

## Sweden – Arlanda EMU's ... ONIX 1500



### ONIX for Arlanda EMU's

- 28 cars
  - 14 ONIX inverters
  - ONIX 1500
- AC inverter  
and 4-Quadrant converter

### Contract overview

ALSTOM is a partner in the Arlanda Link Consortium, responsible for the construction of the rail link to the airport, with a 45 year operating concession from the Swedish Government. These high-speed EMU's are for service on the 40 km route between Stockholm Central Station and the new stations at Arlanda International Airport. The trains are designed for speeds of 200 km/h and offer a high standard of passenger comfort, each trainset seats 190 people and provides a reduction of 20 minutes journey time on the present service.

### ONIX flexible package

**15kV ac. 162/3 Hz supply.** For this supply, ALSTOM uses a main transformer, a 4-Quadrant converter and a standard ONIX 1500 module which is specifically adapted for the 15kV supply and which is proven in service. ONIX 1500 is running on Barcelona Metro and also on the TER-2N bi-level, dual voltage EMU in France.

### Reliable service

ALSTOM's use of **IGBT technology** ensures a low component count. This has the overall effect of reducing volume and increasing reliability with the added benefit of a big reduction in maintenance. Ease of maintenance was a key issue, to ensure a high availability of trains throughout the 45 years of service running.

### ONIX design for high speed

Departures are scheduled for every 15 minutes throughout the day, running in mixed traffic on existing track and capable of achieving speeds up to 200 km/h. The ONIX high-performance specification can meet and exceed this requirement.

### ONIX design for comfort

The passenger environment required from the trains is similar to airline business standards, offering a high degree of comfort and low ambient noise levels. The ONIX 1500 is underfloor mounted.

### Electromagnetic compatibility

In order to maintain electromagnetic compatibility (EMC) with existing systems. 4-quadrant converters were offered as the best solution to eliminate interference with neighbouring systems, including the airport navigation systems. The propulsion equipment comprises two interlaced 4-quadrant, single phase bridges which provides a stabilised 1700 V dc link supply to the 3-phase inverter. The interlacing reduces the effect of harmonic currents in the 15kV catenary supply.

### Arduous operating environment

The traction system is able to withstand temperatures as low as -40°C rising to + 35°C. The case and its equipment is carefully specified to ensure correct operation under extreme conditions.

**ALSTOM**

**Operational specification**

Operator: A-Train AB  
 Carbuilder: ALSTOM Transport  
 Line gauge: 1435mm  
 Line voltage range: 12-17kV 16<sup>2</sup>/3Hz  
 Line length: 40 km  
 Number of trains: 7  
 Number of cars: 28

Traction range: ONIX1500  
 Number of stations: 3  
 Type of vehicle: EMU  
 Train consist: ( DM-T-PT-DM )  
 Axle load: 15 tonnes  
 Power collection: Pantograph

\*Driving Motor Car -Trailer Car - Pantograph  
 Transformer Car - Driving Motor Car

Maximum tractive power: 2.2 MW  
 Maximum electric braking power: 2.7 MW  
 Maximum starting tractive effort: 146 kN  
 Maximum design speed: 200 km/h  
 Maximum design acceleration: 0.7 ms<sup>-2</sup>  
 Maximum design braking rate: 1.0 ms<sup>-2</sup>

**PROPULSION**

ONIX IGBT 4-Quadrant converters and inverter with rheostatic chopper and regenerative braking.

**CONTROL**

AGATE 32 bit microprocessor control  
 -Performance monitoring  
 -Slip/slide control  
 -Energy consumption recording

**TRACTION DRIVE**

4 x ONIX 3 phase AC asynchronous motors

**HIGH VOLTAGE**

Contactors  
 Crowbar  
 Tuned filter inductor

**Technical characteristics**

**IGBT Inverter**

Nominal dc input: ..... 1700 V  
 Peak accelerating current, rms: ..... 1250 A  
 Cooling: ..... forced air  
 Motor/inverter ratio: ..... 4:1  
 Modulation frequency: .. <2400 Hz

**Auxiliary Converter**

Nominal dc input: ..... 400 Vrms  
 16<sup>2</sup>/3Hz  
 Total output: ..... 2 x 97 kVA  
 400 Vrms, 50 Hz, 3 phase

**ONIX AC Motor**

Supply voltage: ..... 1325 Vrms  
 Nominal power rating: ..... 280 kW  
 Rated speed: ..... 3095 rpm  
 Maximum speed: ..... 5000 rpm  
 Cooling: ..... self-ventilation  
 Motors per axle: ..... 1  
 Class 200 insulation

**Dimensions and mass**

**Traction equipment case**

Length: ..... 4500 mm  
 Width: ..... 1800 mm  
 Depth: ..... 620 mm  
 Mass: ..... 2460 kg  
 Mounting: ..... underfloor

**Motor**

Mass: ..... 650 kg  
 Height: ..... 678 mm  
 Length: ..... 630 mm

**Propulsion performance**

