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BRAKE SYSTEM – GENERAL INFORMATION

BRAKE SYSTEM (G2386585)

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PRINCIPLES OF OPERATION

For a detailed description of the Brake System, refer to the relevant Description and Operation section in the workshop manual. REFER to section 206-08: Brake Controls and Actuation - Anti-Lock Control

INSPECTION AND VERIFICATION

 CAUTION:

Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

 NOTES:

- If a control module or a component is at fault and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual, or determine if any prior approval program is in operation, prior to the installation of a new module/component.
- Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the Jaguar Land Rover approved diagnostic equipment).
- When performing voltage or resistance tests, always use a digital multimeter that has the resolution ability to view 3 decimal places. For example, on the 2 volts range can measure 1mV or 2 K Ohm range can measure 1 Ohm. When testing resistance always take the resistance of the digital multimeter leads into account.
- Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern

2. Visually inspect for obvious signs of damage and system integrity

Visual Inspection

MECHANICAL	ELECTRICAL
■ Brake pedal cover ■ Brake pedal ■ Pedal bracket ■ Integrated power brake	■ Fuses ■ Wiring harnesses and connectors ■ Brake pad wear sensors ■ Brake fluid level sensor

MECHANICAL	ELECTRICAL
■ Brake fluid ■ Brake fluid reservoir ■ Brake pipes and hoses ■ Brake calipers ■ Brake pads ■ Brake discs ■ Electric park brake actuators ■ Wheel bearings ■ Tires	■ Wheel speed sensors ■ Electric park brake switch ■ Electric park brake actuators ■ Steering angle sensor ■ Integrated power brake control module ■ Restraints control module ■ Powertrain control module

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 symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Code(s) (DTC) and refer to the DTC Index

5. Check the Jaguar Land Rover (JLR) claims submission system for open campaigns. Refer to the corresponding bulletins and SSMS which may be valid for the specific customer complaint and complete the recommendations as required.

ROAD TEST

Perform 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. When 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, use the symptom chart in order to isolate it to a specific sub-system and condition description. From this description, a list of possible sources can be used to further narrow the cause to a specific component or condition

SYMPTOM CHART

SYMPTOM	POSSIBLE CAUSES	ACTION
Brakes noise	- Foreign object(s) in brakes - Front/rear left/right brake pads excessively worn - Front/rear left/right brake disc(s) excessively worn	- Check for foreign objects in the front and rear brakes - Check the front and rear brake discs and pads are within the specified service wear limit. REFER to: Specifications (206-00 Brake System - General Information, Specifications). - If the brake discs and pads are free from foreign material and are within the specified service wear limit. GO to Pinpoint Test A. .
Vibration when brakes are applied	- Wheels/tires out of balance - Wheel hub nuts loose - Brake caliper mounting bolts loose - Brake pads - Foreign material /scratches /corrosion on brake disc contact surfaces - Excessive brake disc thickness variation - Excessive brake disc runout - Wheel bearing wear or failure - Suspension bushes wear or failure - Steering bushes wear or failure	GO to Pinpoint Test F.

SYMPTOM	POSSIBLE CAUSES	ACTION
The brakes pull or drift	■ Tire pressures/wear ■ Brake calipers ■ Brake pads ■ Brake discs ■ Wheel alignment adjustment ■ Wheel bearing ■ Suspension bushings and ball joints	■ GO to Pinpoint Test G.
The pedal feels spongy	■ Air in brake hydraulic system ■ Leak in hydraulic system ■ Integrated power brake control module ■ Brake pads	■ GO to Pinpoint Test H.
The pedal goes down fast	■ Air in brake hydraulic system ■ Leak in hydraulic system ■ Integrated power brake control module ■ Brake pads	■ GO to Pinpoint Test I.
The pedal goes down slowly	■ Air in brake hydraulic system ■ Integrated power brake control module	■ GO to Pinpoint Test J.
Excessive brake pedal effort required	■ Brake pads ■ Integrated power brake control module	■ GO to Pinpoint Test K.
Brake lockup during light brake pedal force	■ Brake pads ■ Brake calipers	■ GO to Pinpoint Test L.
Brakes drag	■ Park brake applied /malfunction	■ GO to Pinpoint Test M.

SYMPTOM	POSSIBLE CAUSES	ACTION
	- Seized brake caliper slide pins - Seized brake caliper - Integrated power brake control module - Pedal gear	
Excessive /Erratic brake pedal travel	- Hydraulic system - Brake pads - Brake discs - Hub and bearing assembly	GO to Pinpoint Test N.
The red brake warning indicator is always on	- Fluid level - Brake reservoir fluid level sensor - Park brake control - Electrical circuit	Fill the system to specification. Check for leaks. Install a new Integrated power brake fluid reservoir and/or sensor as required. Refer to the relevant section in the workshop manual for the Integrated power brake control module and circuit tests
Slow or incomplete brake pedal return	- Brake pedal binding - Integrated power brake control module	GO to Pinpoint Test O.

PINPOINT TESTS

PINPOINT TEST A : BRAKE NOISE	
A1: BRAKE NOISE INITIAL CHECK	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Confirm customer noise
	Has the customers concern been confirmed? Yes GO to A2. No No further action required
A2: CHECK FOR CAMPAIGNS, BULLETINS AND SSMS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check the Jaguar Land Rover claims submission system to clarify if the vehicle has any outstanding campaigns. Refer to the corresponding bulletins and SSMS which may be valid for the specific customer complaint

A2: CHECK FOR CAMPAIGNS, BULLETINS AND SSMS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	Has a corresponding campaign, bulletin or SSM been located? Yes Complete the recommendations as required No GO to A3.
A3: BRAKE NOISE ORIGIN - FRONT OR REAR	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Confirm the origin of the brake noise, if available using the Jaguar Land Rover approved diagnostic equipment (Steelman ChassisEAR)
	Has the brake noise origin been located? Yes If the brake noise origin is coming from the front brakes, for vehicles with high performance brakes GO to Pinpoint Test B. . For vehicles with standard brakes GO to Pinpoint Test C. . If the brake noise origin is coming from the rear brakes, for vehicle with standard brakes GO to Pinpoint Test D. . For vehicles with high performance brakes GO to Pinpoint Test E. No Raise a Technical Assistance (TA) with an attached sound file.

PINPOINT TEST B : FRONT BRAKE NOISE VEHICLES INSTALLED WITH: HIGH PERFORMANCE BRAKES ONLY	
B1: FRONT BRAKE NOISE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Assess noise.
	Can brake noise be heard from the front brakes under normal driving conditions? Is this the first time the vehicle has had a reported front brake noise? Yes Raise an Electronic Product Quality Report (EPQR), attach a noise file, brake questionnaire and any other supporting evidence No Road test the vehicle with the customer to confirm the noise has gone.

PINPOINT TEST C : FRONT BRAKE NOISE VEHICLES INSTALLED WITH: STANDARD BRAKES ONLY	
C1: FRONT BRAKE NOISE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Assess noise.
	Can brake noise be heard from the front brakes under normal driving conditions? Is this the first time the vehicle has had a reported front brake noise? Yes Raise an EPQR, attach a noise file, brake questionnaire and any other supporting evidence No Road test the vehicle with the customer to confirm the noise has gone.

PINPOINT TEST D : REAR BRAKE NOISE VEHICLES INSTALLED WITH: STANDARD BRAKES ONLY	
D1: REAR BRAKE NOISE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Assess noise.
	Can a squeal noise be heard from the rear of the vehicle while braking? This usually will occur at low speeds. Yes Raise an EPQR, attach a noise file, brake questionnaire and any other supporting evidence No Road test the vehicle with the customer to confirm the noise has gone.

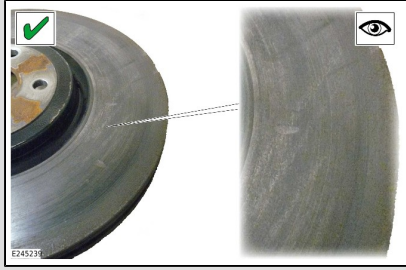
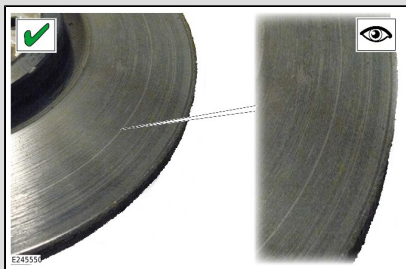
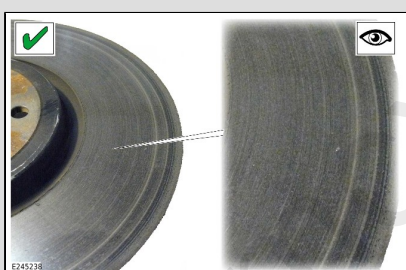
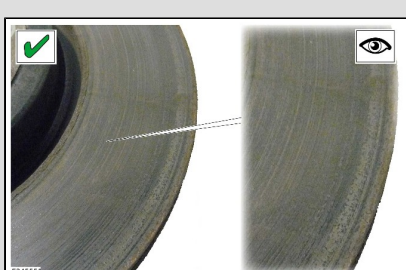
PINPOINT TEST E : REAR BRAKE NOISE VEHICLES INSTALLED WITH: HIGH PERFORMANCE BRAKES ONLY	
E1: REAR BRAKE NOISE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Assess noise.
	Can brake noise be heard from the rear brakes under normal driving conditions? Is this the first time the vehicle has had a reported rear brake noise? Yes Raise an EPQR, attach a noise file, brake questionnaire and any other supporting evidence No Road test the vehicle with the customer to confirm the noise has gone.

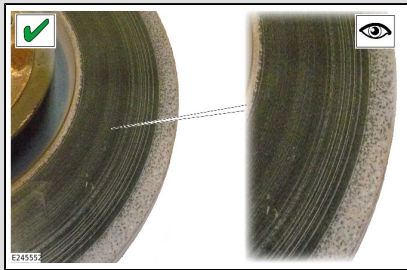
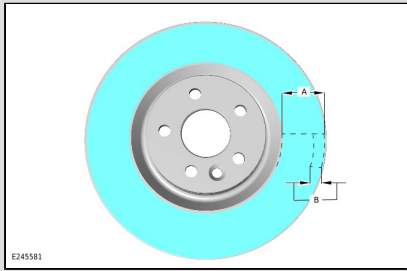
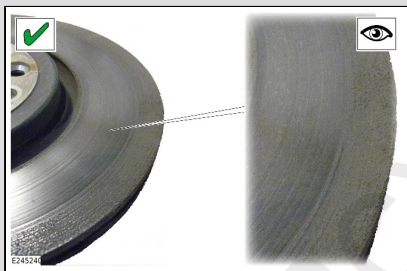
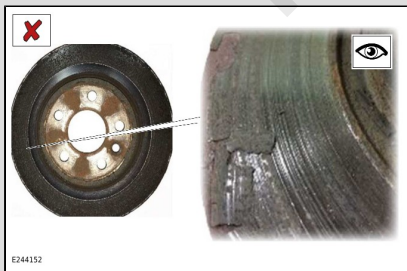
Brake Disc Corrosion Inspection

NOTES:

- Jaguar Land Rover braking systems are designed to achieve peak performance under a broad range of driving conditions. Jaguar Land Rover's priority is the safety of its braking systems, and they are designed to perform in all circumstances, however the brake may, dependent on the environment and driving style, produce the occasional noise. This does not impair the operation or performance. Brake noise is an issue facing many vehicle manufacturers and Jaguar Land Rover are constantly working in conjunction with the leading brake caliper and brake pad suppliers to develop design solutions which reduce brake squeal noises.
- Jaguar Land Rover Limited offers no warranty and is not responsible for any repair or replacement to the vehicle, part or accessory that is required as a direct result of: Normal wear and tear this includes brake pads, brake discs, and any other friction related components. The list is not exhaustive. Defects or damage caused as a result of the vehicle being used in motor sport events, or for any purpose other than normal, private, or commercial use. Brake pads, brake discs, and any other friction related components are covered against manufacturing defects for the duration of the manufacturer's warranty.
- Most JLR brake pads now utilize NAO brake pad friction material technology. This creates a 'transfer layer' on the brake disc, whereas previous brake pads use an abrasive friction mechanism, which leads to greater pad and disc wear. This NAO transfer layer has a dull metallic appearance.

- However, some situations with low brake usage, or through the use of non- JLR approved wheel cleaners, can lead to a build up of surface corrosion on the disc (see guidance below and in workshop manual Diagnosis and Testing) - this surface corrosion build-up does not adversely affect brake performance.

	EXAMPLE IMAGES	DESCRIPTION
1.		 NOTE: If the brake disc(s) is similar to illustration E245239, This is not a manufacturing defect and is not covered under warranty. Light corrosion - If the disc(s) condition is as illustrated and within the service wear limit REFER to: Specifications (206-00 Brake System - General Information, Specifications). This is not detrimental to braking performance and brake disc replacement is not required.
2.		 NOTE: If the brake disc(s) is similar to illustration E245550, This is not a manufacturing defect and is not covered under warranty. Light corrosion - If the disc(s) condition is as illustrated and within the service wear limit REFER to: Specifications (206-00 Brake System - General Information, Specifications). This is not detrimental to braking performance and brake disc replacement is not required.
3.		 NOTE: If the brake disc(s) is similar to illustration E245238, This is not a manufacturing defect and is not covered under warranty. Moderate corrosion - If the disc(s) condition is as illustrated and within the service wear limit REFER to: Specifications (206-00 Brake System - General Information, Specifications). This is not detrimental to braking performance and brake disc replacement is not required.
4.		 NOTE: If the brake disc(s) is similar to illustration E245551, This is not a manufacturing defect and is not covered under warranty. Uneven corrosion with pitting - If the disc(s) condition is as illustrated and within the service wear limit REFER to: Specifications (206-00 Brake System - General Information, Specifications). This is not detrimental to braking performance and brake disc replacement is not required.
5.		 NOTE: If the brake disc(s) is similar to illustration E245552, This is not a manufacturing defect and is not covered under warranty. Uneven corrosion with pitting - If the disc(s) condition is as illustrated and within the service wear limit REFER to: Specifications (206-00 Brake System -

	EXAMPLE IMAGES	DESCRIPTION
		General Information, Specifications). This is not detrimental to braking performance and brake disc replacement is not required.
6.		Brake pad to brake disc surface contact area measurement instruction ■ Section (A) is 100% of the brake disc working surface. To work out 30% section (B) of the brake disc working surface follow the below steps. ■ Step 1. Measure section (A) of the brake disc working surface. Example 60mm. ■ Step 2. Divide the measurement from step 1 by 100. Example $60\text{mm} \div 100 = 0.6\text{mm}$. ■ Step 3. Multiply the total of step 2 by 30. Example $0.6\text{mm} \times 30 = 18\text{mm}$ ■ Step 4. This will give 30% section (B) of the brake disc working surface. Example 18mm.
7.		NOTE: If the brake disc(s) is similar to illustration E245240, This is not a manufacturing defect and is not covered under warranty. Heavy pitting with corrosion - It is not necessary to replace the disc unless the corroded region covers more than 30% of the brake disc working surface.
8.		NOTE: Brake discs are recommended to be replaced in axle sets. Severe pitting and corrosion - If the disc(s) condition is similar to the illustration. Replace the brake discs.
9.		NOTE: The use of non- JLR approved wheel cleaners can cause accelerated corrosion of the brake disc. ■ Use of non-Jaguar Land Rover wheel cleaners - Evidence of use of non-JLR approved cleaners may be indicated where discoloration/corrosion of brake caliper/springs occurs.

	EXAMPLE IMAGES	DESCRIPTION
	 	■ SSM73952 and SSM73953 - Brake Caliper Discoloration - provides guidance to use of wheel cleaners. ■ The pictures shown illustrate typical calipers on vehicles that are corroded due to using unsuitable cleaning agents ■ Corroded calipers, due to using unsuitable cleaning agents, are NOT covered by warranty.

PINPOINT TEST F : VIBRATION WHEN BRAKES ARE APPLIED	
F1: ROAD TEST VEHICLE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Road test the vehicle between 40-80 km/h (25-50 mph) without applying brakes
	Is the vibration present? Yes Refer to the relevant section in the workshop manual for noise vibration and harshness tests No GO to F2.
F2: CHECK FOR BRAKE VIBRATION	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Road test the vehicle between 40-80 km/h (25-50 mph) with light and medium application on the brake pedal
	Is a vibration present? Yes Check the brake caliper mounting bolts and wheel hub nuts and tighten to specification as required. Check the balance of all road wheels and tires and repair as required. Check the brake discs for excessive wear, runout, thickness variation or cracks. Install new brake discs and brake pads as required GO to F3. No No action required, vehicle is OK
F3: IS VIBRATION STILL PRESENT UNDER BRAKE APPLICATION?	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Road test the vehicle between 40-80 km/h (25-50 mph) with light and medium application on the brake pedal

F3: IS VIBRATION STILL PRESENT UNDER BRAKE APPLICATION?	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	Is a vibration present? Yes 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 No No action required, vehicle is OK

PINPOINT TEST G : THE BRAKES PULL OR DRIFT	
G1: ROAD TEST VEHICLE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Road test the vehicle and apply the brake pedal
	Does the vehicle pull or drift? Yes GO toG2. No No action required, vehicle is OK
G2: INSPECT TIRE CONDITION/PRESSURE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check for excessive tire wear or incorrect pressures
	Are the tires at the correct pressure and in good condition? Yes GO toG3. No Adjust the tire pressures or install new tires if excessively worn. Retest the system for normal operation
G3: CHECK CALIPERS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check the disc brake caliper pistons and pins for binding, leaking or sticking
	Do the disc brake caliper pistons and pins bind, leak or stick? Yes Rectify sticking pins and install new brake calipers as required. Retest the system for normal operation No GO toG4.
G4: INSPECT BRAKE DISCS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check the brake discs for excessive damage, thickness variation or runout
	Does excessive damage or runout exist? Yes Install new brake discs and brake pads as required. Retest the system for normal operation No GO toG5.

G5: INSPECT THE FRONT HUB AND WHEEL BEARING ASSEMBLY	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check the front hub and wheel bearing assembly
	Are the wheel bearings OK? Yes GO to G6. No Install new wheel bearings as required. Retest the system for normal operation
G6: CHECK SUSPENSION BUSHINGS AND BALL JOINTS.	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check all suspension bushings and ball joints
	Are the suspension bushings and ball joints OK? Yes GO to G7. No Install new front suspension bushings and ball joints as required. Install new rear suspension bushings and ball joints as required. Refer to the relevant section in the workshop manual
G7: CHECK VEHICLE ALIGNMENT	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check the vehicle alignment
	Is the alignment within specification? Yes No action is required, vehicle is OK No Adjust the alignment as required

PINPOINT TEST H : THE PEDAL FEELS SPONGY	
H1: CHECK FOR SPONGY PEDAL	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check for a firm brake pedal
	Is the brake pedal effort and brake pedal travel normal? Yes No action is required, vehicle is OK No GO to H2.
H2: CHECK BRAKE PEDAL RESERVE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Pump the brake pedal 10 times and hold on the final application
	Does the brake pedal feel firm on final application? Yes GO to H3. No Bleed the brake system

H3: CHECK BRAKE PEDAL RESERVE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Using the Jaguar Land Rover approved diagnostic equipment, check the anti-lock brake system module for related DTCs and refer to the relevant DTC index
	Have any brake controller related DTCs been set? Yes Perform the relevant corrective action, clear the DTCs and retest No GO to H4.

H4: CHECK BRAKE FLUID LEVEL	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check the brake reservoir fluid level
	Is the fluid level OK? Yes Bleed the brake system. Retest the system for normal operation No Check for leaking brake system and rectify as required. Add fluid and bleed the brake system. Retest the system for normal operation

PINPOINT TEST I : THE PEDAL GOES DOWN FAST	
I1: ROAD TEST VEHICLE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Road test the vehicle and apply the brake pedal
	Is the brake pedal effort and brake pedal travel normal? Yes No action required, vehicle is OK No GO to I2.

I2: CHECK BRAKE PEDAL TRAVEL-PRESSURIZE SYSTEM	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Pump the brake pedal rapidly (five times)
	Does the brake pedal travel build up and then hold? Yes Bleed the brake system. Retest the system for normal operation No GO to I3.

I3: CHECK FOR BRAKE SYSTEM LEAKS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check for external brake system leaks
	Is there a leak present? Yes Repair as necessary, add fluid and bleed brake system. Retest the system for normal operation No No action required, system is OK

PINPOINT TEST J : THE PEDAL GOES DOWN SLOWLY	
J1: ROAD TEST VEHICLE - CHECK BRAKE PEDAL OPERATION	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check if the condition occurs during actual stopping application by applying the brake pedal while the vehicle is moving
	Does the condition occur when the vehicle is moving? Yes GO toJ2. No GO toJ3.
J2: CHECK FOR BRAKE SYSTEM LEAKS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check for external brake system leaks
	Are there any external brake system leaks? Yes Rectify as necessary. Add fluid and bleed the brake system. Retest the system for normal operation No GO toJ3.
J3: BRAKE MASTER CYLINDER SEAL LEAKING	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Pump the brake pedal 10 times and hold on the final application
	Does the brake pedal go down slowly? Yes Using the Jaguar Land Rover approved diagnostic equipment, perform routine - Test Tandem Master Cylinder - and routine - Test Leakage and Air, add fluid and bleed the brake system. Retest the system for normal operation No No action required, system is OK

PINPOINT TEST K : EXCESSIVE BRAKE PEDAL EFFORT	
K1: CHECK BRAKE PADS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check the brake pads for wear, contamination, correct installation, damage and type
	Has a concern been identified? Yes Correctly install or install new brake pads as required. Retest the system for normal operation No GO toK2.
K2: CHECK THE BRAKE CONTROLLER	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check the brake controller is operating correctly
	Is the brake controller operating correctly?

K2: CHECK THE BRAKE CONTROLLER	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	Yes No action is required, vehicle is OK No Using the Jaguar Land Rover approved diagnostic equipment, check the anti-lock brake system control module for integrated power brake control module related DTCs and refer to the relevant DTC index

PINPOINT TEST L : BRAKE LOCKUP DURING LIGHT BRAKE PEDAL FORCE	
L1: TEST BRAKE LOCKUP	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Road test the vehicle and apply the brake pedal lightly
	Do the brakes lockup? Yes GO toL2. No No action required, vehicle is OK
L2: INSPECT BRAKE PADS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Inspect brake pads for contamination, correct installation, damage and type
	Has a concern been identified? Yes Correctly install or install new brake pads as required. Retest the system for normal operation No GO toL3.
L3: INSPECT BRAKE CALIPERS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Inspect brake calipers for binding, leaking or sticking
	Has a concern been identified? Yes Correctly install or install new brake calipers as required. Retest the system for normal operation No No action required, vehicle is OK

PINPOINT TEST M : BRAKES DRAG	
M1: ROAD TEST VEHICLE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Road test the vehicle and apply the brakes
	Are the brakes functioning correctly? Yes No action required, vehicle is OK No GO toM2.

M2: CHECK BRAKE CALIPERS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check the front and rear calipers pistons and pins for binding, leaking or sticking
	Do the disc brake caliper pistons and pins bind, leak or stick? Yes Inspect the brake calipers and park brake cables. Install new components as required. Retest the system for normal operation No GO to M3.
M3: CHECK BRAKE CONTROLLER	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check the Integrated power brake control module connecting rod alignment and travel
	Is the connecting rod OK? Yes Vehicle is OK No Install a new integrated power brake control module as required. Retest the system for normal operation

PINPOINT TEST N : EXCESSIVE/ERRATIC BRAKE PEDAL TRAVEL	
N1: TEST ON ROUGH ROAD	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Road test the vehicle on rough road conditions
	2 Apply the brakes slowly
	Is the brake pedal effort and brake pedal travel normal? Yes No action required, vehicle is OK No GO to N2.
N2: CHECK BRAKE FLUID LEVEL	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check the brake reservoir fluid level
	Is the fluid level OK? Yes GO to N3. No Check the brake reservoir sealing points. Add brake fluid and bleed the brake system. Retest the system for normal operation
N3: CHECK BRAKE PEDAL RESERVE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Road test the vehicle on rough road conditions
	Does the brake pedal move downward on rough road conditions? Yes

N3: CHECK BRAKE PEDAL RESERVE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	GO to N4. No Using the Jaguar Land Rover approved diagnostic equipment, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
N4: CHECK THE FRONT WHEEL BEARING ASSEMBLY	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Check the front wheel bearing assembly
	Are the front wheel bearings loose/damaged? Yes Tighten to specification or install a new front wheel bearing as required. Retest the system for normal operation No Check the front brake discs for thickness variances

PINPOINT TEST O : SLOW OR INCOMPLETE BRAKE PEDAL RETURN	
O1: CHECK FOR BRAKE PEDAL RETURN	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Set the ignition to on and make several brake applications
	2 Release the brake pedal and measure the distance to the toe board
	3 Make a hard brake application
	4 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? Yes No action required, vehicle is OK No GO to O2.
O2: CHECK FOR BRAKE PEDAL BINDING	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 Disconnect the brake controller from the brake pedal. Check the brake pedal to make sure free operation
	Is the brake pedal operating freely? Yes Install a new integrated power brake control module as required. Retest the system for normal operation No Repair or install new brake pedal. Retest the system for normal operation

INTEGRATED POWER BRAKE CONTROL MODULE

1. Check the hydraulic brake system for leaks or low fluid

BRAKE MASTER CYLINDER

Usually, the first and strongest indicator of anything wrong in the brake system is a feeling through the brake pedal. The tandem master cylinder is internal to the integrated power brake control module. In this system, pedal feel is provided by an internal pedal feel simulator. It operates as a Brake By-Wire system. The driver pressure is not directly connected to the brake calipers. The Integrated power brake control module monitors for air and leakage in the brake system. This can also be tested using the Jaguar Land Rover diagnostic equipment.

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, make sure 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.
- Rear brakes lock up during light pedal force. This may be caused by damaged brake pads, a partially applied park brake, a damaged wheel speed sensor or bearing failure.
- Brake pedal effort erratic. This condition could be caused by the integrated power brake control module or incorrectly installed brake pads.
- Brake warning indicator is on. This may be caused by low brake fluid level.

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 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 reservoir mounting seals. Repair such a leak by installing new seals and make sure that the brake reservoir retaining bolt is correctly installed

DTC INDEX

For a list of DTCs that could be set on this vehicle, please refer to Section 100-00. REFER to: [Diagnostic Trouble Code Index - DTC: Anti-Lock Brake System Control Module \(ABS\)](#) (100-00 General Information, Description and Operation).

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