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Climate Control System - General Information -

General Specification

Type	Description
Automatic Temperature Control (ATC) heating, ventilation and air conditioning unit:	Dual zone with side to side temperature control
Compressor	Clutchless, belt driven from engine with electronically controlled outputs.

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Climate Control System - General Information - Climate Control System

Diagnosis and Testing

Principle of Operation

For a detailed description of the Climate Control System, refer to the relevant Description and Operation section in the workshop manual. REFER to:

Air Distribution and Filtering (412-01 Air Distribution and Filtering, Description and Operation),
Heating and Ventilation (412-02A Heating and Ventilation, Description and Operation),
Auxiliary Heater (412-02B Auxiliary Heating, Description and Operation),
Air Conditioning (412-03A Air Conditioning - TDV6 3.0L Diesel, Description and Operation),
Air Conditioning (412-03A Air Conditioning - TDV6 3.0L Diesel, Description and Operation).

REFER to: Control Components (412-04 Control Components, Description and Operation).

Inspection and Verification

WARNING: Servicing must be carried out by personnel familiar with both vehicle system and the charging and testing equipment. All operations must be carried out in a well ventilated area away from open flame and heat sources.

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

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

1. Verify the customer concern
2. Visually inspect for obvious signs of damage and system integrity

Visual Inspection

Mechanical	Electrical
• Coolant level • Hose(s) • Coolant pump • Control flap(s) • Duct(s) • Vent(s) • Cabin air filter • Drive belt • Air conditioning compressor • Thermostatic expansion valve • Evaporator • Receiver drier • Air conditioning condenser • Refrigerant pipes • Auxiliary drive belt • Fuel fired booster heater • Fuel fired booster heater fuel pump • Fuel fired booster heater fuel pipes	• Fuse(s) • Wiring harness • Electrical connectors • Blower • Air conditioning compressor • Electric cooling fan • Automatic Temperature Control Module (ATCM) • Refrigerant pressure sensor

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index
5. Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required

Distribution motor self-test

The motor and flap operation can be checked using the on-board distribution motor self-test function.

The self-test can be initiated by pressing and holding the **ECON** and **RECIRC** buttons while turning the ignition switch to the **ON** position.

The control module will then compare the current motor position with the values stored in the module and will indicate an error by flashing the **ECON** LED (light emitting diode).

If there are no errors, the LED will go out and the system will function normally.

To confirm that there are no errors, turn the ignition switch to the **OFF** position, then back to the **ON** position.

Observe the operation of the **programmed defrost** LED.

If there are errors present, the **programmed defrost** LED will flash and the system will attempt to calibrate itself.

Symptom Chart

Symptom	Possible Causes	Action
No climate control function, flashing LED at start-up	• The system is in calibration mode	Check the motors and levers at the heating and ventilation assembly for damage/foreign objects jamming the movement of the flaps. For additional information on the self-calibration process, see the distribution motor self-test above
Air conditioning performance poor or inoperative	• Refrigerant undercharged • Refrigerant overcharged • Thermostatic expansion valve faulty • Receiver drier restricted • Water in refrigerant	• GO to Pinpoint Test A.
Air conditioning operates briefly and then switches off	• Electric cooling fan inoperative • Air conditioning condenser airflow obstructed	• Test the operation of the electric cooling fan • Check the air conditioning condenser for external obstructions

Pinpoint Tests

PINPOINT TEST A : PRELIMINARY TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: PRELIMINARY TEST 1	
NOTES: This test is performed with the engine **not** running.	
Normal pressure for a correctly charged and switched off system is approximately 4.5 bar on both gauges (system equalised).	
	1 Close the valves on the air conditioning station
	2 Connect the air conditioning station to the vehicle charging ports
	3 Check the pressure values
	Is a pressure registered on both gauges? **Yes** GO to Pinpoint Test B. **No** GO to Pinpoint Test D.

PINPOINT TEST B : FUNCTIONALITY TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: FUNCTIONALITY TEST 1	
NOTES: Normal pressures for a correctly charged and working system are 1.0 bar to 2.0 bar (low) and 11.0 bar to 15.0 bar (high).	
Normal temperature (measured at the center air vent) for a correctly charged and working system is -7°C to -2°C when ambient temperature is 20°C.	
	1 Close the valves on the air conditioning station
	2 Connect the air conditioning station to the vehicle charging ports
	3 Open all doors and the tailgate
	4 Start the engine
	5 Set the temperature to the lowest setting (all zones)
	6 Set the fan speed to maximum
	7 Set the recirculate switch to off
	8 Insert a temperature probe into the centre air vent
	9 Raise engine speed to 1500rpm and maintain this speed for 5 minutes

	10 Check the temperature value
	11 Check the pressure values
	Are the pressure readings stable and in the green 'normal' region of the gauge? **Yes** Air conditioning system operating normally **No** Air conditioning system fault present. GO to Pinpoint Test C.

PINPOINT TEST C : GAUGE TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: GAUGE TEST 1	
NOTE: This test is performed with the engine running and the air conditioning set to on.	
	1 Check the pressure values
	Did the gauges register a change in pressure when the air conditioning was switched on? **Yes** GO to C2. **No** Using the manufacturer approved diagnostic system, check the Automatic Temperature Control Module (ATCM) for related DTCs and refer to the relevant DTC index
C2: GAUGE TEST 2	
NOTE: This test is performed with the engine running and the air conditioning set to on.	
	1 Check the pressure values
	Are the pressure gauge readings fluctuating? **Yes** Moisture present in the air conditioning system. Recover the refrigerant. Install a new receiver drier. Refer to the relevant section of the workshop manual and evacuate and recharge the air conditioning system. GO to Pinpoint Test B. **No** GO to C3.
C3: GAUGE TEST 3	
NOTES: This test is performed with the engine running and the air conditioning set to on. Normal pressures for a correctly charged and working system are 1.0 bar to 2.0 bar (low) and 11.0 bar to 15.0 bar (high).	
	1 Check the pressure values
	Are the pressure gauge readings too low? **Yes** GO to C4. **No** GO to C6.
C4: GAUGE TEST 4	
NOTE: This test is performed with the engine **not** running.	
	1 Stop the engine
	2 Using the manufacturer approved refrigerant leak detector, check for a refrigerant leak
	Was a refrigerant leak detected? **Yes** Refer to the relevant section of the workshop manual and recover the refrigerant. Repair as necessary. Evacuate and recharge the air conditioning system. GO to Pinpoint Test B. **No** GO to C5.
C5: GAUGE TEST 5	
NOTE: This test is performed with the engine **not** running.	
	1 Refer to the relevant section of the workshop manual and recover the refrigerant
	Was the weight of the recovered refrigerant less than specified for the air conditioning system? **Yes** Refer to the relevant section of the workshop manual and evacuate and recharge the air conditioning system. GO to Pinpoint Test B. **No** Install a new receiver drier. Refer to the relevant section of the workshop manual and evacuate and recharge the air conditioning system. GO to Pinpoint Test B.
C6: GAUGE TEST 6	
NOTES: This test is performed with the engine running and the air conditioning set to on.	

 Normal pressures for a correctly charged and working system are 1.0 bar to 2.0 bar (low) and 11.0 bar to 15.0 bar (high).	
	1 Check the pressure values
	Are the pressure gauge readings too high? **Yes** GO to C7. **No** Test inconclusive. GO to Pinpoint Test B.
C7: GAUGE TEST 7	
 NOTE: This test is performed with the engine **not** running.	
	1 Stop the engine
	2 Refer to the relevant section of the workshop manual and recover the refrigerant
	Was the weight of the recovered refrigerant more than specified for the air conditioning system? **Yes** Refer to the relevant section of the workshop manual and evacuate and recharge the air conditioning system. GO to Pinpoint Test B. **No** Install a new thermal expansion valve. Refer to the relevant section of the workshop manual and evacuate and recharge the air conditioning system. GO to Pinpoint Test B.

PINPOINT TEST D : NITROGEN LEAK TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: NITROGEN LEAK TEST	
 CAUTION: When charging the system with nitrogen, the pressure should be regulated to 7.0 bar.	
 NOTE: This test is performed with the engine **not** running.	
	1 Charge the air conditioning system with nitrogen
	2 Isolate the nitrogen supply
	3 Monitor the pressure gauge and check for leaks
	Has the source of the leak been identified? **Yes** Rectify the leak as necessary. Install a new receiver drier. Refer to the relevant section of the workshop manual and evacuate and recharge the air conditioning system. GO to Pinpoint Test B. **No** Refer to the relevant section of the workshop manual and evacuate and recharge the air conditioning system. GO to Pinpoint Test B.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Automatic Temperature Control Module (ATC) (100-00 General Information, Description and Operation).

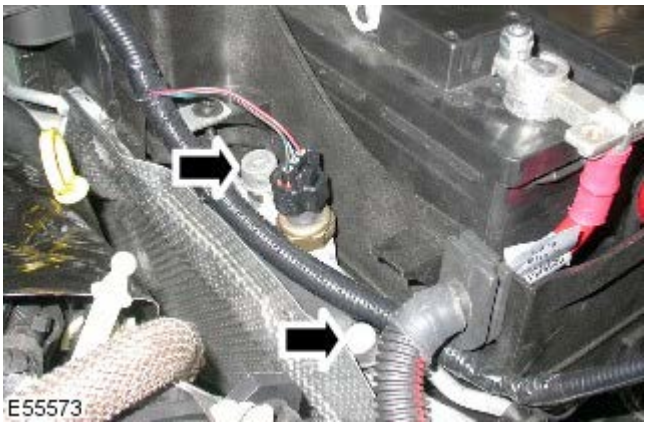
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Climate Control System - General Information - Air Conditioning (A/C) System Recovery, Evacuation and Charging

General Procedures

WARNING: Servicing must be carried out by personnel familliar with both vehicle system and the charging and testing equipment. All operations must be carried out in a well ventilated area away from open flame and heat sources.

NOTE: The receiver drier need only be changed under the following circumstances: There is dirt in the refrigerant circuit (eg. compressor seizure); the system is leaking and refrigerant has been lost to atmosphere; refrigerant circuit has been open more than 24 hours due to repair.



1. **Refrigerant recovery:** Remove the dust covers from the high and low pressure connections.
2. Connect the high and low pressure lines to the appropriate connections.
3. Open the valves on the connections.
4. Turn the valves on the station to the correct positions.
5. Turn the process switch to the correct position.
6. Turn the main switch to 'ON'.
7. WARNING: Refrigerant must always be recycled before re-use to ensure that the purity of the refrigerants high enough for safe use in the air conditioning system. Recycling should always be carried out with equipment which is design certified by Underwriter Laboratory Inc. for compliance with SEA J1991. Other equipment may not recycle refrigerant to the required level of purity. R143a Refrigerant Recover Recycling Recharging station must not be used with any other type of refrigerant. Refrigerant R134a from domestic and commercial sources must not be used in motor vehicles air conditioning systems.

   Allow the system to recover the refrigerant from the system.
8. Close the valves on the refrigerant station.
9. Turn the main switch 'OFF'.
10. Close the valves on the connections.
11. Disconnect the high and low pressure connections.
12. Install the dust covers to the connectors.
13. Open the tap at the rear of the station to drain the refrigerant oil.
14. Measure and record the quantity of refrigerant oil recovered from the system.
15. Close the tap at the rear of the station.

16. **Evacuation:** Remove the dust covers from the high and low pressure connections.

17. Connect the high and low pressure lines to the appropriate connections.

18. Open the valves on the connections.

19. Turn the valves on the station to the correct positions.

20. Turn the process switch to the correct position.

21. Turn the main switch to 'ON'.

22. Allow the station to evacuate the A/C system.

23.  CAUTION: The system must be evacuated immediatley before recharging commences. Delay between evacuation and recharging is not permitted

    Recharging: Close the valves on the refrigerant station.

24. Close the valve on the oil charger.

25. Disconnect the yellow line from the refrigerant station.

26. Remove the cover from the oil charger.

27. Pour the correct quantity of refrigerant oil into the oil charger.

28. Install the cover to the oil charger.

29. Connect the yellow line to the refrigerant station.

30. Open the valve on the oil charger.

31. Move the pointer on the refrigerant gauge to mark the position of the refrigerant drop.

32. Slowly open the correct valve on the refrigerant to allow the vacuum to pull the refrigerant into the system.

33. Close the valve on the refrigerant station when the correct amount of refrigerant has been drawn into the air conditioning system.

34. Turn the main switch 'OFF'.

35. Close the valves on the connections.

36. Disconnect the high and low pressure connections.

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Climate Control System - General Information - Air Conditioning (A/C) Compressor Commissioning

General Procedures

Activation

 CAUTION: Failure to follow this instruction may result in damage to the component.

1. Set the ignition to the on position, make sure the air conditioning (A/C) is in the off position.
2. Start the engine and allow to run for a minimum of 5 minutes.
3. Set the heater controls to 22°C, with the fan speed set to 75%.
4. Switch on the A/C system.
5. Open all air vents in the dashboard.
6. Run the A/C system for a minimum of 5 minutes, while the engine is still at idle speed.
7. Once this is achieved the compressor is stabilized, with the oil being distributed evenly throughout the system.

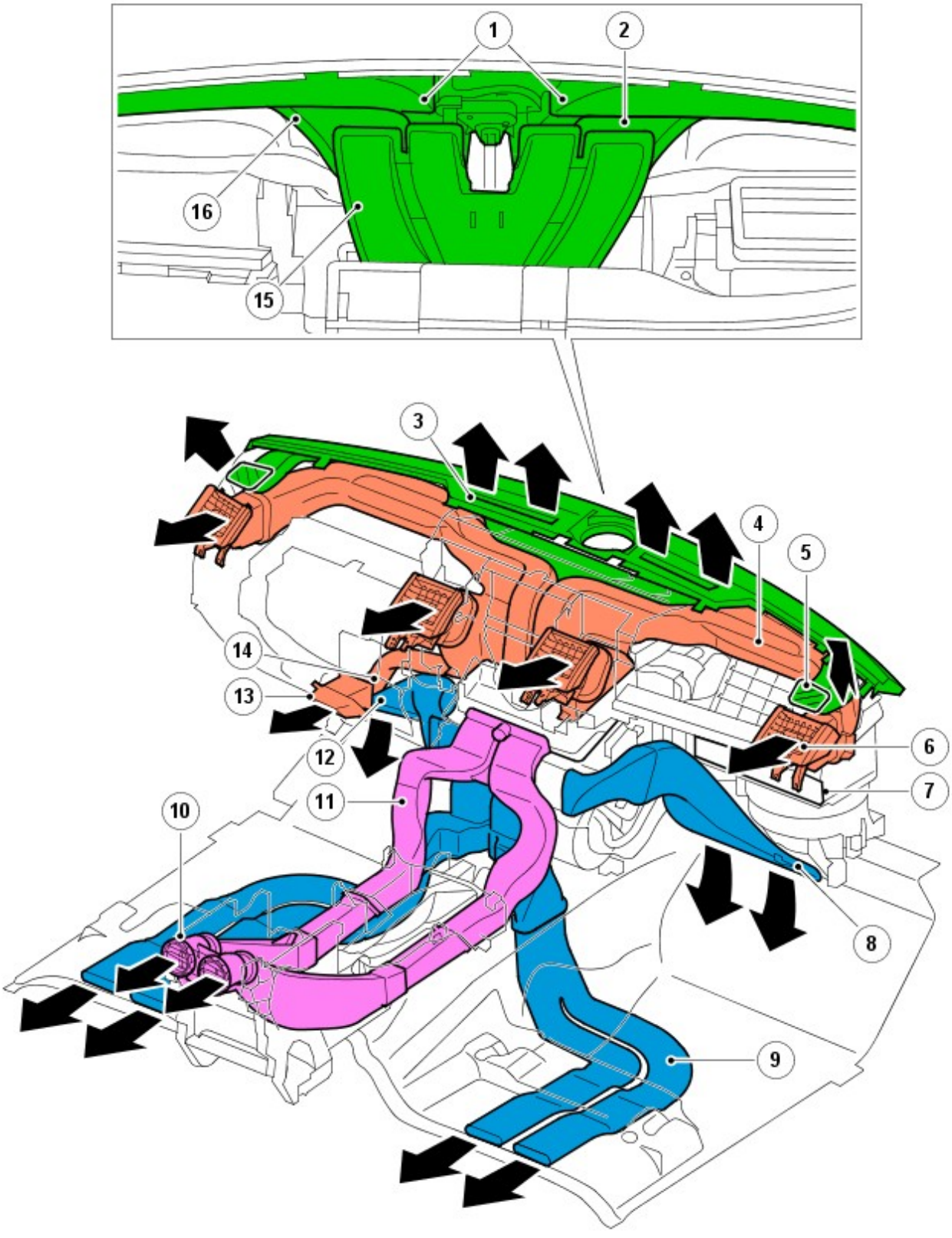
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Air Distribution and Filtering - Air Distribution and Filtering

Description and Operation

COMPONENT LOCATIONS

NOTE: left-hand drive (LHD) installation shown, right-hand drive (RHD) similar



E54969

Item	Part Number	Description
1	-	Side window ducts
2	-	Windshield duct

3	-	Windshield vent
4	-	Instrument panel register duct
5	-	Side window vent
6	-	Instrument panel register
7	-	Cabin air filter
8	-	Front passenger footwell duct
9	-	Second row footwell duct
10	-	Second row register
11	-	Second row register duct
12	-	Driver footwell duct
13	-	Driver lap register
14	-	Driver lap register duct
15	-	Heater outlet manifold
16	-	Windshield duct

GENERAL

The air distribution and filtering system controls the distribution and quality of air supplied to the vehicle interior. The system consists of:

- Air ducts.
- Air registers and vents.
- A cabin air filter.

AIR DUCTS

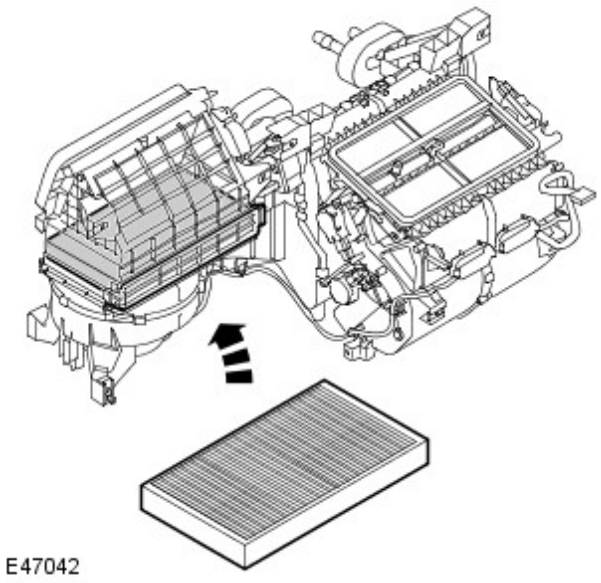
The air ducts distribute the air from the heater to the various registers and air vents around the vehicle interior. The air ducts for the instrument panel registers, the driver lap register and the second row registers are connected to the heater outlet manifold on top of the heater. The air ducts for the front and second row footwells are connected direct to outlet ports on the heater. The air ducts for the windshield vents and the side window vents form part of the structure of the instrument panel.

AIR REGISTERS AND VENTS

The air registers allow occupants to control the flow and direction of air from the air ducts. The driver lap register has moveable vanes to regulate the flow and direction of the air. The instrument panel and second row registers each have a thumbwheel to regulate flow, and moveable vanes to control direction.

The air vents are fixed outlets either integrated into the end of the air duct or installed in the trim panel connected to the air duct.

CABIN AIR FILTER



The cabin air filter is a combined pollen and odor filter installed in the air inlet duct. The filter removes particulates and unpleasant odors from the fresh and recirculated air entering the blower.

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Air Distribution and Filtering - Air Distribution and Filtering

Diagnosis and Testing

Principles of Operation

For a detailed description of the air distribution and filtering system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Air Distribution and Filtering (412-01 Air Distribution and Filtering, Description and Operation).

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious mechanical faults.

Mechanical
• Air ducts (blocked/damaged) • Air vents (blocked/damaged) • Pollen filter (blocked/contaminated)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Automatic Temperature Control Module (ATC) (100-00 General Information, Description and Operation).

Published: 11-May-2011

Air Distribution and Filtering - Driver Side Register Trim Panel

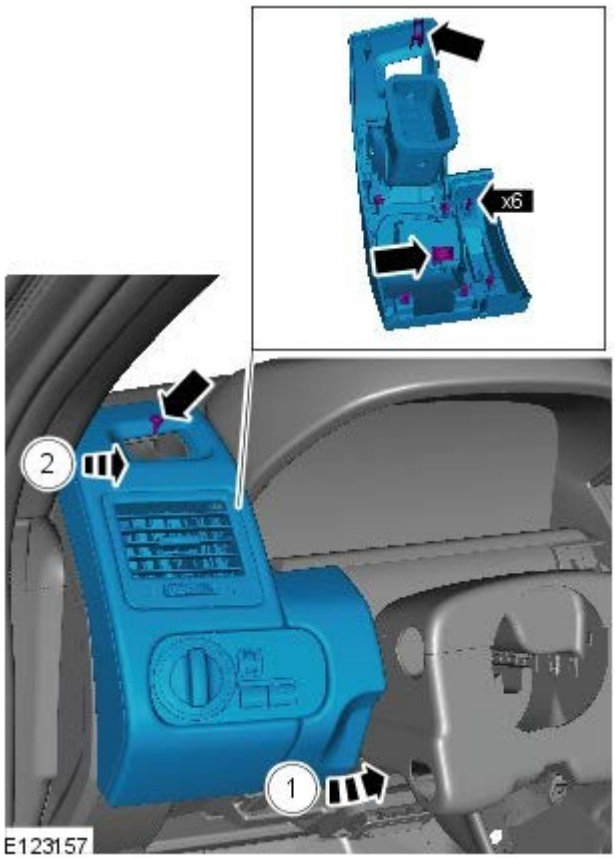
Removal and Installation

Removal

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

1.





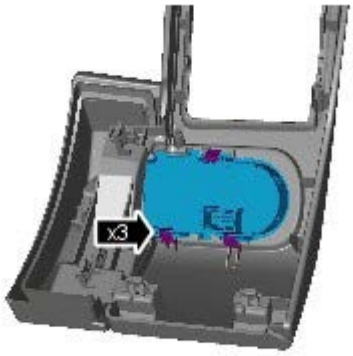
2. NOTE: To install, reverse the removal sequence.

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



E123158

4.



E123159

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Air Distribution and Filtering - Passenger Side Register Trim Panel

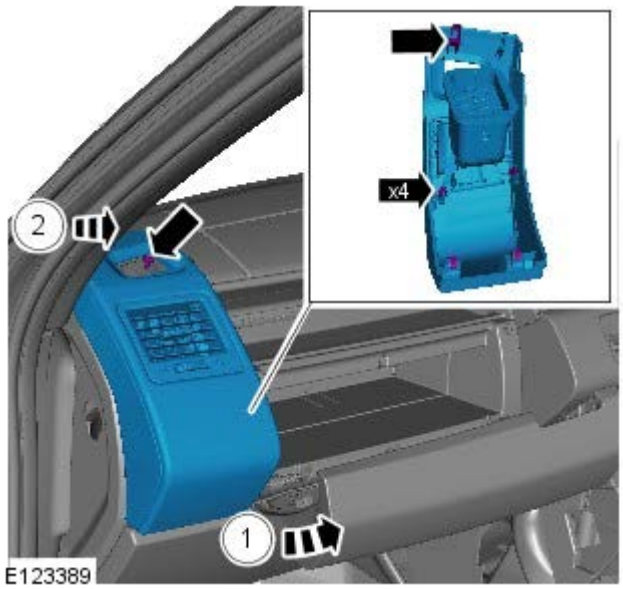
Removal and Installation

Removal

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

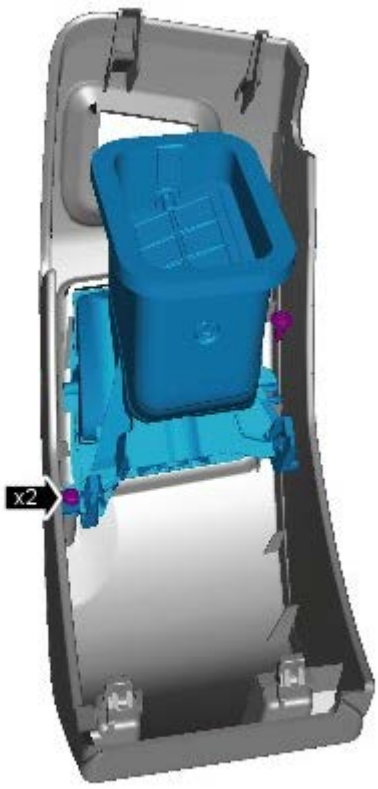
1.





2. NOTE: To install, reverse the removal sequence.

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



E123390

Installation

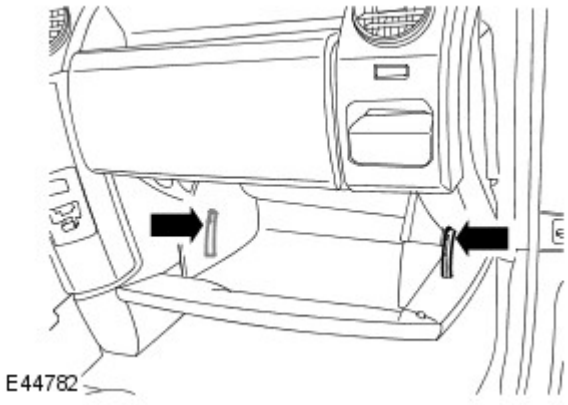
1. To install, reverse the removal procedure.

Published: 11-May-2011

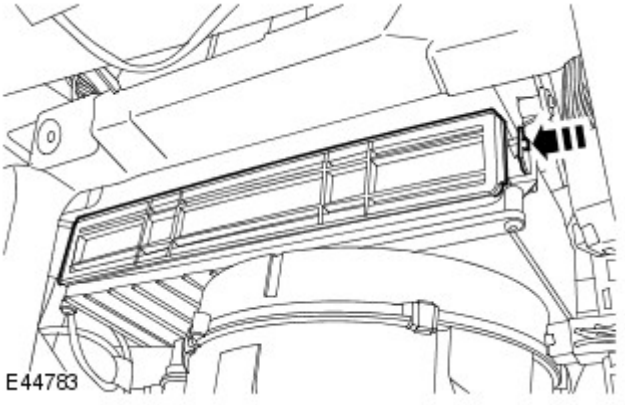
Air Distribution and Filtering - Pollen Filter

Removal and Installation

Removal



1. Open the glove compartment to the service condition.
    - Release the glove compartment latch stops.



2. Remove the pollen filter housing cover.
3. Remove the pollen filter.

Installation

1. To install, reverse the removal procedure.
    - Clean the component mating faces.

Published: 11-May-2011

Air Distribution and Filtering - Plenum Chamber

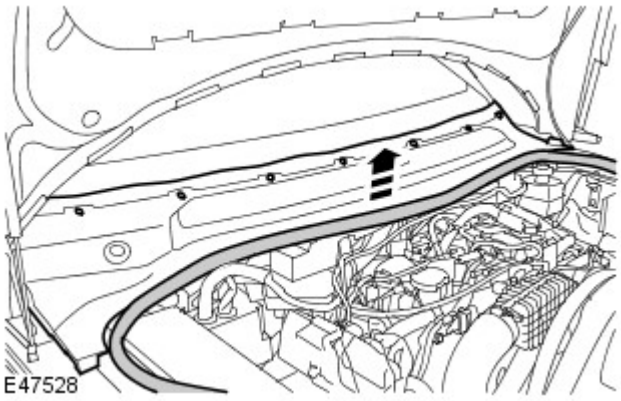
Removal and Installation

Removal

1. Remove the A-pillar mouldings.
   For additional information, refer to: A-Pillar Moulding LH (501-08, Removal and Installation).

2. Remove the windshield wiper arms.
   For additional information, refer to: Front Wiper Pivot Arm (501-16, Removal and Installation).

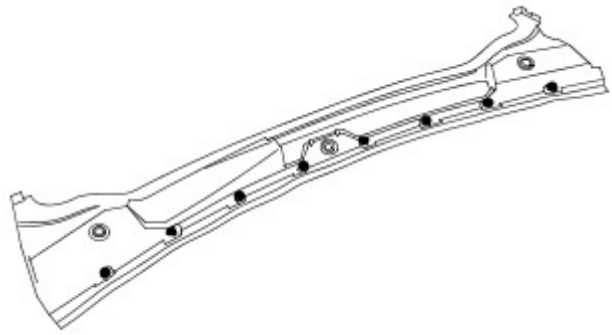
3. Release the hood seal from the plenum chamber.


E47528

4. Remove the plenum chamber panel.
   - Release the 8 clips.

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

   Remove the clips from the plenum chamber panel.


E47529

Installation

1. To install, reverse the removal procedure.

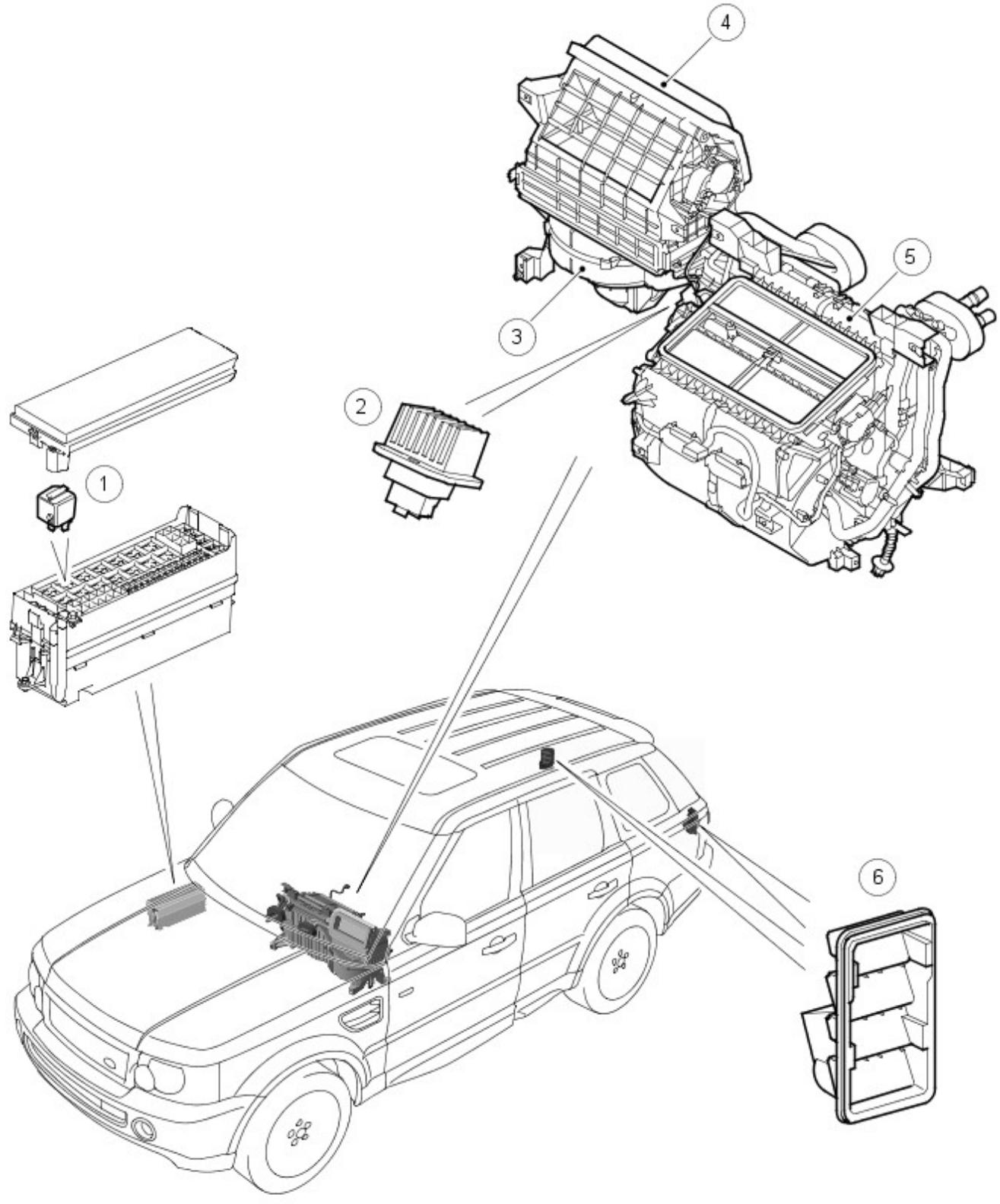
Published: 11-May-2011

Heating and Ventilation - Heating and Ventilation

Description and Operation

COMPONENT LOCATIONS

NOTE: right-hand drive (RHD) installation shown, left-hand drive (LHD) similar



E54966

Item	Part Number	Description
1	-	Blower relay
2	-	Blower control module

3	-	Blower
4	-	Air inlet duct
5	-	Heater
6	-	Ventilation outlets

GENERAL

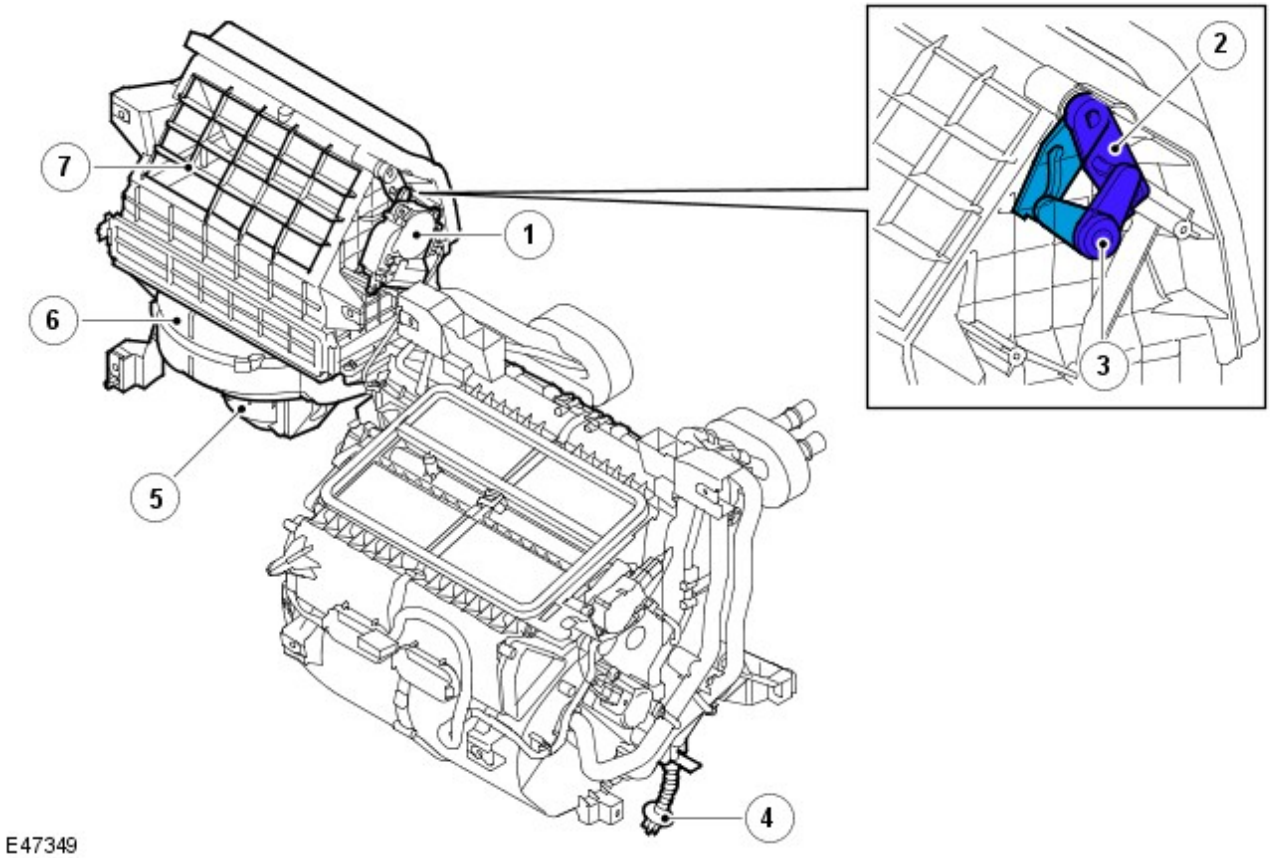
The heating and ventilation system controls the temperature and flow of air supplied to the vehicle interior. The system consists of:

- An air inlet duct.
- A blower.
- A blower control module.
- A blower relay.
- A heater.
- Two ventilation outlets.

Fresh or recirculated air flows into the heater assembly from the inlet duct. The blower, and ram effect when the vehicle is moving, forces the air through the heater assembly. Air from the cabin exhausts through the ventilation outlets.

AIR INLET DUCT

NOTE: RHD version shown, LHD mirror image



Item	Part Number	Description
1	-	Recirculation door motor
2	-	Recirculation door arm
3	-	Recirculation motor arm
4	-	Evaporator drain tube
5	-	Blower
6	-	Air inlet duct
7	-	Recirculation air inlet

The air inlet duct is installed behind the instrument panel, on the front passenger side, and connected between the plenum chamber below the windshield and the heater.

The plenum chamber is formed by the upper and lower cowl and a plenum molding. Grilles in the plenum molding allow fresh air into the plenum chamber. From the plenum chamber, the air passes through a water separator and into the fresh air inlet of the air inlet duct.

The air inlet duct incorporates a grille to provide the inlet for recirculated air from the vehicle interior. The air inlet duct also accommodates:

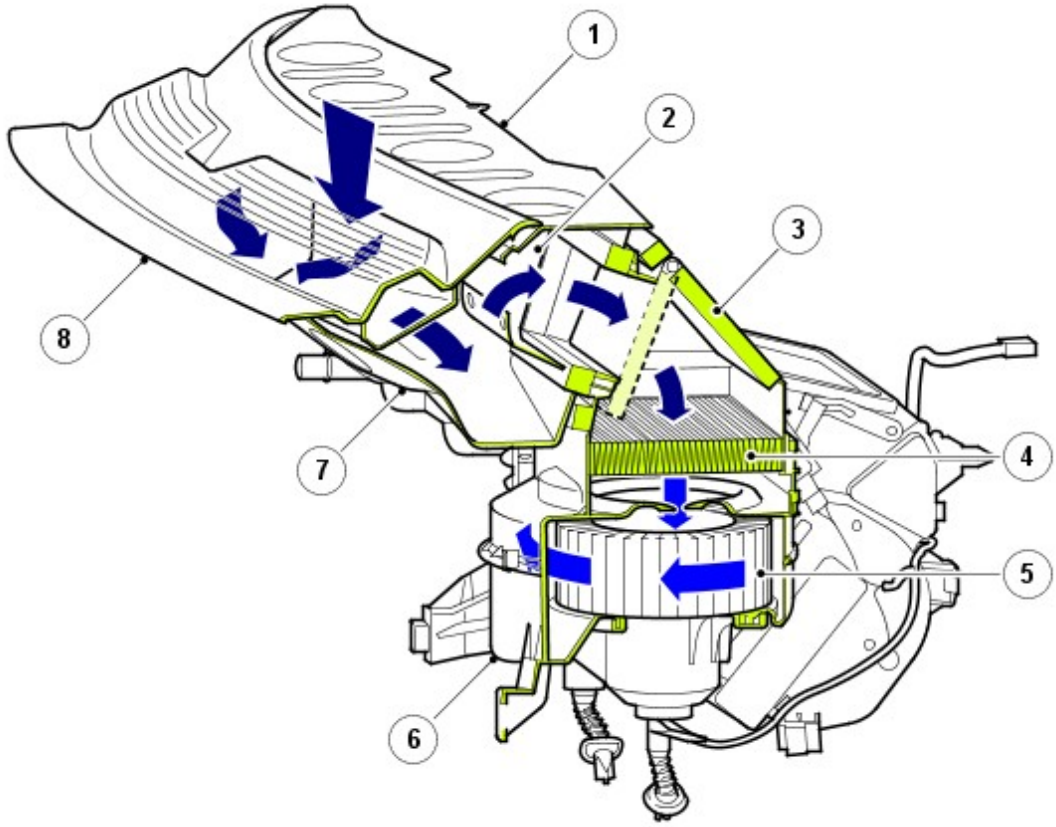
- The cabin air filter.
  For additional information, refer to: Air Distribution and Filtering (412-01 Air Distribution and Filtering, Description and Operation).
- The blower.
- The blower control module.

The outlet from the air inlet duct forms the rear wall of the heater, enclosing the evaporator and incorporating the two evaporator drain outlets. Drain tubes connect the evaporator drain outlets to the transmission tunnel, to direct the water that condenses on the evaporator overboard.

A recirculation door is installed between the fresh and recirculated air inlets, to control the source of incoming air. A lever on the recirculation door is driven by the recirculation door motor. Operation of the recirculation door motor is automatically controlled by the automatic temperature control (ATC) module and manually controlled by a switch on the ATC module control panel.
For additional information, refer to: Control Components (412-04 Control Components, Description and Operation).

Fresh or recirculated air enters the air inlet duct and passes through the cabin air filter to the hub of the blower. From the blower, the air flows to the outlet of the air inlet duct and into the heater. The blower, and ram effect from the forward motion of the vehicle, forces the air through the air inlet duct.

Air Flow Through Air Inlet Duct



E47350

Item	Part Number	Description
1	-	Upper cowl
2	-	Water separator
3	-	Recirculation door
4	-	Cabin air filter
5	-	Blower
6	-	Air inlet duct casing
7	-	Lower cowl
8	-	Plenum molding

BLOWER

The blower is installed in the air inlet duct, below the cabin air filter, and consists of an open hub, centrifugal fan powered by an electric motor. Operation of the blower is controlled by the ATC module, using the blower relay in the battery junction box (BJB) and the blower control module. The blower control module is installed in the air inlet duct downstream of the blower, where any heat generated during operation is dissipated by the air flow. A wiring harness on the air inlet duct connects the recirculation door motor, blower and blower control module to the vehicle wiring.

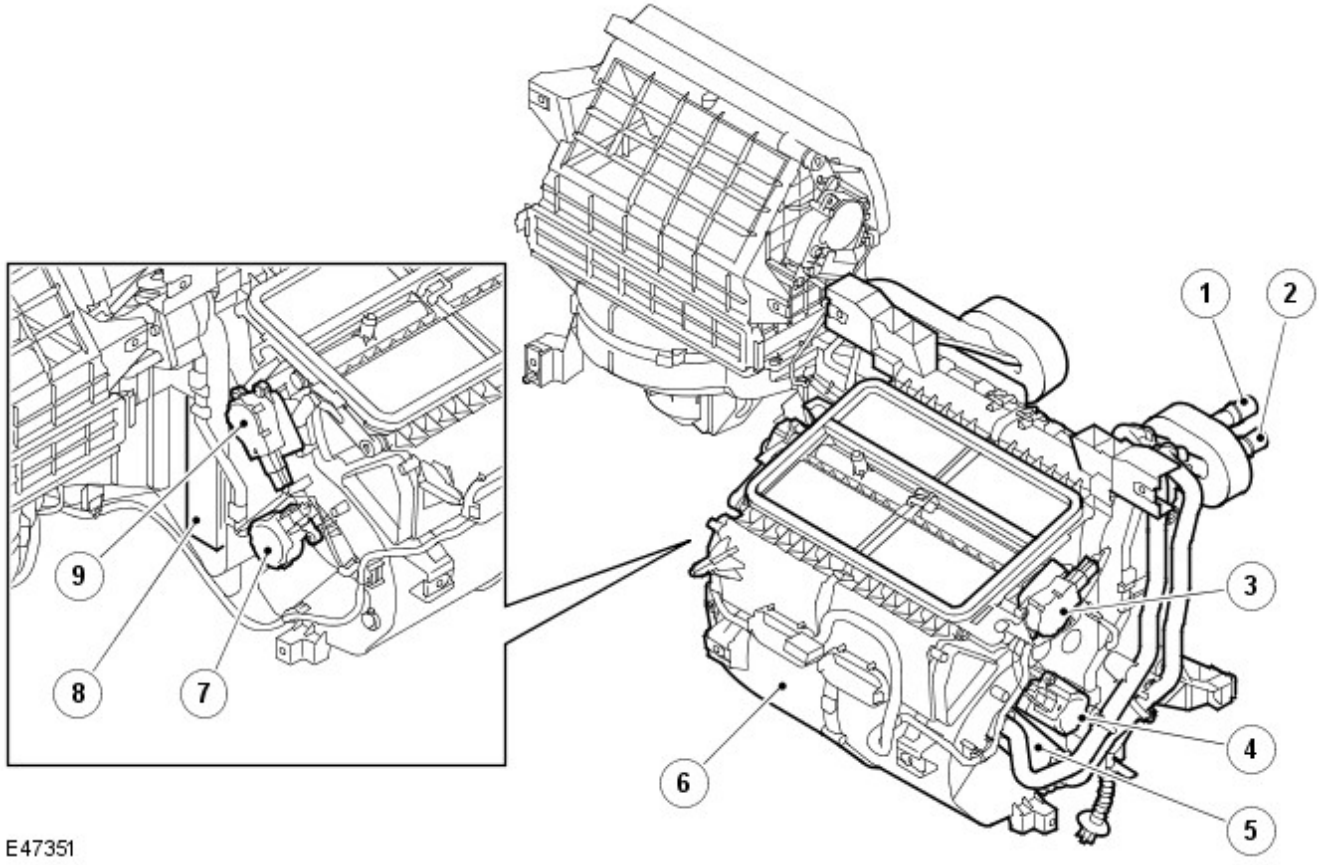
When the blower is required, the ATC module energizes the coil of the blower relay. The energized blower relay supplies battery power to the blower motor, which is connected to ground through the blower control module. The speed of the blower is controlled by the blower control module, which regulates the blower motor voltage in response to a pulse width modulation (PWM) signal from the ATC module. To vary the blower motor voltage the ATC module

varies the duty cycle of the PWM signal.

When the blower is in the automatic mode the ATC module determines the blower speed required from the comfort algorithms. When the blower is in the manual mode, the ATC module operates the blower at one of seven fixed speeds as selected on the control panel.
For additional information, refer to: Control Components (412-04, Description and Operation).

HEATER

NOTE: RHD unit shown, LHD units similar



Item	Part Number	Description
1	-	Coolant outlet pipe
2	-	Coolant inlet pipe
3	-	Windshield distribution door motor
4	-	right-hand (RH) temperature blend motor
5	-	Heater core
6	-	Heater casing
7	-	left-hand (LH) temperature blend motor
8	-	Evaporator
9	-	Face and feet distribution door motor

The heater controls the temperature of the air supplied to the distribution ducts, as directed by the ATC module. The heater is installed on the vehicle center-line, between the instrument panel and the engine bulkhead. The heater consists of a casing, formed from plastic moldings, which contains an evaporator, heater core and control doors. Internal passages integrated into the casing guide the air through the casing and separate it into two flows, one for the LH outlets and one for the RH outlets.

When the air conditioning (A/C) system is operating, the evaporator cools the air entering the heater.

The heater core provides the heat source to warm the air being supplied to the distribution ducts. The heater core is an aluminum two pass, fin and tube heat exchanger, installed across the width of the heater housing. Two aluminum tubes attached to the heater core extend through the engine bulkhead to connect with the engine cooling system. When the engine is running, coolant is constantly circulated through the heater matrix by the coolant pump. On vehicles with a FFBH (fuel fired booster heater), when the FFBH is active the coolant flow is assisted by an electric circulation pump.
For additional information, refer to: Auxiliary Heater (412-02B Auxiliary Heating, Description and Operation).

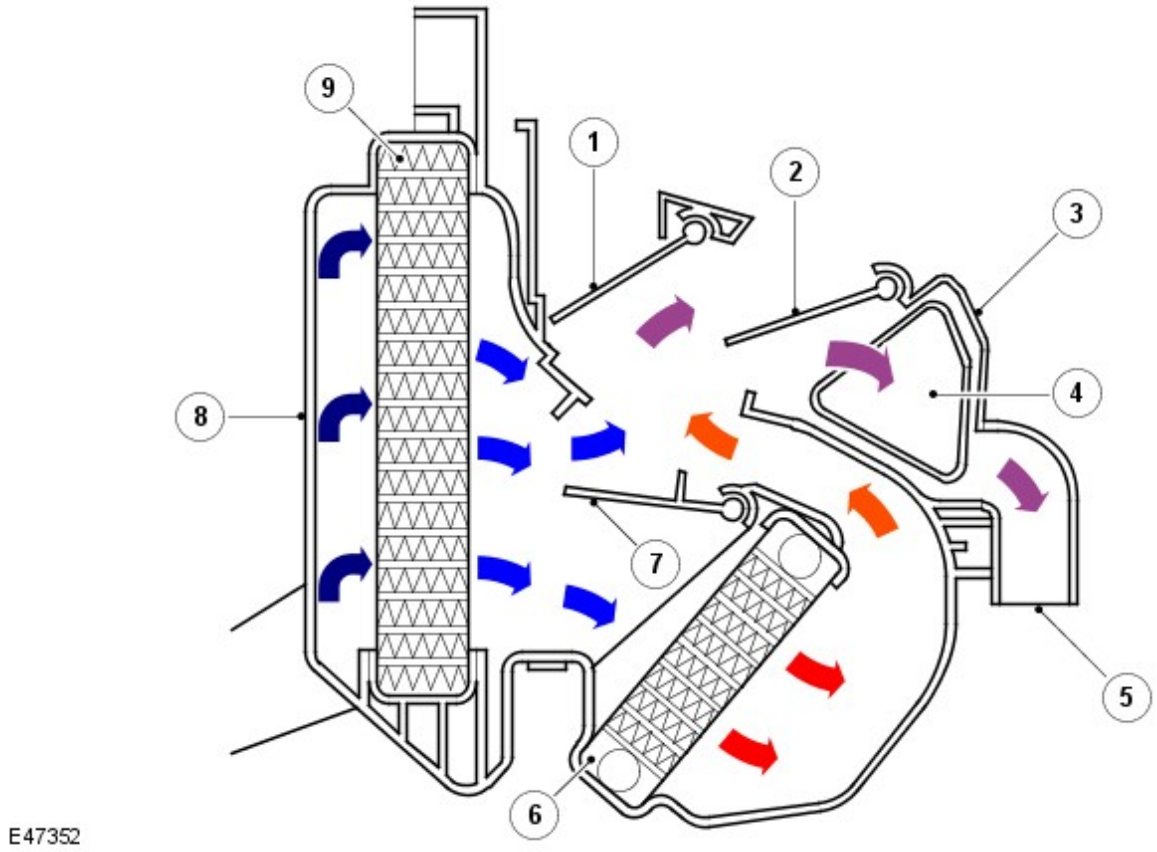
Two temperature blend doors, one LH and one RH, regulate the flow of air through the heater core to control the temperature of the air leaving the heater. The two temperature blend doors operate independently to allow different temperatures to be set for the LH and RH outlets. Each temperature blend door is driven by a separate stepper motor.

A drive arm is attached to the drive spindle of each temperature blend door stepper motor. The end of the stepper

motor drive arm engages with a slot in the drive arm of the related temperature blend door.

Operation of the temperature blend door stepper motors is controlled by the ATC module.
For additional information, refer to: Control Components (412-04 Control Components, Description and Operation).

Air Flow Through Heater



Item	Part Number	Description
1	-	Windshield distribution door
2	-	Face and feet distribution door
3	-	Heater casing
4	-	Front footwell outlet
5	-	Rear footwell outlet
6	-	Heater core
7	-	Temperature blend door
8	-	Air inlet duct casing
9	-	Evaporator

VENTILATION OUTLETS

The ventilation outlets promote the free flow of air through the passenger compartment. The outlets are installed in the LH and RH rear quarter body panels, behind the tail lamps.

Each ventilation outlet consists of a grille covered by soft rubber flaps and is effectively a non-return valve. The flaps open and close automatically depending on the differential between cabin and outside air pressures.

Published: 20-Aug-2012

Heating and Ventilation - Heating and Ventilation

Diagnosis and Testing

Principles of Operation

For a detailed description of the heating and ventilation system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Heating and Ventilation (412-02A Heating and Ventilation, 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. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Front End Accessory Drive (FEAD) belt • Intake ducts blocked/restricted • Cabin air filter • Coolant level • Air in cooling system • Cooling fan • Distribution motors and flaps	• Fuses • Harnesses and connectors • Blower relay • Blower control module • Blower motor assembly • Cooling fan • Automatic temperature control module • Actuators

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Air intake stuck in one position	• Sensor fault • Distribution motor fault	• Using the manufacturer approved diagnostic system, check the automatic temperature control module for related DTCs and refer to the relevant DTC index • Refer to the relevant section of the workshop manual and perform the distribution motor self-test
Excessive blower noise	• Blower mechanical fault • Debris drawn into the blower • Solar sensor fault	• Check for mechanical faults / debris in the blower motor or fixings • Using the manufacturer approved diagnostic system, check the automatic temperature control module for related DTCs and refer to the relevant DTC index
Unable to control the air flow or temperature	• Distribution motor fault(s) • Automatic temperature control module fault	• Using the manufacturer approved diagnostic system, check the automatic temperature control module for related DTCs and refer to the relevant DTC index • Refer to the relevant section of the workshop manual and perform the distribution motor self-test
No hot air	• Cooling system fault • Viscous fan locked • Distribution motor fault(s) • Automatic temperature control module fault	• Check the coolant level • Test the operation of the viscous fan • Refer to the relevant section of the workshop manual and perform the distribution motor self-test • Using the manufacturer approved diagnostic system, check the automatic temperature control module for related DTCs and refer to the relevant DTC index

DTC Index

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

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Automatic Temperature Control Module (ATC) (100-00 General Information, Description and Operation).

Published: 11-May-2011

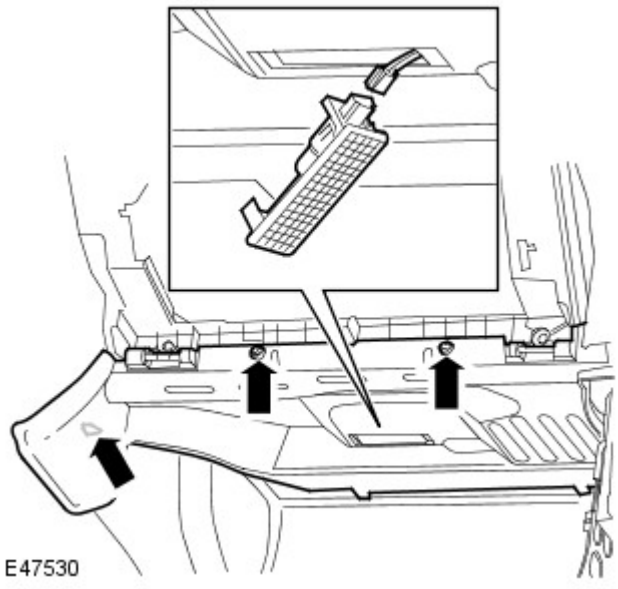
Heating and Ventilation - Blower Motor

Removal and Installation

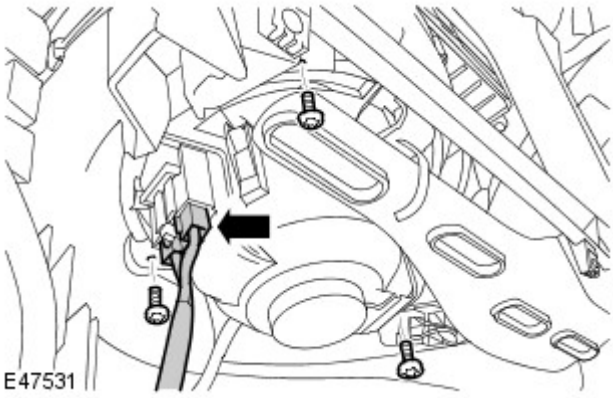
Removal

1. Remove the glove compartment.
   For additional information, refer to: Glove Compartment (501-12, Removal and Installation).

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



3. Position the footwell duct aside for access.
   - Release the clip.



4. Remove the blower motor.
   - Disconnect the electrical connector.
   - Remove the 3 screws.

Installation

1. CAUTION: Fixings must be started by hand to avoid damaging threads.

   Install the blower motor.
   - Tighten the screws.
   - Connect the electrical connector.

2. Secure the footwell duct.
   - Install the clip.

3. Install the closing trim panel.
   - Connect the electrical connector.
   - Secure the clip.
   - Tighten the screws.

4. Install the glove compartment.
   For additional information, refer to: Glove Compartment (501-12, Removal and Installation).

Published: 25-Nov-2013

Heating and Ventilation - Heater Core LHD AWD

Removal and Installation

Removal

1. Remove the engine cover.

2. Evacuate 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).

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

   Raise and support the vehicle.

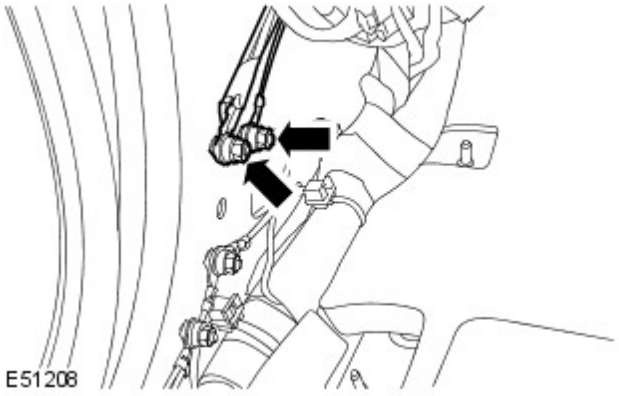
4. Drain the cooling system.
   For additional information, refer to: Cooling System Partial Draining, Filling and Bleeding - V8 S/C 5.0L Petrol (303-03B Engine Cooling - V8 5.0L Petrol/V8 S/C 5.0L Petrol, General Procedures).

5. Remove the driver side front seat.
   For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

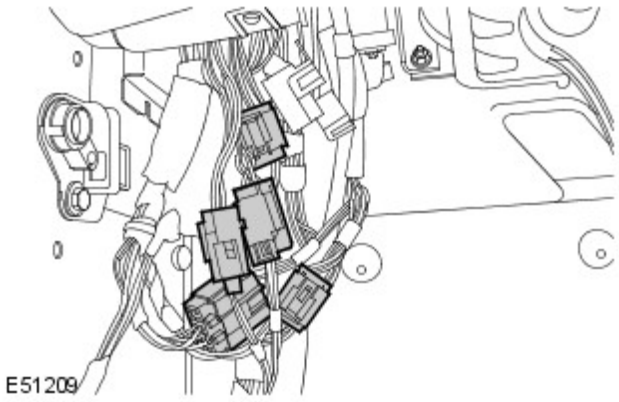
6. Remove the floor console.
   For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

7. Remove the instrument panel upper section.
   For additional information, refer to: Instrument Panel Upper Section (501-12 Instrument Panel and Console, Removal and Installation).

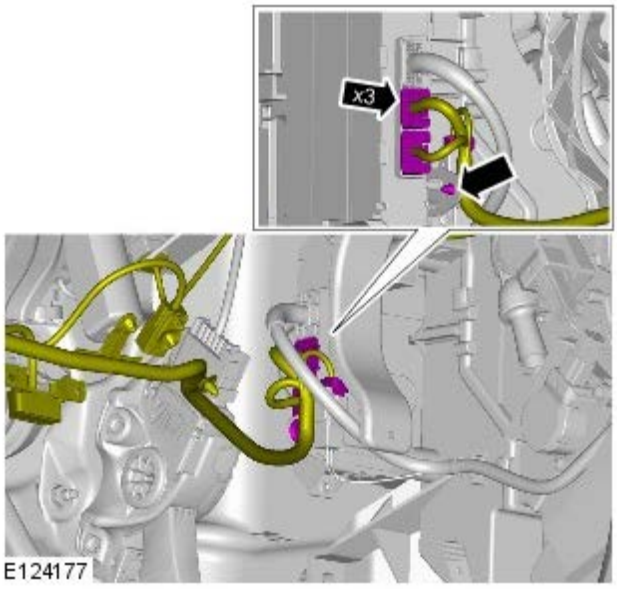
8. Release the 3 ground cables from the driver side lower A-pillar.
   - Remove the 2 nuts.



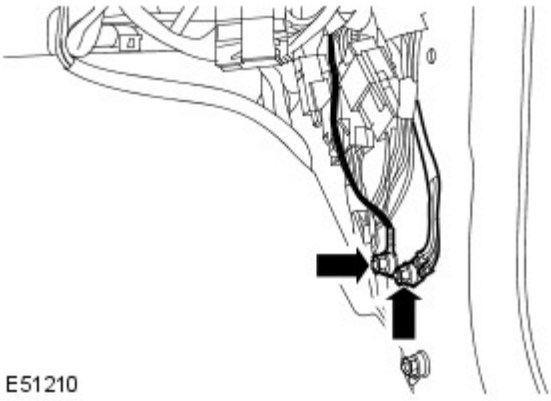
9. Disconnect the 5 electrical connectors from the driver side lower A-pillar.



10. Disconnect the 3 electrical connectors.

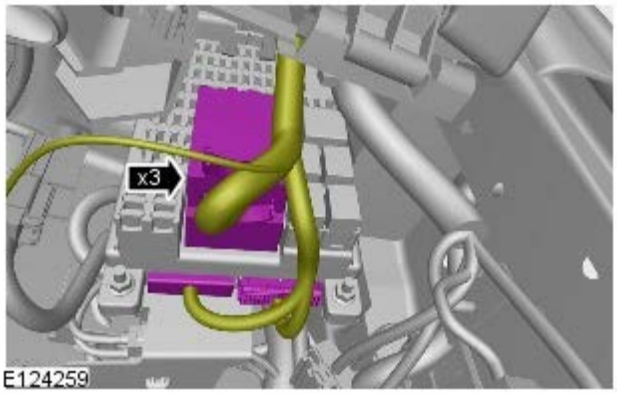


11. Release the 3 ground cables from the passenger side lower A-pillar.
    - Remove the 2 nuts.



12. Disconnect the 5 electrical connectors from the passenger side lower A-pillar.

13. Disconnect the central junction box (CJB) three electrical connectors.



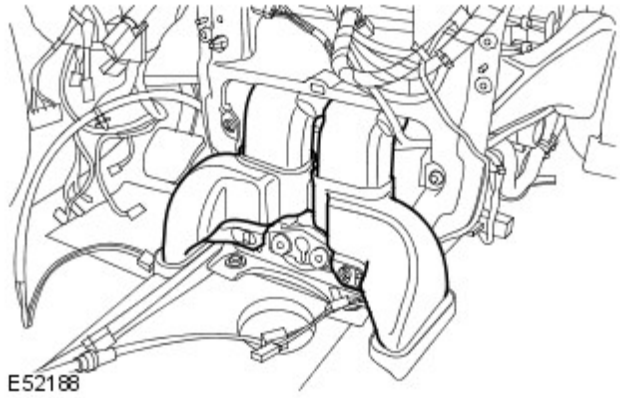
14. Disconnect 2 electrical connectors from the instrument panel center reinforcement.

15. CAUTION: Cover fiber optic cable connectors to minimize dust ingress and avoid bending the cables in a radius of less than 30 mm.

    If installed, disconnect the instrument panel center reinforcement fibre optic cables.
    - Disconnect the electrical connector.



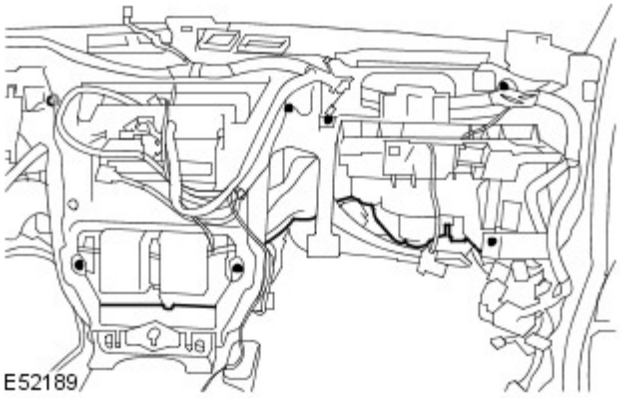
16. Remove the heater housing center ducts.



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

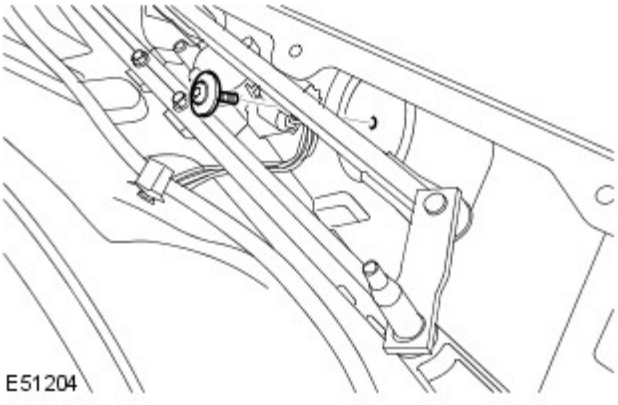


18. Release the heater housing from the instrument panel carrier.
    - Remove the 7 Torx screws.

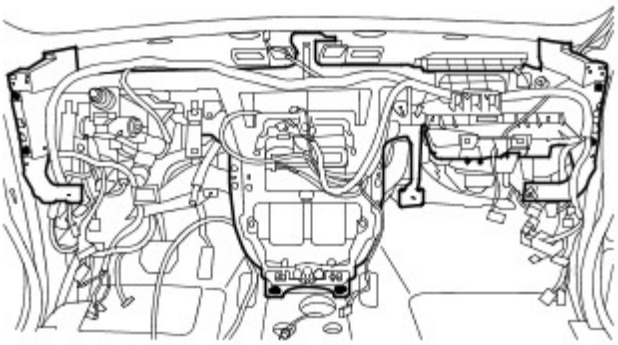


19. Remove the plenum chamber panel.
    For additional information, refer to: Plenum Chamber (412-01 Air Distribution and Filtering, Removal and Installation).

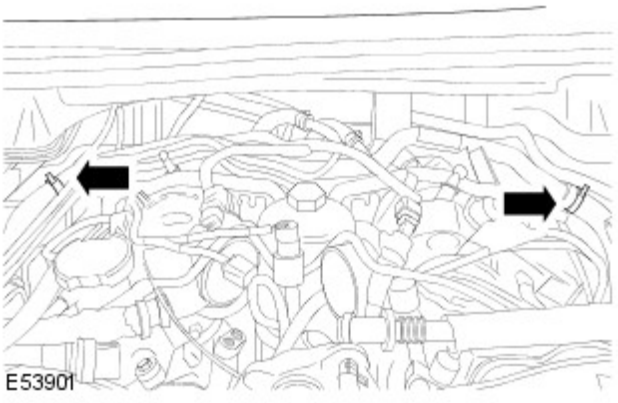
20. Remove the instrument panel carrier to bulkhead Torx bolt.


E51204

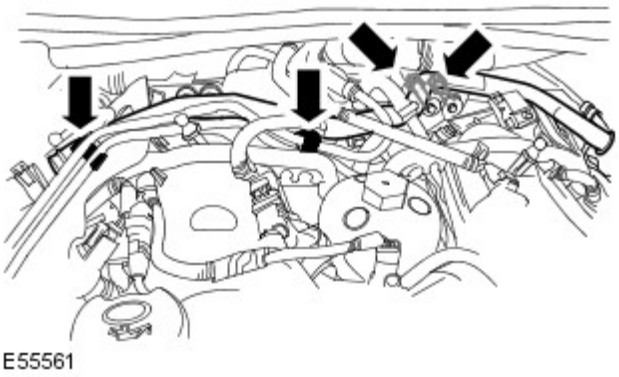
21. With assistance, remove the instrument panel.
    - Remove the 6 Torx bolts.


E52190

22. Disconnect both exhaust gas recirculation (EGR) coolant cross-over pipe hoses.
    - Release the 2 clips.

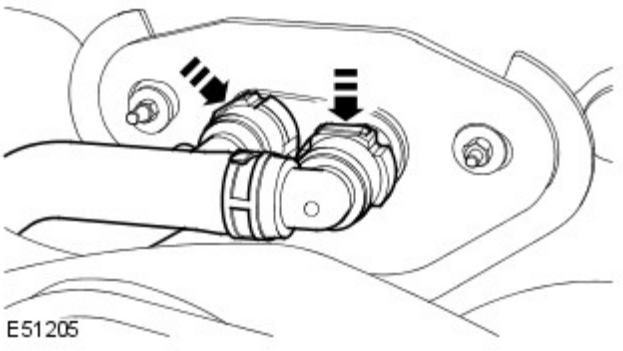

E53901

23. Remove the EGR coolant cross-over pipe.
    - Remove the 2 bolts.
    - Release the 2 clips.


E55561

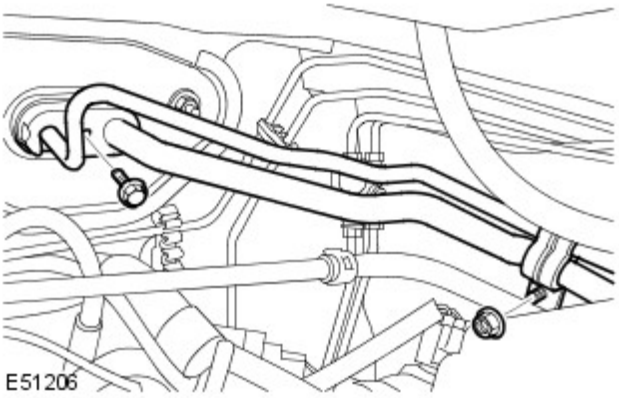
24. CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

    Disconnect 2 heater hoses from the bulkhead.
    - Release the 2 clips.

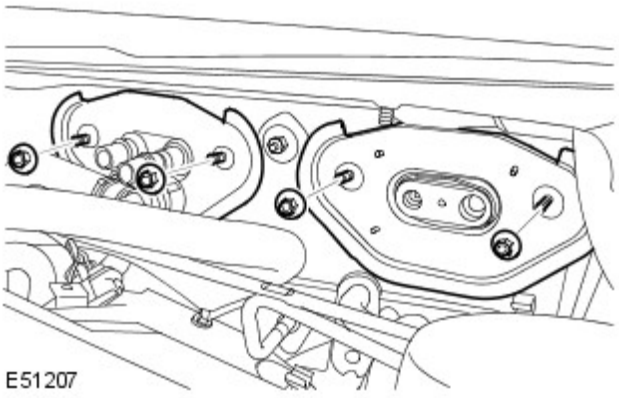


25. CAUTION: Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

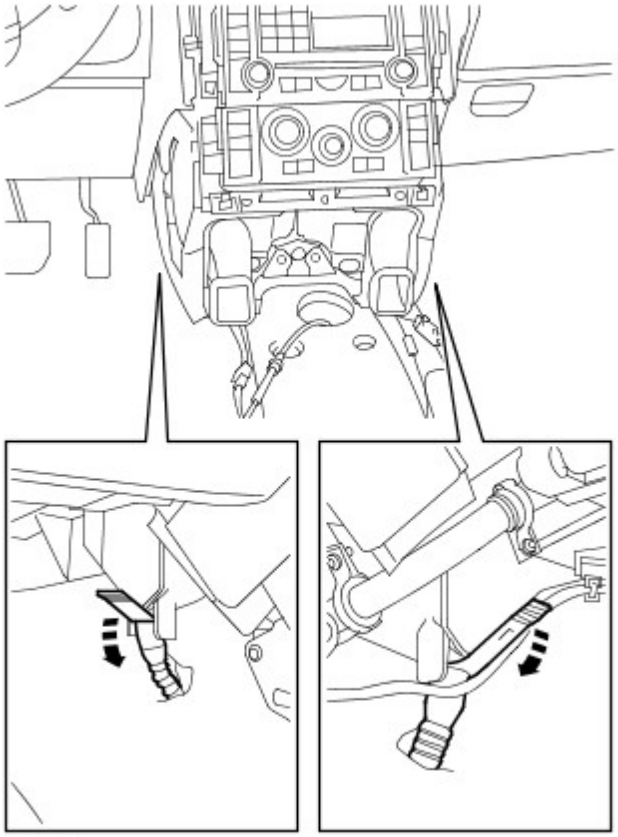
    Release the 2 A/C refrigerant lines.
    - Remove the nut and bolt.
    - Remove and discard the O-ring seals.



26. Remove the 2 adapter panels.
    - Remove the 4 nuts.

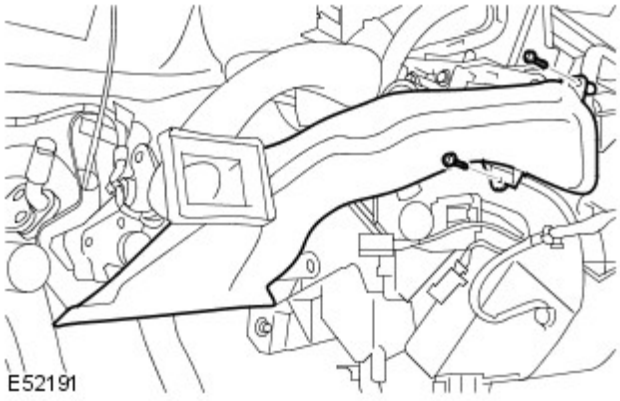


27. Disconnect 2 drain tubes from the heater housing.



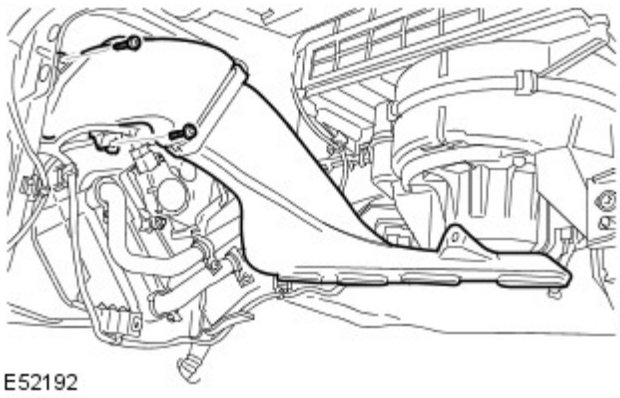
E51199

28. Remove the driver side footwell duct.
    - Remove the 2 Torx screws.



E52191

29. Remove the passenger side footwell duct.
    - Remove the 2 Torx screws.

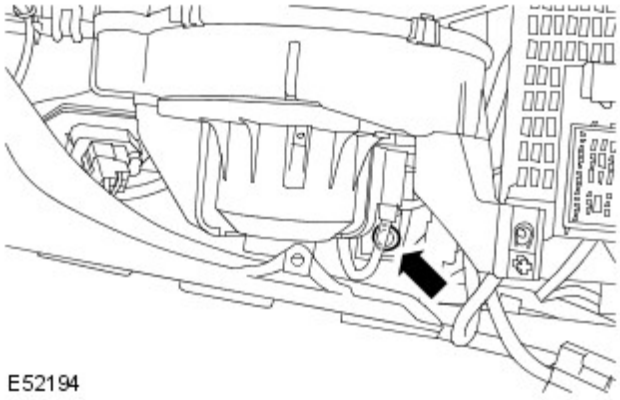


E52192

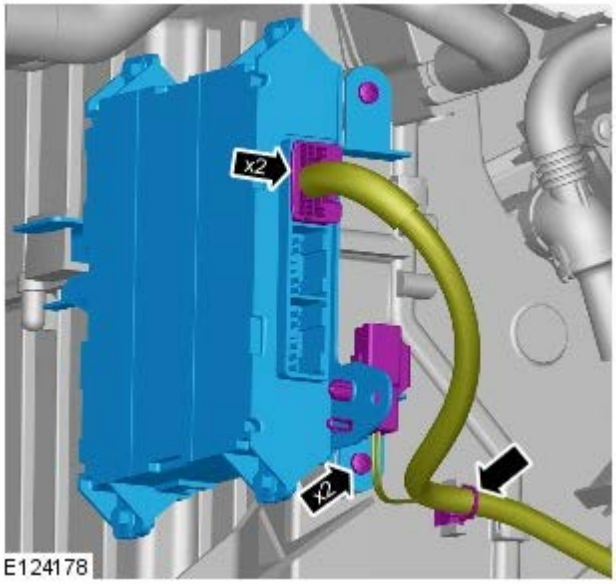
30. Driver side: Remove the heater housing to bulkhead Torx bolt.



31. Passenger side: Remove the heater housing to bulkhead Torx bolt.
    - With assistance, remove the heater and evaporator core housing.



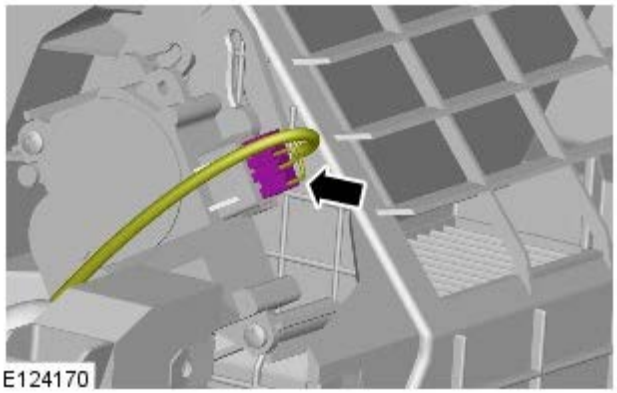
32. Remove the A/C control module.



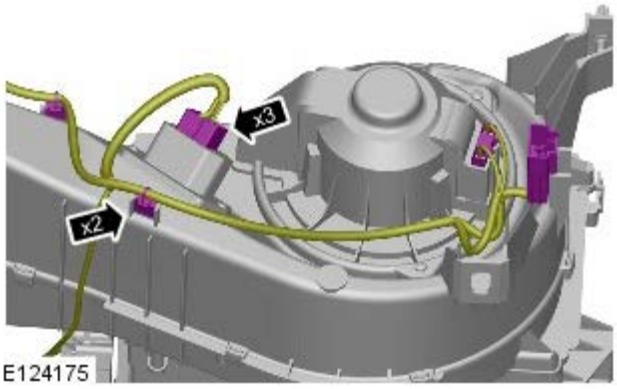
33. Disconnect the evaporator core temperature sensor electrical connector.



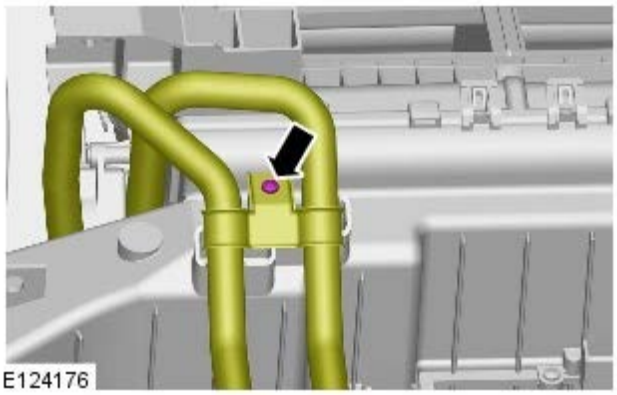
34. Disconnect the electrical connector.



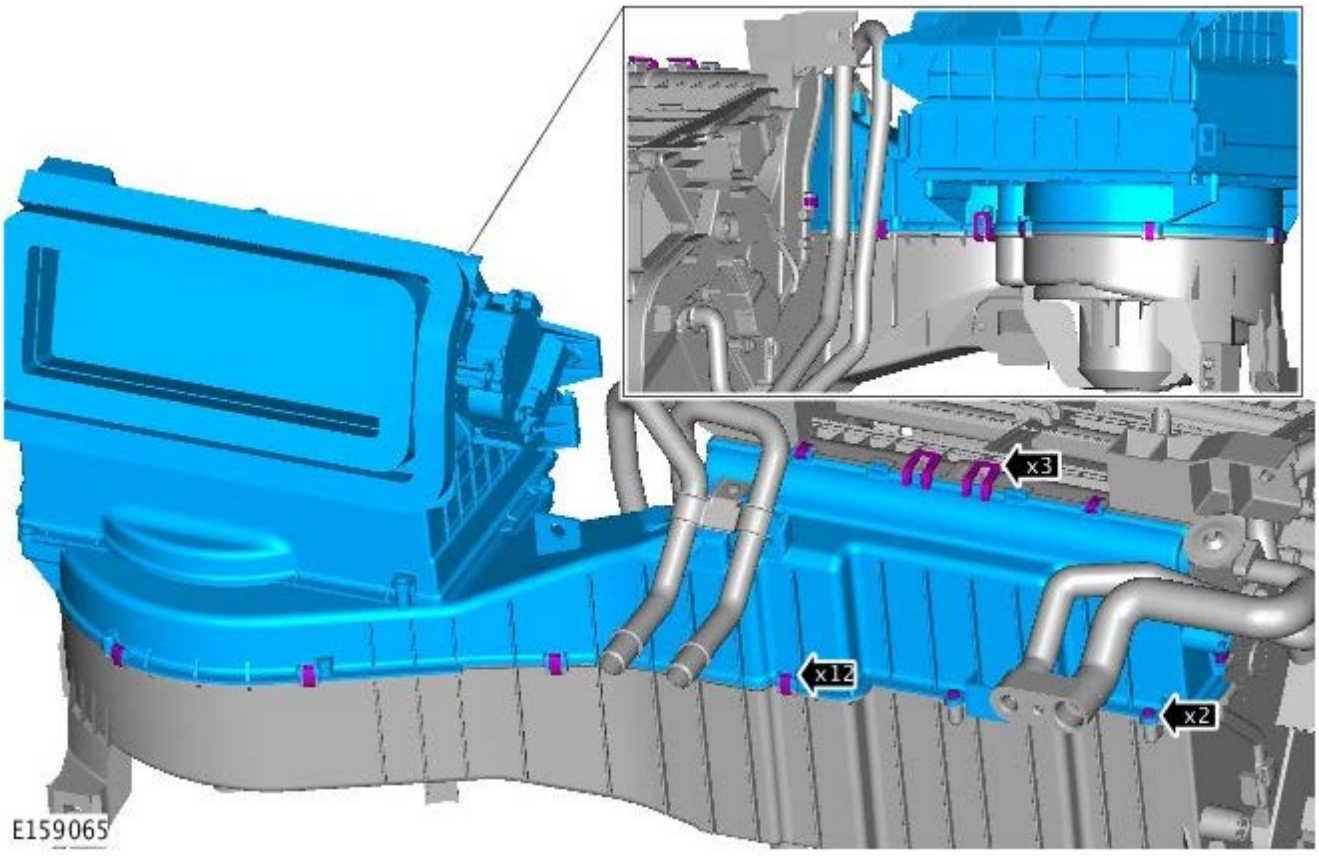
35. Detach the wiring harness.



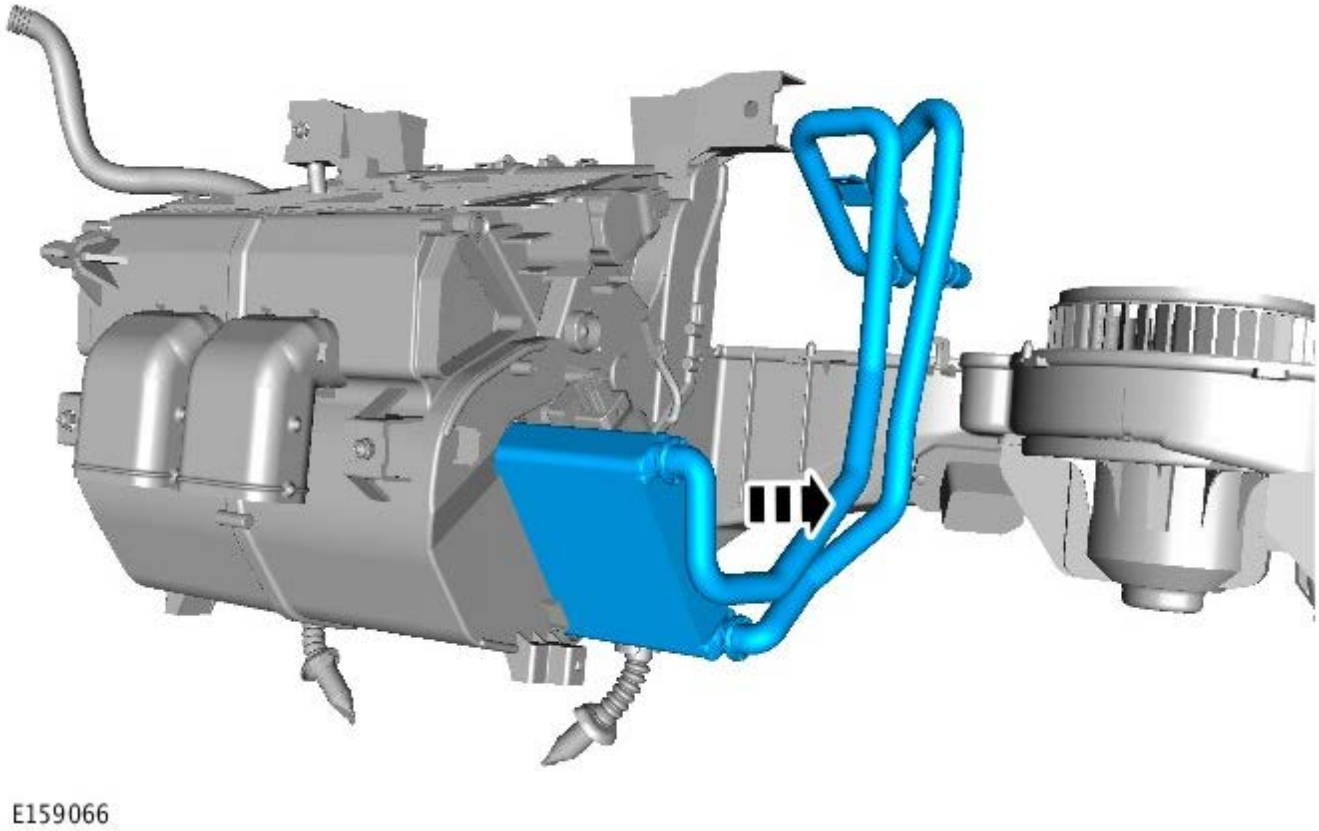
36. Remove the bolt from the support bracket.



37. Remove the 2 screws.
    - Release the 12 clips.
    - Carefully release the 3 clips.



38. Carefully remove the heater core.



Installation

1. Install the heater core.
    - Carefully insert the heater core

2. Secure the heater core housing.
    - Install the clips.

3. Install the wiring harness.

4. Install and tighten the bolt.

5. Connect the temperature sensor electrical connector.

6. Install the CC module.
   - Tighten the bolts.

7. Passenger side: Install the heater housing to bulkhead Torx bolt and tighten to 6 Nm (4 lb.ft).
   - With assistance, install the heater and evaporator core housing.

8. Driver side: Install the heater housing to bulkhead Torx bolt and tighten to 6 Nm (4 lb.ft).

9. Install the footwell ducts.
   - Tighten the Torx screws.

10. Connect the drain tubes to the heater housing.

11. Install the adapter panels.
    - Tighten the nuts to 6 Nm (4 lb.ft).

12. Secure the A/C refrigerant lines.
    - Clean the components.
    - Install new O-ring seals.
    - Tighten the bolt to 5 Nm (4 lb.ft).
    - Tighten the nut to 6 Nm.

13. Connect the bulkhead heater hoses.

14. Install the EGR coolant cross-over pipe.
    - Tighten the bolts to 10 Nm (7 lb.ft).
    - Secure the clips.
    - Connect the hoses and secure with the clips.

15. With assistance, install the instrument panel.
    - Tighten the Torx bolts to 25 Nm (18 lb.ft).

16. Install the instrument panel carrier to bulkhead Torx bolt and tighten to 25 Nm (18 lb.ft).

17. Install the plenum chamber panel.
    For additional information, refer to: Plenum Chamber (412-01 Air Distribution and Filtering, Removal and Installation).

18. Secure the heater housing.
    - Tighten the screws.

19. Connect the steering column intermediate shaft.
    - Install the special bolt and tighten the new nut to 22 Nm (16 lb.ft).

20. Install the heater housing center ducts.

21. Connect the instrument panel center reinforcement fibre optic cables.

22. Connect the instrument panel center reinforcement electrical connectors.

23. Connect the CJB electrical connectors.

24. Connect the electrical connectors to the passenger side lower A-pillar.

25. Connect the ground cables to the passenger side lower A-pillar.
    - Tighten the nuts to 10 Nm (7 lb.ft).

26. Connect the electrical connectors to the driver side lower A-pillar.

27. Connect the ground cables to the driver side lower A-pillar.

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

28. Connect the 3 electrical connectors.

29. Install the instrument panel upper section.
    For additional information, refer to: Instrument Panel Upper Section (501-12 Instrument Panel and Console, Removal and Installation).

30. Install the floor console.
    For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

31. Install the front seat.
    For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

32. 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).

33. Refill the cooling system.
    For additional information, refer to: Cooling System Partial Draining, Filling and Bleeding - V8 S/C 5.0L Petrol (303-03B Engine Cooling - V8 5.0L Petrol/V8 S/C 5.0L Petrol, General Procedures).

34. Install the engine cover.

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Heating and Ventilation - Heater Core RHD AWD

Removal and Installation

Removal

1. Remove the engine cover.

2. Evacuate 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).

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

   Raise and support the vehicle.

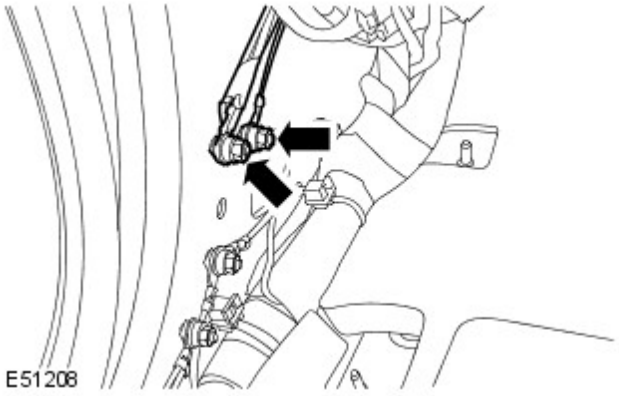
4. Drain the cooling system.
   For additional information, refer to: Cooling System Partial Draining, Filling and Bleeding - V8 S/C 5.0L Petrol (303-03B Engine Cooling - V8 5.0L Petrol/V8 S/C 5.0L Petrol, General Procedures).

5. Remove the driver side front seat.
   For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

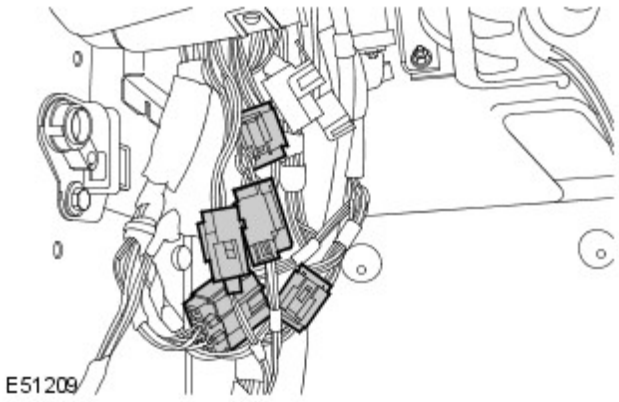
6. Remove the floor console.
   For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

7. Remove the instrument panel upper section.
   For additional information, refer to: Instrument Panel Upper Section (501-12 Instrument Panel and Console, Removal and Installation).

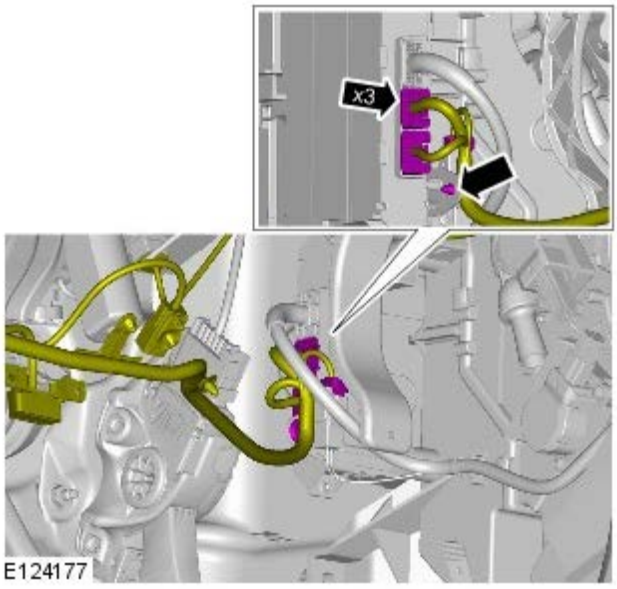
8. Release the 3 ground cables from the driver side lower A-pillar.
   - Remove the 2 nuts.



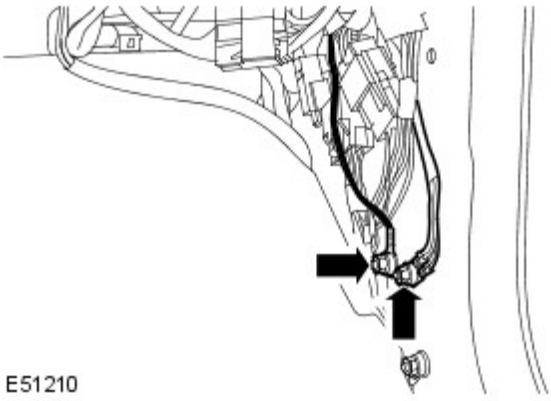
9. Disconnect the 5 electrical connectors from the driver side lower A-pillar.



10. Disconnect the 3 electrical connectors.

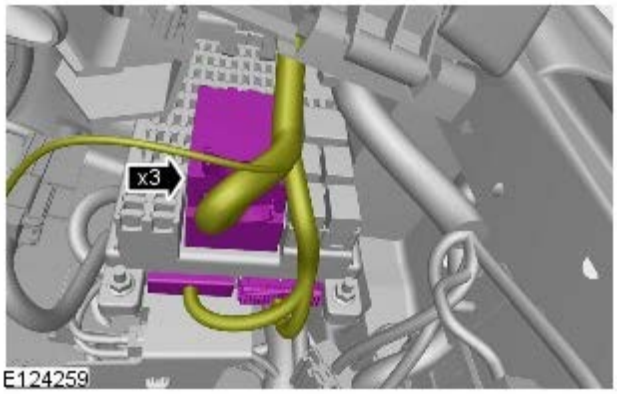


11. Release the 3 ground cables from the passenger side lower A-pillar.
    - Remove the 2 nuts.



12. Disconnect the 5 electrical connectors from the passenger side lower A-pillar.

13. Disconnect the central junction box (CJB) three electrical connectors.



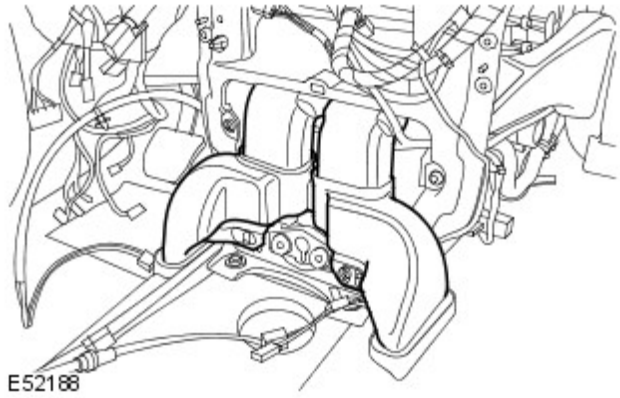
14. Disconnect 2 electrical connectors from the instrument panel center reinforcement.

15. CAUTION: Cover fiber optic cable connectors to minimize dust ingress and avoid bending the cables in a radius of less than 30 mm.

    If installed, disconnect the instrument panel center reinforcement fibre optic cables.
    - Disconnect the electrical connector.



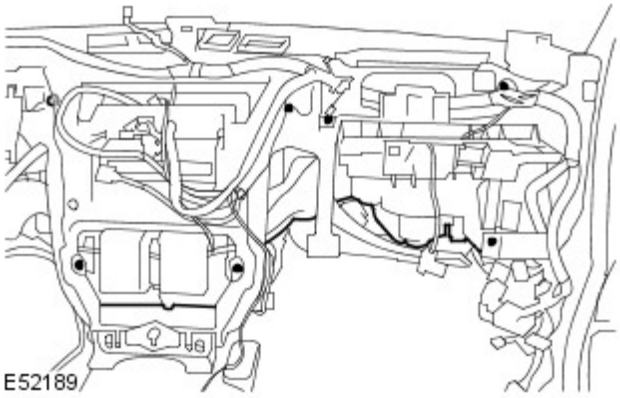
16. Remove the heater housing center ducts.



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

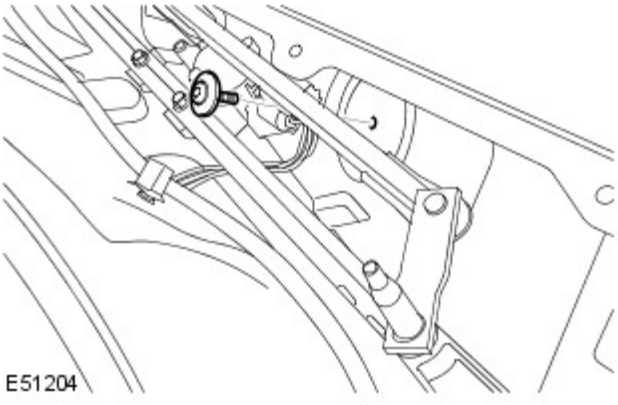


18. Release the heater housing from the instrument panel carrier.
    - Remove the 7 Torx screws.

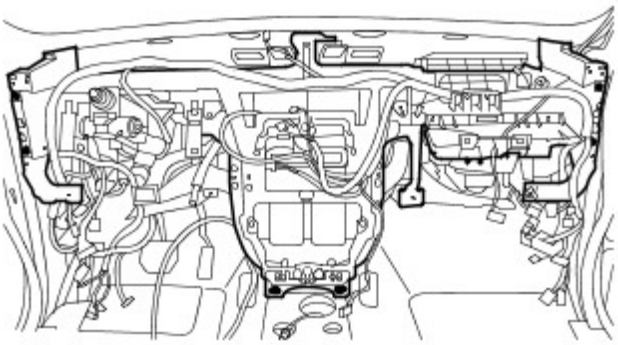


19. Remove the plenum chamber panel.
    For additional information, refer to: Plenum Chamber (412-01 Air Distribution and Filtering, Removal and Installation).

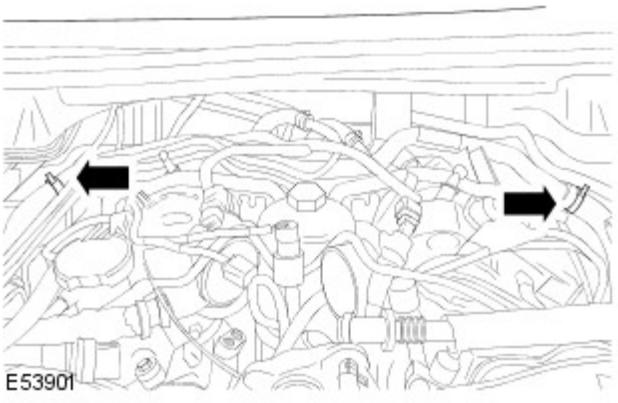
20. Remove the instrument panel carrier to bulkhead Torx bolt.


E51204

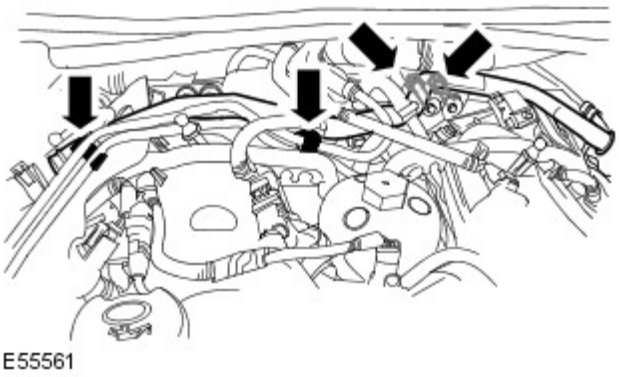
21. With assistance, remove the instrument panel.
    - Remove the 6 Torx bolts.


E52190

22. Disconnect both exhaust gas recirculation (EGR) coolant cross-over pipe hoses.
    - Release the 2 clips.

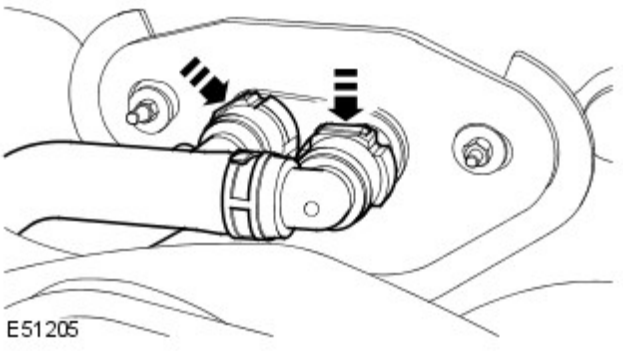

E53901

23. Remove the EGR coolant cross-over pipe.
    - Remove the 2 bolts.
    - Release the 2 clips.


E55561

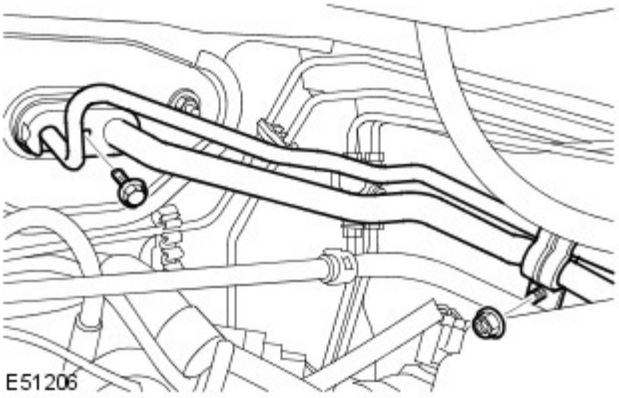
24. CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

    Disconnect 2 heater hoses from the bulkhead.
    - Release the 2 clips.

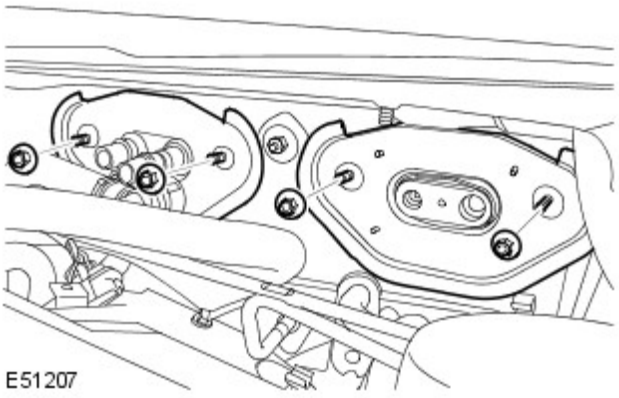


25. CAUTION: Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

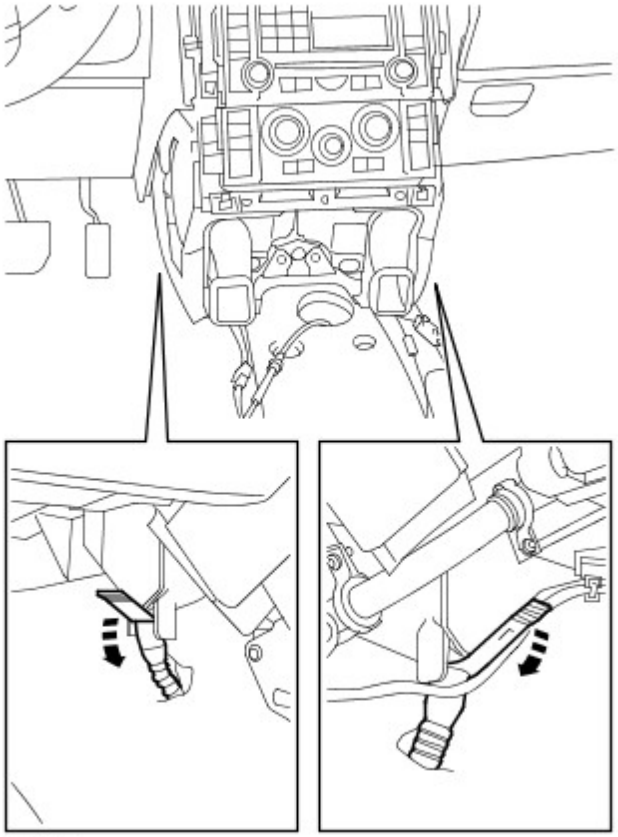
    Release the 2 A/C refrigerant lines.
    - Remove the nut and bolt.
    - Remove and discard the O-ring seals.



26. Remove the 2 adapter panels.
    - Remove the 4 nuts.

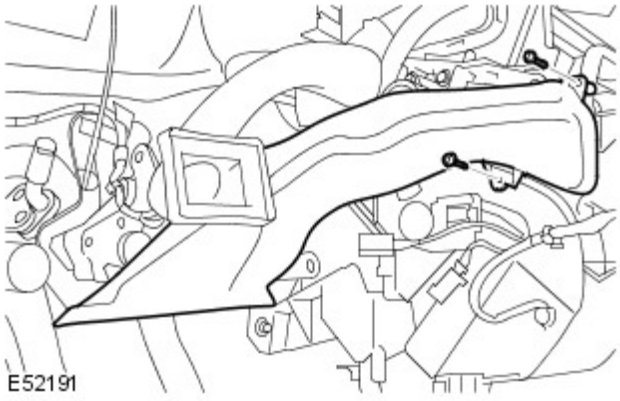


27. Disconnect 2 drain tubes from the heater housing.



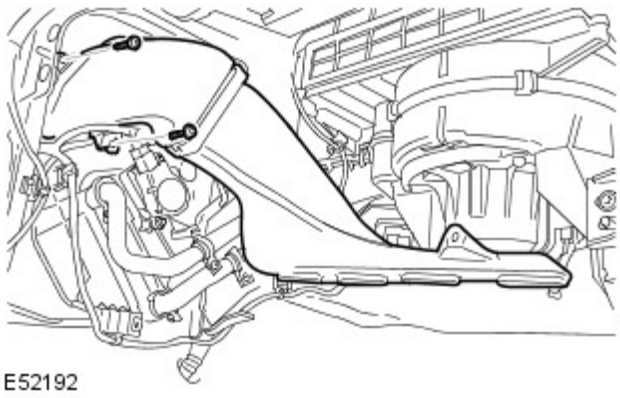
E51199

28. Remove the driver side footwell duct.
    - Remove the 2 Torx screws.



E52191

29. Remove the passenger side footwell duct.
    - Remove the 2 Torx screws.

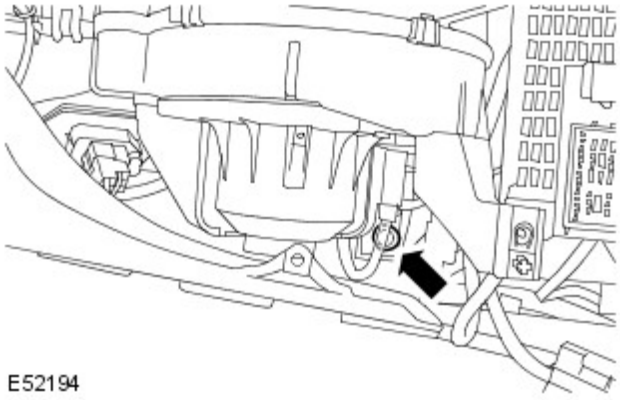


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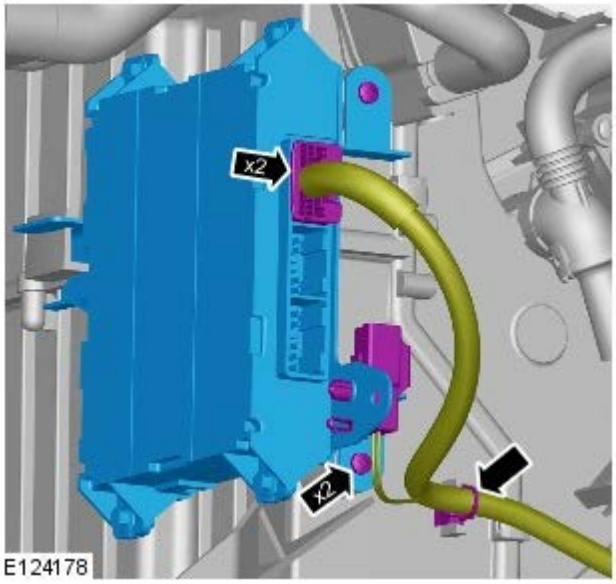
30. Driver side: Remove the heater housing to bulkhead Torx bolt.



31. Passenger side: Remove the heater housing to bulkhead Torx bolt.
    - With assistance, remove the heater and evaporator core housing.



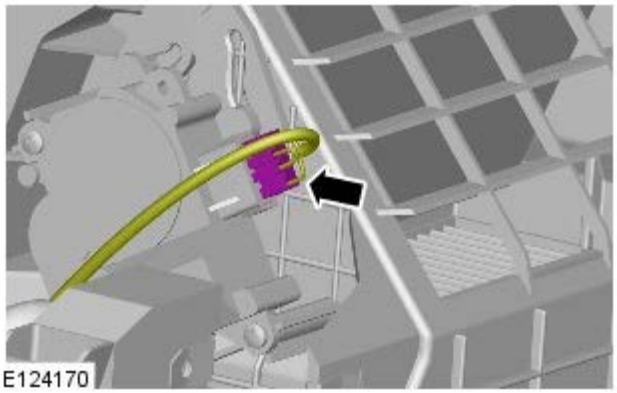
32. Remove the A/C control module.



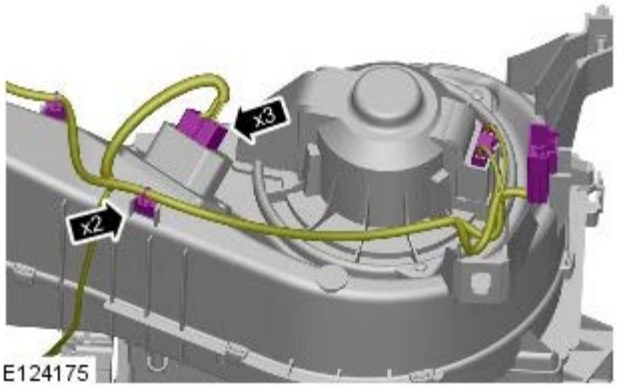
33. Disconnect the evaporator core temperature sensor electrical connector.



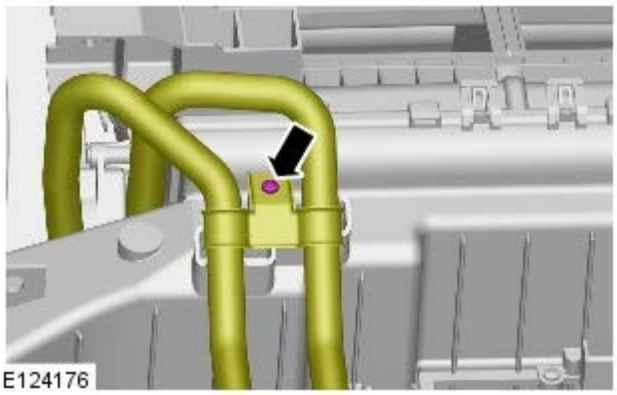
34. Disconnect the electrical connector.



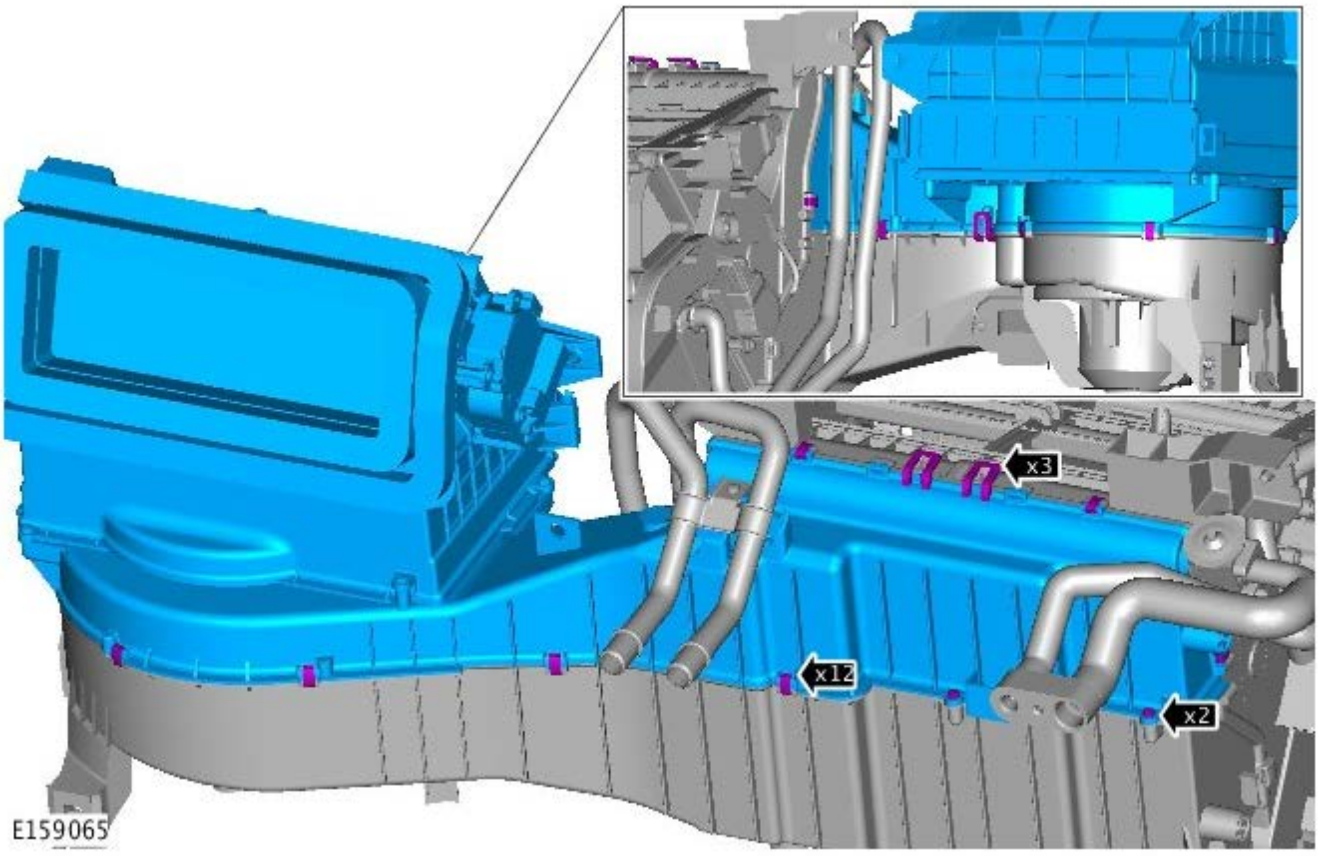
35. Detach the wiring harness.



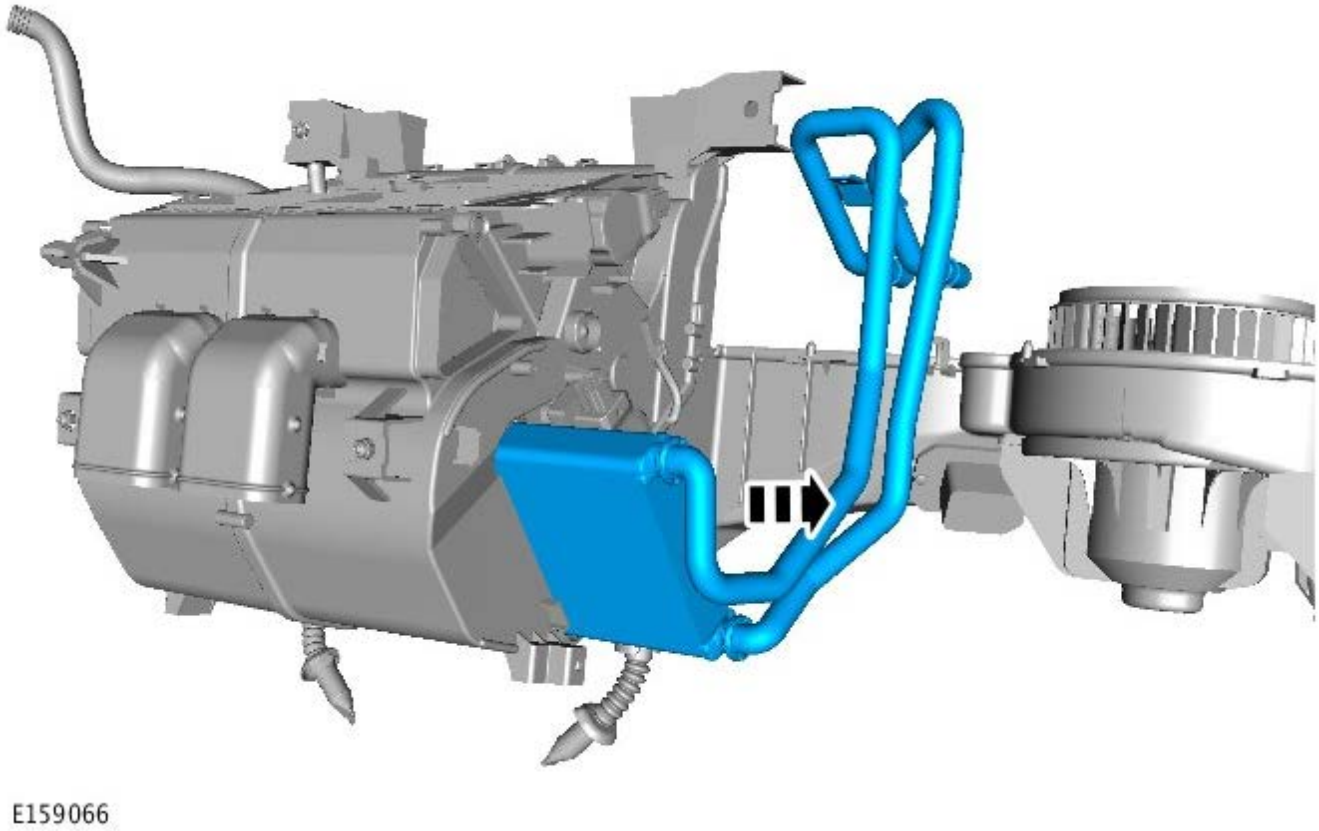
36. Remove the bolt from the support bracket.



37. Remove the 2 screws.
    - Release the 12 clips.
    - Carefully release the 3 clips.



38. Carefully remove the heater core.



Installation

1. Install the heater core.
    - Carefully insert the heater core

2. Secure the heater core housing.
    - Install the clips.

3. Install the wiring harness.

4. Install and tighten the bolt.

5. Connect the temperature sensor electrical connector.

6. Install the CC module.
   - Tighten the bolts.

7. Passenger side: Install the heater housing to bulkhead Torx bolt and tighten to 6 Nm (4 lb.ft).
   - With assistance, install the heater and evaporator core housing.

8. Driver side: Install the heater housing to bulkhead Torx bolt and tighten to 6 Nm (4 lb.ft).

9. Install the footwell ducts.
   - Tighten the Torx screws.

10. Connect the drain tubes to the heater housing.

11. Install the adapter panels.
    - Tighten the nuts to 6 Nm (4 lb.ft).

12. Secure the A/C refrigerant lines.
    - Clean the components.
    - Install new O-ring seals.
    - Tighten the bolt to 5 Nm (4 lb.ft).
    - Tighten the nut to 6 Nm.

13. Connect the bulkhead heater hoses.

14. Install the EGR coolant cross-over pipe.
    - Tighten the bolts to 10 Nm (7 lb.ft).
    - Secure the clips.
    - Connect the hoses and secure with the clips.

15. With assistance, install the instrument panel.
    - Tighten the Torx bolts to 25 Nm (18 lb.ft).

16. Install the instrument panel carrier to bulkhead Torx bolt and tighten to 25 Nm (18 lb.ft).

17. Install the plenum chamber panel.
    For additional information, refer to: Plenum Chamber (412-01 Air Distribution and Filtering, Removal and Installation).

18. Secure the heater housing.
    - Tighten the screws.

19. Connect the steering column intermediate shaft.
    - Install the special bolt and tighten the new nut to 22 Nm (16 lb.ft).

20. Install the heater housing center ducts.

21. Connect the instrument panel center reinforcement fibre optic cables.

22. Connect the instrument panel center reinforcement electrical connectors.

23. Connect the CJB electrical connectors.

24. Connect the electrical connectors to the passenger side lower A-pillar.

25. Connect the ground cables to the passenger side lower A-pillar.
    - Tighten the nuts to 10 Nm (7 lb.ft).

26. Connect the electrical connectors to the driver side lower A-pillar.

27. Connect the ground cables to the driver side lower A-pillar.

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

28. Connect the 3 electrical connectors.

29. Install the instrument panel upper section.
    For additional information, refer to: Instrument Panel Upper Section (501-12 Instrument Panel and Console, Removal and Installation).

30. Install the floor console.
    For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

31. Install the front seat.
    For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

32. 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).

33. Refill the cooling system.
    For additional information, refer to: Cooling System Partial Draining, Filling and Bleeding - V8 S/C 5.0L Petrol (303-03B Engine Cooling - V8 5.0L Petrol/V8 S/C 5.0L Petrol, General Procedures).

34. Install the engine cover.

Published: 11-May-2011

Auxiliary Heating -

Torque Specifications

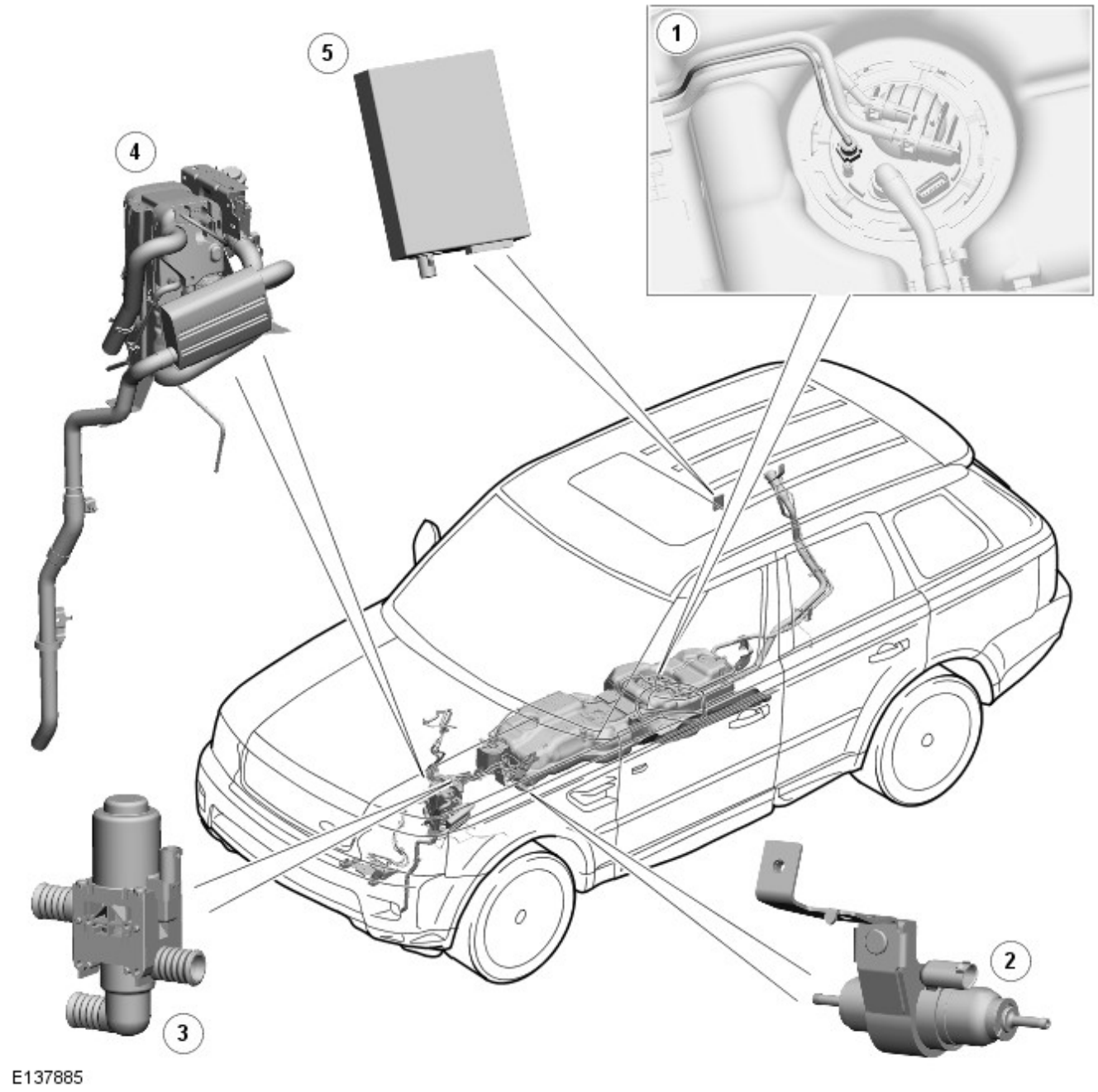
Description	Nm	lb-ft
Fuel fired booster heater exhaust bracket bolt	10	7
Fuel fired booster heater	10	7

Published: 30-Sep-2011

Auxiliary Heating - Auxiliary Heater

Description and Operation

COMPONENT LOCATIONS



E137885

Item	Part Number	Description
1	-	FFBH (fuel fired booster heater) fuel line connection to fuel tank
2	-	FFBH auxiliary fuel pump
3	-	FFBH changeover valve
4	-	FFBH
5	-	FFBH receiver

INTRODUCTION

Auxiliary heating is provided by a FFBH (fuel fired booster heater), which boosts the temperature of the engine coolant. Fuel for the FFBH is taken from the vehicle fuel tank, through a fuel line attached to the fuel pump module. An auxiliary fuel pump supplies the fuel at low pressure to the FFBH. In the FFBH, the fuel is burned and the resultant heat output is used to heat the engine coolant.

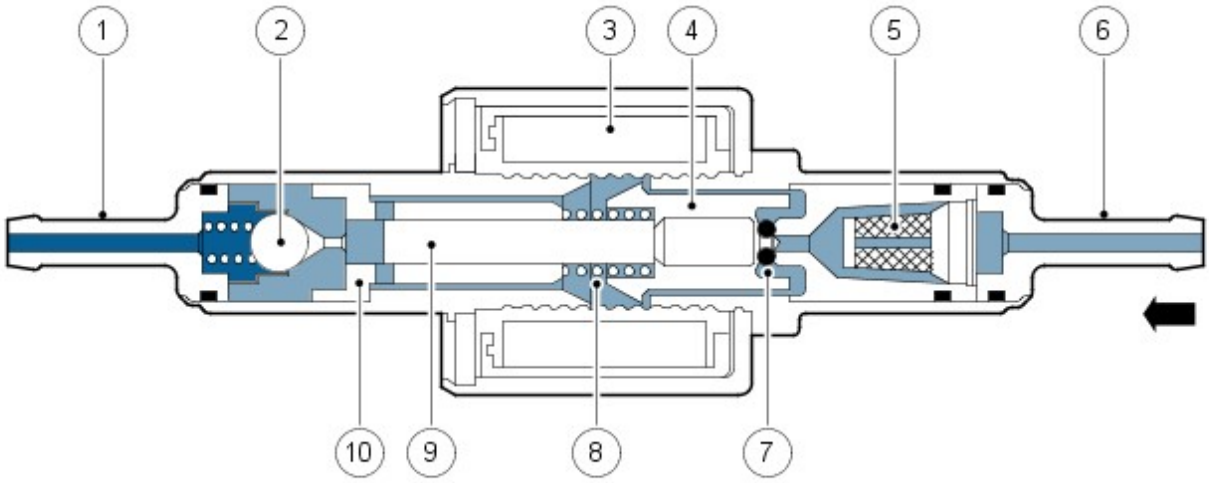
For remote operation, the system includes a FFBH receiver and a remote handset.

AUXILIARY FUEL PUMP

The auxiliary fuel pump regulates the fuel supply to the FFBH. The pump is a self priming, solenoid operated plunger pump, controlled by a pulse width modulation (PWM) signal from the control module in the FFBH. When the pump is

de-energized, it provides a positive shut-off of the fuel supply.

Sectioned View of Auxiliary Fuel Pump



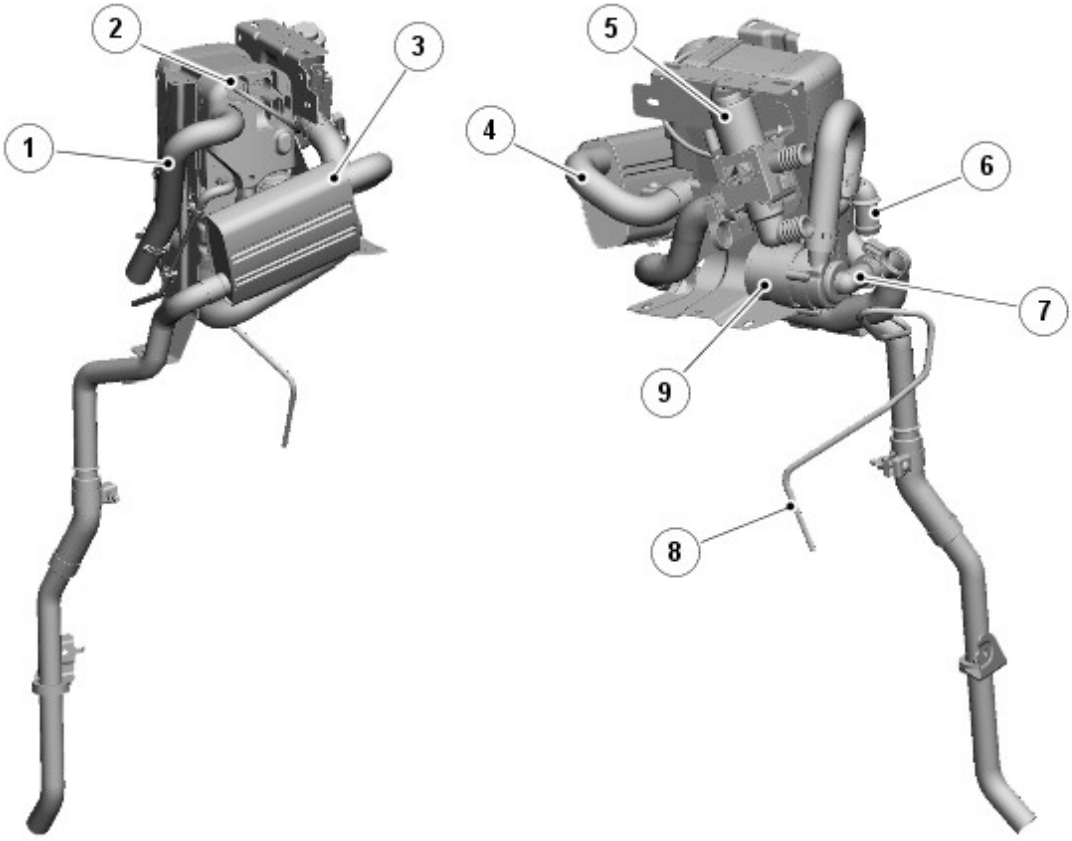
E43569

Item	Part Number	Description
1	-	Fuel line connector
2	-	Non return valve
3	-	Solenoid coil
4	-	Plunger
5	-	Filter insert
6	-	Fuel line connector
7	-	O-ring seal
8	-	Spring
9	-	Piston
10	-	Bush

The solenoid coil of the auxiliary fuel pump is installed around a housing which contains a plunger and piston. The piston locates in a bush, and a spring is installed on the piston between the bush and the plunger. A filter insert and a fuel line connector are installed in the inlet end of the housing. A non return valve and a fuel line connector are installed in the fuel outlet end of the housing.

While the solenoid coil is de-energized, the spring holds the piston and plunger in the closed position at the inlet end of the housing. An O-ring seal on the plunger provides a fuel tight seal between the plunger and the filter insert, preventing any flow through the pump. When the solenoid coil is energized, the piston and plunger move towards the outlet end of the housing, until the plunger contacts the bush; fuel is then drawn in through the inlet connection and filter. The initial movement of the piston also closes transverse drillings in the bush and isolates the pumping chamber at the outlet end of the housing. Subsequent movement of the piston then forces fuel from the pumping chamber through the non return valve and into the line to the FFBH. When the solenoid de-energizes, the spring moves the piston and plunger back towards the closed position. As the piston and plunger move towards the closed position, fuel flows past the plunger and through the annular gaps and transverse holes in the bush to replenish the pumping chamber.

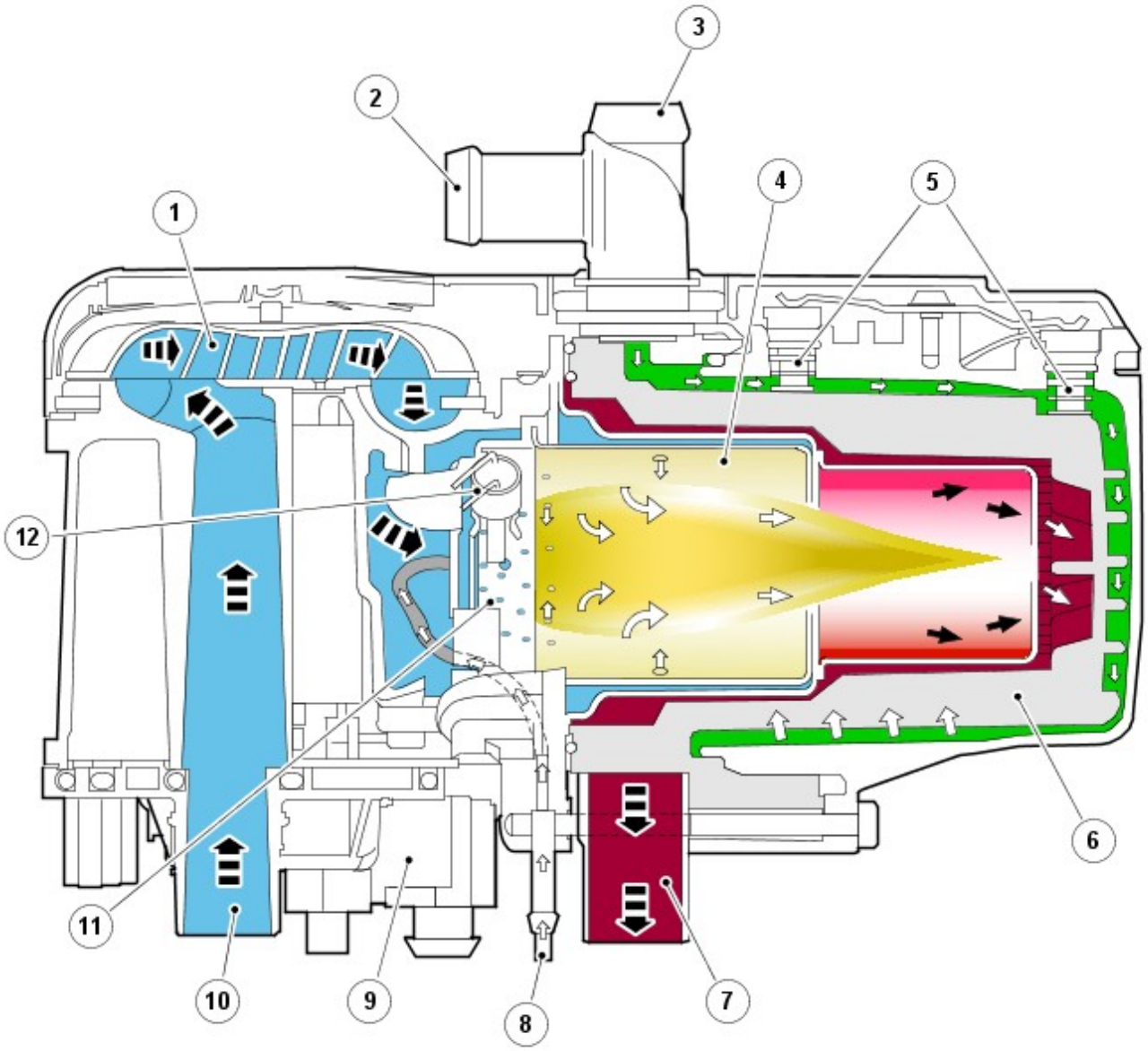
FFBH (Fuel Fired Booster Heater)



E137284

Item	Part Number	Description
1	-	Air inlet pipe
2	-	Electrical connectors
3	-	Exhaust muffler
4	-	Exhaust pipe
5	-	Changeover valve (if fitted)
6	-	Coolant outlet connection
7	-	Coolant inlet connection
8	-	Fuel supply line
9	-	Coolant circulation pump

Sectioned View of FFBH



E137285

Item	Part Number	Description
1	-	Combustion air fan
2	-	Coolant inlet
3	-	Coolant outlet
4	-	Burner insert
5	-	Coolant temperature sensors
6	-	Heat exchanger
7	-	Exhaust outlet
8	-	Fuel inlet
9	-	Control unit
10	-	Air inlet
11	-	Fuel evaporator
12	-	Glow plug / flame sensor

Coolant Circulation Pump

The coolant circulation pump is installed at the coolant inlet to the FFBH to assist the coolant flow through the FFBH and the vehicle heater core. The pump runs continuously while the FFBH is in standby or active operating modes. While the FFBH is inactive, coolant flow is reliant on the engine coolant pump. Operation of the FFBH coolant circulation pump is controlled by a power feed direct from the FFBH control module.

Combustion Air Fan

The combustion air fan regulates the flow of air into the FFBH to support combustion of the fuel supplied by the auxiliary fuel pump and to purge and cool the FFBH after operation.

Burner Housing

The burner housing contains the burner insert and also incorporates connections for the exhaust pipe, the coolant inlet from the coolant circulation pump and the coolant outlet to the vehicle heater core.

The burner insert incorporates the fuel combustion chamber, an evaporator and a glow pin and flame sensor. Fuel from the auxiliary fuel pump is supplied to an evaporator mat, where it evaporates and enters the combustion chamber to mix with air from the combustion air fan. The glow pin/flame sensor provides the ignition source of the fuel: air mixture and, once combustion is established, monitors the flame.

Heat Exchanger

The heat exchanger transfers heat generated by combustion to the coolant. Two sensors are installed in the heat exchanger casing to provide the control module with inputs of coolant temperature. The control module uses the temperature inputs to control system operation.

Air Inlet Pipe

The air inlet pipe delivers air to the combustion chamber for fuel ignition.

Exhaust Pipe and Muffler

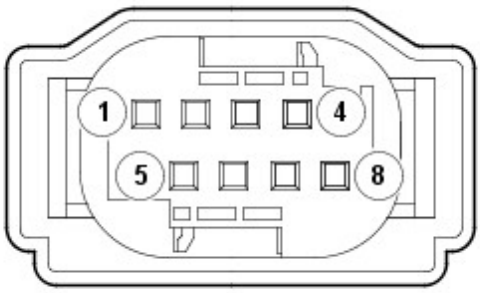
The exhaust pipe and muffler directs exhaust combustion gases to atmosphere. Exhaust vapor may be visible when the FFBH is running, depending on atmospheric conditions.

Control Module

The control module controls and monitors operation of the FFBH system. An internal flow of air from the combustion air fan ventilates the control module to prevent it overheating.

The control module communicates with other systems on the vehicle over the medium speed CAN (controller area network) bus.

FFBH Control Module Harness Connector C0925

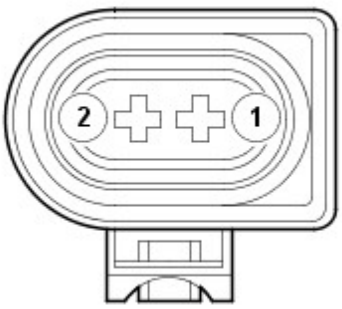


E50045

FFBH Control Module Harness Connector C0925 Pin Details

Pin No.	Description	Input/Output
1	Not used	-
2	WBUS diagnostic (Telestart signal)	Input/Output
3	Not used	-
4	Medium speed controller area network (CAN) bus low	Input/Output
5	Auxiliary fuel pump power feed	Output
6	Not used	-
7	Medium speed CAN bus high	Input/Output
8	Not used	-

FFBH Control Module Harness Connector C0926



E50046

FFBH Control Module Harness Connector C0926 Pin Details

Pin No.	Description	Input/Output
1	Permanent battery power supply	Input
2	Ground	Output

Changeover Valve

The changeover valve is a normally open solenoid valve installed between the supply and return sides of the heater coolant circuit. When de-energized, the changeover valve connects the heater coolant circuit to the engine coolant circuit. When energized, the changeover valve isolates the heater coolant circuit from the engine coolant circuit.

The changeover valve is controlled by a power feed from the ATC (automatic temperature control) module.

FFBH Receiver

The FFBH receiver translates the FFBH request radio signals, relayed from the TV (television) antenna amplifier, into a voltage output to the FFBH unit. When a request for parked heating is received, the FFBH receiver outputs a battery power feed to the FFBH unit. When a request to switch off parked heating is received, the FFBH receiver disconnects the power feed.

The FFBH receiver has a permanent power feed from the BJB (battery junction box) and is connected to the TV antenna amplifier by a coaxial cable.

FFBH Remote Handset



E103416

Item	Description
1	On button
2	Off button
3	LED (light emitting diode)
4	Antenna

The FFBH remote handset allows parked heating to be remotely controlled up to a minimum of 100 m (328 ft) from the vehicle. 'On' and 'off' buttons activate and de-activate parked heating.

An LED:

- Flashes green when parked heating is active.
- Flashes red after a start selection, if communication has not been established with the vehicle.
- Flashes orange when the remote handset battery needs replacing.

The FFBH remote handset is powered by a 3.3 V CR1/3N battery located under a cover on the rear of the handset.

Remote Handset Pairing:

Each remote handset must be 'paired' to the receiver to enable communications. Each handset has a unique identification number which is stored by the receiver. The receiver can store up 3 handset identification numbers. If a fourth handset is paired to the receiver, the receiver will replace the first paired handset number with that for the fourth handset in the receiver memory. Subsequently, the first paired handset will no longer be paired and will not be recognized by the receiver.

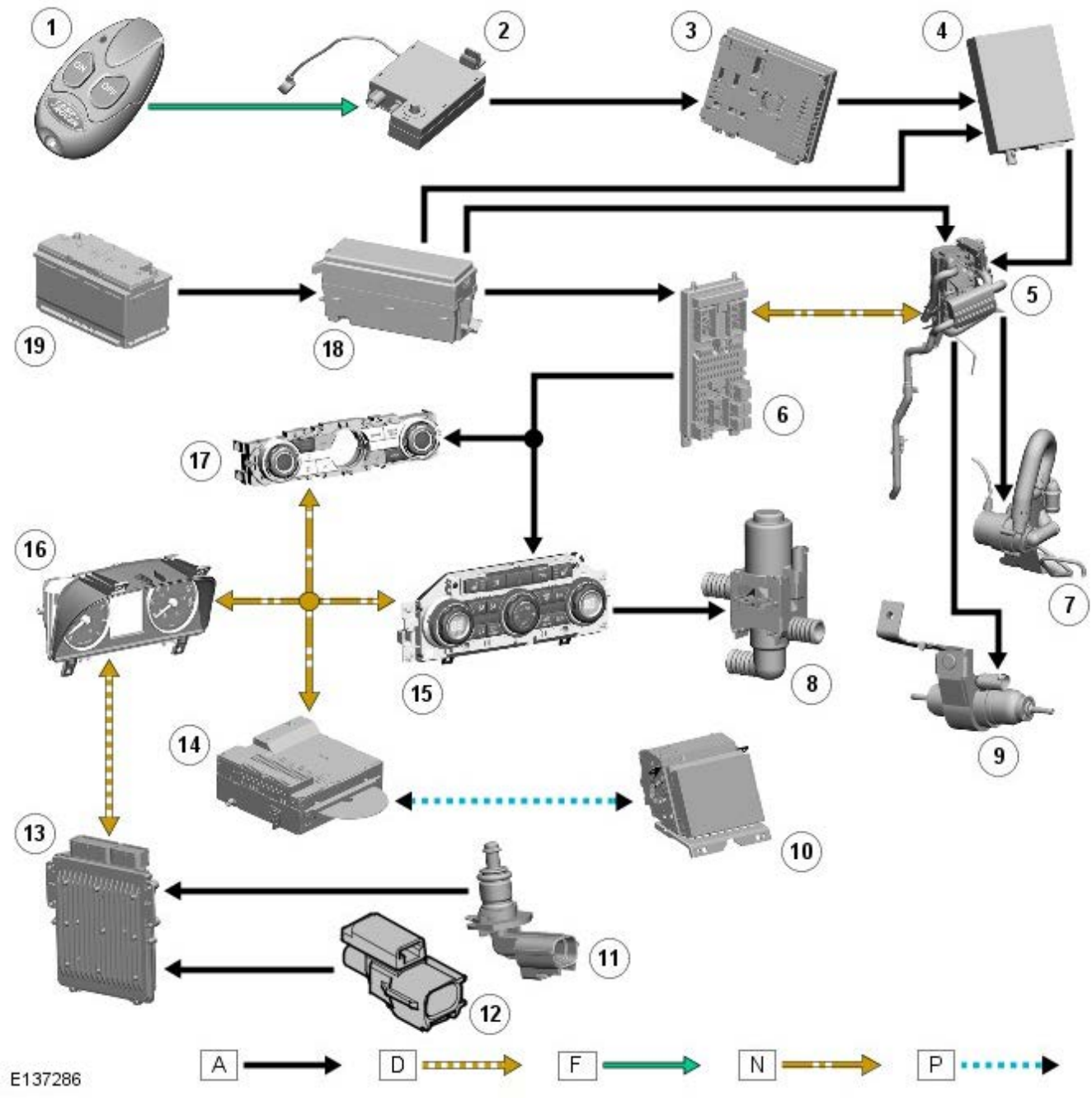
The following procedure details the pairing process:

NOTE: The pairing process relies on the FFBH receiver having the power supply removed and then the power supply re-instated. The fuse method is the easiest method but it can also be achieved by battery disconnection or removal of the harness connector from the receiver unit.

- Remove mini-fuse F2 5A (telestart fuse) from the BJB
- Wait for a minimum of 5 seconds
- Replace fuse to position F2 5A in the BJB
- Within 5 seconds of replacing the fuse (and restoring the receiver power supply), press and hold the remote handset OFF button
- Confirmation of successful pairing is displayed by the remote handset LED illuminating in a red color for 2 seconds.

CONTROL DIAGRAM

NOTE: A = Hardwired connections; D = High speed CAN bus; F = RF transmission; N = Medium speed CAN bus; P = MOST bus



Item	Part Number	Description
1	-	FFBH remote handset
2	-	TV antenna
3	-	TV tuner module
4	-	FFBH receiver
5	-	FFBH
6	-	CJB (central junction box)
7	-	FFBH coolant circulation pump
8	-	Changeover valve (if fitted)
9	-	FFBH fuel pump
10	-	Touch screen display
11	-	ECT (engine coolant temperature) sensor
12	-	Ambient air temperature sensor
13	-	ECM (engine control module)
14	-	IAM (integrated audio module)
15	-	ATC module
16	-	Instrument cluster
17	-	Integrated control panel

18	-	BJB
19	-	Battery

OPERATION

The FFBH system operates in two modes:

- Provides additional heating by boosting heater performance while the engine is running.
- If fitted; parked heating heats the passenger compartment or engine while the vehicle is parked with the engine off.

The ATC module disables FFBH operation if battery voltage is too low, as determined from an ambient air temperature, dependent voltage-map. Where fitted, the battery monitoring system can also disable FFBH operation based on the battery charge state with the engine off.

Parked Heating/Ventilation

Parked heating works in conjunction with parked ventilation. When parked heating/ventilation is selected, the vehicle interior is either heated by parked heating or cooled by parked ventilation, depending on the ambient temperature. Parked heating occurs if the ambient temperature is less than 16 °C (61 °F); parked ventilation occurs if the ambient temperature is 16 °C (61 °F) or more.

Parked heating/ventilation is controlled by direct selection on the (TSD) Touch Screen Display. This is achieved by using the TSD to program one or two 'on/off' cycle start-times per day, and one 'on/off' cycle start-time further in the future.

The direct selection and programmed time modes of operation are selected when the engine is stopped and the smart key is in the vehicle. The key can then be removed and the vehicle locked. Any timed event will automatically run without the key inside the vehicle.

In all operating modes, to prevent excessive drain on the battery, parked heating/ventilation is automatically de-activated after:

- 20 minutes in moderate climate conditions, and
- after 30 minutes in climates where the ambient temperature regularly falls below minus 25 °C (minus 13 °F).

Parked ventilation is automatically de-activated when the ignition is switched on.

When programmed start times for parked heating/ventilation are entered on the TSD, the times are stored in the CJB.

If the engine is started while parked heating is on and:

- the engine coolant temperature is equal to or more than the heater coolant temperature, parked heating is switched off.
- the engine coolant temperature is less than the heater coolant temperature, parked heating remains on until the engine coolant temperature reaches the heater coolant temperature. The changeover valve also remains closed until the engine coolant temperature reaches the heater coolant temperature.

Parked heating/ventilation can also be operated by using the FFBH remote handset.

Programmed Parked Heating/Ventilation

At a programmed parked heating/ventilation start time, the EJB (engine junction box) sends a start signal to the ATC module on the medium speed CAN.

On receipt of the message:

- If the ambient temperature is less than 16 °C (61 °F) and more than -20 °C (-4 °F), the ATC module initiates parked heating and:
  - Energizes the changeover valve.
  - Sends a CAN bus message to activate the FFBH.
  - Operates the blower at 47% of the maximum speed.
  - Operates the distribution doors in the heater assembly to direct the air to the footwells for approximately 30 seconds, then to either only the windscreen, or to both the footwells and the windscreen, depending on the ambient air temperature.
  - Flashes the auto blower LED at 2 Hz.
  - If the ambient temperature is -20 °C (-4 °F) or below, the ATC module sends a CAN bus message to activate the FFBH, but leaves the changeover valve de-energized and does not operate the blower or distribution doors. Heated coolant is circulated around the engine and heater core(s) to heat the engine and improve engine starting.
  - Once the FFBH coolant temperature is above a suitable threshold the cabin blower is switched on and cabin heating commenced.
- If the ambient temperature is 16 °C (61 °F) or more, the ATC module initiates parked ventilation and:
  - Operates the blower at 47% of maximum speed.
  - Operates the distribution doors in the heater assembly to direct the air to the face level outlets.
  - Flashes the A/C (air conditioning) distribution LED at 2 Hz.

After 20 minutes in moderate climate conditions and after 30 minutes in climates where the ambient temperature regularly falls below minus 25 °C (minus 13 °F), the ATC module stops the parked heating/ventilation:

- If parked heating is active, the ATC module:
  - Sends a CAN bus message to de-activate the FFBH.
  - Switches off the blower.

- Returns the distribution doors to the previous settings.
- After 3 minutes, de-energizes the changeover valve.

- If parked ventilation is active, the ATC module:
  - Switches off the blower.
  - Returns the distribution doors to the previous settings.

Remotely Selected Parked Heating/Ventilation

When parked heating/ventilation is selected 'on' with the remote handset, the request is received by the FFBH receiver via the TV antenna and TV antenna amplifier. The FFBH receiver relays the request as a hardwired signal to the FFBH control module. On receipt of the request, the FFBH control module sends the request to the ATC module on the CAN bus. The ATC module then determines if parked heating or ventilation is required.

Operation of the FFBH is controlled by a status message from the automatic temperature control (ATC) module to the control module. A similar status message, from the control module to the ATC module, advises the ATC module of the current operating status of the FFBH.

While the engine is running, if the ambient air temperature is less than 9 °C (48 °F) and the engine coolant temperature (ECT) is less than 75 °C (167 °F) the ATC module changes the status message from 'heater off' to 'supplemental heat'. The control module then changes the status message it sends the ATC module to 'supplemental heat' and starts the FFBH. The control module will not start the FFBH, or will discontinue operation, if any of the following occur:

- The control module is in the error lockout mode (see Diagnostics, below).
- A crash message is received from the restraints control module (RCM).
  For additional information, refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B, Description and Operation).
- A low fuel level message is received from the instrument cluster.
  For additional information, refer to: Information and Message Center (413-08, Description and Operation).
- The engine is not running, or stops running for approximately 4 seconds. The time delay is included for stall protection.

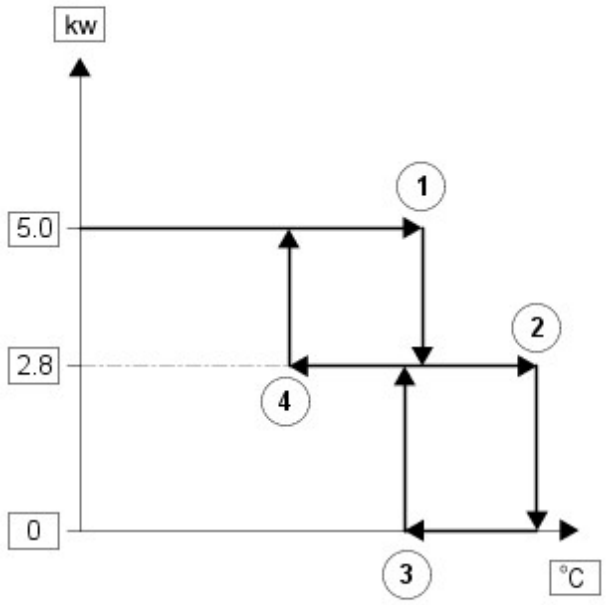
If the control module does not start the FFBH, or discontinues operation, the status message to the ATC module remains at, or changes to, 'heater off'. If the ambient air temperature increases to 9 °C (48 °F), or the ECT increases to 75 °C (167 °F), the ATC module cancels supplementary heating, by changing the status message to the control module back to 'heater off'. The control module then cancels FFBH operation and changes the status message to the ATC module to 'heater off'.

The FFBH is controlled at one of two heat output levels, 2.8 kW at part load combustion and 5 kW at full load combustion. The control module transmits the FFBH coolant temperature to the ATC module.

Start Sequence: At the beginning of a start sequence, the control module energizes the glow pin function of the glow pin and flame sensor, to pre heat the combustion chamber, starts the combustion air fan at slow speed and energizes the coolant circulation pump. After approximately 30 seconds, the control module energizes the auxiliary fuel pump at the starting sequence speed. The fuel delivered by the auxiliary fuel pump evaporates in the combustion chamber, mixes with air from the combustion air fan and is ignited by the glow pin and flame sensor. The control module then progressively increases the speed of the auxiliary fuel pump and the combustion air fan. Once combustion is established the control module switches the glow pin and flame sensor from the glow pin function to the flame sensing function to monitor combustion. From the beginning of the start sequence to stable combustion at full load takes approximately 240 seconds.

Coolant Temperature Control: While the FFBH is running, the control module cycles the FFBH between full load combustion, part load combustion and a control idle phase of operation, depending on the temperature of the coolant in the heat exchanger.

Switching Point Diagram



E56856

Switching Point		Temperature, °C (°F)
Figure Item No.	Description	
1	Full load to part load	84 (183)
2	Part load to control idle	88 (190)
3	Control idle to part load	78 (172)
4	Part load to full load	74 (165)

After the start sequence, the control module maintains full load combustion until the coolant temperature reaches switching point temperature 1. At this temperature, the control module decreases the speed of the auxiliary fuel pump and the combustion air fan to half speed, to produce part load combustion. The control module maintains part load combustion while the coolant temperature remains between switching point temperatures 2 and 4. At part load combustion the temperature of the coolant will increase or decrease depending on the amount of heat required to heat the vehicle interior. If the coolant temperature decreases to switching point temperature 4, the control module increases the speed of the auxiliary fuel pump and the combustion air fan to full speed, to return to full load combustion. If the coolant temperature increases to switching point temperature 2, the control module enters a control idle phase of operation.

On entering the control idle phase, the control module immediately switches the auxiliary fuel pump off, to stop combustion, and starts a timer for the combustion air fan. After a 2 minute cool down period, the control module switches the combustion air fan off and then remains in the control idle phase while the coolant temperature remains above switching point temperature 3. If the coolant temperature decreases to switching point temperature 3, the control module initiates a start to part load combustion. A start to part load combustion takes approximately 90 seconds.

In order to limit the build up of carbon deposits on the glow pin and flame sensor, the control module also enters the control idle phase if continuous combustion time exceeds 72 minutes (at part load, full load or a combination of both). After the cool down period, if the coolant is still in the temperature range that requires additional heat, the control module restarts the FFBH.

Shutdown: To stop the FFBH, the control module de-energizes the auxiliary fuel pump to stop combustion, but continues operation of the combustion air fan and the coolant circulation pump for a time, to cool down the FFBH. The cool down time is 100 seconds if the FFBH was operating at part load combustion and 175 seconds if the FFBH was operating at full load combustion.

DIAGNOSTICS

The control module monitors the FFBH system for faults. Any faults detected are stored in a volatile memory in the control module, which can be interrogated by approved diagnostic equipment via the medium speed CAN bus. A maximum of three faults and associated freeze frame data can be stored at any one time. If a further fault is detected, the oldest fault is overwritten by the new fault.

The control module also incorporates an error lockout mode of operation that inhibits operation to prevent serious faults from causing further damage to the system. In the error lockout mode, the control module immediately stops the auxiliary fuel pump, and stops the combustion air fan and coolant circulation pump after a cool down time of approximately 2 minutes. Error lockout occurs for start sequence failures, combustion flameouts, heat exchanger casing overheat and if battery voltage is out of limits. The error lockout mode can be cleared using approved

diagnostic equipment.

Start Failure and Flameout: If a start sequence fails to establish combustion, or a flameout occurs after combustion is established, the control module immediately initiates another start sequence. The start failure or flameout is also recorded by an event timer in the control module. The event timer is increased by one after each start failure or flameout, and decreased by one if a subsequent start is successful. If the event timer increases to three (over any number of drive cycles), the control module enters the error lockout mode.

Heat Exchanger Casing Overheat: To protect the system from excessive temperatures, the control module enters the error lockout mode if the heat exchanger coolant temperature exceeds 125 °C (257 °F).

Battery Voltage Limits: 10.25 - 15.5 volts.

Published: 20-Aug-2012

Auxiliary Heating - Fuel Fired Booster Heater

Diagnosis and Testing

Principles of Operation

For a detailed description of the fuel fired booster heater system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Auxiliary Heater (412-02B Auxiliary Heating, 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. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Fuel fired booster heater - Combustion air fan - Coolant inlet/outlet - Heat exchanger - Temperature sensor - Exhaust - Fuel inlet - Air inlet - Evaporator • Auxiliary fuel pump and pipes • Auxiliary coolant pump	• Fuses • Harnesses • Electrical connector(s) • Fuel fired booster heater • Automatic temperature control module

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

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

Diagnostic Trouble Code (DTC) Index - DTC: Fuel Fired Booster Heater Control Module (FFBH) (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Automatic Temperature Control Module (ATC) (Description and Operation).

Published: 11-May-2011

Auxiliary Heating - Fuel Fired Booster Heater TDV6 3.0L Diesel

Removal and Installation

Removal

NOTES:

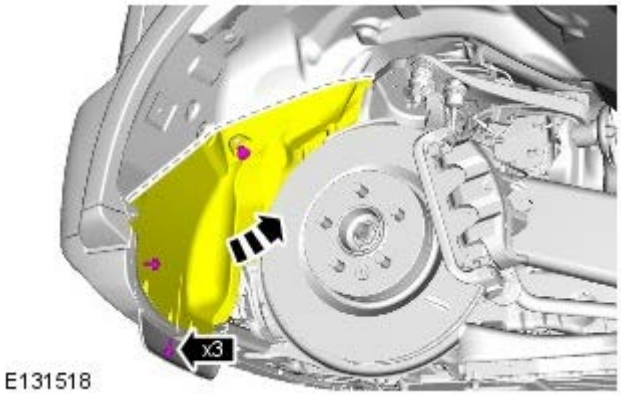
Removal steps in this procedure may contain installation details.

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

1. Refer to: Specifications (414-00, Specifications).

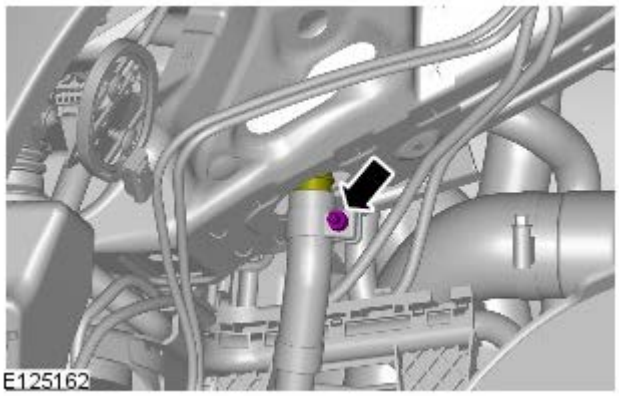
2. WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.



3. NOTE: Wheel shown removed for clarity.

   - Carefully release the wheel arch liner, to allow access to the fuel fired burner heater (FFBH) exhaust clamp retaining bolt.

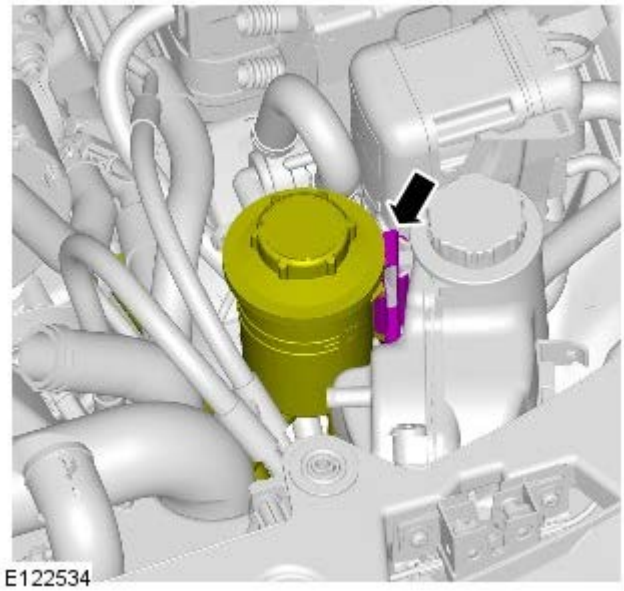


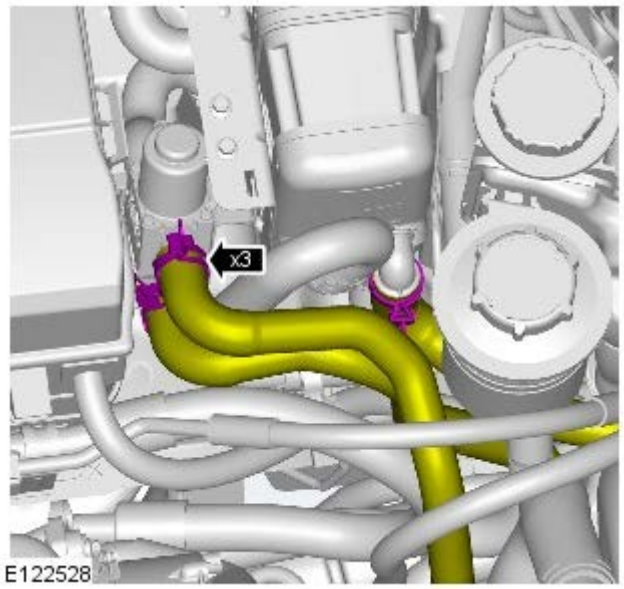
4.

   - NOTE: Components removed for clarity.

     Torque: 10 Nm

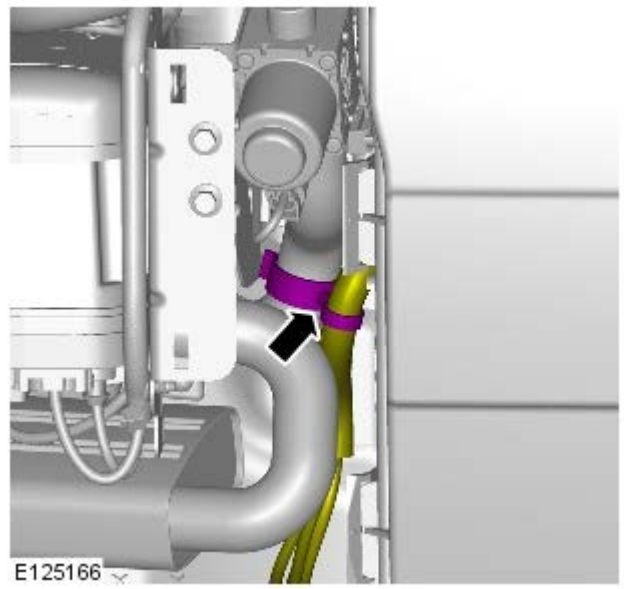
5.



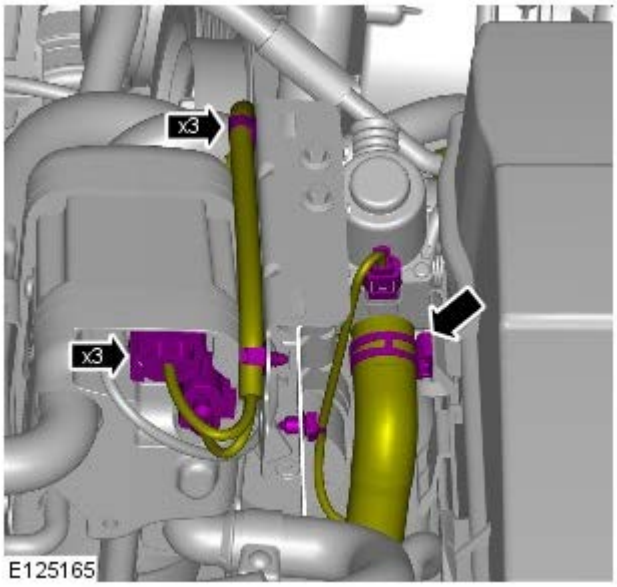


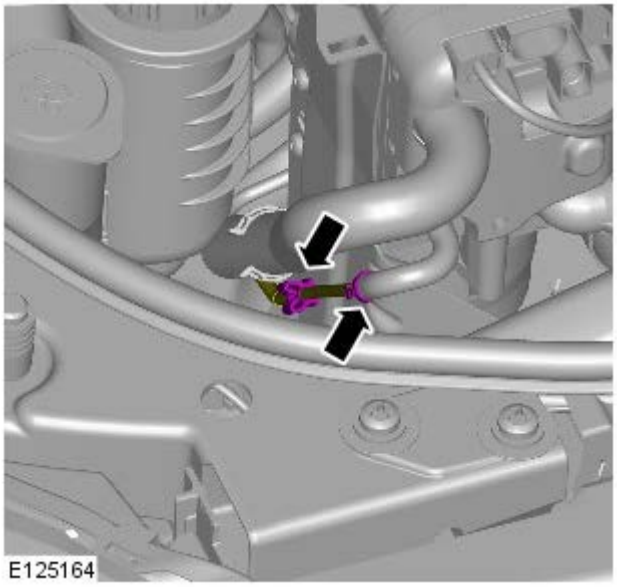
6. CAUTION: Be prepared to collect escaping coolant.
   - Clamp the hoses to minimize coolant loss.

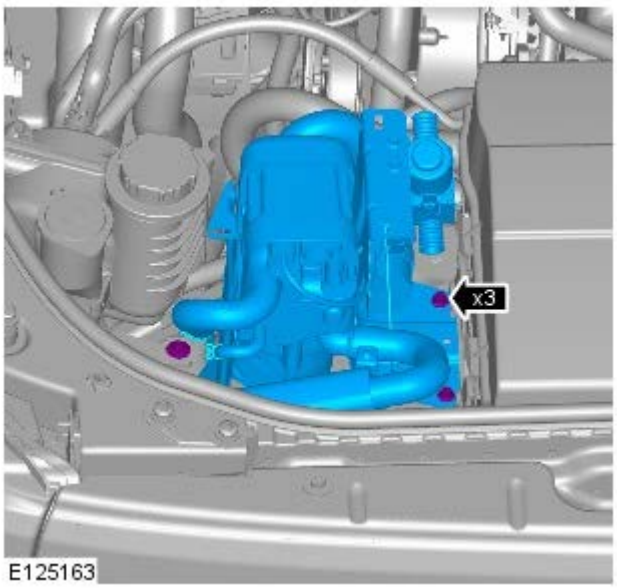
7.



8.







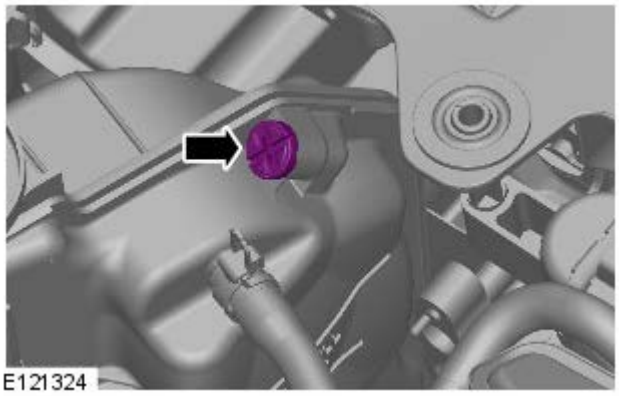
9. CAUTION: Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

10. *Torque:* 10 Nm

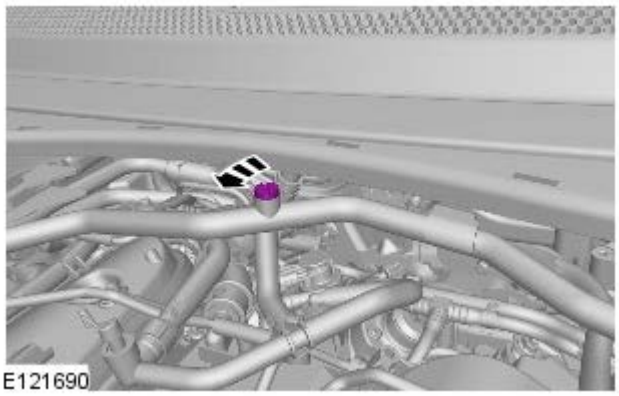
Installation

1. To install, reverse the removal procedure.
2. Refer to: Engine Cover - 3.0L V6 - TdV6 (501-05, Removal and Installation).

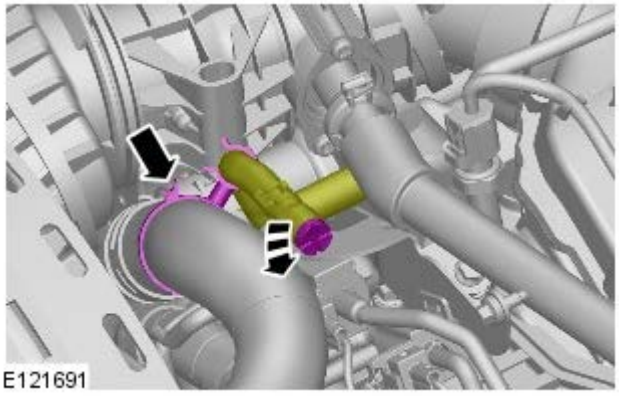
3.


E121324

4.


E121690

5.

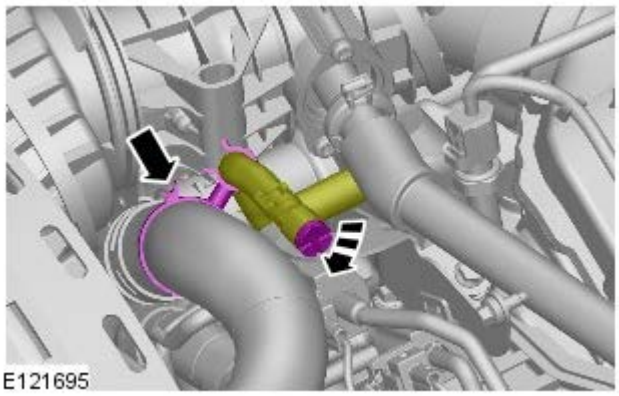

E121691

6. CAUTIONS:

Anti-freeze concentration must be maintained at 50%.

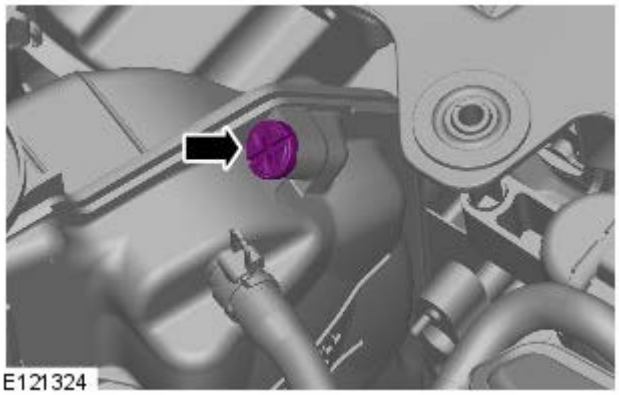
Be prepared to collect escaping coolant.

Fill the coolant expansion tank until coolant appears through the bleed ports.


E121695

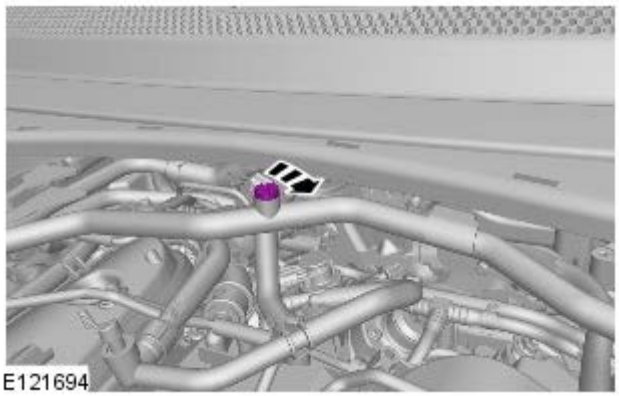
7. CAUTION: Be prepared to collect escaping coolant.

Fill the coolant expansion tank until coolant appears through the bleed ports.


E121324

8.
- Set the heater controls to maximum.

9.
- Start the engine and continue to fill the coolant until the maximum level is reached.

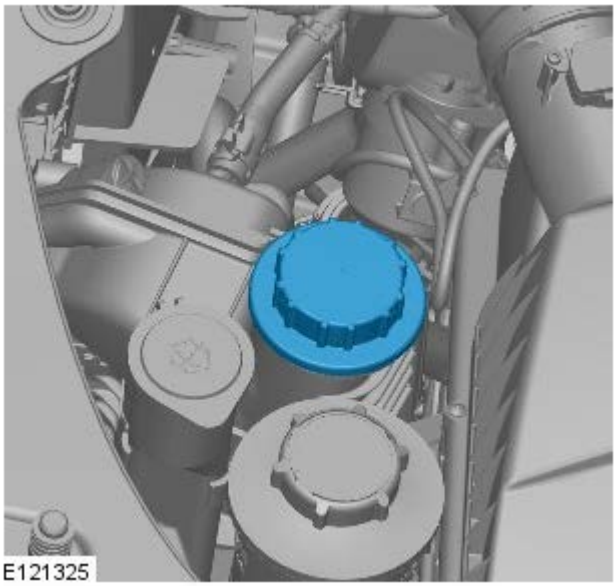

E121694

10. CAUTION: Be prepared to collect escaping coolant.

    Fill the coolant expansion tank until coolant appears through the bleed ports.

11. Increase engine speed to 2500rpm and cycle between this and idle.

12.
- Continue to top-up with coolant with the engine at idle.


E121325

13. CAUTION: Correct installation of the Coolant expansion tank cap can be obtained by tightening the cap until an audible click is heard.

14. Allow the engine to idle, until hot air is emitted at the face registers.

15. Once the front heater is warm, check if the rear heater is warm (if equipped). If no heat is felt, increase the engine speed to 3000 rpm for 30 seconds and return to idle.

16.  CAUTION: Switch off the engine and allow the coolant temperature to go cold.

17. Visually check the engine and cooling system for signs of coolant leakage.

18.  WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

    CAUTIONS:

     Since injury such as scalding could be caused by escaping steam or coolant, make sure the vehicle cooling system is cool prior to carrying out this procedure

     Make sure the coolant level remains above the "COLD FILL RANGE" lower level mark.

     NOTE: When the cooling system is warm, the coolant will be approximately 10mm above the upper level mark on the expansion tank with the cap removed.

    Check and top-up the coolant if required.

19. Refer to: Engine Cover - 3.0L V6 - TdV6 (501-05, Removal and Installation).

Published: 11-May-2011

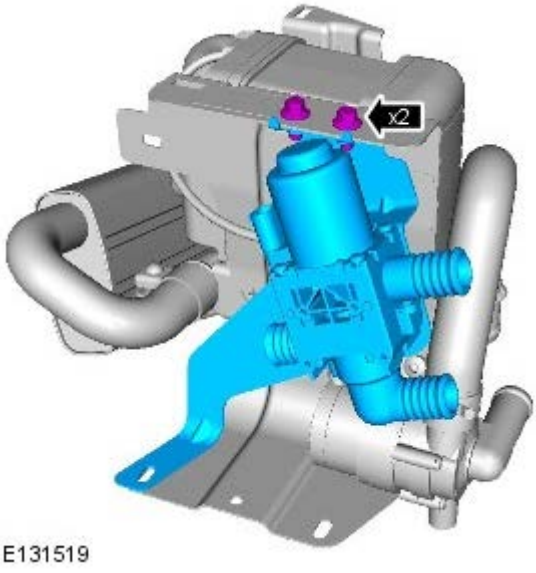
Auxiliary Heating - Fuel Fired Booster Heater Glow Plug And Burner Assembly TDV6 3.0L Diesel

Removal and Installation

Removal

1. Refer to: Specifications (414-00, Specifications).
2. WARNING: Make sure to support the vehicle with axle stands.

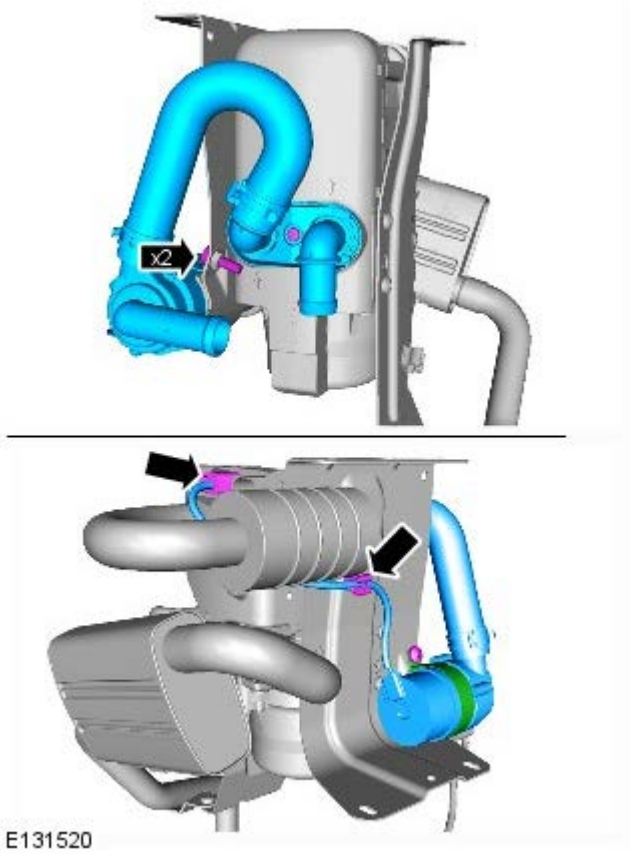
   Raise and support the vehicle.
3. Refer to: Fuel Fired Booster Heater - 3.0L V6 - TdV6 (412-02B, Removal and Installation).



E131519

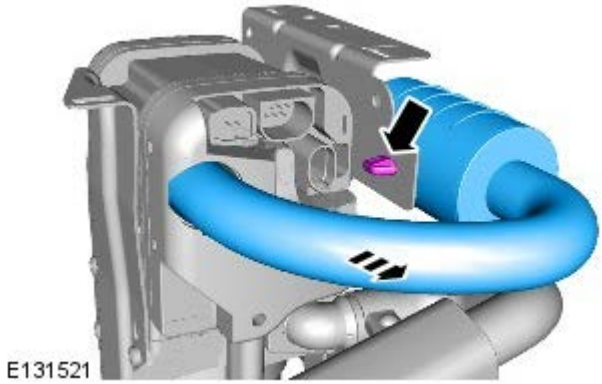
4. NOTE: Where installed.

   10 Nm
5. 7.5 Nm



E131520

6.



7. 10 Nm



8. 10 Nm



9.



E131524

10.


E131525

11.



E131526

12.



E131527

13. 7 Nm



E131528

Installation

1. To install, reverse the removal procedure.
2. Refer to: Fuel Fired Booster Heater - 3.0L V6 - TdV6 (412-02B, Removal and Installation).

Published: 30-Sep-2011

Auxiliary Heating - Fuel Fired Booster Heater Receiver Unit

Removal and Installation

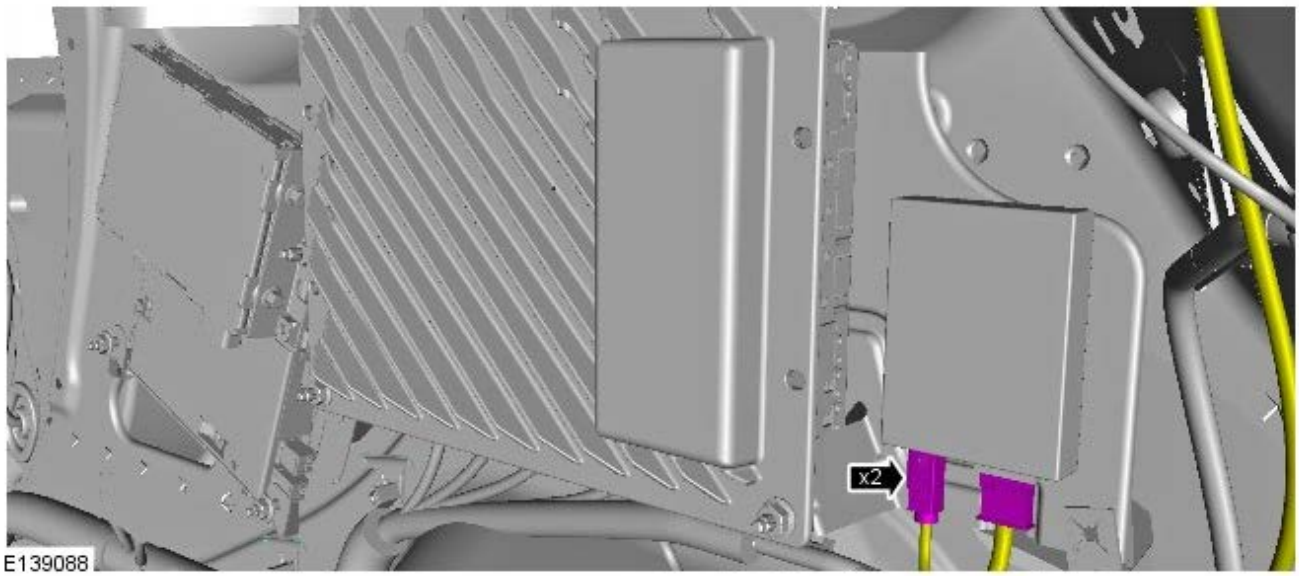
Removal

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

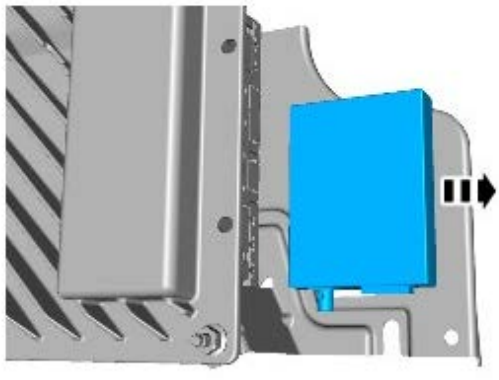
1. NOTE: RH side only.

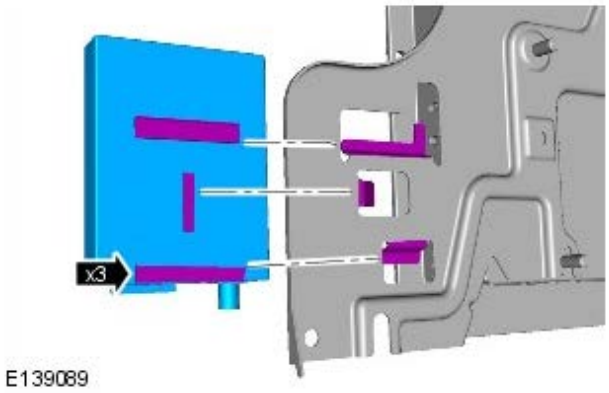
   Refer to: Rear Quarter Trim Panel (501-05, Removal and Installation).

2.



3.





Installation

1. To install, reverse the removal procedure.
2. Using the diagnostic tool, calibrate the component.

Published: 11-May-2011

Air Conditioning - TDV6 3.0L Diesel -

Lubricant

Item	Specification
Air conditioning (A/C) compressor oil type	Sanden SP-10 PAG oil
A/C compressor oil	110 cm^3

Refrigerant

Item	Specification
Refrigerant type	R134A
Refrigerant - vehicles with 5.0L	700 grammes
Refrigerant - vehicles with 3.0 diesel	600 grammes

Torque Specifications

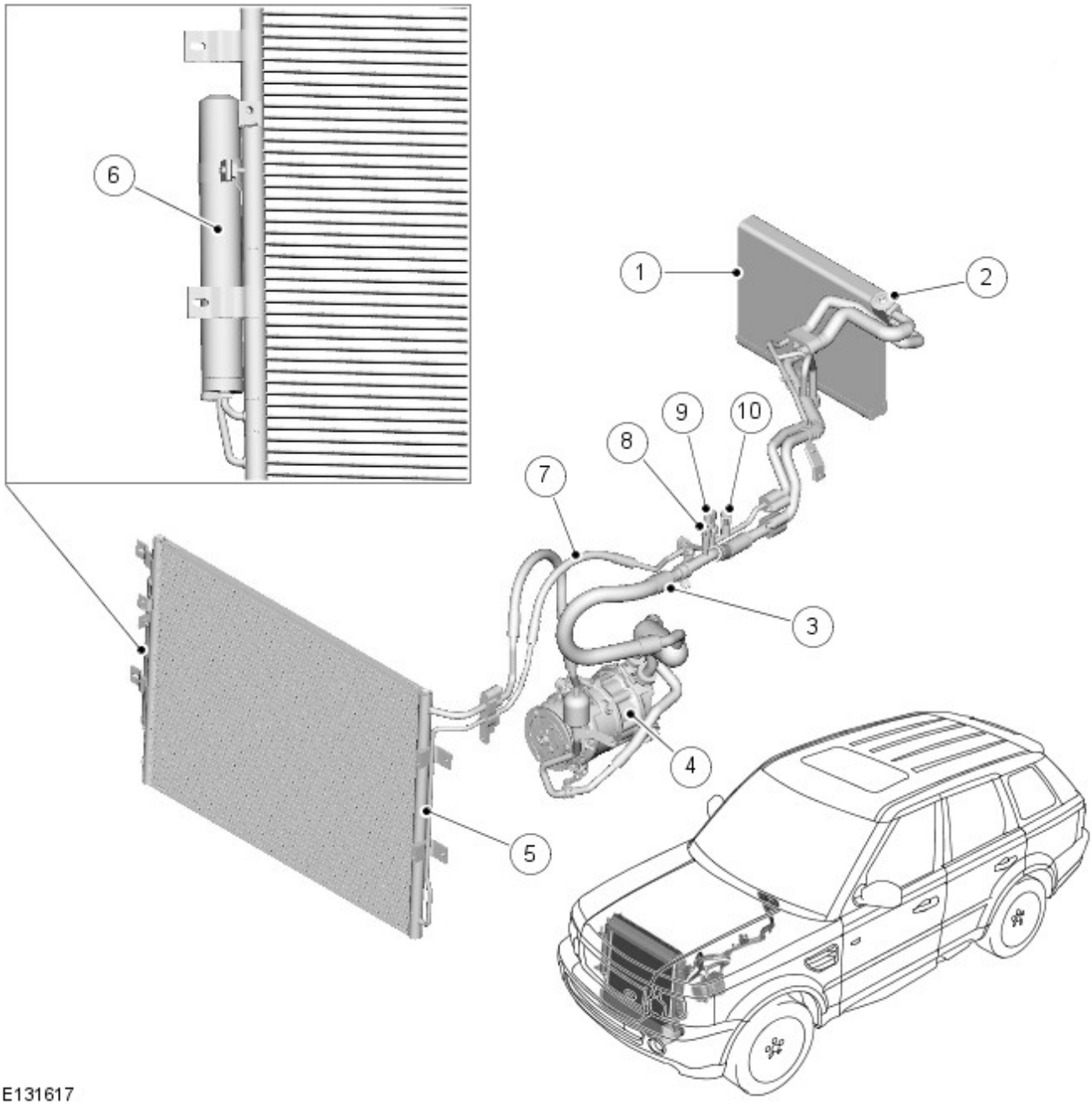
Description	Nm	lb-ft	lb-in
A/C compressor bolts	25	18	-
A/C discharge line to compressor bolt	18	13	-
A/C suction line to compressor bolt	18	13	-
A/C suction line bracket bolts	6	-	53
A/C discharge line to condenser bolt	6	-	53
A/C liquid line to condenser bolt	6	-	53
A/C condenser manifold to radiator bolt	10	7	-
Condenser to radiator bolt - vehicles with 5.0L	10	7	-
Condenser to radiator bolt - vehicles with 3.0 diesel	5	-	44
Evaporator line to evaporator core bolt	6	-	53
Evaporator line bracket nut	6	-	53
A/C pressure transducer	10	7	-
Thermostatic expansion valve (TXV) to refrigerant line clamp bolts	5	-	44

Published: 11-May-2011

Air Conditioning - TDV6 3.0L Diesel - Air Conditioning

Description and Operation

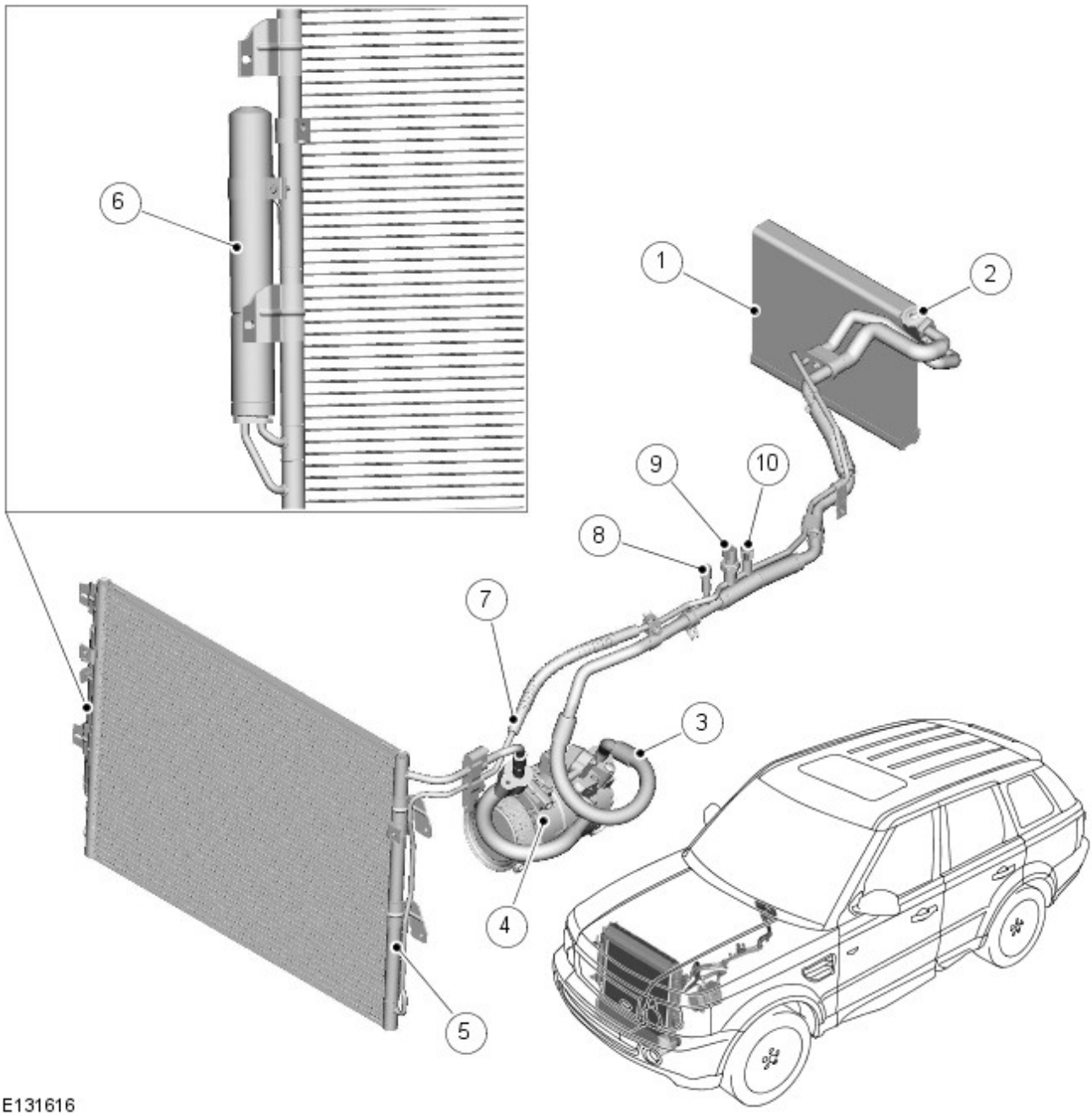
COMPONENT LOCATION 3.0L TdV6



E131617

Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic expansion valve
3	-	Low pressure line
4	-	air conditioning (A/C) compressor
5	-	Condenser
6	-	Receiver drier
7	-	High pressure line
8	-	Low pressure servicing connection
9	-	Refrigerant pressure sensor (reference)
10	-	High pressure servicing connection

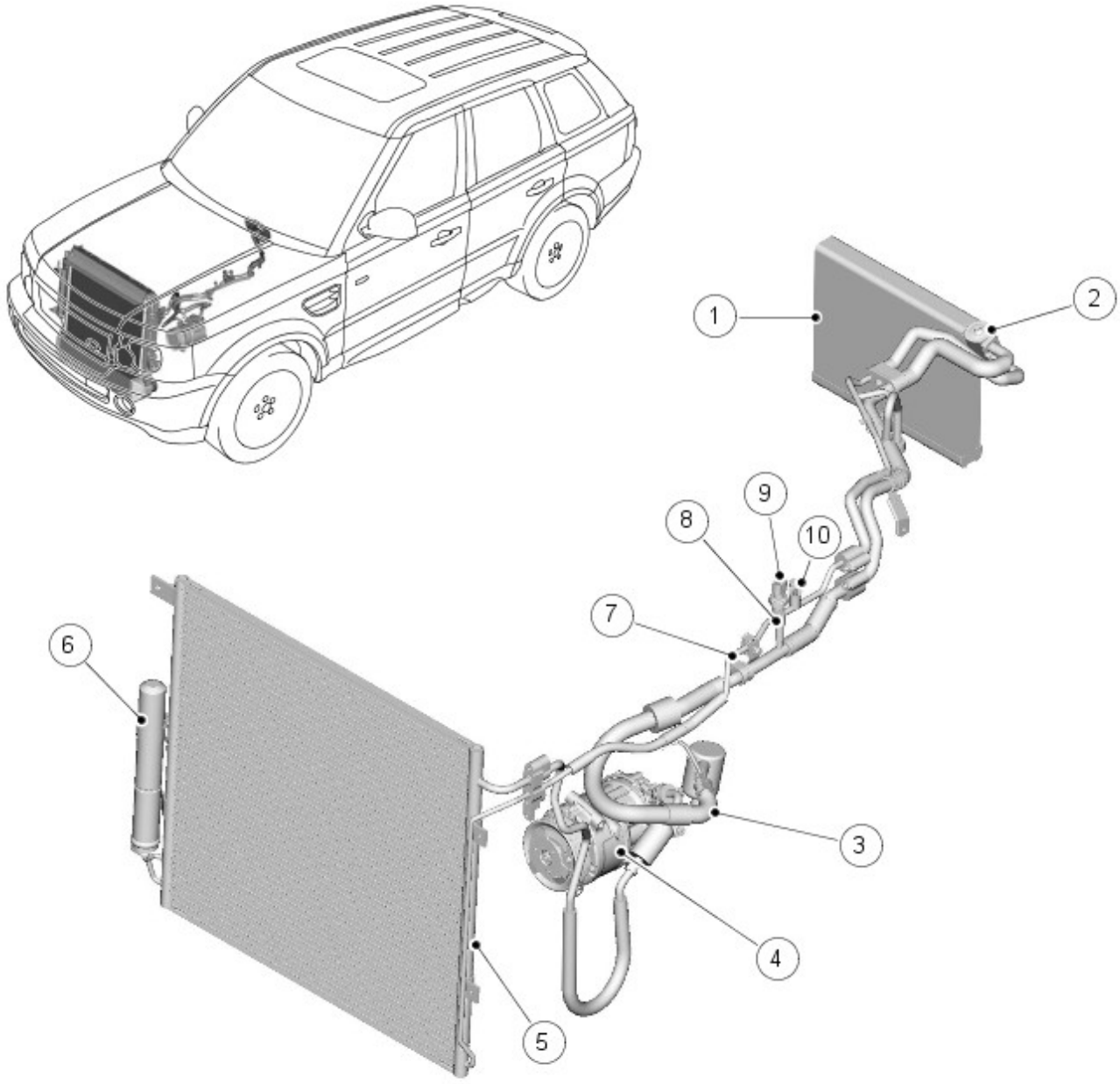
COMPONENT LOCATION 3.6L TdV8



E131616

Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic expansion valve
3	-	Low pressure line
4	-	A/C compressor
5	-	Condenser
6	-	Receiver drier
7	-	High pressure line
8	-	Low pressure servicing connection
9	-	Refrigerant pressure sensor (reference)
10	-	High pressure servicing connection

COMPONENT LOCATION - 5.0L V8



E131618

Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic expansion valve
3	-	Low pressure line
4	-	A/C compressor
5	-	Condenser
6	-	Receiver drier
7	-	High pressure line
8	-	Low pressure servicing connection
9	-	Refrigerant pressure sensor (reference)
10	-	High pressure servicing connection

OVERVIEW

The A/C system transfers heat from the vehicle interior to the outside atmosphere to provide the heater assembly with dehumidified cool air. The system is a sealed, closed loop, filled with a charge weight of R134a refrigerant as the heat transfer medium. Oil is added to the refrigerant to lubricate the internal components of the A/C compressor.

To accomplish the transfer of heat, the refrigerant is circulated around the system, where it passes through 2 pressure/temperature regimes. In each of the pressure/temperature regimes, the refrigerant changes state, during which process maximum heat absorption or release occurs. The low pressure/temperature regime is from the thermostatic expansion valve, through the evaporator to the A/C compressor; the refrigerant decreases in pressure and temperature at the thermostatic expansion valve, then changes state from liquid to vapor in the evaporator, to absorb heat. The high pressure/temperature regime is from the A/C compressor, through the condenser and receiver drier to the thermostatic expansion valve; the refrigerant increases in pressure and temperature as it passes through

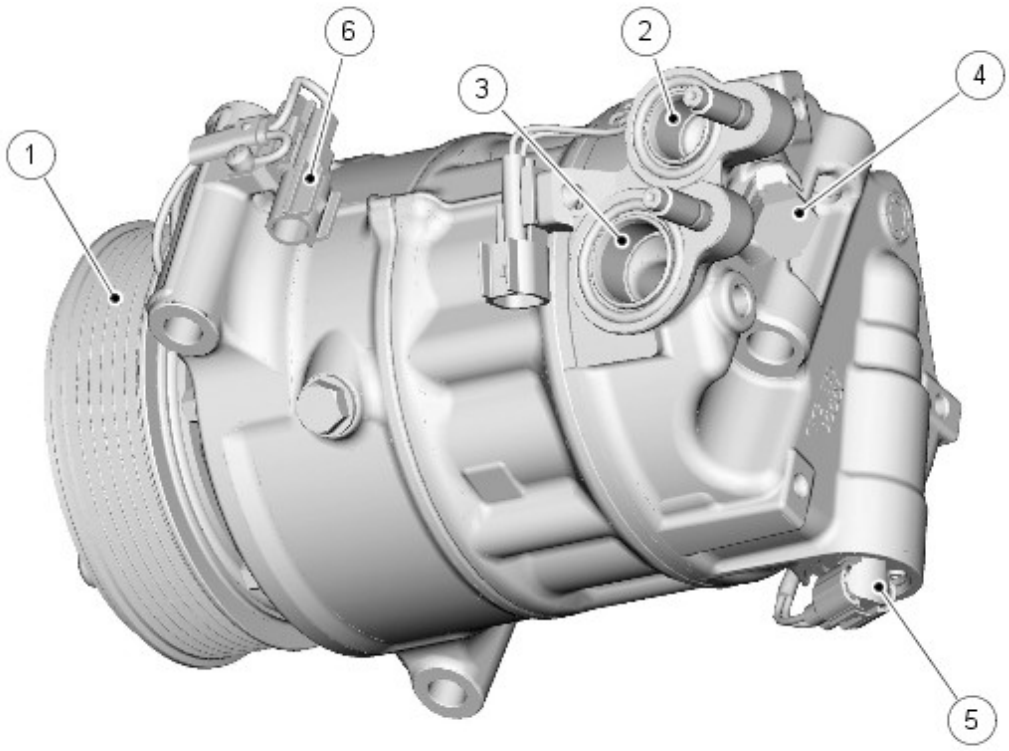
the A/C compressor, then releases heat and changes state from vapor to liquid in the condenser.

Some vehicles may be fitted with a 4 zone climate control system.
For additional information, refer to: Air Conditioning (412-03B, Description and Operation).

A/C COMPRESSOR

The A/C compressor circulates refrigerant around the system by compressing low pressure, low temperature vapor from the evaporator and discharging the resultant high pressure, high temperature vapor to the condenser. On 5.0L vehicles, the A/C (air conditioning) compressor is driven directly from the pulley. On 3.0L and 3.6L diesel vehicles the A/C compressor is driven via an electro-magnetic clutch.

3.0L TdV6 A/C Compressor



E131579

Item	Part Number	Description
1	-	Pulley
2	-	Outlet port
3	-	Inlet port
4	-	Pressure relief valve
5	-	Electronic control valve connector
6	-	electromagnetic clutch connector

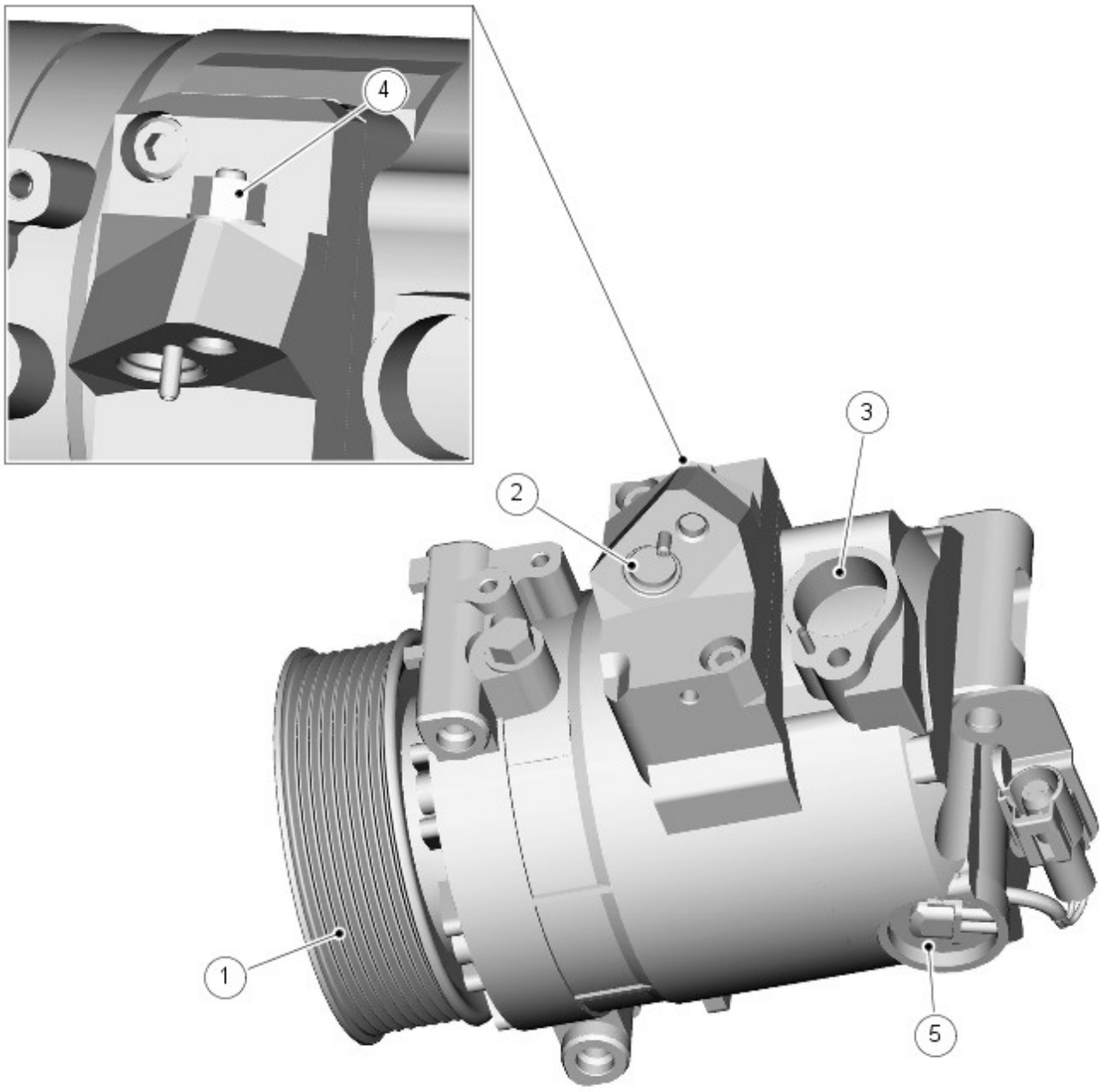
The A/C compressor fitted to 3.0L TdV6 diesel vehicles is a variable displacement unit. The secondary accessory drive belt, driven by the engine crankshaft, drives the A/C compressor via a pulley and an electromagnetic clutch. Operation of the clutch is controlled by a power feed from the ATC (automatic temperature control) module.

The A/C compressor is a 7 cylinder swash plate unit with a minimum displacement of 1.6 cm^3/rev (0.10 in^3/rev) and maximum displacement of 163 cm^3/rev (9.95 in^3/rev). The ATC module automatically adjusts the displacement of the A/C compressor between the minimum and maximum values, to match the thermal load of the evaporator. By matching refrigerant flow and the thermal load of the evaporator, the ATC module maintains cabin comfort whilst also considering fuel economy.

To protect the refrigerant system from unacceptably high pressure, a pressure relief valve is installed in the outlet side of the A/C compressor. The pressure relief valve is set to open at 3.5 to 4.1 MPa (508 to 595 lbf/in^2) and vents excess pressure into the engine compartment. The pressure relief valve closes again when the pressure decreases to 3.1 MPa (449 lbf/in^2).

The clutch of the A/C compressor incorporates a thermal cut-off fuse, which disconnects the power feed from the ATC module if the temperature increases to 182 ± 5 ^oC (360 ± 9 ^oF).

3.6L TdV8 A/C Compressor



E131615

Item	Part Number	Description
1	-	Pulley
2	-	Outlet port
3	-	Inlet port
4	-	Pressure relief valve
5	-	Electronic control valve connector

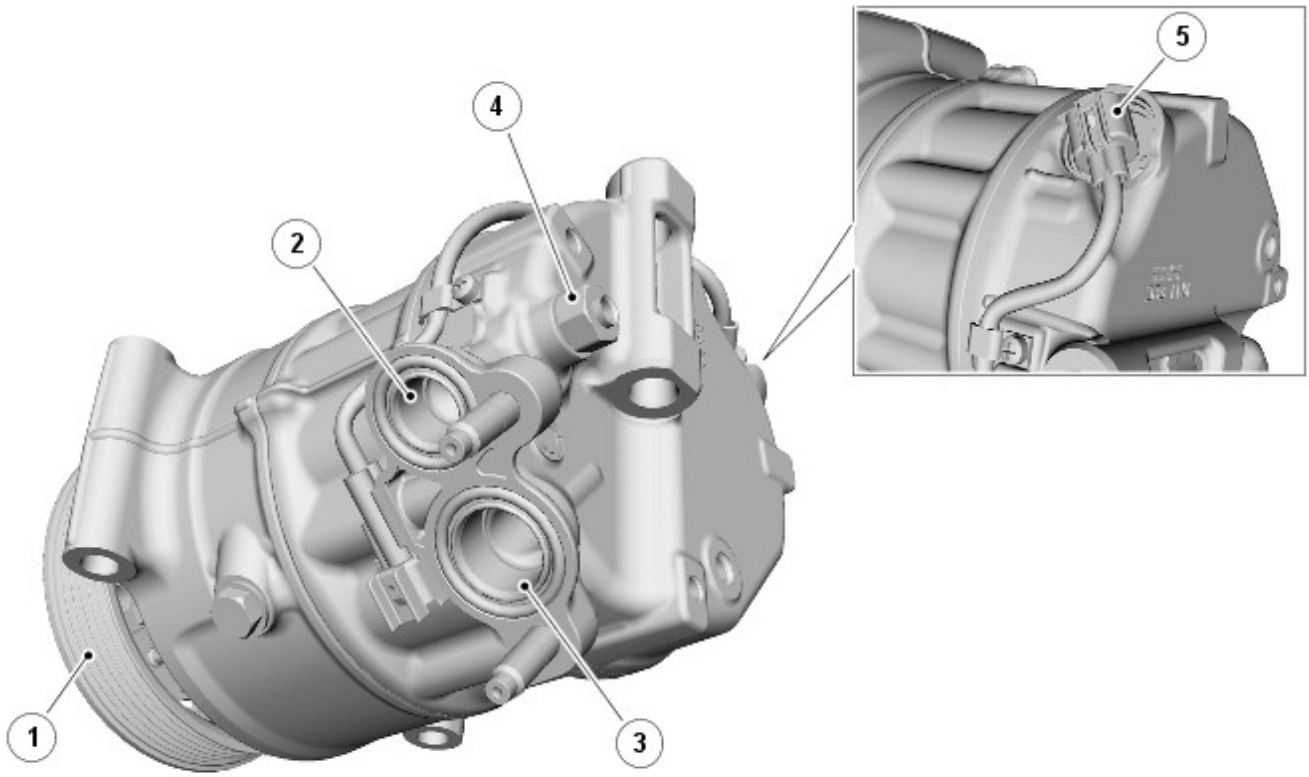
The A/C compressor fitted to 3.6L TdV8 diesel vehicles is a variable displacement unit. The secondary accessory drive belt, driven by the engine crankshaft, drives the A/C compressor.

The A/C compressor is a 7 cylinder swash plate unit with a minimum displacement of 5.5 cm^3/rev (0.34 in^3/rev) and maximum displacement of 171.4 cm^3/rev (10.4 in^3/rev). A control valve in the A/C compressor automatically adjusts the displacement (i.e. flow of refrigerant), between the minimum and maximum values, to match the thermal load of the evaporator. By matching the refrigerant flow to the thermal load of the evaporator, the variable A/C compressor maintains a relatively constant evaporator temperature of approximately 3 to 4^oC (37 to 39^oF).

To protect the refrigerant system from unacceptably high pressure, a pressure relief valve is installed in the outlet side of the A/C compressor. The pressure relief valve is set to open at 3.5 to 4.1 MPa (508 to 595 lbf/in^2) and vents excess pressure into the engine compartment. The pressure relief valve closes again when the pressure decreases to 3.01 MPa (437 lbf/in^2).

The pulley of the A/C compressor incorporates a mechanical torque limiter, which disconnects the drive plate from the compressor shaft if torque increases to a level that indicates imminent compressor seizure.

5.0L V8 A/C Compressor



E131337

Item	Part Number	Description
1	-	Pulley
2	-	Outlet port
3	-	Inlet port
4	-	Pressure relief valve
5	-	Electronic control valve connector

The A/C compressor fitted to 5.0 V8 petrol vehicles is a variable displacement unit. The secondary accessory drive belt, driven by the engine crankshaft, drives the A/C compressor via a pulley. Operation of the compressor is controlled by an electronic control valve working in conjunction with the ATC module.

The A/C compressor is a 7 cylinder swash plate unit with a minimum displacement of 1.6 cm^3/rev (0.10 in^3/rev) and maximum displacement of 163 cm^3/rev (9.95 in^3/rev). The ATC module automatically adjusts the displacement of the A/C compressor between the minimum and maximum values, to match the thermal load of the evaporator. By matching refrigerant flow and the thermal load of the evaporator, the ATC module maintains cabin comfort whilst also considering fuel economy.

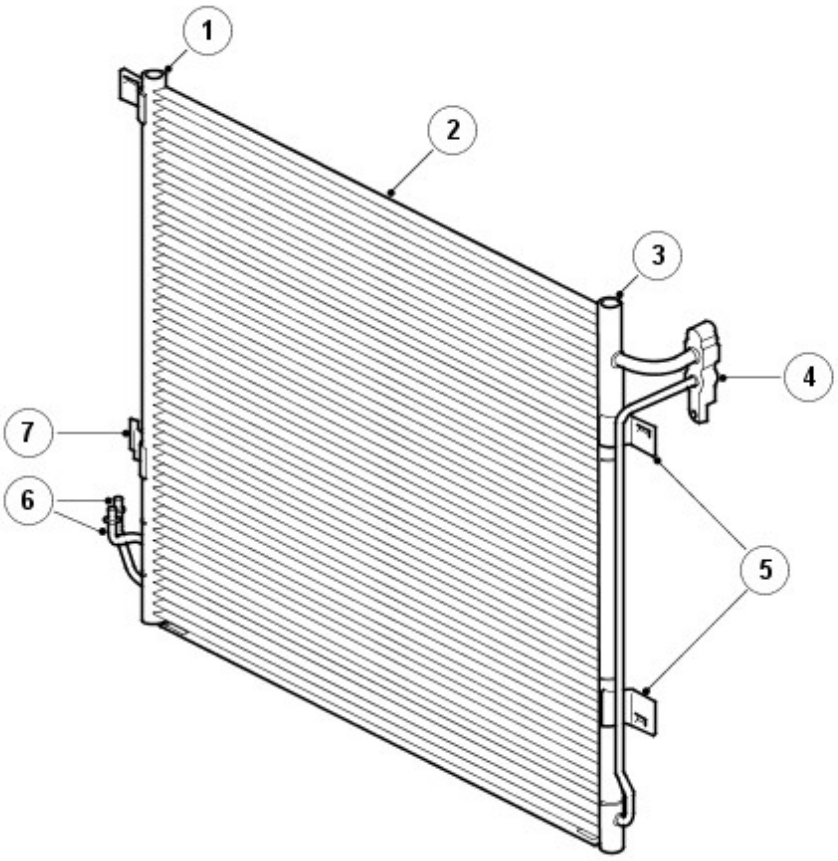
To protect the refrigerant system from unacceptably high pressure, a pressure relief valve is installed in the outlet side of the A/C compressor. The pressure relief valve is set to open at 3.5 to 4.1 MPa (508 to 595 lbf/in^2) and vents excess pressure into the engine compartment. The pressure relief valve closes again when the pressure decreases to 3.1 MPa (449 lbf/in^2).

The pulley of the A/C compressor incorporates a mechanical torque limiter, which disconnects the drive plate from the compressor shaft if torque increases to a level that indicates imminent compressor seizure.

CONDENSER AND RECEIVER DRIER

NOTE: 5.0L V8 version shown other installations similar

Condenser



E46920

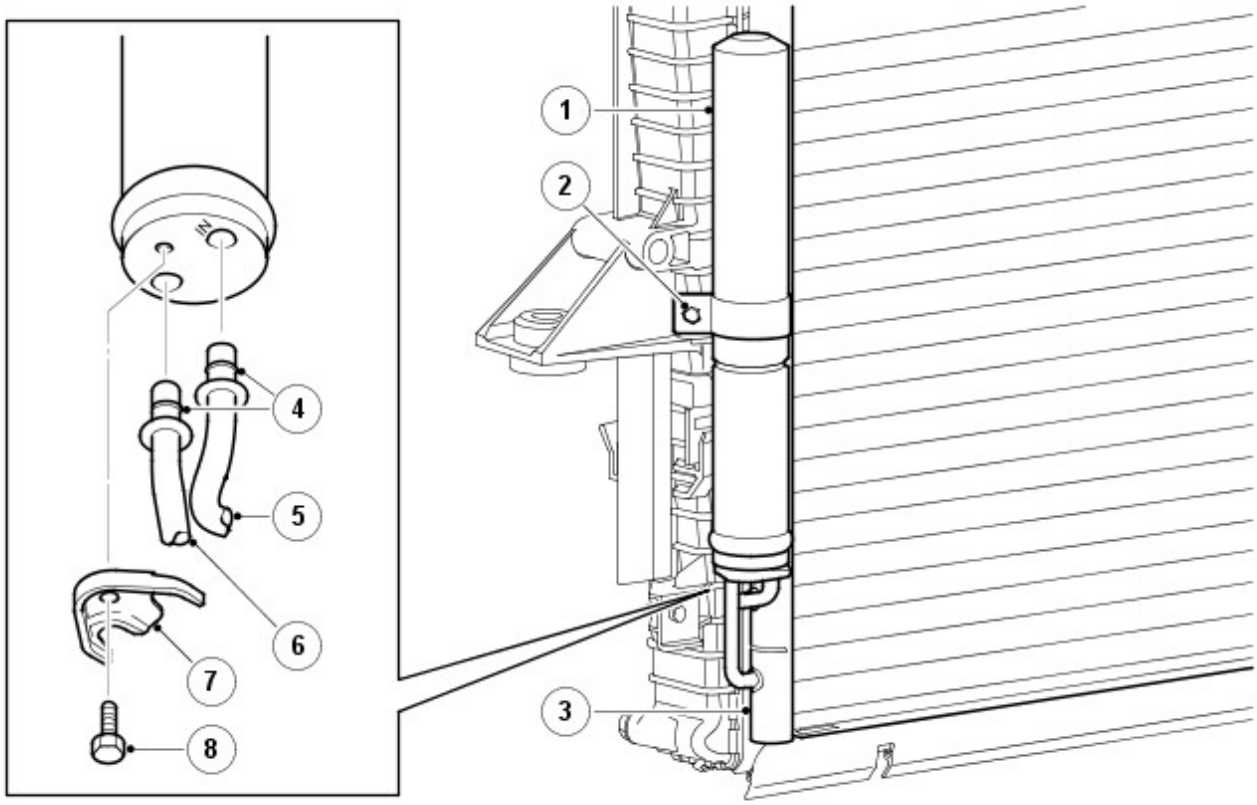
Item	Part Number	Description
1	-	right-hand (RH) end tank
2	-	Condenser core
3	-	left-hand (LH) end tank
4	-	High pressure line connector block
5	-	Condenser attachment brackets
6	-	Receiver drier pipes
7	-	Receiver drier attachment bracket

The condenser transfers heat from the refrigerant to the surrounding air to convert the vapor from the A/C compressor into a liquid. A receiver drier module, integrated onto the LH side of the condenser, incorporates a filter and a desiccant to remove solid impurities and moisture from the refrigerant. The receiver drier module also functions as a reservoir for liquid refrigerant, to accommodate changes of heat load at the evaporator.

The condenser is installed immediately in front of the radiator.

The condenser is classified as a sub-cooling condenser and consists of a fin and tube heat exchanger installed between two end tanks.

Receiver Drier



E46921

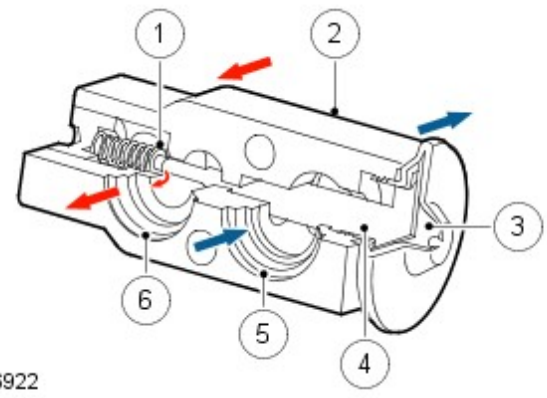
Item	Part Number	Description
1	-	Receiver Drier
2	-	Clamp
3	-	Condenser RH end tank
4	-	O-ring seals
5	-	Inlet pipe
6	-	Outlet pipe
7	-	Collar
8	-	Bolt

The receiver drier removes solid impurities and moisture from the refrigerant, and provides a reservoir for liquid refrigerant to accommodate changes of heat load at the evaporator.

The receiver drier is attached to the two stub pipes on the right end tank of the condenser. A collar, located on lands on the stub pipes and secured with a bolt, attaches the stub pipes to the receiver drier. A clamp secures the body of the receiver drier to a bracket welded to the right end tank of the condenser. The inlet and outlet ports of the receiver drier are the same size, so care must be taken to install the receiver drier the correct way round on the stub pipes; to assist with installation, the inlet port is identified with the word IN etched into the receiver drier.

Refrigerant entering the receiver drier passes through a filter and a desiccant pack, then collects in the base of the unit before flowing through the outlet stub pipe back to the condenser. The desiccant and the filter are non-serviceable; the complete unit must be replaced when a change of desiccant is required.

THERMOSTATIC EXPANSION VALVE



E46922

Item	Part Number	Description
1	-	Metering valve

2	-	Housing
3	-	Diaphragm
4	-	Temperature sensitive tube
5	-	Outlet passage from evaporator
6	-	Inlet passage to evaporator

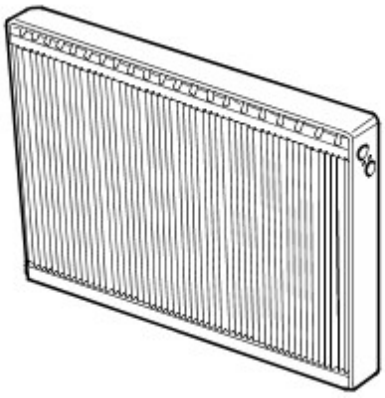
The thermostatic expansion valve meters the flow of refrigerant into the evaporator, to match the refrigerant flow with the heat load of the air passing through the evaporator.

The thermostatic expansion valve is a block type valve located behind the heater assembly, and attached to the inlet and outlet ports of the evaporator. The thermostatic expansion valve consists of an aluminum housing containing inlet and outlet passages. A ball and spring metering valve is installed in the inlet passage and a temperature sensor is installed in the outlet passage. The temperature sensor consists of a temperature sensitive tube connected to a diaphragm. The bottom end of the temperature sensitive tube acts on the ball of the metering valve. Pressure on top of the diaphragm is controlled by evaporator outlet temperature conducted through the temperature sensitive tube. The bottom of the diaphragm senses evaporator outlet pressure.

Liquid refrigerant flows through the metering valve into the evaporator. The restriction across the metering valve reduces the pressure and temperature of the refrigerant. The restriction also changes the liquid stream of refrigerant into a fine spray, to improve the evaporation process. As the refrigerant passes through the evaporator, it absorbs heat from the air flowing through the evaporator. The increase in temperature causes the refrigerant to vaporize and increase in pressure.

The temperature and pressure of the refrigerant leaving the evaporator act on the diaphragm and temperature sensitive tube, which regulate the metering valve opening and so control the volume of refrigerant flowing through the evaporator. The warmer the air flowing through the evaporator, the more heat available to evaporate refrigerant and thus the greater the volume of refrigerant allowed through the metering valve.

EVAPORATOR



E46923

The evaporator is installed in the heater assembly between the blower and the heater matrix, to absorb heat from the exterior or recirculated air. Low pressure, low temperature refrigerant changes from liquid to vapor in the evaporator, absorbing large quantities of heat as it changes state.

Most of the moisture in the air passing through the evaporator condenses into water, which drains out of the heater and through the floorpan, to the underside of the vehicle, through two drain tubes.

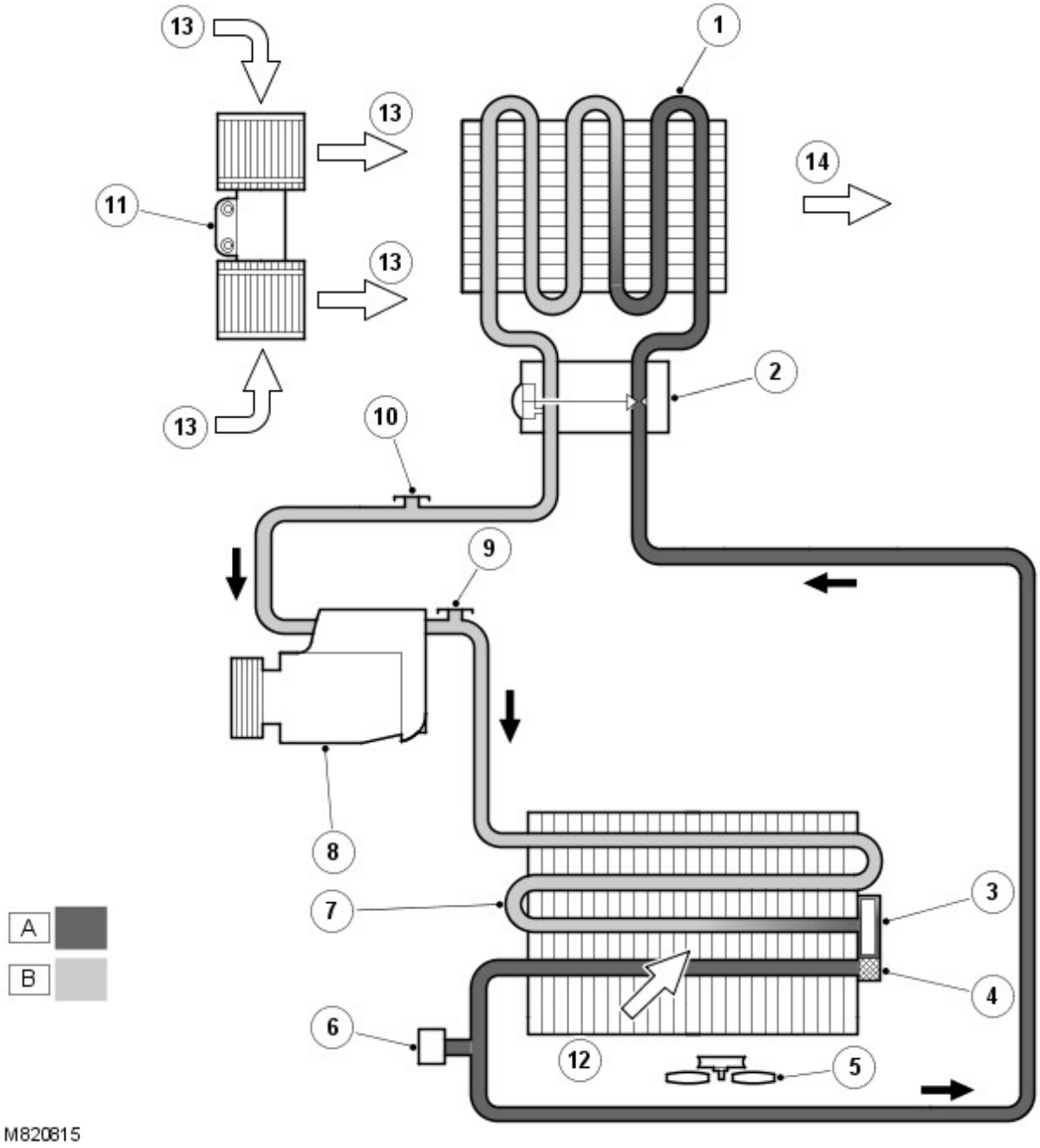
REFRIGERANT LINES

To maintain similar flow velocities around the system, the diameter of the refrigerant lines varies to suit the two pressure/temperature regimes. The larger diameters are installed in the low pressure/temperature regime and the smaller diameters are installed in the high pressure/temperature regime.

Low and high pressure charging connections are incorporated into the refrigerant lines near the front RH corner of the engine compartment.

CONTROL DIAGRAM

NOTE: **A** = Refrigerant liquid; **B** = Refrigerant vapor



Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic expansion valve
3	-	Desiccant (in modulator)
4	-	Filter (in modulator)
5	-	Electric cooling fan
6	-	Refrigerant pressure sensor
7	-	Condenser
8	-	A/C compressor
9	-	High pressure servicing connection
10	-	Low pressure servicing
11	-	Blower
12	-	Air flows: Ambient air flow through condenser
13	-	Fresh/Recirculated air flow through blower
14	-	Cooled air flow to vehicle interior

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Air Conditioning - TDV6 3.0L Diesel - Air Conditioning

Diagnosis and Testing

For additional information.
REFER to: Climate Control System (412-00, Diagnosis and Testing).

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Air Conditioning - TDV6 3.0L Diesel - Air Conditioning (A/C) Compressor

Removal and Installation

Removal

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

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

   Raise and support the vehicle.

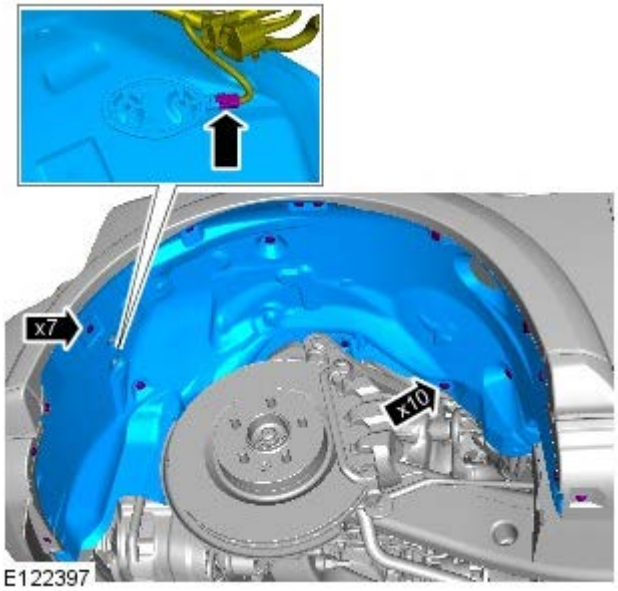
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).

3. Refer to: Accessory Drive Belt (303-05, Removal and Installation).

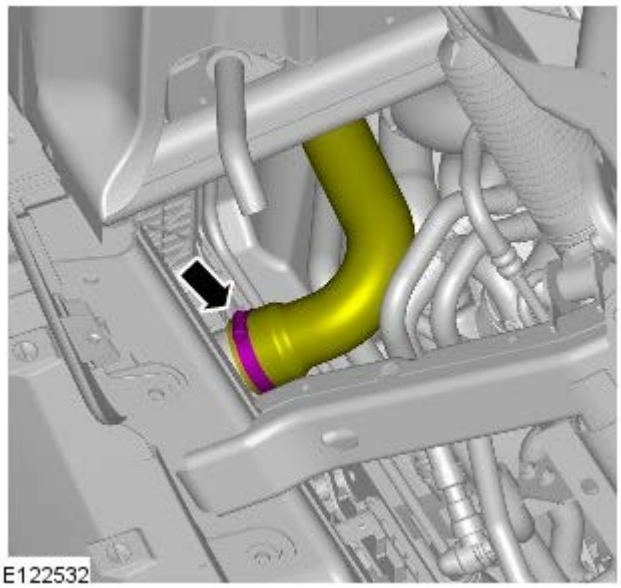
4. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00, General Procedures).

5. Refer to: Transmission Fluid Cooler Tubes - 3.0L Diesel (307-02, Removal and Installation).

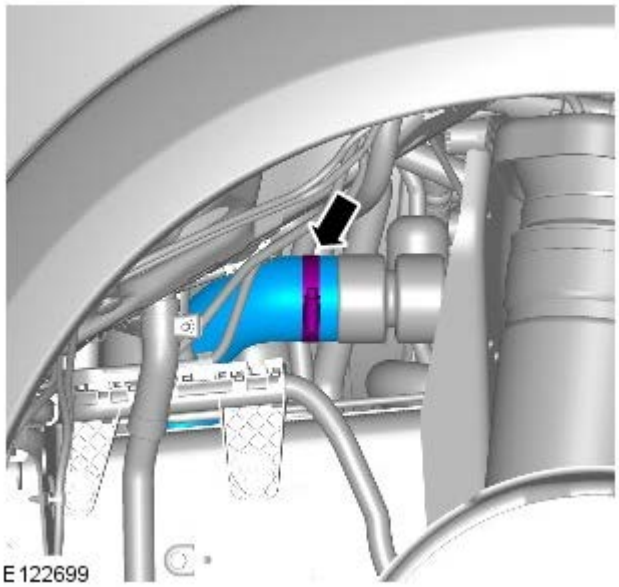
6.



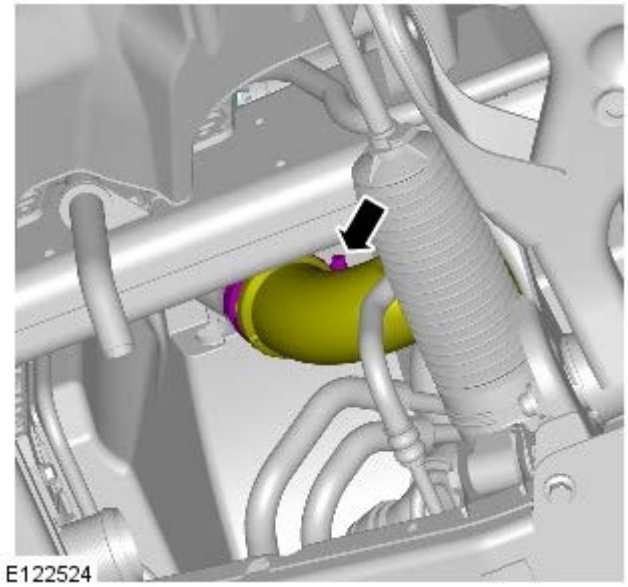
7. CAUTION: Be prepared to collect escaping coolant.



8.

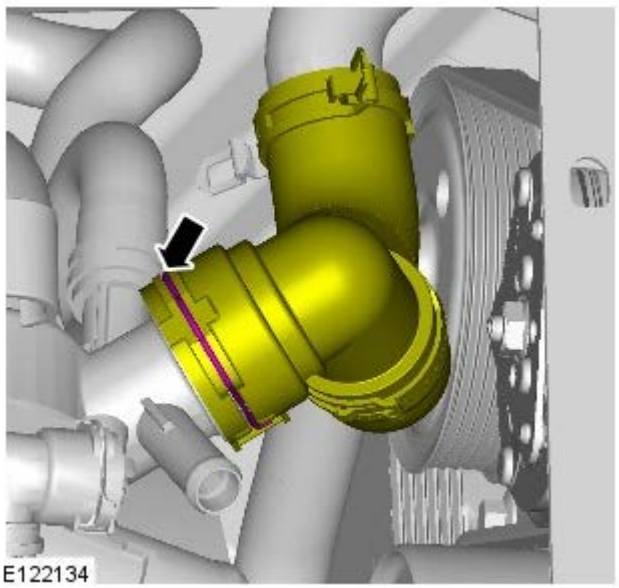


9.

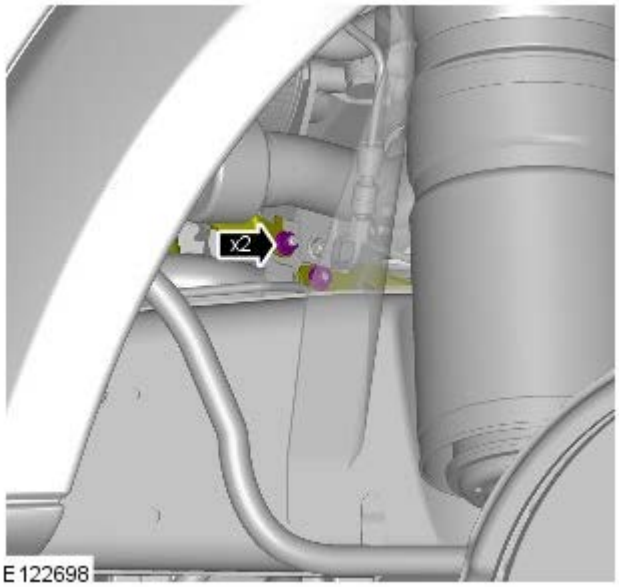


10. CAUTION: Be prepared to collect escaping coolant.

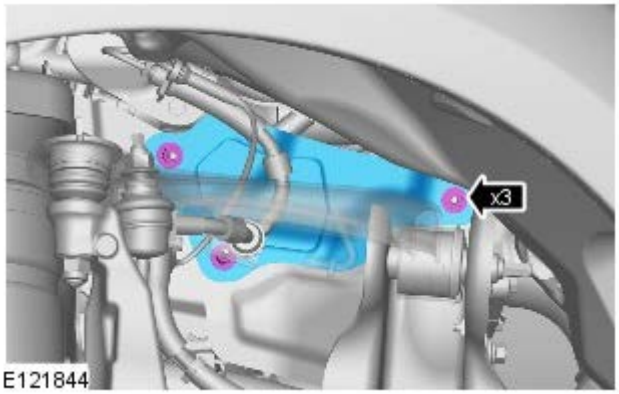
NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



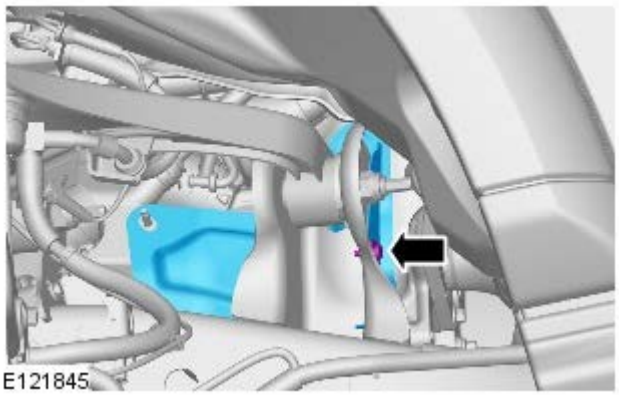
11. *Torque:* 6 Nm



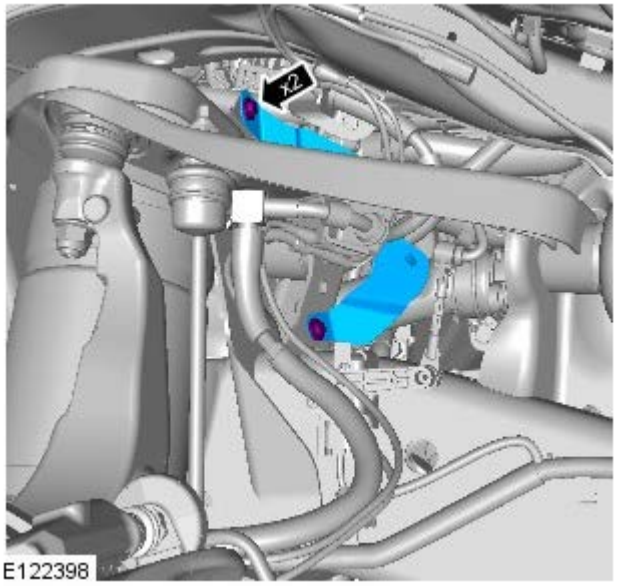
12. *Torque:* 9 Nm



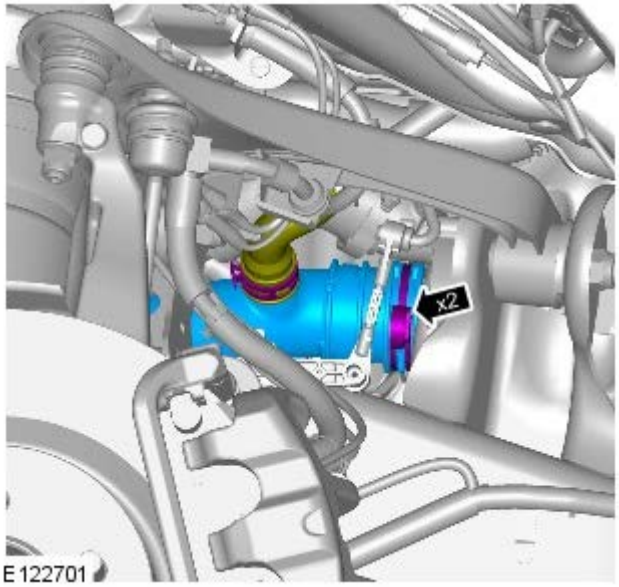
13. *Torque:* 9 Nm



14. *Torque:* 9 Nm



15.

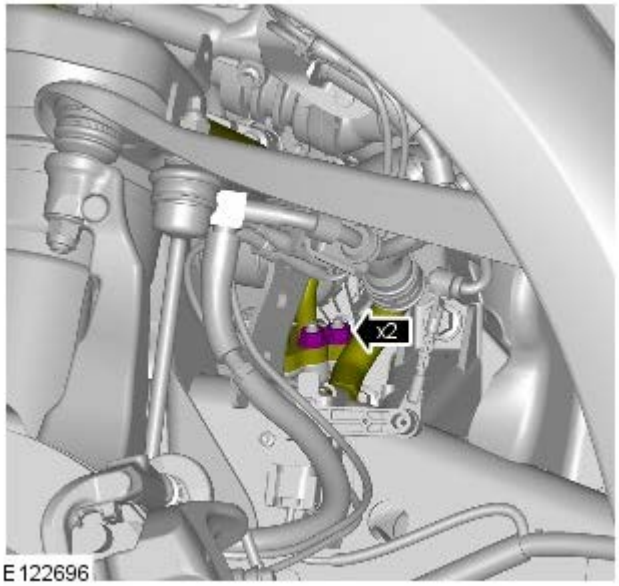


16. CAUTIONS:

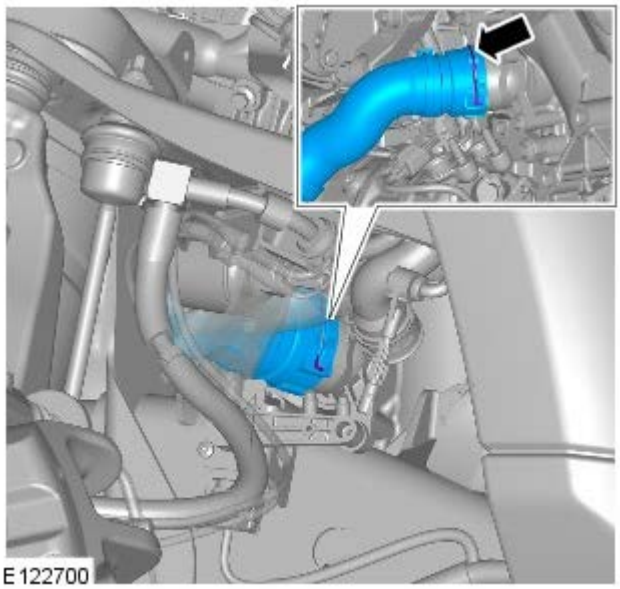
Make sure that all openings are sealed. Use new blanking caps.

A new O-ring seal is to be installed.

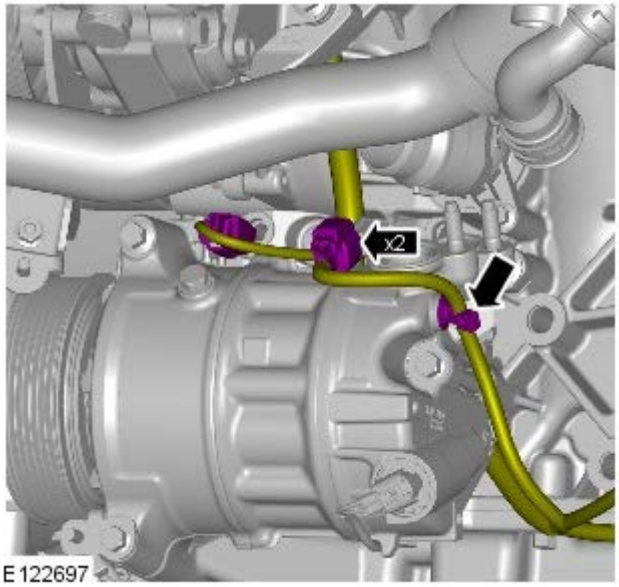
Torque: 18 Nm



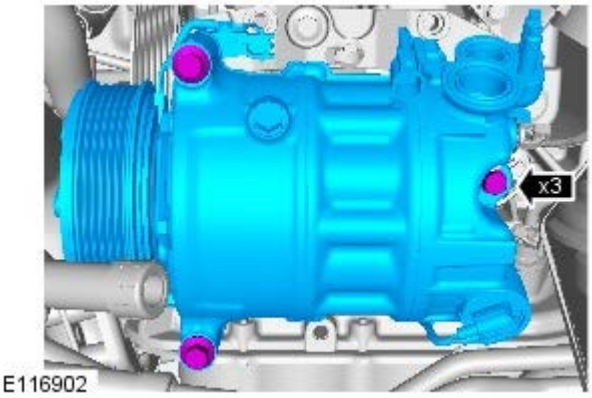
17. CAUTION: Be prepared to collect escaping coolant.



18.



19. *Torque:* 25 Nm



Installation

1. To install, reverse the removal procedure.

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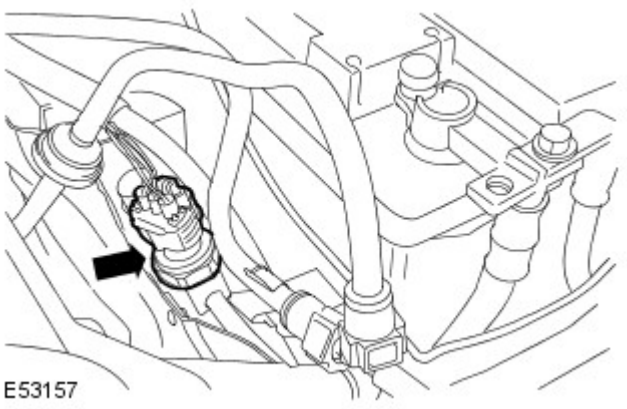
Air Conditioning - TDV6 3.0L Diesel - Air Conditioning (A/C) Pressure Transducer

Removal and Installation

Removal

1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).

2. Recover the 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).



3. CAUTIONS:

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

   To prevent damage to components, use an additional wrench when loosening or tightening unions.

   Remove the A/C pressure transducer.
   - Disconnect the electrical connector.
   - Remove and discard the seal.

Installation

1. Install the A/C pressure transducer.
   - Clean the component mating faces.
   - Install a new seal.
   - Tighten the transducer to 10 Nm (7 lb.ft).
   - Connect the electrical connector.

2. 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).

3. Connect the battery ground cable.
   For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).

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Air Conditioning - TDV6 3.0L Diesel - Condenser Core

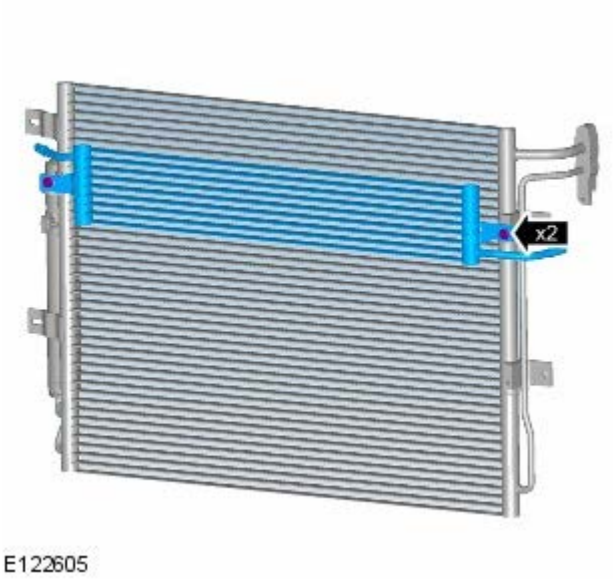
Removal and Installation

Removal

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

1. For additional information, refer to: Radiator (303-03, Removal and Installation).

2. TORQUE: 5 Nm



Installation

1. To install, reverse the removal procedure.

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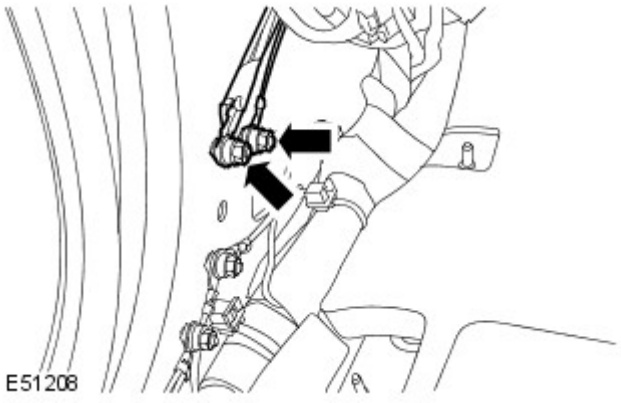
Air Conditioning - TDV6 3.0L Diesel - Evaporator Core

Removal and Installation

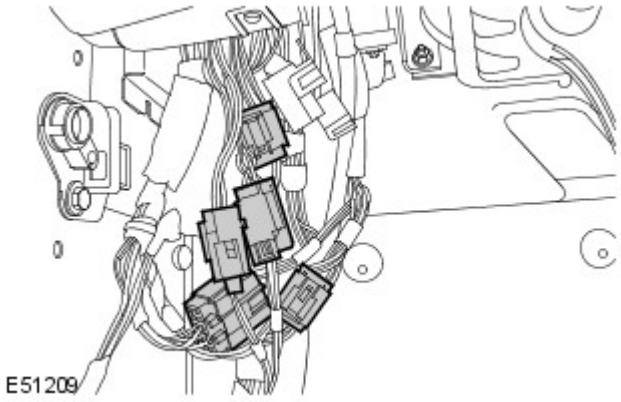
Removal

1. Remove the engine cover.
2. Evacuate 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).
3. WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

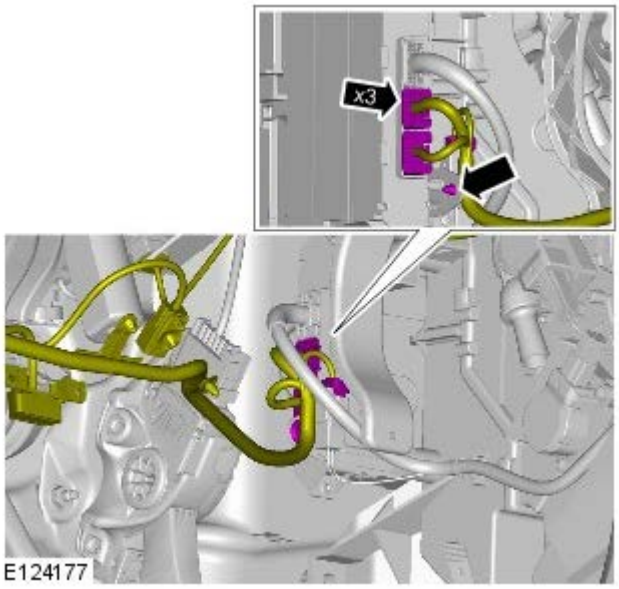
   Raise and support the vehicle.
4. Drain the cooling system.
   For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - TDV6 3.0L Diesel, General Procedures).
5. Remove the driver side front seat.
   For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).
6. Remove the floor console.
   For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).
7. Remove the instrument panel upper section.
   For additional information, refer to: Instrument Panel Upper Section (501-12 Instrument Panel and Console, Removal and Installation).
8. Release the 3 ground cables from the driver side lower A-pillar.
   - Remove the 2 nuts.



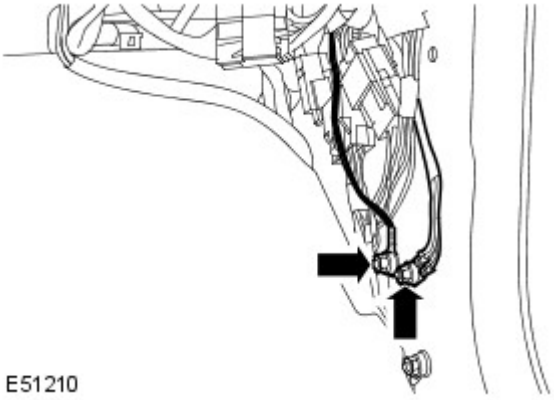
9. Disconnect the 5 electrical connectors from the driver side lower A-pillar.



10. Disconnect the 3 electrical connectors.

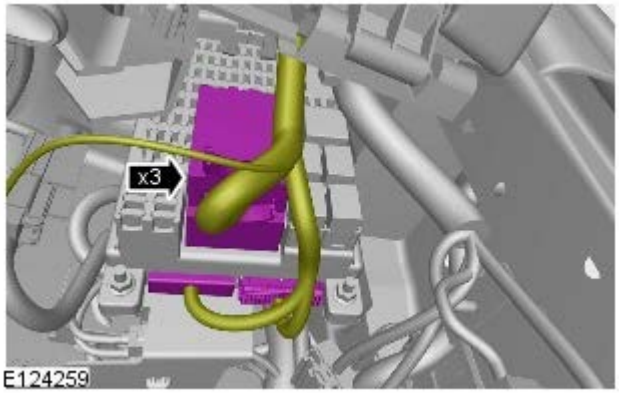


11. Release the 3 ground cables from the passenger side lower A-pillar.
    - Remove the 2 nuts.



12. Disconnect the 5 electrical connectors from the passenger side lower A-pillar.

13. Disconnect the central junction box (CJB) three electrical connectors.



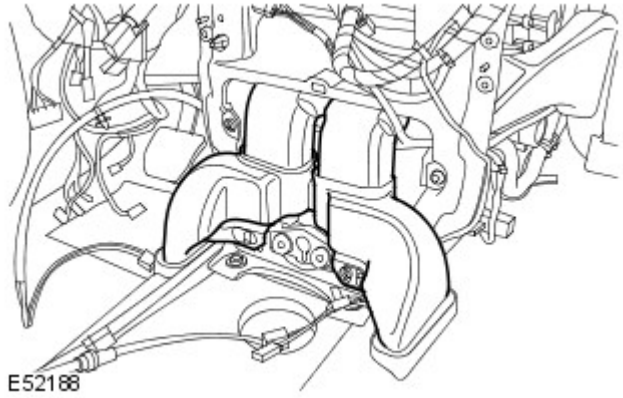
14. Disconnect 2 electrical connectors from the instrument panel center reinforcement.

15. CAUTION: Cover fiber optic cable connectors to minimize dust ingress and avoid bending the cables in a radius of less than 30 mm.

    If installed, disconnect the instrument panel center reinforcement fibre optic cables.
    - Disconnect the electrical connector.



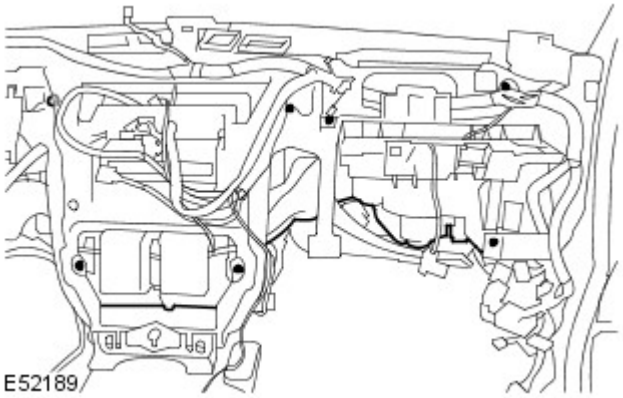
16. Remove the heater housing center ducts.



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

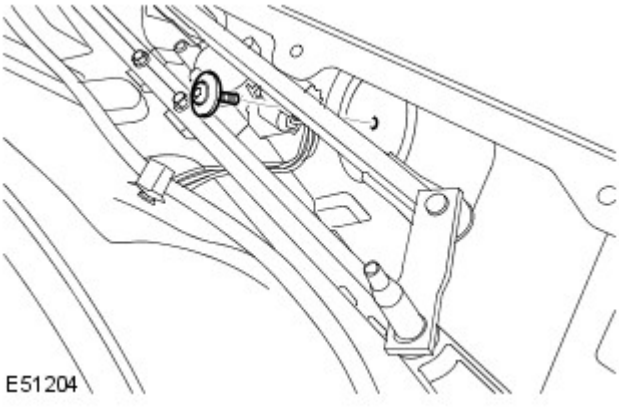


18. Release the heater housing from the instrument panel carrier.
    - Remove the 7 Torx screws.

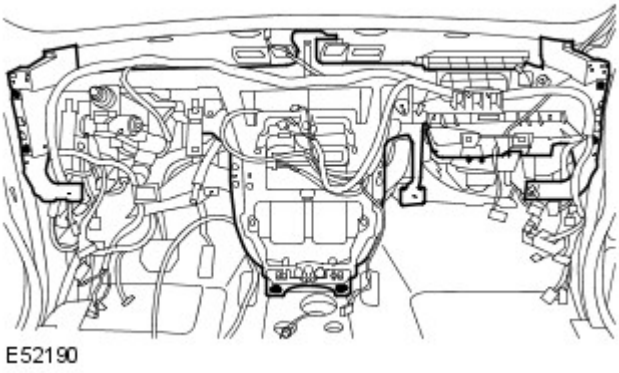


19. Remove the plenum chamber panel.
    For additional information, refer to: Plenum Chamber (412-01 Air Distribution and Filtering, Removal and Installation).

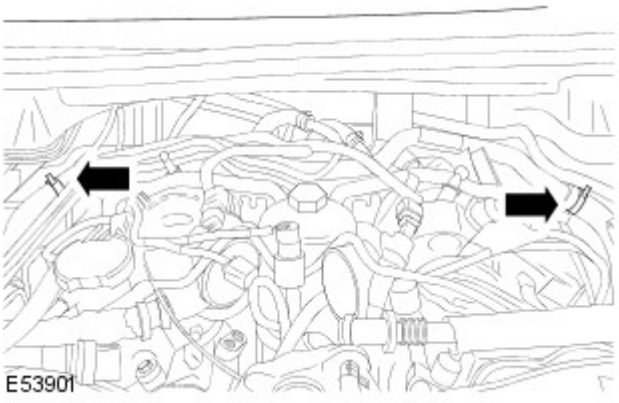
20. Remove the instrument panel carrier to bulkhead Torx bolt.



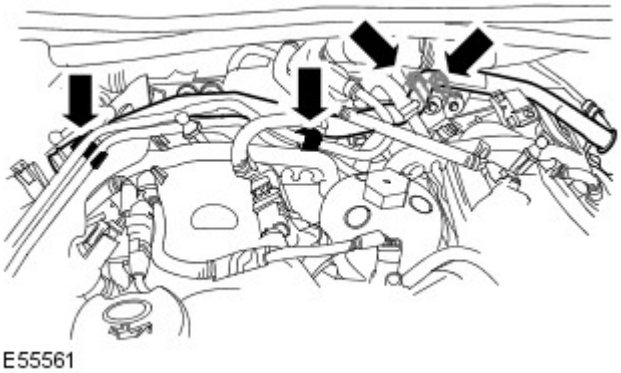
21. With assistance, remove the instrument panel.
    - Remove the 6 Torx bolts.



22. Disconnect both exhaust gas recirculation (EGR) coolant cross-over pipe hoses.
    - Release the 2 clips.

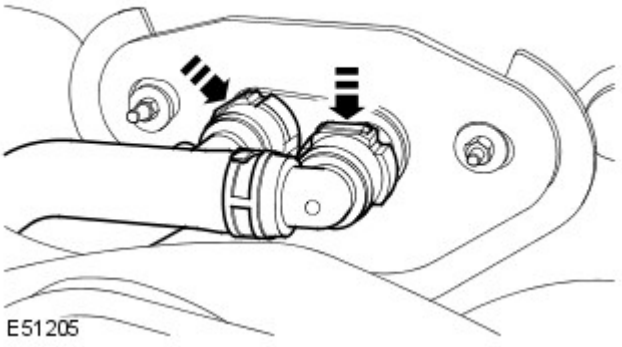


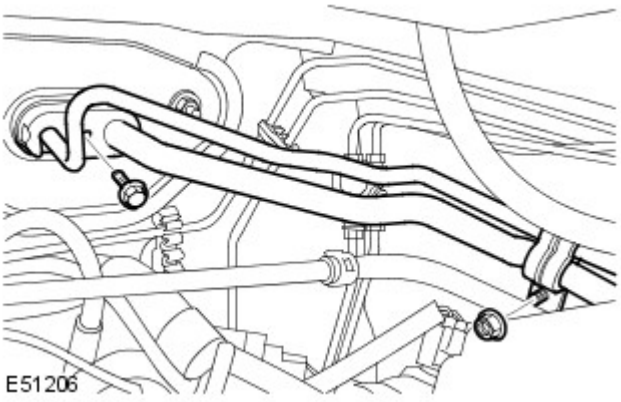
23. Remove the EGR coolant cross-over pipe.
    - Remove the 2 bolts.
    - Release the 2 clips.



24. 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.

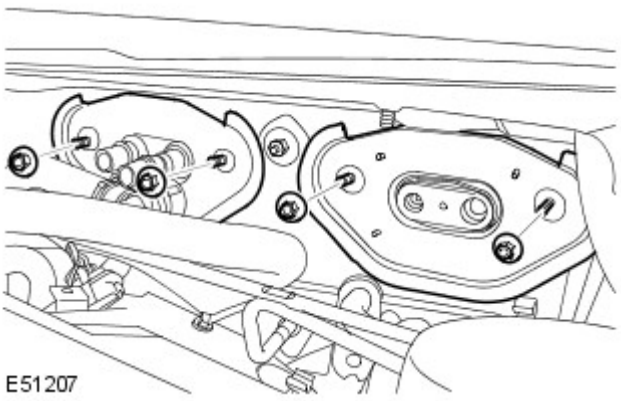
    Disconnect 2 heater hoses from the bulkhead.
    - Release the 2 clips.





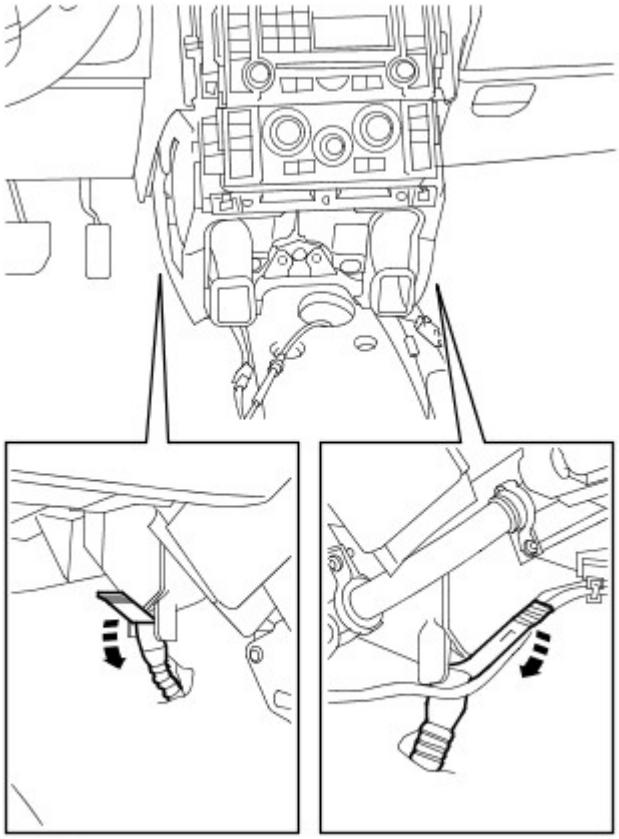
25. CAUTION: Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

    Release the 2 A/C refrigerant lines.
    - Remove the nut and bolt.
    - Remove and discard the O-ring seals.



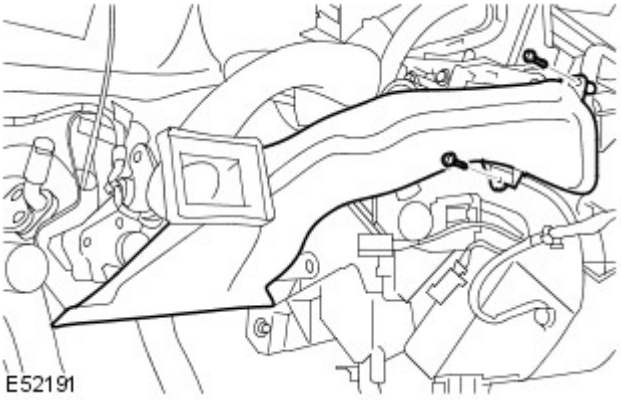
26. Remove the 2 adapter panels.
    - Remove the 4 nuts.

27. Disconnect 2 drain tubes from the heater housing.



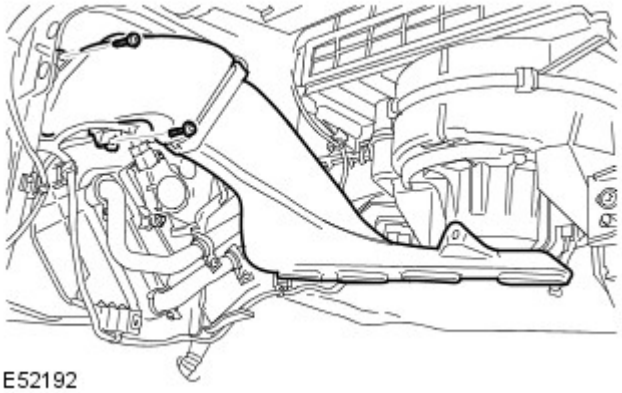
E51199

28. Remove the driver side footwell duct.
    - Remove the 2 Torx screws.



E52191

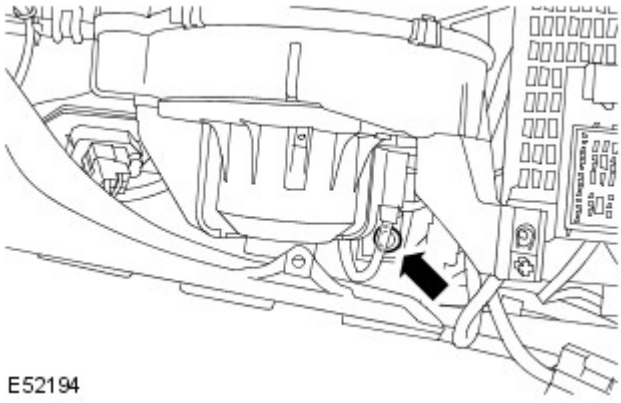
29. Remove the passenger side footwell duct.
    - Remove the 2 Torx screws.



E52192

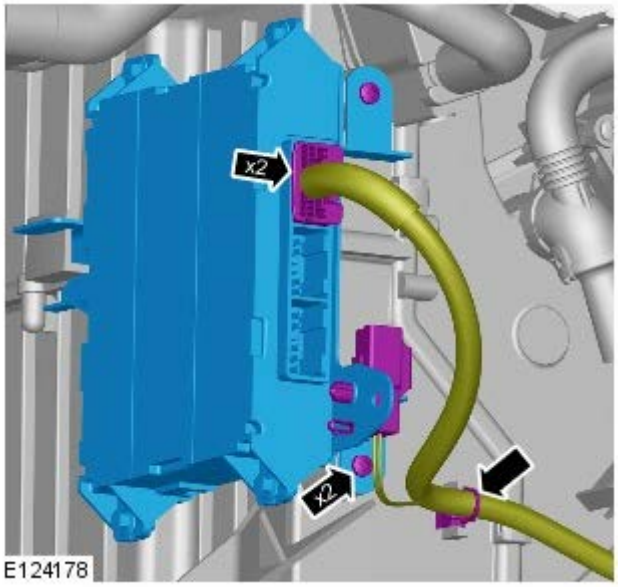
30. Driver side: Remove the heater housing to bulkhead Torx bolt.





31. Passenger side: Remove the heater housing to bulkhead Torx bolt.
    - With assistance, remove the heater and evaporator core housing.

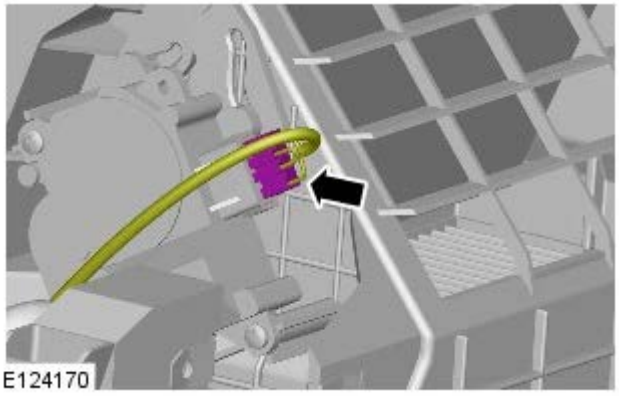
32. Remove the A/C control module.



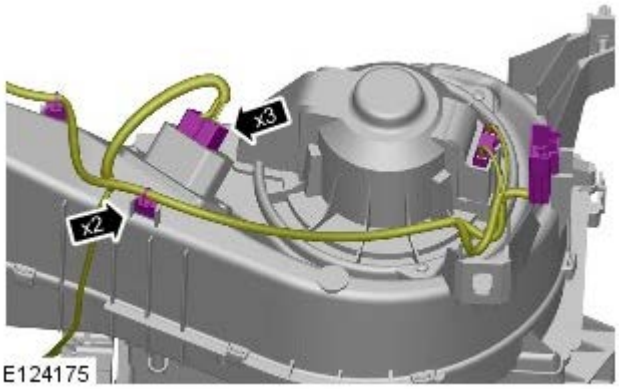
33. Disconnect the evaporator core temperature sensor electrical connector.



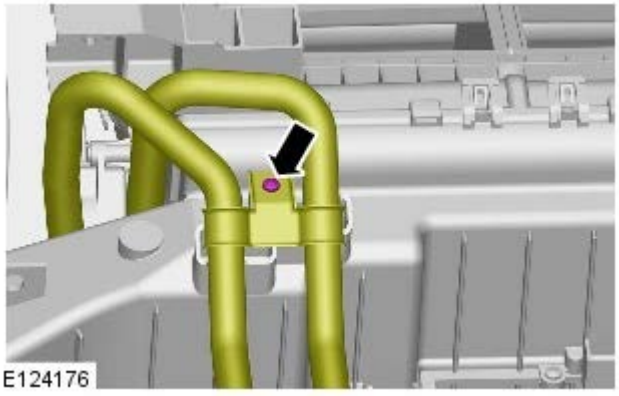
34. Disconnect the electrical connector.



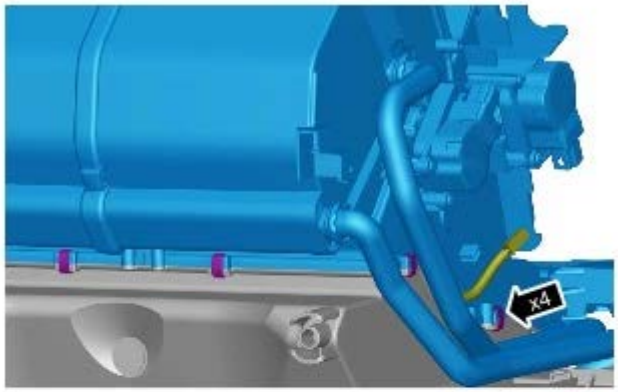
35. Detach the wiring harness.

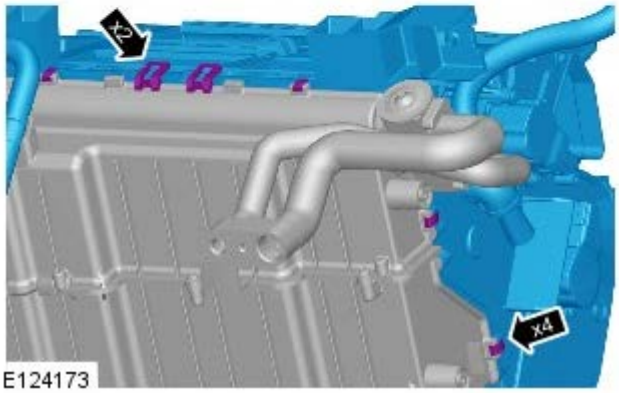


36. Remove the bolt from the support bracket.



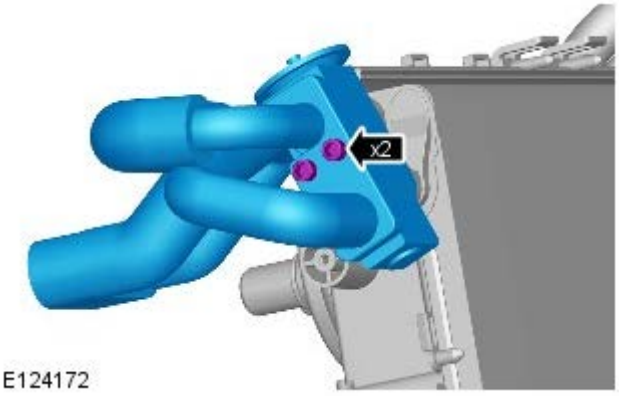
37. Remove the heater and evaporator core housing.
    - Remove the 8 clips.
    - Carefully release the 2 clips.





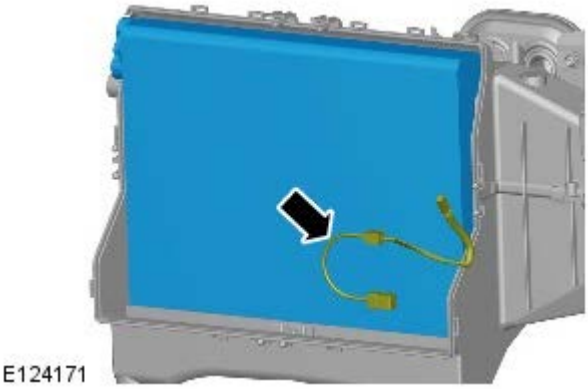
E124173

38. Remove the thermostatic expansion valve.



E124172

39. Remove the evaporator core.
    - Release the temperature sensor.


E124171

Installation

1. Install the evaporator core.
    - Secure the temperature sensor.
2. Secure the heater core housing.
    - Install the clips.
3. Install the thermostatic expansion valve.
    - Tighten the bolts to 3.5 Nm (2.5 lb.ft).

4. Install the wiring harness.

5. Install and tighten the bolt.

6. Connect the temperature sensor electrical connector.

7. Install the CC module.
   - Tighten the bolts.

8. Passenger side: Install the heater housing to bulkhead Torx bolt and tighten to 6 Nm (4 lb.ft).
   - With assistance, install the heater and evaporator core housing.

9. Driver side: Install the heater housing to bulkhead Torx bolt and tighten to 6 Nm (4 lb.ft).

10. Install the footwell ducts.
    - Tighten the Torx screws.

11. Connect the drain tubes to the heater housing.

12. Install the adapter panels.
    - Tighten the nuts to 6 Nm (4 lb.ft).

13. Secure the A/C refrigerant lines.
    - Clean the components.
    - Install new O-ring seals.
    - Tighten the bolt to 5 Nm (4 lb.ft).
    - Tighten the nut to 6 Nm.

14. Connect the bulkhead heater hoses.

15. Install the EGR coolant cross-over pipe.
    - Tighten the bolts to 10 Nm (7 lb.ft).
    - Secure the clips.
    - Connect the hoses and secure with the clips.

16. With assistance, install the instrument panel.
    - Tighten the Torx bolts to 25 Nm (18 lb.ft).

17. Install the instrument panel carrier to bulkhead Torx bolt and tighten to 25 Nm (18 lb.ft).

18. Install the plenum chamber panel.
    For additional information, refer to: Plenum Chamber (412-01 Air Distribution and Filtering, Removal and Installation).

19. Secure the heater housing.
    - Tighten the screws.

20. Connect the steering column intermediate shaft.
    - Install the special bolt and tighten the new nut to 22 Nm (16 lb.ft).

21. Install the heater housing center ducts.

22. Connect the instrument panel center reinforcement fibre optic cables.

23. Connect the instrument panel center reinforcement electrical connectors.

24. Connect the CJB electrical connectors.

25. Connect the electrical connectors to the passenger side lower A-pillar.

26. Connect the ground cables to the passenger side lower A-pillar.
    - Tighten the nuts to 10 Nm (7 lb.ft).

27. Connect the electrical connectors to the driver side lower A-pillar.

28. Connect the ground cables to the driver side lower A-pillar.
    - Tighten the nuts to 10 Nm (7 lb.ft).

29. Connect the 3 electrical connectors.

30. Install the instrument panel upper section.
    For additional information, refer to: Instrument Panel Upper Section (501-12 Instrument Panel and Console, Removal and Installation).

31. Install the floor console.
    For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

32. Install the front seat.
    For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

33. 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).

34. Refill the cooling system.
    For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - TDV6 3.0L Diesel, General Procedures).

35. Install the engine cover.

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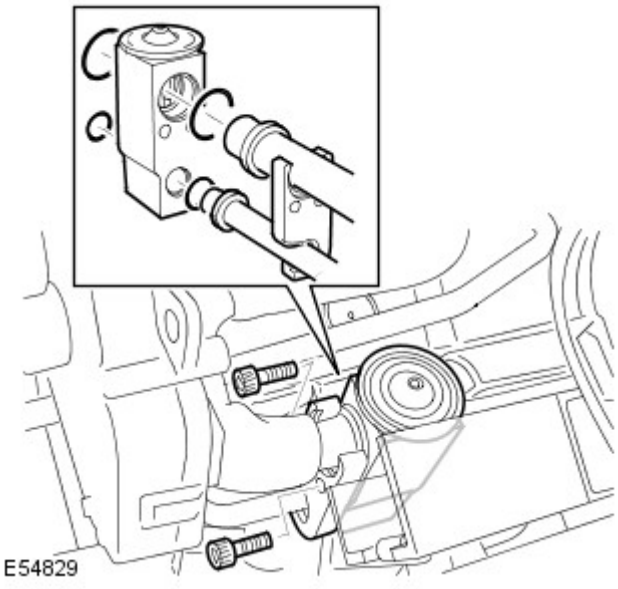
Air Conditioning - TDV6 3.0L Diesel - Thermostatic Expansion Valve

Removal and Installation

Removal

1. Evacuate the A/C system.
   For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00, General Procedures).

2. Remove the instrument panel upper section.
   For additional information, refer to: Instrument Panel Upper Section (501-12, Removal and Installation).



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

   Remove the thermostatic expansion valve.
   - Remove the cover.
   - Remove the 2 Allen bolts.
   - Remove and discard the 4 O-ring seals.

Installation

1. Install the thermostatic expansion valve.
   - Clean the components.
   - Install the new O-ring seals.
   - Tighten the Allen bolts to 5 Nm (4 lb.ft).
   - Install the cover.

2. Install the instrument panel upper section.
   For additional information, refer to: Instrument Panel Upper Section (501-12, Removal and Installation).

3. Recharge the A/C system.
   For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00, General Procedures).

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Air Conditioning - V8 5.0L Petrol/V8 S/C 5.0L Petrol -

Lubricant

Item	Specification
Air conditioning (A/C) compressor oil type	Sanden SP-10 PAG oil
A/C compressor oil	110 cm^3

Refrigerant

Item	Specification
Refrigerant type	R134A
Refrigerant - vehicles with 5.0L	700 grammes
Refrigerant - vehicles with 3.0 diesel	600 grammes

Torque Specifications

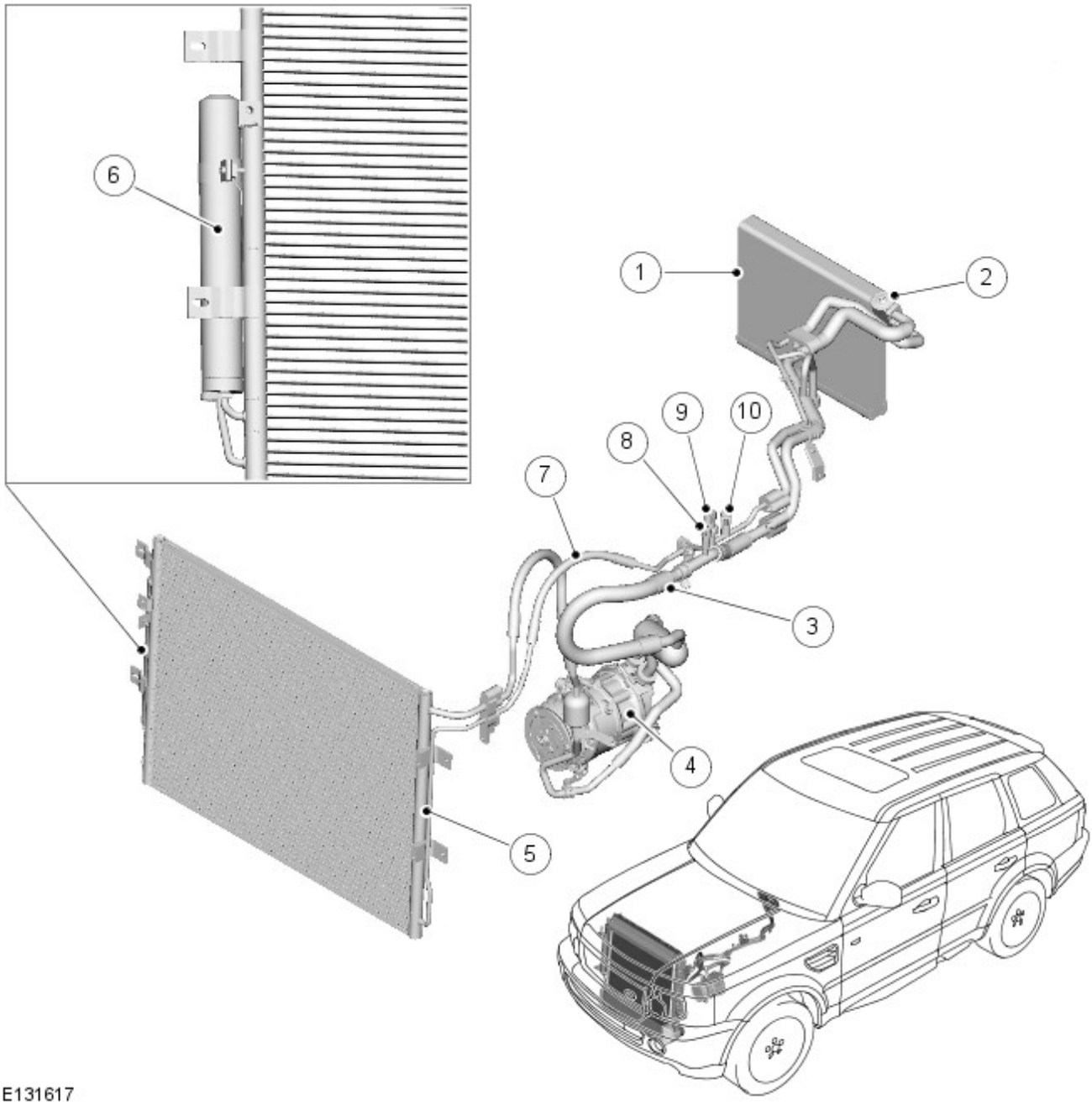
Description	Nm	lb-ft	lb-in
A/C compressor bolts	25	18	-
A/C discharge line to compressor bolt	18	13	-
A/C suction line to compressor bolt	18	13	-
A/C suction line bracket bolts	6	-	53
A/C discharge line to condenser bolt	6	-	53
A/C liquid line to condenser bolt	6	-	53
A/C condenser manifold to radiator bolt	10	7	-
Condenser to radiator bolt - vehicles with 5.0L	10	7	-
Condenser to radiator bolt - vehicles with 3.0 diesel	5	-	44
Evaporator line to evaporator core bolt	6	-	53
Evaporator line bracket nut	6	-	53
A/C pressure transducer	10	7	-
Thermostatic expansion valve (TXV) to refrigerant line clamp bolts	5	-	44

Published: 11-May-2011

Air Conditioning - V8 5.0L Petrol/V8 S/C 5.0L Petrol - Air Conditioning

Description and Operation

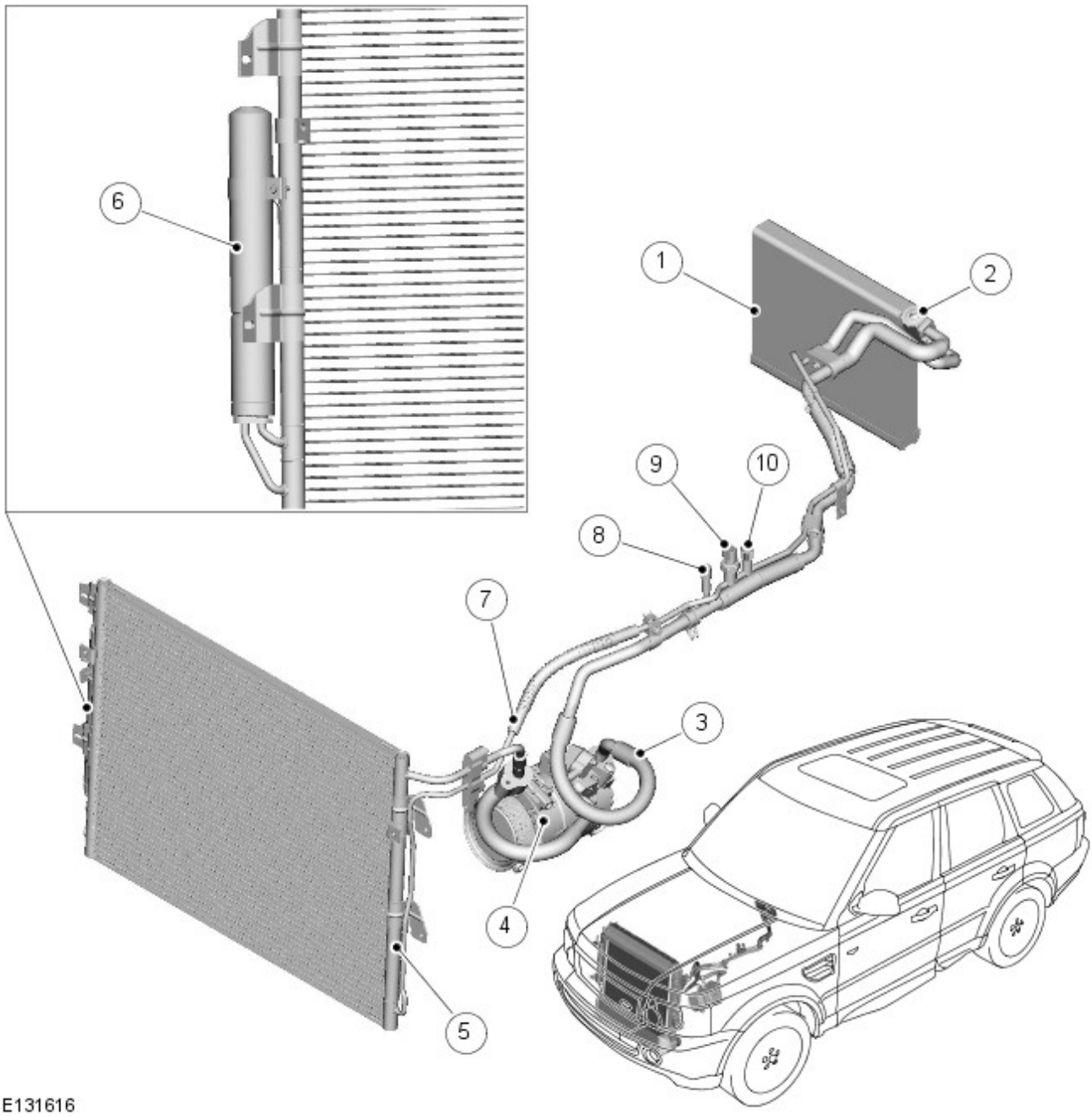
COMPONENT LOCATION 3.0L TdV6



E131617

Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic expansion valve
3	-	Low pressure line
4	-	air conditioning (A/C) compressor
5	-	Condenser
6	-	Receiver drier
7	-	High pressure line
8	-	Low pressure servicing connection
9	-	Refrigerant pressure sensor (reference)
10	-	High pressure servicing connection

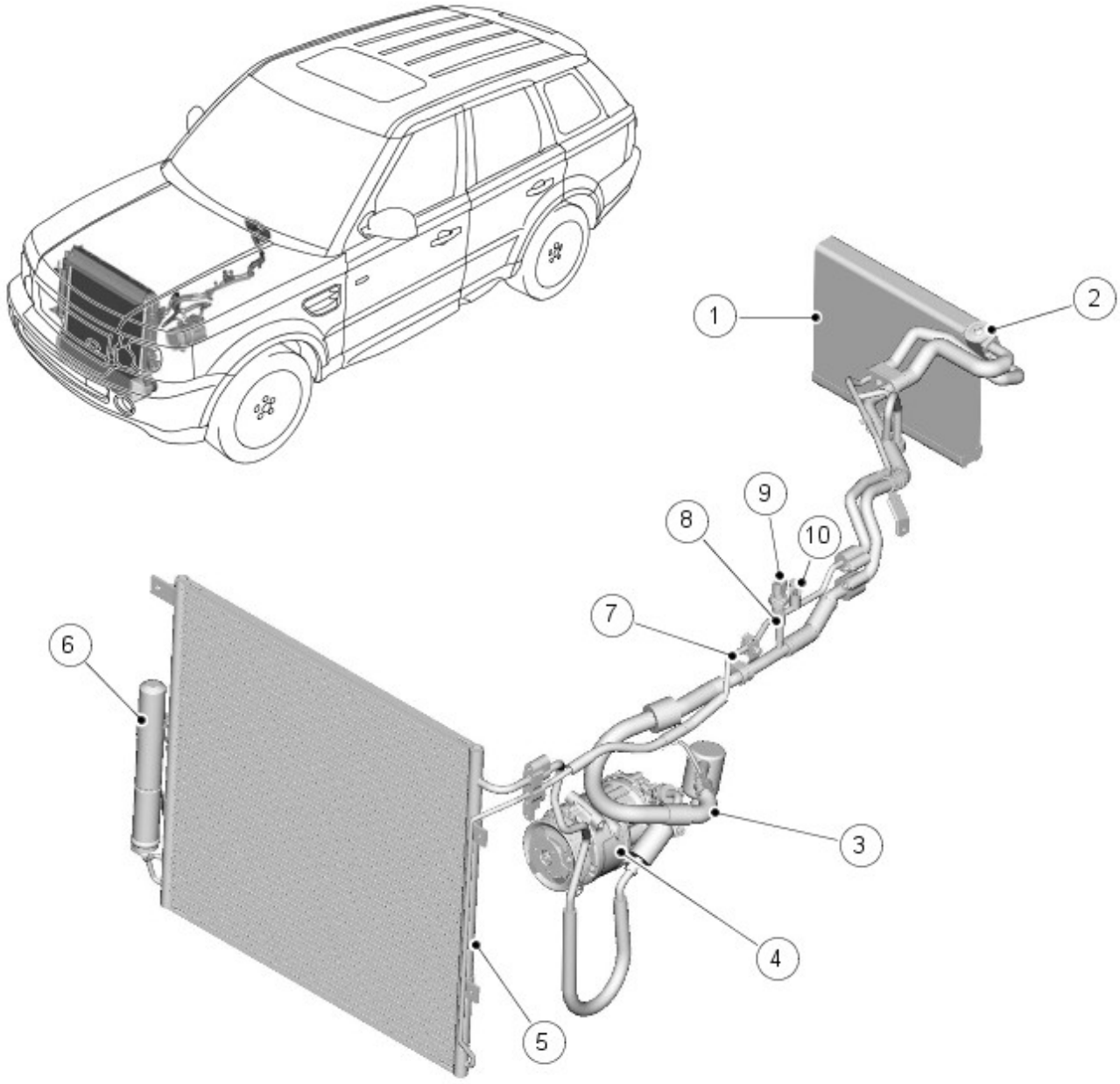
COMPONENT LOCATION 3.6L TdV8



E131616

Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic expansion valve
3	-	Low pressure line
4	-	A/C compressor
5	-	Condenser
6	-	Receiver drier
7	-	High pressure line
8	-	Low pressure servicing connection
9	-	Refrigerant pressure sensor (reference)
10	-	High pressure servicing connection

COMPONENT LOCATION - 5.0L V8



E131618

Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic expansion valve
3	-	Low pressure line
4	-	A/C compressor
5	-	Condenser
6	-	Receiver drier
7	-	High pressure line
8	-	Low pressure servicing connection
9	-	Refrigerant pressure sensor (reference)
10	-	High pressure servicing connection

OVERVIEW

The A/C system transfers heat from the vehicle interior to the outside atmosphere to provide the heater assembly with dehumidified cool air. The system is a sealed, closed loop, filled with a charge weight of R134a refrigerant as the heat transfer medium. Oil is added to the refrigerant to lubricate the internal components of the A/C compressor.

To accomplish the transfer of heat, the refrigerant is circulated around the system, where it passes through 2 pressure/temperature regimes. In each of the pressure/temperature regimes, the refrigerant changes state, during which process maximum heat absorption or release occurs. The low pressure/temperature regime is from the thermostatic expansion valve, through the evaporator to the A/C compressor; the refrigerant decreases in pressure and temperature at the thermostatic expansion valve, then changes state from liquid to vapor in the evaporator, to absorb heat. The high pressure/temperature regime is from the A/C compressor, through the condenser and receiver drier to the thermostatic expansion valve; the refrigerant increases in pressure and temperature as it passes through

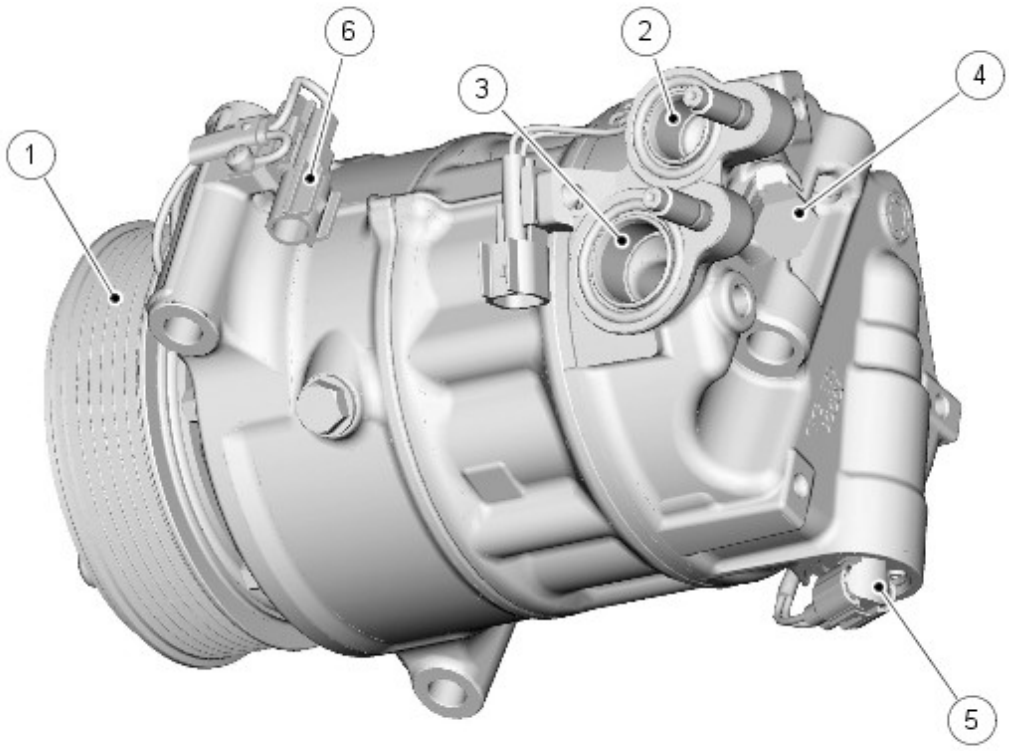
the A/C compressor, then releases heat and changes state from vapor to liquid in the condenser.

Some vehicles may be fitted with a 4 zone climate control system.
For additional information, refer to: Air Conditioning (412-03B, Description and Operation).

A/C COMPRESSOR

The A/C compressor circulates refrigerant around the system by compressing low pressure, low temperature vapor from the evaporator and discharging the resultant high pressure, high temperature vapor to the condenser. On 5.0L vehicles, the A/C (air conditioning) compressor is driven directly from the pulley. On 3.0L and 3.6L diesel vehicles the A/C compressor is driven via an electro-magnetic clutch.

3.0L TdV6 A/C Compressor



E131579

Item	Part Number	Description
1	-	Pulley
2	-	Outlet port
3	-	Inlet port
4	-	Pressure relief valve
5	-	Electronic control valve connector
6	-	electromagnetic clutch connector

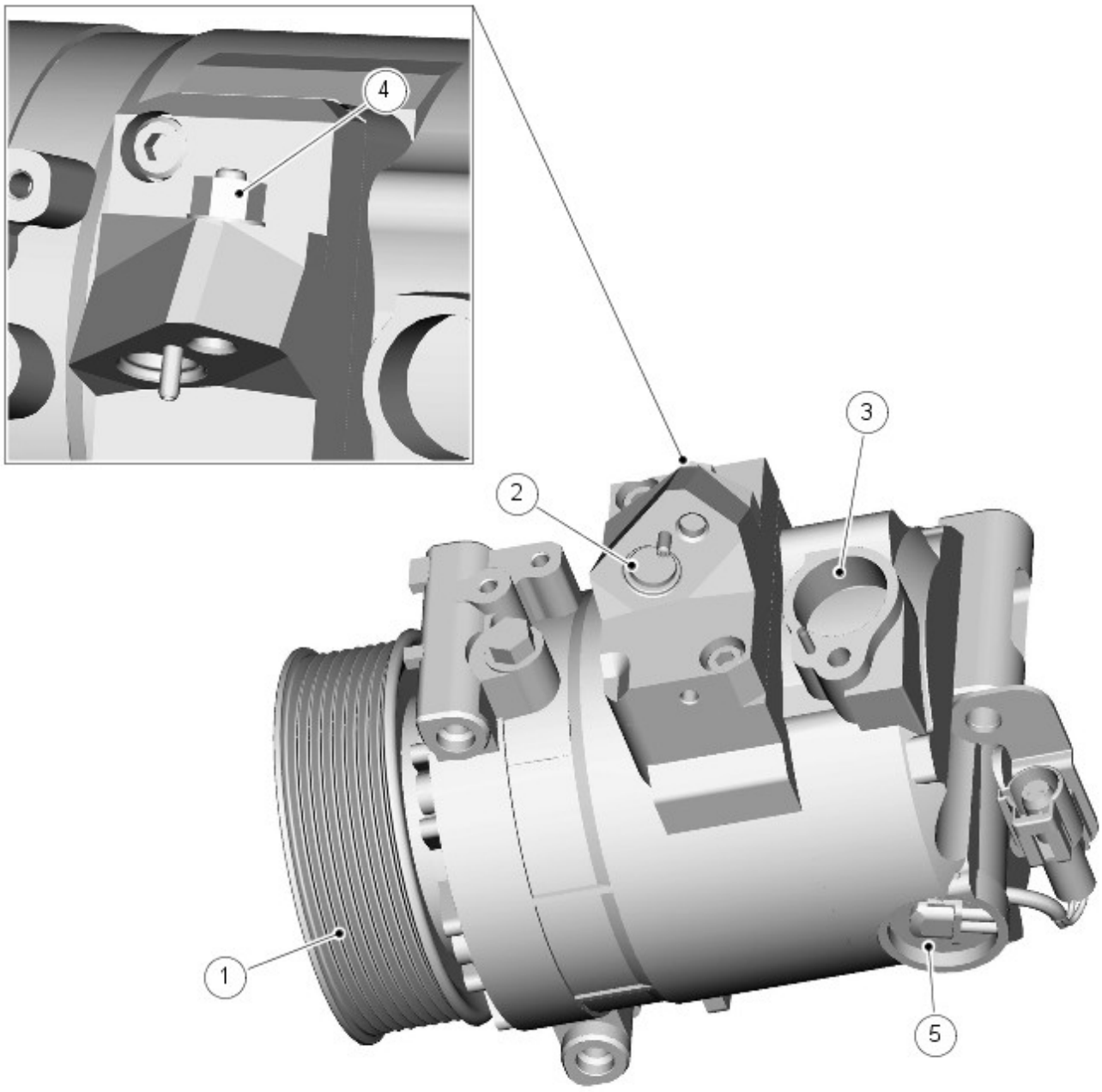
The A/C compressor fitted to 3.0L TdV6 diesel vehicles is a variable displacement unit. The secondary accessory drive belt, driven by the engine crankshaft, drives the A/C compressor via a pulley and an electromagnetic clutch. Operation of the clutch is controlled by a power feed from the ATC (automatic temperature control) module.

The A/C compressor is a 7 cylinder swash plate unit with a minimum displacement of 1.6 cm^3/rev (0.10 in^3/rev) and maximum displacement of 163 cm^3/rev (9.95 in^3/rev). The ATC module automatically adjusts the displacement of the A/C compressor between the minimum and maximum values, to match the thermal load of the evaporator. By matching refrigerant flow and the thermal load of the evaporator, the ATC module maintains cabin comfort whilst also considering fuel economy.

To protect the refrigerant system from unacceptably high pressure, a pressure relief valve is installed in the outlet side of the A/C compressor. The pressure relief valve is set to open at 3.5 to 4.1 MPa (508 to 595 lbf/in^2) and vents excess pressure into the engine compartment. The pressure relief valve closes again when the pressure decreases to 3.1 MPa (449 lbf/in^2).

The clutch of the A/C compressor incorporates a thermal cut-off fuse, which disconnects the power feed from the ATC module if the temperature increases to 182 ± 5 ^oC (360 ± 9 ^oF).

3.6L TdV8 A/C Compressor



E131615

Item	Part Number	Description
1	-	Pulley
2	-	Outlet port
3	-	Inlet port
4	-	Pressure relief valve
5	-	Electronic control valve connector

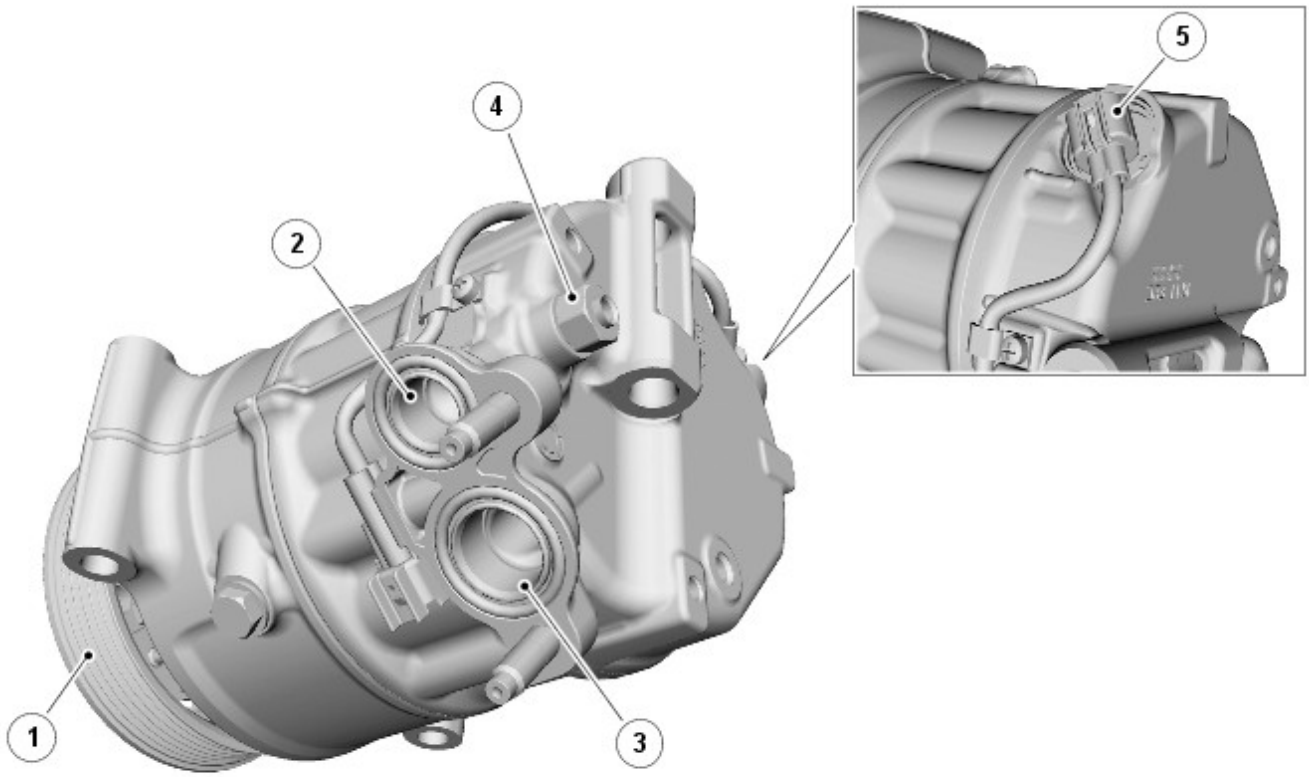
The A/C compressor fitted to 3.6L TdV8 diesel vehicles is a variable displacement unit. The secondary accessory drive belt, driven by the engine crankshaft, drives the A/C compressor.

The A/C compressor is a 7 cylinder swash plate unit with a minimum displacement of 5.5 cm^3/rev (0.34 in^3/rev) and maximum displacement of 171.4 cm^3/rev (10.4 in^3/rev). A control valve in the A/C compressor automatically adjusts the displacement (i.e. flow of refrigerant), between the minimum and maximum values, to match the thermal load of the evaporator. By matching the refrigerant flow to the thermal load of the evaporator, the variable A/C compressor maintains a relatively constant evaporator temperature of approximately 3 to 4^oC (37 to 39^oF).

To protect the refrigerant system from unacceptably high pressure, a pressure relief valve is installed in the outlet side of the A/C compressor. The pressure relief valve is set to open at 3.5 to 4.1 MPa (508 to 595 lbf/in^2) and vents excess pressure into the engine compartment. The pressure relief valve closes again when the pressure decreases to 3.01 MPa (437 lbf/in^2).

The pulley of the A/C compressor incorporates a mechanical torque limiter, which disconnects the drive plate from the compressor shaft if torque increases to a level that indicates imminent compressor seizure.

5.0L V8 A/C Compressor



E131337

Item	Part Number	Description
1	-	Pulley
2	-	Outlet port
3	-	Inlet port
4	-	Pressure relief valve
5	-	Electronic control valve connector

The A/C compressor fitted to 5.0 V8 petrol vehicles is a variable displacement unit. The secondary accessory drive belt, driven by the engine crankshaft, drives the A/C compressor via a pulley. Operation of the compressor is controlled by an electronic control valve working in conjunction with the ATC module.

The A/C compressor is a 7 cylinder swash plate unit with a minimum displacement of 1.6 cm^3/rev (0.10 in^3/rev) and maximum displacement of 163 cm^3/rev (9.95 in^3/rev). The ATC module automatically adjusts the displacement of the A/C compressor between the minimum and maximum values, to match the thermal load of the evaporator. By matching refrigerant flow and the thermal load of the evaporator, the ATC module maintains cabin comfort whilst also considering fuel economy.

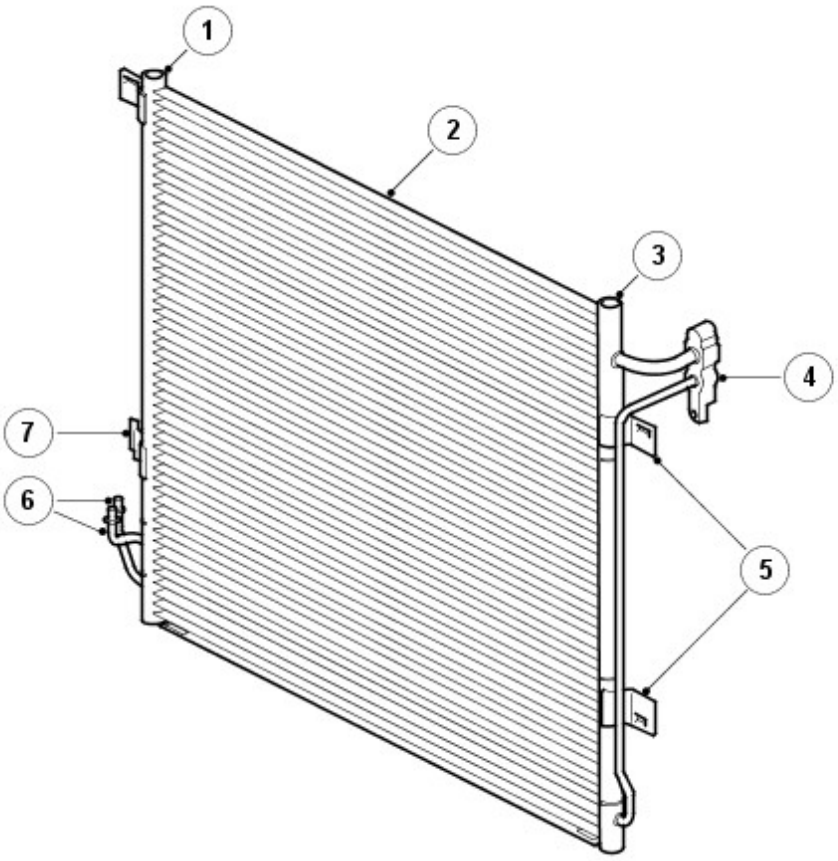
To protect the refrigerant system from unacceptably high pressure, a pressure relief valve is installed in the outlet side of the A/C compressor. The pressure relief valve is set to open at 3.5 to 4.1 MPa (508 to 595 lbf/in^2) and vents excess pressure into the engine compartment. The pressure relief valve closes again when the pressure decreases to 3.1 MPa (449 lbf/in^2).

The pulley of the A/C compressor incorporates a mechanical torque limiter, which disconnects the drive plate from the compressor shaft if torque increases to a level that indicates imminent compressor seizure.

CONDENSER AND RECEIVER DRIER

NOTE: 5.0L V8 version shown other installations similar

Condenser



E46920

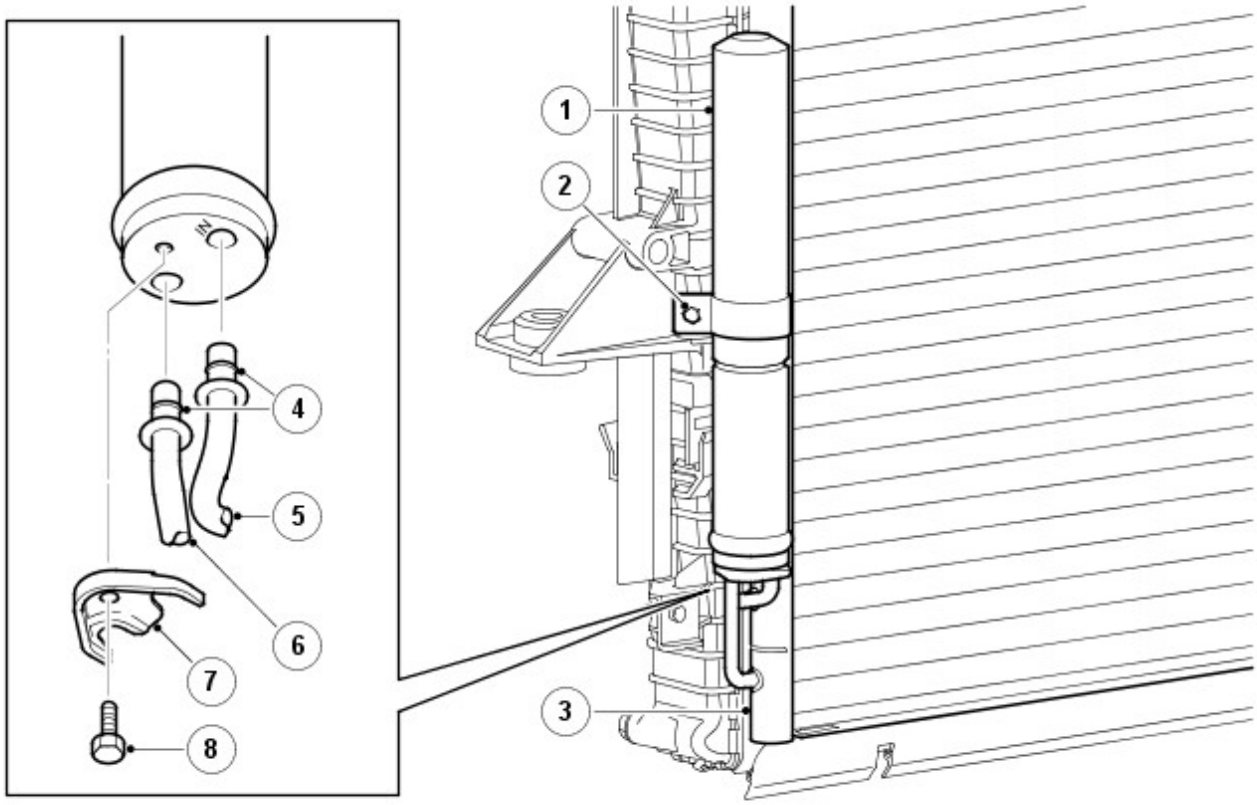
Item	Part Number	Description
1	-	right-hand (RH) end tank
2	-	Condenser core
3	-	left-hand (LH) end tank
4	-	High pressure line connector block
5	-	Condenser attachment brackets
6	-	Receiver drier pipes
7	-	Receiver drier attachment bracket

The condenser transfers heat from the refrigerant to the surrounding air to convert the vapor from the A/C compressor into a liquid. A receiver drier module, integrated onto the LH side of the condenser, incorporates a filter and a desiccant to remove solid impurities and moisture from the refrigerant. The receiver drier module also functions as a reservoir for liquid refrigerant, to accommodate changes of heat load at the evaporator.

The condenser is installed immediately in front of the radiator.

The condenser is classified as a sub-cooling condenser and consists of a fin and tube heat exchanger installed between two end tanks.

Receiver Drier



E46921

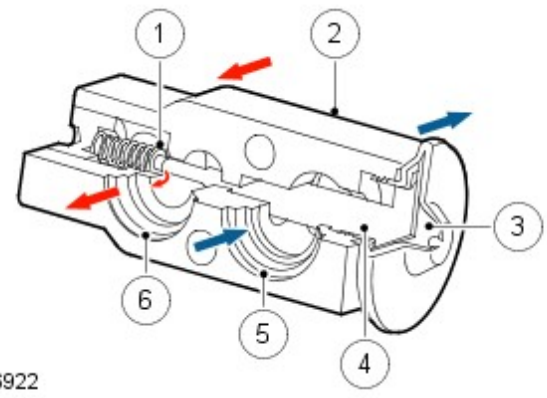
Item	Part Number	Description
1	-	Receiver Drier
2	-	Clamp
3	-	Condenser RH end tank
4	-	O-ring seals
5	-	Inlet pipe
6	-	Outlet pipe
7	-	Collar
8	-	Bolt

The receiver drier removes solid impurities and moisture from the refrigerant, and provides a reservoir for liquid refrigerant to accommodate changes of heat load at the evaporator.

The receiver drier is attached to the two stub pipes on the right end tank of the condenser. A collar, located on lands on the stub pipes and secured with a bolt, attaches the stub pipes to the receiver drier. A clamp secures the body of the receiver drier to a bracket welded to the right end tank of the condenser. The inlet and outlet ports of the receiver drier are the same size, so care must be taken to install the receiver drier the correct way round on the stub pipes; to assist with installation, the inlet port is identified with the word IN etched into the receiver drier.

Refrigerant entering the receiver drier passes through a filter and a desiccant pack, then collects in the base of the unit before flowing through the outlet stub pipe back to the condenser. The desiccant and the filter are non-serviceable; the complete unit must be replaced when a change of desiccant is required.

THERMOSTATIC EXPANSION VALVE



E46922

Item	Part Number	Description
1	-	Metering valve

2	-	Housing
3	-	Diaphragm
4	-	Temperature sensitive tube
5	-	Outlet passage from evaporator
6	-	Inlet passage to evaporator

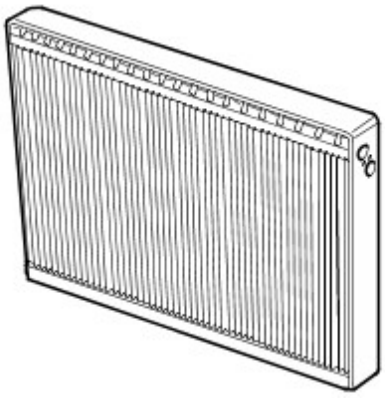
The thermostatic expansion valve meters the flow of refrigerant into the evaporator, to match the refrigerant flow with the heat load of the air passing through the evaporator.

The thermostatic expansion valve is a block type valve located behind the heater assembly, and attached to the inlet and outlet ports of the evaporator. The thermostatic expansion valve consists of an aluminum housing containing inlet and outlet passages. A ball and spring metering valve is installed in the inlet passage and a temperature sensor is installed in the outlet passage. The temperature sensor consists of a temperature sensitive tube connected to a diaphragm. The bottom end of the temperature sensitive tube acts on the ball of the metering valve. Pressure on top of the diaphragm is controlled by evaporator outlet temperature conducted through the temperature sensitive tube. The bottom of the diaphragm senses evaporator outlet pressure.

Liquid refrigerant flows through the metering valve into the evaporator. The restriction across the metering valve reduces the pressure and temperature of the refrigerant. The restriction also changes the liquid stream of refrigerant into a fine spray, to improve the evaporation process. As the refrigerant passes through the evaporator, it absorbs heat from the air flowing through the evaporator. The increase in temperature causes the refrigerant to vaporize and increase in pressure.

The temperature and pressure of the refrigerant leaving the evaporator act on the diaphragm and temperature sensitive tube, which regulate the metering valve opening and so control the volume of refrigerant flowing through the evaporator. The warmer the air flowing through the evaporator, the more heat available to evaporate refrigerant and thus the greater the volume of refrigerant allowed through the metering valve.

EVAPORATOR



E46923

The evaporator is installed in the heater assembly between the blower and the heater matrix, to absorb heat from the exterior or recirculated air. Low pressure, low temperature refrigerant changes from liquid to vapor in the evaporator, absorbing large quantities of heat as it changes state.

Most of the moisture in the air passing through the evaporator condenses into water, which drains out of the heater and through the floorpan, to the underside of the vehicle, through two drain tubes.

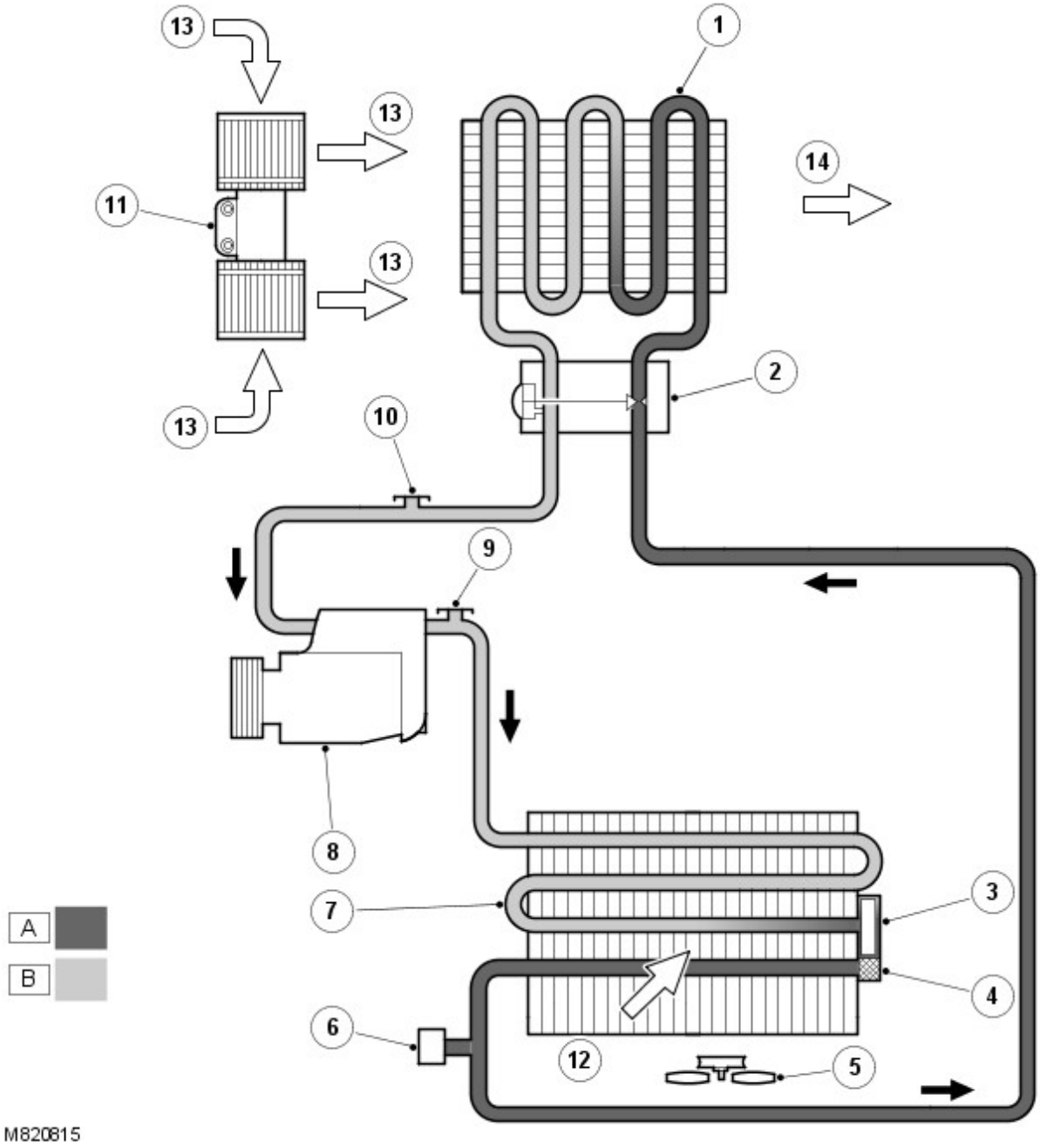
REFRIGERANT LINES

To maintain similar flow velocities around the system, the diameter of the refrigerant lines varies to suit the two pressure/temperature regimes. The larger diameters are installed in the low pressure/temperature regime and the smaller diameters are installed in the high pressure/temperature regime.

Low and high pressure charging connections are incorporated into the refrigerant lines near the front RH corner of the engine compartment.

CONTROL DIAGRAM

NOTE: **A** = Refrigerant liquid; **B** = Refrigerant vapor



Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic expansion valve
3	-	Desiccant (in modulator)
4	-	Filter (in modulator)
5	-	Electric cooling fan
6	-	Refrigerant pressure sensor
7	-	Condenser
8	-	A/C compressor
9	-	High pressure servicing connection
10	-	Low pressure servicing
11	-	Blower
12	-	Air flows: Ambient air flow through condenser
13	-	Fresh/Recirculated air flow through blower
14	-	Cooled air flow to vehicle interior

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Air Conditioning - V8 5.0L Petrol/V8 S/C 5.0L Petrol - Air Conditioning

Diagnosis and Testing

For additional information.
REFER to: Climate Control System (412-00, Diagnosis and Testing).

Published: 25-Nov-2013

Air Conditioning - V8 5.0L Petrol/V8 S/C 5.0L Petrol - Air Conditioning (A/C) Compressor

Removal and Installation

Removal

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

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

   Raise and support the vehicle.

2. Refer to: Cooling System Partial Draining, Filling and Bleeding - V8 5.0L Petrol (303-03B Engine Cooling - V8 5.0L Petrol/V8 S/C 5.0L Petrol, General Procedures).

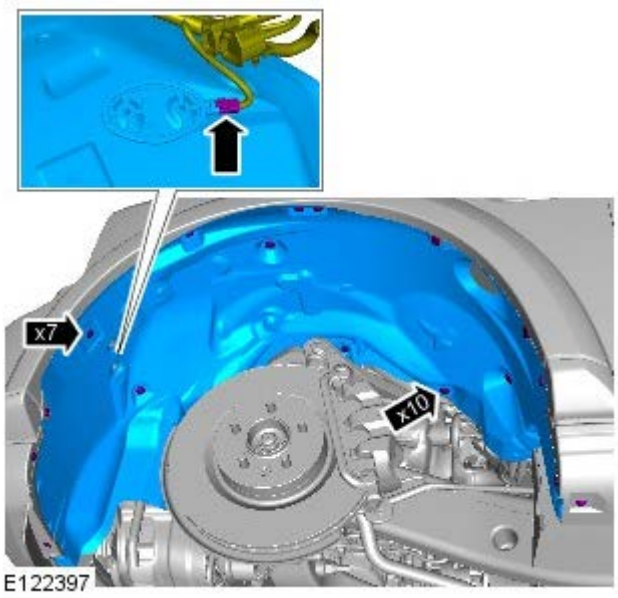
3. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

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

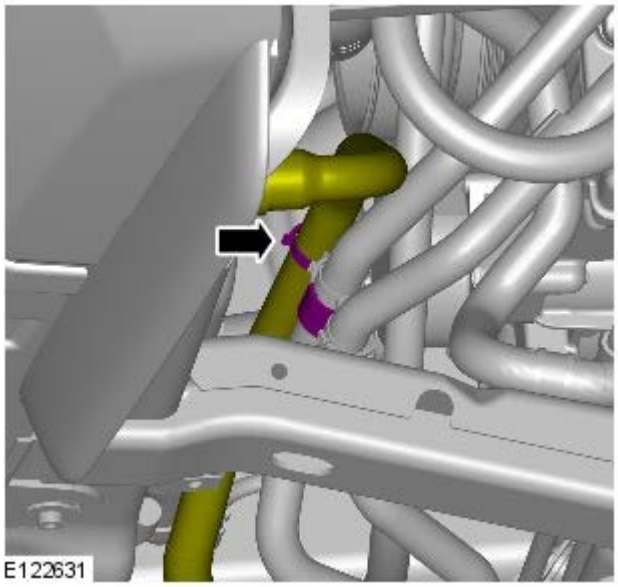
5. Remove the LH front road wheel.

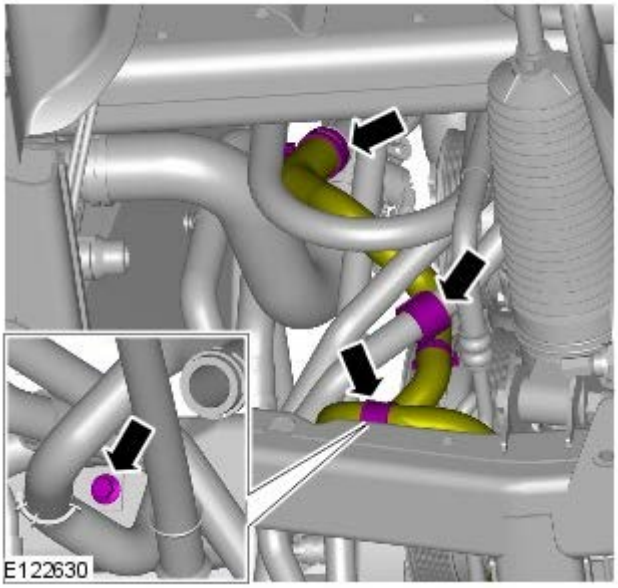
   Torque: 140 Nm

6.



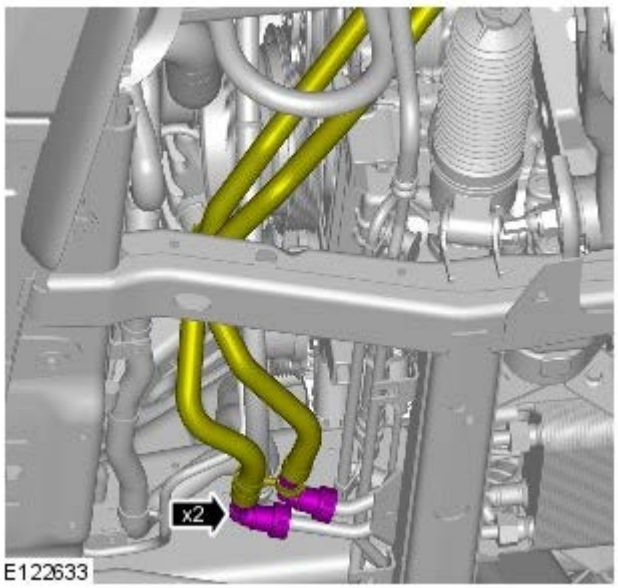
7. CAUTION: Be prepared to collect escaping coolant.





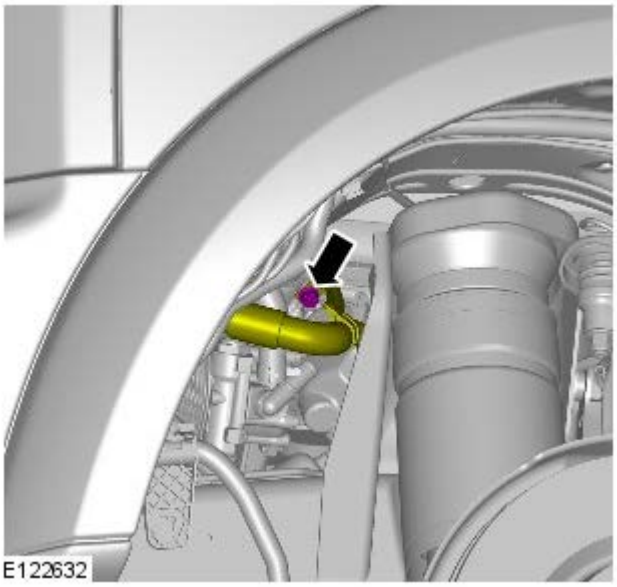
8. CAUTION: Be prepared to collect escaping coolant.

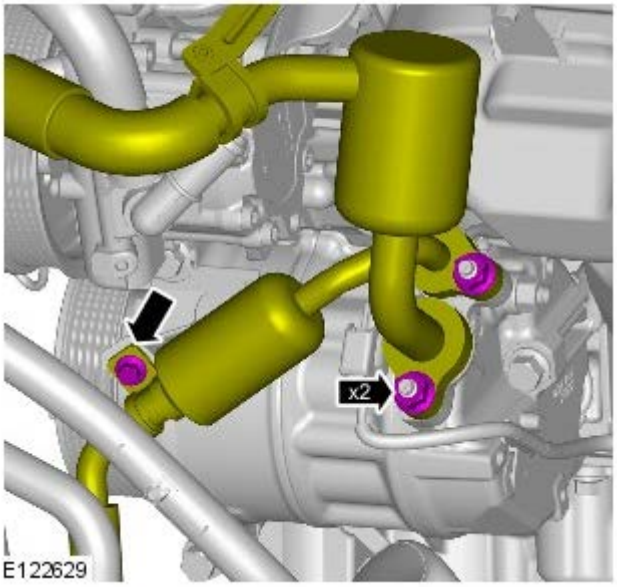
   Torque: 10 Nm



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

10. *Torque:* 18 Nm





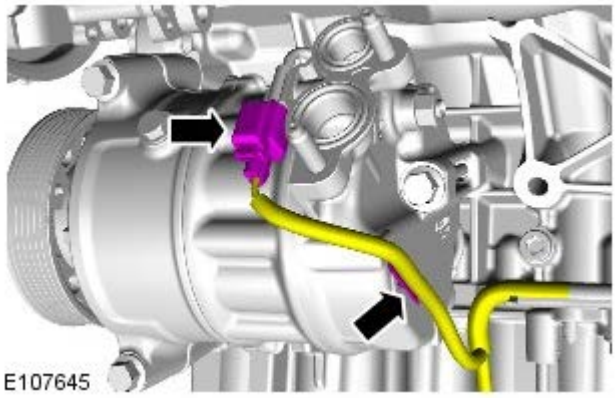
11. CAUTIONS:

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

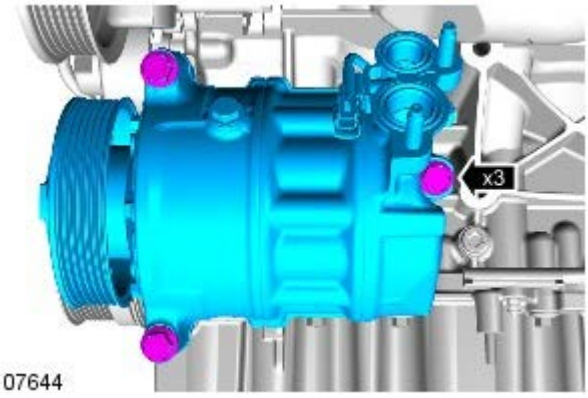
    A new O-ring seal is to be installed.

    Torque:
    M8 18 Nm
    M6 6 Nm

12.



13. *Torque:* 25 Nm



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Air Conditioning - V8 5.0L Petrol/V8 S/C 5.0L Petrol - Condenser Core V8 S/C 5.0L Petrol

Removal and Installation

Removal

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

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

   Raise and support the vehicle.

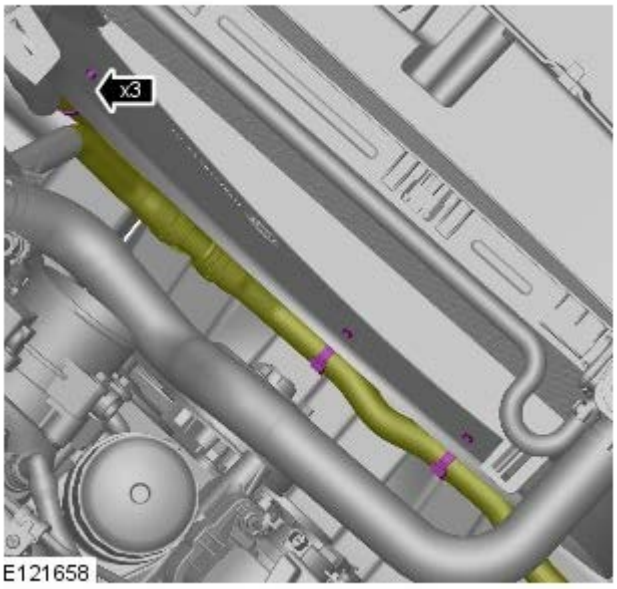
2. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00, General Procedures).

3. Refer to: Radiator Grille (501-08, Removal and Installation).

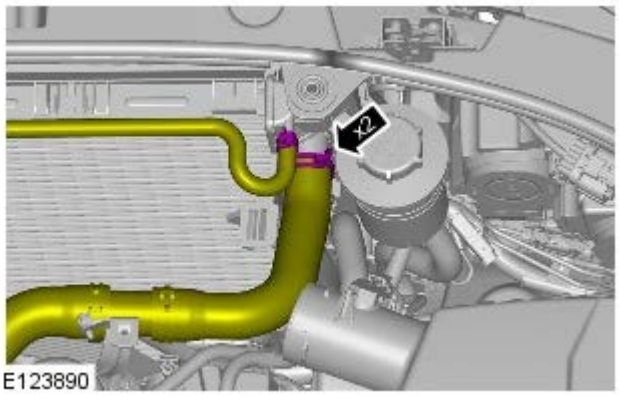
4. Refer to: Coolant Pump (303-03, Removal and Installation).

5. Refer to: Cooling Fan - Vehicles With: Supercharger (303-03, Removal and Installation).

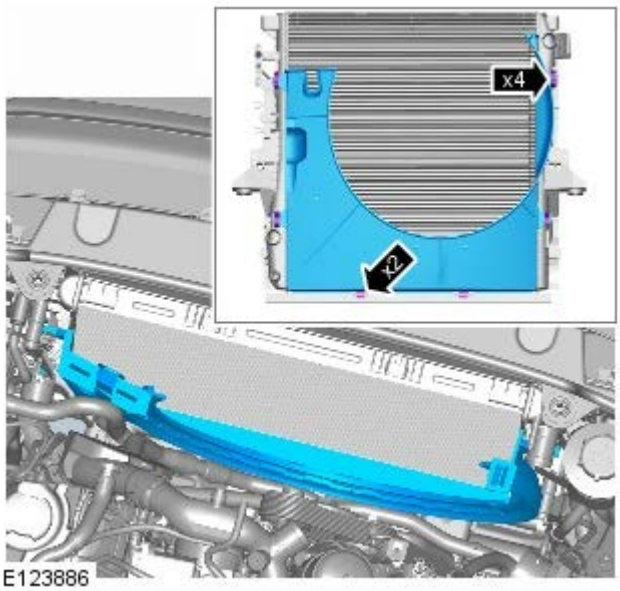
6. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



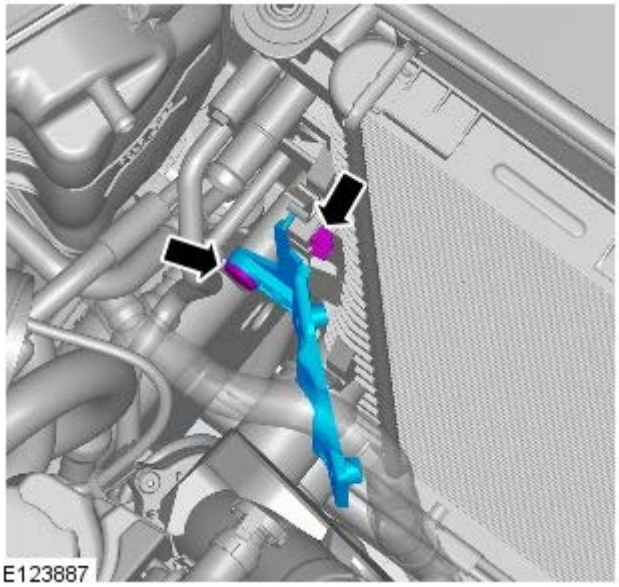
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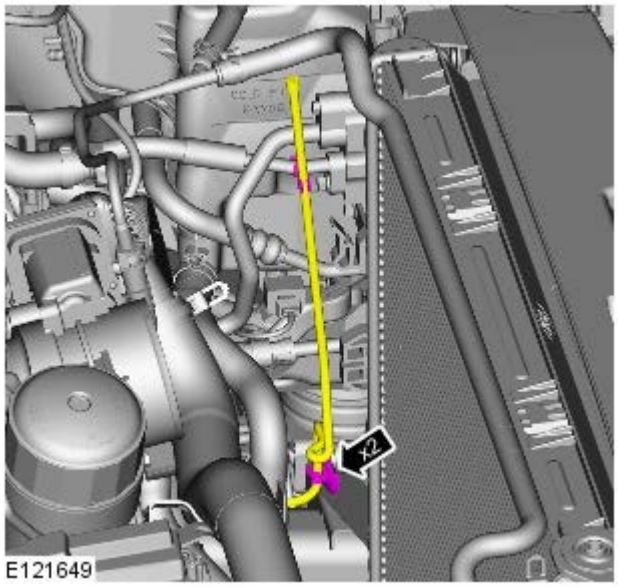
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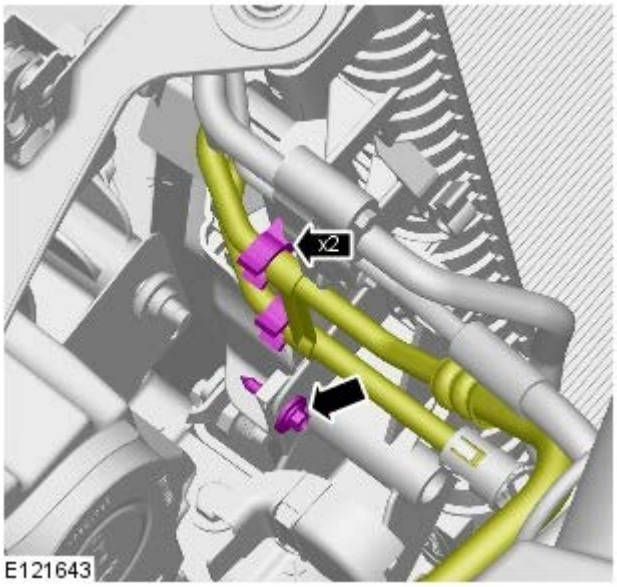
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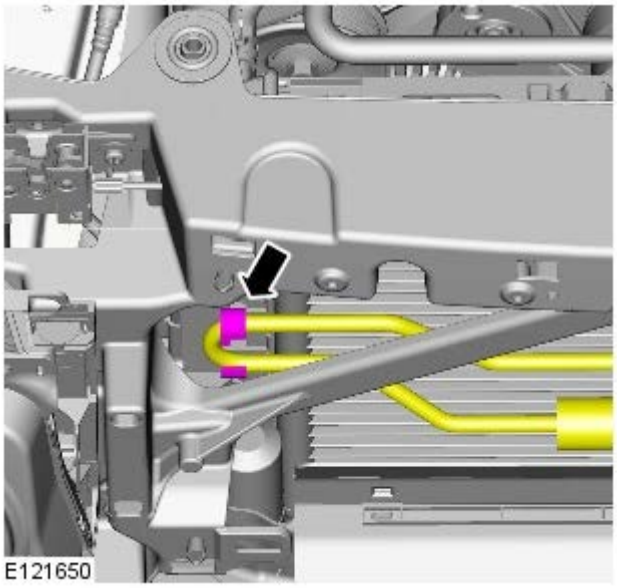


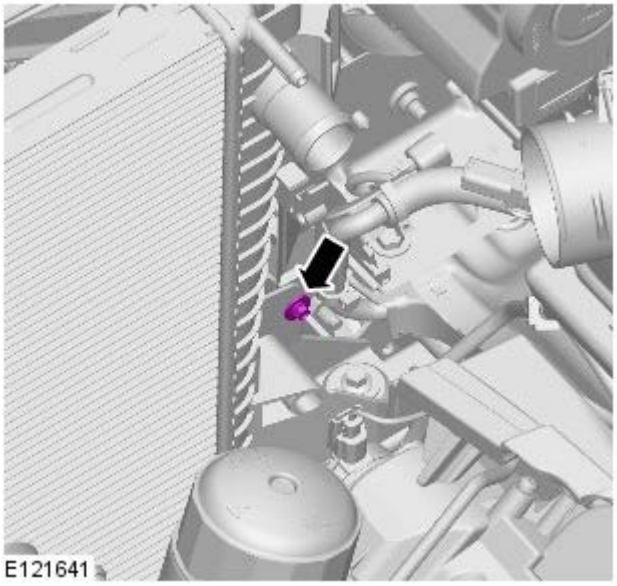
10.



11. *Torque:* 9 Nm







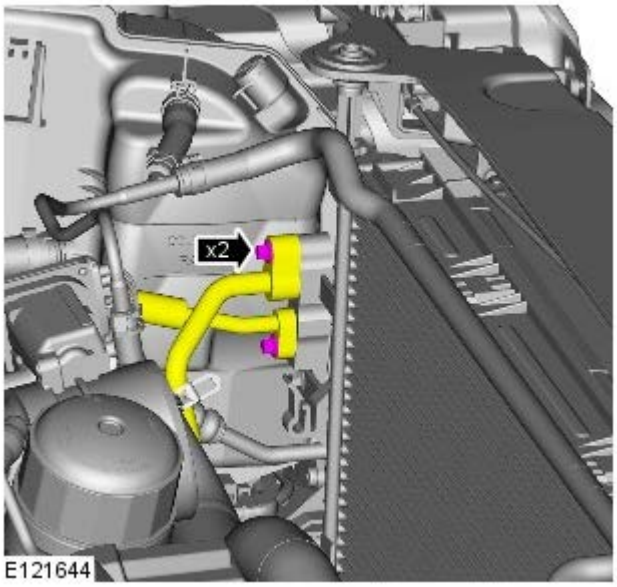
12. CAUTION: Always plug any open connections to prevent contamination.

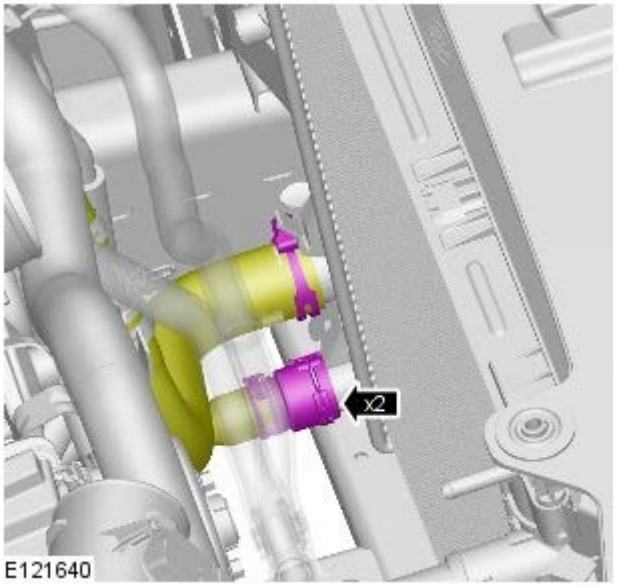
13. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Torque: 9 Nm

14. 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.

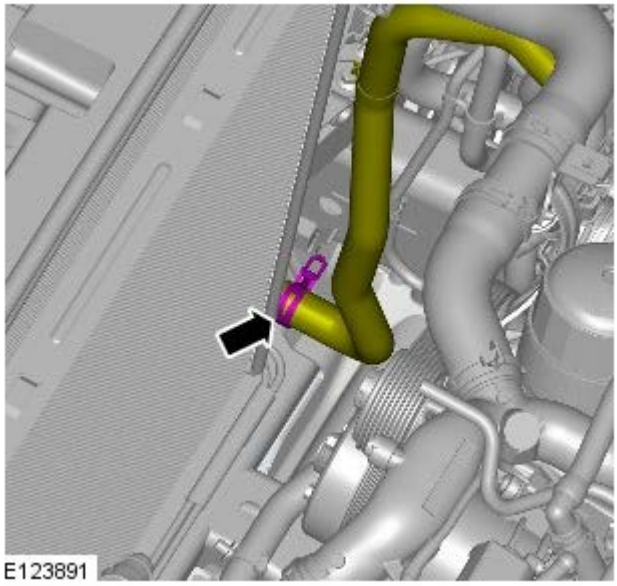
Torque: 10 Nm





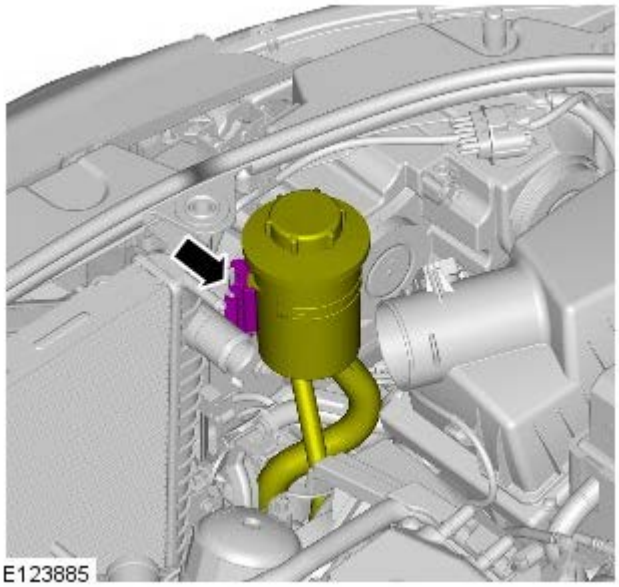
15. CAUTION: Be prepared to collect escaping coolant.

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

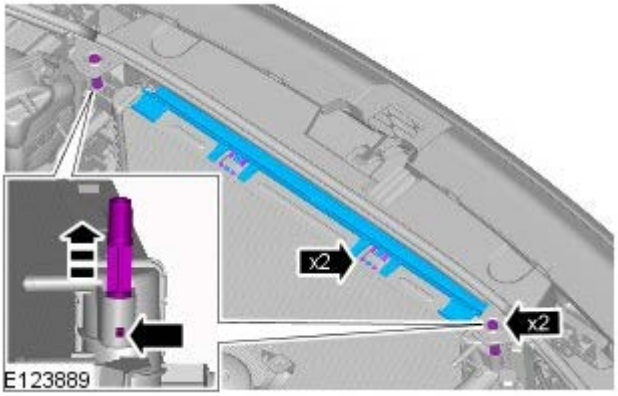


16. CAUTION: Be prepared to collect escaping coolant.

17.

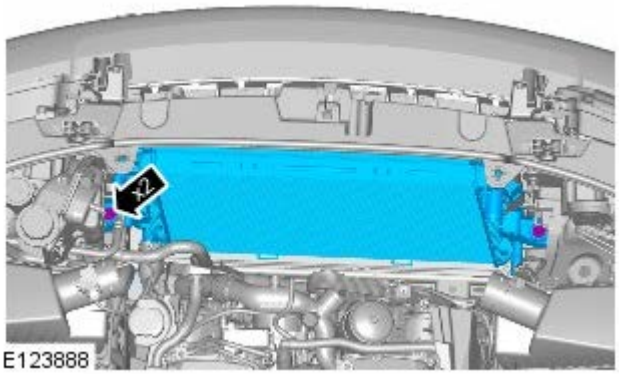


18.



19. CAUTION: Always protect the cooling pack elements to prevent accidental damage.

Torque: 25 Nm

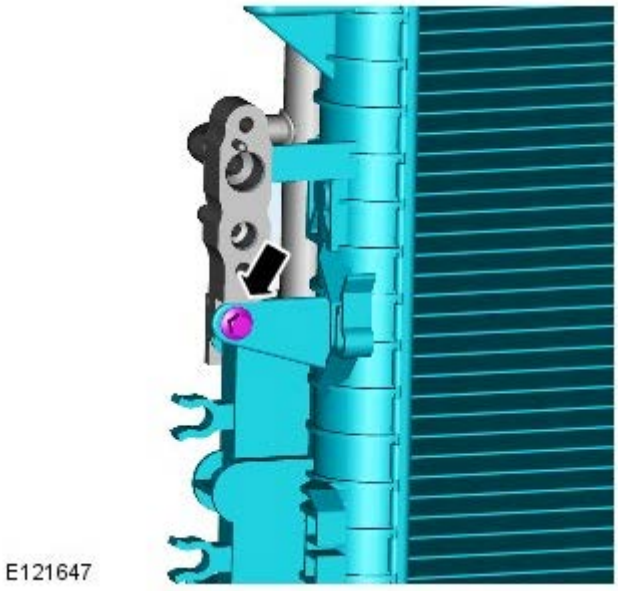


20. *Torque:* 10 Nm



E123892

21. *Torque:* 10 Nm



E121647

22. *Torque:* 10 Nm



E121646

Installation

1. To install, reverse the removal procedure.

Published: 25-Nov-2013

Air Conditioning - V8 5.0L Petrol/V8 S/C 5.0L Petrol - Condenser Core V8 5.0L Petrol

Removal and Installation

Removal

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.

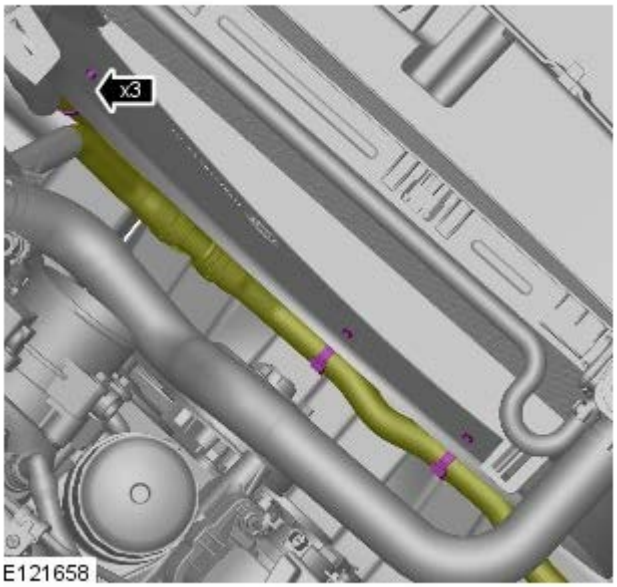
3. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

4. Refer to: Cooling System Partial Draining, Filling and Bleeding - V8 5.0L Petrol (303-03B Engine Cooling - V8 5.0L Petrol/V8 S/C 5.0L Petrol, General Procedures).

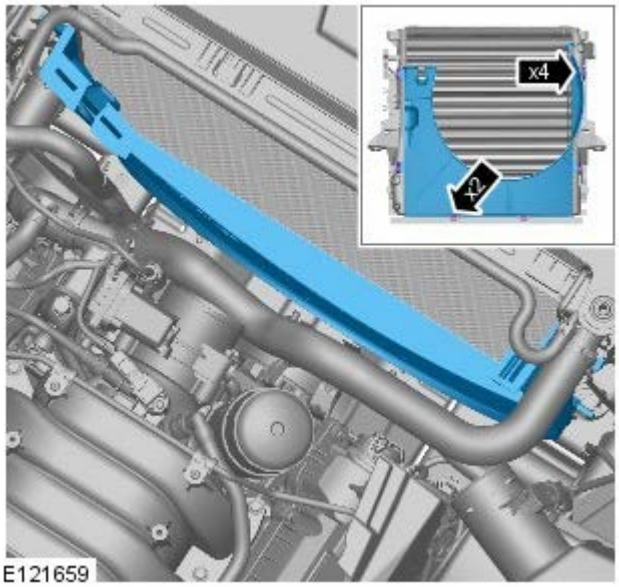
5. Refer to: Radiator Grille (501-08 Exterior Trim and Ornamentation, Removal and Installation).

6. Refer to: Cooling Fan - V8 5.0L Petrol (303-03B Engine Cooling - V8 5.0L Petrol/V8 S/C 5.0L Petrol, Removal and Installation).

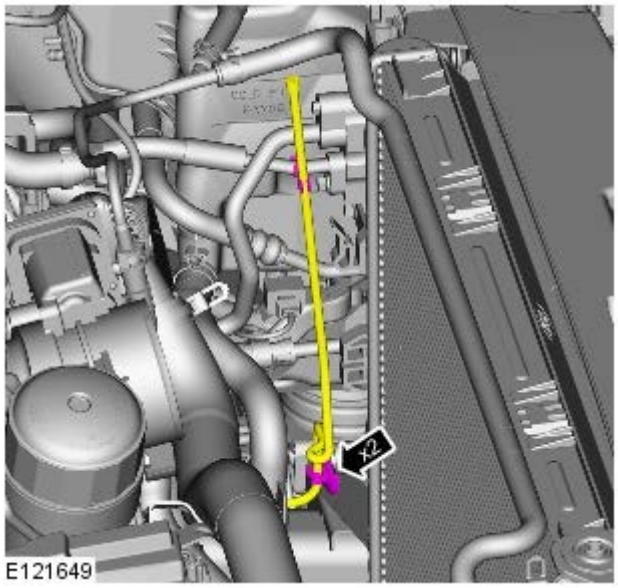
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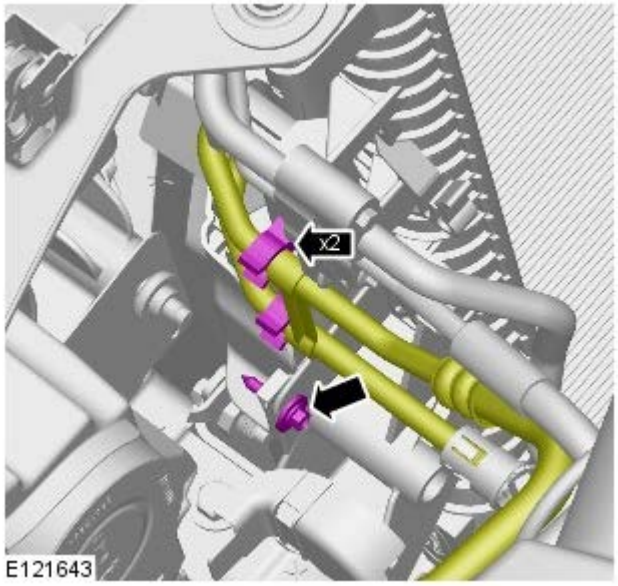
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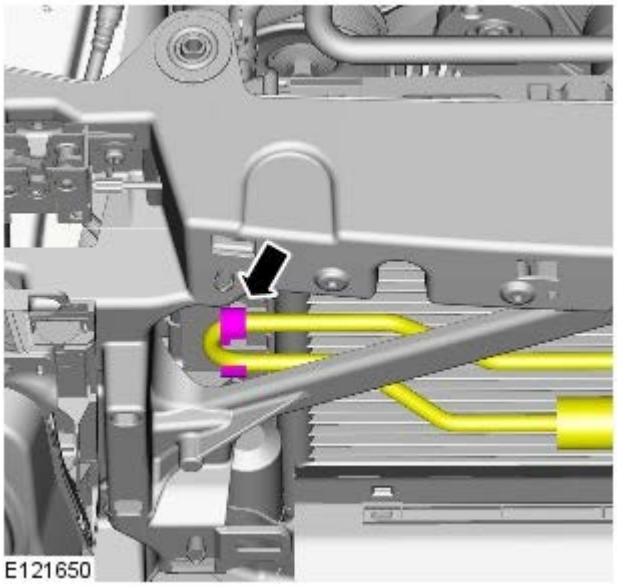
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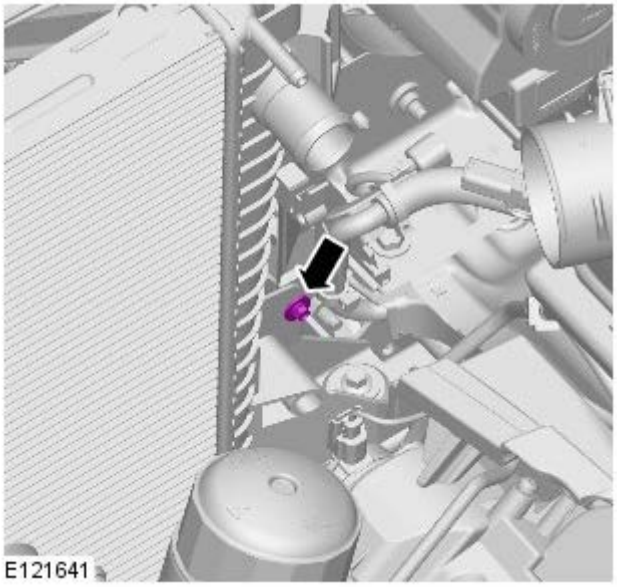
10.



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

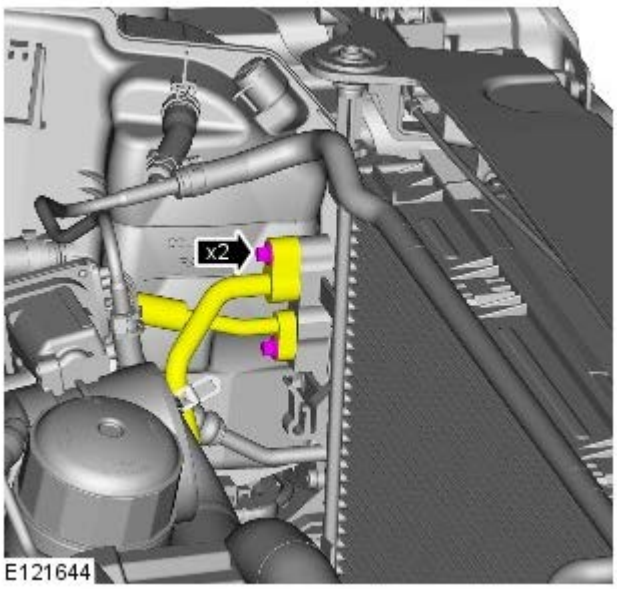


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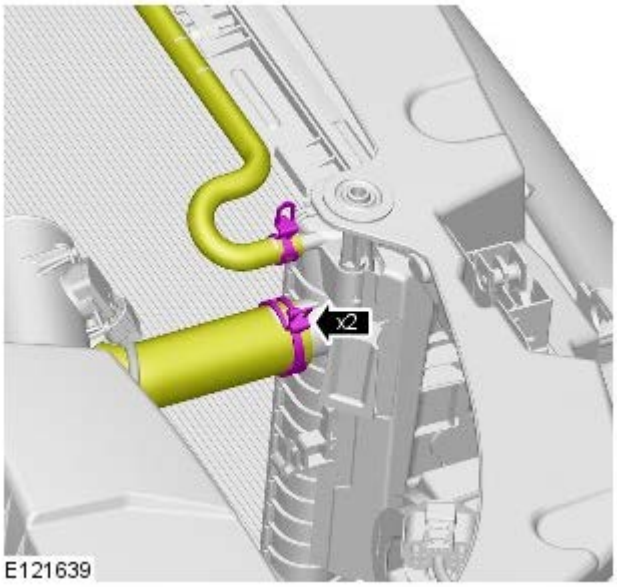


13. CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

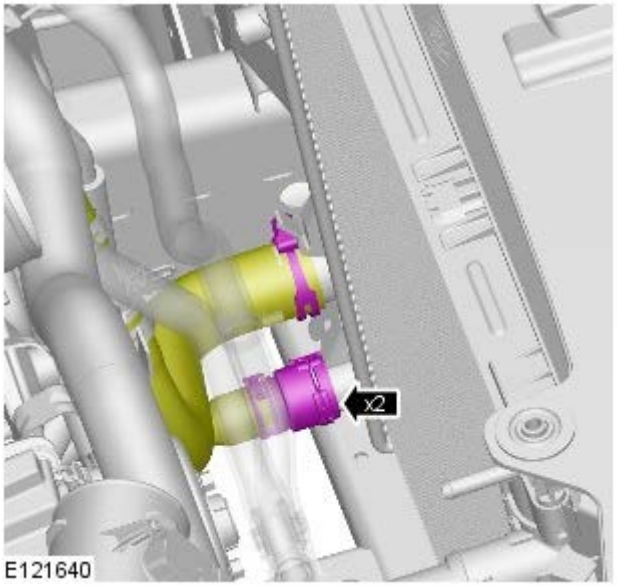
Torque: 10 Nm



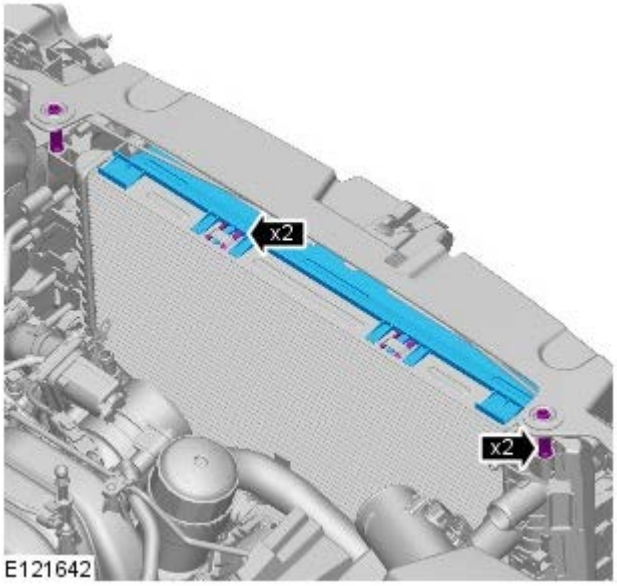
14.



15.

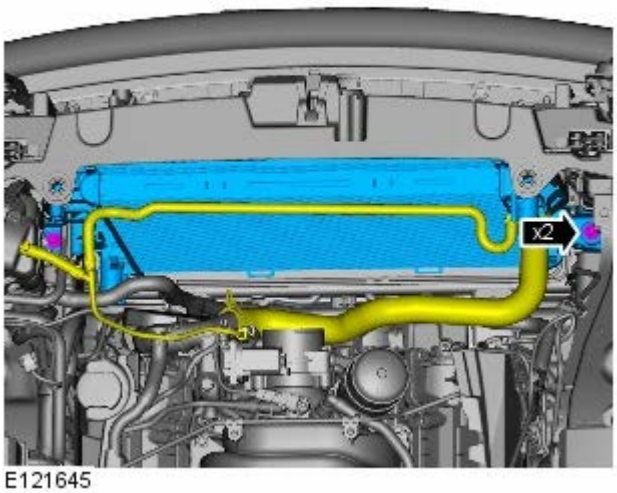


16.



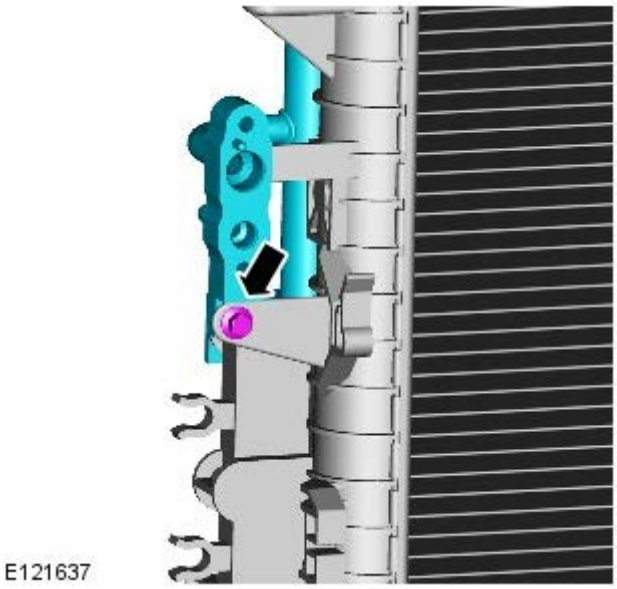
17. CAUTION: Always protect the cooling pack elements to prevent accidental damage.

Torque: 25 Nm

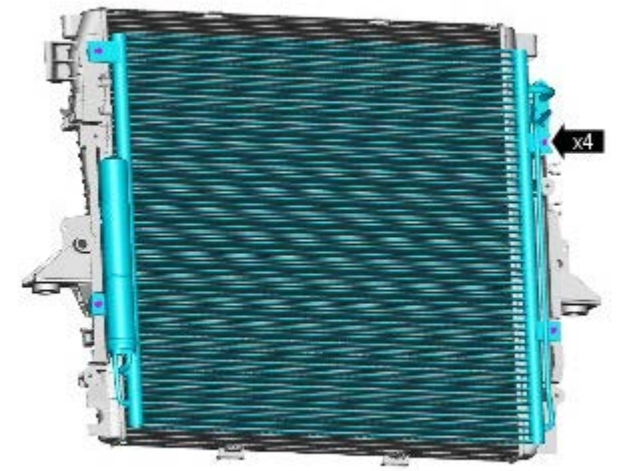


E121645

18. *Torque:* 10 Nm


E121637

19. *Torque:* 10 Nm



E121636

Installation

1. To install, reverse the removal procedure.

Published: 25-Nov-2013

Air Conditioning - V8 5.0L Petrol/V8 S/C 5.0L Petrol - Evaporator Core V8 S/C 5.0L Petrol

Removal and Installation

Removal

1. Remove the engine cover.

2. Evacuate 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).

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

   Raise and support the vehicle.

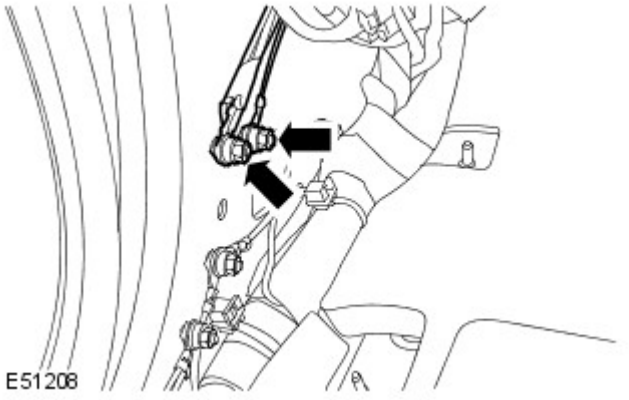
4. Drain the cooling system.
   For additional information, refer to: Cooling System Partial Draining, Filling and Bleeding - V8 S/C 5.0L Petrol (303-03B Engine Cooling - V8 5.0L Petrol/V8 S/C 5.0L Petrol, General Procedures).

5. Remove the driver side front seat.
   For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

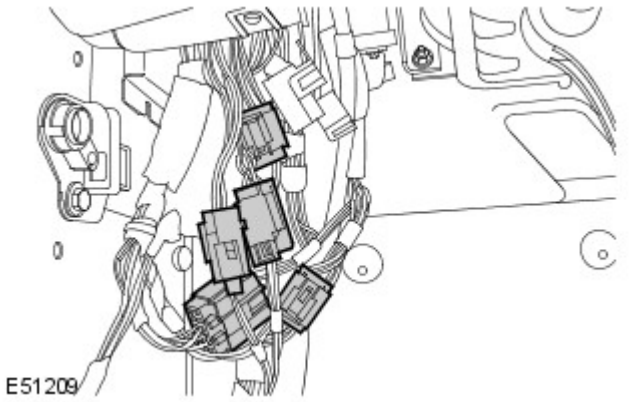
6. Remove the floor console.
   For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

7. Remove the instrument panel upper section.
   For additional information, refer to: Instrument Panel Upper Section (501-12 Instrument Panel and Console, Removal and Installation).

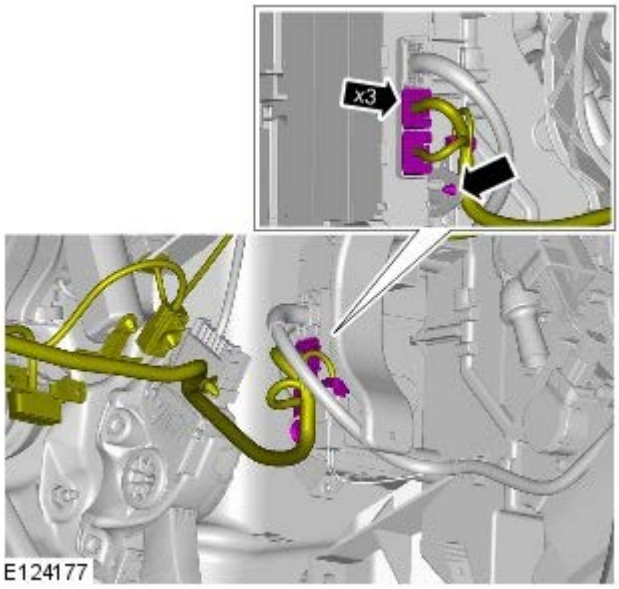
8. Release the 3 ground cables from the driver side lower A-pillar.
   - Remove the 2 nuts.



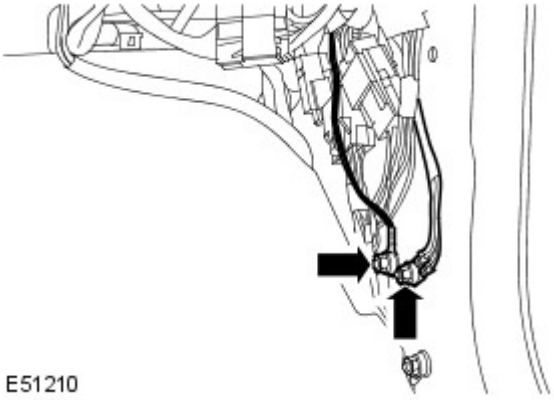
9. Disconnect the 5 electrical connectors from the driver side lower A-pillar.



10. Disconnect the 3 electrical connectors.

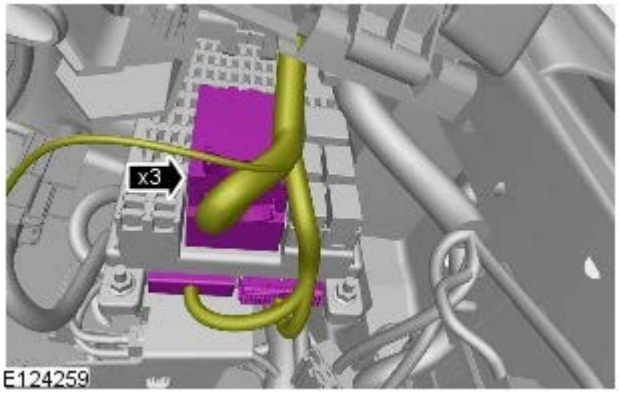


11. Release the 3 ground cables from the passenger side lower A-pillar.
    - Remove the 2 nuts.



12. Disconnect the 5 electrical connectors from the passenger side lower A-pillar.

13. Disconnect the central junction box (CJB) three electrical connectors.



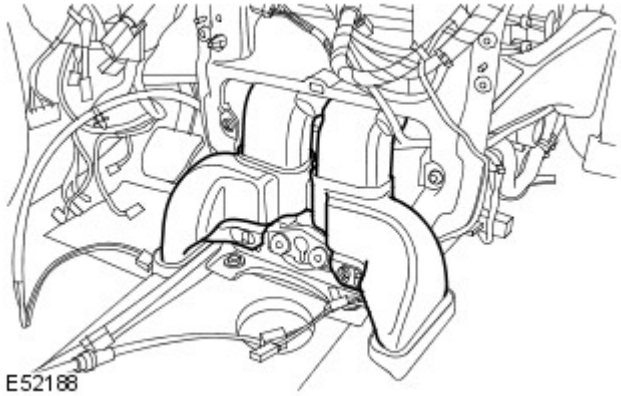
14. Disconnect 2 electrical connectors from the instrument panel center reinforcement.

15. CAUTION: Cover fiber optic cable connectors to minimize dust ingress and avoid bending the cables in a radius of less than 30 mm.

    If installed, disconnect the instrument panel center reinforcement fibre optic cables.
    - Disconnect the electrical connector.



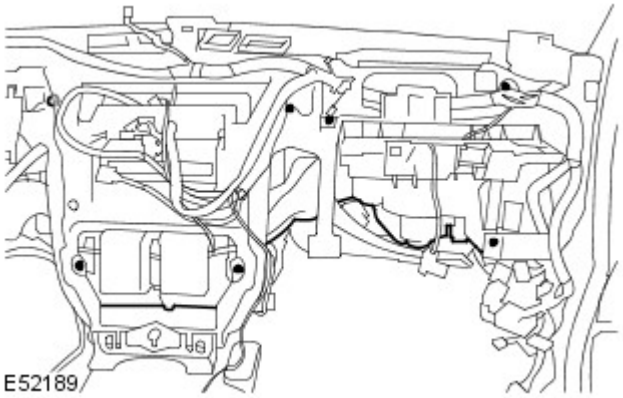
16. Remove the heater housing center ducts.



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

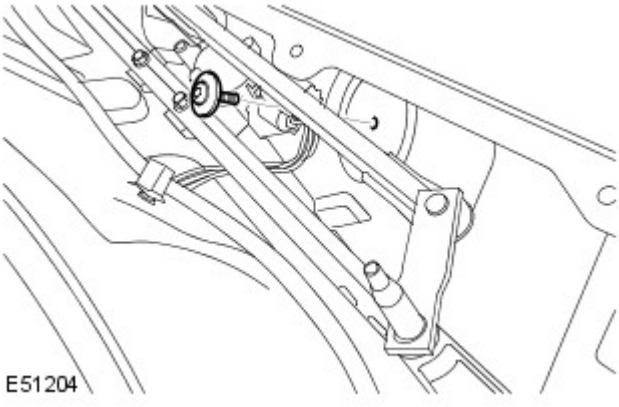


18. Release the heater housing from the instrument panel carrier.
    - Remove the 7 Torx screws.

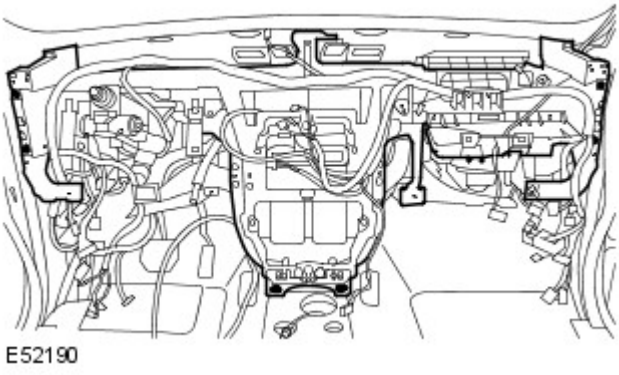


19. Remove the plenum chamber panel.

20. Remove the instrument panel carrier to bulkhead Torx bolt.

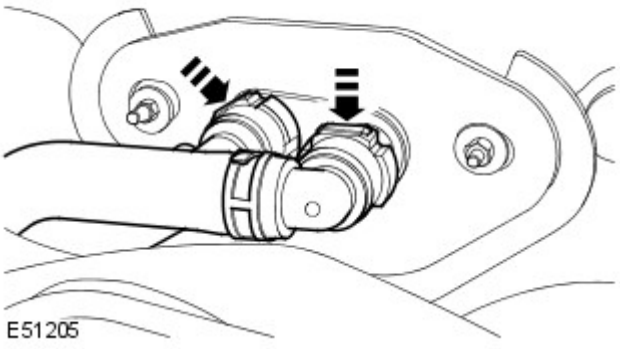


21. With assistance, remove the instrument panel.
    - Remove the 6 Torx bolts.



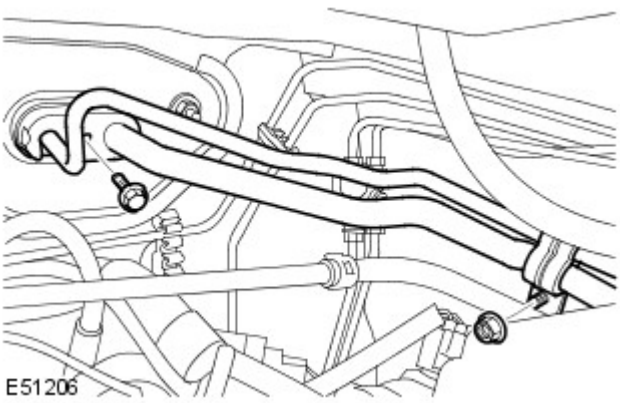
22. CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

    Disconnect 2 heater hoses from the bulkhead.
    - Release the 2 clips.

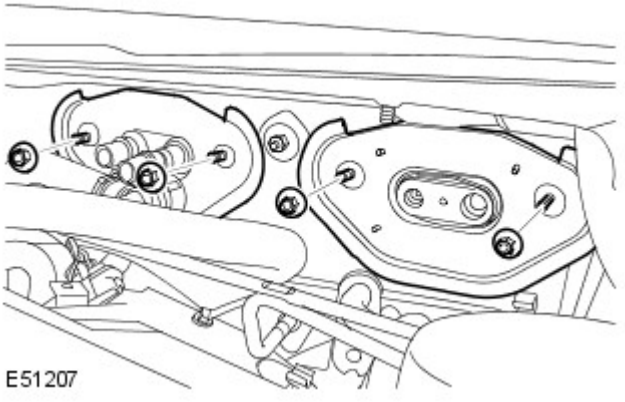


23. CAUTION: Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

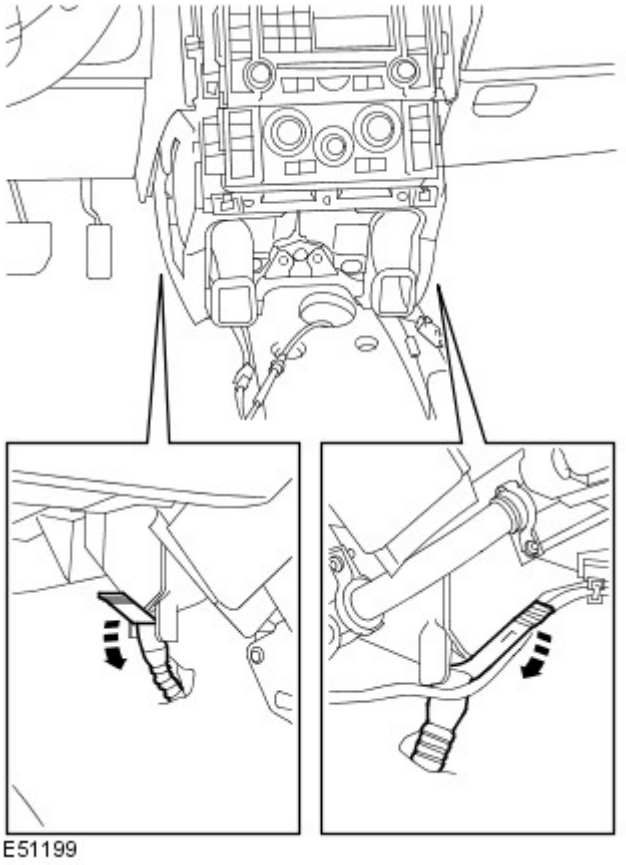
    Release the 2 A/C refrigerant lines.
    - Remove the nut and bolt.
    - Remove and discard the O-ring seals.



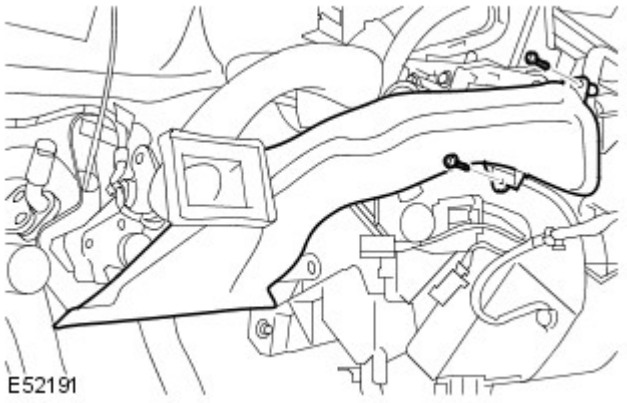
24. Remove the 2 adapter panels.
    - Remove the 4 nuts.



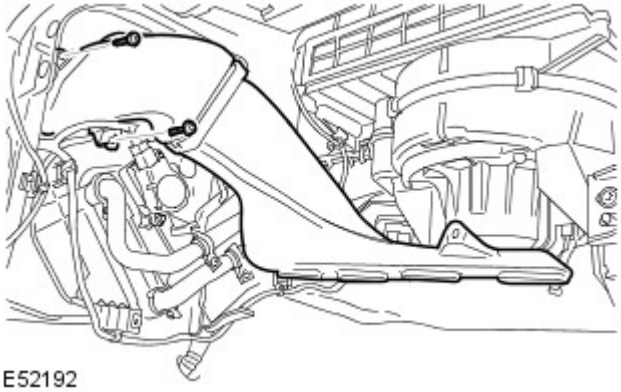
25. Disconnect 2 drain tubes from the heater housing.



26. Remove the driver side footwell duct.
    - Remove the 2 Torx screws.



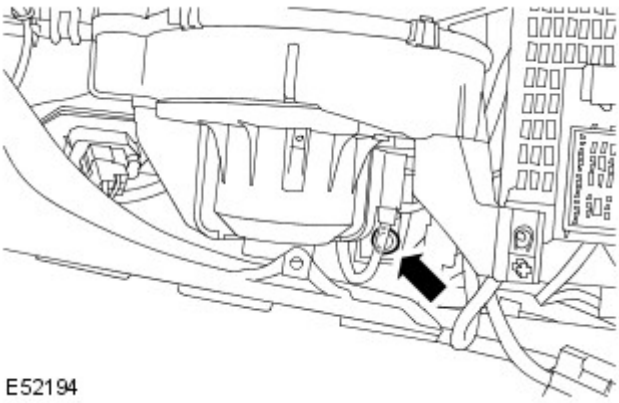
27. Remove the passenger side footwell duct.
    - Remove the 2 Torx screws.


E52192

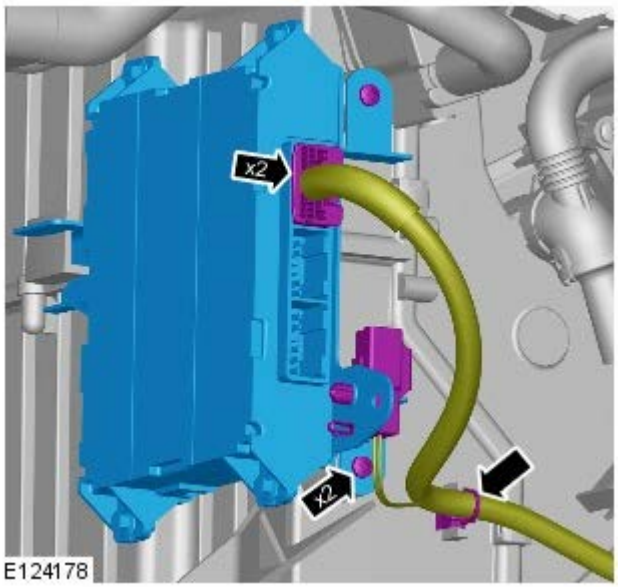
28. Driver side: Remove the heater housing to bulkhead Torx bolt.


E52193

29. Passenger side: Remove the heater housing to bulkhead Torx bolt.
    - With assistance, remove the heater and evaporator core housing.


E52194

30. Remove the A/C control module.

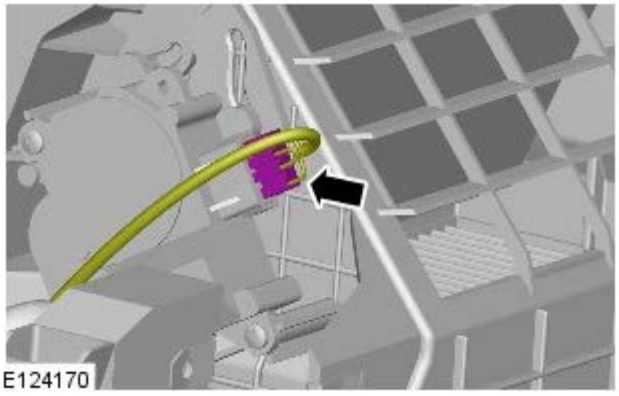


E124178

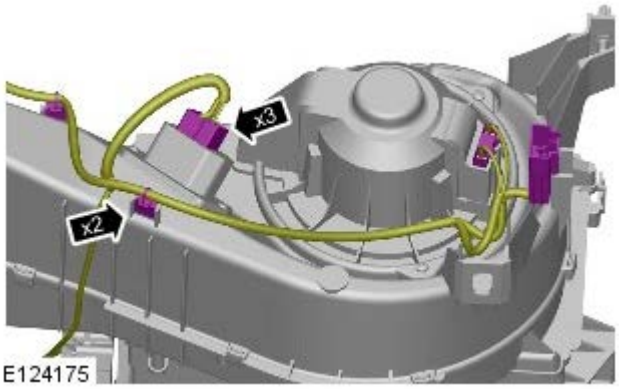
31. Disconnect the evaporator core temperature sensor electrical connector.



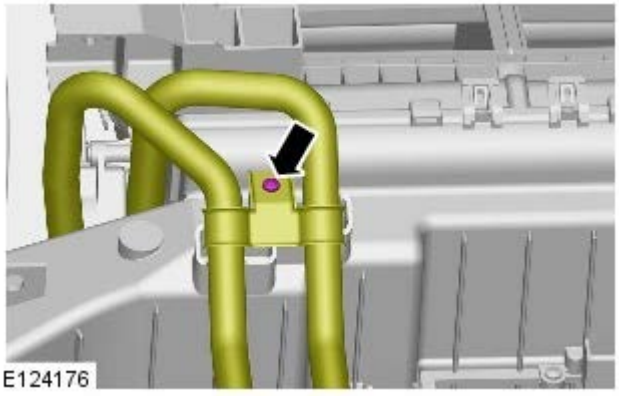
32. Disconnect the electrical connector.



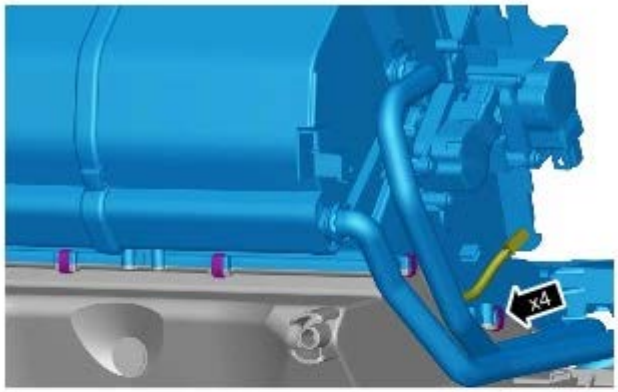
33. Detach the wiring harness.

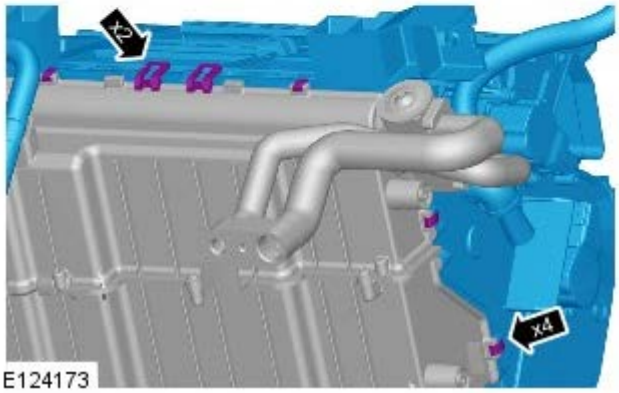


34. Remove the bolt from the support bracket.



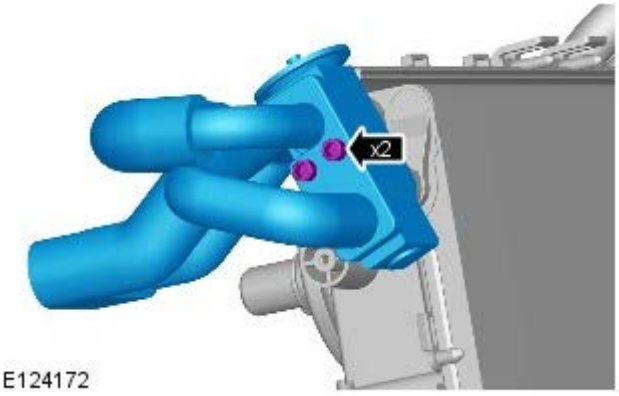
35. Remove the heater and evaporator core housing.
    - Remove the 8 clips.
    - Carefully release the 2 clips.





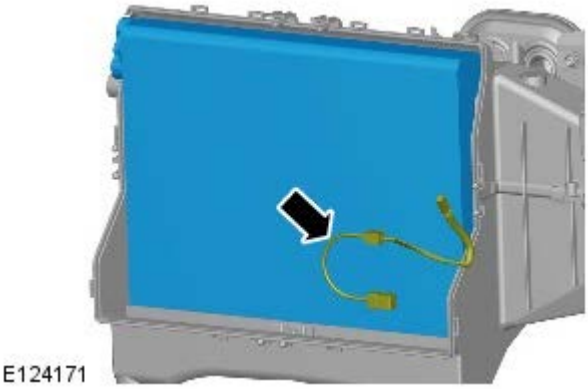
E124173

36. Remove the thermostatic expansion valve.



E124172

37. Remove the evaporator core.
    - Release the temperature sensor.


E124171

Installation

1. Install the evaporator core.
    - Secure the temperature sensor.
2. Secure the heater core housing.
    - Install the clips.
3. Install the thermostatic expansion valve.
    - Tighten the bolts to 3.5 Nm (2.5 lb.ft).

4. Install the wiring harness.
5. Install and tighten the bolt.
6. Connect the temperature sensor electrical connector.
7. Install the CC module.
    - Tighten the bolts.
8. Passenger side: Install the heater housing to bulkhead Torx bolt and tighten to 6 Nm (4 lb.ft).
    - With assistance, install the heater and evaporator core housing.
9. Driver side: Install the heater housing to bulkhead Torx bolt and tighten to 6 Nm (4 lb.ft).
10. Install the footwell ducts.
    - Tighten the Torx screws.
11. Connect the drain tubes to the heater housing.
12. Install the adapter panels.
    - Tighten the nuts to 6 Nm (4 lb.ft).
13. Secure the A/C refrigerant lines.
    - Clean the components.
    - Install new O-ring seals.
    - Tighten the bolt to 5 Nm (4 lb.ft).
    - Tighten the nut to 6 Nm.
14. Connect the bulkhead heater hoses.
15. With assistance, install the instrument panel.
    - Tighten the Torx bolts to 25 Nm (18 lb.ft).
16. Install the instrument panel carrier to bulkhead Torx bolt and tighten to 25 Nm (18 lb.ft).
17. Install the plenum chamber panel.
18. Secure the heater housing.
    - Tighten the screws.
19. Connect the steering column intermediate shaft.
    - Install the special bolt and tighten the new nut to 22 Nm (16 lb.ft).
20. Install the heater housing center ducts.
21. Connect the instrument panel center reinforcement fibre optic cables.
22. Connect the instrument panel center reinforcement electrical connectors.
23. Connect the CJB electrical connectors.
24. Connect the electrical connectors to the passenger side lower A-pillar.
25. Connect the ground cables to the passenger side lower A-pillar.
    - Tighten the nuts to 10 Nm (7 lb.ft).
26. Connect the electrical connectors to the driver side lower A-pillar.
27. Connect the ground cables to the driver side lower A-pillar.
    - Tighten the nuts to 10 Nm (7 lb.ft).
28. Connect the 3 electrical connectors.
29. Install the instrument panel upper section.
    For additional information, refer to: Instrument Panel Upper

Section (501-12 Instrument Panel and Console, Removal and Installation).

30. Install the floor console.
    For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

31. Install the front seat.
    For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

32. 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).

33. Refill the cooling system.
    For additional information, refer to: Cooling System Partial Draining, Filling and Bleeding - V8 S/C 5.0L Petrol (303-03B Engine Cooling - V8 5.0L Petrol/V8 S/C 5.0L Petrol, General Procedures).

34. Install the engine cover.

Published: 25-Nov-2013

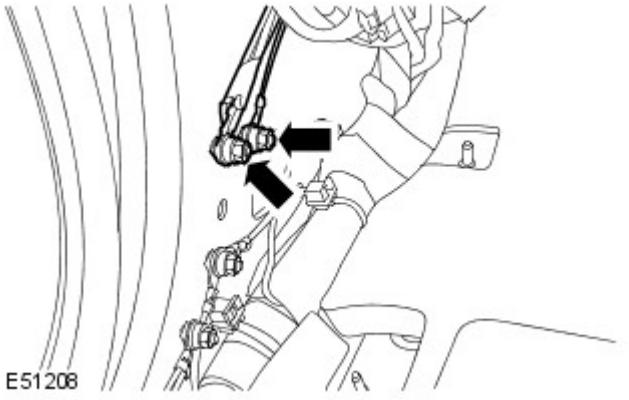
Air Conditioning - V8 5.0L Petrol/V8 S/C 5.0L Petrol - Evaporator Core V8 5.0L Petrol

Removal and Installation

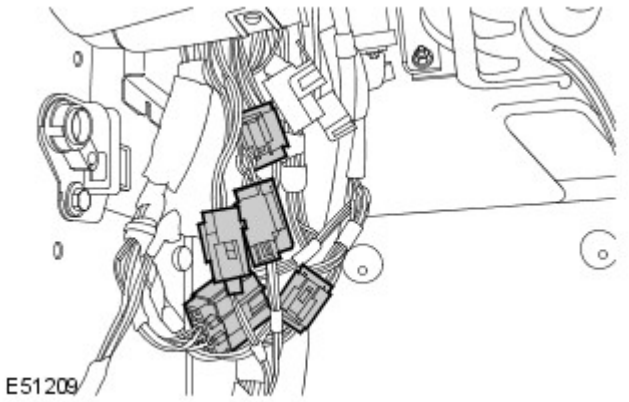
Removal

1. Remove the engine cover.
2. Evacuate 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).
3. WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

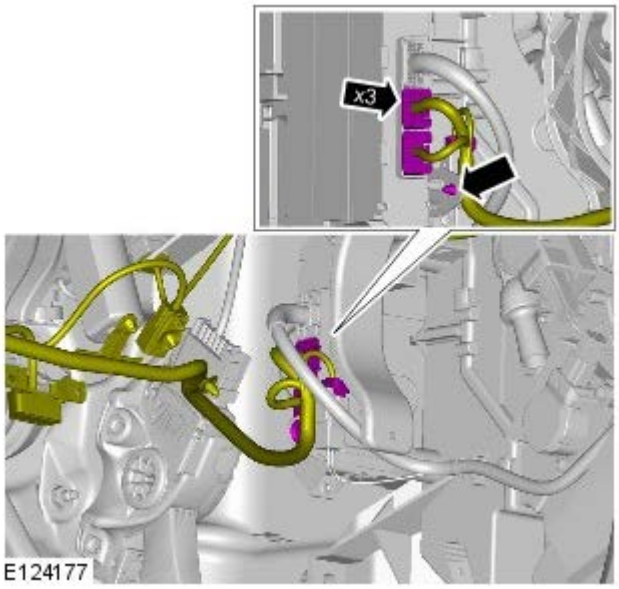
   Raise and support the vehicle.
4. Drain the cooling system.
   For additional information, refer to: Cooling System Partial Draining, Filling and Bleeding - V8 5.0L Petrol (303-03B Engine Cooling - V8 5.0L Petrol/V8 S/C 5.0L Petrol, General Procedures).
5. Remove the driver side front seat.
   For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).
6. Remove the floor console.
   For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).
7. Remove the instrument panel upper section.
   For additional information, refer to: Instrument Panel Upper Section (501-12 Instrument Panel and Console, Removal and Installation).
8. Release the 3 ground cables from the driver side lower A-pillar.
   - Remove the 2 nuts.



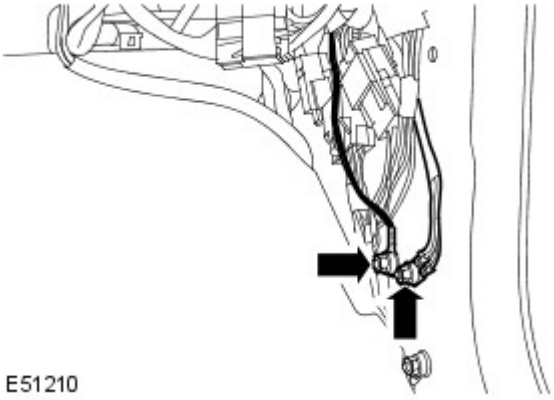
9. Disconnect the 5 electrical connectors from the driver side lower A-pillar.



10. Disconnect the 3 electrical connectors.

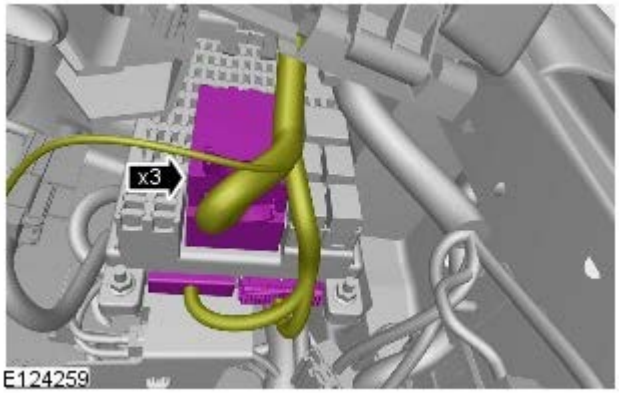


11. Release the 3 ground cables from the passenger side lower A-pillar.
    - Remove the 2 nuts.



12. Disconnect the 5 electrical connectors from the passenger side lower A-pillar.

13. Disconnect the central junction box (CJB) three electrical connectors.



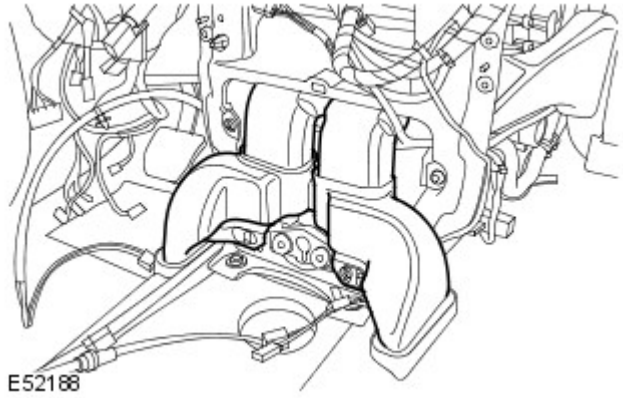
14. Disconnect 2 electrical connectors from the instrument panel center reinforcement.

15. CAUTION: Cover fiber optic cable connectors to minimize dust ingress and avoid bending the cables in a radius of less than 30 mm.

    If installed, disconnect the instrument panel center reinforcement fibre optic cables.
    - Disconnect the electrical connector.



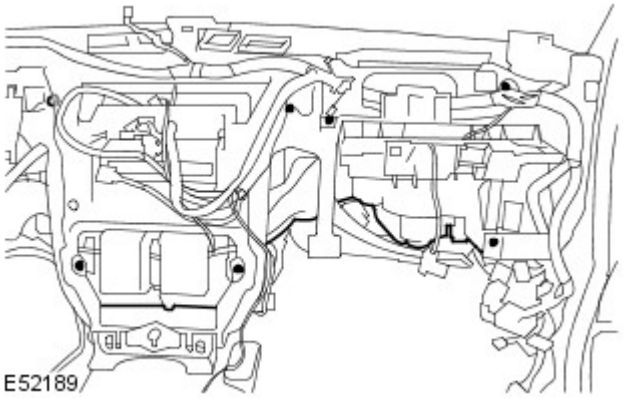
16. Remove the heater housing center ducts.



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

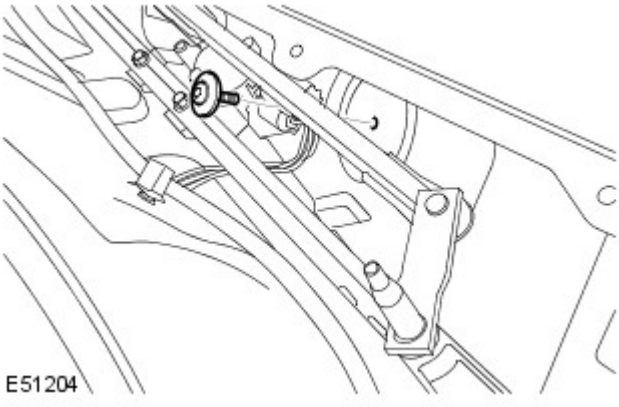


18. Release the heater housing from the instrument panel carrier.
    - Remove the 7 Torx screws.

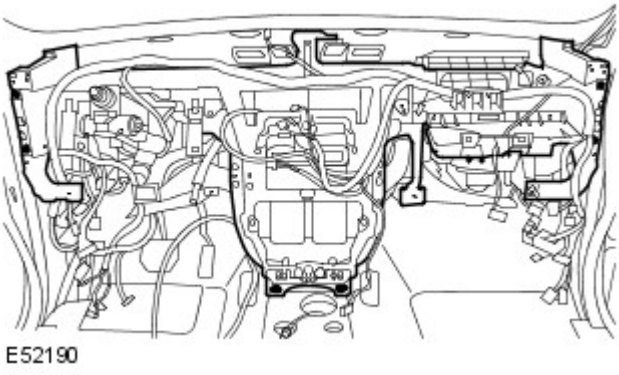


19. Remove the plenum chamber panel.
    For additional information, refer to: Plenum Chamber (412-01 Air Distribution and Filtering, Removal and Installation).

20. Remove the instrument panel carrier to bulkhead Torx bolt.

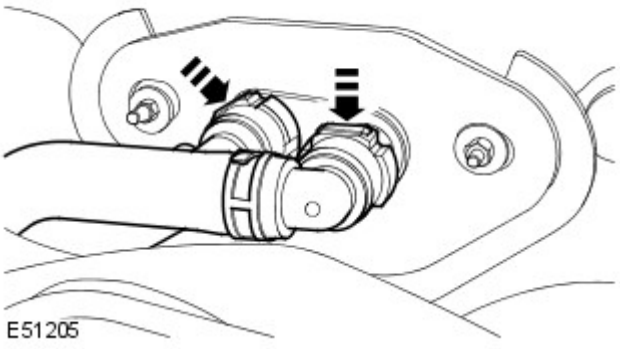


21. With assistance, remove the instrument panel.
    - Remove the 6 Torx bolts.



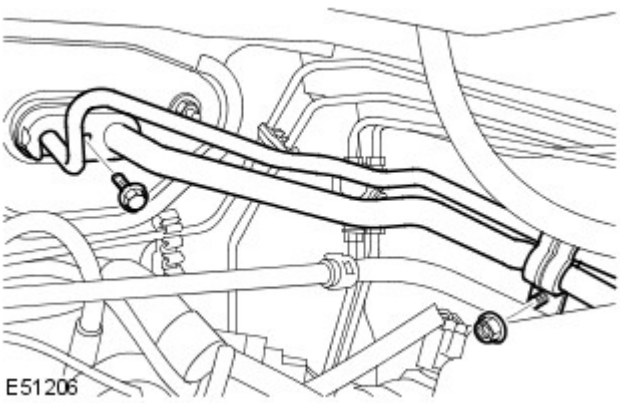
22. CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

    Disconnect 2 heater hoses from the bulkhead.
    - Release the 2 clips.

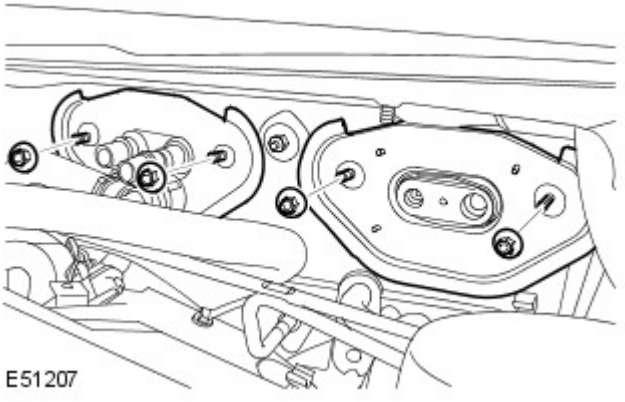


23. CAUTION: Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

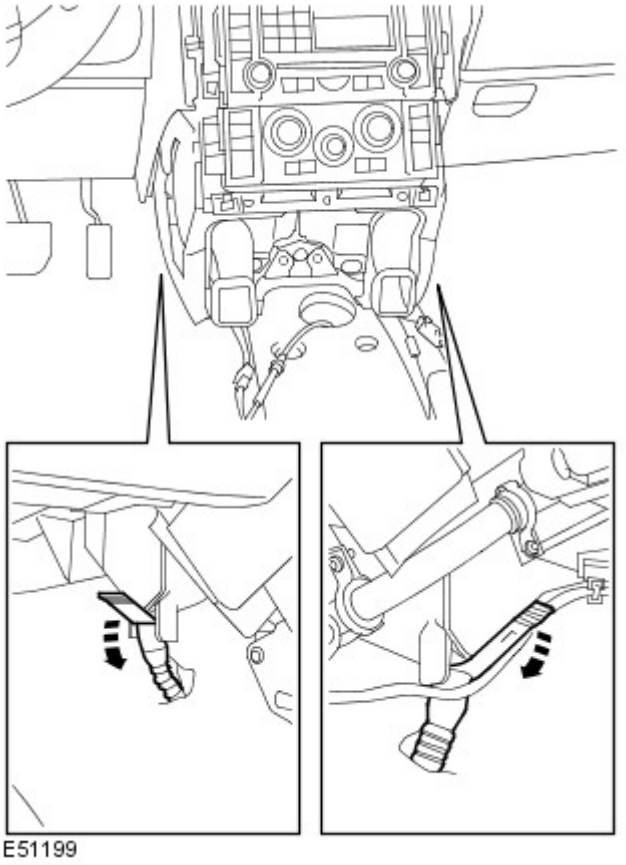
    Release the 2 A/C refrigerant lines.
    - Remove the nut and bolt.
    - Remove and discard the O-ring seals.



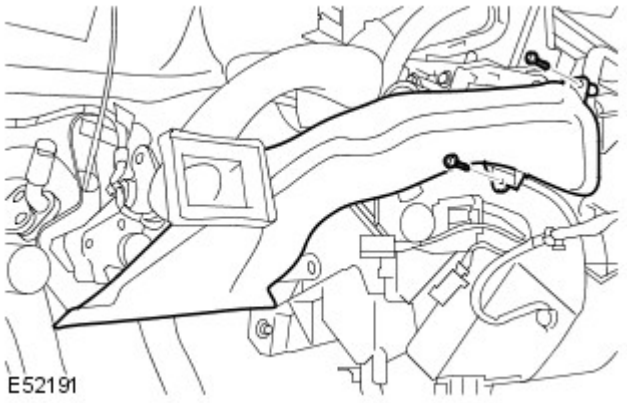
24. Remove the 2 adapter panels.
    - Remove the 4 nuts.



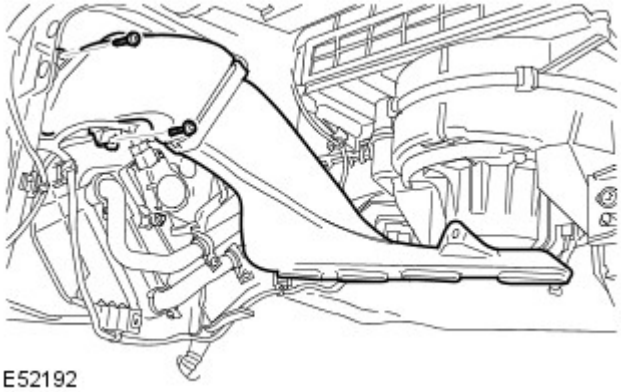
25. Disconnect 2 drain tubes from the heater housing.



26. Remove the driver side footwell duct.
    - Remove the 2 Torx screws.



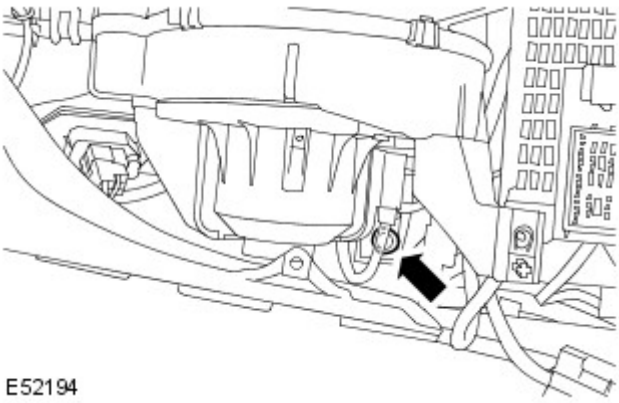
27. Remove the passenger side footwell duct.
    - Remove the 2 Torx screws.


E52192

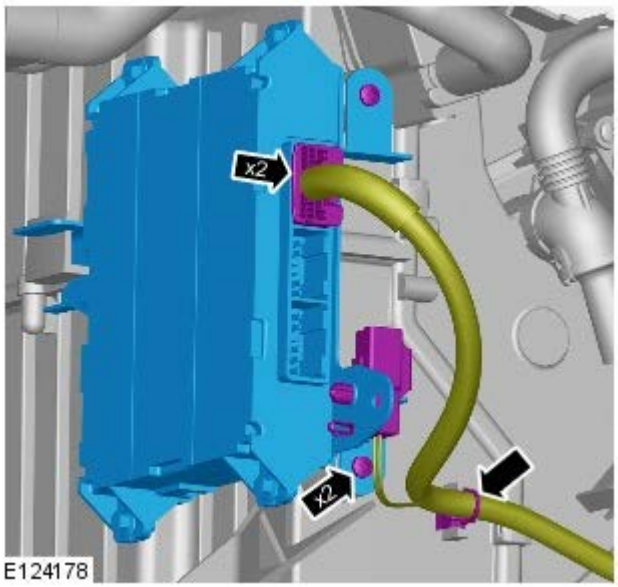
28. Driver side: Remove the heater housing to bulkhead Torx bolt.


E52193

29. Passenger side: Remove the heater housing to bulkhead Torx bolt.
    - With assistance, remove the heater and evaporator core housing.


E52194

30. Remove the A/C control module.

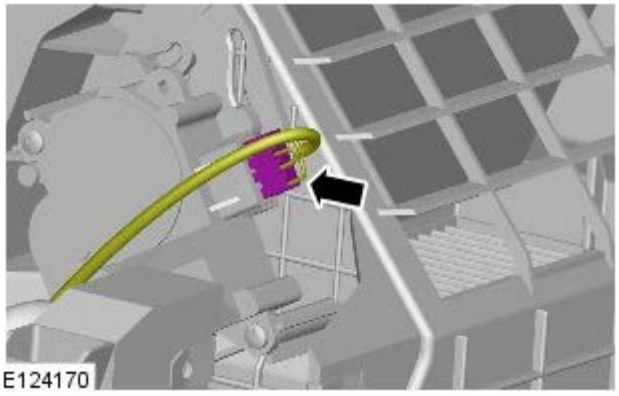


E124178

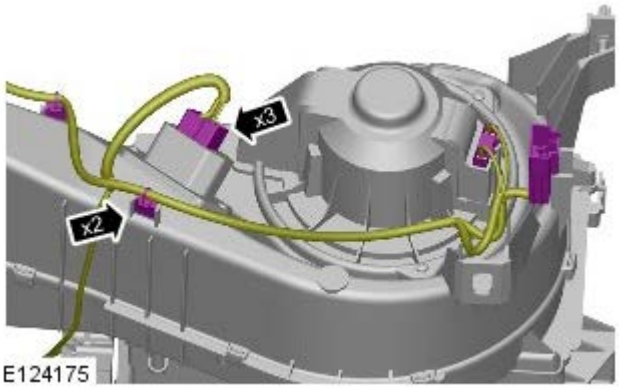
31. Disconnect the evaporator core temperature sensor electrical connector.



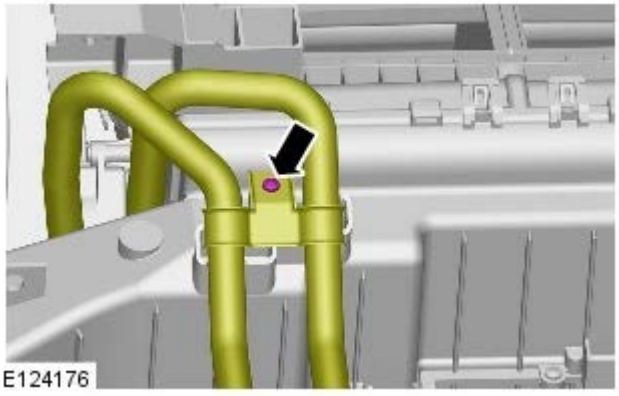
32. Disconnect the electrical connector.



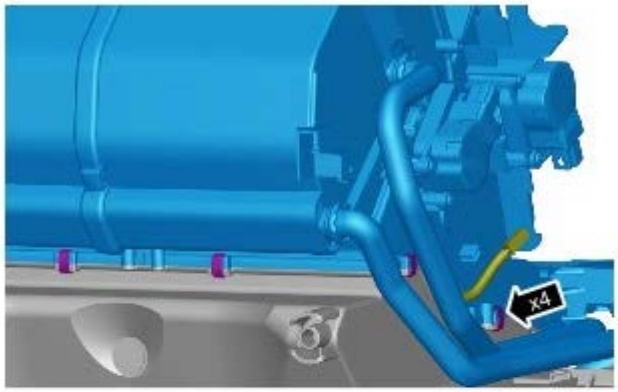
33. Detach the wiring harness.

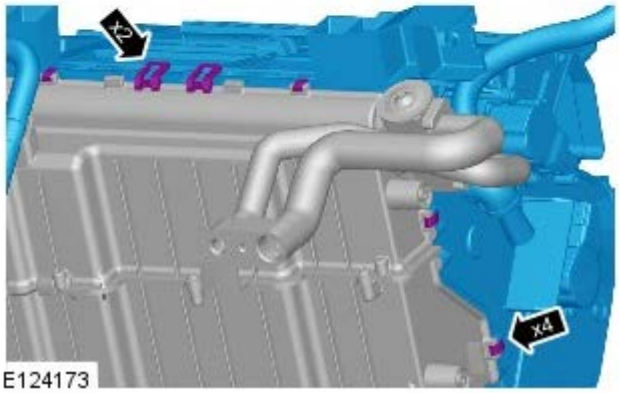


34. Remove the bolt from the support bracket.



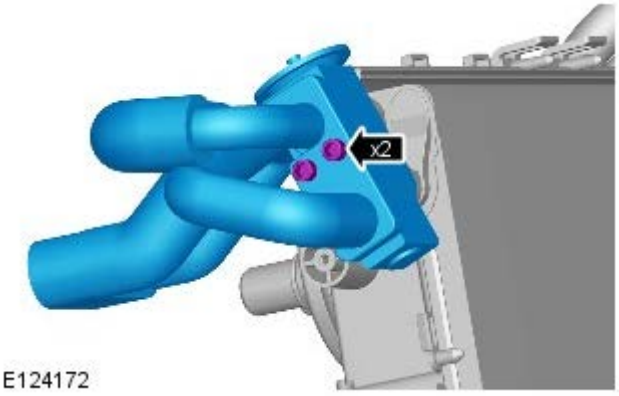
35. Remove the heater and evaporator core housing.
    - Remove the 8 clips.
    - Carefully release the 2 clips.





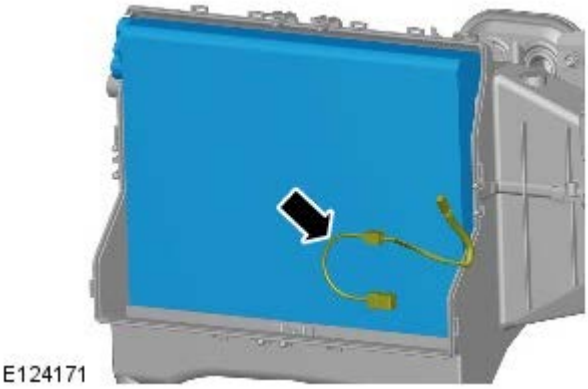
E124173

36. Remove the thermostatic expansion valve.



E124172

37. Remove the evaporator core.
    - Release the temperature sensor.


E124171

Installation

1. Install the evaporator core.
    - Secure the temperature sensor.
2. Secure the heater core housing.
    - Install the clips.
3. Install the thermostatic expansion valve.
    - Tighten the bolts to 3.5 Nm (2.5 lb.ft).

4. Install the wiring harness.
5. Install and tighten the bolt.
6. Connect the temperature sensor electrical connector.
7. Install the CC module.
    - Tighten the bolts.
8. Passenger side: Install the heater housing to bulkhead Torx bolt and tighten to 6 Nm (4 lb.ft).
    - With assistance, install the heater and evaporator core housing.
9. Driver side: Install the heater housing to bulkhead Torx bolt and tighten to 6 Nm (4 lb.ft).
10. Install the footwell ducts.
    - Tighten the Torx screws.
11. Connect the drain tubes to the heater housing.
12. Install the adapter panels.
    - Tighten the nuts to 6 Nm (4 lb.ft).
13. Secure the A/C refrigerant lines.
    - Clean the components.
    - Install new O-ring seals.
    - Tighten the bolt to 5 Nm (4 lb.ft).
    - Tighten the nut to 6 Nm.
14. Connect the bulkhead heater hoses.
15. With assistance, install the instrument panel.
    - Tighten the Torx bolts to 25 Nm (18 lb.ft).
16. Install the instrument panel carrier to bulkhead Torx bolt and tighten to 25 Nm (18 lb.ft).
17. Install the plenum chamber panel.
    For additional information, refer to: Plenum Chamber (412-01 Air Distribution and Filtering, Removal and Installation).
18. Secure the heater housing.
    - Tighten the screws.
19. Connect the steering column intermediate shaft.
    - Install the special bolt and tighten the new nut to 22 Nm (16 lb.ft).
20. Install the heater housing center ducts.
21. Connect the instrument panel center reinforcement fibre optic cables.
22. Connect the instrument panel center reinforcement electrical connectors.
23. Connect the CJB electrical connectors.
24. Connect the electrical connectors to the passenger side lower A-pillar.
25. Connect the ground cables to the passenger side lower A-pillar.
    - Tighten the nuts to 10 Nm (7 lb.ft).
26. Connect the electrical connectors to the driver side lower A-pillar.
27. Connect the ground cables to the driver side lower A-pillar.
    - Tighten the nuts to 10 Nm (7 lb.ft).
28. Connect the 3 electrical connectors.

29. Install the instrument panel upper section.
    For additional information, refer to: Instrument Panel Upper Section (501-12 Instrument Panel and Console, Removal and Installation).

30. Install the floor console.
    For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

31. Install the front seat.
    For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

32. 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).

33. Refill the cooling system.
    For additional information, refer to: Cooling System Partial Draining, Filling and Bleeding - V8 5.0L Petrol (303-03B Engine Cooling - V8 5.0L Petrol/V8 S/C 5.0L Petrol, General Procedures).

34. Install the engine cover.

Published: 11-May-2011

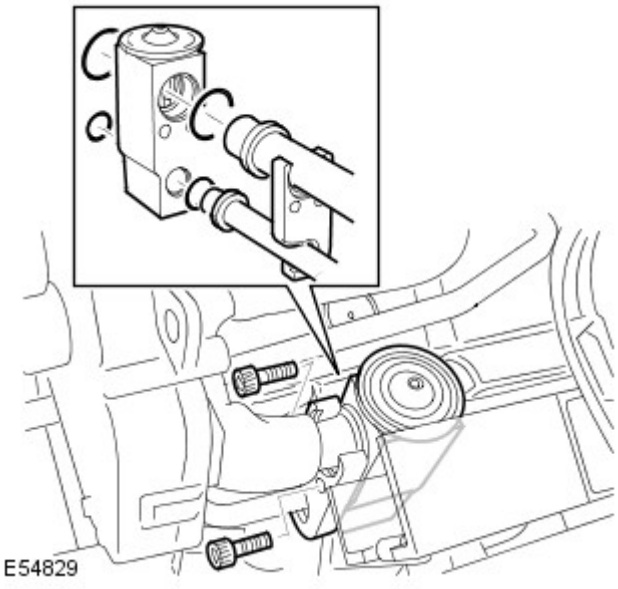
Air Conditioning - V8 5.0L Petrol/V8 S/C 5.0L Petrol - Thermostatic Expansion Valve

Removal and Installation

Removal

1. Evacuate the A/C system.
   For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00, General Procedures).

2. Remove the instrument panel upper section.
   For additional information, refer to: Instrument Panel Upper Section (501-12, Removal and Installation).



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

   Remove the thermostatic expansion valve.
   - Remove the cover.
   - Remove the 2 Allen bolts.
   - Remove and discard the 4 O-ring seals.

Installation

1. Install the thermostatic expansion valve.
   - Clean the components.
   - Install the new O-ring seals.
   - Tighten the Allen bolts to 5 Nm (4 lb.ft).
   - Install the cover.

2. Install the instrument panel upper section.
   For additional information, refer to: Instrument Panel Upper Section (501-12, Removal and Installation).

3. Recharge the A/C system.
   For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00, General Procedures).

Published: 11-May-2011

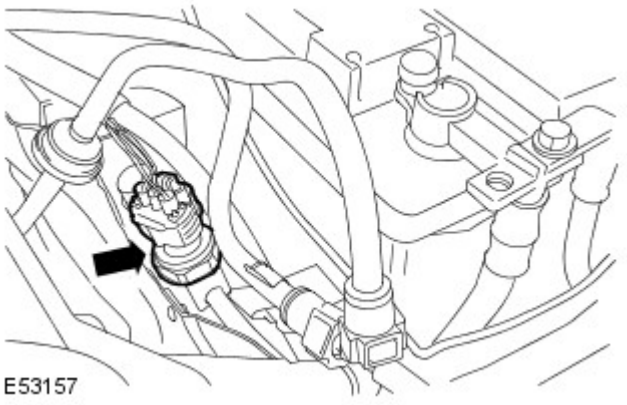
Air Conditioning - V8 5.0L Petrol/V8 S/C 5.0L Petrol - Air Conditioning (A/C) Pressure Transducer

Removal and Installation

Removal

1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).

2. Recover the 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).



3. CAUTIONS:

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

   To prevent damage to components, use an additional wrench when loosening or tightening unions.

   Remove the A/C pressure transducer.
   - Disconnect the electrical connector.
   - Remove and discard the seal.

Installation

1. Install the A/C pressure transducer.
   - Clean the component mating faces.
   - Install a new seal.
   - Tighten the transducer to 10 Nm (7 lb.ft).
   - Connect the electrical connector.

2. 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).

3. Connect the battery ground cable.
   For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).

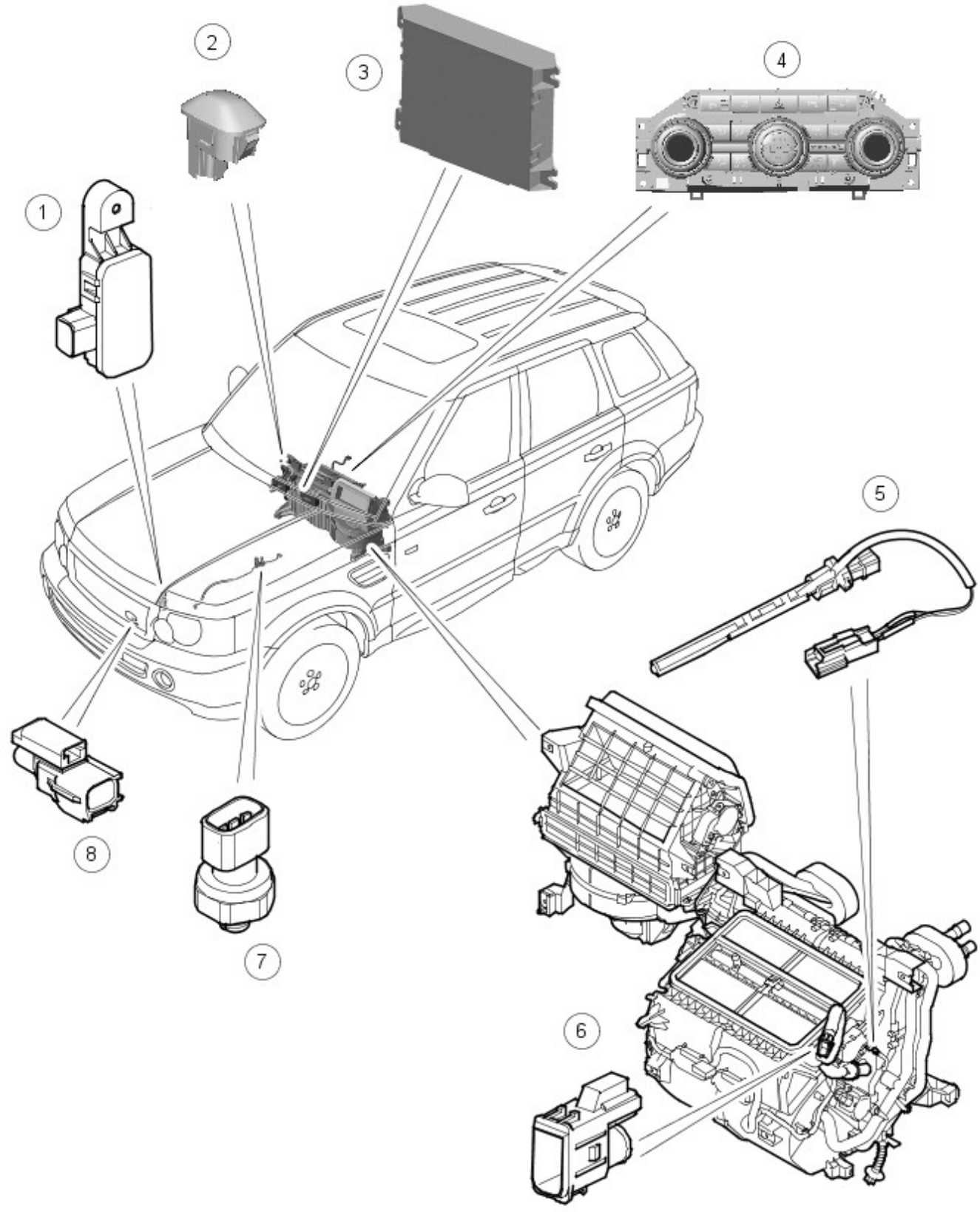
Published: 30-Jan-2012

Control Components - Control Components

Description and Operation

COMPONENT LOCATIONS

NOTE: right-hand drive (RHD) installation shown; left-hand drive (LHD) installation similar



E132925

Item	Part Number	Description

1	-	Pollution sensor (Japan only)
2	-	Sunlight sensor
3	-	automatic temperature control (ATC) module
4	-	Integrated control Panel
5	-	Evaporator temperature sensor
6	-	In-vehicle temperature sensor (all except Japan), or in-vehicle temperature and humidity sensor (Japan only)
7	-	Refrigerant pressure sensor
8	-	Ambient air temperature sensor

GENERAL

The control system operates the air conditioning (A/C) system and the heating and ventilation system to control the temperature, volume and distribution of air from the heater.

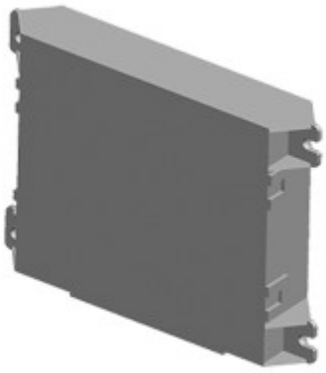
The system is a dual zone system that automatically adjusts the temperature, volume and distribution of the air from the heater to maintain the individual temperature levels selected for the left-hand (LH) and right-hand (RH) sides of the passenger compartment. The system also has manual overrides for the intake air source, blower speed and air distribution. The system includes:

- An ATC module.
- Integrated control Panel
- An ambient temperature sensor.
- A refrigerant pressure sensor.
- An evaporator temperature sensor.
- An in-vehicle temperature sensor.
- A sunlight sensor.

Vehicles in the Japan market also incorporate:

- A pollution sensor.
- A humidity sensor.

ATC MODULE



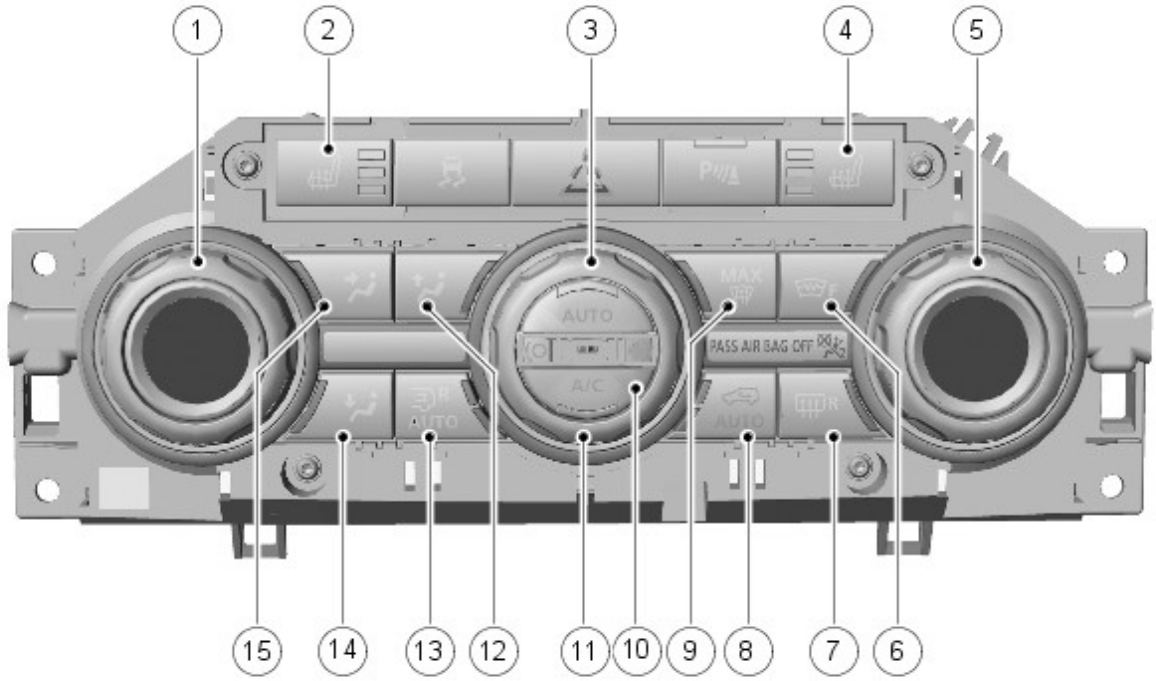
E128058

The ATC (automatic temperature control) module is mounted on the outboard end of the air inlet duct, behind the front passenger side of the instrument panel.

The ATC module processes inputs from the integrated control Panel, system sensors and the medium speed controller area network (CAN) bus, then outputs the appropriate control signals to the A/C system and the heating and ventilation system. In addition to controlling the A/C system and the heating and ventilation system, the ATC module also controls the following:

- The front seat heaters.
- The rear window heater.
  For additional information, refer to: Glass, Frames and Mechanisms (501-11, Description and Operation).
- The windshield heater.
  For additional information, refer to: Glass, Frames and Mechanisms (501-11, Description and Operation).
- The windshield washer jets and exterior mirror heaters.
  For additional information, refer to: Rear View Mirrors (501-09, Description and Operation).

INTEGRATED CONTROL PANEL



E132922

Item	Part Number	Description
1	-	LH temperature switch
2	-	LH front seat heater switch
3	-	Automatic mode switch
4	-	RH front seat heater switch
5	-	RH temperature switch
6	-	Heated windshield switch
7	-	Heated rear window switch
8	-	Defrost program switch
9	-	Air recirculation switch
10	-	A/C (air conditioning) control switch
11	-	Blower control switch
12	-	Windshield and side window distribution switch
13	-	Rear environment
14	-	Footwell distribution switch
15	-	Face distribution switch

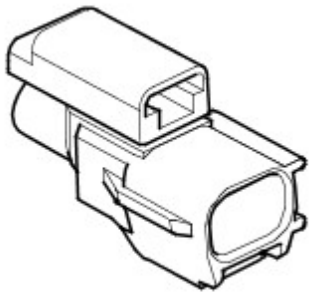
The switches on the **integrated control Panel** have the following functions:

- Adjusts the nominal temperature settings of the LH and RH sides of the passenger compartment. The switch can rotate through 270°, between full cold and full hot. The switch surrounds are graduated in 2° increments between 16 and 28 °C. Minor detents define 1 °C steps over the range of the switch. Amber light emitting diode (LED)s in the switch surround illuminate to indicate the temperature setting. When maximum cold is selected, the ATC module also automatically sets the air source to recirculated air, blower speed to maximum and distribution to face. When maximum hot is selected, the ATC module also automatically sets the air source to fresh air, blower speed to maximum and distribution to footwell.
- **LH and RH Seat Heater Switches:** Activates the heater elements in the seat cushion and seat back at one of two heat levels. The first press of the switch energizes the heater elements at the higher heat setting and illuminates two LEDs in the switch. A second press of the switch sets the heater elements to the lower heat setting and extinguishes one of the LEDs. A further press of the switch de-energizes the heater elements and extinguishes the second LED. The seat heaters remain on until selected off or the engine is turned off.
- **Blower Switch:** For manual adjustment of blower speed. The switch can rotate through 240°, from off to maximum speed. Eight primary detents define the off position and seven blower speeds. Minor detents define small steps between the primary detents. When blower speed is manually adjusted, amber LEDs in the switch surround illuminate to indicate the selected blower speed. The LEDs remain off when blower speed is under automatic control.
- **Automatic Mode Switch:** Activates the automatic modes for the A/C system, blower speed and distribution. Separate amber LEDs in the automatic mode switch illuminate to show when the blower and the distribution are in automatic mode. Manually selecting the blower speed or a distribution switch extinguishes the related LED.
- **A/C control switch:** Controls activation of the A/C compressor. Allows the A/C compressor to be selected off for economy operation. A LED (light emitting diode) switch is illuminated when the A/C compressor is selected

on.

- **Defrost program switch:** Activates a program that automatically selects: inlet air to fresh air; distribution to screen only; blower to speed 5; rear screen heater on; windshield heater on (where fitted), A/C system to automatic mode. An amber LED in the switch is illuminated while the defrost program is active.
- **Heated windshield switch:** Energizes the windshield heater for a set time period, until the switch is pressed again or until the engine stops, whichever occurs first. An amber LED in the switch is illuminated while the heater is on.
- **Heated rear window switch:** Enabled only with the engine running. Pressing the switch energizes the rear window heater for a set time period, until the switch is pressed again or until the engine stops, whichever occurs first. An amber LED in the switch is illuminated while the heater is on.
- **Air recirculation switch:** For selection of fresh or recirculated air. On models without pollution sensing, an amber LED in the switch is illuminated when recirculated air is selected. On models with pollution sensing, the recirculation switch incorporates two amber LED. The first press of the switch sets the recirculation flaps to automatic mode and illuminates one LED. A second press of the switch manually selects recirculated air and illuminates the second LED. A further press of the switch manually selects fresh air and extinguishes the two LEDs.
- **Distribution Switches (Windshield, Face and Footwell):** For manual selection of air distribution in any combination of windshield, face and footwell outlets. Each switch has a LED which illuminates when the related distribution mode is selected.

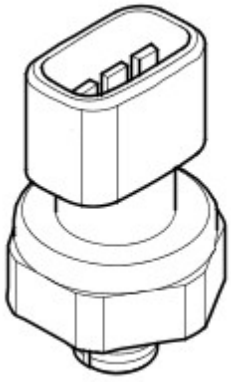
AMBIENT AIR TEMPERATURE SENSOR



E43580

The ambient air temperature sensor is a negative temperature coefficient (NTC) thermistor that provides the ATC module with an input of external air temperature. The sensor is attached to a bracket on the rear of the bumper beam, on the vehicle center-line.

REFRIGERANT PRESSURE SENSOR



E43581

The refrigerant pressure sensor provides the ATC module with a pressure input from the high pressure side of the refrigerant system. The refrigerant pressure sensor is located in the refrigerant line between the condenser and the thermostatic expansion valve.

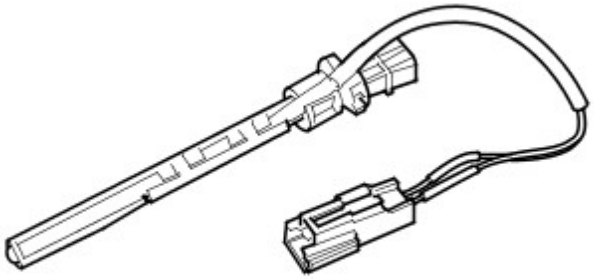
The ATC module supplies a 5 V reference voltage to the refrigerant pressure sensor and receives a return signal voltage, between 0 and 5 V, related to system pressure.

The ATC module uses the signal from the refrigerant pressure sensor to protect the refrigerant system from extremes of pressure and to calculate A/C compressor load on the engine. The ATC module also transmits the A/C compressor load value to the engine control module (ECM), via the medium speed CAN bus, instrument cluster and high speed CAN bus, for use in controlling the speed of the engine cooling fan.

To protect the system from extremes of pressure, the ATC module sets the A/C compressor to the minimum flow position if the pressure:

- Decreases to 1.9 ± 0.2 bar (27.5 ± 3 lbf/in^2); the ATC module loads the A/C compressor again when the pressure increases to 2.8 ± 0.2 bar (40.5 ± 3 lbf/in^2).
- Increases to 33 ± 1 bar (479 ± 14.5 lbf/in^2); the ATC module loads the A/C compressor again when the pressure decreases to 23.5 ± 1 bar (341 ± 14.5 lbf/in^2).

EVAPORATOR TEMPERATURE SENSOR

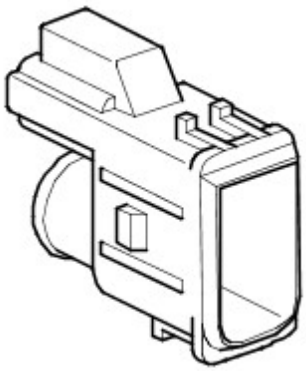


E43582

The evaporator temperature sensor is a NTC thermistor that provides the ATC module with a temperature signal from the downstream side of the evaporator. The evaporator temperature sensor is installed in the right side of the heater assembly casing.

The ATC module uses the input from the evaporator temperature sensor to control the load of the A/C compressor and thus the operating temperature of the evaporator.

IN-VEHICLE TEMPERATURE SENSOR



E43583

The in-vehicle temperature sensor is a NTC thermistor installed behind a grill in the instrument panel, on the inboard side of the steering column. The sensor is connected to a tube, the other end of which is connected to a venturi on the side casing of the heater. An air bleed from the heater, through the venturi, induces a flow of air down the tube, which draws cabin air through the grill and over the sensor.

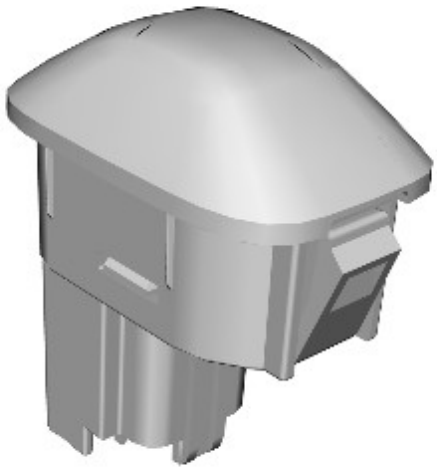
HUMIDITY SENSOR (WHERE FITTED)

The humidity sensor is a capacitive device integrated into the in-vehicle temperature sensor (see above).

The humidity sensor element is constructed from film capacitors on different substrates. The dielectric is a polymer which absorbs or releases water proportional to the relative humidity of the air being drawn through the sensor, and thus changes the capacitance of the capacitor. For protection, the sensor element is contained in a nylon mesh cover.

The humidity sensor and the in-vehicle temperature sensor are connected to a PCB (printed circuit board) inside the sensor housing. The PCB is powered by a 5V feed from the ATC module. Separate signals of temperature and relative humidity are transmitted from the PCB to the ATC module.

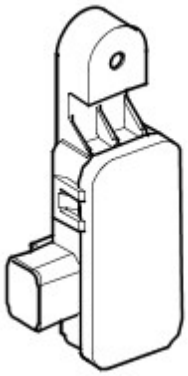
SUNLIGHT SENSOR



E132923

The sunlight sensor consists of two photoelectric cells that provide the ATC module with inputs of light intensity, one as sensed coming from the left of the vehicle and one as sensed coming from the right. The inputs are a measure of the solar heating effect on vehicle occupants, and are used by the ATC module to adjust blower speed, temperature and distribution to improve comfort. The sensor is installed in the center of the instrument panel upper surface and is powered by a 5V feed from the ATC module.

POLLUTION SENSOR (WHERE FITTED)



E43588

The pollution sensor allows the ATC module to monitor the ambient air for the level of hydrocarbons and oxidized gases such as nitrous oxides, sulphur oxides and carbon monoxide. The sensor is attached to a bracket on the front-end carrier, at the top left corner of the condenser.

The pollution sensor is powered by a battery voltage feed from the ATC module, and returns separate signals of hydrocarbon and oxidized gases.

If there is a fault with the pollution sensor, the ATC module disables the automatic operation of the recirculation door.

SYSTEM OPERATION

A/C Compressor Control

The variable displacement A/C compressor is permanently driven by the engine. The flow of refrigerant through the A/C compressor, and the resultant system pressure and evaporator operating temperature, is regulated by the refrigerant solenoid valve. Operation of the refrigerant solenoid valve is controlled by the ATC module using a 400 Hz pulse width modulation (PWM) signal. The duty cycle of the PWM signal is calculated using the following parameters:

- A/C compressor torque.
- A/C compressor torque maximum.
- A/C cooling status.
- A/C demand.
- A/C refrigerant pressure.
- Ambient air temperature.
- Blower speed.
- Engine cranking status.
- Evaporator temperature.
- Transmission gear status.

When A/C is selected, the ATC module maintains the evaporator at an operating temperature that varies with the in-vehicle cooling requirement. The ATC module increases the evaporator operating temperature, by reducing the refrigerant flow, as the requirement for air cooling decreases, and vice versa. During an increase of evaporator

operating temperature, to avoid compromising the dehumidification function, the ATC module controls the rate of temperature increase, which keeps the cabin humidity at a comfortable level.

When the economy mode is selected, the PWM signal holds the refrigerant solenoid valve in the minimum flow position, effectively switching off the A/C function.

The ATC module incorporates limits for the operating pressure of the refrigerant system. When the system approaches the high pressure limit, the duty cycle of the PWM signal is progressively reduced until the system pressure decreases. When the system pressure falls below the low pressure limit, the duty cycle of the PWM signal is held at its lowest setting, so that the A/C compressor is maintained at the minimum stroke, to avoid depletion of lubricant from the A/C compressor. The protection algorithm is calculated at a high rate, to enable early detection of the rapid pressure changes possible if a system fault develops.

A/C Compressor Torque

The ATC module uses refrigerant pressure, evaporator temperature and engine speed to calculate the torque being used to drive the A/C compressor. The calculated value is broadcast on the medium speed CAN bus for the ECM, which uses the calculated value for idle speed control and fueling control. The ATC module also compares the calculated value with a maximum A/C compressor torque value received from the ECM over the medium speed CAN bus. If the calculated value exceeds the maximum value, the ATC module signals the refrigerant solenoid valve to reduce the refrigerant flow and so reduce the torque being used to drive the A/C compressor. By reducing the maximum A/C compressor torque value, the ECM is able to reduce the load on the engine when it needs to maintain vehicle performance or cooling system integrity.

Idle Speed Control

In order to maintain A/C cooling performance, the ATC module requests an increase in engine idle speed if the evaporator temperature starts to rise while the refrigerant solenoid valve is already set to the maximum flow rate. The increase in engine idle speed is requested in three stages, using a medium speed CAN bus message to the ECM. For additional information, refer to:

Electronic Engine Controls (303-14A, Description and Operation),
Electronic Engine Controls (303-14B, Description and Operation),
Electronic Engine Controls (303-14C, Description and Operation).

The need for a change in idle speed is determined as follows:

- If the evaporator temperature increases by 3 °C (5.4 °F), or to 6 °C (10.8 °F) above the target operating temperature, over a 10 seconds period, the first stage of idle speed increase is requested.
- When the first stage of idle speed increase is set, if the evaporator temperature increases by 3 °C (5.4 °F), or increases to 12 °C (21.6 °F) above the target operating temperature, over a 9 seconds period, the second stage of idle speed increase is requested.
- When the second stage of idle speed increase is set, if the evaporator temperature increases by 3 °C (5.4 °F), or increases to 15 °C (27 °F) above the target operating temperature, over a 10 seconds period, the third stage of idle speed increase is requested.
- When an idle speed increase is set, if the evaporator temperature decreases by 3 °C (5.4 °F) over a 10 seconds period, the next stage down of idle speed increase is requested.

Electrical Load Management

The ATC module manages the vehicle electrical loads to:

- Maintain the vehicle battery in a healthy state of charge.
- Ensure adequate power is available for defrost demisting during engine warm-up.
- Ensure adequate power is available for A/C during extended periods with the engine at idle speed.
- To maintain system voltage within acceptable limits.
- To provide adequate power to meet customer expectations.

Electrical load management is achieved by increasing the engine idle speed and controlling the electrical load of systems that do not affect the driveability or safety of the vehicle.

During the engine warm-up period, the ATC module manages the electrical load to make sure that the battery voltage is maintained above a pre-determined level. The battery voltage level that is maintained and the duration of the start period varies with ambient air temperature and engine coolant temperature (ECT). After the engine warm-up period, the ATC module manages the electrical load to make sure that the requested electrical load does not exceed the generator output.

The duration of the engine warm-up period depends on the ambient air temperature and the ECT, as detailed in the following table:

Engine Warm-up Times

Ambient Air Temperature, °C (°F)	**ECT, °C (°F)**			
	<10 (<50)	**>10 to <30 (>50 to <86)**	**>30 to <60 (>86 to <140)**	**>60 (>140)**
		Warm-up Period, Minutes		
>10 (>50)	15	15	15	15
>5 to <10 (>41 to <50)	15	15	15	15
>0 to <5 (>32 to <41)	10	15	15	15
>-10 to <0 (>14 to <32)	10	10	15	15
<-10 (<14)	5	5	10	15

The ATC module calculates the electrical load from the battery voltage and generator output voltage, and compares the result against the maximum load available from the generator. The calculation is averaged across the first 20

seconds after the engine starts, and subsequently averaged every 60 seconds. When the engine is turned off, the ATC module stores the status of the electrical load management for 20 seconds. If the engine is re-started within the 20 seconds, the ATC module resumes electrical load management using the stored status. If the engine is re-started after the 20 seconds, the timers are reset and the ATC module re-calculates the status.

If the electrical load is more than the maximum load available, the ATC module requests an increase of engine idle speed using the medium speed CAN bus message to the ECM. If an electrical load imbalance remains after an increase in engine idle speed, or if the electrical load is more than the capacity of the charging system, the ATC module reduces the electrical load by reducing the power of some vehicle systems or inhibiting their operation. The number of systems controlled depends on the electrical load reduction required. The systems controlled and the order in which their power is reduced or they are inhibited are contained in three priority tables. The table used depends on the ambient air temperature, battery temperature and ECT:

- The cold start table is used when the ambient air temperature is less than 5 °C (41 °F) and the ECT is less than 30 °C (86 °F).
- The hot start table is used when the ambient air temperature is 5 °C (41 °F) or more and the ECT is less than 30 °C (86 °F).
- The continuous table is used when battery temperature is more than 5 °C (41 °F) and the ECT is more than 50 °C (122 °F).
- If none of the above conditions are met, the ATC module adopts the last used table.

Cold Start Electrical Load Management

Priority		System
Power Reduction	Inhibited	
1	-	Air suspension
2	-	Front seat heaters
3	-	Entertainment system
-	4	Front seat heaters
5	-	Rear window heater
6	-	Windshield washer jet and exterior mirror heaters
-	7	Windshield washer jet and exterior mirror heaters
8	-	Windshield heater
9	-	Climate control blower
-	10	Rear window heater
-	11	Windshield heater

Hot Start Electrical Load Management

Priority		System
Power Reduction	Inhibited	
-	1	Front seat heaters; windshield washer jet and exterior mirror heaters
2	-	Windshield heater
3	-	Rear window heater
4	-	Air suspension
5	-	Entertainment system
-	6	Windshield heater
-	7	Rear window heater

Continuous Electrical Load Management

Priority		System
Power Reduction	Inhibited	
-	1	Front seat heaters
2	-	Windshield heater
3	-	Rear window heater
4	-	Air suspension
5	-	Entertainment system

Engine idle speed changes, and electrical load changes of systems not under direct control of the ATC module (air suspension and entertainment), are initiated using the appropriate medium speed CAN bus message. When partial operation is requested:

- The air suspension system still performs height changes but reduces air compressor operation by not replenishing the reservoir.
- The entertainment system restricts the maximum volume level and reduces the output frequency bandwidth.

Cooling Fan Control

The ATC module determines the amount of condenser cooling required from the refrigerant pressure, since there is a direct relationship between the temperature and pressure of the refrigerant. The cooling requirement is transmitted to the ECM in a medium speed CAN bus message. The ECM controls the condenser cooling using the cooling fan. For additional information, refer to:

Electronic Engine Controls (303-14A, Description and Operation),
Electronic Engine Controls (303-14B, Description and Operation),
Electronic Engine Controls (303-14C, Description and Operation).

Air Temperature Control

Air from the evaporator enters the heater assembly, where temperature blend doors direct a proportion of the air through the heater core to produce the required discharge air temperature. The two temperature blend doors operate independently to enable independent temperature selection for the left and right sides of the vehicle interior. The

temperature blend doors are operated by stepper motors. The stepper motors are controlled by the ATC module.

The ATC module calculates the stepper motor position required to achieve the selected temperature and compares it against the current position, which is stored in memory. If there is any difference, the ATC module signals the stepper motor to adopt the new position.

Air temperature is controlled automatically unless maximum heating or maximum cooling is selected. The required air temperature may be adjusted between 16 °C (61 °F) and 28 °C (82 °F) using the air temperature control switches. The control algorithms then attempt to maintain the desired set temperature.

Turning the temperature switches fully counterclockwise gives maximum available cooling. Turning the temperature switches fully clockwise gives maximum available heating. When maximum cooling or maximum heating is selected, the comfort algorithm adopts an appropriate strategy for the air distribution, blower speed,

A/C and air source functions, except where a function is under manual control.

The temperature control of one zone can be compromised by the other zone being set to maximum heating or maximum cooling. True maximum heating or maximum cooling can only be obtained with both controls set to the same maximum state.

When the economy mode is selected, the automatic temperature control function still operates, but with no cooling capability the minimum discharge temperature achievable will be ambient air temperature plus any heat pick up in the air intake path.

Air Distribution Control

When the A/C is in the automatic mode, the ATC module automatically controls air distribution according to a comfort strategy. Automatic control is overridden when one of the manual modes is selected. Air distribution remains manually controlled until the automatic mode is selected again. The distribution doors are operated by two stepper motors, which are controlled by the ATC module.

Blower Control

When A/C is selected or the blower speed is manually selected, the ATC module energizes the coil of the blower relay in the battery junction box (BJB). The energized blower relay supplies battery power to the blower motor, which is grounded through the blower control module. The speed of the blower is controlled by a PWM signal from the ATC module to the blower control module. The blower control module regulates the blower motor voltage in relation to the PWM signal.

When the blower is in the automatic mode the ATC module determines the blower speed required from the comfort algorithms. When the blower is in the manual mode, the ATC module operates the blower at one of seven fixed speeds as selected on the control panel.

Maximum Defrost

The maximum defrost function automatically provides the maximum defrosting of the vehicle. When the maximum defrost function is selected, the ATC module configures the control system as follows:

- Automatic mode off.
- Air inlet to fresh air, manual control.
- Selected temperature unchanged, automatic control.
- Air distribution set to screen mode, manual control.
- Blower speed set to speed 5, manual control.
- Rear screen heater and windshield heater (if applicable) selected on.
- A/C mode in automatic.

The maximum defrost function is cancelled by one of the following:

- Selecting any distribution switch. The system response will be identical to the normal manual distribution control operation.
- Selecting the automatic switch. This will restore the system to fully automatic operation.
- Selecting the maximum defrost switch again. This returns the system to the state in use immediately before the maximum defrost function was first selected.
- Turning the engine off.

The blower speed can be adjusted manually without terminating the maximum defrost function.

Intake Air Control

The source of intake air is automatically controlled unless overridden by manual selection of recirculation. Under automatic control the ATC module determines the required position of the recirculation door from the comfort strategy and the input from the pollution sensor (if fitted). The recirculation door is operated by an electric motor, which is controlled by hardwired analogue signals from the ATC module. A potentiometer in the motor supplies the ATC module with a position feedback signal for closed loop control.

Provided the intake air has not been manually selected to recirculation, the ATC module adjusts the recirculation door to reduce the ram effect produced by the forward motion of the vehicle.

When the ignition switch is turned off, the ATC module evaluates the ambient air temperature. If the ambient air temperature is less than a pre-determined value, the intake air source is set to recirculation, to prevent the ingress of damp air while the vehicle is parked.

When the vehicle is in the transportation mode, the ATC module sets the intake door to recirculation every time the engine is turned off, regardless of the ambient air temperature.

Pollution Sensing

With a pollution sensor fitted to the vehicle, the ATC module controls the intake air source to reduce contamination of the intake air by external pollutants. This function is fully automatic, but can be overridden by manual selection of the intake air source.

Humidity Sensing

With a humidity sensor fitted, the ATC module controls the moisture content of the air in the vehicle. This is achieved by raising the evaporator temperature to increase the humidity of the air entering the vehicle, and reducing the evaporator temperature to reduce the humidity of the air entering the vehicle.

Front Seat Heaters

The front seat heaters are enabled when Power mode 6 engaged, and operate at one of two temperature settings. With the first press of a front seat heater switch the ATC module adopts the higher temperature setting, supplies a power feed to the related front seat heater elements and illuminates two amber LEDs in the switch. At the second press of the switch the ATC module adopts the lower temperature setting and extinguishes one of the LEDs. At the third press of the switch the ATC module de-energizes the heater elements and extinguishes the second LED. The seat heaters remain on until selected off or the engine is turned off.

The ATC module receives an input from a temperature sensor in each front seat, and regulates the power feed of the heater elements to control the seat temperature at the appropriate temperature setting between 35 and 45 °C (95 and 113 °F). The actual temperature settings vary with the type of seat covering, to allow for the different heat conduction properties of the different materials.

When the front seat heaters are activated at the higher temperature setting, the ATC module automatically resets them to the lower temperature after a time delay. The length of the time delay depends on the in-vehicle temperature.

Temperature Reset Time Delay

In-vehicle Temperature, °C (°F)	<-15 (5)	-15 to -10 (5 to 14)	-10 to 0 (14 to 32)	0 to 15 (32 to 59)	15 to 25 (59 to 77)	>25 (77)
Time Delay, minutes	Remains at higher temperature until manually de-selected	20	15	10	5	3

To protect the heater elements, the ATC module disables front seat heating if battery voltage exceeds 16.5 ± 0.3 V for more than 5 seconds. Front seat heating is re-enabled when battery voltage decreases to 16.2 ± 0.3 V.

The ATC module monitors the power feeds to the heater elements and disables the applicable front seat heating if a short or open circuit is detected. The ATC module also disables seat heating if the seat temperature rises significantly above the target temperature setting.

The plausibility of the temperature sensor inputs is also monitored by the ATC module. When seat heating is selected, if one of the temperature sensor inputs is within 5 °C (9 °F) below the target temperature, the ATC module monitors the sensor input for a temperature increase and checks that it is between the minimum and maximum working temperatures. If a temperature sensor input is at the high end of the working range, while the ambient air temperature and the engine temperature are within 10 °C (18 °F) of each other, the ATC module disables front seat heating until the input decreases below the target temperature setting. The ATC module interprets a temperature sensor input value of -45 °C (-49 °F) or below as an open circuit, and temperature sensor input value of 100 °C (212 °F) or more as a short circuit.

Rear Window Heater

The ATC module controls operation of the rear window heater using medium speed CAN messages to operate the rear window heater relay in the central junction box (CJB). The control module in the CJB interprets the CAN messages and switches the ground connection of the relay coil to operate the rear window heater. While the rear window heater relay is energized, a battery power feed is connected to the rear window heater elements. Rear window heater operation is only enabled when the engine is running.

The ATC module operates the rear window heater in heating cycles of varying power and time. The heating cycle used depends on the ambient air temperature and whether it is the initial or subsequent operation during the current Power mode cycle.

When the rear window heater switch is pressed, the ATC module illuminates an LED in the switch and initiates the appropriate heating cycle. The LED remains illuminated until the rear window heater is selected off, the heating cycle is completed or the engine stops. If the engine stalls or turned off, rear window heating resumes if the engine is re-started within 20 seconds.

On the initial selection of rear window heating, the ATC module uses a short or long defrost phase at full power, followed by a low power phase. The defrost phase used depends on the ambient temperature. During the low power phase, the rear window heater relay is cycled off for 80 seconds and on for 40 seconds.

On subsequent operations, during the same Power mode cycle, the ATC module operates the rear window heater at full power for a fixed time period.

Rear Window Heating Phases

Phase	Time, minutes
Short defrost (-5°C (23°F) and above)	10
Long defrost (less than -5°C (23°F))	15
Low power	20
Subsequent operation	10

Windshield Heater

The ATC module controls operation of the windshield heater using the windshield heater relay in the BJB. The ATC module switches the ground connection of the relay coil to operate the windshield heater. While the windshield heater relay is energized, a battery power feed is connected to each of the two windshield heater elements. Windshield heater operation is only enabled when the engine is running.

The ATC module operates the windshield heater in heating cycles of varying power and time. The heating cycle used depends on the ambient air temperature and whether it is the initial or subsequent operation during the current Power mode cycle.

When the windshield heater switch is pressed, the ATC module illuminates a LED in the switch and initiates the appropriate heating cycle. The LED remains illuminated until the windshield heater is selected off, the heating cycle is completed or the engine stops. If the engine stalls or turned off, windshield heating resumes if the engine is re-started within 20 seconds.

On the initial selection of the windshield heater, the ATC module uses a short or long defrost phase at full power, followed by a low power phase. The defrost phase used depends on the ambient temperature. During the low power phase, the windshield heater relay is cycled off for 80 seconds and on for 40 seconds.

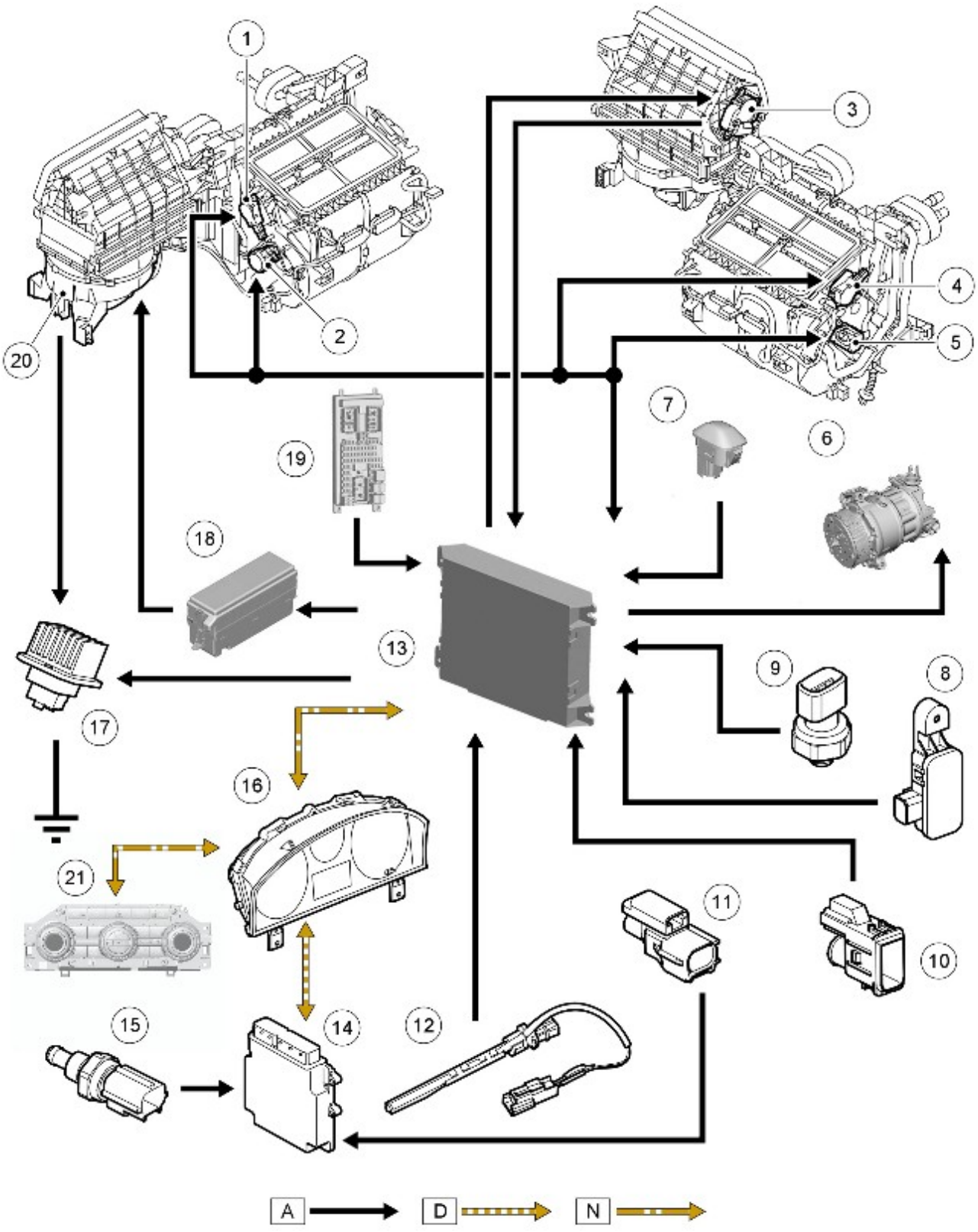
On subsequent operations, during the same Power mode cycle, the ATC module operates the windshield heater at full power for a fixed time period.

Windshield Heating Phases

Phase	Time, minutes
Short defrost (-5 °C (23 °F) and above)	3
Long defrost (less than -5 °C (23 °F))	5
Low power	10
Subsequent operation	3

CONTROL DIAGRAM

NOTE: **A** = Hardwired connections; **D** = High speed CAN bus; **N** = Medium speed CAN bus



E132924

Item	Part Number	Description
1	-	Face and feet distribution motor
2	-	LH temperature blend motor
3	-	Recirculation motor
4	-	Windshield distribution motor
5	-	RH temperature blend motor
6	-	A/C compressor solenoid valve
7	-	Sunlight sensor
8	-	Pollution sensor
9	-	Refrigerant pressure sensor
10	-	In-vehicle temperature sensor (all except Japan) or in-vehicle temperature and humidity

		sensor (Japan only)
11	-	Ambient air temperature sensor
12	-	Evaporator temperature sensor
13	-	ATC module
14	-	ECM
15	-	ECT sensor
16	-	Instrument cluster
17	-	Blower control module
18	-	BJB (battery junction box)
19	-	CJB
20	-	Blower
21	-	Integrated control Panel

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Control Components - Control Components

Diagnosis and Testing

Principle of Operation

For a detailed description of the climate control system and operation, refer to the relevant Description and Operation section of the workshop manual.
REFER to: Control Components (412-04 Control Components, 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. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Front End Accessory Drive (FEAD) belt • Refrigerant • Heater control flaps • Ducting • Cabin air filter • Coolant level • Compressor • Cooling fan	• Fuses • Electrical harnesses • Harness connectors • Blower motor • Cooling fan • Actuators

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Automatic Temperature Control Module (ATC) (100-00 General Information, Description and Operation).

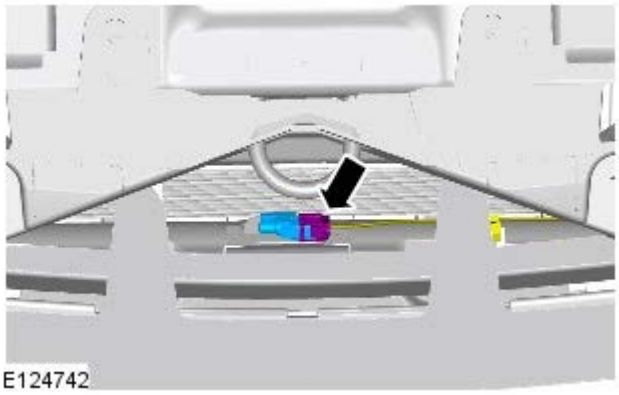
Published: 11-May-2011

Control Components - Ambient Air Temperature Sensor

Removal and Installation

Removal

1. Remove the front spoiler.
   For additional information, refer to: Front Bumper Lower Cover (501-19, Removal and Installation).


E124742

2. Remove the ambient air temperature sensor.
   - Disconnect the electrical connector.
   - Release the clip.

Installation

1. To install, reverse the removal procedure.

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Control Components - Climate Control Assembly

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

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

Make sure that the gear selector lever is in position N before removing any components.

1.





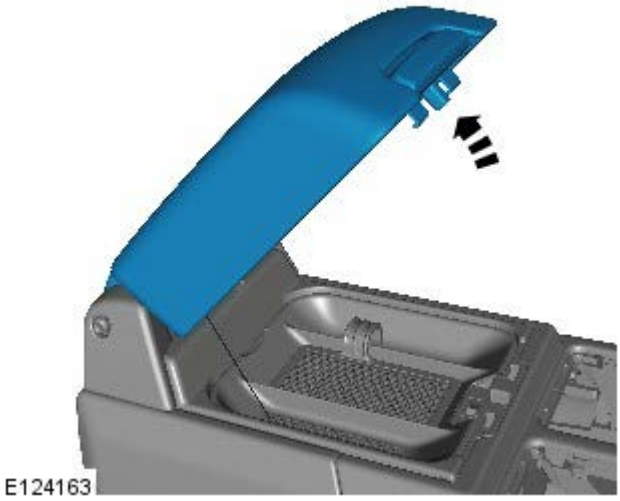
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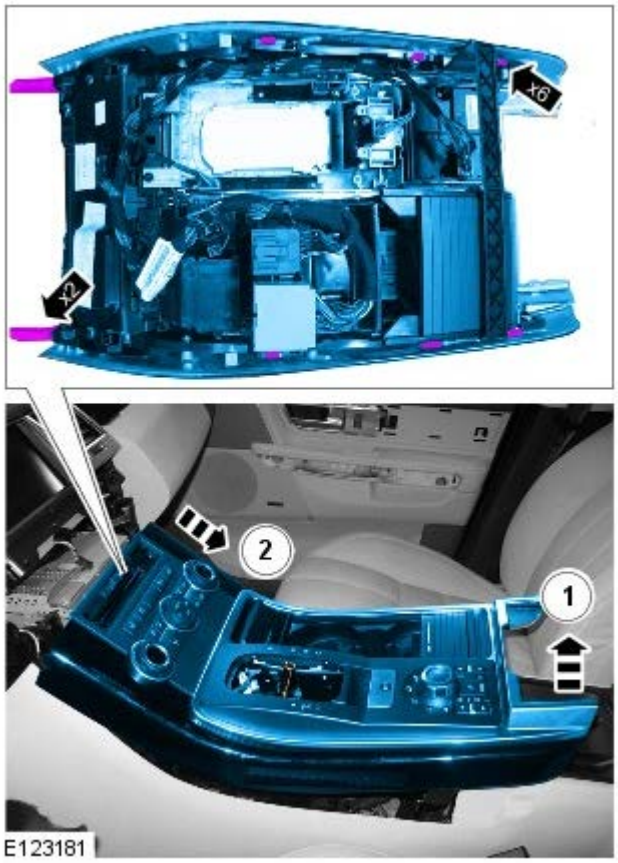
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4.



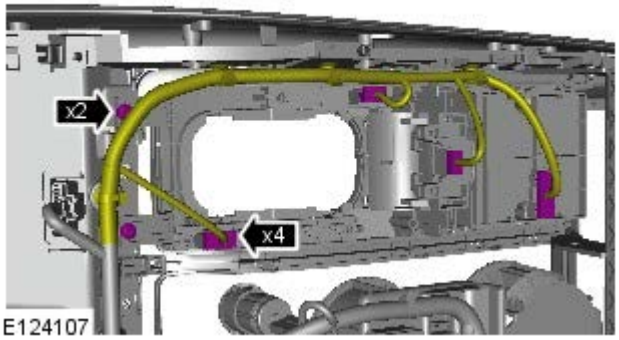
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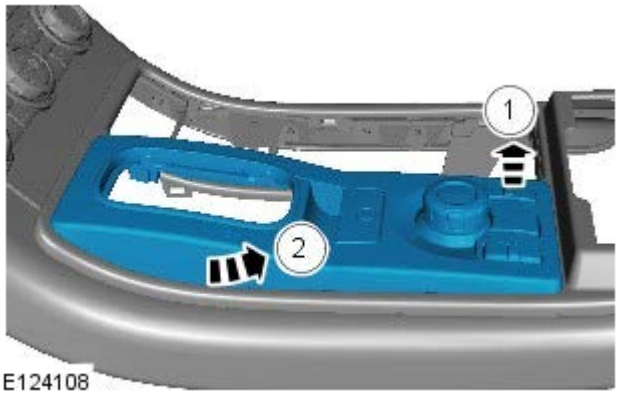
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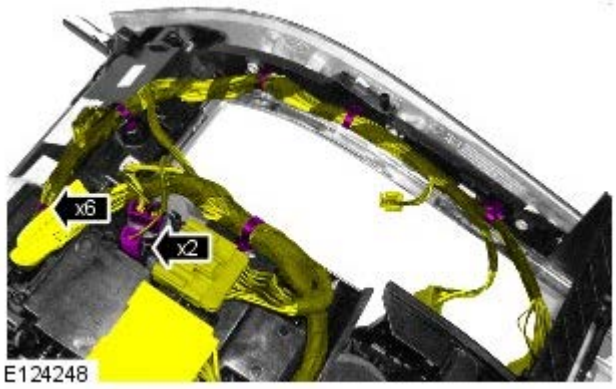
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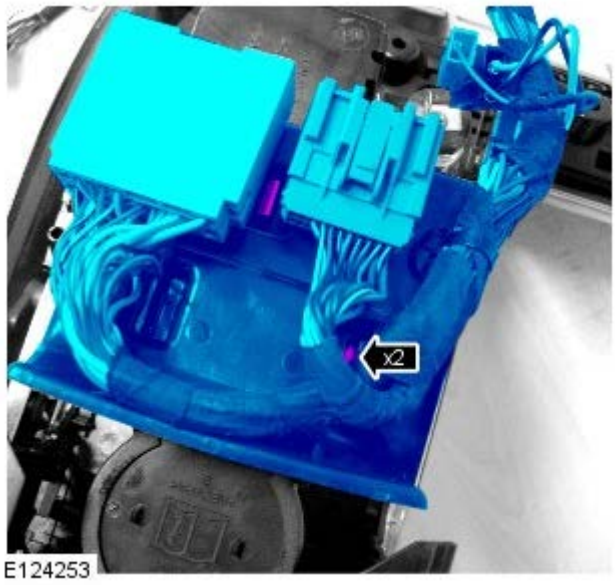
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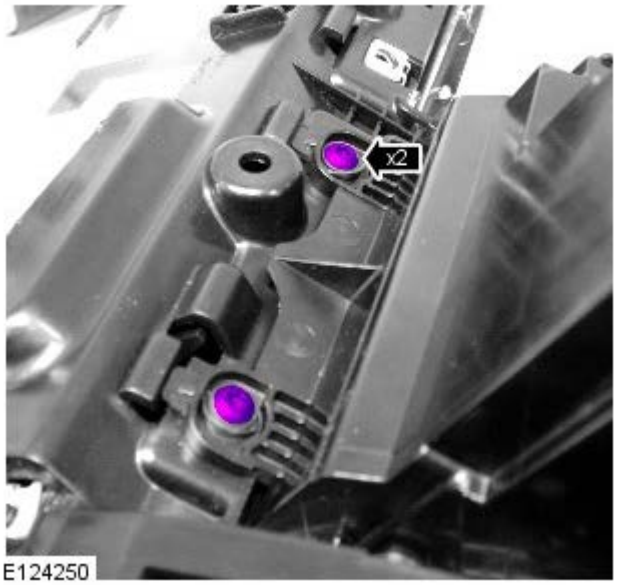
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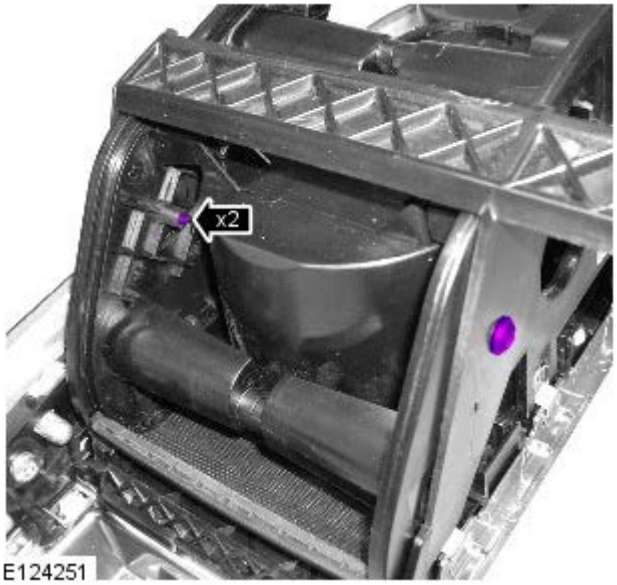


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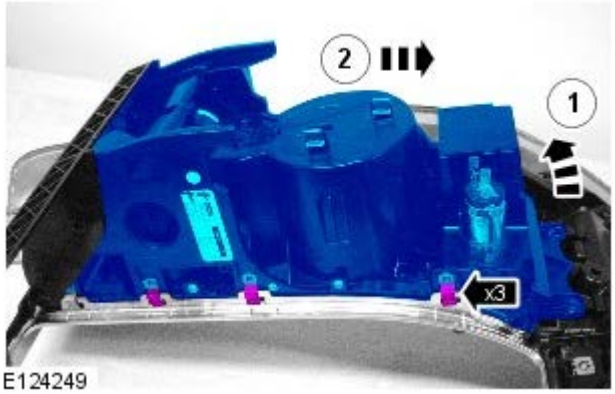
E124250

12.



E124251

13.

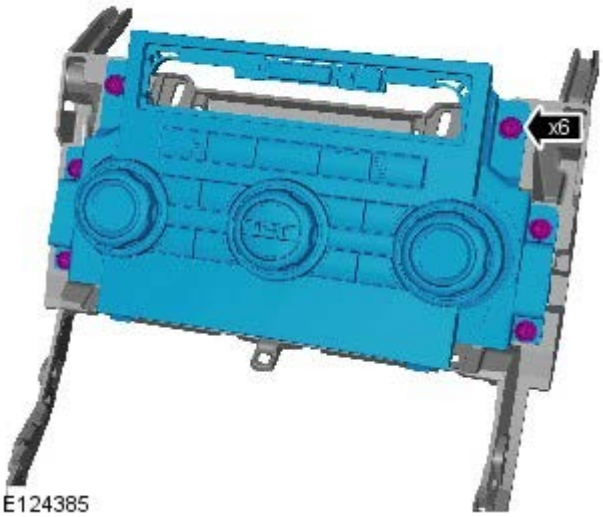


E124249

14.



15.



Installation

1. To install, reverse the removal procedure.

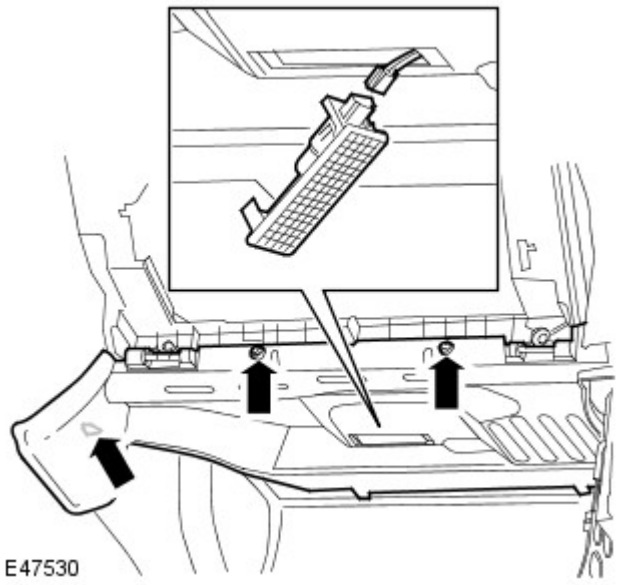
Published: 11-May-2011

Control Components - Defrost Vent/Register Blend Door Actuator LHD AWD

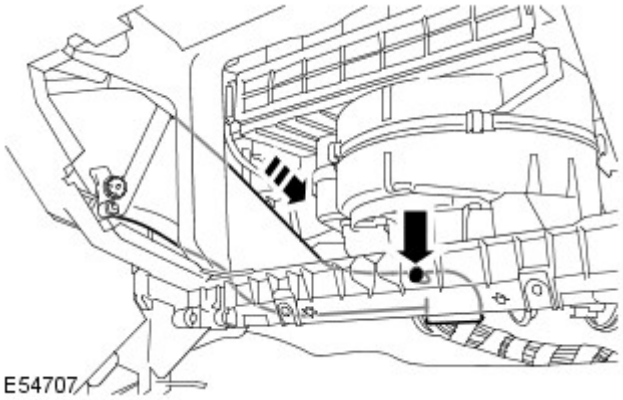
Removal and Installation

Removal

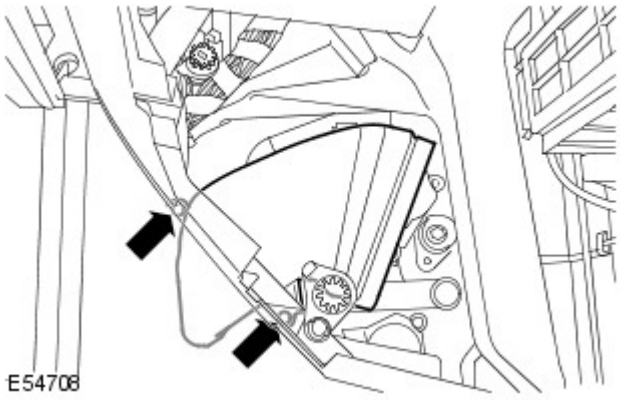
1. Remove the glove compartment.
   For additional information, refer to: Glove Compartment (501-12, Removal and Installation).



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

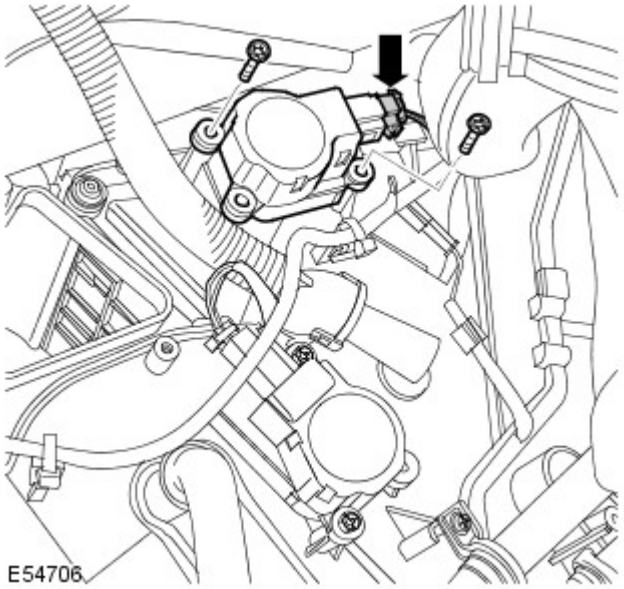


3. Remove the passenger side footwell duct.
   - Remove the clip.



4. Remove the passenger side footwell duct elbow.
   - Remove the 2 Torx screws.

5. Remove the defrost vent/register blend door actuator.
   - Disconnect the electrical connector.
   - Remove the 2 screws.



Installation

1. Install the defrost vent/register blend door actuator.
    - Tighten the screws to 1 Nm.
    - Connect the electrical connector.

2. Install the passenger side footwell duct elbow.
    - Tighten the screws.

3. Install the passenger side footwell duct.
    - Install the clip.

4. Install the passenger side closing trim panel.
    - Install the interior lamp.
    - Connect the electrical connector.
    - Secure the clip.

5. Install the glove compartment.
   For additional information, refer to: Glove Compartment (501-12, Removal and Installation).

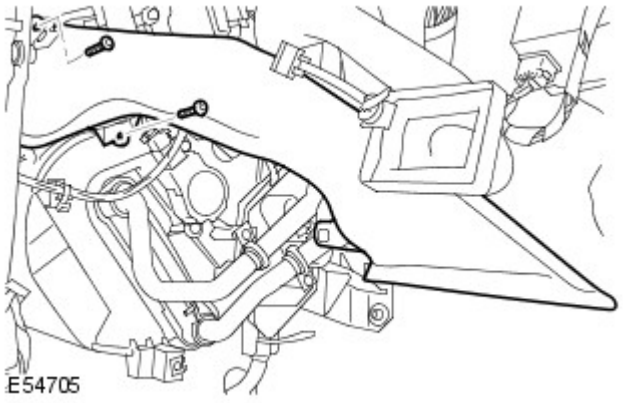
Published: 11-May-2011

Control Components - Defrost Vent / Register Blend Door Actuator RHD AWD

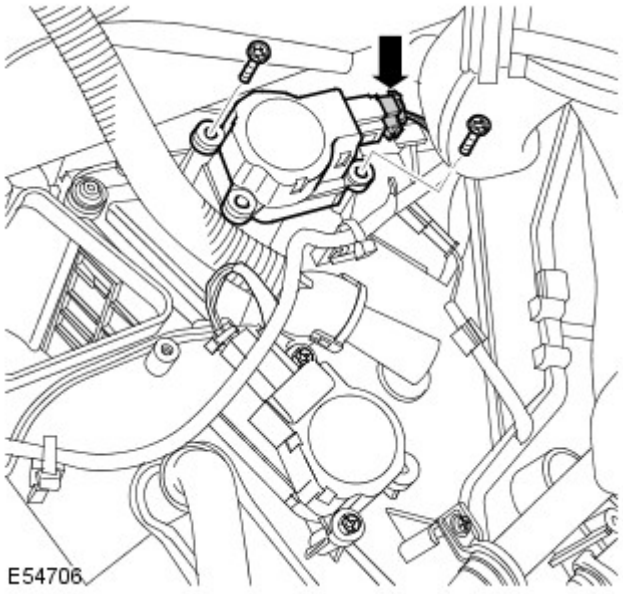
Removal and Installation

Removal

1. Remove the instrument panel driver side reinforcement.
   For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).



2. Remove the driver side footwell duct.
   - Remove the 2 Torx screws.



3. Remove the defrost door actuator.
   - Disconnect the electrical connector.
   - Remove the 2 screws.

Installation

1. Install the defrost door actuator.
   - Tighten the screws.
   - Connect the electrical connector.

2. Install the driver side footwell duct.
   - Tighten the screws.

3. Install the instrument panel driver side reinforcement.
   For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).

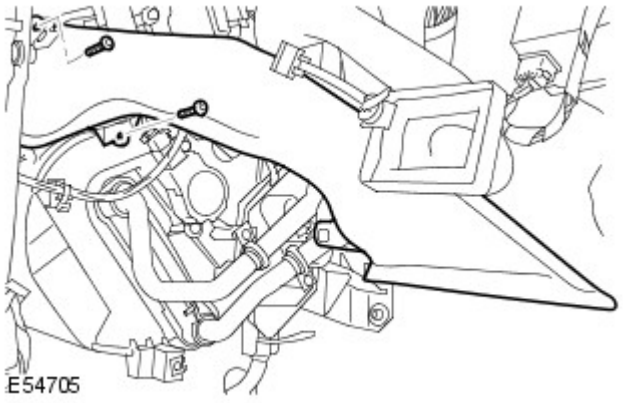
Published: 11-May-2011

Control Components - Driver Side Temperature Blend Door Actuator LHD AWD

Removal and Installation

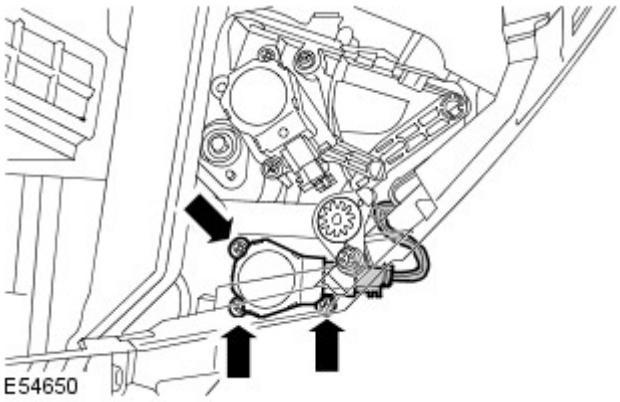
Removal

1. Remove the instrument panel driver side reinforcement.
   For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).



2. NOTE: RHD illustration shown, LHD is similar.

   Remove the driver side footwell duct.
   - Remove the 2 Torx screws.



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

   Remove the temperature blend door actuator.
   - Disconnect the electrical connector.
   - Remove the 3 screws.

Installation

1. Install the temperature blend door actuator.
   - Tighten the screws to 1 Nm.
   - Connect the electrical connector.

2. Install the driver side footwell duct.
   - Tighten the screws.

3. Install the instrument panel driver side reinforcement.
   For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).

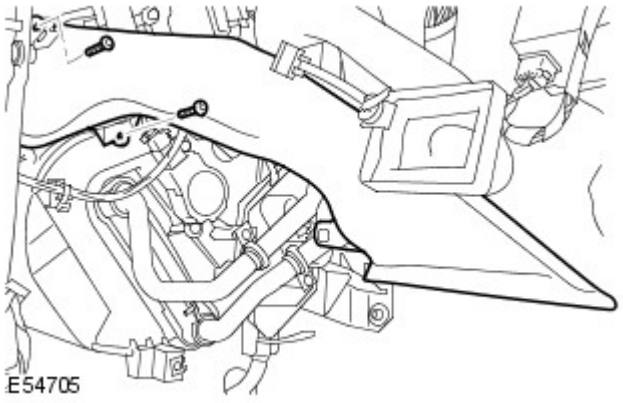
Published: 11-May-2011

Control Components - Driver Side Temperature Blend Door Actuator RHD AWD

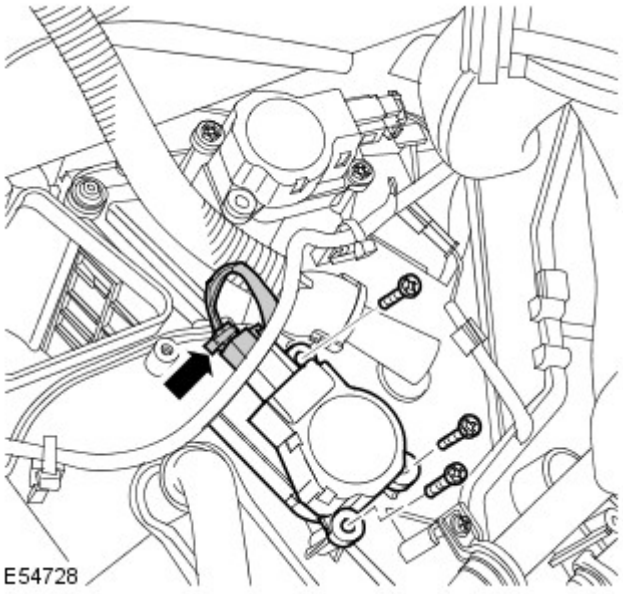
Removal and Installation

Removal

1. Remove the instrument panel driver side reinforcement.
   For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).



2. Remove the driver side footwell duct.
   - Remove the 2 Torx screws.



3. Remove the temperature blend door actuator.
   - Disconnect the electrical connector.
   - Remove the 2 screws.

Installation

1. Install the temperature blend door actuator.
   - Tighten the screws.
   - Connect the electrical connector.

2. Install the driver side footwell duct.
   - Tighten the screws.

3. Install the instrument panel driver side reinforcement.
   For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).

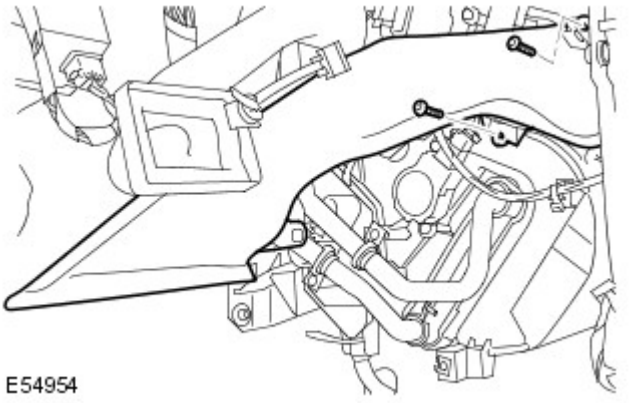
Published: 11-May-2011

Control Components - Instrument Panel Blend Door Actuator LHD AWD

Removal and Installation

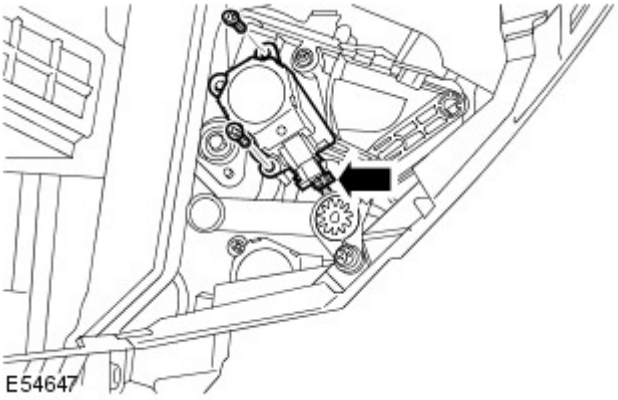
Removal

1. Remove the instrument panel driver side reinforcement.
   For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).



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

   Remove the driver side footwell duct.
   - Remove the 2 Torx screws.



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

   Remove the instrument panel blend door actuator.
   - Disconnect the electrical connector.
   - Remove the 2 screws.

Installation

1. Install the instrument panel blend door actuator.
   - Tighten the screws to 1 Nm.
   - Connect the electrical connector.

2. Install the driver side footwell duct.
   - Tighten the screws.

3. Install the instrument panel driver side reinforcement.
   For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).

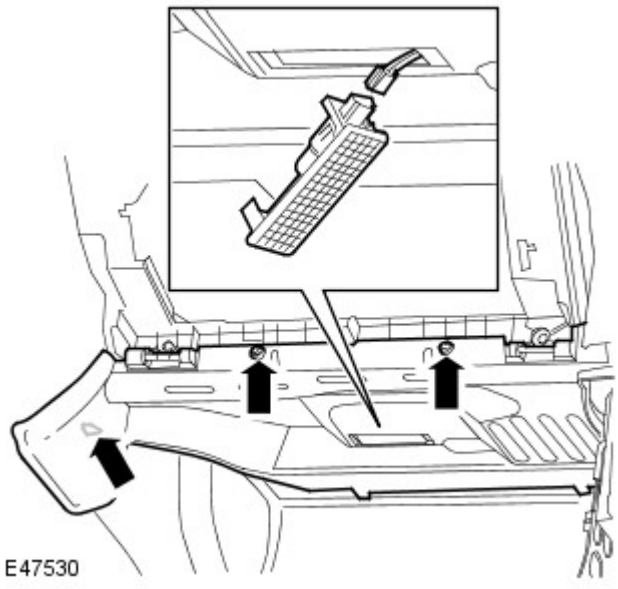
Published: 11-May-2011

Control Components - Instrument Panel Blend Door Actuator RHD AWD

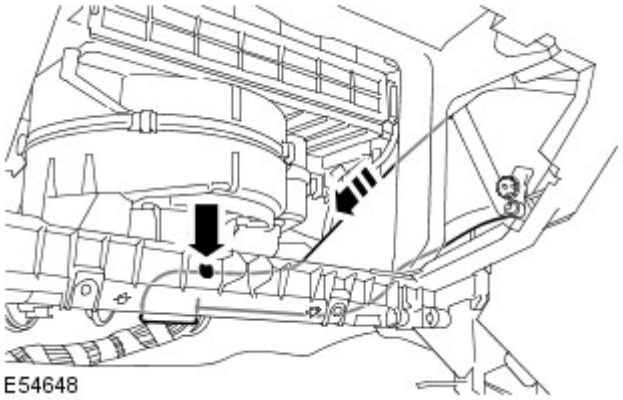
Removal and Installation

Removal

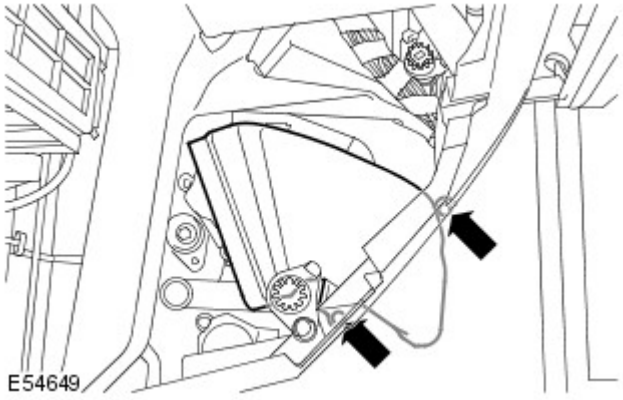
1. Remove the glove compartment.
   For additional information, refer to: Glove Compartment (501-12, Removal and Installation).



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

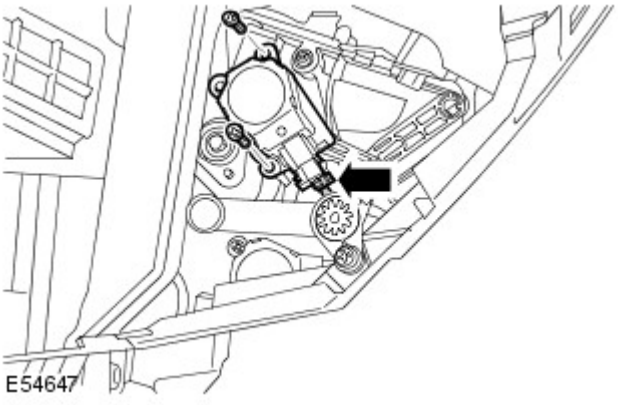


3. Remove the passenger side footwell duct.
   - Remove the clip.



4. Remove the passenger side footwell duct elbow.
   - Remove the 2 Torx screws.

5. Remove the instrument panel blend door actuator.
   - Disconnect the electrical connector.
   - Remove the 2 screws.



Installation

1. Install the instrument panel blend door actuator.
    - Tighten the screws.
    - Connect the electrical connector.

2. Install the passenger side footwell duct elbow.
    - Tighten the screws.

3. Install the passenger side footwell duct.
    - Install the clip.

4. Install the passenger side closing trim panel.
    - Install the interior lamp.
    - Connect the electrical connector.
    - Secure the clip.

5. Install the glove compartment.
   For additional information, refer to: Glove Compartment (501-12, Removal and Installation).

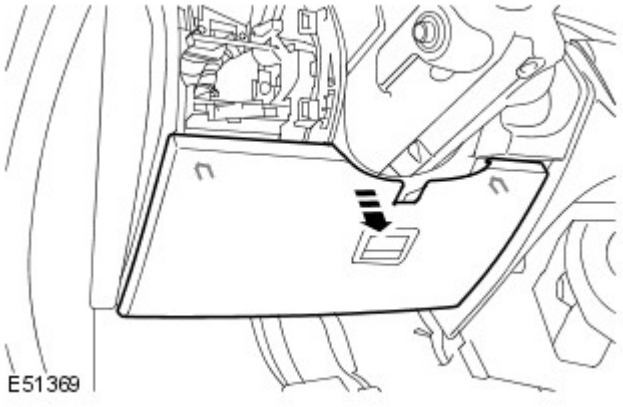
Published: 11-May-2011

Control Components - In-Vehicle Temperature Sensor

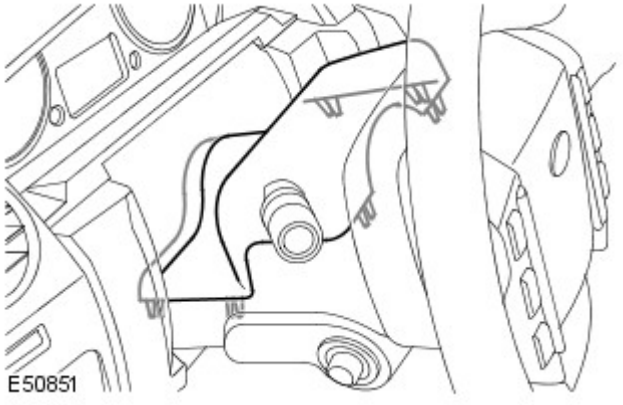
Removal and Installation

Removal

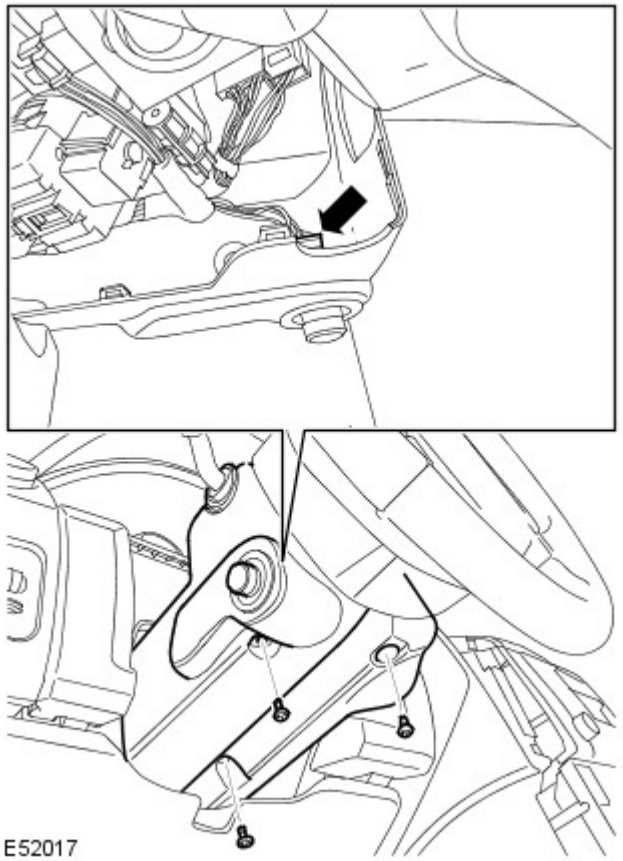
1. Fully extend the steering column for access.



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



3. Remove the steering column upper shroud.
   - Release the 6 clips.

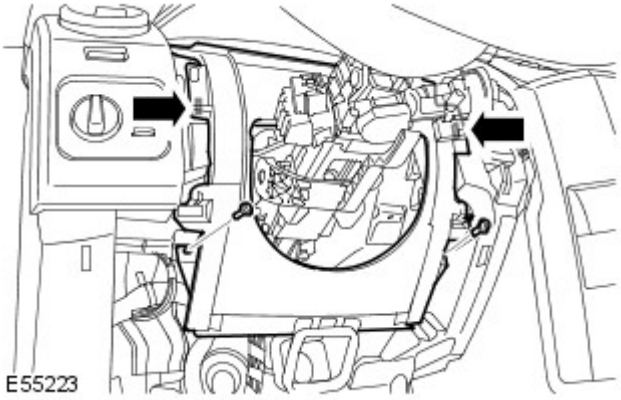


4. Remove the steering column lower shroud.
   - Remove the 3 Torx screws.
   - Disconnect the electrical connector.

5. Remove the instrument panel centre finisher.



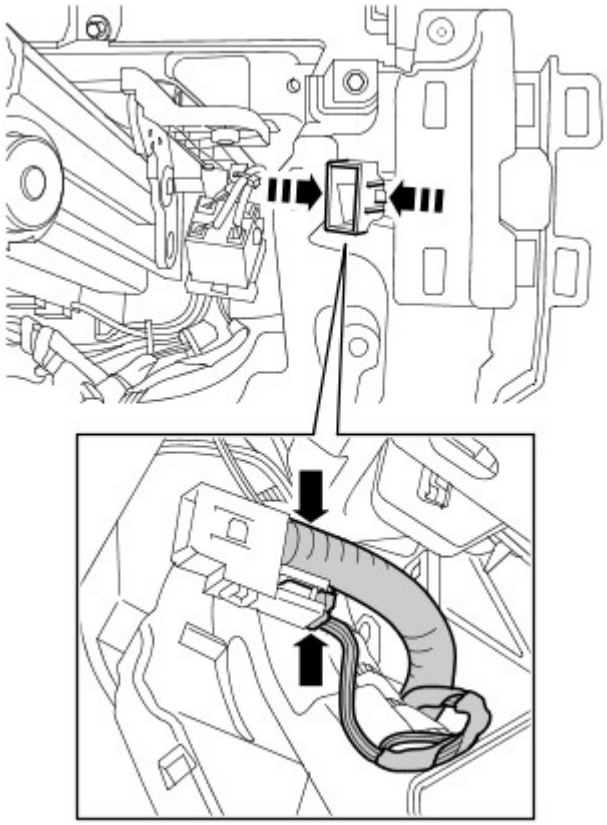
E122692



E55223

6. Release the steering column gaiter panel.
    - Remove the 2 Torx screws.
    - Release the 2 clips.

7. Remove the in-vehicle temperature sensor.
    - Release the 2 clips.
    - Disconnect the electrical connector.
    - Disconnect the hose.



E55224

Installation

1. Install the in-vehicle temperature sensor.
    - Connect the hose.
    - Connect the electrical connector.
    - Secure with the clips.

2. Install the steering column gaiter panel.
    - Secure with the clips.
    - Tighten the Torx screws.

3. Install the instrument panel centre finisher.

4. Install the steering column shrouds.
    - Tighten the screws.
    - Secure with the clips.

5. Install the instrument panel access panel.
    - Secure with the clips.

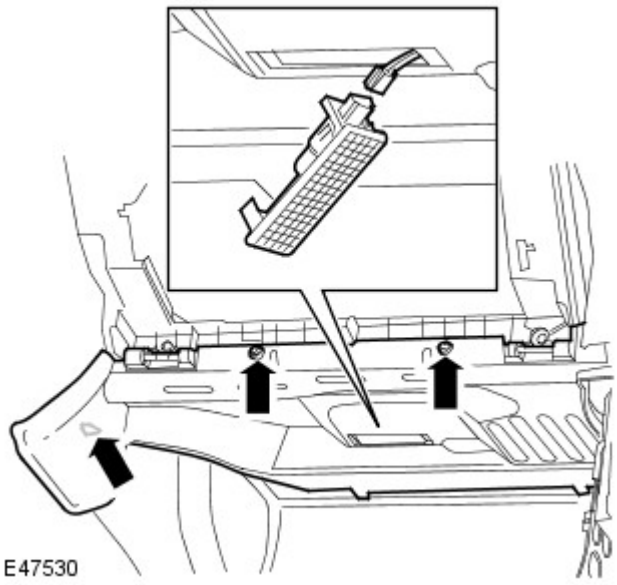
Published: 11-May-2011

Control Components - Passenger Side Temperature Blend Door Actuator LHD AWD

Removal and Installation

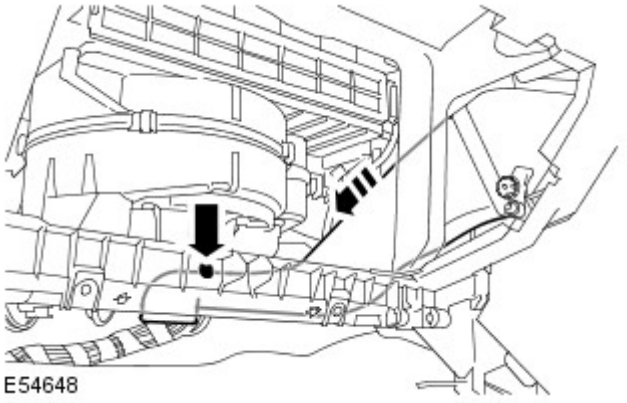
Removal

1. Remove the glove compartment.
   For additional information, refer to: Glove Compartment (501-12, Removal and Installation).



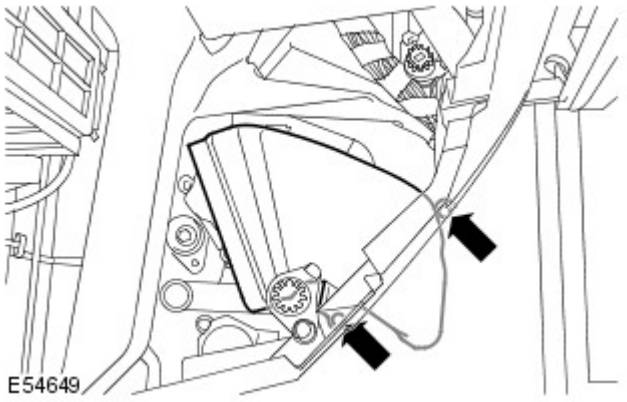
2. NOTE: RHD illustration shown, LHD is similar.

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



3. NOTE: RHD illustration shown, LHD is similar.

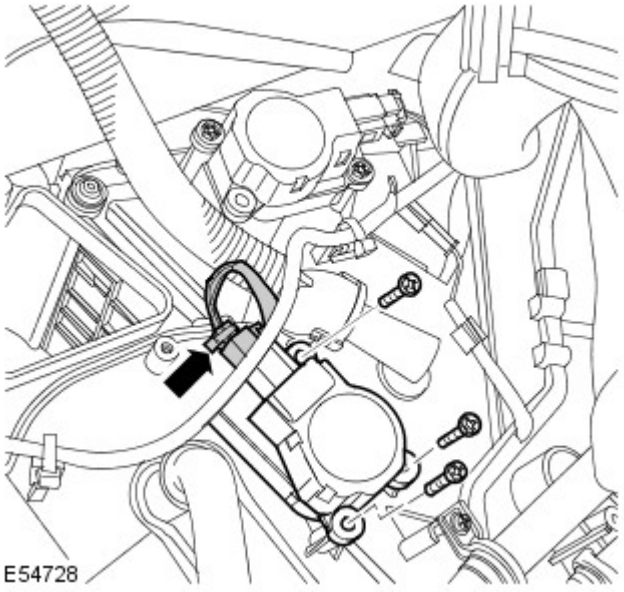
   Remove the passenger side footwell duct.
   - Remove the clip.



4. NOTE: RHD illustration shown, LHD is similar.

   Remove the passenger side footwell duct elbow.
   - Remove the 2 Torx screws.

5. Remove the temperature blend door actuator.
   - Disconnect the electrical connector.
   - Remove the 3 screws.



Installation

1. Install the temperature blend door actuator.
    - Tighten the screws to 1 Nm.
    - Connect the electrical connector.
2. Install the passenger side footwell duct elbow.
    - Tighten the screws.
3. Install the passenger side footwell duct.
    - Install the clip.
4. Install the passenger side closing trim panel.
    - Connect the electrical connector.
    - Tighten the screws.
    - Secure the clip.
5. Install the glove compartment.
   For additional information, refer to: Glove Compartment (501-12, Removal and Installation).

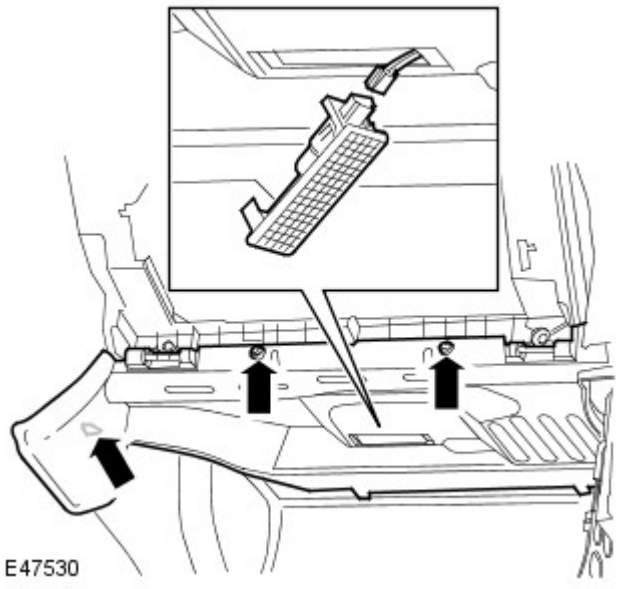
Published: 11-May-2011

Control Components - Passenger Side Temperature Blend Door Actuator RHD AWD

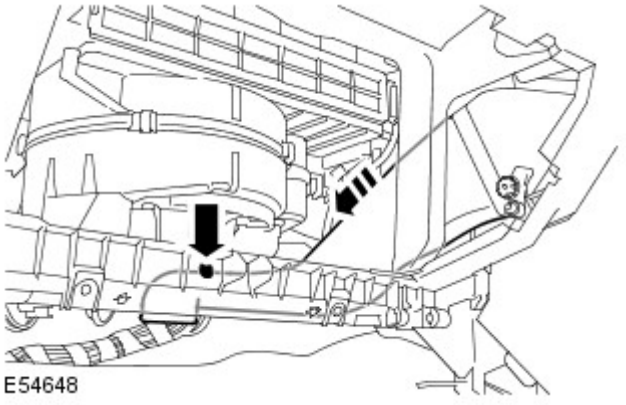
Removal and Installation

Removal

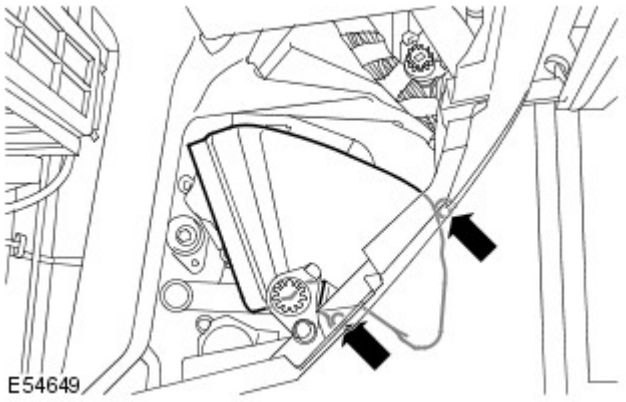
1. Remove the glove compartment.
   For additional information, refer to: Glove Compartment (501-12, Removal and Installation).



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

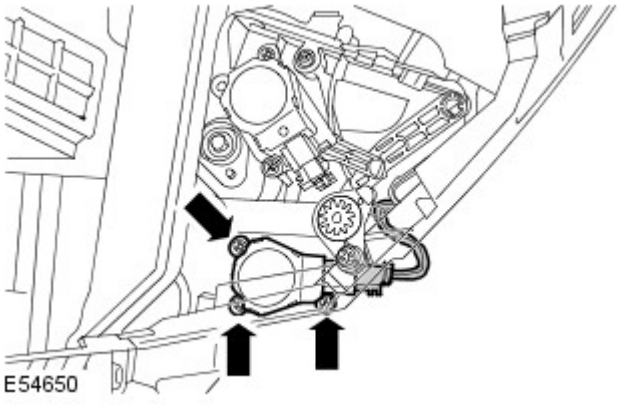


3. Remove the passenger side footwell duct.
   - Remove the clip.



4. Remove the passenger side footwell duct elbow.
   - Remove the 2 Torx screws.

5. Remove the temperature blend door actuator.
   - Disconnect the electrical connector.
   - Remove the 2 screws.



Installation

1. Install the temperature blend door actuator.
    - Tighten the screws.
    - Connect the electrical connector.
2. Install the passenger side footwell duct elbow.
    - Tighten the screws.
3. Install the passenger side footwell duct.
    - Install the clip.
4. Install the passenger side closing trim panel.
    - Connect the electrical connector.
    - Tighten the screws.
    - Secure the clip.
5. Install the glove compartment.
   For additional information, refer to: Glove Compartment (501-12, Removal and Installation).

Published: 11-May-2011

Control Components - Recirculation Blend Door Actuator LHD AWD

Removal and Installation

Removal

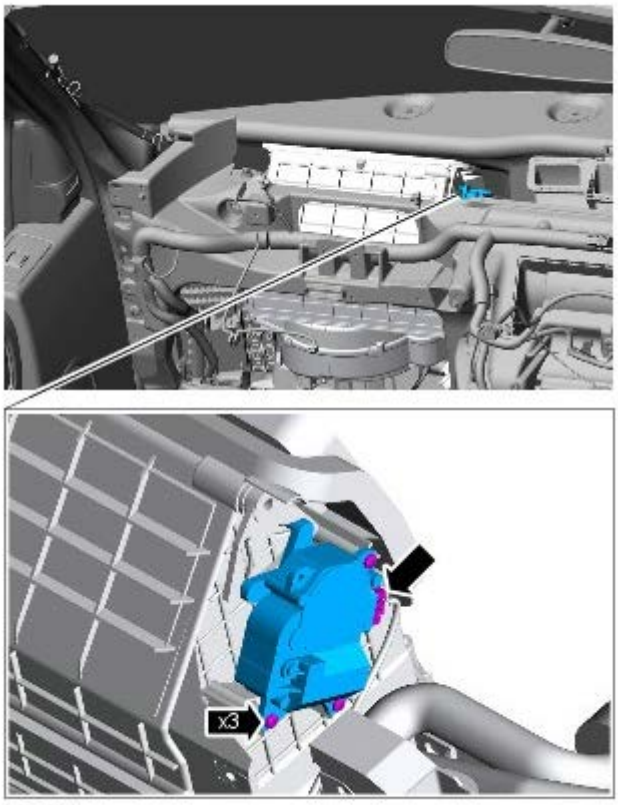
1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

2. Make the SRS system safe.
   For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).

3. Remove the instrument panel upper section.
   For additional information, refer to: Instrument Panel Upper Section (501-12, Removal and Installation).

4. NOTE: RHD illustration shown, LHD is similar.

   Remove the recirculation blend door actuator.
   - Disconnect the electrical connector.
   - Remove the 3 screws.



E91604

Installation

1. Install the recirculation blend door actuator.
   - Align the control arm to the recirculation blend door.
   - Install the 3 screws.
   - Connect the electrical connector.

2. Install the instrument panel upper section.
   For additional information, refer to: Instrument Panel Upper Section (501-12, Removal and Installation).

3. Connect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

Published: 11-May-2011

Control Components - Recirculation Blend Door Actuator RHD AWD

Removal and Installation

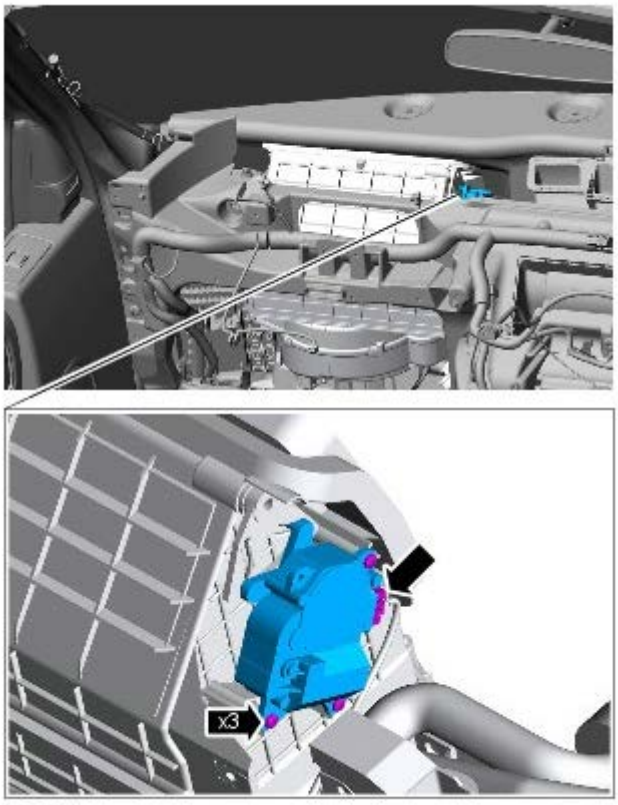
Removal

1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

2. Make the SRS system safe.
   For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).

3. Remove the instrument panel upper section.
   For additional information, refer to: Instrument Panel Upper Section (501-12, Removal and Installation).

4. Remove the recirculation blend door actuator.
   - Disconnect the electrical connector.
   - Remove the 3 screws.



E91604

Installation

1. Install the recirculation blend door actuator.
   - Align the control arm to the recirculation blend door.
   - Install the 3 screws.
   - Connect the electrical connector.

2. Install the instrument panel upper section.
   For additional information, refer to: Instrument Panel Upper Section (501-12, Removal and Installation).

3. Connect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

Published: 11-May-2011

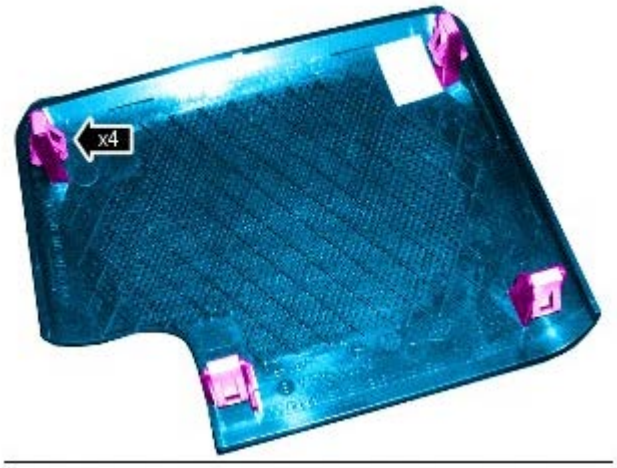
Control Components - Sunload Sensor

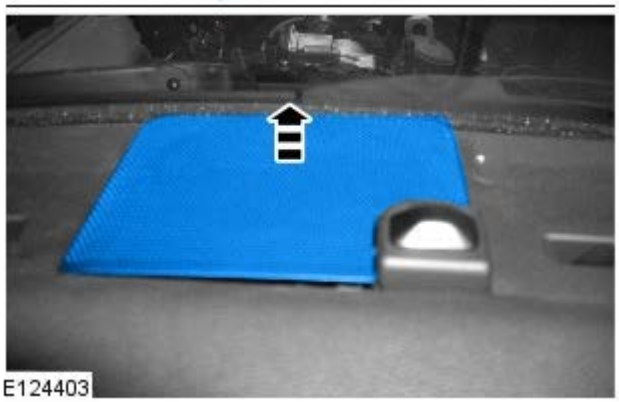
Removal and Installation

Removal

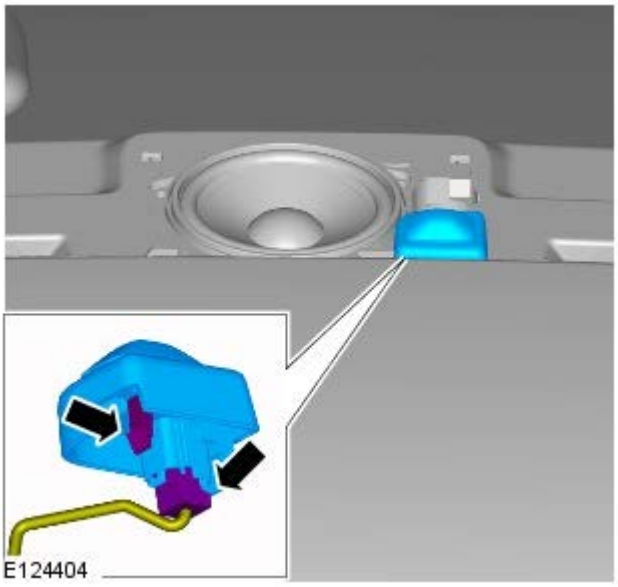
NOTE: Removal steps in this procedure may contain installation details.

1.

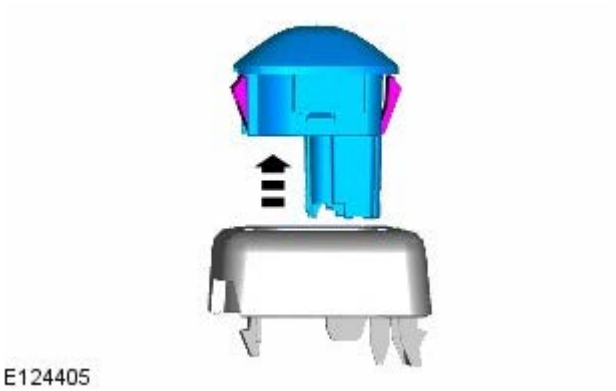




2.



3.



E124405

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Instrument Cluster -

Description	Nm	lb-ft
Steering column switch assembly	3	2

Published: 01-Nov-2011

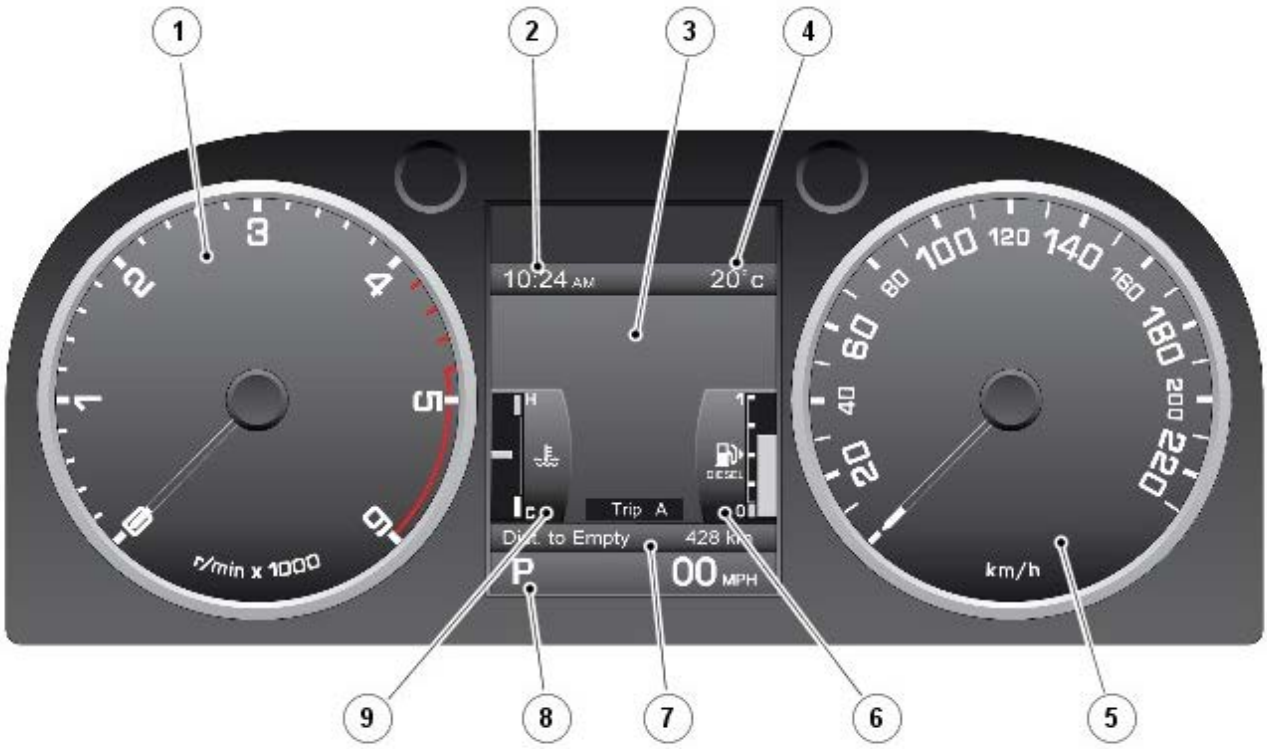
Instrument Cluster - Instrument Cluster

Description and Operation

OVERVIEW

A new instrument cluster is introduced where in addition to the larger speedometer and tachometer gauges the cluster also incorporates a Thin Film Transistor (TFT) 5” high-definition display unit.

Instrument cluster overview



E123742

Item	Part Number	Description
1	-	Tachometer
2	-	Clock
3	-	Message center
4	-	External temperature
5	-	Speedometer
6	-	Fuel gauge
7	-	Total distance odometer and trip recorder
8	-	Gear selector position display
9	-	Temperature gauge

The TFT display incorporates a ‘Message Center’ that communicates vehicle information and status data to the driver. Menus displayed in the message center allow access to a number of vehicle functions through the guidance of the message center menus. The driver operates the message center using the ‘menu control’ located on the right-hand-side of the steering wheel. Refer to the ‘Information and Message Center’ section for further information.

The instrument cluster features a number of warning indicators, where in addition to those located within the speedometer and tachometer gauges, another six indicators are positioned within the TFT unit above the message center.

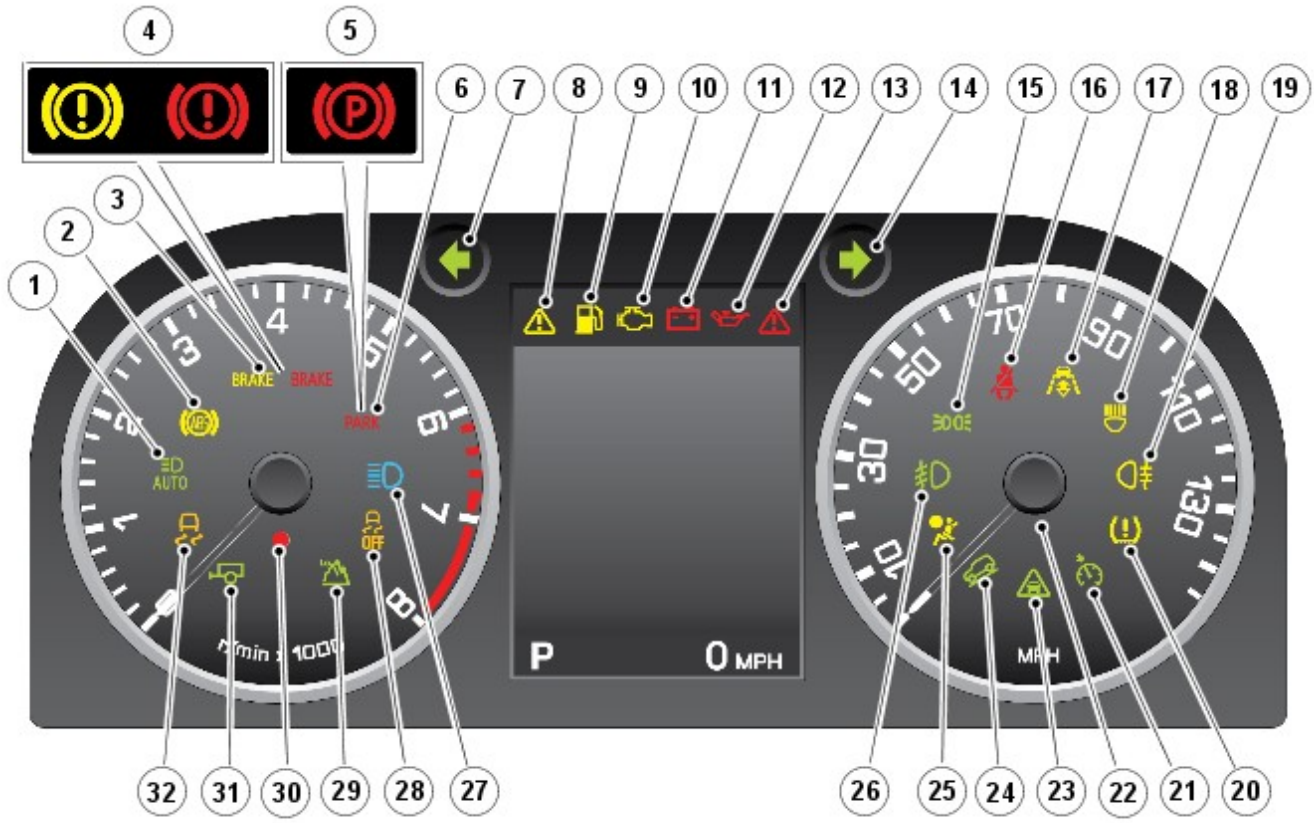
DESCRIPTION

Warning Indicators – ROW Diesel Shown



Item	Part Number	Description
1	-	Automatic high beam active warning - green
2	-	Anti-lock Brake System (ABS) warning - amber
3	-	Brake system warning – amber
4	-	Brake system warning - red
5	-	Park brake system warning - red
6	-	Left-hand turn signal indicator - green
7	-	Warning/information - amber
8	-	Glow plug warning / Low fuel warning (dual function indicator) – amber
9	-	Check engine MIL warning - amber
10	-	Charge indicator - red
11	-	Oil pressure warning - red
12	-	Critical warning - red
13	-	Right-hand turn signal indicator - green
14	-	Side lamps - green
15	-	Seat belt warning - red
16	-	Adaptive Speed Control active - amber
17	-	Adaptive Front lighting System (AFS) warning - amber
18	-	Rear fog lamps active - amber
19	-	Tire pressure monitoring warning - amber
20	-	Speed control active - green
21	-	Ambient light sensor (reference only)
22	-	Forward alert active - green
23	-	Hill Descent Control (HDC) active - green
24	-	Airbag warning secondary - amber
25	-	Front fog lamps active - green
26	-	High beam warning - blue
27	-	Dynamic Stability Control (DSC) off warning - amber
28	-	Low range selected - green
29	-	Security Light Emitting Diode (LED) - red
30	-	Trailer warning - green
31	-	Dynamic Stability Control (DSC) active warning - amber

Warning Indicators – NAS Gasoline Shown



E123745

Item	Part Number	Description
1	-	Automatic high beam active warning - green
2	-	Anti-lock Brake System (ABS) warning - amber
3	-	Brake system warning USA only – amber/red
4	-	Brake system warning Canada only - amber/red
5	-	Park brake system warning Canada only - red
6	-	Park brake system warning USA only – red
7	-	Left-hand turn signal indicator - green
8	-	Warning/information - amber
9	-	Glow plug warning / Low fuel warning (dual function indicator) – amber
10	-	Check engine MIL warning - amber
11	-	Charge indicator - red
12	-	Oil pressure warning - red
13	-	Critical warning - red
14	-	Right-hand turn signal indicator - green
15	-	Side lamps - green
16	-	Seat belt warning - red
17	-	Adaptive Speed Control active - amber
18	-	Adaptive Front lighting System (AFS) warning - amber
19	-	Rear fog lamps active - amber
20	-	Tire pressure monitoring warning - amber
21	-	Speed control active - green
22	-	Ambient light sensor (reference only)
23	-	Forward alert active - green
24	-	Hill Descent Control (HDC) active - green
25	-	Airbag warning secondary - amber
26	-	Front fog lamps active - green
27	-	High beam warning - blue
28	-	Dynamic Stability Control (DSC) off warning - amber
29	-	Low range selected - green
30	-	Security Light Emitting Diode (LED) - red
31	-	Trailer warning - green
32	-	Dynamic Stability Control (DSC) active warning - amber

Stepper motors are used to actuate the mechanical speedometer and tachometer gauges to provide a smooth and progressive response.

The warning indicators above the message center are functioned using Thin Film Transistor (TFT) technology. LEDs are used to illuminate the warning indicators in the speedometer and tachometer gauges and provide backlight illumination of the instrument cluster.

A single ambient light sensor is used to measure cabin lighting and adjust the backlight brightness of the instrument cluster accordingly. The instrument cluster also incorporates an anti-glare coating.

When the vehicle is locked the TFT unit goes off. When the vehicle is unlocked, a welcome screen is displayed featuring a Land Rover logo and an image of the vehicle, together with the current date and odometer information.

The coolant temperature and fuel quantity gauges are the default display when the stop/start button is pressed. These can be overwritten by different permutations of screens which are available to cover numerous vehicle functions through a menu selection. Refer to the 'Information and Message Center' section for further information.

Thin Film Transistor Display Unit



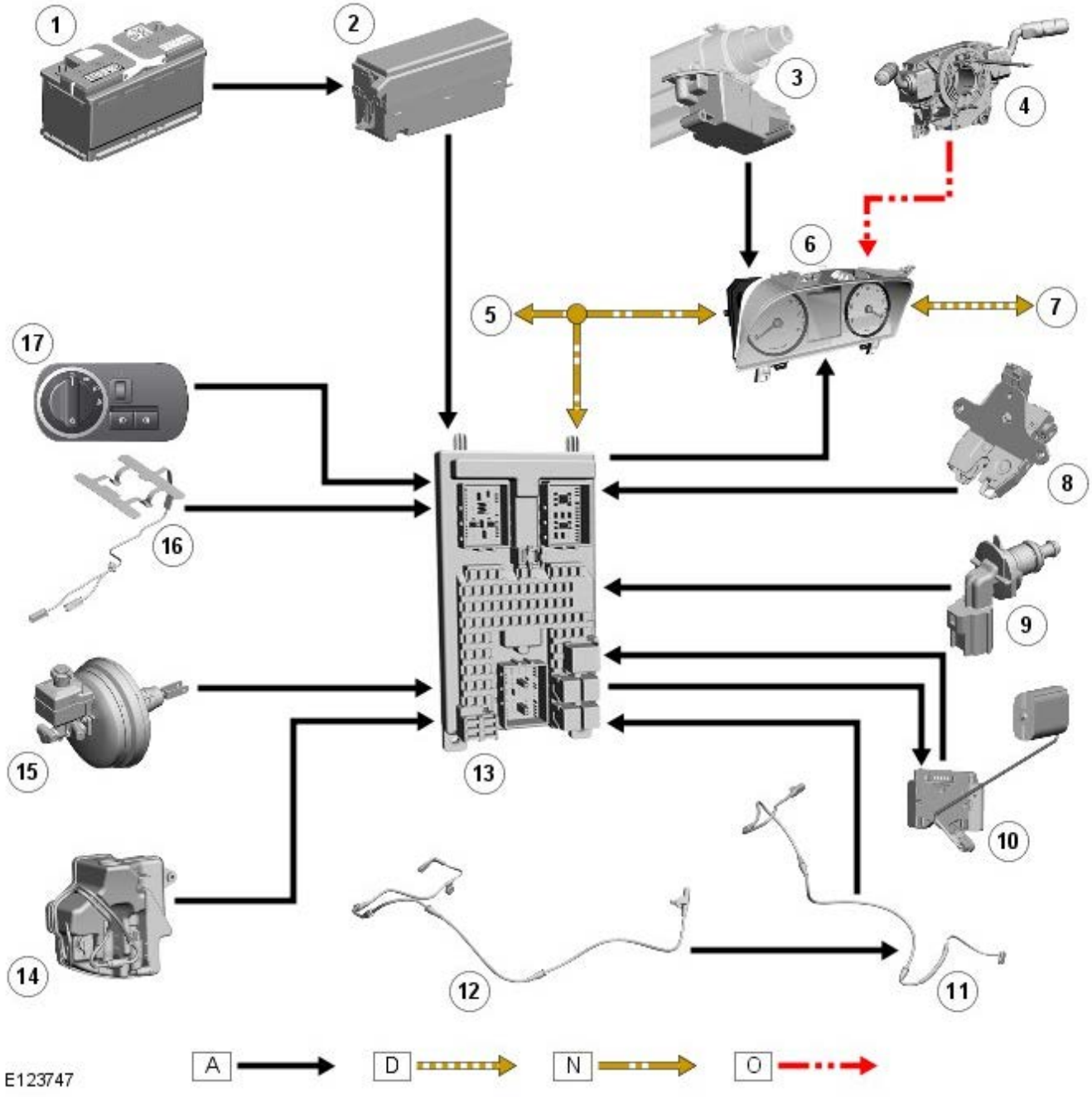
E123746

Item	Part Number	Description
1	-	Warning Indicators – this area cannot be overwritten by other information
2	-	Message Center – this area can be overwritten by other information
3	-	Gear Selection and Digital Speedometer Display - this area cannot be overwritten by other information

OPERATION

Control Diagram

NOTE: **A** = Hardwired; **D** = High Speed CAN; **N** = Medium Speed CAN; **O** = LIN Bus;



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box (BJB)
3	-	Steering-column-lock module
4	-	Clockspring
5	-	Medium-speed CAN bus connection to other vehicle systems
6	-	Instrument cluster
7	-	High-speed CAN bus connection to other vehicle systems
8	-	Tailgate ajar switch
9	-	Engine coolant level sensor
10	-	Fuel level sensor
11	-	Front brake-pad wear sensor
12	-	Rear brake-pad wear sensor
13	-	Central Junction Box (CJB)
14	-	Washer fluid level sensor
15	-	Brake fluid level sensor
16	-	Safety belt – occupant detection pressure sensor
17	-	Exterior light control switch

The instrument cluster receives a permanent fused supply from the Battery Junction Box (BJB).

The cluster is connected to other vehicle systems and control modules via the:

- medium speed CAN bus,

- high speed CAN bus and
- LIN bus connections

However, some vehicle sensors are hardwired directly to the instrument cluster.

The steering lock control module is connected to a hardwired connection to the instrument cluster. Security information from other control modules is passed via the network buses and when the conditions are correct the instrument cluster instructs the steering lock control module to unlock the steering column.

The clockspring is connected to the instrument cluster on a LIN bus connection. The LIN bus passes driver selections made on the steering wheel mounted switches to the instrument cluster for processing and transmission to other control modules.

Published: 20-Aug-2012

Instrument Cluster - Instrument Cluster

Diagnosis and Testing

Principles of Operation

For a detailed description of the instrument cluster system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Instrument Cluster (413-01 Instrument Cluster, 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. Verify the customer concern.
2. Visually inspect for obvious signs of damage.

Visual Inspection

Electrical
• Battery • Fuses • Wiring harness • Damaged, loose or corroded connectors • Controller Area Network (CAN) circuits • Instrument Cluster (IC) • Central Junction Box (CJB) • Engine Control Module (ECM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Instrument Cluster (IC) (100-00 General Information, Description and Operation).

Published: 11-May-2011

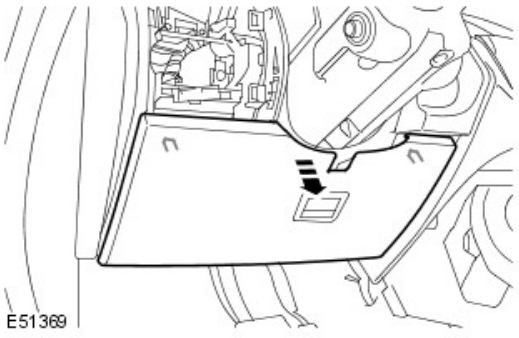
Instrument Cluster - Instrument Cluster

Removal and Installation

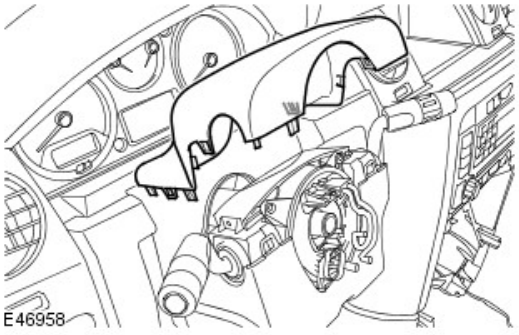
Removal

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

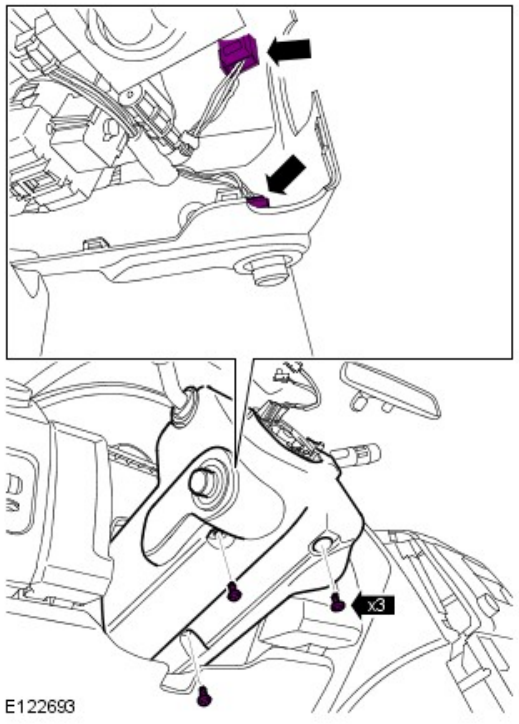
1. Fully extend the steering column for access.
2. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-01, Specifications).
3. Remove the steering wheel.
   For additional information, refer to: Steering Wheel (211-04, Removal and Installation).
4. Remove the driver side register trim panel.
   For additional information, refer to: Driver Side Register Trim Panel (412-01, Removal and Installation).



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



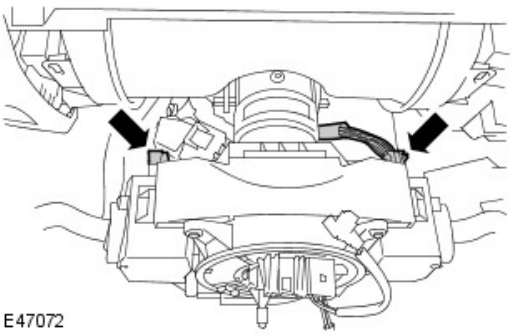
6. Remove the steering column upper shroud.
   - Release the 4 clips.



7. Remove the steering column lower shroud.
   - Remove the 3 Torx screws.
   - Disconnect the electrical connectors.
8. Remove the steering column side trim panel.
   - Release the clips.
   - Disconnect the electrical connectors.

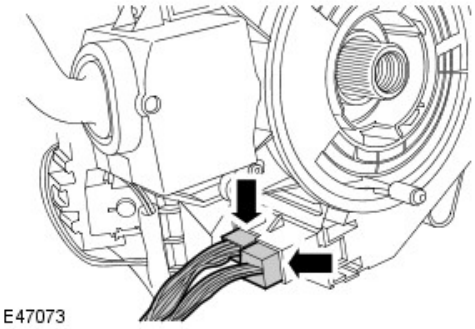


E122692



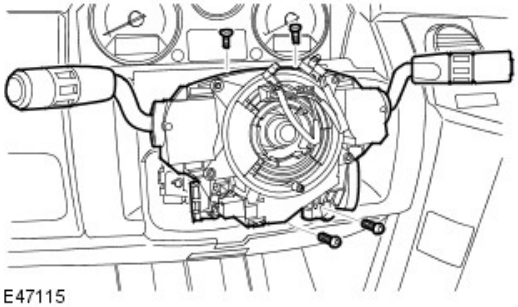
E47072

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



E47073

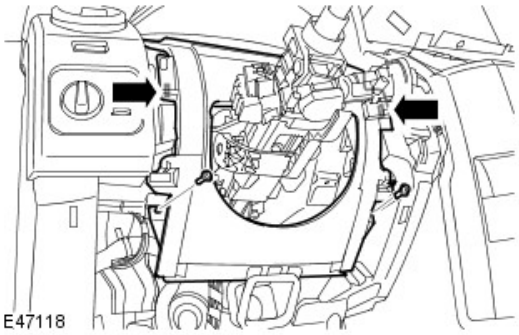
10. Disconnect the 2 electrical connectors from the clockspring.



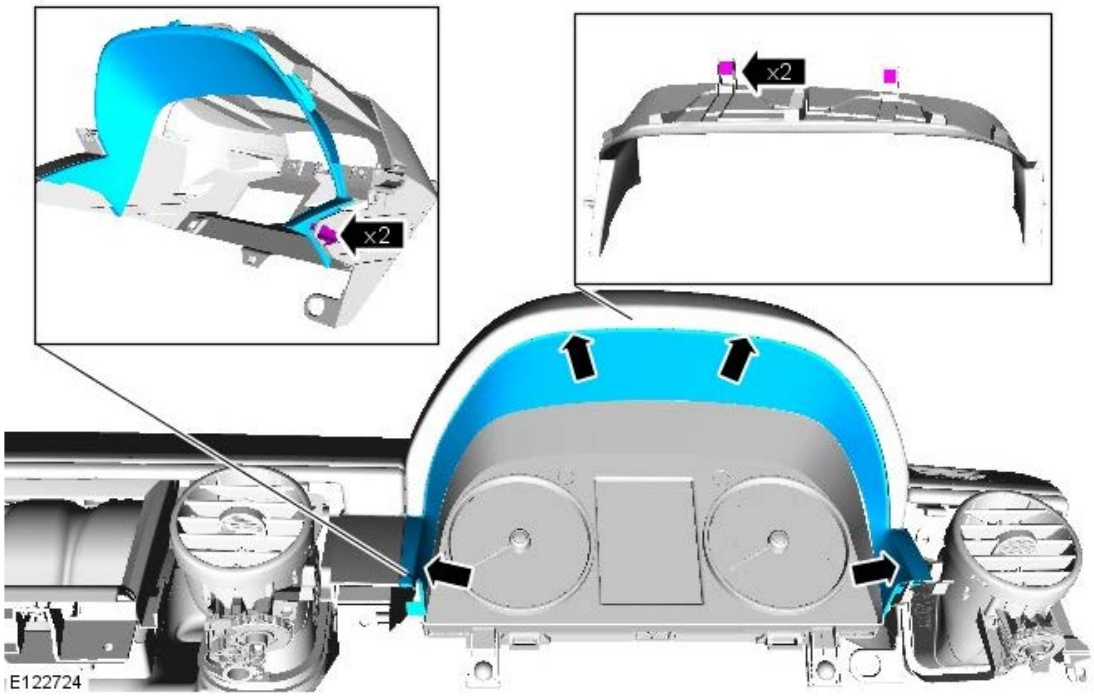
E47115

11. Remove the steering column switch assembly.
    - Remove the 4 Torx bolts.

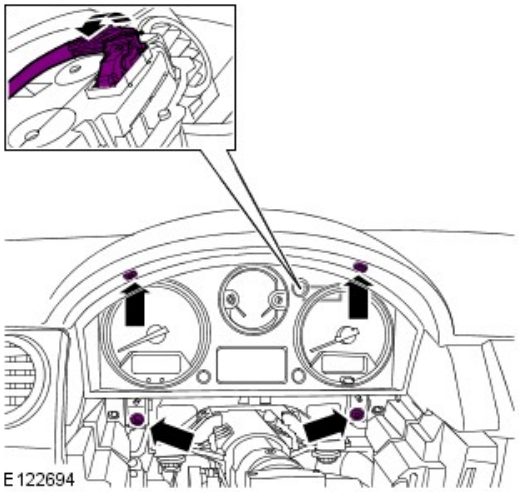
12. Remove the steering column gaiter panel.
    - Remove the 2 Torx screws.
    - Release the 2 clips.



13. Remove the instrument cluster trim panel.
    - Release the 2 clips.



14. Remove the instrument cluster.
    - Remove the 2 Torx screws.
    - Remove the 2 retaining screws.
    - Disconnect the electrical connector.



Installation

1. Install the instrument cluster.
    - Connect the electrical connector.
    - Tighten the screws.
2. Install the instrument cluster trim panel.
    - Secure the 2 clips.
3. Install the steering column gaiter panel.
    - Secure with the clips.
    - Tighten the Torx screws.
4. Install the steering column switch assembly.
    - Tighten the Torx bolts to 3 Nm (2 lb.ft).
5. Connect the clockspring and multifunction switch electrical connectors.

6. CAUTION: When installing the trim panel, protect the surrounding areas using masking tape.

   NOTE: Make sure that all the clips are correctly installed.

   Install the steering column side trim panel.
   - Connect the electrical connectors.
   - Secure with the clip.

7. Install the steering column shrouds.
   - Tighten the Torx screws.

8. Install the instrument panel access panel.
   - Secure with the clips.

9. Install the driver side register trim panel.
   For additional information, refer to: Driver Side Register Trim Panel (412-01, Removal and Installation).

10. Install the steering wheel.
    For additional information, refer to: Steering Wheel (211-04, Removal and Installation).

11. Connect the battery ground cable.
    For additional information, refer to: Specifications (414-01, Specifications).

12. Using the diagnostic tool, configure the instrument cluster.

Published: 23-May-2012

Instrument Cluster - Instrument Cluster Lens

Removal and Installation

Removal

CAUTION: Make sure that the dial indicators are not moved during the removal and installation of the lens. If this occurs, you must not attempt to reset them using your hands as this will affect the calibration of the instrument cluster and will require a full instrument cluster calibration to be carried out.

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

1. Refer to: Instrument Cluster (413-01 Instrument Cluster, Removal and Installation).



E142894

2. CAUTION: To prevent static damage to the circuits, place the instrument cluster inside the electro static discharge bag and use the gloves provided during this procedure.



E141966

3. NOTE: Gently release by pressing down on the white part of the clips.

4. CAUTION: Take care not to damage the circuit board.

NOTE: Gently release by pressing down on the black part of the clips.



5. Remove the instrument cluster lens from the electro discharge bag and discard.



Installation



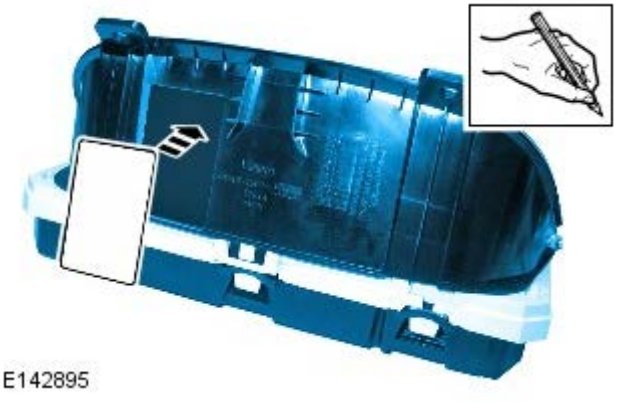
1. CAUTION: Take care not to damage the circuit board.

   Gently install the clips.

2. Gently install the clips and remove the instrument cluster from the electro discharge bag.



E141966



E142895

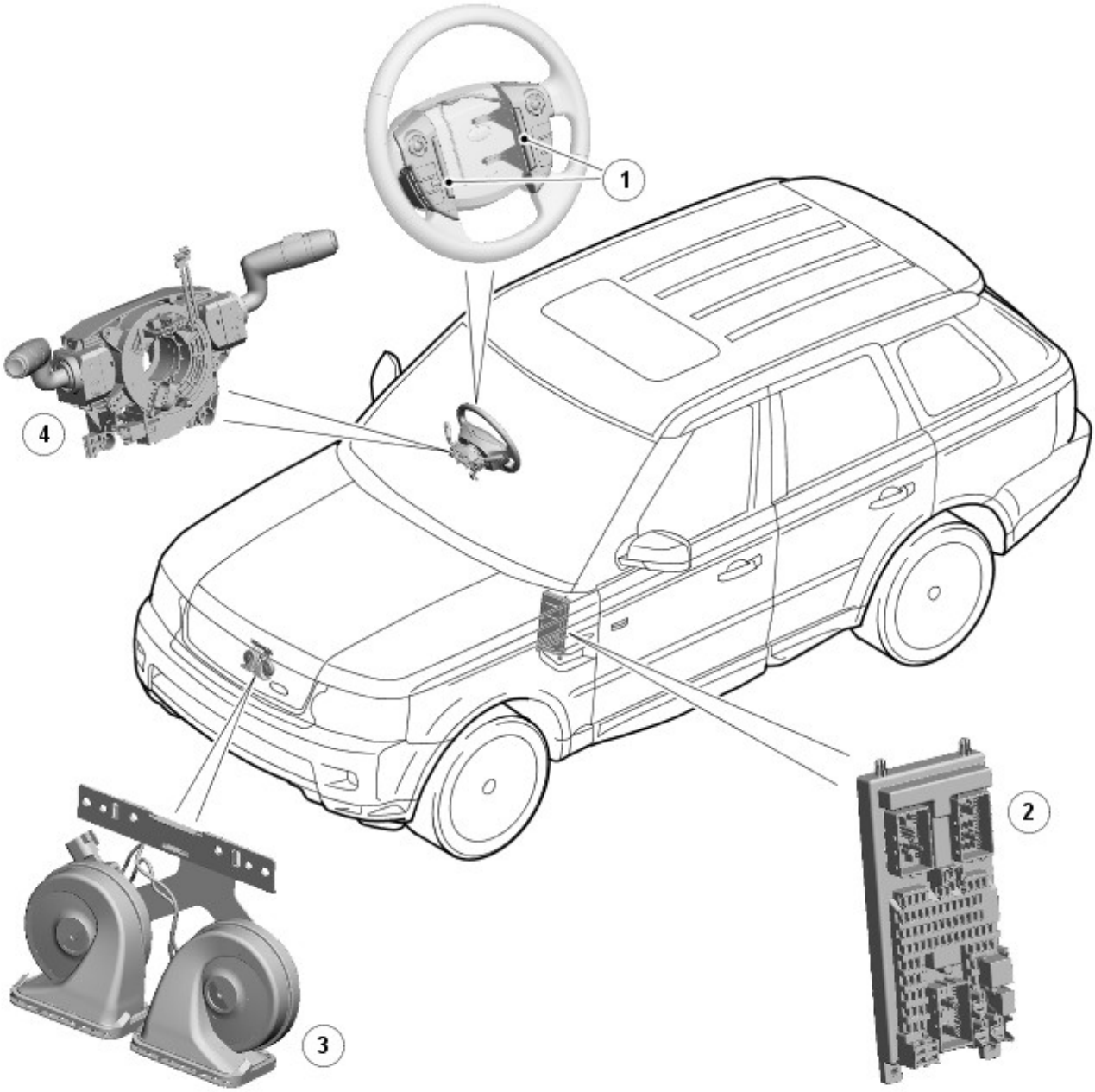
3. Copy the serial number, build date and assembly number from the old label onto the new label.

4. Refer to: Instrument Cluster (413-01 Instrument Cluster, Removal and Installation).

Published: 31-Oct-2011

Horn - Horn

Description and Operation



E140012

Item	Part Number	Description
1	-	Steering wheel horn switches
2	-	Central Junction Box (CJB)
3	-	Horns
4	-	Clockspring

GENERAL

Two horns are fitted to the vehicle; a high tone and a low tone. The horns are mounted on bracket, which is attached centrally to the front end carrier assembly.

The horns are operated by pressing one of the two horn switches, located on each side of the driver airbag, on the steering wheel.

The horns are also used by the vehicle alarm system. When the alarm system requires the horns to operate, the Central Junction Box (CJB) provides a ground, closing the relay contact which in turn supplies battery voltage to operate the horns.
For additional information, refer to: Anti-Theft - Active (419-01A, Description and Operation).

The horn circuit is permanently connected to battery voltage and therefore the horns can be operated at any time, irrespective of ignition switch position.

The horns are controlled by the CJB.

Published: 20-Aug-2012

Horn - Horn

Diagnosis and Testing

Principles of Operation

For a detailed description of the horn system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Horn (413-06 Horn, 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. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Horn(s) condition and installation	• Battery condition and state of charge • Fuses • Relay • Electrical connections • Horn switches • Clock spring • Central Junction Box (CJB) • Battery Junction Box (BJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Horn(s) operate with a muffled tone Horn(s) inoperative	• Low battery voltage • Horn circuit fault • Horn switch fault • Horn(s) faulty	• Refer to the relevant section of the workshop manual and test the battery • Refer to the electrical circuit diagrams and test the horn circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00 General Information, Description and Operation).

Published: 01-Nov-2011

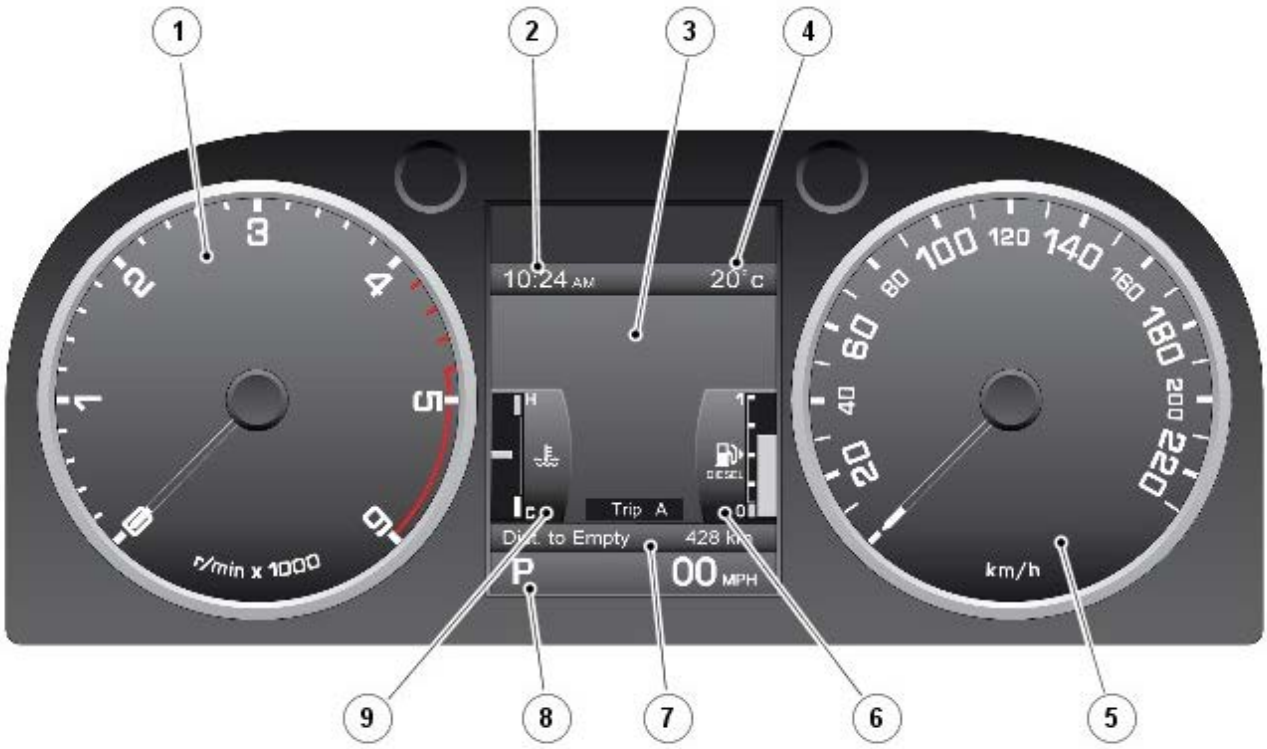
Information and Message Center - Information and Message Center

Description and Operation

OVERVIEW

A new instrument cluster is introduced where in addition to the larger speedometer and tachometer gauges the cluster also incorporates a TFT (Thin Film Transistor) 5” high-definition display unit.

Instrument Cluster Overview



E123742

Item	Part Number	Description
1	-	Tachometer
2	-	Clock
3	-	Message center
4	-	External temperature
5	-	Speedometer
6	-	Fuel gauge
7	-	Total distance odometer and trip recorder
8	-	Gear selector position display
9	-	Engine temperature gauge

The TFT display incorporates a ‘Message Center’ that communicates vehicle information and status data to the driver. Menus displayed in the message center allow access to a number of vehicle functions through the guidance of the message center menus. The driver operates the message center using the ‘menu control’ located on the right-hand-side of the steering wheel.

The instrument cluster also features a number of warning indicators, where in addition to those located within the speedometer and tachometer gauges, another six indicators are positioned within the TFT unit above the message center. Refer to the ‘Instrument Cluster’ section for further information.

The TFT display unit comprises three distinct areas, as shown below:

Thin Film Transistor Display Unit



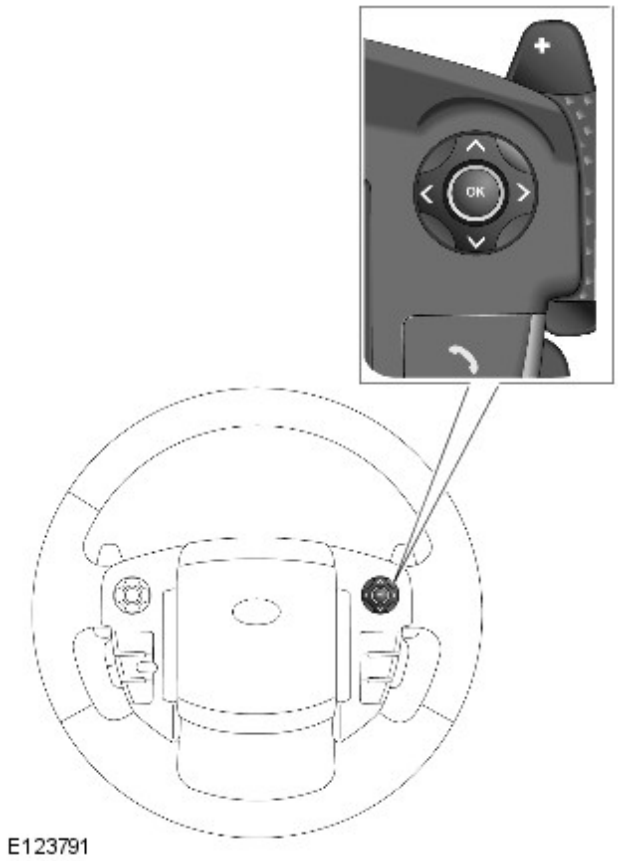
E123746

Item	Part Number	Description
1	-	Warning Indicators – this area is fixed and cannot be overwritten
2	-	Message Center – this area can be overwritten by other information
3	-	Gear Selection and Digital Speedometer Display - this area is fixed and cannot be overwritten

MESSAGE CENTER

The coolant temperature and fuel quantity gauges are the default display in the message center when the stop/start button is pressed. These can be overwritten through the guidance of message center menus, to obtain different permutations of screens which are available to communicate vehicle information and status data to the driver.

Menu Control



The driver operates the message center using the ‘menu control’ located on the right-hand-side of the steering wheel. A preference menu is available which allows the driver to personalize certain features and functions in the message center.

Messages displayed in the message center are mainly generated by the instrument cluster which monitors system status via the medium-speed and high-speed CAN (controller area network) bus systems. Other system control modules are also capable of generating messages to communicate system status. Some messages are accompanied by a chime, which is requested by the control module generating the message and functioned by the instrument cluster via the integral sounder.

The driver can view system status messages which are current in the instrument cluster RAM (random access memory), by pressing and releasing the menu control to display current messages in priority order; refer to ‘Warning Messages’.

Vehicle Information and Settings Menu

Menu selections are made using the menu control to highlight the required menu option. Once the required option is highlighted that option can be selected by pressing the ‘OK’ button. The screen will then display a sub-menu, or activate the selected item where applicable.

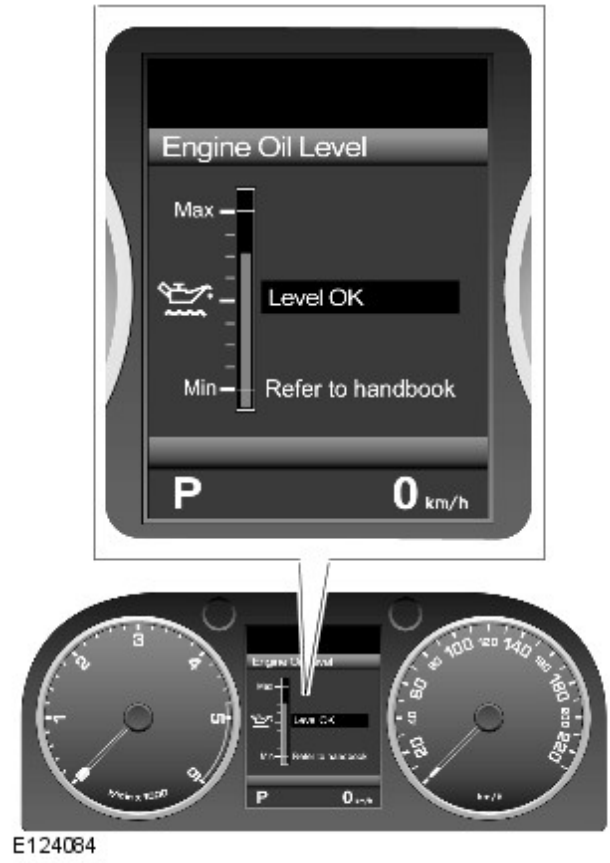
Vehicle Information and Settings Menu



E123790

Scroll arrows to the left of the menu indicate that there are further menu items either above or below the currently viewed menu items. If the arrow is displayed brightly there are additional menu items available. If the arrows appear dim, there are no additional items. For example, the engine oil level display by can be accessed by selecting ‘Service Manual’ and then selecting ‘Oil Level Display’.

Engine Oil Level Display



E124084

To close the main menu, press the left button on the menu control. To close sub-menus press and hold the left button on the menu control.

The menu will close automatically if:

- no action is taken with the main menu within 10 seconds
- action is taken with the main menu and it is then left for 4 minutes

If a further action is taken within the four minutes period, the timer will reset and a further four minutes will have to elapse before the menu closes automatically.

The following table contains an overview of the information and settings menu and option displays:

Close Menu	**-**	Close the vehicle settings and information menu.
Show Warnings	**-**	Display all active warning messages.
Vehicle Set-up	**Forward Alert**	Enable/disable the forward alert feature of the adaptive cruise control system.
	Speed Warning	Enable/disable over speed warning and set the monitored speed.
	High Beam Assist	Enable/disable the operation of the automatic headlamp high beam feature. Configure system for driving on the alternate side of road. **Note:** Headlamps still need to be manually adjusted.
	Alarm Sensors	This setting allows you to temporarily disable the vehicle's interior space protection and tilt sensor the next time the vehicle is locked with Smart Key. This setting is automatically enabled when the vehicle is unlocked with the Smart Key.
	Reverse-dip Mirror	Enable/disable automatic dipping of exterior mirrors when reverse gear is selected.
	Drive-away Locking	Enable/disable automatic locking off the doors when the vehicle speed exceeds 8 km/h (5 mph).
	2-Stage Unlocking	Enable/disable the single-point entry door unlocking feature.
	Headlamp Delay	Enable/disable the headlamp delay feature. Configure the amount of time the headlamps will remain on: **30**, **60**, **120** or **240** seconds.
	TPM Load Setting	Change the monitored tire pressures for the vehicle loading conditions: • **Heavy Load** • **Light Load**
Trip Computer	**Trip A**	Enable/disable display of Trip A readings.
	Trip B	Enable/disable display of Trip B readings.
	Trip Auto	Enable/disable display of Trip Auto readings.
	Units	Select the units to be displayed by the trip computer: • **Miles, MPH, MPG** • **Miles, MPH, MPL** • **Km, km/h, l/100 km**
Display Settings	**Language**	Select the language for text displayed in the message center.
	Temperature	Select the units for the external temperature reading: • **Celsius** • **Fahrenheit**
Service Menu	**VIN Display**	Displays the Vehicle Identification Number.
	Oil Level Display	Displays the oil level display.
	HBA Sensitivity	Change sensitivity of High Beam Assist system: • **Normal Mode** • **Alternate Mode**

Warning Messages

Warning messages are displayed in the message center when a fault is detected or an alert state is triggered. There are three categories of messages that may be displayed in the message center; the driver is made aware of the message by an accompanying warning indicator illuminating.

The warning indicators illuminate in one of three colors, which indicate the level of importance of the warning as follows:

- Critical = red indicator accompanied with and audible alert
- Warning = amber indicator
- Information = green indicator.

NOTE: Messages are displayed in order of importance with ‘Critical’ messages taking priority.

Priority Group ‘P1’ **Critical** - This group includes messages which have a direct affect on the driving ability and safety of the vehicle. This type of message requires an urgent and immediate reaction from the driver in response to the message. P1 messages are also accompanied by an appropriate warning indicator symbol and an audible alert. If

more than one P1 message is present, each message is displayed in turn at 3 second intervals. Critical messages are displayed in the message center until either the fault condition that caused the message has been rectified or the message is suppressed by using the menu control on the steering wheel. Critical messages can also be recalled by using the menu control. If a critical message has been suppressed the accompanying warning symbol will remain illuminated to indicate that a problem exists.

Priority Group 'P2' **Warning** - This group includes messages which do not directly affect driving ability or safety of the vehicle. P2 messages are also accompanied by appropriate warning indicator symbol. This message must be noted by the driver and the cause rectified as soon as possible. Each message is indicated once for a maximum of 23 seconds. Warning messages are displayed in the message center until either the fault condition that caused the message has been rectified or the message is suppressed by using the menu control on the steering wheel. Warning messages can also be recalled by using the menu control. If a warning message has been suppressed the warning symbol will remain illuminated to indicate that a problem exists.

Priority Group 'P3' **Information** – This group displays messages which relate to fluid levels 'LOW WASHER FLUID' for example, or when an alert state is triggered when driving the vehicle. For example, cancelling cruise control will display the message 'CRUISE CANCELLED'. Depending on the message, some are only displayed at the end of a journey to avoid irritation to the driver. Information messages are displayed for four seconds before extinguishing.

Information Message



E123786

The messages are displayed in a language applicable to the vehicle market configuration and can be changed using the instrument cluster menu. The following list shows the possible messages which can be displayed.

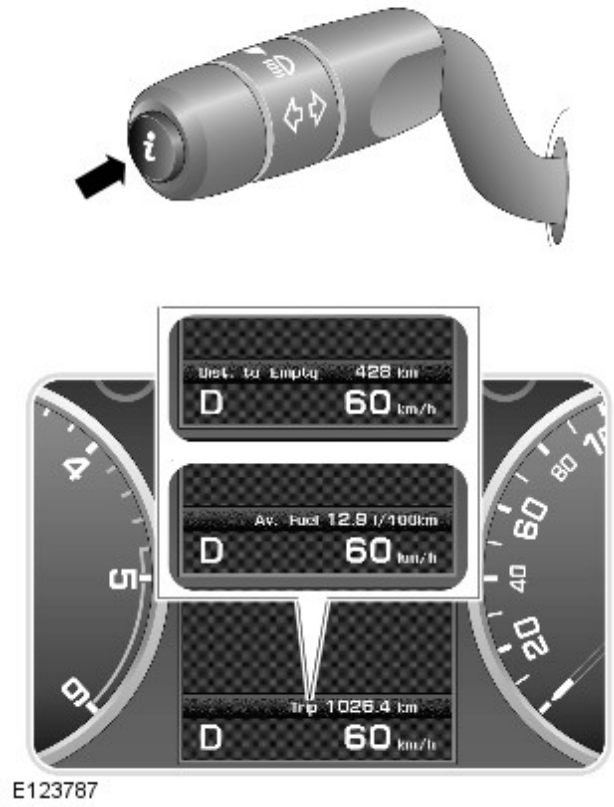
NOTE: If the instruction given in the 'Action' column does not resolve the message display, use the Workshop Manual Diagnosis and Testing section for the applicable vehicle system to determine the fault and perform any additional action required.

AMBIENT TEMPERATURE

The ambient temperature is displayed in the right-hand position at the top of the message center. The temperature can be displayed in Fahrenheit or Centigrade and this is selectable by the driver using the instrument cluster menu.

ODOMETER AND TRIP METER

Trip Meter



E123787

The odometer is located in a central position at the bottom of the message center. In addition to displaying the total distance the vehicle has traveled. Short presses of the ‘I’ button, on the end of the 'left-hand' steering column multifunction switch will scroll through the following statistics:

- Odometer
- Trip distance
- Trip average speed
- Trip average fuel consumption
- Instantaneous, short term average, fuel consumption
- Range available from remaining fuel
- Blank display

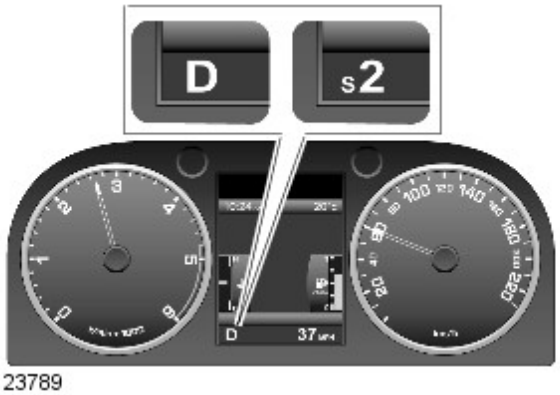
There are three trip memories available: A, B and Auto. The instrument cluster menu is used to select which trip recording is displayed.

The Auto trip is always available and is reset each time the engine is started and the vehicle moves. Previous trips can be added to form a continuous trip recording by pressing and holding the trip button when the automatic trip information is displayed. The message center will confirm that the previous journey information has been added and pressing and holding the trip button for 1 second will add the data. The previous trip information can also be deleted by pressing and holding the trip button when the automatic trip information is displayed. The message center will confirm deletion of the previous journey data and pressing and holding the trip button for 1 second will delete the previous trip information.

Trip A and B can be reset by the driver at any time. When the required trip information is displayed, pressing and holding the trip button for 2 seconds will erase the previous trip information stored. Resetting trip A or B will not affect the other trip information, for example, if trip A is reset, trip B will retain its information until it is reset.

GEAR POSITION DISPLAY

Gear Position Display



E123789

The gear position shows the current selector position: P, R, N, D or S.

When the transmission is in manual 'CommandShift' mode, the display will show the currently selected gear.

The gear position is illuminated in response to 'CAN' bus messages from the TCM (transmission control module).

The instrument cluster has no control over the gear position display and obtains the information by monitoring the controlling CAN bus messages. If the instrument cluster detects ten incorrect CAN bus messages, 'TRANS. FAILSAFE PROG' is illuminated in the message center.

If a correct CAN bus message is received when the ignition is next switched on, the error is erased and the message removed.

SERVICE INTERVAL INDICATOR

A service interval message will automatically appear in the message center when a pre-determined distance or time before a scheduled service is reached. The kilometer or mileage countdown is controlled by the engine management system and is adjusted to allow for driving style and conditions to gauge when the appropriate service becomes necessary.

Service Interval Message



E123788

The service indicator displays information calculated by the ECM (engine control module) to the remaining distance to the next service based on the amount of fuel used since the last service interval indicator reset.

The ECM counts down the distance to engine service and the instrument cluster rounds this down to the nearest 50 miles. The fuel used based count down starts from 3200 miles displaying the required figure in the trip computer message center, for example 'Service Required in 1950 miles'.

When the ECM has calculated the distance to service is 0 miles, the ECM will request the instrument cluster to display 'Service Required' in the message center.

The ECM also monitors and calculates when the time to the next oil service is required, 'Service Required' is displayed in the message center. This message takes priority over the distance to service calculation.

The service information is displayed in the message center for 4 seconds at each ignition cycle. There is no minus figure if the service distance is exceeded, 'Service Required' is displayed until the ECM service counter is reset using an approved diagnostic system.

Published: 20-Aug-2012

Information and Message Center - Information and Message Center

Diagnosis and Testing

Principles of Operation

For a detailed description of the information and entertainment system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Information and Message Center (413-08 Information and Message Center, 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. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Message center screen	• Fuses • Wiring harness • Electrical connector(s) • Battery condition, state of charge • Instrument Cluster (IC)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Instrument Cluster (IC) (100-00 General Information, Description and Operation).

Published: 11-May-2011

Warning Devices -

Torque Specifications

Description	Nm	lb-ft
Low tire pressure module bolts	1.5	1.1

Published: 11-May-2011

Warning Devices - Low Tire Pressure Module

Removal and Installation

Removal

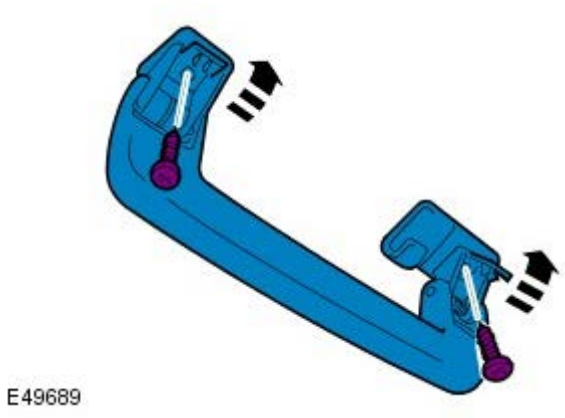
1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

2. Remove the LH B-pillar upper trim panel.
   For additional information, refer to: B-Pillar Upper Trim Panel (501-05, Removal and Installation).

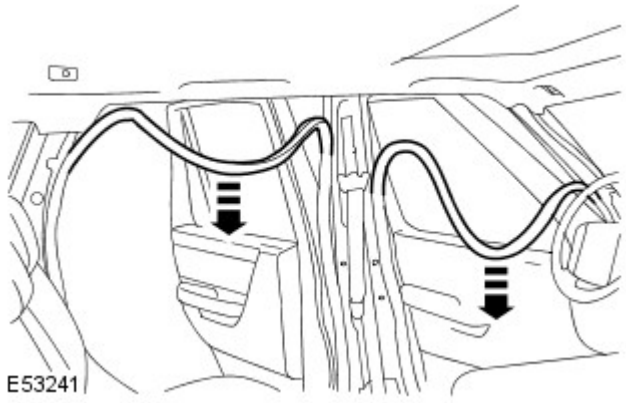
3. Remove the LH C-pillar upper trim panel.
   For additional information, refer to: C-Pillar Upper Trim Panel (501-05, Removal and Installation).

4. Remove the LH D-pillar upper trim panel.
   For additional information, refer to: D-Pillar Trim Panel (501-05, Removal and Installation).

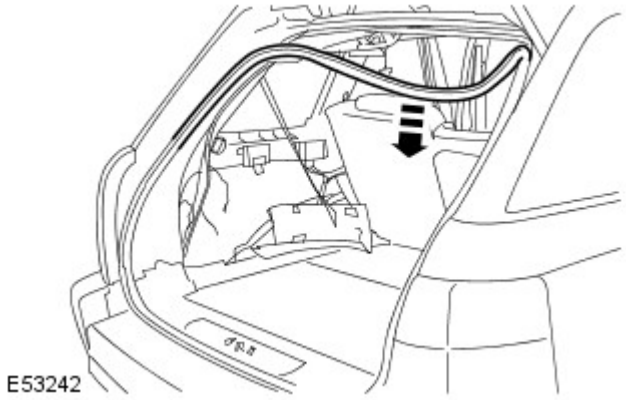
5. Remove the passenger assist handle.
   - Release the 2 screw covers.
   - Remove the 2 screws.
   - Repeat the above procedure for the other handle.


E49689

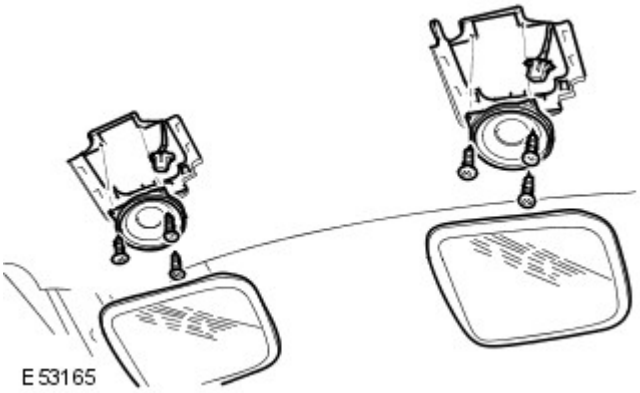
6. Release the front and rear door weatherstrips for access.


E53241

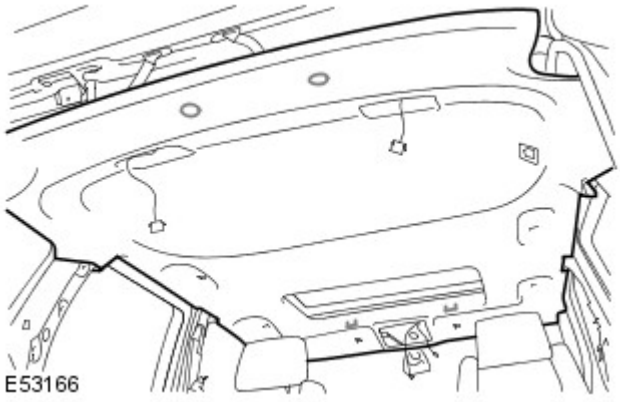
7. Release the liftgate weatherstrip


E53242

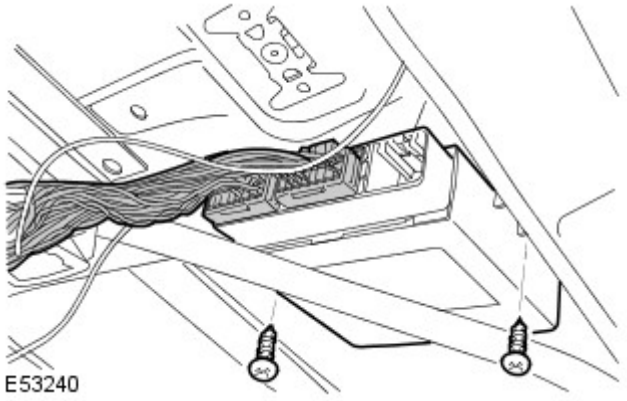
8. Remove the rear speakers.
   - Remove the speaker grilles.
   - Remove the 6 screws.
   - Disconnect the 2 electrical connectors.



9. Release the headliner for access.
    - Remove the 4 screws.
    - Release the 2 clips.



10. Remove the low tire pressure module.
    - Release and disconnect the 2 electrical connectors.
    - Remove the 2 screws.



Installation

1. Install the low tire pressure module.
    - Install the screws.
    - Connect and secure the electrical connectors.

2. Attach the headliner.
    - Install the screws.

3. Attach the door weatherstrips.

4. Install the passenger assist handles.
    - Install the screws.
    - Secure the screw covers.

5. Install the rear speakers.
    - Connect and secure the electrical connectors.
    - Install the screws.
    - Install the speaker grilles.

6. Install the D-pillar upper trim panel.
   For additional information, refer to: D-Pillar Trim Panel (501-05, Removal and Installation).

7. Install the C-pillar upper trim panel.
   For additional information, refer to: C-Pillar Upper Trim Panel (501-05, Removal and Installation).

8. Install the B-pillar upper trim panel.
   For additional information, refer to: B-Pillar Upper Trim Panel (501-05, Removal and Installation).

9. Connect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

10. Program a new control module using T4.

Published: 11-May-2011

Engine Protection System -

Torque Specifications

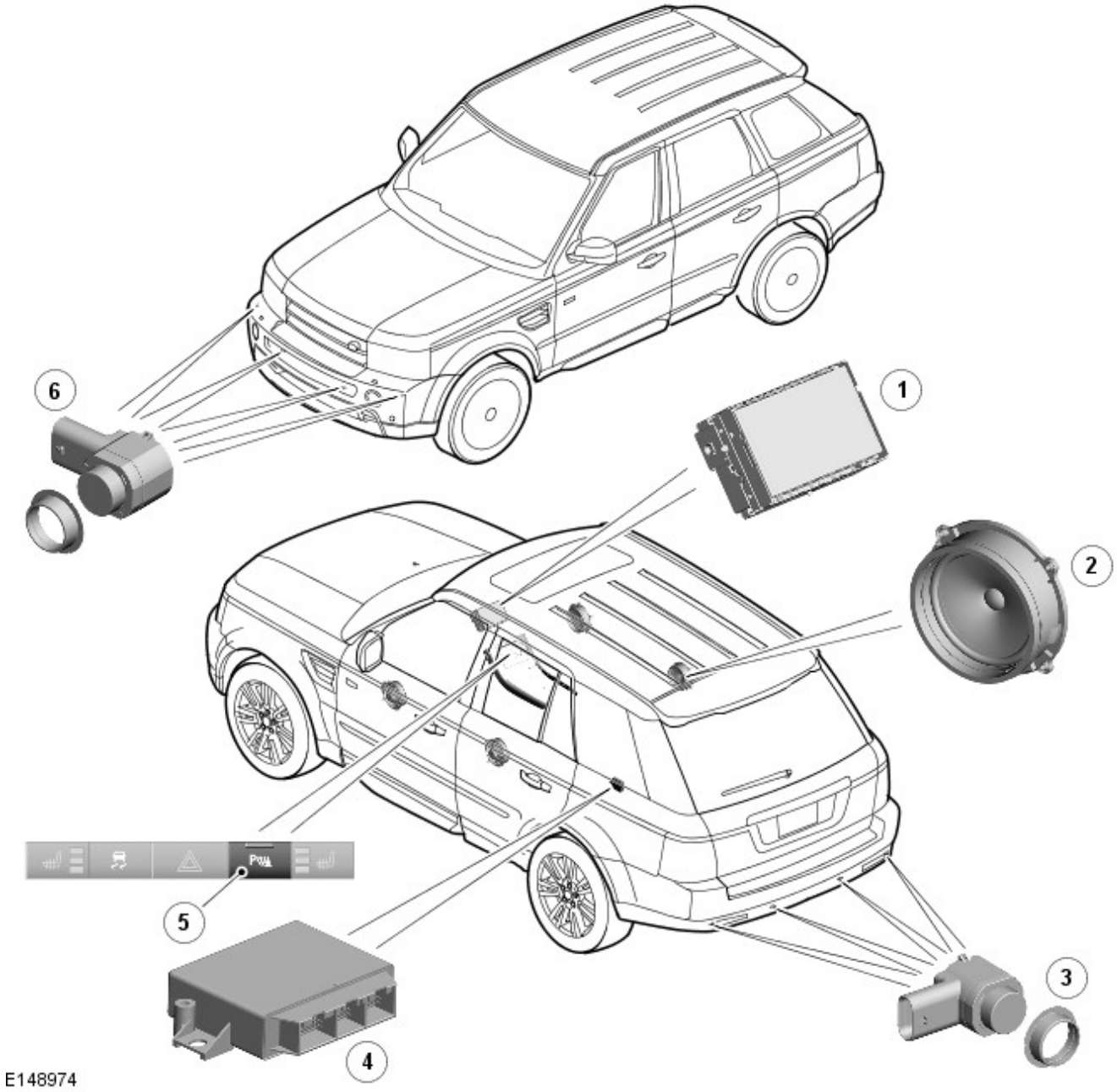
Description	Nm	lb-ft
Passive anti-theft system (PATS) module bolts	10	7

Published: 08-Apr-2013

Parking Aid - Parking Aid

Description and Operation

Parking Aid Component Location



Item	Part Number	Description
1	-	Touch screen display
2	-	Audio system speakers
3	-	Rear sensors
4	-	Parking aid module
5	-	Parking aid switch
6	-	Front sensors

INTRODUCTION

The parking aid module receives and ignition power mode 6 supply from the CJB (central junction box).

The parking aid module is connected to the entertainment system control module by the medium speed CAN (controller area network) bus and the Media Orientated System Transport (MOST). The entertainment system is used by the parking aid system to provide the driver with an audible warning. If an obstacle is sensed by the rear parking aid sensors, the rear audio system speakers will sound. If an obstacle is sensed by the front parking aid sensors (if fitted), the front audio system speakers will sound.

The parking aid system operates using ultrasonic signals which are transmitted by the sensors. The reflected echo from this output is received by the sensors and used by the parking aid module to calculate the distance from an

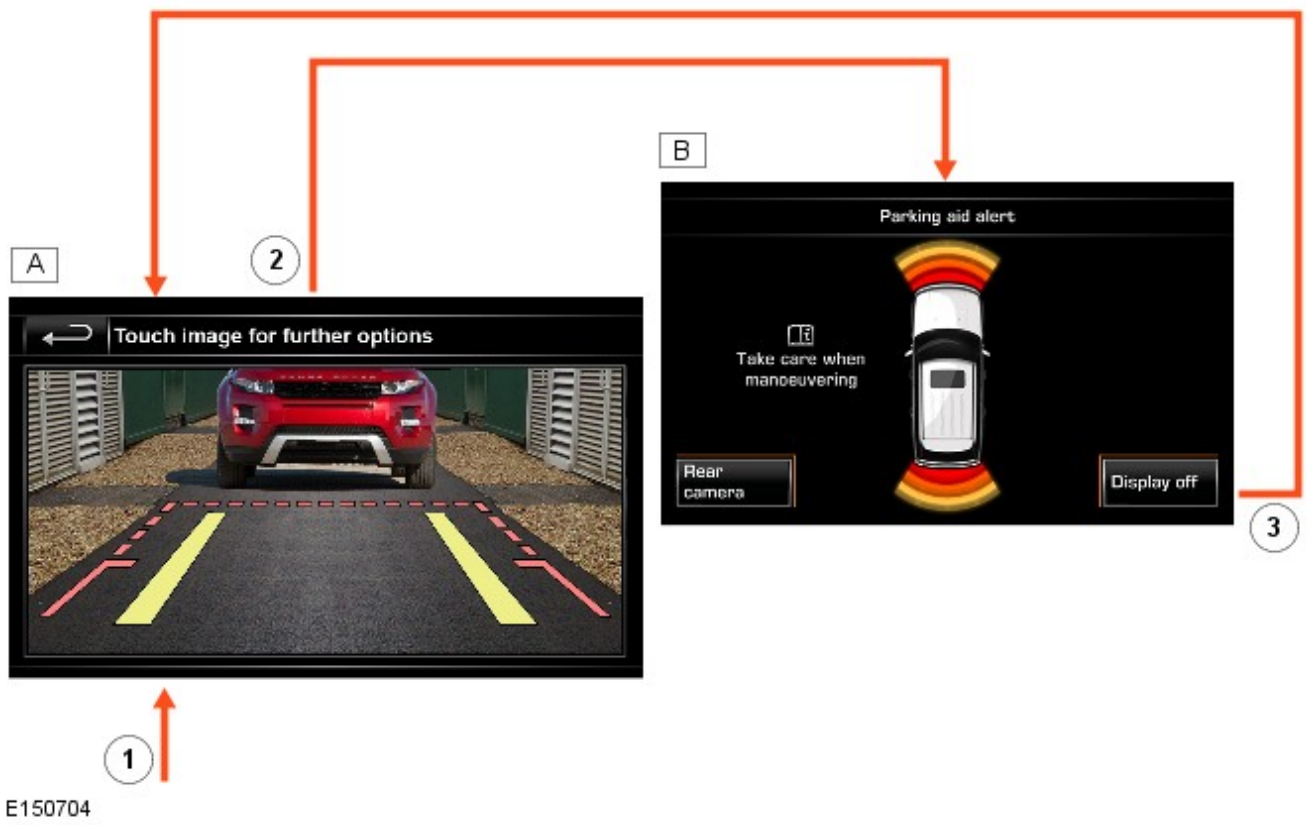
object.

When the parking aid module activates the system, the switch LED (light emitting diode) is illuminated to indicate that the system is operating. The parking aid module then processes signals received from the sensors to determine if there is an object with the detection range of the sensors. A parking aid screen is automatically displayed in the Touch Screen Display. If the vehicle has a parking aid camera fitted, the camera display is automatically displayed in the TSD in preference to the parking aid alert display. To view the parking aid sensor display, a single touch of the TSD screen will remove the camera image display and show the parking aid alert display.

The fascia mounted control switch allows the driver to activate/deactivate the parking aid system if operation is required or not

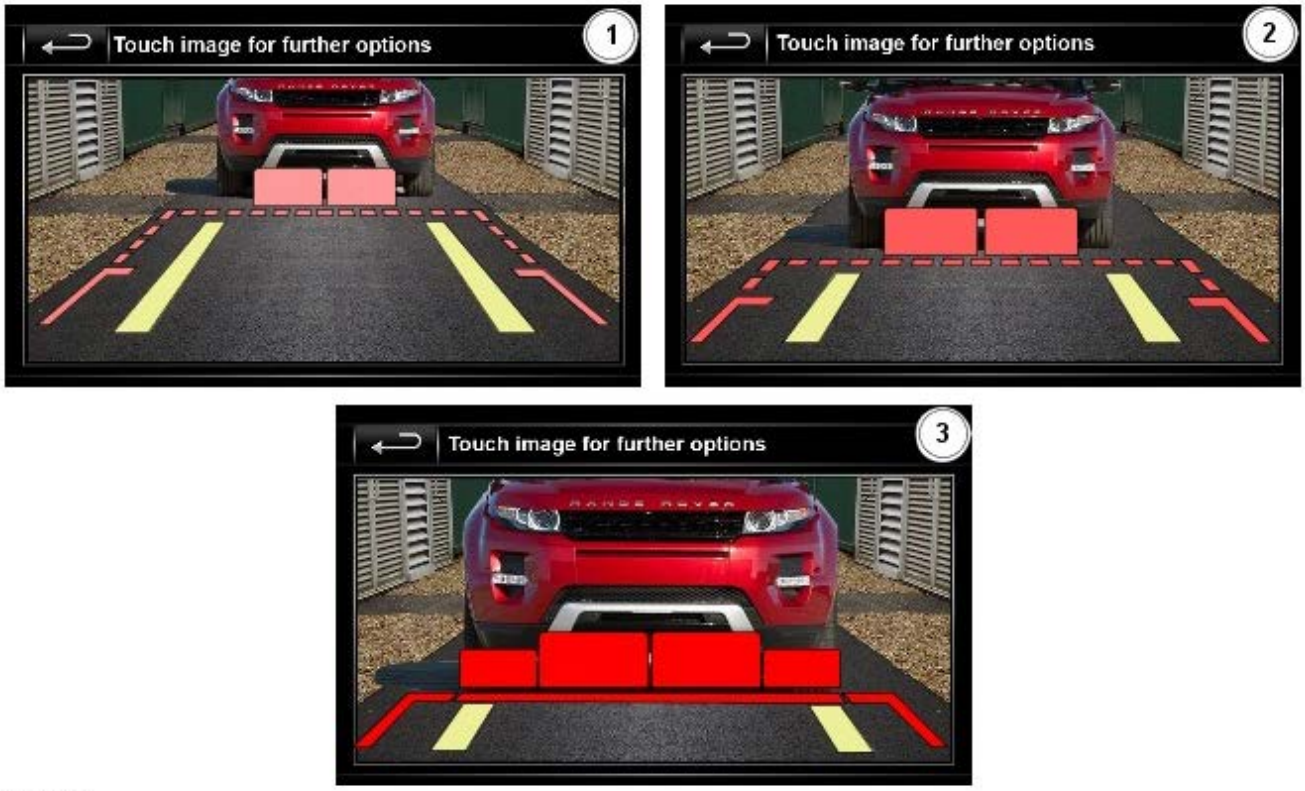
NOTE: The control switch is only fitted to vehicles with front and rear parking aid sensors.

Parking Aid Alert Display - Lo-line Camera System



Item	Part Number	Description
A	-	Camera image
B	-	PDC (park distance control) image
1	-	User selects reverse
2	-	User touches screen
3	-	‘Rear camera’ soft key selected

Parking Aid Alert Display - Hi-line Camera System



E148937

Item	Part Number	Description
A	-	Camera image
B	-	PDC (park distance control) image
1	-	User selects reverse
2	-	User touches screen

CONTROL MODULE



E117295

The parking aid control module is located in the left hand rear quarter panel, behind the side trim panel. The control module uses a single microprocessor to perform the following tasks:

- Control of the ultrasonic sensors
- Monitoring of the sensors
- Evaluation of received echo signals from the sensors
- Noise and disturbance suppression
- Control and monitoring of the switch status LED and associated wiring
- Evaluation and monitoring of the control inputs
- Management of diagnostic and test functions
- Monitoring of power supply
- Communication via diagnostic link.

The control module is connected to the vehicle electrical system by either 3 (vehicles fitted with front and rear sensors) or 2 (vehicles fitted with rear sensors only) multiplug connectors.

Inputs and Outputs

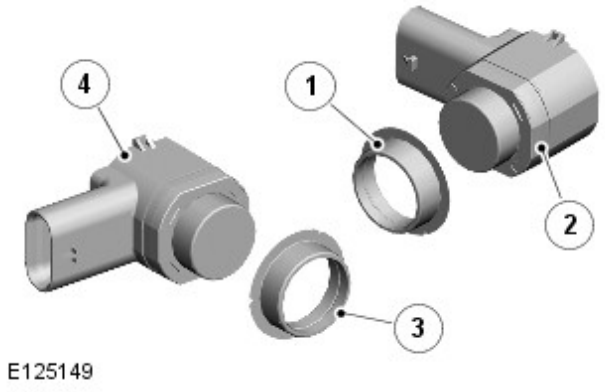
The module receives inputs from the following:

- Reverse selected - CAN message from transmission control module (automatic transmission).
- Forward gear selected (not in reverse or neutral) - CAN message from transmission control module (automatic transmission).
- Parking aid switch
- Trailer fitted - CAN message for CJB
- Ignition - power supply

The module outputs signals to the following:

- Sensors - power and ground connections
- Sensors - digital signal - transmit and receive signals
- Audio system - CAN message to TSD
- Parking aid switch - power supply for switch LED operation

PARKING AID SENSORS



Item	Part Number	Description
1	-	De-coupling ring
2	-	Front parking aid sensor
3	-	De-coupling ring
4	-	Rear parking aid sensor

Four sensors are positioned in the rear bumper and the front bumper (if fitted). Each sensor housing has two raised location keys which locate in corresponding grooves in the sensor housing and sets the correct orientation for the sensor bodies.

Each sensor has a three pin connector which connects into a common harness linking all four sensors. This harness is connected to the main vehicle body harness for the rear sensors or the engine compartment harness for the front sensors. The three pins are for sensor negative and positive feeds and a signal line.

CONTROL SWITCH



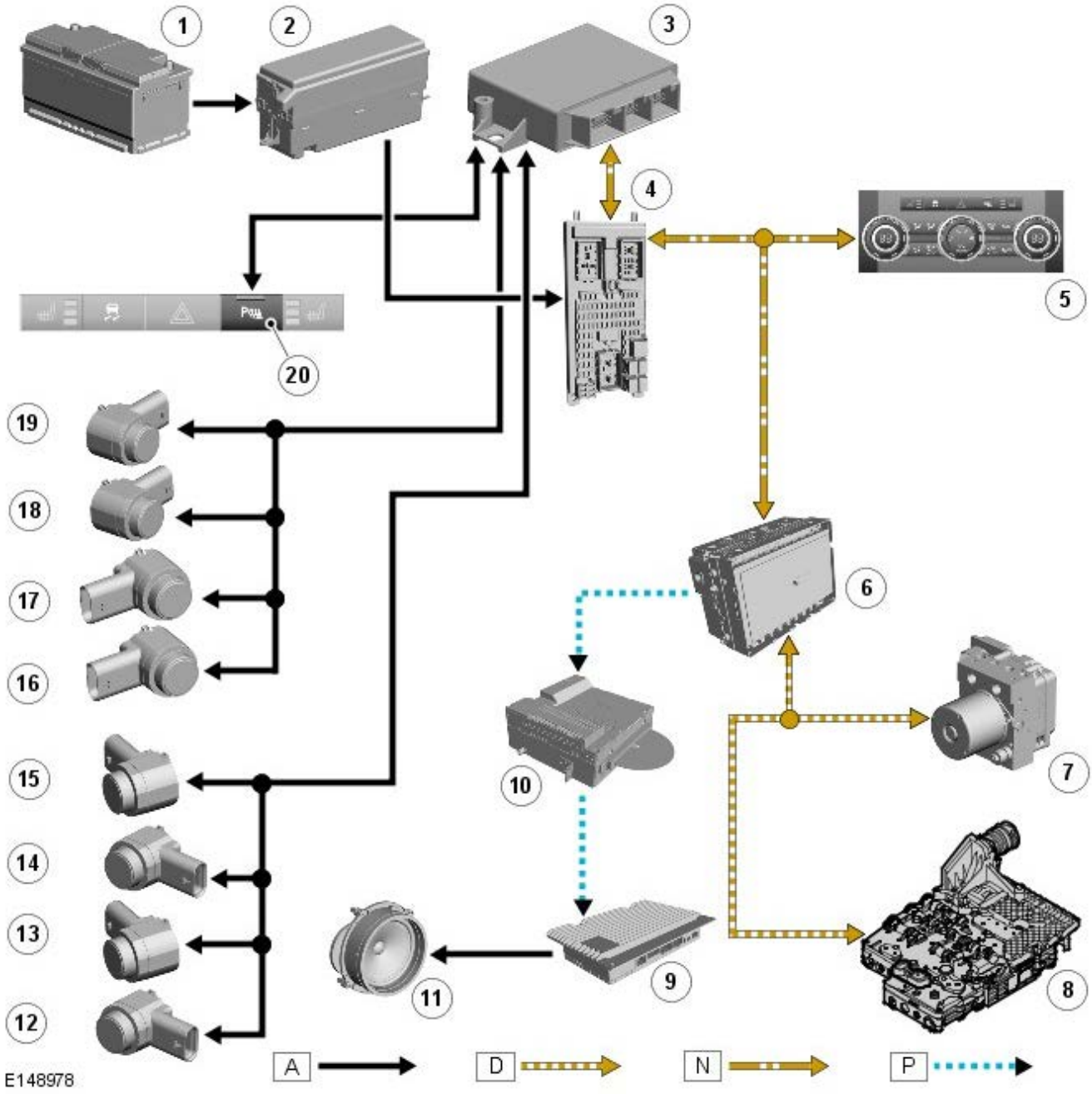
E122823

The parking aid switch, located in the center console, is non-latching with an integral LED. The switch receives a 12V output to drive the LED when required. The switch is also connected to ground. When the switch is operated, the momentary completion of the ground is interpreted by the parking aid module as a signal to enable or disable the parking aid system.

NOTE: The control switch allows the driver to activate/deactivate the parking aid system if operation is required or not required.

CONTROL DIAGRAM

NOTE: **A** = Hardwired; **N** = Medium Speed CAN bus; **P** = MOST



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box (BJB)
3	-	Parking aid module
4	-	Central Junction Box (CJB)
5	-	Automatic Temperature Control (ATC) module
6	-	TSD
7	-	ABS (anti-lock brake system) module
8	-	Transmission control module
9	-	Audio system amplifier
10	-	Integrated Audio Module (IAM)
11	-	Audio system speakers
12	-	Left inner front sensor
13	-	Right inner front sensor
14	-	Right outer front sensor
15	-	Left outer front sensor
16	-	Left outer rear sensor
17	-	Left inner rear sensor
18	-	Right inner rear sensor
19	-	Right outer rear sensor
20	-	Parking aid switch

PRINCIPLES OF OPERATION

If reverse (R) is the first gear selected after the ignition is switched on, both the front (if fitted) and rear parking aid sensors will become operational. If a forward drive gear is subsequently selected, the front and rear parking aid sensors will remain operational until vehicle speed increases above 16 km/h (10 mph), park (P) is selected or the PDC control switch is pressed.

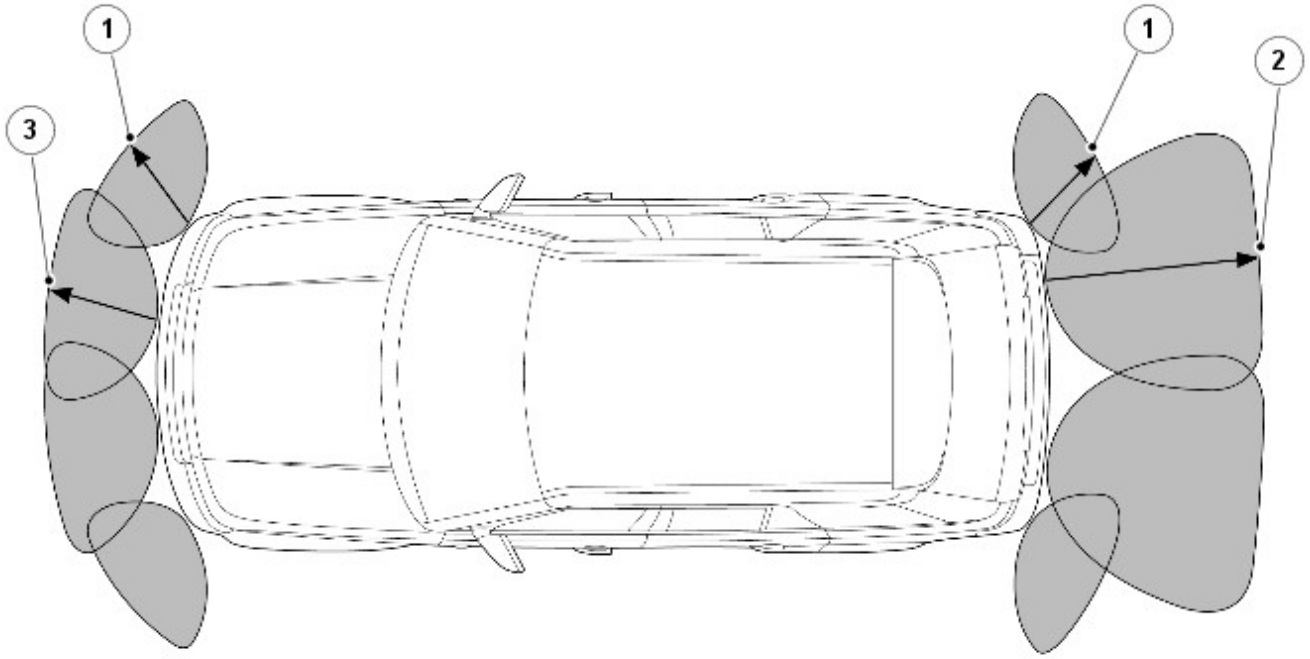
If drive (D) is the first gear selected after the ignition is switched on the parking aid system will have to be activated by pressing the PDC control switch.

NOTE: The PDC system can not be activated whilst the vehicle is in park (P).

Audible Warnings

The control module processes the distance readings from the ultrasonic parking aid sensors to determine if there are any objects within the detection areas. If there are no objects no audible warning will be emitted. If an object is detected, repeated audible warnings are emitted via the audio system speakers. The time delay between the audible warnings decreases as the distance between the detected object and the vehicle decreases until eventually a continuous tone is emitted from the audio system speakers.

Distance Calculation for Audible Warnings



E145978

The detection ranges of the sensors are shown in the table below.

Item Number	Sensor Location	Maximum Detection Range Audio Tone	Continuous Audio Tone
1	Rear/Front Outer	Approximately 600 mm (24 inches)	Approximately 300 mm (12 inches)
2	Rear Inner	Approximately 1800 mm (71 inches)	Approximately 300 mm (12 inches)
3	Front Inner	Approximately 800 mm (31 inches)	Approximately 300 mm (12 inches)

Detection Calculation

In the combined mode, the sensors emit a series of ultrasonic impulses and then switch to receiver mode to receive the echo reflected by an obstacle within the detection range. The received echo signals are amplified and converted from an analogue signal to a digital signal by the sensor. The digital signal is passed to the parking aid module and compared with pre-programmed data stored in an EEPROM (electrically erasable programmable read only memory) within the module. The module receives this data via the signal line from the sensor and calculates the distance from the object using the elapsed time between the transmitted and received impulse. The duration of the impulse duration is determined by the module, with the sensor controlling the frequency of the impulse output.

In receiver mode, the sensor receives impulses that were emitted by adjacent sensors. The module uses this information to precisely determine the position and distance of the object.

If no objects are detected there are no further warning tones. If an object is detected, repeated audible tones are emitted from either the front or rear audio speakers as appropriate. The time delay between the tones decreases as the distance between the object and the vehicle decreases, until at approximately 300 mm (12 inches), the audible tone becomes continuous.

After the initial detection of an object, if there is no decrease in the distance between an object and the central sensors, the time delay between the audible warnings remains constant. If an object is detected by one of the corner sensors only, the audible warnings stop after approximately 3 seconds if there is no change in the distance between an object and the corner sensor.

When approaching several objects within detection range, the control module recognises the distance from the vehicle to the nearest object.

The PDC module will prioritise the objects detected, the nearest object detected will take priority and the corresponding audio outputs will be emitted. For example if 2 objects are detected (one front one rear) the nearest detected object will take priority and relevant audible tone will be heard.

If two objects are detected at equal distance (one front one rear) the audible tones will alternate between the front and rear speakers.

If reverse (R) is the first gear selected after the ignition is switched on, both the front (if fitted) and rear parking aid sensors will become operational. If a forward drive gear is subsequently selected, the front and rear parking aid sensors will remain operational until vehicle speed increases above 16 km/h (10 mph), park (P) is selected or the PDC control switch is pressed.

If drive (D) is the first gear selected after the ignition is switched on the parking aid system will have to be activated by pressing the PDC control switch.

The volume output of the parking aid audible tones can be adjusted using the audio volume control when the PDC is activated, the volume can also be adjusted by selecting the 'Vehicle Settings' menu and selecting 'Parking' from the menu on the TSD. The volume can be adjusted using the + or - selections on the TSD.

The parking aid module receives a signal on the CAN from the CJB when a trailer is fitted. When this signal is detected, the parking aid module suspends operation of the PDC system.

 NOTE: The ignition needs to be cycled once the trailer has been disconnected to activate the rear parking aid system.

Diagnostics

The control module has a diagnostic connection via the medium speed CAN bus to enable faults to be retrieved using the Land Rover approved diagnostic equipment. Additionally an on-board diagnostic routine within the control module constantly monitors the system and alerts the driver to a system fault by emitting a 3 second continuous tone through the front audio speakers when the ignition is switched on. If front parking aid sensors are fitted, the control switch LED will also flash 6 times when reverse gear is selected of PDC switch is pressed.

LO-LINE CAMERA SYSTEM

A shielded co-axial cable connection between the camera and the Touch Screen Display (TSD) is used for the video image transmission.

The camera receives power at all times when the ignition is in power mode 6. When reverse gear is selected, the CJB transmits a reverse selected signal on the medium speed CAN bus message to the TSD. The TSD displays the parking aid camera video input from the camera in preference to the parking aid alert screen.

If the driver does not require the camera image in the TSD, a single touch on the screen will revert the display to the parking aid alert screen. The camera view can be reselected by pressing the 'Rear Camera' softkey on the TSD.

When reverse gear is deselected, the camera image remains on the TSD for 10 seconds after the transmission has been put into drive 'D'. This is to prevent the TSD switching between screens if the vehicle is being manoeuvred into a parking space. If the vehicle forward speed exceeds 16 km/h (10 mph) within the 10 second period, the camera image is removed from the TSD.

If the TSD display is switched off, the camera image will be automatically displayed when reverse gear is selected. When reverse gear is deselected and the 10 second period has expired, the TSD will revert back to its switched off state.

Rear View Camera



E139948

The rear view camera provides additional information to the driver when reversing the vehicle. When reverse gear is selected the camera integrated into the tailgate handle assembly, automatically displays a wide-angle color image of the view from the rear of the vehicle onto the TSD.

The rear view images are overlaid with:

- Dashed lines representing the perimeter of the vehicle.
- Fixed solid lines representing the vehicle's axle width.

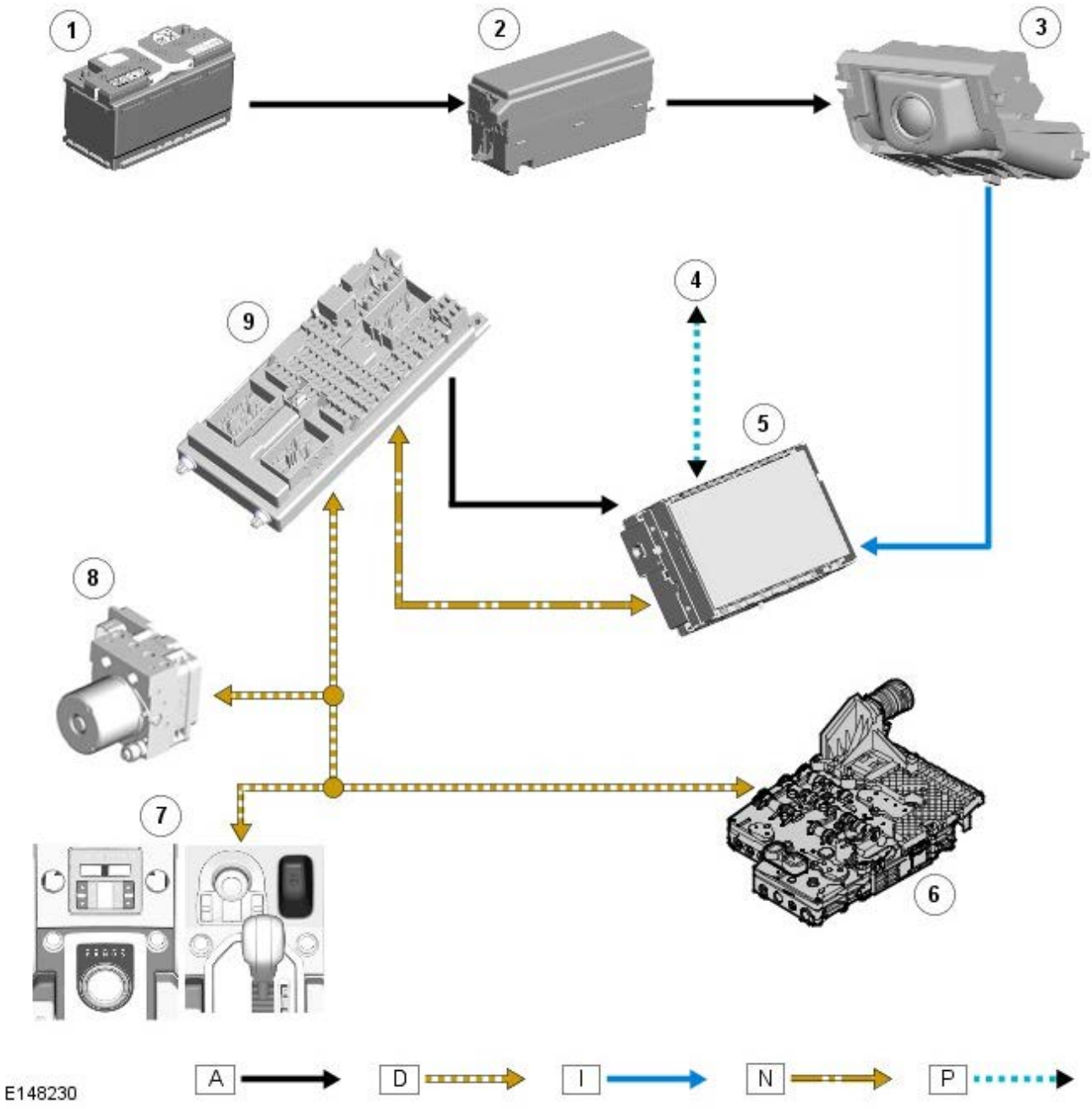
The camera is connected to the vehicle harness by one 3 pin connector for the power, ground and the video co-axial cable.

The image captured by the camera is mirrored to give the driver a true representation of the rear view on the TSD.

NOTE: The lo-line camera has no "intelligence" and simply transmits a video signal through the coaxial cable. The display of the camera image is controlled solely by the touch screen device dependant on reverse gear. The camera system has no diagnostic information available through the Land Rover approved diagnostic equipment.

CONTROL DIAGRAM

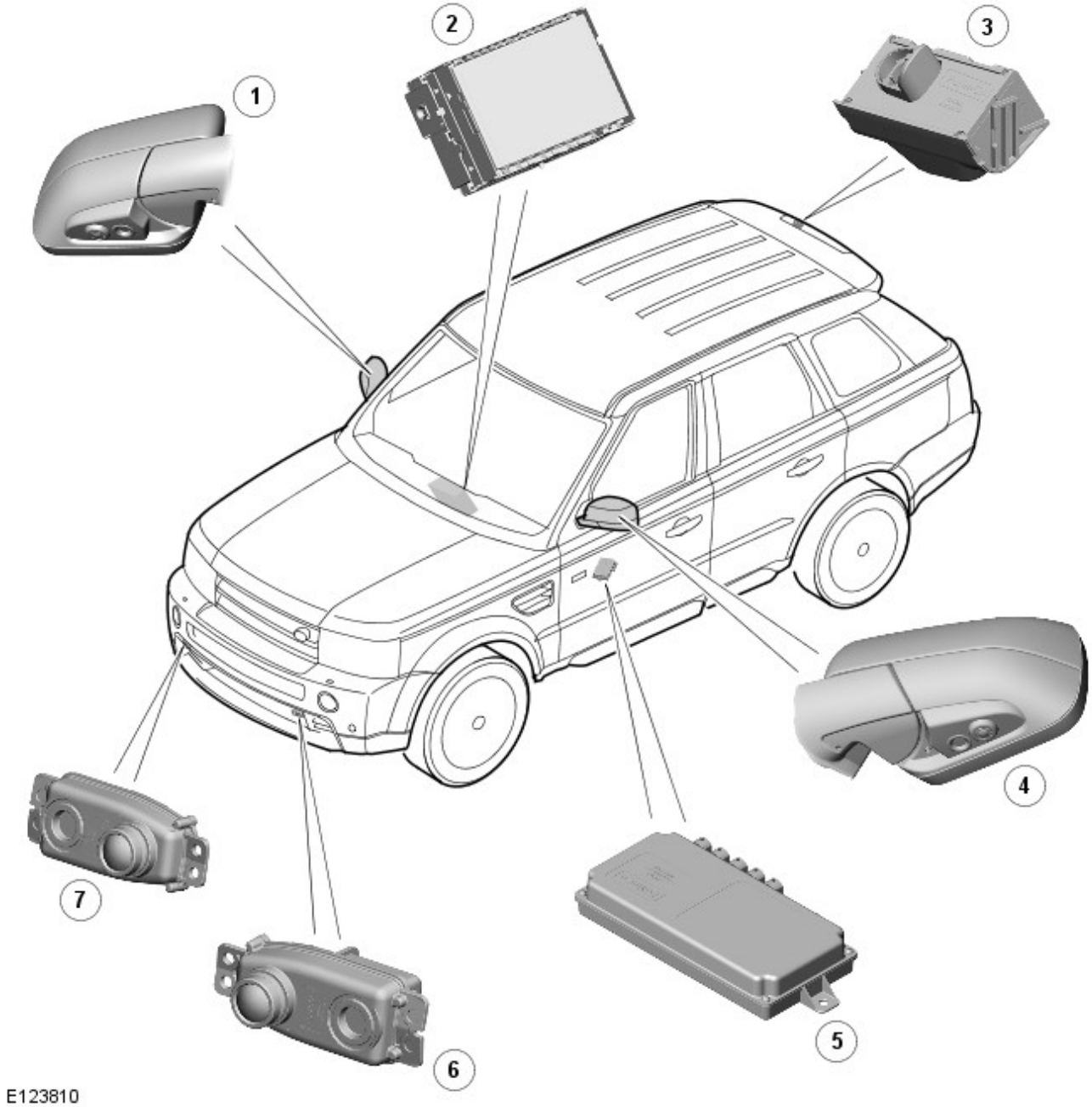
NOTE: **A** = Hardwired; **N** = Medium Speed CAN; **O** = LIN Bus; **AD** = NTSC Signal; **AE** = LVDS Signal.



Item	Part Number	Description
1	-	Battery
2	-	BJB (battery junction box)
3	-	Rear view camera
4	-	To MOST ring
5	-	TSD
6	-	TCM (transmission control module)
7	-	Transmission selector lever
8	-	ABS (anti-lock brake system) module
9	-	Central Junction Box (CJB)

HI-LINE CAMERA SYSTEM

Proximity Camera Component Location



Item	Part Number	Description
1	-	Right-hand mirror camera
2	-	Touch screen display
3	-	Rear view camera
4	-	Left-hand mirror camera
5	-	Control module
6	-	Left-hand-front bumper camera
7	-	Right-hand-front bumper camera

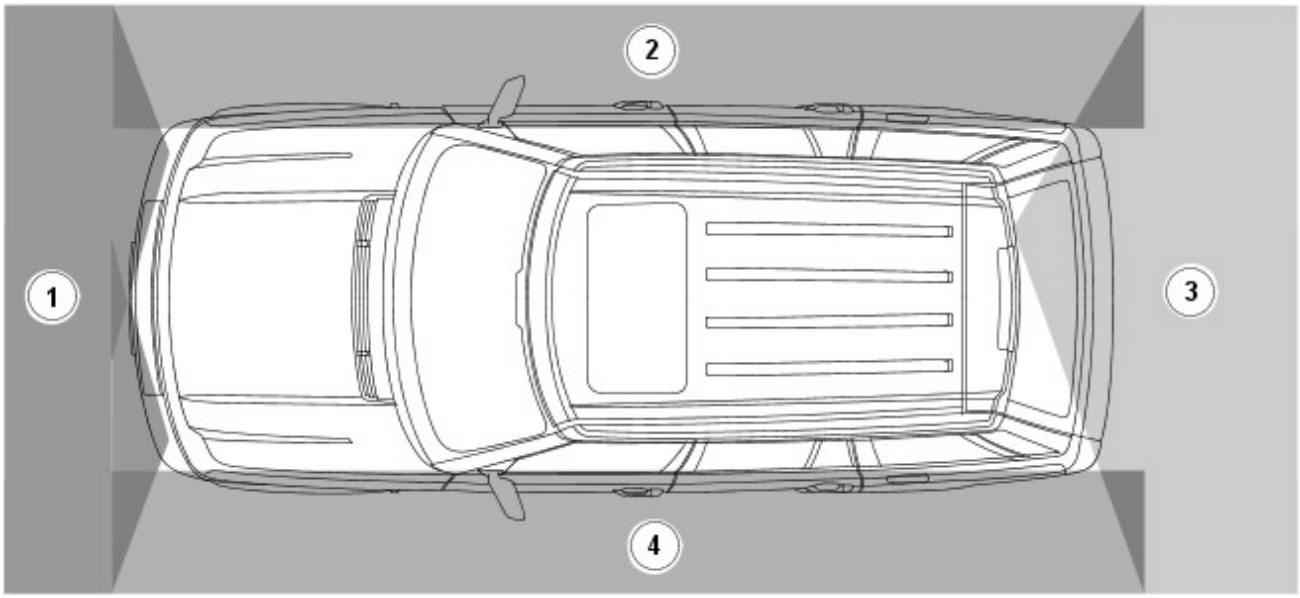
OVERVIEW

The proximity camera system provides the driver with a visual-aid when maneuvering the vehicle at low speeds. The system uses a dedicated control module to capture the camera data and display the resulting images on the TSD (Touch Screen Display), providing the driver with a 360° view around the vehicle. The camera system is also supported by various driving-aid features where graphical information and warnings are superimposed onto the images displayed on the TSD.

The proximity camera system uses five VGA (Video Graphic Array) resolution cameras:

- two mounted in the front bumper
- one mounted in each door mirror
- one mounted in the rear tailgate handle assembly.

Camera Coverage Zones

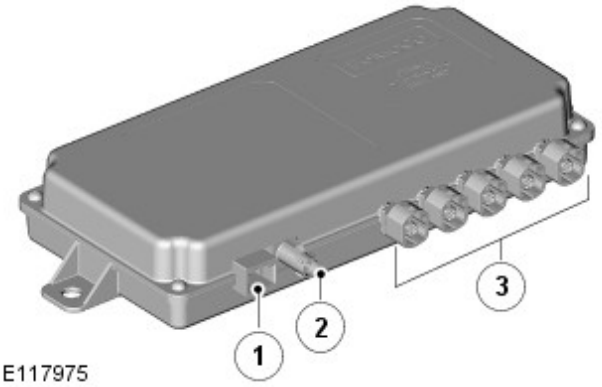


E117972

Item	Part Number	Description
1	-	Front camera coverage zone
2	-	Right-hand mirror camera coverage zone
3	-	Rear camera coverage zone
4	-	Left-hand mirror camera coverage zone

SYSTEM DESCRIPTION

Proximity Camera Control Module



E117975

Item	Part Number	Description
1	-	Power supply, ground and BUS connector
2	-	Connection to touch screen display
3	-	Five camera connections

The proximity camera control module is located under the left-hand-front seat; connections to the module include:

- medium speed CAN network
- five camera inputs
- video signal output to the TSD
- power supply and ground.

The control module gathers the camera images and analyses and alters them by adjusting perspectives and applying corrections. The resulting processed images are then relayed to the touch screen display via the NTSC (National Television System Committee) analogue video line.

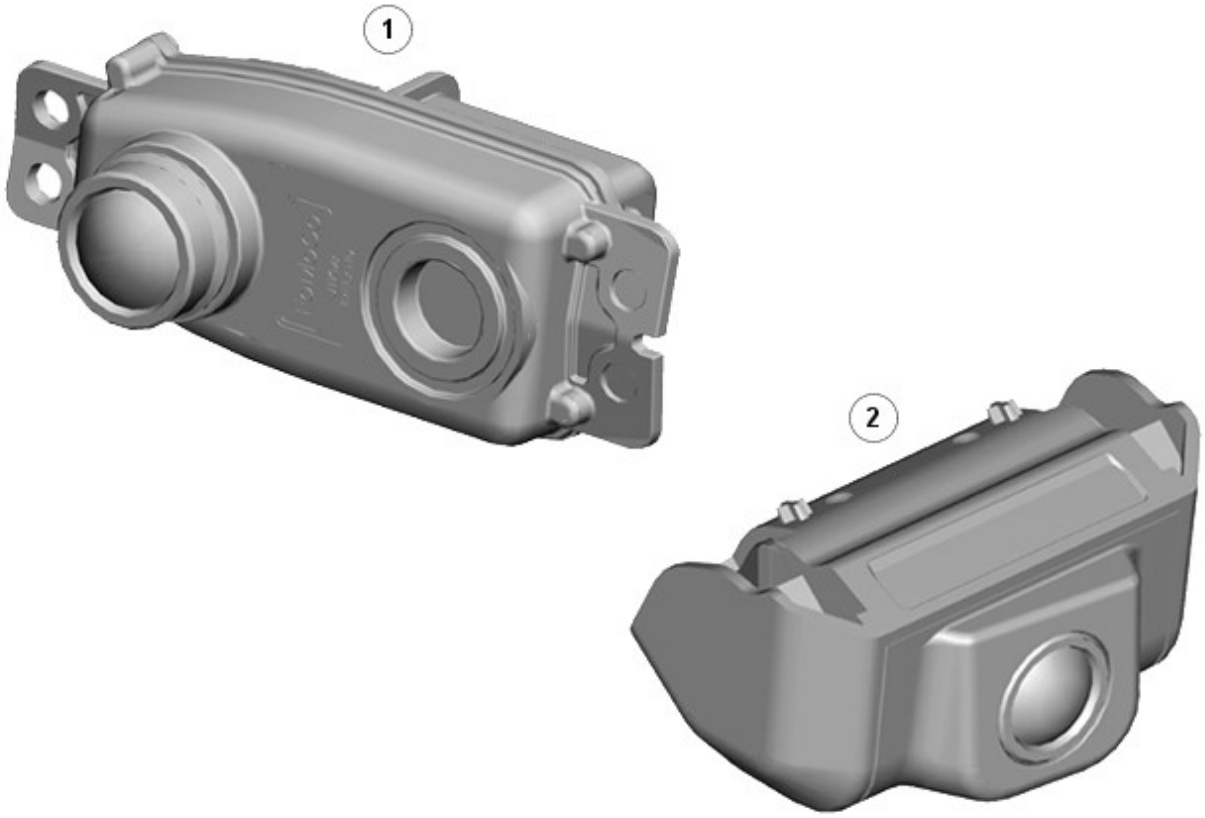
The control module also adds guidance and warning overlays to the camera images to create the various driving-aid features supported by the camera proximity system; for example, visual direction is made available when reversing

the vehicle.

The module communicates with each individual camera via the LIN (local interconnect network) bus connection. This data link transmits diagnostic information, for example camera serial numbers and fault notifications to the control module. Camera adjustments, for instance a correction to color-balance are also communicated via the LIN bus link to the camera.

NOTE: Care must be taken when routing, disconnecting and reconnecting the camera harnesses.

Cameras



E148977

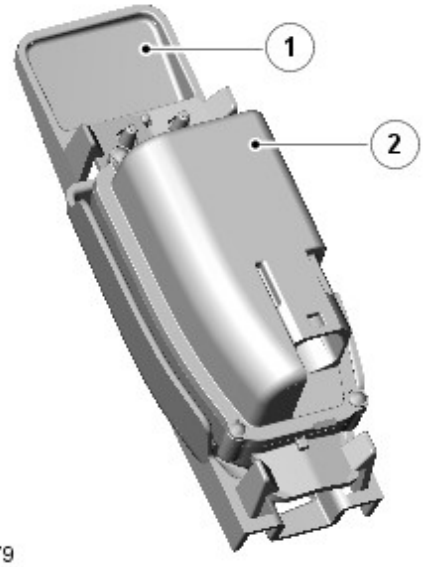
Item	Part Number	Description
1	-	Front and side cameras
2	-	Rear view camera

The system uses five VGA resolution cameras, permanently powered whenever the ignition is 'on'. Each camera provides an image covering a zone approximately 130° wide by 112° deep and is capable of capturing approximately thirty frames per second.

The cameras employ high-quality digital, HDR (High Dynamic Range) imaging, which is a set of techniques that allows a greater range of luminance between light and dark areas of an image scene. This allows HDR to more accurately represent the varying intensity levels found in the image scenes that can range from direct sunlight to deep shadows.

NOTE: Reversing lights are crucial to successful night operation of the rear view camera.

Front Camera mounting



Item	Part Number	Description
1	-	Camera ‘break free’ bracket
2	-	Camera

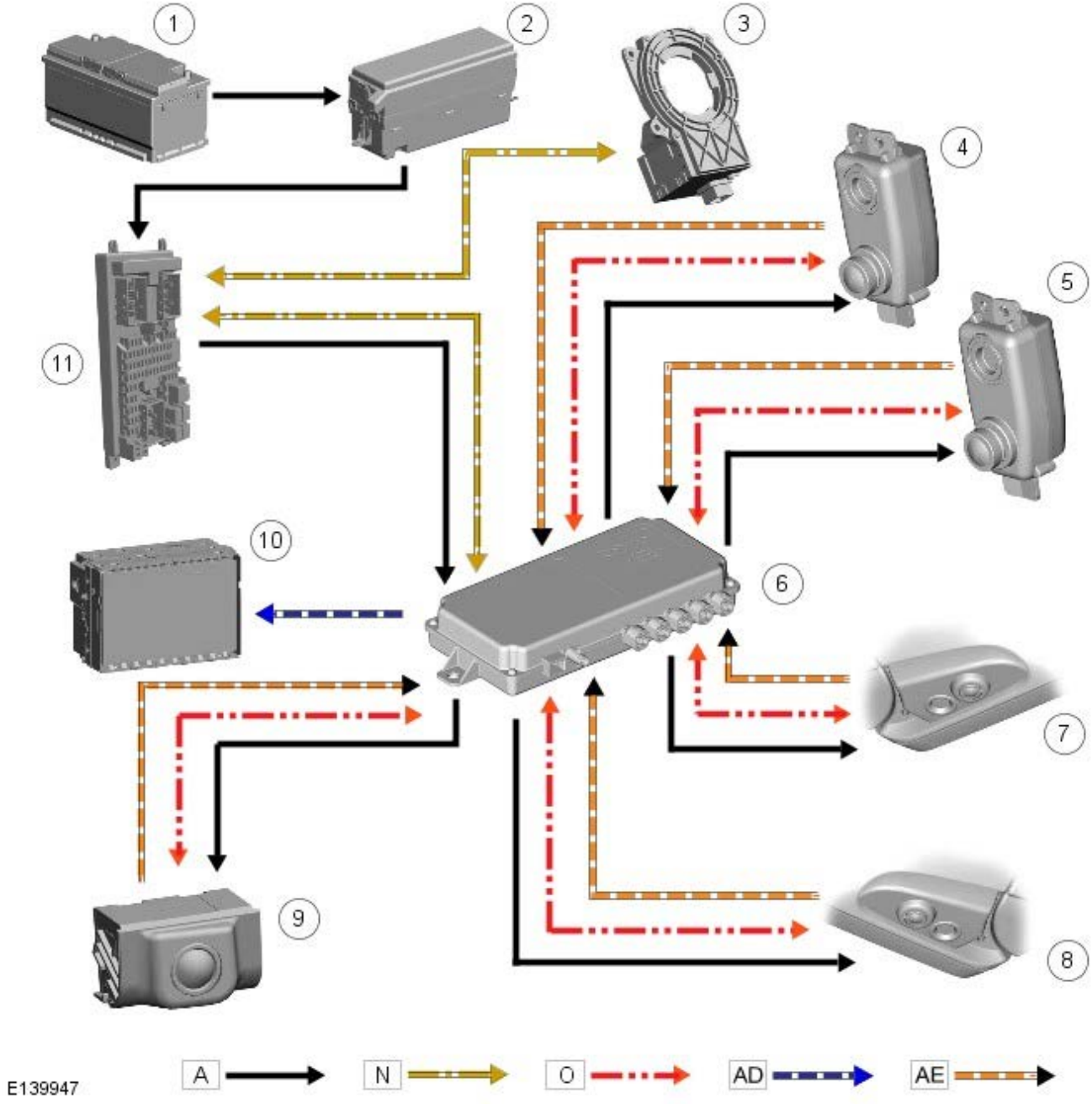
To reduce the cost of accident repair the mounting of the front bumper cameras feature a ‘snap free’ bracket. On impact, the bracket will release the camera preventing damage to the camera itself. Depending on the severity of the accident it may also be possible to reuse the brackets as they are manufactured from a memory type plastic.

The front cameras are not ‘handed’ so therefore interchangeable. This is also applicable for the door-mirror cameras, although these cameras do feature the approach lighting LED integral within the camera body.

The positioning accuracy of all the cameras is crucial for the successful operation of the proximity camera system. The camera housings are manufactured using metal to maintain a structural stability in high-ambient temperatures. Without this stability a loss of image focus would be a possibility, therefore care must be taken when mounting the cameras in ensuring they sit correctly into their locations. Secure mounting of the cameras provides an initial ‘build up’ tolerance accurate to 2mm. In the event of camera replacement a calibration routine must be performed.

CONTROL DIAGRAM

NOTE: **A** = Hardwired; **N** = Medium Speed CAN; **O** = LIN Bus; **AD** = NTSC Signal; **AE** = LVDS Signal.



Item	Part Number	Description
1	-	Battery
2	-	BJB
3	-	Steering wheel angle sensor
4	-	Front bumper camera
5	-	Front bumper camera
6	-	Proximity camera control module
7	-	Mirror camera
8	-	Mirror camera
9	-	Rear view camera
10	-	Touch Screen Display (TSD)
11	-	Central Junction Box (CJB)

SYSTEM OPERATION

Automatic Operation

All markets except Japan

- When reverse gear is selected the rear camera view is shown.
- The images will automatically switch off when the vehicle speed exceeds 18 km/h (11 mph) or a forward gear has been selected for more than five seconds.

Japanese Specification Vehicles Only

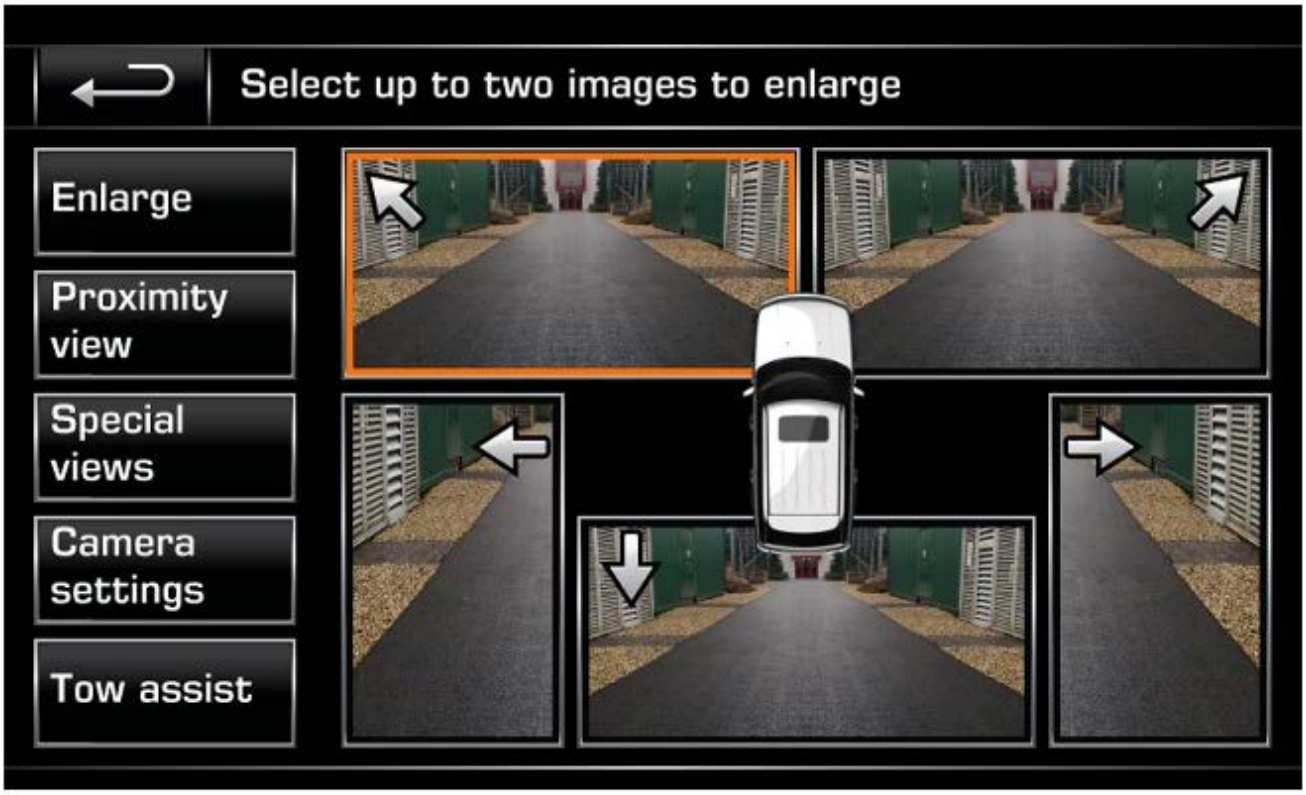
- When either ‘Drive’ of ‘Reverse’ are selected the relevant camera view for the direction of movement is shown.

- When ‘Reverse’ is selected rear camera and RH (right-hand) mirror camera views will be shown.
- When ‘Drive’ is selected front camera and RH mirror camera views will be shown.
- The images will automatically switch off when the vehicle speed exceeds 18 km/h (11 mph), the automatic camera function will only operate once per ignition cycle.

Manual Operation

- The camera views can be accessed by selecting the ‘Cameras’ icon on the ‘Navigation’ home screen on the TSD.

Selecting Views



E148936

- Displayed on the home page are real-time images transmitted from each of the five cameras.
- Any two of the images can be selected and enlarged to view side-by-side on the screen.
- When viewing any two images, any single image can then be selected to view as a full screen image which can be zoomed and panned around using the magnifier and arrow icons.

Manual Proximity View

- Selecting proximity view from the camera home screen will display a combination of three images, from both front cameras and the passenger side door mirror camera. These images provide the driver with an enhanced view of the area forward and opposite the driver.

Rear View Camera



E139948

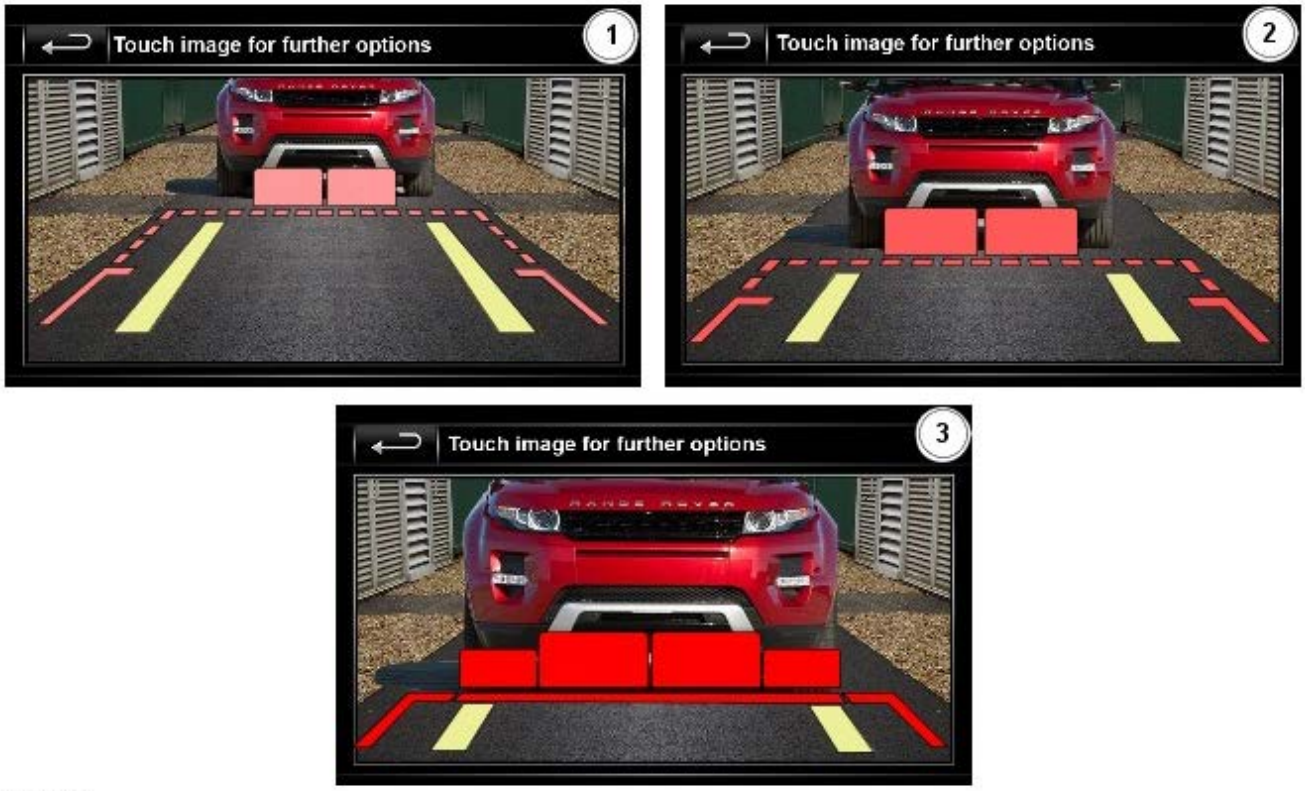
The rear view camera provides additional information to the driver when reversing the vehicle. When reverse gear is selected the camera integrated into the tailgate handle assembly, automatically displays a wide-angle color image of the view from the rear of the vehicle onto the TSD.

The rear view images are overlaid with:

- Dashed lines representing the perimeter of the vehicle.
- Solid lines representing the predicted trajectory of the vehicle; calculated from the steering wheel angle sensor.
- Colored bars represent the amount of distance between the vehicle and the object being approached. Working in conjunction with the standard ‘rear parking aid’ this adds a visual representation to the existing audible warning. The distance data is received from the parking aid module via the medium speed CAN.

The reversing-aid graphics can be disabled in the settings menu or by touching the TSD whilst reverse gear is selected and the camera view is displayed.

Reversing Visual Warnings



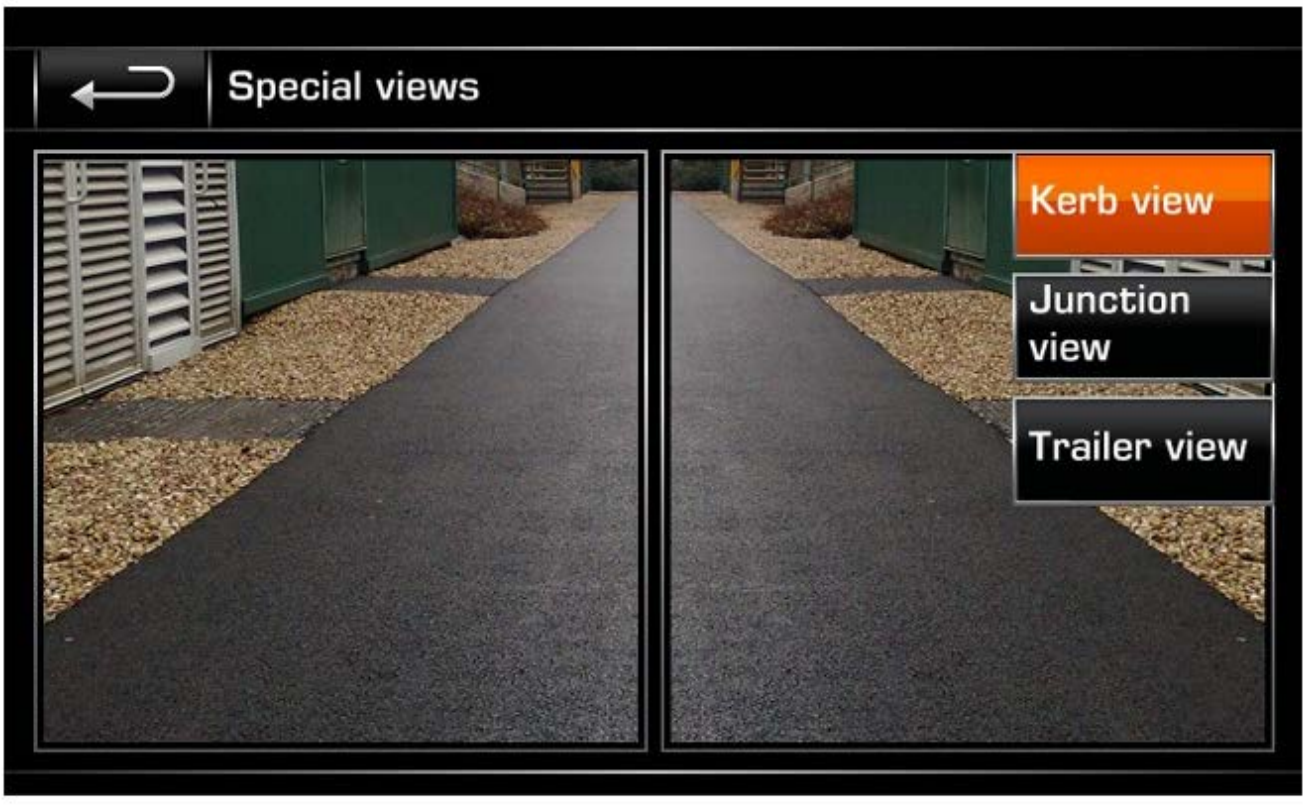
E148937

Item	Part Number	Description
1	-	Object being approached - ‘yellow strip’ with steady intermittent warning tone
2	-	Object being approached - ‘orange strip’ with faster intermittent warning tone
3	-	Object being approached - ‘red strip’ with continuous warning tone

The rear view image will not be displayed when any of the following apply:

- Drive is selected for longer than 5 seconds.
- Drive is selected and the vehicle speed is greater than 18 km/h (11 mile/h).

Special Views



E148971

The special views are a selection of pre-set views that provide the driver with some useful driving aids. These can be considered as a shortcut to some pre-determined images that have been developed to assist the driver in various situations:

- Curb view: downward view from the two door mirror cameras.
- Junction view: outward view from the two front cameras.
- Trailer view: rear camera view of trailer being towed.

System Calibration

This level of accuracy must be maintained after any service procedures are performed on the vehicle that affects the proximity camera system. Should the control module or any one of the cameras require replacement, static re-calibration must be carried out using the approved Land Rover diagnostic equipment.

Camera replacement is detected by the proximity camera control module, through the recognition of a new serial number during the 'camera count' procedure that takes place during the 'ignition on' phase via the LIN. This detection will log a DTC (diagnostic trouble code) advising a calibration routine should be performed.

Alignment adjustments to the cameras are performed using the diagnostic equipment and the vehicle's TSD (touch screen display). During the calibration procedure, setup software in the control module overlays fine colored lines on the TSD highlighting reference points on the bodywork. For example, the mirror camera image must capture the side repeater indicator, the shut-line of the doors and the lower sill trim.

Direction arrows are pressed to shift the image in the desired direction to meet the reference points viewed on the TSD.

Adjustments include:

- Up
- Down
- Left
- Right
- Rotation

When the reference points correspond exactly, the setting is saved and the calibration procedure is complete for that camera.

 NOTE: If body repairs are performed that affect the camera system, a calibration procedure must be executed after the repairs are completed.

System Fault

In the event of camera fault, a DTC is logged in the proximity camera control module and an icon is presented to the driver on the TSD (touch screen display) where the camera image would normally be viewed.

TOW HITCH ASSIST

The rear view camera provides additional information to the driver when hitching a trailer to the vehicle. When reverse gear is selected the camera integrated into the tailgate handle assembly, automatically displays a wide-angle color image of the view from the rear of the vehicle onto the TSD (touch screen display).

Within the settings menu the driver can activate the Hitch Guidance and Auto-towball Zoom feature. Hitch guidance provides a trajectory line indicating the path of the towball in relation to the steering angle applied to the vehicle. 'Auto-towball Zoom' initiates an automatic image zoom when the trailer is within 60cm of the towball to allow more accurate alignment of vehicle to trailer.



Item	Part Number	Description
1	-	Touch Screen Display – Auto towball Zoom feature
2	-	Tow ball trajectory line
3	-	Automatic zoom

TOW ASSIST

Tow Assist aids the driver with the reversing of a trailer by displaying information on the TSD (touch screen display).

The system uses a tracking target sticker attached to the trailer to monitor and predict the direction of the trailer. Calculations are made by the proximity camera control module, based on the relationship of angles between the vehicle and trailer and the current steering wheel position.

Tow Assist becomes active when a trailer is attached to the vehicle and the trailer electrical plug is attached to the vehicle socket. The CJB detects the connection has been made and sends a message via the medium speed CAN to the proximity camera control module.

NOTE: If the connection is not detected, setup can be manually prompted by touching the ‘Tow Assist’ icon on the ‘Camera’ menu.

Tow Assist – New Trailer

When the CJB detects the trailer electrical plug has been connected, the trailer setup screen is displayed automatically on the TSD with the question: ‘Has a trailer been connected?’

Selecting ‘Yes’ will bring up the first of a number of trailer setup screens. On first use the setup screens take the user through a series of configuration options for the connected trailer. To configure a new trailer select ‘Add New’ and then ‘OK’.

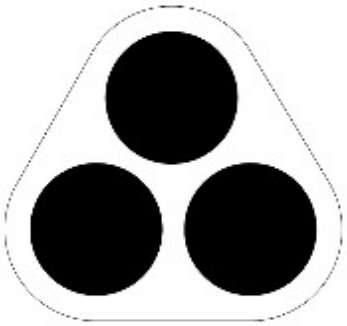
Trailer Setup – Step 1 of 6

- Choose from the list of generic trailer descriptive names for the trailer attached, then select ‘Next’.

Trailer Setup – Step 2 of 6

- Position the trailer straight behind the vehicle, to allow more accurate positioning of the target. Stick the self adhesive tracking target to the front of the trailer within the orange highlighted zone displayed, then select ‘Next’.
- The highlighted zone will turn green when the target sticker is correctly positioned.

Tracking target sticker



E125745

Trailer Setup – Step 3 of 6

- Select the correct number of axles for the chosen trailer, then select ‘Next’.

Trailer Setup – Step 4 of 6

- Select the preferred camera view for use with this trailer, then select ‘Next’.

NOTE: The Side Cameras view is more suited to tall and/or long trailers for example caravans. The Reverse Camera view is more suited to small and/or short trailers.

Trailer Setup – Step 5 of 6

- Using the numeric pad, enter the Hitch Length of the trailer, then select ‘Next’.

NOTE: Hitch Length is the distance from the hitch point to the pivot point of the trailer. The pivot point will vary depending on the number of axles, and will be:

- the center-line of the axle on a single axle trailer,
- the mid-point between the axles on a twin axle trailer,
- the center line of the center axle on a triple axle trailer.

Trailer Setup – Step 6 of 6

- Using the distance adjustment buttons, set the orange overlay graphics at the width of the trailer wheels and then select ‘Finish’.

NOTE: The orange overlay graphics determine the position of the trailer reverse guidance lines.

A confirmation message will appear to show that the trailer information has been retained.

Finally, highlight the trailer that has been memorized, and select ‘OK’.

NOTE: In order to learn the central position of the trailer, the vehicle must be driven forwards at less than 15mph with the steering wheel in the straight-ahead position. There is currently no confirmation for when this process has completed, however the status can be derived by selecting Reverse gear and noting the presence of message 'Trailer tracking in progress'. Whilst tracking feature is learning the central position, the trailer trajectory lines will appear in a light blue color, when process is complete they will change to a dark purple color.

The Tow Assist feature is now ready to use.

Tow Assist – Previously Saved Trailer

When the CJB detects the trailer electrical plug has been connected, the trailer setup screen is displayed automatically on the TSD with the question: ‘Has a trailer been connected?’

Selecting ‘Yes’ from the previous screen brings a list of pre-set, or previously saved, trailers. Highlight the required trailer, and select ‘OK’.

NOTE: In order to learn the central position of the trailer, the vehicle must be driven forwards at less than 15mph with the steering wheel in the straight-ahead position. There is currently no confirmation for when this process has completed, however the status can be derived by selecting Reverse gear and noting the presence of message 'Trailer tracking in progress'. Whilst tracking feature is learning the central position, the trailer trajectory lines will appear in a light blue color, when process is complete they will change to a dark purple color.

The Tow Assist feature is now ready to use.

Published: 03-Dec-2013

Parking Aid - Parking Aid

Diagnosis and Testing

Principles of Operation

For a detailed description of the parking aid system, characteristics and limitations refer to the relevant description and operation section in the workshop manual. REFER to: Parking Aid (413-13 Parking Aid, Description and Operation).

Parking Aid System On-Board Self-Test

As part of the strategy of the system if any DTCs are detected, a long high-pitched tone approx 3 seconds will sound and the parking aid switch (where fitted) indicator LED will flash 6 times at ignition on

- If a fault is present when the parking aid system is activated then the parking aid switch (where fitted) status LED will flash 6 times indicating an issue with front or rear parking aid sensors, wiring switch, parking aid control module or hard wired sounders
- The rear parking aid sounder/rear audio system will emit an error tone for approx 3 seconds at ignition on if a fault is detected with the front or rear sensors, the switch, or if there is a controller area network (CAN) bus error
- (Only applicable to vehicles fitted with front parking aid and a hard wired rear parking aid sounder). If there is a fault with the rear parking aid sounder the error tone will come from the front parking aid sounder unit (integral with the instrument cluster)

Audible and Visual Warnings when Parking Aid System is in Error State

Rear Parking Aid System Fitted and No Parking Aid System Switch Fitted	Rear Parking Aid System Fitted and Parking Aid System Switch Fitted	Front and Rear Parking Aid System Fitted with Parking Aid System Switch Fitted
A long high-pitched error tone will sound at Ignition On for approx 3 seconds	• A long high-pitched error tone will sound at ignition on for approx 3 seconds and the parking aid switch indicator LED will flash 6 times at ignition on. Every time the parking aid system is activated within the same ignition cycle, parking aid switch indicator LED will flash 6 times	• A long high-pitched error tone will sound at ignition on for approximately 3 seconds and the parking aid switch indicator LED will flash 6 times at ignition on. Every time the parking aid system is activated within the same ignition cycle the parking aid switch indicator LED will flash 6 times

Inspection and Verification

CAUTIONS:

If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the warranty policy and procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

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

Do not apply any grease based products to any parking aid system connector or pins

NOTE: Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

1. Verify the customer concern
2. Visually inspect for obvious signs of mechanical or electrical damage
3. Ensure that the parking aid sensor face is clear of contamination that could affect the performance of the sensor

Visual Inspection

Mechanical	Electrical
• Parking aid sensor condition/damaged • Parking aid sensor installation and holder • Parking aid sensor alignment • Parking aid sensor contamination • Bumper cover(s) • Vehicle ride height • Non standard/non manufacturer approved accessories fitted	• Battery • Fuse(s) • Relays • Wiring harness • Electrical connector(s) • Front parking aid sensor(s) • Rear parking aid sensor(s)

	• Parking aid switch and LED • Parking aid control module • Parking aid sounder • Audio system

4. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
5. If the cause is not visually evident, check for diagnostic trouble codes (DTCs) and refer to the DTC index

Symptom Chart

 CAUTION: Do not apply any grease based products to any parking aid system connector or pins

NOTES:

 Please note if this diagnosis is being carried out on a vehicle without a hard wired parking aid speaker, ensure the in car infotainment system is fully functional and configured correctly

 Parking aid sensors that are painted incorrectly and not to the manufacturer standards, will not be considered in any warranty claim

Symptom	Possible Causes	Action
 NOTE: Permanent/Intermittent fault Parking aid system not functioning correctly. (No DTCs displayed)	• Front or rear parking aid sensors dirty • Front or rear parking aid sensor position incorrect • Front or rear parking aid sensor incorrectly installed • Front or rear parking aid sensor coupling rings not installed/incorrectly installed • Parking aid control module or parking aid sensor connector not fully latched • Parking aid sensors painted without being removed from the bumper assembly or not painted to the manufacturer specification	• Clean front or rear parking aid sensors • Check the front or parking aid rear sensor position • Check the front or rear parking aid sensor are correctly installed • Check front or rear parking aid sensor coupling rings are installed/installed correctly • Ensure all parking aid system connectors are correctly latched • Remove parking aid sensor and ensure correctly painted parking aid sensor is installed - Parking aid sensors that are painted incorrectly and not to the manufacturer standards, will not be considered in any warranty claim
 NOTE: Permanent/Intermittent fault Parking aid system not functioning correctly. (No DTCs displayed). System characteristics or environmental effects	• Parking aid sensors incorrectly mounted • Incorrect vehicle ride height • Dirty parking aid sensor face. Ice/snow covered sensor. Debris trapped between parking aid sensor and parking aid sensor body. Heavy rain or water splash from the ground • Non standard, bumper, exhausts/tailpipes, tow bar or external spare wheel mounting • Area around vehicle is not clear of obstacles such as channels, gutters or other	• Ensure the sensors are a tight fit in the holder and locked. Ensure the sensors are central in the holder and bumper and at the correct angle • Ensure vehicle ride height is within the specified limits. Rectify as required • Clean the sensor face as required. Defrost the sensor and dry as required. Clear any debris from the sensor and holder as required. Water flowing over the sensor is a system limitation. (no action required) • Check for non standard, bumper, exhausts/tailpipe, tow bar or external spare wheel mounting that may be being detected by the parking aid system. Rectify as required • Ensure the area around the vehicle is clear of any obstacles, move the vehicle to a suitable area before continuing diagnosis • Ensure no exhaust gas or warm area clouds are in the area around the parking aid sensor detection range • Ensure the vehicle is on level ground and clear of any ramps, potholes or speed bumps, move the vehicle to a suitable area before continuing diagnosis • Remove parking aid sensor and ensure correctly painted parking aid sensor is installed - Parking aid sensors that are painted incorrectly and not to the manufacturer standards, will not be considered in any warranty claim

	items on the ground • Exhaust gas and warm air clouds creating ghost echoes • Vehicle not on level ground or next to a gradient • Parking aid sensors painted without being removed from the bumper assembly or not painted to the manufacturer specification	
Parking aid sensors are being returned with no faults found or signs of water ingress/corrosion	Possible issue with sensor connectors not latched correctly	• When either no/intermittent operation has been reported the following action should be taken • 1. Using Datalogger, identify the position of the suspect parking aid sensor within the bumper • 2. Visually locate the position of the suspect parking aid sensor. Inspect and provide details in claim if the sensor has any sign of physical damage • 3. Remove the bumper. Disconnect the wiring at the main harness connector. Inspect the main harness connectors and terminals for signs of damage, backed out pins, corrosion and water ingress, or damage to the seals. Provide details in claim if any of the above symptoms are present • 4. Attempt to remove the harness connector from the suspect parking aid sensor without using the connector latch i.e. lightly pull back on **ALL** wires together, ensuring the harness is held close to the back of the connector, not elsewhere on the wiring harness. **DO NOT** apply excessive force. If the connector can be removed without using the latch, provide details in claim if connector is loose. If the connector is fully latched, disconnect it from the sensor • 5. Inspect and provide details in claim if the suspect sensor harness connector has any sign of water ingress/corrosion • 6. Inspect and provide details in claim if the suspect parking aid sensor harness connector shows any sign that the terminals have backed-out of the connector or for any damage to the terminal seals. Replace/repair the harness as required and proceed • 7. Remove the suspect parking aid sensor from the bumper. Inspect the parking aid sensor connector for signs of water ingress/corrosion. Provide details in claim if corrosion/water ingress is present • 8. Exchange the suspect parking aid sensor with another parking aid sensor within the bumper that is performing correctly. Reconnect all sensors and reconnect the bumper main harness connector. Repeat step 1. Confirm if the original fault now appears at the new position of the suspect parking aid sensor, if so, proceed to step 10 • 9. If not, carry out the appropriate open circuit and short circuit checks between the original suspect parking aid sensor harness connector and the parking aid control module • 10. Refit the parking aid sensors to their original position in the bumper • 11. Reconnect the parking aid sensor to the bumper harness connector. Reconnect main harness connector and refit the bumper • 12. Repeat Step 1. If fault is still present, **replace only the faulty sensor**

PINPOINT TEST A : PARKING AID SYSTEM NOT FUNCTIONING CORRECTLY WITH NO DTCS LOGGED	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: PERMANENT FAULT	
	1 When the parking aid system is activated, there is a vibration on the parking aid sensor membrane. This can be verified by touching the parking aid sensor face with a hard item such as a pencil, ball-pen, small screwdriver, or fingernail. **Ensure no damage is caused to sensor painted surface**
	Are the parking aid sensor(s) vibrating?

	Yes GO to A2. **No** GO to A5.
A2: SENSORS VIBRATING WITH PARKING AID FAULT	
	1 Clean the parking aid sensor face
	Parking aid system functioning correctly? **Yes** No further action required **No** GO to A3.
A3: SENSORS VIBRATING WITH PARKING AID FAULT	
	1 Check parking aid sensors correctly mounted. Parking aid sensor holder correctly mounted. Parking aid sensor decoupler ring fitted or fitted correctly. Parking aid sensor positioning correct. Parking aid sensor painted without being removed from the bumper assembly or not painted to manufacturer specification. Rectify as required
	Parking aid system functioning correctly? **Yes** No further action required **No** GO to A4.
A4: SENSORS VIBRATING WITH PARKING AID FAULT	
	1 Carry out speaker test. Only applicable to vehicles with rear hard wired parking aid speakers. Check the parking aid speaker wiring circuit and connector. Rectify as required. Check and install a new parking aid speaker as required. Vehicles with audio parking aid system. Confirm audio system is functioning correctly. Refer to the relevant section of the workshop manual
	Parking aid system functioning correctly **Yes** No further action required
A5: SENSORS NOT VIBRATING WITH PARKING AID FAULT	
	1 Isolate the fault to front or rear parking aid sensors
	Are all rear parking aid sensors vibrating? **Yes** GO to A6. **No** GO to A10.
A6: FRONT SENSORS NOT VIBRATING WITH PARKING AID FAULT	
	1 Check the parking aid control module is correctly configured. Check and update the car configuration file as required
	Parking aid system functioning correctly? **Yes** No further action required **No** GO to A7.
A7: FRONT SENSORS NOT VIBRATING WITH PARKING AID FAULT	
	1 Check the correct parking aid control module is installed to the vehicle
	Parking aid system functioning correctly? **Yes** No further action required **No** GO to A8.
A8: FRONT SENSORS NOT VIBRATING WITH PARKING AID FAULT	
	1 If all 4 front parking aid sensors are not vibrating, carry out harness test on common ground, power supply. Check main parking aid harness connector to bumper harness connector. Rectify as required
	Parking aid system functioning correctly? **Yes** No further action required **No** GO to A9.
A9: FRONT SENSORS NOT VIBRATING WITH PARKING AID FAULT	
	1 Check and install a new parking aid control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
	Parking aid system functioning correctly **Yes** No further action required
A10: REAR SENSORS NOT VIBRATING WITH PARKING AID FAULT	
	1 Check the parking aid control module is correctly configured. Check and update the car configuration file as required
	Parking aid system functioning correctly? **Yes** No further action required **No** GO to A11.
A11: REAR SENSORS NOT VIBRATING WITH PARKING AID FAULT	

	1 If all 4 rear parking aid sensors are not vibrating, carry out harness test on common ground, power supply. Check main parking aid harness connector to bumper harness connector. Rectify as required
	Parking aid system functioning correctly **Yes** No further action required **No** GO to A12.
A12: REAR SENSORS NOT VIBRATING WITH PARKING AID FAULT	
	1 Check and install a new parking aid control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
	Parking aid system functioning correctly **Yes** No further action required

PINPOINT TEST B : PARKING AID SYSTEM NOT FUNCTIONING CORRECTLY WITH NO DTCS LOGGED	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: PARKING AID SYSTEM GIVES WARNING SIGNAL WITHOUT OBSTACLE	
	1 Clean the parking aid sensor face. Check for any damage to the parking aid sensor face. Rectify as required. Snow, water or ice on sensor face. Parking aid sensor face has been repainted to the incorrect thickness. Rectify as required
	Parking aid system functioning correctly? **Yes** No further action required **No** GO to B2.
B2: PARKING AID SYSTEM GIVES WARNING SIGNAL WITHOUT OBSTACLE	
	1 Ensure the vehicle ride height is within manufacturer specified limits. Rectify as required
	Parking aid system functioning correctly? **Yes** No further action required **No** GO to B3.
B3: PARKING AID SYSTEM GIVES WARNING SIGNAL WITHOUT OBSTACLE	
	1 Check for any non standard accessories are not fitted, such as tow bar, bike rack, body kit, modified exhaust, lighting or licence plate holder
	Parking aid system functioning correctly? **Yes** No further action required **No** GO to B4.
B4: PARKING AID SYSTEM GIVES WARNING SIGNAL WITHOUT OBSTACLE	
	1 Limitations or characteristics of the parking aid system such as vehicle on a gradient, exhaust gas vapour, signal reflection
	Parking aid system functioning correctly? **Yes** No further action required **No** For a detailed description of the parking aid system, refer to the relevant description and operation section in the workshop manual. REFER to: Parking Aid (413-13 Parking Aid, Description and Operation).

DTC Index

For a list of diagnostic trouble codes that could be logged on this vehicle, please refer to Section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Parking Aid Control Module (PACM) (100-00 General Information, Description and Operation).

Published: 11-Apr-2012

Parking Aid - Parking Aid Camera Module

Removal and Installation

Removal

NOTES:

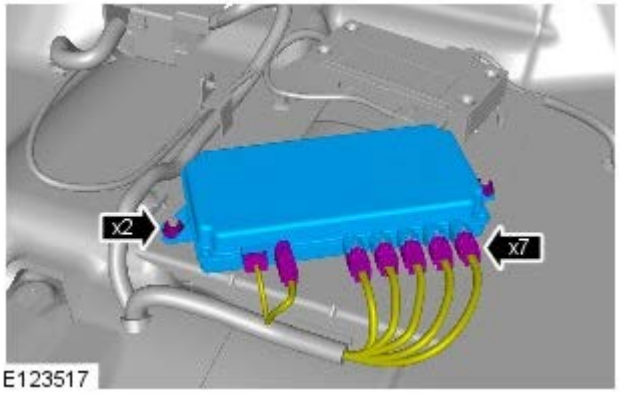
Removal steps in this procedure may contain installation details.

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

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00, Specifications).

2. Move the front seat to the fully forward and fully raised positions to allow access.



3. CAUTION: Take extra care not to damage the wiring harnesses.

   Torque: 5 Nm

Installation

1. CAUTION: If a new component has been installed, configure using Land Rover approved diagnostic equipment.

   To install, reverse the removal procedure.

Published: 11-May-2011

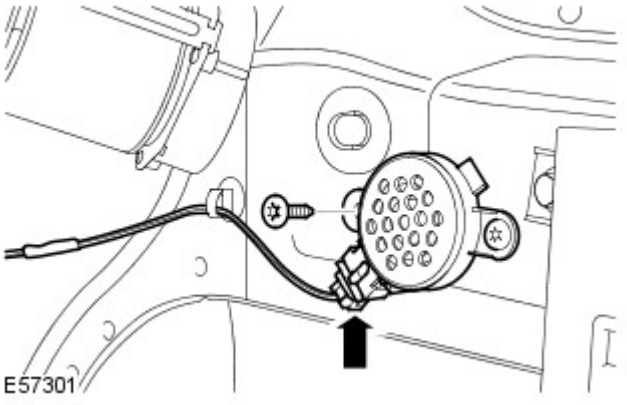
Parking Aid - Parking Aid Speaker

Removal and Installation

Removal

1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

2. Remove the LH lower rear quarter trim panel.
   For additional information, refer to: Rear Quarter Trim Panel (501-05, Removal and Installation).



3. Remove the parking aid sounder.
   - Remove the 2 screws.
   - Disconnect the electrical connector.

Installation

1. Install the parking aid sounder.
   - Tighten the screws.
   - Connect and secure the electrical connector.

2. Install the rear quarter trim panel.
   For additional information, refer to: Rear Quarter Trim Panel (501-05, Removal and Installation).

3. Connect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

Published: 11-May-2011

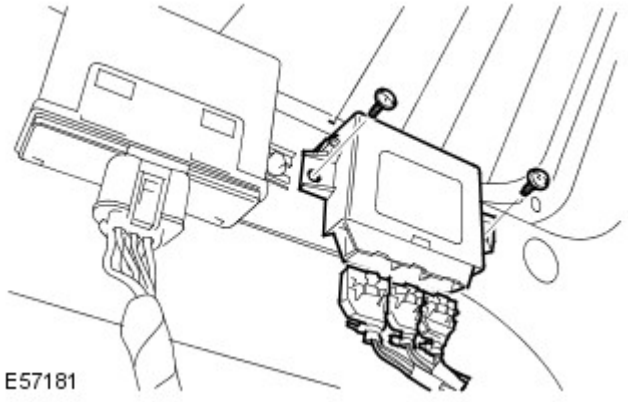
Parking Aid - Parking Aid Module

Removal and Installation

Removal

1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

2. Remove the LH rear quarter trim panel.
   For additional information, refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



3. Remove the parking aid module.
   - Remove the 2 screws.
   - Disconnect the 3 electrical connectors.

Installation

1. Install the parking aid module.
   - Connect and secure the electrical connectors.
   - Tighten the screws.

2. Install the rear quarter trim panel.
   For additional information, refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Connect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

Published: 04-Mar-2013

Parking Aid - Front Inner Parking Aid Sensor

Removal and Installation

Removal

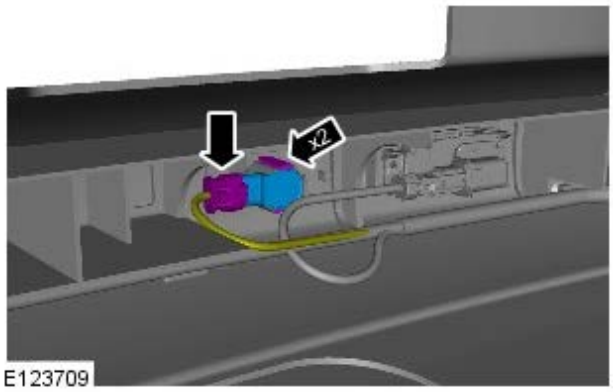
NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00, Specifications).

2. Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).

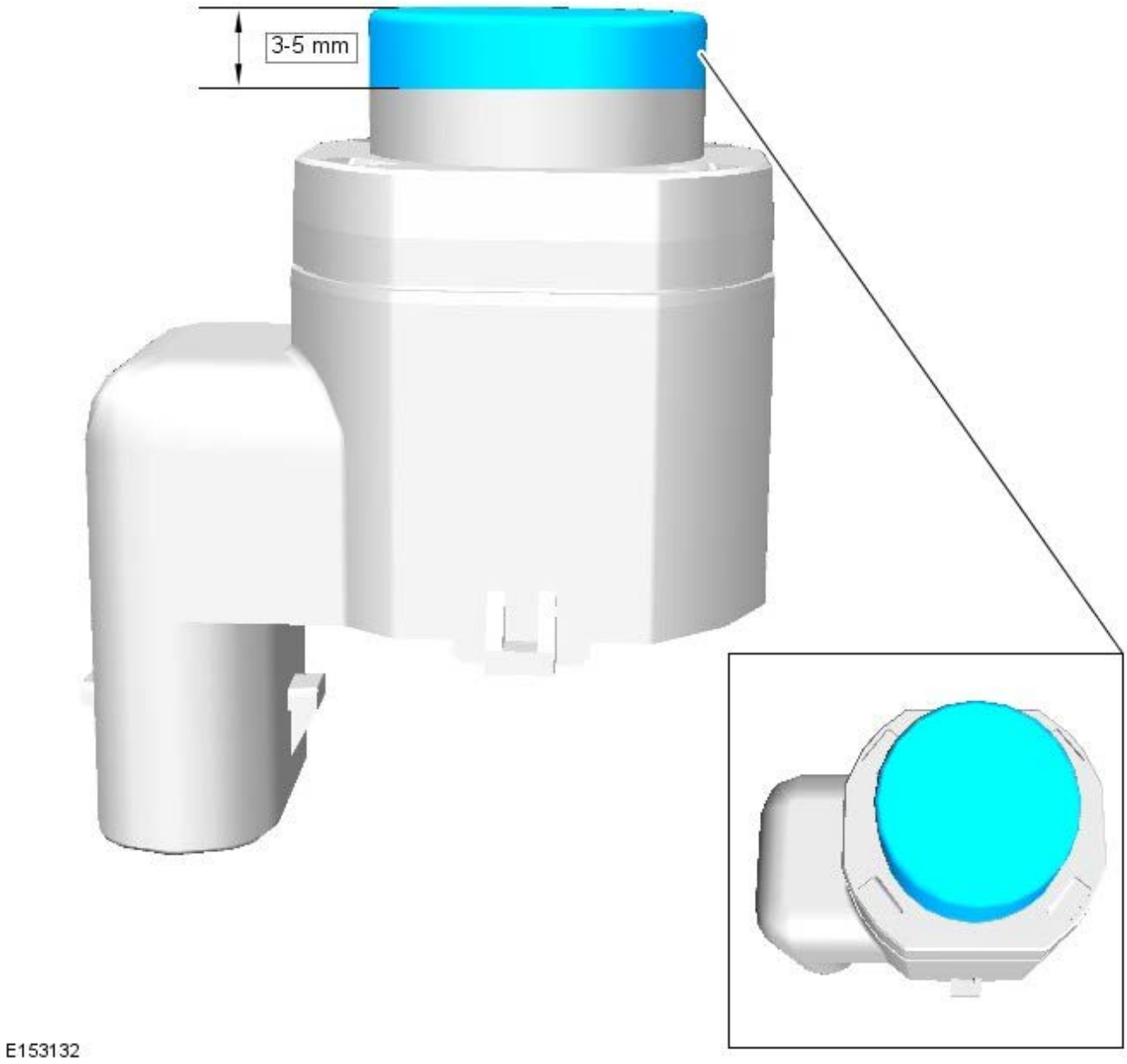
3.



Installation

1. CAUTION: If a new sensor is installed, make sure that the area illustrated is the **only** area painted. Failure to follow this instruction may result in the component malfunctioning.

   NOTE: On vehicles that are equipped with black or unpainted bumpers, the sensor(s) do not require painting.



E153132

2. To install, reverse the removal procedure.

Published: 04-Mar-2013

Parking Aid - Front Outer Parking Aid Sensor

Removal and Installation

Removal

CAUTION: LH illustration shown, RH is similar.

NOTES:

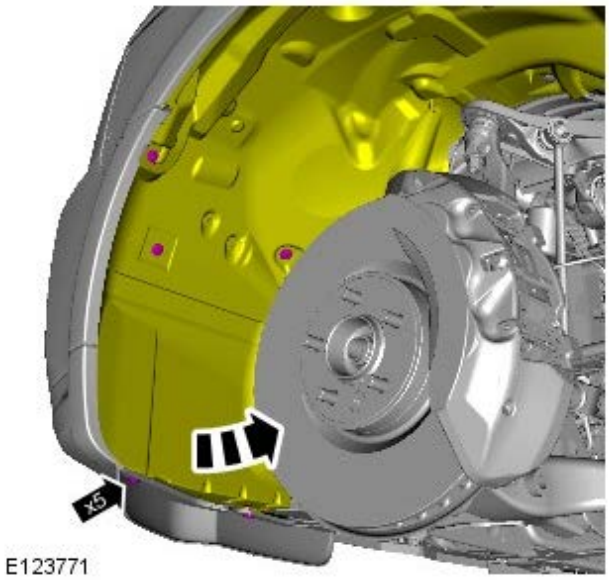
Removal steps in this procedure may contain installation details.

The ignition must be switched off.

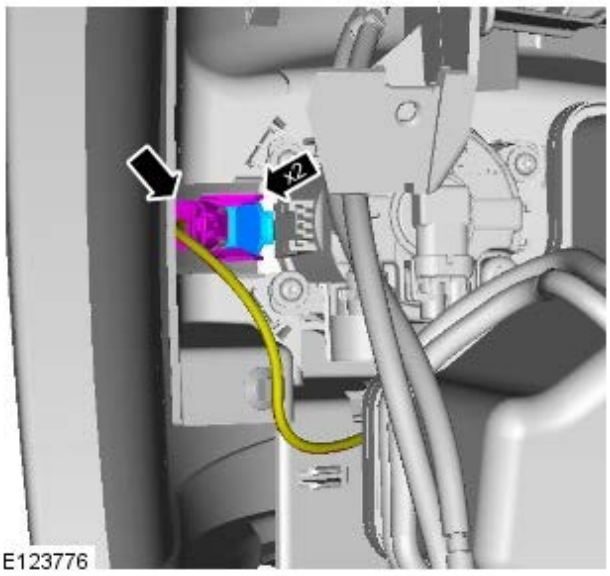
1. WARNING: Make sure to support the vehicle with axle stands.

   Remove the front wheel and tire.

2. *Torque:* 1 Nm



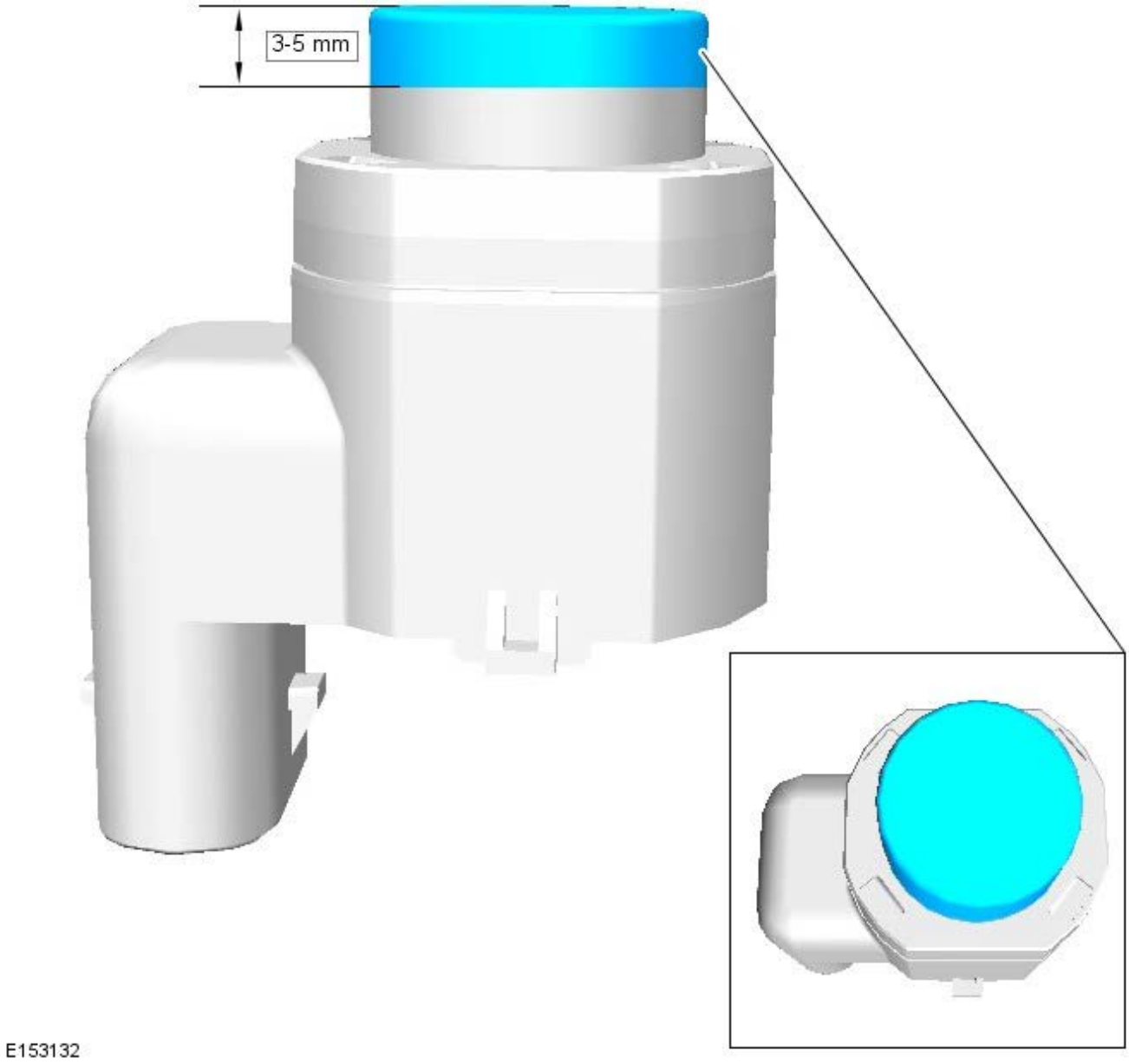
3.



Installation

1. CAUTION: If a new sensor is installed, make sure that the area illustrated is the **only** area painted. Failure to follow this instruction may result in the component malfunctioning.

NOTE: On vehicles that are equipped with black or unpainted bumpers, the sensor(s) do not require painting.



2. To install, reverse the removal procedure.

Published: 11-May-2011

Parking Aid - Front Parking Aid Camera

Removal and Installation

Removal

NOTES:

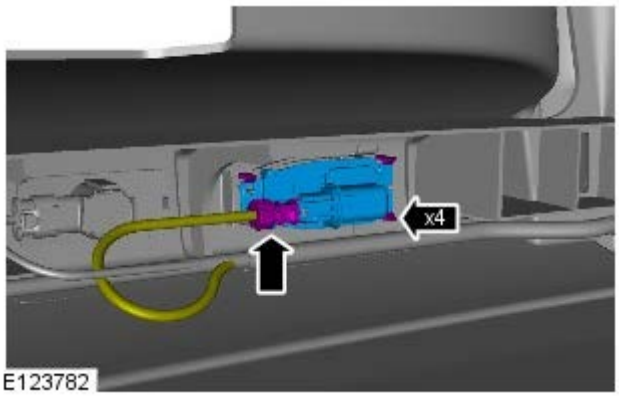
Removal steps in this procedure may contain installation details.

The ignition must be switched off.

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

   Raise and support the vehicle.

2. Refer to: Front Bumper Cover (501-19, Removal and Installation).



3. CAUTIONS:

   LH illustration shown, RH is similar.

   Make sure that the component is correctly located on the locating dowels.

   Take extra care not to damage the wiring harnesses.

Installation

1. CAUTION: If a new component has been installed, configure using Land Rover approved diagnostic equipment.

   To install, reverse the removal procedure.

Published: 04-Mar-2013

Parking Aid - Rear Inner Parking Aid Sensor

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

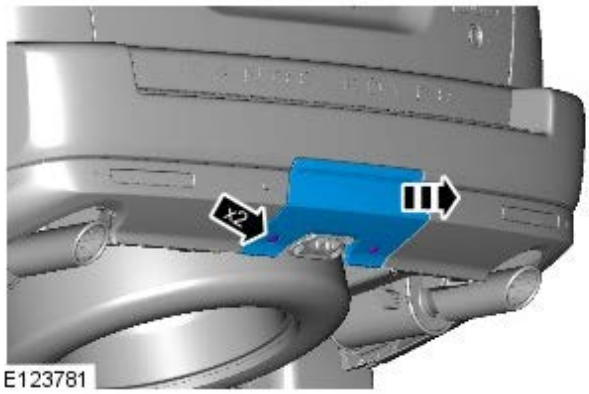
The ignition must be switched off.

RH illustration shown, LH is similar.

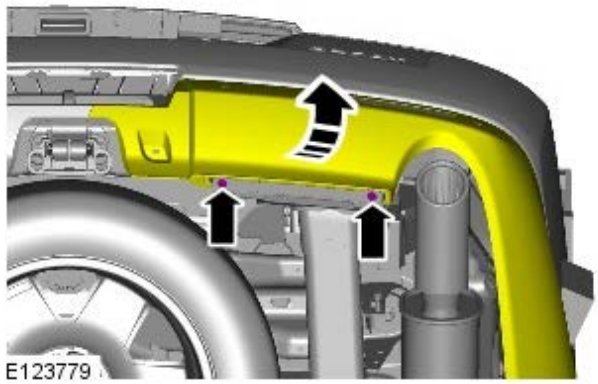
1. WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

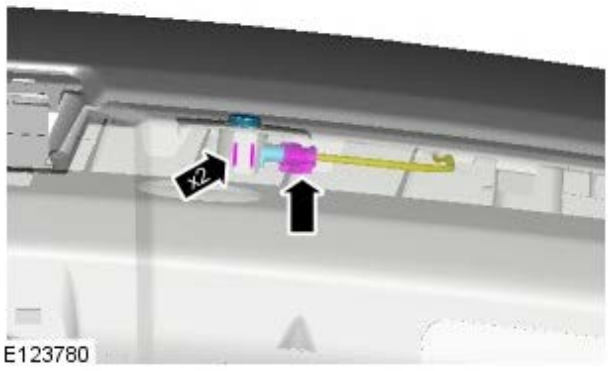
2.



3. *Torque:* 1 Nm



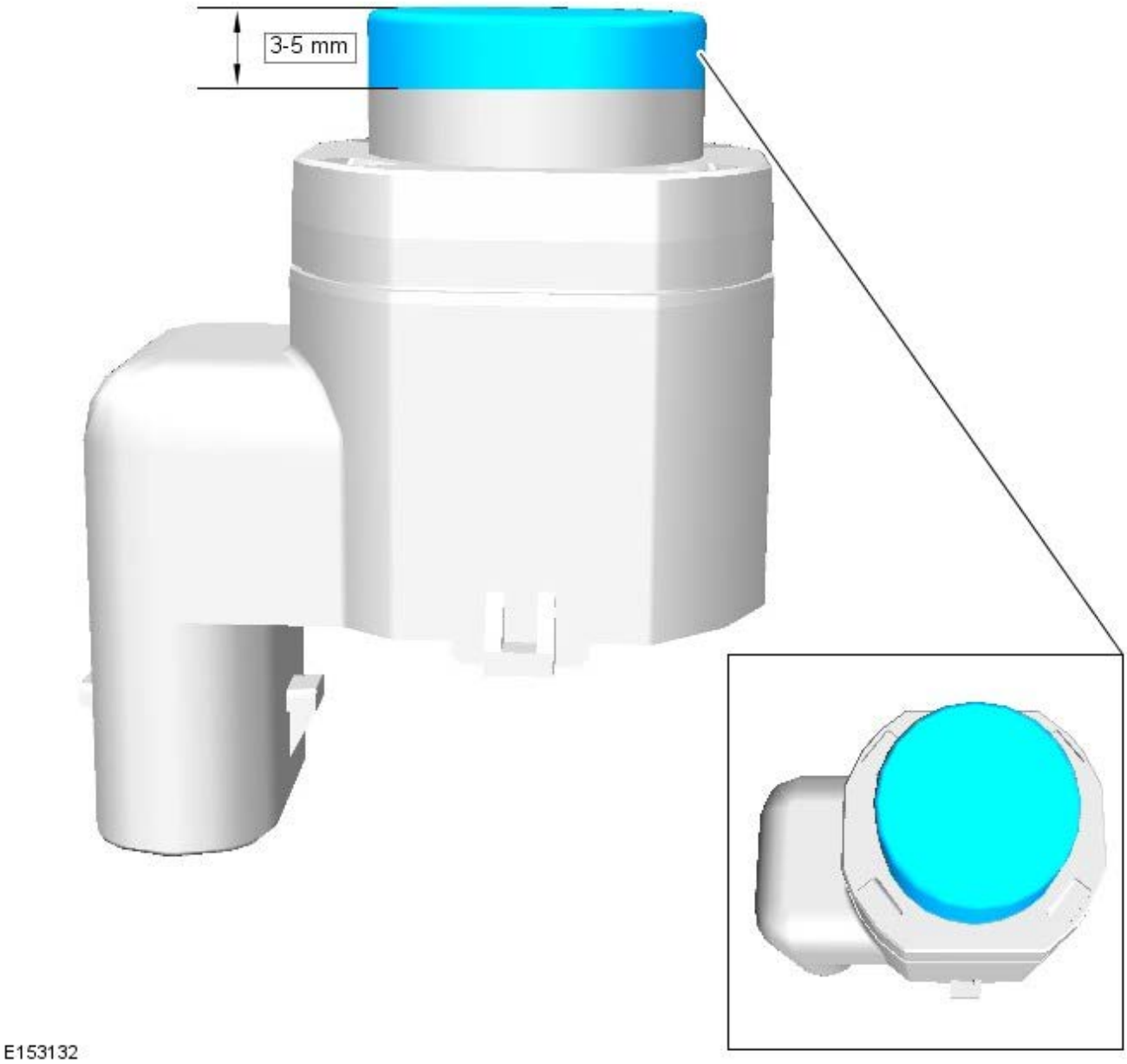
4.



Installation

1. CAUTION: If a new sensor is installed, make sure that the area illustrated is the **only** area painted. Failure to follow this instruction may result in the component malfunctioning.

   NOTE: On vehicles that are equipped with black or unpainted bumpers, the sensor(s) do not require painting.



2. To install, reverse the removal procedure.

Published: 04-Mar-2013

Parking Aid - Rear Outer Parking Aid Sensor

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

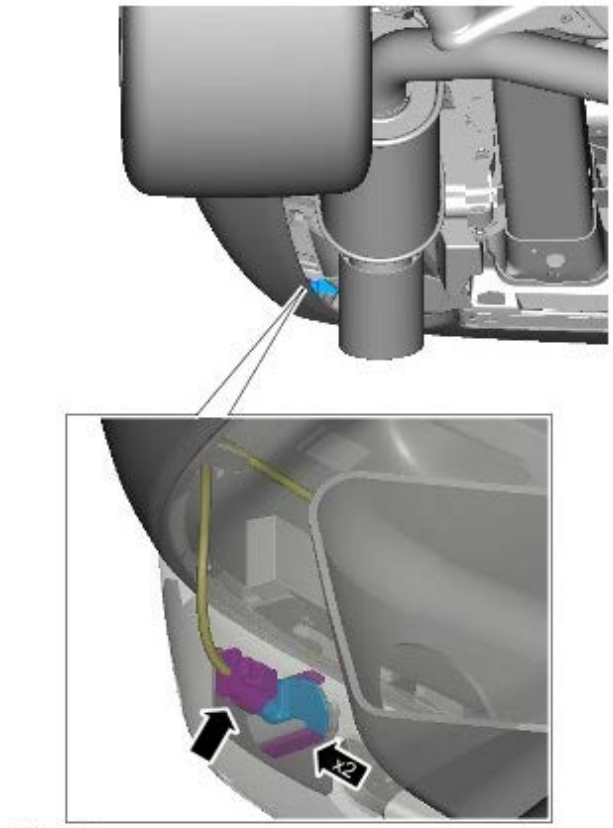
The ignition must be switched off.

RH illustration shown, LH is similar.

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

   Raise and support the vehicle.

2.

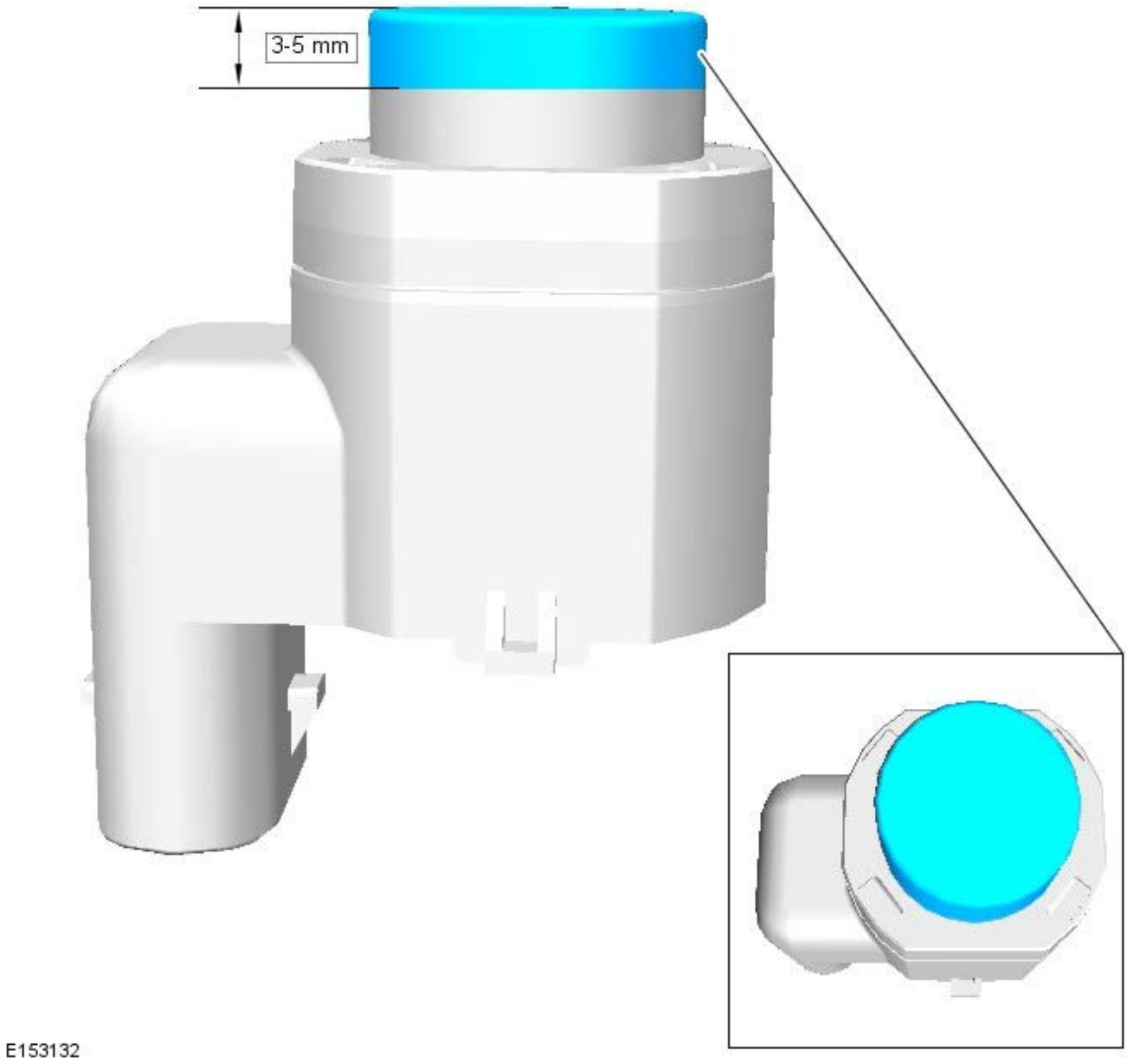


E123778

Installation

1. CAUTION: If a new sensor is installed, make sure that the area illustrated is the **only** area painted. Failure to follow this instruction may result in the component malfunctioning.

   NOTE: On vehicles that are equipped with black or unpainted bumpers, the sensor(s) do not require painting.



E153132

2. To install, reverse the removal procedure.

Published: 11-May-2011

Parking Aid - Side Parking Aid Camera

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

RH illustration shown, LH is similar.

The ignition must be switched off.

1. Refer to: Exterior Mirror Cover (501-09, Removal and Installation).



2. CAUTIONS:

   Take extra care not to damage the component.

   Take extra care not to damage the wiring harnesses.

   Torque: 0.5 Nm

Installation

1. CAUTION: If a new component has been installed, configure using Land Rover approved diagnostic equipment.

   To install, reverse the removal procedure.

Published: 11-May-2011

Parking Aid - Parking Aid Camera

Removal and Installation

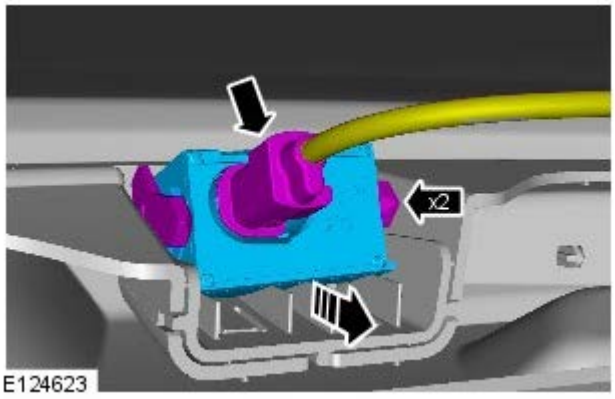
Removal

NOTES:

Removal steps in this procedure may contain installation details.

The ignition must be switched off.

1. Refer to: Rear Spoiler (501-08, Removal and Installation).



2. CAUTIONS:

   Take extra care not to damage the clips.

   Take extra care not to damage the wiring harnesses.

Installation

1. To install, reverse the removal procedure.

Published: 14-Jun-2011

Battery and Charging System - General Information -

Battery

Item	Specifications
All Gasoline (Petrol) Models:	
Type	Maintenance free lead-calcium
Capacity	690 amps - 75 amp/hour
Reserve capacity	150 minutes @ 25 amps
Diesel Models:	
Type	Maintenance free lead-calcium
Capacity	825 amps - 90 amp/hour
Reserve capacity	190 minutes @ 25 amps

Battery Disconnect/Connect

CAUTION: The vehicle status and battery condition must be established before attempting battery disconnect/connect. Reference must be then made to the following table to establish the relevant procedure to be followed.

Vehicle status	Battery charged	Battery discharged
	Procedure	Procedure
Engine running	1	
Vehicle powered down, locked and alarmed	2	3
Vehicle unlocked	4	5

Procedure 1

Disconnect battery	Connect battery
1. If possible, apply parking brake or alternatively, chock wheels	**1.** Ensure that all electrical loads are switched **OFF**
2. Switch off ignition	**2.** Connect battery leads - GROUND lead last
3. Wait 2 minutes for engine management system to 'power down'	**3.** Switch on ignition
4. Open the hood	**4.** Operate parking brake switch several times until parking brake warning lamp is extinguished
5. Disconnect battery - GROUND lead first	**5.** Reset electric window one-touch facility. Power window up to hard stop, release switch, reapply and hold for 1 second (relay in door will click). One touch should now work

Procedure 2

Disconnect battery	Connect battery
1. Unlock the vehicle and disarm the alarm using the 'plip' button	**1.** Ensure that all electrical loads are switched **OFF**
2. Enter the vehicle, turn the ignition key to position II, apply the parking brake or chock the wheels and then turn the ignition key to position 0. Remove the key to 'power down' the ICE system	**2.** Connect battery leads - GROUND lead last
3. Wait 2 minutes for engine management system to 'power down'	**3.** Switch on ignition
4. Open the hood	**4.** Operate parking brake switch several times until parking brake warning lamp is extinguished
5. Disconnect battery - GROUND lead first	**5.** Reset electric window one-touch facility. Power window up to hard stop, release switch, reapply and hold for 1 second (relay in door will click). One touch should now work

NOTE: **1. Disconnect battery -** The door unlock process initialises the ICE system.

Procedure 3

Disconnect battery	Connect battery
1. Unlock the vehicle from the left hand front door using the key	**1.** Ensure that all electrical loads are switched **OFF**
2. Enter the vehicle, turn the ignition key to position II, apply the parking brake or chock the wheels and then turn the ignition key to position 0. Remove the key to 'power down' the ICE system	**2.** Connect battery leads - GROUND lead last
3. Wait 2 minutes for engine management system to 'power down'	**3.** Switch on ignition
4. Open the hood	**4.** Operate parking brake switch several times until parking brake warning lamp is extinguished
5. Disconnect battery - GROUND lead first	**5.** Reset electric window one-touch facility. Power window up to hard stop, release switch, reapply and hold for 1 second (relay in door will click). One touch should now work

NOTES:

1. - Disconnect battery - The door unlock process initialises the ICE system

1. Connect battery - If there is insufficient capacity in the battery to disarm the alarm, the alarm may sound on reconnection of the battery - Step 3 will disarm the alarm

Procedure 4

Disconnect battery	Connect battery
1. Enter the vehicle, turn the ignition key to position II, apply the parking brake or chock the wheels and then turn the ignition key to position 0. Remove the key to 'power down' the ICE system	**1.** Ensure that all electrical loads are switched **OFF**
2. Wait 2 minutes for engine management system to 'power down'	**2.** Connect battery leads - GROUND lead last
3. Open the hood	**3.** Switch on ignition
4. Disconnect battery - GROUND lead first	**4.** Operate parking brake switch several times until parking brake warning lamp is extinguished
	5. Reset electric window one-touch facility. Power window up to hard stop, release switch, reapply and hold for 1 second (relay in door will click). One touch should now work

Procedure 5

Disconnect battery	Connect battery
1. Enter the vehicle, turn the ignition key to position II, apply the parking brake or chock the wheels and then turn the ignition key to position 0. Remove the key to 'power down' the ICE system	**1.** Ensure that all electrical loads are switched **OFF**
2. Wait 2 minutes for engine management system to 'power down'	**2.** Connect battery leads - GROUND lead last
3. Open the hood	**3.** Switch on ignition
4. Disconnect battery - GROUND lead first	**4.** Operate parking brake switch several times until parking brake warning lamp is extinguished
	5. Reset electric window one-touch facility. Power window up to hard stop, release switch, reapply and hold for 1 second (relay in door will click). One touch should now work

NOTE: **1. Disconnect battery -** If the remote control module (RCM) is not functioning, it will be necessary to manually unlock the vehicle using the key.

Vehicle Jump (Emergency) Starting - Using Another Vehicle

Carry out the following operations in the sequence given
1. Connect one end of the BLACK (-) booster cable to the GROUND (-) battery terminal of the **DONOR** vehicle
2. Connect the other end of the BLACK (-) booster cable to a good earth point e.g. unpainted metal surface or engine mounting at least 0.5 m (20.0 in) from the battery or fuel lines on the **DISABLED** vehicle
3. Connect one end of the RED (+) booster cable to the positive (+) battery terminal of the **DONOR** vehicle
4. Connect the other end of the RED (+) booster cable to the positive (+) battery terminal of the **DISABLED** vehicle
5. Start the engine of the **DONOR** vehicle and allow it to idle for a few minutes
6. Start the engine of the **DISABLED** vehicle
7. Allow engines of both vehicles to idle for a few minutes then switch off the engine of the **DONOR** vehicle
8. Disconnect the RED (+) booster cable from the battery of the **PREVIOUSLY DISABLED** vehicle
9. Disconnect the RED (+) booster cable from the battery of the **DONOR** vehicle
10. Disconnect the BLACK (-) booster cable from the earth point of the **PREVIOUSLY DISABLED** vehicle
11. Disconnect the BLACK (-) booster cable from the battery of the **DONOR** vehicle

WARNINGS:

During normal use, batteries emit explosive hydrogen gas sufficient to cause severe explosions and capable of causing serious injury - keep sparks and naked lights away from the engine compartment.

DO NOT attempt to start the disabled vehicle if it is suspected that the electrolyte in the battery is frozen.

Suitable eye protection must be worn when working in the vicinity of the battery.

Take care when working near rotating parts of the engine.

Prior to attempting to start the disabled vehicle, ensure that the parking brake is applied or suitably chock the

wheels. Ensure that 'P' - PARK - Automatic Gearbox or NEUTRAL - Manual Gearbox is selected.

CAUTIONS:

 Ensure that all electrical loads are switched OFF prior to connecting booster cables and disconnect booster cables prior to using any electrical equipment.

 Ensure that the battery of the DONOR vehicle is of 12 volt capacity and that all electrical loads on the disabled vehicle are switched OFF prior to connecting booster cables.

 Ensure that there is no physical contact between the donor and disabled vehicles other than the booster cables.

Vehicle Jump (Emergency) Starting - Using a Slave Battery/Starting Aid

Carry out the following operations in the sequence given
1. Connect the end of the BLACK (-) booster cable to the ground (-) battery terminal of the vehicle
2. Connect the end of the RED (+) booster cable to the positive (+) battery terminal of the vehicle
3. Start the engine of the vehicle and allow it to idle
4. Disconnect the RED (+) booster cable from the battery terminal of the vehicle
5. Disconnect the BLACK (-) booster cable from the battery terminal of the vehicle

WARNINGS:

 During normal use, batteries emit explosive hydrogen gas sufficient to cause severe explosions and capable of causing serious injury - keep sparks and naked lights away from the engine compartment.

 DO NOT attempt to start the disabled vehicle if it is suspected that the electrolyte in the battery is frozen.

 Suitable eye protection must be worn when working in the vicinity of the battery.

 Take care when working near rotating parts of the engine.

 Prior to attempting to start the disabled vehicle, ensure that the parking brake is applied or suitably chock the wheels. Ensure that 'P' - PARK - Automatic Gearbox or NEUTRAL - Manual Gearbox is selected.

CAUTIONS:

 Ensure that all electrical loads are switched OFF prior to connecting booster cables and disconnect booster cables prior to using any electrical equipment.

 Ensure that the slave battery/starting aid are of 12 volt capacity and that all electrical loads on the disabled vehicle are switched OFF prior to connecting booster cables.

Published: 05-Dec-2012

Battery and Charging System - General Information - Battery Care Requirements

Description and Operation

1. INTRODUCTION

This document sets out the requirements for care and maintenance of batteries and thereby the standard of battery care at dealers and retailers for new vehicles

This applies to all types of 12 Volt Lead Acid Batteries used in Jaguar and Land Rover vehicles whether they are conventional flooded technology or Absorbed Glass Mat (AGM – also known as Valve Regulated Lead Acid (VRLA)) technology and also applies to both Primary and Auxiliary Batteries. AGM batteries offer improved resistance to cycling as seen in stop start applications.

In order to prevent damage to the battery and ensure a satisfactory service life, all processes detailed within this document must be rigorously adhered to.

It is equally important therefore to note the following key points:

- All new vehicles leave the factory with either a transit relay installed and/or have a transit mode programmed into the vehicle control modules. The transit relay must be removed and the transit mode disabled (where applicable) using an approved diagnostic system, **NOT MORE THAN 72 HOURS** before the customer takes delivery.
- The battery can be discharged by the following mechanisms:
  - **Self Discharge**: -A lead acid battery will very slowly discharge itself due to its own internal chemical processes whether it is connected to a vehicle or not.
  - **Quiescent Discharge**: - The vehicle electrical systems when connected to the battery will draw charge from the battery.

12 Volt Lead Acid Batteries rely on internal chemical processes to create a voltage and deliver current. These processes and the internal chemical structure of the battery can be damaged if the battery is allowed to discharge over a number of weeks / months, or is left in a discharged state for a lengthy time period.

- **On vehicles with conventional ignition keys**, these must not be left in the ignition lock barrel when the transit relay has been removed, otherwise quiescent current will increase and the battery will discharge more rapidly.
- **For keyless vehicles**, the Smart Key must be stored at least 5m away from the vehicle when the vehicle is parked or stored.
- **AGM Batteries are fully sealed and cannot have the electrolyte level topped up.**

NOTE: Dealers and retailers involved in the storage / handling of vehicles and replacement batteries have a responsibility to ensure that only a fully charged battery may be processed through the distribution selling chain.

2. GENERAL RULES FOR BATTERY CARE

2.1 Dealer Demonstration Vehicles

Vehicles used as dealer demonstrator(s), in a showroom, must be connected to a showroom conditioner capable of delivering 50 Amps. This will prevent the battery from being damaged.

2.2 Software Reflash, SDD work or Ignition On related workshop activities

Due to the high electrical current demand and high depth of Discharge that can occur during vehicle software re-flash activities, SDD work or ignition on related work in the workshop, vehicles that are undergoing such activities MUST have a power supply capable of delivering 50 Amps or more.

2.3 Extended Vehicle Rework

For any extended vehicle rework that results in consuming vehicle power, either the battery should be disconnected or a suitable power supply connected.

2.4 Jump Starting New vehicles before they have been delivered to the customer

- It is the dealer / retailers responsibility to make sure the battery is not allowed to go flat by following the instructions and processes defined in this manual.
- However, if circumstances dictate that a new vehicle must be jump started due to a flat battery whilst the vehicle is in the dealer / retailers care, **the battery on this vehicle must be replaced with a new** one prior to delivery to the customer at the dealer / retailers liability.
- The vehicle should also undergo investigation as to why the battery went flat.
- Do not connect the jump starting cable to the negative (-) terminal of the battery. Always connect to the recommended earth point. As defined in the owners handbook or service documentation for that vehicle.

2.5 AGM Batteries

- **AGM batteries must not be charged above 14.8 Volts. Doing so will damage them.**
- AGM Batteries must be tested with a capable battery tester as **detailed in the equipment section (Section 5) of this procedure.**

NOTE: Under no circumstances should the battery be disconnected with the engine running because under these conditions the alternator can give a very high output voltage. This high transient voltage will damage the electronic components in the vehicle. Loose or incomplete battery connections may also cause high transient voltage.

3. HEALTH AND SAFETY PRECAUTIONS

WARNINGS:

BATTERY CELLS CONTAIN SULPHURIC ACID AND EXPLOSIVE MIXTURES OF HYDROGEN AND OXYGEN GASES. IT IS THEREFORE ESSENTIAL THAT THE FOLLOWING SAFETY PRECAUTIONS ARE OBSERVED.

Batteries emit highly explosive hydrogen at all times, particularly during charging. To prevent any potential form of ignition occurring when working in the vicinity of a battery:

- Do not smoke when working near batteries.
- Avoid sparks, short circuits or other sources of ignition in the battery vicinity.
- Switch off current before making or breaking electrical connections.
- Ensure battery charging area is well ventilated.
- Ensure the charger is switched off when: a) connecting to a battery; b) disconnecting from the battery.
- Always disconnect the ground cable from the battery terminal first and reconnect it last.

Batteries contain poisonous and highly corrosive acid. To prevent personal injury, or damage to clothing or the vehicle, the following working practices should be followed when topping up, checking electrolyte specific gravity, removal, refitting or carrying batteries:

- Always wear suitable protective clothing (an apron or similar), safety glasses, a face mask and suitable gloves.
- If acid is spilled or splashed onto clothing or the body, it must be neutralized immediately and then rinsed with clean water. A solution of baking soda or household ammonia and water may be used as a neutralizer.
- In the event of contact with the skin, drench the affected area with water. In the case of contact with the eyes, bathe the affected area with cool clean water for approximately 15 minutes and seek urgent medical attention.
- If battery acid is spilled or splashed on any surface of a vehicle, it should be neutralized and rinsed with clean water.
- Heat is generated when acid is mixed with water. If it becomes necessary to prepare electrolyte of a desired specific gravity, SLOWLY pour the concentrated acid into water (not water into acid), adding small amounts of acid while stirring. Allow the electrolyte to cool if noticeable heat develops. With the exception of lead or lead-lined containers, always use non-metallic receptacles or funnels. Do not store acid in excessively warm locations or in direct sunlight.

Due to their hazardous contents, the disposal of batteries is strictly controlled. When a battery is scrapped, ensure it is disposed of safely, complying with local environmental regulations. If in doubt, contact your local authority for advice on disposal facilities.

4. BATTERY CARE REQUIREMENTS

4.1 RECEIPT OF A NEW VEHICLE

Within 24 hours of receipt of a new vehicle, a battery condition check must be carried out in accordance with the battery test process utilizing an appropriate tester as outlined in **the equipment section (Section 5) of this procedure**.

NOTE: The midtronics code must be recorded on the form.

Any actions must be carried out in accordance with the table shown in the **determining battery condition section (Section 6) of this procedure**. The details must be recorded on the New Vehicle Storage Form which is part of the new vehicle storage document.
For additional information, refer to: New Vehicle Storage Form (100-11, Description and Operation).

4.2 NEW VEHICLE STORAGE

If the vehicle is to be stored the transit relays MUST be refitted and / or the vehicle put into transport mode.

Transit relay removal / vehicle placed in normal mode should only be completed a maximum of 72 hours prior to handover to customer

For vehicles without either a transit mode or transit relay the battery negative cable must be DISCONNECTED from the battery.

The battery must be tested and/or re-charged every 30 days and MUST be re-charged after every 90 day period.

NOTE: The midtronics code must be recorded on the form.

Any actions must be carried out in accordance with the table shown in the **determining battery condition section**

(Section 6) of this procedure. The details must be recorded on the New Vehicle Storage Form which is part of the new vehicle storage document.
For additional information, refer to: New Vehicle Storage Form (100-11, Description and Operation).

4.3 PDI / DELIVERY TO CUSTOMER

Before the vehicle is handed over to the customer and as part of the PDI, the condition of the battery needs to be confirmed. The battery condition must be checked in accordance with the battery test process utilizing an appropriate tester as outlined in **the equipment section (Section 5) of this procedure**.

 NOTE: The midtronics code must be recorded on the form.

Any actions must be carried out in accordance with the table shown in the **determining battery condition section (Section 6) of this procedure**. The details must be recorded on the New Vehicle Storage Form which is part of the new vehicle storage document.
For additional information, refer to: New Vehicle Storage Form (100-11, Description and Operation).

4.4 REPLACEMENT BATTERIES FOR SERVICE

All service replacement batteries must have the battery condition checked within 24 hours of receipt and controlled on a 'First In First Out' basis to ensure batteries are not allowed to age unnecessarily.

For batteries in storage and not yet fitted to a vehicle, they must be stored in a dry environment, not in direct sunlight or under any direct heat source. Any batteries exhibiting any forms of damage or corrosion must not be fitted to any vehicle. Any batteries which are dropped must be scrapped, this applies even if no external damage is apparent.

The battery condition must be checked every 30 days in accordance with the battery test process utilizing an appropriate tester as outlined in **the equipment section (Section 5) of this procedure**.

Any actions must be carried out in accordance with the table shown in the **determining battery condition section (Section 6) of this procedure**.The details must be recorded on the New Vehicle Storage Form which is part of the new vehicle storage document.
For additional information, refer to: New Vehicle Storage Form (100-11, Description and Operation).

4.5 BATTERY MAINTENANCE

Any battery whether it is in a vehicle or a replacement part must be tested and/or re-charged every 30 days and MUST be re-charged after every 90 day period.

4.6 BATTERY TEST PROCESS

It is recommended that this test is conducted at least 24 hours after the vehicle engine has been run or the battery charged to avoid the need of surface charge removal. If time constraints make this unacceptable then the surface charge must be removed.

Surface Charge Removal

A vehicle which has had its battery charged or been driven in a 24 hour period before the test, must have its surface charge removed.

- Turn on the ignition but do not start the vehicle
- Switch on the headlamps on high beam for a minimum 3 minutes
- Switch off the headlamps
- Wait a minimum of 5 minutes before recording test results for any battery measurements

Battery Test

The battery may be tested either on a bench or on the vehicle.

The battery condition must be checked in accordance with the battery test process utilizing an appropriate tester as outlined in **the equipment section (Section 5) of this procedure**.

 NOTE: The midtronics code must be recorded on the form.

Any actions must be carried out in accordance with the table shown in the **determining battery condition section (Section 6) of this procedure**. The details must be recorded on the New Vehicle Storage Form which is part of the new vehicle storage document.
For additional information, refer to: New Vehicle Storage Form (100-11, Description and Operation).

 CAUTION: DO NOT connect the tester to any other circuit or chassis point other than the battery negative terminal.

5. EQUIPMENT

All equipment used must be functionally capable of meeting the compliance requirements. Please refer to the approved equipment document.

In the case of batteries fitted to a new vehicle at the dealership, battery condition should be measured using the appropriate hand-held Midtronics tester as follows:

Battery Type	Battery Tester	Battery Tester
	Jaguar	Land Rover
Flooded	Midtronics MCR 394 & 494 Midtronics EXP1080 & GR1/GRX	Midtronics MCR 393 & 493 Midtronics EXP1080 & GR1/GRX
AGM	Midtronics EXP1080, GR1/GRX	Midtronics EXP1080, GR1/GRX

The test results must be recorded on the New Vehicle Storage Form which is part of the new vehicle storage document.
For additional information, refer to: New Vehicle Storage Form (100-11, Description and Operation).

NOTE: All equipment must be calibrated

6 DETERMINING BATTERY CONDITION

TESTER RESULTS	ACTION
GOOD BATTERY	Return to service.
GOOD RE-CHARGE	Fully charge battery and return to service.
CHARGE AND RE-TEST	Fully charge battery. Remove surface charge. Re-test battery. If same result replace battery.
REPLACE BATTERY OR BAD CELL BATTERY	Verify surface charge removed. Disconnect battery from vehicle and re-test. If result repeats after surface charge removal, replace battery. **DO NOT RECHARGE**.
UNABLE TO DO TEST	Disconnect battery from vehicle and re-test.

7 BATTERY CHARGING

It is essential that a suitably ventilated defined area exists in each dealership / retailer for battery charging.

CAUTION: It is very important that when charging batteries using the traction charger or other stand-alone chargers that the charger is set for the correct type of battery before charging commences. If the wrong switch is selected the result would be a battery that is not charged fully and / or overheating can occur. Follow the manufacturers operating instructions.

Batteries **MUST BE** tested and if necessary charged every 30 days and charged after 90 days irrespective of any test. It is recommended that dealers / retailers always have fully charged batteries ready for use.

CAUTION: Do not charge AGM batteries with voltages over 14.8 Volts as this will damage the battery.

A designated controlled area must be allocated for scrap batteries and clearly controlled as such.

To bring a discharged but serviceable battery back to a fully charged condition proceed as follows:

- Check and if necessary top-up the battery electrolyte level. (Flooded maintainable batteries only)
- Charge the battery using a charger as detailed in the approved equipment document following the manufacturers operating instructions.

NOTE: When using the Midtronics Diagnostic Charger, automatic mode must always be used. After charging and analysis, the charger may display ‘Top-Off Charging’, Hit STOP To End. Do not stop charging until the current falls to 5A or less, otherwise the battery will not be fully charged.

Following charging a post charge battery condition test must be carried out in accordance with the table shown in the **determining battery condition section (Section 6) of this procedure**.

NOTE: The midtronics code must be recorded on the form.

Any actions must be carried out in accordance with the table shown in the **determining battery condition section (Section 6) of this procedure**. The details must be recorded on the New Vehicle Storage Form which is part of the new vehicle storage document.
For additional information, refer to: New Vehicle Storage Form (100-11, Description and Operation).

8 BATTERY REPLACEMENT

If it is determined that a battery requires replacement, always refer to the appropriate section of the workshop manual for instructions on removing and installing the battery from the vehicle.

On in service vehicles fitted with a Battery Monitoring System (BMS), the BMS module must be reset following the installation of a new battery. The BMS module reset procedure must be performed using an approved diagnostic system.

9 CONFIRMING ELECTROLYTE LEVEL

WARNINGS:

BEFORE CHECKING AND TOPPING-UP THE BATTERY ELECTROLYTE, REFER TO THE HEALTH AND SAFETY PRECAUTIONS SECTION.

 AGM TECHNOLOGY BATTERIES ARE FULLY SEALED FOR LIFE AND NO ATTEMPT SHOULD BE MADE TO CHECK OR TOP UP THE ELECTROLYTE LEVEL.

On certain types of battery the electrolyte level may need to be checked.

- Make sure the battery is of a type suitable for topping up. These types of batteries will have cell plugs visible on the top face of the battery or a removable access panel to allow access to the cells.
- On batteries with a clear or opaque case and level marks, check the electrolyte level by visual inspection of the maximum level indicator mark on the battery casing indicating adequate level above the battery separators.
- On batteries with black cases, remove the cell plugs or access panel and ensure the electrolyte level is level with the indicator in the cell hole. A flashlight may be required to see the electrolyte level on this type of battery.
- If the electrolyte level is low, top-up using distilled water.

 NOTE: Maintenance free and Valve Regulated (AGM) batteries are sealed and therefore cannot be topped up.

 CAUTION: **DO NOT** overfill.

Published: 21-Dec-2012

Battery and Charging System - General Information - Quiescent Drain

Description and Operation

VEHICLE QUIESCENT CURRENT TESTING

On vehicles fitted with a Battery Monitoring System (BMS), the diagnostic routine for quiescent drain testing in the approved Jaguar or Land Rover diagnostic system should be utilized.

If a customer complains of a vehicle battery that discharges continuously or when left for a prolonged period of time, it is recommended that a quiescent drain test is performed as described below.

The battery drain should be measured using the approved Jaguar or Land Rover diagnostic system or a Digital Multi-Meter (DVOM). A procedure for quiescent drain measurement using the diagnostic system is available in the Diagnosis and Testing section of the Workshop Manual. The vehicle should be in the locked/armed state (for example vehicle alarm fully armed), all doors, engine and luggage compartment lids are open and latched (so as to appear closed from an electrical point of view). The test should take place after the vehicle has entered shutdown mode. The time taken for this to occur after the ignition is switched off varies according to model (Refer to the Topix On line resource for details).

When the vehicle is armed, the effect of the security system Light Emitting Diode (LED) flashing is to cause a pulsation in the measured current drain. In this case, either the average current should be taken (using a Digital Multi- Meter (DVOM) with an averaging system) or the current reading taken, ignoring the brief high current peaks.

EQUIPMENT

Approved Jaguar or Land Rover diagnostic system with current probe**OR** Digital Multi-Meter (DVOM) with current probe.

METHOD OF MEASUREMENT

Using an Approved Jaguar or Land Rover Diagnostic System.

1. Switch off all electrical loads and ensure that the ignition is off
2. Connect the current probe to the approved Jaguar or Land Rover diagnostic system
3. Calibrate the probe
4. Install a clamp around the battery lead/junction box lead
5. Go to the Quiescent Current Testing section in this procedure

Using a digital multimeter

Do not use an in-line DVOM to measure the quiescent drain on vehicles fitted with an electronic throttle (for example Range Rover 2002MY onwards). The current exceeds the maximum amount the fuse in the DVOM is capable of handling.

1. Switch off all electrical loads and ensure that the ignition is off
2. Connect the current probe to the digital multmeter
3. Calibrate the probe
4. Install a clamp around the battery lead/junction box lead
5. Go to the Quiescent Current Testing section in this procedure

QUIESCENT CURRENT TESTING

1. Switch ignition to ‘on’ or select ignition mode in keyless vehicles and switch to ‘off’ (do not crank)
2. Remove key from ignition switch (if equipped)
3. Open and latch all doors, hood and luggage compartment lid
4. Lock the vehicle using the remote function on the remote handset. (Single lock only to avoid volumetric alarm arming)
5. Remove any other potential electrical drains such as accessories plugged into accessory sockets
6. Record the amperage readings after the shutdown period referenced in the Topix on line resource for details. Note all cars from 10MY onwards should be less than 30mA after 30 minutes
7. Record the final reading on the battery report form

The preferred method of testing following an excessive current consumption figure is to use a current probe around individual junction box leads to the various suspected circuits to identify a potential cause. This is in preference to the old method of removing fuses for the following reasons:

The drain may be caused by a module remaining active and preventing the quiescent drain from reducing to normal levels
The drain may be caused by a relay winding that is activated. Pulling the fuse can allow this to ‘reset’ and the drain will be lost and go un-diagnosed

Land Rover Quiescent Drain Values

MODEL	SHUT DOWN PERIOD (minutes)	TYPICAL VALUES BATTERY DRAIN (mA)
Range Rover (LM) - Up to 2009MY	30	<30
Range Rover (LM) - From 2010MY	20 (after lock/arm condition) [2]	<30
	33 (unlocked)	<30
Range Rover (LG) From 2013MY	<10 (after lock/arm condition) [2]	<20

	<20 (unlocked)	<20
Range Rover Sport (LS) - Up to 2007MY	30	<30
Range Rover Sport (LS) - From 2007MY to 2010MY	30	<30
	33 (unlocked)	<30
Range Rover Sport (LS) - From 2010MY	10 (after lock/arm condition) [2]	<20
	30 (unlocked)	<20
Range Rover Evoque (LV) - From 2012MY	20 (after lock and arm condition) [2]	<20
	<20 (unlocked)	<20
Discovery 3/LR3 (LA) - Up to 2007MY	30	<30
Discovery 3/LR3 (LA) - From 2007MY to 2010MY	30	<30
	33 (unlocked)	<30
Discovery 4/LR4 (LA) - From 2010MY	<20 (after lock/arm condition) [2]	<20
	<20 (unlocked)	<20
Freelander (LN) - Up to 2007MY	30	<30
Freelander 2/LR2 (LF) - From 2007MY	35 (single locked or unlocked)	<25
	15 (double locked)	<25
Defender (LD) - 1998MY to 2007MY	30	<25
Defender (LD) - from 2007MY	<30	<30
Discovery Series 2 (LT)	30	<30

NOTE:

1. The total current drain will be higher if certain approved accessories are fitted (for example: tracker, trailer module, etc.)

2. Applies to vehicles without Tire Pressure Monitoring System (TPMS). Vehicle shut-down period with TPMS is approximately 15 minutes.

Published: 01-Aug-2013

Battery and Charging System - General Information - Battery Report Form – In Service Batteries Only

Description and Operation

BATTERY REPORT FORM - IN SERVICE BATTERIES ONLY

NOTE: Fields marked with * are mandatory and must be completed.

General Information							
*Vehicle Identification Number (VIN):				*Repair Date:	Vehicle Model:		
*Mileage:						Engine type:	
Customer Questions							
*1: What is the customer's reason for dealer visit? (tick symptoms as appropriate)				Non crank	Crank but non start	Warning message	Other:
*2: How long was the vehicle left prior to issue.				*			
*3: How was the car left (Locked/unlocked)				*			
*4: How did you access to the vehicle					Key fob	Manual key	Handle pull
*5: Has the vehicle required assistance for battery issues previously?						Yes	No
*6: Is the vehicle used? (tick symptoms as appropriate)				Daily	Every other day	Weekly	Less than weekly
*7: Average journey length				*			
*8: How many starts do you typically do in a day				*			
*9: Did the customer see any instrument pack warnings prior to the issue?				*			
*10: Have any of the features been used without the engine running in the last 3 days (if fitted?)	Radio	Power point accessory	CD	DVD	USB or IPOD connection	TV	Rear seat entertainment
11: Customer comments:- Please add any additional comments that are relevant.				*			
Diagnostics (Battery Testing)				-	-	-	-
1: Loose battery clamps				Yes	*	No	*
2: Loose hold down clamps				Yes	*	No	*
3: Corroded terminal posts				Yes	*	No	*
4: Physical damage/leaks				Yes		No	*
5: Low electrolyte (Flooded batteries only)				Yes	*	No	*
6: Battery Date Code				*			
7: FEAD belt tension				OK	*	Not OK	*
8: Quiescent Drain				mA	*		
9: Vent tube correctly installed				Yes	*	No	*
10: Number of Times Battery Charged:				*			
10: Vent tube correctly installed				Yes		No	
11: Remove the Surface (414-00 battery care requirements)				Yes	*	No	*
12: Battery voltage				*			
13: Midtronics test code before charging (EXP-1080)				*			
13a: If Midtronics indicates that the battery needs re-charging, charge the battery following instructions on the recommended battery charger				*			
13b: Midtronics test code after charge				*			
13c: Midtronics test code result after charge				*			
13d: If "good and re-charge" charge the battery following instructions on the recommended battery charger				*			
13e: If "charge and re-test" for both before and after the charge renew the battery				*			
13f: Only renew the battery if "renew battery", "bad cell" or charge and re-test has been displayed twice.				*			
Technician Comments:- Please add any additional comments that are relevant.							
*							
*							
*							
*							
*							

Published: 20-Aug-2012

Battery and Charging System - General Information - Charging System

Diagnosis and Testing

Principle of Operation

For a detailed description of the charging system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to:

Generator (414-02A Generator and Regulator - TDV6 3.0L Diesel, Description and Operation),
Generator (414-02A Generator and Regulator - TDV6 3.0L Diesel, Description and Operation),
Generator (414-02A Generator and Regulator - TDV6 3.0L Diesel, Description and Operation),
Generator (414-02B Generator and Regulator - V8 5.0L Petrol/V8 S/C 5.0L Petrol, 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. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Generator • Auxiliary drive belt • Auxiliary drive belt tensioner • Generator pulley • Check the security of the generator fittings	• Generator • Battery • Starter motor • Harnesses and connectors • Fuses • Charge warning indicator function • Engine Control Module (ECM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Charge warning indicator does not come on	• Bulb/circuit fault • Generator fault • Controller Area Network (CAN) circuit fault • Engine Control Module (ECM) fault	• Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index
Charge warning indicator stays on / battery discharges	• Auxiliary drive belt broken • Generator pulley slipping on shaft • Generator fault • Battery cable fault • Controller Area Network (CAN) circuit fault • Engine Control Module (ECM)	• Refer to the electrical circuit diagrams and test the generator circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index • Check the auxiliary drive belt condition and tension • Check that the pulley does not rotate independently of the generator

	fault	
Charge warning indicator intermittent	• Auxiliary drive belt slipping • Battery cable fault • Generator wiring fault • Generator fault • Controller Area Network (CAN) circuit fault	• Refer to the electrical circuit diagrams and test the generator circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index • Check the auxiliary drive belt condition and tension • Check that the pulley does not rotate independently of the generator
Battery discharges without the charge warning indicator staying on	• Battery fault • Battery quiescent drain • Intermittent generator fault	• Refer to the relevant section of the workshop manual and test the battery • Refer to the relevant section of the workshop manual and test the battery quiescent drain • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index
Noise (mechanical)	• Auxiliary drive belt slipping • Generator fault	• Check the auxiliary drive belt condition and tension • Remove the auxiliary drive belt and check that the generator rotates freely

DTC Index

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

Diagnostic Trouble Code (DTC) Index - TDV6 3.0L Diesel , DTC: Engine Control Module (ECM) (100-00 General Information, Description and Operation),
Diagnostic Trouble Code (DTC) Index - V8 5.0L Petrol/V8 S/C 5.0L Petrol, DTC: Engine Control Module (ECM) (100-00, Description and Operation).

Published: 13-Jul-2011

Battery, Mounting and Cables -

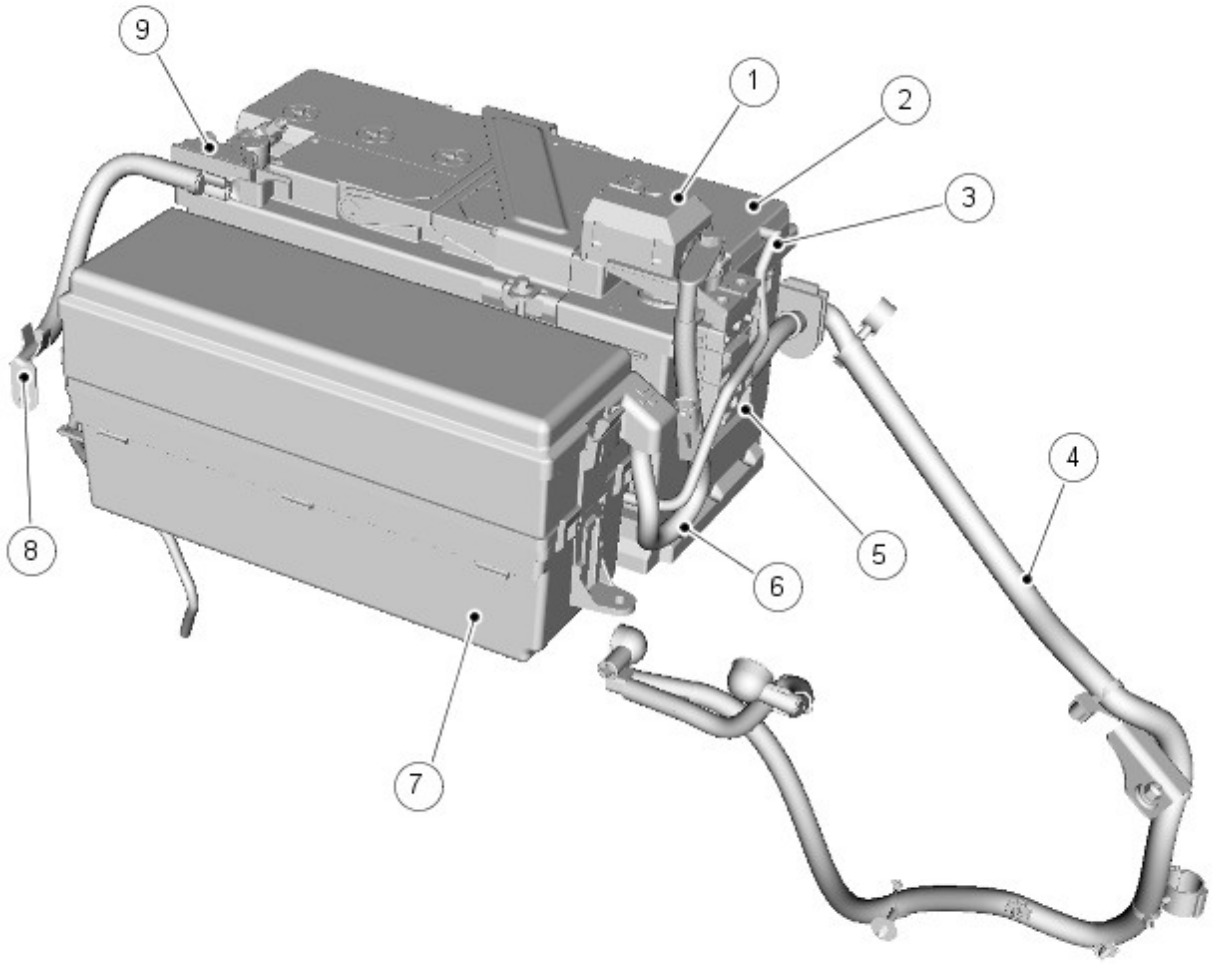
Torque Specifications

Description	Nm	lb-ft
Battery clamp bolts	5	4
Battery terminal nuts	5	4
Battery tray nuts	12	9
Auxiliary battery tray nuts	12	9

Published: 11-May-2011

Battery, Mounting and Cables - Battery and Cables

Description and Operation



E133244

Item	Part Number	Description
1	-	Transit relay
2	-	Battery
3	-	Vent pipe
4	-	Positive (+VE) battery cable
5	-	Megafuse
6	-	Power feed to the BJB (battery junction box)
7	-	BJB
8	-	Negative (-VE) battery cable
9	-	Battery monitoring module

OVERVIEW

The battery is mounted in a protective box, located in the engine compartment, on the passenger side. It sits in a tray and is secured with clamp plates and bolts.

The battery terminal posts allow for the battery cables to be connected with clamp type connections.

The battery positive terminal is fitted with a mega fuse, which is a 400 Amp device housed in a black fuse carrier, integral to the battery clamp. Power feed to the BJB is taken from a tap on the battery clamp before the mega fuse.

In the event of a crash the mega fuse is designed to blow, this isolates the power from the generator and starter motor, but allows power to be delivered, via the CJB (central junction box), to the rest of the vehicle.

There are two different battery sizes:

- H7 - All petrol variants
- H8 - All diesel variants

The battery has a vent pipe to allow for thermal expansion and to vent oxygen and hydrogen gases, which are produced under certain charging conditions.

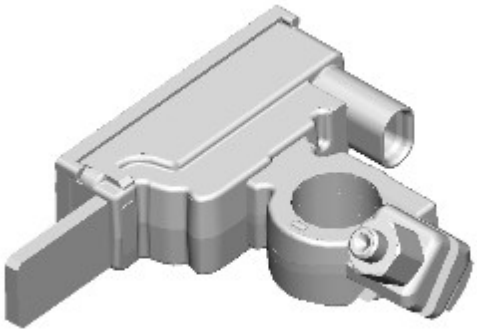
When removing the battery, ensure the alarm is disarmed and the ignition is switched off. Always disconnect the negative terminal first and then the positive. When refitting the battery, always fit the positive terminal first followed by the negative.

If the battery requires recharging, always use an approved constant current charger, designed for lead-calcium batteries. DO NOT use a fast charger, as permanent damage to the battery may occur.

Delivery Mode

The vehicle is fitted with a transit relay which must be removed before delivery of the vehicle to the customer. This is a disposable device and **NOT** for use by the customer. This relay fits in series with the battery and ground; it disconnects the battery from the vehicle's ground and thus eliminates quiescent current during delivery. The relay must be removed before delivery to the customer. The connector to the relay has a permanent live feed and therefore must be stowed on the given stowage point.

Battery Monitoring System



E115177

Optimal battery health is a fundamental factor in the correct operation of the Stop/Start system, therefore to calculate and communicate the battery status a Battery Monitoring System (BMS) module is introduced.

Published: 13-Aug-2012

Battery, Mounting and Cables - Battery

Diagnosis and Testing

Principles of Operation

For a detailed description of the battery system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: (414-01 Battery, Mounting and Cables)

Battery and Cables (Description and Operation),
Battery and Cables (Description and Operation),
Battery and Cables (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.

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

Visual Inspection

Mechanical	Electrical
• Generator • Drive belt • Drive belt tensioner • Generator pulley • Check the security of the generator fixings	• Generator • Battery • Battery connections • Starter motor • Harnesses and connectors • Fuses • Charge warning lamp function • Engine Control Module (ECM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

NOTES:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

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

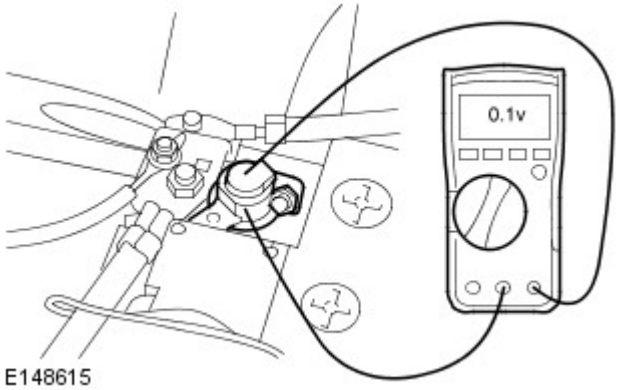
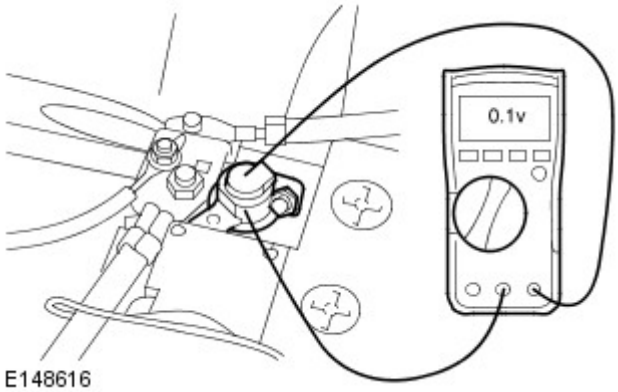
If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

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

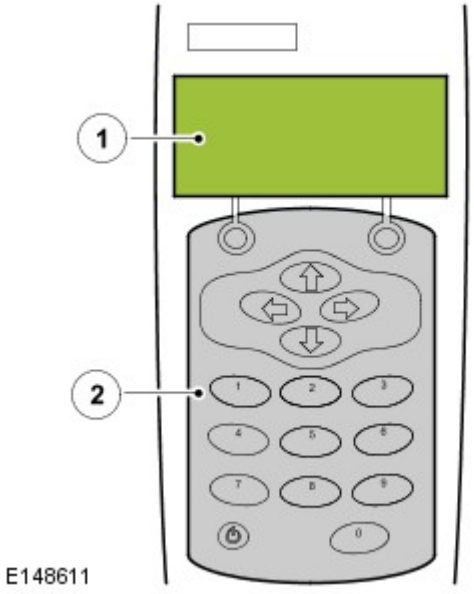
Midtronics EXP-1080 User Guide

Carry out the following: -

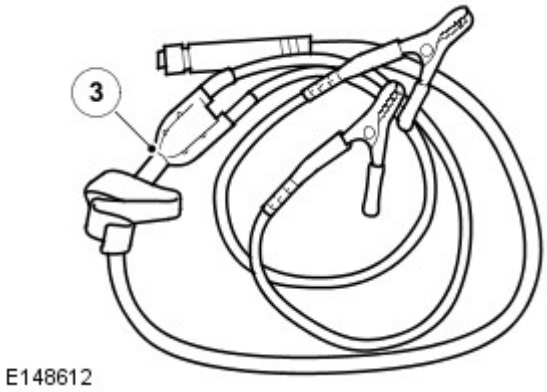
PINPOINT TEST A : VOLTAGE DROP	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: GROUND CIRCUIT	
NOTE: This test checks for high resistance between the battery terminal and the battery clamp	
	1 Start the engine, turn on the following: • (1) Air conditioning • (2) Blower fan on full speed • (3) Headlights on main beam

 E148615	• (4) Heated screen - rear • (5) Heated screen - front (if installed) • (6) Heated seats (if installed)
	2 Connect the multimeter between the battery negative terminal and the battery clamp as shown in picture below (do not disconnect the battery at this stage)
	3 Set the multimeter to read DC voltage and record the reading
	Is reading equal to or below 0.1 volts? **Yes** GO to A2. **No** Switch all electrical loads and engine off, return the vehicle to an ignition off condition. Disconnect the battery negative clamp, clean clamp and terminal then reconnect and repeat test GO to A1.
A2: POWER CIRCUIT	
NOTE: This test checks for high resistance between the battery terminal and the battery clamp	
 E148616	**1** Start the engine, turn on the following: • (1) Air conditioning • (2) Blower fan on full speed • (3) Headlights on main beam • (4) Heated screen - rear • (5) Heated screen - front (if installed) • (6) Heated seats (if installed)
	2 Connect the multimeter between the battery positive terminal and the battery clamp as shown in picture below (do not disconnect the battery at this stage)
	3 Set the multimeter to read DC voltage and record the reading
	Is reading equal to or below 0.1 volts? **Yes** Carry out midtronics battery test procedure **No** Switch all electrical loads and engine off, return the vehicle to an ignition off condition. Disconnect the battery power clamp, clean clamp and terminal then reconnect and repeat test GO to A2.

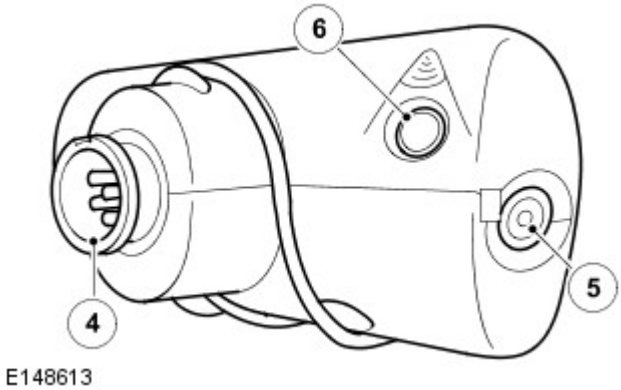
Reference	Description
1	LCD screen with main menu
2	Control panel (key board and power button)
3	Positive and negative fly leads
4	Fly leads connection
5	Temperature sensor
6	Infra-red sensor (data transfer for printer)
7	Amp hour
8	Battery rating (CCA)
9	Rating units
10	Battery type



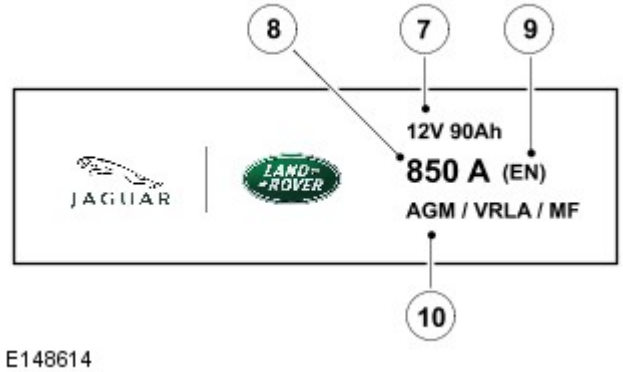
E148611



E148612



E148613



E148614

The following steps must be carried out to ensure correct operation of the EXP-1080 during the battery test procedure

Checks	Action

Battery fluid leakage, check for battery fluid leaks or damage to the battery casing	NOTE: If visible damage to the case is evident do not return battery under warranty Replace the battery if there is any battery fluid leaks evident
Battery vent pipe routing	Check for routing, ensure there are no kinks
EXP-1080 fly lead, condition of clamps	Clean or replace as required
EXP-1080 fly lead connection	Confirm secure connection

NOTE: The Midtronics EXP-1080 is suitable for testing flooded and absorbed glass mat (AGM) type batteries

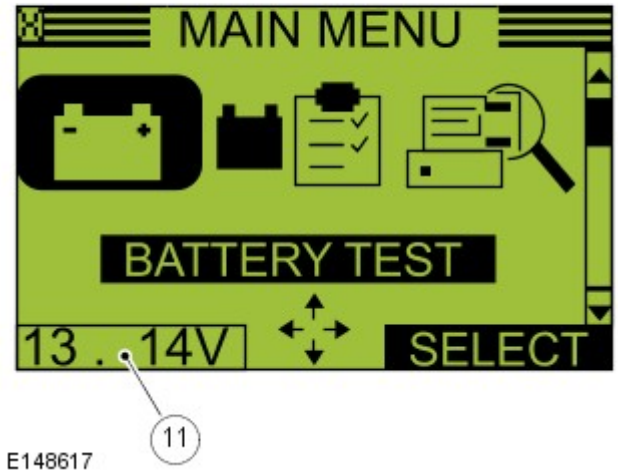
Typical Values

Amp Hour	CCA (Cold Cranking Amps	Rating Units
12	200	EN
70	760	SAE
80	700	SAE
80	800	SAE
90	800	SAE
95	850	SAE
90	950	SAE
105	950	SAE

Midtronics Battery Test Procedure

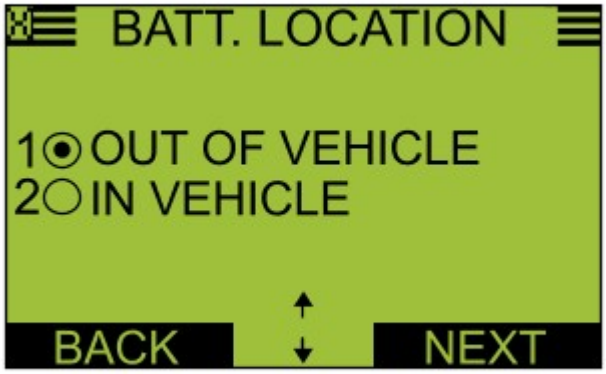
This midtronics battery test procedure will confirm the serviceability of the battery

- 1. Connect the fly-lead to the midtronics EXP-1080
- 2. Connect the fly-leads to the battery terminals
  - **Black lead to negative terminal**
  - **Red lead to positive terminal**
  - Confirm the connections are secure
- 3. The EXP-1080 will power on automatically when connected to a battery, screen below is displayed



NOTE: MAIN MENU SCREEN

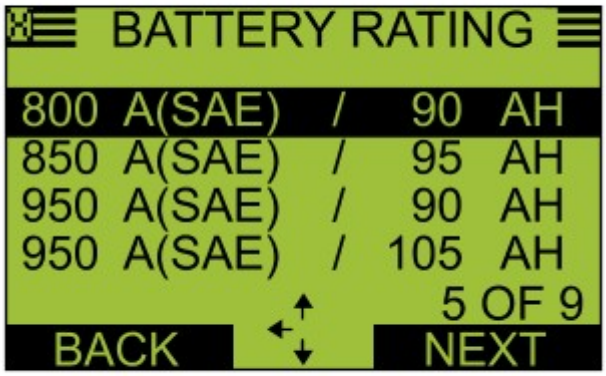
- 4. **Main Menu**. Select **Battery test** and press **SELECT**



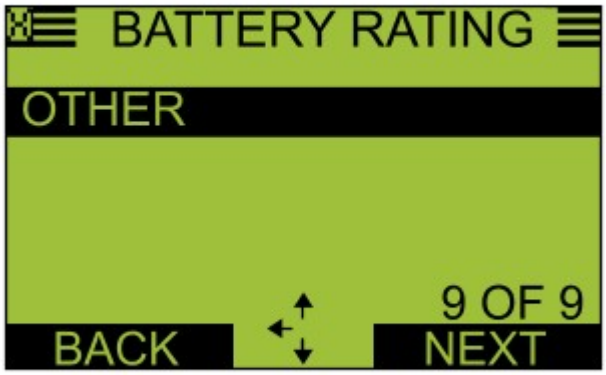
E148618

NOTE: BATTERY LOCATION

- 5. **Battery Location**. Select either, **Out of vehicle** or **In Vehicle** as appropriate
- Select **Next**



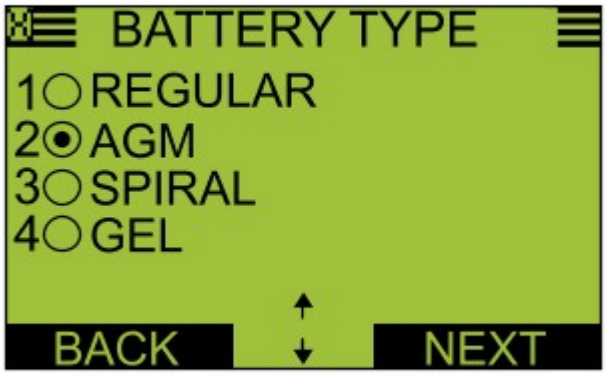
E148619



E148620

NOTE: BATTERY RATING

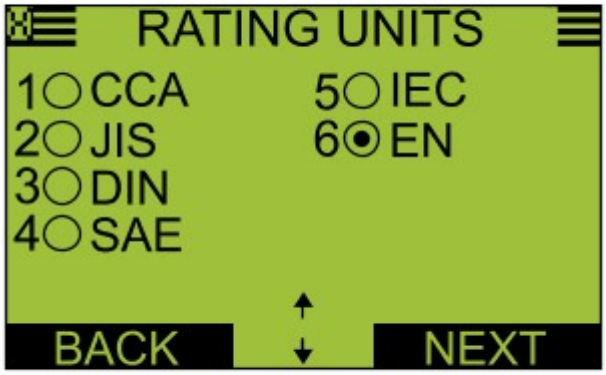
- 6. **BATTERY RATING**. Select the correct battery rating from the pre-installed list, **(Goto step 10)**. **Or**,
- To manually enter the correct battery type, specification and CCA rate. Scroll using the arrow keys on the midtronics panel and select **Other** from the menu
- Select **Next**



E148621

NOTE: BATTERY TYPE

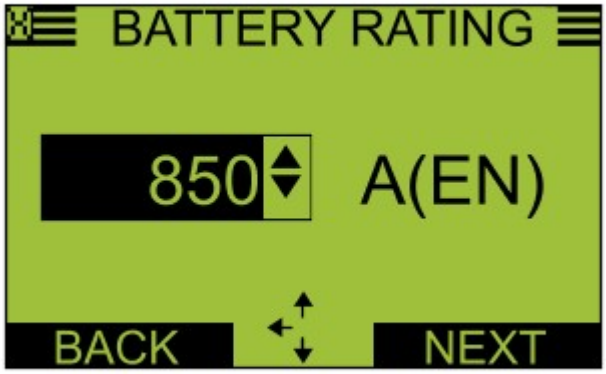
- 7. **Battery Type**. Select the correct battery type (**Regular** or **AGM**)
  - NOTE: All **AGM** batteries are marked (Refer to battery label)
- Select **Next**



E148622

NOTE: RATING UNITS

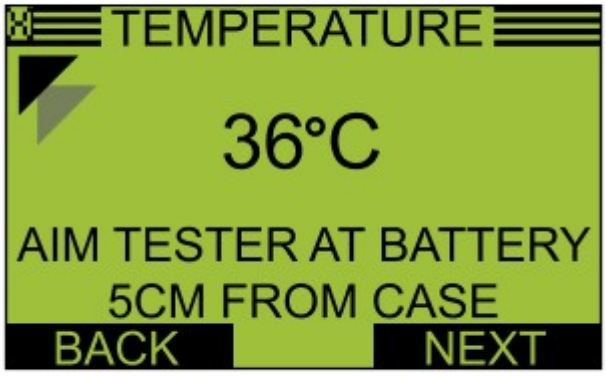
- 8. **Rating Units**. Select the correct rating units. Refer to the battery label for correct specification. Options **EN, DIN, SAE**
- Select **Next**



E148623

NOTE: BATTERY RATING

- 9. **BATTERY RATING**. Scroll using the arrow keys on the midtronics panel, select the correct **CCA** rating (For CCA refer to battery label)
- Select **Next**



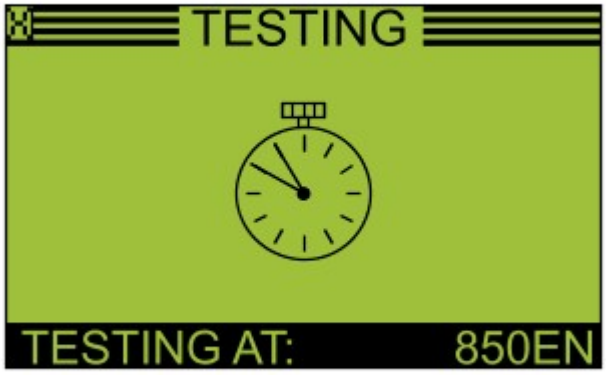
E148624

NOTES:

TEMPERATURE

Ensure that the temperature sensor does not touch any part of the battery or vehicle, this will cause damage not be covered under the midtronics warranty and will require the unit to be returned to a service center

- 10. **Temperature**. Aim the temperature sensor towards the battery casing (Maintain distance of 5cm)
- Select **Next**



E148625

NOTE: TESTING

- 11. **Testing**. The screen displays clock hand's rotating, the EXP-1080 will automatically advance when test has completed



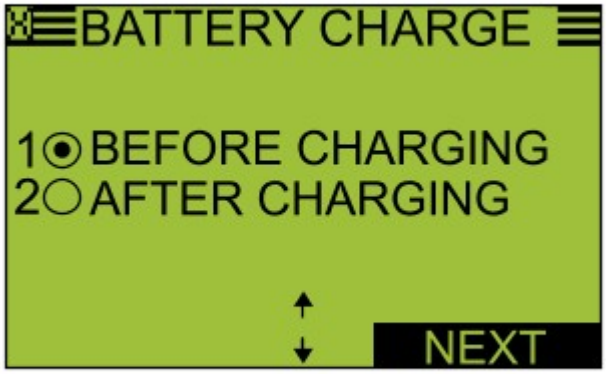
E148626

NOTES:

SURFACE CHARGE

If there is no surface charge this step will not show. **Go to next step**

- 11a. **Surface Charge**. Ensure the **ignition state is on**. Switch on the headlights (high beam) until EXP-1080 shows **Turn off headlights** then return ignition state to off



E148627

NOTES:

BATTERY CHARGE

If the state of charge is sufficient this step will not show. **Go to next step**

- 11b. **Battery Charge.** Select **Before Charging** if battery has not been on a recommended mains charger for a minimum of 6 hours
- Select **After Charging** if battery has been on a recommended mains charger for a minimum of 6 hours



E148628

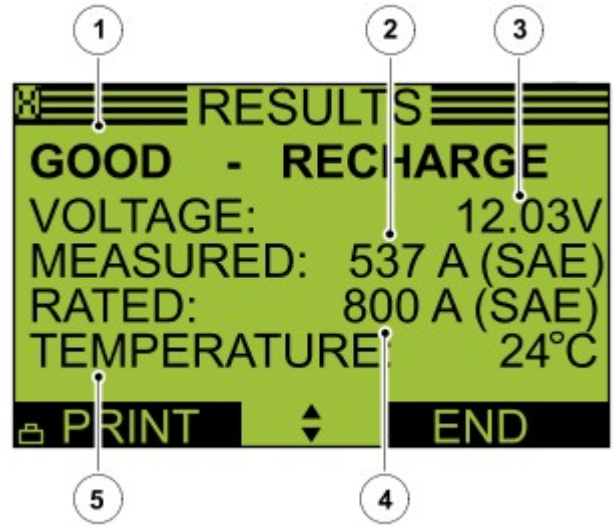
NOTES:

DEEP SCAN TECHNOLOGY

This test is automated and will show if required. **Go to next step**

- 12. **Testing**. The EXP-1080 will carry out the deep scan test, then automatically advance when test has completed

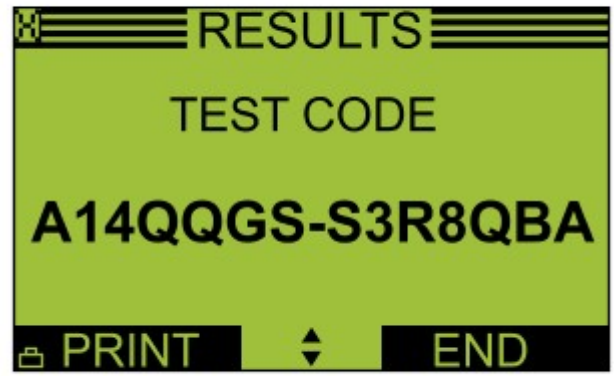
Number	Description
1	Battery test result
2	CCA (Measured capacity rating)
3	Voltage
4	CCA (Manually entered)
5	Temperature



E148629

NOTE: RESULTS

Test Result	Action
GOOD BATTERY	Test complete no action required
GOOD - RE-CHARGE	Charge battery using a recommended mains charger (minimum 50 amp) until charging complete
CHARGE AND RE-TEST	Charge battery using a recommended mains charger (minimum 50 amp) until charging complete. Retest. If the result is the same replace battery
REPLACE BATTERY / BAD CELL BATTERY	Replace battery. **Do Not Recharge**
UNABLE TO COMPLETE TEST	Disconnect battery from vehicle and re-test

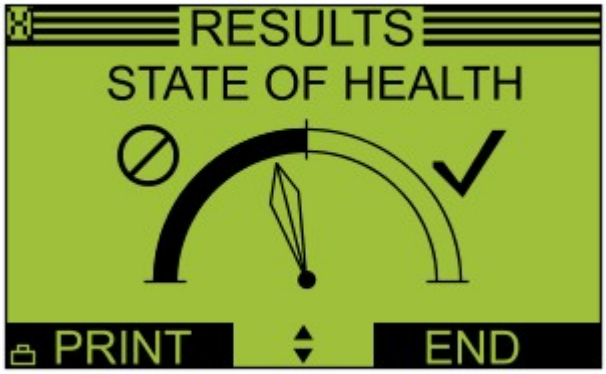


E148630

NOTES:

TEST CODE

Battery test code, must be given if a battery, starter motor or generator is exchanged under warranty

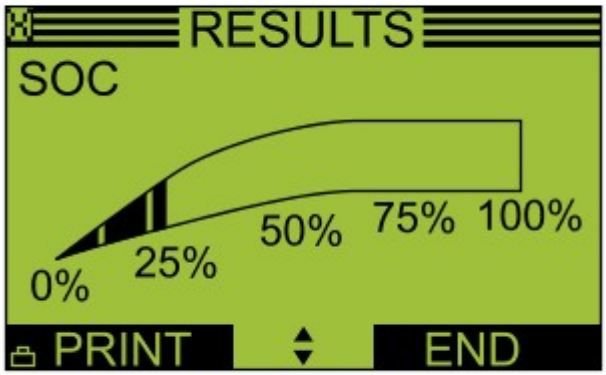


E148631

NOTES:

STATE OF HEALTH

General health of the battery and its ability to deliver its specified performance compared with a new battery



E148632

NOTES:

SOC (State Of Charge)

BATTERY STATE OF CHARGE

- **Results**. From the result display use the arrow keys on the control panel to view the test code
- The test code **must** be quoted with every battery claim under warranty

Flooded Battery Care Point

If the vehicle is equipped with a flooded battery, ensure the replacement battery is a flooded battery of the same specification (cold cranking amperage (CCA) / amp hour rating (Ah)) as the original battery

Under no circumstances should you fit a flooded battery to a vehicle that originally had an AGM battery, unless formally instructed by Jaguar/Land Rover

AGM Battery Care Point

If the vehicle is equipped with an absorbed glass mat (AGM) battery, ensure the replacement battery is a AGM battery of the same specification (cold cranking amperage (CCA) / amp hour rating (Ah)) as the original battery, unless formally instructed by Jaguar/Land Rover

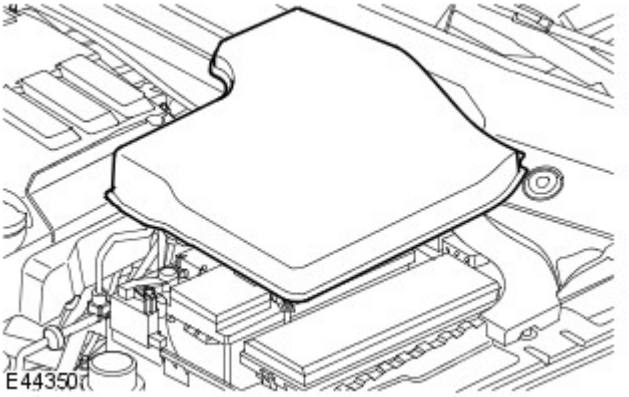
Published: 11-May-2011

Battery, Mounting and Cables - Battery

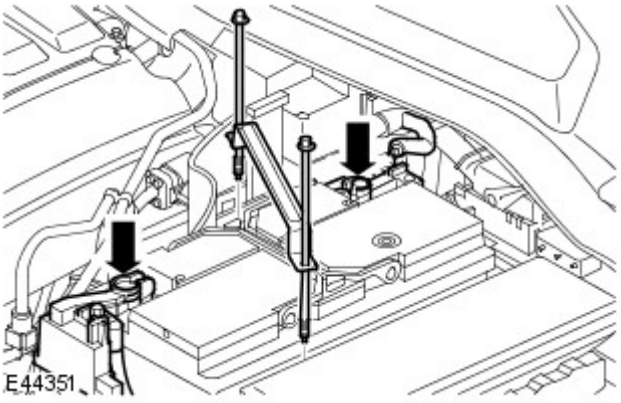
Removal and Installation

Removal

1. Secure the hood in the service position.
   - Release the support struts.
2. Remove the battery cover.



3. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).
4. Disconnect the battery positive cable.
5. Remove 2 bolts securing the battery clamp and remove the clamp.



6. Remove the battery.

Installation

1. NOTE: Apply petroleum jelly to the battery terminals.

   To install, reverse the removal procedure.
   - Tighten the battery clamp bolts to 5 Nm (4 lb.ft).
   - Tighten the battery terminals to 5 Nm (4 lb.ft).

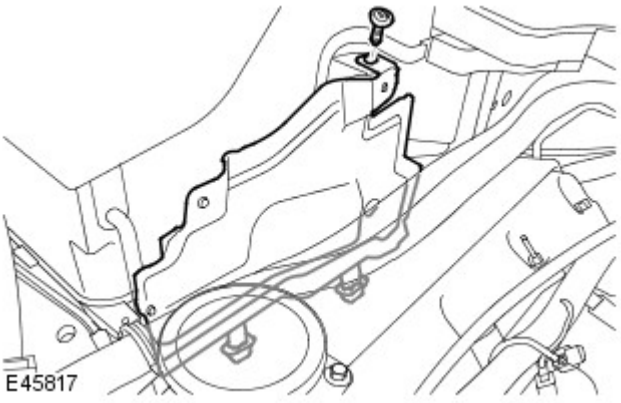
Published: 11-May-2011

Battery, Mounting and Cables - Battery Tray

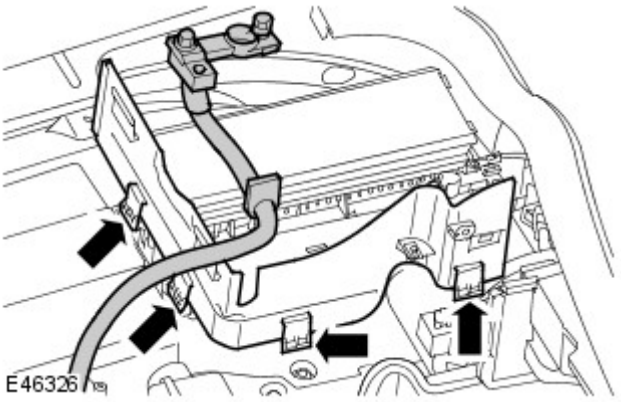
Removal and Installation

Removal

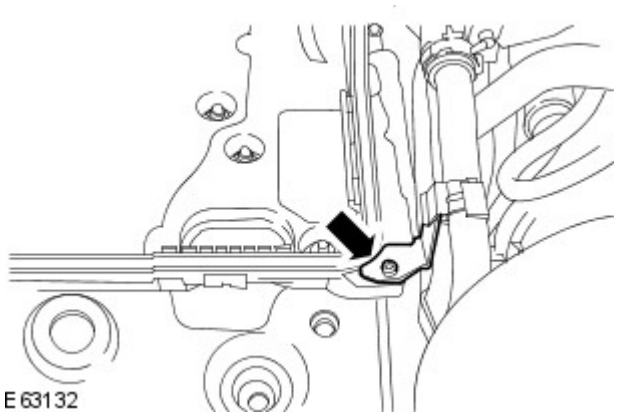
1. Remove the battery.
   For additional information, refer to: Battery (414-01, Removal and Installation).



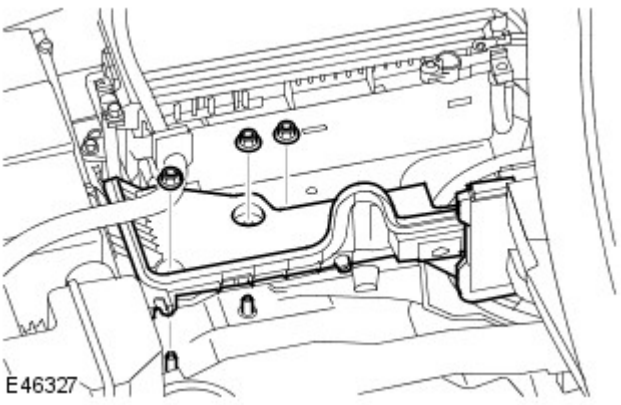
2. Remove the engine compartment upper heat shield.
   - Remove the screw.
   - Release the 2 clips.



3. Remove the battery compartment side wall.
   - Release the battery positive cable and grommet.
   - Release the four clips.



4. Release the heater pipes.
   - Remove the retaining screw.



5. Remove the battery tray.
   - Remove the three retaining nuts.

Installation

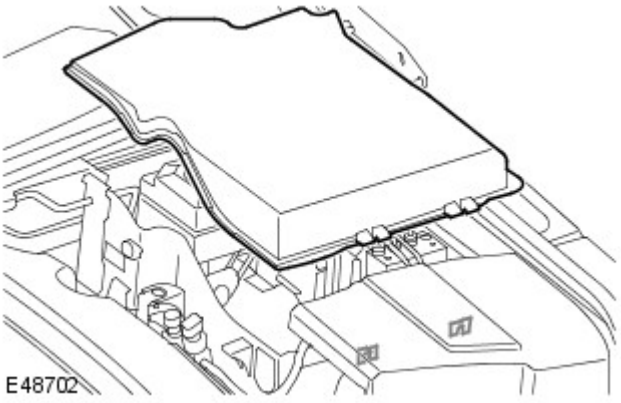
1. To install, reverse the removal procedure.
    - Tighten the nuts to 12 Nm (9 lb.ft).

Published: 11-May-2011

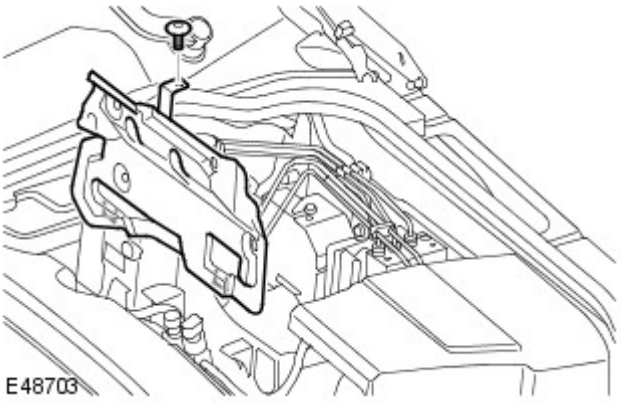
Battery, Mounting and Cables - Auxiliary Battery Tray

Removal and Installation

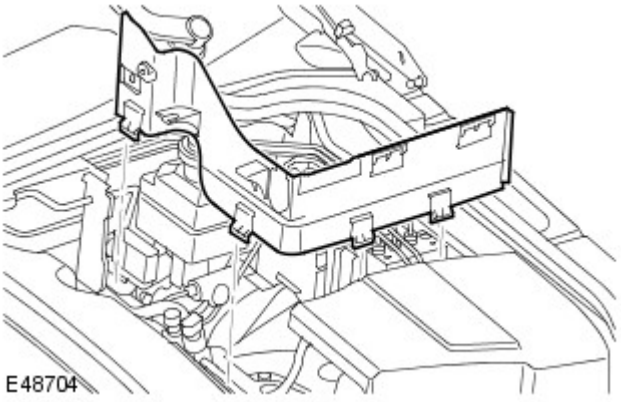
Removal



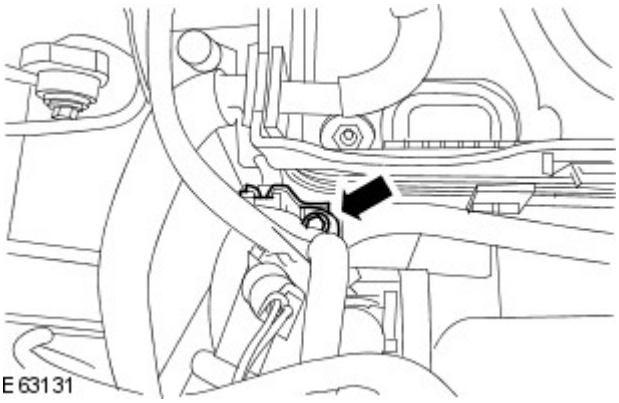
1. Remove the battery cover.
   - Release the 2 clips.
2. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).
3. If installed, remove the auxiliary battery.



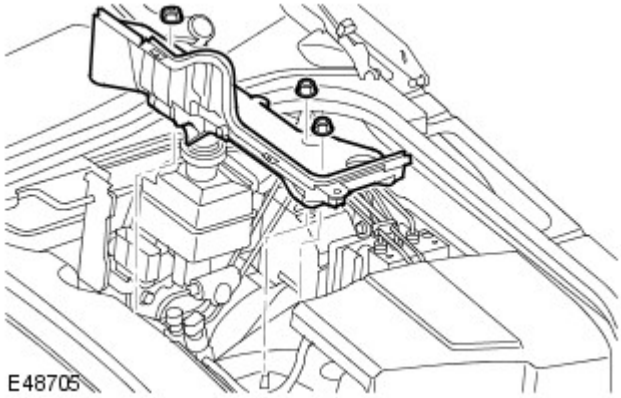
4. Remove the engine compartment upper heat shield.
   - Remove the screw.
   - Release the 2 clips.



5. Remove the auxiliary battery compartment side wall.
   - Release the battery positive cable and grommet.
   - Release the four clips.
6. Release the A/C pipes.
   - Remove the retaining screw.



7. Remove the auxiliary battery tray.
    - Remove the three retaining nuts.



Installation

1. To install, reverse the removal procedure.
    - Tighten the nuts to 12 Nm (9 lb.ft).

Published: 11-May-2011

Generator and Regulator - TDV6 3.0L Diesel -

Description	Nm	lb-ft	lb-in
Generator retaining bolts	47	35	-
Battery positive cable retaining nut	12	9	-

Published: 11-May-2011

Generator and Regulator - TDV6 3.0L Diesel - Generator - Component Location

Description and Operation



E117288

Published: 11-May-2011

Generator and Regulator - TDV6 3.0L Diesel - Generator - Overview

Description and Operation

OVERVIEW

The charging system consists of a 180 Amp output generator and regulator assembly. The generator and regulator assembly generates electrical power for the vehicle electrical system and maintains the battery in a charged state. When the engine is running the generator produces an alternating current, which is converted to a direct current internally. The output from the generator is controlled by the voltage regulator (located inside the generator) and then supplied to the battery through the main battery positive cable.

The generator is mounted on the front right side of the engine and driven at approximately 3 times engine speed by the accessory drive belt.

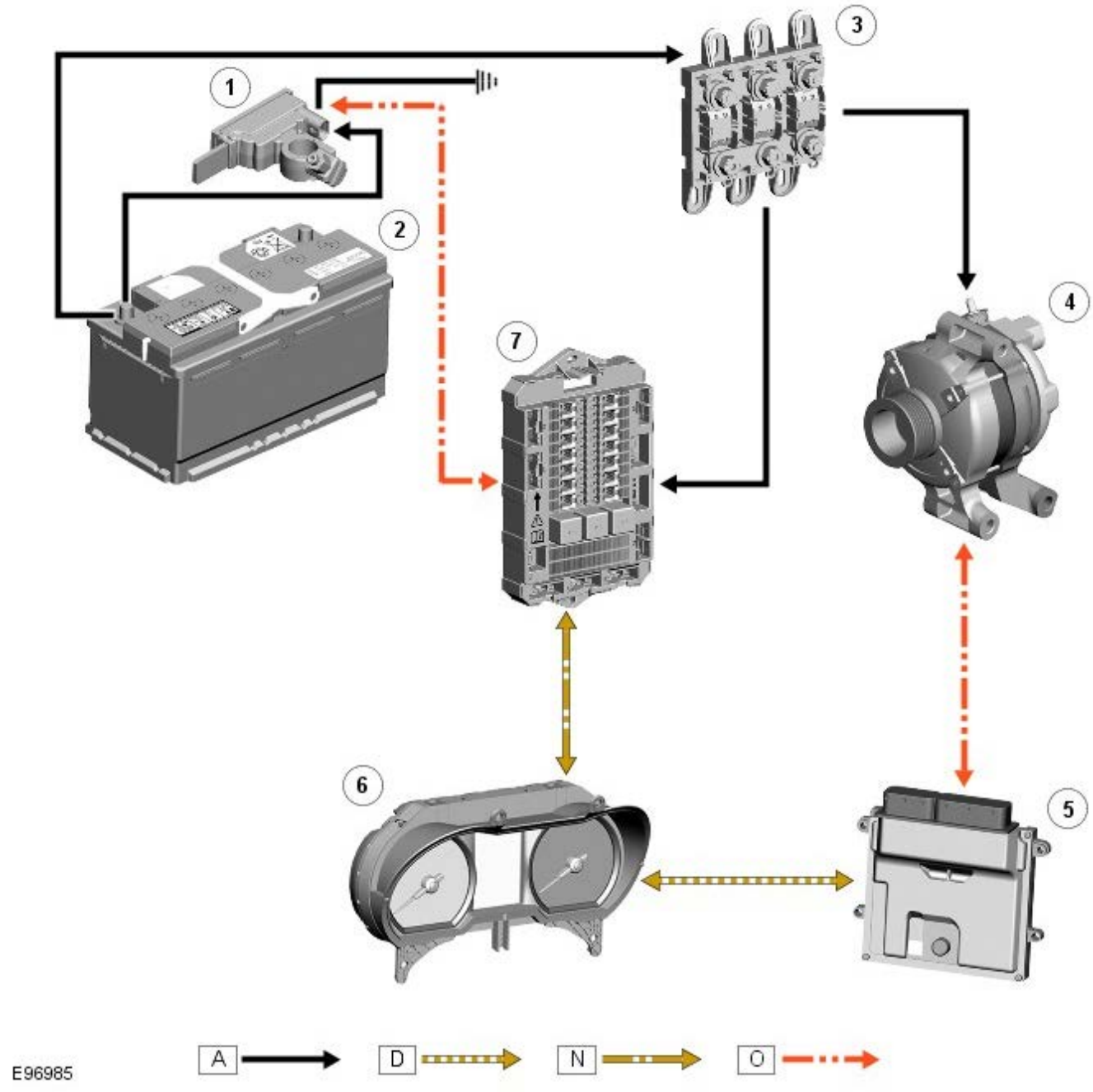
Published: 11-May-2011

Generator and Regulator - TDV6 3.0L Diesel - Generator - System Operation and Component Description

Description and Operation

Control Diagram

NOTE: **A** = Hardwired; **D** = High speed CAN (controller area network) bus; **N** = Medium speed CAN bus; **O** = LIN (local interconnect network) bus.



Item	Description
1	Battery monitoring system module
2	Battery
3	BJB (battery junction box)
4	Generator and regulator
5	ECM (engine control module)
6	Instrument cluster
7	RJB (rear junction box)

System Operation

OPERATION

The output voltage required from the generator and regulator is calculated by the battery monitoring system.

Refer to: Battery and Cables (414-01, Description and Operation).

The battery monitoring system signals the calculated voltage to the ECM via the RJB and the instrument cluster. The ECM then transmits the calculated voltage to the generator and regulator on the LIN (local interconnect network) bus connection.

The ECM will over-ride the voltage value requested by the battery monitoring system if it detects a fault in the generator and regulator. The ECM also signals the instrument cluster to display a warning message if it detects a fault with the generator and regulator.
Refer to: Instrument Cluster (413-01, Description and Operation).

Component Description

DESCRIPTION

The regulator provides a controlled variable voltage output from the generator. Two electrical terminals are provided on the outer casing of the generator. One terminal supplies the DC (direct current) voltage output from the generator to the battery positive terminal. The second terminal provides the LIN bus connection between the regulator and the ECM.

Published: 11-May-2011

Generator and Regulator - TDV6 3.0L Diesel - Generator

Diagnosis and Testing

For further information.
REFER to: Charging System (414-00, Diagnosis and Testing).

Published: 28-Feb-2012

Generator and Regulator - TDV6 3.0L Diesel - Generator

Removal and Installation

Removal

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

All vehicles

1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00, Specifications).

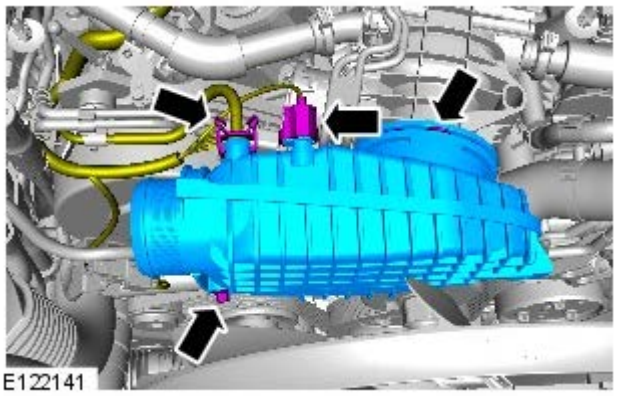
2. WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

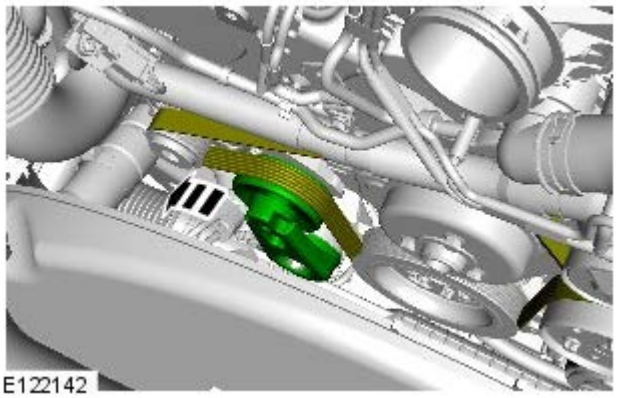
3. Refer to: Engine Cover - TDV6 3.0L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

4. Refer to: Cooling Fan (303-03A, Removal and Installation).

5.

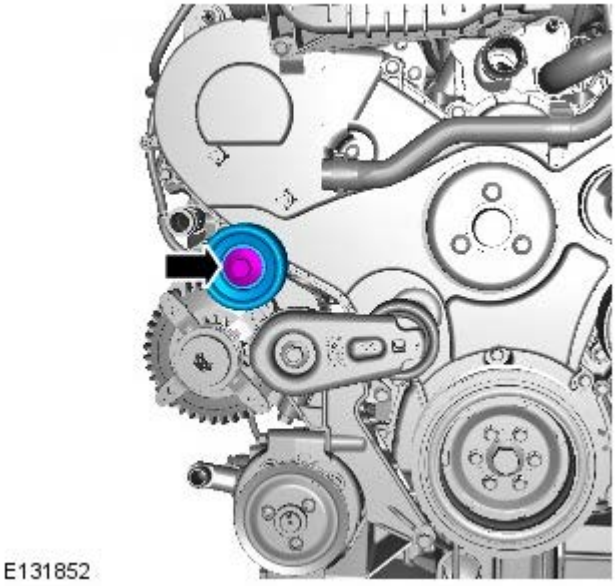


6.



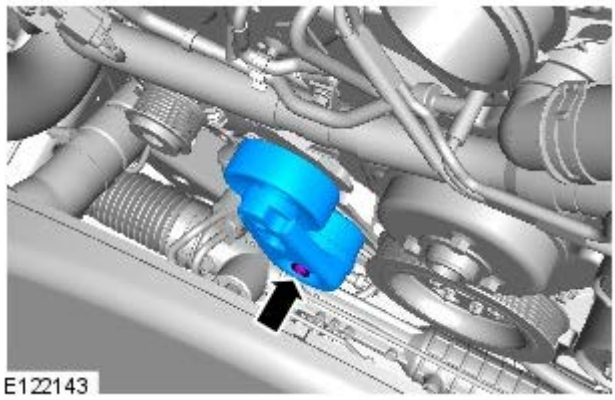
Vehicles with dynamic suspension

7. *Torque:* 47 Nm

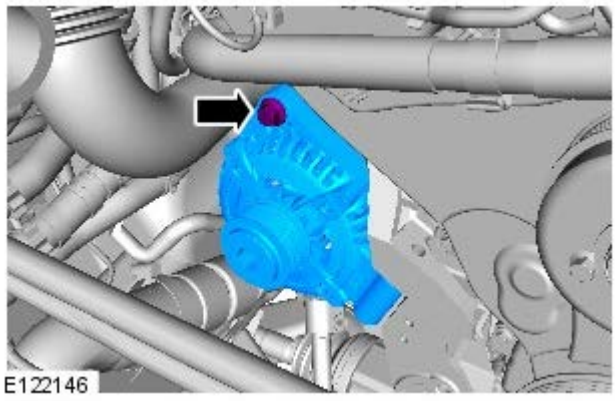


All vehicles

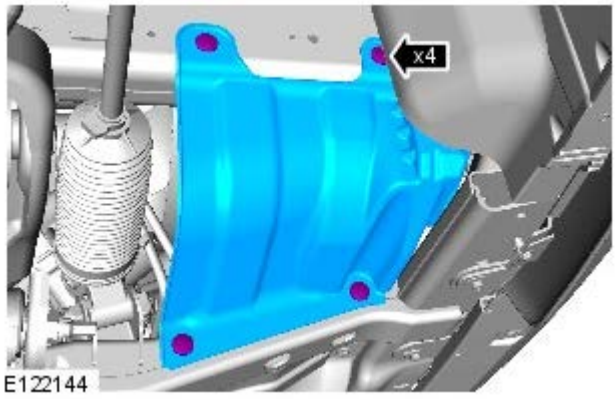
8. *Torque:* 47 Nm



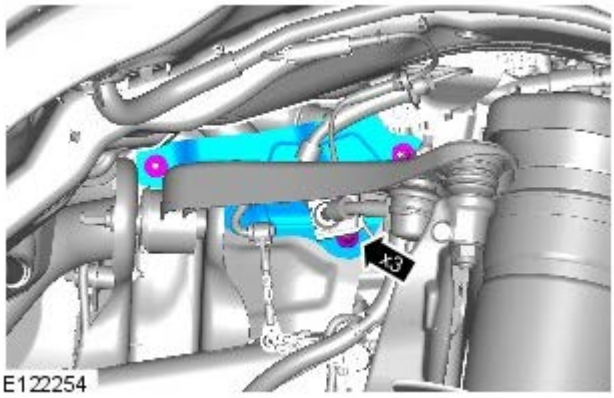
9. *Torque:* 47 Nm



10.



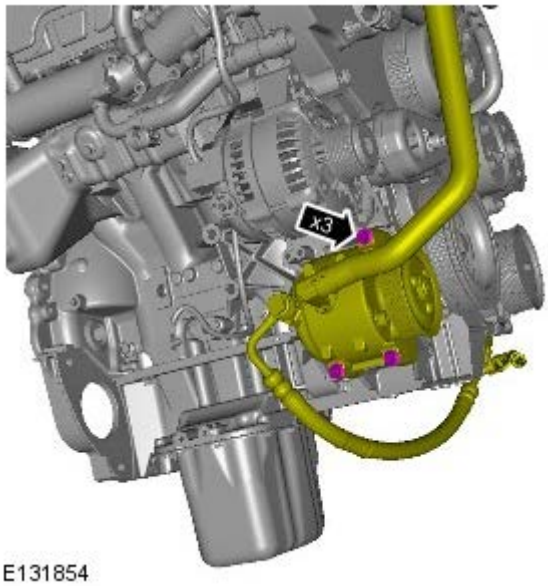
11.



E122254

Vehicles with dynamic suspension

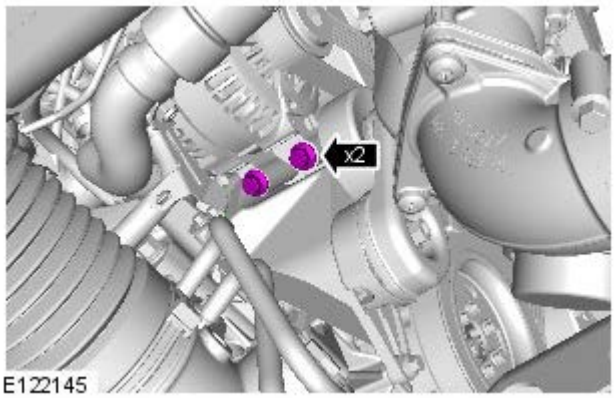
12. *Torque:* 22 Nm



E131854

All vehicles

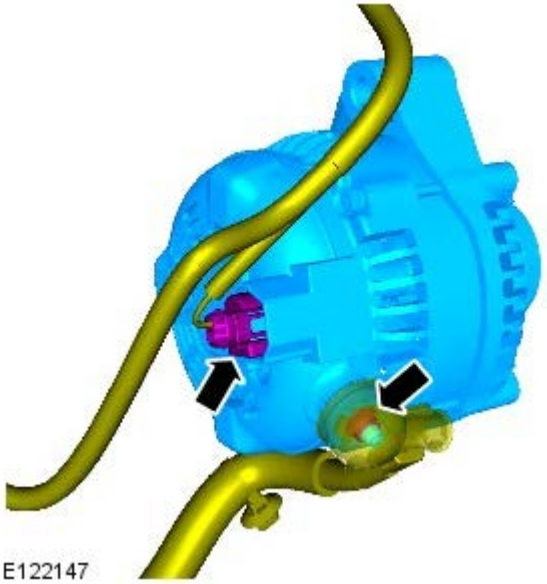
13. *Torque:* 47 Nm



E122145

14. NOTE: Access to the electrical connectors via the heat shield aperture.

Torque: 12 Nm



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Generator and Regulator - V8 5.0L Petrol/V8 S/C 5.0L Petrol -

Description	Nm	lb-ft	lb-in
Generator retaining bolts	47	35	-
Battery positive cable retaining nut	12	9	-

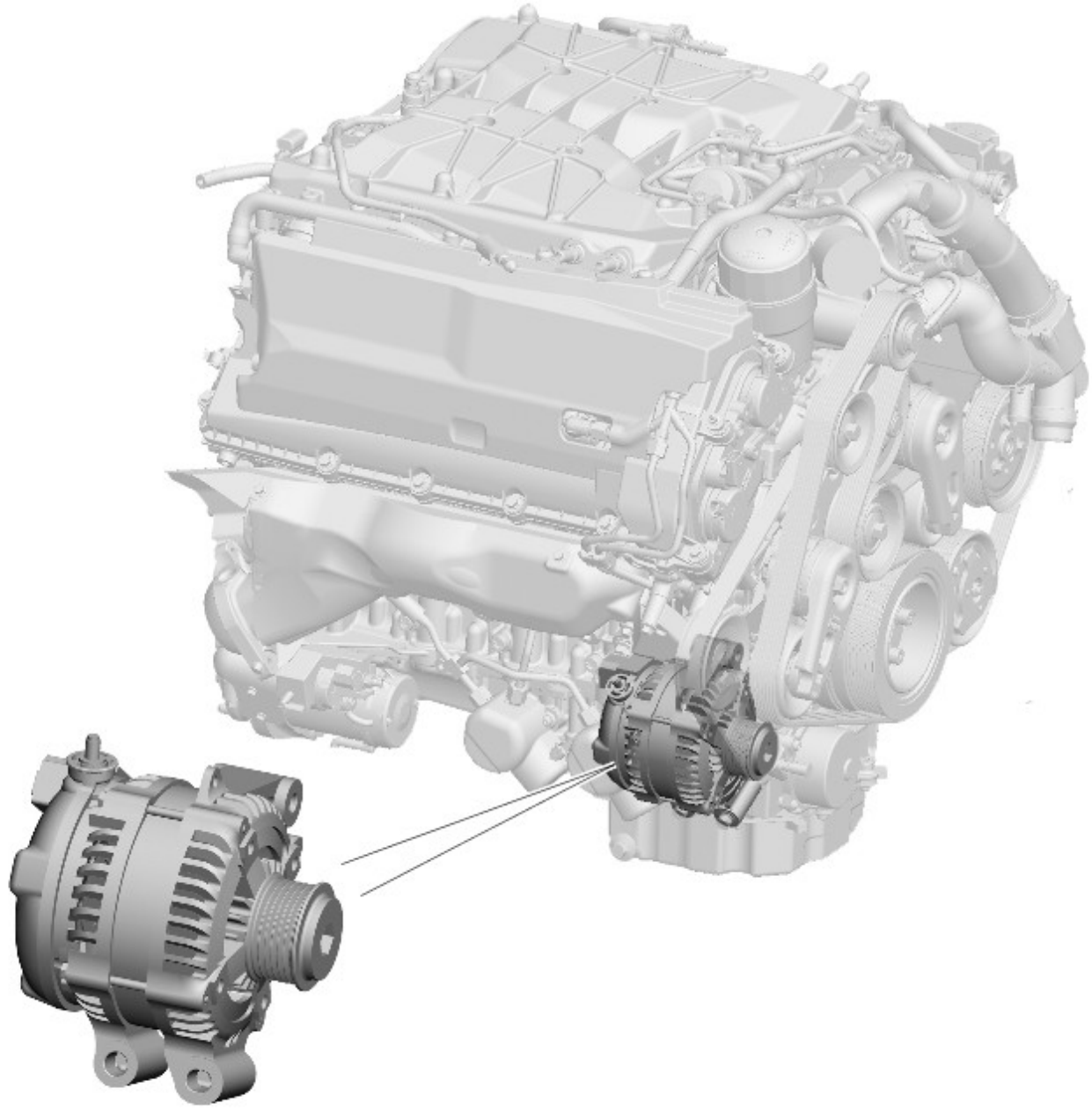
Published: 11-May-2011

Generator and Regulator - V8 5.0L Petrol/V8 S/C 5.0L Petrol - Generator

Description and Operation

COMPONENT LOCATION

NOTE: Installation on supercharged engine shown, installation on naturally aspirated engine similar.



E116462

INTRODUCTION

On 5.0L vehicles (naturally aspirated and supercharged), the electrical charging system consists of a 150 A output generator with an integral voltage regulator. The output from the generator is set by the voltage regulator under the control of the ECM (engine control module).

GENERATOR

The generator produces power for the vehicle electrical system and maintains the battery in a charged state.

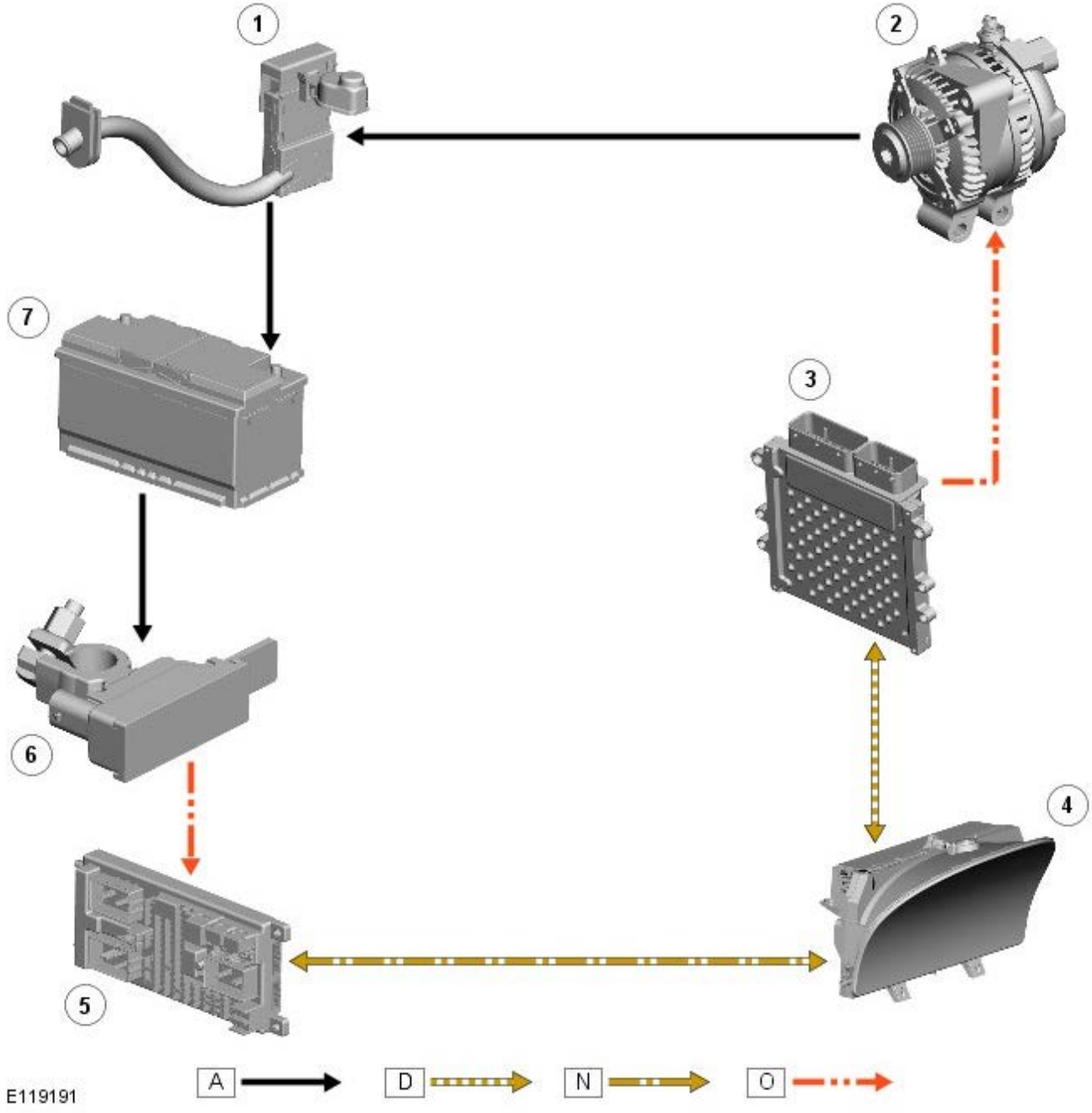
The generator is located at the front right side of the engine and attached directly to the cylinder block and the sump body. A terminal post on the generator provides the connection point for the battery positive cable. A single pin electrical connector on the rear cover provides the interface for a LIN (local interconnect network) bus connection with the ECM. A pulley on the front of the generator is driven at approximately three times engine speed by the accessory drive belt.
For additional information, refer to: Accessory Drive (303-05 Accessory Drive - 5.0L, Description and Operation).

When the engine is running the generator produces an alternating current, which is converted to a direct current

internally.

CONTROL DIAGRAM

NOTE: A = Hardwired; D = High speed CAN (controller area network); N = Medium speed CAN; O = LIN bus



Item	Part Number	Description
1	-	400 A megafuse
2	-	Generator
3	-	ECM (engine control module)
4	-	Instrument cluster
5	-	CJB (central junction box)
6	-	Battery monitoring sensor
7	-	Battery

PRINCIPLES OF OPERATION

The output voltage required from the generator is calculated by the battery monitoring system. For additional information, refer to Battery, Mounting and Cables (414-01 Battery, Mounting and Cables, Description and Operation).

The battery monitoring system signals the required voltage to the ECM via the CJB (central junction box) and the instrument cluster. The ECM then transmits the required voltage on the LIN bus connection with the voltage regulator in the generator. The output from the generator is supplied to the battery through the main battery positive cable.

The ECM will over-ride the voltage value requested by the battery monitoring system if it detects a fault in the generator. The ECM also signals the instrument cluster to display a warning message if it detects a fault with the generator.

Published: 11-May-2011

Generator and Regulator - V8 5.0L Petrol/V8 S/C 5.0L Petrol - Generator

Diagnosis and Testing

For further information.
REFER to: Charging System (414-00, Diagnosis and Testing).

Published: 11-May-2011

Generator and Regulator - V8 5.0L Petrol / V8 S/C 5.0L Petrol - Generator

Removal and Installation

Removal

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

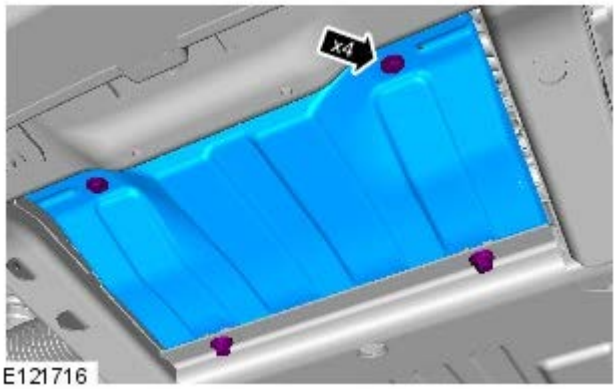
1. Disconnect the battery ground cable.

   Refer to: Specifications (414-00, Specifications).

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

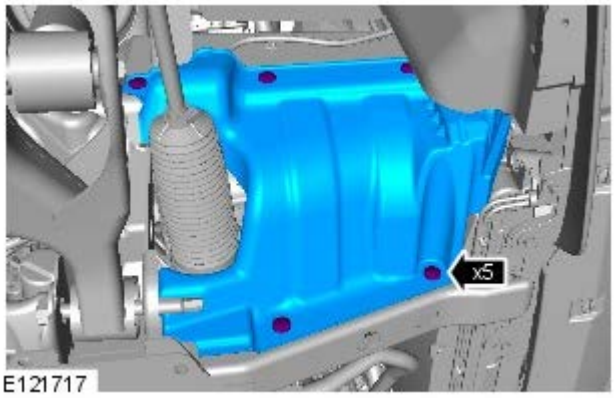
   Raise and support the vehicle.

3. *Torque:* 62 Nm



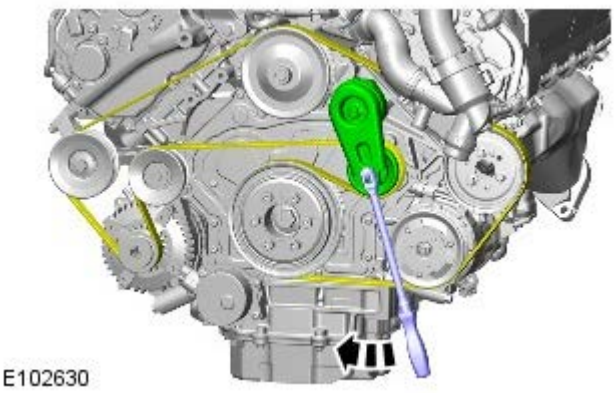
E121716

4.



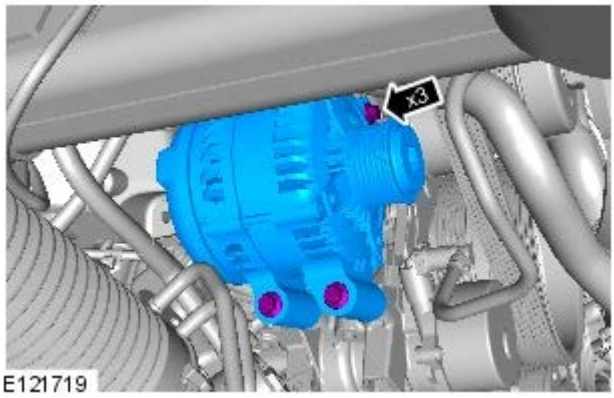
E121717

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


E102630

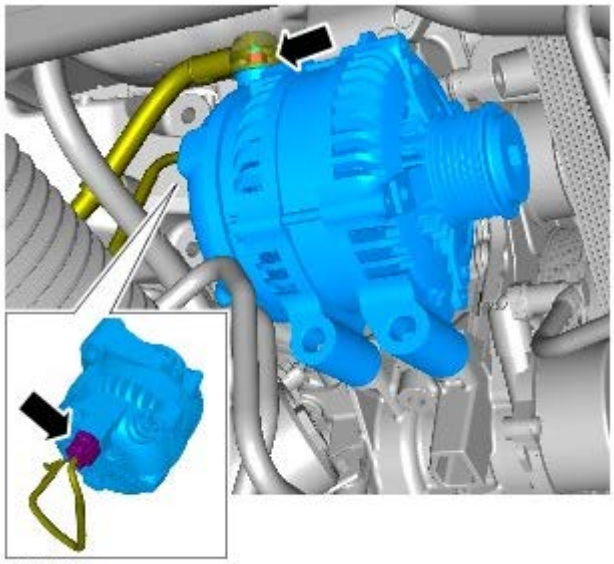
6. CAUTION: Take extra care not to damage the wiring harnesses.

   Torque: 47 Nm



E121719

7. *Torque:* 12 Nm


E121718

Installation

1. To install, reverse the removal procedure.

Published: 06-Nov-2013

Information and Entertainment System - General Information - Navigation System Map Updates

Description and Operation

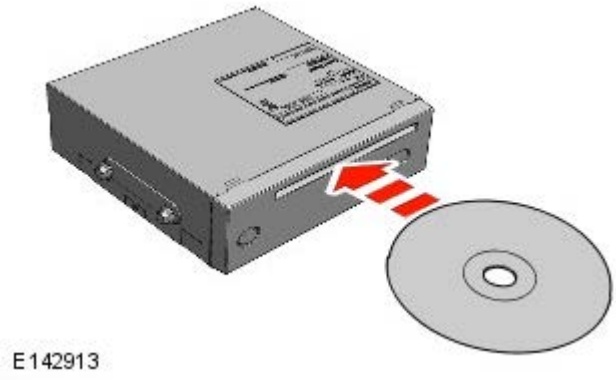
Map Update Applicability

Vehicle	Pre - 10MY	10 MY	11 MY	12MY	13MY	14MY
XK	DVD	DVD	DVD	DVD	DVD	DVD
F-Type	-	-	-	-	-	USB
XF	DVD	DVD	DVD	USB	USB	USB
XJ	-	USB	USB	USB	USB	USB
Freelander	DVD	DVD	DVD	DVD	USB	USB
Discovery 3	DVD	-	-	-	-	
Discovery 4	-	External HD Service Tool	External HD Service Tool	USB	USB	USB
Range Rover Evoque	-	-	-	USB	USB	USB
Range Rover Sport (L320)	DVD	External HD Service Tool	External HD Service Tool	USB	USB	USB
Range Rover Sport (L494)	-	-	-	-	-	USB
Range Rover (L322)	DVD	External HD Service Tool	External HD Service Tool	External HD Service Tool	-	-
Range Rover (L405)	-	-	-	-	USB	USB

Mapping Regions

Region	Mapping Area
1	North America (USA, Canada and Mexico)
2	Western and Eastern Europe
3	Japan
4	Middle East (Bahrain, Jordan, Kuwait, Oman, Qatar, Saudi Arabia and UAE
5	South Africa
6	South America (Brazil and Argentina)
7	Russia
8	Pacific (Australia and New Zealand)
9	South East Asia (Malaysia and Singapore)

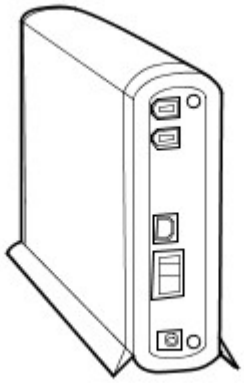
DVD Map Updates



E142913

Vehicles equipped with the 'remote' navigation module are supplied with a DVD map update which is loaded into and left in the navigation module. Map data is read directly from the DVD. This update can be carried out by the customer.

External HD Service Tool Map Updates



E142915

Discovery 4, Range Rover Sport and Range Rover vehicles, equipped with a HDD (hard disc drive) integrated into the touch screen, are updated at point of service. Dealers are supplied with a set of master pack map update DVD's which are loaded onto the dealer Jaguar/Land Rover approved diagnostic equipment. The map data is then loaded from the diagnostic equipment onto the navigation tool hard drive. The map data is loaded to the touch s screen from the navigation tool hard drive.

The following process should be used to update the map data:

NOTE: The navigation update tool does not need the map data loading every time. This is only necessary when a new map update DVD is released.

- Using the approved Jaguar/Land Rover diagnostic equipment select the navigation update tool.





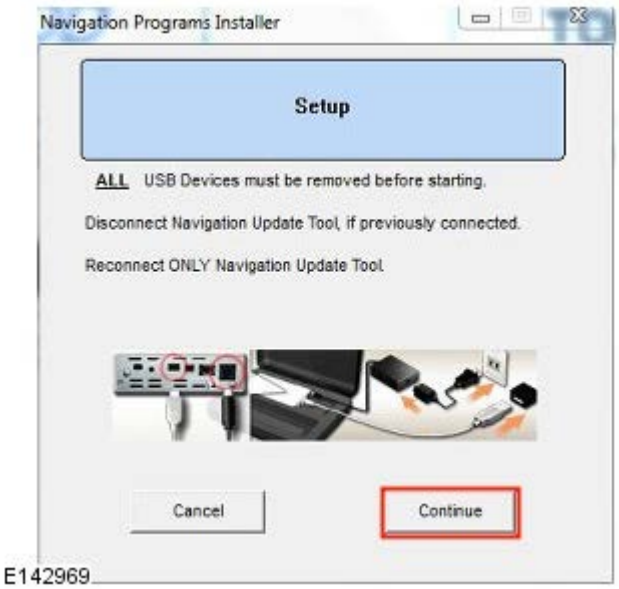
E142966

- Select **Setup** on th navigation update tool.



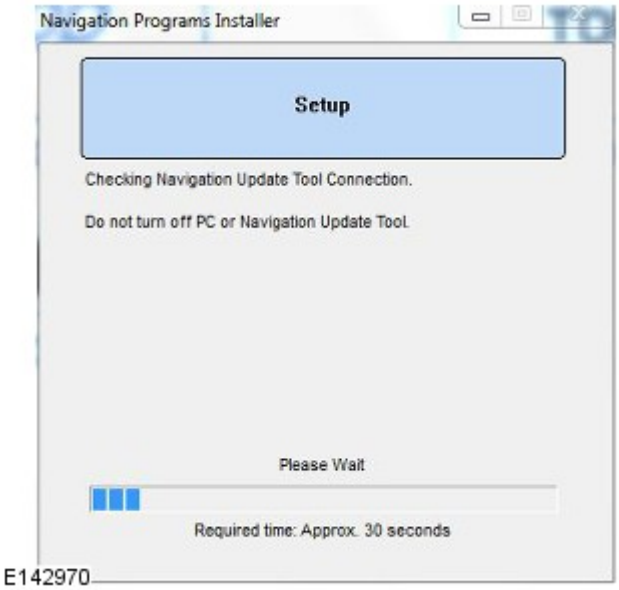
E142967

- Connect the navigation update tool to the Jaguar/Land Rover approved diagnostic equipment using the USB cable and press **Continue** proceed.



E142969

- The navigation update tool will then check the connection.



E142970

- Select your preferred language from the drop down menu then press **Save and Continue Setup** to proceed.



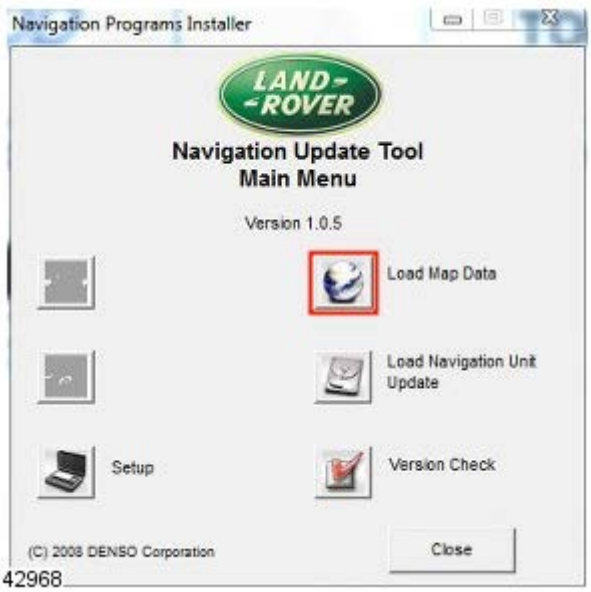
E142971

- When the navigation update tool confirms the initial setup is complete, press **Continue** to proceed.



E142972

- The navigation update tool will the return to the main menu screen, select **Load Map Data** to proceed.



E142968

- Disconnect then reconnect, the USB cable connecting to the navigation update tool to the Jaguar/Land Rover approved diagnostic equipment, press **Continue** proceed.



E142973

- The navigation update tool will then check the connection.



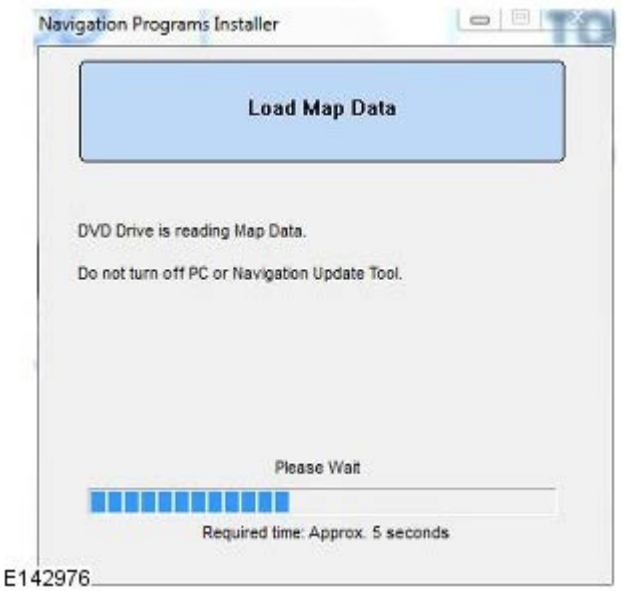
E142974

- Insert map update disk 1 into the DVD drive of the Jaguar/Land Rover approved diagnostic equipment and press **Continue** proceed



E142975

- The navigation update tool will then read the map data



E142976

- Map data will then be copied from disk 1 to the Jaguar/Land Rover approved diagnostic equipment.



E142977

- Insert map update disk 2 into the DVD drive and press **Continue** proceed



E142978

- Map data will then be copied from disk 2 to the Jaguar/Land Rover approved diagnostic equipment.



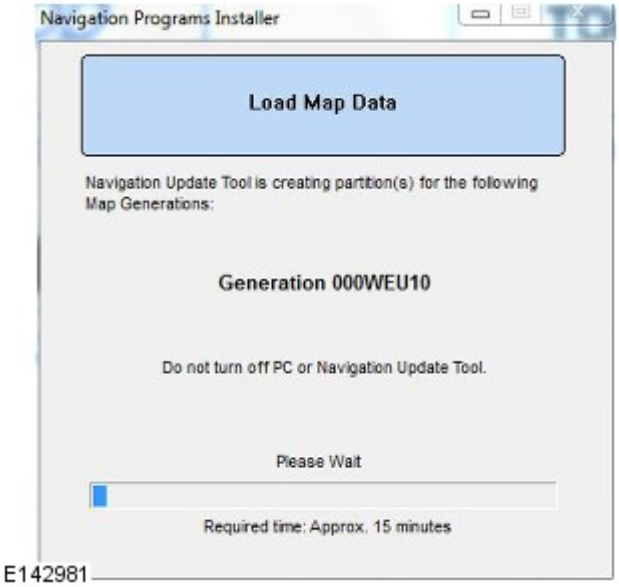
E142979

- Map data is now ready to be uploaded onto the navigation update tool, press **Continue** proceed.



E142980

- The map data is now being uploaded onto the navigation update tool.



E142981

- Map data upload is now complete.



E142982

- Disconnect the navigation update tool from Jaguar/Land Rover approved diagnostic equipment.
- Connect the navigation update tool to the vehicle using the firewire cable.

- Select **Navigation** using the touch screen display soft key.



E142956

- Select **Navigation Setup** using the touch screen soft key.



E142957

- Select **Map Change** using the touch screen.



E142958

- Select map region using the touch screen display and press **Map Data Update** to continue.



E142959

- The current map data version and the proposed update map data versions will now be shown, Select the relevant region, using the related touch screen key to proceed.



E142960

- Select **OK** to input the licence key using the touch screen.



E142961

- Input the licence key using the touch screen display and press **OK** to continue.



E142962

- Select **OK** using the touch screen.



E142963

- The map update will begin.



E142964

- When the map update is complete a message will be shown in the touch screen, select **OK** to continue using the touch screen display soft key. The navigation system will restart with the new map data.



E142965

- Disconnect the navigation update tool from the vehicle.

USB Map Updates



E142914

All Gen 2.1 equipped vehicles are supplied with a USB map updates, these updates can be carried out by the customer.

The following process should be used to update the map data:

- Start the engine.
- Navigate to the touch screen **Home Menu** screen.



E142916

- Insert the USB memory stick containing the map data into the vehicle USB port.



E142914

- Press **Continue** on the touch screen to proceed with the installation of the map update.



E142917

- using the touch screen enter the licence code and press **OK** to proceed.



E142918

- NOTE: Selecting 'Cancel' returns to the 'Home Menu' screen, the map update will continue to run in the background

  The map update will begin and a message will be displayed in the touch screen display advising that navigation is unavailable.



E142919

- Map update progress can be viewed as a percentage of the completed download in the **Home Menu** screen.



E142920

- When the update is complete a message is displayed informing the user.



E142921

- The navigation will restart upon completion of the map update.

NOTE: Remove USB stick immediately



E142922

- Turn off the engine.
- Exit, lock the vehicle and leave for at 15 minutes before using the navigation system.

Japanese Navigation

The Japanese satellite navigation system uses a separate navigation computer module.

The HDD in the ACM/IAM is not used for navigation downloads in this market.

Map updates are supplied in DVD format. The DVD is loaded into the navigation module. Map data is read directly from the DVD.

Asia Navigation

The Asia market navigation system is an aftermarket unit.

Map updates are supplied in an SD card format. The SD card is loaded into the navigation module. Map data is read directly from the SD card.

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Information and Entertainment System - General Information - Information and Entertainment System

Diagnosis and Testing

Principles of Operation

For a detailed description of the Information and Entertainment System, refer to the relevant Description and Operation sections in the workshop manual. REFER to:

Audio System (415-01A Audio Unit, Diagnosis and Testing),
Antenna (415-02 Antenna, Diagnosis and Testing),
Speakers (415-03 Speakers, Diagnosis and Testing),
Video System (415-07 Video System, 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 tested and/or the donor vehicle.

NOTES:

If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.

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

1. Verify the customer concern
2. Visually inspect for obvious signs of damage and system integrity

Visual Inspection

Mechanical	Electrical
• Integrated Audio Module (IAM) • Audio Amplifier Module (AAM) • Touch Screen (TS) • Satellite Radio Control Module (SRCM) • Digital Radio Control Module (DRCM) • TV Control Module (TVCM) • Rear Seat Entertainment Control Module (RSECM) • Speakers • Scratched/dirty compact discs • Water ingress	• Fuses • Wiring harnesses and connectors • Integrated Audio Module (IAM) • Audio Amplifier Module (AAM) • Touch Screen (TS) • Satellite Radio Control Module (SRCM) • Digital Radio Control Module (DRCM) • TV Control Module (TVCM) • Rear Seat Entertainment Control Module (RSECM) • Antennae • Speakers

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index
5. Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required

Symptom Chart

Symptom	Display	Possible Causes	Action
Audio/video system inoperative at start up	Audio/video soft key greyed out on touch screen	• Last used audio/video source inoperative • MOST network fault	• GO to Pinpoint Test A.
Soft key response different to soft key touched	Display normal	• Touch screen calibration incorrect	• Perform touch screen calibration. GO to Pinpoint Test C.
Poor audio quality (all sources)	Display normal	• MOST harness connections loose • MOST harness connections	• Check MOST harness connectors for security • Check MOST harness connectors for contamination

		contaminated • MOST harness misrouted - Too many bends or bend radius less than 25mm • Audio amplifier system fault	• Check the routing of the MOST harness • Using the manufacturer approved diagnostic system, check the audio amplifier module for related DTCs and refer to the relevant DTC index
One or more speakers inoperative	Display normal	• Audio amplifier system fault	• Using the manufacturer approved diagnostic system, check the audio amplifier module for related DTCs and refer to the relevant DTC index
Radio inoperative	-	• AM/FM antenna fault • Integrated audio module internal failure	• Using the manufacturer approved diagnostic system, check the integrated audio module for related DTCs and refer to the relevant DTC index
Digital radio inoperative	-	• Digital radio antenna fault • Digital radio control module internal failure	• Using the manufacturer approved diagnostic system, check the digital radio control module for related DTCs and refer to the relevant DTC index
Digital radio no signal reception - New digital radio control module	-	• Initial tuning not completed	NOTE: Some functions are inhibited when the vehicle is moving. • Operate the **Auto-tune** soft key
Digital radio poor signal reception	-	• Tuning not refreshed • **Link DAB** set to off • L-band antenna set to off in a L-band antenna region • Band 3 antenna set to off in a band 3 antenna region • L-band antenna or link harness damaged • Band 3 antenna or link harness damaged • Software issue	NOTE: Some functions are inhibited when the vehicle is moving. • Operate the **Auto-tune** soft key • Operate the **Settings** soft key, followed by the **Options** soft key and set **Link DAB** to on • Operate the **Settings** soft key, followed by the **L band and Band 3** soft key • Operate the **Settings** soft key, followed by the **L band and Band 3** soft key • Check the L-band antenna and link harness for damage • Check the band 3 antenna and link harness for damage • Using the manufacturer approved diagnostic system, re-configure the digital radio control module with the latest level software
Digital radio channel list not displayed	-	• Tuning not refreshed • L-band antenna set to off in a L-band antenna region • Band 3 antenna set to off in a band 3 antenna region	NOTE: Some functions are inhibited when the vehicle is moving. • Operate the **Auto-tune** soft key • Operate the **Settings** soft key, followed by the **L band and Band 3** soft key • Operate the **Settings** soft key, followed by the **L band and Band 3** soft key
Digital radio interrupted by announcements	-	• **Announcements** set to on	NOTE: Some functions are inhibited when the vehicle is moving. • Operate the **Settings** soft key, followed by the **Announcements** soft key, and set all **Announcements** to off
Unable to store preset channels in digital radio	-	• **Preset #** soft key not operated for sufficient duration	• Operate the **Preset #** soft key for at least 2 seconds to store the current station
Digital radio will not select preset station when **Preset #** soft key operated	-	• No station stored to relevant **Preset #** soft key	• Store a station to the relevant **Preset #** soft key and retest

NOTE: Satellite Digital Audio Radio Service (SDARS) applies to NAS market vehicles only. Satellite radio inoperative	-	• Satellite radio antenna fault • Satellite radio control module internal failure	• Using the manufacturer approved diagnostic system, check the satellite radio control module for related DTCs and refer to the relevant DTC index
NOTE: Satellite Digital Audio Radio Service (SDARS) applies to NAS market vehicles only. No Satellite Digital Audio Radio Service (SDARS) channels available	**No signal** or **Acquiring signal**	• Vehicle not in USA • Poor signal reception • Satellite Digital Audio Radio Service (SDARS) system fault	• No fault to rectify • The vehicle must have clear line of sight to a satellite, which means being outside and having no blockages between the vehicle and the satellite • Using the manufacturer approved diagnostic system, check the Satellite Radio Control Module (SRCM) for related DTCs and refer to the relevant DTC index
NOTE: Satellite Digital Audio Radio Service (SDARS) applies to NAS market vehicles only. Only one Satellite Digital Audio Radio Service (SDARS) channel available (channel 184)	**Unsubscribed**	• Channel 184 is available without subscription for a limited period (6 months)	• No fault to rectify. Subscribe to Satellite Digital Audio Radio Service (SDARS) to resume service
NOTE: Satellite Digital Audio Radio Service (SDARS) applies to NAS market vehicles only. No Satellite Digital Audio Radio Service (SDARS) channels available after 6 months without subscribing	**Unsubscribed**	• Channel 184 is available without subscription for a limited period (6 months)	• No fault to rectify. Subscribe to Satellite Digital Audio Radio Service (SDARS) to resume service
NOTE: Satellite Digital Audio Radio Service (SDARS) applies to NAS market vehicles only. Some Satellite Digital Audio Radio Service (SDARS) unavailable	**Unsubscribed**	• Adult channels blocked by subscription type (family package)	• No fault to rectify. Subscribe to Satellite Digital Audio Radio Service (SDARS) full package to receive adult channels
NOTE: Satellite Digital Audio Radio Service (SDARS) applies to NAS market vehicles only. Satellite Digital Audio Radio Service (SDARS) pay channels unavailable	**Unsubscribed**	• Payment not made	• No fault to rectify
Compact disc player inoperative	-	• Incompatible/damaged compact disc • Integrated audio module internal failure	• Insert a known good disc and retest • Using the manufacturer approved diagnostic system, check the integrated audio module for related DTCs and refer to the relevant DTC index
Unable to upload files to the hard drive	-	• Incompatible/damaged compact disc • Integrated audio module internal failure	• Insert a known good disc and retest • Using the manufacturer approved diagnostic system, check the integrated audio module for related DTCs and refer to the relevant DTC index
Auxiliary audio inoperative	-	• Incompatible/faulty auxiliary device	• Connect a known good auxiliary device to the auxiliary socket and retest

		• Auxiliary device link cable fault • Integrated audio module internal failure	• Connect a known good auxiliary device to the auxiliary socket using a known good link cable and retest • Using the manufacturer approved diagnostic system, check the integrated audio module for related DTCs and refer to the relevant DTC index
USB audio/video inoperative	-	• Incompatible/faulty USB device • Integrated audio module internal failure	• Connect a known good USB device to the auxiliary socket and retest • Using the manufacturer approved diagnostic system, check the integrated audio module for related DTCs and refer to the relevant DTC index
USB audio/video inoperative - Apple devices	-	• Incompatible/faulty Apple device • Bluetooth® and USB connections made in the incorrect order • Integrated audio module internal failure	• Check Apple device compatibility table below. Connect a known good Apple device to the auxiliary socket and retest • Audio streaming is supported via the USB cable but this must be connected after the cellular phone connects via Bluetooth® - Best practice is to start the engine (causing the Bluetooth® connection to be made) before connecting the USB cable • Using the manufacturer approved diagnostic system, check the integrated audio module for related DTCs and refer to the relevant DTC index
Television inoperative	-	• TV antenna fault • TV control module internal failure	NOTE: Some functions are inhibited when the vehicle is moving. • Using the manufacturer approved diagnostic system, check the TV control module for related DTCs and refer to the relevant DTC index
DVD player inoperative	-	• Incompatible/damaged compact disc • Incorrect region set • Integrated audio module internal failure	NOTE: Some functions are inhibited when the vehicle is moving. • Insert a known good disc and retest • Change region setting • Using the manufacturer approved diagnostic system, check the integrated audio module for related DTCs and refer to the relevant DTC index
Unable to pair mobile phone to vehicle via Bluetooth®	-	• Incompatible mobile phone	NOTE: Installing new components will not improve connectivity with an incompatible mobile phone. • Check mobile phone compatibility by referring to: www.landrover.com/Owners/Bluetooth and following the instructions on the page
Echo when using a mobile phone via Bluetooth®	-	• Noise cancelling set to On in mobile phone and vehicle	• Set noise cancelling to Off in mobile phone
Navigation system inoperative (integrated navigation system)	-	• Navigation antenna fault • Integrated audio module internal failure	• Using the manufacturer approved diagnostic system, check the integrated audio module for related DTCs and refer to the relevant DTC index
Navigation system inoperative (with navigation control module)	-	• Navigation antenna fault • Navigation control module internal failure	• Using the manufacturer approved diagnostic system, check the navigation control module for related DTCs and refer to the relevant DTC index
Traffic message channel inoperative	-	• FM/TMC antenna fault • VICS antenna fault • Integrated audio module internal failure	NOTE: Vehicle Information and Communication System (VICS) is a type of

			Traffic Message Channel system used in the Japan market only. • Using the manufacturer approved diagnostic system, check the integrated audio module for related DTCs and refer to the relevant DTC index
Rear seat entertainment system inoperative	-	• Rear seat entertainment control module internal failure	• Using the manufacturer approved diagnostic system, check the rear seat entertainment control module for related DTCs and refer to the relevant DTC index

USB/CD Data Disk Audio File Compatibility

NOTE: Before attempting a repair to the in-vehicle infotainment system following concerns regarding no playback of audio files stored either on a USB data storage device or on a CD data disc, check below to ensure that the audio files in question are encoded in a compatible format

There are a number of variables that can be set (either automatically or by the user) at the point of creating the audio file that may contribute to an audio file being encoded in an incompatible format. These include:

- The **type of audio file** created (MP3/WMA/AAC)
- The specification of **Variable Bit Rate** (VBR) or **Constant Bit Rate** (CBR) encoding
- If CBR encoding is being used, then a particular **bit rate** value (measured in kilobits per second - kbps) may be selected
- The rate of **sampling frequency**, measured in kilohertz (kHz), may also be selected

Diagnostic Procedures For Audio Files

Identify File Type: if a customer reports issues with audio file playback, first confirm that the data source is operating normally and is not locked or corrupted. This may be achieved by reading the USB storage device or data disk via a PC and confirming that the audio files can be seen/accessed as expected. If the storage device/data disk appears to be operating normally, the next step is to ascertain the file type of those files that will not play through the infotainment system. There are three types of compatible audio file, either **MP3** (which must have a file extension of .mp3); or **WMA** (which must have a file extension of .wma); or **AAC** (which must have a file extension of either .aac or .m4a). If the affected audio files are not of these types, then successful playback via the infotainment system may not be possible.

Further information about the audio file may be accessed via the file properties tab either when viewing the file in Windows Explorer or when playing the file via a digital media player programme. In such a way, it should be possible to ascertain some or all of the required information concerning the file's specified encoding type/bit rate/sampling frequency. Once this information has been obtained, use the tables detailed below to check if the suspect audio file is compatible with the vehicle infotainment system.

Playback Of Audio Files Stored On A USB Storage Device

USB MP3 Files (only if file extension is '.mp3'): Playback of MP3 audio files encoded in Variable Bit Rate (VBR) format is supported at bit rates between 8-320 kbps. For Constant Bit Rate (CBR) files, see table below for compatible sampling rates and bit rates.

File Format/Encoding Format	Sampling Rate	Bit Rates	Notes
MP3 (MPEG 2.5*)	All available are supported	8-160 kbps playback supported	*For MPEG 2.5 format audio files, playback cannot be guaranteed but an attempt will be made to play
MP3 (MPEG 2)	All available are supported	8-160 kbps playback supported	-
MP3 (MPEG 1)	All available are supported	32-128 kbps; 160-320 kbps playback supported	Playback of MPEG 1 audio files with a bit rate of 144 kbps is not supported

USB WMA Files (only if file extension is '.wma'): Playback of WMA audio files encoded in Variable Bit Rate (VBR) format and created using Windows Media Player Version 8.0 and/or Version 9.0 is supported at bit rates between 5-384 kbps. For Constant Bit Rate (CBR) files, see table below for compatible sampling rates and bit rates. Note that WMA CBR files created using Windows Media Player Versions 7.0, 8.0 and 9.0 can be supported, while playback will be attempted but cannot be guaranteed for files created using Windows Media Player Versions 4.0, 4.1, 9 Beta and 9.1.

File Format/Encoding Format	Sampling Rate	Bit Rates	Notes
WMA - Constant Bit Rate (CBR)	At sampling rates of 8 KHz playback supported only at specified bit	5-8 kbps (mono); 12 kbps (stereo) playback supported. 31 kbps (mono) playback cannot be guaranteed but an attempt will be made to play	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported

	rates		
	At sampling rates of 11.03 KHz playback supported only at specified bit rates	8-10 kbps (mono) playback supported	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported
	At sampling rates of 16 KHz playback supported only at specified bit rates	10-12 kbps and 16 kbps (mono); 16-20 kbps (stereo) playback supported	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported
	At sampling rates of 22.05 KHz playback supported only at specified bit rates	16-20 kbps (mono); 20, 22 and 36 kbps (stereo) playback supported	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported
	At sampling rates of 32 KHz playback supported only at specified bit rates	20 kbps (mono); 32, 40, 48 kbps (stereo) playback supported. 32 kbps (mono); 22, 36, 44, 64, 384 kbps (stereo) playback cannot be guaranteed but an attempt will be made to play	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported
	At sampling rates of 44.1 KHz playback supported only at specified bit rates	20, 32 and 48 kbps (mono); 32, 48, 64, 80, 96, 128, 160, 192, 256 and 320 kbps (stereo) playback supported. 15 kbps (mono) playback cannot be guaranteed but an attempt will be made to play	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported
	At sampling rates of 48 KHz playback supported only at specified bit rates	64, 96, 128, 160, 192 and 256* kbps (stereo) playback supported. 32 kbps (mono) & 48, 63, 95, 127, 191 and 320 kbps (stereo) playback cannot be guaranteed but an attempt will be made to play	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported. *All available versions can be supported at a bit rate of 256 kbps for this sampling rate only

USB AAC Files (only if file extension is '.aac' or '.m4a'): Playback of AAC audio files encoded in Variable Bit Rate (VBR) format is supported at bit rates between 8-320 kbps. For Constant Bit Rate (CBR) files, see table below for compatible sampling rates and bit rates.

File Format/Encoding Format	Sampling Rate	Bit Rates	Notes
AAC - Constant Bit Rate (CBR)	At sampling rates of between 8-32 KHz, playback cannot be not guaranteed but may be possible at some bit rates	8-320 kbps playback cannot be not guaranteed, but may be possible in some cases	-
	At sampling rates of between 44.1 - 48 KHz, playback supported at specified bit rates	48-80 kbps; 96-128 kbps; 160-256 kbps; 320 kbps playback supported	Playback at other bit rates between 44.1-576 kbps may be possible, but cannot be verified
	At sampling rates of between 64-96 KHz, playback cannot be not guaranteed but an attempt will be made to play at some bit rates	96-768 kbps playback cannot be not guaranteed but an attempt will be made to play	Playback at other bit rates between 64-1152 kbps cannot be not guaranteed but an attempt will be made to play

Playback Of Audio Files Stored On A CD Data Disk

CD Data Disk MP3 Files (only if file extension is '.mp3'): Playback of MP3 audio files encoded in Variable Bit Rate (VBR) format is supported at bit rates between 8-320 kbps. For Constant Bit Rate (CBR) files, see table below for compatible sampling rates and bit rates.

File Format/Encoding Format	Sampling Rate	Bit Rates	Notes

MP3 (MPEG 2.5*)	All available are supported	8-160 kbps playback supported	*For MPEG 2.5 format audio files, playback cannot be guaranteed but an attempt will be made to play
MP3 (MPEG 2)	All available are supported	8-160 kbps playback supported	-
MP3 (MPEG 1)	All available are supported	32-128 kbps; 160-320 kbps playback supported	Playback of MPEG 1 audio files with a bit rate of 144 kbps is not supported

CD Data Disk WMA Files (only if file extension is '.wma'): Playback of WMA audio files encoded in Variable Bit Rate (VBR) format and created using Windows Media Player Version 9.0 is supported at bit rates between 32-192 kbps. For Constant Bit Rate (CBR) files, see table below for compatible sampling rates and bit rates. Note that WMA CBR files created using Windows Media Player Version 9.0 can be supported, while playback will be attempted but cannot be guaranteed for files created using Windows Media Player Versions 4.0, 4.1, 7.0, 8.0, 9 Beta and 9.1.

File Format/Encoding Format	Sampling Rate	Bit Rates	Notes
WMA - Constant Bit Rate (CBR)	At sampling rates of 22.05 KHz playback supported only at specified bit rates	32 kbps (stereo) playback supported	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported
	At sampling rates of 32 KHz playback supported only at specified bit rates	32, 36, 40, 44 and 48 kbps (stereo) playback supported	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported
	At sampling rates of 44.1 KHz playback supported only at specified bit rates	32 and 48 kbps (mono); 32, 48, 64, 80, 96, 128, 160 & 192 kbps (stereo) playback supported	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported
	At sampling rates of 48 KHz playback supported only at specified bit rates	64, 96, 128, 160 & 192 kbps (stereo) playback supported	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported

CD Data Disk AAC Files (only if file extension is '.aac' or '.m4a'): Playback of AAC audio files encoded in Variable Bit Rate (VBR) format is supported at bit rates between 8-320 kbps. For Constant Bit Rate (CBR) files, see table below for compatible sampling rates and bit rates.

File Format/Encoding Format	Sampling Rate	Bit Rates	Notes
AAC - Constant Bit Rate (CBR)	At sampling rates of between 8-24 KHz playback supported at specified bit rates	32-40 kbps; 48-80 kbps; 96-128* kbps playback supported	*112 & 128 kbps bit rate playback not supported for audio files with a sampling rate of 8 KHz
	At sampling rates of between 16-32 KHz playback supported at specified bit rates	160-256* kbps playback supported	*224 & 256 kbps bit rate playback not supported for audio files with a sampling rate of 16 KHz
	At sampling rates of between 32-48 KHz playback supported at specified bit rates	48-80 kbps; 96-128 kbps; 160-256 kbps; 320 kbps playback supported	-

Portable Audio Interface Panel/USB Power Supply

If DTC B1252-19 (USB Port General Electrical Failures - Circuit current above threshold) has been logged, the IAM has detected a current draw from the Portable Audio Interface Panel in excess of 1.7 Amps. In these circumstances, the power supply to the Portable Audio Interface Panel will be cut for an ignition cycle. To reset the system and restore power, the vehicle needs to be locked (with ignition off) and armed for at least 5 minutes.

The USB port on the Portable Audio Interface Panel is able to supply current to a maximum of 500mA. It should be noted that any portable devices connected via the USB port that required more power may not charge or power up correctly and that this may affect the operation of this device with the infotainment system.

Apple Device Compatibility

The following table lists some Apple devices and their compatibility with the information and entertainment system using a USB cable.

Fully Supported	Partially Supported	Not Supported
• iPod® Classic - 6th/7th generation • iPod® Nano - 3rd/4th/5th/6th generation • iPod® Touch - 2nd/3rd/4th generation • iPhone™ 3/3S • iPhone™ 4/4S • iPad™ - 1st generation (with iOS 4.0 or later)	• iPod® Classic - 4th/5th generation • iPod® Nano - 1st/2nd generation • iPod® Touch - 1st generation • iPhone™	• iPod® Classic - 1st/2nd/3rd generation • iPod® Shuffle - 1st/2nd/3rd/4th generation

Pinpoint Tests

PINPOINT TEST A : SOURCE TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: SOURCE TEST 1	
NOTE: Soft key confirmation tones will not be audible if this preference is set to off (Set-up / System / Button feedback)	
	1 Operate the available soft keys
	Was there an audible confirmation tone to indicate that the soft key input was detected? **Yes** Audio amplifier module and MOST network functioning. GO to A2. **No** Audio amplifier module fault or MOST ring break. GO to A2.
A2: SOURCE TEST 2	
NOTES: Operating the steering wheel mode switch briefly will cycle through the audio/video sources as follows: Radio - DAB/SDARS - My Music - My Video	
Operating the steering wheel mode switch for >2 seconds will cycle through the minor sources as follows: (Radio) FM1 - FM2 - FM3 - AM1 - AM2, and (My Music) DVD/CD - iPod® - BT - Stored CDs - USB - AUX	
Depending on vehicle specification, various audio/video sources may be installed and are contained in the control modules as follows: • Integrated Audio Module (IAM) - including radio, CD, iPod®, USB, my music, my video, phone and navigation • Digital Radio Control Module (DRCM) • Satellite Radio Control Module (SRCM) • Television Control Module (TVCM) • Rear Seat Entertainment Control Module (RSECM)	
	1 Cycle through the audio/video sources by operating the steering wheel mode switch
	Did the audio/video soft key return to normal and/or the selected source function normally? **Yes** MOST network functioning. GO to A3. **No** Possible MOST ring break. GO to A3.
A3: SOURCE TEST 3	
	1 Operate the **Navigation** soft key (or switch)
	Did the navigation system start up and display a map? **Yes** GO to A4. **No** GO to A4.
A4: SOURCE TEST 4	
	1 Operate the **Phone** soft key (or switch)
	Is the phone menu displayed? **Yes** GO to Pinpoint Test B. **No** GO to Pinpoint Test B.

PINPOINT TEST B : FUSE PULL TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: FUSE PULL TEST 1	
	1 Remove the fuse from the missing audio/video source control module circuit
	2 Inspect the fuse
	Has the fuse blown? **Yes** Refer to the electrical circuit diagrams and test the circuit for short circuit to ground. Repair as necessary. Install a new fuse. GO to B2. **No** Wait at least 30 seconds and re-install the fuse. GO to B2.
B2: FUSE PULL TEST 2	
NOTE: Depending on vehicle specification, various audio/video sources may be installed and are contained in the control modules as follows: • Integrated Audio Module (IAM) - including radio, CD, iPod®, USB, my music, my video, phone and navigation • Digital Radio Control Module (DRCM) • Satellite Radio Control Module (SRCM) • Television Control Module (TVCM)	

- Rear Seat Entertainment Control Module (RSECM)

	1 Set the ignition to off
	2 Set the ignition to on
	3 Check the operation of the touch screen and all audio/video sources
	Has full audio/video functionality been restored? **Yes** If the missing source was part of the integrated audio module, using the manufacturer approved diagnostic system, re-configure the integrated audio module with the latest level software. Tests complete **No** GO to B3.
B3: FUSE PULL TEST 3	
	1 Refer to the electrical circuit diagrams and identify the next control module connected to the MOST network
	Is there another control module that has not been reset? **Yes** GO to B4. **No** MOST ring break present. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
B4: FUSE PULL TEST 4	
	1 Remove the fuse from the next control module circuit
	2 Inspect the fuse
	Has the fuse blown? **Yes** Refer to the electrical circuit diagrams and test the circuit for short circuit to ground. Repair as necessary. Install a new fuse. GO to B2. **No** Wait at least 30 seconds and re-install the fuse. GO to B2.

PINPOINT TEST C : TOUCH SCREEN CALIBRATION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: TOUCH SCREEN CALIBRATION	
NOTE: A suitable stylus (for example the stylus supplied with a Panasonic CF-19) will be required for this procedure.	
	1 Operate the **Valet** soft key continuously until the engineering mode screen is displayed (approximately 20 seconds)
	2 Scroll down and select **Touch Calibration**
	3 Select **OK**
	4 Tap the touch screen to proceed
	5 Using a suitable stylus, tap the touch screen at the points indicated until a pass/fail result is displayed
	Was the touch screen calibration successful? **Yes** Calibration complete **No** Calibration failed. GO to C1.

Pinpoint Tests For Suspected Loudspeaker Faults In Harman/Kardon Audio Systems

NOTE: See separate Pinpoint Tests (below) for sub-woofer faults

PINPOINT TEST D : NO SOUND OUTPUT FROM LOUDSPEAKER(S)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: NO SOUND OUTPUT FROM LOUDSPEAKER(S)	
	1 Check loudspeaker operation
	Is the harness connector securely connected to the audio amplifier module and the loudspeaker unit(s)? **Yes** Proceed to the next step GO to D2. **No** Reconnect wiring harness to audio amplifier module/loudspeaker unit(s)
D2: NO SOUND OUTPUT FROM LOUDSPEAKER(S)	
	1 Check integrated audio module (IAM) operation
	Is the integrated audio module (IAM) operational? **Yes** Proceed to the next step GO to D3. **No** Check the integrity of the power supply circuits/fuses to the integrated audio module and rectify as required. Check the IAM for related DTCs and refer to the relevant DTC index

D3: NO SOUND OUTPUT FROM LOUDSPEAKER(S)	
	1 Check which loudspeakers are operational
	Are all loudspeakers working? **Yes** Proceed to the next step GO to D4. **No** Use the fader control to direct audio output to different loudspeaker locations to establish which units are non-operational. Refer to the electrical circuit diagrams and check the circuits between the audio amplifier module and the affected loudspeaker units for short circuit to ground, open circuit, high resistance. Repair circuit(s) as required. If fault persists, replace non-operational loudspeaker unit(s) as required
D4: NO SOUND OUTPUT FROM LOUDSPEAKER(S)	
	1 Check for signs of water ingress
	Does the loudspeaker drive unit show any signs of water damage? **Yes** Replace the loudspeaker unit(s) as required **No** Proceed to the next step GO to Pinpoint Test E.

PINPOINT TEST E : POOR OR WEAK SOUND OUTPUT FROM LOUDSPEAKER(S)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: POOR OR WEAK SOUND OUTPUT FROM LOUDSPEAKER(S)	
	1 Check connections to loudspeaker units
	Are the connectors inserted securely into the loudspeaker units? **Yes** Proceed to the next step GO to E2. **No** Ensure all connectors are securely attached to the loudspeaker units
E2: POOR OR WEAK SOUND OUTPUT FROM LOUDSPEAKER(S)	
	1 Check integrity of vehicle power supply fuses
	Are the vehicle/audio amplifier module power supply fuses functional? **Yes** Proceed to the next step GO to E3. **No** Replace fuse(s) as required
E3: POOR OR WEAK SOUND OUTPUT FROM LOUDSPEAKER(S)	
	1 Check power and ground circuits to the infotainment system components
	Are all the necessary power and ground feeds present? **Yes** Proceed to the next step GO to E4. **No** Refer to the electrical circuit diagrams and check the infotainment power and ground circuits for short circuit to ground, open circuit, high resistance. Repair circuit(s) as required
E4: POOR OR WEAK SOUND OUTPUT FROM LOUDSPEAKER(S)	
	1 Check power supply voltage at power supply connectors
	Is the power supply voltage measured at the power supply connectors between 12 and 14 volts? **Yes** No further action **No** Refer to the electrical circuit diagrams and check the infotainment power supply circuits for short circuit to ground, open circuit, high resistance. Repair circuit(s) as required. Refer to the relevant section of workshop manual and battery care manual. Check battery state of charge and starting/charging system performance and rectify as required

PINPOINT TEST F : LOUDSPEAKER VIBRATING (BUZZING) EXCESSIVELY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: LOUDSPEAKER VIBRATING (BUZZING) EXCESSIVELY	
	1 Check for extreme bass/treble settings
	Is the audio system output settings for bass and/or treble set too high? **Yes** Adjust settings to appropriate levels **No** Proceed to the next step GO to F2.
F2: LOUDSPEAKER VIBRATING (BUZZING) EXCESSIVELY	
	1 Check loudspeaker unit(s) fixing screws are securely fastened
	Are all loudspeaker fixing screws fully secured to the surrounding trim? **Yes** Proceed to the next step GO to F3. **No** Tighten the fixing screws to the correct torque as directed in the workshop manual
F3: LOUDSPEAKER VIBRATING (BUZZING) EXCESSIVELY	
	1 Check if the wiring harness is resting against the internal surface of the loudspeaker
	Is there any cabling or other parts of the wiring harness resting against the internal surface of the loudspeaker?

	Yes Re-route and secure the wiring harness so that it is not resting against any internal surfaces of the loudspeaker **No** Proceed to the next step GO to F4.
F4: LOUDSPEAKER VIBRATING (BUZZING) EXCESSIVELY	
	1 Check security of trim in the vicinity of the loudspeaker units
	Is the trim secure in the vicinity of the loudspeaker units? **Yes** No further action **No** Secure loose trim components to ensure no vibration
F5: AUDIO OUTPUT DISTORTED	
	1 Check for extreme bass/treble settings
	Is the audio system output settings for bass and/or treble set too high? **Yes** Adjust settings to appropriate levels **No** No further action

Pinpoint Tests For Suspected Sub-Woofer Faults In Harman/Kardon Audio Systems

NOTE: See separate Pinpoint Tests (above) for other loudspeaker faults

PINPOINT TEST G : NO SOUND OUTPUT FROM SUB-WOOFER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: NO SOUND OUTPUT FROM SUB-WOOFER	
	1 Check sub-woofer operation
	Is the harness connector securely connected to the audio amplifier module and the sub-woofer unit? **Yes** Proceed to the next step GO to G2. **No** Reconnect wiring harness to audio amplifier module/sub-woofer unit
G2: NO SOUND OUTPUT FROM SUB-WOOFER	
	1 Check integrated audio module (IAM) operation
	Is the integrated audio module (IAM) operational? **Yes** Proceed to the next step GO to G3. **No** Check the integrity of the power supply circuits/fuses to the integrated audio module and rectify as required. Check the IAM for related DTCs and refer to the relevant DTC index
G3: NO SOUND OUTPUT FROM SUB-WOOFER	
	1 Check which sub-woofers are operational
	Are all sub-woofers working? **Yes** Proceed to the next step GO to G4. **No** Use the fader control to direct audio output to different sub-woofer locations to establish which units are non-operational. Refer to the electrical circuit diagrams and check the circuits between the audio amplifier module and the affected sub-woofer units for short circuit to ground, open circuit, high resistance. Repair circuit(s) as required. If fault persists, replace non-operational sub-woofer unit(s) as required
G4: NO SOUND OUTPUT FROM SUB-WOOFER	
	1 Check for signs of water damage around sub-woofer unit(s)
	Are there any signs of water damage around sub-woofer unit(s)? **Yes** Dis-assemble sub-woofer moulding and check loudspeaker condition. If the sub-woofer drive unit shows signs of water damage, replace the sub-woofer unit(s) as required **No** Proceed to the next step GO to G5.
G5: NO SOUND OUTPUT FROM SUB-WOOFER	
	1 Check for any visible loose components on sub-woofer drive unit
	Are there any visible loose components (ie: loose wires) on the sub-woofer drive unit **Yes** Replace the sub-woofer unit(s) as required **No** No further action

PINPOINT TEST H : POOR OR WEAK SOUND OUTPUT FROM SUB-WOOFER(S)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: POOR OR WEAK SOUND OUTPUT FROM SUB-WOOFER(S)	
	1 Check connections to sub-woofer units
	Are the connectors inserted securely into the sub-woofer units? **Yes**

	Proceed to the next step GO to H2. **No** Ensure all connectors are securely attached to the sub-woofer units
H2: POOR OR WEAK SOUND OUTPUT FROM SUB-WOOFER(S)	
	1 Check integrity of vehicle power supply fuses
	Are the vehicle/audio amplifier module power supply fuses functional? **Yes** Proceed to the next step GO to H3. **No** Replace fuse(s) as required
H3: POOR OR WEAK SOUND OUTPUT FROM SUB-WOOFER(S)	
	1 Check power and ground circuits to the infotainment system components
	Are all the necessary power and ground feeds present? **Yes** Proceed to the next step GO to H4. **No** Refer to the electrical circuit diagrams and check the infotainment power and ground circuits for short circuit to ground, open circuit, high resistance. Repair circuit(s) as required
H4: POOR OR WEAK SOUND OUTPUT FROM SUB-WOOFER(S)	
	1 Check power supply voltage at power supply connectors
	Is the power supply voltage measured at the power supply connectors between 12 and 14 volts? **Yes** No further action **No** Refer to the electrical circuit diagrams and check the infotainment power supply circuits for short circuit to ground, open circuit, high resistance. Repair circuit(s) as required. Refer to the relevant section of workshop manual and battery care manual. Check battery state of charge and starting/charging system performance and rectify as required

PINPOINT TEST I : SUB-WOOFER VIBRATING (BUZZING) EXCESSIVELY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1: SUB-WOOFER VIBRATING (BUZZING) EXCESSIVELY	
	1 Check for extreme bass/treble settings
	Is the audio system output settings for bass and/or treble set too high? **Yes** Adjust settings to appropriate levels **No** Proceed to the next step GO to I2.
I2: SUB-WOOFER VIBRATING (BUZZING) EXCESSIVELY	
	1 Check sub-woofer unit(s) fixing screws are securely fastened
	Are all sub-woofer fixing screws fully secured to the surrounding trim? **Yes** Proceed to the next step GO to I3. **No** Tighten the fixing screws to the correct torque as directed in the workshop manual
I3: SUB-WOOFER VIBRATING (BUZZING) EXCESSIVELY	
	1 Check security of trim in the vicinity of the sub-woofer units
	Is the trim secure in the vicinity of the sub-woofer units? **Yes** No further action **No** Secure loose trim components to ensure no vibration

PINPOINT TEST J : SUB-WOOFER AUDIO OUTPUT DISTORTED	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
J1: SUB-WOOFER AUDIO OUTPUT DISTORTED	
	1 Check for extreme bass/treble settings
	Is the audio system output settings for bass and/or treble set too high? **Yes** Adjust settings to appropriate levels **No** Proceed to the next step GO to J2.
J2: SUB-WOOFER AUDIO OUTPUT DISTORTED	
	1 Check if the distortion continues when sub-woofer casing is removed
	Does the distortion continue when sub-woofer casing is removed? **Yes** Replace the sub-woofer unit(s) as required **No** No further action

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Audio Amplifier Control Module (AAM) (100-00 General Information, Description and Operation) /
Diagnostic Trouble Code (DTC) Index - DTC: Digital Radio Control Module (DRCM) (100-00 General Information,

Description and Operation) /
Diagnostic Trouble Code (DTC) Index - DTC: Integrated Audio Module (IAM) - High Line (100-00 General Information, Description and Operation) /
Diagnostic Trouble Code (DTC) Index - DTC: Integrated Control Panel (ICP) (100-00 General Information, Description and Operation) /
Diagnostic Trouble Code (DTC) Index - DTC: Integrated Control Panel B (ICPB) (100-00 General Information, Description and Operation) /
Diagnostic Trouble Code (DTC) Index - DTC: Rear Seat Entertainment Control Module (RSECM) (100-00 General Information, Description and Operation) /
Diagnostic Trouble Code (DTC) Index - DTC: Satellite Radio Control Module (SRCM) (100-00 General Information, Description and Operation) /
Diagnostic Trouble Code Index: Touch Screen - DTC: (TS) (100-00 General Information, Description and Operation) /
Diagnostic Trouble Code (DTC) Index - DTC: TV Control Module (TVCM) (100-00 General Information, Description and Operation).

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Information and Entertainment System - General Information - Cellular Phone

Diagnosis and Testing

Principle of Operation

For a detailed description of the Cellular phone system and operation, refer to the relevant Diagnosis and Testing section of the workshop manual. REFER to:

Audio System (415-01 Audio Unit, Description and Operation),
Antenna (415-02 Antenna, Description and Operation),
Speakers (415-03 Speakers, Description and Operation),
Video System (415-07 Video System, 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. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Check all information and entertainment system modules • Speakers • Switch(s) stuck or damaged	• Fuses • Electrical harnesses • Harness connectors • Battery condition, state of charge

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Action
Unable to pair	• GO to Pinpoint Test A.
Not Auto Connecting	• GO to Pinpoint Test B.
Poor Quality Audio	• GO to Pinpoint Test C.
No Audio to 3rd Party	• GO to Pinpoint Test D.
No Audio from 3rd Party	• GO to Pinpoint Test E.
No Audio	• GO to Pinpoint Test F.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Bluetooth Module (TEL) (100-00 General Information, Description and Operation).

Pinpoint Tests

PINPOINT TEST A : UNABLE TO PAIR	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: 'NO PHONE FITTED' DISPLAY	
NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the bluetooth function is activated and the telephone handset is placed within the vehicle cabin area.	
	1 Carry out checks to determine if 'No Phone Fitted' is shown on vehicle display.
	Is 'No Phone Fitted' displayed? **Yes** GO to A2.

	No Locate the connected telephone and if not Customer telephone, disconnect from the system.
A2: TELEPHONE BLUETOOTH DEVICE SEARCH	
	1 Carry out Bluetooth device search using Customer handset.
	Is 'Land Rover' identified in Bluetooth device list? **Yes** Select device from list, then continue with diagnosis.GO to A3. **No** Carry out further Bluetooth device search, to a maximum of 4 times, waiting approximately 20 seconds between searches. If 'Land Rover' still not identified in Bluetooth device list, set ignition status to OFF, wait approximately 30 seconds and set ignition status to ON. Carry out further Bluetooth device search, to a maximum of 4 times, waiting approximately 20 seconds between searches. If 'Land Rover' still not identified in Bluetooth device list, contact your local in market support for further assistance.
A3: TELEPHONE HANDSET ERROR	
	1 Check for any error shown on the telephone handset when 'Land Rover' is selected from the Bluetooth device list.
	Was an error immediately shown on the telephone handset? **Yes** Wait approximately 10 seconds then re-attempt selection, to a maximum of 4 times, waiting approximately 10 seconds between each attempt. If error still being displayed, contact your local in market support for assistance. **No** Enter PIN '2121' then continue with diagnosis.GO to A4.
A4: PIN ENTRY STATUS	
	1 Check for successful PIN entry.
	Was PIN entry successful? **Yes** GO to A5. **No** Wait approximately 10 seconds then re-attempt PIN entry, to a maximum of 4 times, waiting approximately 10 seconds between each attempt. If PIN entry is still un-successful, contact your local in market support for assistance.
A5: 'NO PHONE FITTED' DISPLAY	
	1 Carry out checks to determine if 'No Phone Fitted' is still shown on vehicle display.
	Is 'No Phone Fitted' still displayed? **Yes** From the telephone handset, select the connect option for the 'Land Rover' device identified in the Bluetooth device list. If 'No Phone Fitted' is still displayed, suspect a telephone handset fault. Carry out Pinpoint test again using known good telephone handset. **No** The telephone is paired and connected to the system. No further action is required for this symptom.

PINPOINT TEST B : NOT AUTOMATICALLY CONNECTING	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CUSTOMER TELEPHONE IN POSITION 1	
NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the bluetooth and auto connect functions are activated and the telephone handset is placed within the vehicle cabin area.	
	1 Carry out checks to determine if the Customer telephone is in position 1 in the Bluetooth Module device list.
	Is the Customer telephone in position 1? **Yes** GO to B2. **No** Advise Customer that delays in connection will occur if telephone is not listed in position 1.
B2: BLUETOOTH CONNECTION	
	1 Carry out checks to determine if Bluetooth connection to the vehicle has been achieved.
	Has Bluetooth connection to the vehicle been achieved? **Yes** No further action is required for this symptom. **No** GO to B3.
B3: 'NO PHONE FITTED' DISPLAY	
	1 Carry out checks to determine if 'Land Rover' is shown in the Customer Bluetooth telephone device display.
	Is 'Land Rover' identified in the Customer Bluetooth device list? **Yes** Select the device to connect then follow pairing instructions. **No** Carry out the 'Unable to Pair' Pinpoint Test.

PINPOINT TEST C : POOR QUALITY AUDIO	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: SIGNAL STRENGTH	
NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the telephone is placed within the vehicle cabin area and is connected to the vehicle via bluetooth.	
	1 Check the signal strength displayed on the telephone handset.
	Are at least two signal strength bars shown on the telephone handset display? **Yes** GO to C2. **No** Suspect GSM Network issue. This can explain intermittent audio and dropped calls, and the inability to initiate calls.
C2: POOR AUDIO FROM THIRD PARTY ONLY	
	1 Establish from Customer feedback/symptom if there is poor audio from the Third Party only.
	Is the poor audio from the Third Party only? **Yes** Suspect GSM Network issue. This can explain intermittent audio and dropped calls, and the inability to initiate calls. **No** GO to C3.
C3: POOR AUDIO TO THIRD PARTY ONLY	
	1 Establish from Customer feedback/symptom if there is poor audio to the Third Party only.
	Is the poor audio to the Third Party only? **Yes** Check and install a new microphone as necessary. **No** GO to C4.
C4: POOR AUDIO WITH VEHICLE STATIONARY	
	1 Establish from Customer feedback/symptom if there is poor audio when the vehicle is stationary only.
	Is the poor audio when the vehicle is stationary only? **Yes** Check and install a new microphone as necessary. **No** GO to C5.
C5: THIRD PARTY MOVING VEHICLE	
	1 Establish from Customer feedback/symptom if the Third Party is in a moving vehicle.
	Is the Third Party in a moving vehicle? **Yes** There are limitations to the way the system can improve audio, and in this situation it is not possible to determine the source of the audio degradation. **No** GO to C6.
C6: CUSTOMER HEARING ECHO	
	1 Establish from Customer feedback/symptom if the Customer is hearing an echo.
	Is the Customer hearing an echo? **Yes** Echo from the Third Party is not vehicle failure, it is the Third Party set-up. No further action is required for this symptom. **No** Contact your local in market support for assistance.

PINPOINT TEST D : NO AUDIO TO THIRD PARTY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: MICROPHONE DIAGNOSTIC TROUBLE CODES (DTCS)	
NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the telephone is placed within the vehicle cabin area and is connected to the vehicle via bluetooth.	
	1 Using the Manufacturer approved diagnostic system, check for any logged microphone DTCs in Audio Front Control module.
	Is DTC B1D79-01 logged? **Yes** Carry out diagnosis of electrical failure as advised in Action column of DTC Index. **No** Contact your local in market support for assistance.

PINPOINT TEST E : NO AUDIO FROM THIRD PARTY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: 'IN CALL' DISPLAY	

NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the telephone is placed within the vehicle cabin area and is connected to the vehicle via bluetooth.	
	1 Carry out checks to determine if 'In Call' is shown on the vehicle display.
	Is vehicle display showing 'In Call'? **Yes** Contact your local in market support for assistance. **No** Call has ended. No further action is required for this symptom.

PINPOINT TEST F : NO AUDIO	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: AUDIO FROM THIRD PARTY	
NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the telephone is placed within the vehicle cabin area and is connected to the vehicle via bluetooth.	
	1 Establish from Customer feedback/symptom if there is Audio from the Third Party.
	Is there Audio from the Third Party? **Yes** GO to F2. **No** Refer to the 'No Audio From Third Party' Pinpoint test.GO to E.
F2: AUDIO TO THIRD PARTY	
	1 Establish from Customer feedback/symptom if there is Audio to the Third Party.
	Is there Audio to the Third Party? **Yes** GO to F3. **No** Refer to the 'No Audio To Third Party' Pinpoint test.GO to D.
F3: CD OR RADIO AUDIO	
	1 Establish from Customer feedback/symptom if there is Audio from the CD or Radio.
	Is there Audio from the CD or Radio? **Yes** GO to F4. **No** Suspect MOST ring fault, refer to electrical circuit diagrams and check/rectify MOST ring as necessary.
F4: TELEPHONE HANDSET AUDIO	
	1 Establish from Customer feedback/symptom if there is Audio from the telephone handset.
	Is there Audio from the telephone handset? **Yes** Ensure vehicle is parked. Disconnect and reconnect handset. If issue not resolved, contact your local in market support for assistance. **No** Contact you local in market support for assistance.

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Information and Entertainment System - General Information - Navigation System

Diagnosis and Testing

Principles of Operation

For a detailed description of the navigation system and operation, refer to the relevant Description and Operation section of the workshop manual.
REFER to: Navigation System (419-07 Navigation System, 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.

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

Visual Inspection

Electrical
• Battery • Fuses - Central Junction Box - Battery Junction Box - Megafuses • Wiring harness • Damaged, loose or corroded connectors • Touch Screen (TS) • GPS antenna • TV antenna • Satellite antenna • FM antenna • Rear view camera • Microphone • Accessory USB unit • Steering wheel controls • Clock spring • Integrated Head Unit (IHU) • Audio Amplifier Module (AAM) • Anti-lock Brake System (ABS) control module • Wheel speed sensors • Vehicle Information and Communication System (VICS) receiver - Japan only • VICS beacon antenna - Japan only • Controller Area Network (CAN) circuits • Media Oriented System Transport (MOST) system • Gigabit Video Interface (GVIF) • Central Junction Box (CJB) • Terrain Response (TR) • Mobile telephone

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Touch Screen (TS) and Navigation Diagnostics

Fault codes and diagnostics can be retrieved/achieved using the manufacturer approved diagnostic system

Hard Key Test

The hard key test is used to check the operation of the hard switches.

If switch operation is normal, the switch colour on the screen will change when a hard switch is pressed. (Power switch operation cannot be checked on this screen.)

Touch Switch Test

The touch switch test calibrates the touch switch coordinates and checks touch switch operation.

Start Calibration - Calibrates the switch coordinates. Calibrate the coordinates by touching each of the "+" marks in the four corners of the screen.

NOTE: Do not touch any locations other than the "+" marks. (Touching other locations may invalidate the

calibration.)

Touch Switch Check - Checks for deviation in the coordinates. Check the coordinates of the touched location by verifying the displayed values. Touch and hold "press here" to return to the previous screen. If there is a large deviation in the coordinates, calibrate the touch switch using the "Start Calibration" function.

DTC Information

Search for the meaning of the displayed DTC.

Vehicle Configuration

Display the status of each vehicle system.

Speed Lock Configuration - Display the status of compulsory navigation settings (setting status of switches that cannot be operated) when driving.

Configurations

Display primary system information.

Vehicle Signals

Display the status of vehicle signals inputted to the Touch Screen (TS). These signals include:

- Lights (on or off)
- Ambient light sensor voltage
- Backlight dimming duty
- Graphic illumination dimming duty
- Vehicle speed, GPS speed, MOST km/h
- Battery voltage
- Reverse gear / park brake position (electric park brake on or off)
- Speed inhibit
- MOST Fibre Optic Transceiver (FOT) temperature
- Output audio allocation

Video Inputs Test

This screen will allow the testing of video inputs that are connected to the Touch Screen (TS). These include:

- Rear view / proximity camera
- TV/DVD

Self Test

Performs system self-diagnosis and displays the diagnostic results.

If an abnormality is present, a DTC is displayed.

MOST Test

Display the MOST connection status, and reception/transmission messages related to MOST.

"Mpr" displays the number of MOST devices existing on MOST. When "0" or "1" is displayed, communication is not possible.

Colour bar

This function allows the technician to test the colours generated by the TSD. A second screen displays six solid colours, selecting the colour will fill the screen with the chosen colour and pressing the TSD again will revert back to the colour test screen.

Loading

Update the navigation program.

For details on the update method, refer to the "Navigation Update Tool" operation manual.

HDD information

Display information on the Hard Disc Drive (HDD).

SMART test (Self-Monitoring Analysis and Reporting Technology) is initiated from this screen

Vehicle information

Display information on the vehicle.

- Car configuration - Displays information on vehicle environment settings.
  - Unit (distance) - Units of distance
  - Unit (time) - Units of time
  - Language - Displayed language
  - Fuel information - Remaining fuel quantity
  - Mileage information - Vehicle mileage display
  - Time information - Current time display
  - Override information - Status of switch operation inhibitions (Setting status of switches that cannot be operated.)

GPS information - Display GPS related information.
- Received position - Displays the latitude and longitude (displayed in degrees, minutes, and seconds) for the position information calculated by GPS.
- Map matched position - Displays the latitude and longitude (displayed in degrees, minutes, and seconds) for the position information being used for map matching.
- Satellites - Number of acquired satellites.
- Current address - Address of the current location.
- Satellite Information - Displays satellite information for up to 12 GPS satellite search targets.
- Measurement HDOP - Positioning accuracy.
- Status - Positioning status.
- Date - Displays the current date and time in the following order: day, month, year, hour, minute, second. The year is displayed using the four-digit western calendar; time is displayed in Greenwich Mean Time (GMT).

- Vehicle sensor - Display vehicle signals inputted to the Touch Screen (TS).
  - REV - Reverse signal status.
  - Speed - Current vehicle speed.
  - Speed pulse count - Speed pulse count value.
  - Distance calibration - Learning information for distance calibration.
  - Voltage/Offset - Gyro sensor output voltage value/voltage correction value.
  - Relative bearing - Relative bearing (0° when navigation is started.)
  - Gyro sense - Learning value for gyro sensitivity.
  - Reset - Resets the gyro sensor relative bearing value.
- RDS-TMC information - Display RDS-TMC related information.
  - Date/time (GMT) - Date and time for the TMC signal.
  - Frequency - TMC signal frequency.
  - PI code - Personal identification code for the broadcast station.
  - PS name - Broadcast station name.
  - Country code - Database country code.
  - LTN - Database location number (location table number.)
  - Service ID - Service provider identification number.
  - Air data - TMC data.

Microphone

Check the volume for the voice recognition microphone inputted to the Touch Screen (TS). These include:

- PTT switch status - Checks the PTT switch connection. When the PTT switch is pressed, a signal will be outputted, and the indicator displays in green.
- Microphone input level judging - If a sampling of the user's voice command is at or above the threshold value, the indicator displays in blue.
- Microphone level - Displays the microphone input level.

Voice output check

Check the audio output.

- ON (Normal) - Outputs ADPCM voice (1 kHz sine wave) for five seconds.
- ON (Max) - Outputs ADPCM voice (maximum 1 kHz sine wave) for five seconds.

Symptom Chart

Symptom	Possible Cause	Action
Black screen (navigation and audio screens do not display.)	• Temperature in passenger compartment too low • Condensation in passenger compartment • Electrical harness open/short circuit, dis-connected • Component failure	• GO to Pinpoint Test A.
The navigation screen does not display, even when the "NAVIGATION" button is pressed (screen does not change.)	• Electrical harness open/short circuit, dis-connected • Component failure	• GO to Pinpoint Test B.
The hard switches do not respond.	• Component failure • Switch failure	• GO to Pinpoint Test C.
The audio screen cannot be operated (does not display.)	• Media Oriented System Transport (MOST) system • Electrical harness open/short circuit, dis-connected	• GO to Pinpoint Test D.
The screen does not dim.	• Electrical harness open/short circuit, dis-connected	• GO to Pinpoint Test E.

	• Component failure	
Noise on the screen, screen colour is abnormal.	• Electrical harness open/short circuit, disconnected • Component failure	• GO to Pinpoint Test F.
The touch switches do not respond.	• Electrical harness open/short circuit, disconnected • Component failure	• GO to Pinpoint Test G.
There is considerable deviation between the displayed vehicle position and the actual position.	• Electrical harness open/short circuit, disconnected • Component failure	• GO to Pinpoint Test H.
The GPS no reception mark does not disappear.	• Electrical harness open/short circuit, disconnected • Component failure • No reception from satellite	• GO to Pinpoint Test I.
No sound is emitted.	• Electrical harness open/short circuit, disconnected • Component failure • Incorrect system settings	• GO to Pinpoint Test J.
There is no navigation voice guidance.	• Volume level set too low • The amplifier and speakers are incorrectly connected	• GO to Pinpoint Test K.
Voice recognition does not function.	• Electrical harness open/short circuit, disconnected • Component failure	• GO to Pinpoint Test L.
The vehicle position rotates randomly.	• Electrical harness open/short circuit, disconnected • Component failure • Vehicle on a turntable in a parking building	• GO to Pinpoint Test M.
The vehicle mark display is unstable.	• Electrical harness open/short circuit, disconnected • Component failure • No reception from satellite	• GO to Pinpoint Test N.
The vehicle position does not update.	• HDD contaminated/damaged • Electrical harness open/short circuit, disconnected • Component failure	• GO to Pinpoint Test O.
The map display is incomplete.	• HDD contaminated/damaged • Electrical harness open/short circuit, disconnected • Component failure	• GO to Pinpoint Test P.
Calls cannot be received or placed with Bluetooth®; Bluetooth® cannot connect with the vehicle.	• Incompatible Bluetooth® telephone • Incorrect initial connection settings • Electrical harness open/short circuit, disconnected • Component failure	• GO to Pinpoint Test Q.
The map cannot be updated.	• Refer to the "Navigation Update	• Refer to the "Navigation Update

	Tool" operation manual	Tool" operation manual
An error screen displays on the navigation screen.	• Access to the map data has not been granted	• GO to Pinpoint Test R.
The dual view cannot be switched.	• Incorrect car configuration data received • Media Oriented System Transport (MOST) system • Component failure	• GO to Pinpoint Test S.

Pinpoint Tests

NOTES:

If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval Program is in operation, prior to the installation of a new module/component.

The built in diagnostics are accessed as follows:

- 1.With the vehicle at rest, place the ignition switch "ON", or start the engine.
- 2. Press and hold the TSD in the centre at the top of the screen for approximately 5 seconds and then press and hold the TSD at the top left corner of the screen for approximately 5 seconds.
- 3. A 'Diag PIN Entry' box will appear' Type in the access code 753.
- 4.Once this code has been accepted the Diagnostic Menu screen will be displayed.

PINPOINT TEST A : BLACK SCREEN (NAVIGATION AND AUDIO SCREENS DO NOT DISPLAY.)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: THE SCREEN SAVER FUNCTION WORKS	
	1 Check the screen saver function works.
	Does the screen saver function work? **Yes** Operation is normal. **No** Proceed to the next step.GO to A2.
A2: THE DISPLAY BACKLIGHT EMITS LIGHT	
	1 Check the display backlight emits light.
	Does the display backlight emits light? **Yes** Proceed to the next step. **No** GO to A12.
A3: THE SCREEN IS TURNED OFF	
	1 Check the screen is not turned off.
	Do the navigation and audio screens display when the screen is turned on? **Yes** Operation is normal. **No** GO to A4.
A4: THE VEHICLE INTERIOR TEMPERATURE IS -20°C OR LESS	
	1 Check the cabin internal temperature.
	Is the cabin internal temperature -20°C or lower? **Yes** Raise the cabin internal temperature, re-test the vehicle. **No** GO to A5.
A5: CONDENSATION IS FORMING INSIDE THE VEHICLE	
	1 Check for condensation occurring inside the passenger compartment.
	Is condensation occurring inside the passenger compartment? **Yes** Dry out the passenger compartment, re-test the vehicle. **No** GO to A6.
A6: THE LED FOR THE POWER SUPPLY BUTTON IS FLASHING. (RANGE ROVER ONLY)	
	1 Check the status of the audio power button LED.
	Is the audio power button flashing? **Yes** Carry out MOST Ring diagnostics to locate fault. **No**

	GO to A7.
A7: ONLY THE NAVIGATION SCREEN OR AUDIO SCREEN IS BLACK	
	1 Check to see if only the navigation screen is blank.
	Is only the navigation screen blank? **Yes** Check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index. **No** GO to A8.
A8: ONLY THE BACK MONITOR SCREEN IS BLACK	
	1 Check to see if only the audio screen is blank.
	Is only the audio screen blank? **Yes** Proceed to the next step. **No** GO to A10.
A9: AFTER INITIATING THE "VIDEO INPUT TEST" DIAGNOSIS, VIDEO CAN BE DISPLAYED	
	1 Carry out the "Video Input Test" diagnosis' (PIN code 753).
	Are the results of the "Video Input Test" diagnosis' normal? **Yes** Re-check the system. **No** Refer to the electrical circuit diagrams and check the cameras control module.
A10: ONLY THE TV SCREEN IS BLACK	
	1 Check to see if only the TV screen is black.
	Is only the TV screen blank? **Yes** Proceed to the next step. **No** GO to A12.
A11: AFTER INITIATING THE "VIDEO INPUT TEST" DIAGNOSIS, VIDEO CAN BE DISPLAYED	
	1 Carry out the "Video Input Test" diagnosis' (PIN code 753).
	Are the results of the "Video Input Test" diagnosis' normal? **Yes** Re-check the system. **No** Refer to the electrical circuit diagrams and check the TV control module.
A12: THE CONNECTIONS BETWEEN THE VISUAL NAVIGATION AND POWER SUPPLY WIRING HARNESS AND CONNECTORS ARE CORRECT	
	1 Check the display and power supply harness, power, auxiliary and ground circuits, for short, open circuits and are correctly connected.
	Was a fault identified with the display and power supply harness, power auxiliary and ground connections? **Yes** Rectify the fault and re-test the vehicle. **No** Check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST B : THE NAVIGATION MAP SCREEN DOES NOT DISPLAY, EVEN WHEN THE "NAVIGATION" BUTTON IS PRESSED (SCREEN DOES NOT CHANGE.)	
NOTE: When re-confirming the symptoms after inspecting the wiring harness/connector, turn the ignition status to OFF, wait for the Audio power button LED on the display to turn OFF, then turn the ignition status to ON and run the diagnosis again from the beginning.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: NO RESPONSE TO PRESSING NAVIGATION MENU	
NOTE: 15 minutes are required for the program to update. If the ignition is accidentally turned OFF, turn the ignition ON again, and wait for 15 minutes.	
	1 Check that the ignition was not turned 'OFF' during a navigation software update.
	Was the ignition turned 'OFF' during a navigation software update? **Yes** Wait for 15 minutes with the ignition ON. Then turn the ignition to OFF then ignition ON. **No** Refer to electrical circuit diagrams and check integrity of navigation system wiring harness and connectors. GO to B2.
B2: NO RESPONSE TO PRESSING NAVIGATION MENU	
	1 Wait for 15 minutes with the ignition ON. Then turn the ignition to OFF then ignition ON.
	Does the navigation screen displays when the "NAVIGATION" button is pressed. **Yes** Operation is normal. **No**

	Check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST C : THE HARD SWITCHES DO NOT RESPOND.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK FOR FOREIGN OBJECTS	
	1 Check for foreign objects near to the button.
	Are there any foreign objects close to the button causing it to be pressed? **Yes** Remove foreign objects and re-test vehicle. **No** GO to C2.
C2: DISPLAY DIAGNOSTICS CHECK	
	1 Check to see if the display diagnostics can be displayed.
	Can the display diagnostics be displayed? **Yes** Proceed to the next step. **No** Check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index.
C3: HARD KEY TEST	
	1 Carry out the display diagnostics hard key test.
	Is the operation normal when carrying out the display diagnostics hard key test? **Yes** Operation is normal. **No** Check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST D : THE AUDIO SCREEN CANNOT BE OPERATED (DOES NOT DISPLAY.)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CD CHANGER CHECK	
	1 Check to see if a CD changer is installed.
	Is a CD changer installed? **Yes** Proceed to the next step. **No** Normal operation, CD screen will not be displayed when there is no CD changer installed.
D2: THE AUDIO SCREEN DISPLAYS WHEN THE "AUDIO VIDEO" HARD SWITCH IS PRESSED.	
	1 The audio screen displays when the "AUDIO VIDEO" hard switch is pressed.
	Does the audio screen displays when the "AUDIO VIDEO" hard switch is pressed? **Yes** Proceed to the next step. **No** Refer to the hard switches do not respond diagnosis.
D3: THE AUDIO SCREEN DISPLAYS WHEN "AUDIO VIDEO" ON THE "HOME MENU" IS PRESSED.	
	1 The audio screen displays when "Audio Video" on the "Home Menu" is pressed.
	Does the audio screen displays when "Audio Video" on the "Home Menu" is pressed? **Yes** Proceed to the next step. **No** Refer to the touch switches do not respond diagnosis.
D4: EACH SWITCH (AM FM, CD, IPOD/USB, TV/DVD.) ON THE AUDIO SCREEN RESPONDS.	
	1 Each switch (AM FM, CD, iPod/USB, TV/DVD.) on the audio screen responds.
	Does each switch (AM FM, CD, iPod/USB, TV/DVD.) on the audio screen respond? **Yes** Carry out MOST Ring diagnostics to locate fault. **No** GO to D5.
D5: THE IGNITION IS TURNED FROM IGNITION ON TO OFF, AND AFTER WAITING FOR APPROXIMATELY 30 SECONDS, THE TOUCH SCREEN DISPLAY (TSD) POWER SUPPLY LED WENT OUT. WHEN THE IGNITION IS TURNED TO ON, THE AUDIO SCREEN CAN BE OPERATED.	
	1 The ignition is turned from Ignition ON to OFF, and after waiting for approximately 30 seconds, the Touch Screen Display (TSD) power supply LED went out.
	When the ignition is turned to ON, can the audio screen be operated? **Yes** Operation is normal. **No** Carry out MOST Ring diagnostics to locate fault.

PINPOINT TEST E : THE SCREEN DOES NOT DIM.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**

E1: CHECK FOR FOREIGN OBJECTS	
	1 Check for foreign objects adhered to the display light sensor. • Range Rover - Top right of display • Discovery/Range Rover Sport - Instrument panel
	Are there any foreign objects adhered to the display light sensor? **Yes** Remove foreign objects and re-test vehicle. **No** GO to E2.
E2: DISPLAY LIGHT SENSOR CHECK	
	1 Check to see if display screen switches to low light when sensor is covered.
	Does the display screen switch to low light when the sensor is covered? **Yes** Operation is normal. **No** GO to E3.
E3: VEHICLE LIGHT SWITCH TESTS	
	1 Check to see if display screen switches to low light when the vehicle light switch is pressed.
	2 When the vehicle exterior lights are switched on, check diagnostic menu "Vehicle Signals" lights on the diagnostics screen is "ON."
	Does the display screen switch to low light when the vehicle light switch is pressed? **Yes** Operation is normal. **No** Check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST F : NOISE ON THE SCREEN; SCREEN COLOUR IS ABNORMAL.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: DISPLAY POWER AND GROUND CHECKS	
	1 Refer to electrical circuit diagrams and check battery power and power ON relay voltage, and ground resistance.
	Is the battery power and power ON relay voltage between 10.5 and 16 volts, and continuity to ground? **Yes** Proceed to the next step. **No** Check and rectify the vehicle wiring harness and connectors.
F2: CONTRAST CHECK	
	1 Check to see if the screen colour is normal when the screen setting (contrast) is re-ret to the default values.
	Is the screen colour normal with the default values? **Yes** Operation is normal. **No** GO to F3.
F3: CABIN INTERNAL TEMPERATURE CHECK	
	1 Check the cabin internal temperature.
	Is the cabin internal temperature -20°C or lower? **Yes** Raise the cabin internal temperature and re-test. **No** GO to F4.
F4: ADDITIONAL SCREEN CHECKS	
	1 Check all other screens.
	Are all other screens beside the navigation display screen normal? **Yes** Check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index. **No** GO to F5.
F5: COLOUR BAR CHECK	
	1 Carry out the display diagnostics colour bar check test.
	Are the results of the display diagnostics colour bar check normal? **Yes** Operation is normal. **No** Check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST G : THE TOUCH SWITCHES DO NOT RESPOND.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**

G1: TOUCH SWITCH TEST	
	1 The touch switches not responding on the navigation screen only
	Are the touch switches not responding on the navigation screen only? **Yes** Proceed to the next step. **No** Check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index.
G2: TOUCH SWITCH CHECK	
	1 Carry out the touch switch check in the display diagnostics.
	Are the results of the display diagnostics touch switch check normal? **Yes** Check the symptoms again.Operation is normal. **No** GO to G3.
G3: START CALIBRATION ROUTINE	
	1 Carry out the start calibration routine from the display diagnostics touch switch test.
	Is normal operation resumed after correction? **Yes** Operation is normal. **No** Check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST H : THERE IS CONSIDERABLE DEVIATION BETWEEN THE DISPLAYED VEHICLE POSITION AND THE ACTUAL POSITION.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: GPS MARK DISPLAY CHECK	
	1 The GPS no reception mark is displayed.
	Is the GPS no reception mark displayed on the display screen? **Yes** Refer to GPS no reception mark does not disappear diagnosis. **No** GO to H2.
H2: LOCATION CHECK	
	1 Check for symptom occurring in particular locations - parallel roads, elevated roads, loop roads, parking centres (buildings) etc.
	Does the symptom occur in a particular location? **Yes** In places where the vehicle position is hard to specify, the vehicle position may be matched incorrectly and result in position discrepancies. Additionally, a new road layout will mean the Gyro does not match the map position. **No** Proceed to the next step.
H3: DISTANCE CALIBRATION CHECK	
NOTE: Refer to diagnostic menu "Vehicle Sensor" – Distance Calibration, this value should be approximately 200mm, a large deviation from this value indicates a speed signal fault or incorrect wheel size.	
	1 Check to see if distance calibration is being performed.
	Is distance calibration being performed? **Yes** Monitor the condition until distance calibration is complete (drive for over 10km/6.2 miles) **No** GO to H4.
H4: VEHICLE SIGNAL INSPECTION	
	1 Check vehicle sensor display screen, from vehicle information diagnostics menu for the following: vehicle speed signal, REV: ON is indicated when the gear shift lever is in the REV position and gyro sensor input status are normal.
	Are the vehicle speed signal, REV signal, and gyro sensor input status normal? **Yes** GO to H5. **No** Refer to the electrical circuit diagrams and check the integrity of the wiring harness and connectors, and CAN circuit, to the Touch Screen Display (TSD).
H5: TIRE CHECK	
	1 Check to see if new tires have recently been installed.
	Have new tires been recently installed? **Yes** From the navigation map screen, enter the navigation menu, select navigation setup then select calibration, press ‘Distance’ then drive the vehicle for 10 to 20 km. Operation will return to normal after performing distance calibration and driving the vehicle for 10 to 20 km. **No** Adjust the current location, and after the GPS no signal mark has disappeared, drive the vehicle for a while to monitor conditions.

PINPOINT TEST I : THE GPS NO RECEPTION MARK DOES NOT DISAPPEAR.	
NOTES:	
 Move the vehicle to an open area, radio waves from satellites may not be received inside buildings.	
 Correct the vehicle cursor to the current location.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1: RETRO-INSTALL INSTALLATIONS CHECK	
	1 Check to see if there are any retro-install installations (anti-theft, radar, etc.)
	Are there any retro-install installations? **Yes** GO to I2. **No** GO to I3.
I2: RETRO-INSTALL INSTALLATIONS RF CHECK	
	1 Turn power supply (including back-up power) to OFF status.
	Does the GPS no reception mark disappear? **Yes** GPS reception may deteriorate when devices receiving radio waves are retro-installed. Alter the position of the retro-install device, and re-test vehicle. **No** GO to I4.
I3: SATELLITE RECEPTION CHECKS	
	1 Check to see if a 'P' or 'T' is displayed in the 'STS' column of the navigation diagnostics GPS information screen after 10 minutes have passed.
	Is a 'P' or a 'T' displayed? **Yes** Wait for reception of another satellite so that position calculation can be performed. **No** Refer to the electrical circuit wiring diagrams and check the integrity of the wiring harness and connectors to the GPS antenna.Proceed to the next step.
I4: GPS ANTENNA REPLACEMENT	
	1 Install a new GPS antenna.
	Does the GPS no signal mark disappears when the GPS antenna is replaced. **Yes** Fault has been rectified. **No** Check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST J : NO SOUND IS EMITTED.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
J1: SOUND OUTPUT CHECK	
	1 Check sound output across all systems.
	Is there no sound output across all systems? **Yes** GO to J2. **No** GO to J3.
J2: VOLUME LEVEL CHECK	
	1 Check the volume level is not set too low.
	Is the volume level set too low? **Yes** Increase the volume level and re-test vehicle. **No** GO to J3.
J3: INTEGRITY OF AMPLIFIER AND SPEAKER WIRING.	
	1 The amplifier and speaker wiring harnesses are correctly connected.
	Are the amplifier and speaker wiring harnesses correctly connected? **Yes** Check the MOST devices.GO to J4. **No** Refer to the electrical circuit diagrams and check integrity of amplifier and speaker wiring harness and connections.
J4: ONLY VOICE RECOGNITION DOES NOT OUTPUT	
	1 Check to see if only voice recognition does not output.
	Is there no output only from the voice recognition? **Yes** GO to J5. **No** Proceed to step 8.
J5: VOICE GUIDANCE	

	1 Check the volume level for voice guidance is not set too low.
	Is the volume level for voice guidance set too low? **Yes** Increase the volume level and re-test vehicle. **No** GO to J6.
J6: VOICE GUIDANCE SETTINGS	
	1 Check to see if the voice guidance is set to 'OFF' in the navigation settings.
	Is the voice guidance set to 'OFF' in the navigation settings? **Yes** Set to 'ON' and re-test the vehicle. **No** GO to J7.
J7: ADDITIONAL ITEMS	
	1 Check to see if the following items apply. • There is no destination set • There is no movement along the route
	Do the two items apply? **Yes** Normal operation, confirm customer symptom and re-test vehicle. **No** Check MOST connection at the Touch Screen Display (TSD), check the MOST devices.Proceed to the next step.
J8: ONLY VOICE RECOGNITION DOES NOT OUTPUT	
	1 Check to see if only voice recognition does not output.
	Is there no output only from the voice recognition? **Yes** Refer to the there is no navigation voice guidance diagnosis. **No** GO to J9.
J9: SOUND IS ONLY ABSENT WHEN USING THE AUDIO SYSTEM OR TELEPHONE.	
	1 Check to see if sound is only absent when using the audio system or telephone.
	Does only the audio system or telephone sound not output? **Yes** Check MOST connection at the Touch Screen Display (TSD), check the MOST devices. **No** Refer to the electrical circuit diagrams and check integrity of wiring harness and connections.

PINPOINT TEST K : THERE IS NO NAVIGATION VOICE GUIDANCE.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
K1: SOUND MISSING AUDIO SYSTEM ONLY	
	1 Sound is only absent from the audio system (CD, radio.)
	Is sound only absent from the audio system (CD, radio.)? **Yes** GO to K4. **No** Proceed to the next step.
K2: VOICE MISSING NAVIGATION SYSTEM ONLY	
	1 Voice is only absent from the navigation system.
	Is voice only absent from the navigation system? **Yes** GO to K3. **No** GO to K3.
K3: NAVIGATION VOICE GUIDANCE CANNOT BE HEARD	
	1 Operate the navigation replay switch and raise the volume.
	Can navigation voice guidance be heard after pressing the navigation replay switch, and raising the volume? **Yes** Operation is normal. **No** Check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index.
K4: INTEGRITY OF AMPLIFIER AND SPEAKER WIRING.	
	1 The amplifier and speaker wiring harnesses are correctly connected.
	Are the amplifier and speaker wiring harnesses correctly connected? **Yes** GO to K5. **No** Refer to the electrical circuit diagrams and check integrity of amplifier and speaker wiring harness and connections.
K5: VOLUME LEVEL CHECK	
	1 Check the volume level is not set too low.

	Is the volume level set too low? **No** Increase the volume level and re-test vehicle. **No** Refer to the electrical circuit diagrams and check integrity of complete audio system.

PINPOINT TEST L : VOICE RECOGNITION DOES NOT FUNCTION.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
L1: AUDIO SOUND IS MUTED WHEN PTT SWITCH IS DEPRESSED	
	1 Check to see if the audio sound is muted when the PTT switch is depressed.
	Is the audio sound muted? **Yes** GO to L3. **No** GO to L2.
L2: PTT SWITCH STATUS	
	1 Check to see if the PTT switch status is ok in the navigation diagnostics, manual check, microphone test.
	Is the PTT switch status, in navigation diagnostics, ok? **Yes** Check MOST connection at the Touch Screen Display (TSD), check the MOST devices. **No** Replace the MOST master, or the gateway module.
L3: TALK BACK	
	1 Check to see if there is talk back when other voice recognition demands are executed.
	Is there talk back? **Yes** System operation is normal, (advise change in manner of speech, as incorrect recognition is occurring). **No** GO to L4.
L4: HARNESS/CONNECTOR CHECKS	
	1 Refer to the electrical circuit diagrams and check integrity of Touch Screen Display (TSD) harness and connections.
	Has a fault been identified with the Touch Screen Display (TSD) harness or connections? **Yes** Rectify the fault and re-test the vehicle. **No** Check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST M : THE VEHICLE POSITION ROTATES RANDOMLY.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
M1: VEHICLES CURRENT POSITION MARK TURNS ON ITS OWN	
	1 Determine if the ignition status was turned to Auxiliary or On, while the vehicle was on a turntable in a parking building etc.
	Was ignition status set to Auxiliary or On? **Yes** The angular speed of the vehicle at the time of the ignition status change will be logged as the standard value. To re-set the standard value, turn ignition status to 'OFF' then to 'Auxiliary' or 'On' with the vehicle stationary. Re-test the vehicle. **No** Check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST N : THE VEHICLE MARK DISPLAY IS UNSTABLE.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
N1: VEHICLE SPEED SIGNAL	
	1 The vehicle speed signal is being properly inputted under "Vehicle Sensor" on the "Vehicle information" diagnostics screen.
	Is the vehicle speed input correctly? Note: MOST and navigation system module speeds are approximately the same. **Yes** GO to N2. **No** Carry out MOST ring circuit checks.Check the Anti-Lock Brake System Module for related DTCs and refer to the relevant DTC Index.Carry out network integrity tests using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required.Rectify the fault and re-test the vehicle.
N2: CHECK NUMBER OF SATELLITES	
	1 "0" is displayed in the "Satellites" column under "GPS Information" (on the "Vehicle information" diagnostics screen.)
	Is the number of satellites displayed on the screen 0?

	Yes Refer to GPS no reception mark does not disappear diagnosis. **No** GO to N3.
N3: CHECK IF SYMPTOMS ARE OCCURRING IN PARTICULAR LOCATIONS	
	1 Confirm if the 'car current position not stable' symptom is occurring in particular locations.
	Is the 'car current position not stable' symptom occurring in particular locations? **Yes** System operation is normal. Signal reflections from buildings or a particular location may be responsible. **No** Refer to GPS no reception mark does not disappear diagnosis.

PINPOINT TEST O : THE VEHICLE POSITION DOES NOT UPDATE.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
O1: VEHICLE POSITION DOES NOT UPDATE	
	1 Check the GPS no reception mark.
	Has the GPS no reception mark disappeared? **Yes** GO to O2. **No** Refer to GPS no reception mark does not disappear diagnosis.
O2: VEHICLE POSITION DOES NOT UPDATE	
	1 Check the map screen scroll function.
	Can the map screen be touched scrolled? **Yes** GO to O3. **No** Initiate the "SMART test" on the "HDD information" diagnostics screen.
O3: VEHICLE POSITION DOES NOT UPDATE	
	1 The vehicle speed signal is being properly inputted under "Vehicle Sensor" on the "Vehicle information" diagnostics screen.
	Is the vehicle speed input correctly? Note: MOST and navigation system module speeds are approximately the same. **Yes** Check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index. **No** Carry out MOST ring circuit checks.Check the Anti-Lock Brake System Module for related DTCs and refer to the relevant DTC Index.Carry out network integrity tests using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required.Rectify the fault and re-test the vehicle.

PINPOINT TEST P : THE MAP DISPLAY IS INCOMPLETE.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
P1: MAP DISPLAY IS INCOMPLETE	
	1 Check to see if the map screen displays correctly when it is touch scrolled.
	Does the map screen display correctly when it is touch scrolled? **Yes** GO to P2. **No** Initiate the "SMART test" on the "HDD information" diagnostics screen.
P2: MAP DISPLAY IS INCOMPLETE	
	1 Check to see if the map screen scale can be reduced.
	Can the map screen scale be reduced? **Yes** GO to P3. **No** Initiate the "SMART test" on the "HDD information" diagnostics screen.
P3: MAP DISPLAY IS INCOMPLETE	
	1 Check to see if a point of interest search can be performed.
	Can a point of interest search be performed? **Yes** Check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index. **No** Initiate the "SMART test" on the "HDD information" diagnostics screen.

PINPOINT TEST Q : CALLS CANNOT BE RECEIVED OR PLACED WITH BLUETOOTH®; BLUETOOTH® CANNOT CONNECT WITH THE VEHICLE.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Q1: DISPLAY CHECK	
	1 Press the telephone button.

	Is 'Telephone not connected' displayed on the screen? **Yes** GO to Q2. **No** Proceed to step 7.
Q2: BLUETOOTH® COMPATIBILITY CHECK	
	1 Check to see if the telephone handset is Bluetooth® compatible.
	Is the telephone handset Bluetooth® compatible? **Yes** GO to Q3. **No** Use a Bluetooth® compatible telephone handset.
Q3: HANDSET POWER CHECK	
	1 Check to see if the handset is switched 'ON'.
	Is the telephone handset switched 'ON'? **Yes** GO to Q4. **No** Switch handset 'ON' and re-test.
Q4: INITIAL CONNECTION SETTINGS	
	1 Check to see if the initial connection settings to the in-vehicle system have been performed.
	Have the initial connection settings to the in-vehicle system been performed? **Yes** GO to Q5. **No** Perform the initial connection settings.
Q5: HANDSET COMMUNICATION CHECK	
	1 Check to see if the telephone handset recognizes the in-vehicle system.
	Does the telephone handset recognize the in-vehicle system? **Yes** GO to Q6. **No** Re-test using a different Bluetooth® compatible telephone handset. If the fault is still evident, suspect the telephone module. Refer to the new module/component installation note at the top of this procedure.
Q6: HANDSET COMMUNICATION CHECK	
	1 Switch the Bluetooth® telephone handset 'OFF' then back 'ON' again.
	Does the telephone handset recognize the in-vehicle system? **Yes** Operation is normal. **No** Suspect the telephone module. Refer to the new module/component installation note at the top of this procedure.
Q7: HANDSET COMMUNICATION CHECK	
	1 Check to see if the telephone is within communications range.
	Is the telephone within a 10 metre range of the bluetooth® telephone module? **Yes** GO to Q8. **No** Move the telephone handset to within a 10 metre range of the Bluetooth® telephone module.
Q8: HANDSET COMMUNICATION CHECK	
	1 Check to see if when transmitting, the telephone handset is also receiving.
	When transmitting, is the telephone handset also receiving? **Yes** Check MOST connection at the Touch Screen Display (TSD), check the MOST devices. **No** Replace the telephone handset.

PINPOINT TEST R : AN ERROR SCREEN DISPLAYS ON THE NAVIGATION SCREEN.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
R1: MAP DATA CANNOT BE READ	
	1 Access to the map data has not been granted.
	Has new Touch Screen Display (TSD) been installed? **Yes** Initiate the "Map Lock routine." **No** Check that a valid activation code for the particular map version installed is available and is being used, it may be necessary to purchase a new activation code from Navteq.If the activation code is valid but map cannot be activated, check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index.Initiate the "Map Lock routine."

PINPOINT TEST S : THE DUAL VIEW CANNOT BE SWITCHED.


NOTE: Prior to troubleshooting, verify that the vehicle and the Touch Screen Display (TSD) are compatible with Dual Directional View.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
S1: AUDIO VIDEO HARD SWITCH CHECK	
	1 The audio screen displays when the "AUDIO VIDEO" hard switch is pressed.
	Does the audio screen displays when the "AUDIO VIDEO" hard switch is pressed? **Yes** GO to S2. **No** Refer to the hard switches do not respond diagnosis.
S2: AUDIO SOURCE	
	1 TV or DVD is the audio source.
	Does TV or DVD display? **Yes** GO to S3. **No** Switch the audio source to TV or DVD and carry out diagnosis again.
S3: VIDEO AND SOUND CORRECTLY DISPLAYED	
	1 Video with sound is displayed on the passenger side from the audio screen after the "AUDIO VIDEO" hard switch is pressed.
	Is video with sound displayed on the passenger side from the audio screen after the "AUDIO VIDEO" hard switch is pressed? **Yes** Operation is normal. **No** GO to S4.
S4: VIDEO AND SOUND INCORRECTLY DISPLAYED	
	1 Video with sound is incorrectly displayed on the passenger side from the audio screen after the "AUDIO VIDEO" hard switch is pressed
	Is video with sound incorrectly displayed on the passenger side from the audio screen after the "AUDIO VIDEO" hard switch is pressed? **Yes** Refer to the black screen (navigation and audio screens do not display) diagnosis. **No** GO to S5.
S5: VEHICLE CONFIGURATION	
	1 The following set values are present on the "Vehicle Configuration" diagnostics screen. • HLDF = Dual view • HLDF is fitted • Hand of Drive is correct for vehicle being tested
	Are values present on the "Vehicle Configuration" diagnostics screen. **Yes** Check and install a new Touch Screen Display (TSD) as required. Refer to the new module/component installation note at top of DTC Index. **No** Contact dealer technical support to assist in re-configuring the Car Configuration File (CCF) using the manufacturers approved diagnostic system. Clear the DTC, switch off the ignition and allow sufficient time for the infotainment relay to power downCheck MOST connection at the Touch Screen Display (TSD), check the MOST devices.

DTC Index

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Integrated Audio Module (IAM) - High Line (100-00 General Information, Description and Operation).

Published: 11-May-2011

Audio Unit -

Torque Specifications

Description	Nm	lb-ft
Audio amplifier bolts	10	7

Published: 11-May-2011

Audio Unit - Audio System

Diagnosis and Testing

For additional information.
REFER to: Information and Entertainment System (415-00, Diagnosis and Testing).

Published: 30-Sep-2011

Audio Unit - Audio Unit

Removal and Installation

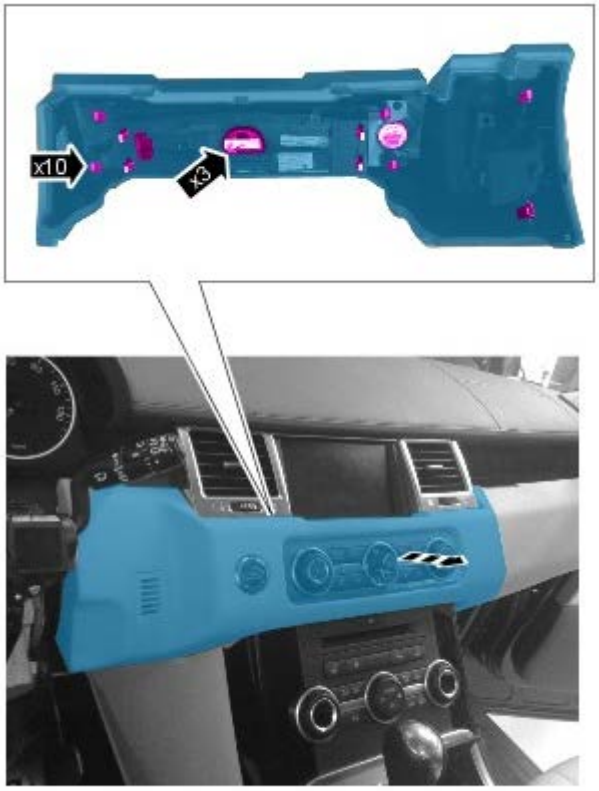
Removal

NOTES:

Removal steps in this procedure may contain installation details.

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

1.



E122692

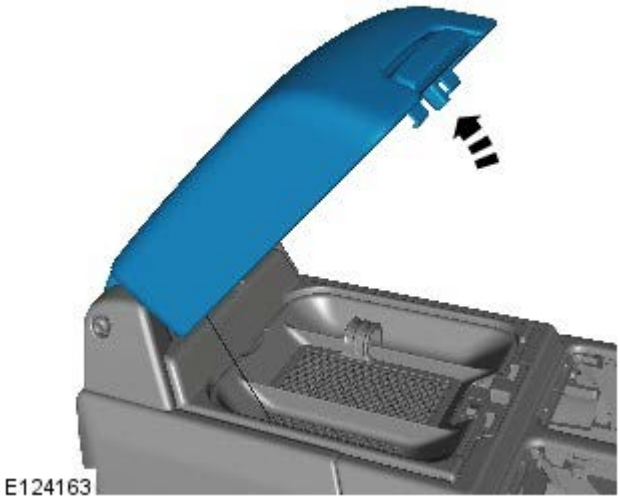
2.



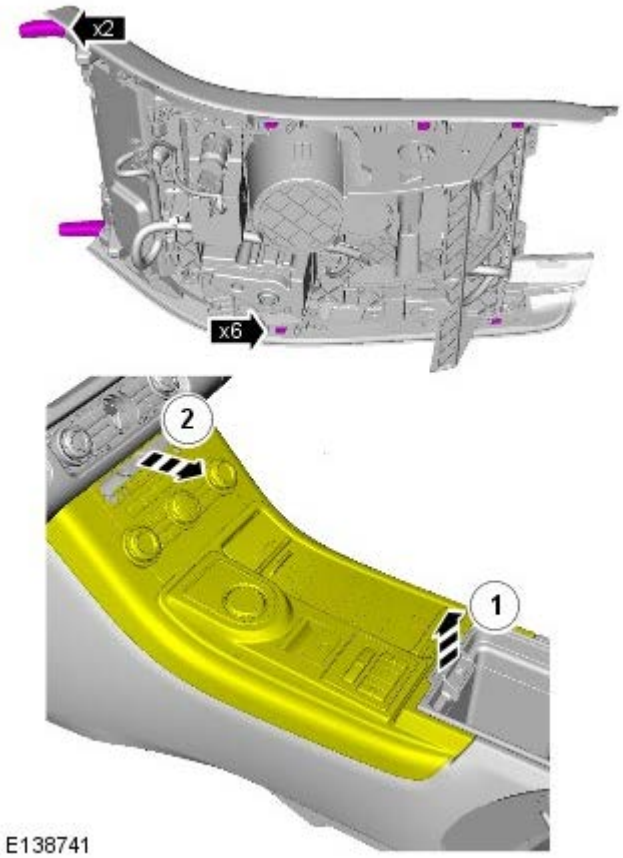
3. *Torque:* 2.5 Nm



4.

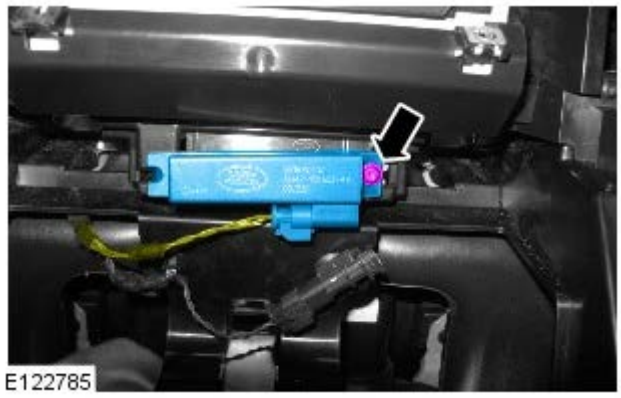


5.

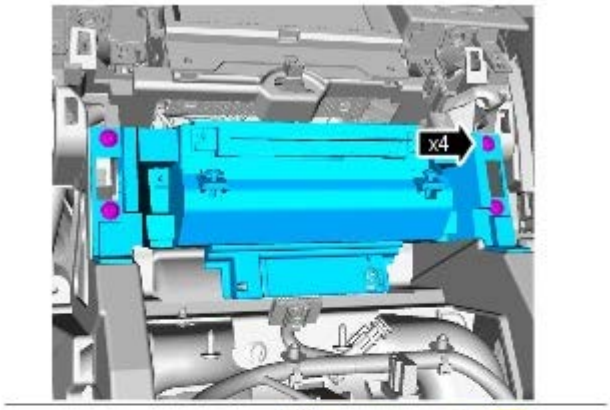


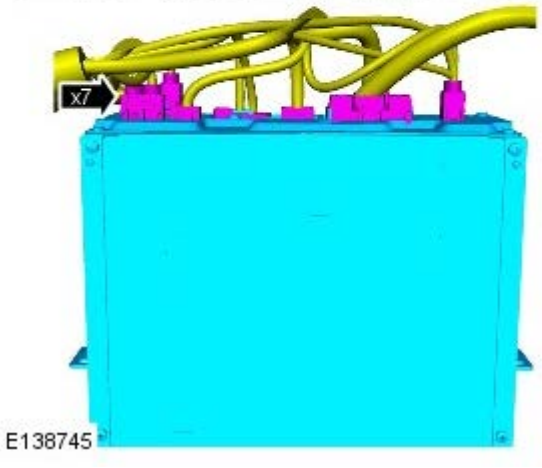
E138741

6. *Torque:* 2.5 Nm


E122785

7. *Torque:* 2.5 Nm





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

   Torque: 2.5 Nm



Installation

1. To install, reverse the removal procedure.

Published: 26-Sep-2011

Audio Unit - Audio Amplifier

Removal and Installation

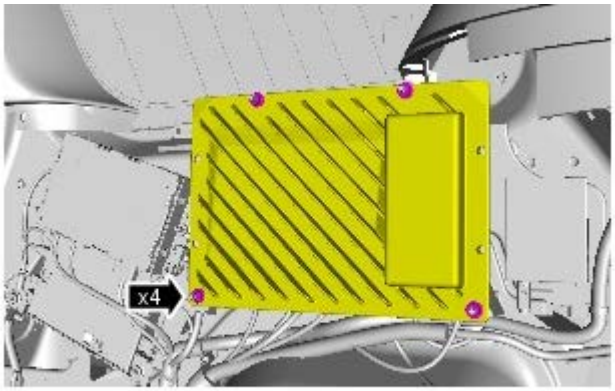
Removal

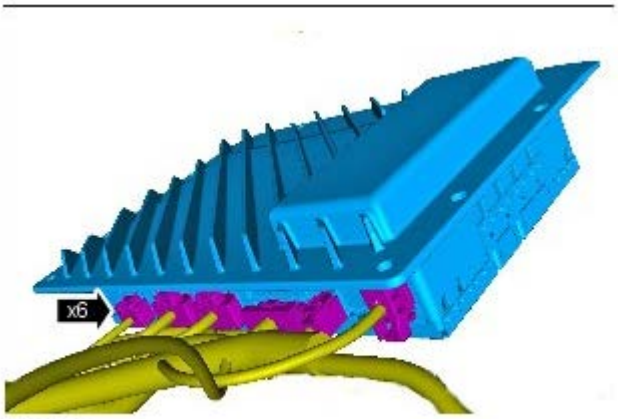
NOTE: Removal steps in this procedure may contain installation details.

1. NOTE: RH side only.

   Refer to: Rear Quarter Trim Panel (501-05, Removal and Installation).

2. *Torque:* 9 Nm





E139083

Installation

1. To install, reverse the removal procedure.
2. Using the diagnostic tool, calibrate the component.

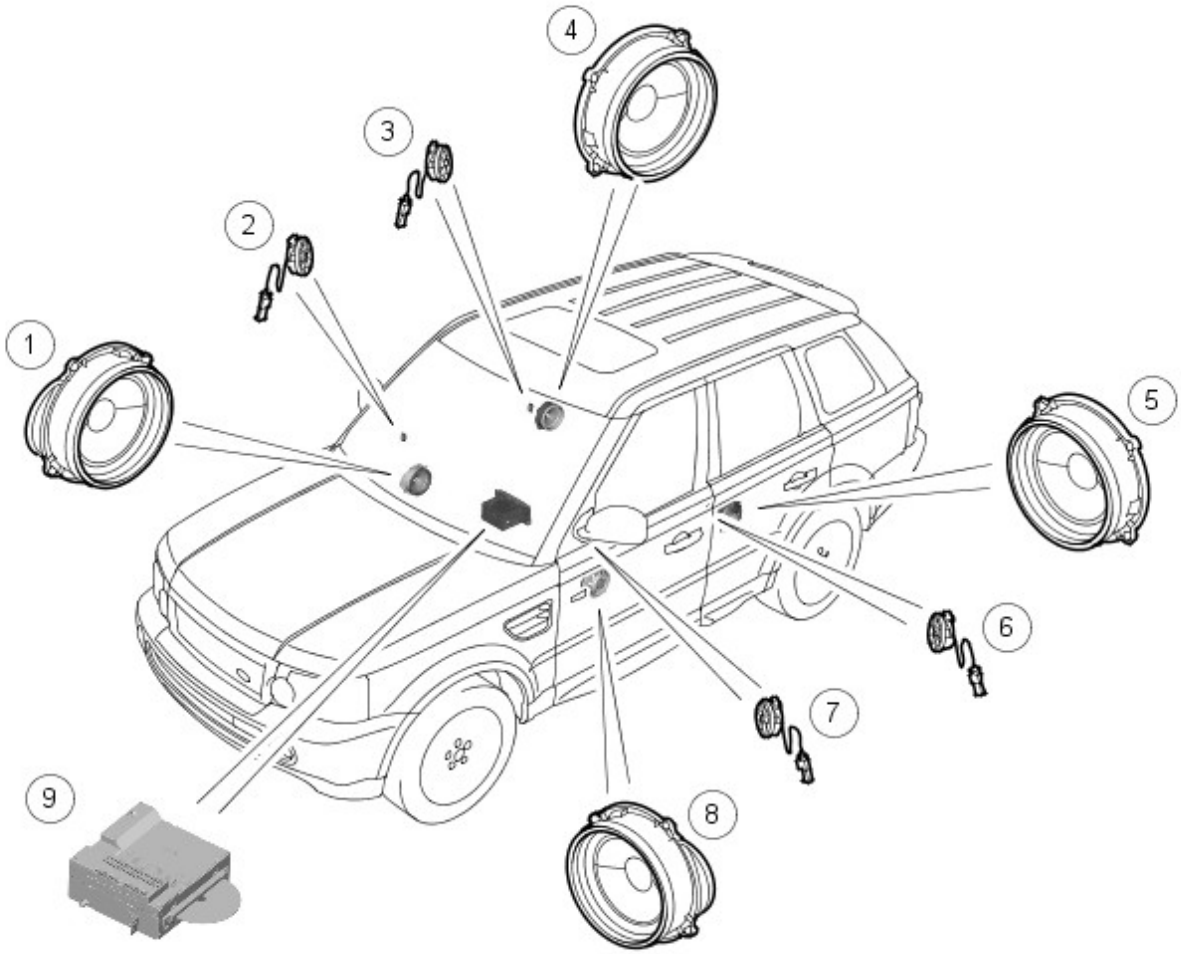
Published: 11-May-2011

Information and Entertainment System - Speakers

Description and Operation

LOW LINE AUDIO SYSTEM

Low Line Audio System Speaker Component Location

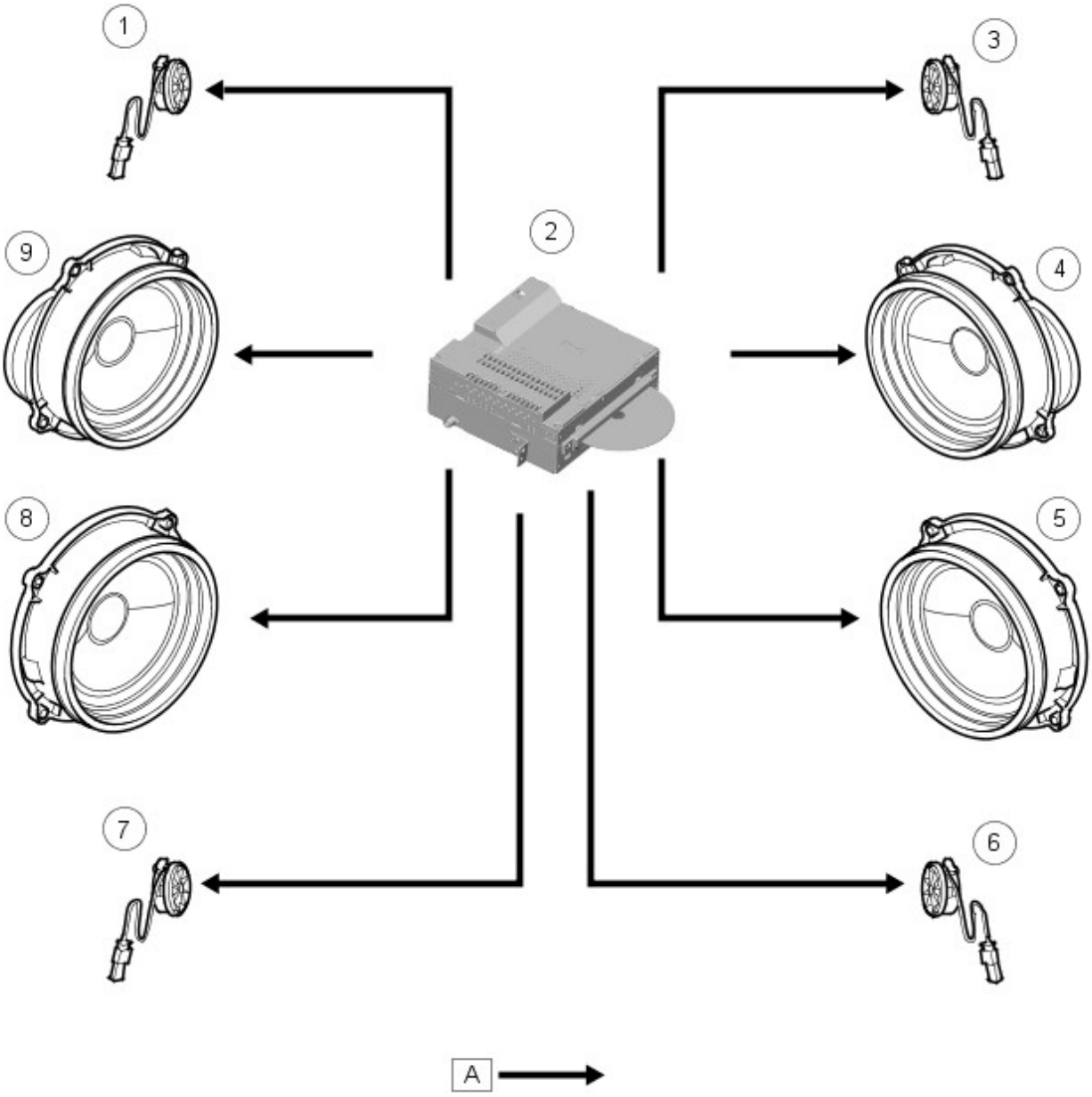


E132121

Item	Part Number	Description
1	-	Front right-hand (RH) door mid/bass speaker
2	-	Front RH door tweeter
3	-	Rear RH door tweeter
4	-	Rear RH door full range speaker
5	-	Rear left-hand (LH) door full range speaker
6	-	Rear LH door tweeter
7	-	Front LH door tweeter
8	-	Front LH door mid/bass speaker
9	-	Integrated Head unit (IHU)

Low Line Audio System Speaker Control Diagram

NOTE: A= Hardwired



E132122

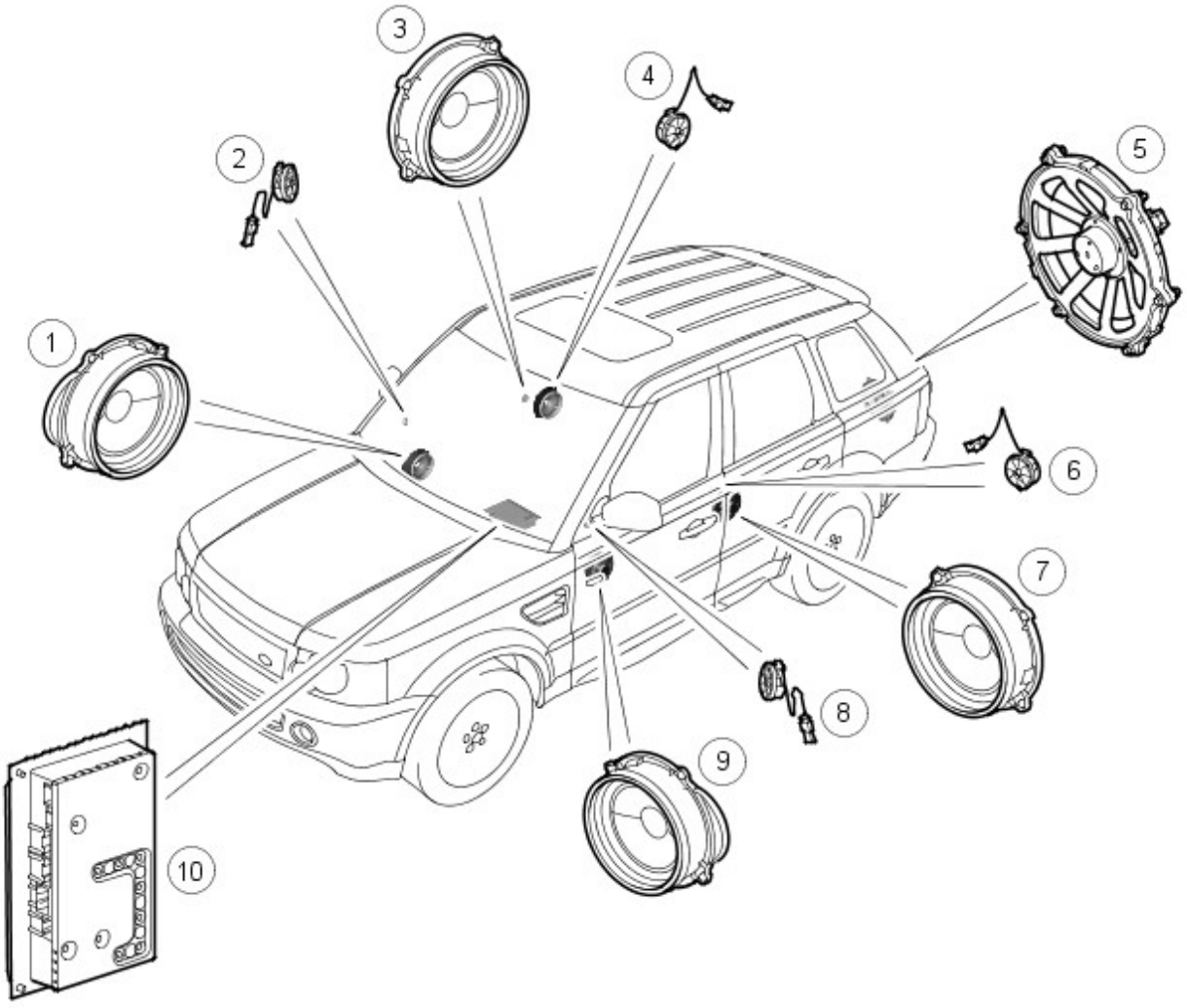
Item	Part Number	Description
1	5HA 41258 AA	Front LH tweeter
2	-	Integrated Head Unit (IHU)
3	-	Front RH tweeter
4	-	Front RH mid/bass speaker
5	-	Rear RH full range speaker
6	-	Rear RH tweeter
7	-	Rear LH tweeter
8	-	Rear LH full range speaker
9	-	Front LH mid/bass speaker

The low line audio speaker system is driven directly from the Integrated Head Unit (IHU) For additional information, refer to: Audio System (415-01B, Description and Operation). .The system comprises:

- Head unit
- Two front door mounted mid/bass speakers (one per side)
- Two front door mounted tweeters (one per side)
- Two rear door mounted full range speakers (one per side).
- Two rear door mounted tweeters (one per side)

HIGH LINE-HARMAN/KARDON AUDIO SYSTEM

High line-Harman/Kardon Audio System Speaker Component Location

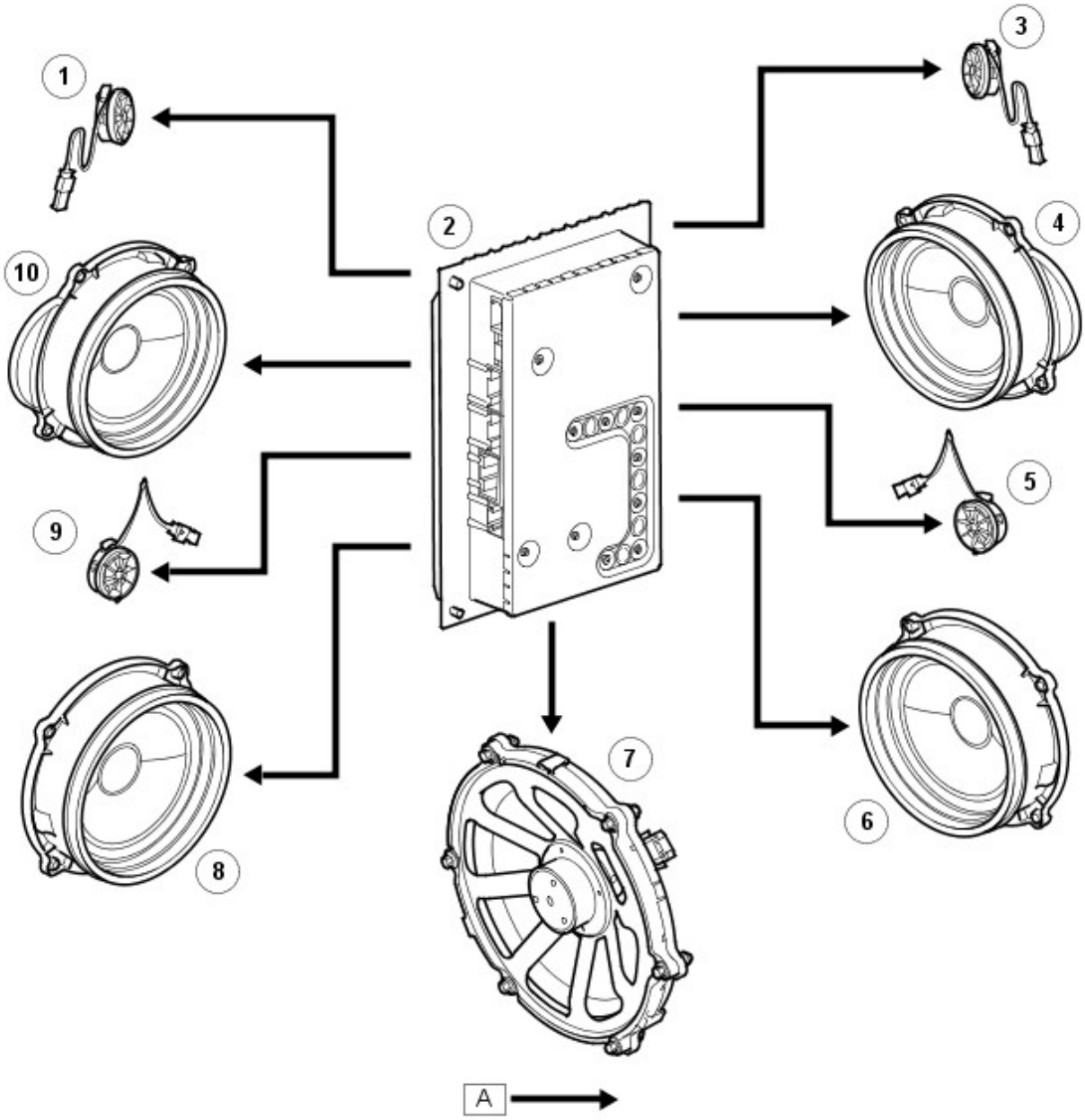


E56923

Item	Part Number	Description
1	-	Front RH mid/bass speaker
2	-	Front RH tweeter
3	-	Rear RH mid/bass range
4	-	Rear RH tweeter
5	-	Sub-woofer
6	-	Rear LH tweeter
7	-	Rear LH mid/bass range
8	-	Front LH tweeter
9	-	Front LH mid/bass speaker
10	-	High line amplifier

High line-Harman/Kardon Audio System Speaker Control Diagram

NOTE: A= Hardwired



E48353

Item	Part Number	Description
1	-	Front LH tweeter
2	-	High line amplifier
3	-	Front RH tweeter
4	-	Front RH mid/bass speaker
5	-	Rear RH tweeter
6	-	Rear RH mid/bass speaker
7	-	Sub-woofer
8	-	Rear LH mid/bass speaker
9	-	Rear LH tweeter
10	-	Front LH mid/bass speaker

The High line-Harman/Kardon audio speaker system is driven by an amplifier located under the RH front seat. The amplifier is controlled by the Integrated Head Unit (IHU) on the MOST bus and supplies 6x50 Watts output, giving a total system power rating of 300 Watts

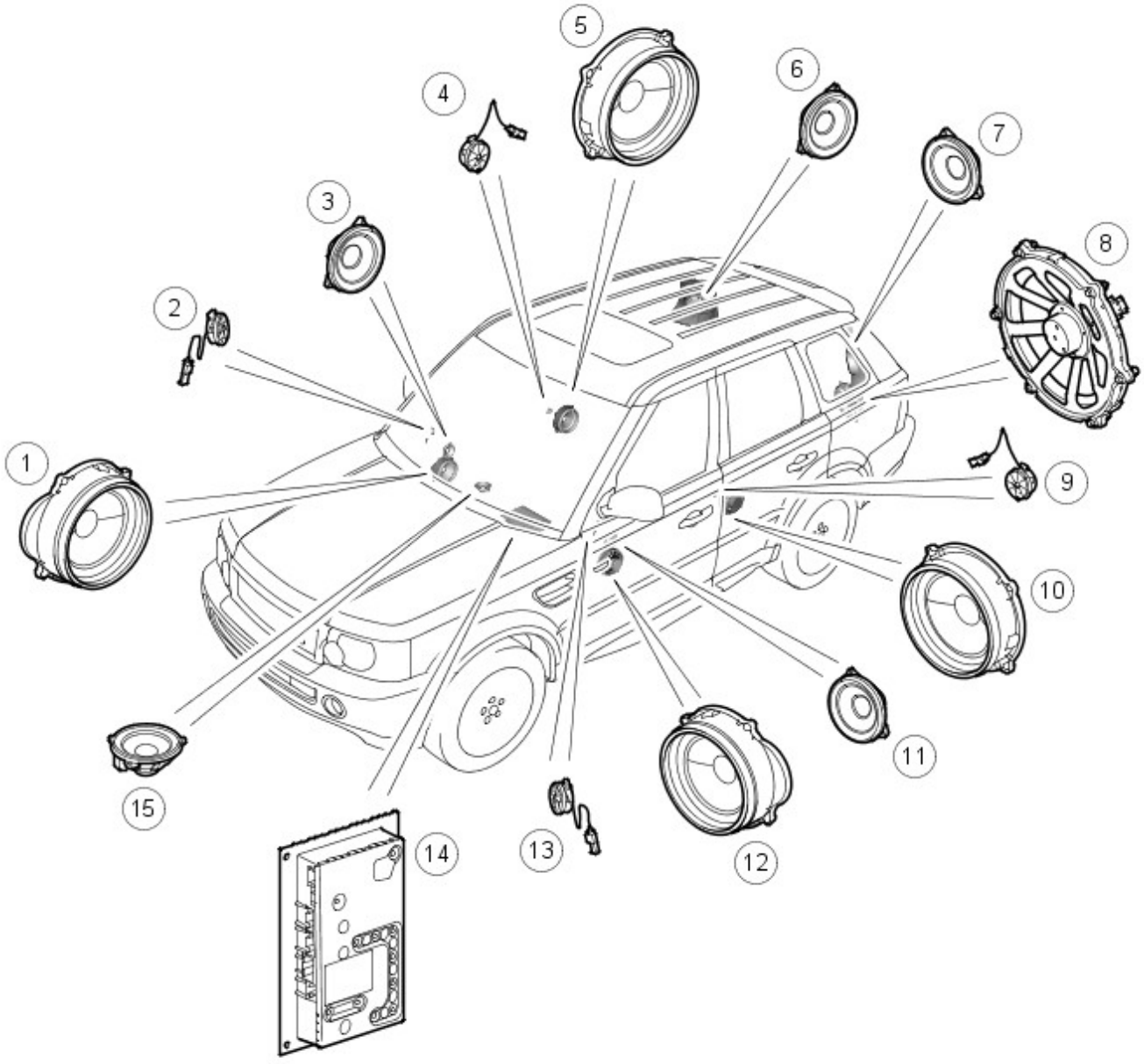
For additional information, refer to: Audio System (415-01B, Description and Operation).

. The system comprises:

- Integrated Head Unit (IHU) Head unit
- Two front door mounted mid/bass range speakers (one per side)
- Two front door mounted tweeters (one per side)
- Two rear door mounted mid/bass range speakers (one per side)
- Two rear door mounted tweeters (one per side)
- A sub-woofer located in the lower tailgate
- An audio amplifier located under the front RH seat.

PREMIUM AUDIO SYSTEM - HARMAN/KARDON LOGIC7

Premium Audio - Harman/Kardon LOGIC7 Audio System Speaker Component Location

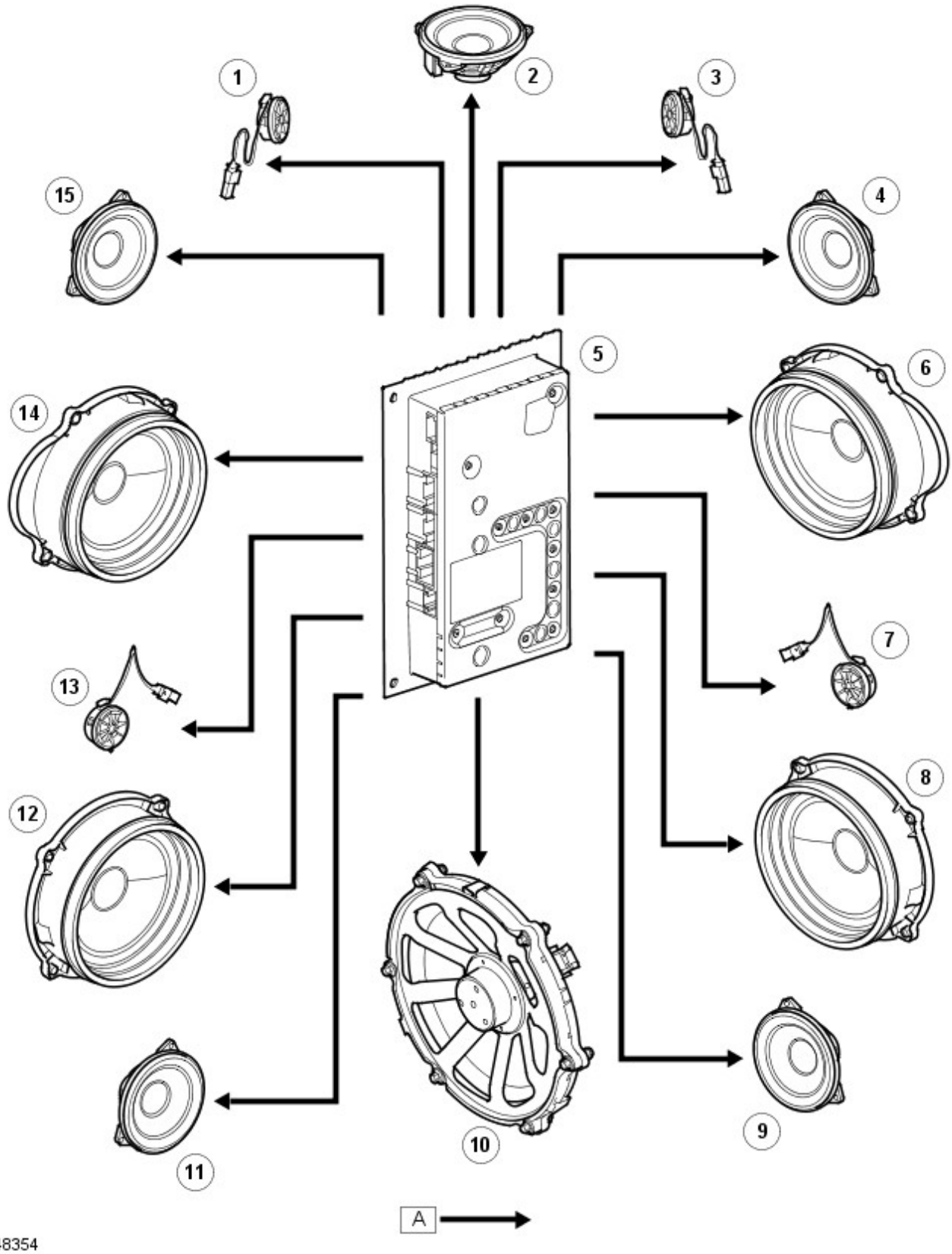


E56924

Item	Part Number	Description
1	-	Front RH bass speaker
2	-	Front RH tweeter
3	-	Front RH mid range speaker
4	-	Rear RH tweeter
5	-	Rear RH mid/bass speaker
6	-	Rear RH surround speaker
7	-	Rear LH surround speaker
8	-	Sub-woofer
9	-	Rear LH tweeter
10	-	Rear LH mid/bass speaker
11	-	Front LH mid range speaker
12	-	Front LH bass speaker
13	-	Front LH tweeter
14	-	Premium amplifier
15	-	Front center fill speaker

Premium Audio - Harman/Kardon LOGIC7 Audio System Speaker Control Diagram

NOTE: A= Hardwired



E48354

Item	Part Number	Description
1	-	Front LH tweeter
2	-	Front center fill speaker
3	-	Front RH tweeter
4	-	Front RH mid range speaker
5	-	Premium amplifier
6	-	Front RH bass speaker
7	-	Rear RH tweeter
8	-	Rear RH mid/bass range speaker

9	-	Rear RH surround speaker
10	-	Sub-woofer
11	-	Rear LH surround speaker
12	-	Rear LH mid/bass range speaker
13	-	Rear LH tweeter
14	-	Front LH bass speaker
15	-	Front LH mid range speaker

The Premium Audio - Harman/Kardon LOGIC7 audio speaker system is driven by an amplifier located under the RH front seat. The amplifier is controlled by the Integrated Head Unit (IHU) on the MOST bus and supplies 12x50 Watts output, giving a total system power rating of 600 Watts. The system comprises:

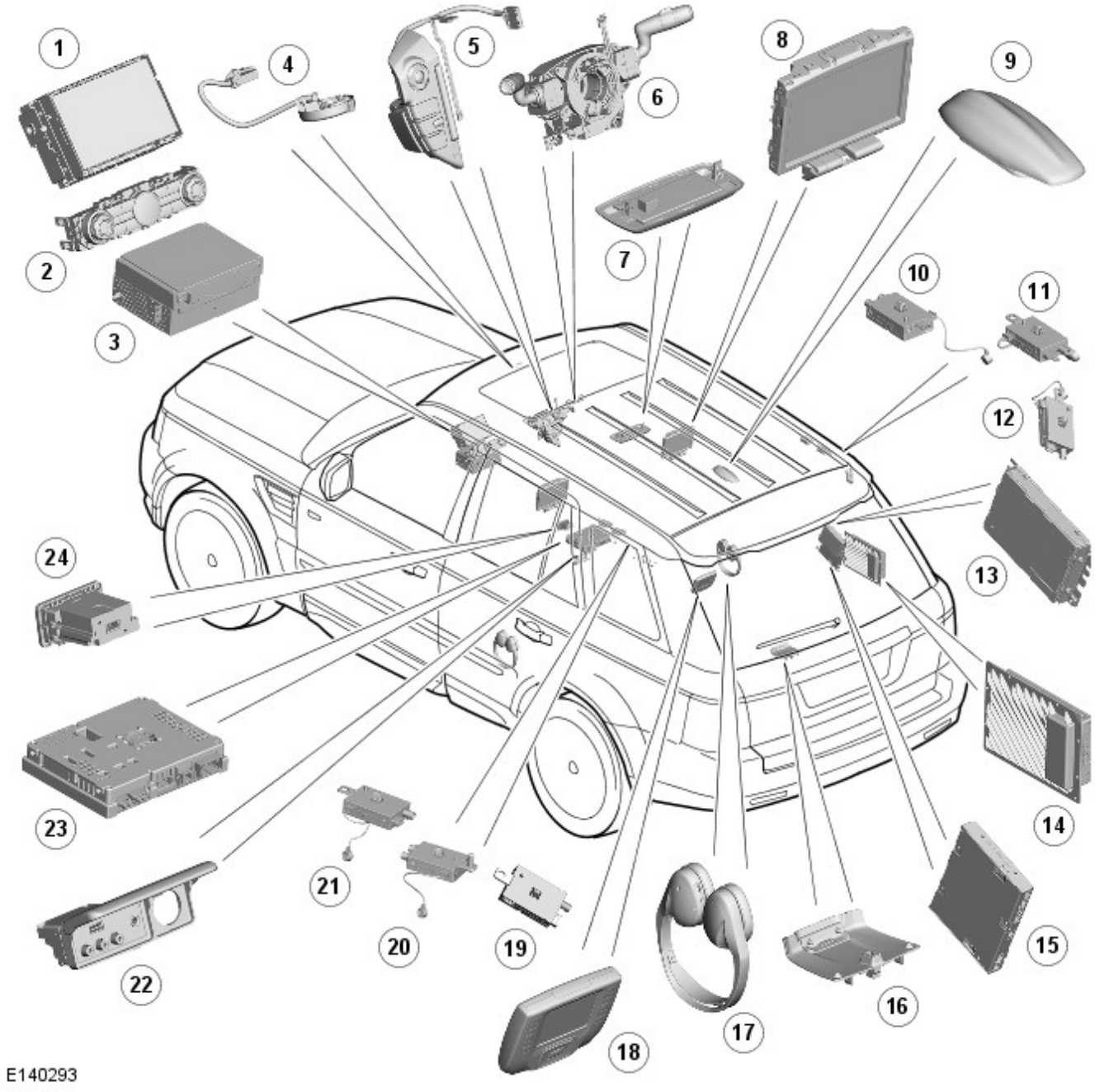
- Integrated Head Unit (IHU) Head unit
- Two front door mounted mid range speakers (one per side)
- Two front door mounted bass speakers (one per side)
- Two front door mounted tweeters (one per side)
- Two rear door mounted mid/bass range speakers (one per side)
- Two rear door mounted tweeters (one per side)
- A sub-woofer located in the lower tailgate
- Two rear surround speakers
- One center fill speaker located in the center of the instrument panel
- Premium amplifier.

Published: 01-Nov-2011

Information and Entertainment System - Audio System - Component Location

Description and Operation

Component Location



Item Description

1 Touch screen display (TSD)
2 ICP (integrated control panel)
3 IAM (integrated audio module)
4 Microphone
5 Steering wheel audio controls
6 Clockspring
7 Wireless headphone transmitter
8 Rear LCD screens
9 Digital Audio Broadcasting (DAB) L-Band/Satellite Digital Audio Radio Service (SDARS) antenna
10 TV antenna amplifier
11 AM/FM1 antenna amplifier
12 TV antenna amplifier
13 Digital Audio Broadcasting (DAB)/Satellite Digital Audio Radio Service (SDARS) Receiver
14 Audio amplifier

15 Rear entertainment module (RSE)
16 RSE remote control docking station
17 Wireless headphones
18 RSE remote control
19 TV antenna amplifier
20 FM2/DAB3/VICS antenna amplifer
21 TV antenna amplifier
22 Audio/Video input/output panel
23 Television tuner module
24 Portable audio module

Published: 01-Nov-2011

Information and Entertainment System - Audio System - Overview

Description and Operation

OVERVIEW

The audio system is available in three versions:

TL2 System

- 600W Harman Kardon sound system - separate amplifier
- 11 speakers including passive sub-woofer
- single slot CD (compact disc) player.
- Touch Screen Display (TSD)
- HD Radio™ receiver
- Media Oriented System Transport (MOST) based system.
- 3.5mm jack plug.

High-Line System

- 600W Harman Kardon sound system - separate amplifier
- 11 speakers including passive sub-woofer
- single slot CD player and virtual multi-changer
- Touch Screen Display (TSD)
- HD Radio™ receiver
- 40GB HDD storage
- Media Oriented System Transport (MOST) based system.
- Auxiliary input - USB and MP3/iPod
- 3.5mm jack plug.

Premium System

- 1200W Harman Kardon Logic 7 sound system - separate amplifier
- 17 speakers including passive sub-woofer
- single slot CD player and virtual multi-changer
- Touch Screen Display (TSD)
- HD Radio™ receiver
- 40GB HDD storage
- Media Oriented System Transport (MOST) based system.
- Auxiliary input - USB and MP3/iPod
- 3.5mm jack plug.

All sound systems include:

- MP3-compatible, single slot CD player
- AM / FM radio
- EON, RDS, PTY, TA
- 3.5mm jack plug

All systems can be specified with Bluetooth™

Hi-Line and Premium systems can be specified with:

- Hard Drive Navigation system (except Asian markets) with virtual CD multi-changer and single slot DVD (digital versatile disc) for front Touch Screen Display (TSD)
- Interactive Voice (Navigation required)
- Digital audio tuner (DAB) (Europe and Asia only) or Satellite Digital Audio Radio Service (SDARS) receiver (NAS only).

The Lo-Line system comprise an audio head unit and a multifunction display. The head unit has the following functions:

- AM/FM tuner
- single CD player
- integral audio power amplifier
- Bluetooth™ and audio streaming capability
- optional DAB tuner.

The TL2 systems comprise an Integrated Audio Module (IAM) and TSD. The IAM has the following function:

- AM/FM tuner
- single CD player
- separate audio power amplifier
- Bluetooth™ and audio streaming capability
- optional DAB tuner.

The Hi-Line system comprise an Integrated Audio Module (IAM) and TSD. The IAM has the following function:

- AM/FM tuner
- single CD player 40GB HDD virtual multi-changer (The 40GB hard drive is used by the audio for storing music and also stores the operating system and files for the navigation system (not applicable to Asian market vehicles).
- Bluetooth™ and audio streaming capability

The Premium system comprise an Integrated Audio Module (IAM) and TSD. The IAM has the following function:

- AM/FM tuner
- single CD player 40GB HDD virtual multi-changer (The 40GB hard drive is used by the audio for storing music and also stores the operating system and files for the navigation system (not applicable to Asian market vehicles).
- Bluetooth™ and audio streaming capability

Digital Audio Broadcasting (DAB) is available for most European and Asian markets and gives access to digital radio channels for better sound quality and enhanced functionality depending on local service availability. The DAB module is located behind the RH (right-hand) side luggage compartment trim panel on TL2, High-Line and Premium systems or in the audio head unit on the Lo-Line system. The DAB system receives reception signals from the following sources to ensure optimum signal strength.

- DAB band L antenna located in the roof pod.
- DAB band III antenna located in the LH (left-hand) rear side window.

For NAS vehicles with TL2, High-Line and Premium systems, the digital format adopted is Satellite Digital Audio Radio Service (SDARS) which specifically links to the Sirius network. The system operates in the S-band frequency range, and as a result of the use of satellite transmission, has the ability to provide CD quality audio broadcasts over very large areas (typically continents). The SDARS receiver is located behind the RH luggage compartment trim panel. The system receives reception signals from the satellite radio antenna located in the roof pod. SDARS is not available on Lo-Line systems.

HD Radio™ Technology is a free digital radio format broadcast available in NAS market. HD Radio™ digital broadcasts are transmitted alongside the analogue AM and FM signals by stations broadcasting HD Radio™ signals. The HD Radio™ receiver is integrated into the AM FM tuner on NAS variants of the IAM.

Primary user control of the TL2, High-Line and Premium audio systems is via the Integrated Control Panel (ICP) and the Touch Screen Display (TSD) which are located in the center of the instrument panel. Control signals from the ICP are relayed on the medium speed CAN (controller area network) bus to the IAM. The IAM relays the control signals to the rest of the audio system on the Media Oriented System Transport (MOST) ring. The TSD is the timing master for the MOST ring and also hosts a gateway function between the medium speed CAN bus and the MOST ring.

The primary user control of the Lo-Line audio system is via the ICP and the multi-function display, which are located in the center of the instrument panel. Control signals from the ICP are relayed on the medium speed CAN bus to the multi-function display. The control signals are passed to the audio head unit on a dedicated CAN bus.

Published: 01-Nov-2011

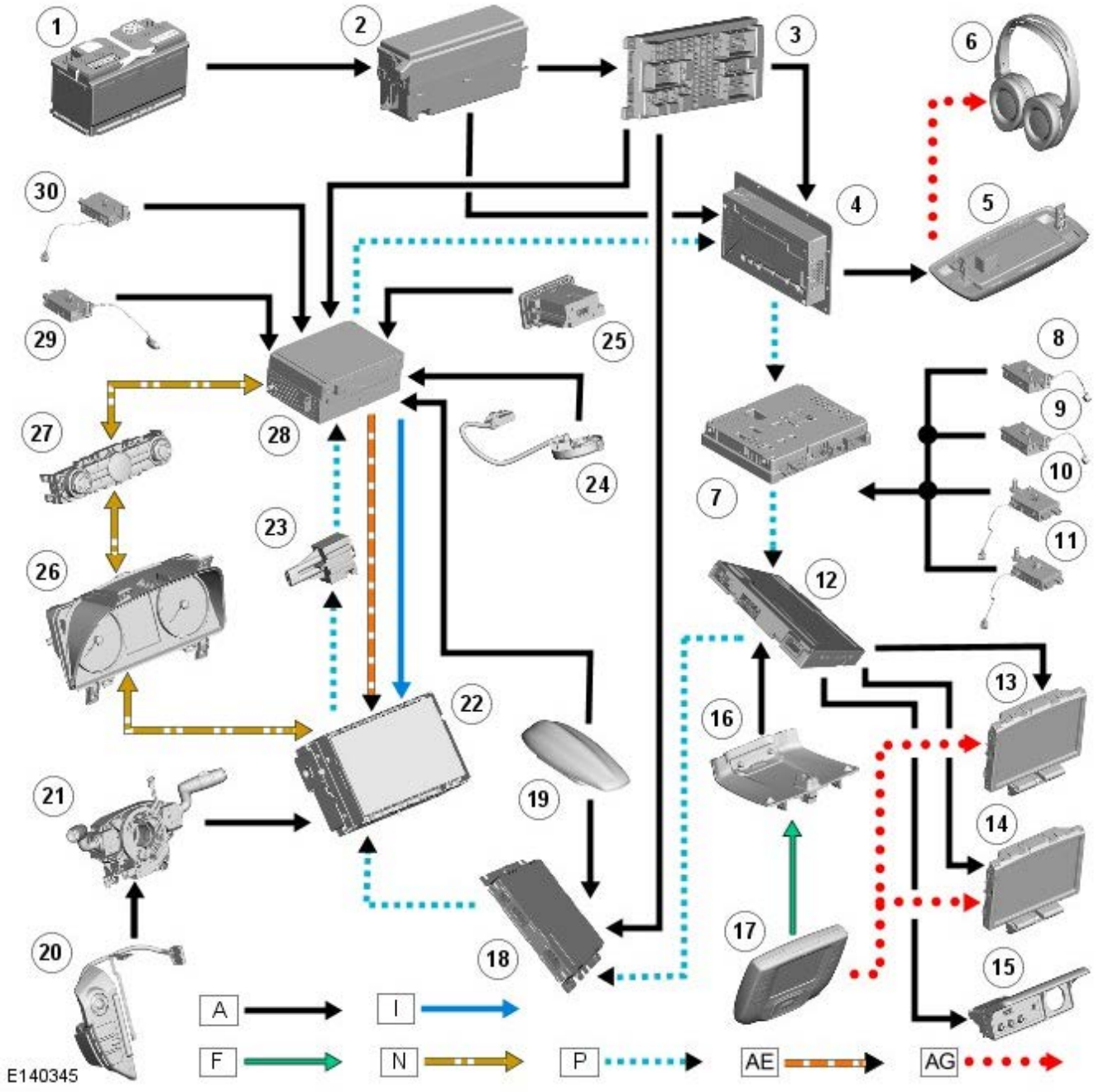
Information and Entertainment System - Audio System - System Operation and Component Description

Description and Operation

Control Diagram

NOTE: **A** = Hardwired connection; **F** = RF transmission; **I** = CVBS; **N** = Medium speed CAN (controller area network); **P** = MOST; **AE** = LVDS; **AG** = Infra-red

CONTROL DIAGRAM - TL2, HI-LINE AND PREMIUM AUDIO SYSTEMS

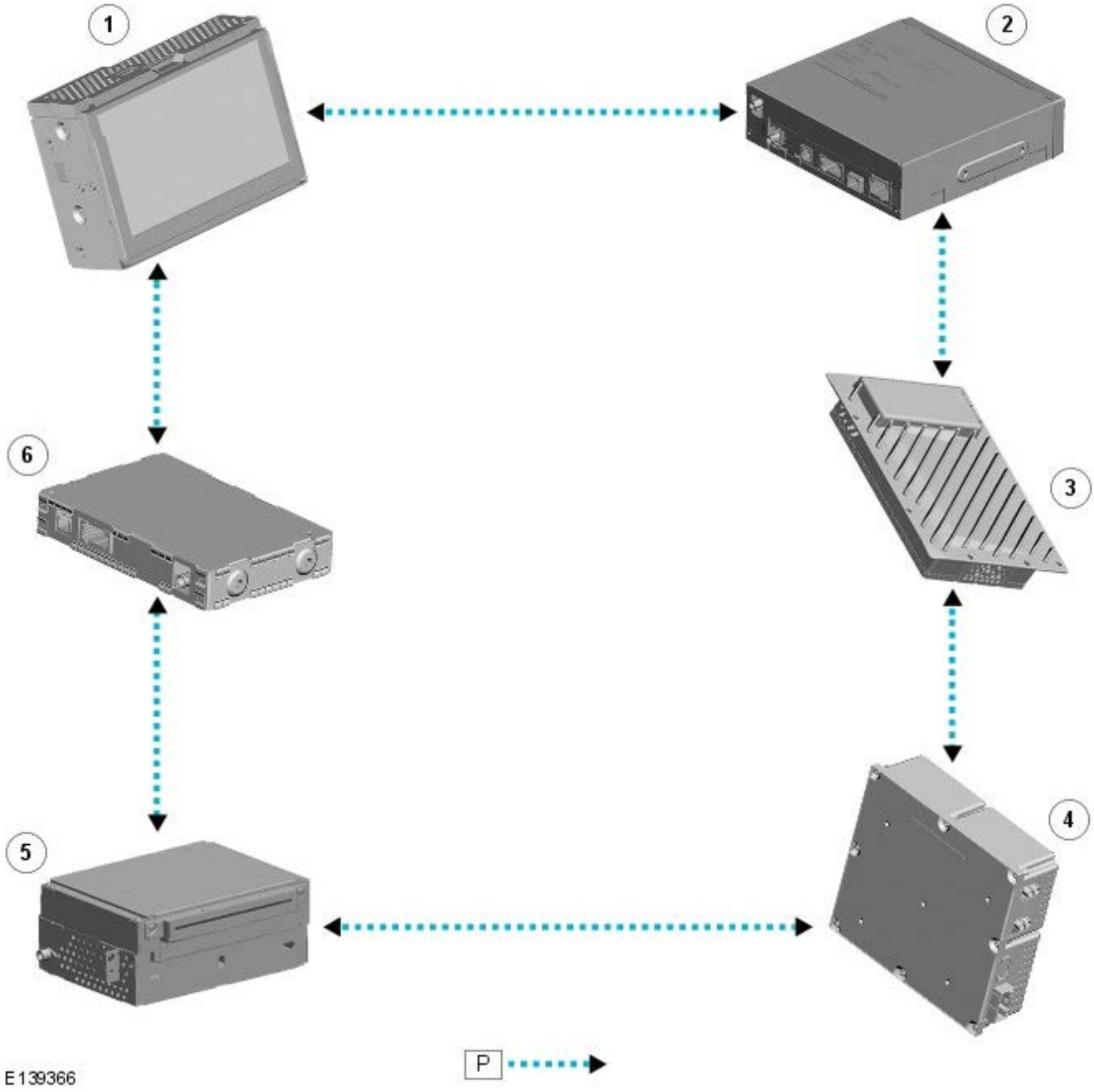


Item Description

1 Battery
2 Battery junction box (BJB)
3 Central junction box (CJB)
4 Audio power amplifier
5 Headphone emitter
6 Headphones
7 TV Module
8 TV antenna amplifier 1
9 TV antenna amplifier 2
10 TV antenna amplifier 3

11 TV antenna amplifier 4
12 Rear Seat Entertainment (RSE) module
13 RSE screen - RH
14 RSE screen - RH
15 Audio Visual Input/Output (AVIO) panel
16 RSE remote control docking station
17 RSE remote control
18 Digital Audio Broadcasting (DAB)/Satellite Digital Audio Radio Service (SDARS) Module
19 Roof pod
20 Steering wheel audio switches
21 Clockspring
22 Touch Screen Display (TSD)
23 MOST diagnostic connector
24 Microphone
25 Portable audio interface panel
26 Instrument cluster
27 Integrated control panel (ICP)
28 Integrated Audio Module (IAM)
29 FM2/DAB III/VICS antenna amplifier
30 AM/FM antenna amplifier

CONTROL DIAGRAM - MOST



Item	Description
1	TSD
2	Navigation computer (Japanese market only)
3	Amplifier
4	TV tuner (if fitted)
5	Integrated Audio Module (IAM)
6	DAB receiver or Satellite Digital Audio Radio Service (SDARS) receiver (NAS only)

System Operation

PRINCIPLES OF OPERATION

TL2, HI-LINE AND PREMIUM AUDIO SYSTEMS

The components of the TL2, Hi-Line and Premium audio/infotainment system are all connected on the Media Oriented Systems Transport (MOST) ring. The MOST ring is a fibre optic communications bus for multimedia applications. Audio and control information is passed around the MOST ring and can be picked up by any of the systems units. For example, radio station tuning/selection input by the vehicle user into the Touch Screen Display (TSD) is sent along the MOST ring and collected by the Integrated Audio Module (IAM) which then selects the requested radio station.

MOST technology uses a plastic optical fibre which forms a network connecting the audio and multimedia system components. Each component in the ring is connected to the plastic optical fiber through a device known as a Fiber Optical Transceiver (FOT). Each FOT has two optical connections; one connection is sensitive to light and is the input, the second connection forms the light source and is the output. The system operates by connecting the output from one FOT to the input of another FOT.

The light signals are sent in one direction only and are formed in the following way:

- Electrical signals are converted into an electrical current
- The current then drives an LED (light emitting diode) in the FOT to produce a high intensity red light
- The LED transmits the light through a fiber optic cable
- A photo diode in the FOT at the opposite end of the fiber optic cable detects the light.

The following components may be connected to the MOST ring dependant on the vehicle equipment level:

- IAM
- TSD
- DAB receiver (if fitted)
- SDARS receiver (NAS only)
- Audio power amplifier
- Navigation computer (Japan only)
- TV tuner (if fitted).

MOST is a synchronous network. A timing master supplies the clock information and all other devices on the network synchronize their operation to this clock. The timing master for the MOST network on this vehicle is the TSD. This unit controls and manages the MOST ring and the system components. An Optical Bus tester is used in conjunction with approved Land Rover diagnostic equipment to diagnose the MOST system.

The Optical Bus tester emits a visible, high intensity red light which can be connected into the ring at any point to test the ring integrity. Disconnecting a MOST connector will reveal if the high intensity red light is visible. If a break occurs in the MOST ring, fault codes are stored in the TSD which can be retrieved using approved Land Rover diagnostic equipment.

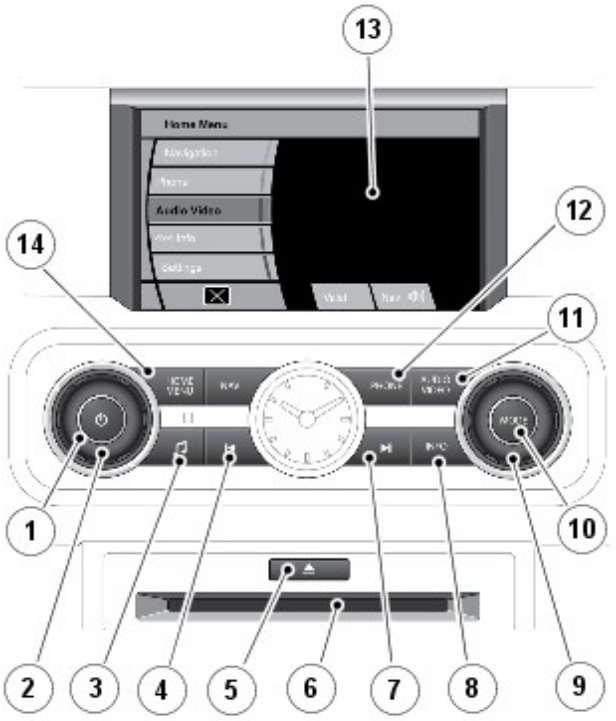
TL2, Hi-Line and Premium Audio System Gateway Functions

The TSD is the gateway between medium speed CAN bus and the MOST systems. A typical example of information transfer is vehicle speed information from the ABS (anti-lock brake system) module used to control the automatic volume control function. The vehicle speed information from the ABS module is sent on the high speed CAN bus and collected by the instrument cluster gateway. The signal is passed to the medium speed CAN bus and onto the IAM via the TSD. The IAM calculates the volume adjustment required. The corrected audio volume level signal is sent on the MOST (media orientated systems transport) network to the power amplifier for output to the speaker system.

Component Description

TL2, HI-LINE AND PREMIUM AUDIO SYSTEMS

Touch Screen Display and Integrated Control Panel



E140299

Item Description

1 Audio on/off
2 Volume control
3 Tone button
4 Seek down/CD (compact disc) previous track/manual tuning down
5 CD eject button
6 CD slot
7 Seek up/CD next track/manual tuning up
8 Info button
9 Menu navigational controller
10 Mode button
11 Audio/video menu button
12 Phone menu button
13 TSD
14 TSD off button
15 Navigation menu button.

The TL2, Hi-Line and Premium audio systems are based around an Integrated Audio Module (IAM) which communicates on the MOST with other audio and entertainment system modules. The Integrated Control Panel (ICP) communicates on the medium speed CAN with the Touch Screen Display (TSD).

The ICP has a rotary control for audio volume control. The control can also be pressed to turn the audio system on and off.

The ICP duplicates many of the TSD audio user control features. Any volume setting made whilst in audio, TV, phone, navigation or voice activation mode will be memorized for that system. The ICP communicates with the TSD on the medium speed CAN bus. The TSD converts control/command signals from the ICP and then distributes the information onto the MOST system to the audio system and other information and entertainment systems.

Integrated Audio Module (IAM)



E140303

The IAM is located in the instrument panel, behind the Integrated Control Panel (ICP) and the ATC (automatic temperature control) module.

Two levels of IAM are available; IAM 1 and IAM3. IAM3 is the high level unit and supports the following features in addition to the features supported by IAM1:

- Navigation
- TMC/VICS
- Off Road Navigation
- DVD
- 40GB Hard Disc Drive (HDD) - virtual CD/DVD - allows the storage of up to 10 CDs to create a 'virtual' multi-changer.
- Voice recognition
- Rear Seat Entertainment (RSE)
- Whitefire™ headphones.

Both versions of the IAM contain the following functionality:

- AM/FM radio tuner with diversity
- HD Radio™ receiver (NAS only)
- CD/MP3 player (Single CD
- Auxiliary audio/video is available via a portable audio interface panel. The panel allows for the connection of portable audio/video via 2 USB's, a 3.5mm jack plug and iPod connectivity.
- Bluetooth® and audio streaming.

When the vehicle systems become active the TSD is woken up by CAN bus activity and subsequently wakes up the IAM via the MOST.

The IAM incorporates an AM/FM tuner which allows for the storage of 3 banks of FM presets FM1/2/3 containing 6 presets each and 3 banks of AM Presets AM1/AM2/AMA containing 6 presets each. The AMA bank gives the 6 strongest AM stations stored by an AM autostore. Pre-set stations are stored in the IAM and TSD memory. The radio tuner also incorporates the following radio functions:

- HD Radio™ (NAS only)
- AM Auto Store (AST)
- FM station list
- Presets
- Traffic announcements (TA) – Europe only
- RDS (radio data system) EON (Enhanced Other Networks) function (Radio Broadcast Data System (RBDS) in NAS markets)
- Seek station
- Tune up/down
- Scan
- PTY

When the optional Digital Audio Broadcasting (DAB) tuner is specified, the audio system is fitted with a separate DAB receiver. This allows the reception of digital broadcast stations which can be received via the FM2/DAB III antenna located in the LH (left-hand) rear quarter glass or via the DAB L antenna in the roof pod.

In NAS markets, Satellite Digital Audio Radio Service (SDARS) can be specified, the audio system is fitted with a separate SDARS tuner. This allows for the reception of the satellite digital broadcast stations which are received via an SDARS antenna located in the roof pod.

All radio antennas are routed into the IAM. The IAM supplies a power output to the antenna amplifier except for AM which has a separate power feed to the amplifier.

The IAM incorporates a power management function. Should the vehicle battery level drop below a predetermined level, the unit will limit its functionality. The audio head unit receives medium speed CAN signals from other vehicle systems which it uses to determine the wake up/shut down process.

Calibration of the IAM using approved Land Rover diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates. If the IAM is replaced it must be configured as a new module using approved Land Rover diagnostic equipment.

CD Player/DVD Player (where fitted)

The CD player has the capability to play MP3 files. The MP3 discs follow a format of folders and files within the

folder. It is also possible to place all the files in the root directory on the CD.

The random and repeat features follow the normal CD random and repeat feature functions.

When an CD error occurs, the audio head unit will alert the user by showing a message related to the error in the multi-function display. This will be displayed while the CD audio mode is selected until the error is corrected. The CD related error does not affect other areas of the audio head unit and a different audio source can be selected.

Error Message in IAM display	Cause
Mechanism error	Mechanical Error, CD stuck, Servo related error, etc..
Disc error	Invalid Disc, CDROM (read only memory) inserted, disc inserted upside-down, etc.

The IAM has the ability to load audio files and 'rip' the music onto the internal hard drive, a 10GB partition is reserved to store music. It is possible to store up to 10 uncompressed albums onto the hard drive. Only CDDA files can be loaded into the virtual changer.

File compatibility for the single slot CD mechanism includes:

- CD audio
- MP3 – (MPEG Layer III)
- WMA – (Microsoft Windows Media Audio)
- WAV – (waveform)
- AAC – (Advanced Audio Coding. Apple iTunes - only through iPod interface).

NOTES:

 The CD player may take a longer time to load an MP3 disc, if there are more tracks than on a normal CD. To minimise loading time, a rigid folder structure is recommended.

 In the event of customer complaints relating to audio quality, file compression should be taken into consideration during diagnosis.

Dynamic Volume Control (DVC)

DVC controls the audio output parameters in relation to the noise inside the cabin (road noise, wind noise, etc.) and vehicle speed. No customer settings are available for adjustment.

Touch Screen Display (TSD)

The TSD is an 8" color touch sensitive display, located in the instrument panel, above the ICP.

Two versions of the TSD are available; single view and dual view. Additionally the switches surrounding the TSD differ depending on system specification.

The TSD is the Bus Master for the MOST system and contains the timing master for the MOST system.

When the vehicle systems become active the TSD is woken up by CAN bus activity and subsequently wakes up the the other audio module via the MOST.

The TSD forms the basis of the audio system. It communicates with the rest of the audio/infotainment system on the MOST ring and allows control of the audio system and other infotainment systems from a single point. The TSD communicates with the IAM on the MOST ring and provides the primary user interface and display of the audio system controls. No configuration procedure is required if the TSD is replaced.

Calibration of the TSD using approved Land Rover diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

The TSD provides user control of the following systems:

System	Functions
Audio	Radio display AM/FM or DAB, auxiliary and portable audio, digital TV or CD (compact disc)
Climate control	Air conditioning, distribution, seats, heated steering wheel, automatic air recirculation
Telephone	Digit dialer, phone book, last ten calls (made, received, missed)
Navigation	Destination, stored locations, navigation setup, route options, 4x4 info
Vehicle	Security parking, valet mode, trip computer, clock, brightness, contrast, system settings, vehicle settings, display settings

Clock

The TSD contains the master clock functionality. Other vehicle infotainment modules that require clock functionality use the time supplied from the TSD.

The clock is available to any control module that is connected to an interconnecting bus, for example, either of the CAN buses or the MOST ring.

The clock display configurable to show in AM/PM or 24 hour format. Midnight is shown as 12:00AM or 00:00 respectively. The default condition, if not specified, after power on or delivery, should default to 12:00PM or 00:00. Depending upon the market set the clock will default to either 12 or 24 hour format.

The time is adjusted from the TSD. Under conditions when any bus system could be asleep or shut down, the TSD does not allow clock adjustments.

Dual View

The dual-view TSD enables the passenger and driver to view completely different images from their respective seating positions. This technology has provided a solution for the legal issues attached to viewing moving images whilst the vehicle is in motion. It is not possible for the driver to view moving images with an active speed signal but the passenger can.

NOTE: Due to legislation the NAS markets will not receive this option. A single view display is available in these markets.

The dual-view TSD uses Parallax Barrier Shutter Technology to alternately hide and reveal columns of pixels to the left and right hand views of the screen. The display comes with a specially designed agar coating to help prevent sunlight bleaching.

To access a TV or video image when the vehicle is in motion and single view is selected, the dual view button on the TSD should be pressed by either the driver or the passenger. This will then switch the TSD to dual-view mode allowing the passenger to view TV or video, but not the driver. A second press of the button will change the TSD back to single view.



E135899

Item	Description
A	Passenger view before dual-view button pressed
B	Driver's view before dual-view button pressed
C	Passenger view after dual-view button pressed
D	Driver's view after dual-view button pressed

Once dual-view has been selected, the driver can change the current screen without affecting the passengers view by the source on the TSD.

The audio system can only broadcast one audio source. Therefore, the TV / video source that is current for the passenger will also be the audio the driver can hear. If headphones have been specified as an option, then the passenger's can choose to listen to the sound source accompanying the TV / video. This allows the driver to listen to a different audio source or navigation commands via the vehicle speaker system.

The driver's view is also event driven, for example, if reverse gear were to be selected the rear view camera will be displayed automatically, overriding the currently displayed information.

Integrated Control Panel (ICP)

The ICP is located in the instrument panel, above the ATC module.

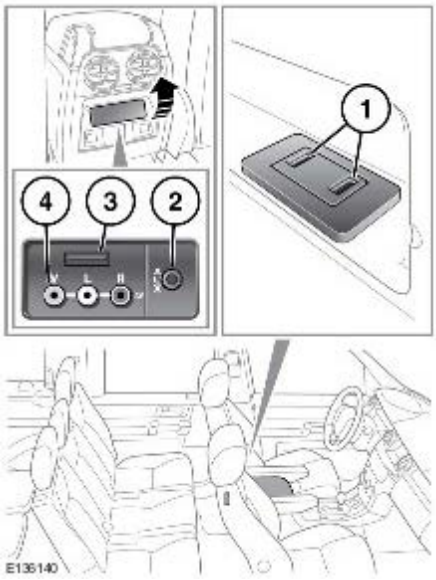
The ICP has a rotary control for audio volume control. The control can also be pressed to turn the audio system on and off.

The ICP duplicates many of the TSD audio user control features. Any volume setting made whilst in audio, TV, phone, navigation or voice activation mode will be memorized for that system. The ICP communicates with the TSD on the medium speed CAN bus. The TSD converts control/command signals from the ICP and then distributes the

information onto the MOST system to the audio system and other information and entertainment systems.

A slot below of the ICP allows a CD to be inserted into the IAM.

Portable Audio Interface Panel and AVIO Panel



Item	Description
1	USB (universal serial bus)/iPod socket
2	3.5 mm AUX socket
3	USB/iPod socket
4	AV sockets

Both the front and the rear auxiliary input connectors are located in the floor console. AUX (Auxiliary Input) mode allows extra equipment to be connected to the vehicle's audio system. Items such as a personal stereo, MP3 player, hand-held navigation unit etc, can be plugged in to the vehicle's audio system.

To listen to an auxiliary input source portable devices must be connected via 3.5 mm stereo jack sockets or USB ports. If the device has a line out socket it is preferable that this is used for connection.

Portable Audio Interface

The portable audio interface is located in the floor console cubby box and is fitted to all Hi-Line and Premium audio specified vehicles. The interface is a media hub between the portable input device and the IAM. The interface contains two USB ports.

Devices that can be connected to the portabloe audio interface include:

- USB mass storage devices (for example a memory stick). Devices must use FAT or FAT32 file format.
- iPod® (iPod Classic, iTouch, iPhone and iPod Nano are supported - full functionality for older devices cannot be guaranteed). iPod Shuffle functionality cannot be guaranteed.
- Auxiliary device (personal audio, MP3 players).
- Devices with Bluetooth® connectivity. Devices must support A2DP and AVRCP Bluetooth® protocols).

When connecting a portable storage device, select AUX on the TSD to select that device input. Depending on the device connected, many of the audio controls on the TSD and ICP can be used.

NOTE: It is recommended to disconnect an iPod when leaving the vehicle. Failure to do so may result in the iPod battery discharging.

To maximise playback quality, it is recommended to use lossless compression for any media files on iPod. Failing this, it is recommended that compressed files utilise a minimum bitrate of 192 kb/s (a higher bitrate is strongly recommended for increased quality playback).

For media files delivered via USB or MP3 players, the highest compression rate supported is 320 kbits per second (kbps). If anything less than 128 kbps is used, Digital Signal Processing (DSP) functionality may be lost.

Some MP3 players may have a file system that is not supported by the IAM. To use an MP3 player, it must be set to USB Removable Device or Mass Storage Device mode. Only music that has been added to the device in this mode can be played.

AVIO Panel

The Audio Video Inout/Output (AVIO) panel is located at the rear of the floor console. The AVIO panel is only fitted to vehicles with RSE installed.

The panel contains one USB port, one 3.5mm jack plug and three Audio/Video (AV) plug sockets. The AVIO panel is connected directly to the Rear Seat Entertainment (RSE) module.

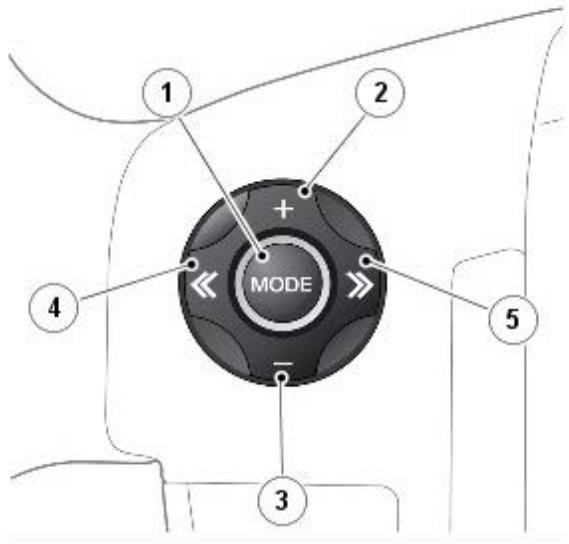
The AV sockets allow for the connection of video (yellow socket), right audio (red socket) and left audio (white

socket) from a remote device such as a PlayStation™. The USB socket allows for the connection of a portable media device.

Aux Panel

The aux panel is located at the rear of the floor console. The aux panel contains one 3.5mm jack plug. If the vehicle is fitted wit RSE the aux panel is replaced by the AVIO panel.

Steering Wheel Controls



E140298

Item	Description
1	Volume increase
2	Mode button
3	Seek up
4	Volume decrease
5	Seek down

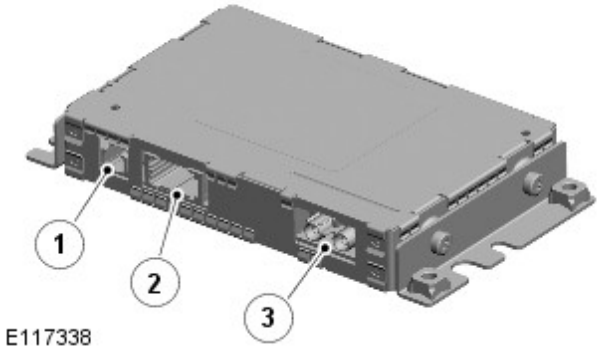
The steering wheel mounted audio control switches are located on the LH side of the steering wheel. The switches are a resistive ladder type which return a different voltage to the ICP in response to different switches being pressed.

The steering wheel audio switch controls the following functions:

- MODE - Press repeatedly to scroll through all audio/video sources.
- Short press up -
  - To select the next radio preset
  - To select the next track on chosen audio source
  - When telephone is in use, press to scroll up lists of calls or phonebook entries.
- Short press down -
  - To select the previous radio preset
  - To select the previous track or start of current track on chosen audio source
  - When telephone is in use, press to scroll down lists of calls or phonebook entries.
- With radio manual seek mode activated, further short presses will change the frequency in single increments. A further long press will scan forwards through the current waveband until the button is released.
- Long press up -
  - To auto seek up the frequency to the next radio station.
- Long press down -
  - To auto seek down the frequency to the next radio station.
- Volume increase for any audio source
- Volume decrease for any audio source

Digital Audio Broadcasting (DAB)

DAB Receiver



Item	Description
1	Power supply and ground connection
2	MOST bus connector
3	L-band and Band III antenna connection

DAB is a digital radio network designed to provide reliable, multi-service broadcasting for reception by mobile, portable and fixed receivers.

DAB provides a clear signal with minimal interference, hiss or fading. After a channel (or station) has been tuned and stored, it does not need retuning.

NOTE: Radio signals travel in a straight line so large obstacles, such as tall buildings, can shield the vehicle from the signal causing temporary loss of reception (known as dead spots).

Digital radio is transmitted from regional terrestrial transmitters. Local digital radio channels are not available outside the range of a transmitter. To receive new local channels during vehicle movement around a country, the auto-tune function is used to build new channel lists.

NOTE: When the vehicle DAB radio is first used the system will not receive any digital stations until the auto-tune function has been completed.

Digital radio channels are organized into groups called ensembles (also known as multiplexes). Some individual channels may also provide a number of subchannels. For example, if several sports events are being held simultaneously, the channel may temporarily choose to broadcast each different event on a separate subchannel.

DAB is broadcast across Europe, Canada and parts of Asia. System transmission is via a terrestrial network, on two separate broadcasting bands:

- DAB band-L
- DAB band III

The DAB system requires additional components to be added to the audio system. DAB antennas and a receiver are fitted to allow reception of the service.

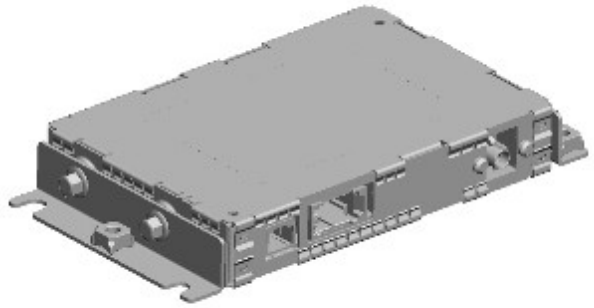
Operation of the DAB system is the same as the radio operation with selections made through the TSD and ICP to access and navigate the system functions.

The DAB receiver is a dedicated tuner which is controlled by the IAM on the MOST ring. The receiver processes the signals from the DAB antennas. Information is transmitted on the MOST ring and processed by the IAM. The processed information is sent out to the power amplifier and broadcast through the speaker system.

No configuration procedure is required if the DAB receiver is replaced. Calibration of the DAB receiver using Land Rover approved diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

Satellite Digital Audio Radio Service (SDARS)

SDARS Receiver



E139370

The SDARS systems operate in the S-Band frequency range (2.3 GHz) and, as a result of the use of satellite transmission have the ability to provide digital audio broadcasts over very large areas (typically continents). SDARS service providers transmit a signal from their up-link facility (which is the original point of transmission of data, voice or other information through an antenna system) to a satellite where the signal is then down linked to both the terrestrial repeater network and the individual SDARS car radios. The radio switches between the satellite signal and the repeater signal depending on the strength of the signal at any given time.

LandRover will be using the Sirius Satellite Radio service provider in the USA.

The SDARS systems comprise:

- Satellites
- Ground repeaters
- Up-link ground stations
- Radio receiver systems

The SDARS system uses three satellites on an inclined elliptical orbit. This ensures that each satellite spends approximately 16 hours a day over the continent of the USA, with at least one satellite over the country at any one time.

The satellites beam their signals down to the ground where the signal is picked up by receivers or is transmitted to repeater stations to cover built up areas where the signal is obscured.

SDARS is a subscription based service which requires the user to contact Sirius to obtain a subscription. In order to obtain a subscription the SDARS unit ID number will need to be retrieved from the unit. This is achieved as follows:

- When the vehicle first receives live signal within the US or Canada, the HLDF shall display ch184 as the tuned channel (labeled as Preview). The radio text shall display Call 1888-539-Sirius. Alternatively, when the radio is subscribed, unsubscribed channels shall also display this information in the radio text
- The ESN/SID can always be found the following way, no matter what the subscription status of the radio. Press **Settings** on the HLDF, then select **Sat Info** button in the settings view. This shall display the ESN/SID and the phone number. If a cell phone is paired to the Bluetooth system, the user can select the green phone button in the Sat info view to call the call center.

If no subscription has been taken, the HLDF will display the Sirius telephone number. To subscribe to Sirius use the displayed phone this number. The user will need payment details, the Sirius ID number and details of the required package.

The SDARS function is accessed by pressing the **SAT** button. To toggle through the Sat bands, select the **+** button next to the **SAT** button. This shall list SAT 1, SAT 2, SAT 3. Select any of these to change Sat band.

The SDARS module is located in the rear RH (right-hand) side of the luggage compartment. The SDARS module is connected to the rest of the audio system on the MOST ring. This allows control signals and received audio to be routed around the system to the relevant module. The SDARS antenna is located in the roof mounted pod (for metal roof cars) and a sigma pod is mounted on the interior of the glass roof cars. The antenna is hardwired to the SDARS module.

HD Radio™

HD Radio™ technology is a free digital radio format broadcast available in the NAS market and may become available for other markets in the future. HD Radio™ digital broadcasts are transmitted alongside the analogue AM and FM signals by stations broadcasting HD Radio™ signals. HD Radio™ technology has the ability to deliver improved sound quality and content to the listener, blending between analogue and a digital audio streams of the primary station and delivering extra multicast stations on the same frequency. The HD Radio receiver is integrated into the AM FM tuner on NAS variants of the IAM.

Amplifier



E139623

The audio system has two amplification options dependent on the audio system specified:

- Internal amplifier (Lo-Line system)
- External amplifier (TL2' High-line and Premium systems)

The amplifier is located under the front LH seat. It is connected to the audio system via the MOST bus. Speaker connections are hardwired.

WhiteFire® Digital Wireless Headphones and Transmitter



E121826

Item	Description
1	WhiteFire® digital wireless headphones
2	WhiteFire® digital infrared transmitter

Digital Wireless Headphones headphone system includes Dolby® headphone surround when listening to the DVD source. It is possible to install the vehicle with up to 3 sets of headphones. Each headset contains 2 AAA batteries.

The controls located on the earpiece include the power switch, volume control and channel browse button. To select a different channel press the browse button, conformation via an audible beep can then be heard followed by the audio transmission on that channel.

Antennas

Digital Audio Broadcasting and DAB L-Band/Satellite Digital Audio Radio Service (SDARS) Antenna

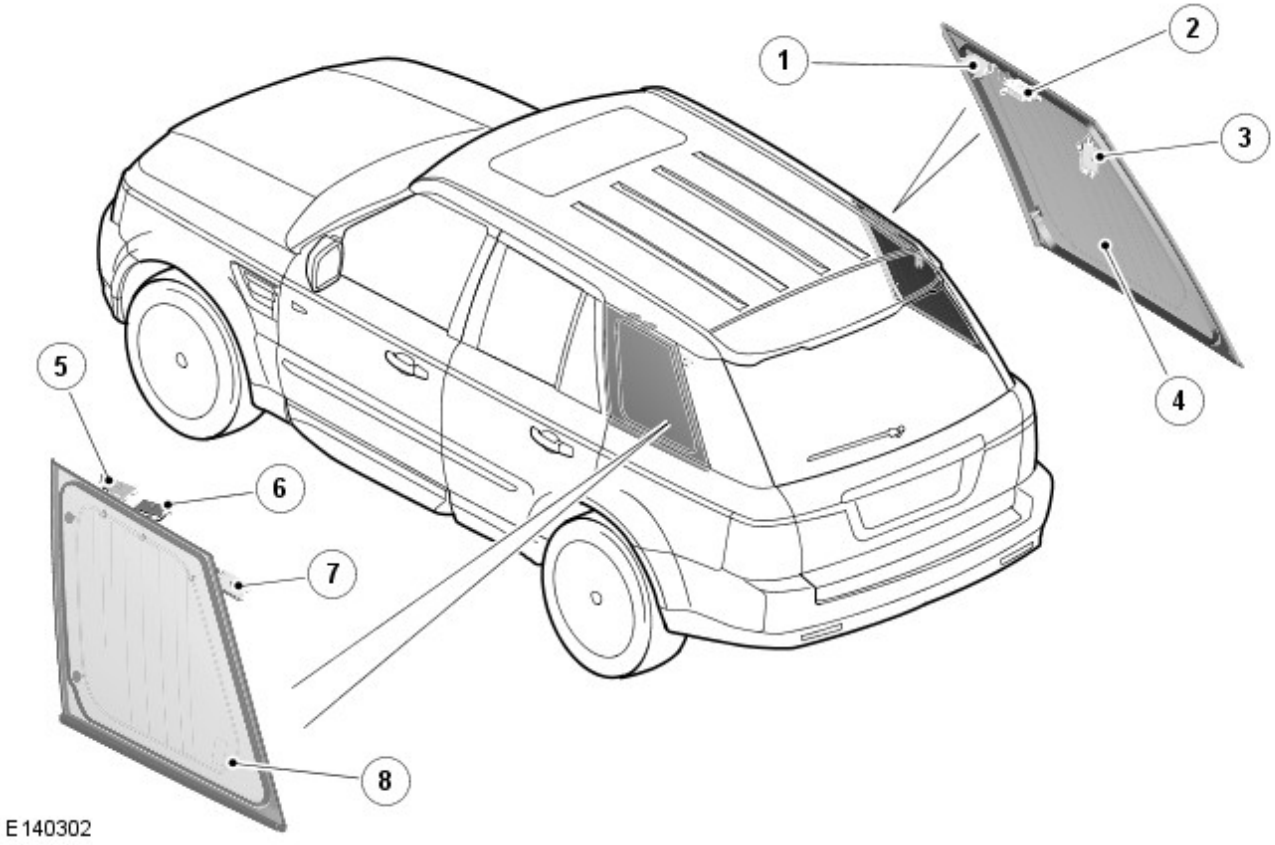


E96387

The DAB L-band/SDARS antenna is located in the roof pod and is shared with the navigation system Global Positioning Satellite (GPS) antenna where fitted.

The DAB III antenna is located in the LHrear side window

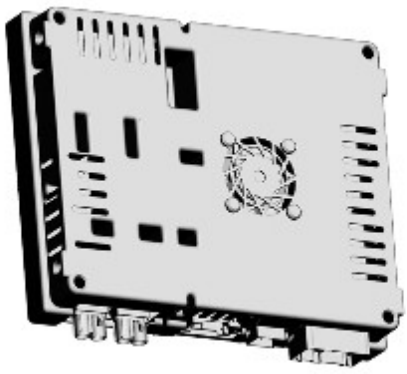
HD Radio™, AM/FM and Television Antenna



E140302

Item	Description
1	TV antenna amplifier
2	AM/FM Amplifier
3	TV antenna amplifier
4	RH rear quarter glass
5	TV antenna amplifier
6	FM2/DAB 3/VICS TV antenna amplifier
7	TV antenna amplifier
8	LH rear quarter glass

TV Tuner


E121834

The TV tuner is located below the RH front seat. The TV tuner forms part of the entertainment system and is available on vehicles fitted with satellite navigation. The TV images can also be viewed on the RSE rear screens when fitted.

TV a
Refer to: Video System (415-07, Description and Operation).
audio output is sent from the TV tuner on the MOST to the audio power apmplfier.

REAR SEAT ENTERTAINMENT (RSE)

RSE Module



E122295

The RSE system consists of the following components:

- Passenger infrared touch screen remote control panel (mounted in the rear of the floor console)
- Two 8'' LCD (liquid crystal display) screens (mounted in the back of the front headrests)
- DVD video player (IAM)
- Rear AVIO panel connectivity
- RSE module
- Two headphone sets.

The fibre optic, Media Orientated System Transport (MOST) based system provides video and audio entertainment for the rear seat occupants. The RSE system provides control of a number of audio and video sources, channelling the output independently to the rear seat passengers via personal infrared digital wireless headphones and video screens or allows output over the main vehicle audio speaker system. The video images can also be displayed on the front Touch Screen Display if the vehicle is below a predetermined speed threshold (or dual view is selected by the passenger).

The video display screens mounted in rear of the front seat headrests can display video pictures from a number of sources and are controlled via the RSE remote control for the rear seat entertainment controls.

The RSE module is located in the RH side of the luggage compartment and manages the request signals from the RSE remote control. The module is connected directly to both rear video displays via a medium speed CAN link. Video signals are communicated via the LVDS (Low Voltage Differential Signal) to one or both screens as requested.

The RSE module is connected directly to the following modules for the purpose of processing audio, video, input and output signals:

- TSD - DVD video and TV to rear screens
- Audio power amplifier - Process audio signals for output on vehicle speaker system or headphones
- TV Module - TV signals processed and passed to TSD and rear screens
- Rear screens/RSE remote control - process infra-red signals
- AVIO panel - process audio and video signals from remote source.

Refer to: Video System (415-07, Description and Operation).

Published: 29-Nov-2011

Information and Entertainment System - Digital Audio Module

Removal and Installation

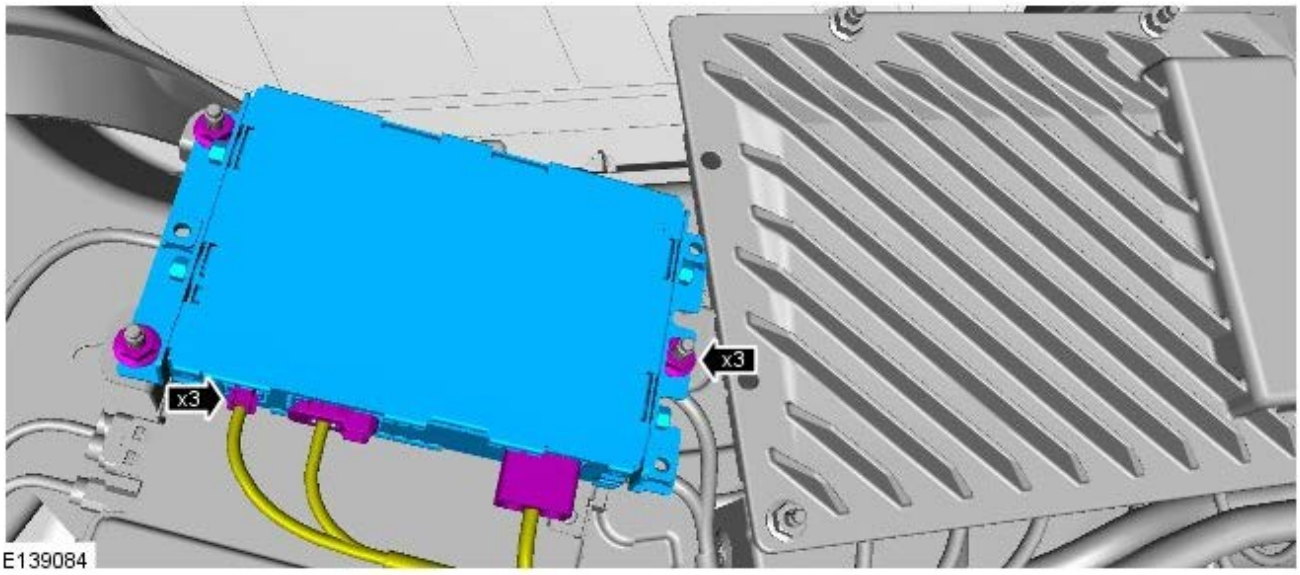
Removal

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

1. NOTE: RH side only.

   Refer to: Rear Quarter Trim Panel (501-05, Removal and Installation).

2. *Torque:* 9 Nm



Installation

1. To install, reverse the removal procedure.
2. Using the diagnostic tool, calibrate the component.

Published: 11-May-2011

Antenna - Antenna

Diagnosis and Testing

For additional information.
REFER to: Information and Entertainment System (415-00, Diagnosis and Testing).

Published: 11-May-2011

Speakers -

Torque Specifications

Description	Nm	lb-ft
Tailgate speaker to casing bolts	10	7
Tailgate speaker to tailgate Torx screws	10	7

Published: 11-May-2011

Speakers - Speakers

Diagnosis and Testing

For additional information.
REFER to: Information and Entertainment System (415-00, Diagnosis and Testing).

Published: 30-Sep-2011

Speakers - Subwoofer Speaker

Removal and Installation

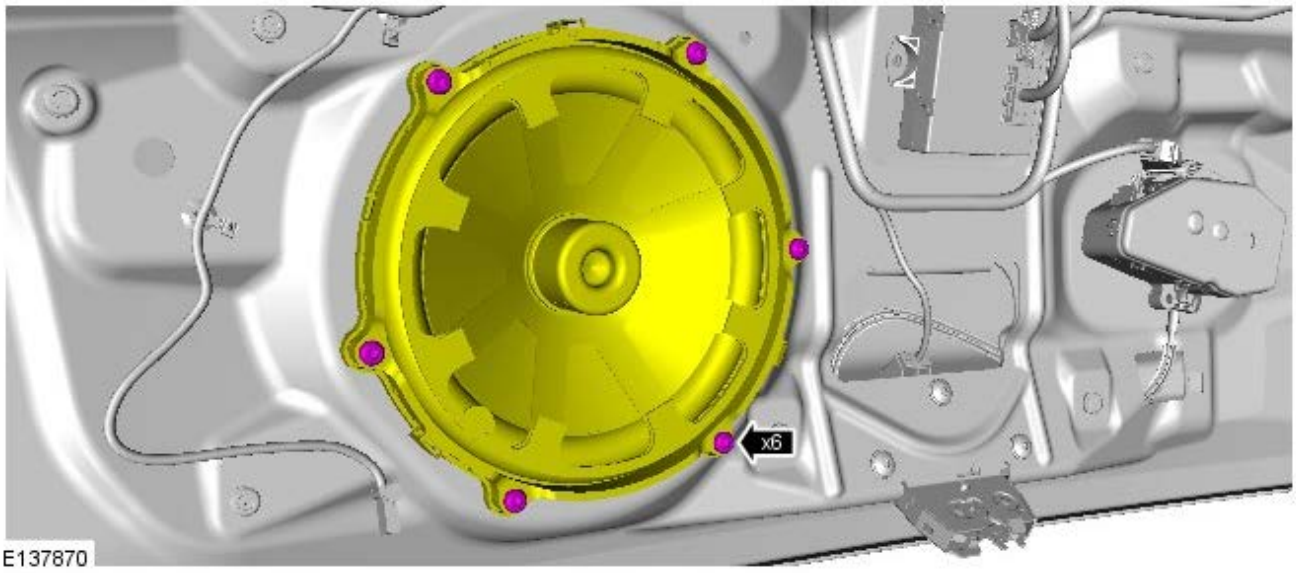
Removal

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

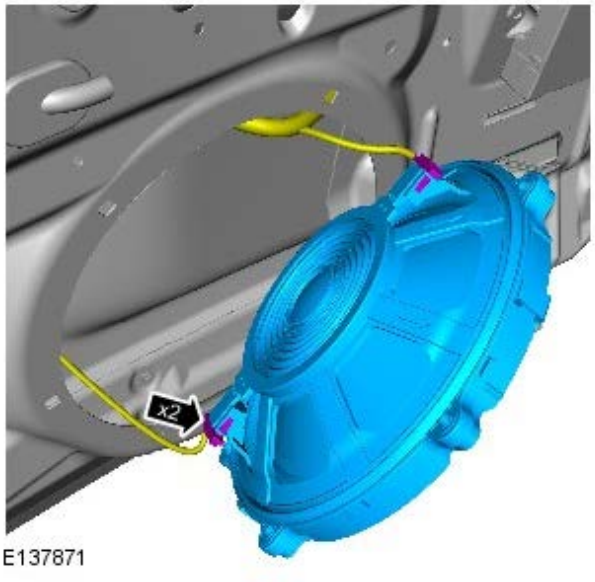
1. Refer to: Liftgate Trim Panel (501-05, Removal and Installation).

2. NOTE: Note the orientation of the component prior to removal.

   Torque: 10 Nm



3.



Installation

1. NOTE: Make sure that the component is installed to the position noted on removal.

   To install, reverse the removal procedure.

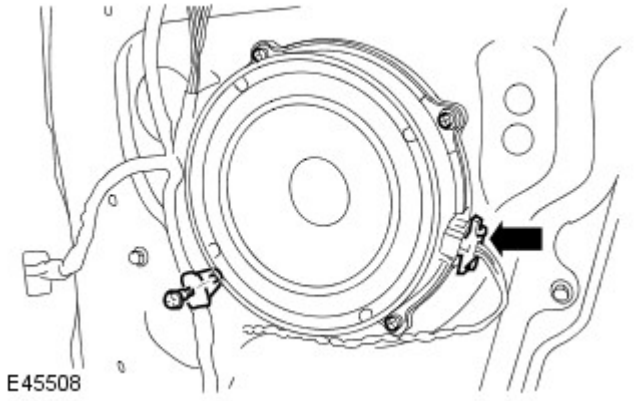
Published: 11-May-2011

Speakers - Front Door Speaker

Removal and Installation

Removal

1. Remove the front door trim panel.
   For additional information, refer to: Front Door Trim Panel (501-05, Removal and Installation).



2. Remove the speaker.
   - Disconnect the electrical connector.
   - Remove the 4 screws.

Installation

1. Install the speaker
   - Align the door wiring harness clip.
   - Tighten the screws.
   - Connect the electrical connector.

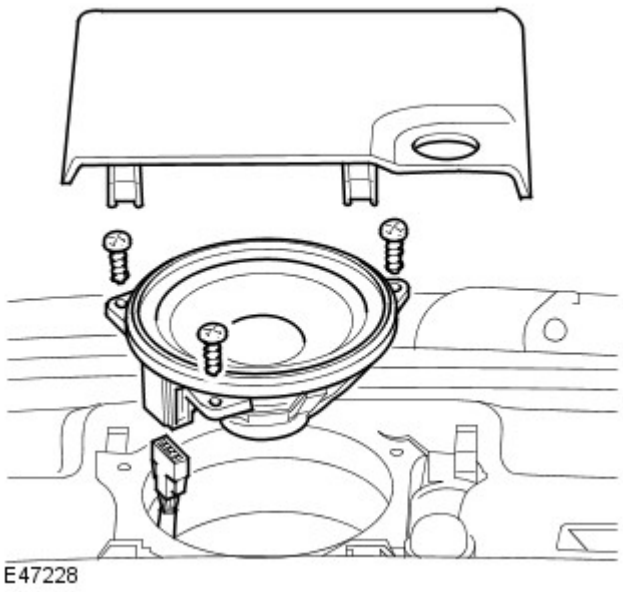
2. Install the front door trim panel.
   For additional information, refer to: Front Door Trim Panel (501-05, Removal and Installation).

Published: 11-May-2011

Speakers - Instrument Panel Speaker

Removal and Installation

Removal



1. Remove the instrument panel speaker.
    - Remove the speaker grille.
    - Remove the 3 screws.
    - Disconnect the electrical connector.

Installation

1. To install, reverse the removal procedure.

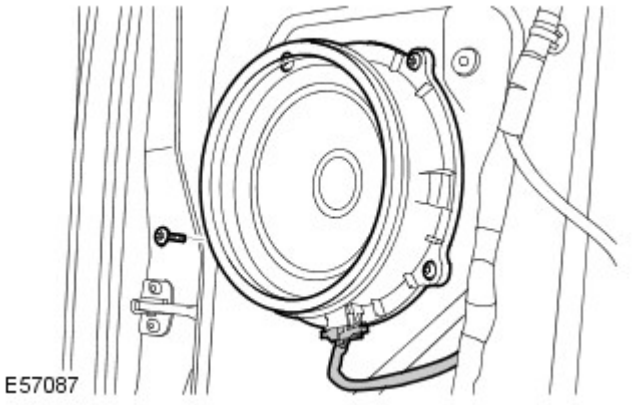
Published: 11-May-2011

Speakers - Rear Door Speaker

Removal and Installation

Removal

1. Remove the rear door trim panel.
   For additional information, refer to: Rear Door Trim Panel (501-05, Removal and Installation).



2. Remove the speaker.
   - Disconnect the electrical connector.
   - Remove the 4 screws.

Installation

1. Install the speaker
   - Tighten the screws.
   - Connect the electrical connector.

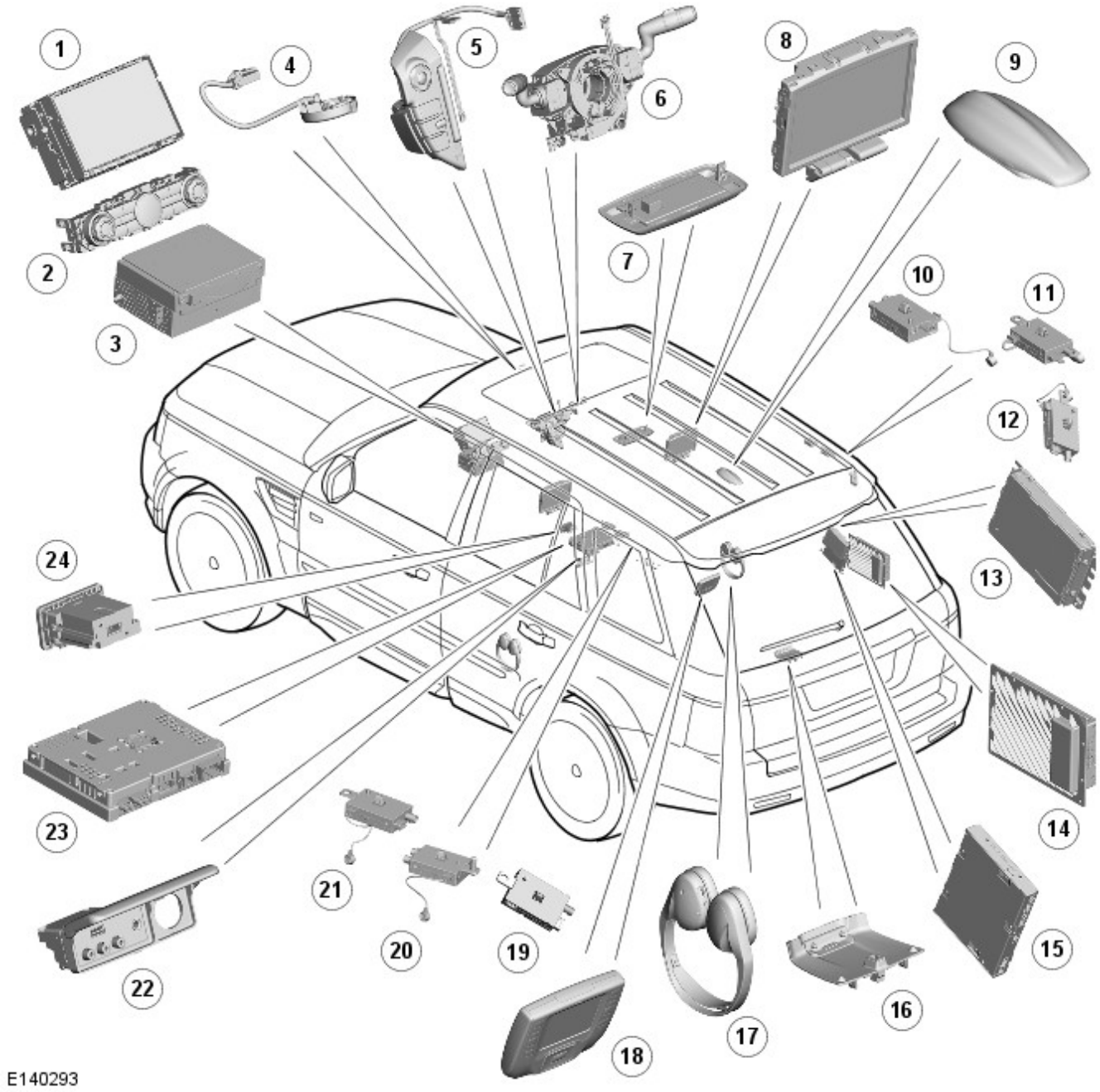
2. Install the rear door trim panel.
   For additional information, refer to: Rear Door Trim Panel (501-05, Removal and Installation).

Published: 01-Nov-2011

Video System - Video System

Description and Operation

Video System Component Location

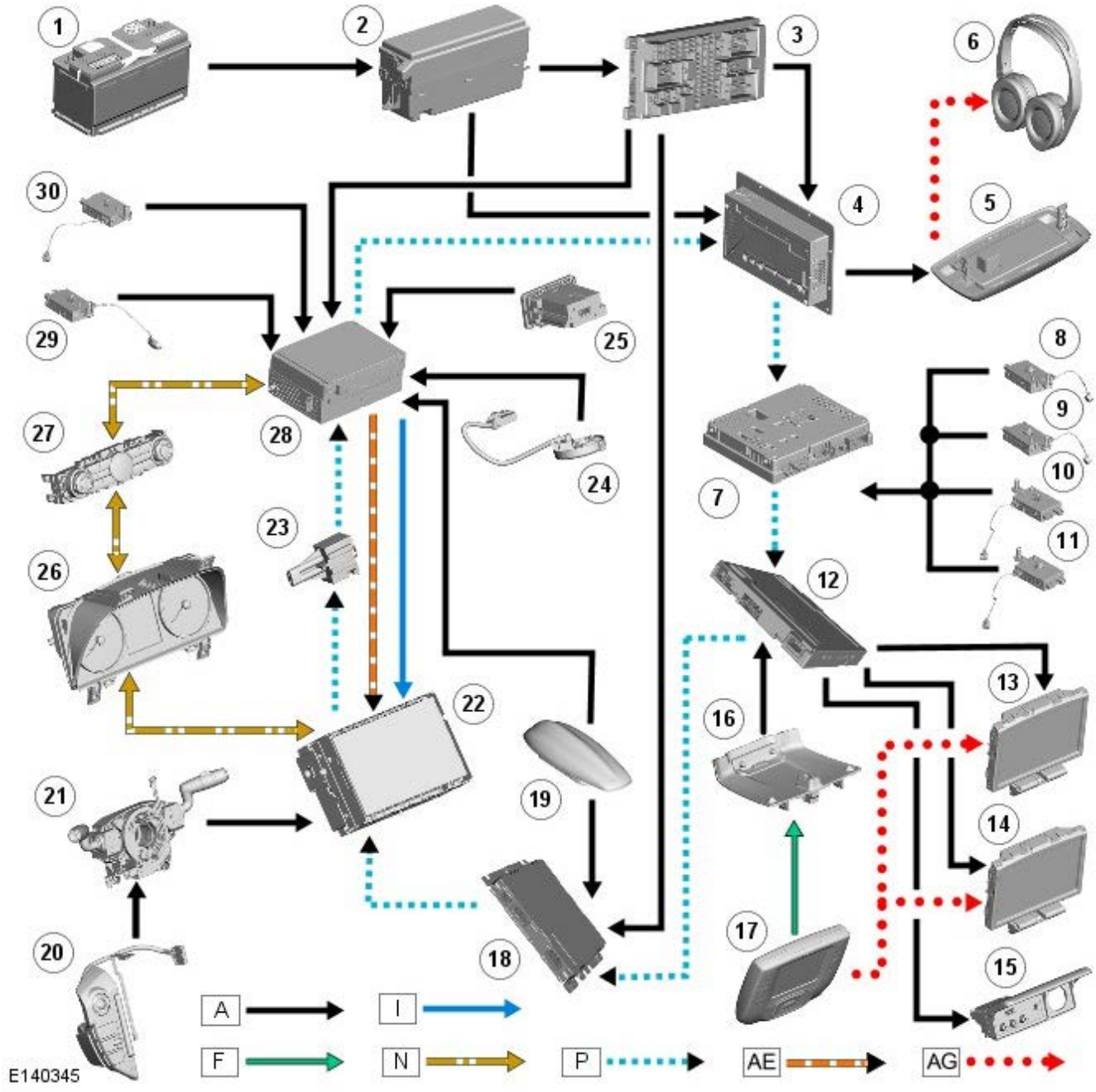


Item	Part Number	Description
1	-	Touch screen display (TSD)
2	-	ICP (integrated control panel)
3	-	IAM (integrated audio module)
4	-	Microphone
5	-	Steering Wheel audio controls
6	-	Clockspring
7	-	Wireless Headphone Transmitter
8	-	Rear LCD screens
9	-	Digital Audio Broadcasting (DAB) L-Band/Satellite Digital Audio Radio Service (SDARS) antenna
10	-	TV antenna amplifier
11	-	AM/FM1 antenna amplifier
12	-	TV antenna amplifier
13	-	Digital Audio Broadcasting (DAB)/SDARS Receiver
14	-	Audio amplifier

15	-	Rear entertainment module
16	-	RSE remote control docking station
17	-	Wireless headphones
18	-	RSE remote control
19	-	TV antenna amplifier
20	-	FM2/DABIII/VICS antenna amplifer
21	-	TV antenna amplifier
22	-	Audio/Video input/output panel
23	-	Television tuner module
24	-	Portable audio module

Video System Control Diagram

NOTE: **A** = Hardwired; **N** = Medium Speed CAN Bus; **P** = MOST **R** = SPDIF (Sony); **I** = CVBS



Item	Part Number	Description
1	-	Battery
2	-	EJB (engine junction box)
3	-	CJB (central junction box)
4	-	Amplifier
5	-	Wireless headphone transmitter
6	-	Wireless headphones
7	-	TV tuner

8	-	TV antenna
9	-	TV antenna
10	-	TV antenna
11	-	TV antenna
12	-	Rear entertainment module
13	-	RH (right-hand) rear LCD screen
14	-	LH (left-hand) rear LCD screen
15	-	Audio/Video input/output panel
16	-	Remote control docking station
17	-	Remote control
18	-	TV Module
19	-	Digital Audio Broadcasting (DAB) L-Band/Satellite Digital Audio Radio Service (SDARS) Antenna
20	-	Steering wheel audio controls
21	-	Clockspring
22	-	TSD
23	-	MOST diagnostic connector
24	-	Microphone
25	-	Portable audio module
26	-	Instrument cluster
27	-	ICP
28	-	IAM
29	-	FM2/DAB3 Antenna
30	-	AM/FM1 Antenna

The Video system comprises:

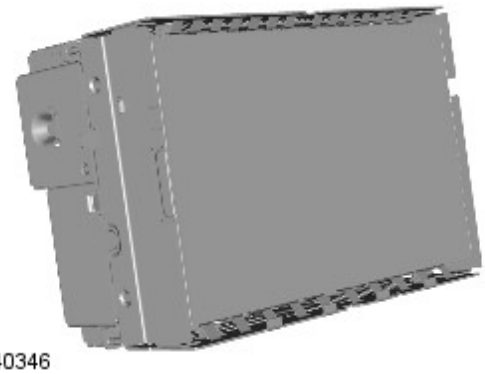
- Touch screen Display (TSD)
- Television tuner module
- Television antennas
- Rear remote control headphone modules

TELEVISION

The television system receives television signals from television antennas in the rear side screens. The antennas are connected to the television tuner via coaxial leads.

COMPONENT DESCRIPTION

Touch Screen Display


E140346

The Touch Screen Display (TSD) is located in the center of the instrument panel and is the driver control interface for the infotainment system. The TSD is connected to the MOST ring and communicates with the other components in the audio/infotainment system.

The TSD communicates with the RSE module via a co-axial cable. The TSD processes its own video for system operation but receives the video image data from the RSE via the co-axial cable.

The TSD also provides driver display and control of the audio system, telephone, the rear view camera, proximity cameras, the Traffic Message Channel (TMC) and the navigation system.

The RSE and other systems are operated by 'virtual' buttons displayed on the touch screen.

The front seat occupants can also view the TV transmissions on the TSD but only if dual view TSD is installed or the vehicle is stationary

Care should be taken with the TSD to ensure its correct operation

- The screen should be cleaned with a lightly, water moistened cloth. Do not use chemical agents or domestic

products to clean the screen or any part of the surround.
- Only use your finger to operate the touch screen. Ensure you only use one finger to avoid incorrect entries.
- A short light press of the touch screen is sufficient. Excessive pressure can damage the screen.

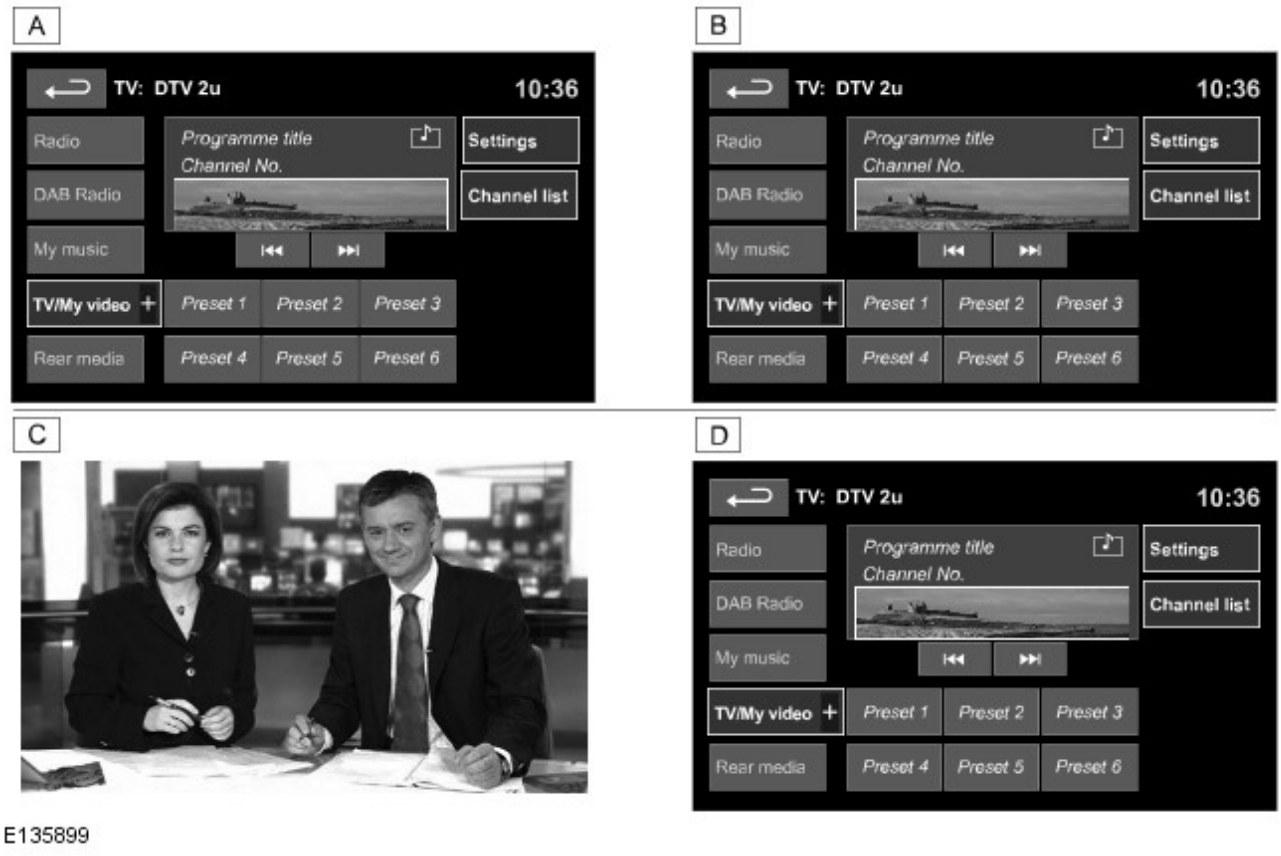
Dual View

The dual-view TSD enables the passenger and driver to view completely different images from their respective seating positions. This technology has provided a solution for the legal issues attached to viewing moving images whilst the vehicle is in motion. It is not possible for the driver to view moving images with an active speed signal but the passenger can.

NOTE: Due to legislation the NAS markets will not receive this option. A single view display is available in these markets.

The dual-view TSD uses Parallax Barrier Shutter Technology to alternately hide and reveal columns of pixels to the left and right hand views of the screen. The display comes with a specially designed agar coating to help prevent sunlight bleaching.

To access a TV or video image when the vehicle is in motion and single view is selected, the dual view button on the TSD should be pressed by either the driver or the passenger. This will then switch the TSD to dual-view mode allowing the passenger to view TV or video, but not the driver. A second press of the button will change the TSD back to single view.



E135899

Item	Part Number	Description
A	-	Passenger view before dual-view button pressed
B	-	Driver's view before dual-view button pressed
C	-	Passenger view after dual-view button pressed
D	-	Driver's view after dual-view button pressed

IAM (Integrated Audio Module)



E140303

The IAM is located in the Instrument panel and incorporates the following systems:

- HD Radio (where fitted)
- Bluetooth® receiver (telephone and audio streaming)
- 40 Gb Hard drive
- USB controller (front)
- Audio AUX
- CD player

ICP (Integrated Control Panel)



E131563

The ICP duplicates many of the touch-screen audio user control features. Any volume setting made whilst in audio, TV, phone, navigation or voice activation mode will be memorized for that system. The ICP communicates with the IAM on the medium speed CAN (controller area network) . The IAM converts control/command signals from the ICP and then distributes the information onto the MOST system to the audio system and other information and entertainment systems.

No configuration procedure is required if the ICP is replaced. There is no option to calibrate the ICP using the Land Rover approved diagnostic equipment.

Rear Seat Entertainemnt Module



E135723

The Rear Seat Entertainment (RSE) module is located in the rear right-hand (RH) side of the luggage compartment. The RSE module is an interface between the video and audio inputs from other system components and the video

display and audio outputs.

The RSE module communicates with the audio systems via the MOST connection. Audio output from the DVD player or the AVIO panel is processed by the RSE module and passed on the MOST ring to the audio amplifier to allow audio output to be played through the vehicle speakers or the headphones.

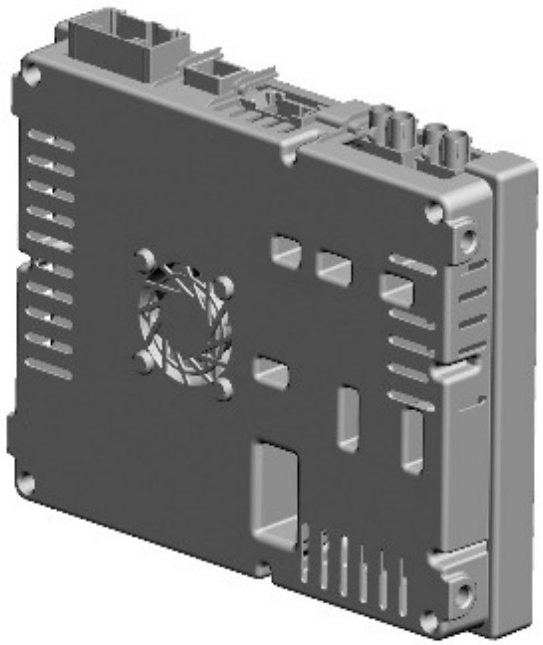
Video input from the TV tuner and the Audio Video Input/Output (AVIO) panel is also processed by the module and passed to the two RSE LCD (liquid crystal display) screens and the TSD on separate video connections. The RSE module also controls the power supplies to the RSE LCD screens and infra-red remote control signals received by the RSE LCD screens. The infra-red signals are passed from the RSE LCD screens to the RSE module on a local CAN bus system

The RSE module has two modes of operation; engine running mode and reduced operation mode. With the engine running the RSE module has full functionality. When the engine is not running the RSE module has reduced functionality to prevent excessive drain on the vehicle battery. The reduced functionality comprises a reduced audio volume and time limit on system operation.

The reduced audio volume is only active when the engine is not running. The audio volume is limited reduce battery consumption. If the volume was set at a higher level than this when the engine was running, when the engine is subsequently started, the volume level will gradually increase to the previously selected setting. This prevents the user being distracted by a sudden increase in volume.

A time limit operation is active when the ignition is off and the system is manually switched on using the TSD. The system will operate for a maximum of ten minutes. The battery voltage is continually monitored by the IAM. If the IAM detects that the battery voltage has fallen to a predetermined level, the IAM will shut the infotainment system down to prevent further battery drain. Once the system has shut down due to low battery voltage, it can only be restarted when the engine is running and the battery voltage has risen above the threshold level for more than one minute.

Television Tuner



E128344

The TV tuner is located under theRH side front seat. The TV tuner allows the rear seat occupants to view television transmissions on the RSE LCD screens. The front seat occupants can also view the TV transmissions on the TSD but only if dual view TSD is installed or the vehicle is stationary. The TV tuner is capable of receiving analogue and DVB-T digital broadcasts in one unit where transmissions allow or ISDB-T digital broadcasts in Japan in a separate unit.

The TV tuner is connected on the MOST ring which it uses to output its audio signals to the amplifier. Video output from the tuner is on a LVDS cable to the RSE module or a screened co-axial cable to the TSD in vehicles without RSE. Four further connections provide for the signal input from four TV antenna amplifiers and four antennae.

The TV tuner contains three internal tuners. All of the tuners are connected to the antennae. These tuners receive the audio and visual signals. The tuner with the strongest signal is automatically used to display the required TV channel.

One of the internal tuners (connected to two of the antennae) is used to scan the locality for receivable channels (background scanning). The tuner can detect different frequencies transmitting the same channel and can select the strongest signal for use.

The TV tuner is able to receive both analogue and digital TV signals. In certain areas both analogue and digital signal strengths will vary. When in an area of weak reception, you may experience a break-up in picture and sound quality, or a blank screen and audio muting. It may be of benefit to possibly switch between analogue and digital TV stations.

The TV tuner is connected to the infotainment system using one harness connector, one LVDS connector, one MOST connector and two dual FACRA connectors for the antennae connections.

Television audio can be heard through the vehicle speakers and the wireless headphones.

Japan TV Tuner

Japanese market vehicles are fitted with a TV tuner unique to that market. The tuner has a slot to allow a B-CAS (BS Conditional Access Systems Co., Ltd.) card to be inserted.

All digital TV's in Japan (home systems included) require a conditional B-CAS access card. This card decrypts the TV broadcast signal to allow it to be displayed as all broadcasts in Japan are encrypted. Without this card there is no picture or audio.

B-CAS (BS Conditional Access Systems Co., Ltd.) is a vendor and operator of the Integrated Services Digital Broadcasting (ISDB) CAS system in Japan. All ISDB receiving apparatus requires a B-CAS card under regulation, the B-CAS card is supplied as the standard accessory in Japan.

Integrated Services Digital Broadcasting (ISDB) is a Japanese standard for digital television and digital radio used by the country's radio and television stations.

Digital Wireless Headphones



E135720

The Infrared Headphones Transmitter is located in the roof headlining near the interior lighting console assembly.

The system can support up to three pairs of wireless headphones. When dual-view screen is fitted, the front passenger can listen to TV/DVD and when RSE is fitted, rear passengers can listen to selected source on RSE screen. The headphones have an adjustable headband which operates on a ratchet mechanism.

The headphones house the infra-red receiver sensors which receive the transmitted signals from the headphone transmitter, two AAA batteries located below a sliding cover and the power on/off switch. When inserting the batteries it is important that the battery polarity is observed as marked in the battery compartment.

The RH side of the headphone houses the volume control, a channel switch and a power 'ON' LED (light emitting diode). The channel switch allows the user to select alternative audio channels (rear left/right, dual-view audio source) when active. The power 'ON' LED is illuminated when the on/off switch on the RH side of headphone is pressed. This will remain on and the headphones powered until the switch is pressed for a second time. If the headphones have not received an infra-red signal from the transmitter for several minutes, they will automatically switch off to prevent battery drain.

LCD Screens



E135724

The RSE screens are located in the rear of the front seat head restraints. The screen is secured in the head restraint with one screw and two metal clips which are covered by a removable surround. The screens are a 8 inch, auto dimming (selectable via remote control settings), 800X480 resolution monitor.

An infra-red receiver sensor is located centrally in the bottom portion of the upper screen surround. The receiver sensor receives infra-red transmissions from the remote control and passes them to the RSE module on a private CAN bus system which is only connected between the RSE module and the RSE screens. The RSE module can then transmit any relevant messages onto the MOST ring. All screen settings can be changed using the RSE remote control.

The screen should be cleaned with a lightly, water moistened cloth. Do not use chemical agents or domestic products to clean the screen or any part of the surround.

AVIO (Audio Visual Input Output) Panel

The AVIO panel is located at the rear of the floor console. The panel provides for the connection of auxiliary audio and video inputs from an external source, such as a games console, via plugs on the panel. The plugs are covered by a lift up panel.

Video and audio phono plugs are provided and are designated as AV. The plugs are connected to the RSE module and allow the auxiliary input video to be played on the RSE LCD screens and the audio to be played on the vehicle speakers or on the cordless headphones. The auxiliary input video cannot be displayed on the TSD.

An additional single, 3.5mm jack plug allows for the attachment of an auxiliary audio input, such as a personal stereo or MP3 player. This plug is connected directly to the IHU and allows audio to be played on the vehicle speakers.

Remote Control



E135721

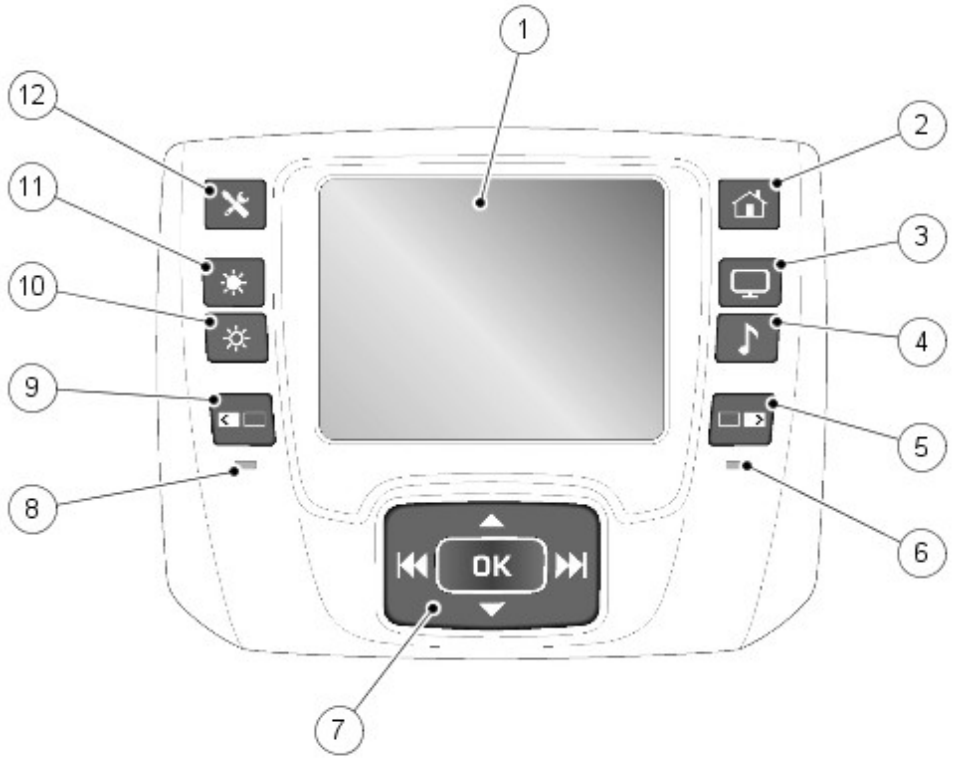
The RSE remote control allows independent multimedia control for left and right rear seat passengers.

The remote control is a dockable unit with a small TsRC (touchscreen remote control) and a number of buttons to control the audio/video functions. The remote control is stored in the rear center panel and, due to its location, the remote control cannot be used in the docked position (only handheld). When the unit is docked, charging is provided

to the 3.7 volt 1200mAh Li-ion battery. When fully charged the remote control can have up to 3 hours 20 minutes of continuous use. From empty to 90% charge takes approximately 2.5 hours.

The charging is powered via an infotainment relay which is located in the Rear Fuse Box directly to the RSE docking station. If the battery charge becomes low, a message is displayed on the remote control advising to dock and recharge the remote control. The remote control has three power modes as follows:

Power Mode	Operating Condition
Operation mode	Fully operational
Sleep mode	Screen and backlight illumination off
Shut down mode	Internal sleep mode (will take approximately 3 seconds to reboot)



E136342

Item	Part Number	Description
1	-	Touch Screen Display (TSD)
2	-	Home button
3	-	Video button
4	-	Audio button
5	-	RH screen select button
6	-	RH screen selection indicator
7	-	Five-way switch - Cursor movement and option selection button
8	-	LH screen selection indicator
9	-	LH screen select button
10	-	Touch screen display brightness decrease button
11	-	Touch screen display brightness increase button
12	-	Touch screen display settings button

The remote control operates the radio, CD (compact disc)/DVD (digital versatile disc), plug-in audio devices and TV selection by displaying options on the remote control. The options then activate menus in the RSE headrest mounted screen which can be navigated using a five-way switch on the remote control. For example, the user can select and press a soft key on the remote control to activate a list of available radio stations in the RSE screen and then use the five-way switch to browse the list and select a radio station.

The remote control is powered by a rechargeable battery located in the rear of the control and is accessible by removing a sliding cover. Located behind the battery cover is a reset button which restores the default settings.

The remote control transmits an infra-red digital signal in response to operation of a button or soft key. The infra-red signal is received by a sensor located on each of the RSE rear screens. The remote control also allows selection of an auxiliary input from the AVIO panel (video or games console) or selection of audio (radio or CD).

When docked, communication from the remote control takes place via two data lines into the RSE module. This link also enables software updates and configurations sent from the RSE module, for example, a language change requested by the user. This link from the RSE module to the docking station is a basic two-wire interface designed for remote control data rates (approx. 38Kbit/sec). It is protected against short to battery or ground on the output pin.

Published: 20-Aug-2012

Video System - Video System

Diagnosis and Testing

Principle of Operation

For a detailed description of the video system and operation, refer to the relevant Diagnosis and Testing section of the workshop manual. REFER to: Video System (415-07 Video System, 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. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Touch Screen (TS) installation and condition • Rear Seat Entertainment (RSE) screen installation and condition • Digital Versatile Disc (DVD) multi-changer installation and condition • Television antennae (two in each rear side window)	• Fuses • Electrical harnesses • Fibre optic cable harnesses • Infotainment relay • Display screens • DVD multi-changer • Television CONTROL module • RSE control module • Television antenna amplifiers (4) • Remote control and batteries

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
The DVD does not operate	• DVD multi-changer fuse blown • No power to display screens • Condensation	• Refer to the electrical circuit diagrams and test the DVD power circuit for short circuit to ground • Refer to the electrical circuit diagrams and test the DVD player power and ground circuits for open circuit, high resistance • Wait at least one hour for the condensation to dry out
Remote control operation is unstable	• Handset batteries low on power • Remote control receiver sensor or transmitter is dirty	• Check and renew the batteries as necessary • Check and clean the receiver and transmitter as necessary
There is no picture	• The display screen is set to an incorrect mode	• Use the switch on the back of the handset to select the correct mode
Playback does not start	• Disc is loaded upside-down • An incorrect format of disc is loaded • Parental lock is set • The setup menu is displayed	• Check that the disc is correctly loaded • Check that the disc format is compatible • Cancel parental lock or check the rating of the disc • Press **SET** for at least 2 seconds to turn the setup menu off
The picture is unclear or noisy	• The disc is being fast forwarded or rewound • The vehicle battery power is low	• The picture may be slightly distorted in fast forward or rewind modes • Check the vehicle battery condition and state of charge
The image "freezes"	• The disc is scratched	• Load an undamaged disc.
NO MAG is displayed	• There is no magazine loaded into the DVD	• Load a magazine

	multi-changer	
NO DISC is displayed	• There is no disc loaded into the magazine • The disc is dirty	• Load a disc into the magazine • Clean the disc as necessary
REGIONAL CODE VIOLATION is displayed	• The disc loaded does not match the regional code number	• Load a disc which matches the regional code number
VIDEO SIGNAL IS NOT CORRECT is displayed	• An NTSC disc is loaded into a PAL system, or vice versa	• Load a disc of the correct format
HI TEMP is displayed	• The system protective circuit is activated as it has detected a high temperature	• Turn the power **OFF** on the unit and then back on again. If the display does not clear, leave the power off until the temperature decreases and turn the power **ON** again

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Rear View Camera (RVC) (100-00 General Information, Description and Operation) /
Diagnostic Trouble Code (DTC) Index - DTC: Integrated Audio Module (IAM) - High Line (100-00 General Information, Description and Operation).

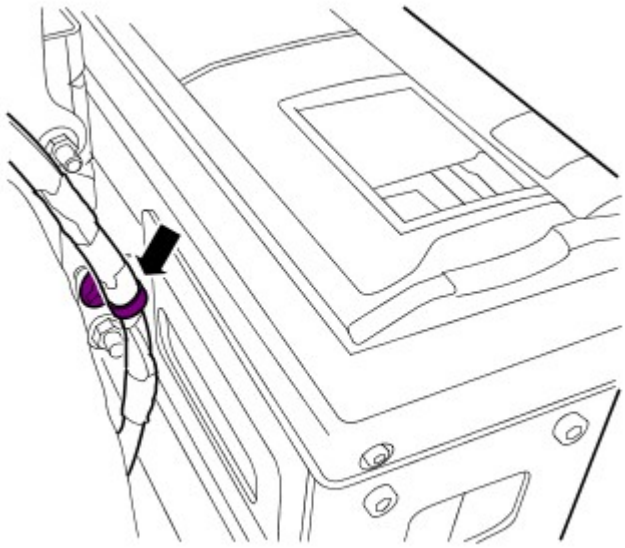
Published: 11-May-2011

Video System - Digital Versatile Disc (DVD) Player

Removal and Installation

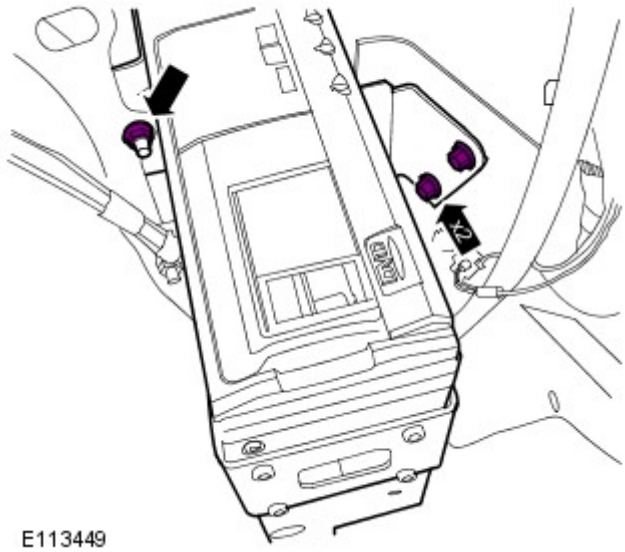
Removal

1. Remove the RH lower rear quarter trim panel.
   For additional information, refer to: Rear Quarter Trim Panel (501-05, Removal and Installation).



E113448

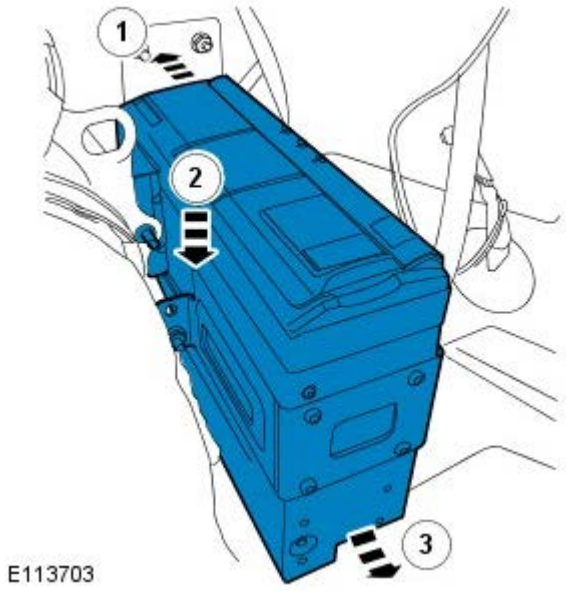
2. Release the DVD player harness.
   - Release the clip.

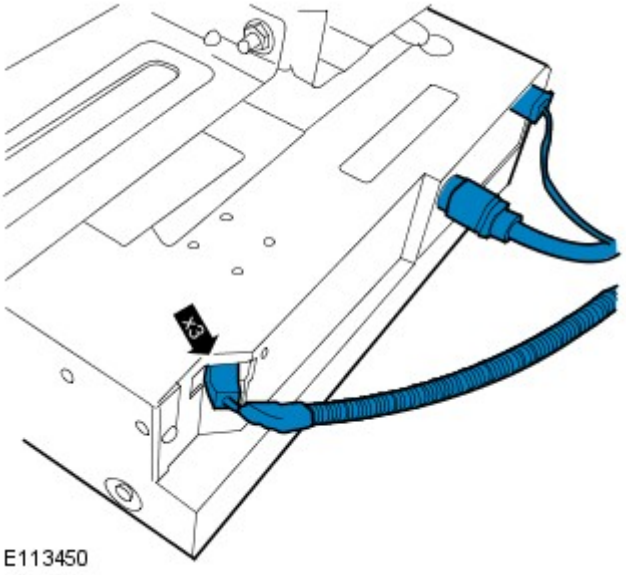


E113449

3. Release the DVD player from the body.
   - Remove the 2 bolts.
   - Remove the nut.

4. Detach the DVD player from the body.





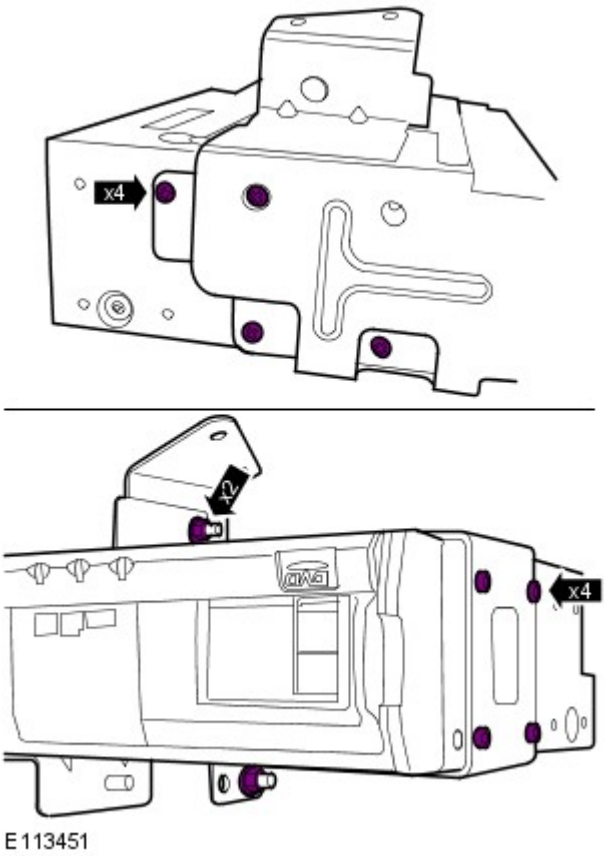
5. CAUTIONS:

   Make sure that the fiber optic cables are not bent to a radius of less than 25 mm.

   Make sure that the optical connectors are clean and free of foreign material.

   Remove the DVD player.
   - Disconnect the 3 electrical connectors.

6. Remove the DVD player mounting bracket.
   - Remove the 8 screws.
   - Loosen the 2 nuts.



E113451

Installation

1. To install, reverse the removal procedure.

Published: 27-Jan-2012

Video System - Video Display

Removal and Installation

Removal

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

1.





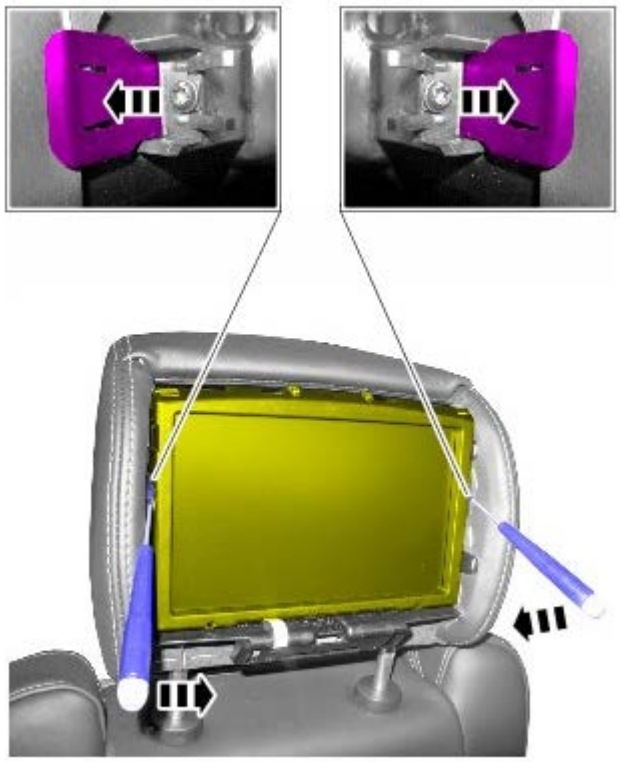
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2.



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3.



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4.



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Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Exterior Lighting -

Bulb	Type	Rating
* Halogen headlamps - Low beam	Halogen H7	55W
* Halogen headlamps - High beam	Halogen H7	55W
+* Xenon headlamps - Low/High beam	Xenon D2S	35W
Front fog lamps	Halogen H11	55W
Rear fog lamps	Bayonet P21	21W
Turn signal indicators - Front - NAS vehicles	Wedge S8W 3457 K	27/7W
Turn signal indicators - Front - ROW vehicles	Bayonet PY21W	21W
Turn signal indicators - Rear	Bayonet P21	21W
Turn signal indicators - Side Repeaters	Capless W5W	5W
Side lamps - Front	Capless W5W	5W
** Stop/Tail lamps	Bayonet - Twin filament P21/5	21W/5W
High mounted stop lamp (HMSL)	LED's	-
License plate lamps	Capless W5W	5W
Reverse lamps	Bayonet P21	21W
Cornering lamp/Static bending lamp	Halogen H8	35W
NAS - Side marker lamps - front/rear	Capless W3W	3W

 WARNING: + Refer to the General Information - Electrical Precautions section of this manual prior to carrying out any procedures on the Xenon headlamp system fitted to certain vehicles.

NOTES:

 * NAS vehicles - Cornering lamps are not fitted to these vehicles.

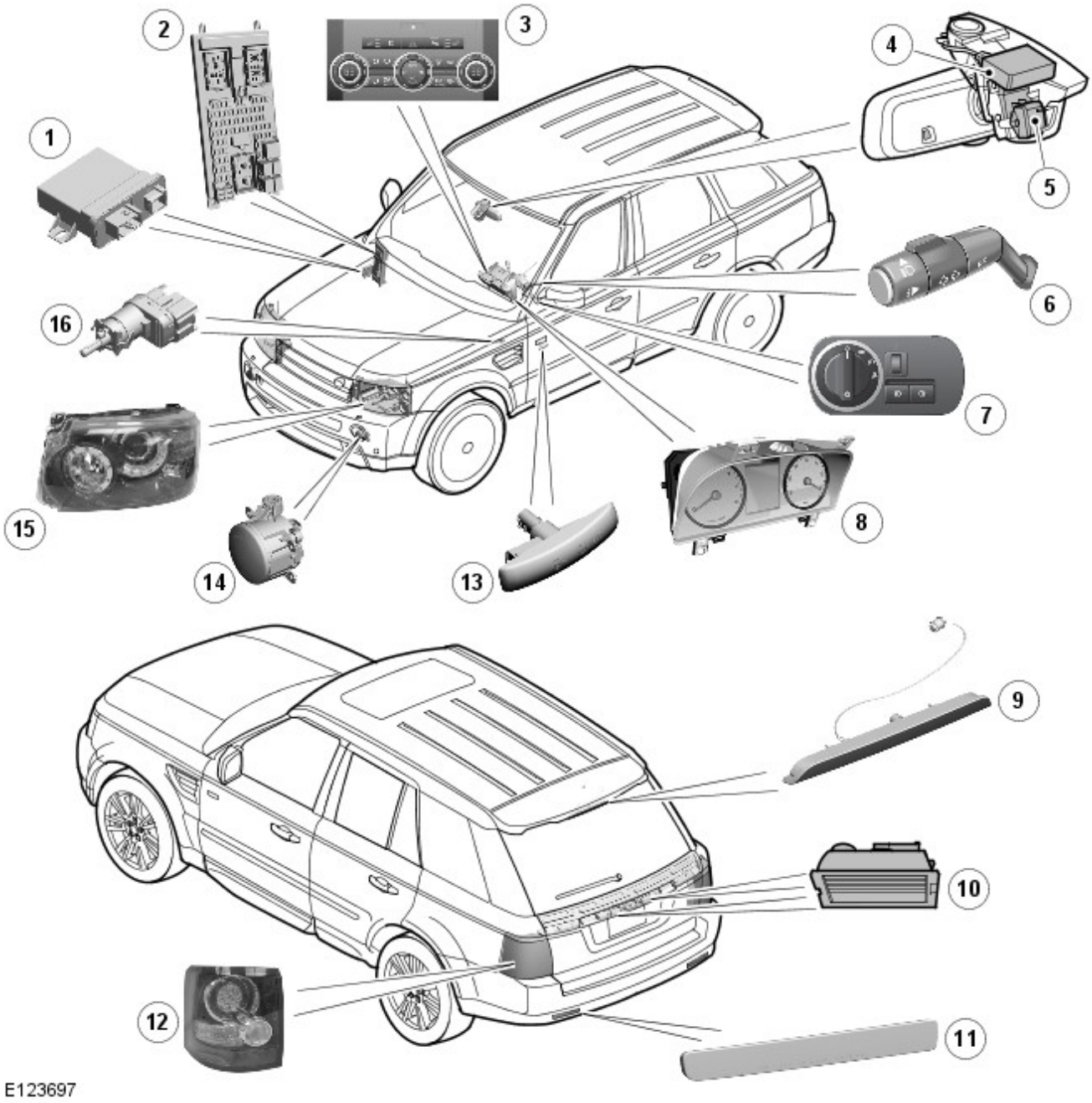
 ** Note: 21W filament is not functional on lower tail lamp.

Published: 11-May-2011

Exterior Lighting - Exterior Lighting

Description and Operation

Exterior Lighting Component Location



Item	Part Number	Description
1	-	Adaptive Front lighting System (AFS) control module
2	-	Central Junction Box (CJB)
3	-	Hazard flasher switch
4	-	Rain/light sensor
5	-	High beam assist control module and image sensor
6	-	LH steering column multifunction switch
7	-	Lighting control switch
8	-	Instrument cluster
9	-	High mounted stop lamp
10	-	License plate lamps
11	-	Reflector
12	-	Rear lamp assembly
13	-	Turn signal indicator repeater lamp
14	-	Front fog lamp
15	-	Headlamp assembly

16 - Stop lamp switch

GENERAL

The exterior lighting system comprises the following exterior lamps:

- Front and rear side lamps
- License plate lamps
- Side marker lamps (if fitted)
- Front and rear turn signal indicator lamps
- Turn signal indicator repeater lamps
- Stop lamps and high mounted stop lamp
- Reversing lamps
- Rear fog lamps
- Front fog lamps (if fitted)
- Cornering/Static bending lamps (if fitted) - All except NAS
- Low and high beam headlamps
- Adaptive Front lighting System (AFS) (if fitted).

The exterior lighting system also has the option of an auto headlamp feature and a high beam assist feature.

Exterior Bulb Type/Rating

The following table shows the bulbs used for the exterior lighting system and their type and specification.

Bulb	Type	Rating
Xenon headlamps - Low/High Beam	Xenon D3S	35W
Headlamps - High Beam	Halogen H7	55W
Front fog lamps	Halogen H11	55W
Rear fog lamps	Bayonet P21	21W
Turn signal indicator lamps - Front	PY24W SV+	24W
Side repeater turn signal indicator lamps	Capless W5W	5W
Turn signal indicator lamps - Rear	12 LED's	-
Side lamps - Front	10 LED's	-
Stop lamps	12 LED's	-
Side lamps - Rear	12 LED's (each side lamp)	-
High mounted stop lamp	LED's	-
License plate lamps	Capless W5W	5W
Reverse lamps	Bayonet P21	21W
Cornering lamp/Static bending lamp	Halogen H8	35W
NAS - Side marker lamp - Front	Capless W3W	3W
NAS - Side marker lamp - Rear	Capless W5W Rear	5W

The bulbs and the Light Emitting Diode (LED)'s are driven by Metal Oxide Semiconductor Field Effect Transistors (MOSFET's) within the Central Electronics Module (CEM) which is an integral component of the Central Junction Box (CJB). An exception to this is the front and rear position lamps, front fog lamps and the reversing lamps which are supplied with power via relays within the CJB and are protected by conventional fuses.

CENTRAL JUNCTION BOX

The CJB is located behind the glove compartment and is connected to the vehicle wiring harness with 8 multiplugs.

The CJB receives four permanent battery power supplies via the Engine Junction Box (EJB).

The lighting circuits are not all protected by conventional fuses as some are protected by MOSFET's. The control circuitry within the CJB for each individual circuit can detect and isolate a problem circuit.

Failure of a lamp is not notified to the driver. If a turn signal indicator fails the turn signal warning indicator in the instrument cluster will flash at double speed.

Input Signals for Lamp Control

The CJB receives inputs from the following switches:

- Lighting control switch for side lamps, headlamps and auto headlamps (if fitted)
- Momentary push switches for front and rear fog lamps
- Left hand steering column multifunction switch for turn signal indicators and high beam/headlamp flash and high beam assist system
- Brake pedal switch
- Momentary push switch for hazard warning.

The switches are supplied with a 10mA supply from the CJB and switch to ground when operated. The CJB detects that a switch has been operated (ON) when its closing resistance is less than 100 Ohm and is detected as OFF when its resistance is more than 10K Ohm.

The lighting control switch uses a binary system which is detected by the CJB which determines the selected position. The output from the lighting control switch is shown in the following table:

Switch State	Switch 1	Switch 2
Off	1	1

Side lamps	1	0
Headlamps	0	0
Auto headlamps	0	1

The CJB also receives ignition status via hard wired connections from the stop/start switch.

A reverse gear engaged signal is also received on the high speed Controller Area Network (CAN) bus from the Transmission Control Module (TCM) to enable the CJB to activate the reverse lamps.

The CJB can receive a hazard warning indicator activation message from the Restraints Control Module (RCM), via the high speed CAN bus, in the event of a crash. The CJB can also activate the hazard warning indicators to signify vehicle locking to the driver.

On vehicles with high beam assist, the high beam assist control module outputs signals on the medium speed CAN bus to the CJB to control the high beam headlamps. Power for the high beam assist control module is supplied via a relay located in the EJB.

Circuit Protection

Operation of the lamps is performed using overload proof Metal Oxide Semiconductor Field Effect Transistors (MOSFETs). The MOSFETs can detect overload, load interruption with the lamps switched on and short circuit to positive with the lamps switched off.

The MOSFETs are protected against short circuits, removing the requirement for the lamps circuits to be protected by fuses. The MOSFETs respond to heat generated by increased current flow caused by a short circuit. Normally this would cause the fuse to blow. The MOSFETs react to the heat increase and cut the supply to the affected circuit. Once the fault has been rectified or the MOSFET has cooled, the MOSFET will automatically reset and operate the circuit normally.

If an overload occurs, the current flow is dependant on the temperature of the related MOSFET and can be up to 20 times the rated current of the lamp. The MOSFET heats up and deactivates the load applied to the circuit. When the MOSFET cools the circuit is once again reactivated. This thermal cycling occurs continuously in the event of an overload occurring.

A number of lamps are controlled by relays and these circuits are protected by conventional fuses.

Bulb Monitoring

Bulb failure monitoring is performed by the CJB processor. The lamps are cold and warm monitored by the MOSFETs in order to detect bulb failure.

 NOTE: Relay controlled lamps have no diagnostic monitoring.

The CJB processor provides outputs to each MOSFET. The output switches the MOSFET to supply the required output to power the applicable lighting circuit. The microprocessor evaluates the circuits by detecting the returned signals from the controlling MOSFET.

When the bulb or LED is functioning normally, the output signal voltage from the controlling MOSFET is 0V. If a bulb or LED in the circuit fails, an open circuit occurs and the MOSFET outputs a signal of 5V to the processor. The signal is interpreted as a bulb or LED failure and generates a Diagnostic Trouble Code (DTC) which can be retrieved using an approved Land Rover diagnostic system.

Warm monitoring is performed continuously when the lights are switched on by evaluating the diagnostic output of the MOSFET switches. Cold monitoring is performed at 32 second intervals when the lights are switched off. The MOSFETs briefly switch on the lights for approximately 1 millisecond (this is insufficient to illuminate the bulb or LED) and checks the bulb or LED as per warm monitoring.

When a xenon bulb fails, the control module's current consumption falls to 60mA, which the CJB detects as unsuccessful bulb illumination.

Alarm Indications

The CJB can also display alarm visual indications for alarm arm, disarm and triggered conditions.

If the hazard warning lamps are active when a lock or unlock request is made, the hazard warning cycle is interrupted to allow the visual indication of the requested lock cycle. When visual indication is completed, the hazard warning operation will continue.

If the vehicle is involved in crash of a severity for the RCM to initiate deployment of the airbags, the control module outputs a hazard warning lamps on request on the medium speed CAN bus to the CJB. The hazard warning lamps will be activated and will continue until the RCM outputs a message to deactivate the hazard warning lamps.

Redundant Data Storage

The CJB stores data relating to the Vehicle Identification Number (VIN), total mileage and service interval indicator. This data is received by the CJB from the instrument cluster and used as a back-up in the event of instrument cluster replacement.

If the CJB is to be replaced, an approved Land Rover diagnostic system must be connected to the vehicle and the CJB replacement procedure followed to ensure that the stored data is transferred to the new unit.

Low Voltage Operation

If the battery voltage falls below 11.2V, the CJB operates the minimum lighting to preserve the remaining battery

charge.

Crash Signal Activation

In the event of an accident of a severity to activate and deploy the airbags, the RCM requests various electrical operations to assist with the crash situation. The RCM requests via the bus systems to the CJB to activate the hazard warning lamps.

Security System Activation

In the event of the security system being triggered, the CJB requests activation of the hazard warning lamps.

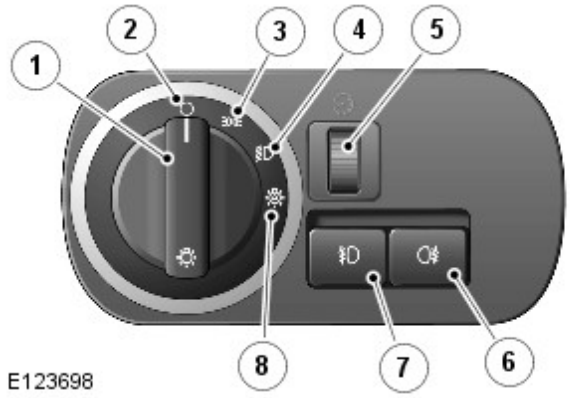
Instrument Panel and Switch Illumination Dimming

The CJB controls the instrument cluster backlighting illumination and also illumination of all instrument panel switches.

The CJB supplies a power output to all switch illumination bulbs with a 12V Pulse Width Modulation (PWM) supply determined by the position of the manual dimmer rheostat. The switch illumination is activated when the lighting control switch is in the side lamp or headlamp position.

LIGHTING CONTROL SWITCH

The lighting control switch is located in the driver's side of the instrument panel, below the outer fresh air vent. The switch contains a rotary switch for selecting the vehicle exterior lighting functions, a rheostat for instrument illumination dimmer, a front fog lamp switch and a rear fog lamp switch.



Item	Part Number	Description
1	-	Lighting rotary control switch
2	-	OFF position
3	-	Side lamps position
4	-	Headlamps position
5	-	Instrument illumination dimmer control
6	-	Rear fog lamp switch
7	-	Front fog lamp switch
8	-	Auto headlamps position

The rotary side and headlamp control switch has 2 connections to the CJB. These 2 connections supply a hardwired binary code to the CJB which correspond to the switch position selection made.

The front and rear fog lamp switches operate by completing earth paths for a reference voltage from the CJB when the switch is pressed. The fog lamp switches are momentary, non-latching switches which briefly complete an earth path which is sensed by the CJB.

Lighting Control Switch Illumination

The switch legends on the lighting control switch are illuminated at the same brightness as the instrument panel switches when the lighting control switch is moved from the 'O' (off) position to the side, headlamp or AUTO position.

Dimmer Control

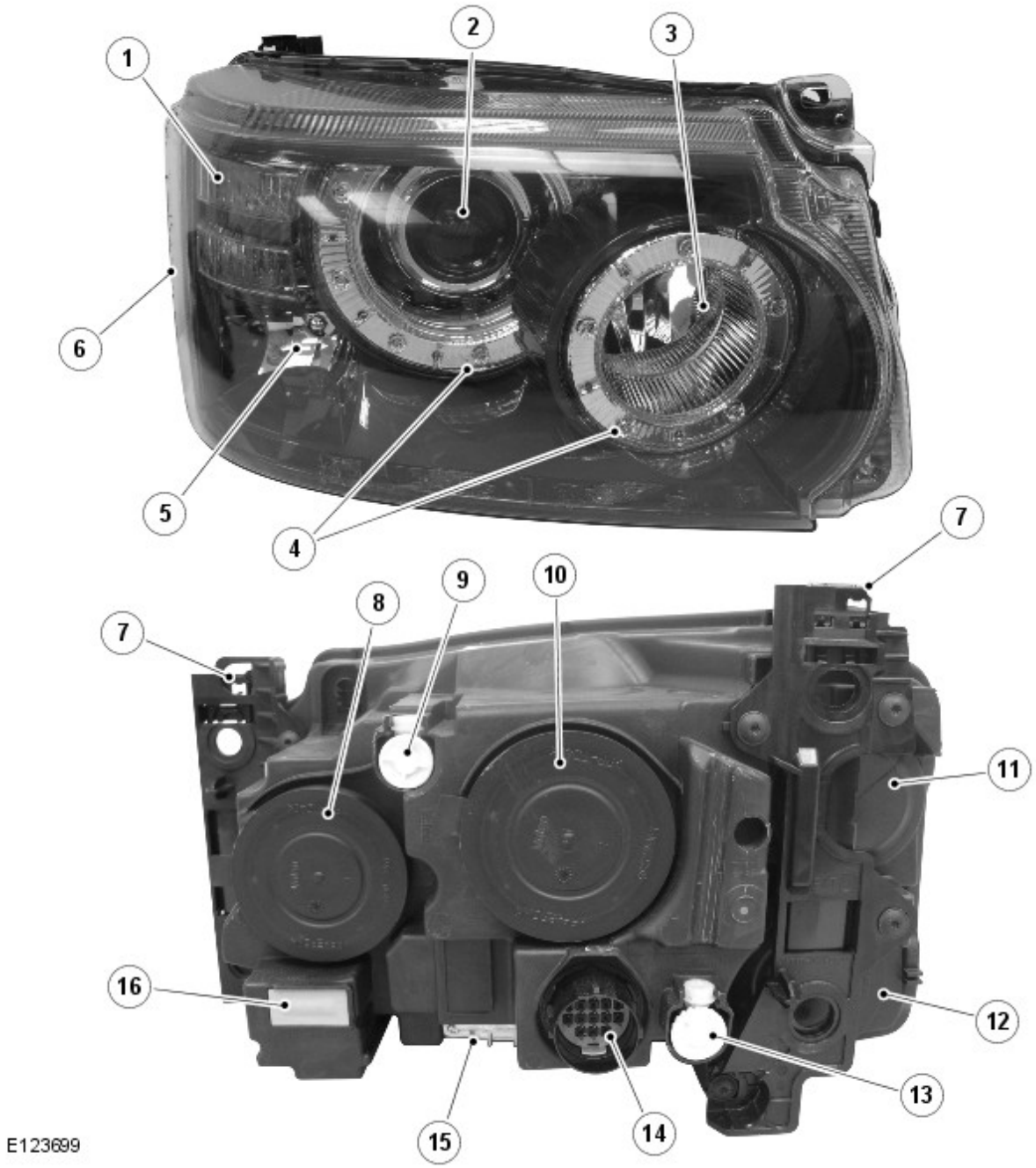
The CJB provides a Pulse Width Modulation (PWM) output to control the illumination brightness of the instrument panel and other fascia illumination. The dimmer switch operates using a rotary thumbwheel which is connected to a rheostat.

The rheostat is a variable resistor which provides a high or low resistance according to its set position. The CJB provides an output to the rheostat measure the voltage passing through to ground. The CJB measures this voltage and uses it to calculate a PWM output to determine the brightness of the illumination.

Automatic Headlamps

Refer to Automatic Headlamps in this section.

HEADLAMP ASSEMBLY



Item	Part Number	Description
1	-	Turn signal indicator lamp
2	-	Xenon projector module
3	-	High beam halogen 'fill-in' headlamp
4	-	Side lamp LED's
5	-	Cornering lamp (Xenon headlamps) or cornering/static bending lamp (AFS headlamps)
6	-	Side marker lamp (NAS only)
7	-	Locking plate
8	-	High beam 'fill-in' lamp bulb
9	-	Vertical adjuster
10	-	Xenon bulb (xenon headlamps)
11	-	Turn signal indicator lamp access cover (hidden)
12	-	Cornering/static bending lamp cover (hidden)
13	-	Horizontal adjuster
14	-	Electrical connector
15	-	Xenon control module
16	-	Waterproof breather

Two types of headlamp are available; Xenon or Xenon with Adaptive Front lighting System (AFS). The headlamps share a common, clear lens.

The headlamps are located behind the front carrier assembly. Each headlamp is secured to the front carrier assembly

with two locking plates. The locking plate slides in grooves in the rear of the headlamp and two holes in each plate locate on pins on the carrier. Each locking plate is pressed down to lock the pins in the locking plate holes. The locking plates allow removal of the headlamp from the carrier for bulb changing without the requirement for special tools.

The rear of the headlamp unit has removable access panels which allow access to the bulbs for replacement. A large rubber cover allows access to the low/high beam bulb on both halogen and xenon headlamps. Another removable rubber cover provides access to the high beam only halogen bulb which is retained by a push fit. A smaller cover can also be rotated anti-clockwise to provide access to the turn signal indicator lamp bulb. The indicator bulb is a PY24WY SV+ orange bulb and is clipped into the cover and is pulled to remove. Below this cover is a removable cover which provides access to the side lamp bulb on halogen headlamps or the cornering lamp/static bending lamp bulb on xenon headlamps and the side marker lamp bulb on NAS models. On xenon headlamps the side lamps are LED's and therefore are not serviceable components.

The headlamps have two adjustment screws on the rear which allow for the manual setting of the vertical and horizontal alignment. On NAS vehicles the headlamp is regarded as Visual Optically Left (VOL) aiming. Refer to the Service Repair Procedures manual for headlamp alignment data.

Each headlamp has an integral sixteen pin connector which provides inputs and outputs for the various functions of the headlamp assembly. The usage of the pins differs between model variants, refer to the Electrical Reference Library (ERL) for pin details.

The low beam headlamps are switched on when the ignition is in ignition mode 6 and:

- the lighting control switch is in the headlamp position
- the lighting control switch is in the AUTO position and a 'lights on' signal is received by the CJB from the rain/light sensor.

The low beam headlamps can also be operated by the headlamp delay feature.

The high beam headlamps are switched on when the ignition is in ignition mode 6 and:

- the low beam headlamps are selected on in the headlamp position or activated via the AUTO feature
- The left hand steering column multifunction switch is pushed forward away from the driver
- The high beam assist system (if fitted) has switched on the high beam headlamps.

The high beam headlamps will be switched off when:

- The left hand steering column multifunction switch is moved rearward towards the driver
- The low beam headlamps are switched off
- The ignition mode is changed to the accessory mode 4 or ignition off
- The high beam assist system (if fitted) has switched off the high beam headlamps.

Common Headlamp Features

Turn Signal Indicator Lamp

The turn signal indicator lamp is incorporated into the outer part of the headlamp assembly. The lamp is located above the static bending/cornering lamp. The turn signal indicator lamp uses a PY24W SV+ orange colored bulb. The bulb is connected via contacts on the headlamp housing to the main connector in the headlamp housing. The holder is fitted with a seal and is located into an aperture in the headlamp housing and rotated to lock into position. Access to the bulb requires removal of the headlamp from the front carrier assembly and removal of the outer locking plate from the headlamp and partial removal of the rubber bulb cover.

The turn signal indicator lamps are operated by the left hand steering column multifunction switch or by the hazard flasher switch. The steering column multifunction switch is only active with the ignition in ignition mode 6 (ignition on), the hazard flasher switch is active at all times. When active, the turn signal indicator lamps will flash at a frequency cycle of 400ms on and 400ms off.

If a bulb fails, the remaining turn signal indicator lamps bulbs continue to flash at normal speed. The turn signal indicators in the instrument cluster will flash at double speed to indicate the failure to the driver.

Side Lamp

The side lamps are LED's. The 10 LED's are arranged around the outer part of the halogen fill-in lamp and the xenon projector module.

The side lamps are operated by selecting side lamps or headlamps on the lighting control switch. The side lamps are operational at all times and are not dependant on the ignition switch position. The side lamps will also be illuminated when the lighting control switch is in the AUTO position and a 'lights on' signal is received by the CJB from the rain/light sensor.

Cornering Lamp - Xenon (non-AFS headlamps only)

The cornering lamps are an optional feature designed to illuminate the direction of travel when cornering at low speeds. The design of the lens projects a spread of light from the vehicle at approximately 45 degrees to the vehicle axis.

The cornering lamp is incorporated into the outer part of the headlamp assembly and shares the same housing and reflector as the side lamp.

The cornering lamp uses a 35W Halogen H8 bulb which locates in a holder which is connected on the headlamp housing. The holder is located in an aperture in the headlamp housing and rotated to lock. The bulb is accessible via a removable cover at the rear of the headlamp housing.

The cornering lamps are controlled by the left hand steering column multifunction switch with the lighting control

switch in the headlamp position and the ignition in ignition power mode 6. The cornering lamps are supplied power via the ignition circuit to ensure that they do not function with the headlamp delay feature. The cornering lamps are deactivated if the vehicle speed exceeds 25 mph (40 km/h).

Only one cornering lamp will illuminate at any one time. If the left hand turn signal indicators are selected on, the left hand cornering lamp will be illuminated and visa versa, providing the vehicle speed and lighting control switch positions are correct. Cornering lamps are disabled when reverse gear is selected.

Cornering/Static Bending Lamps (Xenon AFS headlamps only)

NOTE: The static bending lamp function is not allowed in NAS market vehicles

The cornering/static bending lamps are a standard feature on AFS headlamps designed to illuminate the direction of travel when cornering at low speeds. The design of the lens projects a spread of light from the vehicle at approximately 45 degrees to the vehicle axis. The static bending lamps are powered by the CJB and controlled by the AFS control module. The cornering lamp functionality is controlled by the CJB as described for non-AFS headlamps.

The cornering lamp and static bending lamp is incorporated into the outer part of the headlamp assembly.

The cornering/static bending lamp uses a 35W Halogen H8 bulb which locates in a holder which is connected via wires to the main connector on the headlamp housing. The holder is located in an aperture in the headlamp housing and rotated to lock. The bulb is accessible via a removable cover at the rear of the headlamp housing.

AFS Control

On headlamps with AFS, the cornering lamp function is as described previously for the Xenon non-AFS headlamps.

The static bending lamps operate with a steering angle sensor signal which is received by the AFS control module. The AFS control module sends a static bending lamp on request to the CJB which activates the static bending lamp bulb.

The static bending lamp operation is variable with the speed of the vehicle and the steering wheel angle. The static bending lamps illuminate at 0 mph (0 km/h) when the steering wheel rotation reaches 20 degrees. At 43 mph (70 km/h) the static bending lamps will illuminate when the steering wheel angle reaches 10 degrees. The static bending lamps will be switched off when the vehicle speed exceeds 43 mph (70 km/h).

The operation of the static bending lamps is controlled by the AFS control module. When the operation parameters of the lamp are reached, the CJB switches the static bending lamp bulb on instantly. When the lamp is switched off, the CJB fades the bulb off by decreasing the PWM duty cycle from 100% to 0% over a period of 1 second.

Xenon Headlamps

Safety Precautions

WARNING: The Xenon system generates up to 28000 volts and contact with this voltage could lead to fatality. Make sure that the headlamps are switched off before working on the system.

The following safety precautions must be followed when working on the xenon headlamp system:

- **DO NOT** attempt any procedures on the xenon headlamps when the lights are switched on.
- Handling of the D3S Xenon bulb must be performed using suitable protective equipment, e.g. gloves and goggles. The glass part of the bulb must not be touched.
- Only operate the lamp in a mounted condition in the reflector.

The xenon headlamps use a complex surface reflector for the Halogen fill in high beam lamp only lighting unit, which is of the same design as the high beam unit used on the Halogen headlamps. This type of reflector has the reflector divided into separate parabolic segments, with each segment having a different focal length.

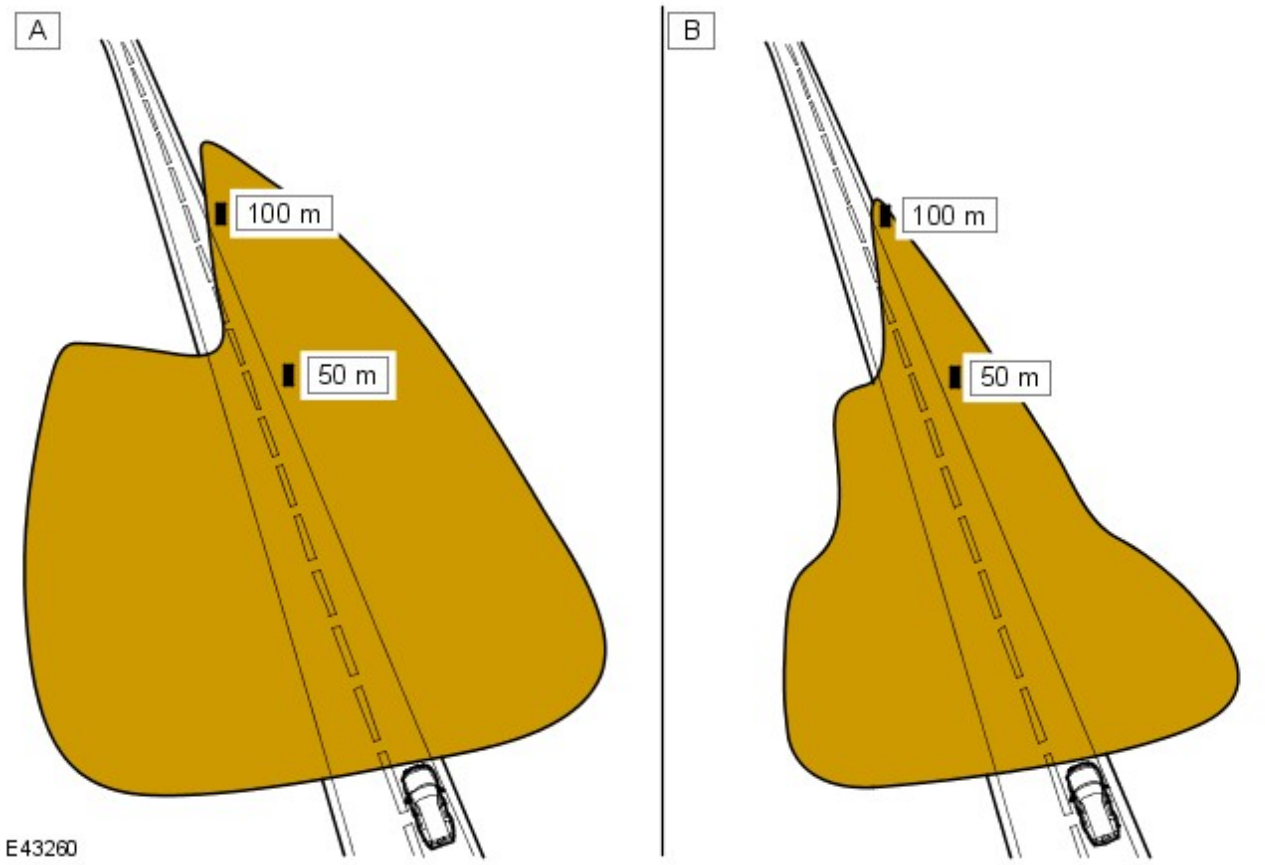
The high beam bulbs are quartz halogen H7, with a rating of 55W. The bulbs are retained in the headlamp unit with conventional wire retaining clips.

The Bi-Xenon™ (the Bi-Xenon™ trademark is the property of Hella KGaA Hueck & Co., Germany) projector module headlamp operates as both low beam and high beam headlamp unit. The Xenon lamp (or High Intensity Discharge (HID) lamp), comprises an ellipsoidal lens with a solenoid controlled shutter to change the beam output from low to high beam. The bulb is retained with a locking ring which must be rotated to facilitate removal of the D3S bulb.

NOTE: If the lighting control switch is in the OFF position, the xenon lamps do not operate when the high beam 'flash' function is operated. If the lighting switch is in the headlamps position or AUTO position with the low beam lamps active, the xenon low beam will remain on when the high beam 'flash' function is operated.

The xenon headlamp system is controlled by the CJB using a control module for each headlamp and an igniter. The control modules and the igniters provide the regulated power supply required to illuminate the xenon bulbs through their start-up phases of operation.

Xenon/Halogen Headlamp Beam Comparison

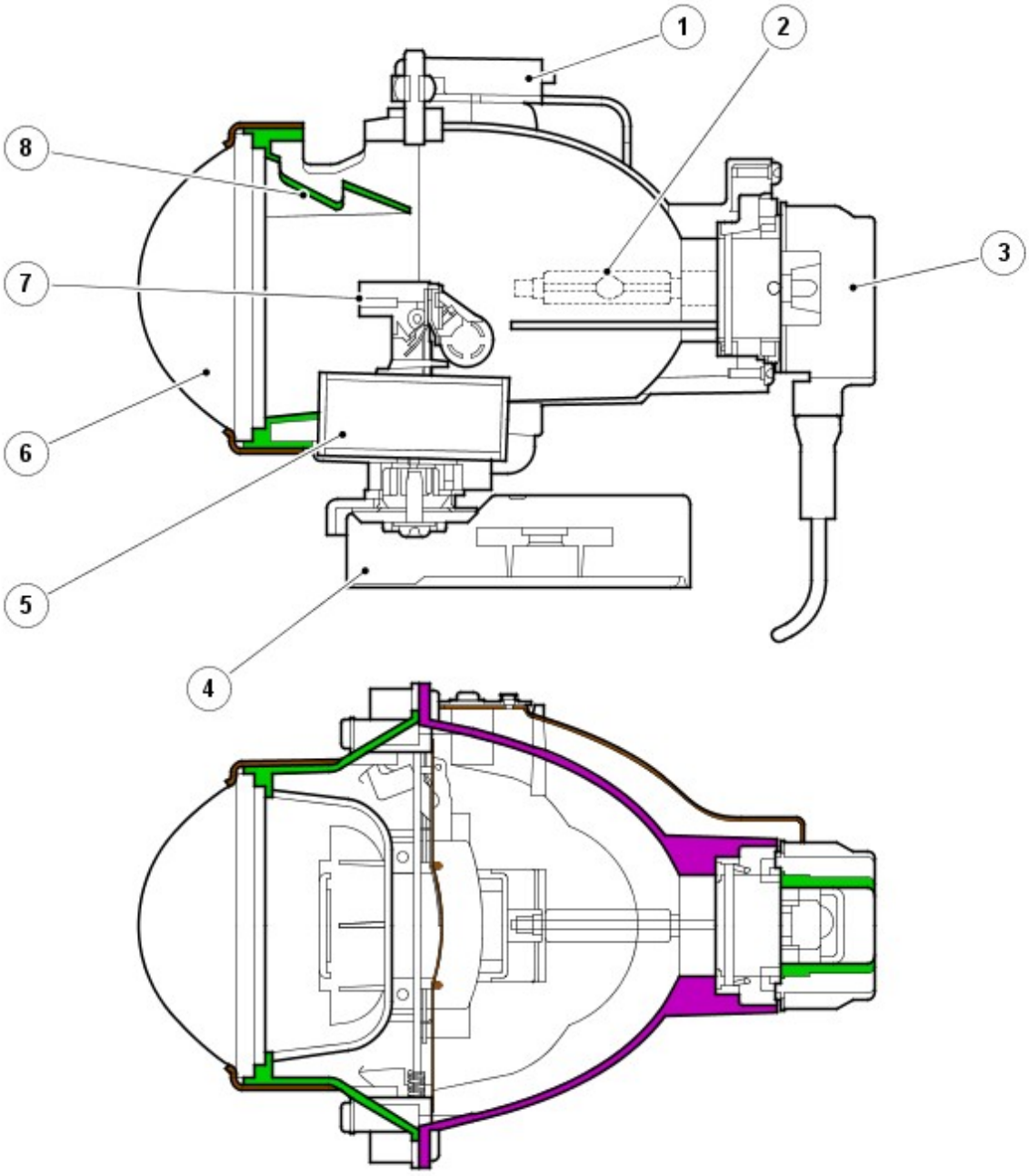


Item	Part Number	Description
A	-	Xenon
B	-	Halogen

The Xenon low/high beam headlamps use ellipsoidal technology for the lens and reflector providing improved night time visibility compared to conventional halogen headlamps. The Xenon headlamps provide the following benefits when compared to halogen headlamps:

- Longer bulb life - Approximately 3 to 5 times longer than a halogen bulb
- Increased light output - Xenon headlamps output 3 to 4 times more light on the road surface than halogen headlamps
- Blue/White light which is closer to natural daylight - Xenon lamps produce a blue/white light compared to a yellow light produced by a halogen bulb
- Improved night time driving visibility - Xenon lamps produce a wider and brighter beam in front of the vehicle than conventional halogen bulbs
- Lower running temperatures
- Lower power consumption
- Mercury free.

Xenon Headlamp Construction



E43261

Item	Part Number	Description
1	-	Bracket
2	-	D3S xenon bulb
3	-	D3S connector
4	-	Swivel actuator (AFS lamp only)
5	-	Solenoid
6	-	Aspheric lens
7	-	Shade
8	-	Shade
9	-	Lens support

The Xenon headlamp is a self contained unit located within the headlamp assembly. The unit comprises a reflector, an adaptor ring, the lens, a shutter controller and the Xenon 35W D3S bulb, which as an assembly is known as the projector module.

The reflector is curved and provides the mounting for the xenon bulb. The bulb locates in a keyway to ensure correct alignment in the reflector and is secured by rotating a locking ring on the projector module to lock. The bulb has a pin connector which is a push to lock fitting.

The shutter controller is a solenoid which operates the shutter via a lever mechanism. The shutter is used to change the beam projection from low beam to high beam and visa versa.

A tourist lever mechanism is located on the right hand side of the projector module. This mechanism moves to blank off a portion of the beam spread to enable the vehicle to be driven in opposite drive hand markets without applying blanking decals to the headlamp lens. The beam is changed by removing the access cover at the rear of the lamp assembly and moving a small lever located near the bulb holder, at the side of the projector module. Make sure that the headlamps are off before removing the access cover.

The Xenon bulbs illuminate when an arc of electrical current is established between two electrodes within the bulb. The xenon gas sealed in the bulb reacts to the electrical excitation and the heat generated by the current flow. The xenon gas reaction to the controlled current flow between the electrodes produces the blue/white light.

To operate at full efficiency, the xenon bulb goes through three stages of operation before full output for continuous operation is achieved. The three phases are; start-up phase, warm-up phase and continuous phase.

In the start-up phase, the bulb requires an initial high voltage starting pulse of 18000 to 28000 volts to establish the arc. This is produced by the igniters. The warm-up phase begins once the arc is established. The Xenon control modules regulate the supply to the bulbs to 2.6A which gives a lamp output of 75W. During this phase, the Xenon gas begins to illuminate brightly and the environment within the bulb stabilizes ensuring a continual current flow between the electrodes. When the warm-up phase is complete, the xenon control modules change to continuous phase. The supply voltage to the bulb is reduced and the operating power required for continual operation is reduced to 35W.

The Xenon system is controlled by the CJB, the two xenon control modules and the two igniters. The xenon control modules (one per headlamp) receive an operating voltage from the CJB when the headlamps are switched on. The modules regulate the power supply required through the phases of start-up.

The igniters (one per headlamp) generate the initial high voltage required to establish the arc. The igniters have integral coils which generate high voltage pulses required for start-up. Once the xenon bulbs are operating, the igniters provide a closed circuit for regulated power supply from the control modules.

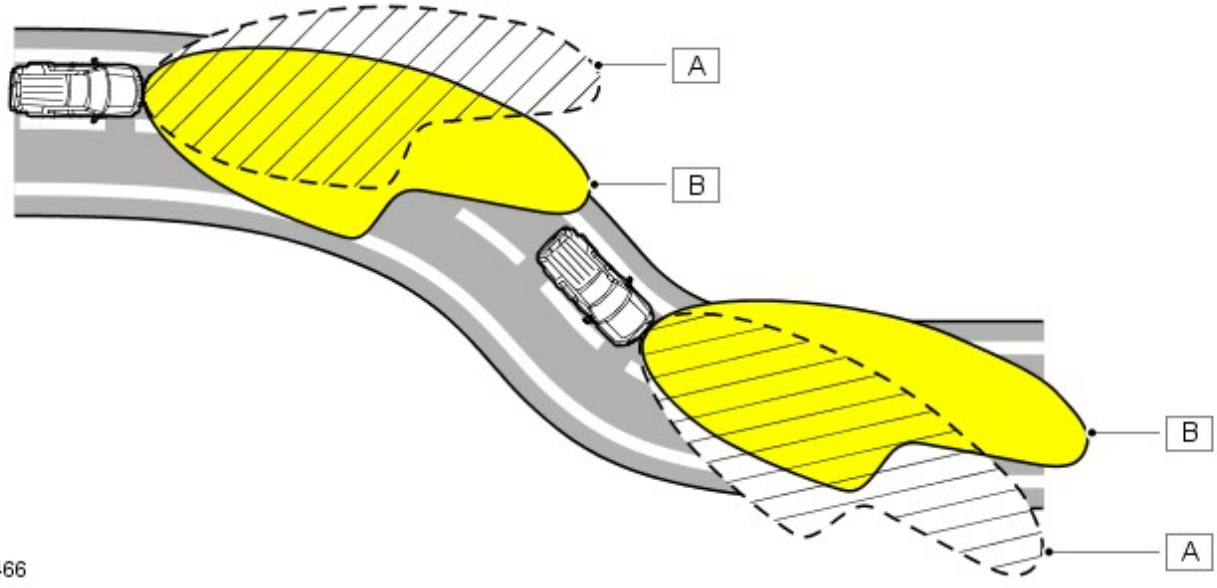
ADAPTIVE FRONT LIGHTING SYSTEM (AFS)

The AFS is a system to improve driver visibility under differing driving conditions. AFS provides a larger visible area which is illuminated when cornering by adjusting the position of the beam distribution on the road. Horizontal adjustment is made automatically to the most suitable orientation for the driving conditions using steering angle and information from other vehicle sensors.

AFS is only available with adaptive Bi-Xenon™ headlamps. The 'Xenon' module within the headlamp is controlled by actuator motors which rotate the projector module on its horizontal axis to adjust the beam output to suit the cornering conditions and vehicle inclination. Only the adaptive bi-xenon™ lamp projector module swivels, the non adaptive xenon and halogen high beam lamp units remains static.

The AFS system is controlled by an AFS control module which is located at the bottom of the passenger side 'A' pillar. The control module controls the horizontal alignment of the adaptive Bi-Xenon™ projector module. The operation of the static bending lamp is controlled by the AFS control module, but powered by the CJB.

AFS Concept



Item	Part Number	Description
A	-	Conventional headlamp beam distribution
B	-	AFS swivel headlamp beam distribution

AFS Control Module

The AFS control module is connected to the high speed CAN bus and receives inputs from other vehicle systems on the status of the following parameters:

- Steering angle - from steering angle sensor
- Vehicle speed - from ABS module
- Low beam status - from CJB
- Suspension height - from air suspension control module
- Odometer value - for diagnostics only
- Engine running - from ECM
- Gear position - From transmission control module or transfer box control module
- Engine crank - from ECM

- Exterior/interior temperature - for diagnostics only.

The AFS will only operate when the AFS control module receives an engine running signal on the CAN bus. When the engine running signal is received, the AFS control module performs an initialization routine which is only performed at engine crank (power mode 9).

The AFS will also function when the lighting control switch is in the AUTO position and the AFS control module receives a lights on signal from the rain/light sensor and an engine running signal.

The AFS control module then monitors the inputs from the other vehicle systems to control the AFS functionality according to cornering angles and vehicle speed.

The AFS control module is connected to each headlamp on a private Local Interconnect Network (LIN) bus. The AFS control module then drives the DC motor actuators inside the headlamp assembly.

The AFS control module controls the swiveling angle of each projector module using speed and steering angle signals. The angles of each projector module differ to give the correct spread of light, For example, when turning left, the Left Hand (LH) projector module will have a greater swiveling angle than the Right Hand (RH) projector module

Reverse mode disables the swivel function when reverse gear is selected. The AFS projector modules move to their central straight ahead position and the static bending lamp, if active, will go off. When reverse gear is deselected, the AFS projector modules will move to a position to match the steering angle and the static bending lamp will illuminate if the operating conditions are correct (for example vehicle speed above 1.86 mph (3 km/h).

Xenon Headlamp Assembly with AFS Construction

The AFS xenon headlamp construction is similar to the non-AFS xenon headlamp assembly. The AFS assembly contains an additional carrier frame which provides the location for the AFS components. The remaining lamps are as described previously for the Xenon headlamp assembly. The functionality of the static bending lamp on the AFS headlamp is different from the functionality of the cornering lamp on the xenon headlamp.

The carrier frame has a radial bearing at the top and a thrust washer at the bottom which provide the horizontal pivot points for the xenon projector module. The lamp module lower pivot has a splined end which locates in the mating splines of the AFS horizontal actuator motor. The carrier frame is suspended on two flexible mountings at the top which provide for the vertical pivot points for the xenon projector module which allow for the vertical adjustment of the projector module. The bottom of the carrier frame is attached to the AFS vertical actuator motor.

The AFS actuator motors are dc motors which are driven by a power output from the CJB in response to signals from the AFS control module.

The actuators contain a potentiometer which is connected via wires with gold plated connector pins to the AFS control module. The two wires to each actuator provide a feedback signal to the AFS control module to give the precise position of the xenon projector module.

The AFS control module receives vehicle speed signals from the ABS module to adjust the projector module vertically to increase the beam range as the vehicle speed increases.

Initialization

When the AFS control module receives an engine running signal, the control module performs the initialisation procedure which ensures that the headlamps are correctly aligned on their horizontal axis.

The AFS swivel initialization is completed in less than 1 second. The LH and RH AFS motors flick the headlamps to calibrate the centre position of the headlamps.

Failure Mode

In the event of a failure of the AFS system, a warning indicator in the instrument cluster is illuminated to warn the driver. The AFS warning indicator illuminates when the ignition is in accessory power mode 4 or ignition power mode 6 and will flash continuously until the fault is rectified. The AFS warning indicator will also be illuminated if a failure of the steering angle sensor or the vehicle speed signal is detected.

Illumination of the AFS warning indicator does not necessarily mean that there is a fault with the AFS system. The fault may be caused by a failure of another system preventing the AFS system operating correctly.

The AFS control module performs a diagnostic routine every time AFS is requested. If any fault is found, the AFS control module will suspend the operation of the AFS function.

If the AFS system has failed with the xenon projector module in a position other than the correct straight ahead position, the AFS control module will attempt to drive the xenon projector module to the zero (straight ahead) position. If this is not possible, the AFS control module will lower the projector module using the leveling actuator motors to prevent excess glare to oncoming vehicles.

The AFS control module software can detect an internal failure of the control module control circuits. The control module will power the projector modules to the zero position and prevent further operation.

Faults can be investigated by interrogating the AFS control module using an approved Land Rover diagnostic system to check for fault codes.

AUTOMATIC HEADLAMP OPERATION

The automatic headlamp function is a driver assistance system. The driver can override the system operation by selection of side lamp or headlamp on if the ambient light conditions require front and rear lighting to be active. The automatic headlamp system uses a light sensor and the CJB, which are connected via the LIN bus to control the headlamp functionality.

A light sensor is incorporated in the rain/light sensor located on the inside of the windshield, below the rear view mirror. The wiper system also uses the rain/light sensor for automatic wiper operation.
For additional information, refer to: Wipers and Washers (501-16, Description and Operation).
The light sensor measures the ambient light around the vehicle in a vertical direction and also the angular light level from the front of the vehicle. The rain/light sensor uses vehicle speed signals, wiper switch position and the park position of the front wipers to control the system.

The automatic headlamp operation uses ambient light levels which are monitored by photodiode incorporated in the rain/light sensor. The rain/light sensor sends a lights on/off request to the CJB on the LIN bus, which responds by switching on the low beam headlamps, front side lamps and rear tail lamps.

The automatic headlamps are activated under the following conditions:

- Twilight
- Darkness
- Rain
- Snow
- Tunnels
- Underground or multistoried car parks.

Operation of the automatic headlamps requires the ignition to be on in power mode 6 (ignition on), the lighting control switch to be in the 'AUTO' position and a lights on request signal from the light sensor. If the rain sensor signal activates the wipers fast speed wipers, the low beam headlamps are activated, providing the lighting control switch is in the 'AUTO' position.

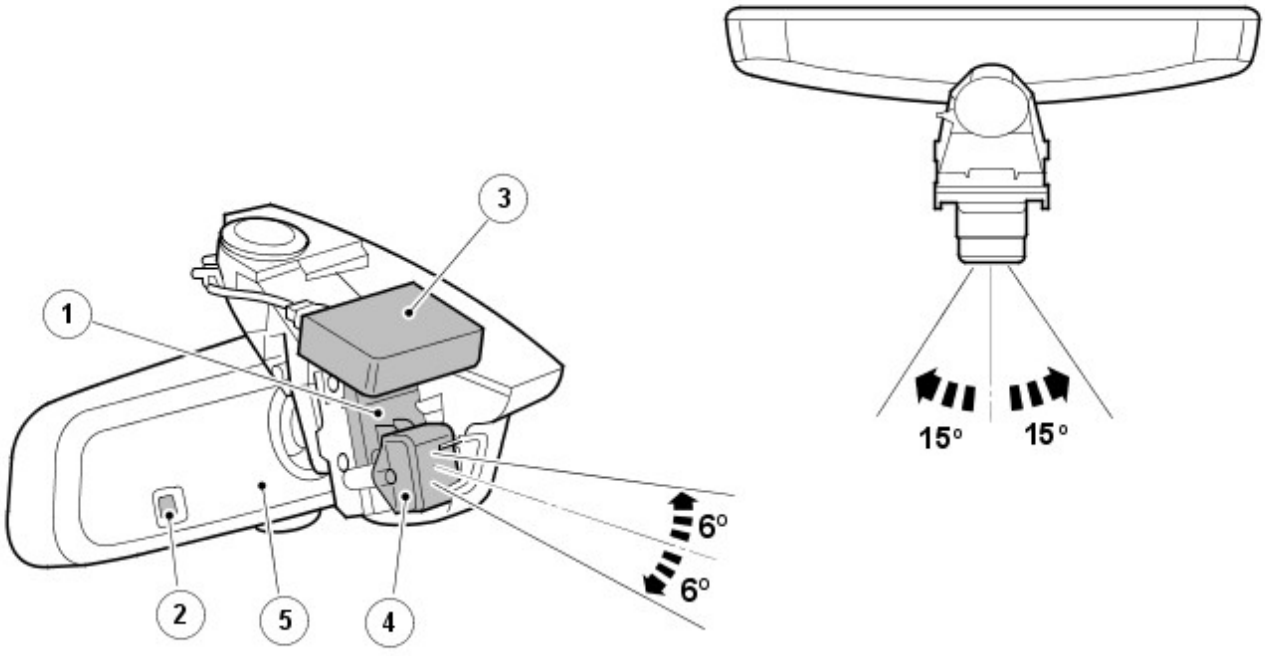
HEADLAMP LEVELING

Headlamp leveling provides for the adjustment of the vertical aim of the headlamps. The leveling system is primarily required to minimise glare to other road users when a heavy load is in the rear of the vehicle.

Vehicle headlamp leveling is performed by the air suspension system and the air suspension control module. The suspension system constantly monitors the vehicle attitude and adjusts the height of the front and/or rear of the vehicle accordingly. This maintains the correct vehicle attitude and consequently maintains the correct headlamp beam alignment.

The vehicle leveling system is fully automatic, therefore the lighting control switch does not have a manual leveling rotary control.

HIGH BEAM ASSIST



E117701

Item	Part Number	Description
1	-	Rear view mirror calibration bracket
2	-	Ambient light sensor (High beam assist)
3	-	Rain/light sensor (Auto headlamps)
4	-	Image sensor

5	-	High beam assist control module (inside mirror body)

High beam assist is a driving aid which automatically controls the high beam function. If required, the system can be overridden by the driver.

CAUTION: The high beam assist system is designed as a driving aid only. Should the road conditions require, it is the driver's responsibility to consider other road users and operate the high beam headlamps in a safe manner. In certain circumstances the driver will be required to intervene.

High Beam Assist Warning Indicator



E117699

Item	Part Number	Description
1	-	Warning indicator (green)

The high beam assist system is controlled by a high beam assist control module which is located in the interior rear view mirror body and by the CJB. The module and the CJB are connected via the medium speed CAN bus.

The high beam assist control module receives a power supply from the CJB when the ignition is in power mode 6 (ignition on). The rear view mirror also includes a low resolution camera (image) sensor which detects headlamps and tail lamps of preceding vehicles. The sensor is connected to the control module which evaluates the image data, checking for light intensity and location.

If conditions are correct, the control module will activate the high beam assist by sending a high or low beam request message to the CJB via the medium speed CAN bus. The CJB then controls the shutter in the Xenon projector module together with the high beam fill-in lamp.

High Beam Assist Operation

The high beam assist operates as part of the automatic headlight system. When driving at night with the lighting control switch in the automatic position and the LH steering column multifunction switch in the central position, with sufficient darkness (approximately 1 lux or less) and a suitable road speed, the high beam assist will automatically operate the high beam lighting when necessary. A warning symbol in the instrument cluster confirms to the driver when the high beam assist system is selected and enabled.

NOTES:

The function of the normal 'blue' high beam indicator remains unchanged and it always reflects the actual status of the high beam lamps

The exterior lighting 'on' threshold for the auto headlamps system is approximately 100 lux which is measured by the rain/light sensor. At light levels below this value the low beam headlamps and exterior lights will be switched on. The high beam assist will not function until the light level has reached approximately 1 lux. At light levels above 1 lux high beam is not required and therefore is not activated.

Activation (system ready)

High beam assist will only activate and illuminate the warning indicator to show system is ready or 'primed' for high beam control, when the following conditions are met:

- High beam assist has been first 'enabled' via the instrument cluster menu
- Lighting control switch is in the 'Auto' position
- LH steering column multifunction switch in the central position
- The ambient light level is below 100 lux – refer to 'Light Levels' section that follows
- The system has not been overridden or cancelled – refer to 'Override' section that follows
- The camera (image) sensor view is not blocked.

High Beam Control

When activated, high beam assist will switch the headlamps to high beam when all the following conditions occur:

- No relevant oncoming traffic
- No relevant preceding traffic
- In non-urban environment, i.e. with no street lighting
- Ambient light level is below 1 lux – refer to 'Light Levels' section that follows

Road speed is suitable – refer to 'Road Speed' section that follows.

Low Beam Control

When activated, high beam assist will switch the headlamps to low beam when any of the following conditions occur:

- Relevant Oncoming traffic is present
- Relevant Preceding traffic is present
- In urban environment, i.e. with street lighting
- Ambient light level is above 1 lux – refer to 'Light Levels' section that follows
- Road speed is not suitable – refer to 'Road Speed' section that follows
- Unrecognisable reflective inputs from road signs or markings – refer to 'System Limitations' section that follows.

Light Levels

The exterior lighting 'on' threshold for the normal 'auto headlamps' feature is approximately 100 lux and is measured by the windscreen mounted 'rain/light' sensor. When the light level falls to this value the low beam headlamps and exterior lights will be switched on together with the high beam assist warning indicator.

This warns the driver that the system is activated and ready to automatically switch on the high beam headlamps when the light level falls a little further to approximately 1 lux, as measured by the 'ambient light sensor' located in the mirror body. High beam is generally not required with light levels above 1 lux.

Road Speed

A road speed signal is received by the CJB from the Anti-lock Braking System (ABS) module via the high speed CAN bus. When the other activation conditions are correct, the CJB will switch the headlamps to high beam when the road speed has increased above 40 km/h (25 mph).

When the road speed falls to below 24 km/h (15mph), the CJB will switch the headlamps to low beam. The 10 mph (15 km/h) difference between the on and off road speed thresholds prevents the system continually switching between high and low beam at low speeds.

Override

The driver can manually override the high beam assist system at any time. When the high beam assist system is activated, pulling the LH steering column multifunction switch to the high beam 'flash' position or pushing it forward to the high beam position will de-activate the system and the high beam assist warning indicator in the instrument cluster will extinguish.

When the multifunction switch is returned to the central position, from a forward high beam position, the system is re-activated and the high beam assist warning indicator will illuminate again.

Correct Performance

In addition, high beam assist will only exhibit best performance if all of the following conditions are met:

- No false inputs are received by the camera (image) sensor, such as reflected light from certain static signs – refer to 'System Limitations' section that follows
- Headlamps are correctly aligned
- High beam assist system has been set for correct 'hand of traffic' via the driver menu settings – refer to 'Setting Hand of Traffic' section that follows
- Headlamps have been set for correct 'hand of traffic' via the mechanical tourist lever in headlamp casing – refer to 'Setting Hand of Traffic' section that follows
- Camera (image) sensor has been through a self learning 'auto aim' calibration procedure if any components have been replaced – refer to 'Calibration' section that follows
- There are no large reflective items, white papers, etc., sitting on top of the dash board in near view of the camera (image) sensor, or stickers placed directly in front of the camera (image) sensor

Driver Menu Features

The high beam assist feature must first be enabled using the configuration menu available in the instrument cluster. However if required, the high beam assist system can be permanently disabled leaving the basic 'Auto Lamps' system still operative.

Within this menu the system can also be configured for driving on the alternate side of the road (Hand of Traffic). This enables the system to be used in different regions and it's setting is important for correct operation.

Setting 'Hand of Traffic' and High Beam Assist 'Enable'

To set the high beam assist options the following steps must be sequenced:

- With the ignition in power mode 6 (ignition on), and the engine not running, use the controls on the steering wheel to select on the instrument cluster menu:
  - Menu > Vehicle Set-up > High Beam Assist
- Configure the 'Hand of Traffic' setting by selecting the appropriate 'Drive on Left' (of road) or 'Drive on Right' (of road) to the applicable Market condition
- Enable the feature by setting 'Activate Assist' if not already selected.

NOTES:

 Enabling or disabling high beam assist will not affect the ‘Hand of Traffic’ settings once set.

The headlamps still require manual adjustment using the tourist lever for driving abroad in countries where the alternate side of the road is used.

The instrument cluster menu also includes a 'High Beam Assist Sensitivity' selection. This is a requirement option for NAS market vehicles only but it is not recommended for normal use and has been superseded.

NOTE: In other markets the 'Sensitivity' selection is greyed out and cannot be selected.

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

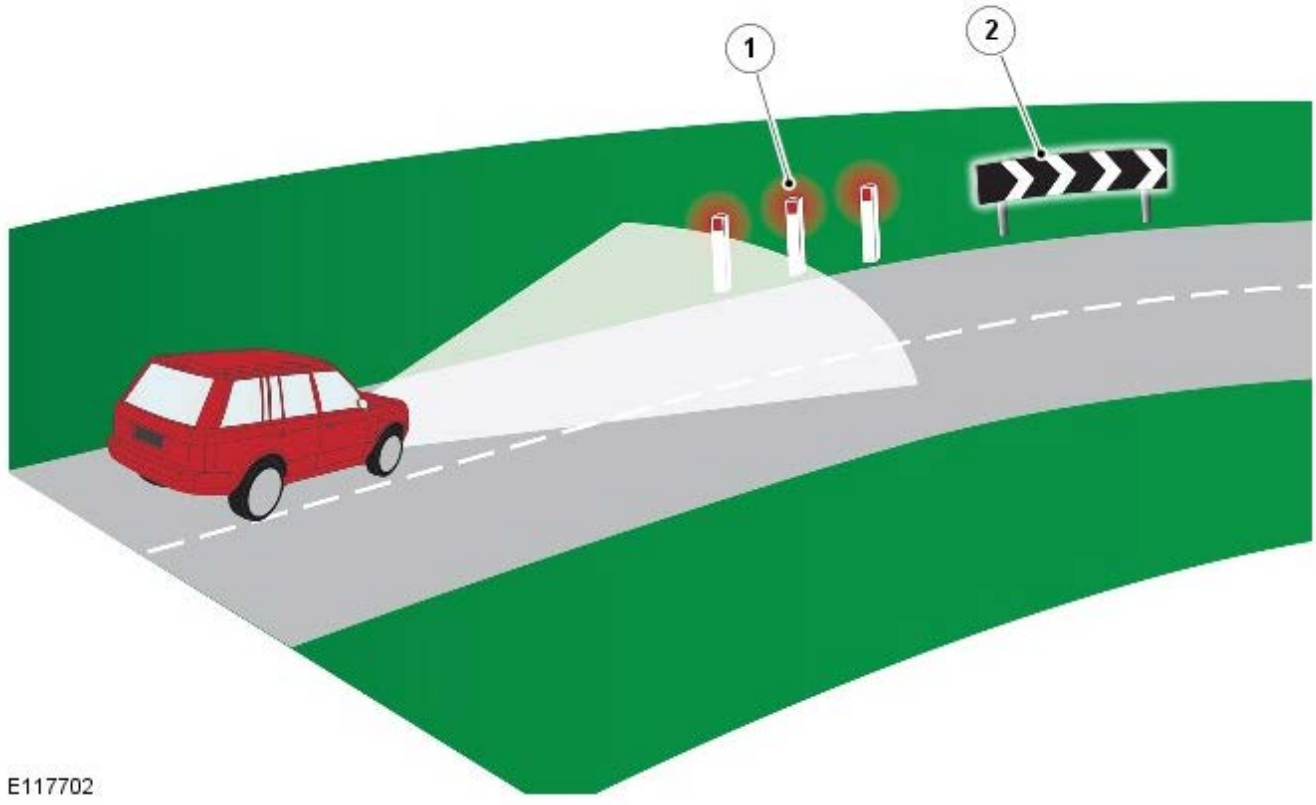
System Limitations

The high beam assist system can occasionally have difficulty distinguishing between light from other vehicles or reflected light from static highly reflective road signs.

These situations may cause the high beam assist system to undesirably operate the high beam headlamps or take no action at all. Examples of these situations are as follows:

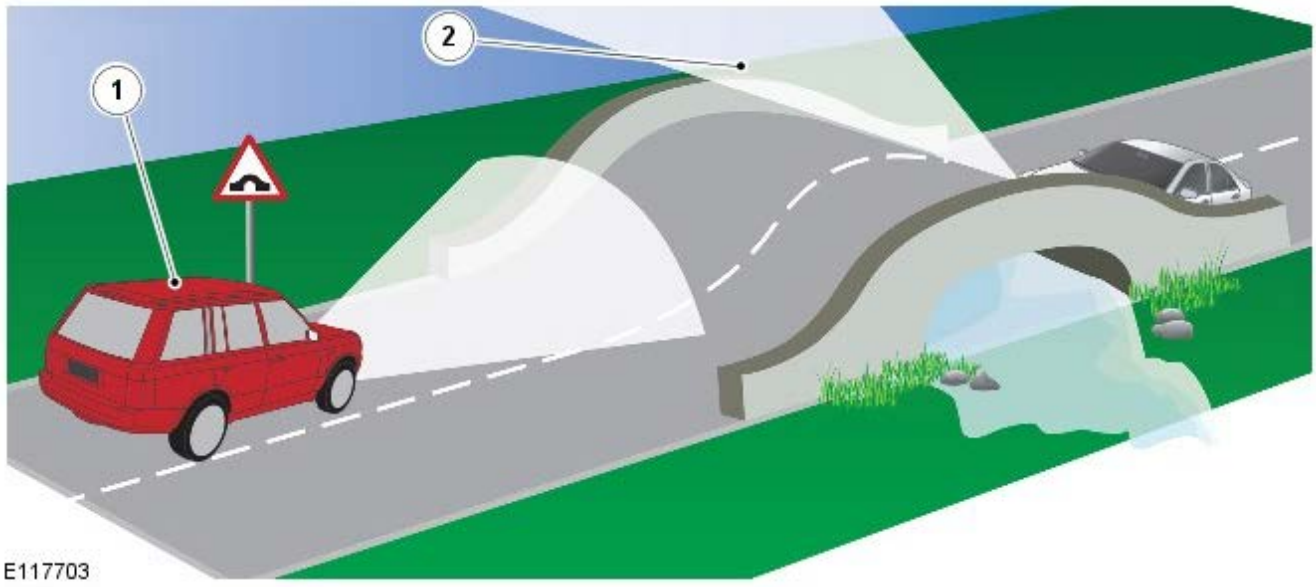
- Dips, hollows or crests in the road
- Highly reflective static Road signs
- Tight bends
- Poorly illuminated vehicles e.g. cyclists or small mopeds
- Motorway central barriers
- Extreme weather conditions e.g. Fog, heavy snow
- Exterior domestic or industrial lighting

Reflective Static Signs



Item	Part Number	Description
1	-	Red reflective signs could be detected as rear tail lamps
2	-	Large reflective signs could affect the system

Manual Deactivation



Item	Part Number	Description
1	-	Vehicle equipped with high beam assist
2	-	Oncoming vehicle headlamps can be seen by the driver before the high beam assist image sensor detects the oncoming light input

There are situations when a driver is able to judge if a high beam deactivation is desirable before the high beam assist system actually operates, for example over a crest of a hill. Headlamps from an oncoming vehicle can sometimes be seen on the horizon prior to the detection sensor receiving an input. It is the driver's preference to determine if early intervention is desired in this and similar situations.

System Diagnosis

NOTE: Windshield stickers, stone chips, dirt and general road film will affect the successful operation of the image sensor if sufficient blocking is present. Avoid placing reflective objects on the instrument panel, for example white paper which can affect the image sensor.

High beam assist has a self diagnosis capability by comparing data from the ambient light sensor input (located in the rear view mirror) to light levels detected by the image sensor. If a deviation is detected it is assumed that the ambient light available to the image sensor is being restricted by dirt or other blockage and the system will be deactivated. Diagnostic Trouble Code (DTC)'s are stored in the control module's memory and can be accessed using an approved Land Rover diagnostic system. Within the diagnostic system is a procedure to test the basic operation of the camera function.

In the event of a fault, the warning strategy to the driver is as follows:

- Image sensor internal fault - green icon will extinguish with no additional message to driver
- CJB has lost all communication with image sensor - green icon will extinguish with no additional message to driver
- Image sensor blocked - green icon will extinguish with an additional "High Beam Assist Sensor Blocked" message within the message centre

System Calibration

To achieve effective operation of the high beam assist system, a calibration routine is performed on vehicle build and system tolerances are set to an accuracy of +/- 0.2 degrees.

This initial calibration is a 'one time only' procedure. Should the high beam assist components or the windshield require replacement at the dealership, an automatic calibration routine will be performed. This 'auto aim' calibration procedure is a continual process that takes place during a normal drive cycle at night and could take between 10 - 30 minutes dependant on the following driving conditions:

- If sufficient road markings (lane markings) are visible to the image sensor - approximately 10 minutes
- If insufficient road markings are visible, the system uses the tail lights of preceding vehicles - approximately 30 minutes.

NOTES:

Until this calibration is complete the system may not react correctly during operation. This should be made clear to the customer before vehicle handover. During any calibration or rectification work the headlamps should be checked for correct alignment.

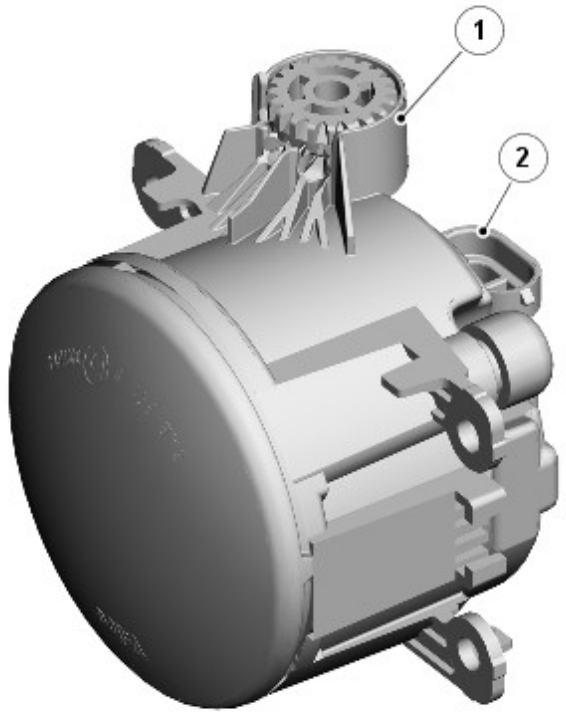
Due to mechanical calibration tolerance the correct mirror assembly must be used for the vehicle model types in question and it is not exchangeable with other vehicle model types.

After any rectification work and before any calibration drives, the headlamps should be checked for correct alignment.

DAYTIME RUNNING LAMPS (DRL)

Refer to the Daytime Running Lamps section for details.
For additional information, refer to: Daytime Running Lamps (DRL) (417-04, Description and Operation).

FRONT FOG LAMP (If Fitted)



E120184

Item	Part Number	Description
1	-	Vertical adjustment wheel
2	-	Electrical connector

Front fog lamps are an optional fitment on low specification vehicles and a standard fitment on high specification vehicles.

Two front fog lamps are located in apertures in the front bumper. Each lamp is secured in the bumper with three screws. The fog lamp has an adjuster wheel which is accessible by removal of the applicable headlamp assembly and is used to set the fog lamp to the correct alignment.

The fog lamp uses a 55W halogen H11 bulb which is located in a holder. The holder is located in a hole in the rear of the fog lamp housing and is turned to lock in position.

The front fog lamps are controlled by the lighting control switch. When the ignition is in power mode 6 (ignition on) and the lighting control switch is in the side lamp or headlamp position, the lighting control switch can be pulled to the first position to activate the front fog lamps.

If the switch is pulled to the second position, the front and rear fog lamps are activated. A front fog lamp warning indicator is illuminated in the instrument cluster when the front fog lamps are active.

Front Fog Lamps Functionality (NAS and Canadian Markets Only)

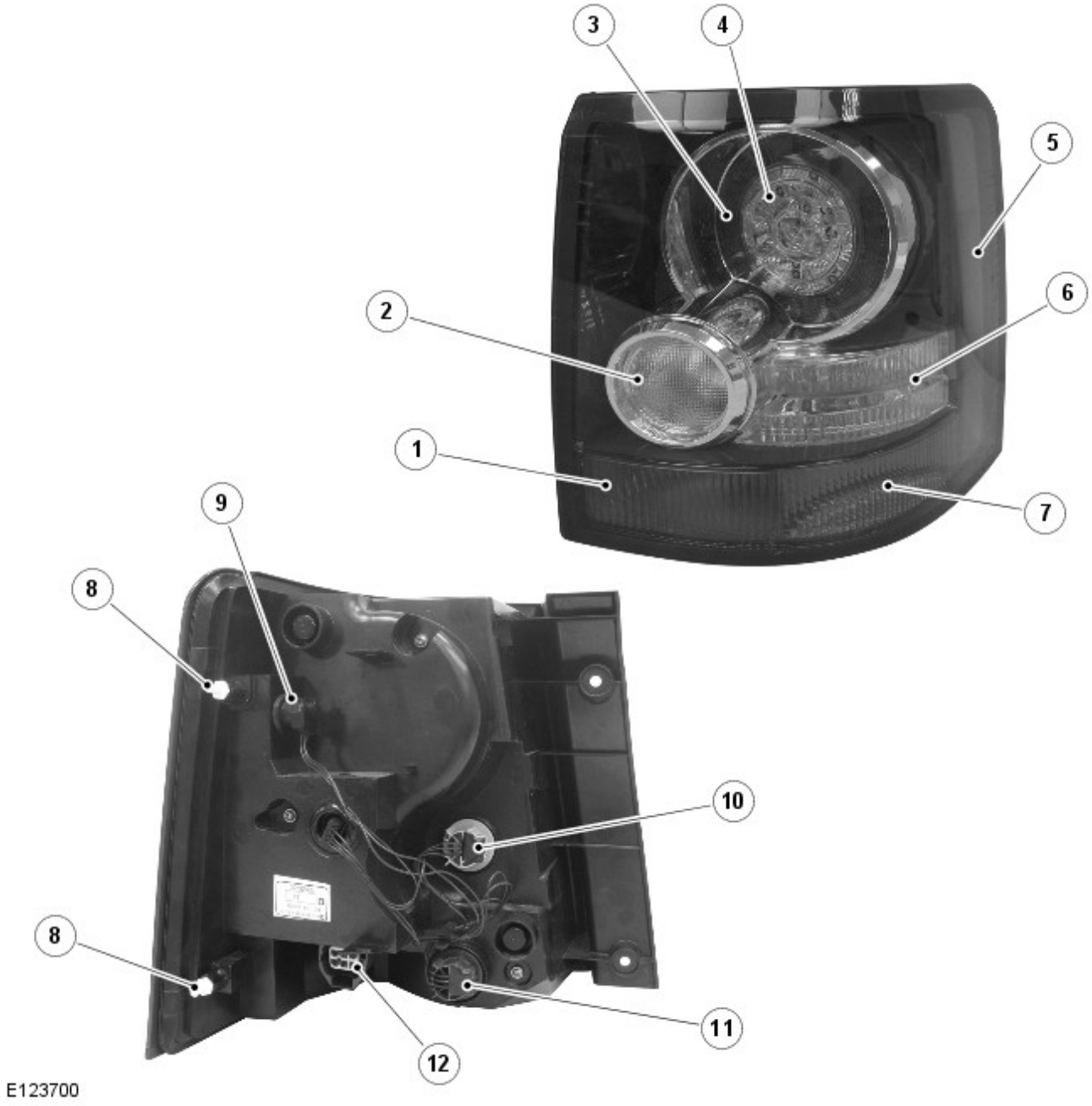
The front fog lamps are powered by an additional relay (relay 5) which is located in the EJB in the engine compartment.

The front fog lamps operate as described previously but with the following differences which cover local laws governing lamp usage.

If the low beam headlamps and the front fog lamps are on at the same time, when the high beam headlamps are switched on, the front fog lamps will be automatically switched off. When the high beam headlamps are switched off, the front fog lamps will be switched back on automatically.

NOTE: The front fog lamps will also be switched off if the headlamp high beam flash function is operated.

REAR LAMP ASSEMBLY



Item	Part Number	Description
1	-	Fog lamp
2	-	Reverse lamp
3	-	Side lamp LED's
4	-	Stop lamp LED's
5	-	Side marker lamp (NAS only)
6	-	Turn signal indicator lamp LED's
7	-	Reflector
8	-	Location studs
9	-	Side marker lamp bulb (NAS only)
10	-	Reverse lamp bulb
11	-	Fog lamp bulb
12	-	Electrical connector

The rear lamp assembly is a one piece unit which contains a stop lamp, a rear side lamp, a turn signal indicator lamp, a second rear side lamp, a reversing lamp and a fog lamp. Light Emitting Diode (LED)'s are used for the tail lamp, stop lamp and turn signal indicator lamp. Reversing lamp and fog lamp use bayonet fitting bulbs. These are located in holders which fit into the applicable hole in the lamp housing and are locked by rotating. Each bulb holder is connected by wires to a connector on the rear of the lamp housing.

The rear lamp assembly is located in a recess in the vehicle body. Two studs on the outer edge of the lamp housing locate in the vehicle body. The lamp is secured with two screws which are located on the inner edge of the lamp housing, near the tailgate aperture.

Rear Stop Lamp

The stop lamp is the inner section of the upper main lamp and uses 12 LED's.

The stop lamp is activated when the ignition is in ignition mode 6 and the brake pedal switch is active (by depressing the brake pedal). The high mounted stop lamp will also be activated when the brake pedal is pressed.

The stop lamps can also be activated by the ABS when Hill Descent Control (HDC) is active. A signal from the ABS module energises a relay which supplies power to the stop lamps and high mounted stop lamp.
For additional information, refer to: Anti-Lock Control - Traction Control (206-09A, Description and Operation).

Turn Signal Indicator Lamp

The turn signal indicator lamp is located adjacent to the reversing lamp and uses 12 LED's.

The turn signal indicator lamps are operated by the LH steering column multifunction switch or by the hazard flasher switch. The steering column multifunction switch is only active with the ignition switch is in ignition mode 6, the hazard flasher switch is active at all times. When active, the turn signal indicator lamps will flash at a frequency cycle of 400ms on and 400ms off.

Side Lamp

The side lamp is the outer ring of the upper main lamp and use 12 LED's in each lamp.

The lamps are operated by selecting side lamps or headlamps on the lighting control switch. The lamps are operational at all times and are not dependant on the ignition switch position. The lamps will also be illuminated when the lighting control switch is in the AUTO position and a 'lights on' signal is received by the CJB from the rain/light sensor.

On NAS market vehicles a side marker lamp is incorporated into the side of the lamp assembly and uses a 5W capless wedge bulb.

Reversing Lamp

The reversing lamp is located adjacent to the turn signal indicator lamp and uses a 21W bayonet fitting bulb.

The reverse lamp is active when the ignition is in ignition mode 6 and the CJB receives a reverse selected signal on the CAN bus. Both manual and automatic transmissions have a reverse switch which senses when reverse is selected.

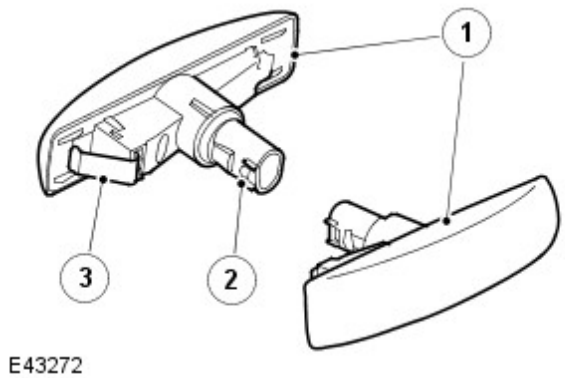
Rear Fog Lamp

The rear fog lamp is located at the bottom of the rear lamp and uses a 21W bayonet fitting bulb.

The rear fog lamp is controlled by a non-latching switch on the lighting control switch. When the ignition is in ignition mode 6 and the lighting control switch is in the side lamp or headlamp position, the rear fog lamp switch can be pressed to activate the rear fog lamps. A second press of the switch will de-activate the rear fog lamps. A rear fog lamp warning indicator is illuminated in the instrument cluster when the rear fog lamps are active.

If the rear fog lamps are active when the lighting control switch is moved to the off position or the ignition is switched off, the fog lamps are de-activated and will need to be reselected on (if required) when the side lamps or headlamps are next selected on.

TURN SIGNAL INDICATOR REPEATER LAMP



E43272

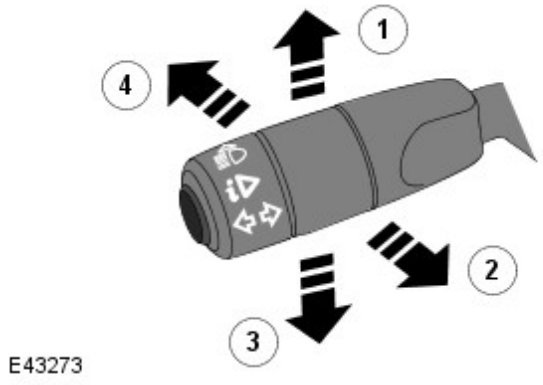
Item	Part Number	Description
1	-	Turn signal indicator repeater lamp
2	-	Bulb holder
3	-	Clip

The repeater lamps are located in the driver and passenger doors, below each door mirror. The lamps are clipped into an aperture in the door panel and can be removed by sliding rearwards and releasing the front edge of the lamp from the door. The repeater lamps use a 5W capless bulb which is located in a holder.

The repeater lamps have the same functionality as the front and rear turn signal indicator lamps and are operated by the left hand steering column multifunction switch or by the hazard flasher switch. The steering column multifunction switch is only active with the ignition in power mode 6 (ignition on), the hazard flasher switch is active at all times.

When active, the repeater lamps will flash at a frequency cycle of 400ms on and 400ms off. If a lamp bulb fails, the remaining turn signal indicator lamp bulbs continue to flash at the normal rate.

LEFT HAND STEERING COLUMN MULTIFUNCTION SWITCH



Item	Part Number	Description
1	-	RH turn signal indicator lamp
2	-	Headlamp flash
3	-	LH turn signal indicator lamp
4	-	Headlamp high beam

The steering column multifunction switch is located on the left hand side of the steering column and controls the following functions:

- Headlamp low/high beam
- Headlamp high beam flash
- Left/right turn signal indicator lamps
- Trip computer functions.
  For additional information, refer to: Information and Message Center (413-08, Description and Operation).

The high beam on and flash functions are connected on separate wires to the CJB. When the switch is operated in either position a ground path is completed which is sensed by the CJB which activates the selected function.

The turn signal indicator lamps are connected and operate in a similar way with the ground path completed through a separate wire which is sensed by the CJB which activates the applicable turn signal indicator lamps. The turn signal indicators have a 'lane change' feature which operates the turn signal indicators 3 times when the LH steering column switch is operated against spring pressure and released. This feature is controlled by the CJB.

HAZARD FLASHERS

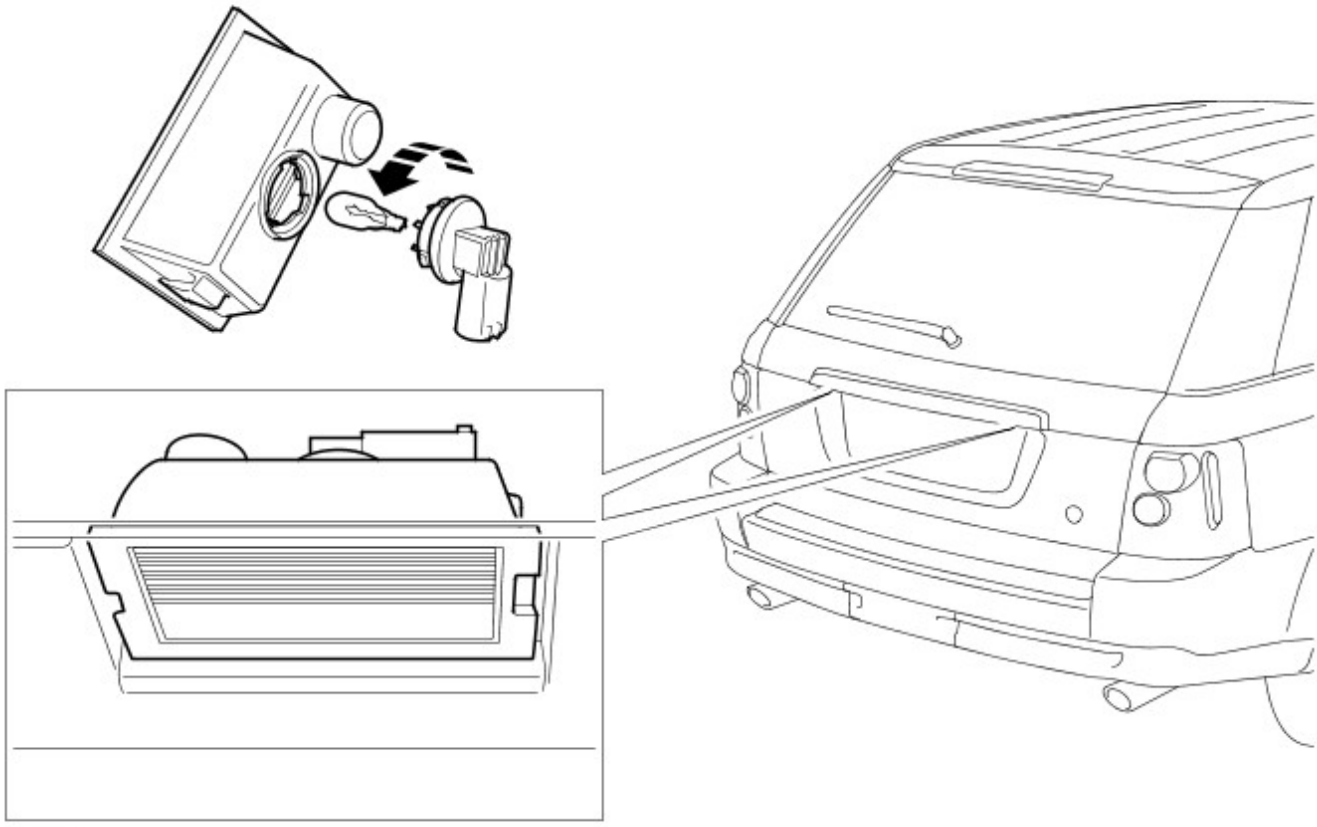
The hazard flashers are controlled by a non-latching switch in the centre of the instrument panel. The hazard flashers operate at all times when selected and are not dependant on ignition switch position.

When the hazard flashers are selected on, all of the front, rear and side turn signal indicator lamps operate as previously described and both left and right turn signal indicators in the instrument cluster also flash. The hazard warning flashers flash at a rate of 380ms on and 380ms off. When the hazard flashers are active, they override any request for turn signal lamp operation.

If a trailer is fitted, the trailer turn signal lamps will flash at the same frequency as the vehicle indicators. The trailer warning indicator in the instrument cluster will also flash. If a trailer bulb is defective, the trailer warning indicator will not flash.

The hazard flashers can also be activated by a crash signal from the restraints control module. This is received by the CJB which activates the hazard flashers. The hazard flashers can be cancelled by moving the ignition switch to the auxiliary position I or the off position O or the crash mode is cancelled by the restraints control module.
For additional information, refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B, Description and Operation).

LICENSE PLATE LAMPS

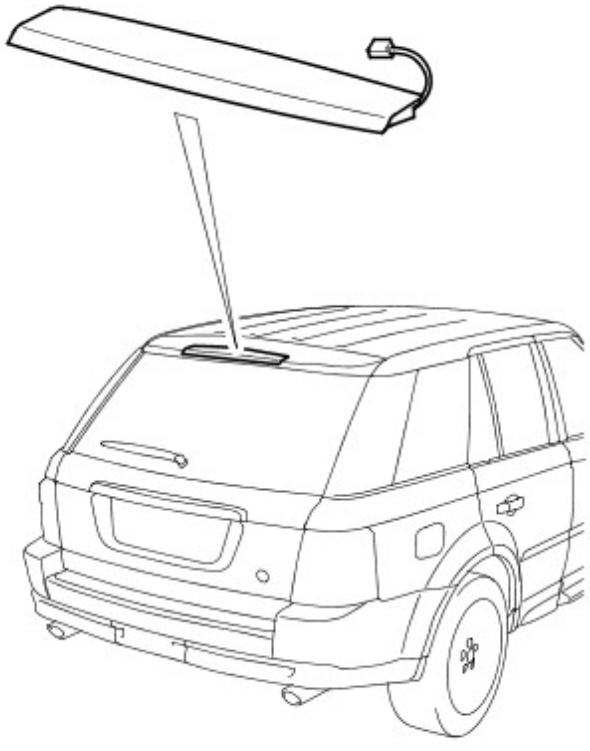


E57838

Two license plate lamps are fitted in the tailgate handle, above the license plate in the upper tailgate. Each lamp uses a 5W capless type bulb. The lamps are secured in the upper tail gate handle with integral clips. The lamps can be released from the handle using a small, flat blade screwdriver.

The license plate lamps are active at all times when the side lamps or headlamps are switched on.

HIGH MOUNTED STOP LAMP



E57839

The high mounted stop lamp is located in the tailgate spoiler.

The lamp comprises a plastic housing with a red coloured lens. The lamp is illuminated by 24 Light Emitting Diodes

(LED's).

The high mounted stop lamp is activated, along with the tail lamp stop lamps, when the ignition switch is in the ignition position (II) and the brake pedal switch is active (by depressing the brake pedal).

The high mounted stop lamp and the stop lamps can also be activated by the ABS when Hill Descent Control (HDC) is active. A signal from the ABS module energises a relay which supplies power to the stop lamps.
For additional information, refer to: Anti-Lock Control - Traction Control (206-09A, Description and Operation).

TRAILER LIGHTING

Several different types of trailer socket can be fitted to the vehicle depending on market specifications. Refer to the Electrical Reference Library for specific socket details.

The CJB monitors the turn signal lamps and can detect if a load is drawn on the trailer turn signal indicator outputs (the side turn signal lamps are not monitored). When a trailer is detected, the trailer warning indicator in the instrument cluster will flash in synchronisation with the turn signal indicators.

The CJB monitors the trailer turn signal indicator outputs once at every ignition on cycle and also whenever the state of the drivers door changes (i.e. closed to open).

If one or more of the turn signal lamps on the vehicle or the trailer are defective, the trailer warning indicator will not flash to alert the driver to the bulb failure.

DIAGNOSTICS

The diagnostic socket is located in the lower instrument panel closing panel, on the driver's side, below the steering column. Various lighting system functions are monitored by different systems which can store fault information. This can be retrieved using an approved Land Rover diagnostic system or other suitable scan tool.

AFS Control Module Fault Monitoring

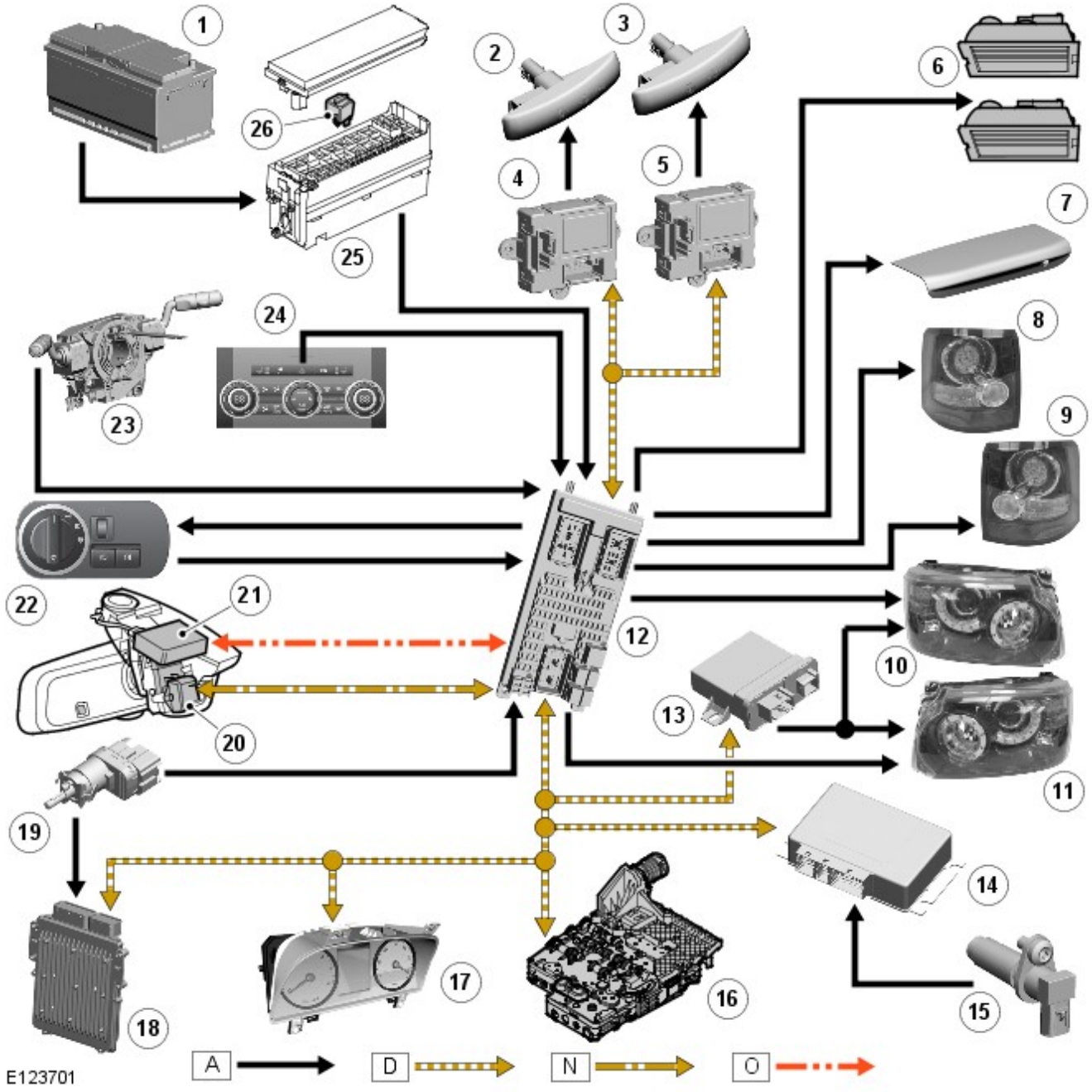
The AFS control module has the capability to monitor faults within the AFS. The control module can store Diagnostic Trouble Codes (DTC's) which can be retrieved using an approved Land Rover diagnostic system.

Central Junction Box (CJB)

The CJB monitors the status of the lighting circuits, relays and switches. If a fault occurs, the CJB stores a fault code applicable to the specific fault which can be retrieved using an approved Land Rover diagnostic system or other suitable scan tool.

CONTROL DIAGRAM

NOTE: **A** = Hardwired; **D** = High Speed CAN Bus; **N** = Medium speed CAN bus; **O** = LIN Bus

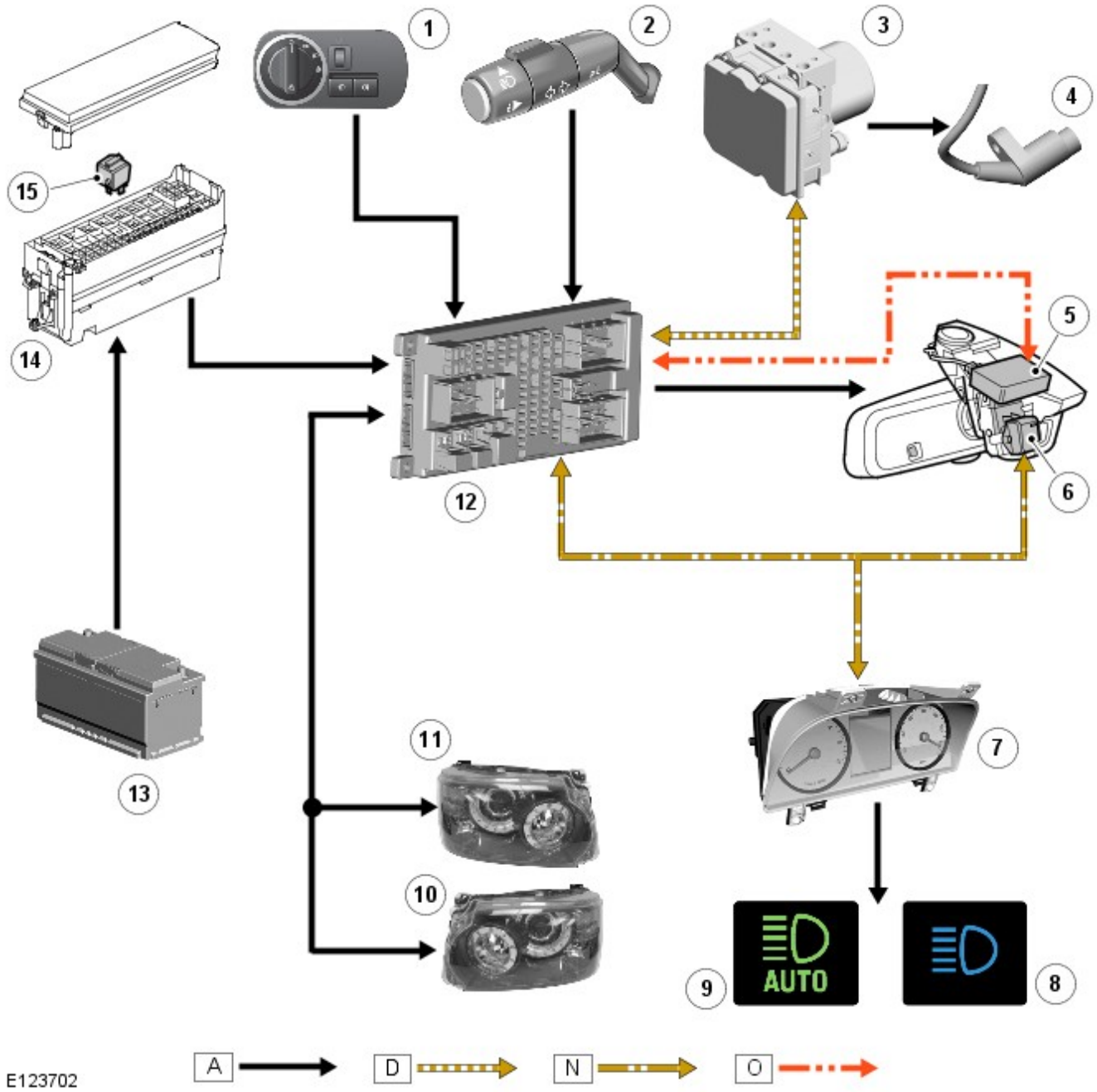


Item	Part Number	Description
1	-	Battery
2	-	LH side repeater turn signal indicator
3	-	RH side repeater turn signal indicator
4	-	LH Door module
5	-	RH Door module
6	-	License plate lamps (2 off)
7	-	High mounted stop lamp
8	-	LH rear lamp assembly
9	-	RH rear lamp assembly
10	-	LH headlamp assembly
11	-	RH headlamp assembly
12	-	Central Junction Box (CJB)
13	-	AFS control module
14	-	Transfer box control module
15	-	Transmission reverse switch (manual transmission only)
16	-	Transmission Control Module (TCM) (Automatic transmission only)
17	-	Instrument cluster
18	-	Engine Control Module (ECM)
19	-	Stop lamp switch
20	-	High beam assist image sensor and control module

21	-	Rain/light sensor
22	-	Lighting control switch
23	-	LH steering column multifunction switch
24	-	Hazard warning indicators switch
25	-	Engine Junction Box (EJB)
26	-	High beam assist relay

HIGH BEAM ASSIST CONTROL DIAGRAM

NOTE: **A** = Hardwired; **D** = High Speed CAN; **N** = Medium Speed CAN; **O** = LIN Bus



Item	Part Number	Description
1	-	Lighting control switch
2	-	LH steering column multifunction switch
3	-	Anti-lock Brake System (ABS) module
4	-	Wheel speed sensor
5	-	Rain/light sensor (Ref)
6	-	High beam assist control module and image sensor
7	-	Instrument cluster
8	-	High beam warning indicator
9	-	High beam assist warning indicator
10	-	LH headlamp assembly

11	-	RH headlamp assembly
12	-	Central Junction Box (CJB)
13	-	Battery
14	-	Engine Junction Box (EJB)
15	-	High beam assist relay

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Exterior Lighting - Headlamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).

Safety Information

WARNING: The xenon headlamp system generates up to 28,000 volts. Make sure that the headlamps are switched off before working on the system. Failure to follow this instruction may result in personal injury.

The following safety precautions must be followed when working on the xenon headlamp system:

1. DO NOT attempt any procedures on the xenon headlamps when the lights are switched on.
2. Handling of the xenon bulb must be performed using suitable protective equipment, e.g. gloves and goggles. The glass part of the bulb must not be touched.
3. Xenon bulbs must be disposed of as hazardous waste.
4. Only operate the lamp in a mounted condition in the reflector.

There are comprehensive instructions on the correct procedures for xenon headlamp system repairs in the workshop manual, refer to section 100-00 - General Information, Standard Workshop Procedures.

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

Visual Inspection

Mechanical	Electrical
• Headlamp(s) condition and installation • Bulb(s) and installation • Bulb holder(s) and installation • Lighting control switch and installation • Left-hand steering column multifunction switch and installation	• Fuses • Relays • Wiring harness • Loose or corroded connector(s) • Battery Junction Box (BJB) • Central Junction Box (CJB) • Headlamp leveling control module • Xenon Bulb Control Modules (XBCM) • Instrument Cluster (IC) • Steering Angle Sensor Module (SASM) • Transmission Control Module (TCM) • Engine Control Module (ECM) • Anti-lock Brake System (ABS) control module • Air suspension control module • Local Interconnect Network (LIN) circuits • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Low beam lamp(s) inoperative High beam lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Circuit fault • Lighting control switch fault	• Check the bulb condition • Check the fuse condition • Refer to the electrical circuit diagrams and test the low/high beam circuits for open circuit • Test the operation of the lighting control switch • Test the operation of the steering column left multifunction

	• Steering column left multifunction switch fault	switch fault • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Low beam lamp(s) dim High beam lamp(s) dim	• Incorrect bulb rating • Tourist lever set in the wrong position • Circuit fault • Lighting control switch fault • Steering column left multifunction switch fault	• Check the bulb condition and rating • Check the tourist lever is set correctly • Refer to the electrical circuit diagrams and test the low/high beam circuits for high resistance • Test the operation of the lighting control switch • Test the operation of the steering column left multifunction switch fault
Low beam lamp(s) stuck on High beam lamp(s) stuck on	• Circuit fault • Lighting control switch fault • Steering column left multifunction switch fault • Headlamp timer function fault	• Refer to the electrical circuit diagrams and test the headlamp low/high beam circuits for short circuit to power • Test the operation of the lighting control switch • Test the operation of the steering column left multifunction switch fault • Test the operation of the headlamp timer • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Headlamp low/high beam switching function inoperative	• Circuit fault • Steering column left multifunction switch fault • Xenon lamp shutter mechanism fault	• Refer to the electrical circuit diagrams and test the low/high beam switching circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Test the operation of the steering column left multifunction switch fault • Test the operation of the xenon lamp shutter mechanism • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Warning indicator(s) inoperative	• Fuse(s) blown • Lighting control switch fault • Steering column left multifunction switch fault • Circuit fault • Instrument cluster fault	• Check the fuse(s) • Test the operation of the lighting control switch • Test the operation of the steering column left multifunction switch fault • Refer to the electrical circuit diagrams and test the warning indicator circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the Instrument Cluster (IC) for related DTCs and refer to the relevant DTC index

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Headlamp Leveling Control Module (HCM) (100-00 General Information, Description and Operation) / Diagnostic Trouble Code (DTC) Index - DTC: Auto High Beam Control Module (AHBCM) (100-00 General Information, Description and Operation).

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Exterior Lighting - Autolamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, 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. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Lighting control switch and installation • Rain/light sensor condition and installation • Steering column right multifunction switch condition and installation	• Fuses • Relays • Wiring harness • Loose or corroded connector(s) • Battery Junction Box (BJB) • Central Junction Box (CJB) • Rain/light sensor control module • Local Interconnect Network (LIN) circuits • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Side and headlamp(s) inoperative when the autolamps option is selected	• Fuse(s) blown • Lighting control switch fault • Steering column left multifunction switch fault • Autolamps circuit short circuit to ground, short circuit to power, open circuit, high resistance • Rain/light sensor fault • LIN circuit fault	• Check the fuse(s) • Test the operation of the lighting control switch • Test the operation of the steering column left multifunction switch • Refer to the electrical circuit diagrams and test the autolamps circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Lighting control switch illumination inoperative	• Fuse(s) blown • Lighting control switch fault	• Check the fuse(s) • Test the operation of the lighting control switch • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Headlamp Leveling Control Module (HCM) (100-00 General Information, Description and Operation) /
Diagnostic Trouble Code (DTC) Index - DTC: Auto High Beam Control Module (AHBCM) (100-00 General Information, Description and Operation) /
Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00 General Information, Description and Operation).

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Exterior Lighting - Stoplamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, 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. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Stop lamp condition and installation • Bulbs and installation • Bulb holders and installation • Brake pedal switch condition and installation	• Fuses • Wiring harness • Loose or corroded connector(s) • Battery Junction Box (BJB) • Central Junction Box (CJB) • Engine Control Module (ECM) • Anti-lock Brake System control module (ABS) • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Stop lamp(s) inoperative	• Bulb failure • LED lamp failure • Fuse(s) blown • Stop lamp circuit short circuit to ground, short circuit to power, open circuit, high resistance • Brake pedal switch fault	• Check the bulb(s) • Check the LEDs • Check the fuses • Refer to the electrical circuit diagrams and test the stop lamp circuit for short circuit to ground, open circuit, high resistance • Using the manufacturer approved diagnostic system, check datalogger signal - Brake Switch (0x0416) • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index
Stop lamp(s) dim	• Stop lamp circuit high resistance	• Refer to the electrical circuit diagrams and test the stop lamp circuit for high resistance
Stop lamp(s) stuck on	• Brake pedal switch fault • Stop lamp circuit short circuit to power	• Using the manufacturer approved diagnostic system, check datalogger signal - Brake Switch (0x0416) • Refer to the electrical circuit diagrams and test the stop lamp circuit for short circuit to power • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index

DTC Index

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

Diagnostic Trouble Code (DTC) Index - TDV6 3.0L Diesel , DTC: Engine Control Module (ECM) (100-00 General Information, Description and Operation),
Diagnostic Trouble Code (DTC) Index - V8 5.0L Petrol/V8 S/C 5.0L Petrol, DTC: Engine Control Module (ECM) (100-00, Description and Operation).

Published: 20-Aug-2012

Exterior Lighting - Turn Signal, Cornering and Hazard Lamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, 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. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Turn signal indicator lamp(s) condition and installation • Cornering lamp(s) condition and installation • Bulbs condition and installation • Bulb holders condition and installation • Lighting control switch condition and installation • Steering column left multifunction switch condition and installation • Hazard warning lamp switch condition and installation	• Fuses • Wiring harness • Loose or corroded connector(s) • Battery Junction Box (BJB) • Central Junction Box (CJB) • Steering Angle Sensor Module (SASM) • Anti-lock Brake System control module (ABS) • Instrument Cluster (IC) • Headlamp Leveling Control Module (HLCM) • Restraints Control Module (RCM) • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Turn signal indicator / hazard warning lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Turn signal indicator / hazard warning lamp(s) circuit short circuit to ground, open circuit, high resistance • Steering column left multifunction switch fault • Hazard warning lamp switch fault	• Check the bulb condition • Check the fuse condition • Refer to the electrical circuit diagrams and test the turn signal indicator / hazard warning lamp(s) circuits for short circuit to ground, open circuit, high resistance • Test the operation of the steering column left multifunction switch • Test the operation of the hazard warning lamp switch • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Turn signal indicator / hazard warning lamp(s) dim	• Incorrect bulb rating • Turn signal indicator / hazard warning lamp(s) circuit high resistance • Steering column left multifunction switch fault • Hazard warning lamp switch fault	• Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the turn signal indicator / hazard warning lamp(s) circuits for high resistance • Test the operation of the steering column left multifunction switch • Test the operation of the hazard warning lamp switch
Turn signal indicator / hazard warning lamp(s) stuck on	• Turn signal indicator / hazard warning lamp(s) circuit short circuit to power • Steering column left multifunction switch fault • Hazard warning lamp switch	• Refer to the electrical circuit diagrams and test the turn signal indicator / hazard warning lamp(s) circuits for short circuit to power • Test the operation of the steering column left multifunction switch • Test the operation of the hazard warning lamp

	fault	switch • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Warning indicator(s) inoperative	• Fuse(s) blown • Steering column left multifunction switch fault • Hazard warning lamp switch fault • Warning indicator circuit short circuit to ground, open circuit, high resistance • Instrument cluster fault	• Check the fuse(s) • Test the operation of the steering column left multifunction switch • Test the operation of the hazard warning lamp switch • Refer to the electrical circuit diagrams and test the warning indicator circuit for short circuit to ground, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the Instrument Cluster (IC) for related DTCs and refer to the relevant DTC index
Cornering lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Cornering lamps circuit short circuit to ground, open circuit, high resistance • Steering column left multifunction switch fault • Lighting control switch fault	• Check the bulb condition • Check the fuse condition • Refer to the electrical circuit diagrams and test the cornering lamps circuit for short circuit to ground, open circuit, high resistance • Test the operation of the steering column left multifunction switch • Test the operation of the lighting control switch
Cornering lamp(s) dim	• Incorrect bulb rating • Cornering lamps circuit high resistance • Steering column left multifunction switch fault • Lighting control switch fault	• Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the cornering lamps circuit for high resistance • Test the operation of the steering column left multifunction switch • Test the operation of the lighting control switch
Cornering lamp(s) stuck on	• Steering column left multifunction switch fault • Lighting control switch fault • Cornering lamps circuit short circuit to power	• Test the operation of the steering column left multifunction switch • Test the operation of the lighting control switch • Refer to the electrical circuit diagrams and test the cornering lamps circuit for high resistance • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00 General Information, Description and Operation).

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Exterior Lighting - Parking, Rear and License Plate Lamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, 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. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Tail lamp(s) condition and installation • License lamp(s) condition and installation • Bulbs and installation • Bulb holders and installation • Lighting control switch and installation • Rain/light sensor condition and installation	• Fuses • Relays • Wiring harness • Loose or corroded connector(s) • Battery Junction Box (BJB) • Central Junction Box (CJB) • Rain/light sensor control module • Local Interconnect Network (LIN) circuits • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Tail / license plate lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Tail / license plate lamp(s) circuit short circuit to ground, open circuit, high resistance • Lighting control switch fault	• Check the bulb condition • Check the fuse condition • Refer to the electrical circuit diagrams and test the tail / license plate lamp(s) circuit for short circuit to ground, open circuit, high resistance • Test the operation of the lighting control switch • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Tail / license plate lamp(s) dim	• Incorrect bulb rating • Tail / license plate lamp(s) circuit high resistance • Lighting control switch fault	• Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the tail / license plate lamp(s) circuit for high resistance • Test the operation of the lighting control switch
Tail / license plate lamp(s) stuck on	• Tail / license plate lamp(s) circuit short circuit to power • Lighting control switch fault	• Refer to the electrical circuit diagrams and test the tail / license plate lamp(s) circuit for short circuit to power • Test the operation of the lighting control switch • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Tail / license plate lamp(s) inoperative when the automatic headlamp switch	• Fuse(s) blown • Lighting control switch fault	• Check the fuse(s) • Test the operation of the lighting control switch

option is selected	• Autolamps circuit short circuit to ground, short circuit to power, open circuit, high resistance • Rain/light sensor fault • Rain/light sensor LIN circuit fault	• Refer to the electrical circuit diagrams and test the autolamps circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and test the rain/light sensor power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and test the rain/light sensor LIN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00 General Information, Description and Operation).

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Exterior Lighting - Front Fog Lamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, 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. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Front fog lamp condition and installation • Bulb and installation • Bulb holder and installation • Adjuster screw • Fog lamp switch condition and installation	• Fuses • Wiring harness • Loose or corroded connector(s) • Fog lamp warning indicator • Fog lamp switch • Battery Junction Box (BJB) • Central Junction Box (CJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Fog lamp inoperative	• Bulb failure • Fuse(s) blown • Front fog lamp circuit short circuit to ground, open circuit, high resistance • Front fog lamp switch fault	• Check the bulb condition • Check the fuse(s) • Refer to the electrical circuit diagrams and test the front fog lamp circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Test the operation of the front fog lamp switch
Fog lamp dim	• Incorrect bulb rating • Front fog lamp circuit short circuit to power • Front fog lamp switch fault	• Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the front fog lamp circuits for short circuit to power • Test the operation of the front fog lamp switch
Fog lamp lighting coverage poor	• Fog lamp alignment incorrect	• Refer to the relevant section of the workshop manual and adjust the front fog lamps alignment
Warning lamp inoperative	• Fuse(s) blown • Front fog lamp switch fault • Instrument cluster fault	• Check the fuse(s) • Test the operation of the front fog lamp switch • Using the manufacturer approved diagnostic system, check the Instrument Cluster (IC) for related DTCs and refer to the relevant DTC index

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00 General Information, Description and Operation).

Published: 20-Aug-2012

Exterior Lighting - Rear Fog Lamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, 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. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Rear fog lamp condition and installation • Bulb holder and installation • Bulb and installation • Rear fog lamp switch condition and installation	• Fuses • Wiring harness • Loose or corroded connector(s) • Rear fog lamp warning indicator • Rear fog lamp switch • Battery Junction Box (BJB) • Central Junction Box (CJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Rear fog lamp inoperative	• Bulb failure • Fuse(s) blown • Rear fog lamp circuit short circuit to ground, open circuit, high resistance • Rear fog lamp switch fault	• Check the bulb condition • Check the fuse(s) • Refer to the electrical circuit diagrams and test the rear fog lamp circuit for short circuit to ground, open circuit, high resistance • Test the operation of the rear fog lamp switch • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Rear fog lamp dim	• Incorrect bulb rating • Rear fog lamp circuit high resistance • Rear fog lamp switch fault	• Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the rear fog lamp circuit for high resistance • Test the operation of the rear fog lamp switch
Warning lamp inoperative	• Fuse(s) blown • Rear fog lamp switch fault • Instrument cluster fault	• Check the fuse(s) • Test the operation of the rear fog lamp switch • Using the manufacturer approved diagnostic system, check the Instrument Cluster (IC) for related DTCs and refer to the relevant DTC index

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00 General Information, Description and Operation).

Published: 20-Aug-2012

Exterior Lighting - Reversing Lamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, 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. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Reverse lamp condition and installation • Reverse lamp bulb and installation • Reverse lamp bulb holder and installation	• Fuses • Wiring harness • Loose or corroded connector(s) • Reverse lamp relay • Battery Junction Box (BJB) • Central Junction Box (CJB) • Transmission Control Module (TCM) • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Reverse lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Reverse lamp circuit short circuit to ground, short circuit to power, open circuit, high resistance • Missing reverse switch signal	• Check the bulb condition • Check the fuse condition • Refer to the electrical circuit diagrams and test the reverse lamp circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Reverse lamp(s) dim	• Incorrect bulb rating • Reverse lamp circuit high resistance	• Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the reverse lamp circuit for high resistance

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00 General Information, Description and Operation).

Published: 20-Aug-2012

Exterior Lighting - Trailer Lamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, 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.

NOTES:

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

Prior to carrying out fault diagnosis of the trailer lamp system, verify the operation of the towing vehicle lighting system with the trailer lighting plug(s) disconnected from the vehicle socket(s).

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

Visual Inspection

Mechanical	Electrical
• Trailer lamp(s) condition and installation • Bulbs and installation • Bulb holders and installation • Trailer socket(s), plug(s) and installation	• Fuses • Relays • Stop lamp switch • Wiring harness • Loose or corroded connector(s) • Trailer socket(s) ground circuit(s) • Battery Junction Box (BJB) • Central Junction Box (CJB) • Trailer fuse box • Trailer relay box • Instrument Cluster (IC) • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Trailer stop lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Trailer stop lamp circuit short circuit to ground, open circuit, high resistance • Brake lamp switch fault	• Check the bulb condition • Check the fuse condition • Refer to the electrical circuit diagrams and test the trailer stop lamp circuit for short circuit to ground, open circuit, high resistance • Using the manufacturer approved diagnostic system, check datalogger signal - Brake Switch (0x0416)
Trailer stop lamp(s) dim	• Incorrect bulb rating • Trailer stop lamp circuit high resistance • Brake lamp switch fault	• Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the trailer stop lamp circuit for high resistance • Using the manufacturer approved diagnostic system, check datalogger signal - Brake Switch (0x0416)
Trailer stop lamp(s) stuck on	• Trailer stop lamp circuit short circuit to power • Brake lamp switch fault	• Refer to the electrical circuit diagrams and test the trailer stop lamp circuit for short circuit to power • Using the manufacturer approved diagnostic system, check datalogger signal - Brake Switch (0x0416)
Trailer fog lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Trailer fog lamp circuit short circuit to ground, open circuit, high resistance	• Check the bulb condition • Check the fuse condition • Refer to the electrical circuit diagrams and test the trailer fog lamp circuit for short circuit to ground, open circuit, high resistance

Trailer fog lamp(s) dim	• Incorrect bulb rating • Trailer fog lamp circuit high resistance	• Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the trailer fog lamp circuit for high resistance
Trailer fog lamp(s) stuck on	• Trailer fog lamp circuit short circuit to power	• Refer to the electrical circuit diagrams and test the trailer fog lamp circuit for short circuit to power
Trailer tail / license plate lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Trailer tail / license plate lamp circuit short circuit to ground, open circuit, high resistance	• Check the bulb condition • Check the fuse condition • Refer to the electrical circuit diagrams and test the trailer tail / license plate lamp circuit for short circuit to ground, open circuit, high resistance
Trailer tail / license plate lamp(s) dim	• Incorrect bulb rating • Trailer tail / license plate lamp circuit high resistance	• Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the trailer tail / license plate lamp circuit for high resistance
Trailer tail / license plate lamp(s) stuck on	• Trailer tail / license plate lamp circuit short circuit to power	• Refer to the electrical circuit diagrams and test the trailer tail / license plate lamp circuit for short circuit to power
Trailer turn signal lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Trailer turn signal lamp circuit short circuit to ground, open circuit, high resistance	• Check the bulb condition • Check the fuse condition • Refer to the electrical circuit diagrams and test the trailer turn signal lamp circuit for short circuit to ground, open circuit, high resistance
Trailer turn signal lamp(s) dim	• Incorrect bulb rating • Trailer turn signal lamp circuit high resistance	• Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the trailer turn signal lamp circuit for high resistance
Trailer turn signal lamp(s) stuck on	• Trailer turn signal lamp circuit short circuit to power	• Refer to the electrical circuit diagrams and test the trailer turn signal lamp circuit for short circuit to power
Trailer reverse lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Trailer reverse lamp circuit short circuit to ground, open circuit, high resistance	• Check the bulb condition • Check the fuse condition • Refer to the electrical circuit diagrams and test the trailer reverse lamp circuit for short circuit to ground, open circuit, high resistance
Trailer reverse lamp(s) dim	• Incorrect bulb rating • Trailer reverse lamp circuit high resistance	• Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the trailer reverse lamp circuit for high resistance
Trailer reverse lamp(s) stuck on	• Trailer reverse lamp circuit short circuit to power • Trailer reverse lamp relay fault	• Refer to the electrical circuit diagrams and test the trailer reverse lamp circuit for short circuit to power • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Warning lamp(s) inoperative	• Fuse(s) blown • Instrument cluster fault	• Check the fuse condition • Using the manufacturer approved diagnostic system, check the Instrument Cluster (IC) for related DTCs and refer to the relevant DTC index
Trailer battery power inoperative	• Fuse(s) blown • Trailer battery power circuit short circuit to ground, open circuit, high resistance	• Check the fuse condition • Refer to the electrical circuit diagrams and test the trailer battery power circuit for short circuit to ground, open circuit, high resistance
Trailer ignition power inoperative	• Fuse(s) blown • Trailer ignition power circuit short circuit to ground, open circuit, high resistance	• Check the fuse condition • Refer to the electrical circuit diagrams and test the trailer ignition power circuit for short circuit to ground, open circuit, high resistance

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00 General Information, Description and Operation).

Published: 20-Aug-2012

Exterior Lighting - Headlamp Leveling

Diagnosis and Testing

Principle of Operation

For a detailed description of the headlamp Leveling system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, 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. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Headlamp leveling motor(s) and linkage(s) condition and installation • Lighting control switch condition and installation • Steering column left multifunction switch condition and installation	• Fuses • Wiring harness • Loose or corroded connector(s) • Battery Junction Box (BJB) • Central Junction Box (CJB) • Headlamp Leveling Control Module (HLCM) • Engine Control Module (ECM) • Anti-lock Brake System (ABS) control module • Air suspension control module • Local Interconnect Network (LIN) circuits • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Headlamp leveling system inoperative Headlamp alignment incorrect	• Fuse(s) blown • Leveling motor/linkage fault • Headlamp leveling circuit short circuit to ground, open circuit, high resistance • Air suspension system fault	• Check the fuse(s) condition • Check the headlamp leveling motor and linkage condition • Refer to the electrical circuit diagrams and test the headlamp leveling circuit for short circuit to ground, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the air suspension control module for related DTCs and refer to the relevant DTC index

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Headlamp Leveling Control Module (HCM) (100-00 General Information, Description and Operation) /
Diagnostic Trouble Code (DTC) Index - DTC: Auto High Beam Control Module (AHBCM) (100-00 General Information, Description and Operation) /
Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00 General Information, Description and Operation).

Published: 11-May-2011

Exterior Lighting - Front Fog Lamp Adjustment

General Procedures

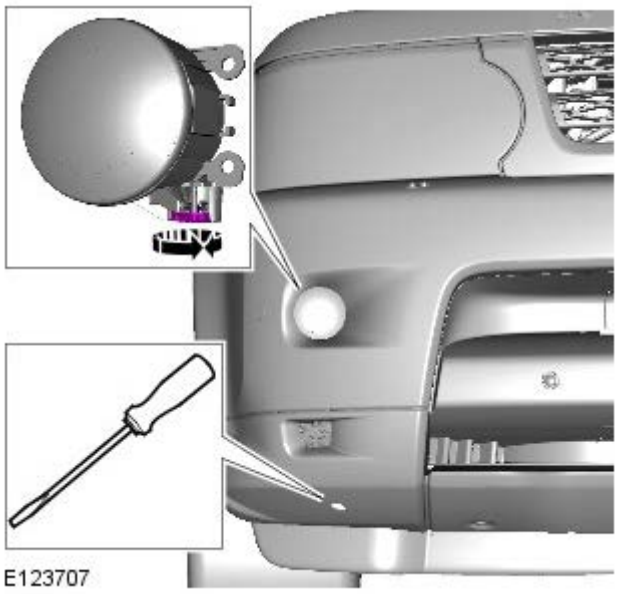
Check

NOTE: With self leveling suspension, make sure the vehicle is at the standard ride height.

1. NOTE: The fog lamp setting is 2% below horizontal.

Adjustment

NOTE: With self leveling suspension, make sure the vehicle is at the standard ride height.



1. NOTE: The procedure must be carried out on both sides.

Published: 11-May-2011

Exterior Lighting - Headlamp Adjustment

General Procedures

NOTES:

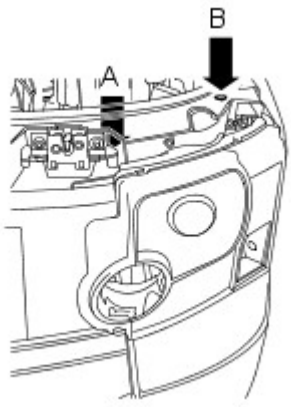
With self leveling suspension, make sure the vehicle is at the standard ride height.

The headlamp setting is 1.2 % below horizontal and parallel.

NAS vehicles have vertical adjustment only.

1. Align the headlamp beam setting equipment to one headlamp.
2. Switch the headlamps on and to dipped beam.
3. NOTE: NAS vehicles have vertical adjustment only.

   Adjust the headlamps with a Philips screwdriver.
   - Rotate the adjusters A and B by an equal amount for vertical alignment.
   - Rotate the adjusters A or B for horizontal alignment.



E49808

4. To adjust the second headlamp, repeat the above procedure.

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Exterior Lighting - Brake Pedal Position (BPP) Switch Adjustment

General Procedures

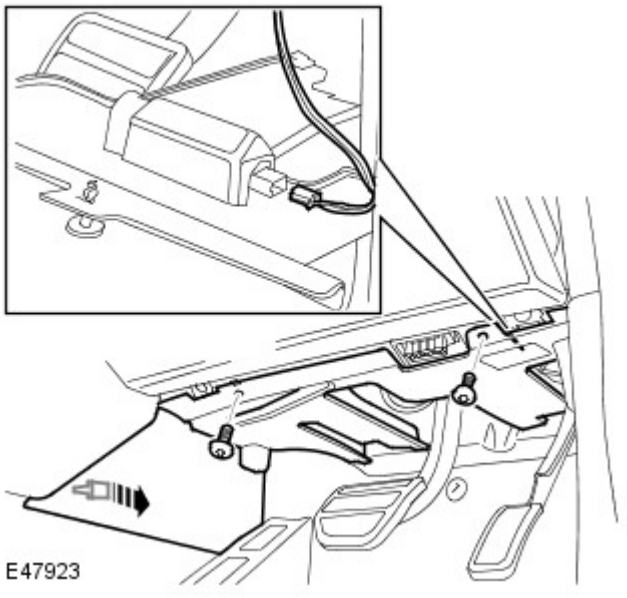
1. Adjust the brake pedal position (BPP) switch.
    - For vehicles with petrol engine,
      For additional information, refer to: Brake Pedal Position (BPP) Switch Adjustment (303-14C, General Procedures) /
      Brake Pedal Position (BPP) Switch Adjustment (303-14D, General Procedures).
    - For vehicles with diesel engine,
      For additional information, refer to: Brake Pedal Position (BPP) Switch Adjustment (303-14A, General Procedures) /
      Brake Pedal Position (BPP) Switch Adjustment (303-14B, General Procedures).

Published: 11-May-2011

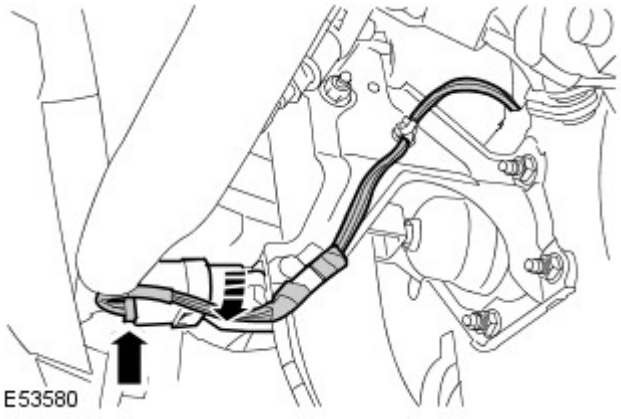
Exterior Lighting - Stoplamp Switch

Removal and Installation

Removal



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



2. CAUTION: The brake pedal MUST NOT be depressed during this operation. Failure to comply will result in damage to the stoplamp switch.

   Remove the stoplamp switch.
   - Disconnect the electrical connector.
   - Rotate the switch clockwise.

Installation

1. CAUTIONS:

   The brake pedal MUST NOT be depressed during this operation. Failure to comply will result in damage to the stoplamp switch.

   Make sure that excessive force is not used when installing the stoplamp switch. Failure to follow this instruction may result in damage to the stoplamp switch.

   Install the stoplamp switch.
   - Rotate the switch counterclockwise.
   - Connect the electrical connector.

2. Install the closing trim panel.
   - Connect the electrical connector.
   - Secure the clip.
   - Tighten the screws.

Published: 24-Oct-2012

Exterior Lighting - Headlamp Assembly

Removal and Installation

Removal

WARNING: Vehicles fitted with Xenon headlamps, the following precautions must be observed. Failure to comply may result in exposure to ultra violet rays, severe electric shock, burns or the risk of explosion. Ensure the headlamps are switched off at all times. Eye and hand protection must be worn. Never switch on the lamps or test the bulbs with the lamp holder released from the headlamp.

NOTES:

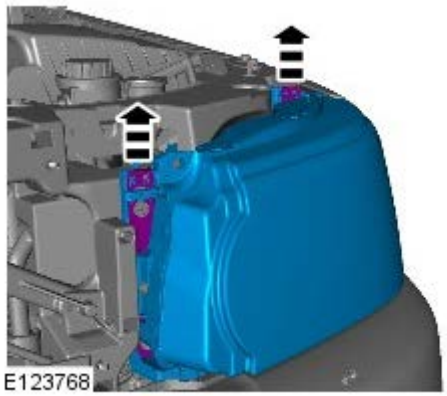
Removal steps in this procedure may contain installation details.

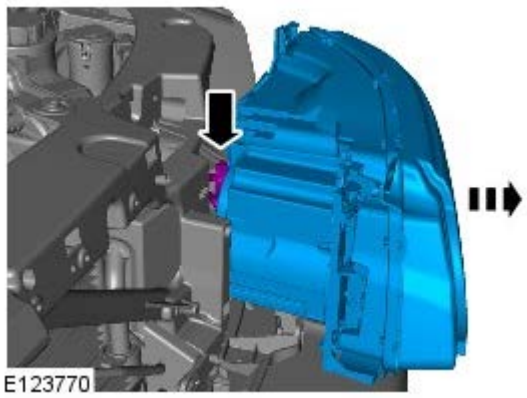
Left-hand shown, right-hand similar.

The ignition must be switched off.

1. Refer to: Radiator Grille (501-08 Exterior Trim and Ornamentation, Removal and Installation).

2.





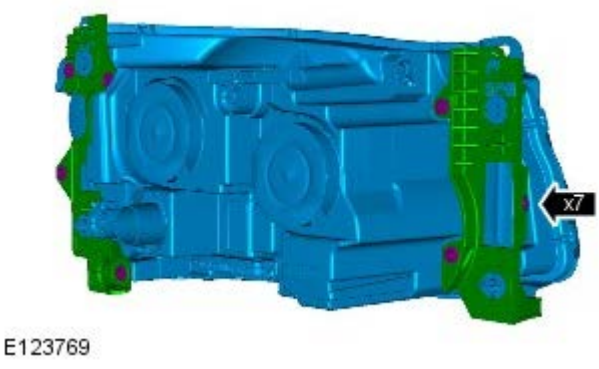
3. CAUTIONS:

   Make sure that the component is correctly located on the locating dowels.

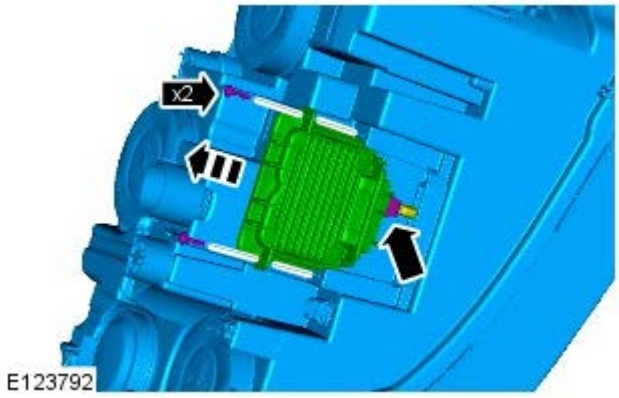
   Protect the surrounding paintwork to avoid damage.

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

   Torque: 2.5 Nm



5. *Torque:* 2.5 Nm



Installation

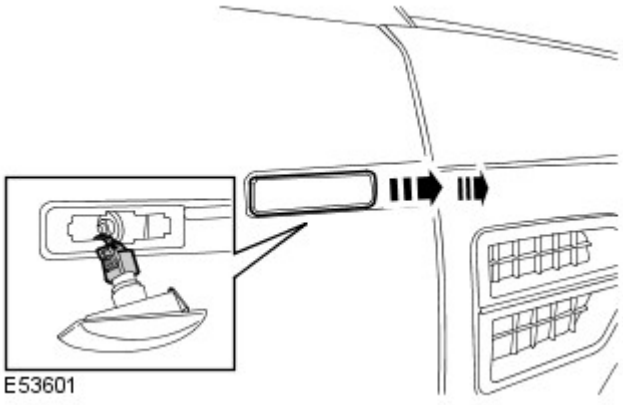
1. To install, reverse the removal procedure.

Published: 11-May-2011

Exterior Lighting - Side Turn Signal Lamp

Removal and Installation

Removal



1. Remove the side turn signal lamp.
    - Push the lamp forwards to release it from the door.
    - Disconnect the electrical connector.

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Exterior Lighting - Rear Lamp Assembly

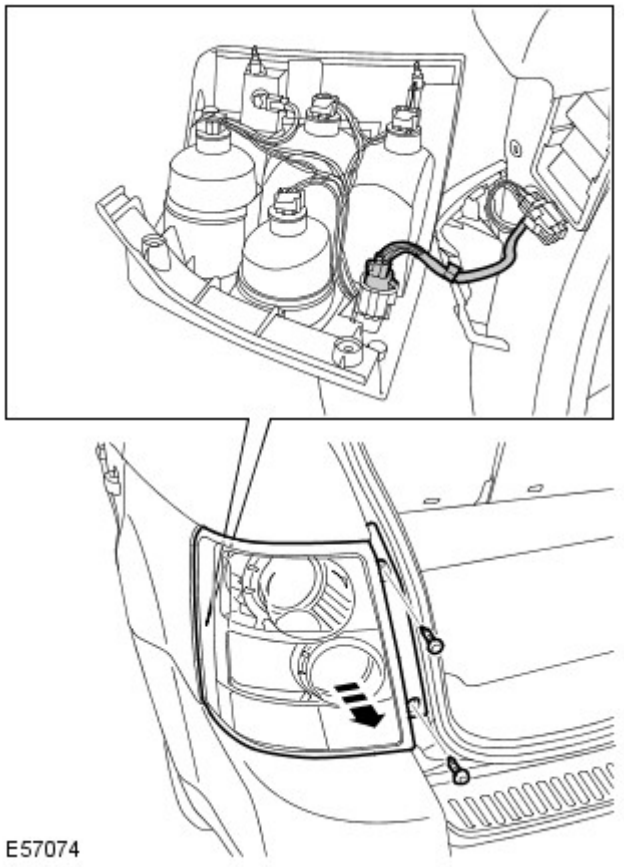
Removal and Installation

Removal

1. Open the liftgate.

2. Release the rear lamp assembly.
   - Remove the 2 screws.
   - Release the 2 clips.

3. Remove the rear lamp assembly.
   - Disconnect the electrical connector.



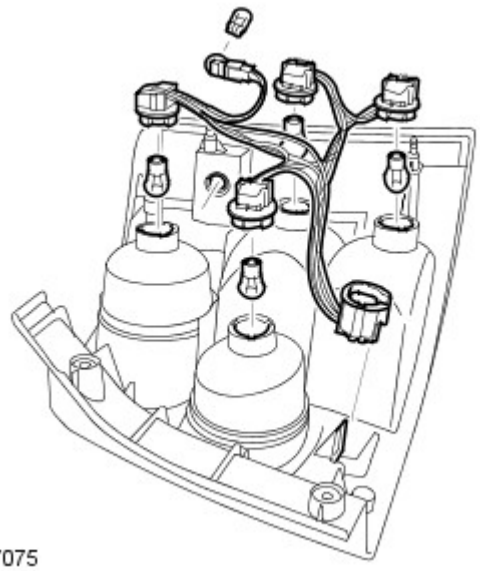
4. NOTES:

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

   Note the fitted position.

   Remove the wiring harness.
   - Release the 5 bulb holders.
   - Release the electrical connector.

5. Remove the 5 bulbs.



E57075

Installation

1. Install the bulbs.

2. Install the wiring harness.
   - Install the bulb holders.
   - Install the electrical connector.

3. Install the rear lamp assembly.
   - Connect and secure the electrical connector.
   - Secure the clips.
   - Tighten the screws.

4. Close the liftgate.

Published: 11-May-2011

Exterior Lighting - Front Fog Lamp

Removal and Installation

Removal

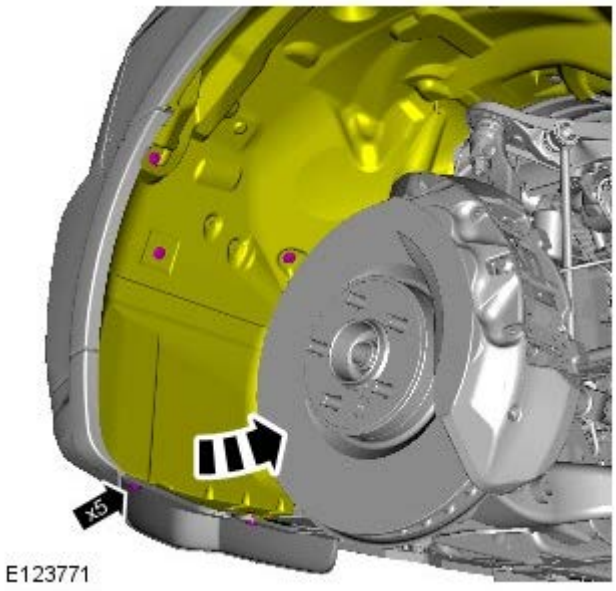
CAUTION: LH illustration shown, RH is similar.

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

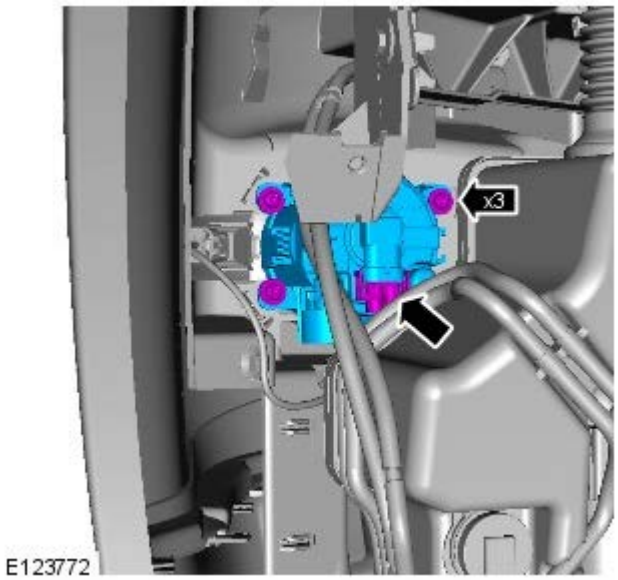
1. WARNING: Make sure to support the vehicle with axle stands.

   Remove the front wheel and tire.

2. *Torque:* 1 Nm



3. *Torque:* 2.5 Nm



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Exterior Lighting - High Mounted Stoplamp

Removal and Installation

Removal

CAUTION: Always protect paintwork and glass when removing exterior components.

NOTES:

Removal steps in this procedure may contain installation details.

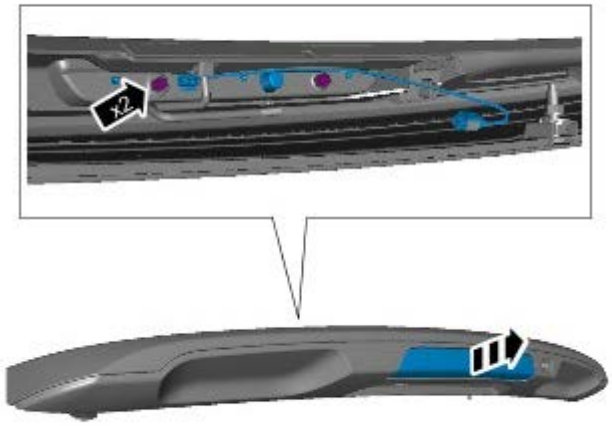
The ignition must be switched off.

1. Remove the rear spoiler.

   Refer to: Rear Spoiler (501-08, Removal and Installation).

2. CAUTION: Make sure that the component is correctly located on the locating pegs.

   Torque: 1.2 Nm



E123708

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Exterior Lighting - Approach Lamp Vehicles With: Parking Aid Camera

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

RH illustration shown, LH is similar.

The ignition must be switched off.

1. Refer to: Exterior Mirror Cover (501-09, Removal and Installation).



2. CAUTIONS:

   Take extra care not to damage the component.

   Take extra care not to damage the wiring harnesses.

   Torque: 0.5 Nm

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Exterior Lighting - Approach Lamp Vehicles Without: Parking Aid Camera

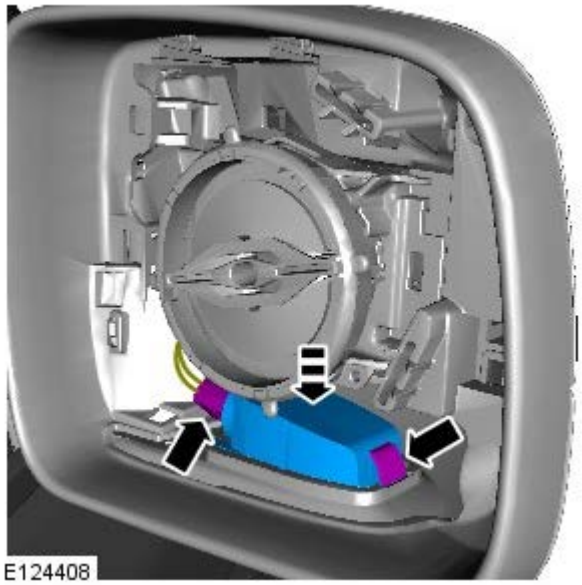
Removal and Installation

Removal

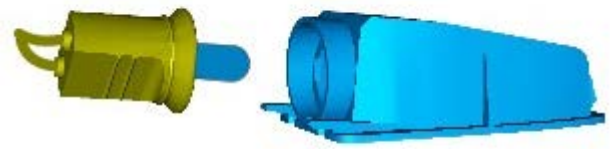
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Exterior Mirror Glass (501-09, Removal and Installation).

2.



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



E124409

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

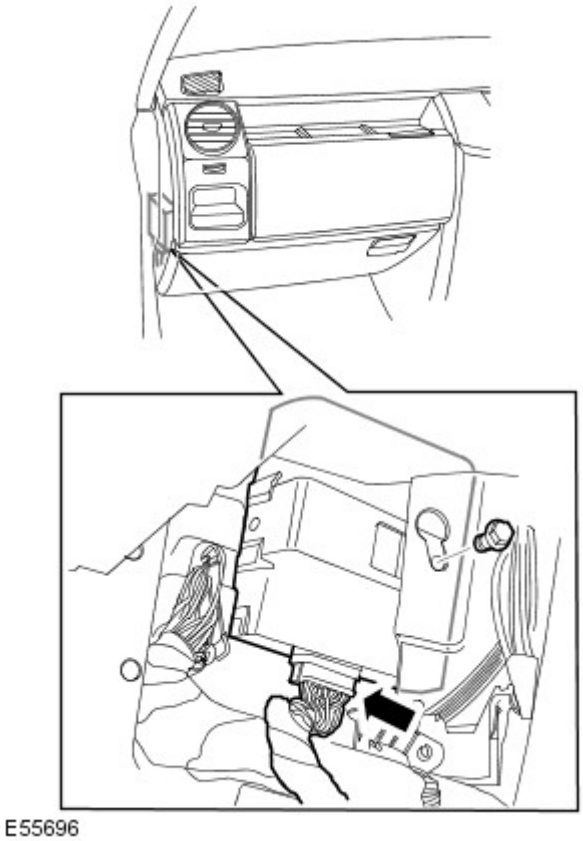
Exterior Lighting - Adaptive Front Lighting Module

Removal and Installation

Removal

NOTE: The position of the adaptive front lighting module will change with hand of drive.

1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).
2. Passenger side: Remove the cowl side trim panel.
   For additional information, refer to: Cowl Side Trim Panel (501-05, Removal and Installation).
3. Remove the CJB.
   For additional information, refer to: Central Junction Box (CJB) (418-00, Removal and Installation).
4. Remove the adaptive front lighting module.
   - Disconnect the electrical connector.
   - Remove the bolt.



E55696

Installation

1. Install the adaptive front lighting module.
   - Tighten the bolt to 10 Nm (7 lb.ft).
   - Connect the electrical connector.
2. Install the CJB.
   For additional information, refer to: Central Junction Box (CJB) (418-00, Removal and Installation).
3. Install the cowl side trim panel.
   For additional information, refer to: Cowl Side Trim Panel (501-05, Removal and Installation).
4. Connect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

Published: 11-May-2011

Exterior Lighting - Headlamp Switch

Removal and Installation

Removal

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



1. CAUTION: Protect the surrounding trim to avoid damage.

   NOTE: The ignition must be switched off.

Installation

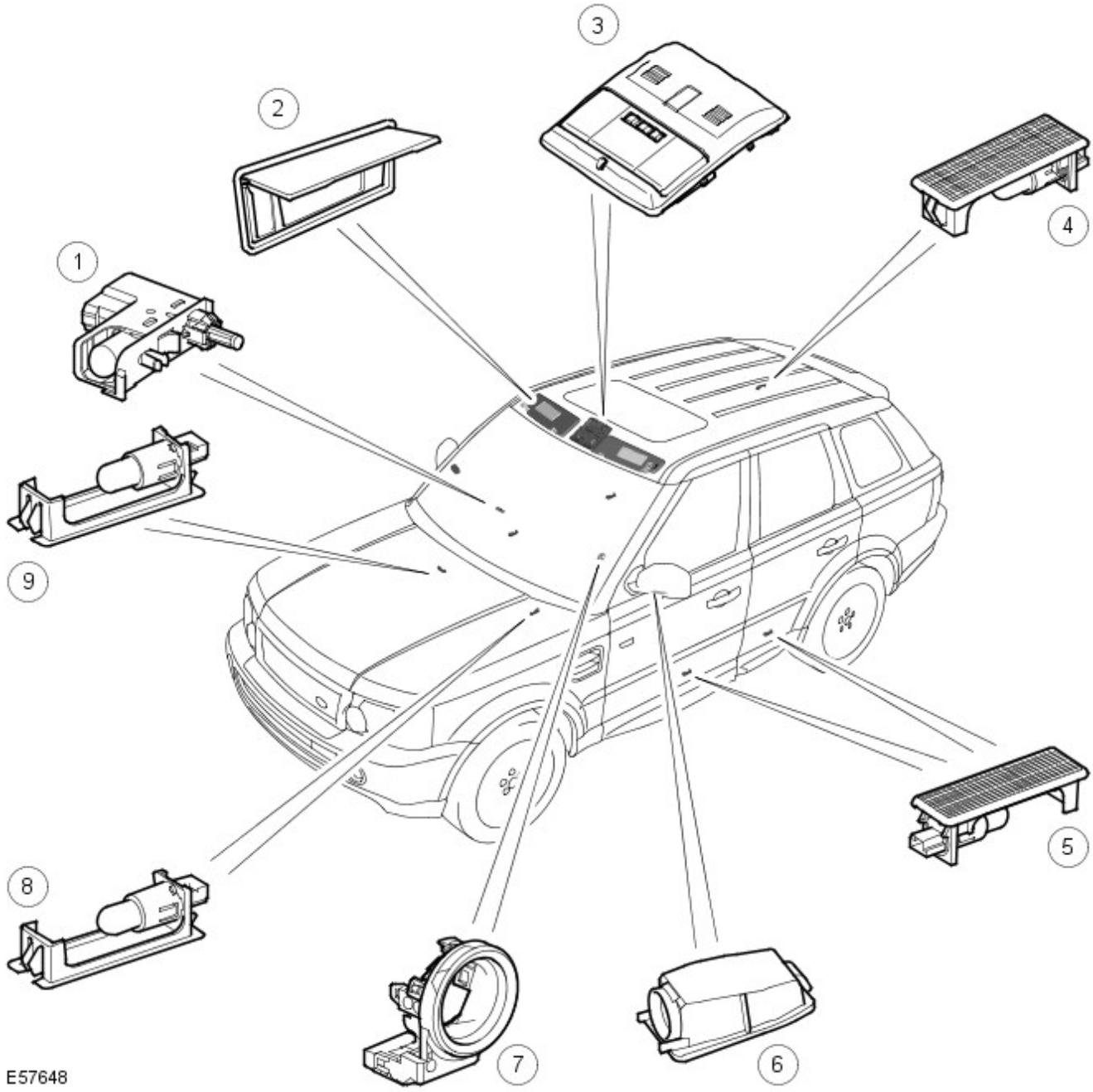
1. To install, reverse the removal procedure.

Published: 11-May-2011

Interior Lighting - Interior Lighting

Description and Operation

Interior Lighting Component Location



Item	Part Number	Description
1	-	Glove compartment lamp and switch
2	-	Vanity mirror lamps
3	-	Main interior lamp and map reading lamps
4	-	Luggage compartment lamp
5	-	Puddle lamps
6	-	Door mirror approach lamps (if fitted)
7	-	Ignition switch glow ring
8	-	Driver footwell lamp
9	-	Passenger footwell lamp

GENERAL

The interior lighting system comprises the following interior lamps:

- Main interior lamp
- Map reading lamps
- Glove compartment lamp
- Luggage compartment lamp

- Vanity mirror lamps
- Footwell lamps
- Puddle lamps
- Ignition switch illumination
- Door mirror approach lamps (if fitted).

Interior Bulb/Type Rating

The following table shows the bulbs used for the interior lighting system and their type and specification.

Bulb	Type	Rating
Main interior lamp	Capless	5W
Map reading lamps	Capless	5W
Luggage compartment lamp	Capless	5W
Vanity mirror lamps	Festoon	14V 0.1A (0.14W)
Door puddle lamps	Capless	5W
Lower instrument panel footwell lamps	Capless	5W
Glove compartment lamp	Festoon	5W
Door mirror approach lamps (if fitted)	Capless	5W

CENTRAL JUNCTION BOX

The Central Junction Box (CJB) is an integrated unit located behind the instrument panel on the passenger side of the bulkhead. The CJB contains fuses, relays and a number of microprocessors which control the power supply and functionality of the interior lighting system and other vehicle systems.

The interior lamps are controlled by the CJB and have two modes of operation: manual and automatic. In the manual mode the interior lamps can be switched on and off using the momentary and latching switches adjacent to each lamp or disabled completely using the same switches. In the automatic mode the interior lamp functionality is controlled by the CJB on receipt of various input signals.

Input signals

The CJB receives the following inputs which affect the operation of the interior lamps:

- Ignition switch
- Door switches
- Tailgate switch
- Glove compartment lamp switch
- Unlock signal
- Main interior lamp switch
- Map reading lamp switches
- Battery saver relay
- Vanity mirror lamp switches.

Circuit Protection

The CJB provides circuit protection for all interior lamp circuits. The following interior lamp circuits are protected by Field Effect Transistors (FETs):

- Main interior lamp
- Luggage compartment lamp
- Footwell lamps
- Ignition switch glow ring
- Door mirror approach lamps (if fitted)
- Puddle lamps.

The above components are protected by FETs which can detect overloads and short circuits. The FETs respond to heat generated by increased current flow caused by a short circuit. On a normal circuit this would cause the fuse to blow, rendering that component and circuit inoperative. The FETs respond to the heat increase and disconnect the supply to the affected circuit. When the fault is rectified or the FET has cooled, the FET will reset and operate the circuit normally.

The following interior lamps circuits are protected by Fuse 1P (10A) in the CJB:

- Glove compartment lamp
- Map reading lamps
- Vanity mirror lamps.

Interior Lamp Time-out

The interior lamps are controlled by a timer within the CJB which allows a 60 second delay period for the lamps to remain on after the ignition has been switched off or when the vehicle is unlocked. The following interior lamps are subject to the delay period:

- Main interior lamp
- Footwell lamps
- Luggage compartment lamp
- Puddle lamps
- Door mirror approach lamps (if fitted)
- Ignition switch glow ring.

The delay period can be adjusted to suit the driver's requirements, refer to following section for adjustment details.

The time-out delay is activated when the CJB receives one of the following signals:

- The CJB receives an unlock signal from the remote handset
- Ignition switch is moved from the crank position (III) or the ignition position (II) or to the auxiliary position (I) to the off position (0).

If a second occurrence of one of the above actions occurs within the time-out period, the timer will be reset and the delay period will start again.

The time-out delay is deactivated when the CJB receives one of the following signals:

- The CJB receives a lock signal from the remote handset
- Ignition switch is moved from the off position (0) or the auxiliary position (I) to the ignition position (II) or the crank position (III).
- The CJB receives a door opened signal (even if door is subsequently closed)

Interior Lamp Time-out Personalisation

The vehicle's customer personalisation options allow the driver or a Land Rover authorised dealer to adjust the interior lamp switch-off delay period to suit their specific requirements. The default delay period of 60 seconds can be adjusted to the following values; OFF, 10 seconds, 20 seconds, 40 seconds, 60 seconds, 120 seconds or 240 seconds.

With the vehicle stationary and the ignition switch in any position, pressing the trip computer button on the end of the left hand steering multifunction switch gives access to the Customer Personalisation options. Using the audio search buttons on the steering wheel the options can be scrolled through. The options are displayed in the message center. When the interior lamp delay option is reached the settings can be changed using the audio search buttons on the steering wheel. When the selection has been made, confirmation is performed by pressing the trip computer button.
For additional information, refer to: Information and Message Center (413-08, Description and Operation).

Battery Saver

The battery saver feature provides automatic shut-off of the interior lamps after a period of 15 minutes in order to prevent excessive drain on the battery. The lamp(s) fade off as described in the 'Interior Lighting' section that follows.

The battery saver feature is additional to the time-out delay feature and prevents battery drain when a lamp is accidentally left switched on, e.g. glove compartment left open.

When the ignition switch is moved from the ignition position (II) or the auxiliary position (I) to the off position (0), the CJB starts a timer which automatically switches off all interior lamps when the 15 minute period has expired.

Once the timer has expired and the lamps are off, any one of the following will 'wake-up' the battery saver and the interior lamps will function again. The timer will be restarted as soon as an input from one of the following is received by the CJB:

- Ignition switch position changed to auxiliary (I), ignition (II) or crank (III)
- Any door, including the tailgate is opened
- Unlock request is received
- Main interior lamp switch is pressed.

DELIVERY MODE

Delivery mode is set at the factory on vehicles to minimise battery drain. The mode enables the switching off of non-critical electrical components, including the interior lighting. The delivery mode feature can be cancelled by the dealer at pre-delivery inspection using T4.

CRASH ILLUMINATION

When a crash signal is received from the restraints control module, the CJB activates the interior lamps once the vehicle speed has reduced to 5 km/h (3.1 mph). The lamps remain on until they are switched off manually or the crash signal no longer exists.
For additional information, refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B, Description and Operation).

INTERIOR LIGHTING

Interior lighting is provided to enable the safe entry and departure from the vehicle for the driver and passengers in low ambient light conditions, without any manual switching of the interior lamps.

 NOTE: The term interior lamps also includes the door mirror approach lamps (where fitted).

When the interior lighting system switches the interior lamps on, the CJB ramps the lamps on up to full power over a period of 1.3 seconds. When the system switches the lamps off, after the time-out delay period has expired, the CJB fades the lamps off over a period of 2.6 seconds.

The interior lighting system will illuminate the interior lamps when one of the following events occurs:

- The CJB receives an unlock signal from the remote handset
- Any door is opened including the tailgate

- The ignition switch is turned from the ignition position (II) or the auxiliary position (I) to the off position (0).

The interior lighting system will turn off the interior lamps when one of the following events occurs:

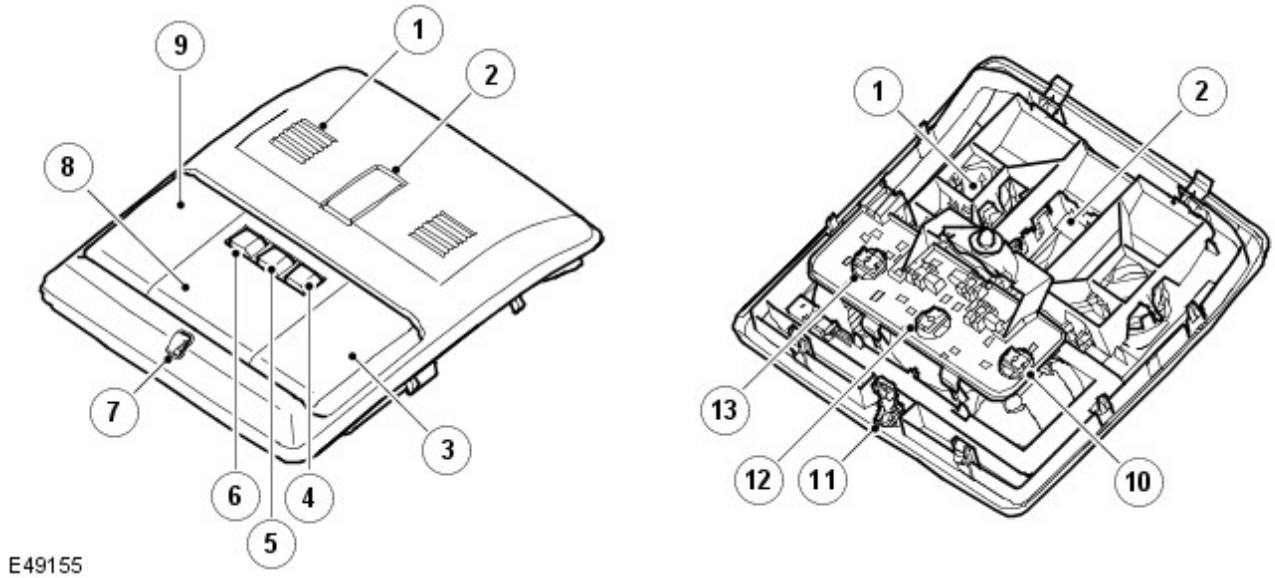
- Once the delay time-out timer has expired since the lamps were either activated or the last door is closed and the vehicle is not locked
- The ignition switch is in the off position (0) and an external lock (using the key or the remote handset) is requested with all doors closed
- The ignition switch is turned from the off position (0) or the auxiliary position (I) to the ignition position (II) with all doors closed
- The last door is closed and the vehicle is externally locked on receipt of an unlock request from the ignition key or a manual unlock using the ignition key in the drivers door lock when the time-out timer is still active
- The last door is closed when the ignition switch is in the ignition position II.

Hunting Mode

The interior lamps can be permanently switched off, preventing automatic operation when a door is opened or the vehicle is unlocked using the remote handset. This is achieved by pressing and holding the central switch of the main interior lamp for 5 seconds. All of the interior lamps, with the exception of the approach lamps, will remain off until the procedure is repeated.

MAIN INTERIOR LAMP ASSEMBLY

Main Interior Lamp



Item	Part Number	Description
1	-	Microphone
2	-	Sunroof switch
3	-	Map reading lamp
4	-	Map reading lamp switch
5	-	Main interior lamp switch
6	-	Map reading lamp switch
7	-	Waterfall lighting LED
8	-	Main interior lamp
9	-	Map reading lamp
10	-	Map reading lamp bulb holder
11	-	LED connector
12	-	Interior lamp bulb holder
13	-	Map reading lamp bulb holder

The main interior lamp assembly is common to all models. The lamp assembly has three switches; one for the main interior lamp and two for the map reading lamps.

The main interior lamp is located in a housing which can also contain the sunroof switch and/or the voice activation microphones, depending on specification.

The main interior lamp operates as part of the automatic interior lighting system. The map reading lamps only operate manually.

Both the interior and map reading lamps use 5W capless bulbs.

The main interior lamp unit also contains an LED for the waterfall lighting. Waterfall lighting is part of the lighting control switch functionality which also controls the brightness of the switch and instrument cluster display illumination. Waterfall lighting provides very limited illumination for the center of the fascia and the center console, when the vehicle is being driven, without affecting the driver's night vision.

Main Interior Lamp

The main interior lamp operates independently of the ignition switch position and can be operated automatically by one of a number of inputs to the CJB or manually by pressing the central switch on the lamp assembly. The switch is a momentary switch which is connected directly to and completes a circuit to the CJB. This completed circuit is a signal for the CJB to activate or deactivate the main interior lamp. The lamp will remain on until the switch is pressed a second time.

The interior lamps can be permanently switched off as previously described in 'Hunting Mode'.

Map Reading Lamps

The main interior lamp assembly contains map reading lamps which are located adjacent to the main interior lamp. The lamps are operated by two momentary switches on the lamp unit, which are located on either side of the main interior lamp switch.

GLOVE COMPARTMENT LAMP

The glove compartment lamp is located inside the glove compartment and contains an integral switch. The switch is operated when the glove compartment lid is opened and closed, switching the lamp on and off.

The glove compartment lamp uses a 5W festoon bulb.

PUDDLE LAMPS

Each door is fitted with a puddle lamp which illuminates the ground below the door when the door is opened. The puddle lamps are located in the bottom of the door trim panel on each front and rear door.

The puddle lamps are part of the automatic interior lighting functionality. Each lamp uses a 5W capless bulb.

FOOTWELL LAMPS

Two footwell lamps are located under the instrument panel, one on each side, to illuminate the footwell area. The footwell lamps are controlled by the CJB and operate as part of the interior lighting functionality.

The footwell lamps use a 5W capless bulb.

LUGGAGE COMPARTMENT LAMP

A luggage compartment lamp is located in the right hand 'D' post trim. The luggage compartment lamp is controlled by the CJB and operates as part of the interior lighting functionality.

The luggage compartment lamp uses a 5W capless bulb.

VANITY MIRROR LAMPS

Four vanity mirror lamps are fitted, two in each vanity mirror. The lamps are illuminated when the mirror cover is raised. The vanity mirror lamps operate independently of the ignition switch position and separately to the interior lighting functionality, although they are subject to the battery saver feature of the CJB.

The vanity mirrors use low voltage, 1.2W festoon type bulbs.

EXTERIOR DOOR MIRROR APPROACH LAMPS (if fitted)

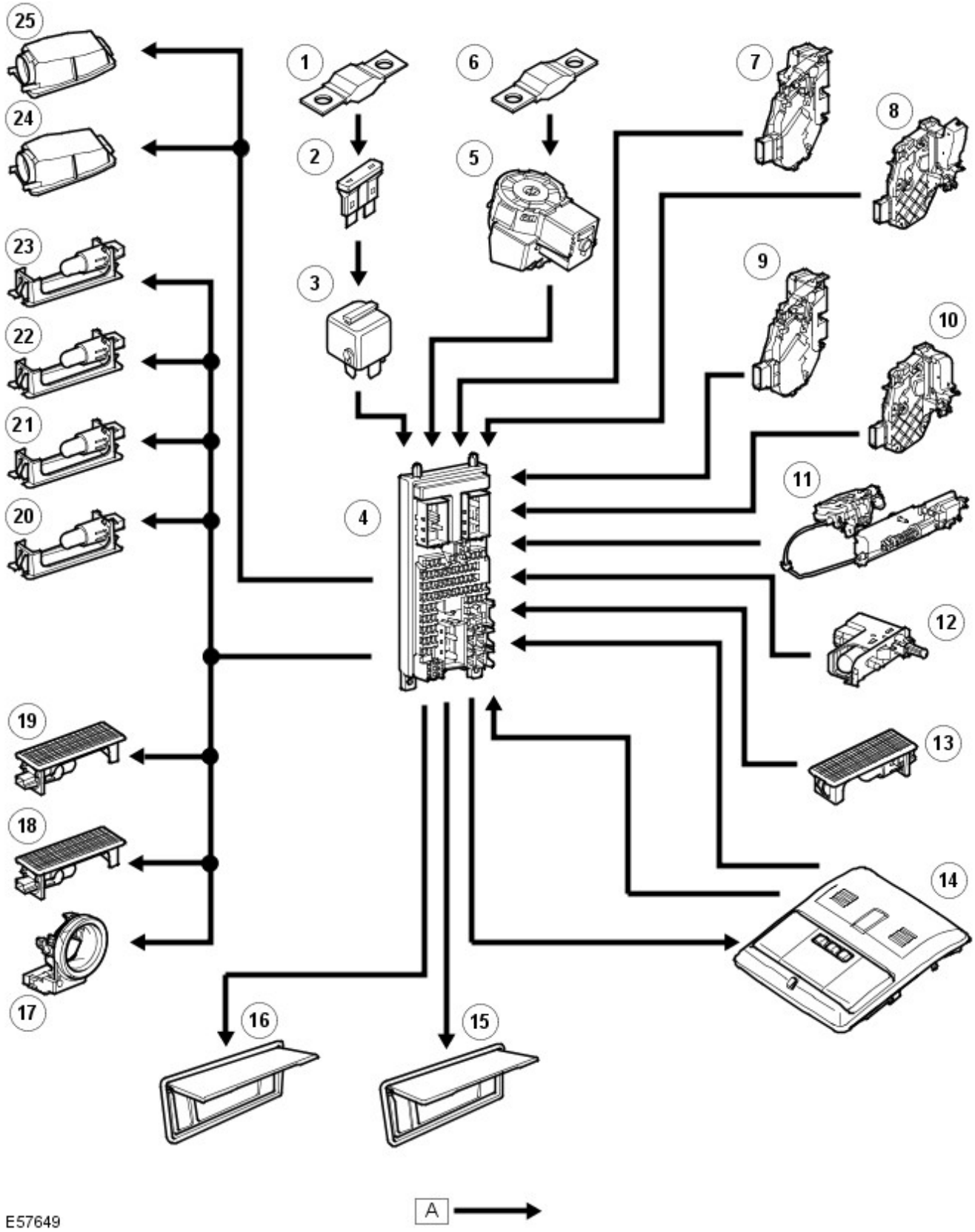
A door mirror approach lamp is located on the underside of each exterior door mirror. The approach lamps are controlled by the CJB and operate on receipt of an unlock request from the ignition key or a manual unlock using the ignition key in the drivers door lock.

The approach lamps remain illuminated for the same period as the interior lamps and are subject to the same interior lamp time-out as detailed earlier.

The approach lamps use 5W capless bulbs.

CONTROL DIAGRAM

 NOTE: **A** = Hardwired



Item	Part Number	Description
1	-	Fusible link 15E (40A) (Permanent 12V supply)
2	-	Fuse 1P (10A)
3	-	Battery saver relay (located inside CJB)
4	-	Central Junction Box (CJB)
5	-	Ignition switch
6	-	Fusible link 11E (30A)
7	-	Passenger door CDL motor
8	-	Driver's door CDL motor
9	-	RH rear door CDL motor
10	-	LH rear door CDL motor

11	-	Tailgate release motor
12	-	Glove compartment lamp
13	-	Luggage compartment lamp
14	-	Main interior lamp assembly
15	-	RH vanity mirror lamp
16	-	LH vanity mirror lamp
17	-	Ignition switch glow ring illumination
18	-	RH footwell lamp
19	-	LH footwell lamp
20	-	RH rear puddle lamp
21	-	LH rear puddle lamp
22	-	RH front puddle lamp
23	-	LH front puddle lamp
24	-	LH door mirror approach lamp
25	-	RH door mirror approach lamp

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Interior Lighting - Interior Lighting

Diagnosis and Testing

Principle of Operation

For a detailed description of the interior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual.
REFER to: Interior Lighting (417-02 Interior Lighting, 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. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
• Main interior lamp condition and installation • Map reading lamp(s) condition and installation • Vanity mirror lamp(s) condition and installation • Glovebox lamp condition and installation • Footwell lamp(s) condition and installation • Door mirror approach lamp(s) condition and installation • Puddle lamp(s) condition and installation • Luggage compartment lamp condition and installation	• Bulbs • Fuses • Battery Junction Box (BJB) • Central Junction Box (CJB) • Wiring harness • Loose or corroded connector(s) • Main interior lamp switch • Map reading lamp switches • Vanity mirror lamp switches • Glove compartment lamp switch • Waterfall lighting LED • Luggage compartment lamp switch

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Main interior lamp inoperative	NOTE: Operate the main interior lamp switch for 3 seconds to toggle automatic mode on/off • Main interior lamp toggled off • Bulb(s) failure • Fuse(s) blown • Main interior lamp circuit short circuit to ground, open circuit, high resistance • Main interior lamp switch fault	• Check that the main interior lamp is not toggled off • Check the bulb(s) condition • Check the fuse(s) • Refer to the electrical circuit diagrams and test the main interior lamp circuit for short circuit to ground, open circuit, high resistance • Test the operation of the main interior lamp switch
Waterfall lighting LED inoperative	• LED failure • Fuse(s) blown • LED circuit short circuit to ground, open circuit, high resistance	• Check the LED condition • Check the fuse(s) • Refer to the electrical circuit diagrams and test the LED circuit for short circuit to ground, open circuit, high resistance
Map reading lamp(s) inoperative	• Bulb(s) failure • Fuse(s) blown • Map reading lamp circuit short circuit to ground, open circuit, high resistance • Map reading lamp switch fault	• Check the bulb(s) condition • Check the fuse(s) • Refer to the electrical circuit diagrams and test the map reading lamp circuit for short circuit to ground, open circuit, high resistance • Test the operation of the map reading lamp switch
Vanity mirror lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Vanity mirror lamp circuit short circuit to ground, open circuit,	• Check the bulb condition • Check the fuse(s) • Refer to the electrical circuit diagrams and test the vanity mirror lamp circuit for short circuit to ground,

	high resistance • Vanity mirror lamp switch fault	open circuit, high resistance • Test the operation of the vanity mirror lamp switch
Glovebox lamp inoperative	• Bulb failure • Fuse(s) blown • Glovebox lamp circuit short circuit to ground, open circuit, high resistance • Glovebox lamp switch fault	• Check the bulb condition • Check the fuse(s) • Refer to the electrical circuit diagrams and test the glovebox lamp circuit for short circuit to ground, open circuit, high resistance • Test the operation of the glovebox lamp switch
Footwell lamp inoperative	• Bulb failure • Fuse(s) blown • Footwell circuit short circuit to ground, open circuit, high resistance	• Check the bulb condition • Check the fuse(s) • Refer to the electrical circuit diagrams and test the footwell circuit for short circuit to ground, open circuit, high resistance
Door mirror approach lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Door mirror approach lamp circuit short circuit to ground, open circuit, high resistance	• Check the bulb condition • Check the fuse(s) • Refer to the electrical circuit diagrams and test the door mirror approach lamp circuit for short circuit to ground, open circuit, high resistance
Puddle lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Puddle lamp circuit short circuit to ground, open circuit, high resistance	• Check the bulb condition • Check the fuse(s) • Refer to the electrical circuit diagrams and test the puddle lamp circuit for short circuit to ground, open circuit, high resistance
Luggage compartment lamp inoperative	• Bulb failure • Fuse(s) blown • Luggage compartment lamp circuit short circuit to ground, open circuit, high resistance • Luggage compartment lamp switch fault	• Check the bulb condition • Check the fuse(s) • Refer to the electrical circuit diagrams and test the luggage compartment lamp circuit for short circuit to ground, open circuit, high resistance • Test the operation of the luggage compartment lamp switch

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00 General Information, Description and Operation).

Published: 11-May-2011

Daytime Running Lamps (DRL) - Daytime Running Lamps (DRL)

Description and Operation

Daytime Running Lamps (DRL) use the full intensity low beam headlamps which are permanently illuminated when the vehicle is being driven. DRL are used in a number of markets and there are two systems to cover these markets.

DRL CANADIAN MARKET

DRL for this market use full intensity low beam headlamps. The side marker lamps, tail lamps and license plate lamps will be on, but instrument cluster illumination will be off. DRL are active when the following parameters are met:

- Parking brake is off on vehicles with manual transmission or PARK is not selected on vehicles with automatic transmission
- Ignition switch is in the ignition position (II)
- The Central Junction Box (CJB) receives an engine running signal
- The lighting control switch is in the off or side lamps position.

NOTES:

 If the lighting control switch is moved to the headlamp position, DRL are deactivated and normal side lamp and headlamp functionality is operational.

 Adaptive Front lighting System (AFS) (where fitted) is non-functional when the DRL are active.

 When DRL are active, the headlamp flash function using the left hand steering column multifunction switch will operate normally. The high beam headlamp function using the left hand steering column stalk switch will be deactivated.

When the parking brake is applied on manual transmission vehicles or the selector lever is in the PARK position on automatic transmission vehicles, DRL are turned off. This is to reduce battery discharge during long periods of engine idling in cold climate conditions. When the parking brake is released or the selector lever is moved from the PARK position, normal DRL functionality is restored.

DRL DENMARK, HOLLAND, NORWAY, SWEDEN, FINLAND & POLAND

DRL for these markets use full intensity low beam headlamps. Side lamps and license plate lamps will be on, but instrument cluster illumination will be off. DRL are active when the following parameters are met:

- Ignition switch is in the ignition position (II)
- The CJB receives an engine running signal
- The lighting control switch is in the off position.

 NOTE: When DRL are active, the headlamp flash function using the left hand steering column multifunction switch will operate normally. The high beam headlamp function using the left hand steering column stalk switch will be deactivated.

If the lighting control switch is moved to the side lamp or headlamp positions, DRL are deactivated and normal side lamp and headlamp functionality is operational.

Published: 08-Feb-2012

Daytime Running Lamps (DRL) - Daytime Running Lamps (DRL)

Diagnosis and Testing

Principles of Operation

For a detailed description of the Daytime Running Lamps (DRL) and operation, refer to the relevant Description and Operation section.
REFER to: Daytime Running Lamps (DRL) (417-04 Daytime Running Lamps (DRL), Description and Operation).

Inspection and Verification

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

Visual Inspection

Mechanical	Electrical
• Headlight assembly for damage/water ingress • LED assembly • Exterior light switch damaged/stuck	• Fuse(s) • Daytime running lights wiring harness • Electrical connector(s) • Central Junction Box (CJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom chart

Symptom	Possible Causes	Action
Daytime running lights inoperative	• Daytime running lights working as specified or within system limitations • Daytime running lights not configured correctly • NOTE: Signal supply, ground supply and power supply circuits Daytime running lights circuit short to ground, short to power, open circuit • Daytime running light assembly internal failure	• Refer to the relevant Description and Operation section for information regarding correct operation. REFER to: Daytime Running Lamps (DRL) (417-04 Daytime Running Lamps (DRL), Description and Operation). • Re-configure the central junction box as required. Update the car configuration file as required. • Refer to the relevant circuit diagram and check daytime running lights circuit short to ground, short to power, open circuit and repair as required. Check for related DTCs and refer to the relevant DTC index. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00 General Information, Description and Operation). • NOTE: Part of headlight assembly Check and install a new daytime running light assembly as required.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00 General Information, Description and Operation).

Published: 11-May-2011

Module Communications Network -

Torque Specifications

Description	Nm	lb-ft
Central junction box bracket retaining nuts	10	7
Central junction box bracket retaining bolts	25	18
Engine compartment ground cable nuts	25	18
Body panel ground cable nuts	25	18
Vehicles with auxiliary heating - Heater pipes to body panel nut	10	7
Wiring harness to plenum chamber nuts	4	3
Vehicles with auxiliary climate control - A/C lines to body panel nut	10	7
Battery ground cable to body nut	25	18
Battery junction box retaining bolt	6	4
Ground cables to the lower A-pillar nut	10	7
Battery positive cable to the battery junction box (BJB) nut	25	18

Published: 15-Nov-2012

Module Communications Network - Communications Network

Diagnosis and Testing

Principles of Operation

For a detailed description of the Communications Network, refer to the relevant Description and Operation sections in the workshop manual.

Inspection and Verification

CAUTIONS:

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

 Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

1. Verify the customer concern
2. Visually inspect for obvious signs of damage and system integrity

Visual Inspection

Electrical
• Fuses (refer to electrical guide) • Wiring harness • Correct engagement of electrical connectors • Loose or corroded connections • Routing of fibre optic harnesses • Correct engagement of optical connectors • Correct placement of optical connectors (ring order) • Correct assembly of optical connectors (backout, etc) • Damage to fibre (chafing, abrasion, kinking, cuts, etc)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index

Symptom Chart

Symptom	Possible Causes	Action
MOST network fault - Touch Screen (TS) soft keys greyed out and inoperative	• MOST ring broken • Control module on MOST network power or ground circuit open circuit, high resistance • Control module on MOST network internal failure	• GO to Pinpoint Test B.
MOST network fault - Touch Screen (TS) blank	• Touch Screen (TS) power or ground circuit open circuit, high resistance • Wake up signal not received by the Touch Screen (TS) • Touch Screen (TS) internal failure	• GO to Pinpoint Test H.

Controller Area Network (CAN)

Control Module Connections to the CAN Harness

Control modules are connected to the CAN harness either in a 'loop' or 'spur' configuration. In the 'loop' type configuration the CAN harness loops into the module (via two connector pins) and then loops out of the module (via another two connector pins). In the 'spur' type configuration, a harness spur is spliced into the main 'backbone' of the CAN harness and the module is connected to the harness spur via two connector pins.

CAN Harness Architecture

For a detailed description of the CAN Networks and architecture, refer to the relevant Description and Operation section in the Workshop Manual.

CAN Network Integrity Tests

If a control module is suspected of non-communication, the Network Integrity test application available on the manufacturer approved diagnostic system can be used to confirm if communication is possible between the control modules on the vehicle and the manufacturer approved diagnostic system (via the J1962 diagnostic connector). The results from the test can be used to determine if either a single module or multiple modules are failing to communicate.

CAN Terminating Modules

If the Network Integrity test indicates that one or more module on one of the CAN networks (HS or MS) are failing to communicate, there are several checks that can be made. The first step is to identify if both of the CAN terminating modules on each individual CAN Bus are communicating. If both CAN terminating modules for each individual CAN Bus are communicating (identified via the Network Integrity test), then it can be confirmed that the main 'backbone' of the CAN harness is complete. The main 'backbone' of the CAN harness consists of all the modules connected to the CAN harness via a 'loop' configuration and also includes the two terminating modules.

Communication with both CAN terminating modules via the Network Integrity test confirms the physical integrity of the main 'backbone' of the CAN harness (and the harness spur to the J1962 diagnostic connector). This means that there is no requirement to check the resistance of the CAN Network. This is because the standard check for 60 ohms across the CAN High and CAN Low lines will not provide any additional information regarding the physical condition of the CAN harness, beyond what has already been determined from the Network Integrity test.

Non-Communication of a Terminating Module

If a Network Integrity test reveals a terminating module is failing to communicate it can indicate a break in the main 'backbone' of the CAN harness. The first checks should always be to confirm the power and ground supplies to the non-communicating module are correct. Providing these are correct, the resistance between the CAN High and CAN Low lines at the J1962 connector can be checked to determine the integrity of the main 'backbone' of the CAN harness. After disconnecting the battery a reading of 120 ohms would indicate an open circuit in the main 'backbone' of the CAN harness. Alternatively, a reading of 60 ohms would indicate that there is no open circuit fault with the main 'backbone' of the CAN harness.

It is worth noting that even if one of the terminating modules is disconnected from the CAN harness, communications between the modules still connected may still be possible. Therefore communication between the manufacturer approved diagnostic system and the connected modules may also be possible.

Locating CAN Harness Open Circuits

In the case where multiple modules, including a terminating module, are failing to communicate, having first confirmed the power and ground supplies are correct, the approximate location of the open circuit can be identified from analysis of the Network Integrity test results and reference to the relevant CAN network circuit diagrams. For example, if an open circuit existed in a certain position on the CAN harness, any module positioned on the Network between the J1962 connector and the open circuit should return a response during the Network Integrity test. No responses would be returned from any modules past the open circuit fault in the Network.

CAN Harness 'Spur' Type Configuration Circuits

If, after the initial checks (Network Integrity test using the manufacturer approved diagnostic system, and power and ground supplies to the module have been checked and confirmed as correct), a module that is connected to the CAN harness via a 'spur' type configuration is suspected of not communicating, then the physical integrity of the CAN harness 'spur' can be checked.

This is most easily undertaken by individually checking the continuity of the CAN High and CAN Low lines between the non-communicating module connector (with the module disconnected) and the J1962 diagnostic connector.

'Lost Communications' DTCs

As well as the methods described so far in this document, which can be used to determine the location of an open circuit in the CAN harness, 'Lost Communications' DTCs can also be used for this purpose. Lost communication DTCs mean that a module is not receiving CAN information from another module.

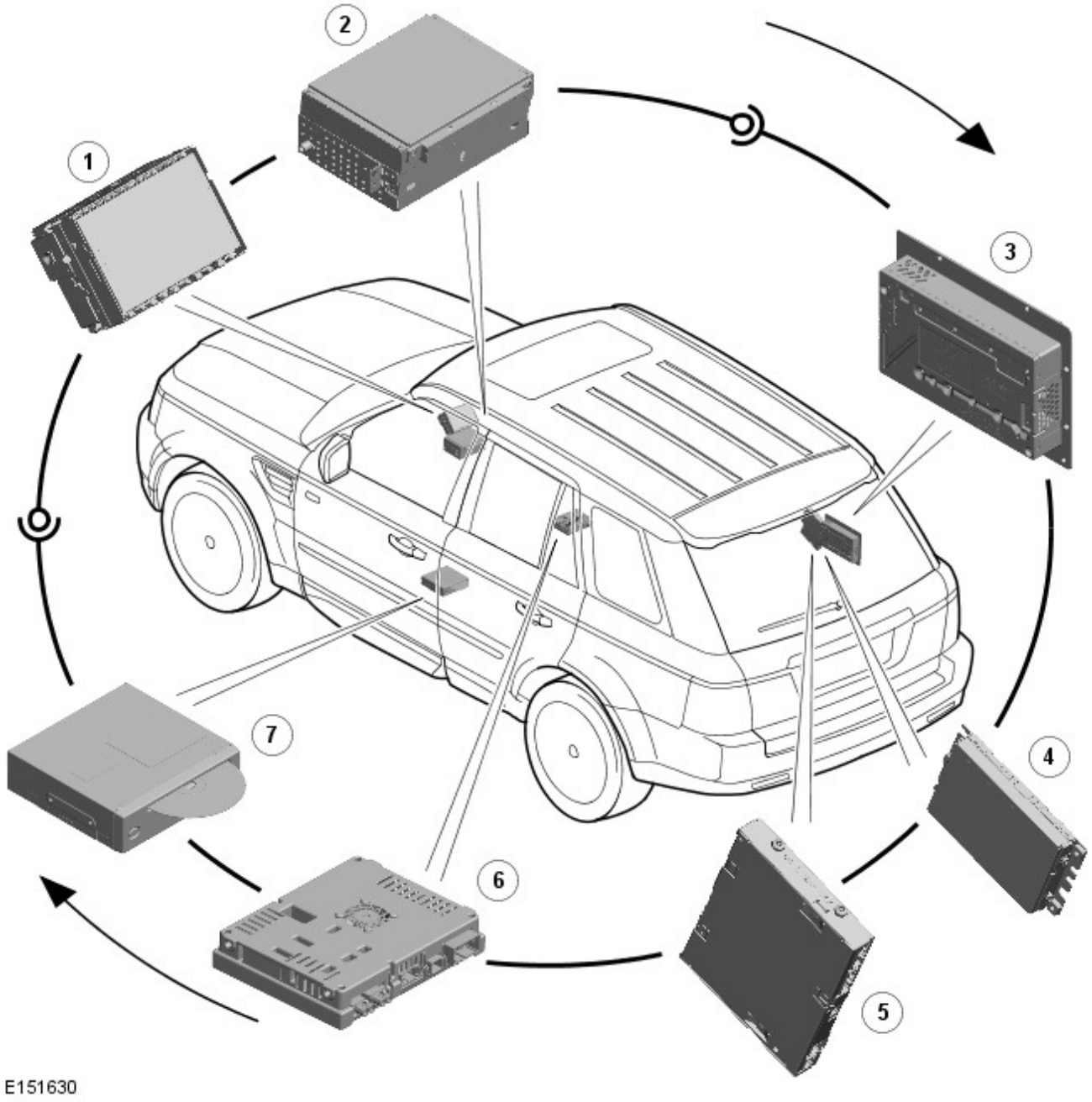
For example, if a global DTC read were to be carried out, only DTCs stored in the modules that the manufacturer approved diagnostic system could communicate with would be displayed. If there was an open circuit fault in a certain position on the CAN harness, the modules that could display DTCs would all be prior to the open circuit on the Network, and these modules should display 'Lost Communications' DTCs with all the modules located on the Network past the open circuit fault.

'Bus off' DTCs

The references to bus and its condition refer to the network concerned and the modules on that network.

If a module logs a 'Bus Off' DTC, it means that the module has detected CAN transmission errors and has disabled it's own CAN transmissions and disconnected itself from the network in an attempt to allow the rest of the network to function. At this point the 'Bus Off' DTC is set. A common cause of 'Bus Off' DTCs can be a short circuit in the CAN network.

Media Oriented Systems Transport (MOST)



E151630

NOTE: Items 1, 2 and 3 will always be present. The remaining items are optional and/or market specific.

Item	Description
1	Touch Screen (TS)
2	Integrated Audio Module (IAM)
3	Audio Amplifier Module (AAM)
4	Digital Radio Control Module (DRCM)
5	Rear Seat Entertainment Control Module (RSECM)
6	TV Control Module (TVCM)
7	Navigation Control Module (NCM) - Japan

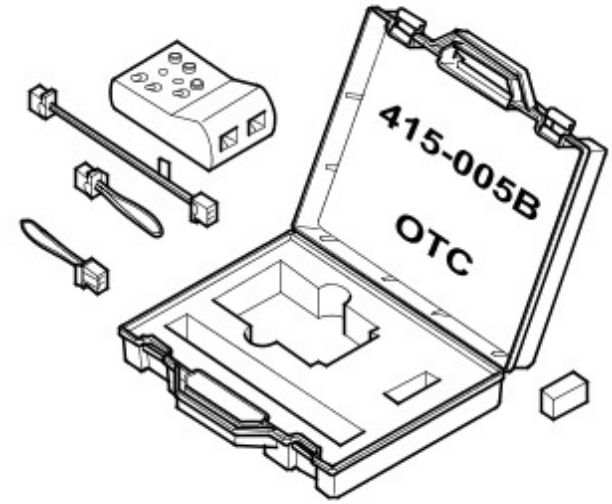
Overview

The basic guidelines are covered in the description and operation section, such as not attempting to repair fibre optic cables, but additional precautions include:

- Do not touch the exposed ends of the optical fibres (grease from skin can contaminate the fibre)
- Whenever the fibre optic cable is disconnected, cover the connectors to prevent dust contamination
- Do not expose the fibre optic cable to heat
- Do not bend the fibre optic cable through less than a 25 mm (one inch) radius
- Do not use laser pens to test the fibre optic cable's ability to pass light

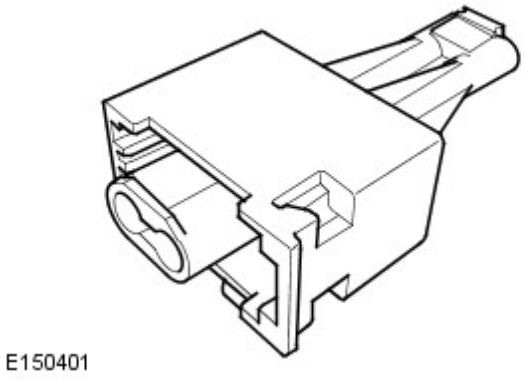
MOST Diagnostic Tools

There are two dedicated tools for testing the MOST system:



E150402

MOST tester: The MOST tester is connected to the MOST network in place of a control module. It will confirm receipt of any existing MOST signal and transmit it to the next control module on the network. Perform the following tests to validate the operation of the MOST tester. GO to Pinpoint Test A.



E150401

MOST prism: The MOST prism is connected in the same way as the MOST tester but will simply reflect any existing signal onward to the next control module. Using the MOST prism before or after a long run of harness may cause a ring break as a good signal may be too weak after travelling the extended distance. Also, the MOST prism will pass light in either direction so will not detect reversed MOST terminals elsewhere in the network. For these reasons, the MOST tester is the preferred tool and should be used unless limited access does not permit it

MOST Ring Break Indication

A ring break in the MOST network is indicated by the Touch Screen (TS) soft keys being greyed out and inoperative. Possible causes of ring breaks are listed in the symptom chart

Pinpoint Tests

PINPOINT TEST A : MOST TESTER TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: MOST TESTER BATTERY TEST	
	1 Set the MOST tester power switch to 'on'
	Is the power LED illuminated? **Yes** Test passed. GO to A2. **No** Test failed. Install a new battery into the MOST tester. GO to A1.
A2: 2+0 INPUT/OUTPUT TEST	
NOTES: '2+0' indicates that the loop harness connector consists of 2 fibre optic terminals and 0 electrical terminals.	
The MOST tester may continue to emit a tone or illuminate the LED after the test switch is released. This does not indicate a fault.	
	1 Set the MOST tester power switch to 'on'
	2 Set the connector selector switch to '2+0'
	3 Set the indication switch to 'beep' or 'LED'

	4	Remove the covers from the MOST tester 2+0 connector and the 2+0 loop harness connector
	5	Connect the 2+0 loop harness to the MOST tester 2+0 connector
	6	Operate the test switch and check the MOST tester beep/LED
	Did the MOST tester emit a tone or illuminate the LED? **Yes** Test passed. GO to A3. **No** Test failed. MOST tester or 2+0 harness fault	
A3: 2+4 INPUT/OUTPUT TEST		
NOTES: '2+4' indicates that the loop harness connector consists of 2 fibre optic terminals and 4 electrical terminals. The MOST tester may continue to emit a tone or illuminate the LED after the test switch is released. This does not indicate a fault.		
	1	Set the MOST tester power switch to 'on'
	2	Set the connector selector switch to '2+4'
	3	Set the indication switch to 'beep' or 'LED'
	4	Remove the covers from the MOST tester 2+4 connector and the 2+4 loop harness connector
	5	Connect the 2+4 loop harness to the MOST tester 2+4 connector
	6	Operate the test switch and check the MOST tester beep/LED
	Did the MOST tester emit a tone or illuminate the LED? **Yes** Test passed. GO to A4. **No** Test failed. MOST tester or 2+4 harness fault	
A4: ADAPTER HARNESS AND PRISM TEST		
NOTE: The MOST tester may continue to emit a tone or illuminate the LED after the test switch is released. This does not indicate a fault.		
	1	Set the MOST tester power switch to 'on'
	2	Set the connector selector switch to '2+0'
	3	Set the indication switch to 'beep' or 'LED'
	4	Remove the covers from the MOST tester 2+0 connector, the prism, and the adapter harness connectors
	5	Connect the adapter harness to the MOST tester 2+0 connector
	6	Connect the prism to the adapter harness
	7	Operate the test switch and check the MOST tester beep/LED
	Did the MOST tester emit a tone or illuminate the LED? **Yes** Test passed **No** Test failed. MOST tester, adapter harness or prism fault	

PINPOINT TEST B : MOST NETWORK INITIAL TESTS		
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**	
B1: MOST NETWORK INITIAL TEST 1		
NOTE: When connecting the MOST tester, use the 2+0 or 2+4 socket as appropriate and set the connector selector switch to match the socket in use		
	1	Switch on the audio/video system
	2	Disconnect the MOST harness connector from the Audio Amplifier Module (AAM)
	3	Set the MOST tester power switch to 'on'
	4	Connect the MOST harness connector to the MOST tester
	5	Check the Touch Screen (TS) for indication of a MOST network fault
	Has the MOST network been restored? **Yes** The disconnected control module is causing the MOST network fault. GO to Pinpoint Test E. **No** The disconnected control module is not causing the MOST network fault. GO to B2.	
B2: MOST NETWORK INITIAL TEST 2		
	1	Check the MOST tester beep/LED
	Did the MOST tester emit a tone or illuminate the LED? **Yes** MOST signal received. The MOST network fault is located downstream of the MOST tester. GO to Pinpoint Test C. **No** MOST signal not received. The MOST network fault is located upstream of the MOST tester. Disconnect the MOST harness connector from the MOST tester and reconnect it to the control module. GO to Pinpoint Test D.	

PINPOINT TEST C : MOST NETWORK DOWNSTREAM TESTS

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: MOST NETWORK DOWNSTREAM TEST 1	
	1 Refer to the electrical circuit diagrams and identify the succeeding control module on the MOST network
	Is this control module the Touch Screen (TS)? **Yes** GO to Pinpoint Test F. **No** GO to C2.
C2: MOST NETWORK DOWNSTREAM TEST 2	
	1 Disconnect the MOST harness connector
	2 Direct the MOST harness connector at a suitable surface and check for the presence of red light
	Is red light present? **Yes** Disconnect the MOST harness connector from the MOST tester and reconnect it to the control module. GO to C3. **No** The fault is in the MOST harness between the MOST tester and the disconnected MOST harness connector. Install a new MOST harness as necessary
C3: MOST NETWORK DOWNSTREAM TEST 3	
NOTE: When connecting the MOST tester, use the 2+0 or 2+4 socket as appropriate and set the connector selector switch to match the socket in use	
	1 Connect the succeeding MOST harness connector to the MOST tester
	2 Check the Touch Screen (TS) for indication of a MOST network fault
	Has the MOST network been restored? **Yes** The disconnected control module is causing the MOST network fault. GO to Pinpoint Test E. **No** The disconnected control module is not causing the MOST network fault. GO to C1.

PINPOINT TEST D : MOST NETWORK UPSTREAM TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: MOST NETWORK UPSTREAM TEST 1	
	1 Disconnect the MOST harness connector from the Integrated Audio Module (IAM)
	2 Direct the MOST harness connector at a suitable surface and check for the presence of red light
	Is red light present? **Yes** The MOST network fault is in the Integrated Audio Module (IAM) or the MOST harness to the succeeding control module. GO to D2. **No** The MOST network fault is located upstream of the Integrated Audio Module (IAM). Reconnect the MOST harness connector to the Integrated Audio Module (IAM). GO to Pinpoint Test G.
D2: MOST NETWORK UPSTREAM TEST 2	
NOTE: When connecting the MOST tester, use the 2+0 or 2+4 socket as appropriate and set the connector selector switch to match the socket in use	
	1 Connect the MOST harness connector to the MOST tester
	2 Check the Touch Screen (TS) for indication of a MOST network fault
	Has the MOST network been restored? **Yes** The disconnected control module is causing the MOST network fault. GO to Pinpoint Test E. **No** The fault is in the MOST harness between the MOST tester and the succeeding control module. Install a new MOST harness as necessary

PINPOINT TEST E : CONTROL MODULE TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CONTROL MODULE TEST 1	
NOTES: When connecting the MOST tester, use the 2+0 or 2+4 socket as appropriate and set the connector selector switch to match the socket in use	
The MOST tester may continue to emit a tone or illuminate the LED after the test switch is released. This does not indicate a fault.	
	1 Connect the MOST tester to the relevant control module using the adapter harness
	2 Operate the test switch and check the MOST tester beep/LED
	Did the MOST tester emit a tone or illuminate the LED? **Yes** MOST signal received. Tests inconclusive. Reconnect the MOST harness connector to the control

	module and confirm that the MOST network fault is still present. Repeat the tests from the beginning. GO to Pinpoint Test B. **No** GO to E2.
E2: CONTROL MODULE TEST 2	
	1 Refer to the electrical circuit diagrams and test the relevant control module power and ground circuits for open circuit, high resistance
	Are the power and ground circuits within specification? **Yes** GO to E3. **No** Repair the power and/or ground circuit
E3: CONTROL MODULE TEST 3	
	1 Reconnect the MOST harness to the control module
	2 Check the Touch Screen (TS) for indication of a MOST network fault
	Has the MOST network been restored? **Yes** Tests inconclusive. Repeat the tests from the beginning. GO to Pinpoint Test B. **No** Install a new control module

PINPOINT TEST F : MOST NETWORK FINAL DOWNSTREAM TEST	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: MOST NETWORK FINAL DOWNSTREAM TEST 1	
NOTES: When connecting the MOST tester, use the 2+0 or 2+4 socket as appropriate and set the connector selector switch to match the socket in use	
The MOST tester may continue to emit a tone or illuminate the LED after the test switch is released. This does not indicate a fault.	
	1 Disconnect the MOST harness connector from the MOST tester
	2 Reconnect the MOST harness connector to the control module
	3 Disconnect the MOST harness connector from the Touch Screen (TS)
	4 Connect the MOST harness connector to the MOST tester
	5 Operate the test switch and check the MOST tester beep/LED
	Did the MOST tester emit a tone or illuminate the LED? **Yes** GO to F2. **No** The fault is in the harness between the Touch Screen (TS) and the preceeding control module. Install a new MOST harness as necessary
F2: MOST NETWORK FINAL DOWNSTREAM TEST 2	
	1 Disconnect the MOST harness connector from the MOST tester
	2 Reconnect the MOST harness connector to the Touch Screen (TS)
	3 Check the Touch Screen (TS) for indication of a MOST network fault
	Has the MOST network been restored? **Yes** Tests inconclusive. Repeat the tests from the beginning. GO to Pinpoint Test B. **No** GO to Pinpoint Test H.

PINPOINT TEST G : MOST NETWORK FINAL UPSTREAM TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: MOST NETWORK FINAL UPSTREAM TEST 1	
	1 Disconnect the MOST harness connector from the Touch Screen (TS)
	2 Direct the Touch Screen (TS) at a suitable surface and check for the presence of red light
	Is red light present? **Yes** The fault is in the MOST harness between the Touch Screen (TS) and the succeeding control module. Install a new MOST harness as necessary **No** GO to Pinpoint Test H.

PINPOINT TEST H : TOUCH SCREEN (TS) TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: TOUCH SCREEN (TS) TEST 1	
	1 Using the manufacturer approved diagnostic system, check the Touch Screen (TS) for related DTCs
	Is communication possible between the manufacturer approved diagnostic system and the Touch Screen (TS)?

	Yes Refer to the relevant DTC index **No** GO to H2.
H2: TOUCH SCREEN (TS) TEST 2	
	1 Refer to the electrical circuit diagrams and test the Touch Screen (TS) power and ground circuits for open circuit, high resistance
	Are the power and ground circuits within specification? **Yes** GO to H3. **No** Repair the power and/or ground circuit
H3: TOUCH SCREEN (TS) TEST 3	
	1 Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and test the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
	Is the medium speed CAN bus within specification? **Yes** Install a new Touch Screen (TS) **No** Repair the medium speed CAN bus circuit

DTC Index

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

Diagnostic Trouble Code (DTC) Index - DTC: Audio Amplifier Control Module (AAM) (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Digital Radio Control Module (DRCM) (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Integrated Audio Module (IAM) - High Line (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Rear Seat Entertainment Control Module (RSECM) (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Satellite Radio Control Module (SRCM) (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: TV Control Module (TVCM) (Description and Operation),
Diagnostic Trouble Code Index: Touch Screen - DTC: (TS) (Description and Operation).

Published: 11-May-2011

Module Communications Network - Battery Junction Box (BJB) 5.0L

Removal and Installation

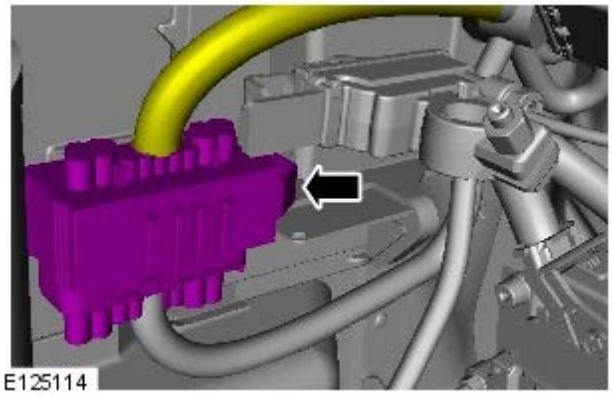
Removal

NOTES:

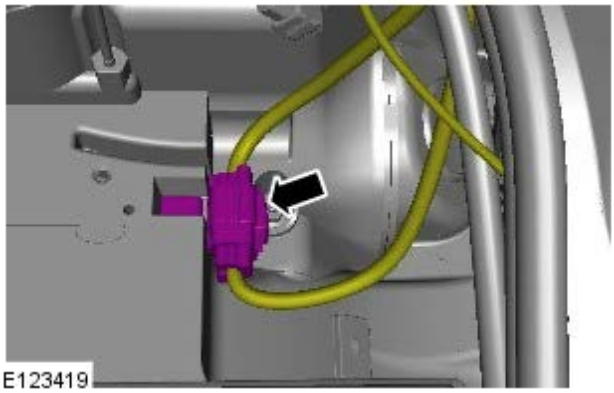
Some variation in the illustrations may occur, but the essential information is always correct.

Removal steps in this procedure may contain installation details.

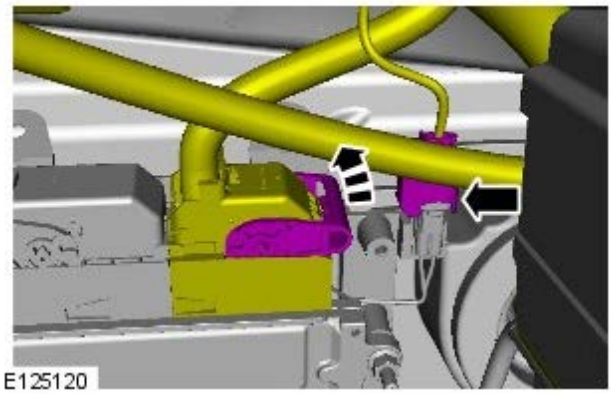
1. For additional information, refer to: Battery (414-01, Removal and Installation).
2. For additional information, refer to: Air Cleaner LH (303-12, Removal and Installation).
3. For additional information, refer to: Air Cleaner RH (303-12, Removal and Installation).
4.



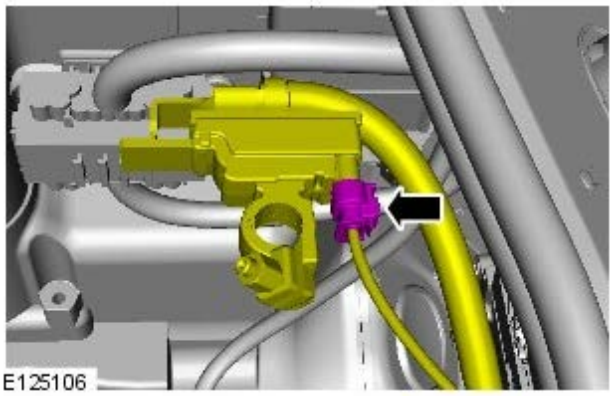
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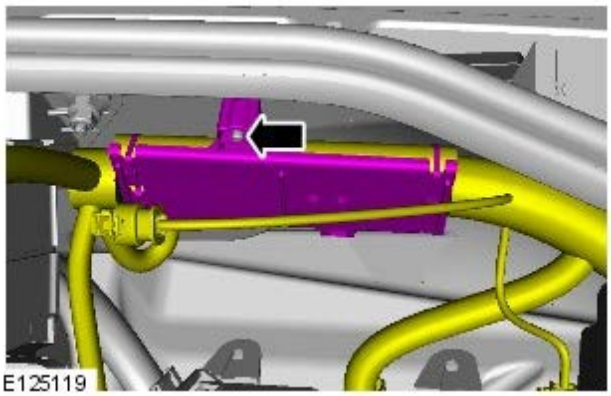
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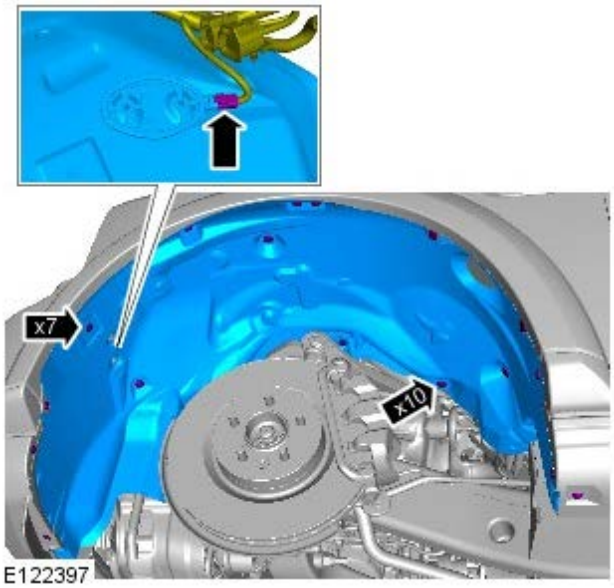


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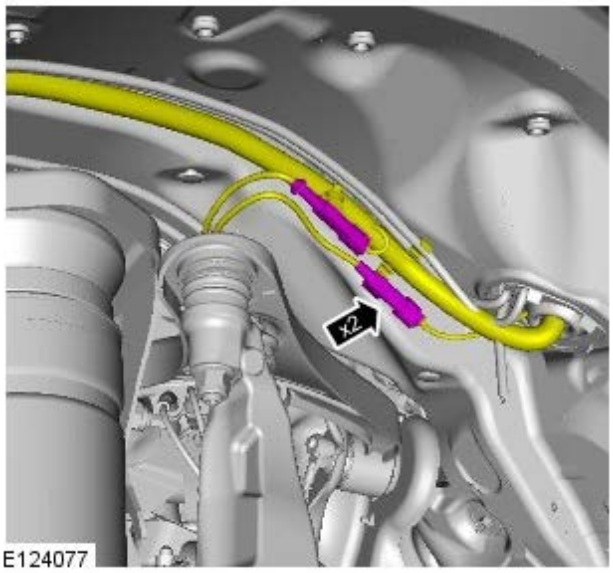


9. Remove the front LH road wheel and tire.

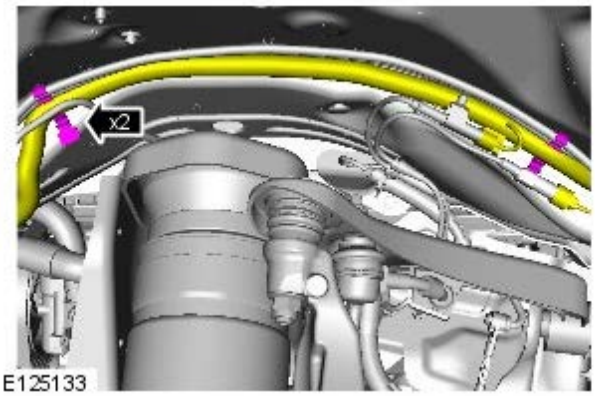
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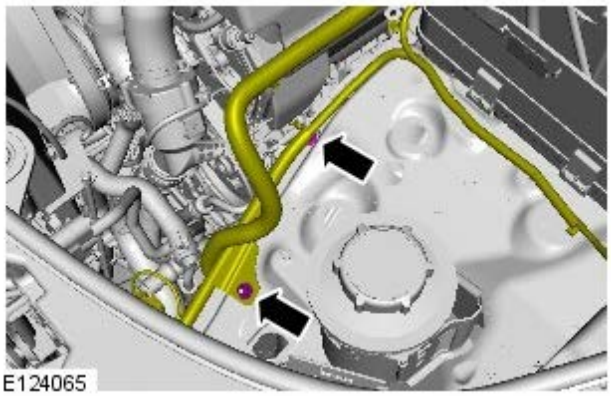
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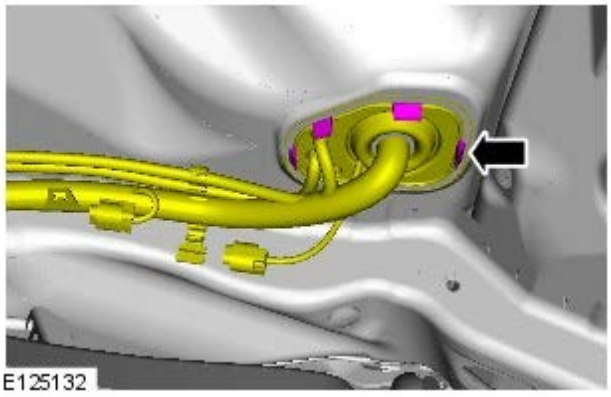
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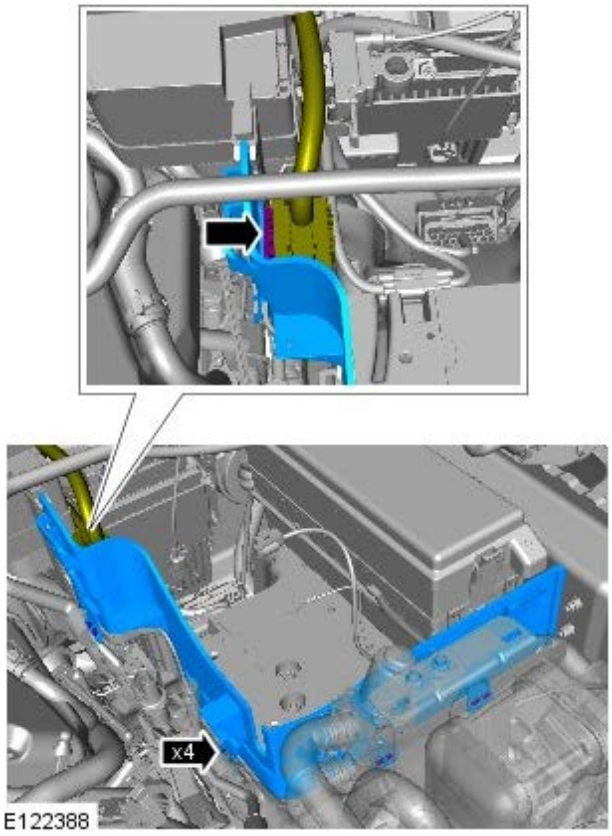
13. TORQUE: 10 Nm



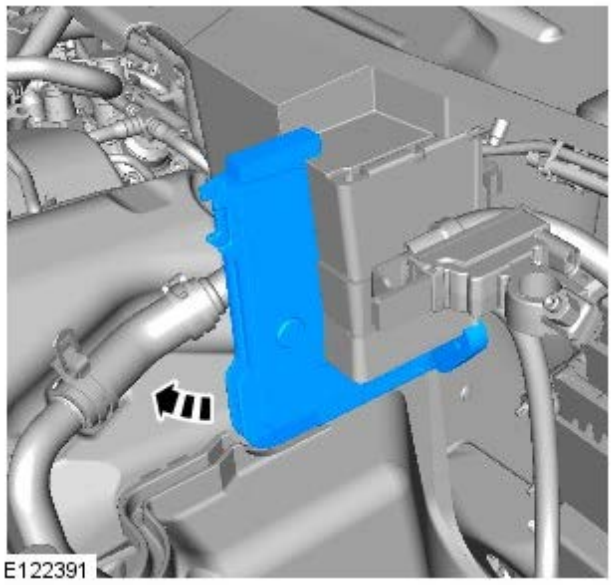
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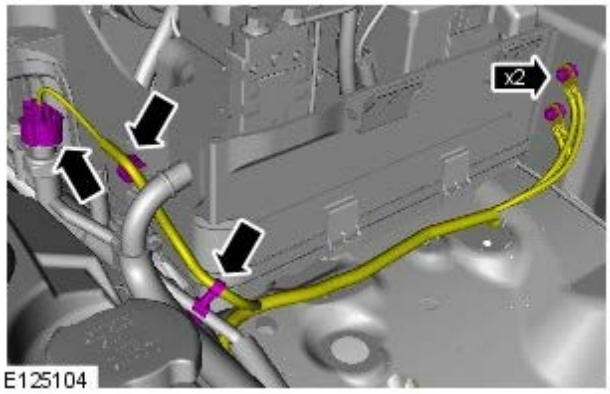
15. NOTE: RHD illustration shown, LHD is similar.



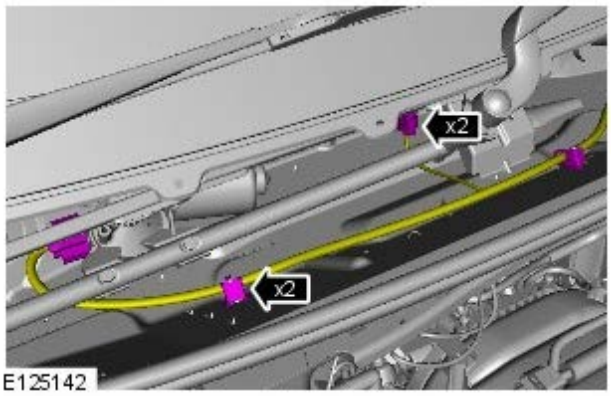
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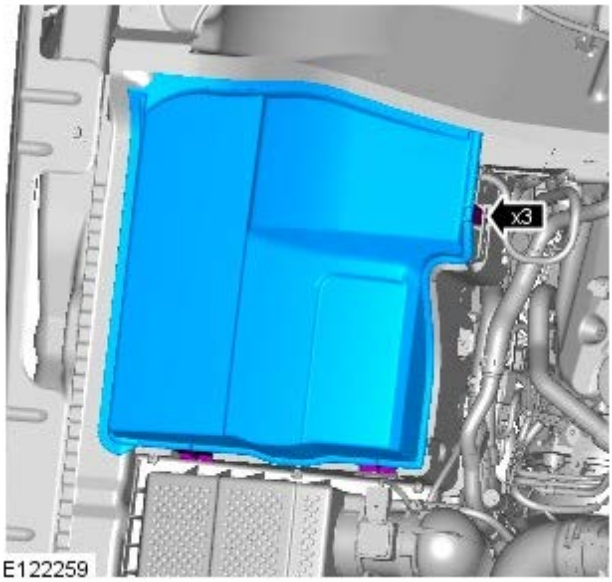
17. TORQUE: 12 Nm



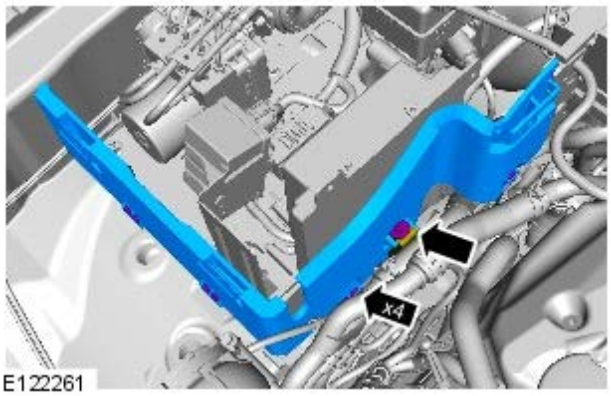
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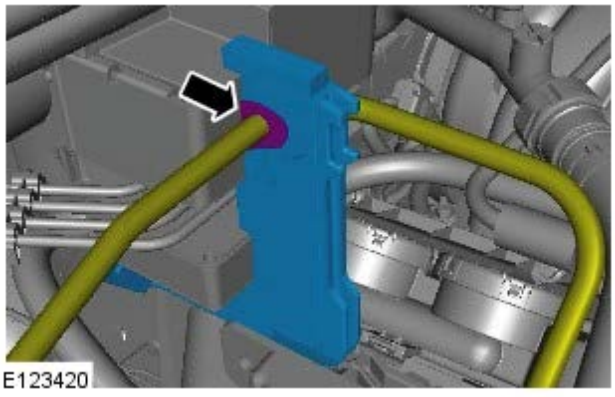
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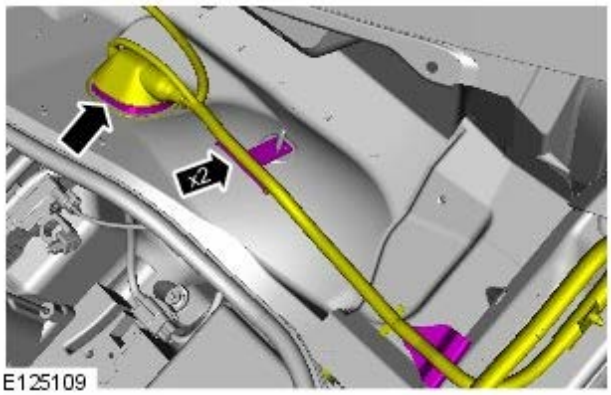
20. TORQUE: 10 Nm



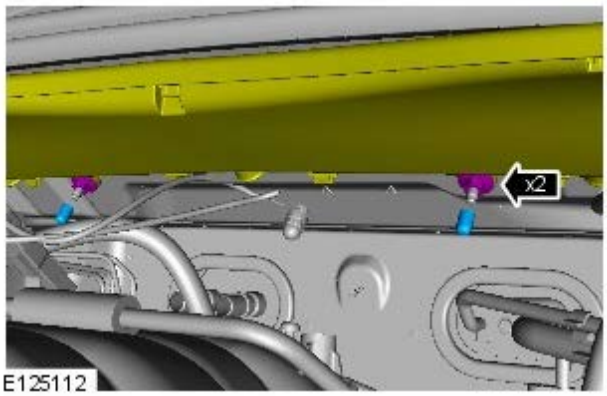
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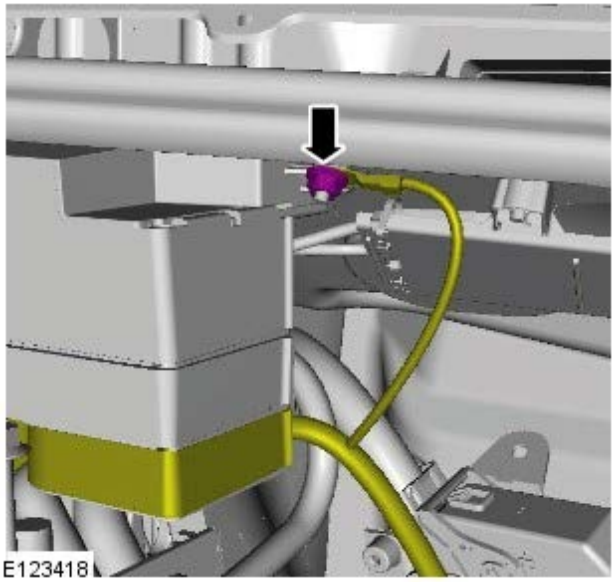
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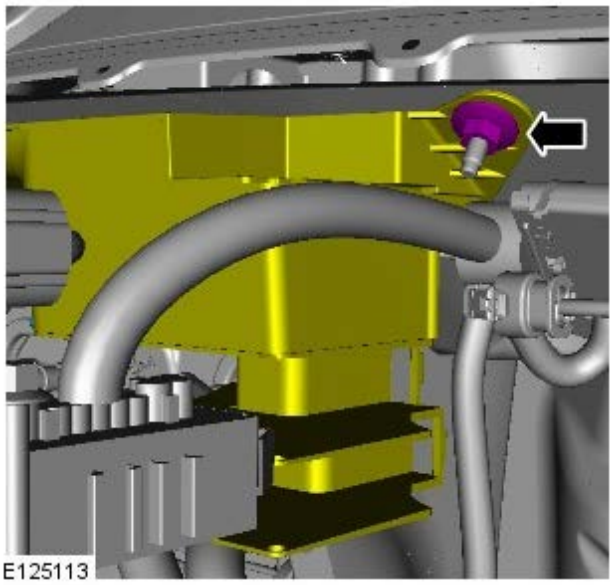
23. TORQUE: 10 Nm



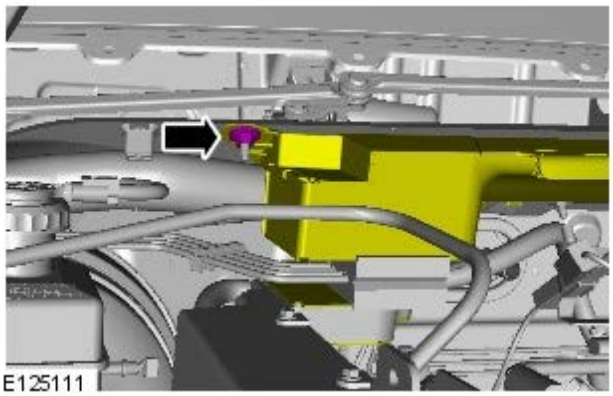
24. TORQUE: 10 Nm



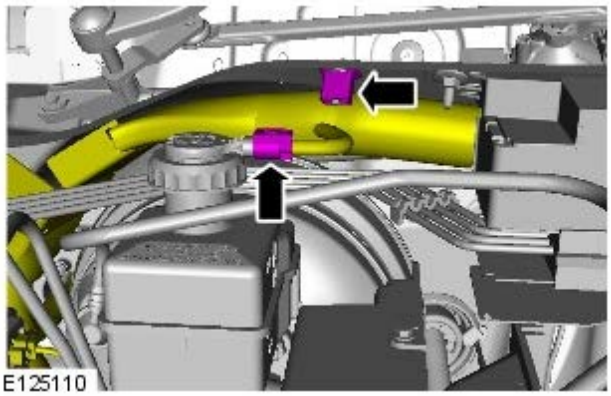
25. TORQUE: 10 Nm



26. TORQUE: 10 Nm

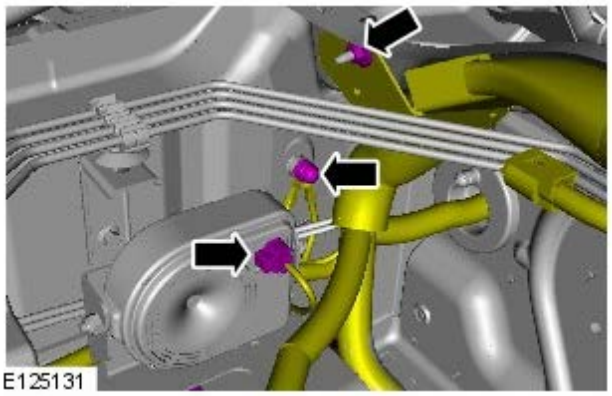


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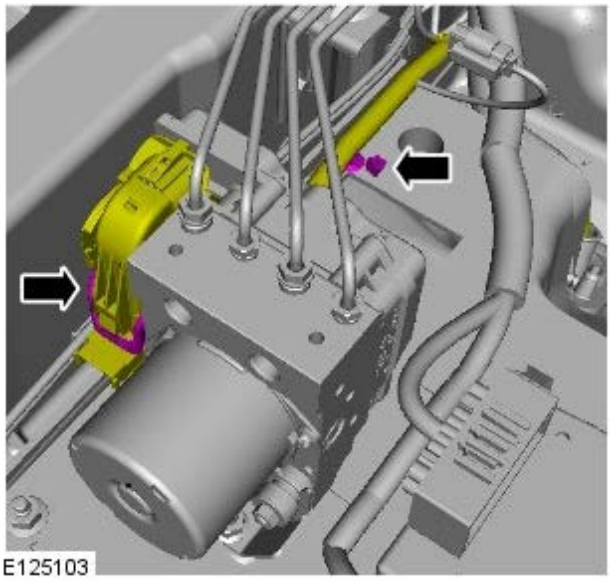


28. For additional information, refer to: Brake Booster (206-07, Removal and Installation).

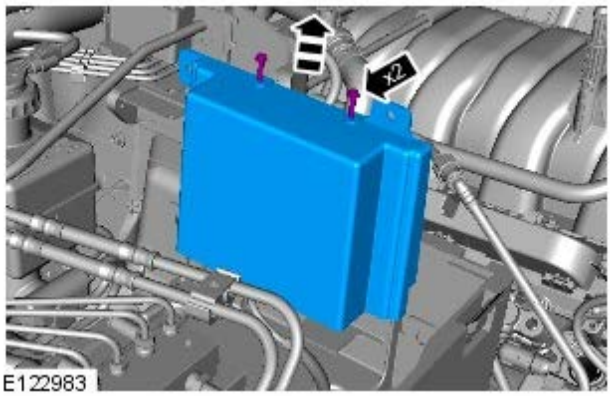
29. TORQUE: 10 Nm



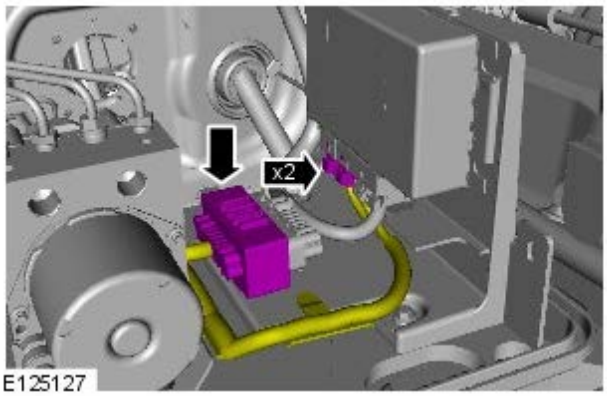
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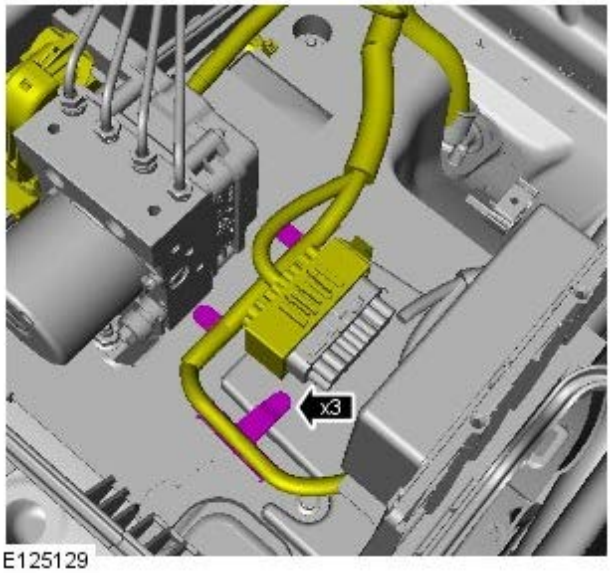
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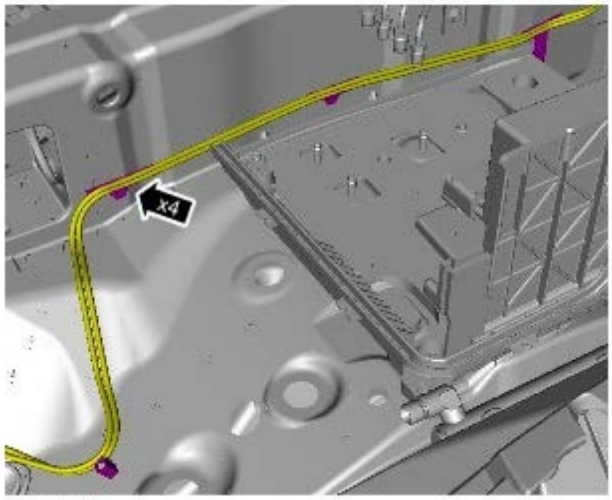


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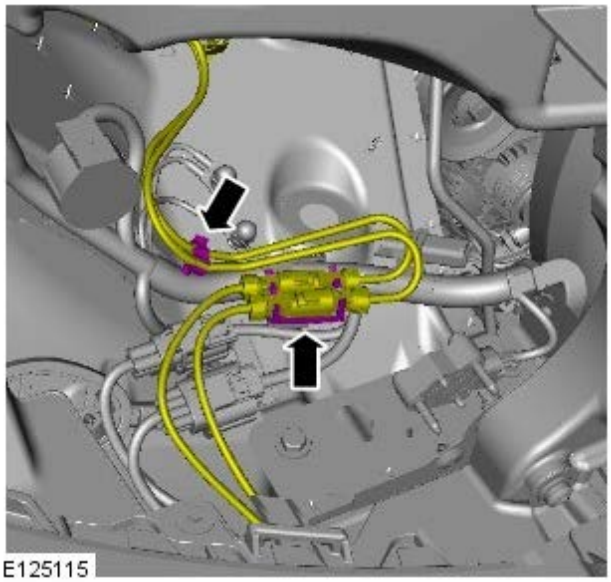
E125129

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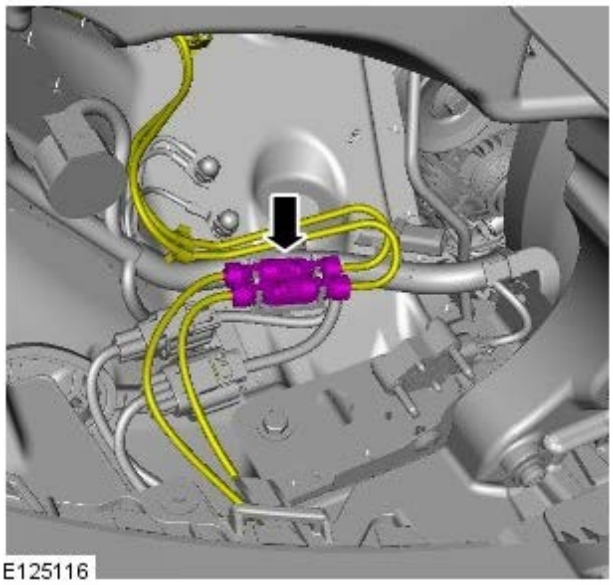


E125125

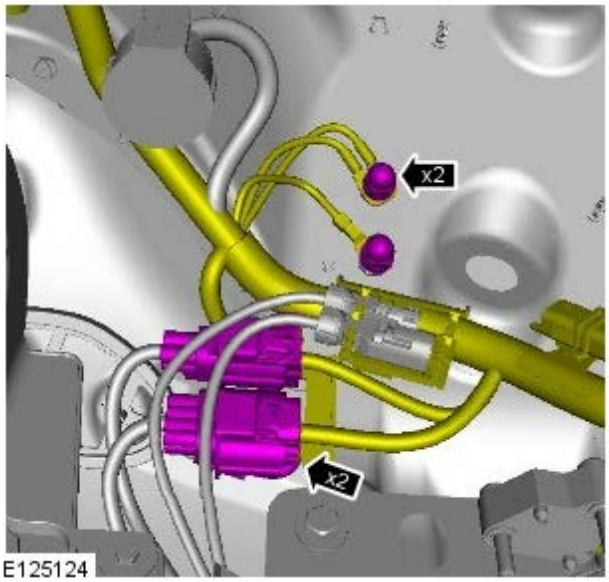
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E125115

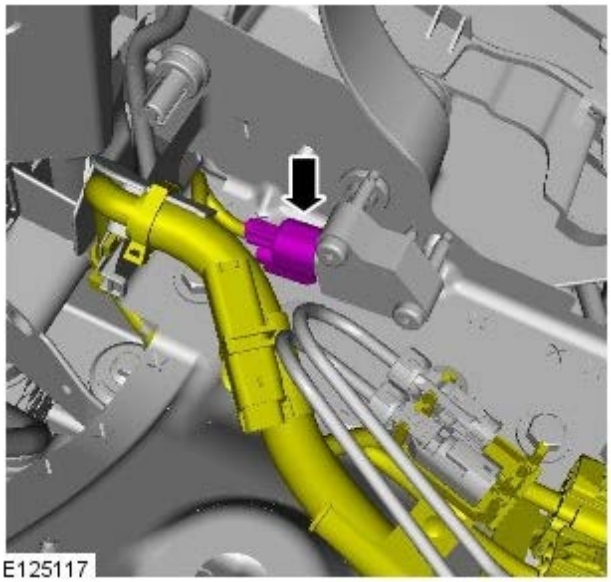
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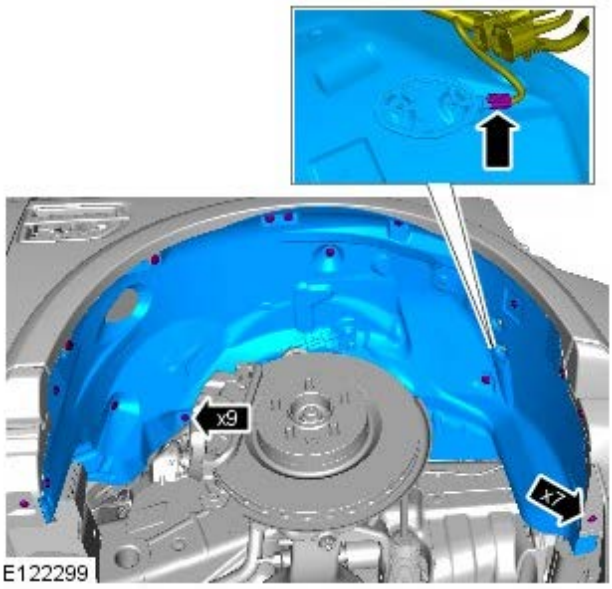
37. TORQUE: 10 Nm



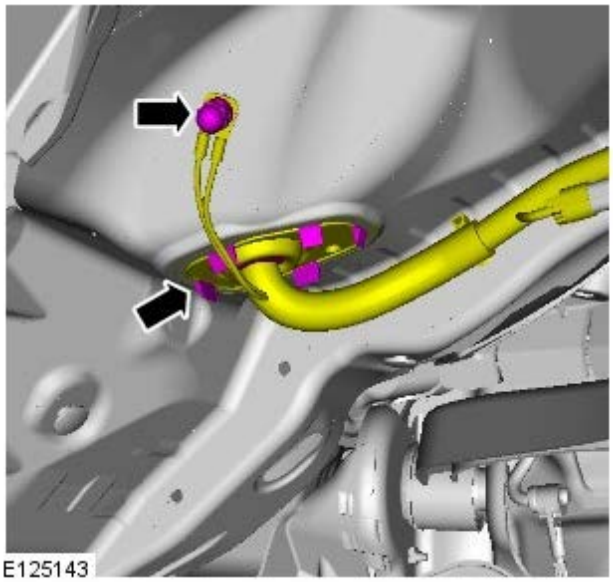
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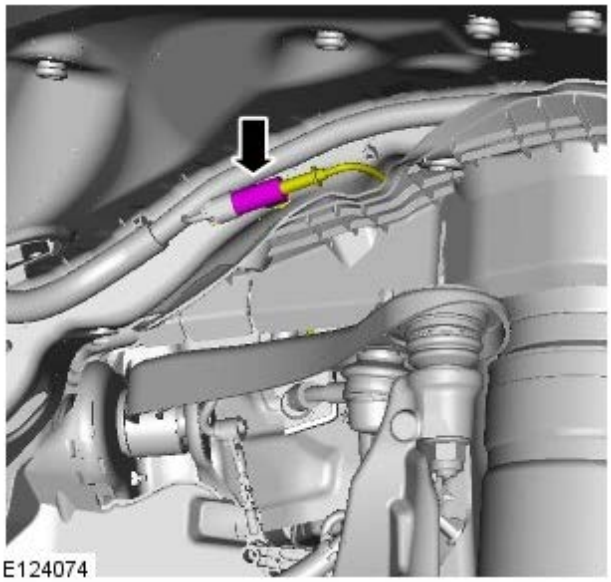
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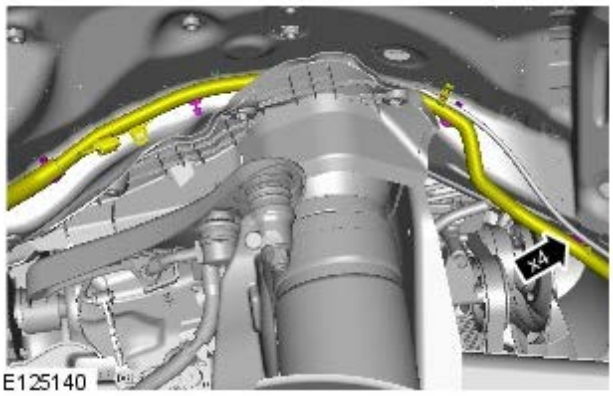
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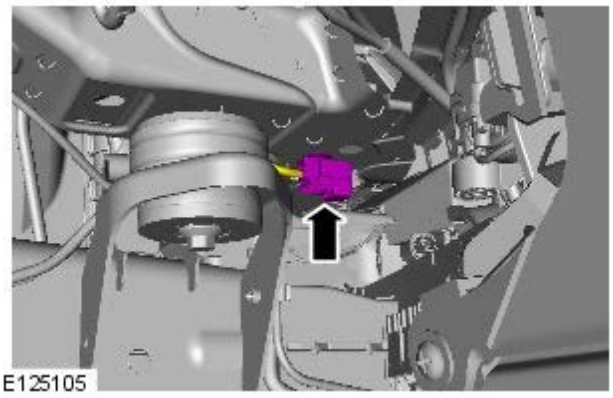
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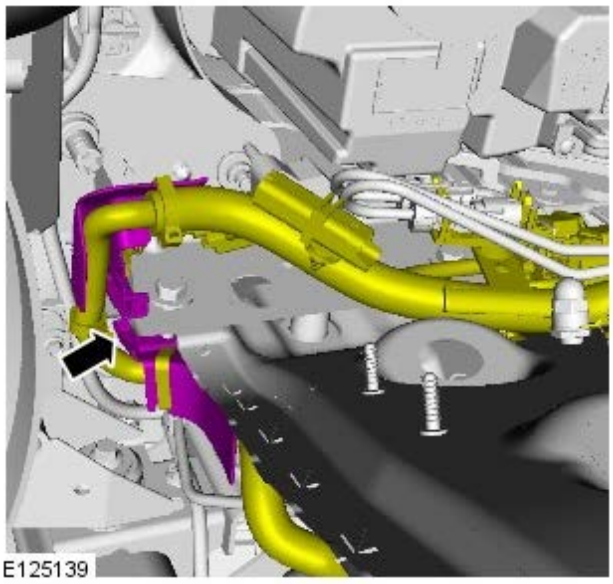
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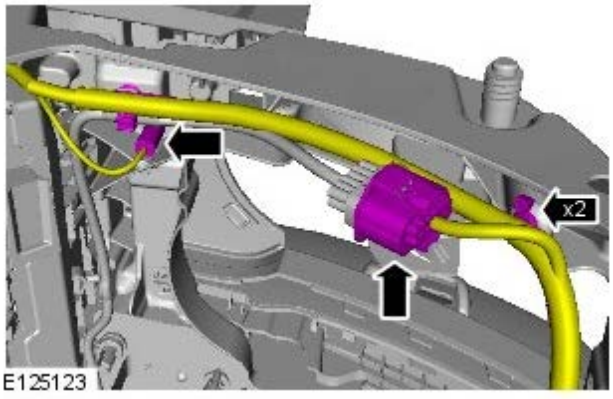
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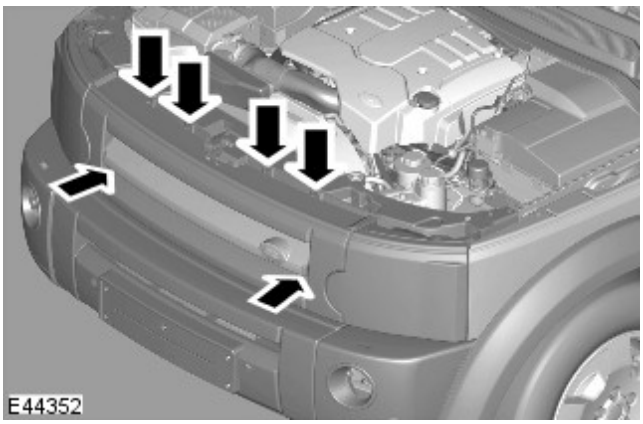
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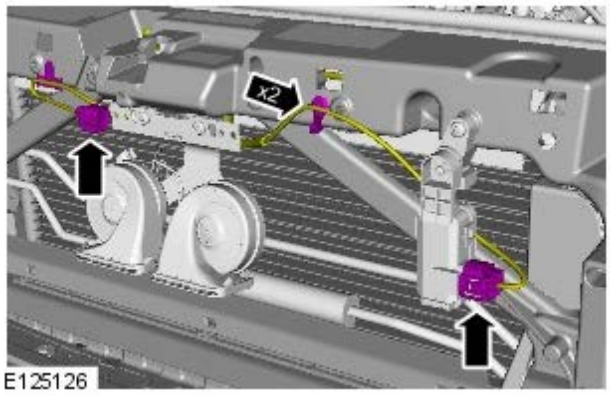
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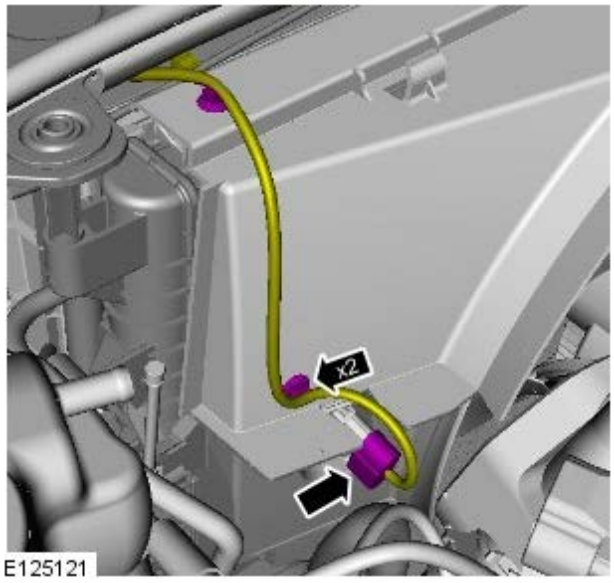
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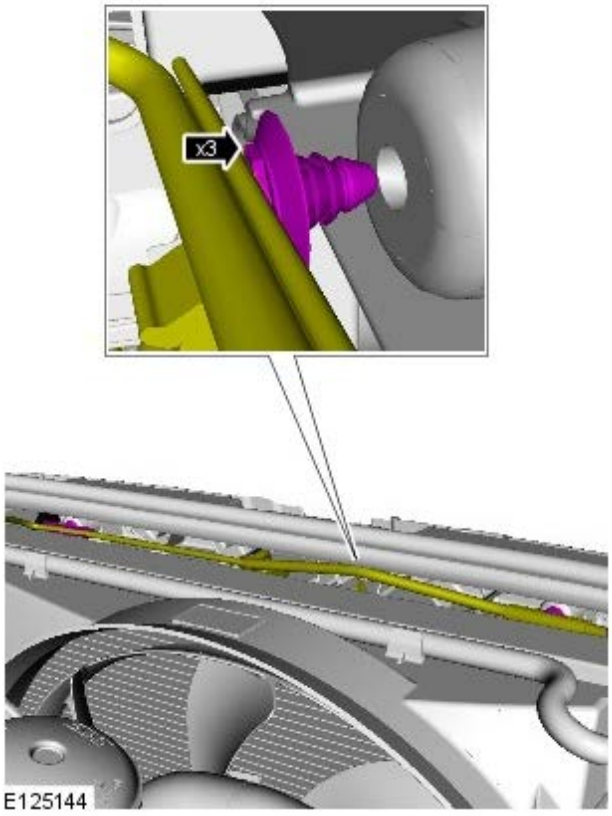
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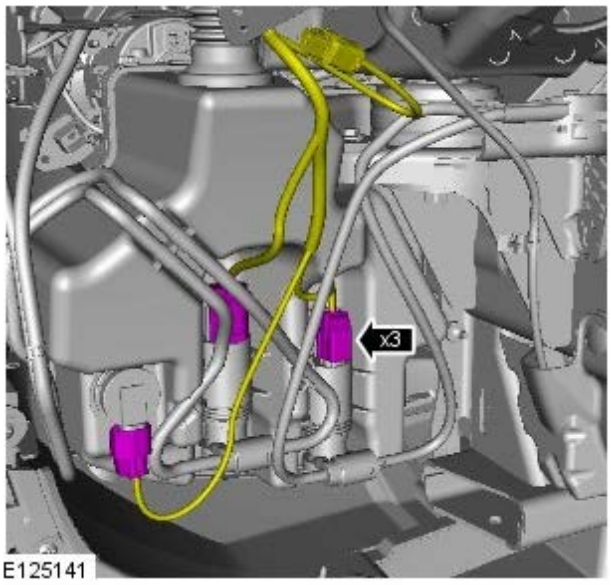
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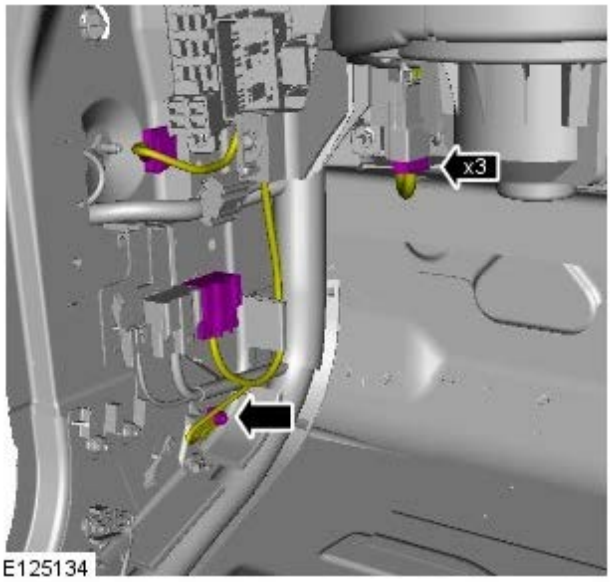


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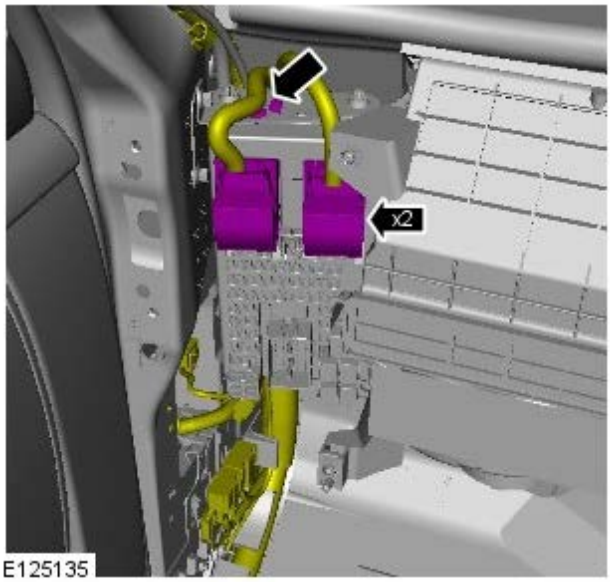


51. For additional information, refer to: Instrument Panel (501-12, Removal and Installation).

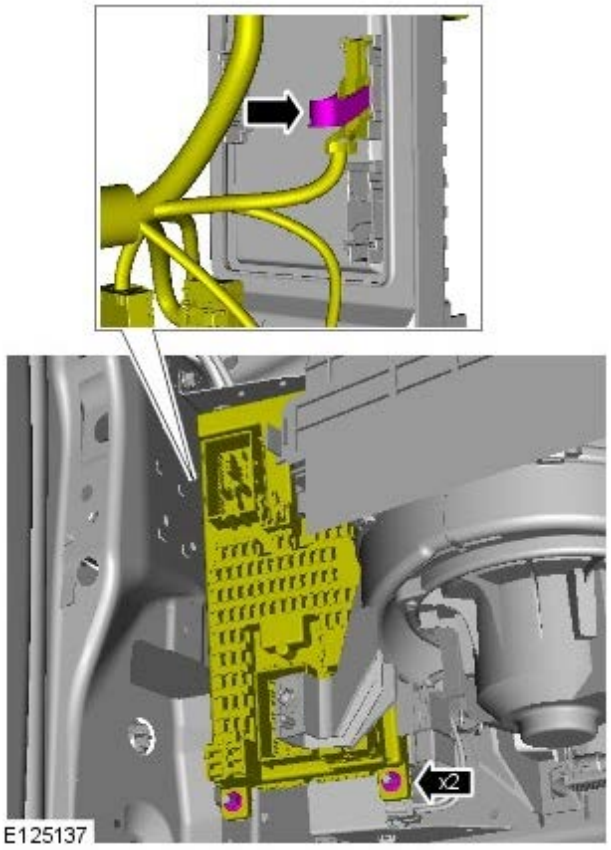
52. TORQUE: 10 Nm



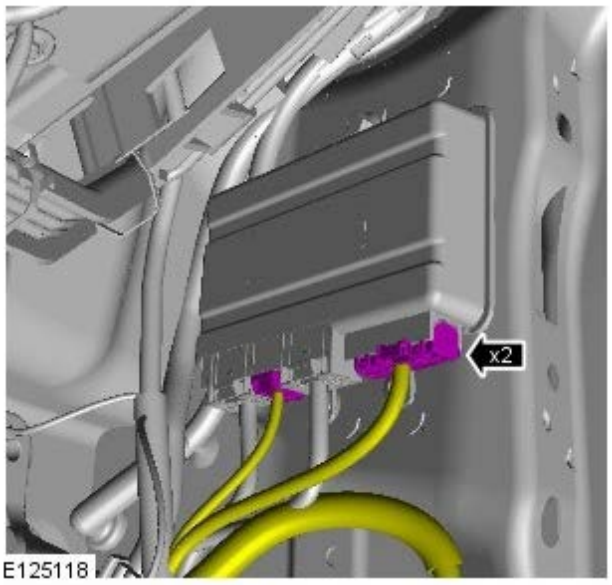
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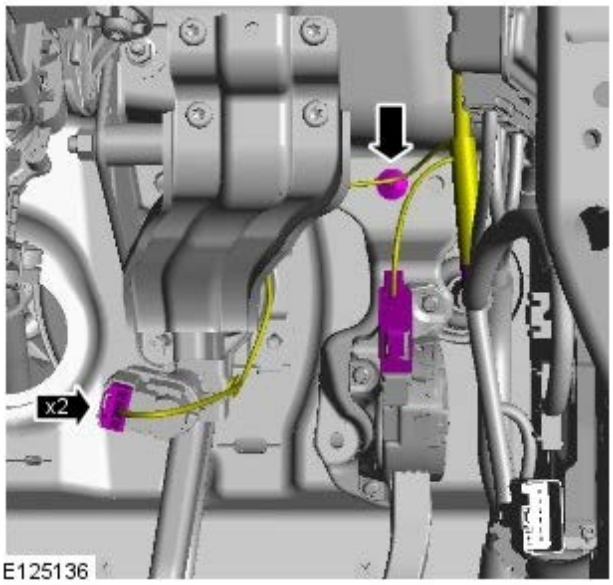
54. TORQUE: 10 Nm



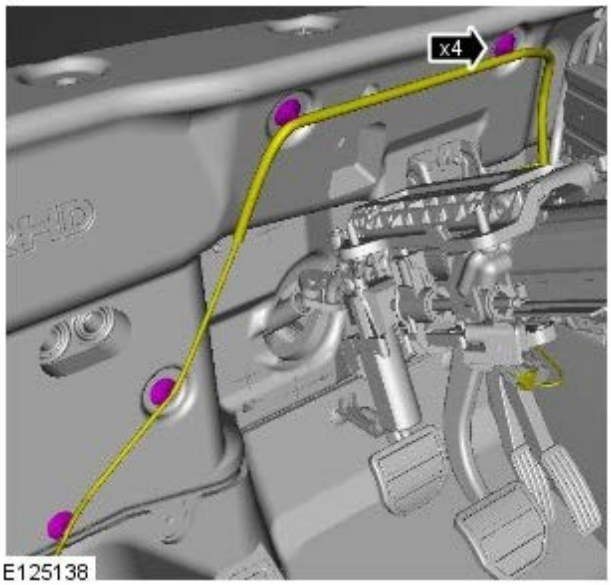
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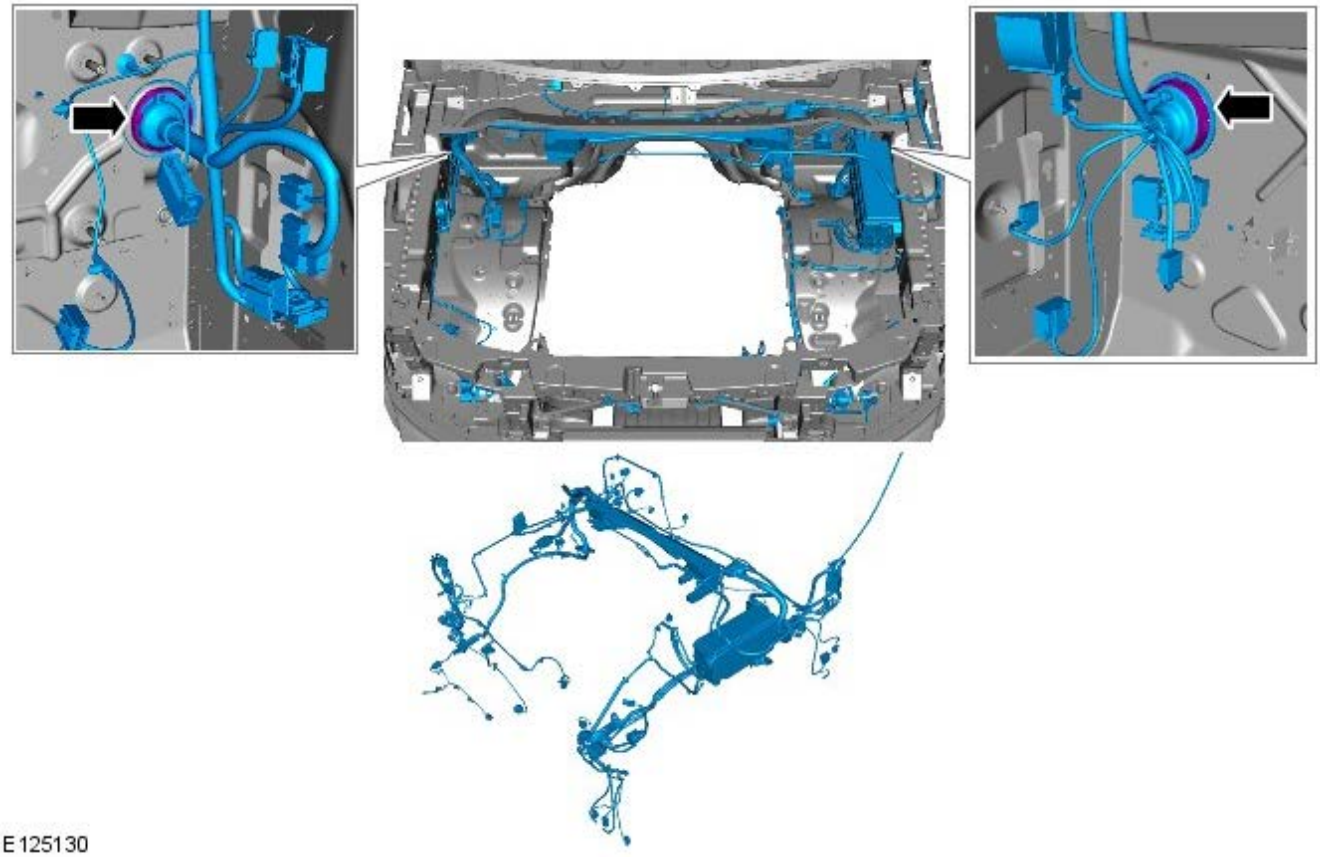
56.



57.



58.



E125130

Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

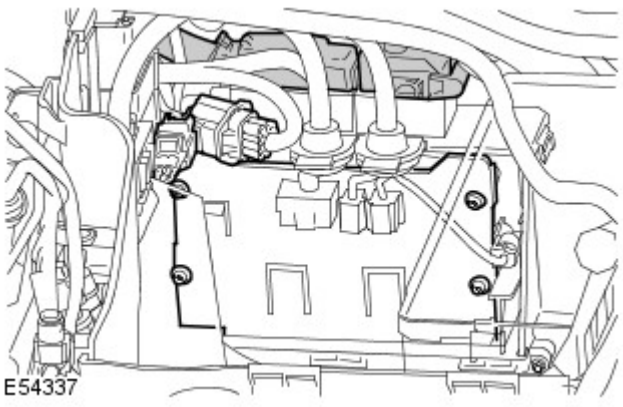
Module Communications Network - Battery Junction Box (BJB) 3.0L Diesel

Removal and Installation

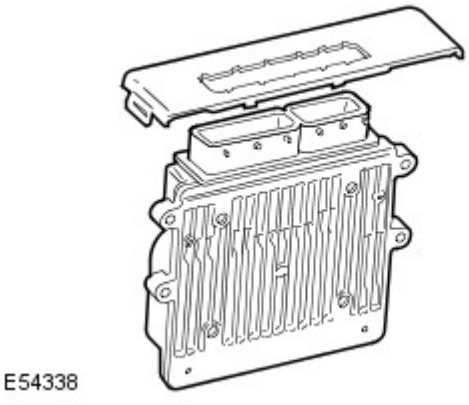
Removal

NOTE: The BJB is an integral component of the engine compartment wiring harness and cannot be removed separately.

1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Make the SRS system safe.
   For additional information, refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the engine cover.
   For additional information, refer to: Engine Cover - 2.7L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).
4. Remove the radiator grille.
   For additional information, refer to: Radiator Grille (501-08 Exterior Trim and Ornamentation, Removal and Installation).
5. Remove the air cleaner assembly.
6. Remove the four-wheel drive control module.
   For additional information, refer to: Four-Wheel Drive (4WD) Control Module (308-07 Four-Wheel Drive Systems, Removal and Installation).
7. Remove the battery tray.
   For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
8. Remove the auxiliary battery tray.
   For additional information, refer to: Auxiliary Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

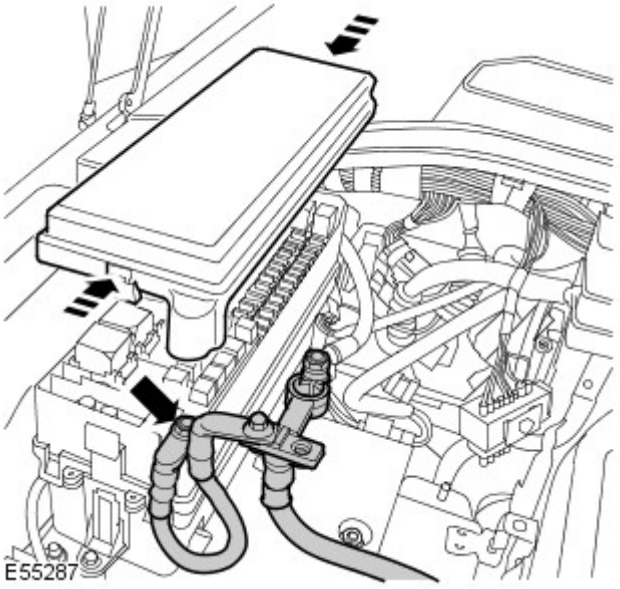


9. Remove the ECM cover.
   - Disconnect 2 electrical connectors for access.
   - Disconnect the 2 ECM electrical connectors.
   - Remove the 4 Torx screws.
10. Remove the ECM.
    - Remove the ECM top cover.


E54338

11. Remove the BJB cover.
    - Release the clip.

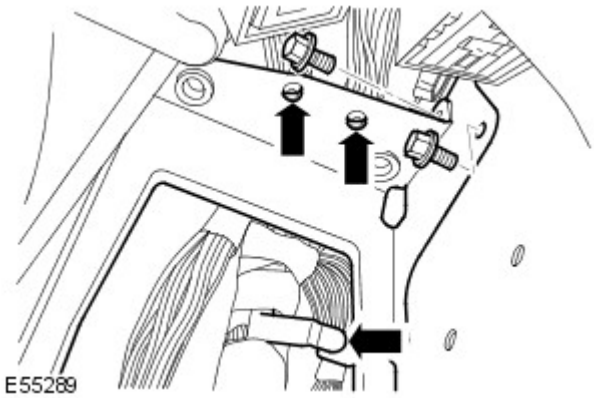
12. Disconnect the battery positive cable from the BJB.
    - Remove the nut.


E55287

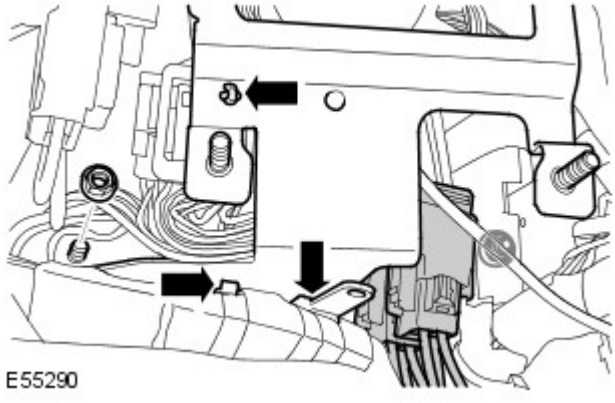
13. Remove both cowl side trim panels.
    For additional information, refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

14. Remove the CJB.
    For additional information, refer to: Central Junction Box (CJB) (418-00 Module Communications Network, Removal and Installation).

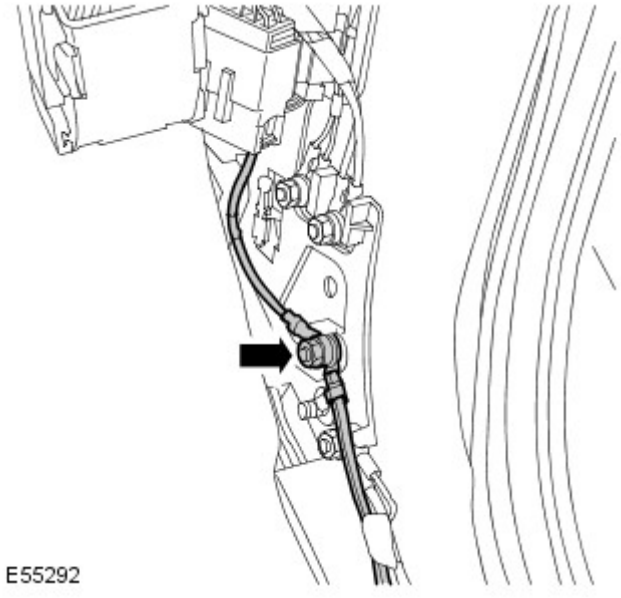
15. Release the CJB bracket.
    - Release the 3 upper wiring harness clips.
    - Remove the 2 bolts.


E55289

16. Remove the CJB bracket.
    - Disconnect the 2 electrical connectors.
    - Release the 3 lower wiring harness clips.
    - Remove the 2 nuts.



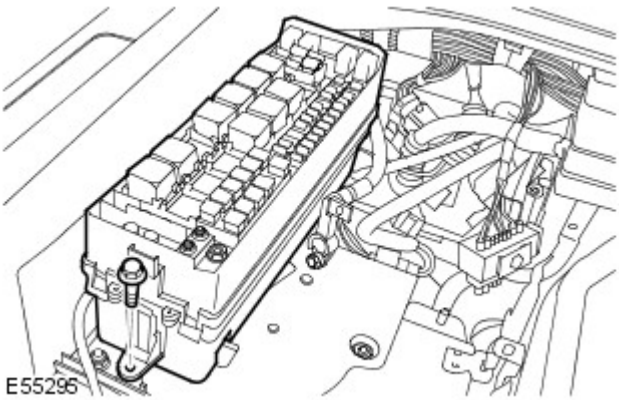
17. Release the 2 ground cables from the lower A-pillar.
    - Remove the nut.



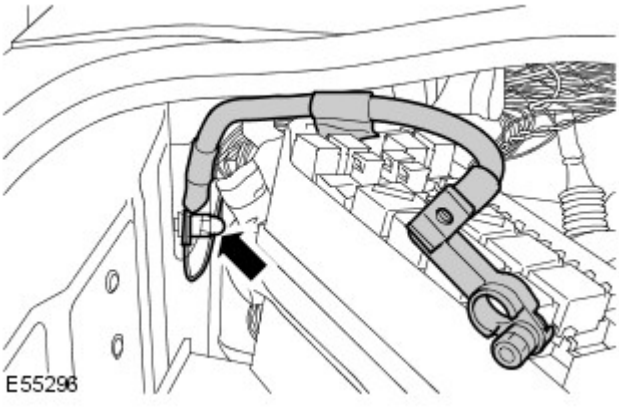
18. Disconnect the heater motor electrical connector.



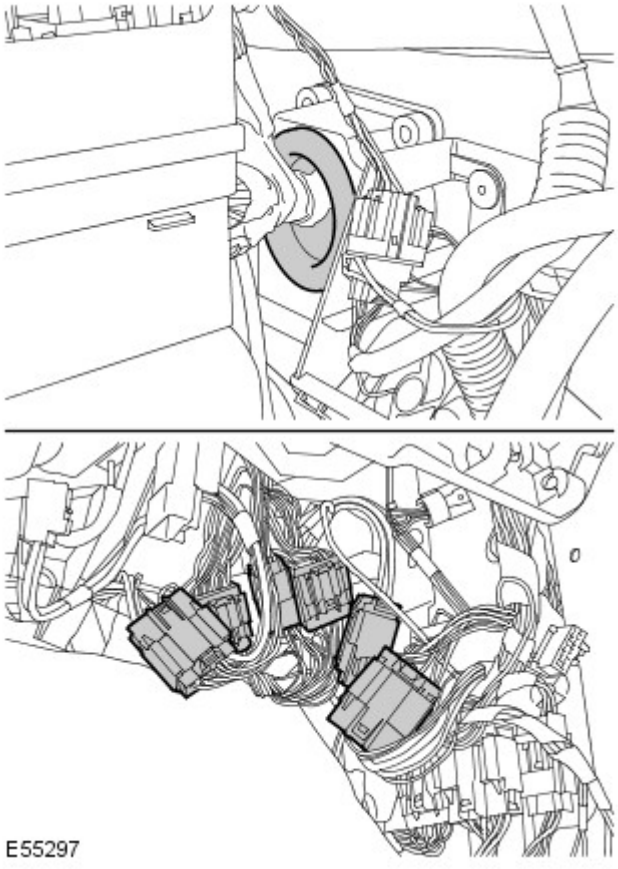
19. Release the BJB from the bracket.
    - Remove the bolt.



20. Remove the battery ground cable.
    - Remove the nut.
    - Release the additional ground cable.



21. Release the BJB wiring harness from the bulkhead.
    - Disconnect the 6 electrical connectors.
    - Release the grommet.



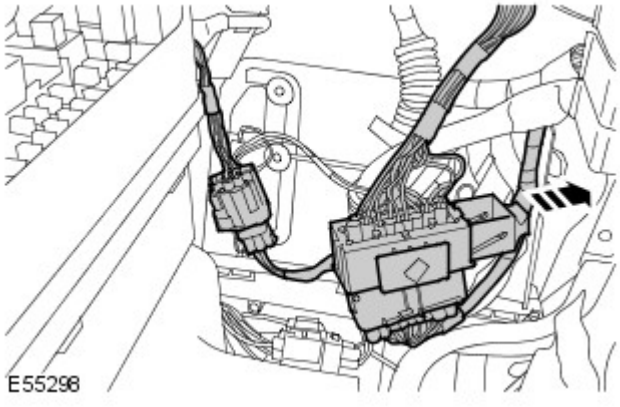
22. Raise and support the vehicle.

23. Remove both front fender splash shields.
    For additional information, refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

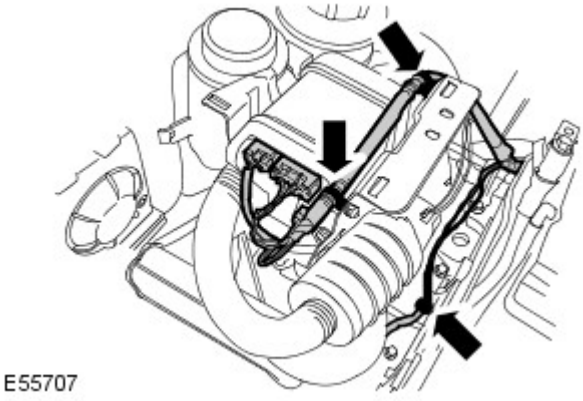
24. Remove both headlamps.
    For additional information, refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

25. Passenger side: Disconnect the engine wiring harness electrical connector.

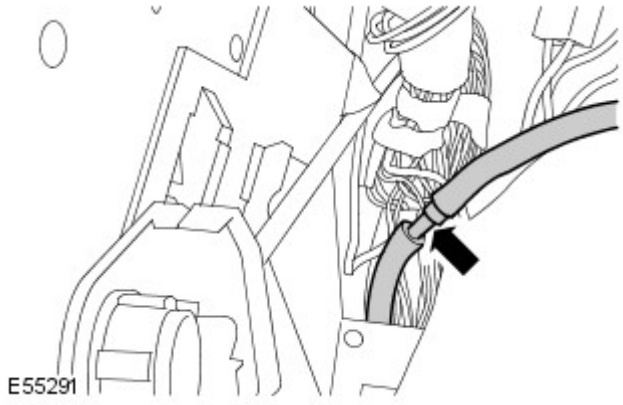
26. Passenger side: Disconnect the transfer case electrical connector.



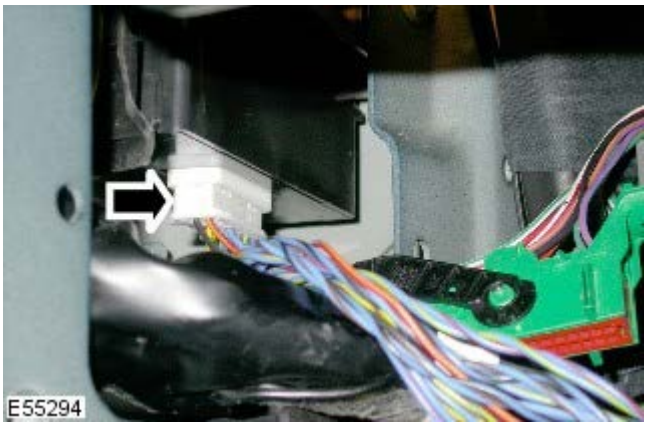
27. LH side: Release the wiring harness from the fuel fired heater.
    - Disconnect the 3 electrical connectors.
    - Release the 3 clips.



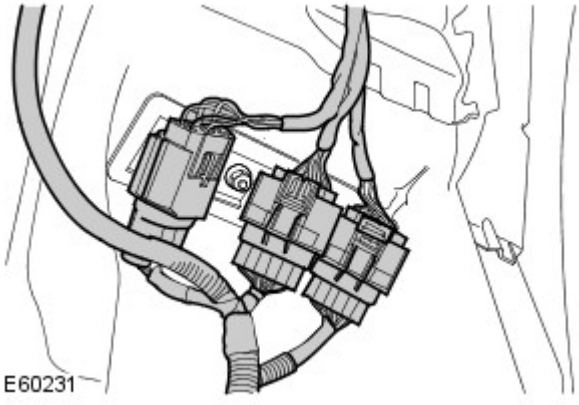
28. LH side: Disconnect the washer jet hose.



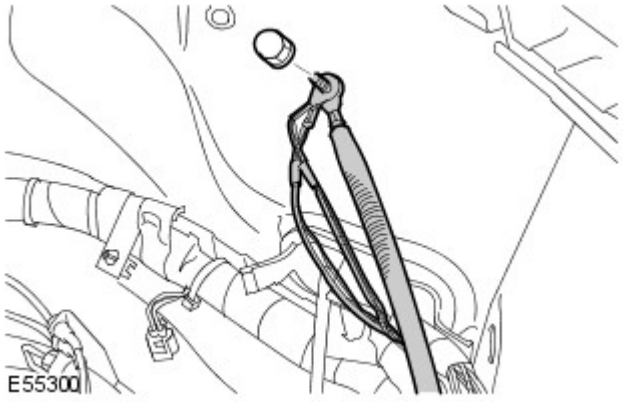
29. LH side: Disconnect the adaptive front lighting module electrical connector.



30. LH side: Disconnect the 3 body panel electrical connectors.

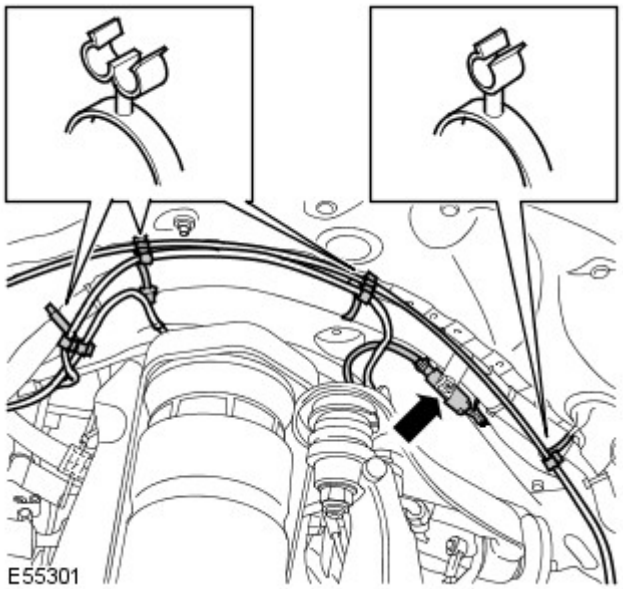


31. LH side: Release the 3 body panel ground cables.
    - Remove the nut.

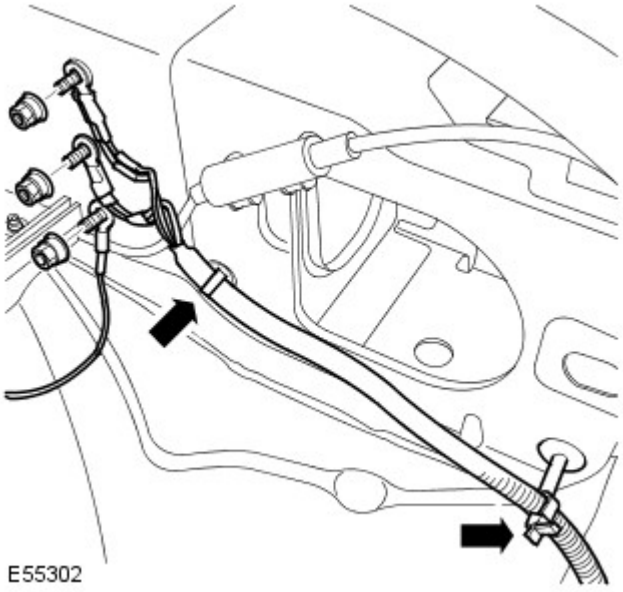


32. LH side: Release the 2 air suspension pipes from the wiring harness.
    - Release the 7 clips.

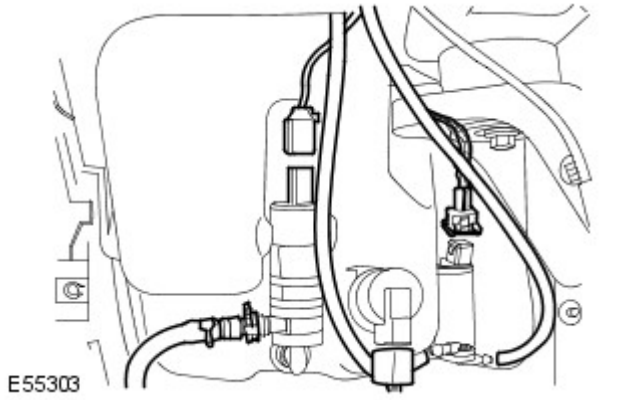
33. LH side: Disconnect the ABS electrical connector.



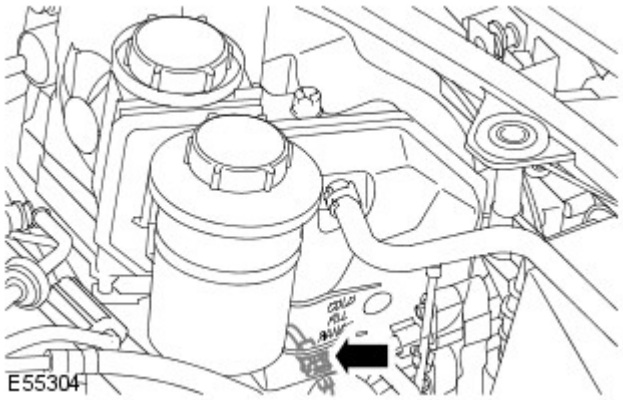
34. LH side: Release 3 engine compartment ground cables.
    - Remove the 3 nuts.
    - Release the 2 clips.



35. LH side: Release the washer reservoir wiring harness.
    - Disconnect the 3 electrical connectors.
    - Disconnect the 2 washer jet hoses.

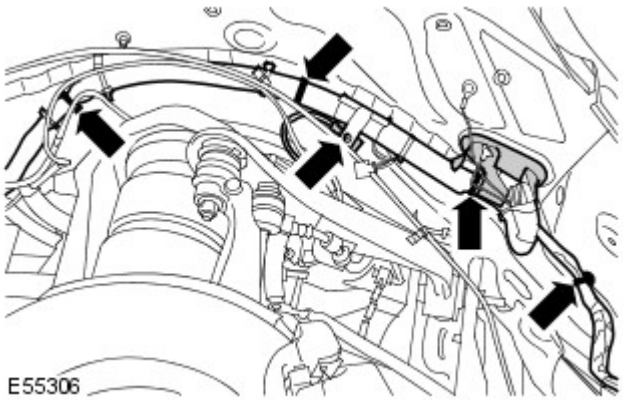


36. LH side: Disconnect the coolant expansion tank level switch electrical connector.



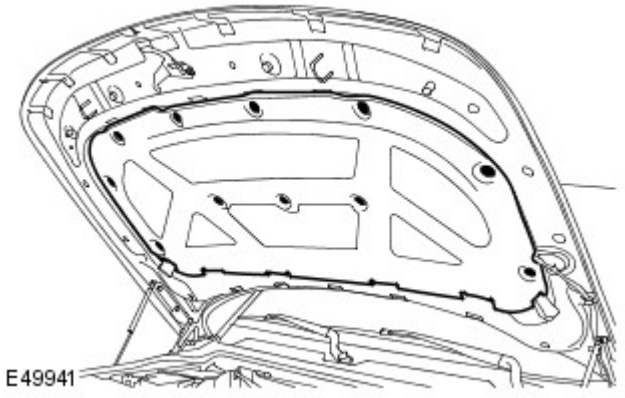
37. LH side: Disconnect the brake pad wear sensor electrical connector.

38. LH side: Release the wiring harness.
    - Release the grommet.
    - Release the 4 clips.

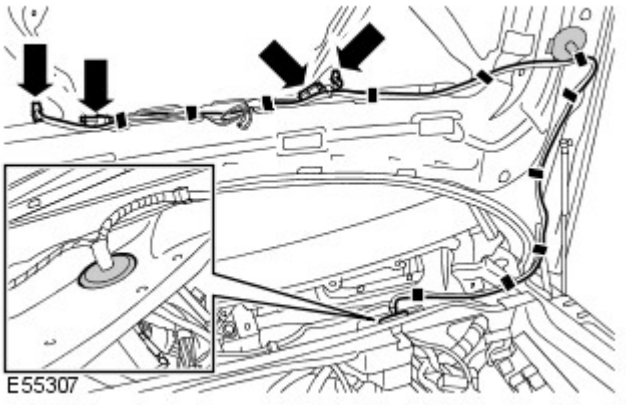


39. Remove the windshield wiper motor.

For additional information, refer to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).



40. Remove the hood pad.
    - Remove the 11 clips.



41. Release the hood wiring harness.
    - Disconnect the 2 washer jet hoses.
    - Disconnect the 2 electrical connectors.
    - Release the 10 clips.
    - Remove the wiring harness cover.
    - Release the grommet.



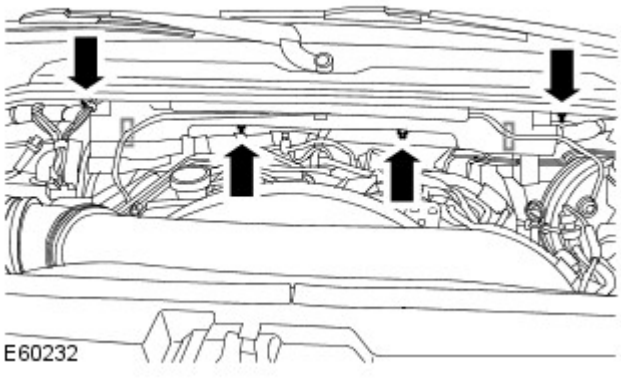
42. Disconnect the A/C pressure transducer electrical connector.



43. NOTE: 4.0L illustration shown, 2.7L Diesel is similar.

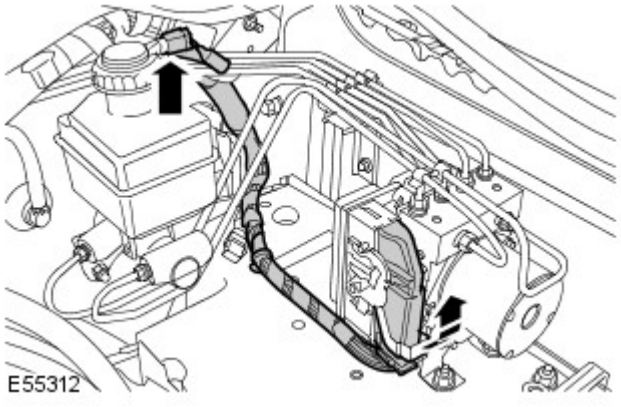
    Disconnect the battery to engine compartment wiring harness electrical connector.

44. Release the wiring harness from the plenum.
    - Remove the 3 nuts.
    - Release the clip.



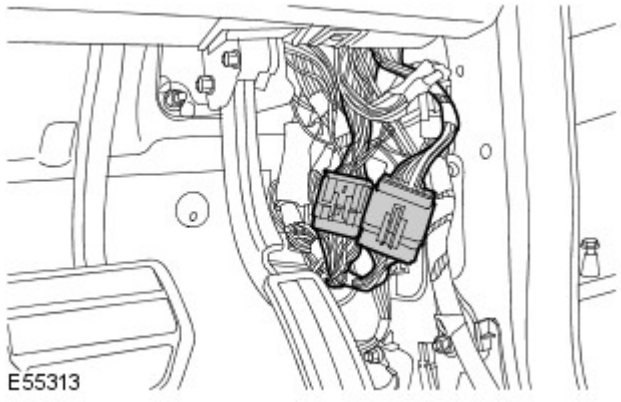
45. Disconnect the brake fluid reservoir electrical connector.

46. Disconnect the ABS module electrical connector.

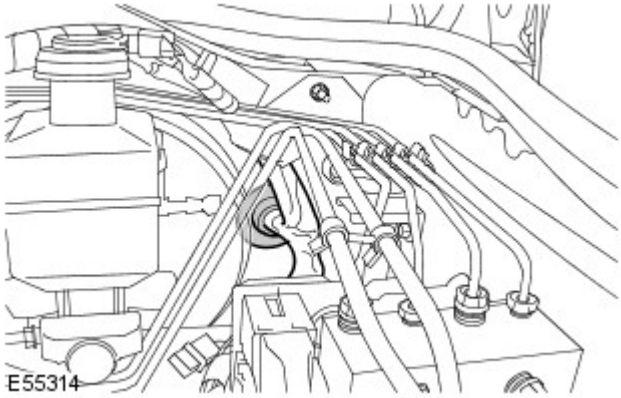


47. Remove the air suspension control module.
    For additional information, refer to: Air Suspension Control Module (204-05 Vehicle Dynamic Suspension, Removal and Installation).

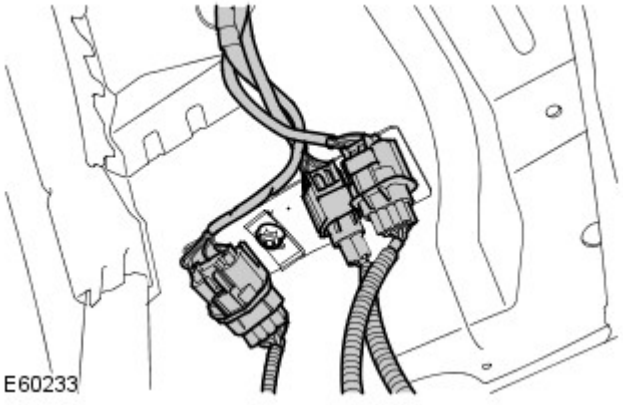
48. Driver side: Disconnect 2 electrical connectors from the lower A-pillar.



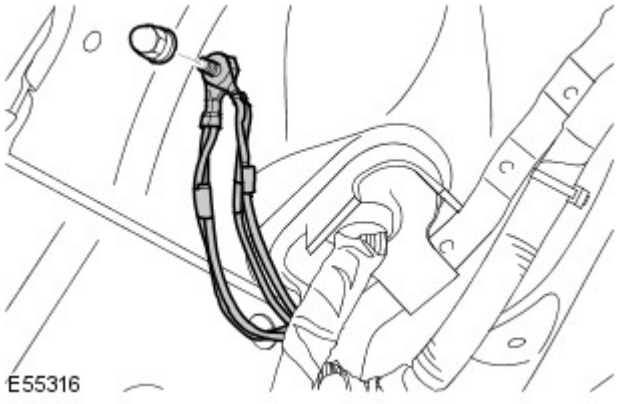
49. Driver side: Release the wiring harness from the bulkhead.
    - Release the grommet.



50. RH side: Disconnect the 3 body panel electrical connectors.

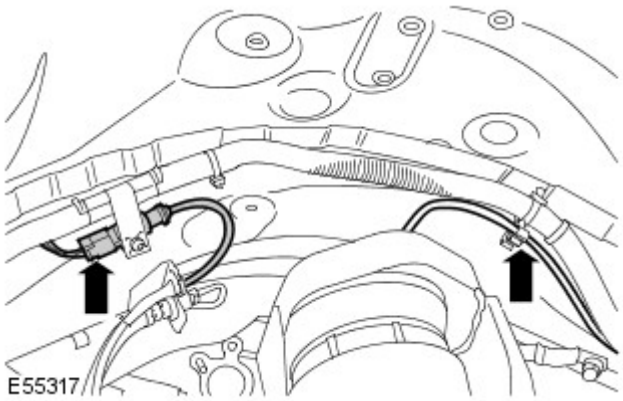


51. RH side: Release the 3 body panel ground cables.
    - Remove the nut.

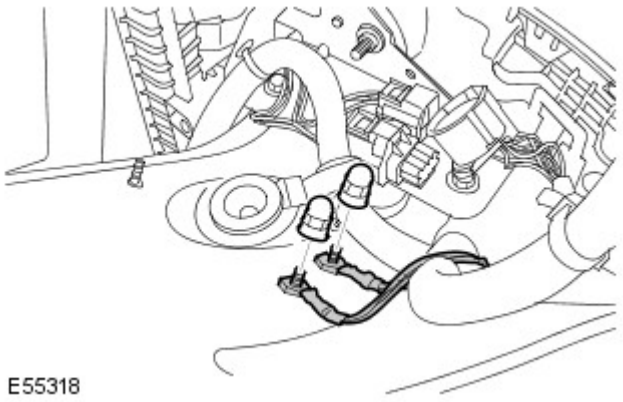


52. RH side: Disconnect the ABS electrical connector.

53. RH side front: Release the air suspension pipe from the wiring harness clip.

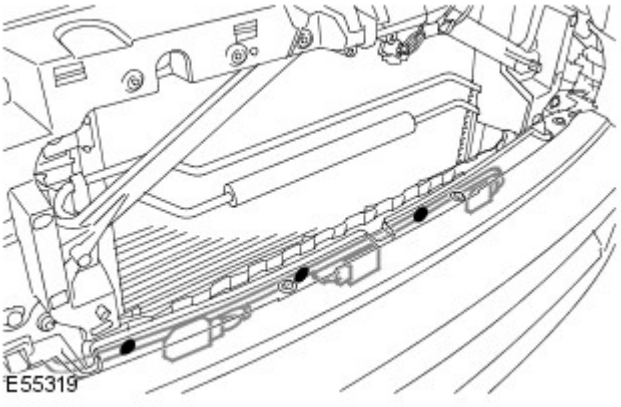


54. RH side: Release 2 engine compartment ground cables.
    - Remove the 2 nuts.

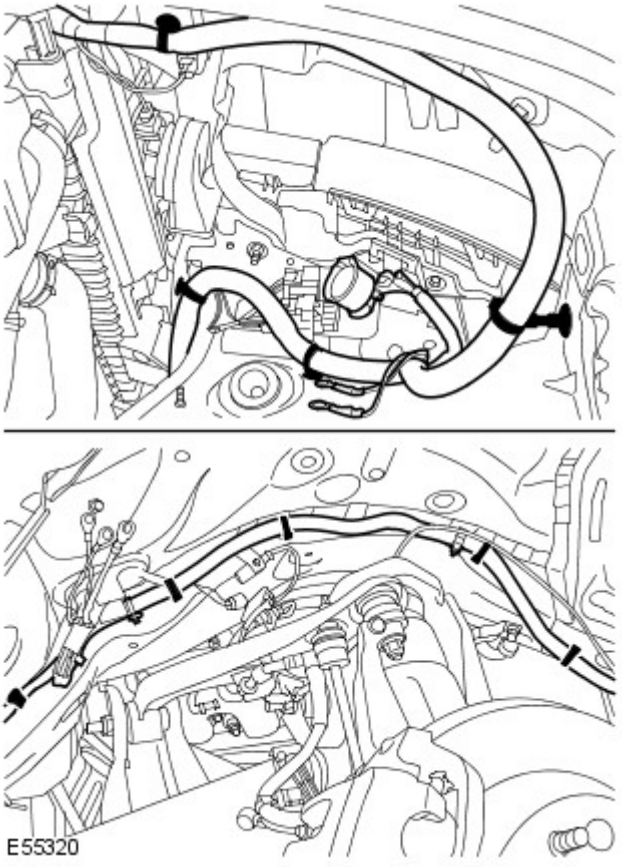


55. Disconnect the ambient air temperature sensor electrical connector.

56. Disconnect both front impact severity sensor electrical connectors.
    - Release the 3 clips.

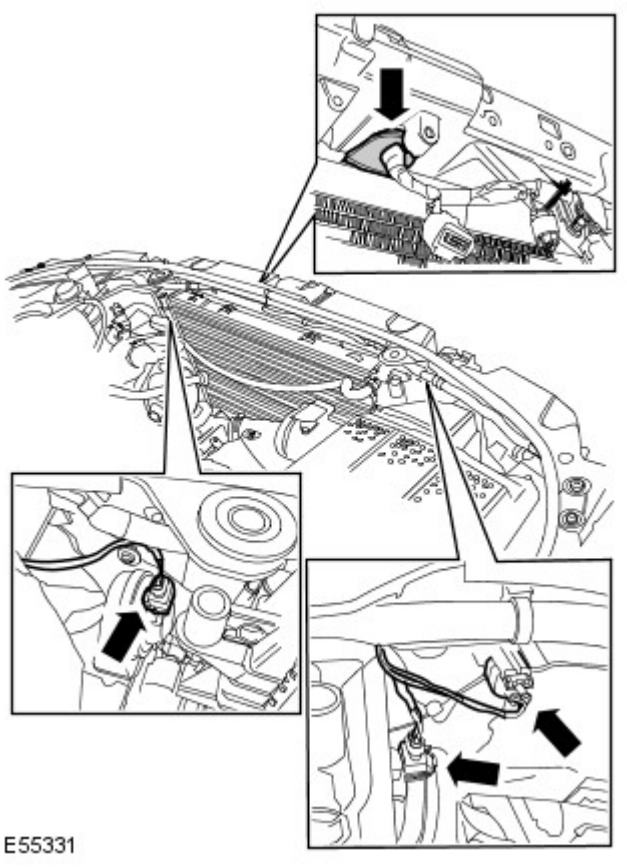


57. RH side: Release the wiring harness.
    - Release the 9 clips.



58. Disconnect the hood switch electrical connector.

59. Disconnect both horn electrical connectors.

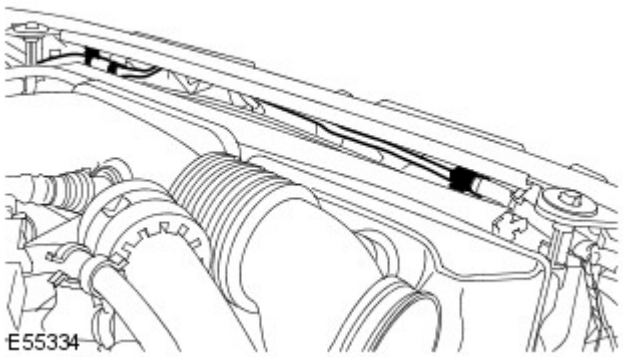

E55331

60. If installed, disconnect the speed control module electrical connector.

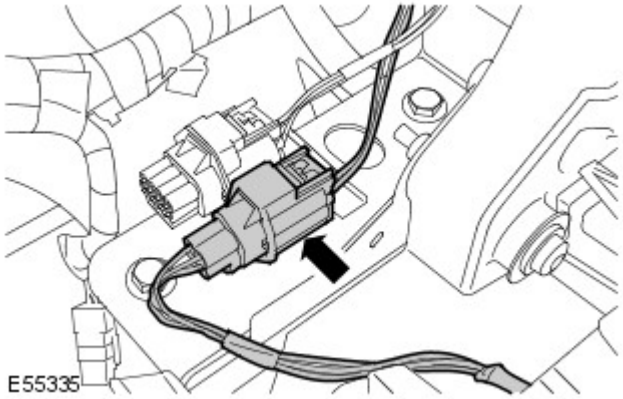
61. If installed, disconnect the pollution sensor electrical connector.
    - Release the clip.
    - Release the grommet.

62. NOTE: 4.0L illustration shown, 2.7L Diesel is similar.

    Release the hood release cable.
    - Release from the 3 clips.


E55334

63. Disconnect the front bumper wiring harness electrical connector.


E55335

64. With assistance, remove the BJB and wiring harness.

Installation

1. With assistance, install the BJB and wiring harness.
2. Connect the front bumper wiring harness electrical connector.
3. Attach the hood release cable.
   - Secure with the clips.
4. If installed, connect the pollution sensor electrical connector.
   - Install the grommet.
   - Secure the clip.
5. If installed, connect the speed control module electrical connector.
6. Connect the horn electrical connectors.
7. Connect the hood switch electrical connector.
8. RH side: Secure the wiring harness.
   - Secure the clips.
9. Connect both front impact electrical connectors.
   - Secure the clips.
10. RH side: Attach the air suspension pipe.
11. Connect the ambient air temperature sensor electrical connector.
12. RH side: Attach the engine compartment ground cables.
    - Tighten the nuts to 25 Nm (18 lb.ft).
13. RH side: Connect the ABS electrical connector.
14. RH side: Attach the body panel ground cables.
    - Tighten the nut to 25 Nm (18 lb.ft).
15. RH side: Connect the body panel electrical connectors.
16. Driver side: Attach the wiring harness to the bulkhead.
    - Install the grommet.
17. Driver side: Connect the lower A-pillar electrical connectors.
18. Install the air suspension control module.
    For additional information, refer to: Air Suspension Control Module (204-05 Vehicle Dynamic Suspension, Removal and Installation).
19. Connect the ABS module electrical connector.
20. Connect the brake fluid reservoir electrical connector.
21. Attach the wiring harness to the plenum.
    - Secure the clips.
    - Tighten the nuts to 4 Nm (3 lb.ft).
22. Connect the battery to engine compartment wiring harness electrical connector.
23. Connect the A/C pressure transducer electrical connector.
24. Attach the hood wiring harness.
    - Install the grommet.
    - Install the cover.
    - Secure with the clips.
    - Connect the electrical connectors.
    - Connect the washer jet hoses.
25. Install the hood pad.
    - Install the clips.
26. Install the windshield wiper motor.

For additional information, refer to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).

27. LH side: Attach the wiring harness.
    - Install the grommet.
    - Secure the clips.

28. LH side: Connect the brake pad wear sensor electrical connector.

29. LH side: Connect the coolant expansion tank level switch electrical connector.

30. LH side: Attach the washer reservoir wiring harness.
    - Connect the washer jet hoses.
    - Connect the electrical connectors.

31. LH side: Attach the engine compartment ground cables.
    - Secure the clips.
    - Tighten the nuts to 25 Nm (18 lb.ft).

32. LH side: Connect the ABS electrical connector.

33. LH side: Attach the air suspension pipes.
    - Secure the clips.

34. LH side: Attach the body panel ground cables.
    - Tighten the nut to 25 Nm (18 lb.ft).

35. LH side: Connect the body panel electrical connectors.

36. LH side: Connect the adaptive front lighting module electrical connector.

37. LH side: Connect the washer jet hose.

38. LH side: Attach the wiring harness to the fuel fired heater.
    - Connect the electrical connectors.
    - Secure with the clips.

39. Passenger side: Connect the transfer case electrical connector.

40. Passenger side: Connect the engine wiring harness electrical connector.

41. Install the headlamps.
    For additional information, refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

42. Install the fender splash shields.
    For additional information, refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

43. Attach the BJB wiring harness to the bulkhead.
    - Connect the electrical connectors.
    - Install the grommet.

44. Install the battery ground cable.
    - Attach the additional ground cable.
    - Tighten the nut to 25 Nm (18 lb.ft).

45. Secure the BJB to the bracket.
    - Tighten the bolt to 6 Nm (4 lb.ft).

46. Connect the heater motor electrical connector.

47. Connect the ground cables to the lower A-pillar.
    - Tighten the nut to 10 Nm (7 lb.ft).

48. Install the CJB bracket.
    - Tighten the nuts to 10 Nm (7 lb.ft).
    - Secure the clips.
    - Connect the electrical connectors.
    - Tighten the bolts to 25 Nm (18 lb.ft).

49. Install the CJB.
    For additional information, refer to: Central Junction Box (CJB) (418-00 Module Communications Network, Removal and Installation).

50. Connect the battery positive cable to the BJB.
    - Tighten the nut to 25 Nm (18 lb.ft).

51. Install the BJB cover.
    - Secure the clip.

52. Install the ECM.
    - Install the ECM top cover.

53. Install the ECM cover.
    - Tighten the Torx screws.
    - Connect the electrical connectors.

54. Install the auxiliary battery tray.
    For additional information, refer to: Auxiliary Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

55. Install the battery tray.
    For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

56. Install the four-wheel drive control module.
    For additional information, refer to: Four-Wheel Drive (4WD) Control Module (308-07 Four-Wheel Drive Systems, Removal and Installation).

57. Install the air cleaner assembly.

58. Install the radiator grille.
    For additional information, refer to: Radiator Grille (501-08 Exterior Trim and Ornamentation, Removal and Installation).

59. Install the engine cover.
    For additional information, refer to: Engine Cover - 2.7L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

60. Connect the battery ground cable.
    For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).

Published: 11-May-2011

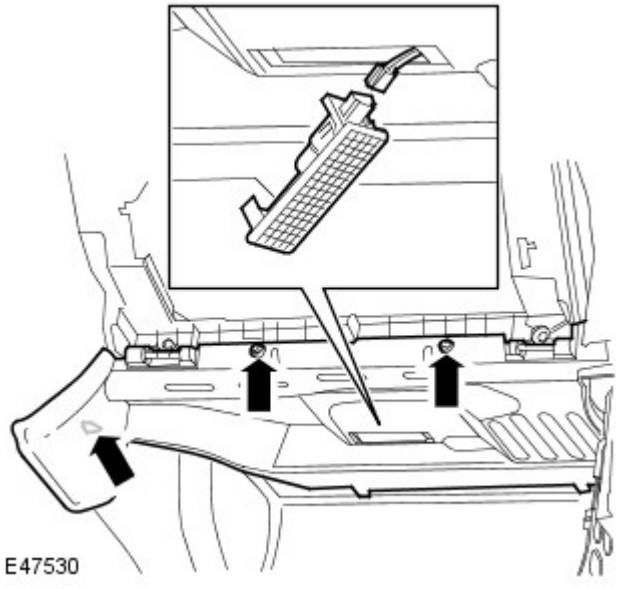
Module Communications Network - Central Junction Box (CJB)

Removal and Installation

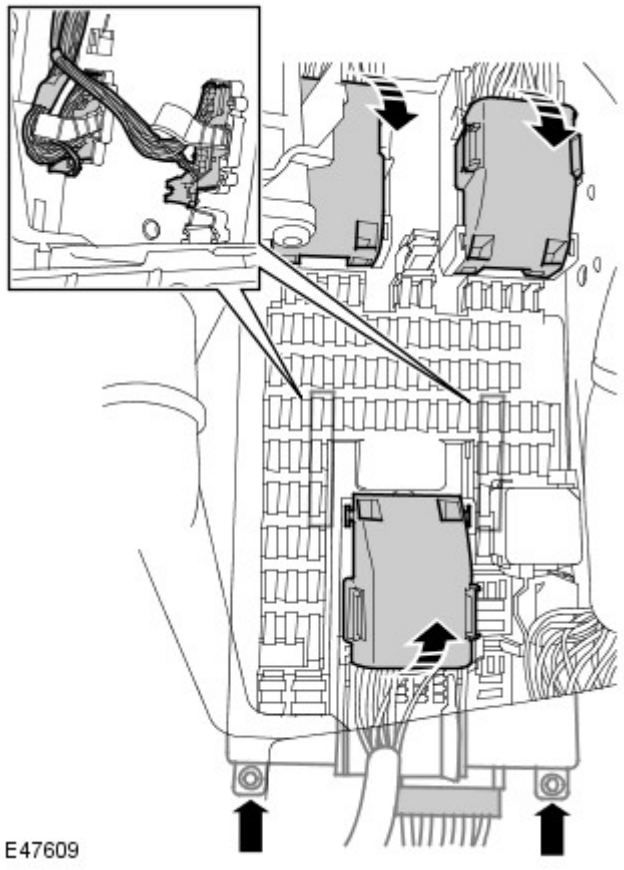
Removal

1. If the central junction box (CJB) is to be replaced, connect T4 to the vehicle.

2. Remove the glove compartment.
   For additional information, refer to: Glove Compartment (501-12, Removal and Installation).



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



4. Remove the CJB.
   - Remove the 2 nuts.
   - Disconnect the 6 electrical connectors.

Installation

1. Install the CJB.
   - Connect the electrical connectors.
   - Tighten the nuts to 10 Nm (7 lb.ft).

2. Install the closing trim panel.
    - Connect the electrical connector.
    - Secure the clip.

3. Install the glove compartment.
   For additional information, refer to: Glove Compartment (501-12, Removal and Installation).

4. Initiate a new CJB using T4.

Published: 21-Jan-2014

Wiring Harnesses - Wiring Harness

Description and Operation

Introduction

CAUTION: Do **not** use any other heat shrink sleeve other than the approved glue lined heat shrink sleeve mentioned in the repair procedure.

The purpose of this document is to promote quick and efficient minor repair to harness connectors or cables using approved methods. Repairs may only be made to cables and connectors which have been mechanically, **not electrically** damaged. It also applies where the whole extent of the damage can be clearly identified and rectified.

Care and neatness are essential requirements in making a perfect repair.

Caution:

This harness repair guide, does not approve repairs to any of the following circuits:

1. Any media orientated system transport network harnesses.
2. Supplement restraint system (SRS) firing circuits (Air bags).
3. Link lead assembles, which are unique to safety critical circuits such as anti-lock brake system (ABS) and thermocouple circuits. An example of this is the ABS wheel speed sensors with moulded connectors.
4. 4. Screened cables, leads and wiring harness(s).

If any harness(s) with defective electrical connector terminals or wires from the above circuits are a concern, new components must be installed.

Repair Components

CAUTION: Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

The wiring harness repair components comprises:

- Pre-terminated wiring harness(s) of different sizes and types
- Three sizes of butt splice connectors
- A selection of colored cable identification sleeves
- Two sizes of glue lined heat shrink sleeves

A suitable heat source, for shrinking heat shrink sleeves will be required.

The pre-insulated diamond grip range of electrical connector terminals and in-line, butt splice connectors are the **only** acceptable product for the repairs of wiring harnesses. The butt connectors not only grip the wire but also the insulation, making a very secure joint.

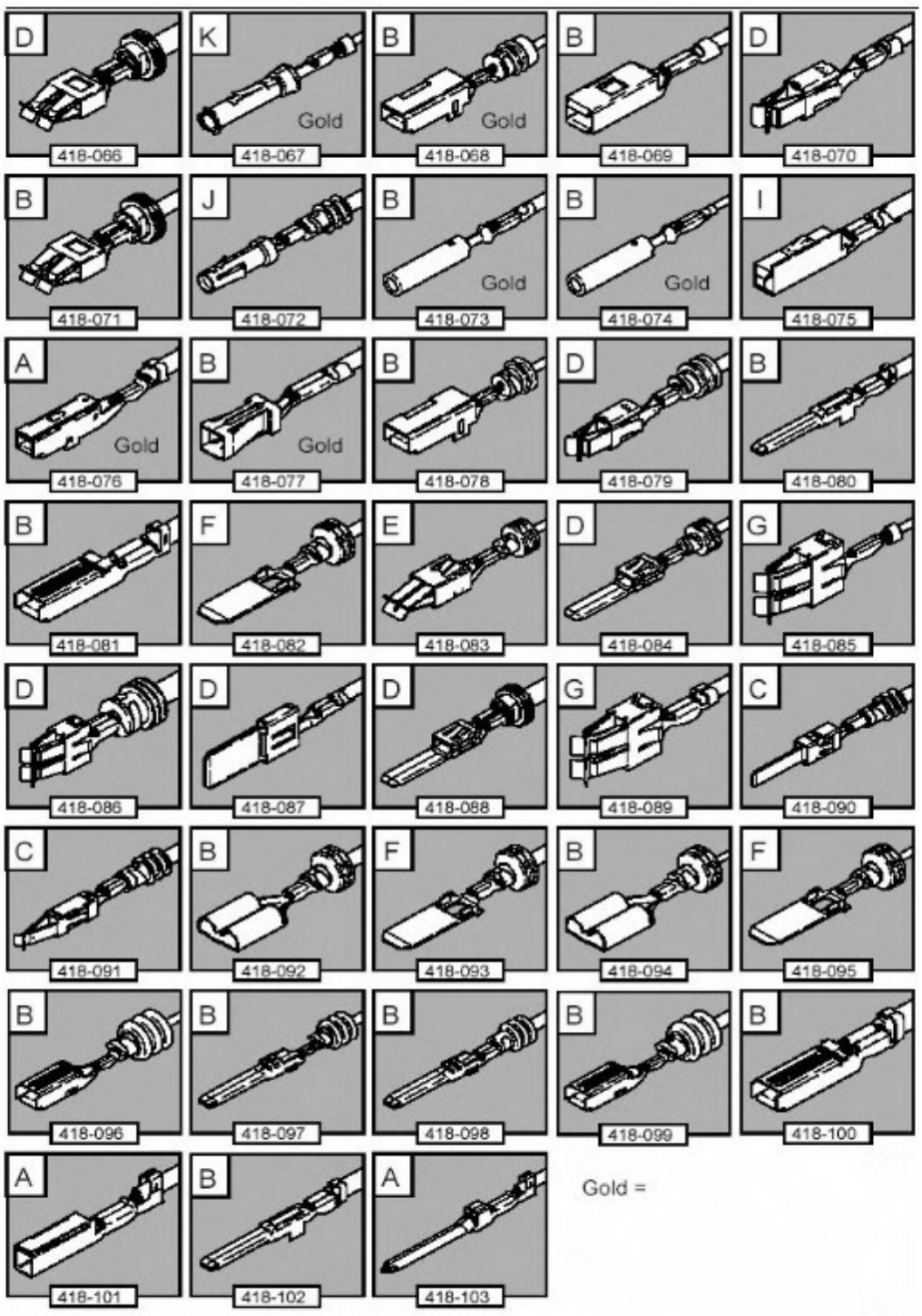
If an electrical connector terminal is not available approval for the repair is **NOT** given and in these circumstances a new wiring harness must be installed.

Pre-Terminated Wiring Harness(s) and Butt Splice Connectors

The pre-terminated wiring harness(s) are supplied with the insulation in one of three colors, red, blue or yellow. The colors do not apply to any particular circuit but to the harness wire size. See the Relationship Table in the Repair Method section.

Butt splice connectors are also supplied with red, blue or yellow coverings, which must be matched to the pre-terminated wiring harness insulation color.

Pre-Terminated Wiring Harness(s)



E130741

The illustration shows:

- The pre-terminated wiring harness(s) which are available via Jaguar/Land Rover authorised parts.
- The part number of the pre-terminated wiring harness
- The letter showing the extractor tip which must be used to remove this type of electrical connector terminal
- Those electrical connector terminals which are gold

Some of the pre-terminated wiring harness(s) have seals installed to the insulation for sealed connector applications. It is essential for prevention of moisture ingress that a sealed pre-terminated wiring harness must be used where a sealed terminal was removed.

CAUTION: Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

Two sizes of heat shrink sleeving are available. Each heat shrink sleeve contains a sealant glue. These must be used when connecting wiring harness(s) or electrical connector terminal(s) at all times. The smaller diameter heat shrink sleeve is to be used with the red and blue butt splice connectors and the larger diameter sleeve with the yellow butt splice connectors.

For ease and speed, some of the pre-terminated wiring harness(s) may already have the insulation partly stripped at the splice end. If the repair requires insulation to be stripped from the cable, refer to the Relationship Table for the correct length of insulation to be stripped.

The Pre-Terminated Wiring Harness(s) illustration shows the electrical connector terminal type, the part number of the pre-terminated wiring harness and the letter of the extractor tip which must be used to extract the electrical connector terminal from the connector housing. Additionally, those electrical connector terminal(s) which are gold are identified, all others are therefore, tinned and not gold.

Wiring Harness Cable Identification Sleeves

A selection of colored sleeves are available for maintaining the wiring harness cable identification on the pre-terminated wiring harness. Place the correct colored sleeve(s) over the pre-terminated wiring harness insulation as near to the electrical connector as possible with the main wiring harness cable color nearest to the electrical connector.

For example, if the original wiring harness cable color is pink with a black trace put the pink wiring harness cable identification sleeve on the pre-terminated wiring harness first followed by a black sleeve, and slide both along the wiring harness cable to the electrical connector terminal.

List of Parts

Description	Part Number	Quantity
Pre-Terminated Wiring Harness(s)	418-066 to 418-103 inclusive	10 each
Glue Lined Heat Shrink Pack – small diameter	418-104	25 per pack
Glue Lined Heat Shrink Pack – larger diameter	418-105	10 per pack
Case Assembly Comprising – carry case, lid, inner lid, base, insert, trays foam spacers	418-106	1
Butt Splice Connector – Red	418-107	50 per pack
Butt Splice Connector – Blue	418-108	50 per pack
Butt Splice Connector – Yellow	418-109	20 per pack
Sleeve Identification Pack – for Red insulation	418-112	500
Sleeve Identification Pack – for Blue insulation	418-113	500
Sleeve Identification Pack – for Yellow insulation	418-114	500

Harness repair components can be ordered from Jaguar/Land Rover authorised parts.

Repair Tools

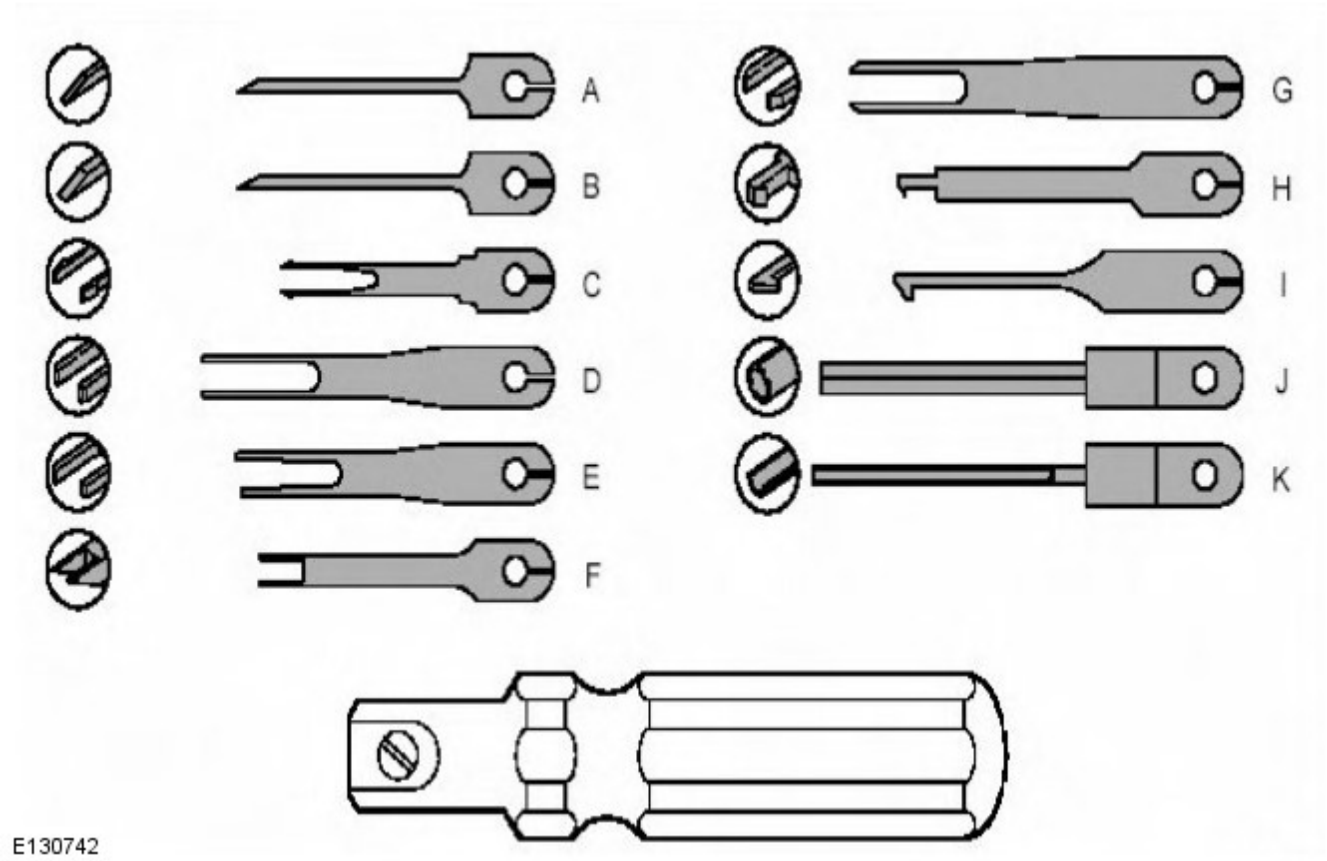
The wiring harness repair tools comprises:

- Crimping pliers
- A wire cutter and insulation stripper
- An electrical connector terminal extraction handle and tips

Extraction Handle and Tips

The extraction handle, in conjunction with the correct tip, is used to remove a terminal from an electrical connector. Each tip is marked with an identification letter, A to K inclusive. Each tip has been specially designed to extract a particular type of electrical connector terminal. The use of any other tool is **not** recommended and is liable to cause damage to the electrical connector. The tip is fastened to the handle by a screw which holds the tip firmly yet allows it to be easily replaced.

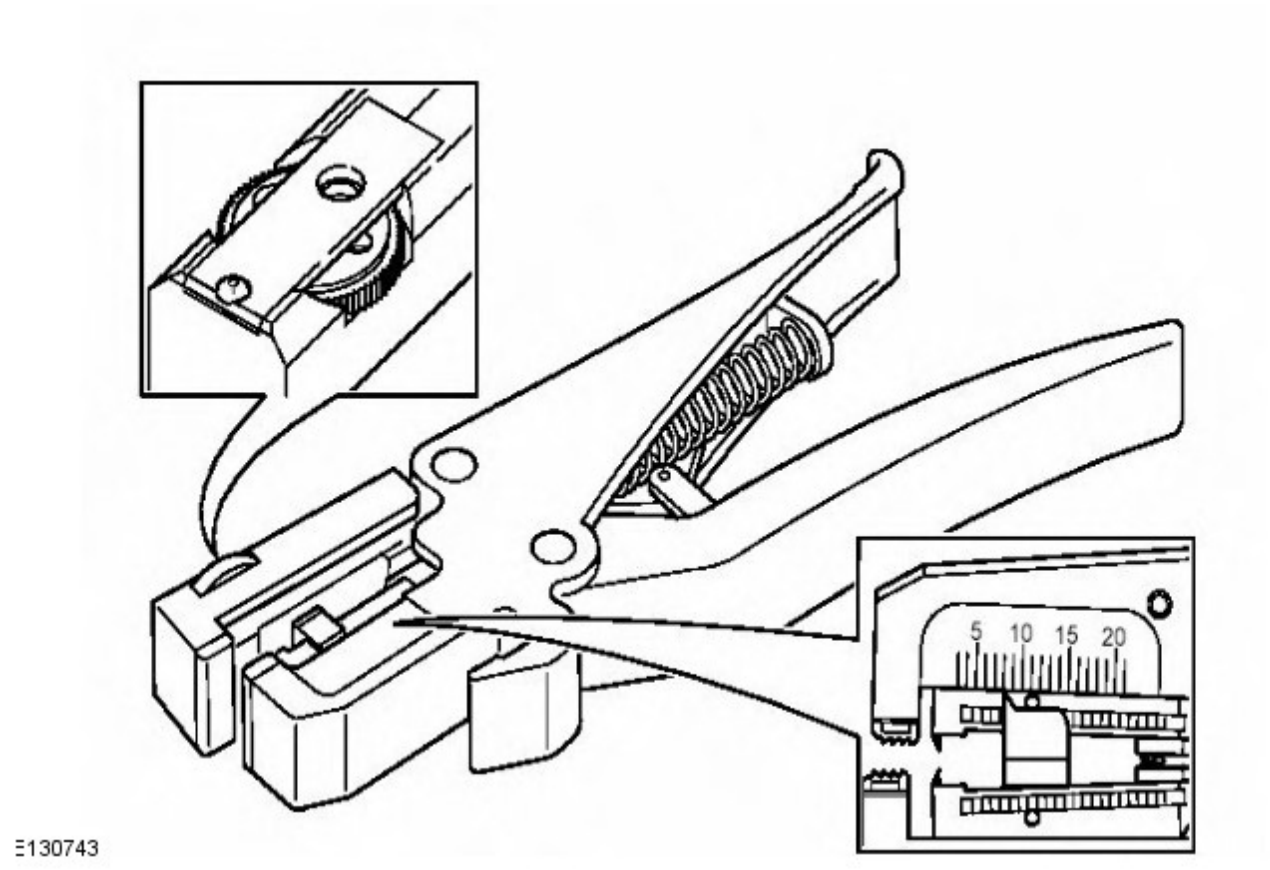
Extraction Handle and Tips



Insulation Stripper

The moving jaw has an adjuster wheel which has a series of holes in it. Turning the wheel and placing the cable in the matching size hole will automatically adjust the jaw to the correct pressure. Note that some wiring harness(s) may have a harder insulation and slight adjustment of the wheel may be needed to make a clean strip but exercise care not to damage the wire.

Insulation Stripper

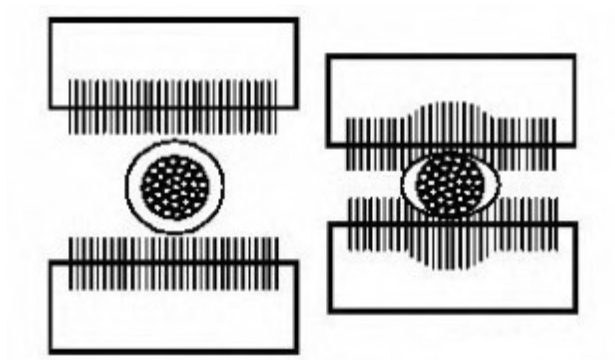


By pressing the outer edges of the wiring harness cable length stop together the adjuster can be slid up or down the jaw. This decreases or increases the length by which the wiring harness cable insulation will be stripped from the

pre-terminated wiring harness or wiring harness wire. The adjuster has a position indicator to align with a graduated scale and this sets the correct length in millimetres, of insulation to be stripped. The amount of insulation to be stripped is shown in the Relationship Table.

The illustration shows the insulation stripper tool and a wiring harness correctly gripped in the jaws. A wire cutter is provided on the outer side of the fixed jaw.

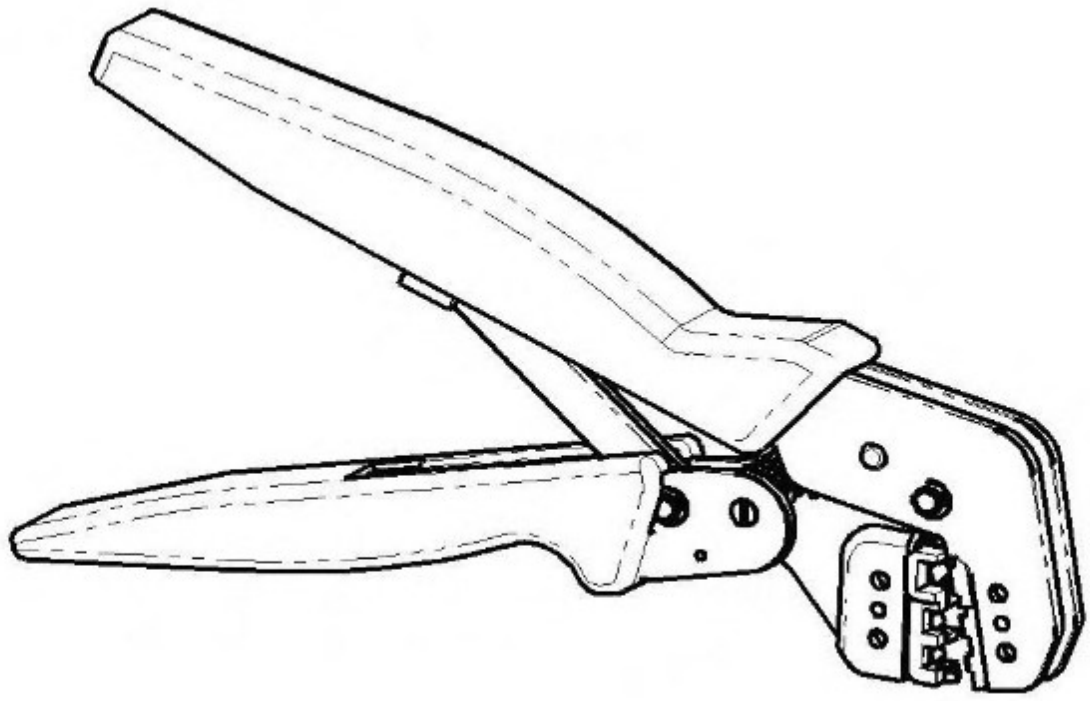
Cable Correctly Gripped in Stripper Blades



E130744

Crimping Pliers

Crimping Pliers



E130745

The crimping pliers have a moving jaw and a stationary jaw, with three different sized crimping enclosures. Each of the enclosures is identified by a red, blue or yellow coloured dot which corresponds to the three colours of the pre-terminated wiring harness(s) and butt splice connector colors.

Description	Part Number	Quantity
Extraction Tool Handle	418-110	1
Extraction Tip Pack consists of 2 spare screws plus	418-S111	1
Tip A	418-118	1
Tip B	418-119	1
Tip C	418-120	1
Tip D	418-121	1
Tip E	418-122	1
Tip F	418-123	1
Tip G	418-124	1
Tip H	418-125	1

Tip I	418-126	1
Tip J	418-127	1
Tip K	418-128	1
Crimping Pliers	YRW500010	1
Wire Stripping Tool	418-117	1

Harness repair tools can be ordered from:

Bosch Automotive Service Solutions

Ironstone Way

Brixworth Industrial Estate

Brixworth

Northants

NN6 9UD

United Kingdom

Telephone: +44 (0) 1327 303400

Fax: +44 (0) 1327 303499

Email: css.uk@bosch-automotive.com

Repair Methods

CAUTION: **Several different types and sizes of terminal may be found in a single electrical connector housing.**

It is necessary to identify:

- The conductor (wire) size of the affected wiring harness
- The electrical connector range from which the damaged wiring harness is to be removed
- The terminal type

Use of the approved diagnostic tool will greatly assist in the quick identification of electrical connectors and faulty pin terminal(s).

Reference can also be made to the vehicle Electrical Guides, held by Dealers, to identify wiring harness(s) and electrical connector(s).

By using the Relationship Table, the wiring harness conductor (wire) size can be related to a suitable pre-terminated wiring harness by the color of the insulation. Also, the correct length of insulation to be stripped from the wiring harness lead is identified.

Relationship Table

CABLE RANGE	SPLICE	STRIP LENGTH
0.35 mm^2 to 1.50 mm^2	RED	6.00 to 7.00 mm
1.00 mm^2 to 2.50 mm^2	BLUE	6.00 to 7.00 mm
4.00 mm^2 to 6.00 mm^2	YELLOW	9.00 to 9.50 mm

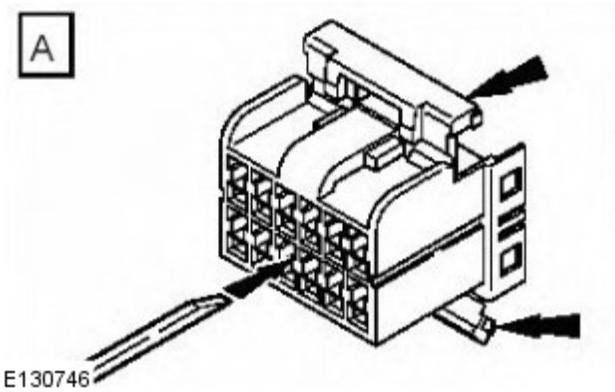
Electrical Connector Terminal Extraction

It must be noted that some electrical connector(s) have anti-backout devices which prevent the terminals from being removed from the electrical connector. Some examples of these are shown in following illustrations. The anti-backout device must be released before attempting to remove the terminal from the electrical connector. Some anti-backout devices require a special tip to release the device. Most can be released by carefully using a suitable small screwdriver.

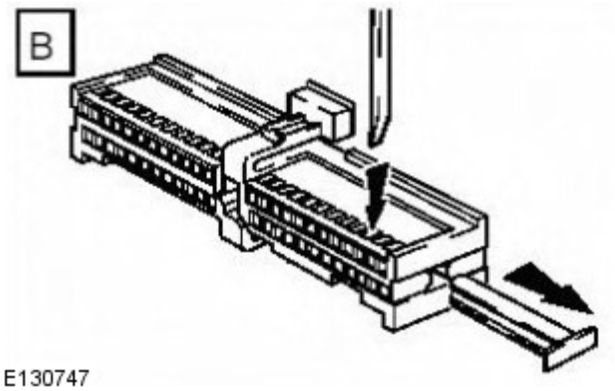
Various types of electrical connector have seals installed internally or externally to prevent moisture ingress. These normally do not have to be removed but make sure that they are installed when the electrical connectors are connected.

The illustrations show examples of each tip used on different types of electrical connector(s). There are a large number of different types of electrical connector used on vehicles therefore only one example using each tip is shown. Technicians experience and judgement will dictate which type of tip should be used for those electrical connector(s) which are not shown. Care should be exercised to avoid further damage when removing the terminals from the electrical connector.

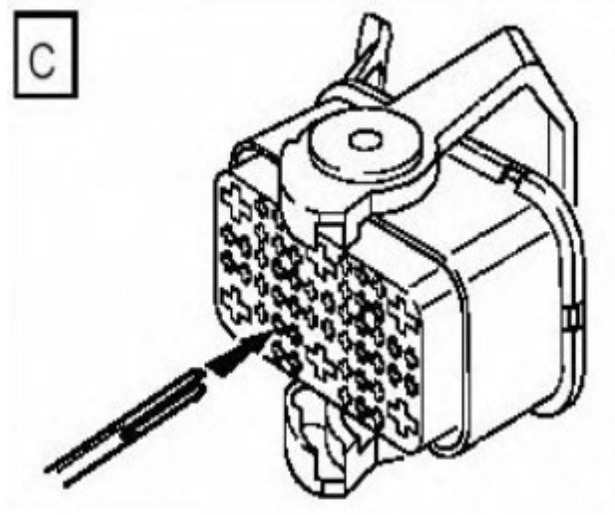
NOTE: **Examples of the extraction tips and anti-backout tips.**

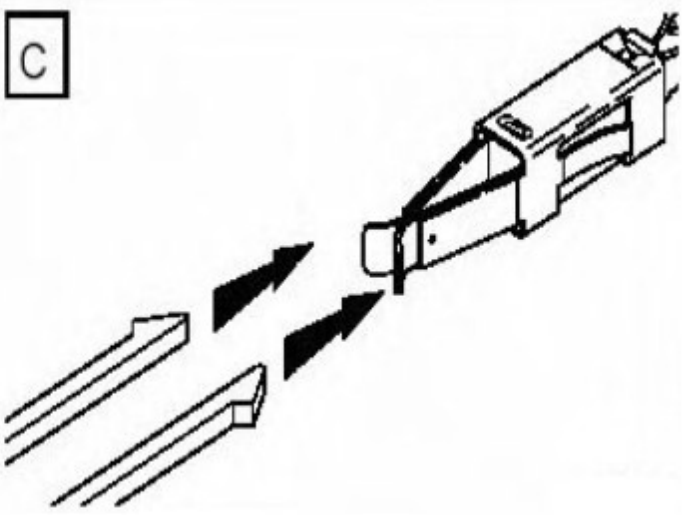


E130746

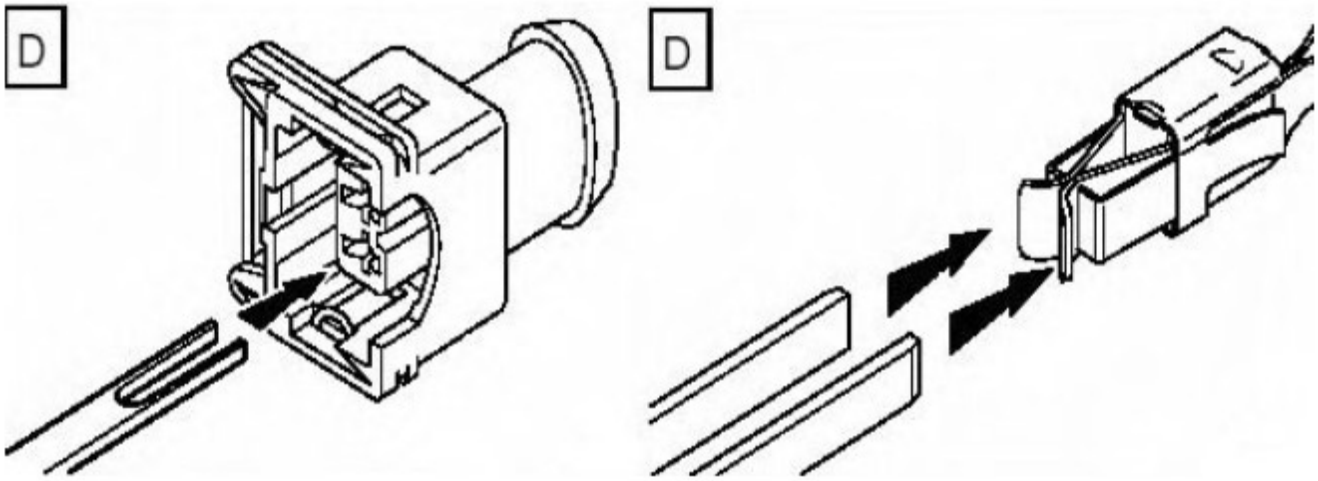


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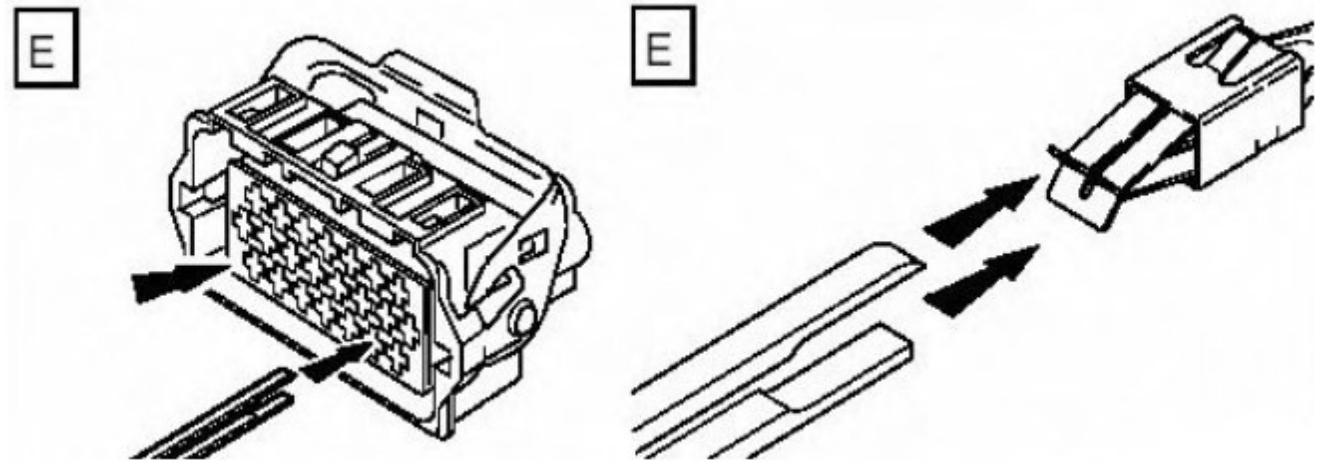




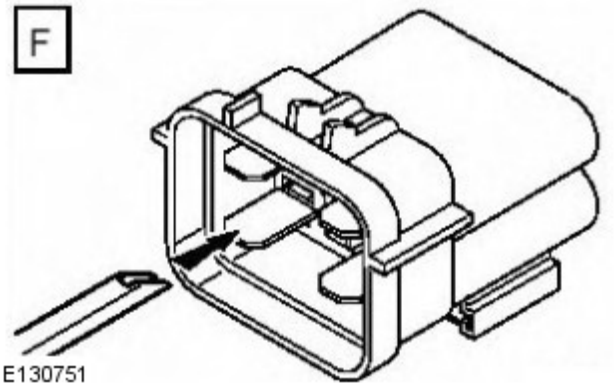
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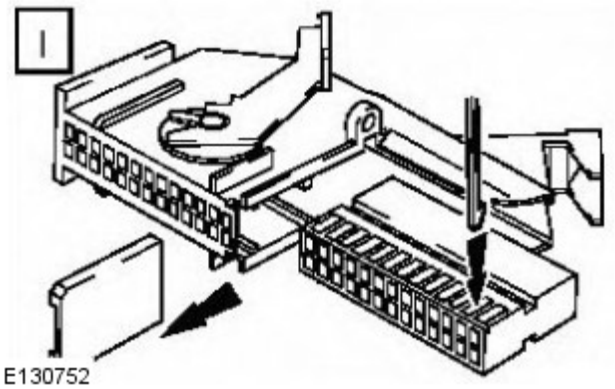
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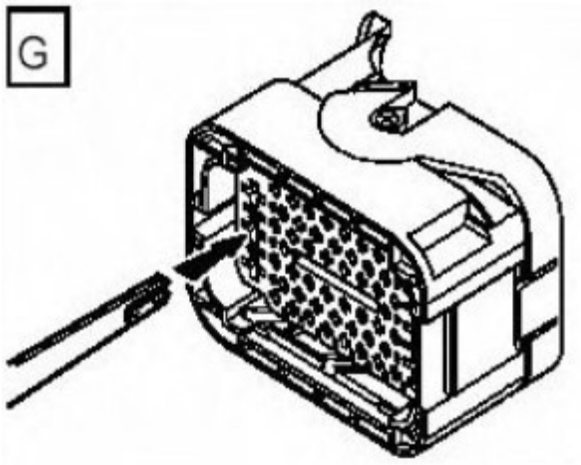
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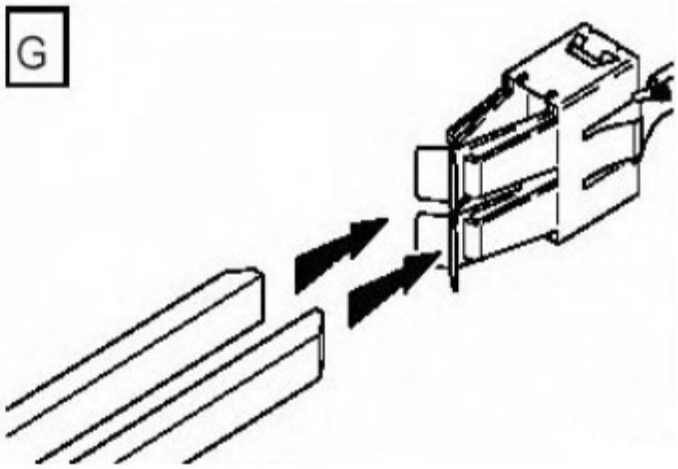


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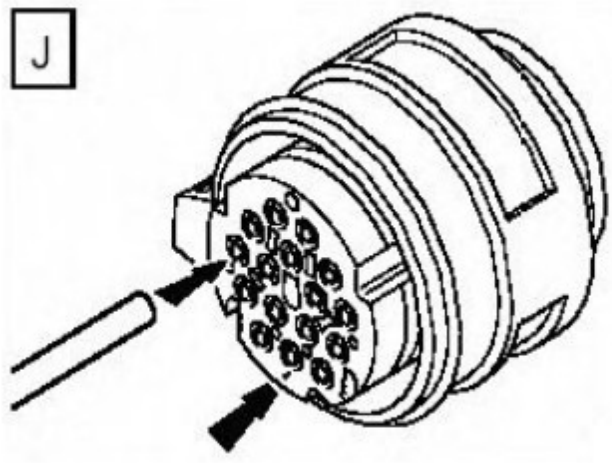


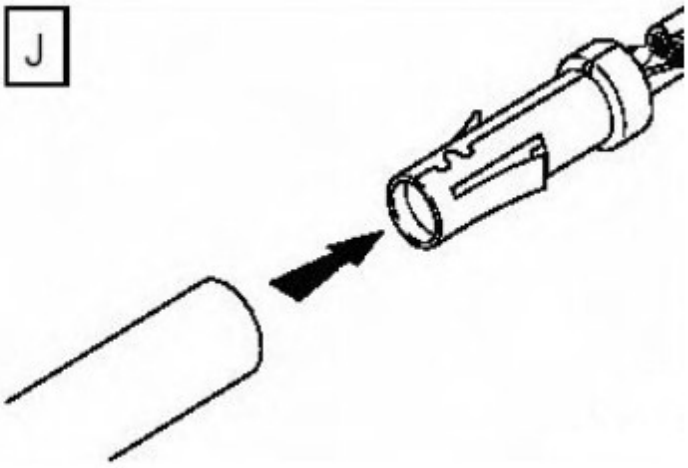
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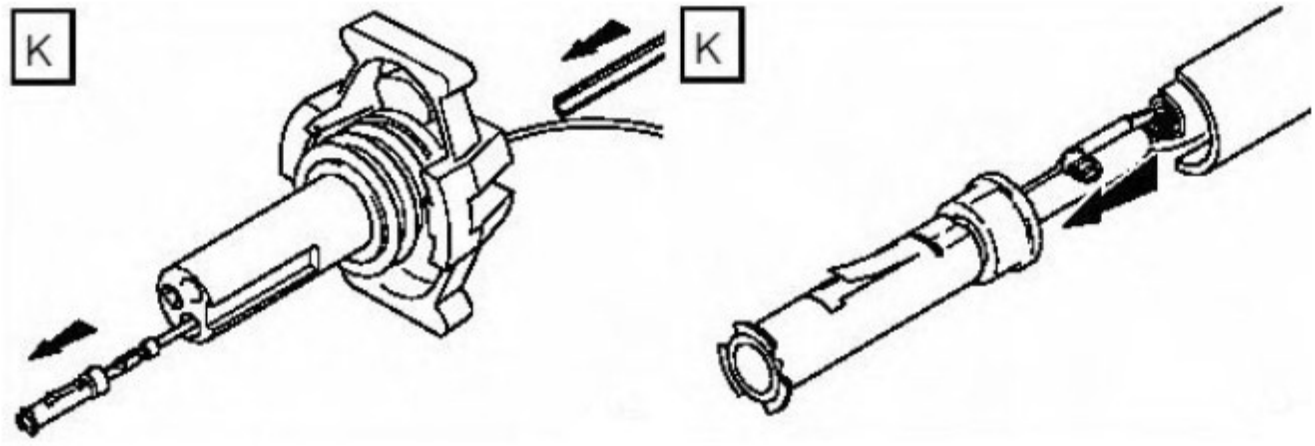


E130753





E130754



E130755

NOTE: The chart shows the electrical connector types, terminal pins/sockets, extractor tip and anti-backout tip.

Electrical connector terminal type	Pin or socket	Extractor tip	Anti-backout tip
Mulitlock 040 series	D	A	
Mulitlock 040 series	B	A	
Mulitlock 070 series	B	B	
Mulitlock 040 series	D	B	
Econoseal III 070 series	D	B	
Econoseal III 070 series	B	B	
Econoseal III 070 series	B	B	
Econoseal III J2	D	B	
Econoseal III 250 series	B	F	
Econoseal III 250 series	D	B	
Econoseal III 250 series	B	F	
Econoseal III 250 series	D	B	
Micro-timer II 1.5mm	D	C	
Micro-timer II 1.5mm	B	C	
Std power timer 4.8 flat	D	G	
Std power timer 5.8 flat	B	D	
Std power timer 5.8 flat	B	D	
Std power timer 2.8 flat	D	D	
Std power timer 4.8 flat	D	G	
Std power timer 5.8 flat	B	D	
Ford 2.8 flat	D	E	H
Mulitlock 070 series	D	B	
Mulitlock 070 series	B	B	
Junior power timer 2.8 flat	D	D	
Sumitomo TS90 connector	B	B	H
Modu IV gold plated	D	B	
Mulitlock 040 series gold plated	D	A	
Micro qualock	D	I	
EECV	D	B	
EECV	D	B	
Kostal dia 1.50 series	D	J	
AMP 6.3 flat	D	B	
Junior power timer 2.8 flat	D	D	
2.8 series	D	B	I
Sumitomo TS90 connector	D	B	H
Ducon 0.60 gold plated	D	K	
AMP 6.3 flat	D	D	
Econoseal III 250 series	B	F	

Repair Procedure

CAUTIONS:

Do not use crimping pliers, insulation strippers, butt splice connectors, heat shrink sleeves or pre-terminated wiring harness(s) that are not supplied with by authourised Jaguar/Land Rover parts. Each part has been designed to

be used only with the other parts available from Jaguar/Land Rover parts.

Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

It is not correct to make more than five repair joints on the wiring harness to any electrical connector and if more damage is found at the same electrical connector then a new wiring harness must be installed.

1. Remove the faulty terminal from the electrical connector using the extractor tool and correct tip. Make sure that any anti-backout device is released before trying to remove the terminal.
2. CAUTION: A number of electrical connector terminals are gold plated or gold flashed. When defective, they must be installed with a gold pre-terminated wiring harness(s). It is not always easy to identify the female as gold but the male pins are visually easier, therefore always check both male and female terminals to identify those which are gold. Under no circumstances are gold and tin terminals to be mixed as this will lead to early failure of the electrical contact.

   NOTE: Never use a harness lead with a smaller diameter than the original harness lead.

   Select the correct size and type of pre-terminated wiring harness and butt splice connector.
3. Using the wire cutter on the stripping tool, cut the pre-terminated wiring harness and the harness cable to the required length.
4. NOTE: See illustration: **Stripping Insulation**

   From the Relationship Table, find the correct length of insulation to be stripped from the pre-terminated wiring harness and set the adjustable cable length stop to the correct length. Place the pre-terminated wiring harness in the wire stripper and remove the insulation.
5. Put the cable identification sleeve(s) on to the wiring harness with the main cable colour nearest to the terminal.
6. During this next step do not over tighten. Place the selected butt splice connector in the crimping tool, matching the aperture and the butt connector colours. Make sure that the window indentation in the butt connector is resting over the guide bar on the lower jaw. Partially close the grip until the butt connector is securely held in the aperture. This will give support to the butt connector while the pre-terminated wiring harness is inserted into it.
7. NOTE: See illustration: **Splice Correctly Located**

   Insert the pre-terminated wiring harness into the butt connector and make sure that the wire is against the wire stop. Close the grip firmly, crimping the lead to the butt connector. When the handles have been completely closed the butt connector will be freed from the tool as the handles are released. If the handles have not been completely closed then the jaws will hold the butt connector and it cannot be removed from the tool until the crimp is fully made by closing the handles completely.
8. Make sure that the harness cable has been squarely cut and the correct length of insulation removed. If more than one splice is needed the butt connectors must be not be crimped to the wiring harness at the same distance from the connector. The splices must be staggered to prevent a bulk of splices in the same area of the wiring harness.
9. It is preferable to cover the butt splice joint with heat shrink sleeve. This is desirable not essential, except where the electrical connector is a sealed electrical connector. Use the smaller diameter sleeve for red and blue pre-terminated wiring harness(s) and the large diameter sleeve for the yellow pre-terminated wiring harness(s). It is advisable to place the heat shrink over the completed joint but in some instances the sleeve will not pass over the terminal. Check, and if required, place the correct size sleeve onto the harness cable or pre-terminated wiring harness before crimping the butt splice to the wiring harness.
10. Place the harness cable into the butt splice with the splice window over the guide bar. Make sure that the cable harness wire is against the stop in the butt splice, crimp the butt splice connector to the wiring harness.
11. Gently pull the harness cables each side of the butt splice to make sure that a secure joint has been made.
12. WARNING: Do not use a naked flame in areas where fuel or oil have been spilt. Clean the area of residual oil and fuel and wait until the fuel spill has fully evaporated.

    CAUTIONS:

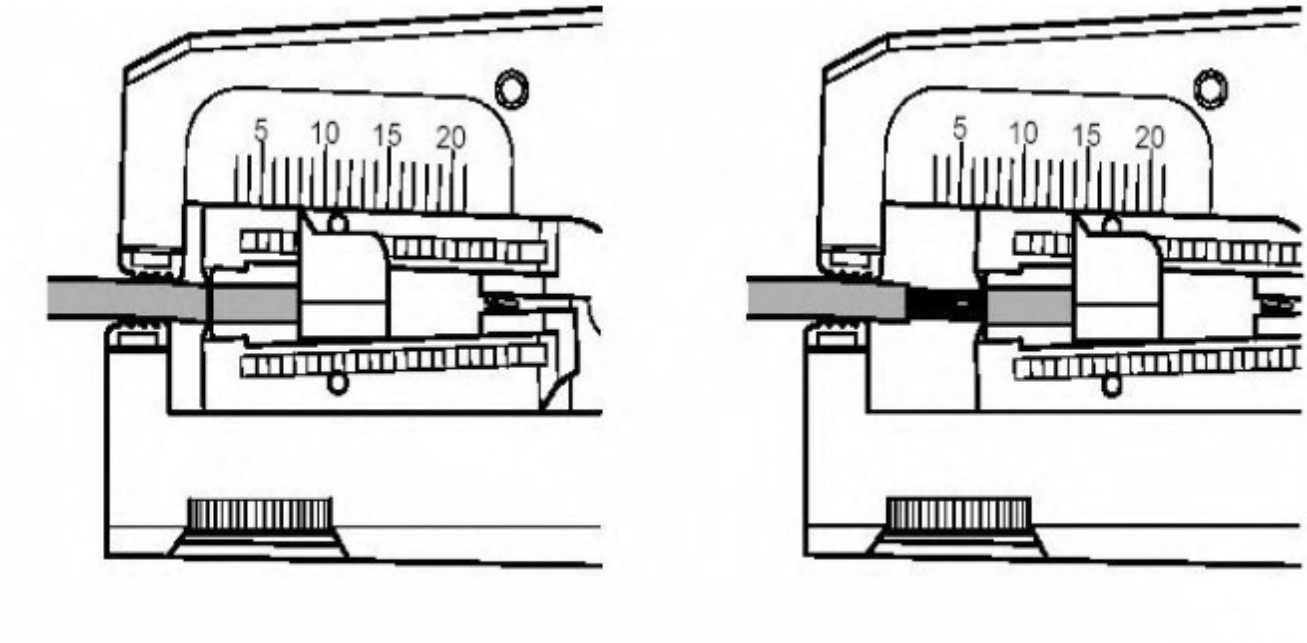
    When using a heat source make sure that it is localised and causes no damage to surrounding materials.

    Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

    Using a suitable heat source, shrink the sleeve over the butt splice.
13. If further pre-terminated wiring harness(s) are to be installed to the same electrical connector, make sure that the lead is cut at a different length to the previous joint. This makes sure that the splices will, where possible, be staggered on the wiring harness and prevent a bulk of splices in one area.
14. When all of the splices have been made, fit the terminal(s) to the electrical connector, taking care that the terminals are correctly orientated.
15. Install the wiring harness cover and secure with adhesive electrical tape. Do not cover the wiring harness

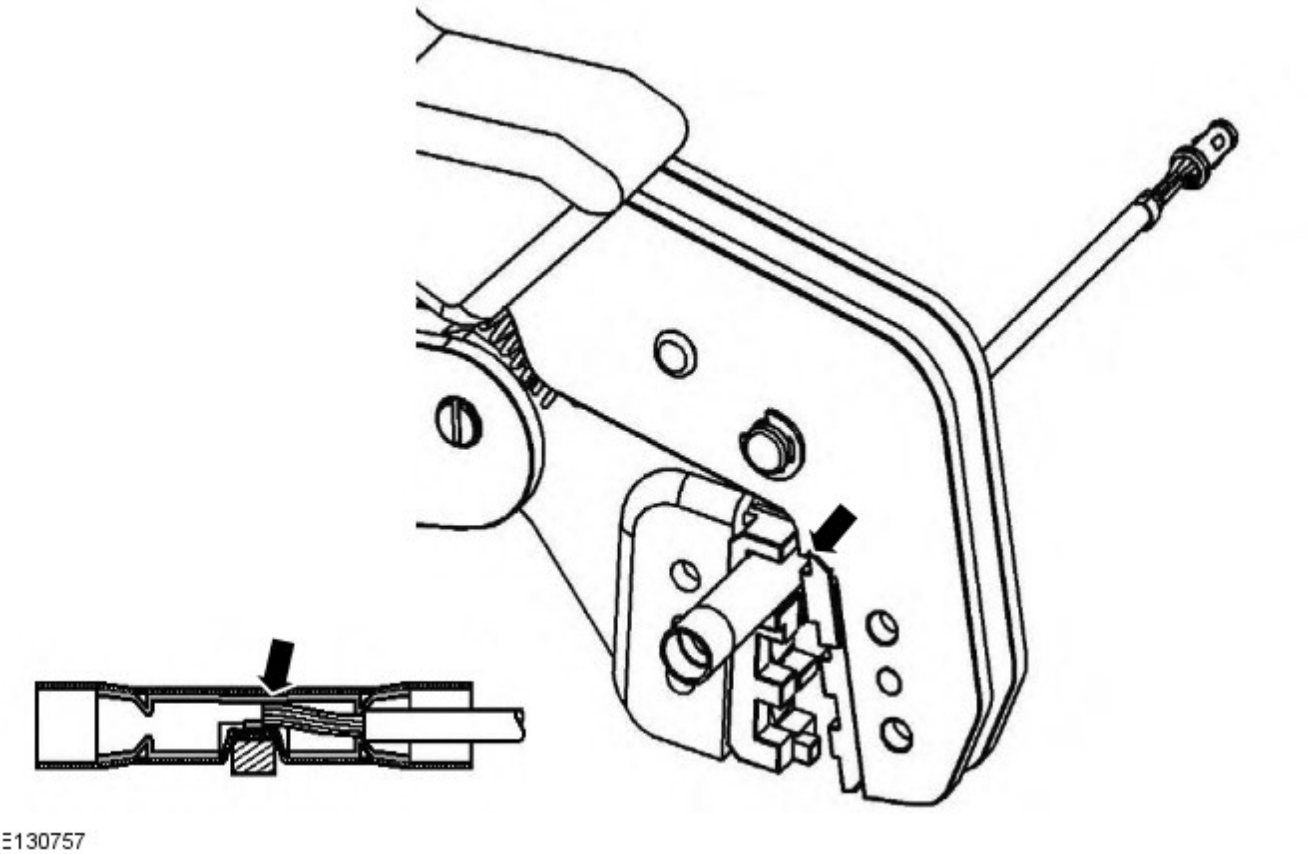
right to the electrical connector as the terminals must have a little movement and not be firmly bound to the electrical connector or wiring harness. Make sure that the cable identification sleeve(s) are showing at the wiring harness electrical connector.

Stripping Insulation



E130756

Splice Correctly Located



E130757

Published: 11-May-2011

Wiring Harnesses - Wiring Harness Repair

General Procedures

1. For additional information, refer to: Wiring Harness (418-02 Wiring Harnesses, Description and Operation).

Published: 11-May-2011

Wiring Harnesses - Engine Wiring Harness TDV6 3.0L Diesel

Removal and Installation

Removal

NOTES:

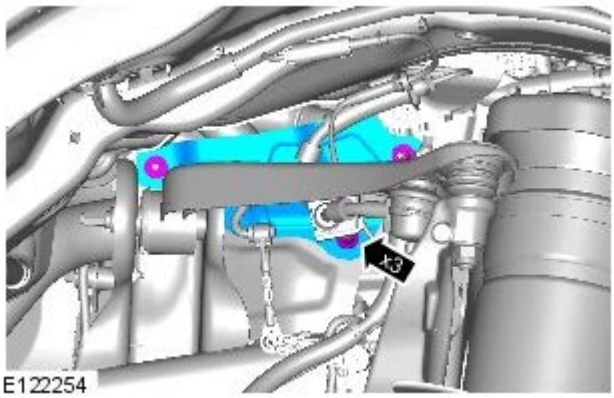
RHD shown, LHD is similar.

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

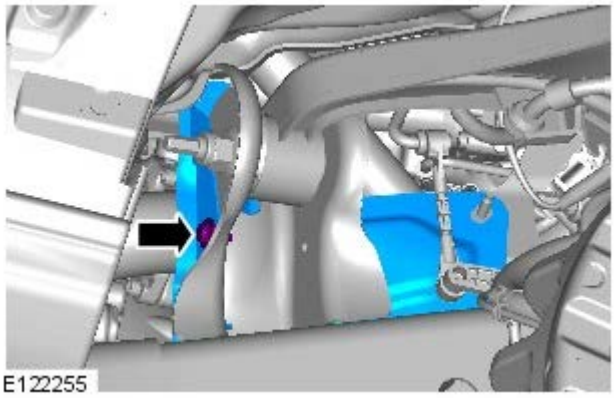
Removal steps in this procedure may contain installation details.

1. Remove the battery.
   For additional information, refer to: Battery (414-01, Removal and Installation).
2. For additional information, refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).
3. For additional information, refer to: Exhaust System (309-00, Removal and Installation).
4. For additional information, refer to: Starter Motor (303-06, Removal and Installation).
5. For additional information, refer to: Generator (414-02, Removal and Installation).
6. For additional information, refer to: Exhaust Gas Recirculation (EGR) Valve LH (303-08, Removal and Installation).
7. For additional information, refer to: Air Conditioning (A/C) Compressor (412-03, Removal and Installation).
8. For additional information, refer to: Power Steering Pump - 3.0L Diesel (211-02, Removal and Installation).
9. WARNING: Make sure to support the vehicle with axle stands.

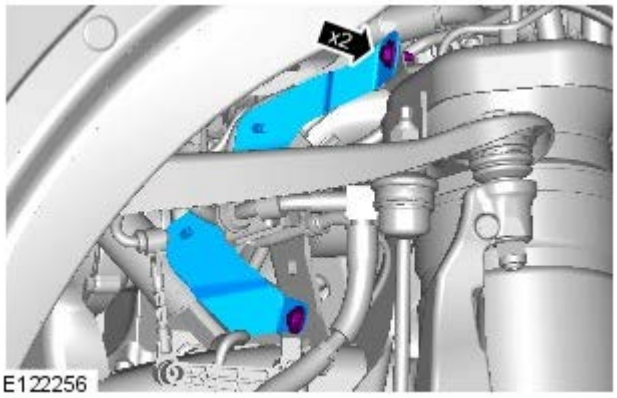
   Raise and support the vehicle.
10. Remove the front road wheels and tires.
    - TORQUE: 140 Nm
11. TORQUE: 9 Nm



12. TORQUE: 9 Nm

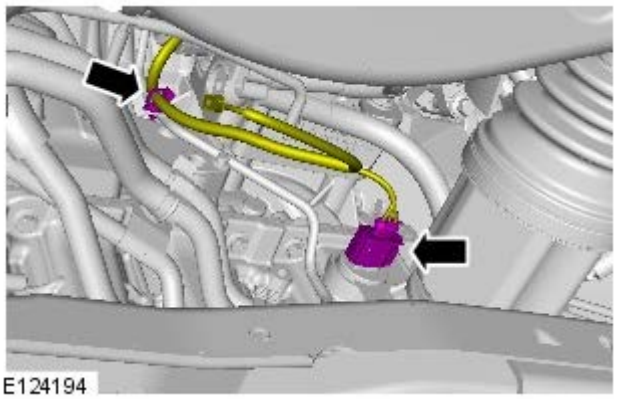

E122255

13. TORQUE: 9 Nm

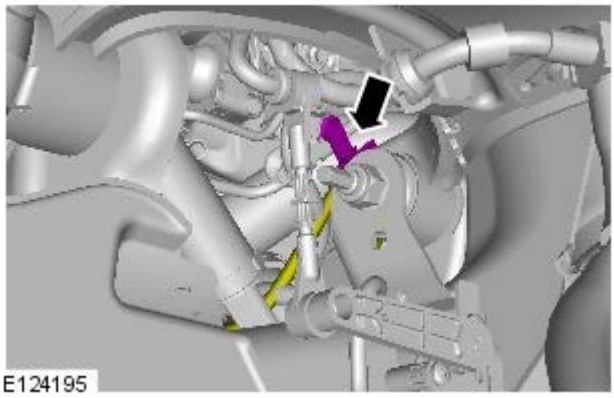


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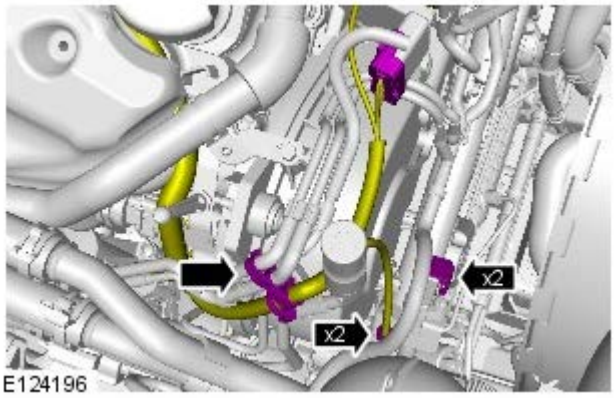
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E124194

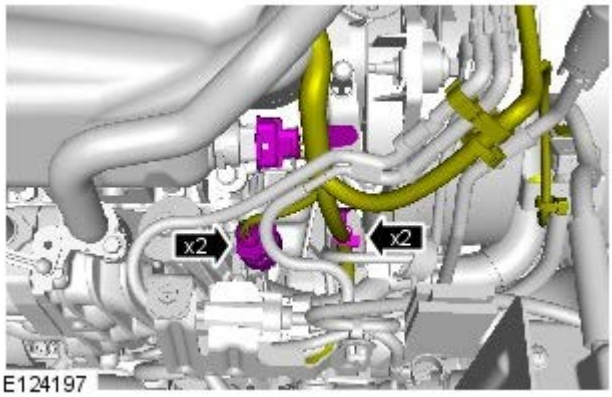
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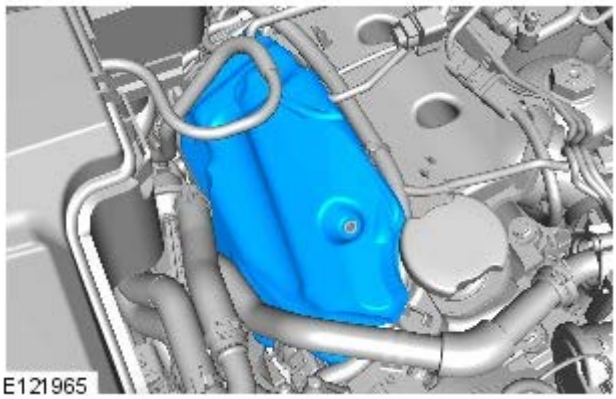
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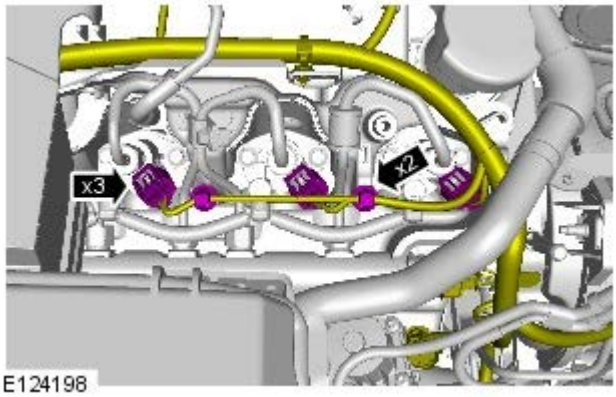
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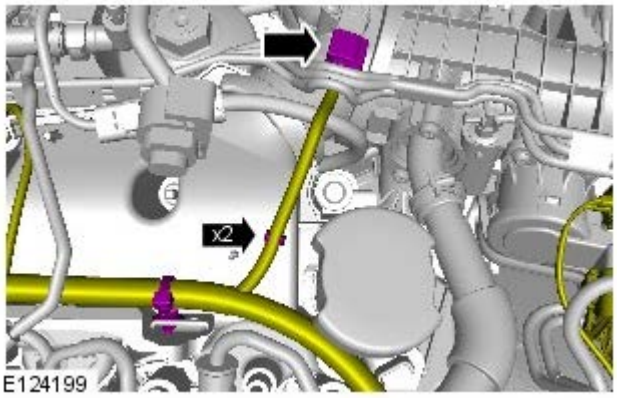
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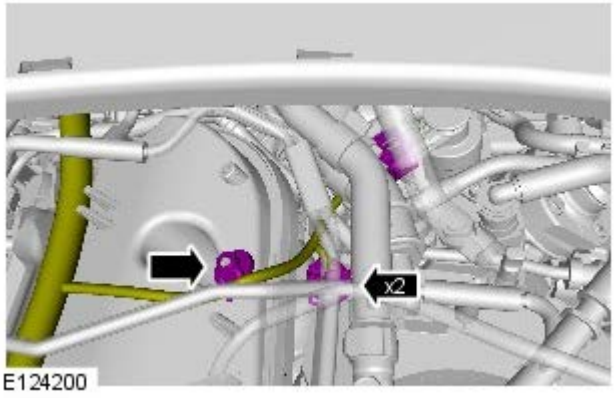
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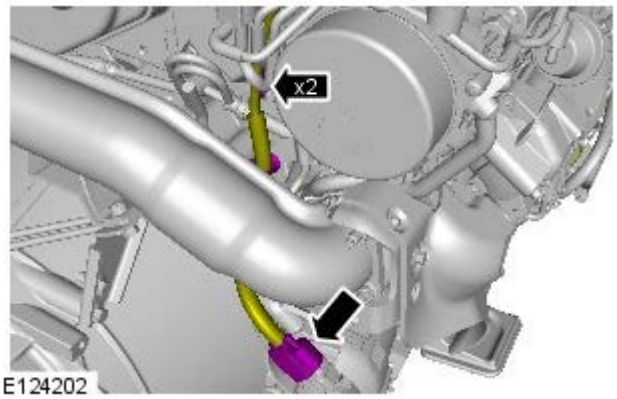
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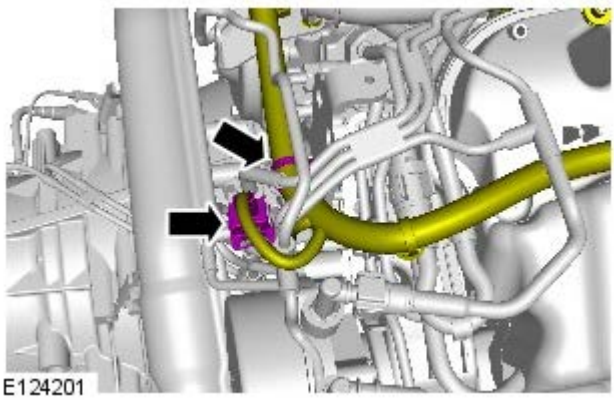
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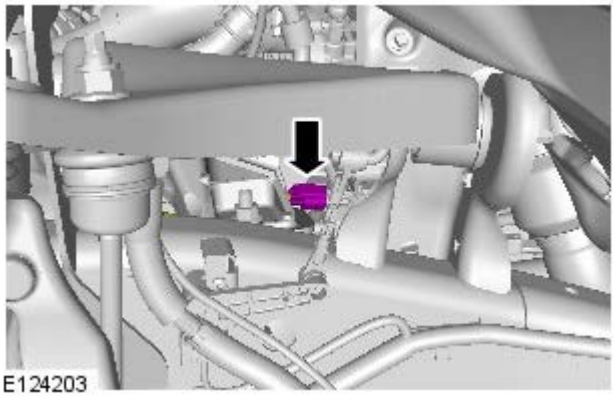
22. NOTE: Engine shown removed for clarity.



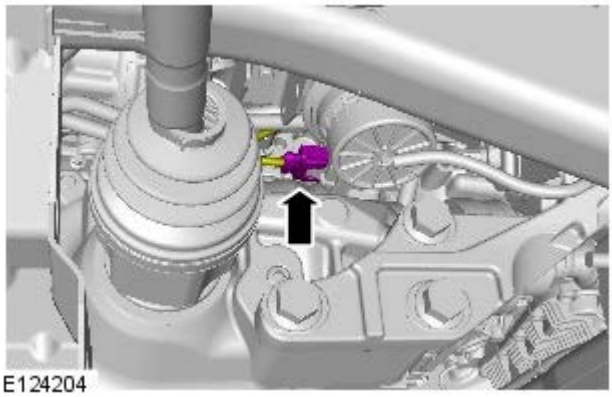
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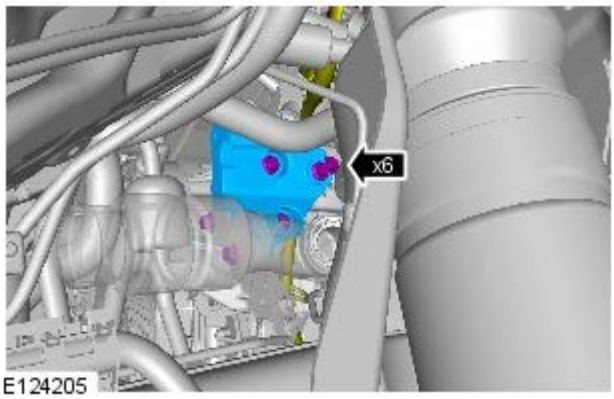
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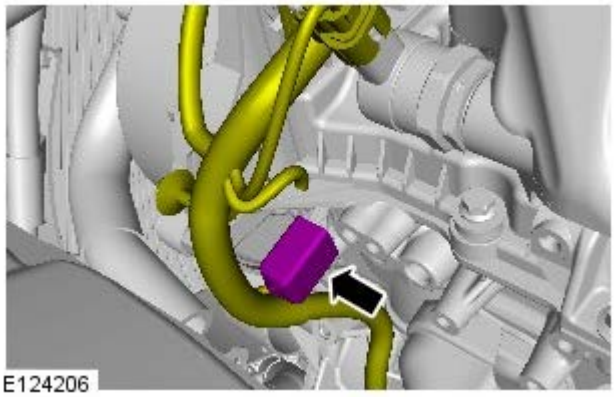
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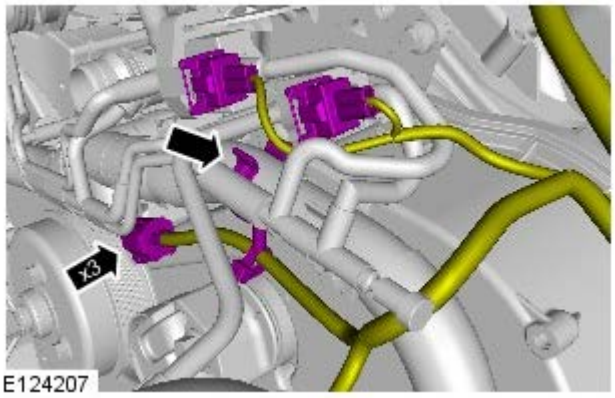
26. TORQUE: 25 Nm



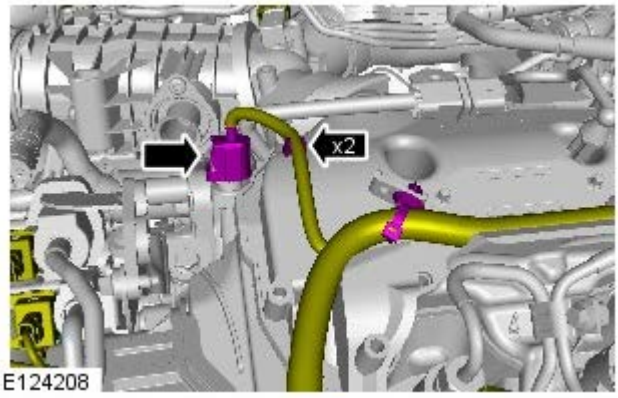
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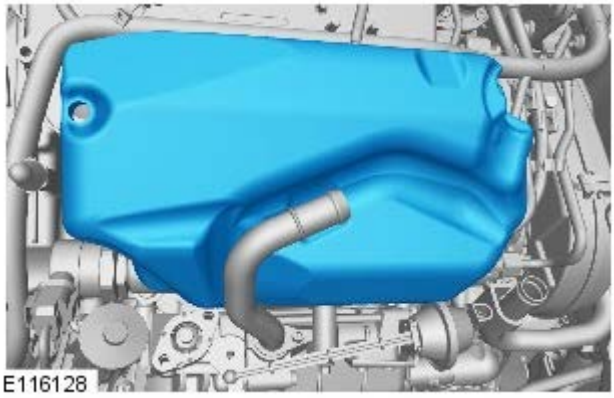
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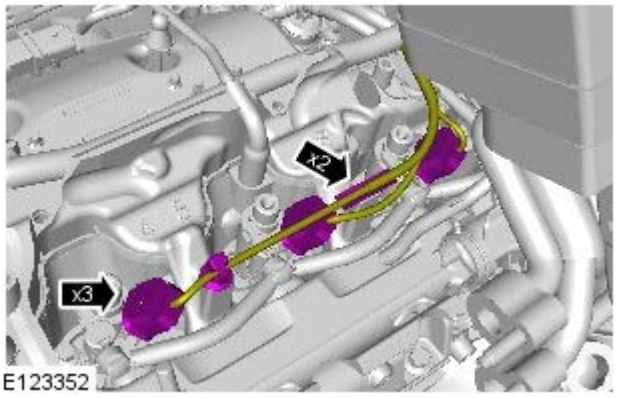
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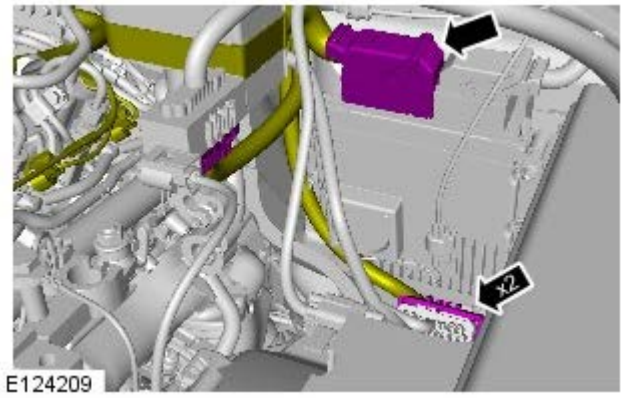
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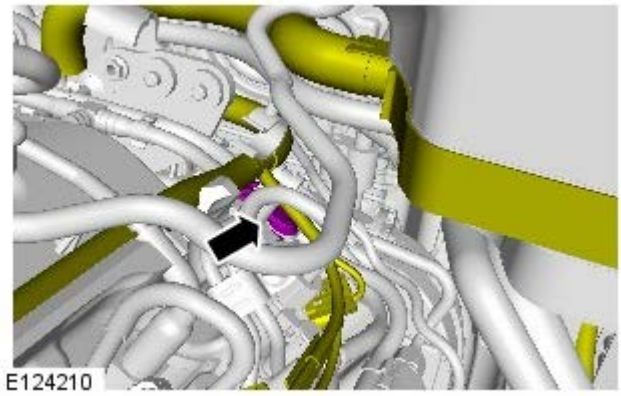
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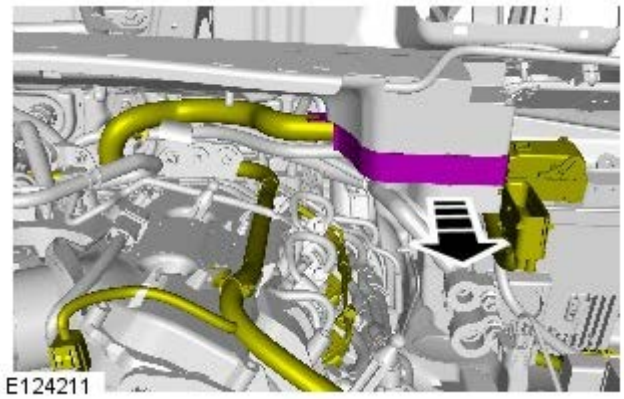
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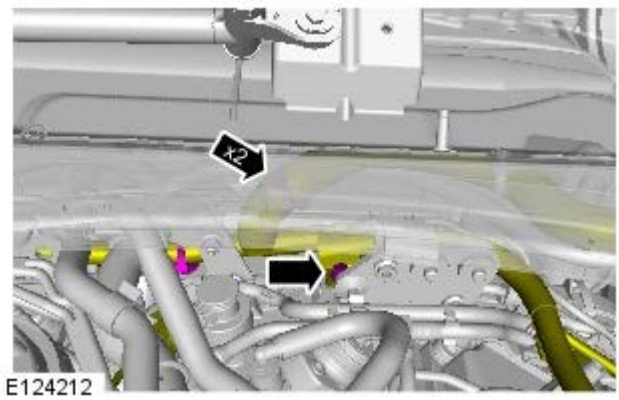
33.



34.

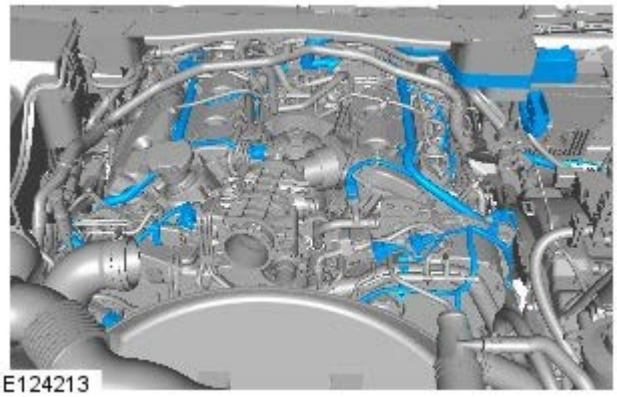


35. TORQUE: 10 Nm



36. CAUTION: Take extra care not to damage the wiring harnesses.

NOTE: Note the position of the wiring harnesses to aid installation.


E124213

Installation

1. To install, reverse the removal procedure.

Published: 01-Jun-2011

Wiring Harnesses - Engine Wiring Harness V8 5.0L Petrol/V8 S/C 5.0L Petrol

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

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. For additional information, refer to: Specifications (414-00, Specifications).

3. For additional information, refer to: Auxiliary Battery Tray (414-01, Removal and Installation).

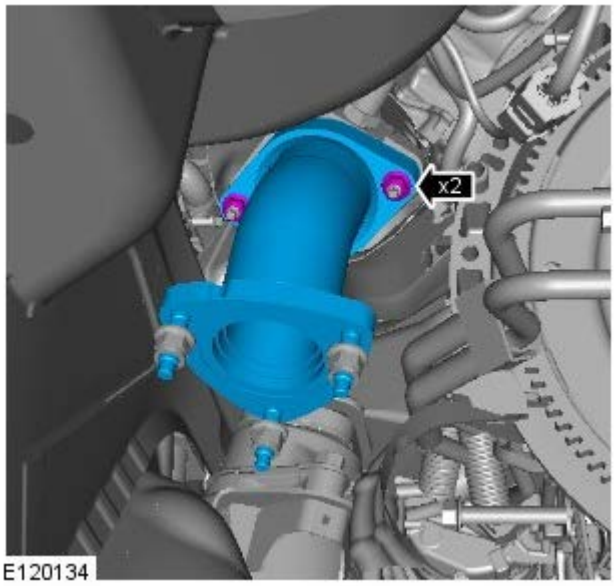
4. For additional information, refer to: Battery Tray (414-01, Removal and Installation).

5. For additional information, refer to: Air Cleaner Outlet Pipe LH (303-12, Removal and Installation).

6. For additional information, refer to: Air Cleaner Outlet Pipe RH (303-12, Removal and Installation).

7. For additional information, refer to: Plenum Chamber (412-01, Removal and Installation).

8. For additional information, refer to: Exhaust System (309-00, Removal and Installation).

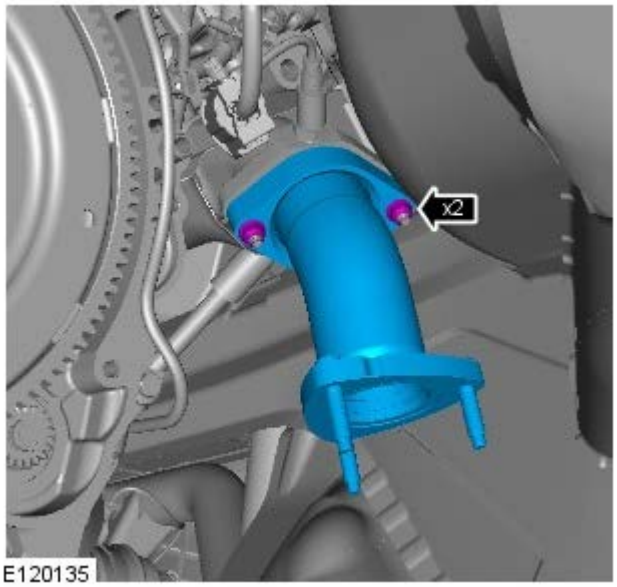


9. NOTE: Remove and discard the gasket.

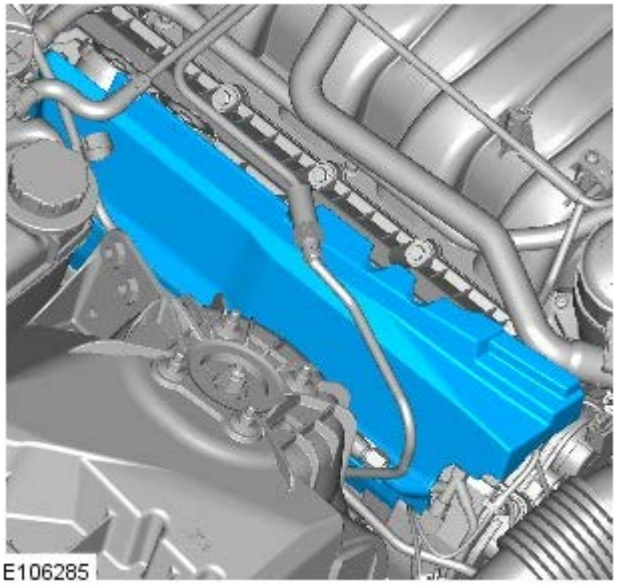
   TORQUE: 48 Nm

10. NOTE: Remove and discard the gasket.

    TORQUE: 48 Nm

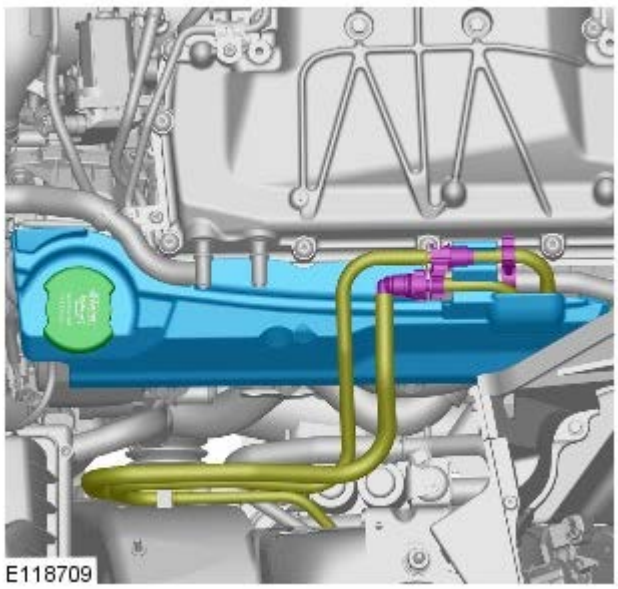


11.

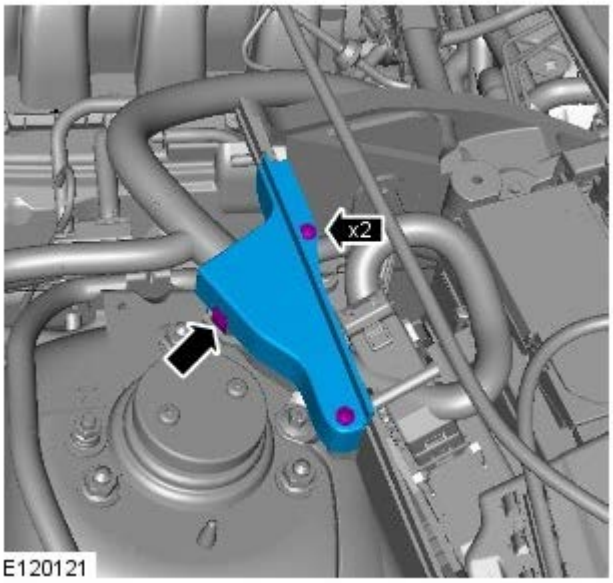


12. WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

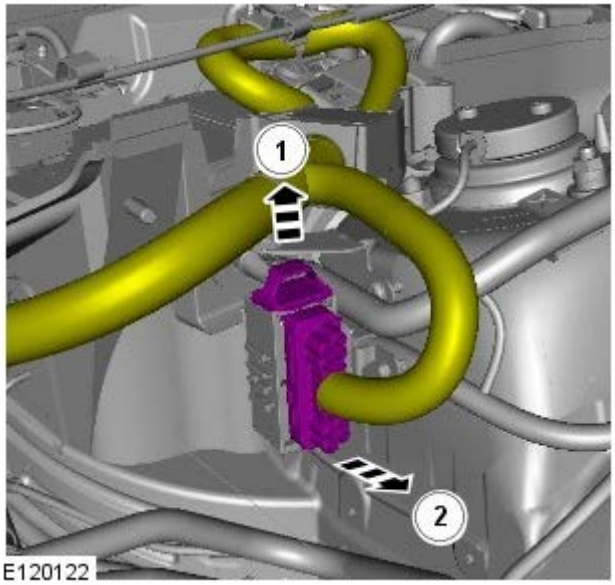
CAUTION: Be prepared to collect escaping fuel.



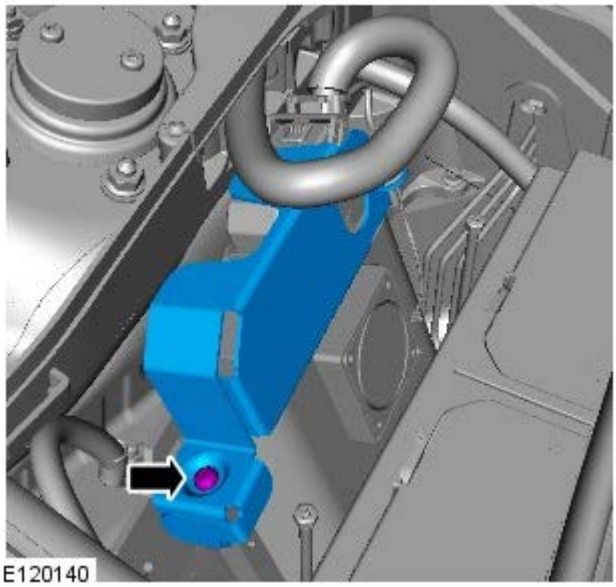
13. NOTE: RHD illustration shown, LHD is similar.



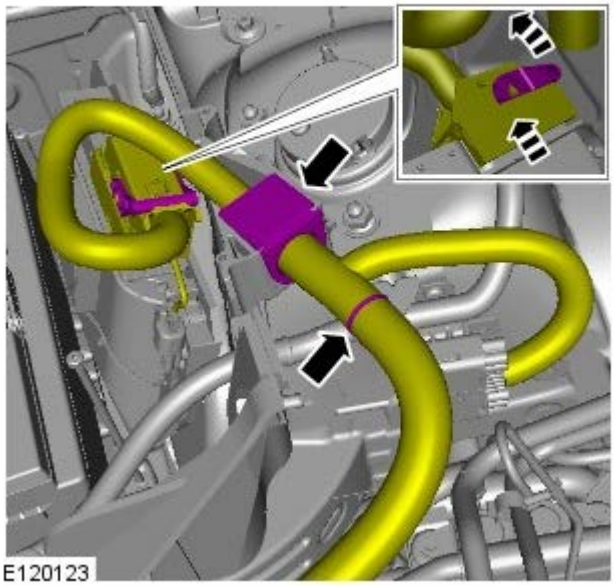
14.



15.

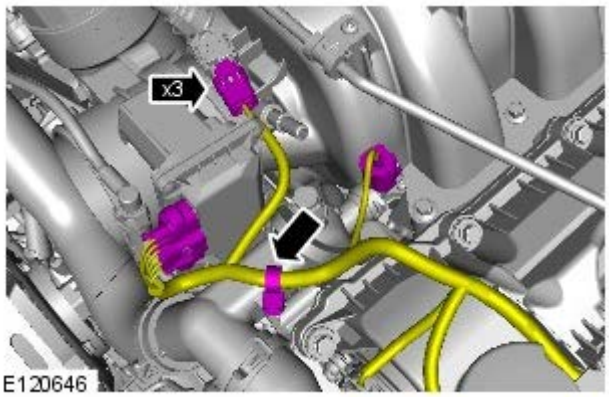


16. NOTE: Make sure the electrical connector is correctly secured.



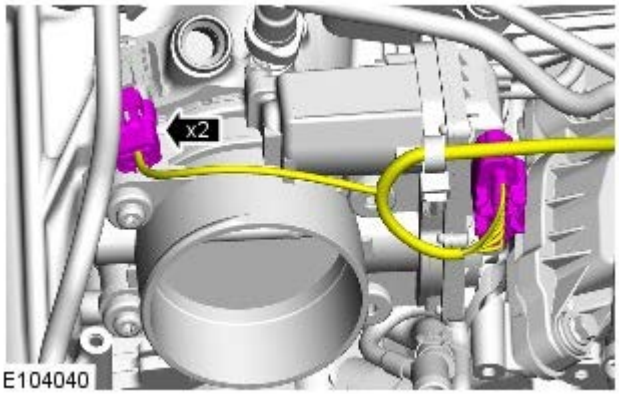
Vehicles without supercharger

17.



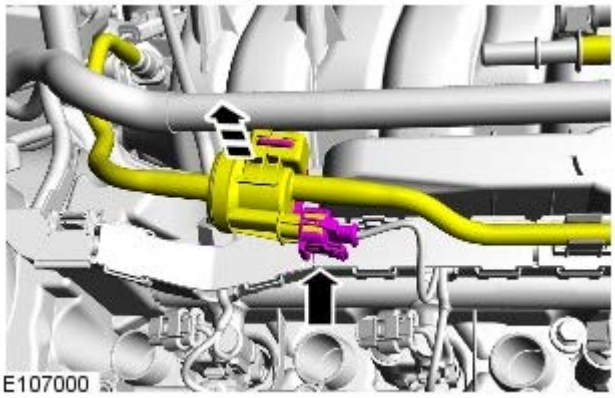
Vehicles with supercharger

18.

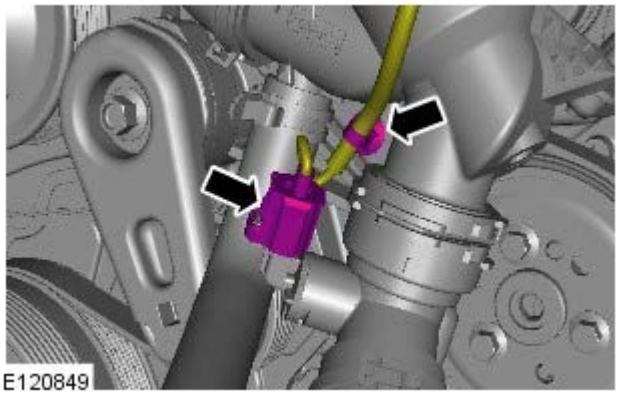


All vehicles

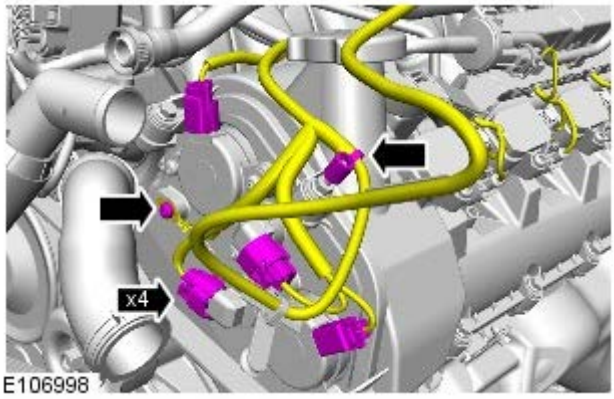
19.



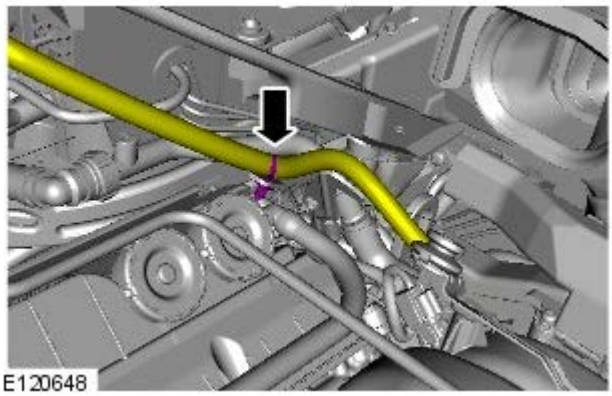
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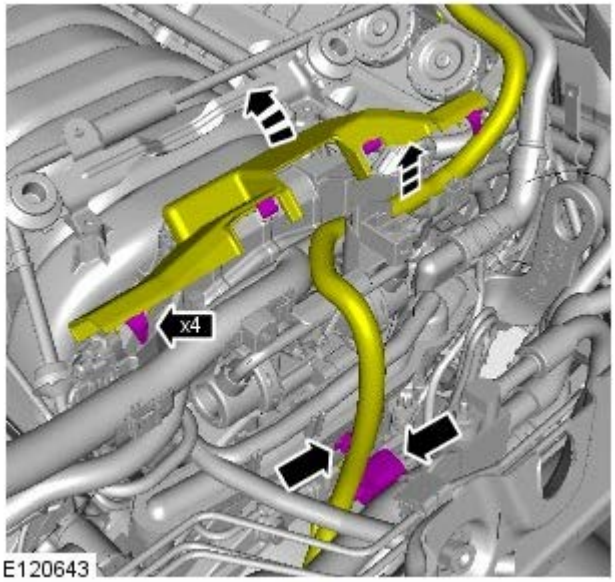
21. TORQUE: 10 Nm



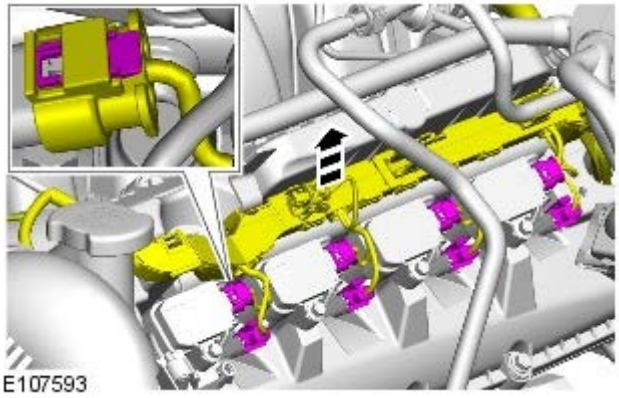
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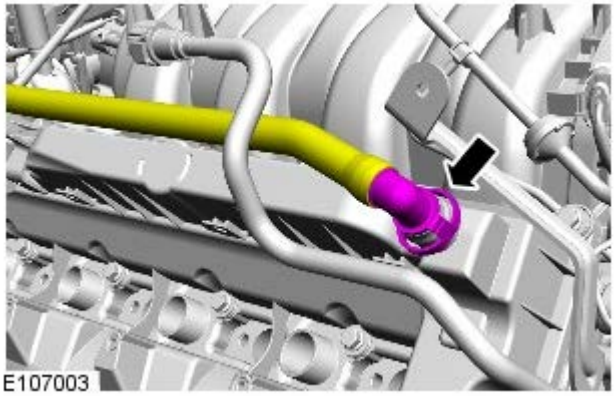
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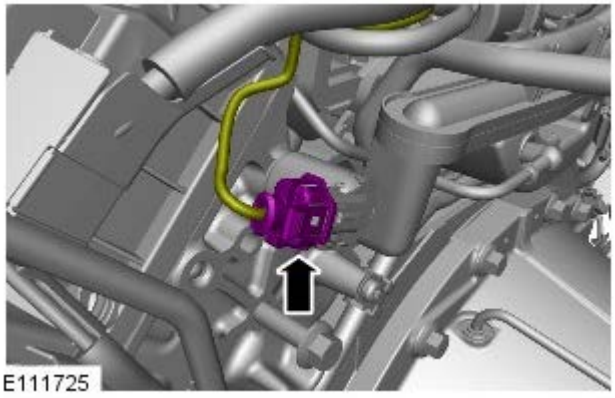
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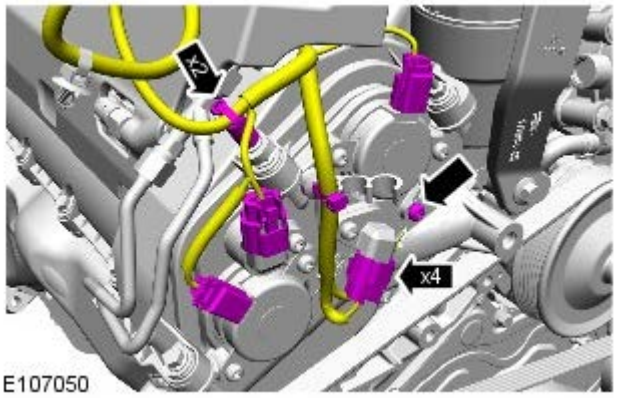
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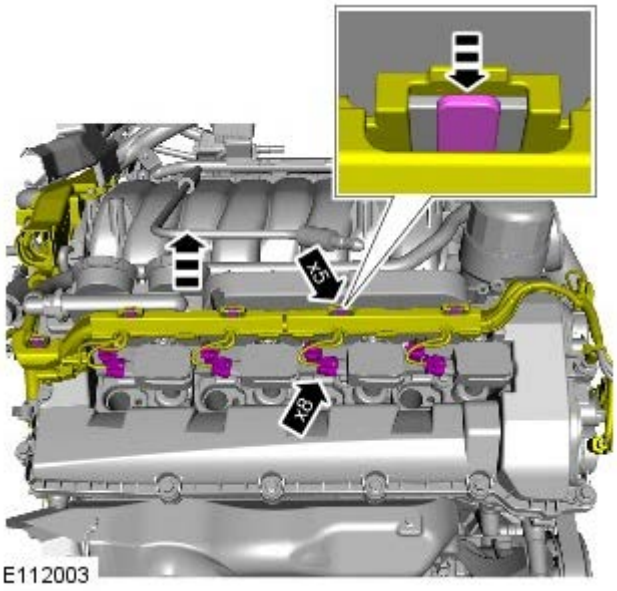
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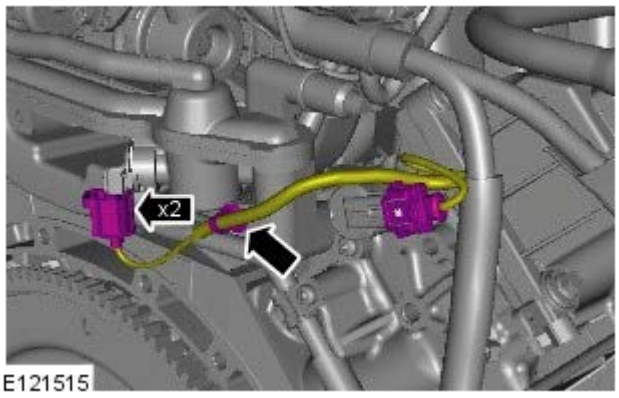
27. TORQUE: 10 Nm



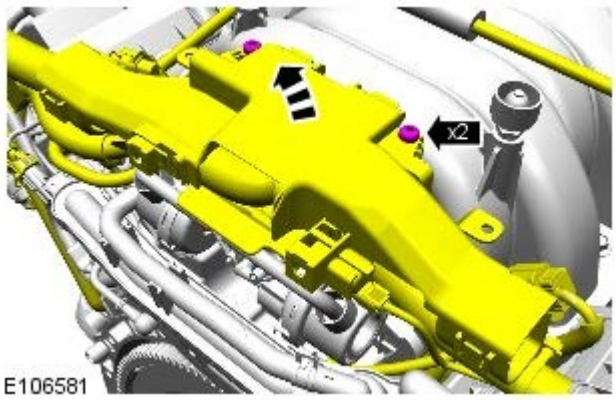
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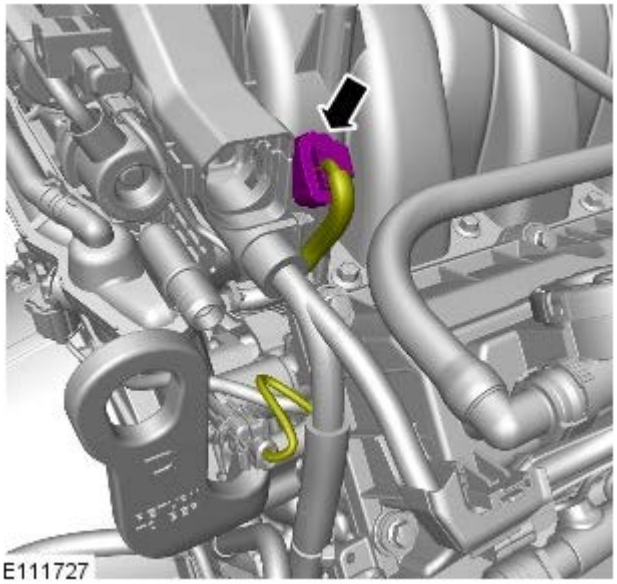
29.



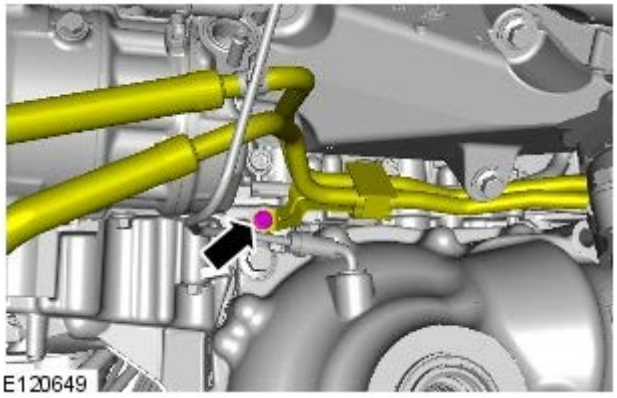
30. TORQUE: 6 Nm



31.

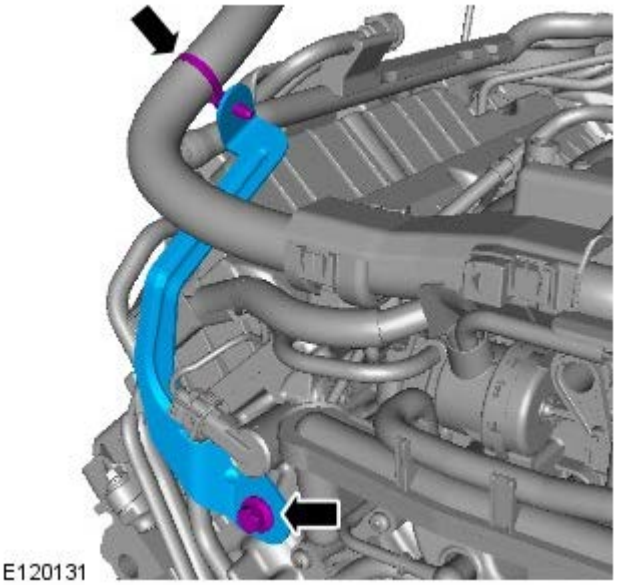


32. TORQUE: 10 Nm



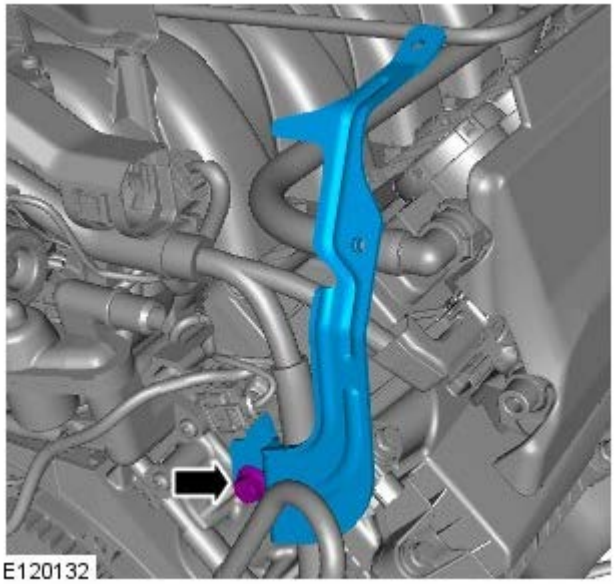
33. NOTE: RHD illustration shown, LHD is similar.

TORQUE: 47 Nm Nm

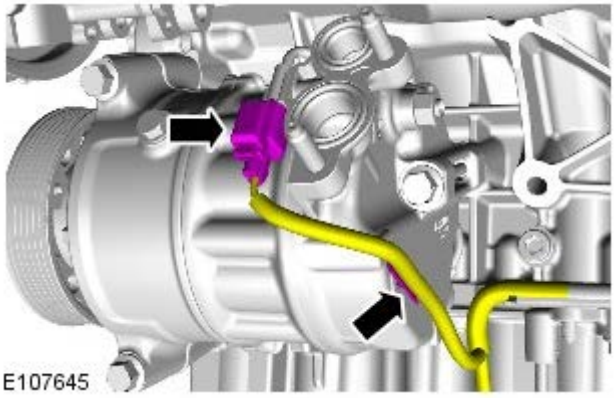


34. NOTE: RHD illustration shown, LHD is similar.

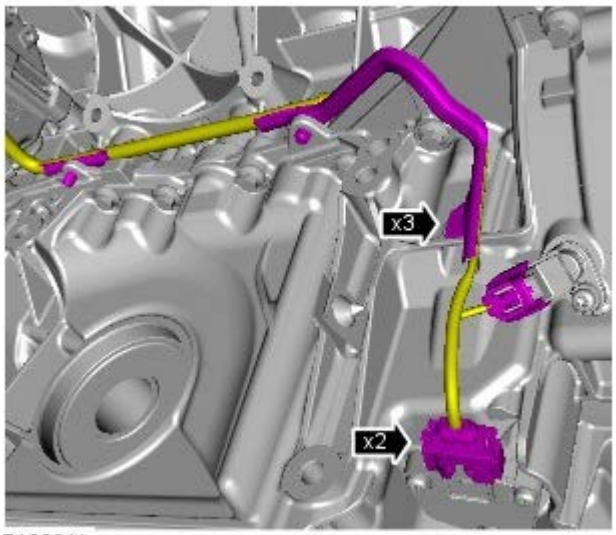
TORQUE: 47 Nm Nm


E120132

35.

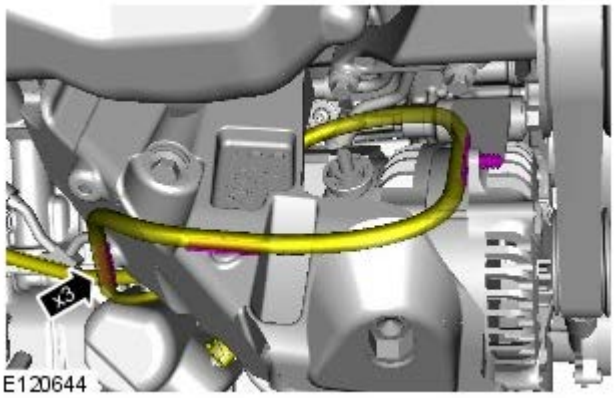

E107645

36.

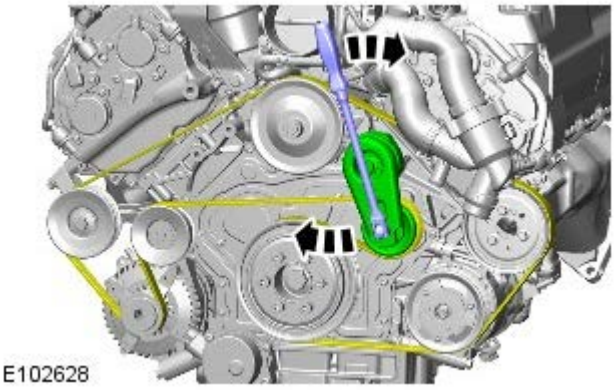


E120641

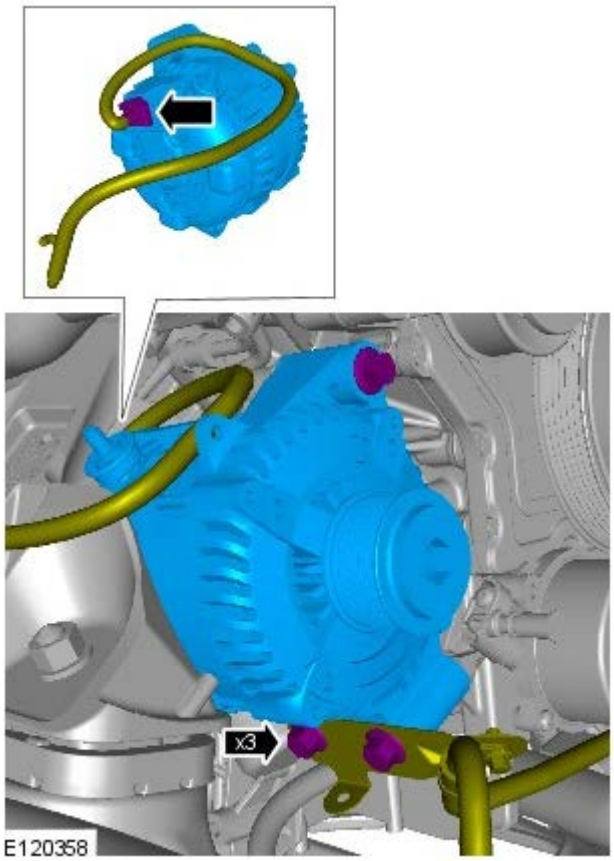
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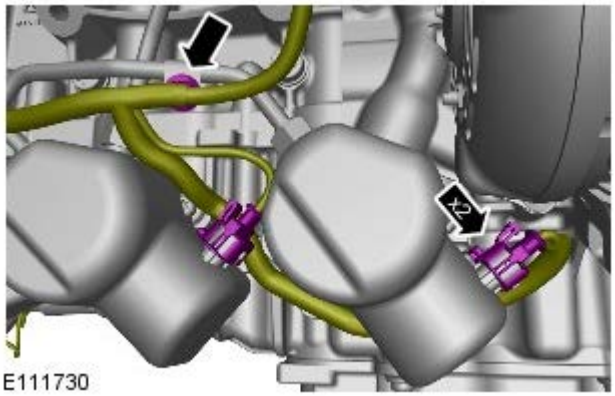
38.



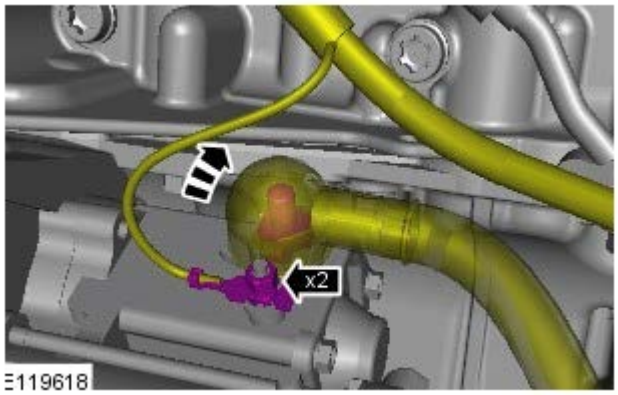
39. TORQUE: 48 Nm



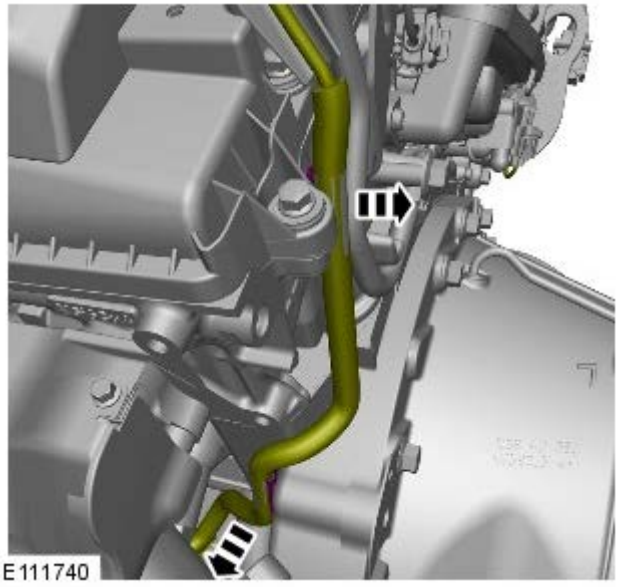
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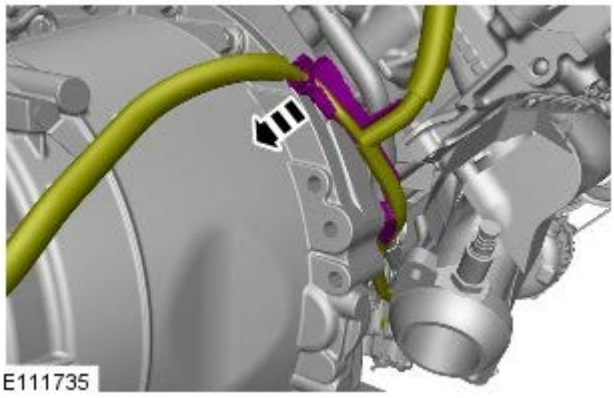
41.



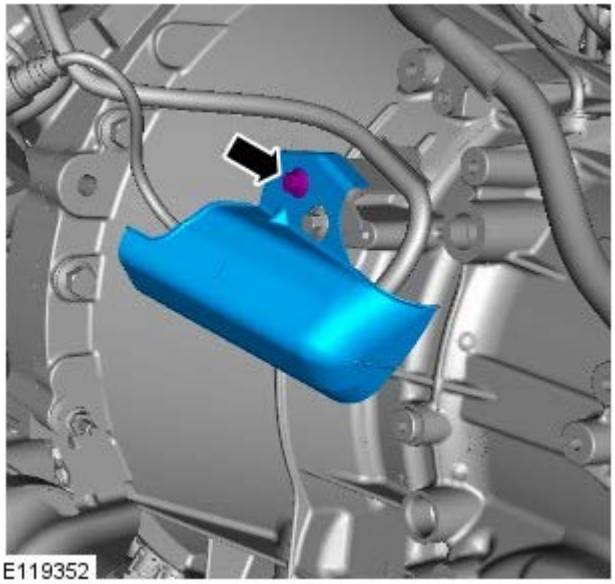
42.



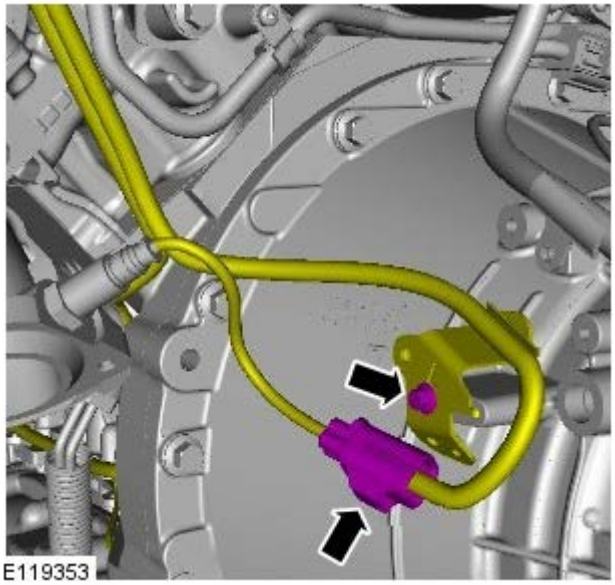
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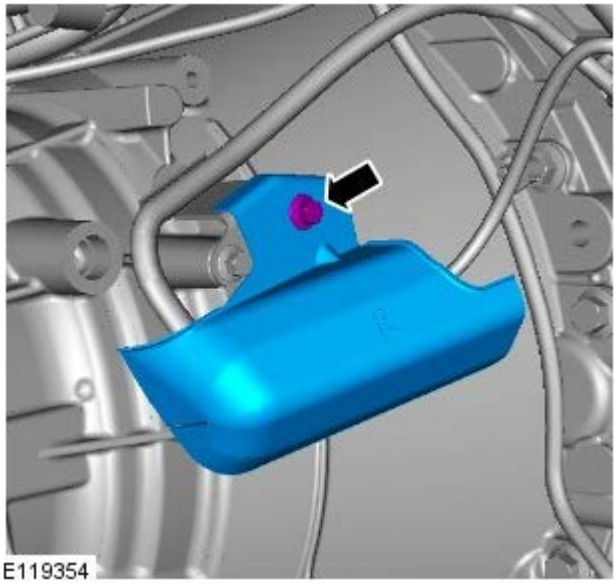
44. TORQUE: 10 Nm



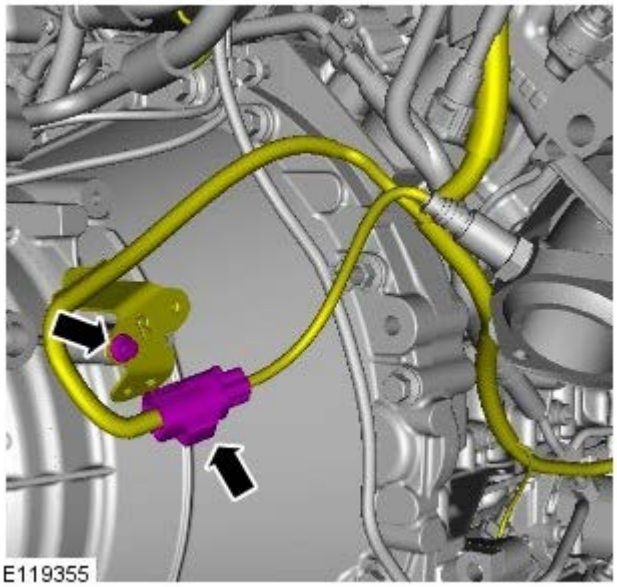
45. TORQUE: 10 Nm



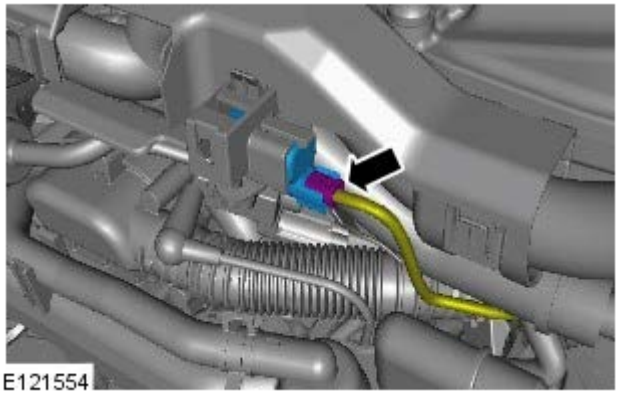
46. TORQUE: 10 Nm



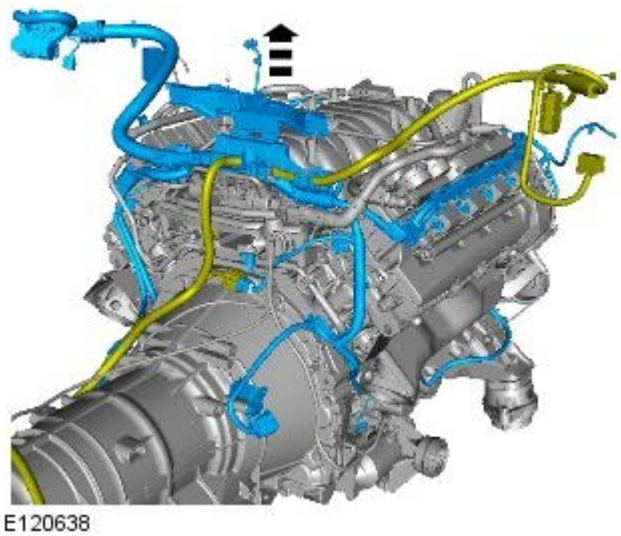
47. TORQUE: 10 Nm



48.



49. NOTE: RHD illustration shown, LHD is similar.



Installation

1. NOTE: After the engine harness has been installed, test using Land Rover/ Jaguar approved diagnostic equipment.

   To install, reverse the removal procedure.

Published: 11-May-2011

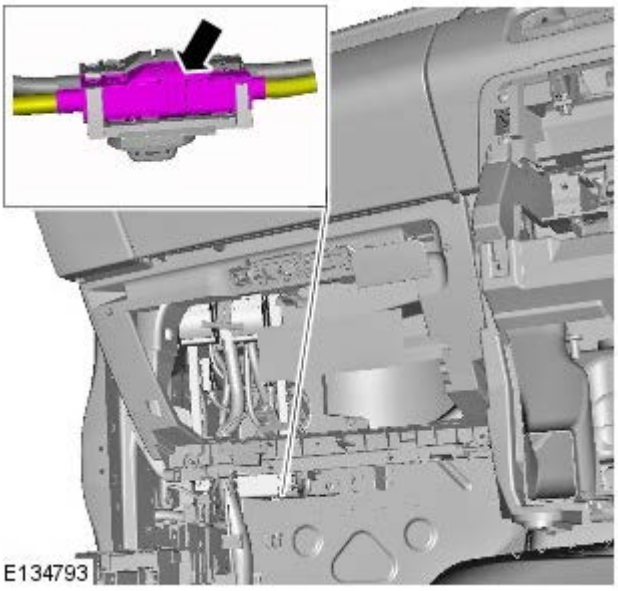
Wiring Harnesses - Front Parking Aid Camera Wiring Harness - Front Section

Removal and Installation

Removal

CAUTION: Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

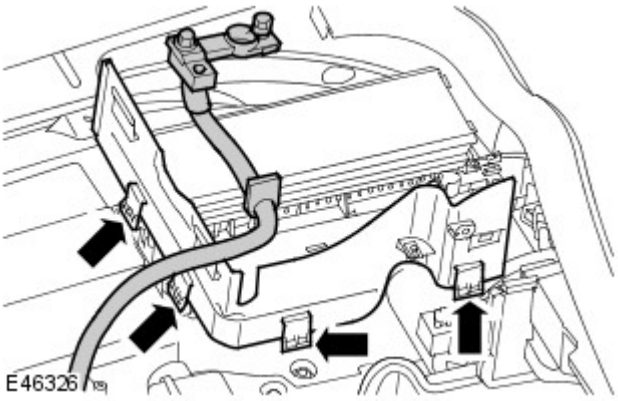
1. Remove the central junction box (CJB).
   For additional information, refer to: Central Junction Box (CJB) (418-00 Module Communications Network, Removal and Installation).



2. NOTE: The left hand front camera wiring harness connectors are coloured magenta, the right hand front camera wiring harness connectors are coloured blue.

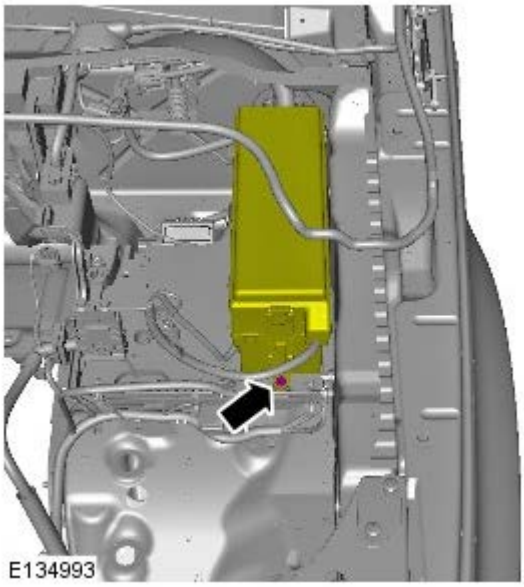
   Disconnect the electrical connector.

3. Remove the battery.
   For additional information, refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

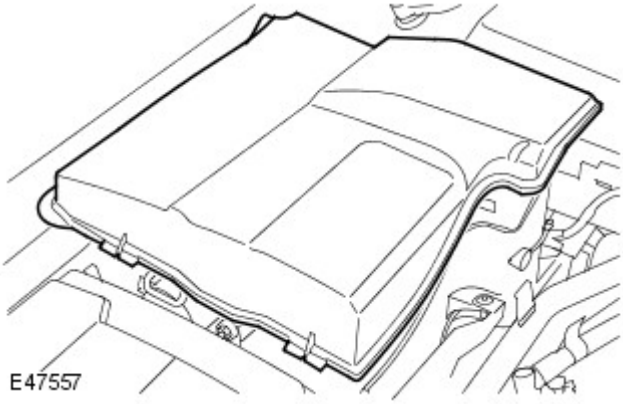


4. Remove the battery compartment side wall.
   - Release the battery positive cable and grommet.
   - Release the 4 clips.

5. Release the engine compartment fuse box.
   - Remove the bolt.

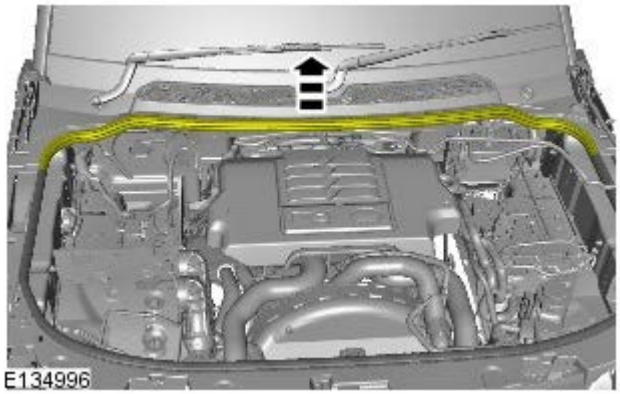


6. Remove the brake master cylinder cover.

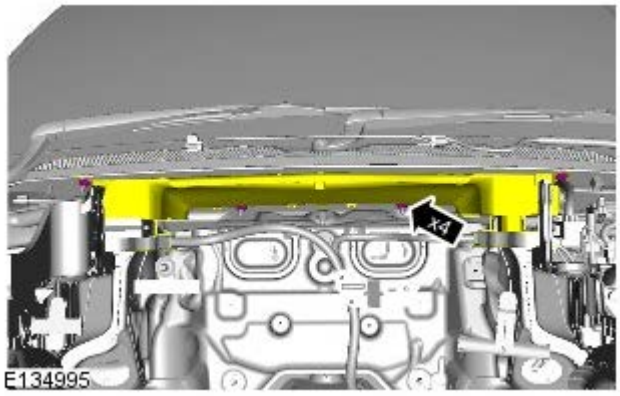


7. Remove the air cleaner RH.
   For additional information, refer to: Air Cleaner RH (303-12 Intake Air Distribution and Filtering - 5.0L SC V8 - AJ133, Removal and Installation).

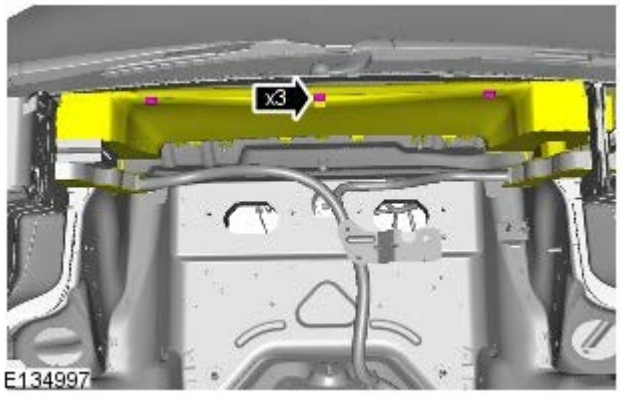
8. Release the hood seal.



9. Release the wiring harness carrier.
   - Remove the 4 nuts.



10. Release the 3 clips.





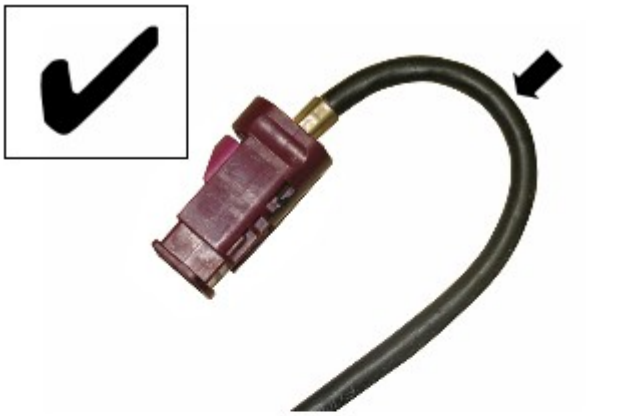
11. NOTE: The left hand front camera wiring harness connectors are coloured white, the right hand front camera wiring harness connectors are coloured green.

    Disconnect the electrical connector.

Installation

1. CAUTION: Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

   Install the camera overlay wiring harness





E135323

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

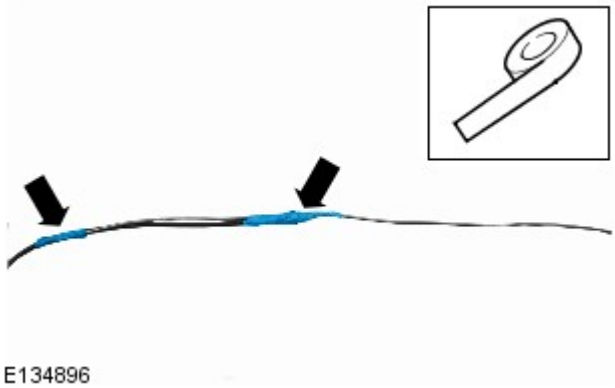
   Remove the connector from the camera overlay wiring harness.
   - Remove the locking tab.
   - Carefully release the clip.
   - Apply suitable tape to protect the end of the camera overlay wiring harness.





E133998

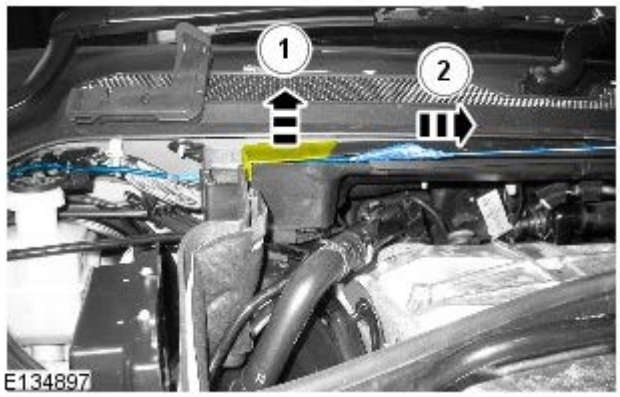
3. Using suitable tape, secure a suitable rod to the camera overlay wiring harness.



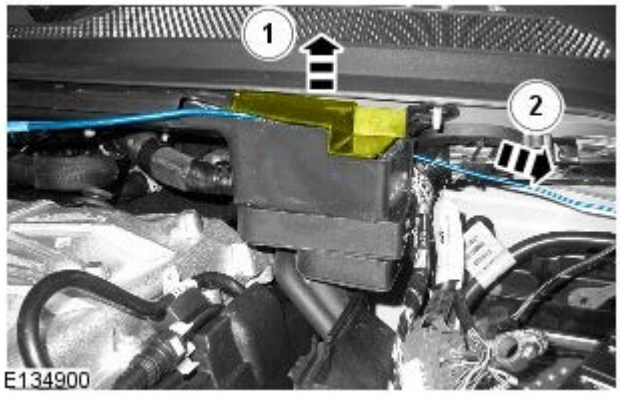
4. Carefully feed the camera overlay wiring harness under the bracket.



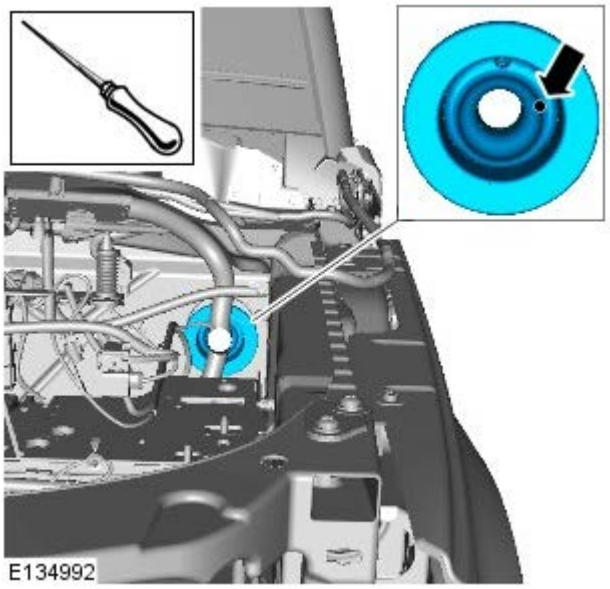
5. Carefully feed the camera overlay wiring harness through the wiring harness carrier.



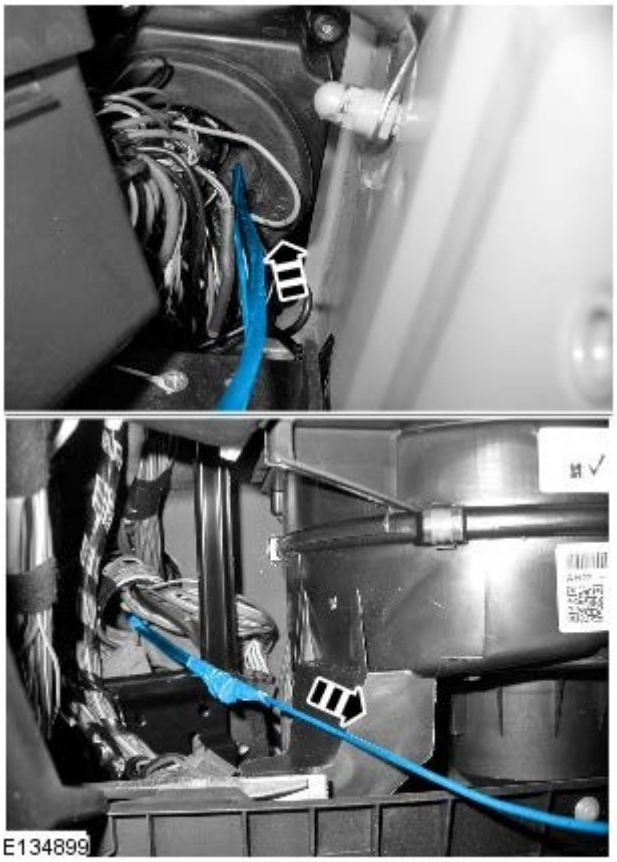
6. Carefully feed the camera overlay wiring harness through the wiring harness carrier.



7. Using a suitable tool, make a hole in grommet in the position shown.

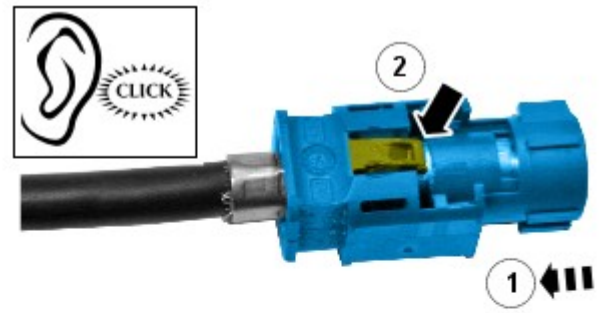


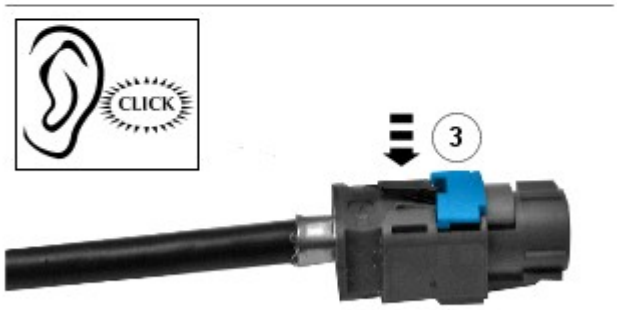
8. With the aid of another technician, carefully feed the camera overlay wiring harness through the grommet.



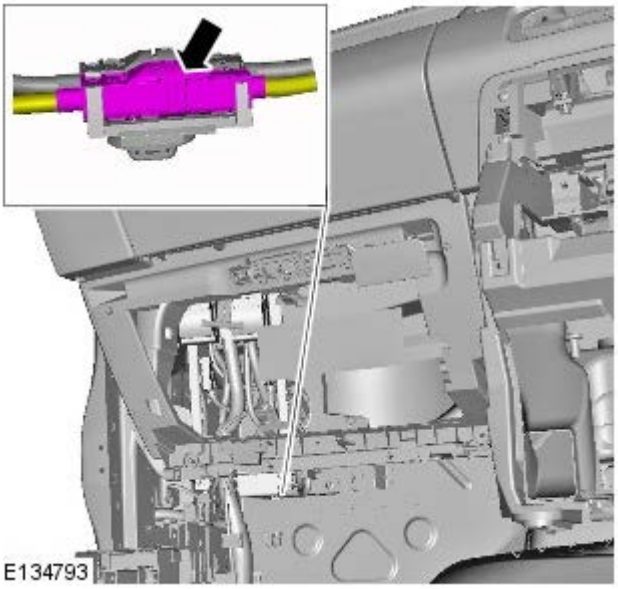
9. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

   Install the connector to the camera overlay wiring harness.
   - Remove the protective tape.
   - Install the electrical connector.
   - Secure the locking tab.





E134007



10. NOTE: The left hand front camera wiring harness connectors are coloured magenta, the right hand front camera wiring harness connectors are coloured blue.

    Connect the electrical connector.

11. NOTE: The left hand front camera wiring harness connectors are coloured white, the right hand front camera wiring harness connectors are coloured green.

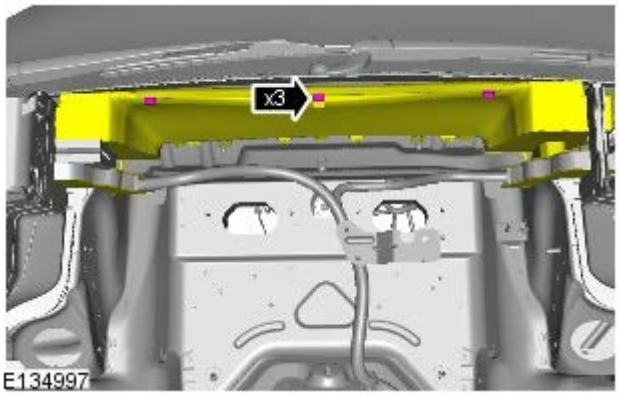
    Connect the electrical connector.



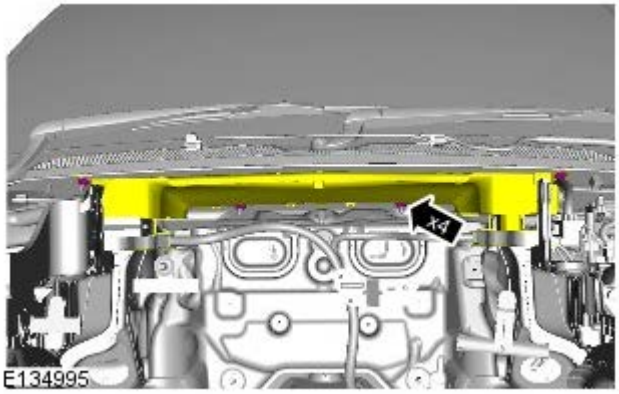
12. CAUTION: Make sure that excessive force is not used when installing the tie straps to the wiring harness. Failure to follow this instruction may result in damage to the harness.

    Using suitable tie straps, secure the camera overlay wiring harness to the main body wiring harness.

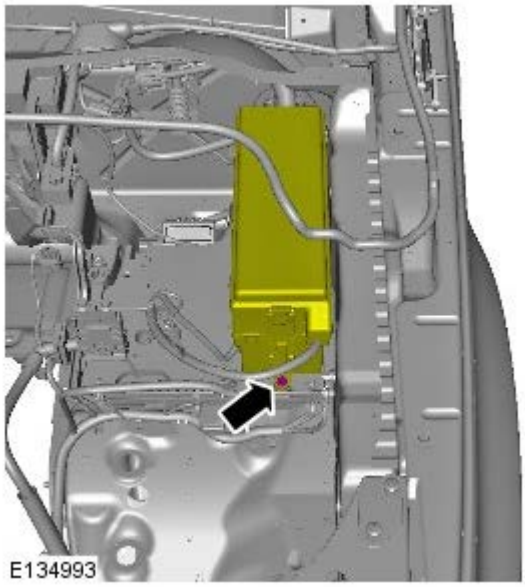
13. Secure the 3 clips.



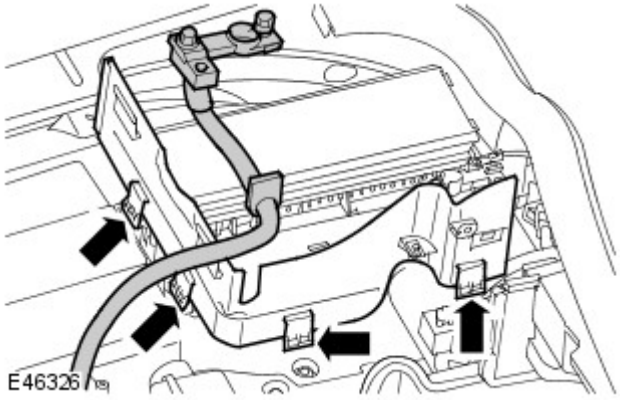
14. Secure the wiring harness carrier.
    - Tighten the 4 nuts.



15. Secure the engine compartment fuse box.
    - Tighten the bolt.

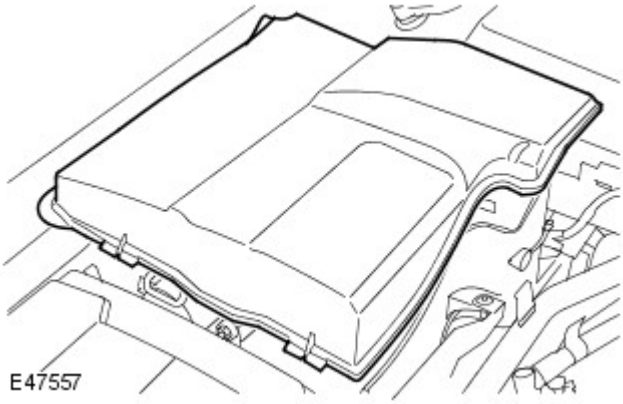


16. Install the battery compartment side wall.
    - Secure the 4 clips.
    - Install the battery positive cable and grommet.



17. Install the air cleaner RH.
    For additional information, refer to: Air Cleaner RH (303-12 Intake Air Distribution and Filtering - 5.0L SC V8 - AJ133, Removal and Installation).

18. Install the brake master cylinder cover.



19. Secure the hood seal.

20. Install the CJB.
    For additional information, refer to: Central Junction Box (CJB) (418-00 Module Communications Network, Removal and Installation).

21. Install the battery.
    For additional information, refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

Published: 11-May-2011

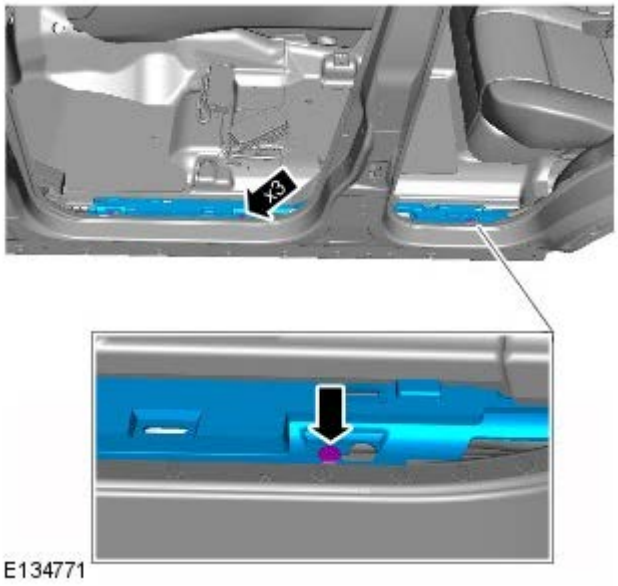
Wiring Harnesses - Right Hand Parking Aid Camera Wiring Harness

Removal and Installation

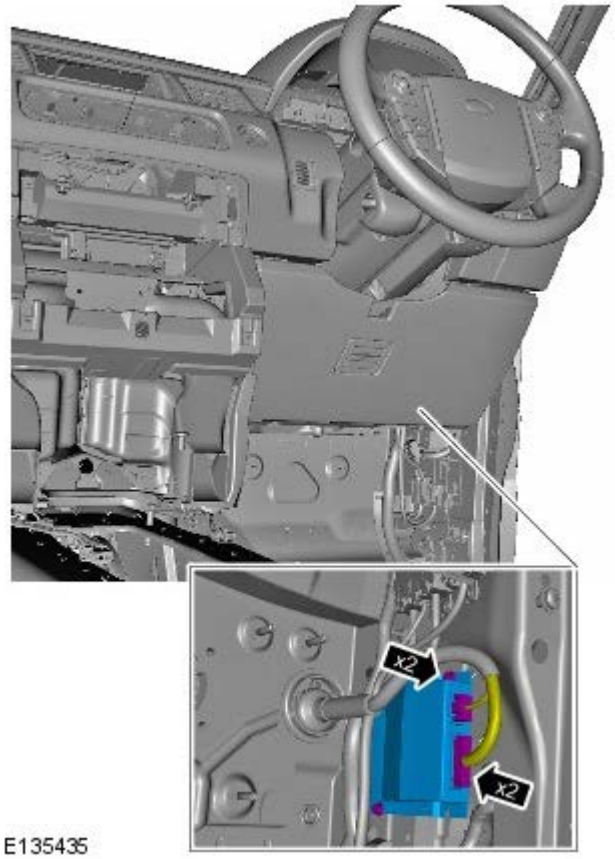
Removal

CAUTION: Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

1. Remove the LH front seat.
   For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).
2. Repeat procedure for the other side.
3. Remove the floor console.
   For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).
4. Remove the LH scuff plate trim panel.
   For additional information, refer to: Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
5. Repeat procedure for the other side.
6. Release the wiring harness cover.
   - Release the 3 clips.

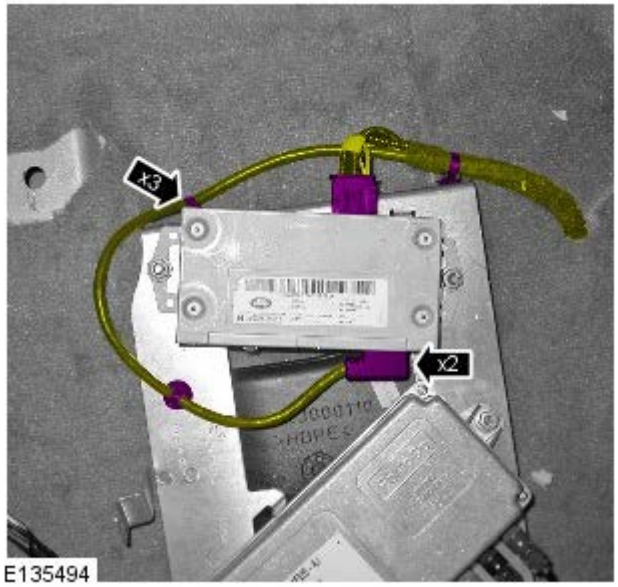


7. Repeat procedure for the other side.
8. Remove the RH cowl side trim panel.
   For additional information, refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
9. Remove the accelerator pedal assembly.
   For additional information, refer to: Accelerator Pedal (310-02 Acceleration Control - 3.6L V8 - TdV8, Removal and Installation).
10. Remove the dynamic response module.
    - Remove the 2 bolts.
    - Disconnect the 2 electrical connectors.



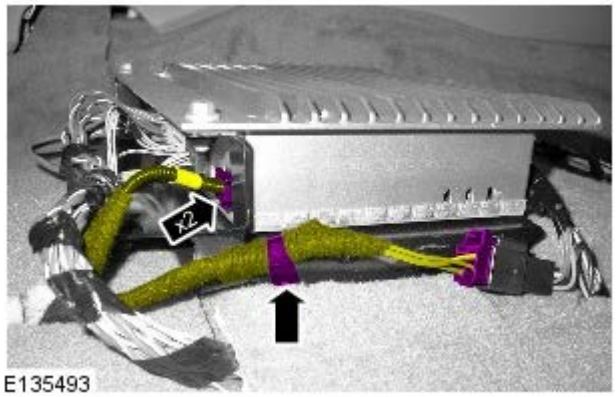
E135435

11. Disconnect the 2 electrical connectors.
    - Release the 3 clips.



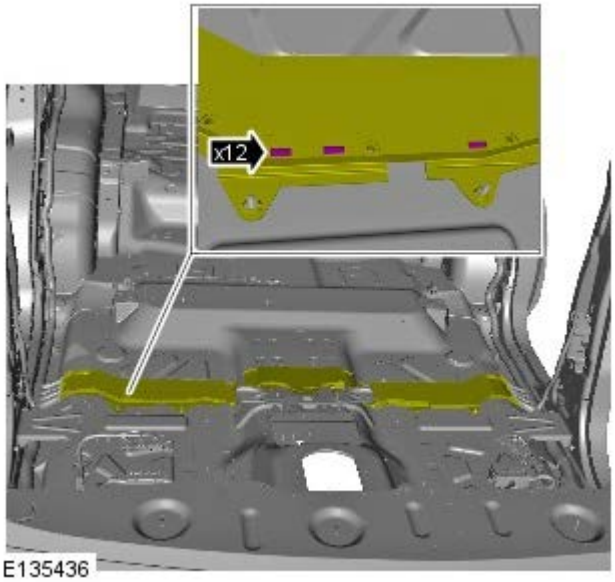
E135494

12. Disconnect the 2 electrical connectors.
    - Release the clip.



E135493

13. Release the wiring harness cover.
    - Reposition the floor covering for access.
    - Using a suitable tool, carefully cut though



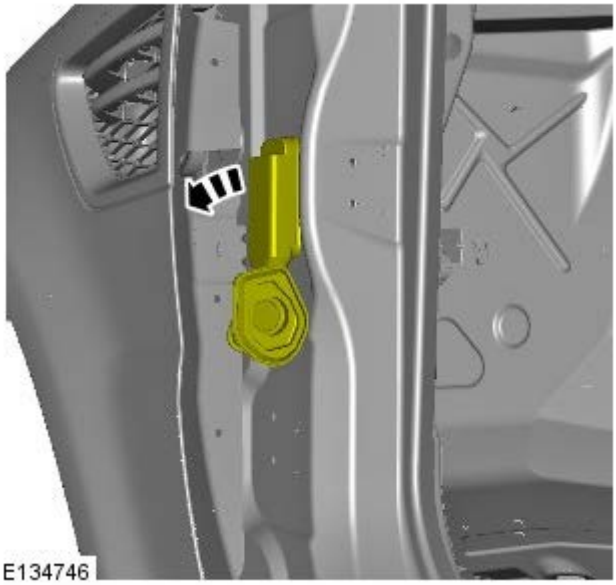
the wiring harness cover retaining tape.
- Release the 12 clips.

14. NOTES:

Door shown removed for clarity.

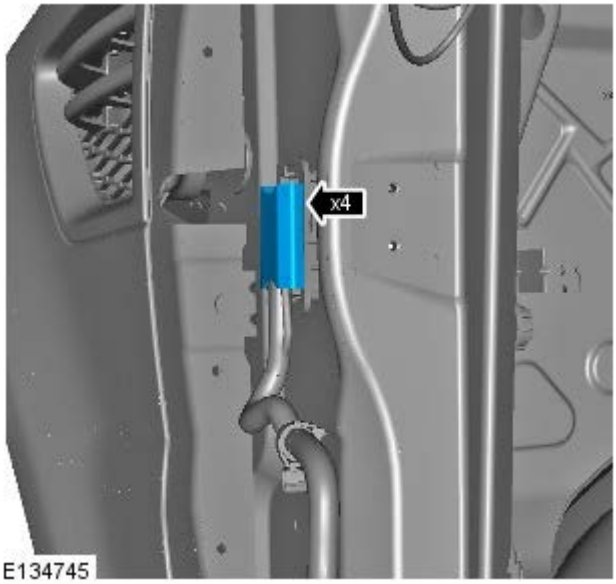
Left-hand shown, right-hand similar.

Release the gater.



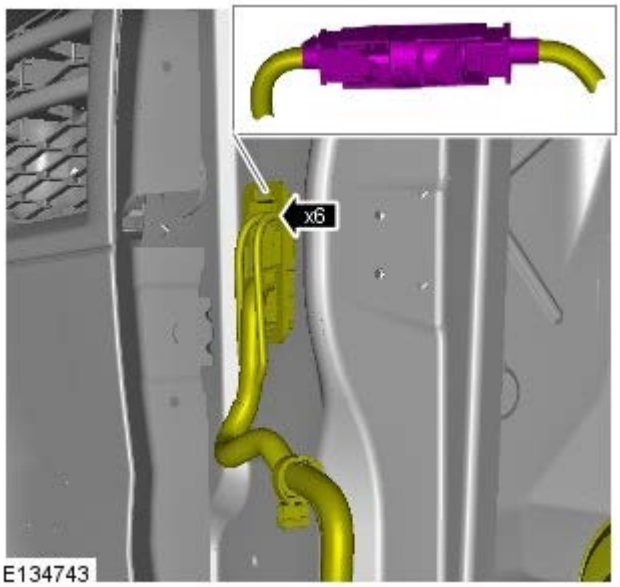
15. NOTE: Left-hand shown, right-hand similar.

Remove the wiring harness cover.
- Release the 4 clips.

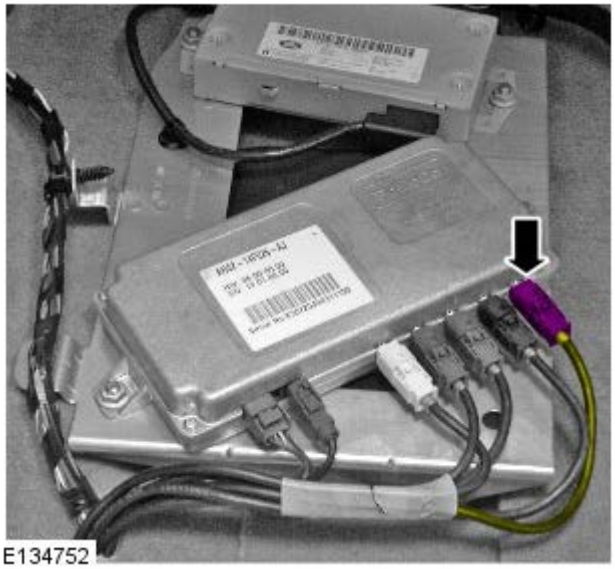


16. NOTE: Left-hand shown, right-hand similar.

Disconnect the electrical connector.
- Release the electrical connector bracket.
- Release the 6 clips.



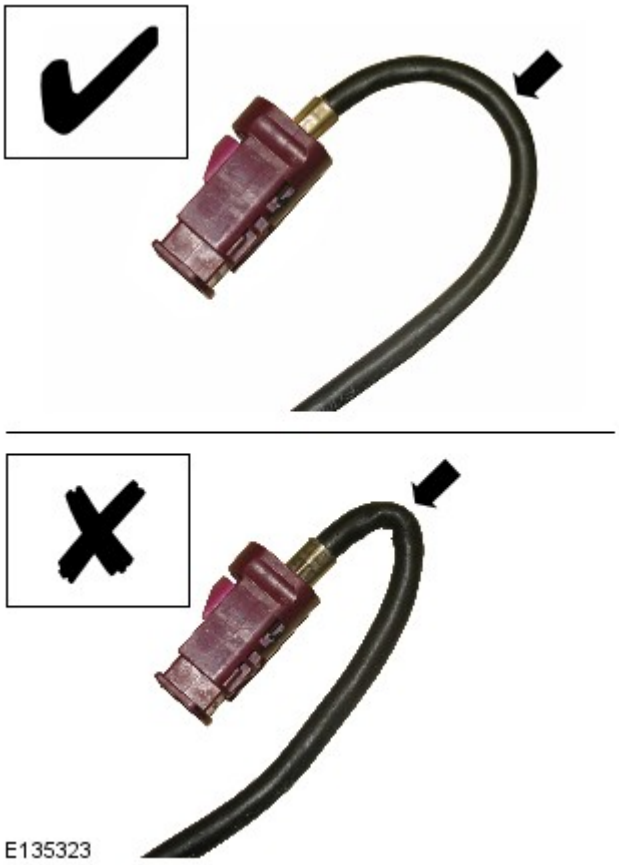
17. Disconnect the electrical connector.



Installation

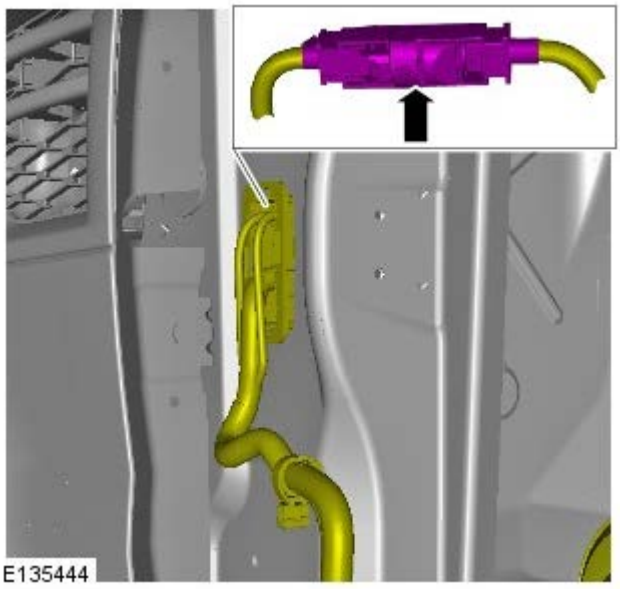
1. CAUTION: Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

   Install the camera overlay wiring harness



2. CAUTION: Make sure that excessive force is not used when installing the tie straps to the wiring harness. Failure to follow this instruction may result in damage to the vehicle.

   Carefully feed the camera overlay wiring harness along the main body wiring harness from the camera module to the RH A-pillar.
   - Using suitable tie straps, secure the camera overlay wiring harness to the main body wiring harness.

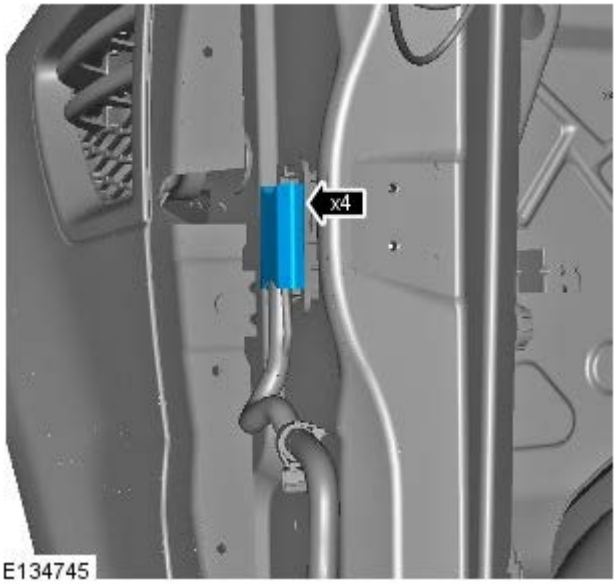


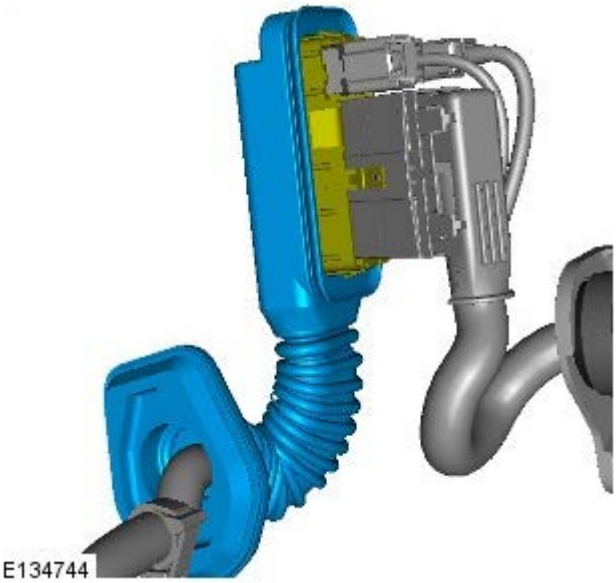
3. NOTE: Left-hand shown, right-hand similar.

   Connect the electrical connector.

4. NOTE: Left-hand shown, right-hand similar.

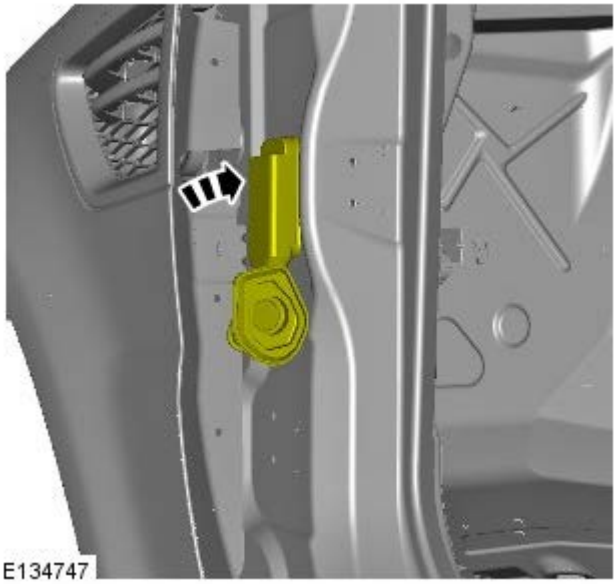
   Install the wiring harness cover.
   - Secure the 4 clips.





5. NOTE: Left-hand shown, right-hand similar.

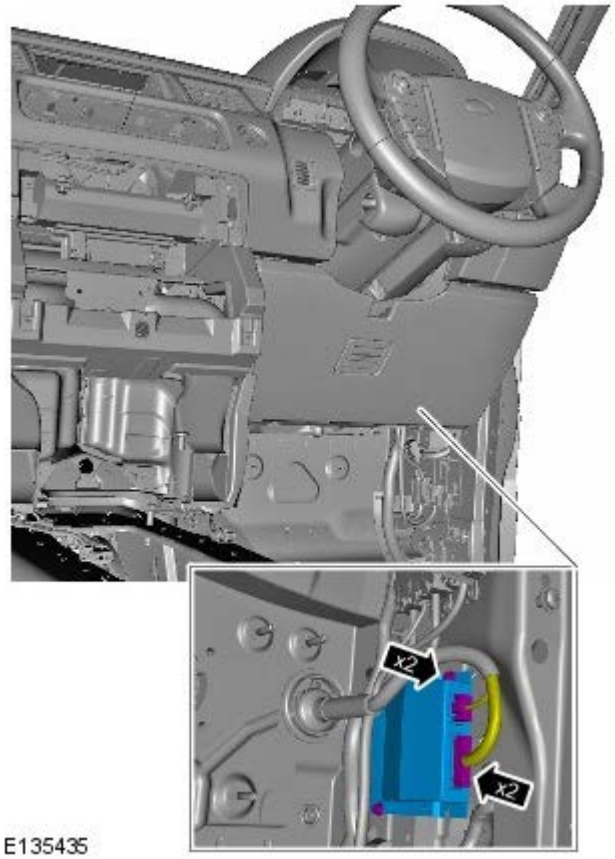
   Install the gaiter.



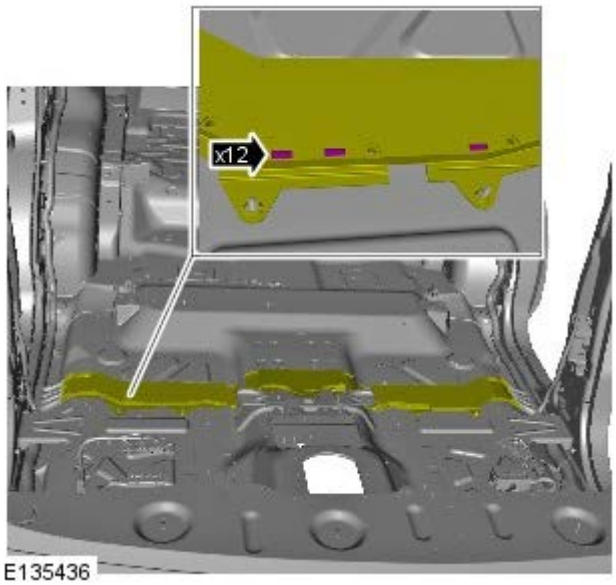
6. NOTE: Left-hand shown, right-hand similar.

   Secure the bracket.
   - Secure the 6 clips.

7. Install the dynamic response module.
   - Connect the 2 electrical connecotrs.
   - Tighten the 2 bolts.



E135435



E135436

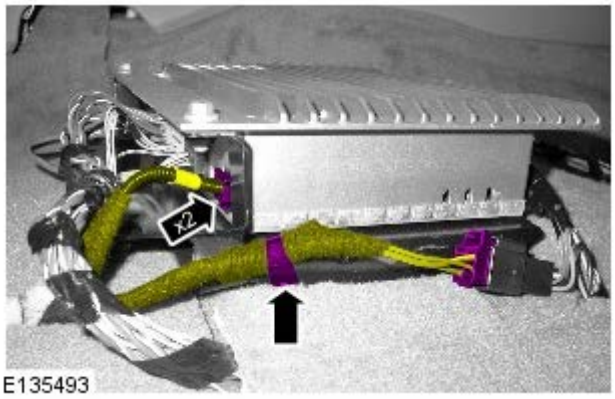
8. Secure the wiring harness cover.
    - Secure the 12 clips.
    - Re-apply suitable tape to the wiring harness cover in the positions previously secured.
    - Install the floor covering.

9. Connect the 2 electrical connectors.
    - Secure the 3 clips.



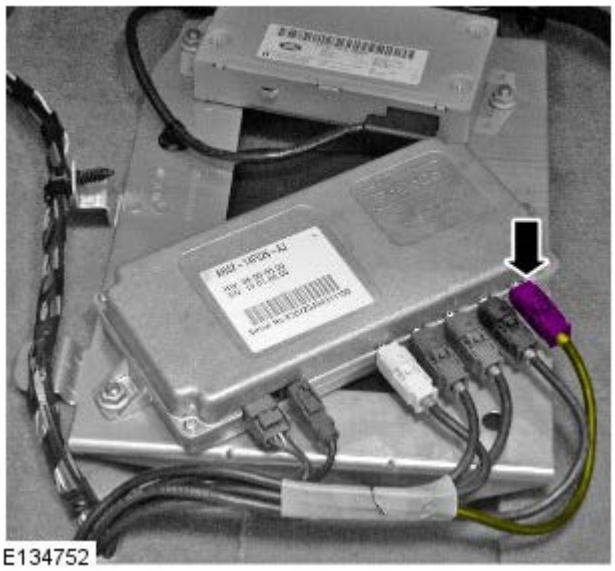
E135494

10. Connect the 2 electrical connectors.
    - Secure the clip.



E135493

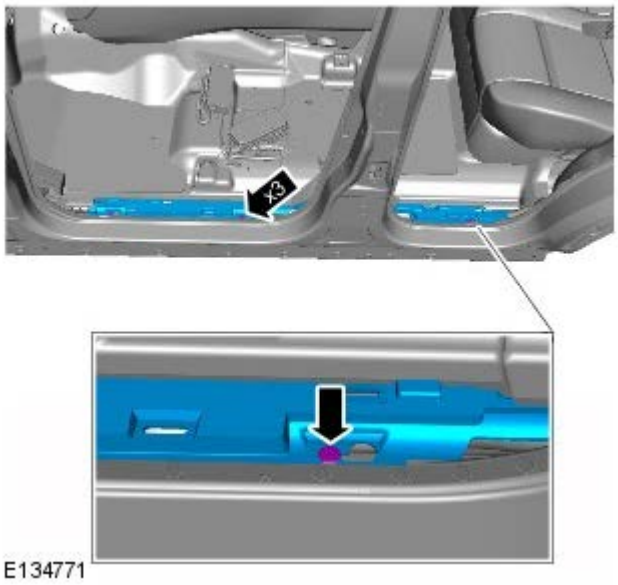
11. Connect the electrical connector.


E134752

12. Install the accelerator pedal assembly.
    For additional information, refer to: Accelerator Pedal (310-02 Acceleration Control - 3.6L V8 - TdV8, Removal and Installation).

13. Install the RH cowl side trim panel.
    For additional information, refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

14. Install the LH wiring harness cover.
    - Secure the 3 clips.



E134771

15. Repeat procedure for the other side.

16. Install the LH scuff plate trim panel.
    For additional information, refer to: Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

17. Repeat procedure for the other side.

18. Install the floor console.
    For additional information, refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

19. Install the LH front seat.
    For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

20. Repeat procedure for the other side.

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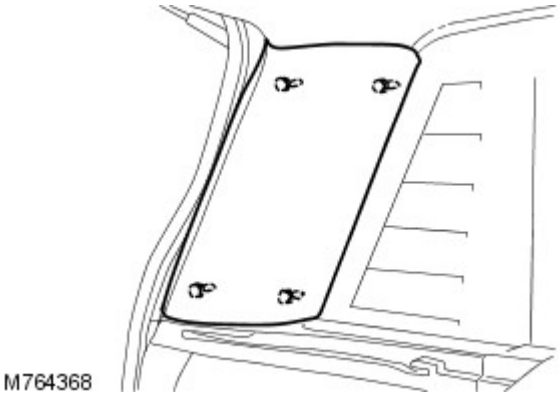
Wiring Harnesses - Rear Parking Aid Camera Wiring Harness

Removal and Installation

Removal

CAUTION: Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

1. Remove the LH rear quarter trim panel.
   For additional information, refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



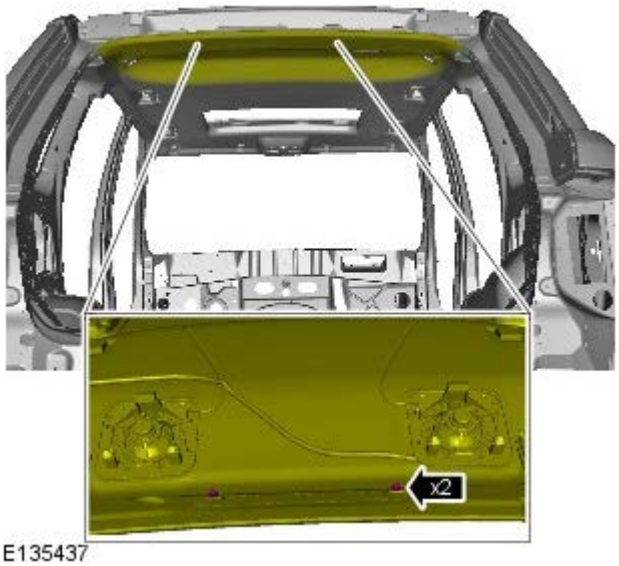
2. Release the rear quarter trim panel.
   - Carefully release the 4 clips.

3. Remove the rear spoiler.
   For additional information, refer to: Rear Spoiler (501-08 Exterior Trim and Ornamentation, Removal and Installation).

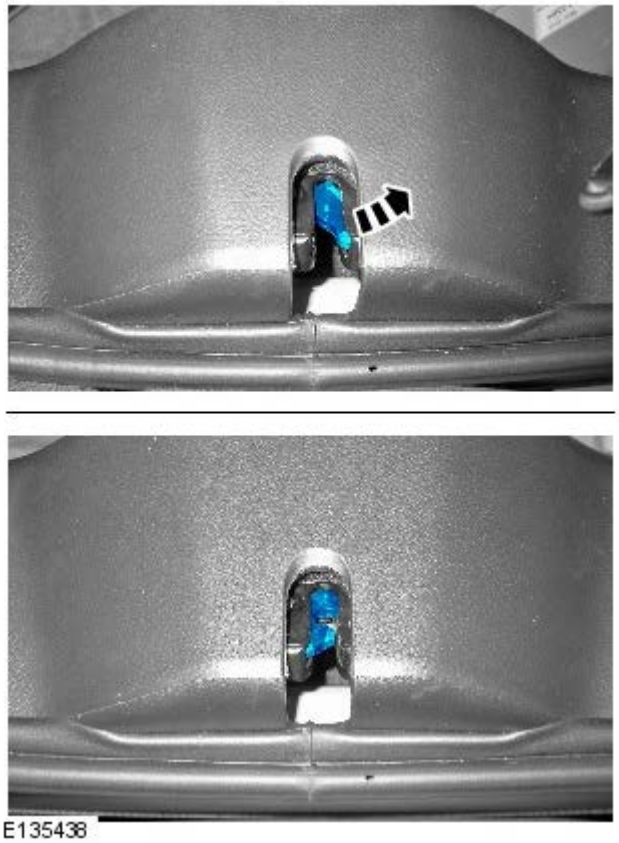
4. Release the liftgate aperture seal.



5. Carefully release the headliner for access.
   - Carefully release the 2 clips.



6. Open the liftgate window glass.



E135438

7. CAUTION: Make sure that the liftgate window glass is not closed while the liftgate window glass latch is in the closed position. Failure to follow this instruction may result in damage to the vehicle.

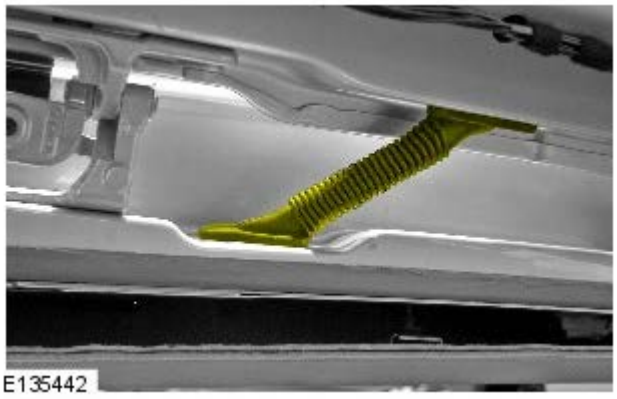
   Using a suitable tool, close the liftgate window glass latch.

8. Open the liftgate and liftgate window glass to the position shown.



E135441

9. Release the liftgate to liftgate window glass gaiter.



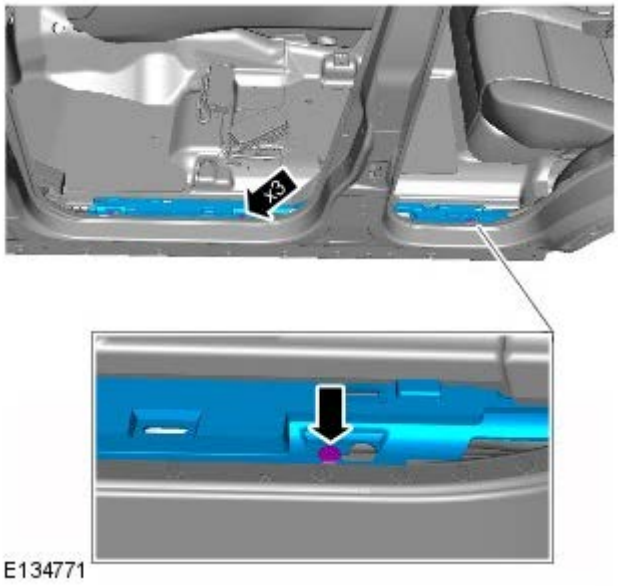
E135442

10. Release the body to liftgate gaiter.


E135440

11. Remove the LH scuff plate trim panel.
    For additional information, refer to: Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

12. Release the wiring harness cover.
    - Release the 3 clips.

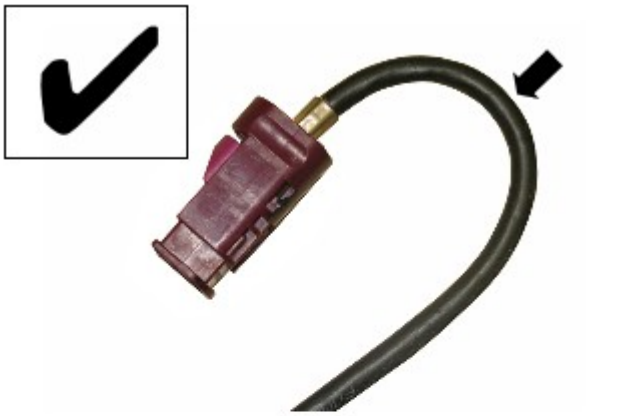


E134771

Installation

1. CAUTION: Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

   Install the camera overlay wiring harness





E135323

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

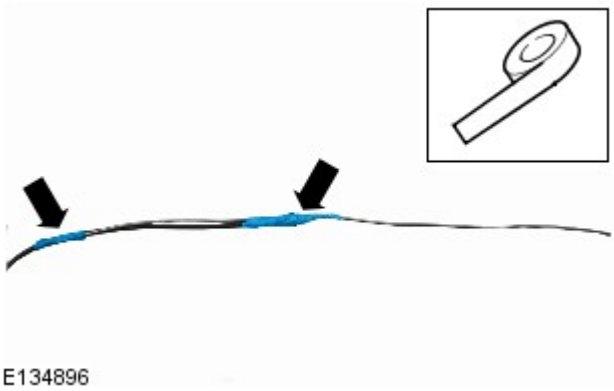
   Remove the connector from the camera overlay wiring harness.
   - Remove the locking tab.
   - Carefully release the clip.
   - Apply suitable tape to protect the end of the camera overlay wiring harness.





E133998

3. Using suitable tape, secure a suitable rod to the camera overlay wiring harness.



E134896



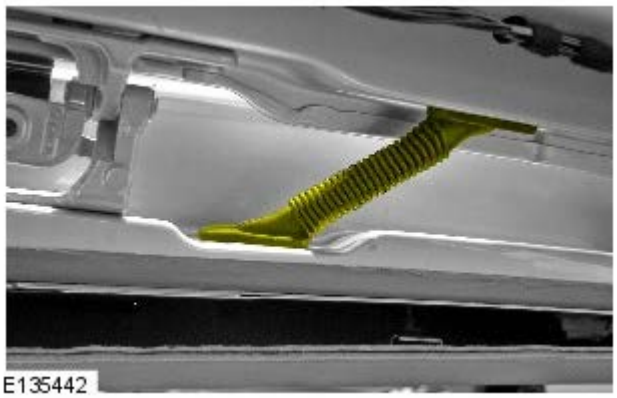
4. NOTE: This step requires the aid of another technician.

   Carefully feed the camera overlay wiring harness through the gaiters and along the main body wiring harness until the new camera overlay wiring harness protrudes an equal distance from the liftgate window glass as the existing camera wiring harness.



E135443

5. Secure the body to liftgate gaiter.



E135442

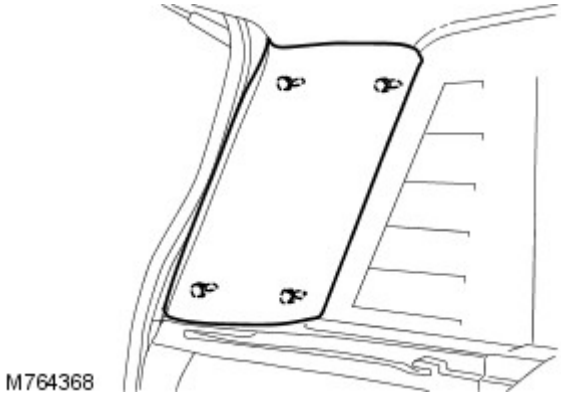
6. Secure the liftgate to liftgate window glass gaiter.


E135440

7. CAUTION: Make sure that excessive force is not used when installing the tie straps to the wiring harness. Failure to follow this instruction may result in damage to the harness.

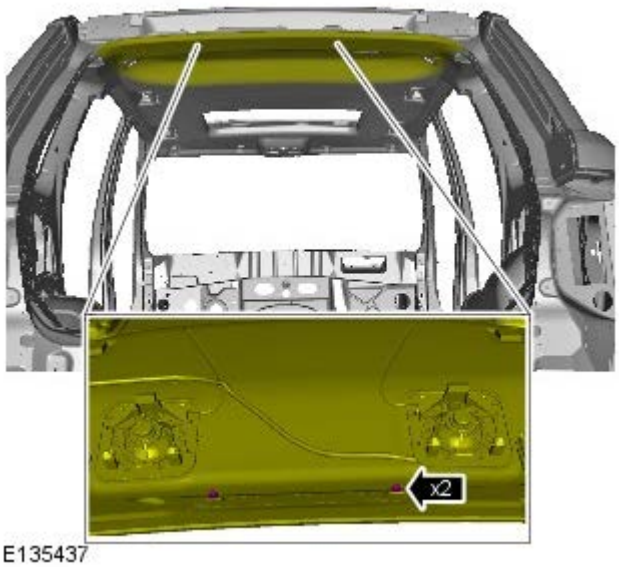
   Using suitable tie straps, secure the camera overlay wiring harness to the main body wiring harness.

8. Install the rear spoiler.
   For additional information, refer to: Rear Spoiler (501-08 Exterior Trim and Ornamentation, Removal and Installation).


M764368

9. Secure the rear quarter trim panel.
   - Secure the 4 clips.

10. Secure the headliner.
    - Secure the 2 clips.



E135437

11. Install the LH rear quarter trim panel.
    For additional information, refer to: Rear Quarter Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

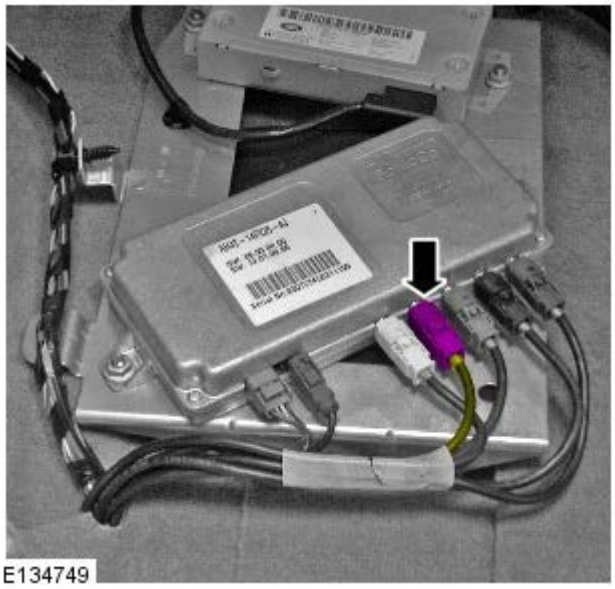
12. CAUTION: Make sure that the liftgate window glass latch is released before closing the liftgate window glass. Failure to follow this instruction may result in damage to the vehicle.


E135439

Install the liftgate aperture seal.

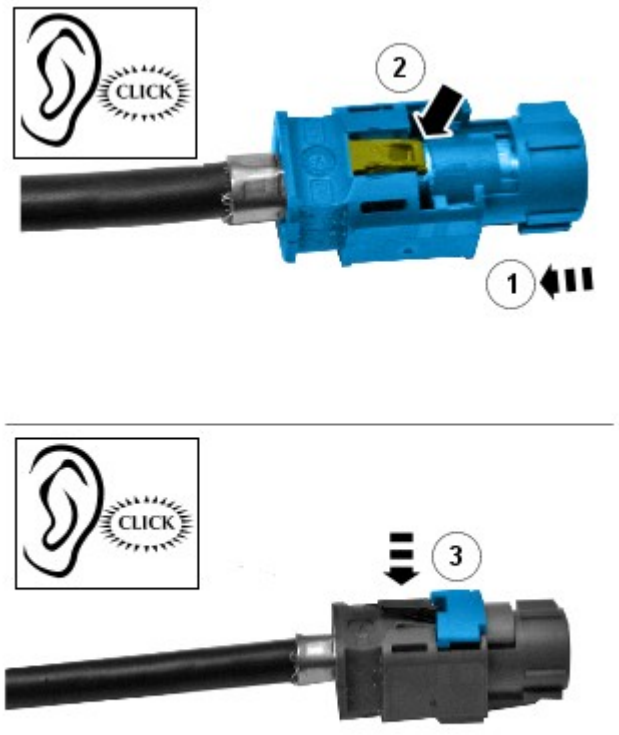
13. Remove the LH front seat.
    For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

14. Disconnect the electrical connector.


E134749

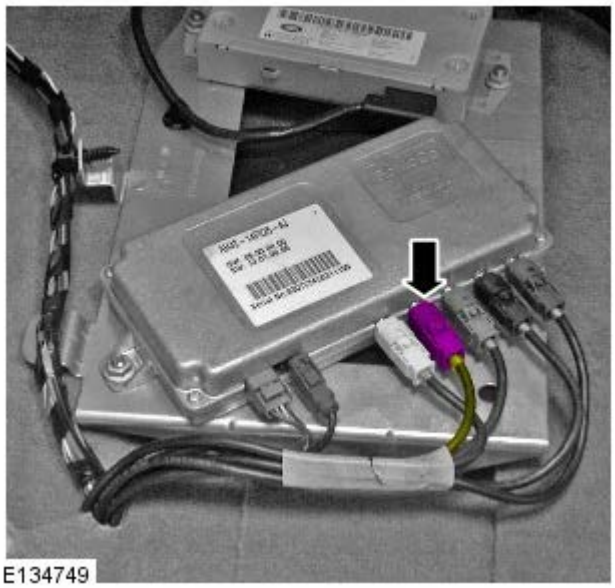
15. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

    Install the connector to the camera overlay wiring harness.
    - Remove the protective tape.
    - Install the electrical connector.
    - Secure the locking tab.



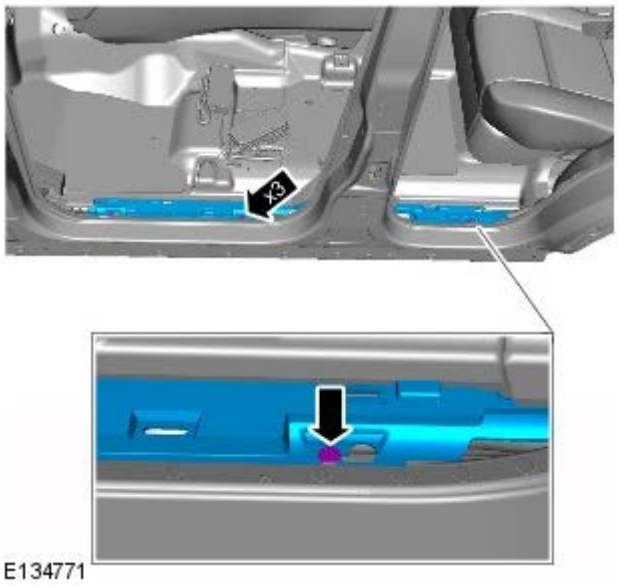
E134007

16. Connect the electrical connector.


E134749

17. Install the LH front seat.
For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

18. Install the wiring harness cover.
- Secure the 3 clips.



E134771

19. Install the LH scuff plate trim panel.
For additional information, refer to: Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

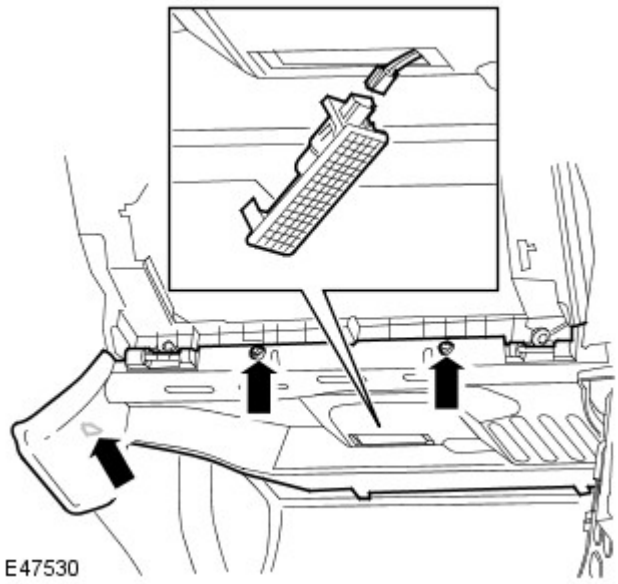
Published: 11-May-2011

Wiring Harnesses - Left Hand Parking Aid Camera Wiring Harness

Removal and Installation

Removal

CAUTION: Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

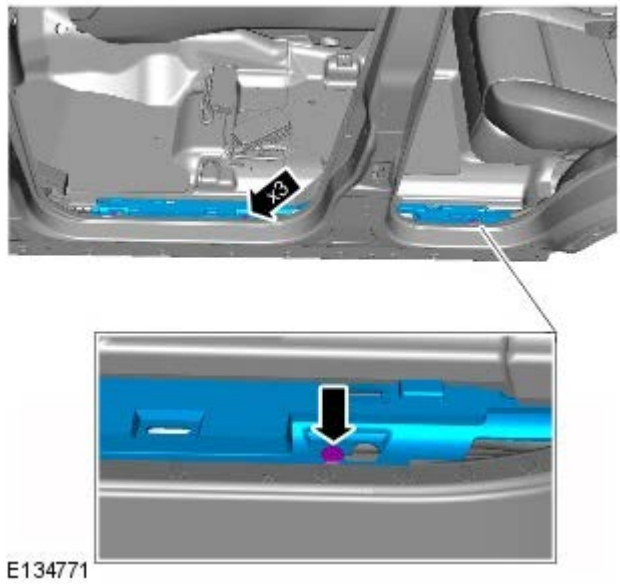


1. Remove the closing trim panel.
   - Release the clip.
   - Remove the 2 screws.
   - Disconnect the electrical connector.

2. Remove the cowl side trim panel.
   For additional information, refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove the LH front seat.
   For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

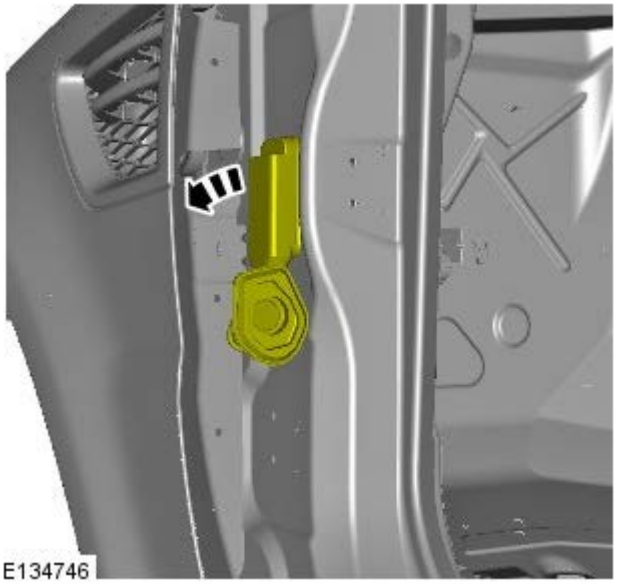
4. Remove the LH scuff plate trim panel.
   For additional information, refer to: Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



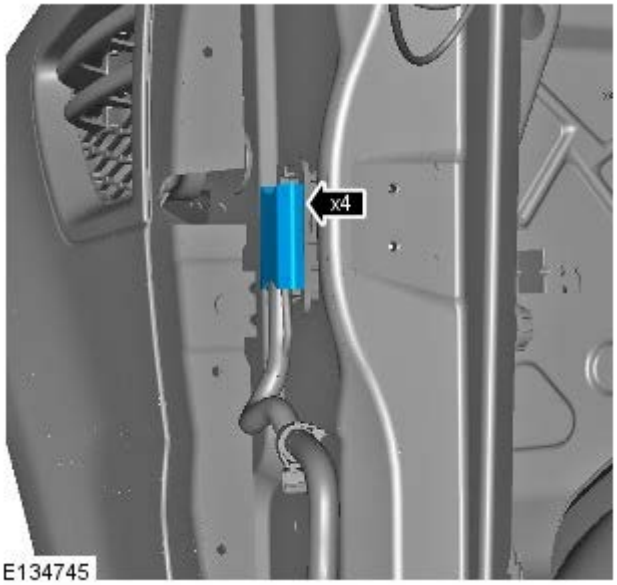
5. Release the wiring harness cover.
   - Release the 3 clips.

6. NOTE: Door shown removed for clarity.

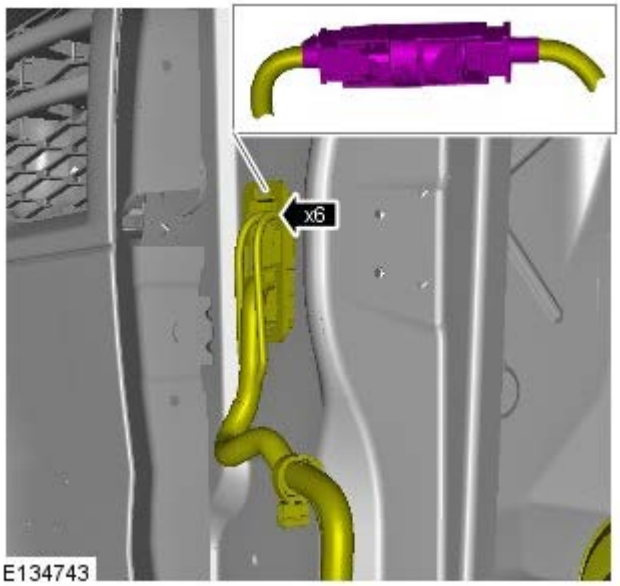
   Release the gaiter.



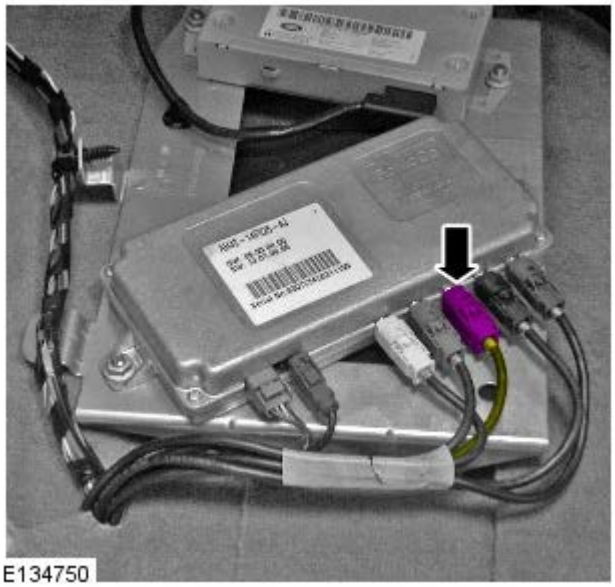
7. Remove the wiring harness cover.
    - Release the 4 clips.



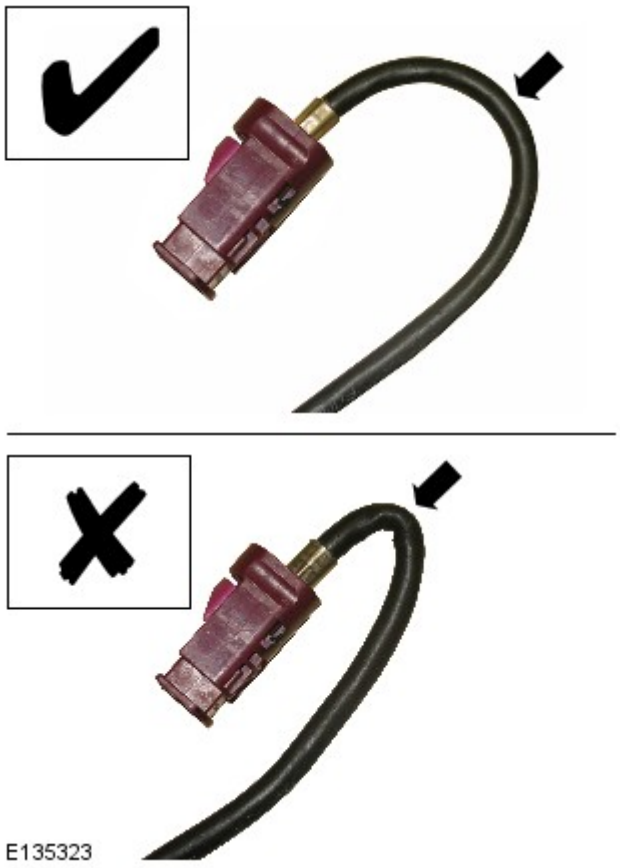
8. Disconnect the electrical connector.
    - Release the electrical connector bracket.
    - Release the 6 clips.



9. Disconnect the electrical connector.



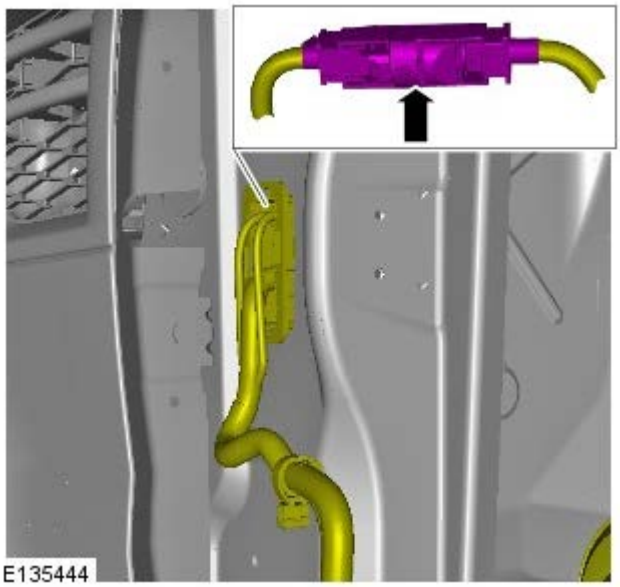
Installation



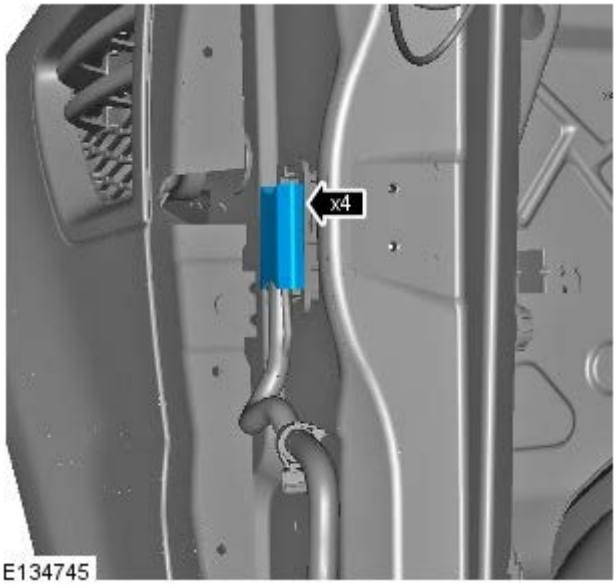
1. CAUTION: Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

   Install the camera overlay wiring harness.

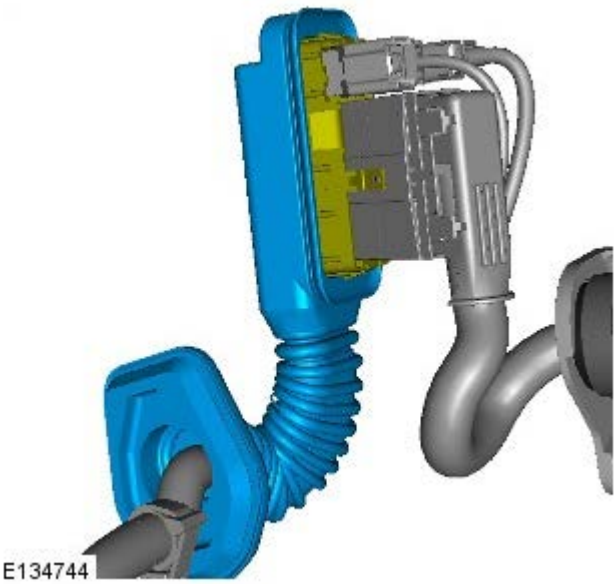
2. Connect the electrical connector.



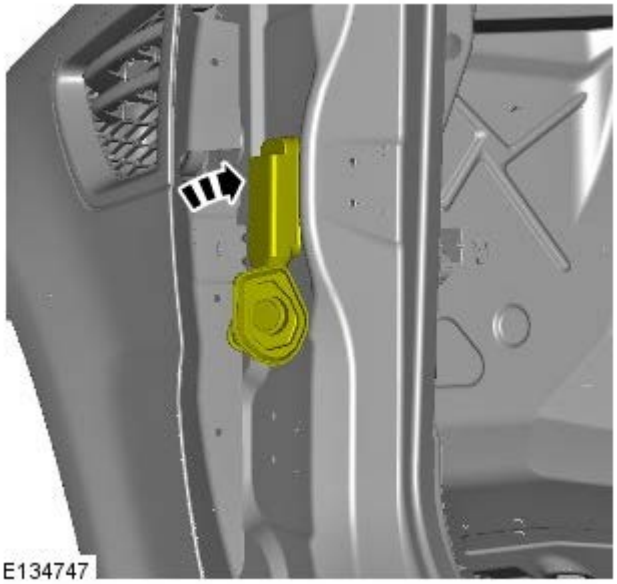
3. Install the wiring harness cover.
    - Secure the 4 clips.



4. Install the gaiter.



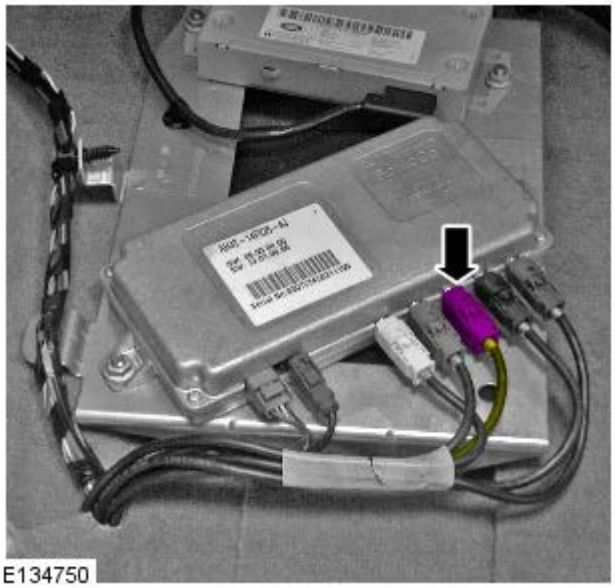
5. Secure the bracket.
    - Secure the 6 clips.


E134747

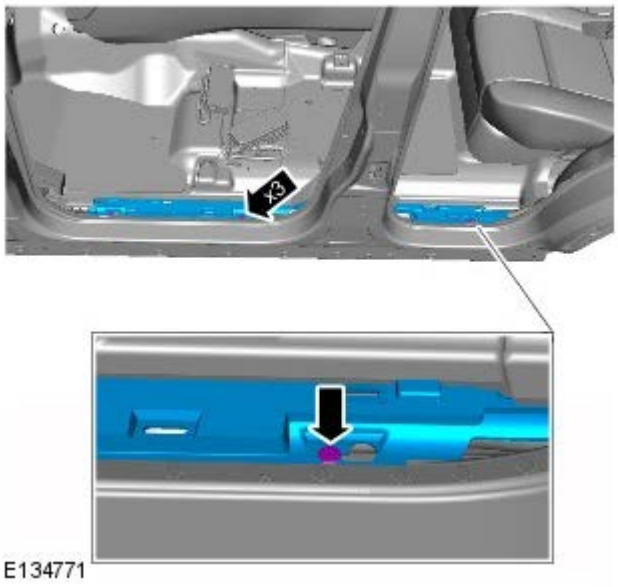
6. CAUTION: Make sure that any tie straps used are not tightened excessively on the camera wiring harness and link leads, Failure to follow this instruction may result in damage to the harness.

   Feed the camera overlay wiring harness along the main wiring harness to the parking aid camera module.
   - Using suitable tie straps, secure the camera overlay wiring harness to the main body wiring harness.

7. Connect the electrical connector.


E134750

8. Install the wiring harness cover.
   - Secure the 3 clips.

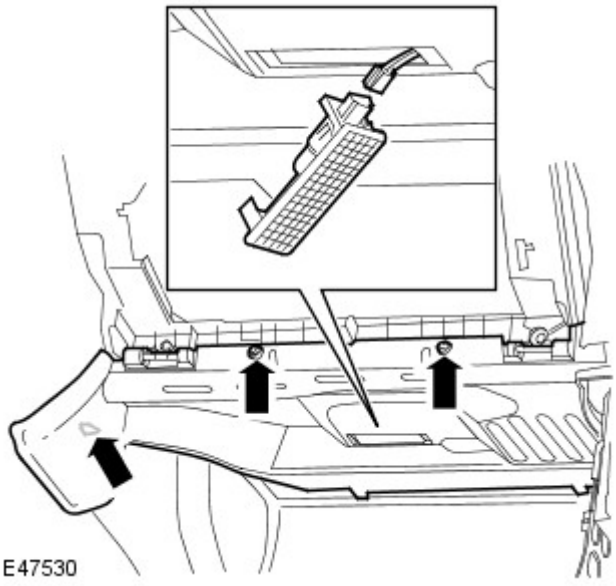


9. Install the LH scuff plate trim panel.
   For additional information, refer to: Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

10. Install the LH front seat.
    For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

11. Install the cowl side trim panel.
    For additional information, refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

12. Install the closing trim panel.
    - Connect the electrical connector.
    - Secure the clip.
    - Tighten the screws.



Published: 11-May-2011

Wiring Harnesses - Front Parking Aid Camera Wiring Harness - Main Body Section

Removal and Installation

Removal

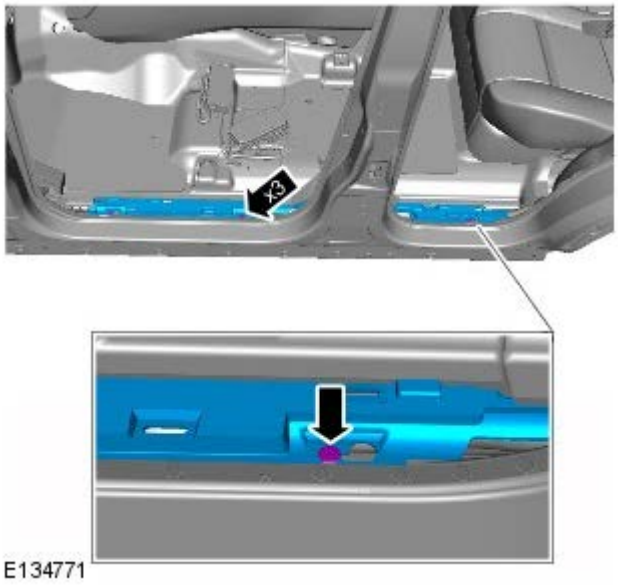
CAUTION: Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

1. Remove the LH front seat.
   For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

2. Remove the central junction box (CJB).
   For additional information, refer to: Central Junction Box (CJB) (418-00 Module Communications Network, Removal and Installation).

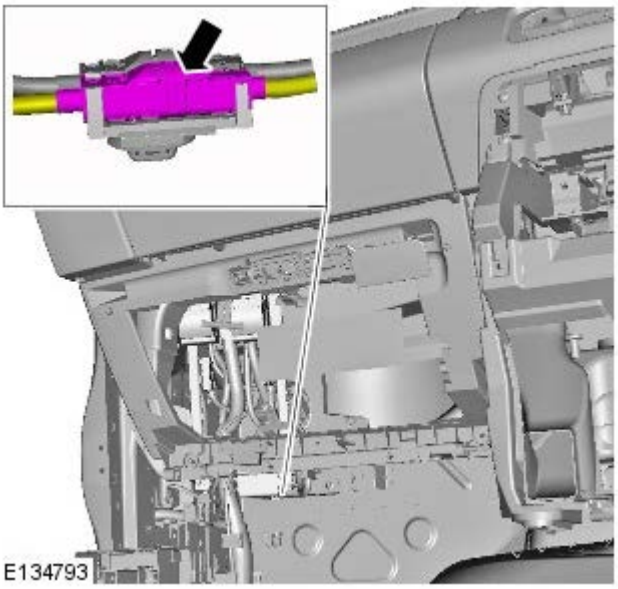
3. Remove the LH scuff plate trim panel.
   For additional information, refer to: Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

4. Release the wiring harness cover.
   - Release the 3 clips.

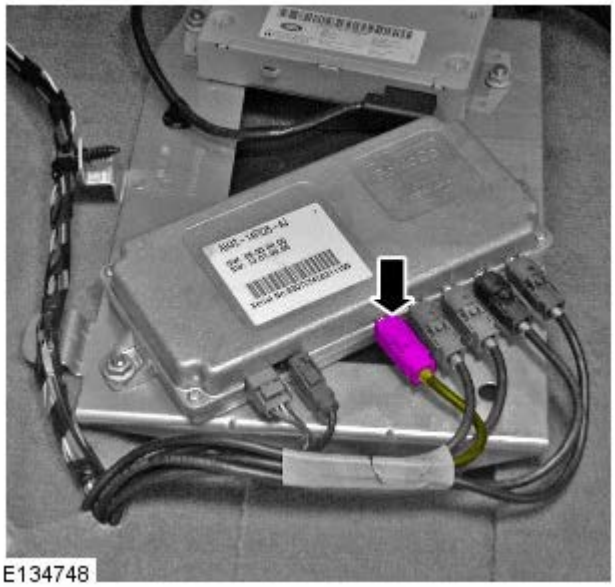


5. NOTE: The left hand front camera wiring harness connectors are coloured magenta, the right hand front camera wiring harness connectors are coloured blue.

   Disconnect the electrical connector.



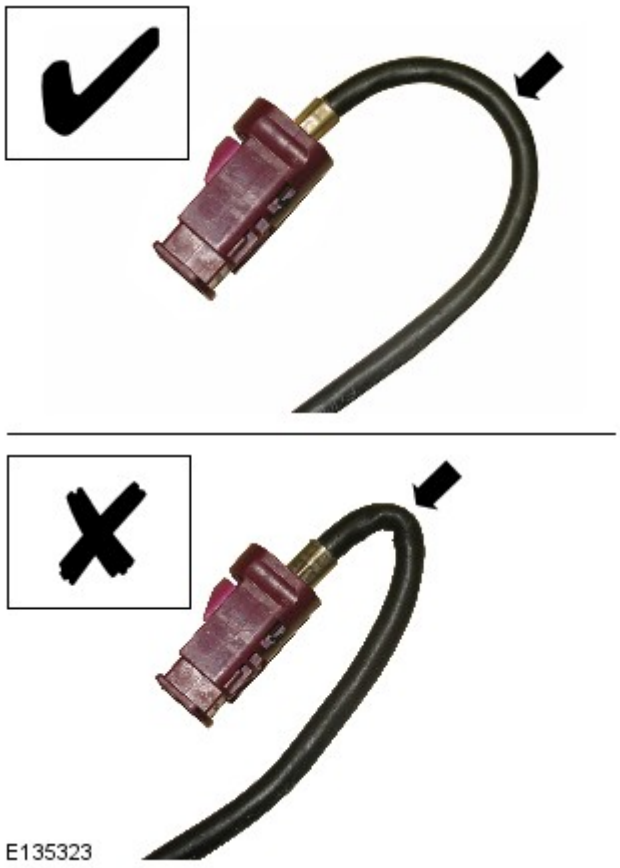
6. NOTE: The left hand front camera wiring harness connectors are coloured white, the right



hand front camera wiring harness connectors are coloured black.

Disconnect the electrical connector.

Installation

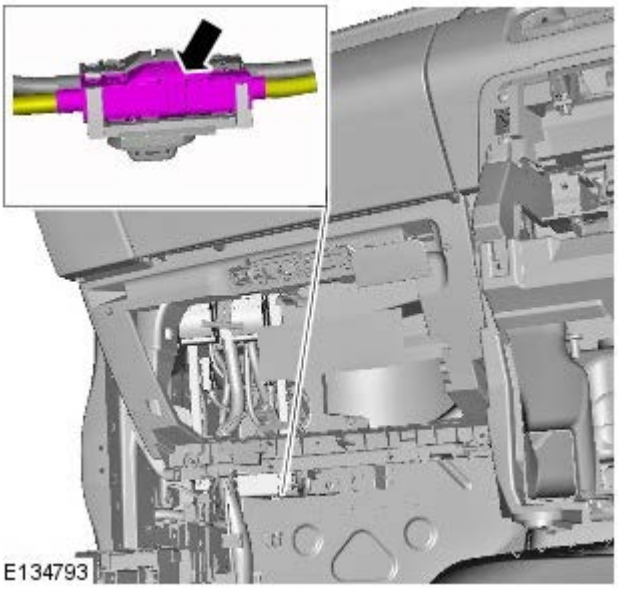


1. CAUTION: Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

   Install the camera overlay wiring harness

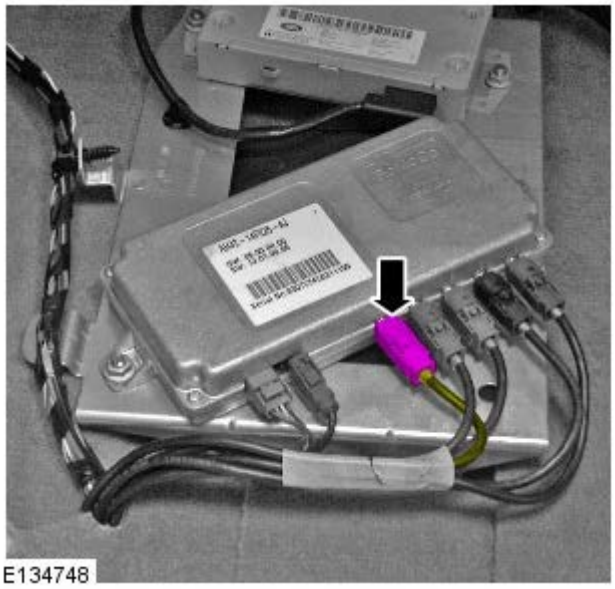
2. NOTE: The left hand front camera wiring harness connectors are coloured magenta, the right hand front camera wiring harness connectors are coloured blue.

   Connect the electrical connector.



3. CAUTION: Make sure that excessive force is not used when installing the tie straps to the wiring harness. Failure to follow this instruction may result in damage to the harness.

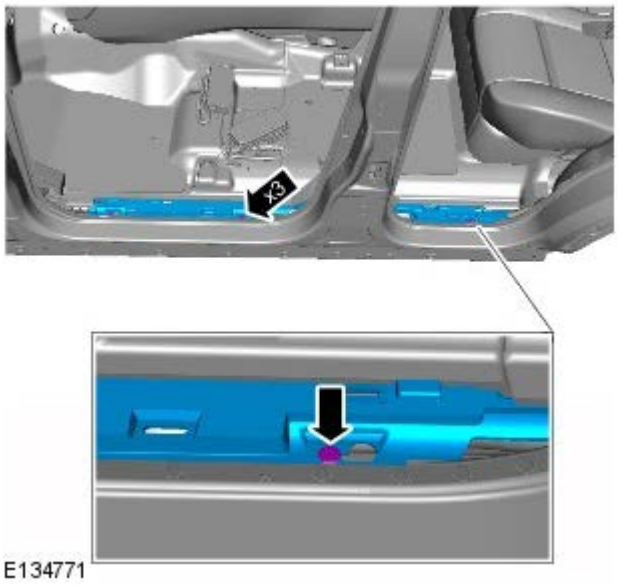
   Feed the camera overlay wiring harness along the main wiring harness to the camera module.
   - Using suitable tie straps, secure the camera overlay wiring harness to the main body wiring harness.



4. NOTE: The left hand front camera wiring harness connectors are coloured white, the right hand front camera wiring harness connectors are coloured black.

   Connect the electrical connector.

5. Install the wiring harness cover.
   - Secure the 3 clips.



E134771

6. Install the LH scuff plate trim panel.
   For additional information, refer to: Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

7. Install the CJB.
   For additional information, refer to: Central Junction Box (CJB) (418-00 Module Communications Network, Removal and Installation).

8. Install the LH front seat.
   For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).

Published: 05-Nov-2013

Wiring Harnesses - Suspension Air Supply Unit Wiring Harness

Removal and Installation

Removal

WARNING: Steps 1 and 2 must be carried out within 10 minutes of each other. Failure to follow this instruction may result in personal injury.

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: New air suspension components are supplied with new Voss connectors tightened to the correct torque. Therefore, do not install new Voss connectors if a new component is being installed.

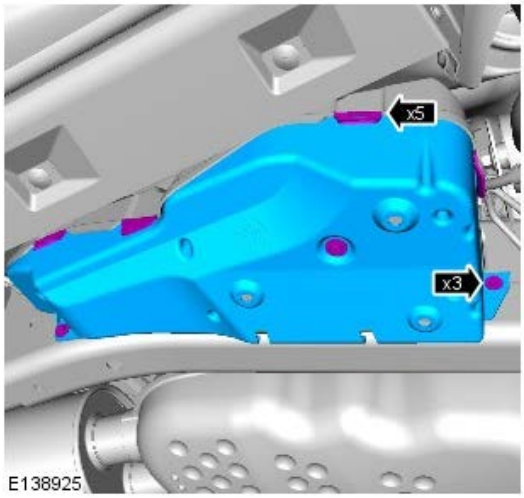
1. CAUTION: Make sure the ignition switch is turned off, the park brake is on and the selector lever is in park.

   Open the front door.

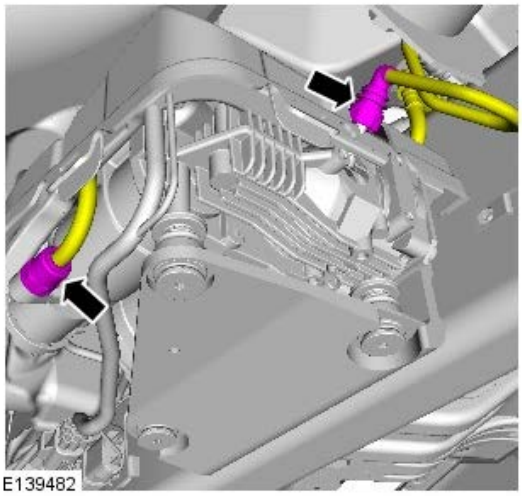
2. WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

   Raise and support the vehicle. Make sure at least one of the wheels is off the ground.

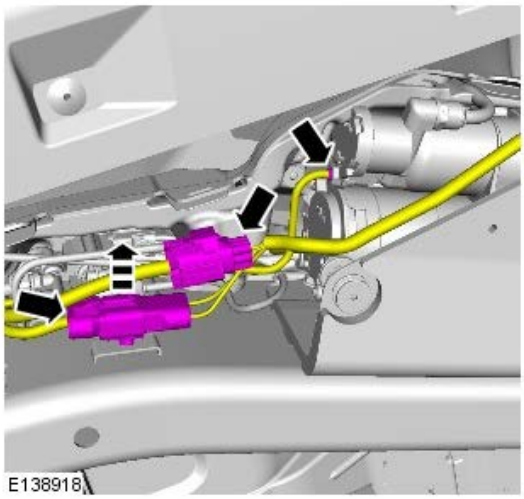
3.



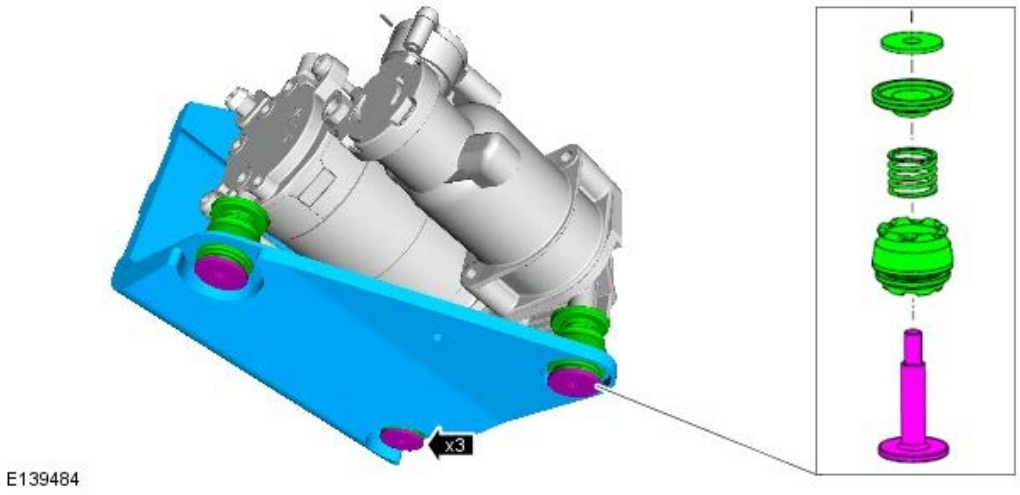
4. CAUTION: Always plug any open connections to prevent contamination.



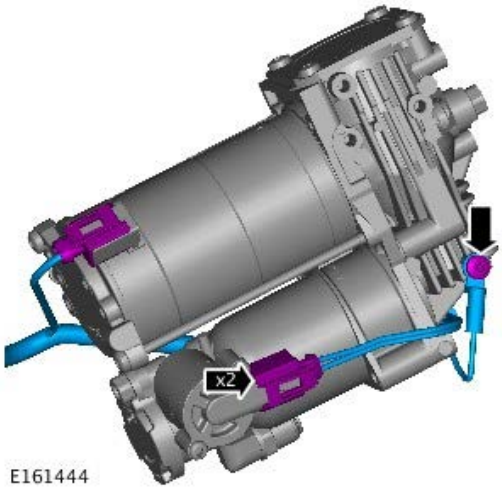
5. CAUTION: Always plug any open connections to prevent contamination.



6. NOTE: Note the orientation of the component prior to removal.

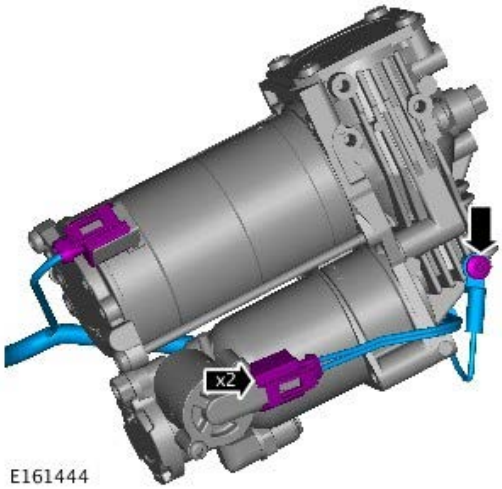


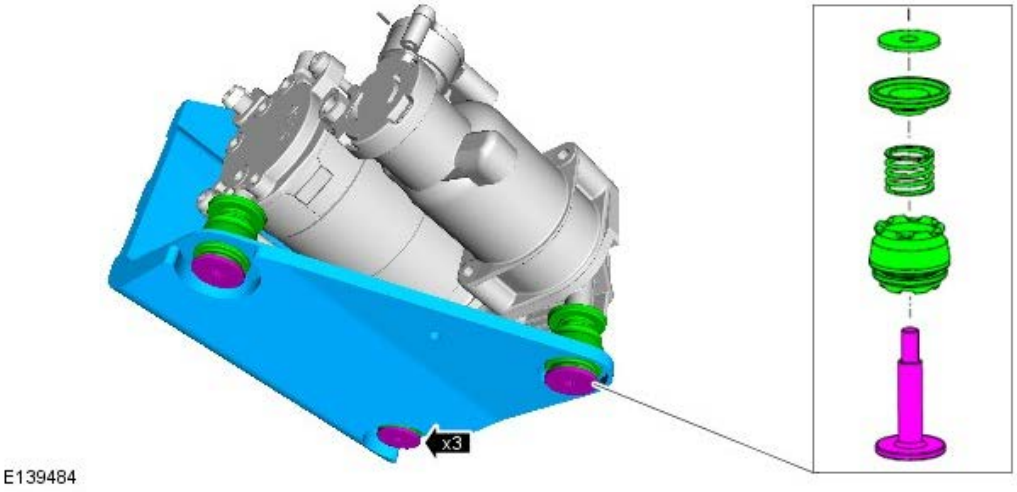
7.



Installation

1. *Torque:* 10 Nm





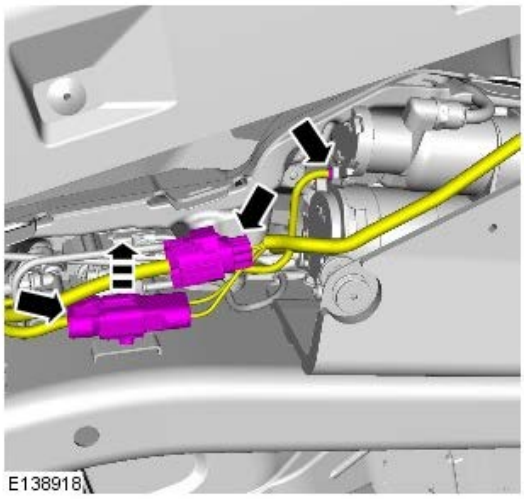
2. CAUTIONS:

   Make sure that these components are installed to the noted removal position.

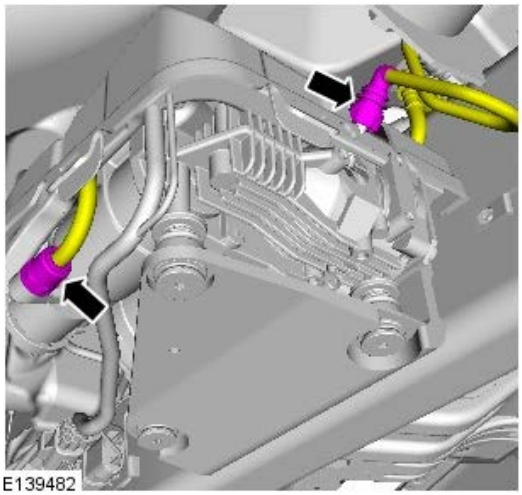
   Make sure that the self tapping bolts remains aligned during the tightening process.

   Torque: 10 Nm

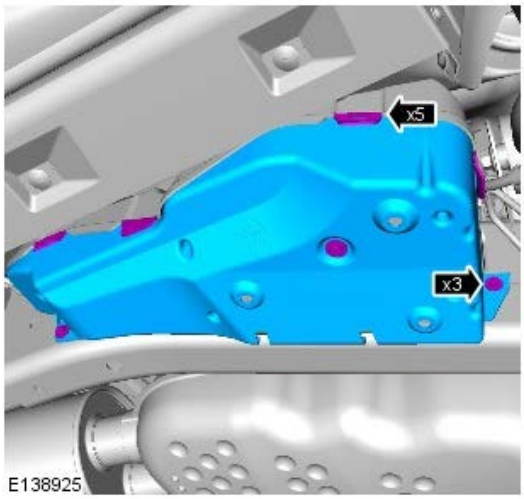
3.



4.



5. *Torque:* 9 Nm



Published: 11-May-2011

Anti-Theft - Active -

Torque Specifications

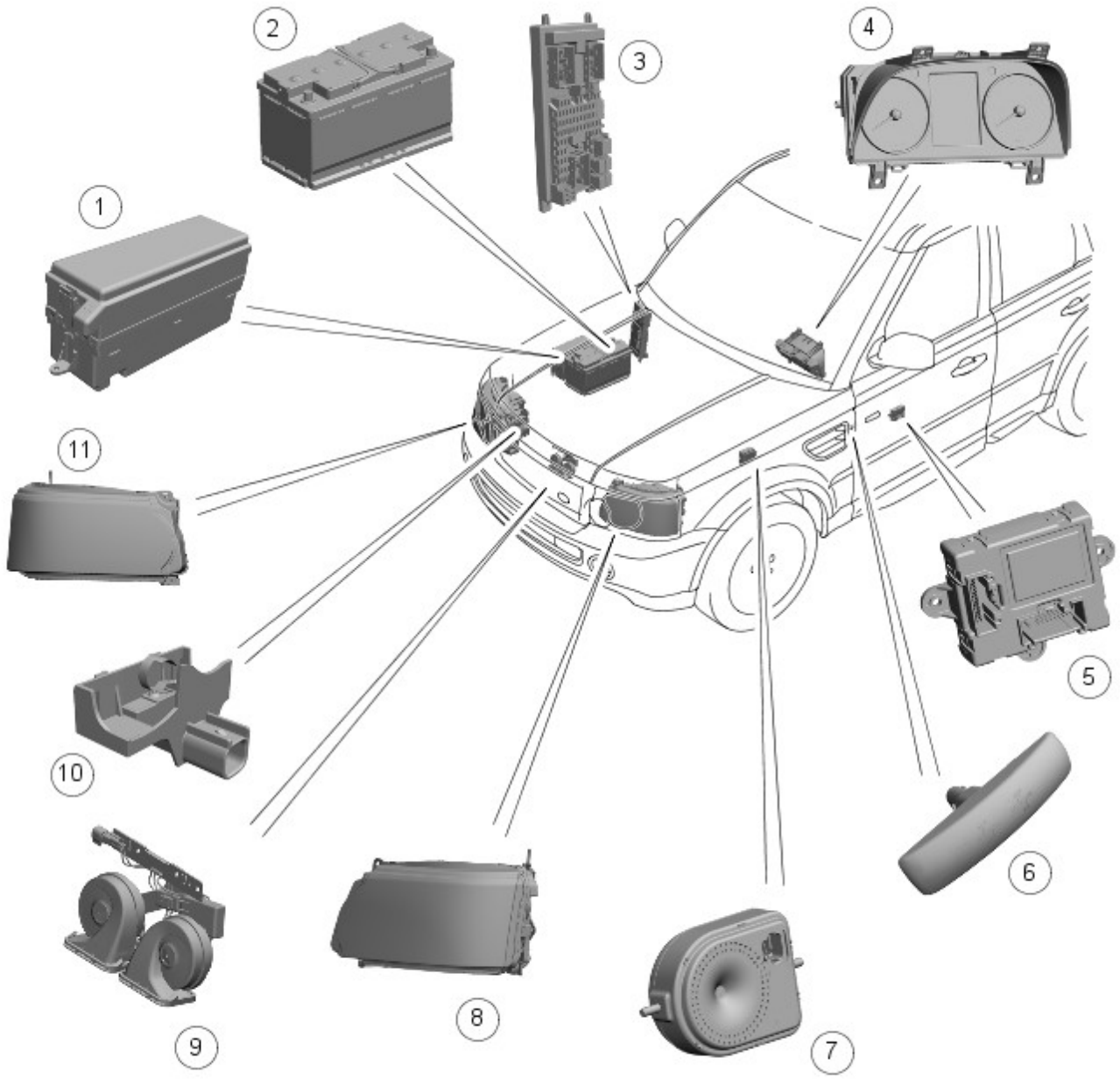
Description	Nm	lb-ft
RH Hood latch Torx bolts	10	7
Security antenna	6	4

Published: 28-Oct-2011

Anti-Theft - Active - Anti-Theft - Active

Description and Operation

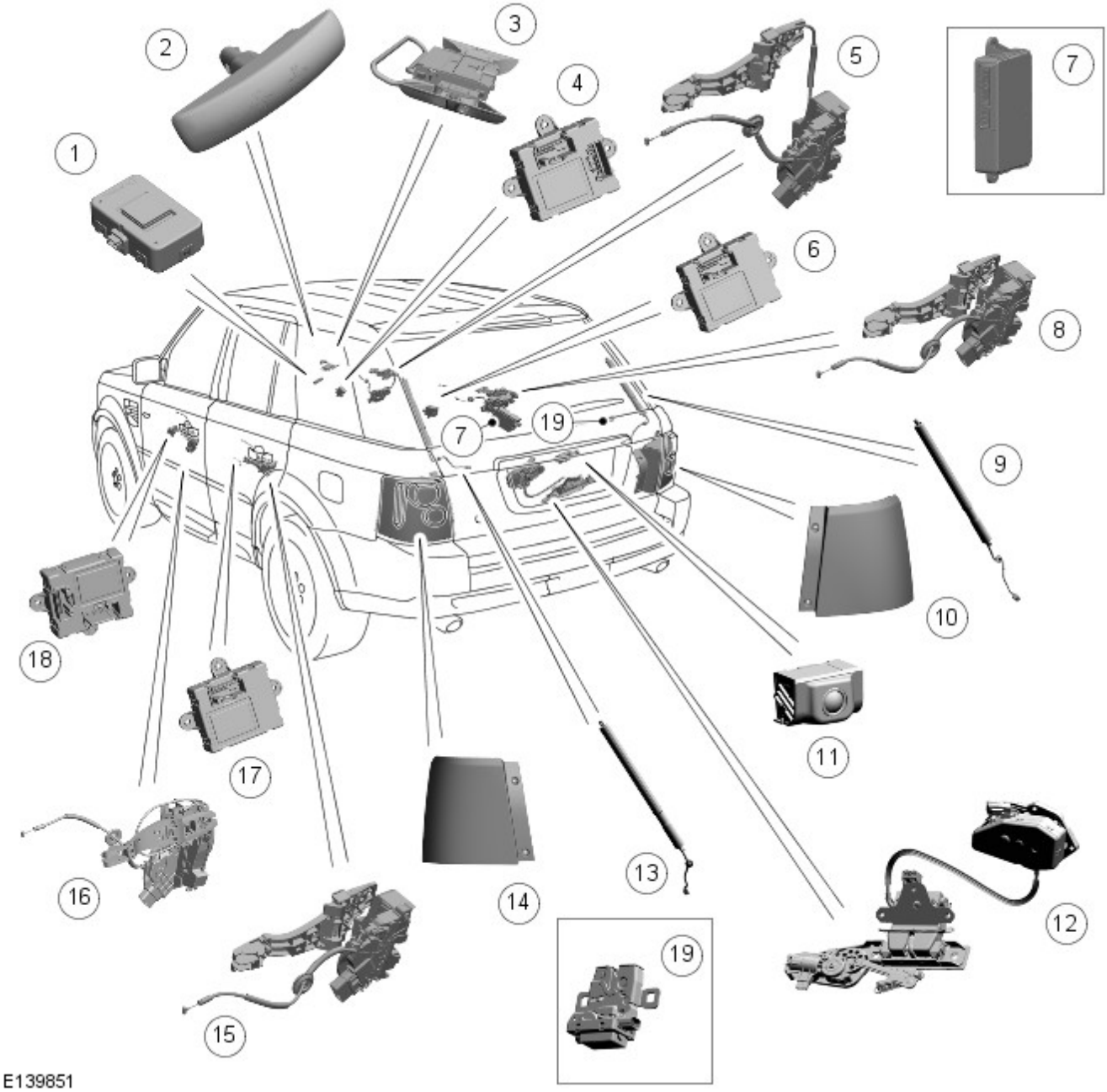
COMPONENT LOCATION - SHEET 1 OF 2



E139850

Item	Part Number	Description
1	-	BJB (battery junction box)
2	-	Battery
3	-	CJB (central junction box)
4	-	Instrument cluster
5	-	LH (left-hand) front door module
6	-	LH front side repeater lamp
7	-	Battery backed-up sounder and inclination sensor (if fitted)
8	-	LH headlamp
9	-	Horns
10	-	Bonnet switch
11	-	RH (right-hand) headlamp

COMPONENT LOCATION - SHEET 2 OF 2



Item	Part Number	Description
1	-	Radio frequency receiver
2	-	RH front side repeater lamp
3	-	Interior motion sensor
4	-	RH front door module
5	-	RH front door latch
6	-	RH rear door module
7	-	RFA (Remote Function Actuator)
8	-	RH rear door latch
9	-	RH tailgate motor
10	-	RH tail lamp
11	-	Rear view camera
12	-	Lower tailgate latch assembly
13	-	LH tailgate motor
14	-	LH tail lamp
15	-	LH rear door latch
16	-	LH front door latch
17	-	LH rear door module
18	-	LH front door module
19	-	Upper tailgate latch

OVERVIEW

The active anti-theft system is available with three different levels of vehicle protection depending on market specification:

- Hinged panel sensing
- Hinged panel and intrusion sensing
- Hinged panel, intrusion and inclination sensing.

The system is controlled by software in the CJB which indicates an alarm trigger condition:

- Visually, using the direction indicators.
- Audibly, using the vehicle horn and, depending on market specification, either a passive or active sounder.

The passive sounder is an anti-theft disc horn and the active sounder is a BBUS (battery backed-up sounder).

The BBUS is an intelligent unit which communicates to the CJB over a LIN (local interconnect network) connection. The BBUS is fitted with an inclination sensor.

Monitoring of the hinged panels is carried out using switches located in each door latch assembly, the hood latch assembly, and the tailgate latch assembly. The condition of the switches is monitored by the CJB.

Monitoring of front door lock status is carried out using switches located in the door latch mechanisms. The condition of the switches is monitored by the front door modules and transmitted to the CJB over the medium-speed CAN (controller area network).

Monitoring of the cabin interior is carried out using an interior motion sensor, which comprises an ultrasonic sound wave sensor to determine if there is movement within the cabin. Information from the interior motion sensor is communicated to the CJB over a LIN connection.

When armed, the active anti-theft system can be triggered in one of the following ways:

- A door ajar switch indicates a door is open.
- The hood or upper tailgate ajar switches indicate that either is open.
- Either front door latch mechanism indicates a door has been unlocked.
- The emergency key blade is used to open the LH front door.
- The CJB is disconnected (this may result in only a partial trigger).
- An attempt is made to start the engine without a valid signal from the Smart Key.
- The BBUS is disconnected (partial trigger only).
- The vehicle battery is disconnected on a vehicle fitted with a BBUS (partial trigger only).
- The inclination sensor detects a change in vehicle attitude.
- The interior motion sensor detects movement within the cabin.
- Panic alarm from the Smart Key.

CAUTIONS:

 The interior motion sensor electrical connections, particularly those to the sensors mounted in the roof console, are very delicate and must be handled with care.

 The interior motion sensor is an electro-statically sensitive part and should only be handled in an electro-statically controlled environment.

Alarm Indicator

The alarm indicator is a LED (light emitting diode) located in the instrument cluster, operation of the alarm indicator is controlled by a hardwired input the CJB. When the ignition is off the indicator gives a visual indication of the active anti-theft system to show if the alarm system is active or not active.

The alarm LED will begin to flash once every 2 seconds to indicate that the vehicle alarm is armed.

Door Modules

The door modules provide the interface between the door latch-motors, the door latch-switches and the CJB. The door modules provide door switch status information and enable the door latch-motors on request from the CJB or the Remote Function Actuator.

Remote Function Actuator

The Remote Function Actuator interfaces with the Central locking, RF (radio frequency) receiver and collects RF signal information which is transmitted from the Smart Key. This information is translated into commands which are passed on the medium-speed CAN to the:

- CJB,
- front door modules, and
- instrument cluster.

The Remote Function Actuator also monitors:

- four interior antennas,
- two load-space antennas,
- four door handle antennas and one rear bumper antenna, if passive entry is fitted.

On vehicles with passive entry, the additional fast latch motors are controlled via the Remote Function Actuator and

the locking status is passed to the CJB on the medium speed CAN.

Passive Anti-Theft Horn

The passive anti-theft horn is hardwired to the CJB and activates when the alarm is triggered.

Battery Backed-Up Sounder (BBUS)

The BBUS uses an integral sounder to produce an audio warning when the alarm is triggered. An inclination sensor is incorporated into the BBUS, to monitor vehicle attitude, see Inclination Sensor.

Operation of the BBUS is controlled by the CJB via exchange signals on the LIN. Under normal operation the BBUS is powered by a permanent battery power supply from the CJB. However, if the power feed is disrupted an integral rechargeable battery powers the BBUS.

On receipt of the arming signals, the BBUS sounder and the inclination sensor respond with a status signal. If there is no response to the arming signals within 12 seconds, the CJB assumes there is a fault and sends a disarm signal to the sounder or the inclination sensor, as appropriate. The CJB also stores a related fault code.

If the alarm is subsequently triggered, with the BBUS sounder disarmed, the CJB uses the passive anti-theft horn or vehicle horn to sound the audio warning.

Inclination Sensor

The inclination sensor measures the longitudinal and lateral angle of the vehicle over a range of ±16° from the horizontal. When the anti-theft alarm system is armed in the intrusion detection mode, the BBUS stores the current angles in memory and monitors the inclination sensor readings. If the vehicle attitude changes in either direction by more than the alarm limit, the BBUS activates the sounder.

Interior Motion Sensor

When the vehicle is double locked, the interior motion sensor monitors for movement in the vehicle's cabin.

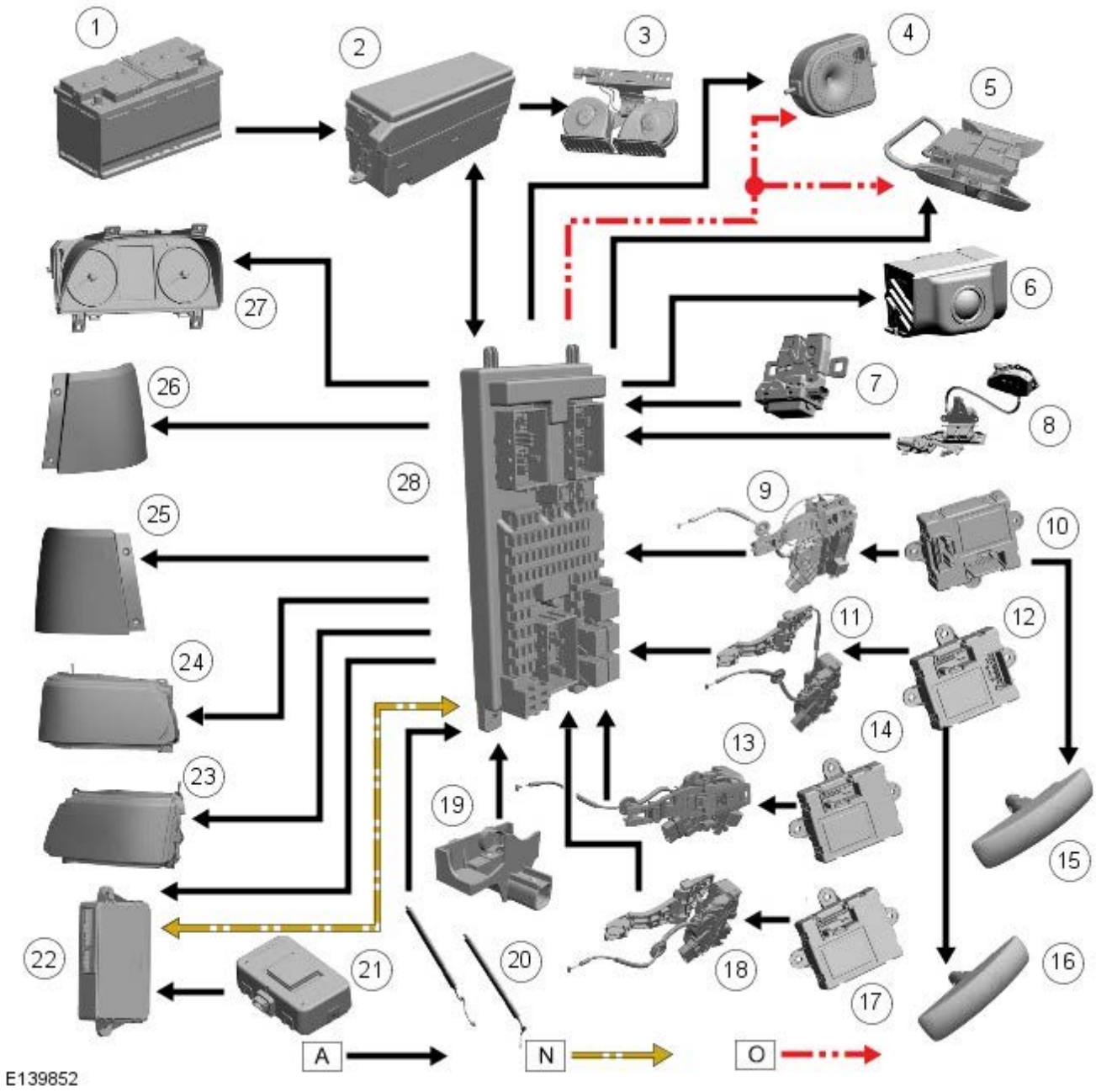
The interior motion sensor consists of a micro-controller, two acoustic transmitters and one acoustic receiver. The receiver and one of the transmitters face forward and the other transmitter faces rearward to ensure complete coverage of the vehicle's cabin.

The interior motion sensor is powered by a feed from the CJB and activates and de-activates the interior motion sensor. When the interior motion sensor is active it outputs ultrasonic pulses from the transmitters and checks the echoes picked up by the receiver for changes to the passenger compartment profile. If it detects a change of profile, indicating movement in the passenger compartment, the interior motion sensor reports the alarm to the CJB.

Each time the interior motion sensor is armed, it performs a self-test. If there are no faults the interior motion sensor sends an acknowledgment signal to the CJB. If the CJB does not receive the acknowledgment signal it de-activates the interior motion sensor.

CONTROL DIAGRAM

NOTE: **A** = Hardwired; **N** = Medium Speed CAN bus; **O** = LIN bus



Item	Part Number	Description
1	-	Battery
2	-	BJB
3	-	Horns
4	-	Battery backed-up sounder with integrated inclination sensor (if fitted)
5	-	Interior motion sensor
6	-	Rear view camera
7	-	Upper tailgate latch
8	-	Upper tailgate latch
9	-	LH front door latch
10	-	LH front door module
11	-	RH front door latch
12	-	RH front door module
13	-	RH rear door latch
14	-	RH rear door module
15	-	LH front side repeater lamp
16	-	RH front side repeater lamp
17	-	Hood ajar switch
18	-	Remote Function Actuator
19	-	Bonnet switch
20	-	Tailgate motors

21	-	Radio frequency receiver
22	-	RFA (Remote Function Actuator)
23	-	LH headlamp
24	-	RH headlamp
25	-	LH tail lamp
26	-	RH tail lamp
27	-	Instrument cluster
28	-	CJB

PRINCIPLES OF OPERATION

The active anti-theft system arms and disarms in conjunction with the locking and unlocking of the central locking system.
For additional information, refer to: Handles, Locks, Latches and Entry Systems (501-14, Description and Operation).

Depending on the configuration of the CJB, the active anti-theft system can be armed and disarmed when the locking system is activated with the Smart Key. Visual and audible confirmation of the arming and disarming is provided by the direction indicators and the BBUS.

On vehicles not fitted with the interior motion sensor and BBUS, the anti-theft alarm system is armed in the perimeter mode when the vehicle is either single or double locked.

On vehicles with the interior motion sensor the anti-theft alarm system is armed in one of two modes:

- Single Locking: only the hinged panels are monitored.
- Double Locking: the hinged panels the vehicle interior, and if the BBUS is incorporated the vehicle attitude, are monitored.

When the vehicle is double-locked, the CJB sends an arming signal to the BBUS. If the CJB does not receive an acknowledgment signal from the BBUS and the interior motion sensor, the CJB disables the associated alarm feature for the remainder of the armed cycle.

Locking and Arming the Vehicle

NOTE: The vehicle will only lock, if all door, tailgate and hood apertures are closed. If a lock attempt is made when an aperture is open, the vehicle will not lock and two audible error warnings will sound.

Single locking:

- Pressing the lock button briefly on either the door handle or Smart Key, will initiate the CJB to arm the anti-theft alarm system in the perimeter mode and send an arming signal to the sounder in the BBUS. This secures the vehicle and prevents the doors being opened from outside of the vehicle; however they can still be unlocked and opened from inside the vehicle. The hazard warning lamps will flash once as confirmation and ‘if enabled’ an audible warning will also sound. The alarm indicator in the instrument cluster will flash continuously.

Double locking:

- Pressing the lock button twice within three seconds on either the door handle or Smart Key, will initiate the CJB to arm the anti-theft alarm system in the perimeter mode and interior motion detection mode. The CJB will also send an arming signal to the BBUS. Double locking secures the vehicle and prevents the doors being unlocked or opened from inside or outside of the vehicle, except with a recognized Smart Key. The perimeter alarm and interior motion protection are turned on. The hazard warning lamps will flash twice, with a long second flash as confirmation and if enabled an audible warning will also sound.
- The vehicle set-up menu in the message center allows the intrusion detection and inclination protection to be temporarily disabled the next time the vehicle is locked using the Smart Key. This feature prevents accidental triggering of the active anti-theft system during transportation of the vehicle or if a pet is left in the vehicle. The sensor override functionality will be active for one lock/unlock cycle only and will default back to sensor active mode automatically.

Emergency Disarming

If the alarm has been triggered and cannot be disarmed with the Smart Key, it can be disarmed using the emergency Smart Key blade. This is achieved by unlocking the left-hand front door with the key blade and deactivating the alarm by:

- pressing the unlock button on the Smart Key, or by
- pressing the engine START/STOP button with the Smart Key inside the vehicle.

Published: 11-May-2011

Anti-Theft - Active - Antenna

Removal and Installation

Removal

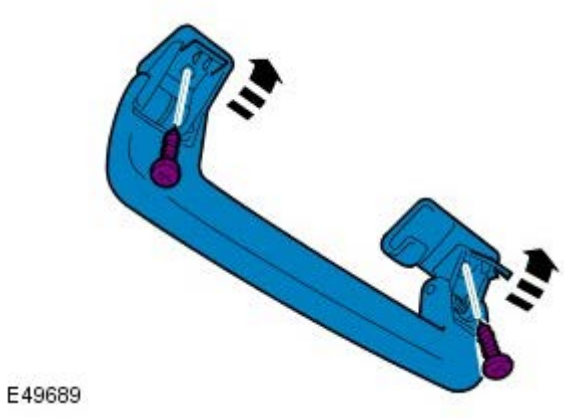
1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

2. Remove the RH B-pillar upper trim panel.
   For additional information, refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

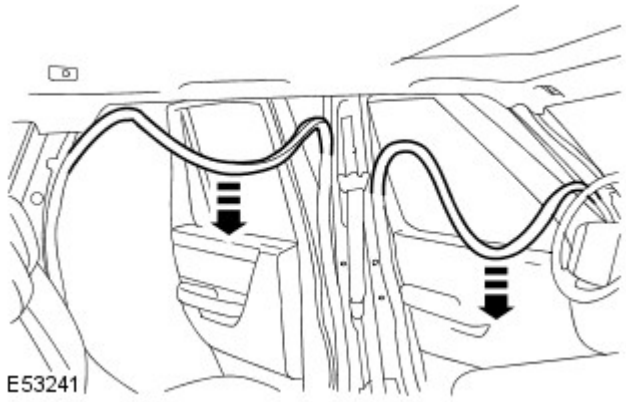
3. Remove the RH C-pillar upper trim panel.
   For additional information, refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

4. Remove the RH D-Pillar upper trim panel.
   For additional information, refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

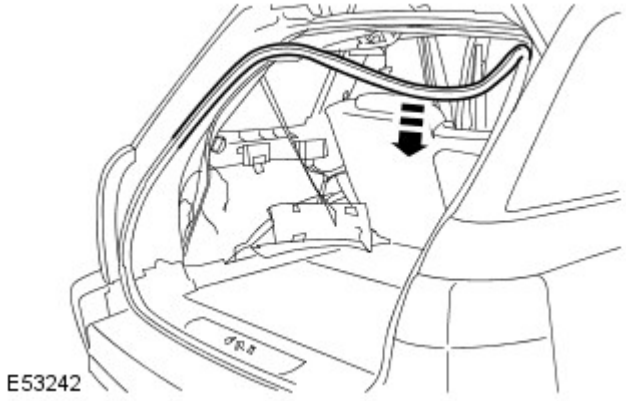
5. Remove the passenger assist handle.
   - Release the 2 screw covers.
   - Remove the 2 screws.
   - Repeat the above procedure for the other handle.


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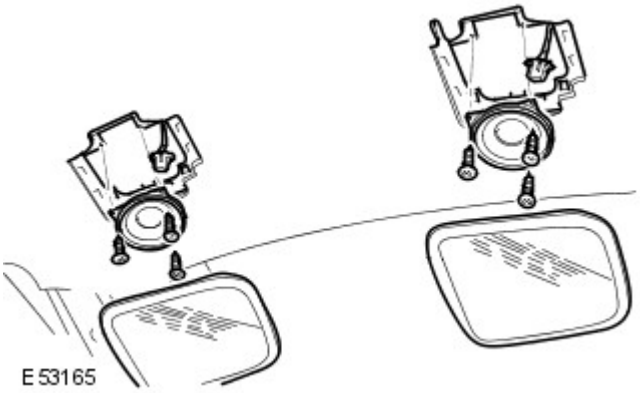
6. Release the front and rear door weatherstrips for access.


E53241

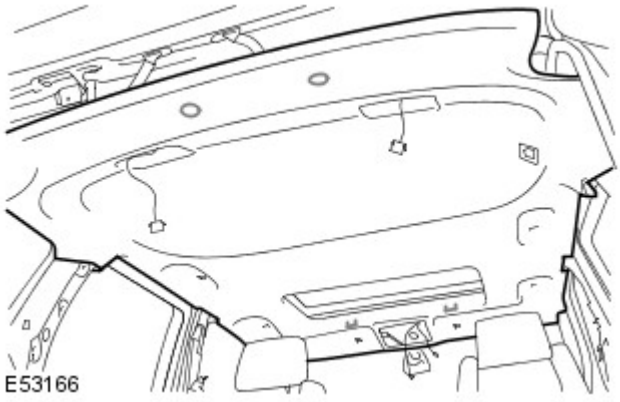
7. Release the liftgate weatherstrip


E53242

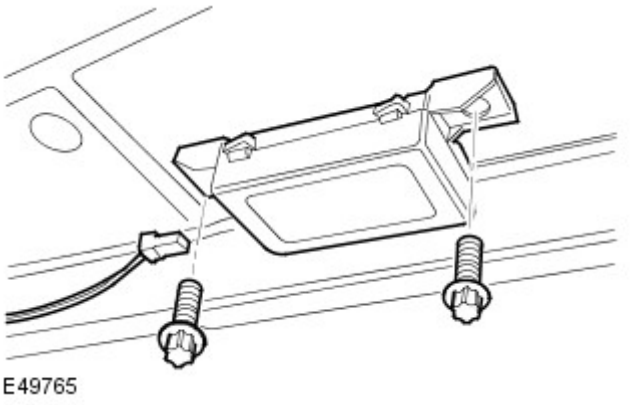
8. Remove the rear speakers.
   - Remove the speaker grilles.



Remove the 6 screws.
- Disconnect the 2 electrical connectors.



9. Release the headliner for access.
    - Release the 2 clips.



10. Remove the alarm antenna.
    - Release and disconnect the electrical connector.
    - Remove the 2 bolts.

Installation

1. Install the alarm antenna.
    - Tighten the bolts to 6 Nm (4 lb.ft).
    - Connect and secure the electrical connector.

2. Install the headliner.
    - Secure in the clips.

3. Attach the door weatherstrips.

4. Install the passenger assist handles.
    - Install the screws.
    - Secure the screw covers.

5. Install the rear speakers.
    - Connect and secure the electrical connectors.
    - Install the screws.
    - Install the speaker grilles.

6. Install the D-pillar upper trim panel.
   For additional information, refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

7. Install the C-pillar upper trim panel.
   For additional information, refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and

Installation).

8. Install the B-pillar upper trim panel.
   For additional information, refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

9. Connect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

Published: 11-May-2011

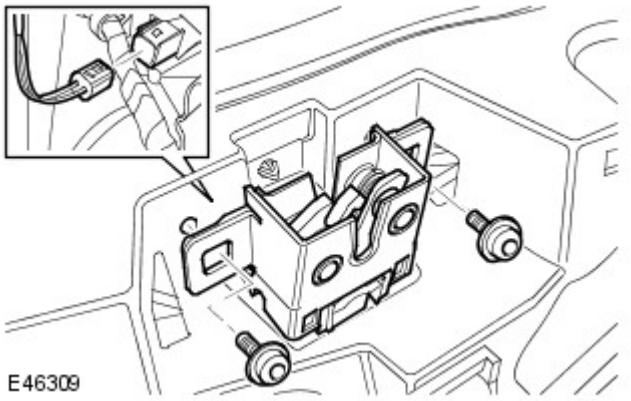
Anti-Theft - Active - Hood Switch

Removal and Installation

Removal

NOTE: **Before installing a new hood switch, diagnose the hood switch by using a digital multimeter. Make sure that continuity through hood switch is present when the switch is pressed (hood closed condition). Repeat the test to make sure continuity IS NOT present when the switch IS NOT pressed. If the hood switch continuity is NOT present, continue with this procedure. If the continuity is present, install the original hood switch to the vehicle.**

1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).



2. Release the RH hood latch.
   - Remove the 2 Torx bolts.
   - Disconnect the electrical connector.
3. Remove the hood switch.

Installation

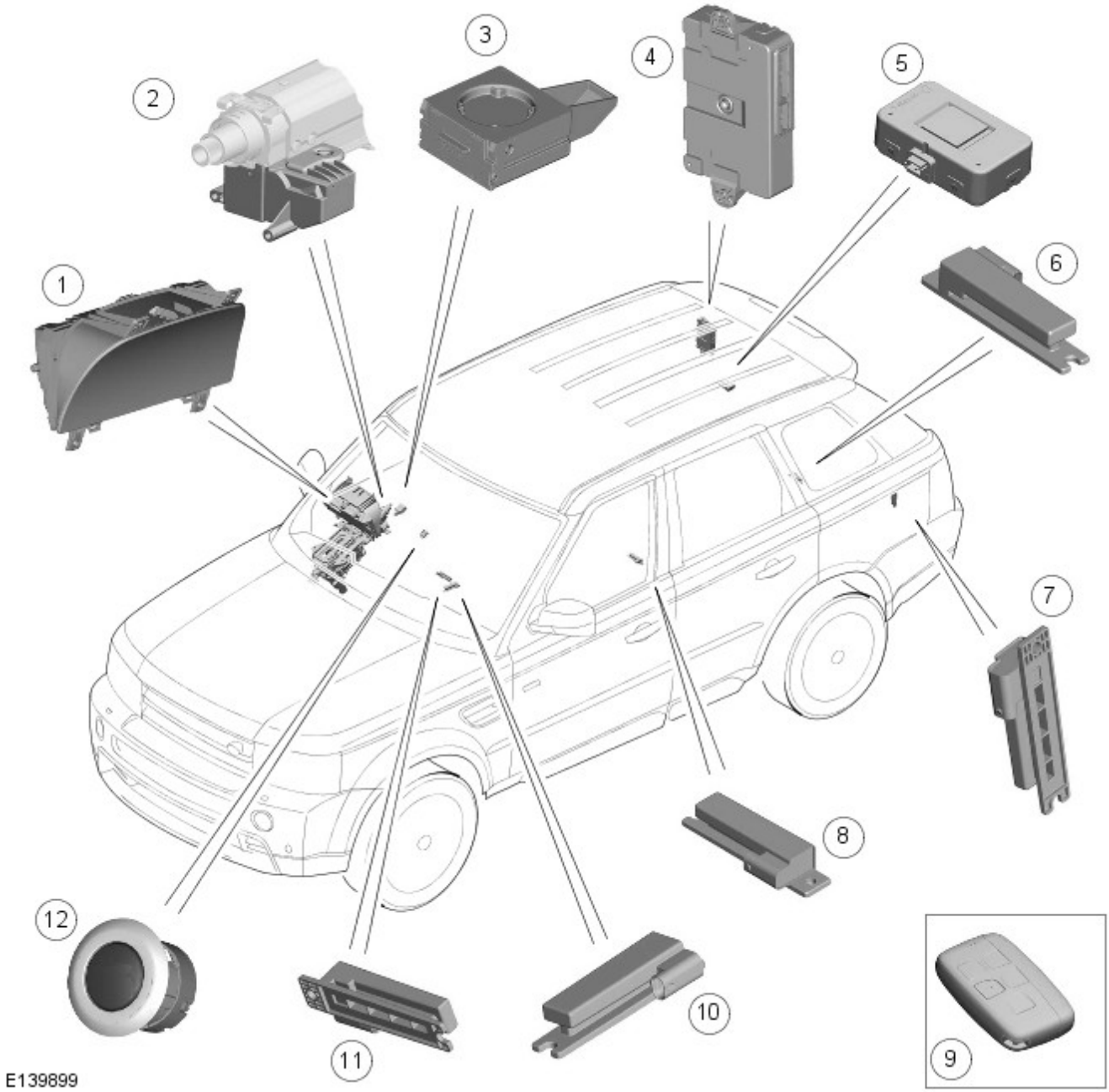
1. Install the hood switch.
2. Install the RH hood latch.
   - Connect the electrical connector.
   - Tighten the Torx bolts to 10 Nm (7 lb.ft).
3. Open and close the hood to check the hood latch operation.
4. Adjust the hood latch.
   - Loosen the 2 hood latch Torx bolts.
   - Lower the hood and check for alignment.
   - Open the hood and tighten the Torx bolts to 10 Nm (7 lb.ft).
   - Check for the correct operation of the hood safety catch.
   - If necessary, repeat the above adjustment procedure.

Published: 16-Apr-2013

Anti-Theft - Passive - Anti-Theft - Passive

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Instrument cluster
2	-	Steering column lock
3	-	Immobilizer antenna unit (IAU)
4	-	Keyless Vehicle Module (KVM)
5	-	Radio frequency receiver
6	-	Interior Antenna – luggage compartment
7	-	Interior Antenna – luggage compartment
8	-	Interior Antenna – center console
9	-	Smart Key
10	-	Interior Antenna – front compartment
11	-	Interior Antenna – front compartment
12	-	Start/Stop switch

OVERVIEW

Passive Start

The passive start system relies on the detection of a uniquely coded Smart Key and low frequency antennas strategically situated within the vehicle. The antennas ensure the Smart Key is always within the active transmission zone of the antennas wherever the Smart Key is placed inside the vehicle. For this reason the orientation and positioning of the antennas is critical to the correct functioning of the system. The Smart Key also operates the passive entry system.
For additional information, refer to: Handles, Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

The system provides a secure interface between the CJB (central junction box) and the ECM (engine control module) to prevent unauthorized starting of the engine. This is achieved by immobilization of the engine crank system and the fuel system, using encoded data exchange between the Smart Key and multiple control modules.

Engine starting is initiated when the encoded data exchange between the Smart Key and the control modules is verified. The engine management system will then allow engine crank and fueling when an authorization data message is received from the CJB.

The engine can be started by pressing the start/stop button and depending on the type of transmission:

- Automatic; when the drive selector is in the 'Park' position and the brake pedal is pressed.
- Manual; when the gear selector is in 'Neutral' and the clutch pedal is pressed.

COMPONENT DESCRIPTION

Immobilizer Antenna Unit

The IAU (immobilizer antenna unit) is used if the keyless vehicle module is unable to authorize the Smart Key. If the keyless vehicle module is unable to identify the Smart Key, for example if the Smart Key battery voltage is low or there is local RF interference, the transponder within the Smart Key can be read in the conventional manner. The driver will be alerted to this by a chime and a message in the instrument cluster message center 'SMART KEY NOT FOUND REFER TO HANDBOOK'.

Refer to Keyless Start Backup section.

Low Frequency Antennas

Five LF (low Frequency) antennas for the passive start system are positioned in specific locations within the vehicle.

The keyless vehicle module transmits an LF signal via the antennas which is received by the Smart Key. The Smart Key then responds by transmitting a RF (radio Frequency) signal which is received by the RF receiver and passed to the KVM (Keyless Vehicle Module) for authorization.

Keyless Vehicle Module

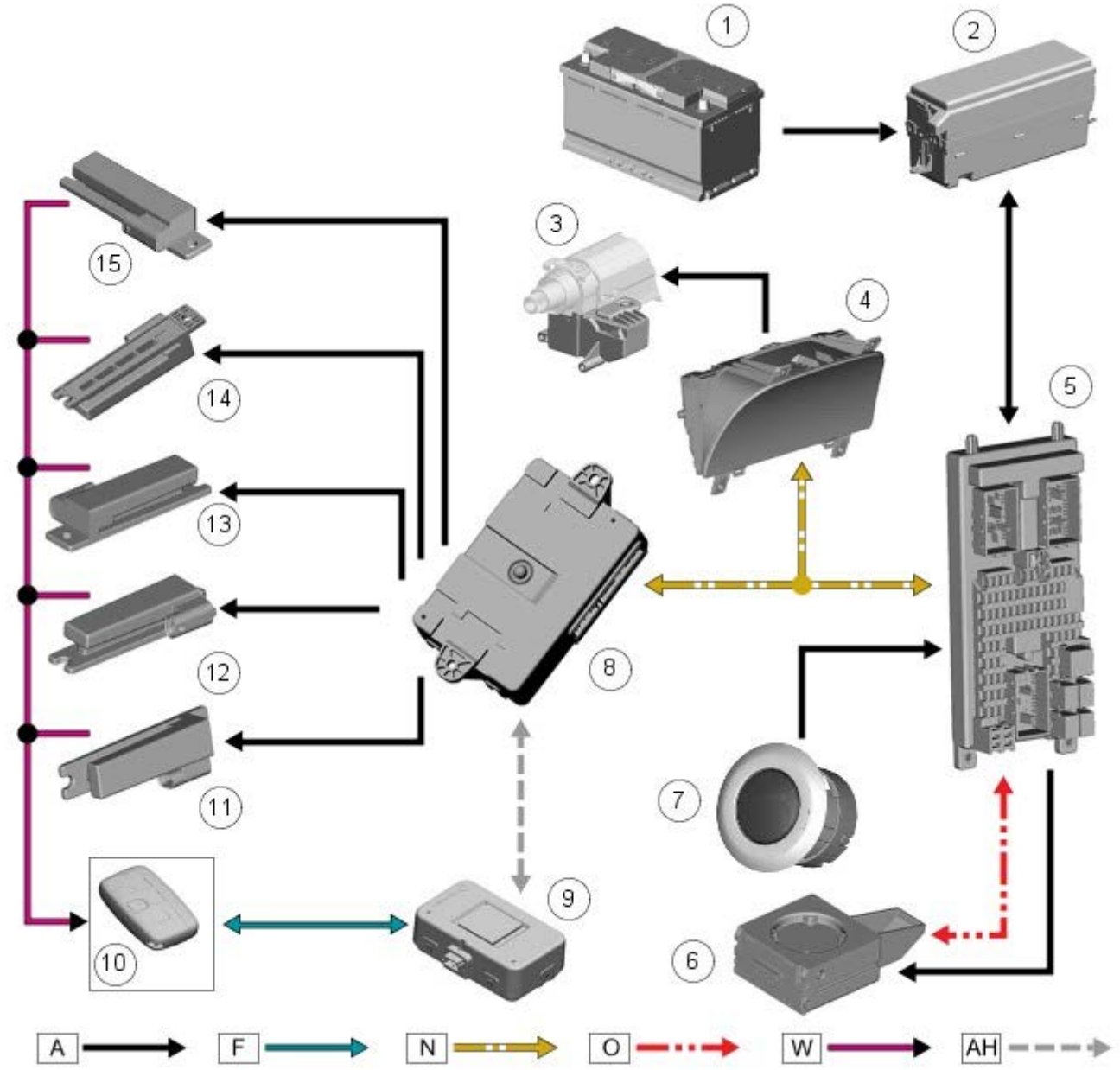
The keyless vehicle module controls signal transmissions to and from the Smart Key and provides authorization to allow the vehicle to be started. The module has a medium speed CAN (controller area network) connection to the CJB for authorizing vehicle starting.

Radio Frequency Receiver

The RF (radio frequency) receiver transmission is received from the Smart Key to enable key identification.

CONTROL DIAGRAM

NOTE: **A** = Hardwired connection; **F** = RF Transmission; **N** = Medium speed CAN bus; **O** = LIN (local interconnect network) bus; **W** = LF Transmission; **AH** = Serial Communications Link



E139900

Item	Part Number	Description
1	-	Battery
2	-	BJB (battery junction box)
3	-	Steering column lock
4	-	Instrument cluster
5	-	CJB
6	-	Immobilizer Antenna Unit (IAU)
7	-	Start/Stop switch
8	-	KVM (Keyless Vehicle Module)
9	-	Radio frequency receiver
10	-	Smart Key
11	-	Interior Antenna – luggage compartment
12	-	Interior Antenna – luggage compartment
13	-	Interior Antenna – front compartment
14	-	Interior Antenna – front compartment
15	-	Interior Antenna – center console

PRINCIPLES OF OPERATION

Passive Start

At the request of the CJB the KVM (Keyless Vehicle Module) prompts each of the internal low-frequency antennas to output a signal. When the Smart Key is in the vehicle cabin, it detects the low-frequency signals and responds with a

RF radio frequency data-identification signal back to the KVM via the RF receiver.

If the data received matches that stored in the KVM it continues the passive start process by communicating a 'Smart Key valid' signal to the CJB via the medium speed CAN bus.

Once the CJB receives the authorization and confirms the response with an internal calculation, it passes coded data to the ECM on the high speed CAN bus. Upon confirmation from the ECM the ignition is enabled.

Before CJB sends a mobilization signal to the ECM it will exchange encrypted data with the electric steering lock mechanism to authorize unlocking of the steering column. The instrument cluster only provides a ground for the steering lock motor.

The CJB will enable the fuel pump relay which, on diesel vehicles operates the fuel pump and on gasoline vehicles sends a battery voltage supply to the fuel pump driver module to operate the fuel pump in conjunction with the ECM.

NOTE: If the KVM fails to locate the Smart Key, a message 'SMART KEY NOT FOUND REFER TO HANDBOOK' will appear in the instrument cluster message center and the keyless start back-up process will have to be used to mobilize and start the vehicle.

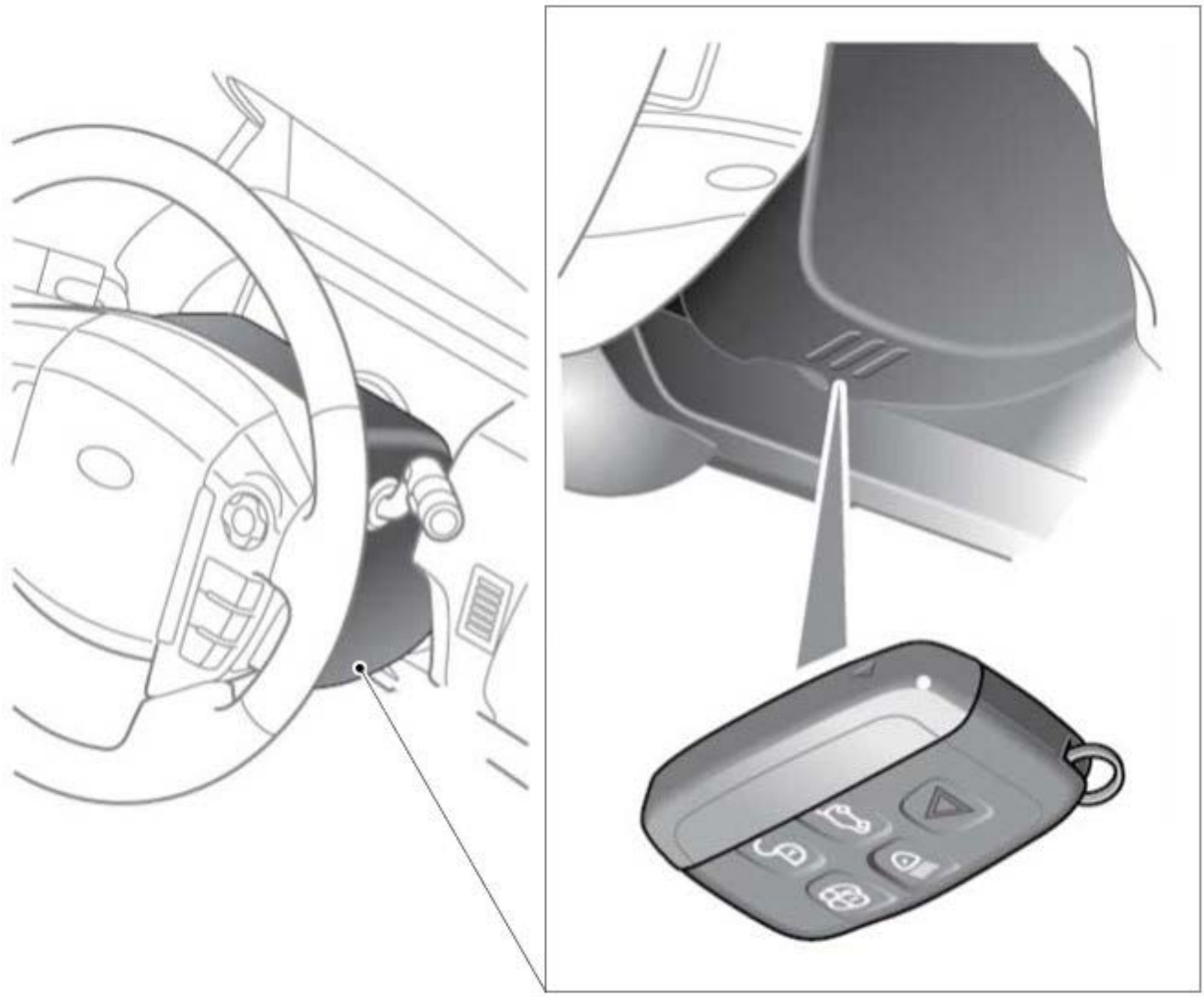
To ensure optimum long term reliability of the smart key the battery must be replaced with a brand new, unused battery. If a used battery is installed the "SMART KEY BATTERY LOW" message may not be cleared. To avoid contamination of the contacts the battery should be removed from its packaging and installed into the smart key while wearing gloves. To confirm that the replacement battery is working correctly press the unlock button twice while holding the smart key outside the vehicle, then enter the vehicle with the smart key, press the start button and confirm that the "SMART KEY BATTERY LOW" message is not displayed.

Keyless Start Backup

If the vehicle has been unlocked using the emergency key blade or the Smart Key is not detected by the vehicle, it will be necessary to use the keyless start backup to disarm the alarm and start the engine. The following process must be followed in this event:

- Position the Smart Key against the underside of the fascia, on the outboard side of the steering column, with the buttons facing downwards. This is the location of the IAU (immobilizer antenna unit).
- Holding the Smart Key in position and the brake / clutch pedal depressed, press the start/stop button to start the engine.

Smart Key positioned next to immobilizer antenna unit



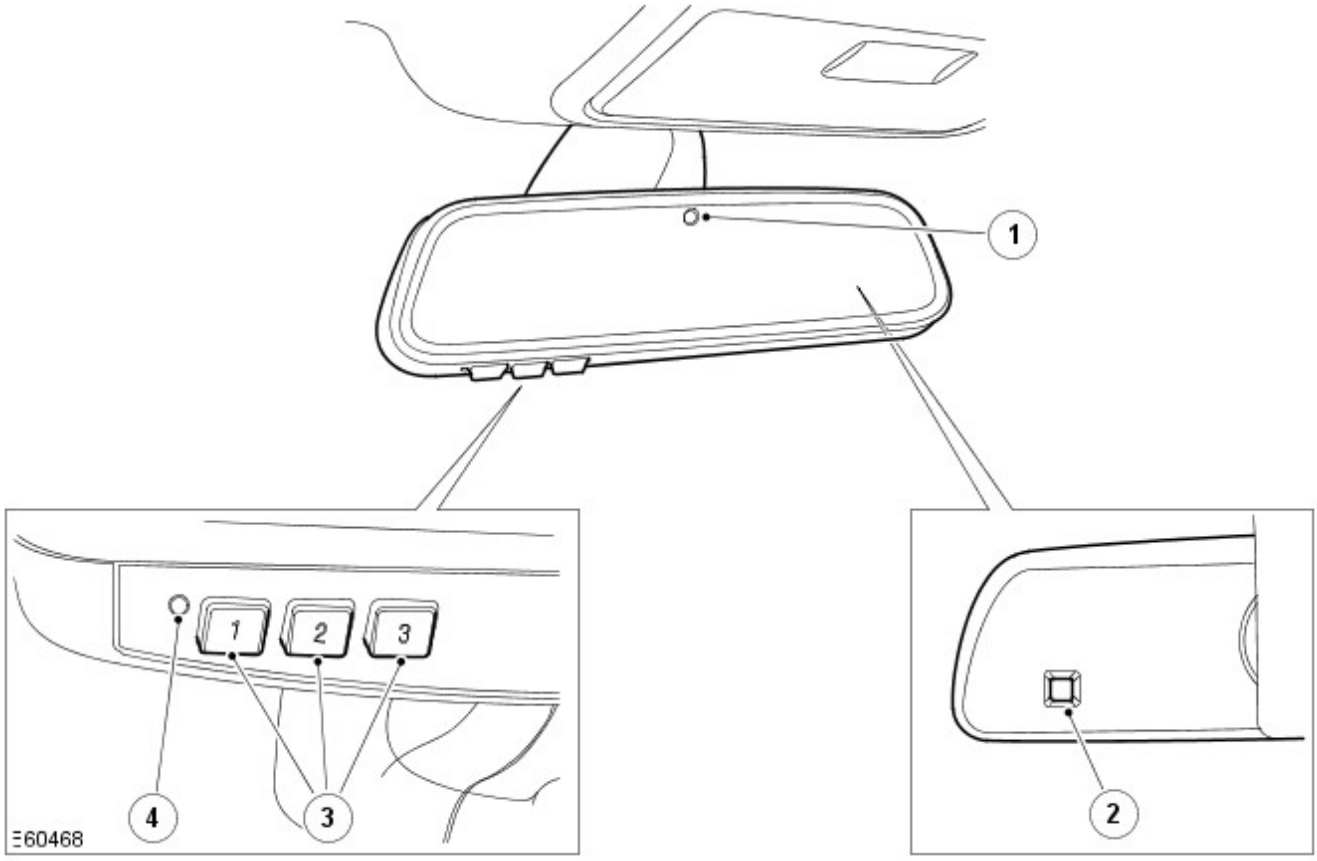
E139891

This process bypasses the data exchange between the KVM and the CJB; this is an inductive process and will operate if the battery in the Smart Key is discharged. A transponder within the Smart Key is detected by the IAU. The IAU confirms the code output from the transponder and communicates this code confirmation with the CJB via a LIN bus connection. The CJB then initiates the vehicle start process in the normal manner.

Published: 11-Jan-2012

Remote Convenience - Universal Transmitter

Description and Operation



Item	Part Number	Description
1	-	Rear light sensor
2	-	Front light sensor
3	-	Universal transmitter channel button (market dependant)
4	-	Universal transmitter light emitting diode (LED) (market dependant)

WARNING: The universal transmitter must not be used with any garage door that lacks safety 'stop' and 'reverse' features, as required by federal safety standards (this includes any garage or door opener model manufactured before April 1 1982). A garage door opener which cannot 'detect' an object in the path of a closing door and then automatically 'stop' and 'reverse' the door, does not meet current federal safety standards. Using a garage door opener without these features increases the risk of serious injury or death.

NOTE: HomeLink is a registered trademark owned by Johnson Controls Inc.

The universal transmitter can operate up to 3 home or office remotely operated systems (e.g. garage door/gate openers, lighting and security systems), replacing the individual hand held transmitters required for each system. The universal transmitter can learn the radio frequency codes of most current transmitters.

NOTE: Universal transmitter frequencies vary across markets

The universal transmitter incorporates 3 buttons, one for each channel, and an amber LED installed on the underside of the interior mirror. When one of the buttons is pressed the universal transmitter outputs the radio signal programmed for the related channel (if any) and illuminates the LED to confirm transmission.

For information on programming the universal transmitter, refer to the 'Owners Handbook'.

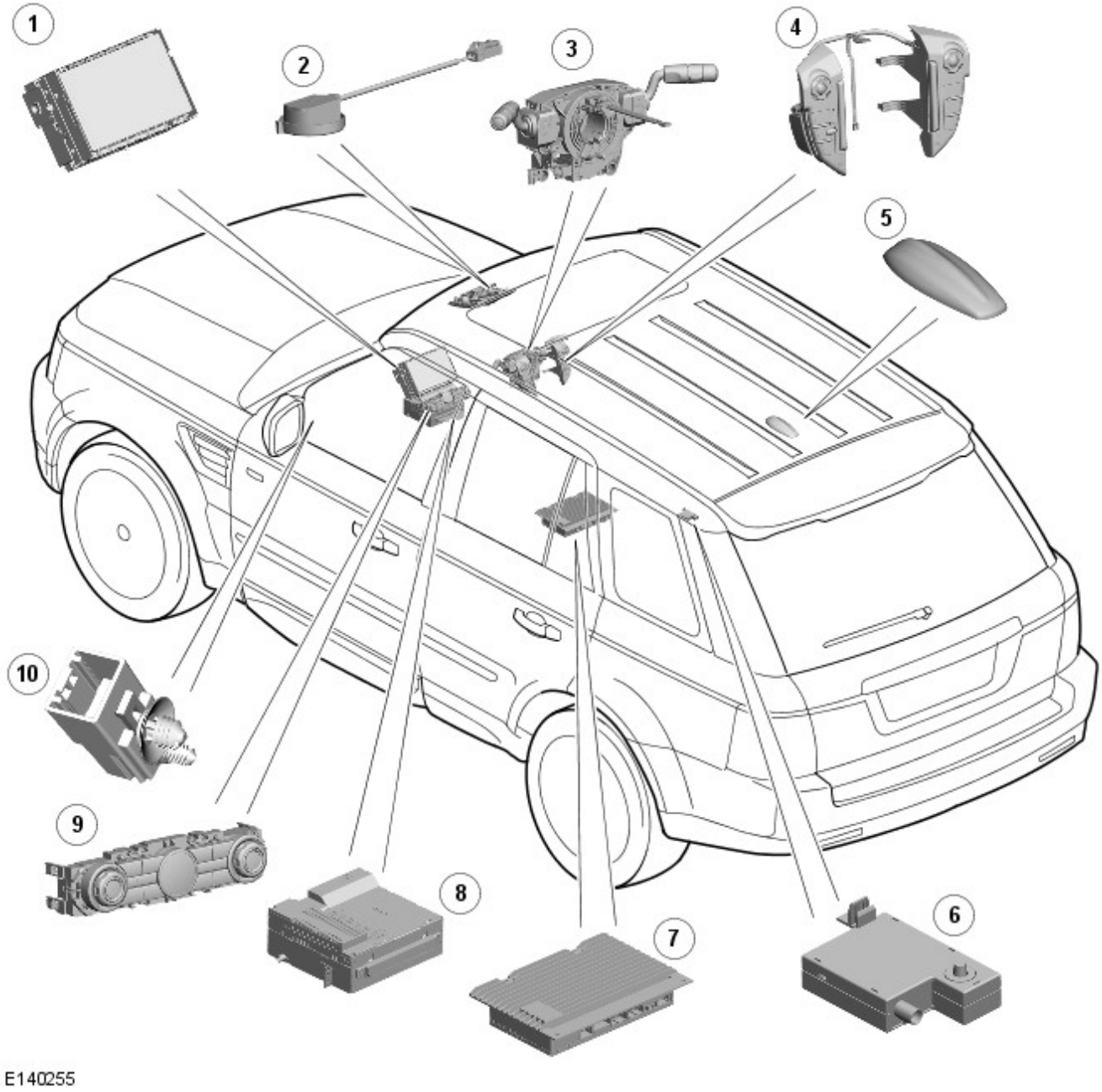
Published: 05-Dec-2011

Navigation System - Navigation System

Description and Operation

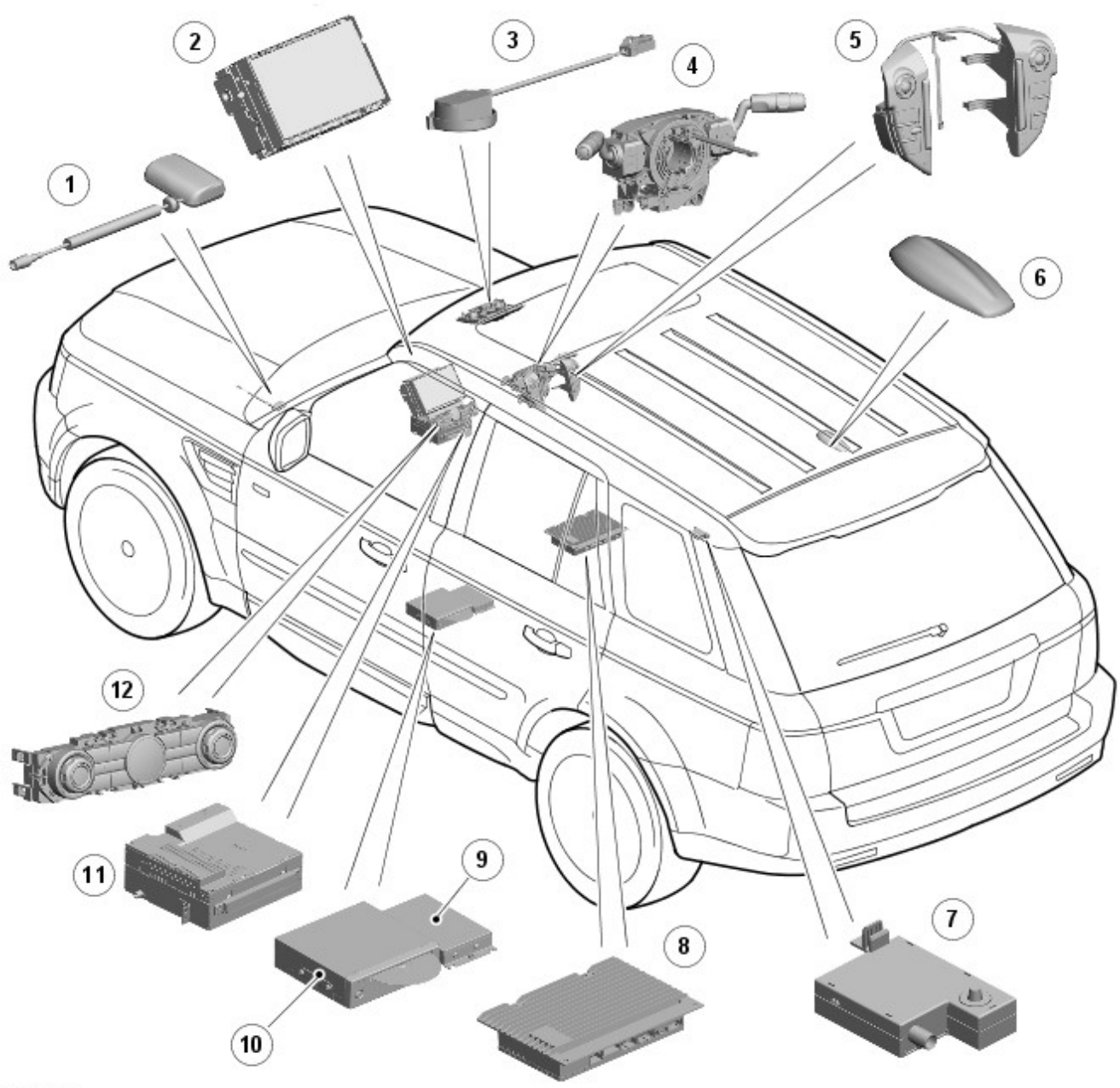
COMPONENT LOCATION

Component Location (ROW)



Item	Part Number	Description
1	-	TSD (touch screen display)
2	-	Microphone - voice recognition
3	-	Clockspring
4	-	Steering wheel switches
5	-	Roof pod incorporating GPS (global positioning system) antenna
6	-	TMC (traffic message channel) antenna amplifier
7	-	Power amplifier
8	-	IAM (integrated audio module), incorporating the navigation module
9	-	Integrated control panel, incorporating the navigation switch
10	-	Navigation update socket

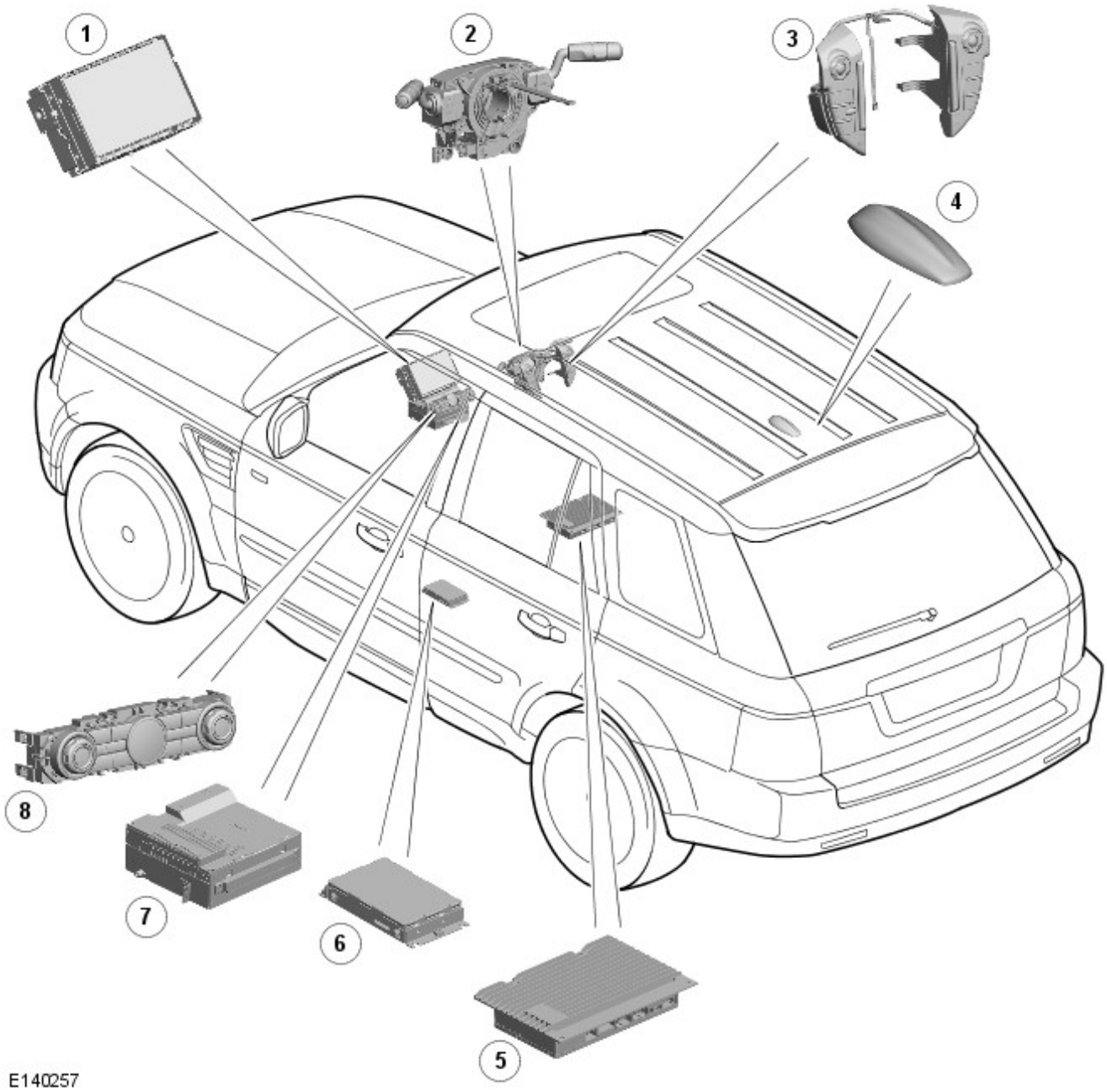
Component Location (Japan)



E140256

Item	Part Number	Description
1	-	VICS (vehicle information and communication system) beacon antenna
2	-	TSD (touch screen display)
3	-	Microphone - voice recognition
4	-	Clockspring
5	-	Steering wheel switches
6	-	Roof pod incorporating GPS antenna
7	-	VICS antenna amplifier
8	-	Power amplifier
9	-	Navigation video interface module
10	-	Navigation computer module
11	-	IAM (integrated audio module)
12	-	Integrated control panel, incorporating the navigation switch

Component Location (Asia)



Item	Part Number	Description
1	-	TSD (touch screen display)
2	-	Clockspring
3	-	Steering wheel switches
4	-	Roof pod incorporating GPS antenna
5	-	Power amplifier
6	-	Navigation computer module
7	-	IAM (integrated audio module)
8	-	Integrated control panel, incorporating the navigation switch

OVERVIEW

The navigation system provides audible and visual route guidance information to enable the driver to reach a desired destination. The system allows the driver to choose the route using minor or major roads or highways with the option of three routes. Directions to hospitals, museums, monuments and hotels are also available.

The navigation system is integrated with the audio/video system and shares a number of components common to all systems. Map information is stored on a hard disk drive located in the IAM (Integrated Audio Module). Map uploads to the hard drive can be uploaded by the customer from a USB (universal serial bus) memory stick (not applicable to Japan/Asia specification vehicles).

The navigation system has various levels of user control through the TSD (Touch Screen Display) and the voice recognition system. System volume adjustment can be made using the Integrated Control Panel, TSD and steering wheel controls.

There are a number of navigation system variants specific to various markets. On all systems the GPS signal is

received by the GPS antenna, incorporated in the roof pod.

The European navigation system includes the TMC (Traffic Messaging Channel) function, which receives traffic information from an FM (frequency modulation) antenna.
For additional information, refer to: Antenna (415-02, Description and Operation).
On a pre-selected route, the system will offer re-routing options depending on traffic conditions.

All NAS (North America Specification) vehicles are configured to receive TMC. TMC is transmitted in the USA and is available in areas of other NAS markets.

The navigation system is primarily controlled from the TSD which is located in the center of the instrument panel. Control signals from the TSD are sent on the MOST (Media Oriented System Transport) ring to the navigation computer. The Asia navigation system is different in that the control signals are transmitted via the medium-speed CAN (controller area network). On all systems the navigation computer uses a dedicated GVIF (Gigabit Video InterFace) bus to transmit video signals to the TSD.

Depending upon the audio system version fitted, the navigation audio output signals are sent on the MOST ring to the IAM (Integrated Audio Module) or the power amplifier for speaker output.

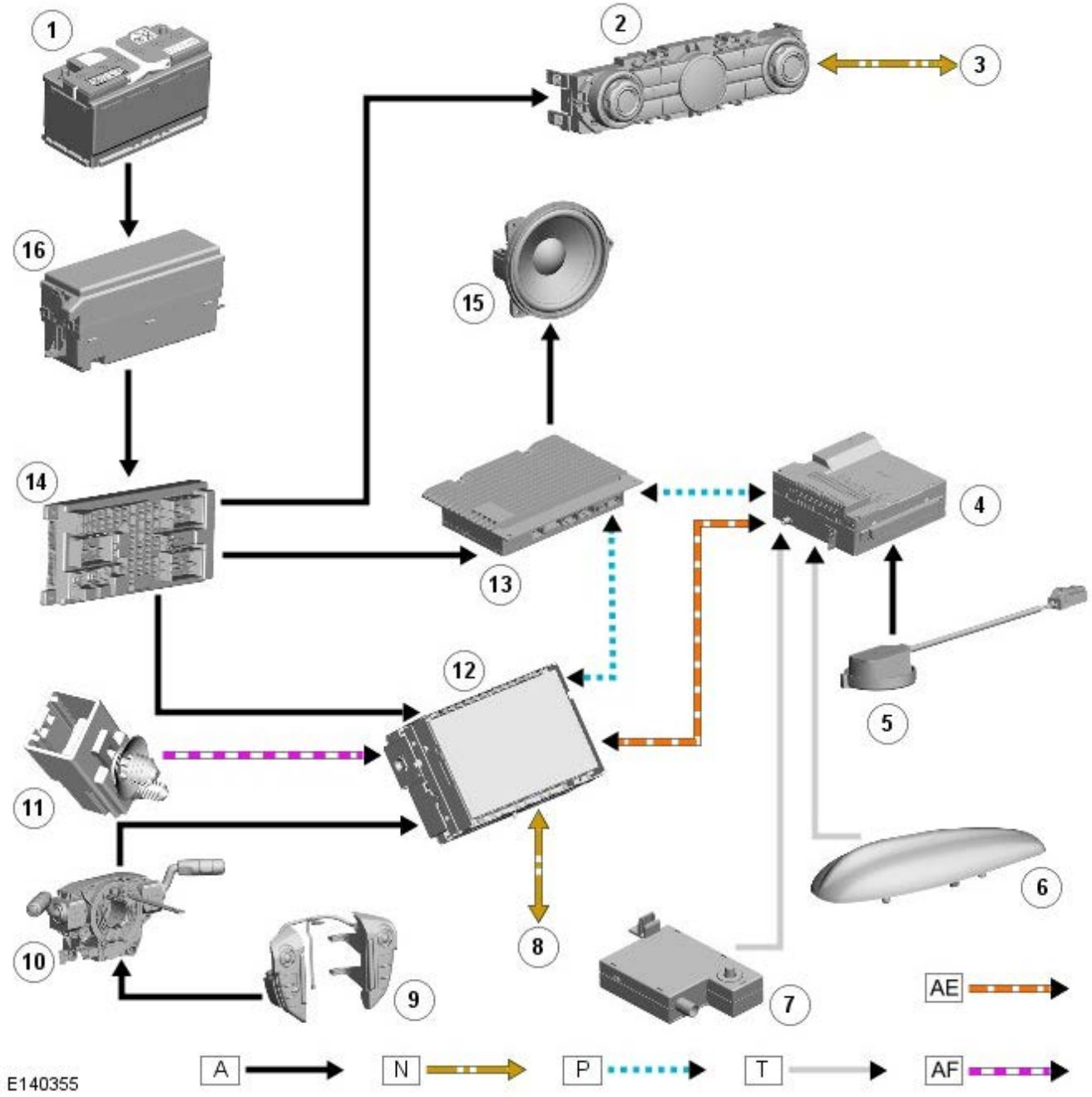
Japanese market vehicles have a modified system from other markets. These vehicles have an additional DVD (digital versatile disc) navigation computer module and a navigation video interface module located below the LH (left-hand) front seat.

The Japanese navigation system includes the VICS (Vehicle Information and Communication System) function. The VICS supplies information to enable the navigation computer to re-route the navigation guidance or to inform the vehicle driver of traffic conditions in the vehicles vicinity. Information is provided to the system through an FM antenna and a VICS beacon antenna.
For additional information, refer to: Antenna (415-02, Description and Operation).

Asia markets have a unique system which is fitted to the vehicles by the dealer or port of entry. These vehicles have a separate navigation computer located below the LH front seat.

CONTROL DIAGRAM (ROW)

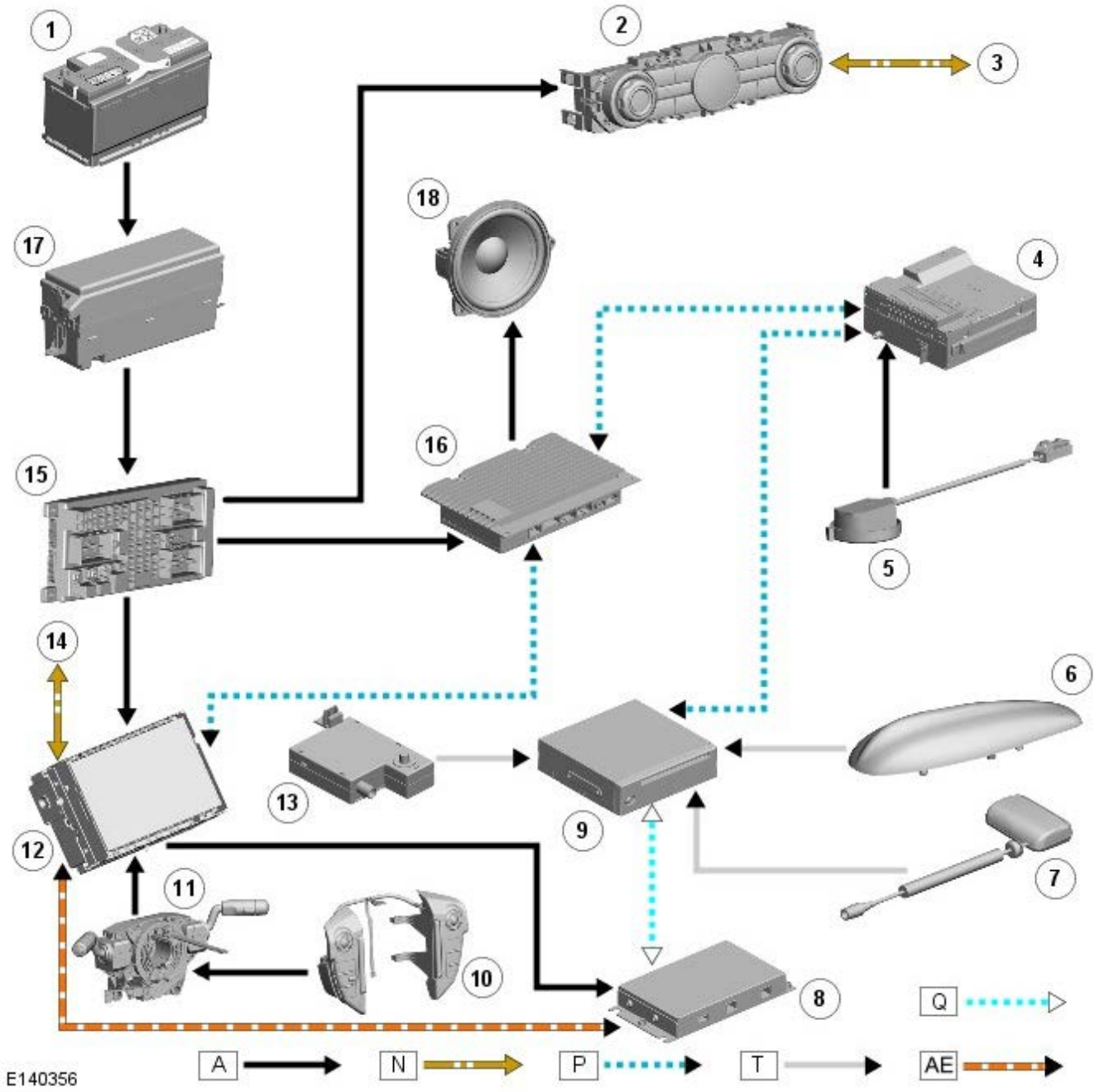
NOTE: **A** = Hardwired; **N** = Medium Speed CAN; **P** = MOST; **T** = Coaxial; **AE** = LVDS; **AF** = Firewire.



Item	Part Number	Description
1	-	Battery
2	-	Integrated control panel, incorporating the navigation switch
3	-	Medium speed CAN bus connection to other vehicle systems
4	-	IAM (integrated audio module), incorporating the navigation module
5	-	Microphone - voice recognition
6	-	Roof pod incorporating GPS antenna
7	-	TMC (traffic message channel) antenna amplifier
8	-	Medium speed CAN bus connection to other vehicle systems
9	-	Steering wheel switches
10	-	Clockspring
11	-	Navigation update socket
12	-	TSD (touch screen display)
13	-	Power amplifier
14	-	CJB (central junction box)
15	-	Speakers
16	-	BJB (battery junction box)

CONTROL DIAGRAM (Japan)

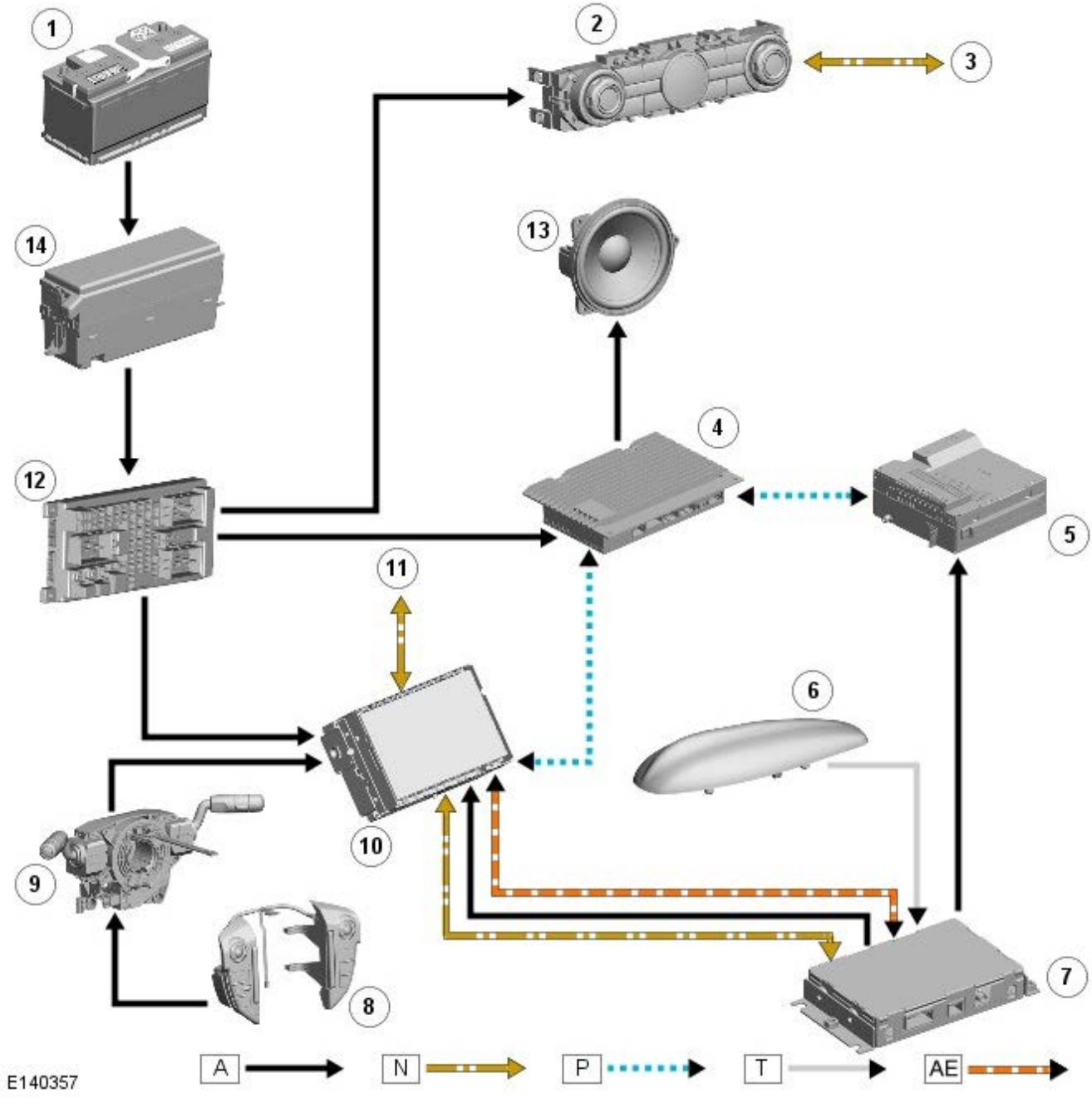
NOTE: **A** = Hardwired; **N** = Medium Speed CAN; **P** = MOST; **T** = CoAxial; **Q** = GVIF; **AE** = LVDS.



Item	Part Number	Description
1	-	Battery
2	-	Integrated control panel, incorporating the navigation switch
3	-	Medium speed CAN bus connection to other vehicle systems
4	-	IAM (integrated audio module), incorporating the navigation module
5	-	Microphone - voice recognition
6	-	Roof pod incorporating GPS antenna
7	-	VICS (vehicle information and communication system) beacon antenna
8	-	Navigation video interface module
9	-	Navigation computer module
10	-	Steering wheel switches
11	-	Clockspring
12	-	TSD (touch screen display)
13	-	VICS antenna amplifier
14	-	Medium speed CAN bus connection to other vehicle systems
15	-	CJB (central junction box)
16	-	Power amplifier
17	-	BJB (battery junction box)
18	-	Speakers

CONTROL DIAGRAM (Asia)

NOTE: **A** = Hardwired; **N** = Medium Speed CAN; **P** = MOST; **T** = CoAxial; **AE** = LVDS.



Item	Part Number	Description
1	-	Battery
2	-	Integrated control panel, incorporating the navigation switch
3	-	Medium speed CAN bus connection to other vehicle systems
4	-	Power amplifier
5	-	IAM (Integrated Audio Module)
6	-	Roof pod incorporating GPS antenna
7	-	Navigation video interface module
8	-	Steering wheel switches
9	-	Clockspring
10	-	TSD (Touch Screen Display)
11	-	Medium speed CAN bus connection to other vehicle systems
12	-	CJB (Central Junction Box)
13	-	Speakers
14	-	BJB (Battery Junction Box)

SYSTEM OPERATION

GLOBAL POSITIONING SYSTEM

The navigation system receives GPS information via the GPS antenna incorporated in the roof pod. The GPS signals are used by the navigation system to calculate the vehicle's position. Once the driver has input a desired destination, the navigation system can calculate a route, based on the driver's pre-determined preferences or the default settings in the navigation system.

The navigation system is accessed from the TSD (Touch Screen Display) home menu.

Navigation is initiated by the driver inputting a destination. This can be achieved by:

- Entering an address using the TSD
- Entering a post code
- Choosing a previous destination
- Choosing a point of interest from the map disc database
- Choosing the home location
- Choosing a memory stored location

The driver is then guided to the destination by a scrolling map display and voice guidance. The display can be varied by scale and display type.

Selection of 'Navigation' on the TSD home menu and subsequent sub-menu selection sends a control request signal to the navigation computer on the MOST (Media Oriented System Transport) ring Rest of World/Japan only. The requested control information is processed by the IAM (Integrated Audio Module) for ROW; or the dedicated navigation computer for Japan and Asia.

- On ROW vehicles, if voice guidance is operational, the voice signals are passed from the IAM to the audio amplifier on the MOST ring for output on the speaker system.
- On Japan vehicles, if voice guidance is operational, the voice signal information is relayed from the navigation computer on the MOST to the audio amplifier for output on the speaker system.

The navigation audio output is through the front speakers whilst the background audio, for example radio or CD (compact disc), is played at a reduced volume on the rear speakers. On Asia vehicles the radio or CD output is muted while the navigation audio output is transmitted.

The GPS signal is available to the navigation system at all times when the vehicle ignition is switched on.

Navigation voice commands are made using the voice recognition system. The TSD processes the analogue signal from the voice recognition switch. This is passed from the TSD onto the MOST system to the voice recognition control software which is integral with the IAM (ROW) or navigation computer (Japan). Voice control of the navigation system is not available on Asia specification vehicles.

The TSD sends an instruction via the MOST ring to the IAM to turn on the microphone facility. The microphone is hardwired to the IAM. For the ROW system, spoken voice commands are processed by the IAM. The processed commands are then sent to the TSD to determine which control signals need to be sent to the navigation system.

For the Japan system, the analogue voice signals are relayed from the IAM via the MOST ring directly to the navigation computer (for processing). Navigation commands are handled internally within the navigation computer without the need for communicating with the TSD for control.

Traffic data from the TMC (Traffic Messaging Channel) or the VICS (Vehicle Information and Communication System) is processed by the IAM or navigation computer, distributed to the TSD with any supporting voice instruction relayed through the MOST ring to either the IAM or power amplifier, dependant on equipment level, for output on the speaker system.

TRAFFIC MESSAGE CHANNEL

 NOTE: TMC (Traffic Messaging Channel) is not available in all markets.

TMC is a function of the FMRDS (radio data system). The system broadcasts real-time traffic and weather information. Data messages are received and decoded by the IAM integral receiver. The IAM processes the received information and alerts the driver of a problem on the planned route and calculates an alternative route to avoid the incident. All TMC events on the map can be viewed not just the ones on the calculated route.

TMC traffic information systems conform to a global standard that has been adopted by traffic data gatherers, information service providers, broadcasters and vehicle/receiver manufacturers.

All TMC receivers use the same list of event codes, while the location database (on the IAM hard drive) contains both a country-specific set of location codes for the strategic European road network.

TMC traffic data is currently broadcast in many European countries and the USA.

Each traffic incident is sent as a TMC message. One message consists of an event code and a location code in addition to time details. The message is coded and can be translated by the IAM into the market language. Location code tables assign numbers to locations on the road network. These location tables are integrated in the maps stored on the IAM hard disk drive. The source of traffic information is typically police, traffic cameras and local network stations.

The TMC system uses the existing FM antenna and audio system antenna amplifiers to pass the signals to the IAM. For additional information, refer to: Antenna (415-02, Description and Operation).

VEHICLE INFORMATION AND COMMUNICATION SYSTEM

The VICS (Vehicle Information and Communication System) is broadcast only in the Japanese market and is similar to the TMC used outside of Japan. VICS gives countrywide coverage and broadcasts of real-time traffic and weather information.

The VICS supplies information to enable the navigation computer to re-route the navigation guidance or to inform the vehicle driver of traffic conditions in the vehicles vicinity.

Information is provided to the system through three methods:

- RF (radio frequency) microwave transmission
- Infra-red transmission
- FM multiplex transmissions.

In certain areas the information is transmitted using an Infra-Red signal or alternately a RF (Radio Frequency) microwave signal, both of which are received by the VICS beacon antenna. Additional information is transmitted on the FM wavelength and is received by the FM antenna. The received FM signal is passed to the navigation computer via an RF (radio frequency) antenna amplifier.

The RF transmissions are generally transmitted from road side beacons mainly on expressways. The information transmitted is as follows:

- Traffic congestion
- Travel time to next intersection
- Traffic conditions in surrounding areas and expressway turn offs
- Traffic accidents
- Speed limits
- Lane regulations
- Tire change
- Parking availability at expressway service areas and parking areas.

Infra-Red transmissions are transmitted from road side beacons on major trunk roads. The information transmitted is:

- Traffic congestion and travel time
- Traffic accidents
- Breakdowns
- Road works restrictions
- Parking availability.

FM transmissions are broadcast as part of the FM multiplex broadcasting system from NHK (Japanese Broadcasting Corporation) FM stations. Information transmitted is:

- Traffic congestion and travel time for wide areas
- Traffic accidents, road works, speed limits and lane restrictions for a wide area.

The traffic data is split from the normal FM transmissions by the diversity antenna module.

VOICE CONTROL

NOTE: Only basic voice controls are available for Japanese specification vehicles. Voice control is not available on Asia specification vehicles.

The voice system provides the driver with the option of voice control for a range of supported functions. In addition to the navigation system, the system also supports the following:

- phone system
- notepad functions
- radio
- satellite radio
- Digital Audio Broadcasting (DAB)
- single CD
- CD autochanger
- USB and auxiliary connection functions.

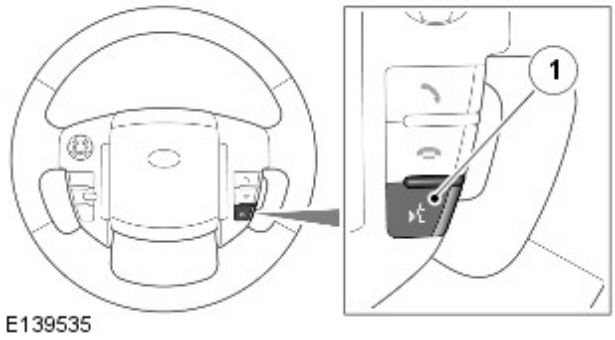
The voice system adopts a concept known as 'Say What You See' (not applicable to Japan specification vehicles). Each of the voice functions are supported by 'Help' commands, saying 'Help' at each point in the conversation will give a context sensitive explanation of what the user can do at that point. The voice menu shown in the TSD always guides the user through the flow showing not only examples of what they can say next, but also confirmation of where they are in the conversation flow.

The 'notepad' facility allows voice notes to be recorded. Nametags for radio tuning, phone dialing and navigation locations allow the system to be personalized and there is a help and tutorial function to provide advice on using the system.

Voice control is a key component of the navigation system, allowing hands free control when issuing navigation commands.

The system is controlled by the voice button on the steering wheel. Voice commands are picked up by a dedicated microphone. When giving a voice command, audible feedback will be heard through the vehicle's audio speakers.

Voice Control Button



Item	Part Number	Description
1	-	Voice control button - push to talk

Efficient operation of voice control is reliant on the user understanding some of the following basic operating conditions:

- Face forwards, sitting in a normal driving position.
- After pressing the voice button, always wait for the end of the tone before speaking.
- Speak naturally, as if you were talking to a passenger or on the phone without pausing between words.
- When the system asks for more information, always wait for the end of the tone before responding.
- Always say numbers correctly.
- Excessive noise, for example while driving with windows open, may cause voice command mis-recognition. For example if it is too noisy to use the phone, it is likely that voice commands will not be recognized.

Most accents are understood without difficulty, but if the system does not recognize the command it will respond "SORRY" and allow two more attempts to say the command.

Voice feedback is given in the same language as the command recognition. It is possible to change the language of the speech control system.

Voice control is mainly a software based system. The software responsible for controlling the voice system is resident in the following control modules:

- Integrated Audio Module (IAM) (All markets except Japan)
- Navigation computer (Japan markets only)
- Touch Screen Display (TSD).

Some of these modules contain more than one software component. Voice control communication between these modules takes place via the MOST network. A voice control microphone is located in the front overhead console and is hardwired to the IAM.

When the push to talk button is pressed on the steering wheel, a voltage is received at the TSD via the clockspring assembly. This voltage is sent on a single wire from the button, through a resistive ladder. The whole process is then initiated via the MOST network, for example the TSD starts the voice session and carries out the resulting action requested by the user, but the IAM maintains the dialogue with the user. The accompanying voice instruction is sent to the audio amplifier for broadcast over the speakers from the IAM. If a recognized user instruction is received via the microphone, this is then processed by the IAM and sent to the TSD to perform the required action.

NOTE: Should a priority view be required in the TSD (for example; Parking aid) this will prevent or cancel the current voice session.

Voice Tags

Voice tags allow the user to store voice entries as shortcuts to control various functions, for example routing to navigation locations, dialing numbers and tuning to radio stations. The voice tags sub-menu accesses controls for navigation, phone, radio and depending on specification DAB radio or SDARS.
For additional information, refer to: Audio System (415-01B, Description and Operation).

Voice Training

The voice system allows two different users to create separate profiles, providing training for a User 1 and User 2. Voice training is used to help the system recognize the user's voice more accurately, and when training is activated for each user, a pop-up is displayed to confirm that training is in process for that user. The pop-up informs the user that voice training must be fully completed in order to activate the new voice profile, and offers the option of 'OK' to initiate the session and store data in that User profile, or 'Cancel' to return to the previous menu. Voice training phrases will be shown in the TSD Menu and the user will be requested to say each phrase after the listening tone.

NOTE: Voice training can only be conducted stationary with the engine running and with the climate control NOT in defrost due to background noise.

Voice tags and training are stored in a non-volatile memory within the IAM. Disconnection of the battery would not cause any customer data loss.

NOTES:

To enable new voice tags and training to be written to memory, a period of ten minutes after the last key off cycle must take place. Should the battery be disconnected before this time then data may be lost.

If the IAM is replaced then all voice tags and training will be lost.

If either the IAM or the TSD are replaced, it is recommended that the vehicle language settings and voice language settings (if vehicle language is not supported by voice control) are reset to the same setting."

Navigation Destination Entry by Voice

Destination entry uses phonetic transcriptions of the navigation data (stored as part of the map data) to offer the user the ability to enter an address or postcode into the Navigation system by voice. The user simply follows the visual and audible instructions given by the voice system and enters their desired address in a step-by-step manner (e.g. city, then street, then house number). At each address entry stage, the user's voice command is matched against the phonetic map data and a list of likely recognition candidates is presented in a "picklist" for the user to select from. If the chosen address has more than one location associated with it, the voice system will work with the user to determine the exact address they wish to navigate to.

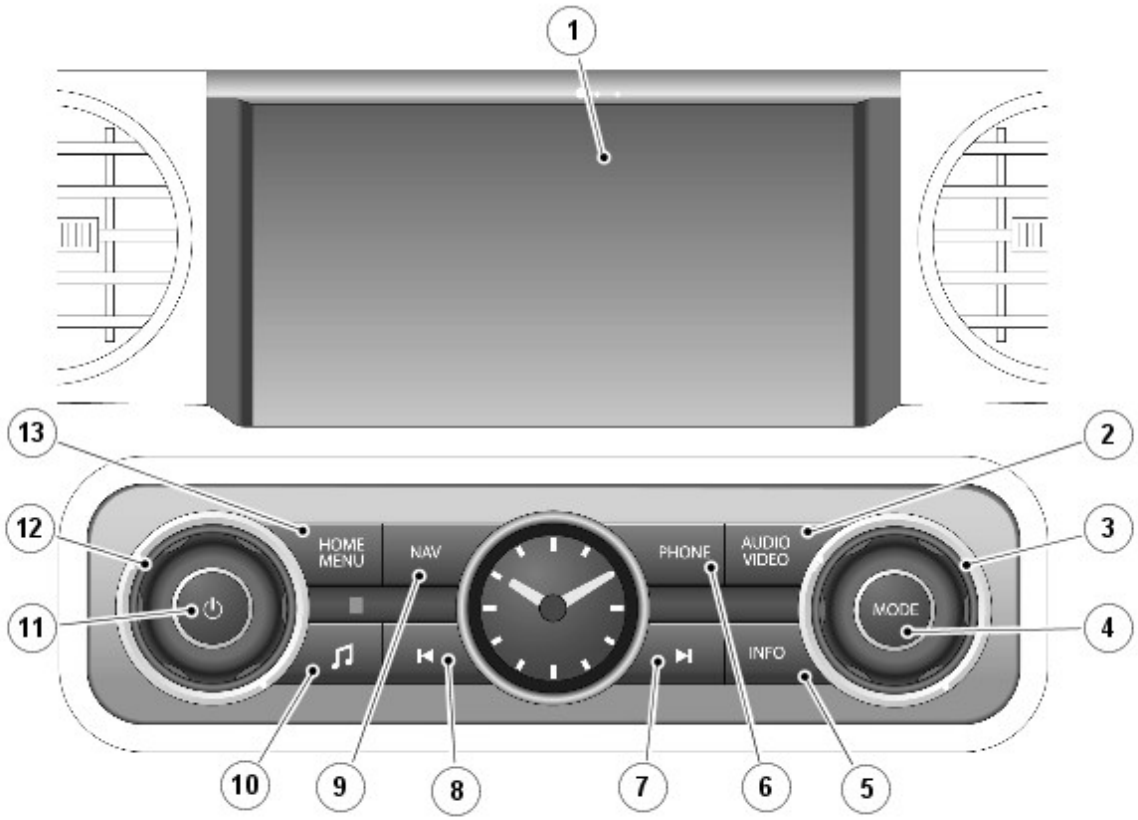
Dialing from the G2P Phonebook

Provided the phonebook has been downloaded via Bluetooth, the voice system is able to perform a grapheme-to-phoneme (G2P) transcription of each of the names stored in the phonebook. This is then used by the voice system to allow the user to dial a contact by saying the name stored in the phonebook, there is no need to store a voice tag first. The user's voice command is matched against the phonebook entries and a list of likely recognition candidates is presented in a "picklist" for the user to select from. If the chosen contact has more than one number associated with it, the voice system will work with the user to determine the exact number they wish to dial.

NOTE: For regularly used contacts with more than one number, the user can store a voice tag as a shortcut.

SYSTEM COMPONENTS

Touch Screen Display and Integrated Control Panel



E124877

Item	Part Number	Description
1	-	Touch screen display
2	-	Access Audio/Video Menu
3	-	Scroll up down (menu control)
4	-	Mode
5	-	Traffic/News information
6	-	Access Phone Menu

7	-	Search up/increase
8	-	Search down/increase
9	-	Access Navigation Menu
10	-	Tone hard key
11	-	Audio on/off
12	-	Volume
13	-	Access touch screen Home Menu

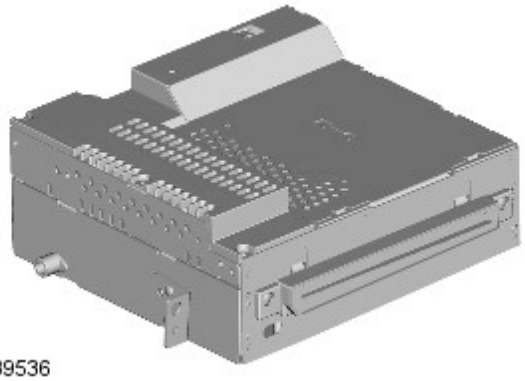
The TSD (touch screen display) and Integrated Control Panel are located in the center of the instrument panel and are the driver's interface with the navigation system. The TSD is connected to the MOST ring and communicates with the other components in the audio/infotainment system.

The screen processes its own video for system operation but receives the navigation graphics from the IAM (ROW) or the navigation computer (Japan/Asia).

The TSD is a seven inch touch sensitive, 1280 X 480 pixels LCD (liquid crystal display) VGA screen.

In addition to the navigation system the TSD and the Integrated Control Panel provides the driver with display and control of various other vehicle functions.

Integrated Audio Module (IAM)



E139536

NOTE: The Japanese/Asia satellite navigation system does not store map data on the IAM. All other functions of the IAM are applicable to the Japanese market. Refer to the following sections 'JAPANESE NAVIGATION SYSTEM' or 'ASIAN NAVIGATION SYSTEM' for details of the Japanese/Asia navigation system.

The IAM is located in central position in the instrument panel, behind the Integrated Control Panel.

The IAM is a multi functional unit
For additional information, refer to: Audio System (415-01B, Description and Operation).

The IAM is connected on the MOST ring to the other audio system components. The driver can control navigation functions by using soft keys on the TSD or by voice commands.

The 40 GB hard drive is used for storing the information for satellite navigation (not applicable to Japan/Asia specification vehicles). A 10GB partition is provided for storing music files, the remaining 30GB is used for map data storage.

Hard Disc Drive

The integral hard drive for the navigation system (not applicable to Japan/Asia specification vehicles) removes the requirement of a separate navigation computer. The IAM stores the navigation map data locally within the 30GB hard drive partition. By storing the information in this way and processing it within the IAM, navigation display, route calculation speeds and accuracy are vastly improved. Map upgrades and software are loaded directly into the IAM from a Universal Serial Bus (USB) memory stick (not applicable to Japan/Asia specification vehicles).

The map images are transmitted from the IAM to the TSD via a LVDS (Low Voltage Differential Signal) link cable. Turn by turn instructions are displayed in the instrument cluster using messages transmitted on the medium-speed CANbus.

The IAM communicates on the MOST ring with the rest of the audio system. If the IAM is replaced it must be configured as a new module using an approved diagnostic system.

Calibration of the IAM using an approved diagnostic system enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

Roof Pod Incorporating the Global Positioning System Antenna



E96387

The GPS antenna passes signals from the GPS satellites to the navigation computer for processing.

The GPS antenna is designed with 50 ohm output impedance. The IAM or navigation computer is fitted with 50 ohm fakra II connectors to ensure compatibility with the antenna. For optimum performance 50 ohm low loss coaxial cable is used between the antenna and IAM or navigation computer.

It is possible for the GPS antenna to lose the signal from the GPS satellites:

- In hilly or tree lined areas
- Built up areas with tall buildings
- In multi storey car parks
- In garages
- In tunnels
- On bridges
- During heavy rain or thunderstorms.

When the signal is lost the IAM or navigation computer will continue to give guidance using memory mapped data from the stored map software (or from the map DVD until the signal is restored.

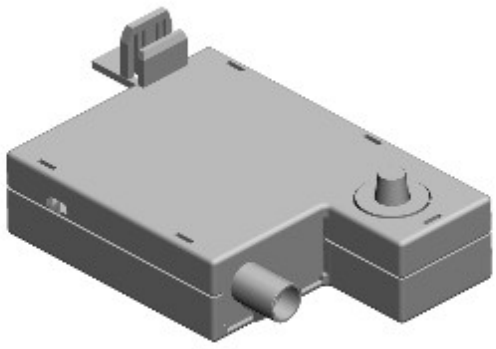
Microphone



E124819

A single microphone is used for hands-free operation using the voice control system. The microphone has an integrated noise suppression system for hands-free use. The microphone is a standard directional type, hardwired to the IAM. When replacing the microphone extra care must be taken to make sure it is fitted into its securing clips for correct positioning and orientation.

TMC Antenna Amplifier



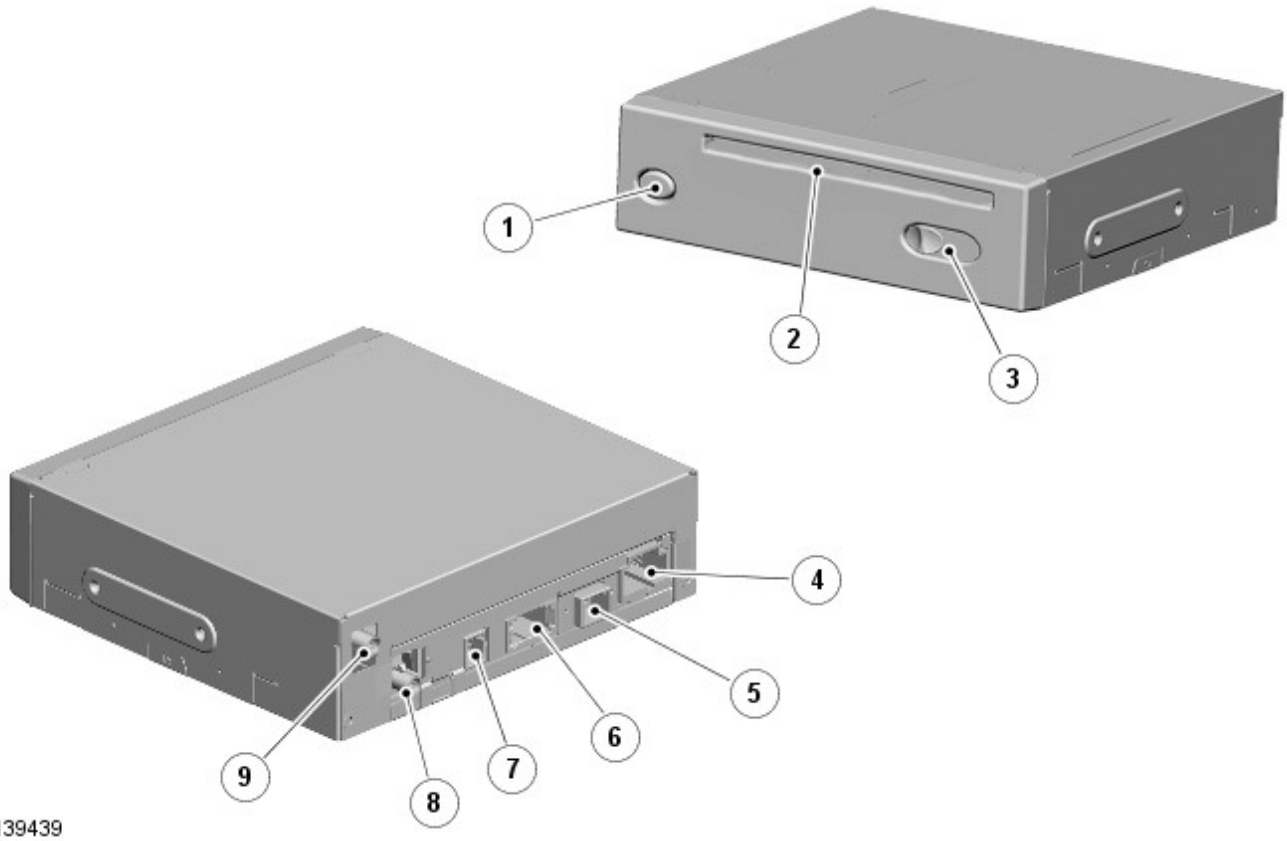
E124881

The TMC (traffic message channel) antenna amplifier is connected to the FM antenna. The TMC signals are received through the normal radio signals via the RDS (radio data system) and are routed separately from the radio signals via the TMC antenna amplifier to the Touch Screen Display unit.

JAPANESE NAVIGATION SYSTEM

The Japanese satellite navigation system uses a separate navigation computer module with map data supported by an DVD disc. Additional components are: a navigation computer module and a navigation video interface module.

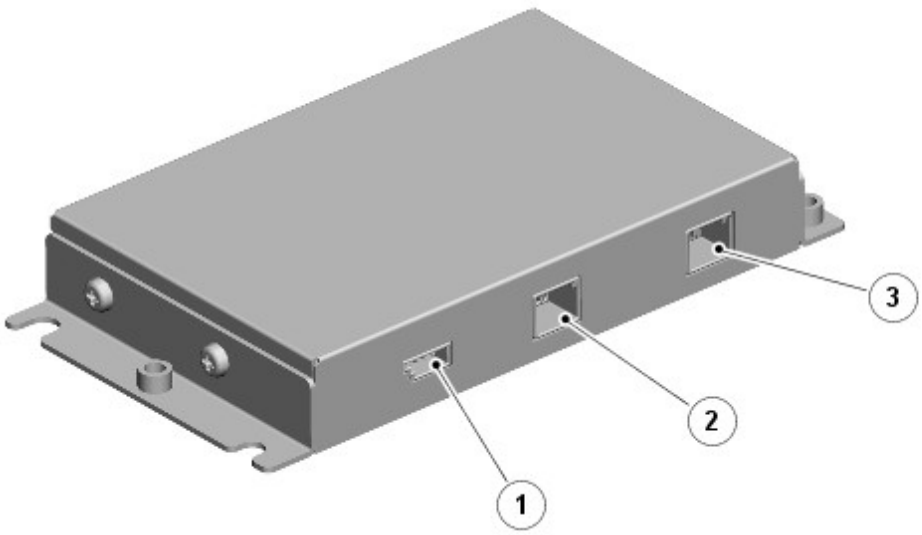
Navigation Computer Module



E139439

Item	Part Number	Description
1	-	DVD eject button
2	-	DVD loading slot
3	-	DVD eject lock
4	-	Power and ground connections
5	-	GVIF video output connector
6	-	MOST connector
7	-	VICS beacon antenna connector
8	-	GPS antenna connector
9	-	VICS FM antenna connector

Navigation Video Interface Module



E139440

Item	Part Number	Description
1	-	GVIF video input from navigation module connector
2	-	LVDS video output to TSD connector
3	-	Power, ground and 5V signal voltage from TSD connector

Navigation Computer Module

The navigation computer module is a DVD drive which reads map data direct from a DVD. The navigation computer module is connected on the MOST ring and communicates with the TSD to initiate navigation video and audio output. The GPS antenna is connected directly to the navigation computer module.

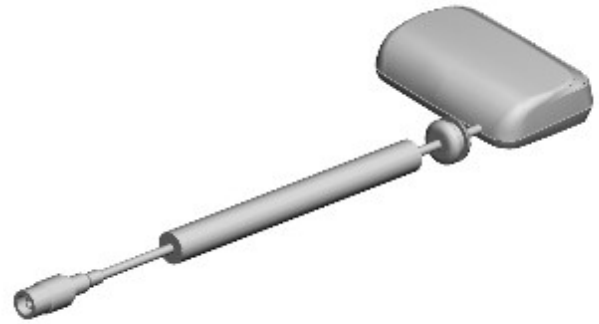
The navigation computer module outputs the video signals in a Gigabyte Video InterFace (GVIF) format to a navigation video interface module which converts the GVIF input to a Low-Voltage Differential Signaling (LVDS) video signal output which is then passed to the TSD. Audio output is on the MOST ring to the audio amplifier. VICS FM transmission signals are received by the navigation computer module via an FM antenna and a VICS antenna amplifier . Infra-red and RF microwave VICS transmissions are also received by the VICS beacon antenna and are passed to the navigation computer module.

Navigation Video Interface Module

The navigation video interface module converts the GVIF video output to LVDS video signal which is compatible with the TSD.

A 5V signal output from the TSD is connected to the video interface module. The signal voltage initiates a power up of the video interface module when the TSD is active.

VICS Beacon Antenna

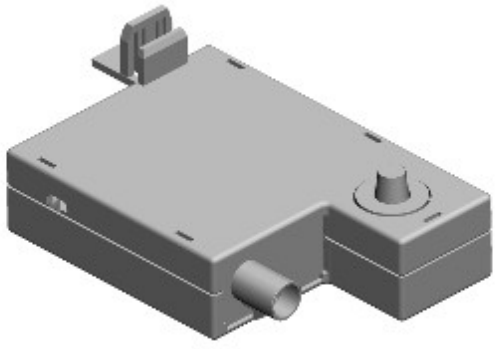


E124822

The VICS beacon antenna is connected to the TSD via a screened co-axial cable.

The VICS (vehicle information and communication system) beacon antenna receives infra red and RF (radio frequency) traffic data signals from road side transmitters. The antenna is connected to the navigation computer which incorporates a VICS (vehicle information and communication system) antenna amplifier.

VICS Antenna Amplifier

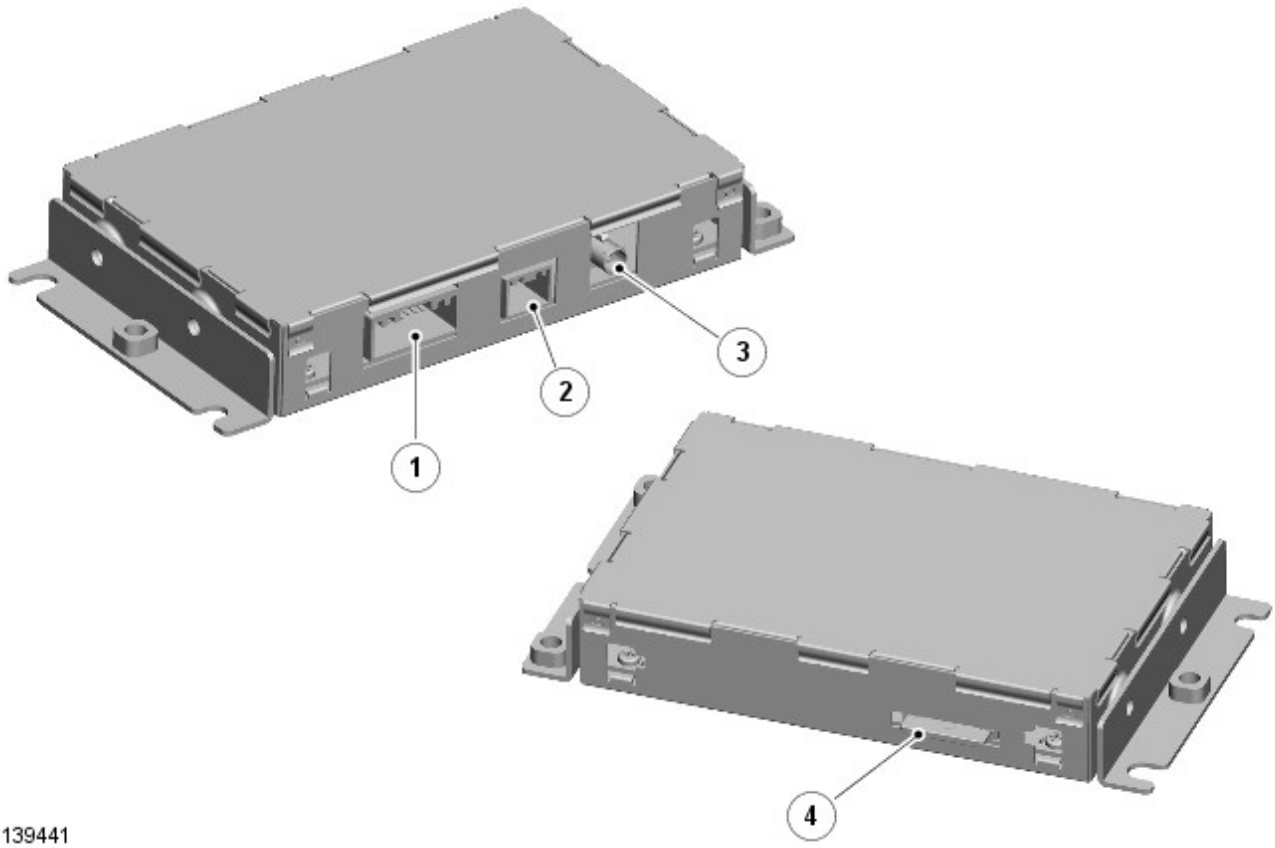


E124881

The VICS antenna amplifier is connected to the TSD unit.

ASIAN NAVIGATION SYSTEM

Navigation Computer Module - Asia



E139441

Item	Part Number	Description
1	-	Power, CAN and audio connector
2	-	LVDS video output to TSD
3	-	GPS antenna connector
4	-	SD storage card slot

In some countries an after market navigation system is fitted at PDI (pre-delivery inspection) by the dealer or at Port of Entry (POE). A medium speed CAN based navigation computer module is fitted below the LH front seat.

The navigation computer module outputs the video signals in a LVDS format direct to the TSD. Audio output is passed to the IAM which converts the signals and passes them to the audio amplifier on the MOST ring. When Audio is required, such as a Voice guidance instruction, the Asia navigation computer module communicates to the vehicle audio system using a hard wire connection between the TSD and the Asia navigation computer module. TSD co-ordinates and vehicle power mode status are obtained through the medium speed CAN. Map data is stored via a multimedia Secure Digital (SD) card accessible through an access point on the module.

Published: 14-Jun-2013

Navigation System - Navigation System

Diagnosis and Testing

Principles of Operation

NOTE: This navigation system is installed in selected Asia market vehicles only.

For a detailed description of the navigation system, refer to the relevant Description and Operation section of the workshop manual. REFER to:

Navigation System (419-07 Navigation System, Description and Operation),
Navigation System (415-01, Description and Operation),
Navigation System (415-01, 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 tested and/or the donor vehicle.

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

1. Verify the customer concern
2. Visually inspect for obvious signs of damage, water ingress and system integrity

Visual Inspection

Mechanical	Electrical
• Navigation control module • Audio amplifier module • Touch screen • Loudspeakers	• Fuses • Loose or corroded connector(s) • Navigation control module • Audio amplifier module • Touch screen • Loudspeakers

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart

Symptom Chart

Symptom	Possible Causes	Action
Navigation soft key missing from Touch Screen (TS) menu	• Car configuration file incorrectly configured	• Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
"Please insert map SD card to enter navigation" message after launching navigation	• Map SD card missing	• Insert map SD card into the navigation control module
"Agree" message after launching navigation	• Car configuration file incorrectly configured	• Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
Blank screen after launching navigation	• Video in signal missing - Navigation Control Module (NCM) not installed - LVDS circuit short circuit to ground, short circuit to power, open circuit, high resistance - Navigation Control Module (NCM) power or ground circuit open circuit, high resistance - Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance	• GO to Pinpoint Test A.
Unable to detect position	• GPS signal missing	• GO to Pinpoint Test B.

	- GPS receiver circuit short circuit to ground, short circuit to power, open circuit, high resistance	
No navigation audio	• Telephone mute circuit short circuit to ground • Navigation audio circuits short circuit to ground, short circuit to power, open circuit, high resistance	• Refer to the electrical circuit diagrams and test the telephone mute circuit for short circuit to ground • Refer to the electrical circuit diagrams and test the audio circuits for short circuit to ground, short circuit to power, open circuit, high resistance

Pinpoint Tests

NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval Program is in operation, prior to the installation of a new module/component.

PINPOINT TEST A : NAVIGATION CONTROL MODULE TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CONFIRM INSTALLATION	
NOTES: The navigation control module **is** installed at the factory for China, Hong Kong, Taiwan and Macau market vehicles. The navigation control module **is not** installed at the factory for Korea, India and Israel market vehicles.	
	1 Verify if the Navigation Control Module (NCM) has been installed.
	Has the Navigation Control Module (NCM) been installed (refer to the Navigation Control Module Locations table)? **Yes** GO to A2. **No** If applicable to market, install a new navigation control module.
A2: NAVIGATION CONTROL MODULE POWER AND GROUND TEST	
	1 Verify that the red LED on the Navigation Control Module (NCM) is illuminated (adjacent to the round connector).
	Is the red LED illuminated? **Yes** Refer to the electrical circuit diagrams and test the LVDS circuit to the Touch Screen (TS) for short circuit to ground, short circuit to power, open circuit, high resistance **No** GO to A3.
A3: NAVIGATION CONTROL MODULE POWER/GROUND TEST	
	1 Refer to the electrical circuit diagrams and test the Navigation Control Module (NCM) power and ground circuits for short circuit to ground, short circuit to power, open circuit, high resistance.
	Are the Navigation Control Module (NCM) power and ground circuits within specification? **Yes** GO to A4. **No** Repair the power or ground circuit as necessary
A4: MEDIUM SPEED CAN TEST	
	1 Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and test the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
	Is the medium speed CAN bus circuit within specification? **Yes** Repair the medium speed CAN bus circuit as necessary **No** Install a new navigation control module

PINPOINT TEST B : GPS TEST	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: GPS SIGNAL TEST	
	1 Remove the map SD card from the navigation control module
	2 Launch navigation by operating the navigation soft key on the Touch screen (TS)
	Is "GPS open" or "GPS short" displayed in a red box? **Yes** Refer to the electrical circuit diagrams and check the GPS receiver circuit to short circuit to

	No	ground, short circuit to power, open circuit, high resistance "GPS open" and "GPS short" displayed in green boxes indicates that the GPS signal is correct

Navigation Control Module Locations

Model	Location
XF - X250	Under the front left seat
XJ - X351	In the luggage compartment behind the left side trim panel
XK - X150	Navigation system not fitted
F-Type - X152	In the luggage compartment under the load floor at the right side
Freelander 2 - L359	Under the front right seat
Discovery 4 - L319	Under the front left seat
Evoque - L538	In the luggage compartment under the load floor at the right side
Range Rover - L405	In the luggage compartment under the load floor at the left side
Range Rover Sport - L320	Under the front left seat
Range Rover Sport - L494	In the luggage compartment under the load floor at the left side

DTC Index

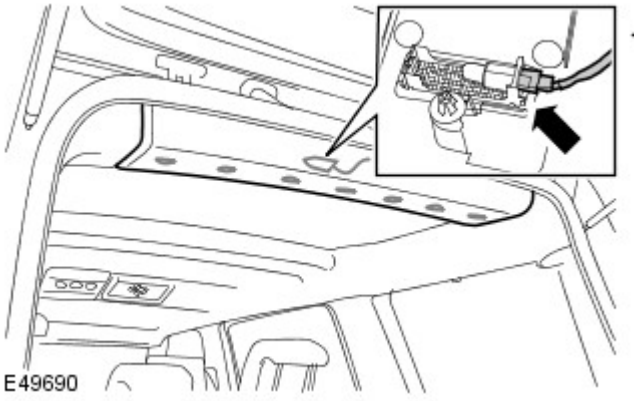
For a list of diagnostic trouble codes that could be logged on this vehicle, please refer to Section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Navigation Control Module (NCM) (100-00, Description and Operation) /
Diagnostic Trouble Code Index: Touch Screen - DTC: (TS) (100-00 General Information, Description and Operation).

Published: 11-May-2011

Navigation System - Navigation System Antenna

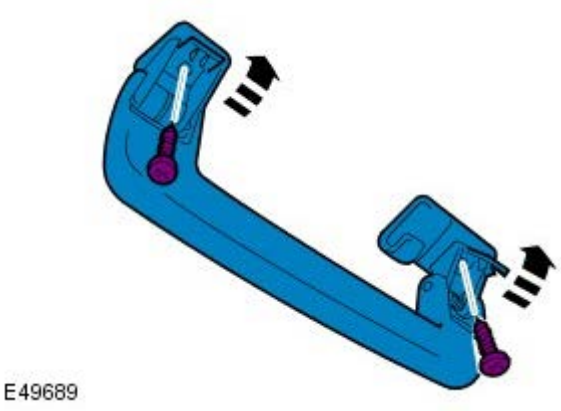
Removal and Installation

Removal

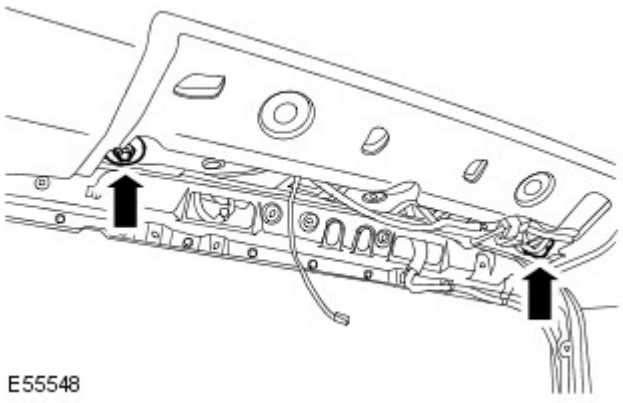


1. Remove the rear headliner trim panel.
   - Release the 7 clips.
   - Disconnect the interior light electrical connector.

2. If installed remove the LH third row seat passenger assist handle.
   - Carefully release the screw covers.
   - Remove the 2 screws.

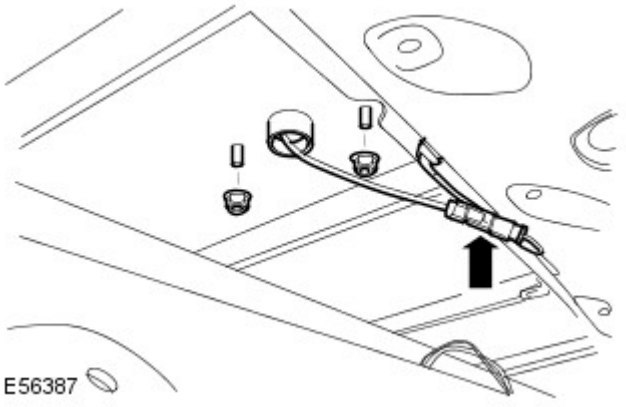


3. If installed, remove the RH third row seat passenger assist handle.
   - Carefully release the screw covers.
   - Remove the 2 screws.



4. Release the rear of the headliner.
   - Release the 2 clips.

5. Remove the navigation system antenna.
   - Disconnect the electrical connector.
   - Remove the 2 nuts.



Installation

1. Install the navigation system antenna.
    - Tighten the nuts to 10 Nm (7 lb.ft).
    - Connect the electrical connector.

2. Attach the rear of the headliner.
    - Secure with the clips.

3. Install the RH third row seat passenger assist handle, if installed.
    - Tighten the screws.
    - Attach the covers.

4. Install the LH third row seat passenger assist handle, if installed.
    - Tighten the screws.
    - Attach the covers.

5. Install the rear headliner trim panel.
    - Secure in the clips.
    - Connect the electrical connector.

Published: 11-May-2011

Navigation System - Navigation System Compact Disc (CD) Unit

Removal and Installation

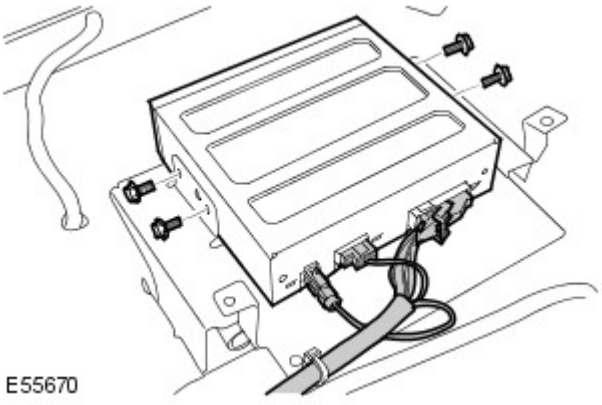
Removal

1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

2. Make the SRS system safe.
   For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).

3. Remove the LH front seat.
   For additional information, refer to: Front Seat (501-10, Removal and Installation).

4. Remove the CD unit.
   - Remove the 4 bolts.
   - Disconnect the antenna cable.
   - Disconnect the 2 electrical connectors.



Installation

1. Install the CD unit.
   - Tighten the bolts to 6 Nm (4 lb.ft).
   - Connect the electrical connectors.
   - Connect the antenna cable.

2. Install the LH front seat.
   For additional information, refer to: Front Seat (501-10, Removal and Installation).

3. Connect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

Published: 11-May-2011

Navigation System - Navigation System Display Module

Removal and Installation

Removal

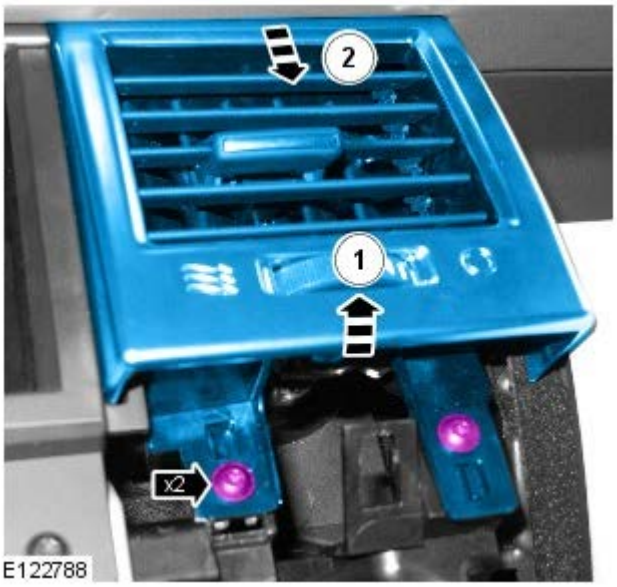
NOTE: Removal steps in this procedure may contain installation details.

1.



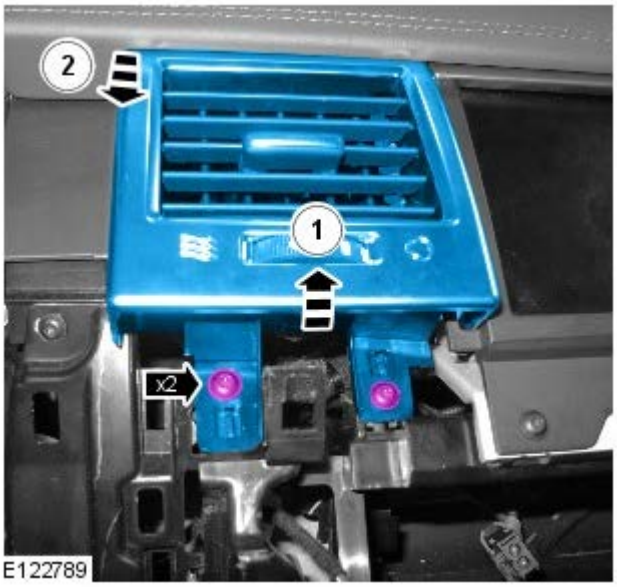
E122692

2. *Torque:* 2.5 Nm



E122788

3. *Torque:* 2.5 Nm



4. *Torque:* 2.5 Nm



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



Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 11-May-2011

Cellular Phone -

Torque Specifications

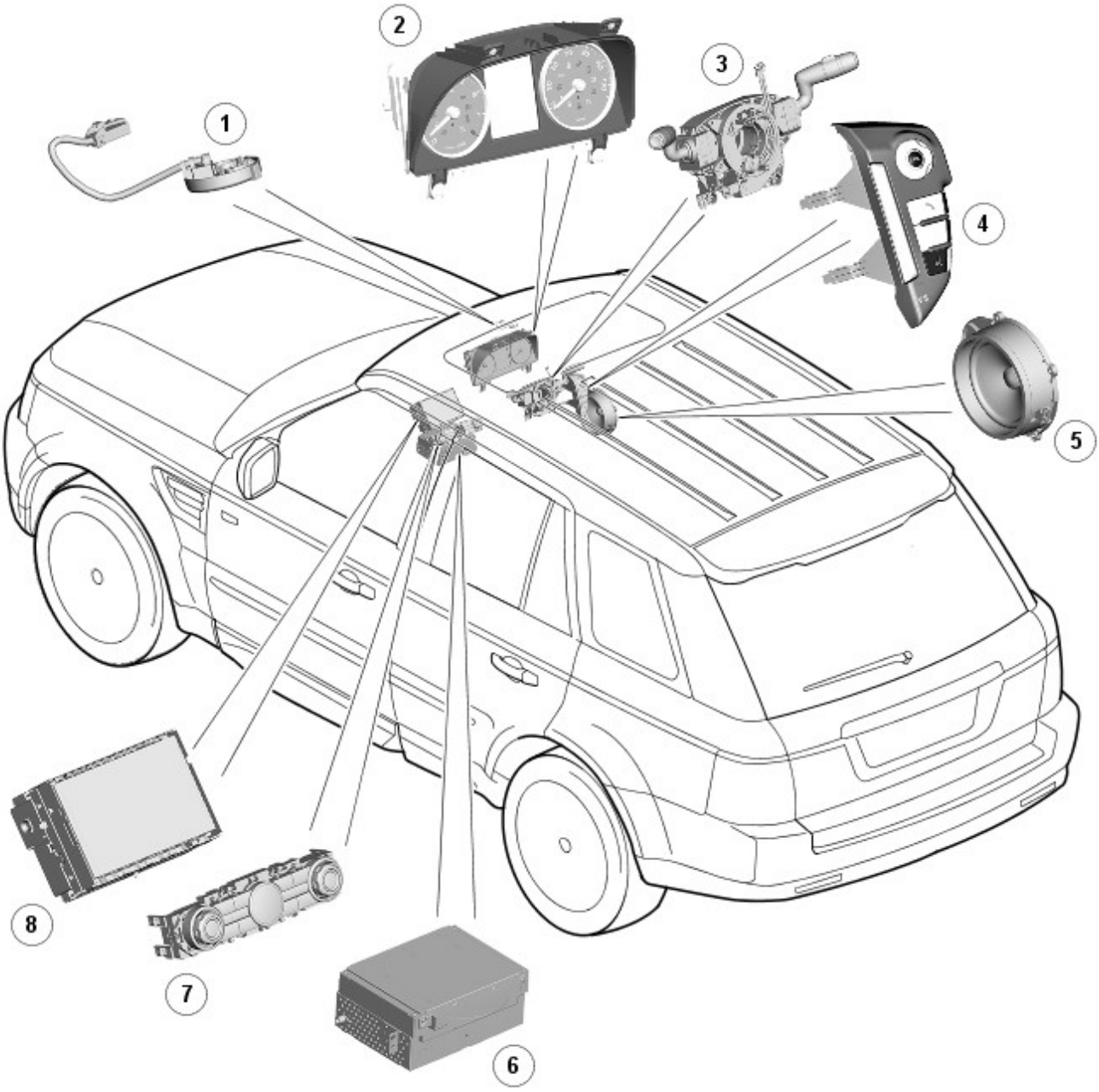
Description	Nm	lb-ft
Cellular phone antenna Torx screw	10	7

Published: 30-Jan-2012

Cellular Phone - Cellular Phone

Description and Operation

Component Location



E141853

Item	Part Number	Description
1	-	Microphone
2	-	Instrument cluster
3	-	Clockspring
4	-	Steering wheel switches
5	-	Vehicle speakers
6	-	Integrated audio module (IAM)
7	-	Integrated control panel (ICP)
8	-	Touch screen display (TSD)

OVERVIEW

The Bluetooth® telephone system uses the customers own Bluetooth® capable telephone handset in conjunction with the vehicle information and entertainment system. The system is controlled by the audio head unit on Lo-Line audio systems or the Integrated Audio Module (IAM) on Hi-Line and Premium audio systems. Both the audio head unit and the IAM have a Bluetooth® antenna incorporated into the unit.

Telephone handsets must be paired with the audio head unit or the IAM, requiring the input of a PIN (personal

identification number) before they can be used with the vehicle system.

Once paired, any telephone handset can be 'connected' to the vehicle without re-entering the PIN. In addition, previous connected devices will be connected automatically the next time they are present in the vehicle and the ignition is in power mode 6 (ignition on) or power mode 7 (engine running).

Bluetooth® wireless technology allows electronic devices to communicate wirelessly through a short-range RF network. Bluetooth® wireless technology can simultaneously handle data and voice transmissions which allows the vehicle's Bluetooth® telephone system to provide hands free operation of the users Bluetooth® telephone.

The Land Rover Bluetooth® system supports Bluetooth® Hands-Free Profile (HFP), Advanced Audio Distribution Profile (A2DP) and Audio Video Remote Control Profile (AVRCP).

Audio Bluetooth® System

The Bluetooth® telephone system uses the Media Oriented System Transport (MOST) ring for communication with the other components in the entertainment and information system.

The system comprises:

- Integrated Audio Module (IAM)
- Instrument cluster (for telephone information in message center)
- Touch Screen Display (TSD)
- Microphone
- Steering wheel control switches
- Audio power amplifier.

Pairing of new handsets is achieved by selection of 'Search New' from the device list screen. The system has two pairing modes; 'vehicle to device' and 'device to vehicle'. Up to 10 Bluetooth® devices can be paired to the vehicle.

NOTE: There is no physical connection or cradle between the telephone handset and the IAM. Communication between the telephone handset and the vehicle system is only via Bluetooth®. This can limit the available functions dependant on the telephone handset used.

The system allows the driver to make, receive and end telephone calls using the TSD or steering wheel switches. On Hi-Line and Premium audio systems the Land Rover Advanced Voice system can be specified.

Compatible Bluetooth® mobile telephones can communicate with the vehicle's in-built telephone system. Pairing and connection must be made with the ignition on or the engine running.

SYSTEM OPERATION

Audio Bluetooth® System

The Bluetooth phone system is controlled from the TSD, via voice control and the steering wheel mounted switches. Signals from the steering wheel switches are sent via the clockspring to the TSD. The TSD sends control signals on the MOST ring to the IAM, where these signals are sent via Bluetooth to the connected mobile phone. Speech is picked up by the microphone and sent to the IAM. Audio from the mobile phone is sent from the IAM on the MOST ring to the audio amplifier and is output on the vehicle speaker system.

The upgraded hands free profile of this system allows the display of the network signal strength, network operator and telephone battery level indication on the vehicle display, where the telephone handset supports this function. Also, if applicable, the telephone handset will show a "car" or "headset" symbol to indicate it is in hands free profile.

Bluetooth® System

Telephone handset manufacturers continually update hardware and software to standard specifications laid down by the Bluetooth® Special Interest Group (SIG), which defines how Bluetooth® should work in an automotive environment. However, because different makes and models may use different software, not all telephone handsets are fully compatible with Land Rover, but through testing individual telephone handset models, Land Rover has produced a list of compatible telephone handsets and the appropriate software version for Land Rover Bluetooth® connectivity.

Refer to the Bluetooth® Connectivity section of the Land Rover website at www.landrover.com, for a list of compatible phones. The list also describes how to check the software version of each individual telephone manufacturer. This list must be consulted by users, sales and service teams to confirm whether customer's telephone handsets are compatible or not. Performance will vary, based on the phone’s software version, battery condition, coverage and the network provider. Telephones are warranted by their manufacturer, not Land Rover.

Land Rover is continually validating compatible telephone handset and software combinations. The most up-to-date compatibility list will always be available on-line from Land Rover.

NOTE: To achieve full Bluetooth® telephone handset functionality, it is crucial that the telephone software level matches the version detailed in the list of compatible telephone handsets.

BLUETOOTH®

Bluetooth® is a short-range Radio Frequency (RF) technology that operates at 2.4 GHz and is capable of transmitting voice and data wirelessly. The effective range of Bluetooth® devices is 32 feet (10 meters) with a data transfer rate of 1 Mbps.

Bluetooth® is a wireless RF connection which operates with the user's own telephone handset. It does not have to be

fixed into the vehicle and is designed to function without an external aerial. The telephone handset can be located anywhere within the cabin, even in a bag, or jacket pocket. It can work from the luggage compartment, although the signal could be compromised. The telephone handset can be charged from the 12 volt power socket or USB (if supported) while in use.

The Bluetooth® system supports Bluetooth® Hands-Free Profile (HFP), Phonebook Access Profile (PBAP), Advanced Audio Distribution Profile (A2DP) and Audio Video Remote Control Profile (AVRCP).

COMPONENT DESCRIPTION - AUDIO BLUETOOTH® TELEPHONE SYSTEM

Integrated Audio Module (IAM)



E140303

The IAM is located in the instrument panel, behind the Integrated Control Panel (ICP). The IAM communicates with the Bluetooth® phone using internal hardware and a Bluetooth® antenna and software for telephone functionality.

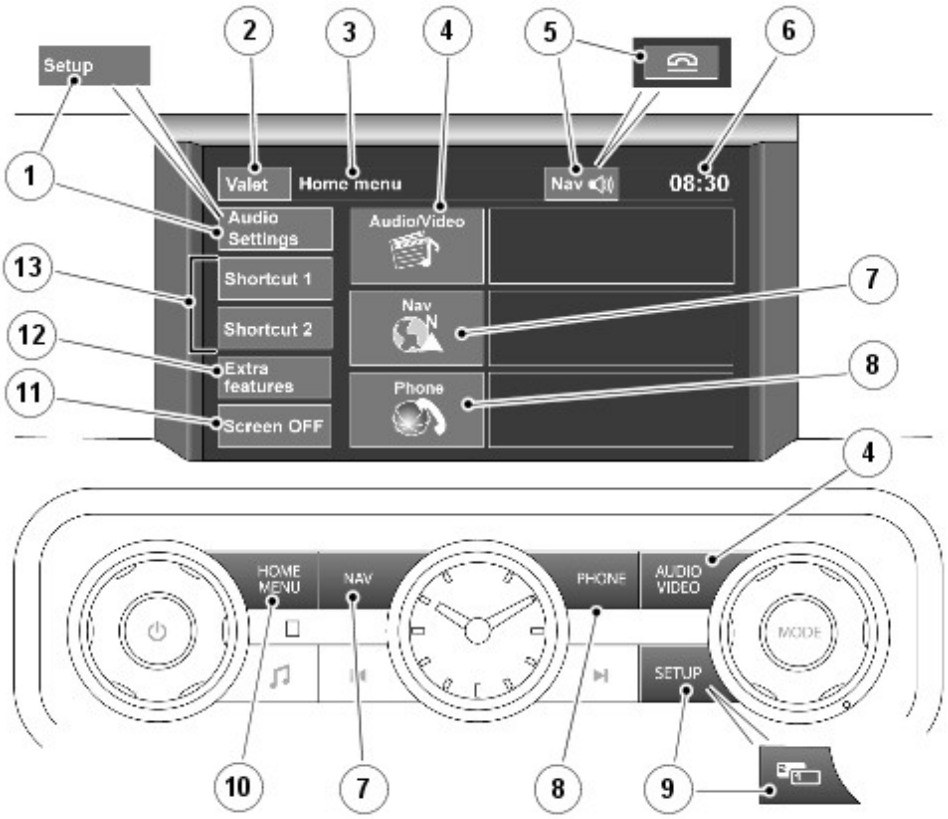
The IAM is connected to the Media Oriented system Transport (MOST) ring and communicates with the TSD and audio amplifier in order to provide the telephone feature in the vehicle.

When the Bluetooth® telephone is specified, the IAM supports the Bluetooth™ telephone functionality and audio streaming. Bluetooth® telephone software and a Bluetooth® antenna are located within the IAM. The software within the IAM processes the Bluetooth® wireless signals from the users Bluetooth® telephone and allows audio output, voice input and data display on the TSD.

The hands free microphone is hardwired to the IAM. The microphone is also used by the Land Rover Voice system for telephone and other infotainment system operation.

For additional information, refer to: Audio System (415-01B, Description and Operation).

Touch Screen Display (TSD)



E141851

Item	Part Number	Description
1	-	Audio settings menu (vehicles without dual view) or the touch screen Setup menu
2	-	Valet mode
3	-	Menu title
4	-	Audio/Video menu
5	-	End a call when using the phone or last given navigation instruction repetition
6	-	Time display
7	-	Navigation menu
8	-	Phone menu
9	-	Touch screen setup menu (vehicles without dual view) or to activate dual view display
10	-	Home menu
11	-	Turn off the touch screen display
12	-	Extra features menu
13	-	Home menu presets

The Touch Screen Display (TSD) provides the user interface of the Bluetooth® telephone system.

The Touch Screen Display (TSD) forms the basis of the telephone system. It communicates with the rest of the audio/infotainment system on the MOST ring and allows control of the telephone system and other infotainment systems from a single point.

The TSD communicates with the Integrated Audio Module (IAM) on the MOST ring and provides the driver interface and driver display of the telephone system. The TSD also provides driver display and control of the audio, the rear view camera, the navigation system, the Traffic Message Channel and the rear seat entertainment.

The telephone system and other systems are operated by a combination of the physical buttons located on each side of the screen and the 'virtual' buttons (icons) displayed on the touch screen, in addition to the steering wheel mounted switches. For clarification, the physical buttons on the TSD are referred to as 'buttons' and the touch screen virtual buttons are referred to as 'icons'.

For additional information, refer to: Audio System (415-01B, Description and Operation).

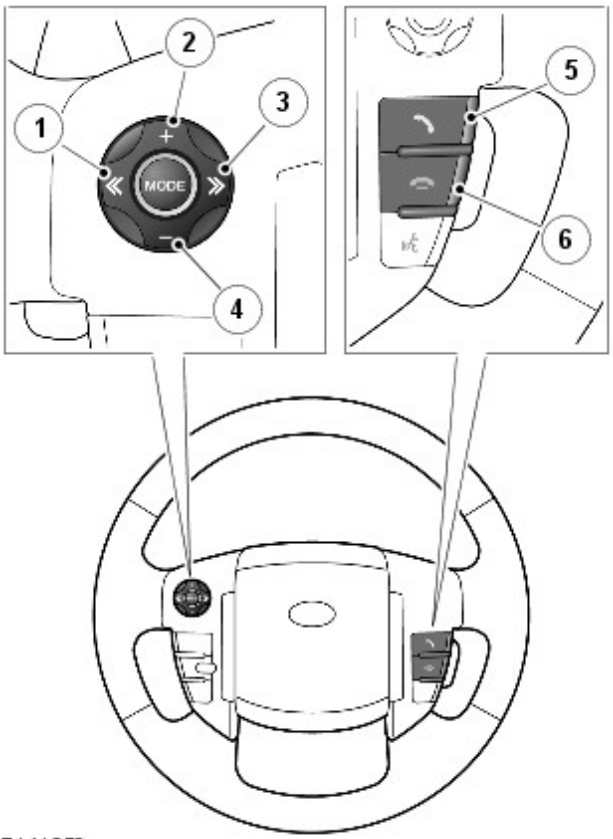
Microphone



E142032

The directional type microphone is fitted to the driver's side of the overhead console so that it is directed towards the driver. It is connected to the Integrated Audio Module (IAM) for hands free telephony, voice control and dynamic volume control (DVC) systems. The IAM has an integrated noise suppression and echo cancellation system for hands-free telephone use.

Steering Wheel Control Switches



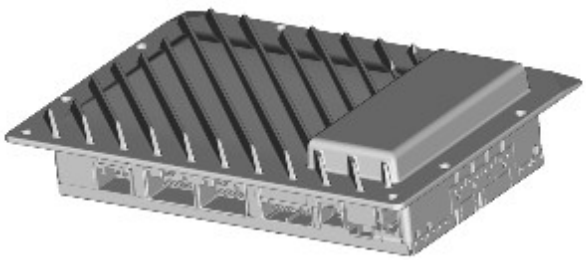
E141852

Item	Part Number	Description
1	-	Press to scroll up a displayed list.
2	-	Press to increase volume when in a call.
3	-	Press to scroll down a displayed list.
4	-	Press to decrease volume when in a call.
5	-	Press and release to access last 10 dialled list or dial a number/contact. Press and hold to access phonebook list view.
6	-	Press to end a call or to reject an incoming call.

The steering wheel switches for the telephone system are located on the LH (left-hand) side of the steering wheel. The driver is able to use these switches for several phone related functions including:

- Accept incoming calls.
- Reject incoming calls.
- Make phone calls from the phones own phone book (phone book/call lists).

Audio Power Amplifier



E136029

The audio power amplifier is located below the front LH seat. It is connected to the audio system via the MOST bus. Speaker connections from the amplifier are hardwired.

Telephone audio during a call is played through the front speakers.

Bluetooth®

The Bluetooth® phone system allows the user to pair and connect their own mobile phone handset (Bluetooth® enabled only) to the vehicle telephone system.

Once connected, the user can use the vehicle hands free functions. The Bluetooth® system limits the functions to those available in the Bluetooth® hands free profile.

The available features include:

- Make/receive calls
- Dial voicemail number
- Signal strength, network operator and battery level indication on the TSD (if supported by the telephone handset software)
- Phonebook download (if supported by the telephone handset)
- Dialled calls (if supported by the telephone handset)
- Missed calls (if supported by the telephone handset)
- Received calls (if supported by the telephone handset).

Bluetooth® Pairing

Before a Bluetooth® phone handset can be used on the vehicle hands free system, the phone must be 'paired' to the Bluetooth® phone system. The following steps describe the 'pairing' process.

There are two ways of pairing a mobile phone to the vehicle system: From vehicle to device or from device to vehicle.

 NOTE: The process of pairing and connecting your phone with the vehicle using the mobile phone will vary depending on the type of mobile phone used. Selecting 'search new' only appears if pairing for the 1st time, subsequent attempts to use the 'search new' soft key needs to be accessed by pressing the Change Phone 1st soft key.

- Switch the ignition system on and ensure that the touch screen is active.
- From the home menu, select **Phone**.
- A menu will appear. Select **Search new**.

 NOTE: The vehicle's Bluetooth® system is discoverable for only 3 minutes.

Device to Vehicle

- Select **Device To Vehicle** option. On some phones, this is referred to as new paired device. See your phone's operating instructions for further information.
- When the vehicle's Bluetooth® system is discovered (named Land Rover), follow the on-screen instructions. Select **Yes** when prompted, to confirm the pairing. Either the phone or the vehicle system will ask for a PIN (Personal Identification Number). When prompted, enter a PIN of your choice and select **OK** to confirm.
- Enter the same PIN into the other device.
- Once your phone is paired and connected to the system, a confirmation message will be displayed before switching to the Digit Dial screen.

Vehicle to Device

- Select **Vehicle To Device** option.
- Identify your phone from the displayed list and select the corresponding **Pair and Connect** option.
- A PIN will be displayed in the TSD, enter this PIN into your phone.
- Once your phone is paired and connected to the system, a confirmation message will be displayed before switching to the Digit Dial screen.

 NOTE: Some mobile phones require the Bluetooth® pairing to be set as 'authorized' or 'trusted' in order to automatically connect. Please refer to your phone's operating instructions for further information.

Changing the connected phone

Up to 10 mobile devices (mobile telephones or other Bluetooth® audio devices) can be paired with the vehicle in the same way. However, only one can be connected and ready for use as a phone at any one time.

 NOTE: Bluetooth audio devices will use one of the 10 allocated pairing slots, but will not be displayed in the telephone device list if they do not support telephony function.

To connect a different paired phone, follow the steps below:

- From the Home menu, select **Phone**.
- A menu will appear. Select **Change phone**.
- Identify and select the phone from the displayed list.
- Once the phone is connected to the system, a confirmation message will be displayed before switching to the Digit Dial screen.

Advanced Land Rover Voice Control (TL2, Hi-Line and Premium Systems Only)

The advanced Land Rover system provides the driver with the option of voice control for a range of supported functions. The following systems include Land Rover Voice functionality:

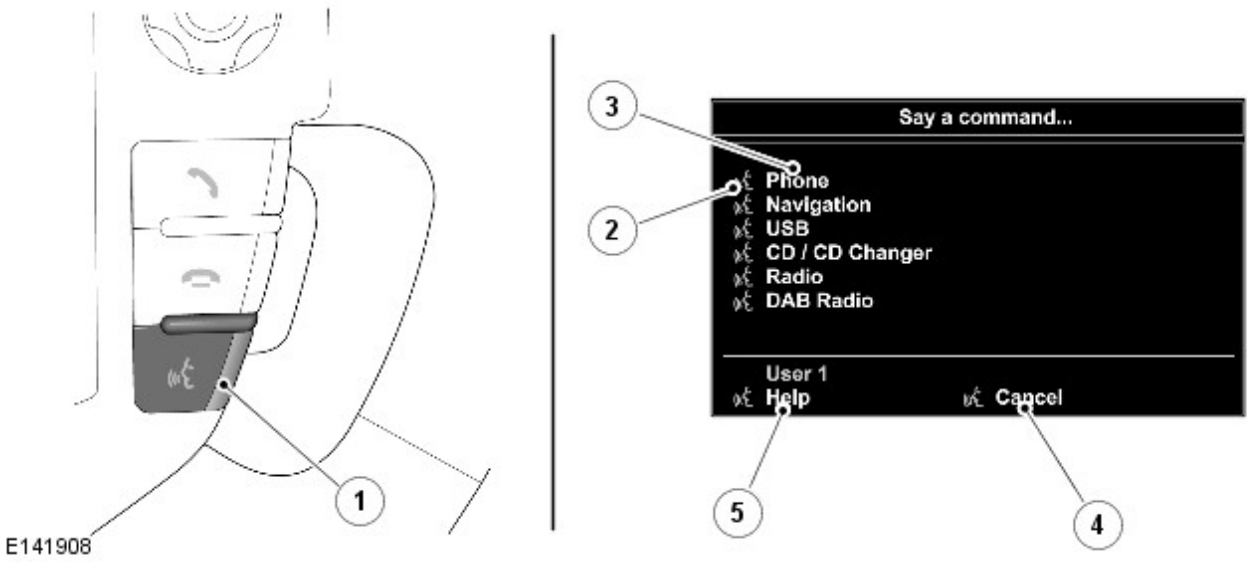
- Bluetooth® Telephone system
- Navigation system
- Vehicle notepad
- Radio, SDARS and DAB (if fitted)
- CD (compact disc) player
- Hard disk drive/virtual CD player
- USB and auxiliary connections.

There is a help and tutorial function to provide advice on using the system. The 'notepad' facility allows voice notes to be recorded. Voice tags for phone dialling, radio stations and navigation locations allow the system to be personalized.

The system allows the vehicle user to concentrate fully on driving the vehicle, without any need to divert their eyes from the road ahead in order to check information read outs on the vehicle instrument panel information units. The voice control system also feeds back audible information to the vehicle user.

The advanced Land Rover Voice system uses a 'visual prompter' system known as 'Say What You See' (SWYS). Each of the Advanced Land Rover Voice functions are supported by 'Help' commands; saying "Help" at each point in the conversation will give a context sensitive explanation of what the user can do at that point. The SWYS is shown in the TSD.

Voice control is mainly a software based system. The software for controlling the voice system is resident in the IAM and the TSD. The IAM and TSD each contain more than one voice control software component and communication between the two modules is via the MOST ring. A voice control microphone is located in the front overhead console and is hardwired to the IAM.



Item	Part Number	Description
1	-	Voice button
2	-	Voice symbol
3	-	SWYS command list
4	-	When displayed, say Cancel to cancel the current voice session
5	-	When displayed, say Help to get assistance during a voice session

Advanced Land Rover Voice is a key component of the Bluetooth® telephone system, allowing hands free control and use of the Bluetooth® enabled phone.

NOTE: Telephony voice commands are only accessible when a Bluetooth® device is docked to the vehicle.

The system is operated by the voice button on the LH side of the steering wheel. Voice commands are detected by the microphone in the overhead console. When giving a voice command audible feedback will be heard through the vehicle's audio speakers.

Efficient operation of Advanced Land Rover Voice is reliant on the user understanding some of the following basic operating conditions;

- Face forwards, sitting in a normal driving position
- After pressing the voice button, always wait for the end of the audible tone before speaking
- Speak naturally, as if you were talking to a passenger or on the phone without pausing between words
- When the system asks for more information, always wait for the end of the tone before responding
- Always say numbers clearly but at a natural pace
- Excessive noise, for example while driving with windows open, may cause voice command mis-recognition. If it is too noisy to use the phone, it is likely that voice commands will not be recognized

Most accents are understood without difficulty, but if the system does not recognize the command it will respond

"SORRY" and allow two more attempts to say the command.

Voice feedback is given in the same language as the command recognition. It is possible to change the language of the speech control system by changing the system language.

Starting a Voice Session

To start a voice session the driver must press the voice button briefly. An audible tone can be heard, followed by the presentation of the voice command menu list in the SWYS pop-up in the TSD. A voice symbol alongside each item in the list indicates that the system is listening for one of the available commands. Always wait for the listening tone before using the command. To end the voice session press and hold the voice button.

When the voice button is pressed on the steering wheel, a voltage signal is received by the TSD via the clockspring. The voltage is sent on a single wire through a resistive ladder. The voice system activation is processed on the MOST ring, for example the voice menu list is retained in and presented by the TSD. The accompanying voice instruction is sent to the audio power amplifier from the IAM on the MOST ring for broadcast over the vehicle speakers. When a recognized user instruction is received by the IAM via the microphone, the instruction is processed by the IAM and sent to the TSD to perform the required action.

Voice Tutorial

There is a voice tutorial that can be accessed either by giving the 'voice tutorial' command or by pressing the 'voice tutorial' button located in the 'operating guide' option in the 'Voice settings' menu on the TSD. The tutorial gives information on how to use the voice system, useful tips and how an experienced user can speed up their interaction with the voice system by turning voice feedback off, using barge-in and saying shortcut commands.

Voice Training

The voice system allows two different users to create separate profiles, providing training for a User 1 and User 2. Voice training is used to help the system recognize the users voice more accurately. When training is activated for each user, a message is displayed to confirm that training is in progress for that user. The message informs the user that voice training must be fully completed in order to activate the new voice profile and offers the option of 'OK' to initiate the session and store data in that user profile, or 'Cancel' to return to the previous menu. Once activated, another message indicates that training is in progress. Voice training phrases will be shown in the TSD voice menu and the user will be requested to say each phrase after the listening tone.

 NOTE: Voice training can only be conducted when the vehicle is stationary with the engine running and the climate control NOT in defrost due background noise.

Voice tags and training are stored in a non-volatile memory in the IAM. Disconnection of the vehicle battery will not cause any loss of data stored.

NOTES:

 To enable new voice tags and training to be written to memory, a period of 10 minutes after the last ignition off cycle must take place. Should the battery be disconnected before this time then the data may be lost.

 If the IAM is replaced then all stored data will be lost. If either the IAM or TSD are replaced, it is recommended that the vehicle language settings and voice language settings (if vehicle language is not supported by voice control) are reset to the same setting.

Voice Tags

Voice tags allow the user to store voice entries as shortcuts to control dialling numbers (as well as to recall radio stations and plot to navigation locations). The voice tags sub-menu accesses controls for navigation, telephone, radio and DAB/SDARS (where fitted).

Phone Dial Number

Phone dial number allows the user to verbally enter a dial string into the voice system to allow the user to dial that number using a connected Bluetooth® telephone.

Voice Caller Announce

When enabled in the Phone settings, the Voice system will announce the name of the incoming caller identity through the system speakers.

Dialing from GP2 Phonebook

Provided the phonebook has been downloaded via Bluetooth®, the voice system is able to perform a grapheme-to-phoneme (GP2) transcription of each of the names stored in the phonebook. This is then used by the voice system to allow the user to use the 'phone dial contact' command to dial a contact by saying the name stored in the phonebook, there is no need to store a voice tag first.

 NOTE: The phonebook must be fully downloaded for speech to build a recognition dictionary. It does not use the cached version that the phone does. This is why in some circumstances the phonebook can be seen on the TSD, but if the phonebook has not yet been fully downloaded, then the voice system will give the audible error feedback 'this function is currently unavailable'.

The users' voice command is matched against the phonebook entries and a list of likely recognition candidates is displayed in a 'picklist' for the user to select from. If the chosen contact has more than one number associated with it, the voice system will work with the user to determine the exact number they wish to dial.

NOTE: For regularly used contacts with more than one number, the user can store a voice tag as a shortcut.

Command List

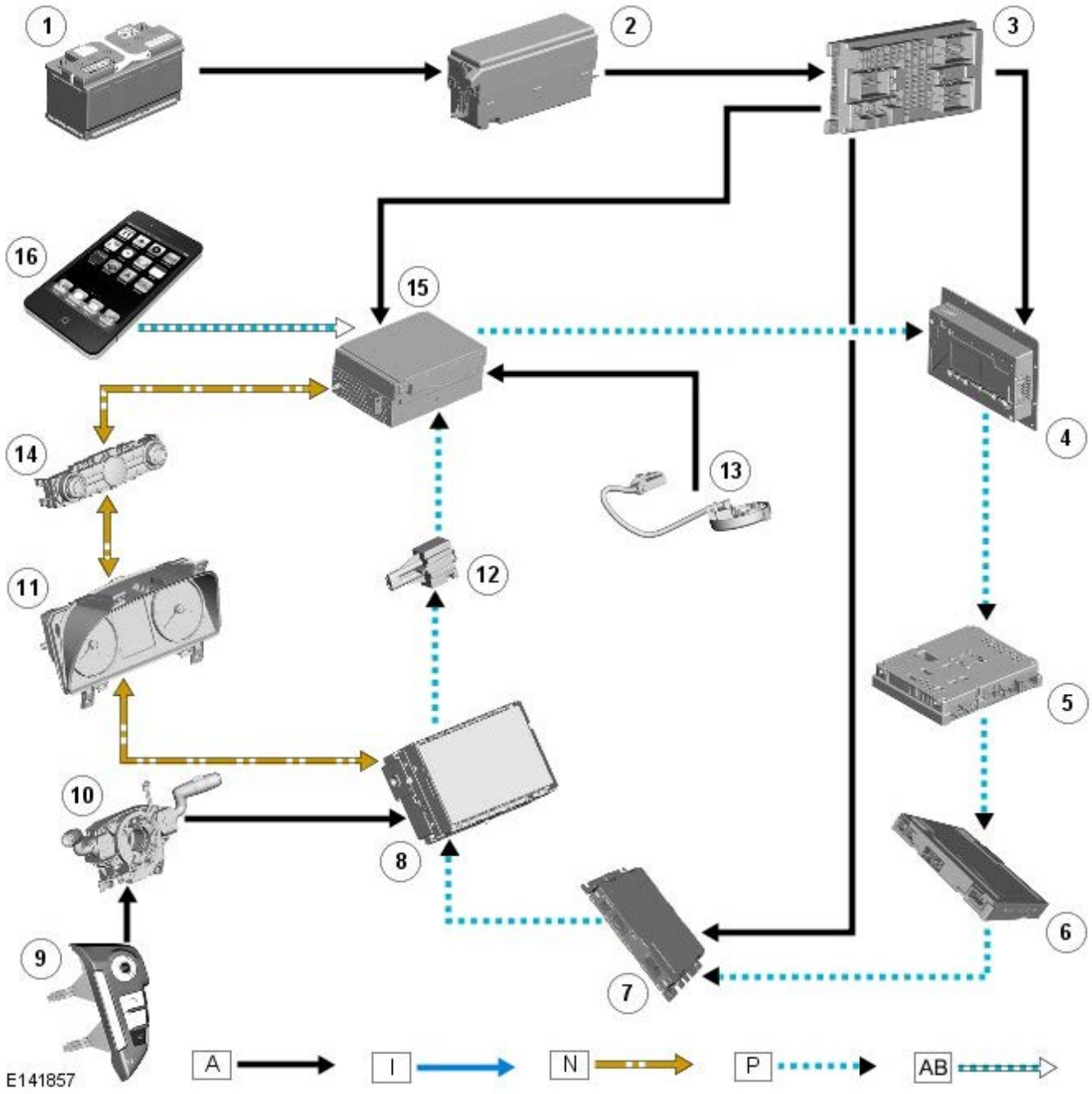
A full list of all shortcut voice commands can be found on the TSD by pressing the 'command list' button in the 'voice settings' menu. Select a device name from the list to see all the shortcut commands available to interact with that device. Pressing the '**i**' button next to any command shows alternative ways of saying the same command.

Navigation Destination Entry by Voice

Destination entry uses phonetic transcriptions of the navigation data (stored as part of the map data) to offer the user the ability to enter an address or postcode into the Navigation system by voice. The user simply follows the visual and audible instructions given by the voice system and enters their desired address in a step-by-step manner (e.g. city, then street, then house number). At each address entry stage, the user's voice command is matched against the phonetic map data and a list of likely recognition candidates is presented in a "picklist" for the user to select from. If the chosen address has more than one location associated with it, the voice system will work with the user to determine the exact address they wish to navigate to.

CONTROL DIAGRAM

CONTROL DIAGRAM - TL2, HI-LINE AND PREMIUM AUDIO BLUETOOTH® TELEPHONE SYSTEM



Item	Part Number	Description

1	-	Battery
2	-	EJB (engine junction box)
3	-	CJB (central junction box)
4	-	Audio power amplifier
5	-	TV tuner (Reference only)
6	-	Rear Seat Entertainment (RSE) module (Reference only)
7	-	DAB/SDARS receiver (Reference only)
8	-	Touch screen display (TSD)
9	-	Steering wheels switches
10	-	Clockspring
11	-	Instrument cluster
12	-	MOST diagnostic connector
13	-	Microphone
14	-	Integrated Control Panel (ICP)
15	-	Integrated audio module (IAM)
16	-	Customer telephone

Published: 11-May-2011

Cellular Phone - Transceiver Module

Removal and Installation

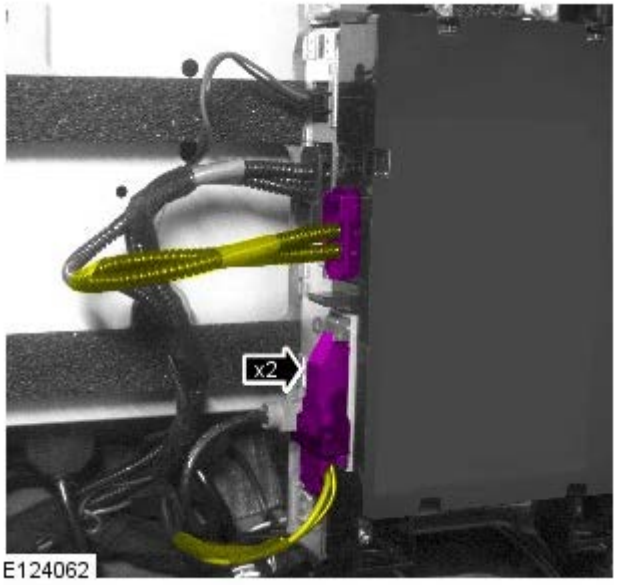
Removal

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

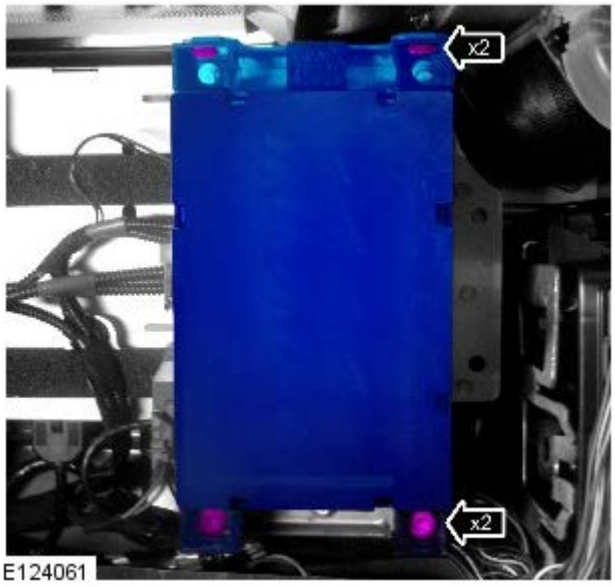
1. Remove the RH lower rear quarter trim panel.

   Refer to: Rear Quarter Trim Panel (501-05, Removal and Installation).

2.



3. *Torque:* 10 Nm



Installation

1. To install, reverse the removal procedure.

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Multifunction Electronic Modules - Driver Door Module (DDM)

Diagnosis and Testing

Principles of Operation

For a detailed description of the Driver/Passenger door systems and operation, refer to the relevant Description and Operation sections in the workshop manual.

Inspection and Verification

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

Visusal Inspection

Mechanical	Electrical
• Switches/mechanisms	• Fuses • Electrical connectors • Harnesses • Modules

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

For a list of DTCs that may be logged on this vehicle, refer to the DTC Index in section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Driver/Passenger Door Module (DDM/PDM) (100-00, Description and Operation).

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Multifunction Electronic Modules - Driver Seat Module (DSM)

Diagnosis and Testing

Principles of Operation

For a detailed description of the Driver/Passenger seat systems and operation, refer to the relevant Description and Operation sections in the workshop manual.

Inspection and Verification

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

Visusal Inspection

Mechanical	Electrical
• Switches/mechanisms	• Fuses • Electrical connectors • Harnesses • Modules

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

For a list of DTCs that may be logged on this vehicle, refer to the DTC Index in section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Driver/Passenger Front Seat Module (DSM/PSM) (100-00, Description and Operation).

Published: 26-Sep-2011

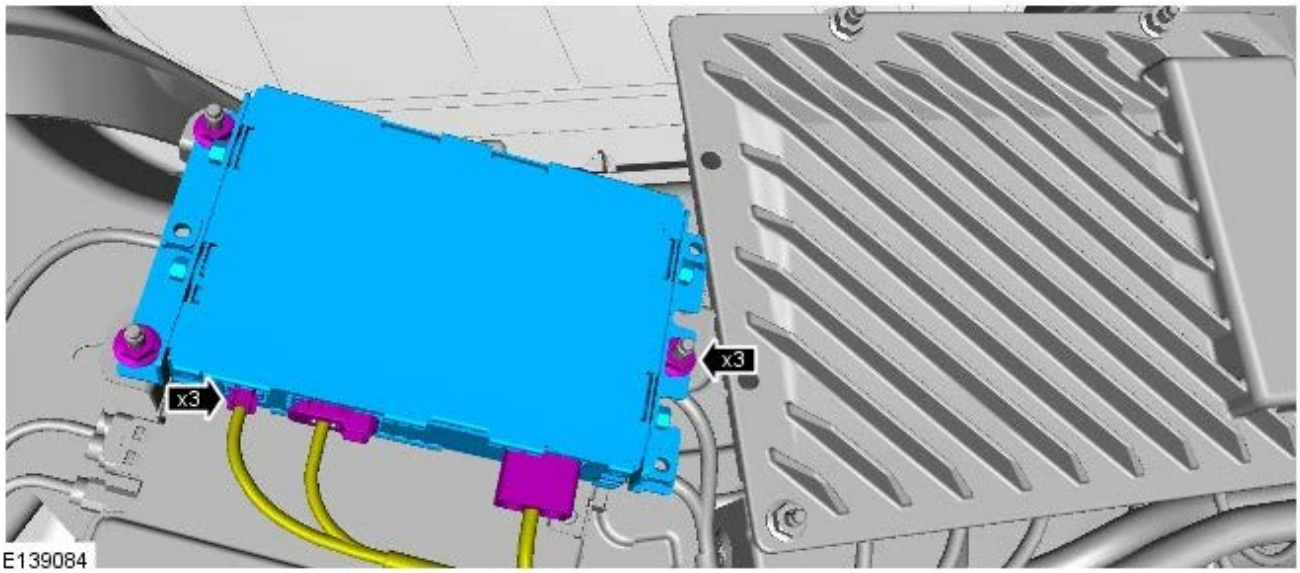
Multifunction Electronic Modules - Rear Entertainment Control Module

Removal and Installation

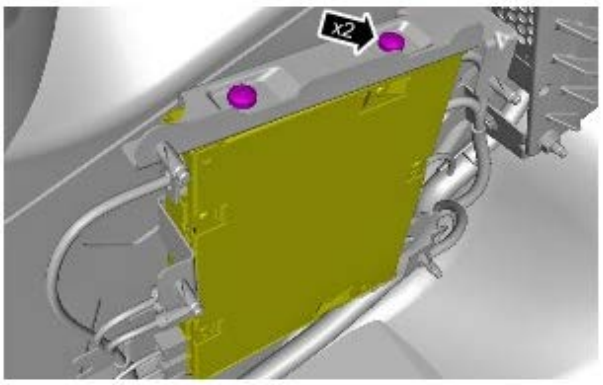
Removal

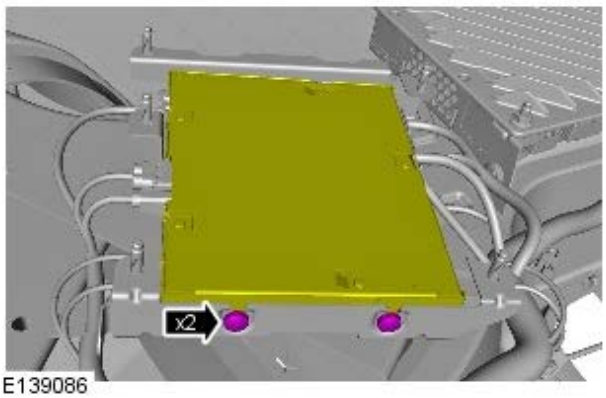
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Remote Keyless Entry (RKE) Module (501-14, Removal and Installation).
2. *Torque:* 9 Nm

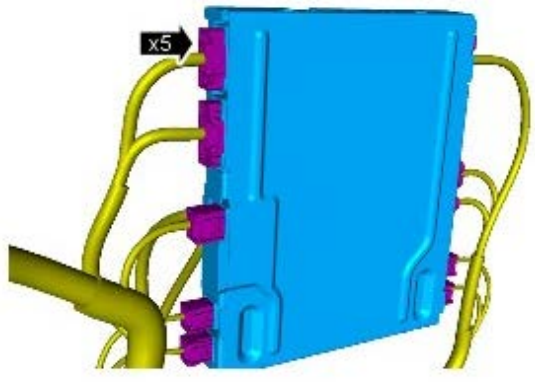


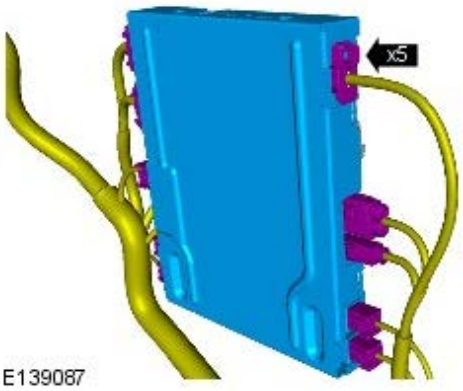
3. *Torque:* 9 Nm





4.





Installation

1. To install, reverse the removal procedure.
2. Using the diagnostic tool, calibrate the component.