



## CLASS 93 TRI-MODE LOCOMOTIVE

Rail Operations (UK) Limited, United Kingdom

In early 2021, Stadler and the British company, Rail Operations (UK) Limited signed a framework agreement for the supply of thirty Class 93 tri-mode locomotives with an initial batch of ten locomotives. The Bo'Bo' mixed-traffic locomotives are based on Stadler's Class 68 and Class 88 locomotives. They reach a maximum speed of 110mph. Future-proofed, their innovative hybrid coupler enables coupling via a draw hook and through automatic coupling.

Stadler's first tri-mode locomotives have three different power sources, and in electric mode, can run on 25kV AC overhead lines with a power up to 4,000 kW. Under certain conditions, they can reach 4,600 kW in boost mode. They also feature a Stage V 900 kW-engine and two Lithium Titanate Oxide (LTO) traction battery packs, allowing the operations on non-electrified lines. The battery packs provide 400 kW extra power to supplement the engine when the locomotives are running in diesel/battery hybrid mode. The batteries can also work alone, enabling carbon-free operations. The advanced locomotives will significantly reduce emissions of core pollutants and of greenhouse gases for both rail freight as well as potential passenger transport services, supporting net zero targets in the UK. They also include efficiency features to minimise energy consumption. Class 93 locomotives underscore Stadler's green credentials.

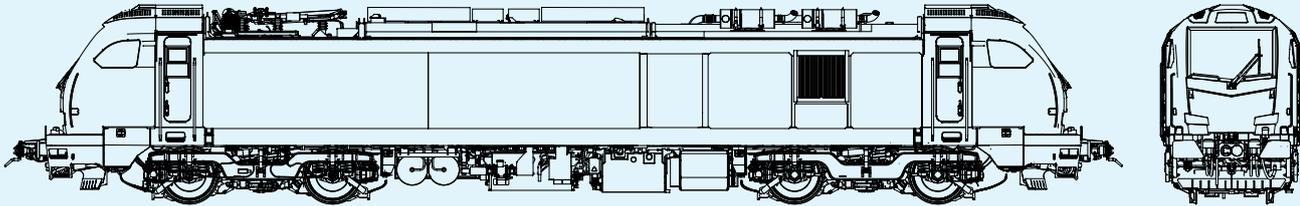
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## Technical features

### Technology

- Applications: rail freight and passenger operations
- Based on Stadler's Class 68 and Class 88 locomotives
- Efficient AC traction system with IGBT, one inverter per axle
- High-performance electric brake with energy recovery
- Two Lithium Titanium Oxide (LTO) traction batteries
- Lightweight monocoque structure made of carbon steel, high strength steel and oxidation-resistant steel
- Train heating system: AC HEP
- Able for multiple unit operation coupled with another locomotive in tandem with a master cab
- Hybrid coupler: draw hook and automatic coupler

### Comfort / Personnel

- Two driver's cabs with HVAC and universal central desk designed according to safety and ergonomic criteria
- High cab comfort and visibility, beyond TSI requirements
- Full cab insulation
- Additional foldable seat for driver assistant available

### Reliability / Availability / Maintainability / Safety

- EC 26/2004 Stage V compliant
- Decreased environmental footprint
- LED lighting
- Designed to minimize downtimes during maintenance tasks
- Equipped with remote diagnosis system and fuel consumption estimator
- Equipped with several safety, security and cybersecurity measures

## Vehicle data

<b>Customer</b>	Rail Operations (UK) Limited
<b>Operation area</b>	UK
<b>Number of vehicles</b>	Up to 30
<b>Commissioning</b>	2023
<b>Track gauge</b>	1,435 mm
<b>Axle arrangement</b>	Bo' Bo'
<b>Locomotive type</b>	Tri-mode: electric / diesel / batteries
<b>Supply voltage</b>	25 kV AC
<b>Diesel engine</b>	CAT C32, Stage V
<b>Traction batteries</b>	2 x LTO
<b>Power</b>	E: 4,000 kW E boost mode: up to 4,600 kW D: 900 kW Batt: 400 kW Hybrid: 900 + 400 kW
<b>Transmission</b>	AC / AC
<b>Length over coupling</b>	20,500 mm
<b>Carbody width</b>	2,690 mm
<b>Starting tractive effort</b>	290 kN
<b>Coupler</b>	Hybrid
<b>Maximum speed</b>	110 mph (177 km/h)
<b>Fuel tank</b>	3,200 litres
<b>Brake system</b>	Mechanic: pneumatic Dynamic: regenerative
<b>Suspension</b>	Primary: Coil springs Secondary: Coil springs Vertical and transverse dampers