

BR. 33003/81

May, 1960

2,000 H.P. DIESEL PULLMAN TRAINS
DIESEL ELECTRIC MOTOR COACHES
M.60090-60093, W.60094-60099
COACHES WITH AUXILIARY ENGINES
M.60730-60733, W.60644-60649
TRAILER COACHES
M.60740-60743, W.60734-60739 &
60744-60749

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PRELIMINARY

**PRELIMINARY DRIVER'S INSTRUCTIONS FOR
OPERATING 2,000 H.P. DIESEL PULLMAN TRAINS
DIESEL ELECTRIC MOTOR COACHES M.60090-60093,
W.60094-60099**

**COACHES WITH AUXILIARY ENGINES M.60730-60733,
W.60644-60649**

**TRAILER COACHES M.60740-60743, W.60734-60739 AND
60744-60749**

TRAIN DATA

Type—End vehicles	2-B.
Adjacent vehicles	B-2.
Weight of train in running order (6 car)	299 tons, approx. (8 car)=357 tons, approx.
Continuous tractive effort (2 En- gines)	12,000 lb.
Bogie centres (all vehicles)	46ft. 6in.
Bogie wheelbase (leading and power bogies)	9ft. 6in.
(remaining bogies)	8ft. 6in.
Total wheelbase of train (6 car) (8 car)	396ft. 0in. 532ft. 0in.
Wheel diameter (new)	3ft. 6in.
(worn)	3ft. 3½in.
Maximum width overall	9ft. 3in.
Maximum length of end vehicles (over buffers)	68ft. 6½in.
Maximum length of train (over buffers)	409ft. 1in.
(8 car)	545ft. 1in.
Maximum height	12ft. 7½in.
Maximum curve negotiable	3½ chains.
Maximum permitted speed	90 m.p.h.
Fuel tank capacity (main engines) four main tanks each	250 gallons.
Fuel tank capacity (main engines) two service tanks each	20 gallons
Total main engine fuel tank capacity	1,040 gallons.
Fuel tank capacity (auxiliary en- gines) two tanks each	100 gallons
Main engine lubricating oil sump, two each	47 gallons

Cooling water:-

Each engine total 175 gallons

Auxiliary engine. Lubricating oil
sump each (2) 9 gallons

Cooling water:-

Each engine total 14 gallons

Brakes

Air and Hand.

(Westinghouse E.P. and Auto-
matic with High Speed feature).

MAIN POWER EQUIPMENT

12 cylinder Diesel Engine (2) North British/M.A.N.
L 12 V 18/21 S.

Direction of rotation Anti-clockwise (looking on genera-
tor end).

L.H. Bank of cylinders 1-6 (looking on generator end).

R.H. Bank of cylinders 7-12 (looking on generator end).

Cylinder bore and stroke 180 m.m. x 210 m.m.

Cylinder Firing order 1-11-2-9-4-7-6-8-5-10-3-12-1
(looking on generator end).

Fuel Pumps BPE 6Z 130 N400/3YS 6508.

Fuel Injector Holder No. BKC 57S DY 5014

Fuel Injector Nozzle No. BDN OSDY 6191

Pressure at which fuel injector
nozzle should be set 180 atmospheres (2,650 lb./sq. in.).

Main Generator (2) G.E.C. type WT.882.
D.C. Self Ventilated—6 pole.
Continuous rating:-
1700 amps. at 383 volts at 1500
r.p.m.
1250 amps. at 523 volts at 1500
r.p.m.
Maximum current 3050 amps.
maximum voltage 575 volts.

Auxiliary Generator G.E.C. type WT.762.
D.C. Self Ventilated—6 pole.
Continuous rating 10 Kw.
91 amps. at 110 volts at 1500
r.p.m.

Traction Motors (8) G.E.C. type WT.361.
D.C. Self Ventilated—4 pole.
Continuous rating 199 h.p.
425 amps. at 383 volts at 1360
r.p.m.
Maximum current 750 amps.

Battery for starting main engines (2)	D. P. Battery Co. Ltd. 48 cell D.P. type DSKA 154. 110 volts.
Warning light and control voltage	110 volts.
Cab and engine room lamp voltage	24 volts.
Air Compressors (2)	Westinghouse D.H.C.5. Motor driven.
Communication system guard/driver	Loudaphone.

AUXILIARY POWER EQUIPMENT

8 cylinder Diesel Engine (2)	Rolls Royce, type C8N FLH Series 821. 180 B.H.P. at 1500 r.p.m.
Direction of rotation	Clockwise viewed from front of engine.
Cylinder numbering	No. 1 cylinder at front of engine.
Cylinder bore and stroke	5.125 ins. x 6.000 inches.
Cylinder firing order	1, 6, 2, 5, 8, 3, 7, 4.
Fuel Pump	C.A.V. type NN R8F 100/176 fitted with all-speed mechanical governor type LVW B24M (228.750).
Fuel injector (holder)	C.A.V. BKBL 965 684M.
(nozzle)	C.A.V. BDLL 150 S.6130A.
Engine Starter	24V C.A.V. type U624A-38M.
Pressure at which fuel injector nozzle should be set	175 atmospheres. 2,570 lbs./sq. in.
Alternator	Stone's type ARK 64L/XR22S 400V. 3-phase 50-cycles. Continuous rating 150 KVA.
Battery for starting auxiliary engine	Chloride Battery Co. 24 volt type 12 MVA-13, of 216 Ah capacity.

DRIVER'S CONTROLS IN EACH CAB

1. AWS key (removable) or AWS switch (Western Region).
2. Reversing handle locking key.
3. Reversing handle, marked REV-OFF-E.S. FORWARD.
4. Power handle, marked OFF-1 to 10.
5. Air Brake Valve handle.
6. Air brake switch (removable key).
7. Control Key Switch (removable key).
8. Engine START push button (Main Engines only).
9. Engine STOP push button (Main Engines only).
10. Overload re-set push button.

11. Deadman's treadle.
12. Deadman's hold-over button.
13. Light control master switch (cab and engine room).
14. High speed brake relay test button.
15. Auxiliary heater switch. (2).
16. Combined cab heater and de-mister switch. (2).
17. Fresh or recirculated air control.
18. A.W.S. re-set button.
19. Handbrake wheel.
20. Windscreen wiper control. (2).
21. Fire extinguishers (hand type). (3).
22. Warning horn control. (2).
23. Headcode light switches (3) with indicators.
24. Loudaphone unit (2 buttons combined).
25. Instrument light switch.
26. Instrument light dimmer control.
27. Handlamp socket switch.
28. Heater—cooker changeover switch.
29. Cab light switch. (2).
30. A.W.S. Isolating switch (cock on Western Region).

EACH ENGINE COMPARTMENT

1. Local start and stop push button.
2. Lubricating oil priming pump test button.
3. Water high temperature cooling switch.
4. Fire alarm test button.
5. Engine stop button.

GAUGES AND INDICATORS

(a) In each cab.

1. Duplex air pressure gauge.
2. Brake cylinder air pressure gauge.
3. Speedometer.
4. Traction ammeter.
5. Auxiliary engine stopped indicator lamp (2) (Red). (Normally out, illuminated in event of fire).
6. Main engine stopped indicator lamp. (Red). (Normally dim, bright on fault).
7. Fault indicator lamp. (Blue). (Normally dim, bright on fault).
8. E.P. brake indicator lamp. (Green). (Normally bright, extinguished on fault).

9. High speed brake indicator lamp. (White). (The light becomes bright about 40 m.p.h. when accelerating, and goes out when train speed falls to 30 m.p.h.).
10. A.W.S. Indicator.
11. Handbrake indicator light. (Blue). (Bright when handbrake applied, dim when both handbrakes are fully released).
12. Fire alarm bell.

(b) In each control cubicle.

1. Battery charging voltmeter.
2. Battery charging ammeter.
3. Indicator lamps:-
 - Engine cooling—Header tank "low water level".
 - Engine lubricating oil pressure.
 - Overload relays—OL1 and OL2.
 - Earth fault.
 - Engine cooling water high temperature.

} All white.
Normally dim,
bright on fault.

(c) In each engine-room.

1. Engine hour recorder.
2. Engine speed indicator (R.P.M.).
3. Engine cooling water temperature gauge.
4. Header tank water level gauge.
5. Fuel oil service tank gauge.
6. Control air pressure gauge (located in generator room).

(d) On body side at the respective filling points.

1. Fuel contents gauge showing the quantity of fuel oil in the main engine fuel tanks.

NOTE: The two 250-gallon fuel tanks in each power car are inter-connected and the fuel gauge shows the total quantity of fuel oil in the two tanks.

2. Fuel contents gauge showing the quantity of fuel oil in the auxiliary power fuel tank.

(e) On each vehicle underframe (except Main Power Cars).

1. Brake cylinder pressure gauges.

(f) On each leading bogie.

1. Mileage counter.

DRIVER'S CONTROLS IN EACH CONTROL CUBICLE

1. Battery charging changeover switch (Aux. Gen/external socket).
2. Voltmeter changeover switch (Aux. Gen/battery).

3. Main engine isolating switch—normally closed.
4. Compressor isolating switch.
5. Earth fault relay, isolating switch.
6. Fuse test contacts.
7. Compressor synchronising wire isolating switch.

DRIVER'S CONTROLS AND INDICATORS IN EACH ENGINE COMPARTMENT

1. Fire control box containing a Fire Alarm test button and an indicating light.

DRIVER'S CONTROLS IN EACH HIGH TENSION CUBICLE

1. Battery isolating switch.
2. Traction motor cut out switch.
3. Engine emergency stop.

FUSES FITTED AND CHANGING PROCEDURE

<i>Fuse</i>	<i>Capacity</i>	<i>Position</i>
Compartment lights	20 A.	Control Cubicle
Headcode and tail light	20 A.	" "
Auxiliary cab heater	20 A.	" "
Engine room sockets and cab and Instrument lights	20 A.	" "
Sockets on underframe	20 A.	" "
De-mister and cab heater motor	30 A.	" "
Compressor	125 A.	" "
Hotplate	20 A.	" "
Oil priming pump	30 A.	" "
Control	30 A.	" "
Battery (2)	80 A.	H.T. "
Main lighting (2)	30 A.	Control "
Voltmeter	5 A.	" "
E.P. brake	5 A.	" "
Fire circuit protection	5 A.	" "

SPARE FUSES CARRIED IN CONTROL CUBICLE

- | | | |
|---|---|--------|
| 1 | — | 125 A. |
| 1 | — | 80 A. |
| 2 | — | 30 A. |
| 1 | — | 20 A. |
| 1 | — | 5 A. |

SPARE LIGHT BULBS CARRIED

Spare light bulbs are carried.

CHANGING FUSES

In the event of a fuse failure, ONE of the spares carried may be used, but care must be taken that it is of the same capacity as the one which is defective.

These fuses are all of the "cartridge type" and can be identified by their markings which are labelled on all fuses and stamped on the end of the larger sizes (80-125 amp.).

A blown fuse can usually be detected by a burnt patch on the body of the fuse cartridge, but if in doubt, check the fuse.

To check or change a fuse

Shut down the engine; the battery isolating and control switches must be left closed except in the case of battery fuses, in **this case the battery isolating switch MUST be opened** and great care exercised in changing these fuses.

Check that the fuse tester is "alive" by bridging the contacts with a spare fuse.

The earth fault indicating lamp will glow brightly; then check the suspected fuse. Touch the metal ends of the cartridge simultaneously to the tester contacts; if the fuse is sound the lamp will light.

Defective fuses must NOT be replaced in the spare fuse rack.

All fuses changed must be reported on a repair card.

NOTE: If all control cubicle lights are OUT—suspect the control fuse. If the control fuse is blown, the fuse tester is inoperative!

DRIVER'S DAILY DUTIES WHEN IN SERVICE

(a) At Leading End of Train:-

1. Check that the hand brake is ON (manually).
2. Close the main lighting switch.
3. Close the battery isolating switches in the H.T. cubicle.
4. Open the control cubicle door with the key provided and check:-
 - (i) That the battery charging switch is in the GENERATOR position.
 - (ii) That the traction motor cut-out switch is in the ALL MOTORS IN position—in H.T. cubicle.
 - (iii) Check that the compressor isolating switch is closed also that the compressor synchronising wire switch is closed.
5. Inspect the overload contactors in the Power cubicle, through the windows provided and ensure that all the overload indicating tags are in the SET position.
6. Check that the earth fault isolating switch is sealed.

NOTE: This switch must be sealed before leaving shed. If the

switch is not sealed, a member of the maintenance staff must seal it before leaving.

7. Check that the main engine isolating switch is closed.
8. Test the fire alarm bells from the button in the Engine Compartment.
9. Check that the complement of detonators and red flags is complete.
10. When walking down the outside of the train, check operation of the fire alarm by pressing the test button on the fire alarm panel adjacent to the auxiliary engines, on each side of train.

(b) At Trailing End of Train:-

1. Check that the handbrake is OFF (manually).
2. Close the main lighting switch.
3. Close the battery isolating switches in the power cubicle.
4. Open the control cubicle door with the key provided and check:-
 - (i) That the battery charging switch is in the GENERATOR position.
 - (ii) That the traction motor cut-out switch is in the ALL MOTORS IN position—in H.T. cubicle.
 - (iii) Check that the compressor isolating switch is closed, also that the compressor synchronising wire switch is closed.
5. Inspect the overload contactors in the Power cubicle, through the windows provided, and ensure that all the overload indicating tags are in the SET position.
6. Check that the earth fault isolating switch is sealed.

NOTE: This switch must be sealed before leaving shed. If the switch is not sealed a member of the maintenance staff must seal it before leaving.

7. Check that the main engine isolating switch is closed.
8. Test the fire alarm bells from the button in the Engine Compartment.
9. Check that the complement of detonators and red flags is complete.
10. On Western Region trains, check that the A.W.S. IN/OUT OF USE switch is in the OUT OF USE position; and indicator shows "OUT OF USE."

Colour Identification of Pipes

Line	Colour
Cooling Water	French Blue
Fuel Oil	Brown
Lubricating Oil (engine)	Salmon Pink
Compressed Air	White
Drains	Black
Fire Installations	Signal Red
Electrical	Light Orange

STARTING THE ENGINES FROM THE LEADING END OF TRAIN

1. Place A.W.S. key into position and move to ON (London Midland Region). Insert the air brake switch key and the control switch key.
2. Insert the Reversing handle locking key into the controller.
3. Move the Reversing handle to the E.S. (ENGINE START) position.
4. Press the engine start push button and hold it down. The lubricating oil priming pump will first run to build up lubricating oil pressure and the starting contactors will close when the pressure is sufficient. The engines will then be motored over and will fire. The engine stopped indicator lamp (Red) will glow brightly until both engines have fired.
5. As soon as the engine stopped indicator red light ceases to glow brightly, release the engine start push button.
6. If either engine fails to start, release start button and pause for at least 10 seconds before making another attempt to start. After a second attempt, endeavour to establish the reason for the failure. If the reason for the failure cannot quickly and easily be remedied, do not attempt any further starts, but report the failure.
7. With both engines running, check that the red and blue indicator lights in the occupied cab are glowing dimly.

NOTE : These two lights are not operative in any other cab than that in which the master switch key is inserted.

8. Place air brake handle into the Running and Release position and check the air brake pressure while the system is charging up. Final pressures should be:—

Brake Pipe	70 lbs./sq. in.
Main Reservoir	125 lbs./sq. in.
Brake Cylinders	Zero lbs./sq. in.
10. Ensure E.P. Brake indicator light is on.
11. Check the E.P. Brake, the automatic brake and High Speed brake as described under the heading "Brake Tests."

TO START THE TRAIN

Before attempting to move the train:—

1. On Western Region trains, move the A.W.S. IN/OUT OF USE switch in the occupied cab to IN USE position. Indicator must show "IN USE." The A.W.S. apparatus must be reset by pressing and releasing the reset button.
2. Check that the air pressure has built up to a maximum (approx. 125 lbs./sq. in.).
3. Make a service application of the E.P. brake and check that the brake cylinder pressure rises to at least 45 lbs./sq. in. (Note:—this figure is provisional).
4. Release the handbrake **Fully**, and ensure that the indicator light on driving panel goes dim.
5. Place a foot on the Deadman's pedal.

6. Move the Reversing handle to the **FORWARD** or **REVERSE** position.
7. **To start the train**, providing the engine indicator and alarm lights are glowing dimly, move the power handle to the first notch and release the E.P. brake application.

8. As soon as the brakes are released and the traction ammeter responds, notches 2 and 3 may be engaged smartly, but notch 4 must not be engaged until the train is moving.

NOTE : Provided all motors are "IN" at both ends of the train, each consecutive notch above notch 4, may be selected provided the ammeter needle is falling and is not above 2,500 amps. During this acceleration period on selecting a higher notch, current will rise above 2,500 amps, but should only enter the red zone on selecting notch 5. Under this condition, if the current exceeds 3,200 amps, the overload will operate to protect the equipment.

9. Gradually notch up the power handle to the requirements above, until the desired notch position is obtained, depending on the speed required, Notch 10 gives maximum power.
10. Glance occasionally at the traction ammeter and the indicating lights.
11. **MAXIMUM PERMITTED SPEED IS 90 M.P.H.**, under power or coasting, and this must not be exceeded under any circumstances.

WHILST RUNNING

1. Overloads

If an overload circuit breaker trips, the blue fault light will brighten, move the Power handle to the **OFF** position and push the overload re-set button. If tripping is persistent, stop the train and inspect the overload trips through the window provided in the Power cubicle. The defective traction motor can be identified by the corresponding indicating tag being in the **TRIP** position. Move the traction motor cut-out switch to such a position as to cut out the defective traction motor. The train speed is, however, now limited, depending on notch position, as weak field is not available and the generator output is now divided between the remaining traction motors on the effected Power car and/or Kitchen car. Weak fields are still obtainable on the power equipment at the other end of the train.

2. Earth Fault

If the earth fault relay trips the blue fault light will brighten, proceed to re-set as detailed under "Overloads". If tripping is persistent, proceed to the Control Cubicle and if the local indicator shows an earth fault on the equipment, shut down the engine and operate the sealed earth fault isolating switch, moving it to the **ISOLATED** position.

The journey may be continued to terminus, but the fault must be reported as soon as possible and the train examined before continuing diagram.

3. Engine Overspeed Device

The diesel engine idles at 650 r.p.m. and has a maximum speed of 1,500 r.p.m. A mechanical overspeed governor is fitted directly to the engine governor. This is a centrifugal governor which, should the engine overspeed, throws out a plunger at a speed of between 1,650 and 1,680 r.p.m. This in turn releases a spring loaded plunger which returns the fuel racks to the NO FUEL position.

If the engine overspeed device operates, the following action must be taken:—

- (a) Return the power handle to OFF.
- (b) Move the red handle towards the pumps to re-set the overspeed device.
- (c) Investigate the cause and if possible re-start the engine.

4. Indicator Lamps (Cab)

Indicator lamps are provided to show that the train equipment is functioning correctly. The lamps glow dimly for normal running and glow brightly under fault conditions except high speed brake indicator, E.P. brake and auxiliary engines indicator lights.

5. Red Lights, Auxiliary Engine (leading and trailing)

When either of these indicator lamps show simultaneously with the ringing of the fire alarm bell, it indicates that fire has occurred on that particular engine and that the engine has stopped. If this happens, stop the train and investigate.

6. Red Light, Main Engine Stopped

When the lamp glows brightly, it indicates that either engine has stopped. In the case of the adjacent engine, running can be checked by direct observation. If the engine has been stopped by either loss of lubricating oil pressure or by low cooling water level, the particular fault causing the shut down can be located by observation of the fault indicator lamps on the adjacent control panel.

7. Low Lubricating Oil Pressure

If the lubricating oil pressure falls, the engine is stopped automatically and the corresponding fault indicator light on the adjacent control cubicle brightens.

8. Low Water Level

If the water level in the radiator falls below the safe limit, the engine is stopped automatically and the appropriate fault indicator light brightens on the adjacent control cubicle. The engine cannot be re-started until the safe working level is restored. (The engine should be allowed to cool down before adding coolant).

9. Blue Alarm Light

If this light brightens it can be caused either by—

- (a) The water temperature in the header tank having reached

its maximum permissible value, the engine returns to idling and will have to be allowed to cool down before power can be restored.

(b) The overload relay has tripped.

(c) The earth fault relay has tripped.

It is possible to identify the fault by observation of the local warning lights on the control cubicle.

For action required in cases (b) and (c) see instructions under the heading "Overloads" and "Earth Fault".

10. Engine Failure

In the event of an engine failure, move the engine isolating switch to the OFF position and the corresponding traction motor isolating switch to the ALL MOTORS OUT position. Care should be exercised in operating the power handle since no ammeter readings will be obtained if the rear engine unit is shut down. Due to this, there is the possibility of persistent tripping of the "overloads".

11. Battery Charging

The main engine starting batteries are charged by the adjacent auxiliary generators through the voltage regulators. The charging current for the adjacent battery may be read on the ammeter mounted in each control cubicle. The auxiliary generator or battery voltages may also be read on the voltmeters mounted adjacent to the ammeters by operating the selector switches.

12. Deadman's Device

If the Deadman's pedal is released, the drive to the wheels is cut off and an Automatic Air Brake application is made after five seconds delay. The diesel engines now run at idling speed.

When a Deadman's application has taken place, the following action must be taken to regain control.

(a) Return the Power handle to the OFF position.

(b) Depress the Deadman's pedal; then wait for 20 seconds before attempting to regain control.

(c) On release of the brake cylinder pressure and restoration of normal brake pipe pressure, the power handle may be operated normally to re-start the train.

NOTE: Should there be a failure of the Deadman's device, a sealed cock is provided for isolating this apparatus. The cock situated below the driver's desk should be closed in an emergency only and a second man should be with the driver throughout the time the Deadman's device is out of order. This isolating cock is only effective on that particular power car. On changing ends, the apparatus in the other cab is operative.

STOPPING THE TRAIN

1. Return the Power handle to the OFF position.

2. Apply the brakes.

TO REVERSE THE TRAIN

1. Return the Power handle to the OFF position.
2. Apply the E.P. brake to hold the train stationary.

DO NOT ATTEMPT TO REVERSE WHEN THE TRAIN IS MOVING.

3. Move the Reversing handle to the position required.
4. Release the brakes, then operate the power handle as required.

CHANGING ENDS

When changing from one end of the train to the other, proceed as follows:—

1. Move the brake handle to the EMERGENCY position and allow the automatic brake to apply fully.
2. Check that the Power handle is in the OFF position, then place the Reversing handle to the OFF position.
3. Turn the air brake switch key $\frac{1}{2}$ turn clockwise.
4. Move the brake handle to the SHUT DOWN position.
5. Remove the air brake switch key, the Reversing handle locking key and the control switch key, also A.W.S. key on London Midland Region.
6. On the Western Region, place the A.W.S. IN/OUT OF USE switch into the OUT OF USE position; the indicator must show "OUT OF USE."
7. Switch off lights, lock compartment doors, proceed to the other cab.
8. Place the air brake switch key, the Reversing handle locking key and the control switch key into position.
9. On the Western Region, place the A.W.S. IN/OUT OF USE switch into the IN USE position, indicator must show "IN USE." On London Midland Region place A.W.S. key into position. The A.W.S. apparatus must be reset by pressing and releasing the reset button.
10. Place the Reversing handle into the required direction of travel.
11. Before moving off, check that—
 - (a) Indicator lights are normal.
 - (b) Gauges show correct pressures.

STABLING THE TRAIN

1. Press the engine stop button.
2. Apply both handbrakes.
3. Move air brake handle to the EMERGENCY position and allow the automatic brake to apply fully.
4. Turn air brake switch key $\frac{1}{2}$ turn anti-clockwise.
5. Move air brake handle to the SHUT DOWN position.
6. Remove air brake switch key, the Reversing handle locking key and the control switch key also A.W.S. key on London Midland

Region. On Western Region place A.W.S. IN/OUT OF USE switch to OUT OF USE position and check that the indicator shows "OUT OF USE."

7. Open battery isolating switches.
8. Switch off the compartment lights, cab lights and open the main lighting switches.
9. Report any defects.

TOWING THE TRAIN (DEAD)

If for any reason it is required to tow the train, the controls must be set in the OFF position, the Reversing handle locking key, the air brake switch key and the control switch key removed, also A.W.S. key (L.M.R.), and the traction motor cut-out switch placed in the ALL MOTORS OUT position, and ALL air pressure released. On Western Region trains, the A.W.S. IN/OUT OF USE switch must be placed into the OUT OF USE position; the indicator must show "OUT OF USE."

The train is now under control of the hand brakes only.

FUEL SUPPLY TO THE DIESEL ENGINE

An engine driven transfer pump supplies fuel to the service tank under pressure—from there it flows through filters to the engine fuel injection mono-bloc pumps. Any surplus fuel is by-passed from the service tanks back to the main tanks. The lift pump is belt driven, and in the event of its failure, a hand operated lift pump is provided and the header tank may be replenished in this manner and the journey continued. In addition, there is a small hand priming device on the mono-bloc pumps for the elimination of the air locks, etc., in the injector pipes.

ENGINE LUBRICATING OIL SYSTEM

The lubricating oil pressure is obtained from a gear-driven pump situated in the sump and the oil is directed through an oil heat exchanger. From the heat exchanger the oil flows through filters to the engine bearings, valves and timing gear.

A safety valve is fitted in the line ahead of the heat exchanger to prevent excessive oil pressure in the case of cold oil, and by-passes the oil through the filter to the bearings.

An electrically-driven oil priming pump operates when the start button is depressed and, as soon as sufficient pressure is obtained, pressure switches close and the engines are turned over by the main generators. Until sufficient engine oil pressure is obtained the engine will not turn over.

ENGINE COOLING WATER SYSTEM

The system consists of independent main and secondary circuits. The duplex water pump is gear-driven from the engine and has large and small casings with the respective impellers on a common shaft.

The larger pump in the main system circulates the cooling water through the engine water spaces and the exhaust gas turbo-charger before returning it to the radiators.

The smaller pump in the secondary system circulates the cooling water through the engine lubricating oil heat exchanger before returning it to the radiator.

The radiator fans and shutters are automatically controlled by the water outlet temperature of both the engine and lubricating oil heat exchanger and are driven by the Serck-Behr hydrostatic pump and motor system.

FIRE WARNING SYSTEM

An audible fire warning system forms part of the train equipment.

The system is arranged to operate a fire alarm bell in the driving cab in the event of fire occurring. To test the operation of the warning system, test buttons are provided in each main engine compartment and below the frames near each auxiliary engine and these must be operated by each driver on taking charge of the train.

If the fire bell does not operate, check the fuse, and if necessary, replace.

FIRE PROTECTION

Auxiliary Engine(s)

1 off-14 lb. Chlorobromomethane extinguisher pressurised to 250 lbs. per sq. in. with nitrogen. This C.B. extinguisher is fitted with an electrically operated cartridge that when fired generates pressure, which shears a diaphragm in the extinguisher head and releases the pressurised extinguishant.

This cartridge can be fired by either the Pyrotechnic Flame Switch or the Resetting Detector sensing an appreciable increase in temperature, such as would be caused by a fire and completing an electrical circuit. This in effect puts the cartridge directly across the 24-v. supply and causes the extinguisher to operate.

In the event of a fire, which will be normally indicated by the fire warning bells ringing if fire is adjacent to an engine, bring the train to a stand as laid down in Rule No. 188. When the train has been brought to a stand, take a hand-operated fire extinguisher from the driving compartment and inspect the engine that has been affected, as shown by the indicator light in the driving compartment. An additional indication of the engine concerned will be given by the red warning light which will be illuminated on the appropriate fire alarm box at sole-bar level.

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, extinguish the warning light and render it impossible to re-start the affected engine.

If the automatic extinguishing apparatus has operated, avoid inhaling a concentration of the gas which has a faint smell, and avoid touching the liquid with the skin or clothes.

As the gas is heavier than air, the concentration will be at low levels near the ground.

See General Instructions and Notices in Appendix to the Operating Instructions regarding First-Aid treatment to a person

contaminated by the fire extinguishing medium used in the automatic appliance.

Main Engines

2 off-50 lbs. CO₂ extinguishers. These CO₂ extinguishers are also fitted with an electrically operated cartridge, which in this case fires a cutter that shears a diaphragm.

These cartridges are fired by the Resetting Detectors disposed around the engine and generator compartments.

The apparatus does **not** require to be made alive, but is a fully automatic system that is constantly monitoring the Auxiliary and the Main Engine. This system functions from the 24-v. battery, which is independent of the position of the main battery switch.

If the fire bell rings:—

STOP THE TRAIN as laid down in Rule 188.

In the event of a small internal or external outbreak of fire detected by sight or sound or smell, hand extinguishers of the CO₂ and C.T.C. type are provided in each driving cab. The CO₂ extinguishers should only be used against internal fires, if used externally the gas very rapidly dissipates and its efficiency is seriously reduced.

The C.T.C. Extinguishers should only be used against external fires, they **MUST NOT** be used against internal fires.

If a fire is detected in the engine or generator room, care must be exercised before deciding to enter, as when the temperature rises to the appropriate value, the automatic extinguisher system will operate without warning, and an individual may be in some distress. The fire extinguishing medium used in the automatic appliances comprises a toxic gas which dissipates very rapidly when exposed to open air. Care should be taken, therefore, to avoid contact with, or inhaling the vapour. See Miscellaneous Instructions B.R.33003/6 and Notices in Appendix to the Operating Instructions regarding First Aid treatment to a person contaminated by the fire extinguishing medium used in the automatic appliance.

Do not leave waste or cloths, or litter of any description lying about in the engine rooms as these can be a contributory cause of fire.

Naked lights should not be used in or around these trains for any purpose except in the driving cabs where smoking is permitted.

BRAKE INFORMATION

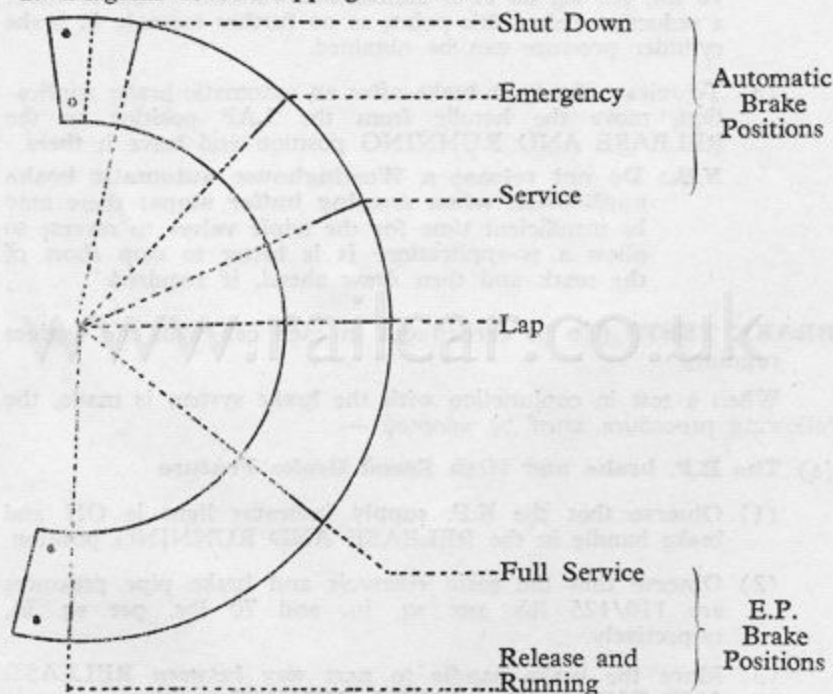
1. The train is braked by compressed air and combines under the control of a single brake handle:—

- (a) The E.P. (electro-pneumatic) brake which is an electrically controlled compressed air brake and is used to give the normal service application. It provides simultaneous braking on each vehicle of the train.
- (b) The automatic brake, which provides an emergency application either by the driver, guard, passenger or if the train should part. It can be operated by the driver's brake valve handle (see diagram below), if the E.P. brake cannot be used, e.g. in the case of electrical failure, and is then used for service stops.

Also incorporated is the High Speed brake which is an automatic feature superimposed on the E.P. brake and the automatic brake and which makes available a higher brake force above certain train speeds.

NOTE : Two pressure gauges are provided in each cab. One indicates the pressure in the brake cylinders and the other is a duplex pressure gauge indicating main reservoir and train pipe pressures. When an E.P. brake application is made, the brake cylinder pressure gauge will show an increase of pressure and the train pipe pressure gauge will remain stationary. When an automatic brake application is made the brake cylinder pressure gauge will show an increase of pressure (as before) and the train pipe pressure gauge will show a decrease of pressure.

2. Diagram of Self-lapping Driver's Brake Valve.



NOTE :

- (a) The **EMERGENCY** application position applies to both E.P. and automatic brakes. When an **EMERGENCY** brake application is made, leave the brake handle in this position until the train stops.

Note : The brake cylinder safety valves will blow when an "emergency" brake application is made.

- (b) An E.P. brake application is not released when the brake valve handle is moved to the automatic brake positions.
- (c) The nearer the handle is to the **FULL SERVICE** the heavier is the E.P. brake application, the actual brake

cylinder pressure depending on whether or not the high speed brake is in operation.

- (d) To make an automatic brake application the **FULL SERVICE** position **must not be used**, the handle must be moved quickly to the **LAP** position, then to the **SERVICE** position for a few seconds. When the brake pipe pressure has been reduced the desired amount the handle must be moved back to the **LAP** position.

The degree of braking obtained corresponds with the amount the brake pipe pressure is reduced. Maximum brake force is obtained when the brake pipe pressure has dropped to the figure at which auxiliary reservoir and dummy cylinder pressures equalise. Equalisation takes place at about 50 lbs. per sq. in. which corresponds with a reduction of about 20 lbs. per sq. in. from the normal brake pipe pressure of 70 lbs. per sq. in. It is useless and wasteful of air to effect a reduction below this point, as no further increase in brake cylinder pressure can be obtained.

- (e) To release the train brake after an automatic brake application, move the handle from the **LAP** position to the **RELEASE AND RUNNING** position and leave it there.

N.B.: Do not release a Westinghouse automatic brake application when nearing buffer stops; there may be insufficient time for the triple valves to reverse to allow a re-application. It is better to stop short of the mark and then draw ahead, if required.

BRAKE TESTS (To be carried out in each cab with the engines running)

When a test in conjunction with the brake system is made, the following procedure must be adopted:—

(a) **The E.P. brake and High Speed Brake Feature**

- (1) Observe that the E.P. supply indicator light is **ON** and brake handle in the **RELEASE AND RUNNING** position.
- (2) Observe that the main reservoir and brake pipe pressures are 110/125 lbs. per sq. in. and 70 lbs. per sq. in. respectively.
- (3) Move the brake handle to part way between **RELEASE AND RUNNING** and **FULL SERVICE** positions and note that brake cylinder pressure builds up to about 25 lbs. per sq. in.
- (4) Move the brake handle to **FULL SERVICE** position and note that the brake cylinder pressure builds up to not less than 45 lbs. per sq. in. The guard in the driving cab at the rear must check that the brake cylinder pressure rises to not less than 45 lbs. per sq. in., the Loudaphone equipment being used for communication.
- (5) Depress and hold the High Speed Test button and check that:—

The High Speed Brake Indicator Lamp lights.

- (6) Release the high speed brake test button and return the brake controller to the **RELEASE AND RUNNING** position and check that:—
 - (a) high speed brake indicator light goes out as the button is released.
 - (b) the brake cylinder pressure falls to zero.
- (b) **The Automatic Brake (for Continuity)**
 - (1) Check the Main Reservoir and brake pipe pressures as in A (2) above.
 - (2) In the rear Guard's compartment the Guard must check that:—
 - (a) the brake pipe is charged to 70 lbs. per sq. in.
 - (b) on opening the Guard's valve and reducing the brake pipe pressure to zero and check with the driver that the brake cylinder pressure rises to at least 45 lbs. per sq. in.
 - (3) Return the Guard's valve handle to the **CLOSED** position.
NOTE: To prevent loss of air pressure from the main reservoir system during these tests, the driver should on seeing gauge indication of a brake pipe drop, move his air brake valve handle quickly to the **LAP** position.
 - (4) The driver must then release the brakes by moving the brake handle to the **RELEASE AND RUNNING** position. The Driver and Guard must check that the Brake Pipe pressure is restored to 70 lbs. per sq. in.
 - (5) Make a service application of the automatic brake by moving the brake handle smartly (so as to prevent an **E.P.** application) to **SERVICE** position to reduce the brake pipe pressure by at least 25 lbs. per sq. in. and then back to **LAP** position and check that the brake cylinder pressure builds up to not less than 45 lbs. per sq. in. Release the brakes and check that the brake cylinder pressure drops to zero.
- (c) **Test of Deadman's Brake Apparatus**
 - (1) Depress the Deadman's pedal and move the reversing handle to the **FORWARD** or **REVERSE** position and check that the brake does not apply.
 - (2) Release the Deadman's pedal and check that:—
 - (a) after a delay of about 5 seconds, the brake pipe pressure falls rapidly by at least 30 lbs. per sq. in.
 - (b) the brake cylinder pressure rises to about 50 lbs. per sq. in.
 - (3) Re-depress the Deadman's pedal and note that:—
 - (a) the brake pipe pressure rises to 70 lbs. per sq. in.
 - (b) the brake cylinder pressure returns to zero.
 - (4) Return the reverser handle to the **OFF** position and release the Deadman's pedal when the test is complete.

HANDBRAKES

The handbrake in each cab operates on the wheels of the bogie immediately below the cab.

It is necessary to ensure that both handbrakes are **FULLY** released before the train is moved. Indicator Lights are provided to show when the handbrake is **ON**—bright when **ON**, dim when released.

AUXILIARY DIESEL ENGINES

Power for lighting, heating, cooking and air conditioning on the train is provided by the Rolls Royce auxiliary diesel engines driving Stones 3 phase 50 cycle 400 volt alternators. These engines are started and stopped from inside the train by the Travelling Maintenance Attendant and are automatically controlled while working.

LOUDAPHONE COMMUNICATION

The loudaphone apparatus is a means by which the driver and guard may speak to each other, or exchange bell signals but it does not in any way relieve staff from their obligation to carry out the relevant Rules and Regulations.

A bell, which is actuated by the depression of the "call" button on the loudaphone, is provided in both the guard's and driver's compartments and the bell communication must always be used for the exchange of signals in accordance with the standard code shown in the Instructions for Working Multiple-Unit Diesel Trains.

Standard bell codes will be used for all normal movements but the driver, if requiring to speak to the guard, or the guard, if requiring to speak to the driver, must send on the call button the code 3 pause 3 "Guard required to speak to Driver", or "Driver required to speak to Guard", and the man at the other end must acknowledge by repetition as detailed in the Instructions referred to above. Conversation may then proceed provided both men keep the "Speak" button depressed.

The apparatus must only be used for essential conversations on matters affecting the working of the train and, except in the case of emergency, should not be used when the train is in motion. The apparatus may also be used by shunters, in the absence of guards, in order to communicate with drivers, in connection with shunting operations.

In order to avoid any possibility of unauthorised use of the apparatus in driver's cabs the door leading to the driver's compartment must be kept locked when the driver's cab is not in use.

BATTERY FAILURE

In the event of a battery failure at the driving end:—

In emergency only the batteries at the remote end may be used for driving purposes if the control switch key is inserted in the remote cab's driving panel.

REVERSING HANDLE

The reversing handle **MUST NOT** be moved from the selected direction of travel (Forward/Reverse) under any circumstance whilst the train is in motion.

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May, 1960