

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

7,000

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

Connection system (VOSSLok⁴⁰)

Check valve

Tank boss

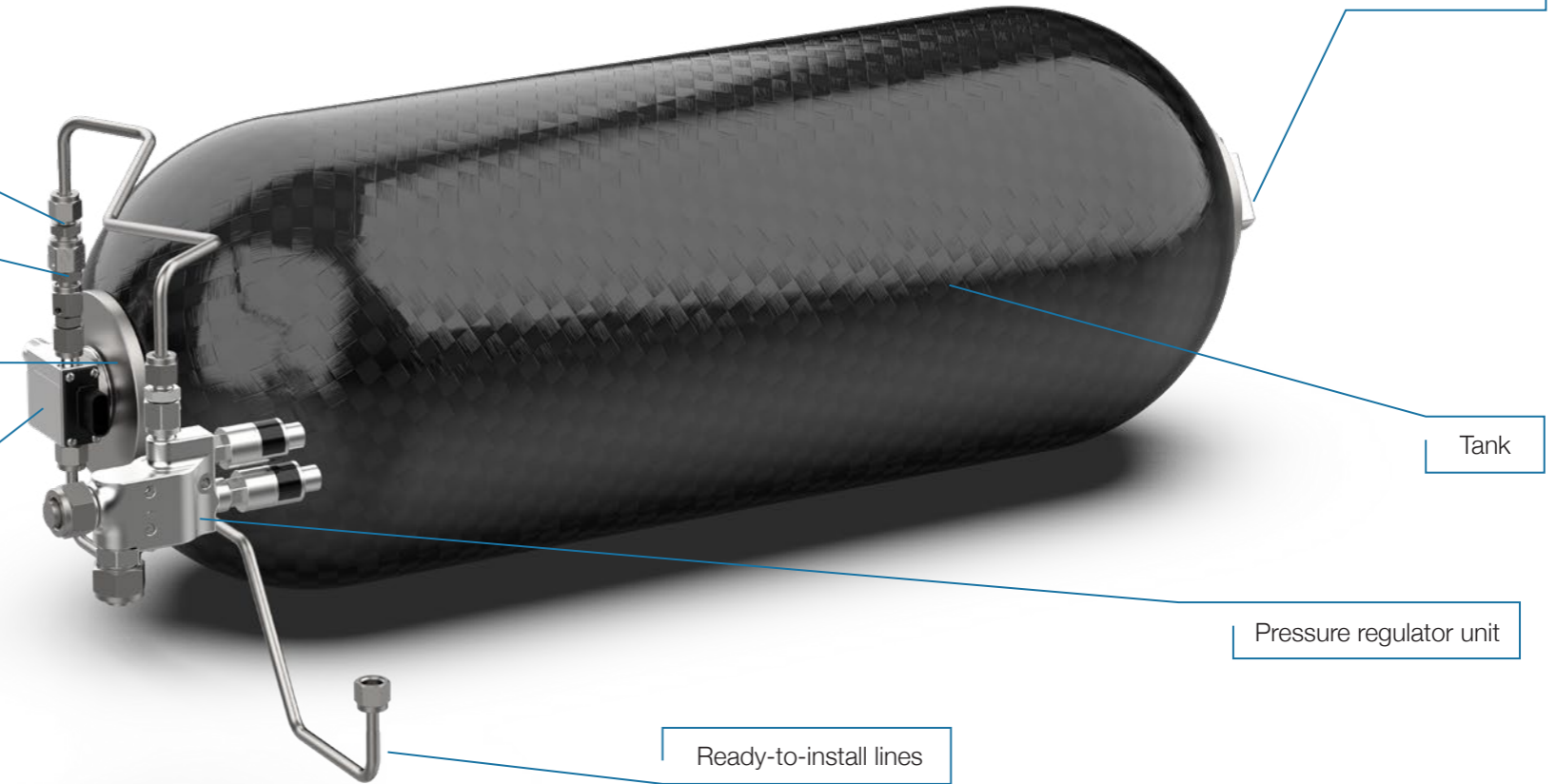
On tank valve

End plug unit

Tank

Pressure regulator unit

Ready-to-install lines



COMPONENTS FOR HIGH-PRESSURE APPLICATIONS



Ready-to-install lines with VOSS Lok⁴⁰

Customized, ready-to-install tube systems with VOSS Lok⁴⁰ – the tube connection system for high precision tightness

- Bended stainless steel tubes with perfectly matched individual components, especially developed for hydrogen applications
- Completely pre-assembled modules
- Integration of flex lines on request
- On request, with 100% inspection of tube geometry and tightness
- Approved according to EC79 / EU No 406/2010

- Tube forming system for a safe and easy handling of connections
- Fast and more process-reliable forming process
- 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 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

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 (TPRD, mechanical bleed valve, mechanical shut-off valve, electromagnetic shut-off valve), a temperature sensor and a filter system
- 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 Lok⁴⁰ MM06 studs (metallic sealing)
- Other connection systems possible on request



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 Lok⁴⁰ 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 Lok⁴⁰ 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

Check valves

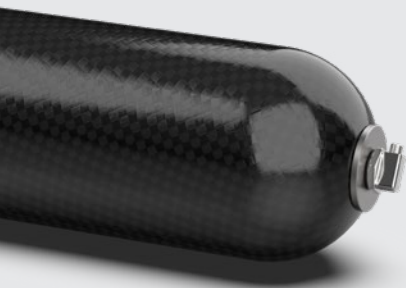
Customized check valves for controlled flow in the hydrogen system

- 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 Lok⁴⁰ MM06, also possible in other connection sizes



COMPONENTS FOR HIGH-PRESSURE APPLICATIONS



Tank boss

Customized, 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 + VOSS Lok⁴⁰

- 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
- Only available upon request and customized



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



LOW-PRESSURE APPLICATIONS

Alternative drives for mobile applications



VOSS SOLUTIONS

Hydrogen low-pressure lines

VOSS quick connect system 246^{MX}

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VOSS quick connect system 246^{DS}

VOSS quick connect system 270^{DL}

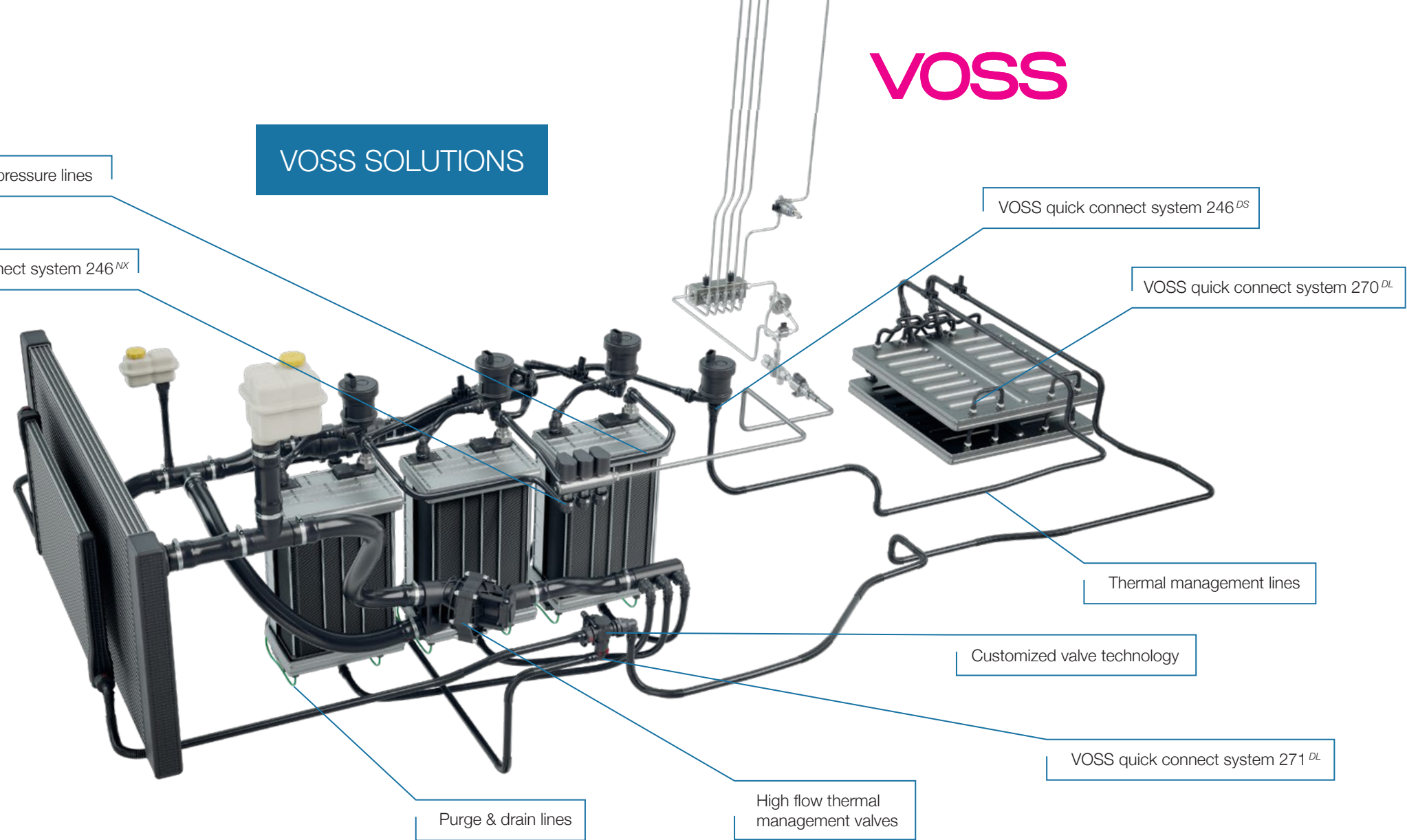
Thermal management lines

Customized valve technology

VOSS quick connect system 271^{DL}

Purge & drain lines

High flow thermal management valves



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
- Integration of sensors possible

- Precision sealing connection of tube and connector by laser welding
- 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



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
- Nominal sizes S6, S10, S14
- Quick and safe assembly
- Double Lock (DL) for additional safety
- Release mechanism can be supplied in two different positions for easy access
- Very low system height
- Temperature range -40 °C bis +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
- Nominal sizes S6, S10, S14, S18
- Quick and safe assembly
- Double Lock (DL) for additional safety
- Release mechanism can be supplied in two different positions for easy access
- Very low system height
- Temperature range -40 °C bis +85 °C
- Operating pressure max. 2 bar



High flow thermal management valves

Customized valve solutions for thermal management applications with large volume flows

- 3/2- & 2/2-way proportional valves
- Volume flow: 400 to 650 l/min
- Valve pressure drop: < 150 mbar @ 450 l/min

- 24 V and CAN-Bus communication
- For hose connections with inner diameter 50 mm
- Minimal leakage flows
- Max. operating pressure of up to 3.5 bar

Customized valve technology

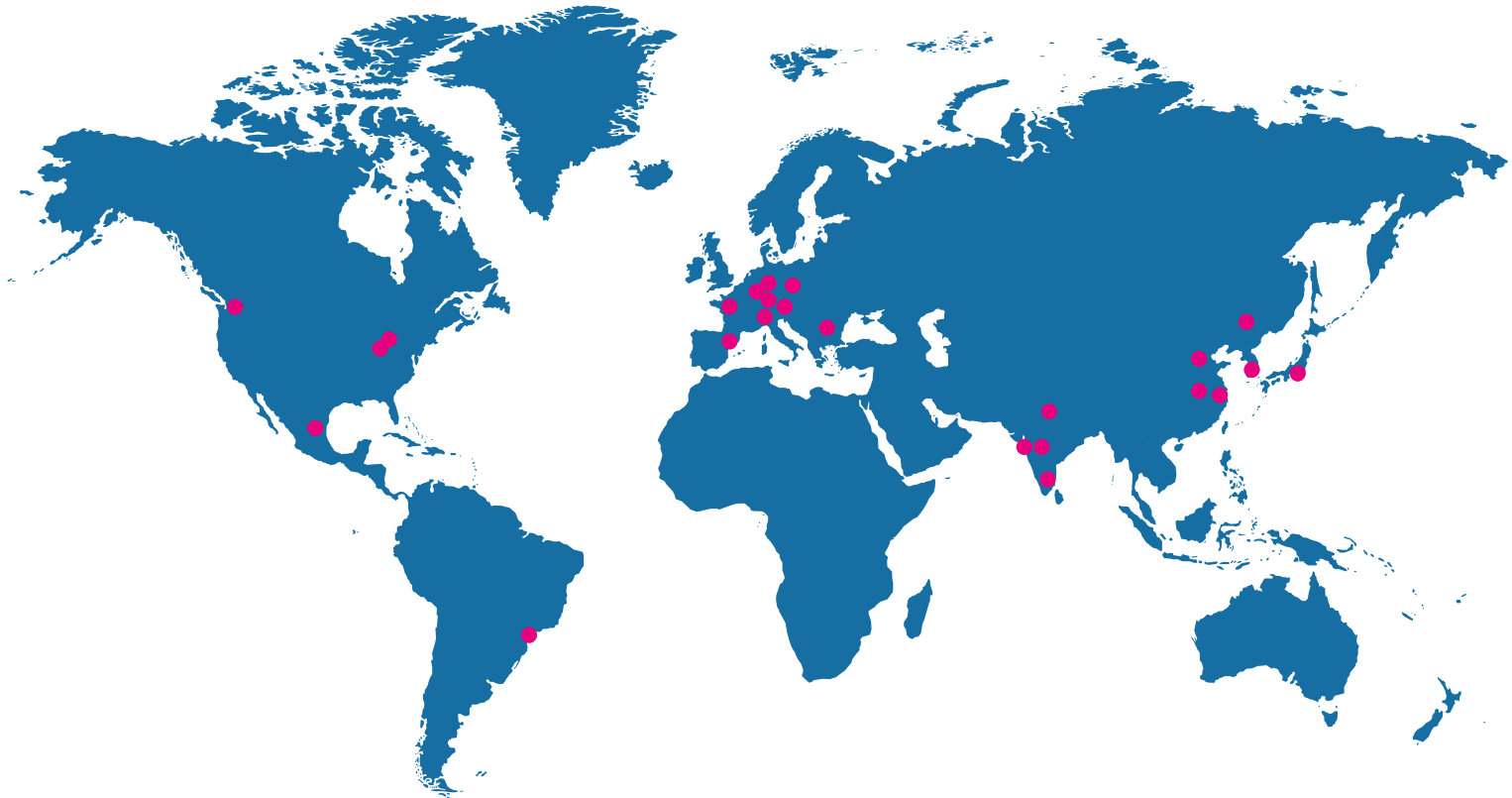
Future-oriented valve solutions for thermal management applications

- 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)



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