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# Velaro CN high-speed trains

## for China Railway (CR)

November 2005 saw the conclusion of a contract between Siemens and the Chinese Ministry of Railways (MOR; now China Railway (CR)) for delivery of 60 high-speed trains. The 300 km/h trains are already in service on the Beijing–Tianjin and Wuhan–Guangzhou lines, and as of July 2014 the fleet had run a total of almost 185 million km.

The Velaro® CN is based on the advanced train set technology of the Velaro platform, which is already in use by German Rail (DB AG), Spanish National Railways (RENFE), and Russian State Railways (RZD) and has also been sold to Turkish State Railways (TCDD).

Based on the Velaro CN and working with Chinese partners, a 16-car train was developed that has reached speeds of 350 km/h in passenger service on the Beijing–Shanghai line since late 2010. Siemens supplied the traction components, bogies, and train control system. Since the spring of 2012 a further train type has been in service, and is designed for the Dalian–Harbin line with a temperature range of –40 to +40°C.

Currently, more than 400 trains with Siemens technology are operating on the Chinese high-speed rail network, with a total distance traveled of over 400 million km. Another 300 trains have been ordered.

Technical Data	8-car	16-car
Maximum operating speed	300 km/h	350 km/h
Length of train	200.7 m	399.3 m
Voltage	25 kV / 50 Hz	
Traction output	9,200 kW	18,400 kW
Brakes	Regenerative, pneumatic	
Number of axles	32 (16 driven)	64 (32)
Number of bogies	16	32
Max. axle load	17 t	
Number of cars / train	8	16
Number of seats	601 (72 1st class, 528 2nd class, 1 position for wheelchair users)	1026 (37 VIP, 124 1st class, 864 2nd class, 1 wheelchair position)
Track gauge	1,435 mm	
Operating temperature range	(–40°C) –25°C to +40°C	



The car body geometry and the arrangement of the interior furnishings have been specially coordinated to achieve the best combination of high travel comfort and high seating capacity. The train offers two classes in which catering is provided for the passengers. Passengers may also visit the bistro restaurant for snacks and beverages. In first and second class, a video and audio entertainment system meets high expectations.

With an installed traction power rating of 9,200 kW or 18,400 kW for the 16-car train, the Velaro CN is designed for a maximum operating speed of 300 km/h or 350 km/h. During braking, 9.2 MW / 18.4 MW of this power can be converted again and fed back into the overhead line.

Ride comfort and safety are guaranteed by the proven running gear technology from Siemens.

Automatic control and protection of the train is performed by an operations control system developed by Siemens for the Chinese market and that is based on Europe's standardized ETCS.

#### **The proven train set concept**

Like its predecessors – the ICE® 3 and Velaro E – the Velaro CN is a multiple-unit train set in which the traction and the technical modules are distributed under floor over the length of the train. This means that the full length of the train above floor is available to the passengers, offering some 20% more passenger compartment space than conventional trains of the same length. The high capacity also provides higher profitability than push-pull configurations.

#### **The clear advantage:**

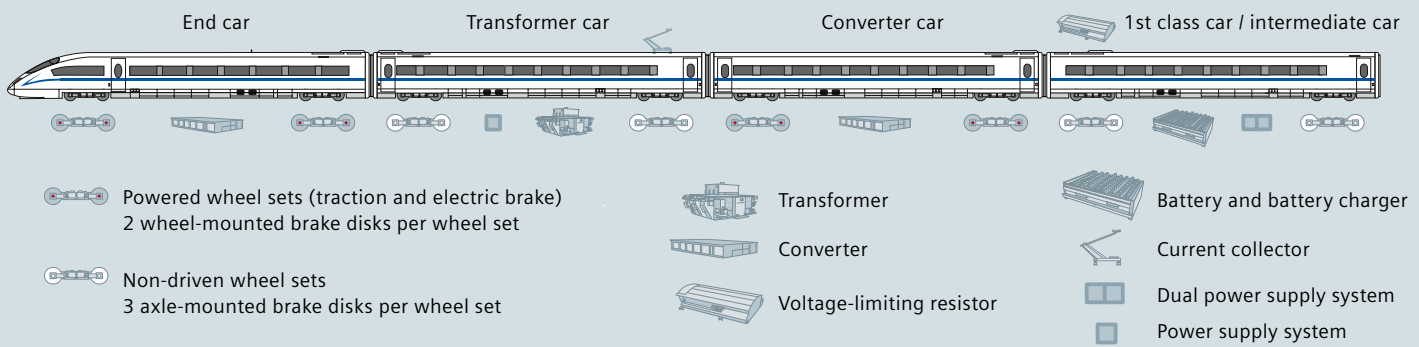
Optimized performance characteristics. The train set concept stands out thanks to the following operating advantages:

- Improved utilization of the adhesion coefficient during acceleration because 50% of the axles are driven.
- Ability to travel up sections with steep gradients up to 40‰.
- Due to the evenly distributed weight across the entire train set, the load on each individual wheel set is reduced. This reduces stress on the track and reduces the maintenance requirements for the running gear. The load per wheel set is lower than the international standard of max. 17 metric tons.
- Comfortable ride. The evenly distributed weight also improves the running characteristics and thus the ride.

#### **Impressive traction**

The Velaro CN has four or eight identical, independent traction converters. This principle provides clear advantages in continuous service:

- If one converter fails, it can be disabled without affecting the remaining units. This enables the train to safely reach its destination with 75% of its maximum traction output.
- Low-maintenance three-phase asynchronous motors with cage rotors ensure high availability for productive service.
- The 9,200 kW power rating of the traction system has been chosen to guarantee excellent acceleration and deceleration values when the train is fully laden.



### A train with a high seating capacity and plenty of comfort

The Velaro CN is the epitome of interior spaciousness. Thanks to its extra-wide car body, the train offer seats for 601 or for 1026 passengers – and plenty of comfort. Located at both ends of the train immediately behind the driver's cab is a first-class lounge. One particular highlight is the transparent glass panel between the lounge and the driver's cab, which gives the passengers an unobstructed view of the track. In addition, the lounge is fitted out with swivel seats, so that the passengers can always sit facing forward. The middle section of the train accommodates a further first-class car, in which the wheelchair position and the toilet for general use is located.

The result:

A spatial marvel that makes no compromises when it comes to comfort.

### Exciting entertainment

The passenger information system is based on previous experience and incorporates the latest technologies.

- In the first-class car, large video screens that are clearly visible from every seat provide exciting entertainment.
- Compatibility with advanced media and formats – such as DVD and MP3 – makes sure that passengers have access to the latest productions in top quality.
- Five different stereo audio programs can be received at every seat in the first-class car.



End car 1st and 2nd class



Transformer car 2nd class



Intermediate car 2nd class



Bistro car 2nd class



1st class car



Intermediate car 2nd class



Transformer car 2nd class



End car 1st and 2nd class





### The latest news

- The central announcements for all passengers are coordinated from the customer service office via a computer with GSM interface.
- Announcements and internal communication can be made from six fixed intercom stations. The system offers the option of making group-selective announcements (e.g., for individual cars, classes).
- Passengers receive information via interior and exterior LED displays. Owing to the expected international audience, the information can be provided alternately in Chinese and English.

### Perfect control

The Train Communication Network (TCN), consisting of the wired train bus (WTB) and multifunctional vehicle bus (MVB), ensures trouble-free and reliable data transfer, both between the traction units of a train and between two coupled trains. The consistently redundant design of the TCN system provides additional advantages:

- Significant improvement in the availability of the data communications paths
- Savings in terms of hardware, installation dimensions, weight, and lifecycle costs
- Increased data transparency and shorter data propagation delays through the reduced number of interfaces and subsystems

### Efficient on-board power supply system

An efficient on-board power supply system reduces power consumption and increases the cost effectiveness of a vehicle. The on-board power supply system of the Velaro CN has been optimized with respect to the entire power network supply system. The system topology stands out due to the small number of energy conversion stages it comprises. Since every conversion stage leads to energy losses, the efficiency of the train's overall system has been able to be improved in this way.

Furthermore, redundancy structures ensure a reliable power supply for the auxiliaries in all operating situations. For instance, the auxiliary equipment power supply is maintained without interruption when the train passes sectioning points and is briefly isolated from the line.

### Proven safety

The proven SF 500 bogies family – which is rated for running speeds of up to 350 km/h – contributes to the exemplary lateral guidance of the train, maximizing stability for excellent running comfort. Even more important than rapid acceleration is rapid deceleration. The Velaro CN is equipped with a brake management system that controls automatic switchover between the electric and pneumatic brakes. Braking is preferentially performed in electric mode during routine service. Only when the line system is no longer able to absorb the electric braking energy of the traction motors does the brake management system gradually switch over to the pneumatic brake. This saves energy and also reduces mechanical wear.

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