PENDOLINO
TILTING TRAINS TO CUT TRAVEL TIMES
Highly flexible interior configurations and high comfort for passengers

FASTER TRAINS FOR BETTER RESULTS

As fleet owners and operators you always have to consider things from two perspectives: yours and your passengers. Ultimately, the goals are the same—getting from point to point in safety and comfort as quickly and economically as possible. But the responsibility is all on you to provide the solution. Ideally, you would like flexible, service-proven trains that can run at up to 250 km/h on conventional lines and offer your passengers even more comfort—thus improving service while avoiding the heavy costs of dedicated high speed rail infrastructure. Your choice in rolling stock also depends on the equipment onboard: you need the latest technology to optimise lifecycle costs and improve onboard amenities and security.

ALSTOM AT FULL TILT

Alstom has the answer. Our Pendolino’s structural design, powerful traction and active tilting system allow you to offer a high speed service at a much lower cost than a new dedicated high speed line. Pendolino leans into curves on conventional main line track, rather than slowing down, allowing 20-30% time savings in curves and more comfort than their non-tilt cousins. In the Czech Republic, our Pendolino has cut the journey time by 21% on certain major intercity routes. A fourth generation train, Pendolino offers the assurances of a well-proven and popular product and the advantages of the latest technology. Passengers can enjoy the onboard amenities they crave, while operators benefit from the train’s flexibility and optimised lifecycle costs. Our tilting trains also meet new standards for cross-border interoperability.

THE PENDOLINO CUTS TRAVEL TIMES, RUNNING AT HIGHER SPEEDS ON CONVENTIONAL MAIN LINES

WiFi services onboard Pendolino Allegro train for Helsinki-St Petersburg line
PENDOLINO, UNIQUE IN THE TILTING MARKET

With almost 400 trainsets in operation and more than 300 million passengers transported over a total of 200 million km, Pendolino is unique in the tilting train market.

THE TRAIN FOR YOU

We offer two Pendolino versions:
• for UIC track (1,435 mm) with bodyshell width of 2,830 mm. This Pendolino is fully compliant with Technical Specifications for Interoperability (TSI) and can run at temperatures ranging from -25°C to +45°C.
• for wide track (1,522 mm) with bodyshell width of 3,200 mm. This Pendolino is winterised for operating in temperatures as low as -40°C with ice and snow.

MODERN, FLEXIBLE DESIGN

To ensure that you get the train that best suits your situation, we leave many of the design choices up to you. For example, the Pendolino’s highly flexible interior configurations can be planned for high density by removing luggage areas and reducing seat pitch. The trains can feature bar-bistros or full restaurant service. It can also be equipped with an electronic seat reservation system. Disabled passengers benefit from the easy-access boarding.

<table>
<thead>
<tr>
<th>Maximum speed</th>
<th>250 km/h</th>
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<tbody>
<tr>
<td>Configurations</td>
<td>4 to 9 cars</td>
</tr>
<tr>
<td>Capacity</td>
<td>232 to 660 seated passengers</td>
</tr>
<tr>
<td>Full interoperability</td>
<td>Up to 4 power supply voltages (3,300 V, 5,000 V, 15kV &amp; 3,000 V)</td>
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- 2 trains may be coupled
- Onboard ERTMS system as well as the national signalling equipment required
ABOARD THE PENDOLINO

DRIVER COMFORT

The driver’s cab is based on an ergonomic design for maximum driver comfort and conforms to UIC 651 standards. It can be fitted with an external CCTV system to allow an external side view of the entire train.

ONBOARD ENTERTAINMENT AND SECURITY SYSTEMS

Onboard passenger information and entertainment systems can include a server, WLAN and WIFI for access to an onboard intranet or internet service. Touch screen displays can also offer passengers access to interactive services. For improved security, the Pendolino can also be equipped with an external and internal video surveillance system.

PASSENGER COMFORT: AN INDIVIDUAL EXPERIENCE

• Seats with individual reading lights, reclining function, electric sockets and video/audio controls.
• Seats aligned with the large-dimension windows for panoramic view and natural light source.
• Comfortable seat widths in both first and second class.
• All special areas are concentrated in one single car: disabled space, toilets, lift, train manager office, bar/restaurant service.
• Multiple dedicated areas for disabled passengers: toilets, wheelchair storage, handrails.

Styling by Giugiaro

Italian industrial design firm Giugiaro Design, renowned for their car designs for Alfa Romeo, created the exclusive exterior and interior design for the Pendolino for Trenitalia and Cirail. Giugiaro based their choice of the interior’s materials on four key factors: ergonomics, comfort, socialisation and well being.

Alstom works regularly with such external designers but we also have our own in-house Design & Styling department to design train exteriors and interiors that reflect each customer’s image. This department also supervises the work of external designers to assure that their designs are industrially sound.
Our Tiltronix technology is the only active tilting system in rail. It allows the Pendolino to tilt at an angle of up to 8° in curves and run at a higher speed than is possible with the passive tilt systems used on other trains while guaranteeing the passengers’ comfort. The tilting equipment is completely train-borne, avoiding costly track installations. Tiltronix provides either reactive or anticipative tilting.

In reactive mode, bends in the track are detected by gyroscopes, which determine their precise angle, and by accelerometers situated on the first bogie of the lead car. The onboard computer ascertains the tilt angle required and transmits an order to each car’s bogie cylinders, timed according to their position and speed of the train.

In anticipative mode, the system relies on a database of the line’s parameters. By comparing the data to information received by onboard sensors, the system can pinpoint the train’s exact position on the line at any moment and order the corresponding tilt for the route as it is reached. By reacting quicker at approaching bends, it is less sensitive to track irregularities and so can offer a smoother transition, for greater passenger comfort.

A hydraulic tilting bogie, equipped with tilting rods, activates the bodyshell’s tilting. To improve the train’s dynamic performance and passenger comfort, an active lateral air suspension system keeps the bodyshell centered. The tilting bogies use standard, service-proven components, guaranteeing performance and reliability. In reducing unsprung and simple suspended masses, the train’s dynamic behaviour has been optimised, its wheel forces minimized.

The Pendolino’s robust pantograph system is in use on Swiss ICN trains, Virgin UK Pendolino and the latest Trenitalia and Cisalpino fleets. The pantograph is mounted on a sliding carriage that is fixed firmly to the car roof. When the car tilts, an active counter-translation hydraulic system slides the carriage sideways to compensate for the tilt, allowing the pantograph to remain in its central position.
MAINTENANCE IN MIND

To reduce life cycle costs and increase efficiency, the Pendolino was designed taking into account the requirements of maintenance operations. The traction and auxiliary system are equipped with standard sub-systems for improved accessibility and easier replacement, such as the “plug and play” power module. The cooling system, auxiliary package and control unit are based on the same principle.

The Pendolino can also benefit from remote maintenance. Our Traintracer module can be added to the train’s Agate control and monitoring system, allowing train fault codes and service status information to be sent in real-time or on demand to the maintenance staff. Armed with the information to make informed decisions, technical teams can better anticipate issues and diagnose faults. When preventive care rises, down time out of service (and costs) falls.

PERFORMANCE AND SAFETY

Our proven Onix traction system offers optimum traction performance, compliant with TSI requirements. Pendolino can reach its maximum speed of 250 km/h with only 75% of its available traction power. The traction system is based on standard, service-proven elements such as IGBT technology, the latest water-cooled 6.5 kV power modules.

Meeting TSI standards, the nose and car extremities have anti-climbers and a compliant energy absorption structure. The front and intermediate coupler are also fitted with recoverable energy absorption devices.

The braking system is also fully UIC and TSI compliant for safety and performance. The Pendolino is equipped with fire detection and extinguishing systems, the first in Europe to provide this level of fire protection.
TRENITALIA AND CISALPINO INTEROPERABILITY (AND SPEED) ACROSS THE ALPS

Trenitalia and Cisalpino ordered 12 and 14 seven-car Pendolino trains respectively in March 2004. This order comes after the success of their earlier Pendolino fleets. Both are equipped with modern passenger information and security systems. Pendolino can run in Italy on the conventional network (3kV) and the high speed lines (25kV and 3kV). On the Napoli Reggio Calabria line, Pendolino should cut travel times by 29 minutes. Cisalpino’s new fleet will link Germany, Switzerland and Italy using ERTMS signaling for interoperability.

VIRGIN, UK
FLEXIBILITY (AND SPEED) IN SERVICE

For the West Coast Main Line, Europe’s most heavily travelled route, private operator Virgin Trains wanted state-of-the-art tilting trains to offer its passengers a faster, more comfortable intercity service. The external design of the 53 nine-car trains was completely adapted to the customer’s requirements. Since its 2004 service debut, the fleet has provided undisrupted performance and reliability. High quality maintenance also plays a part in its success. Using our Traintracer system, our technical teams can anticipate issues and diagnose faults. Increasing preventive and predictive care reduces costs and downtime for the operator. Virgin recently ordered four new trains and an additional 62 cars to increase part of the fleet to 11 cars.

VR, FINLAND
RELIABILITY (AND SPEED) IN A COLD CLIMATE

In 2010, four new Pendolino will assure the Helsinki - St. Petersburg rail link, cutting travel time nearly in half, from almost 6 to 3 hours. Two more trains are on option. Karelian Trains, a joint-venture between Russian Railways (RZD) and Finland’s VR, ordered the Alstom trains in September 2007. The Pendolino is already a popular train in Finland. The first entered service here in 1995, and VR currently operates a fleet of 18. Their reputation for quality comes from their steadfast relability and passenger comfort in harsh climatic conditions: they are designed to operate in outside temperatures as low as -40°C, with couplers, underframe mounted equipment, bogies and pantographs given additional protection against snow.
PENDOLINO WITHIN THE FULL ALSTOM OFFER

A FULL RANGE OF ROLLING STOCK

We offer urban, suburban, regional and very high speed trains. The market leader in high speed trains, Alstom also offers conventional (non-tilting) high speed trains. For the Chinese Ministry of Transport, Alstom is supplying 60 EMU trains derived from our Pendolino product, an order signed in 2004. Several are now in operation. Thanks to our experience in technology transfers, 51 are being built locally in China.

RAILWAY INFRASTRUCTURE AND RAIL CONTROL SYSTEMS

Our infrastructure experts provide railway network managers with infrastructure solutions in track laying, electrification, and maintenance, carefully tailored to meet their specific needs. Thanks to our experience in this domain, we can optimize their infrastructure network to boost the speed of Pendolino trains.

We also offer the rail control systems you need to operate your Pendolino fleet.

PROJECT MANAGEMENT AND MAINTENANCE

We can also provide project management for your Pendolino train project. We ensure the complete system integration from design through commissioning, assuming all the risks.

We provide full maintenance and spare parts services; our customers benefit from our decades of experience with the Pendolino, ensuring that fleet performance, availability and operational costs are optimised throughout the lifecycle.

Alstom is a global leader in the world of power generation, power transmission and rail infrastructure and sets the benchmark for innovative and environmentally friendly technologies. The Group is the only multi-specialist manufacturer in the railway sector, offering the widest range of rolling stock, signaling, services and infrastructures.

Alstom provides turnkey integrated power plant solutions and associated services for a wide variety of energy sources, including gas, coal, hydro, nuclear and wind as well as solutions for power transmission, with a focus on smart grids. The Group employs 96,500 people in more than 70 countries, and had sales of over € 23 billion* in 2009/10.

*Proforma figures
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