

Hydraulic Actuation Systems **for Transportation Applications**



LIEBHERR

Electro-Hydraulic Actuators

Electro-hydraulic actuators (EHA) work as compact, high-performance “power houses” in rail vehicles and are developed and produced by Liebherr to meet specific customer requirements.

Applications

Applications include active lateral suspension and active lateral centering systems, car positioning systems, active radial control, active wheelset control and tilt technology.

Among other attributes, EHA make a valuable contribution to reduce the burden on the environment and to reduce wear – while increasing performance. At train speeds of up to 350 km/h EHA are used to move heavy loads of several tons into the position specified by intelligent control units, or counteract vibrations occurring on the vehicle. The train can run faster and the passenger comfort is increased.

Wear Reduction

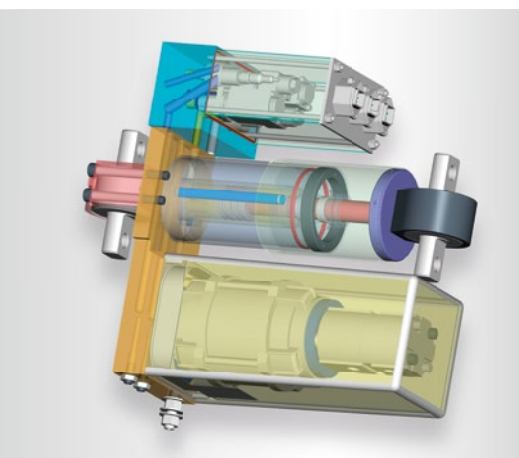
A further key advantage of EHA is that they reduce car and infrastructure wear considerably. The initial high investment costs are recouped very quickly through lower maintenance expenses, reduced total energy costs and higher carrying capacity compared with conventional hydraulic systems. EHA are self-contained hydraulic systems. Liebherr performs their as-

sembly, filling and final testing under extremely clean conditions and thus ensures that they will achieve many years of service in the tough environment of rail transport. The car manufacturer simply fits the EHA to the vehicles and installs the cable connection for the energy supply and control systems. The time-consuming installation work required on conventional hydraulic systems to route the line, fill and vent the circuit is thus eliminated. This also removes the risk of contaminating the hydraulic fluid through incorrect installation work and, as a result, damaging the actuator.

Maintenance-Free

EHA from Liebherr are generally maintenance-free. If a fault should occur, however, the entire unit can be quickly replaced without any hydraulic expertise, thus avoiding prolonged vehicle downtime.

Electro-hydraulic actuator concept



Testing of electro-hydraulic-actuators



Buckling protection system



Special Dampers

Steering Damper

The steering damper replaces a rigid steering mechanism, which serves as the cross-connection between the cars at the steering joint.

It both improves the vehicle's running behaviour and reduces the forces in its structure.

Moreover, the device features final position damping, which reduces high forces and noise in the stroke limit area.

Intercar Damper

On straight tracks, the intercar damper eliminates relative movement by interlocking tram bodies. In curves and during travel at low speeds, this interlocking mechanism is deactivated.

To simplify maintenance and diagnosis, the damper is also fitted with a monitoring system.

Such monitoring systems can be integrated into all Liebherr dampers.

Passive Running Gear Control

Buckling Protection System

The buckling protection system is mostly used on four-unit or longer low-floor trams. Its hydraulic control guarantees compliance with clearance values under all operating conditions. However, if the buckling control system fails with the result that compliance is no longer ensured, it connects with a safety-critical system, which is additionally monitored by Liebherr electronics.

In addition, the system significantly increases passenger comfort and reduces wheel and tyre wear.

Hydraulic Bogie Coupling System

This system reduces the lateral forces between rail and wheels by coupling the swivel angles of the two bogies.

Due to its damping valves, the hydraulic bogie coupling system also performs the damping function - there is no need for additional yaw dampers.

In addition, system offers a very simple method of monitoring the damping function.

Leveling Control System

The leveling control system adjusts the entrance height of the car to each station or platform.

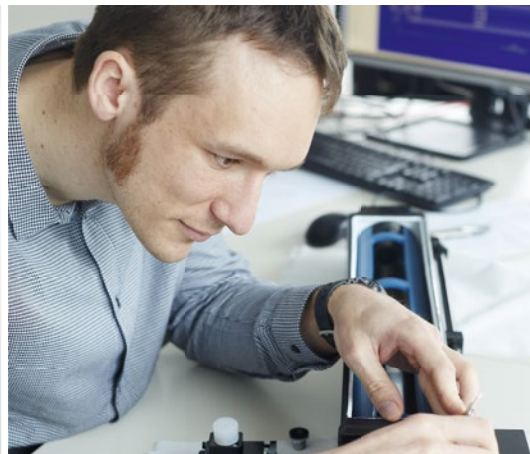
It also facilitates the coordination of the vehicle's and reduces the strain on wheels and rails.

Thanks to a backup system, the vehicle can be kept at the right level even if the main system fails.

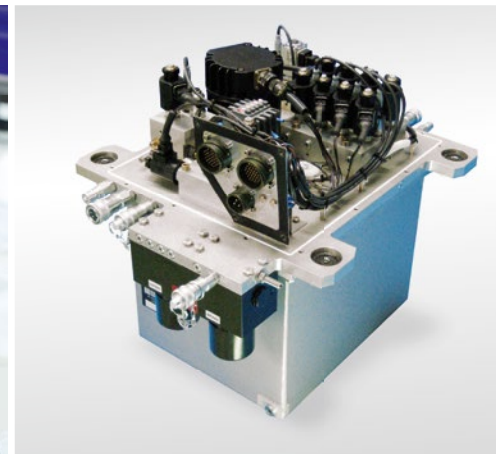
Leveling control system



Engineering



Hydraulic power unit



Hydraulic Systems Solutions for Transportation Applications

Liebherr's range of hydraulic systems for rail vehicles and busses includes simple passive dampers as well as electro-hydraulic actuators and complete leveling systems.

Drawing on a wealth of technical expertise comprising transportation systems, aviation and construction machinery, Liebherr is able to satisfy individual customer requirements through innovative products.

Steering damper ▷

Intercar damper ▷

Articulated bus damper ▷

Buckling angle control system ▷

Buckling protection system ▷

Hydraulic roll coupling system ▷

Hydraulic bogie coupling system ▷

Active yaw damper ▷

Active lateral suspension and carbody centering ▷

Hydraulic roll compensation ▷

Hydraulic leveling system ▷

Customer Solutions

Liebherr-Transportation Systems provides solutions to customers such as Alstom, Bombardier, Changchung Railway Vehicles, Deutsche Bahn, Hübner, RNV, SBB CFF FFS, Siemens, Škoda, Stadler, Talgo, Üstra and Voith.

- Siemens Combino platform
- Bombardier Flexity Classic in Dresden
- Streetcar MGT 6 De Lin

- Changchun Tram
- Bombardier Flexity Classic in Dresden
- Variobahn Rhein-Neckar

Several Hübner bus articulation dampers

Alstom Lirex of City Railway Kopenhagen

Siemens Budapest and Lisbon

Special solutions for Siemens Combino in Bern and Basel

- Škoda locomotive
- Voith locomotive

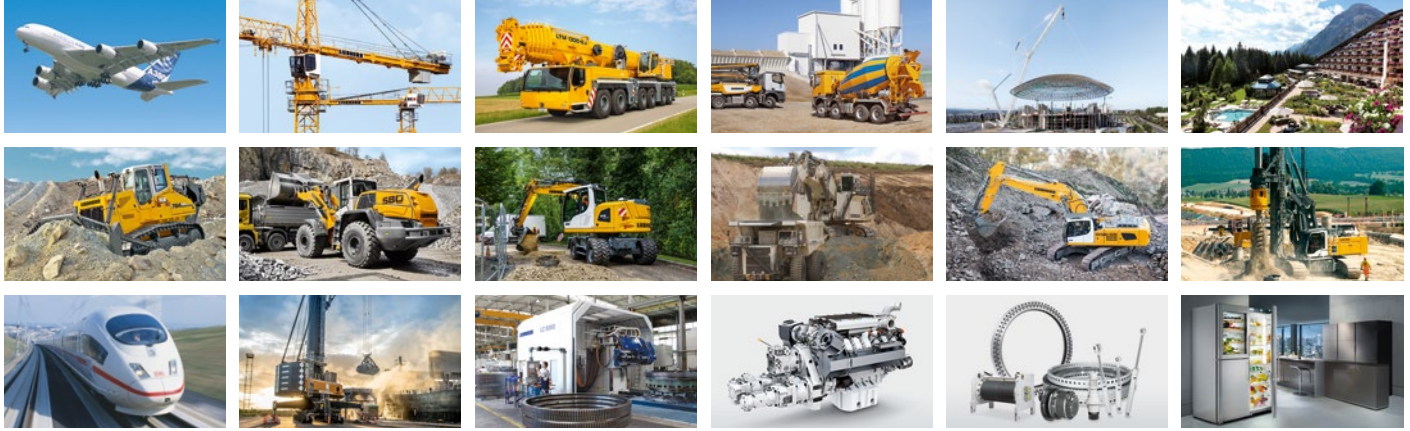
- Siemens BR189 and RH116 locomotives
- Alstom Prima locomotive

Bombardier Regina 250 and V300 Zefiro

Bombardier Twindexx for SBB

Bombardier for Chicago Transit Authority and Metrolinx

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 that time, the enterprise has steadily grown to a group of more than 130 companies with over 41,000 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