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Wiener Linien Electric Bus

12 midibuses for the city centre

The first fully-electric bus fleet in scheduled service
Until 2012 only prototype electric buses were in service in Europe. Vienna is the first city to operate these trend-setting vehicles on two bus service routes in the city centre as from autumn 2012.

This innovative concept and the drive technology of the 12 electric buses are from Siemens. It is the first fully electric bus fleet in scheduled service in Europe whose complete power requirement is supplied from the on-board battery system. The major advantages compared to diesel or gas-driven buses are their approx. 25% lower power requirements, minimum maintenance and local emission-free operation.

Technical data	
Total weight	12,000 kg
Tare weight	8,500 kg
Length / width / height	7,720 / 2,200 / 3,200 mm
Passenger capacity (seated / standing / wheelchair / driver)	40 + 1 13 / 26 / 1 / 1
Wheelbase	3,675 mm
Maximum speed	62 km/h
Operating autonomy	unlimited on the planned route
Batteries	lithium-ferrite
Battery capacity	96 kWh
Heating, ventilation, air conditioning	driver's and passenger areas fully electric
Motor	three-phase asynchronous 85 / 150 kW
Inverter	DC-AC IGBT mono inverter
Brakes	regenerative braking system with self-ventilated disc-brakes
Charging time	6~8 minutes per cycle

The concept:
Electric bus without local emissions
By using the advanced battery technology it is for the first time possible to accumulate electricity so efficiently that it can be used on vehicles for public transport.

On this basis and in combination with the latest electrotechnology, Siemens has developed an eBus concept, whose operating power is supplied solely from the on-board batteries. The heating and air-conditioning equipment is also battery-powered.

This all-electric concept has been implemented for the first time on a series-production scale in cooperation with the bus manufacturer Rampini. The results are 12 midibuses operating in Vienna's city centre since autumn 2012. Highly manoeuvrable, low-noise, no-smell and emission-free and offering high passenger ride comfort, these electric buses set new standards in public transport in Vienna and in Europe.

The operational concept is designed for a quick-charging process at the terminal stop, which allows the reduction of the capacity of the batteries and increases their life time by following a constant charging cycle.

The design:
Low-floor bus with kneeling function
The electric bus of the Wiener Linien is a low-floor vehicle with an average floor height of 350 mm, so that the bus can be boarded from street level at a height corresponding to one step. The kneeling function enables the entrance height in the front door area to be lowered to 250 mm, in the centre door area to 290 mm. The vehicle is boarded through two doors provided on the right side of the vehicle: one single-leaf swing door at the front and a two-leaf swing door in the centre of the bus. All doors are equipped with an anti-trap system which acts automatically when the doors close. When the vehicle is in motion a further safety system ensures that the doors cannot be opened.

The chassis is of modern design, comprising a self-supporting tube-frame structure which are electrically welded, sandblasted, painted and sealed. Highly corrosion-resistant materials are used for the exterior bodywork. The complete structure provides high protection in the event of a side collision.

The electric bus of the Wiener Linien features independent wheel suspension with pneumatic suspension and shock absorbers at the front and a rigid axle with pneumatic suspension and shock absorbers at the rear. This means high passenger ride comfort to meet the high expectations of passengers in Vienna.

The interior:
Numerous seats accessible without steps
The interior of the electric bus of the Wiener Linien meets the high standards of the whole Vienna bus fleet. The midibus offers space for 26 standees and 13 seats. Space for a wheelchair is also provided. During design, particular emphasis was placed on easy access to as many seats as possible without steps.

The stop-request buttons are arranged at the doors and also further inside the vehicle. A running display in the roof area indicates the next stop.

A modern air-conditioning and heating system ensures cooled air in summer and warm air in the winter.

The lighting is provided in the ceiling. A sufficient number of lights are provided at suitable positions to ensure pleasant and safe illumination throughout the passenger area.

The driver's area:
Modern work place with optimum vision
The driver's area is of high-quality design to meet the requirements the responsible job of bus drivers involves. The ergonomically designed seat features self-adjusting pneumatic suspension and can easily be adjusted to the right position for the driver. The curved windscreen, a small window in the front right-hand corner of the bus and several interior and exterior mirrors ensure optimum vision. The non-mist exterior mirrors feature electric heating and can be adjusted both electrically and manually. A parabolic mirror is fitted in the driver's area to ensure a good view of the passenger area and another is fitted by the centre door.

The bus is of course equipped with all obligatory equipment such as powder fire extinguisher, first-aid box, breakdown triangle and wheel chock.

The drive technology:
Electric motor with energy recuperation
Siemens is responsible for the operation concept of the electric bus of the Wiener Linien and also supplies the modern drive technology. The core of the system is the water-cooled electric drive motor. Whereas conventional diesel engines have an efficiency of approx. 25%, this three-phase motor achieves over 90%.

The motor with a continuous rating of 85 kW is equipped with a Siemens IGBT inverter. A reduction gear unit from Rampini, which was specially developed for this bus, is used for the connection to the rear-axle differential.

The brake system:
Energy recuperation when braking
The brake system is controlled by two separate, independent circuits. All brakes are designed as self-ventilated disc brakes. Safety equipment such as anti-blocking system, anti-slip control, electronically-controlled braking, electronic stability control and "vehicle stop when door open" are integrated.

The brake system is moreover designed as a regenerative system – as soon as the driver lifts his foot off the accelerator, the first stage of energy recuperation is activated and the motor acts as a generator. When the brake pedal is actuated, recuperation is increased for the first third of pedal travel, the other two thirds serve to activate the pneumatic system.

The battery system:
Charging by current collector
Lithium-ferrite cells is the advanced battery technology. The electric bus of the Wiener Linien is equipped with nine batteries, of which three are located on the roof, five in the rear end and one under the bus in the place which is initially planned for diesel tank. The battery capacity installed on board is 96 kWh. An efficient battery-management system is provided to control the batteries and to monitor battery temperature and voltage.

Batteries are charged at the respective terminal stop of the bus route. Electrical power is drawn from the overhead line system of the Vienna Light Rail/Tram by means of current collectors and fed to the on-board battery-charging unit.

A particular advantage with regard to energy efficiency is that the electric buses are supplied with recuperated energy – this means energy recuperated during the braking process from tramcars and metro cars.

The service concept:
In-house maintenance
Well-tried bus components are used on the electric bus of the Wiener Linien. Maintenance can thus easily be performed by Wiener Linien personnel. If required, Siemens service is available for the maintenance of electrical components.

During design, particular attention was paid to ensuring easy access to all relevant parts. Cleaning work can also be done in the usual manner.

All advantages

- First fully electric bus fleet in scheduled service
- Fully electric design, i.e. complete energy requirements are covered by the on-board batteries
- Latest battery technology LiFe
- Significantly lower operating costs compared to diesel or gas-driven buses
- Zero emission – no local CO_2 emission
- Low-noise, no smell
- Power supply from recuperated energy from operating system of Wiener Linien
- Reduced maintenance costs compared to diesel/gas busses
- High manoeuvrability for city-centre traffic
- Low-floor bus with kneeling function
- Comfortable interior with sufficient seating capacity, access to sufficient seats without a step

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