

Velaro Novo – the new vehicle concept for high-speed trains

The number of passengers traveling over long distances has been climbing for years, and operators of high-speed trains face tight competition with airlines and new providers of long-distance, road-based services. Future-proof trains with reduced lifecycle costs and enhanced travel comfort are therefore more important than ever for securing and increasing high-speed rail transport.

Demands fulfilled: a competitive advantage

Siemens Mobility has meticulously developed the new Velaro Novo to meet today's demands – from its sophisticated concept to its innovative technologies. The vehicle concept sets new standards when it comes to economic efficiency and sustainability: Operators profit from lower maintenance costs, reduced energy consumption and maximized availability.

The design of the Velaro Novo, tailored to meet the needs of operators, provides additional capacity without compromising passenger experience. The new vehicle platform is also highly flexible, offering scalable trainset configurations that satisfy customer wishes and changing requirements. The Velaro Novo naturally meets all current requirements and standards, in particular the Technical Specification for Interoperability (TSI).

Innovative train concept

The new high-speed train from Siemens Mobility draws on the extensive experience gained from three generations of Velaros operating since the Velaro E (AVE S103) was delivered to Spain in 2005. Since then, more than 1,000 Velaro trains operating worldwide have covered over two billion kilometers at speeds up to 380 km/h and are adding one million kilometers to this total every single day.

The new Velaro Novo trainset is based on the proven distributed traction system used since the ICE 3, can be delivered as a single- or dual-system train (15 kv/25 kV), and has a scalable traction system for top speeds of 250 km/h to 360 km/h. The corresponding power outputs range from 4,700 to 8,000 kW. In a seven-car configuration, the Velaro Novo is 202 meters long and can be operated with either single or dual systems. A 404-meter long 14-car version is also available.

Outstanding energy efficiency

With the Velaro Novo, Siemens Mobility is writing a new chapter in its Velaro success story – one marked by innovations in energy efficiency. Running at 300 km/h, for example, the new high-speed train uses 30 percent less energy than previous Velaro models, which translates to savings of 1,375 tons of CO₂ emissions a year.

Rigorously improved aerodynamics are essential for achieving higher energy efficiency and thus substantially reduced lifecycle costs. The completely covered and streamlined bogies cut energy consumption by roughly 15 percent and lower noise emissions. The aerodynamics of the end cars, further improved with a more streamlined front surface, and gangway connections that are flush with the train's body shell substantially reduce aerodynamic drag and cut energy consumption by around ten percent. In addition, the high-voltage equipment on the car roof is also completely covered, further improving the aerodynamics.

Furthermore, the Velaro Novo is around 15 percent lighter than previous Velaro generations. New profile and welding technologies for the body shells, mass-optimized inbound bogies, new on-board converters and the use of innovative materials and construction solutions are just a few examples of the advances that have reduced the train's weight by over 70 tons. The design of the inbound bogies, proven in the Desiro City trainsets operating in the United Kingdom, was combined with experience gained with Velaro bogies and further refined for the Velaro Novo. The inbound bearings substantially lighten the running and traction bogies and, as a result of the lower unsprung mass, ensure smoother operation and reduced wear.

Low-wear, cost-efficient operation

Maintenance costs for the new train will also be substantially reduced. Continuously collected status data from the train can be analyzed and provide precise instructions

for predictive, condition-oriented maintenance work. The electrical high-performance brakes with brake resistors enable braking largely without wear and tear, considerably reducing maintenance costs for the pneumatic braking system.

Flexible interior concept

The Velaro Novo's lightweight body shell is based on the empty tube concept, meaning that there are no permanent installations inside the car and the interior can be furnished according to customer wishes and altered whenever requirements change. The cars have no underseat containers or electrical cabinets in their interior. Technical installations are reduced to a minimum and are functionally organized to optimize cable routes and weight savings. As a result of this design, the maximum possible capacity is available for passengers.

Despite the car length of 28.75 meters – a length that requires a somewhat narrower body shell to meet structure gauge requirements – the new cars have an aisle width of 535 mm, 11 mm wider than the previous Velaro, while offering the same seating comfort. For operations on rail routes with larger structure gauges, a variant is available with a wider body shell, making possible a 2+3 seating configuration. Internet service, passenger information systems, on-board entertainment and CCTV security surveillance systems can be integrated to meet customer needs.

Stringent testing

Siemens Mobility has been rigorously testing the innovations used in its new high-speed train since April 2018. A test car, integrated into the ICE S operated by DB Systemtechnik, is currently undergoing test runs throughout Germany. The tests are being conducted under various operating conditions to monitor and analyze the performance of the car body and bogies, among other things. This data serves the project-independent testing and securing of the key vehicle features.

Future-proof and sustainable

The Velaro Novo from Siemens Mobility is a systematic further development of three Velaro generations. Numerous innovations in details have made the new high-speed train a unique, highly efficient concept that consumes up to 30 percent less energy and clearly reduces investment and maintenance costs. At the same time, developers managed to increase the train's available space by ten percent. With its empty tube concept and numerous configuration possibilities, the Velaro Novo is

future-proof and can be flexibly adjusted to meet new design concepts and customer needs even after years in operation. With its new key technical data, the Velaro Novo sets a new standard for high-speed rail transport.

Technical data

	Velaro Novo 280 km/h	Velaro Novo 320 km/h	Velaro Novo 360 km/h	Velaro AC single system
Traction power	4,700 kW	6,600 kW	8,000 kW	8,000 kW
Traction startup force	230 kN	230 kN	275 kN	300 kN
Brake power recuperative	7,200 kW	9,900 kW	11,800 kW	8,200 kW
Brake power rheostatic	5,600 kW	7,000 kW	8,400 kW	-
Mass	412 t	416 t	420 t	485 t
Trainset length	202 m	202 m	202 m	201 m
Maximum speed	280 km/h	320 km/h	360 km/h	320 km/h

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