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RegioPanter EMUs

On 14 February 2011 České dráhy and ŠKODA VAGONKA signed a contract worth 2.5 billion CZK (100 million EUR) for a batch of single deck EMUs. These have the works designation 7 Ev. The order comprises 15 three-car and four two-car trains. 12 of the three-car ones will be 3 kV DC only, the remainder, including all the two-car trains, will be dual voltage (3 kV DC and 25 kV AC 50 Hz).

Development

The vehicle design stems from a new project started in late 2009 with the objective of extending the ŠKODA VAGONKA EMU range, which is based on the Class 471 double deck trains, and types derived from these for sale to Ukraine, Lithuania and Slovakia. Similarly, it was planned to make the new single deck design available both for the domestic market and for export. A decision was taken to develop a non-articulated train, with each car mounted on two bogies, rather than an articulated one using Jakobs bogies. The design of the new family of trains was developed by the members of the ŠKODA TRANSPORTATION Group, in this instance involving participation of ŠKODA VAGONKA, ŠKODA TRANSPORTATION and ŠKODA ELECTRIC. However various other companies were also involved in the project, namely:

- VÚKV, which carried out the development work for selected structural components, in particular the basic bodysell construction and main crossbeams, this work involving the calculations of structural strength and crashworthiness, the design of the cabs and the inter-car connections, and the realization of certain tests;
- Inter-Informatics, whose design offices in Praha, Plzeň and Trenčín (Slovakia), provided the construction of the car interiors, except the driving cabs. This company worked according to the specifications laid down by the designer, and developed the pertinent documentation for specific features, such as inner panelling, entrance vestibules, flooring, and plumbing;
- VKV Praha designed the WC cubicles, and specifically the treatment of water and effluents;
- MOSLED, České Budějovice, was involved in developing the driving cabs;
- Electrical Engineering, Plzeň, was involved in developing the documentation for wiring and for cabling ducts within the cars.

The first order for the new trains came, as mentioned above, from ČD, which invited tenders in September 2010. The results from this were announced in February 2011. The trains are co-financed by EU regional development programmes. Deliveries are scheduled to run from the second half of 2012 to spring 2014. The timescale is rather brief, given the fact that trains of a completely new development are involved [1].

Under the Czech classification system, the type ŠKODA 7 Ev EMUs are designated Classes 650 (two-car dual-voltage), 640 (three-car dual-voltage) and 440 (three-car 3 kV DC). On 22 July 2011 ŠKODA announced the results of a competition organized in spring that year for the naming of the new trains. 10, 518 suggestions were submitted and the most popular one, for three reasons, was RegioPanter. This follows on from the CityElefant brand name for the Class 471 suburban EMUs, maintaining the animal theme. It also indicates the type of ser-



RegioPanter three-car unit Class 640, dual system

RegioPanter (Factory Designation Type 7 Ev): Principal Technical Data			
ČD Class Designation	440	640	650
Number Of Trains Ordered In ČD's 2011 Contract	12	3	J4f
Track Gauge	1,435 mm	1,435 mm	1,435 mm
Axle Arrangement	Bo'2' + Bo'2' + 2'Bo'	Bo'2' + Bo'2' + 2'Bo'	Bo'2' + 2'Bo'
Individual Car Class Designation	440/442/441	640/642/641	650/651
Manufacturer's Car Designation	HV4/W/HV2	HV1/W/HV3	HV1/HV2
Power Supply System	3 kV DC	3 kV DC, 25 kV 50 Hz	3 kV DC, 25 kV 50 Hz
Maximum Speed	160 km/h	160 km/h	160 km/h
Nominal Output	2,040 kW	2,040 kW	1,360 kW
EDB Output — Recuperative/Resistance	2,205/1,695 kW	2,205/1,695 kW	1,470/1,130 kW
Maximum Tractive Effort	196.5 kN	196.5 kN	131 kN
Length Over Couplings	79,400 mm	79,400 mm	52,900 mm
Car Length — End/Intermediate	26,450/26,500 mm	26,450/26,500 mm	26,450/26,500 mm
Distance Between Bogie Centres	19,000 mm	19,000 mm	19,000 mm
Bogie Wheelbase — Powered/Non-Powered	2,400 mm	2,400 mm	2,400 mm
Bodyshell Width	2,820 mm	2,820 mm	2,820 mm
Height Above Rail Top	4,260 mm	4,260 mm	4,260 mm
Floor Height Above Rail Top	580, 1,050, 1,160 mm	580,1,050,1,160 mm ^	580, 1,050, 1,160 mm
Low Floor Section Length (% Of Total Length)	61%	61%	64%
Wheel Diameter (New/Worn)	850/770 mm	850/770 mm	850/770 mm
Minimum Curve Radius Negotiable	90 m	90 m	90 m
Weight In Working Order	144 t	152,5 t	102,8 t
Second Class Seats	56/94/82	56/94/82	56/82
First Class Seats	9	9	9
Standeese	92/86/78	92/86/78	92/78
Wheelchair Harness Points	2	2	2
Pram Storage	in each entrance vestibule, number according to size		

vice (middle distance) on which the new trains will be used. However "pantak" is a colloquial Czech noun for an EMU, and is vaguely similar to the Czech noun "panter" (panther).

Historically, these are the first single deck middle distance EMUs to be built for the Czech state operator since 1978, when deliveries of the Class 460 3 kV DC EMUs terminated. These trains are now over 34 years old. Over four decades have elapsed since the last 25 kV AC EMUs were delivered to the then ČSD, and these were the Class 560s, built in 1970–71. Thus the RegioPanter will only be the second type of middle distance EMUs owned by ČD capable of operating off 25 kV 50 Hz (as are the Class 671 EMUs recently built for ZSSK in Slovakia).

Technical Description. The Concept

The RegioPanter are designed for middle distance and suburban services on the 1,435 mm gauge network, under temperatures ranging from -25 to +40 °C. Their maximum speed is 160 km/h, and they are designed so that up to four trains can be operated in multiple, when passenger demand is heavy. The trains have distributed traction: each car, including the intermediate ones, has one powered and one non-powered bogie, thus giving an axle arrangement of Bo'2' for each vehicle. The result is that a two-car train can offer the same level of traction performance as a three-car one.

The two main differences between the possible versions of the train are the type of traction equipment installed (for 3 kV, or 3/25 kV operation), and the types of cars incorporated [2]. There are four types of end car and one type of intermediate car, in

all, five types of vehicle. ŠKODA designates the end cars HV1, HV2, HV3 and HV4, and the intermediate one, VV. The design is based to a large extent on the use of the same construction concept and elements in each car. There are only certain differences, reflecting the types of individual components fitted. It should be noted that ČD designates the trains according to class, and also sub-designates the various cars according to class. As a result:

- **HV1** end cars are the first end cars used on two- and three-car dual-voltage EMUs, and are fitted with all the traction equipment required for operation off 3 kV DC and 25 kV AC. The HV1s are designated Classes 640 (three-car trains) and 650 (two-car trains), thus determining RegioPanter EMUs designation according to the ČD's train classification system;
- **HV2** end cars are the second end cars on Class 650 (two-car) EMUs. They are designated Class 651. However, HV2s are also the second end cars of the Class 440 EMUs (three-car 3 kV DC only), and in these trains are designated Class 441. They are fitted with traction equipment, but lack pantographs and a main switch. They are thus linked by a 3 kV DC power line from the HV1 or HV4 end cars;
- **HV3** end cars are the second end cars on Class 640 three-car dual-voltage EMUs and according to the ČD's train classification system they are designated Class 641. They are equipped with traction equipment without a pantograph and a main switch, but are provided with a traction transformer. The power is supplied from the HV1 end car by means of a roof-mounted 25 kV cable running the length of the train;
- **HV4** end cars are the first end cars on the Class 440 three-car 3kV DC trains, and are designated as such — Class 440.

They are fitted with a complete range of traction equipment, including pantographs and a 3 kV DC main switch;

- **VV** are the intermediate cars in the three-car EMUs. They are mounted on one non-powered and one powered bogie. The pair of traction motors in the latter is fed from a roof-mounted traction converter. In the Class 440 trains these cars are designated Class 442, and are fed with tractive power from a 3 kV DC cable running from the HV4 end car. In the Class 640 trains the intermediate cars are designated Class 642 and are fed by a similar 3 kV DC cable running from the HV1 end car. Moreover they are also fed with power from a roof-mounted 25 kV AC cable running from the traction transformer in the HV3 end car.

The above-mentioned car types can be used to create also a four-car unit, using two end cars (as in the case of the three-car version) and two intermediate ones. This is the maximum possible trainset length, and each train will still only have one pantograph.

LITERATURE

1. *RegioPanter EMUs / Tomáš Kuchta, Jaromír Pernička // Railvolution. — 2012. — № 5/12. — Pp. 54–67.*
2. *Internet source: <http://www.skoda.cz>.*

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