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QUESTIONS AND ANSWERS  
ON  
MULTIPLE UNIT DIESELS  
AND  
DIESEL ELECTRIC SHUNTS

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*Whitehall Printing Co. (Bristol) Ltd.*

G O R D O N   R O A D   B R I S T O L   5

## P R E F A C E

After numerous requests from Enginemen the booklet *Questions and Answers on Multiple Unit Diesels* has been revised, and also incorporated with it are *Questions and Answers on Diesel Electric Shunts*, trusting it will be of assistance to Enginemen when receiving their course of instruction.

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2/- per copy, post free  
Dozen copies £1 post free

## MULTIPLE UNIT DIESELS.

### Description of Engine

Leyland. 6-cylinder horizontal. Stroke 5.75". Bore 5". Rotation Clockwise from free end. Compression ratio 15.75—1.  
A.E.C. 6-cylinder horizontal. Stroke 5.59". Bore 5.12". Compression Ratio 16—1. 4-stroke Cycle. Firing order: 1, 5, 3, 6, 2, 4

### Give Transmission

Engine. Fluid. Flywheel. Freewheel. Gearbox. Propeller Shaft. Final Drive. Torque Arm.

### Auxiliaries Driven by Leyland Type Engine

By Gears: Compressor, Camshaft, Fuel Pump, Engine Lubricating Pump, Water Pump, Tachometer.  
Belt-driven Free End: Radiator Fan.  
From Input to Gearbox: Exhauster.  
From Output of Gearbox: Generator on No. 1 Engine Subs.

### Auxiliaries Driven by A.E.C. Type Engine

By Gears: Compressor, Camshaft, Fuel Pump, Engine Lubricating Pump, Tachometer.  
Belt-driven Free End: Water Pump, Radiator Fan.  
From Input: Exhausters.  
From Output : Generator No. 2 Engine C.C.  
On Gloucester singles and Gloucester C.C. there are 2 Alternators belt-driven from the input side.

### Keys Required

Brake Handle, Reverser, Control Isolating Switch, Carriage Key, Corridor Door Key.

### **Switches to be Closed before Engines can be Started Locally**

Main Battery Switch, Control Isolating Switch, Engine Isolation Switch. If this is switched off fitters must be seen for reason. Control Isolating Switch, when Mains Battery Switch is closed gives through control currents throughout train.

Reverser makes desk alive and selects direction, enabling currents through C.I.S. to be used to operate Controls from Cab.

Deadman's (throttle) must be engaged, as this in turn energises the Gear Selector.

### **Preparing Car**

Collect satchel from foreman. Proceed to cab which is to be driven from, see hand brake is on, flags and detonators, hand lamp, and two fire extinguishers are intact, see that deadman's valve is not isolated, no keys left in panel. A.T.C. flag in use.

Place tools on desk then insert and turn C.I.S., place reverser in pocket, proceed down No. 2 side Subs. and Gloucester C.C., No. 1 side Swindon C.C., and turn on battery switch. On Leyland engines, examine sump first, then pull out throttle control and press start button, five seconds after engine fires, release start button, and gradually reduce throttle till engine ticks over. Examine belts, fuel, fire bottle connections, springs, brakes, final drive isolating bolts, jumpers, vacuum hoses and air pipes, whilst walking round to No. 1 engine. Start engine, then walk down car examining as before, then switch on other battery switch, and start up. Climb into rear cab and examine, take off brake. and isolate A.T.C., also see no other keys left in desk, lock all doors then start other engine. Walk down to first engine, examine for leaks, then, if in the shed, stop by the stop button, if outside, stop by testing the fire alarm test switch. On A.E.C. engines test sump, stop other engines the same. When passing guard's van notice if isolating fork is there.

Air pressure should now be 75 p.s.i., proceed to cab and insert reverser, engage Deadman's, press start buttons individually and start engines. If necessary open throttle slightly to assist.

Create vacuum and see if it stands at 20"-21" with valve in lap, destroy 5" to test I.R. glands, release Deadman's to see if it operates. Give Guard vacuum test.

Take handbrake off, create 15" of vacuum, select No. 1 gear, then immediately blow brake off, and when car moves open throttle.

## **Changing Gear**

No. 1: 1-15 m.p.h. No. 2: 15-27 m.p.h. No. 3: 27-41 m.p.h.  
No. 4: 41-65 m.p.h.

When maximum 1,800 revs, are reached, close throttle, let revs. die to 1,400, select gear, let revs. die to 800, open throttle to 2. When engine has built up to road speed, i.e., tachometer finger comes to a stand, open throttle wide.

When about to coast, shut throttle, let revs. die to 1,400 and select gear 4. Coasting must not be done in neutral, neutral must be engaged just before coming to a stand.

## **What speed does Generator charge Battery?**

At 17 m.p.h., maximum charge at 24 m.p.h. Alternator charges at 550-600 revs.

## **How would you define Engines?**

No. 1 engine is always on the L.H. side when sitting in the driving cab. No. 2 on R.H. side.

## **What are the Valves in the Air System?**

Unloader valve, Safety valve, Diverter valve, Reducing valve.

## **What are their Purposes?**

The unloader valve eases the load on the compressors by closing the valve from the reservoir and opening it to the atmosphere at 95 p.s.i. When the pressure reaches 80 p.s.i. in the reservoir the spring in the unloader closes it from the atmosphere and allows the compressor to pump air in again.

## **The Safety Valve?**

Releases the air pressure at 98 p.s.i. when the unloader is defective and blanked off.

## **The Diverter Valve?**

Allows air to the pressure of 50 p.s.i. to be built up in the small primary chamber to form a nucleus for the throttle motors and Forward and Reverse. After 50 p.s.i. the diverter valve opens and allows air into the large secondary chambers.

### **The Reducing Valve?**

Reduces the air pressure from 95 p.s.i. to 65 p.s.i. for operation of gear brake bands.

### **What are the Valves in the Vacuum System?**

Feed valve, Automatic Isolating valve, Deadman's valve, A.T.C. Isolation Flag, Communication Cord, Emergency Brake valve, A.T.C. Emergency valve.

### **What is the Purpose of the Feed Valve?**

To allow feed back of air (from brake application) into high vacuum cylinder to fetch brakes off. This valve also maintains the 21" in the train pipe by its adjusting spring.

### **What is the Purpose of the Automatic Isolating Valve?**

When both vacuum sides are destroyed this valve operates and isolates the high vacuum chamber allowing 19" to be kept in there. This saves a long wait in recreating vacuum after coupling or uncoupling from another set.

### **What is the Purpose of the A.T.C. Emergency Valve?**

When passing over a 'Dead' ramp, by the armature dropping, air is admitted underneath and lifts this valve, thus allowing air to pass through siren on desk and pass through the valve and operate brake.

### **How many Electro-Pneumatic Valves are there?**

4 Gear—G.1, G.2, G.3, G.4.  
4 Throttle—T.1, T.2, T.3, T.4.  
1 Forward.  
1 Reverse.  
All ON types.

### **What is the purpose of Electro-Pneumatic Valves?**

When the valve solenoid is magnetized by selection in the cab, valve opens and allows air to enter its respective gears, or throttles, or directions, and operate them.

### **How many types of E.P.V. are there?**

Two, an 'ON' and an 'OFF'.

The 'ON' type opens air valve when energised.

The 'OFF' type closes air valve when energised.

### **How is Reversing achieved?**

By means of a sliding dog clutch between bevel gears.

### **Engine will not Motor?**

Check battery isolation switch, control isolating switch, engine isolating switch. If these are all right it could be defective starter motor, burred starter ring, broken connections, flat battery, or firebottle exploded and 2-pole switch reset. If burred starter ring, turn fluid flywheel round to engage good teeth.

### **Engine Motors but will not Fire?**

1, Low fuel; 2, Fuel cock shut off; 3, Low water; 4, Low engine lubricating oil; 5, Air lock; 6, Engine shut down solenoid stuck up; 7, Blockage in fuel delivery pipe; 8, Fuel pump defective; 9, Air intake blocked.\*

### **How is an Engine and Final Drive Isolated?**

Stop engines, turn engine isolation switch with carriage key, take isolating fork and walk round other side and pull out final drive isolation bolt and turn horizontal; go in cab and reverse two or three times, back down and see if bolt has gone home and that propeller shaft is free.

With an electrical failure, engines must be stopped with the shut down solenoid, and dogs blown over by manually operating the F. & R. E.P.V. because there is not any electric current to operate with from cab.

On Swindon C.C. dog can be centred by removing a small plug on side of final drive gear box and using the final drive dipstick to lever dog into midgear.

With a final drive isolated the air and axle light will not illuminate as electrical connection is broken by the dog not being in mesh. The final drive to be isolated is always on the left when facing the defective engine.



### **Is it always necessary to Isolate Final Drive?**

No. If only engine is defective it is not necessary, but if propeller shaft, final drive, or gearbox defective, or engine been on fire, electrical failure or loss of air, the drive must be isolated.

### **In what cases Engine only Isolated?**

Low water, low fuel oil, low engine lubricating oil, air lock, shut down solenoid stuck up, fuel oil or water in engine sump, knocking in engine, fuel pump coupling broken or loose, throttle motor stuck open, fuel delivery pipe broken, or, IF IN DOUBT ISOLATE.

### **In what cases Engine(s) and Final Drive(s) Isolated?**

Fluid flywheel hot, engine been on fire, propeller shaft broken gearbox defective, final drive defective, air failure, electric failure, or maximum revs. in No. 4 gear, i.e., gear not operating.

### **What would cause Tachometer to have Maximum Revs. other than changing for a Higher Gear?**

1. Wheel Slip ;
2. Gear not properly selected ;
3. Gear brake band defective ;
4. Gear E.P.V. defective ;
5. Rubber hose to gear defective ;
6. Drain plug missing from under gear piston chamber
7. If No. 4 gear, clutch plates may be broken.

### **How would you deal with these defects?**

1. Lose revs. and use next higher gear to reduce tractive effort until slip is corrected.
2. Lose revs. and select gear properly.
3. Miss that gear but if possible isolate that engine and final drive till gear can be toggled.
4. According to circumstances miss that gear, or if practicable isolate both engines and final drives.
- 5 & 6. Miss that gear or if possible isolate that engine.
7. Isolate engine and final drive as gear will be in neutral when coasting.

### **How would you tell the difference between Brake Band defective or E.P.V. defective?**

Switch tachometer over to other engine, if still at maximum it is E.P.V.

### **How would you test E.P.V.?**

Press button underneath valve and release. If air is released it is an electrical failure, if no air it is an air failure. For forward and reverse E.P.V. reverser must be removed.

### **How would you toggle Gear Brake Band?**

Stop engines, engage Deadman's, then engage defective gear about twenty times, pausing 2 seconds each time. Automatic adjuster should tighten band. It is advisable to toggle gears 1, 2, and 3, once a day, engaging them about six times.

### **What would cause maximum revs. in all gears?**

1. Teeth broken off dog; 2. Spine collapsed; 3. Propeller shaft broken; 4. Hardy Spicer couplings uncoupled; 5. Loss of oil from fluid flywheel; 6. Electrical connections from Deadman's not being made; 7. Not enough air to operate gears.

### **What would cause Fluid Flywheel to heat?**

Loss of oil through defective gland, or through bad driving, e.g., driving with revs. below 1,100 causing greater slip in flywheel. At 1,800 revs. flywheel torque is at its maximum 2% slip, at 1,100 revs. slip is 7½%.

### **What would cause intermittant Black Smoke at Exhaust?**

Piston wiper rings defective, improper operation of injectors, improper valve timing, dirty air intake filter. Isolate that engine.

### **What would cause continuous Black Smoke?**

Fuel pump coupling bolts broken; or could be unsuitable fuel oil, or engine overloaded. Isolate that engine.

### **What would cause higher reading in Engine Sump?**

Water entering from a cracked liner, or defective gasket.  
Fuel oil entering past defective piston rings, or loose dribble pipe unions on Leyland type engines. Isolate that engine.

### **What could cause a Loud Knock on Engine?**

Worn big end or little end bearings, or main bearings or fused piston head. Isolate that engine.

### **What would you do if you could not stop an Engine from the Cab or Local Stop Button?**

A.E.C. engine, push shut-down solenoid up by hand. Leyland engines, lever shut-down solenoid up (from over top of radiator) by using handle of isolating rod. If this does not do the trick close fuel cock; it will take about ten minutes for engine to stop when idling, three minutes if throttle is open.

### **How do you tell Train Pipe from High Vacuum?**

Train pipe is situated on R.H. side when looking at front of power car.

### **How do you destroy High Vacuum for Uncoupling etc.?**

After train pipe vacuum has been destroyed, release Deadman's and place brake handle in the 'OFF' position.

### **Suppose when starting engines you had only one Bank of lights?**

Go back defective side and examine Jumpers.

### **How many Jumpers can be worked with?**

There must always be two outside jumpers (white), but there need only be one inside (black). Outside jumpers are control, gears, forward or reverse, throttles. Inside jumpers are lights and Deadman's.

### **What is a simple test for seeing if Battery is low?**

Switch on cab lights, then press start button and notice the amount of dimness in the lights.

### **Engine Light goes out whilst running?**

Press starter button to see if it will restart, try 3 times with a 10 second pause between, check bulb. Stop at next convenient place and try to start locally, if unable, isolate that engine. Probable causes as previous question.\*

### **Why 10 seconds pause before pressing Starter Button?**

To allow engine to stop motoring so that starter motor pinion will not damage starter ring.

### **What does Air and Axle Light mean?**

That both final drive dogs are in mesh in the direction of travel selected, and that there is sufficient air 70-75 p.s.i. to keep them there and operate air pressure switch.

### **When engine only has been Isolated, how is Air and Axle Light got in?**

Owing to the fact that engine is isolated, propeller shaft will not turn to put dog in mesh, so therefore light will not illuminate. To get light in, move car about six inches, road wheels will now turn bevel gear and allow dog to go in mesh and make electrical contact to illuminate light.

### **Suppose when changing ends you could not get an Air and Axle Light in?**

Notice if sufficient air, reverse a couple of times, if still no light, proceed to other power car with C.I.S. and reverser, switch in and put reverser in Reverse, light should now illuminate, switch off C.I.S. then remove reverser. Proceed back to leading cab knowing that the Dog's are in Forward gear so alright to proceed. Possible cause defective bulb or loose connections.

### **Suppose Air and Axle Light or Lights go out?**

Reduce speed to 25 m.p.h. (this failure is generally caused by an air leak). proceed watching air pressure gauge to see if it drops (if it drops below 60 p.s.i. gears will not operate). If it holds, clear section, if it drops, stop and close cocks between the coaches. Good car's air pressure will now rise and their axle lights illuminate, defective car's axle light will still be out.

When in protection of signals, apply handbrakes, stop engines, remove reverser, lock doors, proceed back to defective car, start engines locally, test unloader valve, if leaking blank off, if it is all right search for a broken pipe, and if that is the cause isolate that car, i.e., both engines and final drives. If nothing can be found and bulb has been checked, propellor shafts are not rotating, air pressure in cab all right, it is probably bad connections of electrical switches on final drives, so check position of pointers and proceed. Sufficient air should be left in the primary chamber (held there by diverter valve) to isolate final drives, if unable to isolate proceed at 25 m.p.h. and back in the wrong direction at 5 m.p.h.

### **Suppose you had an Air Failure on Leading Car?**

Shut air cocks between coaches and proceed out of the section at 25 m.p.h. Have Guard in next power car to blow horn; drive from leading power car. If unable to remedy leak when in protection of signals, isolate both engines and final drives; get another car as soon as possible.

### **Suppose you had a Complete Air Failure through whole of Train?**

After stopping engines and locking up, etc., get assistance with a W.L.O. When assistance arrives couple up, also vacuum pipes; isolate all Deadman's and A.T.C.s.; if unable to isolate final drives (no air) or if it is more practicable to leave them up for quickly clearing the line, instruct assisting driver not to exceed 25 m.p.h.; back inside at 5 m.p.h. If better for quicker clearing of main line, and it is possible to isolate final drives, isolate them and treat cars a coaches.

### **Running along the road Vacuum suddenly Destroys?**

Immediately close throttle, lap brake, gears in neutral. When at a stand call Guard on buzzer. While he is coming apply hand-brake and stop engines, then ask him if he has applied setter; if not, tell him communication cord has probably been pulled. While he is finding out, go back and examine A.T.C. flags and isolate all Deadman's in the rear. If cord has been pulled, proceed back and protect according to rule, when Guard calls you back on the horn, leave the three detonators down and pick up other two, inform signaller in advance and obtain three more detonators off him to replenish canister. If cord has not been pulled and vacuum could be recreated, it must be a Deadman's

defective, so book all isolated Deadman's to be examined. If vacuum could not be recreated after previous examination, it must be a vacuum leak proper, so each coach must be examined separately till found. When testing, engines must be running.

### **Suppose you had a Vacuum Failure on Leading Car?**

Disconnect vacuum pipes between coaches and replace on stoppers, isolate both engines, pull brake release cords, propel from next power car. Guard in front to transmit signals, etc., speed not to exceed 15 m.p.h. to clear line, and put off at next convenient place. If necessary engines can be left running if a heavy gradient is to be climbed.

### **Suppose you had a complete Vacuum Failure through whole of Train?**

After locking up, get assistance with W.L.O., couple up shackle only, pull at brake cylinder release cords, Driver not to exceed 15 m.p.h. to clear line, you and Guard to stand by handbrakes in case Driver needs assistance in stopping.

### **Running along the road lose an Air and Axle Light, also Brake Application:**

Electrical failure on car indicated. Close throttle, lap brake, remove reverser, apply handbrake. Go back to car indicated and isolate that Deadman's valve, back to leading car, regain controls and proceed at 25 m.p.h. to clear section. In protection of signals, stop both engines with the shut down solenoids, and isolate, isolate both final drives with the forward and reverse E.P.V.s. With an electrical failure it is possible it would not be noticed till speed had slackened to below 17 m.p.h., i.e., when generator stops charging on Swindon C.C.

### **Running along the road lose Power, no controls at front, all Panel Lights out. Deadman's operates?**

Electrical failure in leading car. Brake into lap, remove C.I.S. reverser, apply handbrake, isolate Deadman's. Take C.I.S. to next power car, insert and turn on, back to leading car, insert reverser. All lights would return except leading air and axle light. Proceed at 25 m.p.h. to clear section. When in protection of signals stop engines with shut down solenoid, and isolate. Isolate final drives with forward and reverse E.P.V.s.

### **Suppose you could not Regain Control at Front?**

After inserting C.I.S. in all other cabs I should assume that leading desk had failed, so I should now go back to second cab and insert C.I.S. and reverser and see if I could get control in that cab. If not, try others. When control was regained in one of the cabs, put Guard in front and propel at 15 m.p.h. to clear section. Put car off at next convenient place. It is a remote chance that you would not be able to get control in one of the cabs.

### **Electrical Failure on Leading Car**

With certain electrical failures it is possible, after isolating Deadman's, to still be able to control rear car without taking C.I.S. back. In another case it is possible, after taking C.I.S. back, to regain full control.

### **Suppose you did have Complete Electrical Failure?**

Take out C.I.S. and reverser, apply handbrakes, stop all engines with shut down solenoids. Take W.L.O. and fetch assistance, when it arrives, couple up, also train pipes, isolate all Deadman's and A.T.C. Instruct Driver not to exceed 25 m.p.h. and backing inside at 5 m.p.h. According to circumstances prevailing to clear line quickly no need to isolate, proceed at 25 m.p.h. and back inside at 5 m.p.h. On the other hand if more delay would be incurred by not isolating, all engines and final drives can be isolated and cars treated as coaches.

### **Suppose when fetching assistance for a failure, it was a M.U.D. of the same type?**

If vacuum system is all right both vacuum pipes can be coupled, control jumpers can be attached if defective engines and final drives are isolated.

### **Action when Firebell rings?**

Notice which engine from panel (light goes out). Stop train in a suitable place, stop all engines, apply handbrake. Take reverser and fire extinguisher to affected car, see if firebottle has exploded, if not explode it by operating the flame switch, if necessary use hand extinguisher. When fire is out isolate that engine and final drive, tear tag off fire control panel and reverse 2-pole switch; this breaks engine starter circuit, stops bell ringing, and brings thermostat into circuit over the fluid flywheel, so should

this engine set on fire again fire bell will ring. In the case of a second fire on the same engine, immediately go with hand-extinguisher as there is no automatic extinguisher. Rules according to circumstances, 188.

### **Why always take Reverser when leaving Cab?**

If for any reason an unauthorised person gets into cab in your absence, no controls can be operated because desk is dead.

### **Suppose you have a higher Vacuum in one Power Car than the other?**

On leaving the higher car to drive from lower, I should pull release cords on brake cylinders, proceed to lower car and apply handbrake, then pull release cords on cylinders, recreate vacuum and proceed. The reason being is that the feed valve in the cab driving from, controls the amount of vacuum created in train pipe, so if cords were not pulled when proceeding to drive from lower cab, brakes would drag. Book feed valve to be adjusted.

### **How would you couple up to another M.U.D.?**

Stop 6 feet away, wait till called by Shunter, proceed at idling until buffers touch, apply vacuum brake, release Deadman's, stop engines, remove C.I.S. and reverser, destroy high vacuum, place A.T.C. flag out of use, lock doors, see that shunters have coupled up correctly and inform Driver that everything is all right and all tools are removed.

When coupling up C.I.S. must always be removed.

When picking up vans or coaching stock worked by W.R., instruct shunter to pull brake cylinder release cords, otherwise brakes will drag owing to 25 inches of vacuum having been created.

### **If you noticed Brakes dragging causing Tyres to get hot, what would you do?**

Try pulling cylinder cords, if this does not remedy, wire for nearest carriage and wagon examiner to meet you, and remedy defect.

### **What is procedure when coming to a stand at a Signal with a Telephone, or Fireman's Call Plunger?**

Driver must apply vacuum brake, place handle in lap. Stop all engines, apply handbrake, remove reversing lever, lock all doors, then communicate with Signaller according to rule. If no communication with Signaller go back to cab, call Guard and tell him to go to signal box to carry out Rule 55.



### **Procedure when stopped at an I.B.S. Signal?**

Carry out duties as before and communicate with Signalman. If no communication, inform Guard, wait 3 minutes and proceed cautiously. If a tunnel intervenes, wait 10 minutes.

### **Procedure when changing Tokens or Staffs?**

Cars must be stopped dead when setting down or taking up token or staffs. On R.H. side of cab is a Deadman's button which, when depressed, keeps Deadman's solenoid energised.

### **Procedure if failure occurred in Severn Tunnel**

Guard will cut wire and telephone Signalman. If assistance is required he will fetch it from the rear, protecting at same time. Driver to remain with cars.

## **DIESEL ELECTRIC SHUNTS**

English Electric Diesel Engine, 6-cylinder, 4-stroke cycle. Bore 10". Stroke 12". Idles at 330 r.p.m., full throttle 680 r.p.m. Traction motors are situated on the leading and trailing axles

There are 5 belts for the Fan Drive, 3 belts for the Blower, 7 or 9 belts for the Auxiliary Generator.

There are 4 Oil Filters, 1 R.H. side Fram (lubricating), 3 L.H. side. Auto Klean (fuel), Duplex (lubricating), Zwicky (fuel from main tank to service tank).

Engine is normally in Parallel, but can be used in Series (with special permission), by operating the Series-Parallel switch, when controller is closed. In Parallel, Main Ammeter must not register more than 600 amps with momentary flicks to 800 amps; in Series Main Ammeter must not register more than 400 amps and speed not to exceed 10 m.p.h. When in Parallel half power goes to each motor, in Series full power goes to each motor.

On old type 10-15 p.s.i. lubricating oil pressure is required before Starter contact is made for battery current to turn main Generator to start engine.

Forty p.s.i. air pressure is required to operate air pressures switch to make controller contacts to send current to traction motor to move locomotive.

No 1 must always be engaged first for controller contacts to be made to send currents to traction motors.

Contained in the cubicle are, Air Pressure Switch, Sealed Earth Switch (small with split pin in), Switch for making Propulsion Start, Compressor Fuse, Lighting Fuse, Control Fuse, Cooker Fuse.

### **Starting Drill**

Collect keys off foreman, go to cab, see if handbrake is on, flags and detonators, 4 fire extinguishers, note oil in service tank, go down R.H. side, note oil in main tank, close battery isolation switch, examine water in radiator, close air cylinder drain cock, examine exhausters' sumps, round other side close battery isolating switch, close air cylinder drain cock, open doors of engine room, examine fan belts, turn Auto Klean filter, examine sump, emergency shut down lever, examine blower belts, and auxiliary generator belts. Leave doors open and come back to front, if the priming pump is there prime, then into cab and place starter handle to start (if pump is in the cab, prime there). As soon as engine fires loose starter and leave on 'Engine Only' to warm up diesel engine. If necessary open controller between 2 and 3 to assist the warming, then place to the 'ON' position. Now compressor will build up air pressure, and battery will charge.

It is important to observe radiator as engine can be started with no water in the radiator. Also to see Series—Parallel Switch in Parallel.

### **Engine will not Motor**

Battery switches not in, battery flat, insufficient lubricating oil pressure, faulty contacts on starter, control fuse blown, water in cylinders, engine seized, generator starting contactor faulty.

### **Engine will Motor but not Fire**

No fuel in service tank, emergency shut off lever in closed position, fuel cock shut off, air lock, fuel filter choked, fuel injectors faulty, poor compression. If engine fires with loud blaring noise, compression relief valves open on cylinders.

### **Engine starts, but stops after a short time?**

Fuel cock not open. Auto Klean filter partly blocked. Duplex filter dirty. Air locks in fuel system.

### **What could cause High Water Temperature?**

Radiator water low. Slipping fan drive or driving belts broken. Radiator shutters closed. Cooling elements choked with dirt and dust. Water pump not working or defective. Thermostatic valve defective.

### **What could cause High or Low Air Pressure?**

Compressor defective. Compressor fuse blown. Compressor governor defective. Control circuit volts low. Excessive air leaks

### **What could cause Battery volts to be Low or High. Ammeter showing continual Discharge or High Charge?**

Auxiliary Generator belts slipping or broken. Defective auxiliary generator. Voltage regulator faulty.

### **What could cause Low Lubricating Oil Pressure?**

Low oil in engine sump. Lubricating oil diluted with fuel oil. Duplex filter dirty. Lubricating oil hot.

### **What could cause Main Ammeter to read High?**

Brakes on locomotive not fully released. Excessive trailing load, or brakes down on wagons. Controller opened too rapidly.

### **What could cause Locomotive not to move?**

Control governor faulty. Deadman's device faulty. Overload relay tripped. Earth fault relay tripped. Bad contacts on generator starting contactor interlocks. Insufficient air for air pressure switch to operate controller contacts, or air pressure switch stuck down.

### **Suppose Air Brake stuck on?**

Apply handbrake, place reverser in neutral. This will stop Deadman's operating. Go down and pull release cord. There are two applications of the straight air brake, normal service application, and emergency application.

### **How is Air Pressure created and controlled?**

By an electrically driven compressor which builds up to 85 p.s.i.; then governor cuts out compressor by opening contactor until pressure drops to 65 p.s.i., when contractor closes and brings in compressor to rebuild air pressure.

### **What would you do if Pressure would not build up after working some Time?**

This is generally caused by compressor governor being faulty and not closing compressor contactor. In this case close cock on compressor governor situated near front end of engine room, R.H. side. Compressor will now work continuously, and safety valve will blow at 90 p.s.i. Wire shed and inform them of defect.

### **What would you do if Air Pressure was building up high (100 p.s.i.)**

Reservoir tanks are only tested to a 100 p.s.i., so open one of the drain cocks slightly to keep pressure down, inform shed, but carry on working.

### **Suppose you had a continual High Charge on Battery?**

Inform shed, and at every opportunity shut engine off, as batteries are liable to blow.

### **Suppose you had a continual Discharge?**

See if auxiliary generator belts are defective, inform shed, do not stop engine as you may not start it again.

### **Suppose you had a high Water Temperature?**

Stop locomotive, do not stop engine, otherwise you would not see broken fan drive, broken water pump spindle, or slipping fan belts. Other defects can be seen easily, if not, thermostatic valve faulty, if unable to remedy, wire shed and state failure.

If high temperature due to heavy shunting, stand for ten minutes with engine idling and fan should bring temperature down.

### **Where would you look for Water Leaks?**

At the rubber hose connections. Inform shed and state approximate size.

**What if Cab Radiators are leaking?**

Close valve in cab, and also valve in L.H. front of engine room.

**Suppose Radiators would not Heat?**

Probably caused by an airlock. Release air with key provided.

**What is purpose of Thermostatic Valve?**

Its first purpose is to allow the water to circulate round engine water jackets to warm engine. After a temperature of 140° to 160°F. is reached valve opens and allows water to flow through radiator to be cooled.

**Suppose Lubricating Oil pressure low?**

Examine sump for low oil, diluted oil or hot oil. If sump all right Duplex filter dirty, turn to good filter and book it when going to shed. Loss of oil through leaks is generally caused by pipe cracking near flange joint of sump drain, or by leaking Fram filter. If this is leaking close cock and wire shed.

**How is Vacuum created?**

By closing electric switch on back of cab. This will start motor driven exhauster and create vacuum. To more quickly create vacuum depress the booster on top of the vacuum brake handle when handle is in the 'OFF' position; this will increase exhauster speed. When brake is applied air pressure is applied to brakes of locomotive through a proportional valve situated under floor of cab. When finished working with vacuum brake.—Place air brake on, open electric switch, destroy train pipe, release reservoir vacuum, give an emergency brake application and a release.

**What if Proportional Valve sticks leaving Brake on?**

Recreate vacuum and give several sharp applications. This should move valve.

**Procedure if Overload Trip operated?**

Return controller to 'OFF', select 1 again and open up.

**Procedure if Earth Trip operated?**

If inside yard clear stop engine, open battery switches, wait for electricians. If fouling main line, close controller, open cubicle and pull earth switch down. Get inside clear and shut down, open battery switches and wait for electricians.

### **Procedure if Control Fuse had blown?**

Power will be lost and diesel engine stop. Wire for electricians. If fouling main line open battery switches, change control fuse with cooker fuse, both 20 amps., close battery switches, restart engine and clear main line.

### **Procedure if Compressor Fuse Blown?**

Change defective fuse with one of the exhaustor fuses.

### **Suppose all Blower Belts had broken?**

Locomotive is a failure. Stop engine and wire shed.

### **Why must 20 m.p.h. not be exceeded?**

Because traction motors are liable at a higher speed to break apart; also blower would not be sending sufficient cooling air to cool them.

### **Suppose Deadman's operated?**

Engine would go back to idling and brake applied. Also controls would be locked. Depress Deadman's treadle, this frees controls. Make an emergency brake application and a release, proceed as normal.

### **Emergency Propulsion start**

If battery is low and no means to charge it, the following method may be adopted, by turning a traction motor into a generator. Maintenance men must be present. Sand the rails for about thirty yards. Obtain another loco to pull you. Place switch in cubicle to emergency starting, place master key in 'ON' position, controller in 'OFF' position, reverser in the opposite direction to which being pulled. Close motor contactor with stick provided, signal for engine to proceed, as soon as diesel engine fires lower motor contactor, stop assisting engine, place reverser to neutral, switch back to normal position.

Speed when being pulled during this operation not to exceed 4 m.p.h.

### **Daily Duties to be performed by Drivers?**

Check oil level in sump, check radiator water level, check fuel oil in main and service tank, leave 70 gallons in service tank for relief, drain moisture from compressed air reservoirs every 8 hrs., inspect water, lubricating oil and fuel oil systems for leaks,

examine brakes and brake gear and springs on Weslak adjuster, check fire extinguishers and detonators. Every 24 hours check sanders to see if they operate, lubricate all axle box guides, side rods, buffer rams, handbrake column.

If sander is not working remove plug or open shutter and free sand trap with a piece of wire.

### **Suppose Diesel Engine would not stop running?**

Close fuel rack lever (emergency shut down valve). This will cut off fuel and stop engine.

### **Suppose Locomotive would not move nor Diesel Engine stop with Master Switch, or Emergency Shut Down Valve?**

Possible cause, starting contactors welded in. Place Master Switch to engine only and smartly pull out Battery Isolation Switches. If this is not done battery will go flat.

### **Stabling Locomotive?**

Apply handbrake, release air brake, remove master key, lock doors, make examination of loco, open both battery isolation switches, open both air reservoir drain cocks, return keys to Foreman and book any known defects.

## **204 h.p. DIESEL MECHANICAL**

### **Reading R.H. side of Engine Room**

Radiator, compressor 3 belts, compressor air intake, sump dipstick, starter motor, exhaustor 3 belts, fuel shut off cock, gear box, final drive.

### **Reading L.H. side of Engine Room**

Compressor governor and isolating cock, generator 1 belt, lubricating oil pressure clocks, tachometer drive and chain, lubricating oil pressure electrical warning, air safety valve, fuel pump primers, water temp. thermometer, lub. oil thermometer, oil hole for throttle damper, starter motor, fluid flywheel, cab radiator water heater cock, fuel drain cock.

### **Valves on the Footplate**

Large valve L.H. side for Deadman's operation, when horizontal AIR BRAKE, when in line VACUUM BRAKE.

Small 3 way cock to the right, to isolate final drive from air system when air failure, so that auxiliary air pump can build up pressure to isolate final drive.

Cock R.H. side of cab, to isolate final drive from air system while air pressure is being built up.

### **Preparing Engine**

See that handbrake is on, four fire extinguishers, flags and detonators, hand lamp etc., final drive isolating cock is closed, examine fuel gauge, final drive dipstick, gear box dipstick, exhaustor sump, engine sump, compressor sump, all belts, radiator, turn water pump grease cap, oil throttle damper, check fuel cock is open and fuel drain cock is closed, close all air cocks.

In cab, see all controls in neutral, shut engine stop valve, switch on main battery switch, press starter button and as soon as engine fires release, see lubricating oil pressure is 20-35 p.s.i. (red light goes out).

If starter button is released before engine fires, sufficient time must be allowed for engine to stop motoring before pressing button again.

While air pressure is being built up examine for leaks, oil rods, axle boxes and jack shaft bearings.

When air pressure reaches 80 p.s.i. STOP engine, open final drive isolating cock, select direction, restart engine, see lub. oil pressure is 20-35 p.s.i. and gear box pressure 60-65 p.s.i., test sanders, test Deadman's, apply air brake, take off handbrake, select Gear 1, release air brake, open throttle and proceed.

### **Changing Gear Up**

Maximum engine revs. 1,200 r.p.m.

When engine reaches maximum for that gear, close throttle, select next gear, pause to allow gear band to operate, then open throttle.

### **Changing Down**

Ease throttle and select gear.

### **Gear Speeds**

1—3.66 m.p.h.    2—6.35.    3—9.6.    4—14.9.    5—27.9.

When coasting gear must be left in the last one selected, the reason being that there is no free wheel, this will cause a braking effect on the engine as the road wheels are driving the engine.



If owing to the load and gradient the speed increases and the engine revs. reach maximum, the next higher gear must be selected, if in gear 5 the brake must be applied to keep speed down. Coasting must never be done in Neutral, Neutral must only be selected just before coming to a stand.

The locomotive must not stand in gear with the brake on and the Diesel engine running, because maximum slip will occur in the fluid flywheel causing it to get hot.

When working if revs. will not increase out of the Yellow a lower gear must be selected, otherwise fluid flywheel will heat.

Locomotive must not be reversed whilst moving but must come to a stand with engine idling.

Air pressure is built up to a 100 p.s.i. then governor allows Unloader to open till air pressure reduces to 85 p.s.i., Unloader now closes and pressure is built back up to a 100 p.s.i. If Unloader unloads all the time through faulty governor, the isolating cock can be closed and Safety valve will blow at 105 p.s.i.

### **High Water Temperature**

Check radiator water level, check fan to see if it is running, belts are not broken or slipping, gills are not stopped up.

### **Low Lubricating Oil Pressure. Max. Temp. 190°F.**

Check radiator level, Check fan and belts, Stop engine and examine sump, if everything appears alright and pressure still drops when engine is restarted, Stop engine and wire shed.

### **Daily Duties**

Engine and belts to be examined, compressed air cocks to be blown every 8 hours. Gear Bands to be toggled every day, procedure, STOP engine, have about 90 p.s.i. air pressure, engage Deadman's, select gears 1. 2. 3. 5. six times pausing 3-4 secs. in each gear, 4 gear not to be operated.

### **Operation of Deadman's.**

If Deadman's operates gear box goes to neutral and brake applied, to reset engage Deadman's and give emergency brake application and release.

### **To Isolate Final Drive if a Failure**

Stop engine, turn final drive isolating pin to isolate position, slowly move reverser to opposite direction, pin will now drop and hold dog in central position, check by manually turning propeller shaft.

### **To Isolate if No Air Available**

Stop engine, turn 3 way cock horizontal, and pump up air pressure to about 75 p.s.i. with auxiliary pump, reverse direction with reverser, pin will now drop and hold dog central.

### **If Air Pump of No Avail**

Dog can be isolated manually by operating handle provided at back of final drive.

## ABBREVIATIONS

- M.U.D. — Multiple Unit Diesel.  
C.I.S. — Control Isolating Switch.  
Subs. — Suburban M.U.D.S.  
C.C. — Cross-Country M.U.D.s.  
E.P.V. — Electro-Pneumatic Valve.  
P.S.I. — Per Square Inch.  
I.R. Gland — India Rubber Gland.

## BUZZER CODES FOR M.U.D.s.

- |  |                                    |
|--|------------------------------------|
| 1 — STOP.                                      | 6 — DRAW FORWARD.                  |
| 2 — START.                                     | 7 — VACUUM CORRECT IN<br>REAR VAN. |
| 3 — SETBACK.                                   | 3-3 — DRIVER REQUIRES<br>GUARD.    |
| 4 — SET BACK STEADY.                           |                                    |
| 5 — GUARD OR DRIVER GONE<br>TO CARRY OUT RULE. |                                    |

## PIPE COLOURS

- RED — Fire.  
BROWN — Fuel Oil.  
WHITE — Compressed Air and Vacuum.  
SALMON PINK — Lubricating Oil.  
BLACK — Drains.  
LIGHT ORANGE — Electrical.  
FRENCH BLUE — Cooling Water.

