

London Underground – Northern Line ... ONIX 800



ONIX for Northern Line contract

- 106 new trains
- 424 ONIX inverters
- Long term maintenance
- Maximum availability

Contract overview

In 1995 ALSTOM won the contract to supply London Underground with 106 new tube trains for the Northern Line. Under the terms of the contract, ALSTOM is responsible for the provision and maintenance of a fleet of trains for 20 years, with options for 16 further years.

The overriding requirement therefore, was a safe and reliable system, easy to maintain and which would meet and exceed the demanding performance targets set by our customer. In collaboration with London Underground, we

selected a drive system from our ONIX 800 range using IGBT technology.

Systems approach to design

ALSTOM analysed the service pattern to determine the fleet size and train performance requirements. System assurance activities started as early as the tender stage and were fully integrated into the project. The project focused on:

- Systems design
- Reliability
- Ease of maintenance
- Management of risk

Built in reliability

As with all our customers, London Underground set stringent performance targets for daily availability of trains.

Reliability was therefore a critical project requirement.

ALSTOM's solution was to analyse the design at all stages – design, manufacture, test and in-service. The aim was to prove the reliability of the equipment by analysis and test rather than by numerical prediction alone.

Design for maintenance

Ease of maintenance was a principal design requirement. The components were analysed to determine repair or replacement levels and this determined "Line Replacement Units" or LRU's. LRU's were defined by weight, size, reliability, installation and time to fault find and repair. The main case layout design was focused around the LRU's to optimise access for removal and maintenance. It was revised several times to optimise access to equipment.

Systems compatibility

A comprehensive risk analysis identified key components and systems which were critical to the safe and reliable operation of the equipment. The systems were assessed based on their complexity, criticality, use of new or novel technology, the number of items per set and the component rating. The analysis focused on:

- Identification of potential safety issues.
- Rigorous analysis of all hazards.
- Modelling, simulation and testing of the traction drive to ensure signalling compatibility.

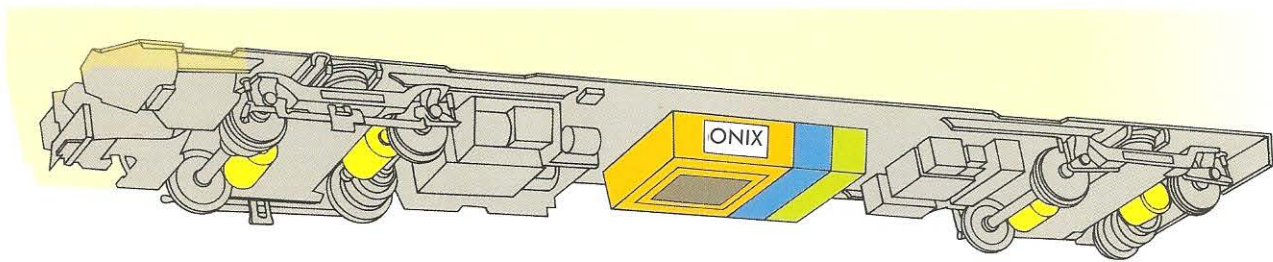
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Operational specification

Operator: London Underground Ltd
 Carbuilder: ALSTOM Transport
 Number of trains: 106
 Number of cars: 636
 Type of vehicle: Heavy Metro

Train consist: 6 car train configuration (M-T-M-M-T-M)
 Line gauge: 1435 mm
 Line voltage range: 400-800 V
 ONIX range: 800
 Line length: 37 km
 Number of stations: 32

Axle load: 7 tonnes MC,
 5.5 tonnes TC Tare
 Power collection: 3rd + 4th Rail
 Max design speed: 100 kmh⁻¹
 Max design acceleration: 1.3 ms⁻²
 Max design braking rate: -1.3 ms⁻²



PROPULSION

An ONIX IGBT inverter with rheostatic chopper and regenerative braking

CONTROL

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

TRACTION

4 x ONIX 3 phase AC asynchronous motors

HIGH VOLTAGE

Line inductor
 Interference current monitoring unit
 Crow-bar
 Circuit breakers

Technical characteristics

ONIX inverter

Range ONIX 800
 Nominal DC input 630 V
 Peak accelerating current, rms 1700 A
 Cooling forced air
 Motor/inverter ratio 4:1

ONIX motor

Nominal power rating 85 kW
 Rated speed 1892 rpm
 Maximum speed 4555 rpm
 Cooling self-ventilation
 Motors per axle 1
 Class 200 insulation

Dimensions and mass

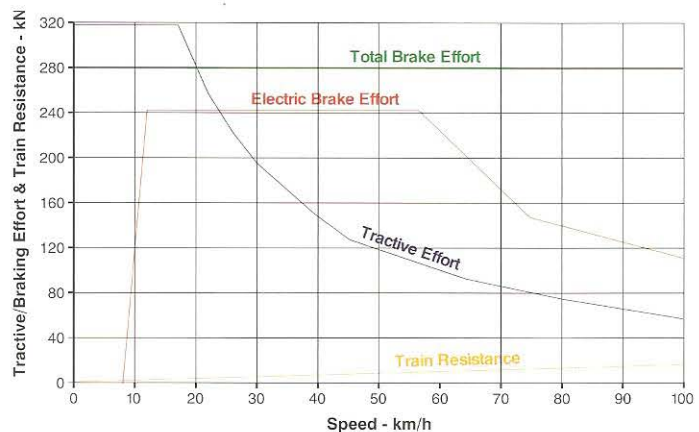
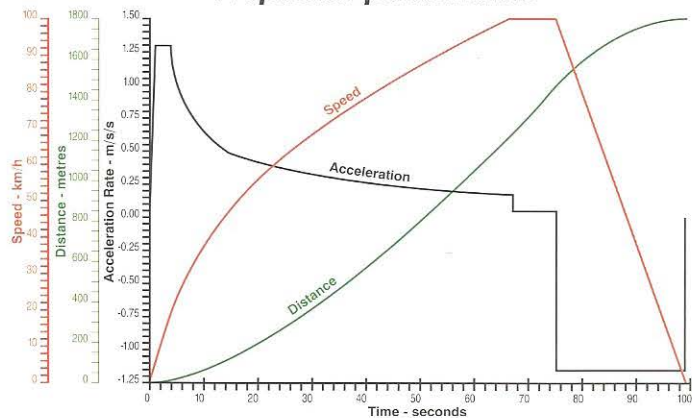
Traction equipment case

Length 3200 mm
 Width 2400 mm
 Depth 400 mm
 Mass 1250 kg

Motor

Rotor diameter 245 mm
 Mass 500 kg
 Height 420 mm
 Width 420 mm
 Depth 630 mm

Propulsion performance



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