

GE
Transportation

Electronic Air Brake System, PH37ACmi PowerHaul[®] Series Locomotive

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imagination at work

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1. GENERAL INFORMATION

1.1. INTRODUCTION

This publication covers maintenance of the Electronic Air Brake (EAB) system and its major components as provided on the CCA controlled locomotives with FastBrake™ for the PowerHaul® Series locomotives. The PowerHaul® Series locomotives comply with the UIC emissions regulations for railway locomotives.

The EAB system provided consists of the following devices (Figure 1 , Figure 2 , and Figure 3):

1. Cab Control Unit (CCU, 1 in each Operator Cab)
2. Pneumatic Operating Unit (POU)
3. Main Reservoir Inputs
4. Brake Pipe
5. Brake Cylinders
6. Piping, cut-out cocks, end connections and hoses required for multiple-unit operation

The major components of the electronic air brake system are located in several areas of the locomotive. The Air Brake Compartment which houses the Pneumatic Operating Unit (POU) is located on the A-side of the locomotive just behind the Operating Cab at the Number 2 End. The Operating Control Console(s) houses the Cab Control Unit (CCU), also known as the Electronic Brake Valve (EBV).

The Electronic Brake Valve (EBV) is located in the Operating Cab on the Operator's side. Piping and tubing, connecting the various parts of the air brake system (and providing multiple-unit connections) are located beneath the locomotive platform.

1.2. SAFETY INFORMATION

Safety precautions, which must be observed when working on this equipment, appear throughout this publication. **WARNING** indicates the potential for personal injury, and **CAUTION** indicates the potential for equipment damage.

The following instructions must be observed when maintenance is performed on the Electronic Air Brake System. These instructions do not cover all details or variations in equipment nor provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise that are not covered sufficiently for the user's purposes, the matter should be referred to General Electric Company.

NOTE: Any applicable Federal, State, or Local Regulations or Company Safety and Operating Rules must take precedence over any instructions given in this material.

1. Apply locomotive hand brake or electric parking brake.
2. Always remove power to the EAB equipment (open LEB Computer and Air Brake Computer circuit breakers on the EC panel) before removing any component/device.

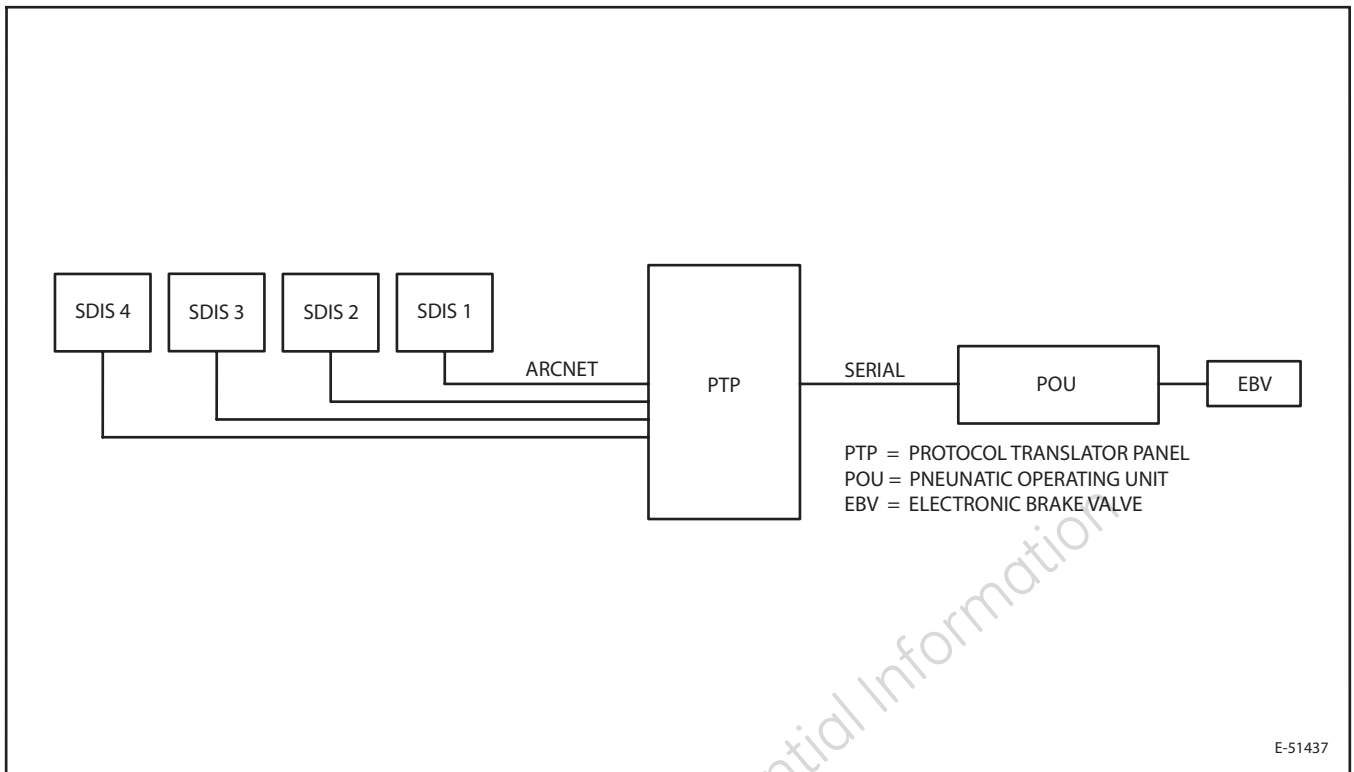


Figure 1. Electronic Air Brake Simplified System Diagram.

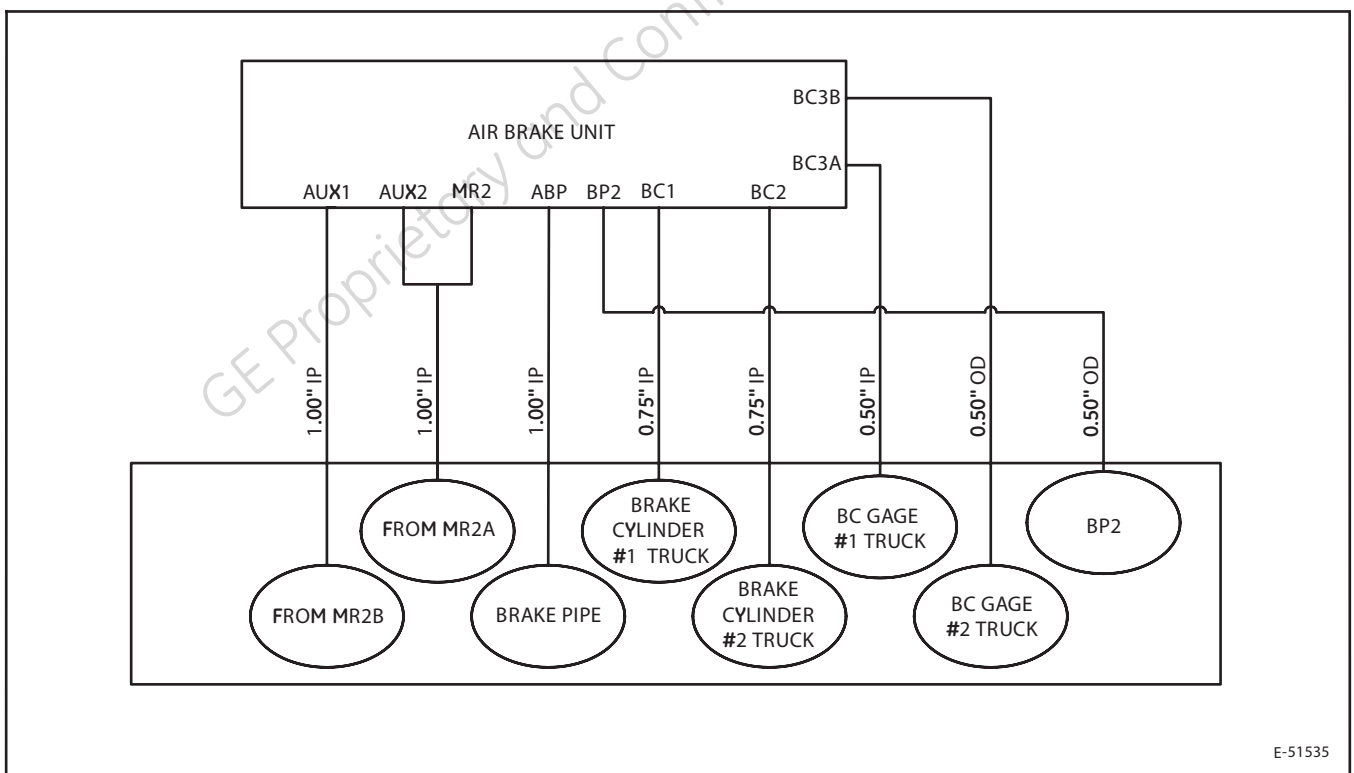


Figure 2. Electronic Air Brake System, Pneumatic Diagram (Sheet 1 of 2).

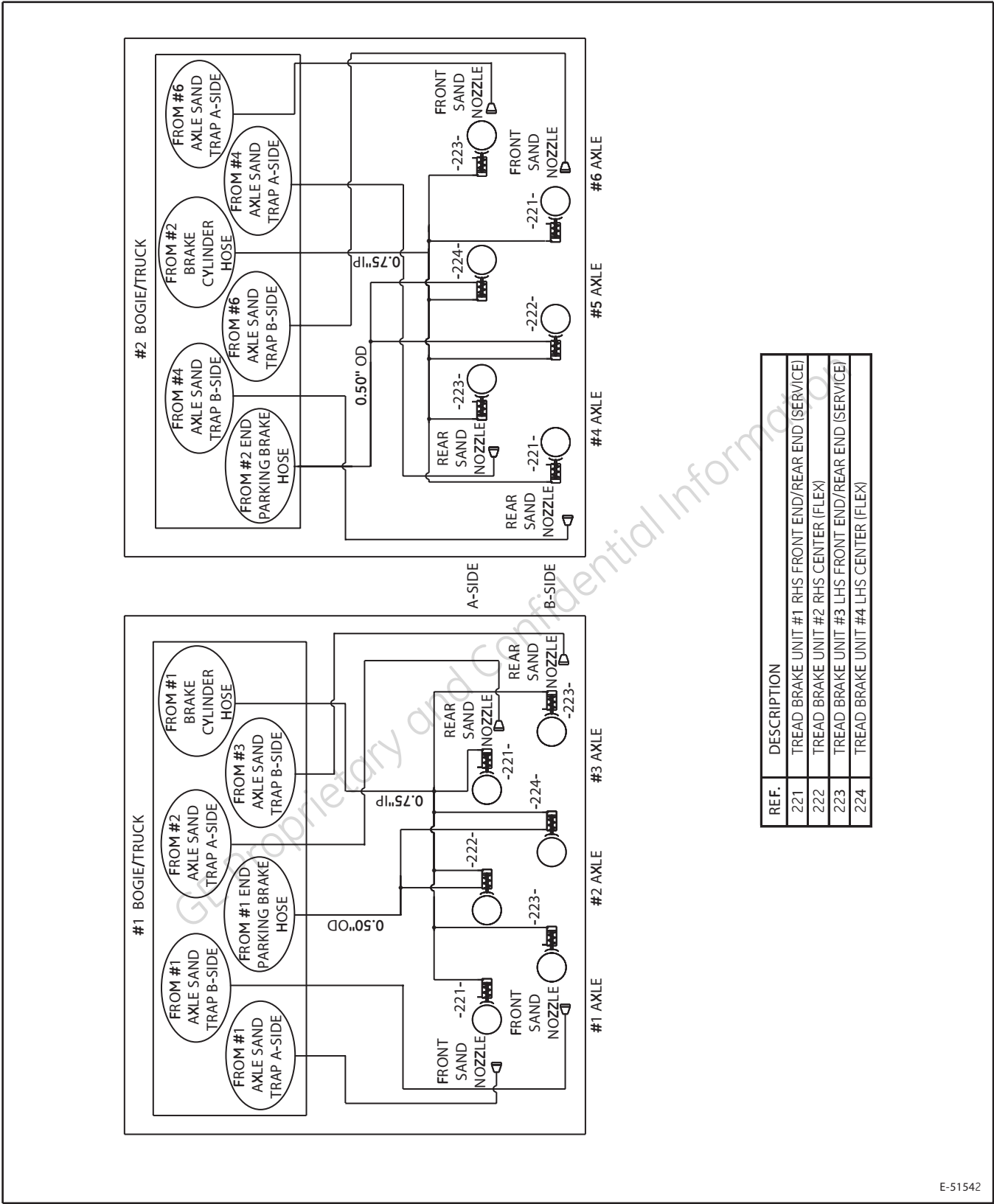


Figure 3. Electronic Air Brake System, Pneumatic Diagram (Sheet 2 of 2).

3. Always cut-off the air supply to the EAB equipment before removing any component/device. (Vent the brake pipe at the BP MU Valve and close the Main Reservoir cut out cocks to the air rack at the Number 2 end of the main reservoirs under the platform.)
4. When certain components/devices are removed from the equipment arrangement, trapped air under pressure (even though the air supply is cut-off) may cause gaskets and/or particles of dirt to become airborne. The trapped air may also increase the sound level. Therefore, personal eye and ear protection must be worn when performing any work on the equipment.
5. When a component/device is removed from the equipment arrangement, all open ports, tube ends, and/or cable connectors should be protected to prevent foreign matter from entering until a replacement component/device is installed.
6. After performing maintenance, a complete locomotive standing test must be performed per standard *Railroad Operating Procedures*.
7. Verify POU and Cab Control Unit (CCU) software for correctness and compatibility. Refer to the **GEK-114188 SOFTWARE LOADING** publication for the appropriate locomotive. The software components for the Electronic Air Brake (EAB) system cannot be loaded using the SDIS panels. They must be loaded directly using a special cable and a portable test unit loaded with Air Brake software.

2. CONTROLS AND INDICATORS

Not Applicable

3. FUNCTIONAL DESCRIPTION

The electronic air brake system consists of two Cab Control Units (handles) and a set of electro-pneumatic control hardware. The cab controls are mounted on the desktop of each of the locomotive control console and the electro-pneumatic control hardware is mounted in the Radiator Cab.

The EAB block (Figure 4) consists of the air brake computer and the pneumatic controls. These components control the pressure in BP and in the locomotive brake cylinders. The EAB device is the link between the air brake system and the other systems on the locomotive.

The pneumatic brake control components (on the EAB) control the brakes of the locomotives directly by controlling the pressures in the brake cylinders. The brakes of the other locomotives in the consist are controlled by the BP. By controlling the pressure in the BP, the EAB can apply or release the brakes on all the cars in the train and any MUed locomotives operating in trail mode.

The Cab Unit is a desktop style brake unit with separate handles for the automatic and independent brakes. The handles operate in the vertical plane.

The EAB broadcasts and receives commands using LSI Class-B protocol. These are sent to the protocol translator panel (PTP). The PTP converts these messages to the ARCNET protocol. This serial interface allows the operator to set up the EAB using the operator display and allow other components on the locomotive to request penalty brake applications.

The EAB sends out a status message containing the pressures in the unit, as well as its current configuration, to the Locomotive Process Controller (ILC) and other network devices.

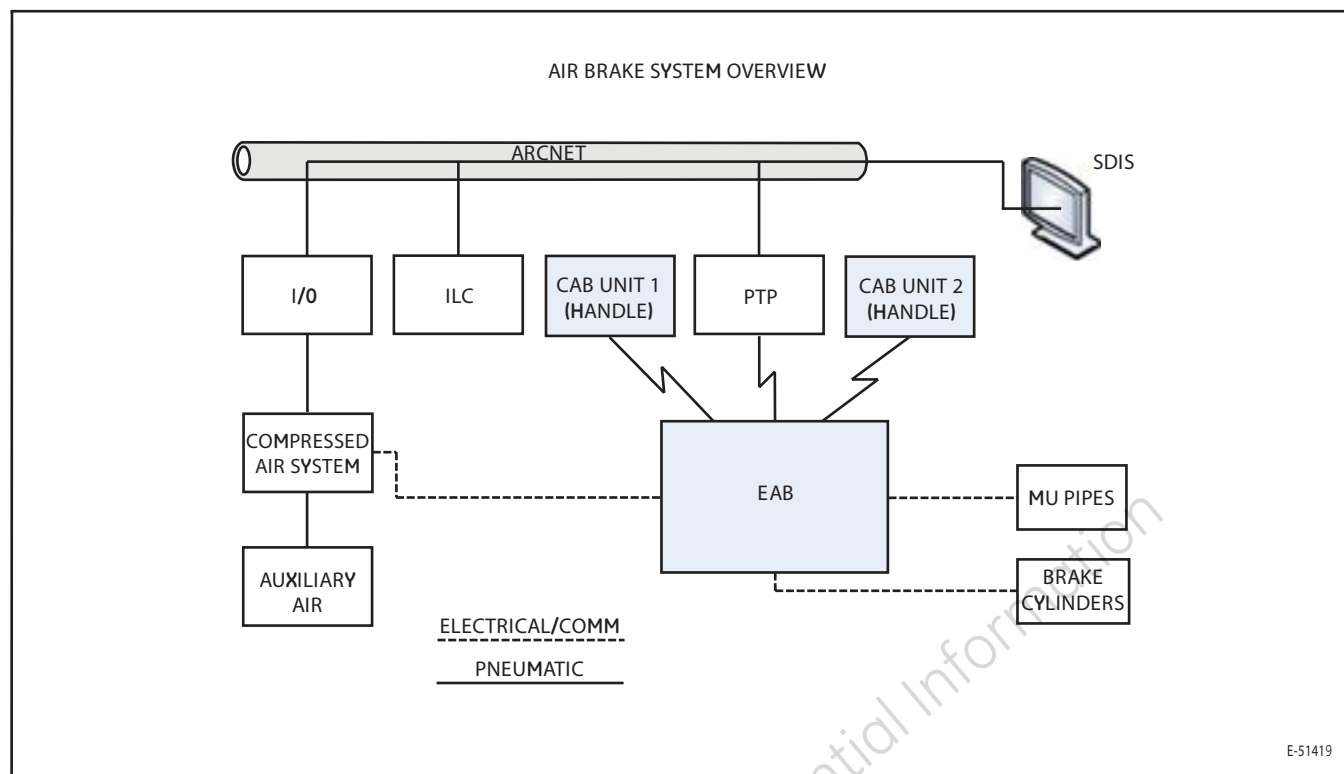


Figure 4. Air Brake System Overview.

3.1. FASTBRAKE™ AIR BRAKE EQUIPMENT

The Air Brake Equipment consists of the Electronic Brake Valve (EBV), the air brake components on the Pneumatic Operating Unit (POU), trainline brake pipes, and electronic devices for operator command.

FastBrake™, a microcomputer-based, electro-pneumatic blended brake control system, is featured on this locomotive. All logic is under computer control, except for initiation of Emergency Brake applications via brake vent or through the Emergency Brake Valve on the Crew Member Console. FastBrake™ is compatible with 26L Type pneumatic air brake systems. Figure 1 shows a simplified FastBrake™ system diagram.

NOTE: FastBrake™ is an electro-pneumatic system which needs locomotive battery power to function. Verify that the Air Brake 1 and Air Brake 2 circuit breakers on the Engine Control (EC1) panel are set to ON.

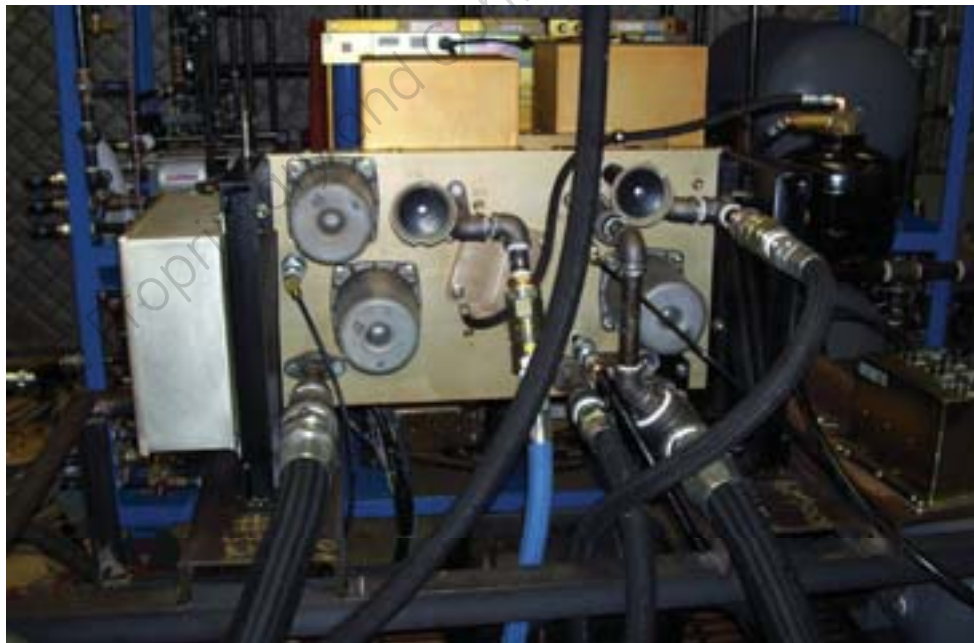
The main computer for the FastBrake™ system is located on the POU (Figure 5) in the Radiator Cab. The Protocol Translator Panel (PTP) is mounted in the Electronic Equipment Locker and serves as the interface between FastBrake™ and the Smart Displays (SDIS). The PTP communicates with SDIS for Alert messaging, crew messaging, and diagnostic fault messaging. FastBrake™ provides a backup pneumatic brake cylinder control in the event of computer failure or loss of input power from the locomotive. This function is provided by the manifold-mounted MC-30 Control Valve (Figure 6).

WARNING: Under no circumstances should a train be permitted to continue in operation if the Brake Pipe air pressure falls below 45 psi (3.10 bar). If this situation occurs, the train must be stopped and the Brake Pipe recharged to the railroad particular setting. Failure to comply with this warning may result in the inability to control or stop the train. Follow all Railroad Operating Procedures.

The Electronic Brake Valve (EBV) is an operator-actuated selector for Automatic or Independent Air Brake operation. The movement of the brake handles provides the requested brake application.



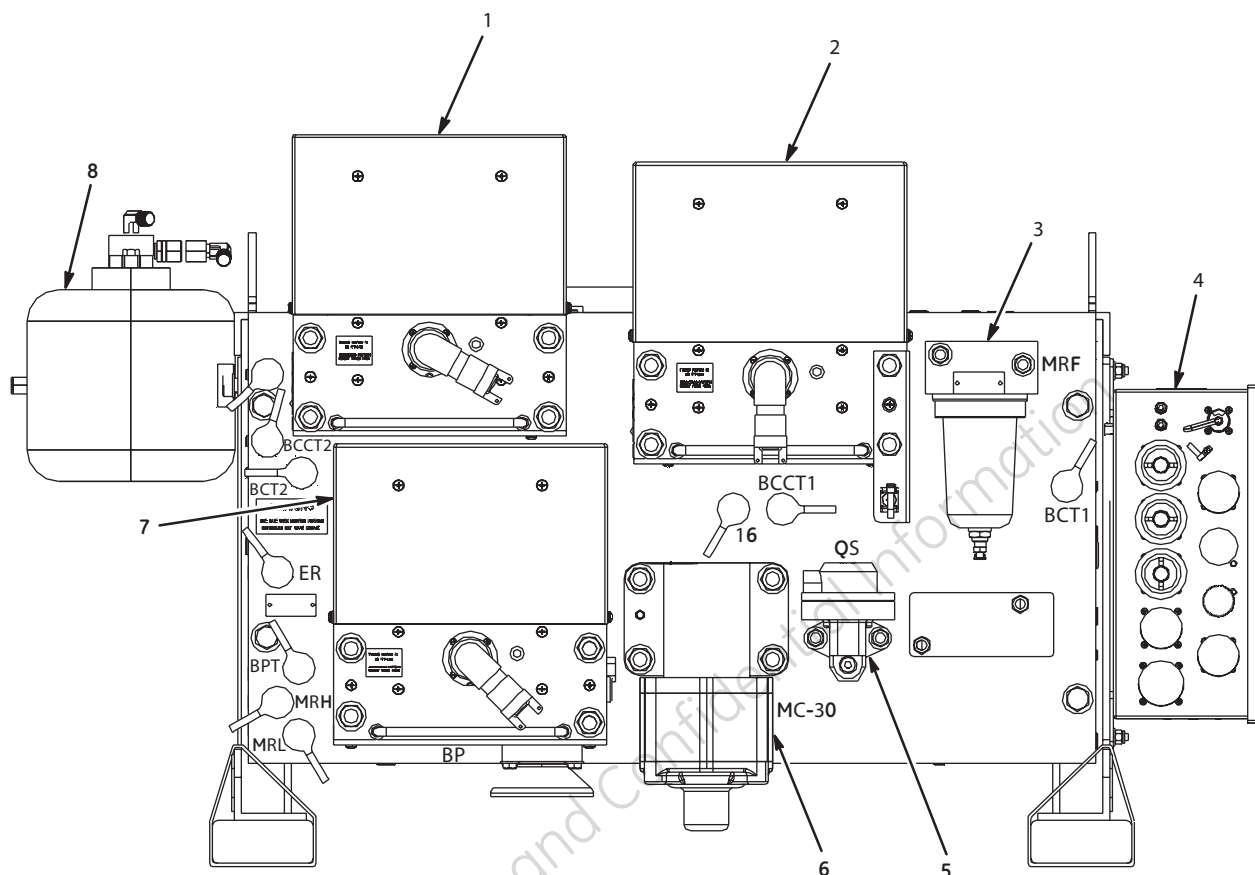
PNEUMATIC OPERATING UNIT (FRONT VIEW)



PNEUMATIC OPERATING UNIT (REAR VIEW)

E-51622

Figure 5. Front and Rear Views of the Pneumatic Operating Unit (POU).



REF.	DESCRIPTION	REF.	DESCRIPTION
1	BRAKE CYLINDER CONTROL PORTION #1 (BC1)	5	QUICK SERVICE VALVE PORTION (QS)
2	BRAKE CYLINDER CONTROL PORTION #2 (BC2)	6	MC-30 CONTROL VALVE PORTION
3	MAIN RESERVOIR FILTER PORTION (MRF)	7	BRAKE PIPE CONTROL PORTION (BP)
4	POWER SUPPLY	8	CONTROL RESERVOIR

E-51361

Figure 6. Air Brake Compartment — Pneumatic Operating Unit (POU) Component Locations.

The Air Brake Compartment (containing the POU) is located on the A-side of the locomotive behind the Secondary Operator Cab and part of the Radiator Cab. It is accessible from the walkway through a hinged panel. The POU consists of the control components (pneumatic, electrical, mechanical and electronic) for air pressure regulation in the trainline air pipes (Figure 6).

These POU components communicate and perform the following functions:

- Brake Pipe Control Portion (BP) – Controls the Brake Pipe relay and provides cut in and cut out of Brake Pipe as well as an Emergency Brake function.
- Quick Service Valve (QS) Portion – Assures adequate in shot pressure to the brake cylinders.
- Brake Cylinder Control Portion Number 1 and 2 (BCC1 and BCC2) – BCC1 controls brake cylinder pressure to bogie 1 and BCC2 controls brake cylinder pressure to bogie 2. Each houses the brake cylinder relay and check valves to allow BC pressure to develop from the MC-30 in pneumatic backup mode.
- Power Supply – Houses the POU power supply Air Brake Manager (computer), locomotive computer interfaces, inputs and outputs.
- MC-30 Control Valve – Provides pneumatic backup in the event of electronics failure.

CAUTION: To avoid equipment damage, the locomotive must be properly set up when being hauled Dead (in tow). The Park Brake must be manually released. Chock the wheels prior to release. Once the Park Brake is manually released it can only be re-applied if main reservoir air is supplied to the locomotive.

The trainline brake piping is connected at the end of the locomotive. These connections should be made according to *Railroad Operating Procedures*.

3.1.1. Cab Control Unit

The CCU is the dedicated physical control of the train brakes. It is to be a desktop style brake valve with the handles operating in the vertical plane. The CCU shall have separate controls for the automatic and independent brakes. The CCU is electronically linked to the EAB to relay handle position information. Loss of communication with the controlling EBV results in a penalty brake application when configured as Lead Cut-in.

The secondary controller is identical to the primary controller. A jumper in the cable from the EBV to the HJB determines primary and secondary handles. The driver controls the active controller through the use of the cab select switch. The inactive controller does not respond to movement of either independent or automatic handle, except for the automatic emergency position.

Both independent and automatic brake handles are arranged such that moving the handle away from the operator increases the brake application and moving the handle toward the operator decreases the brake application.

The location of the independent and automatic brake handles with respect to a seated driver is as follows. The automatic brake handle shall be located on the right side and the independent handle shall be located on the left.

3.1.2. Automatic Brake Handle

On the locomotive the brake force developed by an automatic brake application will primarily be a combination of friction and dynamic brake, also known as blended braking. It will be possible for the operator to cut out the dynamic brake and operate strictly with friction brake if desired.

The automatic brake applies the brakes on both the locomotives and the cars of the train. These brakes are controlled by the operator with the automatic brake handle (Figure 7) on the Cab Control Unit (CCU), by the Locomotive Process Controller (ILC) using the penalty braking commands, or by the ILC using the air brake command message. Except for penalty, low BP, and emergency brake applications, tractive power will not be restricted by the application of the brakes.

Automatic braking for the train is accomplished by reducing pressure in the ER, which then causes an equal reduction in the BP pressure. This BP signal will activate equipment on the car that will cause brake cylinder on each car to activate. Braking for the locomotives is accomplished by increasing pressure on the brake cylinders directly.

Charging the ER will increase BP pressure, which will control release of the automatic brakes on the cars. Graduated release of the automatic brake is provided.

The Brake System must be configured such that recovery from a penalty brake application requires the automatic brake handle to be placed in the suppression position before recovery can occur. Following an emergency application the automatic brake handle must be placed in the emergency position before recovery can occur. Once the EAB has cleared the penalty or emergency, the operator can place the automatic brake handle into the REL position to release the brake application.

If the locomotive is configured as LEAD/CUT-IN, the Cab Control Unit Automatic Brake Handle provides control of the Automatic and Emergency Brakes. However, if configured as LEAD/CUT-OUT or TRAIL, the Cab Control Unit Automatic Brake handle may only initiate an Emergency Brake application.

To function as a lead locomotive, the FastBrake™ equipment must be configured for LEAD CUT-IN with Brake Pipe, Equalizing Reservoir, and Main Reservoir fully charged, all MU hoses connected and cut-out cocks OPEN.



Figure 7. Electronic Brake Valve (EBV) or Cab Control Unit (CCU).

The Automatic Brake handle (Figure 8) operates through a series of detented control positions: RELEASE (REL), MINIMUM REDUCTION (MIN), FULL SERVICE (FULL), SUPPRESSION (SUP), HANDLE OFF (HO), and EMERGENCY (EM). During train movement, the normal operating range of the Automatic Brake Handle is between MINIMUM REDUCTION (MIN) and FULL SERVICE (FULL). The operating positions are indicated by a plate located next to the handle. The Automatic Brake is graduated in both apply and release. A description of these positions follows:

1. RELEASE (REL) Position - In this position, the brake system is charged to the normal equalizing reservoir pressure setting. This is the normal position when motoring in forward or reverse.
2. MINIMUM REDUCTION (MIN) Position - When making a Service Brake application, move the Automatic Brake handle toward the MIN position. The MINIMUM REDUCTION position provides a 6.0 to 8.0 psi (.41 to .55 bar) equalizing reservoir (ER) pressure reduction (note on the SDIS: BRAKE CYLINDER reading 10 to 14 psi or .69 to .96 bar showing pressure has been developed). If necessary to increase the reduction, move the Automatic Brake handle progressively toward the FULL position, bearing in mind that the further the handle is moved into the service zone, the greater will be the reduction. The system will automatically maintain any brake pipe leakage.
3. FULL SERVICE (FULL) Position - A Full Service Brake application is obtained by moving the Automatic Brake handle to the FULL position. This position will reduce the Brake Pipe by 26 to 28 psi (1.79 to 1.93 bar) and increase the Brake Cylinder pressure to 67 to 69 psi (4.62 to 4.76 bar).
4. SUPPRESSION (SUP) Position - The SUP position provides a Full Service Brake application and, in addition, on locomotives equipped with overspeed control and safety control penalty brakes, these applications will be suppressed.

WARNING: To ensure safe consist operation, follow specific Railroad Operating Procedures for setting-up units for Trail or Dead operation.

5. HANDLE OFF (HO) Position - The Automatic Brake handle should be moved to the HO position when the locomotive is a Trail unit in a multiple-unit consist or is being towed Dead. In HANDLE OFF (HO), equalizing reservoir pressure is reduced to zero (0) at a service rate.

WARNING: STOPPING HAZARD. In an EMERGENCY situation, when operating as a single unit or part of a multi-unit consist (locomotives only), moving the INDEPENDENT Brake Handle to FULL APPLICATION is the fastest way to develop brake cylinder pressure on the unit/consist up to the full independent brake cylinder pressure setting. Immediately after moving the INDEPENDENT Handle, move the AUTOMATIC Handle into EMERGENCY. Failure to comply with this procedure during an EMERGENCY situation, COULD EXTEND THE STOPPING DISTANCE.

WARNING: STOPPING HAZARD. Following an EMERGENCY BRAKE application, if the train is not at rest, brake release MUST NOT be attempted. Any movement of the AUTOMATIC Brake Handle to RELEASE while train is moving may cause equipment and/or personnel damage.

6. EMERGENCY (EM) Position - An Emergency Brake application is obtained by moving the Automatic Brake handle to the EM position. The words OPERATOR EMERGENCY or EMERGENCY BRAKE EMERGENCY will appear yellow in the Air Brake/Alert Box on the Operation display screen for 60 seconds. The operator can recover by moving the brake handle to REL.

NOTE: If operating as a Lead unit, the control imposes a one-minute time delay before it is possible to recharge the brake pipe after an Emergency Brake application.

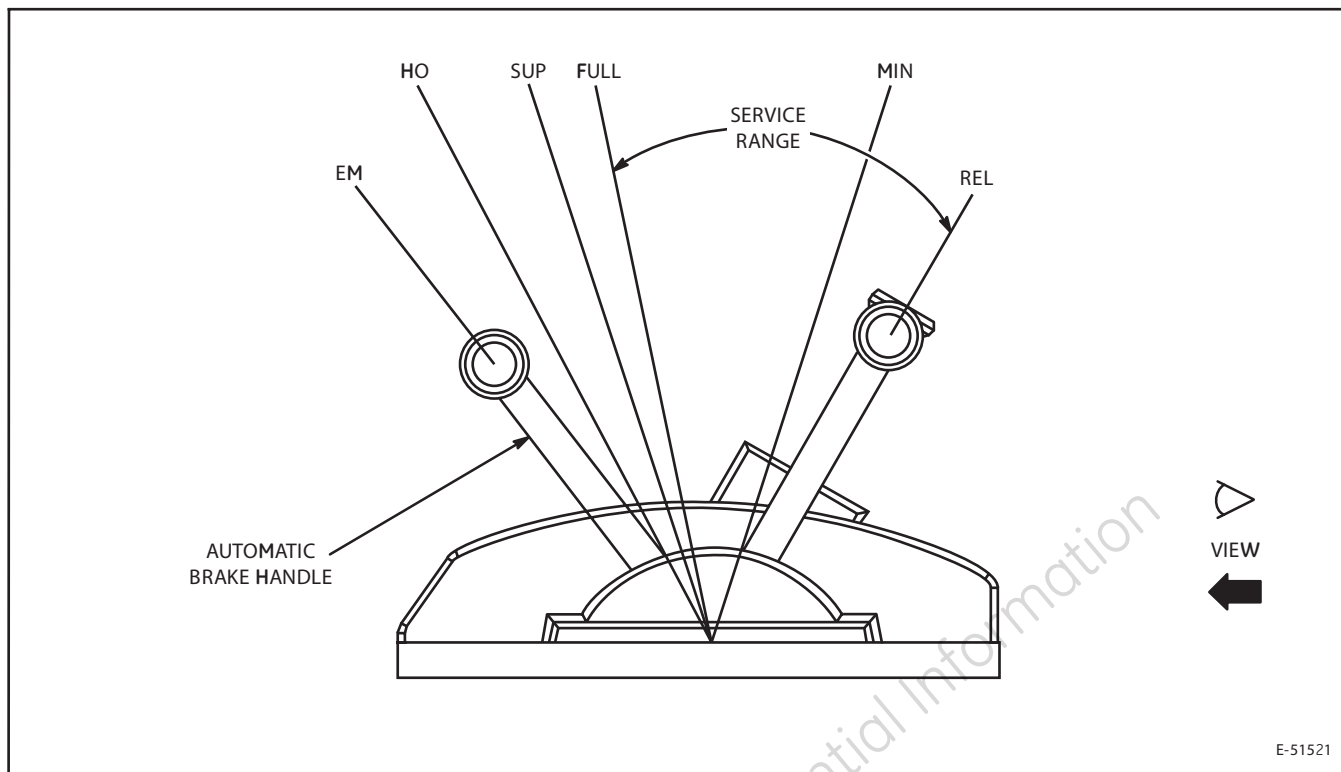


Figure 8. Automatic Brake Handle Positions.

3.1.3. Independent Brake Handle

The independent braking function controls the BC pressure and braking efforts of the locomotive only. The independent brake handle (Figure 7) on the CCU controls the independent brakes. The independent brake is graduated in both application and release.

The independent brake will not be overridden by any brake release request. However, if a higher level of braking is requested by a simultaneous automatic or emergency brake application, the signal requesting the highest brake cylinder pressure will be applied (the automatic and independent brakes shall not be additive in any way).

If the automatic brakes have been applied in the service range, the operator can use the independent brakes to increase the braking force on the locomotive while keeping the automatic brakes on the cars of the train constant. Releasing the independent brake will not affect any automatic brake in effect.

An emergency application of the train brakes will apply maximum pressure to the brake cylinder regardless of the state of the independent brake controls. The EAB is capable of increasing the brake cylinder pressure at a rate of 16.0 to 24.0 psi (1.10 to 1.65 bar) per second through the range of zero to 50 psi (0 to 3.45 bar). The EAB shall be capable of decreasing the brake cylinder pressure at a rate of 14.0 to 22.0 psi (0.97 - 1.52 bar) per second from the maximum brake cylinder pressure through 5 psi (0.34 bar).

NOTE: Increasing Independent brake cylinder pressure above 10 psi (0.69 bar) will disable blended brake and return the brake force to pneumatic (friction) only.

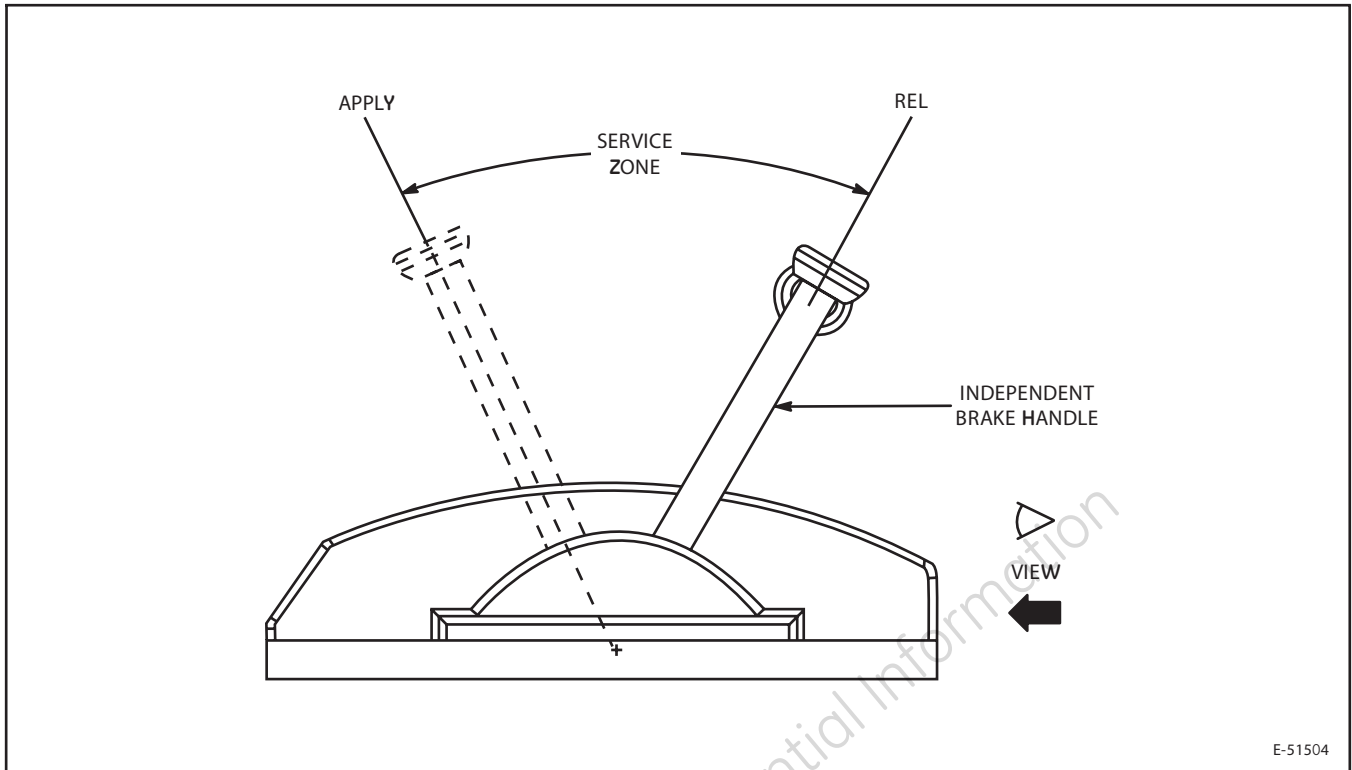


Figure 9. Independent Brake Handle.

An Independent Brake application is initiated by movement of the Cab Control Unit Independent Brake handle from RELEASE to an applied position (Figure 9). An Independent Brake release is initiated by movement of the Cab Control Unit Independent Brake handle from an applied position towards or to RELEASE. The Independent Brake is a graduated release type brake.

NOTE: The Independent Brake Handle must be in RELEASE to cause a complete release of the brake cylinder pressure. Should the handle be in an applied position, the brake cylinder pressure will only be released to the level demanded by the Independent Brake Handle.

WARNING: To ensure safe consist operation, follow specific Railroad Operating Procedures for setting-up units for Trail or Dead operation.

The Independent Brake handle should always be in REL position when the unit is a Trail unit in a multiple-unit consist or is being towed Dead.

3.1.4. Penalty Brake Application and Reset

A Penalty Brake application is a Full Service, Automatic Brake application that is initiated by a safety control device. The FastBrake™ equipment provides for both suppressible (Penalty Brake application forestalled by placing the Cab Control Unit Automatic Brake handle in SUPPRESSION) and non-suppressible (Penalty Brake application cannot be forestalled by placing the Cab Control Unit Automatic Brake handle in SUPPRESSION).

A Penalty Brake application may be initiated by one or more of the following:

1. Cab Signal penalty
2. Alerter penalty

3. CCA Control System to Power Supply communication failure (COMM LOSS) penalty
4. Overspeed penalty
5. Power Loss penalty
6. Internal FastBrake™ EAB system communication loss
7. Air Brake Power Up (POWER UP) penalty

If the penalty is suppressible, the operator may avoid the penalty by satisfying the preset suppression conditions before the penalty command is initiated. If the penalty is non-suppressible, the penalty will occur no matter what conditions exist before the penalty command. Once the penalty command clears, the operator will begin the penalty recovery sequence.

The operator may recover from a penalty brake application by moving the automatic brake handle to the Suppression (SUP) position for at least 8 seconds. EAB will not reset the penalty until the penalty timer has elapsed and the penalty source has been cleared. After this, he may move the handle to Release (REL) and begin charging BP to release brakes.

3.1.5. Pneumatic Operating Unit (POU)

The POU (Figure 6) is located in rear of the Radiator Cab on the A-side of the locomotive. This unit consists of the pneumatic manifold and the air handling devices.

Pneumatic connections on the rear face of the manifold interface between the POU and the locomotive. The pipe connections are identified as follows (refer to Figure 2):

- MR — Main Reservoir Pipe (input), AUX1 and AUX2
- BP — Brake Pipe (input/output), ABP and BP2
- BC — Brake Cylinder Pipe (output), BC1 and BC2
- EX — Exhaust (output)

3.1.6. Pneumatic Manifold

The Pneumatic Manifold is a central unit for the connection of the locomotive air piping and electrical wiring. This arrangement facilitates removal and replacement of air handling devices without having to disturb the locomotive's wiring or piping. Test ports with quick disconnects are provided for troubleshooting and maintenance testing.

3.1.7. Brake Pipe Control Portion (BP)

The Brake Pipe Control Portion provides brake pipe pressure control when the Automatic Brake is CUT-IN, allows CUT-IN/CUT-OUT configuration of the Automatic Brake, and provides the means to initiate an emergency vent of brake pipe pressure.

When the locomotive is in lead mode this connection will allow the POU to charge the air brake system in each car of the train, as well as control the automatic service and emergency braking by controlling the pressure in the BP. When in trail mode the BP shall control the automatic and emergency braking functions of the POU.

Additionally, the Compressed Air Subsystem provides BP pressure feedback from a location near the BP connection for the emergency valve. This connection on the POU provides BP feedback to the EAB system.

3.1.8. MC-30 Control Valve

The MC-30 Control Valve provides back-up protection and braking in situations involving total loss of electrical power, computer shutdown, or when the locomotive is being hauled Dead-In-Consist/Dead-In-Train.

3.1.9. Quick Service Valve (QS) Portion

The Quick Service Valve Portion provides adequate pressure to the brake cylinders under all Automatic Brake applications.

3.1.10. Brake Cylinder Control Portion (BC)

The Brake Cylinder Control Portion provides the means to control the supply of Number 2 main reservoir pressure to the brake cylinders and the exhaust of brake cylinder pressure to atmosphere for all brake applications and releases.

BC pressures are maintained in accordance with the braking effort requested by the operator in the case of a lead locomotive. Brake requests can be from either the automatic brake independent brake, or the locomotive control system. In the case of a trail locomotive, the braking effort is derived from the BP signal input.

The EAB system provides redundant brake cylinder control such that no single point failure will result in loss of more than 50% of the brake effort. This requires two physical connections to the POU, one to feed brake cylinders on truck number 1 and one to feed brake cylinders on truck number 2. The Compressed Air Subsystem provides the piping required between the EAB and the trucks.

Additionally, the Compressed Air Subsystem provides brake cylinder pressure feedback on each truck from a location between the brake cylinders and any truck cut outs to ensure the feedback is actual brake cylinder pressure.

3.1.11. Dead-In-Train Feature

The Dead-In-Train Feature is used when the locomotive is hauled in a completely shut down condition. This portion allows a locomotive in a consist that is not running the ability to brake with the running locomotives in the consist.

In the case where the MRP is available, the compressed air system will supply MR2A and MR2B from the MRP through a non-return valve. This will allow MR2A and MR2B to charge to approximately 100 psi (7 bar). When no MRP is available, the compressed air system will supply MR2A and MR2B from the BP through two restricted non-return valves. Restriction will be 0.125 in (3.18 mm) diameter in order to reduce the flow of air from brake pipe.

3.1.12. Power Supply

The Power Supply provides a redundant source of power for the FastBrake™ portion controller's logic and magnet valve driver circuits and is configured as two separate 74V power supplies.

It receives 74V power from both the locomotive battery via a dedicated circuit and the 13T trainline. The primary power supply receives its input from the locomotive battery and its output is set to 24V. The secondary power supply receives its input from the 13T trainline and its output is set to 22.5V.

3.1.13. Air Filter

The FastBrake™ Air Filter provides moisture removal and filtration for the portion of the Number 2 main reservoir supply utilized by the air brake equipment magnet valves. This air, called Filtered Main Reservoir, is utilized to control the relay valves, which in turn control brake systems pressures.

3.2. EMERGENCY BRAKE VALVE

The Emergency Brake Valve, or Crew Member Brake Valve, is located on the crew member side of the Operating Cab. This valve is manually opened to initiate an Emergency Brake application.

4. SCHEDULED MAINTENANCE

Refer to **GEK-114501, SCHEDULED MAINTENANCE PH37ACmi PowerHaul® SERIES LOCOMOTIVE.**

4.1. CLEANING

WARNING: To prevent personal injury when cleaning parts with compressed air, observe all Railroad Operating Procedures and Government Regulations.

The exterior surfaces of the FastBrake™ Brake Equipment may be cleaned by wiping with a soft, clean, lint-free cloth or blown clean with a low pressure jet of clean, dry air (less than 30 psi [2.07 bar]). Care must be taken to ensure that dirt is not blown into any open ports or chambers of the equipment.

4.2. REPAIRS

No on-locomotive component repair is permitted. Repairs are limited to the removal and replacement of the suspected device or component. All removed devices or components are to be returned to the manufacturer for repair.

4.3. MAINTENANCE SCHEDULE

Refer to Table 1 for recommended maintenance.

NOTE: Refer to the Wabtec Locomotive FastBrake™ Operation and Maintenance Manual for detailed information on scheduled maintenance.

TABLE 1. MAINTENANCE SCHEDULE

Frequency	Action
Thirty days	Standing Emergency Test
Periodic inspection	Standing Function Test (including Emergency) Pressure Gauge Calibration/ Pressure Transducer Verification
Annually	Main Reservoir Air Filter Replacement 20 and 13 Pipe E Filter Replacement Standing Function Test (including Emergency) Lubricate Cab Control Unit
5 years or sooner if service or federal regulations indicate (whichever comes first)	Pneumatic and electro-pneumatic components/devices of the FastBrake™ equipment are to be removed from the locomotive and returned to an approved manufacturer's repair center for cleaning, repair, and testing.

NOTE: Verify POU and Cab Control Unit software for correctness and compatibility.

5. REMOVE AND RENEW/REFIT PROCEDURES

NOTE: Verify POU and Cab Control Unit software for correctness and compatibility.

5.1. CAB CONTROL UNIT (CCU)

Perform the following procedure to remove and replace the Cab Control Unit:

WARNING: To prevent personal injury, follow all instructions outlined in the SAFETY INFORMATION section of this publication.

1. Using a lint-free cloth or a low pressure (less than 30 psi [2.07 bar]) jet of clean, dry air, clean the Cab Control Unit.
2. Disconnect the electrical interconnect cable to the Cab Control Unit.
3. Remove the setscrews that secure the handle assemblies to the Cab Control Unit. Remove the handle assemblies.
4. Loosen the four screws that secure the cover to the Cab Control Unit. Remove the cover.
5. Remove the four screws that secure the Cab Control Unit to the locomotive. Remove the unit.
6. Provide adequate protection to prevent dirt or debris from entering the Cab Control Unit. Cover protectors must be installed on the electrical connector. Return the unit to the manufacturer for service.
7. Inspect the mounting face of a new or repaired and tested Cab Control Unit. Remove the cover protectors on all electrical connectors.
8. Install the unit in place in the locomotive and secure it in place using the four screws.
9. Install the cover in place on the Cab Control Unit and secure it in place using the four screws.
10. Install the handle assemblies and secure them in place using the setscrews.
11. Connect the electrical interconnect cable to the Cab Control Unit.
12. Return power to the Electronic Air Brake (EAB) system.
13. Run a Self Test (found under the Air Brake menu on the SDIS) and any tests required by *Railroad Operating Procedures*.

5.2. BRAKE PIPE CONTROL PORTION (BP)

Perform the following procedure to remove and replace the Brake Pipe Control Portion on the POU:

WARNING: To prevent personal injury, follow all instructions outlined in the SAFETY INFORMATION section of this publication.

1. Using a lint-free cloth or a low pressure (less than 30 psi [2.07 bar]) jet of clean, dry air, clean the Brake Pipe Control Portion and the pneumatic manifold.
2. Disconnect the power/communications cable.

3. Remove the four 3/8 inch self-locking hex nuts and flat washers from the mounting studs. Slide the portion off the pneumatic manifold.
4. Remove and dispose of the flat gasket.
5. Provide adequate protective covering such as masking tape to prevent dirt or debris from entering the Brake Pipe Control Portion and return the unit to the manufacturer for service.
6. Inspect the passages of the pneumatic manifold to see that the ports are clean and unobstructed. If necessary, blow the ports clean using a low pressure (less than 30 psi [2.07 bar]) jet of clean, dry air.
7. Inspect the mounting face of a NEW or repaired Brake Pipe Control Portion and remove any tape.
8. Inspect the electrical connector to verify that it is free of defects.
9. Install a new flat gasket in place on the mounting face of the pneumatic manifold.
10. Position the portion on the four studs mounted to the pneumatic manifold and secure it in place with the four 3/8 inch self-locking hex nuts and flat washers. Refer to the torque specifications in .
11. Connect the power/communications cable.
12. Verify the microcontroller Side A and B programmed.
13. Run a Self Test (found under the Air Brake menu on the SDIS) and any tests required by *Railroad Operating Procedures*.

5.3. BRAKE CYLINDER CONTROL PORTION (BC)

Perform the following procedure to remove and replace the Brake Cylinder Control Portion on the POU:

WARNING: To prevent personal injury, follow all instructions outlined in the SAFETY INFORMATION section of this publication.

1. Using a lint-free cloth or a low pressure (less than 30 psi [2.07 bar]) jet of clean, dry air, clean the Brake Cylinder Control Portion and the pneumatic manifold,
2. Disconnect the power/communications cable.
3. Remove the four 3/8 inch self-locking hex nuts and flat washers from the mounting studs. Remove the cable tie mount. Slide the portion off the pneumatic manifold.
4. Remove and dispose of the flat gasket.
5. Provide adequate protective covering such as masking tape to prevent dirt or debris from entering the Brake Cylinder Control Portion and return the unit to the manufacturer for service.
6. Inspect the passages of the pneumatic manifold to see that the ports are clean and unobstructed. If necessary, blow the ports clean using a low pressure (less than 30 psi [2.07 bar]) jet of clean, dry air.
7. Inspect electrical connector to make sure that it is free of defects.
8. Inspect the mounting face of a new or repaired Brake Cylinder Control Portion and remove any tape.
9. Install the NEW flat gasket in place on the mounting face of the pneumatic manifold.

10. Position the portion on the four studs mounted to the pneumatic manifold. Position the cable tie mount on the four studs and secure it in place with the four 3/8 inch self-locking hex nuts and flat washers. Refer to the torque specifications in .
11. Connect the power/communications cable.
12. Verify the microcontroller Side A and B programmed.
13. Run a Self Test (found under the Air Brake menu on the SDIS) and any tests required by *Railroad Operating Procedures*.

5.4. MAIN RESERVOIR FILTER PORTION AND RELATED FILTERS

Perform the following procedure to remove and replace the Main Reservoir Filter Portion mounted on the front of the POU and related filters:

WARNING: To prevent personal injury, follow all instructions outlined in the SAFETY INFORMATION section of this publication.

1. Using a lint-free cloth or low pressure (less than 30 psi [2.07 bar]) jet of clean, dry air, clean the Main Reservoir Filter Portion and the pneumatic manifold.
2. Remove the two 3/8 inch self-locking hex nuts and flat washers from the mounting studs. Slide the portion off the pneumatic manifold.
3. Remove and dispose of the flat gasket.
4. Provide adequate protective covering such as masking tape to prevent dirt or debris from entering the Main Reservoir Filter Portion and return the unit to the manufacturer for service.
5. Refer to the Air Filter (MRF) in the *MAIN RESERVOIR FILTER PORTION* section of this publication for instruction on the Air Filter/Element replacement.
6. Inspect the passages of the pneumatic manifold to see that the ports are clean and unobstructed. If necessary, blow the ports clean using a low pressure (less than 30 psi [2.07 bar]) jet of clean, dry air.
7. Inspect the mounting face of the NEW or repaired Main Reservoir Filter Portion and remove any tape.
8. Install the new flat gasket in place on the mounting face of the pneumatic manifold.
9. Position the portion on the two studs mounted to the pneumatic manifold and secure it in place with the two 3/8 inch self-locking hex nuts and flat washers. Refer to the torque specifications in .
10. Apply air to the locomotive and verify that the filters/strainers do not leak.
11. If seal is good, return power to the EAB system.
12. Run a Self Test (found under the Air Brake menu on the SDIS) and any tests required by *Railroad Operating Procedures*.

5.4.1. AIR FILTER (MRF) IN THE MAIN RESERVOIR FILTER PORTION

The filter element is to be removed and replaced annually or more frequently if service conditions so indicate, as follows:

NOTE: Items in parentheses refer to items in Figure 10 .

1. Blow down main reservoir pressure by closing Number 2 main reservoir cut-out cock. Blow down main reservoir filter by opening the petcock.
2. Using a lint-free cloth or a low pressure (less than 30 psi [2.07 bar]) jet of clean, dry air, clean the Main Reservoir Filter Portion and the pneumatic manifold.
3. Remove the filter collar (2) that secures the filter bowl (3) to the body (1).
4. Remove filter bowl (3) from the body (1).
5. Remove and dispose of the retainer (4) from body (1).

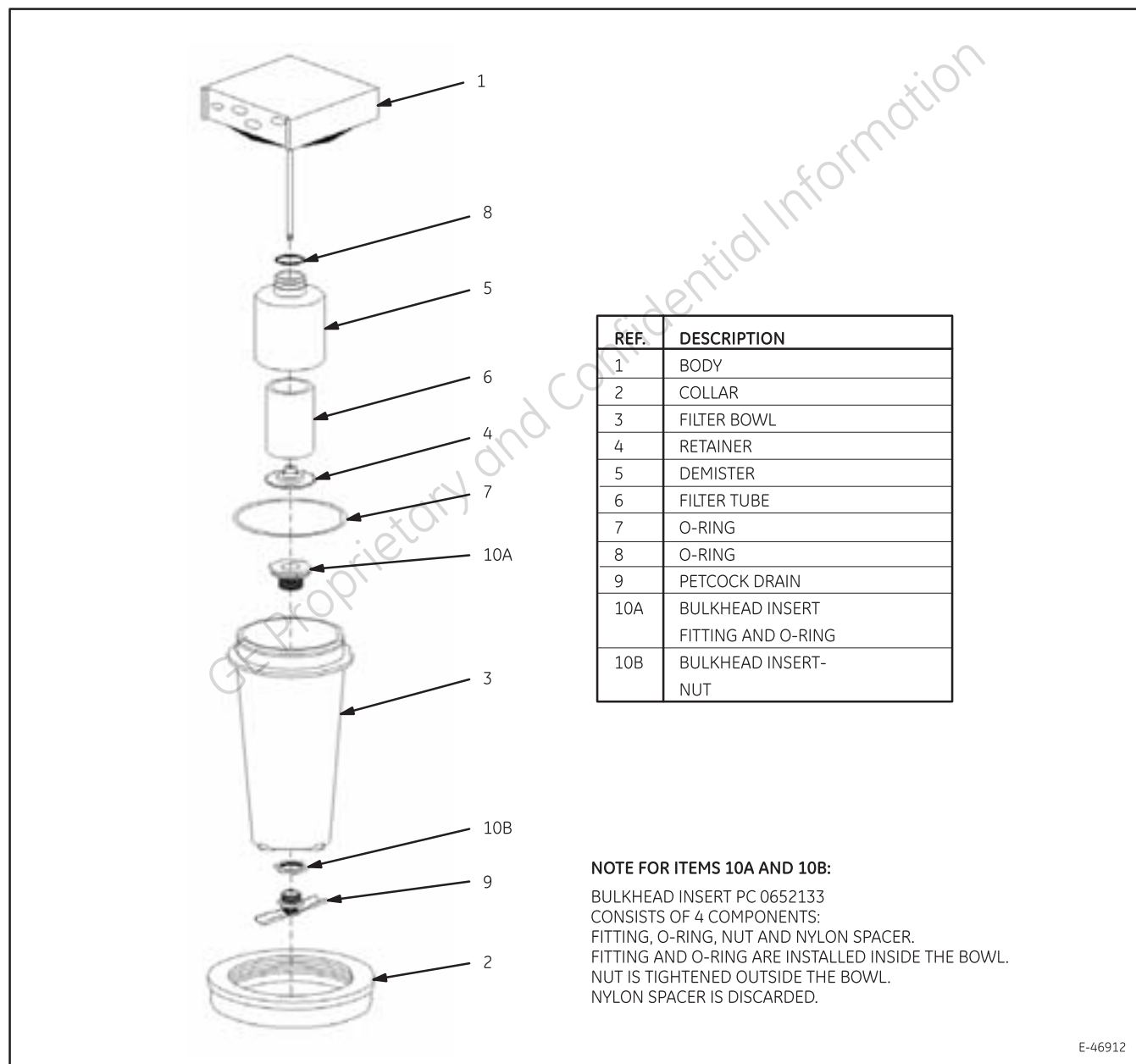


Figure 10. Main Reservoir Filter Portion.

6. Remove and dispose of the filter (6), demister (5), and seals (7 and 8).
7. A new filter assembly which includes the seals, retainer, demister and filter may be ordered from the manufacturer.
8. Install the new seal (8) in the groove in the new demister (5).
9. Install the demister (5) into the body (1).
10. Install the new filter (6) into the demister (5) and secure it in place with the new retainer (4).
11. Install the new seal (7) in the groove of the filter bowl (3).
12. Position the filter bowl (3) on the body (1). Secure the filter bowl (3) in place on the body (1) using the filter collar (2).
13. Close the filter bowl petcock.
14. Open the Number 2 main reservoir cut-out cock.

5.5. POWER SUPPLY

1. Using a lint-free cloth or a low pressure (less than 30 psi [2.07 bar]) jet of clean, dry air, clean the Power Supply.
2. Disconnect the electrical interconnect cables to the Power Supply.
3. Remove the Power Supply from the locomotive.
4. Provide adequate protection to prevent dirt or debris from entering the Power Supply. Cover protectors must be installed on all electrical connectors. Return the unit to the manufacturer for service.
5. Remove cover protectors from all electrical connectors on the new or repaired Power Supply. Inspect the connectors for bent or broken pins.
6. Install a new or repaired Power Supply. Refer to the torque specifications in .
7. Connect the electrical interconnect cables to the Power Supply.

5.6. QUICK SERVICE VALVE PORTION (QS)

1. Using a lint-free cloth or a low pressure (less than 30 psi [2.07 bar]) jet of clean, dry air, clean the Quick Service Valve Portion (QS) and the pneumatic manifold.
2. Remove the two 3/8 inch self-locking hex nuts and flat washers from the mounting studs. Slide the portion off the pneumatic manifold.
3. Remove and dispose of the two ring gaskets.
4. Provide adequate protective covering such as masking tape to prevent dirt or debris from entering the Quick Service Valve Portion and return the unit to the manufacturer for service.
5. Inspect the passages of the pneumatic manifold to see that the ports are clean and unobstructed. If necessary, blow the ports clean using a low (less than 30 psi [2.07 bar]) jet of clean, dry air.
6. Inspect the mounting face of a new or repaired Quick Service Valve Portion and remove any tape.

7. Install the new ring gaskets in place on the mounting face of the pneumatic manifold.
8. Position the portion on the two studs mounted to the pneumatic manifold and secure it in place with the two 3/8 inch self-locking hex nuts and flat washers. Refer to the torque specification in .
9. Run a Self Test (found under the Air Brake menu on the SDIS) and any tests required by *Railroad Operating Procedures*.

5.7. MC-30 CONTROL VALVE PORTION

1. Using a lint-free cloth or a low pressure (less than 30 psi [2.07 bar]) jet of clean, dry air, clean the MC-30 Control Portion and the pneumatic manifold.
2. Remove the four 1/2 inch self-locking hex nuts and flat washers from the mounting studs. Slide the portion off the pneumatic manifold.
3. Remove and dispose of the flat gasket.
4. Provide adequate protective covering such as masking tape to prevent dirt or debris from entering the MC-30 Control Portion and return the unit to the manufacturer for service.
5. Inspect the passages of the pneumatic manifold to see that the ports are clean and unobstructed. If necessary, blow the ports clean using a low (less than 30 psi [2.07 bar]) jet of clean, dry air.
6. Inspect the mounting face of a new or repaired MC-30 Control Valve Portion and remove any tape.
7. Install the new flat gasket in place on the mounting face of the pneumatic manifold.
8. Position the portion on the four studs mounted to the pneumatic manifold and secure it in place with the four 1/2 inch self-locking hex nuts and flat washers. Refer to the torque specifications in

5.8. VOLUME (45 CU. IN.)

1. Using a lint-free cloth or a low pressure (less than 30 psi [2.07 bar]) jet of clean, dry air, clean the Volume and the pneumatic manifold.
2. Remove the four 3/8 inch self-locking hex nuts and flat washers from the mounting studs. Slide the Volume off the pneumatic manifold.
3. Remove and dispose of the gasket.
4. Inspect the Volume. If Volume is cracked, broken, or is in such a condition that may result in unsatisfactory operation of the brake equipment, dispose of the Volume.
5. Inspect the passages of the pneumatic manifold to see that the ports are clean and unobstructed. If necessary, blow the ports clean using a low (less than 30 psi [2.07 bar]) jet of clean, dry air.
6. If a new Volume is being installed, inspect the mounting face and remove any tape.
7. Install the new gasket in place on the mounting face of the pneumatic manifold.
8. Position the Volume on the four studs mounted to the pneumatic manifold and secure it in place with the four 3/8 inch self-locking hex nuts and flat washers. Refer to the torque specifications in .

5.9. VOLUME (90 CU. IN.)

1. Using a lint-free cloth or a low pressure (less than 30 psi [2.07 bar]) jet of clean, dry air, clean the Volume and the pneumatic manifold.
2. Remove the four 3/8 inch self-locking hex nuts and flat washers from the mounting studs. Slide the Volume off the pneumatic manifold.
3. Remove and dispose of the gasket.
4. Inspect the Volume. If Volume is cracked, broken, or is in such a condition that may result in unsatisfactory operation of the brake equipment, dispose of the Volume.
5. Inspect the passages of the pneumatic manifold to see that the ports are clean and unobstructed. If necessary, blow the ports clean using a low (less than 30 psi [2.07 bar]) jet of clean, dry air.
6. If a new Volume is being installed, inspect the mounting face and remove any tape.
7. Install the new gasket in place on the mounting face of the pneumatic manifold.
8. Position the Volume on the four studs mounted to the pneumatic manifold and secure it in place with the four 3/8 inch self-locking hex nuts and flat washers. Refer to the torque specifications in .

5.10. FLOW BLOCK

1. Using a lint-free cloth or a low pressure (less than 30 psi [2.07 bar]) jet of clean, dry air, clean the flow block and the pneumatic manifold.
2. Loosen the main reservoir pipe fitting and disconnect pipe from the flow block flange.
3. Remove the four hex head screws, lock washers and flat washers that secure the flow block to the pneumatic manifold.
4. Remove the flow block from the pneumatic manifold.
5. Remove and dispose of the gaskets.
6. Inspect the flow block. If the flow block is cracked, broken, or is in such a condition that may result in unsatisfactory operation of the brake equipment, dispose of the flow block.
7. Inspect the passages of the pneumatic manifold to see that the ports are clean and unobstructed. If necessary, blow the ports clean using a low (less than 30 psi [2.07 bar]) jet of clean, dry air.
8. Install the new ring gaskets in place on the mounting face of the pneumatic manifold.
9. If a new flow block is being installed, inspect the mounting face and remove any tape.
10. Install the flow block to the pneumatic manifold with the four hex screws, lock washers and flat washers. Refer to the torque specifications in .
11. Connect the main reservoir pipe and tighten the pipefitting.

6. SUMMARY DATA

TABLE 2. TORQUE SPECIFICATIONS

Component	Recommended Torque Values
Main Reservoir Filter	20 lb.-ft. (27 Nm)
Brake Cylinder Control Portion	35 lb.-ft. (47 Nm)
Brake Pipe Control Portion	35 lb.-ft. (47 Nm)
MC-30 Control Valve	75 lb.-ft. (102 Nm)
Quick Service Valve	20 lb.-ft. (27 Nm)
Power Supply	60 lb.-in. (678 Ncm)
Flow Block	35 lb.-ft. (47 Nm)
90 cu. in. Volume	15 lb.-ft. (20 Nm)
45 cu. in. Volume	15 lb.-ft. (20 Nm)