SIEMENS

Background information

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Inspiro – the new generation of metro trains for urban transport

The challenges of the future are clear: Traffic flows in conurbations need to be optimized, traffic systems must be intelligently network, and CO_2 emissions have to be reduced. New concepts for people's individual mobility and future-oriented transport systems are in demand. In order to combine these diverse requirements of potential operators, passengers and the environment with one another, Siemens Mobility has developed the new Inspiro metro platform. The Inspiro has been newly developed and tailored to meet current and future market requirements. The train combines technologies that have been tried and tested in metro systems for many years with innovations that are consistently oriented toward customer benefit while ensuring flexibility and cost-effectiveness. The extensive experience gained from previous customer projects contributed to the development. Metro trains built by Siemens are now in service in 16 countries, where they are helping to optimize traffic flows in conurbations and meet rising transport demands, while at the same time reducing CO_2 emissions.

The metro train from Siemens marketed under the "Inspiro" name considerably reduces energy consumption by systematically using lightweight construction and modern traction technology Siemens gave high priority to re-usability when selecting the materials for both the car body and interior. At the end of its service life, around 95 percent of a car can be recycled.

The design of the Inspiro was based on the experience Siemens Mobility had gained from a number of previous metro projects. These included the Oslo, Vienna and Nuremberg metro trains. Main criteria for the development of the Inspiro platform were reducing energy consumption, operating and maintenance costs, and using natural materials that can be recycled. Priority was also given to developing a new vehicle design. The most important requirement was to give the passenger a feeling of pleasant spaciousness, and thus a positive travel experience.

Proven equipment is used in the new vehicles, which ensures that they have high reliability. Low-maintenance, rugged systems enable maintenance intervals to be lengthened, and consequently give high vehicle availability. The lightweight aluminum car body, the new, need-controlled air conditioning system and the weight-optimized bogie all contribute toward reducing energy

consumption. The electrodynamic braking system brings the train to a standstill quietly, so reducing noise emissions in metro stations. Using the option of driverless operation also increases the energy efficiency of the metro system.

The modular, self-contained train concept consists of motorized end and intermediate cars, and non-motorized intermediate cars. The length of the standard version of the train can be varied up to eight-cars. The motorization can vary from 60 to 100 percent, depending on the train configuration. The six-car, basic train configuration can carry 1267 passengers at a density of six standing passengers per square mater, and 67 percent motorization. The trains have a maximum speed of 90 km/h.

The new vehicle design has optimized capacity, comfort and passenger flow

The design of the interior and exterior of the Inspiro, the through corridor along the full length of the train, and the optimal interior layout are among the main attractions of the vehicle, and enhance passenger comfort. The train was designed in cooperation with well-known designers, and its futuristic front end sets new standards. The open, modern interior heightens the attractiveness of this metro train. The through corridor and the interior design of the train combine to make a big contribution to the passengers' feeling of safety. A natural, inviting atmosphere has been created in the car by using high-quality materials in the interior, and by integrating lighting islands.

The variously shaped stanchions are an important design element, which offers passengers different ways of holding on while maintaining a comfortable distance to fellow passengers. The passenger area can be optionally fitted with longitudinal or transverse seating, or combinations of the two. There are no cabinets or under-seat units in the passenger compartment so keeping the entire interior space clear for passengers. The seating arrangement can be freely selected.
The standard version has passenger doors up to 1,400 mm wide, which can be either twin-leaf, external sliding doors or swing-plug sliding doors. The doors can be equipped with innovative light graphics which help passengers on the platform get their bearings.

A number of innovative components combine to reduce energy consumption.

- **Innovative floor design using renewable raw materials**
  - Cork-aluminum sandwich floor plate
  - Improved acoustic and thermal insulation

  - Significant weight saving in comparison to conventional plywood floors
  - High recyclability

- **HVAC (heating, ventilation and air-conditioning)**
  - Modular design to meet varied requirements and performance classes (ventilation, heating or air-conditioning)
  - The output of the air-conditioning systems is demand controlled (optionally via CO_2 sensor)

- **Weight-optimized car body**
  - Lightweight car body made of welded aluminum.
  - Weight-optimized main transoms made of longitudinal extruded aluminum profiles
  - Innovative, multi-functional aluminum profile in the roof area.

- **Energy-saving LED lighting in the passenger compartment**

Adaptable car body

The new car body design can be adapted to meet various infrastructure requirements. The weight-savings reduce energy consumption and axle loads, which allows higher passenger capacities, even where the infrastructure limits axle loads. The platform concept allows the width and length of the car body to be varied within defined limits. The standard design allows a maximum car body width of three meters. The maximum length of the end and intermediate cars is approximately 20 meters. Each side of a car can be fitted with three or four passenger doors according to the operator's request. Each car body has two bogies. Each wheelset of a motorized bogie is driven by a traction unit (geared traction motor).

Modular design of driver's cab

Even the exterior design of the front end can be adapted individually. The use of a lightweight glass-reinforced plastic (GRP) front shell makes it easy to adapt to differing heights and widths. The modular driver's cab concept can be adapted for either a driver or driverless operation. The train front can be constructed with or without a driver's cab door and emergency door.

The bogie design

The type SF 1000 bogie developed for modern metro trains has been further optimized for the Inspiro. It is suitable for operational speeds of up to 90 km/h and axle loads up to around 13.5 metric tons. Each bogie axle has a disk brake with a compact brake caliper unit and can be equipped with spring accumulators for the parking brake. Secondary suspension is provided by air springs, and metal-rubber springs are used for the primary suspension. One current collector can be mounted on each side of the motor bogie. The traction motors are mounted transversally and suspended on the bogie frame. The Inspiro bogie can be used in all versions of the train.

Longer intervals between maintenance

This new generation of vehicles is leading the way, not only in environmental protection, but also in terms of operating costs. Maintenance intervals have been considerably lengthened, to both lower maintenance costs and increase train availability. This enables a metro operator to carry more passengers with the same number of vehicles.

The development of the platform placed particular importance on easy exchangeability of wearing and spare parts. The use of optional remote diagnostics enables maintenance activities to be further optimized. This further increases the availability of metro trains for passenger services.

The Mobility location in Vienna

Vienna is the headquarters and competence center for metro and main line cars of the Siemens Mobility Division. This location has the combined know-how of the entire logistics and process chain of research, development, engineering, production, final assembly and commissioning. Vehicles are assembled simultaneously on seven modules on the almost 14,000 m^2 of the final assembly hall. Up to 500 vehicles leave the plant each year.