

VOSS

Liquid Cooling Solutions for Energy Storage Systems.

Stay Cool, Store Efficiently.



bess.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



| Competence for Battery Energy Storage Systems

Our system competence. Your added value.

Our expertise is in the development and production of customer-specific system solutions for the thermal management of mobile and stationary applications. Optimum temperature control is essential for maximum battery performance in electric vehicles or battery energy storage systems. To this end, VOSS designs connection and manifold solutions tailored to individual customer requirements.

This includes the creation of precisely fitting line routings for the smallest and most complex installation spaces as well as the integration of supplementary system components such as quick connect systems, valves, sensors or customer-specific components. User-friendly innovations such as double flow stop valves for leak-proof battery module removal impress with minimal installation effort. Customers and users benefit from the system expertise of the entire VOSS Group. This includes not only our innovative product solutions but also our comprehensive services:

- In-house tool construction
- 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

Applications



Mobility

- ✓ Onshore/offshore power supply
- ✓ Mobile power supply (eg. construction sites)
- ✓ Charging infrastructure for electric vehicles



Trade & industry

- ✓ UPS (Uninterruptible Power Supply)
- ✓ Replacement of diesel generators
- ✓ Peak load disconnection
- ✓ Load balancing
- ✓ Charging station control
- ✓ Self-consumption optimization

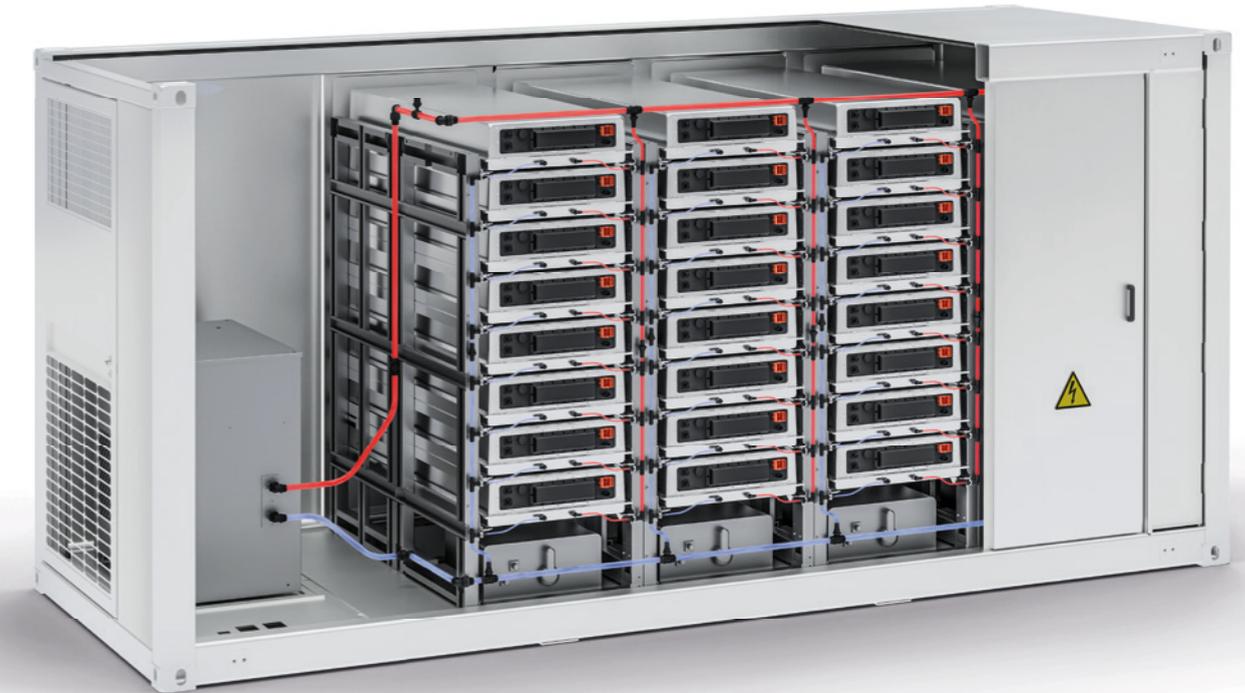


Energy supply

- ✓ Frequency control
- ✓ Load balancing
- ✓ Peak shaving
- ✓ Capacity adjustment
- ✓ Power quality
- ✓ Safety reserve
- ✓ Self-contained start
- ✓ Energy trading

The complete system

Our innovative liquid cooling solutions offer numerous advantages, including efficient heat dissipation for longer battery life, even temperature distribution for optimal performance and reliability, and a compact design for spacesaving installations. They also enable higher C-rates and more frequent charging cycles. Benefit from higher operational efficiency and improved service life for your battery system.



System Experience and Innovations

Our customized system solutions start with:

- System analysis and benchmarking
- Innovative product and system development
- Continuous accompanying simulations and FE analysis
- Rapid prototype and pre-series construction
- Validations and tests during development

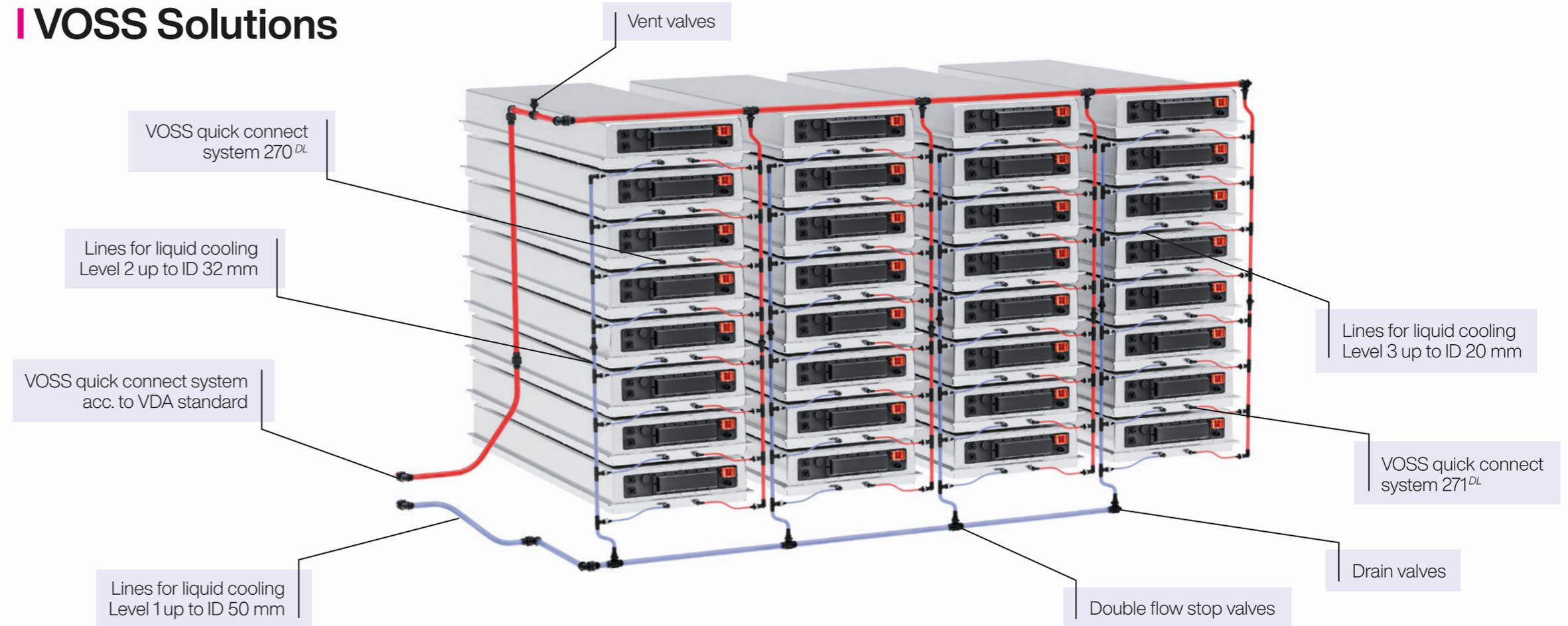
We succeed through:

- Development, design and production of customer-specific solutions for liquid cooling systems
- Maximum system and component expertise
- Tightness of the systems over the entire service life
- Components that are easy and safe to (dis)assemble
- Reliable and cost-effective solutions

Our product innovations are the perfect combination of:

- Maintenance-free and space-optimized connection technology
- Precisely preformed line systems and their routing
- Innovative double flow stop valves for leak-proof battery module removal
- Easy-to-integrate sensors, manifolds and valves as well as customer-specific components and assemblies

VOSS Solutions



Components for Battery Energy Storage Systems



VOSS quick connect system 270^{DL}

Robust plastic couplings for fir-tree connection of plastic tubes

- Particularly suitable for connections to filigree cooling plates and similar components
- Quick and secure assembly
- Double Lock (DL) for additional safety through active confirmation of the correctly inserted QC system
- Very low system height
- Opening mechanism available 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 connectors for fir-tree connection of plastic tubes

- Particularly suitable for components with recessed ports or with material for profiles bores
- Quick and secure assembly
- Double Lock (DL) for additional safety through active confirmation of the correctly inserted QC system
- Very low system height
- Opening mechanism available 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



Double flow stop valves

Double-sided flow stop valves for disconnecting cooling circuits – for maintenance purposes and changing battery modules

- Can be integrated into various QC systems of different sizes
- Automatic opening of the valve during assembly
- Automatic closing of the valve during disassembly
- Leakage-free over the entire service life
- Compact and robust design
- Consistent flow with very low pressure loss



Vent and drain valves

Valves for manual and automatic venting and draining of cooling circuits

Automatic vent valve

- Permanent automatic venting valve with quick connect system contour for integration into the line routing
- Integrated at the highest point of the circuit
- Compact design

Manual vent and drain valve

- Single-sided flow stop valve for manual operation
- Closed leakage-free when not actuated
- Inserting the appropriate line activates the automatic valve opening
- Compact design
- Can be used as a manual vent valve when integrated at the highest point of the circuit
- When integrated at the lowest point of the circuit, can be used as a manual drain valve

Customized solutions for Battery Energy Storage Systems

Integrable components

- Large selection of standard products
- Individually developed system components and special products according to requirements and customer wishes
- Based on our many years of experience, visionary creativity and state-of-the-art production technologies, we design custom-made products according to specific requirements
- We are also available as a development partner and manufacture individual customer solutions in the usual high VOSS quality
- The best examples are specific T-pieces with different internal diameters for an even distribution of the cooling liquid
- Also possible in combination with double flow stop valves



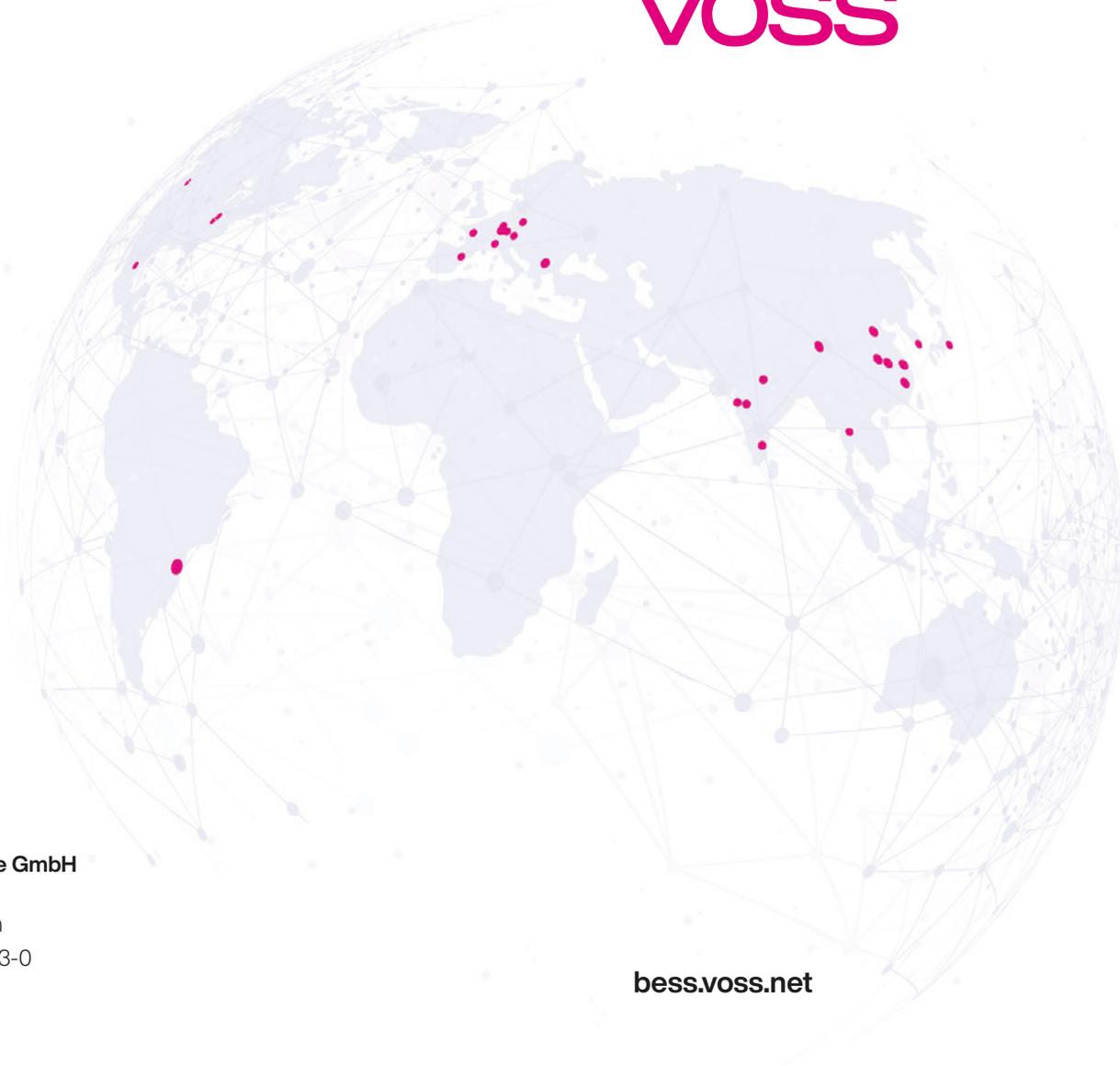
VOSS



Tailor-made lines

- Large selection of plain tubes for cost-efficient and durable line routing
- Large selection of corrugated tubes for maximum flexibility and tolerance compensation
- Individual line routing design can be realized
- Inner diameters from 6 to 50 mm available for fluidic supply for mobile to stationary storage systems
- Sustainable due to the use of bio-based materials

VOSS



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