

BR 33003/71

W.M.D. RAILBUSES

79960-79964

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BRITISH TRANSPORT COMMISSION
DRIVERS' INSTRUCTIONS FOR OPERATING W.M.D.
RAILBUS. NOS. 79960 - 79964

TECHNICAL DATA

Type	...	...	...	...	...	...	...	2-2 (1-A)
Weight	...	...	...	...	...	...	...	18 tons (approx.) in running order.
Wheel base	...	...	...	...	...	...	...	19 ft. 8.2 ins.
Wheel diameter	...	...	...	...	...	...	...	3 ft. 3.37 ins.
Width of car body	...	...	...	...	...	...	...	8 ft. 8.3 ins.
Length overall	...	...	...	...	...	...	...	45 ft. 9.2 ins.
Height overall	...	...	...	...	...	...	...	11 ft. 8.55 ins.—Ht. of warning device.
Maximum speed	1st Gear	2nd Gear	3rd Gear	4th Gear	5th Gear	6th Gear	...	...
Equivalent engine speed	1800 r.p.m.	1800 r.p.m.	1850 r.p.m.	1800 r.p.m.	1850 r.p.m.	1600 r.p.m.	...	...
Fuel oil capacity	...	...	...	...	...	...	...	44 galls.
Fuel oil capacity for pre-heating Unit	...	...	...	...	...	...	...	5½ galls.
Lubricating oil sump capacity	...	...	...	...	...	...	...	4 galls.
Cooling water capacity	...	...	...	...	...	...	...	22 galls.
Control system	...	...	...	...	...	...	...	Pneumatic and Electro-pneumatic.
Brake system	...	...	...	...	...	...	...	Compressed air—disc brake.
Warning horn	...	...	...	...	...	...	...	Triple-Ton "Makrofan" Set— Compressed Air.
Gear ratio	1st Gear	2nd Gear	3rd Gear	4th Gear	5th Gear	6th Gear	...	...
	5.54: 1	2.99: 1	1.85: 1	1.34: 1	1: 1	0.72: 1	...	...

ENGINE

One Horizontal Diesel four-stroke engine	6-cylinder	Under floor-engine U10 + Bussing Braunschweig 150 h.p. @ 1,900 r.p.m.
Compression ratio	...	21: 1
Bore	...	4 41/64 ins.
Stroke	...	5 29/32 ins.
Firing Order	...	1, 5, 3, 6, 2, 4.
Rotation	...	Clockwise.
Fuel injector nozzle type	...	Bosch Pintle D N O SD 211.
Fuel injector lifting pressure	...	1,777 lbs./sq. in. (121 atmospheres).
Fuel pump type	...	Bosch PE 6 A 85 B 310 LS 172.

TRANSMISSION

Fluid coupling	...	Bussing type F K 9-2 Oil capacity 17½ to 18½ pints.
Gearbox	...	Zahnradfabrik Friedrichshafen AG - SF - Electro operated gear box type 6E - 75 S Constant mesh Oil capacity 19½ pints.
Reversing arrangement	...	Gmeinder Axle Reverse Gear type GM 160 V 520 (Axially sliding dog clutch between bevel gears).
Final drive; gear ratio	...	5.20: 1.

AUXILIARIES

Batteries	...	...	2 batteries each of 12 volts— 180 amp/hr.
Generator	...	...	Bosch dynamos (Two-belt driven) 12 V.700 W LJ/GTL. 700/12/1000 R 6.
Starter Motor	...	...	24 volts starting motor.
Compressor	...	...	BPD 6/24 ARS 153.
Railbus heating equipment	...	...	Dreiha hot water heating type W 604 connected to Diesel Engine Cooling Water System.
Windscreen wipers	...	...	Electrical.
Speedometer	...	...	Electrical.
Diesel engine cooling water pre-heater	...	...	Webasto Model 180 W.

DRIVER'S CONTROLS

1. Battery isolating switch—No. 1 end only.
2. Air brake handle (detachable).
3. Gear change handle (detachable).
4. Control switch key (detachable).
5. Forward and Reverse lever (detachable).
6. Deadman's handle.
7. Throttle control pedal.
8. Warning horn pedal.
9. Hand brake lever—ratchet type.
10. Speedometer.
11. Engine r.p.m. Indicator.
12. Gearbox ammeter.
13. Engine Cooling Water Temperature Gauge.
(Running Temperature 158° to 176° F).
14. Brake Pipe and Brake Cylinder Air Pressure gauge.
15. Main Air Reservoir and Engine Control Air Pressure gauge.
16. Speedometer changeover switch.
17. Battery charging warning indicators (2 blue lights).
18. Battery Charging Voltmeter.
19. Oil pressure indicator lamp—Red.
20. Cooling water temperature indicator lamp—Amber (illuminated
at 194° F).
21. Forward and Reverse indicator lamps—Amber.
22. Ventilation Switch.
23. Heating Switch.
24. Engine Stop button.
25. Engine heater plug Starter Switch.
26. Engine heater plug indicator.
27. Code lamp switches (headlamps).
28. Instrument light.
29. Instrument light switch.
30. Car Lighting Switch (2).
31. Windscreen Wiper.
32. Bell.
33. Defroster.
34. Buzzer.
35. Left, Right and Close buttons for carriage door operation.
36. Sanding control.

Webasto heater Starting Switch.
Webasto heater Glow Plug Switch.
Webasto heater Glow Plug Indicator.

GENERAL INFORMATION

The control devices for Deadman's device, gear selection and the Passenger Sliding Doors are operated by electrical switches; the warning device, throttle pedal (engine speed), reversing lever are operated by pneumatic valves, therefore **DO NOT USE FORCE WHEN MOVING THE CONTROL LEVERS, HANDLES OR PEDALS.**

The control system of each railbus is complete in itself and cannot be linked to that of another car.

Any failure of the air pressure system resulting in a severe drop in pressure will shut down the engine to Idling.

Air brake tell-tale indicators are fitted in the sole-bar.

Loss of engine oil pressure will be indicated by the red lamp being illuminated on the driver's control panel.

Excessive water temperature is indicated by the illumination of amber lamp.

When the generators are charging correctly the blue indicator lights are extinguished.

The Deadman's Device is situated on the left hand side of the control panel and can easily be depressed by the weight of the left hand.

Throttle Pedal (engine speed) is operated by the right foot and situated below the control panel.

Reversing Lever is below the control panel and on the left side.

The Reversing Lever must not be moved unless the gear selector handle is in a **NEUTRAL** position, i.e. horizontal.

SPECIAL NOTES

DO NOT MOVE THE GEAR SELECTOR HANDLE FROM THE NEUTRAL POSITION UNTIL READY TO MOVE THE RAILBUS. DO NOT MOVE THE REVERSING LEVER UNTIL GEAR SELECTOR HANDLE IS IN NEUTRAL AND THE CAR IS STATIONARY.

DRIVER'S DAILY DUTIES

1. Obtain the satchel containing the battery isolating switch key, control switch key, compressed air brake handle, carriage keys, gear selector and reversing handle.
2. Check that
 - (a) The detonator cases are intact.
 - (b) The hand brake is **ON** in the leading driving compartment.
 - (c) The hand brake is **OFF** in the trailing compartment. The hand brake is off when with the foot on the release pedal and the plunger at the top of the brake lever depressed the brake lever can be moved freely, leave in the forward position.**LOCK DOOR OF TRAILING COMPARTMENT.**

3. Before commencing the first diagram of the day the Driver must carry out the following procedure:—

- (a) Check the cooling water header tank level.
- (b) Start the Webasto heater to pre-heat the engine cooling water.

NOTE.—In cold weather the Webasto heater can be run for a suitable period before the vehicle is required for service to raise the temperature of the passenger compartment.

- (c) Check engine sump oil level.
- (d) Check gearbox oil level.
- (e) Check fuel oil level.
- (f) Make a general inspection of the vehicle to ensure that the running gear is in order.

In the event of water, lubricating oil or fuel oil being required early opportunity should be taken to restore the levels if the requisite facilities are not immediately available and the levels are not seriously low.

STARTING THE ENGINE (FROM COLD)

1. (a) Close the battery isolating switch which is situated at the No. 1 End in the cupboard below Air Brake Valve.
(b) Push the control switch key into the fully home position.
(c) Check that the gear selector is in the Neutral position.
(d) Check that the Forward/Reverse lever is in the Neutral position.
(e) Close cock marked "change over valve for heating" situated behind an access door on the front R.H. side of car at No. 2 End.
(f) Start the Webasto Diesel engine Cooling Water pre-heater.
2. (a) Press glow plug push button until glow plug control shows bright red, keeping push button depressed; turn Webasto heater switch to switch step "1" ('full load' and the $\frac{1}{2}$ position are bridged and position $\frac{1}{2}$ should not be used.)
(b) Release glow plug push button when the green indicator light in the Webasto heater switch is illuminated.
(c) If after 2 minutes the control lamp in the Webasto heater switch does not light up, turn the switch back to stop "ON" and repeat "starting operations."
Before starting the diesel engine allow cooling water temperature to build up to at least 120° F. and preferably 185° F. when the heater will automatically shut down. (It is essential for maximum engine life that the temperature of the cooling water is raised as high as possible before starting the diesel engine).
(d) Turn Webasto heater switch to "O."
(e) Open the cock marked "Change over valve for heating."
3. (a) Turn the engine starter switch to position one and allow the cylinder heater plug indicator to glow for a few seconds.
(b) Press and rotate engine starter switch to position "two"; hold in this position until engine fires. Release the heater plug/starter switch; warm the engine up at **medium speed** while keeping the oil pressure light under observation.

NOTES.—If the engine does not start within approximately 10 seconds, release Starter switch for not less than 20 seconds to allow engine to come to rest before attempting to start it again. If the engine refuses to start, check the fuel tank dip stick for fuel content and ensure that the fuel cock is open.

When main reservoir air pressure has built up to 90/100 lbs./sq. in. select direction of travel and note that the correct indicator light is illuminated.

When the car is stationary and the engine is running for a period in excess of 5 mins. the gear selector must be put in the red spot position between Nos. 1 and 2 gears.

4. Starting the Engine (When the Engine is Hot)

(a) Carry out Items as shown in 1 (a, b and c) and 3b.

With the Engine Running

(a) Turn control Switch key to position 1.

(b) Depress Deadman's handle.

(c) Place the air brake handle into position and move it to the **Release** position, check that brake cylinder pressure drops to zero and Train Pipe pressure is 73 lbs./sq. in.

(d) Make a full air brake application and check that brake cylinder pressure is 50 lbs./sq. in. and that train pipe pressure is at zero; if brake cylinder pressure does not rise check that the Triple Valve is not isolated (cock should be in vertical position for normal operation).

(e) Place brake handle in release position and release Deadman's handle. Check that the Deadman's handle springs up, and that after a 5 to 7 seconds delay the brake is applied.

(f) Apply the air brake and take off the hand brake in the driving compartment.

Starting the Railbus

(a) Ensure that there is adequate air pressure in the main air reservoir.

(b) Obtain control of the Deadman's device.

(c) Release air brake sufficiently to hold car.

(d) With the engine Idling move the gear selector handle to third gear position (if gradient conditions are favourable) and note that the gearbox ammeter reads 12 amps.

(e) Release air brake to OFF position. The railbus should not be moved with brakes dragging.

(f) Depress throttle pedal slowly and the railbus will commence to move. As the speed increases, change gear as indicated by engine r.p.m. indicator.

NOTE.—Never stand for more than a few seconds with a gear selected.

GEAR CHANGING

(a) Changing Up

When the engine r.p.m. indicator reaches 1,800 to 1,900 r.p.m.

1. Allow throttle pedal to return towards idling position.

2. Move gear selector to "spot" between gear present position and next higher gear.

3. Allow the engine speed indicator needle to fall to between 1,300 and 1,400 r.p.m.

4. Move gear selector to the **next higher gear position**. Check that the gearbox ammeter reads 11-12 amps. then depress throttle pedal slowly.

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

1. When engine r.p.m. indicator falls between 1,200 and 1,300 r.p.m.
2. Move gear selector to "spot" between the next lower gear and that which selector is in.
3. Allow engine revolutions to rise.
4. Engage **next lower gear** position.
5. Depress throttle pedal to full extent when the gearbox ammeter reads 11-12 amps.

N.B.—Do not move the gear selector handle until the actual gear change is to be made.

COASTING

When maximum running speed required is obtained, to allow train to coast:

1. Allow the throttle pedal to return to the idling position.
2. Place the gear selector handle into the "**red spot**" position between the 5th and 6th gear positions.

Re-operating the Throttle

If it is necessary to re-open the throttle, place the gear selector handle into the appropriate gear, check that the gearbox ammeter reads 11-12 amps., then depress throttle pedal.

Note the correct speeds for re-engagement are as follows:—

- 3rd gear. Up to 24 m.p.h. indicated by brown band on speedometer.
- 4th gear. 24 to 33 m.p.h. indicated by green band on speedometer.
- 5th gear. 33 to 45 m.p.h. indicated by white band on speedometer.
- 6th gear. Over 45 m.p.h. indicated by orange band on speedometer.

STOPPING THE RAILBUS

1. Return the throttle pedal to the idling position.
2. Apply the air brakes as required.
3. When almost at a stand return the gear selector handle to "**O**" position without pausing in any other gear.

NOTE.—If the 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 air brake and then follow the procedure described under "Coasting, Re-opening the throttle," above. Tend to engage a **higher gear** rather than a lower, after coasting.

CHANGING ENDS

1. Put the air brake ON.
2. Place the reversing handle into the **neutral** (horizontal) position, then remove handle.
3. Move the air brake handle from ON into the **lap** position, check that the air brake is still applied, then remove handle.
4. Place control switch key in the "O" position and remove key.
5. Remove gear selector handle.
6. Lock driving compartment door and remove key.
7. Proceed to the other end of the railbus and place handles and levers in their appropriate positions, place control switch key in position 1.
8. Place reversing lever into forward or reverse as required.

REVERSING THE RAILBUS

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

1. With the engine IDLING move the reversing lever to REVERSE. Check that the indicator lights are illuminated, indicating that the final drive has correctly engaged. If not, with the engine still IDLING, place the reversing lever to the opposite direction of travel—pause, and then re-select REVERSE.
2. Proceed as for "Starting the Railbus," items (c) to (f).

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

STOPPING THE ENGINE

1. Return the throttle pedal to Idling position.
2. Check that the air brake is ON.
3. Press engine "Stop" button and hold in that position until engine has stopped. (Oil pressure light still illuminated).
4. Release the air brake, then apply the hand brake.

STABLING THE RAILBUS

After stopping the engine by the method shown above:—

1. Check that the hand brake is applied.
2. Place air brake valve to LAP position and remove the handle.
3. Remove reversing lever. Place control switch in "O" position and remove key.
4. Remove gear selector key.
5. Shut off compartment heaters if in use.
6. Lock the driving compartment doors.
7. Return the satchel containing the brake handle, reversing lever, control switch key, gear selector key and carriage keys to the Running Foreman or other responsible person on duty.

RAILBUS HEATING

Heating is by means of 4 Dreiha hot-water heaters W 604. The heating of the heat exchanger is performed by the engine cooling water, the heater being connected to the cooling system by means of an intake and return pipe.

The circulating air is drawn in by the fan, conveyed through the laminations of the heat exchanger, where it is heated up and then it is blown through the circulating air discharge vents into the passenger compartment. The railcar can be preheated by using the Webasto oil heater.

Control of the Dreiha hot water heater is by the switches in the Driver's compartments. Each switch controls two heaters. When the switch handle is pulled towards the driver only one heater will operate, when the switch is pushed away from the driver both heaters will operate.

VENTILATION

Apart from windows of the hinged opening type, fans are fitted in the roof (in the middle of each compartment). These fans are controlled by switches under the Driver's control. They may also be operated by passenger operated switches to extract air from the carriage or blow the fresh air into the compartments.

FAULTS IN TRAFFIC

If the engine stops while the railbus is running, stop the railbus, place gears into NEUTRAL, then attempt to restart the engine by operating the engine starter switch, not more than three times. If this fails to restart the engine, lock the final drive in NEUTRAL. The railbus will then require towing to a terminal point.

1. Failure of Final Drive.—Air cylinder defective.

- (a) Stop engine.
- (b) Lift trap door above final drive unit.
- (c) Kneel down over trap door facing No. 1 end.
- (d) Close air cocks to air cylinders situated below carriage floor left side of trap door.
- (e) Remove bridge bolt by first pulling R.H.S. of bolt towards the propellor shaft and then lift the bridge clear.
- (f) Insert long leg of bridge bolt in the R.H. hole of the two exposed holes. To line the holes up it may be necessary to swing the horizontal lever fitted on top of the final drive box the full extent of the quadrant plate until the holes are in line. Push the bridge bolt right home; to release the horizontal lever from its central position in the quadrant plate it will be necessary to pull the spring loaded handle of this lever upwards. Lock the bridge bolt in place by swinging the free end over the left hole and clipping it.
- (g) Depending on the direction of travel required swing the horizontal lever to the following positions:—
Driving from No. 1 end
 1. For forward direction, lever to be locked in rear hole of quadrant plate.
 2. For Reverse direction lever to be locked in front hole of quadrant plate.

2. To Lock Final Drive in the Neutral Position.

- (a) Carry out Items 1 (a, b, c, e, and f) of Failure of Final drive air cylinder.
- (b) Lock horizontal lever in the centre of the three holes in the quadrant plate.
- (c) Check that the Final drive is in the NEUTRAL position by rotating the propellor shaft.

ASSISTING DISABLED RAILBUS

In an emergency a disabled car can be assisted by another diesel car or by a locomotive.

1. Assistance by a railbus of same type.

- (a) If the air brake system is in order the railbus may be coupled to a unit of the same type; and the air pipes between the units should be coupled up.

- (b) Before proceeding the engine must be stopped and the final drive locked in the NEUTRAL position.
 - (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 railbus can be taken out of traffic.
 - (d) Remove all control keys.
2. **Assistance by a diesel train or locomotive.**
When assisted by a different type of train or by a locomotive:—
- (a) Stop engine and lock the final drive in the NEUTRAL position.
 - (b) Put the brake handle in the lap position and release brake by pulling rods attached to the triple valve ; check that the brake is released by examining brake tell-tale indicators fitted to sole-bar.
 - (c) Remove all control keys.
 - (d) 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 car can be taken out of traffic.

COMPRESSED AIR SYSTEM—UNLOADER VALVE

In the event of an unloader valve defect the unloader valve can be isolated by turning the cock fitted in the line from the air reservoir to the no-load regulator to the closed position.

FIRE PRECAUTIONS

In the event of a fire, bring the car to a stand as laid down in Rule No. 188 and General Appendix. When the train has been brought to a stand the driver must use the hand operated extinguishers to extinguish the fire.

In the event of the engine, transmission or control system being damaged the driver must carry out the instructions as laid down for assisting Disabled Railbuses.

WARNING HORNS

When sounding the horns, to comply with Rule 127 and the Appendix Instructions, operate the lever in such a manner as to give the triple-horn 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.