

Hydraulic Brake Actuation -

General Specification

Item	Specification
Master cylinder bore diameter:	
Primary	27 mm
Secondary	27 mm
Stroke	36 mm

Torque Specifications

Description	Nm	lb-ft
Brake booster to brake pedal bracket nuts	22	16
Brake master cylinder nuts	26	19
Brake pedal bracket nuts	25	18
Brake pipe unions	15	11
Fluid reservoir to master cylinder	6	4

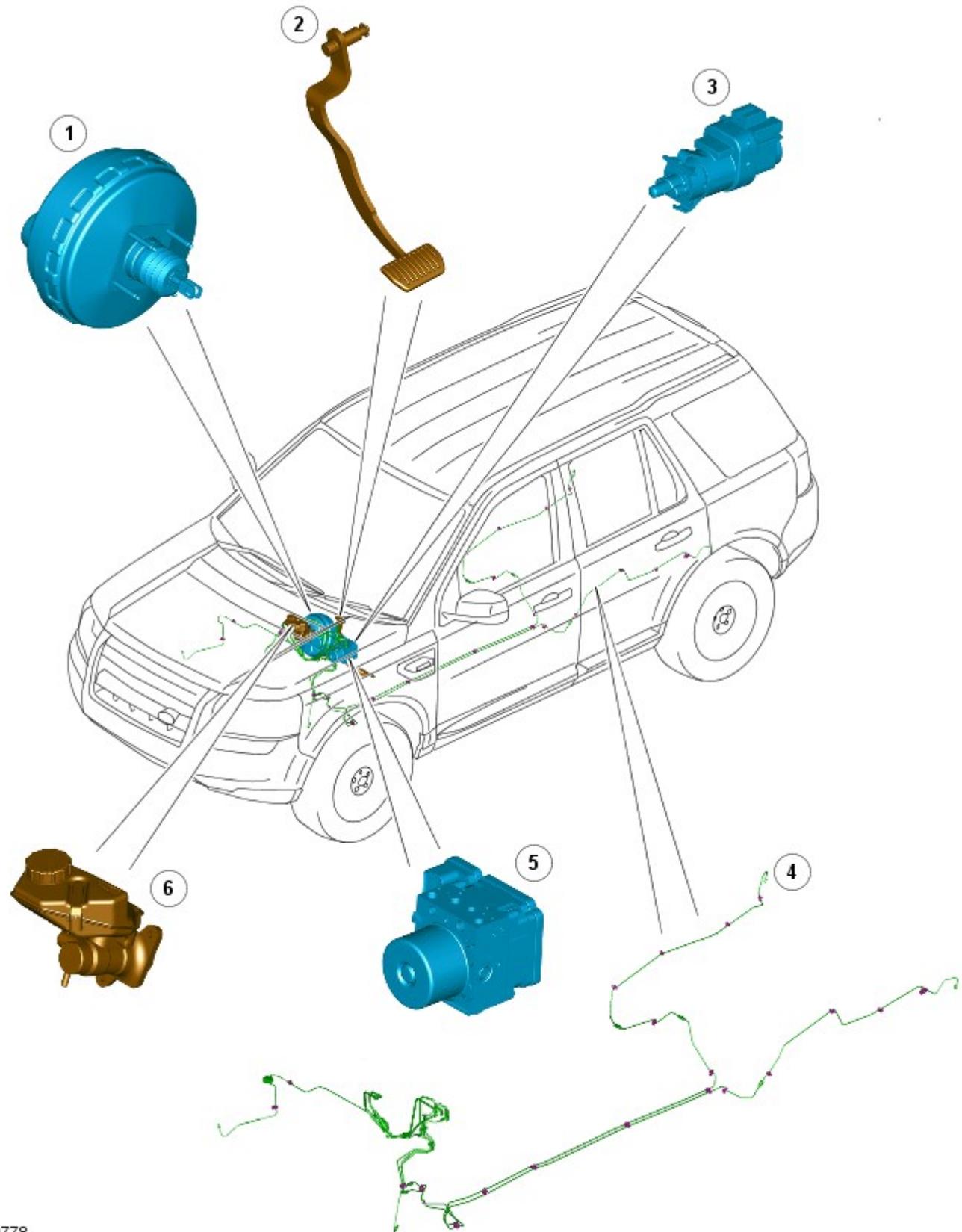
Part Number Hydraulic Brake Actuation - Hydraulic Brake Actuation

Published: 11-May-2011

Description and Operation

COMPONENT LOCATION

NOTE: Left-Hand Drive (LHD) shown; Right-Hand Drive (RHD) similar.



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Item	Part Number	Description
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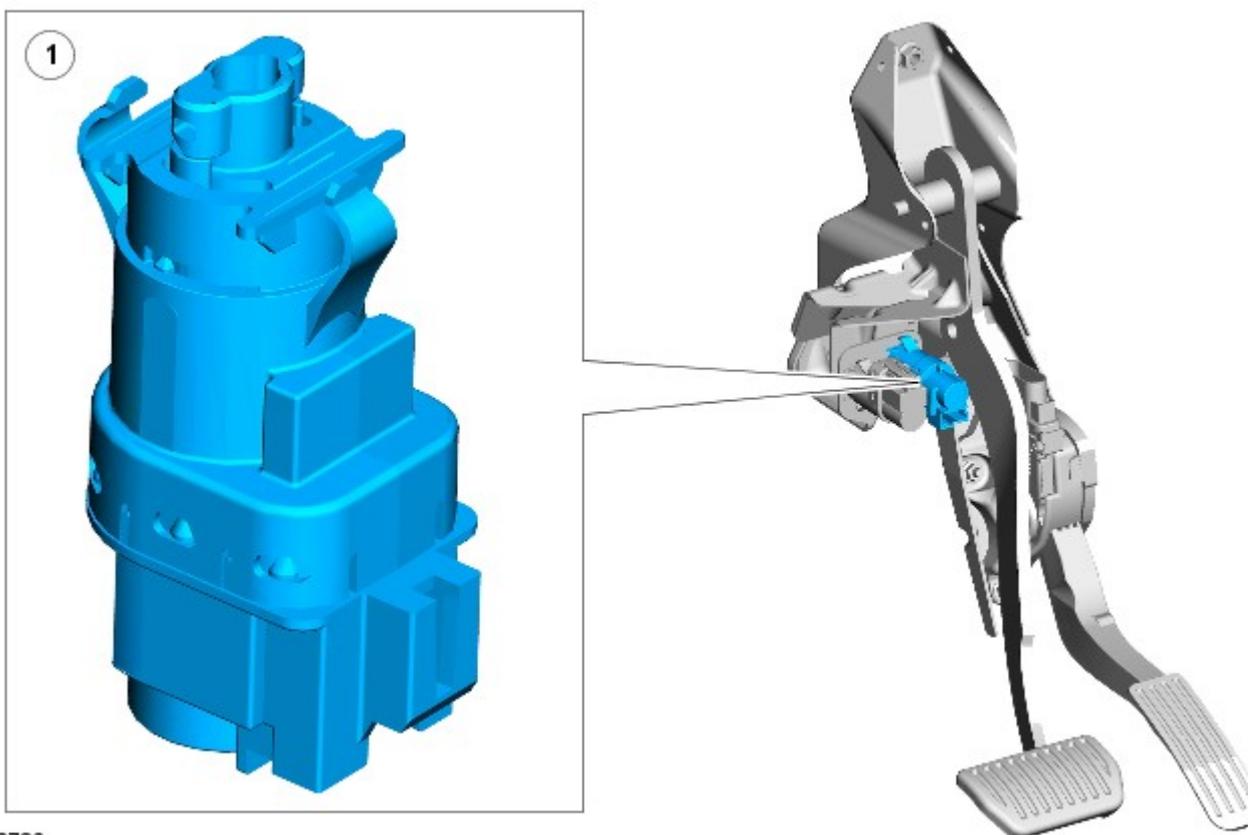
1		Brake booster
2		Brake pedal
3		Stoplamp switch
4		Hydraulic pipes
5		Integrated Hydraulic Control Unit (HCU) and Anti-lock Brake System (ABS) module
6		Brake master cylinder and fluid reservoir

OVERVIEW

The hydraulic brake system is a diagonally split dual circuit system and consists of the brake pedal, brake master cylinder, HCU and the hydraulic pipes and hoses. The system also features a non-active brake booster. For additional information, refer to: Brake Booster (206-07 Power Brake Actuation, Description and Operation).

The preformed rigid brake pipes distribute pressure from the master cylinder to the 4 brake calipers, via the integrated HCU and ABS module. Flexible hoses connect the rigid brake pipes to the front and rear calipers.

BRAKE PEDAL



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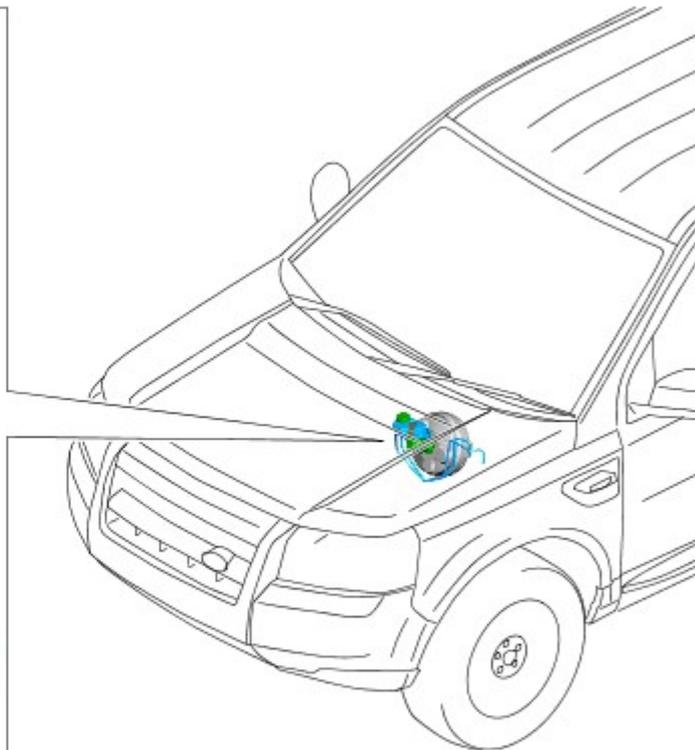
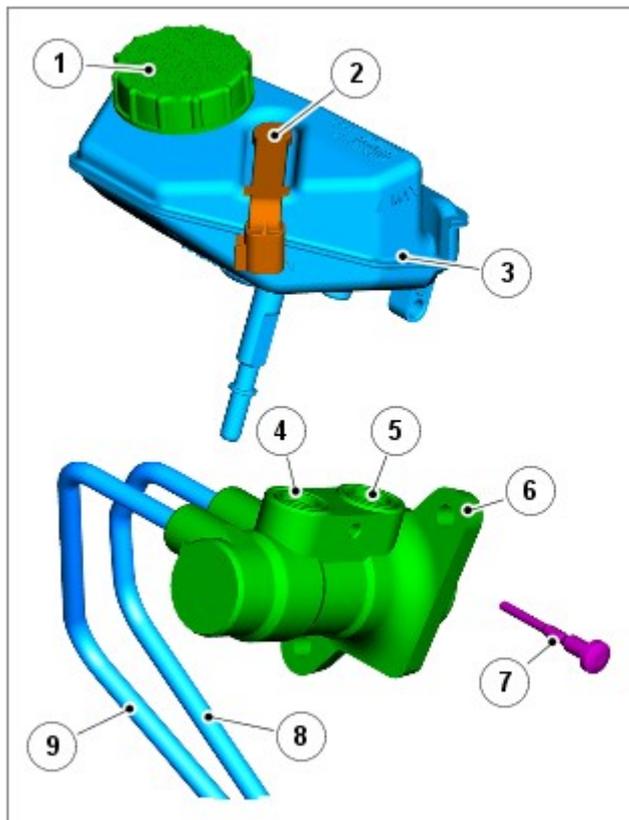
Item	Description
1	Stoplamp switch

The brake pedal is mounted in a bracket that is attached to the rear side of the engine bulkhead. The pedal assembly is different for LHD and RHD vehicles, and is connected to the brake booster push rod with a clevis pin.

The stoplamp switch is mounted on the brake pedal bracket and will illuminate the vehicle stoplamps when the brake pedal is pressed. The stoplamp switch is also used as an input to the speed control system, and will cancel the current speed setting when the brake pedal is pressed. For additional information, refer to:

- Speed Control - 3.2L (310-03 Speed Control - 3.2L, Description and Operation),
- Speed Control - 2.2L Diesel (310-03 Speed Control - 2.2L Diesel, Description and Operation).

BRAKE MASTER CYLINDER AND FLUID RESERVOIR



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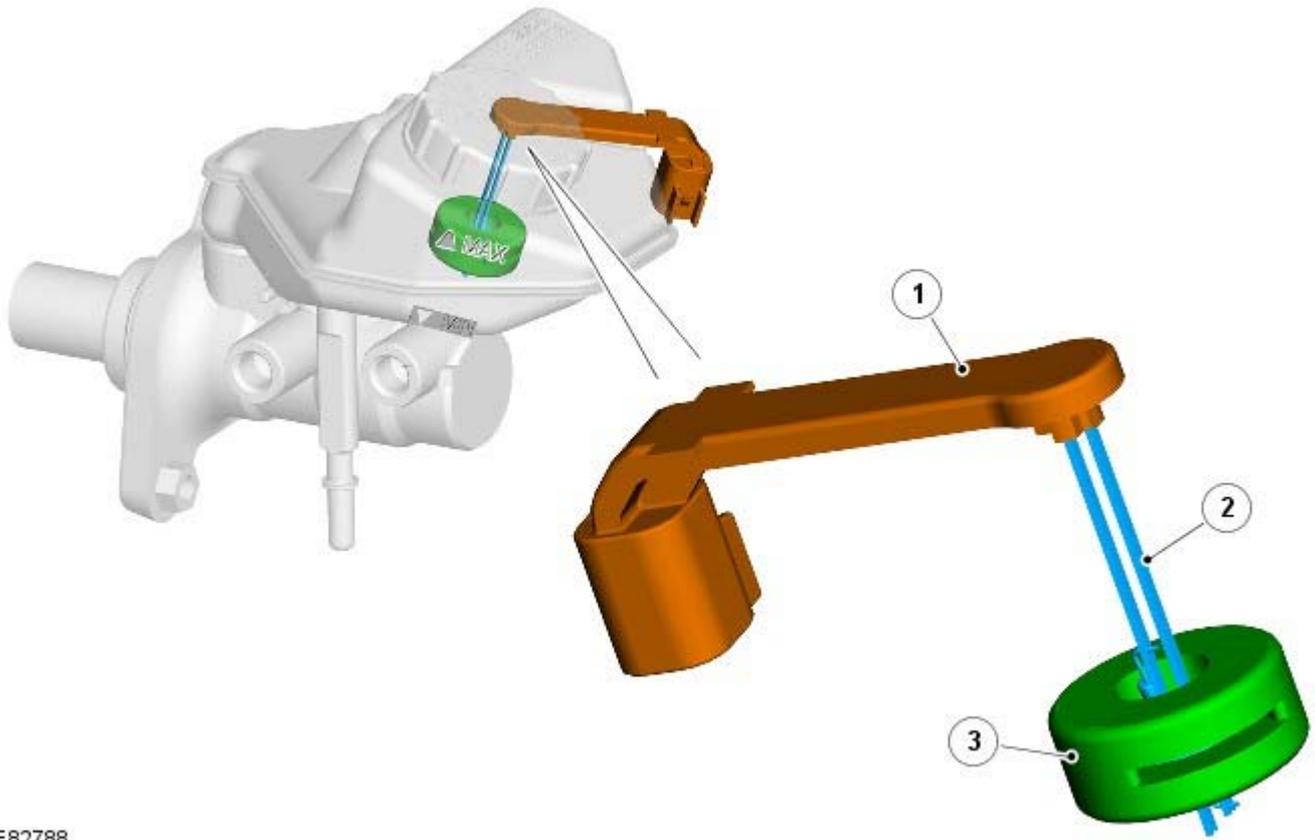
Item	Description
1	Brake fluid reservoir cap
2	Brake fluid level switch
3	Brake fluid reservoir
4	Secondary circuit inlet port
5	Primary circuit inlet port
6	Brake master cylinder
7	Screw
8	Primary circuit outlet port
9	Secondary circuit outlet port

The brake master cylinder is attached to the front of the brake booster, on the driver's side of the engine compartment. The brake master cylinder is a tandem design that supplies pressure to 2 independent (primary and secondary) hydraulic circuits. Each circuit is connected between the calipers of diagonally opposing front and rear wheels to provide a fail safe brake system.

A reservoir is mounted on top of the master cylinder and retains sufficient volume of hydraulic fluid to allow for normal system use, and to compensate for the replenishment of the system as the brake linings wear. The reservoir is internally divided to provide an independent supply of fluid to each brake circuit, and prevents a single fluid leak from disabling both primary and secondary brake circuits. If a failure occurs in one brake hydraulic circuit the remaining circuit will still operate effectively, although brake pedal travel and vehicle braking distances will increase.

On vehicles with manual transmission, the brake fluid reservoir also supplies hydraulic fluid for operation of the clutch assembly.

Brake Fluid Level Switch



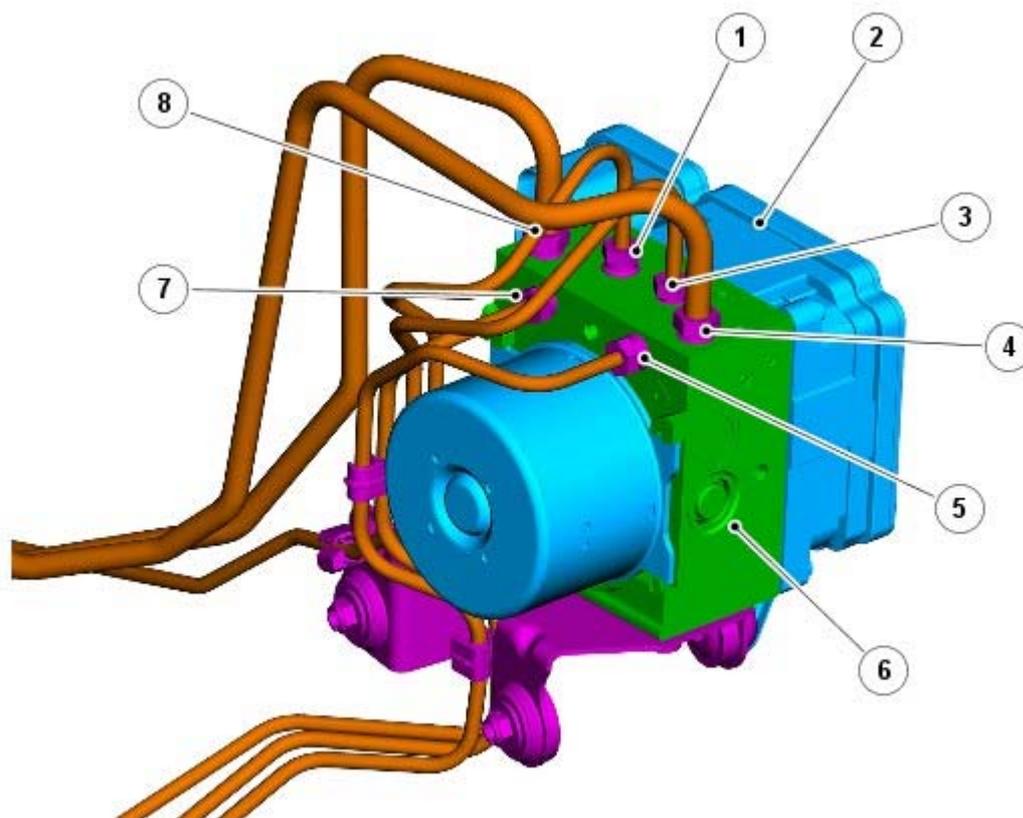
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Item	Description
1	Contact carrier
2	Contact
3	Float

The reservoir incorporates a brake fluid level switch that is hardwired to the Central Junction Box (CJB). When the reservoir fluid falls to a predetermined low level, the switch contacts close and provide a signal feed back to the CJB. The CJB then broadcasts a message on the medium speed Controller Area Network (CAN) bus to the instrument cluster that in turn illuminates the brake fluid warning indicator lamp.

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

HYDRAULIC CONTROL UNIT



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Item	Description
1	Brake pipe to LH front caliper
2	ABS module
3	Brake pipe to RH front caliper
4	Master cylinder primary circuit connection
5	Brake pipe to LH rear caliper
6	HCU
7	Brake pipe to RH rear caliper
8	Master cylinder secondary circuit connection

The HCU is located on the rear LH side of the engine compartment and is an integral component with the ABS module. 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 primary and secondary outlet ports of the master cylinder are connected via 8 mm (0.315 in) diameter brake pipes to the primary and secondary circuits of the HCU. The primary circuit in the HCU provides 2 separate outlet ports to the RH front and LH rear brakes. The secondary circuit in the HCU provides 2 separate outlet ports to the LH front and RH rear brakes.

The HCU incorporates 3 brake operating modes as follows:

- Normal braking/ Electronic Brake Force Distribution (EBD)
- ABS braking
- Active braking.

As the HCU and ABS module is a fully integrated unit, the description and operation details for the HCU and ABS functionality, including the 3 braking modes, are detailed in the Anti-Lock Control - Stability Assist section of the manual.

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

Servicing Information

The ABS module and HCU form a single component and must not be separated. The ABS module and HCU assembly is supplied in a pre-filled state. After installation, the hydraulic brake system only requires a conventional bleed of the system; there is no requirement to pressure bleed the system.

NOTE: The ABS module and HCU is a fragile component and must be discarded if dropped or damaged.

PRINCIPLES OF OPERATION

As the brake pedal is pressed, the front push rod in the brake booster pushes the master cylinder primary piston along the

bore of the housing. This produces pressure in the primary pressure chamber and 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 located inside the master cylinder. Further movement of the pistons then pressurizes the fluid in the primary and secondary chambers and the brake circuits. The fluid in the chambers behind the pistons is unaffected by the movement of the pistons and will flow unrestricted through the inlet ports, between the chambers and the reservoir.

Pressurized fluid enters the HCU that is mounted on the front of the ABS module. The HCU then modulates the supply of pressurized fluid to the brakes under control of the ABS module.

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

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Hydraulic Brake Actuation - Hydraulic Brake Actuation

Diagnosis and Testing

For additional information.

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

Hydraulic Brake Actuation - Brake Pedal and Bracket

Removal and Installation

Removal

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

1. Make the SRS system safe.

Refer to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20, General Procedures).

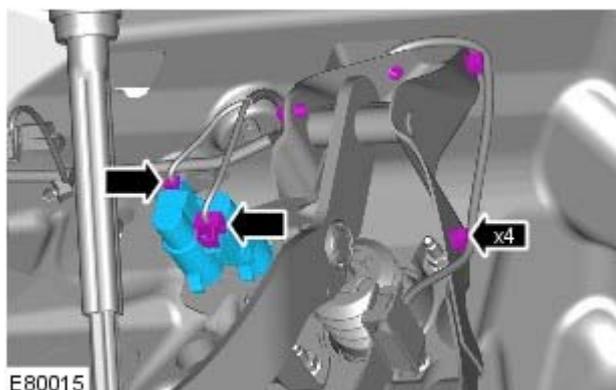
2. Remove the driver lower air bag module.

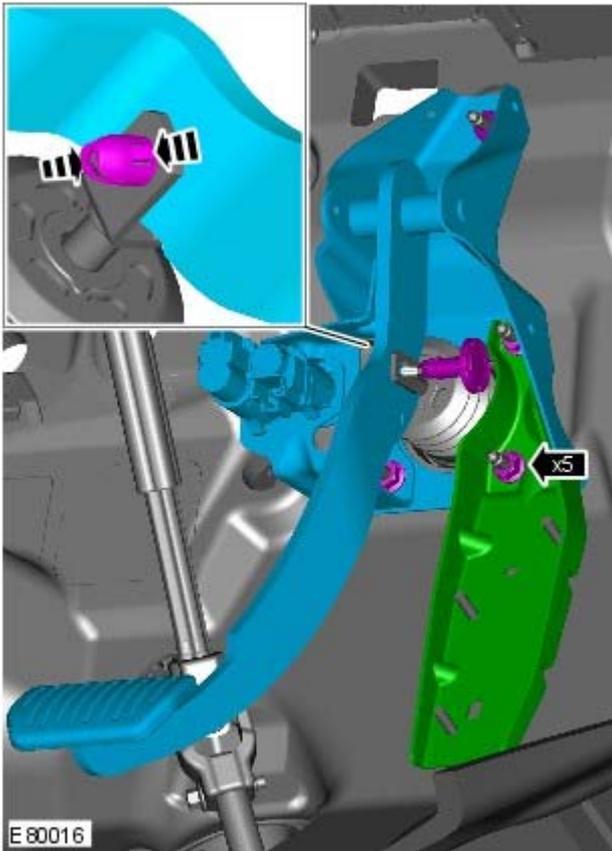
Refer to: [Driver Lower Air Bag Module](#) (501-20B Supplemental Restraint System, Removal and Installation).

3. Remove the throttle pedal assembly.

Refer to: [Speed Control Actuator](#) (310-03B Speed Control - TD4 2.2L Diesel, Removal and Installation).

- 4.



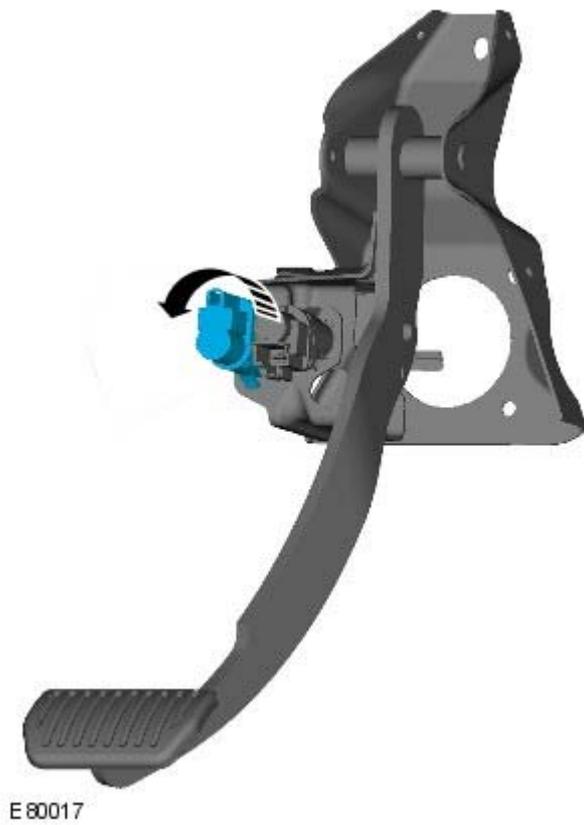


5. Remove the brake pedal assembly.

Torque: 25 Nm

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

Remove the stoplamp switch.



7. Remove the speed control deactivation switch.



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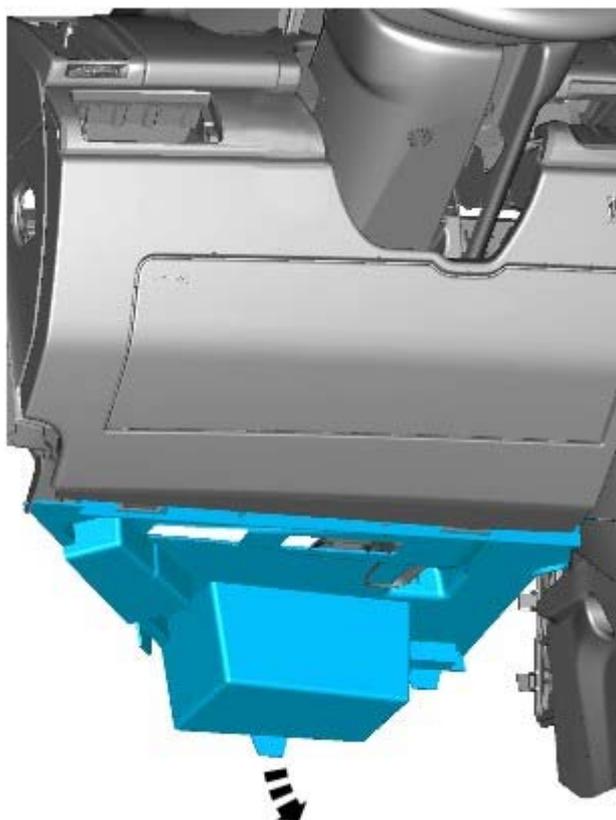
Installation

1. To install, reverse the removal procedure.

Hydraulic Brake Actuation - Brake Pedal Control Switch

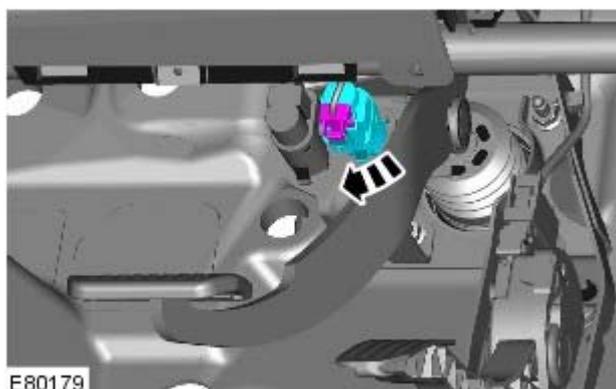
Removal and Installation

Removal



E 79760

1. Remove the closing panel.



E80179

2. Remove the stoplamp switch.

Installation

1. To install, reverse the removal procedure.

Hydraulic Brake Actuation - Brake Master Cylinder

Removal and Installation

Removal

CAUTIONS:



Extreme cleanliness must be exercised when handling these components.



If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

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

All vehicles

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

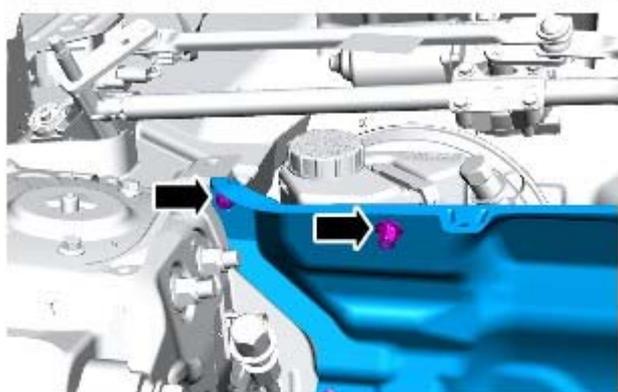
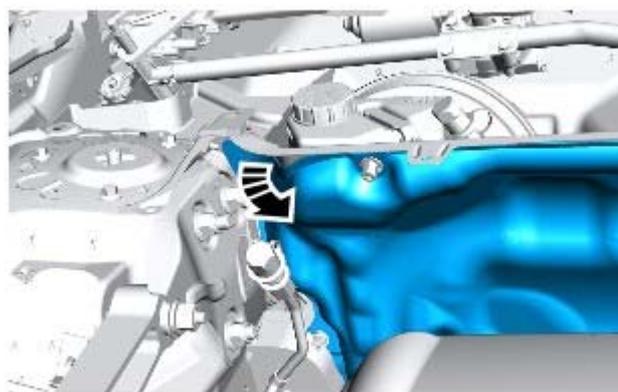
2. Remove the brake fluid reservoir.

Refer to: [Brake Fluid Reservoir](#) (206-06 Hydraulic Brake Actuation, Removal and Installation).

Right-hand drive vehicles

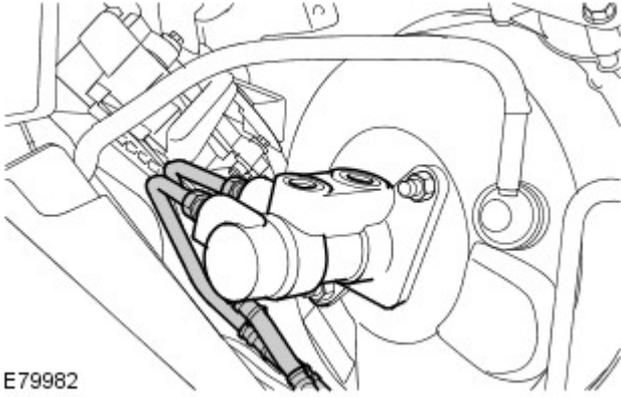
3. NOTE: Torque applies to bolt only.

Torque: 10 Nm



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All vehicles

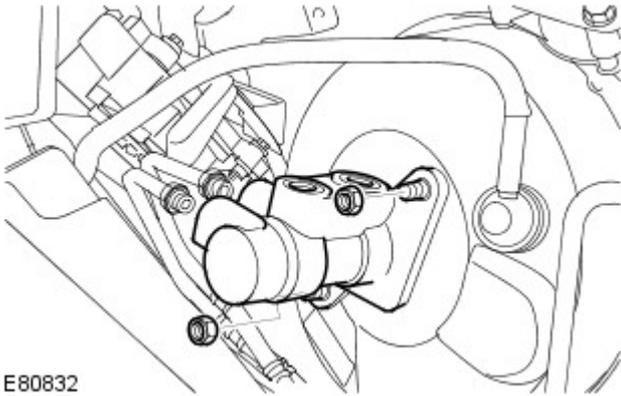


4. CAUTIONS:

 Be prepared to collect escaping fluids.

 Make sure that all openings are sealed.

Torque: 15 Nm



5. CAUTIONS:

 Be prepared to collect escaping fluids.

 The seal is to be reused unless damaged.

Torque: 26 Nm

Installation

1. To install, reverse the removal procedure.

Hydraulic Brake Actuation - Brake Fluid Reservoir

Removal and Installation

Removal

CAUTIONS:



Extreme cleanliness must be exercised when handling these components.



If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

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

All vehicles

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

Left-hand drive vehicles

2. Remove the battery.

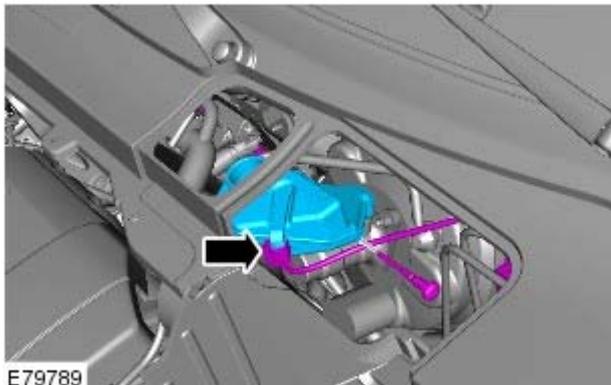
Refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

Right-hand drive vehicles

3. Remove the plenum chamber panel.

Refer to: [Plenum Chamber](#) (412-01 Climate Control, Removal and Installation).

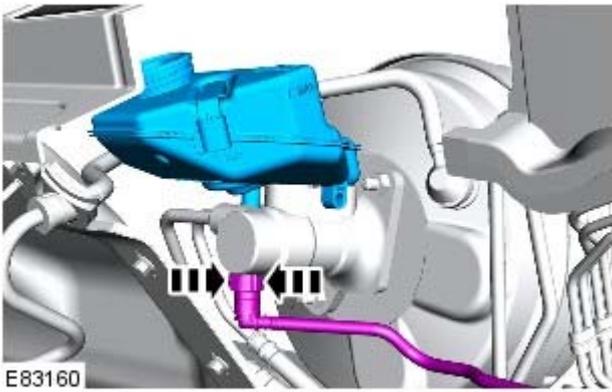
All vehicles



4.  **CAUTION:** Be prepared to collect escaping fluids.

Torque: 6 Nm

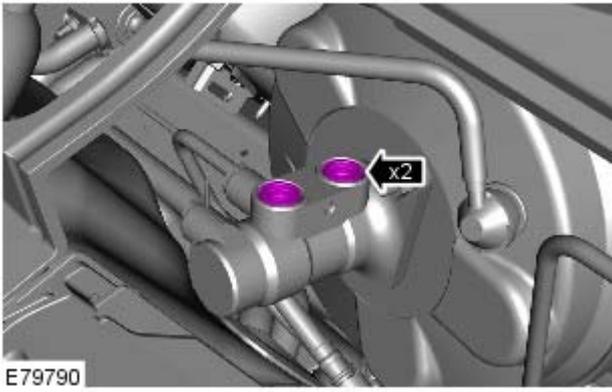
Vehicles with manual transmission



5. CAUTIONS:

-  Be prepared to collect escaping fluids.
-  Make sure that all openings are sealed.

All vehicles



- 6.  CAUTION: Make sure that all openings are sealed.

Installation

All vehicles

1. To install, reverse the removal procedure.
2. Bleed the brake system.

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

Vehicles with manual transmission

3. Bleed the clutch system.

Refer to: [Clutch System Bleeding](#) (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).