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Pendolino - ETR 470 - CISALPINO

Swiss Express is indebted to Leslie & Naomi Falkson who collected the following Cisalpino data in English from that company's Head Office in Bern mid-April. Herr Meier, Deputy Director, received the Falksons most affably and was pleased to learn of the potential interest among SRS members, which is warmly appreciated.

The Pendolino Cisalpino is derived from the ETR 460 (Pendolino for Italian State Railways - FS.) and it is an EMU (Electric Multiple Unit) composed of 9 vehicles divided into 3 independently powered sets.

The electrical equipment is capable of working with different types of catenary. Two pantographs are fitted, 1 SBB and 1 FS handling 15Kv 16.7 Hz AC and 3Kv DC. Each traction unit comprises a transformer, traction converter and auxiliary equipment. The traction equipment is capable of delivering approximately 6000Kw to produce a maximum speed of 200km/h and at the same time enabling the necessary acceleration needed to run on mountainous lines.

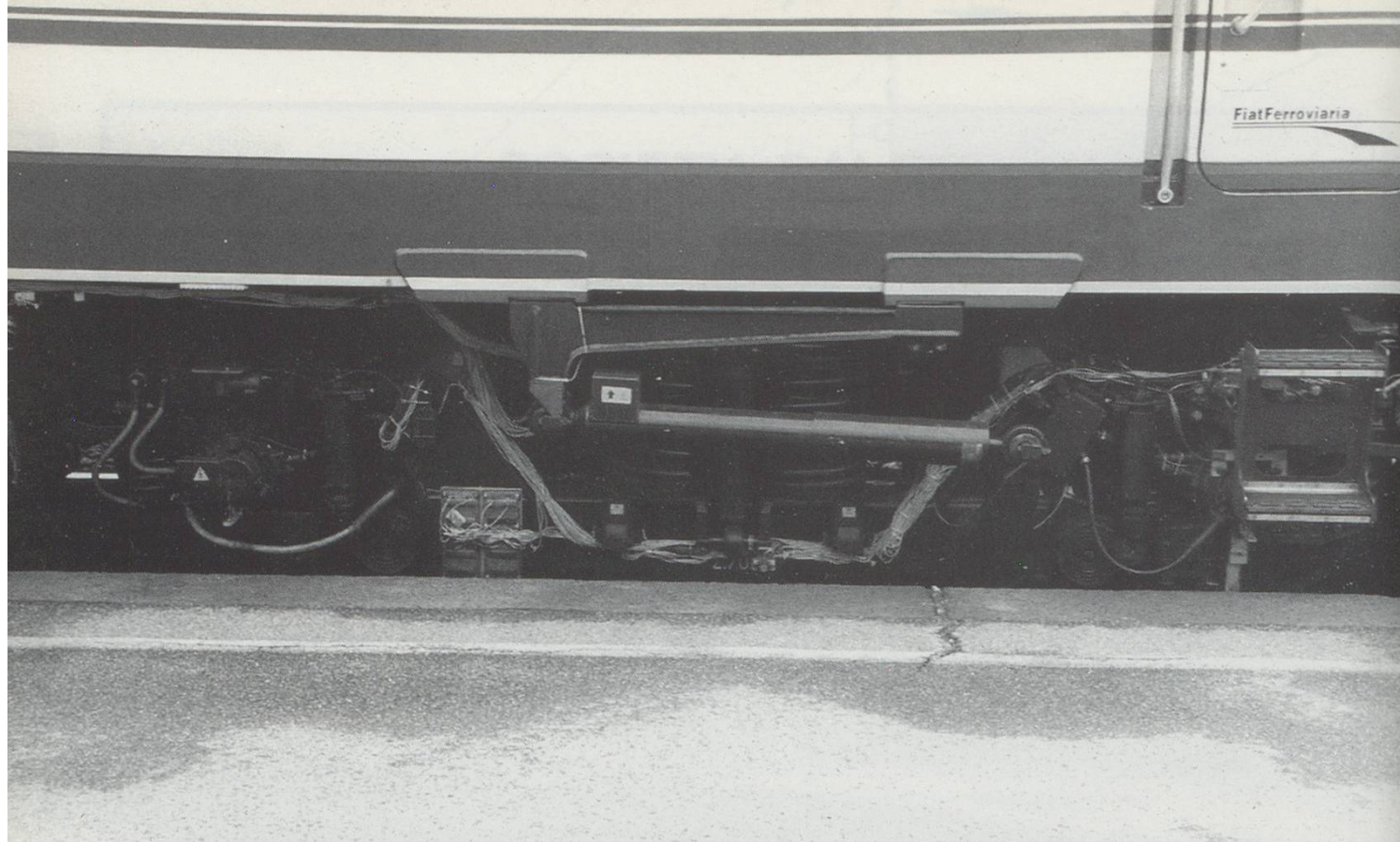
Each traction converter (3 for the whole train)

composed of four quadrant GTO inverters, are able to deliver a maximum of 2000kW to the four asynchronous motors. As in the ETR 460, the motors are suspended from the bodyshell and linked to the bogie by means of a cardan shaft. Thanks to the innovation introduced on the Italian Pendolino the maximum use of the bodyshell space available is achieved by housing the entire tilting actuation system under the floor.

Another component that is directly derived from the ETR 460 is the bodyshell. This takes advantage of the large aluminium extrusion technology allowing the maximum use of the loading gauge dimensions and allows significant weight saving, thus producing a very low axle weight, permitting increased speed on the existing networks

The aerodynamic design of the train has been conceived by the famous Italian designer Giugiaro, to minimise the air resistance of the trains which has been rigorously tested in Fiat's Research Centre wind tunnel.

The cab front in a composite material is



mounted on a carrying structure in light alloy guaranteeing the safety of the structure in case of collision at very low speed.

The driving cab is ergonomic and comfortable. Train personnel are not affected by any strong lateral accelerations since all of the Pedolno vehicles tilt, giving the same comfort level for all.

The train is equipped with first and second class seating, respectively 2 + 1 and 2+2. The seats can all be reclined giving excellent comfort.

The bar/restaurant, telephones and in-seat audio system help to achieve the highest possible service standard.

Particular attention has been given to minimise the effect of pressure waves in the train compartment. Thanks to its particular air conditioning equipment, Fiat has been able to produce a pressure tight train thus avoiding this possible discomfort.

Each coach is equipped with closed circuit toilets (1 in first class and 2 in second class). The train is also equipped with amenities for the disabled, including a specially equipped toilet.

The nine coaches are, 3 first class (top), 5 second class (tourist) and 1 bar/restaurant car.

In order to meet the extremely challenging target of running on a particularly tortuous line at high speeds, the bogie of the ETR 460 has been specifically modified. Thanks to a very low axle

Previous page: Test train passing through Frütigen station during test runs to Kandersteg.

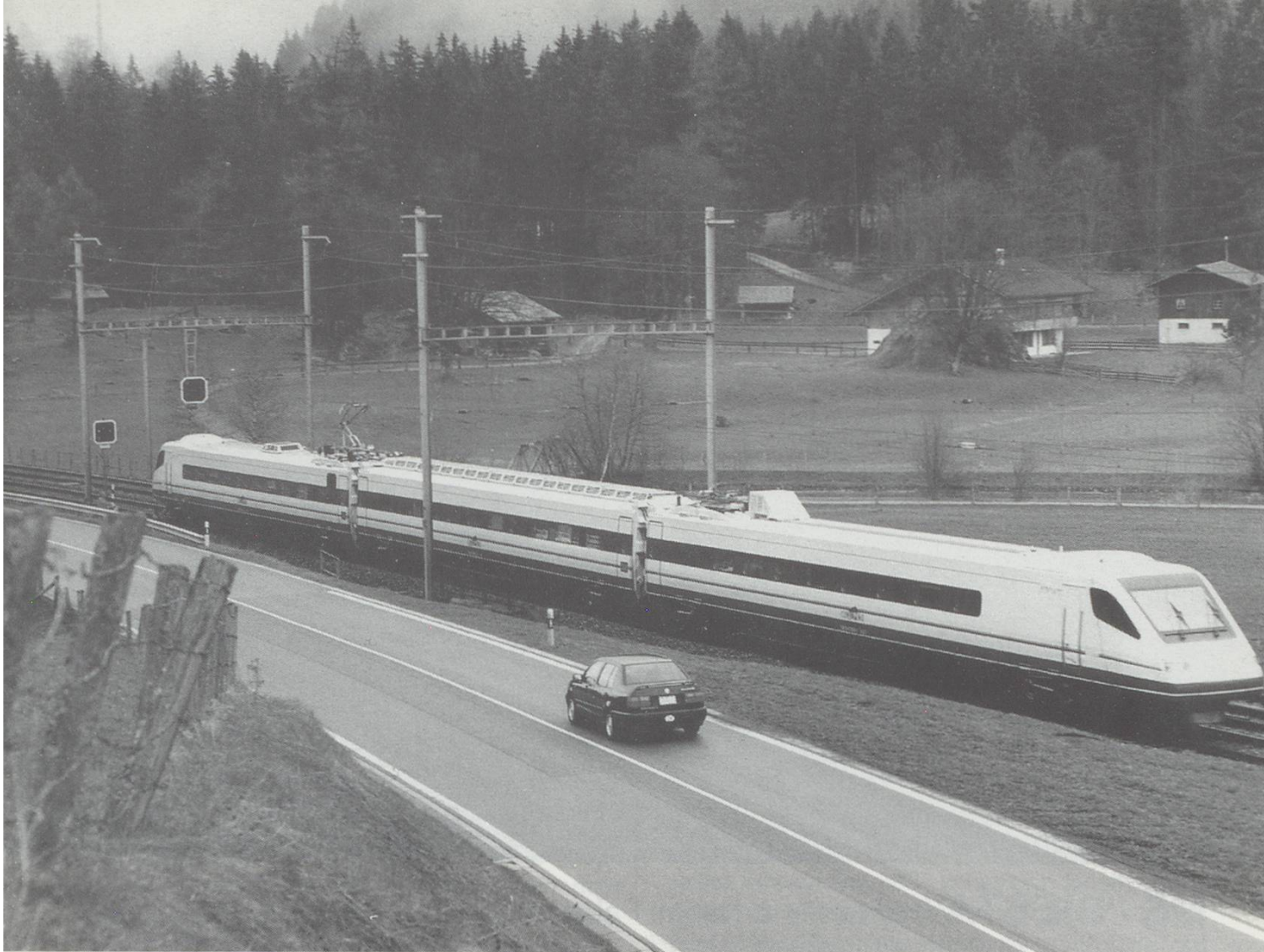
Above: Leading bogie with wiring linked to onboard computers during tests. Photos: 24/4/96 Les Heath

weight and to the exclusive axle-box to bogie frame connection the axle is able to dispose itself radially in curves, thus the bogie enters the curve with a very reduced attack angle. (Self steering axles in the bogies) This allows the train to run at higher speeds on sharp curves whilst substantially reducing track wear and tear. Thanks to all the above, the ETR 470 is able to increase the running speed not only in curves but also on straight sections, thus giving overall time savings on journeys, without any need for major infrastructure costs.

Both the primary and secondary helicoidal suspensions afford the highest possible safety against derailment, while giving top class comfort levels.

The motor and trailer bogie structure is identical and interchangeable. The basic bogie is fitted with three disc brakes while the motor has two discs to allow for the installation of gearboxes.

Thanks to its active tilting system (developed from the APT, BR) higher speeds in curves and improved passenger comfort is achieved. The



system makes it possible to tilt the body by 8°. The first vehicle tilts as soon as the system 'reads' the curve, while for the remaining coaches the command is calculated by the computerised system according to the curve information and the actual speed of the train. The body control and actuation system comprises a MASTER microprocessor electronic control unit which acquires information from the various transducers installed on the first vehicle front bogie and calculates the body's angle of inclination. The angle signal is used to pilot the hydraulic valves acting as hydraulic cylinders, causing the body to tilt. The MASTER control unit, in addition, sends the speed and angle data to SLAVE electronic control units positioned on each intermediary and terminal vehicle. This information is then processed by various SLAVE processors, generating the effective tilt angle for the vehicle involved at the appropriate moment.

The firm CISALPINO AG is the first European shareholding company to operate its own high-speed trains on transalpine routes. Founder members of this public limited company under

Above: The Pendolino on test between Kandersteg and Frütigen on 24th April 1996, note different coloured pantographs.
Photo: Les Heath

Swiss law, are the Italian State Railways (FS), the Swiss Federal Railways (SBB) and the Bern-Lötschberg-Simplon Railway (BLS).

To date Cisalpino AG has ordered nine ETR 470 sets, these are to run between Geneva-Milan, Basel-Milan via Brig and Zurich-Milan via the Gotthard route.

Some facts and figures:

Interior	Pressurised, air conditioned
Seats	490 (booking obligatory)
Top speed	200 km/h
Builder	Fiat Ferroviaria S.p.A. -Savigliano
Design	Giugiaro Design, Turin
Service	Rail Gourmet Swissair, Zurich

The pantographs are two different colours the Swiss one is silver, and the Italian one is red, presumably to help drivers and maintenance personnel get it right?