

## Portugal TAGE EMU's ... ONIX 1500



Thanks to the use of IGBT 3.3 kV, 1200A switching device, ALSTOM could provide a package that was:

**Competitive:** Cost-effective, economical to run and viable

**Superb car package:** Light, compact, weight sensitive which met the stringent load stress of the bridge.

**Reliable:** In-service experience worldwide, using a standard proven design.

**High performance:** Double deck vehicles are heavier, larger and required a more powerful higher voltage system to ensure good journey times – ONIX 1500 provided this.

**Flexible:** Provided the best solution versus many options e.g. GTO competitors did not have ALSTOM's IGBT technology. ALSTOM's solution provided a bi-level design with good weight tolerance; competitors could only provide a single level package.

**Local expertise:** ALSTOM's ability to work jointly with Portuguese companies on electrical casing, auxiliaries and the motor as well as testing "on-site" provided a truly local solution to a local problem.

### ONIX for Portugal TAGE EMU's

- 30 double-deck EMU's
- 4-car trainsets carrying 1310 passengers
- 120 ONIX 1500 inverters

### Contract overview

In 1996, ALSTOM in consortium with CAF, Spanish carbuilder, were contracted by the Portuguese National Railways and Gabinete do No Ferroviario de Lisboa to supply a fleet of double-deck trainsets for the city of Lisbon. The trains are designed for a new 18 km line running north-south, crossing the "25 April Bridge", linking the suburban rail network with Lisbon's metro system.

### Customer requirement

For the Consortium, the principal design requirement was to provide a rail system which would have maximum passenger carrying capacity and which would also respect the weight limitations of the bridge. ALSTOM were challenged with designing a traction package which would be:

Compact, lightweight and reliable and not expensive.

### ALSTOM technology breakthrough

ALSTOM's experience with the ONIX 1500 inverter on Barcelona Metro, SNCF and Arlanda meant that they were able to present a reliable, available drive system to meet the Portuguese Railway requirements.

**ALSTOM**

### Operational specification

Operator: Chemins de Fer Portugais (CP)  
 Carbuilder: CAF/ALSTOM  
 Line voltage range: 25 kV a.c. 50 Hz  
 Line length: 22 km  
 Number of trains: 18  
 Number of cars: 72

Traction range: ONIX 1500  
 Type of vehicle: Bi-level EMU  
 Train consist: 2M-2T  
 Axle load: 20 Tonnes  
 Maximum tractive power per motor car: 1738 kW  
 Maximum braking power per motor car: 2510 kW

Maximum starting tractive effort: 153 kN  
 Maximum design speed: 140 kmh<sup>-1</sup>  
 Maximum design acceleration: 0.94 ms<sup>-2</sup>  
 Maximum design braking: 0.6 ms<sup>-2</sup>

#### PROPULSION

1 ONIX IGBT Inverter with regenerative braking

#### CONTROL

AGATE 32 bit microprocessor  
 - Equipment performance monitoring  
 - Slip/slide control

#### TRACTION

2 x ONIX 3 phase AC Motors

#### HIGH VOLTAGE

Line inductor  
 Signalling current monitoring unit  
 Soft Crow-bar  
 Circuit breakers

### Technical characteristics

#### ONIX IGBT Inverter

Nominal DC input: ..... 1800 V  
 Peak accelerating current, rms: ..... 800 A rms  
 Cooling: ..... forced air  
 Motor/inverter ratio: ..... 2:1  
 Modulation frequency: ..... 600 Hz

#### ONIX AC Motor

Nominal power rating: ..... 375 kW  
 Rated speed: ..... 3357 rpm  
 Maximum speed: ..... 3495 rpm  
 Cooling: ..... forced  
 Motors per axle: .... 2 motors/bogie  
 Class 200 insulation

#### Dimensions and mass

##### Traction Equipment Case

Length: ..... 1950 mm  
 Width: ..... 2067 mm  
 Depth: ..... 950 mm  
 Mass: ..... 1100 kg

##### Motor

Rotor diameter: ..... 600 mm  
 Mass: ..... 1250 kg  
 Height: ..... 746 mm  
 Width: ..... 867 mm  
 Depth: ..... 921 mm

### Propulsion performance

