

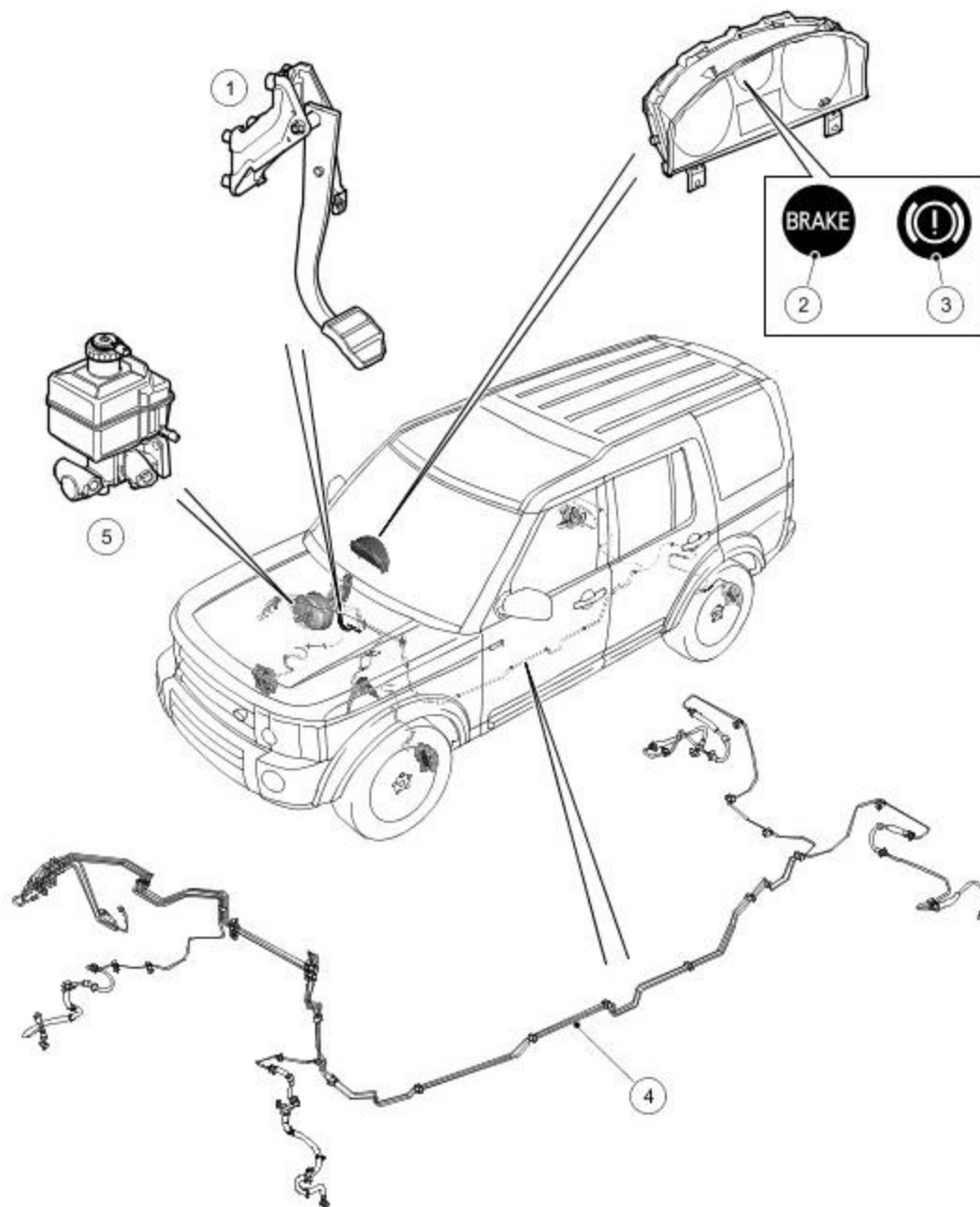
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## Hydraulic Brake Actuation

### 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

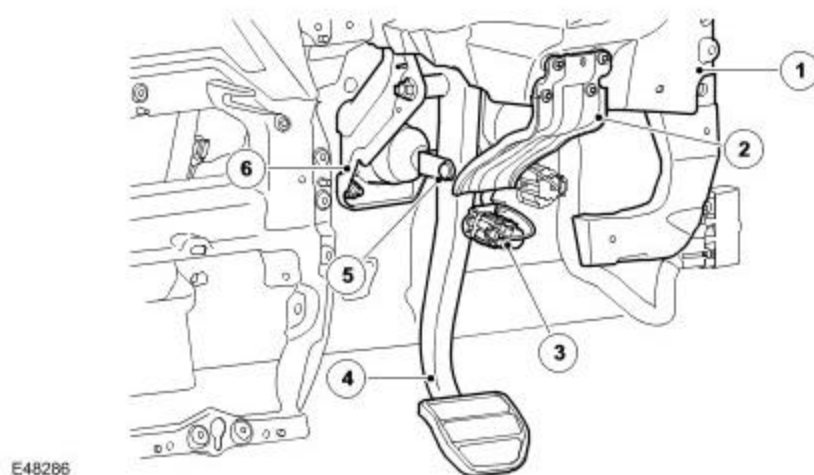
## GENERAL

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



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

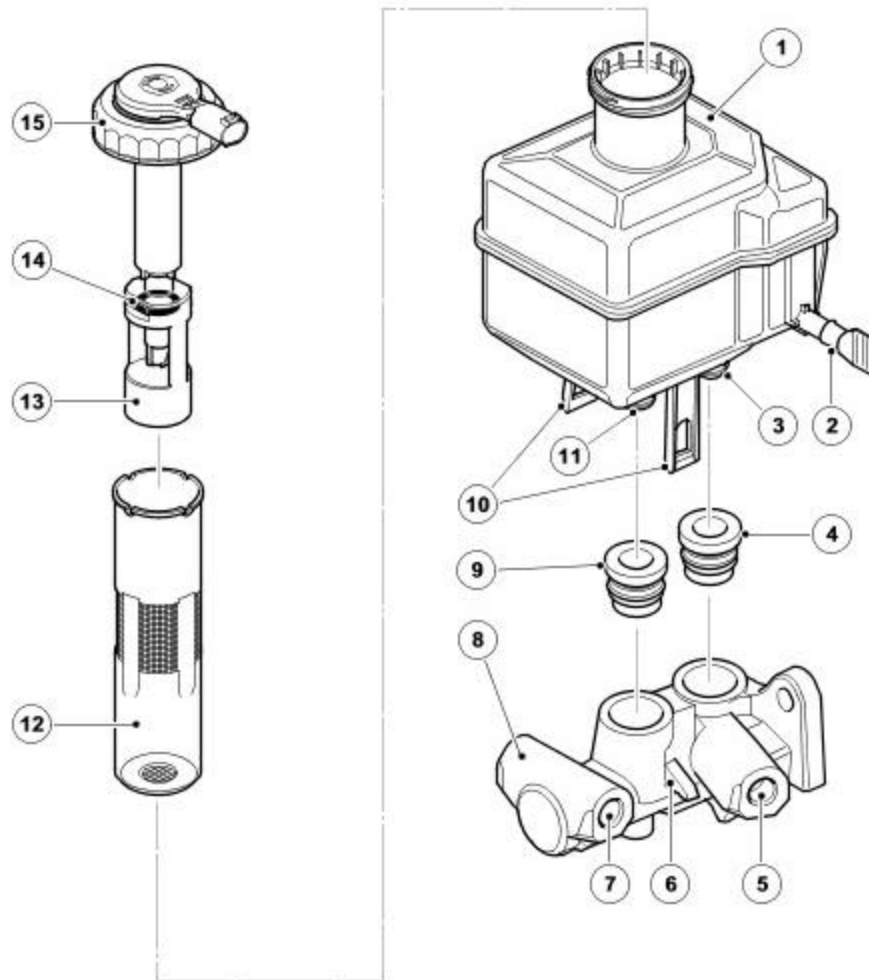
The brake pedal is mounted in a bracket attached to the rear side of the engine bulkhead. On Left Hand Drive (LHD) manual gearbox models, the brake pedal shares a bracket and pivot bolt with the clutch pedal. On Right Hand Drive (RHD) manual gearbox models, the brake pedal has a separate bracket. A clevis 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)

## 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 - 2.7L Diesel)

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.

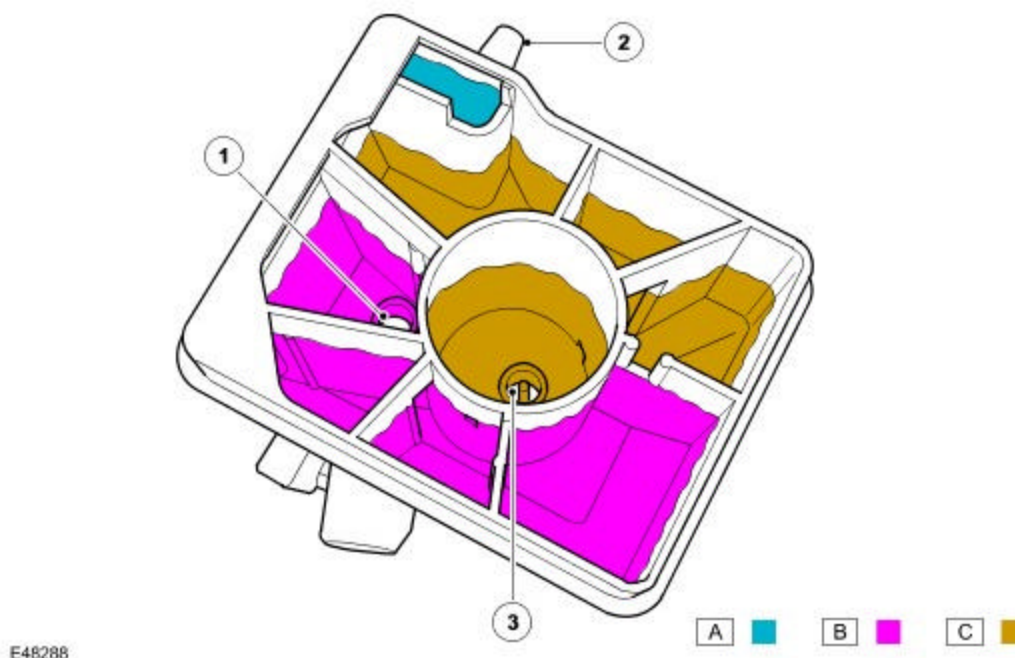
The reservoir is internally divided to isolate the circuits from each other at low fluid levels, and so prevent a leak in one circuit from disabling the other circuit(s). The dividing walls support a central well and divide the area around the well into a further eight separate compartments. The well 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. The following figure shows the 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



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)

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)

## 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.