

# Steering System - General Information - Steering System

Diagnosis and Testing

## Principles of Operation

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

REFER to: [Power Steering](#) (211-02 Power Steering, Description and Operation) /  
[Steering Linkage](#) (211-03 Steering Linkage, Description and Operation) /  
 Steering Column (211-04 Steering Column, 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 or electrical damage.

### Visual Inspection

| Mechanical   | Electrical  |
|--|---|
| <ul style="list-style-type: none"> <li>● Check the tires for correct pressure, size and tread pattern</li> <li>● Check for wheel rim and tire damage</li> <li>● Check road wheel security</li> <li>● Check the power steering fluid level and the hydraulic circuit for oil leaks</li> <li>● Check the power steering pump drive belt condition and tension</li> <li>● Check the power steering pump for security, wear, damage and excessive noise</li> <li>● Check the steering gear assembly for damage, wear and security</li> <li>● Check the hydraulic pipes and cooler lines for damage and correct routing</li> <li>● Check the steering joints for damage, excessive play, wear and security</li> <li>● Check the steering column and joints for damage, excessive play, wear and security</li> </ul> | <ul style="list-style-type: none"> <li>● Steering Angle Sensor Module (SASM) and circuits</li> <li>● Controller Area Networks (CAN) circuits</li> </ul> |

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   |
|--|--|--|
| Steering wanders                                     | <ul style="list-style-type: none"> <li>● Excessive free play in the steering system</li> <li>● Steering geometry incorrectly aligned</li> </ul>  | Check for excessive movement or play in the steering system with the engine running. Check for play at several different steering positions. Carry out steering geometry and alignment checks. Refer to the relevant section of the workshop manual  |
| Steering pulls to the left or right                  | <ul style="list-style-type: none"> <li>● Steering geometry incorrectly aligned</li> </ul>  | Carry out steering geometry and alignment checks using a four wheel alignment system.<br>REFER to: <a href="#">Four-Wheel Alignment</a> (204-00 Suspension System - General Information, General Procedures).<br>Ensure that the tire direction of rotation is correct for the position on the vehicle (where directional tires are installed) |
| Steering feels notchy when turning from lock to lock | <ul style="list-style-type: none"> <li>● Steering or suspension swivel joints seized</li> <li>● Steering tie rod end joints or track rod inner joints seized</li> <li>● Steering column or universal joints seized</li> <li>● Steering gear internal components misaligned, worn or damaged</li> </ul> | Disconnect the steering gear from the suspension. Check for freedom of movement in the suspension. Disconnect the steering column from the steering gear. Check the steering column and universal joints for freedom of movement. Check the steering gear for freedom of movement. Rectify as necessary  |
| Steering feels tight and does not self-center        | <ul style="list-style-type: none"> <li>● Steering or suspension swivel joints seized</li> <li>● Steering tie rod end joints or track rod inner joints seized</li> <li>● Steering column or universal joints seized</li> <li>● Steering gear internal components misaligned, worn or damaged</li> </ul> |  |

| Symptom  | Possible Causes   | Action  |
|--|---|---|
| Power steering hydraulics noisy operation                            | <ul style="list-style-type: none"> <li>● Power steering fluid level low or contaminated</li> <li>● Incorrect specification of power steering fluid</li> <li>● Filter in the power steering reservoir blocked</li> <li>● Power steering fluid aerated</li> <li>● power steering hoses twisted or restricted</li> </ul> | Check and top-up the power steering fluid level if required, using the correct specification of fluid. REFER to: Specifications (211-00 Steering System - General Information, Specifications). Check for contaminated fluid. Drain the fluid from the reservoir and visually inspect the filter for obstructions/blockage. Repair/renew as necessary. Check for air ingress into the system. Check the power steering hoses for twisting or restrictions. Rectify as necessary |
| Power steering pump noisy  | <ul style="list-style-type: none"> <li>● Power steering fluid level low or contaminated</li> <li>● Filter in the power steering reservoir blocked</li> <li>● Pump internal components worn or damaged</li> </ul>  | Check and top-up the power steering fluid level if required. REFER to: <a href="#">Power Steering System Filling and Bleeding</a> (211-00 Steering System - General Information, General Procedures). Check for contaminated fluid. Drain the fluid from the reservoir and visually inspect the filter for obstructions/blockage. Repair/renew as necessary. Check for excessive pump noise. Rectify as necessary   |
| Power steering gear noisy  | <ul style="list-style-type: none"> <li>● Power steering fluid level low or contaminated</li> <li>● Steering gear internal components worn or damaged</li> </ul>   | Check and top-up the power steering fluid level if required. Refer to the relevant section of the workshop manual. Check for contaminated fluid. Check for excessive steering gear noise. Rectify as necessary  |
| Steering column noisy  | <ul style="list-style-type: none"> <li>● Steering column fouling or universal joints dry</li> </ul>   | Check the steering column and universal joints. Rectify as necessary  |
| Power steering feels heavier than normal through its operating range | <ul style="list-style-type: none"> <li>● Lack of power assistance</li> </ul>  | Check the power steering pump pressure. Check the steering column has no damage and rotates freely  |
| Power steering feels too light at speed                              |   |   |
| Power steering feels too heavy at standstill and low speed           |   |   |


## DTC Index

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

# Steering System - General Information - Power Steering System Filling and Bleeding

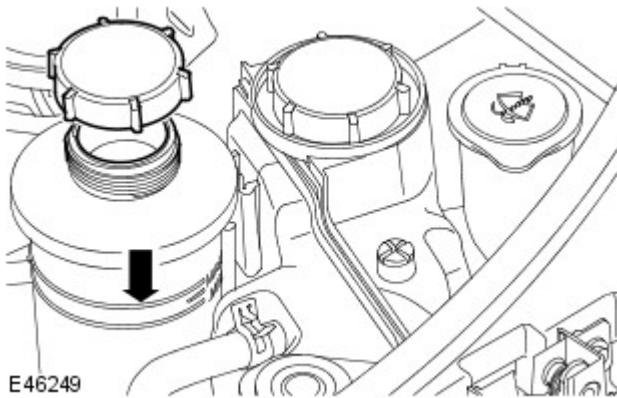
General Procedures

1. Check the power steering fluid level.

2.  **CAUTION:** Fluid must always be present in the reservoir during bleeding.

Remove the filler cap and fill to the MAX level mark.

- Install the reservoir filler cap.



3. Start the engine and allow to run for 10 seconds, stop the engine.

- Check the power steering fluid, if aerated, wait until fluid is free from bubbles then top-up reservoir to UPPER level mark with recommended fluid.

4.  **CAUTION:** Do not hold steering on full lock for longer than 10 seconds.

Start the engine and turn steering fully lock to lock, stop the engine.

- Check and top-up power steering fluid level.

5. Start and run the engine for 2 minutes, turn the steering fully lock to lock.

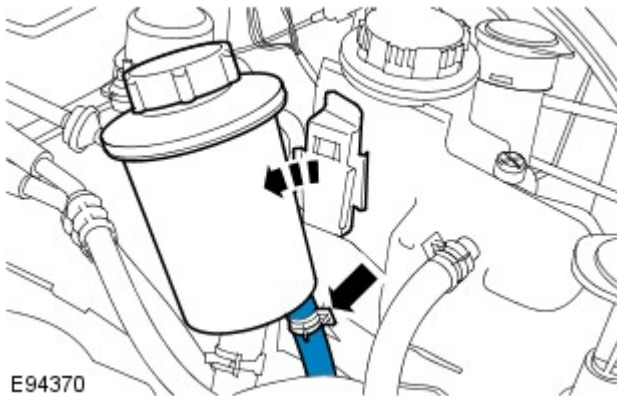
- Check and top-up power steering fluid level.

## Steering System - General Information - Power Steering System Flushing

### General Procedures

- NOTE: If heavy steering or contamination within the power steering system is found, it is necessary to carry out the system flush procedure as detailed below. If any components have been replaced in the power steering system the procedure below must be carried out in full.
- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Remove the power steering fluid reservoir cap.
2. Using a suitable syringe, remove the power steering fluid from the power steering fluid reservoir.



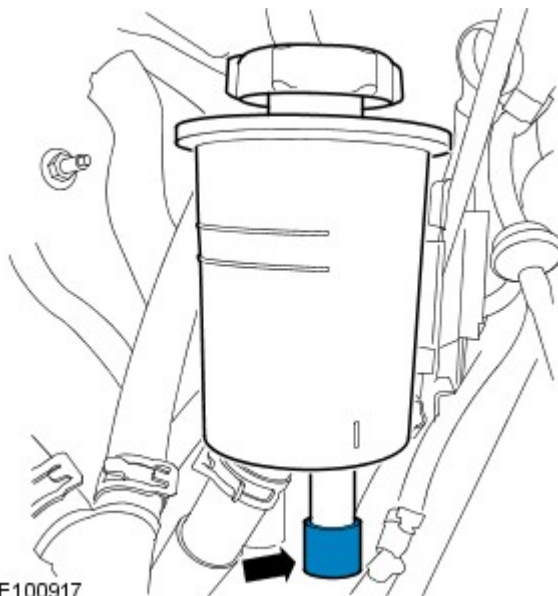
E94370

3.  CAUTION: Be prepared to collect escaping fluids.

- NOTE: Note the orientation of the clip.

Detach the power steering fluid reservoir.

- Detach but do not remove the power steering fluid reservoir.
- Release the power steering fluid return hose from the power steering fluid reservoir.
- If a quick release coupling is fitted to the power steering return hose, release the power steering fluid return hose from the coupling by removing the clip.



E100917

4.  CAUTION: Be prepared to collect escaping fluids.

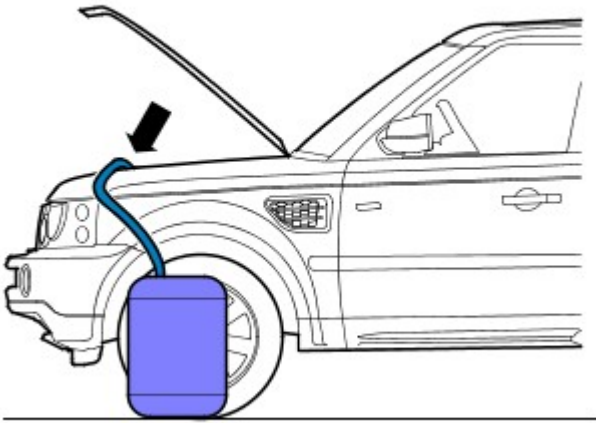
- NOTE: Make sure that all openings are sealed. Use new blanking caps.

Using a suitable blanking cap, cap the power steering reservoir return pipe.

5.  CAUTION: Be prepared to collect escaping fluids.

• NOTE: Make sure the extended pipe is not kinked or twisted and is correctly secured with hose clips.

Attach a suitable pipe to the power steering return hose to allow the fluid to drain.

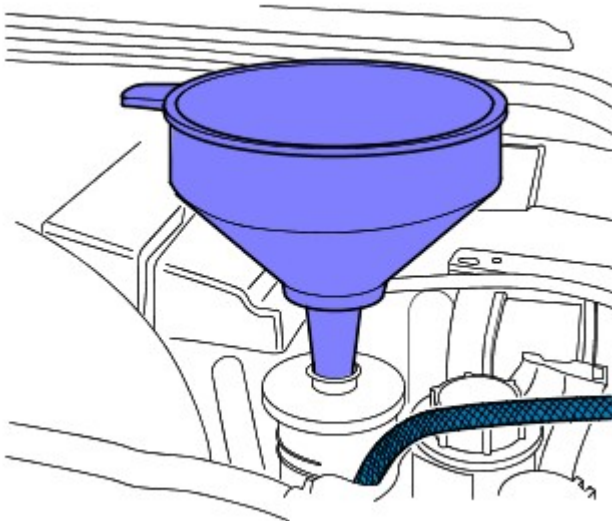


E 100918


6. NOTE: The suitable funnel should have the a capacity of 4 litres and O-ring seal

• NOTE: The suitable funnel must be tightly sealed to the power steering fluid reservoir to avoid fluid leakage.

Install a suitable funnel onto the power steering fluid reservoir.




E94372

7.  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 with the wheels just clear of the ground.

8. CAUTIONS:

 Steps 8 and 9 must be carried out within 2 - 3 seconds of each other. Failure to follow this instruction may result in damage to the power steering system.

 Be prepared to collect escaping fluids.

Using the suitable funnel, top up the power steering system with the specified fluid. Make sure the fluid level is maintained at two thirds full in the funnel.

## 9. CAUTIONS:



Be prepared to collect escaping fluids.



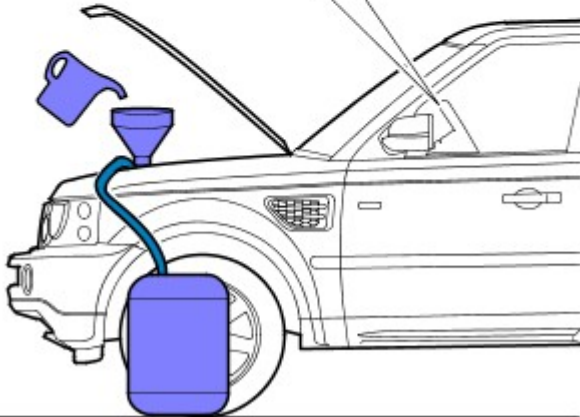
Do not allow the power steering fluid level in the power steering fluid reservoir to fall below the minimum power steering fluid level. Failure to follow this instruction may result in damage to the power steering system.



Make sure the engine is switched off as soon as the full 4 litres of power steering fluid has entered the power steering fluid reservoir.

Flush the power steering system.

- Start the engine
- With assistance turn the steering slowly lock to lock 3 times at approximately 1 revolution every 5 seconds.
- Continue to flush the power steering system until 4 litres of power steering fluid has been added to the power steering reservoir. This should take approximately 30 seconds.

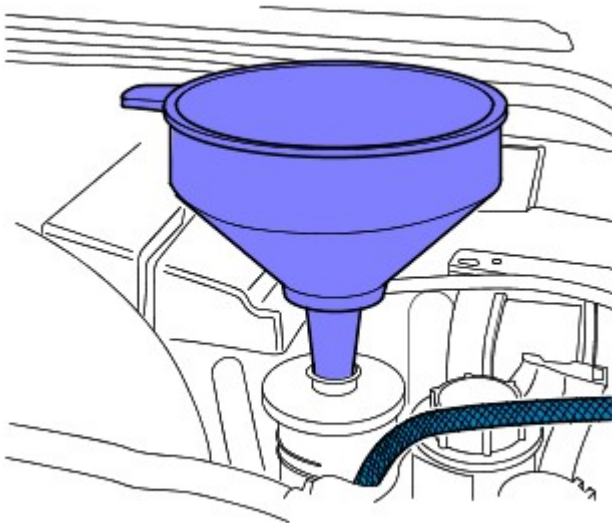


E94373



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

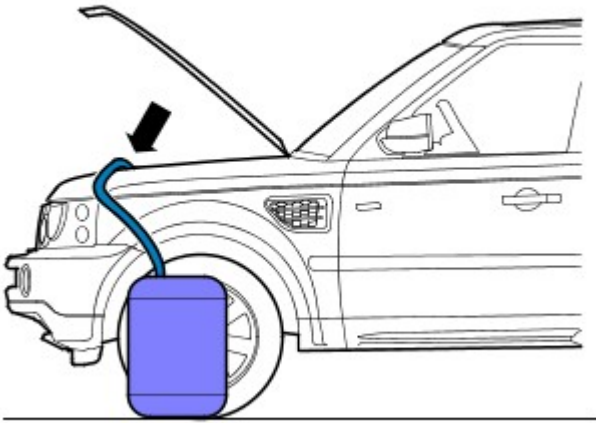
Remove the suitable funnel.



E94372

- 11.**  **CAUTION:** Be prepared to collect escaping fluids.

Remove the suitable pipe to the power steering return hose.



E 100918

- 12.**  **CAUTION:** Be prepared to collect escaping fluids.

- **NOTE:** Note the orientation of the clip.

If a quick release coupling is fitted to the power steering return hose, connect the power steering fluid return hose to the coupling by installing the clip.

- 13.** Install a new power steering fluid reservoir.

For additional information, refer to: [Power Steering Fluid Reservoir - V6 4.0L Petrol/V8 5.0L Petrol/TDV6 3.0L Diesel](#) (211-02 Power Steering, Removal and Installation).

## Power Steering -

### Power Steering Fluid

| Item                             | Specification                   |
|----------------------------------|---------------------------------|
| Recommended power steering fluid | Texaco Cold Climate Fluid 14315 |

### Capacity

| Item  | Capacity                               |
|---|--|
| System capacity - Maximum - Fill to mark on reservoir | 0.89 litre (1.5 pints) (0.9 US quarts) |

### General Specification

| Item                                   | Specification   |
|--|---|
| Type                                   | Power assisted rack and pinion, speed proportional with belt driven pump, remote hydraulic fluid reservoir and fluid cooler |
| Steering wheel diameter                | 395 mm (15.5 in)  |
| Number of turns - lock to lock         | 3.32  |
| Turning circle                         | 11.45 m (37.5 ft)   |
| System ratio                           | 17.8:1  |
| System operating pressure              | 110 bars (11000 kPa)(1595 lbf/in <sup>2</sup> )   |
| Pump relief valve operating pressure   | 114 ± 4 bar (11400 ± 400 kPa) (1653 ± 58 lbf/in <sup>2</sup> )  |
| Fluid flow rate - constant             | 8.8 ± 0.5 litre/min (15.4 ± 0.8 pints/min) (9.2 ± 0.5 US quarts/min)  |
| Steering rack travel                   | 166 mm (6.22 in)  |
| Piston diameter                        | 52 mm (1.9 in)  |
| Rack bar diameter                      | 30 mm (1.12 in)   |
| Steering angle sensor make/part number | Panasonic ECS64SUKX   |

### Torque Specifications

| Description   | Nm  | lb-ft |
|---|-----|-------|
| Power steering pump bolts - All engines                       | 25  | 18    |
| High pressure line to power steering pump - All engines       | 25  | 18    |
| Power steering pump bolts - All engines                       | 25  | 18    |
| High pressure line to power steering pump - All engines       | 25  | 18    |
| Low pressure line to power steering pump - All engines        | 25  | 18    |
| Steering angle sensor Torx screws                             | 3   | 2     |
| * Steering column intermediate shaft nut                      | 22  | 16    |
| ++ Steering column intermediate shaft to the lower shaft bolt | 25  | 18    |
| Horn nut  | 10  | 7     |
| Coolant expansion tank bolts                                  | 10  | 7     |
| A/C condenser refrigerant line bolts                          | 25  | 18    |
| ++ Power steering fluid lines bolt - 2.7 litre                | 25  | 18    |
| + Power steering gear to cross member bolts                   | 175 | 129   |
| High pressure line to steering gear bolt                      | 25  | 18    |
| Power steering line support bracket bolt                      | 10  | 7     |
| High pressure line union nut                                  | 30  | 22    |
| * Tie rod end ball joint nuts                                 | 76  | 56    |
| ** Universal joint to steering gear bolt                      | 25  | 18    |
| Radiator access panel bolts                                   | 10  | 7     |
| Oil filter  | 18  | 13    |

\* **New nut(s) must be fitted**

+ **New cage nuts must be fitted**

\*\* **New 'Patchlok' bolt must be fitted**

++ **New bolt must be fitted**

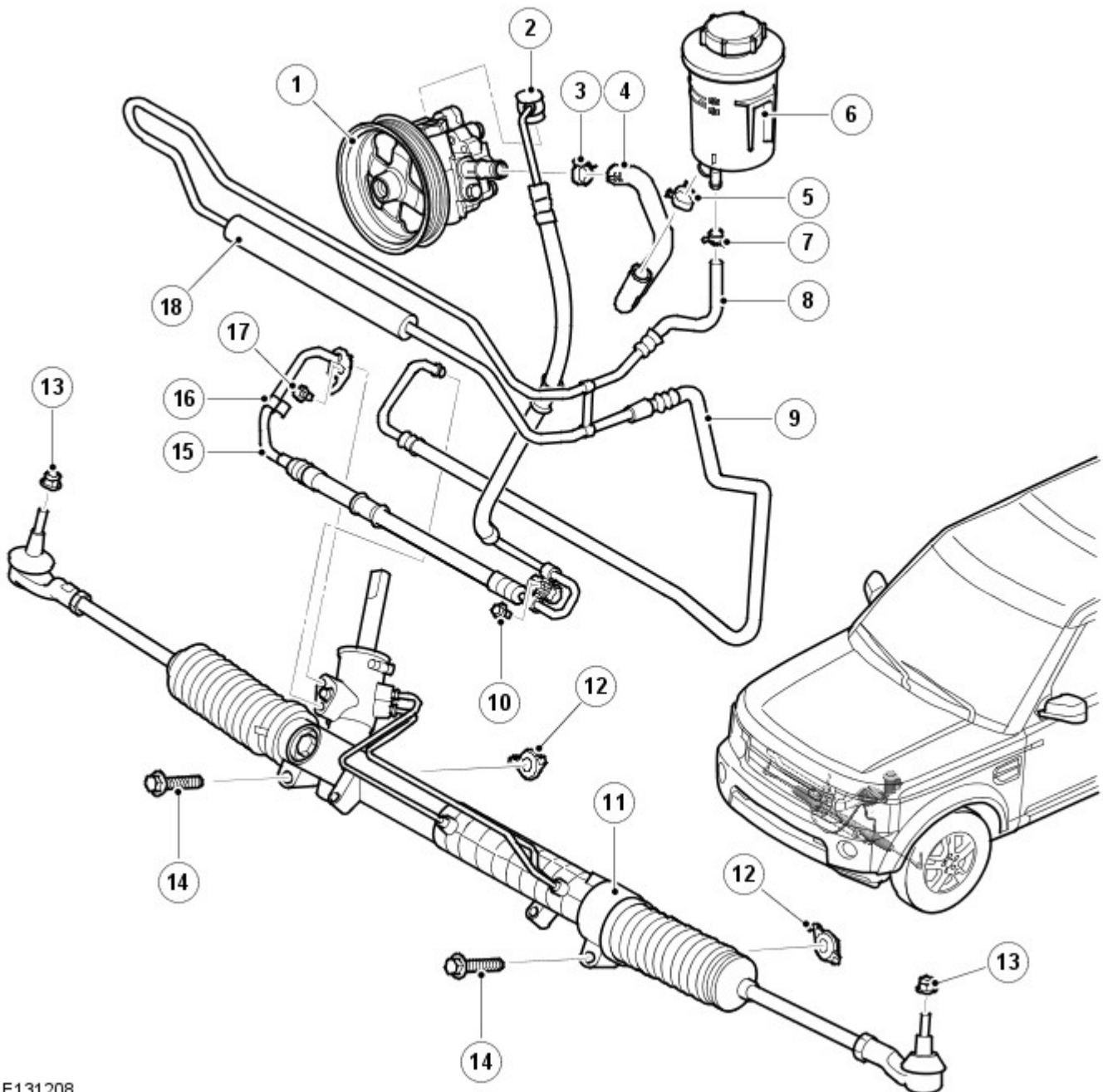


## Power Steering - Power Steering

Description and Operation

### COMPONENT LOCATION

- NOTE: 5.0L RHD shown.



E131208

| Item | Part Number | Description                                      |
|------|-------------|--|
| 1    | -           | Power steering pump                              |
| 2    | -           | Banjo bolt                                       |
| 3    | -           | Spring clip                                      |
| 4    | -           | Suction hose - reservoir to pump                 |
| 5    | -           | Spring clip                                      |
| 6    | -           | Reservoir  |
| 7    | -           | Spring clip                                      |
| 8    | -           | Fluid cooler and hose assembly - fluid return    |
| 9    | -           | Hose assembly - Steering gear to cooler - return |
| 10   | -           | Screw  |
| 11   | -           | Steering gear                                    |
| 12   | -           | Caged nut (2 off)                                |
| 13   | -           | Self-locking nut (2 off)                         |
| 14   | -           | Bolt (2 off)                                     |
| 15   | -           | Hose - pump to steering gear - pressure          |
| 16   | -           | Pipe clip  |

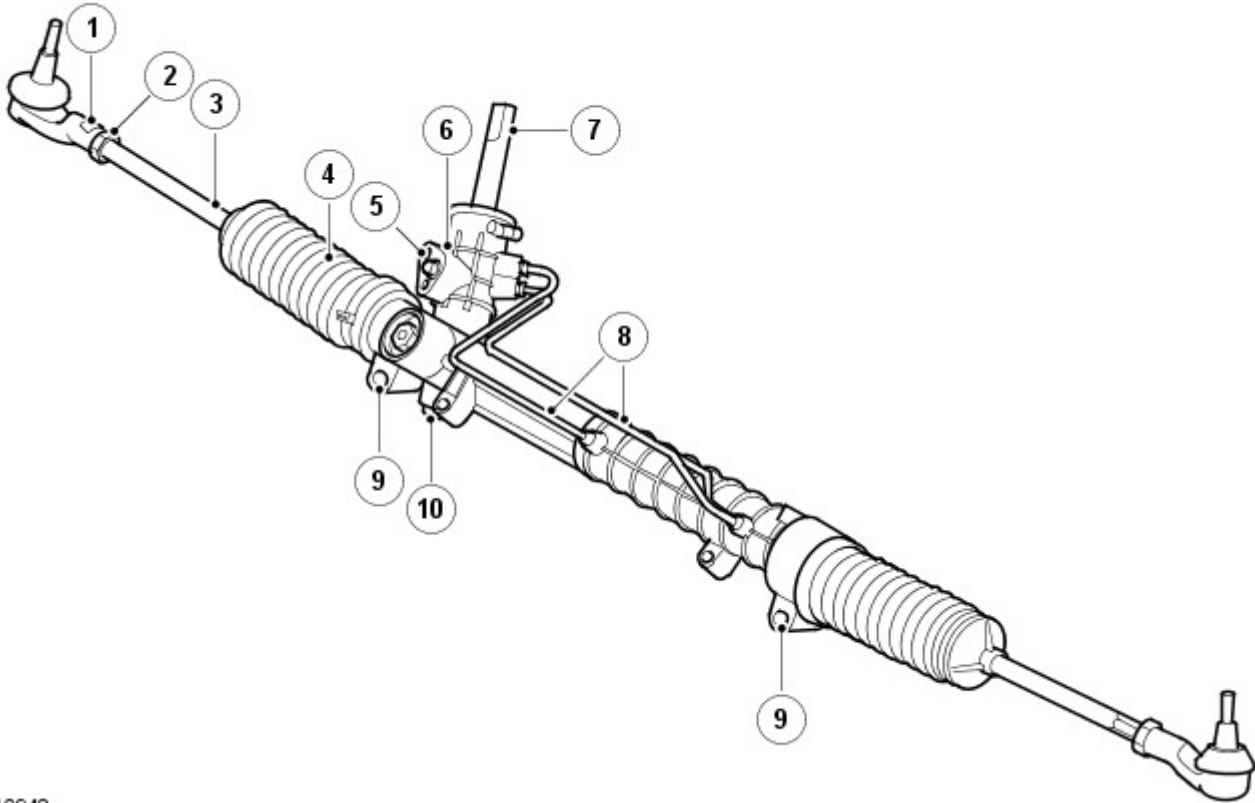
|    |   |        |
|----|---|--------|
| 17 | - | Screw  |
| 18 | - | Cooler |

## GENERAL

The steering system comprises a TRW manufactured rack and pinion steering gear, a power steering pump, a reservoir, a fluid cooler and fluid hoses. The steering gear is a conventional end take-off rack and pinion power assisted unit.

The steering gear rack has a travel of 166 mm (6.53 in). Lock to lock requires 3.33 revolutions of the steering wheel, which gives a ratio of 45 mm (1.77 in)/revolution at the center position and 52.6 mm (2.07 in)/revolution at end of lock.

## STEERING GEAR



E46942

| Item | Part Number | Description                             |
|------|-------------|---|
| 1    | -           | Tie-rod end                             |
| 2    | -           | Locknut                                 |
| 3    | -           | Tie-rod                                 |
| 4    | -           | Gaitor                                  |
| 5    | -           | Pressure/return connection from/to pump |
| 6    | -           | Valve unit housing                      |
| 7    | -           | Input shaft                             |
| 8    | -           | Pressure/return pipes                   |
| 9    | -           | Steering gear casing attachment lugs    |
| 10   | -           | Pinion housing                          |

The steering gear is located at the front of the engine, below the accessory belt drive. The gear is attached to two brackets on the chassis and is secured to the brackets with flanged bolts and caged nuts. The cage prevents the nuts from turning when the bolts are loosened or tightened. The cage nuts can only be used once and must be replaced when the gear is removed. For service, M12 Nylock nuts are available as a replacement for the cage nut.

The steering gear comprises an aluminium, cast, one piece housing which contains a mechanical steering rack, a valve unit and an integrated hydraulic power unit.

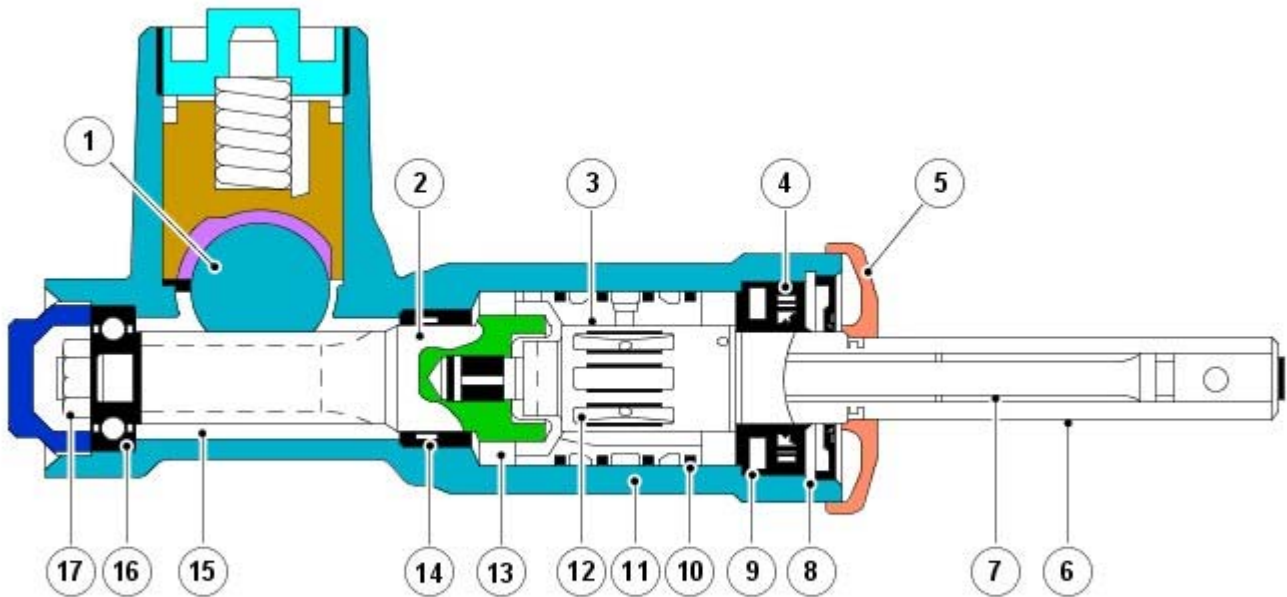
The steering gear uses a rack with an integrated piston which is guided on plain bearings within the rack housing. The pinion, which is attached to the valve unit, runs in bearings and meshes with the rack teeth. The rack is pressed against the pinion by a spring loaded yoke which ensures that the teeth mesh with the minimum of play. The pinion is connected to the valve unit via a torsion bar. The rotary motion of the steering wheel is converted into linear movement of the rack by the pinion and is initiated by the valve unit. This movement is transferred into movement of the road wheels by adjustable tie-rods.

The 49 mm (1.92 in) diameter piston of the hydraulic power unit is located at one end of the gear housing. Each side of the piston is connected to fluid pressure or fluid return via external metal pipes which are connected to the valve unit.

Each end of the gear has a threaded hole which provides for the fitment of the tie-rod. The external ends of the gear are sealed with gaitors which prevent the ingress of dirt and moisture. The tie-rod has a long threaded area which allows for the fitment of the tie-rod end. The thread allows for the adjustment of the steering toe. When the correct toe is achieved, a locknut is tightened against the tie-rod end preventing inadvertent movement.

The gear has a central hole machined along its length. The hole allows the air in the gaitors to be balanced when the steering is turned. The gaitors are serviceable items and are retained on the gear housing and the tie-rod with zip ties.

## Valve Unit



E46943

| Item | Part Number | Description                        |
|------|-------------|------------------------------------|
| 1    | -           | Rack                               |
| 2    | -           | Pinion shaft                       |
| 3    | -           | Outer sleeve                       |
| 4    | -           | Oil sleeve                         |
| 5    | -           | Dirt seal                          |
| 6    | -           | Input shaft                        |
| 7    | -           | Torsion bar                        |
| 8    | -           | Circlip                            |
| 9    | -           | Oil seal                           |
| 10   | -           | PTFE ring                          |
| 11   | -           | Steering gear casting              |
| 12   | -           | Slots                              |
| 13   | -           | Pin - Pinion shaft to outer sleeve |
| 14   | -           | Oil seal                           |
| 15   | -           | Pinion shaft                       |
| 16   | -           | Bearing                            |
| 17   | -           | Pinion shaft nut                   |

The valve unit is an integral part of the steering gear. The principle function of the valve unit is to provide maximum power assistance (i.e. when parking) with minimum effort required to turn the steering wheel.

The pinion housing of the valve is an integral part of the main steering gear casting. The pinion housing has four machined ports which provide connections for pressure feed from the power steering pump, return fluid to the reservoir and pressure feeds to each side of the cylinder piston.

The valve unit comprises an outer sleeve, an input shaft, a torsion bar and a pinion shaft. The valve unit is co-axial with the pinion shaft which is connected to the steering column via the input shaft. The valve unit components are located in the steering gear pinion housing which is sealed with a cap.

The outer sleeve is located in the main bore of the pinion housing. Three annular grooves are machined on its outer diameter. PTFE rings are located between the grooves and seal against the bore of the pinion housing. Holes are drilled radially in each annular groove through the wall of the sleeve. The bore of the outer sleeve is machined to accept the input shaft. Six equally spaced slots are machined in the bore of the sleeve. The ends of the slots are closed and do not continue to the end of the outer sleeve. The radial holes in the outer sleeve are drilled into each slot.

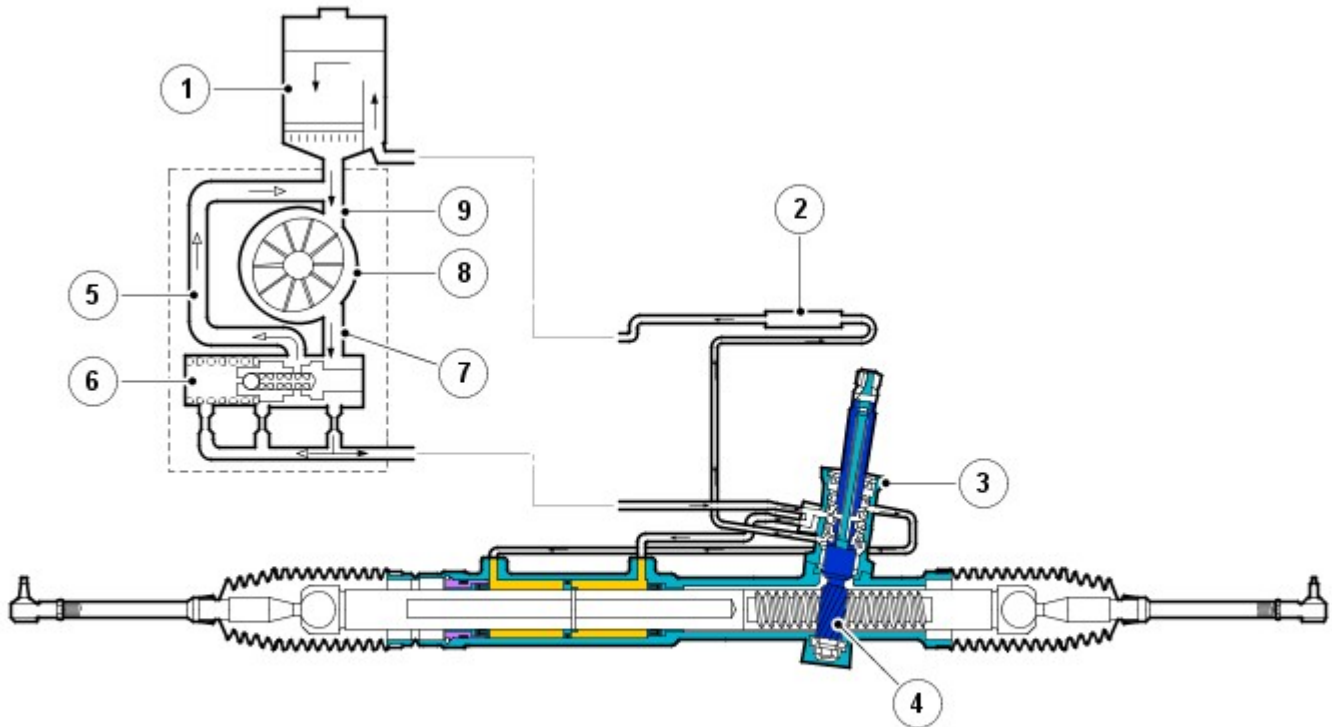
The input shaft has two machined flats at its outer end which allow for the attachment of the steering column intermediate shaft yoke. The flats ensure that the intermediate shaft is fitted in the correct position to maintain the optimum phase angle. The inner end of the input shaft forms a dog-tooth which mates with a slot in the pinion shaft. The fit of the dog-tooth in the slot allows a small amount of relative rotation between the input shaft and the pinion shaft before the dog-tooth contacts the wall of the slot. This ensures that, if the power assistance fails, the steering can be

operated manually without over stressing the torsion bar. The central portion of the input shaft has equally spaced longitudinal slots machined in its circumference. The slots are arranged alternately around the input shaft.

The torsion bar is fitted inside the input shaft and is an interference fit in the pinion shaft. The torsion bar is connected to the input shaft by a drive pin. The central diameter of the torsion bar is machined to a smaller diameter in its central section. The smaller diameter allows the torsion bar to twist in response to torque applied from the steering wheel in relation to the grip of the tyres on the road surface.

The pinion shaft has machined upper teeth on its central diameter which mate with teeth on the steering gear rack. A slot, machined in the upper end of the pinion shaft mates with the dog-tooth on the input shaft. The pinion shaft locates in the pinion housing and rotates on ball and roller bearings.

### Power Steering Hydraulic Operation



E46944

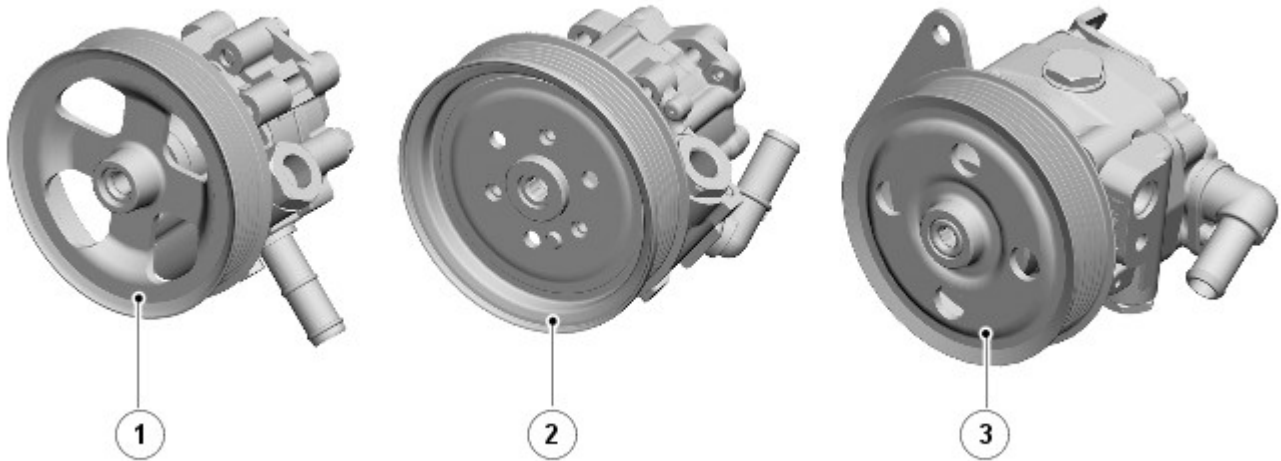
| Item | Part Number | Description                         |
|------|-------------|-------------------------------------|
| 1    | -           | Reservoir                           |
| 2    | -           | Cooler                              |
| 3    | -           | Valve unit                          |
| 4    | -           | Steering rack and pinion            |
| 5    | -           | Flow control/pressure relief return |
| 6    | -           | Flow control/Pressure relief valve  |
| 7    | -           | Output port                         |
| 8    | -           | Power steering pump                 |
| 9    | -           | Low pressure suction line           |

When the engine is started the power steering pump draws fluid from the reservoir into the low pressure suction line. The fluid passes through the pump and emerges as pressurised fluid at the outlet port. The attenuated high pressure hose passes the pressurised fluid to the steering gear valve unit.

If no steering effort is applied, there is minimal restriction within the system and the supply pressure from the pump is low. Minimal pressure is applied, via the valve unit, to each side of the piston in the hydraulic cylinder and the full flow from the power steering pump returns to the reservoir via the fluid cooler.

When steering effort is applied in either direction, the return flow of fluid to the reservoir is restricted, causing the supply pressure from the pump to increase. The pressurised fluid is directed to the applicable side of the piston in the hydraulic cylinder, via the valve unit, providing the power assistance required to reduce the steering effort. Fluid displaced from the low pressure side of the cylinder is returned via the valve unit and fluid cooler to the reservoir. The fluid cooler reduces the fluid temperature which prolongs the life of hoses and seals in the system.

### POWER STEERING PUMP



E131159

| Item | Part Number | Description     |
|------|-------------|-----------------|
| 1    | -           | 4.0L V6         |
| 2    | -           | 5.0L V8         |
| 3    | -           | 2.7L, 3.0L TdV6 |

The power steering pumps used on the four engine variants are basically the same pump with different connection fittings. The pump is a positive displacement, vane type pump which supplies hydraulic pressure to the steering gear valve unit. The pump is driven by a Poly Vee belt from the crankshaft pulley and output from the pump increases proportionally with engine speed. A self-adjusting tensioner is fitted to maintain the correct tension on the belt.

The pump has an internal flow control valve which also incorporates a pressure relief valve. The pressure relief valve limits the maximum pressure supplied to the steering gear to 114 bar (1653 lbf in<sup>2</sup>) ± 4 bar (58 lbf in<sup>2</sup>) on V6 petrol engines, and 115 bar (1667 lbf in<sup>2</sup>) ± 4 bar (58 lbf in<sup>2</sup>) for V8 petrol, and V6 diesel models. The flow control valve regulates the flow to a constant value of 8.8 l/min (1.93 gal/min) ± 0.5 l/min (0.1 gal/min) regardless of engine speed. The pump has a displacement of 9.6 cc/rev (0.58 in<sup>3</sup>/rev) on V6 petrol, and V6 diesel, but 11 cc/rev (0.67 in<sup>3</sup>/rev) for V8 petrol.

A shaft runs longitudinally through the pump. One end of the shaft is fitted with a pressed-on drive pulley, the opposite end of the shaft is closed by a cover. The shaft runs in bearings located in the body and oil seals at each end of the shaft prevent leakage of hydraulic fluid.

The pump contains ten vanes on petrol models, and eleven vanes on diesel models which rotate within a cam ring and are driven by the shaft. As the vanes rotate, the cam ring causes the space between the vanes to increase. This causes a depression between the vanes and fluid is drawn from the reservoir via the suction hose into the space between the vanes.

As the shaft rotates, the inlet port is closed to the vanes which have drawn in fluid, trapping the fluid between the vanes. The cam ring causes the space between the vanes to reduce and consequentially compresses and pressurises the hydraulic fluid trapped between them.

Further rotation of the shaft moves the vanes to the outlet port. As the vanes pass the port plate the pressurised fluid passes from the pump outlet port into the pressure hose to the steering gear.

The pressurised fluid is subject to control by the flow control and pressure relief valve. The flow control valve maintains a constant flow of fluid supplied to the steering gear irrespective of engine speed variations. The pressure relief valve limits the pressure on the output side of the pump. A metering orifice is included in the discharge port of the pump. If the pressure in the orifice reaches a predetermined level, a spring loaded ball in the center of the flow control valve is lifted from its seat and allows pressurised fluid to recirculate within the pump.

The pressure relief valve will operate if the discharge from the pump is restricted, i.e.; steering held on full lock. If the output from the pump is blocked, all output is recirculated through the pump. In this condition, as no fresh fluid is drawn into the pump from the reservoir, the fluid temperature inside the pump will increase rapidly. Consequentially, periods of operation of the steering gear on full lock should be kept to a minimum to prevent overheating of the pump and the fluid within it.

## RESERVOIR



E46941

The fluid reservoir is located on a bracket in the left hand side of the engine compartment, behind the radiator. The reservoir comprises a body, cap and filter. The purpose of the reservoir is to contain a surplus of the hydraulic fluid in the system to allow for expansion and contraction of the fluid due to temperature variations. The fluid level ensures that the supply connection on the bottom of the reservoir is covered with fluid at all operating vehicle attitudes. Any air which is present in the system is exhausted from the system in the reservoir.

The body is a plastic moulding with two ports at the bottom which provide for the connection of the suction supply and return hoses. Moulded markings on the side of the reservoir denote the upper and lower fluid levels. A non-serviceable, 100 micron nylon mesh filter is fitted in the body. The filter removes particulate matter from the fluid before it is drawn into the pump supply connection.

The cap is rotated counterclockwise for one quarter turn to release from the body. The cap is fitted with an O-ring to prevent fluid leakage. The cap incorporates a breather hole to allow for changes in fluid level during operation and prevent vacuum or pressurisation of the reservoir.

## **HIGH PRESSURE HOSE**

The high pressure hose connecting the pump to the steering gear valve unit contains two attenuators. Each attenuator comprises a bullet shaped restrictor which is secured inside the hose. The restrictors damp pressure pulses from the pump, consequently reducing noise and strain on downstream components. The attenuators are an integral part of the hose and cannot be serviced separately.

## **FLUID COOLER**

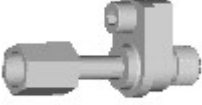




- **NOTE:** Diesel engine vehicles are not fitted with a fluid cooler.

The fluid cooler is located in the return line from the steering gear to the reservoir. The cooler comprises a flexible hose and a solid pipe which connect between the reservoir and the return pipe from the steering gear. The cooler is an integral part of the pipe and cannot be replaced as a separate component.

The cooler is a fabricated aluminium tube, through which the power steering fluid passes. The outer diameter of the cooler tube has aluminium loops attached to it which dissipate heat. Cool air entering the front of the vehicle passes over the cooler and flows through the loops. The loops act as heat exchangers, conducting heat from the fluid as it passes through the tube.

# Power Steering - Power Steering Pressure Test TDV6 2.7L Diesel

General Procedures

| Special Tool(s)  |  |
|--|--|
|  <p>E87857</p>                  | Adaptor, power steering pressure test<br>211-011-12                  |
|  <p>211-011-02<br/>E58730</p>   | Hose - power steering pressure test<br>211-011-02(LRT-57-002)        |
|  <p>211-011-02<br/>E58730</p>   | Hose - power steering pressure test<br>211-011-02(LRT-57-002)        |
|  <p>211-011-01<br/>E58732</p> | Valve block power steering test<br>211-011-01(LRT-57-001)            |
|  <p>211-287<br/>E58733</p>    | Hose and gauge - power steering pressure test<br>211-287(LRT-57-005) |



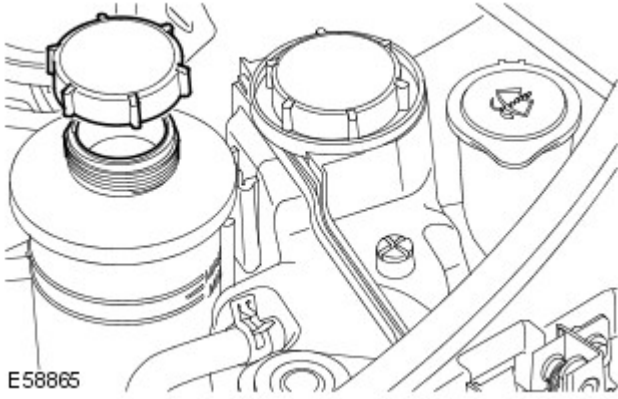
**CAUTION:** If power steering fluid comes into contact with the paintwork, the affected area must be immediately washed down with cold water.

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

- 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.

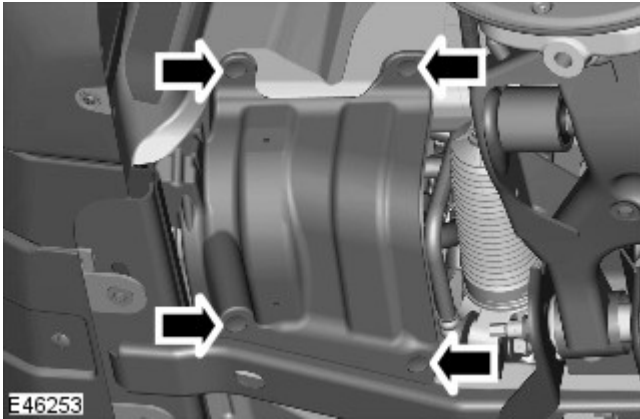
- Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).



E58865

**3.** Siphon the fluid from the power steering reservoir.

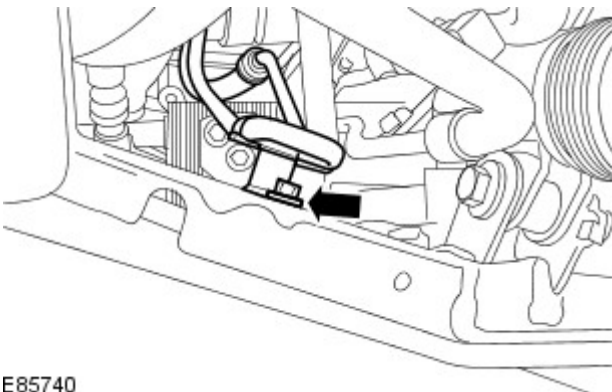
- Remove the filler cap.



E46253

**4.** Remove the front LH splash shield.

- Remove the 4 clips.



E85740

**5.** Release the steering gear high-pressure line.


- Remove the bolt.

**6.** Remove the front LH fender splash shield.

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

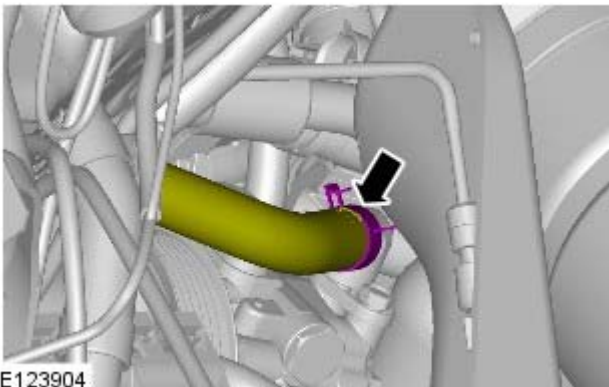
**7. CAUTIONS:**

 Make sure that all openings are sealed. Use new blanking caps.

 Make sure that the area around the component is clean and free of foreign material.

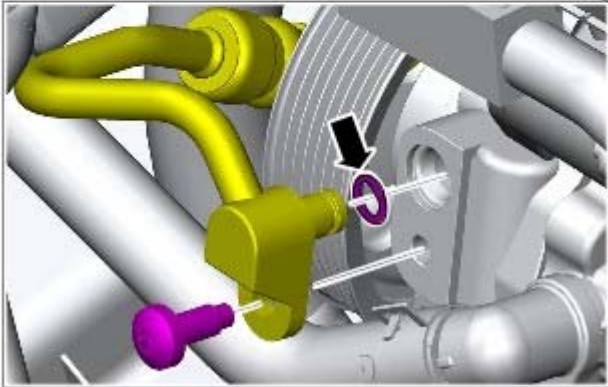
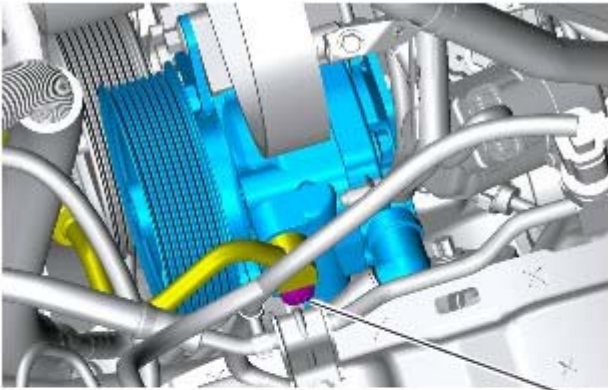
Disconnect the power steering pump supply hose.

- Release the clip.
- Position a container to collect the fluid.




E123904





E94170

**8.**  **CAUTION:** Make sure that the area around the component is clean and free of foreign material.

Disconnect the power steering pump high-pressure line.

- Remove the bolt.

**9.** Install the special tools.

- Tie the pressure gauge aside.

**10.** **NOTE:** Remove and discard the blanking caps.

Connect the power steering pump supply hose.

- Secure with the clip.

**11.** Fill the power steering reservoir.

**12.** Connect the battery ground cable.

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

**13.** **NOTE:** Make sure the steering components and test equipment are free from leaks.

- **NOTE:** Maintain the maximum fluid level during the test.
- **NOTE:** Make sure the steering is in the straight ahead position.
- **NOTE:** Under no circumstances must the low pressure spigot be removed from the steering pump.

With the test valve open start the engine.

- Start the engine and turn steering fully lock to lock, stop the engine.
- Top-up the power steering fluid reservoir.
- Install the reservoir filler cap.

**14.** For correct power steering pressures, refer to the steering specification section.

For additional information, refer to: [Specifications](#) (211-02 Power Steering, Specifications).

**15.**  **CAUTION:** Do not hold steering at full lock for longer than 10 seconds.

With the engine at idle, slowly turn the steering wheel and hold on full lock.

- Record the pressure reading.

**16.** Repeat the above procedure for the other side.

- Record the pressure reading.

**17.** With the engine at idle, release the steering wheel. The pressure should be, at or below, the pressure specified.

**18.** Pressure outside this tolerance, indicates a fault.

**19.**  **CAUTION:** Pump damage will occur if test valve is closed for longer periods.

To determine if the fault is in the steering pump or the steering rack, close the test valve for a maximum of 5 seconds.


**20.** If the pressures recorded fall outside the given values, replace the power steering pump.

**21.** If the maximum pump pressure is correct, check the hoses for correct routing and condition, if correct suspect the steering gear.

**22.** On completion of the test stop the engine, disconnect the battery ground cable and siphon the steering fluid from the reservoir.

**23. CAUTIONS:**

 Make sure that all openings are sealed. Use new blanking caps.

 Make sure that the area around the component is clean and free of foreign material.

Disconnect the power steering pump supply hose.

- Release the clip.

**24.** Disassemble the test equipment.

**25.** Connect the power steering pump high-pressure line.

- Tighten the bolt to 25 Nm (18 lb.ft).
- Install a new O-ring seal.

**26. NOTE:** Remove and discard the blanking caps.

Connect the power steering pump supply hose.

- Secure with the clip.
- Remove the container.

**27.** Secure the steering gear high-pressure line.

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

**28.** Install the front LH splash shield.

- Install the clips.

**29.** Install the front LH fender splash shield.

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

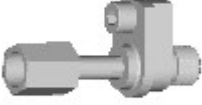




**30.** Connect the battery ground cable.

**31.** Fill and bleed the power steering system.

For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).

# Power Steering - Power Steering Pressure Test TDV6 3.0L Diesel

## General Procedures

| Special Tool(s)   |   |
|---|---|
|  <p>E87857</p>   | <p>Adaptor, power steering pressure test</p> <p>211-011-12</p>                  |
|  <p>E58730</p>   | <p>Hose - power steering pressure test</p> <p>211-011-02(LRT-57-002)</p>        |
|  <p>E58730</p>   | <p>Hose - power steering pressure test</p> <p>211-011-02(LRT-57-002)</p>        |
|  <p>E58732</p> | <p>Valve block power steering test</p> <p>211-011-01(LRT-57-001)</p>            |
|  <p>E58733</p> | <p>Hose and gauge - power steering pressure test</p> <p>211-287(LRT-57-005)</p> |



**CAUTION:** If power steering fluid comes into contact with the paintwork, the affected area must be immediately washed down with cold water.



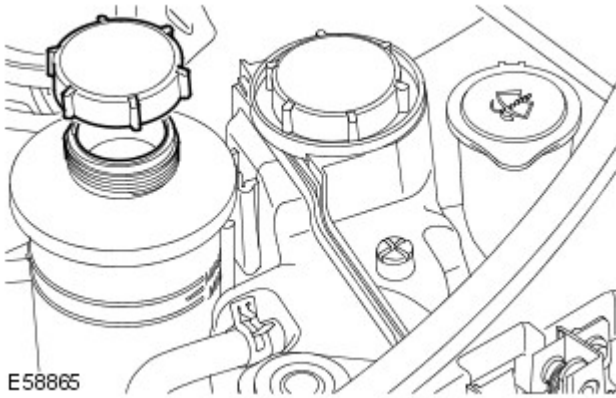
**1. WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

**2.** Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

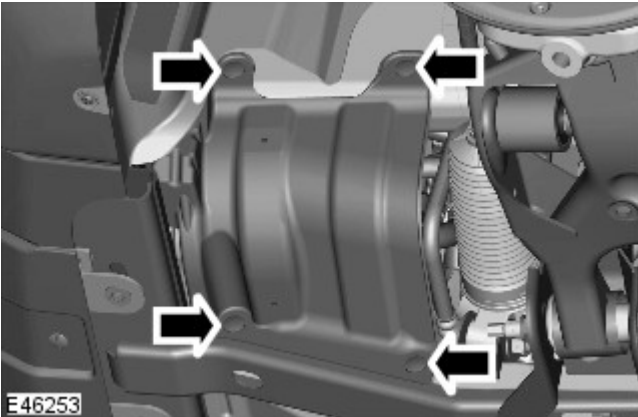
**3. Siphon the fluid from the power steering reservoir.**

- Remove the filler cap.



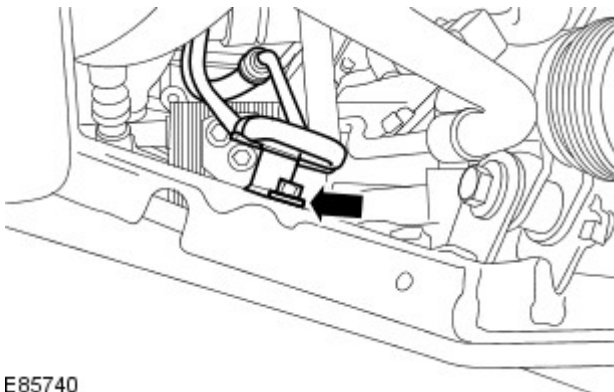
**4. Remove the front LH splash shield.**

- Remove the 4 clips.



**5. Release the steering gear high-pressure line.**

- Remove the bolt.



**6. Remove the front LH fender splash shield.**

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

**7. CAUTIONS:**



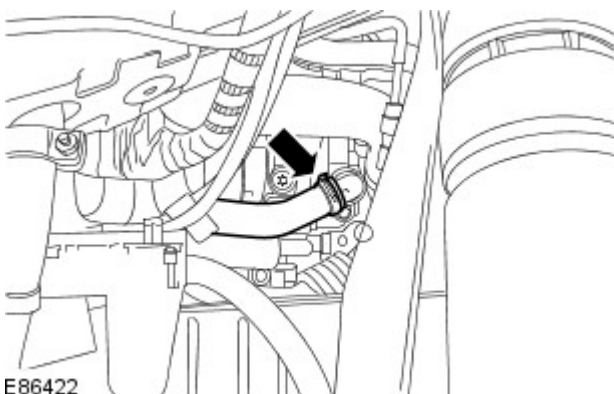
Make sure that all openings are sealed. Use new blanking caps.

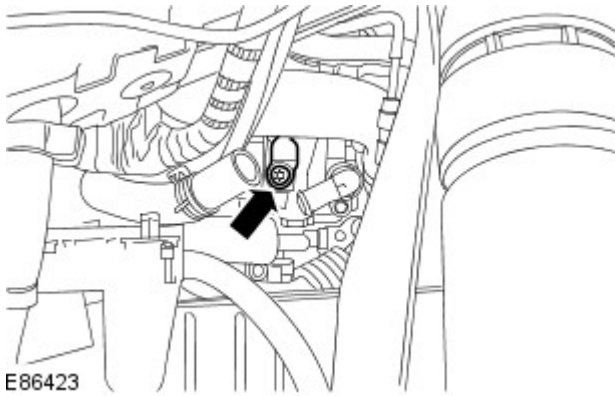



Make sure that the area around the component is clean and free of foreign material.

Disconnect the power steering pump supply hose.

- Release the clip.
- Position a container to collect the fluid.





**8.**  **CAUTION:** Make sure that the area around the component is clean and free of foreign material.

Disconnect the power steering pump high-pressure line.

- Remove the bolt.

**9.** Install the special tools.

- Tie the pressure gauge aside.

**10.** **NOTE:** Remove and discard the blanking caps.

Connect the power steering pump supply hose.

- Secure with the clip.

**11.** Fill the power steering reservoir.

**12.** Connect the battery ground cable.

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

**13.** **NOTE:** Make sure the steering components and test equipment are free from leaks.

- **NOTE:** Maintain the maximum fluid level during the test.
- **NOTE:** Make sure the steering is in the straight ahead position.
- **NOTE:** Under no circumstances must the low pressure spigot be removed from the steering pump.

With the test valve open start the engine.

- Start the engine and turn steering fully lock to lock, stop the engine.
- Top-up the power steering fluid reservoir.
- Install the reservoir filler cap.

**14.** For correct power steering pressures, refer to the steering specification section.

For additional information, refer to: [Specifications](#) (211-02 Power Steering, Specifications).

**15.**  **CAUTION:** Do not hold steering at full lock for longer than 10 seconds.

With the engine at idle, slowly turn the steering wheel and hold on full lock.

- Record the pressure reading.

**16.** Repeat the above procedure for the other side.

- Record the pressure reading.

**17.** With the engine at idle, release the steering wheel. The pressure should be, at or below, the pressure specified.

**18.** Pressure outside this tolerance, indicates a fault.

**19.**  **CAUTION:** Pump damage will occur if test valve is closed for longer periods.

To determine if the fault is in the steering pump or the steering rack, close the test valve for a maximum of 5 seconds.

**20.** If the pressures recorded fall outside the given values, replace the power steering pump.

- 21.** If the maximum pump pressure is correct, check the hoses for correct routing and condition, if correct suspect the steering gear.
- 22.** On completion of the test stop the engine, disconnect the battery ground cable and siphon the steering fluid from the reservoir.

**23. CAUTIONS:**



Make sure that all openings are sealed. Use new blanking caps.



Make sure that the area around the component is clean and free of foreign material.

Disconnect the power steering pump supply hose.

- Release the clip.

**24.** Disassemble the test equipment.

**25.** Connect the power steering pump high-pressure line.

- Tighten the bolt to 25 Nm (18 lb.ft).
- Install a new O-ring seal.

**26. NOTE:** Remove and discard the blanking caps.

Connect the power steering pump supply hose.

- Secure with the clip.
- Remove the container.

**27.** Secure the steering gear high-pressure line.

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

**28.** Install the front LH splash shield.

- Install the clips.

**29.** Install the front LH fender splash shield.

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

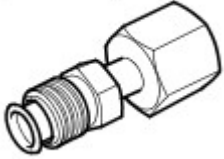


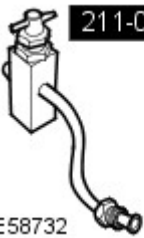


**30.** Connect the battery ground cable.

**31.** Fill and bleed the power steering system.

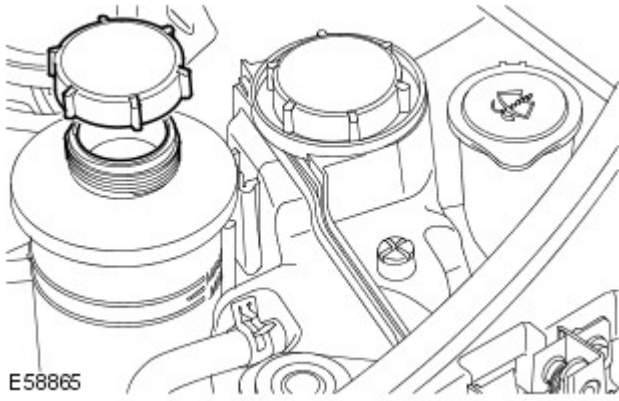
For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).

**Power Steering - Power Steering Pressure Test V6 4.0L Petrol**

General Procedures

| <b>Special Tool(s)</b>   |   |
|--|---|
| <p><b>211-313</b></p>  <p>E58729</p>      | <p>Adapter, power steering pressure test</p> <p>211-313 (LRT-57-035A)</p>       |
| <p><b>211-011-02</b></p>  <p>E58730</p>   | <p>Hose, power steering pressure test</p> <p>211-011-02 (LRT-57-002)</p>        |
| <p><b>211-011-11</b></p>  <p>E58731</p>   | <p>Hose, power steering pressure test</p> <p>211-011-11</p>                     |
| <p><b>211-011-01</b></p>  <p>E58732</p> | <p>Valve block, power steering pressure test</p> <p>211-011-01 (LRT-57-001)</p> |
| <p><b>211-287</b></p>  <p>E58733</p>    | <p>Hose and gauge, power steering pressure test</p> <p>211-287 (LRT-57-005)</p> |
| <p><b>211-325</b></p>  <p>E58734</p>    | <p>Adapter, power steering pressure test</p> <p>211-325 (LRT-57-042)</p>        |


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 - V6 4.0L Petrol](#) (501-05 Interior Trim and Ormentation, Removal and Installation).



**3.** Siphon the fluid from the power steering reservoir.

- Remove the filler cap.
- Install the filler cap.

**4.** Position an absorbent cloth to collect fluid spillage.

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

- **NOTE:** Some fluid spillage is inevitable during this operation.
- **NOTE:** Care must be taken to avoid contamination of the drive belt.

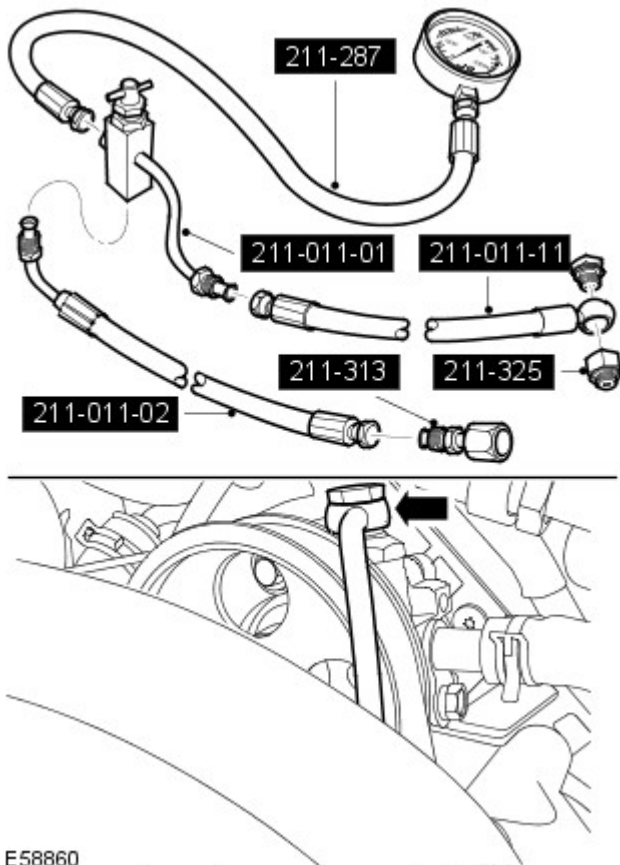
Disconnect the power steering high-pressure pipe union.

- Remove the bolt.
- Remove and discard the 2 sealing washers.
- Position a container to collect the fluid.

**6.** Install the special tools to the power steering high-pressure port.

- Install the O-ring seal.
- Tie the pressure gauge aside under the hood.





E58860

**7.** Install the special tool to the high-pressure union.

- Install the O-ring seals.
- Connect the special tool line, to the special tool valve block assembly.

**8.** Refill the power steering reservoir.

- Remove the filler cap.

**9.** Connect the battery ground cable.

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

**10.** NOTE: Ensure the steering components and test equipment are free from leaks.

- NOTE: Maintain the maximum fluid level during the test.
- NOTE: Make sure the steering is in the straight ahead position.
- NOTE: Under no circumstances must the low pressure spigot be removed from the steering pump.

With the test valve open start the engine.

- Start the engine and turn steering fully lock to lock, stop the engine.
- Top-up the power steering fluid reservoir.
- Install the reservoir filler cap.

**11.** For correct power steering pressures, refer to the steering specification section.

For additional information, refer to: [Specifications](#) (211-02 Power Steering, Specifications).

**12.** With the engine at idle, slowly turn the steering wheel and hold on full lock.

- Record the pressure reading.

**13.** Repeat the above procedure for the other side.

- Record the pressure reading.

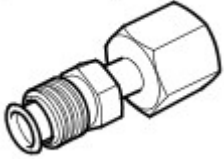


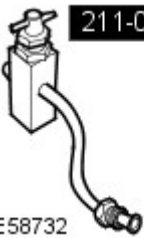


**14.** With the engine at idle, release the steering wheel. The pressure should be at or below the pressure specified. To determine if the fault is in the steering pump or the steering rack, close the test valve for a maximum of 5 seconds.


1. Pressure outside this tolerance, indicates a fault.

- 16.** If the pressures recorded fall outside the given values, replace the power steering pump.
- 17.** If the maximum pump pressure is correct, then suspect the power steering rack.
- 18.** On completion of the test stop the engine, disconnect the battery ground cable and siphon the steering fluid from the reservoir.
  - Remove the filler cap.
  - Install the filler cap.
- 19.** Disassemble the test equipment.
- 20.** Connect the high-pressure line to the power steering pump.
  - Clean the component mating faces.
  - Install the new O-ring seals.
  - Tighten the bolt to 25 Nm (18 lb.ft).
- 21.** Install the engine cover.  
For additional information, refer to: [Engine Cover - V6 4.0L Petrol](#) (501-05 Interior Trim and Ornementation, Removal and Installation).
- 22.** Connect the battery ground cable.
- 23.** Refill and bleed the power steering.  
For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).

**Power Steering - Power Steering Pressure Test V8 5.0L Petrol**

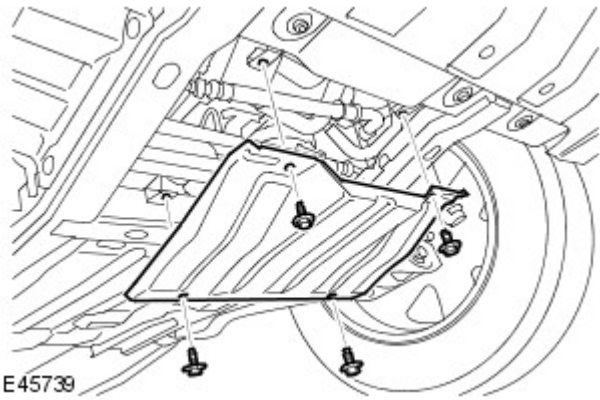
General Procedures

| <b>Special Tool(s)</b>  |   |
|---|---|
|  <p><b>211-313</b><br/>E58729</p>      | Adapter, power steering test<br>211-313 (LRT-57-035A)       |
|  <p><b>211-011-02</b><br/>E58730</p>   | Hose, power steering test<br>211-011-02 (LRT-57-002)        |
|  <p><b>211-011-11</b><br/>E58731</p>   | Hose, power steering test<br>211-011-11                     |
|  <p><b>211-011-01</b><br/>E58732</p> | Valve block, power steering test<br>211-011-01 (LRT-57-001) |
|  <p><b>211-287</b><br/>E58733</p>    | Hose and gauge, power steering test<br>211-287 (LRT-57-005) |
|  <p><b>211-325</b><br/>E58734</p>    | Adapter, power steering test<br>211-325 (LRT-57-042)        |

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

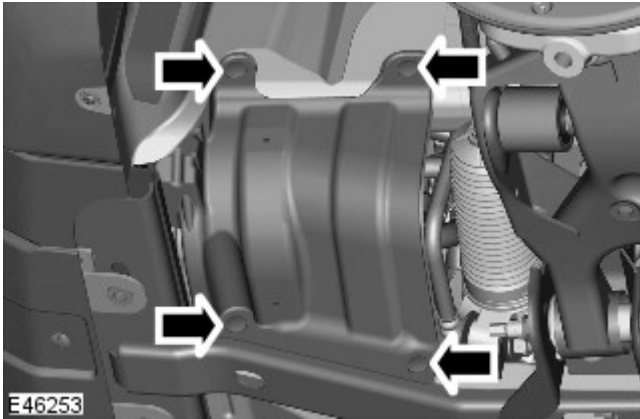
Raise and support the vehicle.

**2.** Disconnect the battery ground cable.  
 For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).



**3.** Remove the radiator access panel.

- Remove the 4 bolts.



**4.** Remove the front LH splash shield.

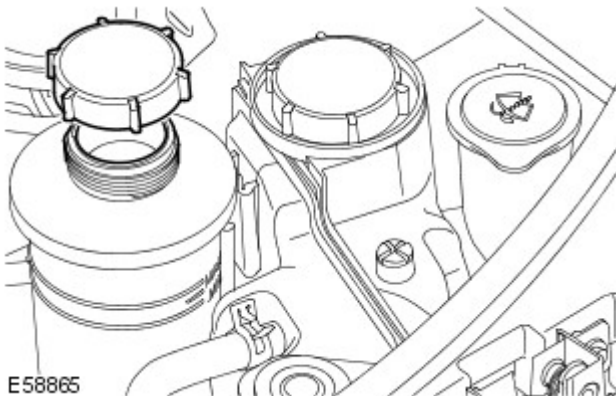
- Remove the 4 clips.

**5.** Remove the front LH fender splash shield.


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

**6.** Siphon the fluid from the power steering reservoir.

- Remove the filler cap.
- Install the filler cap.



**7.** Position an absorbent cloth to collect fluid spillage.

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

- **NOTE:** Some fluid spillage is inevitable during this operation.
- **NOTE:** Care must be taken to avoid contamination of the drive belt.

Disconnect the power steering high-pressure pipe union.

- Remove the bolt.
- Remove and discard the 2 sealing washers.
- Position a container to collect the fluid.

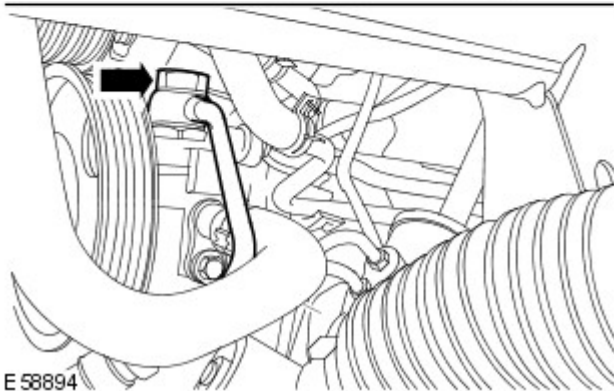
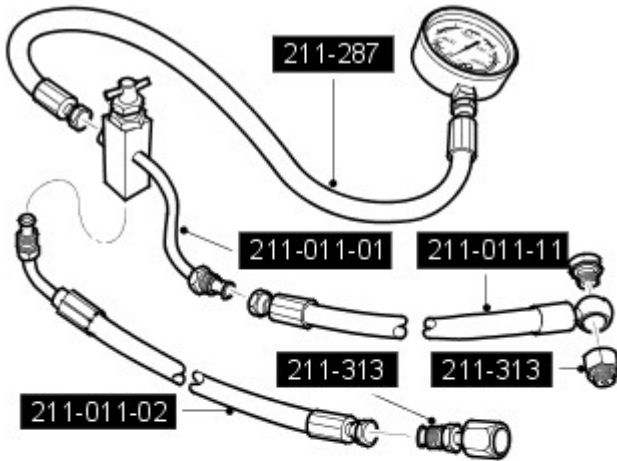
**9.** Install the special tools to the power steering high-pressure

port.

- Install the O-ring seal.
- Tie the pressure gauge aside under the hood.

**10.** Install the special tool to the high-pressure union.

- Install the O-ring seals.
- Connect the special tool line, to the special tool valve block assembly.



E 58894

**11.** Refill the power steering reservoir.

- Remove the filler cap.

**12.** Connect the battery ground cable.

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

**13.** NOTE: Ensure the steering components and test equipment are free from leaks.

- NOTE: Maintain the maximum fluid level during the test.
- NOTE: Make sure the steering is in the straight ahead position.
- NOTE: Under no circumstances must the low pressure spigot be removed from the steering pump.

With the test valve open start the engine.

- Start the engine and turn steering fully lock to lock, stop the engine.
- Top-up the power steering fluid reservoir.
- Install the reservoir filler cap.

**14.** For correct power steering pressures, refer to the steering specification section. For additional information, refer to: [Specifications](#) (211-02 Power Steering, Specifications).

**15.** With the engine at idle, slowly turn the steering wheel and hold on full lock.

- Record the pressure reading.

**16.** Repeat the above procedure for the other side. With the engine at idle, release the steering wheel. The pressure should be at or below the pressure specified.


- Record the pressure reading.

- 18.** Pressure outside this tolerance, indicates a fault.
- 19.** To determine if the fault is in the steering pump or the steering rack, close the test valve for a maximum of 5 seconds.
- 20.** If the pressures recorded fall outside the given values, replace the power steering pump.
- 21.** If the maximum pump pressure is correct, then suspect the power steering rack.
- 22.** On completion of the test stop the engine, disconnect the battery ground cable and siphon the steering fluid from the reservoir.
  - Remove the filler cap.
  - Install the filler cap.
- 23.** Disassemble the test equipment.
- 24.** Connect the high-pressure line to the power steering pump.
  - Clean the component mating faces.
  - Install the new O-ring seals.
  - Tighten the bolt to 25 Nm (18 lb.ft).
- 25.** Install the front LH fender splash shield.  
For additional information, refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).
- 26.** Install the front LH splash shield.
  - Secure with the clips.
- 27.** Install the radiator access panel.
  - Tighten the M6 bolts to 10 Nm (7 lb.ft).
  - Tighten the M10 bolts to 45 Nm (33 lb.ft).
- 28.** Connect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
- 29.** Refill and bleed the power steering.  
For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).

# Power Steering - Steering Gear V6 4.0L Petrol

Removal and Installation

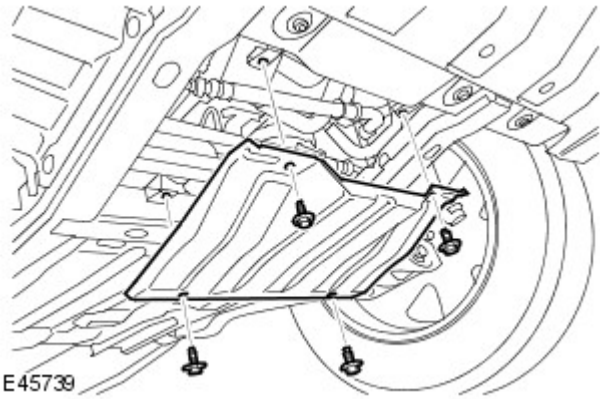
## Removal

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.

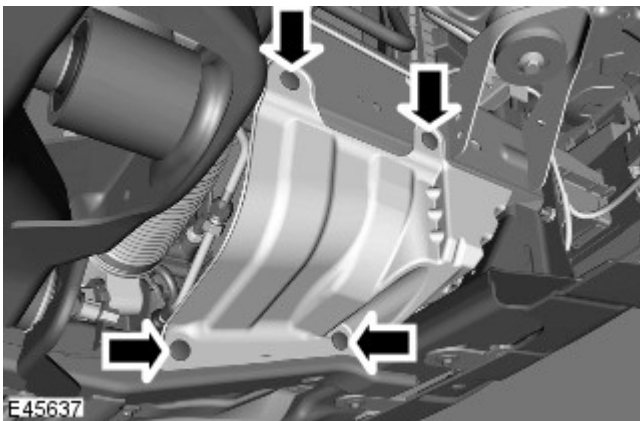
2. Remove the radiator access panel.

- Remove the 4 bolts.



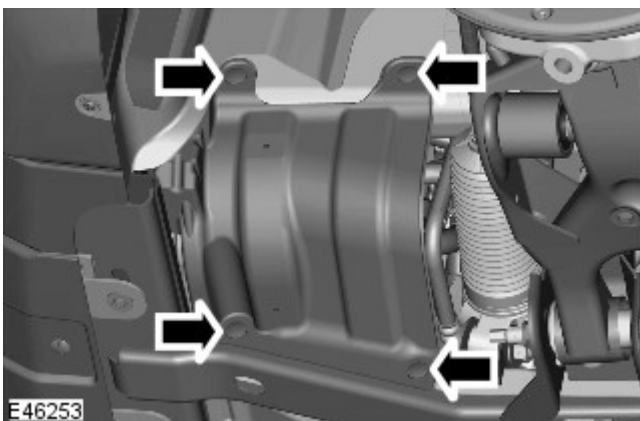
3. Remove the front RH splash shield.

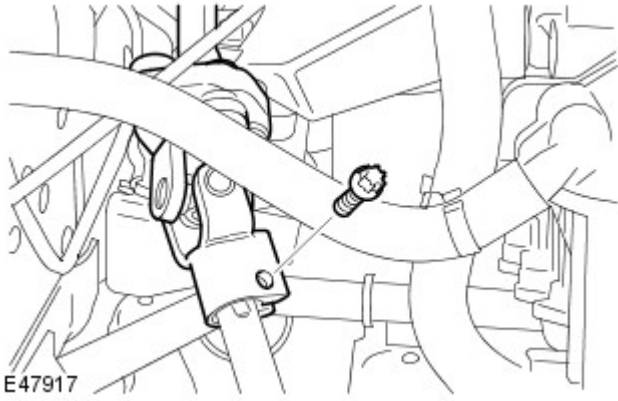
- Remove the 4 clips.



4. Remove the front LH splash shield.

- Remove the 4 clips.

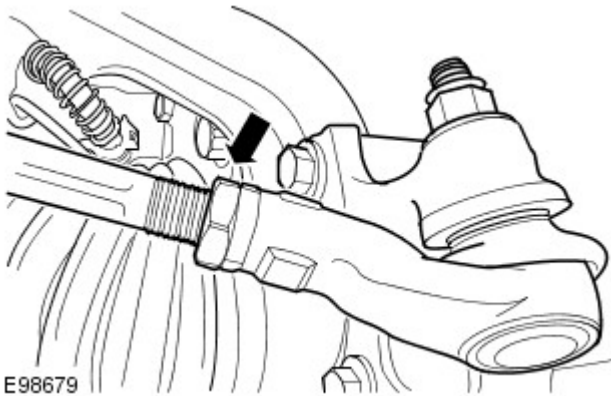




**5. NOTE:** Make sure the steering is in the straight ahead position.

Release the universal joint from the steering gear.

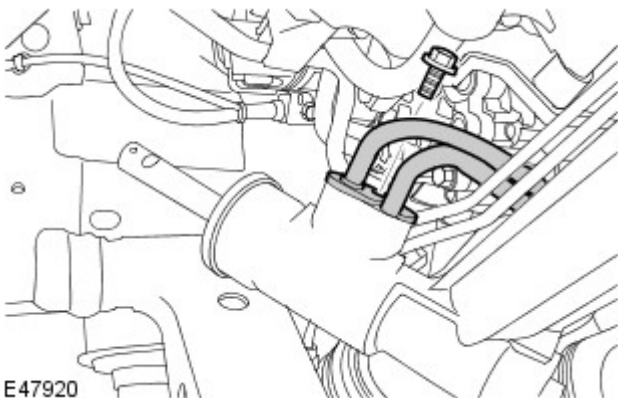
- Remove and discard the bolt.



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

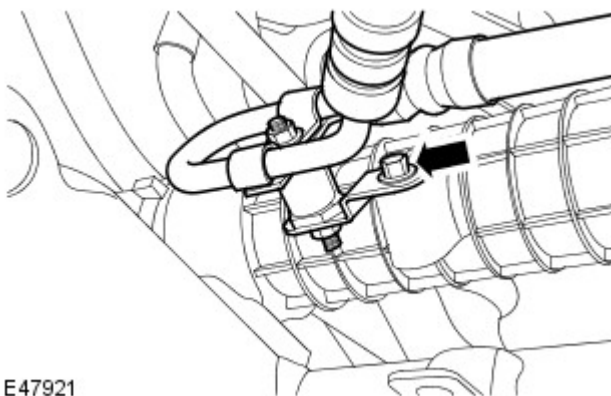
Release both tie-rod end ball joints.

- Loosen the locknut.
- Release both track rods from tie rod ends, note the number of turns for installation.



**7.** Disconnect the pressure lines from the power steering gear.

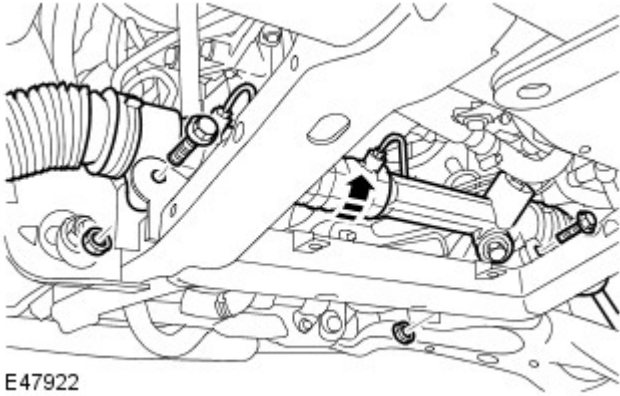
- Remove the bolt.
- Position an absorbent cloth to collect fluid spillage.
- Remove and discard the O-ring seals.



**8.** Remove the steering gear high-pressure line.

- Remove the bolt.





**9.** Remove the steering gear.

- Remove the 2 bolts and discard the cage nuts.
- With assistance, carefully rotate and release the steering gear.

## Installation

**1.** With assistance, install the steering gear.

- Clean the component mating faces.
- Tighten the bolts to 175 Nm (129 lb.ft).

**2.** NOTE: Do not install the support bracket bolt until the steering gear connections are tightened.

Install the steering gear high pressure line.

**3.** NOTE: Lubricate the seals with clean power steering fluid.

Connect the steering gear pressure lines.

- Clean the component mating faces.
- Install new O-ring seals.

**4.** Install the power steering line support bracket.

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

**5.** Connect the tie-rod end ball joints.

- Attach both tie rods to previously noted positions.
- Tighten the tie-rod locking nut.

**6.** Connect the universal joint to the steering gear.

- Install a new patchlock bolt and tighten to 25 Nm (18 lb.ft).

**7.** Install the radiator access panel.

- Install the 4 bolts and tighten to 10 Nm (7 lb.ft).

**8.** Install the front LH splash shield.

**9.** Install the front RH splash shield.

**10.** Fill and bleed the power steering system.

For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).


**11.** Adjust the front wheel alignment.

## Power Steering - Steering GearTDV6 3.0L Diesel


Removal and Installation

### Removal

- NOTE: LHD illustration shown, RHD is similar.
- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

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

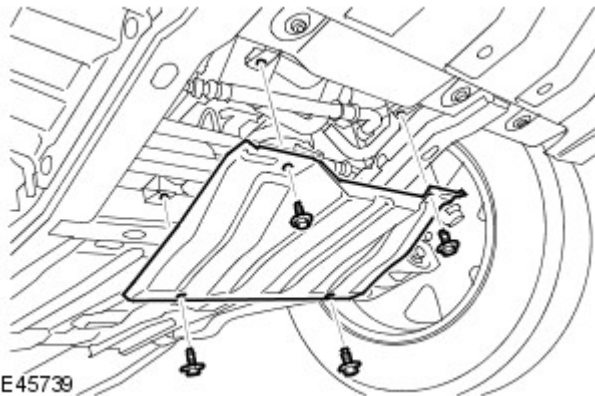
Raise and support the vehicle.

2.  **CAUTION:** Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

Center the steering wheel.

3. Remove the radiator splash shield.

- Remove the 4 bolts.

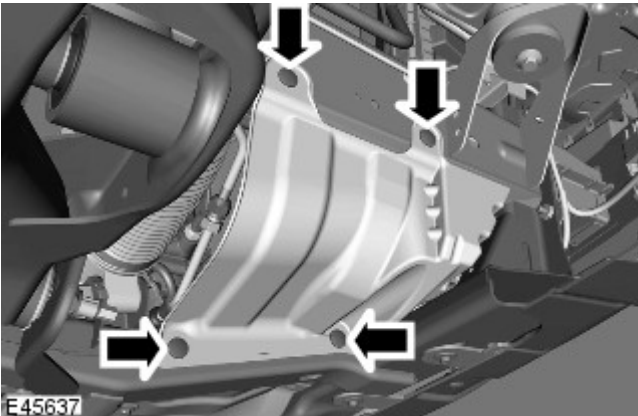


4. Remove the engine undershield.

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

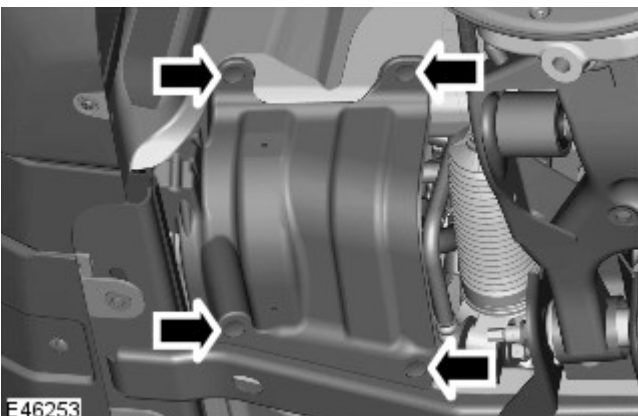
5. Remove the front RH splash shield.

- Remove the 4 clips.



6. Remove the front LH splash shield.

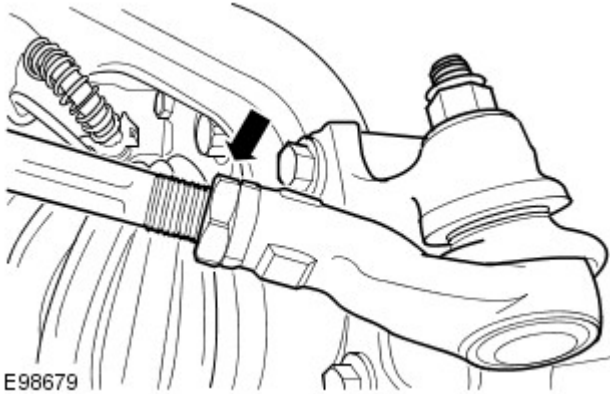
- Remove the 4 clips.



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

Release both tie-rod end ball joints.

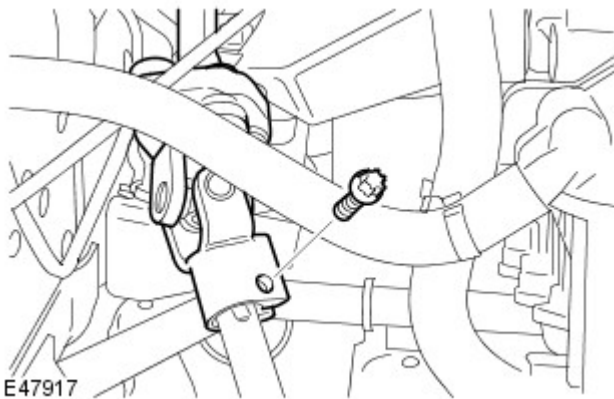
- Loosen the locknut.
- Release both track rods from tie rod ends, note the number of turns for installation.



**8. NOTE:** Note the fitted position.

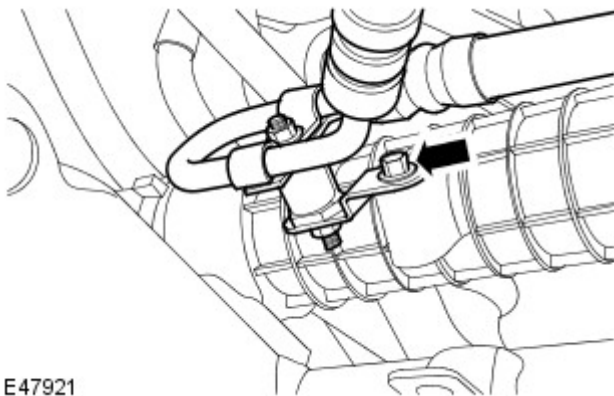
Disconnect the lower steering column from the steering gear.

- Remove and discard the bolt.



**9.** Remove the steering gear high-pressure line.

- Remove the bolts.

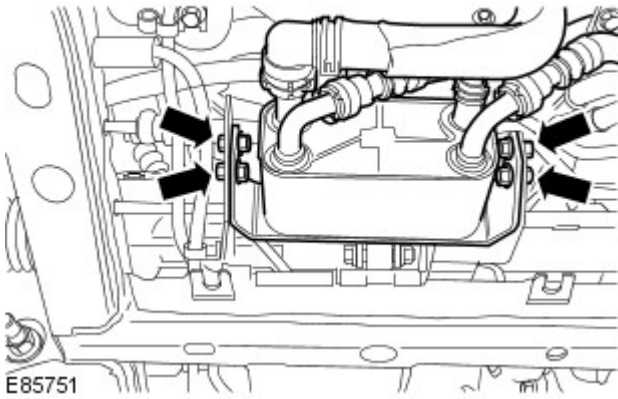


**10.** Disconnect the steering gear control valve actuator electrical connector.



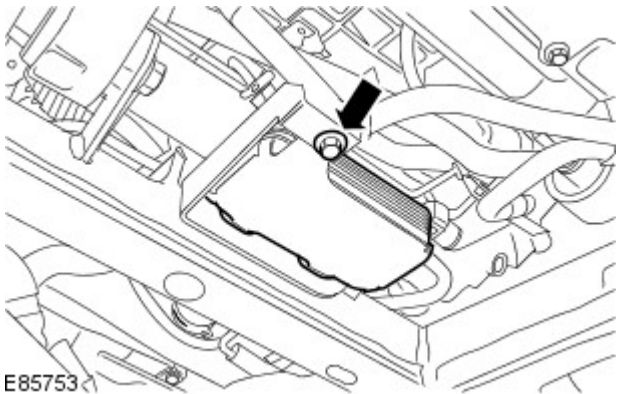
**11. Release the transmission fluid cooler.**

- Remove the 4 bolts.




**12. Release the fuel cooler.**

- Remove the bolt.



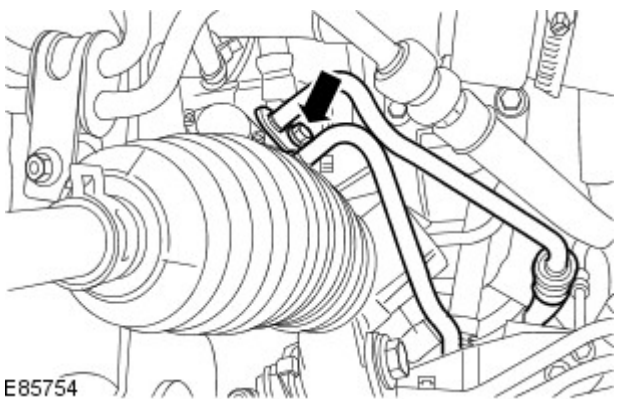
**13. CAUTIONS:**

 Make sure that the area around the component is clean and free of foreign material.

 Make sure that all openings are sealed. Use new blanking caps.

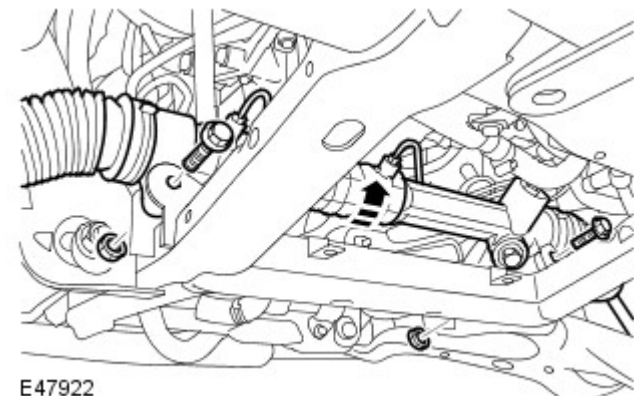
Disconnect the power steering high pressure line and return line from the steering gear.

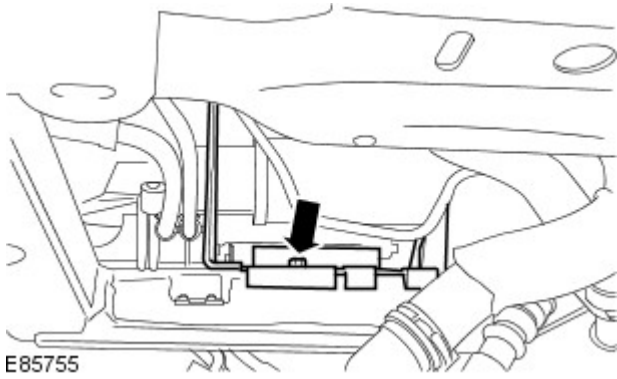
- Remove and discard the bolt.
- Remove and discard the 2 O-ring seals.



**14. Release the steering gear.**

- Remove the 2 bolts.





**15.** Remove the transmission fluid cooler and fuel cooler support bracket.

- Remove the bolt.
- Release the coolant line.

**16.** Remove the steering gear.

### Installation

**1.** Install the steering gear.

**2.** Install the transmission fluid cooler and fuel cooler support bracket.

- Secure the coolant line.
- Tighten the bolt to 23 Nm (17 lb.ft).

**3.** Secure the steering gear.

- Tighten the bolts to 175 Nm (129 lb.ft).

**4. NOTE:** Remove and discard the blanking caps.

• **NOTE:** Lubricate the seals with clean power steering fluid.

Connect the power steering high pressure line and return line to the steering gear.

- Install new O-ring seals.
- Tighten the new bolt to 22 Nm (16 lb.ft).

**5.** Secure the fuel cooler.

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

**6.** Secure the transmission fluid cooler.

- Tighten the nuts and bolts to 25 Nm (18 lb.ft).

**7.** Connect the steering gear control valve actuator electrical connector.

**8.** Install the power steering line support bracket.

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

**9.** Connect the lower steering column shaft to the steering gear.

- Tighten the new bolt to 24 Nm (18 lb.ft).

**10.** Connect the tie-rod end ball joints.

- Attach both tie rods to previously noted positions.
- Tighten the tie-rod locking nut.

**11.** Install the front LH splash shield.

- Install the clips.

**12.** Install the front RH splash shield.

- Install the clips.

**13.** Install the engine undershield.

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

**14.** Install the radiator splash shield.

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

**15.** Fill and bleed the power steering system.

For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).


**16.** Adjust the front wheel alignment.

# Power Steering - Steering Gear V8 5.0L Petrol

Removal and Installation

## Removal

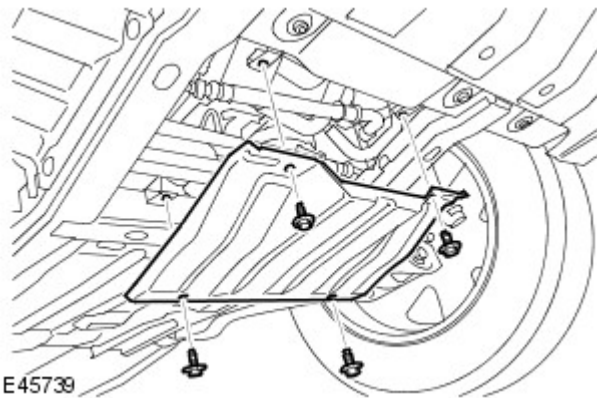
- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.
- NOTE: LHD illustration shown, RHD is similar.

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.

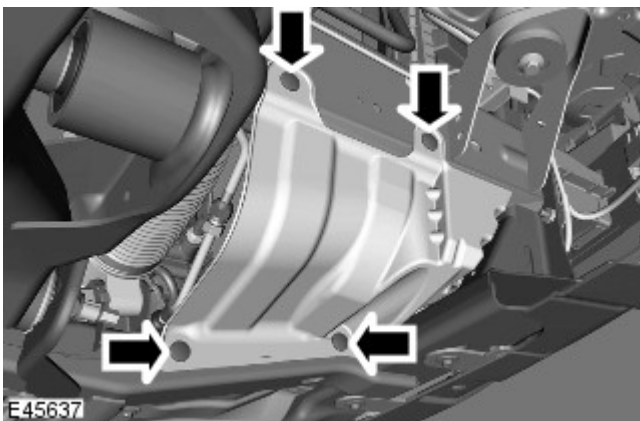
2. Remove the radiator access panel.

- Remove the 4 bolts.



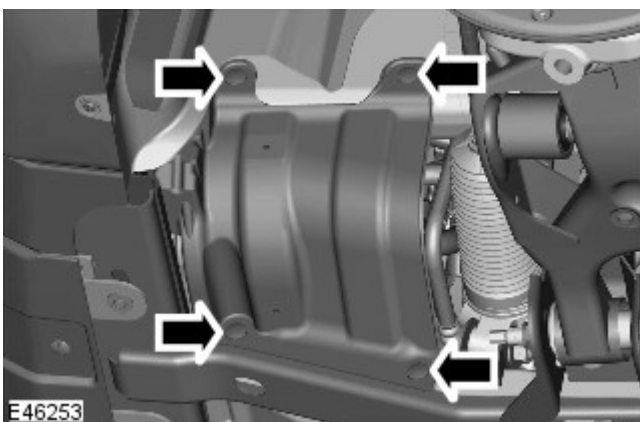
3. Remove the front RH splash shield.

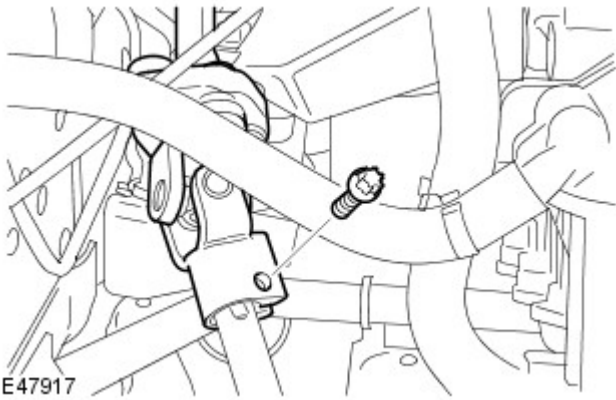
- Remove the 4 clips.



4. Remove the front LH splash shield.

- Remove the 4 clips.



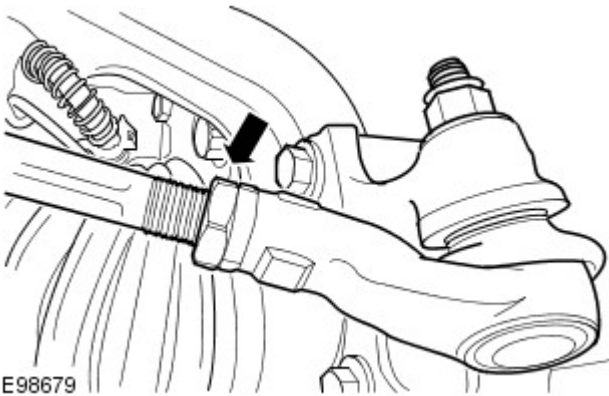


**5. ⚠ CAUTION:** Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

• **NOTE:** Make sure the steering is in the straight ahead position.

Release the universal joint from the steering gear.

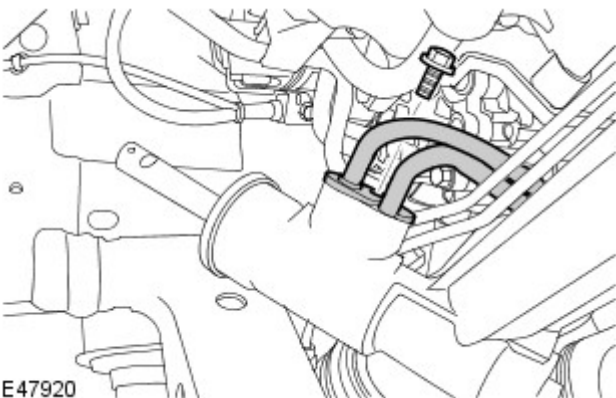
- Remove and discard the bolt.



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

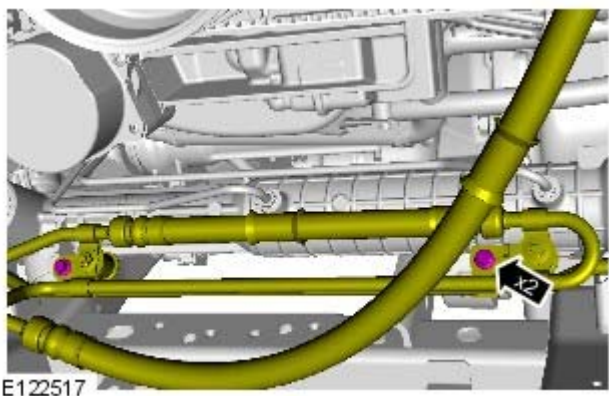
Release both tie-rod end ball joints.

- Loosen the locknut.
- Release both track rods from tie rod ends, note the number of turns for installation.



**7.** Disconnect the pressure lines from the power steering gear.

- Remove the bolt.
- Position an absorbent cloth to collect fluid spillage.
- Remove and discard the O-ring seals.



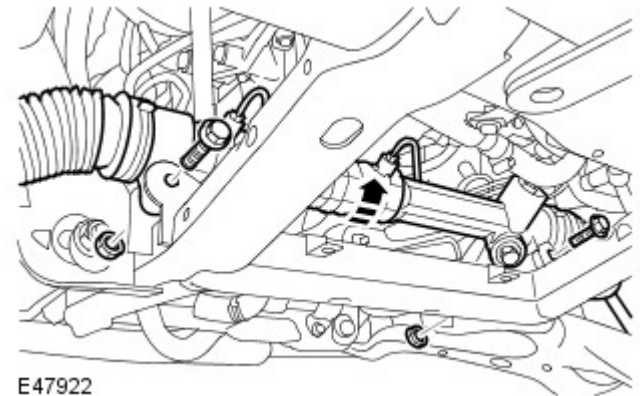
**8.** Remove the steering gear high-pressure line.

- Remove the bolts.





9. Disconnect the steering gear electrical connector.



10. Remove the steering gear.

- Remove the 2 bolts and discard the cage nuts.
- Release the steering gear.

## Installation

1. Clean the component mating faces.
2. Install the steering gear.
  - Tighten the bolts to 175 Nm (129 lb.ft).
3. Connect the electrical connector.
4. **NOTE: Do not install the support bracket bolt until the steering gear connections are tightened.**

Install the steering gear high pressure line.
5. **NOTE: Lubricate the seals with clean power steering fluid.**

Connect the steering gear pressure lines.


  - Clean the component mating faces.
  - Install new O-ring seals.
  - Tighten the bolt to 22 Nm (16 lb.ft).
6. Install the power steering line support bracket.
  - Tighten the bolt to 10 Nm (7 lb.ft).
7. Connect the tie-rod end ball joints.
  - Attach both tie rods to previously noted positions.
  - Tighten the tie-rod locking nut.
8. Connect the universal joint to the steering gear.
  - Install a new patchlock bolt and tighten to 25 Nm (18 lb.ft).
9. Install the radiator access panel.
  - Install the 4 bolts and tighten to 10 Nm (7 lb.ft).
10. Install the front LH splash shield.

- 11.** Install the front RH splash shield.
- 12.** Fill and bleed the power steering system.  
For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).
- 13.** Adjust the front wheel alignment.

# Power Steering - Steering Gear TDV6 2.7L Diesel

Removal and Installation

## Removal

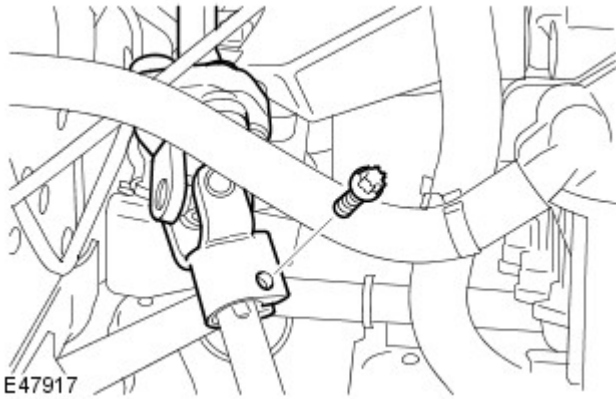
1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. **NOTE:** Make sure the steering is in the straight ahead position.

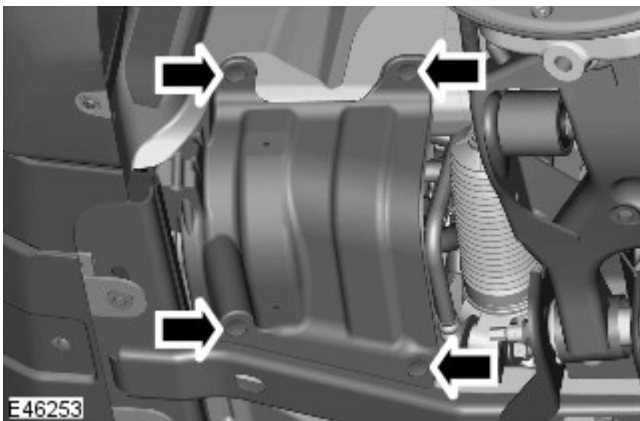
Release the universal joint from the steering gear.

- Remove and discard the bolt.



3. Remove the front RH and LH splash shields.

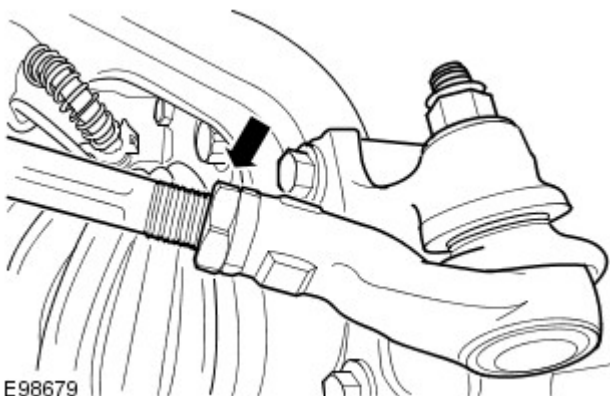
- Remove the 8 clips.

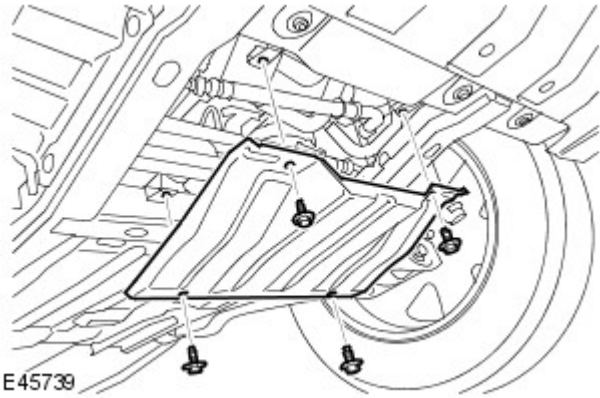


4. **NOTE:** LH illustration shown, RH is similar.

Release both tie-rod end ball joints.

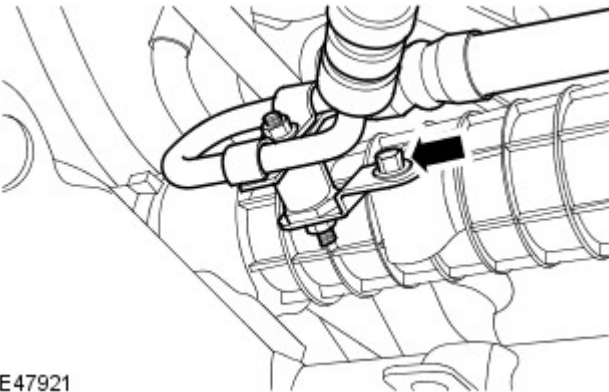
- Loosen the locknut.
- Release both track rods from tie rod ends, note the number of turns for installation.





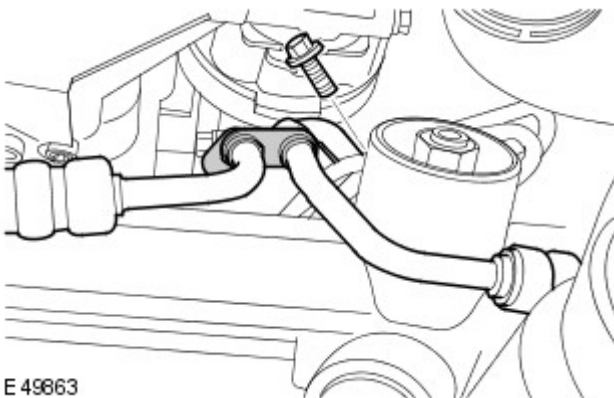
**5.** Remove the radiator access panel.


- Remove the 4 bolts.



**6.** Release the power steering line support mount.

- Remove the bolt.

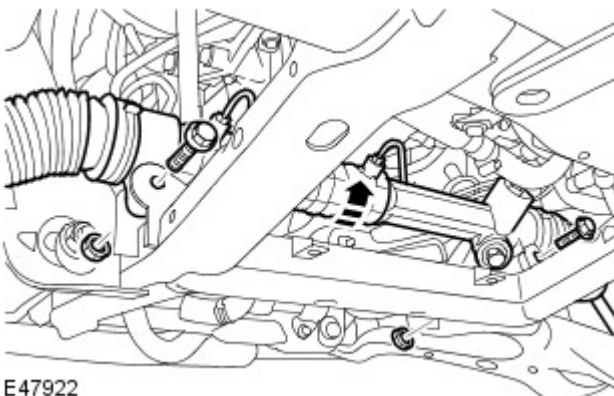


**7.**  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

- **NOTE:** Some fluid spillage is inevitable during this operation.

Disconnect the power steering fluid lines.

- Position a container to collect spillage.
- Remove the clip.
- Remove and discard the bolt.
- Discard the O-ring seals.



**8.** Remove the steering gear.

- Remove the 2 bolts and discard the nuts.

## Installation

**1.** Install the steering gear.

- Clean the component mating faces.

- Use new nuts and tighten the nuts and bolts to 175 Nm (129 lb.ft).
2. Install the power steering fluid lines.
    - Clean the component mating faces.
    - Install new O-ring seals.
    - Install the clip.
    - Tighten the new bolt to 25 Nm (18 lb.ft).
  3. Secure the power steering line support mount.
    - Install the bolt.
  4. Connect the universal joint to the steering gear.
    - Install a new patchlock bolt and tighten to 25 Nm (18 lb.ft).
  5. Install the radiator access panel.
    - Tighten the bolts to 10 Nm (7 lb.ft).
  6. Install the splash shields.
    - Install the clips.
  7. Connect the tie-rod end ball joints.
    - Attach both tie rods to previously noted positions.
    - Tighten the tie-rod locking nut.
  8. Fill and bleed the power steering system.  
For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).
  9. Adjust the front wheel alignment.

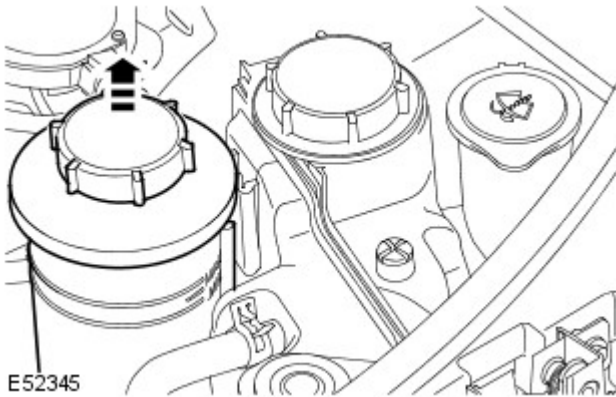
# Power Steering - Power Steering Fluid Reservoir V6 4.0L Petrol/V8 5.0L Petrol/TDV6 3.0L Diesel


Removal and Installation

## Removal

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

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Siphon the fluid from the power steering reservoir.
3. Release the power steering fluid reservoir from the bracket.

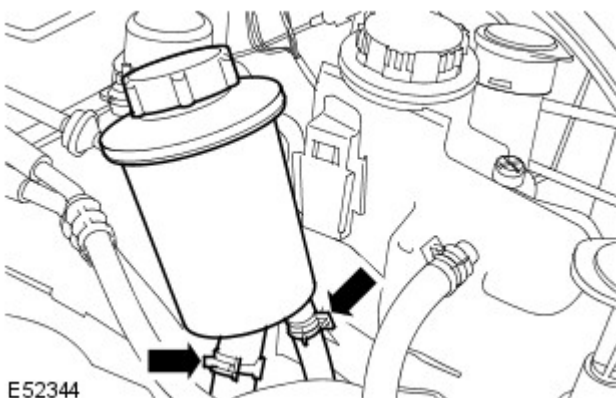


4.  CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

- NOTE: Some fluid spillage is inevitable during this operation.

Remove the power steering fluid reservoir.

- Position an absorbent cloth to collect fluid spillage.
- Release the hose clips and disconnect the hoses.



## Installation

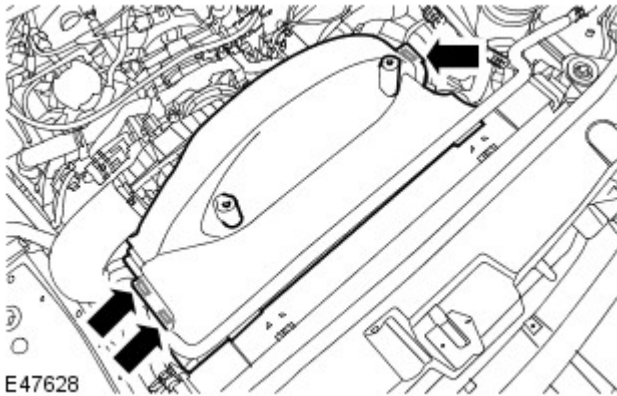
1. To install, reverse the removal procedure.
2. Fill and bleed the power steering system.  
For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).

# Power Steering - Power Steering Fluid Reservoir TDV6 2.7L Diesel

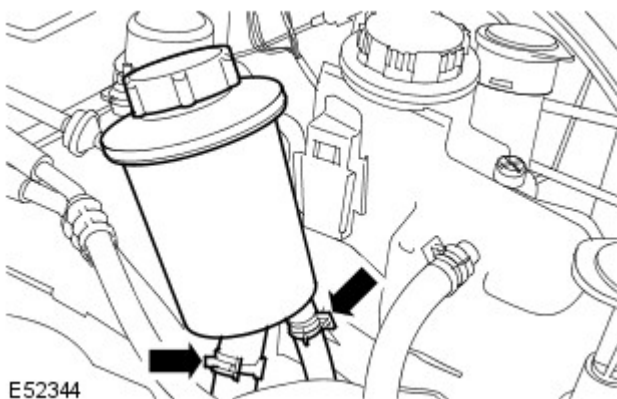
Removal and Installation


## 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 air cleaner assembly.  
For additional information, refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Removal and Installation).
3. Remove the cooling fan shroud.



- Release the coolant hose.
- Release the 3 clips.



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

● **NOTE:** Some fluid spillage is inevitable during this operation.

Remove the power steering reservoir.


- Position a container to collect spillage.
- Release the 2 clips.
- Disconnect the 2 hoses.

## Installation

1. Install the power steering fluid reservoir.
  - Clean the component mating faces.
  - Connect the hoses.
  - Secure with the 2 clips.
2. Install the cooling fan shroud.
  - Secure the coolant hose.
3. Install the air cleaner assembly.  
For additional information, refer to: [Air Cleaner](#) (303-12A Intake Air Distribution and Filtering - TDV6 2.7L Diesel, Removal and Installation).
4. Fill and bleed the power steering system.  
For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).

# Power Steering - Power Steering Fluid Cooler V6 4.0L Petrol/V8 5.0L Petrol

Removal and Installation

| Special Tool(s)  |                       |
|--|-----------------------|
|  <p>310-044</p> <p>E50921</p> | Spring lock decoupler |
|  | 310-044               |

## Removal

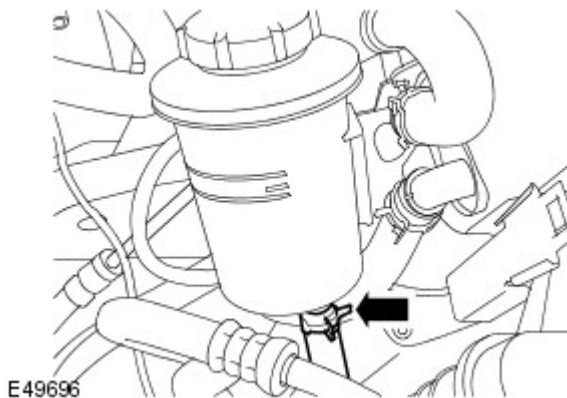
All vehicles

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the front radiator grille.  
For additional information, refer to: [Radiator Grille](#) (501-08 Exterior Trim and Ornamentation, Removal and Installation).
3. Remove the coolant expansion tank.  
For additional information, refer to: [Coolant Expansion Tank](#) (303-03D Engine Cooling - V8 5.0L Petrol, Removal and Installation) / [Coolant Expansion Tank](#) (303-03C Engine Cooling - V6 4.0L Petrol, Removal and Installation).
4. Siphon the fluid from the power steering reservoir.

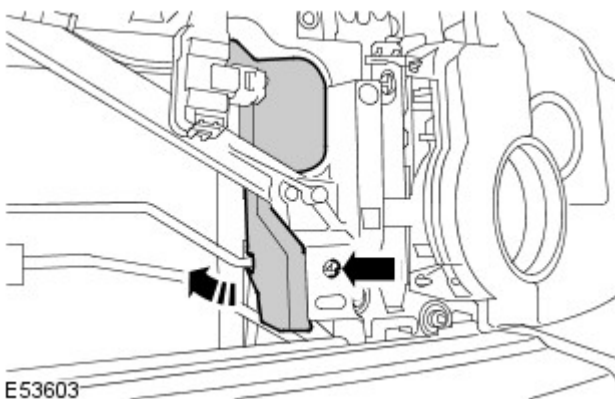
**5. ⚠ CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Disconnect the steering reservoir return hose.

- Position an absorbent cloth to collect fluid spillage.
- Release the clip.



6. Release the LH radiator air deflector lower clip, position the deflector aside.

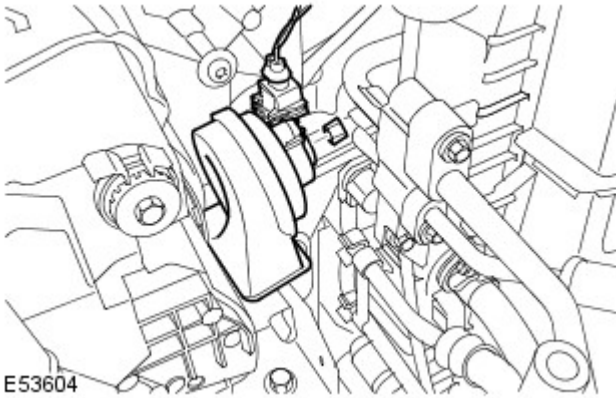


Vehicles with 4.0L engine



7. Position the LH horn aside for access.

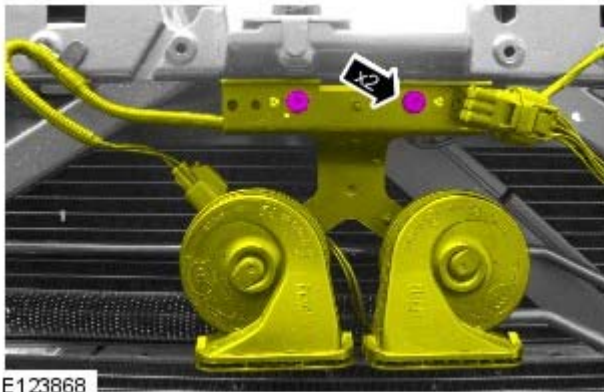
- Remove the nut.




Vehicles with 5.0L engine

8. Position the horns to one side for access.

- Remove the 2 bolts.



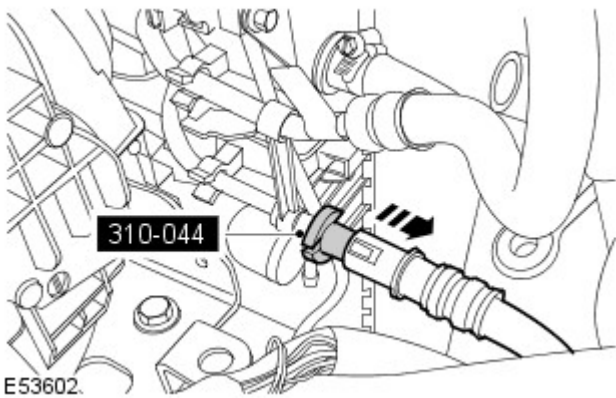
All vehicles

9.  **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.

● **NOTE:** Some fluid spillage is inevitable during this operation.

Using the special tool, disconnect the cooler line.

- Position an absorbent cloth to collect fluid spillage.

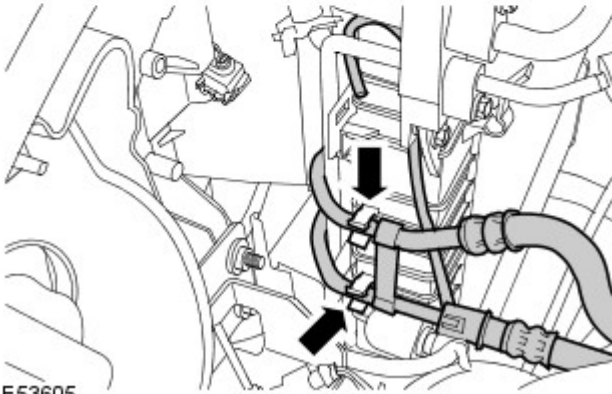
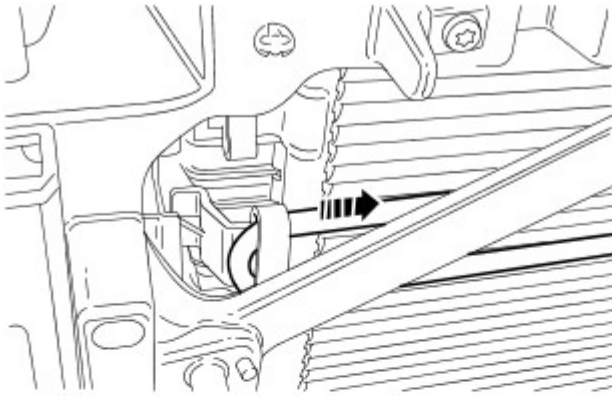


10. Remove the cooler line separating clip.

**11. NOTE:** Care must be taken to prevent damage to the cooler elements during removal and installation.

Remove the power steering fluid cooler.

- Release the 3 clips.



E53605

## Installation

All vehicles

1. Install the power steering fluid cooler.
  - Position and secure in the clips.
2. Install the power steering fluid line and hose.
  - Clean the component mating faces.
  - Secure the hose with the clip.
3. Install the cooler line separating clip.

Vehicles with 4.0L engine

4. Install the horn assembly.
  - Tighten the nut to 10 Nm (7 lb.ft).

Vehicles with 5.0L engine

5. Install the horn assemblies.
  - Tighten the 2 bolts to 10 Nm (7 lb.ft).

All vehicles

6. Install the radiator deflector.
  - Secure with the clip.
7. Install the coolant expansion tank.  
For additional information, refer to: [Coolant Expansion Tank \(303-03D Engine Cooling - V8 5.0L Petrol, Removal and Installation\) / Coolant Expansion Tank \(303-03C Engine Cooling - V6 4.0L Petrol, Removal and Installation\)](#).
8. Install the radiator grille.  
For additional information, refer to: [Radiator Grille \(501-08](#)

Exterior Trim and Ornamentation, Removal and Installation).

- 9.** Connect the battery ground cable.


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

- 10.** Fill and bleed the power steering system.


For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).

# Power Steering - Power Steering Fluid Cooler TDV6 2.7L Diesel

Removal and Installation

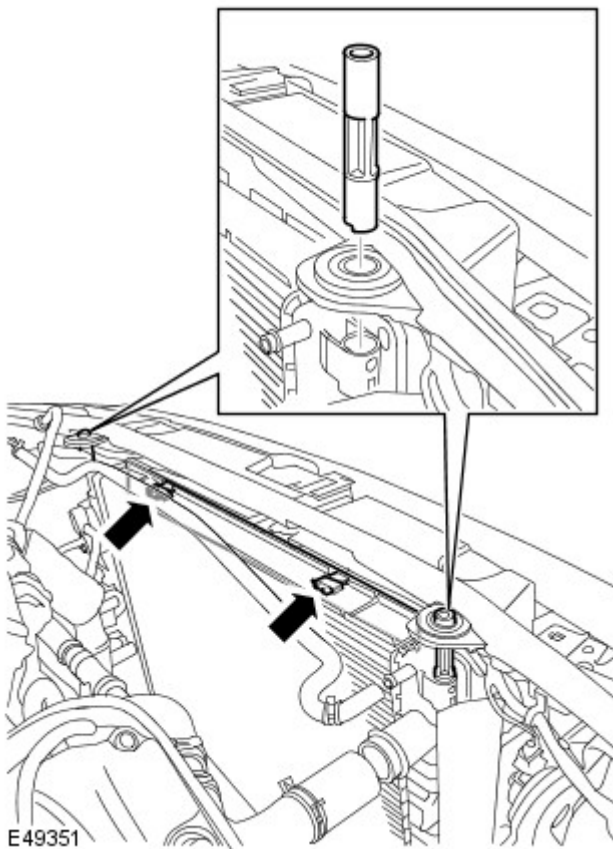
| Special Tool(s)   |                       |
|---|-----------------------|
|  | Spring lock decoupler |
|   | 310-044               |

## Removal

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

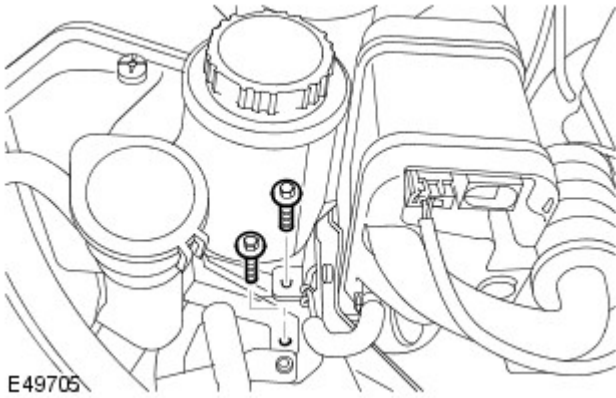
Raise and support the vehicle.

- Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
- Remove the cooling fan lower shroud.  
For additional information, refer to: [Cooling Fan Shroud](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, Removal and Installation).
- Remove the radiator grille.  
For additional information, refer to: [Radiator Grille](#) (501-08 Exterior Trim and Ornamentation, Removal and Installation).
- Remove the radiator securing pegs.
- Remove the radiator upper deflector.
  - Release the 2 clips.



**7.** Release the coolant expansion tank.

- Remove the 2 bolts.



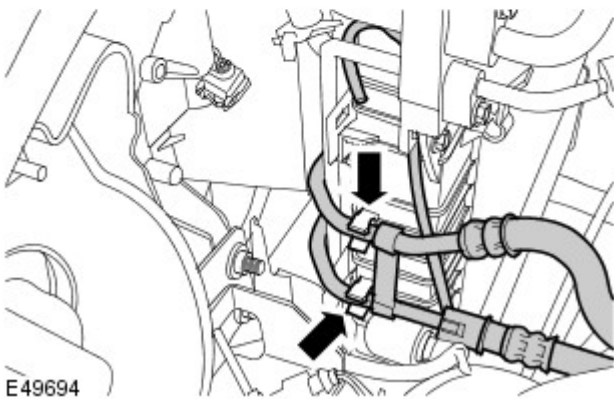
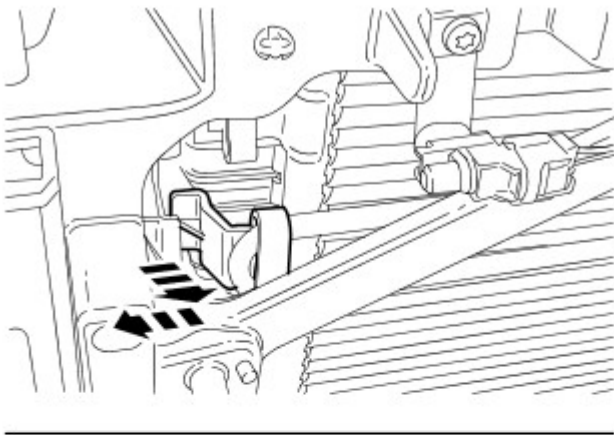
**8.** Tie the engine air intake duct towards the engine.

**9.** Tie the fuel fired booster heater coolant lines towards the engine.

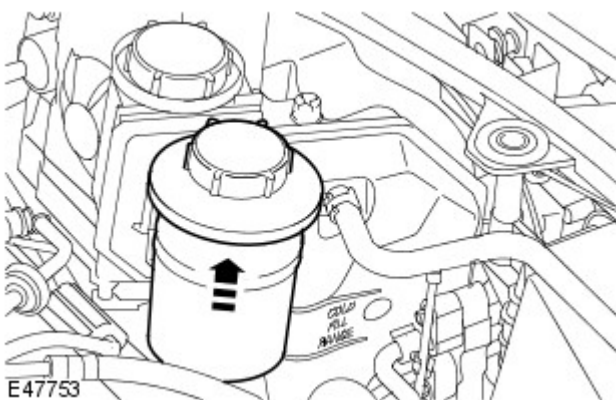
**10. NOTE:** Note the position of the differential breather line.

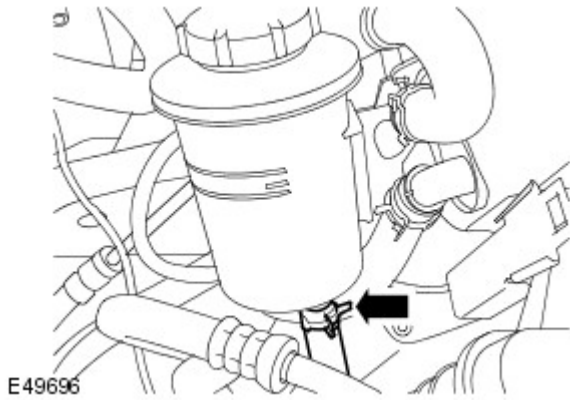
Release the power steering fluid cooler.


- Release it from 3 clips.



**11.** Release the power steering fluid reservoir.



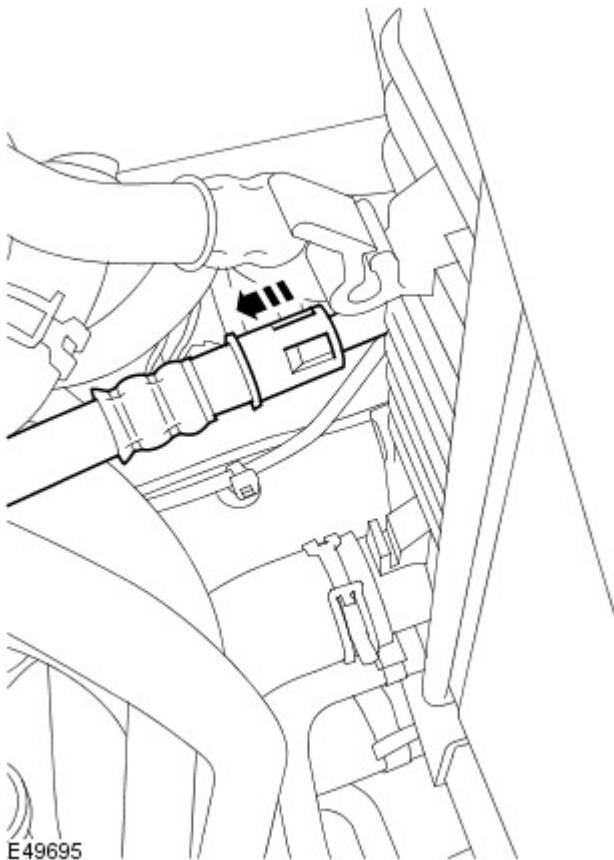



**12.**  **CAUTION:** Before the disconnection or removal of any components, ensure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

• **NOTE:** Some fluid spillage is inevitable during this operation.

Disconnect the power steering cooler line from the fluid reservoir.

- Release the clip.
- Allow the fluid to drain into a container.



**13.**  **CAUTION:** 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.

• **NOTE:** Some fluid spillage is inevitable during this operation.

Remove the power steering fluid cooler.

- Using the special tool, release the clip.

## Installation

- 1.** Install the power steering fluid cooler.
  - Clean the component mating faces.
  - Secure the clip.
- 2.** Connect the power steering cooler line to the fluid reservoir.
  - Clean the component mating faces.
  - Secure with the clip.
- 3.** Install the power steering fluid reservoir.
- 4.** Position the front differential breather line.
- 5.** Secure the power steering fluid cooler line.
  - Secure in the 3 clips.
- 6.** Secure the coolant expansion tank.
  - Tighten the 2 bolts to 10 Nm (7 lb.ft).

- 7.** Install the radiator upper deflector.
- 8.** Install the radiator securing pegs.
- 9.** Connect the A/C condenser refrigerant lines.
  - Clean the component mating faces.
  - Install new O-ring seals.
  - Tighten the bolts to 25 Nm (18 lb.ft).
- 10.** Install the radiator grille.

For additional information, refer to: [Radiator Grille](#) (501-08 Exterior Trim and Ornamentation, Removal and Installation).
- 11.** Install the cooling fan lower shroud.

For additional information, refer to: [Cooling Fan Shroud](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, Removal and Installation).
- 12.** Connect the battery ground cable.

For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
- 13.** Fill and bleed the power steering system.


For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).

**Power Steering - Power Steering Pump VIN Range: 07 MODEL****YEAR->CURRENT**

## Removal and Installation

**Removal**

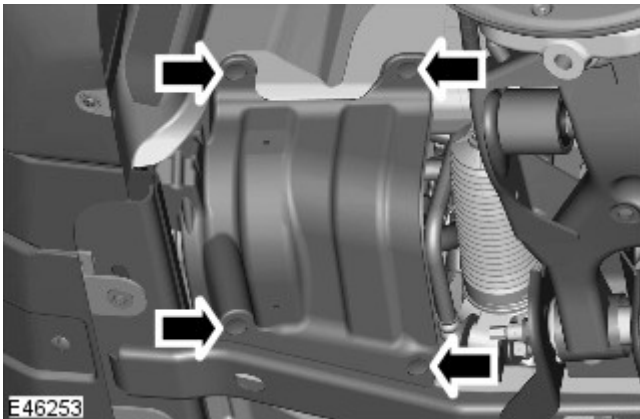
1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the engine cover.  
For additional information, refer to: [Engine Cover - TDV6 3.0L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Remove the cooling fan shroud.  
For additional information, refer to: [Cooling Fan Shroud](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, Removal and Installation).
4. Recover the air conditioning (A/C) refrigerant.  
For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
5. Remove the auxiliary battery tray.  
For additional information, refer to: [Auxiliary Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
6. Remove the accessory drive belt.  
For additional information, refer to: [Accessory Drive Belt](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).

7.  **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.

8. Remove the LH front wheel and tire.
9. Remove the fender splash shield lower trim panel.

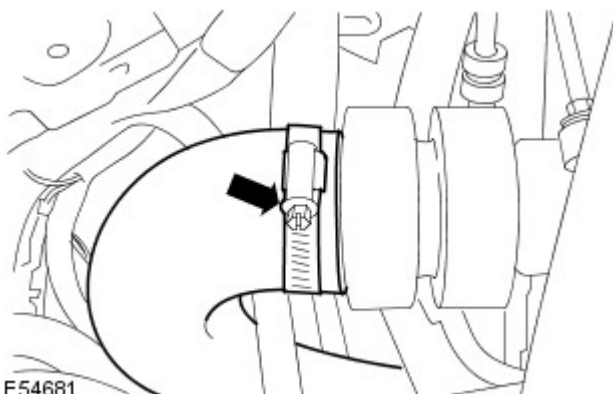
- Remove the 4 clips.



10. Remove the front LH fender splash shield.  
For additional information, refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

11. Remove the upper arm and brake line heat shields for access.
12. Disconnect the charge air cooler inlet hose.

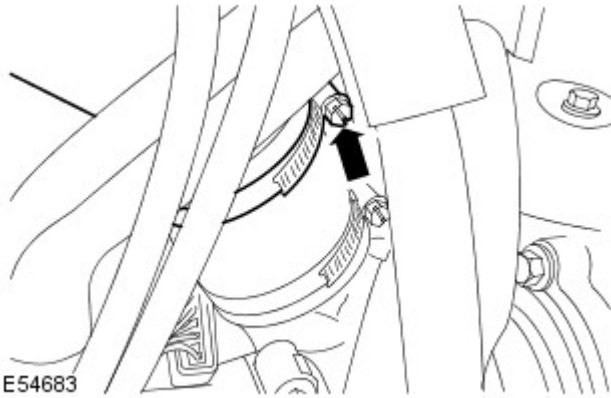
- Remove the two retaining bolts.  
Remove the 3 nuts.
- Remove the retaining nut.
- Remove the 3 bolts.





**14.** Disconnect the charge air cooler inlet hose.

- Loosen the clip.



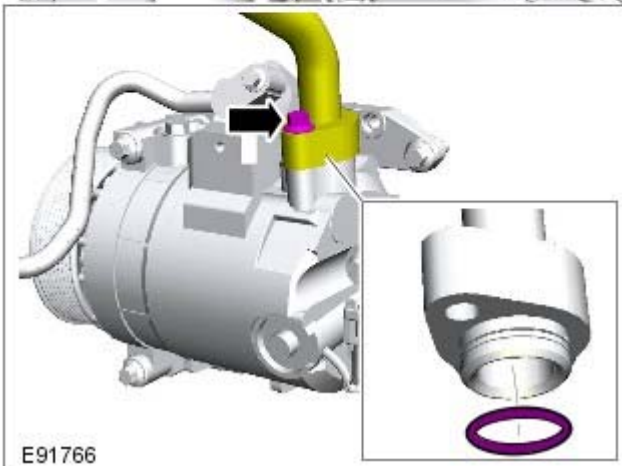
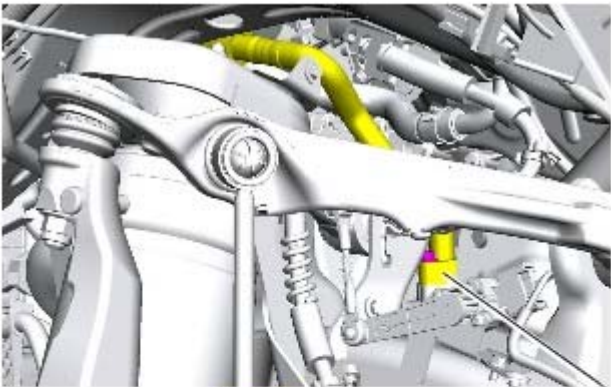
**15. CAUTIONS:**

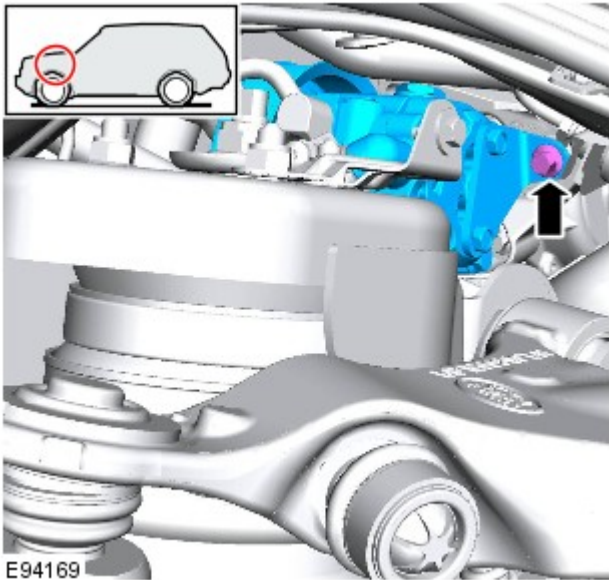
 Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

 Care must be taken to avoid damage to the mating surfaces.

Release the A/C low pressure pipe from the compressor.


- Remove and discard the O-ring seal.
- Using a suitable tie strap, secure the A/C low-pressure pipe aside.






**16.** Remove the power steering pump rear fixing bracket retaining bolt.

- Reposition the charge air cooler inlet pipe to gain access to the power steering pump retaining bolt.

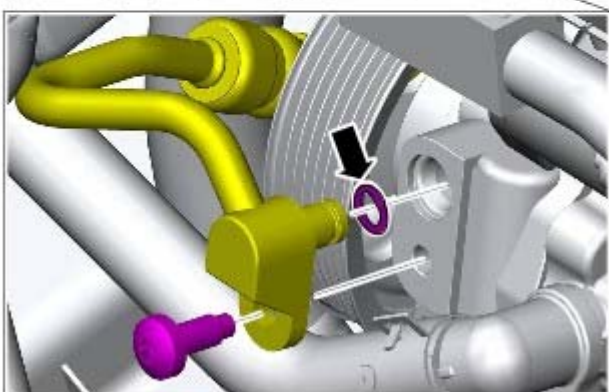
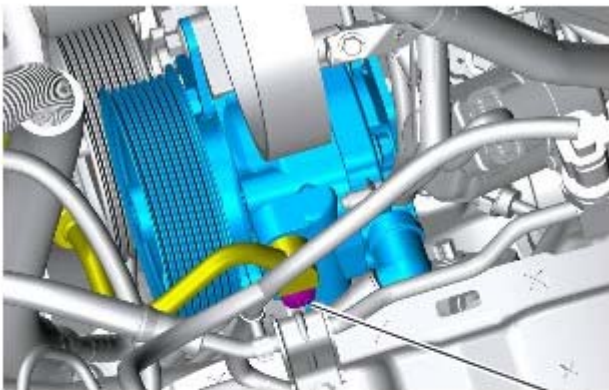
**17.**  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Lower the vehicle.

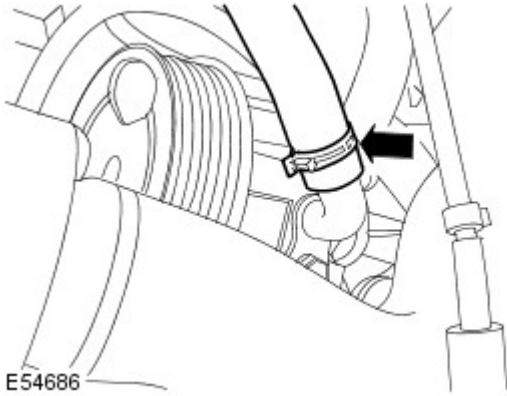
**18.**  **CAUTION:** If power steering fluid comes into contact with the paintwork, the affected area must be immediately washed down with cold water.


Disconnect the high pressure line from the power steering gear.

- Remove and discard the O-ring seal.
- Install blanking caps to the exposed ports.
- Allow the fluid to drain into a container.



E94170



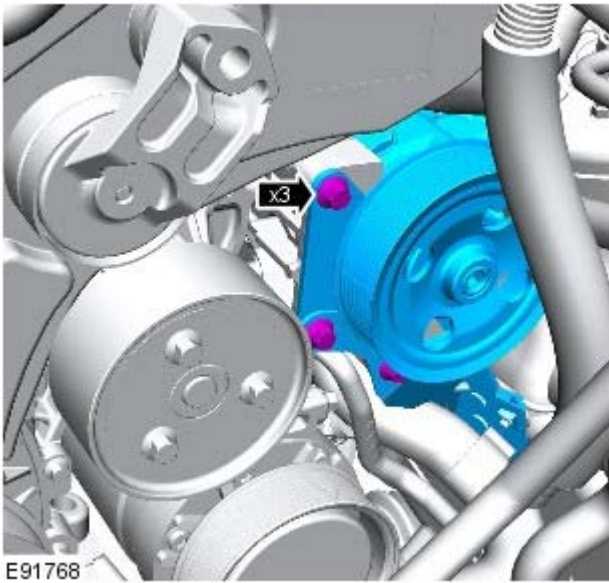
**19.**  **CAUTION:** If power steering fluid comes into contact with the paintwork, the affected area must be immediately washed down with cold water.

Disconnect the power steering pump supply hose.

- Clamp the power steering pump supply hose to minimise fluid loss.
- Install blanking caps to the exposed ports.

**20.** Remove the power steering pump.


- Remove the 3 power steering pump front retaining bolts.



## Installation

**1.** Install the power steering pump and bracket.


- Install the 3 power steering pump front bolts and lightly tighten, then back off each bolt a 1/4 turn.

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

Raise the vehicle.

**3.** Install the power steering pump rear fixing bracket retaining bolt.

- Reposition the charge air cooler inlet pipe to gain access to the power steering pump retaining bolt.
- Tighten the bolt to 25 Nm (18 lb.ft).

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

Lower the vehicle.

**5.** Tighten power steering pump front retaining bolts to 24 Nm (18 lb.ft).

**6.** Connect the power steering supply hose.

- Remove the blanking caps from the ports.
- Remove the hose clamp.

**7.** **NOTE:** Lubricate the seals with clean power steering fluid.


Connect the power steering high-pressure pipe union.

- Remove the blanking caps from the ports.
- Install a new O-ring seal.
- Tighten the Torx bolt to 25 Nm (18 lb.ft).
- Remove the container.

**8.**  **CAUTION:** Lubricate the new seals with clean refrigerant oil.

Install the A/C low pressure pipe to the compressor.

- Remove the blanking caps from the ports.
- Install a new O-ring seal.
- Tighten the bolt to 9 Nm (7 lb.ft).

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

Raise the vehicle.

**10.** Connect the charge air cooler inlet hose.

- Tighten the clips.

**11.** Secure the charge air cooler inlet pipe.

- Install the two retaining bolts.
- Install the retaining nut.
- Tighten to 10 Nm (7 lb.ft).

**12.** Install the upper arm and brake line heat shields.

- Install the 3 bolts.
- Install the 3 nuts.


**13.** Install the fender splash shield lower trim panel.

- Install the 4 clips.

**14.** Install the front LH fender splash shield.

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

**15.** Install the wheel and tire.

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

Lower the vehicle.

**17.** Install the accessory drive belt.

For additional information, refer to: [Accessory Drive Belt](#) (303-05A Accessory Drive - TDV6 2.7L Diesel, Removal and Installation).

**18.** Install the auxiliary battery tray.

For additional information, refer to: [Auxiliary Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

**19.** Recharge the A/C system

For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).

**20.** Install the cooling fan shroud.

For additional information, refer to: [Cooling Fan Shroud](#) (303-03A Engine Cooling - TDV6 2.7L Diesel, Removal and Installation).

**21.** Check and top-up power steering fluid level.

For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).

**22.** Install the engine cover.

For additional information, refer to: [Engine Cover - TDV6 3.0L Diesel](#) (501-05 Interior Trim and Ornammentation, Removal and Installation).

**23.** Connect the battery ground cable.

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

# Power Steering - Power Steering Pump TDV6 3.0L Diesel

Removal and Installation

## Removal

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

1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

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

Raise and support the vehicle.

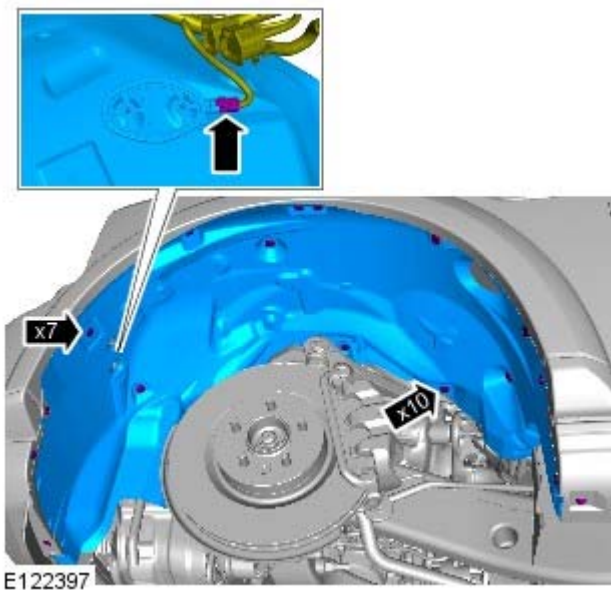
3. Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).

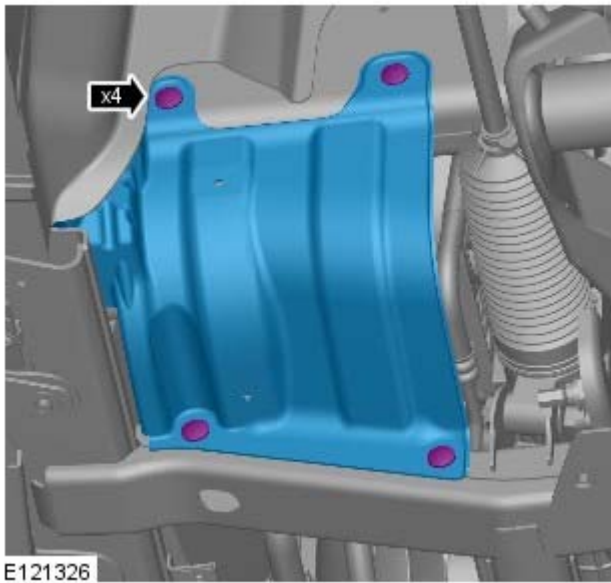
4. Refer to: [Accessory Drive Belt](#) (303-05B Accessory Drive - TDV6 3.0L Diesel, Removal and Installation).

5. Remove the LH front wheel and tire.

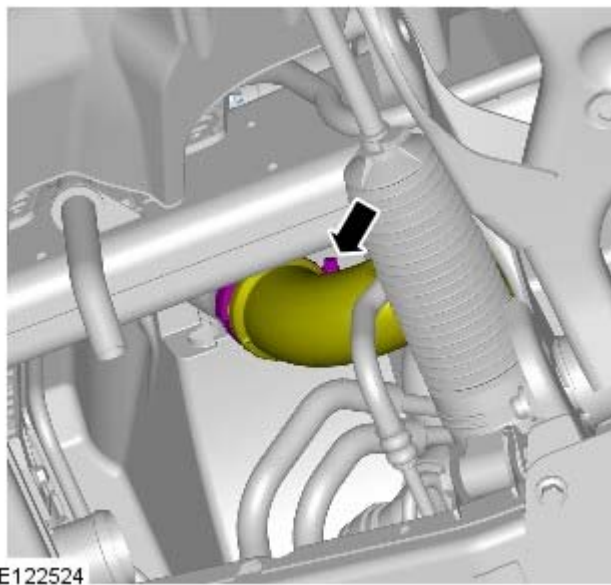
*Torque: 140 Nm*

- 6.

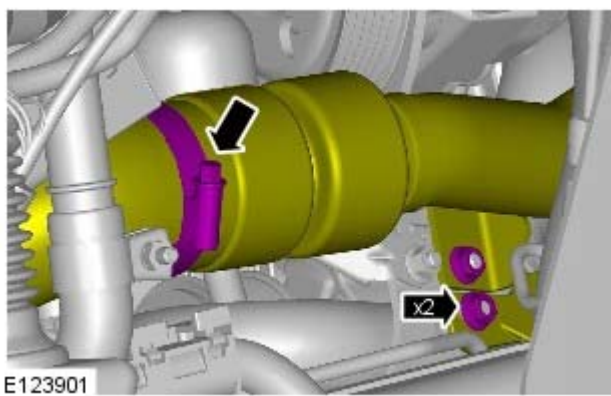




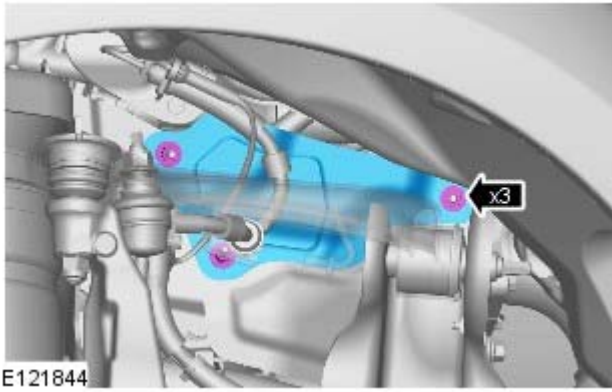
7.



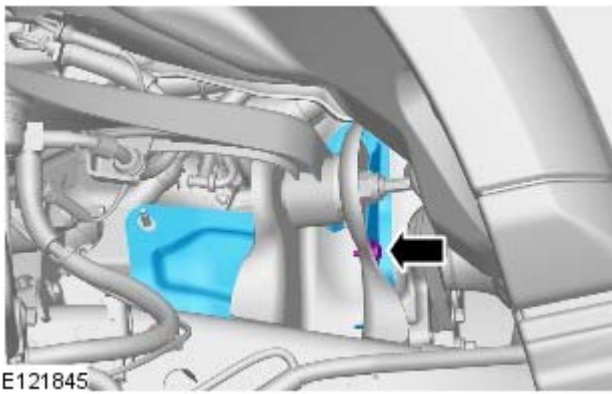
8.



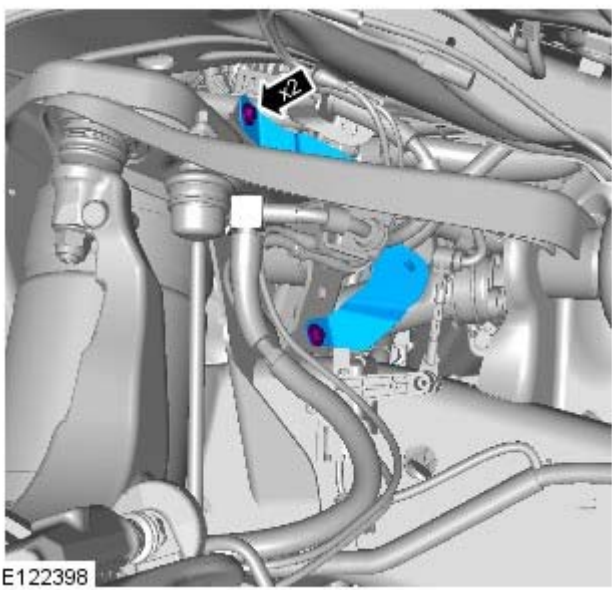
9. Torque:  
Nuts 6 Nm



10. Torque: 9 Nm

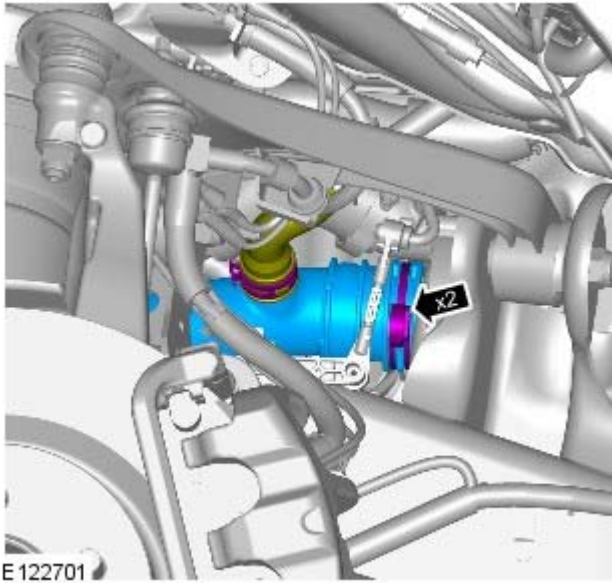


11. Torque: 9 Nm

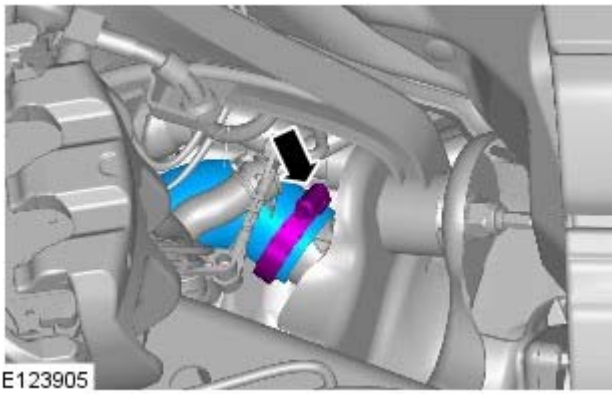


12. Torque: 9 Nm

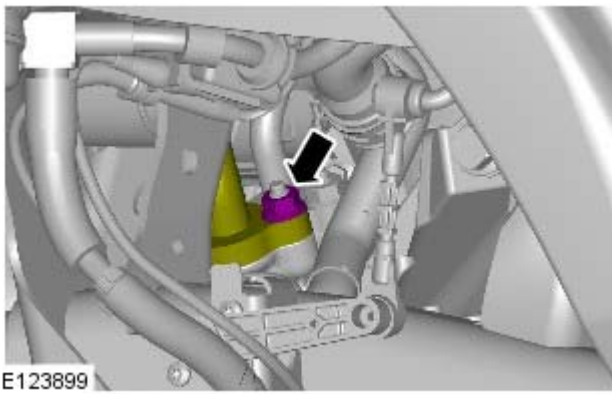




13.

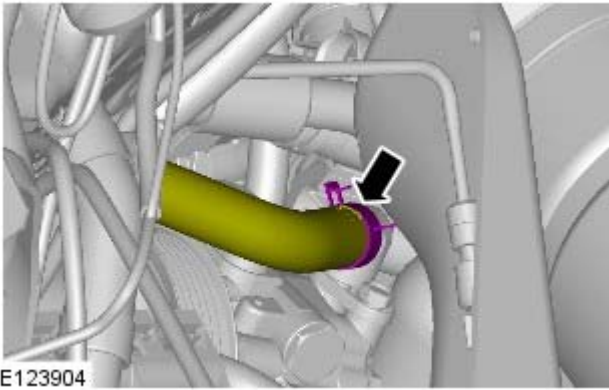



14.




15. **15.** NOTE: Make sure that all openings are sealed. Use new blanking caps.

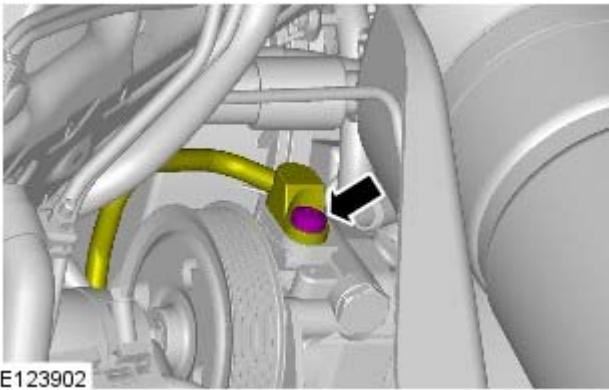
*Torque:* 18 Nm




16. **16.**  **WARNING:** Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.

 **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

- **NOTE:** Make sure that all openings are sealed. Use new blanking caps.

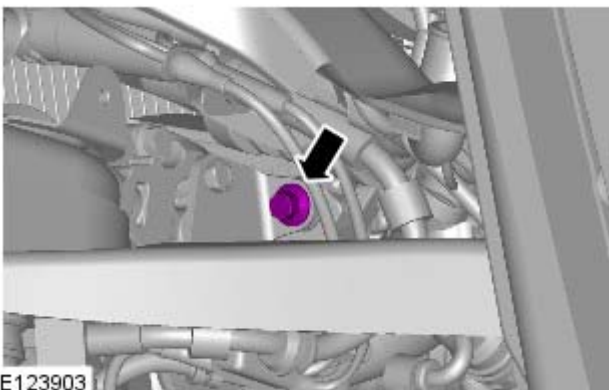


17. **17.**  **WARNING:** Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.

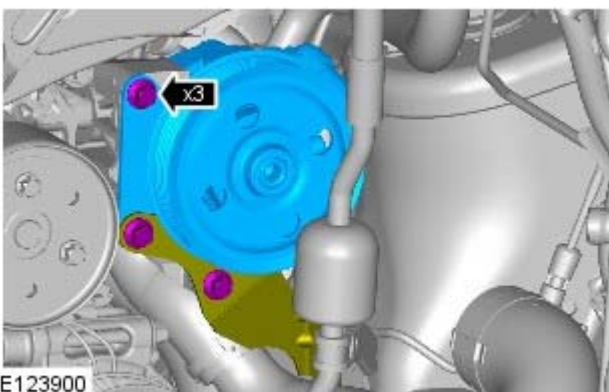
 **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

- **NOTE:** Make sure that all openings are sealed. Use new blanking caps.

*Torque: 24 Nm*



18. *Torque: 25 Nm*



19. *Torque: 25 Nm*

## Installation


1. To install, reverse the removal procedure.

2. Refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).

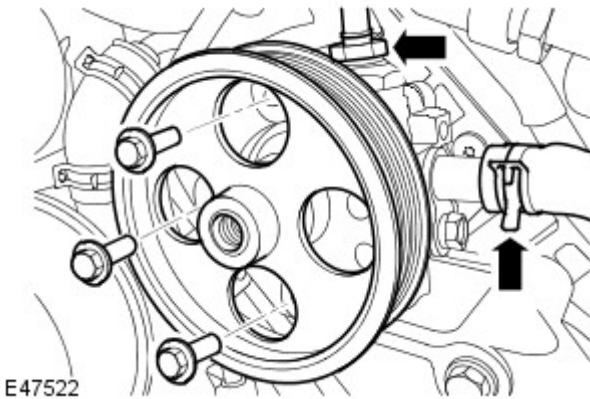
# Power Steering - Power Steering Pump V6 4.0L Petrol

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 accessory drive belt.  
For additional information, refer to: [Accessory Drive Belt](#) (303-05C Accessory Drive - V6 4.0L Petrol, Removal and Installation).
3.  **CAUTION:** 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.
  - **NOTE:** Some oil spillage is inevitable during this operation.

Clamp the power steering pump supply hose to minimise fluid loss.
4. Disconnect the high pressure line at the steering pump union.
  - Position an absorbent cloth to collect fluid spillage.
5. Disconnect the power steering pump supply hose.
  - Release the clip.
6. Remove the power steering pump.
  - Remove the 3 bolts.



## Installation

1. Install the power steering pump.
  - Clean the component mating faces.
  - Install and tighten the bolts to 25 Nm (18 lb.ft).
2. Connect the power steering supply hose to the steering pump.
  - Clean the component mating faces.
  - Secure with the clip.
3. Connect the high pressure line to the steering pump.
  - Clean the component mating faces.
  - Install new seals.
  - Tighten the union to 25 Nm (18 lb.ft).
4. Install the accessory drive belt.  
For additional information, refer to: [Accessory Drive Belt](#) (303-05C Accessory Drive - V6 4.0L Petrol, Removal and Installation).
5. Connect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information,

Specifications).

6. Fill and bleed the power steering system.

For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).

# Power Steering - Power Steering Pump V8 5.0L Petrol

Removal and Installation

## Removal

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

1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

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

Raise and support the vehicle.

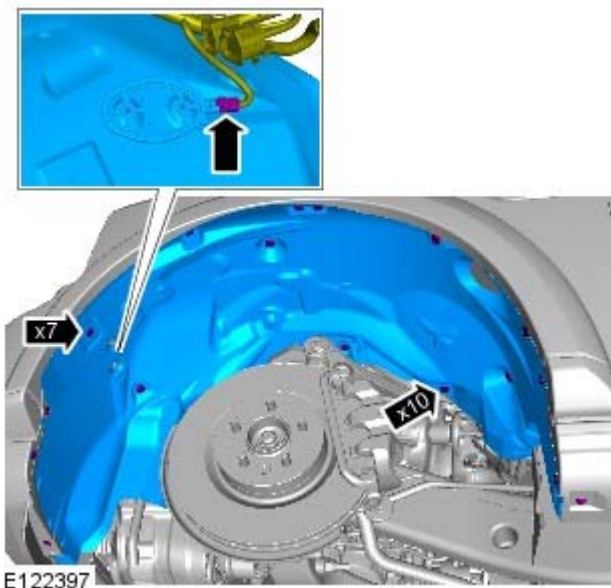
3. Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).

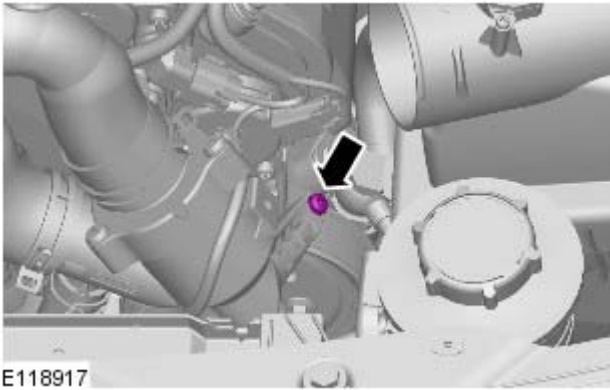
4. Refer to: [Accessory Drive Belt](#) (303-05D Accessory Drive - V8 5.0L Petrol, Removal and Installation).

5. Remove the LH front road wheel.

*Torque: 140 Nm*


- 6.



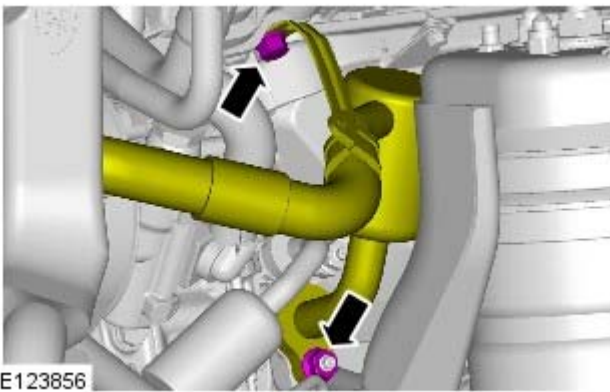


7. Torque: 10 Nm



8.  CAUTION: Note the fitted position of the component prior to removal.

Torque: 25 Nm

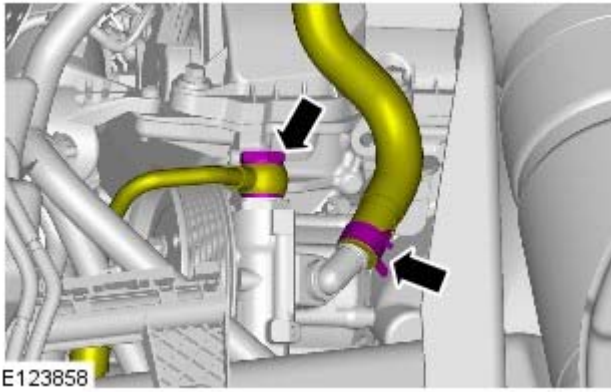


9. **9. CAUTIONS:**


 Make sure that all openings are sealed. Use new blanking caps.

 A new O-ring seal is to be installed.

Torque: 18 Nm

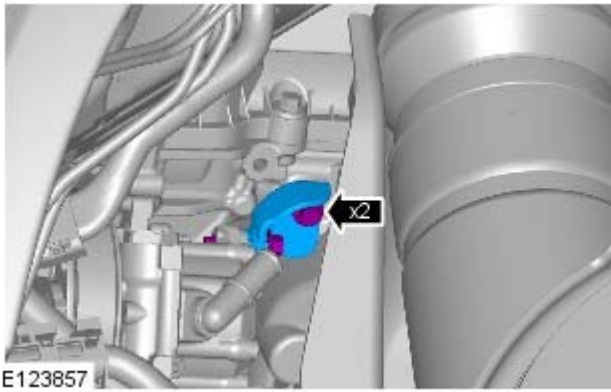


10. **10. CAUTIONS:**

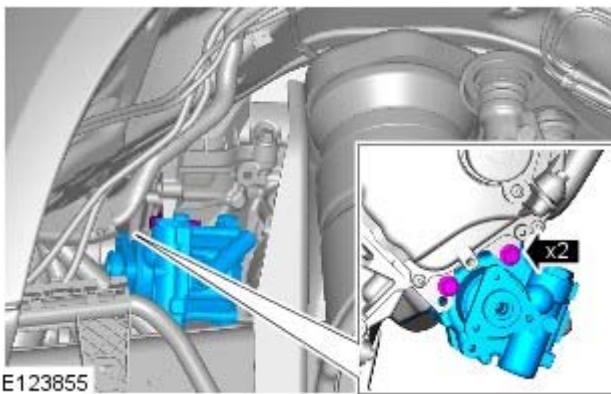
 Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.

 Make sure that all openings are sealed. Use new blanking caps.

*Torque:* 25 Nm



11. *Torque:* 25 Nm



12.  **12. CAUTION:** Note the fitted position of the component prior to removal.

*Torque:* 25 Nm

**Installation**

1. To install, reverse the removal procedure.
2. Refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).



# Power Steering - Steering Angle Sensor

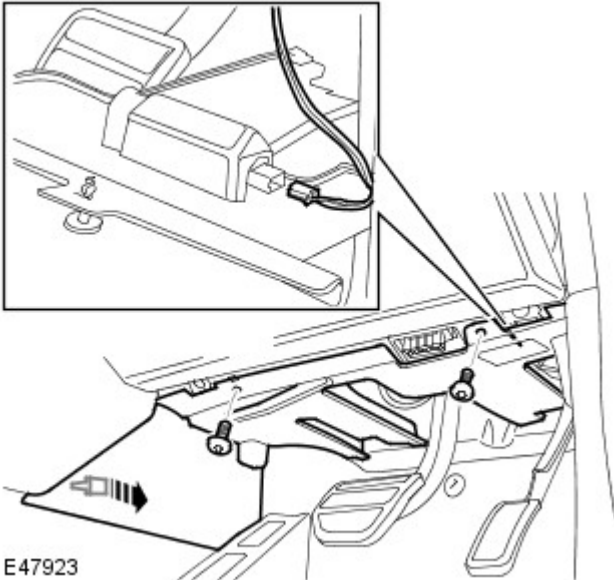
## Removal and Installation

### 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 driver side closing trim panel.

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



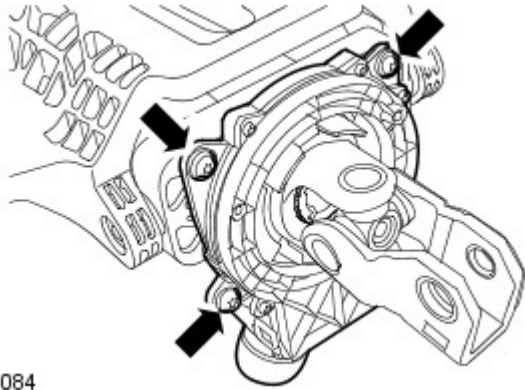
3. Disconnect the steering angle sensor electrical connector.



4. Disconnect the steering column intermediate shaft from the steering column.

- Note the fitted position.
- Remove the special bolt and discard the nut.





E47084

**5. Remove the steering angle sensor.**

- Remove the 3 Torx screws.

**Installation**

**1. Install the steering angle sensor.**

- Tighten the Torx screws to 3 Nm (2 lb.ft).

**2. Connect the steering column intermediate shaft.**

- Install the special bolt and tighten the new nut to 22 Nm (16 lb.ft).

**3. Connect the steering angle sensor electrical connector.**

**4. Install the closing trim panel.**

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

**5. Connect the battery ground cable.**

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

**6. Initiate a new steering angle sensor using T4.**

# Power Steering - Power Steering Pump to Steering Gear Pressure Line

Removal and Installation

## Removal

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

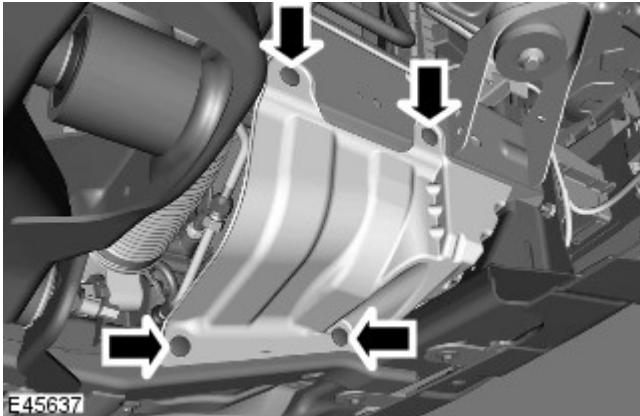
All vehicles

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

Raise and support the vehicle.

2. Remove the front RH splash shield.

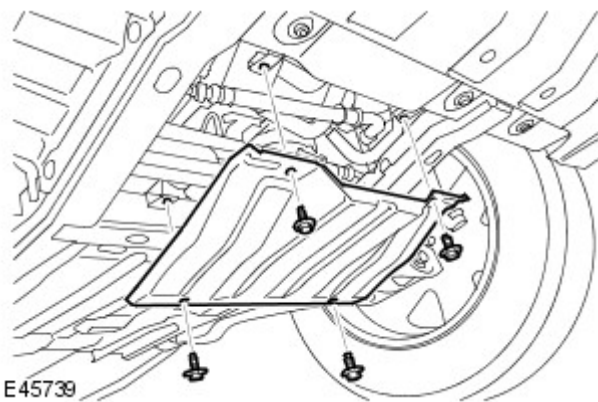
- Remove the 4 clips.

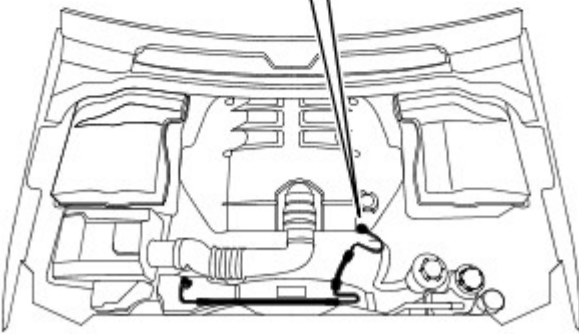
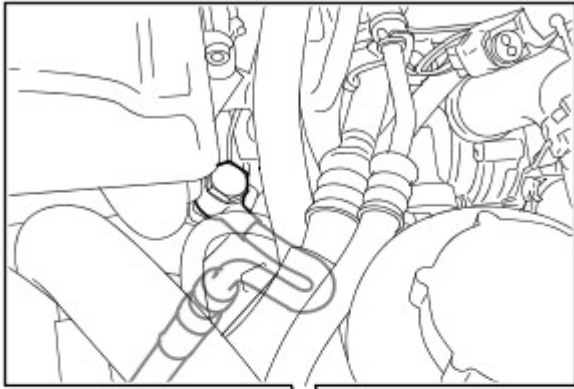


3. Remove the front LH fender splash shield.  
For additional information, refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).

4. Remove the radiator access panel.

- Remove the 4 bolts.





E72350

**5. ⚠ 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.

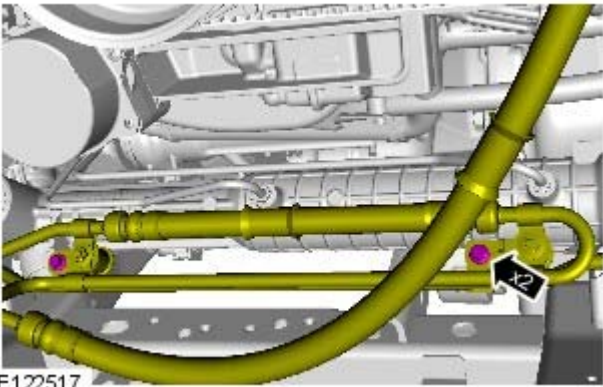
Disconnect the high pressure line from the power steering pump.

- Loosen and release the power steering pump line.
- Allow the fluid to drain into a container.
- Remove and discard the 2 sealing washers.

#### Vehicles with 5.0L engine

**6.** Release the power steering line support brackets.

- Remove the 2 nuts.
- Release the hose.

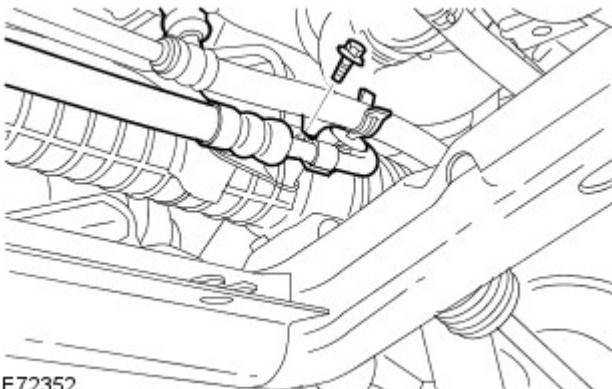


E122517

#### All other engine types

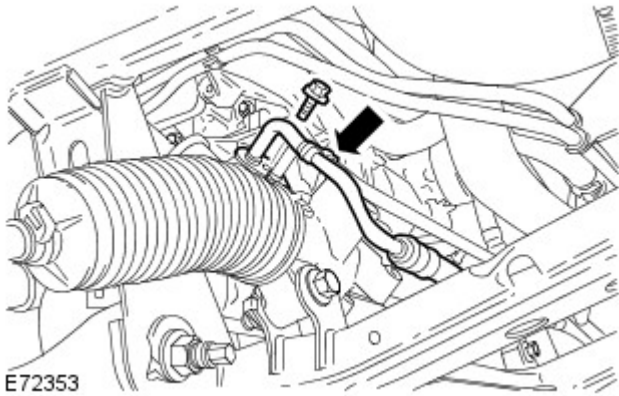
**7.** Release the power steering line support bracket.


- Remove the nut.
- Release the hose.



E72352

All vehicles



**8.**  **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.

Disconnect the high pressure line from the power steering gear.

- Remove the bolt.
- Release the power steering gear line.
- Remove and discard the O-ring seal.

**9.** Remove the steering gear high-pressure line.

## Installation

All vehicles

- 1.** Install the steering gear high-pressure line.
- 2.** Connect the high-pressure line to the power steering gear.
  - Install the O-ring seal.
  - Attach the power steering gear high-pressure line.
  - Tighten the bolt to 25 Nm (18 lb.ft).

Vehicles with 5.0L engine

- 3.** Install the power steering line support brackets.
  - Tighten the nuts to 10 Nm (7 lb.ft).
  - Secure the hose with the clip.

All other engine types

- 4.** Install the power steering line support bracket.
  - Tighten the nut to 10 Nm (7 lb.ft).
  - Secure the hose with the clip.

All vehicles

- 5.** Connect the high-pressure line to the power steering pump.
  - Install new sealing washers.
  - Connect the power steering pump high-pressure line.
- 6.** Install the radiator access panel.
  - Tighten the bolts to 10 Nm (7 lb.ft).
- 7.** Install the front LH fender splash shield.  
For additional information, refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).
- 8.** Install the front RH splash shield.
  - Secure with the clips.
- 9.** Fill and bleed the power steering system.  
For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).

## Steering Linkage -

### Torque Specifications

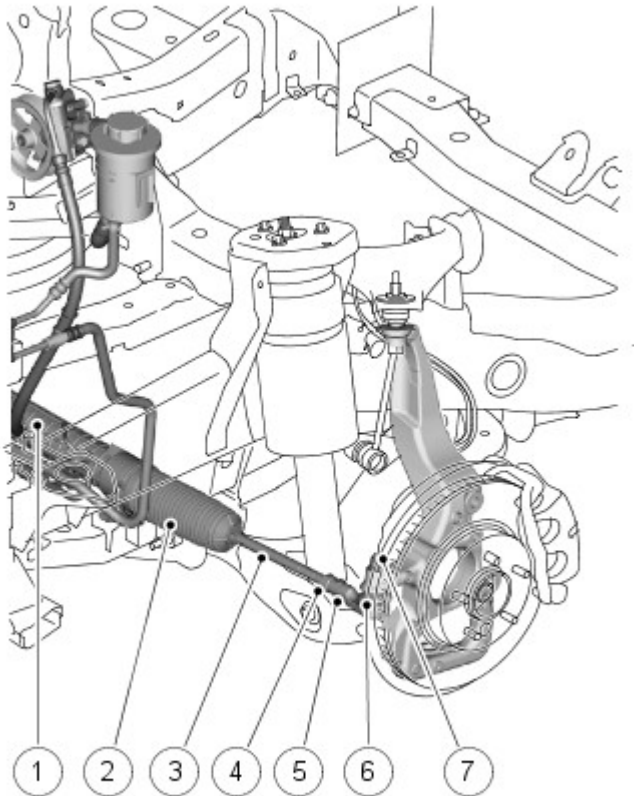
| Description   | Nm  | lb-ft |
|---|-----|-------|
| * Tie-rod end nut - Vehicles fitted with an M12 nut | 76  | 56    |
| * Tie-rod end nut - Vehicles fitted with an M14 nut | 150 | 111   |
| Tie-rod locking nut                                 | 55  | 40    |
| Road wheel nuts                                     | 140 | 103   |

**\* New nut must be installed**

## Steering Linkage - Steering Linkage

Description and Operation

Steering Linkage Component Location



E46659

| Item | Part Number | Description        |
|------|-------------|--------------------|
| 1    | -           | Steering gear      |
| 2    | -           | Steering gear boot |
| 3    | -           | Tie rod            |
| 4    | -           | Locknut            |
| 5    | -           | Tie rod end        |
| 6    | -           | Ball joint         |
| 7    | -           | Self-locking nut   |

### GENERAL

The steering linkage comprises the tie rod which provides the connection between the steering gear and the front wheel knuckle.

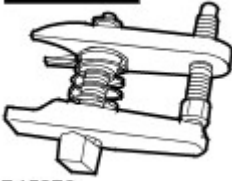
Each end of the steering gear has a threaded hole which provides for the fitment of the tie rods. The external ends of the tie rods are sealed with steering gear boots to prevent the ingress of dirt and moisture into the steering gear.

The outer ends of the tie rods are threaded to allow the fitment of the tie rod ends. The tie rod ends are screwed onto the tie rods and locked with locknuts to prevent inadvertent movement. The thread on the tie rod allows the position of the tie rod end to be adjusted in order to set the correct toe angle for each front wheel.


The tie rod end comprises a forged housing with a threaded bore for attachment to the tie rod. The tie rod end incorporates a non-serviceable tapered ball joint which locates in a tapered hole in the front wheel knuckle and is secured with a self-locking nut. The ball joint has an internal hexagonal drive which enables the joint to be held stationary when the self-locking nut is tightened.

# Steering Linkage - Tie Rod End

Removal and Installation

| Special Tool(s)  |  |
|--|--|
|  <p>205-754A<br/>E45276</p> | <p>Ball joint separator<br/>205-754 (LRT-54-027)</p> |

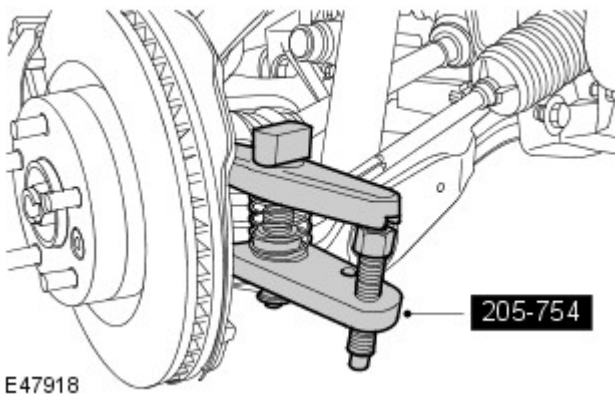
## Removal

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

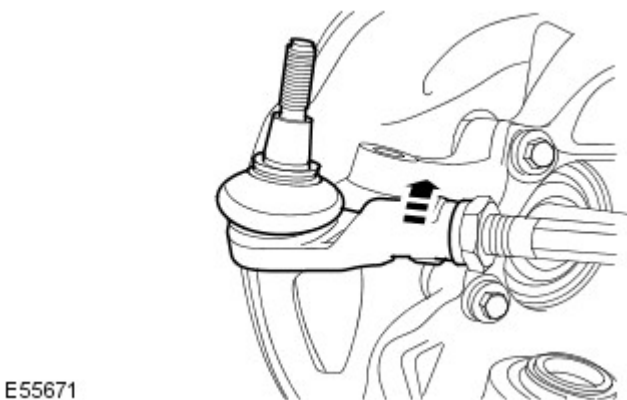
Raise and support the vehicle.

- Remove the front wheel.
- Loosen the tie rod end ball joint retaining nut.
- Loosen the tie rod end lock nut.
- Using the special tool, release the tie-rod end ball joint from the wheel knuckle.

- Remove and discard the tie rod end retaining nut.



- Remove the tie-rod end, note the number of turns for installation.



## Installation

- Install the tie rod end, note the number of turns until adjacent to the locknut.

-  **CAUTION:** To prevent damage to the tie rods, use an additional wrench when loosening or tightening the components.

Connect the tie rod end ball joint.

- Clean the component mating faces.
- For vehicles fitted with an M12 nut, install a new nut and tighten to 76 Nm (56 lb.ft).



- For vehicles fitted with an M14 nut, install a new nut and tighten to 150 Nm (111 lb.ft).

**3.** Tighten the tie rod locking nut.

- Clean the component mating faces.
- Tighten the nut to 55 Nm (40 lb.ft).

**4.** Install the front wheel.

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

**5.** Lower the vehicle.

**6.** Using only four wheel alignment equipment approved by Land Rover, check and adjust the wheel alignment.

## Steering Linkage - Steering Gear Boot

Removal and Installation

### Removal

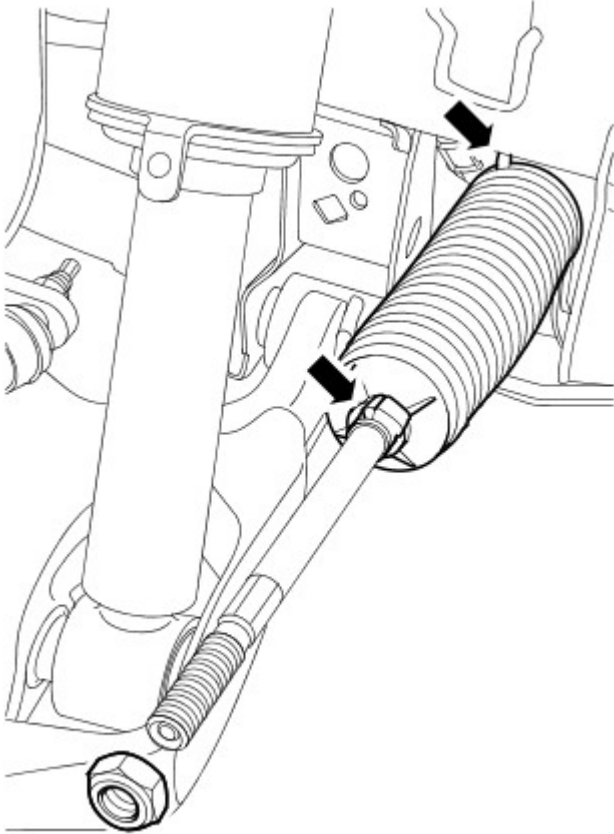
1. Remove the tie-rod end.  
For additional information, refer to: [Tie Rod End](#) (211-03 Steering Linkage, Removal and Installation).

2. **NOTE:** Note the fitted position.

Remove the locknut.

3. Remove the steering gear boot.

- Release the 2 clips.



E55694

### Installation

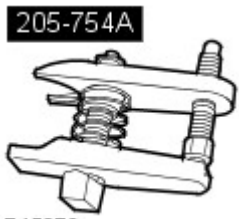
1. Install the steering gear boot.
  - Clean the component mating faces.
  - Secure with the clips.

2. Install the locknut.


3. Install the tie-rod end.  
For additional information, refer to: [Tie Rod End](#) (211-03 Steering Linkage, Removal and Installation).

## Steering Linkage - Tie Rod

Removal and Installation

| Special Tool(s)   |   |
|---|---|
|  <p>205-754A</p> <p>E45276</p> | <p>Ball joint separator<br/>205-754(LRT-54-027)</p> |

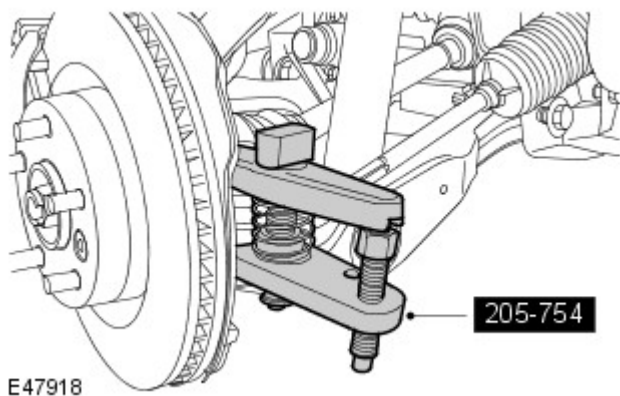
### Removal

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

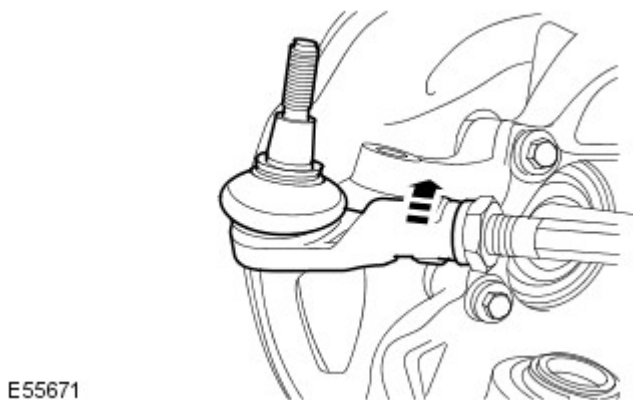
Raise and support the vehicle.

- Remove the front wheel.
- Loosen the outer tie-rod end ball joint retaining nut.
- Loosen the outer tie-rod end lock nut.
- Using the special tool, release the tie-rod end ball joint from the wheel knuckle.

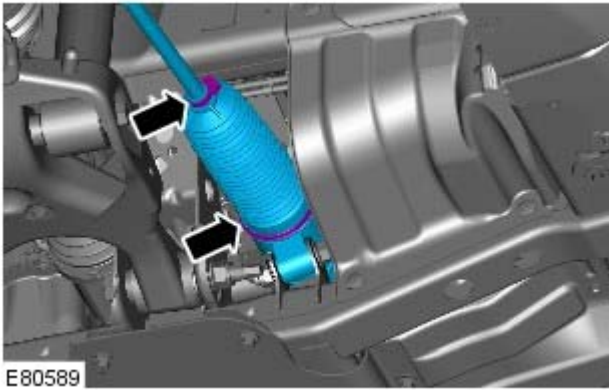
- Remove and discard the tie rod end retaining nut.



- Remove the outer tie-rod end, note the number of turns for installation.

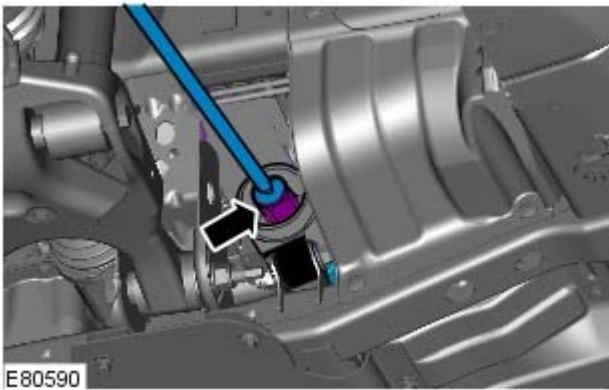


- Remove the outer tie-rod end lock nut.



**8.** Remove the steering gear boot.


- Release the 2 clips.



**9.** Remove the inner tie-rod end.

- Loosen the nut.

## Installation

1. Install the inner tie-rod end.
  - Tighten the nut to 100 Nm (74 lb.ft).
2. Install the steering gear boot.
  - Secure with the clips.
3. Install the outer tie-rod end lock nut.
4. Install the tie rod end, note the number of turns until adjacent to the locknut.
5.  **CAUTION:** To prevent damage to the tie rods, use an additional wrench when loosening or tightening the components.

Connect the tie-rod end ball joint.

- Clean the component mating faces.
  - For vehicles fitted with an M12 nut, install a new nut and tighten to 76 Nm (56 lb.ft).
  - For vehicles fitted with an M14 nut, install a new nut and tighten to 150 Nm (111 lb.ft).
6. Tighten the tie-rod locking nut.
    - Clean the component mating faces.
    - Tighten the nut to 55 Nm (40 lb.ft).
  7. Install the front wheel.
    - Tighten the wheel nuts to 140 Nm (103 lb.ft).
  8. Lower the vehicle.
  9. Using only four wheel alignment equipment approved by Land Rover, check and adjust the wheel alignment.



## Steering Column -

### General Specification

| Item                            | Specification  |
|---------------------------------|--|
| Type                            | Two piece, articulated with flexible coupling to steering rack; fitted with energy absorption system and having a 120 mm (4.7 in) ride down capability with a 4.5 kN (0.45 ton force) maximum decoupling load on the intermediate shaft and a 77 mm (3.0 in) collapse stroke on the lower shaft. |
| <b>Upper column adjustment:</b> |  |
| Reach                           | 40 mm (1.57 in)  |
| Rake                            | 6°   |

### Torque Specifications

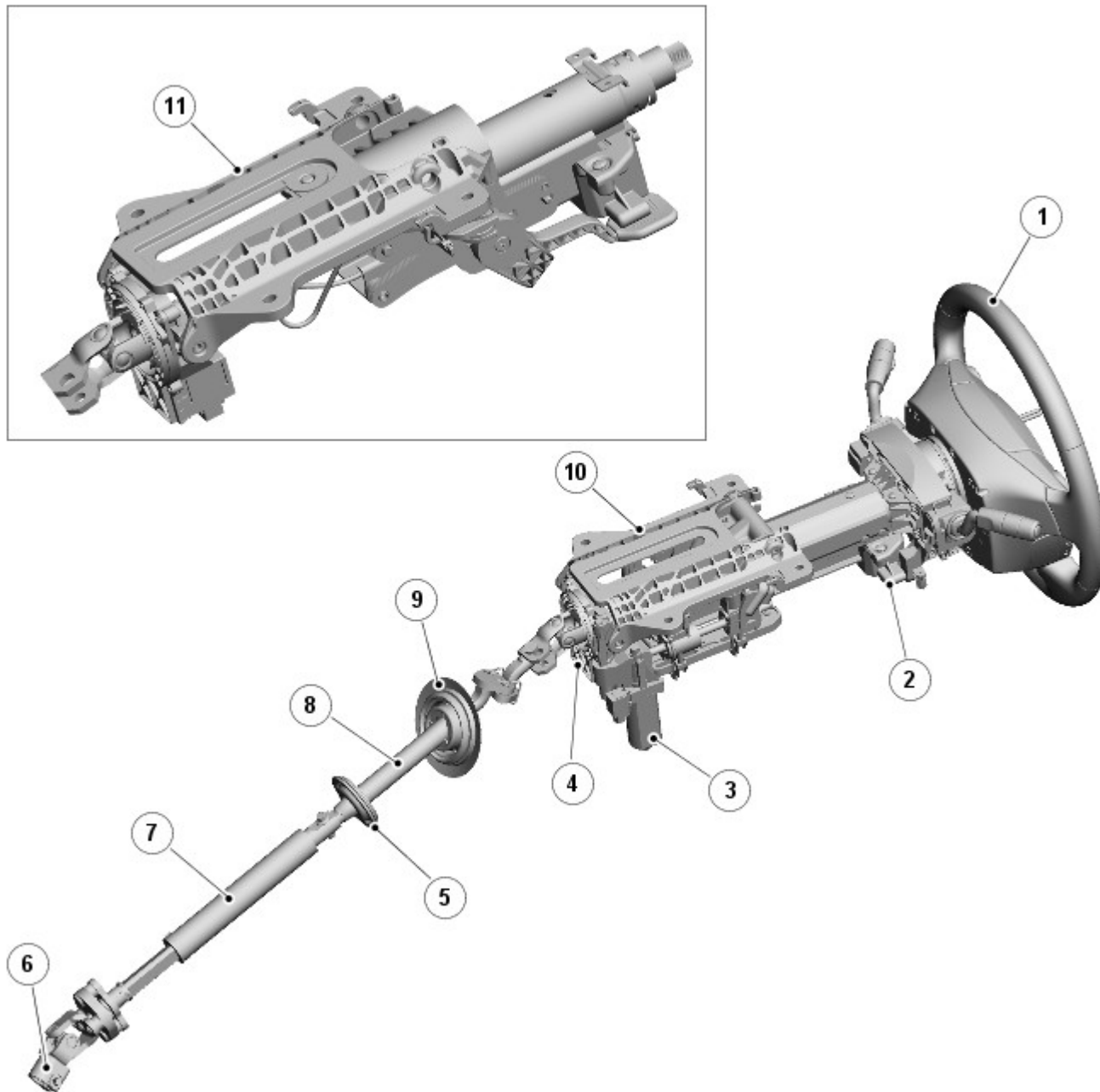
| Description   | Nm | lb-ft |
|---|----|-------|
| Steering angle sensor Torx screws                           | 3  | 2     |
| * Steering column intermediate shaft to lower shaft bolts   | 30 | 22    |
| * Steering column intermediate shaft to steering column nut | 22 | 16    |
| Steering column switch assembly Torx bolts                  | 3  | 2     |
| Steering wheel bolt   | 63 | 46    |

**\* New bolts/nut must be installed**

# Steering Column - Steering Column

Description and Operation

## Component Location



E124335

| Item | Part Number | Description                               |
|------|-------------|---|
| 1    | -           | Steering wheel                            |
| 2    | -           | Electronic steering lock                  |
| 3    | -           | Electric motor                            |
| 4    | -           | Steering angle sensor                     |
| 5    | -           | Bulkhead mounting                         |
| 6    | -           | Lower collapsible shaft yoke              |
| 7    | -           | Lower collapsible shaft                   |
| 8    | -           | Intermediate shaft                        |
| 9    | -           | Gaitor                                    |
| 10   | -           | Upper steering column assembly - Electric |
| 11   | -           | Upper steering column assembly - Manual   |

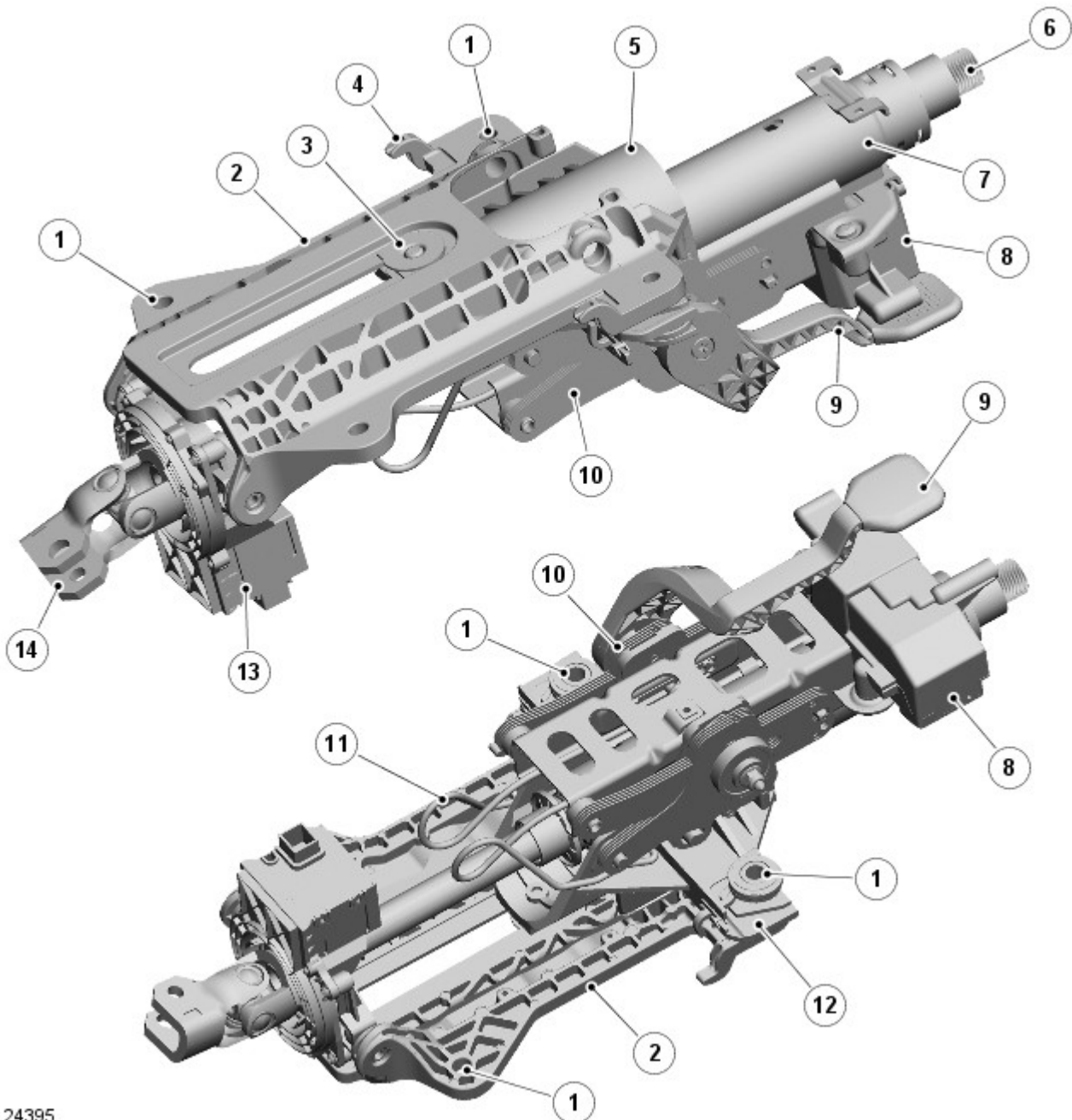
## Overview

The steering column comprises the upper column assembly, the intermediate shaft and the lower collapsible shaft. The three components are positively connected together to pass driver rotary input from the steering wheel to a linear output of the steering rack.





## Upper Column Assembly - Manual



E124395

| Item | Part Number | Description                       |
|------|-------------|-----------------------------------|
| 1    | -           | Attachment holes                  |
| 2    | -           | Roof bracket                      |
| 3    | -           | Screw                             |
| 4    | -           | Locating hook                     |
| 5    | -           | 'U' bracket                       |
| 6    | -           | Steering wheel splines            |
| 7    | -           | Main body                         |
| 8    | -           | Electronic steering lock          |
| 9    | -           | Adjustment lever                  |
| 10   | -           | Clamp plate assembly              |
| 11   | -           | Adjustment balance spring (2 off) |
| 12   | -           | Shearing capsule (2 off)          |
| 13   | -           | Steering angle sensor             |
| 14   | -           | Swing yoke                        |

The steering column is attached to the in-vehicle crossbeam and secured with four, 8 mm thread forming, pan head Torx drive screws. The two forward attachment screws are fixed through the column mounting bracket, the two rearward mounting screws also pass through the shearing capsules. In the event of a high energy frontal impact, the shearing capsules remain fixed to the crossbeam, but the 'U' bracket (with the main body) disengages from the capsules, allowing the column to shorten axially (collapse), with the coiled straps absorbing energy to reduce occupant loading.

**⚠ WARNING:** Take care when handling the column not to trap fingers if releasing the adjustment lever at any point during the removal procedure when the column is not in the vehicle. The balance springs will cause the column to rapidly

move to its upper-most position.

The column comprises a cast magnesium roof bracket which is attached to the in-vehicle crossbeam. Attached to the roof bracket is a pivot housing, a 'U' bracket, upper and lower shafts and a main body. The roof bracket has two hooks which locate in slots in the in-vehicle crossbeam. The hooks assist in supporting the weight of the column during removal or installation.

The pivot housing is attached to the forward end of the roof bracket with two pivot pins. The pivot housing allows for adjustment of the column rake and contains a bearing which supports the column lower shaft.

The 'U' bracket is attached to the roof bracket by a screw, bush and plastic washer assembly (third fixing) located in a slot in the top of the roof bracket. When the column is assembled into the vehicle, the shearing capsules, which are attached to the 'U' bracket, are clamped up against the roof bracket by the fixing screws, preventing movement of the 'U' bracket. The bolts also pass through rectangular section steel straps, which at one end, have coils that locate around a plastic bush (positioned on the shearing capsule). The straps are used to control the rate of column collapse, in the event of a high energy frontal impact.

The main body is positioned in the 'U' bracket via the lever bolt. The bolt is captive within the vertical slots in the 'U' bracket and the horizontal slots in the main body. The bolt also passes through the clamp plate assemblies (one on either side of the 'U' bracket). The body houses the middle and upper bearings through which the upper shaft is located. Two offset holes in the main body provide for the attachment of the electronic steering lock assembly.

The upper and lower shafts are located through the length of the column assembly. The upper shaft is supported in two bearings in the main body and the lower shaft is located in the upper shaft and supported in a bearing in the pivot housing. The lower shaft has a tubular section with external splines. These mate with the internal splines in the upper shaft. The purpose of the splines is to transmit rotational movement of the upper shaft to the lower shaft, but allowing the two components to telescope into each other in the event of a collision. The length of the splined sections allow for 120 mm (4.72 in) of linear movement. The lower shaft is fitted with a universal joint spider to which a swivel yoke is attached. The swivel yoke attaches to the intermediate shaft of the steering column on the interior side of the bulkhead using a special cam bolt and self-locking nut.

A steering angle sensor is attached to the pivot housing of the column and its centre gear is rotated by a drive collar which is attached to the lower shaft and rotates with movement of the steering wheel. The sensor transmits steering angle data on the high speed CAN bus which is used by various systems on the vehicle. The steering angle sensor is designed to become detached from the column in the event of a frontal impact. Care must be taken when handling the column assembly to prevent accidental damage to the sensor.

The upper steering column assembly houses the electronic column lock mechanism and control module.

The steering column is adjustable for reach and rake. The column can be adjusted for 40 mm (1.57 in) of reach adjustment and 6° of rake adjustment. The adjustment mechanism comprises an adjustment lever, a cam plate, a lever bolt and nut, two brake pads and two clamp plate assemblies.

A plastic adjustment lever is located on the underside of the column assembly and is attached to a cam plate. When the lever is pulled downwards, the cam plate rotates and releases tension in the lever bolt. The lever bolt also passes through two sets of clamp plate assemblies. When the lever is moved upwards, the cam plate rotates applying tension to the lever bolt, which applies pressure to the brake pads which in turn apply pressure to the clamp plate assemblies (which lock the column in the desired position). The lever bolt is retained by a self-locking lever nut, which abuts a thrust bearing.



**WARNING:** Under no circumstances should the lever nut torque be reduced, as this will reduce the clamping efficiency of the adjustment mechanism possibly affecting the stability of the column during a frontal impact.

The pivot housing is attached to the roof bracket with two pivot pins. When the rake adjustment is operated, the pivot housing rotates around the pivot pins to allow for the up and down adjustment, but maintains a positive location to the roof bracket. An adjustment spring is fitted between the 'U' bracket and the main body, to counteract the weight of the main body, upper shaft, steering wheel and airbag, preventing the steering wheel from dropping rapidly when the adjustment lever is released.

In the event of a high energy frontal impact, the upper column assembly is designed to axially collapse reducing impact injury to the driver. A number of components interact together to ensure that the collapse of the column is in a controlled manner. The following components control the column collapse:

- Pressure washer and bush (third fixing)
- Shearing capsules
- Straps
- Upper and lower shaft (splined) connection

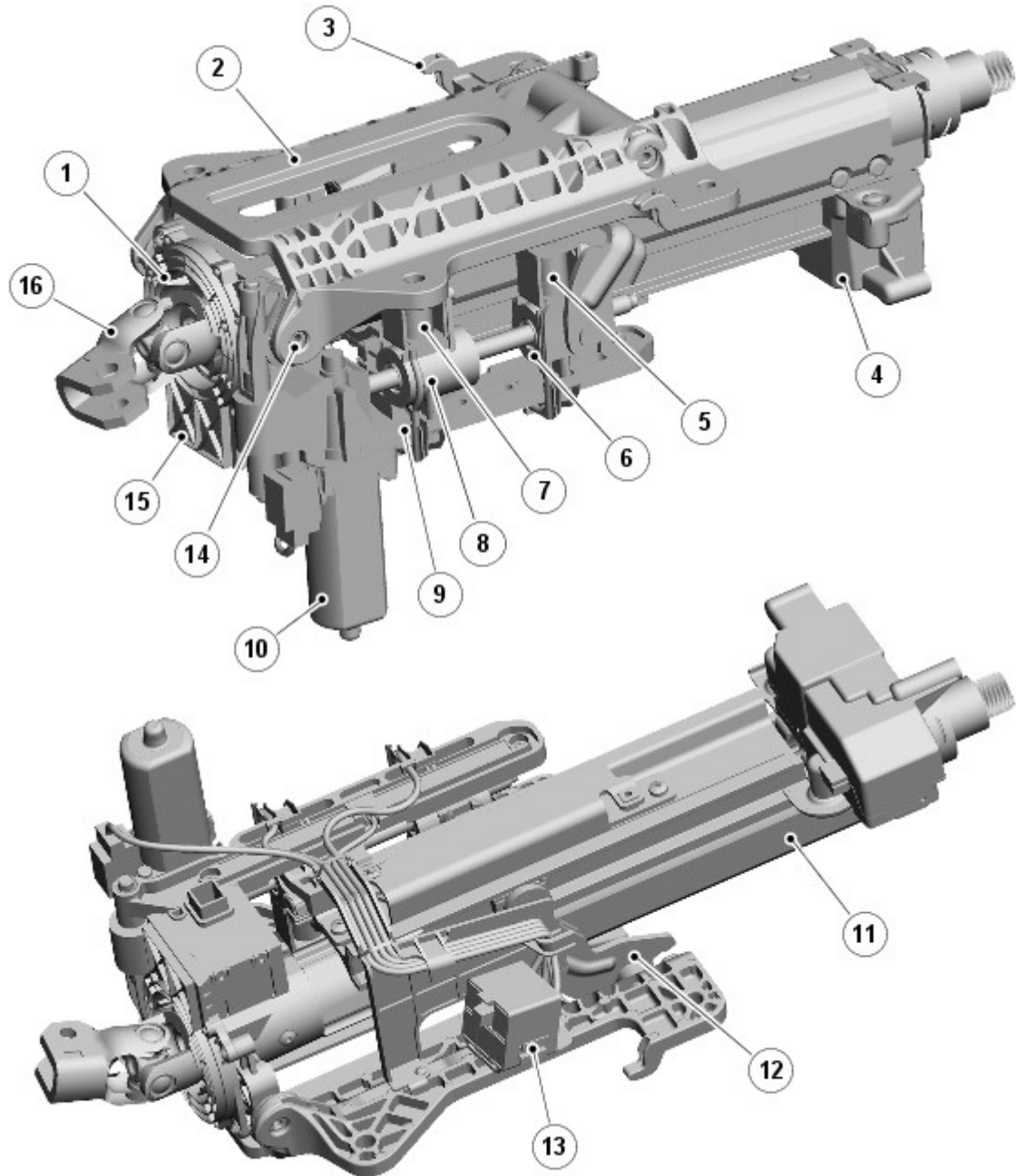
The shearing capsules have a central hole through which the rearward attachment bolts pass through into the roof bracket. The capsules are located in the 'U' bracket by tapered slots, which have small cut-outs in the inside faces. The shearing capsules have a number of small holes which align with the cut-outs in the 'U' bracket. When the capsules are installed, plastic is injected into the holes and cut-outs. This plastic retention of the capsules provides the initial controlled break-out force for the column in the event of a collision. After 10 mm of displacement, the 'U' bracket is no longer located by the shearing capsules. When handling the column, care should be taken that the shearing capsules are not impacted or dislodged.

The tension in the 'Third Fixing' screw, applies a clamp load to the roof bracket (via the bush and compression washers). In the event of a collision, this clamp load (supplementary to the shearing capsules) must be overcome before the column can collapse. When this load has been exceeded (and the fixing has been displaced 20 mm (0.79 in)) it slides easily within the roof bracket slot, providing directional control to the column, as it collapses. Under no circumstances should the screw torque be adjusted.

The straps are rectangular section steel, which at one end, have coils that locate around a plastic bush (positioned on the shearing capsule). The other end is formed into a hook which locates within a slot in the 'U' bracket. When a collision has occurred, and the 'U' bracket has been displaced from the shearing capsules by 8 mm (0.3 in), the straps begin to un-roll due to the displacement of the 'U' bracket. The straps provide the main element for energy absorption as the column collapses. The cross section of the straps change after approximately 40 mm (1.6 in) of extension, changing the amount of

energy that they absorb.

### Upper Column Assembly - Electric



E124336

| Item | Part Number | Description              |
|------|-------------|--------------------------|
| 1    | -           | Pivot housing            |
| 2    | -           | Roof bracket             |
| 3    | -           | Locating hook            |
| 4    | -           | Electronic steering lock |
| 5    | -           | Rake solenoid            |
| 6    | -           | Rake clutch              |
| 7    | -           | Reach solenoid           |
| 8    | -           | Reach clutch             |
| 9    | -           | Potentiometer            |
| 10   | -           | Electric motor           |
| 11   | -           | Outer profile            |
| 12   | -           | Rake lever               |
| 13   | -           | Electrical connector     |
| 14   | -           | Pivot pin                |
| 15   | -           | Steering angle sensor    |
| 16   | -           | Swing yoke               |

The steering column is attached to the in-vehicle crossbeam and secured with four, 8mm, thread forming, pan head Torx drive screws. In the event of a high energy frontal impact, a strap and shear pin on the underside of the column provides a controlled collapse of the outer housing on the inner housing, allowing the column to shorten axially (collapse), absorbing energy to reduce occupant loading.

The column comprises a cast magnesium roof bracket which is attached to the in-vehicle crossbeam. Attached to the roof bracket is a pivot housing, a outer housing and upper and lower shafts. The roof bracket has two hooks which locate in slots in the in-vehicle crossbeam. The hooks assist in supporting the weight of the column during removal or installation.

The rake lever locates the aluminum outer profile, into which is fixed the electronic steering lock adaptor. The inner profile is located within the outer profile, by 2 linear bearing assemblies, which allow a telescopic action for the reach adjustment.

The assembly of the upper and lower shafts is located within the column by the bearings in the electronic steering lock adaptor and the pivot housing. Both shafts are tubular. The lower shaft has external splines (which are over molded with nylon), and these mate with the internal splines in the upper shaft. The purpose of the splines is to transmit rotational movement of the upper shaft to the lower shaft, yet allow telescopic movement during column axial collapse. The lower shaft is fitted with a universal joint spider to which a swivel yoke is attached. The swivel yoke attaches to the intermediate shaft of the steering column on the interior side of the bulkhead using a special cam bolt and self-locking nut.

A steering angle sensor is attached to the pivot housing of the column and its centre gear is rotated by a drive collar which is attached to the lower shaft and rotates with movement of the steering wheel. The sensor transmits steering angle data on the high speed [CAN](#) bus which is used by various systems on the vehicle. The steering angle sensor is designed to become detached from the column in the event of a frontal impact. Care must be taken when handling the column assembly to prevent accidental damage to the sensor.

The upper steering column assembly houses the electronic column lock mechanism and control module.

The steering column is adjustable electrically for reach and rake. The adjustment mechanism comprises an electric adjustment motor, a lead screw, a rake solenoid, a reach solenoid, a rake clutch and a reach clutch.

The column adjustment is controlled by the driver using a joystick switch located on the left hand side of the column cowl. The joystick can be moved forward and backward to adjust the column reach in and out and moved up and down to adjust the rake. The single electric motor is used for both adjustment ranges. The switch selection uses the applicable solenoid, engaging the applicable clutch on the lead screw.

When the auto function is activated, the steering column will adjust to the uppermost tilt position with ignition off, and re-adjust to the previous set position, with ignition on.

For the reach adjustment, the lead screw drives the outer housing in or out as required. For the rake adjustment, the lead screw drives a rake lever which moves the column up or down as applicable.

The pivot housing is attached to the roof bracket with two pivot pins. When the rake adjustment is operated, the pivot housing rotates around the pivot pins to allow for the up and down adjustment, but maintains a positive location to the roof bracket.

The electric steering column is linked to and controlled by the memory control module. The memory control module provides storage of three separate memory positions which are stored against three individual vehicle keys. For additional information, refer to: Seats (501-10, Description and Operation).

. The electric column also has an easy egress feature which lifts the column to its maximum rake to allow easier access to the vehicle.

In the event of a high energy frontal impact, the upper column assembly is designed to collapse reducing impact injury to the driver. A number of components interact together to ensure that the collapse of the column is in a controlled manner. The following components control the column collapse:

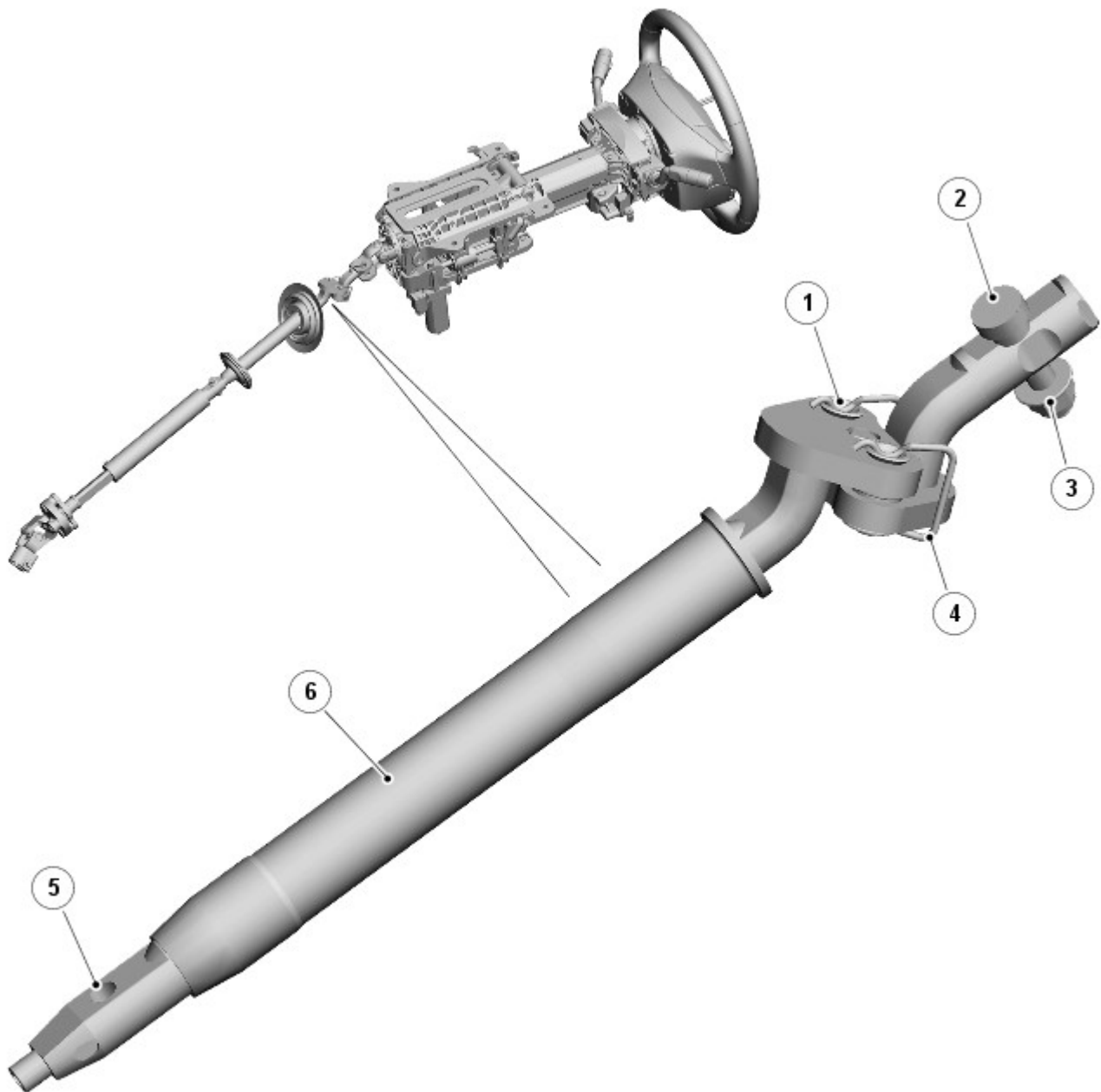
- Shear pin
- Strap
- Upper and lower shaft (splined) connection

The strap is rectangular section steel, which is secured by two Allen screws to the outer housing and by a shear pin to the strap guide. The strap provides the main element for energy absorption as the column collapses. To initiate axial movement of the column, the shear pin has to be severed, friction between several column interfaces has to be overcome, and an axial load applied sufficient to initiate strap guide deformation. Once the column is telescoping, deformation of the strap guide, and sliding friction between column interfaces, absorbs the energy of the occupant in a controlled manner, as the column collapses.



**WARNING:** Do not attempt to dismantle the steering column. The crash safety of the unit will be compromised.

### **Intermediate Shaft**



E124337

| Item | Part Number | Description       |
|------|-------------|-------------------|
| 1    | -           | Load limiter pins |
| 2    | -           | Cam bolt          |
| 3    | -           | Self-locking nut  |
| 4    | -           | Retention spring  |
| 5    | -           | Attachment hole   |
| 6    | -           | Seal sleeve       |

**⚠ CAUTION:** Care should be taken when handling the intermediate shaft, to ensure that it is not subject to impacts or that the retention spring is not displaced.

The non-handed, intermediate shaft is attached at its upper end to the swivel yoke on the lower shaft of the steering column assembly. The intermediate shaft comprises two main parts; the upper and lower axis which are joined together with a shear joint.

The upper axis has a cut-out in the shaft which allows for the fitment of the cam bolt. Only when the shaft is located correctly in the swivel yoke, can the cam bolt be inserted. A self-locking nut is fitted to the cam bolt. The torque applied as the nut is tightened, rotates the bolt, forcing the cam against the shaft, positioning it correctly in the swivel yoke prior to the joint being clamped.

• **NOTE:** If the self-locking nut is removed for any reason, it is recommended that a new, correct nut is fitted to maintain the optimum torque on the cam bolt.

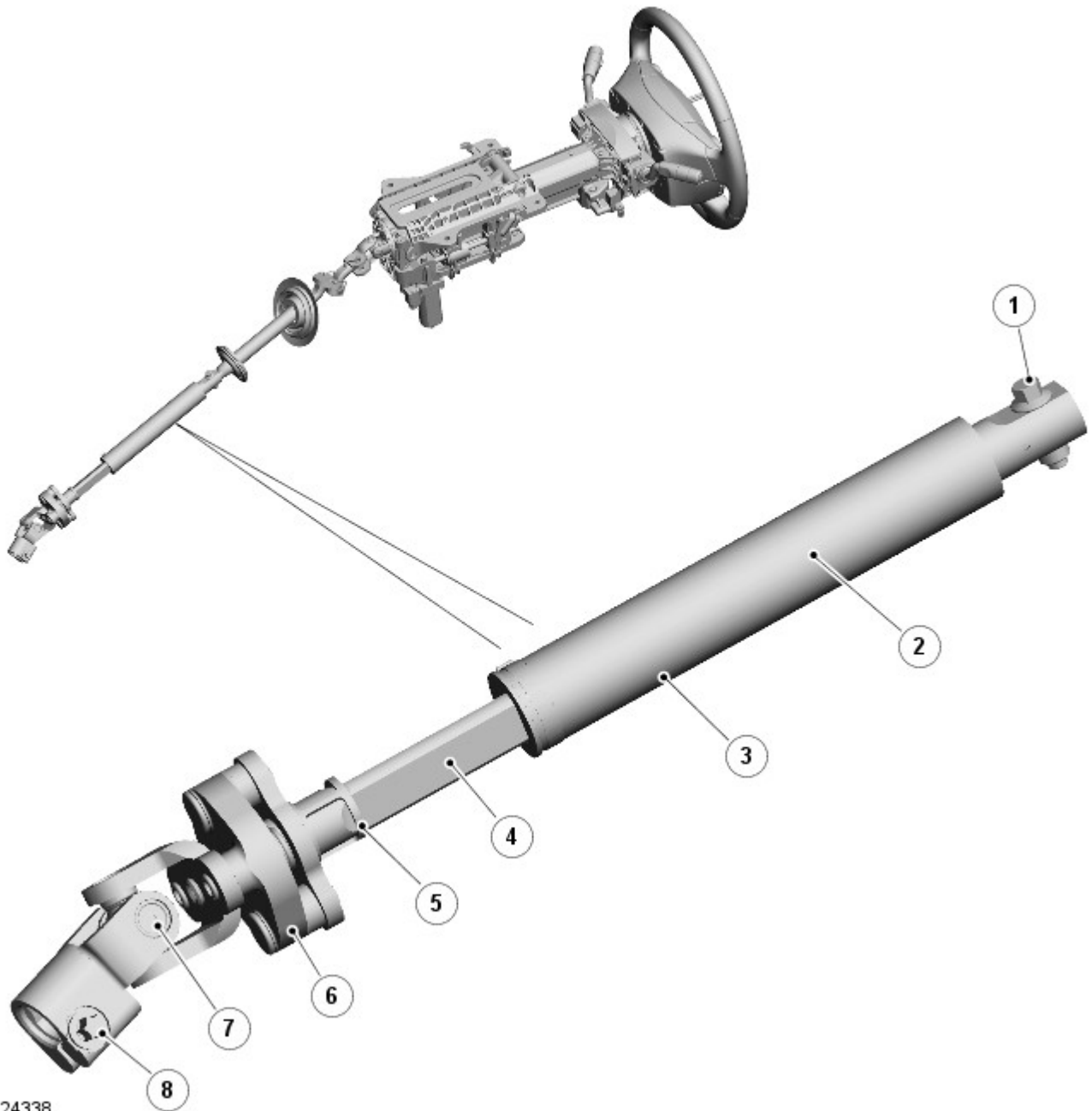
The lower axis is fitted with a plastic molded seal sleeve which provides a suitable surface for the location of the plastic bearings within the two bulkhead seals. The bottom of the lower axis is machined to a double 'D' shape which tapers at the end. One side of the taper has a slot which is used to align the intermediate shaft and the lower collapsible shaft to ensure that the correct orientation of the steering wheel to steering gear is maintained. A hole is drilled through the

double 'D' shape and provides for attachment of the intermediate shaft to the lower collapsible shaft.

The upper and lower axis, are joined together via a load limiter. The load limiter is designed to disconnect the upper and lower axis in the event of a high energy frontal impact preventing an excessive load being applied to the steering column (causing intrusion into the passenger compartment or an unstable airbag deployment).

The load limiter comprises two plates which are part of the upper and lower axis. The plates have a central 'guide' pin, and two retention pins, which pass through bushes in the plates, onto which a rubber and steel washer are staked in position. The size of the staking controls the load at which the lower axis separates from the upper axis. A wire 'retention' spring is also fitted to the load limiter.

### Lower Collapsible Shaft



E124338

| Item | Part Number | Description       |
|------|-------------|-------------------|
| 1    | -           | Bolt              |
| 2    | -           | Heat shield       |
| 3    | -           | Female shaft      |
| 4    | -           | Male shaft        |
| 5    | -           | Plastic spacer    |
| 6    | -           | Flexible coupling |
| 7    | -           | Universal joint   |
| 8    | -           | Torx bolt         |

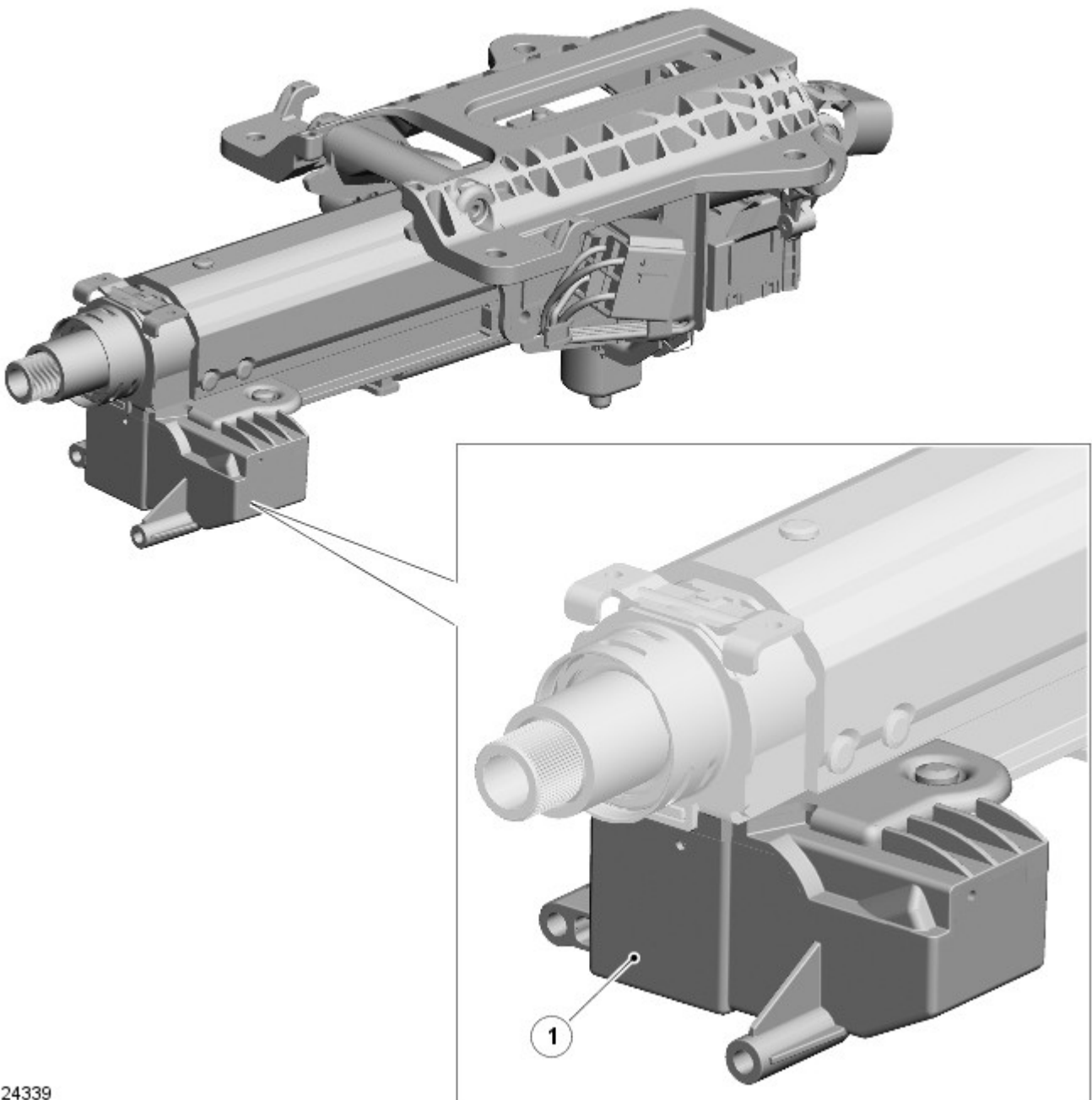
The lower collapsible shaft is a handed component and the correct component must be fitted to ensure that the steering phase angle is maintained. The shaft is attached at its upper end to the intermediate shaft and at its lower end to the valve unit pinion on the steering gear. These attachment joints can only be fitted in one orientation to ensure the correct alignment of the steering wheel to the steering gear. The shaft comprises two female and male shafts which are a telescopic fit on each other. The male shaft can slide up to 77 mm (3.03 in) within the female shaft in the event of a

frontal impact, to minimize the effect of frontal intrusion. The sliding fit also allows for dynamic displacement between the chassis and the body during severe off-road driving. A plastic spacer is fitted to the male shaft which is only used as an assembly aid during vehicle production and serves no function once the shaft is assembled to the vehicle.

The female shaft is a triangular section tube which is formed to a double 'D' hole at its upper end which mates with the intermediate shaft. An indentation pressed in the wall of the tube ensures the correct alignment between the intermediate shaft and the lower collapsible shaft. A captive nut, clinched to one side of a hole in the double 'D' section, allows for the fitment of a patchlock bolt to secure the intermediate shaft. Clamped around the end of the female shaft is a dust seal which prevents the ingress of dirt and moisture into the sliding joint, and a heat sleeve is also fitted to reflect radiant heat from the exhaust.

The male shaft is a triangular section tube which is staked at its lower end into a flange. A cage and curved 'spring plates' are fitted to its upper end, which slide in the female shaft. A pin is fitted into the side of the female tube, to secure the male tube in the bore. The lower end of the male shaft is fitted with a flexible coupling to absorb vibration and steering 'kick back', transmitted from the steering gear. A 'stabilizing pin' is fitted through the coupling to prevent coupling articulation (acting as a universal joint), while still allowing rotational flexing and plunge movement. The coupling is a rubber molding within which are nylon fibres wound around the attachment holes to transmit torque applied to the steering. The coupling is attached to a drive flange (which is part of the male shaft), and to the 'U' yoke which in turn is connected to the pinion yoke, by the universal joint assembly.

**Electronic Steering Column Lock**



E124339

| Item | Part Number | Description                     |
|------|-------------|---------------------------------|
| 1    | -           | Electronic steering column lock |

With the passive start system, a conventional steering lock mechanism cannot be used. An electronic system was developed which comprises a steering column assembly locking unit with an integrated control module. The steering lock is operated with the door locks when the vehicle is locked or unlocked. A control module, located inside the steering column, controls a motor, releasing the steering lock when appropriate.

The upper steering column assembly houses the column lock mechanism and control module. The components are assembled with non-removable pins for security reasons and are therefore non-serviceable. Failure of any steering lock components will require replacement of the upper steering column assembly.

The steering column lock comprises a locking motor and locking bolt. The locking motor drives a cam, which moves the locking bolt into and out of engagement with the locking sleeve on the steering column. The locking motor is fitted with a Hall effect sensor, which informs the control module of the position (locked/unlocked) of the steering lock mechanism.



# Steering Column - Steering Column

Removal and Installation

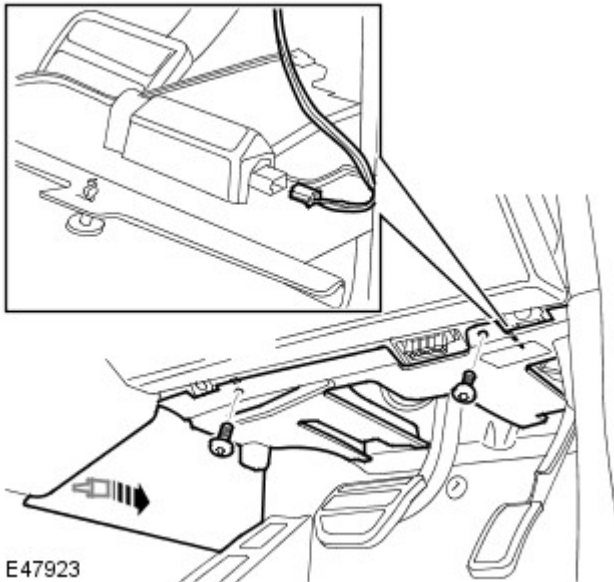
## Removal

**WARNING:** Take care if releasing the adjustment lever when the column has been removed from the vehicle. The spring is under a high tension, and if released, could cause personal injury. Make sure fingers are clear from any areas, likely to be trapped.

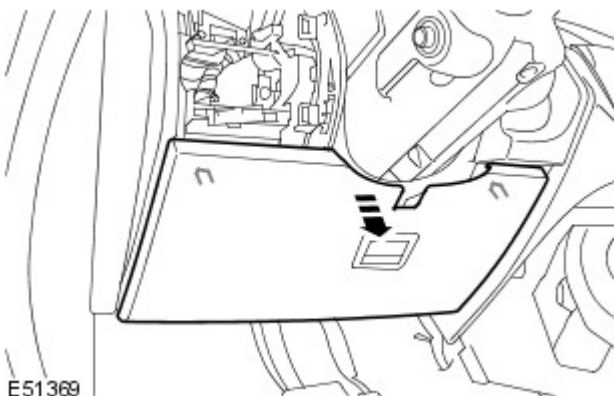
**CAUTION:** Air tools MUST NOT be used on steering column bolts.

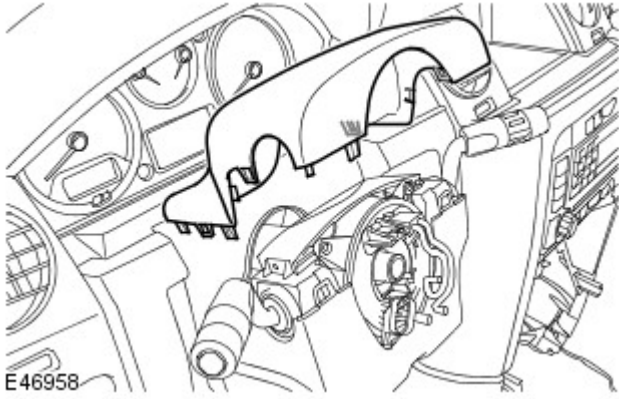
### All vehicles

1. Fully extend the steering column for access.
2. Remove the steering wheel.  
For additional information, refer to: [Steering Wheel](#) (211-04 Steering Column, Removal and Installation).
3. Remove the drivers side register trim panel.  
For additional information, refer to: [Driver Side Register Trim Panel](#) (412-01 Air Distribution and Filtering, Removal and Installation).
4. Remove the driver side closing trim panel.
  - Release the clip.
  - Remove the 2 screws.
  - Disconnect the electrical connector.



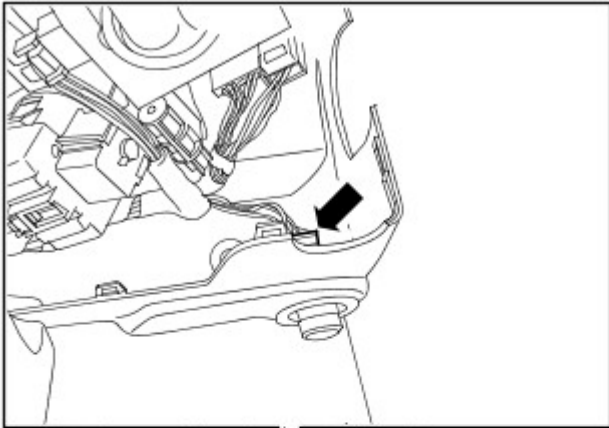
5. Remove the instrument panel access panel.
  - Release the 2 clips.





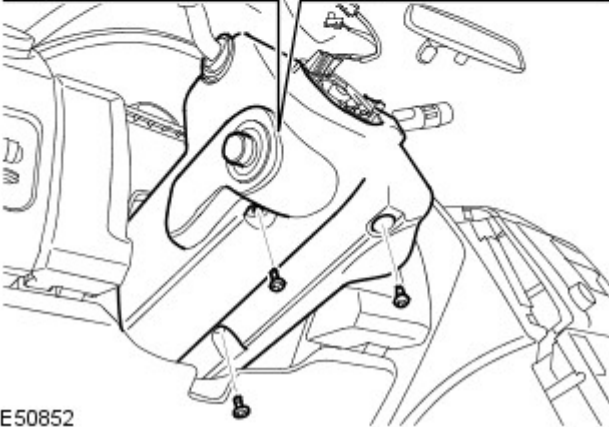
**6. Remove the steering column upper shroud.**

- Release the 6 clips.



**7. Remove the steering column lower shroud.**

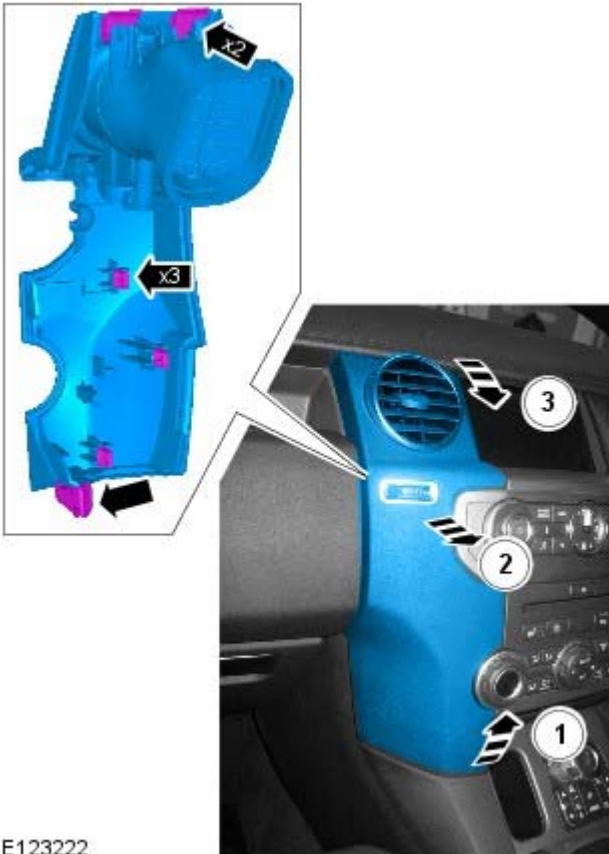
- Remove the 3 Torx screws.
- Disconnect the electrical connector.



E50852

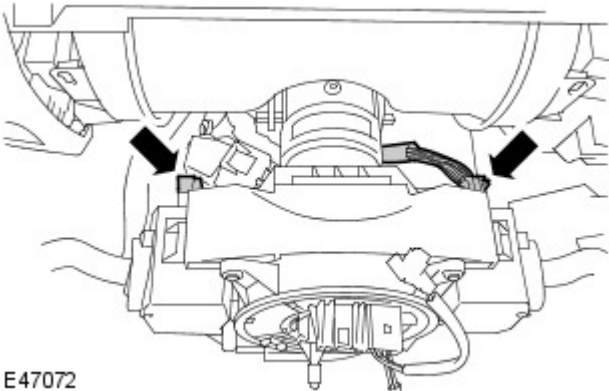
**8.** Remove the steering column side trim panel.

- Release the 4 clips.
- Disconnect 2 tabs.



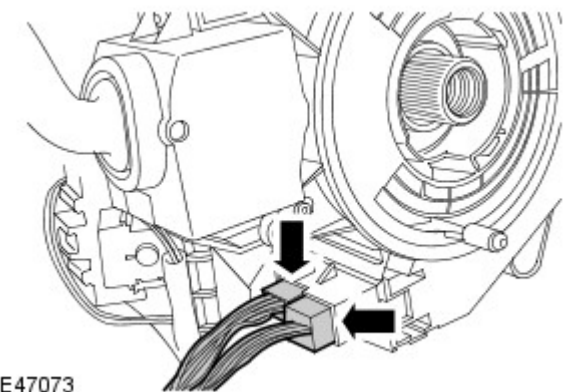
E123222

**9.** Disconnect the 2 electrical connectors from the steering column multifunction switches.



E47072

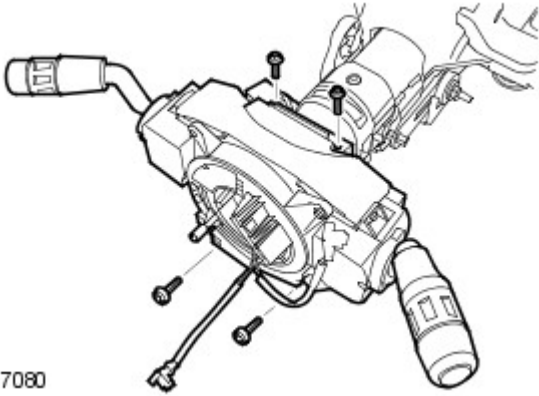
**10.** Disconnect the 2 electrical connectors from the clockspring.



E47073

**11.** Remove the steering column switch assembly.

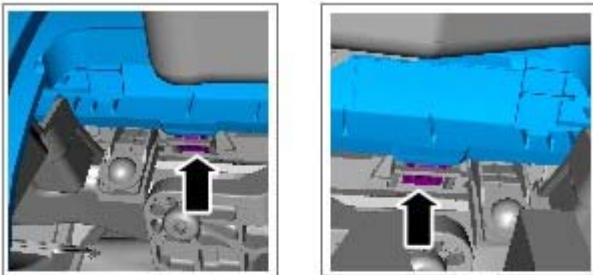
- Remove the 4 Torx bolts.



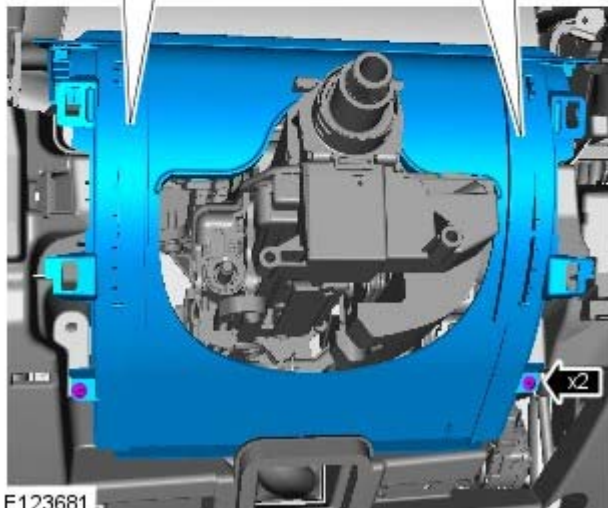
E47080

**12.** Remove the steering column gaiter panel.

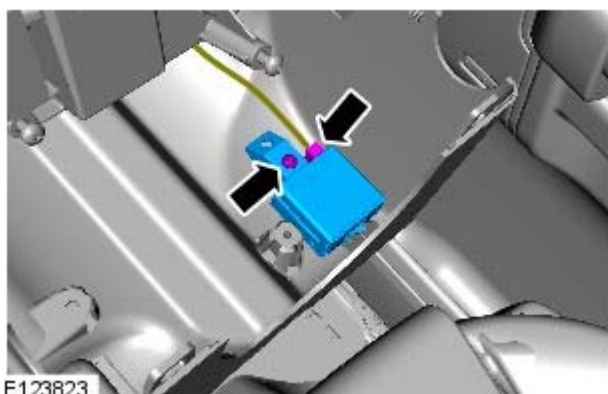
- Remove the 2 Torx screws.
- Release the 2 clips.



E123681

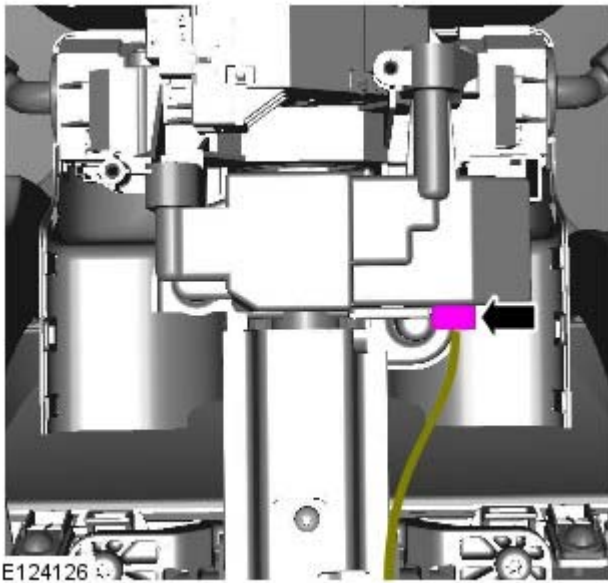


**13.** Disconnect the smart key antenna.

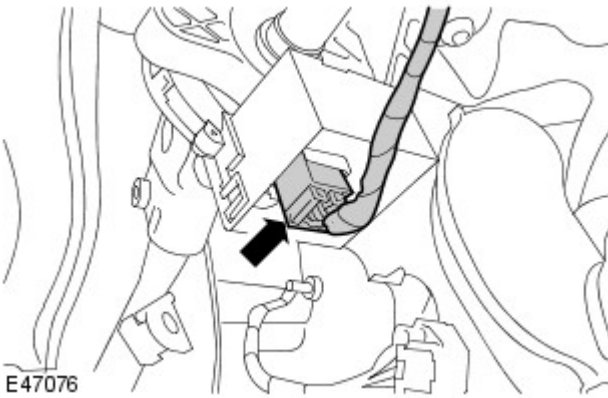


E123823

**14.** Disconnect the steering column lock electrical connector.



**15.** Disconnect the steering angle sensor electrical connector.



Vehicles with electric steering column

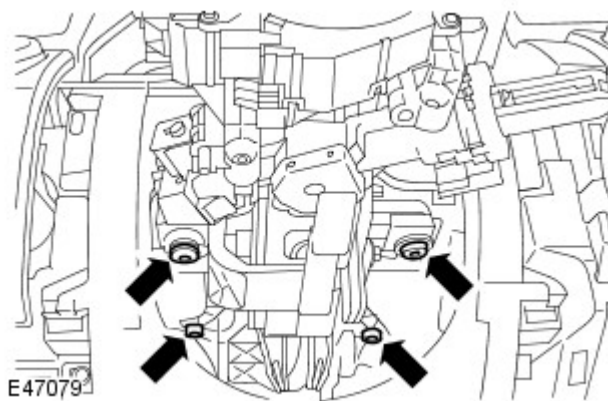
**16.** Disconnect the steering column adjustment motor electrical connector.







17. Disconnect the steering column intermediate shaft from the steering column.

- Note the fitted position.
- Remove the special bolt and discard the nut.

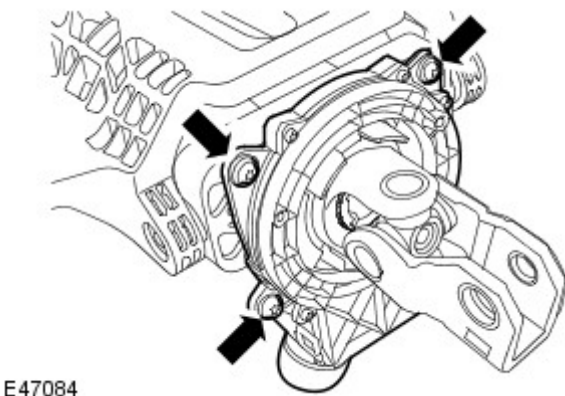


18.  **WARNING:** Take care if releasing the adjustment lever when the column has been removed from the vehicle. The spring is under a high tension, and if released, could cause personal injury. Make sure fingers are clear from any areas, likely to be trapped.

 **CAUTION:** If the steering angle sensor is damaged upon removal of the steering column, the sensor **MUST** be replaced.

With assistance, remove the steering column.

- Remove the 4 Torx bolts.




19. Remove the steering angle sensor.

- Remove the 3 Torx screws.

## Installation

Vehicles with electric steering column

1.  **CAUTION:** The potentiometer adjustment values are unique for each steering column. Failure to enter the correct code during calibration may result in damage to the vehicle.

Note the potentiometer hexadecimal code on the new steering column label for future reference.



E 102064

#### All vehicles

#### 2. Install the steering angle sensor.

- Tighten the Torx screws to 3 Nm (2.2 lb.ft).

#### 3. CAUTIONS:



Make sure the bolt holes are clean and free of swarf.



The steering column bolts must be tightened by hand a minimum of 3 revolutions.



Air tools **MUST NOT** be used on steering column bolts.

With assistance, install the steering column.

- Tighten the bolts in sequence to 25 Nm (18 lb.ft).

#### 4. Connect the steering column intermediate shaft.

- Install the special bolt and tighten the new nut to 22 Nm (16 lb.ft).

#### 5. Secure the wiring harness to the steering column.

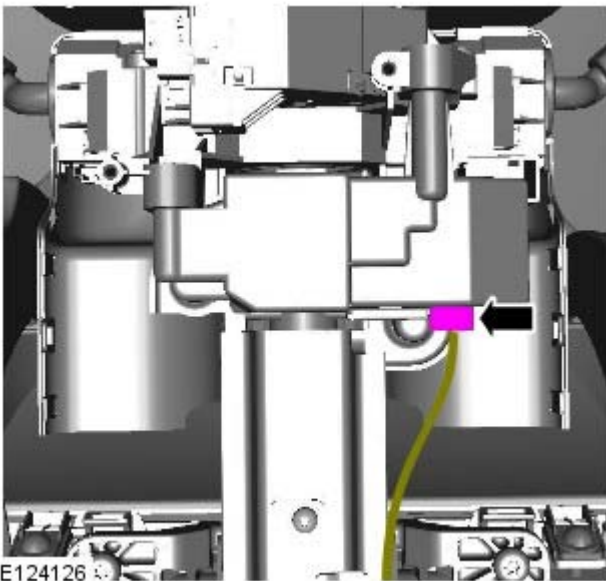
#### Vehicles with electric steering column

#### 6. Connect the steering column adjustment motor electrical connector.

#### All vehicles

#### 7. Connect the steering angle sensor electrical connector.

#### 8. Connect the steering column lock electrical connector.



#### 9. Connect the smart key antenna.

#### 10. Install the steering column gaiter panel.

- Secure with the clips.
- Tighten the Torx screws.

#### 11. Install the steering column switch assembly.

- Tighten the Torx bolts to 3 Nm (2 lb.ft).

#### 12. Connect the clockspring and multifunction switch electrical connectors.

#### 13. Install the steering column side trim panel.

- Secure with the clips.

- 14.** Install the steering column shrouds.
- 15.** Install the instrument panel access panel.
  - Secure with the clips.
- 16.** Install the closing trim panel.
  - Connect the electrical connector.
  - Secure the clip.
  - Tighten the screws.
- 17.** Install the steering wheel.  
For additional information, refer to: [Steering Wheel](#) (211-04 Steering Column, Removal and Installation).
- 18.** Install the drivers side register trim panel.  
For additional information, refer to: [Driver Side Register Trim Panel](#) (412-01 Air Distribution and Filtering, Removal and Installation).
- 19.** Calibrate the steering angle sensor using the Land Rover approved diagnostic tool.

#### Vehicles with electric steering column

- 20.** If a new electric steering column is fitted re-calibrate the steering column potentiometer using the Land Rover approved diagnostic system.



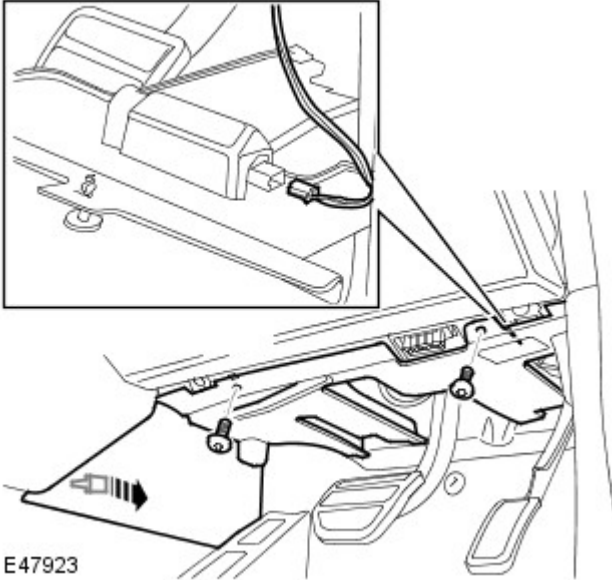
# Steering Column - Steering Column Shaft

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).

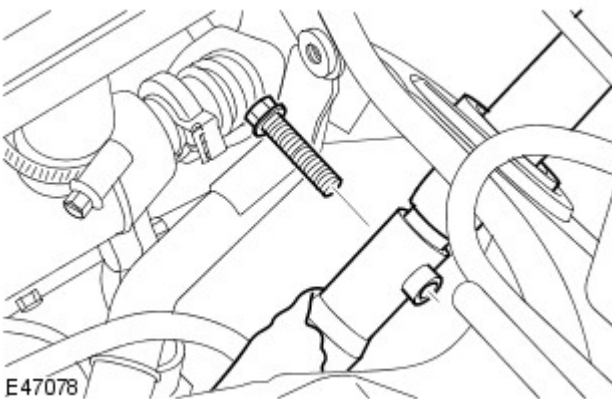
2. Remove the driver side closing trim panel.
  - Release the clip.
  - Remove the 2 screws.
  - Disconnect the electrical connector.



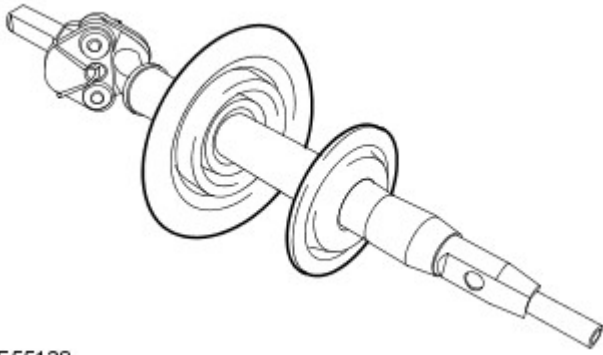
3. Disconnect the steering column intermediate shaft from the steering column.
  - Note the fitted position.
  - Remove the special bolt and discard the nut.



4. Disconnect the steering column intermediate shaft from the lower shaft.
  - Note the fitted position.
  - Remove and discard the bolt.



5. Remove the steering column intermediate shaft.
  - Release the 2 grommets.



E55128

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

- NOTE: Note the fitted position.

Remove the 2 intermediate shaft grommets.

## Installation

1. Install the steering column intermediate shaft.
  - Install the grommets.
2. Connect the steering column intermediate shaft to the lower shaft.
  - Tighten the new bolt to 25 Nm (18 lb.ft).
3. Connect the steering column intermediate shaft to the steering column.
  - Install the special bolt and tighten the new nut to 22 Nm (16 lb.ft).
4. Install the driver side closing trim panel.
  - Connect the electrical connector.
  - Secure the clip.
  - Tighten the screws.
5. Connect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

# Steering Column - Steering Column Lower Shaft

Removal and Installation

## Removal



**CAUTION:** Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

1. Disconnect the battery ground cable.  
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
2. Turn the steering wheel to the straight ahead position.

### 3. CAUTIONS:



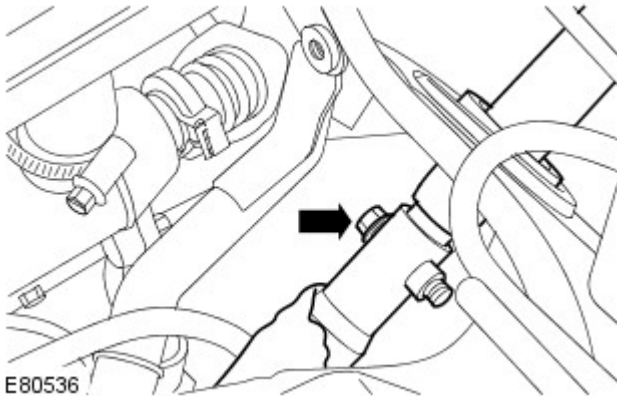
Make sure the steering wheel is in the straight ahead position.



Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

- **NOTE:** Note the fitted position.

Remove and discard the steering column lower shaft upper bolt.



E80536

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

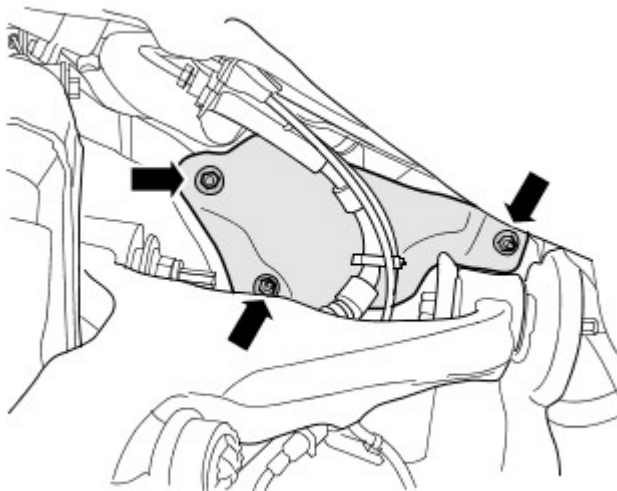
Raise and support the vehicle.



**CAUTION:** Make sure that the brake hose and the wiring harnesses are not damaged during the removal and installation of the heat shields.

Remove the upper suspension arm heat shield for access.

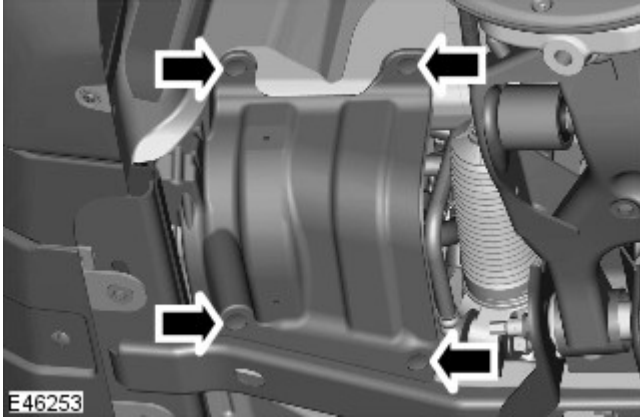
- Remove the 3 nuts.



E102486


6. **CAUTION:** Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

Disconnect the steering column lower shaft from the intermediate shaft.




7. Remove the fender splash shield lower trim.

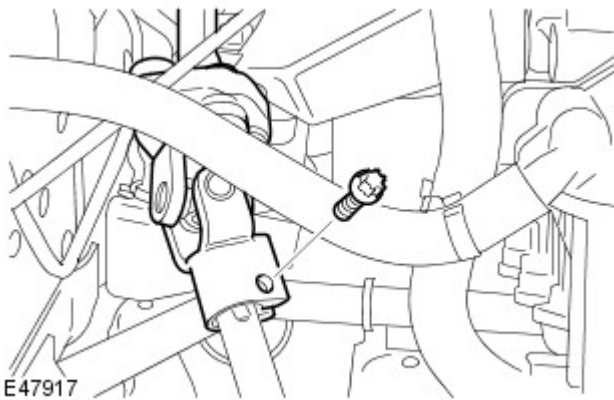
- Remove the 4 clips.

8.  **CAUTION:** Make sure that the steering is correctly positioned using the road wheels. Do not turn the steering wheel. Failure to follow this instruction may result in damage to the vehicle.

Turn the steering until access can be gained to the steering column lower shaft bolt.

9.  **CAUTION:** Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

Remove and discard the steering column lower shaft bolt.




10. Remove the steering column lower shaft.

- Disconnect the steering column lower shaft from the steering gear.

## Installation

1. Clean the component mating faces.

2.  **CAUTION:** Make sure that the road wheels are in the straight ahead position.

Install the steering column lower shaft.

- Connect the steering column lower shaft to the steering gear.
- Connect the steering column intermediate shaft to the lower shaft.

3. Lower the vehicle on the lift.

4.  **CAUTION:** Make sure that a new bolt is installed.

Install the steering column lower shaft upper bolt.

- Install a new bolt and tighten to 30 Nm (22 lb.ft).

5. Raise the vehicle on the lift.

6. **CAUTIONS:**

 Do not turn the steering wheel with the steering column

lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.



Make sure that the steering is correctly positioned using the road wheels. Do not turn the steering wheel. Failure to follow this instruction may result in damage to the vehicle.

Turn the steering until access can be gained to the steering column lower shaft bolt.

**7.** Install the steering column lower shaft to steering gear bolt.

- Install a new bolt and tighten to 30 Nm (22 lb.ft).

**8.** Install the fender splash shield lower trim.

- Install the 4 clips.

**9.** Install the upper suspension arm heat shield.

- Install the 3 nuts.

**10.** Lower the vehicle on the lift.

# Steering Column - Steering Wheel


Removal and Installation

## Removal

1. Refer to: [Important Safety Instructions](#) (100-00 General Information, Description and Operation).

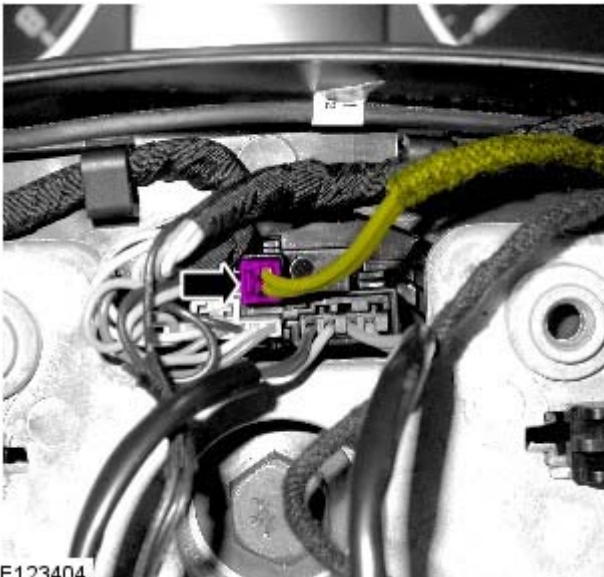
2. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

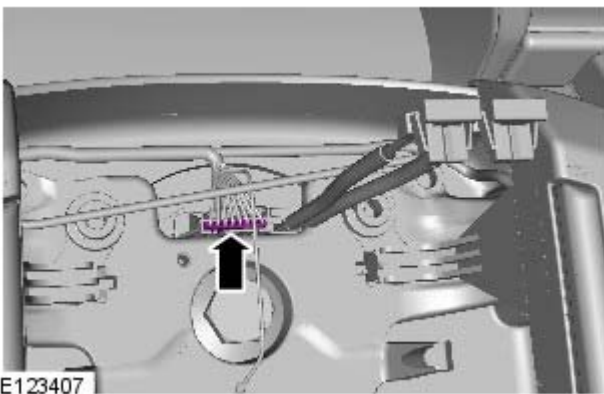
3.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any air bag supplementary restraints system (SRS) components. To deplete the backup power supply energy, disconnect the battery ground cable and wait for one minute. Failure to follow this instruction may result in personal injury.

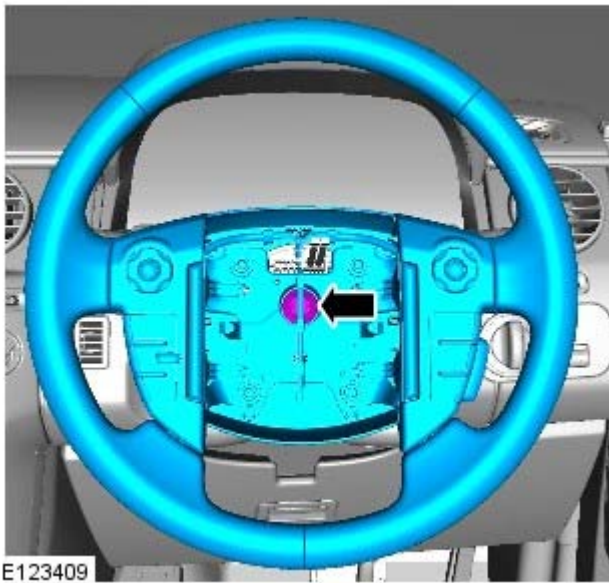
Refer to: [Driver Air Bag Module](#) (501-20B Supplemental Restraint System, Removal and Installation).

- 4.



- 5.





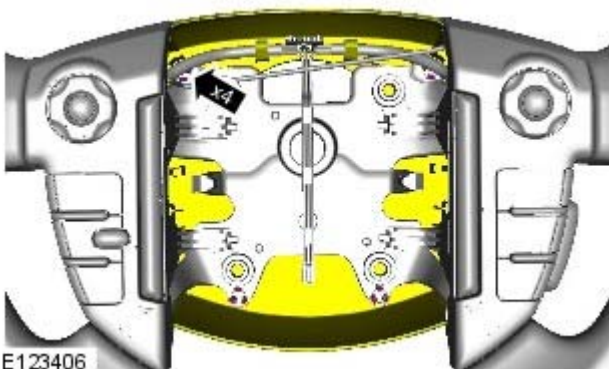
E123409

6. **6.** NOTE: Note the steering wheel to column alignment marks.



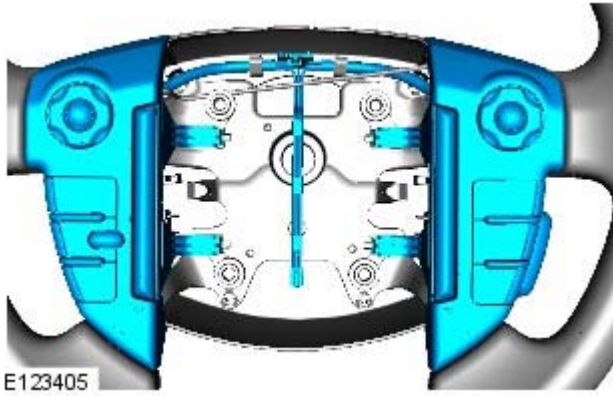
E123408

7.

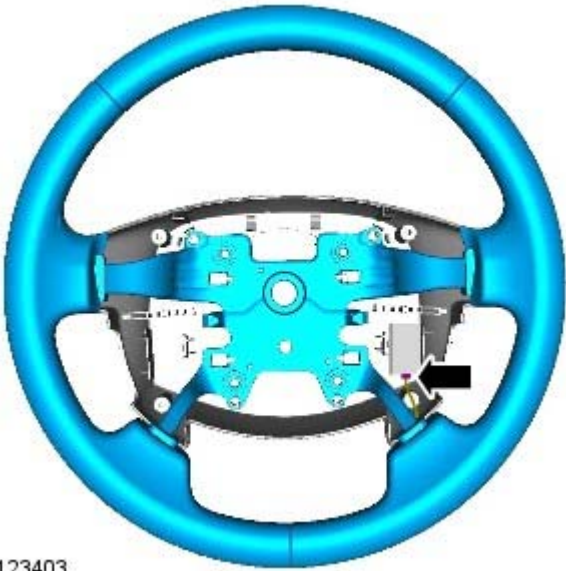


E123406

8.

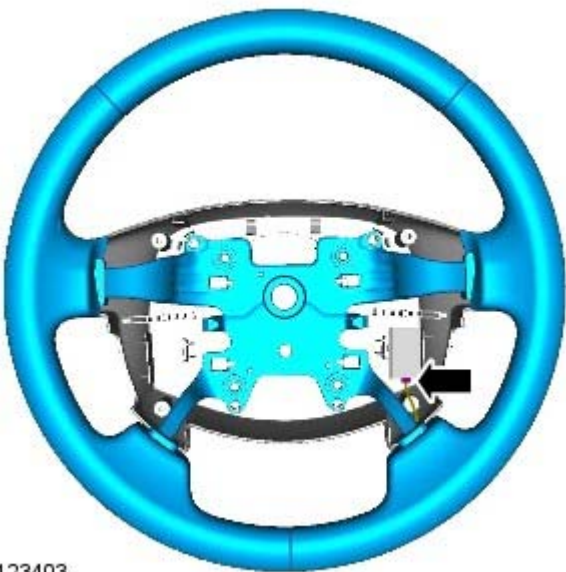


9.



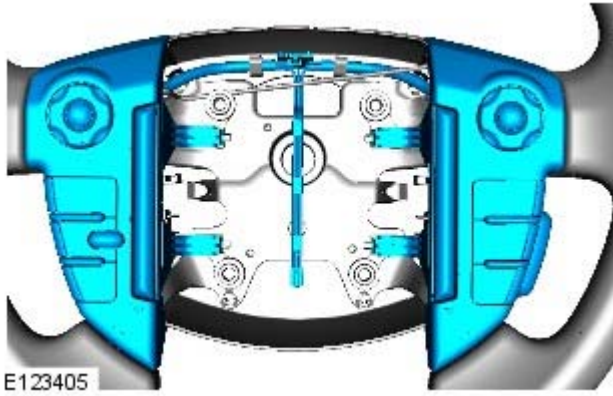
10.

## Installation

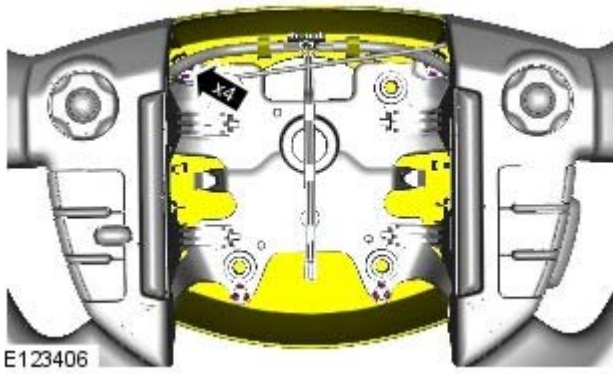


1.





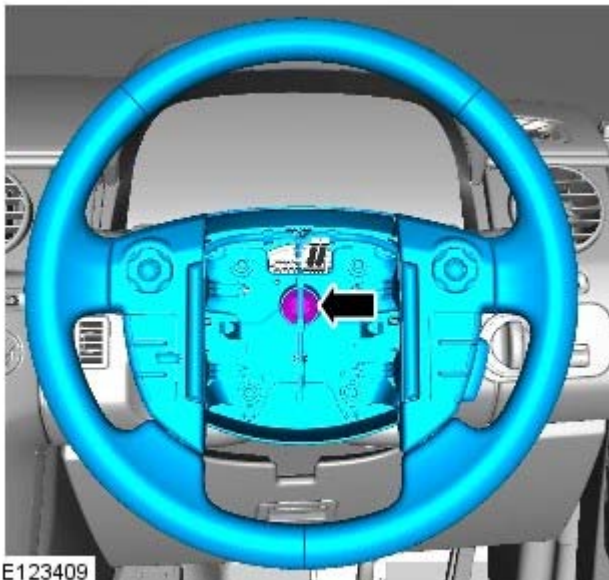
2.



3.

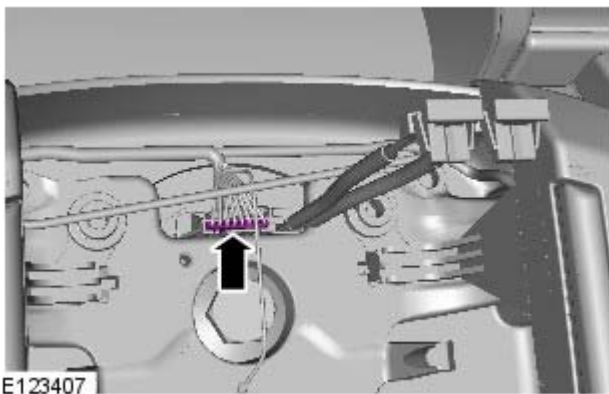


4. Torque: 6 Nm

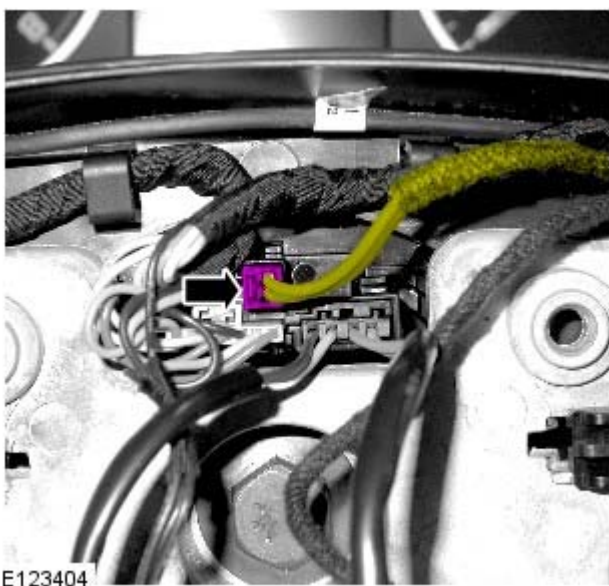


5. **5.** NOTE: Note the steering wheel to column alignment marks.

Torque: 63 Nm



- 6.



- 7.

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

9. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System -

General Information, Specifications).

## Steering Column Switches -

### Torque Specifications

| Description                        | Nm | lb-ft |
|------------------------------------|----|-------|
| Steering column switch Torx screws | 3  | 2     |

# Steering Column Switches - Steering Column Lock and Ignition Switch Housing

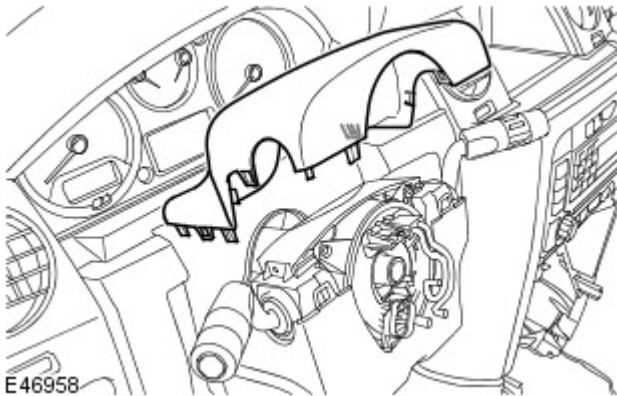
Removal and Installation

## Removal



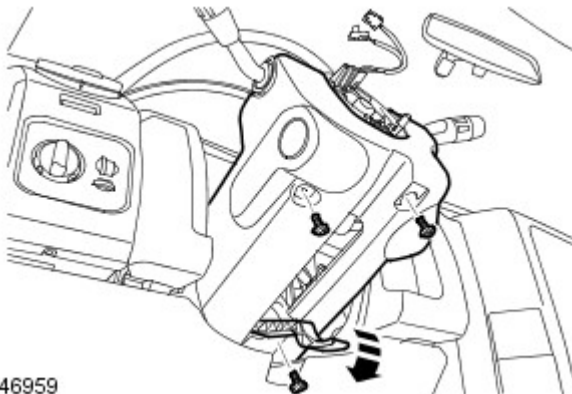
**CAUTION:** If the ignition lock cylinder and switch are both removed from the ignition switch assembly, the assembly shaft **MUST NOT** be rotated. Failure to comply will cause the incorrect operation of the lock, and the assembly must be replaced.

1. Fully extend the steering column for access.
2. Remove the steering wheel.  
For additional information, refer to: Steering Wheel (211-04, Removal and Installation).
3. Remove the steering column upper shroud.
  - Release the 6 clips.



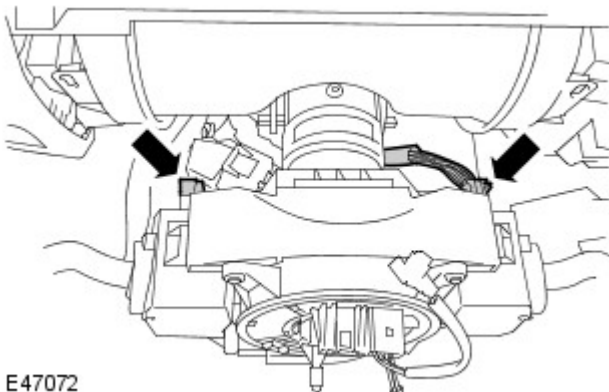
E46958

4. Remove the steering column lower shroud.
  - Remove the 3 Torx screws.
  - Release the steering column adjustment lever.



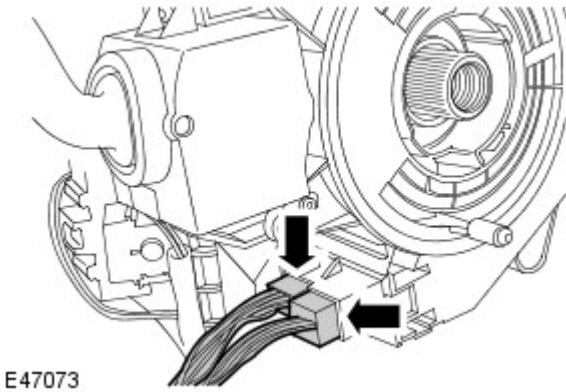
E46959

5. Disconnect the 2 electrical connectors from the steering column multifunction switches.



E47072

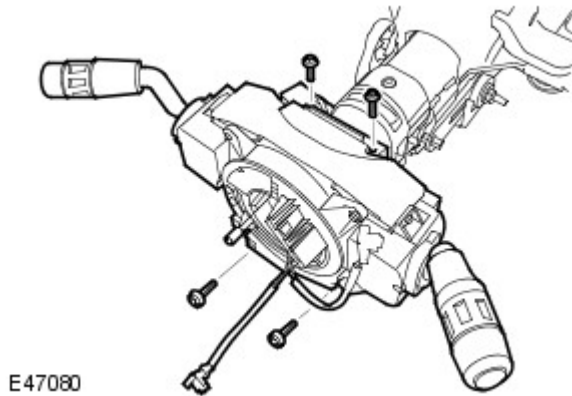
**6.** Disconnect the 2 electrical connectors from the clockspring.



E47073

**7.** Remove the steering column switch assembly.

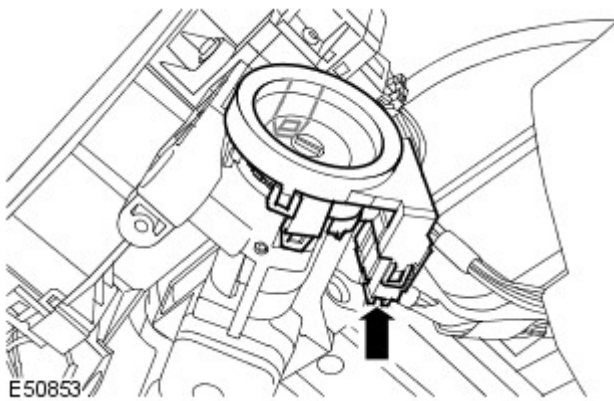
- Remove the 4 Torx bolts.



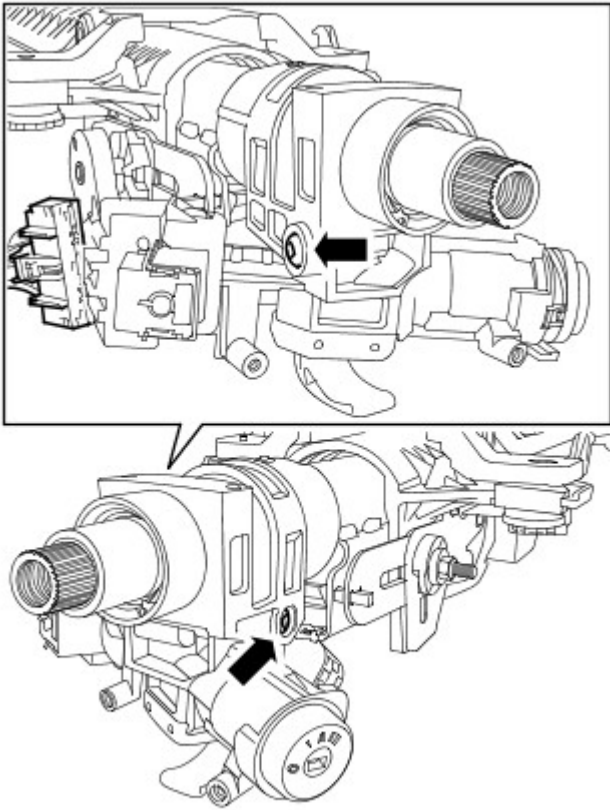
E47080

**8.** Remove the passive coil.

- Disconnect the electrical connector.
- Release the 2 clips.



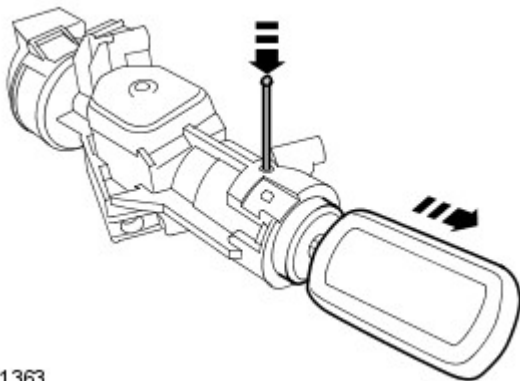
E50853



E50482

**9.** Remove the ignition switch assembly.

- Remove and discard the 2 shear bolts.
- Disconnect the electrical connector.

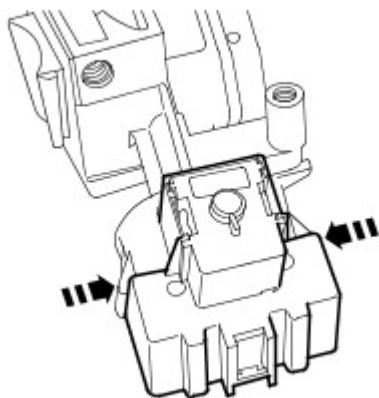


E51363

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

Remove the ignition lock cylinder.

- Turn the ignition key to position 1.
- Insert a pin, not exceeding 2 mm diameter, through the access hole in the ignition lock cylinder housing to depress the plunger, and release the ignition lock cylinder.



E51364

**11.** Remove the ignition switch.

- Depress the 2 clips.

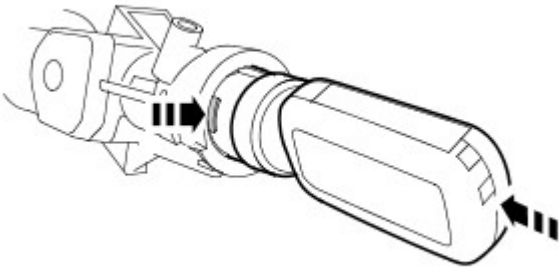
**Installation**

**1.** Install the ignition switch.

- Secure with the clips.

**2.** Install the ignition lock cylinder.

- Turn the ignition key to position 1.
- Locate into guides and depress the plunger.



E51372

**3.** Install the passive coil.

- Secure the clips.
- Connect the electrical connector.

**4.** Install the ignition switch assembly.

- Tighten the shear bolts until the heads shear off.
- Connect the electrical connector.

**5.** Install the steering column switch assembly.

- Tighten the Torx bolts to 3 Nm (2 lb.ft).

**6.** Connect the clockspring and multifunction switch electrical connectors.

**7.** Install the steering column shrouds.

**8.** Install the steering wheel.

For additional information, refer to: Steering Wheel (211-04, Removal and Installation).



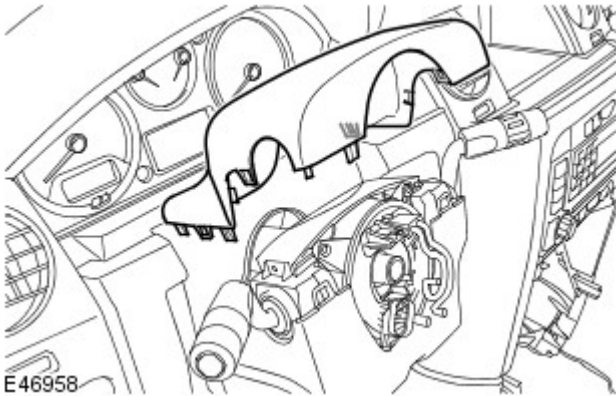
# Steering Column Switches - Ignition Switch

Removal and Installation

## Removal

1. Fully extend the steering column for access.
2. Remove the steering column upper shroud.

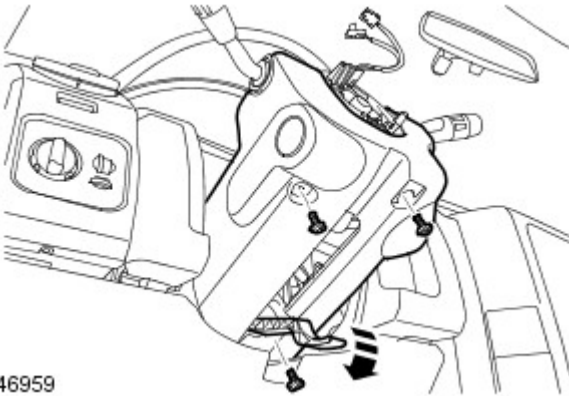
- Release the 4 clips.




E46958

3. Remove the steering column lower shroud.

- Remove the 3 Torx screws.
- Release the steering column adjustment lever.

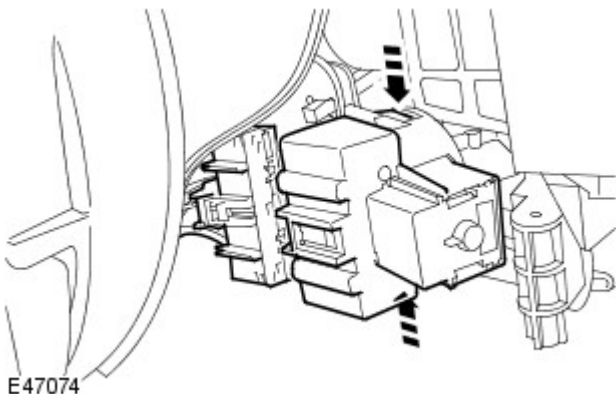


E46959

4.  **CAUTION:** The ignition key must be removed prior to the removal of the ignition switch.

Remove the ignition switch.

- Disconnect the electrical connector.
- Depress the 2 clips.



E47074

## Installation

1. Install the ignition switch.
  - Secure with the clips.
  - Connect the electrical connector.
2. Install the steering column shrouds.
  - Tighten the Torx screws.
  - Secure the clips.
  - Secure the adjustment lever.

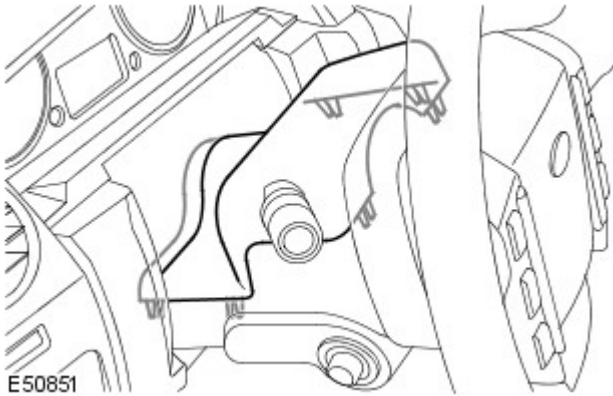


# Steering Column Switches - Steering Column Multifunction Switch RH

Removal and Installation

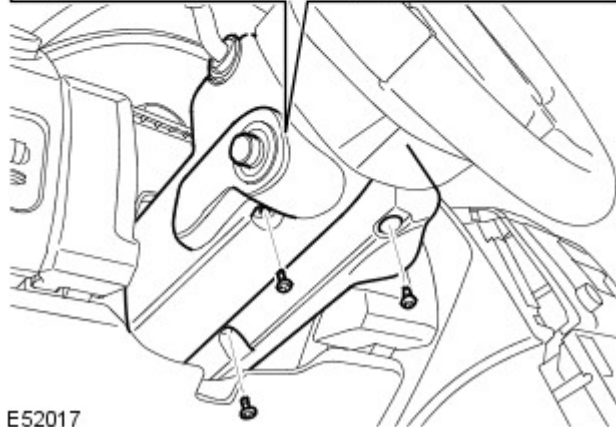
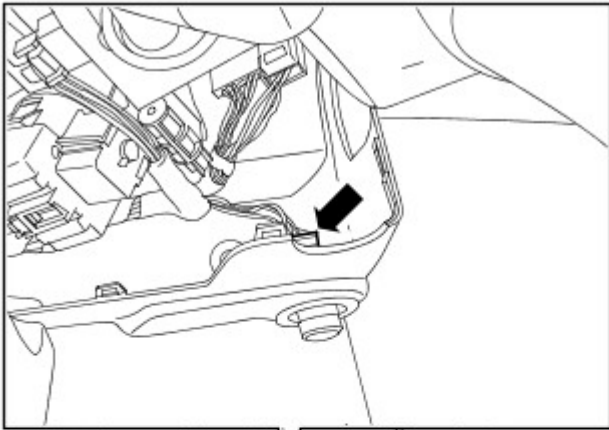
## Removal

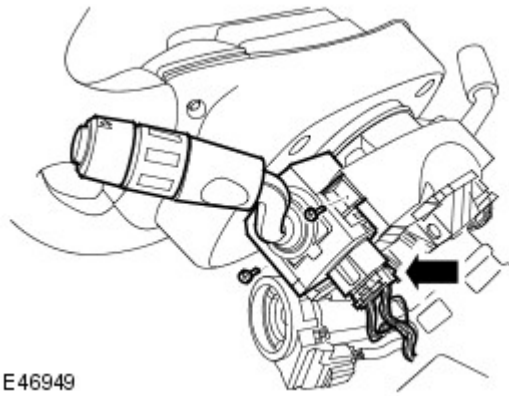
1. Fully extend the steering column for access.
2. Remove the steering column upper shroud.
  - Release the 6 clips.



3. Remove the steering column lower shroud.

- Remove the 3 Torx screws.
- Disconnect the electrical connector.





E46949

**4.** Remove the steering column multifunction switch.

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

**Installation**

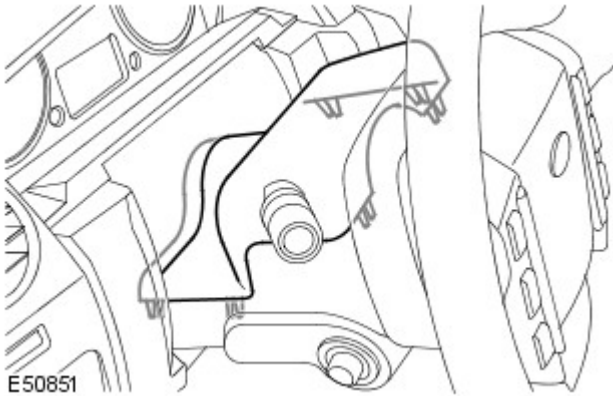
- 1.** To install, reverse the removal procedure.

# Steering Column Switches - Steering Column Multifunction Switch LH

Removal and Installation

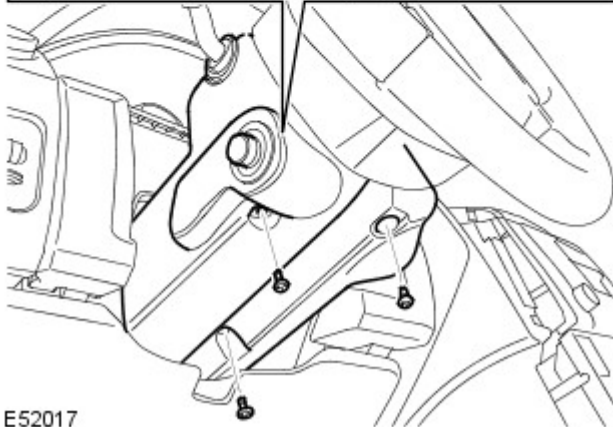
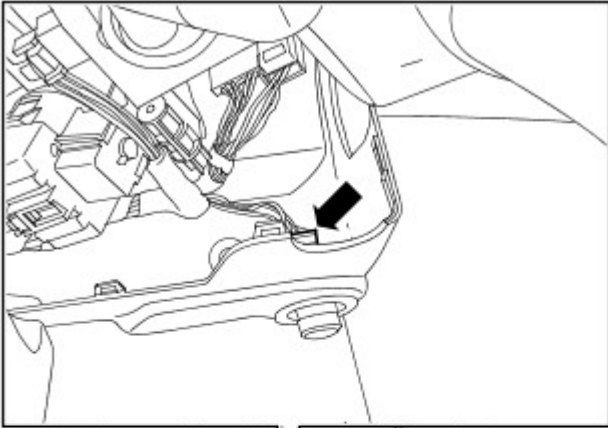
## Removal

1. Fully extend the steering column for access.
2. Remove the steering column upper shroud.
  - Release the 6 clips.



E50851

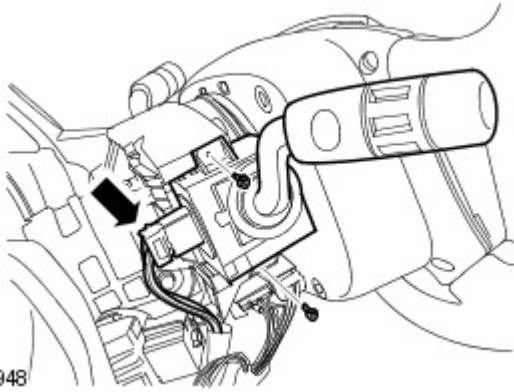
3. Remove the steering column lower shroud.
  - Remove the 3 Torx screws.
  - Disconnect the electrical connector.



E52017

**4.** Remove the steering column multifunction switch.

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



E46948

**Installation**

- 1.** To install, reverse the removal procedure.