

Petr Kadeřávek

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The First Estonian FLIRTs

On 13 December 2012 Elektriraudtee and Stadler celebrated the official presentation of the first electric and diesel FLIRT multiple units in Estonia, the ceremony taking place in the railway company's Pääsküla depot, in the southwestern suburbs of Tallinn.

The trains have not yet been officially handed over, but this was first occasion when both EMU and DMU FLIRTs were present in the country: EMU 1401 arrived in Estonia on 17 November and DMU 2404 on 10 December 2012. The timing of the event lent itself to celebrations, because by coincidence, that same day, Stadler signed a contract with Łódzkiej Kolei Aglomeracyjnej (ŁKA) for 20 FLIRT EMUs, so during his speech, Peter Jenelten had yet another reference to mention when describing the success of the FLIRT family [1].

Elektriraudtee awarded Stadler a contract for 18 EMUs and 20 DMUs, signed in August 2010. The EMUs cost around 80 million EUR, of which 85% is financed from the EU's Cohesion Fund. The DMUs cost 96.3 million EUR, and they are being financed by a capital loan, shouldered by Bussnang-based Estonia Train Finance, a company created for the sole purpose of this transaction. Refinancing is tailor-made, involving private investors and a reputable bank. Elektriraudtee is repaying the loan by monthly installments.

Elektriraudtee ordered 12 three-car and six four-car EMUs, and six two-car, eight three-car and six four-car DMUs from Stadler. On account of their lightweight aluminium structure, modern energy-saving systems and reduced maintenance costs, the new trains will result in substantial cost savings for the operator. The FLIRTs are equipped with regenerative braking, the power being used to power on-board systems or fed back into the overhead wire. The cab design is modern and ergonomic, thus offering drivers a considerably more attractive working environment than that found on the operator's older trains. The installation of the Estonian V.E.P.S. ATP system

enables driver-only operation. This is currently possible with the existing EMUs, but for DMUs some more trackside equipment needs to be installed first.

Both the three- and four-car versions of the EMUs will have a continuous power rating of 2,000 kW and a maximum one of 2,600 kW. The Estonian rail network is electrified at 3 kV DC, so the design of the trains involved blending experience gained from developing features of the wide-bodied 1,524 mm gauge 25 kV AC FLIRT EMUs built for use in Finland and intended for work in severe winter weather with technology borrowed from the numerous 3 kV DC FLIRT EMUs built for use in Italy, the Czech Republic and Poland. Experience gained from building, testing and operating the NSB FLIRTs was also useful. All versions, both EMU

and DMU, will have a top speed of 160 km/h. The EMUs will have an acceleration rate of 1.2 m/s², and the DMUs will have one of between 0.85 and 1.0 m/s². The existing elderly Class ER2 EMUs are only capable of accelerating at 0.6 m/s².

The four-car EMUs are 75,040 mm long over couplings, have a tare weight of 142 t, and are fitted with 274 seats. The four-car DMUs are 74,320 mm long over couplings, have a tare weight of 159 t, and are fitted with 214 seats (166 in second class).

The three-car EMUs are 57,750 mm long over couplings, have a tare weight of 119 t, and are fitted with 196 seats. The three-car DMUs are 59,895 mm long over couplings, have a tare weight of 136 t, and are fitted with 161 seats (137 in second class).



The first Stadler FLIRT train arrived to Tallinn

The two-car DMU is 45,470 mm long over couplings, has a tare weight of 116 t, and is fitted with 105 seats, of which 89 are in second class. Both DMUs and EMUs, regardless of length, have 12 tip-up seats in second class, in a multi-purpose area. Only the DMUs have first class seating areas, since these trains will generally be used on longer journeys.

Elektriraudtee's ubiquitous Class ER2 EMUs weigh around 1881 tare, and have 292 seats. That gives a weight per seat of around 645 kg. By way of comparison a four-car FLIRT EMU has a significantly lower weight per seat of around 518 kg — and that includes the extra weight of on-board equipment such as air conditioning units and passenger information systems.

The DMUs are the very first diesel FLIRTs that Stadler has built, an important milestone for the manufacturer. They incorporate a similar design to that adapted for the earlier GTW DMU family. The prime mover and associated propulsion equipment are housed in a short section known as a FLIRT Powerpack, which on account of its weight is mounted on two Jakobs bogies, shared with the adjacent cars. This section has an aisle on its centreline, and on either side of this there are the prime movers, a pair of 671 kW Cummins QSK23 engines, giving a total power rating of 1,342 kW.

Only one FLIRT Powerpack will be required, regardless of train length. This will result in a remarkably powerful two-car DMU. However to give the four-car version sufficient power for lively acceleration, this version is to be equipped with super capacitors, situated on the roof of each end car, and they will be able to offer a power boost of up to 400 kW. The FLIRT



The interior of the Estonian FLIRT train

Powerpack configuration enables Stadler to create an electro-diesel multiple unit easily. With only the leading and trailing bogies being powered, and the traction equipment distributed along the roof, all that has to be done is to couple the FLIRT Powerpack section within an EMU, and adjust the power transmission accordingly.

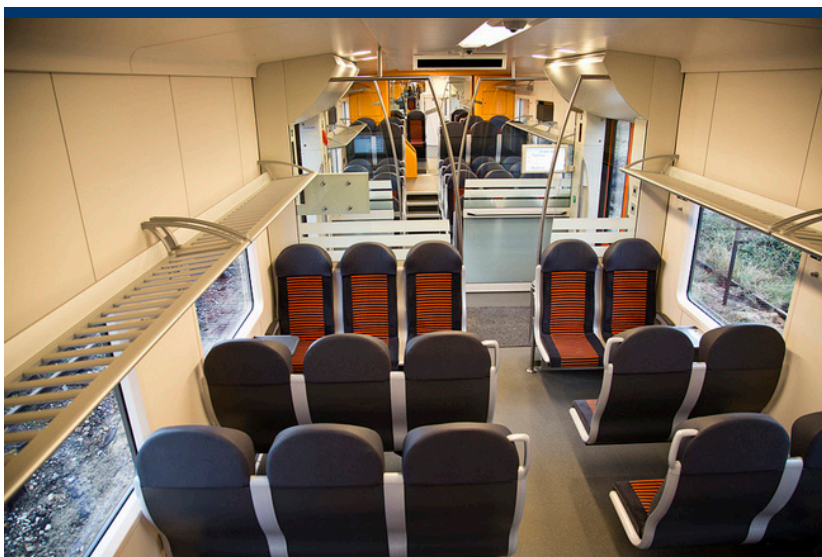
For rail passengers in Estonia the FLIRTs will bring a great improvement in travel comfort. Their arrival in the country has created a degree of national interest; the Estonian Post Office has even issued a special stamp showing a FLIRT on it. All trains will be equipped with information systems, air-conditioning, CCTV and free wireless internet and power sockets in all cars. Moreover, since the number

of new trains will be greater than that of those being displaced, Elektriraudtee will step up service levels when the whole batch has been delivered.

Each train, regardless of length, has a multi-purpose area, equipped for wheelchairs, luggage, prams, and bike racks, and adjacent to this there is a spacious wheelchair-accessible WC cubicle. The entrance doors accessing this area are fitted with electrically operated wheelchair ramps. Each car has one pair of double-leaf, 1,300 mm wide entrance doors, accessing vestibules whose floor is 580 mm above rail top, thus being suitable for station platforms on the Estonian network. As in other ex-Soviet countries, Estonia had station platforms which were between 1,100 and 1,300 mm high, but these have been reduced to just 550 mm above rail top in a rebuilding programme realized by infrastructure manager. Above the bogies of the FLIRTs floor height rises to 1,170 mm above rail top.

The wider loading gauge in Estonia means that the FLIRTs have been built with wider bodyshells — 3,500 mm, and vehicle height above rail top is a generous 4,500 mm — compare the standard European FLIRT which is 2,880 mm wide and 4,150 mm high, or the NSB ones, which are 3,200 mm wide and 4,035 mm high. One result is that second class seating can be arranged in a 3 + 2 configuration, and in 2 + 2 in first class. In rows in second class the distance between seat backs is 825 mm, and in bays, 1,750 mm, and in first class, 1,000 mm and 2,000 mm, respectively. The seats in second class are 460 mm wide, in first, 500 mm wide.

First class passengers are also provided with individual at-seat power sock-



The second class seating area



The exterior of the Estonian FLIRT

ets, these found in pairs under each seat unit. In second class there are two sockets situated only adjacent to the rubbish bins, which are positioned in seating bays underneath the window. The first class accommodation on the four-car DMUs is situated at both extremities of the train, between the electrical equipment cabinet and the entrance doors, in three- and two-car DMUs at one end only. In the two-car DMU the first class saloon is somewhat smaller than on the longer trains, since this end car has the multipurpose area and wheelchair-accessible WC cubicle. These facilities are situated in the intermediate car in all longer FLIRTs.

Apart from certain other details, the interior arrangement and fittings are basically identical for both the DMUs and EMUs. There is just one substantial structural difference, as the intermediate cars of the DMUs are shorter than those of the EMUs. All vehicles are fitted with a fire and smoke detection system, and the DMU's Powerpack section also has a fire extinguishing system. There are no tunnels on the Estonian rail network, so no comprehensive fire extinguishing system is required, or has been installed. There are however conventional hand-held fire

extinguishers underneath the seats, four of them in each of the end cars and two in each intermediate car.

According to the contract terms, Stadler has to hand over the first EMU ready for commercial service by June 2013. This means that authorization has to be completed by then. To obtain this, the trains are to be tested by the TJA (Tehnilise Järelevalve Amet — Estonian Technical Surveillance Authority), which will work together with Elektriraudtee and Stadler. Deliveries of further FLIRTs will continue regularly during the authorization period. In fact the second EMU arrived in Estonia on 13 December 2012. Production plans envisage first the construction of all the four-car EMUs and DMUs, with one of each of the shorter types of train being produced first, for testing purposes, the reminder following on after the four-car ones.

Commissioning of the trains and mounting on 1,520 mm bogies is done at Stadler's commissioning base at Małaszewicze, which is linked by 1,520 mm gauge track to the Belarus rail network. The trains then continue their delivery journeys via Brest, into Belarus and Russia and finally into Estonia via the border crossing at Pechory/Kuldula.

A six-month period of test operation of the EMUs, without passengers being carried, was scheduled to start in January 2013. The duration of the test period is specified by TJA. Not only the technical characteristics of the trains are to be tested and observed, but their adaptability to the Estonian winter climate and the rail network infrastructure has to be assessed, too. Elektriraudtee plans to put the EMUs into commercial service on 28 June 2013, as soon as authorization has been granted. The last of the EMUs is scheduled for handing over in January 2014.

For the DMUs, the six-month authorization testing period stipulated by TJA is planned to start on 8 March 2013. However the testing procedures of EMUs and DMUs are expected to run parallel. The DMUs will start carrying passengers on electrified lines in August 2013 and on 1 January 2014 on non-electrified lines. The FLIRT EMUs and DMUs can be operated together in multiple. This will prove useful, because until the end of 2013 services on the non-electrified lines to be served by the DMUs will be still operated by Edelaraudtee, using Class DR1B DMUs. Elektriraudtee will take these services over on 1 January 2014, by Government order.

The four-car DMUs will be used on the lines with highest patronage levels, such as those radiating from Tallinn to Tartu and Viljandi. The two-car DMUs are to be used in more rural areas of Estonia, on lines such Tartu — Piusa, Lelle — Parnu and Tapa — Narva. The last DMU is scheduled for delivery by June 2014, and as of the 20th of the month the entire FLIRT fleet will be in service. Not one of the operator's older trains is expected to remain in operation after that date.

LITERATURE

1. *The First Estonian FLIRTs* / Petr Kadeřávek // *Railvolution*. — 2012. — № 6/12. — Pp. 24–26.

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