

Brake System - General Information -

Brake Hydraulic Fluid

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



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

General Specification

Item	Specification
Footbrake type:	
Vehicles without Brembo brakes	Hydraulic, servo assisted, self-adjusting with front/rear split hydraulic system, twin piston sliding calipers to the front and single piston sliding calipers to the rear
Vehicles with Brembo brakes	Hydraulic, servo assisted, self-adjusting with front/rear split hydraulic system, opposed six piston calipers to the front and single piston sliding calipers to the rear
Parking brake type	Twin shoe (leading/trailing) operating on rear wheels and controlled from park brake lever in floor console via twin cables

Brake System - General Information - Brake System

Diagnosis and Testing

Principles of Operation

For a detailed description of the Brake System and operation, refer to the relevant Description and Operation section of the workshop manual. 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](#) (206-05 Parking Brake and Actuation, Description and Operation).

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 checked and/or the donor vehicle.

- **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. **1.** Verify the customer concern.
 - If a road test is necessary make sure the vehicle is safe to do so.
2. **2.** Visually inspect for obvious signs of mechanical damage.

Visual Inspection

Mechanical
<ul style="list-style-type: none"> ● Brake pad(s) condition and installation ● Brake caliper(s) condition and installation ● Brake disc(s) condition and installation ● Parking brake disc(s)/parking brake drum(s) condition and installation ● Parking brake shoes condition and installation ● Parking brake cable(s) condition and installation ● Brake booster condition and installation ● Brake booster vacuum hose condition and installation ● Brake master cylinder condition and installation ● Hydraulic Control Unit (HCU) ● Brake fluid leaks ● Brake warning indicator

3. **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. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Brake noise	<ul style="list-style-type: none"> ● Debris ● Brake pads ● Brake disc(s) 	Refer to the relevant section of the workshop manual.
Brake vibration	<ul style="list-style-type: none"> ● Suspension components ● Brake disc(s) 	Refer to the relevant section of the workshop manual.
Excessive brake pedal travel/brake pedal spongy	<ul style="list-style-type: none"> ● Brake pads ● Air in the brake system ● Brake master cylinder ● Brake fluid leak (see visual inspection) 	Worn pads may make the pedal travel excessive, new pads may make the pedal spongy. Check after bedding in the pads. Check the pedal travel. If the pedal "pumps-up", suspect air in the system. Check for a cause for air ingress, rectify as necessary. If the pedal sinks to the floor when held under pressure when there are no external leaks, suspect a master cylinder fault. Refer to the relevant section of the workshop manual.
Excessive brake pedal effort/brake pedal hard	<ul style="list-style-type: none"> ● Brake pipe(s) ● Brake caliper slide(s) ● Brake caliper piston(s) ● Brake vacuum pipe ● Brake vacuum pump ● Brake booster 	Check for damaged brake pipes. Check the brake calipers. Check the brake vacuum pipe for air leaks, rectify as necessary. Check the brake vacuum pump operation. Refer to the relevant section of the workshop manual. Check the brake booster.

Symptom	Possible Causes	Action
Low foot brake efficiency/brakes pulling/sticking/binding	<ul style="list-style-type: none"> ● Brake pipe(s) ● Pads ● Brake caliper piston(s) ● Brake caliper slide(s) ● Brake disc(s) 	Check the vehicle for damaged brake pipes. Inspect the brake pads. Check the brake calipers. Check the brake discs. Refer to the relevant section of the workshop manual.
Parking brake will not engage or release	<ul style="list-style-type: none"> ● Parking brake cables ● Parking brake shoes ● Parking brake adjusters ● Rear brake disc(s)/parking brake drum(s) ● Parking brake actuator malfunction 	Check the parking brake cable(s) for operation/condition. Check that the cable end connector(s) are correctly installed to the operating lever(s). Inspect the parking brake shoes for wear. Check the parking brake shoes for correct adjustment. Check the rear brake disc(s)/parking brake drum(s). Check the parking brake actuator for damage and/or excessive noise in normal operation. Refer to the relevant section of the workshop manual.
Low parking brake efficiency/parking brake sticking/binding		
Brake warning indicator staying illuminated	<ul style="list-style-type: none"> ● Brake reservoir fluid level ● Brake pads ● Brake pad wear sensor leads ● Brake fluid level sensor 	Check the brake fluid level, top up if required. Inspect the brake pads. Check the brake pad sensor circuit. Refer to the electrical guides. Check the function of the brake fluid level sensor. Refer to the relevant section of the workshop manual.


DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

Brake System - General Information - Rear Brake Disc Runout Check

General Procedures

- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.
- NOTE: RH illustration shown, LH is similar.
- NOTE: It is not necessary to carry out the parking brake shoe 'bedding-in procedure' if the rear brake discs or parking brake shoes have been removed for access to other components.

1.  CAUTION: Do not turn the ignition on when the parking brake service mode has been set, this will result in the parking brake being released from the service mode.

Enter the parking brake into the service mode.

- Turn the ignition on.
- Apply, and hold, the footbrake.
- Apply, and hold, the parking brake switch to the RELEASE position.
- Turn the ignition off.
- Release the footbrake.
- Release the parking brake switch.

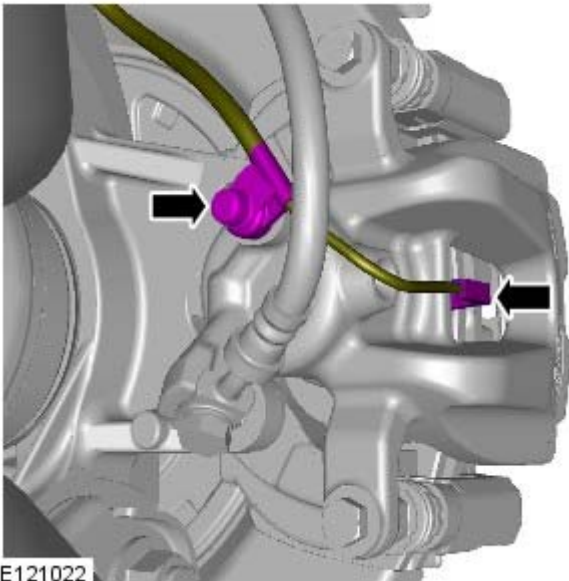
2.  WARNING: Make sure to support the vehicle with axle stands.

Raise rear of vehicle.

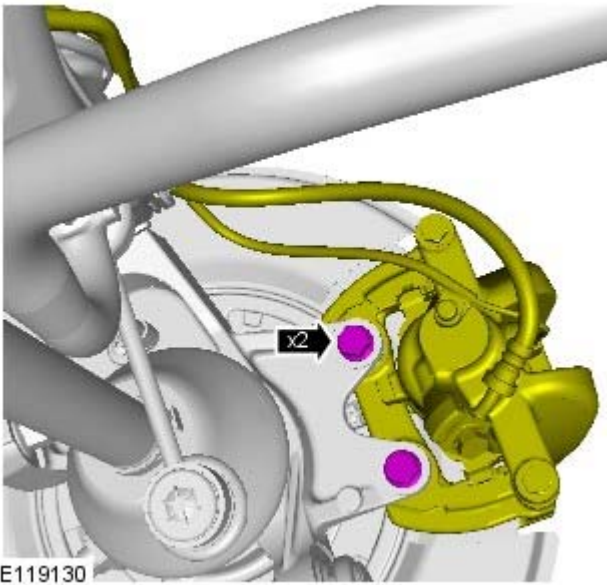
3. Remove road wheel.

4.  CAUTION: The brake pad wear indicator sensor is easily damaged. Do not use a lever to remove the sensor. Use fingers only.

RH side rear only: Disconnect the brake pad wear indicator sensor lead.

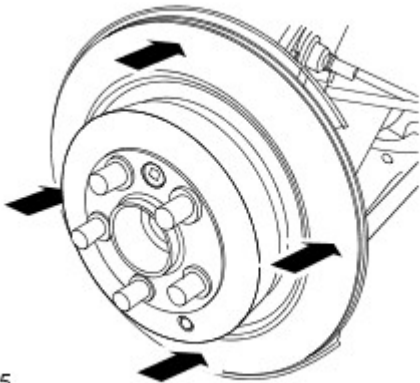


5. Remove 2 bolts securing brake caliper to hub. Release caliper from hub and tie aside.



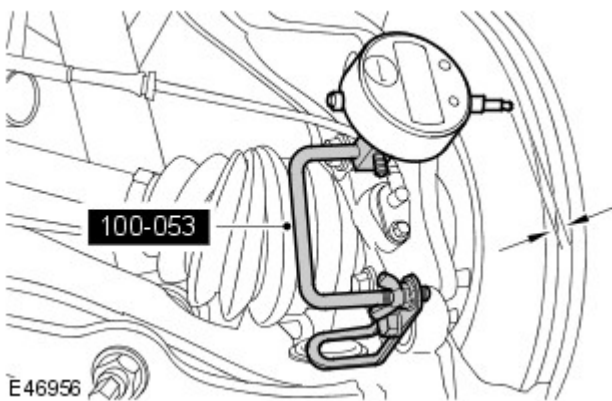
6. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

At 4 points around the disc, measure disc thickness using a micrometer; renew disc if less than service limit or if variation is exceeded: Disc thickness, NEW = 20 mm Service limit = 18 mm. Thickness variation maximum = 0.01 mm.

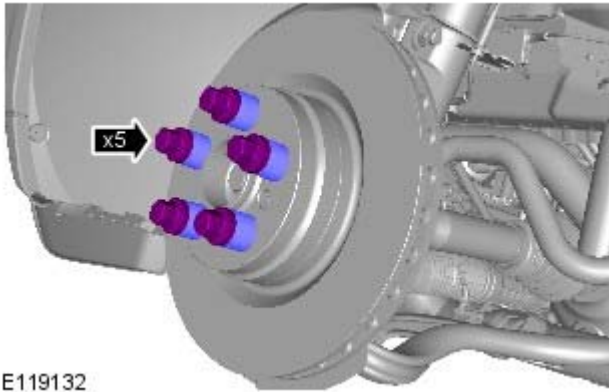


7. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Mount a Dial Test Indicator (DTI) to and secure to inboard side of hub using caliper assembly upper bolt hole.



8. Position DTI probe 5 mm in from outer edge of disc.



E119132

9. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Tighten the wheel nuts to 140 Nm (103 lb.ft).

- Install spacer washers under the wheel nuts.

10. Zero DTI and rotate wheel one complete revolution to measure disc runout. Disc runout must not exceed 0.09 mm (0.003 in).

11. If disc runout is outside limits:

12. Remove the wheel hub nuts.

- Remove the spacer washers.

13. Remove Allen screw securing brake disc to drive flange.

14. Remove brake disc.

15. Ensure mating surfaces of disc and drive flange are clean.

16. Install the brake disc.

- Tighten the Torx screw to 35 Nm (26 lb.ft).

17. Tighten the wheel nuts to 140 Nm (103 lb.ft).

- Install spacer washers under the wheel nuts.

18. Check disc runout as detailed above.

19. If runout is still outside limits, renew disc and/or hub.

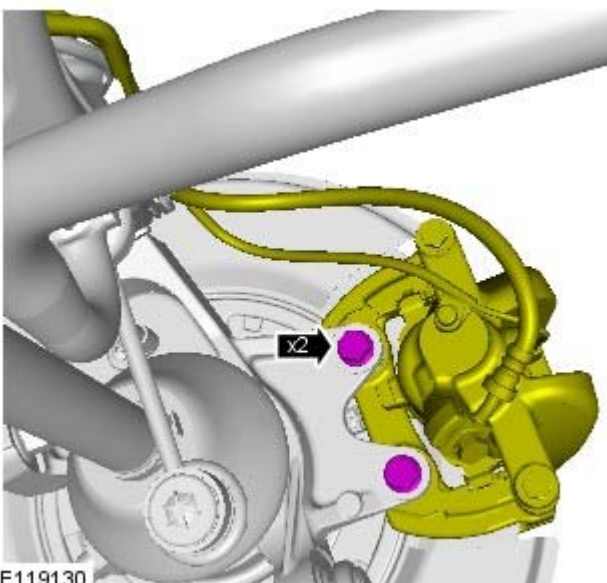
20. Remove the wheel hub nuts.

- Remove the spacer washers.

21. Remove the DTI.

22. Install the brake caliper anchor bolts

- Tighten the bolts to 115 Nm (85 lb.ft).



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23. Tighten the wheel nuts to 140 Nm (103 lb.ft).

24. Depress brake pedal several times to set brake pads.

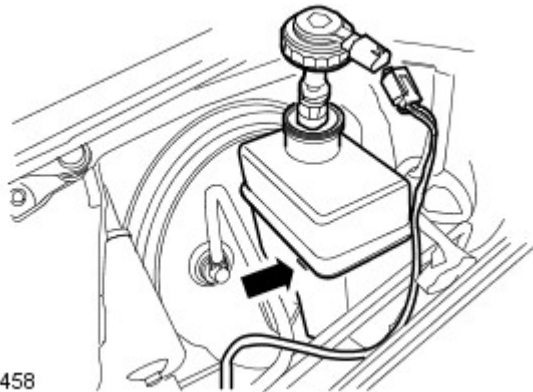
25. Remove stands and lower vehicle.

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:** Bleeding of the complete brake system must be carried out using Land Rover approved diagnostic equipment. 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.
- **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.



E62458

1. **WARNING:** Make sure to support the vehicle with axle 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.

3. **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.

- **CAUTIONS:**

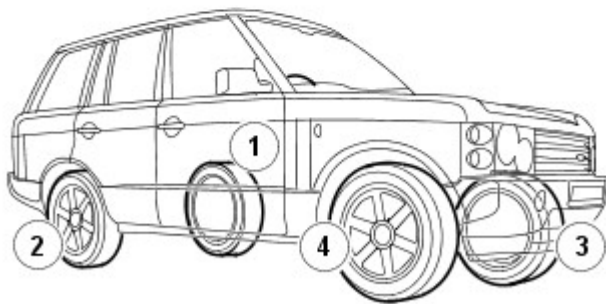
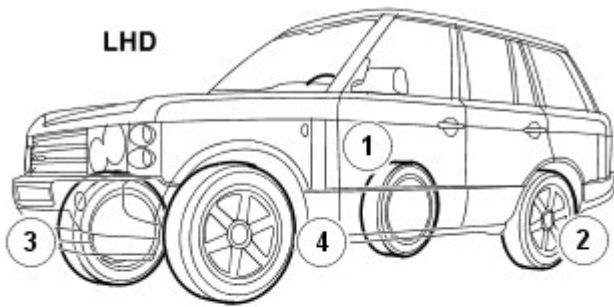
WARNING: Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

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

Fill the brake fluid reservoir to the MAX mark.

- Disconnect the brake fluid reservoir electrical connector.
 - Remove the brake fluid reservoir cap.
4. Conduct the bleed procedure with the engine running.
 5. Connect the diagnostic tool to the vehicle, select diagnostic and proceed as directed for bleeding the brake system.

- 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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RHD

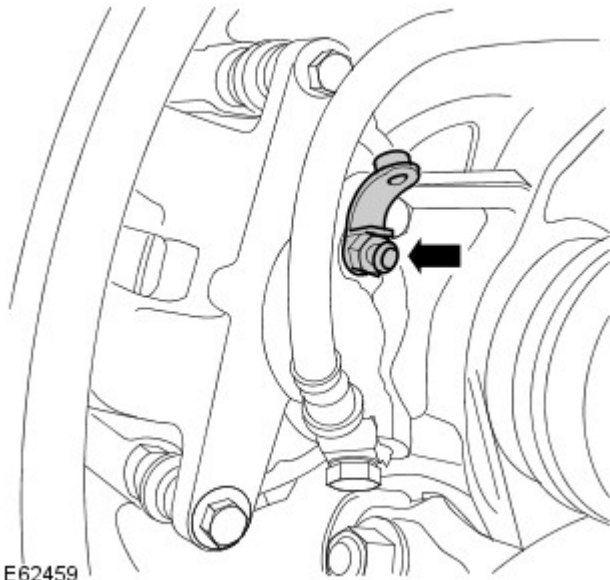
- Install the bleed tube to the brake caliper bleed screw and immerse the free end of the bleed tube in a bleed jar containing a small quantity of approved brake fluid.


- Hold the bleed container at least 300 mm above the Caliper that is being bled.

-  **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 to 2/3 of its full stroke.


- With the brake pedal held down, close bleed screw and then return the brake pedal to 1/3 of its full stroke and hold.
- Repeat steps 8 and 9, 28 times for the rear brake and 10 times for the front brake.
- At the end of the bleed process, depress and hold the brake pedal down.



12.  **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 to 10 Nm (7 lb.ft).

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

14.  **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.

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

16. Apply the brakes and check for leaks.

17. Install the brake fluid reservoir cap.

- Connect the brake fluid reservoir electrical connector.

18. On completion, road test the vehicle and check the brake pedal operation. The pedal travel should be short with a firm feel.

Brake System - General Information - Brake System Pressure Bleeding


General Procedures

- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.


1.  **WARNING:** Make sure to support the vehicle with axle 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.

3.  **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.

- CAUTIONS:

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

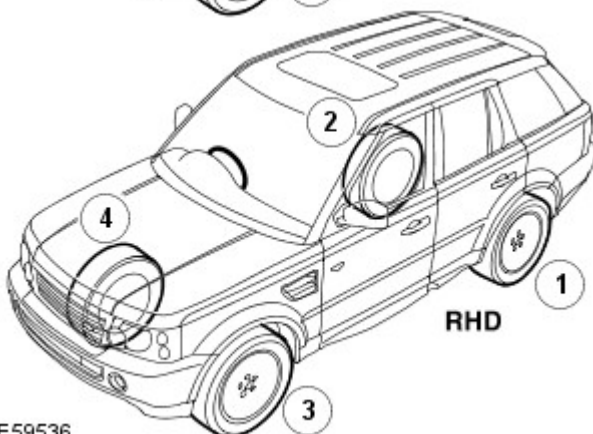
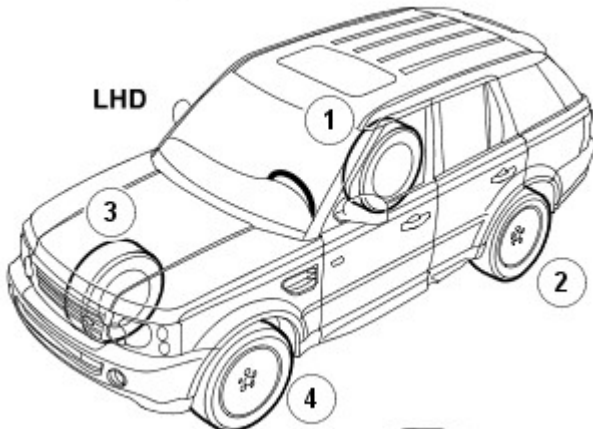
 The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.

Fill the brake fluid reservoir to the MAX mark.

- Disconnect the brake fluid reservoir electrical connector.
- Remove the brake fluid reservoir cap.

4. Conduct the bleed procedure with the engine running.

5. 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.




E59536

- 6.

- 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.

- Hold the bleed container at least 300 mm above the Caliper that is being bled.

7.  **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 to 2/3 of its full stroke.


- 8.** With the brake pedal held down, close bleed screw and then return the brake pedal to 1/3 of its full stroke and hold.
- 9.** Repeat steps 7 and 8, 28 times for the rear brake and 10 times for the front brake.
- 10.** At the end of the bleed process, 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.

- On vehicles with high performance brakes, tighten the front caliper bleed screw to 19 Nm (14 lb.ft).
- On vehicles with standard brakes, tighten the front caliper bleed screw to 10 Nm (7 lb.ft).
- Tighten the rear caliper bleed screws to 10 Nm (7 lb.ft).

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

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.

- Connect the brake fluid reservoir electrical connector.

17. On completion, road test the vehicle and check the brake pedal operation. The pedal travel should be short with a firm feel.

Brake System - General Information - Component Bleeding

General Procedures



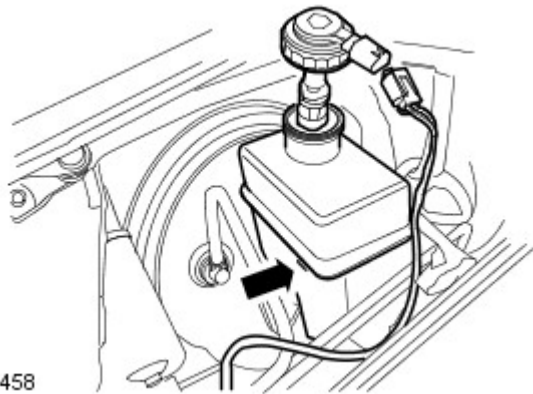
WARNING: If any components upstream of the Hydraulic Control Unit (HCU), including the HCU itself are replaced, the brake system must be bled using Land Rover approved diagnostic equipment. This will ensure that all air is expelled from the new component(s).



CAUTION: LH illustration shown, RH is similar.

• **NOTE:** Bleeding of the complete brake system must be carried out using Land Rover approved diagnostic equipment. The following manual procedure covers bleeding the brake system for components down stream of the HCU, where only the primary or secondary brake circuits have been disturbed in isolation. Partial bleeding of the hydraulic system is only permissible if a brake tube or hose has been disconnected with only minimal loss of fluid.

• **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.



E62458



1. WARNING: Make sure to support the vehicle with axle 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.

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



4. 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.

• **CAUTIONS:**



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



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

Remove the brake fluid reservoir cap.

- Disconnect the brake fluid reservoir electrical connector.
- Fill the brake fluid reservoir to the MAX mark.

5. 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.

- Hold the bleed container at least 300 mm above the Caliper that is being bled.

6. Loosen the bleed screw by one-half turn to three-quarters of a turn.



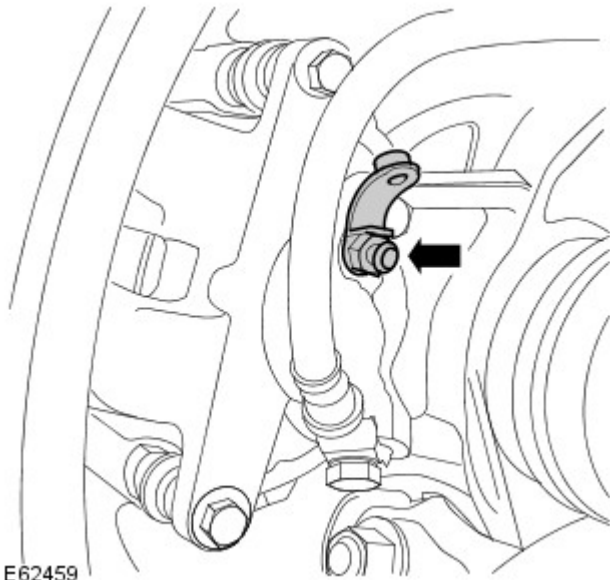
7. CAUTION: The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.


With assistance, depress the brake pedal steadily through to 2/3 of its full stroke.

8. With the brake pedal held down, close bleed screw and then return the brake pedal to 1/3 of its full stroke and hold.

9. Repeat steps 7 and 8, 28 times for the rear brake and 10 times for the front brake.

10. At the end of the bleed process, 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.

- On vehicles with high performance brakes, tighten the front caliper bleed screw to 19 Nm (14 lb.ft).
- On vehicles with standard brakes, tighten the front caliper bleed screw to 10 Nm (7 lb.ft).
- Tighten the rear caliper bleed screws to 10 Nm (7 lb.ft).

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

13. Apply the brakes and check for leaks.

14. Install the brake fluid reservoir cap.

- Connect the brake fluid reservoir electrical connector.

15. On completion, road test the vehicle and check the brake pedal operation. The pedal travel should be short with a firm feel.

Front Disc Brake -

Item	Specification
Disc type	Ventilated
Disc diameter:	
Vehicles with 4.0L or 2.7L diesel engine	317 mm (12.6 in)
Vehicles with 5.0L or 3.0L diesel engine	360 mm (14.2 in)
Disc thickness:	
New	30.0 mm (1.18 in)
Service limit	27.0 mm (1.063 in)
Maximum disc run-out - disc installed	0.05 mm (0.002 in)
Caliper type	Sliding pin, twin piston
Piston diameter	48.0 mm (1.8 in)
Pad minimum thickness	3.0 mm (0.12 in)
Brake pad wear warning lead:	
Location	Front left hand brake pad
Activates at	75% of pad life utilised

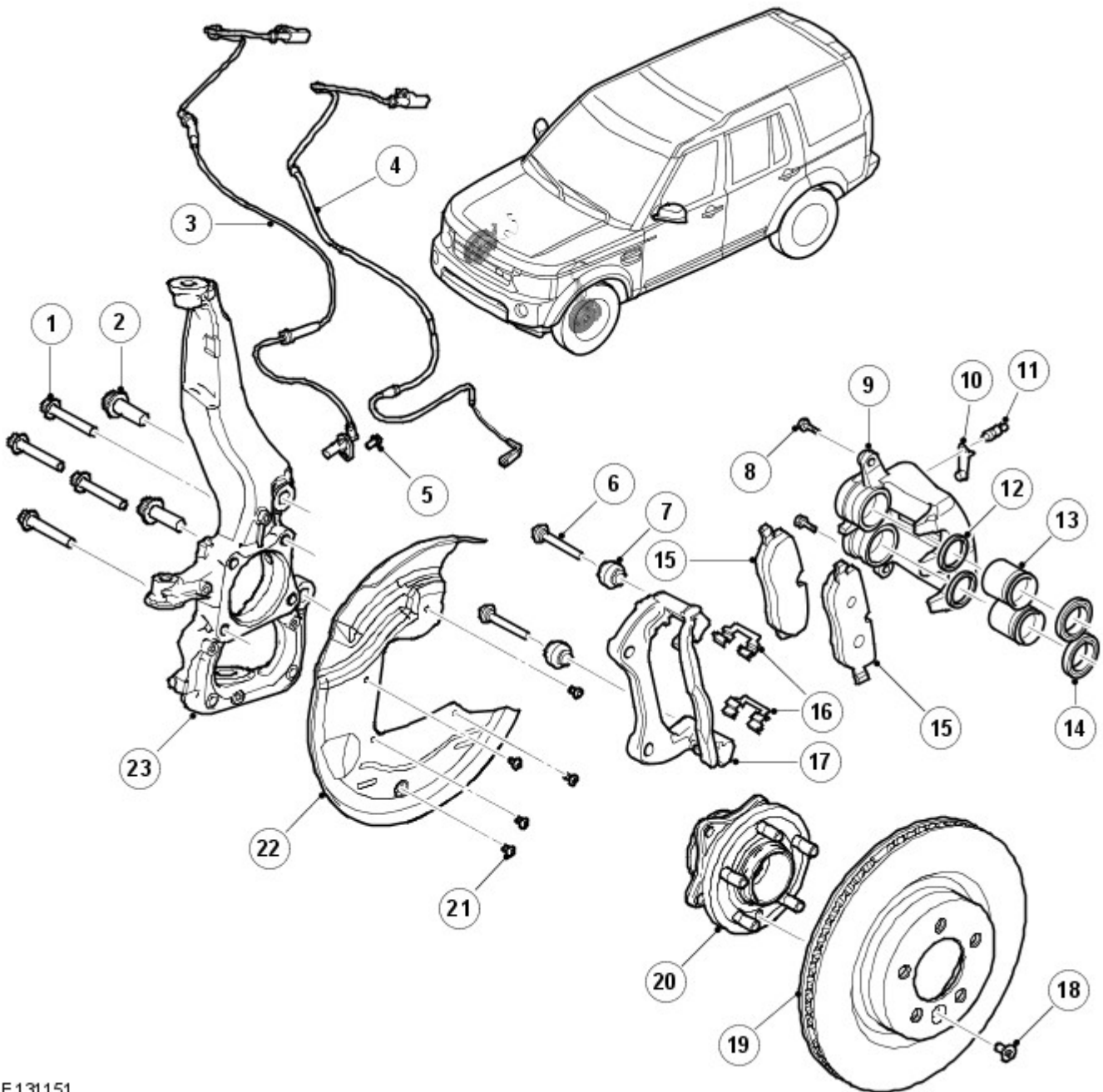
Torque Specifications

Description	Nm	lb-ft
Brake caliper bleed screw	10	7
Brake disc Torx screw	16	12
Brake caliper anchor plate bolts	275	202
Brake caliper housing bolts	35	26
Brake hose union	32	24
Brake hose retaining bracket to wheel knuckle bolt	22	16
Road wheel nuts	140	103

Front Disc Brake - Front Disc Brake

Description and Operation

COMPONENT LOCATIONS



E131151

Item	Part Number	Description
1	-	Hub bearing assembly bolt (x 4)
2	-	Caliper bolt (x 2)
3	-	Wheel speed sensor
4	-	Brake pad wear sensor lead
5	-	Wheel speed sensor bolt
6	-	Guide pin (x 2)
7	-	Guide pin dust cover (x 2)
8	-	Guide pin bolt (x 2)
9	-	Caliper body
10	-	Bleed screw dust cap
11	-	Bleed screw
12	-	Piston seal (x 2)
13	-	Piston (x 2)
14	-	Piston dust cover (x 2)
15	-	Brake pad
16	-	Brake pad retainers
17	-	Caliper carrier

18	-	Brake disc retaining bolt
19	-	Brake disc
20	-	Hub bearing assembly
21	-	Dust shield screw (x 5)
22	-	Dust shield
23	-	Front knuckle

GENERAL

The front brakes each consist of a twin piston brake caliper, a ventilated brake disc and a dust shield. All models except 2.7L feature the same caliper, disc and dust shield.

The brake caliper is attached to the rear of the front knuckle. The brake pads are made from an asbestos free material. The inboard brake pad of the left front brake incorporates a wear sensor.

When hydraulic pressure is supplied to the caliper, the pistons extend and force the inner pad against the disc. The caliper body reacts and slides on the guide pins to bring the outer pad into contact with the disc.

The front brake pad wear sensor is connected in series with the rear brake pad wear sensor, between the instrument cluster and ground. When a brake pad incorporating a brake pad wear sensor is approximately 75% worn, the brake pad wear sensor goes open circuit. When the instrument cluster detects the open circuit, it illuminates the amber Light Emitting Diode (LED) in the brake warning indicator. Vehicles with the high line instrument cluster also display an appropriate warning in the message center and sound a warning chime.

For additional information, refer to: [Instrument Cluster](#) (413-01 Instrument Cluster, Description and Operation).

At the beginning of each ignition cycle, the instrument cluster performs a bulb check on the brake warning indicator: the indicator is illuminated amber for 1.5 seconds, red for 1.5 seconds, then goes off.

Front Disc Brake - Brake Disc Vehicles With: Standard Brakes

Removal and Installation

Removal

 **WARNING:** If installing a new brake disc, install new brake pads.

 **CAUTION:** Brake discs must be renewed in pairs.


- **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.
- **NOTE:** The brake pad wear warning indicator sensor must be replaced each time the brake pads are serviced.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the front wheel and tire.

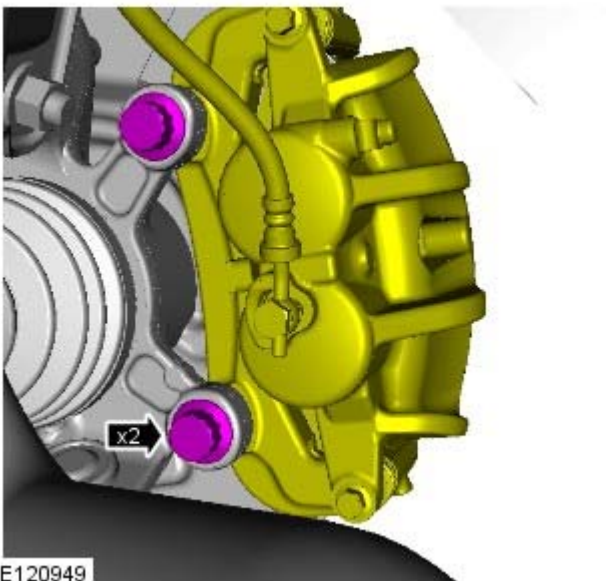
3. CAUTIONS:

 Do not allow the brake caliper to hang on the brake hose.

 **LH side:** Do not allow the brake caliper to hang on the brake pad wear warning sensor lead.

Remove the brake caliper and anchor plate.

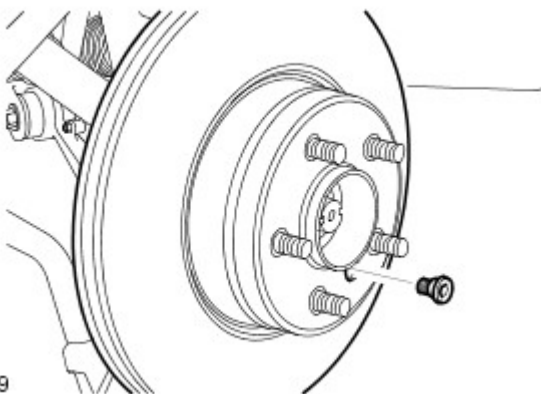
- Remove the brake caliper anchor bolts.
- Tie the brake caliper aside.



E120949

4. Remove the front brake disc.

- Remove the Allen screw.



E61629

Installation

1. Make sure the brake disc and hub mating surfaces are clean.
2. Install the brake disc.

- Tighten the Torx screw to 35 Nm (26 lb.ft).

3. Install the brake caliper and anchor plate.

- Clean the component mating faces.
- Tighten the wheel nuts to 140 Nm (103 lb.ft).
- Tighten the bolts to 275 Nm (203 lb.ft).

5. Depress the brake pedal several times, check the fluid level in the brake fluid reservoir and top-up with brake fluid if necessary.

Front Disc Brake - Brake Pads Vehicles With: Standard Brakes

Removal and Installation

Removal

- WARNINGS:



Brake pads must be renewed in axle sets only, otherwise braking efficiency may be impaired.



If the brake pad wear warning light has been activated, the pad wear sensor must be replaced.

- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. WARNING: Make sure to support the vehicle with axle stands.

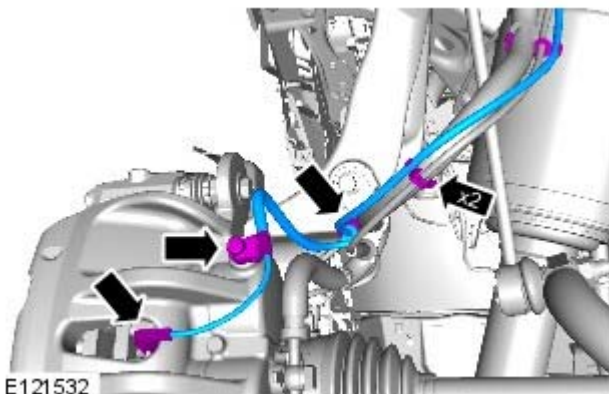
Raise and support the vehicle.

2. Remove the wheels and tires.



3. CAUTION: The brake pad wear indicator sensor is easily damaged. Do not use a lever to remove the sensor. Use fingers only.

LH side front: Disconnect the brake pad wear indicator sensor wiring harness.



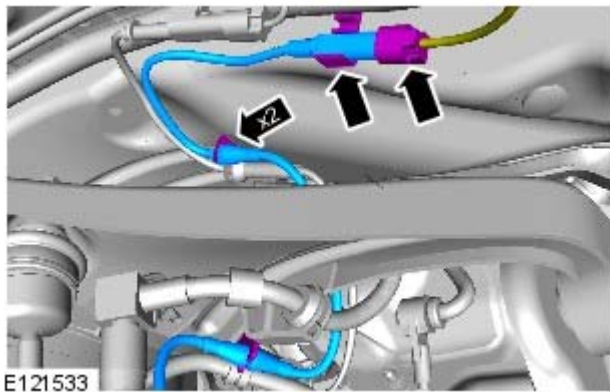
4. NOTE: This step is only required if a new wear indicator harness is installed.

Remove the front LH fender splash shield.

For additional information, refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

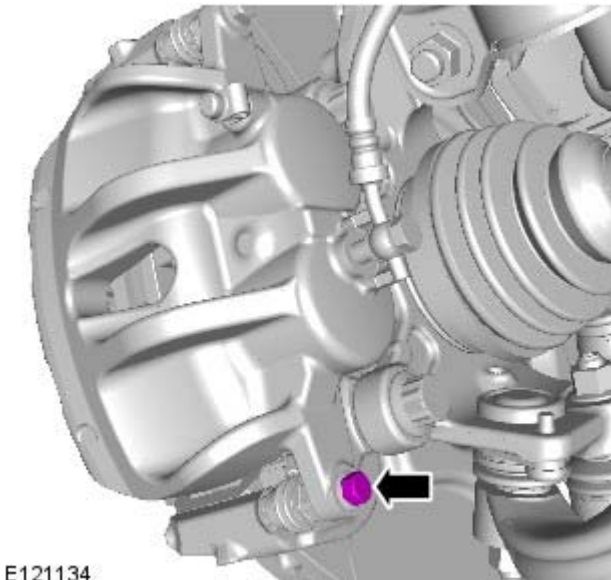
5. NOTE: This step is only required if a new wear indicator harness is installed.

LH side front: Release and disconnect the brake pad wear indicator wiring harness.



6. NOTE: Use an additional wrench to prevent the component from rotating.

Remove the brake caliper lower bolt.

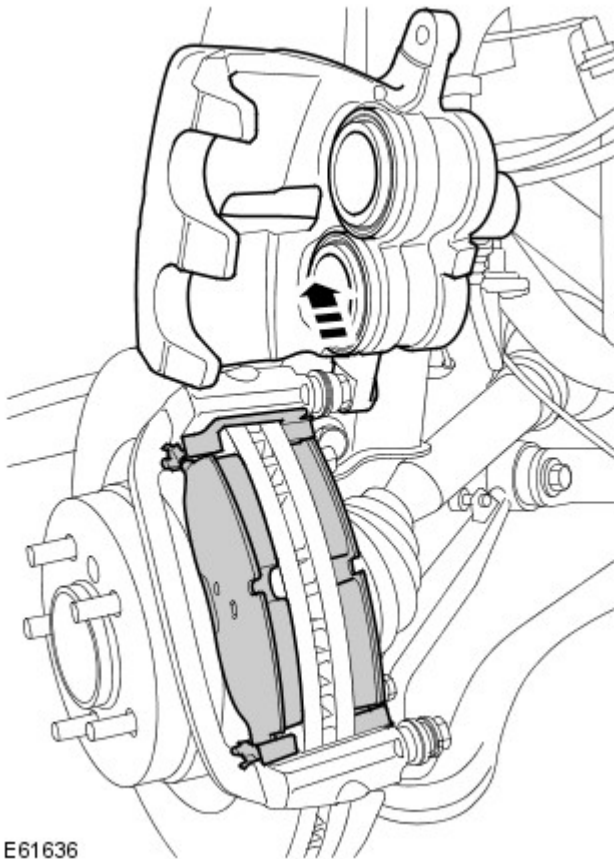


E121134

7. NOTE: Note the orientation of the brake pads.

Remove the brake pads.


- Rotate the brake caliper upwards.
- Remove the 2 clips.



E61636

8. Repeat the above 2 steps for the other side.

Installation

1.  **WARNING:** Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

Clean the brake caliper housing and anchor plate using brake cleaning fluid.

2. Inspect the caliper piston and slide pin seals for damage.

3. CAUTIONS:

 The brake caliper should move freely on both slide pins.



If necessary, renew the components.

Check the slide pins for correct operation.



4. CAUTION: Check the brake fluid reservoir level before pushing the piston back, failure to follow this instruction may result in damage to the vehicle.

• NOTE: As the piston is pushed back into the caliper housing, the brake fluid level in the reservoir will rise. Do not allow the reservoir to overflow.

Press the pistons into the caliper housing.

5. NOTE: Make sure the brake pads are installed in the correct orientation.

Install the brake pads.

- Install the 2 clips.
- Apply a suitable amount of the supplied grease to the mating faces of the brake pads and brake calipers.

6. Rotate the brake caliper downwards.

- Tighten the bolt to 35 Nm (26 lb.ft).

7. Repeat the above procedure for the other side.

8. NOTE: This step is only required if a new wear indicator harness is installed.

LH side front: Connect the brake pad wear indicator wiring harness electrical connection.

9. NOTE: This step is only required if a new wear indicator harness is installed.

Install the front LH fender splash shield.

For additional information, refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

10. LH side front: Connect the brake pad wear indicator wiring harness.

11. Install the wheels and tires.

- Tighten the wheel nuts to 140 Nm (103 lb.ft).

12. Depress the brake pedal several times, check the fluid level in the brake fluid reservoir and top-up with brake fluid if necessary.

Front Disc Brake - Brake Caliper Vehicles With: Standard Brakes

Removal and Installation

Removal

 CAUTION: LH illustration shown, RH is similar.

- NOTE: Removal steps in this procedure may contain installation details.
- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

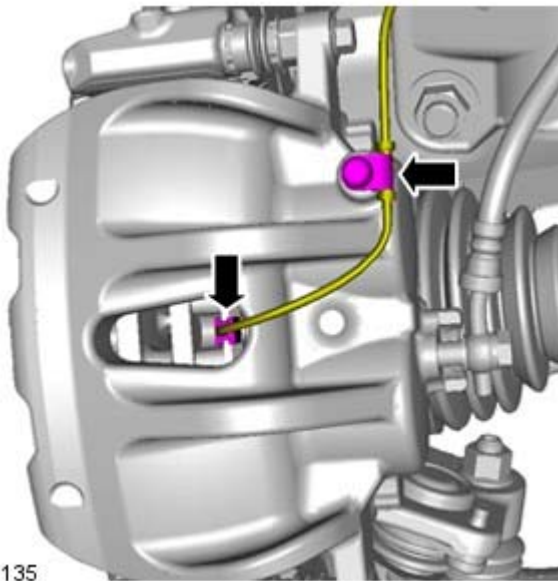
1.  WARNING: Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the wheel and tire.


3.  CAUTION: The brake pad wear indicator sensor is easily damaged. Do not use a lever to remove the sensor. Use fingers only.

LH side only: Disconnect the brake pad wear indicator sensor.



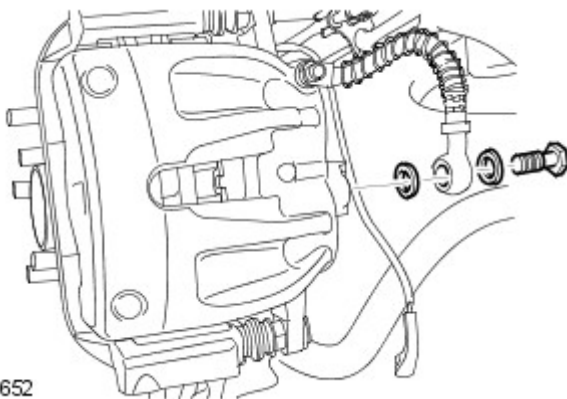
E121135

4.  WARNING: Be prepared to collect escaping fluid.

 CAUTION: Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Disconnect the brake hose from the brake caliper.

- Remove the union.
- Remove and discard the two sealing washers.
- Install blanking caps to the exposed ports.



E61652

5. NOTE: Note the orientation of the brake pads.

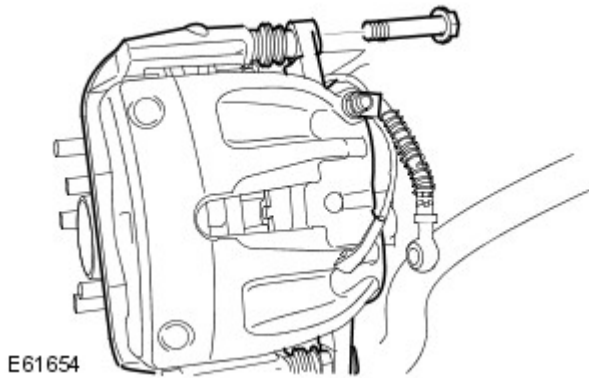
Remove the brake pads.

For additional information, refer to: [Brake Pads - Vehicles With: Standard Brakes](#) (206-03 Front Disc Brake, Removal and Installation).

6. NOTE: Use an additional wrench to prevent the component from rotating.

Remove the brake caliper housing.

- Remove the brake caliper upper bolt.



Installation

1. NOTE: Use an additional wrench to prevent the component from rotating.

● NOTE: Make sure the brake caliper guide pins are installed in the correct orientation.

Install the brake caliper.

- Tighten the brake caliper upper bolt to 35 Nm (26 lb.ft).

2. NOTE: Make sure the brake pads are installed in the correct orientation.

Install the brake pads.

For additional information, refer to: [Brake Pads - Vehicles With: Standard Brakes](#) (206-03 Front Disc Brake, Removal and Installation).

- Apply a suitable amount of the supplied grease to the mating faces of the brake pads and brake calipers.

3. Connect the brake hose to the brake caliper.

- Clean the component mating faces.
- Remove the blanking caps from the ports.
- Install new sealing washers.
- Tighten the brake hose union to 32 Nm (24 lb.ft).

4. LH side only: Connect the brake pad wear indicator sensor.

5. Bleed the brake caliper.

For additional information, refer to: [Component Bleeding](#) (206-00 Brake System - General Information, General Procedures).

6. Install the wheel and tire.

- Tighten the wheel nuts to 140 Nm (103 lb.ft).

Rear Disc Brake -

Item	Specification
Disc type	Ventilated
Disc diameter:	
Vehicles with 4.0L or 2.7L diesel engine	325 mm (12.7 in)
Vehicles with 5.0L or 3.0L diesel engine	354 mm (13.9 in)
Disc thickness - All engines:	
New	20.0 mm (0.78 in)
Service limit	18.0 mm (0.71 in)
Maximum disc run-out - disc installed	0.09 mm (0.003 in)
Caliper type	Sliding pin, single piston
Piston diameter	45.0 mm (1.7 in)
Pad minimum thickness	3.0 mm (0.12 in)
Brake pad wear warning lead:	
Location	Rear right hand brake pad
Activates at	75% of pad life utilised

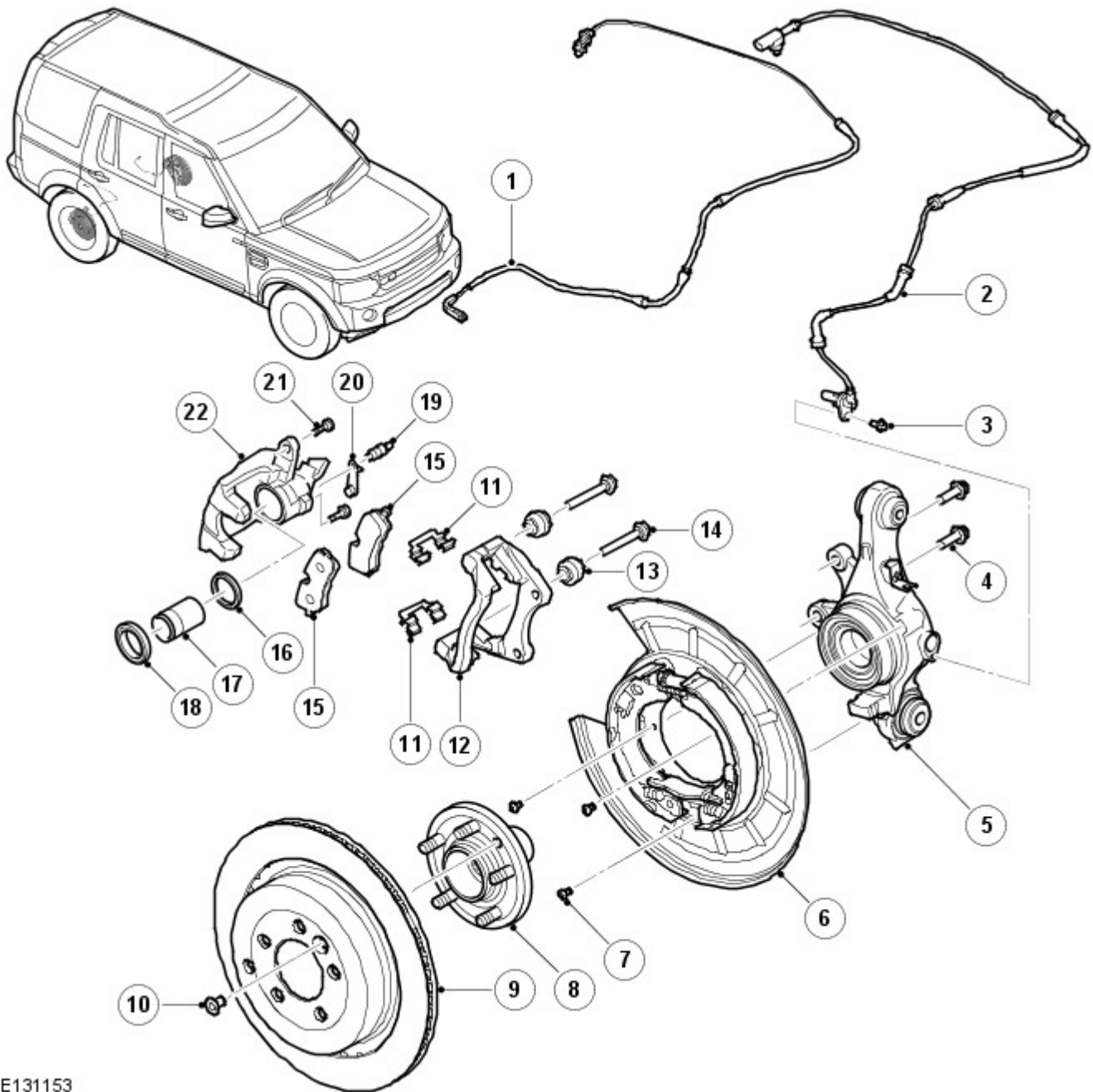
Torque Specifications

Description	Nm	lb-ft
Brake caliper bleed screw	10	7
Brake caliper housing to anchor plate bolts	35	26
Brake hose union	32	24
Brake disc Torx screw	16	12
Brake caliper anchor plate to wheel knuckle bolts	115	85
Road wheel nuts	140	103

Rear Disc Brake - Rear Disc Brake

Description and Operation

COMPONENT LOCATIONS



E131153

Item	Part Number	Description
1	-	Brake pad wear sensor lead
2	-	Wheel speed sensor
3	-	Wheel speed sensor bolt
4	-	Caliper bolt (x 2)
5	-	Rear knuckle
6	-	Backplate assembly and dust shield
7	-	Dust shield screw (x 3)
8	-	Drive flange assembly
9	-	Brake disc
10	-	Brake disc retaining bolt
11	-	Brake pad retainers
12	-	Caliper carrier
13	-	Guide pin dust cover (x 2)
14	-	Guide pin (x 2)
15	-	Brake pad
16	-	Piston seal
17	-	Piston

18	-	Piston dust cover
19	-	Bleed screw
20	-	Bleed screw dust cap
21	-	Guide pin bolt (x 2)
22	-	Caliper body

GENERAL

The rear brakes each consist of a single piston brake caliper, a ventilated brake disc and a dust shield (integrated as part of the parking brake). 2.7L and 4.0L models feature a different caliper and disc than the 3.0L and 5.0L models. The dust shield and parking brake are common on all derivatives.

The brake caliper is attached to the rear knuckle. The brake pads are made from an asbestos free material. The inboard brake pad of the right rear brake incorporates a wear sensor.

When hydraulic pressure is supplied to the caliper, the piston extends and forces the inner pad against the disc. The caliper body reacts and slides on the guide pins to bring the outer pad into contact with the disc.

The rear brake pad wear sensor is connected in series with the front brake pad wear sensor, between the instrument cluster and ground. When a brake pad incorporating a brake pad wear sensor is approximately 75% worn, the brake pad wear sensor goes open circuit. When the instrument cluster detects the open circuit, it illuminates the amber Light Emitting Diode (LED) in the brake warning indicator. Vehicles with the high line instrument cluster also display an appropriate warning in the message center and sound a warning chime.

For additional information, refer to: [Instrument Cluster](#) (413-01 Instrument Cluster, Description and Operation).

At the beginning of each ignition cycle, the instrument cluster performs a bulb check on the brake warning indicator: the indicator is illuminated amber for 1.5 seconds, then red for 1.5 seconds.

Rear Disc Brake - Brake Disc

Removal and Installation

Removal

 **WARNING:** If installing a new brake disc, install new brake pads.

 **CAUTION:** Brake discs must be renewed in pairs.

• **NOTE:** If the parking brake shoes or the brake discs have been removed for access to other components then **DO NOT** carry out the bedding in procedure.

• **NOTE:** LH illustration shown, RH is similar.

• **NOTE:** The brake pad wear warning indicator sensor must be replaced each time the brake pads are serviced.

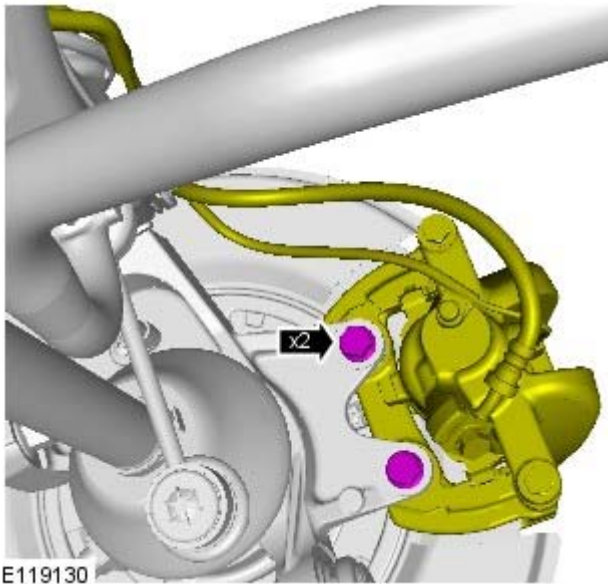
1. Using the Land Rover approved diagnostic system, drive the parking brake to the 'mounting position'.

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Remove the rear wheel and tire.

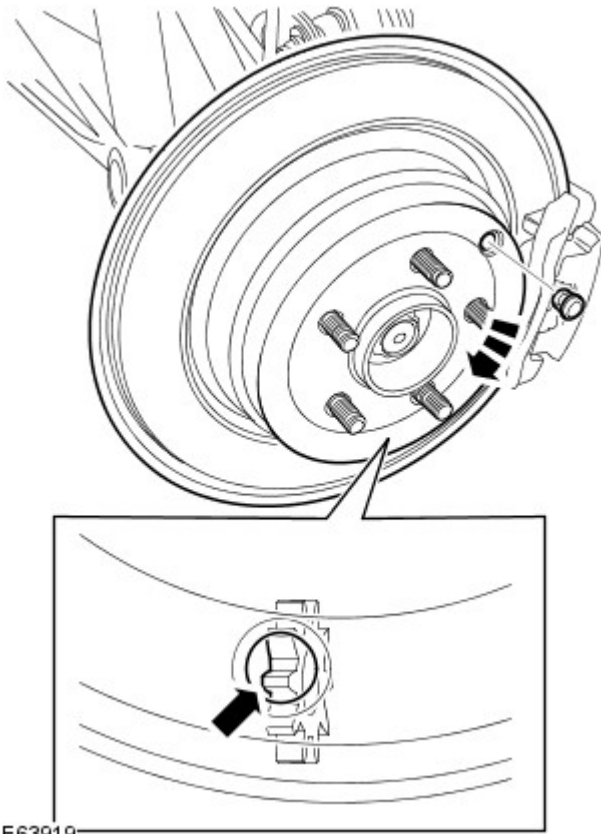
4. Remove the brake caliper and anchor plate.



5. NOTE: Rotate the rear brake disc to locate the parking brake shoe adjuster.

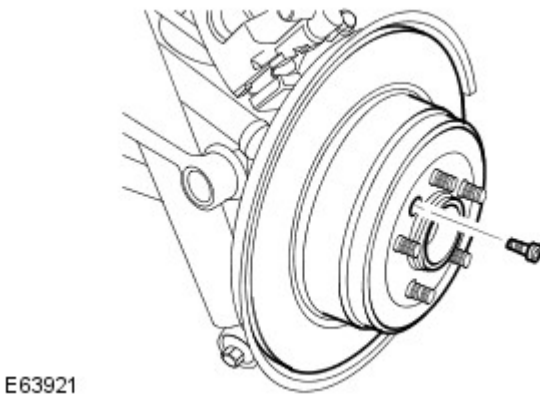
Release the parking brake shoe adjustment.

- Remove the parking brake shoe adjuster access plugs.
- Rotate the parking brake shoe adjuster.



6. Remove the rear brake disc.

- Remove the Allen screw.



Installation

- 1.** Make sure that the rear brake disc and hub mating surfaces are clean.
- 2.** Install the rear brake disc.
 - Tighten the bolt to 35 Nm (26 lb.ft).
- 3.** Install the brake caliper and anchor plate.
 - Tighten the bolts to 115 Nm (85 lb.ft).
- 4.** Adjust the parking brake.
For additional information, refer to: [Parking Brake Shoe and Lining Adjustment](#) (206-05 Parking Brake and Actuation, General Procedures).
- 5.** Install the rear wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Rear Disc Brake - Brake Pads

Removal and Installation

Removal



WARNING: Brake pads must be renewed in axle sets only, otherwise braking efficiency may be impaired.

- NOTE: RH illustration shown, LH is similar.
- NOTE: The brake pad wear warning indicator sensor must be replaced each time the brake pads are serviced.

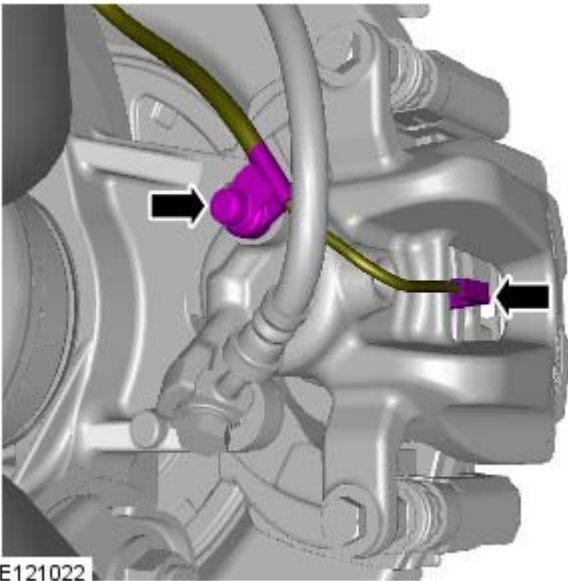


1. WARNING: Make sure to support the vehicle with axle stands.

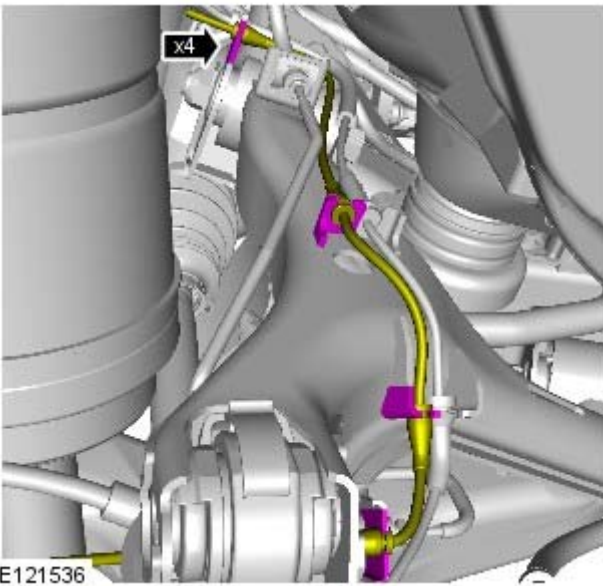
Raise and support the vehicle.

2. Remove the wheels and tires.

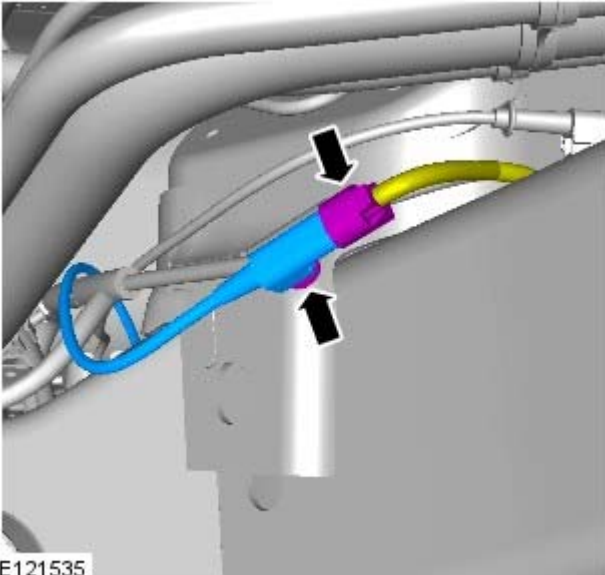
3. RH side rear: Disconnect the brake pad wear indicator sensor wiring harness.



4. RH side rear: Disconnect the brake pad wear indicator sensor wiring harness.



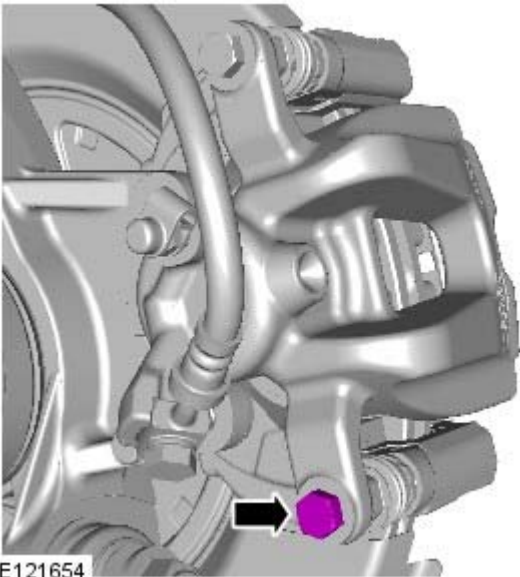
5. RH side rear: Release and disconnect the brake pad wear indicator wiring harness electrical connector.



E121535

6. NOTE: Use an additional wrench to prevent the component from rotating.

Remove the brake caliper lower bolt.



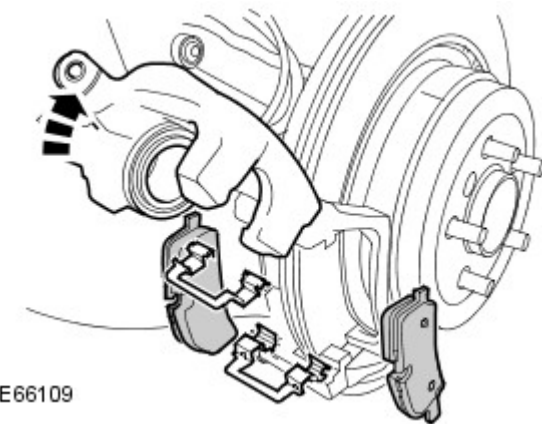
E121654

7. NOTE: Note the orientation of the brake pads.

- NOTE: Note the orientation of the clips.

Remove the brake pads.


- Rotate the brake caliper upwards.
- Remove the 2 clips.



E66109

8. Repeat the above 2 steps for the other side.

Installation

1.  **WARNING:** Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

Clean the brake caliper housing and anchor plate using brake cleaning fluid.

2. Inspect the caliper piston and slide pin seals for damage.

3. CAUTIONS:



The brake caliper should move freely on both slide pins.



If necessary, renew the components.


Check the slide pins for correct operation.

4. Position a bleed jar containing a small quantity of approved brake fluid. Connect the bleed tube to the bleed screw and loosen the screw.

5. Press the piston into the caliper housing.

- Tighten the rear caliper bleed screws to 10 Nm (7 lb.ft).

6. Disconnect the bleed tube and remove the jar.

7.  CAUTION: If installed, the adhesive strips covering the outer brake pads must be removed before installation. Failure to follow this instruction may result in damage to the vehicle.

If installed, remove the adhesive strips from the 2 outer brake pads.

8. NOTE: Make sure the brake pads are installed in the correct orientation.

• NOTE: Make sure that the clips are installed in the correct orientation.

Install the brake pads.

- Install the 2 clips.

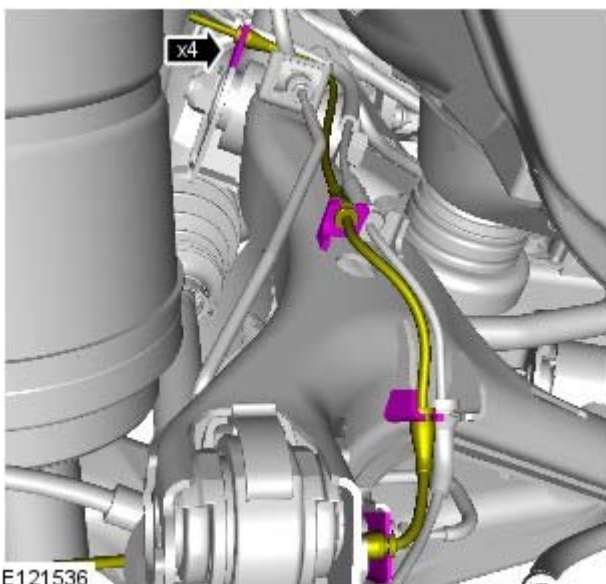
9. Rotate the brake caliper downwards.

- Tighten the brake caliper lower bolt to 35 Nm (26 lb.ft).

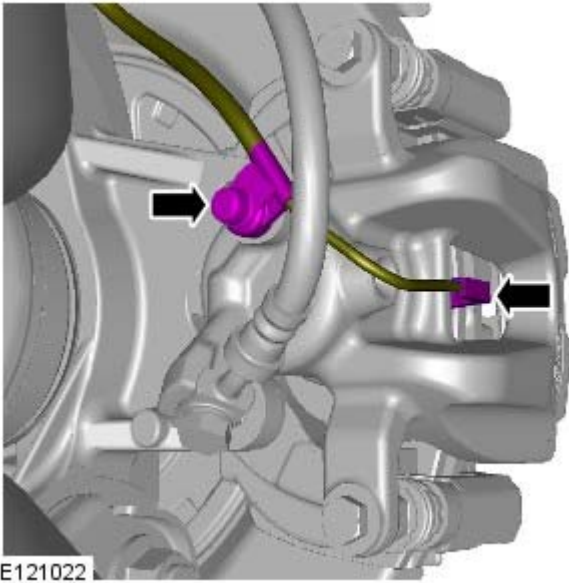
10. Repeat the above procedure for the other side.

11. RH side rear: Connect the brake pad wear indicator wiring harness electrical connection.

12. RH side rear: Connect the brake pad wear indicator sensor wiring harness.



13. RH side rear: Connect the brake pad wear indicator sensor wiring harness.



14. Install the wheels and tires.

- Tighten the wheel nuts to 140 Nm (103 lb.ft).

15. Depress the brake pedal several times, check the fluid level in the brake fluid reservoir and top-up with brake fluid if necessary.

Rear Disc Brake - Brake Caliper

Removal and Installation

- NOTE: RH illustration shown, LH is similar.

Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.

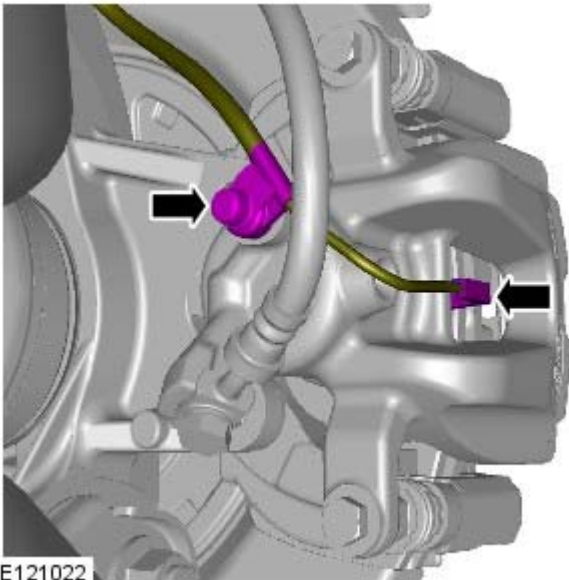
Raise and support the vehicle.

2. Remove the wheel and tire.

3.  **CAUTION:** The brake pad wear indicator sensor is easily damaged. Do not use a lever to remove the sensor. Use fingers only.

RH side only: Disconnect the brake pad wear indicator sensor.


- Release from the clip.



4. NOTE: Note the orientation of the brake pads.

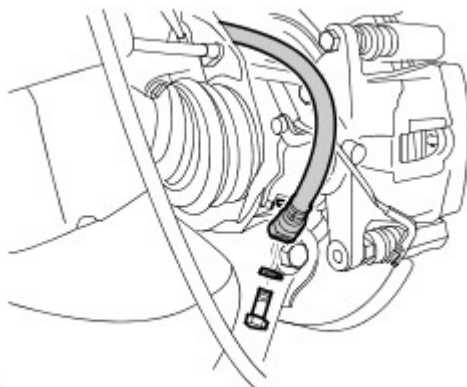
Remove the brake pads.

For additional information, refer to: [Brake Pads](#) (206-04 Rear Disc Brake, Removal and Installation).

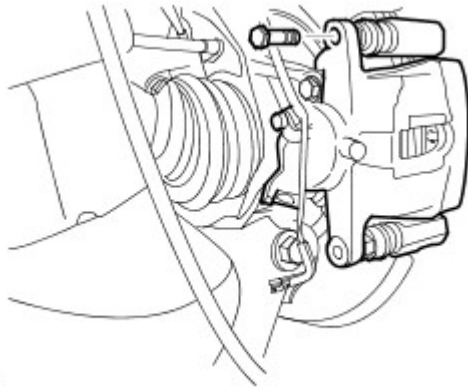
5.  **CAUTION:** Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Disconnect the brake hose from the brake caliper.

- Remove the union.
- Remove and discard the two sealing washers.
- Install blanking caps to the exposed ports.



E66183



E66184

6. NOTE: Use an additional wrench to prevent the component from rotating.

Remove the brake caliper housing.

- Remove the brake caliper upper bolt.

Installation

1. NOTE: Use an additional wrench to prevent the component from rotating.

Install the brake caliper.

- Tighten the brake caliper upper bolt to 35 Nm (26 lb.ft).

2. NOTE: Make sure the brake pads are installed in the correct orientation.

Install the brake pads.

For additional information, refer to: [Brake Pads](#) (206-04 Rear Disc Brake, Removal and Installation).

3. Connect the brake hose to the brake caliper.

- Clean the component mating faces.
- Remove the blanking caps from the ports.
- Install new sealing washers.
- Tighten the brake hose union to 32 Nm (24 lb.ft).

4. Connect the brake pad wear indicator sensor.

5. Bleed the brake caliper.

For additional information, refer to: [Component Bleeding](#) (206-00 Brake System - General Information, General Procedures).

6. Install the wheel and tire.

- Tighten the wheel nuts to 140 Nm (103 lb.ft).

Rear Disc Brake - Brake Caliper Anchor Plate

Removal and Installation

Removal

- NOTE: RH illustration shown, LH is similar.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

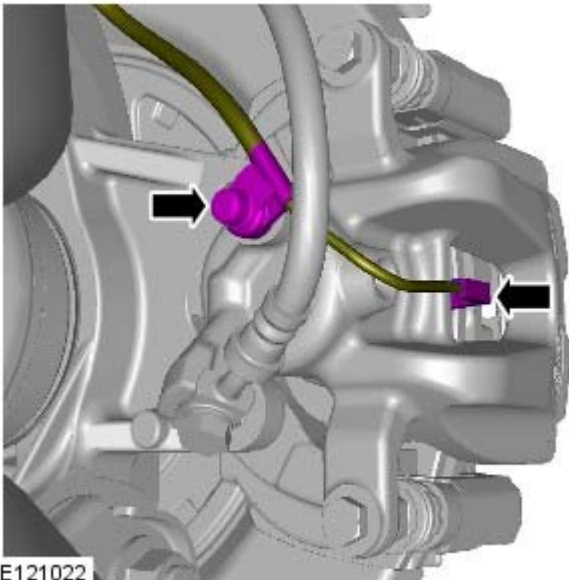
Raise and support the vehicle.

2. Remove the wheel and tire.

3.  **CAUTION:** The brake pad wear indicator sensor is easily damaged. Do not use a lever to remove the sensor. Use fingers only.

RH side only: Disconnect the brake pad wear indicator sensor.

- Release from the clip.

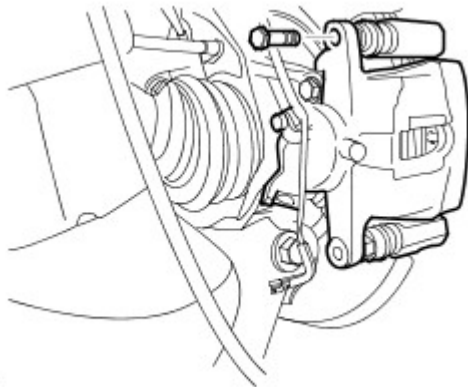


E121022

4. Remove the rear brake pads.
For additional information, refer to: [Brake Pads](#) (206-04 Rear Disc Brake, Removal and Installation).
5. NOTE: Use an additional wrench to prevent the component from rotating.

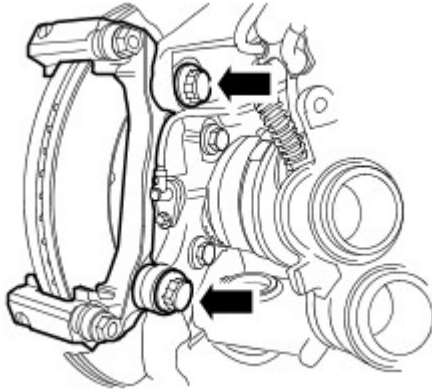
Remove the brake caliper housing.

- Remove the brake caliper upper bolt.



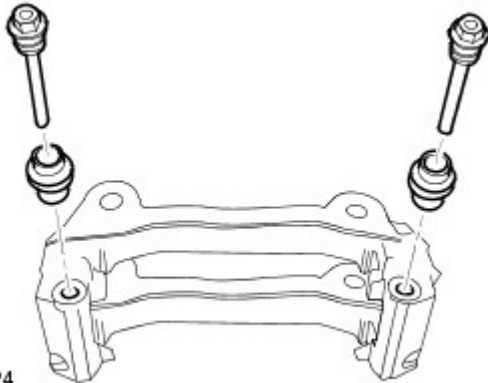
E66184

6. Remove the brake caliper anchor plate.



7. NOTE: Note the orientation of the brake caliper guide pins.

Remove the guide pins and seals.



Installation

1. CAUTIONS:



The brake caliper should move freely on both slide pins.



If necessary, renew the components.

• NOTE: Make sure the brake caliper guide pins are installed in the correct orientation.

Install the brake caliper guide pins.

- Check the condition of the caliper guide pin seals.
- Check for correct operation.

2. Install the brake caliper anchor plate.

- Tighten the bolts to 115 Nm (85 lb.ft).

3. NOTE: Use an additional wrench to prevent the component from rotating.

Install the brake caliper.

- Tighten the brake caliper upper bolt to 35 Nm (26 lb.ft).

4. Install the rear brake pads.

For additional information, refer to: [Brake Pads](#) (206-04 Rear Disc Brake, Removal and Installation).

5. Connect the brake pad wear indicator sensor.

6. Install the wheel and tire.

- Tighten the wheel nuts to 140 Nm (103 lb.ft).

Parking Brake and Actuation -

General Specification

Item	Specification
Make	Continental Teves
Model/type	N5528001
Operation	Twin cable operation to park brake with emergency cable release located in passenger compartment
Minimum brake lining material thickness	2.0 mm (0.078 in)

Torque Specifications

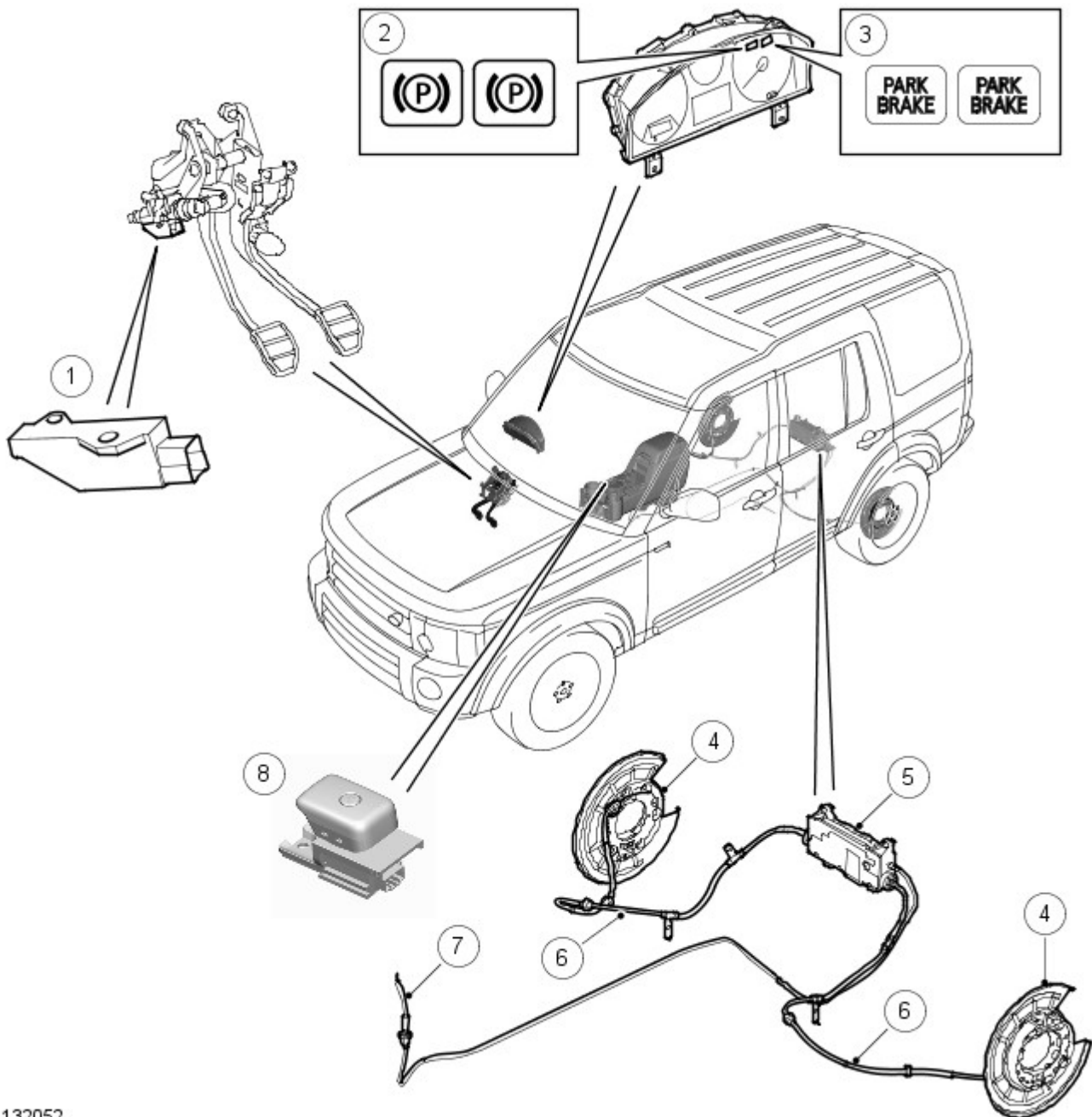
Description	Nm	lb-ft
Wedge adjuster Allen screw	7	5
Rear brake disc Torx screw	35	26
Brake caliper anchor plate to wheel knuckle bolts	115	85
Brake caliper to anchor plate bolts	35	26
Parking brake actuator and cable assembly nuts	5	4
Parking brake actuator mounting bracket bolts	22	16
Fuel tank heat shield nuts	3	2
Fuel tank heat shield bolts	6	4
* LH/RH parking brake cable bolts	22	16
Parking brake cable coupling	8	6
Road wheel nuts	140	103

*** New nuts/bolts must be installed**

Parking Brake and Actuation - Parking Brake

Description and Operation

COMPONENT LOCATIONS



E132052

Item	Part Number	Description
1	-	Clutch pedal position sensor (manual transmission models only)
2	-	Parking brake indicators (all except NAS (north American specification))
3	-	Parking brake indicators (NAS only)
4	-	Drum brake
5	-	Parking brake module
6	-	Parking brake cable
7	-	Emergency release cable
8	-	Parking brake switch

GENERAL

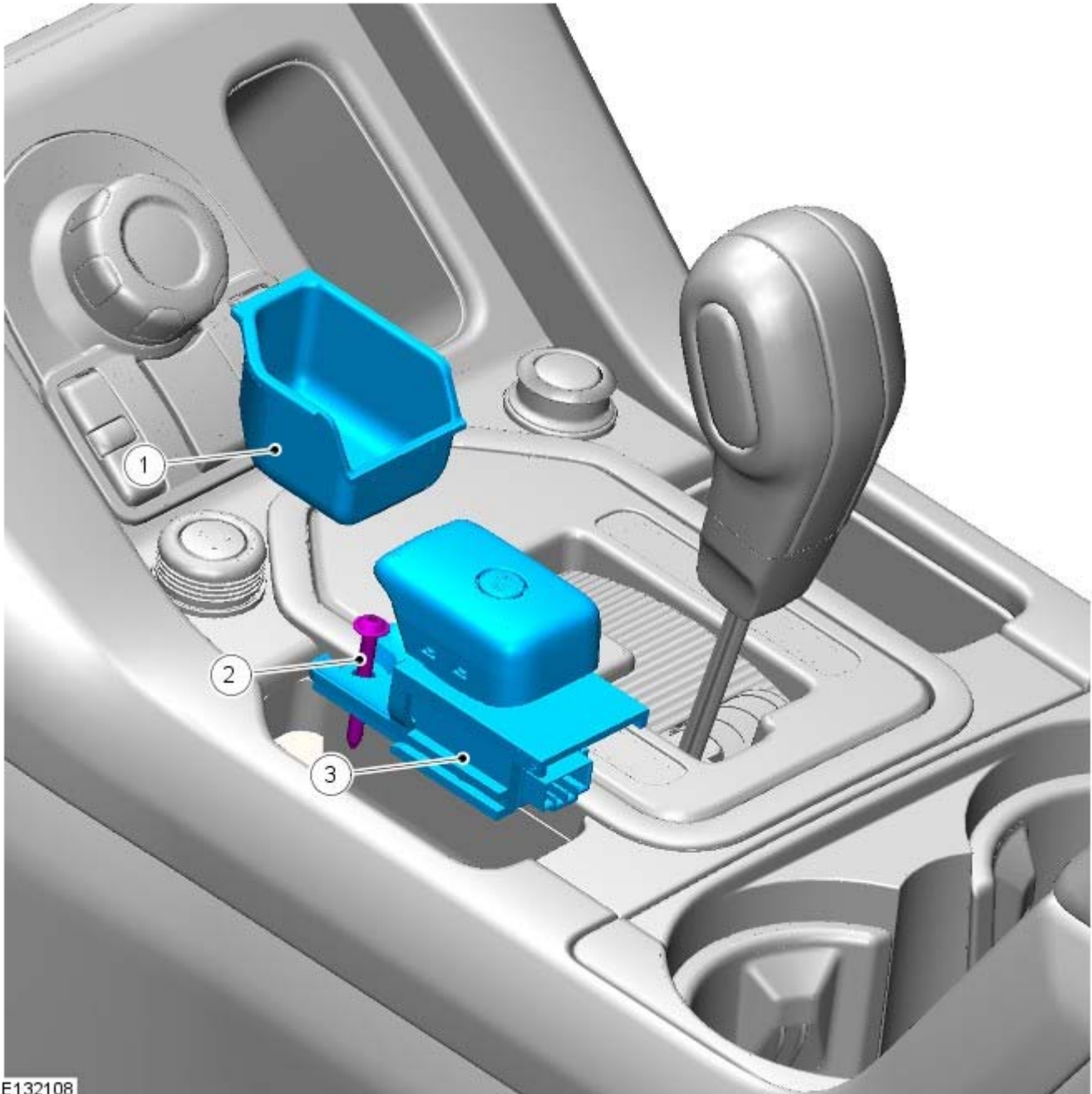
The parking brake is an electrically actuated system that operates drum brakes integrated into the rear brake discs. The parking brake system consists of:

- A parking brake switch.
- Left and right drum brakes.
- Left and right brake cables.
- An emergency release cable.
- A clutch pedal position sensor (manual transmission models only).

- Two parking brake indicators.
- A parking brake module.

The parking brake is operated by the parking brake module, which adjusts the tension of the brake cables to apply and release the drum brakes. Operation of the parking brake module is initiated by the parking brake switch.

PARKING BRAKE SWITCH



Item	Part Number	Description
1	-	Side stowage tray
2	-	Securing screw
3	-	Parking brake switch

The parking brake switch is used by the driver to apply and release the parking brake, and is installed in the center console adjacent to the gear lever.

Slots on the sides of the parking brake switch engage with the top panel of the center console, and a screw secures the parking brake switch in position. An electrical connector on the back of the switch provides the interface with the vehicle wiring. A brake symbol on the switch illuminates when the exterior lamps are selected on.

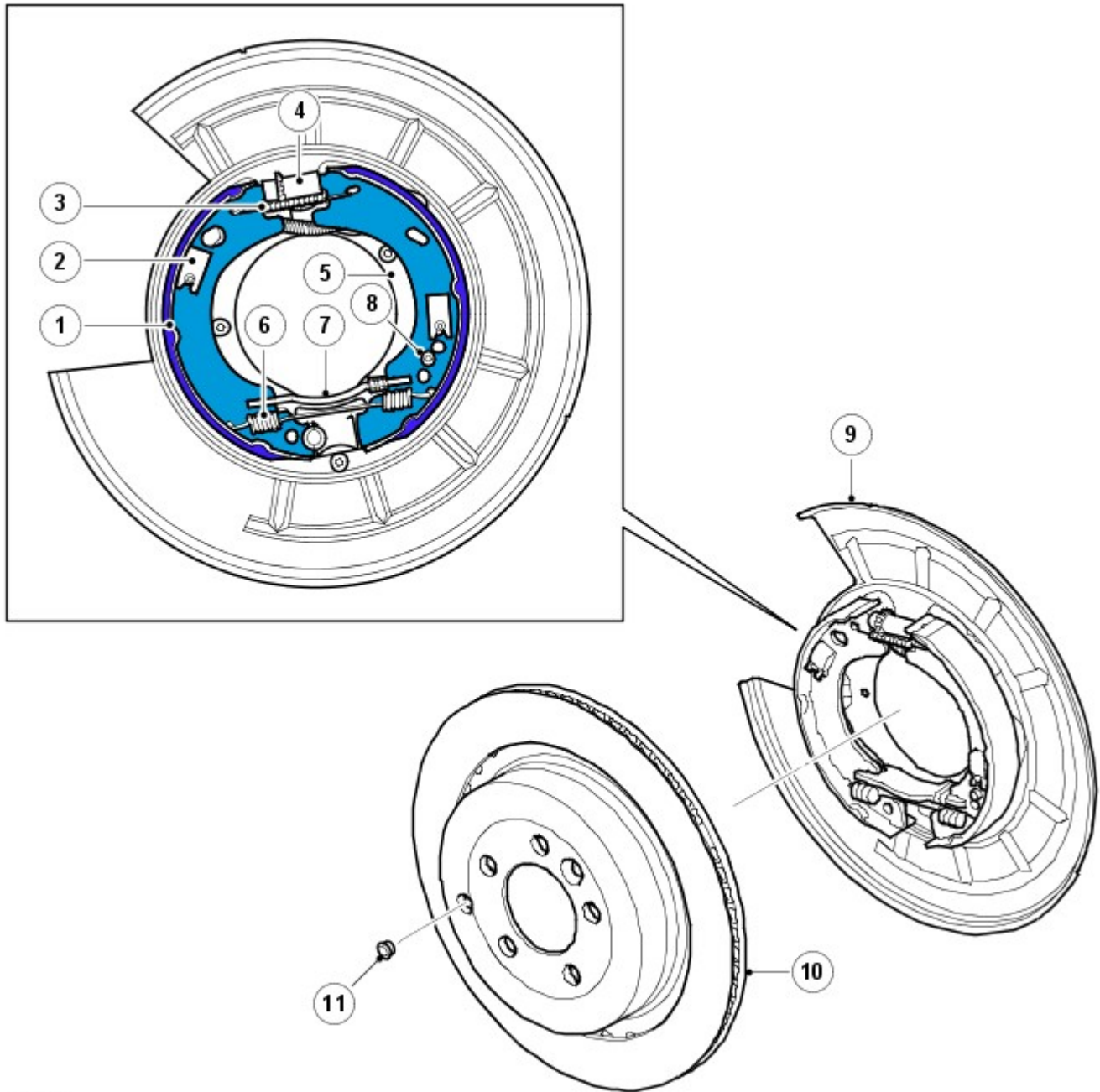
There are three states for the parking brake switch:

- Apply request, when the handle of the parking brake switch is pulled up.
- Release request, when the handle of the parking brake switch is pushed down.
- Idle, when the handle of the parking brake switch is in the central or rest position.

Microswitches, incorporated into the parking brake switch, are activated by the handle of the parking brake switch. To determine the operating state of the parking brake switch, the parking brake module scans the circuits containing the microswitches.

DRUM BRAKES

- NOTE: RH brake shown, LH brake similar



E49844

Item	Part Number	Description
1	-	Brake shoe
2	-	Shoe locating pin and clip
3	-	Adjuster spring
4	-	Toothed wheel adjuster
5	-	Backplate
6	-	Return spring
7	-	Cross strut
8	-	Wedge adjuster screw
9	-	Dust shield
10	-	Rear brake disc
11	-	Adjuster access plug

Each drum brake consists of a pair of brake shoes installed on a backplate attached to the rear hub carrier. The brake shoes operate on the drum integrated into the rear brake disc. The orientation of the brake shoes differ by 180° between the left-hand (LH) and right-hand (RH) brakes.

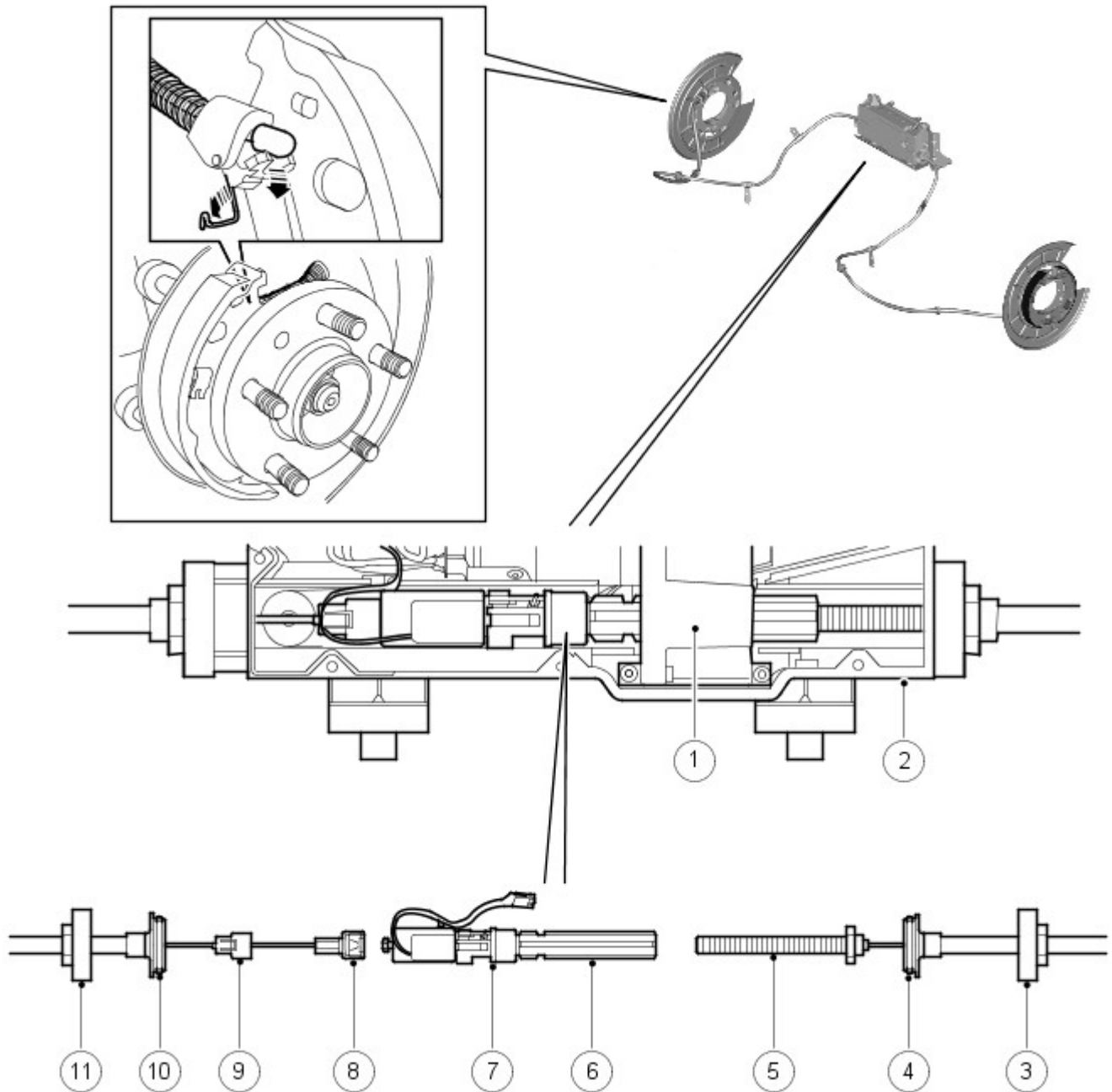
When the parking brake module tensions the brake cables, the movement is transmitted to an operating lever on one of the brake shoes. The operating lever pivots against a cross strut, which forces the brake shoes apart and into contact with the drum in the rear brake disc. Brake shoe to drum clearance is set with two manual adjusters, which are accessed through a hole in the brake disc. One of the adjusters is a conventional toothed wheel adjuster. The second adjuster is a wedge adjuster operated by an Allen screw.

After replacement of the brake shoes or brake discs, a bedding in procedure must be performed to ensure the drum brakes operate satisfactorily.

For additional information, refer to: [Parking Brake Shoe and Lining Adjustment](#) (206-05 Parking Brake and Actuation, General Procedures).

Prior to removing a brake disc from a vehicle, power should be disconnected from the parking brake module. Operation of the parking brake switch while a brake disc is removed can cause the actuating mechanism in the parking brake module to seize.

BRAKE CABLES



E49845

Item	Part Number	Description
1	-	Gearbox
2	-	Parking brake module housing
3	-	Cable nut
4	-	Sealing collar
5	-	Threaded connector
6	-	Spline shaft
7	-	Force sensor
8	-	Shoe
9	-	Locking cover
10	-	Sealing collar
11	-	Cable nut

The brake cables consist of Bowden cables installed between the parking brake module and the drum brakes. Nuts, on the ends of the outer cables, secure the brake cables to the parking brake module and the backplate of the related drum brake. In each drum brake, the inner cable is located in the guide spring and connected to the brake shoe operating lever

by a nipple on the end of the cable. In the parking brake module, the two inner cables are joined together via the force sensor and the spline shaft.

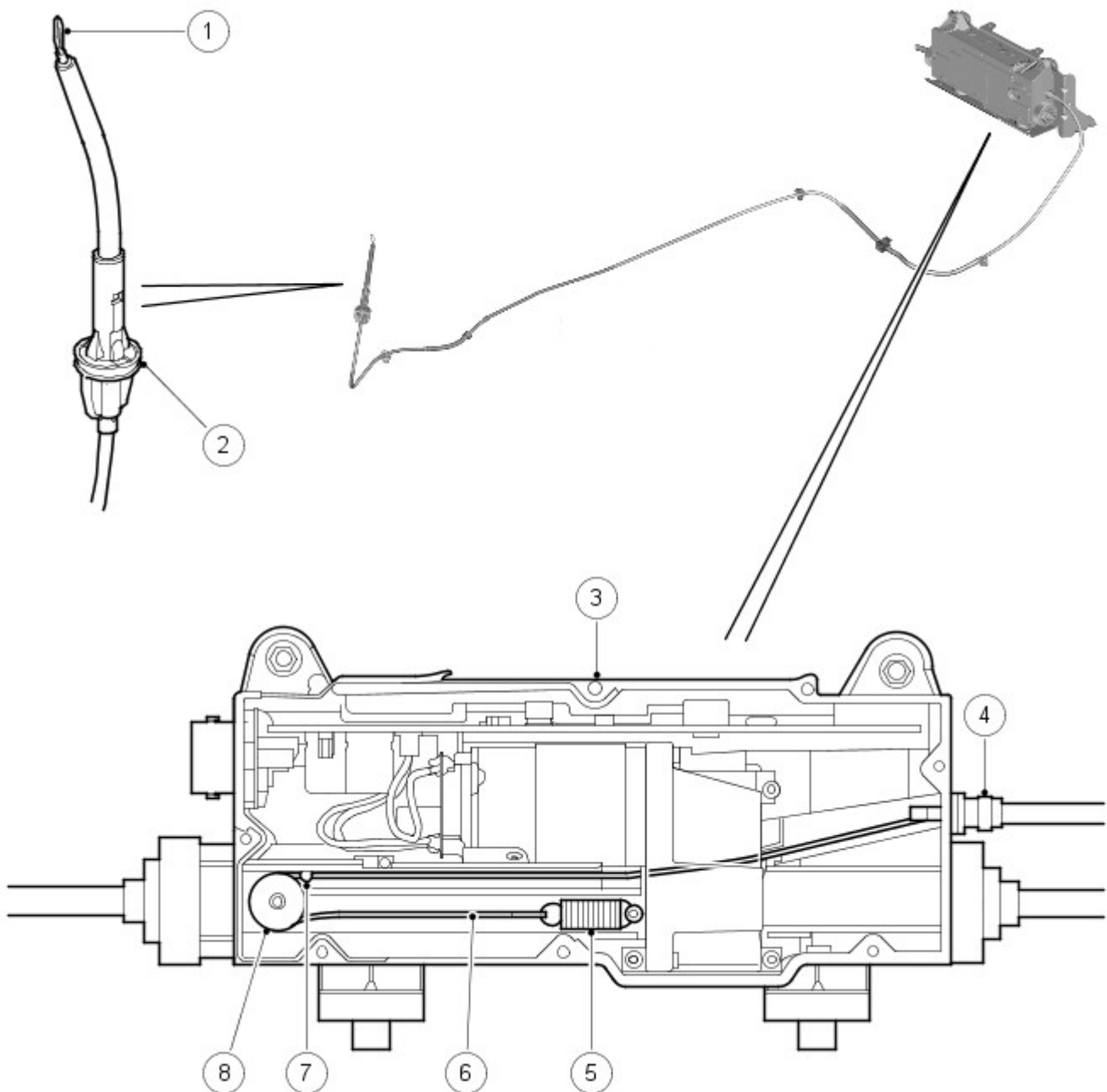
The inner cable of the RH brake cable is connected to a nipple on the force sensor by a 'shoe' on the end of the cable; a locking cover keeps the shoe engaged with the nipple.

The inner cable of the LH brake cable is connected to the spline shaft by a threaded connector (LH thread); a squared flange at the end of the threaded connector locates in the housing of the parking brake module, to prevent the threaded connector from turning with the spline shaft.

When the spline shaft turns, the threaded connector of the LH brake cable is screwed into or out of the spline shaft, which changes the effective length of the inner cables and operates the drum brakes. The ability of the spline shaft to move axially in the gearbox equalizes the load applied by the inner cables to the two drum brakes.

Prior to disconnecting a brake cable, power should be disconnected from the parking brake module. Operation of the parking brake switch while a brake cable is disconnected can cause the actuating mechanism in the parking brake module to seize. In addition, the parking brake may not switch off until 20 minutes after Power mode 0 selected. Automatic re-apply cannot be eliminated until this period has expired.

EMERGENCY RELEASE CABLE



E49846

Item	Part Number	Description
1	-	Pull ring
2	-	Quick release fitting
3	-	Parking brake module
4	-	Sealing collar
5	-	Spring

6	-	Inner cable
7	-	Nipple
8	-	Pulley wheel

The emergency release cable allows the parking brake to be mechanically released if:

- The parking brake cannot be electrically released because of a system fault.
- The battery is disconnected or battery voltage decreases below 7.5 volts while the parking brake is applied, so that the parking brake cannot be electrically released.

The parking brake is mechanically released by disconnecting the force sensor from the spline shaft in the parking brake module. During normal operation, the force sensor and the spline shaft are locked together by a lever operated pawl on the end of the spline shaft, which engages with a spigot on the force sensor.

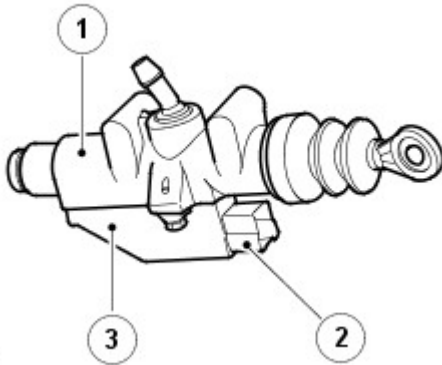
The emergency release cable is a Bowden cable installed between the parking brake module and the center console. The emergency release cable is held in clips along the underside of the vehicle and enters the passenger compartment below the center console through an aperture in the transmission tunnel. A quick release fitting seals the emergency release cable in the aperture. At the parking brake module, a sealing collar on the outer cable is a push fit in the housing of the parking brake module.

In the center console, a pull ring is installed on the end of the inner cable. The pull ring is designed to fit the hook on the end of the jack handle which, in combination with a screwdriver shaft, can be used to pull on the cable.

The pull required to release the latch is approximately 200 N (45 lbf). When the pull ring of the emergency release cable is released, the spring in the parking brake module retracts the inner cable and the nipple moves away from the pawl operating lever.

After the emergency release cable has been used to release the parking brake, the next time an apply selection is made with the parking brake switch, the parking brake module automatically runs through a latching procedure to reconnect the spline shaft with the force sensor. The parking brake module turns the spline shaft so that it moves towards the force sensor. The pawl of the spline shaft then re-engages with the spigot of the force sensor. A second apply selection with the parking brake switch is required to apply the parking brake.

CLUTCH PEDAL POSITION SENSOR (MANUAL TRANSMISSION MODELS ONLY)



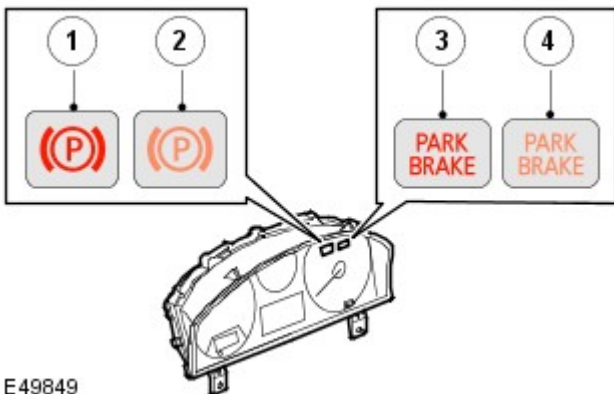
E49848

Item	Part Number	Description
1	-	Clutch master cylinder
2	-	Electrical connector
3	-	Clutch pedal position sensor

The clutch pedal position sensor supplies a signal of clutch pedal position to the parking brake module.

The clutch pedal position sensor is a Hall effect sensor which is attached to the side of the clutch master cylinder. The position of the piston in the clutch master cylinder effects a magnetic field in the sensor, and is translated by the sensor into an analogue voltage signal for the parking brake module. The parking brake module relates the signal to the position of the clutch pedal.

PARKING BRAKE INDICATORS



E49849

Item	Part Number	Description
1	-	Red warning indicator (all except NAS)
2	-	Amber warning indicator (all except NAS)
3	-	Red warning indicator (NAS only)
4	-	Amber warning indicator (NAS only)

The parking brake has two warning indicators, one amber and one red, located in the speedometer of the instrument cluster.

Amber Parking Brake Warning Indicator

The amber parking brake warning indicator is continuously illuminated if there is a parking brake system fault. Operation of the indicator is controlled by a high speed controller area network (CAN) bus signal from the parking brake module to the instrument cluster.

Red Parking Brake Warning Indicator

When the parking brake is applied, the red parking brake warning indicator is continuously illuminated while the ignition is on and for 3 minutes after the ignition is switched off. If the system is unable to comply with an apply or release request, due to a system fault, the indicator flashes.

When the ignition is on and the indicator is not flashing, operation is controlled by a high speed CAN bus signal. When the ignition is off or when the indicator is flashing, operation is controlled by a hardwired signal from the parking brake module to the instrument cluster.

Text Messages

On vehicles with the high line instrument cluster, when there is a fault condition, illumination of the warning indicators is accompanied by a text message displayed in the message center. For additional information, refer to: [Information and Message Center](#) (413-08 Information and Message Center, Description and Operation).

PARKING BRAKE MODULE

The parking brake module monitors external and internal inputs and adjusts the tension of the brake cables to operate the drum brakes and provide the required parking brake function.

The parking brake module is installed on a support bracket attached to the front of the spare wheel carrier. Two rubber mounts, installed on lugs on the underside of the parking brake module, locate in holes in the support bracket. The top corners of the parking brake module are secured to the support bracket with rubber mounts and flanged nuts.

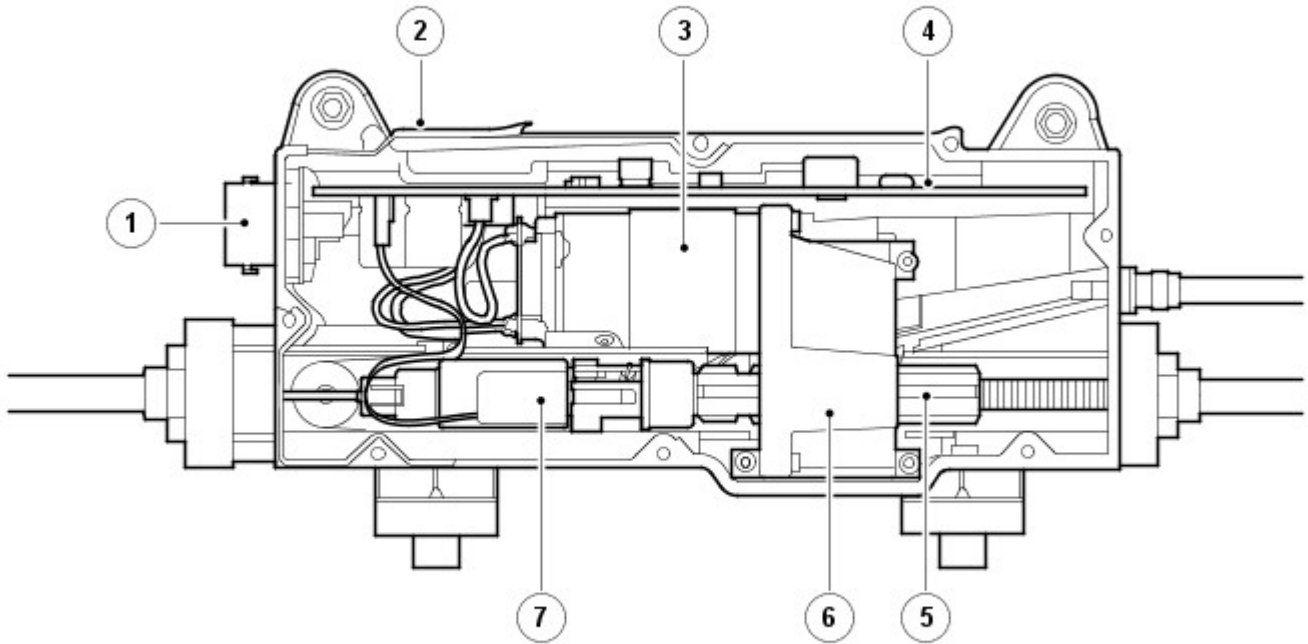
The main components of the parking brake module are:

- A PCB (printed circuit board) incorporating the ASIC (application specific integrated circuit) for control of the parking brake.
- An electric motor.
- A gearbox.
- A spline shaft.
- A force sensor.

The spline shaft and the force sensor are connected together by a latch on the end of the spline shaft. The spline shaft rotates on the latch and moves axially in the gearbox. The latch and the force sensor slide in a channel in the body of the parking brake module.

To apply or release the drum brakes, the parking brake module runs the electric motor, which drives the gearbox. The gearbox turns the spline shaft to increase or decrease the tension in the brake cables. The parking brake module monitors the load exerted by the brake cables using the input from the force sensor.

Interior of Parking Brake Module



E49850

Item	Part Number	Description
1	-	Electrical connector
2	-	Housing
3	-	Electric motor
4	-	PCB
5	-	Spline shaft
6	-	Gearbox
7	-	Force sensor

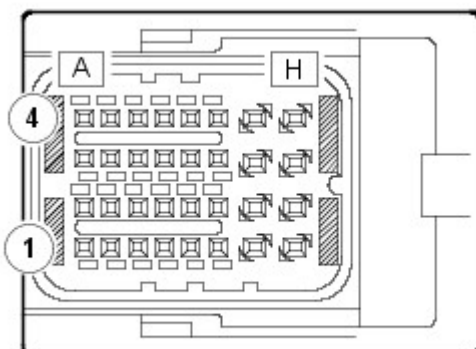
Inputs and Outputs

A 32 pin electrical connector on the RH side of the parking brake module provides the interface between the PCB and the vehicle wiring.

The parking brake module is powered by two permanent battery power feeds from the battery junction box (BJB). Two connections with the central junction box (CJB) provide battery voltage signals in Power mode 0 and Power mode 6. Other hardwired inputs consist of those from the parking brake switch and, on manual transmission models, the clutch pedal position sensor.

In addition to the hardwired connections, the parking brake module is connected to the high speed CAN bus to enable communication with other vehicle systems.

Parking Brake Module Harness Connector C2178



E49851

Parking Brake Module Harness Connector C2178 Pin Details

Pin No.	Description	Input/Output
A1	Not used	-
A2	High speed CAN bus low out	Input/Output
A3	High speed CAN bus high in	Input/Output

Pin No.	Description	Input/Output
A4	High speed CAN bus low in	Input/Output
B1	Not used	-
B2	High speed CAN bus high out	Input/Output
B3	Parking brake switch SW1	Input
B4	Parking brake switch SW4	Input
C1 and C2	Not used	-
C3	Parking brake switch SW2	Input
C4	Parking brake switch SW5	Output
D1 to E1	Not used	-
E2	Clutch pedal position sensor ground	Input
E3	Clutch pedal position sensor signal	Input
E4	Clutch pedal position sensor power supply	Output
F1	Not used	-
F2	Not used	-
F3	Ignition power supply	Input
F4	Red parking brake indicator	Output
G1	Not used	-
G2	Ground	Output
G3	Not used	-
G4	Battery power supply	Input
H1	Not used	-
H2	Ground	Output
H3	Not used	-
H4	Battery power supply	Input

PARKING BRAKE OPERATION

The parking brake can be applied at any time provided sufficient battery power is available. For the parking brake to be released, various pre-conditions are required. The parking brake has manual and automatic operating modes, to cater for different operating circumstances, as detailed in the following table:

Operating Modes

Mode	Pre-Conditions	Driver Action
Static apply	Vehicle speed less than 2.5 km/h (1.6 mph).	Pull up parking brake switch.
Static release	1. Vehicle speed less than 2.5 km/h (1.6 mph). 2. Engine running. OR Ignition is ON and brake pedal or clutch pedal pressed (manual transmission). OR Ignition is ON and brake pedal or accelerator pedal pressed (automatic transmission).	Press down parking brake switch.
Ignition OFF apply	1. Vehicle speed less than 10 km/h (6.25 mph). 2. Ignition is OFF. 3. Selector lever is not in position 'P'. (automatic transmission).	Switch the ignition OFF.
Igniton OFF apply inhibit	1. Vehicle speed less than 2.5 km/h (1.6 mph). 2. Ignition is OFF. 3. Selector lever is not in position 'P'. (automatic transmission).	Switch the ignition OFF while pressing down parking brake switch.
Dynamic apply	Vehicle speed more than 2.5 km/h (1.6 mph).	Pull up parking brake switch as required.
Dynamic release	Vehicle speed more than 2.5 km/h (1.6 mph).	Release (to neutral position) or press down parking brake switch.
DAR (drive away release) (automatic transmission only)	1. Ignition is ON. 2. Transmission in gear 1, 2 or R (with high range selected) or 1, 2, 3 or R (with low range selected). 3. Accelerator pedal pressed more than 2%. 4. Seatbelt is fastened. 5. Drivers door is closed.	None. Parking brake released automatically on drive away.

Operating Voltages

Actuation of the parking brake (apply or release) is only started if the power supply to the parking brake module is within 9 to 18 volts. At any voltage in this range, the parking brake module is able to tighten the brake cables to the maximum, to fully apply the parking brake, although at voltages between 9 and 10.5 volts the actuation time may exceed 1.0 second.

During a parking brake actuation:

- If the power supply to the parking brake module decreases to less than 8.3 volts, the parking brake module continues the actuation, but stores a related fault code. If the ignition is on, the parking brake module also signals the instrument cluster to illuminate the amber parking brake warning indicator and flash the red parking brake warning indicator. On vehicles with the high line instrument cluster, a message advising there is a parking brake fault is shown in the message center. The warning indications are discontinued if the power supply voltage increases to 8.3 volts or more.
- If the power supply voltage decreases to less than 7.5 volts, the parking brake module discontinues the actuation. Actuation is automatically resumed if the power supply voltage subsequently increases to 7.5 volts or more and the parking brake switch request is still valid.
- If the power supply voltage decreases below 6.5 volts, the parking brake function is disabled for the remainder of the ignition cycle.
- If the power supply voltage increases to more than 18.0 volts, the parking brake module immediately disables the

parking brake function and stores a related fault code. If the ignition is on, the parking brake module also signals the instrument cluster to illuminate the amber parking brake warning indicator and flash the red parking brake warning indicator. On vehicles with the high line instrument cluster, a message advising that the parking brake has a fault and is not functioning is shown in the message center. The parking brake function remains disabled until the power supply voltage is within 9 to 18 volts again. When the power supply voltage is within 9 to 18 volts again, the warning indications are cancelled and actuation is automatically resumed if the parking brake module is in a dynamic mode of operation with a valid parking brake switch request.

- **NOTE:** The instrument cluster shuts down below 8 volts, so warning indications and messages are not displayed below 8 volts. CAN transmission stops if battery voltage drops below 7.0 volts and re-starts when voltage goes above 7.5 volts.

Sleep Mode

To reduce quiescent drain on the vehicle battery, the parking brake module incorporates a sleep mode. The parking brake module enters the sleep mode, provided the ignition is off and there are no signals from the wheel speed sensors, when one of the following occurs:

- 20 minutes elapse after the last actuation of the parking brake.
- If no actuation occurred, 20 minutes elapse after the ignition is switched off.

The parking brake module wakes up from the sleep mode when one of the following occurs:

- An apply or release request is made with the parking brake switch.
- The ignition is switched on.
- A key out apply is activated.

The parking brake module wakes up within 500 ms. The high speed CAN bus is activated within 200 ms maximum.

When the parking brake module is woken with a release request from the parking brake switch, the parking brake module ignores the request but illuminates the red brake warning indicator. The parking brake module extinguishes the red brake warning indicator and goes back to sleep immediately the switch is released to the neutral position.

When the parking brake module is woken with an apply request from the parking brake switch, if the parking brake is already applied the parking brake module ignores the request but illuminates the red brake warning indicator. The parking brake module extinguishes the red brake warning indicator and goes back to sleep immediately the switch is released to the neutral position. If the parking brake is in the released condition when the apply request is made, the parking brake module illuminates the red brake warning indicator and applies the parking brake. The parking brake module extinguishes the red brake warning indicator and goes back to sleep 3 minutes after the apply activation, or immediately after the switch is released to the neutral position, whichever occurs last.

Dynamic Apply

In the dynamic apply mode, if the vehicle speed is more than 10 km/h (6.25 mph) when the parking brake switch is selected to apply, the parking brake module requests the ABS module to activate the disc brakes on all four wheels. When the vehicle comes to a standstill, the parking brake module statically applies the parking brake. Once the static load is achieved, the hydraulic pressure is removed. If the parking brake switch is released to the neutral position, or pressed down to the release position, during dynamic apply, braking is cancelled.

The anti-lock brake system (ABS) module monitors the deceleration rate using the wheel speed sensor signals, and adjusts the hydraulic pressure to the disc brakes as required to achieve the required rate. All of the anti-lock control - traction control system brake functions remain enabled in the dynamic apply mode.

The parking brake module incorporates two fallback functions for the dynamic apply mode.

- Fallback 1 is invoked if vehicle speed is between 2.5 km/h (1.25 mph) and V_{max} when the parking brake switch is selected to apply and the ABS module is unable to fulfil a hydraulic request. When fallback 1 is invoked, the parking brake module decelerates the vehicle, using only the parking brake. The parking brake module monitors the deceleration rate using the wheel speed information from the ABS module, and adjusts the tension of the brake cables to achieve the required rate. During deceleration the parking brake module also uses the wheel speed inputs from the ABS module to operate an anti-lock function for the rear wheels. When vehicle speed decreases to 2.5 km/h (1.25 mph) the parking brake module switches to the static apply mode.
- Fallback 2 is invoked if there is a loss of communication between the parking brake module and the ABS module or the CAN bus has failed. When fallback 2 is invoked, the parking brake module decelerates the vehicle using only the parking brake. The parking brake module tightens the brake cables under the control of the driver, no anti-lock function is available.

While dynamic apply is active, including fallback 1 and fallback 2, the parking brake module also outputs high speed CAN bus signals to:

- The ABS module, to apply the stoplamps.
- The instrument cluster, to sound an intermittent warning buzzer, at 0.5 second on, 1.0 second off.
- The instrument cluster, to illuminate the red parking brake warning indicator. The indicator is permanently illuminated except in fallback 2, when it flashes.

DAR Pre-arming

The DAR pre-arming function operates when the transfer box is in high range to reduce the parking brake release time during DAR and to provide a smooth take-off. DAR pre-arming is invoked when:

- The ignition is ON.
- The transmission is in gear 1, 2 or R.
- The vehicle is stationary.
- No failsafe tighten actuation has occurred.

Automatic Load Adjustment

While the ignition is on, the parking brake module constantly monitors the input from the force sensor. If the tension of the brake cables goes outside the limits for a given operating mode, the parking brake module automatically restores the tension within limits.

Failsafe Tighten. If, during pre-arming, the vehicle moves, then the maximum cable force is reinstated for the remainder of that ignition cycle.

Automatic Apply. While the parking brake is applied, if the tension of the brake cables decreases by a prescribed amount from the initial setting, the parking brake module automatically restores the tension to the initial setting.

Automatic Release. While the parking brake is released, if the tension of the brake cables increase to a prescribed amount, the parking brake module automatically reduces the tension to zero.

Parking Brake Switch Monitoring

The parking brake module monitors for the following types of fault in the parking brake switch system. If a fault is detected, the parking brake module stores a related fault code:

- Short circuits between a pull-down transistor in the parking brake module and battery voltage.
- Broken wires and microswitches.
- Plausibility.

The parking brake switch has a degree of in-built redundancy. If a single microswitch fault is detected the parking brake module can still determine the operating state of the parking brake switch. Short circuits or multiple failures cause the parking brake module to disable the parking brake switch for the remainder of the ignition cycle. The parking brake module also disables the parking brake switch if a plausibility fault occurs. However, since plausibility faults are usually caused by incomplete operation of the parking brake switch, the parking brake switch is re-enabled if the parking brake module subsequently establishes a plausible operating state.

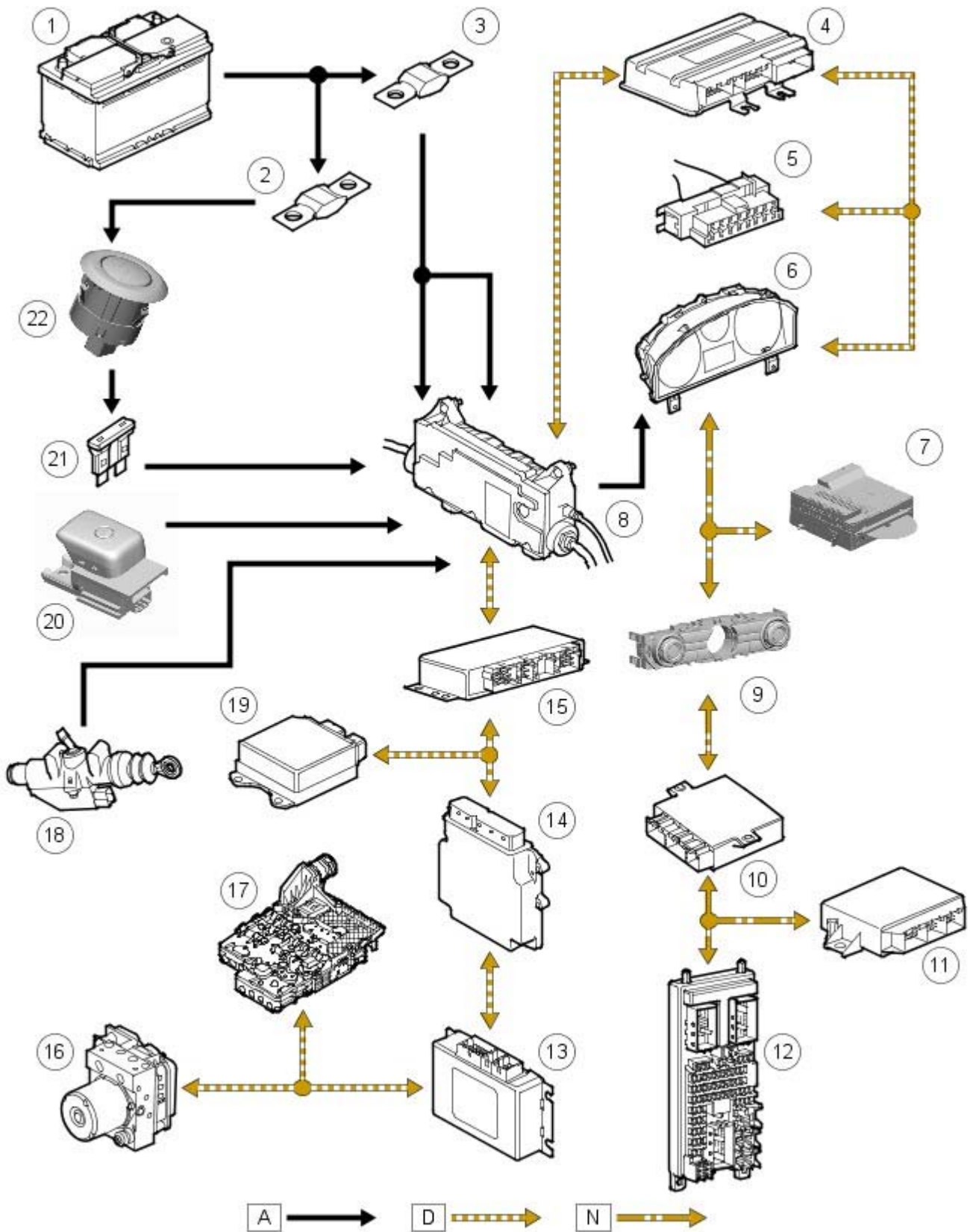
If a single microswitch fault is detected, the parking brake module signals the instrument cluster to illuminate the amber parking brake warning indicator. On vehicles with the high line instrument cluster, the parking brake module also signals the instrument cluster to display a message advising there is a parking brake fault. During an apply actuation, the parking brake module also signals the instrument cluster to flash the red parking brake warning indicator.

For all other fault types, the parking brake module signals the instrument cluster to illuminate the amber parking brake warning indicator, and, on vehicles with the high line instrument cluster, to display a message advising the parking brake has a fault and is not functioning. If it makes an apply actuation, the parking brake module signals the instrument cluster to flash the red parking brake warning indicator for the remainder of the ignition cycle.

On the next ignition cycle, the warning indicators and the messages are only activated if the fault is still present, although the fault code is retained by the parking brake module until cleared by T4.

CONTROL DIAGRAM

- NOTE: A = Hardwired connection; D = High speed CAN bus; N = Medium speed CAN bus



E 132053

Item	Part Number	Description
1	-	Battery
2	-	Fusible link 17E, BJB
3	-	Fusible link 8E, BJB
4	-	Air suspension control module
5	-	Diagnostic socket
6	-	Instrument cluster
7	-	Integrated head unit
8	-	Parking brake module

9	-	automatic temperature control (ATC) module
10	-	Tire Pressure Monitoring Module (TPMM)
11	-	Parking Aid module
12	-	CJB module
13	-	Transfer box control module
14	-	engine control module (ECM)
15	-	Rear differential control module
16	-	ABS module
17	-	transmission control module (TCM)
18	-	Clutch pedal position sensor
19	-	restraints control module (RCM)
20	-	Parking brake switch
21	-	Fuse 9P, CJB (ignition)
22	-	Ignition push button

Parking Brake and Actuation - Parking Brake

Diagnosis and Testing

Principles of Operation

For a detailed description of the Parking Brake System and operation, refer to the relevant Description and Operation section of the workshop manual.

REFER to: [Parking Brake](#) (206-05 Parking Brake and Actuation, Description and Operation).

Inspection and Verification

• CAUTIONS:



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 checked and/or the donor vehicle.



Please note this is a sealed unit and no attempt must be made to open the actuator as it will invalidate any warranty claim.

• NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> ● Parking brake cable(s) condition and installation ● Parking brake shoes condition and fitment ● Parking brake drums (integrated into rear brake discs) ● Parking brake actuator module condition and installation 	<ul style="list-style-type: none"> ● Parking brake indicators ● Fuses ● Wiring harness/electrical connectors <ul style="list-style-type: none"> - Check for bent/corroded pins ● Controller Area Network (CAN) circuits ● Parking brake switch ● Parking brake actuator module

3. **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. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Parking brake will not engage or release	<ul style="list-style-type: none"> ● Parking brake cables fouled, trapped or damaged ● Parking brake cables incorrectly routed or fixed ● Parking brake shoes, linings worn/contaminated ● Parking brake drums (integrated into rear brake discs) ● Parking brake shoes incorrectly adjusted following replacement ● Parking brake actuator module malfunction 	<p>Check the parking brake cables for fouling, trapping or damage. Check the cables for correct routing. Check that the cable end fitting connector(s) are correctly fitted to the operating lever(s). Inspect the parking brake shoes and drums for condition/wear/contamination, REFER to: Rear Disc Brake (206-04 Rear Disc Brake, Description and Operation) / Parking Brake Shoes (206-05, Removal and Installation). Check the parking brake shoes for correct adjustment. REFER to: Parking Brake Shoe and Lining Adjustment (206-05 Parking Brake and Actuation, General Procedures). Check the operation of the parking brake actuator module, check for damage and/or excessive noise during operation. Check for parking brake actuator module DTCs.</p>
Low parking brake efficiency/parking brake sticking/binding		

DTC Index

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index (100-00, Description and Operation).

Brake Bedding Mode

Bedding mode is a special mode available in the parking brake module (PBM) that disables the stability assist system (ABS) and allows the parking brake to provide the braking force rather than the conventional braking system whilst the vehicle is moving at a velocity of >3kph. This mode is entered via a series of brake pedal presses and switch applications, full details on this procedure is available in the relevant section of the workshop manual. If brake bedding mode is entered accidentally by the driver the RED warning lamp will flash in the Instrument Pack, the module will return to normal operational mode when the ignition has been cycled. This DTC (C1104-68) is intended to highlight the fact that although the RED lamp was illuminated there was no fault present in the control module.

Drive Cycles

Drive Cycle 1 Description

- Ignition On
- Make sure that no parking brake activation (diagnostic command or switch input) is attempted for a minimum of 3 seconds
- Retest for functionality

Drive Cycle 2 Description

- Ignition On
- Drive vehicle at a constant speed of 20KPH (13MPH) or slightly above in 2nd gear
- At a constant speed of 20KPH (13MPH) or slightly above apply the parking brake via the parking brake switch
- Press the brake pedal

Drive Cycle 3 Description

- Ignition On
- Make sure that the vehicle is stationary and that the parking brake is released
- Pull the parking brake switch to the apply position and hold in this position until the parking brake motor has stopped (this may take up to 5 seconds)
- Release the parking brake switch to the idle position, leave in the idle position for 2 seconds
- Push the parking brake switch to the release position (while pressing the brake pedal) and keep in this position until the parking brake motor has stopped (this may take up to 5 seconds)
- Release the parking brake switch to the idle position


Parking Brake and Actuation - Parking Brake Shoe and Lining Adjustment


General Procedures

- NOTE: This procedure must be carried out if, new parking brake shoes are fitted, new rear brake discs are fitted or if the vehicle has been mud wading (not water) for more than 50 miles.


1. Check the parking brake for correct operation.

2. CAUTIONS:

 When the vehicle is in the mounting position a red flashing light may appear on the instrument cluster. This indicates that the parking brake actuator is in the mounting position. It does not indicate a vehicle fault.

 The warning lamp on the instrument cluster will flash whilst the parking brake is being driven into the mounting position.

Using the Land Rover approved diagnostic system, drive the parking brake to the mounting position.

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

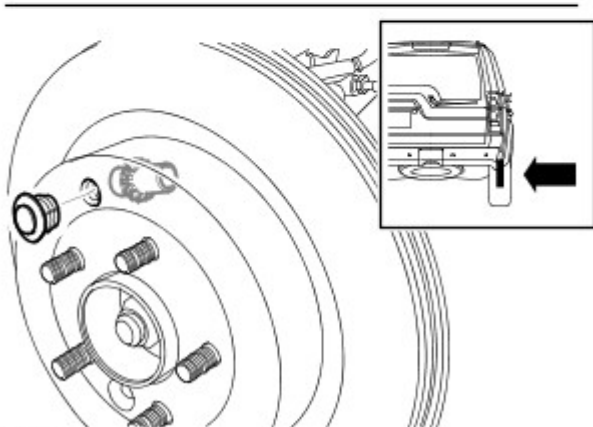
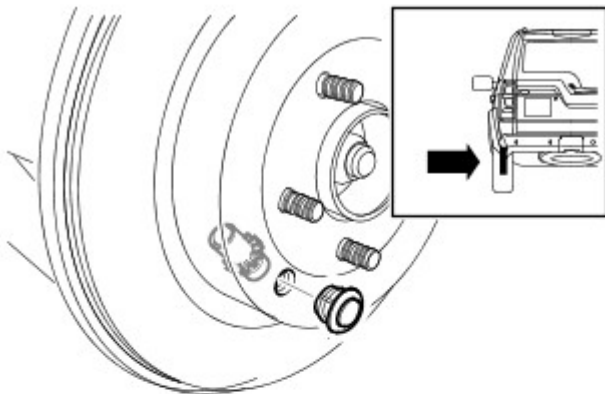
Raise and support the vehicle.

4. Remove the wheels and tires.


5. NOTE: Align the access hole with the indicators located on the back plate.

Locate the parking brake shoe adjuster.

- Remove the access plug.
- Rotate the brake disc.

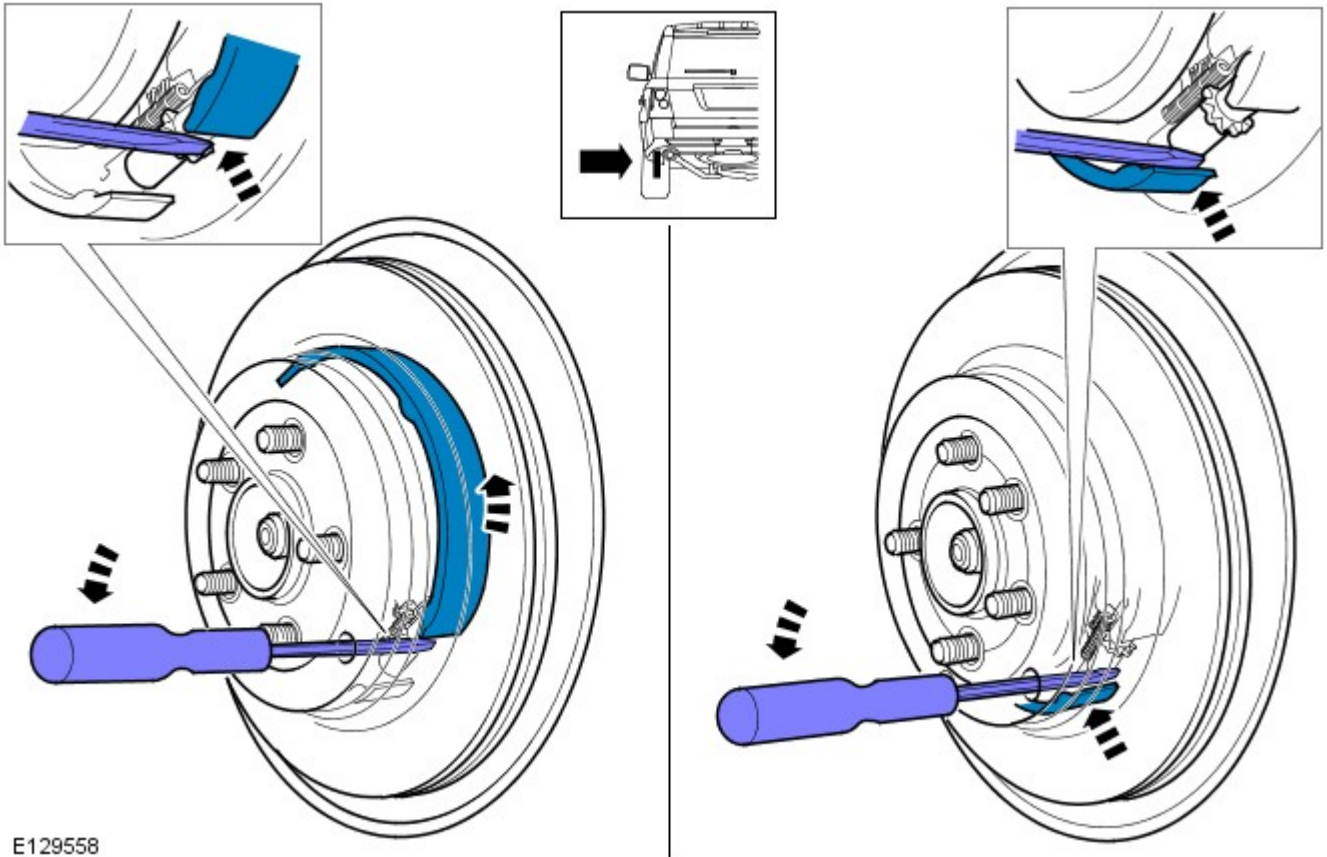


E48748


6.  **CAUTION:** Failure to follow this step may cause damage to the parking brake system. Failure to displace the parking brake shoes, as shown, will result in incorrect clearance when carrying out the adjustment step.

- NOTE: The movement of the parking brake shoe will be small and may not be felt when levering.
- NOTE: LH shown.

Using a flat blade screwdriver, lever the brake shoes as indicated.

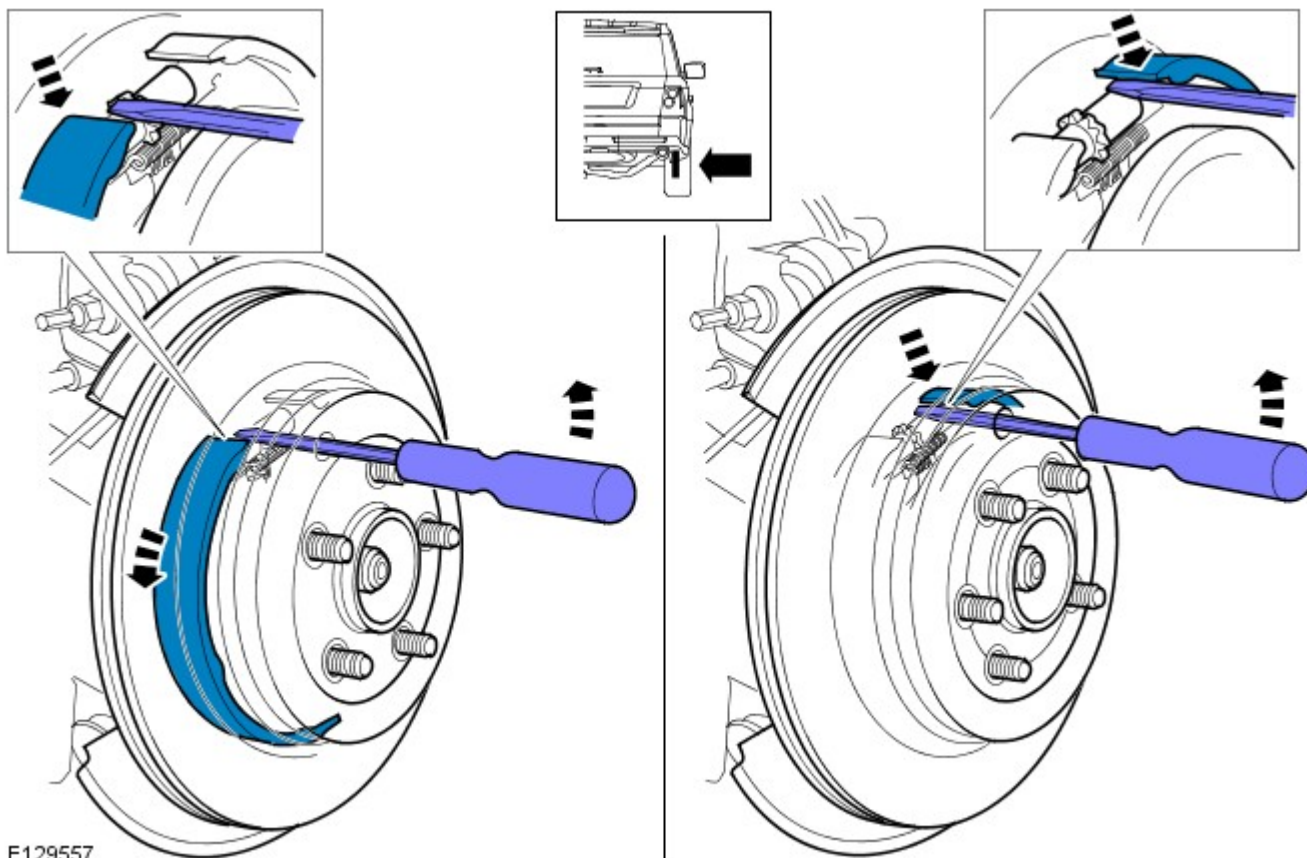


E129558


7.  CAUTION: Failure to follow this step may cause damage to the parking brake system. Failure to displace the parking brake shoes, as shown, will result in incorrect clearance when carrying out the adjustment step.

- NOTE: The movement of the parking brake shoe will be small and may not be felt when levering.
- NOTE: RH Shown.

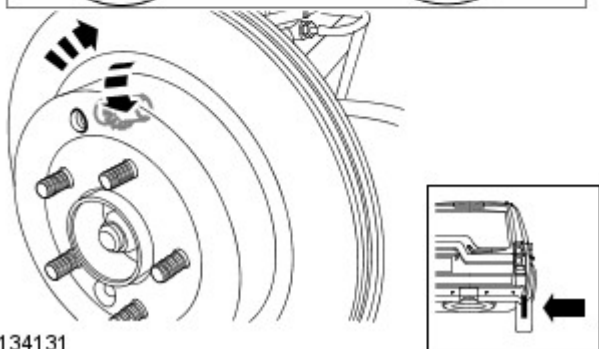
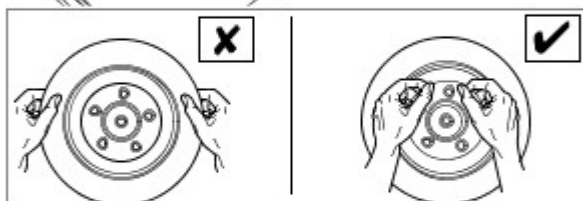
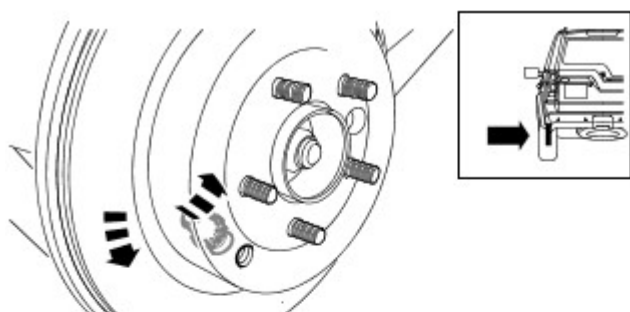
Using a flat blade screwdriver, lever the brake shoes as indicated.



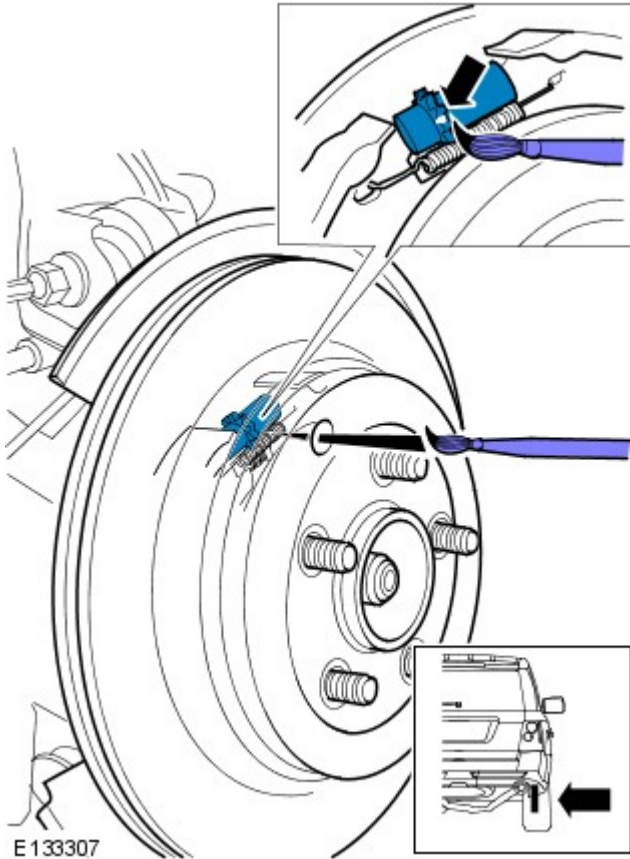
E129557

8.  **CAUTION:** Do not apply excessive force on the brake shoe adjuster. Failure to follow this instruction may result in damage to the parking brake system

Using a flat bladed screwdriver rotate the brake shoe adjuster to extend it until the brake disc is locked hand tight.



E134131



E133307

- 9. ⚠ CAUTION:** The following steps sets the running clearance for the parking brake shoes, failure to adhere to the paint marking process may cause damage to the park brake system when the adjustment steps are carried out.

Using suitable marker, mark the position of the brake shoe adjuster.

- 10. ⚠ CAUTION:** The parking brake adjuster must be rotated back EXACTLY one full revolution. Failure to follow this instruction may result in damage to the parking brake system.

Rotate the adjuster back one revolution until paint mark is visible.

- 12.** Repeat the above procedure for the other side.

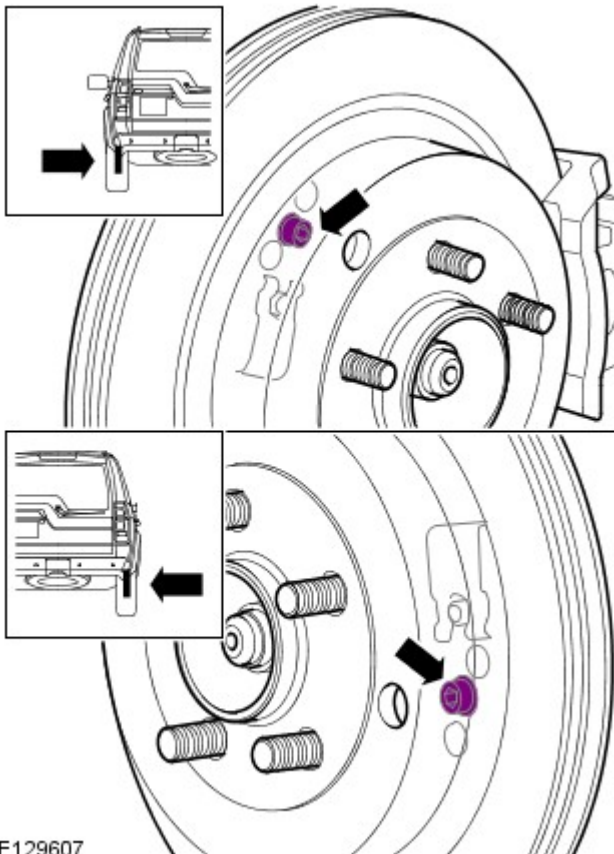
- 11. ⚠ CAUTION:** The wedge adjuster must be correctly seated to make sure the parking brake cable is correctly adjusted. Failure to follow this instruction may result in damage to the parking brake system.

- 13.** Take the vehicle out of the mounting position by operating the parking brake twice.
- 14. ⚠ CAUTION:** If the parking brake shoes or the brake discs have been removed for access to other components then DO NOT carry out this procedure.

• Tap the brake disc lightly with a soft faced mallet, around the parking brake shoe location within the brake disc.

Carry out the parking brake shoe bedding-in procedure. For additional information, refer to: [Parking Brake Shoes Bedding-In](#) (206-05 Parking Brake and Actuation General Procedures).

- Tighten the wedge adjuster Allen screw to 8 Nm (5 lb.ft).
- Install the access plug.



E129607

Parking Brake and Actuation - Parking Brake Shoes Bedding-In

General Procedures

- NOTE: This procedure must be carried out if, new parking brake shoes are fitted, new rear brake discs are fitted or if the vehicle has been mud wading (not water) for more than 50 miles.

1. Carry out the parking brake shoe bedding-in procedure.

2. NOTE: The electronic parking brake 'Service Bedding-in Procedure mode' will be active for the remainder of the ignition cycle, or until the vehicle speed exceeds 31 mph (50 kph). If the procedure needs to be re-entered, the entry actions must be repeated.

To enter 'Service Bedding-in Procedure' mode.

- Start and run the engine.
- Apply the footbrake 3 times within 10 seconds and hold applied after the 3rd application.
- Apply the electronic parking brake switch 4 times, followed by 3 release applications within 10 seconds.

3. Once the Service Bedding-in procedure mode has been entered, the electronic parking brake linings can be bedded-in by conducting 10 repeated stops from 30 - 35 kph (19 - 22 mph), followed by a 500 metre (547 yard) interval between each stop to allow the brakes to cool, using the electronic parking brake control switch.

- The electronic parking brake brake force will be increased up to the dynamic maximum so long as the switch is held in the applied position.
- If the switch is released to either the NEUTRAL or OFF positions, the electronic parking brake will be released.
- The electronic parking brake MUST be allowed to cool between applications, either by driving at 19 mph (30 kph) for 500 metres (547 yards) or remaining stationary for 1 minute between each application.

Parking Brake and Actuation - Parking Brake Cable LH

Removal and Installation


Removal



CAUTION: To avoid accidental operation of the parking brake, and possible damage to the parking brake actuator, remove Fusible link 8, located in the engine compartment fuse box before commencing work.

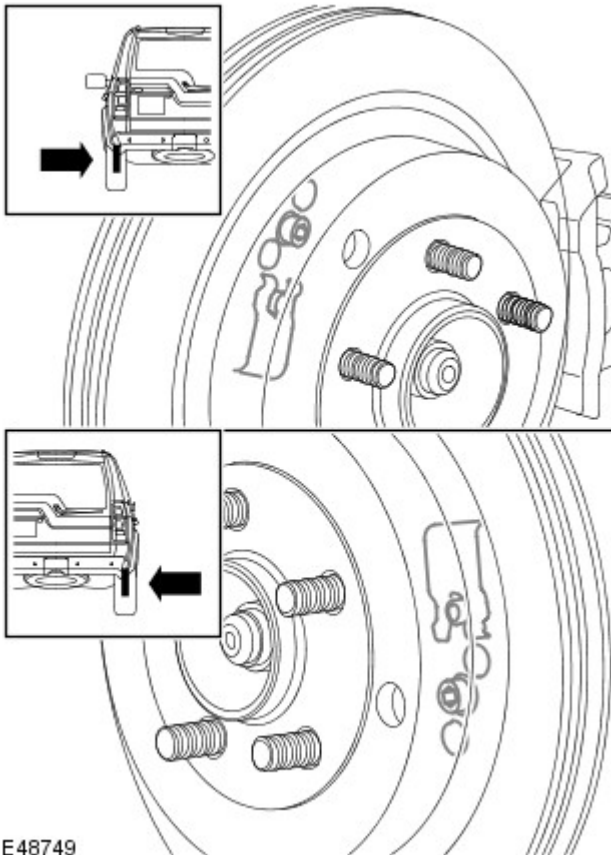
• **NOTE:** If the parking brake system has completed less than 50,000 cycles it is permissible to replace the parking brake cables. If over 50,000 cycles have been completed, then the cables can only be replaced as part of the parking brake actuator and cable assembly. The parking brake cycle count can be checked using the Land Rover approved diagnostic system, (ON/OFF = 1 cycle). If a cable breaks or becomes detached whilst the vehicle is being driven, a 'parking brake actuator unjamming procedure' may be required using the Land Rover approved diagnostic system.

1. Using the Land Rover approved diagnostic system, drive the parking brake to the 'mounting position'.
2. Isolate the parking brake electrical circuit.
 - Remove fuse number 8 from the BJB.

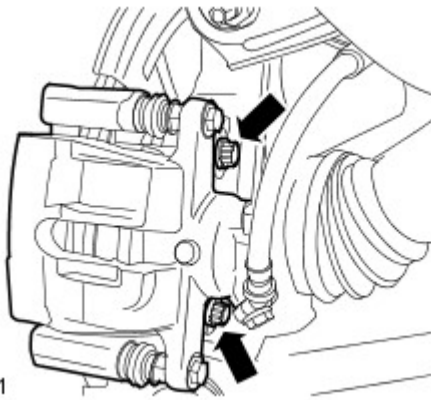
3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

4. Remove both rear wheels and tires.
5. Release the parking brake shoe adjustment.
 - Loosen the screw.



E48749

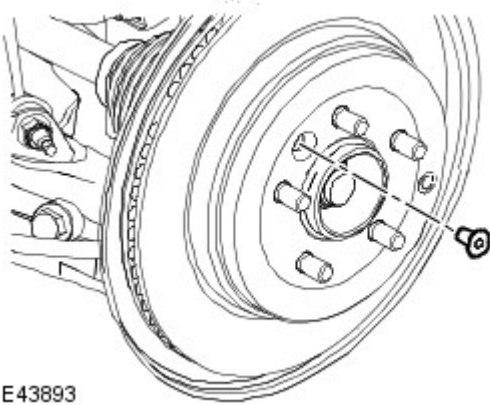


E93861

6.  **CAUTION:** Do not allow the brake caliper to hang on the brake hose.

Reposition the LH rear brake caliper.

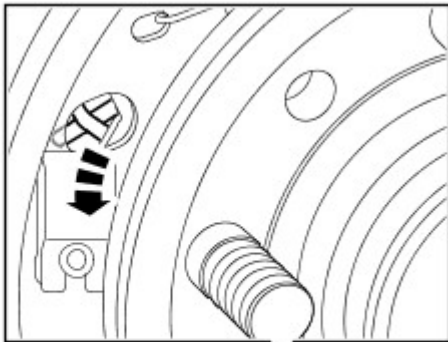
- Remove the 2 bolts.
- Using a suitable tie strap, support the brake caliper.



E43893

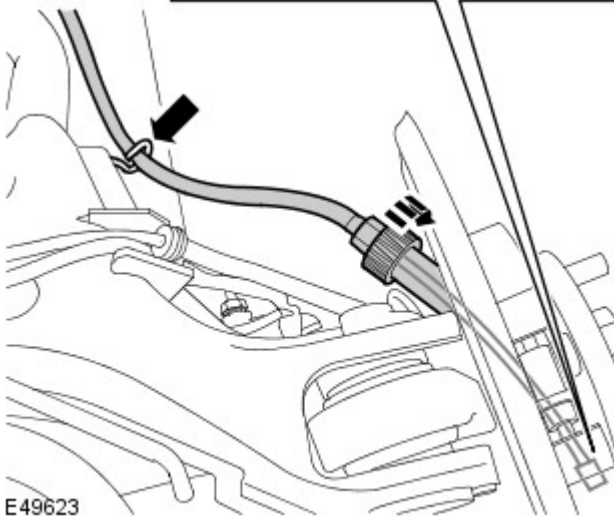
7. Remove the LH rear brake disc.

- Remove the screw.

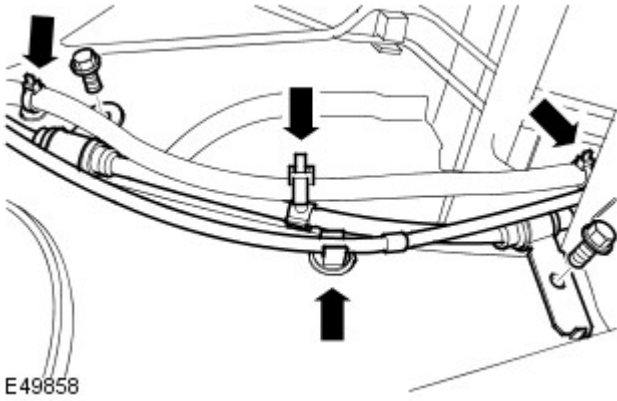


8. Disconnect parking brake cable from the wheel hub.

- Fully loosen the nut.
- Release the cable from the lower arm.
- Disconnect the inner cable from the brake shoe.

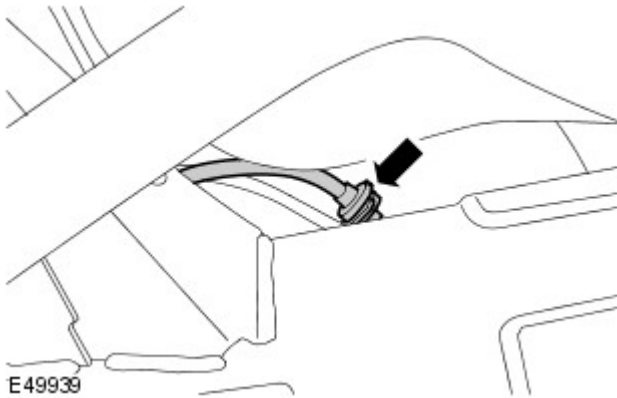


E49623

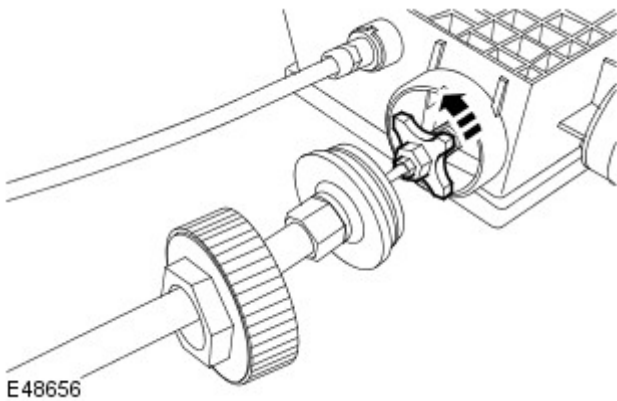


9. Release the LH parking brake cable.

- Remove the 2 bolts.
- Release the 3 wiring harness clips.
- Release the cable from the clip on the chassis.



10. Release the LH parking brake cable.



11. Remove the LH parking brake cable.

- Release the retaining nut.
- Release and remove the cable.

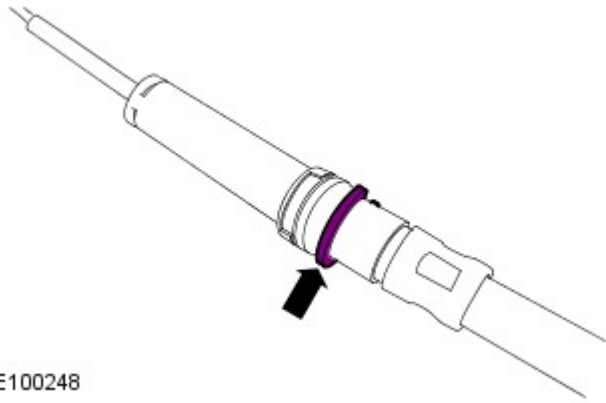
Installation

1. Install the LH parking brake cable.

- LH cable: Screw the cable in 5 complete turns.
- Tighten the retaining nut.

2. Locate and secure the LH parking brake cable.

- Tighten the bolts to 22 Nm (16 lb.ft).
- Secure the wiring harness.
- Secure the cable grommet to the integrated body frame bracket.




E100248

3. NOTE: Make sure that the brake cable circlip is positioned as shown.

Connect the parking brake cable to the wheel hub.

- Connect the cable to the brake shoe lever.
- Locate the cable to the backplate.
- Tighten the nut to 8 Nm (6 lb.ft).

4.  CAUTION: Make sure that the component is clean, free of foreign material and lubricant.

Install the LH rear brake disc.

- Tighten the Torx screw to 35 Nm (26 lb.ft).

5. Secure the LH rear brake caliper.

- Remove and discard the tie strap.
- Tighten the bolts to 115 Nm (85 lb.ft).

6. NOTE: The adjustment procedure must be carried out in full.

Adjust the parking brake shoes.

For additional information, refer to: [Parking Brake Shoe and Lining Adjustment](#) (206-05 Parking Brake and Actuation, General Procedures).

7. Install the rear wheels and tires.

- Tighten the wheel nuts to 140 Nm (103 lb.ft).

8. Install fuse number 8 into the BJB.

Parking Brake and Actuation - Parking Brake Cable RH

Removal and Installation


Removal



CAUTION: To avoid accidental operation of the parking brake, and possible damage to the parking brake actuator, remove Fusible link 8, located in the engine compartment fuse box before commencing work.

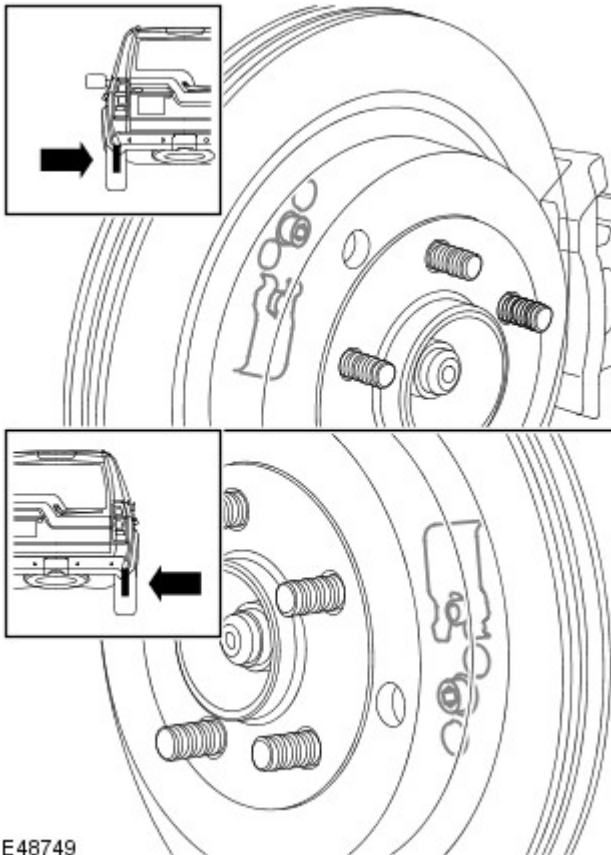
• **NOTE:** If the parking brake system has completed less than 50,000 cycles it is permissible to replace the parking brake cables. If over 50,000 cycles have been completed, then the cables can only be replaced as part of the parking brake actuator and cable assembly. The parking brake cycle count can be checked using the Land Rover approved diagnostic system, (ON/OFF = 1 cycle). If a cable breaks or becomes detached whilst the vehicle is being driven, a 'parking brake actuator unjamming procedure' may be required using the Land Rover approved diagnostic system.

1. Using the Land Rover approved diagnostic system, drive the parking brake to the 'mounting position'.
2. Isolate the parking brake electrical circuit.
 - Remove fuse number 8 from the BJB.

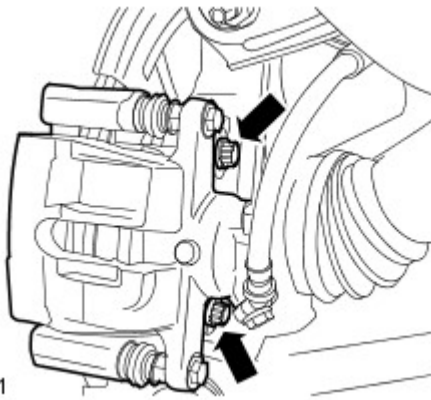
3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

4. Remove the wheels and tires.
5. Release the parking brake shoe adjustment.
 - Loosen the screw.



E48749

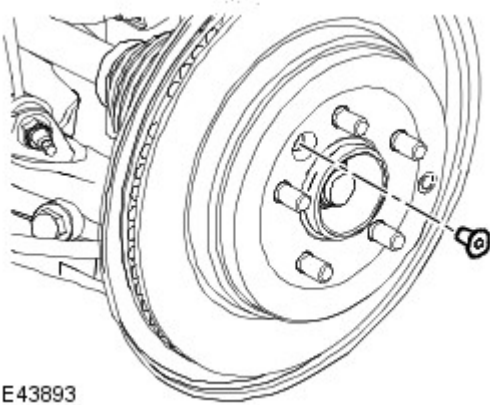


E93861

6.  **CAUTION:** Do not allow the brake caliper to hang on the brake hose.

Reposition the RH rear brake caliper.

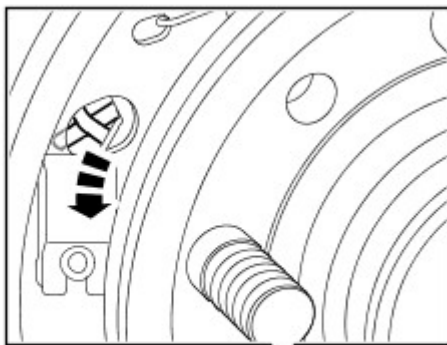
- Remove the 2 bolts.
- Using a suitable tie strap, support the brake caliper.



E43893

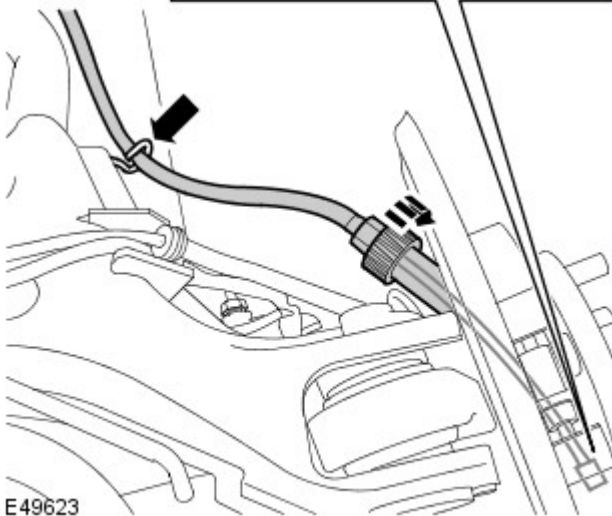
7. Remove the RH rear brake disc.

- Remove the screw.

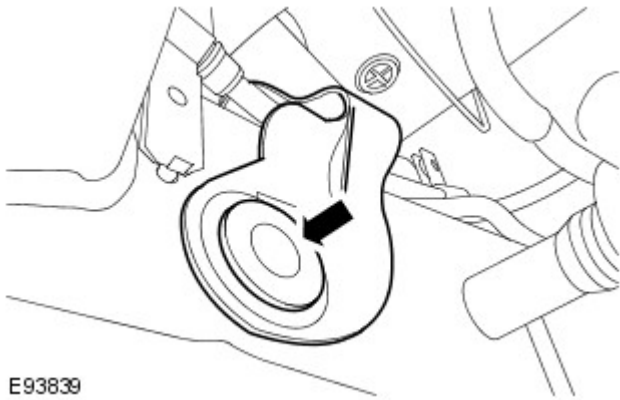



8. Disconnect parking brake cable from the wheel hub.

- Fully loosen the nut.
- Release the cable from the lower arm.
- Disconnect the inner cable from the brake shoe.



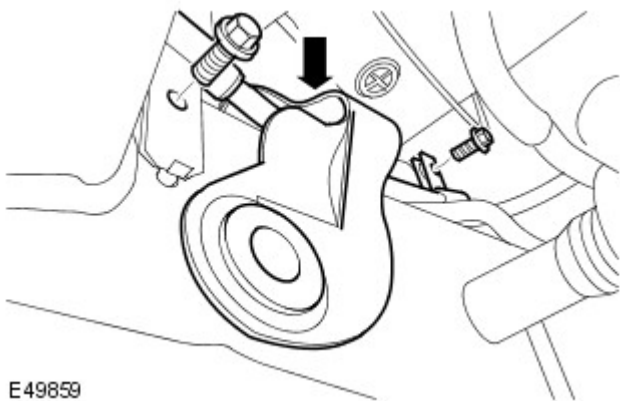
E49623



9.  **CAUTION:** The fuel tank breather line bracket can be easily damaged when releasing it from the chassis.

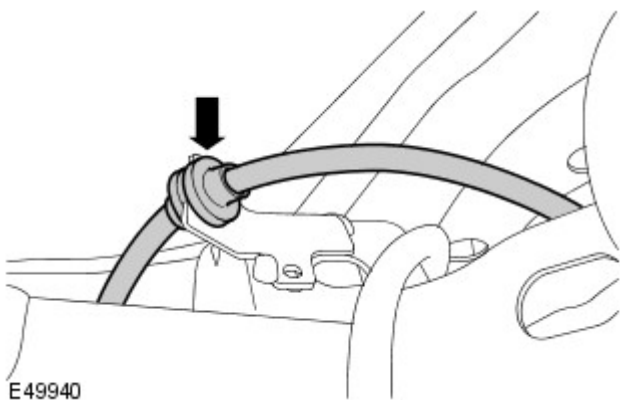
Release the fuel tank breather line bracket.

- Remove the plastic insert.

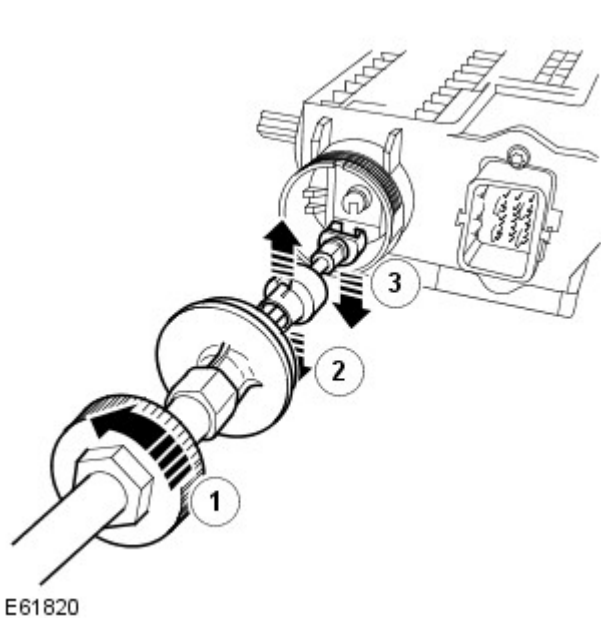



10. Release the RH parking brake cable.

- Remove the 2 bolts.
- Release the parking brake cable from the 2 pipe clips.
- Release the cable from the clip on the chassis.



11. Release the RH parking brake cable.



12.  **CAUTION:** Make sure that no dirt or moisture enters the actuator during cable replacement.

Remove the RH parking brake cable.

- Release the retaining nut.
- Release the cable retaining clip.
- Release and remove the cable.

Installation

1. Install the RH parking brake cable.

- Install the cable.
- Install the cable retaining clip.
- Tighten the retaining nut.

2. Secure the fuel tank breather line bracket.

- Install the plastic insert.

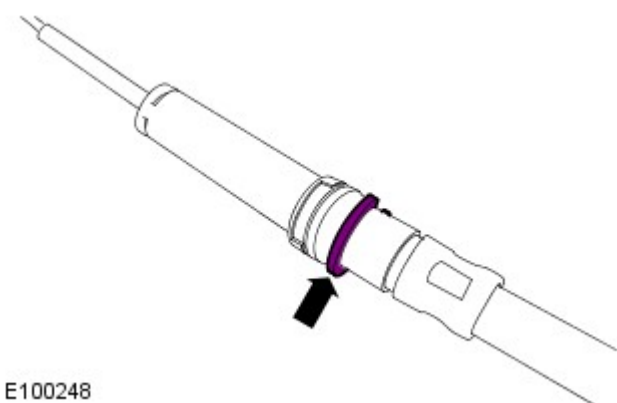
3. Locate and secure the RH parking brake cable.


- Tighten the bolts to 22 Nm (16 lb.ft).
- Secure the parking brake cable to the 2 pipe clips.
- Secure the cable grommet to the integrated body frame bracket.

4. NOTE: Make sure that the brake cable circlip is positioned as shown.

Connect the parking brake cable to the wheel hub.

- Connect the cable to the brake shoe lever.
- Locate the cable to the backplate.
- Tighten the nut to 8 Nm (6 lb.ft).



5.  **CAUTION:** Make sure that the component is clean, free of foreign material and lubricant.

Install the RH rear brake disc.

- Tighten the Torx screw to 35 Nm (26 lb.ft).

6. Secure the RH rear brake caliper.

NOTE: The adjustment procedure must be carried out in full.

- Remove and discard the tie strap.

Adjust the parking brake shoes.

- Tighten the bolts to 115 Nm (85 lb.ft).

[Lining Adjustment](#) (206-05 Parking Brake and Actuation, General Procedures).

8. Install the rear wheels and tires.

- Tighten the wheel nuts to 140 Nm (103 lb.ft).

9. Install fuse number 8 into the BJB.

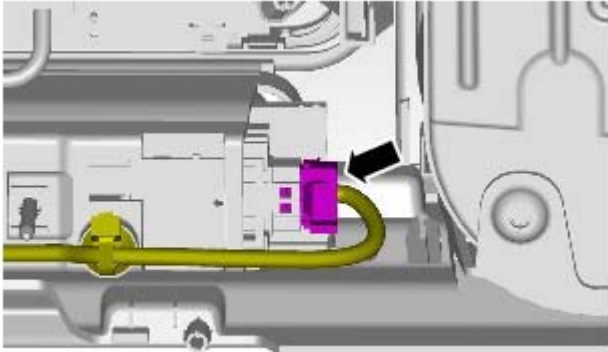
Parking Brake and Actuation - Parking Brake Switch

Removal and Installation

Removal

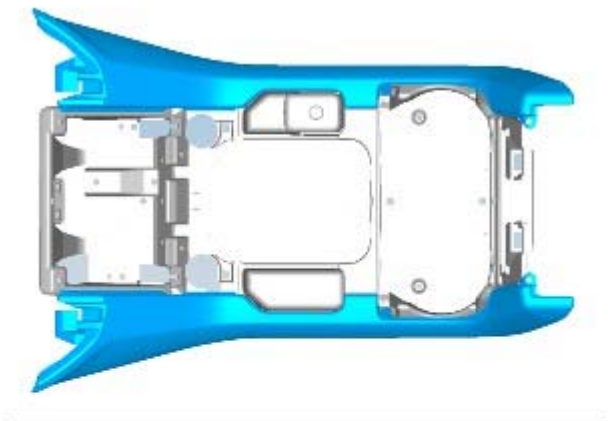
- NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Floor Console Upper Section](#) (501-12 Instrument Panel and Console, Removal and Installation).

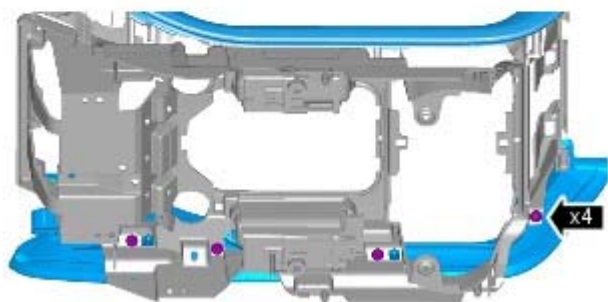


E 129852

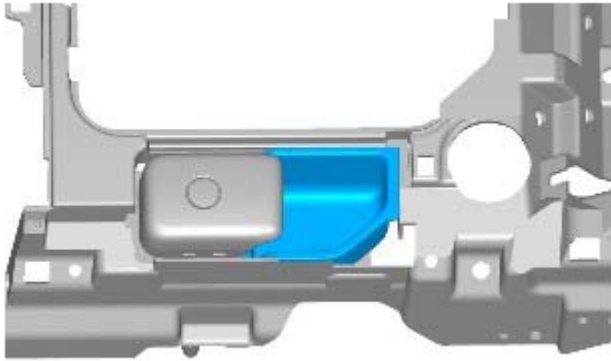
2.



3.

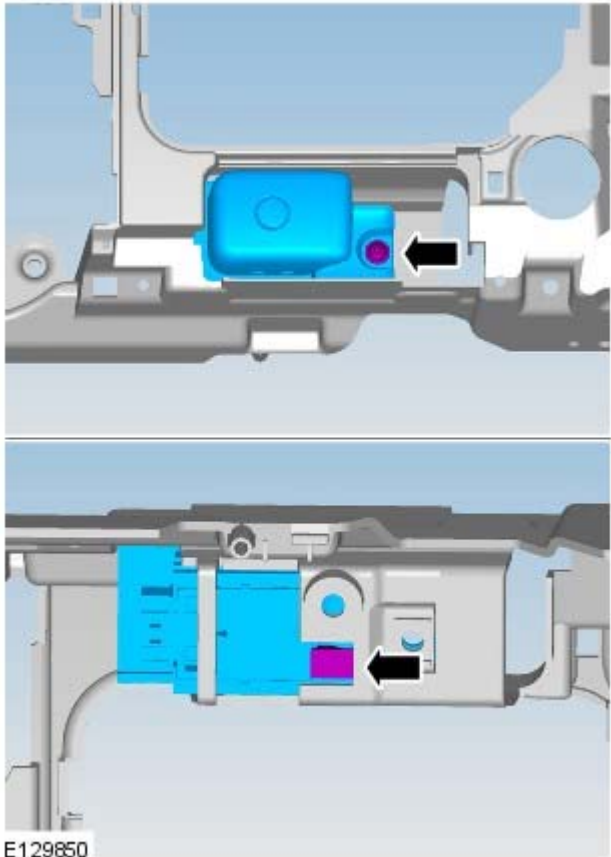


E129849



E 129851

4.



E 129850

5.

Installation

1. To install, reverse the removal procedure.


Parking Brake and Actuation - Parking Brake Actuator

Removal and Installation

Removal

1. Using the Land Rover approved diagnostic system, drive the parking brake to the 'mounting position'.
2. Isolate the parking brake electrical circuit.

- Remove fuse number 8 from the BJB.

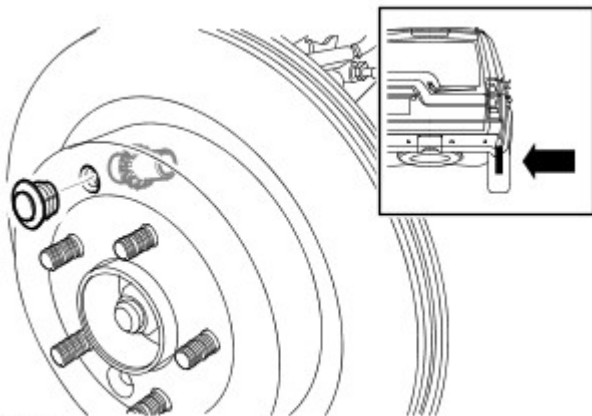
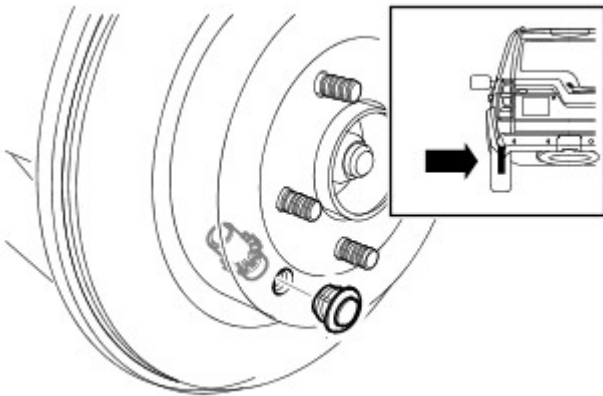
3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

4. Remove the rear wheels and tires.

5. Release the parking brake shoe adjustment.

- Remove the plug from the access hole in the brake disc.
- Using a suitable tool, rotate the brake shoe adjuster to release the adjustment.

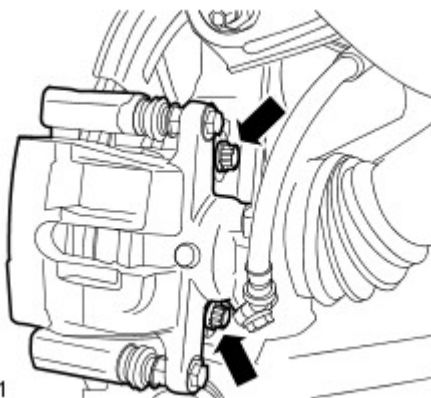


E48748

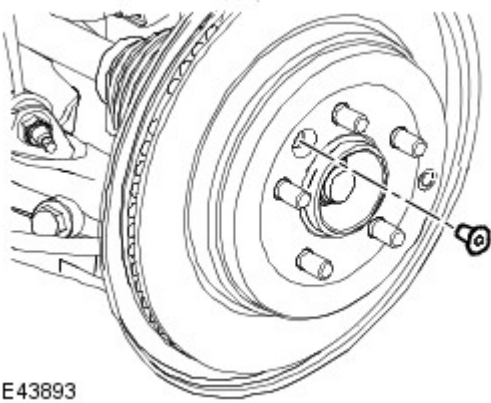
6.  **CAUTION:** Do not allow the brake caliper to hang on the brake hose.

Reposition the RH rear brake caliper.

- Remove the 2 bolts.
- Using a suitable tie strap, support the brake caliper.

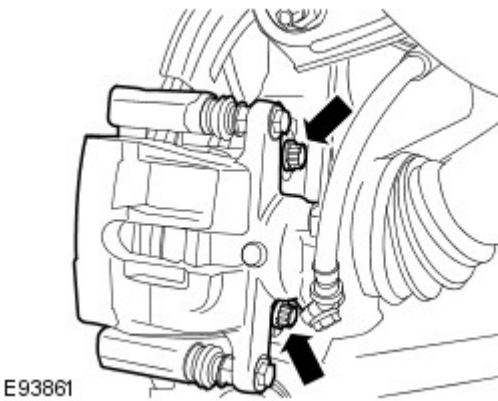


E93861



7. Remove the RH rear brake disc.

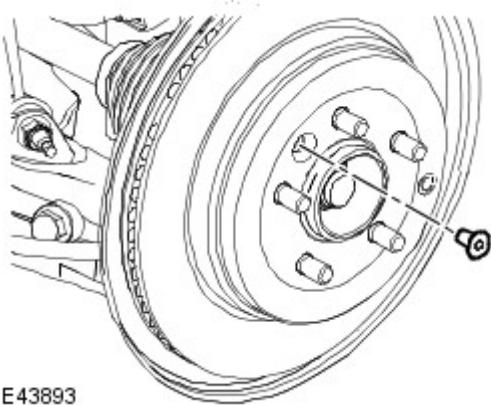
- Remove the screw.



8.  **CAUTION:** Do not allow the brake caliper to hang on the brake hose.

Reposition the LH rear brake caliper.

- Remove the 2 bolts.
- Using a suitable tie strap, support the brake caliper.

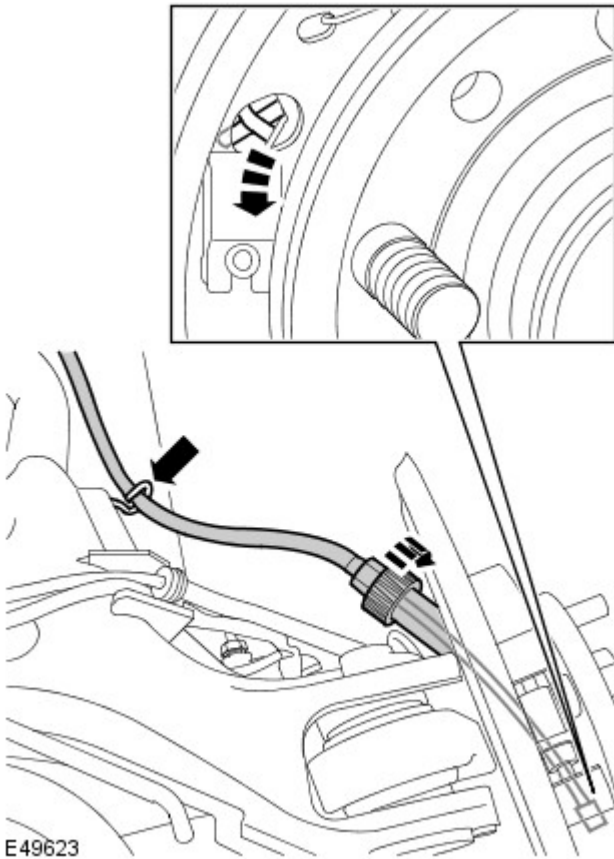


9. Remove the LH rear brake disc.

- Remove the screw.

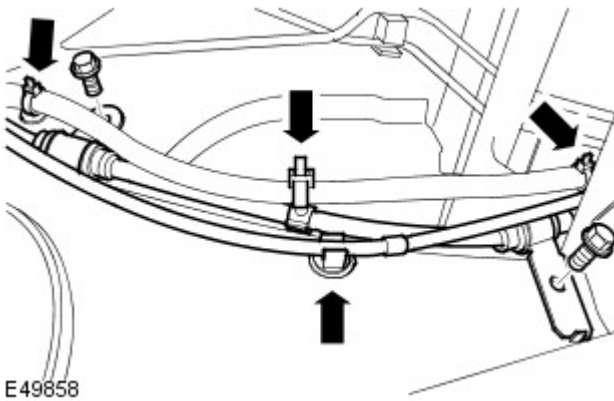
10. Disconnect both parking brake cables from the wheel hubs.

- Fully loosen the nut.
- Release the cable from the lower arm.
- Disconnect the inner cable from the brake shoe.

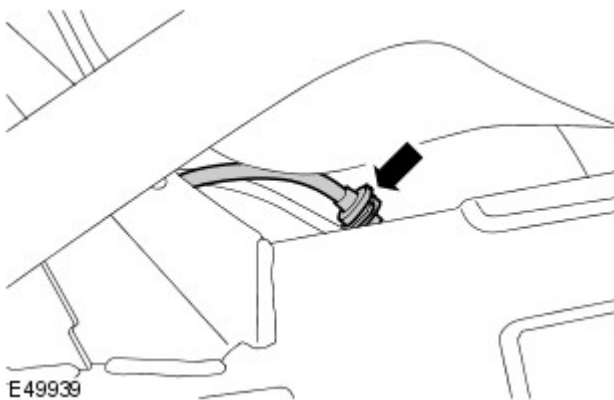


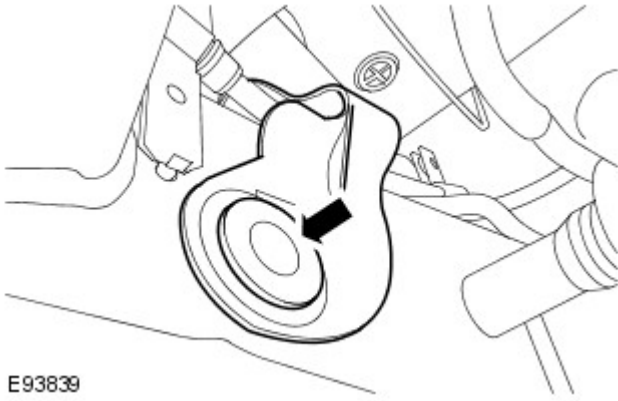
11. Release the LH parking brake cable.

- Remove the 2 bolts.
- Release the 3 wiring harness clips.
- Release the cable from the clip on the chassis.




12. Release the LH parking brake cable.



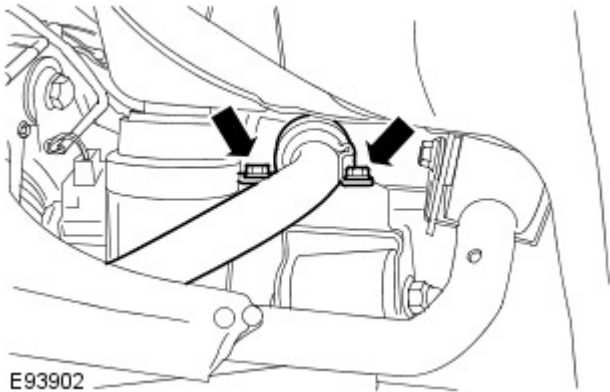


E93839

13.  **CAUTION:** The fuel tank breather line bracket can be easily damaged when releasing it from the chassis.

Release the fuel tank breather line bracket.

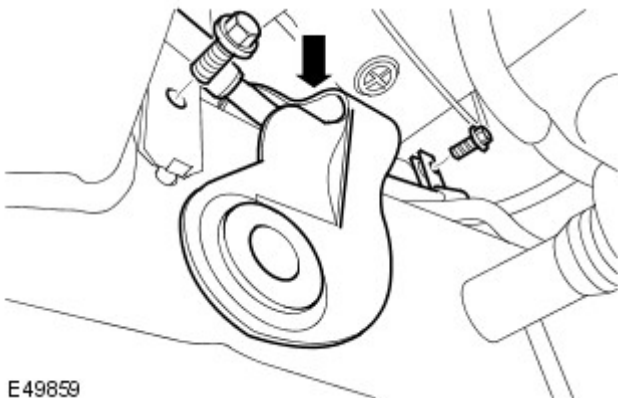
- Remove the plastic insert.



E93902

14. Raise the RH side of the rear stabilizer bar.

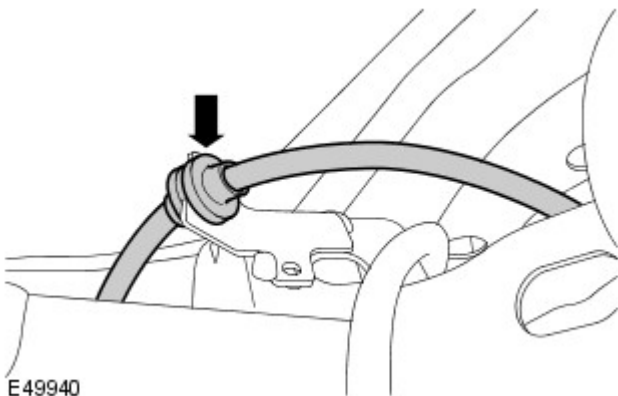
- Loosen the 2 bolts.



E49859

15. Release the RH parking brake cable.

- Remove the 2 bolts.
- Release the parking brake cable from the 2 pipe clips.
- Release the cable from the clip on the chassis.

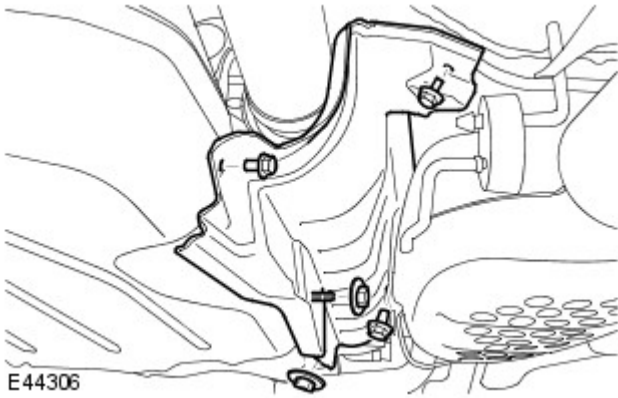



E49940

16. Release the RH parking brake cable.

17. Remove the fuel tank heat shield.

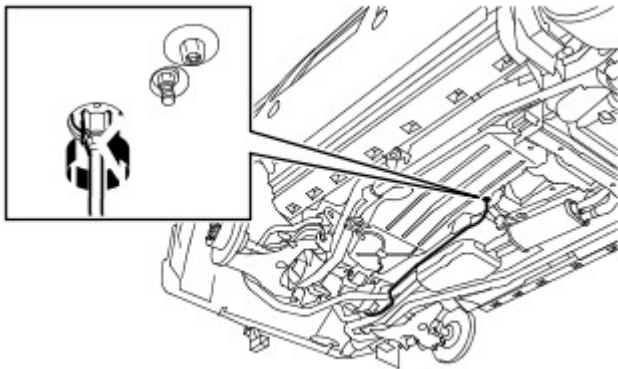
- Remove the 3 bolts and 2 nuts.




18.  **CAUTION:** Inspect the parking brake emergency release cable to body seal and replace if damaged.

- **NOTE:** Note the fitted position of the parking brake emergency release cable to body seal.

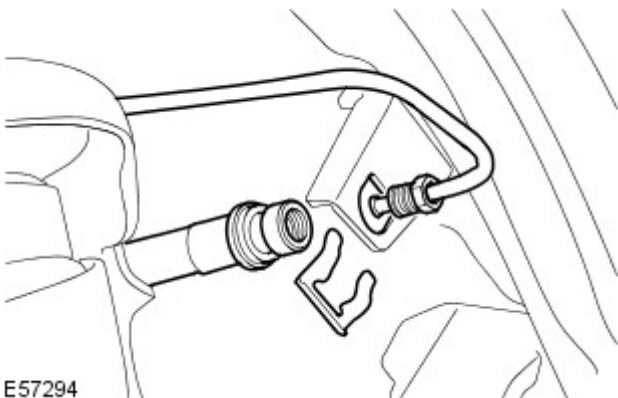
Release the parking brake emergency release cable.



19.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

RH side rear: Disconnect the brake line.

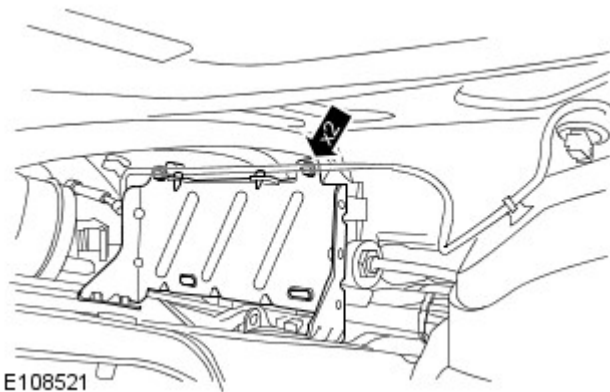
- Position an absorbent cloth to collect fluid spillage.
- Disconnect the line union.
- Remove the clip.



20. **NOTE:** Note the routing of the parking brake emergency release cable.

Displace the parking brake actuator and cable assembly.

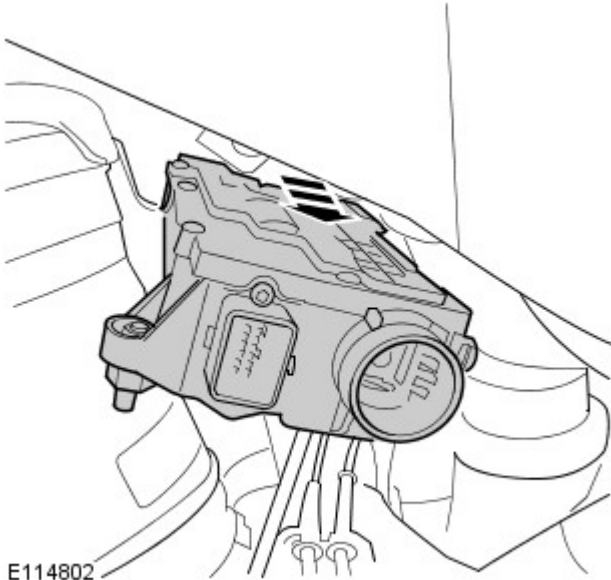
- Disconnect the electrical connector.
- Remove the 2 nuts.



21. NOTE: Brake cable shown removed for clarity.

Remove the parking brake actuator and cable assembly.

- Withdraw from the RH rear wheel arch aperture.



E114802

Installation

1. NOTE: Note the routing of the parking brake emergency release cable.

Install the parking brake actuator and cable assembly.

- Install the 2 nuts.
- Connect the electrical connector.

2. NOTE: Remove and discard the blanking caps.

RH side rear: Connect the brake line.

- Clean the component mating faces.
- Secure the clip.
- Tighten the brake line union to 16 Nm (12 lb.ft).

3. ⚠ CAUTION: Make sure the parking brake emergency release cable to body seal is installed correctly.

Locate and secure the parking brake emergency release cable.

4. Install the fuel tank heat shield.

- Tighten the bolts to 6 Nm (4 lb.ft).
- Tighten the nuts to 3 Nm (2 lb.ft).

5. Secure the fuel tank breather line bracket.

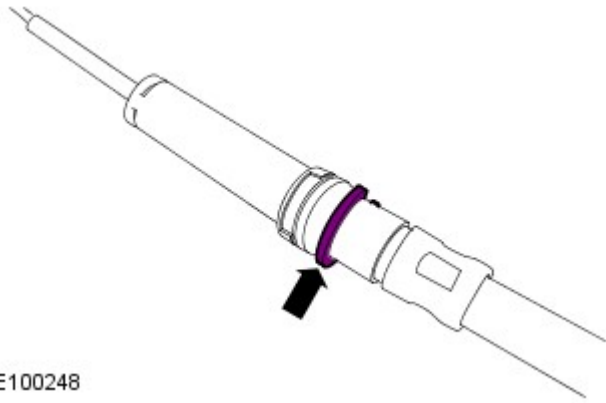
- Install the plastic insert.

6. Locate and secure the RH parking brake cable.

- Tighten the bolts to 22 Nm (16 lb.ft).
- Secure the parking brake cable to the 2 pipe clips.
- Secure the cable grommet to the integrated body frame bracket.

7. Locate and secure the LH parking brake cable.

- Tighten the bolts to 22 Nm (16 lb.ft).
- Secure the wiring harness.
- Secure the cable grommet to the integrated body frame bracket.



E100248

8. NOTE: Make sure that the brake cable circlip is positioned as shown.

Connect the parking brake cables to the wheel hubs.

- Connect the cable to the brake shoe lever.
- Locate the cable to the backplate.
- Tighten the nut to 8 Nm (6 lb.ft).

9. ⚠ CAUTION: Make sure that the component is clean, free of foreign material and lubricant.

Install the LH rear brake disc.

- Tighten the Torx screw to 35 Nm (26 lb.ft).

10. Secure the LH rear brake caliper.

- Remove and discard the tie strap.
- Tighten the bolts to 115 Nm (85 lb.ft).

11. ⚠ CAUTION: Make sure that the component is clean, free of foreign material and lubricant.

Install the RH rear brake disc.

- Tighten the Torx screw to 35 Nm (26 lb.ft).

12. Secure the RH rear brake caliper.

- Remove and discard the tie strap.
- Tighten the bolts to 115 Nm (85 lb.ft).

13. Adjust the parking brake shoes.

For additional information, refer to: [Parking Brake Shoe and Lining Adjustment](#) (206-05 Parking Brake and Actuation, General Procedures).

14. Bleed the brake system.

For additional information, refer to: [Component Bleeding](#) (206-00 Brake System - General Information, General Procedures).

15. Install the wheels and tires.

- Tighten the wheel nuts to 140 Nm (103 lb.ft).

16. Install fuse number 8 into the BJB.

17. Using the Land Rover approved diagnostic system, calibrate the parking brake actuator on an even surface.

18. Apply and release hand brake to confirm operation.

Parking Brake and Actuation - Parking Brake Shoes

Removal and Installation


Removal

• NOTE: If the parking brake shoes or the brake discs have been removed for access to other components then DO NOT carry out the bedding in procedure.

1. Using the Land Rover approved diagnostic system, drive the parking brake to the 'mounting position'.

2. Isolate the parking brake electrical circuit.

- Remove fuse number 8 from the BJB.

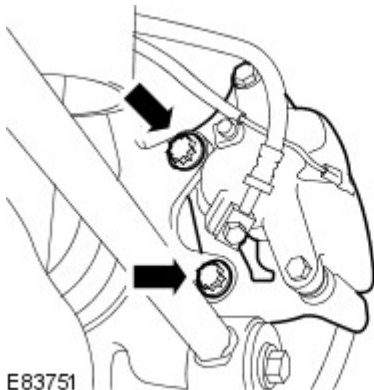
3.  WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.


Raise and support the vehicle.

4. Remove the wheels and tires.

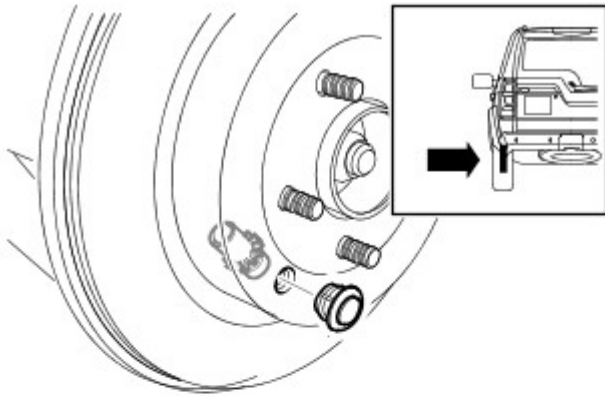
5. Release the brake caliper.

- Remove the brake caliper anchor bolts.



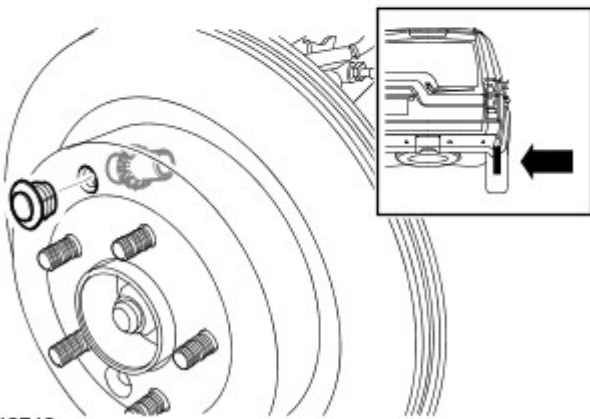
6.  CAUTION: Do not allow the brake caliper to hang on the brake hose.

Tie the brake caliper aside.

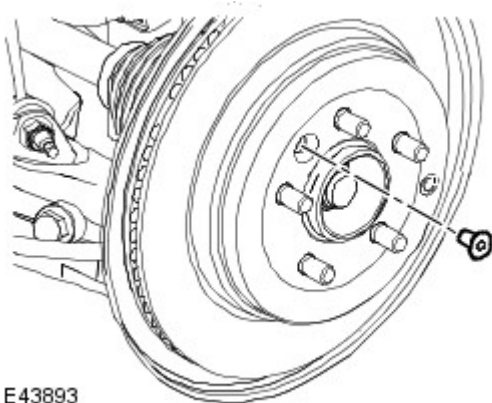


7. Release the park brake shoe adjustment.

- Remove the plug from the access hole in the brake disc.
- Using a suitable tool, rotate the brake shoe adjuster to release the adjustment.



E48748



8. Remove the brake disc.

- Remove the Torx screw.

E43893

9. CAUTIONS:



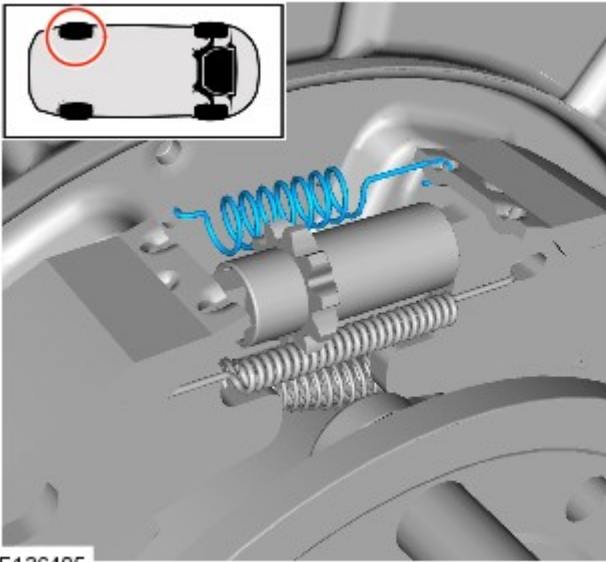
Make sure that the green bias spring is installed to the right hand parking brake shoes and the red bias spring is installed to the left hand parking brake shoes.



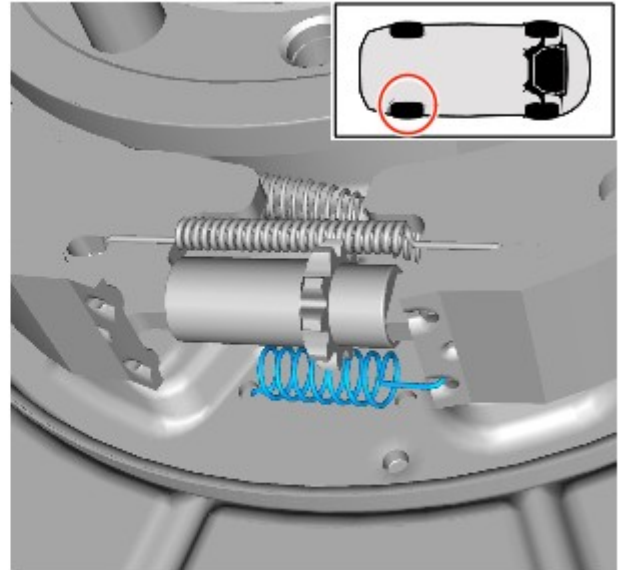
Make sure the brake shoe spring is not over stretched.

- **NOTE: If equipped.**

Remove the bias spring(s).



E136405



10. Remove the adjuster and return spring.

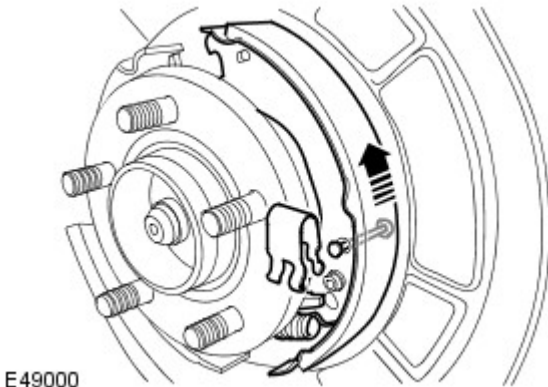
- Release the parking brake shoe adjuster to the minimum adjustment.



E48999

11. Remove the primary brake shoe.

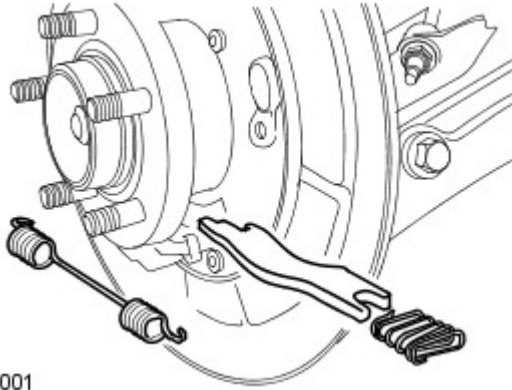
- Remove the hold-down spring and retaining pin.
- Pivot the shoe to release it from the spreader plate and return spring.



E49000

12. Remove the spreader plate and spring.

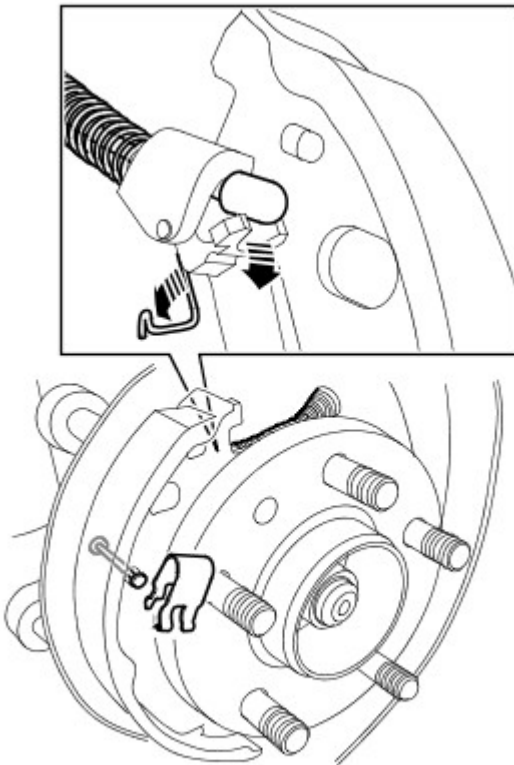
13. Remove the return spring.



E49001

14. Remove the secondary brake shoe.


- Remove the hold-down spring and retaining pin.
- Disconnect the parking brake cable retaining spring from the brake shoe lever.
- Release the parking brake cable.



E49002

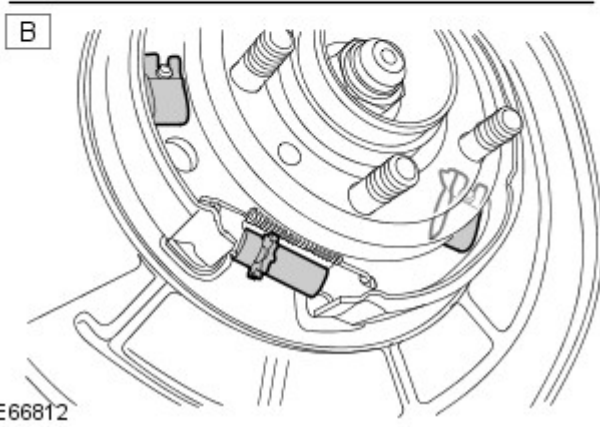
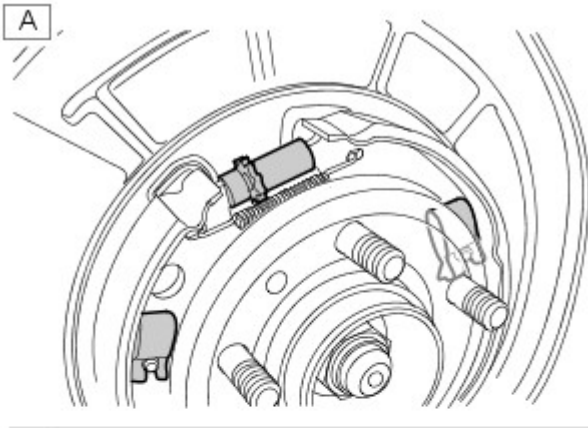
15. Repeat the above procedure for the other side.

Installation

1.  **WARNING:** Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.




Clean the backing plate and apply grease to the brake shoe contacts.

2. Clean the adjuster and set it to its minimum extension.



E66812

3. CAUTIONS:


-  Make sure the brake shoe spring is not over stretched.
-  Make sure the closed end of the retaining clip is installed facing the brake shoe adjuster. Failure to follow this instruction may result in damage to the vehicle.
-  Illustration 'A' is the LH side and 'B' is the RH side.

Install the secondary brake shoe.




- Connect the parking brake cable.
- Connect the parking brake cable retaining spring to the brake shoe lever, making sure the spring is not twisted.
- Install the hold-down spring and retaining pin.

4. Install the spreader plate and the spring.

- Using a tie strap, tie back the spreader plate spring.

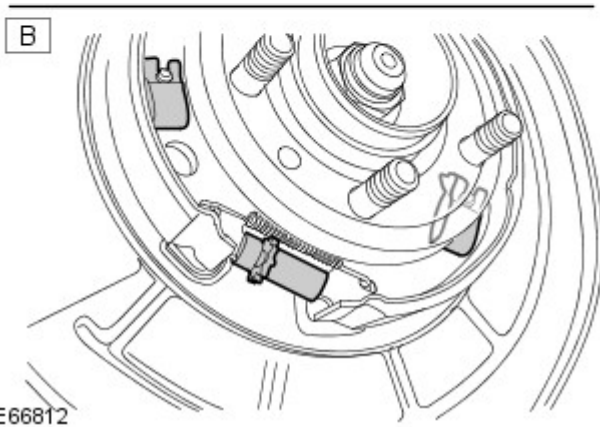
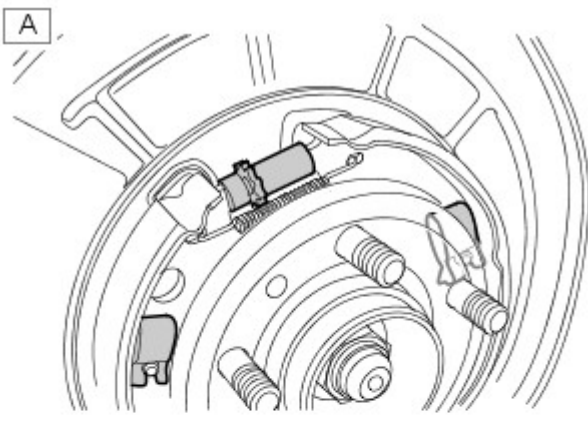
5.  WARNING: Make sure the return spring and the adjuster spring are correctly installed to the primary shoe.

• **CAUTIONS:**

-  Make sure the brake shoe spring is not over stretched.
-  Make sure the closed end of the retaining clip is installed facing the brake shoe adjuster. Failure to follow this instruction may result in damage to the vehicle.
-  Illustration 'A' is the LH side and 'B' is the RH side.

Install the primary brake shoe.

- Install the return spring.
- Connect the primary brake shoe to the return spring.
- Locate the primary brake shoe to the spreader plate.
- Install the hold-down spring and retaining pin.



E66812

6.  CAUTION: Make sure the brake shoe spring is not over

stretched.

Install the brake shoe adjuster and the retaining spring.

7. Remove and discard the spreader plate spring tie strap.

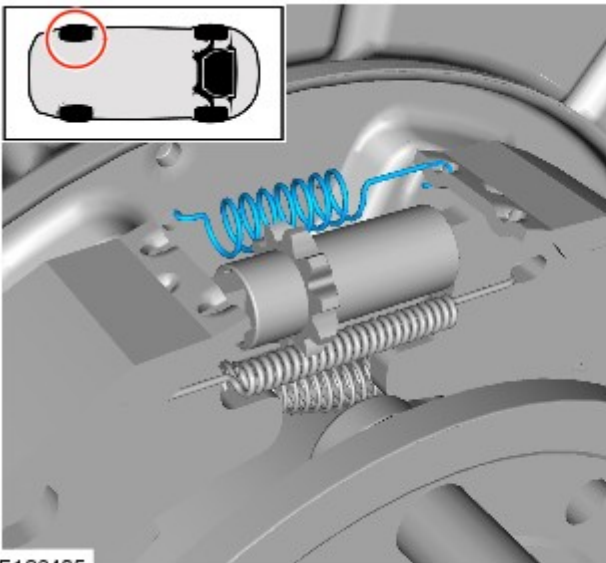
8. CAUTIONS:

 Make sure that the green bias spring is installed to the right hand parking brake shoes and the red bias spring is installed to the left hand parking brake shoes.

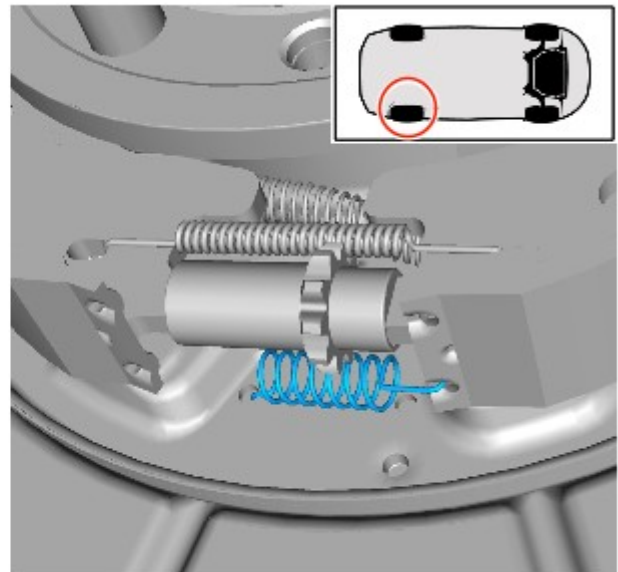
 Make sure the brake shoe spring is not over stretched.

• **NOTE: If equipped.**

Install the bias spring(s).



E136405



9. Make sure the brake disc and hub mating surfaces are clean.

10. Install the brake disc.

- Tighten the Torx screw to 35 Nm (26 lb.ft).

11. Install the brake caliper.

- Tighten the bolts to 115 Nm (85 lb.ft).

12. Repeat the above procedure for the other side.

13. Adjust the parking brake.

For additional information, refer to: [Parking Brake Shoe and Lining Adjustment](#) (206-05 Parking Brake and Actuation, General Procedures).

14. Install the wheels and tires.

- Tighten the wheel nuts to 140 Nm (103 lb.ft).

15. Install fuse number 8 into the BJB.

Hydraulic Brake Actuation -

General Specifications

Item	Specification
Master cylinder bore diameter:	
Primary	27 mm (1.1 in)
Secondary	20.6 mm (0.8 in)
Stroke	36 mm (1.4 in)

Torque Specifications

Description	Nm	lb-ft
Brake pedal nut and bolt - Automatic gearbox	45	33
Brake pedal bracket Torx bolts - Automatic gearbox	10	7
Brake booster to brake pedal bracket nuts - Automatic gearbox	25	18
Brake master cylinder nuts	26	19
Brake pipe unions	18	13

Hydraulic Brake Actuation - Hydraulic Brake Actuation

Description and Operation

COMPONENT LOCATIONS

- NOTE: RHD shown, LHD similar



E48285

Item	Part Number	Description
1	-	Brake pedal (automatic shown)
2	-	Brake warning indicator (NAS)
3	-	Brake warning indicator (all except NAS)

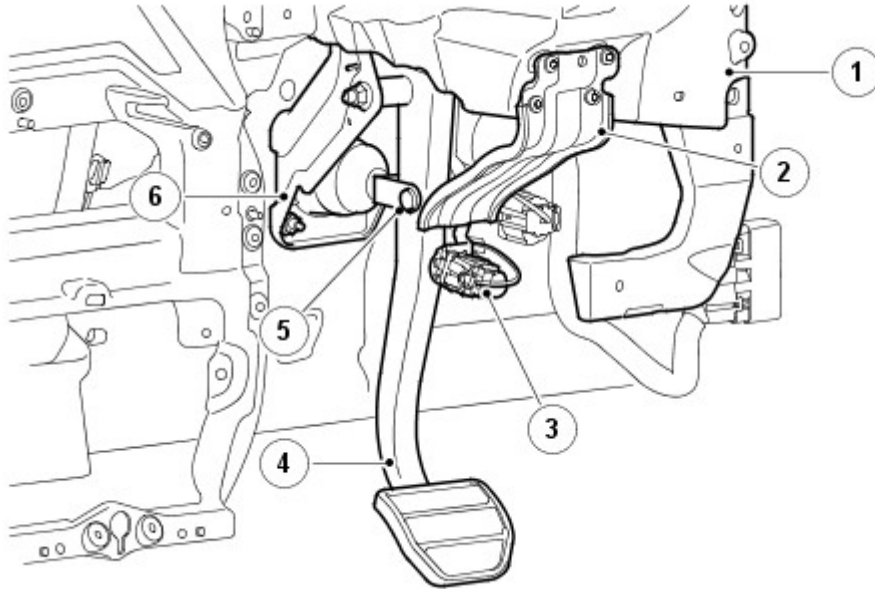
4	-	Brake pipes and hoses
5	-	Brake master cylinder and reservoir

GENERAL

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

BRAKE PEDAL

- NOTE: Automatic gearbox model shown, manual gearbox model similar



E48286

Item	Part Number	Description
1	-	In-vehicle cross beam
2	-	Brake pedal buffer
3	-	Stoplamp switch
4	-	Brake pedal
5	-	Clevis pin and clip
6	-	Brake pedal bracket

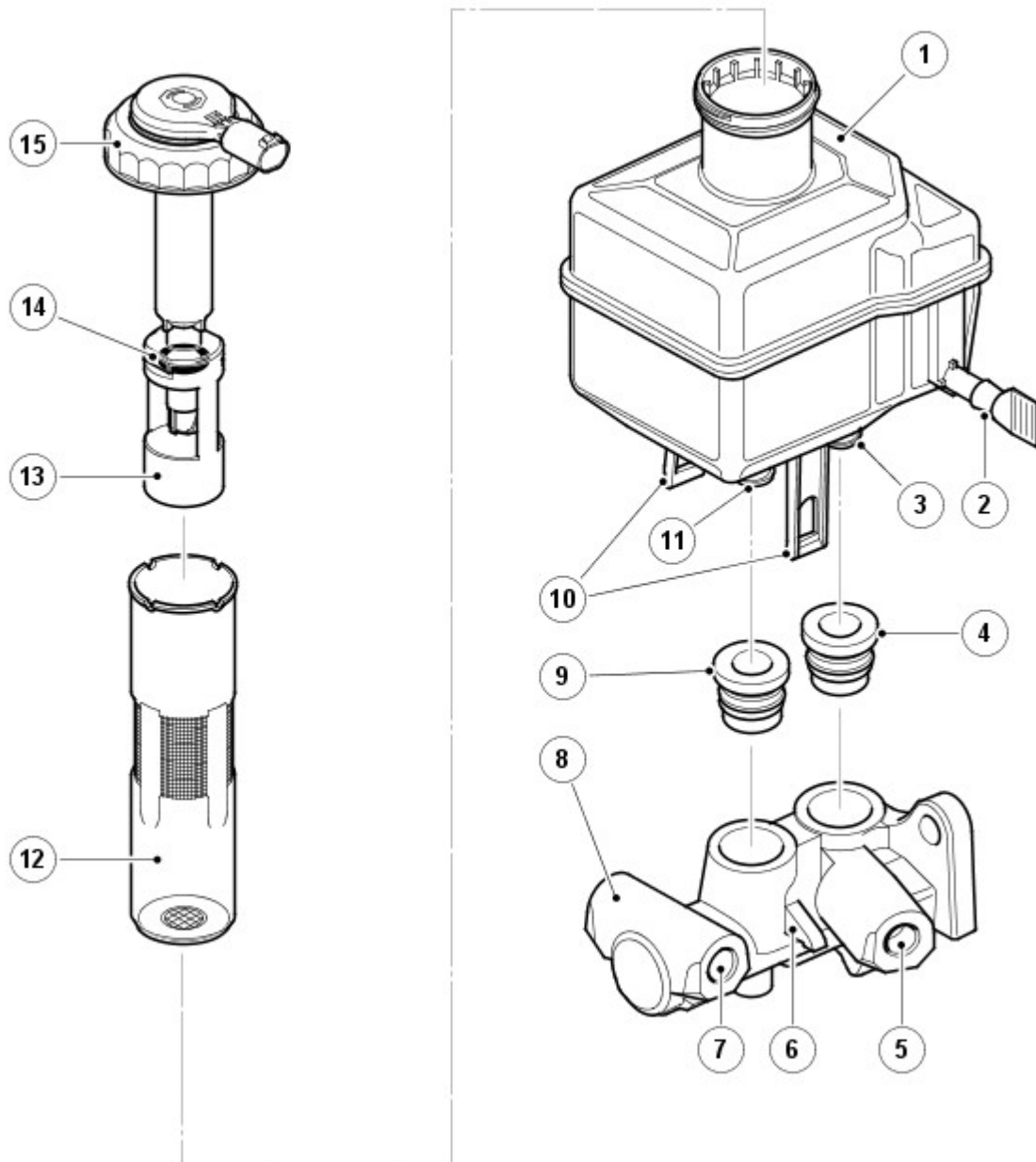
The brake pedal is mounted in a bracket attached to the rear side of the engine bulkhead. On Left Hand Drive (LHD) manual gearbox models, the brake pedal shares a bracket and pivot bolt with the clutch pedal. On Right Hand Drive (RHD) manual gearbox models, the brake pedal has a separate bracket. A clevis pin and clip connect the brake pedal to the push rod of the brake booster. A brake pedal buffer is installed on the in-vehicle cross beam to restrain rearward movement of the brake pedal in an accident.

The stoplamp switch is mounted in the brake pedal bracket and operated by the brake pedal.

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

BRAKE MASTER CYLINDER AND RESERVOIR

- NOTE: RHD version shown, LHD version similar



E48287

Item	Part Number	Description
1	-	Reservoir
2	-	Clutch outlet spigot and sealing cap
3	-	Primary outlet spigot
4	-	Reservoir to master cylinder seal, primary inlet
5	-	Primary outlet port
6	-	Reservoir securing lug
7	-	Secondary outlet port
8	-	Cylinder housing
9	-	Reservoir to master cylinder seal, secondary inlet
10	-	Reservoir securing straps
11	-	Secondary outlet spigot
12	-	Filter
13	-	Float
14	-	Magnet
15	-	Reservoir cap and level switch

The brake master cylinder and reservoir is attached to the front of the brake booster, on the driver side of the engine compartment.

Master Cylinder

The brake master cylinder consists of a cylinder housing containing two pistons in tandem. The rear piston produces pressure for the primary circuit and the front piston produces pressure for the secondary circuit. The pistons incorporate center valves with a high flow rate to ensure there is always sufficient fluid available at the hydraulic control unit for stability control operations.

When the brake pedal is pressed, the front push rod in the brake booster pushes the primary piston along the bore of the cylinder housing. This produces pressure in the primary pressure chamber which, in conjunction with the primary spring, overcomes the secondary spring and simultaneously moves the secondary piston along the bore. The initial movement of the pistons, away from the piston stops, closes the primary and secondary center valves. Further movement of the pistons then pressurizes the fluid in the primary and secondary pressure chambers, and thus the brake circuits. The fluid in the chambers behind the pistons is unaffected by the movement of the pistons and can flow unrestricted through the feed holes between the chambers and the reservoir.

When the brake pedal is released, the primary and secondary springs push the pistons back down the bore of the cylinder housing. As the pistons contact the piston stops, the primary and secondary center valves open, which allows fluid to circulate unrestricted between the two hydraulic circuits and the reservoir, through the center valves, the chambers behind the pistons and the cylinder housing inlets.

Should a failure occur in one of the brake circuits, the remaining brake circuit will still operate effectively, although brake pedal travel and vehicle braking distances will increase.

Reservoir

The reservoir is installed on top of the master cylinder to provide a supply of brake fluid for the primary and secondary circuits of the brake system. On manual gearbox models, the reservoir also provides a supply of brake fluid for the clutch. For additional information, refer to: [Clutch Controls](#) (308-02 Clutch Controls - TDV6 2.7L Diesel, Description and Operation).

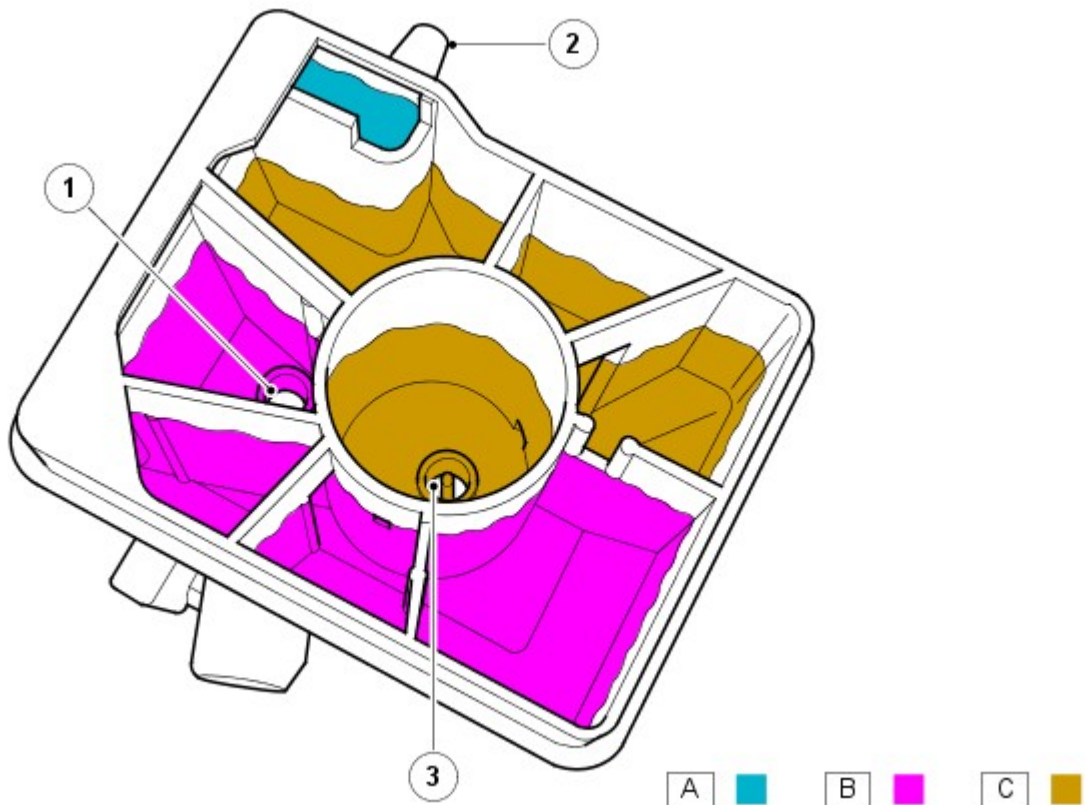
Two straps, integrated onto the sides of the reservoir, engage with lugs on the master cylinder to secure the reservoir in position. Two outlet spigots on the underside of the reservoir locate in seals installed in the inlet ports of the master cylinder. An outlet spigot is installed on the left side of the reservoir for the clutch hydraulic circuit, if required. On automatic gearbox models, the clutch outlet spigot is sealed with a cap, formed during manufacture of the reservoir, which is only removed if the reservoir is installed on a manual gearbox model.

The reservoir is internally divided to isolate the circuits from each other at low fluid levels, and so prevent a leak in one circuit from disabling the other circuit(s). The dividing walls support a central well and divide the area around the well into a further eight separate compartments. The well forms an extension of the filler neck and contains the filter and the fluid level switch.

The well and the surrounding compartments are interconnected by slots in the dividing walls. The slots are positioned such that when the reservoir is full, fluid can move between the well and all of the surrounding compartments, but at low fluid levels the interior forms separate reservoirs for each circuit and the amount retained in each reservoir if there is a leak from one of the other circuits.

Reservoir Interior

- NOTE: A = Clutch reservoir; B = Primary circuit reservoir; C = Secondary circuit reservoir



E48288

Item	Part Number	Description
1	-	Primary outlet
2	-	Clutch outlet
3	-	Secondary outlet

The filler neck of the reservoir is sealed with a cap incorporating the level switch. The level switch is operated by a magnet, which is installed in the float on the bottom of the switch. The switch reacts to the influence of the magnetic field surrounding the magnet.

When the reservoir is full, the float rests against the bottom of the switch and holds the level switch open. When the fluid level decreases, the float moves down and the switch closes to connect a ground to the instrument cluster. When the ground is made, the instrument cluster illuminates the red Light Emitting Diode (LED) in the brake warning indicator. Vehicles with the high line instrument cluster also display an appropriate warning in the message center. For additional information, refer to: [Instrument Cluster](#) (413-01 Instrument Cluster, Description and Operation).

At the beginning of each ignition cycle, the instrument cluster performs a bulb check on the brake warning indicator; the indicator is illuminated amber for 1.5 seconds, then red for 1.5 seconds.

The instrument cluster broadcasts the status of the brake fluid level, on the high speed Controller Area Network (CAN) bus, to the Anti-lock Brake System (ABS) module. For additional information, refer to: [Anti-Lock Control - Traction Control](#) (206-09A Anti-Lock Control - Traction Control, Description and Operation).

BRAKE PIPES AND HOSES

The brake pipes and hoses connect the master cylinder to the wheel brakes via the hydraulic control unit. The pipes are arranged to provide a front and rear split braking system. The brakes on the front axle are operated by the primary system; the brakes on the rear axle are operated by the secondary system.

Hydraulic Brake Actuation - Brake Fluid Reservoir

Removal and Installation

Removal



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

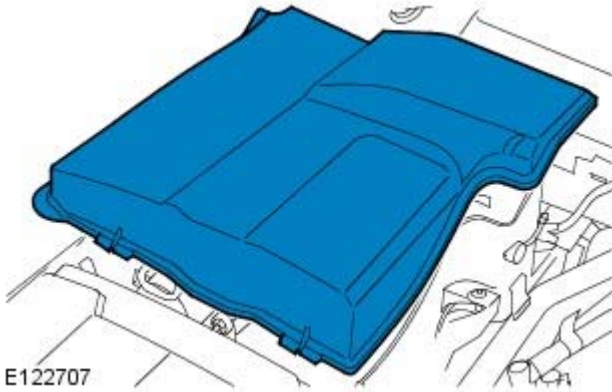
All vehicles



1. WARNING: Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the cover.



3. Position an absorbent cloth to collect fluid spillage.

4. Disconnect the low brake fluid warning indicator switch electrical connector.

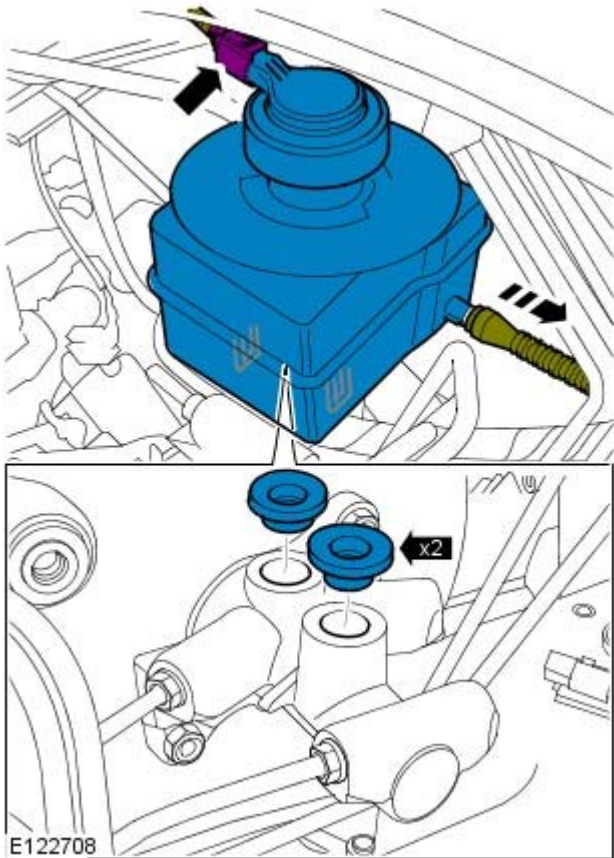
Vehicles with manual transmission



5. CAUTION: Always plug any open connections to prevent contamination.

Disconnect the clutch master cylinder supply line.

All vehicles



6.  CAUTION: Always plug any open connections to prevent contamination.

Remove the brake fluid reservoir.

- Release the 2 clips.
- Remove and discard 2 brake fluid reservoir seals.

Installation

All vehicles

1. Clean the components.
2. Install the brake fluid reservoir.
 - Install new brake fluid reservoir seals.

Vehicles with manual transmission

3. Connect the clutch master cylinder supply line.

All vehicles

4. Connect the low brake fluid warning indicator switch electrical connector.
5. Bleed the brake system using T4.
For additional information, refer to: [Brake System Bleeding](#) (206-00 Brake System - General Information, General Procedures).

Vehicles with manual transmission

6. Bleed the clutch system.
For additional information, refer to: [Clutch System Bleeding](#) (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

Hydraulic Brake Actuation - Brake Master Cylinder


Removal and Installation

Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

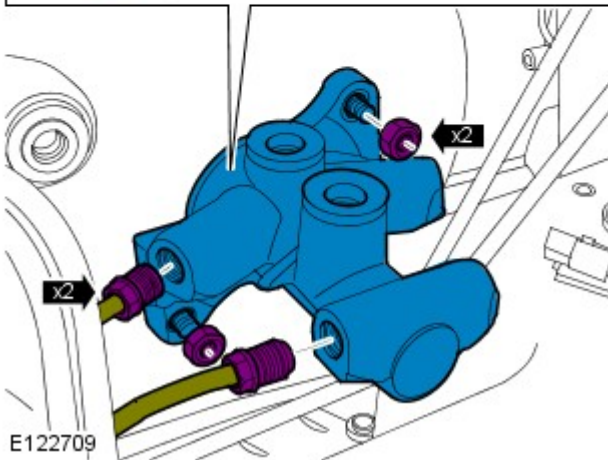
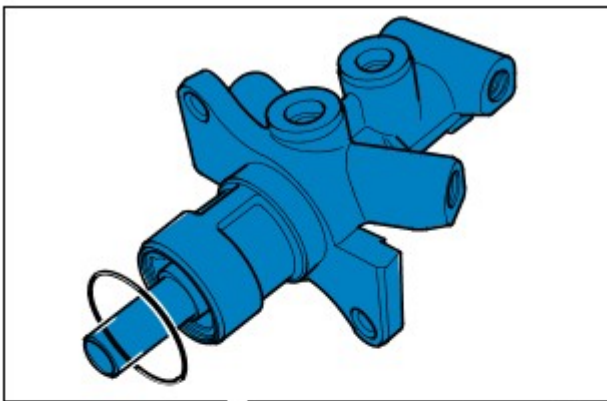
2. Remove the brake fluid reservoir.
For additional information, refer to: [Brake Fluid Reservoir](#) (206-06 Hydraulic Brake Actuation, Removal and Installation).

3.  **CAUTION:** Before the disconnection or removal of any components, make sure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

Disconnect the brake master cylinder brake tubes.

4. Remove the brake master cylinder.

- Remove the 2 nuts.
- Remove and discard the O-ring seal.



Installation

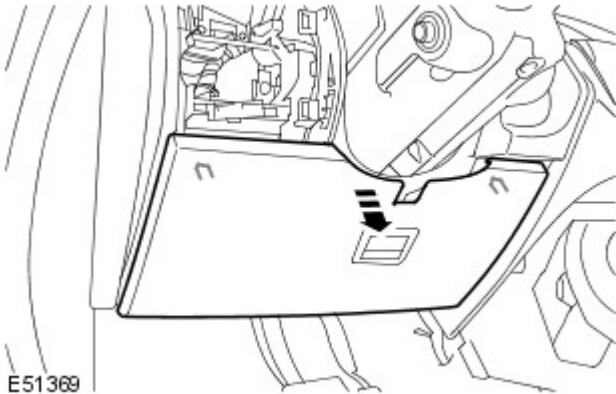
1. Install the brake master cylinder.
 - Install a new O-ring seal.
 - Tighten the nuts to 23 Nm (17 lb.ft).
2. Connect the brake tubes.
 - Tighten the brake tube unions to 18 Nm (13 lb.ft).
3. Install the brake fluid reservoir.
For additional information, refer to: [Brake Fluid Reservoir](#) (206-06 Hydraulic Brake Actuation, Removal and Installation).

Hydraulic Brake Actuation - Brake Pedal Vehicles With: 6HP28 6-Speed Automatic Transmission/6HP26 6-Speed Automatic Transmission

Removal and Installation

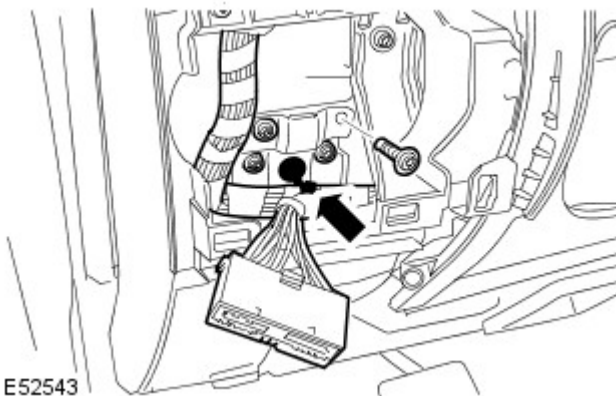
Removal

1. Remove the headlamp switch.
For additional information, refer to: Headlamp Switch (417-01, Removal and Installation).
2. Remove the stoplamp switch.
For additional information, refer to: [Stoplamp Switch](#) (417-01 Exterior Lighting, Removal and Installation).
3. Remove the instrument panel access panel.
 - Release the 2 clips.



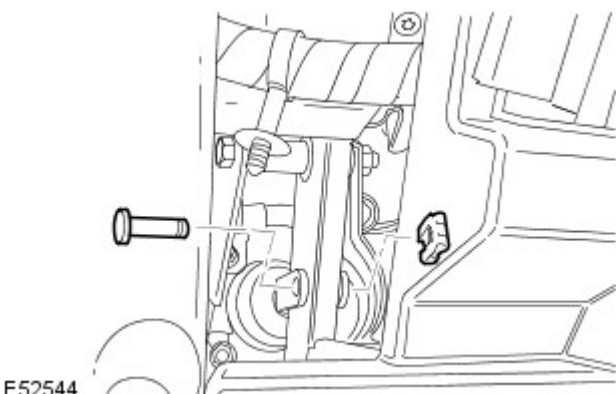
E51369

4. Remove the brake pedal bracket.
 - Release the wiring harness clip.
 - Remove the 4 Torx bolts.



E52543

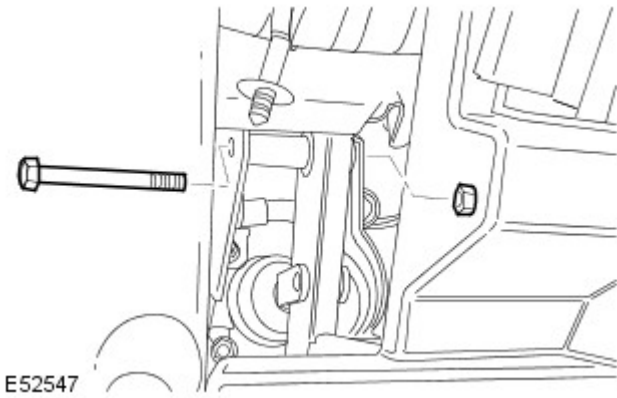
5. Remove the brake pedal clevis pin.
 - Remove the clip.



E52544

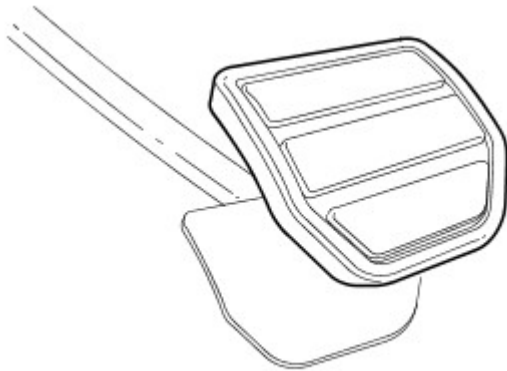
6. Remove the brake pedal.

- Remove the nut and bolt.



7. NOTE: Do not disassemble further if the component is removed for access only.

Remove the brake pedal pad.



Installation

1. Install the brake pedal pad.
2. Install the brake pedal.
 - Clean the component mating faces.
 - Tighten the nut and bolt to 45 Nm (33 lb.ft).
3. Install the brake pedal clevis pin.
 - Install the clip.
4. Install the brake pedal bracket.
 - Tighten the Torx bolts to 10 Nm (7 lb.ft).
 - Secure the wiring harness.
5. Install the instrument panel access panel.
 - Secure with the clips.
6. Install the stoplamp switch.
For additional information, refer to: [Stoplamp Switch](#) (417-01 Exterior Lighting, Removal and Installation).
7. Install the headlamp switch.
For additional information, refer to: [Headlamp Switch](#) (417-01, Removal and Installation).

Hydraulic Brake Actuation - Brake Pedal and Bracket Vehicles With: S6-53 6-Speed Manual Transmission

Removal and Installation

Removal

• NOTE: The brake pedal, clutch pedal and bracket is serviced as a complete assembly. The procedure to remove and install the assembly is shown in the clutch pedal procedure.

1. Remove the clutch and brake pedal assembly.
For additional information, refer to: [Clutch Pedal](#) (308-02 Clutch Controls - TDV6 2.7L Diesel, Removal and Installation).

Installation

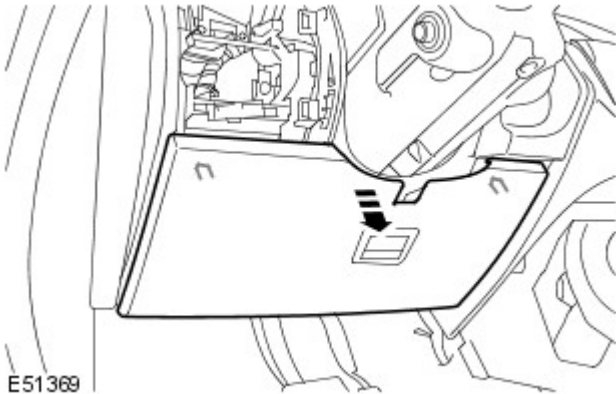
1. Install the clutch and brake pedal assembly.
For additional information, refer to: [Clutch Pedal](#) (308-02 Clutch Controls - TDV6 2.7L Diesel, Removal and Installation).

Hydraulic Brake Actuation - Brake Pedal and Bracket Vehicles With: 6HP28 6-Speed Automatic Transmission/6HP26 6-Speed Automatic Transmission

Removal and Installation

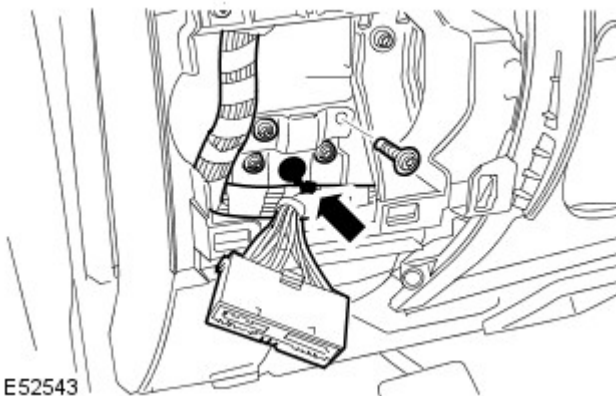
Removal

1. Remove the headlamp switch.
For additional information, refer to: Headlamp Switch (417-01, Removal and Installation).
2. Remove the stoplamp switch.
For additional information, refer to: [Stoplamp Switch](#) (417-01 Exterior Lighting, Removal and Installation).
3. Remove the instrument panel access panel.
 - Release the 2 clips.



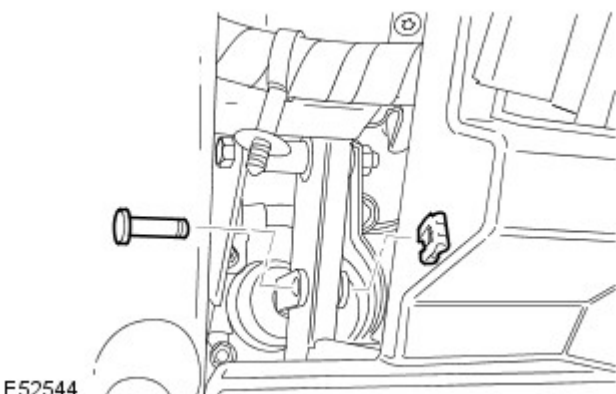
E51369

4. Remove the brake pedal bracket.
 - Release the wiring harness clip.
 - Remove the 4 Torx bolts.

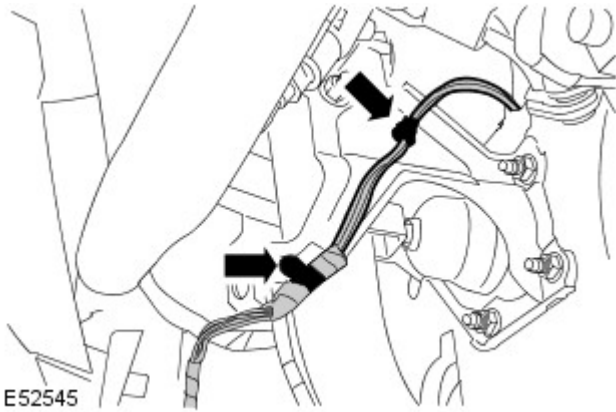


E52543

5. Remove the brake pedal clevis pin.
 - Remove the clip.

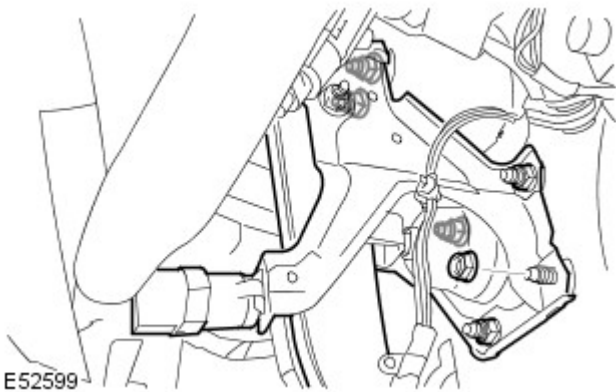


E52544



6. Release the stoplamp wiring harness.

- Release the 2 clips.



7. Remove the brake pedal assembly.

- Remove the 6 nuts.
- Position the brake booster forward to aid the removal of the brake pedal assembly.

Installation

1. Install the brake pedal assembly.

- Position the brake booster to the brake pedal bracket.
- Tighten the nuts to 25 Nm (18 lb.ft).

2. Secure the wiring harness.

- Secure the clips.

3. Install the brake pedal clevis pin.

- Install the clip.

4. Install the brake pedal bracket.

- Tighten the Torx bolt to 10 Nm (7 lb.ft).
- Secure the wiring harness.

5. Install the instrument panel access panel.

- Secure with the clips.

6. Install the stoplamp switch.

For additional information, refer to: [Stoplamp Switch](#) (417-01 Exterior Lighting, Removal and Installation).

7. Install the headlamp switch.

For additional information, refer to: [Headlamp Switch](#) (417-01, Removal and Installation).

Power Brake Actuation -

Sealant

Application	Land Rover Part No.
Brake vacuum pump - 2.7 Litre engine	8510302

General Specifications

Item	Specification
Brake booster type	Twin chamber 228 and 254 mm (9.0 and 10.0 in)
Boost ratio	7:1
Brake vacuum pump make and type:	
V6 - 2.7 litre diesel engine	Bosch 240cc SWP
V6 - 4.0 litre and V8 - 4.4 litre petrol engine	Hella UP28

Torque Specifications

Description	Nm	lb-ft
Brake booster nut	23	17
Brake master cylinder nuts	26	19
M12 brake pipe unions	16	12
M14 brake pipe unions	18	13
Brake pedal buffer bolts	10	7
Brake vacuum pump nuts - 4.0 and 4.4 litre engines	5	4
Brake vacuum pump bolts - 2.7 litre engine	23	17
Brake vacuum pump retaining stud - 2.7 litre engine	13	10
Brake vacuum pump retaining nut - 2.7 litre engine	13	10
High pressure fuel supply line retaining bolt - 2.7 litre engine	10	7
* Exhaust cross-over pipe nuts 2.7 litre engine	22	16
Exhaust cross-over pipe support bracket bolts - 2.7 litre	25	18
Exhaust manifold heatshield bolt - 2.7 litre	10	7

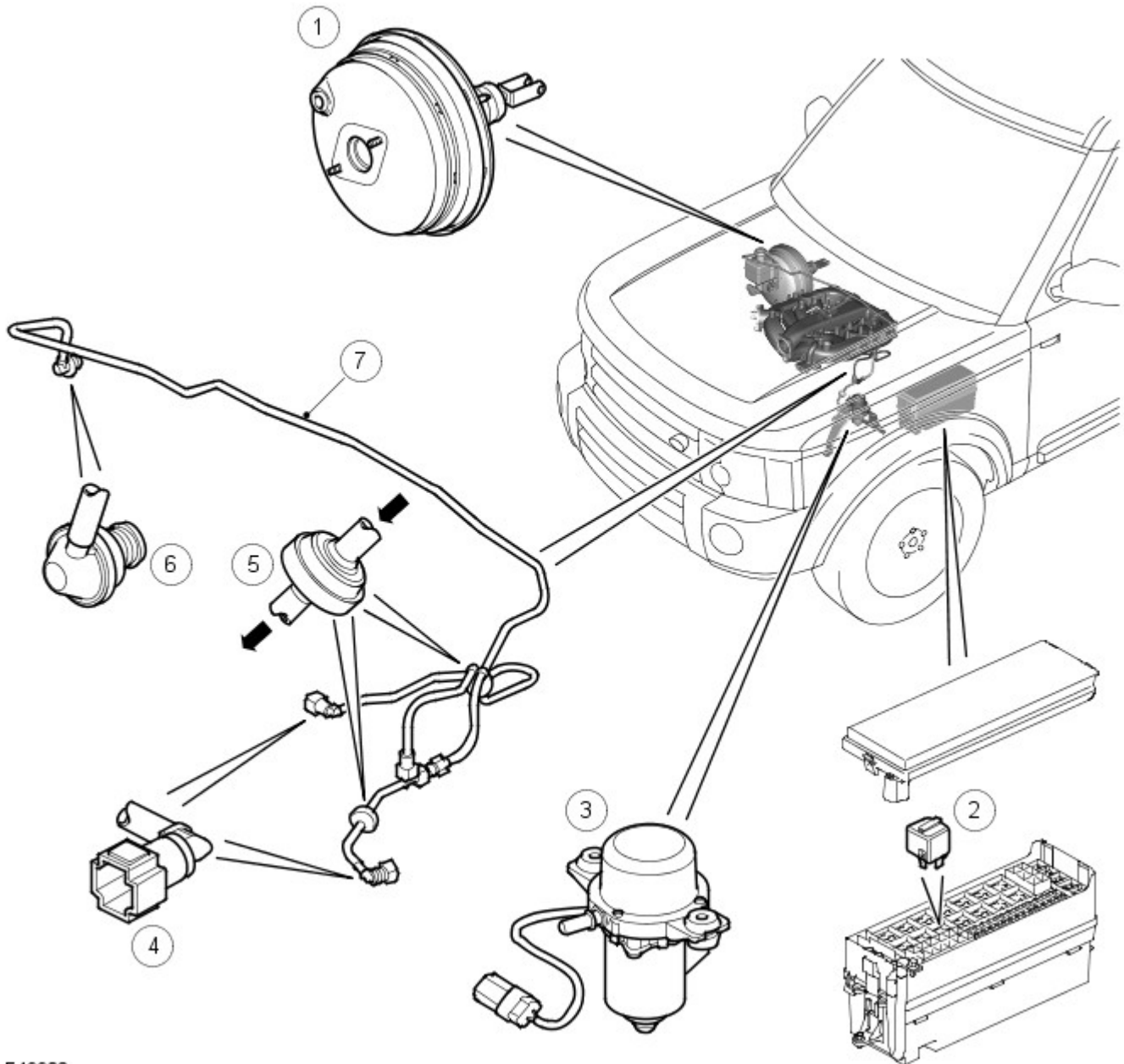
*** New nuts must be fitted**

Power Brake Actuation - Brake Booster

Description and Operation

COMPONENT LOCATIONS - 4.0L

• NOTE: RHD shown, LHD similar

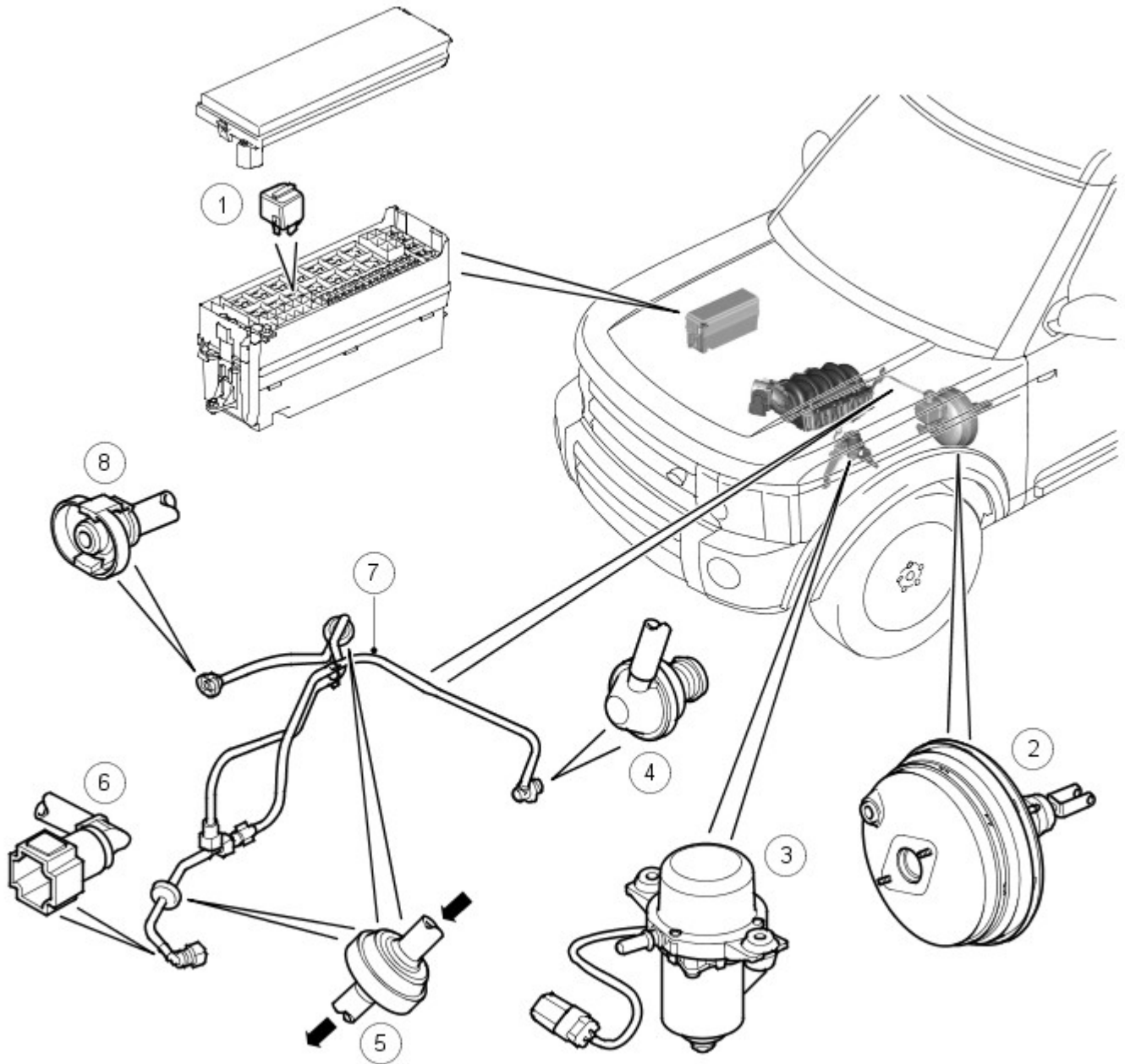


E49902

Item	Part Number	Description
1	-	Brake booster
2	-	Vacuum pump relay
3	-	Vacuum pump
4	-	Vacuum pipe connections to vacuum pump and inlet manifold
5	-	Check valve
6	-	Vacuum pipe connection to brake booster
7	-	Vacuum pipes

COMPONENT LOCATIONS - 4.4L

• NOTE: LHD shown, RHD similar

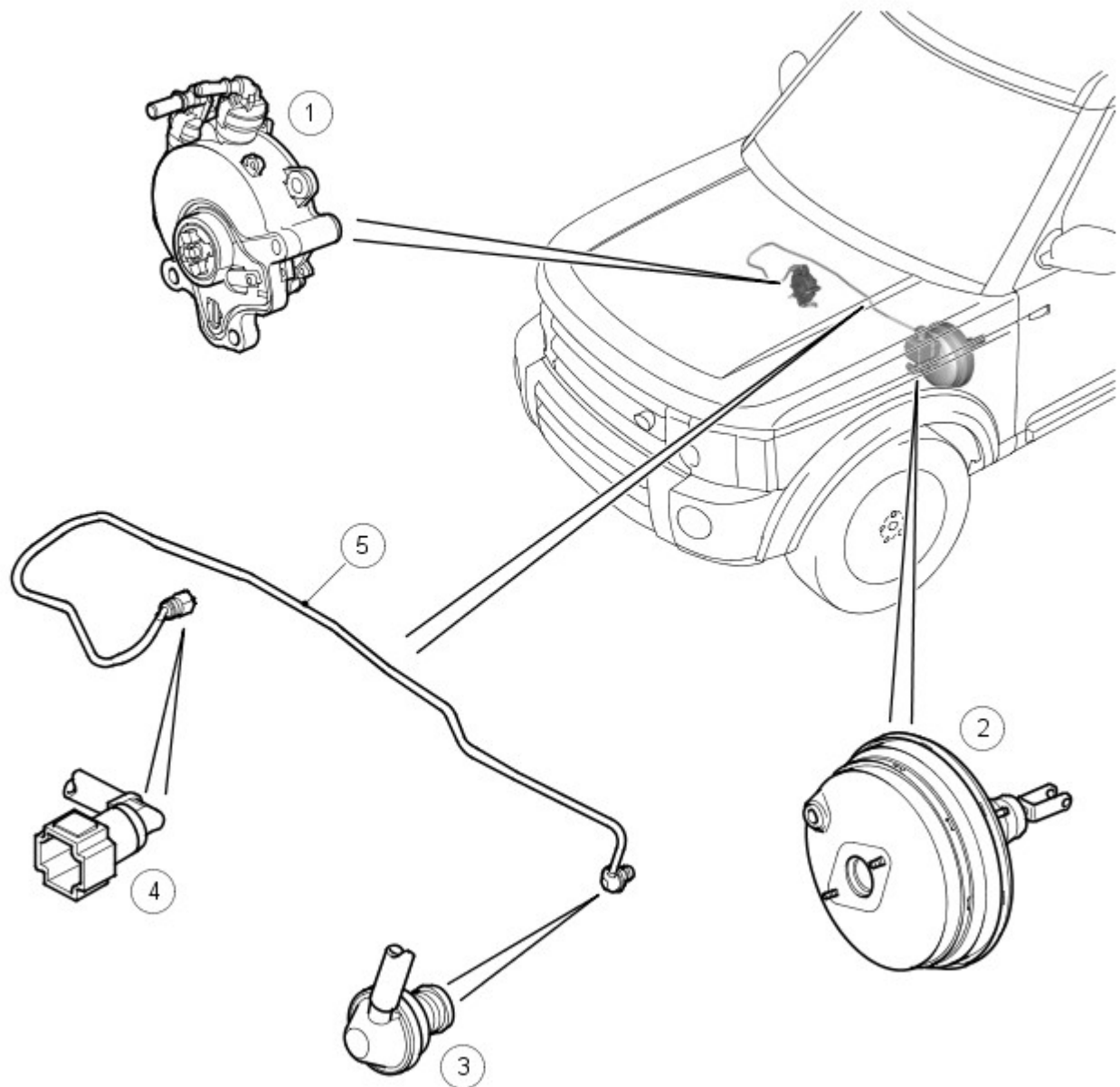


E49903

Item	Part Number	Description
1	-	Vacuum pump relay
2	-	Brake booster
3	-	Vacuum pump
4	-	Vacuum pipe connection to brake booster
5	-	Check valve
6	-	Vacuum pipe connection to vacuum pump
7	-	Vacuum pipes
8	-	Vacuum pipe connection to inlet manifold

COMPONENT LOCATIONS - 2.7L DIESEL

• NOTE: LHD shown



E49904

Item	Part Number	Description
1	-	Vacuum pump
2	-	Brake booster
3	-	Vacuum pipe connection to brake booster (includes check valve)
4	-	Vacuum pipe connection to vacuum pump
5	-	Vacuum pipes

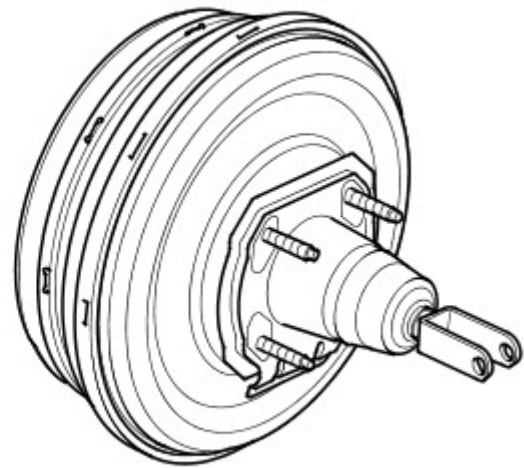
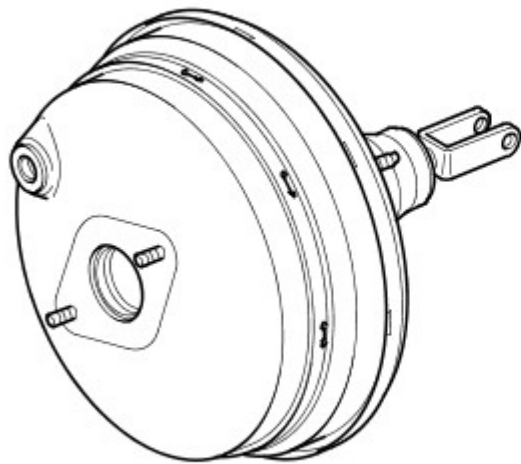
GENERAL

Power assistance for the brakes is provided by a vacuum operated brake booster. On petrol models, the vacuum is produced by the intake manifold and an electric vacuum pump. On diesel models, the vacuum is produced by an engine driven vacuum pump.

VACUUM PIPES

Plastic vacuum pipes connect the brake booster to the vacuum source. Check valves are incorporated into the vacuum pipes. On petrol models there are two in-line check valves, to maintain the vacuum in the brake booster when the throttle is open and the vacuum pump is not running, and prevent fuel vapor entering the brake booster. On diesel models there is a single check valve integrated into the vacuum pipe connection with the brake booster, to maintain the vacuum in the brake booster when the vacuum pump is operating at less than the optimum.

BRAKE BOOSTER

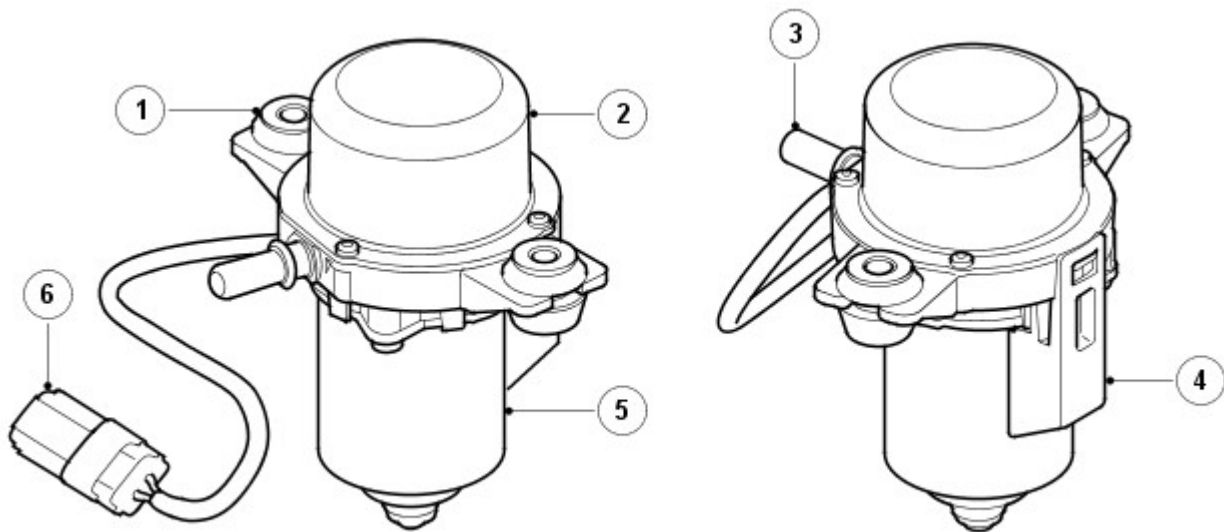


E49905

The brake booster is installed in the driver side of the engine compartment, on the engine bulkhead.

The brake booster is a dual diaphragm unit with a boost ratio of 8.0 : 1 and 28 bar loop-in in all engine variants. The input push rod is connected to the brake pedal. The output push rod locates in the primary piston of the brake master cylinder. A vacuum pipe, installed in a grommet in the front face of the housing, connects the brake booster to the intake manifold and electric vacuum pump (petrol models) or the engine driven vacuum pump (diesel models).

VACUUM PUMP (4.0L AND 4.4L)



E49906

Item	Part Number	Description
1	-	Anti-vibration mount
2	-	Pump cover
3	-	Vacuum pump inlet
4	-	Rubber shroud for exhaust port
5	-	Motor cover
6	-	Electrical connector

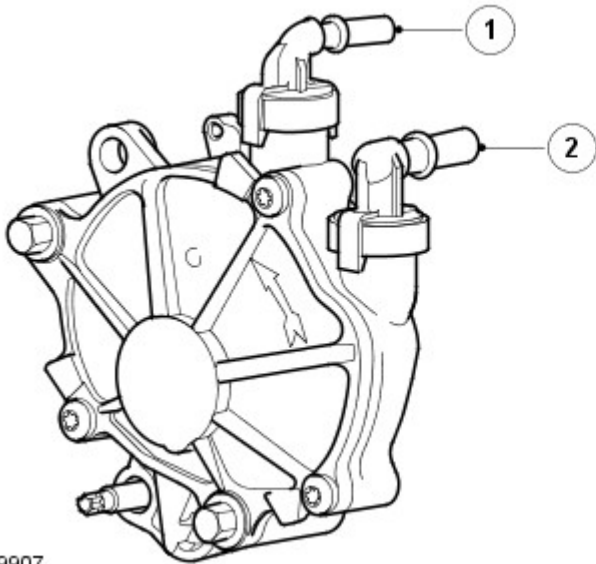
On petrol models the electric vacuum pump supplements the main vacuum supply from the engine manifold.

The vacuum pump is installed on a mounting bracket in the front left corner of the engine compartment. Two anti-vibration mounts on the vacuum pump are located on studs on the mounting bracket and secured with nuts.

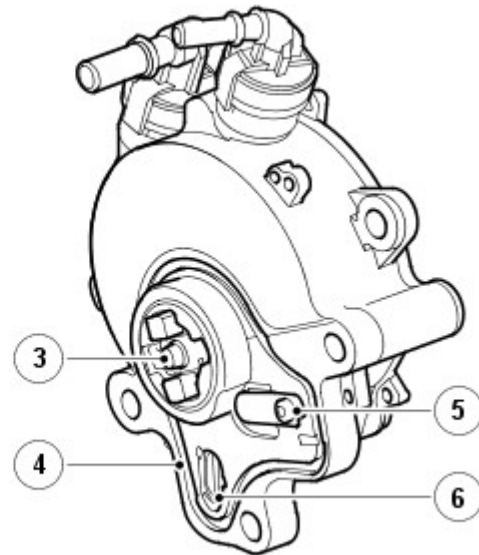
The vacuum pump consists of a radial vane pump driven by an electric motor. The rotor and vanes of the pump are made from a self-lubricating carbon based material. A stub pipe is installed in the inlet of the pump to provide a connection point for the vacuum pipe from the brake booster. A second stub pipe, which is covered by a rubber shroud, is installed in the outlet from the pump.

Operation of the vacuum pump is controlled by the Engine Control Module (ECM), which uses the brake vacuum pump relay in the Battery Junction Box (BJB) to switch power to the vacuum pump. The ECM controls the time for which the vacuum pump is switched on and has in-built safeguards to protect the pump from overuse, e.g. continuous running is not allowed so a minimum delay time is specified between applications.

VACUUM PUMP (2.7L DIESEL)



E49907



Item	Part Number	Description
1	-	Vacuum connection (not used)
2	-	Vacuum connection for brake booster
3	-	Drive dog
4	-	Seal
5	-	Oil inlet port
6	-	Oil return/air vent

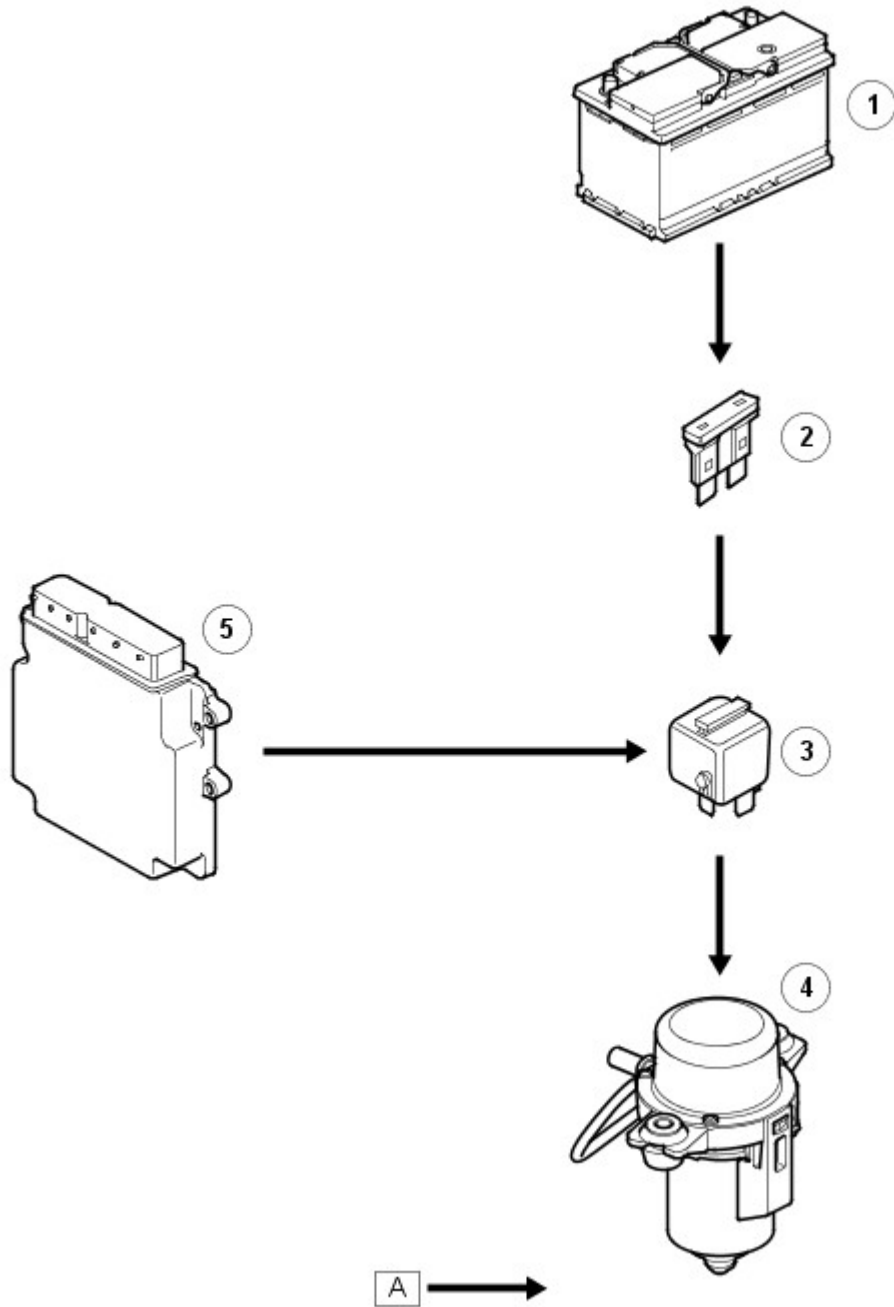
A vacuum pump is installed on diesel models as the air inlet system does not produce sufficient vacuum for satisfactory operation of the brake booster.

The vacuum pump is a radial vane pump which is attached to the rear of the RH cylinder head and driven at half engine speed by the exhaust camshaft. The vacuum pipe from the brake booster connects to an elbow on the rim of the vacuum pump.

The vacuum pump is lubricated and cooled by engine oil supplied to a port in the front face of the vacuum pump from a gallery in the cylinder head. The oil return is through a vent in the front face of the pump into a drain cavity in the cylinder head. Air extracted from the brake booster is vented into the drain cavity with the returning engine oil.

VACUUM PUMP CONTROL DIAGRAM (4.0L AND 4.4L)

- NOTE: A = Hardwired connection



E49908

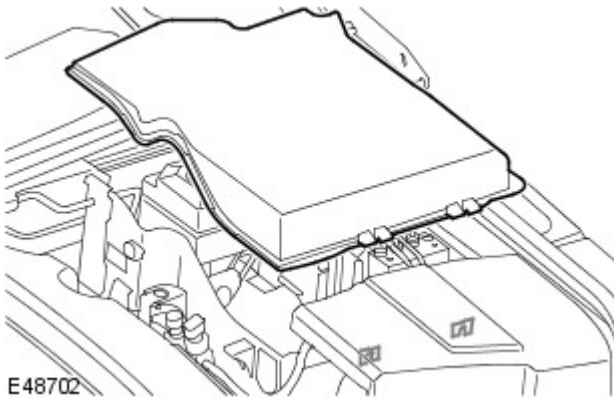
Item	Part Number	Description
1	-	Battery
2	-	Fuse 24E, battery junction box
3	-	Vacuum pump relay
4	-	Vacuum pump
5	-	Engine control module

Power Brake Actuation - Brake Booster

Removal and Installation

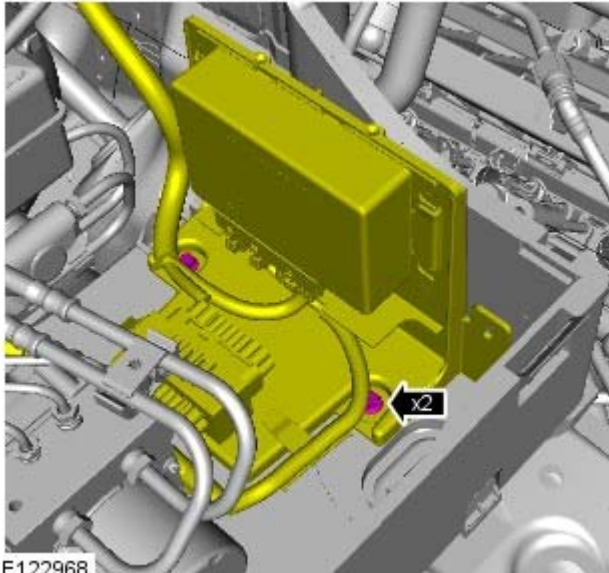
Removal

1. Pump the brake pedal until the brake vacuum assistance is exhausted.
2. Remove the auxiliary battery cover.
 - Release the 2 clips.



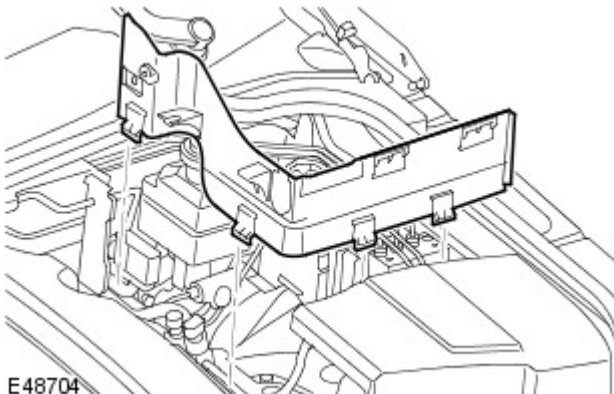
E48702

3. If installed, remove the auxiliary battery.
4. Detach the automatic transmission module bracket and position it to one side.
 - Remove the 2 bolts.

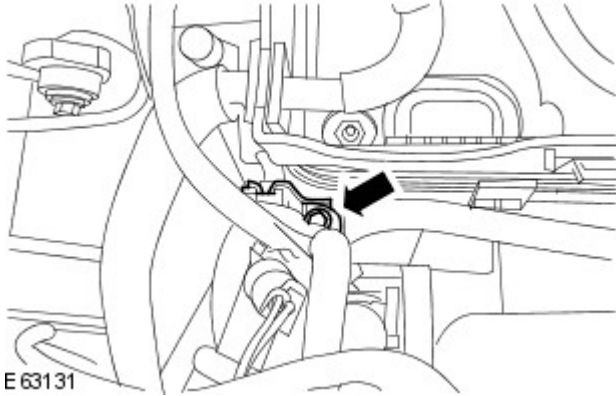


E122968

5. Remove the auxiliary battery compartment side wall.
 - Release the four clips.

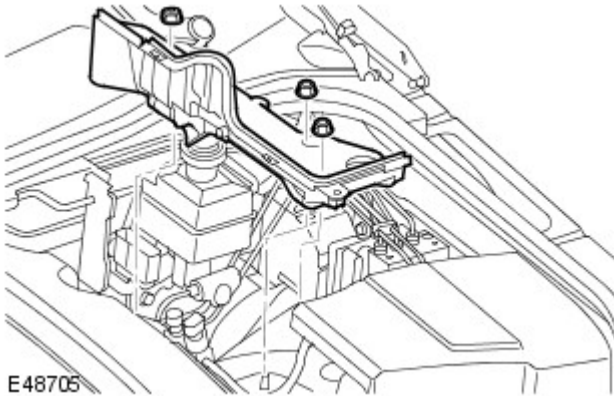


E48704



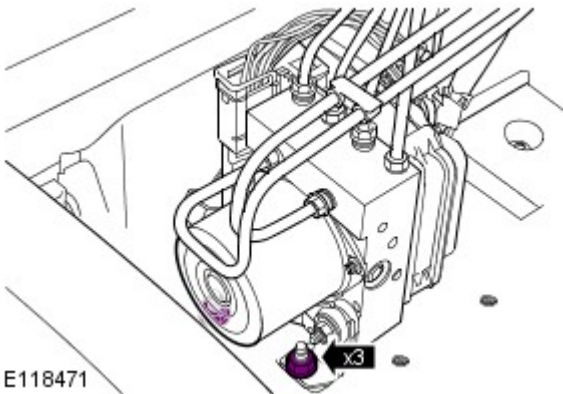
6. Release the Air Conditioning (A/C) pipes.

- Remove the retaining screw.



7. Remove the auxiliary battery tray.


- Remove the 3 bolts.



8. Release the Anti-lock Brake System (ABS) module.

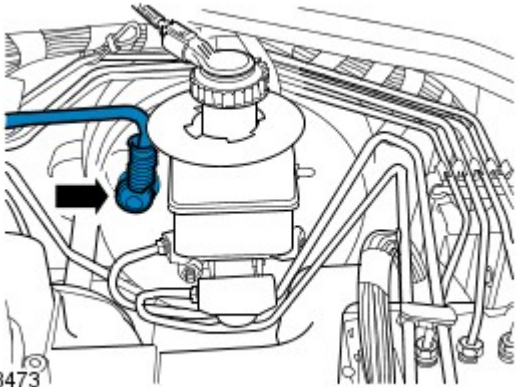
- Remove the 3 nuts.
- Release the brake tubes from the clip.

9. Disconnect the low brake fluid warning indicator switch electrical connector.

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


Position an absorbent cloth to collect fluid spillage.

- 11.** Disconnect the brake booster vacuum hose from the brake booster.




E118473

12. CAUTIONS:

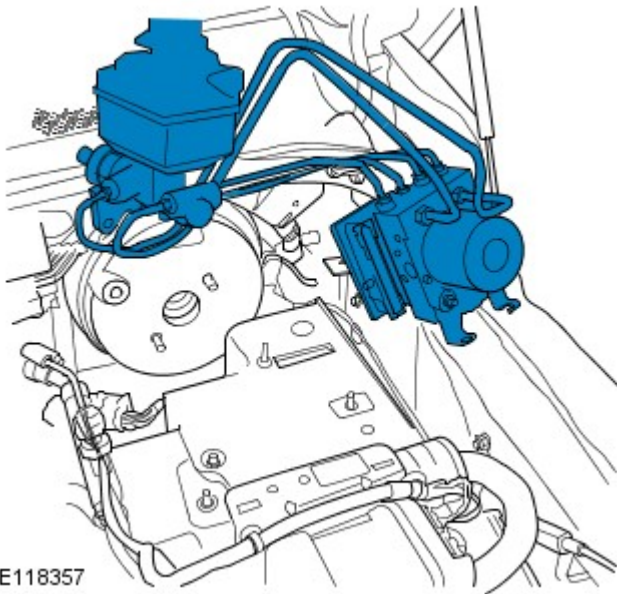
 Make sure that excessive force is not used. Failure to follow this instruction may result in damage to the vehicle.

 Make sure the wings and trim panels are covered and protected, failure to follow this instruction may result in damage to the vehicle.

 Make sure the brake pipes are not damaged when displacing the brake master cylinder and ABS module. Failure to follow this instruction may result in damage to the vehicle.

Displace the brake master cylinder and ABS module as a complete assembly.

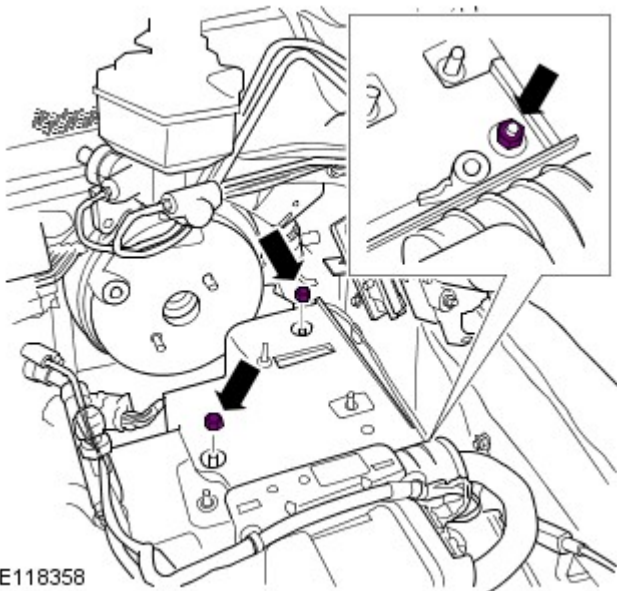
- Remove the 2 nuts.
- Discard the master cylinder seals.



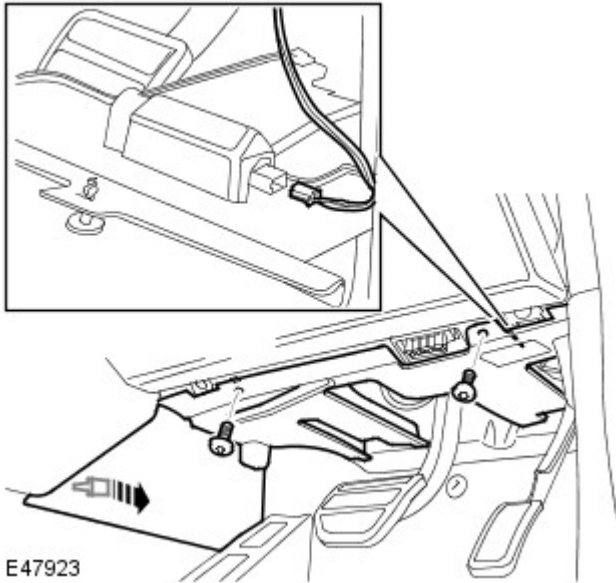
E118357

- 13.** Remove the outer plenum base.

- Remove the 3 nuts.



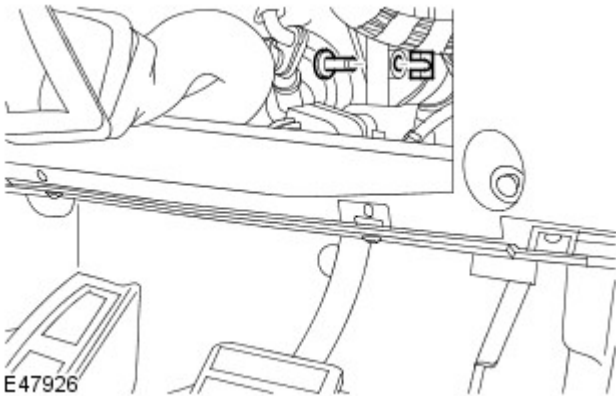
E118358



E47923

14. Remove the driver side closing trim panel.

- Release the clip.
- Remove the 2 screws.
- Disconnect the electrical connector.

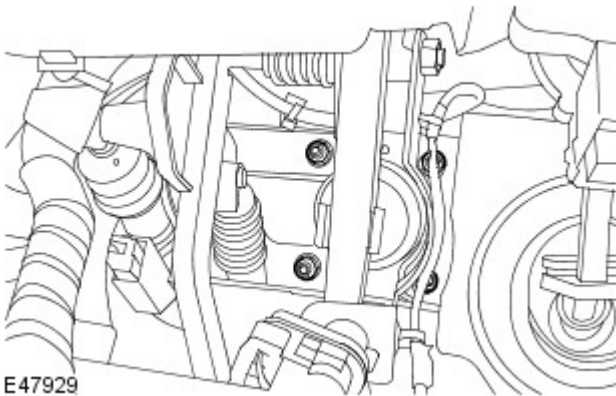


E47926

15. NOTE: The cover is shown removed for clarity.

Remove the brake booster push rod clevis pin.

- Remove the retaining clip.



E47929

16. Remove the brake booster.

- Remove the 4 nuts.

Installation

1. Install the brake booster.

- Tighten the nuts to 23 Nm (17 lb.ft).

2. Install the brake booster push rod clevis pin.


- Install the retaining clip.

3. Connect the brake booster vacuum hose.

4. Install the outer plenum base.

- Carefully lift the anti-lock brake system modulator for access.

- Install the 3 nuts.

5.  **CAUTION:** Make sure the master cylinder is correctly aligned.

- **NOTE:** Install new seals and nuts.

Install the the brake master cylinder and ABS module.

- Tighten the nuts to 23 Nm (17 lb.ft).

6. Secure the anti-lock brake system modulator.

- Install the 3 nuts.
- Secure the brake tubes to the clip.

7. Connect the low brake fluid warning indicator switch electrical connector.

8. Install the auxiliary battery tray.

- Install the 3 bolts.

9. Install the auxiliary battery compartment side wall.

- Secure with the four retaining clips.

10. Secure the A/C pipes.

- Install the retaining screw.

11. Secure the automatic transmission module bracket

- Install the 2 bolts.

12. If installed, install the auxiliary battery.

13. **NOTE:** This step is to check the tightness of the retaining nuts after the initial tighten to make sure that torque has not relaxed.

Check the brake booster retaining nuts.

- Tighten the nuts to 23 Nm (17 lb.ft).

14. Install the closing trim panel.

- Connect the electrical connector.
- Secure the clip.
- Tighten the screws.

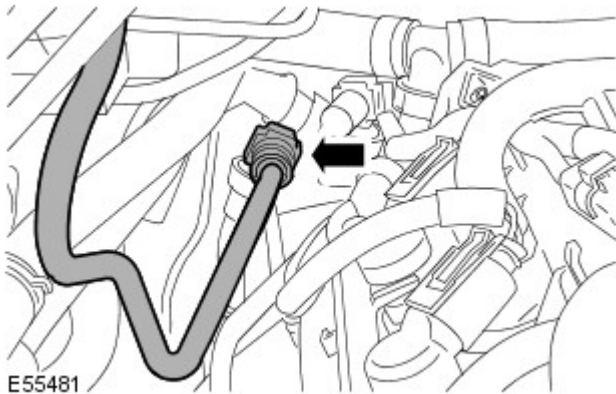
15. Start engine and check the brake booster operation.

Power Brake Actuation - Brake Vacuum Pump TDV6 2.7L Diesel

Removal and Installation


Removal

1. Disconnect the battery ground cable.
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the engine cover.
For additional information, refer to: [Engine Cover - 2.7L V6 - TdV6](#) (501-05 Interior Trim and Oramentation, Removal and Installation).



3.  **CAUTION:** Always plug any open connections to prevent contamination.

Disconnect the brake booster vacuum line from the brake vacuum pump.

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

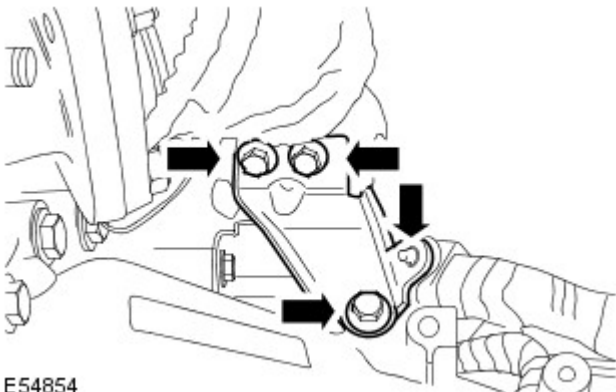
Raise and support the vehicle.

5. Remove the exhaust system. For additional information, refer to: (309-00A Exhaust System - TDV6 2.7L Diesel)

[Exhaust System - Vehicles Without: Diesel Particulate Filter \(DPF\)](#) (Removal and Installation),
[Exhaust System - Vehicles With: Diesel Particulate Filter \(DPF\)](#) (Removal and Installation).

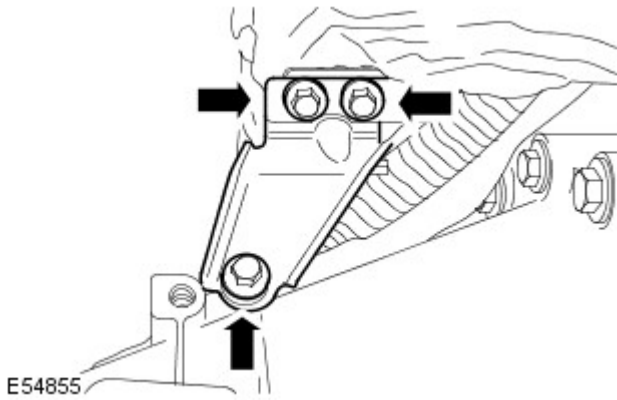
6. Lower the rear of the transmission for access.
7. Remove the exhaust cross-over pipe LH support bracket.

- Release the wiring harness.
- Remove the 3 bolts.



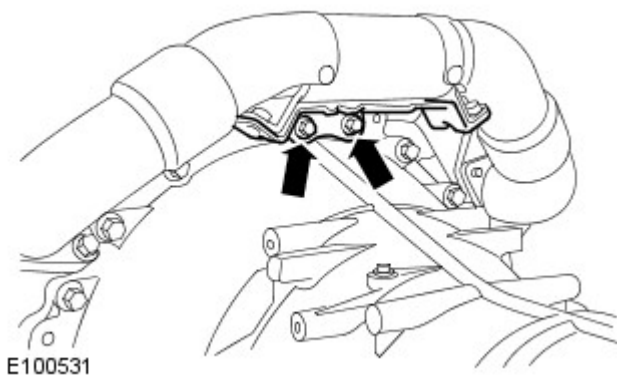
8. Remove the exhaust cross-over pipe RH support bracket.


- Remove the 3 bolts.



9. Remove the exhaust cross-over pipe center support bracket.

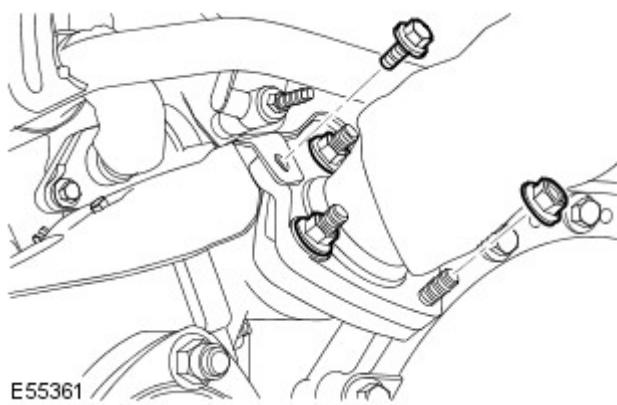
- Remove the 2 bolts.



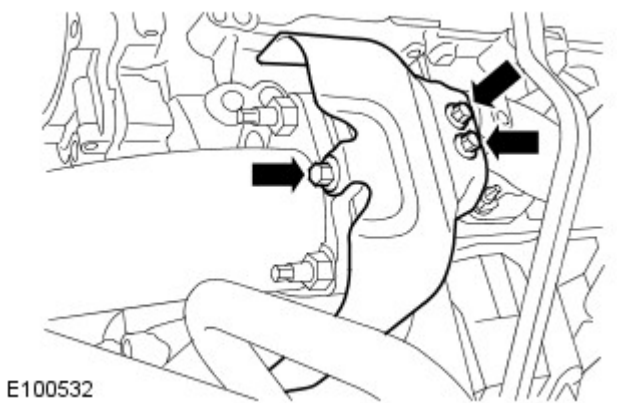
10.  **CAUTION:** Take care when handling the cross-over pipe as damage to the insulating material may occur.

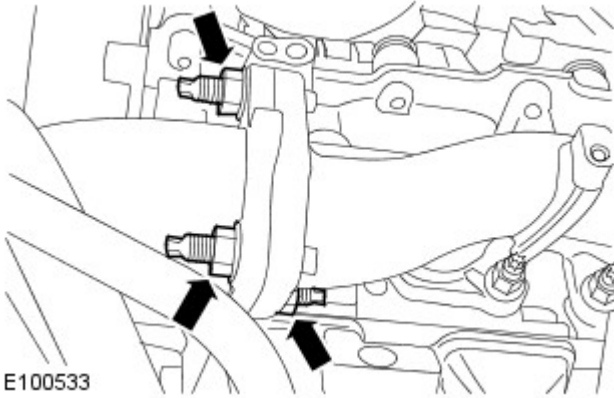
Release the exhaust cross-over pipe from the turbocharger.

- Remove the turbocharger heat shield bolt.
- Remove and discard the 3 nuts.

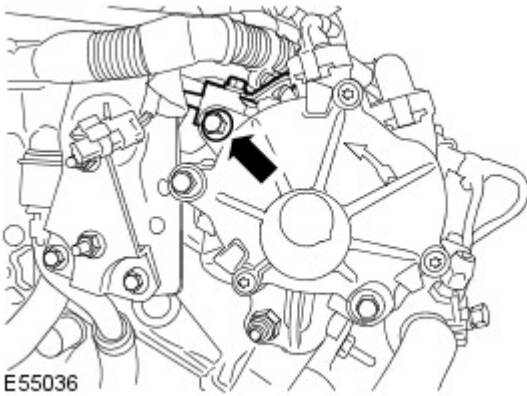


11. Remove the RH exhaust manifold heat shield.

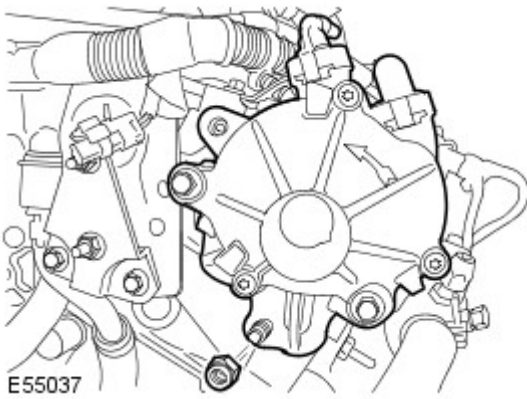




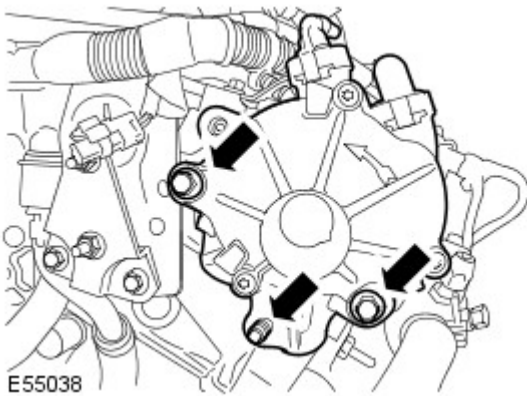
- 12.** Remove the exhaust cross-over pipe.
- Remove and discard the 3 nuts.
 - Remove and discard the 2 gaskets.



- 13.** Release the high-pressure fuel supply line.
- Remove the bolt.

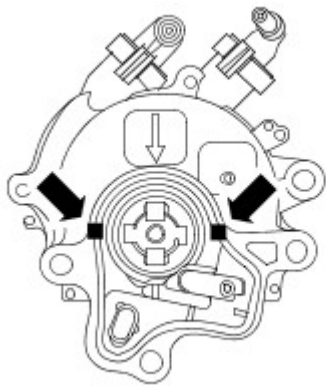


- 14.** Remove the brake vacuum pump nut.




- 15.** Remove the brake vacuum pump.
- Remove the stud.
 - Remove the 2 bolts.

Installation



E56076

1.  **CAUTION:** Extreme care is required during assembly so that the sealant is not smeared. If the sealant is smeared, the mating faces must be cleaned and new sealant must be applied.

Apply sealant to the two places shown.

- Make sure the vacuum pump seal is clean and dry.
- Make sure that the dogs on the vacuum pump are aligned with the camshaft.
- Apply a 2mm square of Loctite 518 sealant in the 2 places shown.
- Install the brake vacuum pump immediately after applying the sealant.
- The brake vacuum pump should be fitted directly to the engine without smearing the sealant.

2. Install the brake vacuum pump.

- Install the 2 bolts.
- Tighten the bolts to 23 Nm (17 lb.ft).

3. Install the brake vacuum pump stud.

- Tighten to 13 Nm (10 lb.ft).

4. Install the brake vacuum pump nut.

- Tighten to 13 Nm (10 lb.ft).

5. Secure the high-pressure fuel supply line.


- Tighten the bolt to 10 Nm (7 lb.ft).

6. Install 3 new exhaust manifold studs.

- Tighten the 3 studs to 13 Nm (10 lb. ft).

7. Install 3 new turbocharger studs.

- Tighten the 3 studs to 13 Nm (10 lb. ft).

8.  **CAUTION:** Take care when handling the cross-over pipe as damage to the insulating material may occur.

Install the exhaust cross-over pipe.

- Clean the component mating faces.
- Install 2 new gaskets.
- Install 6 new nuts
- Tighten the 6 nuts to 24 Nm (18 lb. ft).

9. Install the exhaust cross-over pipe center support bracket.

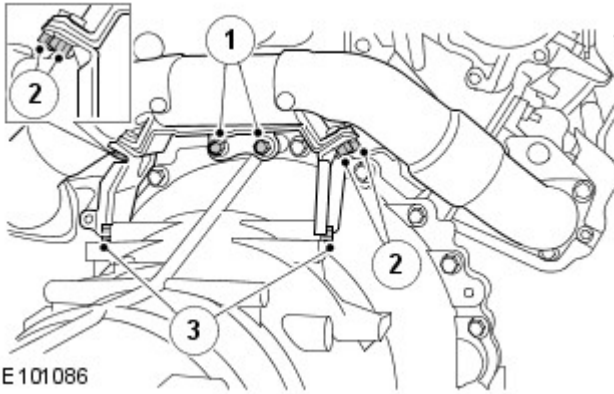
- Loosely install the 2 bolts.

10. Install the exhaust cross-over pipe RH support bracket.

- Loosely install the 3 bolts.

11. Install the exhaust cross-over pipe LH support bracket.

- Loosely install the 3 bolts.



12. Tighten the exhaust cross-over pipe mounting bracket bolts in the following sequence.

- Tighten the 2 bolts marked 1 to 10 Nm (7 lb.ft).
- Undo the 2 bolts by 90 degrees.
- Tighten the 2 bolts marked 3 to 10 Nm (7 lb.ft).
- Undo the 2 bolts by 90 degrees.
- Tighten the 4 bolts marked 2 to 25 Nm (18 lb.ft).
- Tighten the 2 bolts marked 1 to 25 Nm (18 lb.ft).
- Tighten the 2 bolts marked 3 to 25 Nm (18 lb.ft).
- Attach the wiring harness.

13. Install the RH exhaust manifold heat shield.

- Tighten the 3 bolts to 10 Nm (7 lb.ft).

14. Install the turbocharger heat shield.

- Tighten the bolt to 10 Nm (7 lb.ft).

15. Install the exhaust system. For additional information, refer to: (309-00A Exhaust System - TDV6 2.7L Diesel)

[Exhaust System - Vehicles Without: Diesel Particulate Filter \(DPF\) \(Removal and Installation\)](#),
[Exhaust System - Vehicles With: Diesel Particulate Filter \(DPF\) \(Removal and Installation\)](#).

16.  **CAUTION:** Always plug any open connections to prevent contamination.

Connect the brake booster vacuum line to the brake vacuum pump.

17. Install the engine cover.

For additional information, refer to: [Engine Cover - 2.7L V6 - TdV6](#) (501-05 Interior Trim and Oramentation, Removal and Installation).

18. Connect the battery ground cable.

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

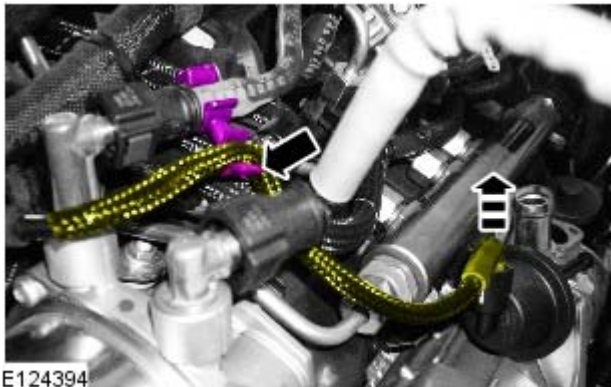
Power Brake Actuation - Brake Vacuum Pump TDV6 3.0L Diesel

Removal and Installation

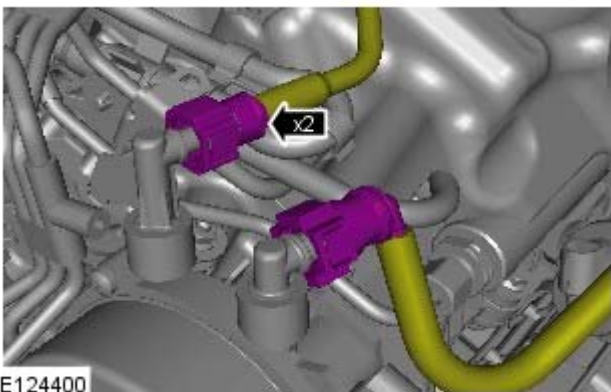
Removal

- NOTE: Removal steps in this procedure may contain installation details.
- NOTE: **Some variation in the illustrations may occur, but the essential information is always correct.**

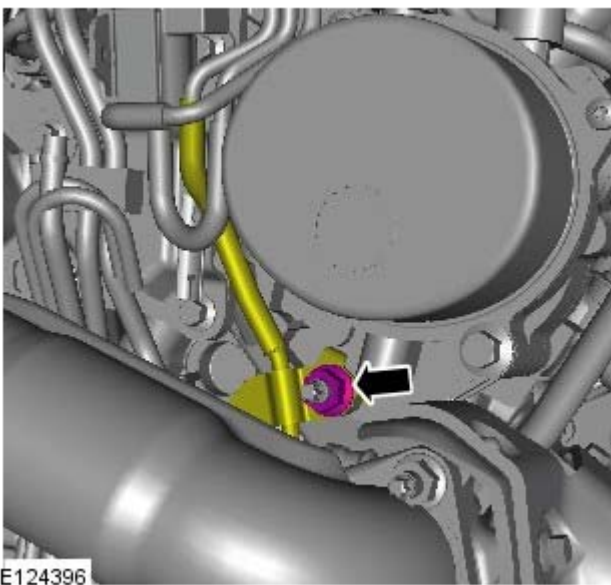
1. Refer to: [Body - TDV6 3.0L Diesel/TDV6 2.7L Diesel](#) (502-02 Full Frame and Body Mounting, Removal and Installation).



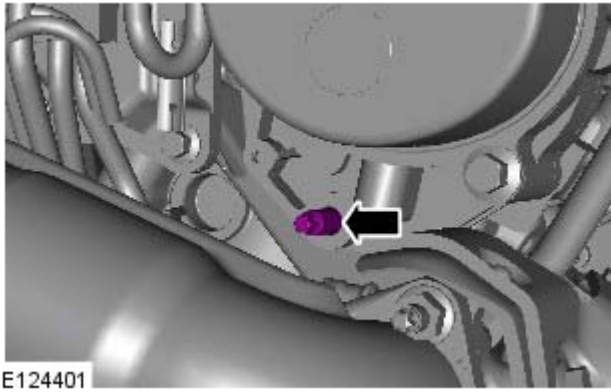
2.



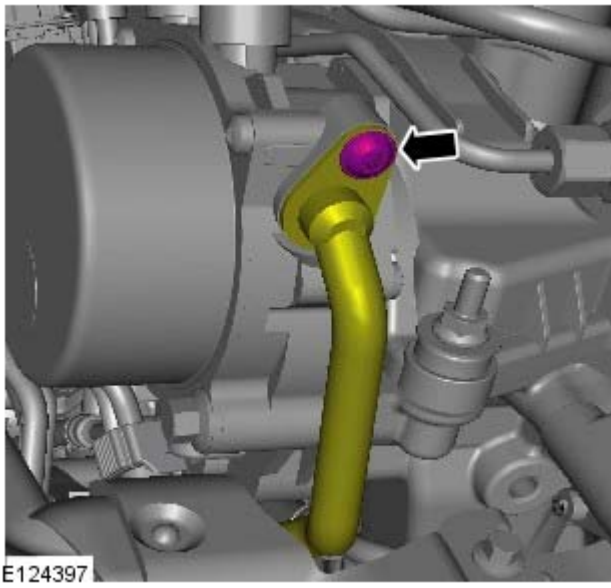
3.



4. Torque: 23 Nm

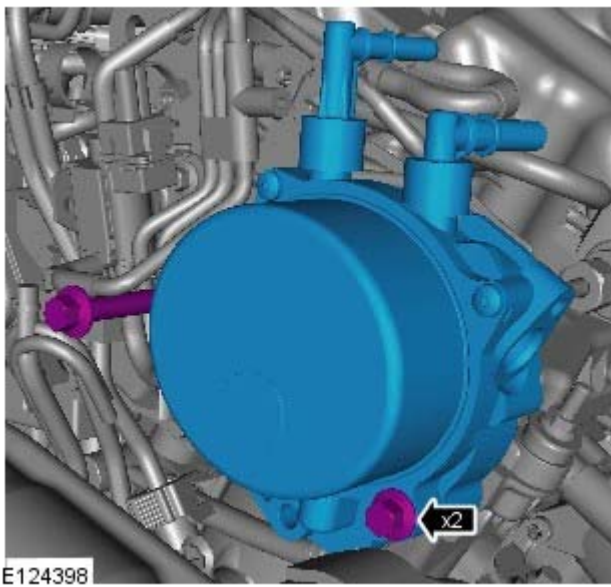


5. Torque: 13 Nm



6. **6.** NOTE: Discard the O-ring seal.

Torque: 10 Nm

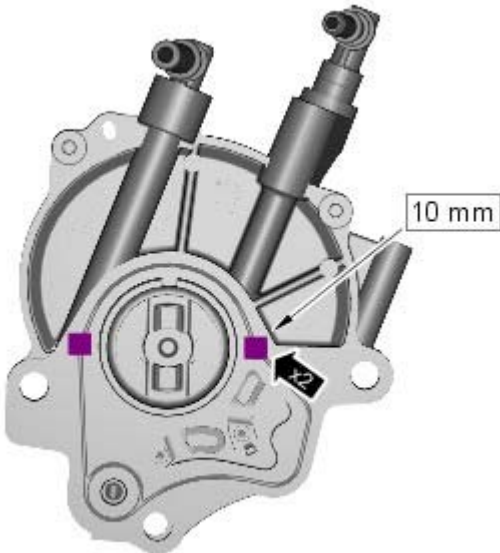


7. Torque: 23 Nm



E124399

Installation



E116820

8.

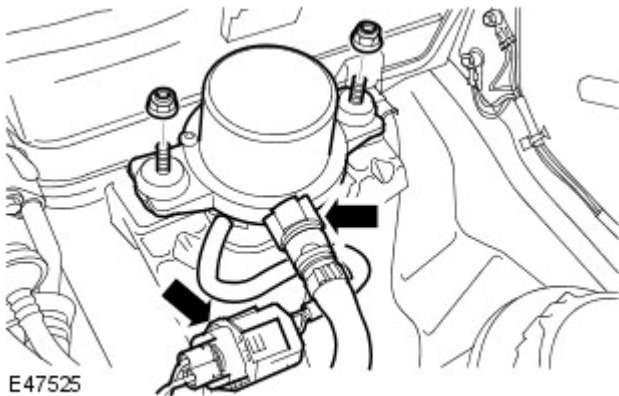
1. **NOTE:** Install a new gasket.
 - **NOTE:** Install a new O-ring seal.
 - **NOTE:** Apply silicone gasket sealant or equivalent meeting Land Rover specification.
 - **NOTE:** The application of sealant must be 10 mm square in two places. Install the brake vacuum pump immediately after applying the sealant.
 - **NOTE:** The brake vacuum pump should be fitted directly to the engine without smearing the sealant.
 - **NOTE:** Make sure that the drive coupling is aligned with camshaft coupling.

To install, reverse the removal procedure.

Power Brake Actuation - Brake Vacuum Pump V6 4.0L Petrol

Removal and Installation

Removal



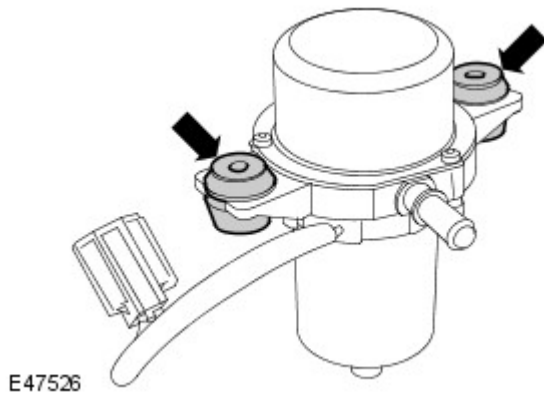
1.  **CAUTION:** Always plug any open connections to prevent contamination.

Remove the brake vacuum pump.

- Release and disconnect the electrical connector.
- Disconnect the vacuum line.
- Remove the 2 nuts.

2. **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the 2 rubber insulators.



Installation

1. To install, reverse the removal procedure.


- Tighten the nuts to 5 Nm (4 lb.ft).

Power Brake Actuation - Brake Vacuum Pump V8 5.0L Petrol

Removal and Installation

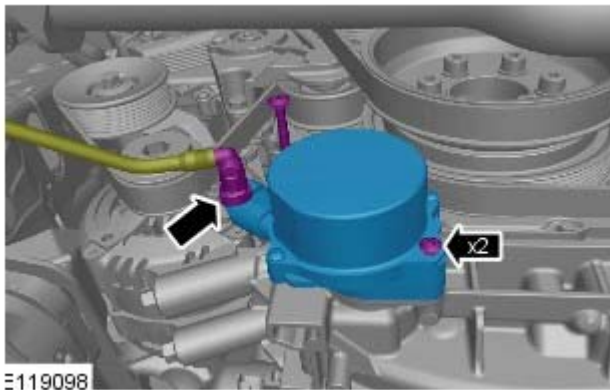
Removal

- NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).
3. Refer to: [Engine Oil Draining and Filling](#) (303-01D Engine - V8 5.0L Petrol, General Procedures).



4.



5. **NOTE:** Discard the seal.

- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Torque: 12 Nm

Installation

1. **NOTE:** Install a new seal.
To install, reverse the removal procedure.

Anti-Lock Control - Traction Control -

General Specification

Item	Specification
System make/type	Bosch 8.0 Anti-lock braking system with Electronic Brake Distribution (EBD), Corner Brake Control (CBC), Electronic Traction Control (ETC), Hill Descent Control (HDC), Anti-roll Mitigation (ARM), Emergency Brake Assist (EBA), and Dynamic Stability Control (DSC)
Wheel speed sensors:	
Make/type	Bosch DF11i
Location	Front and rear knuckles with the active directional sensor acting on the driveshaft pole wheel
Yaw rate sensor make/type	Bosch DRS MM1.OR

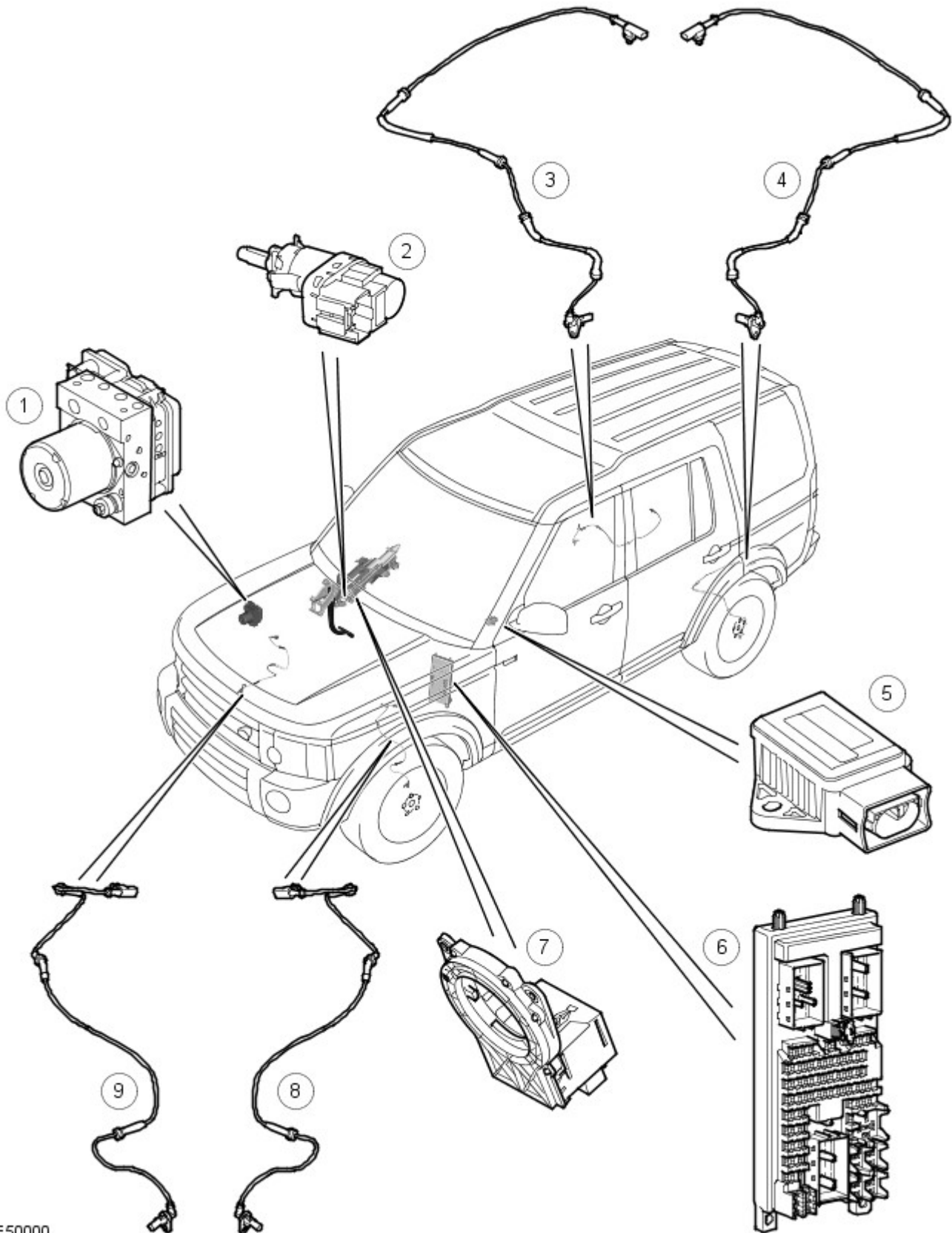
Torque Specifications

Description	Nm	lb-ft
Front road wheel speed sensor bolt	9	7
Front brake caliper anchor plate bolts	275	203
Front brake caliper housing bolts	32	24
Front brake hose retaining bracket to wheel knuckle bolt	25	18
Rear road wheel speed sensor to wheel knuckle bolt	9	7
ABS module mounting bracket nuts	8	6
ABS module to mounting bracket nuts	23	17
M10 Brake tube union nuts	15	11
M12 Brake tube union nuts	15	11
M14 Brake tube union nut	17	13
Yaw rate sensor bolts	7	5
Road wheel nuts	140	103

Anti-Lock Control - Traction Control - Anti-Lock Control - Traction Control

Description and Operation

COMPONENT LOCATIONS - SHEET 1 OF 2

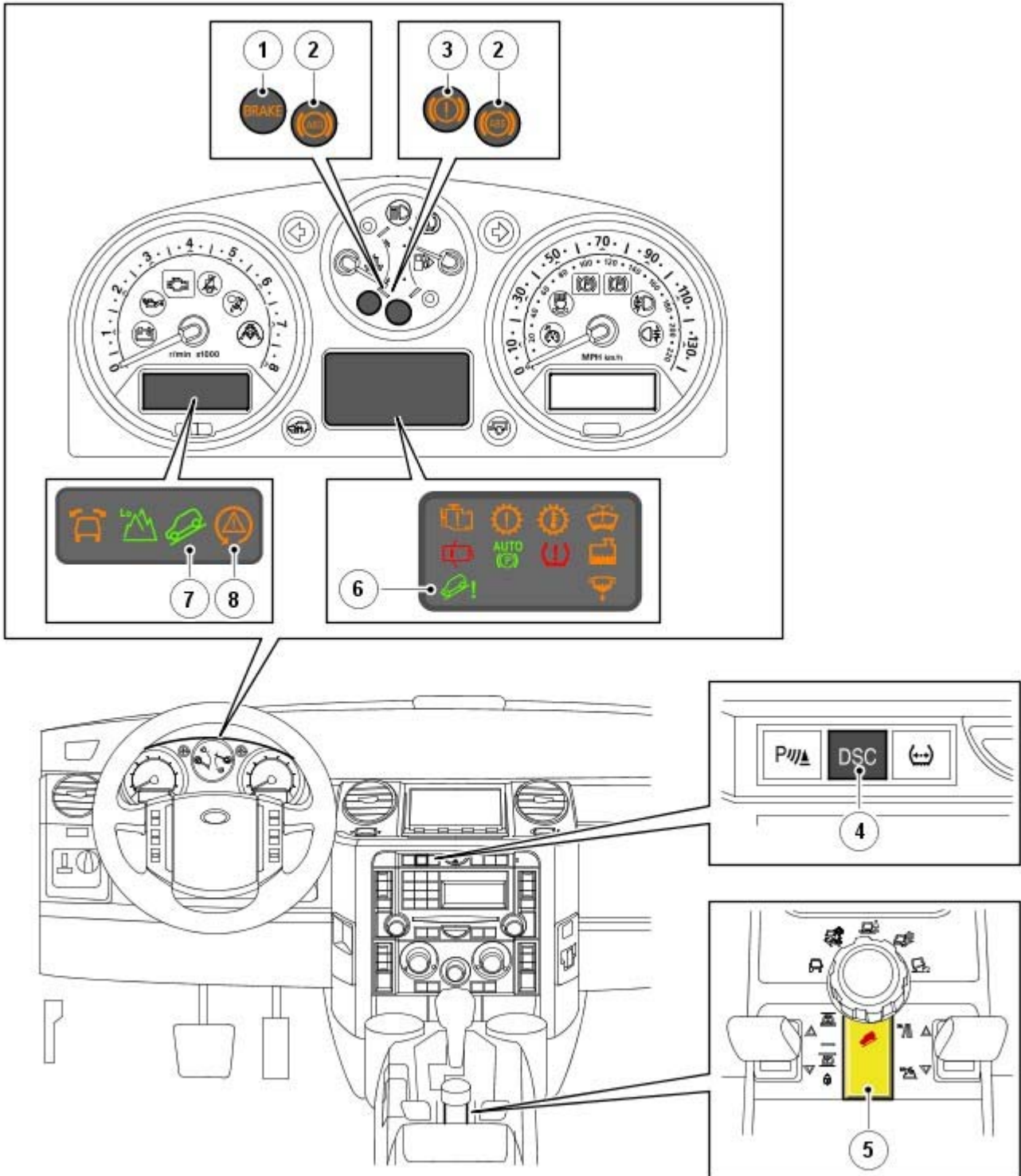


E50000

Item	Part Number	Description
1	-	Hydraulic control unit with attached anti-lock brake system (ABS) module
2	-	Stoplamp switch
3	-	Right rear wheel speed sensor
4	-	Left rear wheel speed sensor

5	-	Yaw rate and lateral acceleration sensor
6	-	HDC (hill descent control) relay (non-serviceable, integrated into central junction box (CJB))
7	-	Steering angle sensor
8	-	Left front wheel speed sensor
9	-	Right front wheel speed sensor

COMPONENT LOCATIONS - SHEET 2 OF 2



E50001

Item	Part Number	Description
1	-	Brake warning indicator (NAS (north American specification) only)
2	-	ABS warning indicator
3	-	Brake warning indicator (all except NAS)
4	-	DSC (dynamic stability control) switch

5	-	HDC (hill descent control) switch
6	-	HDC warning indicator (low line instrument cluster only)
7	-	HDC information indicator
8	-	DSC warning indicator

GENERAL

The anti-lock control - traction control system is based on the 4 channel Bosch 8.0 system and provides the following brake functions:

- ABS.
- ARM (active roll mitigation).
- CBC (corner brake control).
- DSC.
- electronic brake force distribution (EBD).
- ETC (electronic traction control).
- emergency brake assist (EBA).
- EDC (engine drag-torque control).
- HDC.

The system consists of the following components:

- A DSC switch.
- An HDC switch.
- An HDC relay.
- A stoplamp switch.
- Four wheel speed sensors.
- A yaw rate and lateral acceleration sensor.
- A steering angle sensor.
- Warning indicators; four on vehicles with a high line instrument cluster and five on vehicles with a low line instrument cluster.
- A hydraulic control unit (HCU) with attached ABS module.

DSC SWITCH

The DSC switch allows the DSC function to be selected off. Although Land Rover recommend that DSC is selected on for all normal driving conditions, it may be beneficial to de-select DSC, to maximize traction, under the following conditions:

- If the vehicle needs to be rocked out of a hollow or a soft surface.
- Driving on loose surfaces or with snow chains.
- Driving in deep sand, snow or mud.
- On tracks with deep longitudinal ruts.

The DSC switch is a non-latching switch installed in the center switch pack on the instrument panel. Pressing the DSC switch connects an ignition power feed to the ABS module. With the first press of the DSC switch, the ABS module disables the DSC functions. When the DSC switch is pressed again, the ABS module re-enables the DSC functions. The DSC switch must be pressed for a minimum of 0.3 s for the ABS module to react. The DSC function is re-enabled at the beginning of each ignition cycle.

The status of the DSC switch selection is shown by the DSC warning indicator. The DSC warning indicator is off while DSC is selected on, and continuously illuminated while DSC is selected off.

A DSC switch request to disable DSC is ignored if the air suspension system has failed, or is in off-road height at speeds above 60 km/h (37.5 mph).

To guard against incorrect operation or a broken switch, if the input from the DSC switch is held high for more than one minute, a failure is stored in the ABS module.

Even if DSC is deselected, driving maneuvers with extreme yaw or lateral acceleration may trigger DSC activity to assist vehicle stability.

HDC SWITCH

The HDC switch controls the selection of the HDC function.

The HDC switch is a non-latching switch installed on the center console, to the rear of the gear shift lever. Pressing and releasing the HDC switch momentarily connects an ignition power feed to the ABS module. With the first press and release of the HDC switch, the ABS module enables operation of the HDC function. When the HDC switch is pressed and released again, the ABS module disables operation of the HDC function.

To guard against incorrect operation or a broken switch, if the switch is pressed for more than 10 seconds no change of state occurs. If the input from the HDC switch is held high for more than one minute, a failure is stored in the ABS module.

HDC RELAY

The HDC relay is used to illuminate the stoplamps when the brakes are activated during HDC operation and during dynamic application of the parking brake.

The HDC relay is a non-serviceable, solid state relay on the circuit board of the CJB. Operation of the HDC relay is controlled by the ABS module switching the coil to ground. The ABS module monitors brake system hydraulic pressure and energizes the HDC relay during active braking. A pressure threshold and time filter prevent the stoplamps from flickering when HDC is braking.

STOPLAMP SWITCH

The stoplamp switch is mounted in the brake pedal bracket and operated by the brake pedal. The stoplamp switch is a two pole switch: The Brake Switch (BS) pole supplies a brake pedal status signal to the ABS module; the Brake Lamp Switch (BLS) pole operates the stoplamps and also supplies a brake pedal status signal to the ABS module and to the engine control module (ECM).

While the brake pedal is released:

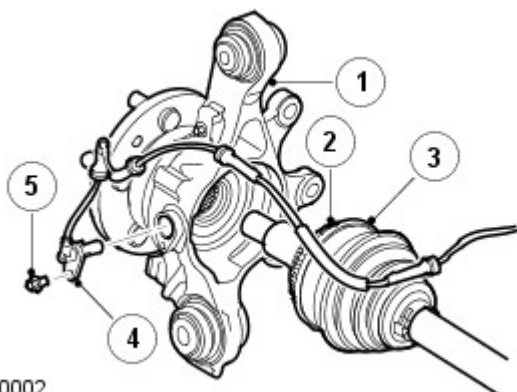
- The BS contacts are closed, and connect an ignition power feed from the CJB to the ABS module.
- The BLS contacts are open.

When the brake pedal is pressed:

- The BS contacts open.
- The BLS contacts close, and connect an ignition power feed from the CJB to the three stoplamps, the ABS module and the ECM.

The ABS module monitors the status inputs from the stoplamp switch and broadcasts the brake pedal status and an associated quality factor on the high speed controller area network (CAN) bus.

WHEEL SPEED SENSORS



E50002

Item	Part Number	Description
1	-	Knuckle assembly
2	-	Sensor ring
3	-	Halfshaft
4	-	Wheel speed sensor
5	-	Screw

An active wheel speed sensor is installed in each wheel hub to provide the ABS module with a rotational speed signal from each road wheel. The head of each wheel speed sensor is positioned close to a 48 tooth sensor ring on the outer diameter of the constant velocity joint of the halfshaft. A flying lead connects each sensor to the vehicle wiring.

The wheel speed sensors each have a power supply connection and a signal connection with the ABS module. When the ignition switch is in position II, the ABS module supplies power to the wheel speed sensors and monitors the return signals. Any rotation of the halfshafts induces current fluctuations in the return signals which are converted into individual wheel speeds and the overall vehicle speed by the ABS module.

The ABS module outputs the individual wheel speeds and the vehicle speed on the high speed CAN bus for use by other systems. The quality of the vehicle speed signal is also broadcast on the high speed CAN bus. If all wheel speed signals are available to calculate vehicle speed from, the quality of the vehicle speed signal is set to 'data calculated within specified accuracy'. If one or more wheel speed sensors is faulty, the quality of the vehicle speed signal is set to 'accuracy outside specification'.

The ABS module monitors the wheel speed sensor circuits for faults. If a fault is detected the ABS module stores a related fault code and illuminates the appropriate warning indicators, depending on the system functions affected (DSC/ETC, ABS, EBA/EBD, HDC). A warning chime sounds and, on vehicles with the high line instrument cluster, a related message is shown in the message center.

For additional information, refer to: [Information and Message Center](#) (413-08 Information and Message Center, Description and Operation).

Since the wheel speed sensors are active devices, a return signal is available when the road wheels are not turning, which enables the ABS module to check the sensors while the vehicle is stationary. In addition, the direction of travel of each wheel can be sensed. This information is broadcast on the high speed CAN bus for use by other systems.

YAW RATE AND LATERAL ACCELERATION SENSOR

The yaw rate and lateral acceleration sensor provides the ABS module with inputs of yaw rate and lateral acceleration.

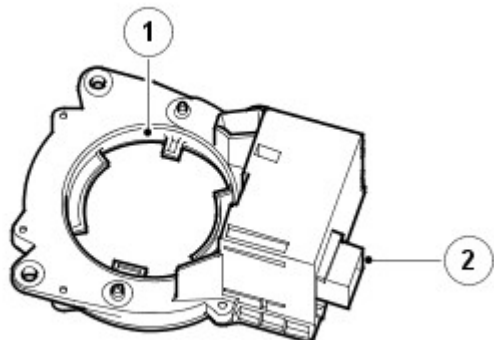
The yaw rate and lateral acceleration sensor is installed under the center console and secured to the transmission tunnel with two bolts.

When the ignition switch is in position II, the yaw rate and lateral acceleration sensor receives an ignition power feed from the CJB. The sensor is self diagnosed by the ABS module and can be interrogated using T4. The ABS module broadcasts the yaw rate and lateral acceleration values, on the high speed CAN bus, for use by other systems.

The ABS module monitors the yaw rate and lateral acceleration sensor for faults. If a fault is detected the ABS module stores a related fault code and illuminates the DSC warning indicator and, on vehicles with the low line instrument cluster,

the HDC warning indicator. A warning chime sounds and, on vehicles with the high line instrument cluster, a message advising of an HDC fault is shown in the message center. For additional information, refer to: [Information and Message Center](#) (413-08 Information and Message Center, Description and Operation).

STEERING ANGLE SENSOR



E50003

Item	Part Number	Description
1	-	Gear wheel
2	-	Electrical connector

The steering angle sensor measures the steering wheel angle and the rate of change of the steering wheel angle (known as the steering wheel angle speed). These measurements are output on the high speed CAN bus, together with a quality factor signal, and used by the ABS module for CBC and DSC operation.

The steering angle sensor is fixed to the pivot bracket of the steering column by three screws. A gear wheel in the steering angle sensor engages with a plastic drive collar fixed onto the lower shaft of the column. Inside the steering angle sensor, the gear wheel meshes with a gear train containing magnets. An eight pin electrical connector provides the interface between the vehicle wiring and integrated circuits in the steering angle sensor.

The steering angle sensor uses the MR (magneto resistive) effect, which evaluates the direction of magnetic fields, to measure the angular position of the lower shaft, and thus the steering wheel angle. When the steering wheel turns, the steering column lower shaft rotates the gear wheel in the steering angle sensor, which drives the gear train and rotates the magnets on the gears. The direction of the magnetic fields is constantly monitored by the steering angle sensor and converted into a steering wheel angle and steering wheel angle speed.

The steering angle sensor performs a plausibility check of the steering wheel angle each time the following conditions co-exist:

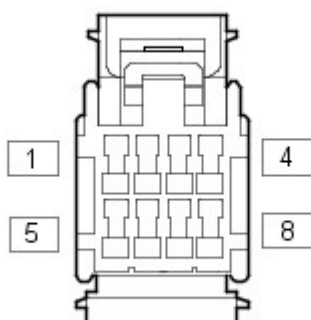
- The vehicle is traveling in a straight line.
- The vehicle speed is between 20 and 25 km/h (12.5 and 15.6 mph).
- The transfer box is in high range.
- The brake pedal is not pressed.
- There is no ABS, DSC or ETC activity.

The steering angle sensor uses inputs of wheel speed, yaw rate and lateral acceleration to determine when the vehicle is traveling in a straight line. When all of the conditions co-exist, the steering angle sensor checks the steering angle, which should be $0 \pm 15^\circ$. If the steering angle is outside the limits on two successive checks, the steering angle sensor changes the quality factor signal to 'outside specification' for the remainder of the ignition cycle and stores a fault code. At the beginning of each ignition cycle the quality factor signal is reset to 'within specified accuracy'.

The status of the steering angle sensor can be determined using T4.

If the steering angle sensor is replaced, the new sensor must be calibrated using T4. The steering angle sensor must also be re-calibrated any time it is disturbed from the steering column, or if the upper and lower steering columns are separated.

Steering Angle Sensor Harness Connector C0862



E50004

Steering Angle Sensor Harness Connector C0862 Pin Details

Pin No.	Description	Input/Output
1 to 4	Not used	-
5	Ignition power supply	Input
6	High speed CAN bus high	Input/Output
7	High speed CAN bus low	Input/Output
8	Ground	-

WARNING INDICATORS

The following anti-lock control - traction control indicators are installed in the instrument cluster:

ABS Warning Indicator

The ABS warning indicator is an amber colored indicator located between the coolant temperature gage and the fuel level gage.

The ABS warning indicator is continuously illuminated if there is a fault that affects ABS performance or causes the ABS function to be disabled.

Operation of the ABS warning indicator is controlled by a high speed CAN bus message from the ABS module to the instrument cluster.

When the ignition switch is first turned to position II, the ABS warning indicator illuminates for approximately 3 seconds as a bulb check. During the bulb check, if a fault is stored in the memory of the ABS module, the ABS warning indicator goes off for 0.5 second, 0.5 second after the start of the bulb check. If a fault during the previous ignition cycle caused the ABS warning indicator to be illuminated, the ABS warning indicator may remain illuminated after the next bulb check, even if the fault has been rectified and cleared from the ABS module; the ABS warning indicator remains illuminated until vehicle speed reaches 15-20 km/h (9.5-12.5 mph) while additional checks of the related inputs are performed.

Brake Warning Indicator

The brake warning indicator is a dual colored indicator, located in the coolant temperature gage, that illuminates amber for EBA faults and red for EBD faults. The brake warning indicator is also used to give warnings of:

- Low brake fluid level (illuminates red).
For additional information, refer to: [Hydraulic Brake Actuation](#) (206-06 Hydraulic Brake Actuation, Description and Operation).
- Brake pad wear (illuminates amber).
For additional information, refer to: [Rear Disc Brake](#) (206-04 Rear Disc Brake, Description and Operation).

Operation of the brake warning indicator is controlled by a high speed CAN bus message from the ABS module to the instrument cluster.

When the ignition switch is first turned to position II, the brake warning indicator illuminates amber for approximately 1.5 seconds then red for approximately 1.5 seconds, as a bulb check.

DSC Warning Indicator

The DSC warning indicator is an amber colored warning indicator located in the tachometer.

Each time the DSC or the ETC function is active, the DSC warning indicator flashes at 2 Hz. If DSC has been selected off, or there is a fault that disables the DSC or the ETC function, the DSC warning indicator is continuously illuminated. If DSC has been selected off, vehicles with the high line instrument cluster also display a message, advising that DSC is switched off.

For additional information, refer to: [Information and Message Center](#) (413-08 Information and Message Center, Description and Operation).

Operation of the DSC warning indicator is controlled by a high speed CAN bus message from the ABS module to the instrument cluster.

When the ignition switch is first turned to position II, the DSC warning indicator illuminates for approximately 3 seconds as a bulb check. If a fault during the previous ignition cycle caused the DSC warning indicator to be illuminated, the DSC warning indicator may remain illuminated after the next bulb check, even if the fault has been rectified and cleared from the ABS module; the DSC warning indicator may remain illuminated during vehicle operation while additional checks of the related inputs are performed.

HDC Information Indicator

The HDC information indicator is a green colored indicator located in the tachometer.

The HDC information indicator is continuously illuminated while the HDC function is selected on and the vehicle is within the parameters for HDC operation; when the vehicle is outside the parameters for HDC operation, the HDC information indicator is flashed at 2 Hz.

Operation of the HDC information indicator is controlled by a high speed CAN bus message from the ABS module to the instrument cluster.

HDC Warning Indicator

On the low line instrument cluster, the HDC warning indicator is an amber colored indicator located between the tachometer and the speedometer. On vehicles with the high line instrument cluster, the HDC warning indicator consists of a message in the message center.

On the low line instrument cluster the HDC warning indicator is continuously illuminated if there is a fault that affects the

HDC function, and flashed at 2 Hz if the HDC function is temporarily unavailable because of brake overheat.

On the high line instrument cluster, appropriate messages are displayed in the message center if there is a fault that affects the HDC function, or if the HDC function is temporarily unavailable because of brake overheat.

For additional information, refer to: [Information and Message Center](#) (413-08 Information and Message Center, Description and Operation).

Operation of the HDC warning indicator is controlled by a high speed CAN bus message from the ABS module to the instrument cluster.

On the low line instrument cluster, when the ignition switch is first turned to position II, the HDC warning indicator illuminates for approximately 3 seconds as a bulb check.

HCU

The HCU is a 4 channel unit that modulates the supply of hydraulic pressure to the brakes under the control of the ABS module.

The HCU is attached by three mounting bushes to a bracket in the plenum box on the driver side of the engine compartment. Hydraulic pipes connect the HCU to the master cylinder and the brakes.

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

The primary and secondary outlets of the master cylinder are connected to primary and secondary circuits within the HCU. The primary circuit in the HCU has separate outlet ports to the front brakes. The secondary circuit in the HCU has separate outlet ports to the rear brakes. Each of the circuits in the HCU contain the following components to control the supply of hydraulic pressure to the brakes:

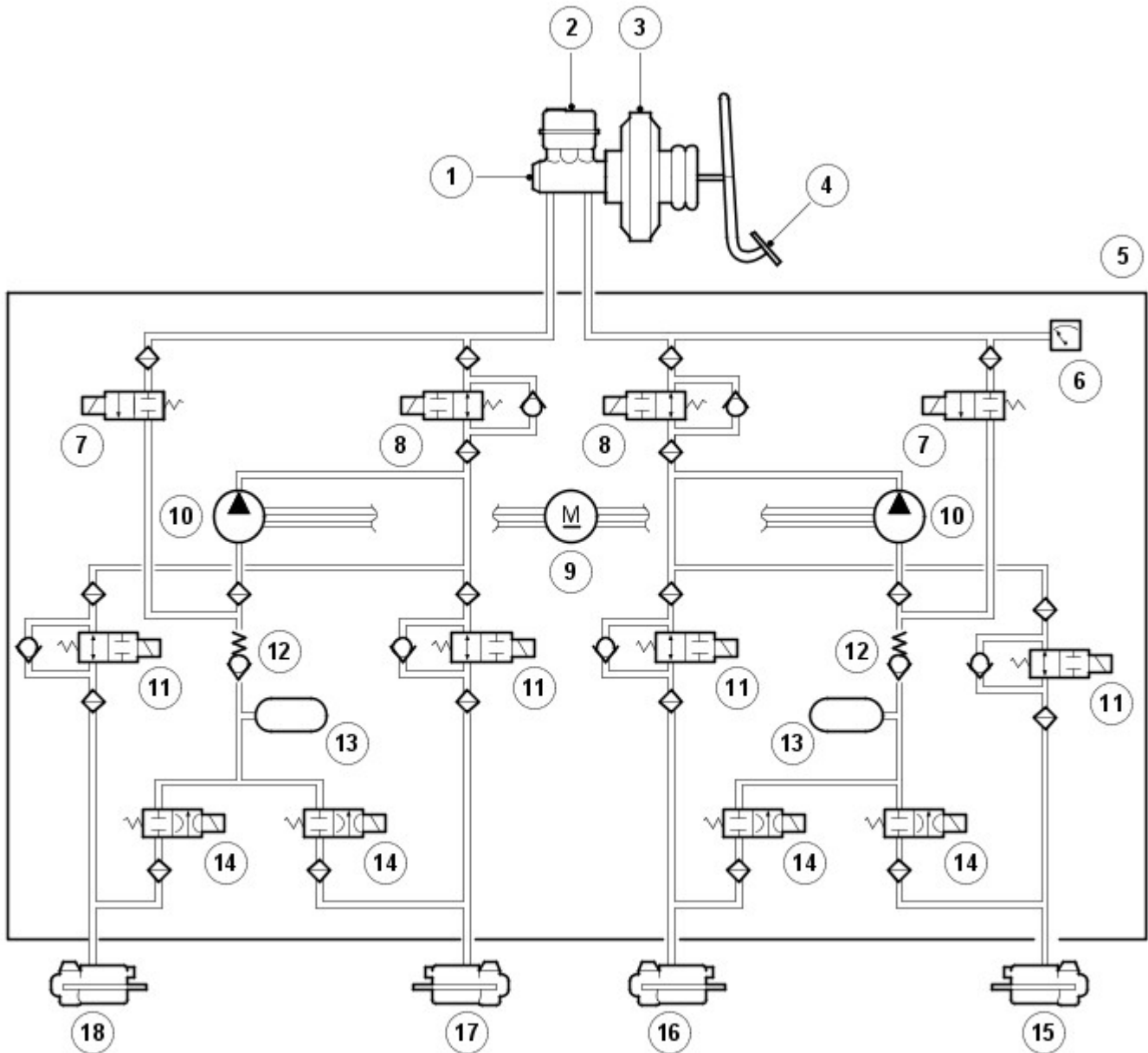
- A normally open, solenoid operated, pilot valve, to enable active braking.
- A normally closed, solenoid operated, priming valve, to connect the brake fluid reservoir to the return pump during active braking.
- A return pump, to generate hydraulic pressure for active braking and return brake fluid to the reservoir.
- Normally open, solenoid operated, inlet valves and normally closed, solenoid operated, outlet valves, to modulate the hydraulic pressure in the individual brakes.
- An accumulator and a relief valve, to allow the fast release of pressure from the brakes.
- Filters, to protect the components from contamination.

The primary circuit also incorporates a pressure sensor to provide the ABS module with a hydraulic pressure signal.

Contact pins on the HCU mate with contacts on the ABS module to provide the electrical connections from the ABS module to the return pump motor and the pressure sensor. The solenoids that operate the valves are installed in the ABS module.

Replacement HCU are supplied pre-filled. After installation on the vehicle, T4 must be used to operate the solenoid valves and the return pump to ensure correct bleeding of the HCU and brake circuits.

Schematic of HCU



E50005

Item	Part Number	Description
1	-	Master cylinder
2	-	Reservoir
3	-	Brake booster
4	-	Brake pedal
5	-	HCU
6	-	Pressure sensor
7	-	Priming valve
8	-	Pilot valve
9	-	Return pump motor
10	-	Return pump
11	-	Inlet valve
12	-	Relief valve
13	-	Accumulator
14	-	Outlet valve
15	-	Left front brake
16	-	Right front brake
17	-	Right rear brake
18	-	Left rear brake

The HCU has three operating modes: Normal braking/EBD, ABS braking and active braking.

Normal Braking/EBD Mode

Initially, all of the solenoid operated valves are de-energized. Operating the brake pedal produces a corresponding increase or decrease of pressure in the brakes, through the open pilot valves and inlet valves. If the ABS module determines that EBD is necessary, it energizes the inlet valves for the brakes of the trailing axle, to isolate the brakes

from any further increase in hydraulic pressure.

ABS Braking Mode

If the ABS module determines that ABS braking is necessary, it energizes the inlet and outlet valves of the related brake and starts the return pump. The inlet valve closes to isolate the brake from pressurized fluid; the outlet valve opens to release pressure from the brake into the accumulator and the return pump circuit; the reduced pressure allows the wheel to accelerate. The ABS module then operates the inlet and outlet valves to modulate the pressure in the brake to apply the maximum braking effort without locking the wheel. Control of the valves for each wheel takes place individually.

Active Braking Mode

The active braking mode is used to generate and control hydraulic pressure to the brakes for functions other than ABS braking, e.g. DSC, EBA, ETC, HDC and dynamic application of the parking brake.

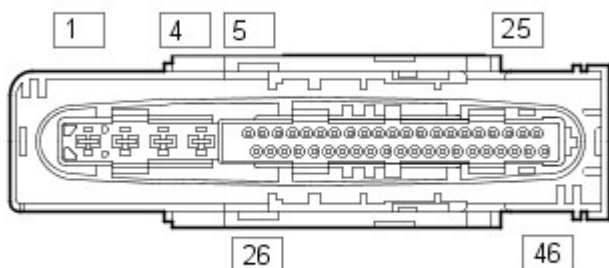
For active braking, the ABS module energizes the pilot valves and priming valves, starts the return pump and energizes all of the inlet valves. Brake fluid, drawn from the reservoir through the master cylinder and priming valve, is pressurized by the return pump and supplied to the inlet valves. The ABS module then operates the inlet valves and outlet valves, as required, to modulate the pressure in the individual brakes. Some noise may be generated during active braking.

ABS MODULE

The ABS module controls the brake functions using the HCU to modulate hydraulic pressure to the individual wheel brakes.

The ABS module is attached to the HCU, in the plenum box on the driver side of the engine compartment. A 46 pin connector provides the electrical interface between the ABS module and the vehicle wiring.

ABS Module Harness Connector C0506



E50006

ABS Module Harness Connector C0506 Pin Details

Pin No.	Description	Input/Output
1	Ground	Output
2	Battery power supply	Input
3	Battery power supply	Input
4	Ground	Output
5	Front left wheel speed sensor signal	Input
6	Rear left wheel speed sensor power supply	Output
7	Rear right wheel speed sensor power supply	Output
8	Rear right wheel speed sensor signal	Input
9	Front right wheel speed sensor power supply	Output
10	Front right wheel speed sensor signal	Input
11 to 13	Not used	-
14	High speed CAN bus low	Input/Output
15	Yaw rate and lateral acceleration sensor ground	Input
16	Yaw rate signal	Input
17	Not used	-
18	Yaw rate and lateral acceleration sensor reference	Input
19	Not used	-
20	Lateral acceleration signal	Input
21	Not used	-
22	HDC relay	Output
23 to 25	Not used	-
26	Front left wheel speed sensor power supply	Output
27	Rear left wheel speed sensor signal	Input
28	Ignition power supply	Input
29	Not used	-
30	Stoplamp switch BLS contacts	Input
31	DSC switch	Input
32	Not used	-
33	Road speed signal	Output
34	Not used	-
35	High speed CAN bus high	Input/Output
36	HDC switch	Input

Pin No.	Description	Input/Output
37	Yaw rate and lateral acceleration sensor test	Output
38 to 40	Not used	-
41	Stoplamp switch BS contacts	Input
42 to 46	Not used	-

SYSTEM OPERATION

ABS

ABS controls the speed of all road wheels to ensure optimum wheel slip when braking at the adhesion limit. This prevents the wheels from locking, which helps to retain effective steering control of the vehicle.

On the front axle, the brake pressure is modulated separately for each wheel. On the rear axle, brake pressure is modulated by select low. Select low applies the same pressure to both rear brakes, with the pressure level being determined by the wheel on the lower friction surface. This maintains rear stability on split friction surfaces.

ARM

The ARM function uses the brakes and the engine to attempt to restore stability if the vehicle is forced into such a harsh manoeuvre that it risks tipping over.

The ABS module monitors driver inputs and vehicle behavior using various powertrain signals and the inputs from the wheel speed sensors, the steering angle sensor and the yaw rate and lateral acceleration sensor. These are compared with modeled behavior and, if vehicle behavior reaches a given risk level, the ABS module cuts the engine power, or brakes one or more wheels, just enough to help the vehicle regain its poise and help the driver remain in control.

While the ignition is on, ARM is permanently enabled, even when DSC has been selected off.

CBC

CBC influences the brake pressures, below the DSC and ABS thresholds, to counteract the yawing moment produced when braking in a corner. CBC produces a correction torque by limiting the brake pressure on one side of the vehicle.

DSC

DSC uses the brakes and powertrain torque control to help maintain the lateral stability of the vehicle. While the ignition is on the DSC function is permanently enabled unless selected off by the DSC switch. Even if DSC is deselected, driving maneuvers with extreme yaw or lateral acceleration may trigger DSC activity to assist vehicle stability.

DSC enhances driving safety in abrupt maneuvers and in understeer or oversteer situations which may occur in a bend. The ABS module monitors the yaw rate and lateral acceleration of the vehicle, and the steering input, then selectively applies individual brakes and signals for powertrain torque adjustments to reduce understeer or oversteer.

In general: in an understeering situation, the inner wheels are braked to counteract the yaw movement towards the outer edge of the bend; in an oversteering situation, the outer wheels are braked to prevent the rear end of the vehicle from pushing towards the outer edge of the bend.

The ABS module monitors the tracking stability of the vehicle using inputs from the wheel speed sensors, the steering angle sensor and the yaw rate and lateral acceleration sensor. The tracking stability is compared with stored target data and, whenever the tracking stability deviates from the target data, the ABS module intervenes by applying the appropriate brakes. On vehicles with an automatic transmission, when the DSC function is active, the ABS module also signals the transmission control module (TCM) to prevent gear shifts. If necessary, the ABS module also signals:

- The ECM, to reduce engine torque.
- The transfer box control module, to adjust the locking torque of the center differential.
- The rear differential control module, to adjust the locking torque of the rear differential.

The DSC function overrides the differential locking torque requests from the terrain response system.

EBD

EBD limits the brake pressure applied to the rear wheels. When the brakes are applied, the weight of the vehicle transfers forwards, which reduces the ability of the rear wheels to transfer braking effort to the road surface. This can cause the rear wheels to slip and make the vehicle unstable.

EBD uses the anti-lock braking hardware to automatically optimize the pressure of the rear brakes, below the point where anti-lock braking would be invoked. Only the rear axle is under EBD control.

ETC

ETC attempts to optimize forward traction by reducing engine torque or braking a spinning wheel until it regains grip.

ETC is activated if an individual wheel speed is above that of the vehicle reference speed (positive slip) and the brake pedal is not pressed. The spinning wheel is braked, allowing the excess torque to be transmitted to the non spinning wheels through the drive line. If necessary, the ABS module also sends a high speed CAN bus message to the ECM to request a reduction in engine torque. Torque reduction requests are for either a slow or fast response: a slow response requests a reduction of throttle angle (4.0L and 4.4L only); a fast response requests an ignition cut-off (4.0L and 4.4L) or a fuel cut-off (2.7L Diesel).

When the DSC function is selected off with the DSC switch, the engine torque reduction feature is disabled.

On vehicles with an automatic transmission, when the ETC function is active the ABS module also signals the TCM to prevent gear shifts.

EBA

EBA assists the driver, in emergency braking situations, by automatically maximizing the braking effort. There are two situations when the ABS module will invoke EBA: when the brake pedal is pressed very suddenly and when the brake pedal is pressed hard enough to bring the front brakes into ABS operation.

When the brake pedal is pressed very suddenly, the ABS module increases the hydraulic pressure to all of the brakes until they reach the threshold for ABS operation, thus applying the maximum braking effort for the available traction. The ABS module monitors for the sudden application of the brakes using the inputs from the stoplamp switch and from the pressure sensor in the HCU. With the brake pedal pressed, if the rate of increase of hydraulic pressure exceeds the predetermined limit, the ABS module invokes emergency braking.

When the brake pedal is pressed hard enough to bring the front brakes into ABS operation, the ABS module increases the hydraulic pressure to the rear brakes up to the ABS threshold.

EBA operation continues until the driver releases the brake pedal enough for the hydraulic pressure in the HCU to drop below a threshold value stored in the ABS module.

EDC

EDC prevents wheel slip caused by any of the following:

- A sudden decrease in engine torque when the accelerator is suddenly released.
- The sudden engagement of the clutch after a downshift on manual transmission vehicles.
- A downshift using the CommandShift™ on automatic transmission vehicles.

When the ABS module detects the onset of wheel slip without the brakes being applied it signals the ECM, on the high speed CAN bus, to request a momentary increase in engine torque.

HDC

HDC uses brake intervention to control vehicle speed and acceleration during low speed descents in off-road and low grip on-road conditions. Generally, equal pressure is applied to all four brakes, but pressure to individual brakes can be modified by the ABS and DSC functions to retain stability. Selection of the HDC function is controlled by the HDC switch on the center console. HDC operates in both high and low ranges, at vehicle speeds up to 50 km/h (31.3 mph).

On manual transmission vehicles, HDC may be used in first and reverse gears in high range and all gears in low range. Once the vehicle is moving, the clutch pedal should be fully released. The vehicle should not be driven with HDC active and the transmission in neutral.

On automatic transmission vehicles, HDC may be used in D, R and CommandShift 1 in high range, and in D, R and all CommandShift gears in low range. When in D, the transmission control module will automatically select the most appropriate gear. The vehicle should not be driven with HDC active and the transmission in N.

HDC can be selected at speeds up to 80 km/h (50 mph), but will only be enabled at speeds below 50 km/h (31.3 mph). When HDC is selected:

- At speeds up to 50 km/h (31.3 mph), the HDC information indicator is permanently illuminated if a valid gear is selected and, on manual transmission vehicles, the clutch pedal is not depressed.
- At speeds from >50 to 80 km/h (>31.3 to 50 mph) the HDC information indicator flashes and, on vehicles with the high line instrument cluster, a message advising that the speed is too high is displayed in the message center. For additional information, refer to: [Information and Message Center](#) (413-08 Information and Message Center, Description and Operation).
If the HDC switch is pressed while vehicle speed is more than 80 km/h (50 mph), the HDC information indicator will not illuminate and HDC will not be selected.
- If the speed reaches 80 km/h (50 mph) or more, a warning chime sounds, the HDC function is switched off, the information indicator goes off and, on vehicles with the high line instrument cluster, a message advising that HDC has been switched off is displayed in the message center.

When HDC is enabled, the ABS module calculates a target speed and compares this with the actual vehicle speed. The ABS module then operates the HCU, in the active braking mode, as required to achieve and maintain the target speed. During active braking for HDC, the ABS module also energizes the HDC relay to operate the stop lamps. Applying the foot brakes during active braking may result in a pulse through the brake pedal, which is normal.

The target speed varies, between minimum and maximum values for each gear and transmission range, depending on driver inputs through the foot pedals. If the foot pedals are not operated, the ABS module adopts a default target speed.

Low Range Target Speeds

Limit	Speed, km/h (mph)			
	Gear			
	Automatic Transmission		Manual Transmission	
	1, R	D, 2 to 6	1, R	2 to 6
Default	3.5 (2.19)	6 (3.75)	3.5 (2.19)	6 (3.75)
Minimum	3.5 (2.19)	3.5 (2.19)	3.5 (2.19)	3.5 (2.19)
Maximum	20 (12.5)	20 (12.5)	20 (12.5)	20 (12.5)

High Range Target Speeds

Limit	Speed, km/h (mph)			Manual Transmission
	Gear			
	Automatic Transmission		1, R	
	1, R	D	1, R	
Default	6 (3.75)	10 (6.25)	6 (3.75)	
Minimum	6 (3.75)	6 (3.75)	6 (3.75)	
Maximum	20 (12.5)	20 (12.5)	20 (12.5)	

The target speed is varied between the minimum and maximum values using the accelerator pedal.

The target speed can also be varied by pressing the speed control '+' and '-' buttons (where fitted). For additional information, refer to:

[Speed Control](#) (310-03C Speed Control - V6 4.0L Petrol, Description and Operation),
[Speed Control](#) (310-03A Speed Control - TDV6 2.7L Diesel, Description and Operation).

During changes of target speed, the ABS module limits deceleration and acceleration to -0.5 m/s^2 (-1.65 ft/s^2) and $+0.5 \text{ m/s}^2$ ($+1.65 \text{ ft/s}^2$) respectively.

On manual transmission models target speed changes are suspended during gear changes, to prevent unwanted braking when the accelerator pedal is released to change gear. The ABS module determines a gear change is occurring from:

- Gear position information on the high speed CAN bus.
- The rate of release of the accelerator pedal.
- The status of the clutch pedal.

To provide a safe transition from active braking to brakes off, the ABS module invokes a fade out strategy, which gradually discontinues the braking effort, if it detects any of the following during active braking:

- HDC selected off with the HDC switch.
- Failure of a component used by HDC, but not critical to fade out function.
- Accelerator pedal pressed when transmission is in neutral.
- Brake overheat.

If fade out is invoked because of deselection or component failure, the HDC function is cancelled by the ABS module. If fade out is invoked because the accelerator pedal is pressed with the transmission in neutral, or because of brake overheat, the HDC function remains in standby and resumes operation when the accelerator pedal is released or the brakes have cooled.

The fade out strategy increases the target speed, at a constant acceleration rate of 0.5 m/s^2 (1.65 ft/s^2), until the maximum target speed is reached or until no active braking is required for 0.5 s. If the accelerator pedal is positioned within the range that influences target speed, the acceleration rate is increased to 1.0 m/s^2 (3.3 ft/s^2).

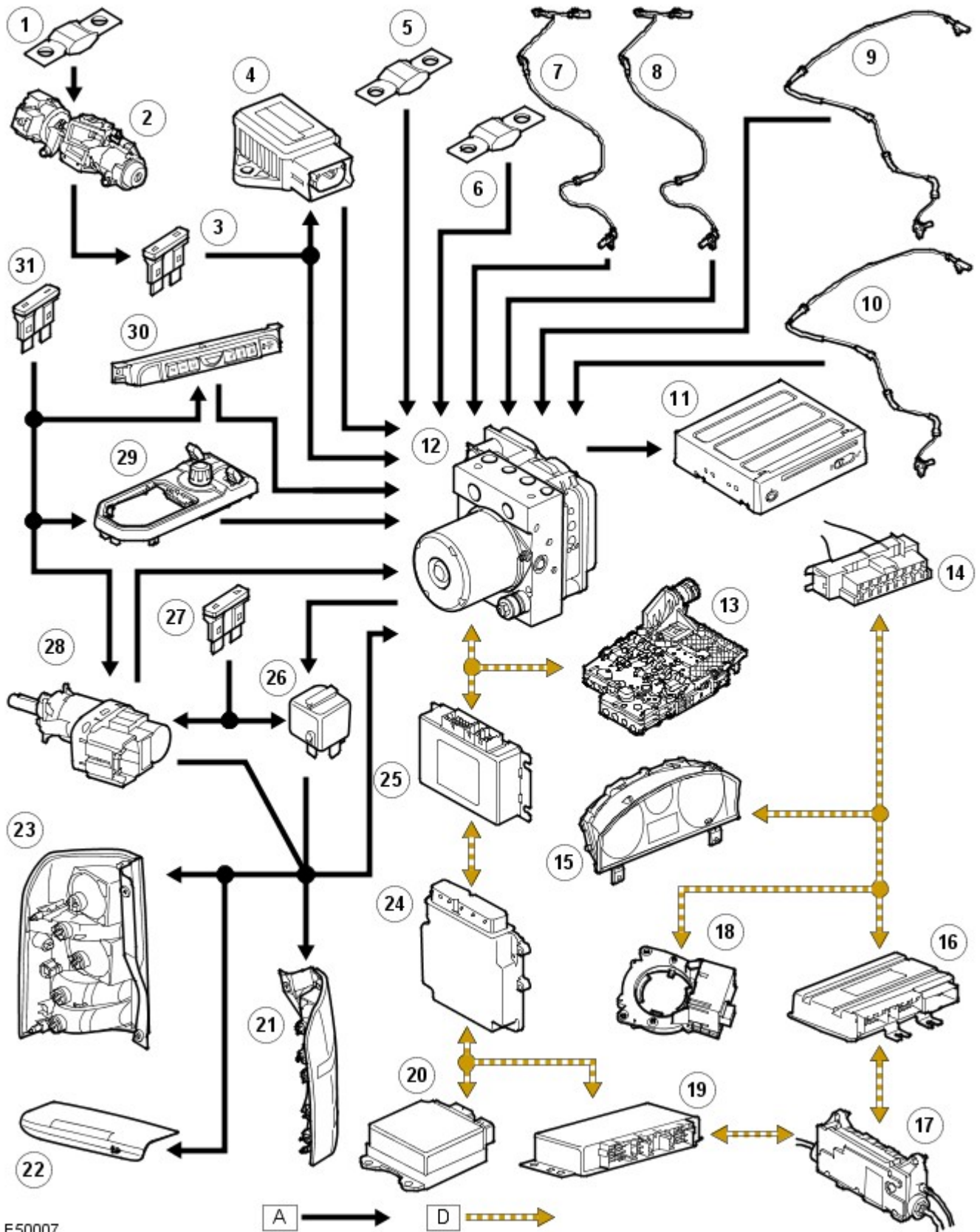
When fade out is invoked because of component failure, a warning chime sounds and the HDC information indicator is extinguished. The HDC warning indicator is illuminated (low line instrument cluster) or a message advising there is a fault is displayed in the message center (high line instrument cluster).

When fade out is invoked because of brake overheat on vehicles with the high line instrument cluster, a message advising that HDC is temporarily unavailable is displayed. On vehicles with the low line instrument cluster, the HDC warning indicator flashes. At the end of fade out, the HDC information indicator flashes. The flashing indicators and/or message continue while HDC remains selected until the brakes have cooled.

To monitor for brake overheat, the ABS module monitors the amount of braking activity and, from this, estimates the temperature of each brake. If the estimated temperature of any brake exceeds a preset limit, the ABS module invokes the fade out strategy. After the fade out cycle, the HDC function is re-enabled when the ABS module estimates that all of the brake temperatures are at less than 64% of the temperature limit.

ANTI-LOCK CONTROL DIAGRAM

- NOTE: A = Hardwired connections; D = High speed CAN bus



E50007

Item	Part Number	Description
1	-	Fusible link 11E, battery junction box (BJB)
2	-	Ignition switch
3	-	Fuse 37P, CJB
4	-	Yaw rate and lateral acceleration sensor
5	-	Fusible link 9E, BJB
6	-	Fusible link 23E, BJB
7	-	Front wheel speed sensor
8	-	Front wheel speed sensor
9	-	Rear wheel speed sensor
10	-	Rear wheel speed sensor
11	-	Navigation computer

12	-	ABS module
13	-	Transmission control module
14	-	Diagnostic socket
15	-	Instrument cluster
16	-	Air suspension control module
17	-	Parking brake module
18	-	Steering angle sensor
19	-	Rear differential control module
20	-	Restraints control module
21	-	Left stoplamp
22	-	Center stoplamp
23	-	Right stoplamp
24	-	ECM
25	-	Transfer box control module
26	-	HDC relay (non-serviceable, integrated into CJB)
27	-	Fuse 15P, CJB
28	-	Stoplamp switch
29	-	HDC switch
30	-	DSC switch
31	-	Fuse 66P, CJB

Anti-Lock Control - Traction Control - Anti-Lock Control - Traction Control

Diagnosis and Testing

Principles of Operation

For a detailed description of the Anti-Lock Control- Traction Control System and operation, refer to the relevant Description and Operation section of the workshop manual.

REFER to: [Anti-Lock Control - Traction Control](#) (206-09A Anti-Lock Control - Traction Control, Description and Operation).

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 checked and/or the donor vehicle.

• **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> ● Tire size, condition and installation ● Wheel speed sensor condition and installation ● Steering Angle Sensor (SAS) condition and installation ● Yaw rate sensor and accelerometer condition and installation ● Hydraulic control unit (with attached ABS module) condition and installation 	<ul style="list-style-type: none"> ● Fuses ● Harnesses and connectors ● Warning lamp operation ● Wheel speed sensors ● Central junction box ● HDC switch ● DSC switch ● Stop lamp switch ● Yaw rate sensor and accelerometer ● Steering Angle Sensor (SAS) ● Anti-lock Braking (ABS) module ● Controller Area Network (CAN) circuits

3. **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. **4.** If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

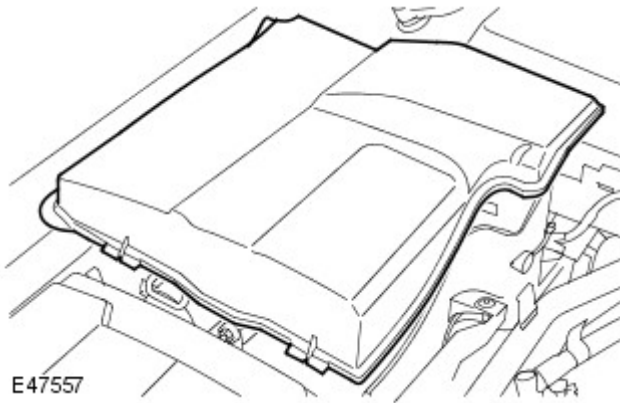
For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: [Diagnostic Trouble Code \(DTC\) Index - DTC: Anti-Lock Braking System \(ABS\)](#) (100-00 General Information, Description and Operation).

Anti-Lock Control - Traction Control - Anti-Lock Brake System (ABS) Module

Removal and Installation

Removal


 **CAUTION:** Make sure the ignition switch is in position 0.




1. Remove the cover.

2. Disconnect the electrical connector.

3. CAUTIONS:

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

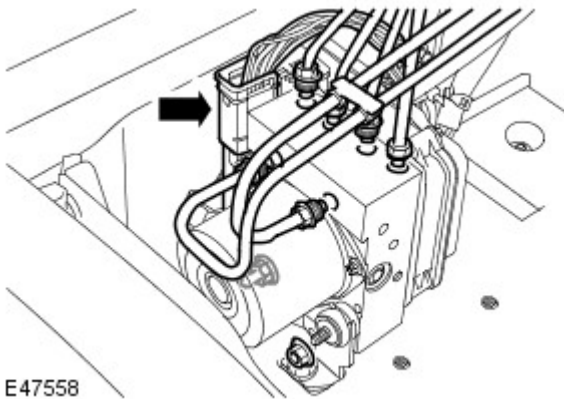
 Before the disconnection or removal of any components, ensure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

Disconnect the 6 brake tubes.

- Position an absorbent cloth to collect fluid spillage.

4. Remove the ABS module from the mounting bracket.

- Loosen, but do not remove, the 2 nuts securing the ABS module to the bracket.



Installation

1. NOTE: Make sure the ABS module locating grommet is correctly seated in the bracket before installing the ABS module.

• NOTE: Make sure the ABS module locating pin is correctly located in the grommet, and the 2 front isolators are fully seated in the bracket slots.

Install the ABS module.

- Tighten the 2 ABS module retaining nuts to 8 Nm (6 lb.ft).
- Remove the blanking caps from the ports.
- Tighten the two M10 and three M12 brake tube unions to 15 Nm (11 lb.ft).

- Tighten the M14 brake tube union to 17 Nm (13 lb.ft).
- Connect the electrical connector.
- Remove the ABS module from the mounting bracket.

2. Using T4, bleed the braking system.

For additional information, refer to: Brake System Pressure Bleeding (206-00, General Procedures).


3. Install the cover.

4. If a new ABS module has been installed, interrogate the ABS system using T4.

Anti-Lock Control - Traction Control - Front Wheel Speed Sensor

Removal and Installation

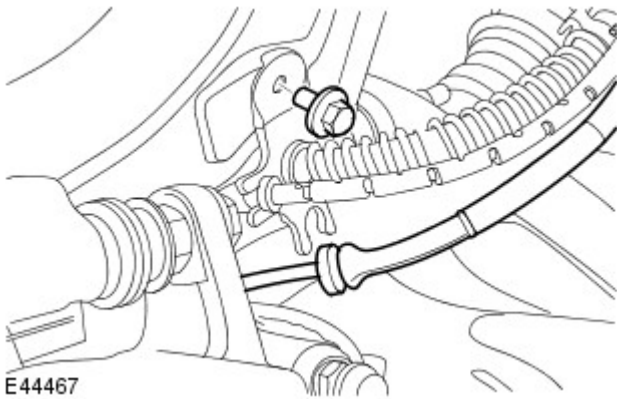
Removal

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. Remove the fender splash shield.
For additional information, refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).
3. Release the brake hose bracket from the wheel knuckle.

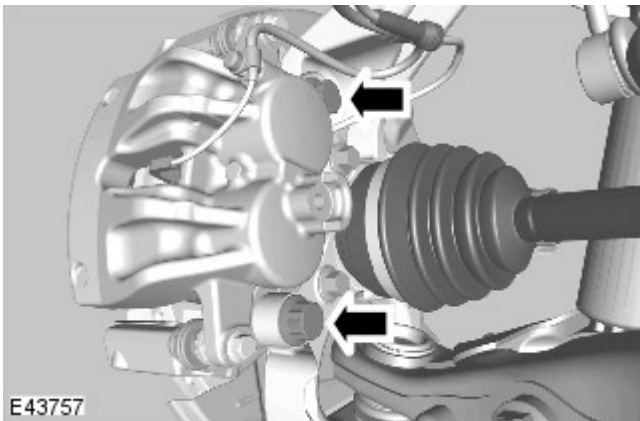
- Remove the retaining bolt.



4.  **CAUTION:** Do not allow the brake caliper to hang on the brake hose.

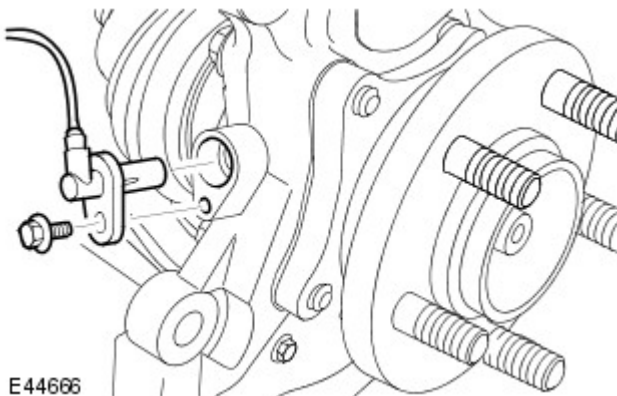
Release the brake caliper anchor plate from the wheel knuckle and tie the caliper aside.

- Remove the two retaining bolts.



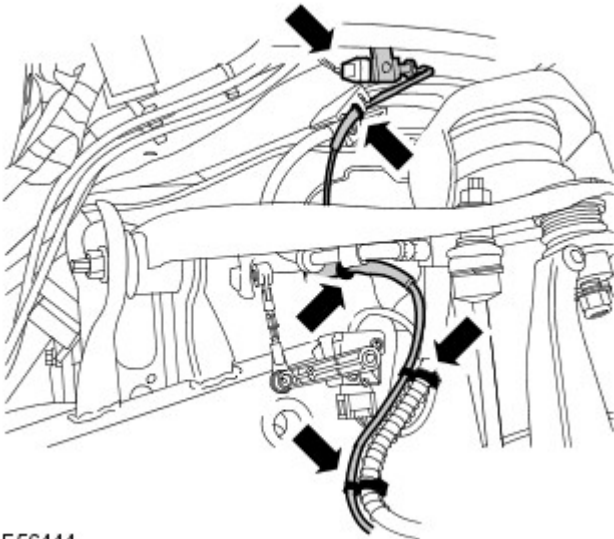
5. Release the wheel speed sensor from the wheel knuckle.

- Remove the bolt.



6. Remove the wheel speed sensor.

- Disconnect the electrical connector.
- Release the wiring harness from the 5 clips.



E56444

Installation

- 1.** Make sure the wheel speed sensor location in the wheel knuckle is free of dirt.
- 2. NOTE:** Make sure the electrical connector retaining clip is attached to the body wiring harness.


Install the wheel speed sensor.

- Connect the electrical connector.
 - Attach the wiring harness to the 5 clips.
 - Tighten the bolt to 9 Nm (7 lb.ft).
- 3.** Secure the brake caliper and anchor plate to the wheel knuckle.
 - Tighten the bolts to 275 Nm (203 lb.ft).
 - 4.** Secure the brake hose retaining bracket to the wheel knuckle.
 - Tighten the bolt to 25 Nm (18 lb.ft).
 - 5.** Install the fender splash shield.
For additional information, refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).
 - 6.** Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
 - 7.** Depress the brake pedal several times, check the fluid level in the brake fluid reservoir and top-up with brake fluid if necessary.
 - 8.** If a new wheel speed sensor has been installed, interrogate the ABS system using T4.

Anti-Lock Control - Traction Control - Rear Wheel Speed Sensor

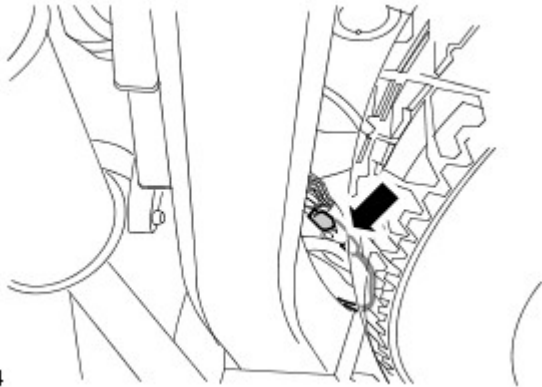
Removal and Installation

Removal

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

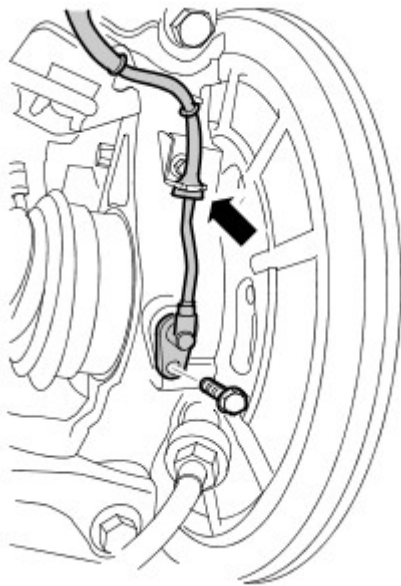
Raise and support the vehicle.

2. Remove the wheel and tire.
3. Disconnect the anti-lock brake system (ABS) sensor electrical connector.
 - Release the wiring harness retaining clip.



E52454

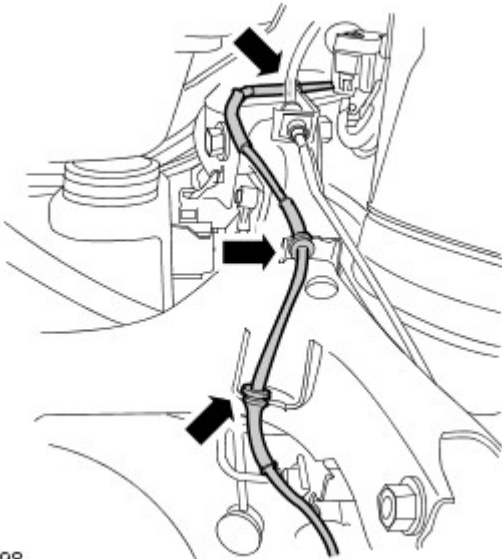
4. Release the wheel speed sensor from the wheel knuckle.
 - Release the wiring harness.
 - Remove the retaining bolt.



E56445

5. Remove the wheel speed sensor.

- Release the wiring harness from the 4 clips.



E56698

Installation

1. Make sure the wheel speed sensor location in the wheel knuckle is free of dirt.

2. Install the wheel speed sensor.

- Attach the wiring harness to the 4 clips.

3. Secure the wheel speed sensor to the wheel knuckle.

- Tighten the bolt to 9 Nm (7 lb.ft).
- Attach the wiring harness to the clip.

4. NOTE: Make sure the electrical connector retaining clip is attached to the body wiring harness.

Connect the ABS sensor electrical connector.

- Attach the wiring harness.

5. If a new wheel speed sensor has been installed, interrogate the ABS system using T4.

Anti-Lock Control - Stability Assist - Yaw Rate Sensor

Removal and Installation

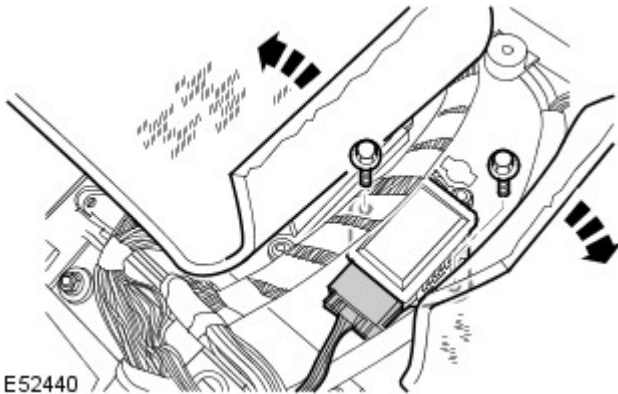
Removal

1. Disconnect the battery ground cable.
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the floor console.
For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

3.  **CAUTION:** Make sure the wiring harness is protected when cutting the carpet.

Remove the yaw rate sensor.

- Cut the carpet for access.
- Position the wiring harness aside.
- Disconnect the electrical connector.
- Remove the two retaining bolts.



Installation

1. Install the yaw rate sensor.
 - Tighten the bolts to 7 Nm (5 lb.ft).
 - Connect the electrical connector.
 - Attach the wiring harness.
 - Attach the carpet.
2. Install the floor console.
For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).
3. Connect the battery ground cable.
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
4. If a new yaw rate sensor has been installed, interrogate the ABS system using T4.

Anti-Lock Control - Stability Assist - Yaw Rate Sensor

Removal and Installation

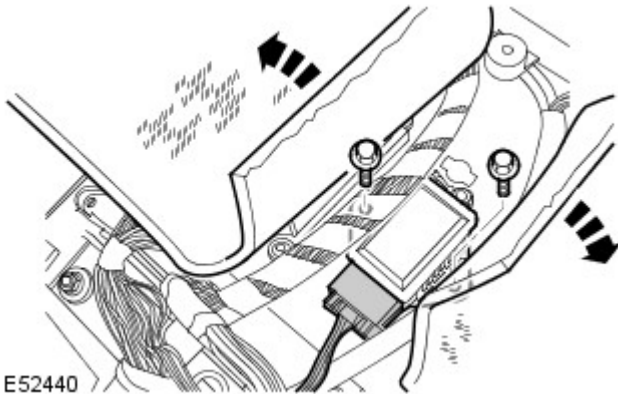
Removal

1. Disconnect the battery ground cable.
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the floor console.
For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

3.  **CAUTION:** Make sure the wiring harness is protected when cutting the carpet.

Remove the yaw rate sensor.

- Cut the carpet for access.
- Position the wiring harness aside.
- Disconnect the electrical connector.
- Remove the two retaining bolts.



E52440

Installation

1. Install the yaw rate sensor.
 - Tighten the bolts to 7 Nm (5 lb.ft).
 - Connect the electrical connector.
 - Attach the wiring harness.
 - Attach the carpet.
2. Install the floor console.
For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).
3. Connect the battery ground cable.
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
4. If a new yaw rate sensor has been installed, interrogate the ABS system using T4.