HeiterBlick

For Quality of Ride

LeoLiner

The LeoLiner: practical, comfortable, modern

The LeoLiner is a tramcar that combines cutting-edge technology with high-quality craftsmanship. It draws on the maintenance and operating knowledge we built up as a former service provider for one of Germany's biggest tramcar operators. When designing our vehicle, we selected those components that have proven their value in rail operations and are inexpensive to maintain.

The LeoLiner is designed as a one-way vehicle. Each end of the car is equipped with full-featured mechanical and electrical couplings that allow multiple unit operation. Two powered bogies and one trailer bogie ensure maximum ride quality.

Thanks to its high technical standard and low operating and maintenance costs, the LeoLiner is a practical, modern alternative to overengineered tramcar designs. Not only is it compatible with existing route networks, but it is also robust (welded light-gauge steel construction, cantilevered articulation joint, bogie systems). That makes it an attractive option for infrastructures with high rates of wear.

The benefits of the bogie

Bogie features	Benefits for operators	Benefits for passengers
Bogie can be swung out from the body	■ Body is not subjected to any undefined forces	■ Increased comfort
Handles curves well / lower steering forces due to bogie linkage; e.g., a bogie pivot and bolster arrangement or a slewing bearing	■ Less wear on wheel set flanges and infrastructure	■ Smooth, jolt-free transport
Triple suspension and damping system: 1. Rubber-sprung wheels 2. Primary suspension between axles and bogie frames 3. Secondary suspension between bogie frame and bolster/body	■ Reduced noise emissions ■ Less vibration transferred to car body	■ "Soft ride": bounces cannot be felt in the car body
Smooth hunting behaviour	■ Lower wear on vehicles and infrastructure ■ Low maintenance needed	■ Car body does not sway unpleasantly

Car body

The 2-section car body is a lightweight, welded steel construction. The two sections are connected by an articulation joint in the form of a slewing bearing. The underframe, superstructure as well as the side wall and roof panelling are made from weatherproof, corrosion-resistant steel. The roof drainage system is made from stainless steel. To accommodate Leipzig's infrastructure, we narrowed the lower section of the LeoLiner car body to 2.20 m so the tram can travel through tram stops without contacting the curbs.

The floor heights are 900 mm in the high-floor section and 350 mm in the low-floor section. Steps are used to bridge the differences in heights. The non-powered bogies are equipped with user-friendly wheel guards. They provide passengers with a barrier-free central gangway.

Incorporated into the floor is a turntable that remains at the same height as the rest of the car floor. The doorless bellows does not need any interior covering. It provides a good, wide line of sight along the length of the car.

Towards the door in the low-floor section, the floor slopes down from the central gangway to the entrance sills, where it reaches approx. 290 mm above TOR.

To minimize noise pollution, the car body is outfitted with aluminium gear doors outside the bogies that have been sprayed on the inside with sound-absorbing insulation. You can also install additional sound-absorbing mats at any time.

The gear doors can be removed and flipped out at any time to provide quick access to the bogies and their external assemblies.

The headlights and wiper motors are covered with fibreglass-reinforced moulded plastic parts.

The roof container is hidden behind panels encircling the entire vehicle roof. The front sides of the roof panelling are made from fibreglass-reinforced moulded plastic: That just looks better.

Electrical equipment

The electrical equipment is installed on the walkable roof, behind the continuous roof panels. Both redundant traction inverters are mounted in a container at the rear end of the car (Section B) for better traction adhesion.

Mounted on the driver's cab rear wall is an equipment cabinet that reaches up to the window sill. It contains the control electronics.

Electrical equipment can also be installed in designated areas in the driver's cab and rear cabinets. The instrument boards are located behind the closable roof covings in the passenger compartment.

The battery is situated in the rear underfloor of the car; it can be pulled out on telescoping rails.

Windows and doors

All the windows are made from single-pane safety glass, tinted and bonded to the car structure. Except for the corner side windows, all the side windows are equipped with pivot-hung windows to ensure adequate ventilation.

Unlike the prototypes, which featured outside swing doors, the LeoLiner production trams use electrically powered external swing-plug doors. The tinted glass panes in the doors (also single-pane safety glass) are bonded to the door leaves. The actual door leaves are made from aluminium.

All doors are protected with a motor current monitoring system, a light barrier, a contact strip in the safety edge rubber profile, a door leaf end position monitoring device and an anti-trap rubber profile. They can be individually monitored by the driver if desired. The visual and audio warning system is built into the door covering.

Doors can be unlocked manually with the emergency release lever and opened while the tram is stopped. The levers are mounted inside every door, in the door post panelling.

Interior equipment

The floor consists of 23 mm Polyvan® 31 birch core plywood panels that are affixed directly to the chassis trusses. The baseboards, made from Finnish birch plywood, are furnished on the inside with an insulating cork layer. The advantage of attaching the floorboards directly to the chassis trusses is that it avoids the transmission of structural noise.

The side wall panelling consists of flat and moulded plastic parts.

The ceiling is a lightweight construction that is attached to the roof frame using extruded aluminium profiles. Strip lighting is integrated in the roof covings along both sides of the tramcar.

The side wall and ceiling panels are thermally separated from the bodyshell to minimize heat transfer and ensure that everything is truly well insulated.

Located in front of the driving shafts under the seats are sand distributors that are operated by a small compressor. They can be filled from inside or outside the tramcar.

The collection areas next to the low-floor entrances are spacious enough so prams and wheelchairs can be easily brought on board.

Interior lighting is installed in the coving flaps on both sides along the entire length of the tramcar. It fills the passenger compartment with pleasant, indirect lighting.

Driver's cab

We fully reworked and redeveloped the driver's work station for the production vehicles to reflect the latest findings in ergonomics and occupational medicine.

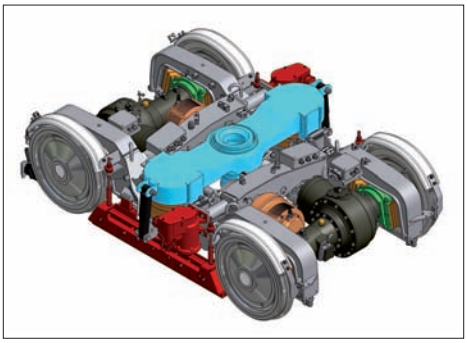
For example, the driver's seat can be tilted and adjusted both vertically and horizontally.

The driver's cab is separated from the passenger compartment by a tinted glass wall with a revolving door (also made from tinted glass).

Insulated air ducts connect to a compact air-conditioning unit for effective air-conditioning and defogging. The air-conditioning unit is installed on the roof above the driver's cab.

A look at the passenger compartment.

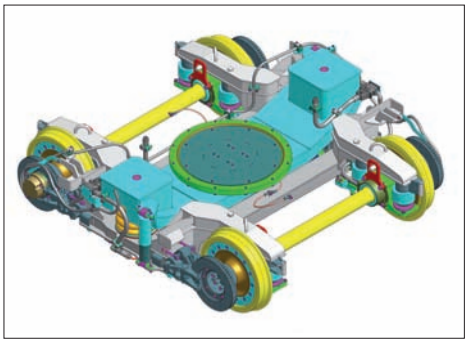
Powered bogies



Powered bogie

The powered bogies are rather conventionally equipped: with two-speed, low-noise axle gear drives and self-ventilated three-phase traction motors longitudinally placed in the car. Power is transferred using driveshaft transmissions. The bogies come standard with rubber-sprung wheel sets. The primary suspension is an MEGI primary spring that provides axle guidance and suspension without additional damping elements. The bogie bolsters rest on the secondary suspension elements, which consist of coil spring combinations and metal/rubber elements. Central pivots link the bogies.

Trailer bogies



Trailer bogies

The newly developed trailer bogie has a wheelbase of 1,600 mm. To maintain a floor height of 475 mm above the bogie, the car uses rubber-sprung wheel sets measuring 550 mm in diameter. The bogie linkage consists of the steel-sprung bolster and a centre plate for the continuous low-floor section. Two links provide the bolster's traction link to the bogie frame. Elastic rubber bumpers and mechanical stops limit lateral bogie travel. Four elastomer springs guide and suspend the axles in the bogie frame.

Powered bogie	
Wheel set wheelbase	1,900 mm
Gauge	1,458 mm/1,435 mm/1,000 mm
Wheel diameter new/worn	700 mm/635 mm
Weight	approx. 4 t
Maximum wheel set load	< 100 kN
Drive power	2x 65 kW
Braking force of rail brake	70 kN
Gear ratio (2-speed)	1:8.7039

Trailer bogie	
Wheel set wheelbase	1,600 mm
Gauge	1,458 mm/1,435 mm/1,000 mm
Wheel diameter new/worn	550 mm/500 mm
Weight	approx. 2.4 t
Braking force of rail brake	55 kN
Maximum wheel set load	approx. 57 kN

Brake system

The LeoLiner feature three independent brake systems:

The traction motor can act as a regenerative brake. It converts kinetic energy into electrical energy, and either feeds it back into the catenary system or uses it to supply the loads in the car. If this is not possible, the electricity is converted to heat in the brake resistor. This electrodynamic brake affects all the axles in the motorized bogies, causes no wear, and is controlled depending on the antiskid systems and vehicle weight.

The spring-loaded brake consists of a spring accumulator with a solenoid, brake disc, pads and rigging. It is used as an additional brake at low speeds, and as a parking brake while the vehicle is stopped. Every powered axle is equipped with one spring-loaded brake. The emergency release can be activated either centrally and electrically in the driver's cab, or mechanically by operating the manual release lever on every spring accumulator.

The emergency brake is supported on all motorized and non-motorized bogies by the rail brake. It works by generating a magnetic field, which causes a brake shoe suspended on springs between the car wheels to be applied firmly against the rail.

The LeoLiner is not equipped with service brakes on its trailer bogies in Leipzig. Service brakes are not needed because Leipzig only has routes with minimal uphill and downhill inclines. However, the trailer bogies are designed to allow the retrofitting of an electrohydraulic braking system at any time.

Draw and buffing gear

Unlike the LeoLiner prototypes, the production tramcars are equipped with mechanically retractable Scharfenberg couplers on the front and rear. The electronic parts are located underneath the coupler front face so the trainset can be hauled by two tramcars. Plus, you can easily replace the leading and following tramcars in this series. The coupler system is designed so two units can be quickly connected or separated at a depot stop.

When not coupled, the retracted, locked coupler is completely hidden by a vertical-swivelling coupler covering that blends in harmoniously with the tram's design.

Traction equipment

The LeoLiner's AC traction equipment is from Vossloh Kiepe. Most of the equipment components – such as the two IGBT direct pulse inverters, both converter control units, the power contactor and the static converter – are installed in the compact roof container at the rear of the tram. The container is specifically built and dimensioned to suit the LeoLiner's requirements.

The traction systems are designed to offer a low weight and high inverter output with IGBT direct pulse inverters. Each tramcar comes with two, independent, fully redundant AC traction systems (two IGBT direct pulse inverters). Every IGBT direct pulse inverter feeds two traction motors. That means that the trainset can still be operated with one traction system in case of a system failure. Thanks to the modular design, individual components can be replaced without any restrictions whatsoever.

Work on the car body.

Information system

The LeoLiner comes standard with an IBIS 2 system. The control board is installed on the driver's console. In addition to the computer with battery-buffered data memory and clock, it houses the power supply unit, a memory chip for the route data, and an interface for trouble-shooting and uploading data to the IBIS 2 system. The IBIS 2 computer can use the car bus to transmit date, time, zone and service number to the validators/ticket machines.

If requested, we will equip the LeoLiner with the IRIS infrared system, which sends the appropriate information from the vehicle to the track and vice versa.

We can also install voice terminals for passengers inside the vehicle so that they can get in touch with the driver if necessary.

The front, rear and side displays are based on high-resolution LCD technology. The information is provided via the IBIS 2 car bus. Letters and numbers are shown as dots with a radius of 6 or 8 mm. If requested, we can equip the vehicles with different displays for stops – ranging from a basic version all the way to a complex, digital passenger information system with multi-media expandability.

The equipment also includes a digital announcement unit that announces the stops. All stop names can be stored digitally and sent from this unit through the interior loudspeakers of the public announcement system.

Other electrical equipment

The front's exterior lighting uses customary headlight combinations; the rear features combined tail and brake lights, reversing lights and integrated LED-based turn signal lights.

The passenger compartment is heated by eight 3 kW heaters that are distributed under the seats. They are controlled electronically by air intake and discharge sensors.

We can also equip the vehicles with a rail-ready video monitoring system. A total of six dome cameras (mounted on the ceiling) ensure that the passenger compartment is monitored optimally, creating a higher subjective level of security for the passengers. The drivers also feel safer when the vehicle stands still: They can easily observe passenger flows in the areas reserved for wheelchair users/prams.

The LeoLiner: with built-in flexibility

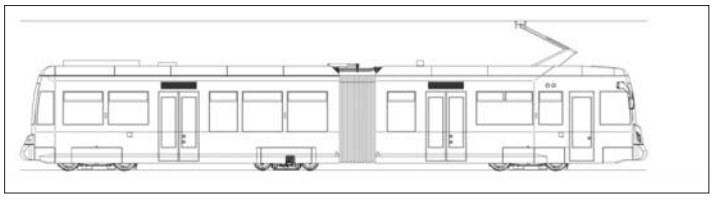
In addition to the LeoLiner cars for Leipzig, we also produced five tramcars for the City of Halberstadt in 2006. We easily satisfied the customer's special requirements: The Halberstadt trams are around 1,600 mm shorter than the Leipzig vehicles; there are fewer doors (no door 4); the bogie is designed for a meter gauge; and the vehicle features are different. Plus, unlike the Leipzig LeoLiner, the Halberstadt cars can draw their traction current from low-voltage sources. That is essential for the vehicles to move on their own power in repair shop areas, which are not equipped with contact wires.

Of course, the LeoLiner can also be produced in other configurations than the Halberstadt Model". We can handle many extras, from adding a third carriage to an entirely new tramcar design. For example, we can use different powered bogies in order to easily lower the floor height in the high-floor section of the passenger compartment. That means that a single step is the only thing separating the low-floor from the high-floor section. This vehicle design is also modular, and allows the full range of car body widths and lengths.

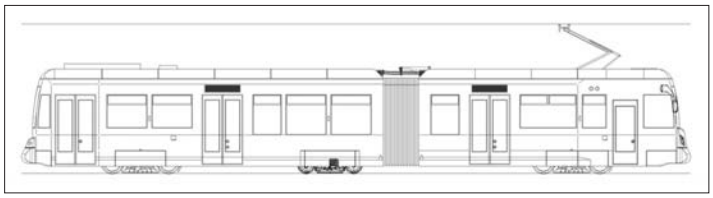
The LeoLiner in Leipzig.

Technical data

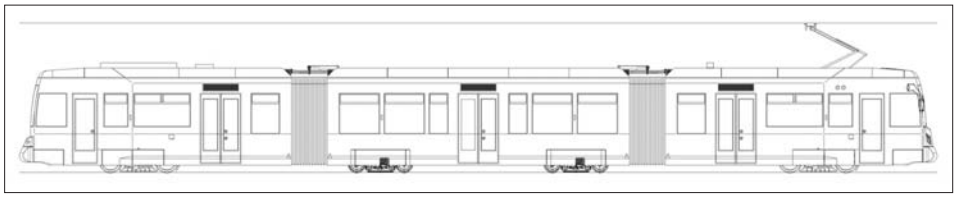
	NGTW6-H	NGTW6-L	NGTW8
Car length over bumpers	21,000 mm	22,590 mm	approx. 32,000 mm
Car length over couplers (extended)	22,000 mm	23,102 mm	approx. 33,000 mm
Car width over bumpers	2,300 mm	2,300 mm	2,300 mm
Car height	3,690 mm	3,690 mm	3,690 mm
Gauge	1,000 mm	1,435/1,458 mm	1,000/1,435/1,458 mm
Vehicle weight empty	26,850 kg	27,300 kg	approx. 41,000 kg
Vehicle weight max. (5,000 N/m²)	38,000 kg	40,000 kg	approx. 60,200 kg
Powered bogie wheel diameter (new)	700 mm	700 mm	700 mm
Trailer bogie wheel diameter (new)	550 mm	550 mm	550 mm
Engine output	4 x 65 kW	4 x 65 kW	4 x 105 kW
Low-floor percentage	approx. 70 %	approx. 60 %	approx. 75 %
Height of floor above powered bogie	900 mm	900 mm	900 mm
Height of floor in low-floor section	350 - 475 mm	350 - 475 mm	350 - 475 mm
Boarding height	approx. 290 mm	approx. 290 mm	approx. 290 mm
Passenger capacity (4 people/m²)	105	118	178
Including seating capacity for:	42	39	63



Six-axle low-floor articulated tramcar NGTW6-H



Six-axle low-floor articulated tramcar NGTW6-L



Eight-axle low-floor articulated tramcar NGTW8

Service conditions

Uphill gradient max.	6 %
Transition between gradients	300 m
Minimum negotiable track radius	17 m
S-curve with intermediate straights	20 m with 3 m straights
Static pressure testing force	According to VDV 152
Smallest-possible traction unit	One car
Largest-possible traction unit	Up to 2 cars
Possible gauges	1,458/1,435/1,000 mm

HeiterBlick GmbH
Spinnereistrasse 13
D-04179 Leipzig
Germany

Phone +49 (0)3 41.35 52 11-0
Fax +49 (0)3 41.35 52 11-12
info@heiterblick.de
www.heiterblick.de

HeiterBlick GmbH is a joint venture of KIROW Leipzig KE Kranbau Eberswalde AG and Leipziger Verkehrsbetriebe (LVB) GmbH. Its goal is to develop and produce light-rail vehicles.

Copyright ©HeiterBlick GmbH 2007. All rights reserved.