

BR 33003/19

Ex-G. W. R. CARS

Nos. 19-38

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RAIL CAR DATA

Type	0—4—4—0 (Bogie Coach).
Weight in running order ..	Nos. 19-33—35 tons 13 cwts. No. 34—34 tons 18 cwts. No. 35—36 tons 14 cwts. Nos. 36 and 38—37 tons 12 cwts.
Tractive effort:—	Twin Cars Single Ratio Cars
	1st gear 5th gear 1st gear 5th gear
	11380lbs. 1840lbs. 10060lbs. 1630lbs.
	Dual Ratio Cars (Nos. 19 and 20)
	High Low
	1st gear 5th gear 1st gear 5th gear
	6720lbs. 1090lbs. 10060lbs. 1630lbs.
Wheel base	52ft. 0in.
Wheel diameter	3ft. 2in.
Width overall	9ft. 3in.
Length overall	65ft. 8in.
Height overall	12ft. 2½in.
Minimum curve negotiable ..	3½ chains.
Maximum speed m.p.h.:—	1st 2nd 3rd 4th 5th
Twin cars	11.8 16.8 29.9 46.1 75.5
Single ratio cars	6.7 9.4 16.8 26.0 42.5
Dual ratio cars low	6.7 9.4 16.8 26.0 42.5
Dual ratio cars high	10.0 14.1 25.2 38.8 63.7
Fuel tanks	100 gallons per car.
Lubricating oil sumps	8 gallons per engine.
Cooling water, radiator and engine	36 gallons.
Carriage warming boiler ..	Vapor Clarkson steam generator on Cars Nos. 19-33 (Car No. 33 re-designed to run with Car No. 38 and a standard carriage as a 3-car set). It is also carried on Car No. 35 for heating standard carriage running between Cars Nos. 35 and 36 as a 3-car set.
Carriage warming boiler fuel tank	50 gallons.
Carriage warming boiler water tank	100 gallons.
Brakes—vacuum and hand brakes	Standard W.R. type brake blocks, etc.
Sanding	Compressed air operated.

POWER EQUIPMENT

6-cylinder diesel engines ..	A.E.C. 105 h.p. at 1,650 r.p.m. Single and double ratio cars 2 engines = 210 h.p. Twin Cars 4 engines = 420 h.p.
Cylinder bore and stroke ..	120 m/m. x 142 m/m.
Firing order	1, 5, 3, 6, 2, 4.
Fuel injector nozzle type ..	C.A.V. multiple-hole long stem 150°.
Fuel injector holder type ..	B.K.B. L.67 S.567.
Pressure at which fuel injector nozzles should be set ..	2,500lbs./sq.in.

Fuel pumps C.A.V.38 B.P.E.6 B.80 Q.320 S.626 or
C.A.V.38 B.P.E.6 B.80 N.320 S.626.

TRANSMISSION

Fluid coupling Daimler type fluid flywheel (under
Licence A.E.C. J.150).

Gear boxes Pre-selective Wilson 5-speed epicyclic
(electro-pneumatic operated) A.B.C.
U87067.

Gear ratio:— 1st 2nd 3rd 4th 5th
6.38:1 4.5:1 2.53:1 1.64:1 1:1

Auxiliary reduction Twin Cars. Single Ratio Cars.
0.919:1 1.63:1
Dual Ratio Cars 19 and 20.
High 1.09:1. Low 1.63:1.

Reverse gear Bevel gear and pinions in driving axle
box.

Final drive Bevel gear ratio 2.59:1.

AUXILIARIES

Battery Oldham lead acid 24 cells 224 amp./
hrs.

Lighting circuit 24 volts.

Dynamo Split field shunt wound C.A.V. D8C40
8in.

Radiator fan Belt driven.

Starter motors C.A.V. clockwise axial BS62402.

Compressors Rotary type Clayton Dewandre GA6.
R.C.

Exhausters Rotary type Clayton Dewandre REG.
A.131, 5½in. bore 7½in. long.

GAUGES AND INDICATORS FITTED

1. Speedometer and change gear indicator (2).
 2. Vacuum gauges (2).
 3. Air pressure gauges (4).
 4. Steam pressure gauge (1).
 5. Fuel pressure gauge (1).
 6. Pilot lights (2).
 7. Red warning lights (2).
- } Steam generator

DRIVERS' DAILY DUTIES WHEN IN SERVICE

1. Obtain gear locking key.
2. Close battery main and lighting switches.
3. Check that radiator water tanks are full.
4. Check oil level in engine sumps.
5. Check quantity of fuel oil in tanks.
6. Check sand boxes and that sanders are operating.
7. Check that all panels are secure.
8. Check that the compressed air line drain cock adjacent to electro-pneumatic valve boxes is closed, also the drain cocks on the air reservoirs.
9. Check that detonators, etc., are complete.

10. Check that the fire-fighting equipment is intact.
11. Make a short inspection of the rail car and equipment at a convenient time and check that the apparatus generally is in good working condition.
12. Report all known defects at the end of each turn of duty.

STARTING THE ENGINES

(a) Starting up Cold Engines.

1. Remove small panel in valance just ahead of engine.
2. Pull throttle lever over to the right and hold in that position.
3. Press " Starter " button until engine fires.

NOTE: Under no circumstances should the " Starter " button be held depressed if the diesel engine fails to turn over immediately. The " Starter " button **MUST NOT** be depressed after the engines have started, otherwise serious damage may be done to the teeth of the starter motor pinions.

4. With engine running hold throttle lever open without racing the engine until 40 lbs. air pressure is obtained.
5. Repeat operation for 2nd engine.
6. Warm engines for about 5 minutes.
7. With engines running check that 25 in. of vacuum has been obtained.

Stop engines and check that the vacuum gauge needle remains at steady—restart engines.

(b) Starting up Warm Engines.

8. If less than 40 lbs./sq. in. of air pressure is available, items 1-5 apply.
9. If over 40 lbs./sq. in. air pressure is available, start engines by " Starter " buttons in cab.

BEFORE MOVING THE RAIL CAR

1. Check that 75 lbs./sq. in. of air pressure is obtained.
2. Check that the A.T.C. flag is **DOWN** at the driving end and **UP** at the trailing end.
3. Release hand brake in rear cab.
4. Insert control key in lock at driving end.
5. Stop engines.
6. Move control key quarter turn to the **LEFT**. Hold clutch lever over to the right and place reverse handles in central position. Now move control key a further quarter turn to the **LEFT**. Release clutch lever. The control panel is now unlocked (on Cars 19 and 20 the dual ratio gear lever must also be placed in the central position during this operation). The reverse lever and gear ratio lever are interlocked with the gear engaging lever and this must be held over to the right, while moving either of the other two. Before restarting the engines place reverse lever in required position while **HOLDING OVER** the clutch lever.

RUNNING

1. Stop engines, place reverse lever in position required (on Cars 19 and 20 place dual ratio gear lever in required position). If reverse

pinion does not engage, press the engine "Start" and "Stop" buttons simultaneously.

2. Restart engine.
3. Select and engage 1st or 2nd gear as necessary.
4. Release vacuum brakes. Release hand brake when depressing accelerator pedal.
5. Depress accelerator pedal and when speedometer needles rise to the "Change Up" position marked on gauge, release accelerator pedal, select and engage the next gear and so on until top gear is reached.

The pre-selector gear lever should be left in the gear last engaged and the next gear selected when required.

6. Changing to a lower gear act as in item 5, except that the accelerator pedal must be kept gently depressed during the change.
NOTE: When changing gear either up or down it is necessary to make a slight pause between each operation.
7. **NEUTRAL MUST NOT BE ENGAGED WHEN RUNNING AT SPEED** as over-heating of the fluid couplings would occur and the vacuum exhausters would not maintain the vacuum required (the only exception to this is shown under the heading "To Stop the Rail Car").
8. If the driving wheels slip, release accelerator pedal and operate sanders.
NOTE: High engine revolutions in low gear tends to increase wheel spin. Under these circumstances it is advisable to engage a higher gear earlier, care being exercised to avoid stalling the engines.
9. **DO NOT** change over from high to low dual gear ratio or vice versa on Cars 19 and 20 while the car is running.
10. **DO NOT REVERSE ANY CAR WHEN RUNNING OR STANDING WITH THE ENGINES RUNNING.**

TO STOP THE RAIL CAR

1. Release accelerator pedal.
2. Apply vacuum brakes.
3. **When speed has been reduced to about 10 m.p.h. select and engage neutral gear.**
4. In making an emergency stop items 1 and 2 apply, **NEUTRAL** being engaged before stopping if possible.

TO STOP THE ENGINES

1. With not less than 50 lbs./sq. in. air pressure, check that the gears are in **NEUTRAL**.
2. Press "Stop" button.
3. If engines do not stop press "Stop" button at other end of car and if still unable to stop close fuel cock on engine, re-opening after engines have stopped. Prime the fuel pump by means of fuel pump lever and open bleed cock.

REVERSING THE CAR

When car has been brought to a stand.

1. **STOP ENGINES.**
2. Hold clutch engaging lever over to the **RIGHT** and move reversing lever to the direction required.

3. Release clutch engaging lever.
4. Press engine "Stop" and "Starter" simultaneously for a few revolutions of the engines for the driving dogs to engage.

OPERATING HIGH AND LOW RATIO GEARS CARS Nos. 19 and 20

If it is necessary to engage high or low ratio gears:—

1. Stop rail car.
2. Stop engines.
3. Hold over clutch engaging lever and select ratio required.
4. Release clutch engaging lever.
5. Restart engines.

CHANGING ENDS

1. Apply vacuum brake fully.
2. STOP ENGINES.
3. Place brake valve handle in "Lap" position and release hand brake.
4. Place pre-selector reverse and gear levers in NEUTRAL. Hold over clutch engaging lever and give control key quarter turn to the RIGHT. Release engaging lever, give key another quarter turn to the RIGHT, and remove it.
5. Place A.T.C. flag in the UP position.
6. Proceed to other end of car and release controls, etc., placing A.T.C. flag in DOWN position.

STABLING THE RAIL CAR

1. Select and engage NEUTRAL before coming to a stand.
2. Apply hand brake.
3. With engines running see that the fans are running (this will indicate that the gears are in the NEUTRAL position). Remove panels and check over engines and make a thorough examination of the car, including radiator water levels, etc.
4. Stop engines.
5. Examine fan belts.
6. Open drain cocks in air reservoirs until completely drained and reclose.
7. Remove control key.
8. Switch off main battery control and lighting switches.

NOTE: These MUST NOT be switched off until the gears are locked in NEUTRAL and the control key has been removed.

GENERAL NOTES

1. **Releasing Vacuum Brakes when Engines are Dead.**
Puil cord under valance, marked with a star.
2. **Rail Car left in Gear with Engines Stopped.**
If a rail car has been left in gear and the air pressure has fallen below 40 lbs./sq. in., the engines must not be started until the following operations are carried out:—
 - (a) Place gear pre-selector handle with pointer to NEUTRAL.
 - (b) Remove gear box valance panel.
 - (c) Place special spanner provided on the square of the spindle

projecting out of the side of the gear box, and press spanner down as far as it will go. Repeat operation on the other gear box.

- (d) Start up engines and build up air pressure to 75 lbs./sq. in. before proceeding.

THE VAPOR CLARKSON STEAM GENERATOR OPERATING INSTRUCTIONS

NOTE

Before attempting to start the unit make sure that there is sufficient fuel in the fuel tank (by using the dipstick) and that there is ample water (by examination of the water gauge on water tank).

When water tank is replenished the water softener (Disincrustant Powder M.30), which will be found in the container adjacent to the filling cap, must be put in at the rate of ONE LEVEL MEASURE to 10 gallons of water. (The water gauge is marked off in 10-gallon divisions).

TO START THE STEAM GENERATOR

1. Open feed water valves (25, 27), separator blowdown valve (6), and main fuel valve (17). See that the coil blowdown (13), main steam (5), drain valves (28, 29) are all closed, also the main switch (32) and operating switch (33) are "off" and the safety switch (34) "in."

2. Make sure that the water pump is primed. This is done by opening the cocks (one for each pump) situated on the pump castings, and obtaining a flow of water from each one. Close these cocks tightly or water pressure will be lost.

3. Turn on main switch also operating switch to position No. 2 (notice that you should obtain a consistently good spark on the sparking plug (10)).

4. After a short while (about 2 mins.) a full bore of water should be observed issuing from the separator blowdown valve (6). When this is observed the main fuel valve (17) should be firmly closed. The unit should immediately fire, the oil pressure gauge rising promptly to approximately 145 lbs./sq. in. It will be noticed that the pilot light (30) will light up when the unit is switched on, but will go out shortly after the unit commences to fire.

5. After firing for about two minutes the separator blowdown valve (6) should be passing steam (with a small trace of water). When this occurs close the separator blowdown valve (6) and open fully the main steam valve (5).

RUNNING INSTRUCTIONS

1. When the unit is satisfactorily working the steam pressure in the train pipe (as indicated on the gauge (2)) should on speed No. 2 be above 20 lbs./sq. in. If this goes on building up the pressure switch (1) will cut the motor out at approximately 45 lbs./sq. in. and will cut in again at approximately 5 to 10 lbs./sq. in., thus preventing any excessive pressure forming.

2. On a mild day, or due to some other circumstances, the quantity of steam required might be less, thus causing the pressure switch (1) to be constantly cutting out and in. If this is so the motor speed should be reduced to No. 1 speed, thus making an economy in fuel and reducing the wear on the unit. (When running on speed No. 1 the fuel pressure should be approximately 85 lbs./sq. in.).

3. The red warning light (31) coming on after the unit has been working indicates that the unit has stopped owing to excessive heat in the fire pot (usually due to water shortage) and must not be restarted until examined by the Maintenance Staff.

N.B.—This applies to cars which have been modified and have TWO LAMP FITTINGS above the switch panel (i.e., a pilot light (30) and a warning light (31)). On cars which still have only the pilot light this light will come on when the unit gets excessively hot and the unit will subsequently stop through the action of the reset safety switch. The main switch (32) should be turned off (before the reset switch takes effect if possible), and the attention of the Maintenance Staff drawn to the condition of the generator.

4. The separator blowdown valve (6) must be slightly opened approximately every hour to remove excess water collecting in the separator (4). This period can be extended to a maximum of four hours if circumstances make it ABSOLUTELY IMPOSSIBLE to blow-down every hour. (Care should be taken when opening this valve, as steam at approximately 45 lbs./sq. in. follows the water through the valve).

N.B.—THE UNIT SHOULD BE SHUT DOWN ON EVERY POSSIBLE OCCASION WHEN THE CAR IS NOT CARRYING PASSENGERS, THE HEAT ACCUMULATED IN THE CAR BEING RETAINED BY CLOSING ALL OUTSIDE DOORS AND WINDOWS, THUS GIVING THE UNIT AN OPPORTUNITY TO COOL OFF AND AT THE SAME TIME CONSERVING THE SUPPLY OF FUEL AND WATER.

TO STOP THE STEAM GENERATOR

1. Turn off operating switch (33) and main switch (32).
2. Close feed water valves (25, 27).
3. Close main steam valve (5).
4. Open coil blowdown valve (13) and with half the steam in the boiler blow down the coil until water ceases to flow. Close this valve and with the remainder of the steam blow down the separator by means of the separator blowdown valve (6).
5. In frosty weather, if cars are to remain outside, drain off water from supply pipe by opening valve (28), also unscrew water filter (26) and empty out sludge, etc.

The green indicator light in the driver's compartment will be alight the whole time the generator is working. When the generator "cuts out" due to excess steam pressure or excess temperature in the stack, this light will be extinguished and acts as an indicator to the driver.

DEALING WITH DEFECTS WHEN CAR IS IN SERVICE

Question 1.—How does driver uncouple in case of failure?

Answer. Place all controls in neutral and remove control key. For the actual process of uncoupling there are two methods:— (1) Remove set bolts from air connection in

driving axlebox (which incorporates the reverse gear) and replace with neutralising bolts. The latter are distinguished by a number, either 1, 2, 3 or 4, stamped on the head, the axlebox housing is also numbered. Care should be taken to fit the bolt with the number corresponding to those on the axlebox housing, also that the copper washers are replaced on the neutralising bolt and are seated correctly. (2) A quick action release on the axlebox cover. Remove clip on spring loaded bolt, which will then be released. Slack back wing nut on locating cover, take dipstick out, insert in locating hole and move the bar either to the right or left until the spring loaded bolt engages. Check that cardan shaft is free between driving axle and gear box.

NOTE: It is essential during the "learning" period for a driver to actually uncouple under the supervision of the mechanical staff.

Question 2.—How does driver know that both engines are running ?

Answer. The two needles on the rev. counter will rise and the dynamo indicator lights will illuminate.

Question 3.—If one of the needles on the rev. counter suddenly dropped and failed to rise, what should the driver assume ?

Answer. That an engine has stopped.

Question 4.—What action should be taken ?

Answer. Stop car and examine engine.

Question 5.—Suppose no defect was apparent ?

Answer. Examine fuel tank and system, open bleed cock and work hand pump. If no fuel drains from the waste pipe, turn engine over slightly by inserting screwdriver into the teeth of the fluid flywheel and prise downward and repeat pumping operation. If no fuel drains from the waste pipe there is a defect in the fuel system.

Question 6.—How would this defect be dealt with ?

Answer. Uncouple defective side and proceed.

Question 7.—For what other defects is it necessary to uncouple ?

Answer.

- (1) Pronounced knock in engine, which may be due to broken or fused piston, defective large or small end bearing.
- (2) Excessive smoke from either exhaust pipe due to a defective piston.
- (3) Overheated fluid flywheel due to shortage of oil or seized engine.
- (4) Water in engine sump which driver may detect when testing oil level; this would indicate a higher level on the dipstick than when last checked.

- (5) Broken hose connection on engine cooling system, e.g., main radiator or water pump flexible hoses.
- (6) Broken or disconnected cardan shaft.
- (7) Defect in gear box or reverse gear.
- (8) Defective timing gear.
- (9) Complete loss of air pressure, other than defective unloader valve.
- (10) Faulty electrical contacts which may have the effect of putting the controls out of action.

Question 8.—Supposing all controls went dead ?

Answer. Examine fuses and make certain that main switch has not been turned off. Examine Slydlok fuses in compartment under floor next to battery well.

Question 9.—How is a blown fuse dealt with ?

Answer. Take one or two fuses as required from the fuse box at the opposite end of the car, to replace the defective ones at the end which is being driven.

NOTE: In the driver's compartment at the luggage end there are two fuse boxes, the bottom one is the main and must not be interfered with. On the twin type cars there are two fuse boxes in each driving compartment, the bottom ones are the mains.

Question 10.—Suppose injector fuel pipe broke ?

Answer. Bend bottom portion of pipe outwards clear of engine and continue in service. In no circumstances should any part of the pump or injector pipes be blanked off.

Question 11.—Engine stalling, causing loss of speed. What are the causes ?

Answer. (a) Engine seizure—excessive smoke from crankcase.
(b) Shortage of fuel—deal with as in question (5).

Question 12.—What should the driver do after uncoupling for an over-heated part, such as a fluid flywheel ?

Answer. Make a thorough examination and satisfy himself that there is no possibility of a fire breaking out.

Question 13.—Should a fire occur, how should this be dealt with ?

Answer. By playing on the seat of the fire with the extinguishers provided.

Question 14.—If on pressing " Starter " button engine fails to start ?

Answer. Pause for 5 seconds and repeat operations. If the engine does not start then, try starter button on side of engine. If this fails, insert screwdriver in teeth of fluid flywheel to turn engine slightly and press button again. The

failure to start may be due to certain teeth of the starter pinion being defective. If the engine has been running previously, it could be pulled in with the other engine when a rail car speed of about 15 m.p.h. is reached, but if it fails to start, engine should be uncoupled.

Question 15.—Supposing driver discovered engine sump dipstick missing ?

Answer. If car is in service, uncouple engine and report defect on arrival at shed after completing normal service.

Question 16.—What would be the effect and what action should be taken if the unloader valve was defective ?

Answer. Loss of air pressure and a leak from the unloader valve. Fit the blank nut which is supplied on to the escape connection of the unloader and continue in service. The driver should ensure that the air pressure does not exceed 75 lbs. To prevent pressure exceeding 75 lbs. open air cock in front of car sufficiently to maintain that pressure.

Question 17.—What can be done if an air pressure pipe leaks badly ?

Answer. If a flexible, renew if spare one is available. If it should be a pipe leading to the axlebox, either steel or flexible, blank off and cut engine out. The flexible could be blanked by inserting portion of the flagstick in the pipe and securing by using a clip which will be found on the flexible. In the case of a steel pipe, flatten until airtight.

Question 18.—Suppose the air leak is not accessible, and air pressure cannot be maintained ?

Answer. Cut both engines out as the car is a total failure.

Question 19.—These cars are fitted with a shunting side lever to facilitate shunting movements. Explain the operation of this apparatus.

Answer. Release left-hand lever by withdrawing locking bolt, pre-select first or second gear according to load, raise shunting lever on side most convenient for looking out, when gear will be engaged, a further upward movement of the lever will open throttle. When sufficient momentum has been gained, replace lever to normal position. To stop car, lower the shunting lever and the brakes will be applied.

On cars Nos. 19 and 20 place gear ratio to "low."

NOTE: A series of notches will be felt in moving the shunting lever and it should be moved slowly with a slight pause at each notch. On completion of shunting operation, replace shunting lever to normal position and secure with locking bolt. Under no circumstances must undue force be used in operating the lever.