



Rail Operating Code

Code Supplement CS 4.6

Operating Instructions for DH Class Locomotives

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Table of Contents

1.0	TRAINING AND CERTIFICATION	6
2.0	COMMONLY USED ABBREVIATIONS	7
3.0	GENERAL.....	8
4.0	GENERAL DIAGRAMS	9
4.1	Arrangement of DH Locomotive	9
4.2	Traction Motor Arrangement.....	11
5.0	CAB CONTROLS / LAYOUT	12
5.1	Master Controller.....	12
5.2	Gauges - Engine, Compressor, Fuel, and Cooling System.....	13
5.3	Control Stand Gauges.....	18
5.4	Brake Valve Handles.....	19
5.5	Auxiliary Air Equipment	20
6.0	PRE START PROCEDURES	22
6.1	Locomotive Checks.....	22
6.1.1	Outside	22
6.1.2	Running Board	23
7.0	START UP PROCEDURES	25
7.1	Starting the Engine.....	25
7.1.1	Cold Weather Starting	28
7.2	Changing to Remote	29
8.0	OPERATING.....	31
8.1	Moving the Locomotive	31
8.2	Stopping the Locomotive.....	31
8.3	Reversing the Locomotive	31

8.4	Passing over Road Crossings	31
8.5	Emergency Brake Application	32
8.6	Circuit Breakers.....	32
8.7	Engine Lubricating Oils	32
8.8	Engine Water Temperature	33
8.9	Low Water Level	33
8.10	Ground Relays	33
8.11	Wheel-Slip.....	34
8.12	Engine Over-Speed Shutdown	34
8.13	Releasing Brake after Vigilance Device Penalty	35
8.14	Nullifying Vigilance Device Operation	35
8.15	Locomotive Over-Speed Control	35
9.0	SHUT DOWN PROCEDURE.....	36
9.1	Stopping the Locomotive and Shutting Down – Manual.....	36
9.1.1	Emergency Engine Shutdown Switch	37
9.2	Changing from Remote to Manual and Shutting Down	38
10.0	DIESEL ENGINE.....	39
11.0	AIR INTAKE SYSTEMS.....	40
12.0	ELECTRICAL	41
12.1	Forward and Backward Transition	41
13.0	BRAKES.....	42
13.1	Handbrake	42
13.2	Brake System Pressures.....	42
13.3	Brake System Pressures.....	43

13.4	Independent Valve (SA-9)	44
13.5	Automatic Brake Valve (26-C)	45
13.5.1	Cut-Out Portion	46
13.6	MU2A Valve	47
14.0	CUT OUT COCKS	48
14.1	Air Compressor Cut-Out Cock	48
14.2	Brake Valve Cut Off Valve	49
14.3	Main Reservoir Cut-Out Cock	49
14.4	Shutter Control Cut-Out Cock	50
14.5	Control Air Cut-Out Cock	50
14.6	Sander Cut-Out Cock	50
14.7	Horn and Window Wiper Cut-Out Cock	50
14.8	Dead Engine Device Cut-Out Cock	51
14.9	Brake Cylinder Cut-Out Cocks	51
14.10	Vigilance Device Cut-Out Cocks	52
15.0	EMERGENCY EQUIPMENT	53
16.0	EVENT RECORDER / VIGILANCE SYSTEM	54
16.1	Tranzlog	54
17.0	PROTECTIVE DEVICES	56
18.0	SAFETY INSTRUCTIONS	57
19.0	MISCELLANEOUS	58
20.0	DOOR OPERATION	59
21.0	RADIO / PUBLIC ADDRESS SYSTEM	60
21.1	TAIT 8260 Radio	60

22.0 TRAIN ATTENDANTS 61

23.0 TOWING 62

23.1 Dead Single Pipe 62

23.2 Dead 3 Piped 63

24.0 FAULTS..... 64

24.1 Controls..... 64

24.2 Engine..... 67

24.3 Compressor, Air Brakes & Sanders..... 69

24.4 Auxiliary Equipment 71

1.0 TRAINING AND CERTIFICATION

The training for existing Shunt Class Operators shall consist of a two hour conversion course.

If not already done so, the operator must also meet the other certification criteria as detailed in the Rail Operating Code Section 4.0 – Locomotive Engineers Training / Certification



Figure 1: DH Locomotive

2.0 COMMONLY USED ABBREVIATIONS

Abbreviation:	Description:
B Pos	Battery Positive Circuit Breaker
BKS	Battery Knife Switch
CB	Circuit Breaker
CCB	Control Circuit Breaker
ECCB	Engine Control Circuit Breaker
ESS	Emergency Stop Switch
GR	Ground Relay
kPa	Kilopascals
MR	Main Reservoir
RDS	Remote Disconnect Switch
RMS	Remote Manual Switch
SEP	Speed Event Panel
FSCR	Field Shunt Control Relay
TR	Transition Relay

3.0 GENERAL

Category:	Value:
Road Numbers	2816, 2822, 2839, 2845, 2851, 2868
Weight in Service	54,000 kg
Length over Couplers	11.2 m
Fuel Tank Capacity	1514 L
Diesel Engine	Caterpillar D398
Cylinders	V12
Gross Output	672 kW
Continuous Traction Rating	615 kW
Number of Traction Motors	4
Wheel Arrangement	Bo – Bo
Continuous Tractive Effort	146 kN

4.0 GENERAL DIAGRAMS

4.1 Arrangement of DH Locomotive

Figure 2 and Figure 3 show the general arrangement of the major components in a DH diesel electric locomotive.

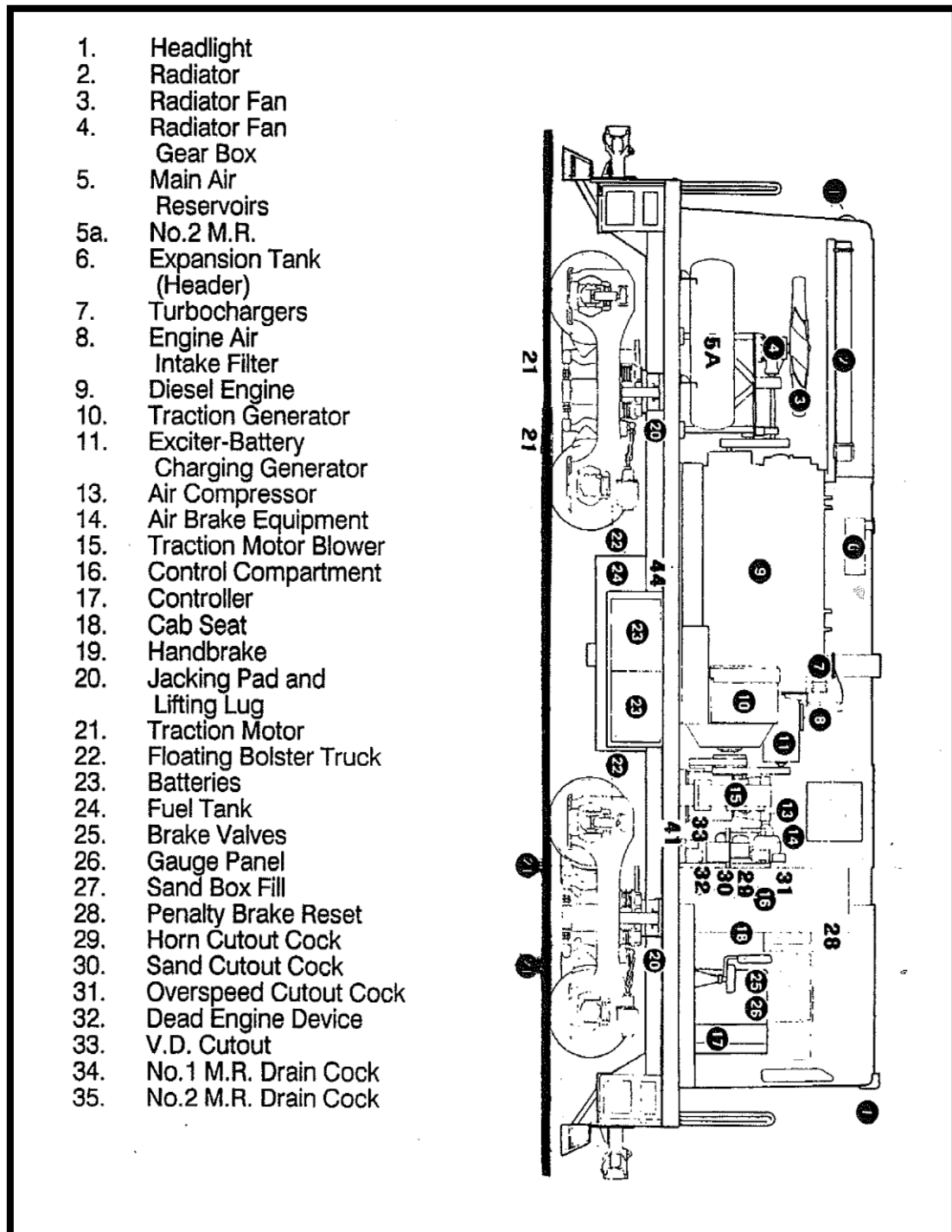


Figure 2: DH Component Identification – Part A

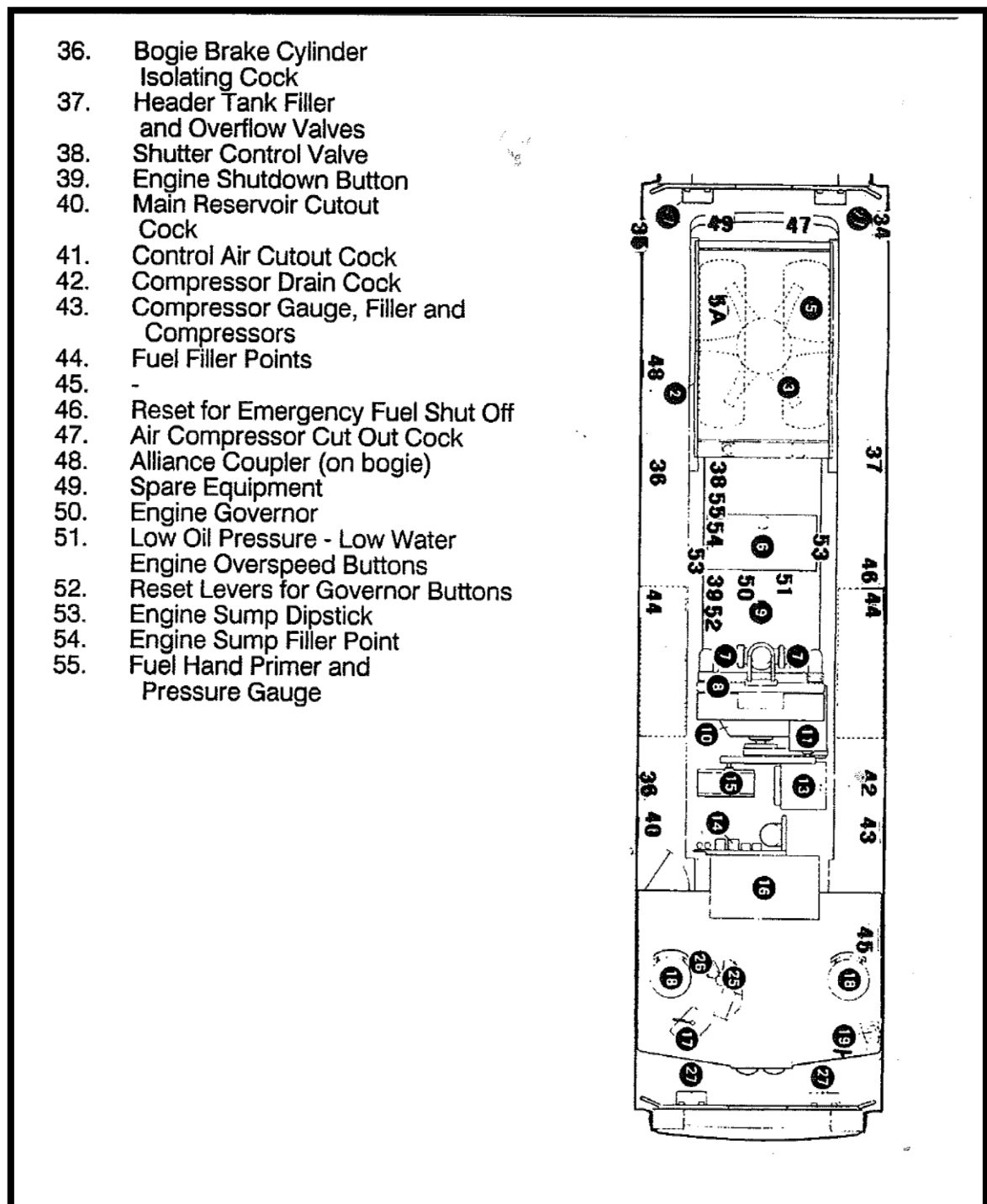


Figure 3: DH Component Identification – Part B

4.2 Traction Motor Arrangement

Figure 4 shows the general arrangement for the four traction motors of the DH diesel electric locomotive.

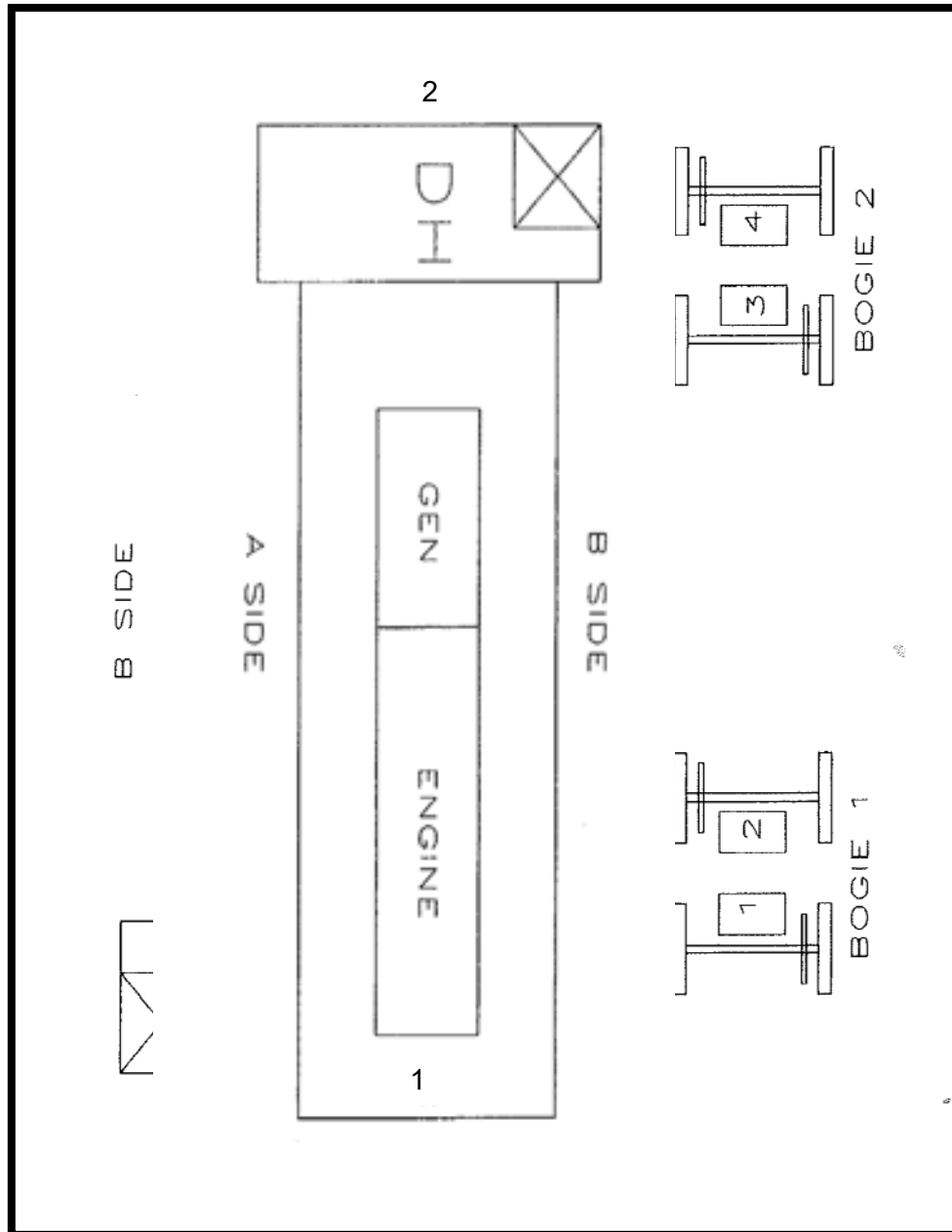


Figure 4: Traction Motor General Arrangement

5.0 CAB CONTROLS / LAYOUT

The locomotive cab is equipped with the necessary operating and braking handles, circuit breakers, switches, indicating lights, alarms and gauges for starting, operating and stopping the engine and locomotive. The equipment located in the cab is as follows:

- Master Controller
- Gauges - Engine, Compressor, Fuel, and Cooling System
- Control Stand Gauges
- Brakes Valve Handles
- Auxiliary Air Equipment
- Operator's Gauge Panel, Engine Gauge Panel

5.1 Master Controller

The Master Controller (*Figure 5*) is equipped with a throttle handle and a reverser handle. The throttle handle has a “neutral” and “eight” different running positions. The reverser handle has positions “forward”, “centred” and “reverse” and is used to control the direction of locomotive travel.

The throttle handle moved towards the operator to increase speed. The locomotive pushes in the direction of the reverser handle movement. Push the handle forward for “forward” locomotive movement, and pull the handle back for “reverse” locomotive movement.

Each handle opens and closes cam-operated contacts. Mechanical interlocking between the handles prevents the improper operation of any handle. Interlocking of the handle is as follows:

- The reverser handle position can be changed only when the throttle handle is in “neutral”.
- The reverser handle can be removed only if it's in the “centred” position, and the throttle handle is in “neutral”.
- The throttle cannot be removed from “neutral” with the reverser handle removed, but may be advanced when the reverser handle is inserted in “centred” position.



Figure 5: Master Controller Unit

5.2 Gauges - Engine, Compressor, Fuel, and Cooling System

The engine lube oil pressure gauge and the cooling water temperature gauge are located in the cab on the top of the electrical panel (*Figure 6*).

- The normal indication for the engine lube oil pressure at top engine speed (notch eight) is 200 kPa.
- The normal indication for the cooling water temperature at top engine speed (notch eight) is between 70 to 90°C.

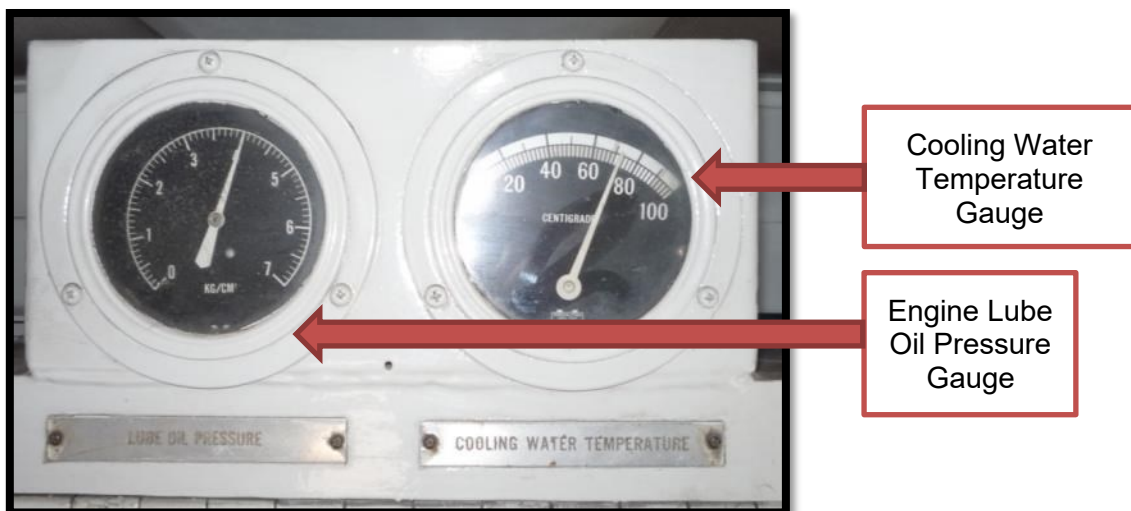


Figure 6: Engine Lube Oil Pressure and Cooling Water Temperature Gauges

The control air pressure gauge is located on the air brake rack within the engine bay (*Figure 7*). The normal indication for the control air pressure at top engine speed (notch eight) is 500 kPa.

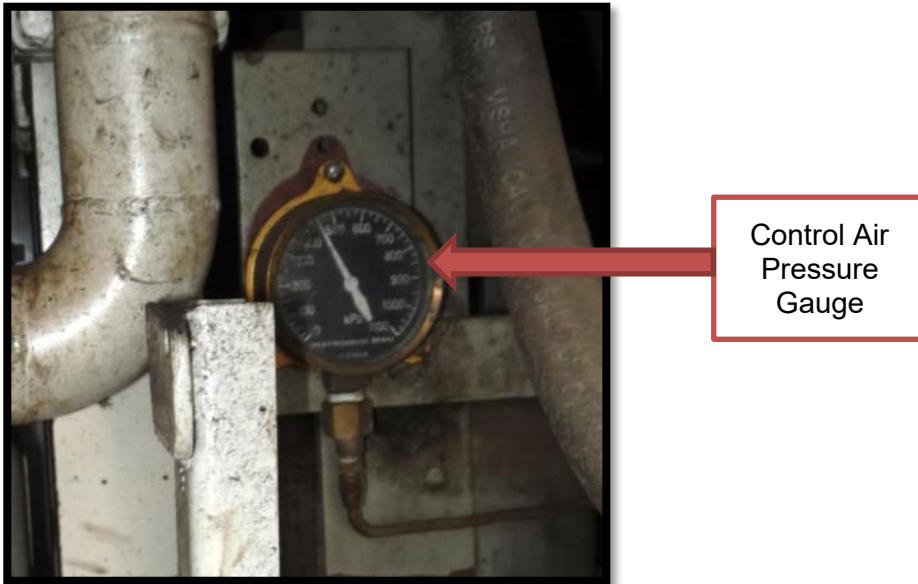


Figure 7: Control Air Pressure Gauge

The engine lube oil dipstick is located on the side of the engine. The lube oil level should be near the “full” mark as shown on the dipstick. Be careful not to overfull the engine with excess oil.

The fuel indication gauge (*Figure 8*) is located on the side of the fuel tank. Fill the tank until auto shut off valve operates.

NOTE: Keep an eye on fuel oil sight glass while filling, if the sight glass show full and auto shut off valve did not operate, it means shut off valve is faulty which requires fixing.

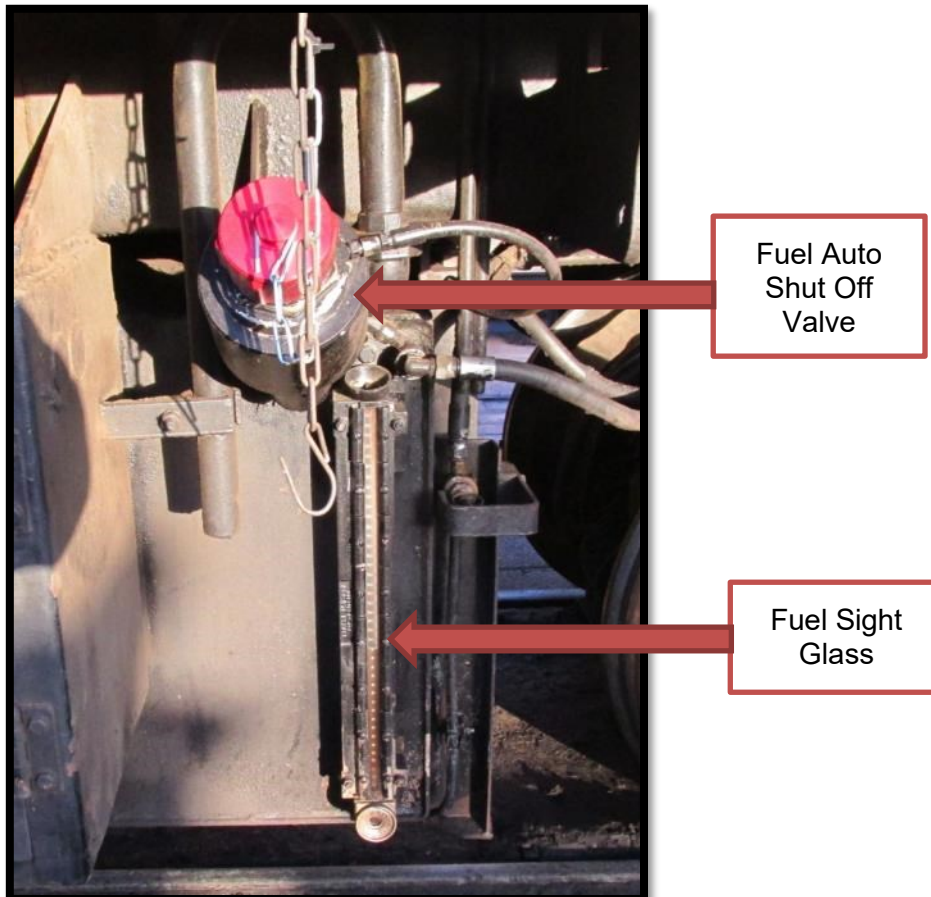


Figure 8: Fuel Indicator Gauge

The compressor lube oil level gauge is located in the engine bay on the side of the compressor (*Figure 9*). The lube oil level should be maintained to indicate in the “full” portion of the gauge.

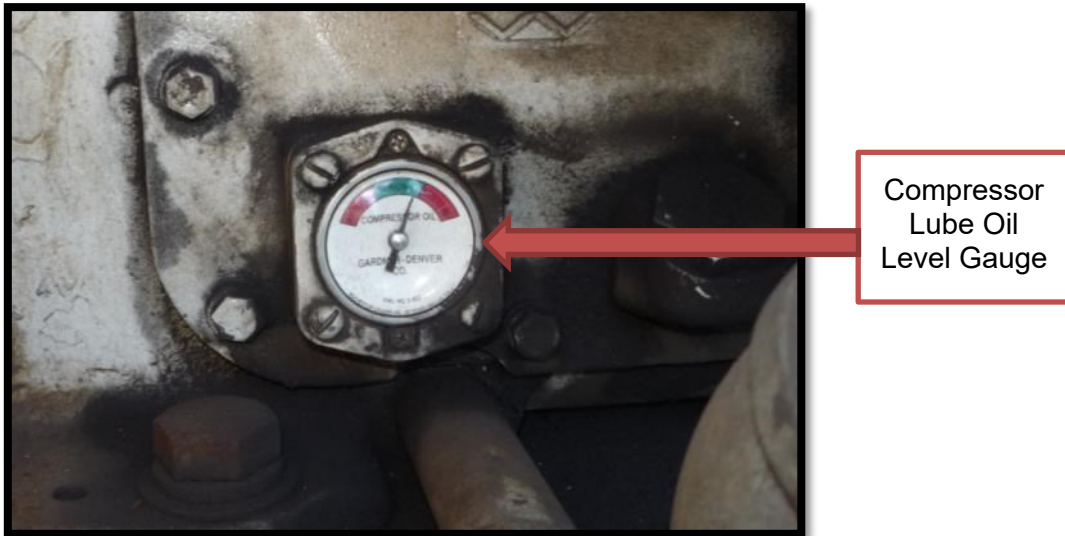


Figure 9: Compressor Lube Oil Level Gauge

The cooling water sight glass is located on the side of the header tank above the front of the engine (*Figure 10*). The cooling water level must maintain at least $\frac{3}{4}$ of the way up the length of the sight glass when the engine is at idle.



Figure 10: Header Tank and Water Sight Glass

The air filter service indicator is located on the wall of the generator compartment (*Figure 11*). If the red band is visible in the sight portion of the indicator it is indicative that the air filters need to be cleaned.

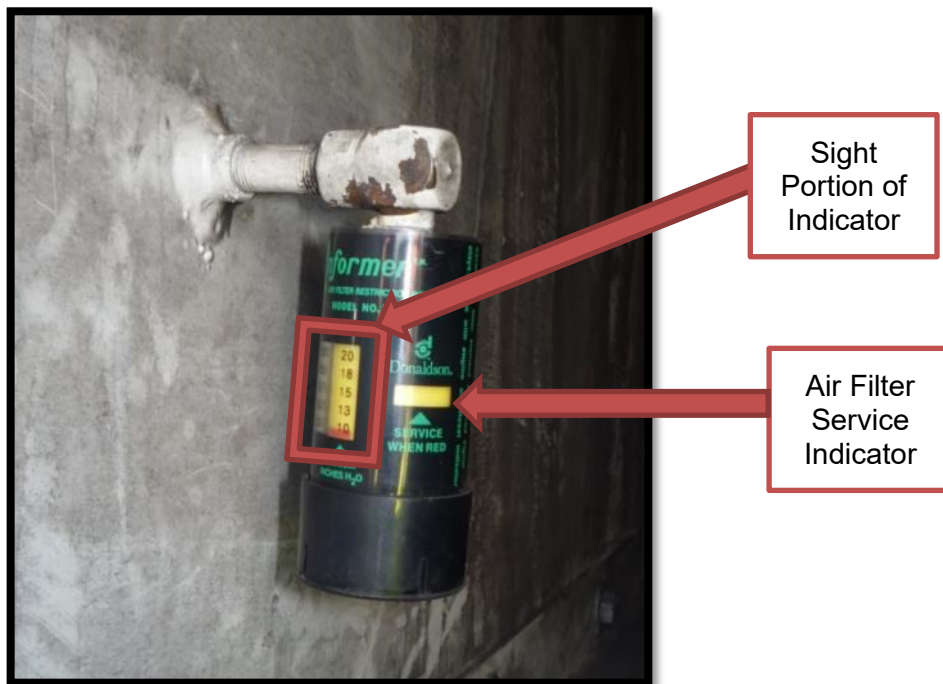


Figure 11: Air Filter Service Indicator

The engine cooling water temperature gauge shows the operator the temperature of the engine cooling water located on the control compartment panel (*Figure 6*).

5.3 Control Stand Gauges

The control stand (*Figure 12*) contains four gauges. The top ones are both duplex gauges. The first has a red pointer which is main reservoir pressure and white pointer which is equalising reservoir. The second duplex gauge reads red pointer for brake cylinder pressure and white pointer for brake pipe pressure.

A further gauge is for brake flow indicator, indicating air flow into brake pipe and a traction motor ammeter divided into 200-amp sections by marks. The colour coded bands are time marks with units displayed in minutes.



Figure 12: Control Stand Gauges

5.4 Brake Valve Handles

Automatic Brake Valve and Independent Brake Valve (*Figure 13*) discussed in Section 13.4 and 13.5 of this document.

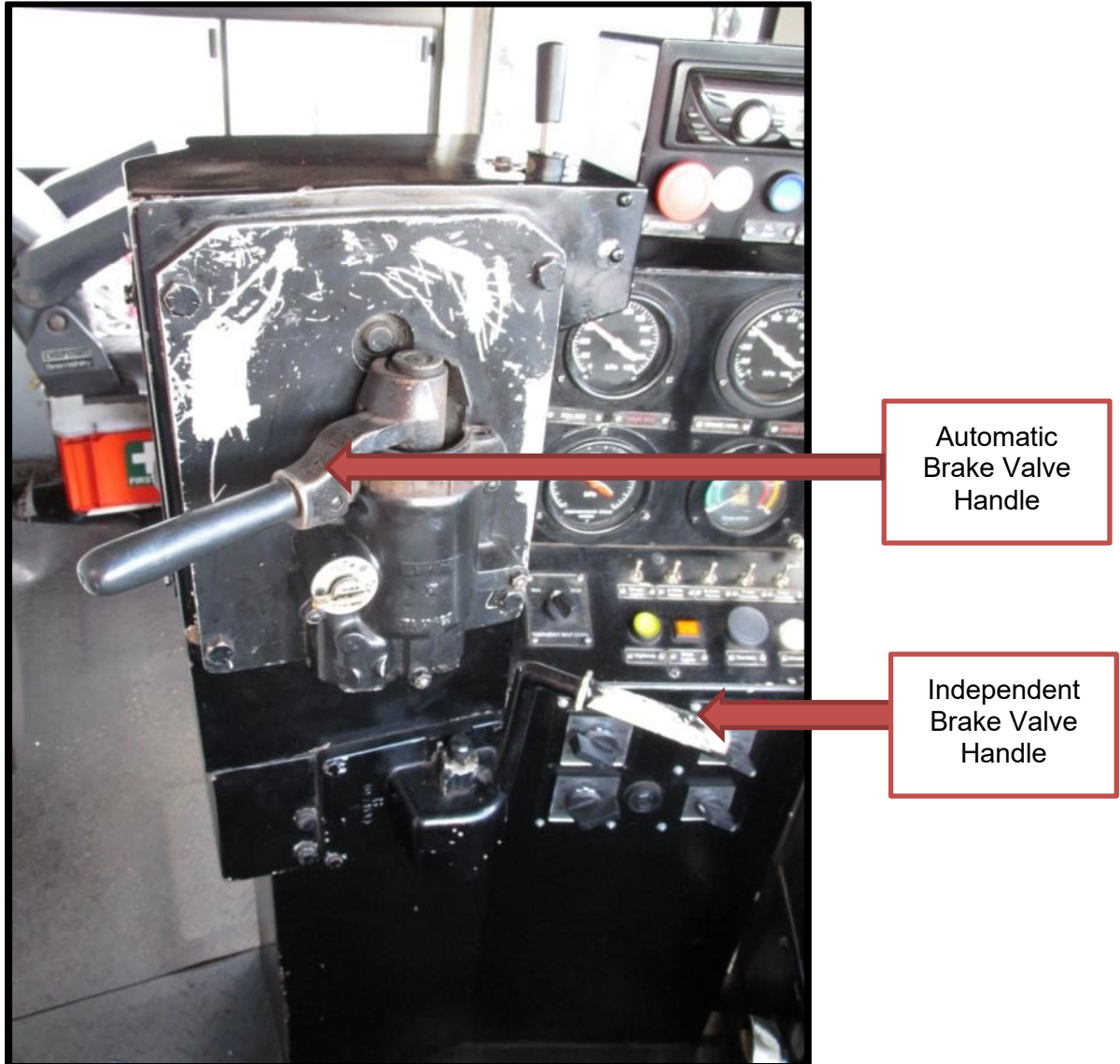


Figure 13: Brake Valve Handles

5.5 Auxiliary Air Equipment

The following auxiliary air equipment is located in the operator's cab as shown in *Figure 14* and *Figure 15*:

- Sander Switch: - Located near the operator's position
- Horn Valve: - Located above the control stand
- Window Wiper Switch – Front: - Located near the operator's position
- Window Wiper Valve – Rear: - Located on the cab wall

Shutter Control Cut-out cock (*Figure 19*)

- Located on the side wall of the radiator compartment

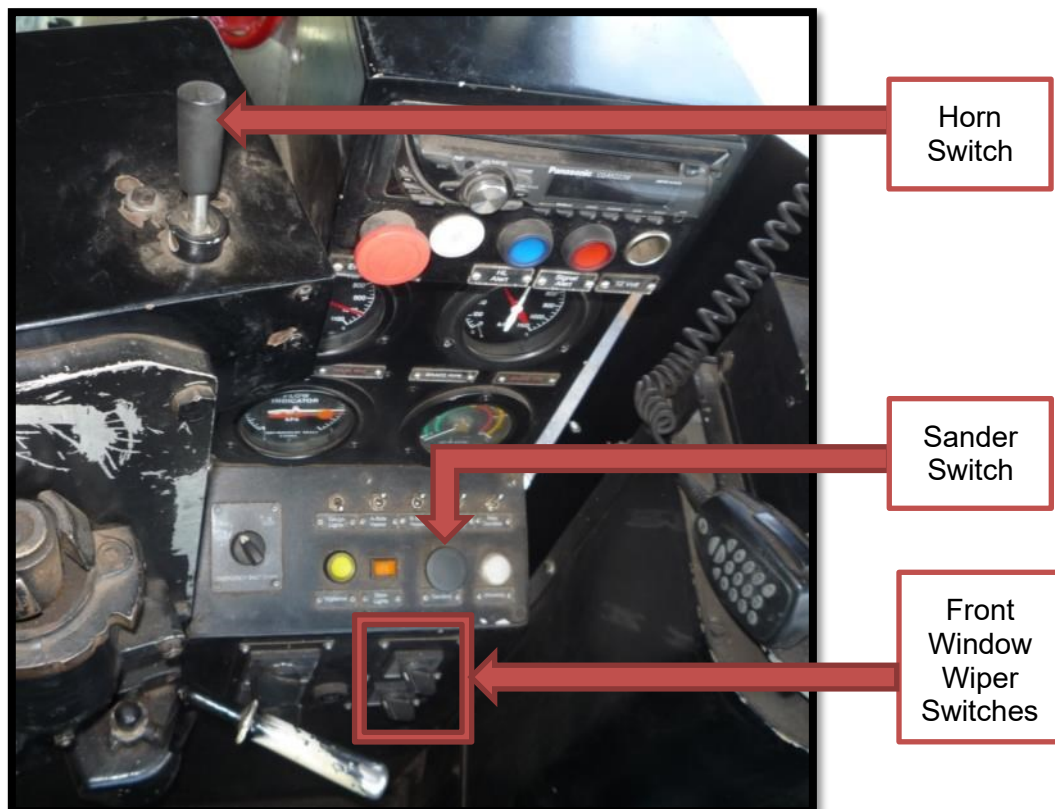


Figure 14: Sander, Horn, and Front Window Wiper Switches



Figure 15: Window Wiper Valve – Rear

6.0 PRE START PROCEDURES

6.1 Locomotive Checks

6.1.1 Outside

- Check sandboxes are full with sand.
- Ensure that the fuel level is correct.
- Open air system drain cocks (*Figure 16*) and close when no more moisture is present.
- Check the brake cylinder cut-out cocks (*Figure 16*) under the running board are “open”. Main reservoir cut-out cock must also be “open”.
- Ensure that the control valve cut-off cock (*Figure 16*) is lock-wired in place.



Figure 16: Air System Cut-out and Drain Cocks

- Check brake block thickness is sufficient for the shift.
- Check for loose, missing, broken or dragging parts.
- Check water levels. Ensure water filler release handle is in the “closed” (upright) position. To take water, place hose on to the rattlesnake filler pipe and pull the release handle forward. Shut off the handle when water flows from the overflow pipe.

6.1.2 Running Board

- Check engine and contactor compartments to ensure there is no flammable material present. As well as being a fire hazard, the lighter material may be drawn into cooling ducts reducing air circulation and causing overheating in generators and traction motors, with consequent risk of breakdown.
- Check all engine room belts.
- Check compressor and lubricating oil levels.
- Check diesel engine priming pump. If the engine has been stopped for a considerable time or if required, prime the fuel system:
 - Turn pump handle knob counter-clockwise and release the lock plate from the retainer (*Figure 17*).



Figure 17: Diesel Engine Priming Pump

- Operate the pump until pressure builds up as shown on the fuel pressure gauge (*Figure 18*).

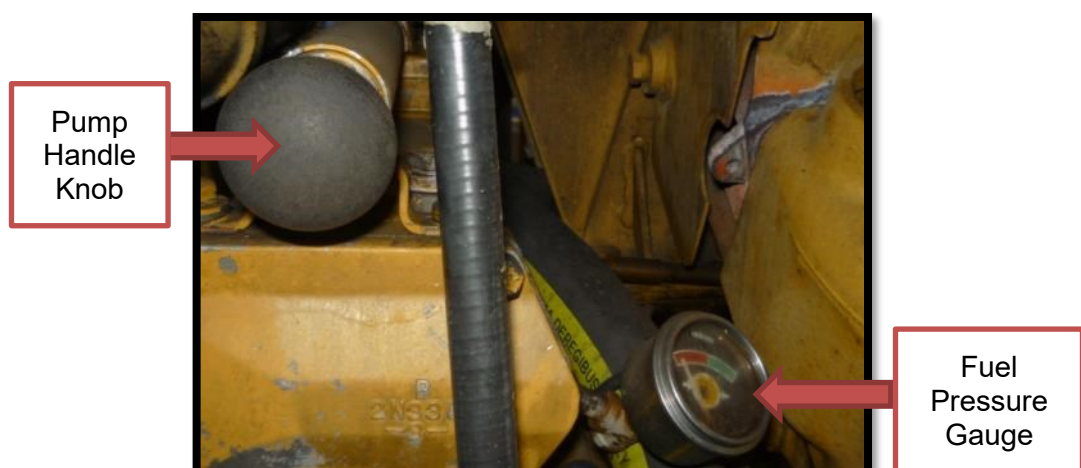


Figure 18: Fuel Pressure Gauge

- Secure the pump handle. Turn the lock plate vertically and turn the pump handle clockwise until the back plate contacts the plate retainer (*Figure 17*).

- Check the shutter contact cut-out cock (*Figure 19*) is in the automatic position.

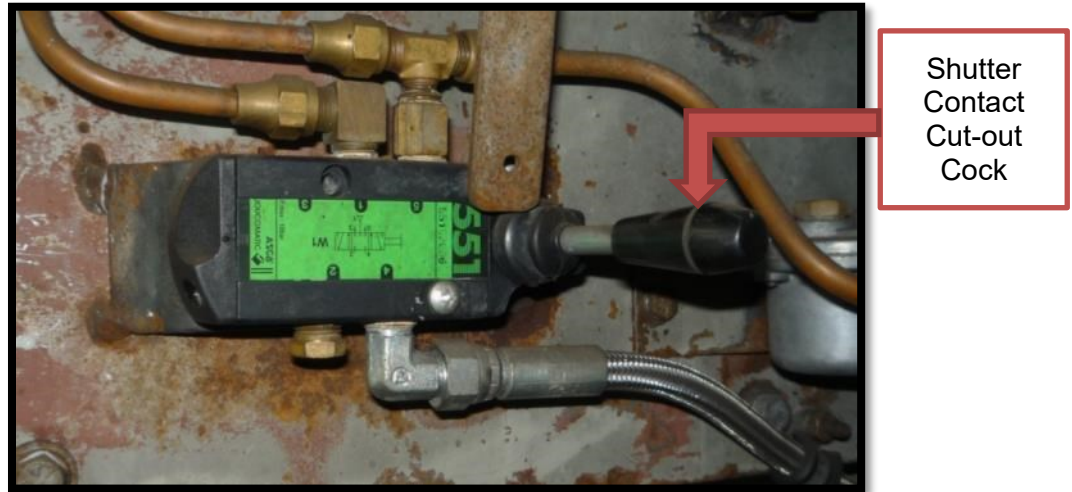


Figure 19: Shutter Contact Cut-out Cock

- Check the “low oil” button on the oil pressure control indication box
- Ensure the engine over-speed handle is in the reset position.
- Check the dead engine device is closed (in line with pipe)
- Ensure the following cut-out cocks are open:
 - Air Compressor Governor.
 - Control Air.
 - Sander.
 - Horn and Windscreen Wipers.
- Check the main reservoir and remote transfer cock is in.
- Check that the remote control brake pipe isolation cocks (*Figure 20*) in manual position (closed across the piping).

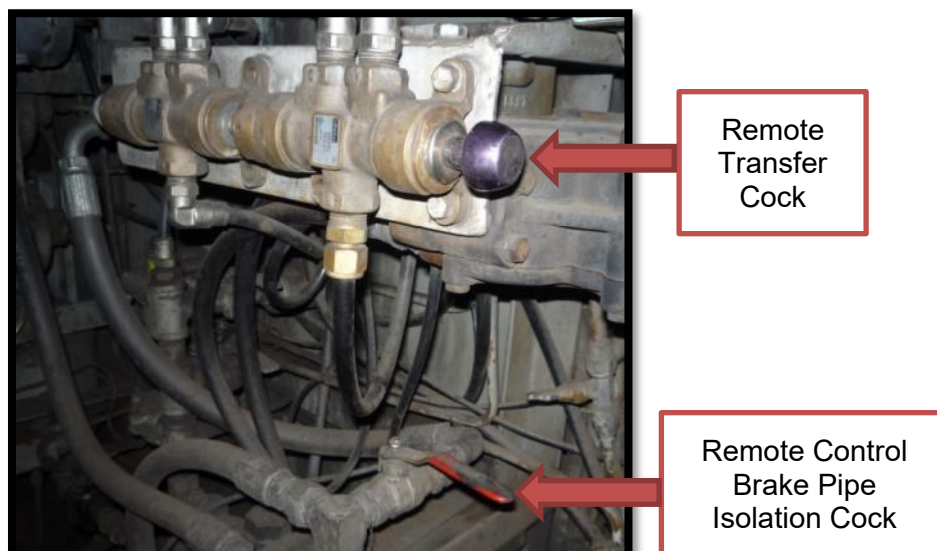


Figure 20: Remote Control Brake Isolation Cock and Remote Transfer Cock

7.0 START UP PROCEDURES

7.1 Starting the Engine

1. Check the Loco 54D book for any open bookings.
2. Check locomotive for “Not to be moved” or “do not start engine” boards.
3. Ensure the handbrake is “on”
4. Change the knife switch position from open (*Figure 21*) to closed (*Figure 22*).

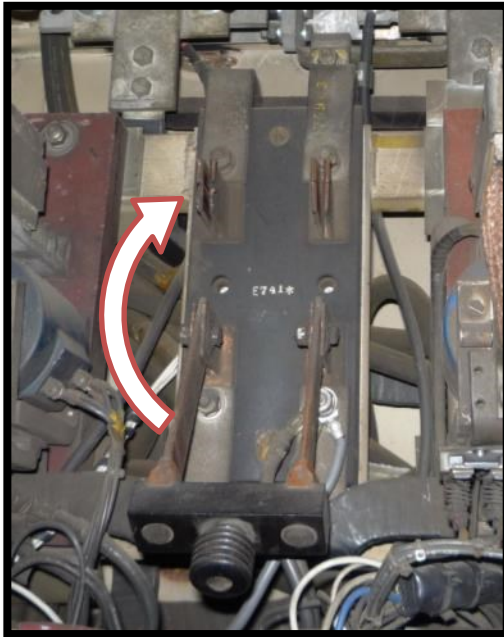


Figure 21: Knife Switch – Open



Figure 22: Knife Switch – Closed

5. Check that the Ground Relay circuit breaker (*Figure 23*) is “closed”. This is a single blade knife switch on the right in the electrical cabinet.

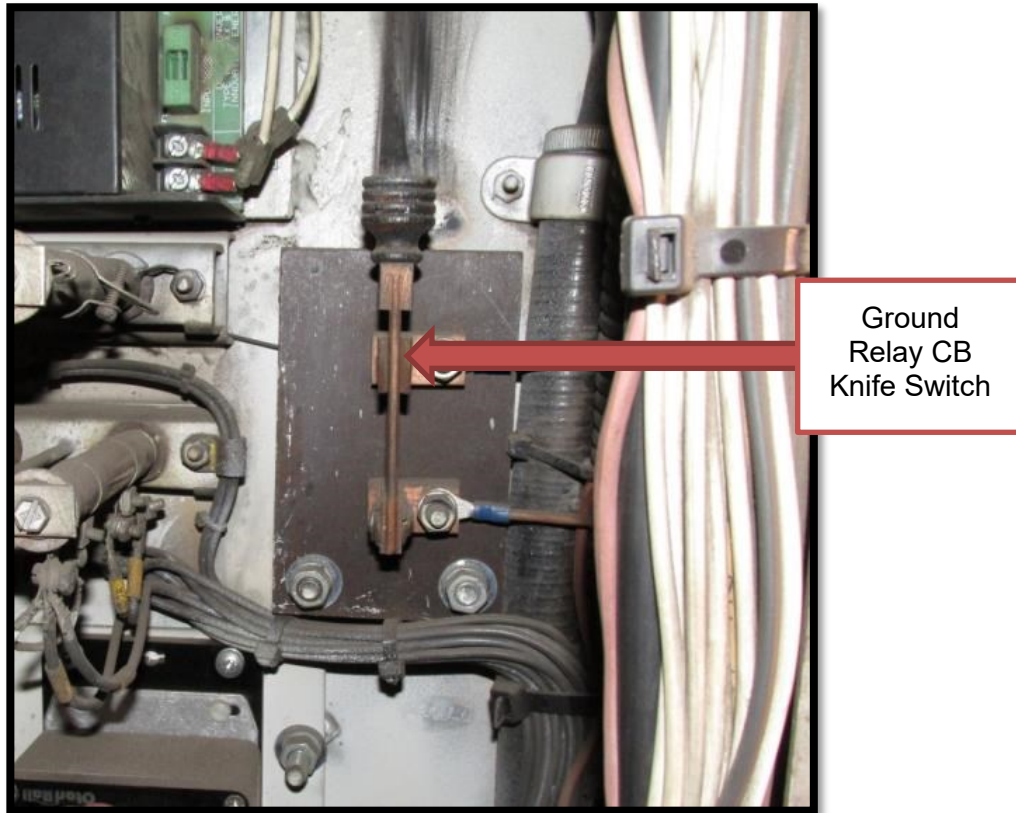


Figure 23: Ground Relay Circuit Breaker Knife Switch

6. On the gauge panel, check that the Emergency Shut-Down switch is in “run”.
7. Check the throttle is closed and the reverser is “centred”.

8. Close the following circuit breakers (*Figure 24*):
- A. Auxiliary Generator
 - B. Control
 - C. Battery Charging
 - D. Auxiliary
 - E. Engine Control

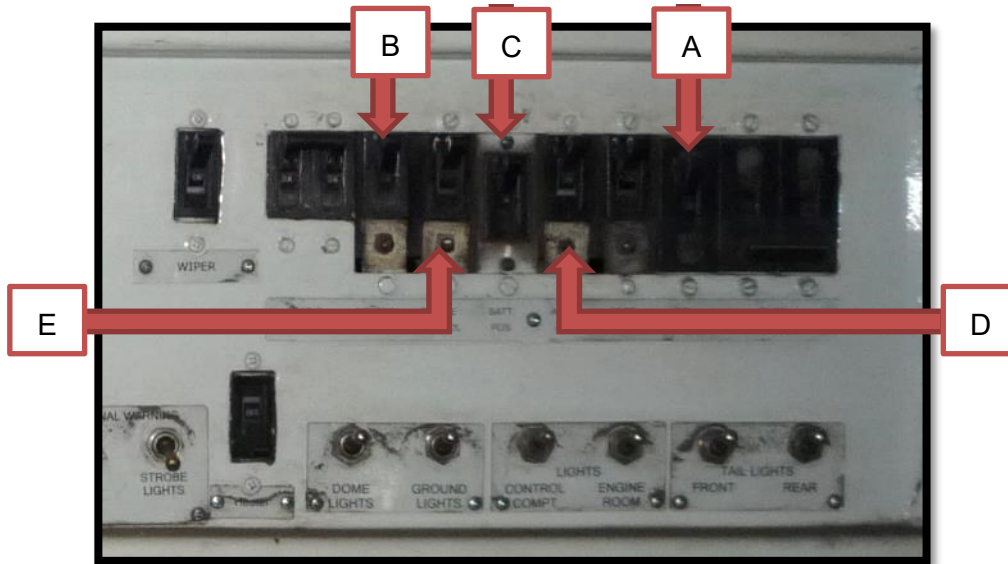


Figure 24: Circuit Breakers to be closed

9. Check that the RMS is in the “MAN” position.
10. Check that the RDS is “off”.
11. Check that the Remote Circuit Breaker is “off” (*Figure 25*).

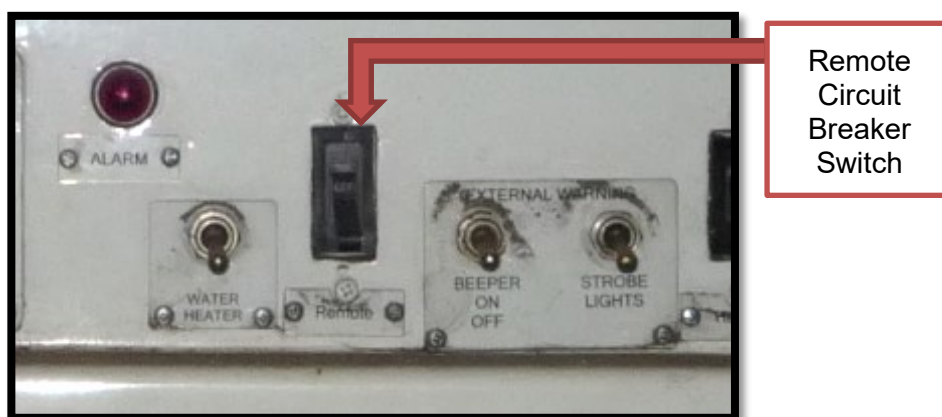


Figure 25: Remote Circuit Breaker to be closed

Press the engine start button. Hold until engine starts (approximately 10 seconds). If the engine does not start, advance the throttle handle to notch 3 and continue to crank engine for another 10 seconds. If the engine does not start, recheck starting procedure. Alarm bells will sound until engine fires and oil pressure builds up to 55 kPa. If this pressure does not build-up within approximately 25 seconds, safety shut-off control device will shut engine down and alarm bells will sound. The low oil button must be pushed to start the engine if a shut-down occurred due to low oil pressure.

NOTE: Occasionally, it may be necessary to press the start button, then advance the throttle handle part way until the engine starts. After engine has started, return the throttle handle to “neutral”.

CAUTION: Do not discharge the battery by repeated attempts to start. If two or three tries are unsuccessful, recheck starting procedure or fuel lines may need bleeding.

Crankcase oil level should be to “full” mark on dipstick with engine running.
Recheck cooling water level.
Carry out a brake valve leakage test.

7.1.1 Cold Weather Starting

NOTE: If temperature is below 15°C, turn on Glow-plug CB, depress and hold switch according to Cold Weather Starting chart below (Glow-plug switch must be released before engaging starter).

Ambient Temp.	Heating Time	Starting Aid
Above 15°C	None	None
0°C to 15°C	Glow-plugs	1 minute
0°C to -20°C	Glow-plugs	2 minutes
*Below -20°C	Glow-plugs and Starting Fluid	3 minutes
* Heating of jacket water and / or crankcase oil; and / or use of extra battery capacity may be required.		



Figure 26: Cab Electrical Board

7.2 Changing to Remote

ATTENTION: This operating procedure does NOT apply to locomotive DH2851.

With the engine running and main reservoir pressure fully charged, the locomotive is now ready to be switched to radio operation:

1. Apply Independent Brake.
2. Automatic Brake Valve handle to “Handle Off” position.
3. Place the Brake Valve Cut-Off Valve to the “cut-out” position.
4. Turn the headlight switches “off”.
5. Throttle lever closed; remove reverser selector handle and place on window ledge.
6. Inside the engine room (cab end), pull out (open) the remote transfer cock.
7. Place the remote control brake pipe isolation valve handle to the “remote” position (in line with the pipe).
8. Inside the cab, turn the RMS switch to “RAD”, the remote disconnect switch to “on” and switch “on” the remote CB.
9. Turn “on” the strobe and external warning beeper switches.

NOTE: If remaining in the cab, this will allow communication with the shunter. To communicate with the Signaller or Train Control, the radio switch must be in the TC mode.

10. With the controller “off”, check brake cylinders for air pressure indicating locomotive brakes are applied.
11. Turn controller “on” with the key while hold in Diagnostic button.
12. Release Diagnostic button, Controller should “beep” twice to confirm operation.
13. Switch the ES override to “off”.
14. Sound the horn to verify operation of the remote.
15. Check operation of the remote pack – refer ROC Section 5.2 (Pre Operation Remote Checks)
16. The water temperature should be at least 60°C.
17. If the locomotive comes to an unplanned stop or fails to respond to the remote commands then the operator must return to the locomotive and check whether the alarm light on the radio cabinet is “on”. After correcting the fault, the alarm reset switch must be operated to return the radio to normal remote operation.
18. When there is a shift change and the locomotive has been correctly checked out at the commencement of the day, or has been shut-down during the shift, then the operator will only be required to perform the manual / remote changeover sequence as well as check the radio control operations.

8.0 OPERATING

8.1 Moving the Locomotive

1. Move the reverser handle to forward or reverse.
2. Release brakes.
3. Advance the throttle handle into the throttle notch which starts locomotive movement.
4. When starting on an ascending grade, do not release the air brakes until the throttle handle has been advanced sufficiently to prevent the locomotive from drifting backwards.
5. After the locomotive has accelerated to the required speed, ease back the throttle handle to maintain this speed.
6. If power fails on the locomotive, move the throttle handle to “neutral” and apply the air brakes.

8.2 Stopping the Locomotive

Move the throttle handle to “neutral” and apply automatic brakes. If leaving the operator’s position, move the reverser handle to “off”.

8.3 Reversing the Locomotive

1. Bring the locomotive to a full stop.
2. Move the reverser handle to the opposite direction.
3. Release air brakes.
4. Advance throttle handle.

8.4 Passing over Road Crossings

Do not pass over road crossings at full power, or traction motor flashover may occur. Reduce power by moving throttle handle to notch 4 or below before passing over the crossing.

8.5 Emergency Brake Application

If an automatic emergency brake application is initiated by a parting, return throttle handle to “neutral” and move automatic brake valve handle to the “full service” position. The locomotive brakes may be kept released by moving the independent brake valve handle to the “quick release” position.

8.6 Circuit Breakers

CB's are located on the control compartment. A fault or short circuit causes the CB to open the circuit and the switch to move to the centre position, indicating the breaker has tripped. To reset, move the switch to full “off”, then to “on”, after waiting for the CB to cool.

8.7 Engine Lubricating Oils

If the engine lubricating oil pressure drops below 55 kPa, the engine will shut down, the alarm bell will sound and a green Low Oil Pressure indicating light will illuminate.

After the engine shuts down, return throttle handle to “neutral” and check the lubricating oil supply. Wait two minutes before again attempting to start the engine. The safety shut-off control button on the “V” of the engine must be depressed before starting the engine by operating the reset lever on the side of the engine.

8.8 Engine Water Temperature

If the engine water temperature exceeds 94°C, the high temperature alarm bells will sound and the red indicating light will illuminate.

Return the throttle handle to “neutral”. Check cooling water supply and the operation of the radiator fan. If the temperature does not return to normal in a reasonable time, shut down the diesel engine.

With radiator shutter's, the automatic control portion of this feature may not be functioning properly. To manually control the shutter's, move the 3-way Rotair valve to the operator's position in the following manner:

- To open the shutter's, move the handle of the valve to the left-of-centre position (as you face it).

NOTE: The right-of-centre position is for automatic operation of the shutter's. The centre position has all ports closed and negates shutter operation and must not be used.

8.9 Low Water Level

A low water level in the header tank will give the same warning indication as a Hot Engine Alarm. If the vehicle is being driven, the water indicator may operate intermittently on and off in the initial stages of low water. This is due to the fluctuation in header tank water level as a result of vehicle movements.

8.10 Ground Relays

If a ground relay occurs in the power circuits, the ground relay trips, and the alarm bell sounds. In doing so, it drops the diesel engine speed to idle (650 rpm) and removes power from the traction motor circuits. A red indicating pointer on the relay will be visible through the sight glass after trip has occurred.

If a ground relay occurs on the control circuits, the ground relay will operate when the engine start button is depressed and the cranking contactors pick up.

The ground relay may be reset by hand. To reset the relay, move the throttle handle to “neutral”, then push in the ground relay reset button. Advance the throttle handle. If the ground relay stays in, continue normal operation. If the ground relay trips a second time, reset and work in a lower notch. If it trips more than 4 times within 15 minutes, shut down engine and prepare for towing.

Under emergency conditions, the locomotive may be moved under its own power after opening the ground relay cut-out switch and resetting the relay. Move the locomotive slowly to clear the main line only, watching for overheating of all electrical circuits.

8.11 Wheel-Slip

When a wheel-slip occurs, the wheel-slip buzzer will sound and a white indicating light will illuminate. When a slip occurs, move the throttle handle rapidly towards “neutral” to correct the slipping. Advance throttle handle carefully after slip ceases. Automatic sanding (if used) or manual sanding also helps.

NOTE: Continuous wheel-slip warning may indicate a locked axle or other defect. Investigate immediately.

8.12 Engine Over-Speed Shutdown

In the event of an engine over-speed (approximately 1575 ± 25 rpm), the engine shuts down automatically.

After an over-speed shutdown, move the throttle handle to “neutral” and the reverser handle to “off”. Reset the over-speed device by pulling back on the reset knob, located on the left side of the diesel engine. The reset handle should catch and stay in place when the mechanism is reset.

If the engine over-speed shutdown continues to operate, investigate the cause.

8.13 Releasing Brake after Vigilance Device Penalty

After a vigilance device brake application has occurred, brakes are released in the following manner:

- Automatic handle to “handle off” position. Push reset button.
- Recharge the brake pipe by moving the automatic handle to “release”.
- Operate the throttle handle as needed.

8.14 Nullifying Vigilance Device Operation

The vigilance safety control feature can be nullified permanently by removing the VES fuse. The brake pipe air supply to the penalty dump valve can be isolated by closing the vigilance device cut-out cock on the brake rake after breaking the seal. Proceed as directed by the relevant rules.

8.15 Locomotive Over-Speed Control

When the locomotive exceeds the maximum permissible speed by 10 seconds, an over-speed penalty brake application is initiated. Resetting of the unit follows the same process stated in section 8.12.

9.0 SHUT DOWN PROCEDURE

9.1 Stopping the Locomotive and Shutting Down – Manual

1. Move the throttle handle to “neutral”.
2. Apply the brakes and stop the locomotive.
3. Push in engine stop knob until engine has stopped or trip “Engine run” CB.

IMPORTANT: The engine must idle for at least five minutes before shutdown.

4. Open the engine control CB
5. Book all repairs necessary in the Loco 54D book and advise repair staff.
6. Remove the reverser.
7. Open all switches and CB's except auxiliary generator and battery charging.
8. Turn off all lights.
9. Open the BKS.
10. Close windows and doors

9.1.1 Emergency Engine Shutdown Switch

An emergency stop switch (*Figure 27*) is located on the operator's gauge panel. When the stop switch is turned, it will shut down the engine. The switch is provided for emergency use only.

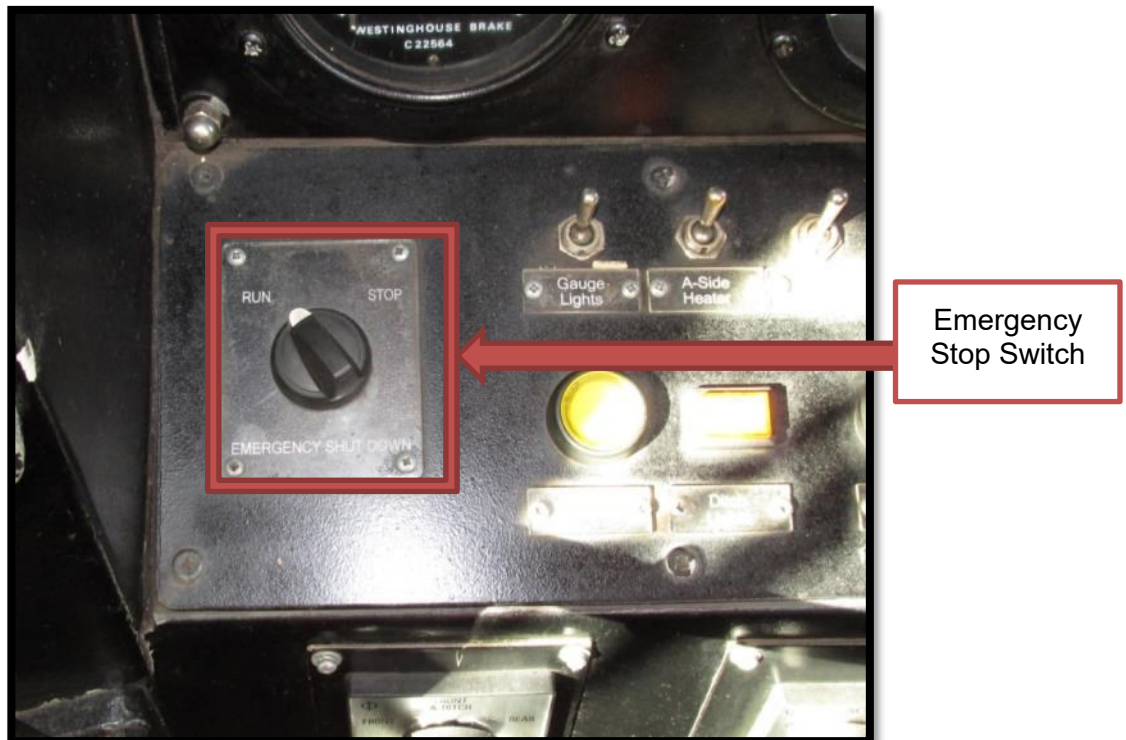


Figure 27: Emergency Stop Switch

9.2 Changing from Remote to Manual and Shutting Down

1. Stop the locomotive.
2. Apply the locomotive brake
3. Switch the transmitter “off” by using the key on the side of the remote pack.
4. Inside the locomotive, apply the handbrake.
5. Turn off the strobe and external warning beeper switches.
6. Switch the RMS to “MAN” position.
7. Switch the remote disconnect switch to “off”.
8. Switch off the remote CB.
9. Push in the throttle and brake remote transfer cock and cut-out the remote control brake pipe isolation valve handle.
10. Push in engine stop button until engine has stopped or trip “Engine run” CB.

IMPORTANT: The engine must idle for at least five minutes before shutdown.

11. Open the engine control CB
12. Book all repairs necessary in the Loco 54D book and advise repair staff.
13. Remove the reverser.
14. Open all switches and CB’s except auxiliary generator and battery charging.
15. Turn off all lights.
16. Open the BKS.
17. Close windows and doors

10.0 DIESEL ENGINE

Engine Specifications

Description	Model Caterpillar D938 B
Number of Cylinders	12
Stroke Cycle	4
Cylinder Arrangement	60 Degree “V”
Bore	158.8mm
Stroke	203.2mm
Turbocharger	2
Weight dry with traction generator	908 kg

11.0 AIR INTAKE SYSTEMS

Reserved for future use

12.0 ELECTRICAL

12.1 Forward and Backward Transition

DH locomotives use several stages of electrical transition to allow the locomotive to accelerate and increase road speed depending on the load.

A frequency signal generator located on the number two wheel set provides a signal to the speed event panel (SEP) located in the electrical cabinet. The SEP controls the field shunt control relay (FSCR) and the transition relay (TR) operation to allow the forwards and backwards transition.

When the locomotive is in power notch setting, from 0 to 20 km/h, the locomotive will operate with the traction motors connected in a series configuration by the use of the “S1” and “S2” contactors. This allows the maximum current to flow through the traction motors to enable the locomotive to get moving.

At 20 km/h the FSCR relay energises to pick up the FS contactors of the field shunt system. This connects a resistance across the field of each of the traction motors allowing more current to flow through the motors and allow road speed to increase.

When the locomotive has been above 27 km/h for more than 6 seconds, the FSCR de-energises and the “S1”, “S2” and FS contactors drop out. At the same time the TR becomes energised and picks up the “P1”, “P2”, “P3”, and “P4” contactors to connect the traction motors in a parallel configuration, allowing the road speed to continue to rise.

At 58 km/h, the FSCR again energises to pick up the FS contactors of the field shunt system.

The reverse of this is backwards transition as the speed drops off with an increase in load due to gradient.

13.0 BRAKES

13.1 Handbrake

Miner Handbrake (*Figure 28*) Turn wheel clockwise to apply and pull up on ratchet to release.

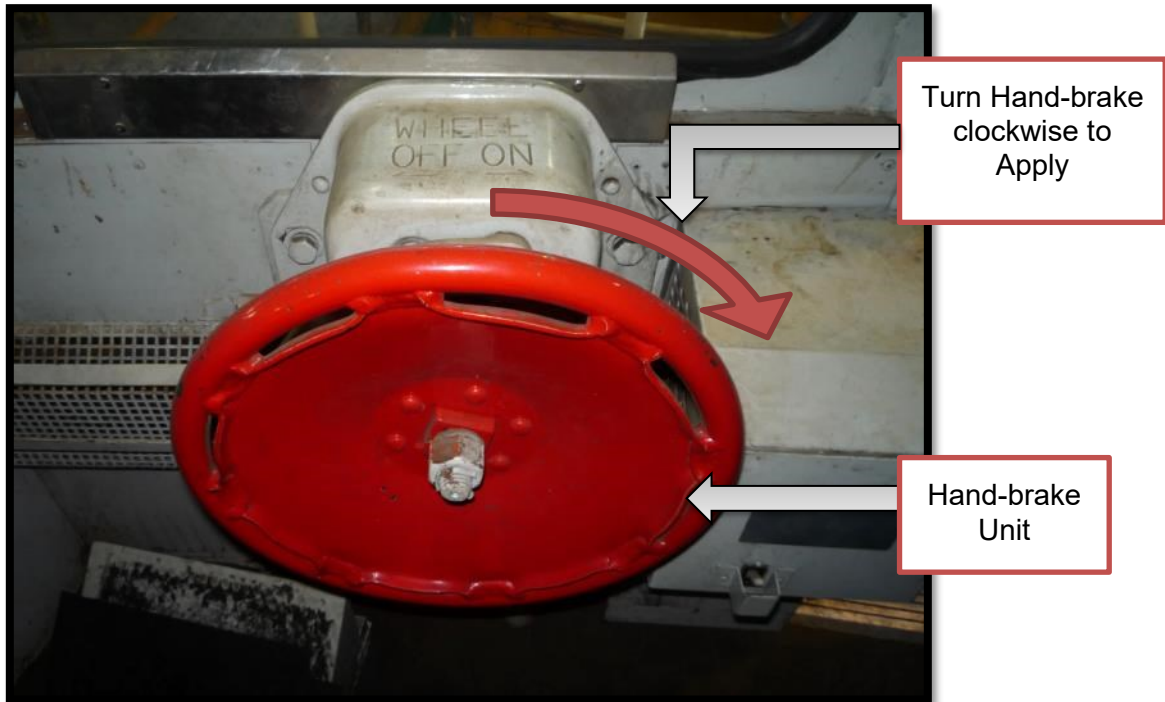


Figure 28: Miner Handbrake

13.2 Brake System Pressures

Two brake valves are provided for brake control. One valve (SA-9) is the independent valve for controlling the locomotive brakes.

The second valve (26-C) is the automatic valve which controls the locomotive and train brakes.

13.3 Brake System Pressures

Normal main air reservoir cut-in and cut-out pressures are 875 kPa and 960 kPa respectively.

Normal equalising reservoir and brake pipe pressure with the automatic brake handle in the “release” position is 550 kPa.

“Full Application” position of the independent brake valve handle provides a locomotive brake cylinder pressure of 400 kPa.

“Full Service” position of the automatic brake valve handle provides a locomotive brake cylinder pressure of 450 kPa.

“Emergency” position of the automatic brake handle provides a locomotive brake cylinder pressure of 450 kPa.

13.4 Independent Valve (SA-9)

The independent valve handle (*Figure 29*) movement provides the following brake control:

Release Position	The brakes are released, and all the air is exhausted from the brake cylinders
Application Zone	The brakes are applied, and air pressure is applied to the brake cylinder. The degree of brake application is determined by the distance towards the “Full Application” the handle is moved. The brake valve is of the self-lapping type which automatically maintains the brake cylinder pressure when the application pressure reaches a valve corresponding to the handle pressure.
Full Application	Maximum brake application available
Quick Release Position	Spring loaded position to the left of the release position provides a means of releasing an automatic brake application on the locomotive without affecting the automatic brake application present of the train brakes.

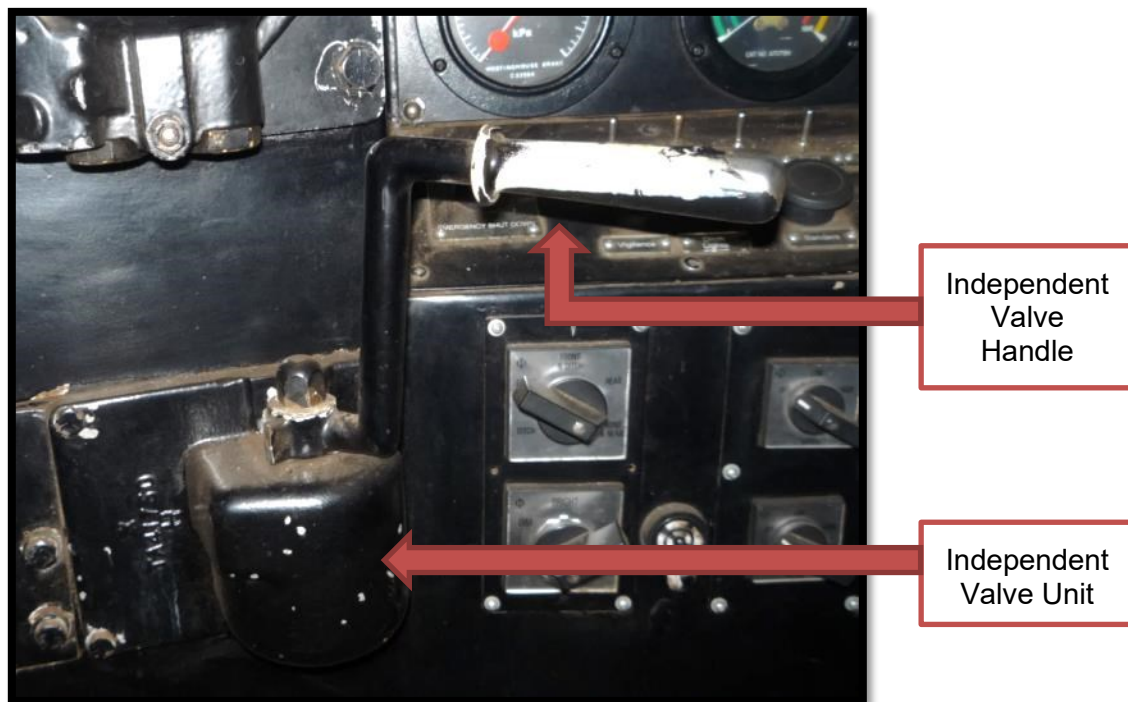


Figure 29: Independent Valve

13.5 Automatic Brake Valve (26-C)

The automatic brake valve (*Figure 30*) operates through six different positions as shown in (*Figure 31*). Note that the service zone is between “minimum service” and “Handle Off” positions.

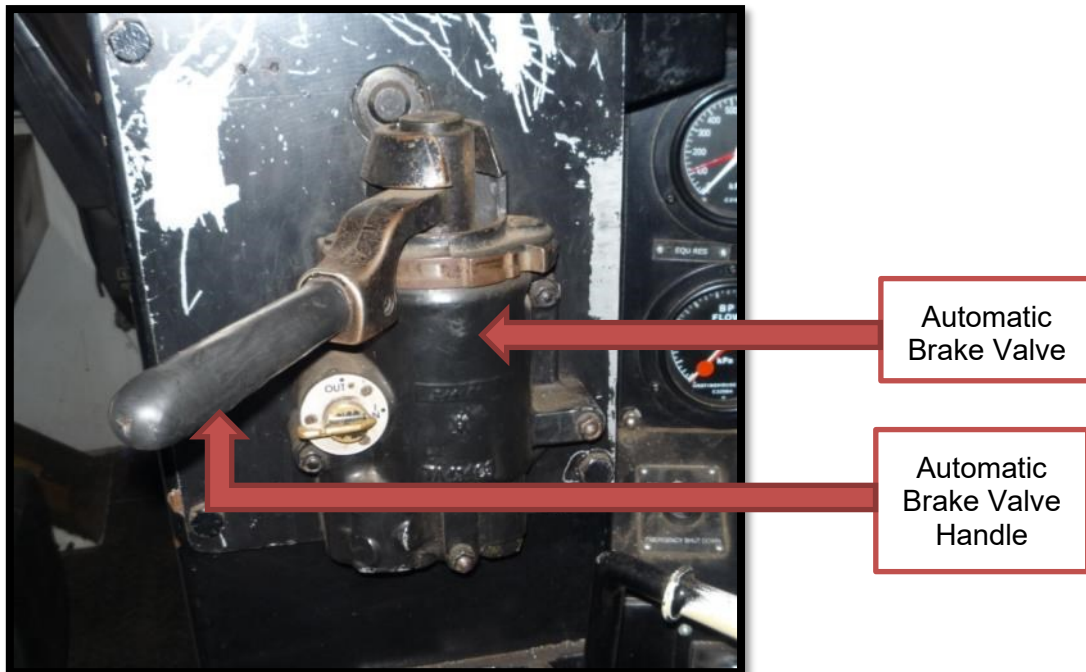


Figure 30: Automatic Brake Valve

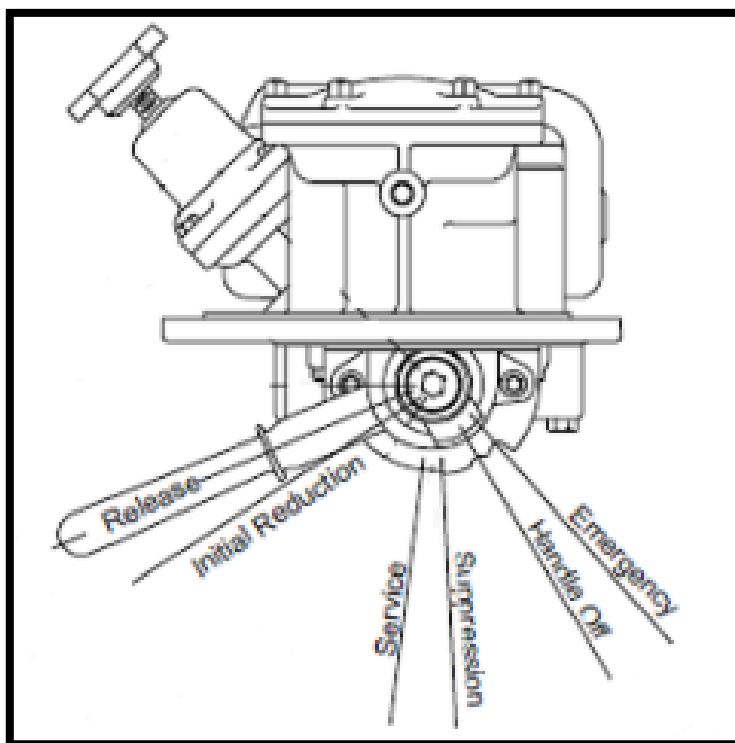


Figure 31: Automatic Brake Valve Positions

13.5.1 Cut-Out Portion

The manually operated cut-off valve handle (*Figure 32*) has three positions, “OUT”, “FRT” and “PASS”.

The “OUT” position is used to cut-out the brake valve to set the brake equipment for “TRAIL” or “DEAD” operation. The handle position also allows for the measurement of brake pipe leakage from the lead cab.

The function of the brake valve with the cut-off valve handle in “FREIGHT” or “IN” position is identical. The position used to set the 26C brake valve to operate in the “Direct Release” mode when the locomotive is being used to haul a freight train.

The “PASS” operation is used to set the 26C brake valve to operate in the “Graduated Release” Mode.

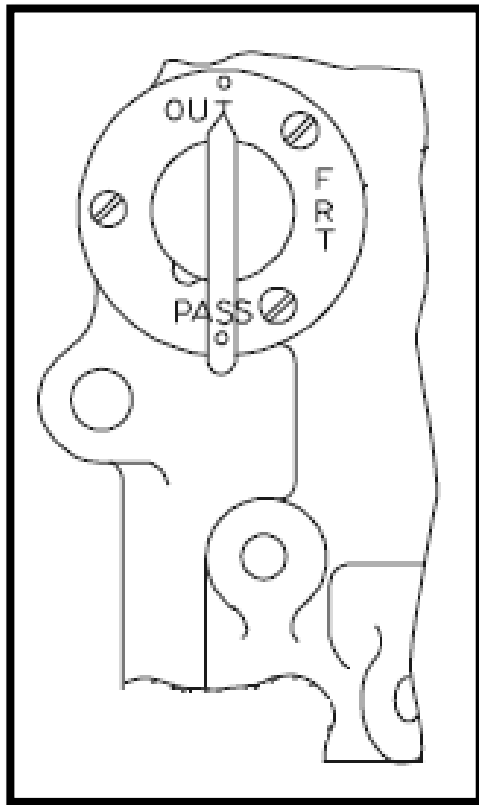


Figure 32: Cut-Off Valve Handle

13.6 MU2A Valve

The MU2A valve is located on the lower back end of the drivers control stand as shown in *Figure 33*. The MU2A valve has three positions:

- Lead or dead
- Trail 6 – 24
- Trail 24

The various positions are indicated on the escutcheon plate.

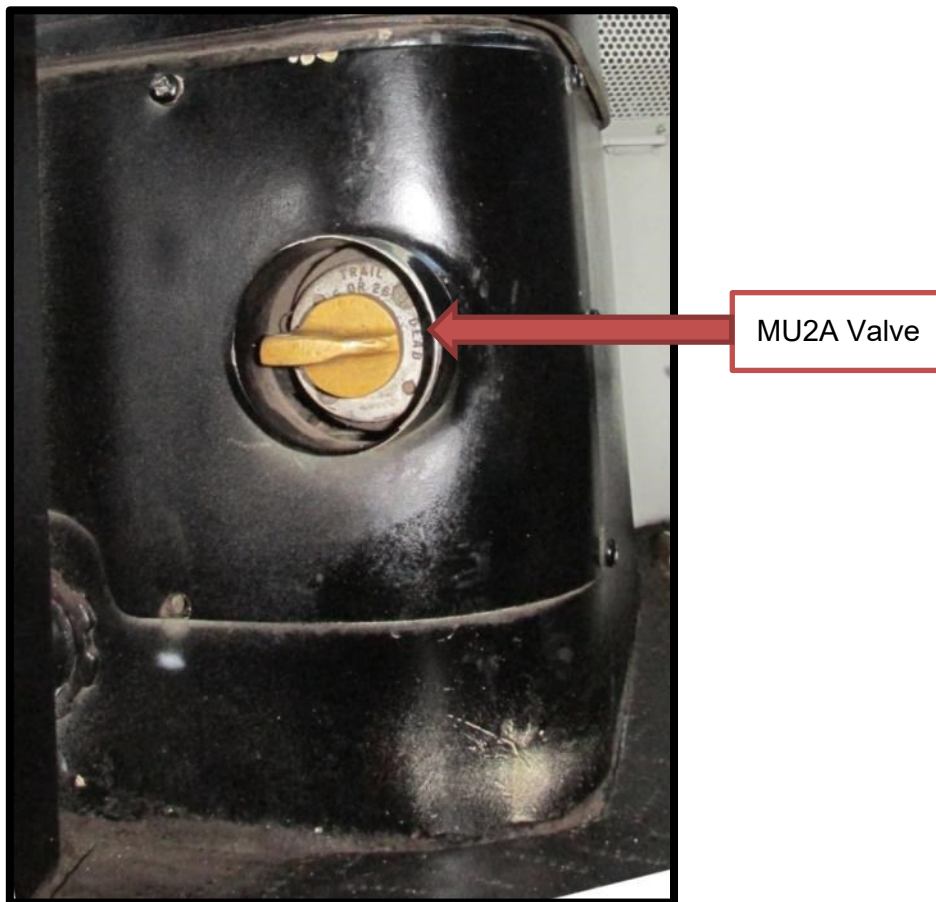


Figure 33: MU2A Valve

14.0 CUT OUT COCKS

Each cut-out cock has a straight mark on the handle. The position of this mark is parallel with the air passage in the pipe when the cock is open.

14.1 Air Compressor Cut-Out Cock

ATTENTION: This cut-out cock (*Figure 34*) must be open when operating the locomotive. Close this cut-out cock only to check the compressor governor of the operation of the main reservoir safety valve

This is located in the radiator compartment and shuts off air to the unloader valve so that the compressor will continually pump air to the main reservoir.

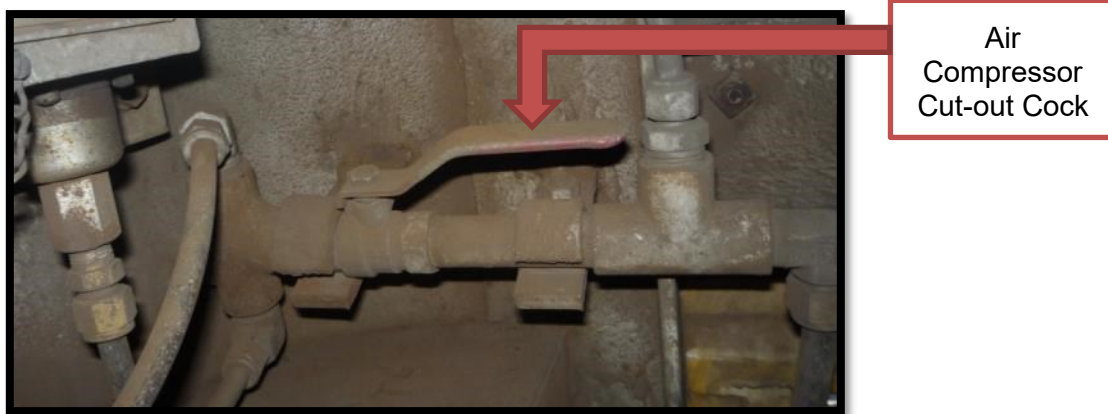


Figure 34: Air Compressor Cut-out Cock

14.2 Brake Valve Cut Off Valve

This is located below the Automatic Brake Valve handle. Normally the cock (*Figure 35*) is in the “freight” position and is in the “cut out” position when hauling the locomotive “dead”.



Figure 35: Brake Valve Cut-out Cock

14.3 Main Reservoir Cut-Out Cock

The main reservoir cut-out cock (*Figure 36*) is located forward of the fuel tank on the right side. It is used to shut off and vent air from the main reservoir pipe when removing a brake valve or other air brake device for maintenance.



Figure 36: Main Reservoir Cut-out Cock

14.4 Shutter Control Cut-Out Cock

This is located by the radiator compartment and is for the automatic operation of the shutter control (*Figure 19*). It can be moved outwards to manually open the shutters.

14.5 Control Air Cut-Out Cock

The control air cut-out cock (*Figure 16*) is located in the air brake rack and shuts off air to the reverser and pneumatic contacts.

14.6 Sander Cut-Out Cock

The sander cut-out cock (*Figure 37*) is used to shut off air to the sander line magnet valves, control valves and sand traps. This cut-out cock is located in the air brake rack and controls air to both sanders.

14.7 Horn and Window Wiper Cut-Out Cock

The horn and window wiper cut-out cock (*Figure 37*) is located in the air brake rack. It is used to shut off air to these devices making them inoperative.

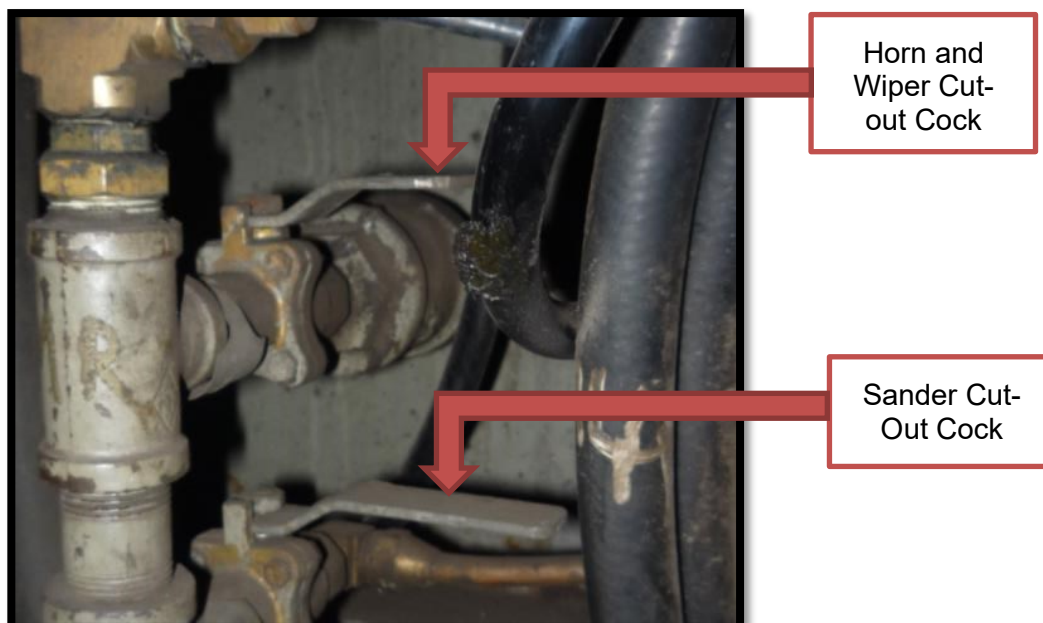


Figure 37: Sander, Horn, and Wiper Cut-out Cocks

14.8 Dead Engine Device Cut-Out Cock

This is a short orange handle located in the air brake rack. Normally this cock is closed (in line with the pipe). It is opened when the locomotive is hauled “dead”



Figure 38: Dead Engine Device Cut-out Cock

14.9 Brake Cylinder Cut-Out Cocks

The brake cylinder cut-out cocks (*Figure 16*) are placed in the brake cylinder piping for cutting out all of the brake cylinders of either bogie, so that brake operation on a bogie is prevented. The cut-out cocks are located under the running board in the pipe to the hose connecting the bogie to the air system.

14.10 Vigilance Device Cut-Out Cocks

These are placed in the air brake rack (*Figure 39*). When glass is broken **both** cocks are cut-out to make vigilance device inoperative due to malfunctions.

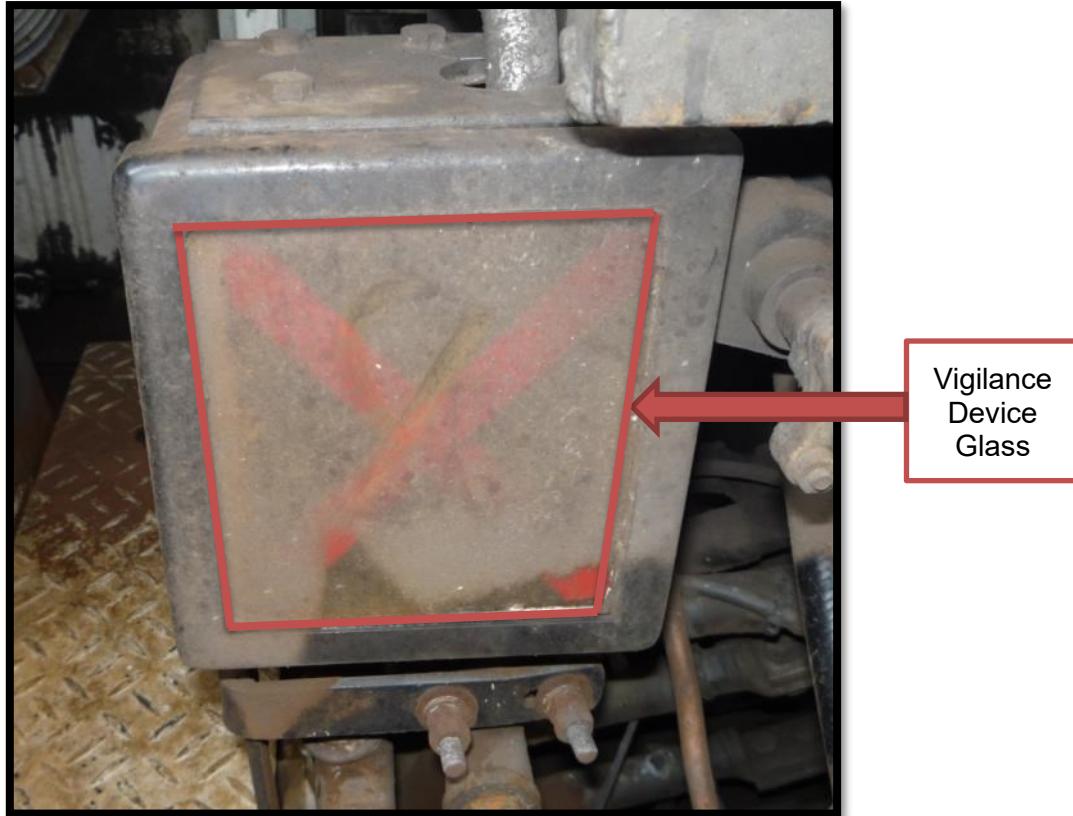


Figure 39: Vigilance Device Cut-Out Cocks

15.0 EMERGENCY EQUIPMENT

Reserved for future use

16.0 EVENT RECORDER / VIGILANCE SYSTEM

16.1 Tranzlog

All DH class locomotives are fitted with the Tranzlog event recorder / vigilance system (*Figure 40*).

The system is located in a compartment in the cab on the “A” side above the front window and is accessible through the access door in the locomotive cab.

A vigilance cycle is employed to ensure the locomotive engineer must perform a function to cancel the cycle. If for some reason the LE does not cancel the cycle the emergency brakes will automatically apply, power is dropped and the train will come to a stop.

The recorder will record specific functions carried out on the locomotive by the LE. Recordings can be downloaded and viewed in real time to see what occurrences have taken place (*Figure 41*).

Tranzlog is also employed to drive the locomotive speedometer, a signal is sent to the Tranzlog via a radar mounted to the underframe. The Tranzlog then sends a signal to the speedo heads to display the locomotive speed.



Figure 40: Tranzlog Event Recorder

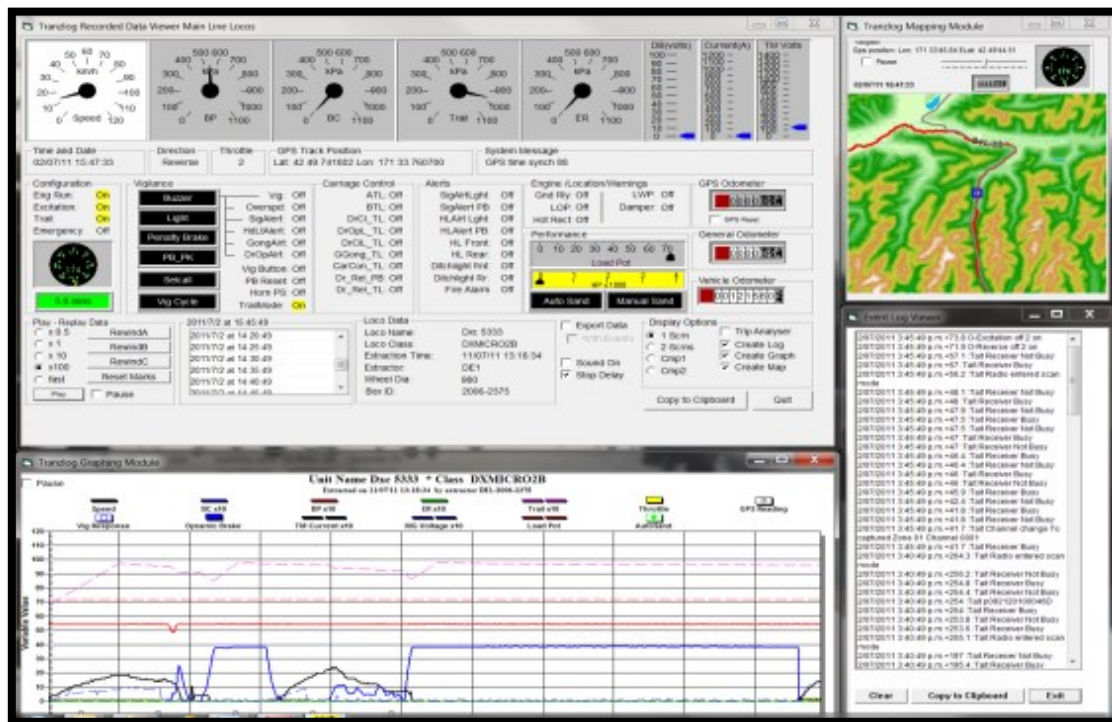


Figure 41: Tranzlog Interface Showing Play Back of Data Recording

17.0 PROTECTIVE DEVICES

Reserved for future use

18.0 SAFETY INSTRUCTIONS

Reserved for future use

19.0 MISCELLANEOUS

Reserved for future use

20.0 DOOR OPERATION

Reserved for future use

21.0 RADIO / PUBLIC ADDRESS SYSTEM

21.1 TAIT 8260 Radio

Fitted to all mainline freight locomotives and shunts.

Refer to the *Radio Systems Manual*.

22.0 TRAIN ATTENDANTS

Reserved for future use

23.0 TOWING

When a locomotive is to be hauled dead in a train (engine shut down), set up as follows:

23.1 *Dead Single Pipe*

When a locomotive is to be hauled dead couple single piped only in a train (engine shut down), set up as follows:

1. Place the throttle handle in “neutral” and reverser handle “centred”. Remove reverser handle and place on window ledge.
2. Place the automatic brake handle in the “off” position and place brake valve cut-off valve in “cut-out” position.
3. Apply handbrake or couple to another locomotive.
4. The locomotive brake application is released by moving the independent brake valve handle to the “quick release” position.
5. Leave independent brake valve handle in the “release” position.
6. Manually centre reverser in control compartment. (Handle attached to the inside of the compartment door).
7. Lock reverser in place with locking handle.
8. Open Battery Knife switch.
9. Open the dead engine device.
10. Reduce No.2 main reservoir pressure to 350 kPa by opening the drain cock on the main reservoir on “B” side of locomotive. The danger of flat wheels is eliminated by avoiding excess pressure of locomotive brakes.
11. Book in Loco 54D book “Prepared for towing dead”.
12. Attach brake pipe, to live locomotive and open cocks. Release handbrake on dead engine if applied.

23.2 Dead 3 Piped

When a locomotive is to be hauled dead behind another locomotive and coupled through with 3 pipes (engine shut down), set up as follows:

- 1. Place the throttle handle in “neutral” and reverser handle “centred”. Remove reverser handle and place on window ledge.*
- 2. Place the automatic brake handle in the “off” position and place brake valve cut-off valve in “cut-out” position.*
- 3. Apply handbrake or couple to another locomotive.*
- 4. The locomotive brake application is released by moving the independent brake valve handle to the “quick release” position.*
- 5. Leave independent brake valve handle in the “release” position.*
- 6. Place the MU2A valve in the Trail 6/26 position.*
- 7. Manually centre reverser in control compartment. (Handle attached to the inside of the compartment door).*
- 8. Lock reverser in place with locking handle.*
- 9. Open Battery Knife switch.*
- 10. Release the handbrake once coupled through to the live locomotive.*

24.0 FAULTS

24.1 Controls

Fault:	Cause:	Remedy:
Engine fails to turn over when starting button is pressed.	Battery switch or CCB open	Close switch or CCB
	Engine Control CB not closed	Close
	Emergency stop switch not in “run”	Reposition
	Ground relays tripped	Reset
	Engine seized / hydraulic	Call Mechanical staff
	Battery discharged	Recharge or replace battery. Check battery charging equipment and voltage regulator fuse (shut engine down and open knife switch when checking / replacing fuse)
Engine turns over but fails to “fire”	Air in fuel line	Bleed fuel line
	Over-speed or oil pressure shutdown device tripped	Reset
	Air temperature too cold	Use Glow-plugs
	Manual shutdown lever stuck in	Pull out

Fault:	Cause:	Remedy:
Engine starts, but locomotive will not move in first position of throttle	Reverser handle in "neutral"	Place in forward or reverse position
	Reverser not throwing	Check control air and cock. Change manually if required
	Brakes (hand or air) applied	Release brakes
	PC Open	Restore brake pipe pressure
	Ground relay tripped	Reset ground relay
Hot water alarm	Check water level	Top up as required, and book amount
	Check shutter operation	Normal position of device is over towards right Manual opening of the shutter's, pull lever fully over to outside of locomotive (left)
	Check fan	Not working – prepare for towing All above, book in Loco 54D book NOTE: If all correct, speed up engine off load to increase cooling
Battery discharged	Voltage control relay fuse blown	Replace fuse NOTE: Engine must be shut down and knife switch opened before removing fuse Book in Loco 54D book

Fault:	Cause:	Remedy:
Engine stops after operating normally	Low oil button tripped	Check engine / governor oil, if okay, reset
	Engine over-speed tripped	Reset
	Engine control CB tripped	Reset
	Emergency stop switch into stop	Reposition
	Check fuel supply	Refill tank
Locomotive will not reverse	Reverser magnet-valve not working	Check control air isolating cock. Operate by hand if required.

24.2 Engine

Fault:	Cause:	Remedy:
Lack of power	Water in fuel tank	Book in Loco 54D book
	Lack of fuel oil	Fill tanks, prime and start
	Clogged fuel oil filters	Book in Loco 54D book
	Engine air filters clogged	Book in Loco 54D book
Low lubricating oil pressure	Lack of lubricating oil	Fill sump to correct level
	Oil dilution	See “Lubricating Oil Dilution”
	Failure of lubricating-oil piping	Book in Loco 54D book
	Leakage in lubricating-oil piping	Tighten piping
	Leaks in pump suction	Tighten piping
	Clogged filters	Book in Loco 54D book
Lubricating-oil dilution (with fuel oil)	Dirty or worn fuel injection nozzles	Book in Loco 54D book
Lubricating-oil dilution (with water)	Leakage at pre-combustion chamber	Book in Loco 54D book
Smokey exhaust	Faulty injection nozzles	Book in Loco 54D book
	Lack of intake air	Check air filter
	Lubricating oil in combustion chamber (blue exhaust)	Book in Loco 54D book
	Oil from stack at continuous full throttle	Book in Loco 54D book
	Oil in air manifold and smoky exhaust	Book in Loco 54D book

Fault:	Cause:	Remedy:
Engine fails to start (see engine turns but fails to fire)	Low starting speed	Check starting equipment
	Fuel supply exhausted or fuel oil not reaching cylinders	Replenish fuel supply. Prime system, make sure over-speed device is set in running position. Check low oil pressure button
	Engine not warm enough for starting	Use glow-plug button and CB
Excess vapor from the crankcase breather	Blow-by past piston rings	Book in Loco 54D book
	Overheated bearing	Check lubricating oil system. Book in Loco 54D book
Oil in water system (seen in header tank sight glass)	Leak in air cooler	Book in Loco 54D book

24.3 Compressor, Air Brakes & Sanders

Fault:	Cause:	Remedy:
Air pressure does not build up properly	Drain valve on main reservoir or dirt collector open	Close valve
	Brake pipe angle cock open	Close angle cock
	Governor not functioning	Check governor
	Pressure switch, magnet valve or unloader valve not functioning	Check operation
	Compressor belts slip or are broken	Book in Loco 54D book
	Belt slipping	Book in Loco 54D book
	Loose fittings	Book in Loco 54D book
Main reservoir pressure not properly controlled	Governor sticking	Book in Loco 54D book
	Broken unloader pipe	Book in Loco 54D book
	Closed cut-out cock in governor pipe	Open
	Sticky unloader valves	Book in Loco 54D book
Brakes re-apply after regular application and release	Brake pipe overcharged	Make a partial brake application, then return brake valve to “running”
	Faulty feed (regulating) valve	Book in Loco 54D book
Low braking power	Too much brake cylinder piston travel	Adjust piston travel
	One bogie brake cut-out out	Cut in (all bogies)
	Low brake cylinder pressure	Book in Loco 54D book. Prepare to tow or do not enter service
	Broken brake cylinder pipe	Book in Loco 54D book. Prepare to tow or do not enter service
	Worn brake shoes	Renew shoes

Fault:	Cause:	Remedy:
Brakes leak off after automatic application Brake cylinder pressure too high	Leak in equalizing reservoir	Book in Loco 54D book
	Feed (regulating) valve stuck open	Book in Loco 54D book
	Distributing or relay valve sticks	Book in Loco 54D book
	Wrong adjustment of feed valve	Book in Loco 54D book
Sanders do not work	No air reaching sand trap	Check magnet valves and control air cock
	Dirty or wet sand	Clean out sand traps and boxes; fill with sand with clean, dry sand
	Kinked hose or “pockets” in hose	Remove hose, cleanout and straighten
	Obstruction in sand pipe	Clean out pipe
Brakes do not release after application	Brake pipe may be undercharged	Book in Loco 54D book
Sand not hitting rail	Sand pipe out of adjustment	Adjust pipe
Flat spot on wheel	Improper brake application	Do not apply brakes to slide wheels
	Incorrect piston travel	Adjust brake rigging

24.4 Auxiliary Equipment

Fault:	Cause:	Remedy:
Cab heater does not work	Tripped CB	Reset
Window wipers do not operate	Main air valve closed	Open
Lamps do not light	Auxiliary CB tripped	Correct cause for tripping and reset
	Burnt out lamps	Renew
Horn does not operate	Air valve not open	Open
Handbrake does not operate	Broken chain	Book in Loco 54D book. Chock wheels