Rebuilt Electric Suburban Trains, Southern Region

THE first of the rebuilt suburban four-car multiple units to carry the new Southern Region, British Raiiways, standard electrical equipment has recently been completed at Eastleigh Carriage Works. The mechanical parts generally and the make-up of the unit are similar to the many all-steel units completed in the last few years, but some changes have been made coincident with the change in electrical equipment with the general object of improving operating efficiency. Buckeye automatic couplers are fitted at the outer ends of the unit, and these, in conjunction with the re-positioning of the brake hose connections above solebar level, make it possible to uncouple and couple units without going between the coaches at track level.

The driving cab has been redesigned without side doors, access being through a sliding door from the guard's compartment. An adjustable seat for the motorman has been provided, and his controls and instruments have been grouped into a desk with a kneehole between the brake and master controllers. A large cupboard at the rear offside of the cab contains all the auxiliary switches, fuses, and contactors, together with such items as the voltage regulator and the compressor governor.

Each of the two motor coaches in the unit is powered by two axle-hung traction motors weighing about 1.9 tons each, both motors being carried in the leading bogie as hitherto. The acceleration has been increased to the maximum possible within the limits of adhesion with 25 per cent. of the axles of the unit motored, and the balancing speed has been raised as far as possible by the use of field weakening. It was not thought worth while to increase the proportion of motored axles for Southern Region conditions, where the average run between stops of a suburban train exceeds 1¼ miles.

The control system takes a supply of current at 73 volts from the motor generator and battery, slung under the leading motor coach, but an alternative supply can be taken in emergency from the motor coach next in rear in the train. The provision of motor generator sets and batteries for control and lighting has been the practice on Southern Region express stock, but with the exception of the experimental double-deck train, their application to suburban stock is new.

The Westinghouse non-interlocked electro-pneumatic brake with self-lapping controllers is provided, in addition to the Westinghouse automatic brake. The electro-pneumatic brake also takes its supply from the motor generator set and

battery. One of the most important features of the new equipment is the extreme simplicity of preparing a train for service and disposing of it afterwards. To prepare a train for service, it is only necessary to enter each driving cab in the train, release the hand brake, and close one switch. On reaching the cab from which the train is to be driven, one key is used to unlock the master switch handle which incorporates the master controller as well as the reversing and power handles.

When the master switch is closed, in addition to making an electrical feed available to the control circuits and electro-pneumatic brake circuit, the automatic brake is cut in by means of a relay valve. The brake isolating key is thereby eliminated, and only the key already mentioned is needed to drive the train.

The master controller has four power notches—shunting; full series full field; full parallel full field; and full parallel weak field. Automatic acceleration is catered for by a single-current limit relay on each motor coach with characteristics varied to cover both series and parallel acceleration. Since the control circuits are battery fed, a no-current relay has had to be provided. Its effect is to return the control equipment to the shunting position on loss of conductor rail supply, and to permit notching up to the state dictated by the master controller when power is restored.

A power bus line and a 27-core control line are carried through the train and are connected between the vehicles by two jumpers with plug and socket connections. At the outer ends of the unit these jumpers are duplicated. There are in addition two auxiliary jumpers carried between each motor coach and the adjacent trailer to feed the heating and lighting on the latter. Train heating is by totally enclosed heaters fed from the traction supply. These heaters are thermostatically controlled.

There are also two heaters in each driving cab under the driver's control. The train lighting is by incandescent lamps fed at 73 volts by the motor generators. Half of the lamps are connected on the battery side of the reverse current contactor and will remain alight should the motor generator supply fail. All the lighting in the passenger accommodation can be controlled from any guard's compartment.

Rebuilt Southern Region multiple-unit suburban train fitted with new standard electrical equipment

The whole of the electrical equipment has been so devised as to be applicable to two- or four-car units and to either suburban or express type stock, a different traction motor gear ratio being used in the latter case.

The principal details of the new trains are as follow:—

Traction supply	Outside conductor rail at 660 volts nominal
Length of four-coach unit	257 ft. 5 in.
Tare weight of four-coach unit	136 tons
Seating capacity of four-coach unit	386
Maximum speed	75 m.p.h. Initial acceleration 1 m.p.h.p.s. to 27 m.p.h.
Balancing speed on level tangent track	63 m.p.h.
Traction motor gear ratio	65 : 16
Motor wheel diameter ...	40 in. (new)
Horsepower at one-hour rating	980
Total nominal heating load	40 kW
Total nominal lighting load	4.3 kW