BRITISH RAILWAYS

(WESTERN REGION)

MULTIPLE UNIT DIESEL TRAINS

FOR THE INFORMATION OF OPERATING DEPARTMENT STAFF

BR 29879/2

NOTE:—

This booklet is intended as a general guide to Operating Department staff who may be concerned with the working of Multiple-Unit diesel trains. It includes for ready reference a reproduction of the instructions relating to the observance of the rules and regulations as shown in the General Appendix and Supplement GA.34 Op, but it must be clearly understood that this booklet is not intended to replace or supersede any of these publications and amendments thereto to which reference must continue to be made as necessary.

S. G. HEARN,
Chief Operating Superintendent,
Paddington.

October, 1957.

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INTRODUCTION

Multiple-Unit diesel trains are being introduced on the Western Region as part of the modernisation of the system as envisaged in the "Plan for the Modernisation and Re-equipment of British Railways".

The trains at present being built are of four main types:—

1. Inter-City
2. Cross-Country
3. Suburban
4. Single cars with Drive-End trailers

The Inter-City sets will run between the more important towns and cities (e.g. Birmingham, Cardiff and Swansea).

The Cross-Country trains will, as the name implies, be used on main cross-country routes (e.g. Bristol to Weymouth and Shrewsbury to Cardiff).

The Suburban sets, consisting usually of three cars, will link the suburbs of the main cities with the centres, and will also be employed on short runs over outer suburban routes (e.g. Bristol to Weston-super-Mare).

Single power cars will, in general, be used on branch lines. Where the number of passengers is more than can be carried in a Single car, the carrying capacity can be increased by the addition of a Drive-End trailer.

DESCRIPTION OF TRAINS

The Multiple-Unit trains consist of two- or three-car sets and have been built to the same standard of comfort as British Railways main-line locomotive-hauled coaches. All vehicles are painted green. Each three-car set in the formation will consist of

two power cars with an intermediate trailer. The two power cars can also work as a two-car set without the intermediate trailer. The ability to couple up to three sets together provides a wide range of operating flexibility since, by using the three-car sets, three-, six- or nine-car trains can be formed; similarly, two-, four- or six-car trains can be formed using two-car sets. If necessary, however, the proportion of power cars to trailers can be varied to give five-, seven- or eight-car trains in order to meet special requirements.

When the buffers are in the extended position, the length over buffers of all cars is 67 ft. 1 in.

The length of the different types of trains over buffers will be as follows:—

Inter-City	nine-car set	596 ft. 1 in.
Inter-City	six-car set	397 ft. 8½ in.
Inter-City	three-car set	199 ft. 4 in.
Cross-Country	three-car set	201 ft. 1 in.
Cross-Country	two-car set	134 ft. 2 in.
Suburban	three-car set	201 ft. 5½ in.
Suburban	two-car set	134 ft. 2 in.
Single cars		67 ft. 1 in.
Single cars with Drive-End trailers		134 ft. 2 in.

The power cars are each provided with two 150-h.p. engines with the throttle, gearbox, and final drives electro-pneumatically operated. The control equipment is so arranged that a maximum of six power cars can be operated from one cab, which would be the normal number of powered cars in a nine-car train. The electric control circuits are carried between adjacent cars by means of 19-point flexible "jumper" couplings (i.e. electrical control cables). There are hosepipes for high and

low vacuum and, except on Inter-City cars, a further hosepipe for compressed air.

DESTINATION INDICATORS

Illuminated destination indicators are provided on Cross-Country, Suburban, and Single-car trains at the front and rear of the set.

DRIVING-CAB LAYOUT

Each cab is equipped with Western Region type automatic train control, two-note warning horn, combined throttle and deadman's control, gear selector and reversing handle, speedometer, engine-speed indicator, driver's heater control, air and vacuum gauges, bell communication to guard, windscreen wiper, vacuum and hand brakes, and, except on Inter-City cars, a brake valve. On some power cars the heater control panels for the car are situated in the driver's cab.

The driving controls will normally be operated by the driver only, except that during propelling movements, to which further reference is made on page 41, the guard or shunter will operate the warning horn, vacuum or handbrake, and bell communication, as necessary.

Access to the driving cab is restricted to the driver, guard, pilotman, staff in possession of engine passes, and maintenance staff.

RUNNING TIMES

There are three ranges of timings applicable to the following formations:—

(*a*) Power car.
(*b*) Two power cars with intermediate trailer.
(*c*) Power car and trailer.

The timings for one power car apply to two power cars also; the timings for two power cars and trailer apply to four power cars and two trailers (i.e. a six-car set), or to six power cars and three trailers (i.e. a nine-car set), and the timings for one power car and trailer apply to two power cars and two trailers.

TAIL TRAFFIC

The instructions relating to the conveyance of tail traffic are given on page 40.

The weights of all cars are shown on the vehicles themselves.

It should be noted, additionally, that in terms of loading, each of the following is equivalent to one Multiple-Unit trailer:—

One bogie van.

One long-wheel-base, four- or six-wheel van.

One milk tank.

Two short-wheel-base, four-wheel vehicles.

QUICK-RELEASE VACUUM BRAKES FOR MULTIPLE-UNIT DIESEL TRAINS

The Gresham and Craven quick-release vacuum brake system has been developed specially for use on diesel railcars. It is a two-pipe system with reservoirs on each vehicle which enables the brakes to be released quickly and at the same time the

passenger communication, deadman's control on the throttle and A.T.C. apparatus all incorporate Gresham emergency valves to ensure full application of the brakes.

Description

The main features of the equipment are shown in their simplest form in Fig. 1 and comprise the exhauster (E), belt driven from the diesel engine, a high vacuum storage reservoir (A), a feed valve (B), a two-pipe driver's brake valve (C), standard vacuum-brake cylinder (D), and an automatic isolating valve (F).

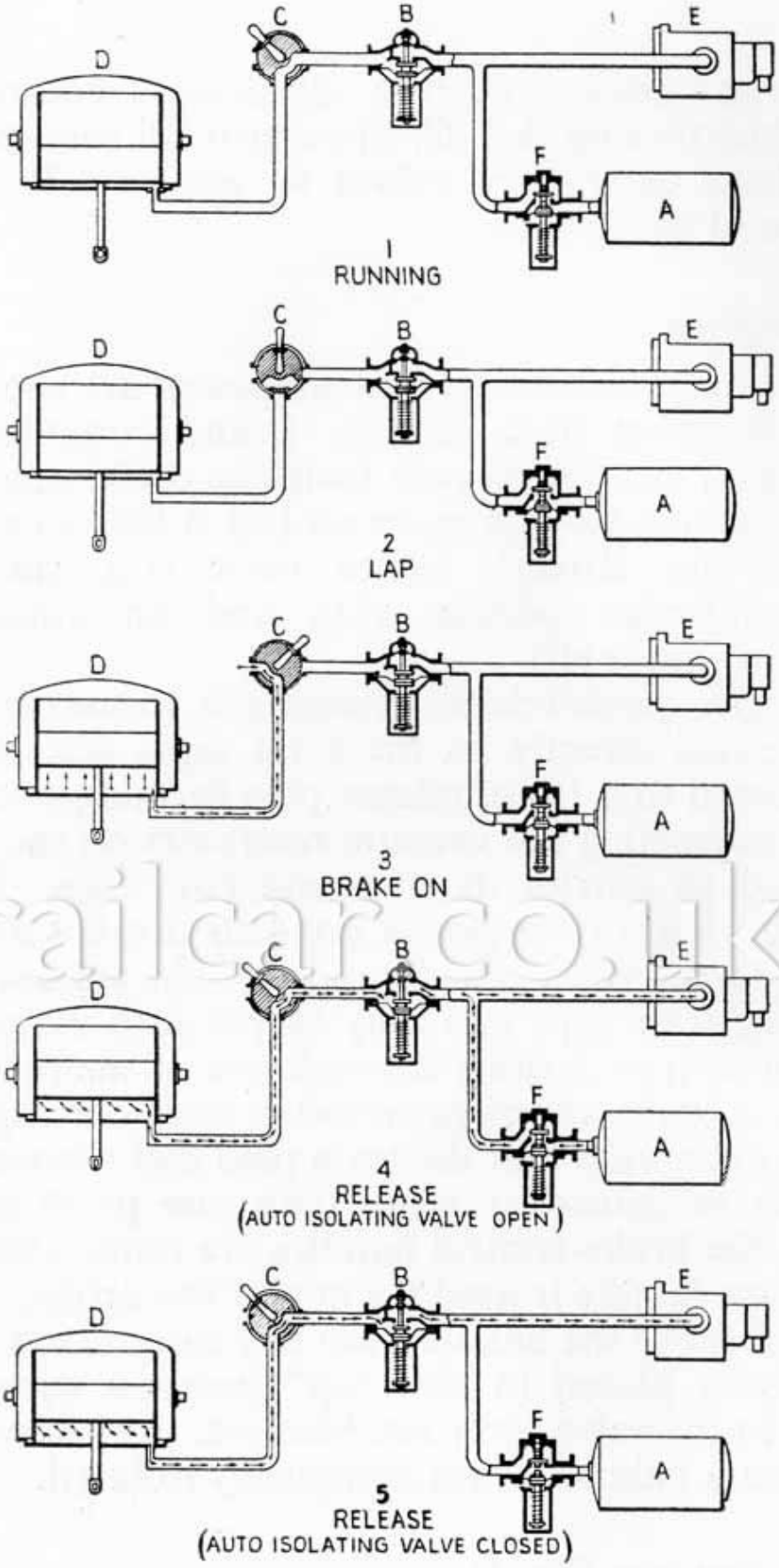
In this quick-release system the exhausters are not joined directly to the train pipe, but are all connected to a $1\frac{1}{2}$-in. release pipe forming a second pipe connecting the vacuum reservoirs on each car, and which carries its own end couplings. These couplings are of opposite hand to prevent attachment to the train-pipe coupling. The release pipe and the train pipe can only be put into communication with each other through one of the two-pipe driver's brake valves provided in each driving cab.

To make sure that the train pipe and release pipe cannot be joined at more than one point in the train, the brake-control handles are removable and only one handle is used for any of the driving cabs.

To remove the handle from any driver's valve the air disc is placed in the "lap" position where all ports in the valve body are blanked. Any valve left without a handle is thus completely isolated.

Operation (see Fig. 1)

No. 1 shows the equipment in the "running"



A—High-vacuum storage reservoir
B—Feed valve
C—Two-pipe driver's brake valve
D—Combined-type vacuum brake cylinder
E—Belt-driven exhauster
F—Automatic isolating valve

Fig. 1—Simplified diagram of new quick-release vacuum brake with automatic isolating valve

position with the car in motion and the exhauster operating at maximum speed. The function of the feed valve is to prevent the train-pipe vacuum from rising above 21 in. To do this, it does not admit air like an ordinary relief valve but shuts down altogether at the required train-pipe vacuum, thus isolating the exhauster from the rest of the system. The exhauster then creates its maximum vacuum, say 29 in. or 30 in. in the reservoir which gives storage capacity for subsequent brake releases. The feed valve consists of a rubber-seated valve normally held off its seat by a powerful spring to which is opposed a large rubber diaphragm. This diaphragm is open to atmosphere on the under-side and in communication with the train pipe on the other side. At 21-in. vacuum, the upward force on the diaphragm overcomes the spring loading and shuts the valve.

No. 2 shows the driver's valve in the "lap" position which it passes through on movement of the handle towards brake application, thereby isolating the feed valve and exhauster before air is admitted to the train pipe, and preserving the high-vacuum conditions in the reservoir.

No. 3 shows the "brake on" position with air admitted to the cylinder to apply the brake, and the high vacuum still preserved in the reservoir. Partial applications can be maintained by returning the handle to "lap" position.

No. 4 shows the brakes in the normal quick-release position, with the automatic isolating valve open. The driver's brake valve now links the train pipe with the reservoir via the feed valve which opens to its full extent due to loss of vacuum above its diaphragm. Air from below the vacuum-brake

piston and from the train pipe flows rapidly through the feed valve into the reservoir which is of ample volume to absorb all the air in the system. Immediately 21 in. is reached on the train pipe side of the feed valve the latter closes as before. It will be appreciated that the speed at which the exhauster is running has no bearing on the speed of brake release which is entirely dependent on the reservoir. It is thus possible to release a full brake application in a few seconds, even though the main engine and exhauster are at idling speed. The driver's valve handle then remains in this position and full-release vacuum is re-created in the reservoir when the car is again in motion and the exhauster running at its full capacity.

No. 5 shows the brake release when the automatic isolating valve is closed. The air is now being withdrawn from the underside of the brake cylinder by the exhauster, the system functioning in the same way as an orthodox vacuum-brake arrangement.

The complete arrangements for a power car and trailer are shown in Figs. 2 and 3.

These illustrations, and Fig. 1, show the automatic isolating valve between the release pipe and each high-vacuum storage reservoir. These valves are controlled-type non-return valves which always permit a flow of air from the reservoir into the release pipe but only allow a reverse flow into the reservoir if the latter is exhausted to a vacuum of 19 in. or 20 in. or above. Any lowering of vacuum on the release pipe side, for any reason whatever, will cause these valves to shut at 18 in. to 19 in. vacuum and thus lock up this degree of vacuum in the storage reservoirs which are then isolated from the rest of the system.

TYPE A.I.V. QUICK-RELEASE VACUUM BRAKE EQUIPMENT FOR INTER-CITIES DIESEL TRAINS DRIVING MOTOR COACHES TYPES LEADING 'X', INTER 'X' & 'K'.

LETTERS	No. OFF	DESCRIPTION	DRAWING NUMBERS LEADING X	INTER X	K
A	1	DRIVER'S BRAKE VALVE	13552	13552	13552
B	1	PASSENGER COMM^{N} VALVE WITH OPERATING LEVER	13557	13557	13557
C	1	4" DUPLEX GAUGE MARKED T.P. & R.P.	14116	14116	14116
D	1	1½" FEED VALVE	14196	14196	14196
E	2	RELEASE RESERVOIR 7½ CU.FT.	12688	12688	12688.
F	1	COMBINED DEADMANS CONTROL & EMERGENCY VALVE	14258	14268	14268
G	2	22" SLIPPING BAND BRAKE CYLINDER	13453	13453	13453
H	2	2" HOSE & COUPLING FOR TRAIN PIPE (R.H.)	14267	14267	14267
J	2	2" HOSE & COUPLING FOR EXHAUSTER (L.H.)	14266	14266	14266
K	2	1½" NON-RETURN VALVE	11119A	11119A	11119A
L	1	6" SINGLE GAUGE. (GUARDS VAN)	14205	14205	NOT
M	1	VAN VALVE	13926	13926	FITTED
N	4	C.I. BEND			
P	2	1½" HOSE & CLIPS	14207	14207	14207
Q	1	COMBINED MANIFOLD & EMERGENCY VALVE	14285	14285	14285
R	2	D.A. VALVE. B.R. TYPE	13506	13506	13506
S	2	CLAYTON DEWANDRE EXHAUSTER TYPE. C 725	13874	13874	13874
T	2	DUMMY & CARRIER. EXHAUSTER PIPE			
U	2	1" AUTOMATIC ISOLATING VALVE	14254	14254	14254
V	2	RELEASE VALVES. B.R. PATTERN	13378	13378	13378
W	2	STRAINER	14210	14210	14210
X	2	HOSE & CLIPS FOR CYLINDER	1/14207	1/14207	1/14207
Y	2	DUMMY & CARRIER TRAIN PIPE			
Z	1	OIL SEPARATOR	13875	13875	13875
	1	INSTRUCTION PLATE. (NOT SHOWN ON DIAGRAM)	14289	14289	14289

Valve "F" wired to dead-man's handle or treadle

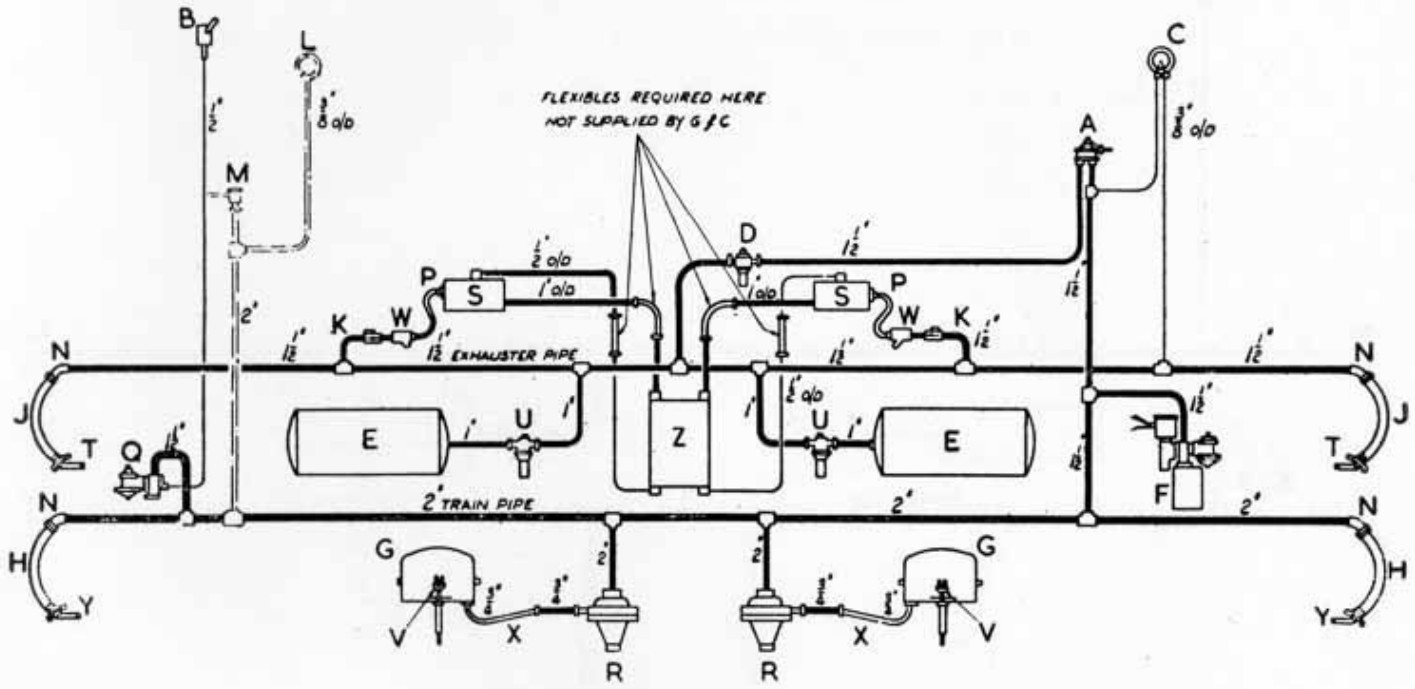


Figure 2

TYPE A.I.V. QUICK-RELEASE VACUUM BRAKE EQUIPMENT FOR INTER-CITY DIESEL TRAINS TRAILER COACH

LETTERS	DRG Nº	Nº OFF	DESCRIPTION.
B	13557	1	PASSENGER COMMUNICATION VALVE WITH OPERATING LEVER
E	12688	3	RELEASE RESERVOIR TOTAL CAPACITY TO BE NOT LESS THAN 15 CU.FT
G	13453/13378	2	BRAKE CYLINDER 22" SLIPPING BAND COMBINED WITH RELEASE VALVE
H	14267	2	2" HOSE & COUPLING (TRAIN PIPE.)
J	14266	2	HOSE & COUPLING (EXHAUSTER PIPE.)
N		4	C.I. BEND.
Q	14285	1	MANIFOLD & EMERGENCY VALVE. (PASS COMM)
R	13506	2	D.A. VALVE (B.R. PATTERN) ONLY REQUIRED WHEN SPECIFIED
T	14264	2	DUMMY & CARRIER. (TRAIN PIPE)
X	14207	2	3/4" HOSE & CLIPS.
Y	14267	2	DUMMY & CARRIER (TRAIN PIPE)
	14289	1	INSTRUCTION PLATE. (NOT SHOWN ON DIAGRAM) ONLY REQUIRED WHEN SPECIFIED
U	14252	2	1" AUTOMATIC ISOLATING VALVE.

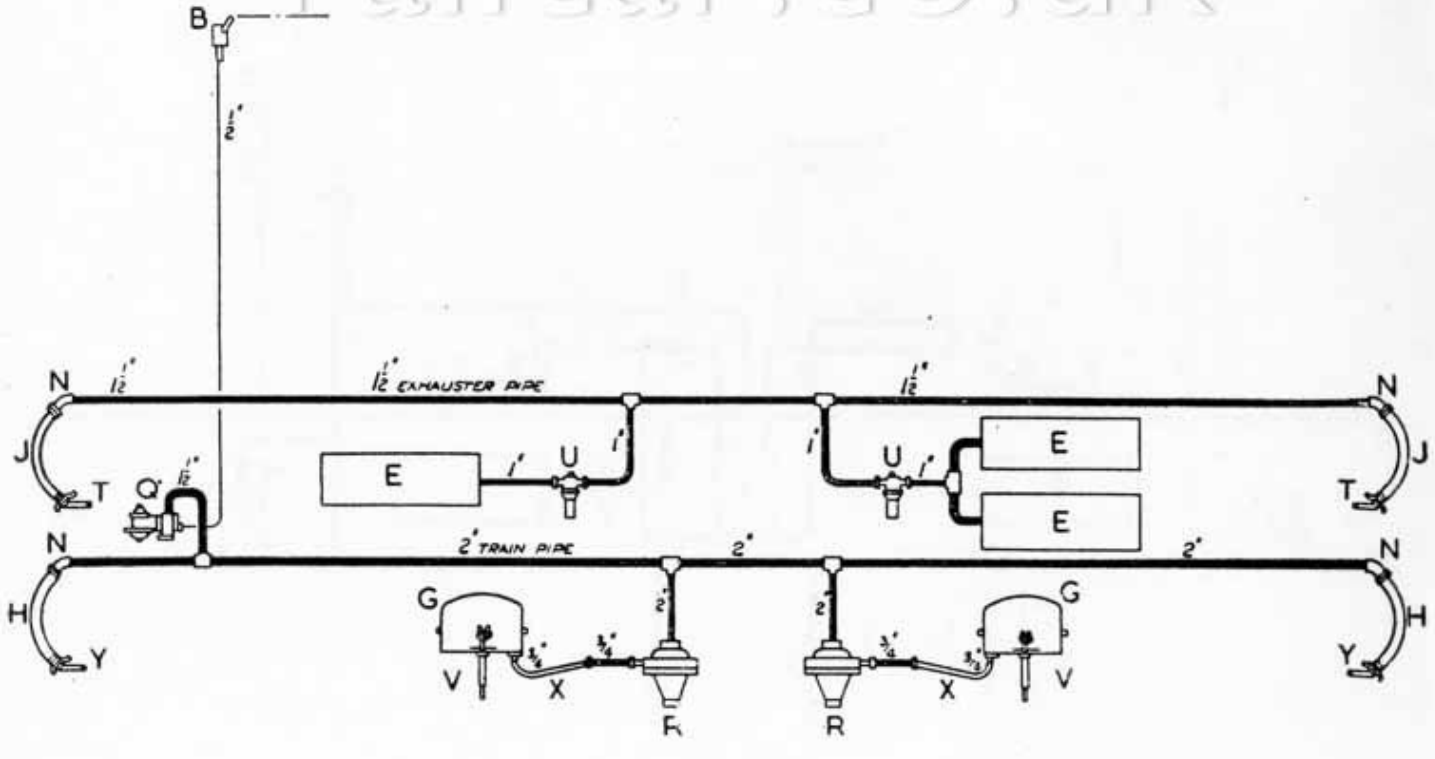


Figure 3

The total volume in the train pipe and release pipe is small and therefore vacuum can be quickly destroyed. This also speeds up brake applications resulting from the operation of passenger communication, A.T.C., or deadman's equipment. Conversely, the recharging of the whole system is accelerated by the large reservoirs already exhausted to 19 in. or 20 in. of vacuum.

The cylinders incorporate their own top-side reserve volume which is exhausted in the usual way from the train pipe to 20 in. or 21 in. The duplex vacuum gauge in the driver's cab does not show the vacuum above the brake pistons, as on a steam locomotive, but records train-pipe vacuum and release-pipe vacuum.

Although standard Multiple-Unit trailers normally carry their own release reservoirs and a through-release pipe, the quick-release brake system as fitted to diesel Multiple-Units is capable of dealing with vehicles fitted with the ordinary vacuum brake. It should be noted that if the proportion of one bogie coach or two vacuum-fitted 4-wheeled vehicles to two diesel cars is exceeded, the speed of release will be slowed down but the braking power will not be affected. The standard coach or vehicle not piped for the quick-release system is attached to the rear of the train and the train-pipe hoses coupled in the usual way; the release-pipe hose on the rear diesel car is placed on the stop. The diesel trains have sufficient high-vacuum storage capacity to deal with the small additional train-pipe volume, particularly if stops are made without completely destroying the vacuum in the train pipe.

ACCESS TO CARS

Inter-City power cars and trailers have doors leading into a vestibule at each end of the vehicle, but the centre compartment of the trailer first has direct access on each side and can be used for stretcher cases as in existing coaching stock.

Cross-Country cars have one or two doors each side, leading into a vestibule.

Suburban vehicles have doors to each bay of seats, as also do Single cars and Drive-End trailers.

Inter-City trains are gangway connected throughout, while each three-car set in a Cross-Country train is similarly connected, but there is no access from one three-car set to another so far as the latter type of set is concerned. Suburban trains, Single cars and Drive-End trailers are not provided with gangways.

It should be specially noted that to avoid a loss of seats the doorways on motor brake second vehicles of Suburban sets between the guard's van and the non-smoking portion of the vehicle and between the latter and the smoking portion, have been built to sub-standard dimensions so far as their suitability for the movement of passengers from one compartment to another is concerned. The doorways, which should normally be kept locked, have been provided solely for the use of train staff for the issue and collection of tickets, as necessary, where unstaffed halts are served, and also to enable the guard to confer with the driver. It is the intention that when two- or three-car sets are running coupled, the unoccupied guard's van will remain locked against public access.

SEATING

All cars consist of open stock except for the first class accommodation in the Inter-City cars which is arranged as compartments.

Details of interior layout and seating are shown on the diagrams at Appendix A and can be summarised as follows:—

	SEATING CAPACITY			
	FIRST		SECOND	
	Smoking	*Non-Smok'g*	*Smoking*	*Non-Smok'g*
Inter-City				
(three-car buffet set)				
Leading motor brake second			52	
Buffet first*	12	6		
Intermediate motor brake second			28	24
(* Also 12 seats in buffet available to first- and second-class passengers.)	12	6	80	24
	18		104	
(three-car non-buffet set)				
Intermediate motor brake second			28	24
Trailer first	30	12		
Leading motor brake second			52	
	30	12	80	24
	42		104	
Cross-Country				
(three-car set)				
Motor brake composite ..	12	6	16	
Trailer buffet second† ..			44	16
Motor second			52	16
(† Provides limited buffet facilities, in which there are also four seats.)	12	6	112	32
	18		144	

	SEATING CAPACITY			
	FIRST		SECOND	
	Smoking	*Non-Smok'g*	*Smoking*	*Non-Smok'g*
Suburban (three-car set)				
Motor brake second ..			45	20
Trailer composite§.. ..	18	10	52	22
Motor second			73	22
	18	10	170	64
	28		234	
Single Power Unit				
Motor brake second ..			45	20
Drive-End Trailer				
Driving trailer second .. (can only be run when attached to a Single power unit.)			73	22
			118	42
			160	

(§ Where there is no demand for first-class accommodation and where greater seating capacity is required, trailer seconds with 106 seats are provided instead of trailer composites.)

SEAT RESERVATIONS

Seat numbers are placed on the side walls of Inter-City and Cross-Country cars immediately above the window seats, and the seats are numbered across from one window to the other. Certain seats are "back and facing," while others face in one direction only. The cars have a slot on the exterior to take the coach registration letter.

Seats in Suburban and Single cars are not numbered.

BRAKE VANS

The brake-van accommodation is as follows:—

Inter-City	three-car set: two vans of 8 ft. 10½ in.
Cross-Country	three-car set: one van of 24 ft. 11¼ in.
Suburban	three-car set: one van of 17 ft. 8¼ in.
Single car:	one van of 13 ft. 7 in.
Drive-End trailer:	NIL.

Letter mails, parcels, parcels post and miscellaneous traffic must only be conveyed on these sets where authorised by instructions issued from time to time by District Officers.

Food heaters are installed and also a locker for "value" or small insured parcels.

The heating and train-lighting switches are positioned on the wall of the van on certain trains, while in others the heater switches are in the drivers' cabs. A bell button is provided over each van door to enable the guard to communicate with the driver. The communication operates from one end of the train to the other.

Each van contains the following equipment:—

(*a*) Standard emergency appliances and first-aid cabinet. (To be opened by breaking the glass and pressing down handle painted red.) For details of appliances see pages 30 and 31.

(*b*) Two fire buckets.

(*c*) Extending ladder (carried in roof).

(*d*) Two vacuum hose pipes (one high and one low pressure).

(*e*) Emergency screw coupling.

(*f*) One fire extinguisher.

BRAKES

Each brake van is equipped with a brake valve, gauge (normal reading 21 in.) and, on Inter-City cars, a handbrake. The guard's duties in connection with the vacuum brake are shown on pages 34 and 35.

All driving cabs are provided with handbrakes and, in addition, all cabs other than Inter-City have brake valves.

HEATING

Heating is provided by hot air directed into the passenger compartments through grilles placed under the seats or along wall skirting. The operation of the heater is automatic apart from switching on and operating the heat control.

In cold weather the cars will be comfortably heated within 30 minutes of switching on.

The heaters are operated from independent panels on each car. On Inter-City power cars, the

controls are in the guard's van, but on Cross-Country and Suburban power cars, in the driver's compartment.

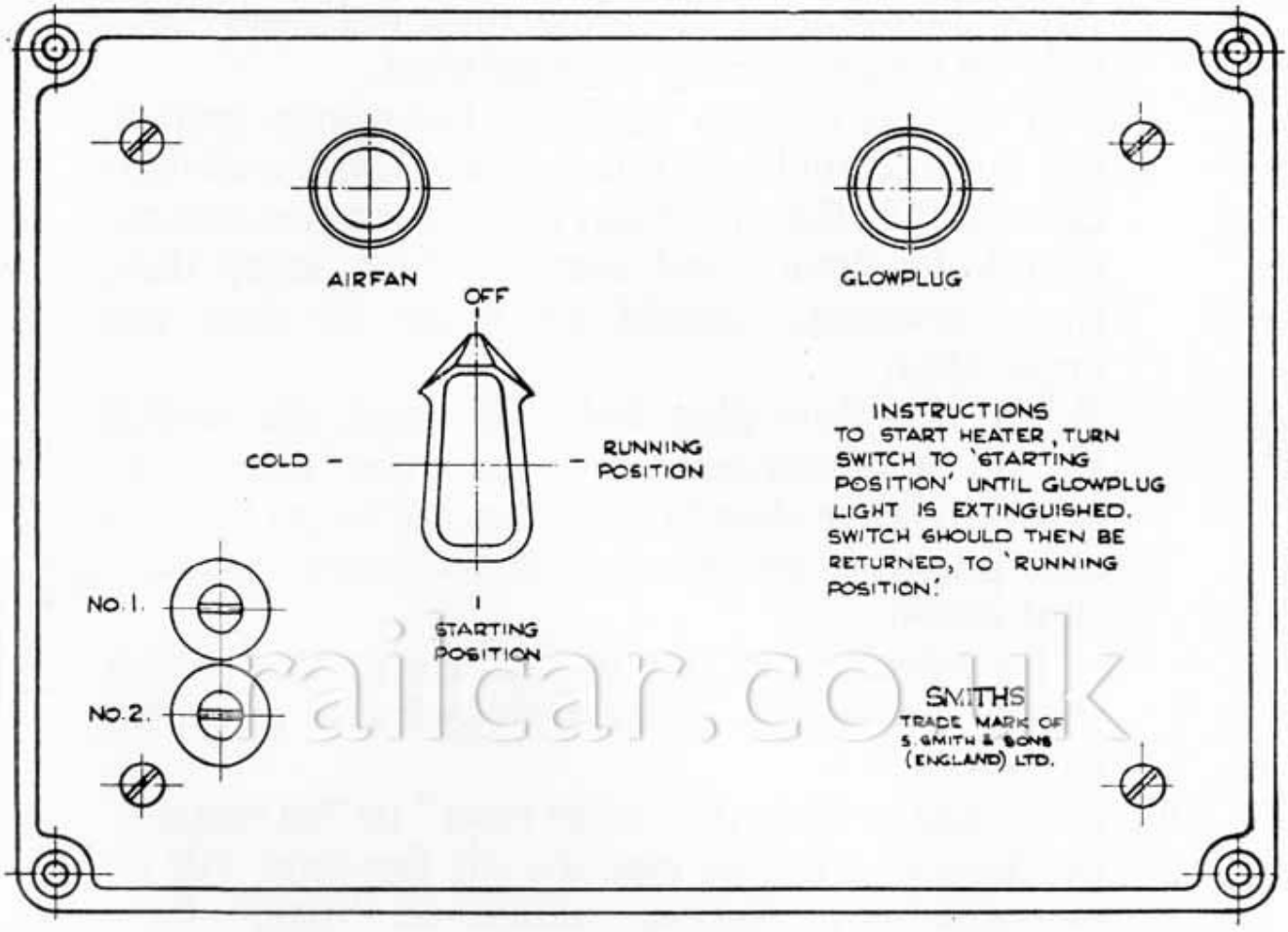


DIAGRAM OF HEATER CONTROL PANEL

INTER CITY & CROSS COUNTRY DIESEL TRAINS

Figure 4

The method of operation is as follows:—

1. Turn on main power switches.
2. Turn heater switch in a clockwise direction to "STARTING" position. This supplies current which illuminates the glow plug light. (If the element does not glow, return switch to the

"OFF" position and do not attempt to restart.)

After a period of 45 seconds, the air fan light will be illuminated on the panel, denoting that the heater fan and fuel pumps are working. After $3\frac{1}{2}$ minutes the glow plug indicator light will be automatically extinguished.

If the oil fails to ignite in the above period, the fan and fuel pump is automatically switched off and it is then necessary to return the control switch to "OFF" and restart. Not more than three attempts should be made to start the apparatus.

3. When the glow plug light goes out, the switch should be turned anticlockwise to the "RUNNING" position; care should be taken not to go beyond this position or the heater will automatically shut down.

   To admit cold air to the train, the switch should be turned in an anticlockwise direction to "COLD."

4. If the heater is in the "STARTING" or "RUNNING" position and it cuts out, the air fan light will be extinguished. Return switch to "OFF," then attempt to restart the heater.

5. To switch heater off, the switch on control panel will always be used. Main switches must *NOT* be used until at least 5 minutes afterwards.

   N.B.: It should be noted that a battery-isolating switch is provided near the solebar of Inter-City power cars and in a special cabinet on Derby-built cars. If the heaters do not function when switched on, it should be ascertained that this isolating switch is also in the "ON" position (i.e. 2 o'clock position).

The control-panel layout on some cars varies slightly and the method of operation is as follows:—

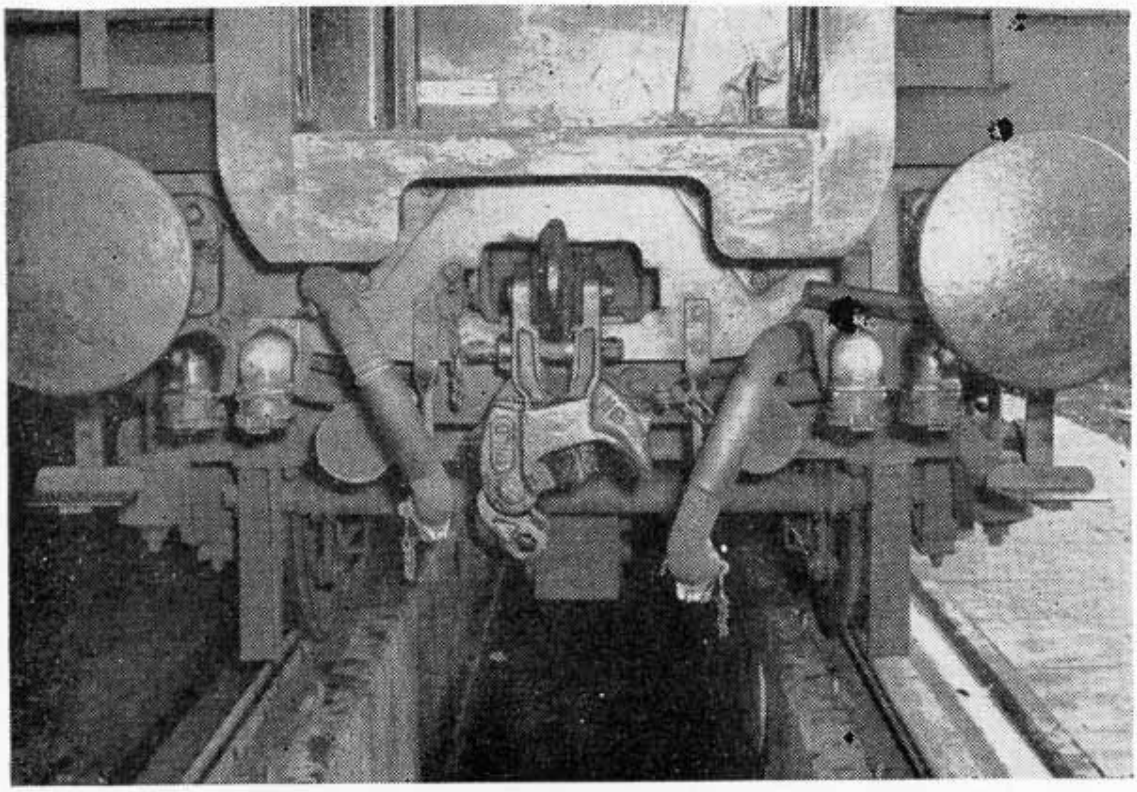
Turn control knob to "FULL HEAT." After $3\frac{1}{2}$ minutes, the heat light will remain and the glow plug light will be extinguished. The heater is then functioning satisfactorily. If all indicator lights go out after $3\frac{1}{2}$ minutes, switch to "OFF" and then to "FULL HEAT" again. Not more than three attempts to start should be made. If desired, as soon as the heater is functioning satisfactorily, the switch can be turned to "REDUCED HEAT."

Temperature in Swindon-built open saloons is controlled by a thermostat situated inside the saloons, but passengers may exercise further control by operating the temperature-control handle situated on the partition. In certain trailers the temperature-control handle, which adjoins the switches, is operated by the guard. On compartment vehicles there are further controls in each compartment and when these are turned down any surplus heat is discharged through grilles into the corridor. (See also pages 41 and 42.)

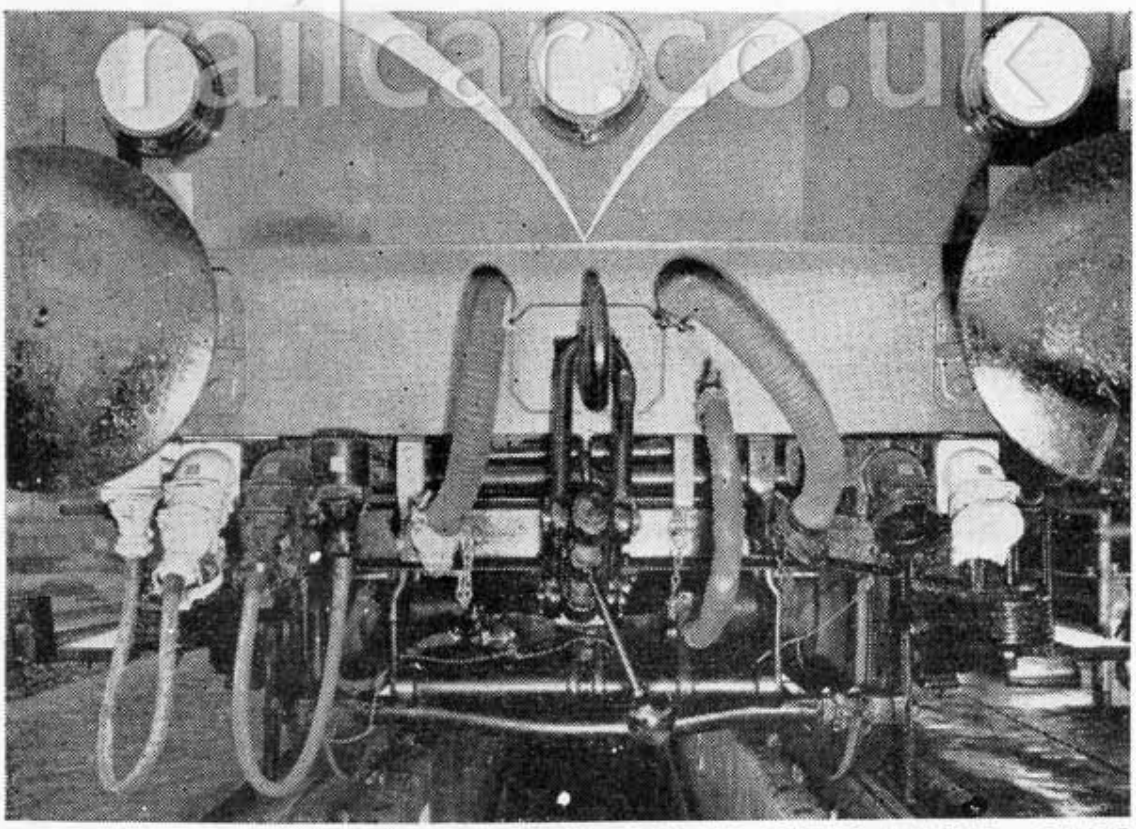
COUPLING OF CARS OR SETS

1. Stationary unit or set to be secured firmly by the handbrake (where provided).
2. Remove gangway shields (where applicable on Inter-City cars).
3. Raise couplers and shorten buffers (on Inter-City cars).
4. Start engines, obtain vacuum and air pressure.
5. Release handbrake, move cars together.

6. Connect screw couplings or buck-eye gear. Great care must be taken to see that the buck-eye couplers are fully engaged. The coupler head must be held in the raised position by the support pin and the tailpiece of the pin should fall downwards to prevent its working loose. See that the couplers have engaged properly by looking or feeling underneath to make certain that the vertical lock on each coupler is projecting below the coupler head and the knuckles of the coupler are clasping each other. [For full instructions relating to buck-eye couplings see General Appendix, page 134 (Supplement GA.28 Op)].
7. Apply handbrake and destroy vacuum (both high and low).
8. Stop engines.
9. Couple vacuum hoses and compressed-air pipes (where fitted). (One of the vacuum-brake hose pipes is fitted with a left-hand lug and the other with a right-hand lug, thus preventing wrong coupling.)
   The cocks on the compressed-air pipes must be open (i.e. with handles in line with ends of vehicles).
10. Remove electrical cables from sockets and connect to cables immediately opposite on adjoining car. (On some Inter-City cars, the electrical connectors are kept in the driver's cab when not in use. They must first be plugged into socket at the end of the car before being connected to the cables of the adjoining car.)
11. Fix gangway curtains (Inter-City cars).
12. Start engines, obtain vacuum, also air pressure.
13. Release *all* handbrakes.



COUPLINGS—INTER-CITY TYPE CARS
Figure 5



COUPLINGS—OTHER THAN INTER-CITY TYPE CARS
Figure 6

UNCOUPLING OF CARS OR SETS

1. Stop engines.
2. Destroy vacuum, both high and low pressure, disconnect vacuum-brake hoses and place on stops. Where compressed-air pipes are provided, the cocks must be closed before pipes are disconnected (i.e. placed at right angles to ends of vehicles).
3. Apply handbrake on vehicle or set to be uncoupled.
4. Remove gangway curtains (Inter-City cars).
5. Disconnect electric-cable connectors by withdrawing from the sockets on the adjacent units and inserting in the dummy sockets provided.

   Where dummy sockets are not provided (e.g. on some Inter-City cars), the two cable connectors on the right-hand side of the buck-eye gear when facing the end of the car should be removed and placed on the brackets provided in the driving compartment.
6. Start engines.
7. Obtain vacuum, release handbrake, "ease" cars together whilst buck-eye release chains are pulled or couplings unhooked.
8. Move cars apart.
9. Stop engines and apply brakes.
10. Put shields on gangways (Inter-City cars).
11. Extend buffers (Inter-City cars).

REVERSING DIRECTION OF TRAVEL

A reversing movement of a two- or three-car set will require approximately $2\frac{1}{2}$ minutes. This includes the time taken by the driver to walk from one end of a three-car set to the other, and will increase by the time taken to walk the length of any additional sets which may be coupled to it.

GAS SUPPLY TO BUFFET CARS

Buffet cars are provided with Propane gas appliances which are supplied from cylinders housed in cylinder boxes on the underframes of the cars. When the service supply is exhausted, the supply to the cooking equipment, etc., is automatically drawn from the reserve cylinder, while an indicator, situated on the outside of the car, gives a clear indication that one set of gas cylinders requires replenishing.

GANGWAY SHIELDS

Gangway shields are provided for intermediate motor vehicles on Inter-City sets which become leading vehicles when a train is divided. They will be carried in the van of the car concerned when not in use.

GUARDS' JOURNALS

Guards' journals will be rendered for each journey as directed and any defects in the sets (e.g. heater failures) should be noted thereon.

MAINTENANCE AND DAY-TO-DAY SERVICING

Maintenance will be carried out at central maintenance depots.

Each set will be made available for agreed periods, when day-to-day inspection will be carried out. This will normally be done at fuelling and inspection points.

CARRIAGE CLEANING

The cars must be maintained from the outset in a clean condition, and this will be facilitated by the fact that the stock is new and the interiors are fitted with much plastic material. Exterior cleaning will be carried out using the special hand-cleaning agent "M.31" in accordance with the "Handbook of Instructions relating to Carriage Cleaning and Servicing." The use of "M.31" should be supplemented by an occasional application of "Exmover" to remove any build-up which may occur by the continued application of "M.31." "M.31" contains a cleaning oil and is not, therefore, suitable for use on windows which should be cleaned with rottenstone, pumice powder or "Exmover."

It is easier for men working on the line to observe the approach of Multiple-Unit diesel trains if the red-painted headstocks are kept in a clean condition. This applies particularly in hot weather when a ground haze exists. The red headstocks on the driving ends of power cars and trailers should therefore be regularly cleaned when the bodywork of the cars is being dealt with.

BATTERY CHARGING

Batteries will be charged when the sets are undergoing periodical maintenance examination.

In most cases they will be automatically charged in running and it is only when speeds below

17 m.p.h. are frequent that they will have to be "topped up" at local battery-charging installations.

FUELLING

Each power car has a fuel-oil capacity of 180 to 200 gallons and will normally run approximately 650 miles without refuelling (approximately 4 m.p.g. per power car). On routes with steep gradients, low-speed restrictions and frequent stops, the consumption will rise to approximately 3 m.p.g., giving a range of approximately 475 miles.

The heaters on power cars consume $\frac{2}{3}$ gallon per hour at maximum output and are also fed from the main fuel tanks. Trailers have one 20-gallon fuel tank which supplies the heaters only.

Sets will normally be refuelled once every 24 hours while undergoing daily inspection. The time taken to refuel will, of course, depend on the number of cars, the number of pumps available and the layout of the fuelling installations.

WATER SUPPLY

Roof water tanks of 70 to 100 gallons capacity are provided for lavatories and 100 gallons capacity for buffets. **Tanks should be drained during frosty weather by opening the drain cocks provided.**

An independent supply of 36 gallons for the engines is carried in tanks on the underframe of each power car. Anti-freeze mixture is added during the winter months and these tanks will not be drained.

ROUTE RESTRICTIONS

Multiple-Unit diesel trains may work over running lines and sidings normally used for

passenger stock, subject to the restrictions shown in the General Appendix and the Working Time Tables.

STATION STOPS

Platforms at many stations at which diesel Multiple-Units call will be provided with numbered indicators showing the point at which the driver should bring the train to a stand depending on the number of cars on the train.

This is intended to facilitate the positioning of passengers, luggage and parcels before arrival of the train and to ensure that delays do not occur. The trains have been scheduled for maximum utilisation, and station stops and turn-round times have been kept to a minimum consistent with the duties to be carried out. It is therefore essential that station staff and train crews should do all they can to avoid delays.

EMERGENCY AND FIRST-AID EQUIPMENT CARRIED IN GUARDS' VANS

Emergency Equipment

One	7-lb. hammer.
Two	steel wedges.
Two	crowbars and one extension.
One	axe, fireman's, large.
One	axe, fireman's, small.
Two	saws (one large, one small).
One	panel-cutting tool.
Two	hand lamps, oil.
One	electric lamp.
Two	coils of rope (one No. 6 size and one $3\frac{1}{2}$-in. circular).
One	fire extinguisher.

First-Aid Equipment

One	instruction card (B.R.7151-2).
One	Report form.
One	set splints (two short, three long, three extensions).
Nine	triangular bandages.
Six	2-in. roller bandages (2 yds.).
Three	packets of cotton wool ($\frac{1}{2}$ oz. sterilised).
Three	packets of lint (white) ($\frac{1}{2}$ oz.).
Six	Mines dressings, large.
Three	Mines dressings, small.
Two	sterilised dressings, small.
Two	sterilised dressings, medium.
Two	sterilised dressings, large.
One	bottle of antiseptic No. 5 (2 oz.).
One	bottle of salvolatile (2 oz.).
One	bottle of eye drops (1A, $\frac{1}{2}$ oz.).
Six	safety pins, rustless.

N.B.: It has been decided that sodium bicarbonate solution will not now be supplied as the chemical at present used in the fire extinguishers is less toxic than that previously supplied.

GENERAL APPENDIX INSTRUCTIONS RELATING TO THE WORKING OF MULTIPLE-UNIT DIESEL TRAINS

The following instructions appear on page 134 of the General Appendix (Supplement GA.34 Op) and will apply in connection with the working of Multiple-Unit mechanical diesel trains on the Western Region.

"These trains are fitted with two-tone warning

horns at each end. The two tones must always be sounded when it is necessary to give a warning. For standard or local whistle-code purposes, the lower note only must be used.

All concerned must warn men employed under their supervision who may be required to work on the permanent way, or to walk upon or cross running lines, of the importance of observing the warning and that they must be prepared for the trains to approach quietly and at high speed. Upon hearing the warning, the Driver should be given an acknowledgment whenever possible.

It is important that men engaged on permanent-way work, etc., shall move promptly to a point of safety upon sighting or receiving audible warning of the approach of a train.

If it is necessary for Multiple-Unit diesel trains to work over a section of line where they are not normally scheduled to run, or if such diesel trains are to be substituted for steam trains or auto cars over a route normally also used by diesel units, Drivers of such trains must sound the two-note warning horn in accordance with Rule 127 and also when approaching curves, level crossings, barrow crossings, overbridges, gangers' huts and other buildings adjacent to the line upon which the trains are running. In such cases prior advice must, where possible, be issued to all concerned, particularly permanent-way staff, by means of printed or other notice. In emergency, when it is not possible to issue prior notice, the Drivers of such diesel trains must be advised.

The speed of trains must not exceed 10 m.p.h. when proceeding along carriage or repair sidings, or sidings in Diesel depots. Before entering sheds,

Drivers must bring their trains to a stand and give a warning signal on the horn to staff who may be at work inside. The speed of trains inside a shed must not exceed 5 m.p.h.

WORKING INSTRUCTIONS

Rules and Regulations

1. The Rules and Regulations are applicable to Multiple-Unit diesel trains, except as modified below:—

(i) Rules:—

55. The duty of going to the signal box to remind the Signalman of the position of the train must be performed by the Guard, but where Fireman's call plungers or telephones are provided, as shown in Note 6 (viii), the Driver must make use of these appliances.

56. In the circumstances described in clause (*b*) of this Rule, the Guard must first protect his train in rear before complying with Rule 55, clause (*a*).

126. A Driver is forbidden to leave charge of his train without:—

(*a*) stopping the engines,
(*b*) removing the reversing lever,
(*c*) applying the vacuum brake and placing in "lap" position,
(*d*) putting the handbrake on hard.
(*e*) locking operative driver's compartment doors.

127. Each driving compartment is fitted with a glass-fronted cabinet containing not less than 12 detonators and a red flag. The cabinet is sealed and the Driver, when

taking over, must ensure the seal is intact. The Driver must have with him in the driving compartment a hand lamp with red shade. (W.R.-gauge lamp or lamp of approved pattern.)

141. The Guard's signal to start the train will be given in accordance with the bell code shown in instruction No. 8.

178-187. The Driver and Guard must carry out the duties as laid down for the men in charge of a light engine, and if the opposite line is obstructed the Driver must go forward on foot to protect such obstructed line. In connection with Rule 181 (*f*), the Driver must carry out the protection as for electric trains—Rule 181 (*h*).

188. In the case of trains conveying passengers, the Driver must carry out the duties allocated to the Fireman after satisfying himself that the fire is being dealt with.

(ii) VACUUM BRAKE REGULATIONS—Pages 98-108 General Appendix.

Reg. 1. Description—The normal vacuum for Multiple-Unit diesel trains is 21 in.

Reg. 3. Before starting from Depot, etc., in order that the Guard and Driver may be aware of the vacuum brake reading in the guard's compartment, as required by clause 3 (*b*) and (*c*) of the Regulations for working the vacuum brake, a test must first be made. To enable this to be done, the Driver must apply the hand brake to avoid the train moving when the vacuum brake is released and must keep the handbrake applied until he receives an indi-

cation on the bell communication from the Guard to the effect that the correct amount of vacuum is registered on the gauge in the rear guard's compartment, after which the hand-brake must be released in the Driver's compartment and the train held by the vacuum brake; the Guard must satisfy himself that the vacuum has been destroyed throughout the train by observing the gauge.

This test must be made daily before the train is taken into service and on each occasion when vehicles are attached or detached.

As it is necessary for these trains to have the vacuum brake applied when standing, the following modifications require to be made to the Regulations for working the vacuum brake:—

Reg. 3, clause (*b*), third paragraph:—

Not applicable to Multiple-Unit diesel trains.

Reg. 3, clause (*c*), second paragraph:—

The words "and that the gauge in the rear van indicates the required vacuum" are not applicable to Multiple-Unit diesel trains.

Reg. 13—Passenger Communication—The passenger communication in some vehicles is by means of short handles painted red, fixed in each car, and in others it is by means of a short chain. When the handle or chain is pulled downwards it causes the brake to be applied and the train to be stopped. Where alarm handles are installed, no discs are provided on the outside of the vehicles to show when the alarm has been operated, and the Guard must ascertain where

this has been done by inspection of the cars. The alarm handle must then be re-set by means of a carriage key. Where, in connection with the chain communication, no discs are provided, this must be re-set from the driver's compartment of the coach concerned. Where discs are provided on the outside of the vehicles they must be re-set by the Guard in the normal manner.

Reg. 13, clause (*c*) (i).

The second sentence of this paragraph is not applicable to Multiple-Unit diesel trains as the Driver or Guard will be unable to release the brakes after the alarm handle or communication chain has been operated until the apparatus is returned to normal.

Head and Tail Lights

2. *HEADCODES.* In some cases the classification of the train will be by means of an illuminated letter followed, when necessary, by a numeral or symbol indicating the route; in other cases, electric head lamps in the standard head-code positions will be fitted.

On the Western Region the position will be as follows:—

Inter-City Trains

Headcode classification will be indicated by illuminated capital letter. The indicator boxes on some cars will be on the roller-blind principle operated by the Driver from the driving compartment, and, on others, removable stencil plates will be used.

In the case of stock with gangwayed ends, an indicator box will be provided on each

side of the gangway below each of the front windows.

Other than Inter-City

Electric head lamps in the standard head-code positions.

TAIL LAMPS. An oil tail lamp will be used, but all cars will be fitted with two tail-lamp brackets (one on either side).

Signalling

3. Multiple-Unit mechanical diesel trains must be signalled in accordance with the bell signals applicable to steam passenger, empty stock, parcels, etc., trains.

Manning of Trains

4. Each train will be manned by a Driver and a Guard only. Except as laid down in instructions Nos. 9, 12 and 13, the Guard must ride in the rear guard's compartment.

Composition of Trains

5. Inter-City cars must not be coupled to any other type units. Cross-Country, Suburban and Single units may be coupled together as required, provided not more than six power cars are included.

Coupling and Uncoupling

6. Inter-City diesel cars are equipped with buck-eye gear at each end, while other types of cars have normal screw couplings. All vehicles are provided with jumper cables (i.e. electric-control cable fitments), two vacuum-brake hose-pipes (one reservoir and one train pipe) and, in

addition, cars other than Inter-City type have compressed-air hose pipes.

The non-gangwayed ends of the leading motor-brake seconds on Inter-City trains are not provided with jumper cables.

Drivers are responsible for seeing that the drivers' controls are in the "off" position before units are coupled or uncoupled.

The following instructions for coupling and uncoupling must be observed:—

(*a*) *Coupling*

The stationary unit must be firmly secured by the hand brake and the following operations must be carried out in the sequence shown:—

(i) the units must be coupled by the screw or buck-eye coupling, as the case may be;

(ii) the engines must be shut off and the vacuum in the train and reservoir pipes destroyed;

(iii) the train and reservoir vacuum hose pipes must be connected, also the compressed-air pipes, where provided. The cocks on the compressed-air pipes must be opened;

(iv) the four jumper cables must be inserted in the appropriate sockets on the adjacent unit. CARE MUST BE TAKEN TO ENSURE THAT THE JUMPER HEADS ARE PUSHED RIGHT HOME AND SECURED.

(*b*) *Uncoupling*

Before uncoupling operations are commenced, the unit to be uncoupled must be firmly secured by the hand brake. The engines must be shut off and the vacuum in the train and reservoir pipes destroyed, after which the following

operations must be carried out in the sequence shown:—

(i) all jumper cables must be released by withdrawing from the sockets on the adjacent unit and be inserted in the dummy sockets, where provided, or placed in the special brackets in the driver's compartment. CARE MUST BE TAKEN TO ENSURE THAT THE JUMPER HEADS ARE PUSHED RIGHT HOME AND SECURED.

(ii) the train and reservoir hose pipes must be disconnected and placed on the dummy plugs. Where compressed-air pipes are fitted, the cocks must be closed and the pipes disconnected and secured by the safety chains.

(iii) the screw or buck-eye coupling must be released.

(*c*) *Coupling and Uncoupling in Service*

This duty must be performed by a member of the operating staff, but the Driver must satisfy himself that all connections have been properly made.

(*d*) *Coupling of Loaded Multiple-Unit Trains*

Where it is necessary to couple two Multiple-Unit trains, either of which is loaded, the undermentioned working must be adopted:—

After the first train has come to a stand at the platform, or other line, the second train may be admitted in accordance with the Permissive Block Regulations, Rule 96, or special instructions as the case may be. A Handsignalman (who may be the Guard of

the first train), exhibiting a red handsignal, must be posted 6 ft. to the rear of the first train or a greater distance if necessary where sighting is restricted, and the Driver of the second train must bring his train to a stand opposite to the Handsignalman. The Handsignalman may give permission for the second train to move forward on to the rear of the first train as soon as he is satisfied it is safe to do so, when the coupling may be carried out.

Tail Traffic

7. Inter-City trains must not convey tail traffic and the booked formation must not be varied. Regular tail traffic must only be attached to other Multiple-Unit diesel trains where authorised and shown in train-working notices. Additional vehicles must not be conveyed unless specially authorised by the District Operating Superintendent or District Traffic Superintendent, and the total trailing tonnage must not exceed the total weight of the power cars; the instructions on pages 109 and 110 of the General Appendix must be observed as far as they apply.

Bell Codes

8. The following code of bell signals between Guard and Driver must always be used by means of the bell communication provided:—
   1. Stop.
   2. Start.
   3. Set-back.

   3-3. Guard required by Driver.

4. Slow down when propelling.
5. Guard leaving train in accordance with rules.
6. Draw up.
7. Correct vacuum indicated in rear guard's compartment during test.

In cases of failure of the bell communication, hand signals must be used, except as indicated in the second paragraph of Instruction No. 9.

Propelling

9. Except during shunting operations, propelling must only be resorted to where specially authorised for Multiple-Unit diesel trains.

When propelling, a speed of 5 m.p.h. must not be exceeded and the Guard must ride in the leading driving compartment, keep a good look-out, operate the warning horn where necessary, and be prepared to stop the train, as required, by application of the vacuum or hand brake. The Guard must carefully observe all signals and signal to the Driver as may be necessary, in accordance with the bell codes shown in Instruction No. 8. In the event of failure of the bell communication the train must be driven from the leading end.

Trains must be driven from the leading end when proceeding on to another train, entering carriage or repair sheds, or proceeding up to buffer stops.

Heating of Train

10. The Guard will be responsible for seeing the heating units are in use when necessary and that

they are switched off when not required. He should also adjust the heating during the journey, as far as practicable, to meet the wishes of the passengers.

The Guard, Depot staff, or person specially appointed for the duty, will be responsible for switching on the heat before leaving the depots at the commencement of the working, and where pre-heating is necessary, suitable arrangements must be made for this to be carried out.

The Guard or Shunter must ensure that all heaters are switched off when the train is to be stabled.

Any defect in the heating system must be advised by the Guard to the Driver, who must report it.

Fire Precautions

11. In the event of an engine becoming overheated, a small red light will be exhibited on the solebar on the side of the vehicle concerned. Should this red light be observed by a Signalman, he must endeavour to bring the train to a stand, but if the train enters the section ahead, the provisions of Block Regulation 17, "Stop and Examine Train," must be carried out.

Each driving cab is equipped with two hand-operated fire extinguishers of the CO_2-gas type; each guard's compartment and each trailer is provided with one 2-gallon CO_2 water-type hand-operated extinguisher. In addition, automatic fire-extinguishing apparatus is fitted on the underframe of motor vehicles. In the event of a fire developing in one of the engines, the

extinguishing equipment will come into operation and at the same time ring a bell in the driver's compartment. After the train has been stopped in accordance with Rule 188 the Driver must proceed to the affected engine and take with him a fire extinguisher and, in the case of trains conveying passengers, must carry out the duties allocated to the Fireman under Rule 188, after satisfying himself that the fire is being dealt with.

Drivers and Guards must, however, act according to the best of their judgment and ability in the circumstances attending the fire.

After ensuring that the fire has been extinguished, the small metal tab on the front of the fire-alarm control box should be pulled off. This will uncover a switch which should be operated to stop the alarm bell and extinguish the warning light. It will also render it impossible to restart the affected engine and after this has been done the train can proceed.

The alarm-isolating switch referred to does not cut out the re-setting thermostat and should this operate through a recurrence of fire on the engine or fluid flywheel, the alarm bells will ring and the warning light will be lit. In this event, the fire will not be extinguished automatically as the extinguishing agent will have been previously discharged. It is essential, therefore, for the remaining hand-operated fire-fighting equipment to be used as a matter of the utmost urgency after the train has been stopped.

The fire-extinguishing medium used in the automatic appliances comprises a toxic gas

which dissipates very rapidly when exposed to the open air. Care should be taken, therefore, to avoid contact with, or inhaling of, the vapour.

If contact is made, however, the following precautions must be taken:—

(*a*) Remove the person concerned from discharge area.

(*b*) Summon medical aid as soon as possible, notifying the doctor that the person has been in contact with chlorobromomethane and that oxygen therapy will probably be required.

(*c*) If contaminated with liquid, ALL clothing, wrist-watches, rings, etc., must be removed and the person washed freely.

(*d*) Contaminated clothing should be isolated for future disposal.

(*e*) Fresh air is essential and artificial respiration may be necessary. Oxygen therapy, if available, should be started at once.

(*f*) If a quantity of chlorobromomethane enters the eyes or nose, wash the affected parts with sodium bicarbonate solution, two bottles of which will be found in the special cabinet in each guard's compartment, also in the ambulance cupboards at diesel-car maintenance depots. If sodium bicarbonate is not available, wash the affected parts freely with plain water.

(*g*) If a quantity of chlorobromomethane enters the mouth or is swallowed, an

emetic of at least 1 pint of the sodium-bicarbonate solution should be given to the patient to drink immediately, and treatment as for shock given whilst a doctor is contacted.

(*h*) There may be certain delayed effects of chlorobromomethane poisoning and every case of contamination, therefore, must be referred to the Regional Medical Department for observation.

Deadman's Handle

12. A deadman's device is incorporated in the throttle-control handle in all driving compartments and, should the Driver release his grip, the power will be cut off and the brakes applied.

Should any defect arise to make the deadman's device inoperative, the Guard must ride with the Driver until another competent man can be provided or the defect remedied.

Driving Apparatus Disabled

13. In the event of the driving apparatus in the leading compartment becoming disabled, and the Driver being able to regain control of the train from another driving compartment, the train must be driven at a reduced speed of not more than 15 m.p.h. from the most convenient driving compartment and proceed with caution to the nearest point where the train can be taken out of service or the disabled unit can be detached.

In such cases, the Guard must ride in the leading driving compartment, keep a good look-

out, operate the warning horns when necessary and practicable, and be in a position to stop the train as required by application of the hand brake.

The Guard must carefully observe all signals and signal to the Driver as may be necessary in accordance with the bell codes shown in Instruction No. 8.

Assisting Disabled Train

14. In an emergency, disabled Multiple-Unit diesel trains can be assisted by any type of train or engine, but in such circumstances the trains must be worked cautiously and at reduced speed.

When a diesel train is being assisted, the working must be in accordance with the special instructions included in the Driver's handbook and according to the type of train or engine which is providing the assistance.

A Multiple-Unit diesel train may be allowed to assist a disabled Multiple-Unit diesel train in accordance with the special instructions included in the Driver's handbook, but must be run at reduced speed. In such circumstances, however, the assistance must only be given to the nearest point at which the disabled train can be placed clear of the running line.

The Inter-City units are fitted with automatic couplings and retractable side buffers for use in emergency. When the automatic coupler is in use, the side buffers are retracted. When it is necessary for screw couplings to be used, the buffers must be placed in the long position and a key which is attached to the buffer beam

must be placed in the slot which is exposed when the buffer rod is extended.

Cross-Country, Suburban and Single cars are provided with screw couplings and buffers and may be coupled to ordinary coaching stock similarly fitted.

If the Multiple-Unit diesel train is to be hauled by a locomotive, the vacuum reservoir hose pipe must remain on the stop plug and the main vacuum brake pipe (i.e. low pressure) must be coupled to the locomotive.

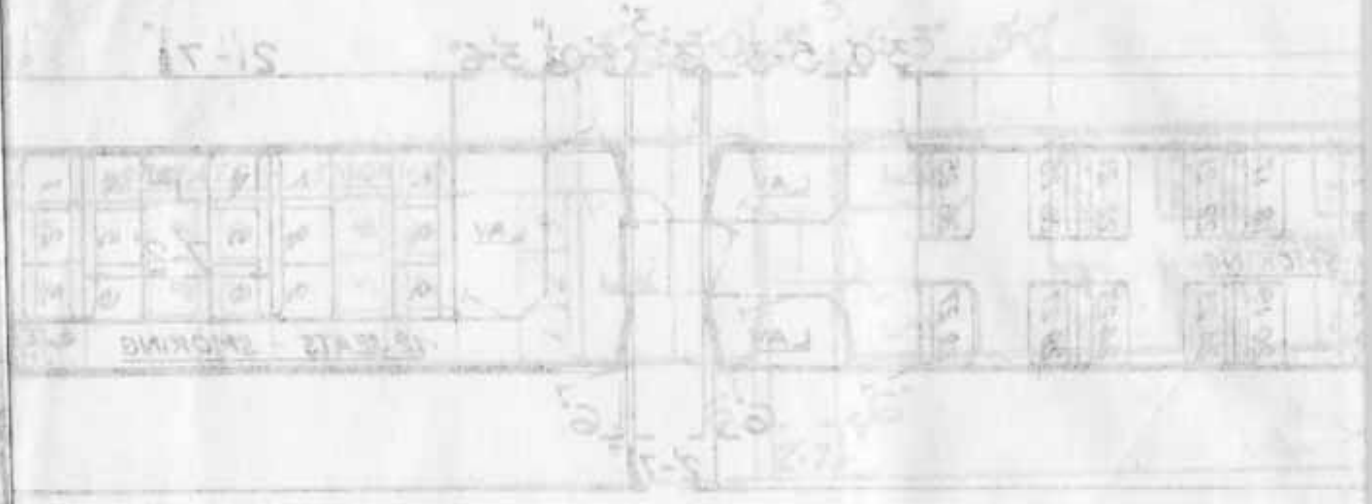
Single Lines

15. To receive or deliver a single-line token, the train must be brought to a stand at the signal box, station platform, or other token-exchange point and the Signalman must receive and/or deliver the token to the Driver by hand at that point.

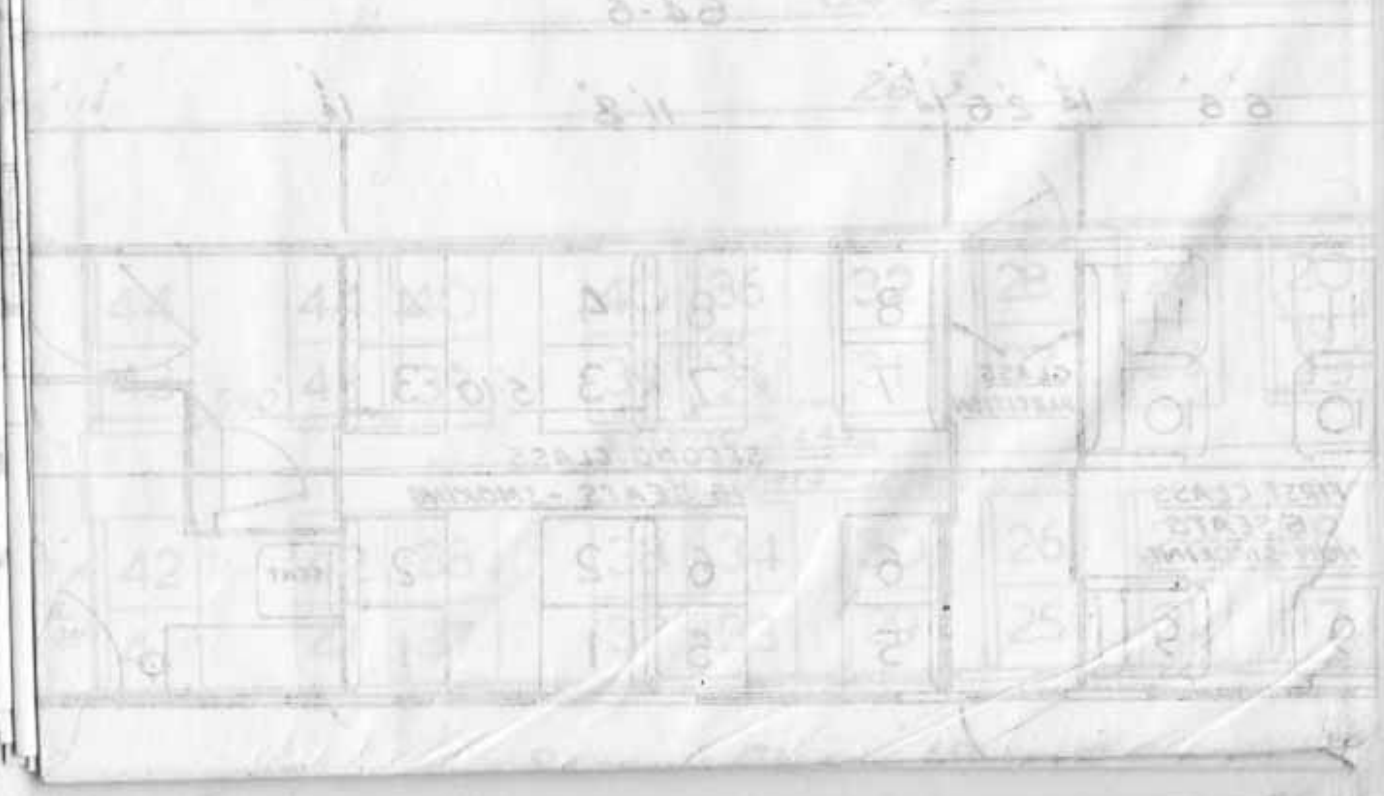
In connection with E.T.T. Regulations 14 and 25, the Driver must carry out the duties of the Fireman.

Should it be necessary to conduct the working in accordance with E.T.T. Regulation 14C, the Driver and Guard will be responsible for ensuring that detonators are maintained on the line to protect the obstruction, as required by clause (*a*) (iv), until Handsignalmen are appointed."

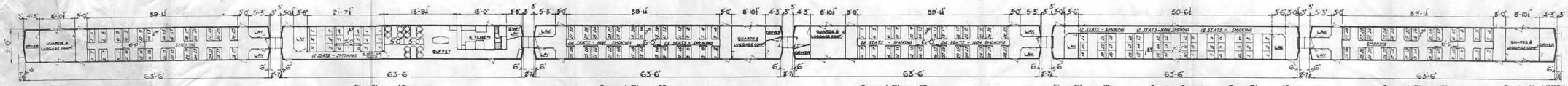
Sanders Phillips & Co., Ltd., London, S.W.9



First Class	60
Second Class	208



INTER CITY DIESEL TRAINS



Second Class—52 seats
LEADING MOTOR BRAKE SECOND

First Class—18 seats
BUFFET FIRST

Second Class—52 seats
INTERMEDIATE MOTOR BRAKE SECOND

Second Class—52 seats
INTERMEDIATE MOTOR BRAKE SECOND

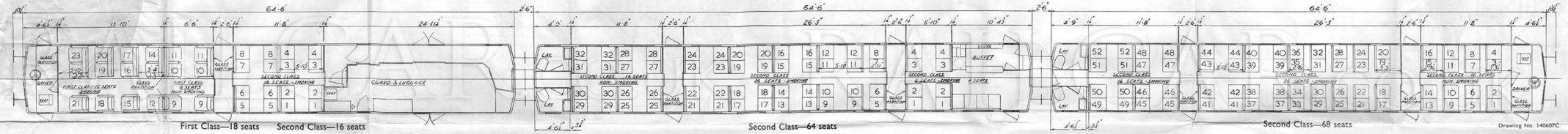
First Class—42 seats
TRAILER FIRST

Seating Capacity
First Class 60
Second Class 208
Total 268

Second Class—52 seats
LEADING MOTOR BRAKE SECOND

Drawing No. 140327H

CROSS COUNTRY DIESEL TRAINS



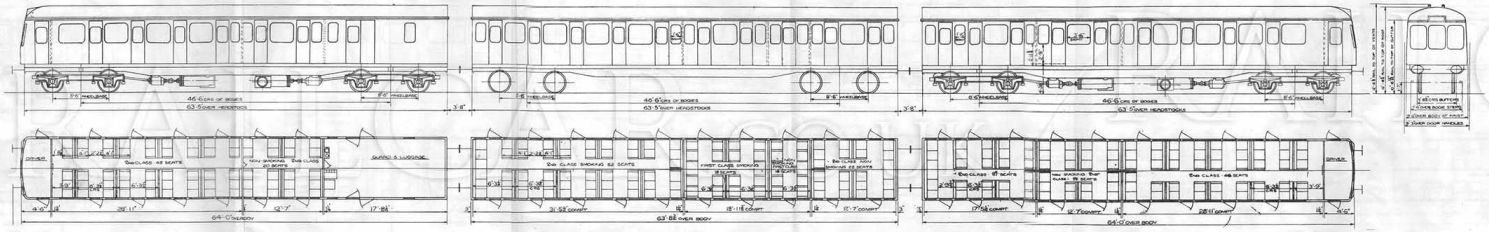
First Class—18 seats Second Class—16 seats
MOTOR BRAKE COMPOSITE

Second Class—64 seats
BUFFET SECOND

Second Class—68 seats
MOTOR SECOND

Drawing No. 140607C

SUBURBAN DIESEL TRAINS



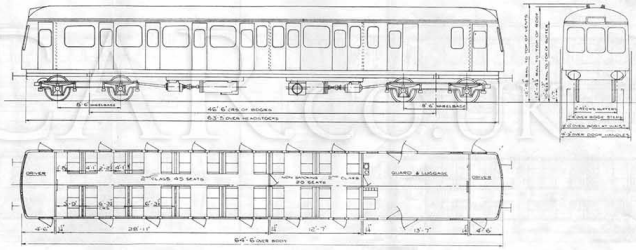
Second Class—65 seats
MOTOR BRAKE SECOND

First Class—28 seats Second Class—74 seats
TRAILER COMPOSITE

Second Class—95 seats
MOTOR SECOND

Drawing No. DE1852E

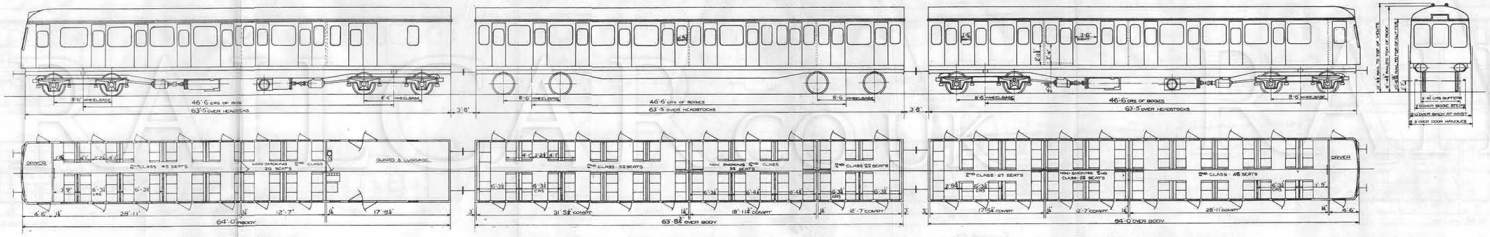
SINGLE CAR DIESEL TRAINS



Second Class—65 seats
MOTOR BRAKE SECOND

Drawing No. DE56762A

SUBURBAN DIESEL TRAINS (Second Class)



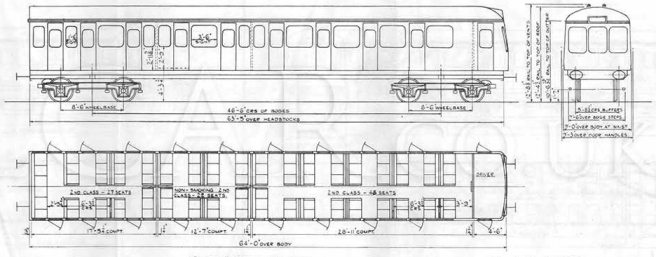
Second Cls—65 seats
MOTOR BRKE SECOND

Second Class—106 seats
TRAILER SECOND

Second Class—95 seats
MOTOR SECOND

Drawing No. DE1931C

DRIVE-END TRAILERS



Second Class—95 seats
DRIVER TRAILER SECOND

Drawing No. DE56752B