

## Brake System - General Information -

### Brake Hydraulic Fluid



**CAUTION:** \* If the fluid shown is not available, use a low viscosity DOT 4 brake fluid meeting ISO 4925 Class 6 and Land Rover LRES22BF03 requirements.

Item	Specification
Recommended hydraulic fluid*	SHELL DONAX YB DOT4 ESL FLUID

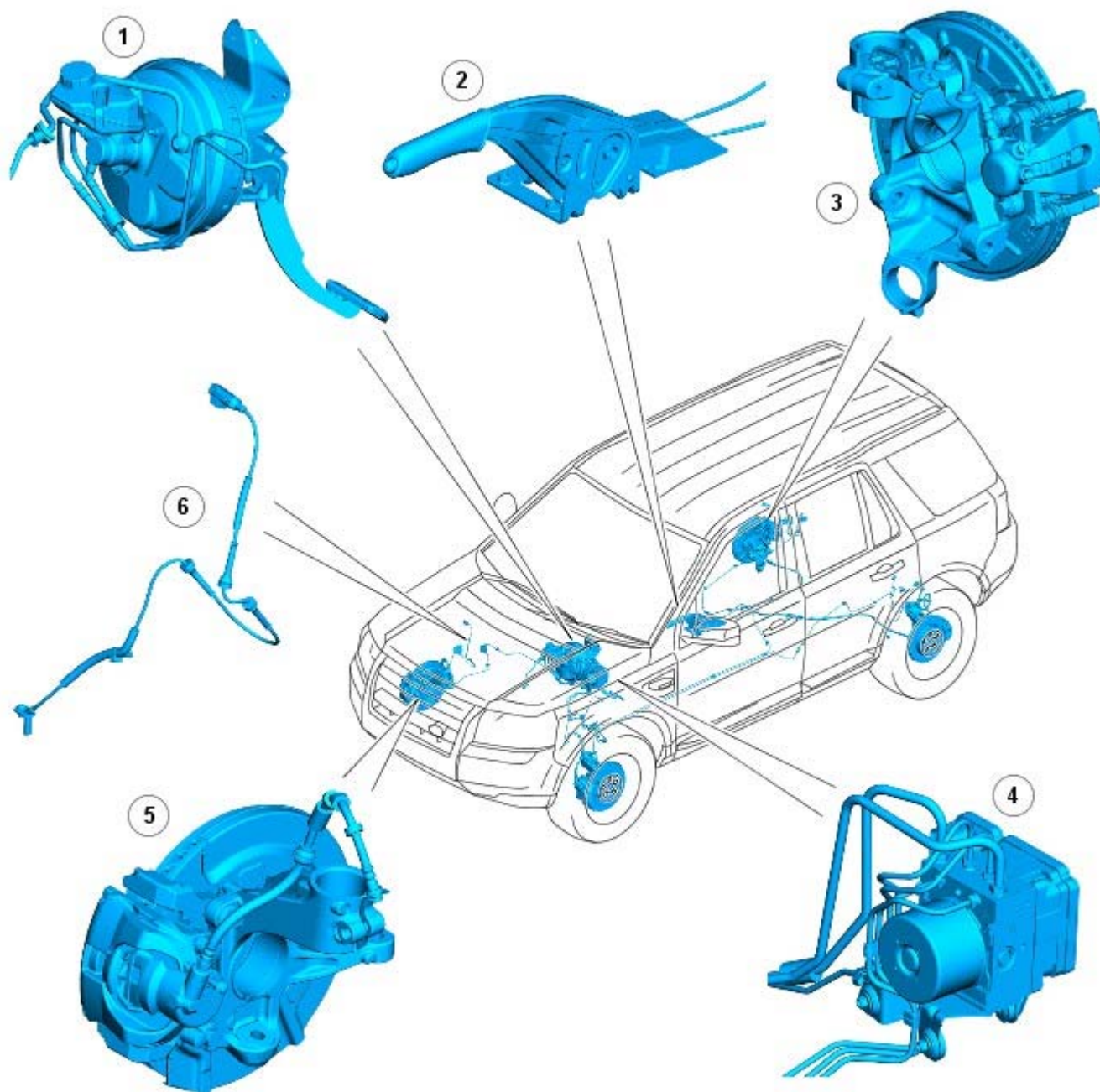
### General Specification

Item	Specification
Front and rear calipers	Single piston sliding calipers
Operation	Hydraulic, self adjusting
Front disc	Ventilated
Rear disc:	
<b>3.2 Petrol</b>	Ventilated
<b>2.2 Diesel</b>	Solid
Parking brake type	Manually applied cable operated system
Master cylinder and booster:	
<b>Make</b>	Continental Teves
<b>Master cylinder type</b>	Tandem design with independent (primary and secondary) hydraulic circuits
<b>Booster type</b>	Compact design with tandem diaphragms 203.20 mm (8.00 in) and 228.60 mm (9.00 in) in diameter

## Brake System - General Information - Brake System

Description and Operation

### COMPONENT LOCATION



E78680

Item	Part Number	Description
1	-	Brake pedal, booster and master cylinder assembly
2	-	Parking brake lever
3	-	Rear disc brake and parking brake assembly
4	-	Anti-lock Brake System (ABS) module and Hydraulic Control Unit (HCU)
5	-	Front disc brake assembly
6	-	ABS speed sensor cable

### INTRODUCTION

Vehicle braking is achieved with a vacuum assisted, hydraulic circuit connected via an integrated ABS module and HCU, to the front and rear disc brake calipers. For increased safety, the hydraulic system is designed as a diagonally split dual circuit. This provides a primary and secondary braking circuit connected between the master cylinder and each front and opposing rear wheel.

The braking system provides anti-lock control to aid the driver, and to make sure the vehicle remains in control during all driving conditions and manoeuvres. The sophisticated ABS functionality also integrates with other vehicle software controlled systems, to provide stability assistance and control when driving off-road.

The parking brake is a manually applied cable system that operates brake shoes, housed within the inner diameter of each rear brake disc.

## FRONT AND REAR DISC BRAKES

The 3.2L i6 vehicle is installed with ventilated front and rear brake discs. The 2.2L TD4 vehicle is installed with ventilated front and solid rear brake discs. Both the i6 and TD4 vehicles feature single piston, sliding calipers on all brake discs. For additional information, refer to:

[Front Disc Brake](#) (206-03 Front Disc Brake, Description and Operation),

[Rear Disc Brake](#) (206-04 Rear Disc Brake, Description and Operation).

## PARKING BRAKE

The parking brake is a manually applied, cable operated system. The RH and LH rear brake discs form the parking brake drums, and provide the location for the parking brake shoes and components.

For additional information, refer to: [Parking Brake](#) (206-05 Parking Brake and Actuation, Description and Operation).

## HYDRAULIC BRAKE ACTUATION

Hydraulic brake actuation consists of the brake pedal, master cylinder, HCU, and the connecting hydraulic pipes and hoses.

The tandem brake master cylinder with reservoir is attached to, and operated by the brake booster. The brake master cylinder is a tandem design that supplies pressure to 2 independent (primary and secondary) hydraulic circuits.

For additional information, refer to: [Hydraulic Brake Actuation](#) (206-06 Hydraulic Brake Actuation, Description and Operation).

## BRAKE BOOSTER

The brake booster is vacuum operated and provides power assistance to the brake hydraulic system. The booster is of tandem design that incorporates 2 separate diaphragms. On both the gasoline and diesel models, the vacuum required for booster operation is produced by an engine driven, vacuum pump.

For additional information, refer to: [Brake Booster](#) (206-07 Power Brake Actuation, Description and Operation).

## ANTI-LOCK CONTROL

The anti-lock control system features a Continental Teves Mk25E1 ABS module with integral 4 channel HCU. The ABS module and HCU provide brake system monitoring, and active brake functions to control the vehicle stability and traction. The ABS module also provides specific functions to assist the vehicle during off-road driving.

The anti-lock control system provides the following functions:

- Anti-lock Brake System (ABS)
- Corner Brake Control (CBC)
- Dynamic Stability Control (DSC)
- Electronic Brake Force Distribution (EBD)
- Electronic Traction Control (ETC)
- Emergency Brake Assist (EBA)
- Engine Drag-Torque Control (EDC)
- Hill Descent Control (HDC) with gradient release control
- Roll Stability Control (RSC)
- Terrain Response™ system integration.

For additional information, refer to: [Anti-Lock Control - Stability Assist](#) (206-09C Anti-Lock Control - Stability Assist, Description and Operation).

# Brake System - General Information - Brake System

Diagnosis and Testing

## Principle of Operation

For a detailed description of the brake system, refer to the relevant Description and Operation section in the workshop manual. REFER to:

[Brake System](#) (206-00 Brake System - General Information, Description and Operation),  
[Front Disc Brake](#) (206-03 Front Disc Brake, Description and Operation),  
[Rear Disc Brake](#) (206-04 Rear Disc Brake, Description and Operation),  
[Parking Brake](#) (206-05 Parking Brake and Actuation, Description and Operation),  
[Hydraulic Brake Actuation](#) (206-06 Hydraulic Brake Actuation, Description and Operation),  
[Brake Booster](#) (206-07 Power Brake Actuation, Description and Operation).

## Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of damage and system integrity.

### Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> <li>● Brake master cylinder</li> <li>● Brake caliper piston(s)</li> <li>● Brake discs</li> <li>● Wheel bearings</li> <li>● Brake pads</li> <li>● Power brake booster</li> <li>● Vacuum pump</li> <li>● Brake pedal linkage</li> <li>● Brake booster vacuum hose</li> <li>● Tires</li> </ul>	<ul style="list-style-type: none"> <li>● Damaged or corroded wiring harness</li> <li>● Brake master cylinder fluid level switch</li> </ul>

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the concern and refer to the Symptom Chart.

### Road Test

Carry out a road test to compare actual vehicle braking performance with the performance standards expected by the driver. The ability of the test driver to make valid comparisons and detect performance deficiencies will depend on experience.

The driver should have a thorough knowledge of brake system operation and accepted general performance guidelines to make good comparisons and detect performance concerns.

An experienced brake technician will always establish a route that will be used for all brake diagnosis road tests. The roads selected will be reasonably smooth and level. Gravel or bumpy roads are not suitable because the surface does not allow the tires to grip the road equally. Crowned roads should be avoided because of the large amount of weight shifted to the low set of wheels on this type of road. Once the route is established and consistently used, the road surface variable can be eliminated from the test results.

Before a road test, obtain a complete description of the customer concerns or suspected condition. From the description, the technician's experience will allow the technician to match possible causes with symptoms. Certain components will be tagged as possible suspects while others will be eliminated by the evidence. More importantly, the customer description can reveal unsafe conditions which should be checked or corrected before the road test. The description will also help form the basic approach to the road test by narrowing the concern to specific components, vehicle speed or conditions.

Begin the road test with a general brake performance check. Keeping the description of the concern in mind, test the brakes at different vehicle speeds using both light and heavy pedal pressure.

If the concern becomes evident during this check, verify it fits the description given before the road test. If the concern is not evident, attempt to duplicate the condition using the information from the description.

If a concern exists, refer to the Symptom Chart.

## Symptom Chart

Symptom	Possible Cause	Action
Brakes noisy	<ul style="list-style-type: none"> <li>● Brake pads</li> <li>● Brake discs</li> </ul>	GO to Pinpoint Test <a href="#">A</a> .

Symptom	Possible Cause	Action
Vibration when brakes are applied	<ul style="list-style-type: none"> <li>● Wheels/tires out of balance</li> <li>● Wheel hub nuts loose</li> <li>● Brake caliper mounting bolts loose</li> <li>● Brake pads</li> <li>● Foreign material/scratches/corrosion on brake disc contact surfaces</li> <li>● Excessive brake disc thickness variation</li> <li>● Excessive brake disc runout</li> <li>● Wheel bearing wear or failure</li> <li>● Suspension bushing wear or failure</li> <li>● Steering bushing wear or failure</li> </ul>	GO to Pinpoint Test <a href="#">B.</a>
The brakes pull or drift	<ul style="list-style-type: none"> <li>● Tire pressures/wear</li> <li>● Brake calipers</li> <li>● Brake pads</li> <li>● Brake discs</li> <li>● Wheel alignment adjustment</li> <li>● Wheel bearing</li> <li>● Suspension bushings and ball joints</li> </ul>	GO to Pinpoint Test <a href="#">C.</a>
The pedal feels spongy	<ul style="list-style-type: none"> <li>● Air in brake system</li> <li>● Leak in hydraulic system</li> <li>● Brake booster/master cylinder failure</li> <li>● Brake pads</li> </ul>	GO to Pinpoint Test <a href="#">D.</a>
The pedal goes down fast	<ul style="list-style-type: none"> <li>● Air in brake system</li> <li>● Leak in hydraulic system</li> <li>● Brake booster/master cylinder</li> <li>● Brake pads</li> </ul>	GO to Pinpoint Test <a href="#">E.</a>
The pedal goes down slowly	<ul style="list-style-type: none"> <li>● Air in brake system</li> <li>● Brake booster/master cylinder</li> </ul>	GO to Pinpoint Test <a href="#">F.</a>
Excessive brake pedal effort	<ul style="list-style-type: none"> <li>● Brake pads</li> <li>● Brake booster</li> </ul>	GO to Pinpoint Test <a href="#">G.</a>
Brake lockup during light brake pedal force	<ul style="list-style-type: none"> <li>● Brake pads</li> <li>● Brake calipers</li> </ul>	GO to Pinpoint Test <a href="#">H.</a>
Brakes drag	<ul style="list-style-type: none"> <li>● Parking brake control applied/malfunction</li> <li>● Seized parking brake cables</li> <li>● Seized caliper slide pins</li> <li>● Seized brake caliper</li> <li>● Brake booster</li> <li>● Pedal gear</li> </ul>	GO to Pinpoint Test <a href="#">I.</a>
Excessive/Erratic brake pedal travel	<ul style="list-style-type: none"> <li>● Hydraulic system</li> <li>● Brake pads</li> <li>● Brake discs</li> <li>● Hub and bearing assembly</li> </ul>	GO to Pinpoint Test <a href="#">J.</a>
The red brake warning indicator is always on	<ul style="list-style-type: none"> <li>● Fluid level</li> <li>● Brake fluid level sensor</li> <li>● Parking brake control</li> <li>● Electrical circuit</li> </ul>	Fill the system to specification. Check for leaks. Install a new brake master cylinder fluid reservoir as required. REFER to: <a href="#">Brake Master Cylinder</a> (206-06 Hydraulic Brake Actuation, Removal and Installation). Check parking brake operation/electrical circuits. REFER to: <a href="#">Parking Brake</a> (206-05 Parking Brake and Actuation, Diagnosis and Testing).
Slow or incomplete brake pedal return	<ul style="list-style-type: none"> <li>● Brake pedal binding</li> <li>● Brake booster/master cylinder</li> </ul>	GO to Pinpoint Test <a href="#">K.</a>

## Pinpoint Tests

PINPOINT TEST A : BRAKES NOISY	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>A1: INSPECT BRAKE PADS</b>	
<b>1</b>	Inspect the condition of the front and rear brake pads. Check for damage to any anti-squeal shims.

	<p>Are the brake pads OK?</p> <p><b>Yes</b></p> <p><a href="#">GO to A2.</a></p> <p><b>No</b></p> <p>CLEAN or INSTALL new brake pads as required.</p> <p>REFER to: <a href="#">Brake Pads</a> (206-03 Front Disc Brake, Removal and Installation) / <a href="#">Brake Pads</a> (206-04 Rear Disc Brake, Removal and Installation).</p> <p>Test the system for normal operation.</p>
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**A2: INSPECT BRAKE DISCS**

	<p><b>1</b> Inspect the brake discs for excessive corrosion, wear or disc thickness variation.</p>
	<p>Does excessive corrosion, wear or disc thickness variation exist?</p> <p><b>Yes</b></p> <p>INSTALL new brake discs and brake pads as required.</p> <p>REFER to: <a href="#">Brake Pads</a> (206-03 Front Disc Brake, Removal and Installation) / <a href="#">Brake Disc</a> (206-03 Front Disc Brake, Removal and Installation) / <a href="#">Brake Pads</a> (206-04 Rear Disc Brake, Removal and Installation) / <a href="#">Brake Disc</a> (206-04 Rear Disc Brake, Removal and Installation).</p> <p>TEST the system for normal operation.</p> <p><b>No</b></p> <p>Vehicle is OK.</p>

**PINPOINT TEST B : VIBRATION WHEN BRAKES ARE APPLIED**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
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**B1: ROAD TEST VEHICLE**

	<p><b>1</b> Road test the vehicle between 40-80 km/h (25-50 mph) without applying brakes.</p>
	<p>Is the vibration present?</p> <p><b>Yes</b></p> <p>TEST for noise vibration and harshness (wheel/tire balance, worn/damaged suspension bushings/components, etc.). REPEAT road test if necessary.</p> <p><b>No</b></p> <p><a href="#">GO to B2.</a></p>

**B2: CHECK FOR BRAKE VIBRATION**

	<p><b>1</b> Road test the vehicle between 40-80 km/h (25-50 mph) with light and medium application on the brake pedal.</p>
	<p>Is a vibration present?</p> <p><b>Yes</b></p> <p>CHECK the brake caliper mounting bolts and wheel hub nuts and TIGHTEN as necessary. CHECK the balance of all road wheels and tires and REPAIR as necessary. CHECK the brake discs for excessive wear, runout, thickness variation or cracks. INSTALL new brake discs and brake pads as required. <a href="#">GO to B3.</a></p> <p><b>No</b></p> <p>Vehicle is OK.</p>

**B3: IS VIBRATION STILL PRESENT UNDER BRAKE APPLICATION?**

	<p><b>1</b> Road test the vehicle between 40-80 km/h (25-50 mph) with light and medium application on the brake pedal.</p>
	<p>Is a vibration present?</p> <p><b>Yes</b></p> <p>CHECK for wear or failure of steering gear bushings. CHECK for wear or failure of steering gear ball joints. CHECK for wear or failure of front wheel bearings, suspension bushings and ball joints. CHECK for wear or failure of rear wheel bearings, suspension bushings and ball joints. REFER to relevant section in workshop manual and INSTALL new components as required.</p> <p><b>No</b></p> <p>Vehicle is OK.</p>

**PINPOINT TEST C : THE BRAKES PULL OR DRIFT**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
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**C1: ROAD TEST VEHICLE**

	<p><b>1</b> Road test the vehicle and apply the brake pedal.</p>
	<p>Does the vehicle pull or drift?</p> <p><b>Yes</b></p> <p><a href="#">GO to C2.</a></p> <p><b>No</b></p> <p>Vehicle is OK.</p>

**C2: INSPECT TIRE CONDITION/PRESSURE**

	<p><b>1</b> Check for excessive tire wear or incorrect pressures.</p>
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	<p>Are the tires at the correct pressure and in good condition?</p> <p><b>Yes</b></p> <p><a href="#">GO to C3.</a></p> <p><b>No</b></p> <p>ADJUST the tire pressures or INSTALL new tires if excessively worn. TEST the system for normal operation.</p>
<b>C3: CHECK CALIPERS</b>	
	<p><b>1</b> Check the disc brake caliper pistons and pins for binding, leaking or sticking.</p>
	<p>Do the disc brake caliper pistons and pins bind, leak or stick?</p> <p><b>Yes</b></p> <p>RECTIFY sticking pins and INSTALL new brake calipers as required. REFER to: Brake Caliper (206-03 Front Disc Brake, Removal and Installation) / <a href="#">Brake Caliper</a> (206-04 Rear Disc Brake, Removal and Installation). TEST the system for normal operation.</p> <p><b>No</b></p> <p><a href="#">GO to C4.</a></p>
<b>C4: INSPECT BRAKE DISCS</b>	
	<p><b>1</b> Check the brake discs for excessive damage, thickness variation or runout.</p>
	<p>Does excessive damage or runout exist?</p> <p><b>Yes</b></p> <p>INSTALL new brake discs and brake pads as required. TEST the system for normal operation.</p> <p><b>No</b></p> <p><a href="#">GO to C5.</a></p>
<b>C5: INSPECT THE FRONT HUB AND WHEEL BEARING ASSEMBLY</b>	
	<p><b>1</b> Check the front hub and wheel bearing assembly.</p>
	<p>Are the wheel bearings OK?</p> <p><b>Yes</b></p> <p><a href="#">GO to C6.</a></p> <p><b>No</b></p> <p>INSTALL new wheel bearings as required. REFER to: <a href="#">Front Wheel Bearing</a> (204-01 Front Suspension, Removal and Installation). TEST the system for normal operation.</p>
<b>C6: CHECK SUSPENSION BUSHINGS AND BALL JOINTS</b>	
	<p><b>1</b> Check all suspension bushings and ball joints.</p>
	<p>Are the suspension bushings and ball joints OK?</p> <p><b>Yes</b></p> <p>Check and adjust steering geometry REFER to: Four-Wheel Alignment (204-00 Suspension System - General Information, General Procedures).</p> <p><b>No</b></p> <p>INSTALL new suspension bushings and ball joints as required. REFER to the relevant section in the workshop manual.</p>

**PINPOINT TEST D : THE PEDAL FEELS SPONGY**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>D1: CHECK FOR SPONGY PEDAL (ENGINE OFF)</b>	
	<p><b>1</b> Check for a firm brake pedal.</p>
	<p>Is the brake pedal effort and brake pedal travel normal?</p> <p><b>Yes</b></p> <p>Vehicle is OK.</p> <p><b>No</b></p> <p><a href="#">GO to D2.</a></p>
<b>D2: CHECK BRAKE PEDAL RESERVE (ENGINE OFF)</b>	
	<p><b>1</b> Pump the brake pedal 10 times and hold on the final application.</p>
	<p>Does the brake pedal feel firm on final application?</p> <p><b>Yes</b></p> <p><a href="#">GO to D3.</a></p> <p><b>No</b></p> <p>BLEED the brake system. REFER to: <a href="#">Brake System Bleeding</a> (206-00 Brake System - General Information, General Procedures) / <a href="#">Brake System Pressure Bleeding</a> (206-00 Brake System - General Information, General Procedures).</p>
<b>D3: CHECK BRAKE PEDAL RESERVE (ENGINE ON)</b>	
	<p><b>1</b> Apply Parking Brake and ensure transmission is in park/neutral.</p>
	<p><b>2</b> Start engine and allow to idle.</p>
	<p><b>3</b> Apply the brake pedal lightly three or four times.</p>
	<p><b>4</b> Wait 15 seconds for the vacuum to recover.</p>



	<b>5</b> Push down on the brake pedal until it stops moving downward or an increased resistance to the brake pedal travel occurs.
	<b>6</b> Hold the brake pedal in the applied position while increasing the engine speed to 2000 rpm.
	<b>7</b> Release the accelerator pedal.
	Does the brake pedal move downward as the engine speed returns to idle? <b>Yes</b> <a href="#">GO to D4.</a> <b>No</b> CHECK the vacuum to brake booster.

**D4: CHECK BRAKE FLUID LEVEL**

	<b>1</b> Check the brake master cylinder reservoir fluid level.
	Is the fluid level OK? <b>Yes</b> BLEED the brake system. REFER to: <a href="#">Brake System Bleeding</a> (206-00 Brake System - General Information, General Procedures) / <a href="#">Brake System Pressure Bleeding</a> (206-00 Brake System - General Information, General Procedures). TEST the system for normal operation. <b>No</b> CHECK for leaking brake system and RECTIFY as necessary. ADD fluid and BLEED the brake system. REFER to: <a href="#">Brake System Bleeding</a> (206-00 Brake System - General Information, General Procedures) / <a href="#">Brake System Pressure Bleeding</a> (206-00 Brake System - General Information, General Procedures). TEST the system for normal operation. REPEAT road test if required.

**PINPOINT TEST E : THE PEDAL GOES DOWN FAST**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>E1: ROAD TEST VEHICLE</b>	
	<b>1</b> Road test the vehicle and apply the brake pedal.
	Is the brake pedal effort and brake pedal travel normal? <b>Yes</b> Vehicle is OK. <b>No</b> <a href="#">GO to E2.</a>

**E2: PRESSURIZE SYSTEM AND CHECK BRAKE PEDAL TRAVEL**

	<b>1</b> With the vehicle stationary pump the brake pedal rapidly (five times).
	Does the brake pedal travel build up and then hold? <b>Yes</b> BLEED the brake system. REFER to: <a href="#">Brake System Bleeding</a> (206-00 Brake System - General Information, General Procedures) / <a href="#">Brake System Pressure Bleeding</a> (206-00 Brake System - General Information, General Procedures). TEST the system for normal operation. <b>No</b> <a href="#">GO to E3.</a>

**E3: CHECK FOR BRAKE SYSTEM LEAKS**

	<b>1</b> Check for external brake system leaks. For additional information, refer to brake master cylinder component test in this section.
	Are leaks found? <b>Yes</b> REPAIR as necessary, ADD fluid and BLEED brake system. REFER to: <a href="#">Brake System Bleeding</a> (206-00 Brake System - General Information, General Procedures) / <a href="#">Brake System Pressure Bleeding</a> (206-00 Brake System - General Information, General Procedures). TEST the system for normal operation. <b>No</b> System is OK.

**PINPOINT TEST F : THE PEDAL GOES DOWN SLOWLY**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>F1: CHECK FOR BRAKE SYSTEM LEAKS</b>	
	<b>1</b> Check for external brake system leaks. For additional information, refer to brake master cylinder component test in this section.
	Are there any external brake system leaks? <b>Yes</b> REPAIR as necessary. ADD fluid and BLEED the brake system. REFER to: <a href="#">Brake System Bleeding</a> (206-00 Brake System - General Information, General Procedures) /



	<a href="#">Brake System Pressure Bleeding</a> (206-00 Brake System - General Information, General Procedures). TEST the system for normal operation.
<b>No</b>	Check for brake master cylinder internal leaks, refer to brake master cylinder component test in this section, and repair as necessary.

### PINPOINT TEST G : EXCESSIVE BRAKE PEDAL EFFORT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>G1: CHECK BRAKE PADS</b>	
	<b>1</b> Check the brake pads for wear, contamination, correct installation, damage and type.
	Are any concerns found? <b>Yes</b> INSTALL brake pads correctly or INSTALL new brake pads as required. REFER to: <a href="#">Brake Pads</a> (206-03 Front Disc Brake, Removal and Installation) / <a href="#">Brake Pads</a> (206-04 Rear Disc Brake, Removal and Installation). TEST the system for normal operation. REPEAT road test.
<b>No</b>	<a href="#">GO to G2.</a>
<b>G2: CHECK VACUUM</b>	
	<b>1</b> Disconnect the vacuum hose from the brake booster.
	<b>2</b> Connect a vacuum/pressure tester to the vacuum hose.
	<b>3</b> Run the engine at normal operating temperature.
	<b>4</b> Record the vacuum reading.
	Is the reading 90 kPa (26.5 in-Hg) or greater <b>Yes</b> <a href="#">GO to G3.</a>
<b>No</b>	LOCATE and REPAIR the source of low vacuum. TEST the system for normal operation.
<b>G3: INSPECT SYSTEM</b>	
	<b>1</b> Switch the engine off.
	<b>2</b> Reconnect the vacuum hose.
	<b>3</b> Inspect the brake booster, rubber grommet, and all vacuum plumbing for cracks, holes, damaged connections, or missing clamps.
	<b>4</b> Pump the brake pedal several times to exhaust the vacuum. Push down on the brake pedal and hold.
	Does the brake pedal move down when the engine is started? <b>Yes</b> Vacuum system is OK.
<b>No</b>	<a href="#">GO to G4.</a>
<b>G4: CHECK POWER BRAKE BOOSTER VALVE</b>	
	<b>1</b> Check the brake booster valve. For additional information, refer to Brake Booster component test in this section.
	Is the power brake booster valve OK? <b>Yes</b> CHECK the brake booster. For additional information, refer to Brake Booster component test in this section. INSTALL a new brake booster as required. REFER to: <a href="#">Brake Booster</a> (206-07 Power Brake Actuation, Removal and Installation). TEST the system for normal operation.
<b>No</b>	INSTALL a new brake booster valve. TEST the system for normal operation.

### PINPOINT TEST H : BRAKE LOCKUP DURING LIGHT BRAKE PEDAL FORCE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>H1: TEST BRAKE LOCKUP</b>	
	<b>1</b> Road test the vehicle and apply the brake pedal lightly.
	Do the brakes lockup? <b>Yes</b> <a href="#">GO to H2.</a>
<b>No</b>	Vehicle is OK.
<b>H2: INSPECT BRAKE PADS</b>	
	<b>1</b> Inspect brake pads for contamination, correct installation, damage and type.
	Are any concerns found? <b>Yes</b> INSTALL the brake pads correctly or INSTALL new brake pads as required. REFER to: <a href="#">Brake Pads</a> (206-03 Front Disc Brake, Removal and Installation) / <a href="#">Brake Pads</a> (206-04 Rear Disc Brake, Removal and Installation). TEST the system for correct operation.

	<b>No</b> <a href="#">GO to H3.</a>
<b>H3: INSPECT BRAKE CALIPERS</b>	
	<b>1</b> Inspect brake calipers for binding, leaking or sticking.
	Are any concerns found? <b>Yes</b> INSTALL the brake calipers correctly or INSTALL new brake calipers as required. REFER to: Brake Caliper (206-03 Front Disc Brake, Removal and Installation) / <a href="#">Brake Caliper</a> (206-04 Rear Disc Brake, Removal and Installation). TEST the system for normal operation. <b>No</b> Vehicle is OK.

**PINPOINT TEST I : BRAKES DRAG**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>I1: ROAD TEST VEHICLE</b>	
	<b>1</b> Road test the vehicle and apply the brakes.
	Are the brakes functioning correctly? <b>Yes</b> Vehicle is OK. <b>No</b> <a href="#">GO to I2.</a>
<b>I2: CHECK BRAKE CALIPERS AND PARKING BRAKE CABLES</b>	
	<b>1</b> Check the front and rear caliper pistons and pins for binding, leaking or sticking and parking brake cables for sticking/binding.
	Do the disc brake caliper pistons and pins bind, leak or stick, or the parking brake cables stick/bind? <b>Yes</b> REPAIR or INSTALL new components as required. Test the system for normal operation. Road test vehicle if necessary. <b>No</b> <a href="#">GO to I3.</a>
<b>I3: CHECK BRAKE BOOSTER</b>	
	<b>1</b> Check the brake booster connecting rod alignment and travel.
	Is the connecting rod OK? <b>Yes</b> Vehicle is OK. <b>No</b> INSTALL a new brake booster. REFER to: <a href="#">Brake Booster</a> (206-07 Power Brake Actuation, Removal and Installation). TEST the system for normal operation.

**PINPOINT TEST J : EXCESSIVE/ERRATIC BRAKE PEDAL TRAVEL**

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
<b>J1: TEST ON ROUGH ROAD</b>	
	<b>1</b> Road test the vehicle on rough road conditions.
	<b>2</b> Apply the brakes slowly.
	Is the brake pedal effort and brake pedal travel normal? <b>Yes</b> Vehicle is OK. <b>No</b> <a href="#">GO to J2.</a>
<b>J2: CHECK BRAKE FLUID LEVEL</b>	
	<b>1</b> Check the brake master cylinder reservoir fluid level.
	Is the fluid level OK? <b>Yes</b> <a href="#">GO to J3.</a> <b>No</b> CHECK brake master cylinder reservoir sealing points. For additional information, refer to Brake master cylinder component test in this section. ADD brake fluid and BLEED the brake system. REFER to: <a href="#">Brake System Bleeding</a> (206-00 Brake System - General Information, General Procedures) / <a href="#">Brake System Pressure Bleeding</a> (206-00 Brake System - General Information, General Procedures). TEST the system for normal operation. REPEAT road test if necessary.
<b>J3: CHECK BRAKE PEDAL RESERVE</b>	
	<b>1</b> Run engine at idle speed.
	<b>2</b> Apply the brake pedal lightly three or four times.
	<b>3</b> Wait 15 seconds for the vacuum to replenish.

	<b>4</b> Push down on the brake pedal until it stops moving downward or an increased resistance to the brake pedal travel occurs.
	<b>5</b> Hold the brake pedal in the applied position while increasing the engine speed to 2000 rpm.
	<b>6</b> Release the accelerator pedal.
	Does the brake pedal move downward as the engine speed returns to idle? <b>Yes</b> <a href="#">GO to J4.</a> <b>No</b> CHECK the vacuum to the brake booster.
<b>J4: CHECK THE FRONT WHEEL BEARING ASSEMBLY</b>	
	<b>1</b> Check the front wheel bearing assembly.
	Are the front wheel bearings loose? <b>Yes</b> INSTALL a new front wheel bearing if damaged. REFER to: <a href="#">Front Wheel Bearing</a> (204-01 Front Suspension, Removal and Installation). TEST the system for normal operation. <b>No</b> CHECK the front brake discs for thickness variances.

<b>PINPOINT TEST K : SLOW OR INCOMPLETE BRAKE PEDAL RETURN</b>	
<b>TEST CONDITIONS</b>	<b>DETAILS/RESULTS/ACTIONS</b>
<b>K1: CHECK FOR BRAKE PEDAL RETURN</b>	
	<b>1</b> Run the engine at idle while making several brake applications.
	<b>2</b> Pull the brake pedal rearward with approximately 44.5 N (10lb) force.
	<b>3</b> Release the brake pedal and measure the distance to the toe board.
	<b>4</b> Make a hard brake application.
	<b>5</b> Release the brake pedal and measure the brake pedal to toe board distance. The brake pedal should return to its original position.
	Does the brake pedal return to its original position? <b>Yes</b> Vehicle is OK. <b>No</b> <a href="#">GO to K2.</a>
<b>K2: CHECK FOR BRAKE PEDAL BINDING</b>	
	<b>1</b> Disconnect the brake booster from the brake pedal. Check the brake pedal to ensure free operation.
	Is the brake pedal operating freely? <b>Yes</b> INSTALL a new brake booster. REFER to: <a href="#">Brake Booster</a> (206-07 Power Brake Actuation, Removal and Installation). TEST the system for normal operation. <b>No</b> REPAIR or INSTALL new brake pedal. TEST the system for normal operation.

## Component Tests

### Brake Booster

1. Check all hoses and connections. All unused vacuum connectors should be capped. Hoses and their connections should be correctly secured and in good condition with no holes and no collapsed areas. Inspect the valve on the brake booster for damage.
2. Check the hydraulic brake system for leaks or low fluid.
3. With the automatic transmission in PARK, stop the engine and apply the parking brake. Pump the brake pedal several times to exhaust all vacuum in the system. With the engine switched off and all vacuum in the system exhausted, apply the brake pedal and hold it down. Start the engine. If the vacuum system is operating, the brake pedal will tend to move downward under constant foot pressure. If no motion is felt, the vacuum booster system is not functioning.
4. Remove the vacuum hose from the brake booster. Manifold vacuum should be available at the brake booster end of the hose with the engine at idle speed and the automatic transmission in PARK. Make sure that all unused vacuum outlets are correctly capped, hose connectors are correctly secured and vacuum hoses are in good condition. When it is established that manifold vacuum is available to the brake booster, connect the vacuum hose to the brake booster and repeat Step 3. If no downward movement of the brake pedal is felt, install a new brake booster.
5. Operate the engine for a minimum of 10 seconds at a fast idle. Stop the engine and allow the vehicle to stand for 10 minutes. Then, apply the brake pedal with approximately 89 N (20lb) of force. The pedal feel (brake application) should be the same as that noted with the engine running. If the brake pedal feels hard (no power assist), install a new valve and then repeat the test. If the brake pedal still feels hard, install a new brake booster. If the brake pedal movement feels spongy, bleed the brake system.  
REFER to: [Brake System Bleeding](#) (206-00 Brake System - General Information, General Procedures) /

[Brake System Pressure Bleeding](#) (206-00 Brake System - General Information, General Procedures).

## Brake Master Cylinder

Usually, the first and strongest indicator of anything wrong in the brake system is a feeling through the brake pedal. In diagnosing the condition of the brake master cylinder, check pedal feel as evidence of a brake concern. Check for brake warning lamp illumination and the brake fluid level in the brake master cylinder reservoir.

### Normal Conditions

The following conditions are considered normal and are not indications that the brake master cylinder is in need of repair.

- Modern brake systems are designed to produce a pedal effort that is not as hard as in the past. Complaints of light pedal efforts should be compared to the pedal efforts of another vehicle of the same model and year.
- The fluid level will fall with brake pad wear.

### Abnormal Conditions

Changes in the brake pedal feel or brake pedal travel are indicators that something could be wrong in the brake system. The diagnostic procedure and techniques use brake pedal feel, warning indicator illumination and low brake fluid level as indicators to diagnosing brake system concerns. The following conditions are considered abnormal and indicate that the brake master cylinder is in need of repair:

**NOTE:** Prior to carrying out any diagnosis, ensure the brake system warning indicator is functional.

- Brake pedal goes down fast. This could be caused by an external or internal leak.
- Brake pedal goes down slowly. This could be caused by an internal or external leak.
- Brake pedal is low or feels spongy. This condition may be caused by no fluid in the brake master cylinder, reservoir cap vent holes clogged or air in the hydraulic system.
- Brake pedal effort is excessive. This may be caused by a bind or obstruction in the pedal/linkage, a faulty non-return valve, booster or insufficient booster vacuum.
- Rear brakes lock up during light pedal force. This may be caused by damaged brake pads, a partially applied parking brake, a damaged ABS sensor or bearing failure.
- Brake pedal effort erratic. This condition could be caused by the brake booster or incorrectly installed brake pads.
- Brake warning indicator is on. This may be caused by low fluid level or float assembly damaged.

## Non Pressure Leaks

Any reduced fluid volume in the brake master cylinder reservoir may be caused by two types of none pressure external leaks.

Type 1: An external leak may occur at the brake master cylinder reservoir cap because of incorrect positioning of the gasket and cap. Reposition cap and gasket.

Type 2: An external leak may occur at the brake master cylinder reservoir mounting seals. Repair such a leak by installing new seals and make sure that the brake master cylinder reservoir retaining bolt is correctly installed.

## Brake System - General Information - Brake System Bleeding

### General Procedures



**WARNING:** If any components upstream of the Hydraulic Control Unit (HCU), including the HCU itself are replaced, the brake system must be bled using Land Rover approved diagnostic equipment. This will ensure that all air is expelled from the new component(s).

**NOTE:** The following procedure covers bleeding the brake system if components down stream of the HCU have been replaced. Where only the primary or secondary brake circuits have been disturbed in isolation, it should only be necessary to bleed that circuit. Partial bleeding of the hydraulic system is only permissible if a brake tube or hose has been disconnected with only minimal loss of fluid.



1. **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

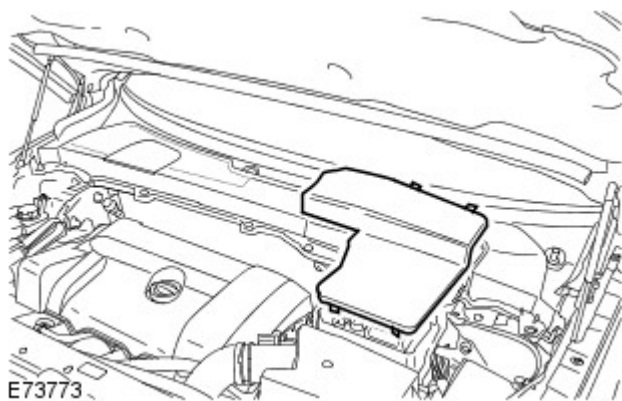
Raise and support the vehicle.

2. Check that the brake fluid lines are secure and that there are no signs of a brake fluid leak. If a brake fluid leak is detected, investigate and rectify the cause of the leak before bleeding the brakes.

Refer to: [Brake System](#) (206-00 Brake System - General Information, Diagnosis and Testing).

3. Pump the brake pedal until the brake vacuum assistance is exhausted.

4.



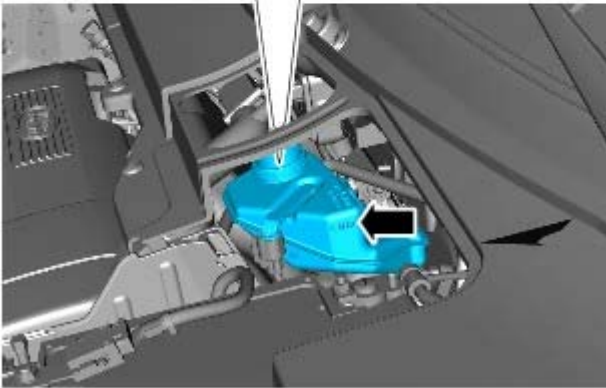
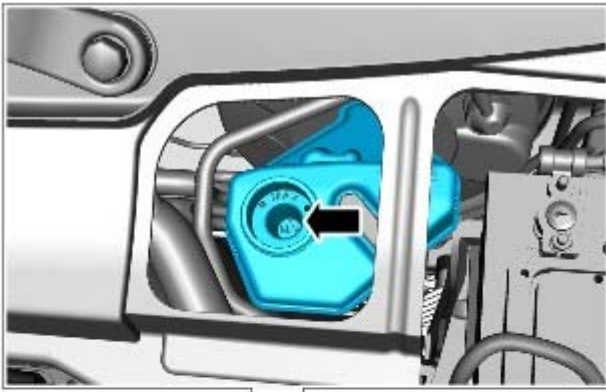
5. **WARNING:** Do not allow dirt or foreign liquids to enter the reservoir. Use only new brake fluid of the correct specification from airtight containers. Do not mix brands of brake fluid as they may not be compatible.



**CAUTION:** Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

Remove the brake fluid reservoir cap.

6. Fill the brake fluid reservoir to the MAX mark.

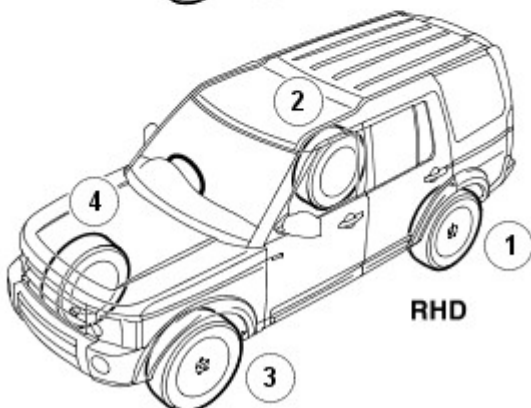
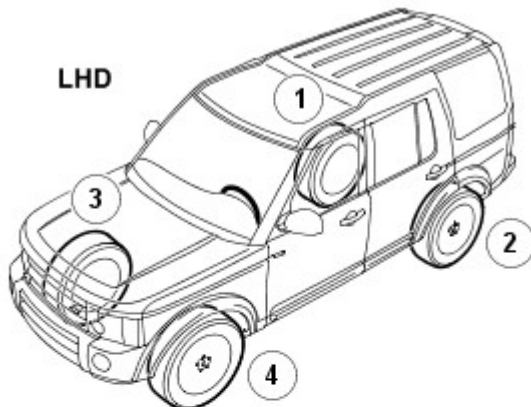


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7. Install the bleed tube to the brake caliper bleed screw and immerse the free end of the bleed tube in a bleed jar containing a small quantity of approved brake fluid.

- 8.

- Starting at the brake caliper furthest away from the brake master cylinder, loosen the bleed screw by one-half to three-quarters of a turn.




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9.  **CAUTION:** The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.

With assistance, depress the brake pedal steadily through its full stroke and allow it to return to the rest position. Repeat the procedure until brake fluid, clean and air-free flows into the bleed jar.

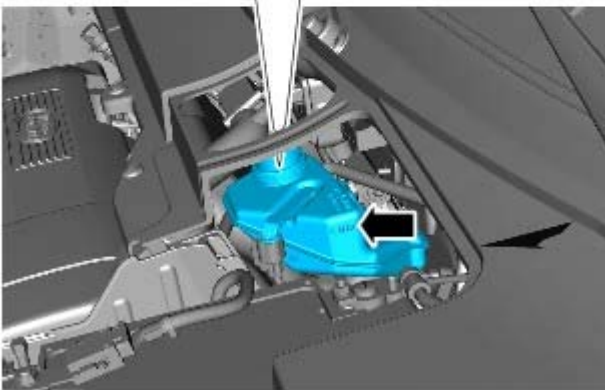
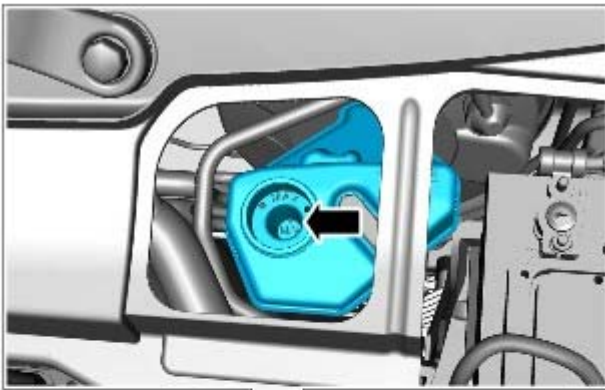
10. When brake fluid, clean and air-free flows into the bleed jar, depress and hold the brake pedal down.

11.  **CAUTION:** Make sure the bleed screw cap is installed after bleeding. This will prevent corrosion to the bleed screw.

With the brake pedal fully depressed, tighten the bleed screw.

*Torque:* 10 Nm

12. Fill the brake fluid reservoir to the MAX mark.



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13.  **WARNING:** Braking efficiency may be seriously impaired if an incorrect bleed sequence is used.

Repeat the brake bleeding procedure for each brake caliper, following the above sequence.

14. Fill the brake fluid reservoir to the MAX mark.

15. Apply the brakes and check for leaks.

16. Install the brake fluid reservoir cap.



17. Install the fluid reservoir access panel.