Rail Operating Code

Code Supplement CS 4.17

Operating Instructions for DL Class Locomotives

Issue Number	Prepared (P) Reviewed (R) Amended (A)	Approved By	Authorised for release by
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Two Effective date: 07.02.11	G.J. Hutchins (P) P. Clifford-Marsh (R)		Phillip O'Connell National Manager HSQE
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Four Effective date 30.11.20	C. Butt (A) W. Houghton (R) R. Simpson (R)	G.J. Hutchins Industry Standards & Safeworking Manager	Alastair Cumming GGM Zero Harm
Five Effective date 19.06.24	G. Hutchins (A)	G.J. Hutchins Industry Standards Manager	D. Robins Head of Systems Standards and Governance

Issue No.	*Date*	*Amendments*		
		Section	*Details*	*Preparer (P) Reviewer (R)*
Six	*05.11.24*	*13.4*	*Park Brake – Add Important box re setup procedure*	*G. Hutchins (P) T. Klok (R)*

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DL Locomotive

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Operating Instructions for DL Locomotives

1.0 TRAINING AND CERTIFICATION

1. The training for existing Locomotive Engineers shall consist of a two day conversion course.

2. The course will be conducted by an authorised trainer.
   The course will consist of:

   First Day:

   a. The Locomotive Engineer being instructed by the authorised trainer on all equipment in the interior and on the exterior of the locomotive plus the operation of all equipment in the cab.

   b. Safety checks.

   c. Starting up and shutting down process.

   d. Fault location and correction.

   e. The operation of the brake equipment including the location and purpose of cut out cocks.

   f. How to set up the locomotive for towing dead, (3 pipe only), assist and for multiple unit operation.

   Second Day:

   a. Recap of the previous day's material.

   b. A light locomotive run.

   c. A run attached to a commercial service (minimum 1 hour)

3. DL trained Locomotive Engineers will be supplied with a copy of this Code Supplement by the trainer.

4. The authorised trainer will practically demonstrate to the Locomotive Engineer the correct operation of the locomotive controls and familiarise the Locomotive Engineer with them by operation of the locomotive on a main line training run.

5. Following successful completion of the conversion course, a STF23 will be issued by the authorised trainer and the Locomotive Engineer will then be certified to drive DL class locomotives.

6. If he / she has not already done so, the Locomotive Engineer must also meet the other certification criteria as detailed in Section 4.0 of the Rail Operating Code.

2.0 ABBREVIATIONS

AA	Auxiliary Alternator
ABV	Automatic Brake Valve
ACU	Auxiliary Control Unit
AG	Auxiliary Generator
BKS	Battery Knife Switch
BLWR	Blower
BMSS	Brake Mode Selector Switch
BP	Brake Pipe
BVCO	Brake Valve Cut Out
DB	Dynamic Brake
DL	Ditch Lights
ESCA	Emergency Safety Control Application
EP	Equalizing Pipe
HL	Head Lights
IBV	Independent Brake Valve
MA	Main Alternator
MCU	Main Control Unit
MR	Main Reservoir
VDU	Visual Display Unit

3.0 GENERAL DESCRIPTION

The DL class locomotives are manufactured by CRRC Dalian Locomotive & Rolling Stock Co Ltd, China.

The locomotive is equipped with an MTU 20V4000R43 diesel engine that develops 2700kW output at a rated speed of 1800 rpm, and the main alternator converts this mechanical energy into electrical energy, which is distributed to the 6 traction motors.

The locomotive has a double drivers cab, connected with exterior walkways.
With the underframe as a division, the whole locomotive is divided into two parts.
The upper part is divided into seven sections by six partitions and consists of:

1. Drivers Cab (No.1 end)
2. Electrical room
3. Transmission room
4. Power room
5. Cooling room
6. Auxiliary room
7. Drivers Cab (No.2 end)

The lower part is running gear consisting of two identical exchangeable bogies, fuel tank, No.1 main reservoir and batteries.

3.1 Drivers Cabs

Both driver cabs are identical in structure, and equipped with both a main and second persons control console. Storage cabinets in the rear wall of each cab hold books and general supplies as specified in ROC Section 4.1, Instruction 1.25. Also provided in each cab are a microwave oven, chiller, electric kettle, wash basin and air conditioner.

3.2 Electrical Room

The electrical room contains an electrical cabinet with high voltage equipment such as reverser switch, brake transfer switch, load test knife switches, various contactors and relays, field weakening resistor, electric control of HB-2 flange lubricator, fire alarm, suppression control system etc. Access to the electrical room is available from the cab (No.1 end) through an interior door. On the outside of the room, to provide dust and waterproofing, both sides are fitted with louvered access doors with filter screens inside. A vent unit is also provided in the roof for air circulation.

HAZARD WARNING: Danger 600V – Entry to this room is prohibited unless the locomotive diesel engine has been shut down.

3.3 Transmission Room

The transmission room contains the vertical dynamic brake cubical, main rectifier cabinet, auxiliary and excitation rectifier cabinets, air brake cabinet and front blower of traction motors whose air intake is so designed that it can cool the main rectifier unit. In the transmission room there is a gearbox with two output ends with which the auxiliary exciter generator and auxiliary alternator are respectively connected. Above the auxiliary generator is an air filter system whose sides are connected to the side walls of carbody. There is also an electrically driven air compressor-motor set in the room. On the outside of the room, to provide dust and waterproofing, both sides are fitted with louvered access doors with filter screens inside.

3.4 Power Room

The power room contains the main engine, engine-alternator set, header tank, fuel pump, fuel pre-filter, carbody draft fans etc. The air intake of the main alternator is taken from the louvers of the access doors in the transmission room and directed to the power room. On the outside of the room, to provide dust and waterproofing, both sides are fitted with louvered access doors with filter screens inside.
Vent ports are arranged on the roof in order to decrease the temperature of power room.
Fire alarm and suppression control system is installed in both transmission and cooling rooms.
DL9008 – DL9515 have a fire alarm only in the power room
DL9521 – DL9688 have a fire alarm suppression system in the power room.

3.5 Cooling Room

The cooling room contains saddle-shaped cooling equipment. In the upper part of the cooling room are two motor-driven radiator cooling fans. The roof is protected with metal net and both sides are installed with two radiators, one at each side for cooling the high and low cooling water circuits. The outside of the radiators are protected with metal net. Inside the cooling room is located a rear traction motor blower, No.2 main reservoir, air dryer etc.

3.6 Auxiliary Room

The auxiliary room contains an auxiliary electrical cabinet containing such low voltage control apparatus as the battery knife switch (BKS), diesel locomotive controller (MCU), MCU power unit, integrated functional control unit (ACU), voltage regulator, converters, silicon rectifier etc. Access to the auxiliary room is available from the cab (No.2 end) through an interior door.

HAZARD WARNING: Entry to this room is prohibited unless the locomotive diesel engine has been shut down.

3.7 Locomotive Specification

Model Designation	CKD9B
Road Numbers	9000 Series
Wheel Arrangement	Co – Co
Locomotive Horsepower - Gross	 2700kW
Diesel Engine: - Model - Transmission - Number Cylinders - Cylinder Arrangement - Cylinder Bore and Stroke - Idle Speed - Full Speed	 MTU 20V4000R43 Diesel Electric 20 90° Vee 170mm x 210mm 600 RPM 1800 RPM
Main Alternator - Model - Rated Voltage	 JF205K / JF205K1 478~780 V AC
Auxiliary Alternator - Model - Rated Voltage	 JF417C3 432 V AC
Auxiliary Exciter Generator - Model - Rated Voltage (Aux Generator) - Rated Voltage (Exciter)	 JGL405L 60 V AC 48 V
Traction Motors - Model - Number	 ZD126D 6
Dimensions: - Height - Width - Length (over couplers)	 3770 mm 2810 mm 18510 mm
Supplies: - Fuel - Lube Oil - Cooling Water	 4300 litres 360 litres 900 litres
Weight: - Basic including Fuel etc.	 108 tonne

4.0 GENERAL DIAGRAMS

4.1 General Layout of DL Locomotive

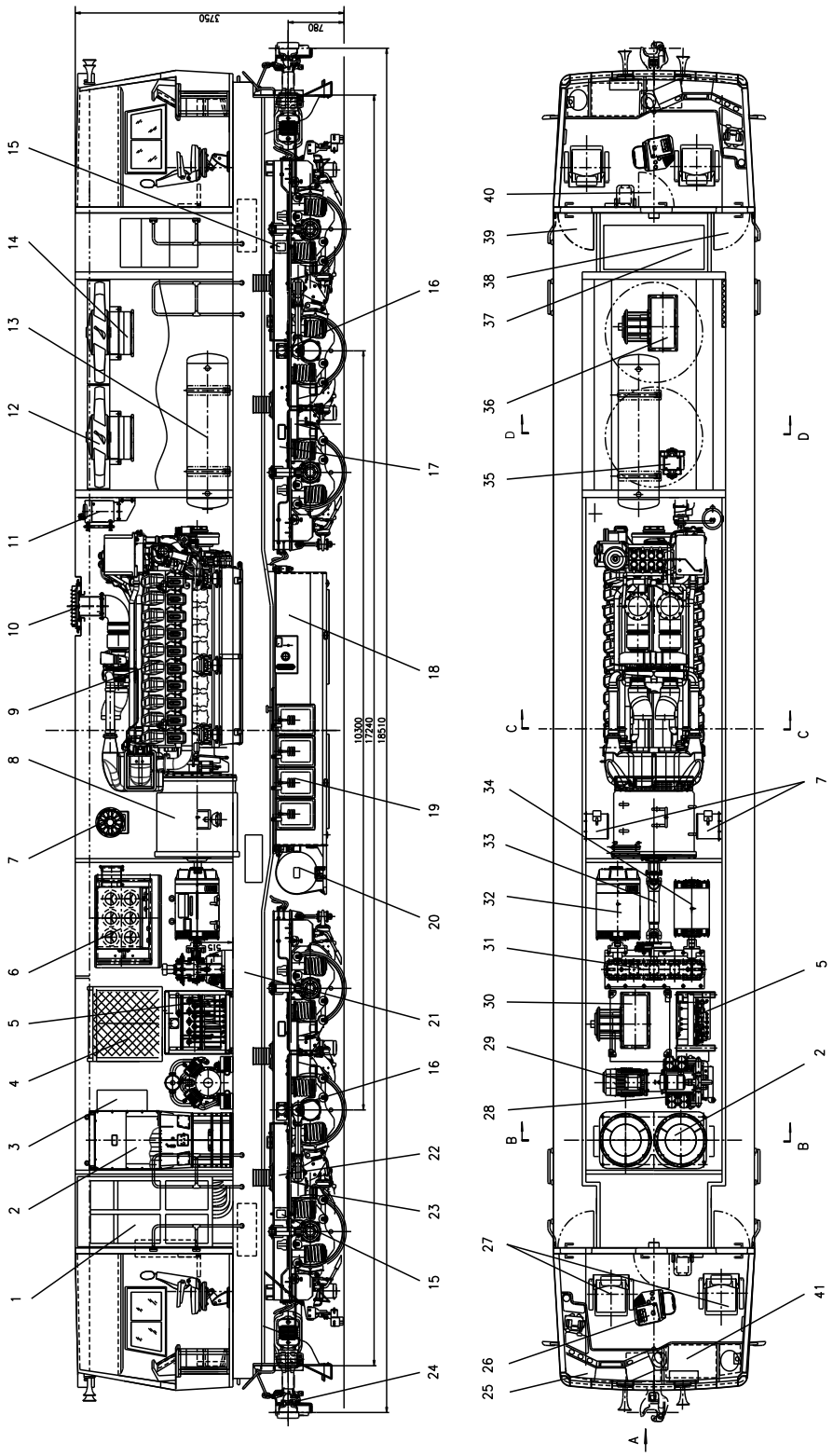


Figure 1: Layout of DL Locomotive - Internal

General Layout of DL Locomotive - cont

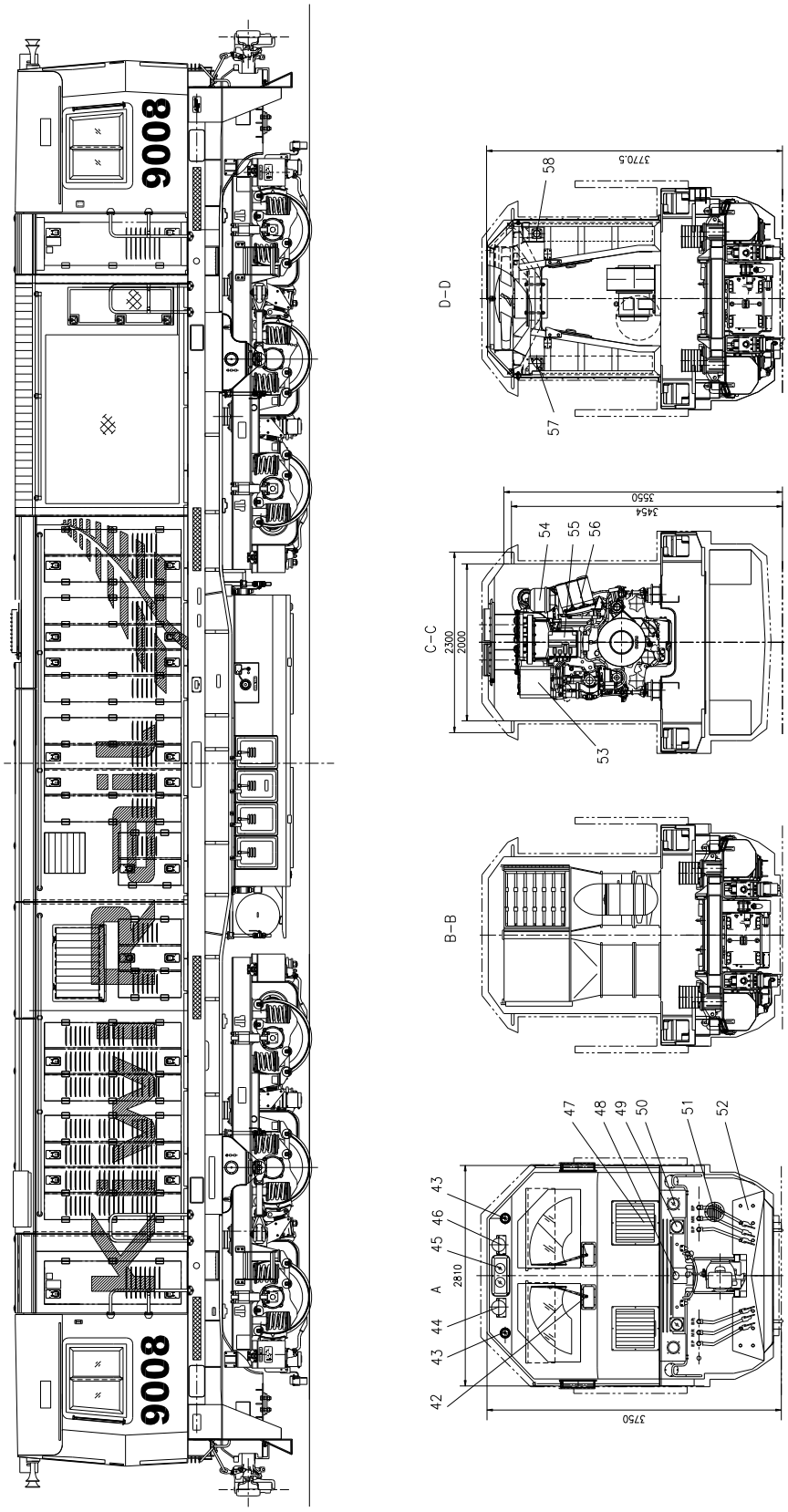


Figure 2: Layout of DL Locomotive - External

General Description Legend

No.	Description	No.	Description
1	Electrical Cabinet	31	Gearbox
2	Dynamic Brake Unit	32	Auxiliary Alternator
3	Exciting (Auxiliary) Rectifier Cubicle	33	Carden Shaft
4	Main Rectifier Cubicle	34	Auxiliary Generator
5	Air Brake Cabinet	35	Air Dryer
6	Air Filter System	36	Rear Blower Motor Set
7	Carbody Draft Fan	37	Auxiliary Electrical Cabinet
8	JF250K / JF250K1 Main Alternator	38	Cab Access Door (Right Hand)
9	MTU 20V4000R43 Engine	39	Cab Access Door (Left Hand)
10	Engine Exhaust Stack	40	Cab Interior Door
11	Header Tank	41	Air Conditioner
12	Cooling Fan	42	Windscreen Wiper / Washer
13	No.2 Main Reservoir	43	Tail Light
14	Cooling Fan Motor	44	Air Horn #5 (Single Tone)
15	Grease pot of Flange Lubricator	45	Headlight
16	Lifter Cylinder	46	Air Horn #3 (Single Tone)
17	Rear Bogie	47	Air Conditioner Intake
18	Fuel Tank	48	Coupler Light
19	Battery Box	49	Multiple Receptacle
20	No.1 Main Reservoir	50	Ditch Light
21	Carbody Underframe	51	Air Horn #2 (Single Tone)
22	Front Bogie	52	Cowcatcher
23	Traction Motors (6)	53	Lube Oil Heater Exchange
24	Coupler and Draft Gear	54	Centrifugal Oil Filter
25	Driver Control Console	55	Engine Control Unit
26	Assistants Driver Control Console	56	Lube Oil Filter
27	Cab Seat	57	Radiator P1
28	Air Compressor	58	Radiator P2
29	Air Compressor Motor		
30	Front Blower – Motor Set		

5.0 CAB CONTROLS / LAYOUT

Both driver cabs are identical in structure.

There are two control consoles in each cab, the main console and island control console. The island control console is arranged at the left hand of the driver.

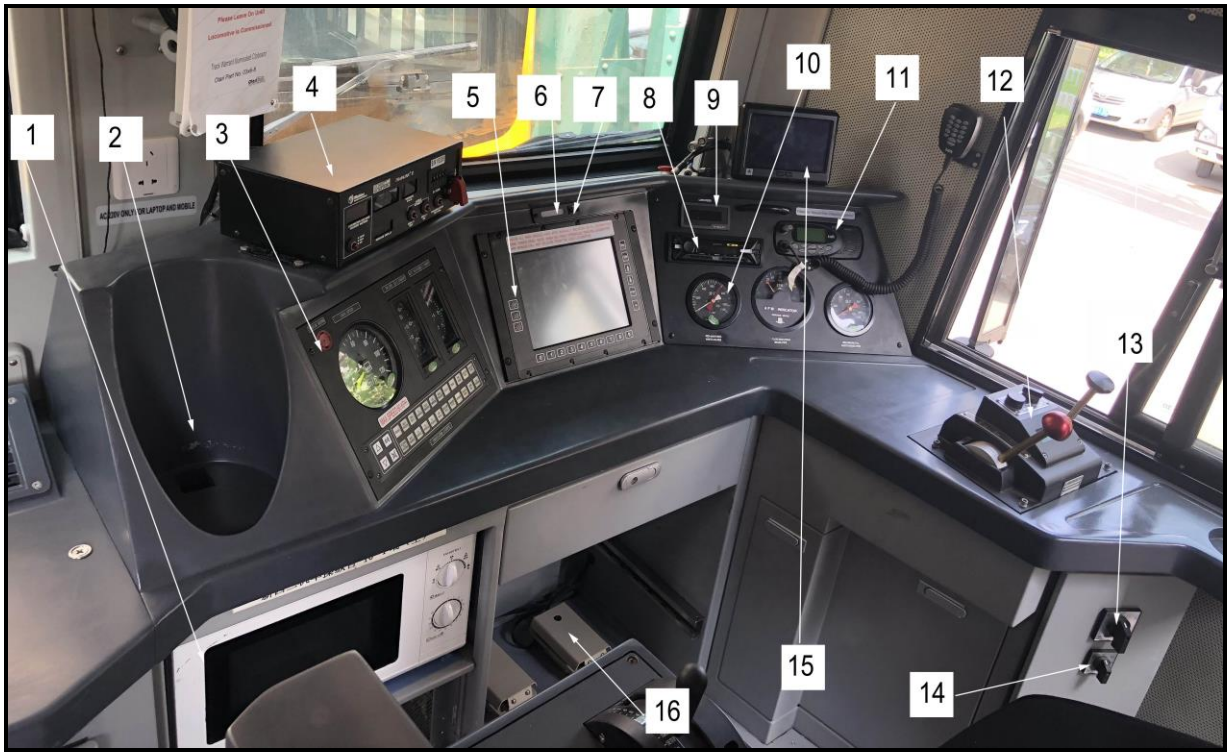


Figure 3: Cab Layout

Layout of Main Control Console

1	Microwave Oven	**10**	Duplex Pressure Gauge
2	Electric Kettle	**11**	Train Radio
3	Gauges and Indications Panel	**12**	Brake Valve
4	Head End Monitor	**13**	Window Demister Switch
5	Visual Display Unit (VDU)	**14**	Front Wiper Switch
6	Vigilance Light	**15**	DAS System
7	Vigilance Light Brightness Adjusting Switch	**16**	Foot Switches
8	Digital Display Module	**17**	Remote offline switch and blue light
9	FM / CD Player		

5.1 Gauges and Indications Panel

Figure 4: Gauge and Indicator Panel

Located on the gauges and Indications panel:

- Tranzlog buzzer.
- Speedometer.
- Duplex Gauge 1 (ENG. RPM / ALT. CURRENT)
- Duplex Gauge 2 (BATT. VOLTAGE / BATT. CURRENT)
- Indications Panel

The indications panel (located under the locomotive speed gauge) shows the status of some equipment. There are 24 indicators (listed below left to right, top to bottom).
When alarms are illuminated “Red” this indicates a fault (except unload indicator).
When alarms are illuminated “Green” this indicates a function or condition.

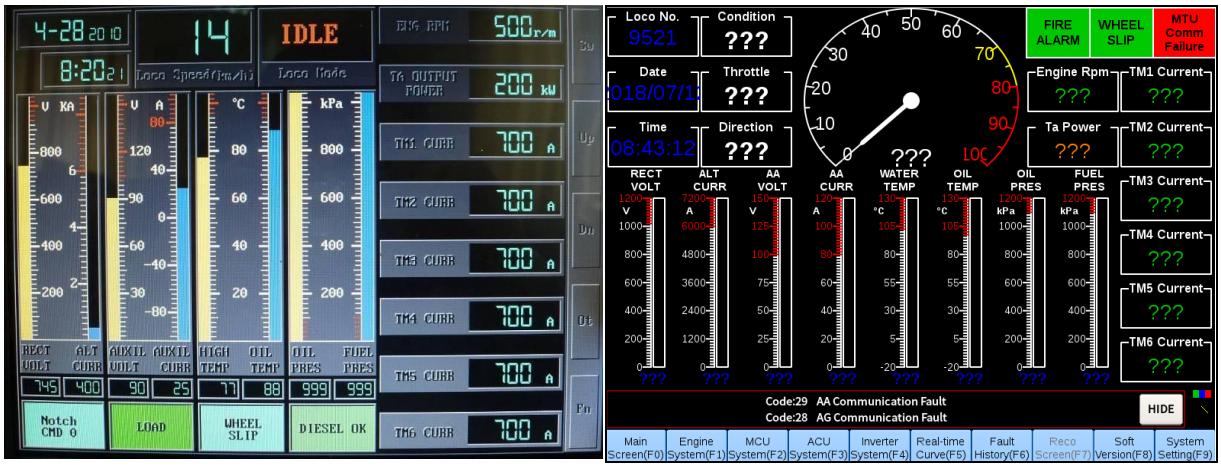
	Indicators	Function
1	**Unload Indicator:** **(Red)**	When the main alternator field contactor is closed the unload light will extinguish. This should normally occur when notch 1 is selected. It may not occur if safety interlocks such as the park brake are active.
2	**Main Overload Indicator:** **(Red)**	When current output from the main alternator is excessive, the Main Overcurrent Relay (MOCR) will trip and the light will illuminate. Driving amps will be lost. Follow instructions in Section 24.2 to reset.
3	**DBLR Fault Indicator:** **(Red)**	When the locomotive is under dynamic brake mode and the speed of the dynamic brake blower is lower than expected, dynamic brake effort will be lost and the DBLR fault light will illuminate.
4	**AG Grounding Indicator:** **(Red)**	When an earth fault occurs in the auxiliary generator circuit, the locomotive will be unloaded and light illuminated.
5	**Field Weakening** **(Green)**	Commonly referred to as the Field Shunt, this light will illuminate when field shunting is active. Field weakening becomes active when locomotive speed exceeds 56km/h and will be removed when locomotive speed reduces below 38km/h.
6	**Air Compressor** **(Green)**	This light will illuminate while the air compressor is loading during normal operation.
7	**Heated Windscreen Indicator:** **(Green)**	When the light is illuminated, it indicated the window heaters are operating.
8	**ESCA Indicator:** **(Red)**	When the light is illuminated, it indicates that an emergency or penalty brake has been triggered and brake pipe pressure has fallen below 390kPa. Reset as per instruction 13.5
9	**TRAIL 6-26 Indicator:** **LEAD or DEAD Indicator:** **TRAIL 6-24-26 Indicator:** **(Green)** **TRAIL 6-24-26 Indicator** **LEAD or DEAD Indicator** **(Red)**	One of these three indicators will be illuminated to show the status of the MU2A valve (located No.1 end cab, rear wall). One of these two indicators will be illuminated to show the locomotive status. Note: Only locomotives with the 26LA brake system will have these warning lights.

	Indicators	Function
10	**Fire Alarm Indicator: (Red)**	When the light illuminates, a buzzer will also sound indicating that a fire has been detected in the engine room.
11	**Cooling Fan No.1 Indicator: (Green)**	When the light is illuminated it indicates that cooling fan No.1 is operating.
12	**Cooling Fan No.2 Indicator: (Green)**	When the light is illuminated it indicates that cooling fan No.2 is operating.
13	**Wheel-slip Indicator: (Red)**	This indicator is now disabled
14	**Main Grounding Indicator: (Red)**	When the light is illuminated it indicates that a ground fault has occurred to the traction circuit and the main ground relay (MGR) has tripped. The locomotive will lose driving amps if this fault occurs. Follow instructions in Section 24.2 to reset.
15	**AA Over-volt Indicator: (Red)**	When the light illuminates it indicate the rectified output voltage of the auxiliary alternator is excessive and the Charging Over Voltage Relay (COVR) has tripped. Battery charging, air conditioning and 220V AC power will be unavailable whilst this fault is active. Follow instructions in Section 24.1 to reset.
16	**AG Over-volt Indicator: (Red)**	When the light illuminates it indicate the output voltage of the auxiliary generator is excessive and the Auxiliary Over Voltage Relay (AOVR) has tripped. Engine cooling fans, traction motor cooling fans and the air compressor will be unavailable whilst this fault is active. Follow instructions in Section 24.2 to reset.
17	**AG Overload Indicator: (Red)**	When the light illuminates it indicates the load of the auxiliary system has exceeded the setting point causing an auxiliary system failure.
18	**Low Water Indicator: (Red)**	When the light illuminates a buzzer will also sound indicating that the water level of the header tank is low. The tank must be re-filled above the minimum level before the light will extinguish. If water levels are dangerously low the engine may perform a self-protective shutdown. WARNING: The header tank is pressurized with hot water and gas near boiling temperatures during normal operation. Refilling should only be performed by trained staff.

	Indicators	Function
19	**Bogie BLWR Fault Indicator: (Red)**	When the light illuminates it indicates a bogie blower failure, as the speed of the traction motor blower is slower than required.
20	**Parking Brake Indicator: (Green)**	When the light illuminates it indicates the park brake has been applied. When the park brake is set to RELEASE there will be a time delay as the park brake releases before the indicator light extinguishes
21	**Alarm Bell Indicator: (Red)**	When the light illuminates it indicates one of the following failures: ➢ Traction Blower Failure ➢ Brake Blower Failure ➢ Low Water ➢ Fire Alarm ➢ Generator Field Grounding ➢ Generator Field Over Current ➢ Auxiliary Generator Over Voltage ➢ Auxiliary Over Current If there are locomotives in multiple, the fault may have occurred on the trailing locomotive.
22	**DB Warning Indicator: (Green)**	When the light illuminates it indicates the locomotive is in Dynamic Brake mode.
23	**Emergency Module Cut-Out**	When the light is illuminated it indicates that penalty brake has been isolated from the brake system, and any penalty brake activation will not apply the train brakes.
24	**Trail**	When the light illuminates it indicates the locomotive is set to trail mode. Note: Only locomotives with the CCBII-P brake system will have this light.

5.2 Visual Display Unit (VDU)

DL locomotives are fitted with a VDU in each cab. The function of the VDU is to display key operating parameters of the locomotive to the Locomotive Engineer. There are two models of VDU, both VDUs are capable of displaying the same information.



Early Model VDU (DL9008-DL9515) Late Model VDU (DL9521-DL9688)

Figure 5: VDU Screens

5.2.1 Early Model VDU User Instructions

The VDU will display locomotive parameters on the primary screen when the power switch is turned on

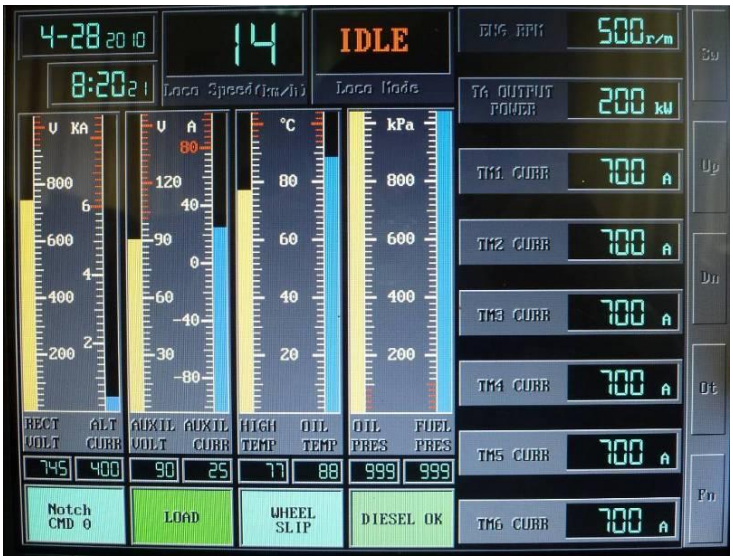


Figure 6: Early Model VDU Screen

The following information is always displayed on the primary screen:

- Rectifier Voltage
- Alternator Current
- Auxiliary Voltage (Battery charging voltage)
- Auxiliary Current (Battery charging current)
- High Temp (Coolant)
- Oil Temp
- Oil Pressure
- Fuel Pressure
- Loco mode (IDLE, MOTOR, BRAKE)
- Loco Speed
- Throttle Notch

Additional locomotive parameters can be displayed by Up (F2) and Dn (F3)

Page 1	**Page 2**	**Page 3**
ENG RPM	ENG RPM	ENG RPM
TA OUTPUT POWER	TA OUTPUT POWER	TA OUTPUT POWER
TM1 CURR	TM1 RPM	AUX GEN CURR
TM2 CURR	TM2 RPM	AUX GEN VOLT
TM3 CURR	TM3 RPM	BOGIE BLWR1 SPEED
TM4 CURR	TM4 RPM	BOGIE BLWR2 SPEED
TM5 CURR	TM5 RPM	LOW SPEED SET
TM6 CURR	TM6 RPM	XB TRAINLINE

The position and function of contactors and relays can be checked by pressing the Sw key (F1). There are three pages of contactor information available. The page visible can be changed by pressing Up (F2) and Dn (F3)

Page 1	**Page 2**	**Page 3**
TRACTION CMD	CYLINDER CNT	COOL FAN IN
DYN BRAKE CMD	MOTOR CUT OUT	DBLR FAULT
SELF LOAD CMD	THROTTLE A	LOW WATER
FORWARD	THROTTLE B	FIRE ALARM
REVERSE	THROTTLE C	MAIN GND
P1 NO	THROTTLE D	MAIN OVER CURR
P2 NO	LOW SPEED CMD	DB OVER VOLT
P3 NO	ENG SPEED SETUP	AC GND
P4 NO	CAB 1	AC OVER VOLT
P5 NO	DBC NO	AC OVER CURR
P6 NO	AGFC NO	WHEELSLFP
EFC NO	DGFC NO	FIELD WEAKENING

Engine and Invertor information is available by pressing the Ot key (F4). There are several pages of information available. The page visible can be changed by pressing Up (F2) and Dn (F3).

Page 1	Page 2	Page 3
Demand engine speed	Operation hours	High Temp Water DEGC
Actual engine speed	Limit override speed	Low Temp Water DEGC
Load	Limit T_Coolant warning	ENG RPM2
T_Oil	Limit T_Coolant alarm	CB1 RPM
T_Coolant	Limit P_Oil warning	CB2 RPM
P_Oil	Limit P_Oil alarm	PREHEAT TEMP
P_Charge air TL	Limit T_Oil warning	VDU Version
T_Charge air TL	Limit T_Oil alarm	MCU Version
T_Fuel	Limit T_Charge warning	ACU Version
P_Fuel	Limit T_Charge alarm	Timer

Fault Display

Locomotive System Faults

Locomotive faults will be displayed in the lower left corner of the VDU screen. Displayed faults should be recorded in the locomotive's 54D book, including the fault code number and the general locomotive setup and parameters.

Engine System Faults

Engine faults will be displayed on the lower right corner of the VDU. Serious engine issues will be displayed with a red coloured square, whilst minor faults will be displayed with a yellow square. Serious engine faults should be investigated before attempting an engine restart. Investigate engine faults by pressing F5 and then F4 twice.

IMPORTANT: Engine restart should not be attempted for "HI P-Crank Case" or "SS P-Crank Case L2" faults. Serious and irreversible damage to the engine can occur if a restart is attempted. Call for maintenance and a tow.

Secondary Display Mode

The Fn key (F5) is used to enter the secondary display mode. Secondary display mode is used to adjust screen brightness, review fault history and perform system maintenance.

Screen brightness

Screen brightness can be adjusted by pressing the function key Br (F1), then requesting the following brightness levels

- Dark F1
- Dim F2
- Light F3
- Bright F4

Press the "…" key (F5) to return to the previous display mode

Fault History

Fault history can be reviewed by pressing the function key XX (F3), then selecting current, previous locomotive system and previous engine system faults.

Maintenance Menu

Maintenance options are password protected, maintenance staff have access to this menu.

5.2.2 Late Model VDU User Instructions

The VDU will display locomotive parameters on the primary screen when the power switch is turned on

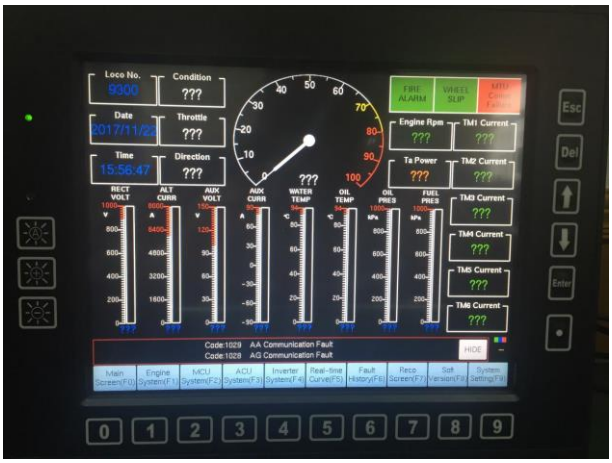


Figure 7: Late Model VDU Screen

The following information is always displayed on the primary screen:

- Rectifier Voltage
- Alternator Current
- Auxiliary Voltage (Battery charging voltage)
- Auxiliary Current (Battery charging current)
- High Temp (Coolant)
- Oil Temp
- Oil Pressure
- Fuel Pressure
- Loco mode (IDLE, MOTOR, BRAKE)
- Loco Speed
- Throttle Notch
- Engine RPM
- TA Power
- TM1-6 Current

Fault Display

Locomotive System Faults

Locomotive faults will be displayed on the bottom of the VDU screen. Displayed faults should be recorded in the locomotive's 54D book, including the fault code number and the general locomotive setup and parameters. Nuisance faults can be hidden. Locomotive faults can be investigated by pressing F6 then F1.

Engine System Faults
Engine faults will be displayed on the top right of the VDU. Serious engine issues will be displayed with a red coloured square, whilst minor faults will be displayed with a yellow square. Serious engine faults should be investigated before attempting an engine restart. Investigate engine faults by pressing F6 then F2 to reach the engine faults screen.

IMPORTANT: Engine restart should not be attempted for "HI P-Crank Case" or "SS P-Crank Case L2" faults. Serious and irreversible damage to the engine can occur if a restart is attempted. Call for maintenance and a tow.

Locomotive and engine parameters can be viewed by pressing the relevant number key at the bottom of the screen. Additional parameters can be viewed by using further number keys. Please refer to the on-screen selections available to view the additional parameters. To return to the main screen, please press the Esc button to the right of the screen.

Engine Parameters (F1)

PARM1 (F1)	PARM2 (F2)
Operation hours	Engine Running
Limit override speed	Cylinder Cut
Limit T_Coolant warning	External Stop
Limit T_Coolant alarm	Tumen Active
Limit P_Oil warning	Starter On
Limit P_Oil alarm	Start Active
Limit T_Oil warning	Automatic Stop
Limit T_Oil alarm	Power Reduction
Limit T_Charge warning	
Limit T_Charge alarm	
Engine(Jacket) Water Temp	
Demand engine speed	
Actual engine speed	
Load	
T_Oil	
T_Coolant	
P_Oil	
P_Charge air TL	
T_Charge air TL	
T_Fuel	
P_Fuel	
AfterCooler Water Temp	

MCU Parameters (F2)

Digital Signal1 (F1)	Digital Signal2 (F2)	Digital Signal3 (F3)	Analog Signal (F4)	Frequency Signal (F5)
Traction CMD	Cool Fan IN	Throttle D	Rect Volt	Eng RPM
Self CMD	Main Over Curr	Throttle C	Alt Curr	Loco Speed
Dyn Brake CMD	Main GND	Throttle B	TA Power	TM1 RPM
Field Weakening	AC Over Volt	Throttle A	XB Trainline	TM3 RPM
Cab 2	DBLR Fault	Eng Start CMD	TM1 Curr	TM5 RPM
Forward CMD	DC Over Volt	Motor Cutout	TM3 Curr	TM2 RPM
Reverse CMD	AC GND	Fire Alarm	TM5 Curr	TM4 RPM
Parking Brake	AC Over Curr	Low Water	Load Signal	TM6 RPM
DBC No FBK	AGFC No FBK	DGFC No FBK	DB Resistance	
EFC No FBK	P5 No FBK	P6 No FBK	Aux Volt	
Low Spd CMD	P3 No FBK	P4 No FBK	Aux Curr	
PB Cock	P1 No FBK	P2 No FBK	Loco Speed Ref	
			TB1 Speed	
			TB2 Speed	
			AA Volt	
			AA Curr	
			TM2 Curr	
			TM4 Curr	
			TM6 Curr	

ACU Parameters (F3)

Digital Signal1 (F1) Input	Digital Signal2 (F2) Input	Digital Signal3 (F3) Output	Digital Signal4 (F4) Output	Analog Signal (F5)
Eng Start	ESC No FBK	INV RDF1 Start	HFMC1 Control	Preheat set temp
Eng Shutdown	FPC No FBK	INV RDF2 Start	AirComp Start CMD	Engine Temp
Fire Monitor CB	IDLE Reset	INV COMP Start	Air Comp Unload	AfterCooler Temp
Auxi Over Curr	DGFC No FBK	INV RDF2 INC	Engine Start Alarm	Fuel Level
Air Comp Ready	RDF1 FBK	INV RDF2 DEC	AGFC Control	Engine Speed
Low Water	RDF2 FBK	INV RDF1 INC	Idle Shutdown Light	CF1 Speed
Preheat Enable	AirComp FBK	INV RDF1 DEC	FPC Control	CF2 Speed
Air Comp Hot	AGFC No FBK	Direct Drive	DGFC Control	TranzlogFB Status
LFMC1 No FBK		ESC Control		
LFMC2 No FBK		Idle Shut Alarm		
HFMC1 No FBK		Engine Shut NC		
HFMC2 No FBK		Preheat Alarm		
AirComp Manual		LFMC2 Control		
Tranzlog CB		HFMC2 Control		
Air Comp Run		LFMC1 Control		
Preheat Stop				

Inverter Parameters (F4)

CFL FAN1 Inv (F1)	CFL FAN2 Inv (F2)	Air Comp Inv (F3)
DC Bus Voltage	DC Bus Voltage	DC Bus Voltage
AC Output Voltage	AC Output Voltage	AC Output Voltage
AC Output Freq	AC Output Freq	AC Output Freq
AC Output A Curr	AC Output A Curr	AC Output A Curr
AC Output B Curr	AC Output B Curr	AC Output B Curr
AC Output C Curr	AC Output C Curr	AC Output C Curr
Temperature	Temperature	Temperature
Heartbeat	Heartbeat	Heartbeat
Hard Fault	Hard Fault	Hard Fault
Soft Fault	Soft Fault	Soft Fault
CCP CRO	CCP CRO	CCP CRO

Real-time Curve (F5)
Use of the real-time curve function is intended for maintenance staff, and is not required for operational staff.

Fault History (F6)
Fault history can be reviewed by pressing F6 from the primary screen. Faults with the locomotive system can be viewed by pressing F1 from the fault history screen. Faults with the engine can be viewed by pressing F2 from the fault history screen. All faults can be viewed by pressing F3.

Reco Interface (F7)
Use of the Reco Interface is intended for maintenance staff, and is not required for operational staff.

Soft Version (F8)
Use of the Soft Version is intended for maintenance staff, and is not required for operational staff.

System Setting (F9)
Use of the System Settings is intended for maintenance staff, and is password protected.

Screen Brightness
The brightness of the screen can be adjusted by pressing the “A”, “+” and “-“ keys available on the left of the screen. The “A” key toggles the adaptive mode, and will automatically adjust the screen brightness to match ambient light levels.

5.3 Switches

Situated on the front right-hand side of the driver's console, below the desk there are 4 switches (from top to bottom)

1. Window demister switch.

2. Remote Offline Control

3. Front wiper switch (five positions)
   - Washer
   - Off
   - Reset
   - Low
   - High

4. Rear wiper switch (inactive)

   Rear window wipers have been deleted, this switch is now inactive.

NOTE: Some locomotives may not have this switch.

Figure 8: Driver Console Right Under Desk Switches

Remote Offline Switch

These switches will be fitted to every DL in both cabs, and will be located under the brake stand, beside the window heater switch. DLs that have had the switches installed will have a notification sticker on the pillar between the two front windows for easy identification.

The switches have two positions and are accompanied by a blue LED light.
The light indicates whether the trail loco is set to Remote Offline or not.

Blue light 'On' in lead DL
The trail locomotive is Remote Offline. The trail locomotive will not respond when in power notches (will stay in idle) but will produce dynamic brake effort when in dynamic brake.

Blue light if 'Off' in lead DL
The trail locomotive is online as normal and will respond to power notches and dynamic brake commands.

Important: The blue light in the trailing locomotive (if fitted) must be off. If left on, the trail locomotive will remain offline, regardless of the switch position of the lead locomotive.

For the remote offline to work, only the lead locomotive needs the switches, and the remote offline will work with any class of locomotive trailing.

Use of switch
The switch can be used while the train is on the move, but the throttle **must** be in IDLE.

When crew changing, advise the relieving LE of the position of the switch.

Should trailing locomotives be no longer needed throughout a journey, the trail locomotive should be shut down to avoid excessive idling.

Use of the switch while using DAS
When using DAS, there is currently no option in the Loco Configuration screen to select Remote Offline so LEs are to leave the DAS set up for two locomotives online, even if the trail locomotive is set to Remote Offline.

In this setting note that DAS will be providing power advice based on the two locomotives working, when essentially the trail locomotive will be offline. In certain areas, LEs will need to leave the locomotive in power for longer to "catch up" to the advice.

If the trail locomotive is set to Remote Offline in the right areas, there will be no time lost against the train schedule, as one locomotive will be sufficient to provide power over the section.

5.4 Foot Switches

There are two foot switches under the control console. The left one is a horn switch (high tone only), and the right switch is a sanding switch.

The foot rest is adjustable by lifting the handle and repositioning to suit.

Figure 9: Foot Switches

5.5 Island Control Console

Figure 10: Drivers Console Overview

1. Control Panel
2. Horn Switch
3. Gauge Dimmer
4. Vigilance Button
5. Driver Controller

5.5.1 Control Panel

Figure 11: Driver's console switches

From left to right, and top to bottom

Button / Switch / Toggle	Function
Ditch light Flash Button	When pushed the Ditch Light flash for 20 seconds.
Low Speed Dial	Used to set the locomotive speed under the low speed mode. The set range is between 0.6 - 3 km/h, and is displayed on the digital display module on the main control console.
Air Comp. Button	Used to start and Stop the air compressor manually.
Sanding Button	Push and hold button to operate sanding when required.
Penalty Brake Reset Button	Push to reset, refer to instruction 13.4
Headlight Alert Reset Button	Select headlight in direction to cancel alert.
Signal Alert Reset Button	Push button to operate Signal Alert. Sets a countdown to an audible alarm at a predetermined distance.

Button / Switch / Toggle	Function
Air Conditioning Switches (2) (Mode / Speed)	**Mode switch** controls the working modes of the air conditioning (Cold, Cool, Off, Warm, Hot and Fan) **Speed switch** controlling the speed of the air conditioning.
Cab Light Toggle	Used to control the ceiling light in the cab (On / Off)
Tail Light Toggle	All, Front, Off and Rear (2 positions)
Coupler Light Toggle	On / Off
AUX. Light Toggle	Used to control the ladder and hood lights. There is a toggle switch in each cab, and a control button near each ladder (On / Off)
Parking Brake Toggle	Toggle switch which will apply and release the park brake (must be applied when leaving cab). The red cover above the parking brake toggle is to prevent Locomotive Engineers from switching the toggle by mistake.
Headlight Front Switch	Front headlight has 3 positions “Off”, “Dim” and “Bright”.
Headlight Rear Switch	Rear headlight has 3 positions “Off”, “Dim” and “Bright”.
HL / DL Selector Front Switch	Front headlight selector switch has 3 positions “Headlight”, “Ditchlight” and “All”.
HL / DL Selector Rear Switch	Rear headlight selector switch has 3 positions “Headlight”, “Ditchlight” and “All”.
LOCO. Control Toggle	Toggle switch to control if throttle and direction controls are active. Should be set to “On” when a throttle or direction setting is required. Should be set to “Off” when leaving the cab unattended.
Foot Heater Toggle	Used to control foot heater under main control console (On / Off)

5.5.2 Horn Switch

A horn switch is located on the left hand side of the island control console, and is used to control the horn device. There are two positions; high and low tone.

The horn is directional depending on the position of the reverser, if the reverser is in “0” the horn will sound from the last selected direction.

5.5.3 Gauge Dimmer

DL9008 – DL9515: Gauge dimmer dial to increase brightness, turn clockwise.
DL9521 – DL9688: Gauge dimmer button. To change the brightness, press the button.

5.5.4 Vigilance Button

Used to cancel vigilance alarm

5.5.5 Driver Controller (DRC)

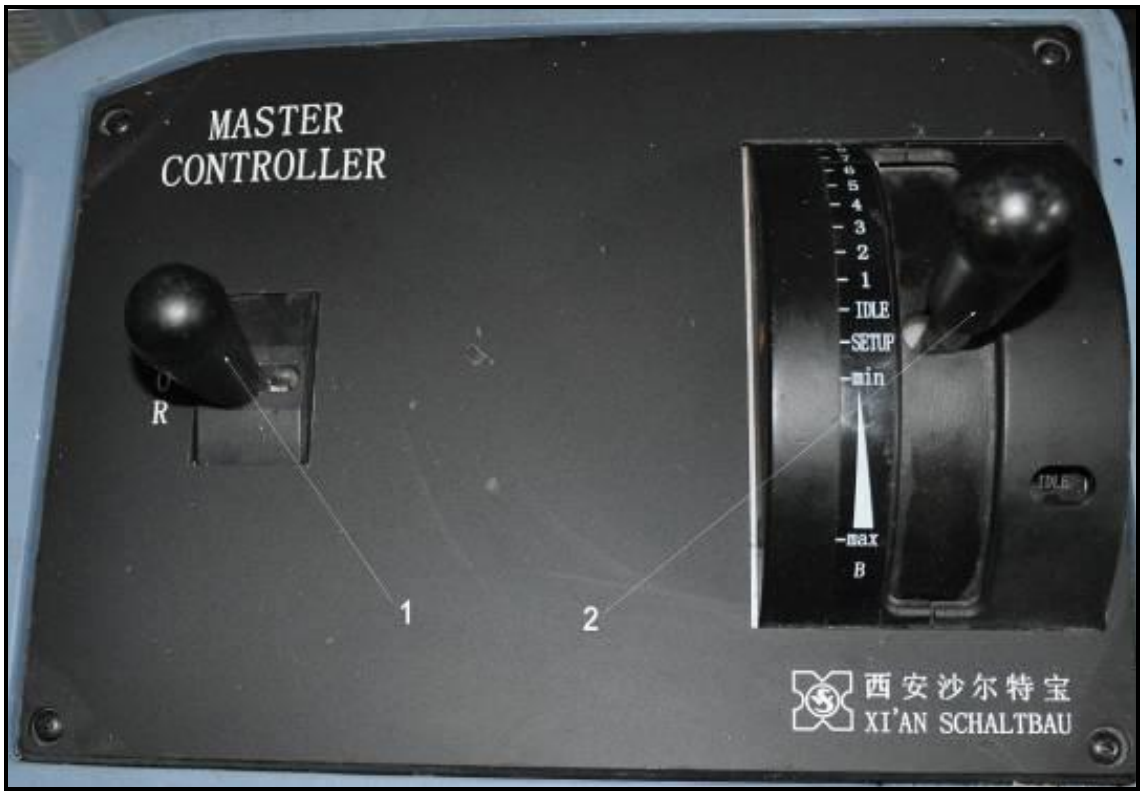


Figure 12: Driver Controller

The driver controller is fitted with a reverser handle and master handle (throttle).

1. The reverser handle has three positions:

   "Forward", "Neutral" and "Reverse" The direction of the locomotive is selected with this lever to the "Forward" or "Reverse" position.

   The reverser can be removed from the controller when the lever is in "Neutral", the throttle is in "Idle" and the selector lever is in "Off". The reverser must be removed from all non-operating cabs when working in multiple, shut down, or towing dead and placed in the portable radio cabinet (No.2 end cab).

   IMPORTANT: Reverser direction must not be changed when the locomotive is moving. Serious damage to traction motors can occur.

2. The throttle has the following positions:

N1 – N8	Operating positions
IDLE	Idle position
SETUP	Setup position for dynamic brake
MIN – MAX	Dynamic brake positions

To gain tractive power, N1 must be selected and tractive amps obtained before moving to a higher notch. Locomotive engineers should ensure that tractive amps are stable and wheelslip is controlled before selecting a higher notch.

The throttle and reverser are mechanically interlocked; the reverser must be in “Forward” or “Reverse” before the throttle can be moved from the “Idle” position. And oppositely, the throttle must be in the “Idle” position before the reverser can change its position.

Throttle movements are electrically interlocked to prevent excessive current through the contactors when transitioning from power to dynamic brake and vice versa. Quick changes between power and dynamic brake will result in a maximum 5 second delay when moving from power to dynamic, to allow traction current to decay to an acceptable level. A similar delay can occur during a quick movement from dynamic brake to power.

Locomotive engineers should wait 3 seconds in the setup position, before moving to dynamic or power, to ensure that transition delays are consistent and predictable.

5.6 Instrument Panel No.1 End Cab

There is an instrument panel on the rear wall of each cab. Buttons and switches related to the normal service are the same in both ends.

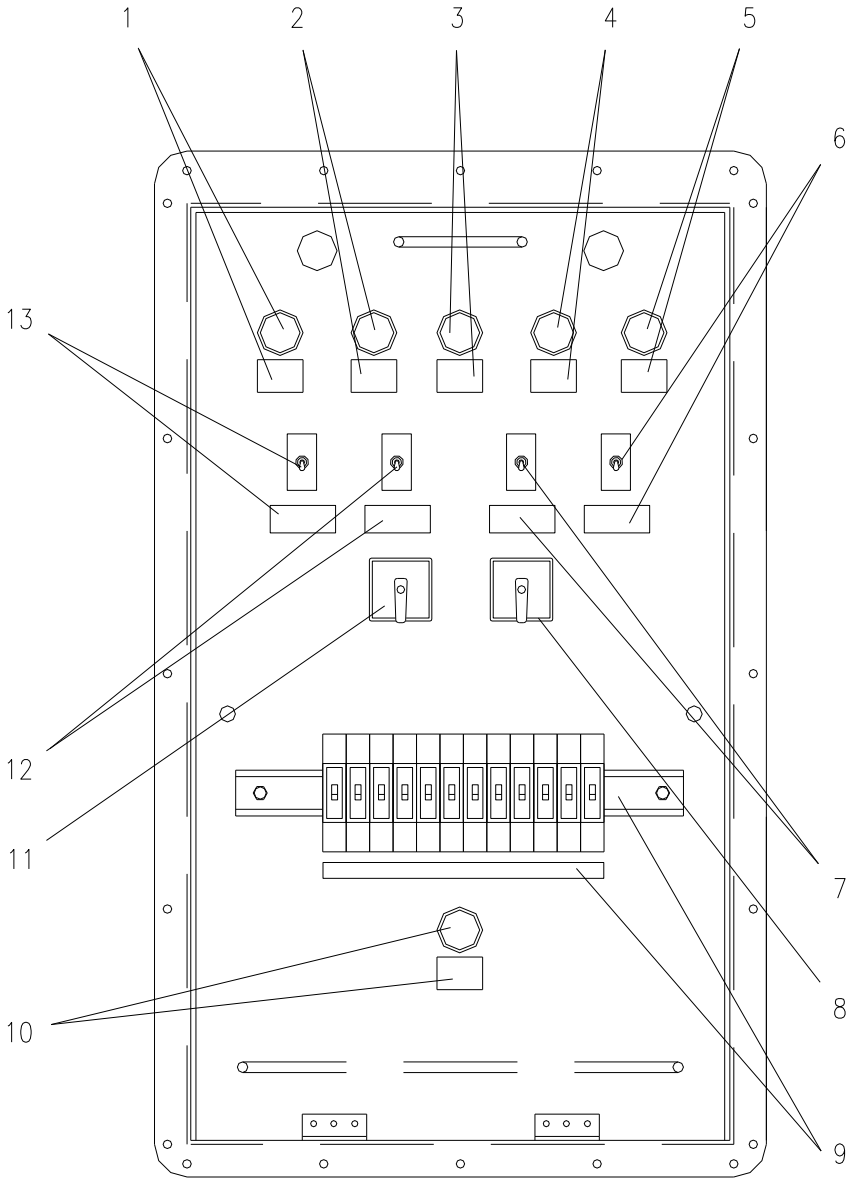


Figure 13: No.1 Cab Instrument Panel Layout

1	Pre-Heat Enable Button / Extended Idle Shutdown On Light	**8**	General Switch
2	Engine Start Emergency Button	**9**	Circuit Breakers
3	Engine Stop Emergency Button	**10**	Deleted
4	Engine Start Button	**11**	Low Speed Switch
5	Engine Stop Button	**12**	DC / AC Switch
6	Electrical Cabinet Light Switch	**13**	Fault Reset Switch
7	Hood Light Switch	**14**	Spare (Gen 2 & 2.2 DL's only)

Figure 14: No.1 Cab Instrument Panel

5.6.1 Pre-heat Enable Button / Extended Idle Shutdown

Pre-heat functionality and Extended Idle Shutdown have been disabled.

5.6.2 Engine Start Emergency Button

Lift latch and push / release button. The fuel pump may need to be manually engaged via the fuel pump switch in Cab II.

NOTE: Must only be used to start the engine if the “Engine Start Button” has failed to operate.

5.6.3 Engine Stop Emergency Button

A self-lock press button used to stop the engine.
This will override all systems and will stop the engine immediately in the case of an emergency. To reset, twist anticlockwise until the button springs back to the normal position. The BKS will need to be opened and closed to ensure an engine restart.

5.6.4 Engine Start Button

Press / release button to start engine.
The engine management system will control the start-up sequence.

NOTE: You will hear a contact click in the electrical room and a short time later an alarm will sound indicating the engine is about to start.

5.6.5 Engine Stop Button

Lift latch and press / release button to stop engine.

5.6.6 Fault Reset Button

Used to reset locomotive faults

5.6.7 DC / AC Switch

Switch operates the 74V DC / 220V AC inverter power supply. When the auxiliary alternator is operating, cab comforts such as the jug and microwave operated by the 220V AC can be operated.

NOTE: A reverser handle must be engaged into the receptacle in order to ensure 220V AC power is available in the cab in use.

DL9521 – DL9688 will NOT have this switch

5.6.8 Hood Light Switch

Used to turn on / off underframe lights, works in conjunction with switch in No.2 cab end

5.6.9 Electrical Cabinet Light Switch

Used to control cabinet lights

5.6.10 Low Speed Switch

The Low Speed Switch activates the automatic regulation of tractive effort to sustain constant locomotive speed. It also activates the low speed speedo, which is far more accurate than the normal speedo below 5 km/h. The Low Speed Switch has two positions.

- Normal: Tractive effort is directly related to the throttle notch selected. Low speed speedo is inactive.
- Low: Tractive effort is regulated to match the low speed set-point selected via the low speed dial. Low speed digital speedo is active, displaying accurate speed below 5 km/h.

Further info on the use of the low speed function is available in Section 8.2

5.6.11 General Control Switch

The General Control Switch disables all driver control switches. It should normally be set to “ON” in both cabs.

5.6.12 Circuit Breakers

In order from left to right:

1. Master Controller CB
2. Loco Control CB
3. AA Excitation CB
4. AG Excitation CB
5. Windscreen CB
6. FM / CD CB
7. Cab Lights CB
8. Wheel Flange CB
9. DAS CB (DL9521 – DL9688 only)

5.6.13 Download Port

Tranzlog download port may be found in either the Cab I portable radio cabinet or the under the Cab I desk

5.7 Instrument Panel in No.2 End Cab

The instrument panel in the No.2 end cab is mainly trouble shooting and operating switches. In addition to the switches / button on the No.1 end cab:

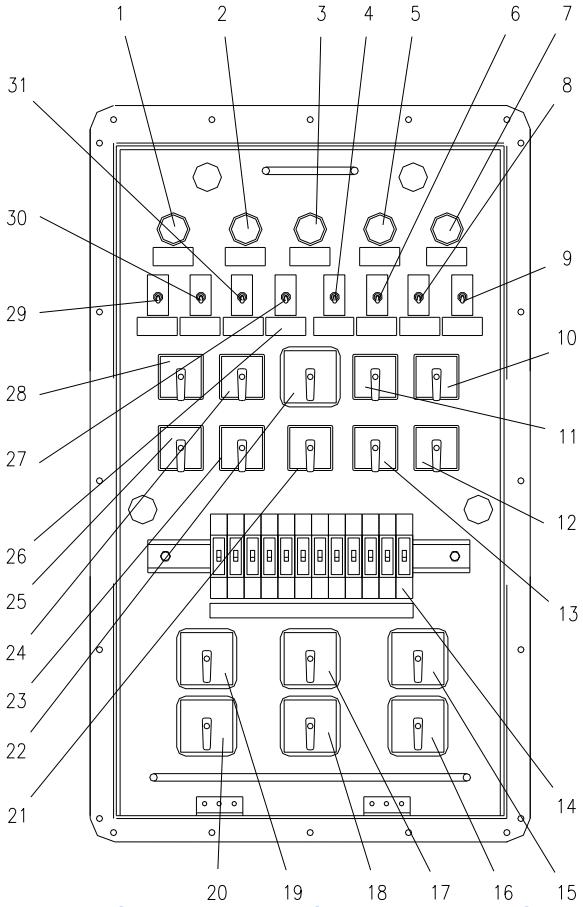


Figure 15: No.2 Cab Instrument Panel

1	Pre-Heat Enable Button (DL9008 – DL9423) Extended Idle Shutdown Button (DL9446 – DL9515)	**16**	AA Field Switch
		17	Lighting Switch
2	Engine Start Emergency Button	**18**	EXC. FIELD Switch
3	Engine Stop Emergency Button	**19**	EXC. FIELS Mode Switch
4	AG Excitation Switch	**20**	AG FIELD Switch
5	Engine Start Button	**21**	TM4 Isolation Switch
6	Spare Switch (DL9008 – DL9204) Computer Reset Switch (DL9210 – DL9515)	**22**	General Control Switch
7	Engine Stop Button	**23**	TM3 Isolation Switch
8	Hood Light Switch	**24**	Low Speed Switch
9	Electrical Cabinet Light Switch	**25**	TM2 Isolation Switch
10	TM1 Isolation Switch	**26**	Deleted
11	Loco Isolation Switch	**27**	AA EXCITATION Switch
12	TM6 Isolation Switch	**28**	Grounding Switch
13	TM5 Isolation Switch	**29**	Fault Reset Switch
14	Circuit Breakers Assembly	**30**	DC / AC Switch
15	Headlight Control Switch	**31**	Fuel Pump Switch

NOTE: Please refer to labels on panel, as switch locations may differ.

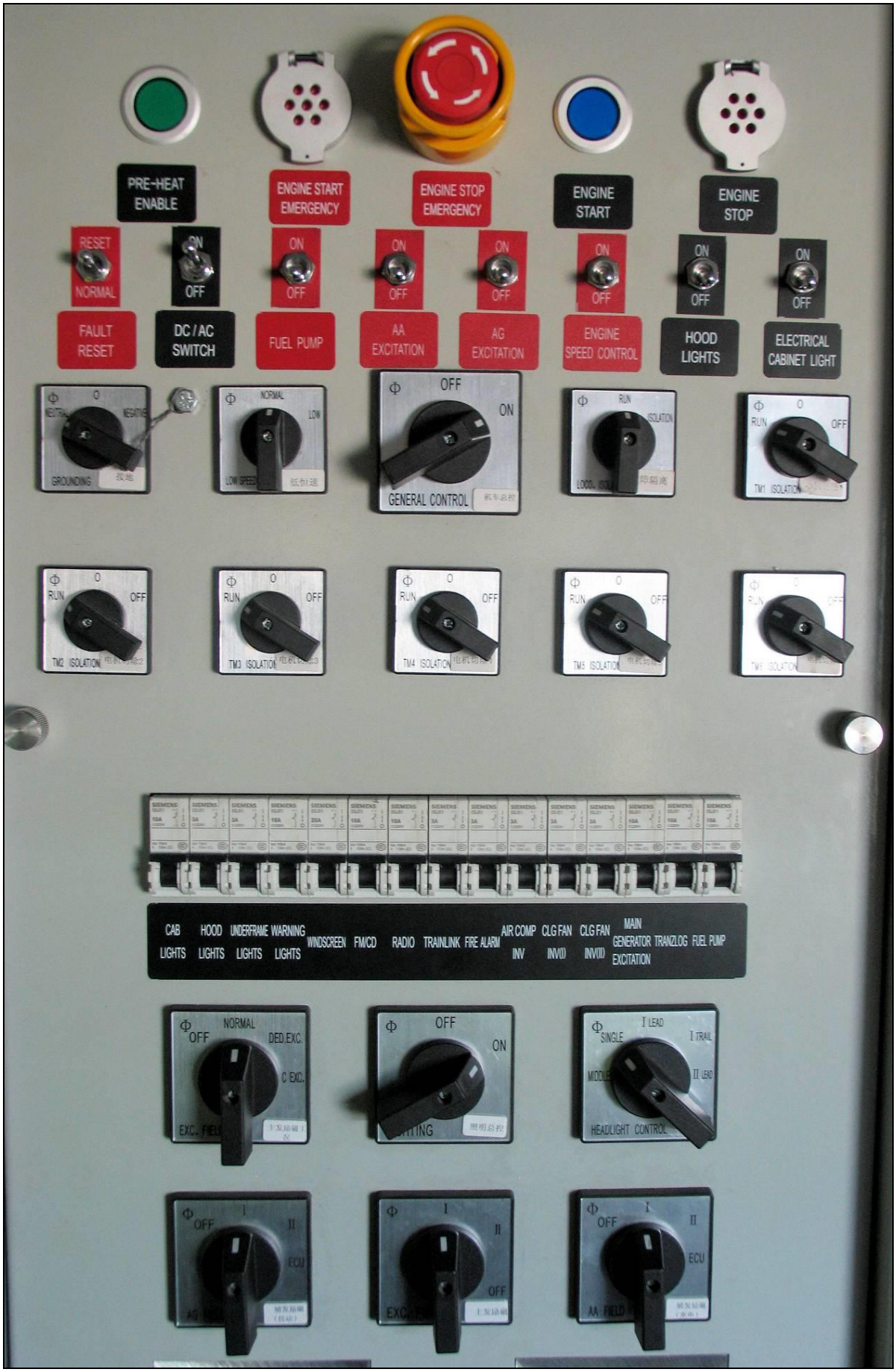


Figure 16: No.2 End Cab Instrument Panel

5.7.1 Pre-heat Enable Button / Extended Idle Shutdown Button

Pre-Heat Enable Button
(DL9008 – DL9423)
This button is disabled and currently has no functionality.

Extended Idle Shutdown Button
(DL9521 – DL9688)
This button is disabled and currently has no functionality.

5.7.2 Engine Start Emergency Button

The Emergency Start Emergency button is used to start the engine only if a normal engine start is not possible. Fuel pump switch must be set to “ON” throughout the start-up cycle. A computer reset must be performed via the computer reset switch following start-up to ensure that the battery charges correctly.

NOTE: Must only be used to start the engine if the “Engine Start Button” has failed to operate.

5.7.3 Engine Stop Emergency Button

A self-lock press button used to stop the engine.
This will override all systems and will stop the engine immediately in the case of an emergency. To reset twist anticlockwise, until the button springs back to the normal position. BKS will need to be opened and closed to ensure an engine restart.

5.7.4 Engine Start Button

Press, hold, and release button to start engine.
The engine management system will control start up sequence. Fuel pump and starter motor control will be automatically carried out.

NOTE: You will hear a contact click in the electrical room and a short time later an alarm will sound indicating the engine is about to start.

5.7.5 Engine Stop Button

Lift latch and press / release the button to stop engine.

5.7.6 Fault Reset Switch

Used to reset locomotive faults

5.7.7 DC / AC Switch

Switch operates the 74V DC / 220V AC inverter power supply. When the auxiliary generator is operating, cab comforts such as the jug and microwave operated by the 220V AC can be operated.

NOTE: A reverser handle must be engaged into the receptacle in order to ensure 220V AC power is available in the cab in use.

Some DL’s may not have this switch.

5.7.8 Fuel Pump Switch

The Fuel Pump Switch manually controls the operation of the fuel pump. It is not required for a normal engine start, as fuel pump operation is automatically controlled. When an emergency engine start is required the Fuel Pump switch must be set to “ON” to prime the fuel system. Once the engine is started the Fuel Pump switch should then be set to “OFF” (the engine has internal fuel pumps which are used when the engine is running).

5.7.9 AA Excitation Switch

The AA Excitation switch manually controls the AA field contactor (AAFC). It should normally be set to “OFF”, as the locomotive computer will automatically control the position of the contactor.

5.7.10 AG Excitation Switch

The AG Excitation switch manually controls the AG field contactor (AGFC). It should normally be set to “OFF”, as the locomotive computer will automatically control the position of the contactor.

5.7.11 Spare Switch / Computer Reset Switch

Computer Reset Switch
Normal position is “On”
If a full computer system reset is required (of the MCU, ACU and VDU), hold the switch in the “Off” position for five seconds before returning to the “On” position

Figure 17: Computer Reset Switch

5.7.12 Hood Light Switch

Used to turn off / on underframe lights, works in conjunction with switch in No.2 cab end

5.7.13 Electrical Cabinet Light Switch

Used to control cabinet lights

5.7.14 Grounding Switch

This switch has 3 positions
"Off", "Neutral" and "Negative"
This switch is used by maintenance personnel for diagnostic purposes.
For normal operation this switch must remain in the "Neutral" position.

5.7.15 Low Speed Switch

The Low Speed Switch activates the automatic regulation of tractive effort to sustain constant locomotive speed. It also activates the low speed speedo, which is more accurate than the normal speedo below 5 km/h. The Low Speed Switch has two positions.

- Normal: Tractive effort is directly related to the throttle notch selected. Low speed speedo is inactive.
- Low: Tractive effort is regulated to match the low speed set-point selected via the low speed dial. Low speed digital speedo is active, displaying accurate speed below 5 km/h.

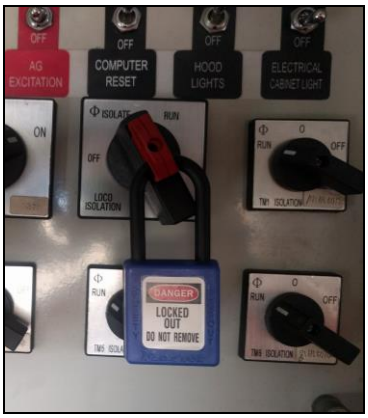
Further info on the use of the low speed function is available in Section 8.2

5.7.16 General Control Switch

The General Control Switch disables all driver control switches. It should normally be set to "ON" in both cabs.

5.7.17 Loco Isolation Switch

Isolation Switch – OFF



Isolation Switch - ISOLATE

Isolation Switch - RUN

Figure 18: Isolation Switch Positions

This lockable switch has a red insert where a padlock can be placed to prevent movement of the switch.
The switch has three positions.

OFF – lockable	Inhibits starting and excitation (driving amps)
ISOLATE – lockable	Inhibits excitation (driving amps), allows starting
RUN – non lockable	Normal running

Locomotives with a padlock attached to the isolation switch must only have the padlock removed by the “maintenance person in charge”.

5.7.18 TM1-6 Isolation Switches

There are six individual traction motor isolation switches on the No.2 end instrument panel. When a traction motor fails the corresponding switch can be used to isolate that traction motor. There will need to be a load reduction of 10% when a traction motor is isolated.

No more than two traction motors should be cut out at any time.

NOTE: Traction Motor isolation is not to be used to assist in low speed handling. Low speed control should be used. Refer to Section 8.2 for more information.

Each isolation switch has three positions:

RUN	Traction motor is connected to the traction circuit.
O	Intermediate position, locomotive tractive effort will be disabled.
OFF	Traction motor is isolated from the traction circuit

5.7.19 Circuit Breakers

In order from left to right:

1. Cab Light CB
2. Hood Light CB
3. Underframe Light CB
4. Warning Lights CB
5. Windscreen CB
6. FM / CD CB
7. Radio
8. Trainlink CB
9. Fire Alarm CB
10. Air Comp. INV CB
11. CLG FAN INV (I) CB
12. CLG FAN INV (II) CB
13. Main Generator Excitation CB
14. Tranzlog CB
15. Fuel Pump CB

5.7.20 EXC Field Mode Switch

The EXC. Field mode switch allows limited “get home” functionality when the locomotive control system has failed. The EXC. Field mode switch has 4 positions:

- OFF: Main Alternator Excitation is disabled. No tractive effort will be available
- NORMAL: Main Alternator Excitation is controlled via the locomotive control system.
- DED.EXC: This function has now been deleted.
- C EXC: Resistor excitation position, used when the locomotive control system has completely failed. If excitation cannot be obtained with either control board 1 or control board 2, this position puts the locomotive into manual excitation controlled by the throttle. Reduced tractive effort will be available in N2, 4, 6 and 8. This function is disabled on locomotives with fire suppression fitted.

NOTE: Some DL’s will not have this switch.

5.7.21 Lighting Switch

The lighting switch allows most internal and external lights to be isolated, including cab lights, headlights and ditchlights. The Lighting Switch has two positions:

- ON: All lights can be switched on
- OFF: Most internal and external lights are disabled. Walkway and Hood lights are still available.

5.7.22 Headlight Control Switch

The headlight control switch allows headlight and ditchlight function to be correctly controlled when operating the locomotive as part of a multiple unit consist. The Headlight Control Switch had six positions:

- MIDDLE: The locomotive is the middle locomotive in the consist.
- SINGLE: The locomotive is the only locomotive in the consist.
- I LEAD: Cab I of the locomotive leads the consist.
- I TRAIL: Cab I of the trailing locomotive is coupled to the other locomotives.
- II LEAD: Cab II of the locomotive leads the consist.
- II TRAIL: Cab II of the trailing locomotive is coupled to the other locomotives.

	Cab I Headlights / Ditchlights	Cab II Headlights / Ditchlights
MIDDLE	Disabled	Disabled
SINGLE	Enabled	Enabled
I LEAD	Enabled	Disabled
I TRAIL	Disabled	Enabled
II LEAD	Disabled	Enabled
II TRAIL	Enabled	Disabled

The Headlight control switch must be correctly set for all locomotives in the consist.

5.7.23 AG FIELD Switch

The AG Field Switch switches between the primary and secondary MCU of the Auxiliary Generator (AG) field control. It also allows limited “get home” functionality if both the primary and secondary MCU fail. The AG Field switch has four positions.

- I: The primary MCU card is used for regulation of the AG field
- OFF: Both primary and secondary MCU cards are disabled
- II: The secondary MCU card is used for regulation of the AG field
- ECU: If AG regulation cannot be achieved with either the primary or secondary MCU card, the ECU can be used to get the locomotive home.

If the AG field switch is required to be shifted from the I position, please write a detailed 54D booking to allow the fault to be rectified.

5.7.24 EXC. FIELD Switch

The EXC. Field Switch switches between the primary and secondary MCU of the exciter (EXC) field control. The EXC field controls the tractive effort and wheelslip of the locomotive. The EXC. Field switch has three positions

- I: The primary MCU card is used for regulation of the EXC. Field
- OFF: Both primary and secondary MCU cards are disabled
- II: The secondary MCU card is used for regulation of the EXC. Field

If the EXC. Field switch is required to be shifted from the I position, please write a detailed 54D booking to allow the fault to be rectified.

5.7.25 AA Field Switch

The AA Field Switch switches between the primary and secondary MCU of the Auxiliary Alternator (AA) field control. It also allows limited “get home” functionality if both the primary and secondary MCU fail. The AA field switch has three positions:

- I: The primary MCU card is used for regulation of the AA field
- OFF: Both primary and secondary MCU cards are disabled
- II: The secondary MCU card is used for regulation of the AA field.

If the AA Field switch is required to be shifted from the I position, please write a detailed 54D booking to allow the fault to be rectified.

5.8 Emergency Brake Button

Figure 19: Emergency Brake Button

An emergency brake button is located on the side wall of the cab. Pressing the emergency brake button will trigger a penalty brake.

To reset, turn anti-clockwise till button pops out and perform an ECSA reset (refer Section 13.5 for more information).

5.9 Other Operating Devices in the Cab

Assistant Horn Push Button
A push button is available to trigger the horn from the assistant side of the locomotive cab.

Water Pump Push Button
Press the water pump to turn the cab water pump on 30 seconds. The pump will automatically turn off after 30 seconds.

Radiant Heater Switch
A radiant heater is available in each cab. Note: The radiant heater is only available when the engine is switched on.

5.10 Air Conditioning System

Air conditioning is available to warm, cool and dehumidify cab air. Control switches for the air conditioning system are available on the control console.

NOTE: Air conditioning is only available when the engine is switched on.

6.0 PRE START PROCEDURES

6.1 Cab Inspection

Ensure that the park brake is applied.
Check the Loco 54D repair book that all repairs have been carried out.
Ensure that all brake equipment is correctly set up in all cabs.

6.2 Ground Inspection

Check:

- Drawgear, Westinghouse hoses, springs, cowcatchers.
- That jumper socket covers are closed and dummies are on hoses.
- That all operating cocks are correctly positioned and that couplings are properly made between coupled locomotives.
- Cooling air flexible ducts and electric cables to traction motors.
- Sand boxes are full.
- Ensure all air reservoir drain cocks are closed.
- Diesel level in tank.
- Brake blocks
- There are no loose or dragging parts.

6.3 General Inspection

Check:

- Oil levels in the diesel engine, transmission gearbox and compressor.
- Water level in header tank.

  HAZARD WARNING: Checks may only be made with the engine shut down.

- All cocks and buttons are correctly positioned.
- Jumper cables are on each end of the locomotive.
- All breakdown and spare equipment including fire extinguishers intact.

While doing the checks watch for fuel oil, water and oil leaks and remove any material from the engine room that may be a fire hazard.

7.0 START UP PROCEDURES

7.1 Before Starting

- Close the BKS (No.2 end cab)
- All necessary CB's are in the "On" position.
- Verify "General Control" (Instrument panel No.2 end) switch is in the "On" position".
- Check the "Loco Control" switch on the control panel is in the "Off" position, and "Park Brake" switch is in the "Apply" position.
- Check reverser handle is on position "O", and throttle is on position "Idle"
- **26LA Brake System Locos Only:** For lead or single operation the MU2A valve (located in No.1 cab back wall) should be in the "Lead" or "Dead" position (check indicator light on panel to confirm).
- In non-driving cab, check brake valve handle positions:
  - **26LA Brake System Locos Only:** Cut-out valve is in the "Cut-out" position.
  - **CCBII-P Brake System Locos Only:** Brake model selector switch set to "TRAIL"
  - Automatic brake valve is in the "Handle Off" position.
  - Independent brake valve is in the "Release" position.
- In the driving cab, check brake valve handle positions:
  - **26LA Brake System Locos Only:** Cut-out valve is in the "Cut-in" position.
  - **CCBII-P Brake System Locos Only:** Brake model selector switch set to "FRT/PASS"
  - Automatic brake valve is in the "Release" position.
  - Independent brake valve is in the "Applied" position.

7.2 To Start

NOTE: Preferred start-up is from the No.2 cab

During the start-up cycle the locomotive control system will automatically control the priming fuel pump and starter motors. To start the locomotive the following process should be followed.

- Check that all engine bay doors are closed to ensure that no staff are at risk of rotating machinery
- Check the Locomotive Isolation Switch is in RUN
- Press, hold, and release the Engine Start Button
- An alarm will sound in the engine bay
- The priming fuel pump will automatically be engaged. Fuel pressure should be between 100kPa and 200kPa
- Up to thirty seconds after the Engine Start Button is pressed the starter motors should engage and crank the engine until self-sustaining combustion is achieved.

7.3 After Starting

Once the engine has been started the locomotive will take an additional thirty seconds to complete automatic start-up tasks. Several auxiliary systems, including battery charging and the air compressor, may operate during this time. A number of checks should be carried out to ensure that the locomotive has completed the start-up tasks and will operate normally.

- Auxiliary voltage on the VDU should be approximately 74V, and Auxiliary current should be higher than 3A. Auxiliary current may be significantly higher than 3A, especially if the locomotive has been on battery power for some time.
- The air compressor should come on if the main reservoir pressure is below 875kPa and run until main reservoir pressure exceeds 950kPa
- Fuel pressure should exceed 600kPa.
- Oil Pressure should exceed 260kPa.
- Engine speed should be stable at idle, at 600RPM

7.4 Before Moving Locomotive

Prior to moving the locomotive checks should be carried out to ensure that the locomotive can be operated safely.

- Main Reservoir pressure is above 875kPa
- ESCA light is extinguished
- Perform a brake pipe leakage test
- Check application of the independent brake
- Release park brake. Check park brake light extinguishes after about five seconds.
- Set headlights on for the direction of travel

7.5 Moving Locomotive – Single Unit Operation

- Loco. Isolation Switch in No.2 End Cab Instrument panel is set to RUN
- Loco control switch on the control console of the driving cab is in the ON position
- Reverser is moved to the direction of travel
- Throttle is set to notch 1. Verify that MOTOR is set as the loco mode on the VDU and that tractive amps are developed. Approximately 200A per motor are expected in notch 1 at low speed.
- If the locomotive does not move, verify brake settings and increase the notch selected.
- Perform a Half-Wheel test as soon as possible.

7.6 Starting Engines, Multiple Units

When starting the engines of locomotives coupled in multiple, proceed as follows

- Check the mechanical, pneumatic and electrical couplings are securely made between locos in the consist.
- Ensure all park brake switches are set to APPLIED
- Ensure that all driver's console Loco control switches are set to OFF
- Close the BKS on each loco to be started
- Press, hold and release the Engine Start button on each locomotive
- Perform the after start checks as documented in Section 7.3
- Ensure the Loco. Isolation switch is set to RUN

7.7 Coupling Up for Multiple Unit Working

When making and breaking electrical couplers, the couplers must be handled carefully so as to avoid damage to them. Careful selection of switches and valve positions is required to ensure safe operation.

- Bring the locomotives together and make the mechanical coupling
- Ensure the park brake switch in all cabs are set to APPLIED
- Set all driver's console Loco control switches are set to OFF
- Set up the brake equipment on all locomotives as per the Rail Operating Code, Section 4.1.
- Couple up the air hoses and open the taps.
- Place the reverser handle of the trailing locomotives in the portable radio cabinet (No. 2 end)
- Set the Headlight Control switch (located in the No.2 cab) in all locomotives to the appropriate position (refer Section 5.7.22 for more information)
- Check the pins of the jumper cable plug and receptacle for damage and cleanliness
- Insert the jumper cable into the active plugs for each locomotive (the yellow plug is active, the red plug is a dummy and is disabled). The receptacle cover should latch into the plug indent.
- Ensure all Loco. Isolation switches are set to RUN
- If the trail locomotive is running and is fitted with Remote Offline switches, ensure the blue light in the trailing locomotive is off.

NOTE: If the DL locomotive is not the lead locomotive, the park brake must be released from the cab of the trailing DL locomotive.

7.8 Multiple Unit Jumper Test

After coupling up in multiple, test the jumper connection, as follows

- Check headlights operate in both forward and reverse.
- Release IBV, check brakes release on all units, apply ABV, check the brakes apply on all units, release ABV and check that all brakes have released. Apply IBV
- Check operation of the sanders, in both forward and reverse
- On the leading locomotive, select ISOLATION on the Loco. Isolation switch. Also ensure the Remote Offline light is off.
- Ensure the Remote Offline light is off.
- Release park brake and IBV, select forward and advance throttle to notch 1 (rear locos should push). Reapply IBV.
- Release park brake and IBV, select reverse and advance throttle to notch 2 (rear locos should pull). Reapply IBV and select RUN on the Loco. Isolation switch of the leading locomotive.

7.9 Changing Driving Cabs

- When the locomotives have being brought to a stand with throttle lever in “Idle”, place reverser in “Neutral”.
- Apply park brake.
- Turn Loco Control switch “Off.”
- Turn all Headlight switches “Off.”
- Remove reverser and portable radio (required for use in the other cab).
- Turn off other switches on the island control stand not required.
- Ensure the Remote Offline light is off in the trailing locomotive.
- Set up brakes as per Rail Operating Code, Section 4.1
- Proceed to opposite cab and turn on relevant switches required for operation.
- Place reverser in controller and portable radio in holder.
- Set up brakes as per Rail Operating Code, Section 4.1
- Leave isolation switch in “Run” (No.2 end cab)
- Test vigilance device, brake valves in all positions, sand in both directions, horn and headlights.
- Release park brake.
- Ensure locomotive moves in response to throttle.
- Half wheel test.

7.10 Isolating a Unit When Working in Multiple

When working in multiple and it becomes necessary to isolate a unit.

Lead Unit:

- Place the isolation switch to “isolation”.
- Open the main generator excitation circuit breaker No.2 cab.
- Leave the BKS “Closed”
- Operate the controls as for normal operation to control the trail units.

Remote offline of trail locomotive.

- Ensure the throttle is in idle (can be done while train is moving)
- To offline the trail locomotive, change the Remote Offline switch so that the blue light illuminates. The trail locomotive will now not respond to throttle commands (stays in idle) but will respond to Dynamic Brake commands.
- If the trail locomotive is needed again for power, while in idle, move the switch so that the blue light goes off. Trail locomotive will now be back online.

Trail Unit:

- Follow the procedure for setting up units for towing dead (Refer Instruction 23.0)

7.11 Headlight Control Switch

This switch is located in the No.2 cab only and permits the headlights of the rear unit to be controlled from the lead unit.

The position of the switch depends on which cabs the jumper cable is connected to / from.

7.12 Test Runs Set Up

To set up a trail DL so that it may be operated in Dynamic brake with the brake set up protection modification and the lead locomotive in power:

- Jumper cable out
- Couple BP only. MR and EP hoses remain uncoupled.
- **On 26LA equipped locos only:** MU2A set to Lead & BVCO set to “Out”.
- **On CCBII-P equipped locos only:** BMSS set to “Out”
- Automatic brake set to “Handle Off”.
- Independent brake released
- Park brake released

The trail locomotive will be able to be operated in dynamic brake while the lead locomotive is powering in this situation

NOTE: All braking control for the consist will need to be done using the Automatic brake on the Lead locomotive.
The Independent brake is only operative on each individual locomotive

8.0 OPERATING

8.1 Throttle

This lever when placed in notch one sets up the circuit for the excitation of the main generator.

The range is 600rpm (idle) to 1800rpm (maximum).
Each running notch, after notch one, increases the speed of the engine in increments.
The throttle should be open or closed one notch at a time in normal operation, but may be closed completely in one motion in an emergency.

The maximum authorised speed of a DL class locomotive is 80 km/h.

The road overspeed warning has been set at 90 km/h.

8.2 Low Speed Control

This feature provides automatic control of tractive effort to ensure a stable speed set between 0.6 to 3 km/h. The speed is controlled by a rheostat (low speed dial) placed on the island control console.

The locomotive speed set point can be seen via the Low Speed Set information available on the VDU. The Set speed is in metres/hour.

This feature can be used for low speed operation e.g. discharge / loading / work trains etc.

To operate:

- Turn on the “Low Speed Switch” which is located on the instrument panel.
- Set the reverser in the direction of travel.
- Place the throttle in notch 1 or higher depending on the load.
- Use rheostat dial on the island control stand.
- Dial speed required noted in the digital speed display.

Low speed control may be used in any notch position but N1 is normally acceptable for all low speed trains. Locomotive Engineers should be mindful that Low Speed Control is only capable of adjusting tractive effort, and cannot slow the train via dynamic or pneumatic brake. Low-speed control of trains running downhill should be performed by the LE with pneumatic brakes. It is useful to keep the locomotive in Low-speed mode but with the throttle set to idle when the train is running downhill, as the low-speed speedo will still be available.

The low speed device is also train-lined to operate on trailing DL units.

8.3 Dynamic Brake

To operate the dynamic brake:

- The reverser must be positioned in the direction of travel.
- The throttle must be in “Idle”.
- Move the throttle lever to “Set-up”, then to minimum. The locomotive control system will set the various contactors and relays up for operation of dynamic brake.
- On the indications panel the DB Warning Light will illuminate to indicate that DB has been selected.
- This partially establishes the braking circuit and depending on the speed of the train may bunch up the slack.
- After the slack is bunched, the throttle lever may be advanced to strengthen the braking effort to that required and at the same time the rpm of the engine will increase as the throttle is moved beyond the minimum position.
- The braking amps are automatically limited by the dynamic brake regulator regardless of the throttle position or locomotive speed.
- If maximum braking is required, the throttle should be moved slowly to the maximum position to prevent a sudden surge of current to the grid. Generally, if the throttle is moved slowly, the brake regulator will limit the current without a brake warning light. If the brake light does indicate then the throttle is not to be advanced further until the light goes out. If the light continually comes on, then the throttle must be backed off to a point where the light stays extinguished.
- If necessary the train brakes may be used in conjunction with dynamic braking however independent brake is not available with dynamic brake.
- Braking effort will peak at around 35 km/h, and will reduce as locomotive speed increases or decreases away from 35 km/h.

8.3.1 Wheel Slip in Dynamic Brake

Automatic sanding will occur if wheel slip is detected. If sanding does not occur then the throttle must be backed off until the wheel slip is corrected and the wheel slip light extinguished.

9.0 SHUT DOWN PROCEDURE

9.1 Shutting Engine Down

- Apply air and park brake.
- On control console, throttle in “Idle” and reverser centred.
- Push ‘engine stop’ button (on rear instrument panel).
- Once the engine has stopped move the BKS to the “OPEN” position to ensure that the locomotive batteries do not run flat.

10.0 DIESEL ENGINE

The locomotive is powered by an MTU 20V4000R43 engine. It is furnished with two 32V DC starter motors in series connection. The engine is fully integrated with oil pump, fuel pump, water pump, air filter, oil filter as well as fuel filter.

Rated speed of the diesel engine is 1800 rpm, idle speed is 600 rpm, and rated power is 2700kW.

The engine is coupled with a main alternator via a resilient coupling and together installed on a common base and mounted on the locomotive via 8 rubber mounts.

Engine operating parameters, such as speed, and coolant and oil temperature can be viewed on the VDU.

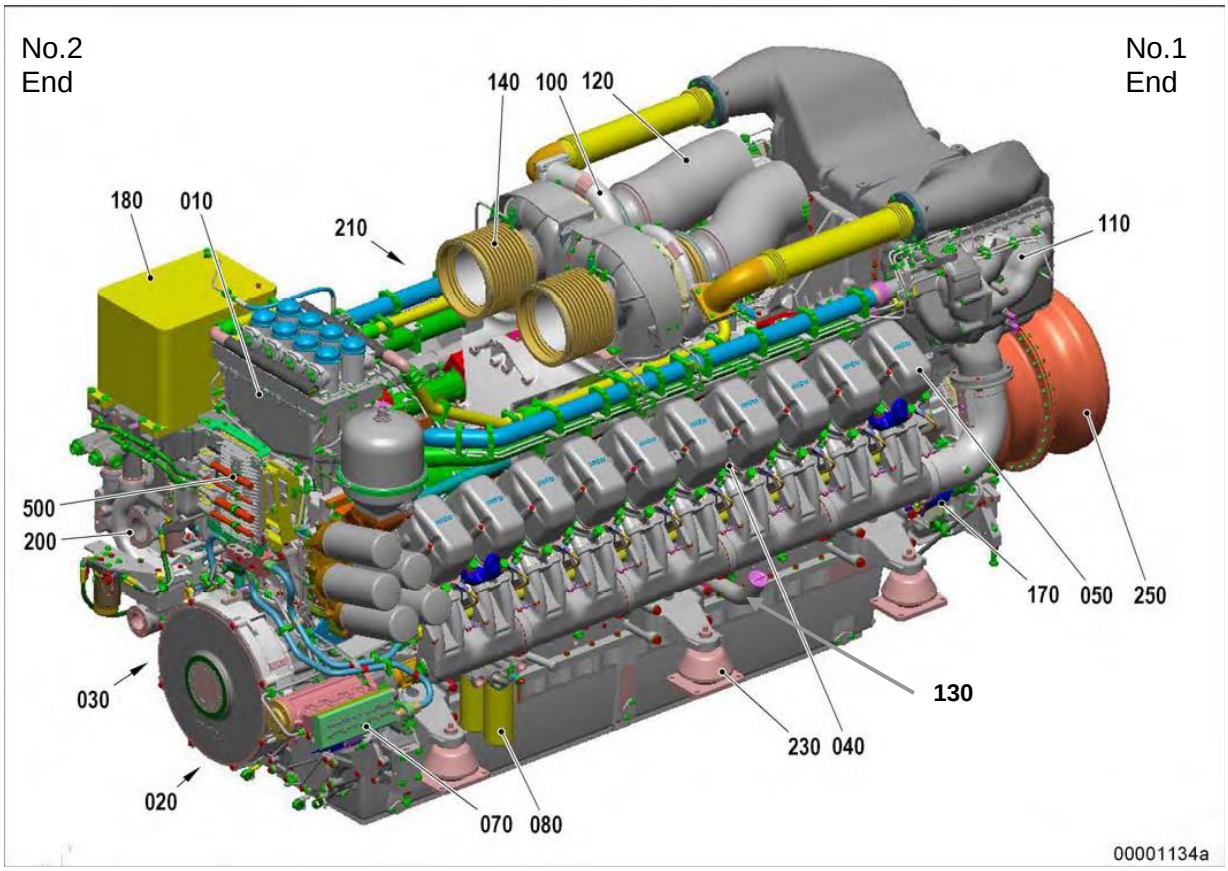


Figure 20: Engine Layout

010	Crankcase and add-on compartment	130	Oil Filler and Dipstick
020	Gear Train	140	Exhaust System
030	Crank Drive	170	Starting Equipment
040	Cylinder Head	180	Lube Oil System / Lube Oil Circuit
050	Valve Gear	200	Coolant System
070	Fuel System (High pressure)	210	Power Supply
080	Fuel System (Low pressure)	230	Mounting / Support
100	Exhaust Turbocharger	250	PTO Systems, Driving End and Free End (Coupling)
110	Intercooler	500	Monitoring and Control Systems, General Electrical Systems
120	Air Intake / Air Supply		

10.1 Cooling System

The locomotive cooling system is two separate high and low temperature pressurised water circuits. The cooling water circuits share one water tank. Two large radiators are provided for heat dissipation of cooling water and two electrically-driven cooling fans are provided for cooling the radiators. Control of fan speed is automatically controlled by the locomotive control system. Fan speed will vary to match cooling demand and control coolant temperatures.

The cooling system contains an inhibitor which under normal conditions is coloured green.

The inhibitor has three functions:

1. To give a visual readout of external leakage by the coloured incrustation being visible at the leakage area.
2. To inhibit the corrosion of bare metal within the cooling system by excluding oxygen.
3. By the water turning black / grey colour when an exhaust gas leak enters the cooling system.

The minimum acceptable level of the header tank is above the minimum fill level. The level of the tank may change as the coolant warms or cools down.

HAZARD WARNING: Hot Liquid
The header tank is pressurized with hot water and gas near boiling temperatures during normal operation. Refilling should only be performed by trained staff

Figure 21: Header Tank

10.2 Traction Motor Blowers

The locomotive is provided with front and rear blowers driven by AC electric motors. The front blower is for cooling the three traction motors on the front bogie and the main rectifier unit. The rear blower is for cooling the three traction motors on the rear bogies.

10.3 Transmission System

The mechanical transmission system is composed of a cardan shaft, gearbox etc. The gearbox is driven by a cardan shaft at the engine output end via an elastic coupling. The gearbox has two output ends by which an auxiliary alternator and an auxiliary exciter generator are driven respectively via elastic ring couplings. Rotating components are hidden by safety covers.

Figure 22: Transmission System

11.0 AIR SYSTEM

11.1 Air Filters

There are 6 paper filters on each side of the locomotive above the auxiliary generator and auxiliary alternator. These paper filters are used to filter the air intake for the main diesel engine.

Figure 23: Engine Air Filters

11.2 Engine Bay Extractor Fans

There are two extractor fans placed high in the car body on each side above the main alternator.
These fans extract hot air from the engine room and should be active if the engine is active.

11.2 Compressor

Two types of air compressor are fitted to DL class locomotives. Most Gen I DLs have a Knorr VV-450 compressor. The VV-450 compressor is a reciprocating compressor which is electrically driven and automatically controlled by the locomotive control system.
The VV-450 will not normally run continuously. When running, the VV-450 will operate at a fixed speed regardless of engine speed.

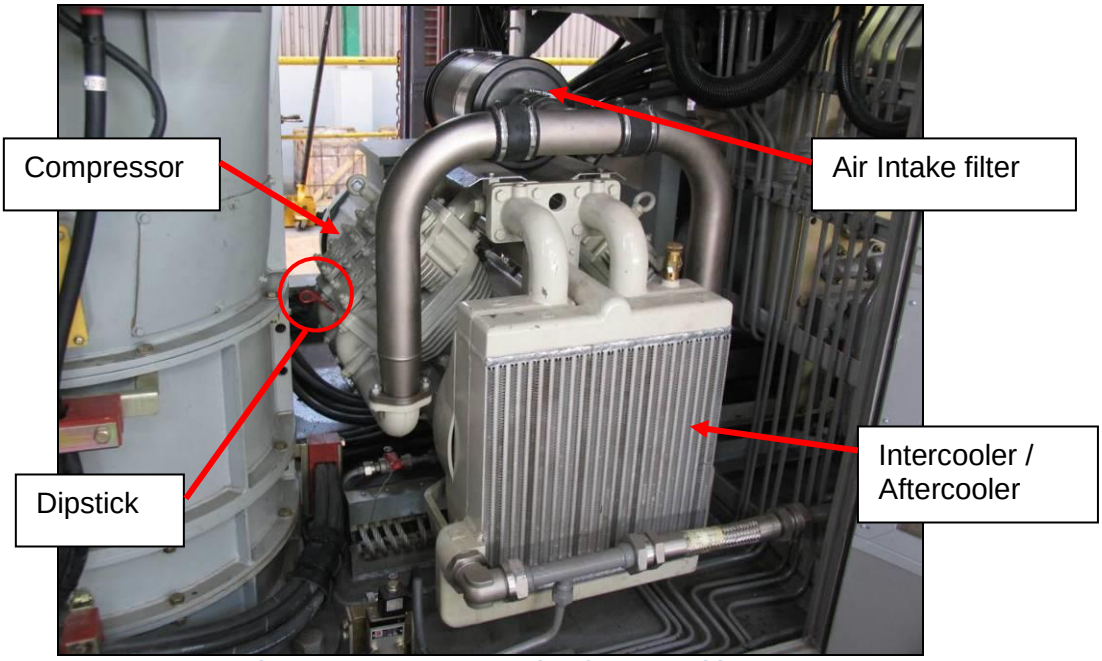


Figure 24: Knorr VV-450 view from "A" side

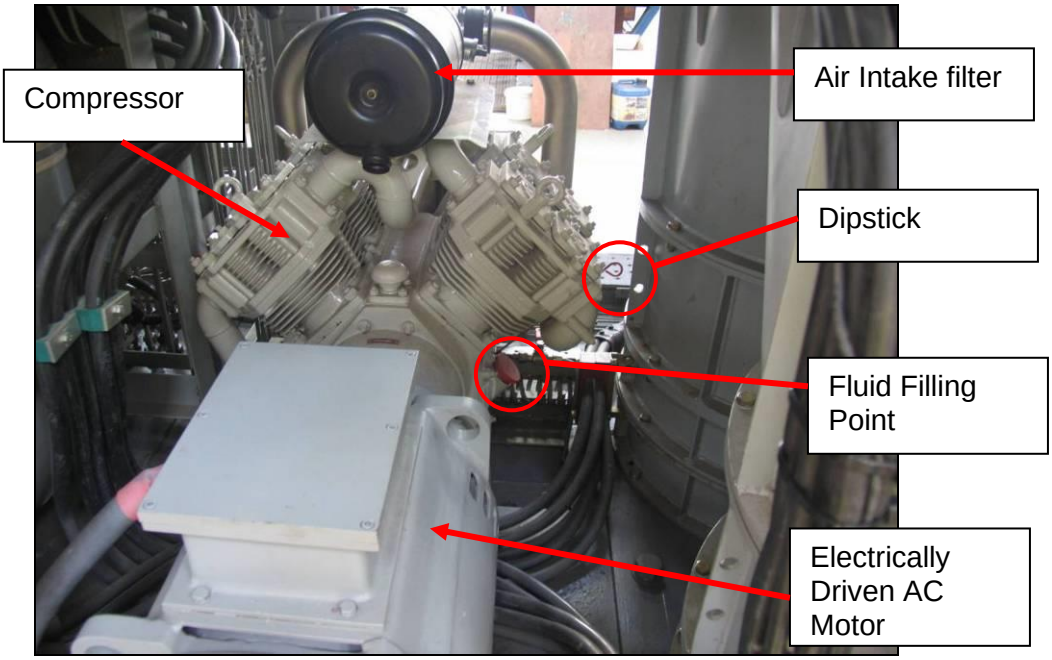


Figure 25: Knorr VV-450 view from "B" side

All Gen II and later DLs and some Gen I DLs have an Atlas Copco GAR-30 air compressor. The GAR-30 is an electrically driven screw compressor. It is designed to feed brake systems and other pneumatic appliances of trains with compressed air. It is automatically controlled by the locomotive control system. The GAR-30 will not normally run continuously. When running, the GAR-30 will run at a fixed speed regardless of engine speed.

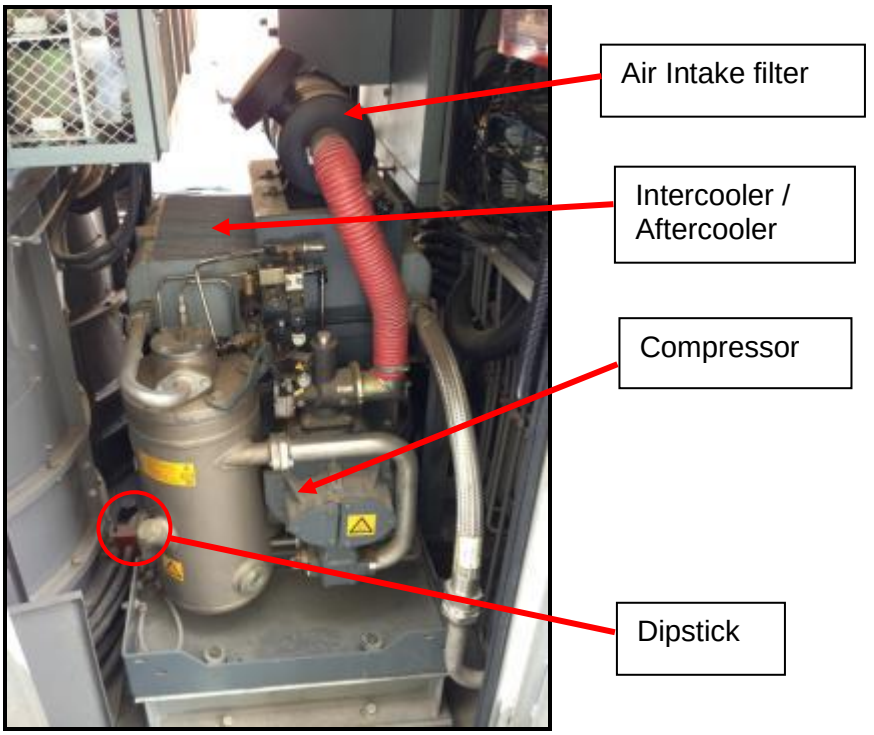


Figure 26: Atlas Copco GAR-30 view from "A" side

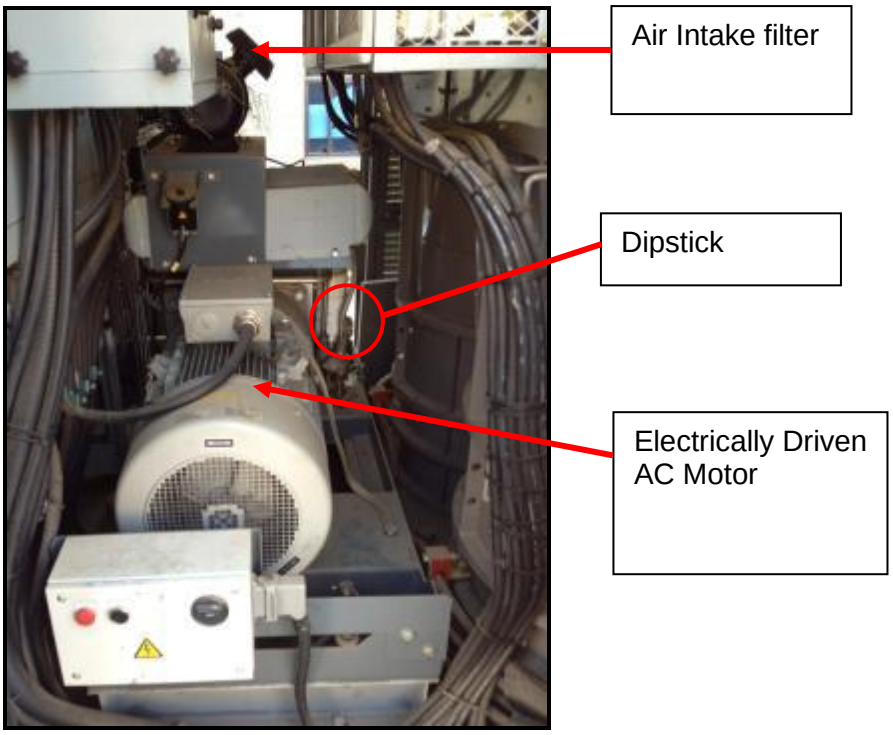


Figure 27: Atlas Copco GAR-30 view from "B" side

11.3 Main Reservoir

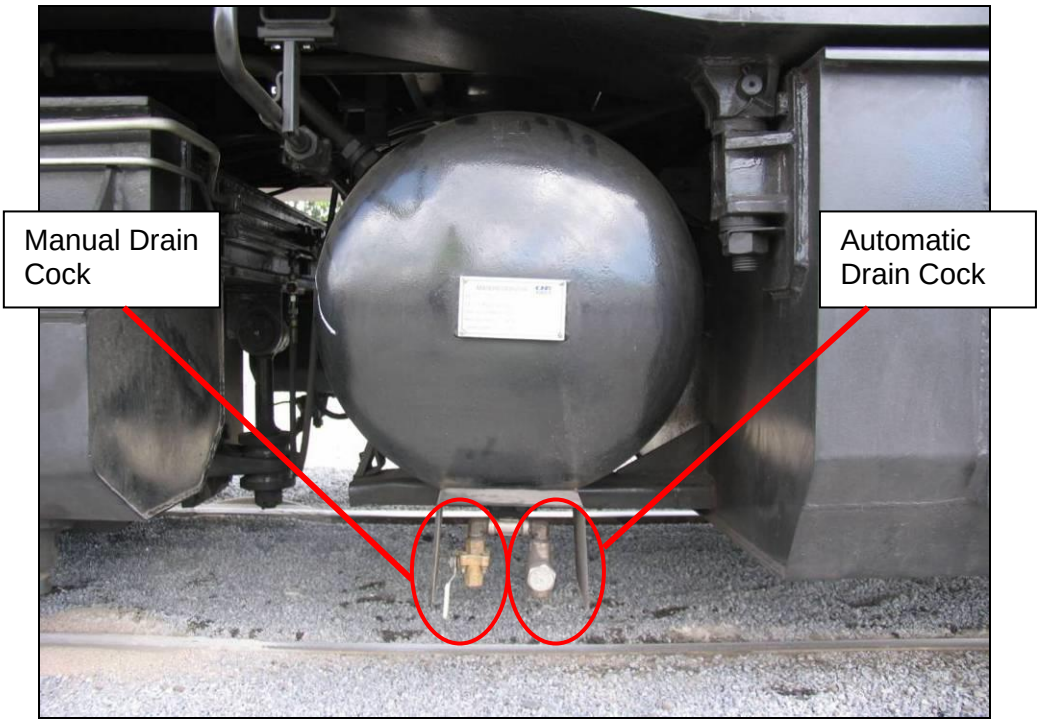


Figure 28: No.1 Main Reservoir

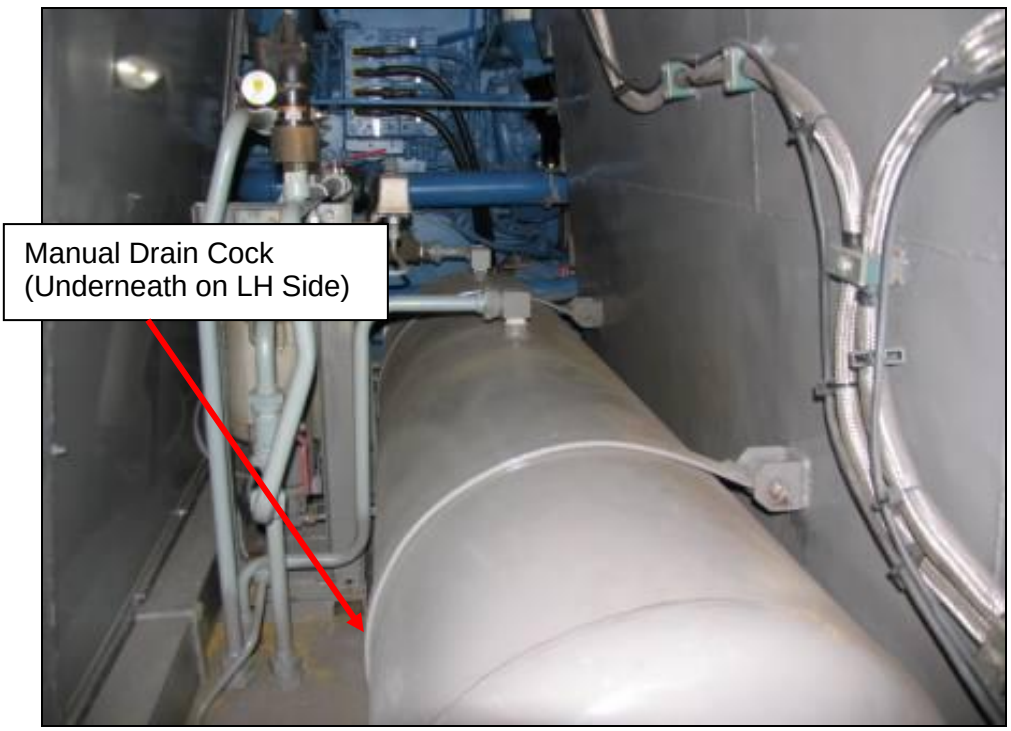


Figure 29: No.2 Main Reservoir

12.0 ELECTRICAL

12.1 Traction Circuit

The locomotive adopts an AC / DC electrical transmission system. The main alternator generates 3-phase AC current, and can normally generate maximum power of around 2,400kW. Field current for the main alternator is supplied by the exciter generator. Main alternator power, current, and voltage are regulated by the locomotive control system to match locomotive speed, engine performance and throttle commands.

AC output current from the main alternator is rectified into DC power for the traction circuit. The traction circuit comprises six traction motors connected in parallel, reversing switches and BKT switches for dynamic braking. Each traction motor can be individually isolated by the traction motor isolation switches available on the Cab II instrument panel. Each traction motor is series excited, with a single stage of field weakening. Field weakening is applied when locomotive speed exceeds 56 km/h, and will be removed when locomotive speed drops below 38 km/h.

Ground fault detection is provided for the entire high voltage circuit. Damage to traction motors may cause a ground fault. When a ground fault is detected, tractive effort will not be available. Locomotive Engineers should use a process of elimination to determine where the ground fault is located and to isolate the damaged section. More information on how to carry out this process is available in Section 24.2

Dynamic braking changes the traction circuit to provide electrically generated braking effort. BKT switches are used to connect each traction motor with the dynamic brake grid. BKT switches are not designed to change position with power applied. Timing interlocks are used to prevent BKT switches from moving with power applied. Locomotive engineers should ensure they wait approximately five seconds when moving from power to dynamic brake.

Energy generated from each traction motor is fed into the dynamic brake grids and turned into heat. Cooling fans keep each dynamic grid within temperature limits. Faults in the dynamic brake grid such as inadequate fan speed or excessive current will result in a reduction or shut-down of the dynamic brake system. Locomotive engineers will have to revert to pneumatic braking if the dynamic brake system shuts down.

Maintenance staff are able to test the traction system by self-loading the main alternator output against the dynamic brake grid.

12.2 Auxiliary Circuit

The locomotive has a number of auxiliary systems that assist in the safe running of the locomotive. The auxiliary circuit powers many of the auxiliary systems on the locomotive, such as the air compressor, engine cooling fans and traction motor blowers. The auxiliary generator (AG) provides up to 275kW of power in notch 8. Auxiliary generator voltage and power are regulated by the locomotive control system to match engine speed and auxiliary system power demands.

AC output current from the auxiliary generator is directly provided to two traction motor blowers and two engine room blower fans. Traction motor blowers and engine room blowers will increase speed as engine speed increases.

AC output current from the auxiliary generator is also rectified into DC power for the three power inverters. Each power inverter provides variable frequency AC output to either an engine cooling fan or the air compressor. Output frequency of the cooling fan power inverters is controlled to regulate engine coolant temperature. Cooling fan speed will change to match cooling demand. If a cooling fan power inverter fails, the locomotive control system will kick the cooling fan to direct drive. Direct drive allows limited “get home” functionality when a cooling fan inverter fails, however engine coolant will be overcooled, which can eventually cause engine damage.

Output frequency of the air compressor power inverter will be controlled to 50Hz to ensure reliable operation of the air compressor. The air compressor power inverter does not have a direct drive mode available. Failure of the air compressor power inverter will require a tow.

12.3 Low Voltage Circuit

Low voltage 74V DC power is provided for a variety of core locomotive functions and additional features. The DC circuit is split into core and non-core systems. Non-core systems will not be provided with power if the engine and battery charger are not running. Core systems receive battery power and should always function when the BKS is closed.

Core Systems

- Locomotive control system
- Engine control system
- Cab lights
- Headlight and ditchlights
- Fuel Pump
- Engine starter motors
- VHF/UHF radios
- Tranzlog
- E-protect
- DAS

Non-core systems

- Battery charging
- Air conditioning
- Cab heaters
- Equipment blower motor
- 220VAC cab power
- Cab comfort features (microwave, jug, etc)

The Auxiliary Alternator (AA) provides rectified DC power to charge the battery and power non-core systems. The AA can provide up to 26kVA at a nominal 74V. Output voltage of the AA is regulated by the locomotive control system to ensure stable output voltage.

12.1 Main Electrical Cabinet

The main electrical cabinet is located in Cab I behind the rear cab door. The main electrical cabinet has all of the contactors for the traction circuit, as well as various protection relays.

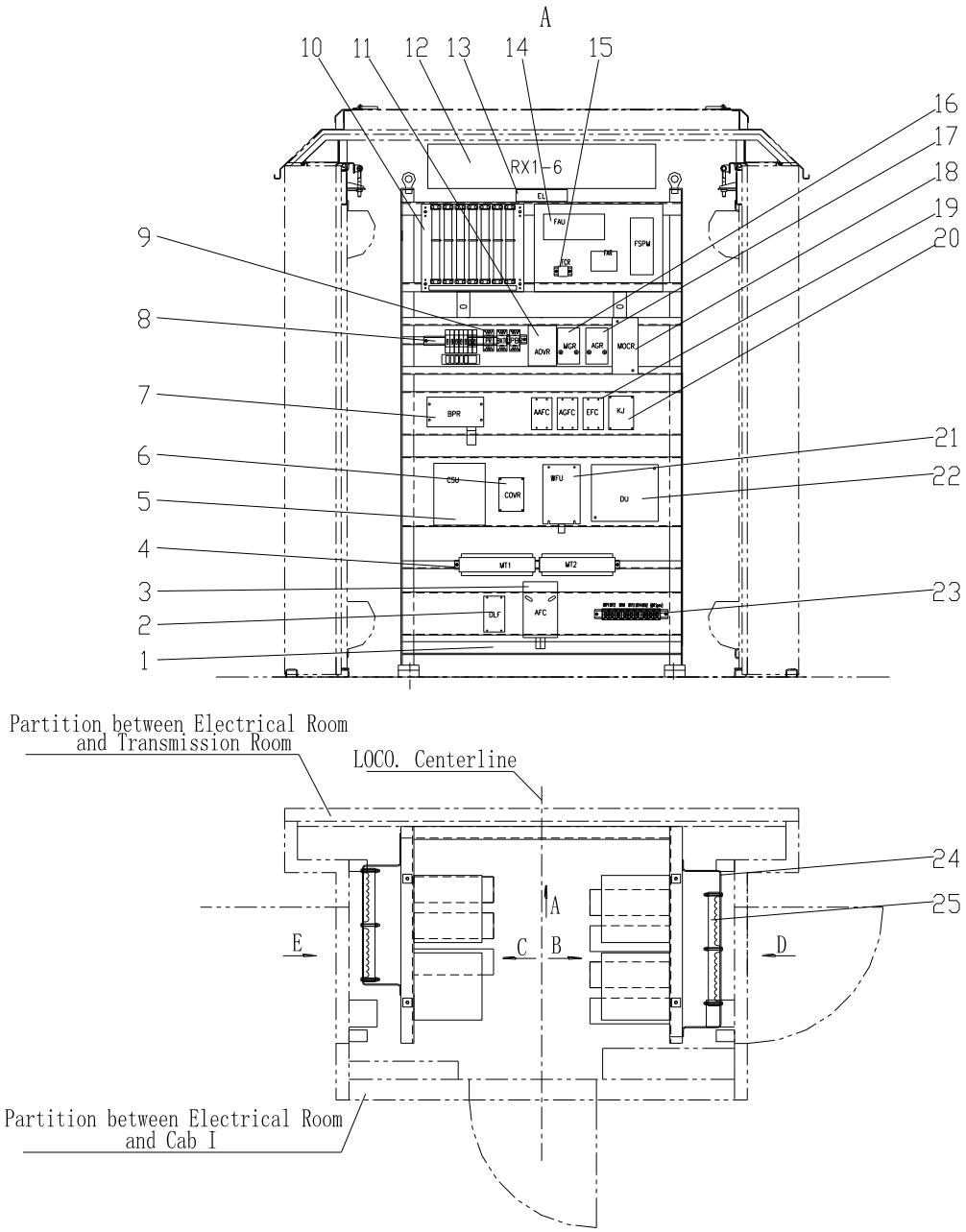


Figure 30: Main Electrical Cabinet - Layout

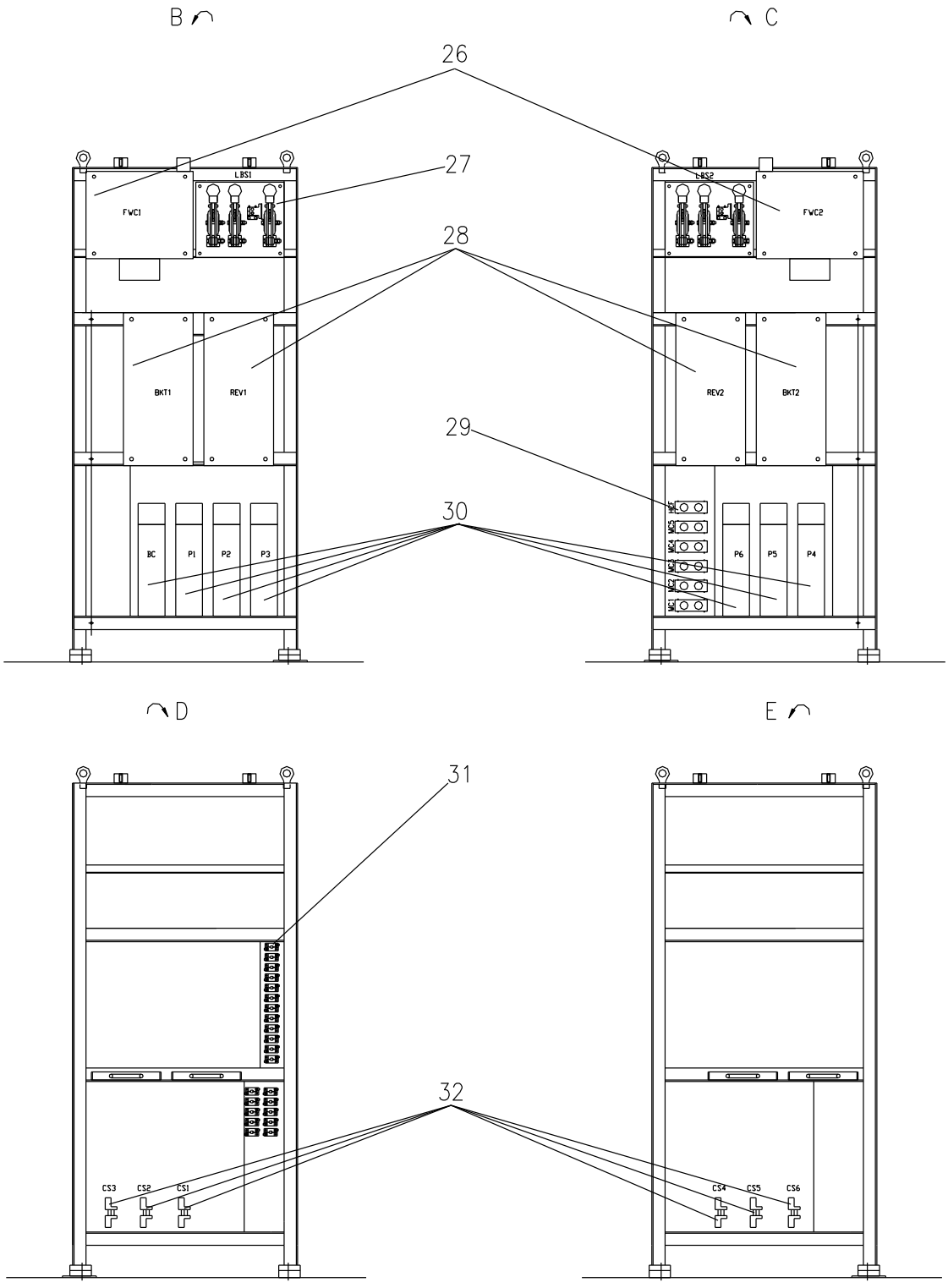


Figure 31: Main Electrical Cabinet - Layout

1	Electrical cabinet Rack	**17**	Grounding Relay (AGR)
2	Flasher Module	**18**	Over-Current Relay
3	DC Contactor	**19**	DC Contactor (EFC, AGFC, AAFC)
4	Terminals	**20**	Time Relay
5	Curve Sensor	**21**	Wheel Flange Lubrication Device
6	Over-Voltage Relay (AA)	**22**	Diode Unit
7	BPR-M Protection Relay	**23**	Big Terminals
8	Circuit Breakers (from left to right) - Foot Warmer CB - No.2 End Lights CB - A/C Control CB - A/C CB - EPCU CB	**24**	Bracket
9	Relay (PR, BKTR, PBR)	**25**	Clamp
10	Resistor Assembly	**26**	Contactor
11	Over-Voltage Relay (AG)	**27**	Knife Switches
12	Resistor Unit	**28**	Switch
13	Electrical Cabinet Light	**29**	Electrical Connector
14	Fire Alarm Controller	**30**	DC Contactor
15	Fire Alarm Control Panel	**31**	Diode ASM
16	Grounding Relay (MGR)	**32**	Shunt

There are six self-load switches in the main electrical cabinet. These switches are normally only used by mechanical staff to test the locomotive. All six self-load switches should normally be set to OPEN.

Figure 32: Self-load Switches

HAZARD WARNING: Danger 600V
Entry to this cabinet is prohibited unless the locomotive diesel engine is shut down.

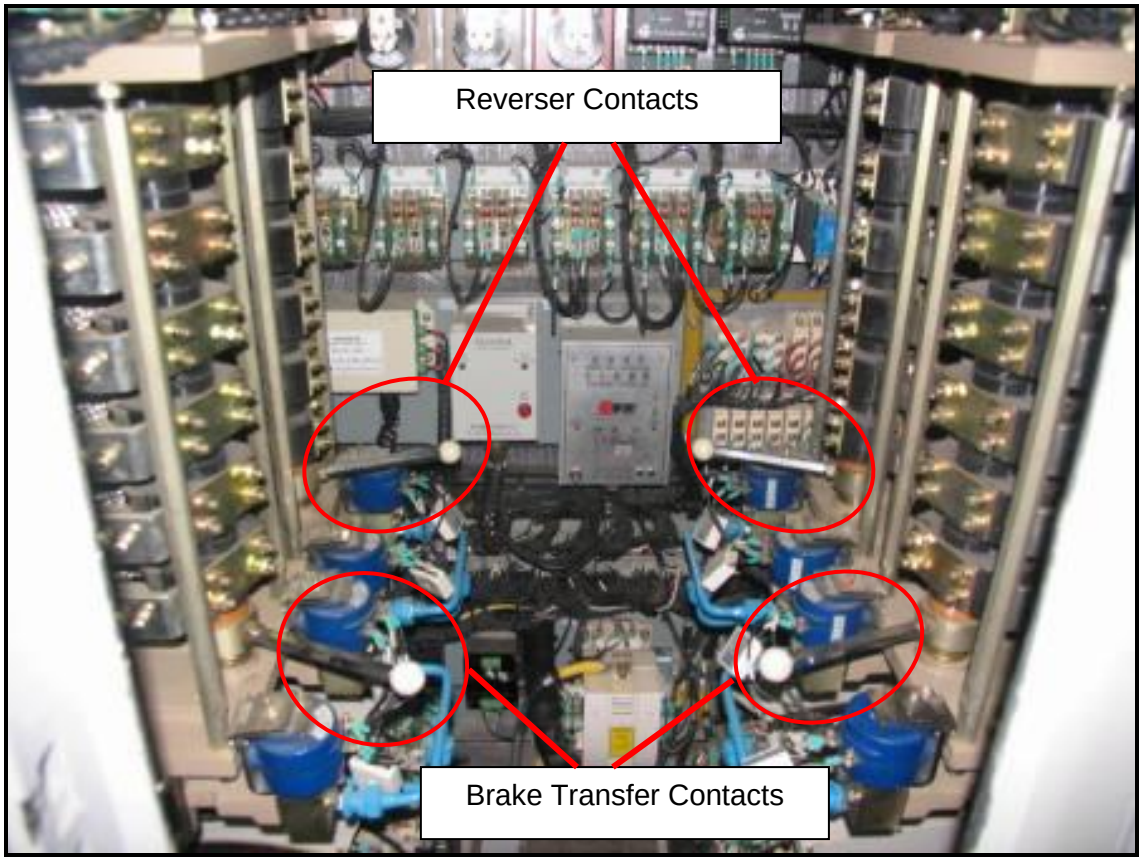


Figure 33: Main Electrical Cab Contactors

Manual switches for the Reversers and the BKTs are in the main electrical cabinet. These switches are normally controlled by the driver's throttle and reverser inputs. If a locomotive is to be transported as a dead locomotive, both the Reversers and BKTs must be placed in the centred position and the BKS must be opened to prevent damage to the traction circuit.

12.2 Auxiliary Electrical Cabinet

The auxiliary electrical cabinet is located behind the rear cab door of Cab II. The auxiliary electrical cabinet contains the Battery Knife Switch (BKS), as well as the locomotive and engine management systems, VHF and UHF radios and power inverters.

Battery knife switch is located inside the auxiliary room (No.2 end)

Figure 34: Battery Knife Switch

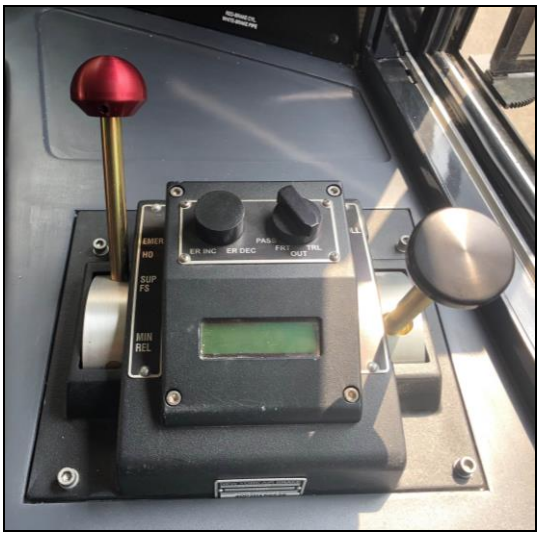
HAZARD WARNING: Entry to this cabinet is prohibited unless the locomotive diesel engine is shut down.

13.0 BRAKES

13.1 Brake System

Two types of brake system are fitted to the DL fleet. Earlier DL's have the Wabtec 26LA system fitted. Later DL's have the Knorr CCBII-P brake system. The brake system fitted to the locomotive can be determined by the brake valve fitted to each cab. The function of both brake systems is the same, however there are minor differences in the control of each brake system.

Wabtec 26LA – 30A-CDW brake control valve



CCBII-P Electronic Brake Valve (EBV)

Figure 35: Brake Control Valves

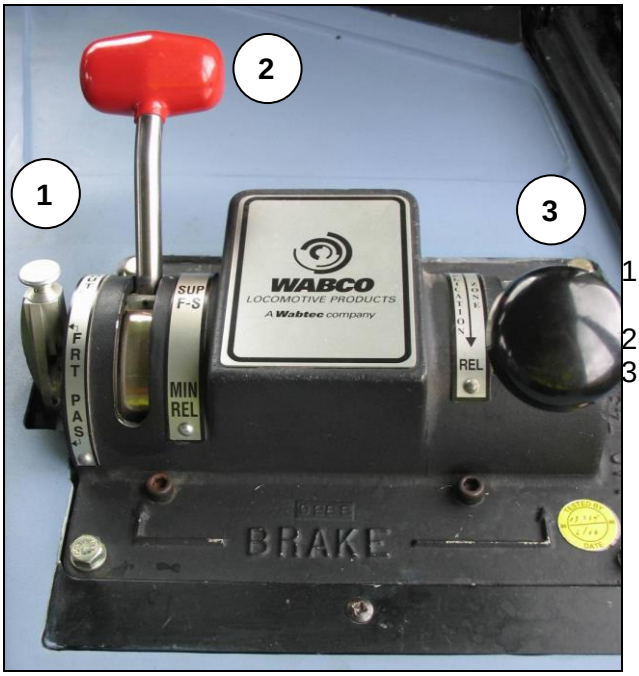
Air for the brake system is sourced from the locomotive air compressor. There are two main reservoirs in series. Between the main reservoirs is the air dryer.

The locomotive is equipped with an air brake cabinet that is used to integrate all brakes devices with the air brake piping. The locomotive is designed so that the air brake and dynamic brake are interlocked.

13.2 Wabtec 26LA brake system

13.2.1 30A-CDW Brake Control Valve

A single 30A-CDW brake control valve is installed in each cab on the control desk. The 30A-CDW valve has three controls available to the locomotive engineer for control of the brake system.



1. Brake Valve Cut-off Handle (BVCO)
2. Automatic Brake Valve (ABV)
3. Independent Brake Valve (IBV)

Figure 36: 30A-CDW Brake Control Valve

Brake Valve Cut-off Handle (BVCO)

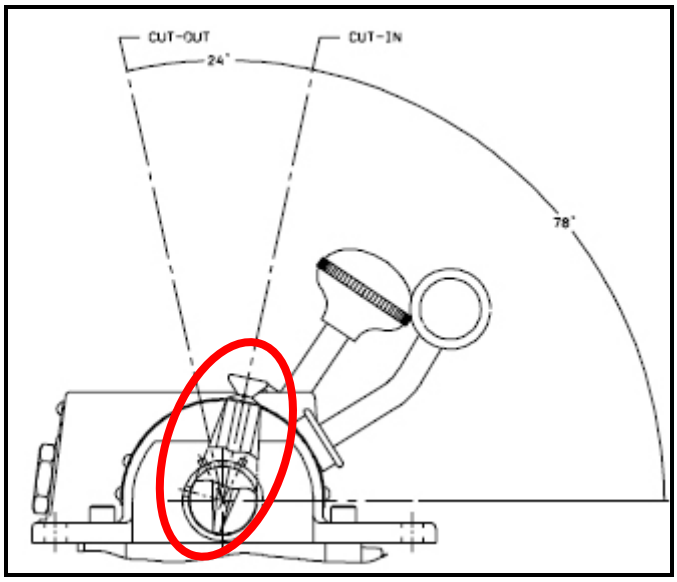


Figure 37: 30A-CDW Brake Valve Cut-off

The manually operated cut-off valve handle is used for to deactivate the brake valve not in use. Only one BVCO on an entire consist should be cut-in at any time. If more than one BVCO is cut-in the vigilance system will trigger a penalty brake.

- Freight services have two positions, “IN” and “OUT”.
- Passenger services have 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. This position is used to set the 30A – CDW brake valve to operate in the “Direct Release” mode when the locomotive is being used to haul a freight train.

The “PASS” position is used to set the 30A – CDW brake valve to operate in the "Graduated Release” mode.

Automatic Brake Valve (ABV)

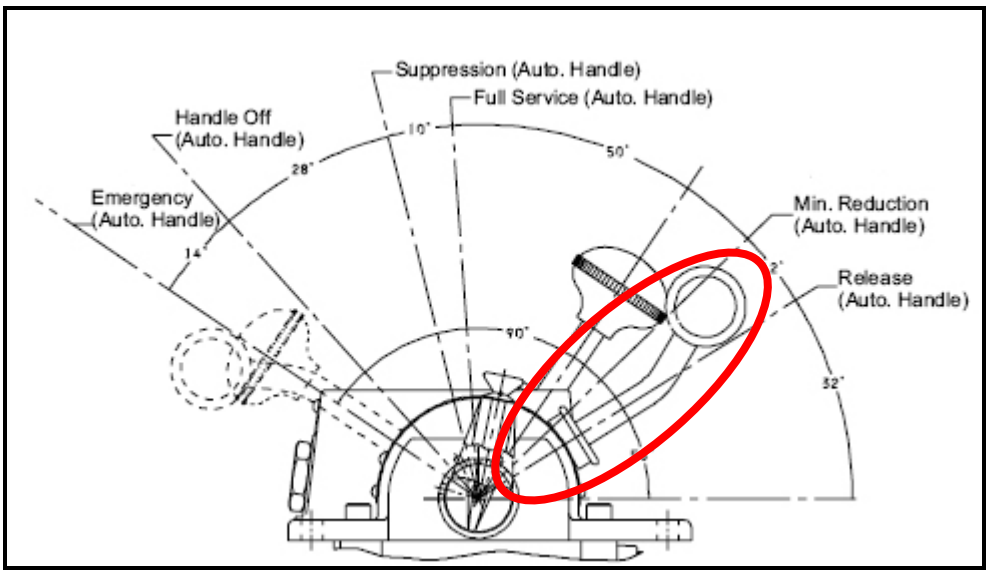


Figure 38: 30A-CDW Automatic Brake Handle

The automatic brake valve handle operates through six positions and controls the automatic train brake:

a) Release
b) Minimum Service
c) Full Service
d) Suppression
e) Handle Off
f) Emergency

The service zone is between “Minimum Service” and “Handle Off” positions.

Independent Brake Valve (IBV)

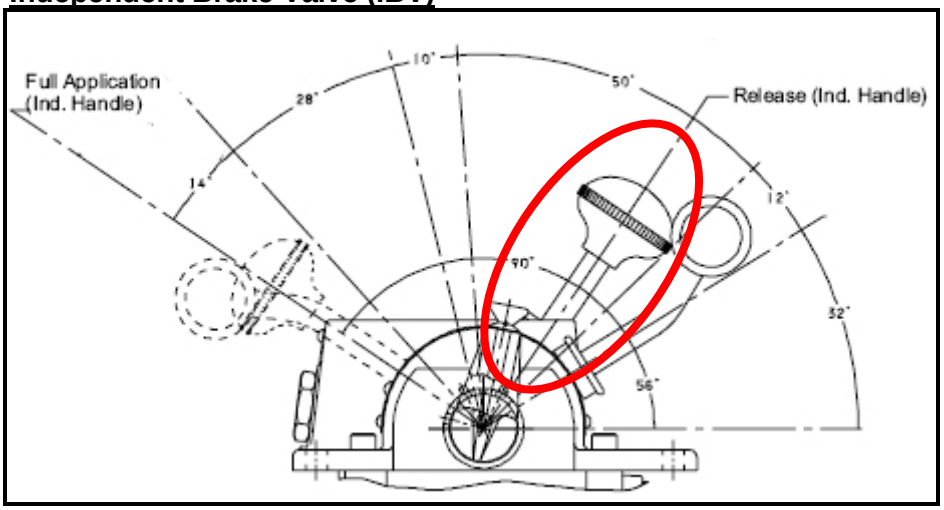


Figure 39: 30A-CDW Independent Brake Valve

The independent brake valve handle has two positions:

a) Release
b) Full Application

The “Release” position is closest to the operator, an application zone is located between these positions the further the handle is moved towards the “Full Application” the greater the independent brake pressure until the full application pressure is obtained.

The IBV has a bail-off feature. Any movement of the independent brake valve handle to the right (away from plate) will initiate the release of any automatic brake application on the locomotive’s brakes and a spring action will return the handle to its original position when released.

13.2.2 MU-2A Multiple Unit Selection Valve

The MU-2-A valve is located in the No.1 end cab, on the back wall under the seat. The MU-2-A valve changes the setup of the locomotive’s brake system, as required when running in lead or as a trail unit.

The MU2A valve has 3 positions:

- Lead-Dead: Independent and automatic brake valve applications are controlled by this locomotive. Only one running locomotive in any multiple-unit or single-unit consist should be set to Lead-Dead.
- Trail 6-26: Independent and automatic brake application is controlled from the locomotive in the consist with the MU-2-A valve set to Lead-Dead.
- Trail 6-24-26: Not typically used in KiwiRail service.

Figure 40: MU-2A valve

NOTE: DL's with the Knorr CCBII-P do not have a MU-2A valve fitted. Trail setup is carried out by the electronic brake valve.
Refer to Section 13.3.1 for more information.

13.2.3 Brake Rack

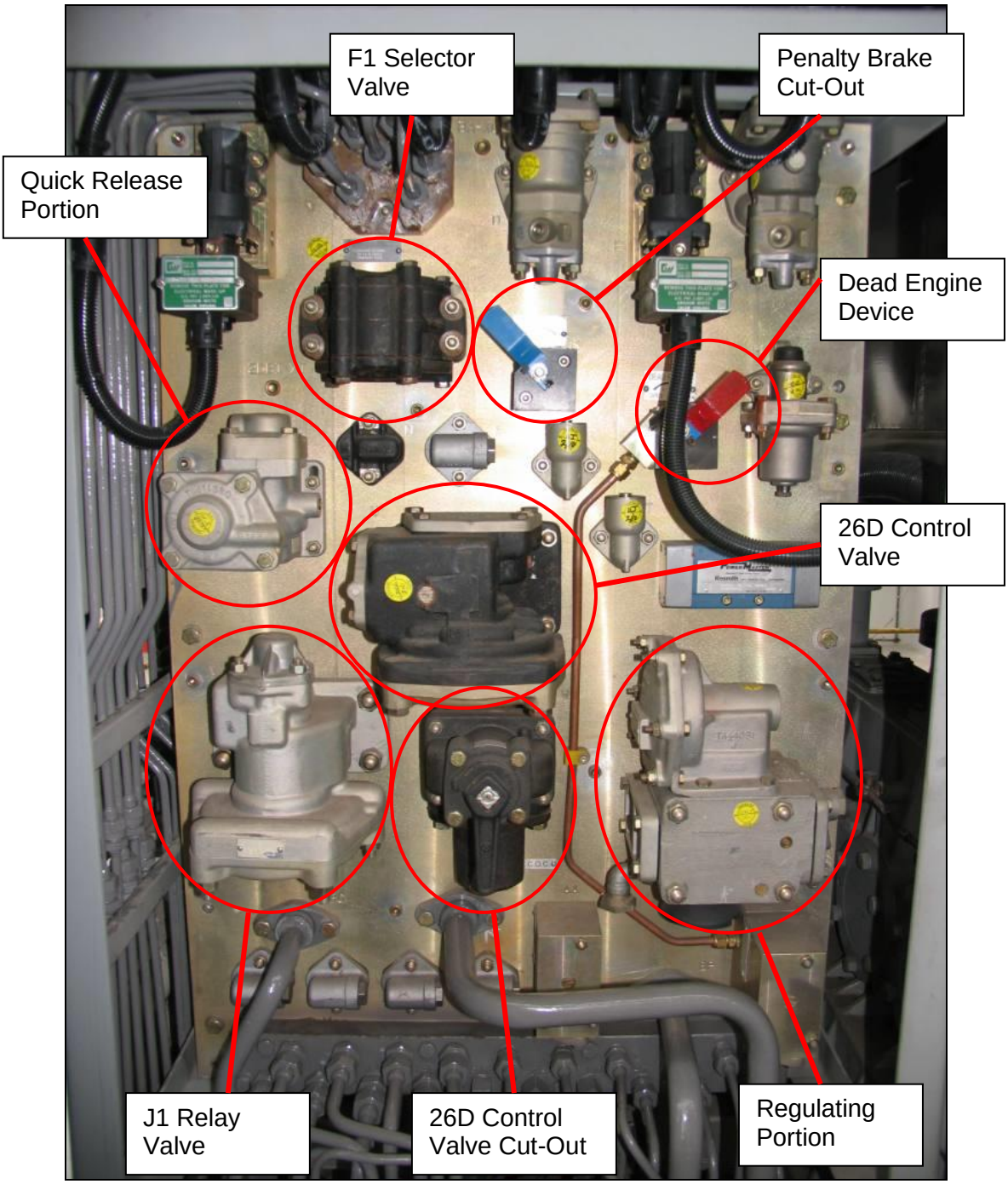


Figure 41: 26LA Brake Rack

There are two controls available on the brake rack

- Dead Engine Device
- Penalty Brake Cut-out

Dead engine device (Red Handle)

The dead engine device allows the main reservoir to be partially charged if the locomotive is to be towed dead single pipe. The dead engine device has two positions

- Closed (Default): The main reservoir can only be charged by the MR line or the locomotive's air compressor
- Open: The main reservoir will be partially charged by the BP line.

NOTE: Locomotive setup for dead engine single pipe must be carried out by mechanical staff.

Penalty Brake Cut-out (Blue Handle)

The penalty brake cut-out handle can be used to isolate the penalty brake if the penalty brake cannot be released. The penalty brake cut-out handle has two positions.

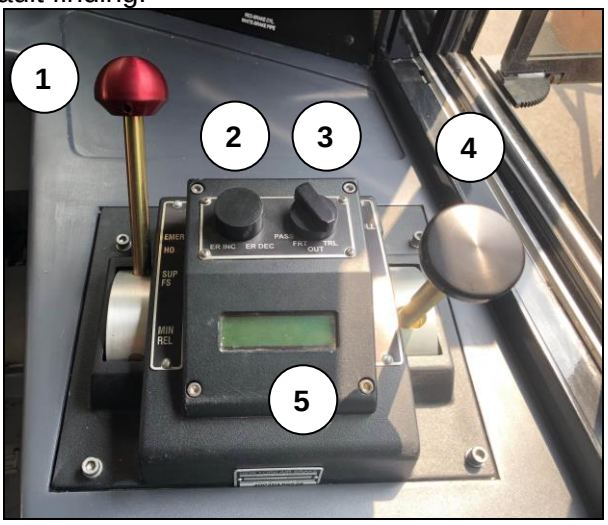
- Open (default): The penalty brake can apply as normal
- Closed: The penalty brake is isolated and cannot apply.

NOTE: The penalty brake cut-out handle must only be used by mechanical staff.

13.3 Knorr CCBII-P

13.3.1 Electronic Brake Valve (EBV)

A single EBV brake control valve is installed in each cab on the control desk. The EBV valve has three controls available to the locomotive engineer for control of the brake system. The EBV is also equipped with an LCD screen that can be used for fault finding.



1. Automatic Brake Handle (ABH)
2. ER Setpoint Knob (Not used)
3. Brake Mode Selector Switch (BMSS)
4. Independent Brake Handle (IBH)
5. EBV Display

Figure 42: Electronic Brake Valve

The operator interface for pressure control of the CCB II Passenger Brake System is the Electronic Brake Valve.

Automatic Brake Handle (ABH)

The automatic brake handle has the same functionality as the ABV fitted to the 30A-CDW valve. The automatic brake valve handle operates through six positions and controls the automatic train brake.

a) Release
b) Minimum Service
c) Full Service
d) Suppression
e) Handle Off
f) Emergency

The service zone is between “Minimum Service” and “Handle Off” positions. The emergency brake is pneumatically controlled, and will function even if the locomotive has no electrical power available.

ER Setpoint Knob

The ER Setpoint Knob is not used in KiwiRail service and is disabled

Brake Mode Selector Switch (BMSS)

The brake mode selector switch is used to select the operating mode of the brake system. It replaces the functionality of the Brake Valve Cut-Out handle and the MU-2A valve used on the 26LA brake system.

The BMSS has four positions available

- PASS: The automatic train brake is capable of graduated release for passenger service. The PASS position is used for passenger service as the lead locomotive’s driver cab.
- FRT: The automatic train brake will only release when returned to the Release position on the ABH. The FRT position is used for freight service as the lead locomotive’s driver cab.
- OUT: The brake valve is cut-out, allowing leakage tests of the brake pipe.
- TRL: The EBV is disabled. The TRL position should be used if the EBV is in a trailing cab. If both EBVs on the locomotive are set to trail, the locomotive is set to run as trail and the brake control system will be disabled. Application of the independent and automatic train brake will be controlled from the lead locomotive in the consist.

  At all times at least one EBV on a locomotive must be set to TRL. If there are no EBVs on a locomotive set to trail, the penalty brake will trip and will be unable to be reset until an EBV is set to TRL.

Independent Brake Handle (IBH)

The independent brake handle has two positions:

a) Release

b) Full Application

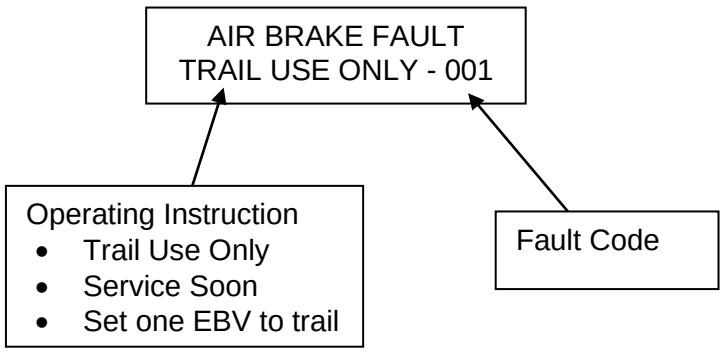
The “Release” position is closest to the operator, an application zone is located between these positions the further the handle is moved towards the “Full Application” the greater the independent brake pressure until the full application pressure is obtained.

The IBH has a bail-off feature. Any movement of the independent brake handle to the right (away from plate) will initiate the release of any automatic brake application on the locomotive’s brakes and a spring action will return the handle to its original position when released.

EBV Display

In most normal operating conditions, the EBV display will show the mode selected on the EBV or the equalizing reservoir target.

In fault conditions, the EBV display will show a fault code and the recommended action required by operating staff. Operating staff should write a 54D booking if a fault is displayed on the EBV. The 54D booking should include the specific fault code displayed on the EBV.



13.3.2 Brake Rack

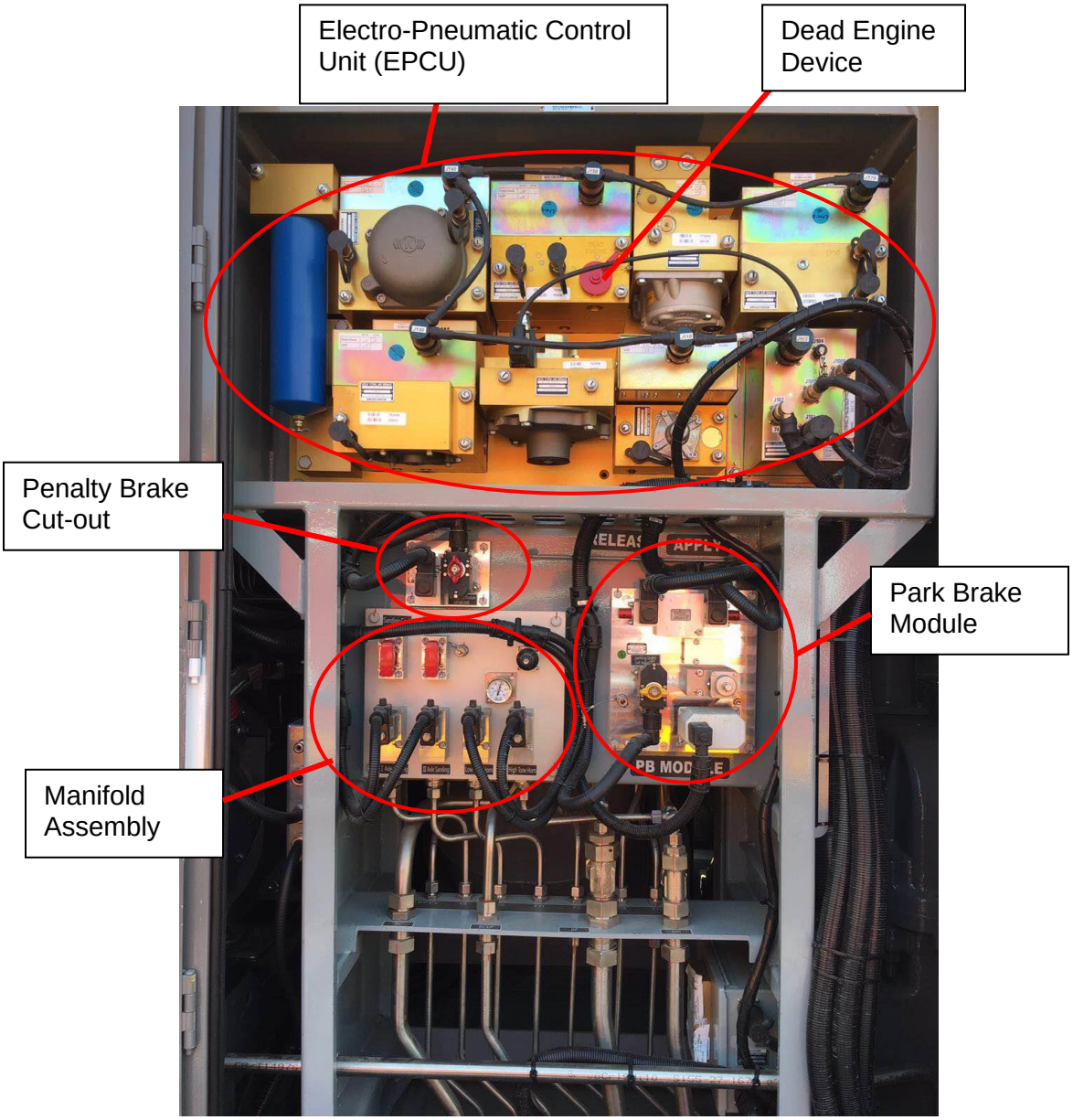


Figure 43: CCBII-P Brake Rack

There are two brake system controls available on the brake rack.

- Dead Engine Device
- Penalty Brake Cut-out

Dead Engine Device

The dead engine device allows the main reservoir to be partially charged if the locomotive is to be towed dead single pipe. The dead engine device has two positions

- Closed (Default): The main reservoir can only be charged by the MR line or the locomotive's air compressor
- Open: The main reservoir will be partially charged by the BP line.

NOTE: Locomotive setup for dead engine single pipe must be carried out by mechanical staff.

Penalty Brake Cut-out Cock

The penalty brake cut-out cock can be used to isolate the penalty brake if the penalty brake cannot be released. The penalty brake cut-out handle has two positions.

- Open (default): The penalty brake can apply as normal
- Closed: The penalty brake is isolated and cannot apply.

NOTE: The penalty brake cut-out handle must only be used by mechanical staff.

13.4 Park Brake

All DL's are fitted with a spring actuated, pneumatically released, electrically controlled park brake. In normal operation, the park brake is electrically controlled from the switch available on each driver's console.

The status of the park brake under normal conditions can be determined by the indicator panel – if the green park brake light is illuminated the park brake is applied. On later DLs there are also indicators available on the locomotive running board.

Park brake commands are train-lined. If a non-DL locomotive is the lead locomotive in a consist, the park brake must be electrically released from the first DL cab in the consist.

If the MR pressure is low, the park brake will automatically apply.

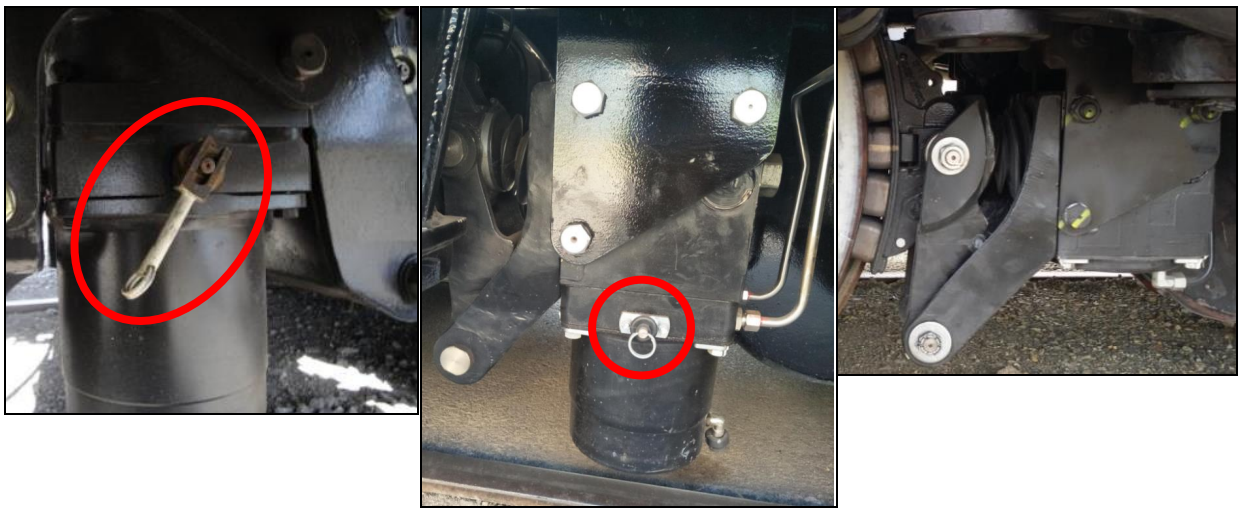
Under abnormal running conditions, the park brake can be released to allow the locomotive to be towed dead. Abnormal park brake releases must be carefully carried out to ensure that the wheelsets are not dragged. Dragging wheelsets for any distance can significantly reduce the lifespan of the wheelset, and may require the wheelset to be condemned and replaced. Abnormal park brake release is required if the locomotive is to be moved and any of the following conditions are met

- Engine off
- BKS out
- MR pressure is less than 480kPa

The procedures in section 23.0 should be followed to set up a DL to be towed.

Two types of brake cylinder are fitted on the DL fleet. The park brake release for towing procedure is different for each type of brake cylinder. The type of brake cylinder fitted can be identified via the manual release lever fitted to each park brake cylinder. Note: the centre wheelset on each bogie does not have a park brake cylinder fitted.

IMPORTANT: *DLs fitted the electronic brake may have either type of manual release lever but the setup procedure remains as per 23.2.*



CRRC DZD-2D
Park Brake Release Lever fitted

Wabtec BCRK 130PS
Park Brake Release Ring fitted

No release ring/lever fitted – non PB cylinder, check a different cylinder

Figure 44: Park Brake Types

NOTE: When a DL locomotive is being towed dead, without a jumper cable being used, it is important to check the park brake has been released.

There are twelve brake cylinders installed on each DL class locomotive, with two brake cylinders per wheelset. Only eight of these brake cylinders have a spring actuated park brake. The remaining four cylinders do not have a park brake.

Wheelset	Left Hand Side	Right Hand Side
1	PB	PB
2	Non-PB	Non-PB
3	PB	PB
4	PB	PB
5	Non-PB	Non-PB
6	PB	PB

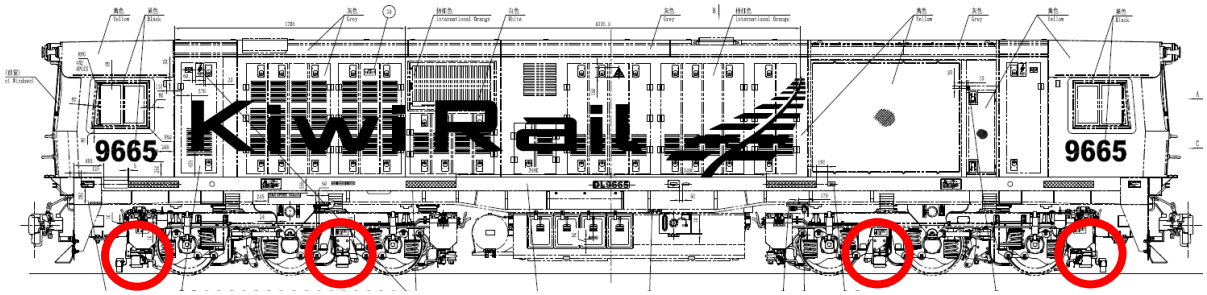


Figure 45: Park Brake Cylinder Location

13.4.1 DZD-2D Brake Cylinder

The DZD-2D brake cylinder can be identified via the manual release lever fitted to each park brake unit. The park brake on each cylinder can be released for a dead tow by pulling the manual release lever. A released park brake cylinder can be reset and applied by cycling the park brake switch from applied to released and back to applied with sufficient main reservoir pressure. The procedures in Section 23.0 should be followed to set up a DL with the DZD-2D brake cylinders for towing.

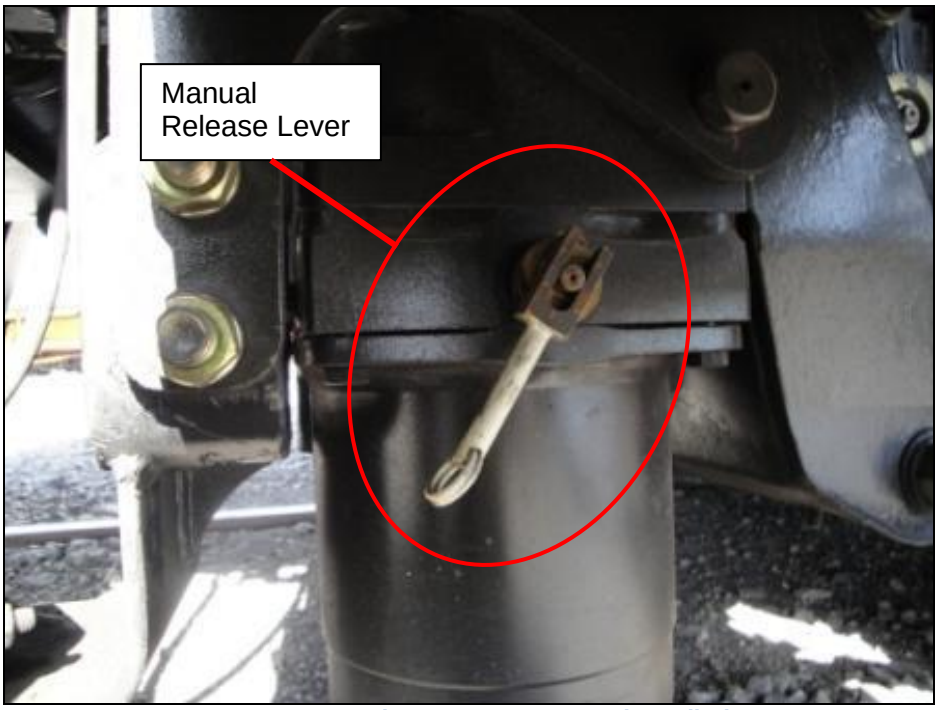


Figure 46: DZD-2D Brake Cylinder

13.4.2 BCRK 130PS Brake Cylinder

The BCRK 130PS brake cylinder can be identified by the manual release ring fitted to each park brake unit. The BCRK 130PS brake cylinder can be released for a dead tow in a number of ways. The procedures in Section 23.0 should be followed to set up a DL with the BCRK 130PS brake cylinders for towing.

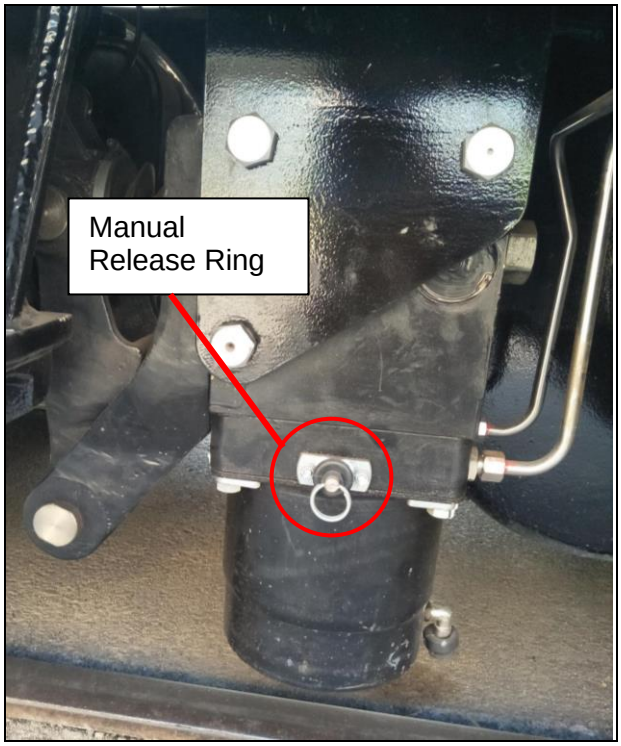
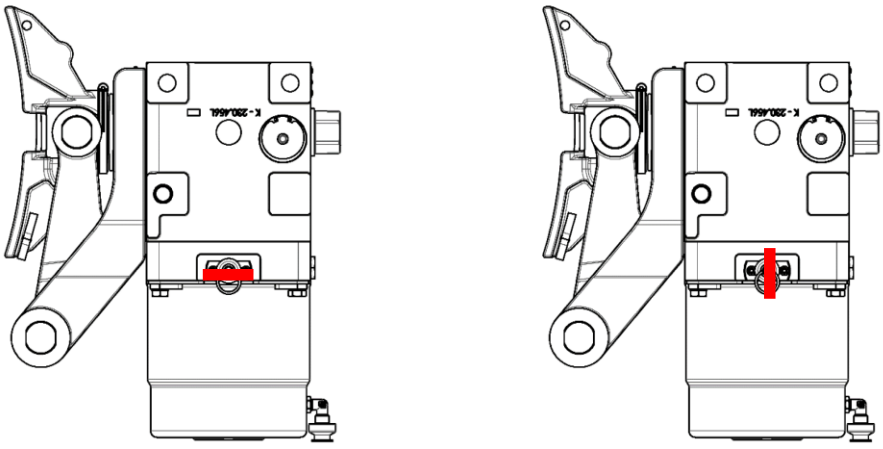


Figure 47: BCRK 130PS Brake Cylinder

The manual release ring has a locked and unlocked position. In the locked position, the shaft attached to the manual release ring is rotated so that the ring is vertical. In the unlocked position, the shaft attached to the manual release ring is rotated so that the ring is horizontal. If the ring is in the locked position, the park brake cannot be applied until the ring is returned to the unlocked position.



Park Brake – Released and Unlocked Park Brake – Released and Locked

Figure 48: BCRK 130PS Manual Release Ring Positions

13.4.3 Park Brake Indicators (BCRK 130PS Brake Cylinders Only)

Locomotives with the BCRK 130PS brake cylinders fitted will have 2x park brake indicators fitted to the locomotive running board. One indicator is visible on each side of the locomotive.

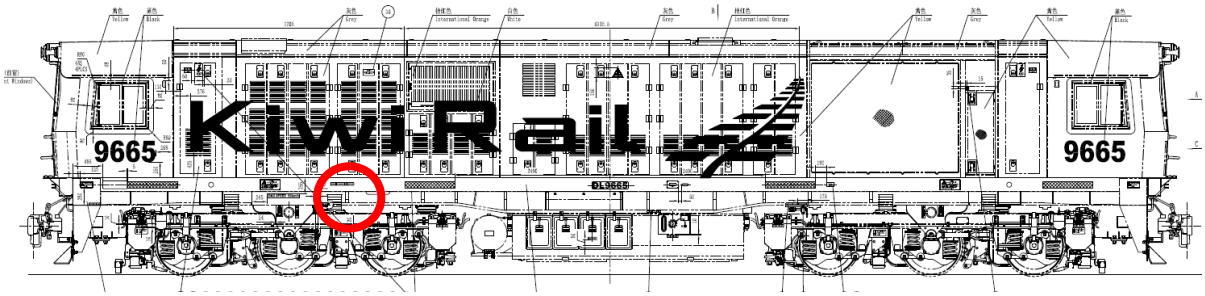


Figure 49: Park Brake Indicator Location (BCRK 130PS Brake Cylinders only)

External Indicator – PB Applied

External Indicator – PB Release

Figure 50: Park Brake Indicator Display

The park brake indicators are pressure actuated and will function correctly with the locomotive dead.

NOTE: If a manual release of the park brake is carried out at the brake cylinder, the indicators may not correctly show the status of the park brake.

13.4.4 Park Brake Pneumatic Release (BCRK 130PS Brake Cylinders Only)

Locomotives with the BCRK 130PS brake cylinders fitted will have a pneumatic release push button available on the park brake control manifold. The pneumatic release push button can be used to release the park brake if the locomotive is three piped and does not have battery power available. The procedures in Section 23.0 should be followed to set up a DL with the BCRK 130PS brake cylinders for towing.

Door label PB Release Push Button

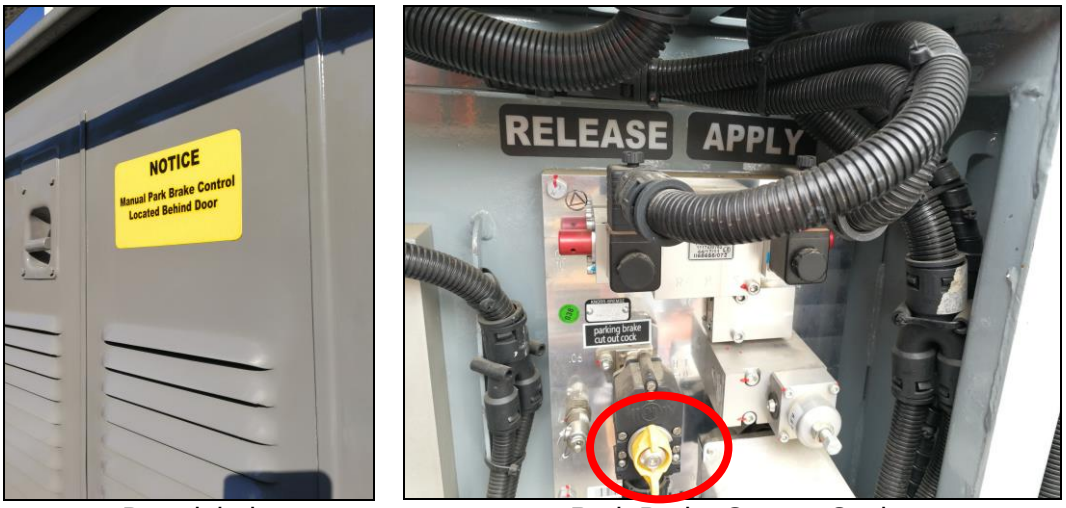
Figure 51: Pneumatic Park Brake Release Push Button

The park brake control manifold is located under the brake rack. A label is located on the exterior door in front of the park brake control manifold to help locate the manifold.

NOTE: If the BKS is closed, the pneumatic park brake release may be reset.

13.4.5 Parking Brake Cut-out Cock (BCRK 130PS Brake Cylinders Only)

Locomotives with the BCRK 130PS brake cylinders fitted will have a Parking Brake Cut-out cock fitted to the park brake control manifold. The Parking Brake Cut-out cock isolates the air supply to each park brake unit and allows each unit to be manually reset. The procedures in Section 23.0 should be followed to set up a DL with the BCRK 130PS brake cylinders for towing.



Door label Park Brake Cut-out Cock

Figure 52: Park Brake Cut-out cock

The park brake control manifold is located under the brake rack. A label is located on the exterior door in front of the park brake control manifold to help locate the manifold.

13.5 Penalty Brake Reset

The penalty brake reset procedure is different for the Wabtec 26LA system and the CCBII-P system.

13.5.1 Penalty Brake Reset – Wabtec 26LA

- Verify that the cause of the penalty brake has been rectified
- Place the ABV into the “Handle off” position.
- Place the BVCO into the “Cut out” position.
- Wait until the ESCA light extinguishes.
- Press the Penalty Brake” reset button.
- Place the BVCO into the “Cut in / Freight” position.
- Release the ABV.

The locomotive should be ready to move

13.5.2 Penalty Brake Reset – Knorr CCBII-P

- Verify that the cause of the penalty brake has been rectified
- Identify the active EBV (BMSS will be set to FRT or PASS). The EBV display will show “SAFETY PENALTY PUT AUTO IN SUPP”.
- Put the ABH into “EMER”. The EBV display will show “SAFETY PENALTY KEEP IN EMER”
- Press the Penalty Brake reset button on the driver’s console
- Wait until the display shows “OKAY TO RUN, ER TARGET 380”, and then place the ABH into the “REL” position. The ESCA light should extinguish.

The locomotive should be ready to move

13.6 Incorrect Brake Set Up Protection

All DL’s have Tranzlog logic to prevent the locomotive from moving with incorrectly set-up brakes.

13.6.1 Penalty Brake

Whenever the penalty brake has activated, the vigilance light will stay illuminated continuously. If the vigilance light is continuously illuminated, the locomotive engineer must rectify the cause of the penalty brake before attempting an ECSA reset.

13.6.2 Brake System set to trail whilst operated as lead

If a reverse handle direction is selected on a locomotive when the brake system is set to trail, Tranzlog will immediately cause a penalty brake to prevent locomotive movement. The vigilance light will be continuously illuminated. No Selcall will be sent for this type of penalty brake

To reset this penalty brake

1. Move the reverse handle to neutral
2. **26LA locomotives only:** Change the MU-2A valve to the Lead or Dead position
3. **CCBII-P locomotives only:** Set the driving cab EBV to PASS or FRT
4. Wait 47 seconds and then press the penalty brake reset push button on the driver's console. The vigilance light will switch off once the reset is complete
5. Reset the ESCA light once the vigilance light is off.

13.6.3 Incorrect Trail Cab Automatic Brake Set Up – Wabtec 26LA only

If the Automatic Brake Valve in the trailing cab is not correctly set to "Handle OFF", an alarm will sound if the leading cab ABV is moved from "Handle OFF". After 10s, the penalty brake will be applied. The vigilance light will remain illuminated after the penalty brake has tripped.

To reset during the Audible alarm cycle

1. Move the lead cab automatic brake valve to Handle Off
2. Go to the trail cab and put the automatic brake valve into Handle Off and ensure that it is set to Cut Out.

To Reset After Penalty Brake

1. Move the lead cab automatic brake valve to Handle Off
2. Set the lead cab automatic brake valve to Cut Out
3. Go to the trail cab and put the automatic brake valve into Handle Off and ensure that it is set to Cut Out.
4. Return to the lead cab and press the penalty brake reset. The vigilance light will go out once the penalty brake has reset.
5. Reset the ESCA light as normal once the vigilance light is off.

NOTE: DL's fitted with Knorr CCBII-P brake control have an alternative incorrect setup protection. Refer to Section 13.6.8 for more information

13.6.4 Incorrect Trail Loco Automatic Brake Set Up

If a trailing locomotive has an automatic brake valve set to “Release”, the penalty brake will be tripped on the trailing locomotive as soon as a throttle selection is made. The vigilance light on the trailing locomotive will be continuously illuminated once the penalty brake has actuated.

NOTE: The vigilance light on the lead locomotive will not be illuminated. If a penalty brake on the trailing locomotive has tripped, the only indication in the lead locomotive will be the brake pipe pressure.

To Reset After Penalty Brake;

1. **Trailing locomotive fitted with Wabtec 26LA brake system:**
   Go to each cab and ensure that the BVCO is Cut-Out and The ABV is in the Handle-Off Position.
2. **Trailing locomotive fitted with the Knorr CCBII-P brake system:**
   Go to each cab and ensure that the BMSS is set to TRL and the ABH is set to Handle-Off.
3. In the trailing locomotive press the Penalty brake reset button once the automatic brake valves have been confirmed as correctly set up for trail. The vigilance light will switch off once the penalty brake has reset.
4. The ESCA light will reset within 15 seconds of penalty brake reset.

13.6.5 Tranzlog Switched-Off or Failed

If the Tranzlog circuit breaker is left switched off or if Tranzlog fails, the vigilance light will be continuously illuminated and throttle control will be locked out to prevent loco operation.

Remedial Action

1. Check that the brake set ups are correct. If the brake set ups are incorrect, make the necessary corrections and then press the penalty brake reset to reset the vigilance system.
2. If the brake set ups are all correct, go to cab 2 and switch the Tranzlog circuit breaker Off and then On again. If the vigilance light goes out the system is reset ready for use.
3. If the vigilance light does not extinguish then go to the KMC cabinet which is located near the compressor and;
   - Change the Tranzlog isolate switch to the Isolated position.
   - Book the fault in the loco 54D book.
   - Operate the locomotive in accordance with the ROC rules for failed vigilance to clear the section / get to a location where it can be set up for trail only operation.

Figure 53 and Figure 54 show the Tranzlog Isolation Switch location

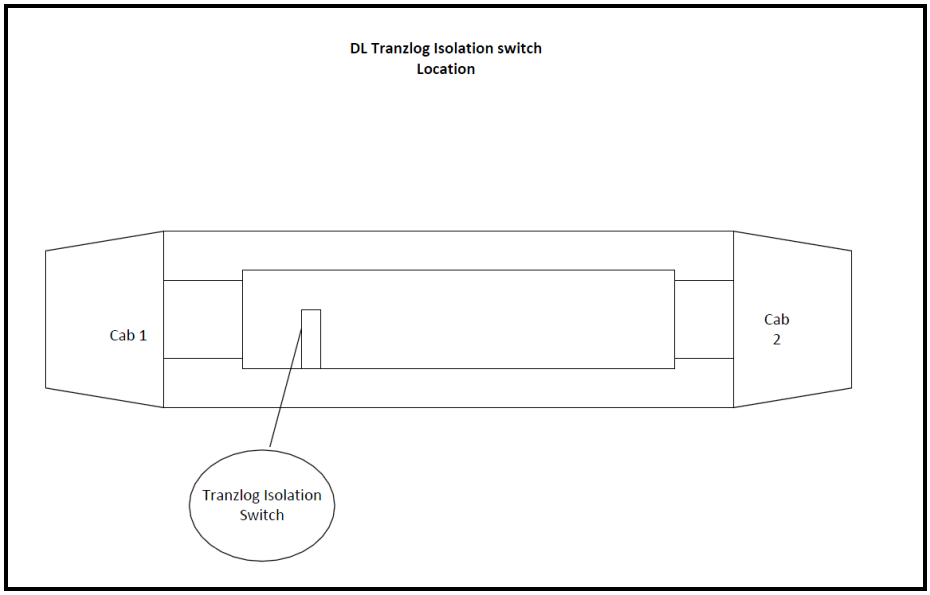


Figure 53: Tranzlog Isolation Switch Location

Figure 54: Tranzlog Isolation Switch

13.6.6 Trailing Locomotive Road Over-Speed

If a road overspeed condition occurs while a DL locomotive is in Trail, the penalty brake will operate to dump the brake pipe and send out a selcall. Normal penalty brake and ESCA light reset procedures apply.

13.6.7 Data Download

Tranzlog class set-ups are as follows

Brake System Fitted	Class Set-Up
Wabtec 26LA	DLOCO0001
Knorr CCBII-P	DLOCOCCB1

13.6.8 Incorrect Trail Cab BMSS – Knorr CCBII-P only

DLs fitted with the Knorr CCBII-P brake system will detect if two EBV are active on a single locomotive and will trip the penalty brake if two EBVs are active. The recovery procedure for an incorrect trail cab setup is as follows.

1. Set the non-driving cab EBV BMSS to TRL
2. Follow the CCBII-P penalty brake reset procedure in Section 13.5.2

14.0 CUT OUT COCKS

14.1 Bogie Isolation Cock

For Gen1 DL Locomotives 9008, 9014, 9020, 9037, 9043 and 9066 only

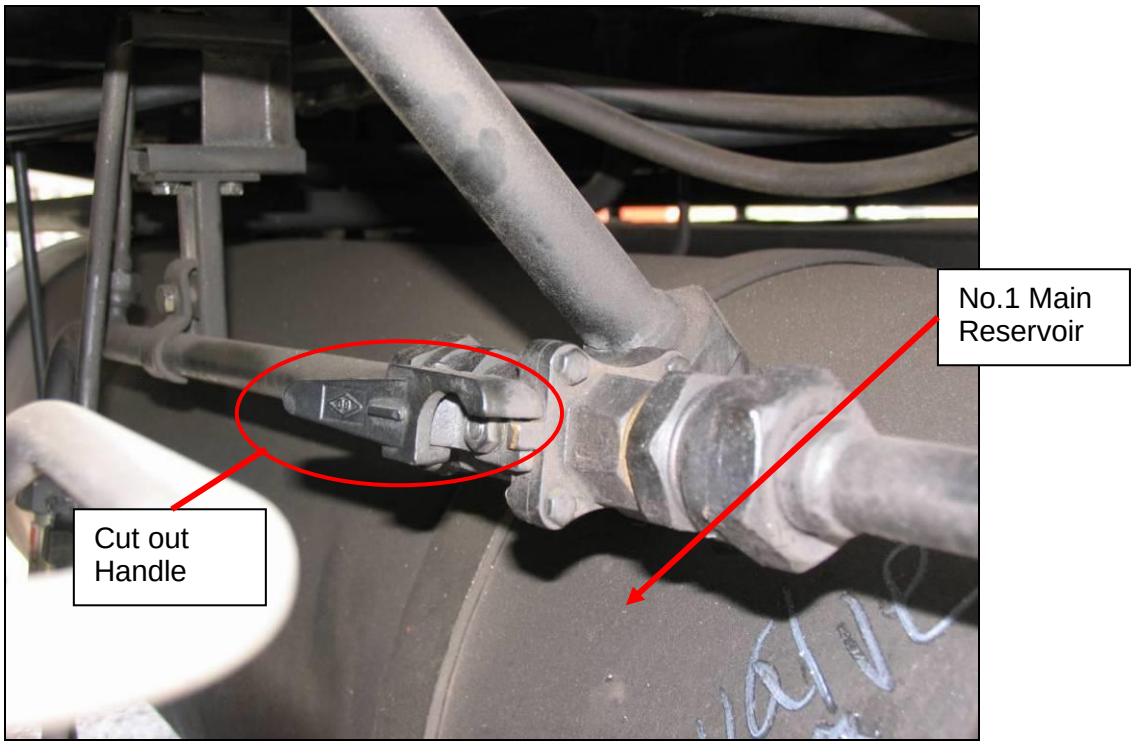


Figure 55: DL9008-DL9066 Bogie Isolating Cock - No.1 End

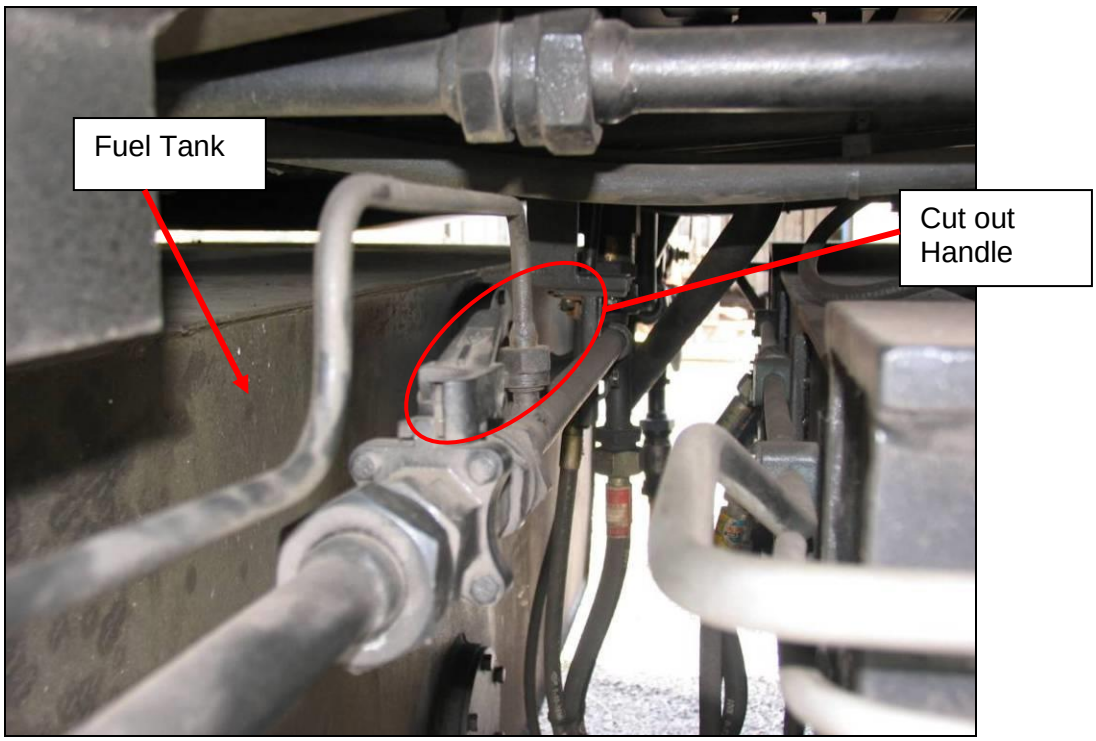


Figure 56: DL9008-9066 Bogie Isolating Cock No.2 End

All other DL locomotives have the following “Bogie Isolating Cocks”

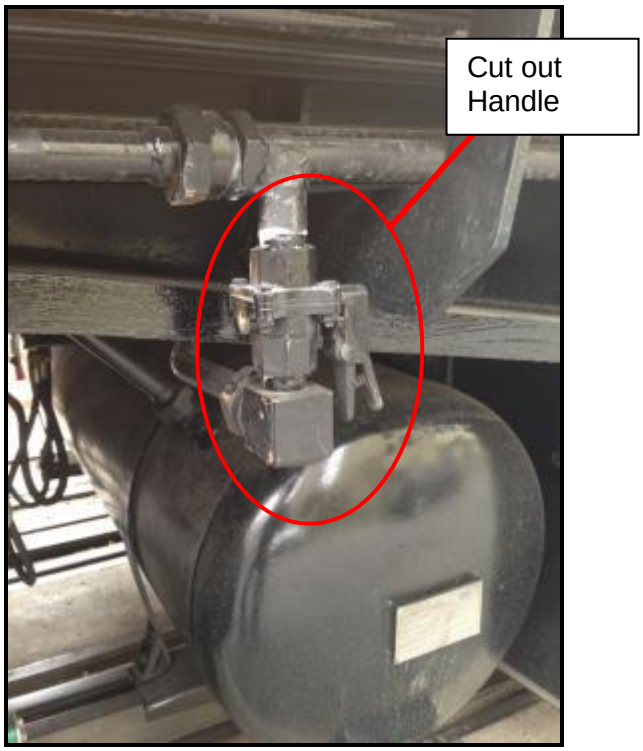


Figure 57: DL9072-onwards Bogie Isolating Cock No.1 End

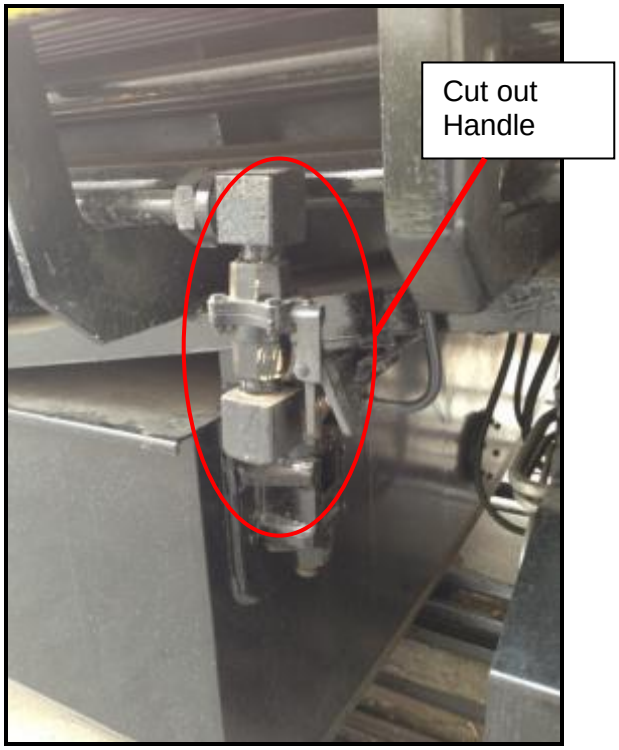


Figure 58: DL9072-onwards Bogie Isolation Cock No.2 End

14.2 Other Cut-out Cocks

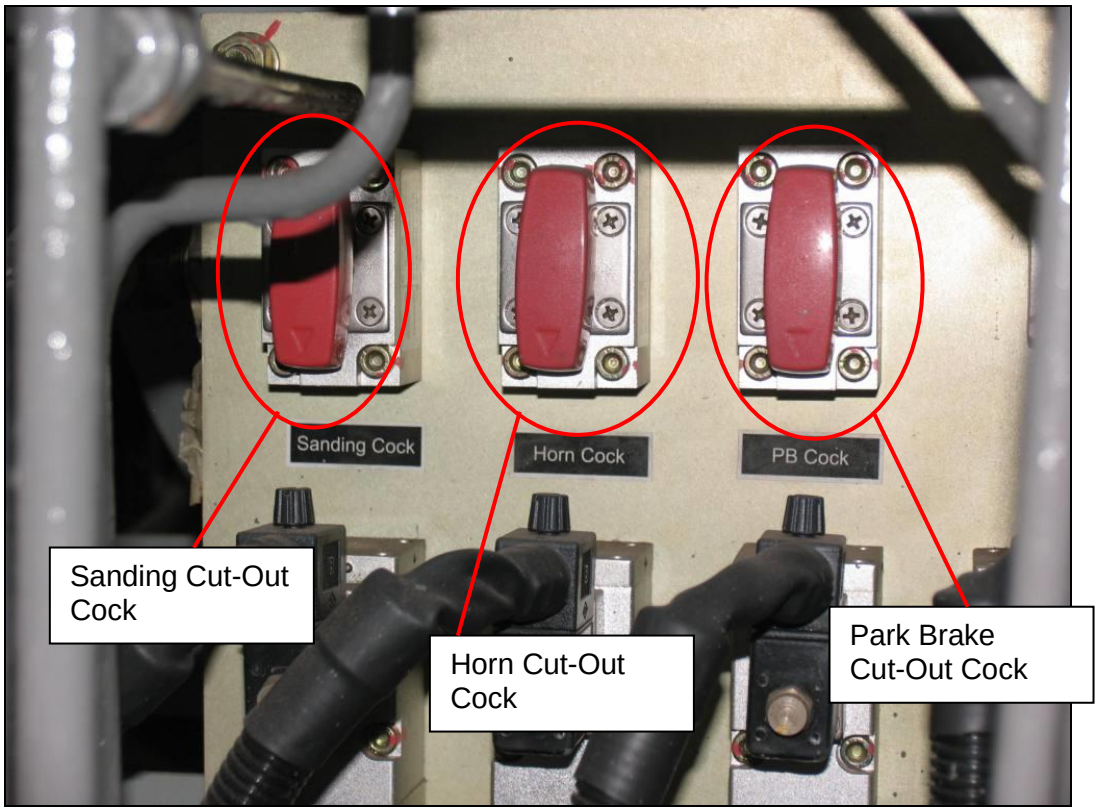


Figure 59: Pneumatic Control Manifold No.1 End (Underneath Brake Rack)

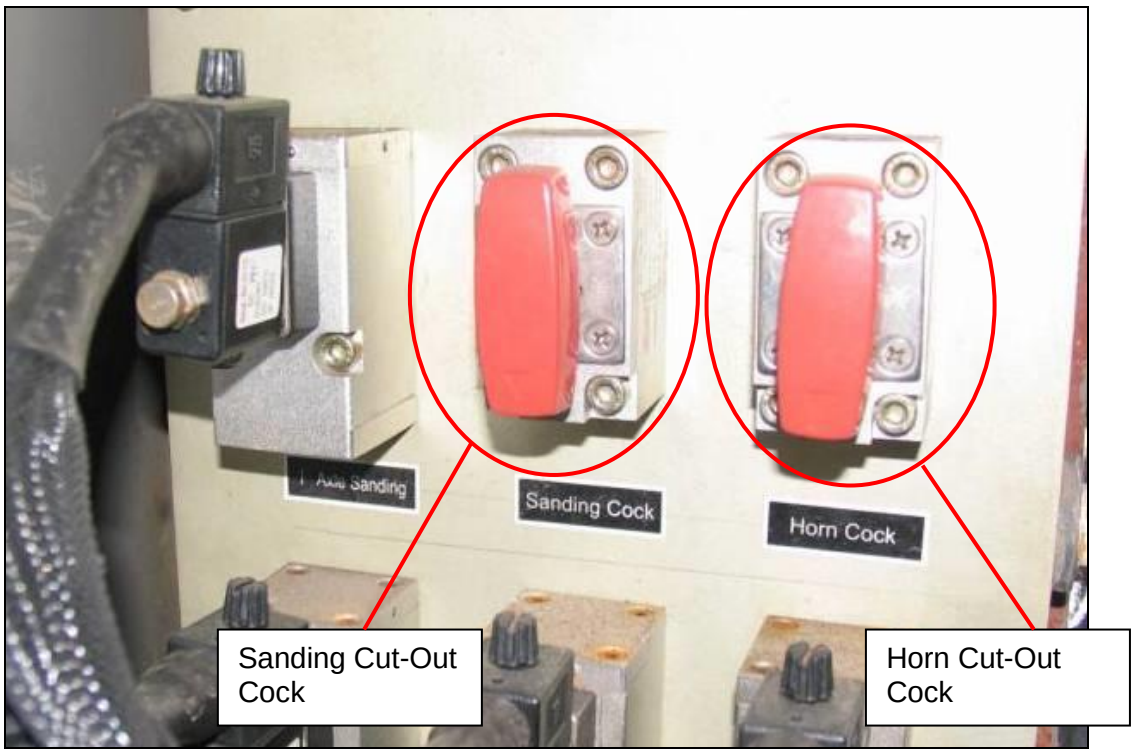


Figure 60: Pneumatic Control Manifold No.2 End (In radiator cabinet)

14.3 Seat Isolation

To isolate the ISRI seat due to leaks or failure, close the cut off cock located under the driver's console.

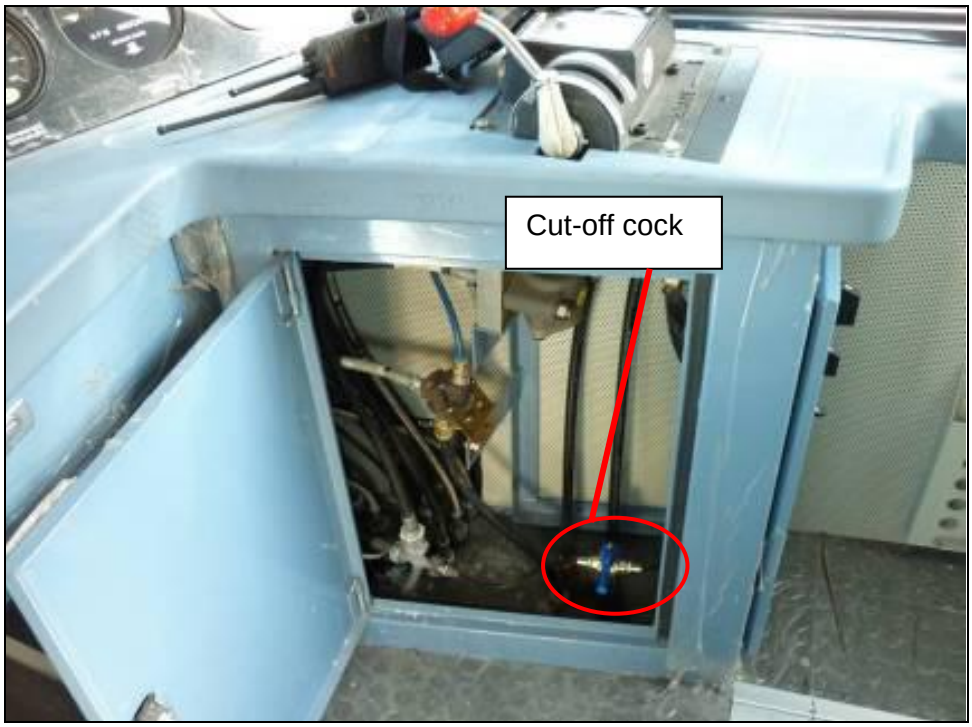


Figure 61: Seat Isolation Cock

15.0 EMERGENCY EQUIPMENT / OPERATION

The front driver's assistant window is the Emergency Egress exit in the locomotive cab. Unscrew the two hand screws at the top of the window, and then push the window out. The window will drop to the ground. A ladder is available to safely access the ground level.

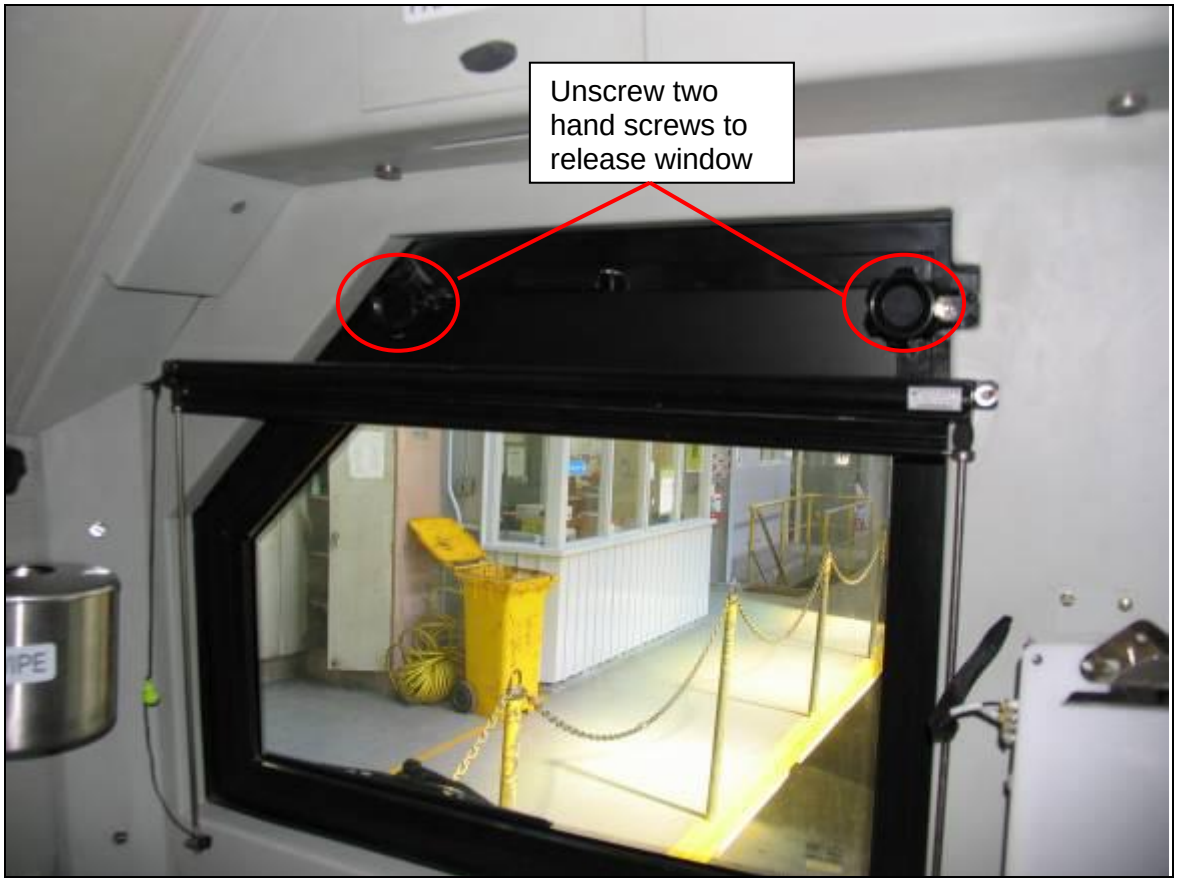


Figure 62: Emergency Egress Exit

15.1 Selcall Emergency Button

The Selcall Emergency Button is situated above the drivers control console in the right hand corner between the front and side windows

Figure 63: Selcall Emergency Button

15.2 Detonators / Tool Bag

These items are located in the cooling room (A side No.2 end)

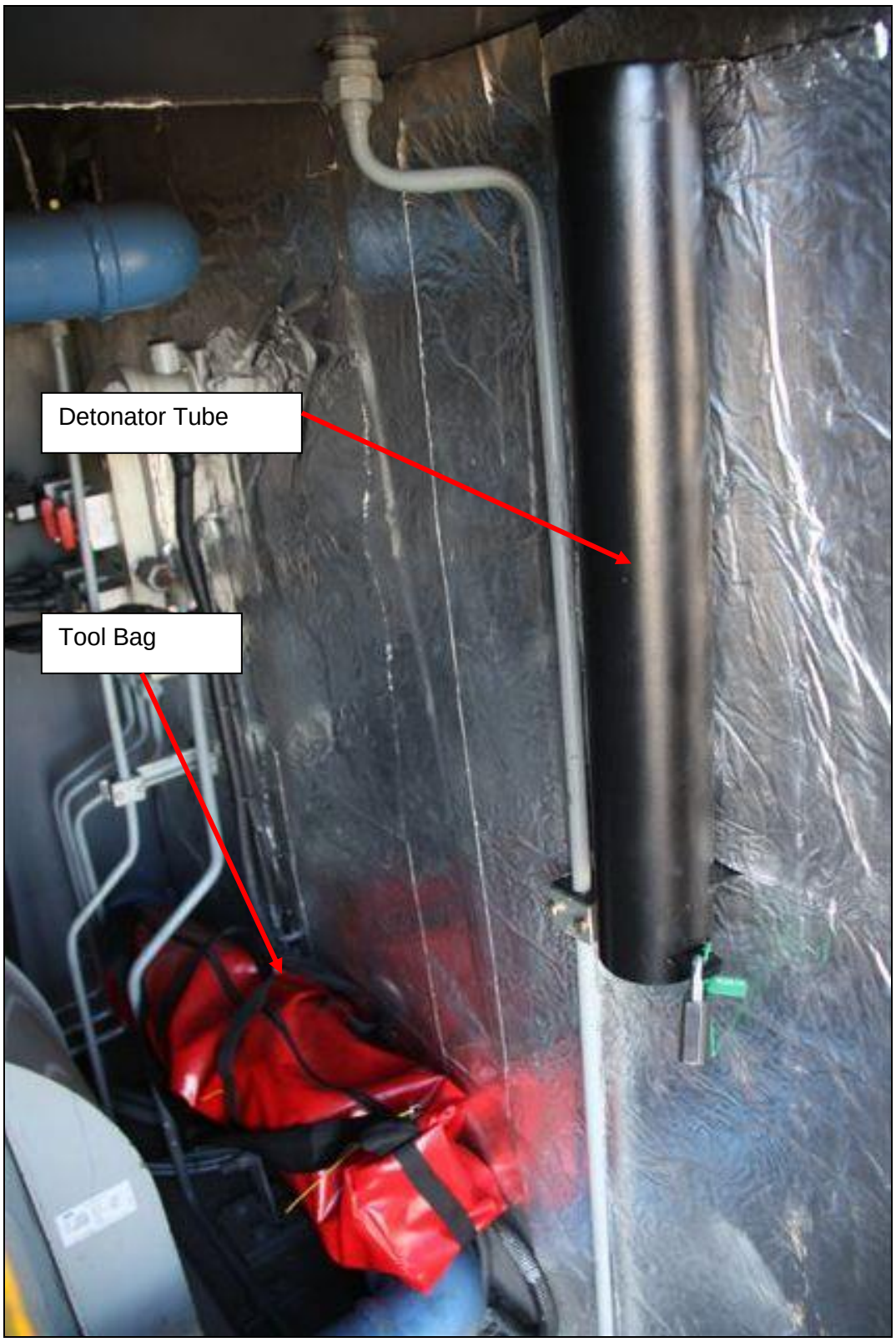


Figure 64: Detonator and Tool Bag Location

16.0 EVENT RECORDER / VIGILANCE

If the Tranzlog circuit breaker is turned or knocked “Off” an alert will be displayed on the VDU screen showing “Fault 61 Tranzlog Circuit Breaker Down”

Resetting the circuit breaker (No.2 end cab) will cancel the alert.

17.0 PROTECTIVE DEVICES

17.1 Fire Detection & Suppression System (STAT-X) where fitted

Some DLs have a fire suppression system fitted. The system consists of 7 STAT-X aerosol generators and a linear heat detection wire that are located in the engine bay. A control module located in the No.1 end electrical cabinet continually monitors the state of the linear heat detection wire and in the event of a fire the detection circuit is activated.

Figure 65: STAT-X Fire System Control Module

Figure 66: STAT-X Cab Control Panel

The control module immediately shuts down the engine and displays a fire alarm condition on the drivers VDU, and the alarm buzzer sounds. There is a delay to allow the engine to come a stop before the 7 STAT-X aerosol generators are discharged. These will flood the engine bay with an ultra-fine, potassium based aerosol.

The engine room and auxiliary room doors are not to be opened for at least 15 minutes and when doing so a portable fire extinguisher must be on hand.

WARNING: Do not enter the engine bay until 15 minutes after all the aerosols have dispersed with the doors open.

OPERATIONAL NOTES:
If a Fire Condition occurs en route, the alarm will sound until the system is reset (by maintenance personnel), and the locomotive will need to be towed dead to a depot for repairs.

17.1.1 Fire Suppression System Fault:

If the Chubb VS-MKII control unit detects an open or short circuit on any part of the system, a fault LED is illuminated on the display panel in each cab. The audible alarm will sound once every 10 seconds while the fault condition exists.

WARNING: Some parts of the system may not work as expected in fault condition

OPERATIONAL NOTES:
The locomotive may run to destination with a fire alarm fault.
The fault must be booked in the Loco 54D repair book.
The locomotive may not leave a depot to run a train with an active alarm fault.

17.2 Fire Alarm

On all DL, the fire alarm will shut-down the engine if a fire is detected in the engine bay. The fire alarm can be momentarily overridden when it is not possible to stop via pressing the fault reset switch available in both cab's instrument panels.

To reset the fire alarm, follow the procedure below:

- Secure the train via ABV and park brake
- Ensure there is no fire on both sides of the engine bay.
- Press the fault reset switch on the Instrument Panel until the fault clears.
- Restart the engine.
- Ensure a record is made of the fault in the 54D book

If the fire alarm continues to trip, cut-out the fire alarm via the circuit breaker on the No.2 End Cab Instrument Panel and perform a computer reset.

18.0 SAFETY INSTRUCTIONS

The following hazards have been identified:

- **Electrical room** (No.1 end cab) – Must not enter unless engine has been shut down.
- **Accessories room** (No.2 end cab) – Must not enter unless the engine has been shut down.
- **Engine room** – Must not enter unless the engine has been shut down.
- **Cowcatcher** – No ride, not fitted with footstep.
- **Engine room doors** – Finger jam / crush when closing doors.

19.0 MISCELLANEOUS

Reserved for future use

20.0 DOOR OPERATION

Reserved for future use

21.0 RADIO / PUBLIC ADDRESS SYSTEM

Reserved for future use

22.0 TRAIN ATTENDANTS

Reserved for future use

23.0 TOWING

At times it may be necessary to tow DL locomotive with the diesel engine shut down.

Set-up of towed locomotives must be carefully carried out to ensure that locomotives are not towed with the park brake applied. There are a number of different towing methods that can be used depending on the configuration of the locomotive and towing scenario. The following flowchart must be used to determine what towing method must be used.

Information to determine what brake cylinders are fitted to the locomotive is available in Section 13.4

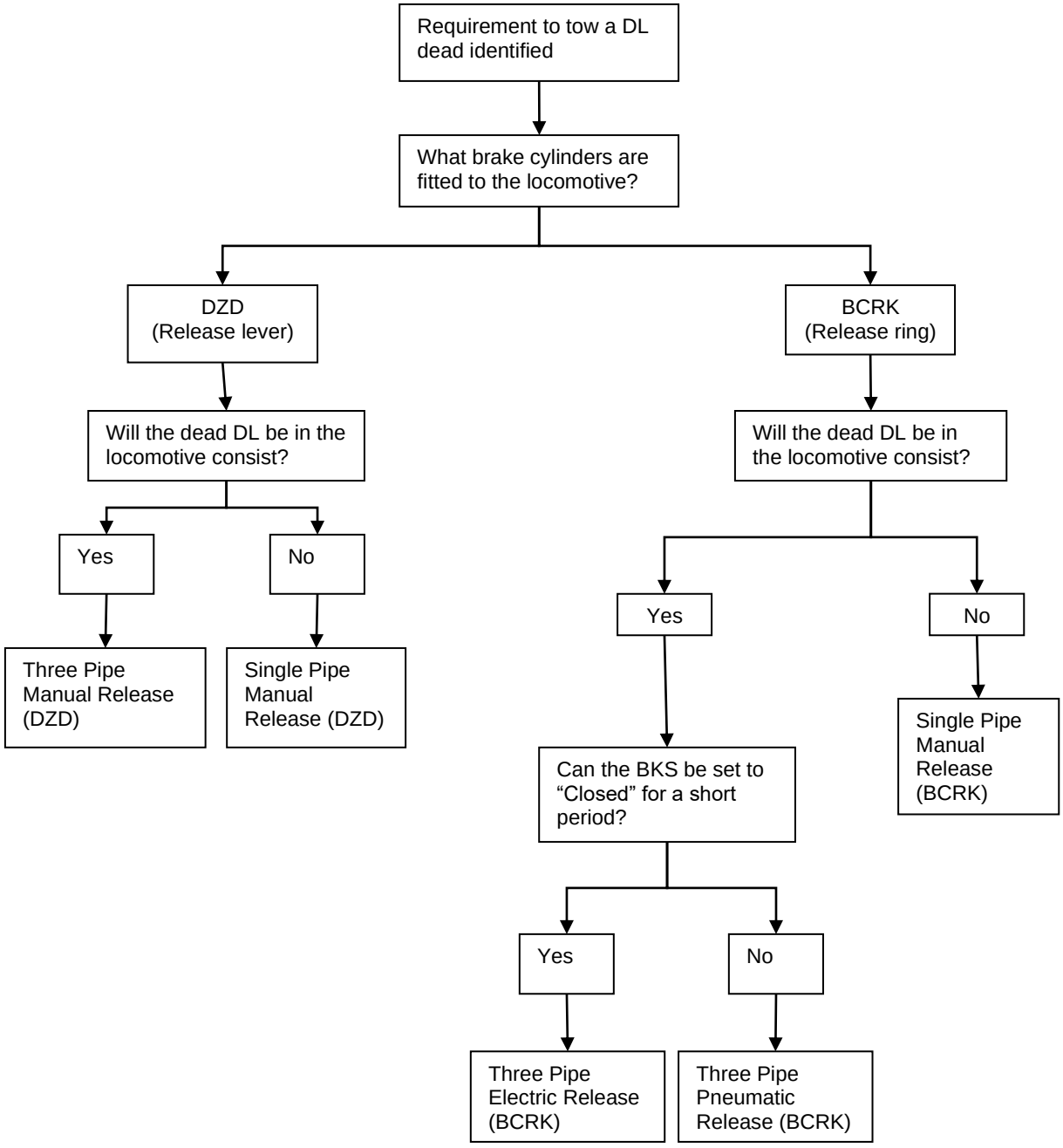


Figure 67: Towing Set-up Flowchart

23.1 Three Pipe Manual Release Towing (DZD brake cylinders)

The three pipe manual release method is the preferred method for locomotives with the DZD brake cylinders fitted.

Process:

1. Ensure locomotive is mechanically coupled to other locomotives in the consist.
2. Remove any jumper cables fitted between the dead locomotive and any others.
3. Shut down the locomotive engine.
4. Open the BKS.
5. In the No.1 end electrical room, centre the reverser contacts and brake transfer switches.
6. Set up brakes as per ROC Section 4.1, Instruction 7.5.
7. Couple up MR, BP and EP pipes and open taps
8. Release park brake units at the wheels (4 each side) by pulling the release lever.
9. On the lead unit complete an automatic and independent brake test. Release the IBV and visually check the park brakes on the dead DL locomotives are released.
10. Book in Loco 54D book as “Three Pipe Dead Manual Release”.

WARNING: If this process is not followed, damage will occur to locomotive wheels and brake units.

NOTE: If the locomotive is being towed dead or with the engine running without a jumper cable used, the brake transfer switches and reverser contacts **must be** centred.

WARNING: If the BKS is closed after this procedure, the park brake may reapply.

The DL should not be coupled with brake pipe only, except where authorised by Depot Manager, Mechanical. In this case mechanical depot personnel will be responsible for setting up the brake equipment.

23.2 Three Pipe Electric Release Towing (BCRK brake cylinders)

The three pipe electric release method is the preferred method for locomotives with the BCRK brake cylinders fitted.

Process

1. Ensure locomotive is mechanically coupled to other locomotives in the consist.
2. Remove any jumper cables fitted between the dead locomotive and any others.
3. Shut down the locomotive engine
4. Ensure that the BKS is closed
5. In the No.2 end driver's console, set the park brake switch to "RELEASED" and wait 10s
6. Open the BKS to ensure that the battery does not run flat.
7. In the No.1 end electrical room, centre the reverser contacts and brake transfer switches.
8. Set up brakes as per ROC Section 4.1, Instruction 7.5.
9. Couple up MR, BP and EP pipes and open taps
10. Verify that the external park brake indicators are green, indicating that the park brake is released.

External Indicator – PB Applied

External Indicator – PB Release

Figure 68: External Park Brake Indicators (BCRK 130PS only)

11. On the lead unit complete an automatic and independent brake test. Release the IBV and visually check the park brakes on the dead DL locomotives are released.
12. Book in the Loco 54D book as "Three Pipe Dead Electric Release"

WARNING: If this process is not followed, damage will occur to locomotive wheels and brake units.

NOTE: If the locomotive is being towed dead or with the engine running without a jumper cable used, the brake transfer switches and reverser contacts **must be** centred.

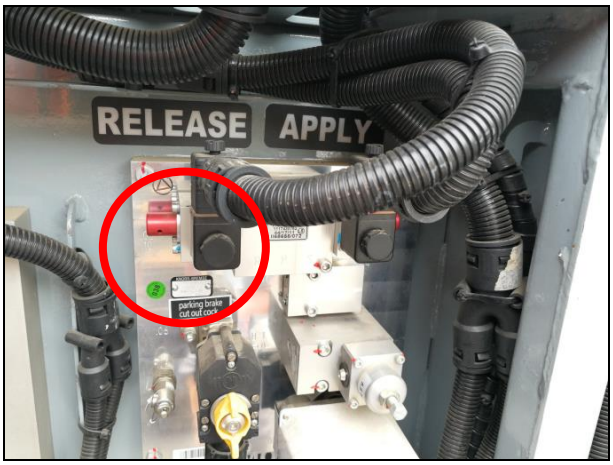
23.3 Three Pipe Pneumatic Release Towing (BCRK brake cylinders)

The three pipe pneumatic release should only be used if the BKS cannot be closed or if the batteries are flat. If a pneumatic release is performed there is a risk that the park brake will be reapplied if the BKS is closed after the towing procedure is performed.

Process

1. Ensure locomotive is mechanically coupled to other locomotives in the consist.
2. Remove any jumper cables fitted between the dead locomotive and any others.
3. Shut down the locomotive engine
4. Ensure that the BKS is opened
5. In the No.1 end electrical room, centre the reverser contacts and brake transfer switches.
6. Set up brakes as per ROC Section 4.1, Instruction 7.5.
7. Couple up MR, BP and EP pipes and open taps
8. Press the PB release push button located on the park brake control manifold below the brake rack.

Door label



PB Release Push Button

Figure 69: PB Pneumatic Release Push Button

9. Verify that the external park brake indicators are green, indicating that the park brake is released.

External Indicator – PB Applied

External Indicator – PB Release

Figure 70:External Park Brake Indicators (BCRK 130PS only)

10. On the lead unit complete an automatic and independent brake test. Release the IBV and visually check the park brakes on the trailing DL locomotives have
11. Book in Loco 54D book as “Three Pipe Pneumatic Release”

WARNING: If this process is not followed, damage will occur to locomotive wheels and brake units.

NOTE: If the locomotive is being towed dead or with the engine running without a jumper cable used, the brake transfer switches and reverser contacts **must be** centred.

WARNING: If the BKS is closed after this procedure, the park brake may reapply.

23.4 Single Pipe Manual Release (DZD brake cylinders)

The single pipe manual release procedure should only be used if the dead DL cannot have a three pipe pneumatic connection with the live locomotive consist. Single pipe connections must be carried out by mechanical staff, due to the risk of incorrect towing setup.

1. Ensure locomotive is coupled to other units in the train, coupling BP pipe only and keeping BP cocks closed for now.
2. If operating previously in multiple, remove jumper cables
3. Shut down locomotive
4. Open the BKS
5. In the No.1 end electrical room, centre reverser contacts and brake transfer switches
6. Drain No.2 Main Reservoir pressure until MR pressure on the cab gauge is below 200kPa.
7. Open the Dead Engine device
8. Slowly open the BP cocks between the locomotive and the train. Main Reservoir pressure will slowly charge to a pre-set pressure
9. Manually release park brake units at the wheels (4 each side) by pulling the release lever on each brake unit.
10. Complete an automatic brake test, and again visually check the park brakes on the DL locomotive are released.
11. Book in Loco 54D book as “Single Pipe Manual Release”

NOTE: If the above process is used to propel a disabled train or locomotive on the main line, the instructions on the following page are also required:

- A bulletin will be required as the leading locomotive will not have control of the brake valve, except for emergency position (ROC Section 4.2 – Instruction 1.1.6 Assisting Locomotives)
- BKS closed, General Control “On”, Lighting Controls to operate headlights.
- ESCA and Park Brake warning lights will remain illuminated.

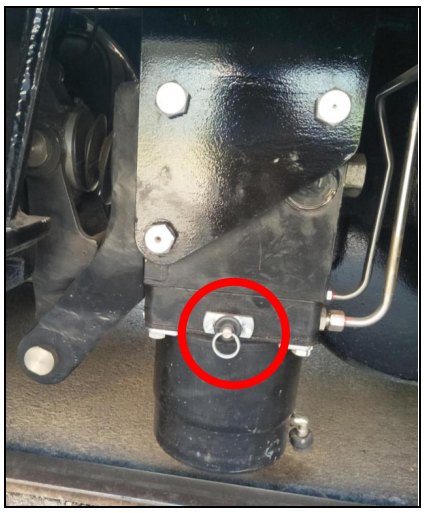
WARNING: If the above process has been followed and the locomotive is to be detached. The Park Brake will not reset due to MR pressure being below 480kPa. If MR pressure cannot be restored to above 480kPa then the locomotive will need to be chocked and secured to a braked vehicle.

NOTE: If the Dead Engine Device is not closed after the above process, amps will not be obtained. (THE DEAD ENGINE DEVICE MUST BE CLOSED TO OPERATE THE LOCOMOTIVE)

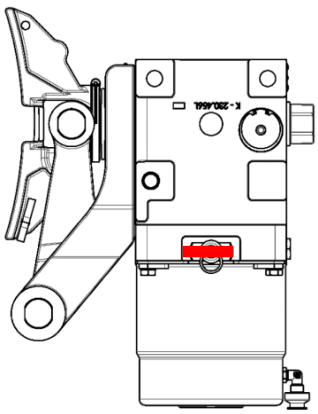
23.5 Single Pipe Manual Release (BCRK brake cylinders)

The single pipe manual release procedure should only be used if the dead DL cannot have a three pipe pneumatic connection with the live locomotive consist. Single pipe connections must be carried out by mechanical staff, due to the risk of incorrect towing setup.

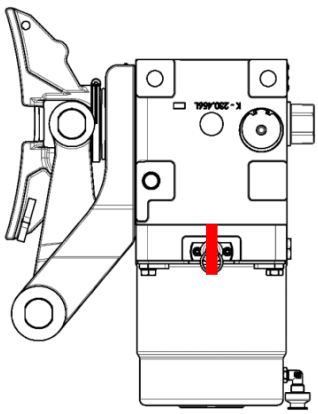
1. Ensure locomotive is coupled to other units in the train, coupling BP pipe only and keeping BP cocks closed for now.
2. If operating previously in multiple, remove jumper cables
3. Shut down locomotive
4. Open the BKS
5. In the No.1 end electrical room, centre reverser contacts and brake transfer switches
6. Drain No.2 Main Reservoir pressure until MR pressure on the cab gauge is below 200kPa.
7. Open the Dead Engine device. The dead engine device is located on the brake rack.
8. Set the Park Brake Cut-out Cock to cut-out (“O”). The Park Brake Cut-out cock is on the brake rack.
9. On the lead locomotive, set the automatic train brake to “Release”
10. Slowly open the BP cocks between the locomotive and the train. Main Reservoir pressure will slowly charge to a pre-set pressure
11. Manually release park brake units at the wheels (4 each side) by pulling the release ring on each brake unit. Each release ring must be rotated into the vertical position to lock the park brake in the released position.



BCRK Park Brake Unit – Release Ring highlighted



Park Brake – Released and Unlocked



Park Brake – Released and Locked

Figure 71: Park Brake Manual Release Ring Position (BCRK 130PS brake cylinders only)

12. Complete an automatic brake test, and again visually check the park brakes on the DL locomotive are released.
13. Book in Loco 54D book as “Single Pipe Manual Release”

NOTE: If a single pipe manual release is performed, the external park brake indicators will not show the correct status of the park brake.

NOTE: If the above process is used to propel a disabled train or locomotive on the main line, the instructions on the following page are also required:

- A bulletin will be required as the leading locomotive will not have control of the brake valve, except for emergency position (ROC Section 4.2 – Instruction 1.1.6 Assisting Locomotives))
- BKS closed, General Control "On", Lighting Controls to operate headlights.

23.6 Towing Reset Procedure – DZD Brake Cylinders

The towing reset procedure must be carried out once the dead tow is completed. If the reset procedure is not carried out, the park brakes will remain released and the locomotive is at risk of rolling away.

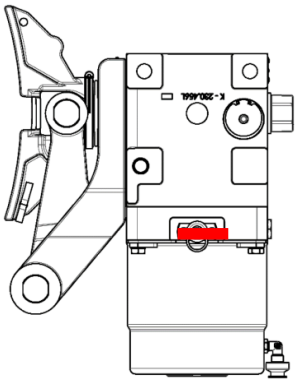
1. Locomotive must be chocked or coupled to a braked locomotive
2. BKS must be set to closed
3. The Dead Engine Device must be set to Closed
4. MR pressure must be above 450kPa. If it is below 450kPa, it can be charged using a donor locomotive or using the locomotive's air compressor. If it cannot be charged, the locomotive will be unable to reapply the park brake and must be chocked.
5. Set the Park Brake switch located on either driver's console to Applied
6. Wait 5 seconds and set the Park Brake switch to Released
7. Wait 5 seconds and set the Park Brake switch to Applied
8. Release the locomotive brakes and confirm that all eight park brake cylinders remain applied.
9. Remove the chocks.

23.7 Towing Reset Procedure – BCRK Brake Cylinders

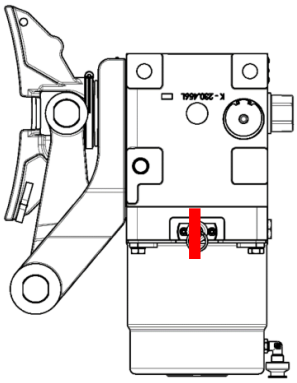
The towing reset procedure must be carried out once the dead tow is completed. If the reset procedure is not carried out, the park brakes will remain released and the locomotive is at risk of rolling away.

1. Locomotive must be chocked or coupled to a braked locomotive
2. BKS must be set to closed
3. The Dead Engine Device must be set to Closed
4. The Park Brake Cut-out cock must be set to Open (“1”)
5. All release rings on the park brake units must be set to the horizontal, released and unlocked position.

BCRK Park Brake Unit – Release Ring highlighted



Park Brake – Released and Unlocked



Park Brake – Released and Locked

Figure 72: Park Brake Manual Release Ring Position (BCRK 130PS brake cylinders only)

6. MR pressure must be above 450kPa. If it is below 450kPa, it can be charged using a donor locomotive or using the locomotive’s air compressor. If it cannot be charged, the locomotive will be unable to reapply the park brake and must be chocked
7. Set the Park Brake switch located on either driver’s console to Applied
8. Wait 5 seconds and set the Park Brake switch to Released
9. Wait 5 seconds and set the Park Brake switch to Applied
10. Release the locomotive brakes and confirm that all eight park brake cylinders remain applied.
11. Remove the chocks

24.0 FAULTS

24.1 General Faults

Fault	Action
Engine Fails to Crank when starting	1. Wait for thirty seconds to ensure start-up cycle has time to complete 2. Check Reverser is in “Neutral” 3. Check BKS is “In” 4. Check battery voltage, it should be above 65V 5. Check VDU for faults 6. Check Isolation switch in Cab II is set to “ISOLATE” or “RUN”, and not “OFF” 7. Check Emergency Engine Stop Button is not depressed. 8. Press and hold Engine Start button for three seconds before releasing. 9. If engine still does not crank, open BKS and close BKS before attempting a restart.
Engine Fails to Start when Cranked	1. Verify fuel pressure is above 100kPa when start-up cycle is in process. 2. Verify battery voltage is above 65V 3. If engine does not start, open and close BKS before attempting a restart.
ESCA light doesn’t extinguish	1. Verify MR pressure is above 875kPa 2. Check ABVs in both cabs are set to “Handle Off” 3. Check BVCOs in both cabs are set to “Cut Out” 4. Press “Penalty Brake Reset” button 5. Verify MU-2A valve located in Cab I is correctly set.
Auxiliary Current on VDU reads 0 amps, indicating the battery is not charging	1. Check engine is running and has completed its startup cycle. 2. Perform a computer reset via switch in Cab II. Avoid shutting down the engine if possible, as battery voltage may not be sufficient to restart engine. 3. Switch the AA Field Switch in Cab II to Position II.
Air Compressor light illuminated but main reservoir does not charge to 975kPa	1. Wait 20s. Air compressor must come up to operating speed before it can charge the main reservoir 2. If air compressor does not charge, set the Air Comp INV circuit breaker on the Cab II instrument panel to OFF for 5s, then set back to ON If the air compressor still does not charge, perform a computer reset via the switch on the Cab I instrument panel
Main Reservoir pressure drops below 875kPa and air compressor light does not illuminate	Press and hold AIR COMP. button located on the console panel until appropriate main reservoir pressure reached.
Braking No pressure in brake cylinder when handle of independent brake valve is at service application zone	1. Check opening of cut-off cocks on brake cylinder pipeline 2. Check if double check valve is stuck, if so 3. Apply emergency braking by using automatic brake valve 4. Release brake and then use independent brake valve to make braking application
AA Overvolt	1. Press the fault reset button 2. Verify that the battery is charging correctly via the VDU. If the battery does not start charging, a tow will be required.

24.2 VDU Faults

Fault	Action
Fault 2 Fire Alarm Shutdown Loss of tractive effort and unload light will be illuminated Engine will shutdown	Indicates that the fire alarm has triggered. 1. Stop and secure train via ABV and park brake 2. Verify there is no fire on both sides of the engine bay. On locomotives with STAT-X fitted do not enter the engine bay If there is a fire, follow emergency procedures. If there is no fire, the fire alarm can be reset. 3. Press the FAULT RESET switch and restart the engine. 4. If the fire alarm continues to trip, cut-out the fire alarm via the circuit breaker located on the Cab II instrument panel
Fault 3 No AA Output	Indicates that the battery is not charging. Note: The engine should not be shut down unless necessary, as an engine restart may not be possible with a flat battery. 1. Press the computer reset switch, available on the Cab II instrument panel 2. Verify Auxil Volt available on the VDU main screen is above 73V. 3. If no volts, switch the AA field switch available on the Cab II instrument panel to position II. 4. Verify Auxil Volt is above 73V. If Auxil Volt does not return, a tow will be required
Fault 6 TB1 Overspeed Loss of tractive effort and unload light will be illuminated	Indicates that the Traction Motor Blower 1 is too fast 1. Press the computer reset switch, available on the Cab II instrument panel 2. If fault occurs again, switch the AA, AG and EXC field switches available in Cab II to position II.
Fault 7 TB2 Overspeed Loss of tractive effort and unload light will be illuminated	Indicates that the Traction Motor Blower 2 is too fast 1. Press the computer reset switch, available on the Cab II instrument panel 2. If fault occurs again, switch the AA, AG and EXC field switches available in Cab II to position II.
Fault 16 TB1 Underspeed Loss of tractive effort and unload light will be illuminated	Indicates that the Traction Motor Blower 1 is too slow 1. Press the computer reset switch, available on the Cab II instrument panel 2. If fault occurs again, switch the AA, AG and EXC field switches available in Cab II to position II. 3. If fault continues to occur, proceed at reduced speed and tractive effort to destination.
Fault 17 TB2 Underspeed Loss of tractive effort and unload light will be illuminated	Indicates that the Traction Motor Blower 2 is too slow 1. Press the computer reset switch, available on the Cab II instrument panel 2. If fault occurs again, switch the AA, AG and EXC field switches available in Cab II to position II. 3. If fault continues to occur, proceed at reduced speed and tractive effort to destination.
Fault 27 EXC Communication Fault Loss of tractive effort	Indicates that no communication is received from the EXC field MCU card 1. Verify the EXC field switch (available on the Cab II instrument panel) is in position I or II and not OFF. 2. Switch the EXC field switch to position II (or back to I)
Fault 28 AG Communication Fault Loss of tractive effort	Indicates that no communication is received from the AG field MCU card 1. Verify the AG field switch (available on the Cab II instrument panel) is in position I or II and not OFF. 2. Switch the AG field switch to position II (or back to I)

Fault	Action
Fault 29 AA Communication Fault Loss of tractive effort	Indicates that no communication is received from the AA field MCU card 1. Verify the AA field switch (available on the Cab II instrument panel) is in position I or II and not OFF. 2. Switch the AA field switch to position II (or back to I)
Fault 38 Field Weaken Contactor Fault	Indicates that the field weakening has not activated above 56 km/h. 1. Proceed at reduced speed to destination
Fault 41 AAFC Contactor Battery will not charge	Indicates the AA field contactor has not picked up. 1. Shut down engine 2. Pull BKS and close BKS 3. Restart engine If fault continues a tow will be required
Fault 42 CFVFC Contactor Cooling Fan 1 will not work	Indicates the Cooling Fan 1 Inverter drive contactor has not picked up 1. Proceed at reduced speed and tractive effort to destination. Engine cooling will be significantly limited and the engine may shut down. A tow will be required if the engine shuts down.
Fault 43 CFFC Contactor Cooling Fan 1 will not work	Indicates the Cooling Fan 1 Direct drive contactor has not picked up 1. Proceed at reduced speed and tractive effort to destination Engine cooling will be significantly limited and the engine may shutdown. A tow will be required if the engine shuts down.
Fault 44 CFVRC Contactor Cooling Fan 2 will not work	Indicates the Cooling Fan 2 Inverter drive contactor has not picked up. 1. Proceed at reduced speed and tractive effort to destination Engine cooling will be significantly limited and the engine may shutdown. A tow will be required if the engine shuts down.
Fault 45 CFRC Contactor Cooling Fan 2 will not work	Indicates the Cooling Fan 2 Direct drive contactor has not picked up 1. Proceed at reduced speed and tractive effort to destination Engine cooling will be significantly limited and the engine may shutdown. A tow will be required if the engine shuts down.
Fault 46 AGFC Contactor Both Cooling Fans and Air Compressor will not work	Indicates the AG field contactor has not picked up. 1. Stop and secure train with the ABV and park brake 2. Press the COMPUTER RESET switch, available on the Cab II instrument panel If the fault does not clear, a tow will be required.
Fault 48 Fuel Pump Contactor Engine will not start	Indicates that the Fuel Pump Contactor has not picked up No engine start will be possible
Fault 49 Engine Start Relay, try restart Engine will not start	Indicates that the Engine Start Relay has not picked up. No engine start will be possible.
Fault 52 Low Water Engine may shut down	Indicates that the coolant level in the cooling system has dropped. 1. Stop train and engine. 2. Inspect the engine compartment for a significant coolant leak. 3. Verify that coolant level in the header tank are above the MIN level If a significant leak has occurred, a tow will be required. NOTE: Do not attempt to refill the cooling system with water. Coolant system contains hot water and gas near boiling temperatures during normal operation. Refilling should only be performed by trained staff.
Fault 53 DBLR Fault Dynamic brake will be unavailable	Indicates that a dynamic brake blower motor is not working correctly. Dynamic braking will be unavailable Revert to pneumatic train braking.
Fault 60 Fire Monitor CB Down	Indicates that the Fire Alarm has been isolated.
Fault 61 Tranzlog CB Down	Indicates that the Tranzlog has been disabled. Note: If the Tranzlog is disabled the Tranzlog PBSO must be isolated at the Tranzlog box in the equipment bay.

Fault	Action
Fault 76 Air Comp Over Temp	Indicates that air compressor oil temperature is excessive. 1. Secure the train with the ABV and park brake. 2. Press the reset button on the Air Compressor Control box located in the equipment bay If the fault continues to trip, a tow will be required
Fault 77 Air Comp not ready	Indicates that the air compressor is not ready to start 1. Verify the AIR COMP INV circuit breaker located on the Cab II instrument panel is set to ON If the air compressor does not start, perform a computer reset with the Computer Reset switch located on the Cab II instrument panel.
Fault 84 Main GND Unload" Loss of tractive effort and unload light will be illuminated Grounding indicator illuminated	Indicates a ground relay has occurred and the main ground relay (MGR) has tripped. 1. Move throttle to idle. 2. Reset the ground relay with "FAULT RESET" switch 3. Grounding indicator should extinguish 4. Select notch 1, allow train to accelerate. Higher notches may be selected if ground relay does not trip again. If the ground relay trips again, the following process must be followed 1. Move throttle to idle 2. Reset the ground relay with the "FAULT RESET" switch, and 3. Set the TM1 isolation switch (located in Cab II) to "OFF" 4. Select notch 1, allow train to accelerate. If the ground relay occurs again, stop the train and set the TM1 isolation switch on "ON" 5. Repeat steps 2-4 for TM2-6 If the faulty traction motor cannot be identified, request a tow.
Fault 87 ALT Over Current Loss of tractive effort and unload light will be illuminated Over-current indicator illuminated	Indicated the current produced by the main alternator is excessive and that the Main Overcurrent Relay (MOCR) has tripped. 1. Move throttle to notch "0" 2. Reset the MOCR with the "FAULT RESET" switch (available on the instrument panel of both cabs) 3. Select notch 1, allow the train to accelerate. Higher notches may be selected if MOCR does not trip again. If the MOCR continues to trip, request a tow.
Fault 89 RECT Over Voltage Loss of tractive effort and unload light will be illuminated	Indicates the voltage on the traction circuit is excessive. 1. Move throttle to notch "0" 2. Press the COMPUTER RESET SWITCH 3. Select notch 1, allow the train to accelerate. Higher notches may be selected if the fault does not occur again 4. If the fault continues to occur, change the EXC. Field switch (available on the instrument panel in Cab II) from the I position to the II position If the fault continues to occur, request a tow
Fault 96-101 TM1-6 Overspeed	Indicates the specific traction motor is running too fast. 1. Reduce locomotive speed 2. Correct any wheelslip that may be occurring 3. If the fault continues, stop the train and set both the AG field switch and the AA field switch from the I position to the II position. Locomotive can continue to run to destination with this fault
Fault 102-107 TM1-6 Over current	Indicates the current consumed by the specific traction motor is excessive. 1. Reduce throttle notch If the fault continues, stop the train and isolate the traction motor via the specific traction motor isolation switch (available on the Cab II instrument panel)
Fault 114-119 TM1-6 Cut-out	Indicates that the specific traction motor is cut out. No action is required by the driver.
Fault 120 DB Grid Overcurrent	Indicates the current produced when in dynamic brake is excessive 1. Reduce dynamic brake effort Use pneumatic braking if necessary

Fault	Action
Fault 121 DB Field Over Current	Indicates the current consumed when in dynamic brake is excessive. 1. Reduce dynamic brake effort Use pneumatic braking if necessary
Fault 146-151 TM1-6 Speed Sensor Faulty	Indicates that a traction motor speed signal is faulty. Wheelslip response may be poor when multiple sensors are faulty. Continue to destination, complete 54D booking
Fault 161 AG Overvoltage Loss of tractive effort and unload light will be illuminated AG overvoltage light will be illuminated	Indicates that the Auxiliary generator overvoltage relay has tripped. 1. Stop train and apply park brake 2. Press the fault reset button 3. Verify that the air compressor can correctly charge the main reservoir higher that 975kPa Continue to destination, complete 54D booking
Fault 163 AG Volt Sensor	Indicates the AG voltage cannot be detected Continue to destination, complete 54D booking
Fault 164 AG Overcurrent Loss of tractive effort and unload light will be illuminated	Indicates the current produced on the auxiliary circuit is excessive 1. Stop train and apply park brake 2. Press the computer reset switch (available on the Cab II instrument panel) 3. Verify the air compressor can correctly charge the main reservoir higher than 975kPa If the air compressor does not work correctly when required, call for a tow.
Fault 166 AG power CKT GND Loss of tractive effort and unload light will be illuminated AG grounding indicator light will be illuminated	Indicates the auxiliary circuit has a ground fault and the auxiliaries ground relay (AGR) has tripped 1. Stop train and apply park brake 2. Press the fault reset switch 3. Verify the air compressor can correctly charge the main reservoir higher than 975kPa If the air compressor does not work correctly when required, call for a tow.
Fault 201 INV1 Under load	Indicates an issue with the power inverter that powers Cooling Fan 1. 1. Verify that the equipment blower motor located in the auxiliary electrical cabinet (Cab II) is functional 2. Set the CLG FAN INV (I) switch to OFF. Circuit breaker switch is on the Cab II instrument panel 3. Set the CLG FAN INV (I) switch to ON If the power inverter does not start working again, the locomotive control system will automatically revert to direct drive of the cooling fan.
Fault 202 INV1 Over load	
Fault 203 INV1 Phase Unbalance	
Fault 204 INV1 Over temperature	
Fault 205 INV1 Over current	
Fault 206 INV1 Over DC Volt	
Fault 207 INV1 Under DC Volt	
Fault 208 INV1 Under 5V	
Fault 209 INV1 Under Batt	
Fault 210 INV1 Over Current Phase A	
Fault 211 INV1 Over Current Phase B	
Fault 212 INV1 Over Current Phase C	
Fault 213 INV1 Over Bus Volt	
Fault 214 INV1 Short Circuit	
Fault 215 INV1 Over temp	
Fault 216 INV2 Under load	Indicates an issue with the power inverter that powers Cooling Fan 2. 1. Verify that the equipment blower motor located in the auxiliary
Fault 217 INV2 Over load	

<table>
<tr><th>Fault</th><th>Action</th></tr>
<tr><td>Fault 218 INV2 Phase Unbalance</td><td rowspan="14">electrical cabinet (Cab II) is functional
2. Set the CLG FAN INV (II) switch to OFF. Circuit breaker switch is on the Cab II instrument panel
3. Set the CLG FAN INV (II) switch to ON
If the power inverter does not start working again, the locomotive control system will automatically revert to direct drive of the cooling fan.</td></tr>
<tr><td>Fault 219 INV2 Over temperature</td></tr>
<tr><td>Fault 220 INV2 Over current</td></tr>
<tr><td>Fault 221 INV2 Over DC Volt</td></tr>
<tr><td>Fault 222 INV2 Under DC Volt</td></tr>
<tr><td>Fault 223 INV2 Under 5V</td></tr>
<tr><td>Fault 224 Under Batt</td></tr>
<tr><td>Fault 225 Over Current Phase A</td></tr>
<tr><td>Fault 226 Over Current Phase B</td></tr>
<tr><td>Fault 227 Over Current Phase C</td></tr>
<tr><td>Fault 228 INV2 Over bus Volt</td></tr>
<tr><td>Fault 229 INV2 Short circuit</td></tr>
<tr><td>Fault 230 INV2 Over temp</td></tr>
<tr><td>Fault 231 INV3 Under load</td><td rowspan="15">Indicates an issue with the power inverter that powers the air compressor.
1. Verify that the equipment blower motor located in the auxiliary electrical cabinet (Cab II) is functional
2. Set the AIR COMP INV switch to OFF. Circuit breaker switch is on the Cab II instrument panel
3. Set the AIR COMP INV switch to ON
4. Verify the air compressor can charge the main reservoir above 975kPa
If the air compressor does begin to work, a tow will be required.</td></tr>
<tr><td>Fault 232 INV3 Over load</td></tr>
<tr><td>Fault 233 INV3 Phase Unbalance</td></tr>
<tr><td>Fault 234 INV3 Over temperature</td></tr>
<tr><td>Fault 235 INV3 Over current</td></tr>
<tr><td>Fault 236 INV3 Over DC volt</td></tr>
<tr><td>Fault 237 INV3 Under DC volt</td></tr>
<tr><td>Fault 238 INV3 Under 5V</td></tr>
<tr><td>Fault 239 INV3 Under batt</td></tr>
<tr><td>Fault 240 INV3 Over Current Phase A</td></tr>
<tr><td>Fault 241 INV3 Over Current Phase B</td></tr>
<tr><td>Fault 242 INV3 Over Current Phase C</td></tr>
<tr><td>Fault 243 INV3 Over bus volt</td></tr>
<tr><td>Fault 244 INV3 Short Circuit</td></tr>
<tr><td>Fault 245 INV3 Over temp</td></tr>
</table>

24.3 CCBII-P Faults

Fault Code	Fault Information	Recommended Action
001	Fault 001 Active, ER Control Node Fault, Trail Use Only	Cycle Air Brake CB. If fault does not disappear, open Air Brake CB and use loco as trail only
002	Fault 002 Active, ER AW4 Fault, Trail Use Only	With parking brakes applied, place mode switch to Trail, Automatic Handle in Emergency, and Independent Brake Handle in Full to clear fault. If fault is not cleared or returns, power off Air Brake Circuit Breaker and use in Trail until it can be repaired
003	Fault 003 Active, ER Transducer Fault, Trail Use Only	Cycle Air Brake Circuit Breaker. If fault is still active, power off Air Brake Circuit Breaker and use in Trail until it can be repaired
004	Fault 004 Active, MR Transducer Fault, Service Soon	Ok to run as trail or lead
006	Fault 006 Active, MVER Fault, Trail Use Only.	Power off Air Brake Circuit Breaker and use in Trail until it can be repaired
009	Fault 009 Active, FL Transducer Fault, Service Soon	Ok to run as trail or lead
010	Fault 010 Active, BP Transducer Fault, Trail Use Only	Cycle Air Brake CB. If fault does not disappear, open Air Brake CB and use loco as trail only
014	Fault 014 Active, MV53 Fault, Trail use only	Cycle Air Brake CB. If fault does not disappear, open Air Brake CB and use loco as trail only
016	Fault 016 Active, BP Control Node Fault, Trail use only.	Power off Air Brake Circuit Breaker and use in Trail until it can be repaired
018	Fault 018 Active, MVEM Fault, Service soon	Ok to run as trail or lead
023	Fault 023 Active, 13 Transducer High Fault, Service Soon	OK to run, but BC on unit will fully release on graduated increases of BP (direct release).
024	Fault 024 Active, 13 Transducer Low Fault, Service Soon	OK to run, but BC on unit will fully release on graduated increases of BP (direct release).
036	Fault 036 Active, 16 AW4 Fault, Service Soon	With parking brakes applied, place mode switch to Trail, Automatic Handle in emergency and Independent Handle in Full to clear fault. If fault is not cleared or returns, system is OK to run, but BC on locomotive will fully release on graduated increases of BP (direct release). Reduced or disabled ED blended brake.
037	Fault 037 Active, 16 Transducer Fault, Service Soon	OK to run, but BC on unit will fully release on graduated increases of BP (direct release).
039	Fault 039 Active, MV16 Fault, Service Soon	OK to run, but BC on unit will fully release on graduated increases of BP (direct release).
048	Fault 048 Active, BP Alternate Transducer Fault, Service Soon	Ok to run as trail or lead
049	Fault 049 Active, BC Transducer Fault, Service Soon	Ok to run as trail or lead
052	Fault 052 Active, 16 Control Node Fault, Service Soon	OK to run, but BC on unit will fully release on graduated increases of BP (direct release).

Fault Code	Fault Information	Recommended Action
055	Fault 055 Active, 20 AW4 Fault, Trail Use Only	With hand brakes applied, place mode switch to Trail, Automatic Handle in Emergency, and Independent/Holding Brake Handle in Full/On to clear fault. If fault is not cleared or returns, power off Air Brake Circuit Breaker and use in Trail until it can be repaired
056	Fault 056 Active, 20TT Transducer Fault, Trail Use Only	Power off Air Brake Circuit Breaker and use in Trail until it can be repaired
058	Fault 058 Active, MVLT Fault, Trail Use Only	Power off Air Brake Circuit Breaker and use in Trail until it can be repaired
062	Fault 062 Active, 20 Control Node Fault, Trail Use Only	Cycle Air Brake CB. If fault does not disappear, open Air Brake CB and use loco as trail only
075	Fault 075 Active, Auto Handle Open Fault, Trail Use Only	Power off Air Brake Circuit Breaker and use in Trail until it can be repaired
076	Fault 076 Active, Independent Handle Open Fault, Service Soon	Check Independent/Holding Brake Handle operation. If handle in Full/On charges BC, then OK to Run. Replace EBV at next service. If not, power off Air Brake Circuit Breaker and use in Trail until it can be repaired
077	Fault 077 Active, EBV Limit Switch Fault, Service Soon	Check EBV Handle response for both Automatic and Independent/Holding Brake. If response is normal then OK to Run.
085	Fault 085 Active, EBV Control Node Fault, Trail Use Only	Cycle Air Brake Circuit Breaker. If fault is still active, power off Air Brake Circuit Breaker and use in Trail until it can be repaired
099	Fault 099 Active, 20TL Transducer Fault, Trail Use Only	Power off Air Brake Circuit Breaker and use in Trail until it can be repaired
103	Fault 103 Active, Blended Brake Control Node Fault, Service Soon	Cycle Air Brake Circuit Breaker. If fault is still active, system is OK to Run but BC on unit will fully release on graduated increases of BP (direct release).
108	Fault 108 Active, Cab Mismatch Fault, Set one EBV to Trail	Check mode selection of both EBVs. Ensure that only the EBV in the active cab is in a Lead Mode. If fault is still active, power off Air Brake Circuit Breaker and use in Trail until it can be repaired
113	Fault 113 Active, 10T Transducer Fault, Trail Use Only	Cycle Air Brake Circuit Breaker. If fault is still active, power off Air Brake Circuit Breaker and use in Trail until it can be repaired
114	Fault 114 Active, ER Supply Magnet Valve Fault, Trail Use Only	Power off Air Brake Circuit Breaker and use in Trail until it can be repaired
115	Fault 115 Active, ER Exhaust Magnet Valve Fault, Trail Use Only.	Power off Air Brake Circuit Breaker and use in Trail until it can be repaired
116	Fault 116 Active, 20 Supply Magnet Valve Fault, Trail Use Only.	Power off Air Brake Circuit Breaker and use in Trail until it can be repaired
117	Fault 117 Active, 20 Exhaust Magnet Valve Fault, Trail Use Only.	Power off Air Brake Circuit Breaker and use in Trail until it can be repaired
118	Fault 118 Active, RCP Control Node Fault, Trail use only.	Cycle Air Brake Circuit Breaker. If fault is still active, power off Air Brake Circuit Breaker and use in Trail until it can be repaired
119	Fault 119 Active, BP Not Reducing Fault	Recharge BP and check BP reduction in response to Penalty Brake. If Penalty Brake reduction occurs, OK to Run. If fault re-occurs, use in Trail until it can be repaired
124	Fault 124 Active, DBTV/BCCP Fault, Trail Use Only	Power off Air Brake Circuit Breaker and use in Trail until it can be repaired

Fault Code	Fault Information	Recommended Action
125	Fault 125 Active, MV26 Fault, Trail Use Only	Power off Air Brake Circuit Breaker and use in Trail until it can be repaired
130	Fault 130 Active, ROL Transition Fault	Power off Air Brake Circuit Breaker and use in Trail until it can be repaired
136	Fault 136 Active, CP16 BP Transducer Fault, Service soon	OK to run, but BC on unit will fully release on graduated increases of BP (direct release).
140	Fault 140 Active, MR/FL Dual Transducer Fault, service soon	Ok to run as trail or lead
147	Fault 147 Active, AST Transducer Fault, service soon	OK to run, BC will develop to AW0 load weigh compensation pressures.