

BR. 33003/47

**Met Cammell 57-ft Power Cars
79047 - 82
and attached
Driving Trailers**

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GENERAL DESCRIPTION

Each power car is provided with two engines. Driving controls are provided at one end only of each power car and each driving trailer. When the trains are marshalled a driving compartment must be at each end.

TECHNICAL DATA

Type	2 - 2 - 2 - 2 (1A-A1)
Weight in running order ..	Twin car set 57 tons (Power car 32 tons; Driving trailer 25 tons).
Tractive effort:	1st gear 2nd gear 3rd gear 4th gear
Total (single Power Car) ..	6,570lbs. 3,710lbs. 2,420lbs. 1,610lbs.
Wheel base (Coach)	48ft. 6in.
Wheel base (Bogie)	8ft. 6in.
Bogie centre distance	40ft. 0ins.
Wheel diameter	3ft. 0ins.
Width overall	12ft. 4ins. (Twin car set).
Length overall	9ft. 3ins.
Height overall	12ft. 6½ins.
Minimum curve negotiable ..	3½ chains
Maximum speed at maximum engine revs ..	1st speed 2nd speed 3rd speed 4th speed
Fuel capacity	15.3 m.p.h. 27 m.p.h. 41 m.p.h. 65.5 m.p.h.
	75 gallons per engine (+ 15 galls. for car heater contained in one main tank).
Lubricating oil sump capacity	6½ gallons per engine
Cooling water capacity	44 gallons per power car
Control system	Electro-pneumatic.
Brake system	Vacuum
Warning device	Compressed air.
Gear ratio	1st gear 2nd gear 3rd gear 4th gear
	4.28:1 2.42:1 1.59:1 1:1

Engines

Two 6-cylinder 11.3 litre horizontal oil engines ..	A.E.C. type, 150 h.p., at 1,800 r.p.m.
Compression ratio	16 to 1.
Bore	130MM=5.12ins.
Strokes	142MM=5.590ins.
Firing order	1, 5, 3, 6, 2, 4.
Rotation	Clockwise.
Fuel injector type	C.A.V. B.D.L. L. 150.S.
Fuel injector lifting pressure	175 atmospheres (2,570lbs./sq.in.).
Fuel pump type	C.A.V. Monobloc type.

Transmission

Type	Fluid Coupling. Wilson type gear box. 4 speed epicyclic. (Electro-pneumatic operated).
Reversing arrangement ..	Axially sliding dog clutch between bevel gears incorporated in final drive gear box.
Final drive: gear ratio ..	2.81:1.

Auxiliaries

Battery (Power Car) ..	Nife, Type LR40, 19 cells: 24 volt: 400 amp. hr.
(Driving Trailer) ..	Nife, Type BBN.12H. 19 cells: 24 volt: 300 amp. hr.

Generator (Power Car)	..	Stones, Type XR 29L 24 volt. Belt driven from the output end of one gear box.
(Driving Trailer)	..	Stones, Type XR 22L. Belt driven.
Starter Motor	Simms Axial type.
Compressors	Clayton-Dewandre. C.D. Series 2½ins. x 1½ins. Type P.C.G.A. 189 gear driven.
Exhausters	Clayton-Dewandre. Type C.725. Belt driven.
Car heating equipment	..	Smith's Combustion Air Heater.
Windscreen wipers	Compressed air.
Speedometer	Smith's (Electrical drive).

DRIVER'S CONTROLS

1. Control isolating switch (with removable key).
2. Throttle handle (engine speed) incorporating the Deadman's device.
3. Change gear selector lever.
4. Reversing lever (detachable).
5. Engine Start buttons.
6. Engine Stop button.
7. Engine Indicator lights.
8. Air pressure indicator lights.
9. Change speed indicator.
10. Dual horn control.
11. Speedometer.
12. Air pressure gauge.
13. Vacuum gauge.
14. Driver's brake valve (handle detachable).
15. Handbrake.
16. Car heater switches.
17. Head light switches.
18. Windscreen wiper valve.
19. Instrument panel light switches.
20. Deadman's buttons (one each side of cab).
21. Change over switch—Engine speed.
22. Destination Indicator light switch.
23. Buzzer and button
24. Fire alarm bell.
25. Passenger Emergency re-setting valve—one each side of cab applicable to each car **only**.

DRIVER'S DAILY DUTIES WHEN IN SERVICE

1. Obtain control switch key, reversing lever, vacuum brake handle and keys of the car.
2. Check that detonator cases are intact.
3. Report all known defects at the end of each turn of duty.
(Make a short inspection of the train at a convenient time and check that the apparatus is generally in good working condition. Also check fuel tank and radiator header tank levels, etc.).

STARTING THE ENGINES

1. Turn the control isolating switch key to the ON position.
2. Check that the gear selector lever is in the NEUTRAL position and that the hand brake is ON.
3. **If 65lbs. per sq. inch air pressure is available** and the engines are warm they may then be started from the cab as follows:—
 - (a) Place reversing lever in the required position for direction of travel.
Before starting the engines, to ensure that the reverse gear in the final drives of the train have properly engaged, press the "Stop" button and hold in while the "Starter" button of each engine is momentarily pressed in turn. This allows the engines to inch over without starting, and move the driving shafts sufficiently to ensure that the final drives engage. Release "Stop" button and start engines as shown below.
 - (b) Hold the throttle handle in the Open position.
 - (c) Press each "Starter" button in turn and release it immediately the indicator lights show that the engine has started.
4. **If 65lbs. per sq. inch air pressure is not available or the engines are cold** they must be started individually from the side of the car. The procedure is as follows:—
 - (a) Pull fuel-injector pump control lever back as far as it will go and hold.
 - (b) Press the "Starter" button which is located on a small panel beside the engine, and release it immediately the engine starts.
 - (c) Release the throttle pump control lever gradually until a fast tick-over results—do not race the engine. As soon as air pressure is available—in about 15 seconds—release the pump control lever. It will then be held in the Idling position by air pressure.
 - (d) Start the other engines in a similar manner. When air pressure has built up to 65 lbs./sq.in. STOP all engines, then proceed to driving cab and restart engines as shown in item 3.

NOTE: If an engine does not start within approximately three seconds, release "Starter" button and allow engine to come to rest before pressing button again.

If one of the engines refuses to start at the second attempt, stop ALL engines before making any further attempts. Failure to do this will result in the engine already started running at maximum revolutions while the throttle is held open to start the engine which has failed to respond.

5. With the engines running, return the throttle handle to Idling position and hold until the air pressure has built up to 70lbs.sq.in. through the entire train, also the correct vacuum is obtained on the train pipe side and not less than 28 inches on the reservoir side.
6. Release throttle handle—this will return it to DEADMAN'S position and after a five-second delay the vacuum brakes will be applied.

NOTE: All control devices, e.g. gears, throttle handle (engine speed), reverser, etc., are operated by electro-pneumatic

(E.P.) valves therefore **DO NOT USE FORCE WHEN MOVING THE CONTROL LEVER OR HANDLES.** The electrical control system of each car is complete in itself but may be linked to that of another car by electrical jumper connections.

Any failure of the air pressure system, resulting in a severe drop in pressure, will shut down the engines and return the gears to neutral.

The throttle handle is also the DEADMAN'S handle and, if it is allowed to spring forward past the Idling position, the engines will drop down to idling speed and, after a five-second delay, the vacuum brake will be applied.

RUNNING

Starting the Train

1. Before attempting to move the train, check that the hand brakes are off in the other driving compartments.
2. Apply vacuum brake, and take off hand brake.
3. With the throttle handle at IDLING position and the vacuum brake still applied, check that the air light indicators are illuminated and that the reversing lever is in the required position. If not, STOP the engines and proceed as for reversing the cars.

NOTE: The reversing lever is mechanically interlocked with the gear selection lever. The gear selector lever is locked in the NEUTRAL position and cannot be moved until the reversing lever is moved to the FORWARD or REVERSE position.

The reversing lever cannot be moved unless the gear selector lever is in NEUTRAL.

THE GEAR SELECTOR LEVER MUST NOT BE MOVED FROM THE NEUTRAL POSITION UNTIL READY TO START THE TRAIN.

4. With the engines idling, and the brakes released, move the selector lever to position 1. This selects and engages 1st gear. If on a rising gradient, hold the train by making a slight application of the brakes. Release immediately 1st gear is engaged and GRADUALLY open the throttle. The train will commence to move. As the speed increases, change gear as indicated on the Engine Speed Indicator. Do NOT engage the gears with the train moving backwards.

Gear Changing

- (a) "Changing Up": When the Engine Speed indicator shows "Change Up," return throttle handle to IDLING position, move gear selector lever to next higher gear position, then after a slight pause open throttle. Change gear progressively in the same manner until top gear is engaged.
DO NOT MOVE GEAR SELECTOR LEVER UNTIL THE ACTUAL GEAR CHANGE IS TO BE MADE.
- (b) "Changing Down": When the Engine Speed indicator shows "Change down," move the throttle handle to the IDLING position, then place the gear selection lever into the next lower gear

position. After a slight pause open the throttle, as required.
DO NOT MOVE GEAR SELECTOR LEVER UNTIL THE ACTUAL GEAR CHANGE IS TO BE MADE.

Coasting

A free wheel is fitted on the output shaft, between the fluid flywheel and the gearbox, so that when the maximum running speed required is obtained, the throttle handle may be returned to Idling and the train allowed to coast.

THE GEAR SELECTOR MUST NOT be returned to NEUTRAL when coasting, except when the train has been braked almost to a stand.

Coasting must not be resorted to when in the **Intermediate** gears except when approaching a stopping point, if running at low speed.

Stopping the Train

1. Return throttle handle to IDLING and hold in that position. position.
2. Apply vacuum brakes as required.
3. When almost at a stand, return gear selector lever to NEUTRAL. If in 4th Gear the lever can be moved direct to neutral. If in an intermediate gear **DO NOT** pause in any of the other gear positions when making the movement.

NOTE: If the train speed has been reduced, e.g., due to a signal check, and the signal is placed in the clear position before the train is brought to a stand, release the vacuum brake immediately **AND WITH THE GEAR SELECTOR LEVER STILL IN THE SAME POSITION** as when the check was observed, **GRADUALLY** re-open the throttle.

If the engine speed indicator shows "Change Down," move gear lever to the next lower gear. The gear change procedure should be carried out as described in Gear Changing, "Changing Down."

Changing Ends

The following procedure should be carried out:—

1. Put the vacuum brakes ON.
2. STOP the engines.
3. Remove reversing lever and place vacuum brake handle to Lap position and remove handle.
4. Place control switch in the OFF position and remove key.
5. Lock cab door and remove key.
6. Proceed to other end of train and place handles and lever in their appropriate positions. Place control switch in the ON position then move reversing lever to Forward position. Before re-starting engines, in order to ensure that reversing gear in the final drives of the train have properly engaged, press Stop button and hold in while the Starter button of each engine is momentarily pressed in turn. This allows the engines to inch over, without re-starting, and move the driving shafts sufficiently to ensure that the final drives engage. Release Stop button and re-start engines in the normal way.

REVERSING THE CARS

If it is necessary to reverse the cars without changing ends, proceed as follows:—

1. When the train has been brought to a stand —
1. STOP THE ENGINES.
2. Move reversing lever to Reverse position.
3. Inch over the engines as shown in item 6 under "Changing Ends."
4. Re-start engines in the normal manner.
5. When the reversing movement is completed, STOP THE ENGINES, then move the reversing lever to the Forward position. Again inch over engines before re-starting. The reversing lever must not be operated at any time with engines running.

STOPPING THE ENGINES

1. Release throttle handle to Deadman's position.
2. Check that the vacuum brake is ON.
3. Press engine Stop button and hold in that position until engines have stopped.
4. Place the reversing lever into the NEUTRAL position.
5. Apply hand brake.

STABLING THE TRAIN

After stopping the engines by the method shown above —

1. Check that the hand brake is applied.
2. Place vacuum brake valve to LAP position and remove the handle.
3. Remove reverser handle and place control switch in the OFF position and remove key.
4. Shut off car heaters, if in use.
5. Lock the cab and partition doors.
6. Return the brake handle, reversing lever, control switch key and door keys to the Running Foreman or other responsible person on duty.

TRAIN HEATING

Heating is by means of hot-air suitably directed into the passenger compartment of each vehicle. The operation of the heater is automatic apart from switching on and operating the heat control.

To operate the heater:—

1. Turn heater switch in a clockwise direction to FULL HEAT (not Reduced Heat) position.

This supplies current to the glow plug (an Element) and the glow plug light on the Indicator Panel should be illuminated. If this fails, return switch to OFF position and do not attempt to restart. After a period of 30 seconds the air fan light will be illuminated on an indicator panel denoting that the heater fan and fuel pumps are working.

In approximately 3½ 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.

2. To reduce heat, the switch should be turned anti-clockwise to "Reduced Heat" position: care should be taken not to go beyond this position or the heater will be automatically shut down.
To admit cold air to the train the switch should be turned in an anti-clockwise direction past the OFF position to Cold.
3. If the switch is in the Full or Reduced Heat position and the heater cuts out, the indicator light will be extinguished. Return switch to OFF, then attempt to restart the heater, as in 1 above.

FAULTS IN TRAFFIC

If there is indication that an engine has stopped while the train is running, before attempting to restart, confirm at the next train stopping point that the engine has in fact stopped. Attempt to restart by depressing the appropriate "Starter" button, not more than three times. If this fails to restart the engine, if possible lock the final drive in NEUTRAL and proceed to the terminal point on the remaining engines. At the terminal point the final drive must be locked in NEUTRAL and the matter reported.

TO LOCK FINAL DRIVE IN NEUTRAL

STOP all the engines, then with the special tool which is available in the Guard's compartment, withdraw the "Neutral" lock and turn it a quarter turn and allow it to go right home. Proceed to the cab and move the reverser lever slowly from Forward to Reverse and back several times and ensure that the "Neutral" lock is entered fully in the slot. Check that the main propellor shaft to the final drive concerned can be rotated by hand.

NOTE: If no air pressure is available the final drive cannot be operated to allow the lock to engage in NEUTRAL.

ASSISTING DISABLED TRAIN

In an emergency, a disabled diesel train may be assisted by another diesel train or by a locomotive.

Engine or transmission failure

1. *Assistance by a train of same type.*

If the control equipment and vacuum brake train systems are in order, normal coupling to units of the same type may be made in accordance with the Appendix instructions for the working of Diesel Trains — Coupling & Uncoupling.

Before proceeding, the gears must be in the NEUTRAL position and the final drive gears of the defective power unit must be set and locked in the NEUTRAL position, if possible. Where the final drive cannot be disengaged, a speed of 25 m.p.h. in either direction must not be exceeded to the point where the disabled train can be taken out of traffic.

2. *Assistance by a train of different type or by a locomotive.*

When assisted by a different type of train or a locomotive, the vacuum hose to the train pipe only must be connected. The driver's brake valve must be set in the LAP position. Stop all engines on the disabled train. Leave the battery switch

key in the appropriate ON position, and hold the throttle lever in the IDLING position, so that the deadman's control does not come into operation.

FAILURES OF CONTROL EQUIPMENT

Driving Controls

(a) *Leading Driving Compartment.*

Remove control isolating switch, reverse key and brake handle and then proceed to the next driving cab and endeavour to gain control. Then act in accordance with the Appendix Instruction for the Working of Diesel Mechanical Trains — Driving Apparatus disabled.

(b) *Two Car Set (Power Car and Driving Trailer).*

Should a current failure from the battery occur in the power car, the train becomes a complete failure and assistance must be obtained to clear the line, if the engines cannot be started.

In the event of a battery failure in the driving trailer, control may be regained by placing the Control Switch Key into the ON position in the driving compartment of the power car. The train can then be driven from either end.

(c) *Train of more than two Cars including two or more Power Cars.*

In a train composed of more than two Cars including two or more Power Cars, the failure of the battery on any one Power Car does not necessitate the failure of the train, as the battery switch can be transferred to any other Power Car and control obtained of the train. It is not possible however, to restart the engine of the Power Car on which the battery has failed. The final drives on this Power Car must be locked in NEUTRAL.

FIRE PRECAUTIONS

In the event of a fire which will be normally indicated by the fire warning bells ringing, 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 cab and inspect the engine that has been affected as shown by the indicator light in the cab. An additional indication of the engine concerned will be given by the red warning light which will be illuminated on the appropriate fire alarm control box.

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 restart the affected engine. After this has been done, and before proceeding, the final drive gears of the defective engine must be set and locked in the NEUTRAL position, if possible. Where the final drive cannot be disengaged, a speed of 25 m.p.h. must not be exceeded to the point where the train can be taken out of traffic.

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. 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.

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.

GENERAL NOTES

COUPLING AND UNCOUPLING

1. See that the Driver's controls are in the " OFF " position before trains are coupled or uncoupled.
2. Place the Control Isolating switch to " OFF " before the jumper cables are coupled or uncoupled.
3. On re-starting the engines ensure that all indicator lights and controls respond before moving the train.

WARNING HORNS

When sounding the horn, to comply with Rule 127 and the Appendix instructions, operate the lever in such a manner as to give the 2-tone sound that these horns are designed to emit. This is of the utmost importance and if the horn is defective it must be reported immediately.

DRIVERS IN COURSE OF TRAINING

Drivers in course of training are only allowed to operate the controls and brake on passenger lines under the direct supervision of the Instructor.