BR 33003/82

ROLLS-ROYCE/CRAVEN POWER CARS
(Mechanical Transmission)
Nos. 51681-51730
"BLUE SQUARE" COUPLING SYMBOLS.

August 1959

BRITISH TRANSPORT COMMISSION
DRIVER'S INSTRUCTIONS FOR OPERATING ROLLS-ROYCE/CRAVEN POWER CARS (MECHANICAL TRANSMISSION). NOS. 51681 - 51730. "BLUE SQUARE" COUPLING SYMBOLS

GENERAL DESCRIPTION

Each car is a power car provided with one engine. Driving controls are provided at one end only of each 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	... Two car set	58½ tons
	Motor 2nd Brake	29½ tons
	Motor-lav. Comp.	29 tons

TRACTIVE EFFORT (Single Power Car)

1st Gear	*2nd Gear*	*3rd Gear*	*4th Gear*
5,040 lbs.	2,830 lbs.	1,900 lbs.	1,225 lbs.

Wheel base (coach)	48ft. 6ins.
Wheel base (bogie)	8ft. 6ins.
Bogie centre distance	40ft. 0ins.
Wheel diameter	3ft. 0ins.
Width overall	9ft. 0ins.
Length overall	121ft. 4ins.
Height overall	12ft. 6½ins.
Minimum curve negotiable ...	3½ chains.

Maximum speed at maximum engine revs.:—

1st Gear	*2nd Gear*	*3rd Gear*	*4th Gear*
16.00 m.p.h.	28.1 m.p.h.	42.5 m.p.h.	67.7 m.p.h.

Gear ratio—(gearbox only)—

4.250:1	2.408:1	1.596:1	1.000:1

Fuel capacity, Power Cars ...	One tank 114 gallons per car for engine and heater.
Lubricating oil sump capacity ...	12½ gallons per engine.
Cooling water capacity	17½ gallons per engine (pressurised system)
Control system	Electro-pneumatic.
Brake system	Vacuum.
Warning horn	Compressed air operated.

ENGINES

One 8-cylinder 16.2 litre horizontal oil engine	R.R. (Series 831 type C8NFH) 238 h.p. at 1,880 r.p.m.
Compression ratio	16 to 1.
Bore	130.175 mm.=5.125 ins.
Stroke	152.4 mm.=6 ins.

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Firing order	... 1, 6, 2, 5, 8, 3, 7, 4.
Rotation from free end	... Clockwise.
Fuel injector type ...	... C.A.V.
Fuel injector lifting pressure	... 175 atmospheres (2.570lb./sq.in.)
Fuel pump type	... C.A.V. Monobloc type N with hydraulic governor.

TRANSMISSION

Type	... "Fluid drive" type S.T.C. 550 fluid coupling: S.C.G. type S.E.4 gearbox.
Final drive	... Type S.C.G.R.F. 28.
Reversing arrangement ...	... Axially sliding dog clutch between bevel gears incorporated in final drive gearbox.
Final drive : gear ratio ...	... 2.97:1.

AUXILIARIES

Battery, Power Car (Motor 2nd Brake) ...	... Lead acid BRA2 type, 12 cells: 24 volts, 440 amp./hr.
Battery, Power Car (Motor Lav. Comp.) ...	... Lead acid BRA2 type, 12 cells: 24 volts, 440 amp./hr.
Alternator	... C.A.V. rectifier and alternator. Belt-driven from accessory drive shaft.
Starter Motors	... Simms axial type.
Compressors	... Westinghouse E.15 gear-driven from fan drive gearbox.
Exhausters	... Clayton - Dewandre Type C.725. Belt-driven from accessory drive shaft.
Car heating equipment ...	... Smith's combustion air heaters, Mark 11B/R.
Windscreen wipers ...	... Compressed air operated.
Speedometer	... Smith's (electrical drive).
Engine hour Recorder ...	... Mounted on flywheel end of engine.

DRIVER'S CONTROLS

1. Electrical control switch (with Yale type removable key) and indicator light.
2. Throttle handle (engine speed) incorporating the Deadman's device.
3. Change-gear selector handle.
4. Reversing lever (detachable).
5. Engine Start buttons.
6. Engine Stop button.
7. Engine indicator lights (12).

8. Air pressure and final drive direction indicator lights.
9. Control panel lights test button (i.e. engine and air indicator lights).
10. Engine Tachometer and Change speed indicator.
11. Dual horn control.
12. Speedometer.
13. Air pressure gauge.
14. Vacuum gauge (Duplex).
15. Driver's brake valve (handle detachable).
16. Emergency vacuum brake valve.
17. Marker light and indicator light switches.
18. Route indicator light switch.
19. Instrument panel light switches and dimmer.
20. Windscreen wiper valve (2).
21. Demister fan control switch.
22. Destination indicator light switch.
23. Buzzer and button.
24. Handbrake.
25. Deadman's isolating valve (in power cars only).
26. Car heater switches (not for the use of the driver).
27. Deadman's hold-over button.
28. Car and train light control.
29. Fire alarm bell.
30. Demister control lever (hot-cold).
31. A.W.S. key (where fitted).

GENERAL INFORMATION

All control devices, e.g. gears, throttle (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 engine to IDLING.

Loss of engine oil pressure will extinguish the engine indicator light and stop the engine.

NOTE : Twelve engine indicator lights are provided so that twin-engined cars (blue square) can be coupled and will indicate normally, but when the single engine of one of these Rolls Royce cars is indicated, both R.H. and L.H. lamps will illuminate or go out together.

The throttle handle is also the Deadman's handle and if it is allowed to spring up the engines will drop down to IDLING speed and after 5 to 7 seconds' delay the vacuum brake will be applied. To re-set the Deadman's device the throttle handle must be moved back past the IDLING position before the handle can be depressed.

The gear selector handle and the reversing lever are mechanically interlocked. The gear selector handle 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 handle is in NEUTRAL.

SPECIAL NOTE : DO NOT MOVE THE GEAR SELECTOR HANDLE FROM THE NEUTRAL POSITION UNTIL READY TO START THE TRAIN, EXCEPT WHEN "TOGGLING UP" THE GEARBOX BRAKE BANDS.

DRIVER'S DAILY DUTIES WHEN IN SERVICE

At Commencement of Turn

1. Obtain the satchel containing the control switch key, reversing lever, vacuum brake handle, A.W.S. key (where fitted) and carriage keys.
2. Check that—
   (a) the detonator cases are intact in all driving compartments;
   (b) the Deadman's isolating valve covers are intact in all Power Cars ;
   (c) the handbrake is ON in the leading driving compartment;
   (d) the handbrakes are OFF in all trailing compartments.
3. LOCK ALL DOORS OF TRAILING DRIVING COMPARTMENTS.

At a convenient time during Turn

1. Make a short inspection of the train and check that the apparatus is generally in good working condition. Check fuel tank levels.
2. "Toggle up" the gearbox brake bands as follows:—
   (a) Check that full air pressure is available.
   (b) STOP the engines.
   (c) Hold the Deadman's device in the RUNNING position.
   (d) With the reversing lever in FORWARD position, move the gear selector handle to engage 1st, 2nd and 3rd gears (not 4th) about six times, pausing in each gear position to allow the brake bands to engage fully.
   (e) Return the gear selector handle to NEUTRAL.
   (f) Re-start the engines.

Report all known defects at end of turn.

STARTING THE ENGINES

1. Turn the control switch key to the ON position. Place A.W.S. key (where fitted) in position.
2. Check that the gear selector handle is locked in the NEUTRAL position, i.e. reversing lever removed from controller, and that the handbrake is ON.
3. If at least 75 lbs./sq.in. air pressure is available in the system, and the engines are warm, they may be started from the driving compartment. The procedure is as follows:—
   (a) Place the reversing lever into position and move it to FORWARD or REVERSE to obtain control of the equipment in the driving compartment.
   (b) Depress the throttle handle to engage the Deadman's device, then move it to 1st or 2nd throttle position.
   (c) Press either "Start" button in turn and release each immediately the indicator lights show that the engines have started. DO NOT PRESS BOTH "START" BUTTONS TOGETHER. When all the engines have started, return throttle handle to IDLING position. Should the train consist in part of cars powered by twin B.U.T. engines, starting procedure laid down for such cars should be employed. In these circumstances, depressing one of the "Start" buttons will start ALL the the Rolls Royce engines and one bank of the B.U.T. engines on each car so fitted. Depressing the other "Start" button will start the remaining B.U.T. engines and will be shown by the indicator lights.
   (d) Check that the air indicator lights have illuminated, indicating that the final drives have engaged. If not, with the engines running at IDLING speed place the reversing lever to the opposite direction of travel—pause—and then re-select required direction of travel.

   NOTE: If an engine does not start, i.e. its indicator light does not light within approximately three seconds, release "Start" button for not less than 10 seconds to allow engine to come to rest before pressing the button again. If an engine 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 shown in item 4 (c-e). STOP the engine, proceed to the driving compartment and start all engines in the normal manner.

4. If 75 lbs./sq.in. air pressure is not available in the system or the engines are cold, they must be started individually from the side of the car. The procedure is as follows:—

   In Driving Compartment

   (a) Check that the electrical control switch key is in the ON position.
   (b) Check that the gear selector handle is locked in the NEUTRAL position and the reversing lever removed from the controller, and that the handbrake is on.

At Side of Car

(c) Select excess fuel by depressing the button on the engine governor, then pull the fuel injection pump handle throttle control to FULL OPEN position and hold it there.

(d) Press the "Start" button, which is located on a small panel beside the engine, and release it immediately the engine starts.

(e) Release the fuel injection pump hand throttle control gradually until the engine runs at IDLING speed—DO NOT RACE THE ENGINE.

(f) Start the other engines in a similar manner.

In Driving Compartment

(g) When the air pressure in the system has built up to 75 lbs./sq .in. STOP all engines, then place the reversing lever into position in the controller and proceed to re-start the engines as shown in Item 3 (a-d).

NOTE : If an engine does not start within approximately three seconds, release "Start" button for not less than 10 seconds to allow the engine to come to rest before pressing the button again.

WITH THE ENGINES RUNNING

(a) Place the brake handle into position, depress and hold down the throttle handle to obtain control of the Deadman's device, then move the brake handle to the RELEASE position. Check that 21 ins. of vacuum can be obtained in the train pipe and remains steady at not less than 19 ins. by returning the brake valve handle to LAP position. There should be at least 26 ins. on the high vacuum reservoir side gauge. This is to ensure that there is sufficient vacuum in the top side of the brake cylinders for the efficient operation of the brake.

Note.—The time required to obtain 21 ins. of vacuum in the top side of the brake cylinders after the strings have been pulled on a vehicle or vehicles should not be **less than 1½ minutes.**

(b) Return the vacuum brake handle to RELEASE position then let go the throttle handle. Check that it springs up to the Deadman's position and that after 5 to 7 seconds' delay the brakes are applied.

(c) Check that the air pressure is built up to approximately 95 lbs./sq.in.

(d) Apply the vacuum brake and take off the hand brake in the driving compartment.

Note.—In future, **single unit** diesel railcars will be fitted with an additional Duplex vacuum gauge which will indicate the top side vacuum in each brake cylinder on that car only ; at least 19 ins. must be registered on this gauge before moving off.

STARTING THE TRAIN

(a) Ensure that there is adequate vacuum on the reservoir side.

(b) Obtain control of the Deadman's device and hold the throttle handle in the IDLING position.

(c) Release the vacuum brake to about 15 ins. of vacuum then "lap" the brake valve.

(d) WITH THE ENGINES IDLING move the gear selector handle to the first gear position. (Do not pause in any other gear position).

(e) Release the vacuum brake fully by placing the brake handle into the OFF position. The train should not be moved with the brakes dragging.

(f) After a pause of NOT LESS THAN TWO SECONDS from the moment of selecting first gear, open the throttle notch by notch ; the train will commence to move. As the speed increases, change gear as indicated on the engine speed indicator (tachometer).

NOTE : Never stand for more than a few seconds with first gear selected. If the brake fails to release, return the gear selector handle to NEUTRAL.

GEAR CHANGING

(a) Changing Up

When the Engine Speed Indicator shows "Change Up":—

1. Return the throttle handle to IDLING position.
2. Allow the engine speed indicator needle to fall to a position midway between "Change Up" and "Change Down."
3. Select the next higher gear.
4. PAUSE FOR TWO SECONDS, then re-open the throttle notch by notch.
5. Change gear progressively in the same manner until top gear is engaged.

N.B.—DO NOT MOVE THE GEAR SELECTOR HANDLE UNTIL THE ACTUAL GEAR CHANGE IS TO BE MADE.

(b) Changing Down

When the Engine Speed Indicator shows "Change Down":—

1. Return the throttle handle to IDLING position.
2. Immediately select the next lower gear.
3. Pause for TWO SECONDS, then re-open the throttle notch by notch.

N.B.—DO NOT MOVE THE GEAR SELECTOR HANDLE UNTIL THE ACTUAL GEAR CHANGE IS TO BE MADE.

COASTING

A free wheel is fitted on the propeller shaft between the fluid flywheel and the gearbox. When the maximum running speed required is obtained, to allow the train to coast:—

1. Return the throttle handle to IDLING position.
2. Place the gear selector handle into the fourth gear position.

Re-opening the Throttle

If it is necessary to re-open the throttle, place the gear selector handle into the appropriate gear then pause for TWO SECONDS before re-opening the throttle handle notch by notch.

NOTE : The correct speeds are as follows:—

1st gear — 0 - 15 m.p.h.
2nd gear — 15 - 27 m.p.h.

3rd gear — 27 - 41 m.p.h.
4th gear — over 41 m.p.h.

STOPPING THE TRAIN

1. Return the throttle handle to IDLING and hold in that position.
2. Apply the vacuum brake as required.
3. When almost at a stand, return the gear selector handle to NEUTRAL without pausing in any other gear. If in 4th gear the lever should be moved direct to NEUTRAL.

NOTE : If the train speed has been reduced, e.g. due to a signal check, and the signal is placed into the clear position before the train is brought to a stand, release the vacuum brake and then follow the procedure described under "Coasting, Re-opening the Throttle," above.

CHANGING ENDS

1. Put the vacuum brake ON.
2. STOP the engines.
3. Remove the reversing lever. Place the vacuum brake handle to the LAP position and remove handle.
4. Turn control switch to the OFF position and remove key.
5. Remove A.W.S key (where fitted).
6. Lock driving compartment doors.
7. Proceed to the other end of the train and place handles and lever into their appropriate positions. Place control switch in ON position.
8. Place A.W.S. key (where fitted) in position.
9. Place reversing lever in FORWARD or REVERSE as required.
10. Proceed to re-start the engines as shown under "Starting the Engine" item 3 (b-d), when at least 75 lbs./sq. in. air pressure is available.

REVERSING THE TRAIN

If it is necessary to reverse the train without changing ends, when the train has been brought to a stand check that the gear selector handle has been placed into the NEUTRAL position, then:—

1. With the engines IDLING move the reversing lever to REVERSE. Noting that the air indicator lights are momentarily extinguished, indicating that the final drives have correctly re-engaged. If not, with the engines still IDLING, place the reversing lever to the opposite direction of travel—pause—and then re-select REVERSE.
2. Proceed as in "Starting the Train," items (c-f).

N.B.—DO NOT ATTEMPT TO REVERSE WHEN THE TRAIN IS MOVING.

STOPPING THE ENGINES

1. Return the throttle handle to IDLING position then release 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 the 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 reversing lever. Turn control switch to OFF position and remove key.
4. Remove A.W.S. key (where fitted).
5. Shut off compartment heaters if in use.
6. Lock the driving compartment and partition doors.
7. Return the satchel containing the brake handle, reversing lever, control switch key, A.W.S. key (where fitted) and carriage 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 compartments and driving compartment of each vehicle.

The operation of the heaters is automatic apart from switching on in the **Guard's** compartment.

The heater local control switches in the driving compartments MUST NOT be operated by either the driver or the guard, these switches are for maintenance check purposes only.

To operate the heater controls in the guard's compartment the following procedure should be followed:—

Heat Cycling—Guard's Compartment

1. Select heating position.
2. Switch Isolator ON: the Isolator and Failure indicators will light up.
3. Press Starter button.

   The Failure indicator light will go out and the heater will operate automatically.

   If the Failure indicator lights up, wait for one minute then press the starter button again.

   If a Failure is still indicated after THREE such attempts to re-start, the matter must be reported.

To stop the heater: place isolator switch to OFF.

Cold Ventilation

1. Select ventilating position.
2. Switch isolator ON.

The isolator indicator will light up and the heater fan will run.

To switch off: place isolator switch to OFF.

FAULTS IN TRAFFIC

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 "Start" button, not more than three times. If this fails to re-start the engine, turn the engine isolating switch to OFF and, if possible, lock the final drive in NEUTRAL. 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 Drives 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 to go right home. Proceed to the driving compartment 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 propeller shaft to the final drive concerned can be rotated by hand.

NOTE: (1) The neutral lock is operated by a loop handle mounted on the rear of the final drive gearbox. It requires to be withdrawn from its slot backwards (i.e. along the axis of the car) before being turned to the Neutral position.

(2) If no air pressure is available, the final drive cannot be operated to allow the lock to be engaged 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 isolating switch of engines concerned to OFF: the final drive gears of the defective power unit must be set and locked in the NEUTRAL position, if possible.

(c) 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 by a locomotive, vacuum release pipe hose should remain on the stop, the vacuum hose to the train pipe only being connected.

(a) Set the driver's brake valve in the LAP position.

(b) Place the gear handle 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.

(c) Tear off the cover on the Deadman's isolating valve and move the handle to the ISOLATE position. When in multiple, ALL Deadman's controls must be isolated.

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

FAILURES OF CONTROL EQUIPMENT

Driving Controls

(a) **Leading Driving Compartment**

Remove control switch key, reversing lever, brake handle and A.W.C. key (where fitted), 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) **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.

(c) **Deadman's Device**

If there is a vacuum brake leakage caused by a defective Deadman's device, tear off the cover on the Deadman's isolating valve and move the handle to the ISOLATE position.

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

The tear-off cover must not be replaced by an unauthorised person.

COMPRESSED AIR SYSTEM—UNLOADER VALVE

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

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 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 re-start the affected engine. After this has been done, and before proceeding, turn the engine isolating switch to OFF, and, if possible, set and lock the final drive gears of the defective engine in the NEUTRAL position. When 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 trains under the direct supervision of the Instructor.