



Electrical Equipment for the  
Light Rail Vehicle K5000 of the

**Cologne Transit Authority**

# Light Rail Vehicle K5000

The light rail network operated by the Cologne Transit Authority (Kölner Verkehrs-Betriebe AG, KVB) has a route network more than 285 km long, making it one of the longest light rail networks in Germany. Within the scope of a project for the expansion and renewal of the rolling stock, Kiepe is supplying the electrical equipment for 59 high-floor light rail vehicles, class K5000, that were developed in close co-operation with Bombardier.

## Project characteristics

- **Monitoring of all important functions**
- **Modular design of the traction drive and on-board power system components**
- **Extensive diagnostics system with display of important status signals for the driver**
- **Transmission of the vehicle data by radio LAN to the garage**
- **Air conditioning for the driver and passenger compartment**
- **Interior surveillance system**

In addition to this, the Bonn Transit Authority (Stadtwerke Bonn GmbH, SWB) has also ordered 15 similar light rail vehicles.

The new high-floor vehicles are in service on the north-south routes in Cologne and on the city link to Bonn since spring 2002.

The vehicle concept of the K5000 is a result of continued development of the proven low-floor light rail vehicle, the K4000. The use of many similar components already used in the K4000 means that spare parts stocking, maintenance and staff training is greatly simplified.

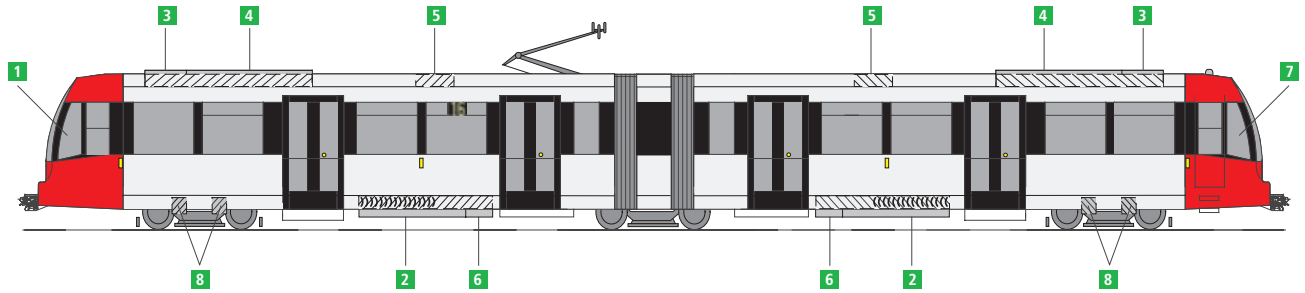
The new vehicles offer an optimum in comfort and safety for the passengers and the operators. Air-cooling and heating units for the passenger compartment provide a pleasant climate in the interior of the vehicle. The drivers' cabs are air-conditioned and meet the requirements of the German professional association. The passengers' safety is enhanced by means of four mini-cameras that are fitted in the ceiling and continuously monitor the passenger compartment.

Kiepe is the supplier of various key systems and thus responsible for the design, supply and commissioning of the electrical equipment of these modern high-floor light rail vehicles. Kiepe's scope of supply includes, among others, the entire traction package, all auxiliary converters, the air-conditioning systems, the diagnostic system including a radio link to the workshop, the passenger information system and the automatic train stop facility.

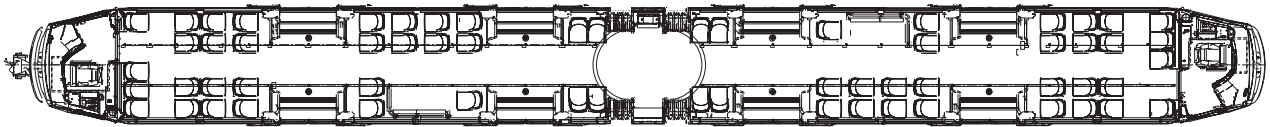
All power converters are of a state-of-the-art air-cooled IGBT type. The vehicles are equipped with two IGBT traction inverters that are directly fed from the overhead line. These power two robust asynchronous AC traction motors each. The fully sprung motors are completely sealed and self-ventilated. Each vehicle is fitted with two independent auxiliary converters for the power supply of subsystems, plus two separate auxiliary converters powering the air-conditioning units. All power converters are installed in under-floor containers that are easily accessible. In case of a fault these containers can be removed easily and replaced by a working unit, thus guaranteeing a shortest possible interruption of service.

The microprocessor control with its embedded spin/slide correction system allows a jerk-free acceleration and deceleration and a regenerative brake to standstill of the vehicle. Most system controls use a serial data bus that operates according to the CAN-open standard. All functions that have an impact on safety are monitored, in general, using dedicated control lines that also serve as back-ups. The train bus allows data transmission within a train consisting of up to four vehicles.

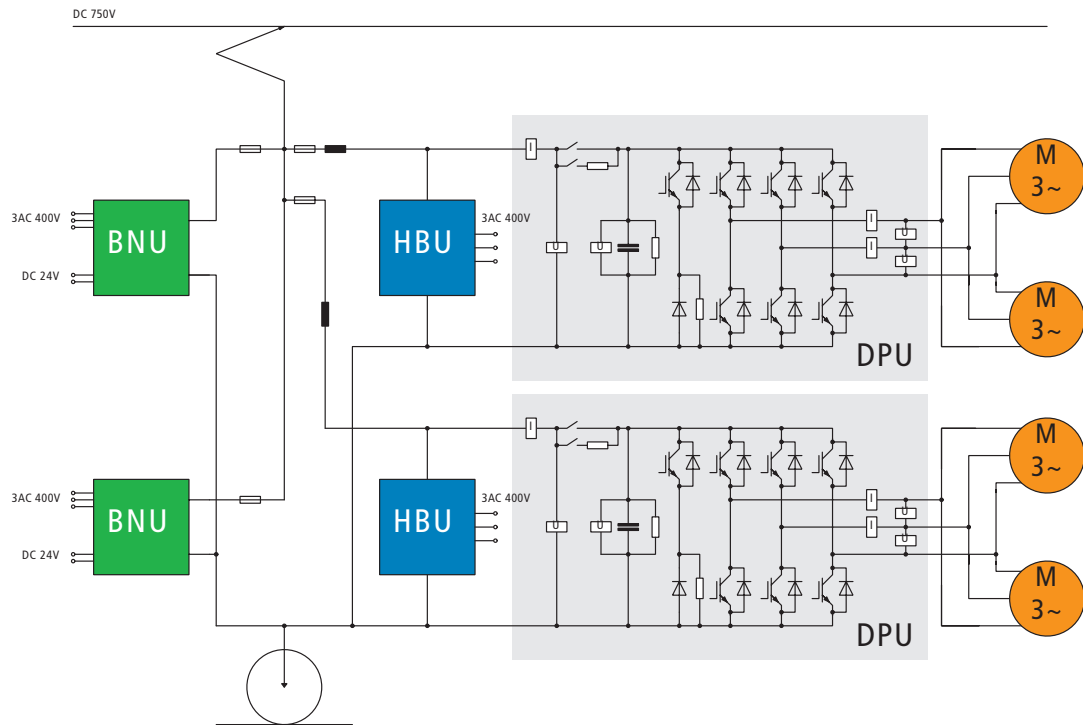
## Arrangement of equipment / seating plan



- 1 Driver's cab 2
- 2 Under-floor containers for propulsion and auxiliary power supply
- 3 HVAC for driver's cab
- 4 Air heating and cooling unit for passenger compartment
- 5 Braking resistor
- 6 Battery
- 7 Driver's cab 1
- 8 Traction motor



## Main circuit schematics



Technical data	
Type of vehicle	articulated 6-axle high-floor light rail vehicle, bi-directional
Class	K 5000
Wheel arrangement	Bo'+2'+Bo'
Rail gauge	1,435 mm
Maximum speed	80 km/h
Acceleration	1.2 m/s <sup>2</sup>
Deceleration	≥ 1.2 m/s <sup>2</sup>
Emergency brake deceleration	2.73 m/s <sup>2</sup>
Catenary voltage	DC 750 V
Vehicle length over coupler faces	29,280 mm
Car body length	28,400 mm
Car body width	2,650 mm
Car body height above TOR	3,650 mm
Distance between bogie centers	10,500 mm
Motor bogie axle base	1,800 mm
Trailer bogie axle base	1,800 mm
Height of entrance level above TOR	980 mm (foldable steps: 560 mm)
Empty vehicle operating weight	approx. 37,800 kg
Seated passengers	62
Standees (4 persons/m <sup>2</sup> )	115
Wheel diameter (new/worn)	660/580 mm
<b>Traction inverter</b>	2 x Kiepe IGBT direct pulse inverters
Output	250 kW (continuous), 650 kW (for t < 30 s) each
Cooling	forced ventilated
<b>Auxiliary power supply</b>	2 Kiepe IGBT static converters
Output 1	DC 24 V/200 A (each)
	End-of-charging voltage adjustable (24 to 28 V)
Output 2	3/N AC 400 V / 230 V ± 5%, 14 kVA (each), 50 Hz ± 1%
Cooling	forced ventilated
<b>Auxiliary converters</b>	2 Kiepe IGBT auxiliary converters
	in modular design with soft start and frequency shifting
Rated voltage	3 AC 400 V
Rated power	20 kVA (each)
Cooling	forced ventilated
<b>Drive</b>	4 self-ventilated three-phase asynchronous AC motors, fully sprung
Type	1 MLU 3441 K/4
Rated power	120 kW (each)
Max. RPM	5,580 1/min
Gear box	4 two-stage spur gear units with quill shaft and rubber pad coupling
Gear ratio	7.6264 : 1
<b>Control technology</b>	On-board information and control system with integrated diagnostic help, based on CAN-open standard, radio-LAN interface

Subject to change without notice.

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