BR. 33003/29

A. E. C - Swindon Inter City

79083 - 79111
79155 - 79168

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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. 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 ..	Power Car 38 tons.

Tractive effort, Total (single Power Car):—

1st Gear	2nd Gear	3rd Gear	4th Gear
6,570 lbs.	3,710 lbs.	2,420 lbs.	1,610 lbs.

Wheel base (Coach)	55 ft. 0 ins.
Wheel base (Bogie)	8 ft. 6 ins.
Bogie centre distance	46 ft. 6 ins.
Wheel diameter	3 ft. 0 ins.
Width overall	9 ft. 3 ins.
Length overall	67 ft. 1 in. (with buffers extended).
Height overall	12 ft. 9½ ins.
Minimum curve negotiable ..	3½ chains.

Maximum speed at maximum engine revs:—

1st Speed	2nd Speed	3rd Speed	4th Speed
15.3 m.p.h.	27 m.p.h.	41 m.p.h.	65.5 m.p.h.

Gear ratio:—

1st Gear	2nd Gear	3rd Gear	4th Gear
4.28:1	2.42:1	1.59:1	1:1

Fuel capacity	90 gallons per engine, including fuel for one heater.
Lubricating oil sump capacity	6¼ gallons per engine.
Cooling water capacity ..	36 gallons per power car.
Control system	Electro-pneumatic.
Brake system	Vacuum.
Warning device	Compressed air operated.

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	130 MM=5.12 ins.
Strokes	142 MM=5.5907 ins.
Firing Order	1, 5, 3, 6, 2, 4.
Rotation	Clockwise.
Fuel injector type	CAV. B.D.L. L. 150 S.
Fuel injector lifting pressure	175 atmospheres (2,570 lbs./sq. in.).
Fuel pump type	CAV. Monobloc type.

Transmission

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

Auxiliaries

Battery	Power Car	..	NIFE. Type LR.40. 19 Cells: 24 volt. 400 amp.hr.
	Trailer	..	NIFE. Type BN. 12H. 19 Cells: 24 volt. 280 amp.hr.
Generator	Power Car	..	Stones, Type XR. 29L. 24 volt. 150 amp. Belt-driven from the output end of one gear box.
	Trailer	..	Stones, Type XR. 29L. 24 volt. 120 amp. Belt-driven.
Starter motor	.. ..	..	Simms.
Compressors	.. ..	..	Clayton-Dewandre. C.D. Series 2⅜ ins. x 1¼ ins. Type P.C.G.A. 189 Gear-driven.
Exhausters	.. ..	..	Clayton-Dewandre. Type C.725. Belt-driven.
Car heating equipment		..	Smith's Combustion Air Heaters.
Fuel tanks	Trailer Cars	..	20 gallons fuel tank on each trailer car for heaters.
Windscreen wipers	..	..	Compressed air operated.
Speedometer	.. ..	..	Smith's (Electrical drive).

DRIVER'S CONTROLS

1. Electrical control 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 (2).
6. Engine Stop button.
7. Engine indicator lights.
8. Air pressure and final drive direction indicator lights.
9. Engine tachometer and Change speed indicator.
10. Dual horn control.
11. Speedometer.
12. Air pressure gauge.
13. Vacuum gauge (Duplex).
14. Driver's brake valve (handle detachable).
15. Handbrake.
16. Driving compartment heater switches.
17. Windscreen wiper valve.
18. Instrument panel light switches.
19. Deadman's hold-over button.
20. Change-over switch—Engine speed.
21. Destination indicator light switch.
22. Buzzer and button.
23. Fire alarm bell.
24. Cab light switch—vestibule light switch where applicable.

DRIVER'S DAILY DUTIES WHEN IN SERVICE

1. Obtain satchel containing the control switch key, reversing lever, vacuum brake handle and carriage keys.
2. Check that detonator cases are intact.
3. Check in all trailing driving compartments that the A.T.C. flags are in the " Out of Use " position (Western Region), the Deadman's isolating valve covers are shut and the handbrakes are released. Lock all doors.

4. 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 levels).

STARTING THE ENGINES

1. Turn the electrical control switch key to the ON position.
2. Check that the gear selector lever is in the NEUTRAL position and that the handbrake is ON.
3. **If 65 lbs. per sq. in. air pressure is available** and the engines are warm, they may then be started from the driving compartment as follows:—
   (a) Place reversing lever in the required position for direction of travel to obtain control in the cab.
   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 for each engine line 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 left and right " Starter " buttons in turn and release each immediately the indicator lights show that all engines on that bank have started.

   NOTE: If an engine does not start, i.e., its indicator light does not light 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 engines already started running at maximum revolutions while the throttle is held open to start the engine which has failed to respond.
   If an engine still refuses to start, check that the engine isolating switch is in the ON position. Check fuel tank contents gauge for fuel content and ensure that the fuel cock is open. Then start engine locally as shewn in item 4 (a-c). STOP engine, proceed to driving compartment and start all engines in the normal manner.
4. **If 65 lbs. per sq. in. 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, 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 locally then proceed to driving compartment and restart engines as shown in Item 3 (a-c).

5. With engines running, return the throttle handle to Idling position and hold until the air pressure lights come on for the entire train; also the correct vacuum is obtained on the train pipe side (21 ins.) and not less than 28 ins. on the reservoir side.
6. Release throttle handle. This will return it to DEADMAN'S position and, after a 5 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 failures of the air pressure system, resulting in a severe drop in presure, will shut down the engines to Idling 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. Apply the vacuum brake, place A.T.C. flag in the " In Use " position (Western Region) and take off handbrake.
2. With the throttle handle at the IDLING position and the vacuum brake still applied, check that all the appropriate air and engine light indicators are illuminated and that the reversing lever is in the required position.
If direction selection is wrong STOP the engines and proceed as for reversing the cars.
If an air pressure/direction indicator light is not illuminated, wait for a short time to see if air pressure will build up on appropriate car. If light does not come on after this period, and change of direction has just been made, STOP engines and then " inch " engines.

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.

3. With the engines idling, and the brakes released, move the gear 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 gradually 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 THE 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 gear box, 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 LEVER **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.
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. Place A.T.C. flag in the " Out of Use " position (Western Region).
2. STOP the engines.
3. Remove the reversing lever and place vacuum brake handle to Lap position and remove handle.
4. Place control switch in OFF position and remove key.
5. Lock driving compartment door and remove key.
6. Proceed to other end of train and place handles and lever in their appropriate positions. Place control switch in ON position then move reversing lever to Forward position. Before re-starting en-

gines, 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 restart engines in the normal way. Place A.T.C. flag in the " In Use " position (Western Region).

REVERSING THE CARS

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

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.

NOTE: 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. (Engine lights are extinguished).
4. Place the reversing lever into the NEUTRAL position.
5. Apply handbrake.

STABLING THE TRAIN

After stopping the engines by the method shown above:—

1. Check that the handbrake is applied.
2. Place vacuum brake valve to LAP position and remove the handle.
3. Remove the reversing lever and place control switch in OFF position and remove key.
4. Shut off compartment heater if in use.
5. Lock the compartment doors.
6. Return the satchel containing 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 STARTING POSITION (not Running 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 re-start. After a period of 45 seconds the air fan light will be illumin-

ated on the 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 re-start. Not more than three attempts should be made to start the apparatus.

2. When the Glow Plug light goes out, the switch should be turned anti-clockwise to the Running Position: care should be taken not to go beyond this point 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 Starting or Running position and the heater cuts out, the indicator light will be extinguished. Return switch to OFF, then attempt to re-start the heater, as in (1) above.

FAULTS IN TRAFFIC

Engine Stopped

If there is indication that an engine has stopped while the train is running, before attempting to re-start, confirm at the next convenient stopping point that the engine has in fact stopped. Attempt to re-start by depressing the appropriate local " Starter " button, not more than three times. If this fails to re-start the engine, if possible lock the final drive in NEUTRAL, turn engine isolation switch to OFF 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 ENGINES, then with the special tool, which is available in the Guard's compartment, withdraw the " Neutral " lock, turn it a quarter turn and allow it go right home, or remove trap door above final drive, push rod on NEUTRAL catch to horizontal position. Proceed to the cab and move the reversing lever slowly from Forward to Reverse and back several times to ensure that the " Neutral " lock is entered fully into 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.

Transmission Failure

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

(a) 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 and Uncoupling.

(b) Before proceeding, turn isolation switch of engines concerned to OFF; the gearbox must be in the NEUTRAL position and the final drive gear 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**

(a) When assisted by a different type of train or by a locomotive, the vacuum release pipe hose should remain on the stop, the vacuum hose to the train pipe only being connected.

(b) The driver's brake valve must be set in the LAP position.

(c) Place the gear lever in the NEUTRAL position and STOP ALL ENGINES on the disabled train. Set and lock ALL the final drive gears in the NEUTRAL position if possible. If a 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.

(d) Break the lead seal securing the isolating handle on the Deadman's control under the table of ALL driving compartments and move the handle to the ISOLATE position.

(e) Remove the reversing lever and control switch key.

FAILURES OF CONTROL EQUIPMENT

Driving Controls

(a) **Leading Driving Compartment**

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

(b) **Deadman's Device defective**

If there is a vacuum brake leakage caused by a defective Deadman's device in any one of the driving compartments, break the lead seal securing the Isolating handle on the Deadman's control under the table of the driving compartment affected and move the handle to the ISOLATE position.

IF A DEADMAN'S CONTROL IS ISOLATED THE MATTER MUST BE REPORTED as soon as possible.

(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 control switch key can be transferred to any other power car and control obtained of the train. It is not possible, however, to re-start the engines of the power car on which the battery has failed.

The final drives on this power car must be locked in NEUTRAL.

Compressed Air System—Unloader Valve

In the event of an unloader valve defect, remove blank nut from dummy stud adjacent to the unloaded valve and fit it on to the escape connection of the unloader valve.

FIRE PRECAUTIONS

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 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 re-start 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 level near the ground.

See General Intructions 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 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.