GENERAL DESCRIPTION

**NOTE:**

This section only covers the pneumatic components of the braking system.

For information on the mechanical components of the braking system, such as linings, pads or discs, see sections 04: ZF FRONT AXLE or 05: ZF REAR AXLE.

For information on the pneumatic supply system, see section 08-000: AIR SUPPLY SYSTEM in this manual.

Conforming to automotive vehicle safety standards, all Nova Bus LFS models are equipped with two separate braking systems:

1. The compressed-air braking system (service or foot brake), consisting of a primary system for the application of the rear brakes and a secondary system for the application of the front brakes.
2. The compressed-air spring-brake system (parking and emergency brake).

OPERATION

COMPRESSED-AIR BRAKING SYSTEM

See Figure 1 for the schematic that shows the principles of the compressed-air braking system. See the Nova LFS PARTS MANUAL for a detailed schematic of the braking system.

The compressed-air braking system governs the application of the service brakes. A primary braking system and a secondary braking system permit the simultaneous application of the service brakes for the front and rear axles.

In the event of a failure in one of the systems, the remaining system can operate independently and control the failed circuit, in order to engage the emergency braking mode.

When the service brakes are applied, compressed air in the primary and secondary circuits activate a pressure switch that lights up the brake lights through the multiplex system. Also, each braking circuit is connected to a transducer or pressure switch, installed, in order for a warning to be given whenever the pressure in the circuit falls below a predetermined safe limit for the operation of the braking system.

PRIMARY COMPRESSED-AIR BRAKING SYSTEM

The primary reservoir continuously supplies the input port of the R-14 relay valve. When the brake pedal is pressed, the upper section of the E-10 brake valve opens. This action sends a pneumatic signal from the primary reservoir to the pilot port of the relay valve.

When the relay valve receives the signal from the E-10 valve, the input port opens and compressed air is sent to the rear brake chambers via the ABS modulator valve, proportionally to the signal received.

In order to reduce the response time for the application of the rear brakes, the QR-1C valve sends compressed air to the rear brake chambers at a high flow rate.

When the operator releases the brake pedal, the air from the pilot is then exhausted through the exhaust port of the E-10 brake valve. At the same time, air from the rear brake chamber is exhausted from the relay valve’s exhaust port. This operation releases the rear brakes.

BRAKE INTERLOCK

The brake interlock device is used as a security measure whenever the vehicle kneels, whenever the ramp is deployed or whenever the rear doors are opened, in order to prevent the vehicle from moving.

A pre-adjusted pressure regulator is installed at the front of the vehicle to create a moderated brake pressure of 50 ±5 psi (345 ±35 kPa) to the pilot port of the R-14 relay valve.

Whenever the ramp is deployed, the rear door is open or the vehicle kneels, the command from the interlock solenoid, which is normally closed, receives a signal from the multiplex system and opens to allow air to pass from the regulator to the relay valve. The R-14 valve then supplies the rear brake chambers.

The brake interlock is deactivated when the rear door is closed or locked, whenever the ramp is retracted and when the vehicle is at normal operating ride-height.

In case of emergency, the circuit may be manually deactivated by switching the emergency interlock override, located above the operator’s seat.
Figure 1 - Principle of Primary and Secondary Service Brake Circuits
SECONDARY COMPRESSED-AIR BRAKING SYSTEM

The secondary braking system applies the front wheel service brakes through the front brake chamber.

Whenever the operator presses the brake pedal, the lower portion of the E-10 brake valve opens. This action allows compressed air to pass directly from the secondary reservoir to the inlet port of the QR-1 valve, the function of which is to send compressed air to the front brake chambers at a high flow-rate, thus reducing the response time for brake application.

The QR-1 valve then sends air proportionally, directly from the E-10 brake valve, to the front brake chamber, via the ABS modulator valve.

When the operator releases the brake pedal, the air from the pilot is then exhausted through the exhaust port of the E-10 brake pedal valve. At the same time, air from the front brake chamber is exhausted from the QR1 valve’s exhaust port. This operation releases the front brakes.

COMPRESSED-AIR SPRING-BRAKE SYSTEM

See Figure 2 for the schematic showing the principles of the compressed-air spring-brake system. See the Nova LFS PARTS MANUAL for a detailed schematic of the braking system.

When the spring-brakes are applied, compressed air activates a pressure switch that lights up the brake lights through the multiplexing system. Also, the circuit is connected to a transducer or a pressure switch, installed on the Actia control module, in order for a warning to be given whenever the pressure in the circuit falls below a predetermined safe limit for the operation of the braking system.

PARKING BRAKE

See Figure 3 for a schematic illustrating the operation of the spring-brake chambers.

Under normal operating conditions, the rear chamber springs are compressed by the amount of air pressure provided by the primary or secondary reservoirs. The choice of reservoir is determined by a double anti-return valve that allows the passage of air from the reservoir having the highest pressure, while simultaneously blocking access from the other reservoir.

Compressed air is routed toward the rear spring-brake chambers by way of the brake release valve to release the emergency brake. The air passes through a QR-1C valve, which sends the air at a high-flow rate to the rear brake chambers.

To apply the parking brake, the operator pushes on the button of the parking brake valve to cut the supply of air to the QR-1C valve. At this point, the piston in the QR-1C valve rises, the air in the brake chambers purges through the exhaust port and the pressure of the spring on the stem in each brake chamber starts the braking. The parking brake is fully applied once the air has been completely evacuated from the brake chamber.

To release the parking brake, the operator pulls on the button of the parking brake valve to reestablish the air supply to the QR-1C valve.

The QR-1C valve also ensures a balancing function that permits an automatic release of the parking brake when a request from the service brake is made. A line is connected directly from the discharge port of the R-14 relay valve to the balance port of the QR-1C valve. Thus, when the request from the service brake is made, air pressure is sent to the rear brake chambers and the parking brake is released.

EMERGENCY BRAKE

When the pressure in the circuit reaches approximately 60 psi (414 kPa), the force exerted by the air pressure on the brake chamber diaphragm is decreased and the spring begins to decompress; then the parking brake begins to apply without any action from the driver. At approximately 30 psi (207 kPa), the release valve of the emergency brake opens and air is completely exhausted from the circuit. As soon as the pressure reaches 0 psi (0 kPa), the parking brake is completely applied.

If the vehicle must be moved to a secure place following the application of the emergency brake, the brake must be released. Depending on the chosen option, the operator either pushes or pulls on the button of the emergency brake release valve, while simultaneously pulling on the button of the parking brake valve. This action opens the passage to the compressed air of the emergency reservoir and reestablishes the supply of air to the QR-1C valve in order to supply the spring brake chambers. The springs are then compressed by the air pressure and the emergency brake is immediately released. No additional pressure on the valves is required to maintain the brakes in a released state.

To reapply the emergency brake, the emergency brake release valve and the parking brake valve must be returned to their initial positions.

⚠️ WARNING:
The air supply for emergency spring brake release is supplied ONLY from the emergency reservoir. The amount and the air pressure in the reservoir only permits three applications for release of the parking brake.

⚠️ WARNING:
Even though the emergency spring brake release permits the vehicle to be removed to a safe place, it is not recommended to continue driving the vehicle that is experiencing a significant loss of pressure.
Figure 2 - Principle of the Parking and Emergency Braking System
Figure 3 - Spring Brake Chamber Operation
TO MANUALLY RELEASE THE PARKING BRAKE

In the case of a complete loss of air in the emergency reservoir, it is still possible to manually release the parking brake. The release bolt can be accessed through a trap door located on the rear wheelhouses. The bolt release procedure is relatively simple, since the bolt is already screwed-in the brake cylinder housing in its normal position, thus protecting it from corrosion and dirt.

**WARNING:**
Before releasing the brakes, block the wheels to prevent any movement of the vehicle.

1. Raise the vehicle.
2. To release the brake cylinder unscrew the release bolt completely.
3. Before returning the vehicle to normal service, ensure that this release bolt is returned to its normal screwed-in position.

**NOTE:**
For more information on the manual releasing of the brakes, see the ZF and Knorr-Bremse maintenance manual.

BRAKE TESTS

**NOTE:**
A Tapley Brake Meter, or an equivalent, is required to perform all the following braking tests. See Figure 4.

**NOTE:**
Before performing the tests make sure air pressure is greater than 100 psi (689 kPa) (check the dashboard) and that the tire pressure meets the manufacturers recommendations.

SERVICE BRAKE TEST

Current safety standards require that the service brakes are capable of keeping the vehicle stationary on an incline of 65%, regardless of whether the vehicle is facing uphill or downhill. The standards are applicable to the Gross Vehicle Weight Rating (GVWR) and for its curb weight.

1. Install the Tapley brake meter (or equivalent) at the front of the vehicle near the operator’s area. Make sure that the brake meter is installed horizontally and facing forward.
2. Once the meter is installed, set the lever to **FREE**. The indicator should display 0. Next, set the lever to **TEST**.

ABS/ATC SYSTEMS

To increase the safety of braking during operation, Nova LFS vehicles are equipped with an ABS system on the front and rear wheels.

During braking in service, wheels can lock up. The ABS manages the application of brakes in service in order to modulate braking and maintain control of the vehicle.

In addition, during slippery driving conditions, when the vehicle is accelerating, the ATC may activate the rear brakes. The ATC system is activated when the speed difference between each set of rear wheels reaches 15%. The ATC system activates the rear ABS valves, to regain traction.

For more information on the ABS and ATC systems, see section 08-224: ANTILOCK BRAKING SYSTEMS.

Figure 4 - Tapley Brake Meter
3. Check the braking efficiency.

[NOTE:]
When a service brake test is carried out using the Tapley brake meter, the vehicle must be traveling at a speed of 30-35 km/h. The efficiency must be a minimum of 65%. If this is not the case, try to obtain this figure by adjusting the pressure regulator. For more information on the regulator and its adjustment, see the heading AIR PRESSURE REGULATOR in this section.

[NOTE:]
If the wheels lock on a wet or slippery road surface and the reading is below 65 %, the test must be performed again on a dry roadway.

4. If the brakes need adjusting, perform another test after adjustment.

[NOTE:]
The performance figures of the air brake test report apply to the LFS vehicle. This test report is available on request from Nova Bus Customer Service.

PARKING BRAKE TEST

Current safety standards require that the parking brake are capable of keeping the vehicle stationary on an incline of 20 %, regardless of whether the vehicle is facing uphill or downhill. The standards are applicable to the Gross Vehicle Weight Rating (GVWR) and for its curb weight.

1. Install the Tapley brake meter (or equivalent) at the front of the vehicle near the operator’s area. Make sure that the brake meter is installed horizontally and facing forward.
2. Once the meter is installed, set the lever to FREE. The indicator should display 0. Next, set the lever to TEST.

BRAKE INTERLOCK TEST

1. Install the Tapley brake meter at the front of the vehicle near the operator’s area. Make sure that the Tapley brake meter is installed horizontally and facing forward.

[NOTE:]
Once the meter is installed, set the lever to FREE. The indicator should display 0. Next, set the lever to TEST.

2. Drive the vehicle.

[NOTE:]
When testing the brake interlock, the vehicle must be traveling at a minimum speed of 3-5 mph (5-8 km/h).

3. Activate the switch. The brake interlock should apply.
4. If the brake interlock requires adjustment, make the adjustment, then perform a further test.
**BRAKING SYSTEM COMPONENTS**

**TWIN BRAKE-APPLYING VALVE (TYPE E-10)**

For information on the operation, the verification and the maintenance of the E-10 valve, see the manufacturer’s documentation.

**PARKING BRAKE CONTROL VALVE**

See Figure 5.

**REMOVAL**

1. Block the wheels in order to prevent any motion of the vehicle when compressed air is released from the system.
2. Release air from the system.
3. Open the access panel on the operator’s left-hand side, to gain access to the valve lines.
4. Identify air lines in order to facilitate reassembly. Disconnect the lines.
5. Loosen the locking nut from the control button. Unscrew the button, then remove the locking nut.
6. Unscrew the retaining bolts holding the valve to the instrument panel.

**INSTALLATION**

1. Repeat the above operations in the reverse order for the control valve installation.
2. Pressurize the vehicle’s pneumatic system.
3. Check the valve for proper operation and for leaks.

**EMERGENCY BRAKE RELEASE VALVE**

See Figure 6.

**REMOVAL**

1. Block the vehicle’s wheels before proceeding with the braking system maintenance.
2. Completely drain air from all supply reservoirs.
3. Open the access panel on the operator’s left-hand side, to gain access to the valve lines.
4. Identify, mark and disconnect all valve lines.
5. Unscrew and remove the button.
6. Unscrew the retaining bolts holding the valve to the instrument panel.

**INSTALLATION**

1. Repeat the above operations in the reverse order for the control valve installation.
2. Pressurize the vehicle’s pneumatic system.
3. Check the valve for proper operation and for leaks.
FRONT BRAKE CHAMBERS

See Figure 7.

A pneumatic brake chamber, located at each front wheel, transforms the compressed-air energy into the mechanical power that is necessary for applying the brakes. The front brake chamber, attached to the axle, activates an internal lever, which in turn, applies or releases the front disk brakes. For more information on the mechanical operation of the front brakes, see section 04: Front Axle, in this manual.

REMOVAL

_blocks 0_ CAUTION:
Block the vehicle’s wheels before removing the brake chambers from the vehicle.

1. Completely drain air from all supply reservoirs. All hoses must be cleared of air.

_blocks 0_ WARNING:
Before attempting any work on pneumatic system components, and in order to prevent injury, release air pressure from the system by opening the discharge valves from all air reservoirs.

2. Hold the hose fitting nut with a wrench while unscrewing the adaptor out of the fitting or elbow in the brake chamber.

3. If a new brake chamber must be installed, remove the adaptor fitting or elbow for future installation on the replacement part.

4. Loosen, remove and dispose of both retaining bolts from the brake chamber. Use new bolts during reinstallation.

5. Remove the brake chamber.

INSTALLATION

_blocks 0_ CAUTION:
Ensure to block the vehicle’s wheels before installing the brake chambers.

1. Apply white grease, such as Renolit HLT2, or equivalent, to the spherical cup in the lever, before mounting the replacement unit. See Figure 8.

_blocks 0_ CAUTION:
Do not use grease containing molybdenum disulphate.

2. Position the brake chamber at the disc brake flange and install retaining bolts. Torque to 100 to 115 lb-ft (135 to 156 N·m), using a hand wrench. Do not use an impact wrench.

3. Install the adaptor fitting in the brake chamber. Ensure proper alignment of the air inlet ports and the vehicle’s air supply hoses. Do not use any shims or spacers.

Figure 7 - Brake Chambers on Front Axle (Typical)

Figure 8 - Installation of Brake Chambers (Front and Rear)
4. Connect the hose as follows:
   a. Screw the adaptor in the fitting or the elbow while firmly holding the hose-fitting nut with a wrench.
   b. Install the hose in the brake chamber, ensuring that there are no bends or kinks in the line.
   c. Apply a torque of 25 to 30 lb-in. (34 to 41 N•m) to the air hose fittings.

5. Start the vehicle and recharge the pneumatic system until a minimum pressure of 100 psi (689.5 kPa) has been reached.

6. Test the brake chamber as described under the heading NORMAL CONDITION OPERATIONAL TESTS, in section 08-000: AIR SUPPLY SYSTEM in this manual.

REAR BRAKE CHAMBERS

See Figure 9.

The rear brake chambers are comprised of two sections, one standard section for the primary braking circuit for the service brakes and one spring section for the parking and emergency braking circuit.

REMOVAL

.lock CAUTION:
Block the vehicle’s wheels before removing the brake chambers from the vehicle.

1. Release the parking brake.
2. Unscrew the release bolt with a maximum torque of 26 lb-ft (35 N•m).
3. Completely drain air from all supply reservoirs. All hoses must be cleared of air.

4. Disconnect the compressed-air source from the brake chambers.
5. Loosen, remove and dispose of both retaining bolts from the brake chamber. Use new bolts during reinstallation.
6. Remove the brake chamber.

☞ WARNING:
Do not attempt to repair the brake actuator because of inner sealing. Use only approved replacement units.

☞ WARNING:
Do not attempt to open a brake chamber. Disassembling the brake chamber can cause injuries, due to the tension of its powerful spring. In order to prevent injuries, all discarded brake springs should be released in a safe manner.

INSTALLATION

☞ CAUTION:
Block the vehicle’s wheels before installing the brake chambers on the vehicle.

1. Replacement units have drain plugs installed. Remove the bottom drain plugs only. All other drain holes should be plugged.
2. Before installing the new unit, the sealing surfaces must be cleaned. Apply white grease, such as Renolit HLT2, to the spherical cup in the lever, before mounting the replacement unit. See Figure 7.

☞ CAUTION:
Do not use grease containing molybdenum disulphate.

3. Install the brake chamber with new nuts and torque to the values indicated in Figure 9. Use a hand wrench. Do not use an impact wrench.
4. Connect the hoses as follows:
   a. Screw the adaptor in the fitting or the elbow while firmly holding the hose-fitting nut with a wrench.
   b. Install the hose in the brake chamber, ensuring that there are no bends or kinks in the line.
   c. The air hose fittings should be torqued to 25 to 30 lb-in. (34 to 41 N•m).
5. Release the parking brake.
6. Move the hand control valve to the **RUN** position and check for any leakage.
7. Torque the brake chamber release bolt as indicated in Figure 9.
8. The fitting screw must always be mounted on the left and right output side in the driving direction (front side). (See Figure 9). Ensure that the installation position of this fitting screw is correct.
9. Start the vehicle and recharge the pneumatic system up to a minimum pressure of 100 psi (690 kPa).
10. Verify the pneumatic system’s circuit as described under the heading **NORMAL CONDITION OPERATIONAL TESTS** in section 08-000: **AIR SUPPLY SYSTEM** in this manual.

**DOUBLE ANTI-RETURN VALVE**

See Figure 10.

Two double anti-return valves are installed in the vehicle’s braking system. One is connected to the interlock solenoid, at the front of the vehicle and the other is installed on the secondary reservoir.

The valves must be inspected every 6 months, or less, depending on operating conditions.

**LEAK TEST**

1. Disconnect the valve at one of the air input ports.
2. Apply soapy water to the open ends of the anti-return valve and apply air pressure to the opposite air input port. The appearance of a bubble of more than 1 in. (2.5 cm) in 5 seconds indicates an excessive leak.
3. If a leak is observed, remove and clean the valve. If no leak is evident, reconnect the valve and repeat on the opposite air input port.

**REMOVAL**

To disassemble the anti-return valve, unscrew the cap at each valve end and remove the seals, the ball and the sleeve.

**CLEANING**

1. Immerse all parts in solvent for cleaning, except seals and linings.
2. Wipe or dry parts with compressed air.
3. Inspect all parts and check for wear and burrs. Replace with new parts if necessary.

**ASSEMBLY**

1. Place the sleeve and the ball in the body, and then place the seals.
2. Position the seals on the caps and screw the caps in the body.
3. Tighten the caps securely.

**QUICK-RELEASE VALVE — QR-1**

For information on the operation, the verification, the maintenance and the installation of the QR-1 valve, see the manufacturer’s documentation.
R-14 RELAY VALVE

For information on the operation, the verification, the maintenance and the installation of the R-14 relay valve, see the manufacturer’s documentation.

QUICK RELEASE VALVE/ DOUBLE ANTI-RETURN — QR-1C

For information on the operation, the verification, the maintenance and the installation of the QR-1C valve, see the manufacturer’s documentation.

AIR PRESSURE REGULATOR

The air-pressure regulating valve sets the air pressure at 45 - 55 psi (310 - 380 kPa) for the rear service brakes. The allowable pressure through the valve should be checked periodically with a pressure gauge.

AIR PRESSURE CHECK

See Figure 11.

1. Connect the pressure gauge to the reduced pressure line fitting, or to the rear brake line. Then apply air pressure to the valve inlet. The pressure should be 45 - 55 psi (310 - 380 kPa).

2. To adjust the regulator, Loosen the lock-nut, then turn the adjustment screw until the correct pressure is shown on the gauge. If the check does not indicate the correct pressure, inspect the diaphragm and replace it if necessary, as described under the heading DIAPHRAGM REPLACEMENT.

DIAPHRAGM REPLACEMENT

The diaphragm can be replaced without a complete disassembly of the valve and without disturbing the pressure adjustment. See Figure 12.

1. Cut off air supply to the pressure-regulating valve by disconnecting the full pressure line.

2. Turn the ring nut until the pressure-regulating valve can be removed.

3. The diaphragm becomes exposed. The diaphragm support and the plate should be loosened.

4. Replace the diaphragm if damaged.

5. Insert the support (14) in the spring. Place the supporting plate above the diaphragm.

6. Pass the cover through the torquing collar (13).

7. Screw the ring nut on the body. Turn until tight.

8. Reconnect the full pressure line and proceed with the reduced pressure check.

VALVE REPLACEMENT

1. Release pressure from the vehicle’s pneumatic system.

2. Remove the dashboard panel.

3. Remove the screws fastening the valve assembly to the floor.

4. Support the valve assembly and disconnect the supply line by pulling it down through the floor. The valve can then be unscrewed from the magnetic valve fitting.

5. Apply a small quantity of Permatex or an equivalent product on line fitting threads when installing the valve.

6. Tighten fittings.

Figure 11 - Pressure Regulator

Figure 12 - Pressure Regulator
VALVE DISASSEMBLY
See Figure 12.
1. Disassemble the unit by unscrewing the ring nut. The diaphragm support and the support plate may then be removed.
2. Remove the lock-nut. Remove the adjustment screw. The spring may then be removed.
3. If the plunger or the spring must be replaced, remove the ring. The plunger, the spring and the seal may then be removed.

VALVE ASSEMBLY
1. Place the plunger and the seal in the body. Apply a small quantity of Special Lubricant (S-17) on the plunger before reassembling.
2. Install the spring, the washer and the ring. Check if the washer and spring operate properly.
3. Insert the spring in the adjustment screw.
4. Turn the adjustment screw in the body. Insert the membrane support in the spring lower end.
5. Install the diaphragm into position. Place the diaphragm support plate on the diaphragm.
6. Place the cover and the springs on the diaphragm. Firmly tighten the ring nut.
7. Install the lock-nut. Do not tighten at this stage.
8. Check reduced pressure operation by connecting the air supply line to the full pressure fitting and by connecting the pressure gauge to the reduced pressure fitting.
9. Turn the end cap of the adjustment screw until the pressure in the pressure-regulating valve reaches 45 - 55 psi (310 - 380 kPa). Tighten the cover end nut after the pressure adjustment is complete.

MAGNETIC BRAKE-LOCK VALVE
See Figure 13.

MAINTENANCE
Foreign matter or particles present in the compressed-air system may enter the magnetic valve and damage contact surfaces and valve seats to such an extent that air leaks may result.

The magnetic valve test can easily be performed at a test bench or with the valve installed on the vehicle. Test by applying a soapy solution on all joints and watching for air bubbles when the valve is actuated. A sticking or leaking valve should immediately be removed and repaired or replaced as needed.

DISASSEMBLY
1. Remove screws (1), then lift the coil section of the unit.
2. Remove the spacer (9) from the valve body (13). Remove the valve shutter (10) and the spring (11).
3. Wipe up and carefully inspect all components.
4. Replace worn or damaged parts.
5. Immerse the valve body in solvent for cleaning.
6. Blow compressed air into the lines.
7. Clean and dry the plunger (5).
8. Check the seal condition (12) and replace if necessary.
ASSEMBLY

1. Insert the valve shutter (10) into the spacer (9).
2. Insert the spring in the valve body (13) and the seal.
3. Install the spacer, the coil and the case on the valve.
4. Install the plunger into position.
5. Install the cap and the terminal plate (7).
6. Tighten all screws equally until they are fully torqued.

This table is not an exhaustive list of all brake maintenance operations that are required. Also, it does not suggest that some of the more frequent inspections can be omitted. CORRECTIVE MAINTENANCE SHOULD BE INITIATED AS SOON AS THE BRAKING SYSTEM PERFORMANCE BECOMES UNSATISFACTORY. See Table 2: TROUBLESHOOTING GUIDE at the end of this section.

Intervals listed in the PREVENTIVE MAINTENANCE TABLE, must be considered according to the actual operating conditions of a specific vehicle. These intervals are recommended by the manufacturer and should be considered as maximum limits.

General Maintenance

The entire pneumatic system must be checked regularly to detect any leaks. See section 08-000: AIR SUPPLY SYSTEM in this manual for more information on general maintenance of the pneumatic system.

Table 1: PREVENTIVE MAINTENANCE GUIDE can serve as a quick reference for the elements of the system that require periodic maintenance.

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>INTERVAL (1)</th>
<th>MAINTENANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front brake chamber</td>
<td>Re lined brakes - 1 year</td>
<td>Remove, disassemble, clean, inspect.</td>
</tr>
<tr>
<td>Spring brake control</td>
<td>2 years</td>
<td>Disassemble, replace.</td>
</tr>
<tr>
<td>E10 brake valve</td>
<td>See manufacturer’s documentation</td>
<td>See manufacturer’s documentation</td>
</tr>
<tr>
<td>Emergency brake-releasing valve</td>
<td>3,600 hours - 160,000 km (100,000 mi) - 1 yr</td>
<td>Disassemble, clean, inspect.</td>
</tr>
<tr>
<td>Normal duty brake interlocking valve</td>
<td>1,800 hours - 80,000 km (50,000 mi) - 6 months</td>
<td>Disassemble, clean, inspect.</td>
</tr>
<tr>
<td>See manufacturer’s documentation</td>
<td>See manufacturer’s documentation</td>
<td></td>
</tr>
<tr>
<td>QR-1 Valve</td>
<td>See manufacturer’s documentation</td>
<td>See manufacturer’s documentation</td>
</tr>
<tr>
<td>QR-1C Valve</td>
<td>See manufacturer’s documentation</td>
<td>See manufacturer’s documentation</td>
</tr>
<tr>
<td>Quick-release valve</td>
<td>See manufacturer’s documentation</td>
<td>See manufacturer’s documentation</td>
</tr>
</tbody>
</table>

(1) When two or more intervals are mentioned, the operation must be performed at the first interval.
(2) Depending on how severe the operating conditions.

Table 1 - Preventive Maintenance Guide

☞ NOTE

Each time an assembly is removed and disassembled for maintenance, it is recommended to replace all grommets, seals, o-rings, etc., and any other worn or damaged part.
## TROUBLESHOOTING GUIDE

<table>
<thead>
<tr>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NO BRAKING</strong></td>
<td></td>
</tr>
<tr>
<td>1. No air pressure.</td>
<td>1. Check for leaks, broken lines, etc. Check for malfunction of air dryer and a blocked emergency valve. Repair or replace as required.</td>
</tr>
<tr>
<td>2. Blocked line or hose.</td>
<td>2. Replace faulty parts.</td>
</tr>
<tr>
<td>3. Faulty braking valve.</td>
<td>3. Repair or replace.</td>
</tr>
<tr>
<td><strong>INSUFFICIENT BRAKING</strong></td>
<td></td>
</tr>
<tr>
<td>1. Primary and/or secondary system low line pressure.</td>
<td>1. Check for leaks in primary and/or secondary system, etc., and repair.</td>
</tr>
<tr>
<td>2. Excessive travel of push rod in brake chamber.</td>
<td>2. Adjust as required.</td>
</tr>
<tr>
<td>3. Worn brake pads or disks.</td>
<td>3. Replace as necessary.</td>
</tr>
<tr>
<td>4. Leaking brake chamber membrane.</td>
<td>4. Replace brake chamber</td>
</tr>
<tr>
<td>5. Badly adjusted slack adjusters.</td>
<td>5. Adjust as required.</td>
</tr>
<tr>
<td>6. Incorrect brake chamber installed.</td>
<td>6. Replace.</td>
</tr>
<tr>
<td><strong>SLOW BRAKING</strong></td>
<td></td>
</tr>
<tr>
<td>1. Low brake line pressure.</td>
<td>1. Check for leaks etc. and repair.</td>
</tr>
<tr>
<td>2. Linkage hardware binding.</td>
<td>2. Lubricate the linkage.</td>
</tr>
<tr>
<td>3. Excessive travel of push rod in brake chamber.</td>
<td>3. Adjust.</td>
</tr>
<tr>
<td>4. Line restriction.</td>
<td>4. Eliminate restriction or replace line.</td>
</tr>
<tr>
<td>5. Leaking braking valve.</td>
<td>5. Repair or replace.</td>
</tr>
<tr>
<td>6. Worn brake pads or disks.</td>
<td>6. Replace as needed.</td>
</tr>
<tr>
<td>7. Leaking brake chamber membrane</td>
<td>7. Replace brake chamber</td>
</tr>
<tr>
<td>8. Seized brake components.</td>
<td>8. Loosen, replace or lubricate as required.</td>
</tr>
<tr>
<td>10. Shaft rings binding or worn.</td>
<td>10. Lubricate or replace.</td>
</tr>
<tr>
<td><strong>SLOW BRAKE RELEASING</strong></td>
<td></td>
</tr>
<tr>
<td>1. Binding linkage.</td>
<td>1. Lubricate the linkage.</td>
</tr>
<tr>
<td>2. Primary system failure - Emergency braking</td>
<td>2. Check primary system pressure.</td>
</tr>
<tr>
<td>3. Line restriction.</td>
<td>3. Eliminate restriction or replace line.</td>
</tr>
<tr>
<td>4. Excessive travel of pushrod in brake chamber.</td>
<td>4. Adjust</td>
</tr>
<tr>
<td>5. Incorrect braking valve collar.</td>
<td>5. Repair or replace.</td>
</tr>
<tr>
<td>6. Cames ou arbres à cames grippés.</td>
<td>6. Lubricate, if possible, or replace.</td>
</tr>
<tr>
<td>7. Weak springs.</td>
<td>7. Replace the springs.</td>
</tr>
<tr>
<td><strong>BRAKE BINDING</strong></td>
<td></td>
</tr>
<tr>
<td>1. Grease or dirt on brake pads.</td>
<td>1. Clean or replace pads.</td>
</tr>
<tr>
<td>2. Weaving disk.</td>
<td>2. Turn or replace disk.</td>
</tr>
<tr>
<td>3. Faulty braking valve.</td>
<td>3. Repair or replace.</td>
</tr>
<tr>
<td><strong>UNEQUAL BRAKING</strong></td>
<td></td>
</tr>
<tr>
<td>2. Weak or broken brake pads.</td>
<td>2. Replace.</td>
</tr>
<tr>
<td>3. Faulty brake chamber.</td>
<td>3. Replace.</td>
</tr>
<tr>
<td>4. Faulty brake disk.</td>
<td>4. Replace.</td>
</tr>
<tr>
<td>5. Unequal springs in brake chambers or between brake pads.</td>
<td>5. Replace in pairs.</td>
</tr>
</tbody>
</table>

*Table 2 - Troubleshooting Guide*