

Hydraulic Levelling

Barrier-free Access for Passengers



HANNING & KAHL

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To avoid differences in car body height and hazardous gaps between tram and platform when passengers are boarding and alighting, HANNING & KAHL has added a system for levelling tram cars to its product portfolio. The first series vehicles have now been equipped with the system and are in successful passenger operation.

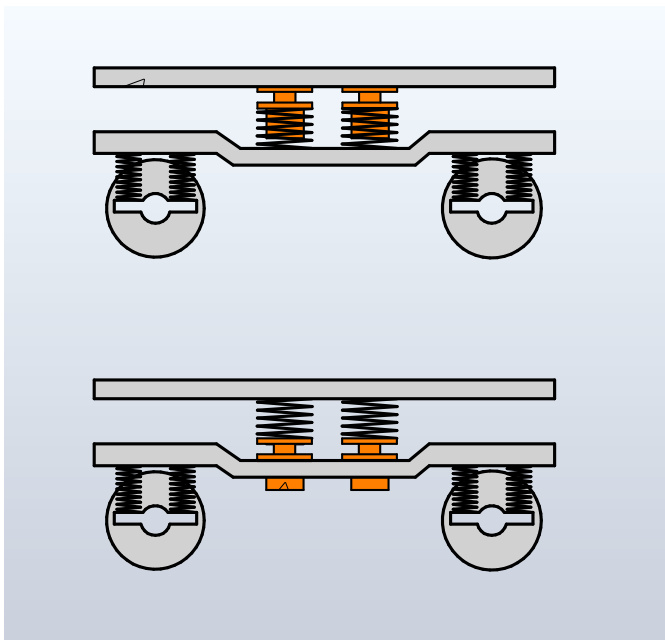
The levelling system ensures that car bodies are kept at a defined level in all operating states and circumstances. Several functions are integrated such as automatic adjustment of wheel wear, compensation of the primary springs in the bogie, as well as levelling of changes in height (caused by passenger change). Position and pressure sensors are used to control and monitor levelling so that wayside and vehicle-dictated clearance limits are kept, thus guaranteeing operational safety at all times.

Below you find an overview of all operating modes:

- Regulation of car body height corresponding to load status (only when vehicle is standing still)
- Freezing of height level for the run between stop stations
- Compensation of wheel wear and relaxation of primary suspension

In general, the overall system consists of the following five main components:

- 1. Hydraulic unit (HZY)** for generation of hydraulic pressure in the system. The device can operate the mechanical brake at the same time.
- 2. Valve control unit (HVU)** which contains the valves for control of the lift cylinder and also pressure sensors for internal monitoring.
- 3. Lift cylinder (HYHZ)** for raising and lowering the car body modules. Position sensors integrated in the lift cylinder control and monitor position.
- 4. Electronic Control Unit (LCU)** for control of the valves and for continuous monitoring of differences in height between the individual car bodies. There is a hardware interface and two independent bus systems for extensive data exchange.
- 5. Position sensors (DS)** for control and monitoring of the relative position between car body and bogie.



Different possibilities of installing the lift cylinder in the bogie



The main components of the hydraulic levelling system

System properties:

Number of lift cylinders per bogie	4
Vertical static force per lift cylinder	ca. 50 kN
Max. cylinder stroke	85 mm
Cylinder stroke tolerance	±1 mm
Permissible system pressure	160 bar