

# MAINLINE ELECTRIC LOCOMOTIVE FOR NEW ZEALAND RAILWAYS CORPORATION



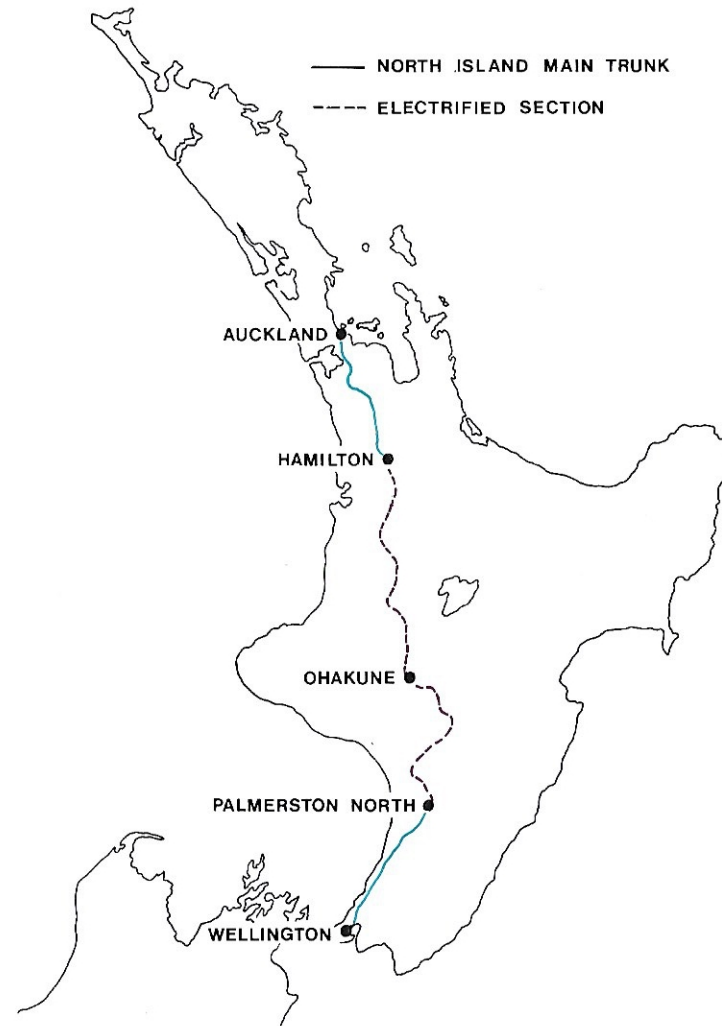
## NEW ZEALAND RAILWAYS CORPORATION

The North Island Main Trunk Railway of New Zealand consists of a single 1067mm gauge track which connects the cities of Wellington and Auckland and spans a total of 680 railway route kilometres.

The New Zealand Railways Corporation announced its intention to electrify the stretch between Palmerston North and Hamilton and for the first stage of this project up to Ohakune awarded to the Hawker Group companies contracts covering the system design audit and co-ordination, the supply of the signalling and communications equipment and the supply of the mainline electric locomotives.

Starting at Palmerston North at 30 metres altitude the line follows a fairly straight route on level track for a short distance before negotiating much steeper terrain and undulating country, with grades up to 1 in 70 and an altitude of 442 metres above sea level.

The contract awarded to Brush Electrical Machines covers the design, supply and on-site commissioning of 22 mainline electric locomotives with a twin cab, full-bodied configuration with six axle-hung nose-suspended traction motors developing 3000kW and mounted in a three bogie (Bo-Bo-Bo) configuration. The locomotives are designed in strict accordance with the New Zealand Railways Corporation's technical specification and embody the most modern traction equipment available.



## LOCOMOTIVE EQUIPMENT DESCRIPTION

The locomotive is of the monocoque body type with a driving cab at each end and a single arm, air-raised pantograph. It is designed to operate at a nominal line voltage of 25kV but can operate at any voltage within the range of 19kV to 28.5kV. Two locomotives can operate in multiple.

### Main Power Supply

Primary power supply is drawn from the 25kV 50Hz single phase a.c. overhead contact wire via the pantograph. The earth return path is through earthing brushes in the traction motor suspension tubes making contact with the axles. A supply from secondary windings of the main transformer is conducted to the d.c. traction motors via converters.

### Traction Motors

Each traction motor is of the four-pole axle-hung type. The six motors are connected in two groups of three, each group of armatures being controlled over the full voltage of the main transformer secondary windings by converters. The six phase winding of a motor/alternator set provides excitation for the traction motor fields via converters.

### Auxiliary Power Supply

The motor/alternator set powered from the main transformer tertiary windings provides the power for all auxiliaries and the traction motor fields. Supply for the auxiliaries is 230/400V 50Hz three phase.

### Battery Supply

Nickel Cadmium batteries for supplying the essential circuits are charged by the locomotive's battery charger, which is supplied from the main transformer tertiary winding and a step-down transformer.

### Air Systems

An electric motor-driven air compressor provides compressed air for the locomotive and train braking and the operation of control equipment. A main blower cools the transformer and convertor radiators and a traction motor blower at each end of the locomotive cools smoothing chokes and power correction reactors before reaching the commutator end of each traction motor.

## Braking System

Clasp type brakes provide braking on all wheels, the shoes being attached to hanger levers actuated by pneumatically-operated brake units which incorporate automatic slack adjusters. An electric regenerative system is also provided, serving mainly as a holding brake when descending long grades. Using the momentum of the locomotive/train, this system changes dynamic energy into electrical energy which is fed back into the overhead line.

## Driver's Cabs

Both cabs are identically equipped with the driver's seat and desk on the right hand side with the air brake levers placed for right hand operation and the master controller handles for left hand operation. The master controller is operated by selector, power and electric braking handles, mechanical interlocking of the handles preventing improper operation. The power handle controls the locomotive power/tractive effort in infinite steps. The selector handle controls the direction of travel and serves as a removable key. Only one selector handle is provided for each locomotive. The electric braking handle controls the degree of electric regenerative braking.

## LOCOMOTIVE TECHNICAL DATA

### Duty

- Mainline traffic duties.

### General Data.

- Single phase 25kV 50Hz overhead.
- Operating voltage range 28.5kV – 19.0kV.
- Wheel arrangement Bo-Bo-Bo.
- Track gauge 1067mm.
- Maximum speed 100km/h.
- Total locomotive weight 108 tonnes.
- Total traction motor rating 3000kW.
- Starting tractive effort 300kN.
- Continuous tractive effort 256kN at 42km/h.

### Power Control

- Thyristor convertor with phase angle control.
- Fully controlled two stage bridge for stepless tractive effort/regenerative braking control.

### Traction Motor.

- Axle-hung, nose-suspended.
- Compensated d.c. motor separately excited.
- Continuous Rating 500kW – 900V – 595amp – 910rpm.

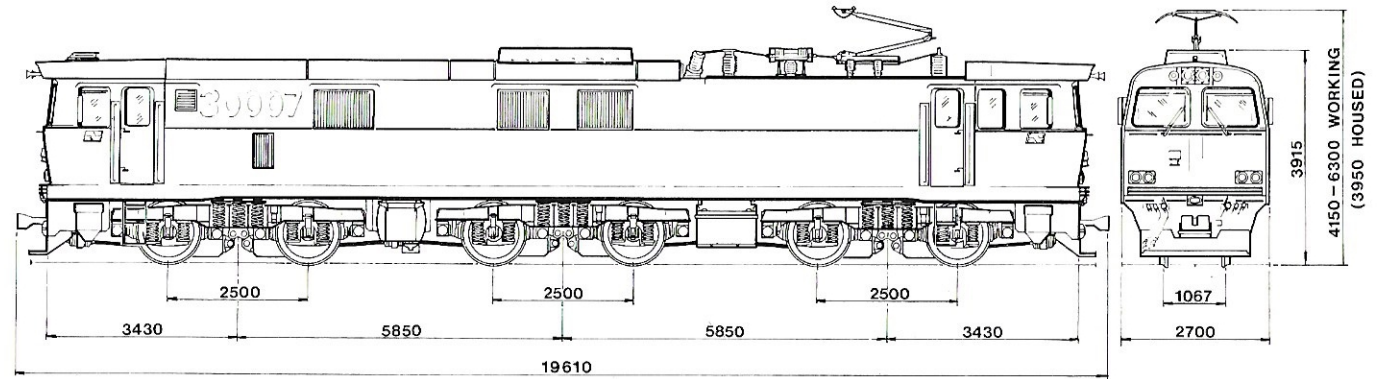
### Braking System

- Regenerative and direct air brake.

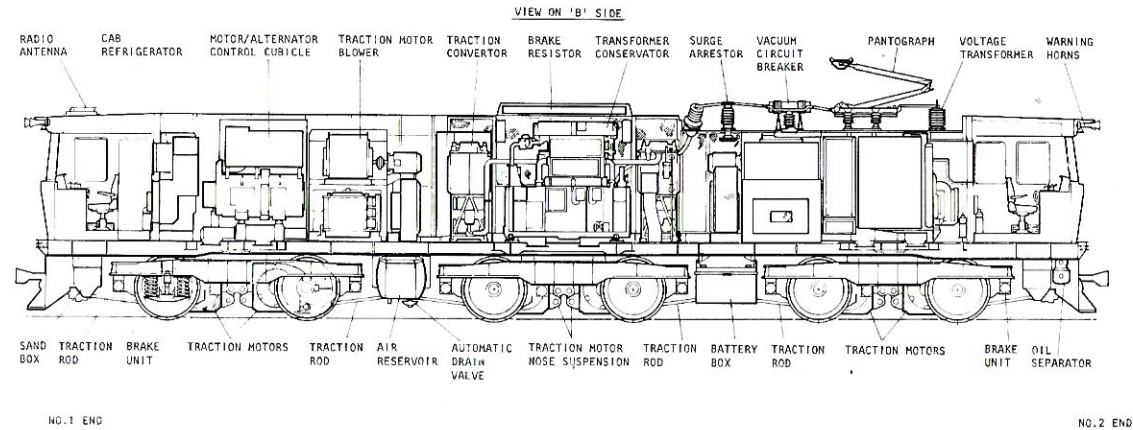
### Auxiliaries

- 400V – 3 phase

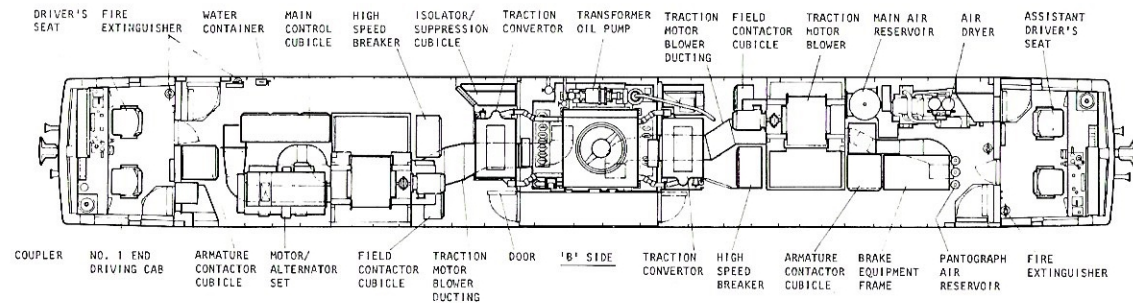
## GENERAL ELEVATION

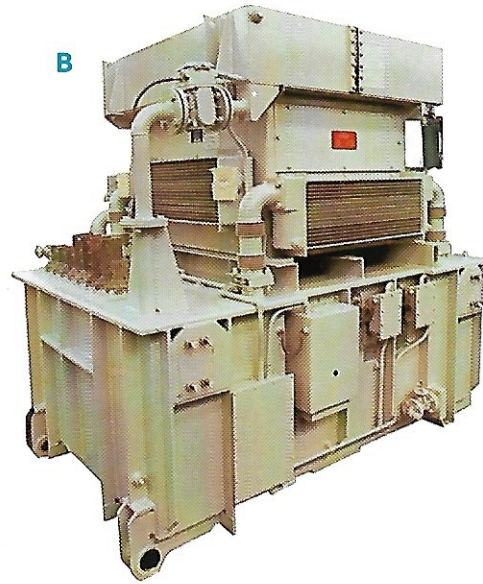
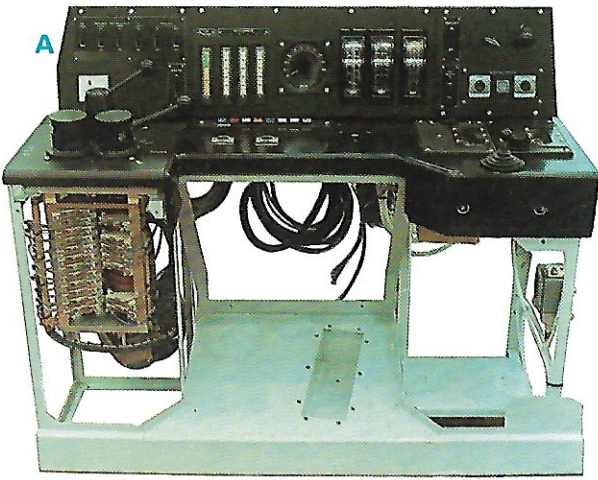


## LONGITUDINAL SECTION



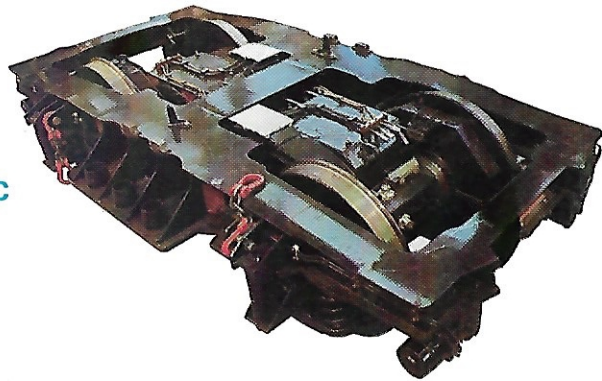
## PLAN SECTION





**A** Driver Control Desk, Showing Main Power Controller and Protection Devices.

**B** Main Traction Transformer for Locomotive Built by Brush Transformers Ltd.



**C** NZ 'Bo' Bogie with Traction Motors.

**BRUSH**

 **HAWKER SIDDELEY**

**BRUSH ELECTRICAL MACHINES LTD** *TRACTION DIVISION*

P.O. Box 18, Loughborough, Leicestershire LE11 1HJ, England. Telephone: Loughborough (0509) 263131.  
Telefax: (0509) 237295 Telex: 341091 (Brush Loughboro)