APPLICATIONS



Hydrogen low-pressure lines

Tailored line concepts for the distribution of hydrogen

- Unheated lines with VOSS QC system 246^{DS}
- Multilayer tubes
- Inner layer made from antistatic, media resistant PVDF
- Mechanically robust PA outer layer

- Temperature range -40 °C to +100 °C, higher temperatures on request
- Operating pressure 3.7 bar, higher pressures on request
- H₂-leak tightness: 5 x 10⁻⁴ mbar L / s @ 3.7 bara & RT



Purge & drain lines

Ready-to-install line assemblies for deionized water and nitrogen

- Electrically heated lines with VOSS QC system 246^{NX}
- Customized line routing with corrugated plastic tubes preventing heat loss and contamination
- Precision sealing connection of tube and connector by laser welding

- Integration of sensors possible
- Reliable and efficient defrosting performance
- Various operating voltages and strategies, e.g. PWM
- Temperature range -40 °C to +100 °C
- Operating pressure 2.5 bar, higher pressures on request



VOSS quick connect system 246^{DS}

Stainless steel QC system for safety and tightness in fuel cell systems

- Connection to plastic tube via fir-tree profile
- Quick and safe assembly and disassembly
- Axial clip for tight sealing under connection profile

- System-specific connection profile 246 for low heights
- Nominal sizes 8 and 12 available
- Temperature range -40 °C to +100 °C
- Operating pressure max. 10 bar, higher pressures on request



VOSS quick connect system 246^{NX}

Plastic plugs for quick and safe assembly and disassembly

- System-specific 246 connection contour for low height of aggregate connections and adapters
- High positive engagement of release clip to connecting profile allows higher pressures
- Temperature range -40 °C to +120 °C

- Release mechanism can be rotated into eight different positions for easy access
- Nominal sizes 8 and 12 for different tube sizes
- Operating pressure max. 2,5 bar, higher pressures on request
- Optionally available as electrically heated variant
- Reliable and efficient defrosting performance

COMPONENTS FOR LOW-PRESSURE APPLICATIONS

Customized valve technology

Future-oriented valve solutions for thermal management applications

- Broad spectrum of expertise: mechanically, pressure, thermally and electrically actuated valves
- In-house developed actuators with tailor-made communication protocols

- Integration of VOSS quick connect systems possible
- Modular design concept for individual requirements
- Combination with customer-specific manifolds and connectors
- Minimal leakage flows
- Easy integration into function-integrated system solutions (modules)

Thermal management lines

Individual solutions for coolant based on line routing and function integration

- Integration of different connection systems, e.g. VOSS QC systems 270, 271 and 246^{NX}, or special solutions according to VDA standard
- Realization of minimum installation space
- Component and installation space optimization through function integration in customer-specific manifolds and connectors

- Leak-tight and maintenance-free media-bearing systems along the entire service life of the vehicle
- Minimized pressure losses
- Hydraulic balancing through defined cross-section changes
- Applicable for DI water, water-glycol mixture and dielectric fluids
- Various combinations of hose and tube, plain and corrugated tube, or straight and preformed lines possible

VOSS quick connect system 270^{DL}

Robust plastic couplings for the fir-tree connection of plastic tubes

- Particularly suitable for connections to filigree cooling plates and similar components
- Quick and safe assembly
- Double Lock (DL) for additional safety

- Very low system height
- Release mechanism can be supplied in two different positions for easy access
- Nominal sizes S6, S10, S14
- Temperature range -40 °C to +85 °C
- Operating pressure max. 2 bar

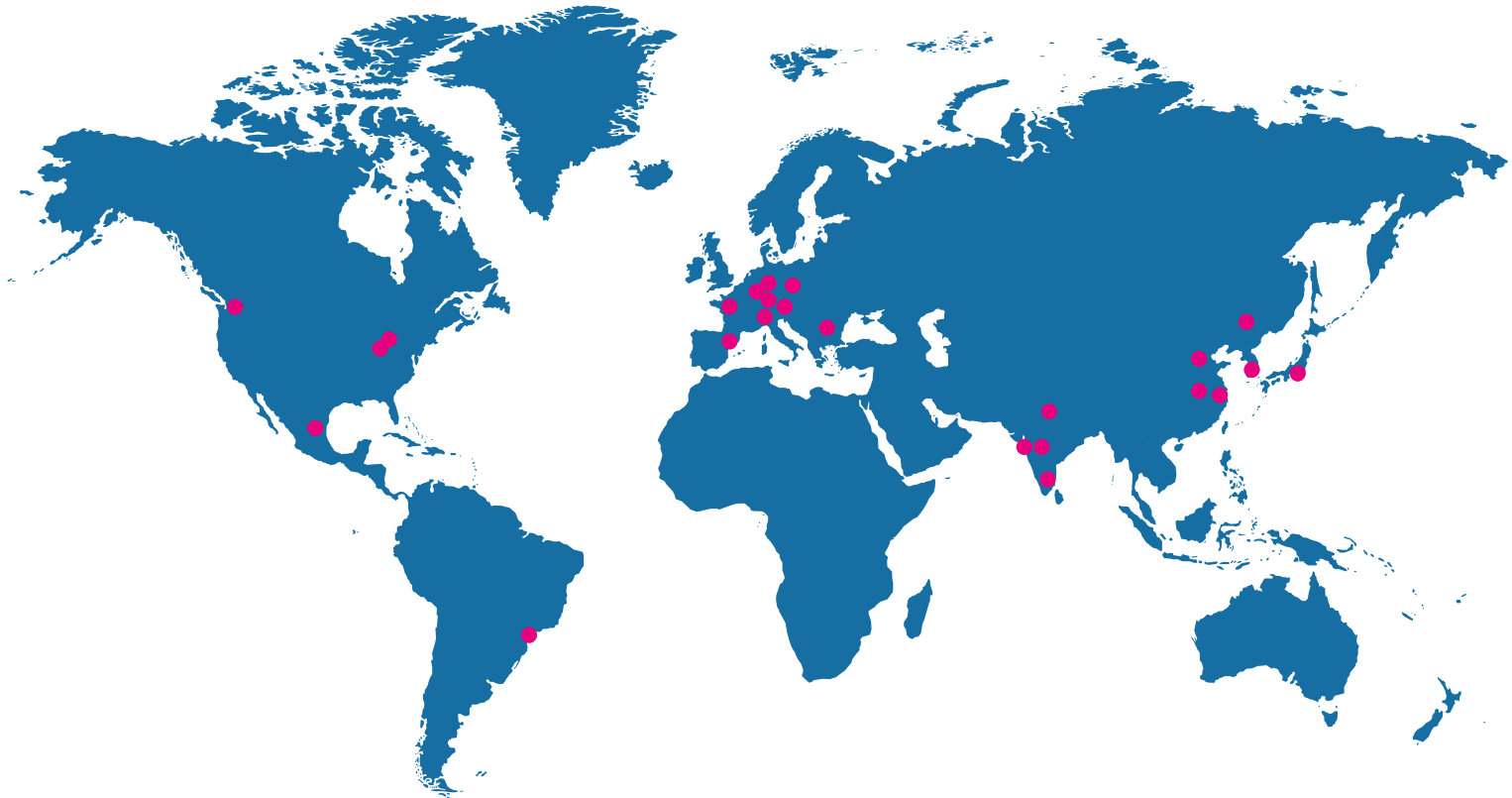
VOSS quick connect system 271^{DL}

Robust plastic plugs for the fir-tree connection of plastic tubes

- Suitable for components with recessed ports, or with material for profiled bores
- Quick and safe assembly
- Double Lock (DL) for additional safety

- Very low system height
- Release mechanism can be supplied in two different positions for easy access
- Nominal sizes S6, S10, S14, S18
- Temperature range -40 °C to +85 °C
- Operating pressure max. 2 bar

VOSS



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