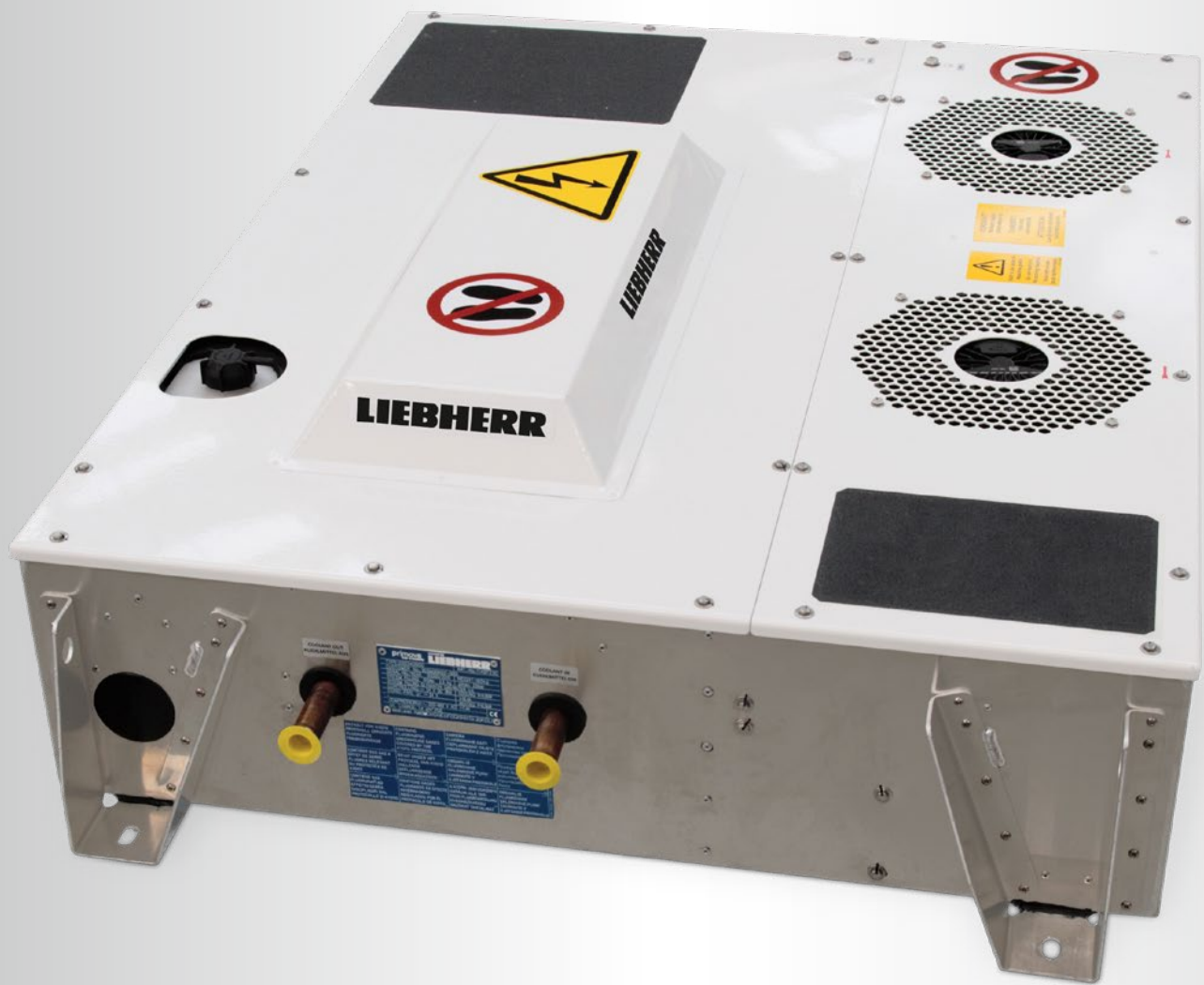


Cooling Technologies for E-mobility

Thermal Conditioning Units



LIEBHERR

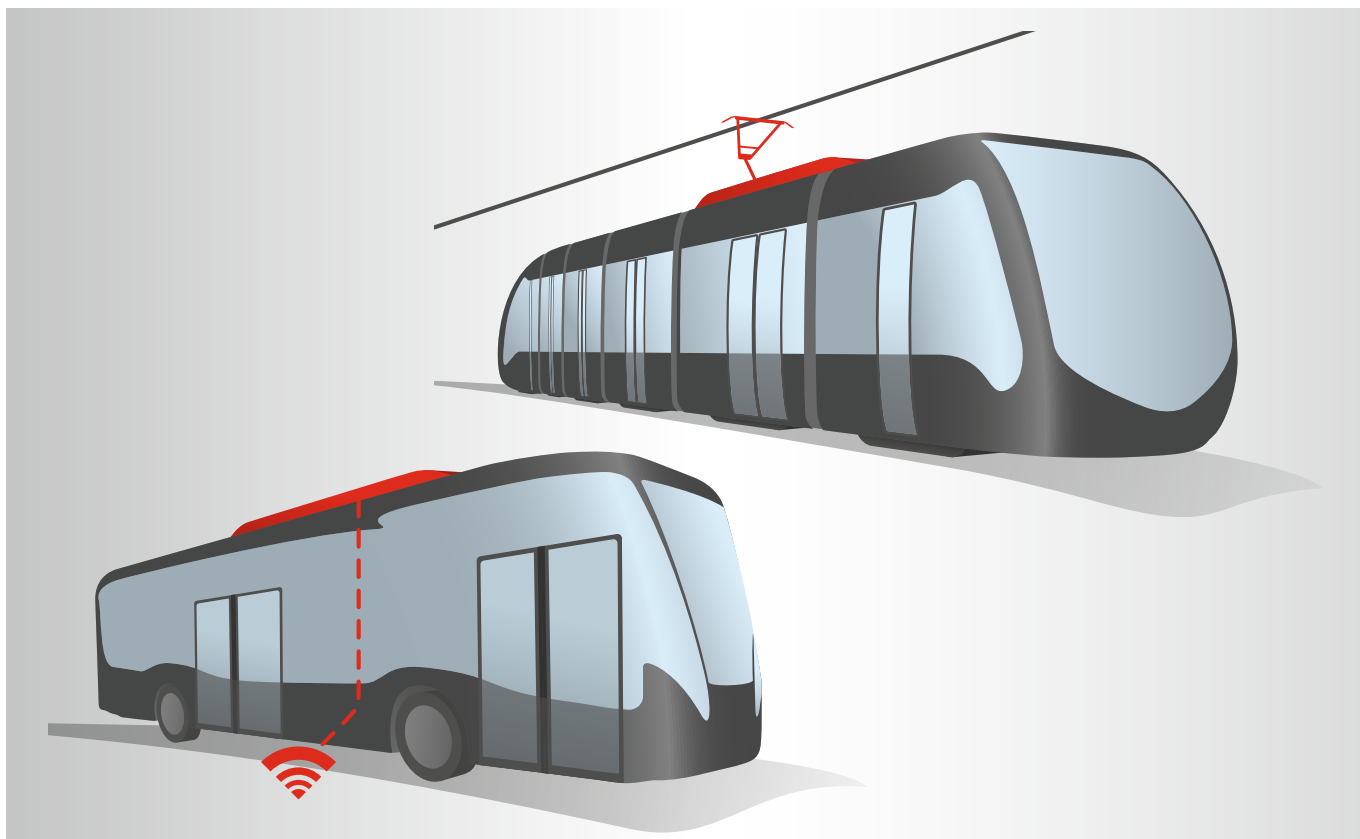
Competitive E-mobility Solutions for Rail and Road Applications

Optimized energy storage systems

Liebherr-Transportation Systems has developed standardized Thermal Conditioning Units (TCU) which respond to the challenging market requirements of the railway and bus automotive industry. TCUs allow e.g. very fast charging processes of batteries, while ensuring the required life time expectations. Due to reliable thermal conditioning the life time of Lithium Ion batteries can be significantly expanded.

Proven in use

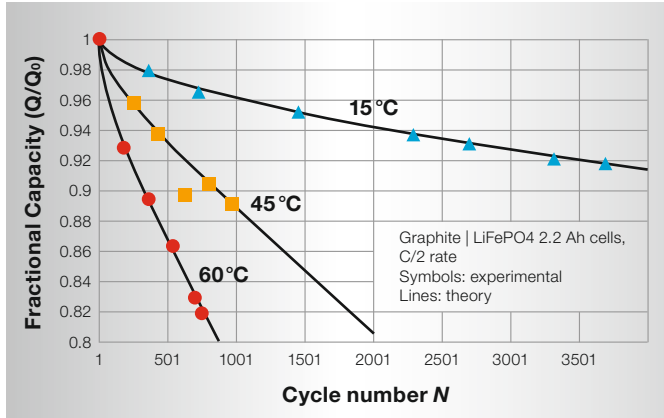
Since 2014, TCUs made by Liebherr are successful in service in Europe and Asia. The highly standardized designs are based on more than 60 years of experience in engineering and production of heating, ventilation and air-conditioning for mobile applications.



Technical Features	TCU BMU Rail	TCU Light Rail	TCU Road
Coolant Volumes / Capacity	3,000 l/h / 8 kW	1,600 l/h / 8 kW	3,000 l/h / 8 kW
Dimensions (W x L x H)	1,110 x 1,435 x 375 mm	430 x 1,700 x 600 mm	1,110 x 1,435 x 375 mm
Usage Temperature Range	-30 °C to +55 °C		
Coolant	1:1 Glysantin / Water		
Controller with integrated logger functionality and self-test run and state of the art Can Bus connectivity			

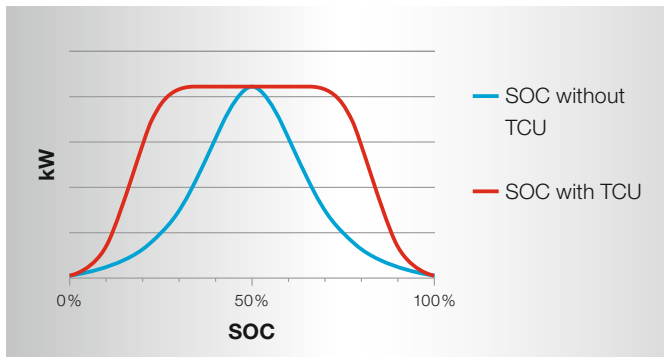
Efficient performance

Active and accurate battery cooling and heating via a water coolant can extend the life time of Lithium Ion batteries significantly.



- ▲ actively water coolant cooled condition
- air cooled condition
- uncooled condition

An accurate temperature enables more performance for the vehicle at a minor or major charging status of the energy storage device (known as Status of Charging SOC).



Optimized battery system

Accurate thermal management of batteries reduces also battery sizing and weight. This leads to an efficient energy storage and generates a positive and reliable business case for the end user.

Easy to integrate

Comparable low weight and a dimension optimized packaging of the 2-circle thermal conditioning system in combination with a state of the art CAN-bus connectivity allows an easy integration in the E-mobility vehicle.

One fits all

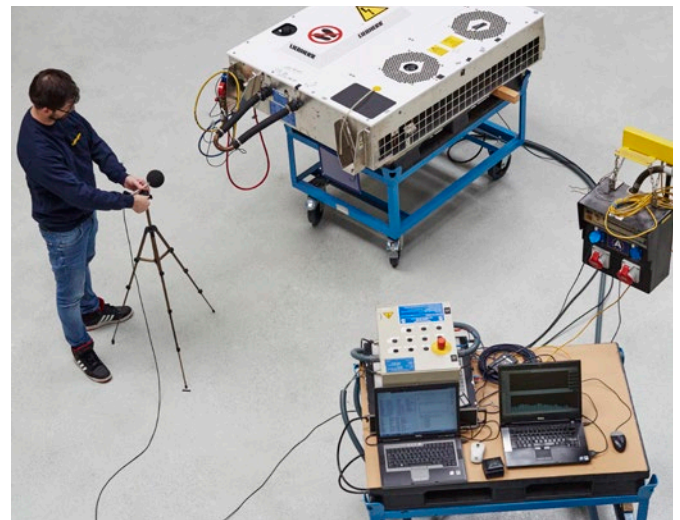
Due to an applicable broad outside temperature range the given designs can be used as a standard solution for various climatic zones worldwide.

Maintenance friendly design

A service oriented engineering approach based on standardized components enables easy maintenance by customers or by the Liebherr service organization throughout the whole life cycle of the product.

Innovative solutions for E-mobility

As a global family-run technology company, the Liebherr Group is one of the world's largest manufacturers of construction machines and recognized for technical advanced and user-oriented products and services as well. Amongst many other technology areas, Liebherr is working on electric mobility solutions. The company has developed innovations in such fields as the electrification of heavy-duty vehicles, electrification of railway transport, electrification of aircraft and electrification of personal vehicles. Liebherr's field of expertise covers such leading edge disciplines as high-voltage / high-power electronics, high-power electrical motors and electrical generators, thermal management for high-power power electronics, cooling systems for electrical batteries, cooling systems for high-speed battery loading devices, and turbo-chargers for fuel cell systems.



The Liebherr Group of Companies



Wide Product Range

The Liebherr Group is one of the largest construction equipment manufacturers in the world. Liebherr's high-value products and services enjoy a high reputation in many other fields. The wide range includes domestic appliances, aerospace and transportation systems, machine tools and maritime cranes.

Exceptional Customer Benefit

Every product line provides a complete range of models in many different versions. With both their technical excellence and acknowledged quality, Liebherr products offer a maximum of customer benefits in practical applications.

State-of-the-art Technology

To provide consistent, top quality products, Liebherr attaches great importance to each product area, its components and core technologies. Important modules and components are developed and manufactured in-house, for instance the entire drive and control technology for construction equipment.

Worldwide and Independent

Hans Liebherr founded the Liebherr family company in 1949. Since then, the family business has steadily grown to a group of more than 130 companies with more than 46,000 employees located on all continents. The corporate headquarters of the Group is Liebherr-International AG in Bulle, Switzerland. The Liebherr family is the sole owner of the company.

www.liebherr.com