Workshop Service Manual for Range Rover 2014

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Climate Control System - General Information -

Climate Control

NOTE: NAS Vehicles.

Type	Description
Heating, ventilation and air conditioning (A/C) unit	Dual zone or four zone automatic system fitted controlled by automatic temperature control module (ATC) module.
A/C compressor	Sanden, internally controlled variable capacity A/C compressor
Refrigerant	HFO-1234yf

Climate Control

NOTE: ROW Vehicles.

Type	Description
Heating, ventilation and air conditioning (A/C) unit	Dual zone or four zone automatic system fitted controlled by automatic temperature control module (ATC) module.
A/C compressor	Sanden, internally controlled variable capacity A/C compressor
Refrigerant	R134a

Climate Control

NOTE: EU Vehicles.

Type	Description
Heating, ventilation and air conditioning (A/C) unit	Dual zone or four zone automatic system fitted controlled by automatic temperature control module (ATC) module.
A/C compressor	Sanden, internally controlled variable capacity A/C compressor
Refrigerant	HFO-1234yf

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
A/C compressor oil type	Sanden SPA2
A/C compressor oil - vehicles fitted with 2 zone	80 ml
A/C compressor oil - vehicles fitted with 4 zone	140 ml

General Specification

Item	Description
A/C compressor	Sanden
Sensor locations:	
Ambient temperature sensor	Left door mirror
Cabin temperature sensor	Mounted behind a grill on the drivers side of the instrument panel, adjacent the steering column
Cabin humidity sensor (optional fit)	Located within the interior mirror and comprises 3 individual elements
Evaporative temperature sensor	Mounted on the right side of the heater casing
High pressure sensor	Located between the condenser and the thermostatic expansion valve
Pollution sensor	Mounted on the inboard side of the blower assembly
Solar sensor	Center of dash top

Capacities

Item	Vehicles fitted with 2 zone	Vehicles fitted with 4 zone
Total system capacity refrigerant	800 grammes ± 10 grammes	1150 grammes ± 10 grammes

Refrigerant oil adding capacities for replacment parts

NOTE: Rotate the A/C compressor shaft at least 6 to 8 turns when draining the refrigerant oil.

Item	Specification
A/C compressor - vehicles fitted with 4 zone	Add 60 ml.
A/C condenser	Add 25 ml.
A/C lines, if the A/C has been operational	Add 5 ml per A/C line.

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Climate Control System - General Information - Climate Control System

Diagnosis and Testing

Principles 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: (412-01A Climate Control)

Air Distribution and Filtering (Description and Operation),
Heating and Ventilation (Description and Operation),
Air Conditioning (Description and Operation),
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

Symptom Chart

Symptom	Possible Causes	Action
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: (100-00 General Information)

Diagnostic Trouble Code (DTC) Index - DTC: Automatic Temperature Control Module (ATCM) (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Rear Integrated Control Panel (Description and Operation).

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Climate Control System - General Information - Auxiliary Climate Control

Diagnosis and Testing

Principles of Operation

For a detailed description of the auxiliary climate control system and operation, refer to the relevant description and operation section of the workshop manual. REFER to: (412-02A Auxiliary Climate Control)

Electric Booster Heater (Description and Operation),
Fuel Fired Booster Heater (Description and Operation),
Auxiliary Climate Control (Description and Operation).

Inspection and Verification

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

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

Visual Inspection

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

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: Module Name: Automatic Temperature Control Module (100-00, Description and Operation).

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Climate Control System - General Information - Climate Control System SDV6 3.0L Diesel - Hybrid Electric Vehicle

Diagnosis and Testing

Principles of Operation

For a detailed description of the Air Conditioning system, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Air Conditioning (412-01B Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle, Description and Operation).

Inspection and Verification

WARNINGS:

A risk assessment must be performed before any work is undertaken.

All hybrid electric vehicle work must be performed by a suitably qualified person.

Appropriate Personal Protection Equipment (PPE) must be worn when working on or near a hybrid electric vehicle high voltage system.

The hybrid electric vehicle battery pack casing must not be opened due to the risk of exposure to hazardous voltage, which may cause serious injury or death.

The electric power inverter converter casing must not be disassembled due to the risk of exposure to hazardous voltage, which may cause serious injury or death.

If the hybrid electric vehicle battery pack is damaged or overcharged, there is a risk of exposure to hazardous voltage and/or highly corrosive electrolyte mist. If liquid or vapour is observed leaking from the hybrid electric vehicle battery pack, take the following action:

- **Evacuate the area**
- **Notify manager**
- **Do not breathe smoke/vapour**
- **Contain spillage using spill kit**
- **Wash any spillage off body and clothing (remove contaminated clothing)**

If the hybrid electric vehicle warning indicator is illuminated, the Battery Energy Control Module (BECM) cannot isolate the high voltage cables. Live working will be necessary to rectify the fault.

The motor generator can generate a voltage if the wheels are rotated, even if the hybrid electric vehicle system has been made safe.

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.

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.

When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

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.

Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

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.

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

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.

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 damage and system integrity

Visual Inspection

Mechanical	Electrical
• Coolant level • Hose(s) • Coolant pump • Control flap(s) • Duct(s) • Vent(s) • Cabin air filter • Electric 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 • Hybrid electric vehicle battery pack cooling system • Battery pack cooler and isolation valve • Battery pack cooler and and thermal expansion valve	• Fuse(s) • Wiring harnesses and connectors • High voltage cables • Automatic Temperature Control Module (ATCM) • Battery Energy Control Module (BECM) • Electric Power Inverter Converter Module (EPICM) • Hybrid electric vehicle battery pack • Refrigerant pressure sensor • Blower • Electric cooling fan • Electric air conditioning compressor • Battery energy control module electric coolant pump

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	Possible Causes	Action
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

Air conditioning inoperative	• Battery energy control module fault • Electric power inverter converter module fault	• Using the manufacturer approved diagnostic system, check the battery energy control module for related DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system, check the electric power inverter converter module for related DTCs and refer to the relevant DTC index

Pinpoint Tests

PINPOINT TEST A : PRELIMINARY TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: PRELIMINARY TEST 1	
	NOTE: This test is performed with the engine **not** running.
	1 Close the valves on the air conditioning station
	2 Connect the air conditioning station to the vehicle charging ports
	3 Record 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	
	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 Record the temperature value
	11 Record 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	
	1 Record 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	
	1 Record 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	
	1 Record the pressure values
	Are the pressure gauge readings too low? **Yes** GO to C4. **No** GO to C6.
C4: GAUGE TEST 4	
	1 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	
	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	
NOTE: This test is performed with the engine running and the air conditioning set to on.	
	1 Record 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	
	1 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 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 (ATCM) (100-00 General Information, Description and Operation).

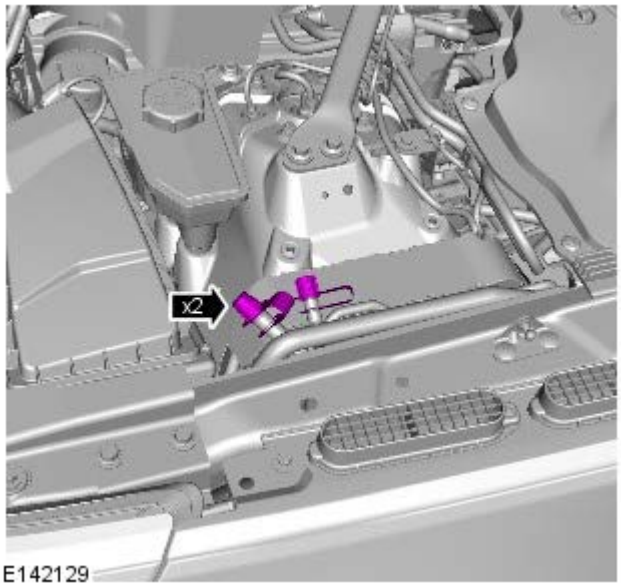
Published: 02-Dec-2013

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

General Procedures

Recovery

1. 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.



2. NOTE: All vehicles.

   Remove the dust covers from the high and low pressure connections.

3. Connect the A/C Charging Trolley high and low pressure lines to the appropriate connections.

4. WARNING: Refrigerant must always be recycled before re-use to make sure that the purity of the refrigerant is high enough for safe use in the air conditioning (A/C) system. Recycling should always be carried out with equipment which is design certified for compliance with SAE J2099 and SAE J2788. Other equipment may not recycle refrigerant to the required level of purity. R-1234yf. Refrigerant Recover Recycling Recharging station must not be used with any other type of refrigerant. Refrigerant R-1234yf from domestic and commercial sources must not be used in motor vehicles A/C systems.

   NOTE: Measure and record the quantity of refrigerant oil recovered from the system.

   Following the A/C Charging Trolley manufacturer's instructions, recover the refrigerant from the A/C system.

5. CAUTIONS:

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

   Always follow the health and safety precautions when handling the refrigerant R-1234yf.

   Collect the refrigerant in specialist equipment and reuse.

Evacuation

1. Following the A/C Charging Trolley manufacturer's instructions, evacuate the A/C system.

2. 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 all the refrigerant has been lost to atmosphere, or the refrigerant circuit has been open more than 1 hour, due to repair.

   Refer to: Receiver Drier (412-01A Climate Control, Removal and Installation).

Charging

1. CAUTION: The system must be evacuated for 30 minutes immediately before recharging commences. Delay between evacuation and recharging is not permitted.

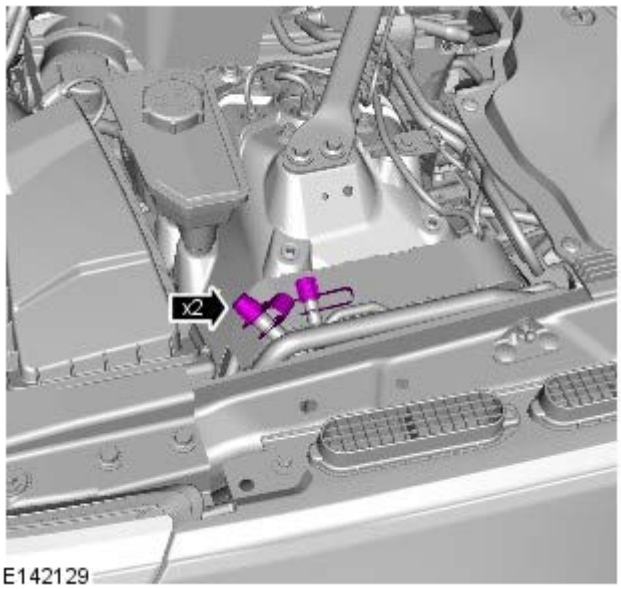
2. Following the AC Charging Trolley Manufacturers Instructions, make sure the correct amount of oil is added to the A/C system before or during recharging.

3. CAUTION: Recharge the A/C System only through the systems high pressure port.

   Recharge the A/C system to the correct specification.

   Refer to: Specifications (412-00 Climate Control System - General Information, Specifications).

4. Disconnect the high and low pressure connections.



5. NOTE: All vehicles.

   Install and firmly tighten the caps that cover the high and low pressure connections.

   Torque: 6 Nm

Published: 15-Nov-2013

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.

Published: 30-Oct-2013

Climate Control -

Torque Specifications

Description	Nm	lb-ft	lb-in
Air conditioning (A/C) compressor refrigerant line clamp to radiator bolt	7	-	62
A/C compressor refrigerant line clamp to engine nut - vehicles with 3.0L diesel	6	-	53
A/C compressor refrigerant lines retaining nuts - vehicles with 3.0L diesel	18	14	-
A/C compressor refrigerant line clamp to engine nuts - vehicles with 4.4L diesel	9		80
A/C compressor refrigerant lines retaining nuts- vehicles with 4.4L diesel	9		80
A/C refrigerant lines clamp to evaporator connector block bolt	10	7	-
A/C compressor refrigerant line retaining nuts - vehicles with 3.0L and 5.0L petrol	18	14	-
A/C compressor retaining bolts	25	18	-
A/C condenser core refrigerant line nuts	8	-	71
A/C condenser fan cowl bolts - vehicles with 3.0L and 5.0L petrol	7	-	62
A/C condenser core to radiator bolts	4.5	-	40
A/C condenser core bracket bolt	4.5	-	40
Receiver drier bolts	4	-	35
Heater core and evaporator core housing bolts	9	-	80
In-vehicle crossbeam to bulkhead bolt	20	15	-
Thermostatic expansion valve bolts	4	-	35

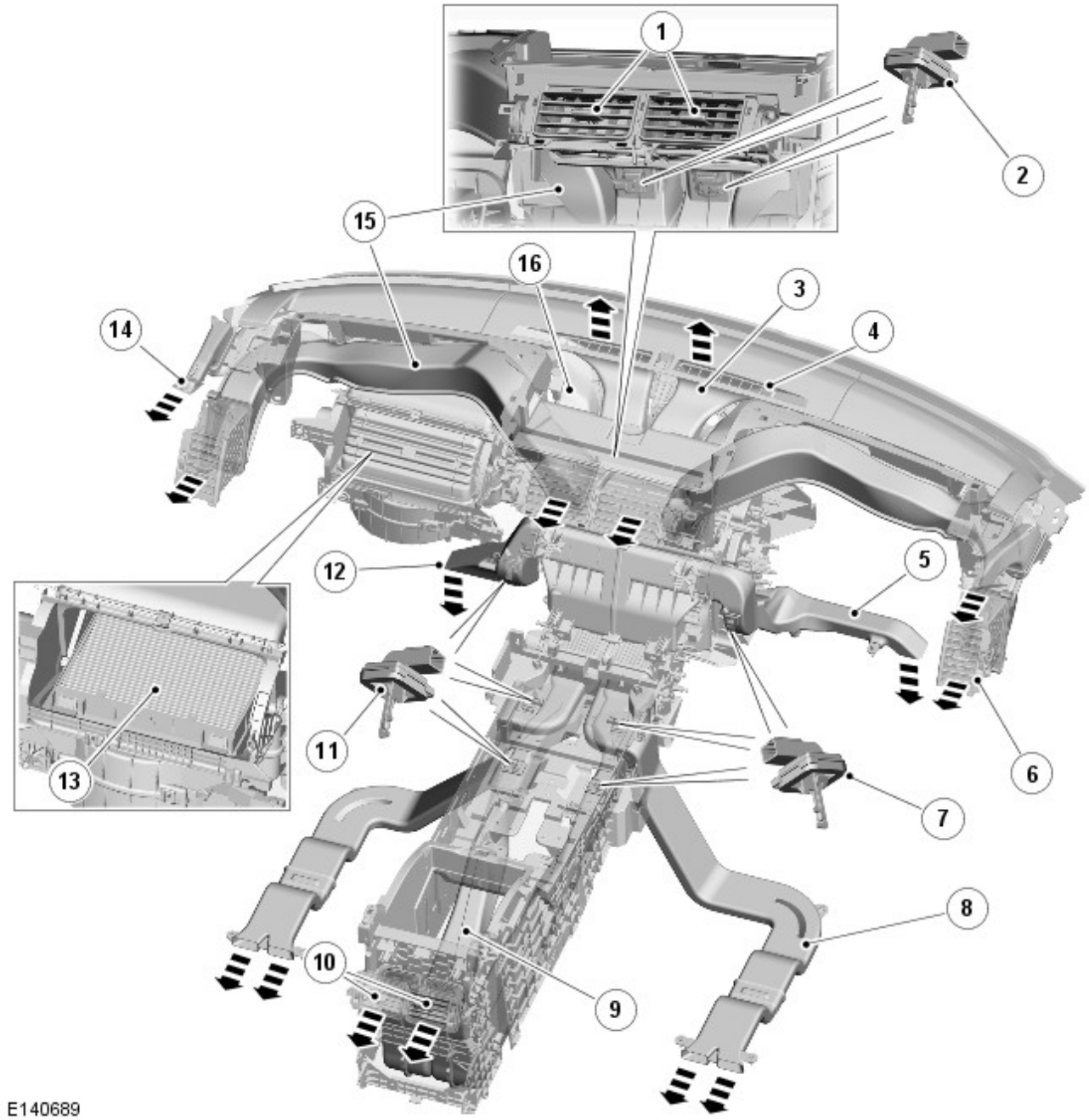
Published: 22-May-2013

Climate Control - Air Distribution and Filtering

Description and Operation

COMPONENT LOCATION

NOTE: RHD (right-hand drive) installation shown, LHD (left-hand drive) installation is mirror image.



Item	Part Number	Description
1	-	Center front face vents
2	-	Duct air temperature sensor - center front face
3	-	Demist duct (2 off)
4	-	Demist vent (2 off)
5	-	Driver foot duct
6	-	Outer front face vent (2 off)
7	-	Duct air temperature sensor - right front foot, rear foot and rear face
8	-	Rear foot duct (2 off)
9	-	Rear face duct (2 off)
10	-	Rear face vents
11	-	Duct air temperature sensor - left front foot, rear foot and rear face
12	-	Front passenger foot duct

13	-	Air filter
14	-	Side window vent (2 off)
15	-	Outer front face duct (2 off)
16	-	Side window duct (2 off)

OVERVIEW

The air distribution and filtering system consists of:

- Air ducts
- Air vents
- Air filter.

DESCRIPTION

Air Ducts

The air ducts consist of tubes connected between the climate control assembly and the various air vents around the vehicle interior. The center sections of the air ducts for the side window vents are integrated into the structure of the instrument panel. The rear foot ducts connect to the climate control assembly via ducts integrated into the structure of the floor console.

Eight duct air temperature sensors are installed to provide more accurate temperature control. The sensors are installed in the front foot ducts, the center front face ducts and in the rear foot and face ducts. The sensors are NTC Negative Temperature Coefficient) thermistors, which are connected to the ATCM (Automatic Temperature Control Module).
For additional information, refer to: Control Components (412-01A Climate Control, Description and Operation).

Air Vents

Adjustable air vents are installed in the face outlets of the instrument panel and the floor console. The remainder of the outlets have fixed vents integrated into the end of the air duct or installed in the trim panel connected to the air duct.

Air Filter

The air filter is a combination pollen and odor filter installed in the air inlet duct, over the blower inlet.

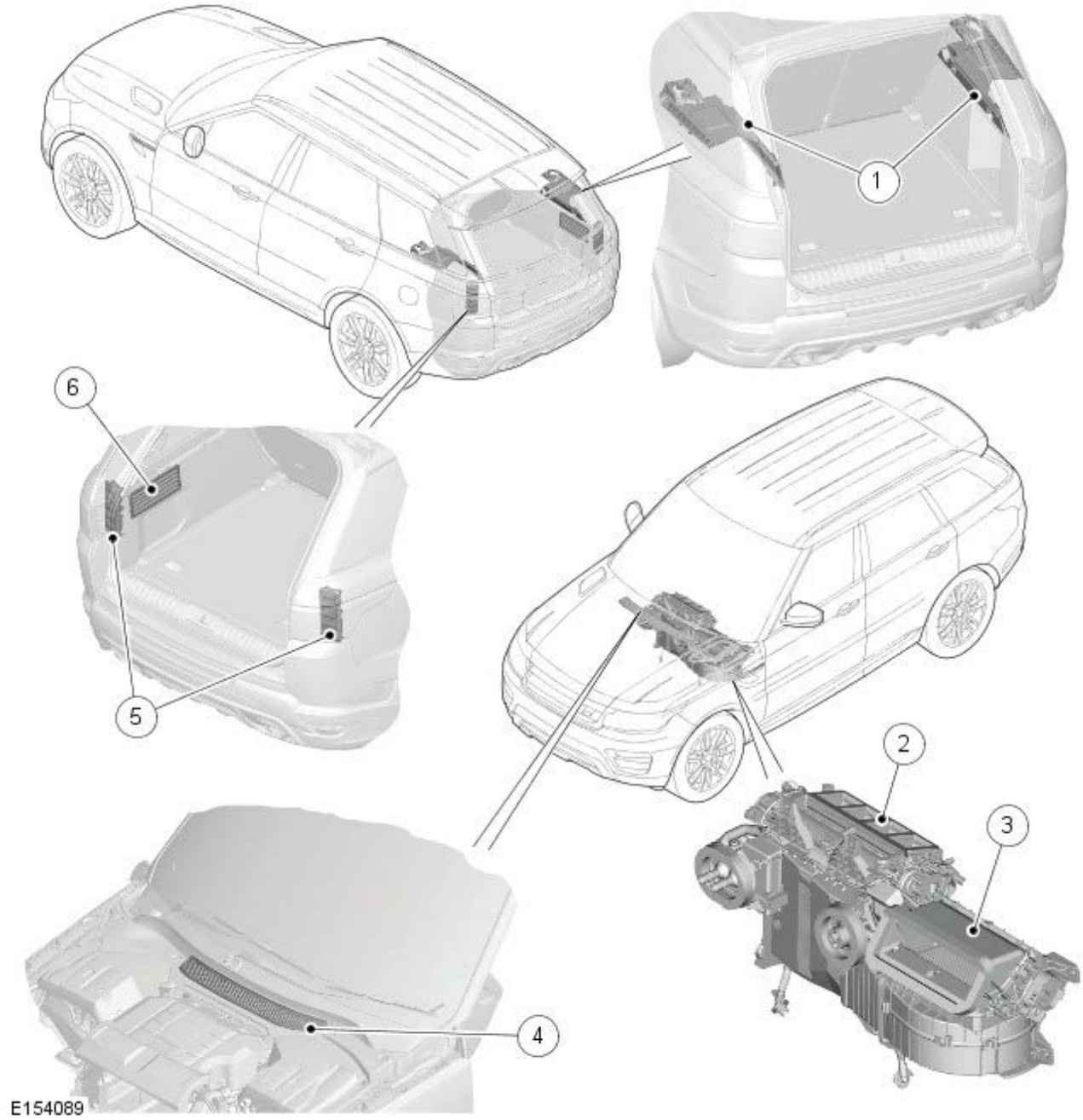
Published: 22-May-2013

Climate Control - Heating and Ventilation

Description and Operation

COMPONENT LOCATION

NOTE: RHD (Right-Hand drive) installation shown, LHD (Left-Hand drive) installation similar.



Item	Part Number	Description
1	-	Left and right upper ventilation outlets (luggage compartment)
2	-	Air outlets from climate control assembly
3	-	Fresh air intake to the climate control assembly
4	-	Air intake duct
5	-	Rear ventilation outlets
6	-	Side ventilation outlet (luggage compartment)

OVERVIEW

The heating and ventilation system consists of:

- An air intake panel
- A climate control assembly with air inlet and outlets
- Ventilation outlets.

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

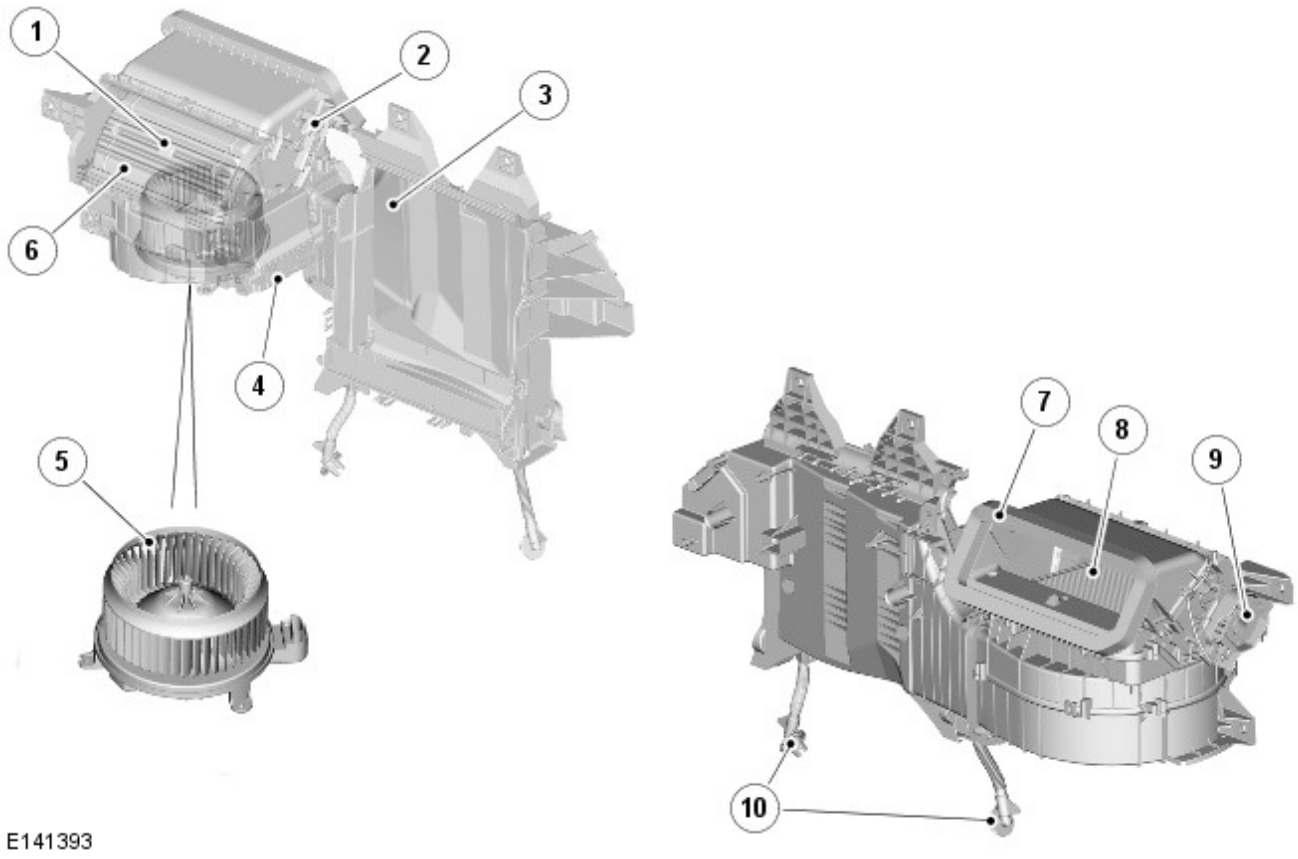
DESCRIPTION

Air Intake Panel

The air intake panel is attached to the front of the bulkhead panel, around the fresh air intake for the air intake duct.

Air Intake Duct

NOTE: RHD (right-hand drive) air intake duct shown, LHD (left-hand drive) air intake duct is mirror image.



Item	Part Number	Description
1	-	Recirculation air intake
2	-	Pollution sensor
3	-	Air outlet to heater
4	-	Automatic Temperature Control Module (ATCM)
5	-	Blower
6	-	Recirculation door
7	-	Fresh air intake
8	-	Air filter
9	-	Recirculation motor
10	-	Evaporator drain tubes

The air intake duct is installed behind the instrument panel, on the front passenger side, and connects the fresh air intake in the bulkhead panel to the heater. The air intake duct also contains:

- An intake for recirculation air
- The blower
- The air filter.
  For additional information, refer to: Air Distribution and Filtering (412-01A Climate Control, Description and Operation).

A recirculation door is installed between the fresh and recirculation air intakes, to control the source of incoming air. The recirculation door is driven by a recirculation motor, which is controlled by the ATCM (Automatic Temperature Control Module) using a LIN (Local Interconnect Network) bus signal. Power for the motor is also supplied by the ATCM module.

The recirculation door has automatic and manual modes of operation. In the automatic mode the ATCM module uses comfort algorithms and the pollution sensor input to set the door position. In the manual mode, the ATCM module sets the door to the position selected on the ICP (Integrated Control Panel).

For additional information, refer to: Control Components (412-01A Climate Control, Description and Operation).

BLOWER

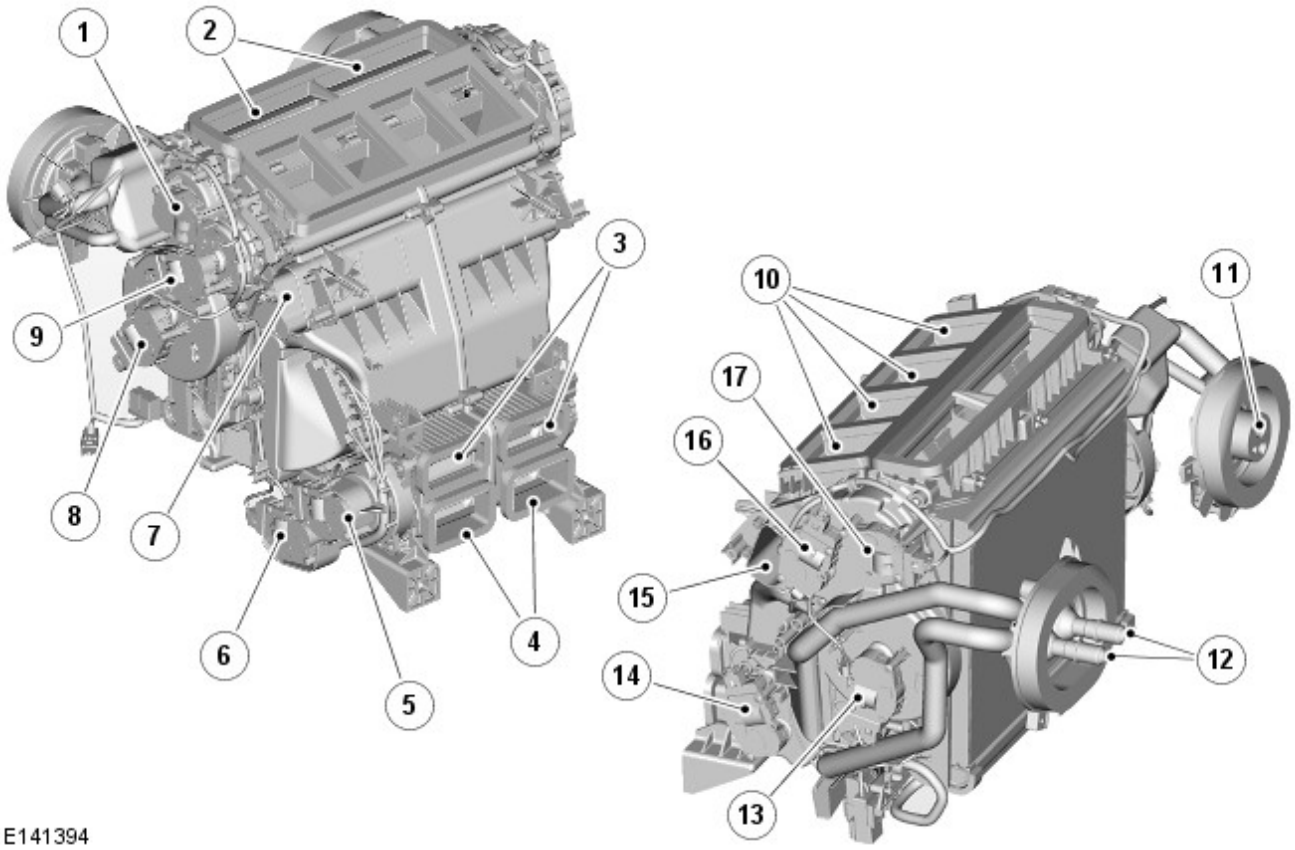
The blower is installed below the air filter, and consists of an open hub, centrifugal fan powered by an electric motor. Operation of the blower is controlled by the ATCM module, using the blower relay in the RJB (Rear Junction Box) and a control module integrated into the blower motor.

When the blower is required, the ATCM energizes the blower relay, which then supplies battery power to the blower motor. The speed of the blower is controlled by the integral control module, which regulates the blower motor voltage in response to a PWM (Pulse Width Modulation) signal from the ATCM.

When the blower is in the automatic mode the ATCM determines the blower speed required from comfort algorithms. When the blower is in the manual mode, the ATCM operates the blower at the speed selected on the ICP.
For additional information, refer to: Control Components (412-01A Climate Control, Description and Operation).

Heater

NOTE: RHD heater shown, LHD heater similar.



E141394

Item	Part Number	Description
1	-	Demist distribution motor
2	-	Demist air outlets
3	-	Rear foot air outlets
4	-	Rear face air outlets
5	-	Rear face/foot distribution motor
6	-	Left rear temperature blend motor
7	-	Left front foot air outlet
8	-	Left front temperature blend motor
9	-	Left front face/foot distribution motor
10	-	Front face air outlets
11	-	Air conditioning pipe connector block
12	-	Coolant pipe connections
13	-	Right front temperature blend motor
14	-	Right rear temperature blend motor
15	-	Right front foot air outlet
16	-	Right front face/foot distribution motor
17	-	Cool air bypass motor

The heater is installed on the vehicle center-line, between the instrument panel and the bulkhead panel. The heater consists of a casing, which contains an evaporator, heater core, distribution doors and temperature blend doors.

Internal passages integrated into the casing guide the air through the casing and separate it into two flows, one for the left outlets and one for the right outlets.

When the A/C (Air Conditioning) system is operating, the evaporator cools the air entering the heater.
For additional information, refer to: Air Conditioning (412-01A Climate Control, Description and Operation).

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 bulkhead panel to connect with the engine cooling system. When the engine is running, coolant is constantly circulated through the heater core by the engine coolant pump. On vehicles with a FFBH (Fuel Fired Booster Heater), when the FFBH is active the coolant flow is assisted by an electric FFBH coolant pump.
For additional information, refer to: Fuel Fired Booster Heater (412-02A Auxiliary Climate Control, Description and Operation).

The distribution doors direct the air flow to the face, foot and demist vents as required. A cool air bypass distribution door directs additional air around the heater core for the face vents.

The temperature blend doors regulate the flow of air through the heater core to control the temperature of the air leaving the heater. The left front and right front temperature blend doors operate independently to allow different temperatures to be set for front zones. The left rear and right rear temperature blend doors operate together on 3 zone vehicles and independently on 4 zone vehicles.

DISTRIBUTION AND TEMPERATURE BLEND MOTORS

Separate motors operate each of the five distribution doors and four temperature blend doors. If a motor is to be replaced, ensure it is replaced with the correct replacement part. Although similar in appearance, each of the motors is different and faults will occur if an incorrect motor is fitted.

Operation of the distribution and temperature blend door motors is controlled by the ATCM, which is connected to the motors by LIN bus, power and ground connections. A Hall effect sensor in each motor provides a position signal for the ATCM.
For additional information, refer to: Control Components (412-01A Climate Control, Description and Operation).

Ventilation Outlets



E141395

The ventilation outlets are installed in the left and right rear quarters, behind the tail lamp assemblies.

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 passenger compartment and outside air pressures.

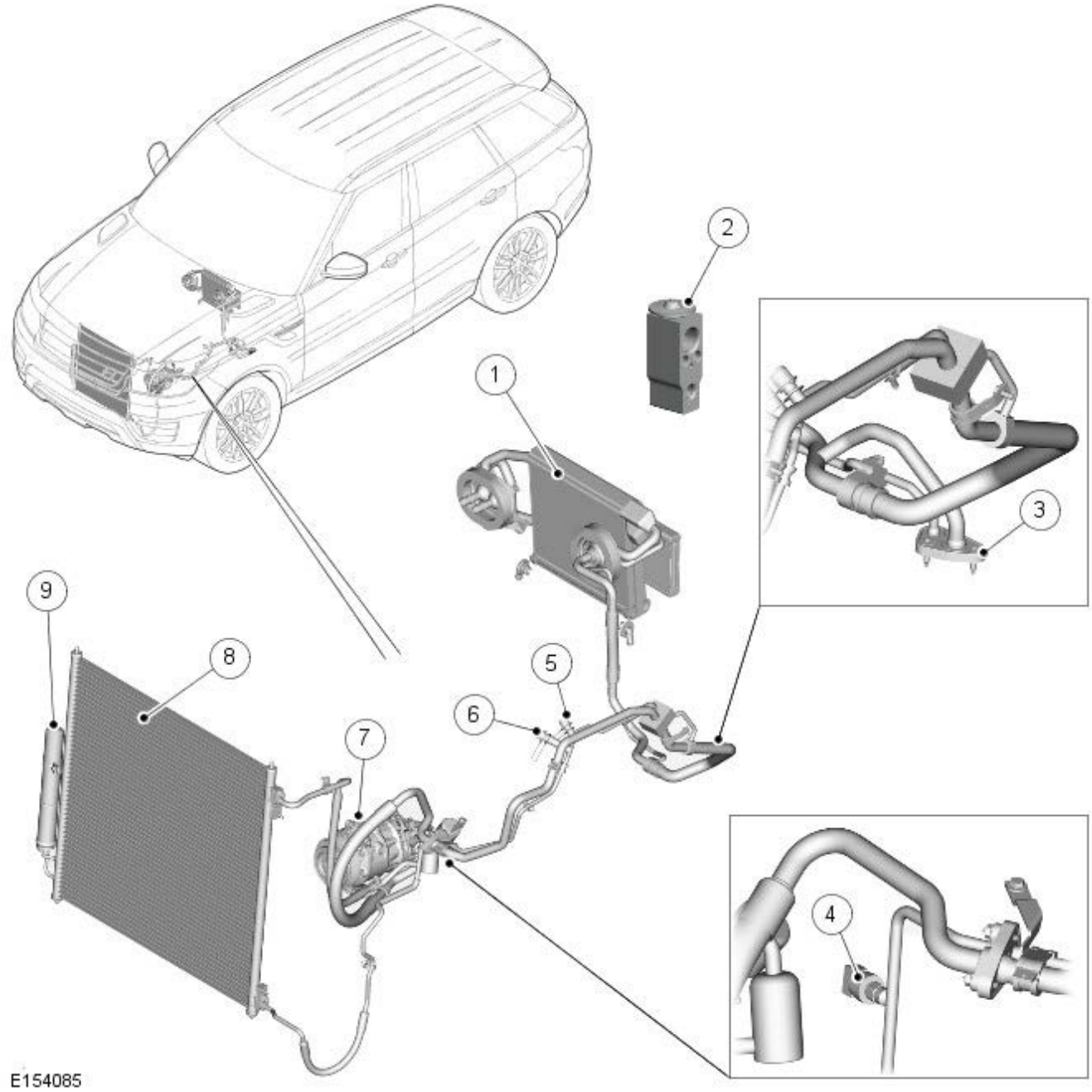
Published: 22-May-2013

Climate Control - Air Conditioning

Description and Operation

COMPONENT LOCATION

NOTE: Installation on V8 S/C 5.0L Petrol engine shown, other installations are similar.



Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic eXpansion Valve (TXV)
3	-	Air conditioning connections for auxiliary climate control (where fitted)
4	-	Refrigerant pressure sensor
5	-	Low pressure servicing connection
6	-	High pressure servicing connection
7	-	Air conditioning compressor
8	-	Condensor
9	-	Receiver drier

OVERVIEW

The A/C (Air Conditioning) system is a sealed, closed loop system filled with a charge weight of refrigerant as the heat transfer medium. Depending on market, the refrigerant is either R1234yf or R134a. Oil is added to the

refrigerant to lubricate the internal components of the A /C compressor. The system consists of:

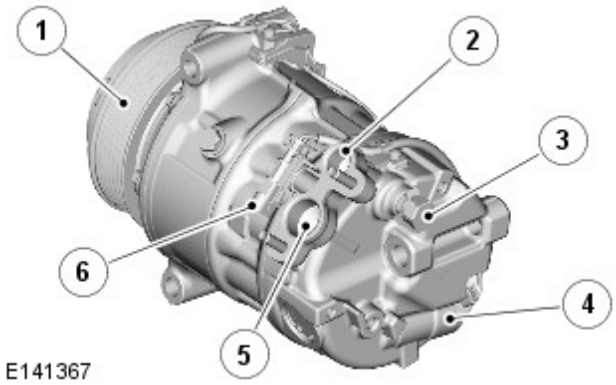
- An A/C compressor
- An A/C condensor
- A receiver drier
- A Thermostatic eXpansion Valve (TXV)
- An evaporator
- Low and high pressure refrigerant lines.

A pressure sensor in the high pressure refrigerant line allows the ATCM (Automatic Temperature Control Module) to monitor the status of the A/C system.
For additional information, refer to: Control Components (412-01A Climate Control, Description and Operation).

DESCRIPTION

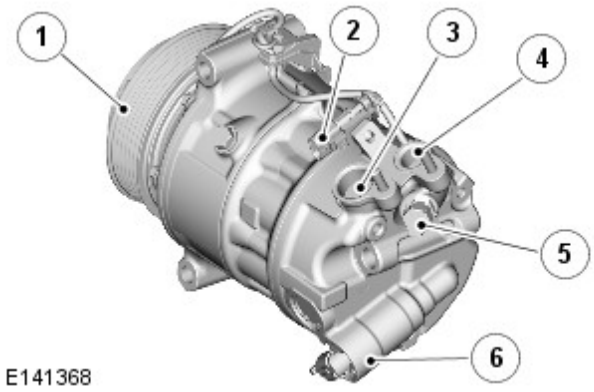
Air Conditioning Compressor

V8 S/C 5.0L Petrol, V6 S/C 3.0L Petrol and TDV8 4.4L Diesel



Item	Part Number	Description
1	-	Pulley
2	-	Refrigerant outlet port
3	-	Pressure relief valve
4	-	Electronic control valve
5	-	Refrigerant inlet port
6	-	Electrical connector

TDV6 3.0L Diesel



Item	Part Number	Description
1	-	Pulley
2	-	Electrical connector
3	-	Refrigerant inlet port
4	-	Refrigerant outlet port
5	-	Pressure relief valve
6	-	Electronic control valve

On all engine variants, the A/C compressor is a variable displacement unit attached to the front left side of the engine with three bolts.

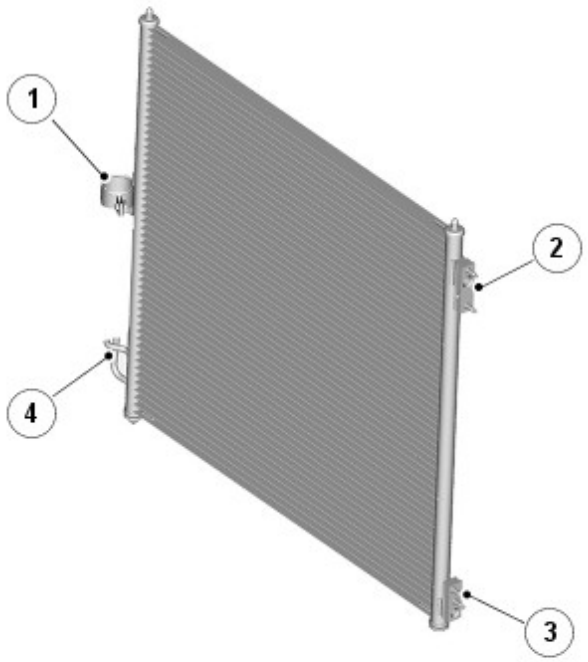
The compressor is driven by the engine accessory drive belt via an electro-magnetic clutch in the compressor pulley. The ATCM controls the operation of the electro-magnetic clutch. The clutch incorporates a thermal cut-off fuse, which disconnects the power feed from the ATCM module if the temperature increases to 182 ± 5 °C (360 ± 9 °F).

The displacement of the compressor is controlled by an integral electronic control valve, which is operated by the ATCM module. The ATCM module automatically adjusts the displacement of the A/C compressor, between the

minimum and maximum values, to match the thermal load of the evaporator.

To protect the refrigerant system from excessive pressure, a pressure relief valve is installed in the outlet side of the A/C compressor. The pressure relief valve vents excess pressure into the engine compartment.

Condensor



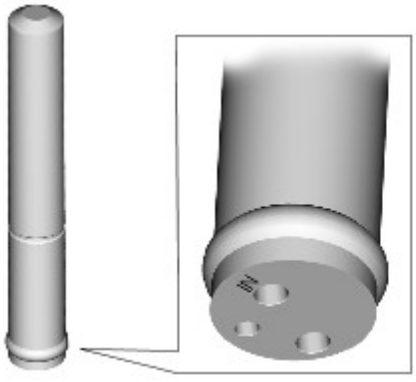
E141369

Item	Part Number	Description
1	-	Receiver drier attachment bracket
2	-	Refrigerant inlet port
3	-	Refrigerant outlet port
4	-	Receiver drier pipes

The condenser is installed immediately in front of the radiator. Pins on the bottom of the end tanks locate in bushes installed in brackets integrated into the bottom of the radiator. Two brackets attach pins on the top of the end tank to pins on the top of the radiator.

The condenser is classified as a sub-cooling condenser and consists of a fin and tube heat exchanger core installed between two end tanks. Divisions in the end tanks separate the heat exchanger into a four pass upper (condensor) section and a two pass lower (sub-cooler) section. Two connector blocks on the left end tank of the condenser provide connections for the high pressure lines from the A/C compressor and the evaporator. Two pipes at the bottom of the right end tank of the condenser provide connections for the receiver drier.

Receiver Drier



E141370

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. The body of the receiver drier is installed in 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 (TXV)

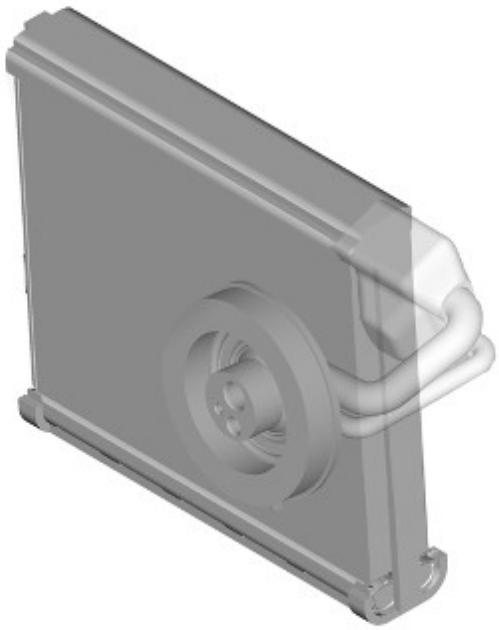


E127740

The thermostatic expansion valve is a block type valve attached to the inlet and outlet ports of the evaporator, under a thermal insulation cover.

Two bolts secure the refrigerant pipes and the thermostatic expansion valve to the inlet and outlet ports of the evaporator.

Evaporator

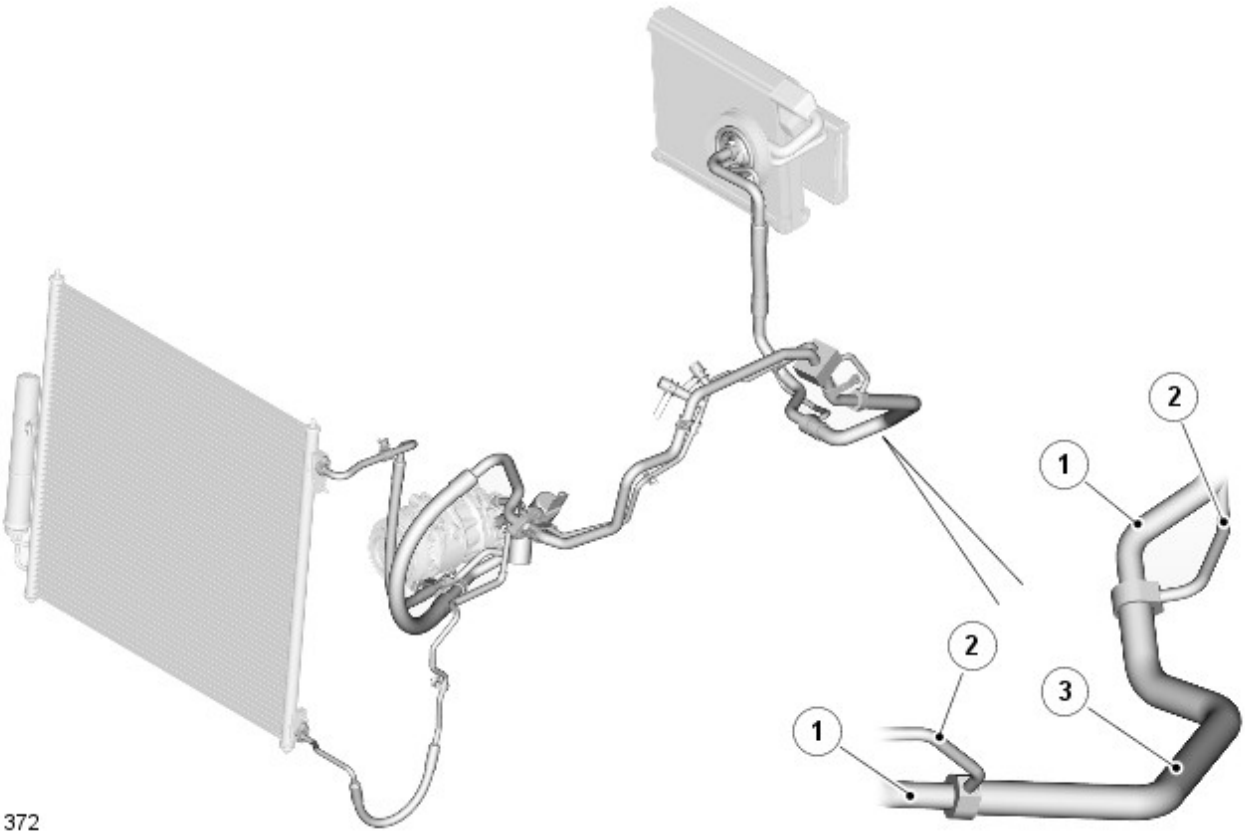


E141371

The evaporator is a fin and tube heat exchanger installed in the heater assembly, between the blower and the heater core.

Refrigerant Lines

NOTE: V8 S/C 5.0L Petrol engine installation is shown, other installations are similar.



Item	Part Number	Description
1	-	Low pressure pipe
2	-	High pressure pipe
3	-	Internal heat exchanger

The refrigerant lines consist of a combination of rigid pipes and flexible hoses that connect the thermostatic expansion valve on the evaporator to the A/C compressor and the condenser. An internal heat exchanger increases the efficiency of the evaporator and ensures any residual liquid in the low pressure line is evaporated before it reaches the compressor.

NOTE: The internal heat exchanger is incorporated primarily because of the introduction of refrigerant R1234yf (which is less efficient than refrigerant R134a), but is included in all systems for commonality reasons.

Low and high pressure servicing connections are incorporated into the refrigerant lines for system servicing. The high pressure line also incorporates a refrigerant pressure sensor for the climate control system.
For additional information, refer to: Control Components (412-01A Climate Control, Description and Operation).

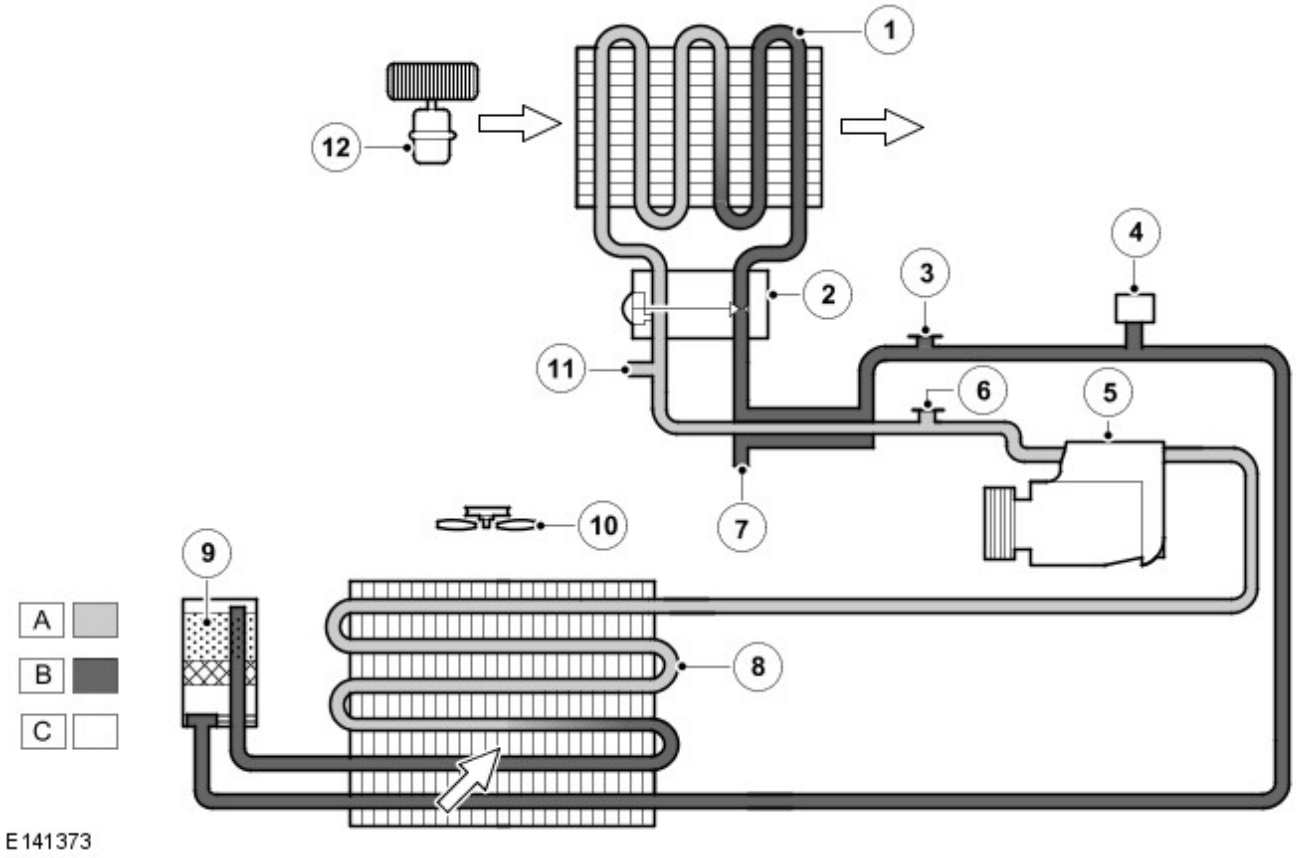
On vehicles with auxiliary climate control, connections for the auxiliary A/C system are incorporated into the refrigerant lines in the left rear corner of the engine compartment.
For additional information, refer to: Auxiliary Climate Control (412-02A Auxiliary Climate Control, Description and Operation).

OPERATION

The A/C compressor circulates the 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. In the condenser the vapor converts to a liquid, which then passes through the receiver drier and out of the condenser to the thermostatic expansion valve. As it passes through the thermostatic expansion valve, the liquid refrigerant changes to a fine, low pressure, spray, which is directed into the evaporator. In the evaporator the refrigerant changes back to a low pressure, low temperature vapor, as it absorbs heat from the air in the passenger compartment, then returns to the A/C compressor to begin the cycle again.

Operation of the air conditioning system is controlled by the ATCM, which adjust the electronic control valve in the A/C compressor to match the refrigerant flow around the system to the thermal load of the evaporator. By matching refrigerant flow to the thermal load of the evaporator, the ATCM maintains the required temperature in the passenger compartment while maximizing fuel economy.

Air Conditioning System Schematic



A = Refrigerant vapor; B = Refrigerant liquid; C = Air flow.

Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic eXpansion Valve (TXV)
3	-	High pressure servicing connection
4	-	Refrigerant pressure sensor
5	-	Air conditioning (A/C) compressor
6	-	Low pressure servicing connection
7	-	High pressure connection for auxiliary climate control (where fitted)
8	-	Condensor
9	-	Receiver drier
10	-	Engine cooling fan(s)
11	-	Low pressure connection for auxiliary climate control (where fitted)
12	-	Blower

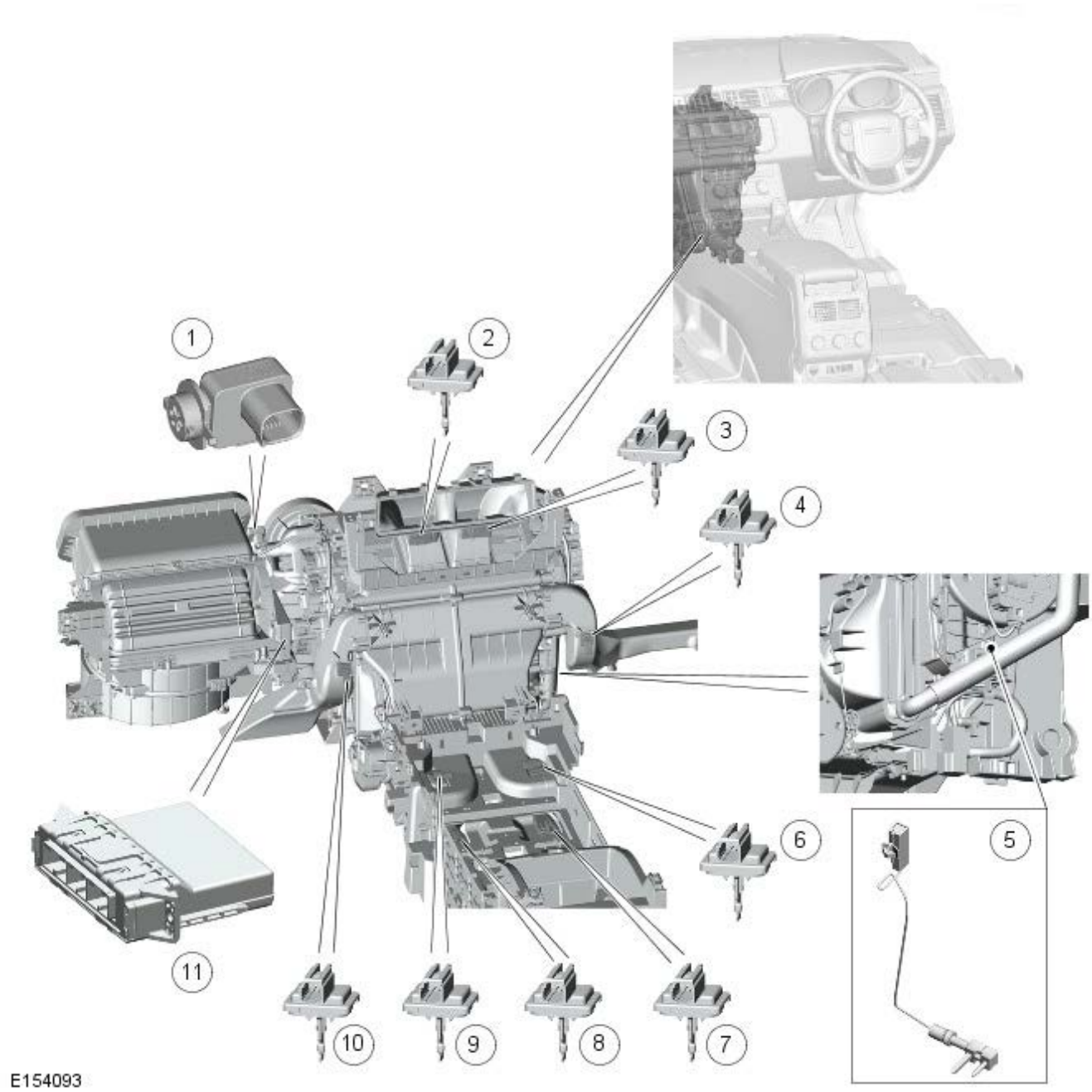
Published: 22-May-2013

Climate Control - Control Components

Description and Operation

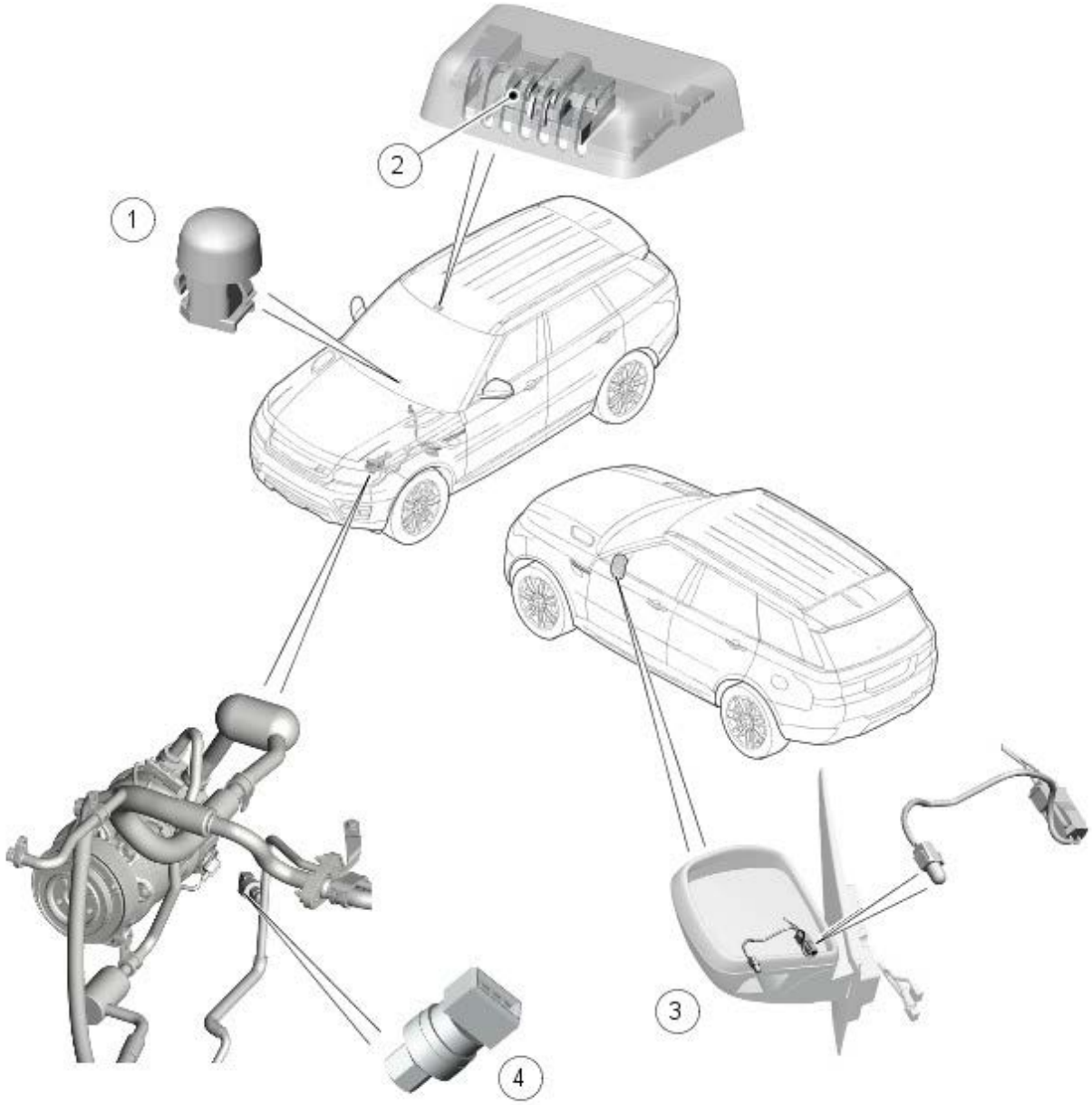
COMPONENT LOCATION - SHEET 1 OF 3

NOTE: RHD (Right-hand drive) installation shown, LHD (Left-hand drive) installation similar.



Item	Part Number	Description
1	-	Pollution sensor
2	-	Duct air temperature sensor - left front face
3	-	Duct air temperature sensor - right front face
4	-	Duct air temperature sensor - right front foot
5	-	Evaporator temperature sensor
6	-	Duct air temperature sensor - right rear foot
7	-	Duct air temperature sensor - right rear face
8	-	Duct air temperature sensor - left rear face
9	-	Duct air temperature sensor - left rear foot
10	-	Duct air temperature sensor - left front foot
11	-	Automatic Temperature Control Module (ATCM)

COMPONENT LOCATION - SHEET 2 OF 3

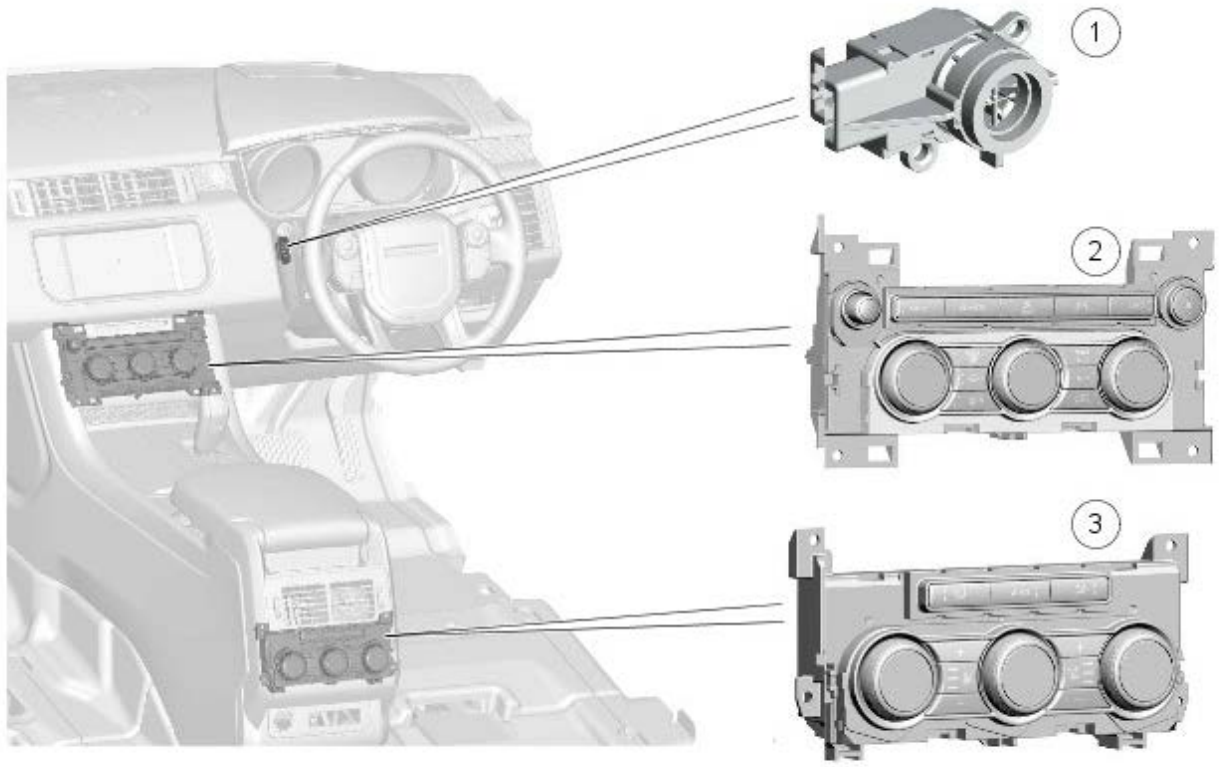


E154094

Item	Part Number	Description
1	-	Sunload sensor
2	-	Humidity sensor
3	-	Ambient Air Temperature (AAT) sensor
4	-	Refrigerant pressure sensor (TDV6 3.0L diesel installation shown, other installations similar)

COMPONENT LOCATION - SHEET 3 OF 3

NOTE: RHD installation shown, LHD installation similar.



E154095

Item	Part Number	Description
1	-	In-vehicle temperature sensor
2	-	Integrated Control Panel (ICP)
3	-	Rear Integrated Control Panel (RICP)

OVERVIEW

The standard climate control system operates the A/C (Air Conditioning) system and the heating and ventilation system to control the temperature, volume and distribution of air from the climate control assembly. Operation can be fully automatic, but manual overrides are provided for the intake air source, blower speed and air distribution. The standard climate control system is a three zone system that maintains the individual temperature levels selected for the driver, front passenger and rear seat passenger areas of the vehicle.

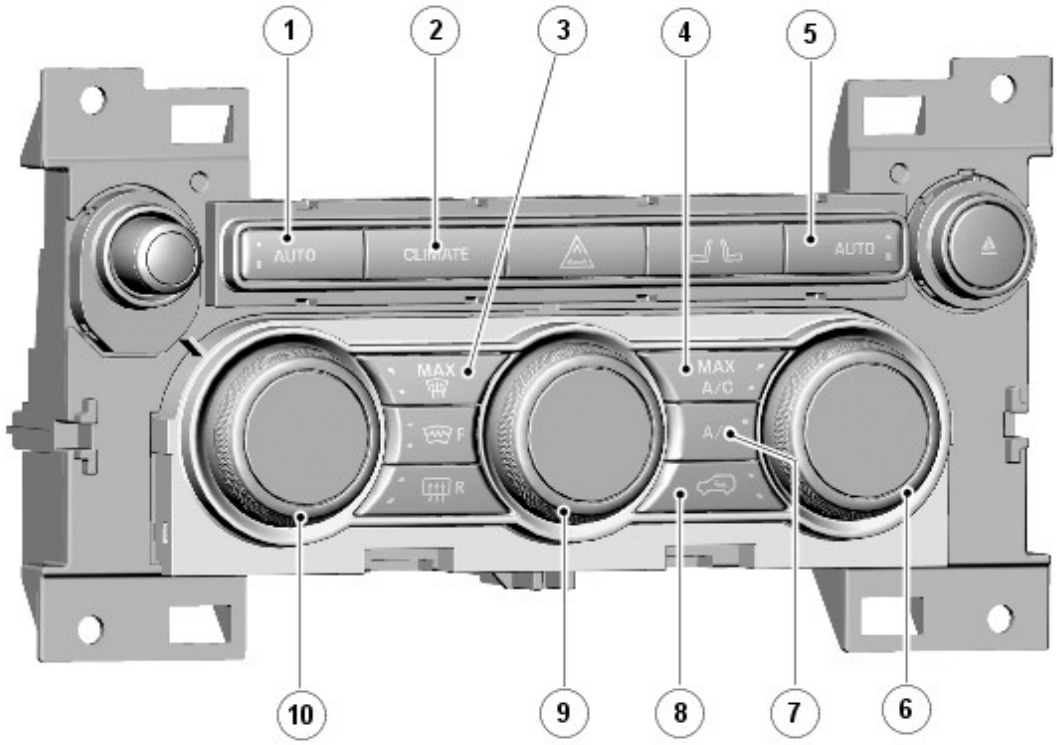
Auxiliary climate control (where fitted) provides individual control for the left and right rear seat passenger areas to give a four zone climate control system.
For additional information, refer to: Auxiliary Climate Control (412-02A Auxiliary Climate Control, Description and Operation).

The standard climate control system consists of the following components:

- Integrated Control Panel (ICP)
- Rear Integrated Control Panel (RICP)
- Automatic Temperature Control Module (ATCM)
- Ambient Air Temperature (AAT) sensor
- Refrigerant pressure sensor
- Evaporator temperature sensor
- In-vehicle temperature sensor
- Humidity sensor
- Front and rear sunload sensors
- Pollution sensor
- Duct air temperature sensors.

DESCRIPTION

Integrated Control Panel



E141125

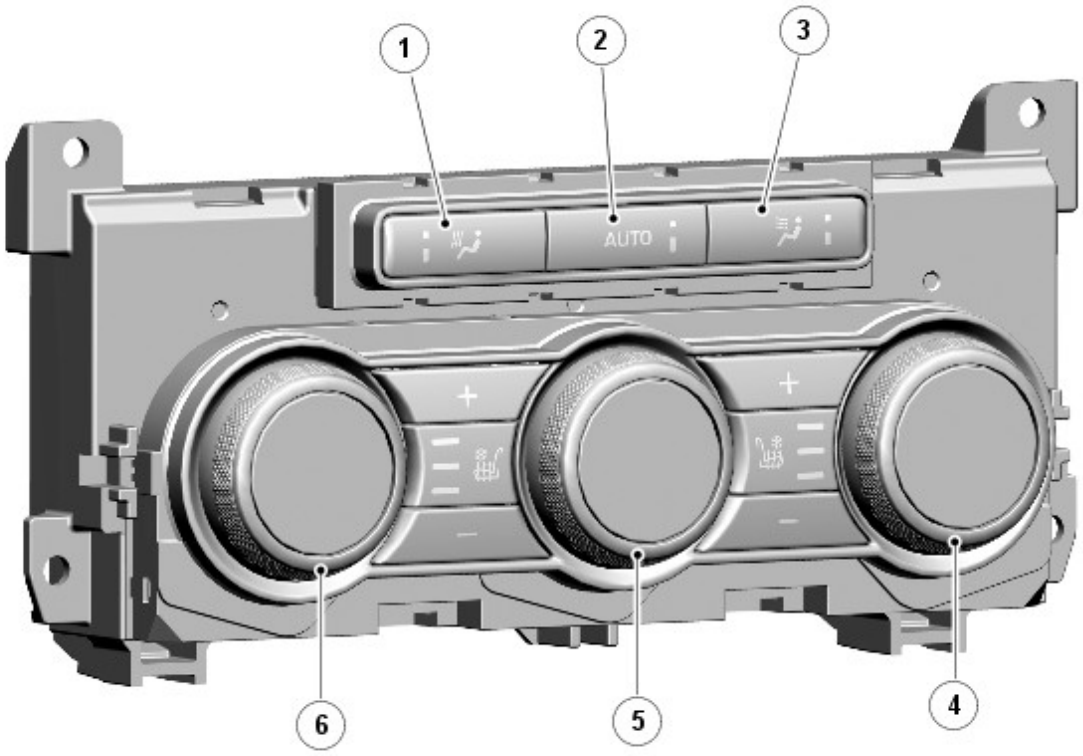
Item	Part Number	Description
1	-	Left automatic mode switch
2	-	Climate control menu switch
3	-	Maximum demist switch
4	-	Maximum air conditioning switch
5	-	Right automatic mode switch
6	-	Right temperature switch
7	-	Air conditioning system on/off switch
8	-	Recirculation switch
9	-	Blower switch
10	-	Left temperature switch

The ICP (Integrated Control Panel) is installed in the center of the instrument panel and contains push switches and rotary switches for operation of the climate control system. Each push switch contains an amber status LED (Light Emitting Diode). Display screens are integrated into the center of the rotary switches to display the selected temperature and blower speed as applicable. In addition to the switches for the climate control system, the ICP also contains switches for operation of:

- The audio system.
  For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).
- The hazard warning lamps.
  For additional information, refer to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).
- The front seat heaters/climate system.
  For additional information, refer to: Seats (501-10, Description and Operation).
- The windshield and rear window heaters.
  For additional information, refer to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).

The ICP converts selections on the climate control switches into medium speed CAN (Controller Area Network) Comfort messages and transmits them to the ATCM module.

Rear Integrated Control Panel



E141159

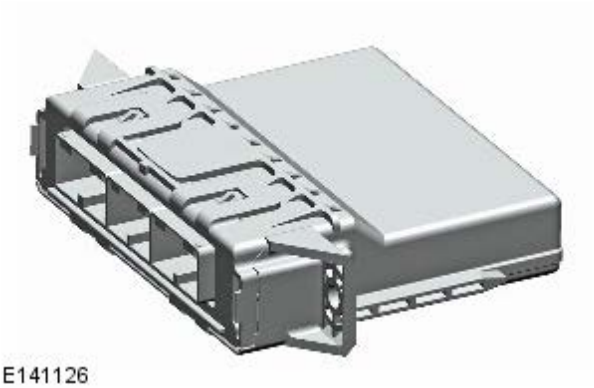
Item	Part Number	Description
1	-	Foot distribution switch
2	-	Automatic mode switch
3	-	Face distribution switch
4	-	Right temperature switch
5	-	Blower switch
6	-	Left temperature switch

On standard climate control systems the RICP (Rear Integrated Control Panel) is installed in the rear of the floor console. The control panel contains rotary and push button switches for controlling the temperature, volume and distribution of air to the rear seats. Each push switch contains an amber status LED. Display screens are integrated into the center of the rotary switches to display the selected temperature and blower speed as applicable.

Additional push switches on the rear ICP are provided for control of seat heating/climate control seats.
For additional information, refer to: Seats (501-10, Description and Operation).

The RICP has a permanent battery power feed from the CJB (Central Junction Box), and is connected to the medium speed CAN bus. The RICP converts selections on the climate control switches into medium speed CAN Comfort messages and transmits them to the ATCM (Automatic Temperature Control Module).

Automatic Temperature Control Module



E141126

The ATCM is mounted on the inboard side of the air inlet duct, behind the front passenger side of the instrument panel.

The ATCM processes inputs from the climate control system sensors, the ICP, the RICP, the TS (Touch Screen) and other systems, then outputs the appropriate control signals to the A/C system and the heating and ventilation system. In addition to the A/C system and the heating and ventilation system, the ATCM also controls the following:

- The windshield washer jet heaters and the wiper blade heater.
  For additional information, refer to: Wipers and Washers (501-16 Wipers and Washers, Description and Operation).
- The front and rear seat heaters (where fitted).
  For additional information, refer to: Seats (501-10, Description and Operation).
- Auxiliary climate control system (where fitted).
  For additional information, refer to: Auxiliary Climate Control (412-02A Auxiliary Climate Control, Description and Operation).
- Fuel Fired Booster Heater (FFBH) (where fitted).
  For additional information, refer to: Fuel Fired Booster Heater (412-02A Auxiliary Climate Control, Description and Operation).
- Electric booster heater (where fitted).
  For additional information, refer to: Electric Booster Heater (412-02A Auxiliary Climate Control, Description and Operation).

Ambient Air Temperature Sensor



E116093

The (AAT) Ambient Air Temperature sensor is a NTC (Negative Temperature Coefficient) thermistor installed in the left exterior rear view mirror, with the bulb of the sensor positioned over a hole in the bottom of the mirror casing.

The ECM (Engine Control Module) supplies the ambient air temperature sensor with a 5 V reference voltage and translates the return signal voltage into a temperature. The ECM transmits the temperature on the high speed CAN Powertrain bus for use by other systems. The ATCM receives the temperature, on the medium speed CAN Comfort bus, by the GWM (Gateway Module).

Refrigerant Pressure Sensor



E141128

The refrigerant pressure sensor is located in the high pressure refrigerant line between the condenser and the thermostatic expansion valve.

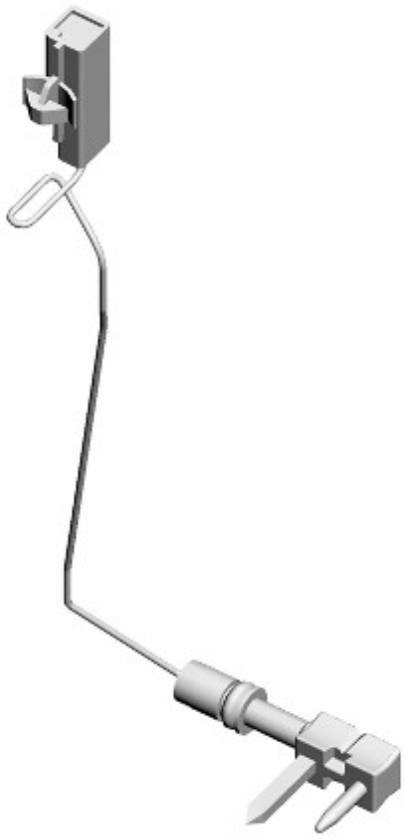
The ATCM supplies a 5 V reference voltage to the refrigerant pressure sensor and receives a return signal voltage related to system pressure.

The ATCM uses the signal from the refrigerant pressure sensor to protect the refrigerant system from extremes of pressure and to calculate the A/C compressor load on the engine. The ATCM transmits the A/C compressor load value to the ECM, via the medium speed CAN Comfort bus, GWM and high speed CAN Powertrain bus, for use in controlling the speed of the engine cooling fan.

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

- Decreases to 1.9 ± 0.2 bar (27.5 ± 3 lbf/in²); the ATCM loads the A/C compressor again when the pressure increases to 2.8 ± 0.2 bar (40.5 ± 3 lbf/in²).
- Increases to 33 ± 1 bar (479 ± 14.5 lbf/in²); the ATCM loads the A/C compressor again when the pressure decreases to 23.5 ± 1 bar (341 ± 14.5 lbf/in²).

Evaporator Temperature Sensor



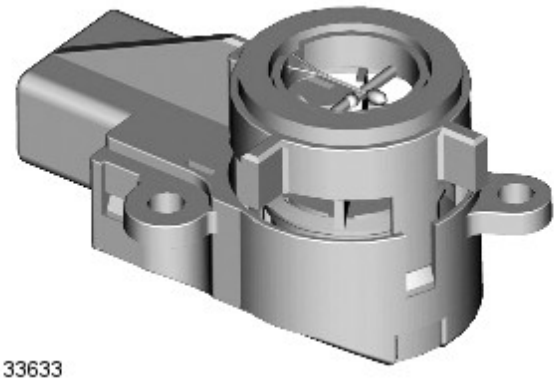
E97626

The evaporator temperature sensor is a NTC thermistor that provides the ATCM with a temperature signal from the air outlet side of the evaporator. The sensor extends into the air flow on the downstream side of the evaporator.

The ATCM 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.

The ATCM supplies the evaporator temperature sensor with a 5 V reference voltage and translates the return signal voltage into a temperature. If the sensor develops a fault, the ATCM adopts a default temperature of 0 °C (32 °F).

In-vehicle Temperature Sensor



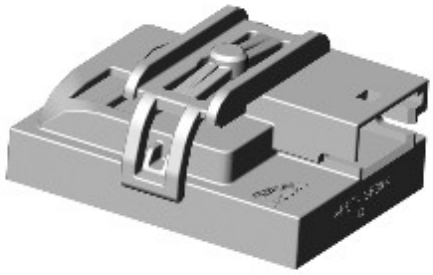
E133633

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. A motor driven fan in the sensor draws air through the grill and over the thermistor.

The ATCM uses the signal from the in-vehicle temperature sensor for control of the climate control assembly output temperatures, blower speed and air distribution.

The ATCM supplies the in-vehicle temperature sensor with a 5 V reference voltage and translates the return signal voltage into a temperature. If the in-vehicle temperature sensor develops a fault, the ATCM adopts a default temperature of 20 °C (68 °F).

Humidity Sensor



E141130

The humidity sensor is installed in a bracket attached to the inside of the windshield, to the right of the interior mirror. The sensor is concealed under a cover, which clips onto the bracket. The sensor comprises three individual elements:

- A capacitive humidity sensor
- A NTC thermistor air temperature sensor
- An infrared windshield glass temperature sensor.

The humidity sensor is powered by a feed from the battery saver relay in the CJB. The data from the three individual elements of the humidity sensor are transmitted in LIN (Local Interconnect Network) bus messages to the ATCM. From the data, the ATCM:

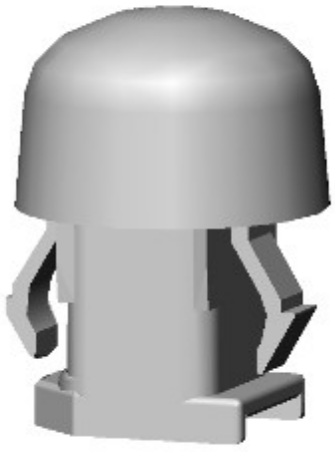
- Adjusts the humidity of the air in the vehicle as necessary, to provide the optimum comfort level for occupants
- Calculates the dew point temperature of the air at the inside of the windshield.

Humidity within the vehicle is controlled by raising or lowering the temperature of the evaporator. An increase in evaporator temperature increases the moisture content of the air at the windshield. Lowering the evaporator temperature reduces the moisture content of the air in the interior.

If the temperature of the windshield glass is equal to or less than the dew point temperature, misting is likely to occur. To prevent this, the ATCM will:

- Increase the temperature of the air leaving the climate control assembly
- Adjust the position of the demist motor to direct more air to the windshield
- Adjust the position of the recirculation motor to admit more fresh air
- Energize the windshield heater.

Sunload Sensor



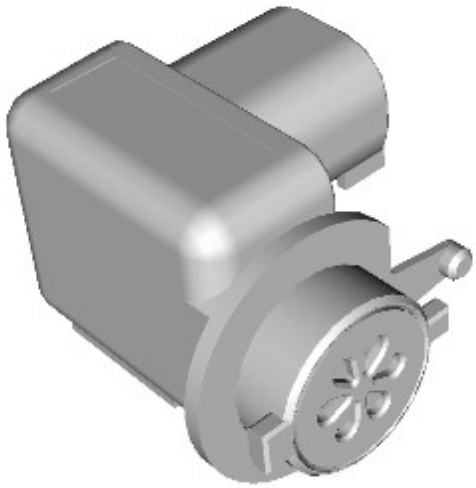
E154098

A front sunload sensor is installed. The sunload sensor is installed in the top of the instrument panel, in the center demist grille.

The ATCM supplies the sunload sensor with a 5 V reference voltage. The sensor contains photoelectric cells that provide the ATCM with two inputs of light intensity, which equates to the solar heating effect on the left and right sides of the vehicle.

The ATCM module compensates for the solar heating effect by adjusting blower speed, climate control assembly output temperature and air distribution to maintain the required zone temperatures.

Pollution Sensor



E154097

The sensor is mounted on the inboard side of the air inlet duct, in the fresh air inlet.

The pollution sensor has battery power, ground and signal connections with the ATCM module. Semiconductor material in the sensor undergoes a change of conductance if exposed to specific gases. The sensor uses this property to monitor for gases such as CO and NOx and so determine the quality of the fresh air entering the vehicle. The sensor transmits the air quality to the ATCM, in a PWM (Pulse Width Modulation) signal, as one of the following four conditions:

- Static or reduced pollution levels
- Small increase in pollution levels
- Medium increase in pollution levels
- Rapid or large increase in pollution levels.

Based on the signal from the pollution sensor, the ATCM controls the intake air source to reduce the amount of contaminants entering the interior. This function is fully automatic, but can be overridden by manual selection of the air intake source using the fresh/re-circulated air switch on the ICP.

Duct Air Temperature Sensors



E141132

The duct air temperature sensors are NTC thermistors installed in the following distribution ducts:

- Left and right center front face ducts
- Left and right front foot ducts
- Left and right second row foot ducts
- Left and right second row face ducts

The duct air temperature sensors are provided with 5V reference signal and ground connections with the ATCM. The ATCM uses the sensor inputs in the calculations used to set the temperatures of the air leaving the climate control assembly.

OPERATION

When the engine is running, the standard climate control system can be activated using the AUTO switches on the ICP, or the AUTO soft keys on the **Front climate** or **Rear climate** menus of the touch screen. Provided the rear climate control panel is unlocked (on the touch screen **Rear climate** menu), pressing the AUTO switch on the rear ICP will also activate the system.

Intake Air Control

The source of inlet air is automatically controlled by the ATCM, unless overridden by pressing the recirculation switch on the ICP to give timed or latched recirculation. A brief press of the switch illuminates the switch indicator and

activates timed recirculation. Pressing and holding the switch causes the switch indicator to flash and then illuminate constantly, indicating that the air inlet is in latched recirculation and the switch can be released. A second press of the switch cancels recirculation and the ATCM returns the recirculation door to the fresh air position. Timed recirculation is automatically cancelled after a set time, which varies with ambient air temperature.

During automatic control, the ATCM determines the required position of the recirculation door from comfort algorithms and the pollution sensor. If it detects pollution, the ATCM sets the air source to recirculation for 10 minutes, then to fresh air for 20 seconds to renew the air in the vehicle. The ATCM repeats this cycle until the pollution is no longer present.

The sensitivity of the pollution sensor can be adjusted on the TS, using the **Settings** soft key of the **Front climate** menu. The pollution sensing function can also be switched off by adjusting sensitivity to the minimum setting. If there is a fault with the pollution sensor, the ATCM disables automatic operation of the recirculation door.

Air Temperature Control

The ATCM calculates the temperature blend motor positions required to achieve the selected temperature and compares it against the current position. If there is any difference, the ATCM signals the motors to adopt the new position.

Air temperature is controlled automatically unless maximum heating (HI) or maximum cooling (LO) is selected. When maximum heating or cooling is selected, a comfort algorithm in the ATCM adopts an appropriate strategy for air distribution, blower speed, and air source.

Temperature control in one zone can be compromised by another zone being set to a high level of heating or cooling. True maximum heating or cooling (displayed as **HI** or **LO** on the TS and switches) can only be selected for the driver zone. If HI or LO is selected for the driver zone, the temperature for the other zones is automatically set to match the driver zone.

If A/C is selected off in the automatic mode, no cooling of the inlet air will take place. The minimum output air temperature from the system will be ambient air temperature plus any heat pick up in the air inlet path.

If the **Sync** soft key on the TS **Front climate** menu is pressed, the ATCM synchronizes the temperature of the other zones with the driver zone temperature.

Blower Control

When the system is in the automatic mode, the ATCM determines the blower speed required from a comfort algorithm. When the system is in the manual mode, the ATCM operates the blower at the speed selected on the ICP or TS. The ATCM also adjusts blower speed to compensate for the ram effect on inlet air produced by forward movement of the vehicle. As vehicle speed and ram effect increases, blower motor speed is reduced, and vice versa.

The blower switch on the rear ICP has no control over the blower in the climate control assembly. Instead, the ATCM adjusts the rear distribution doors to increase the air flow through the rear distribution ducts from the climate control assembly.

Air Distribution Control

When the A/C system is in automatic mode, the ATCM automatically controls air distribution into the passenger compartment in line with its comfort algorithm. Automatic control is overridden by distribution selections on the TS, the ICP or the RICP. Air distribution remains as selected until one of the AUTO is selected or a different manual selection is made.

Air Conditioning Compressor Control

When A/C is selected the ATCM maintains the evaporator at an operating temperature that varies with the passenger compartment cooling requirements. If the requirement for cooled air decreases, the ATCM module raises the evaporator operating temperature by reducing the flow of refrigerant provided by the A/C compressor. The ATCM closely controls the rate of temperature increase to avoid introducing moisture into the passenger compartment.

If the requirement for cooled air increases, the ATCM lowers the evaporator operating temperature by increasing the flow of refrigerant provided by the A/C compressor.

When A/C is off, the compressor current signal supplied by the ATCM holds the A/C compressor control valve in the minimum flow position and disengages the clutch to switch off the A/C function.

The ATCM incorporates limits for the operating pressure of the refrigerant system. If the system approaches the high pressure limit, the compressor current signal is progressively reduced until the system pressure decreases. If the system falls below the low pressure limit, the compressor current signal is held at its lowest setting so that the A/C compressor is maintained at its minimum stroke. This avoids depletion of the lubricant from the A/C compressor.

Air Conditioning Compressor Torque

The ATCM transmits refrigerant pressure and A/C compressor current values to the medium speed CAN Comfort bus, then through the GWM onto the high speed CAN Powertrain bus, and to the ECM. The ECM uses these values to calculate the torque being used to drive the A/C compressor. The ECM compares the calculated value with its allowable value and, if necessary, forces the ATCM to inhibit the A/C compressor by transmitting the 'ACClutchInhibit' CAN message. This forces the ATCM to reduce the drive current to the A/C compressor control valve, which reduces refrigerant flow. This in turn reduces the torque required to drive the A/C compressor.

By reducing the maximum A/C compressor torque, the ECM is able to reduce the load on the engine when it needs to maintain vehicle performance or cooling system integrity.

Cooling Fan Control

The ATCM determines the amount of condenser cooling required from the refrigerant pressure sensor, since there is a direct relationship between the temperature and pressure of the refrigerant. The cooling requirement is broadcast on the medium speed CAN Comfort bus. Then this message is transmitted through the GWM, onto the high speed CAN Powertrain bus, and to the ECM. The ECM then controls the temperature of the condenser using the cooling fan(s).

Maximum Demist

When the MAX demist switch on the ICP is pressed, the ATCM configures the climate control system as follows:

- Automatic mode off.
- A/C on.
- Selected temperature unchanged.
- Air inlet set to fresh air.
- Air distribution set to windshield.
- Blower speed set to high speed.

The ATCM also sends a medium speed CAN Comfort message through the GWM, to the CJB to activate the windshield and rear window heaters.

The programmed demist function can be cancelled by one of the following:

- A second press of the MAX demist switch.
- Selecting any air distribution soft key on the touch screen.
- Pressing the driver side AUTO switch on the ICP.
- Switching the ignition OFF.

The blower speed can be adjusted without terminating the programmed demist function. If the blower speed has been adjusted and then the MAX demist switch is pressed again, the system will go back to the MAX demist default settings. If the MAX demist program is cancelled with the MAX demist switch or the driver side AUTO switch, the windshield and rear window heaters remain on until they time out.

Rest Heat (Vehicles With Fuel Fired Booster Heater Only)

When the engine is not running, pressing the **Rest heat** soft key on the TS **Front climate** menu activates the rest heat function to heat the passenger compartment with residual heat from the engine. The rest heat function activates provided that:

- It is less than 2 minutes since the ignition was selected off.
- Ambient air temperature is less than 15 °C (59 °F).
- On the previous ignition cycle engine temperature exceeded 70 °C (158 °F).
- Battery voltage is 11.4 V minimum.

To provide the rest heat function, the ATCM:

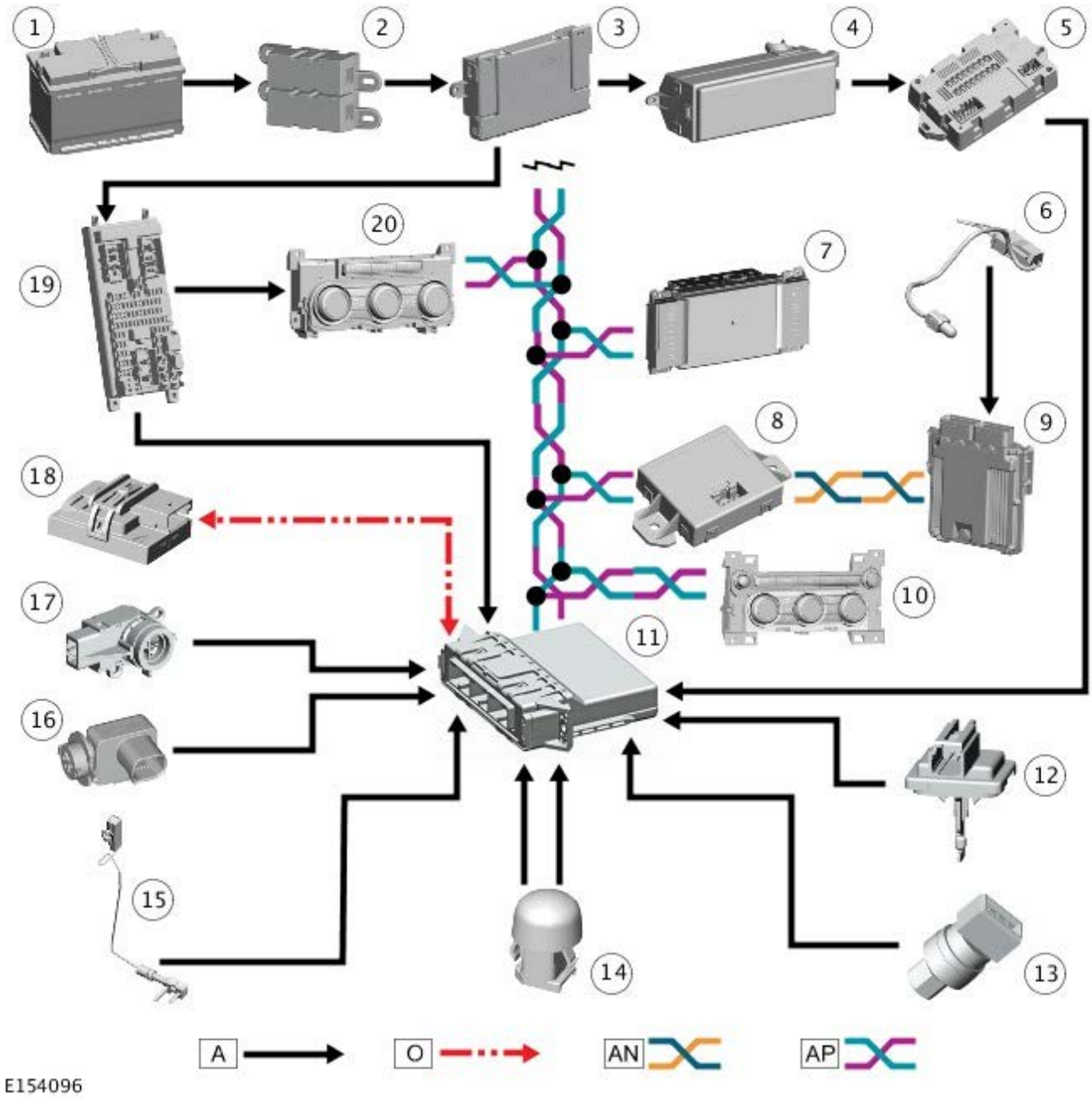
- Sends a LIN bus message to the FFBH (Fuel Fired Booster Heater) control module to run the FFBH coolant pump.
- Operates the blower at medium speed.
- Sets the distribution doors to direct air to the face outlets.
- Sets the temperature blend doors to produce the temperature selected on the driver side before the ignition was switched off.

The rest heat function is cancelled after 15 minutes or when:

- The **Rest heat** soft key is pressed again.
- The ignition is selected on.
- Battery voltage decreases to less than 11 V.

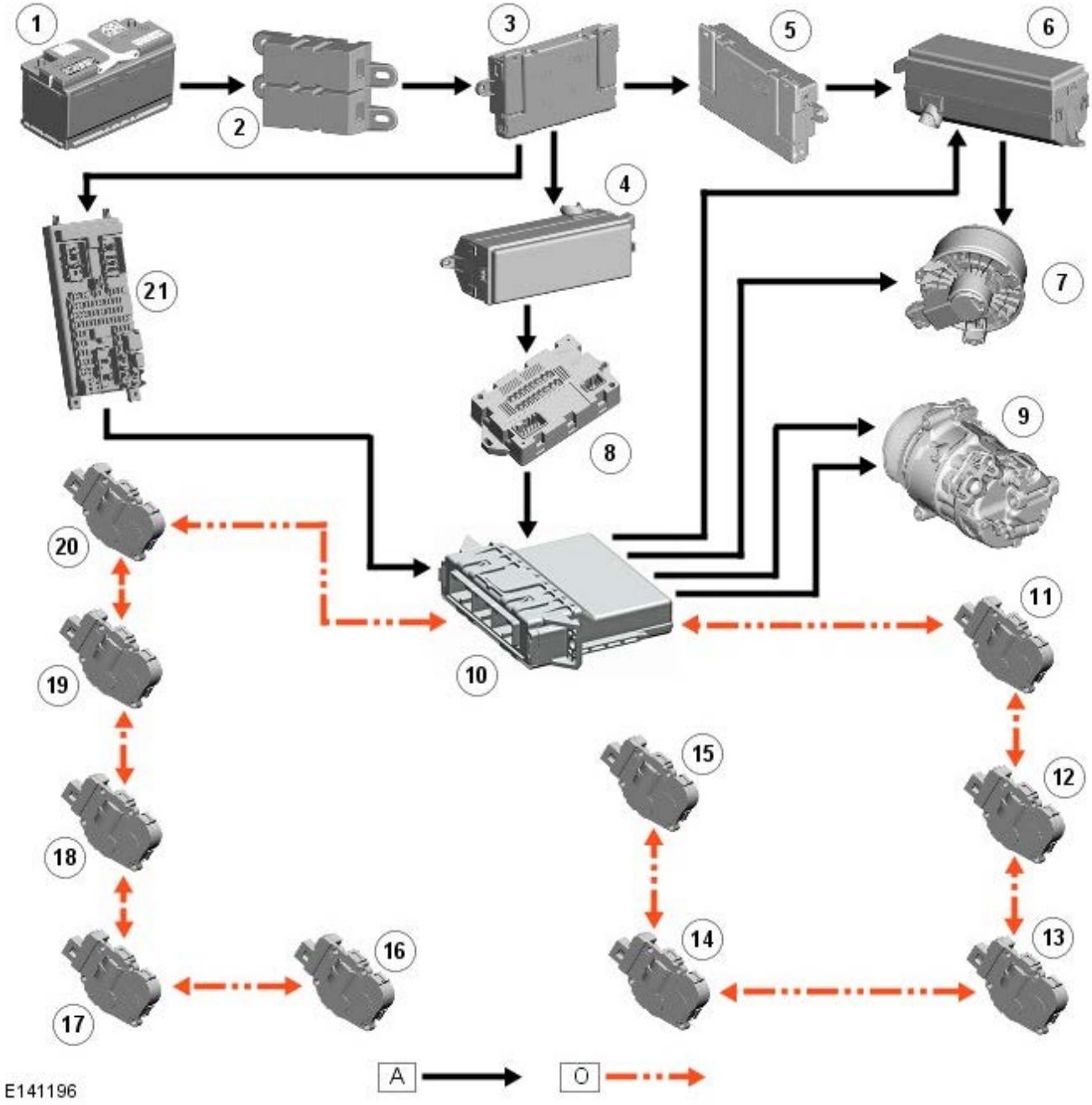
Control Diagram - Sheet 1 of 2 (Inputs)

NOTE: A = Hardwired, O = LIN (Local Interconnect Network) bus, AN = High speed CAN (Controller Area Network) Powertrain bus, AM = Medium speed CAN Comfort bus.



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)
3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)
5	-	Quiescent Current Control Module (QCCM)
6	-	Ambient Air Temperature (AAT) sensor
7	-	Touch Screen (TS)
8	-	Gateway module (GWM)
9	-	Engine Control Module (ECM)
10	-	Integrated Control Panel (ICP)
11	-	Automatic Temperature Control Module (ATCM)
12	-	Duct air temperature (8 off)
13	-	Refrigerant pressure sensor
14	-	Sunload sensor
15	-	Evaporator temperature sensor
16	-	Pollution sensor
17	-	In-vehicle temperature sensor
18	-	Humidity sensor
19	-	Central Junction Box (CJB)
20	-	Rear Integrated Control Panel (RICP)

Control Diagram - Sheet 2 of 2 (Outputs)



A = Hardwired; O = LIN bus.

Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)
3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)
5	-	Auxiliary Junction Box (AJB)
6	-	Engine Junction Box (EJB)
7	-	Blower
8	-	Quiescent Current Control Module (QCCM)
9	-	Air conditioning compressor
10	-	Automatic Temperature Control Module (ATCM)
11	-	Recirculation motor
12	-	Cool air bypass motor
13	-	Distribution motor - right front face and feet
14	-	Temperature blend motor - right front
15	-	Temperature blend motor - right rear
16	-	Distribution motor - left front face and feet
17	-	Temperature blend motor - left front
18	-	Temperature blend motor - left rear

19	-	Distribution motor - rear face and feet
20	-	Distribution motor - demist
21	-	Central Junction Box (CJB)

Published: 16-May-2013

Climate Control - Blower Motor

Removal and Installation

Removal

NOTES:

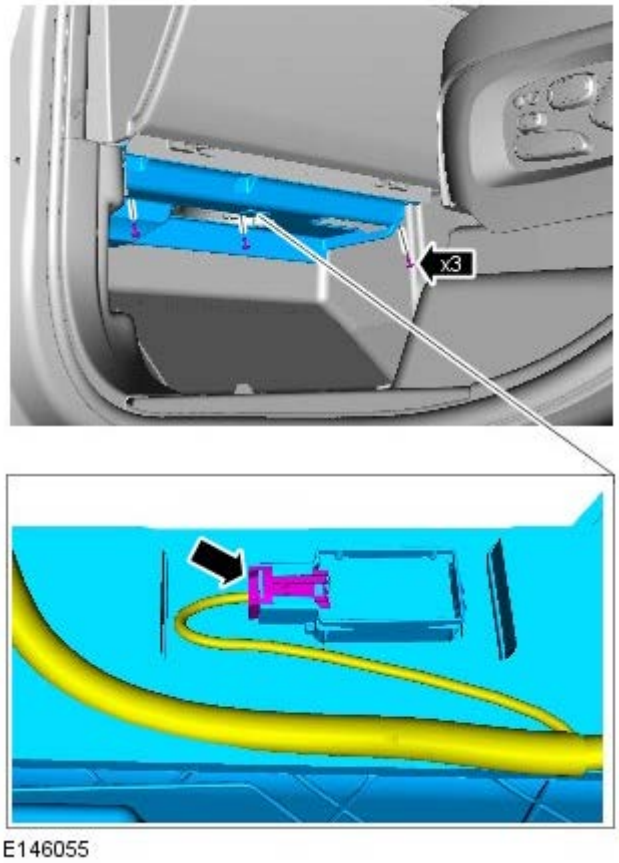
Removal steps in this procedure may contain installation details.

Right Hand illustration shown, Left Hand is similar.

1. Disconnect the battery ground cable.

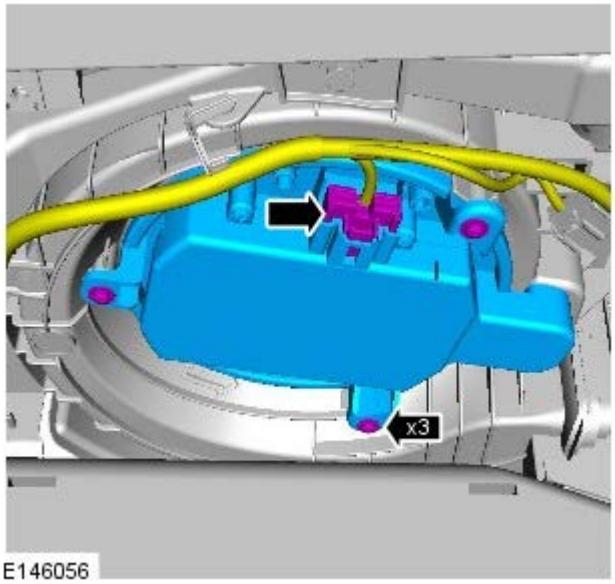
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2.



E146055

3.



Installation

1. To install, reverse the removal procedure.

Published: 16-May-2013

Climate Control - Center Registers

Removal and Installation

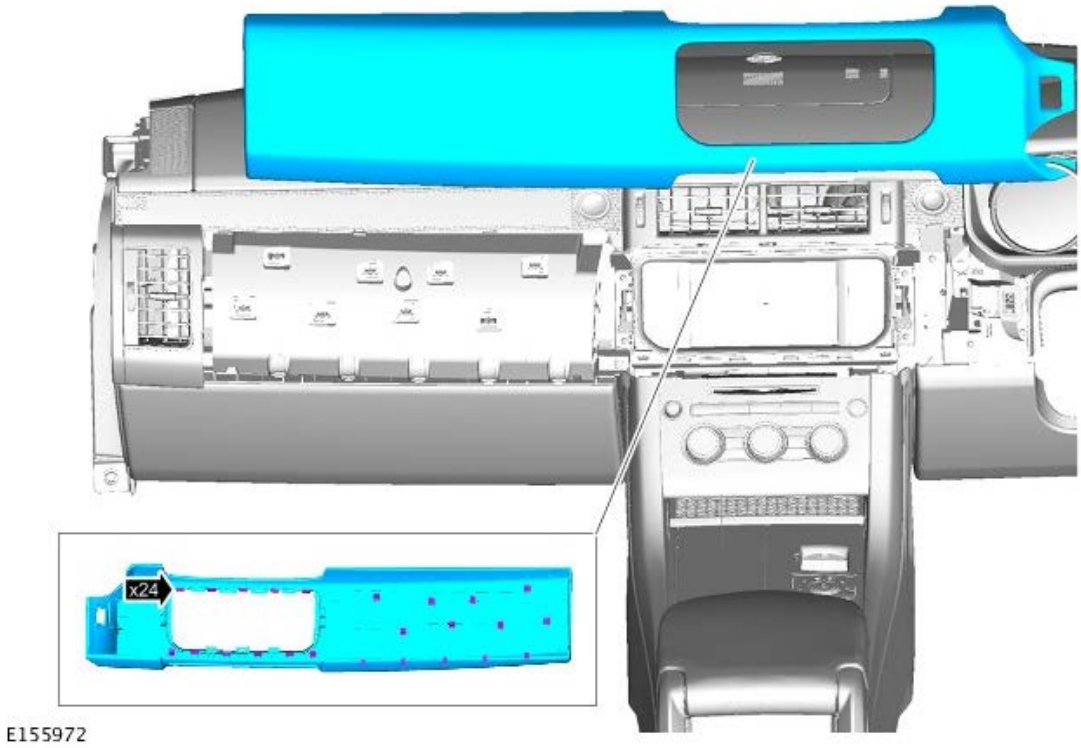
Removal

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.

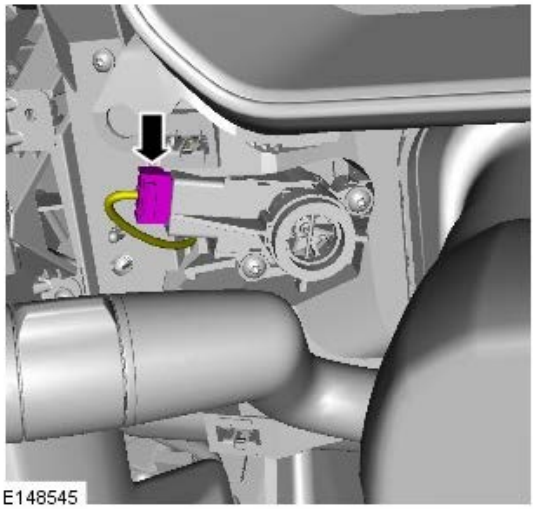


2.

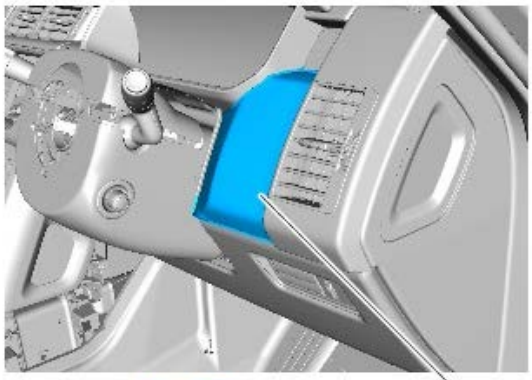


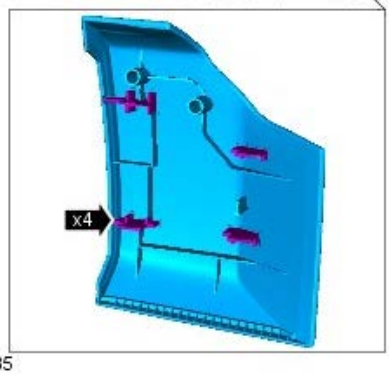


3.



E148545



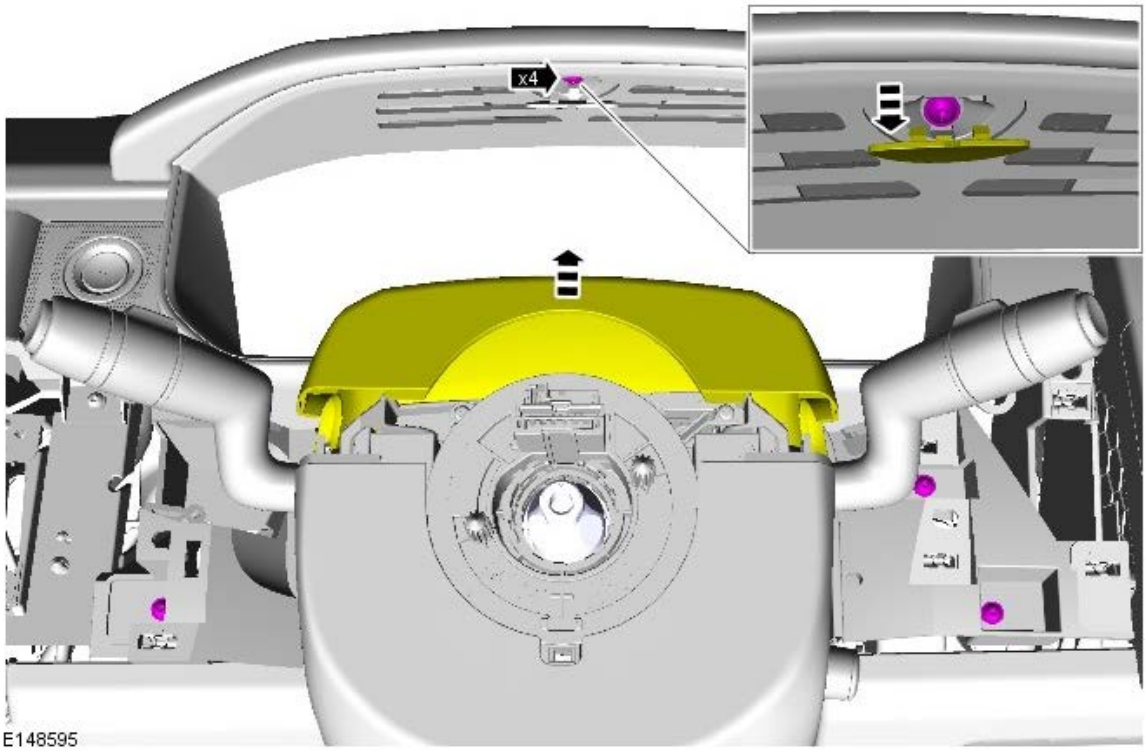


E148285

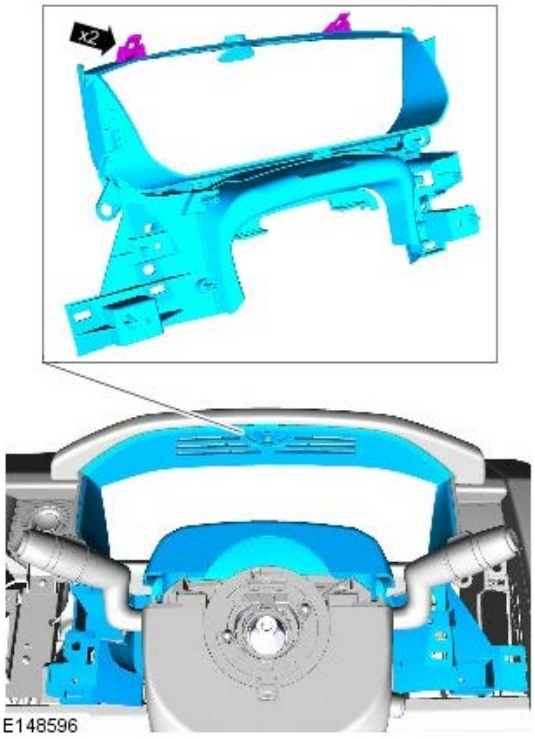
4. NOTE: The steering wheel is shown removed for clarity.

5. NOTE: The steering wheel is shown removed for clarity.

Torque:
1.7 Nm

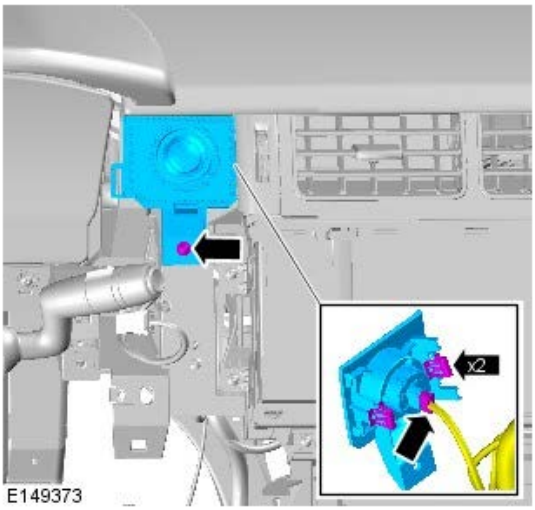


6. NOTE: The steering wheel is shown removed for clarity.

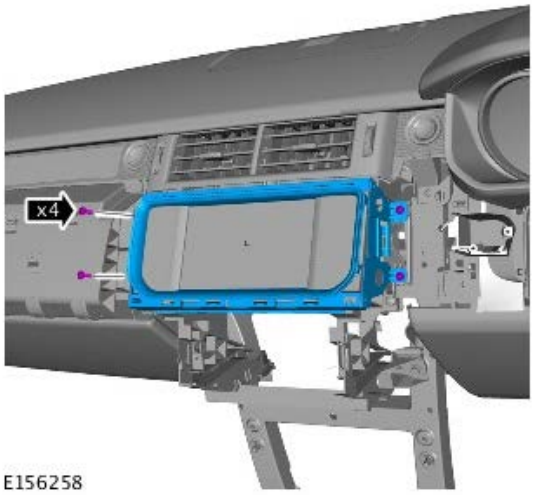


7. NOTE: Left Hand illustration shown, Right Hand is similar.

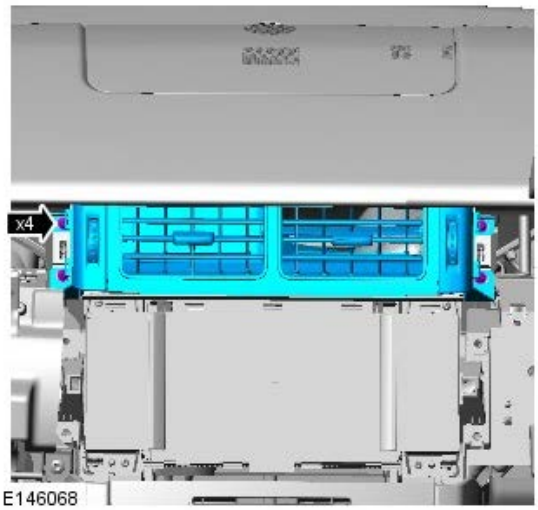
Torque: 1.7 Nm



8.



9.



Installation

1. NOTE: Install the trim retaining clips in the moulding prior to installing the components.



E149095

2. To install, reverse the removal procedure.

Published: 02-May-2013

Climate Control - Climate Control Assembly

Removal and Installation

Removal

NOTES:

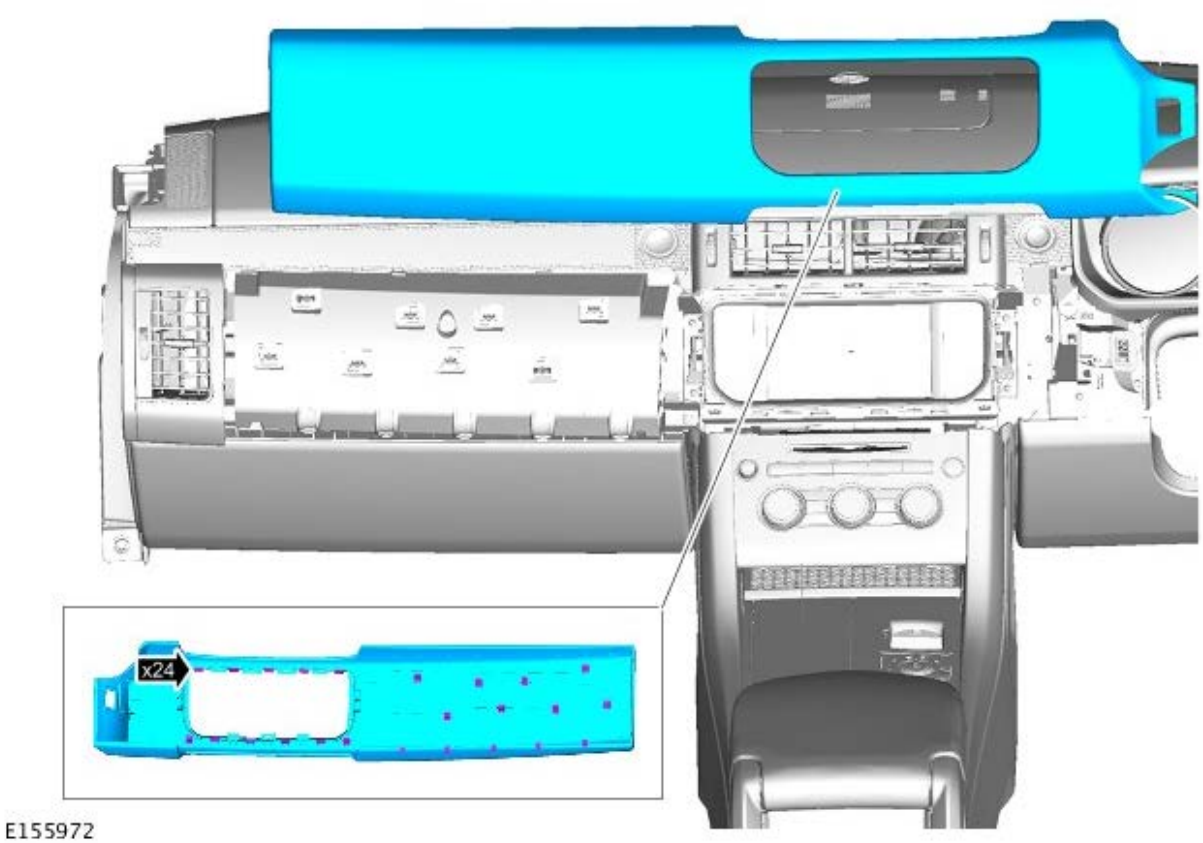
Removal steps in this procedure may contain installation details.

Some components shown removed for clarity.

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

1. Refer to: Specifications (414-01 Battery, Mounting and Cables, Specifications).

2.



3.



E155713

4. *Torque:* 9 Nm



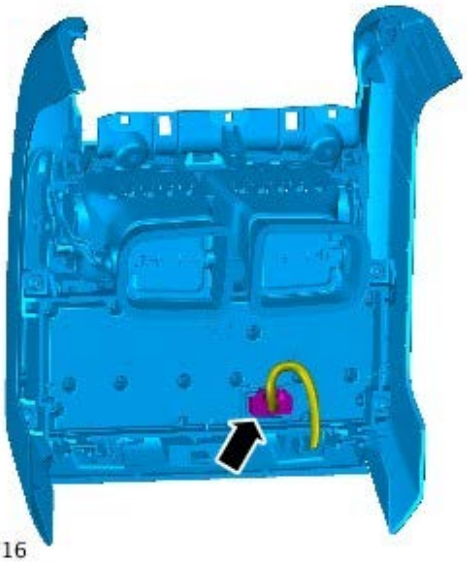
E155714

5.



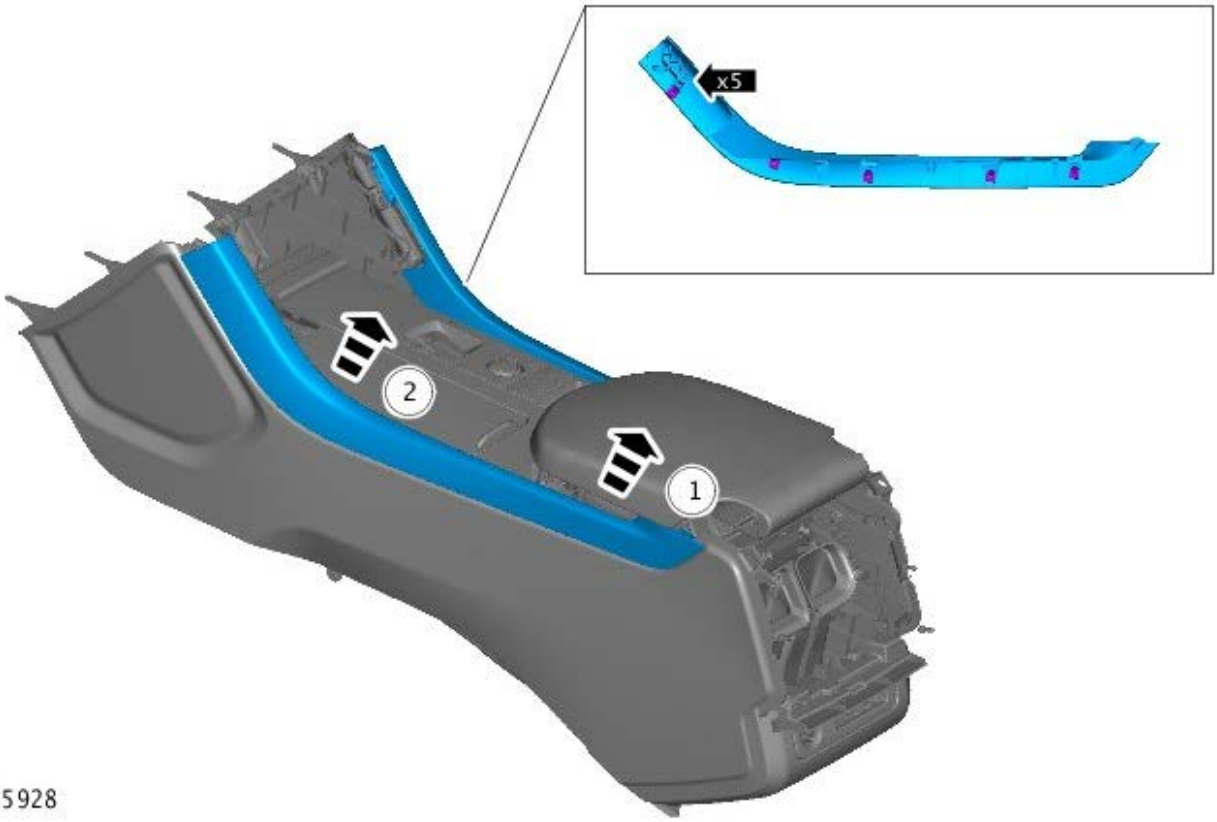
E155715

6.



E155716

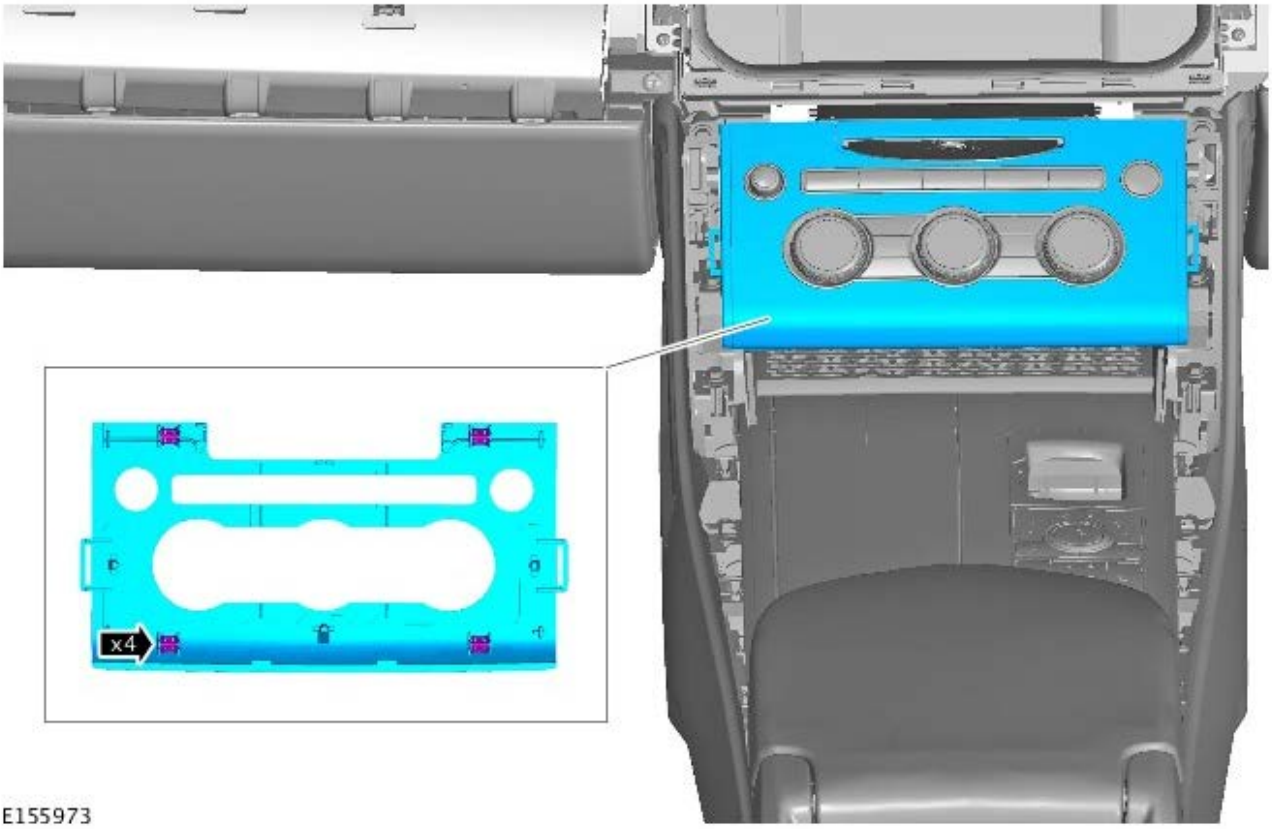
7.



E155928

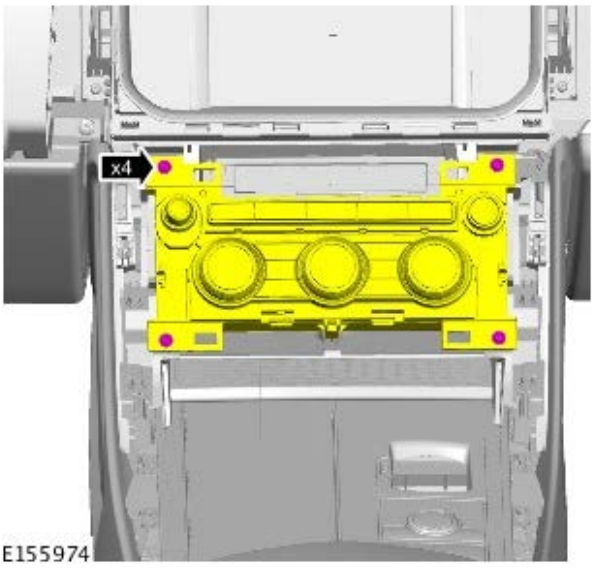
8.

9.



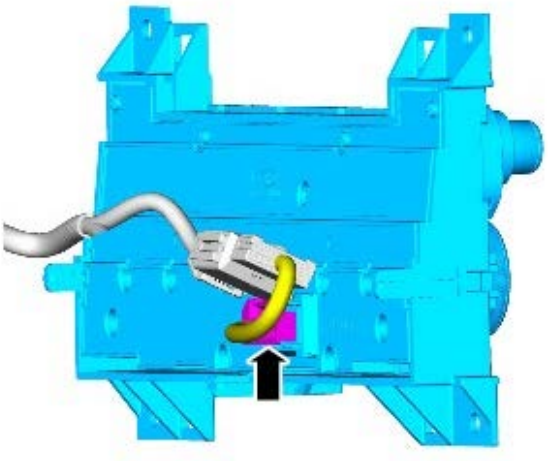
E155973

10.



E155974

11.



E155975

Installation

1. To install, reverse the removal procedure.

Published: 10-Jun-2013

Climate Control - Thermostatic Expansion Valve

Removal and Installation

Removal

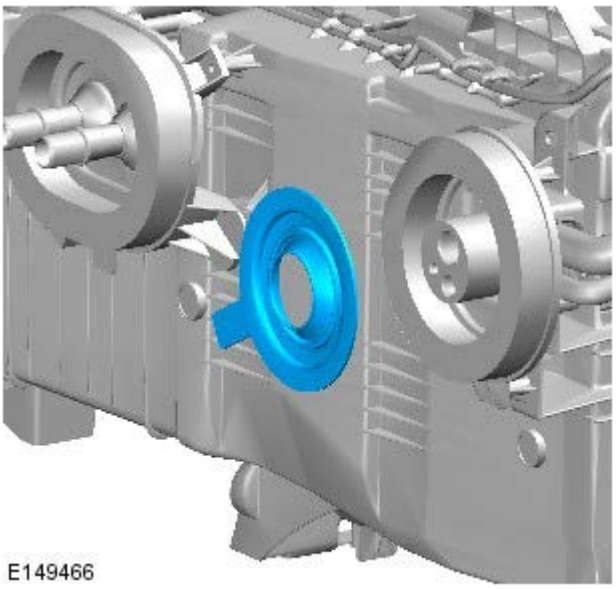
NOTES:

Removal steps in this procedure may contain installation details.

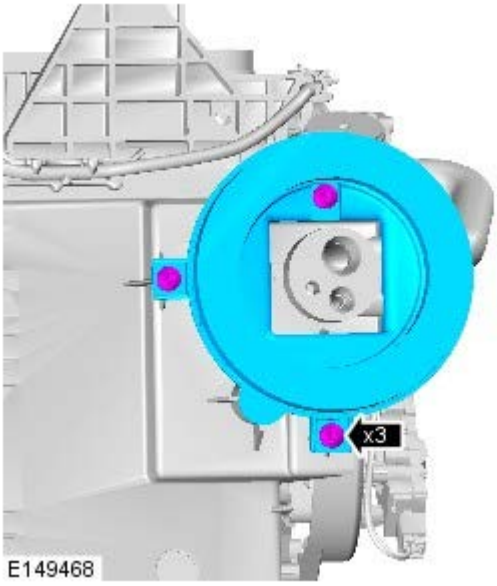
Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: Heater Core and Evaporator Core Housing (412-01A Climate Control, Removal and Installation).

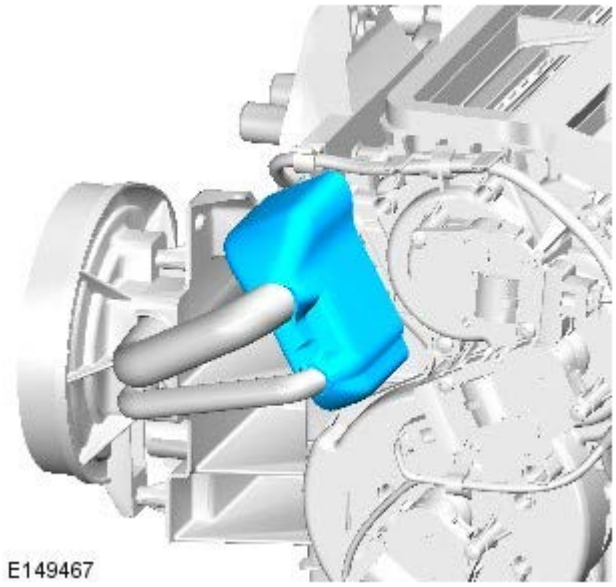
2.



3.



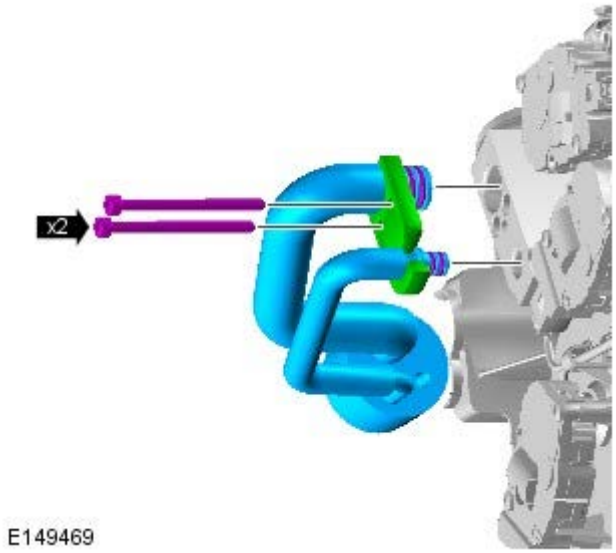
4.



5. CAUTION: Remove and discard the O-ring seals.

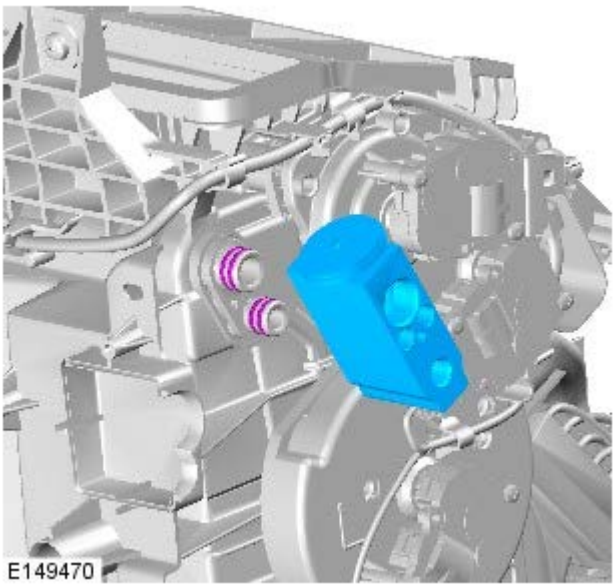
   NOTE: Install new O-ring seals.

   Torque: 4 Nm



6. CAUTION: Remove and discard the O-ring seals.

   NOTE: Install new O-ring seals.



Installation

1. To install, reverse the removal procedure.

Published: 10-Jun-2013

Climate Control - Evaporator

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

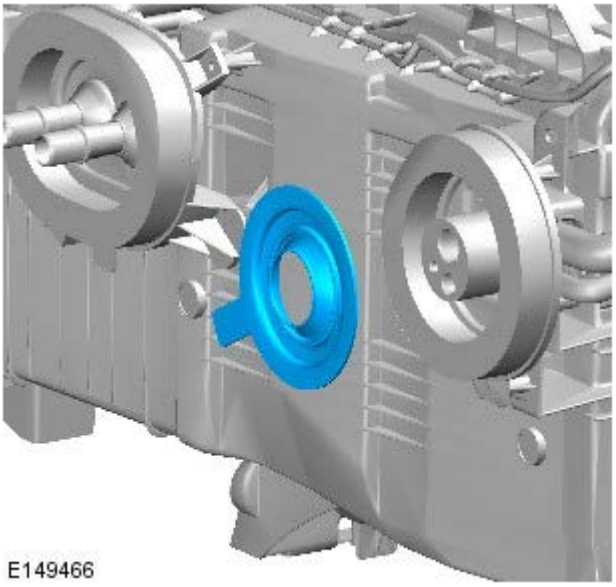
   Raise and support the vehicle.

2. Disconnect the battery ground cable.

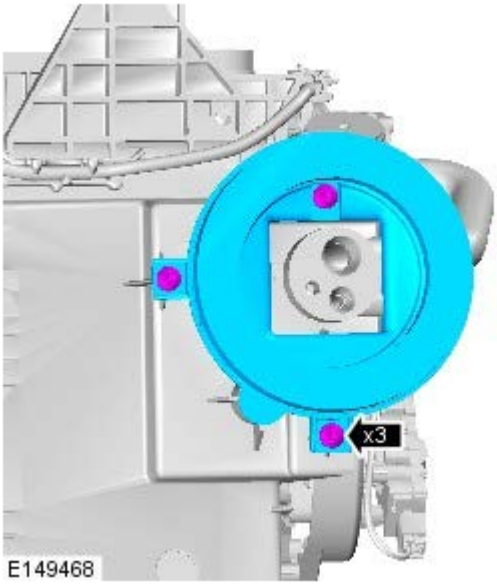
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Refer to: Heater Core (412-01A Climate Control, Removal and Installation).

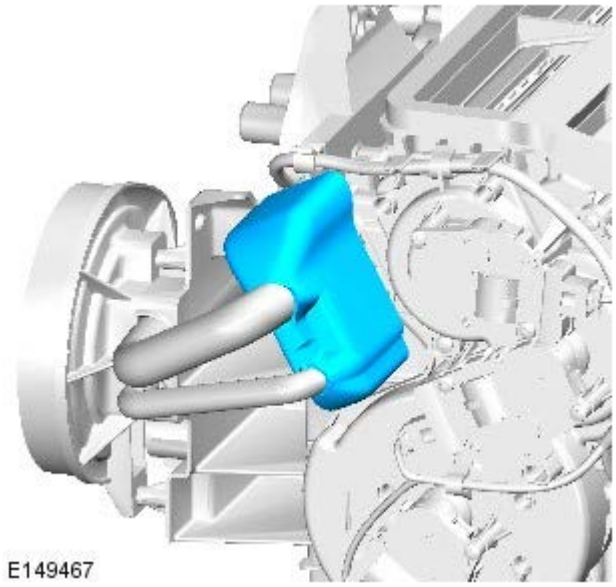
4.



5.



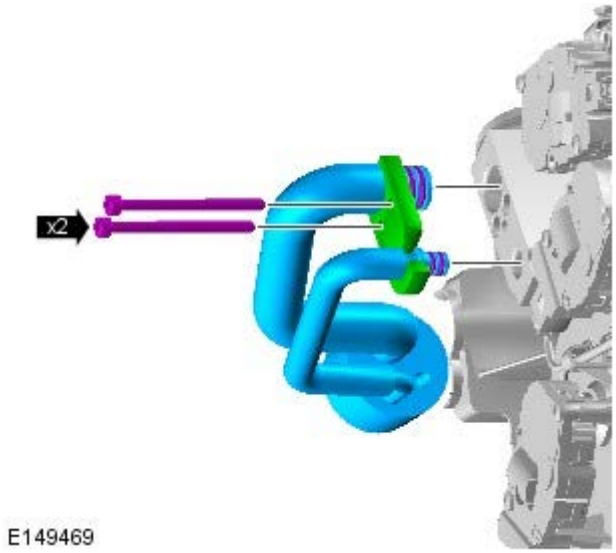
6.



7. CAUTION: Remove and discard the O-ring seals.

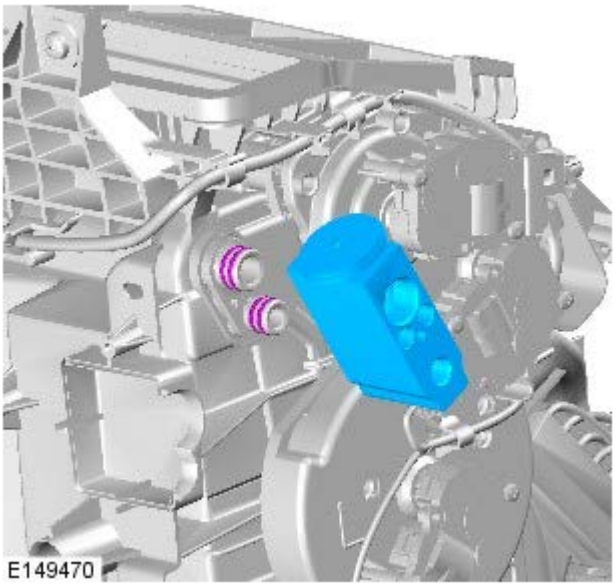
NOTE: Install new O-ring seals.

Torque: 4 Nm

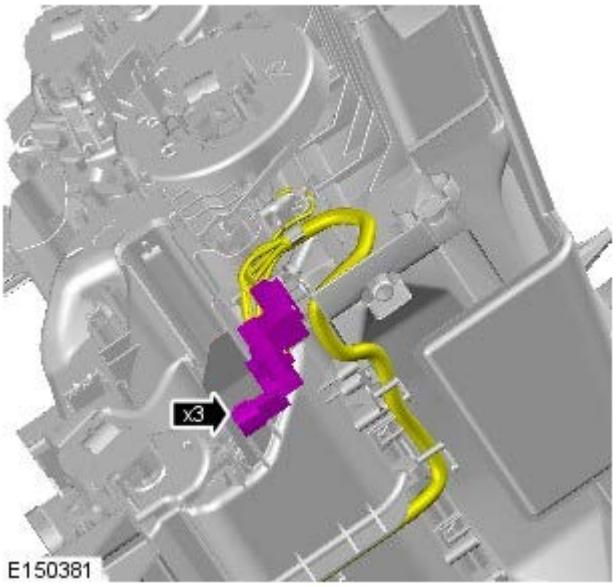


8. CAUTION: Remove and discard the O-ring seals.

NOTE: Install new O-ring seals.

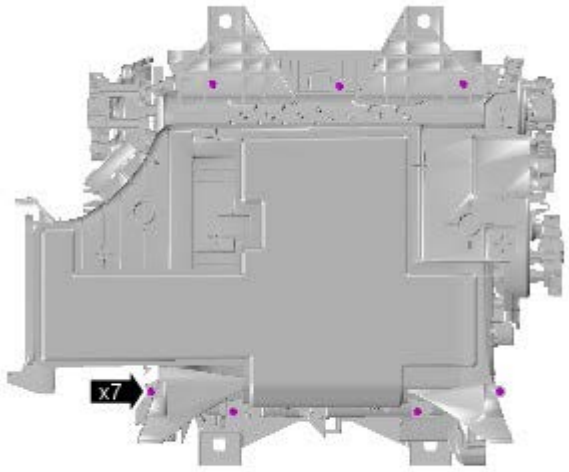


9.



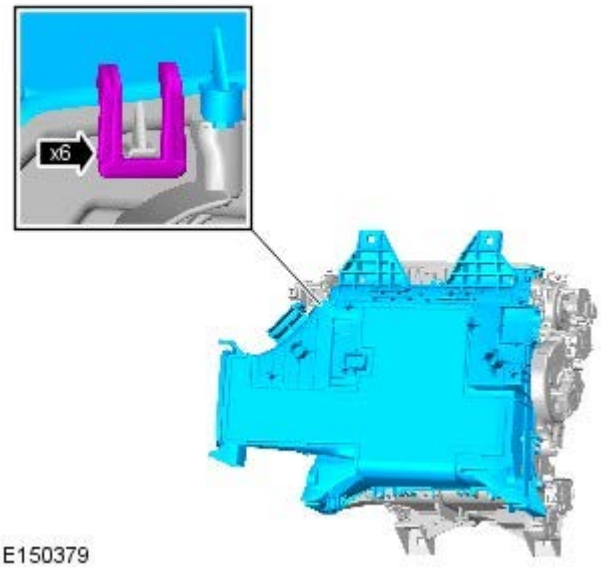
E150381

10.



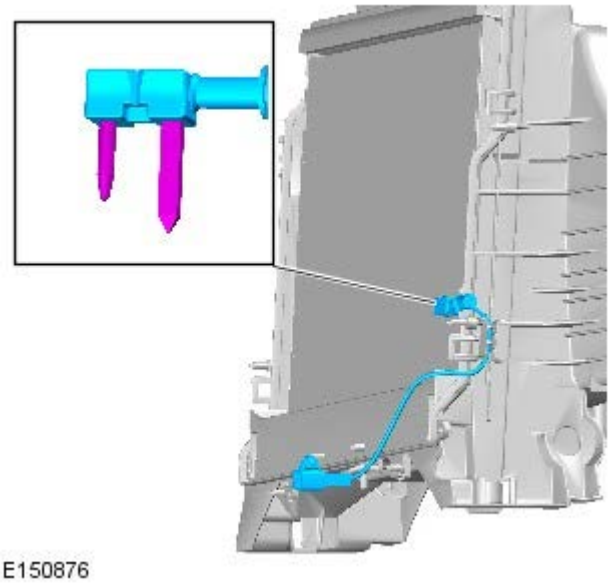
E150380

11.



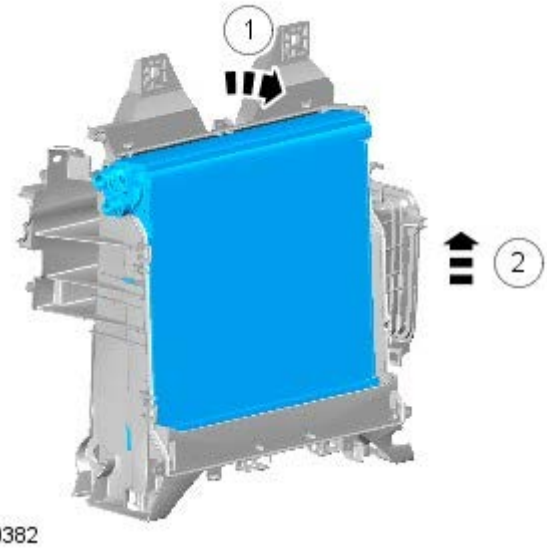
E150379

12.



E150876

13.



E150382

Installation

1. To install, reverse the removal procedure.

Published: 10-Jun-2013

Climate Control - Heater Core

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

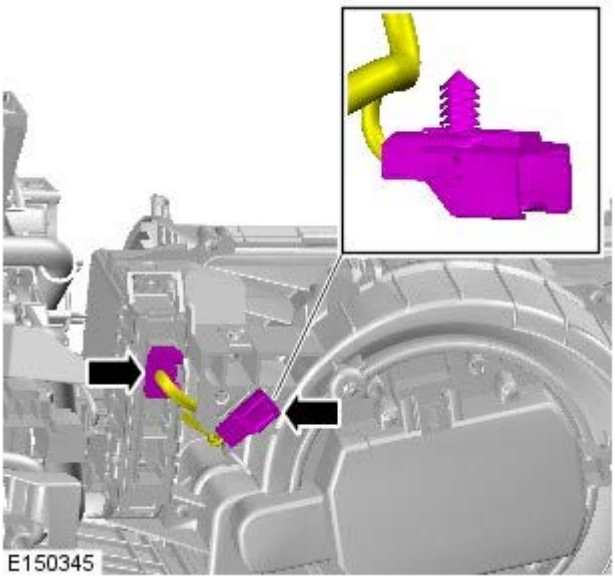
   Raise and support the vehicle.

2. Disconnect the battery ground cable.

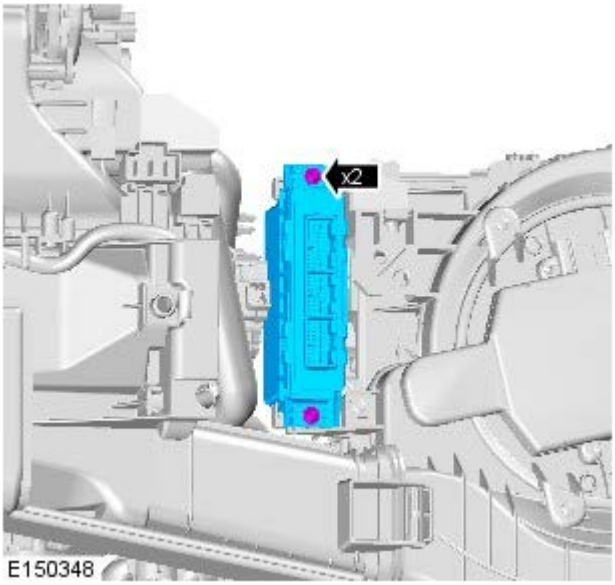
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Refer to: Heater Core and Evaporator Core Housing (412-01A Climate Control, Removal and Installation).

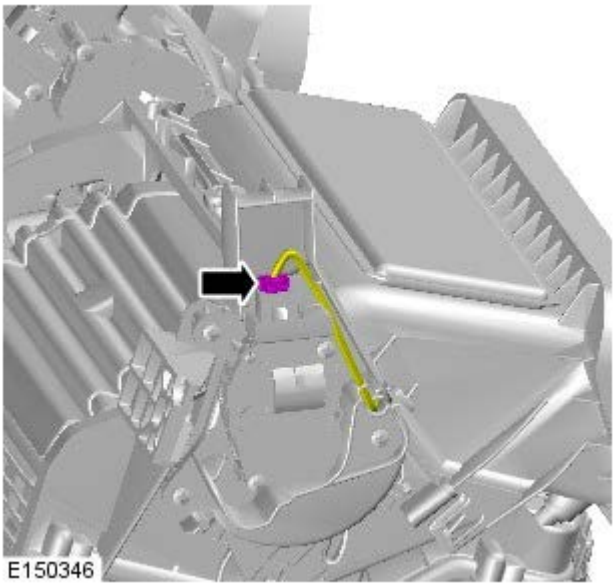
4.



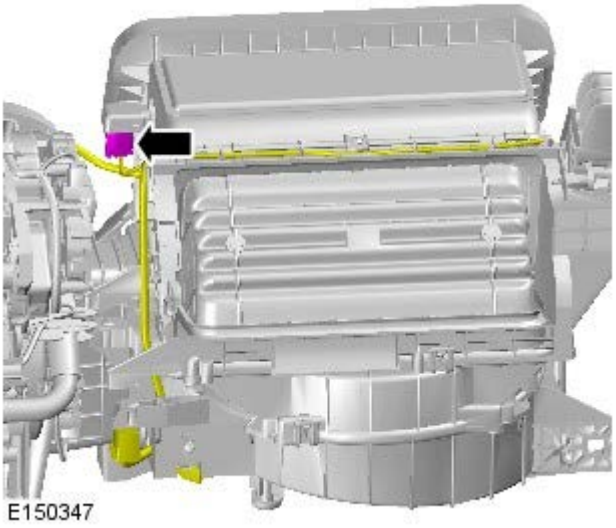
5.



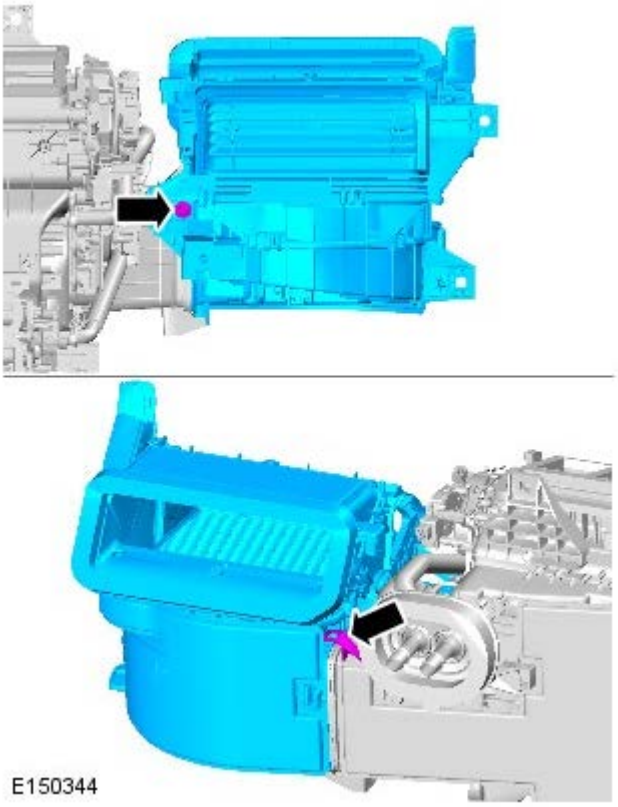
6.



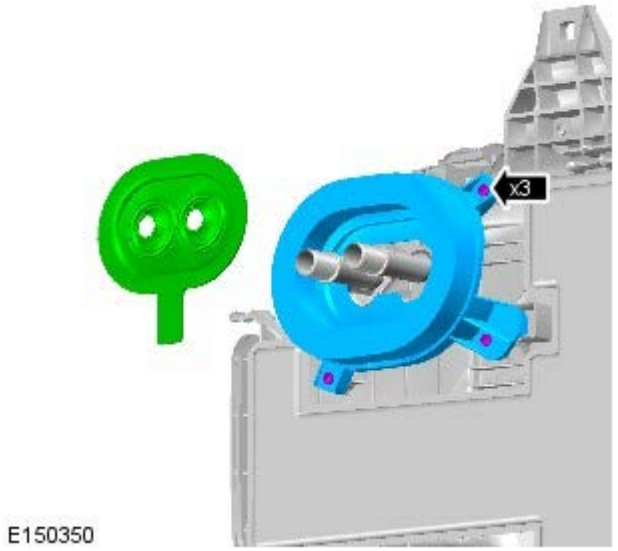
7.



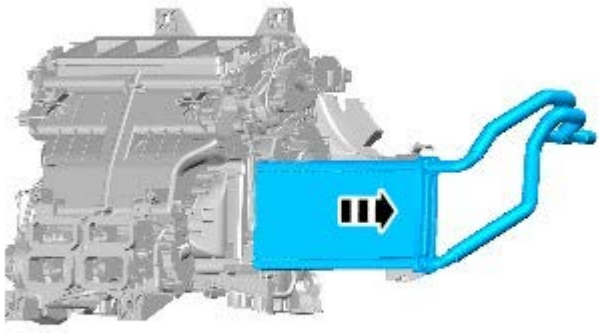
8.



9.



10.



E150349

Installation

1. To install, reverse the removal procedure.

Published: 07-Aug-2012

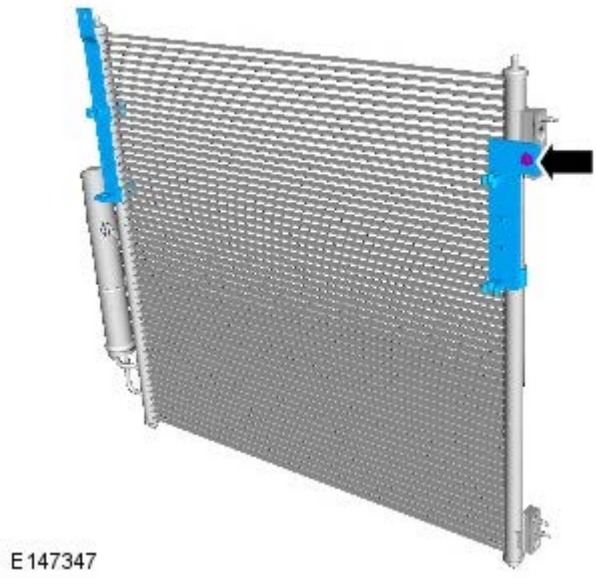
Climate Control - Condenser TDV6 3.0L Diesel

Removal and Installation

Removal

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

1. Refer to: Radiator (303-03A Engine Cooling - TDV6 3.0L Diesel, Removal and Installation).
2. *Torque:* 4.5 Nm



Installation

1. To install reverse the removal procedure.

Published: 07-Aug-2012

Climate Control - Condenser TDV8 4.4L 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. Disconnect the battery ground cable.

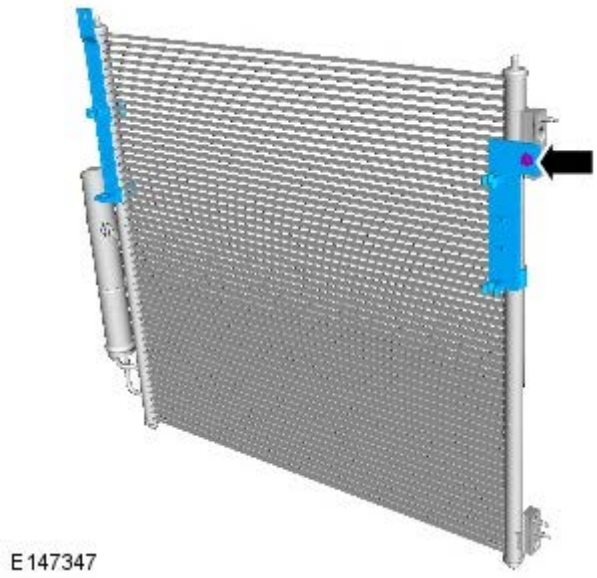
   Refer to: Specifications (414-00, Specifications).

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

   Raise and support the vehicle.

3. Refer to: Radiator (303-03, Removal and Installation).

4. *Torque:* 4.5 Nm



Installation

1. To install reverse the removal procedure.

Published: 02-May-2013

Climate Control - Condenser V6 S/C 3.0L Petrol / V8 S/C 5.0L Petrol

Removal and Installation

Removal

1. Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).
2. Refer to: Radiator (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Removal and Installation).
   Refer to: Radiator (303-03C Engine Cooling - V8 S/C 5.0L Petrol, Removal and Installation).

Installation

1. To install, reverse the removal procedure.

Published: 27-Jun-2013

Climate Control - Ambient Air Temperature 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 Battery and Charging System - General Information, Specifications).

2. The ambient air temperature sensor is an integral part of the door mirror and cannot be removed. A new door mirror must be installed.

   Refer to: Exterior Mirror (501-09 Rear View Mirrors, Removal and Installation).

Installation

1. To install, reverse the removal procedure.

Published: 02-May-2013

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

Removal and Installation

Removal

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

NOTES:

Component shown removed for clarity.

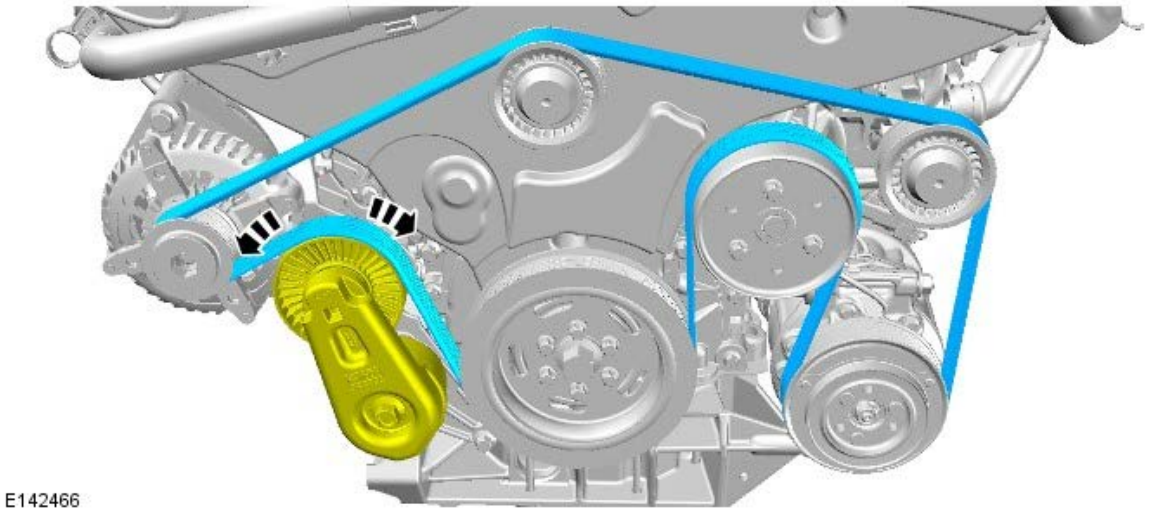
Removal steps in this procedure may contain installation details.

All vehicles

1. Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).
2. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
3. Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03A Engine Cooling - TDV6 3.0L Diesel, General Procedures).
4. Remove the front LH splash shield.

   Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

Vehicles without Dynamic Response

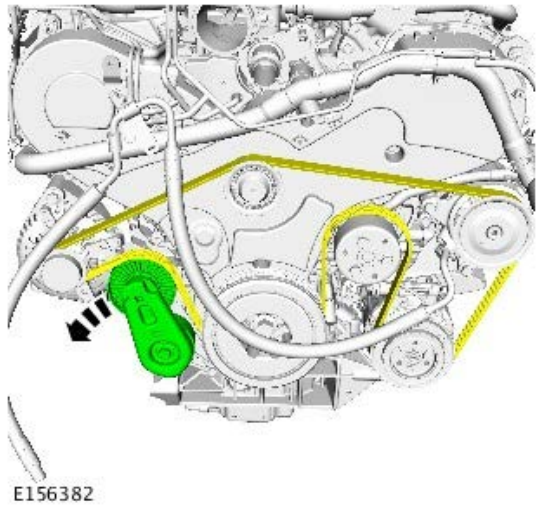

E142466

5. NOTES:

   Note the fitted position of the accessory drive belt.

   Engine shown removed for clarity.

Vehicles with Dynamic Response


E156382

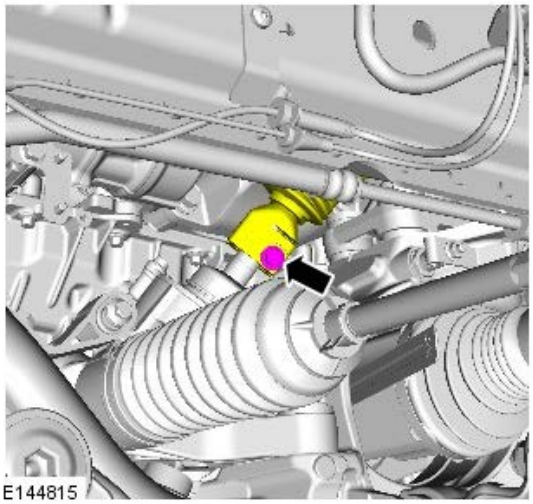
6. NOTES:

   Note the fitted position of the accessory drive belt.

   Engine shown removed for clarity.

All vehicles

7. CAUTIONS:



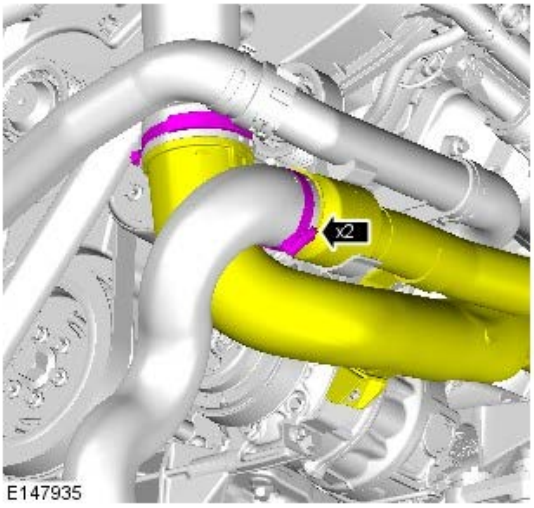
Discard the bolt.

Make sure that a new bolt is installed.

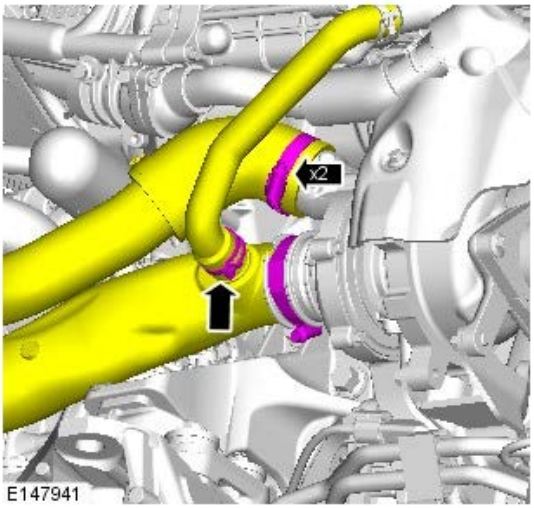
NOTE: Left hand drive only.

Align the steering wheel to straight ahead.

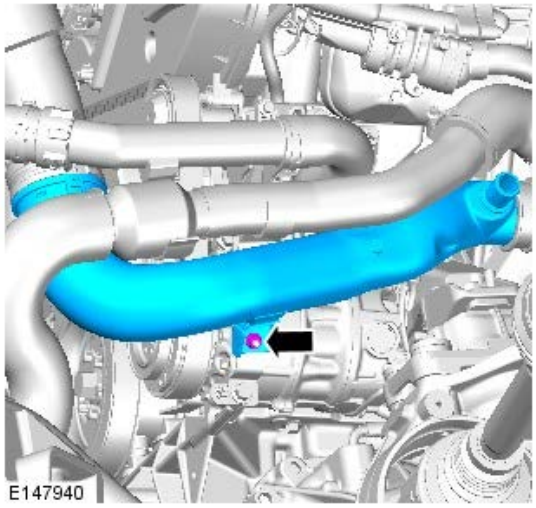
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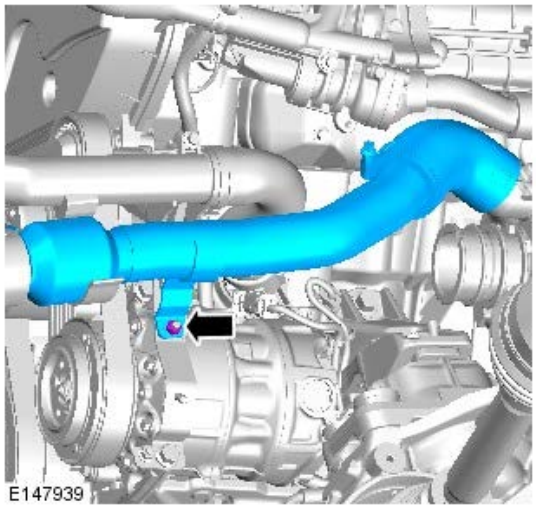
9.



10. *Torque:* 6 Nm

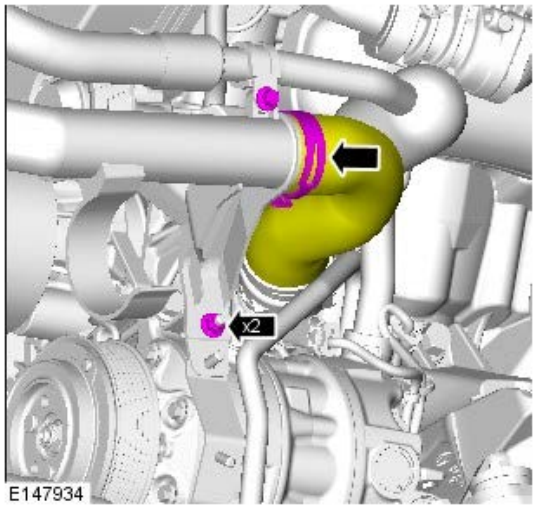


11. *Torque:* 6 Nm

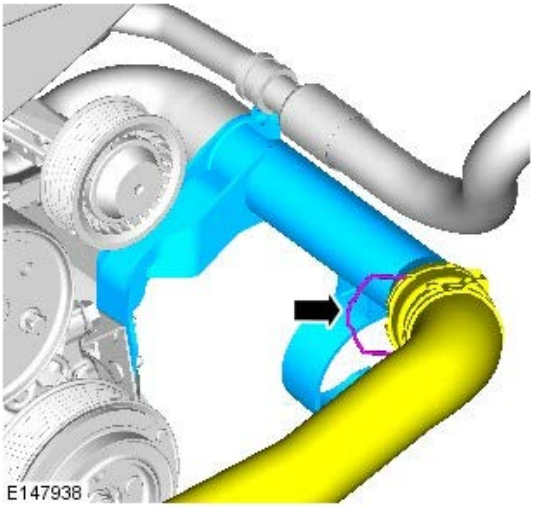


12. CAUTION: Be prepared to collect escaping coolant.

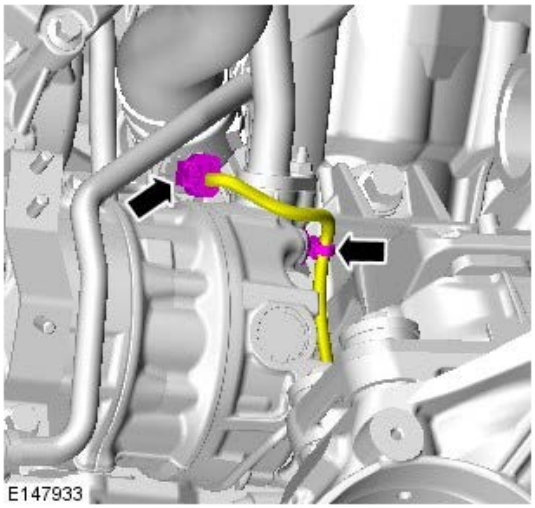
Torque: 6 Nm



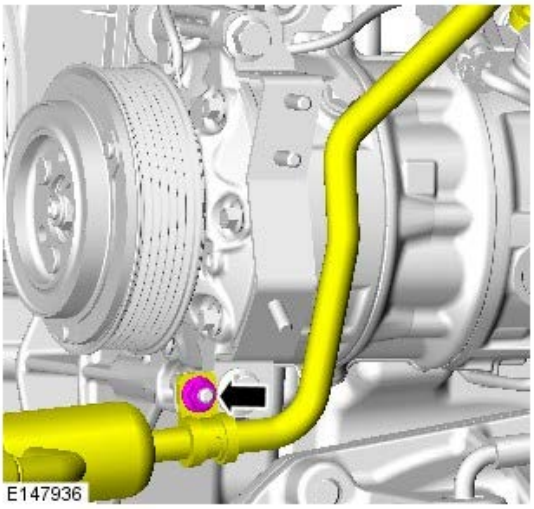
13. CAUTION: Be prepared to collect escaping coolant.



14.

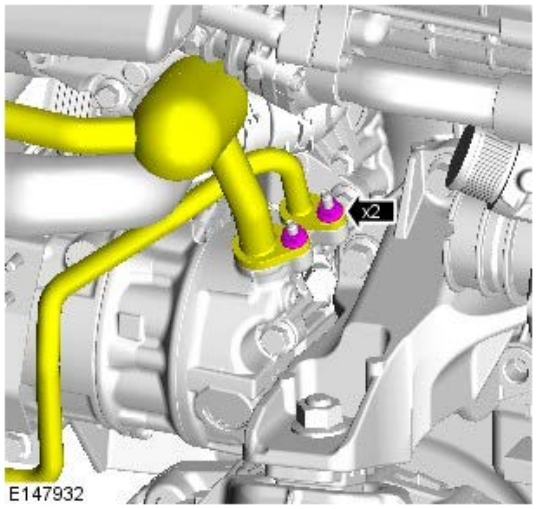


15. *Torque:* 6 Nm

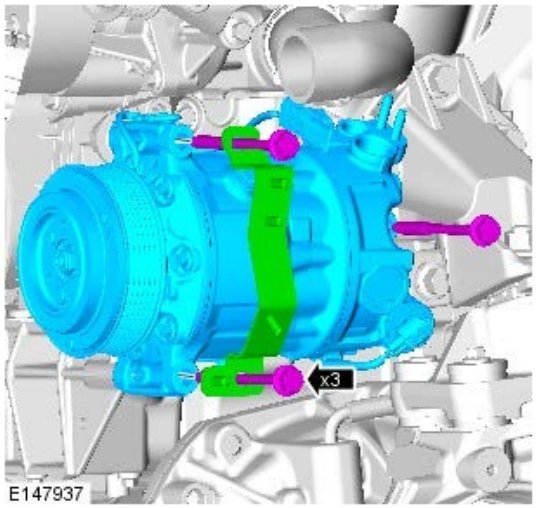


16. NOTE: Install a new O-ring seal.

Torque: 18 Nm



17. *Torque:* 25 Nm



Installation

1. To install, reverse the removal procedure.

Published: 15-May-2013

Climate Control - Air Conditioning (A/C) Compressor TDV8 4.4L Diesel

Removal and Installation

Removal

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

NOTES:

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

Component shown removed for clarity.

1. Disconnect the battery ground cable.

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

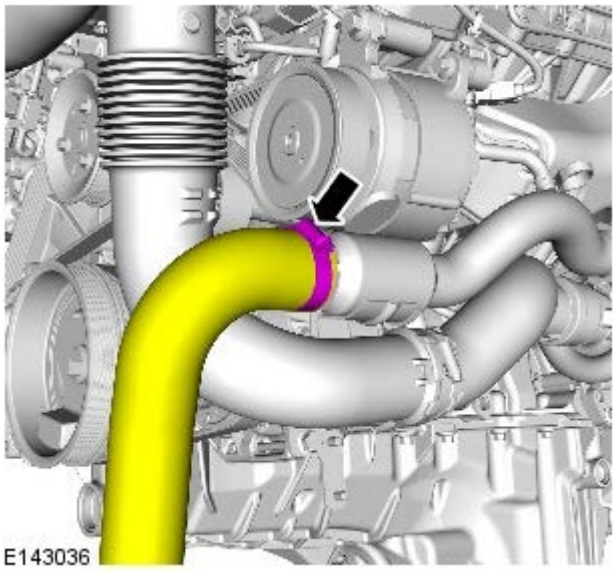
2. WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

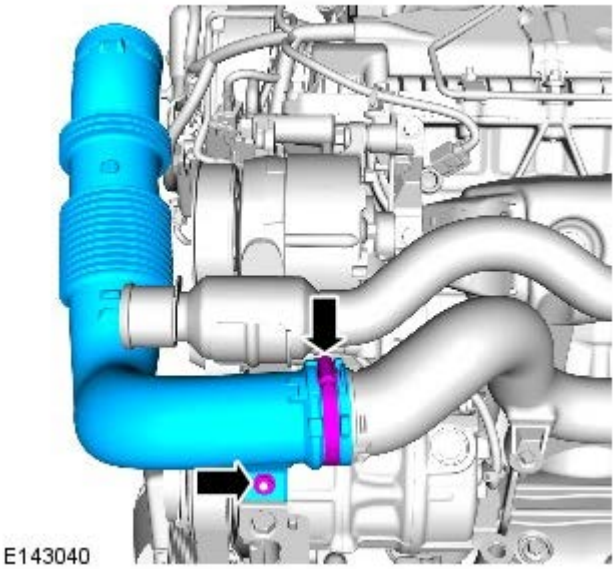
3. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

4. Refer to: Cooling Fan (303-03F Engine Cooling - TDV8 4.4L Diesel, Removal and Installation).

5.



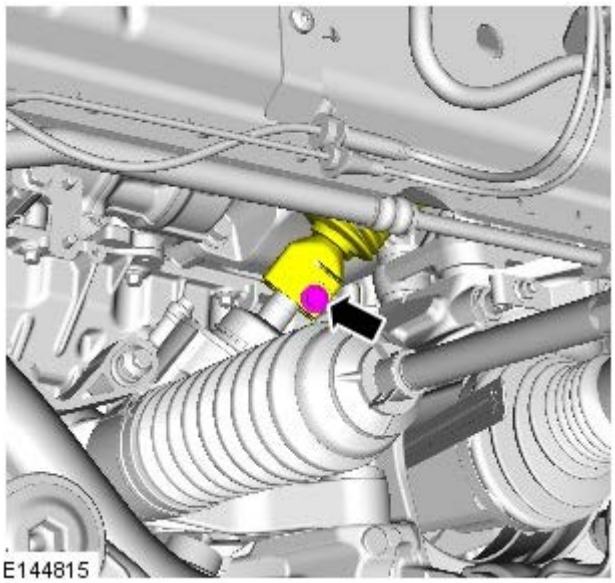
6.



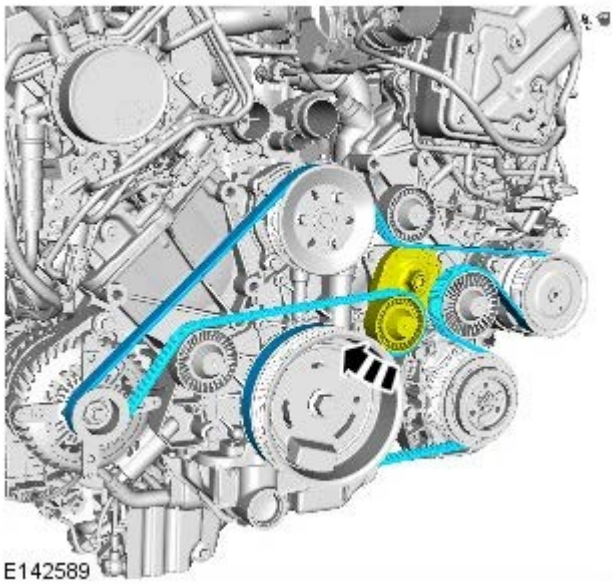
7. CAUTION: Discard the bolt.

NOTE: Left hand drive only.

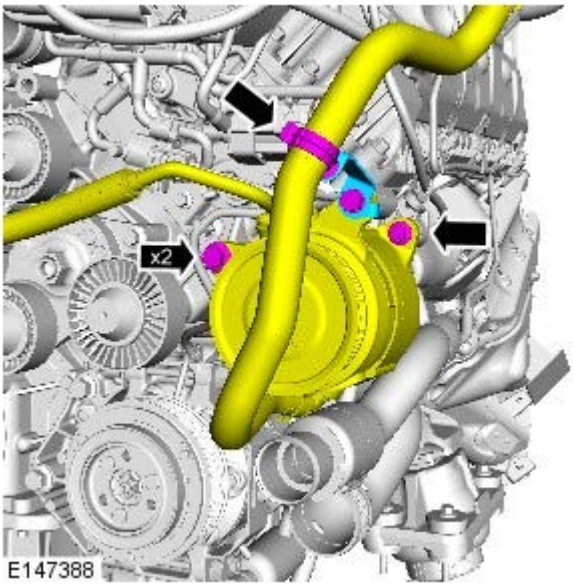
Align the steering wheel to straight ahead.



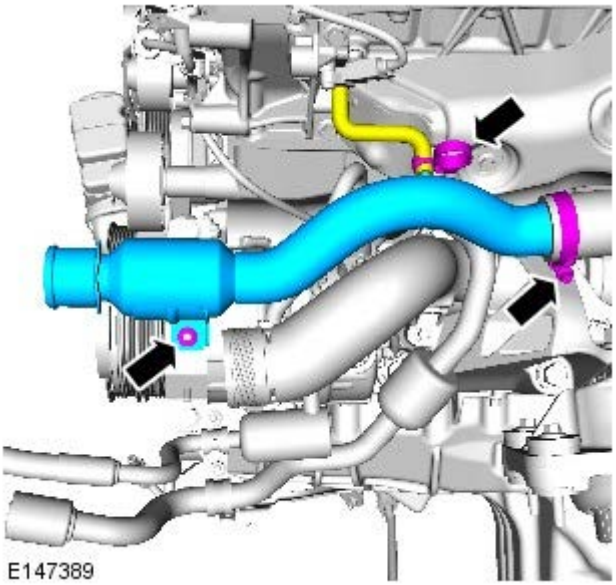
8.



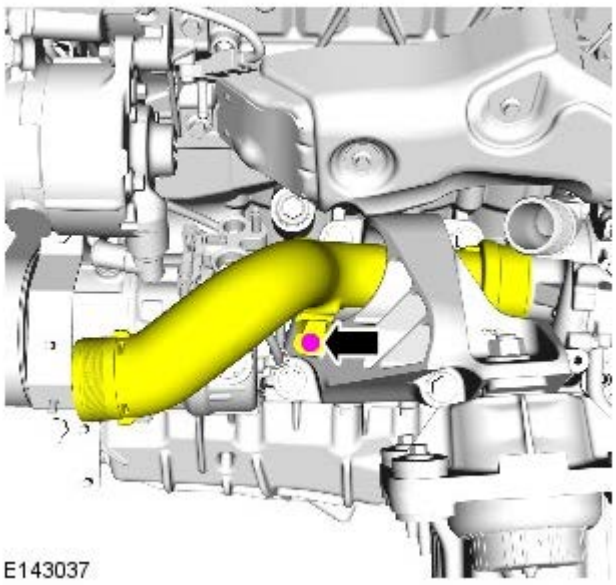
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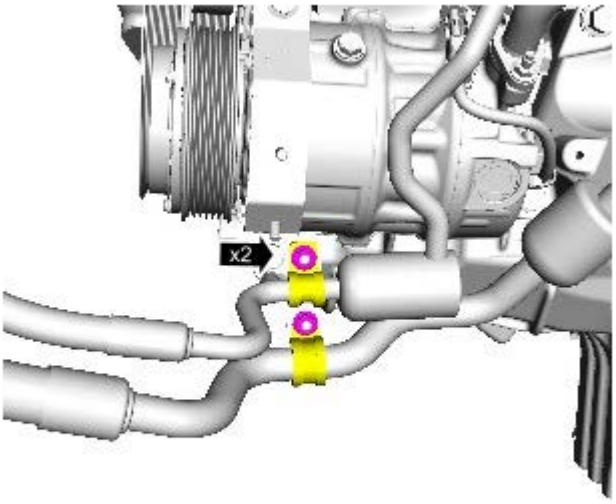
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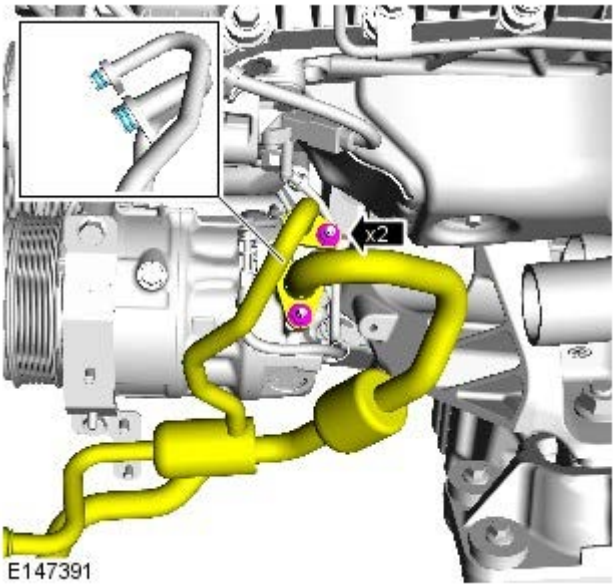
11.



12.



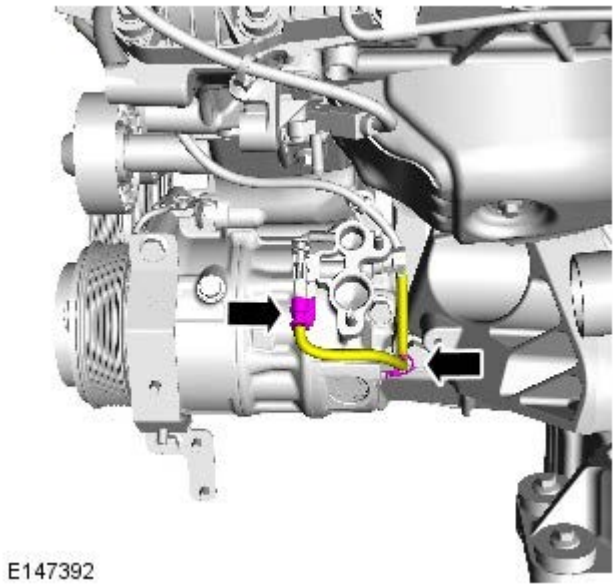
E147390



E147391

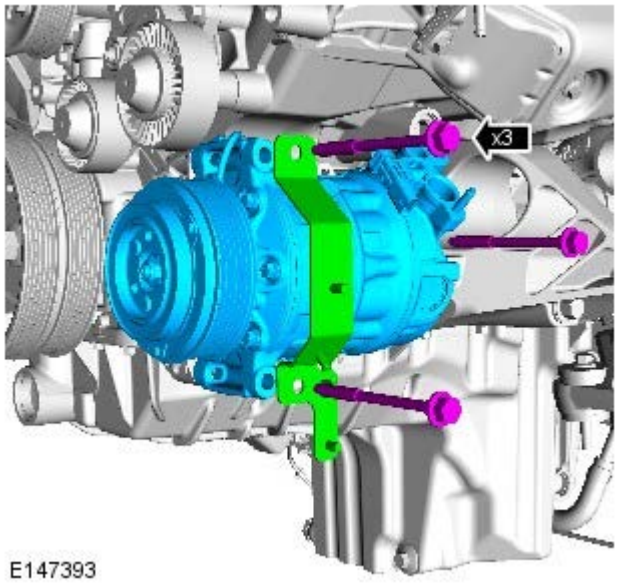
13. CAUTION: Remove and discard the O-ring seals.

14.



E147392

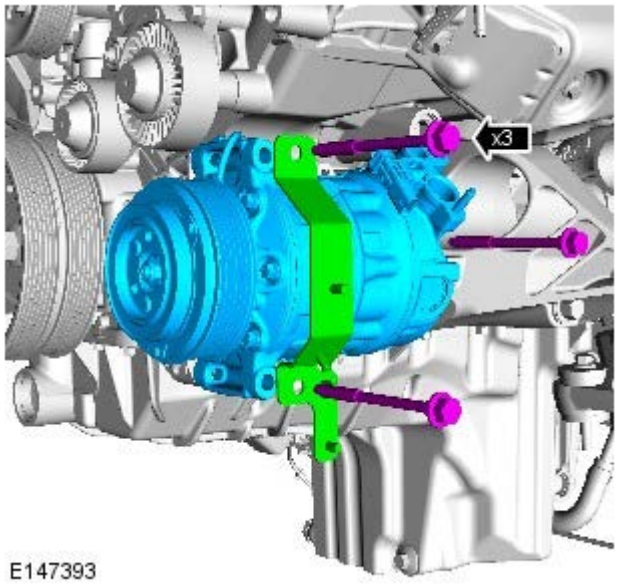
15.



E147393

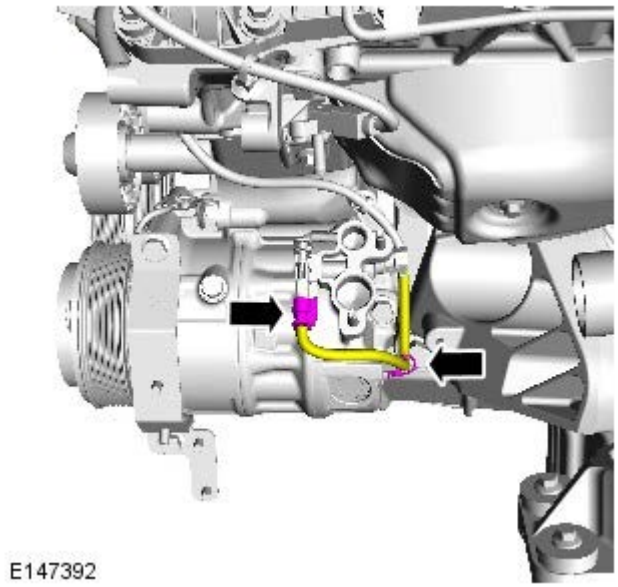
Installation

1. *Torque:* 25 Nm



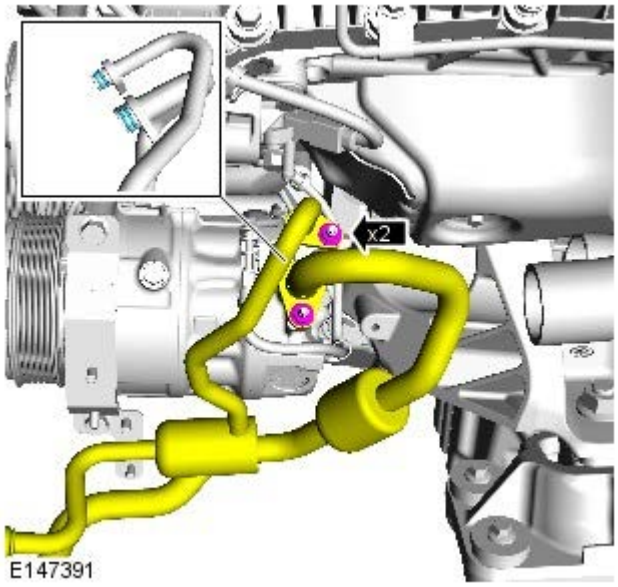
E147393

2.


E147392

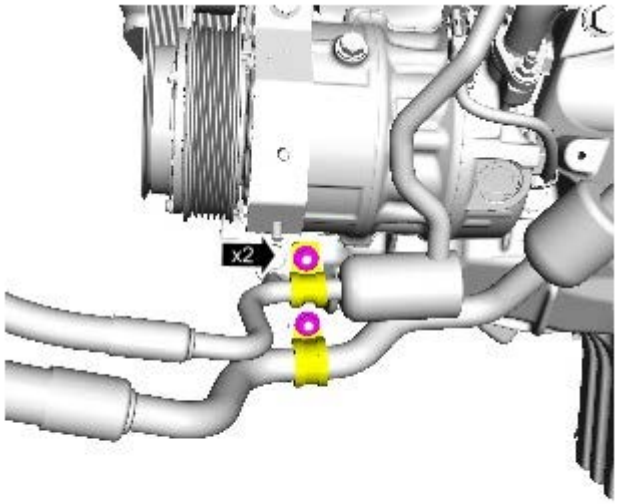
3. CAUTION: Install new o-ring seals

   Torque: 9 Nm



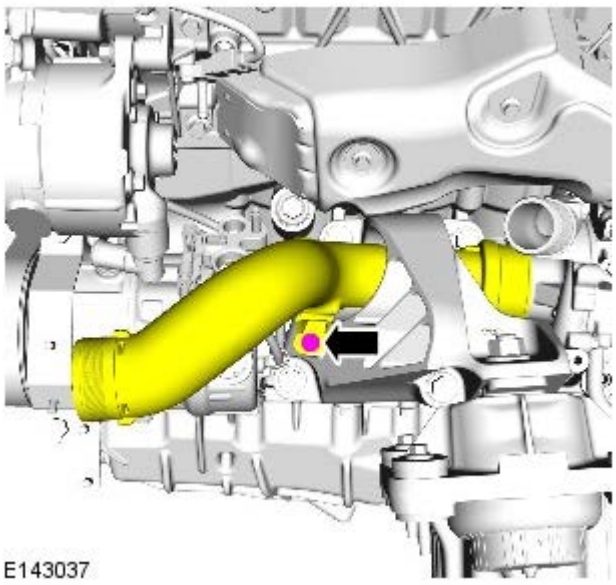
E147391

4. *Torque:* 9 Nm



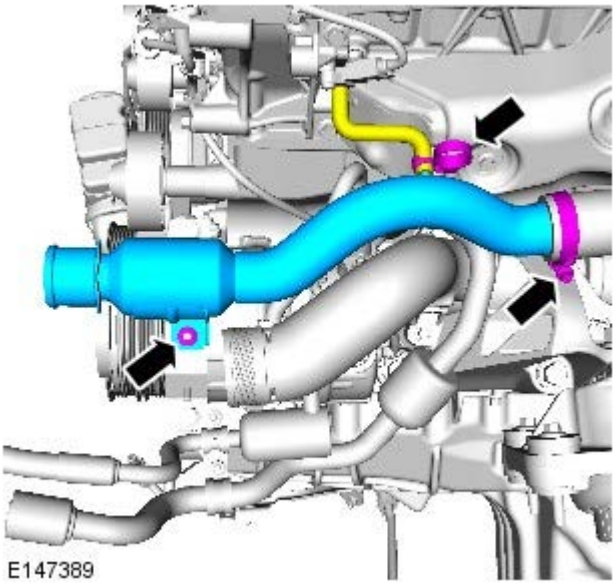
E147390

5. *Torque:* 12 Nm

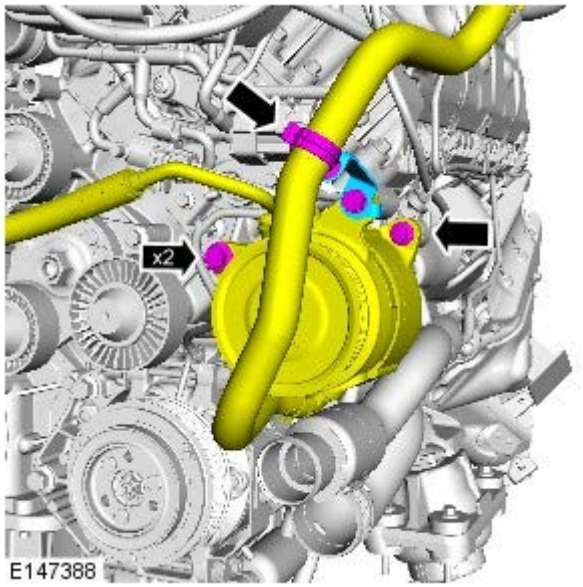

E143037

6. NOTE: Make sure the retaining clips are correctly installed and tightened.

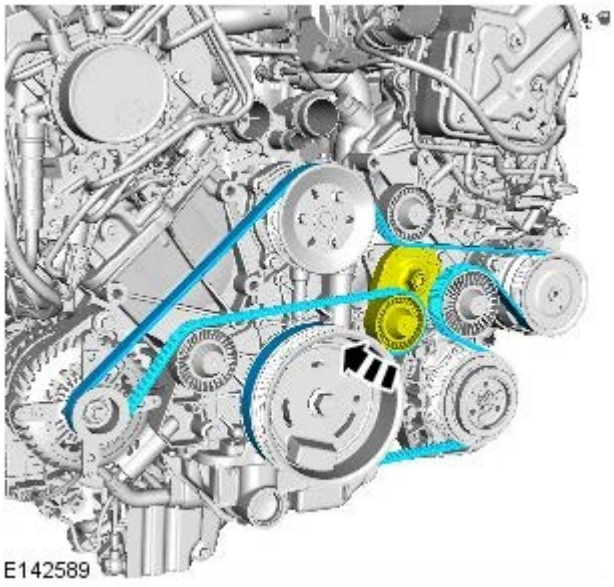
Torque:
M6 10 Nm
Clamp 3.5 Nm



7. *Torque:*
   M8 25 Nm
   M10 45 Nm

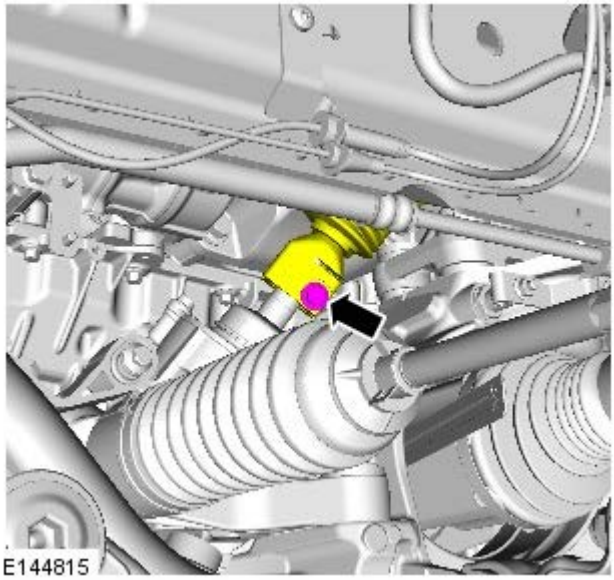


8.



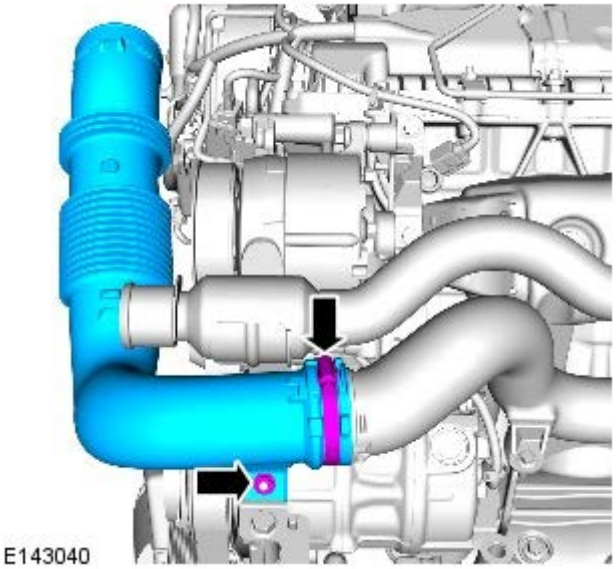
9. CAUTION: Make sure that a new bolt is installed.

NOTE: Left hand drive only.



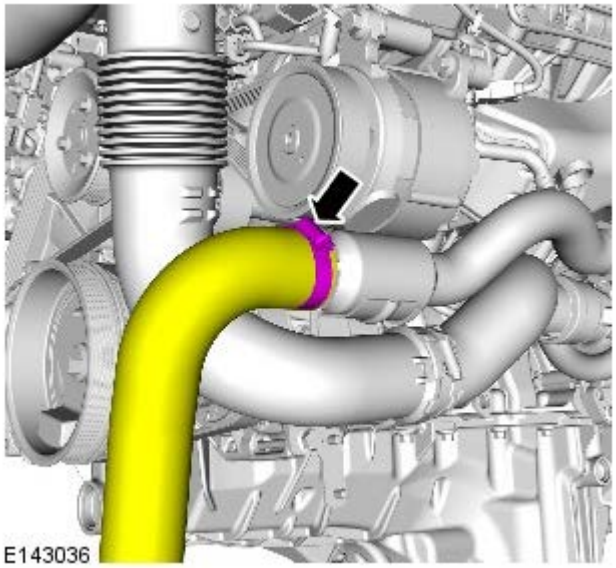
Using a suitable tool, clean out the threads.

Torque: 30 Nm



10. NOTE: Make sure the retaining clips are correctly installed and tightened.

    Torque:
    M6 10 Nm
    Clamp 3.5 Nm



11. NOTE: Make sure the retaining clips are correctly installed and tightened.

    Torque: 3.5 Nm

12. Refer to: Cooling Fan (303-03F Engine Cooling - TDV8 4.4L Diesel, Removal and Installation).

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

14. Reconnect the battery ground cable.

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

Published: 02-May-2013

Climate Control - Air Conditioning (A/C) Compressor V6 S/C 3.0L Petrol

Removal and Installation

Removal

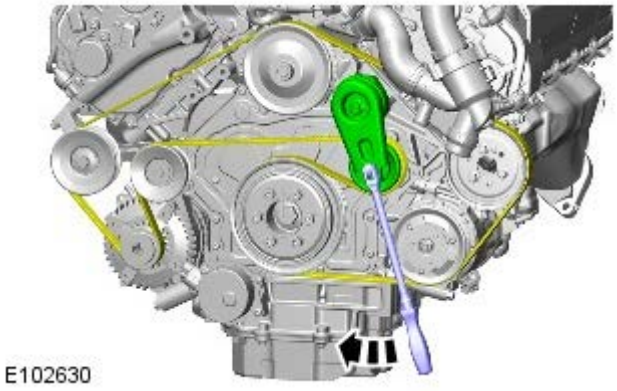
NOTES:

Removal steps in this procedure may contain installation steps.

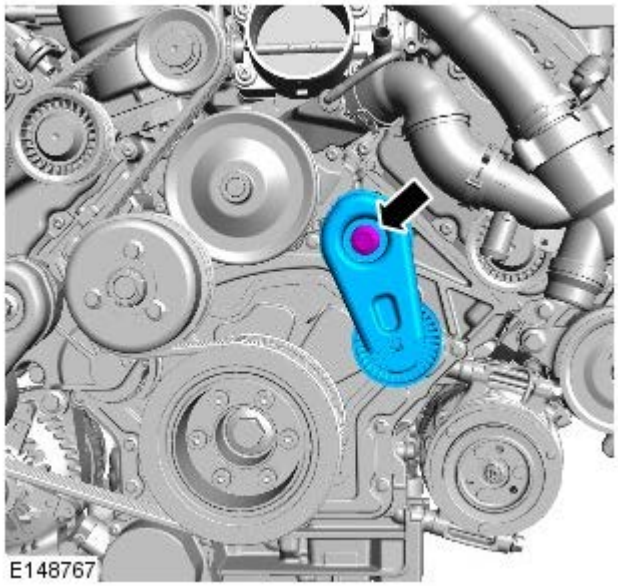
Some variation in illustrations may occur, but the essential information is always correct.

Engine shown removed for clarity.

1. Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).
2. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
3. Refer to: Cooling Fan (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Removal and Installation).
4.



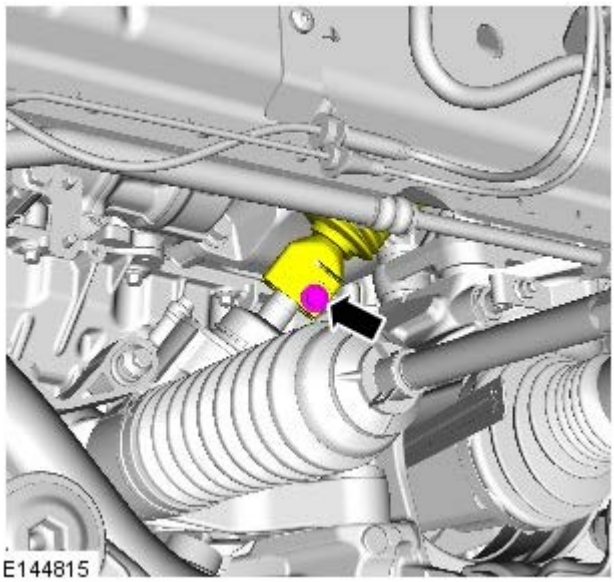
5. *Torque:* 40 Nm



6. CAUTION: Install a new bolt.

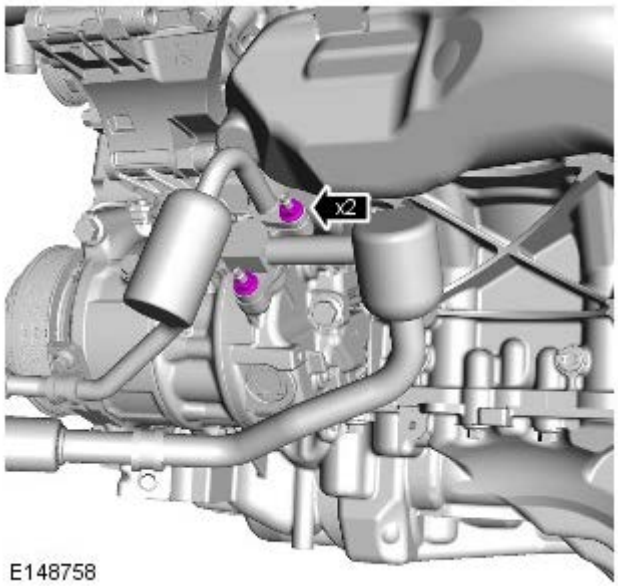
   NOTES:

   Left hand drive vehicles only .



Make sure to clean the threads prior to installation.

Torque: 30 Nm



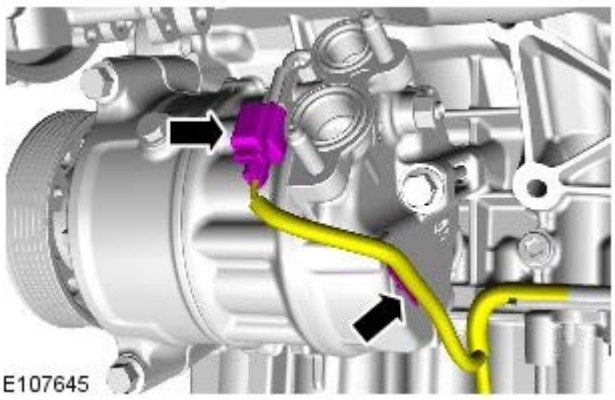
7. CAUTIONS:

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

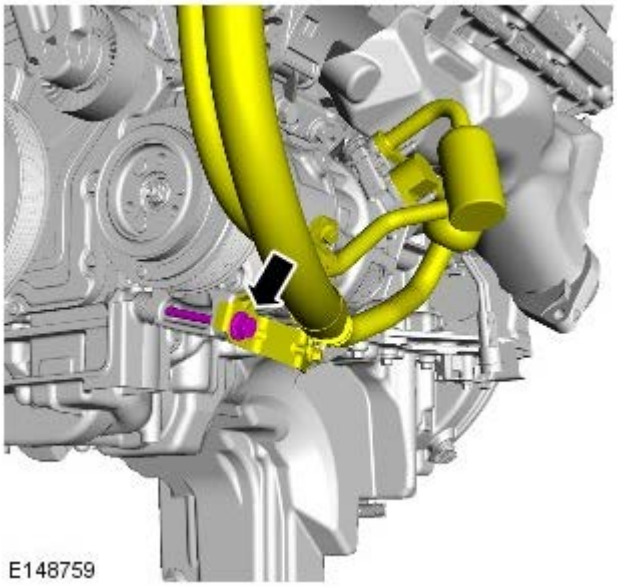
A new O-ring seal is to be installed.

Torque: 18 Nm

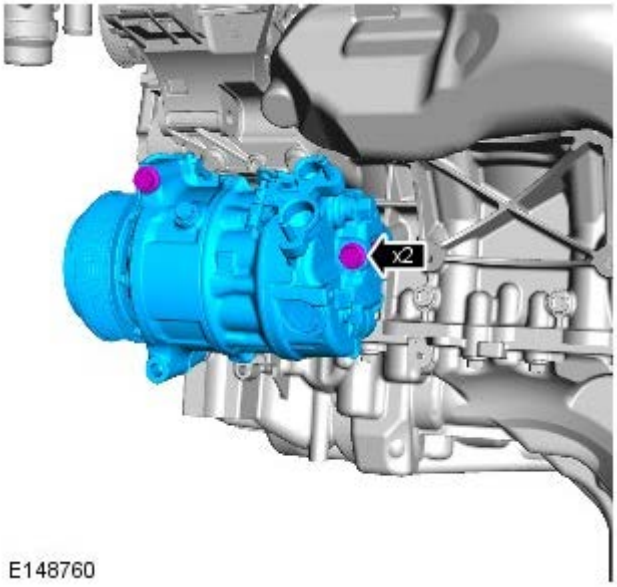
8.



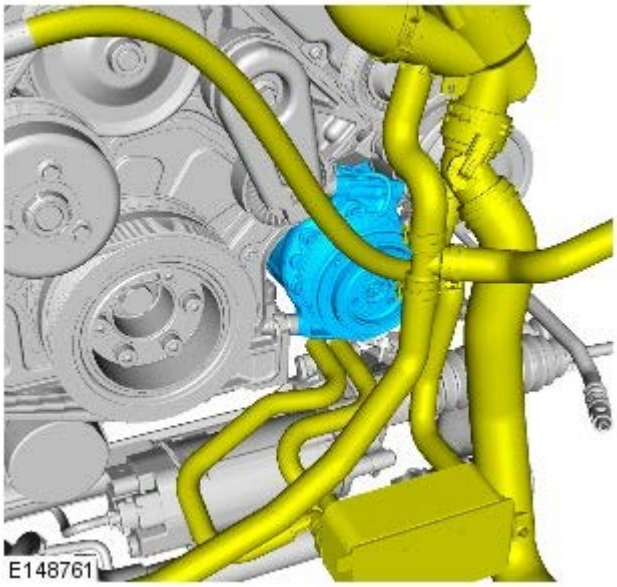
9. *Torque:* 25 Nm



10. *Torque:* 25 Nm



11.



Installation

1. To install, reverse the removal procedure.

Published: 31-Aug-2012

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

Removal and Installation

Removal

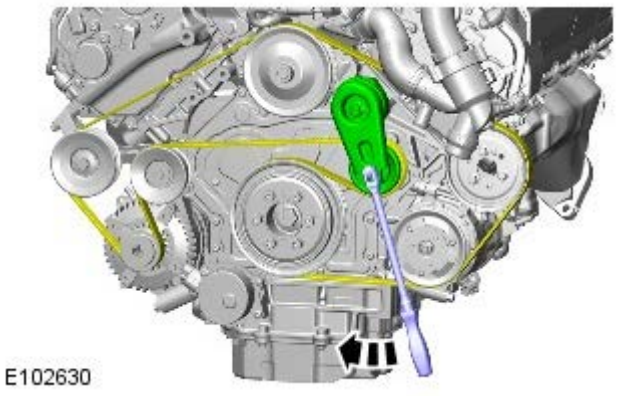
NOTES:

Removal steps in this procedure may contain installation steps.

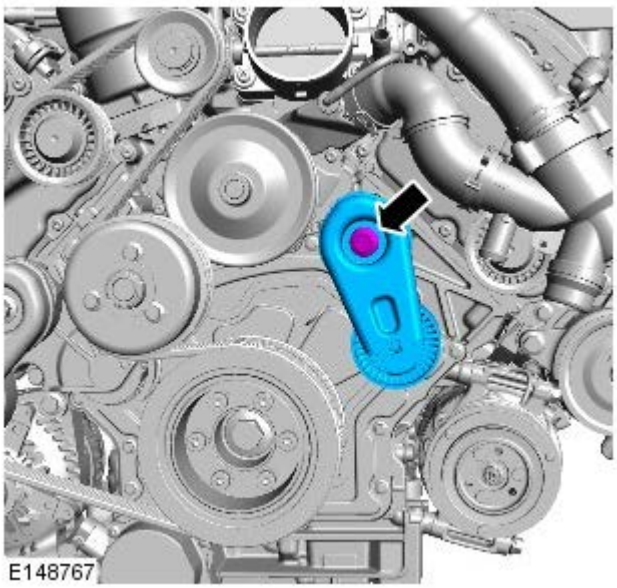
Some variation in illustrations may occur, but the essential information is always correct.

Engine shown removed for clarity.

1. Refer to: Specifications (414-01, Specifications).
2. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
3. Refer to: Cooling Fan (303-03C, Removal and Installation).
4.



5. *Torque:* 40 Nm

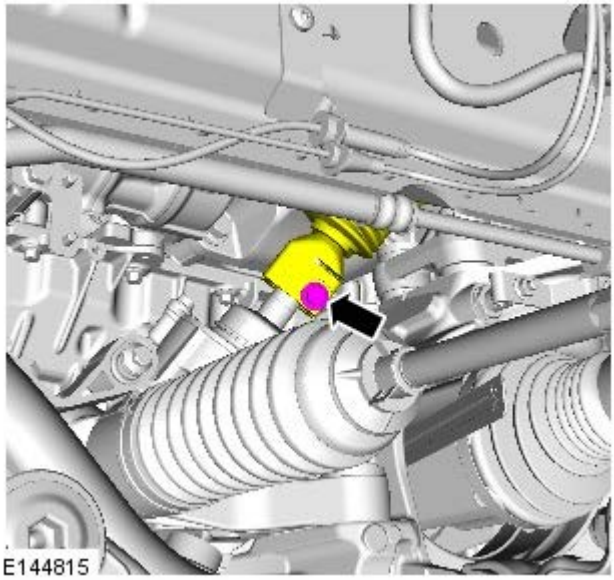


6. CAUTION: Install a new bolt.

   NOTES:

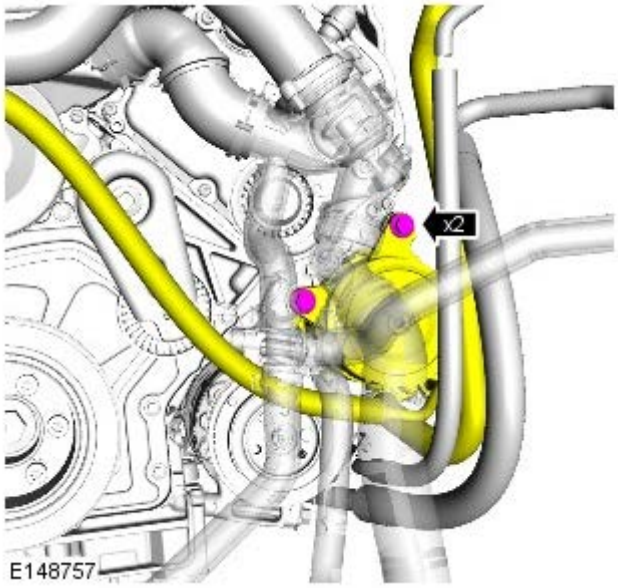
   Left hand drive vehicles only .

   Make sure to clean the threads prior to installation.



Torque: 30 Nm

7. *Torque:* 22 Nm

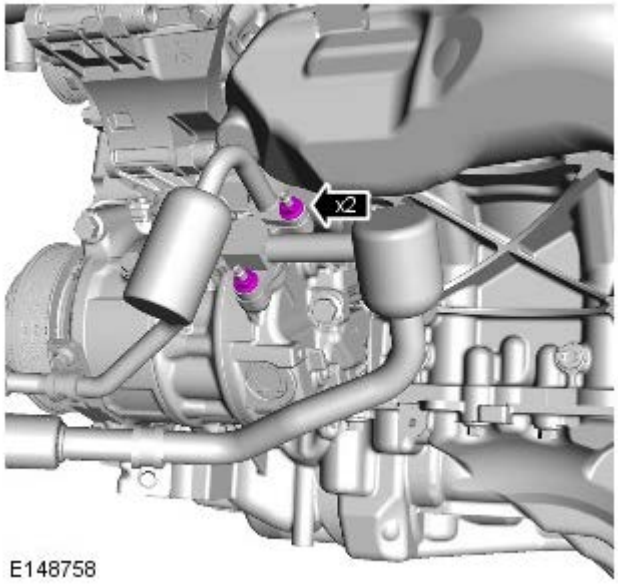


8. CAUTIONS:

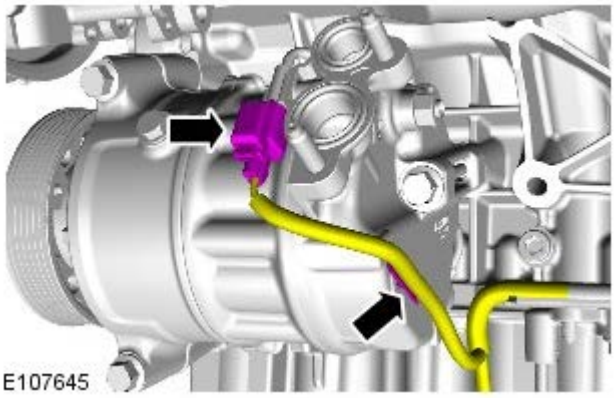
Make sure that all openings are sealed. Use new blanking caps.

A new O-ring seal is to be installed.

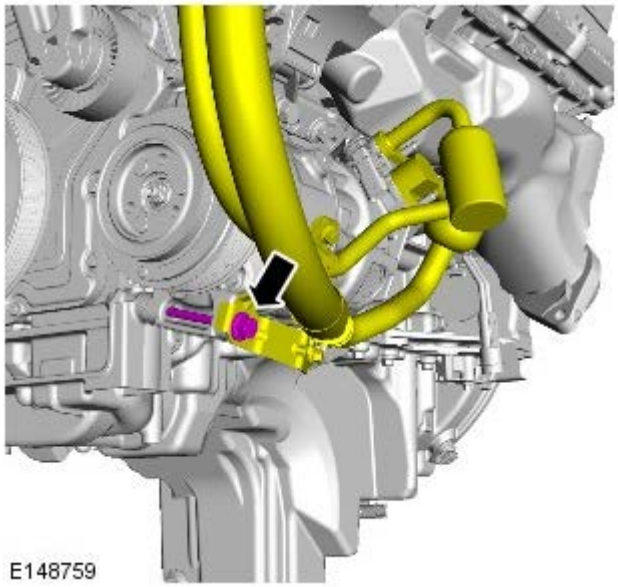
Torque: 18 Nm



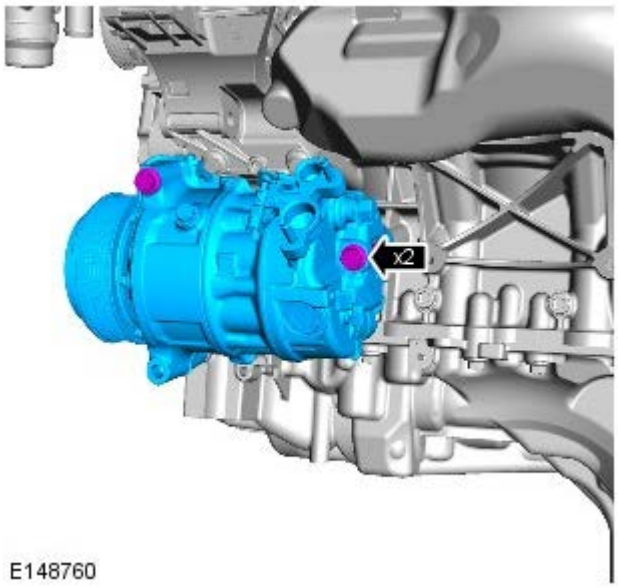
9.



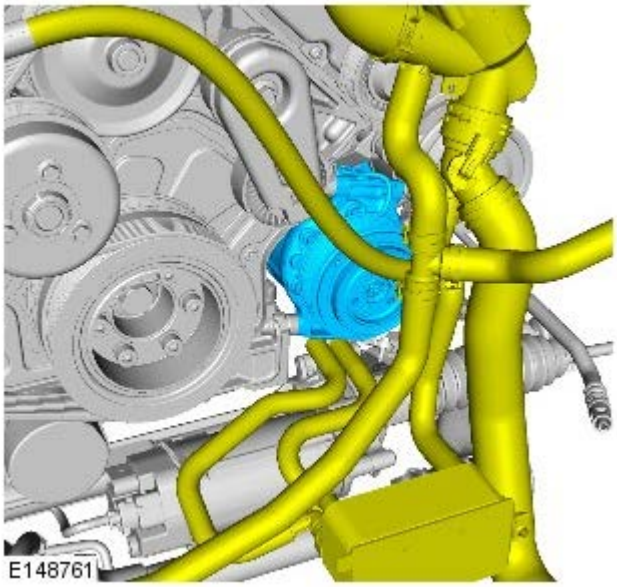
10. *Torque:* 25 Nm



11. *Torque:* 25 Nm



12.



Installation

1. To install, reverse the removal procedure.

Published: 30-Oct-2013

Climate Control - Heater Core and Evaporator Core Housing

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

Some illustrations may show Right hand drive. Left hand drive is similar, but the essential information shown is always correct.

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

   Raise and support the vehicle.

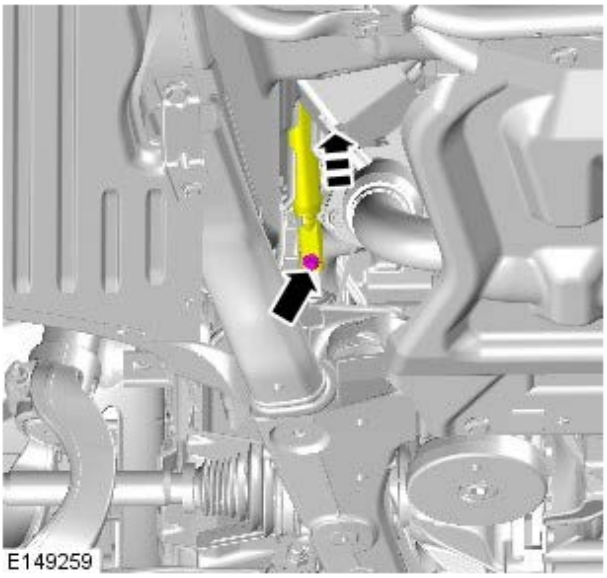
2. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

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

4. Refer to: Wiper Linkage Assembly (501-16 Wipers and Washers, Removal and Installation).

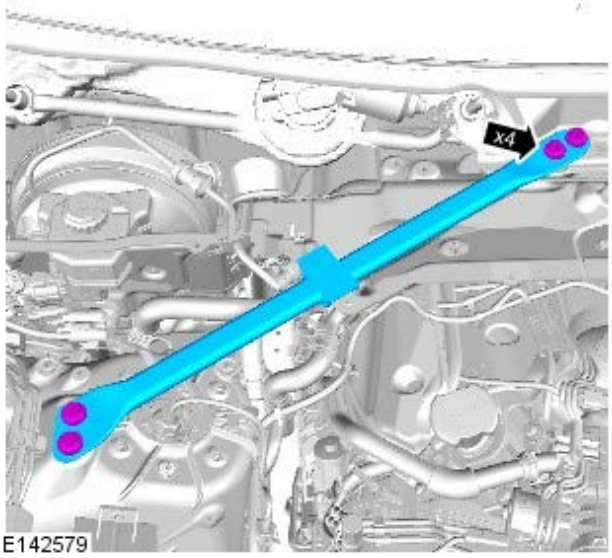
5. Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03A Engine Cooling - TDV6 3.0L Diesel, General Procedures).
   Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03B Engine Cooling - V6 S/C 3.0L Petrol, General Procedures).
   Refer to: Cooling System Partial Draining, Filling and Bleeding - V8 S/C 5.0L Petrol (303-03C Engine Cooling - V8 S/C 5.0L Petrol, General Procedures).
   Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03F Engine Cooling - TDV8 4.4L Diesel, General Procedures).
   Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03G Engine Cooling - SDV6 3.0L Diesel - Hybrid Electric Vehicle, General Procedures).



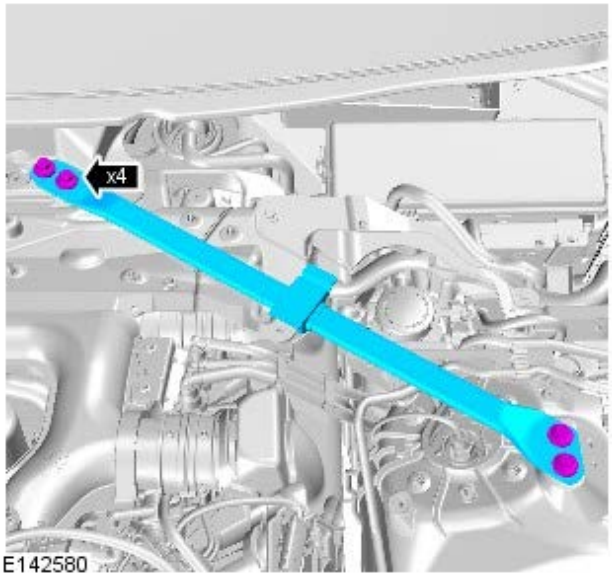
6. CAUTION: Discard the bolt.

   Torque: 44 Nm

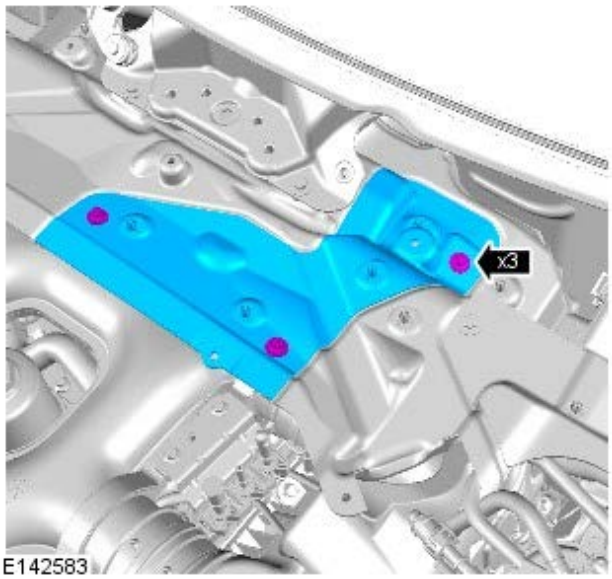
7. *Torque:* 55 Nm



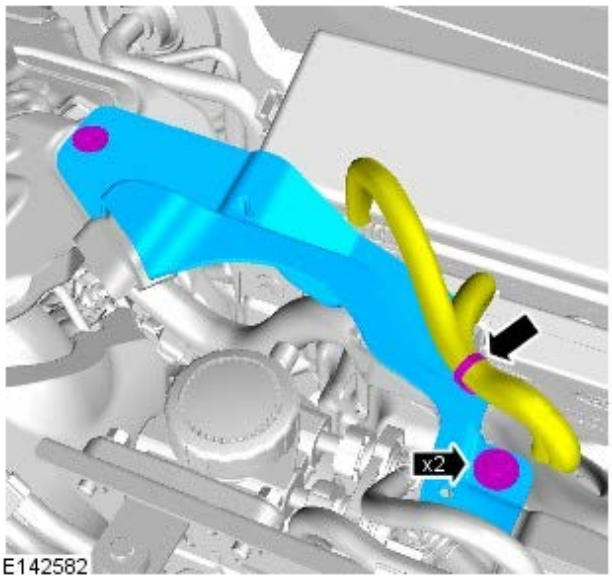
8. *Torque:* 55 Nm



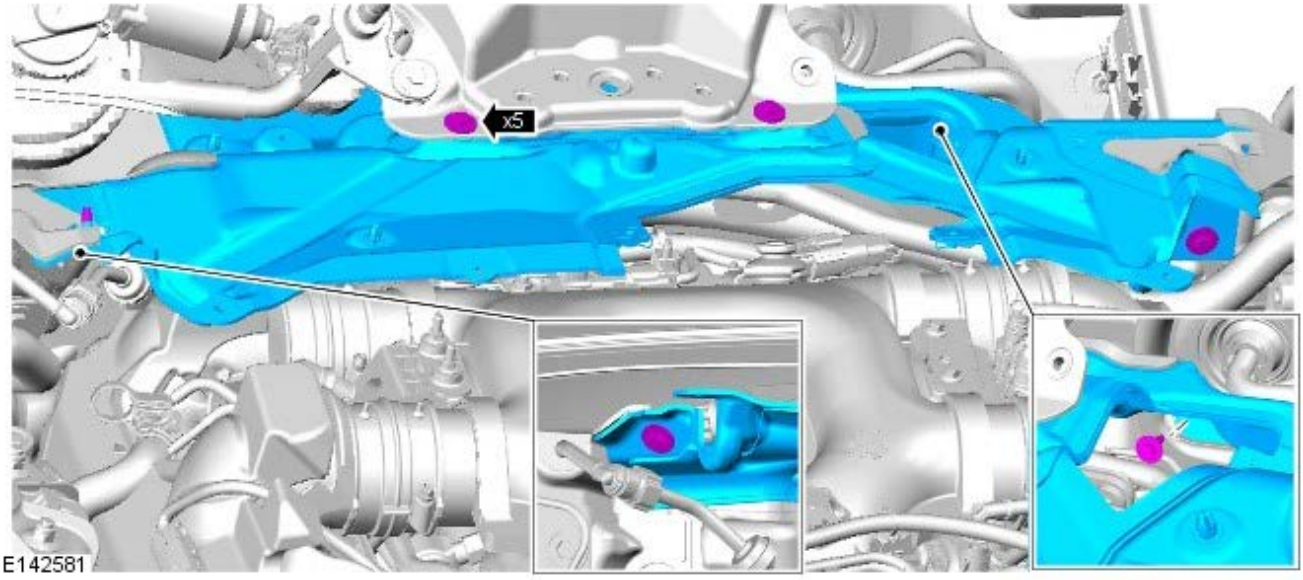
9. *Torque:* 6 Nm

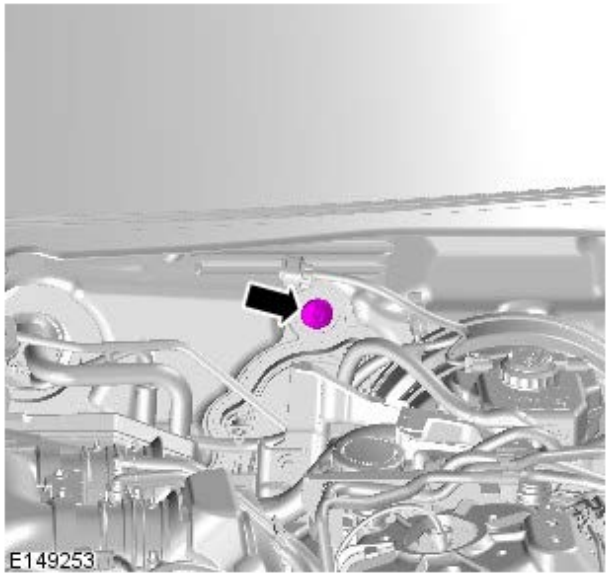


10. *Torque:* 6 Nm



11. *Torque:* 6 Nm



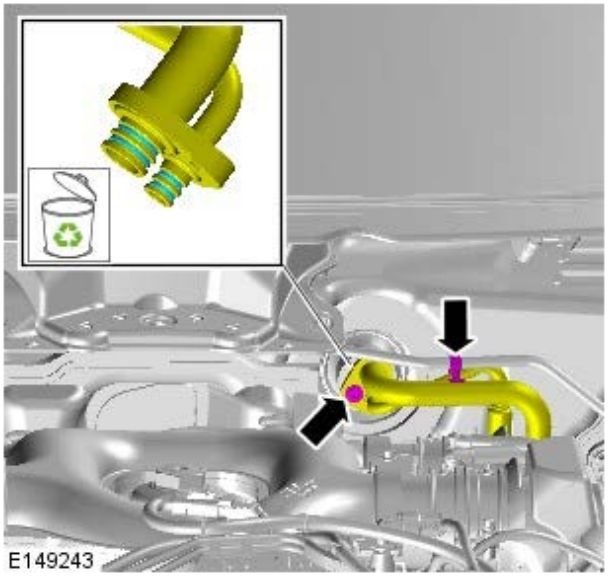


12. CAUTION: Install all the bolts finger tight before final tightening.

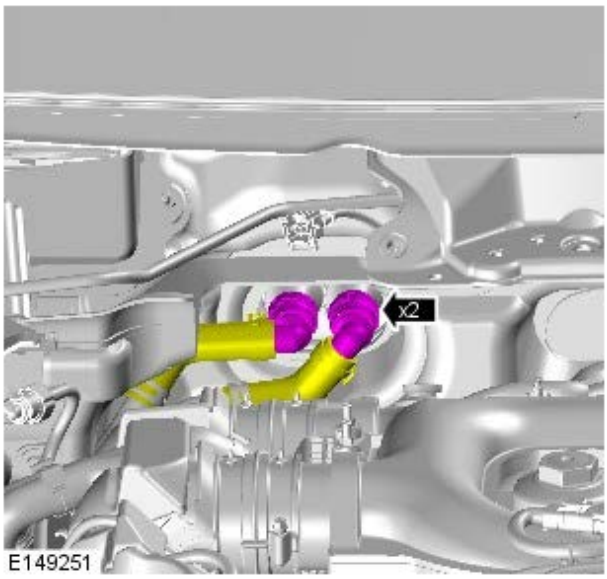
Torque: 20 Nm

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

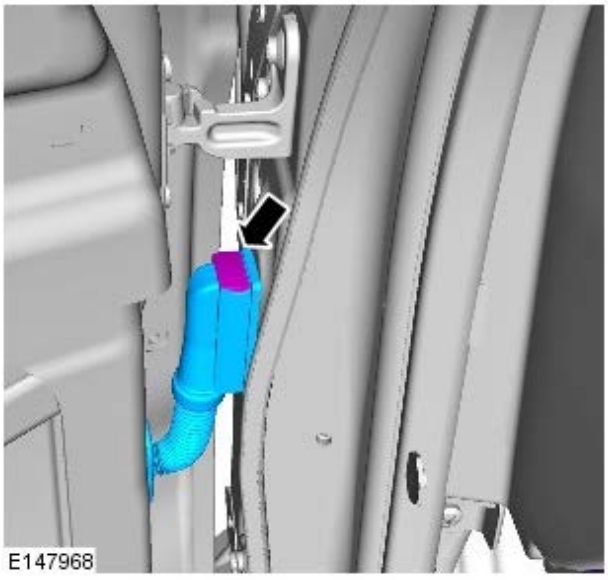
Torque: 10 Nm



14. CAUTION: Be prepared to collect escaping coolant.

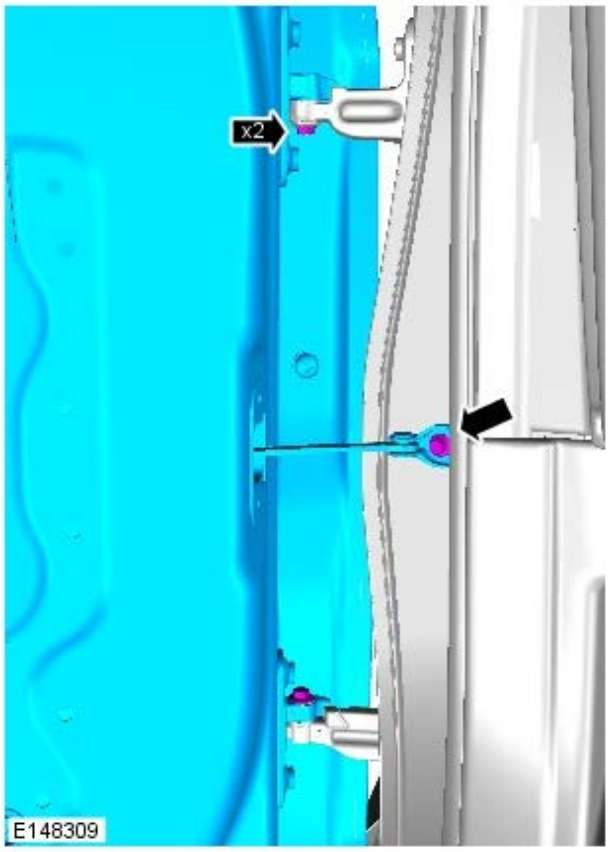


15. NOTE: Left hand illustration shown, right hand is similar.



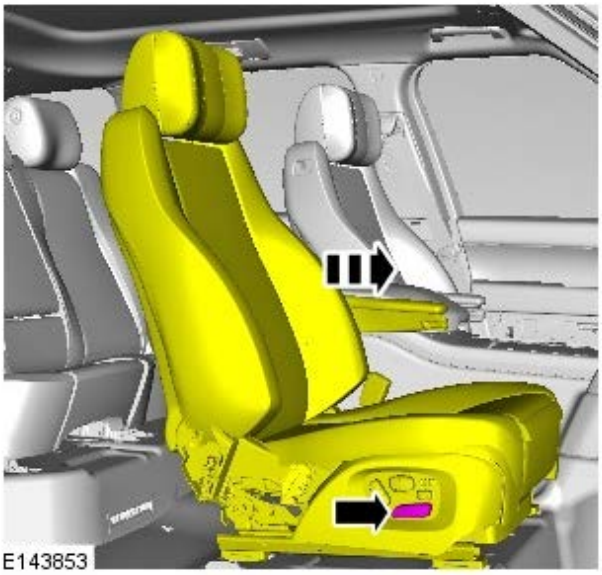
16. NOTES:

Left hand illustration shown, right hand is similar.



This step requires the aid of another technician.

Torque:
Torx bolt 24 Nm
M8 bolt 30 Nm



17. NOTES:

Repeat the procedure for the other side.

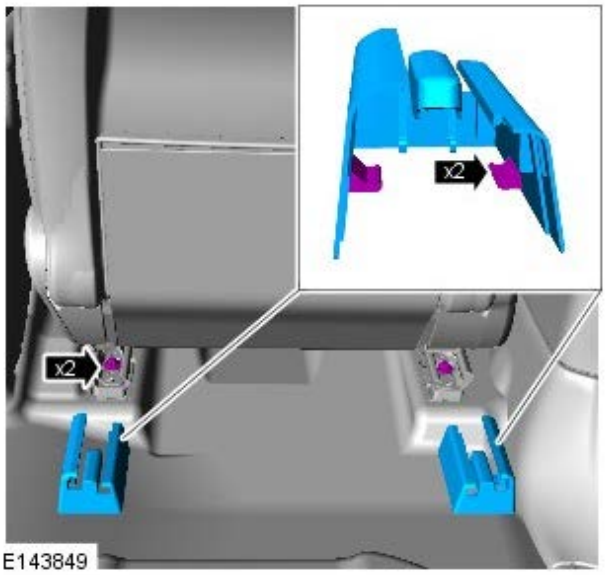
Right hand illustration shown, left hand is similar.

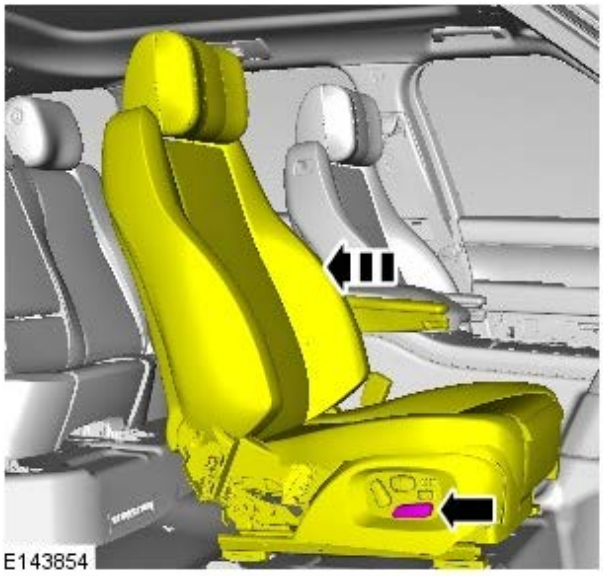
18. NOTES:

Repeat the procedure for the other side.

Right hand illustration shown, left hand is similar.

Torque: 47 Nm

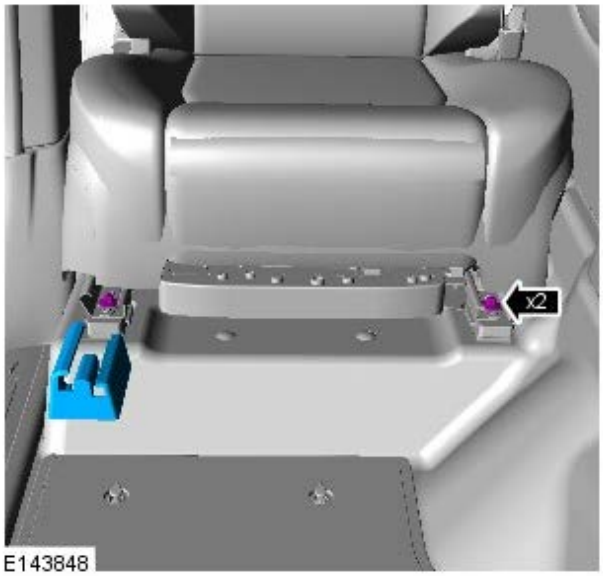




19. NOTES:

Repeat the procedure for the other side.

Right hand illustration shown, left hand is similar.



20. NOTES:

Repeat the procedure for the other side.

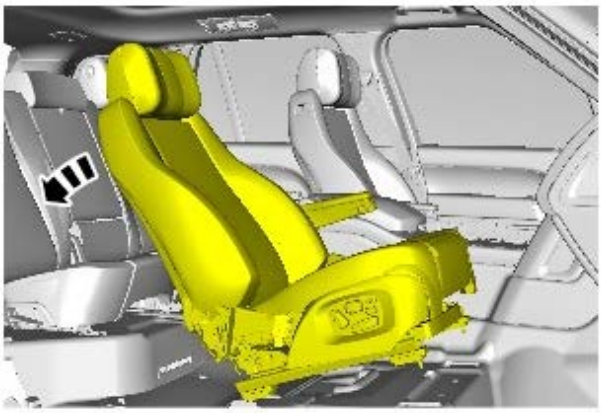
Right hand illustration shown, left hand is similar.

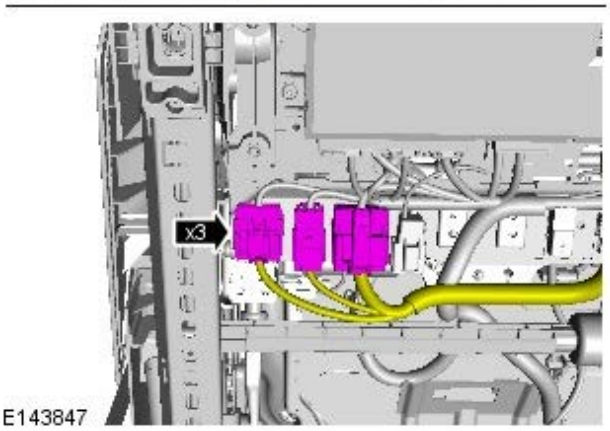
Torque: 47 Nm

21. Disconnect the battery ground cable.

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

22. NOTES:



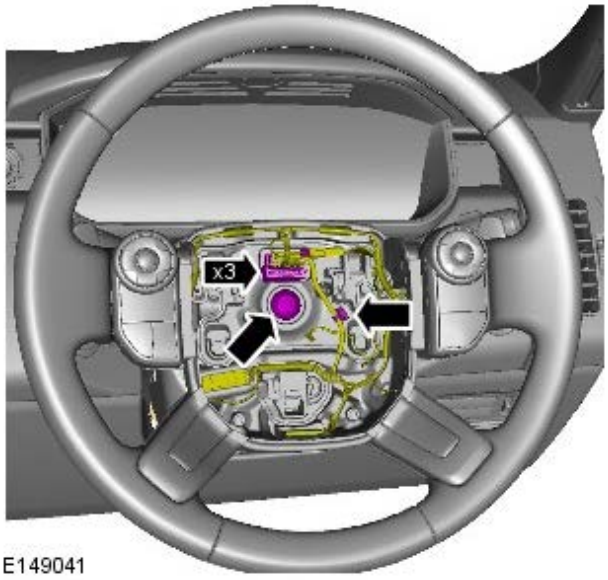


E143847

Repeat the procedure for the other side.

Right hand illustration shown, left hand is similar.

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

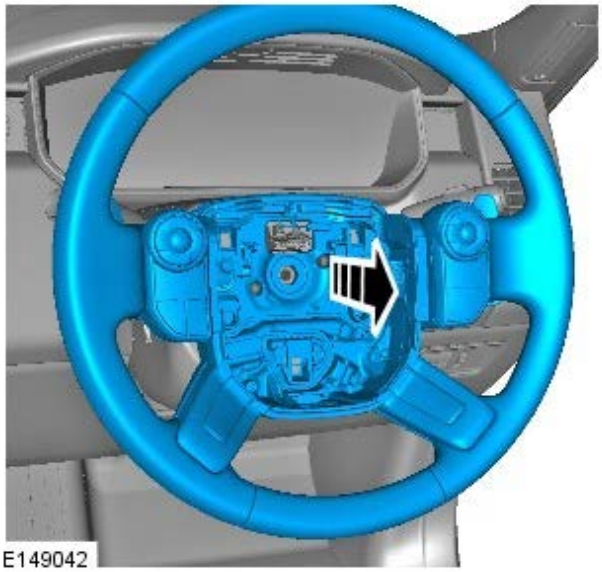


E149041

24. CAUTION: If a new steering column is installed, a new longer retaining bolt must be used to secure the steering wheel.

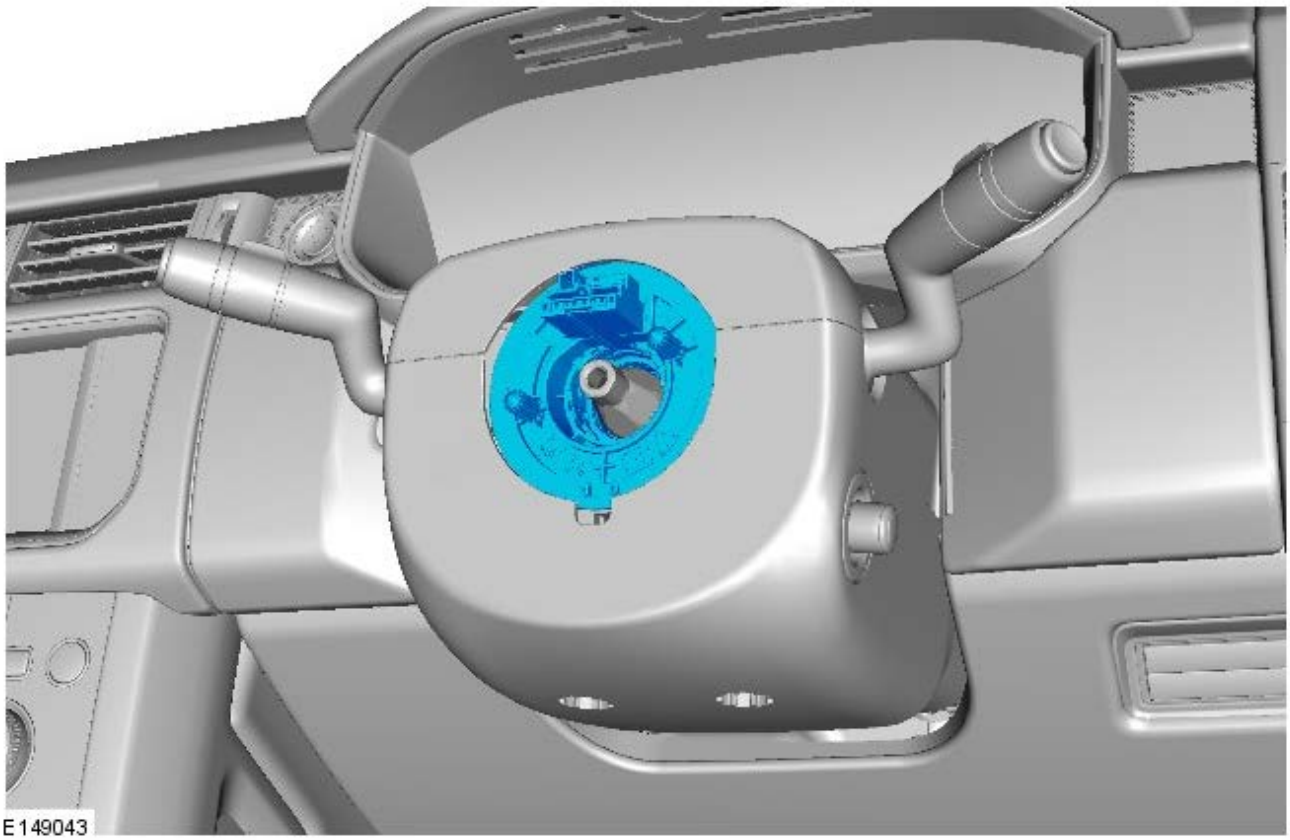
Torque: 47 Nm

25.

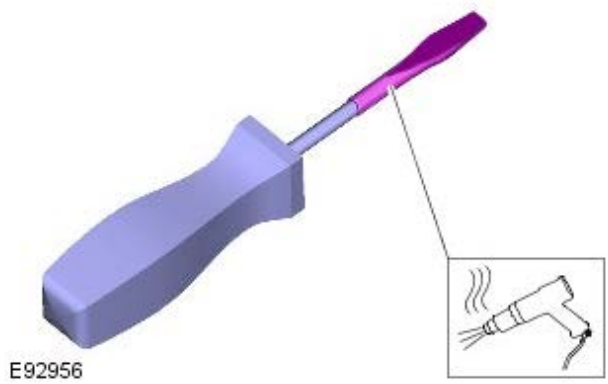

E149042

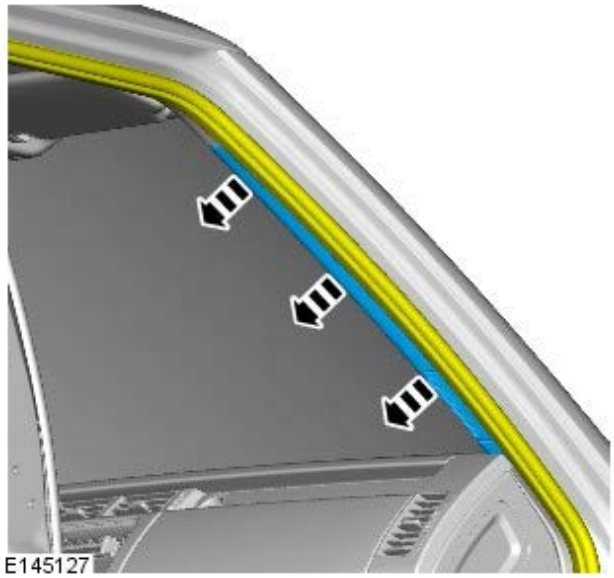
26. CAUTION: Make sure that the clockspring rotor does not rotate.

    Secure with adhesive tape.


E149043

27. CAUTION: Apply heatshrink or protective tape to the end of a suitable tool to protect the interior components.

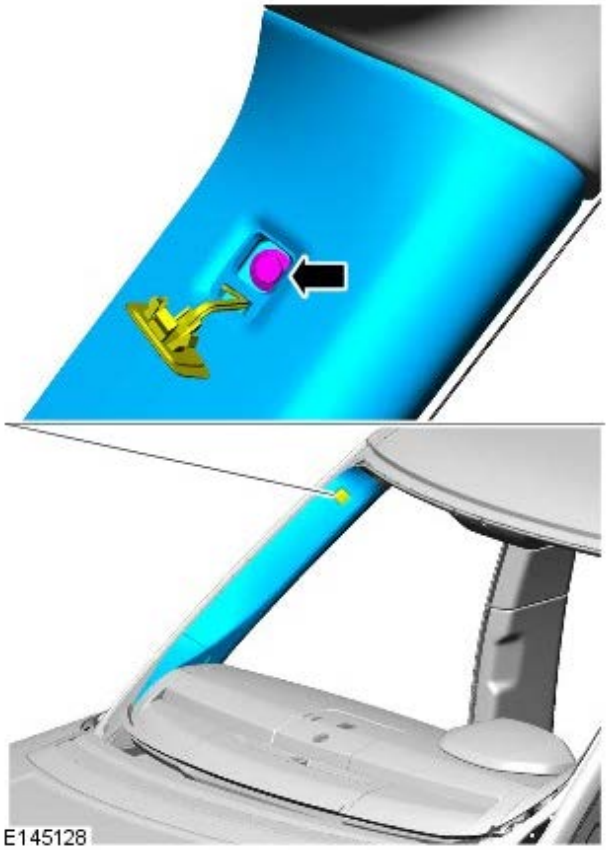

E92956


E145127

28. NOTES:

Repeat the procedure for the other side.

Right hand illustration shown, left hand is similar.


E145128

29. NOTES:

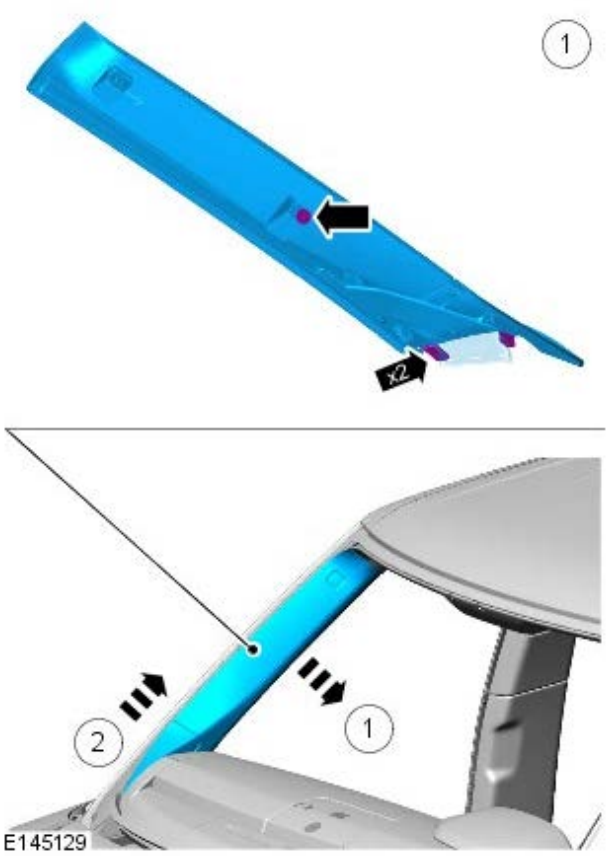
Repeat the procedure for the other side.

Right hand illustration shown, left hand is similar.

Torque: 6 Nm

30. NOTES:

Repeat the procedure for the other side.



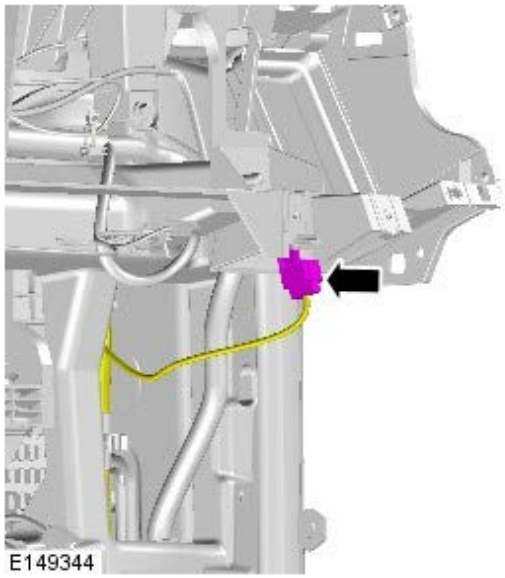
Right hand illustration shown, left hand is similar.

31. Refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

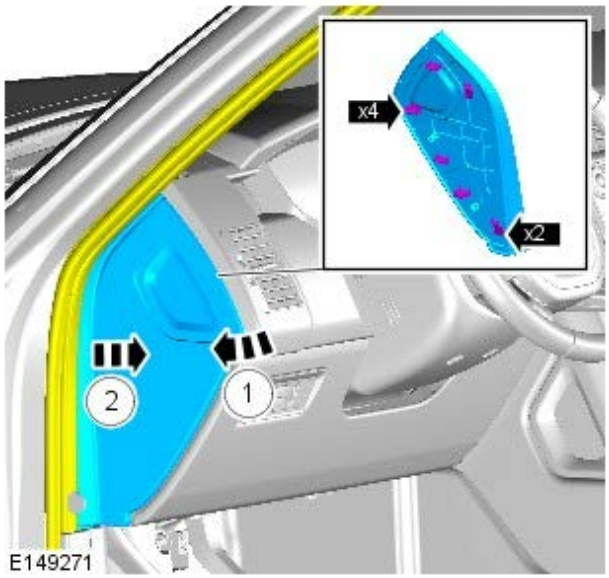
32. Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

33. Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

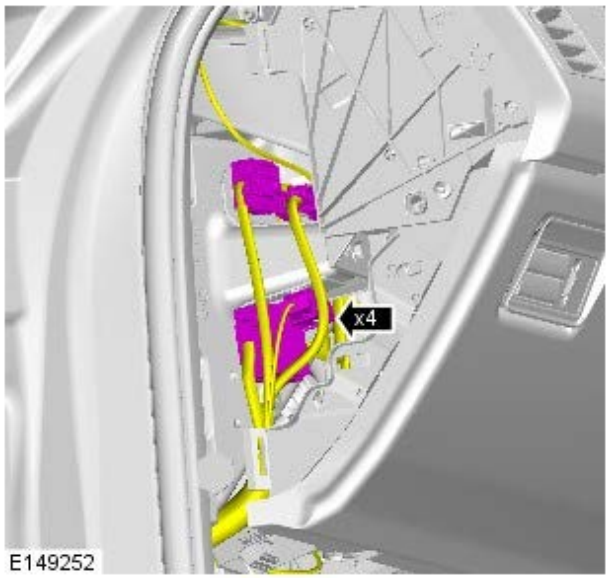
34.



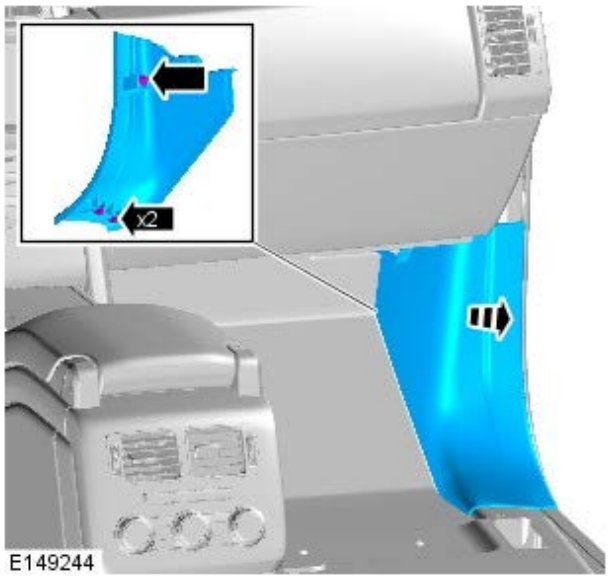
35.



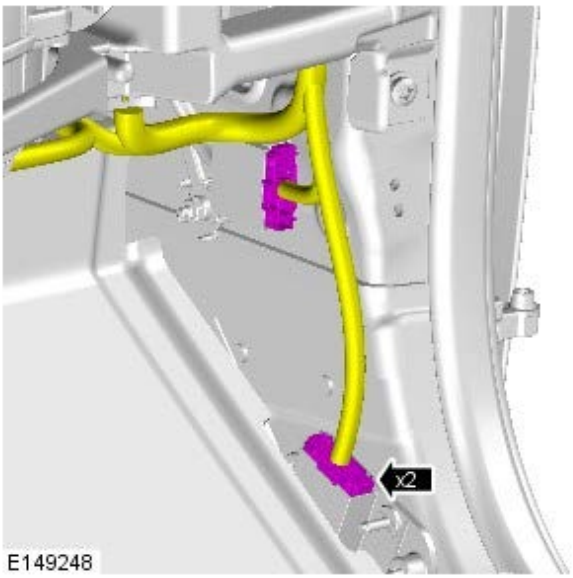
36.



37.



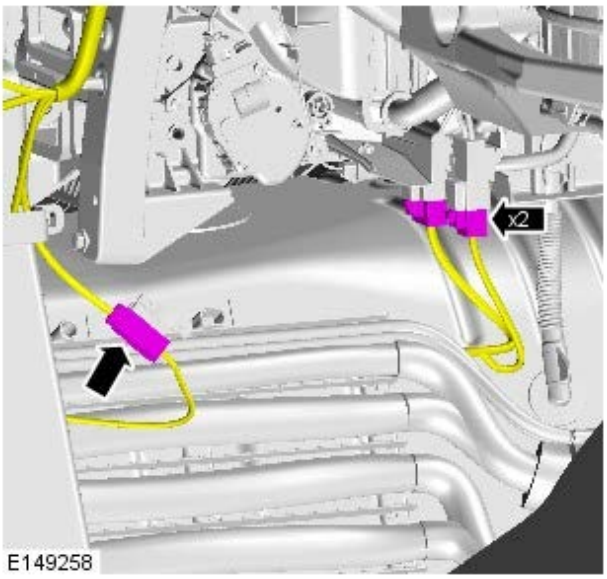
38.



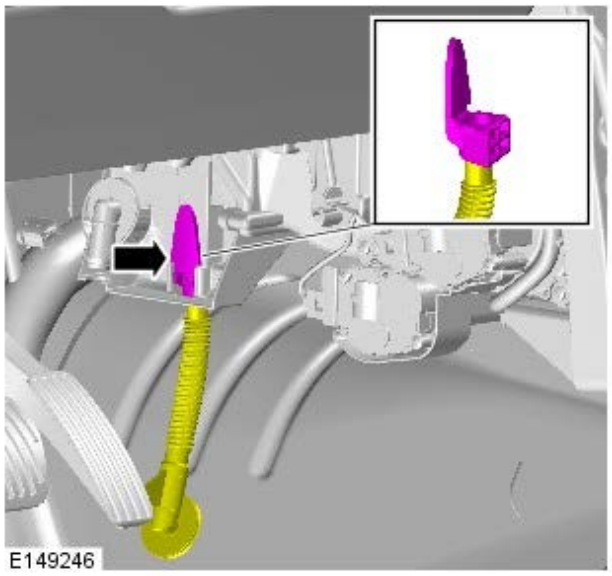
39.



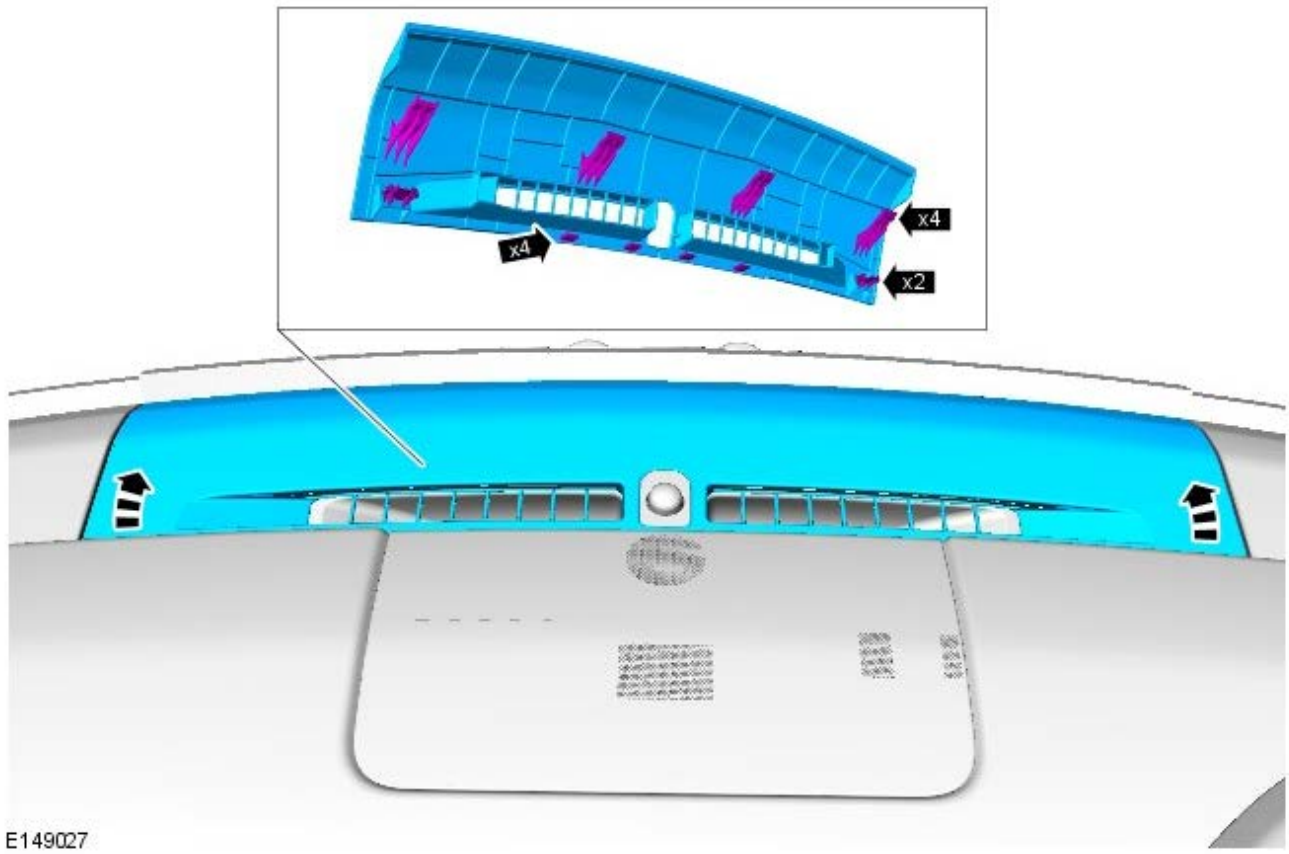
40.



41. NOTE: Repeat the procedure for the other side.

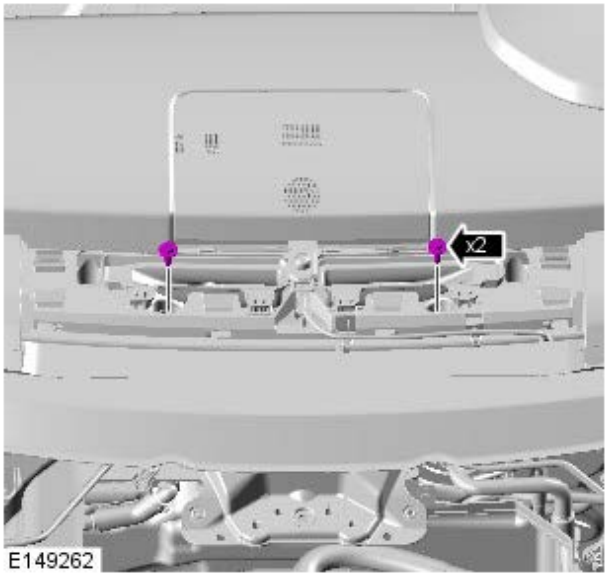


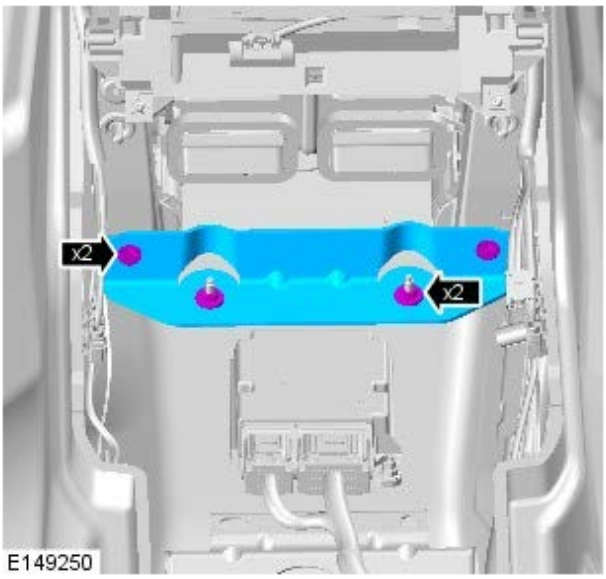
42.



43. CAUTION: Install all the bolts finger tight before final tightening.

Torque: 20 Nm



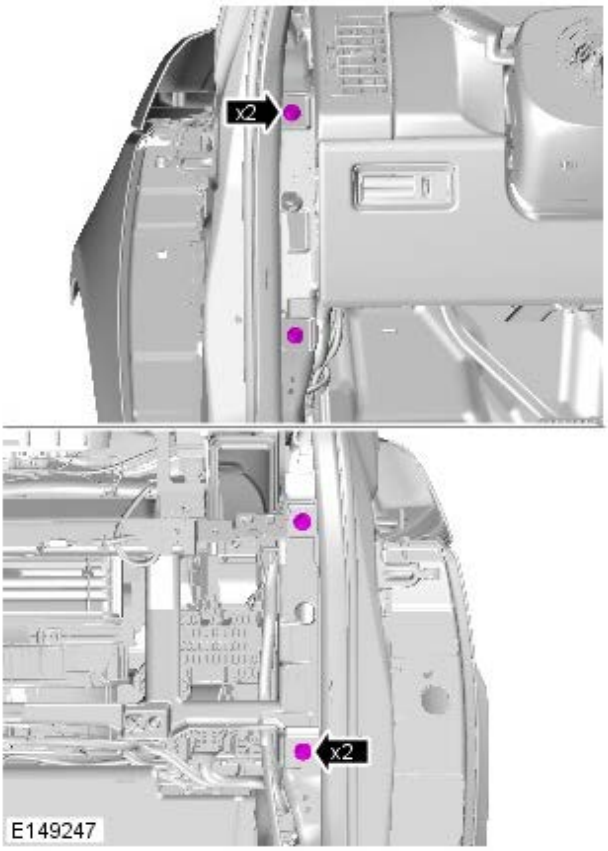


44. CAUTION: Install all the bolts finger tight before final tightening.

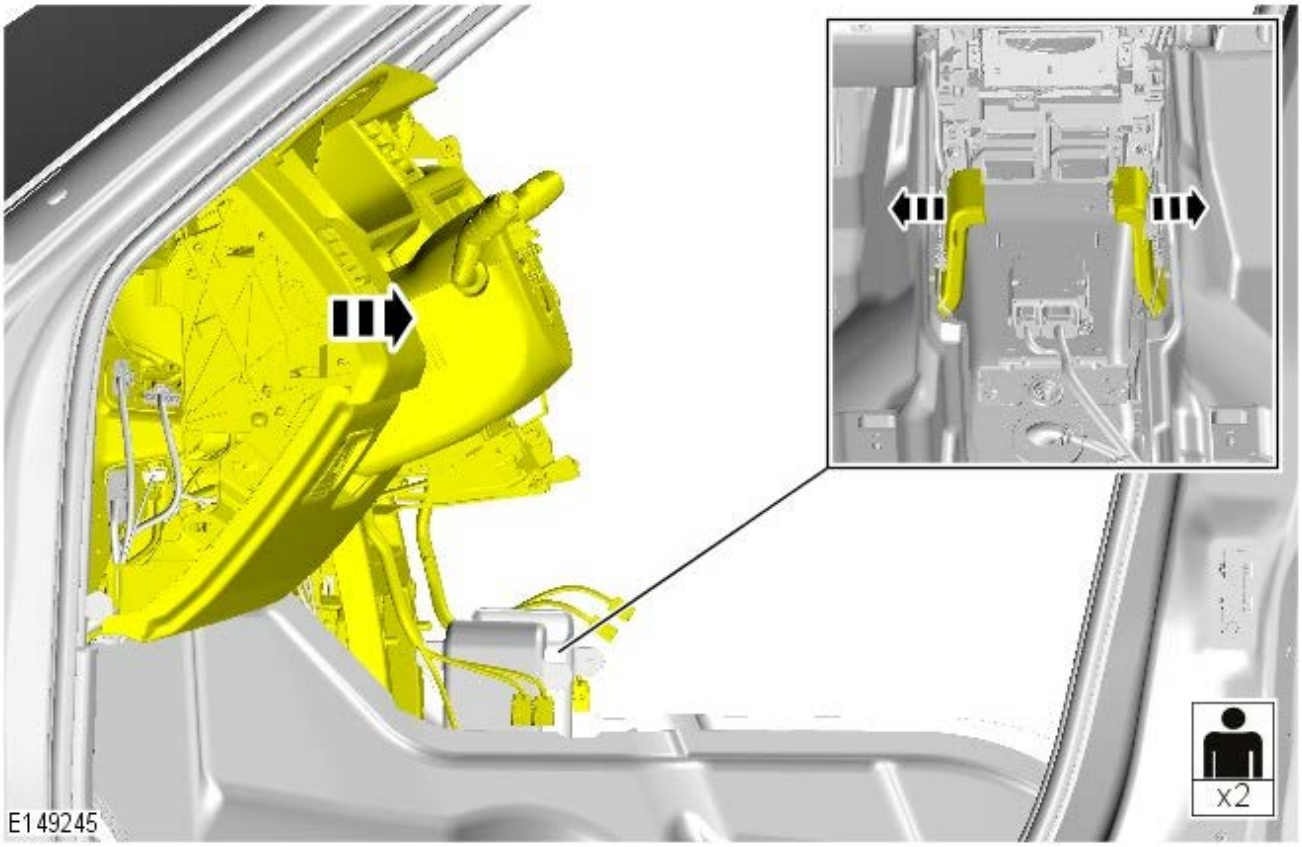
    Torque: 9 Nm

45. CAUTION: Install all the bolts finger tight before final tightening.

    Torque: 20 Nm



46.

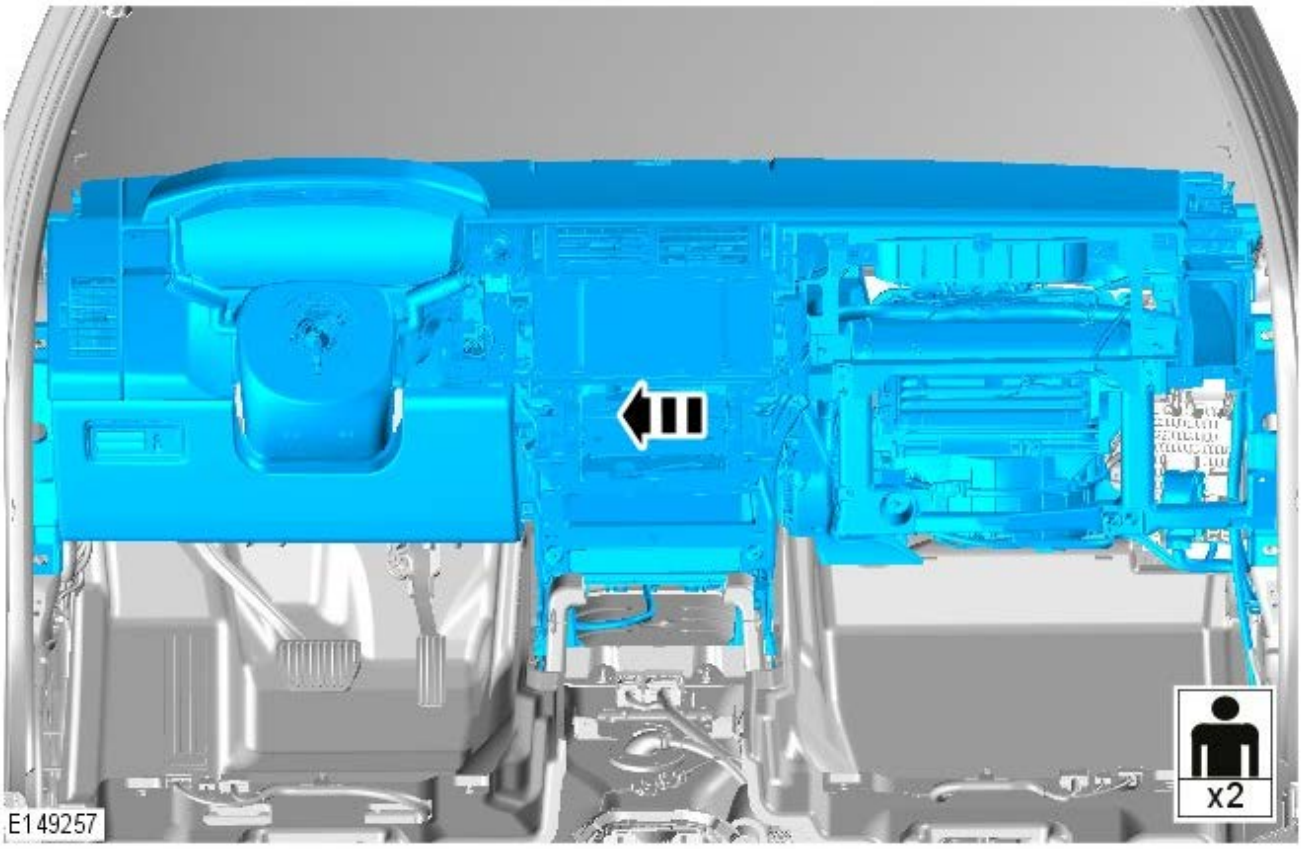


47. NOTE: Secure with cable ties.

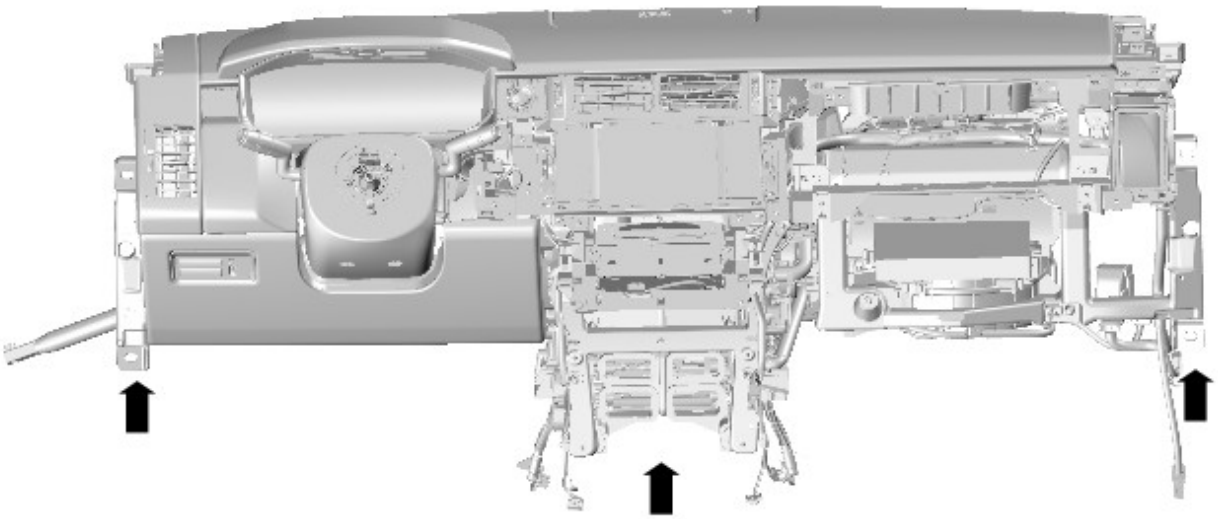


E149260

48.

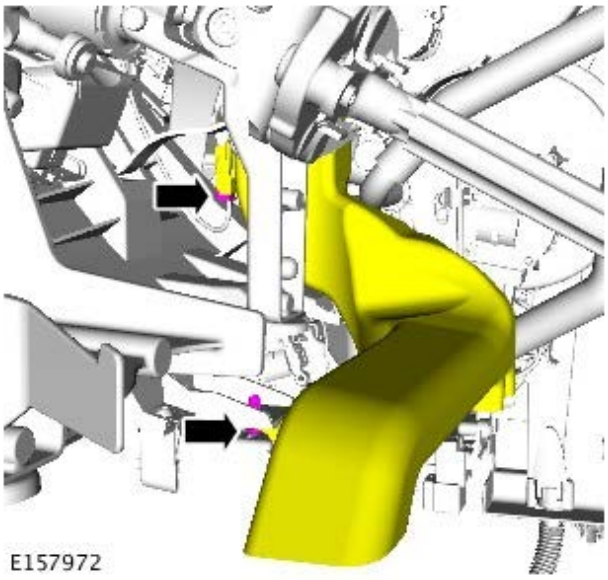


49. CAUTION: Make sure that the weight of the instrument panel is evenly supported. Failure to follow this instruction may result in damage to the components.



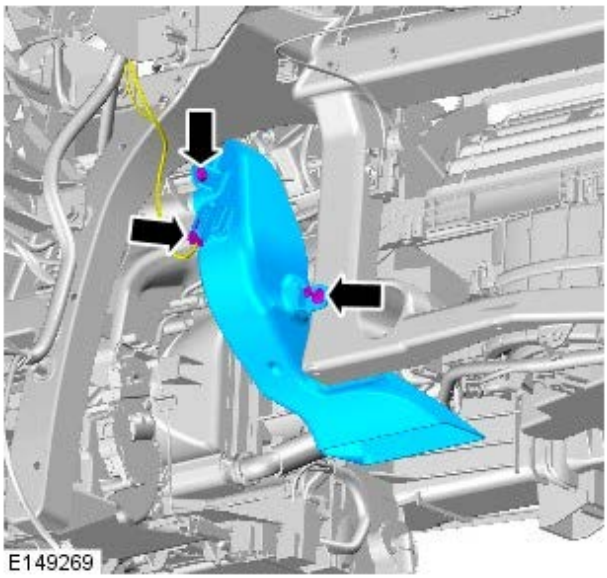
E149261

50.

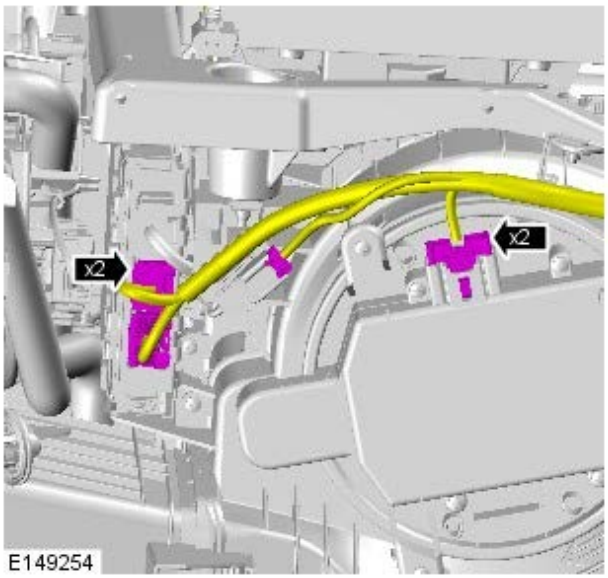


E157972

51.

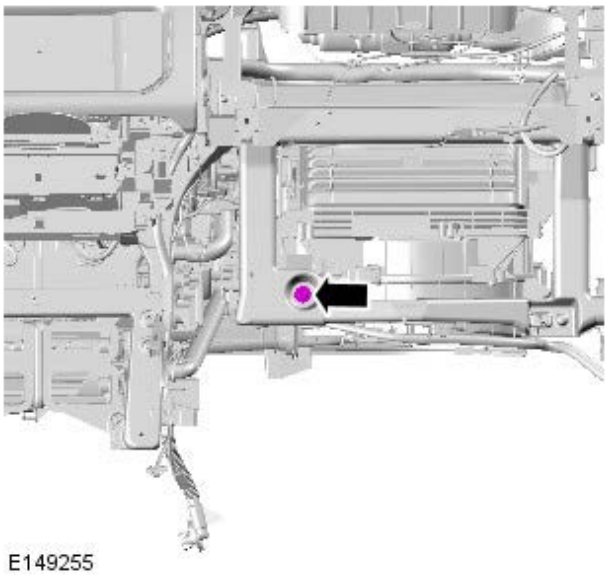


52.



53. CAUTION: Install all the bolts finger tight before final tightening.

Torque: 9 Nm

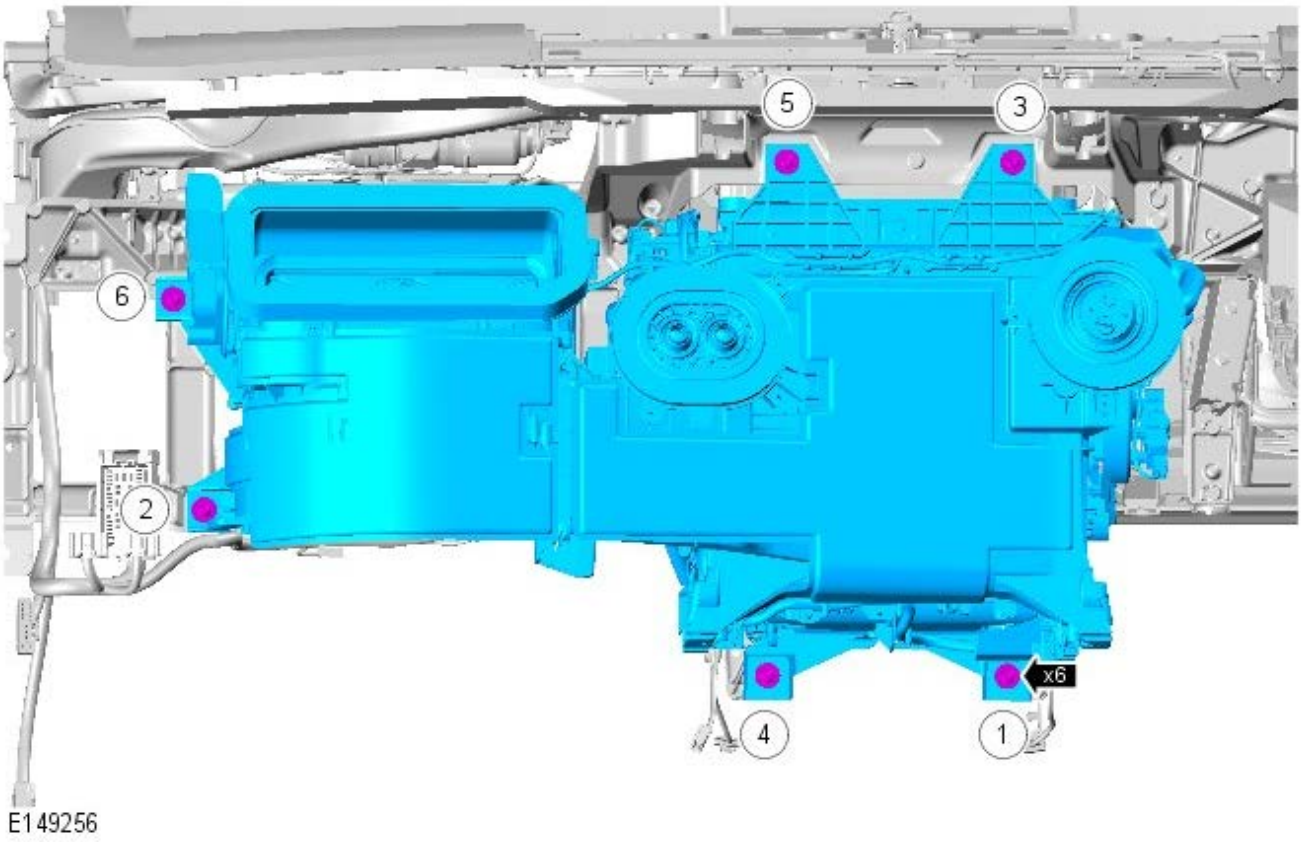


54. CAUTIONS:

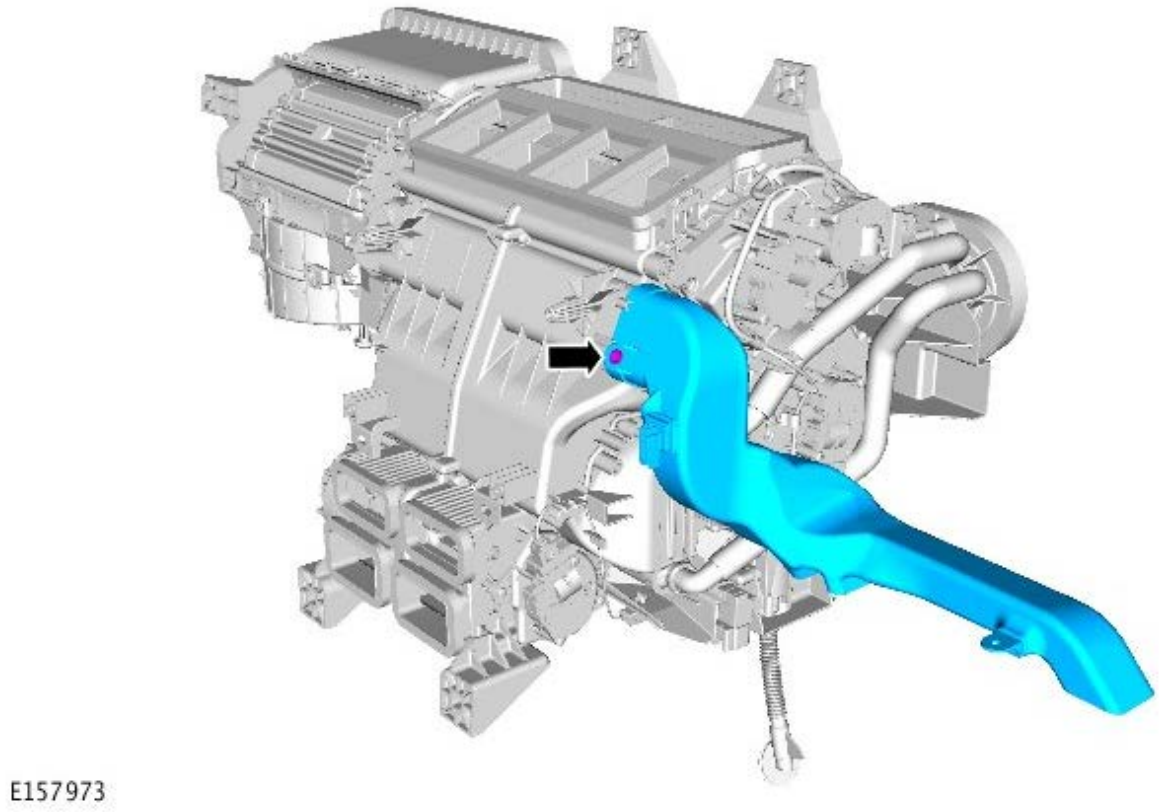
Install all the bolts finger tight before final tightening.

Tighten the bolts in the sequence shown.

Torque: 9 Nm

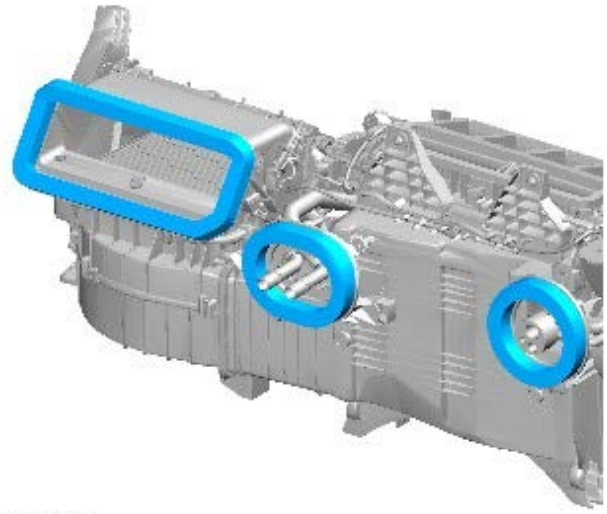


55.



Installation

1. CAUTION: Remove and discard the seals.



E149476

NOTE: Install new seals.



E149477

2. NOTE: Make sure that the grommets are correctly seated.

3. NOTE: Install the trim retaining clips in the moulding prior to installing the components.



E149095

4. To install, reverse the removal procedure.

Published: 12-Jun-2013

Climate Control - Receiver Drier

Removal and Installation

Removal

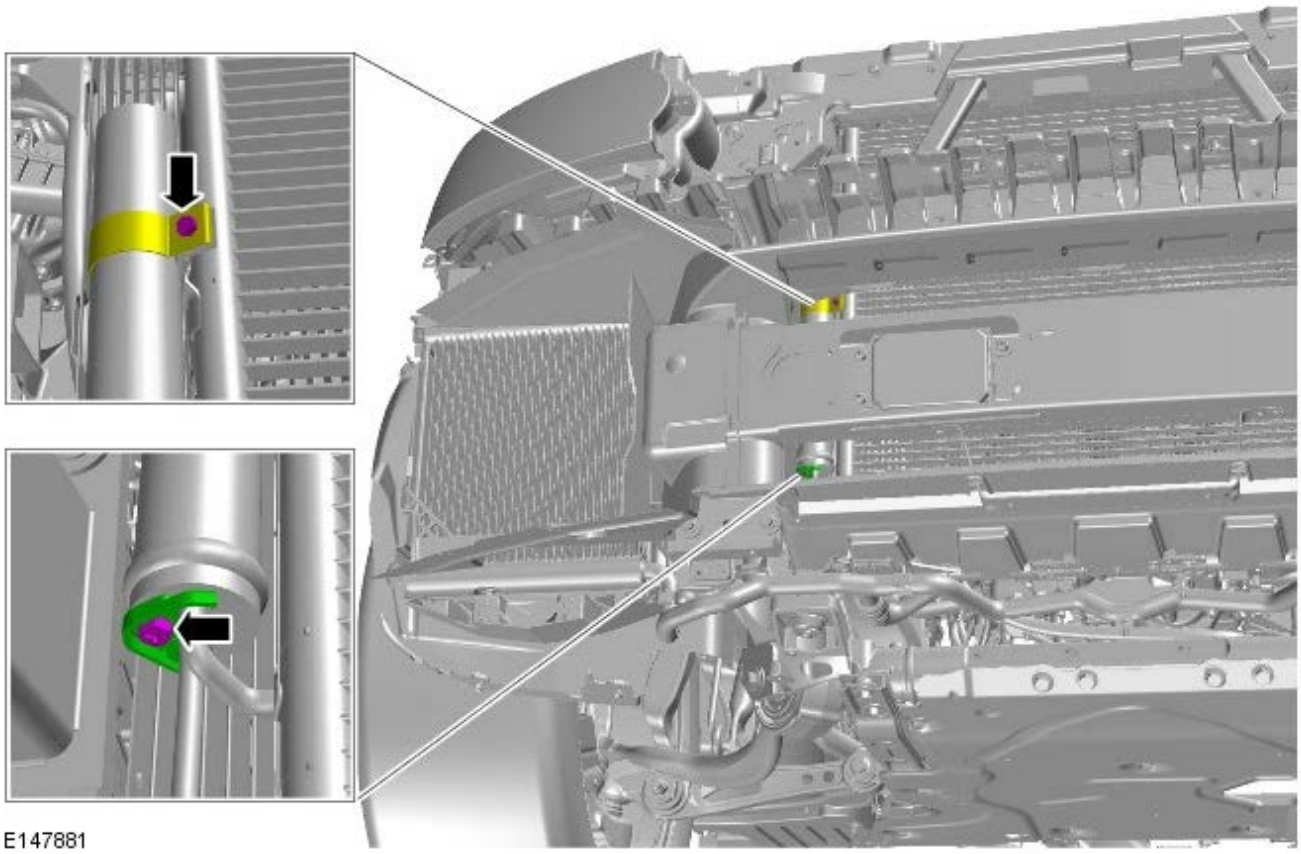
NOTES:

Removal steps in this procedure may contain installation details.

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

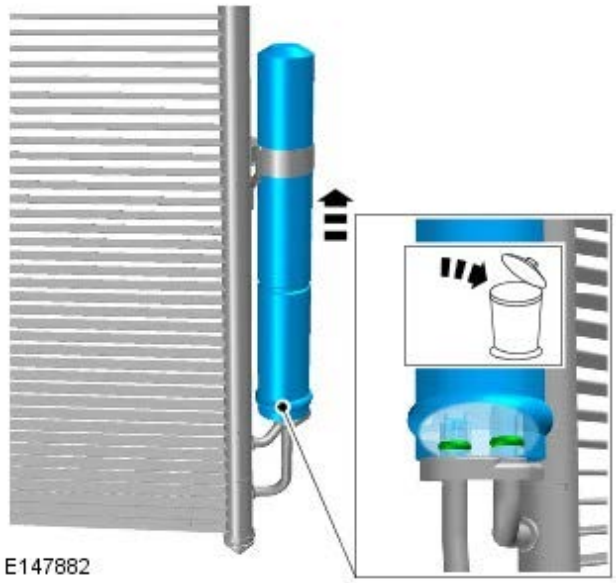
Some variation in the illustrations may occur, but the essential information is always correct.

1. Raise and support the vehicle.
2. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
3. Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).
4.



E147881

5.



Installation

1. To install, reverse the removal procedure.

Published: 16-May-2013

Climate Control - Ambient Air Quality Sensor

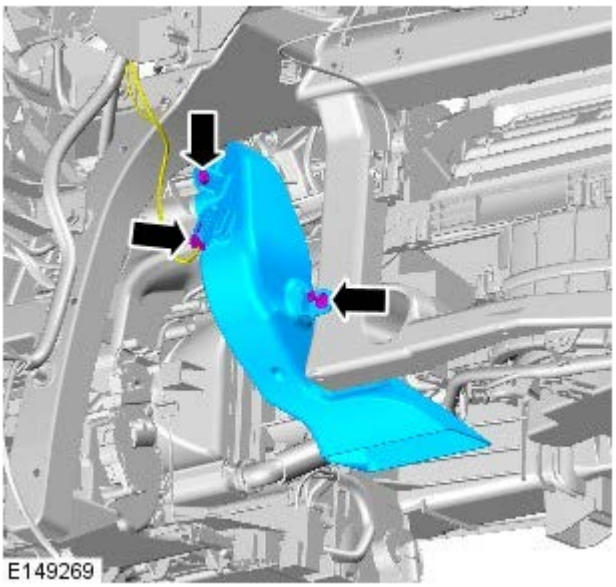
Removal and Installation

Removal

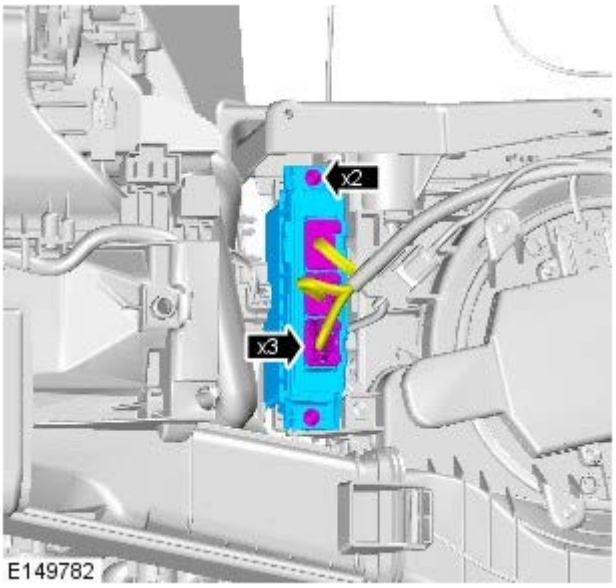
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

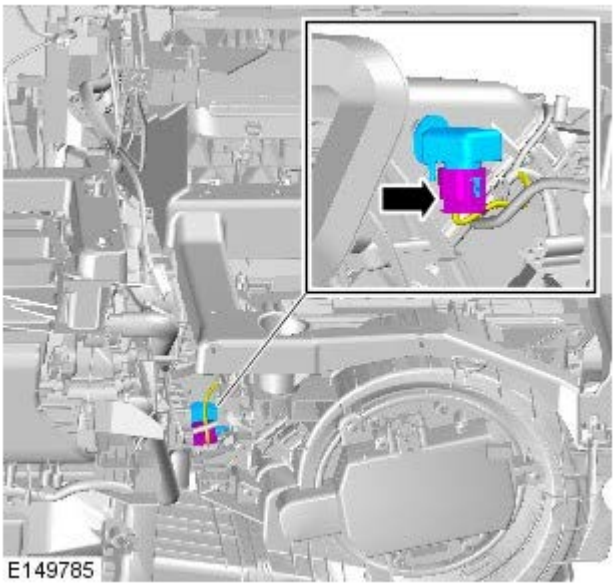
2.



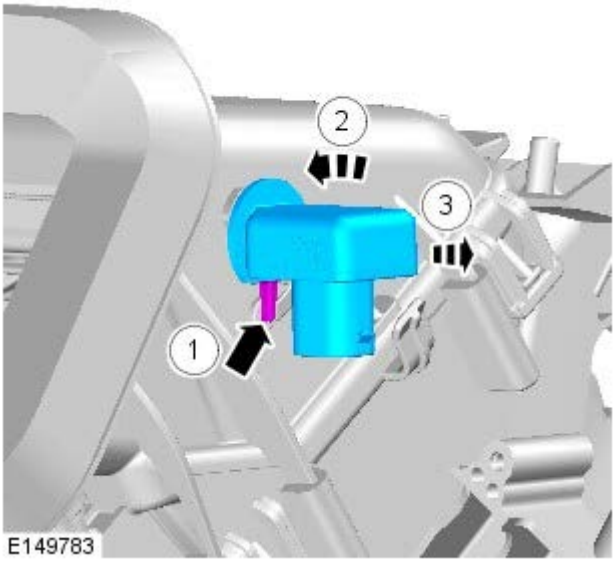
3.



4.



5.



Installation

1. To install, reverse the removal procedure.

Published: 10-Jun-2013

Climate Control - Integrated Control Panel

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

Some components shown removed for clarity.

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

1.



E155713

2.



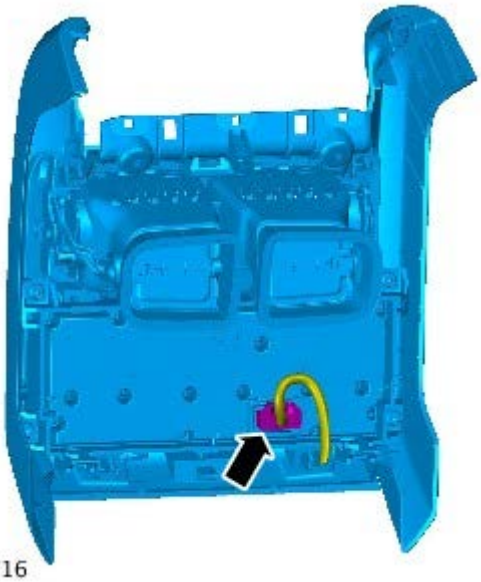
E155714

3.

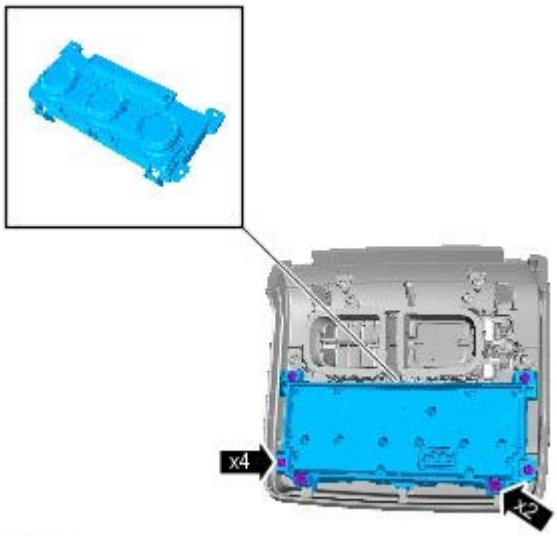


E155715

4.


E155716

5.



E148982

Installation

1. To install, reverse the removal procedure.

Published: 16-May-2013

Climate Control - In-Vehicle Temperature Sensor

Removal and Installation

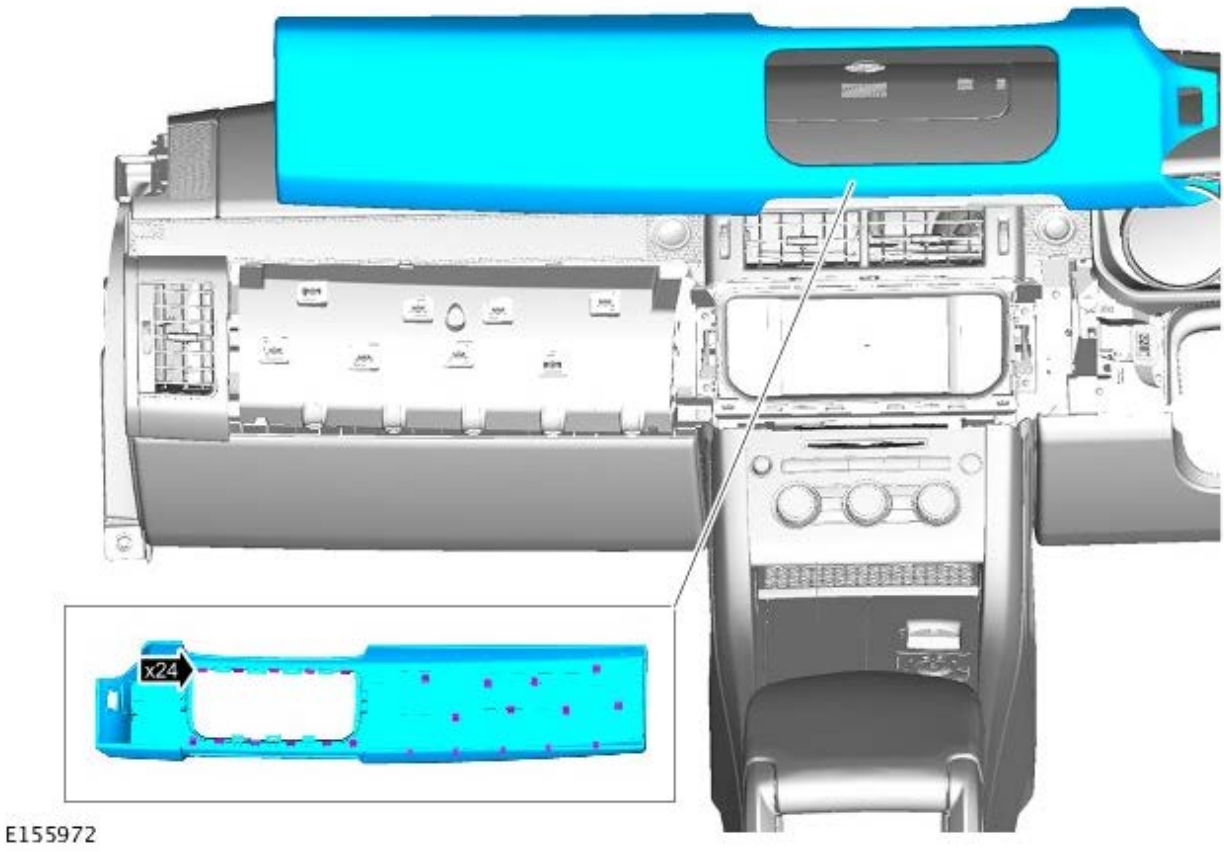
Removal

NOTES:

Removal steps in this procedure may contain installation details.

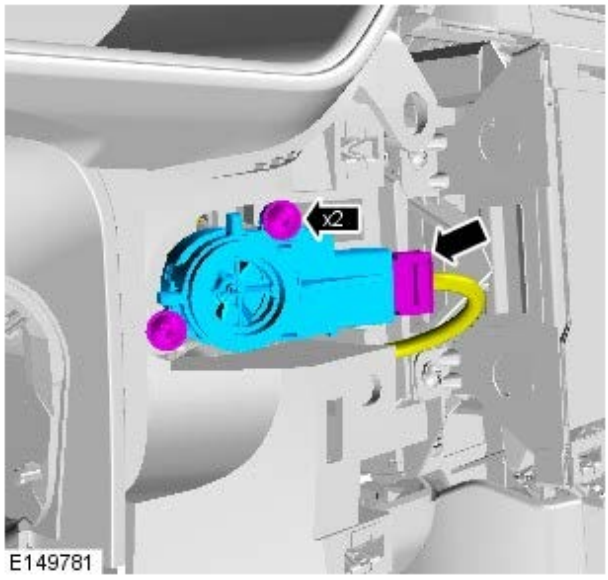
Some variation in the illustrations may occur, but the essential information is always correct.

1.



E155972

2. NOTE: Left Hand illustration shown, Right Hand is similar.



E149781

Installation

1. NOTE: Install the trim retaining clips in the moulding prior to installing the components.



E149095

2. To install, reverse the removal procedure.

Published: 16-May-2013

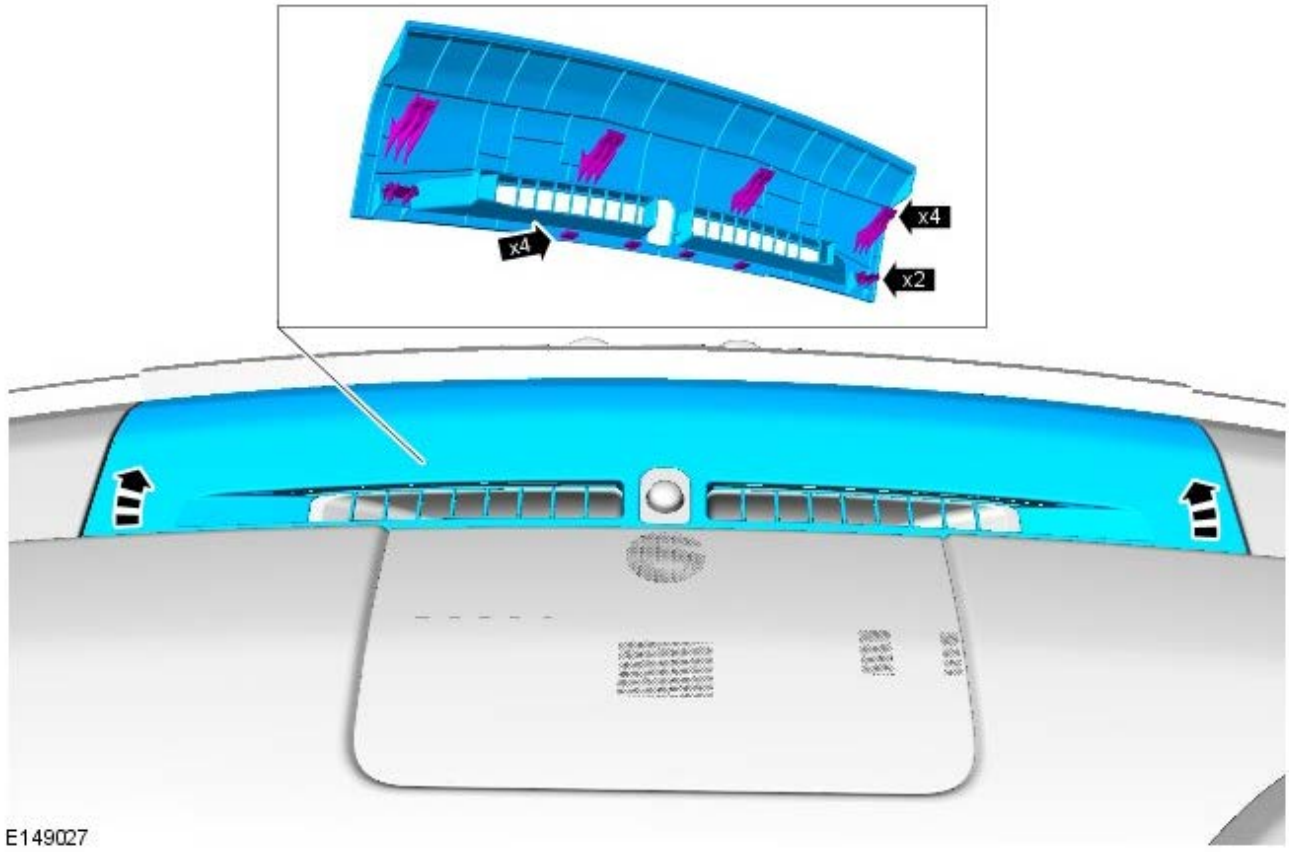
Climate Control - Front Sunload Sensor

Removal and Installation

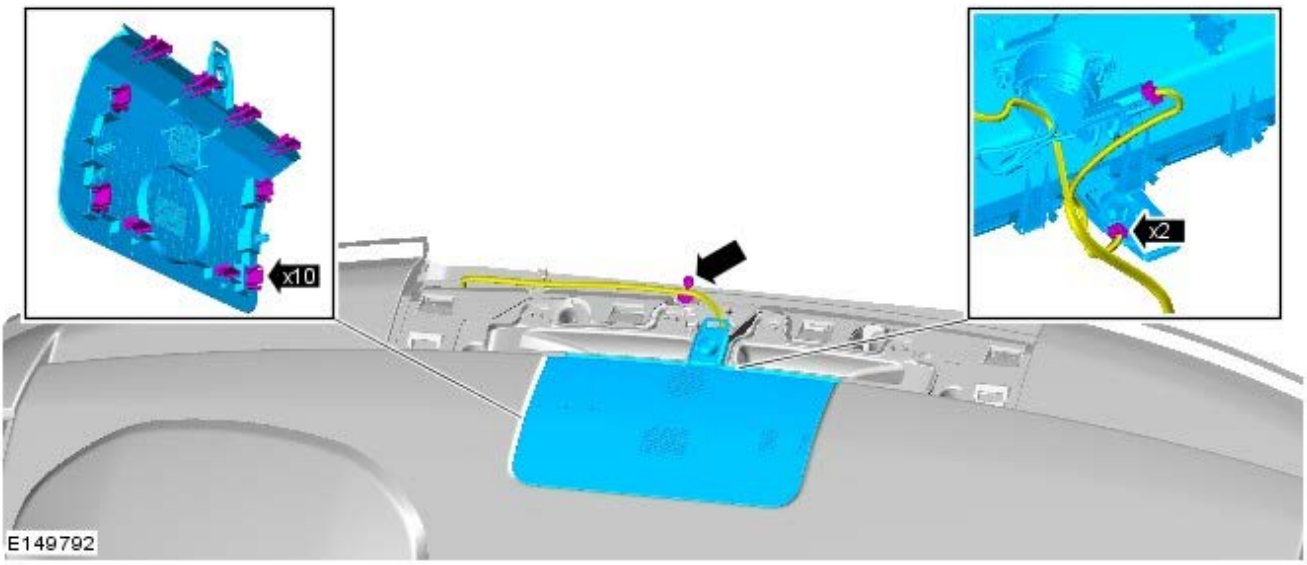
Removal

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

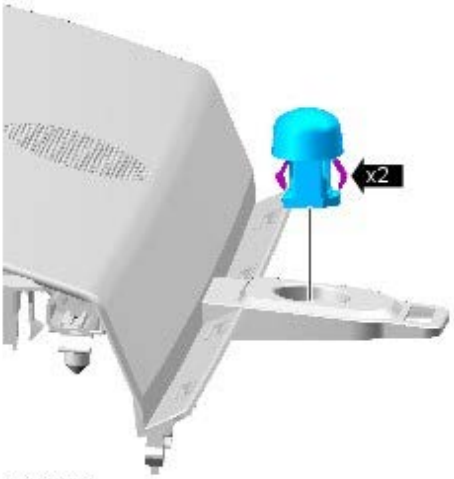
1.



2.



3.



E149793

Installation

1. To install, reverse the removal procedure.

Published: 16-May-2013

Climate Control - Passenger Side Register

Removal and Installation

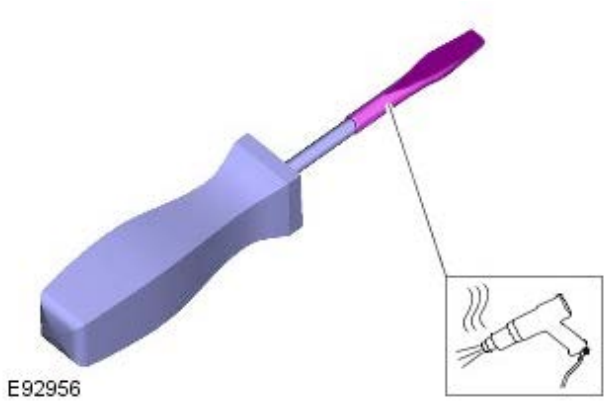
Removal

NOTES:

Removal steps in this procedure may contain installation details.

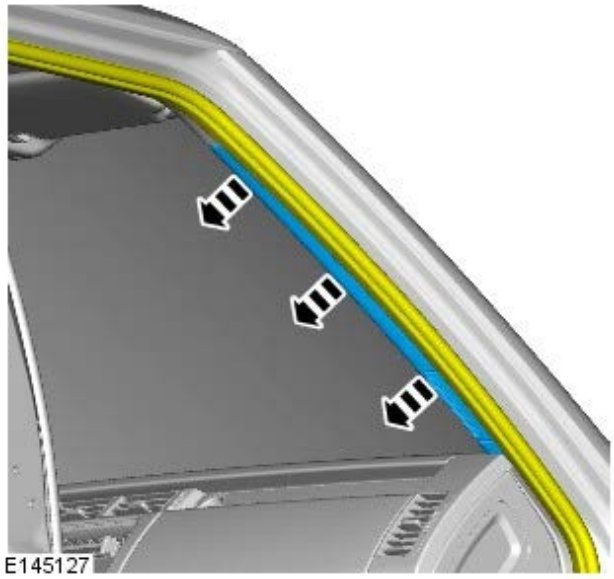
Some illustrations may show left hand drive. Right hand drive is similar, but the essential information shown is always correct.

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

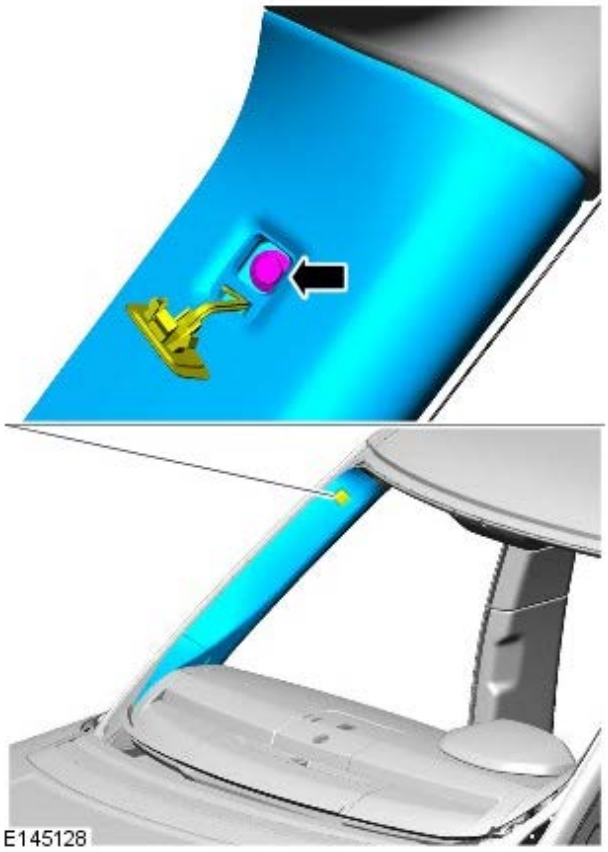

E92956

1. CAUTION: Apply heatshrink or protective tape to the end of a suitable tool to protect the interior components.

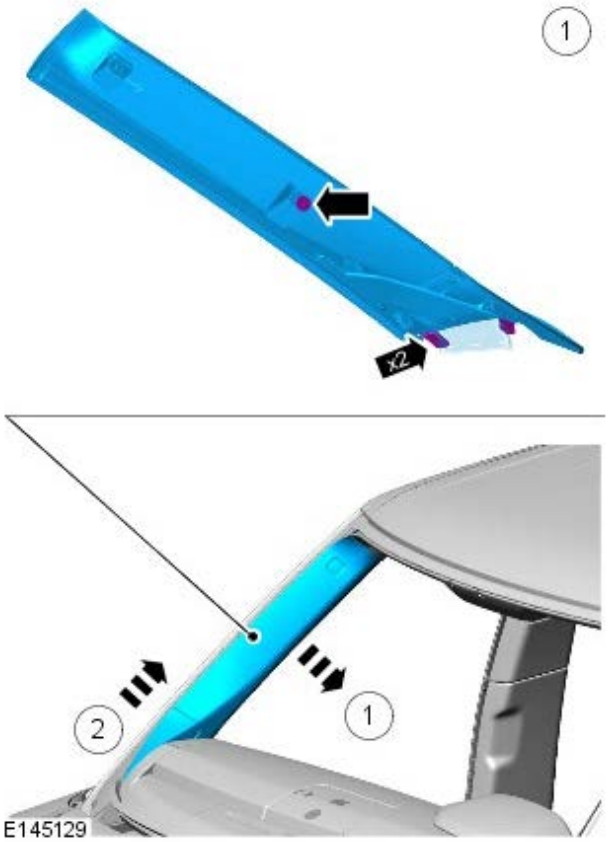
2.


E145127

3. *Torque:* 6 Nm



4.

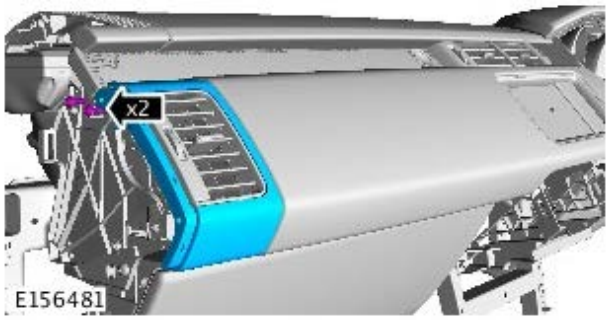


5.

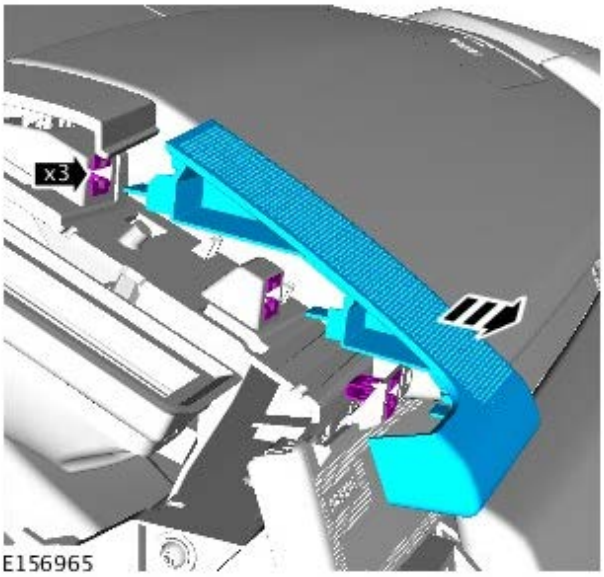


6.

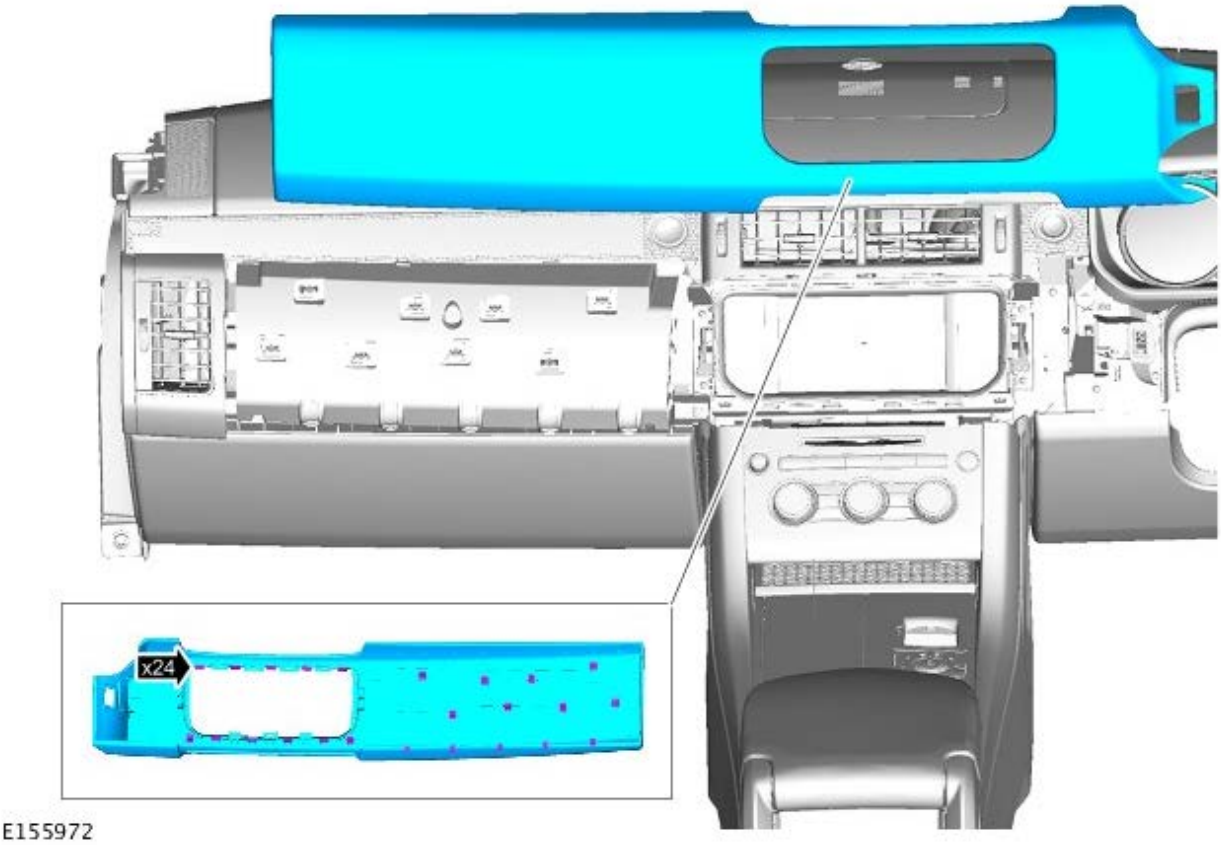




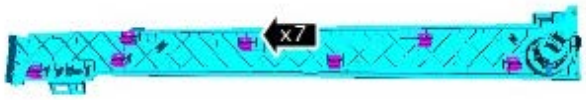
7.

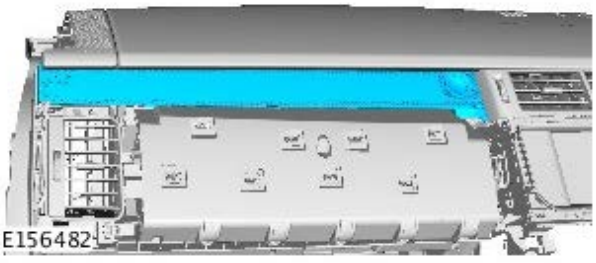


8.

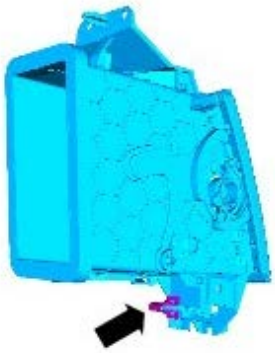


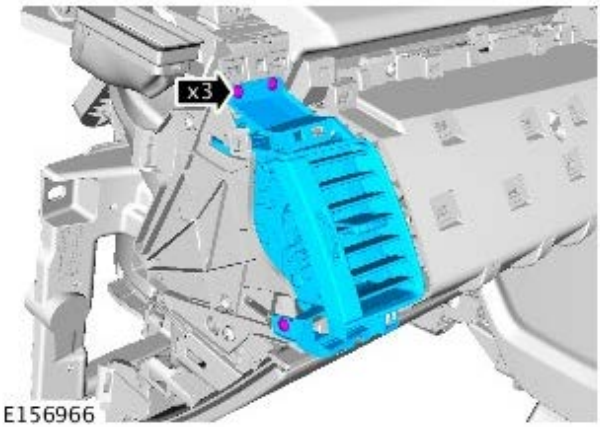
9.





10.





Installation

1. NOTE: Install the trim retaining clips in the moulding prior to installing the components.



E149095

2. To install, reverse the removal procedure.

Published: 13-Jun-2013

Climate Control - Cool Air Bypass Motor

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.

All vehicles

1. Disconnect the battery ground cable.

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

Right-hand drive vehicles

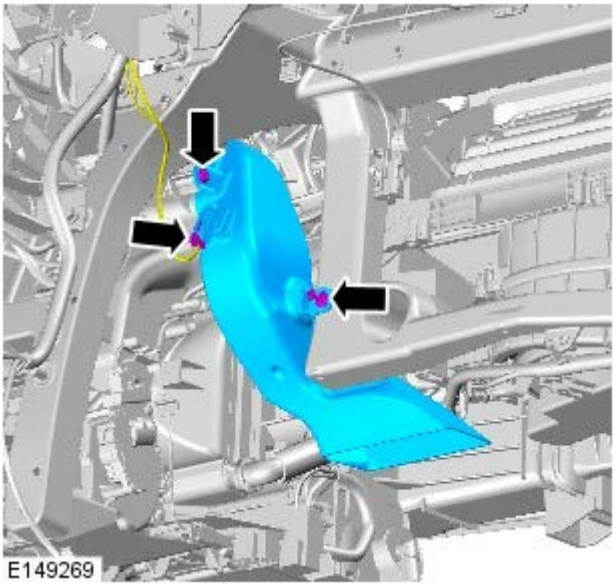
2. Refer to: Instrument Panel Lower Section (501-12 Instrument Panel and Console, Removal and Installation).

Left-hand drive vehicles

3. Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

Left-hand drive vehicles

4.



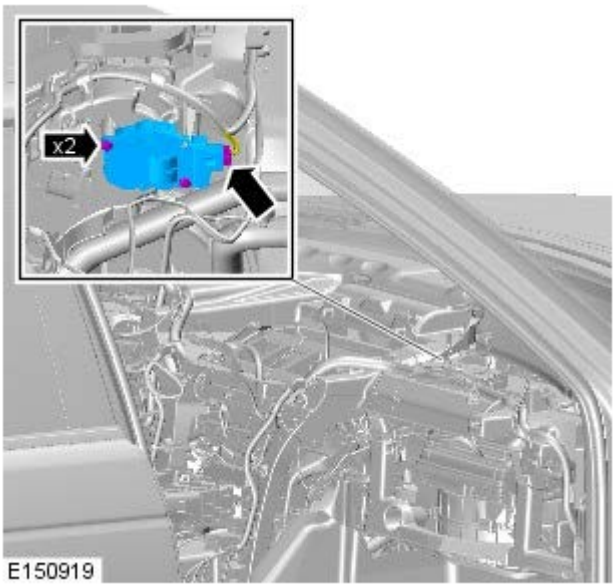
Left-hand drive vehicles

5.



All vehicles

6. NOTE: Left hand drive illustration shown, Right hand drive is similar.



Installation

1. To install, reverse the removal procedure.

Published: 16-May-2013

Climate Control - Driver Side Register

Removal and Installation

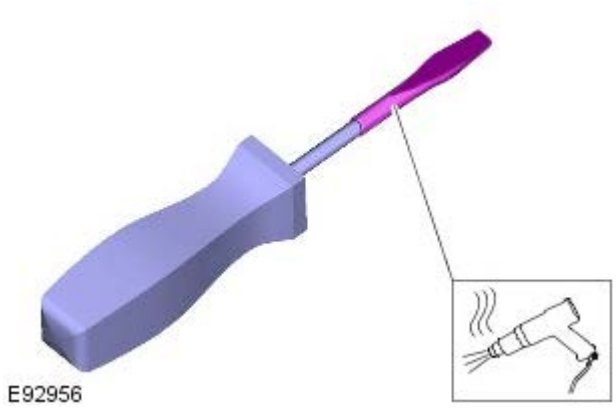
Removal

NOTES:

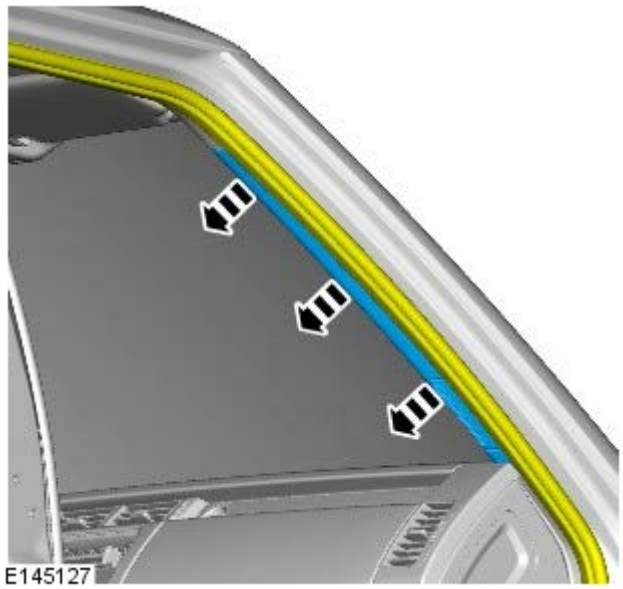
Removal steps in this procedure may contain installation details.

Some illustrations may show Right hand drive. Left hand drive is similar, but the essential information shown is always correct.

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



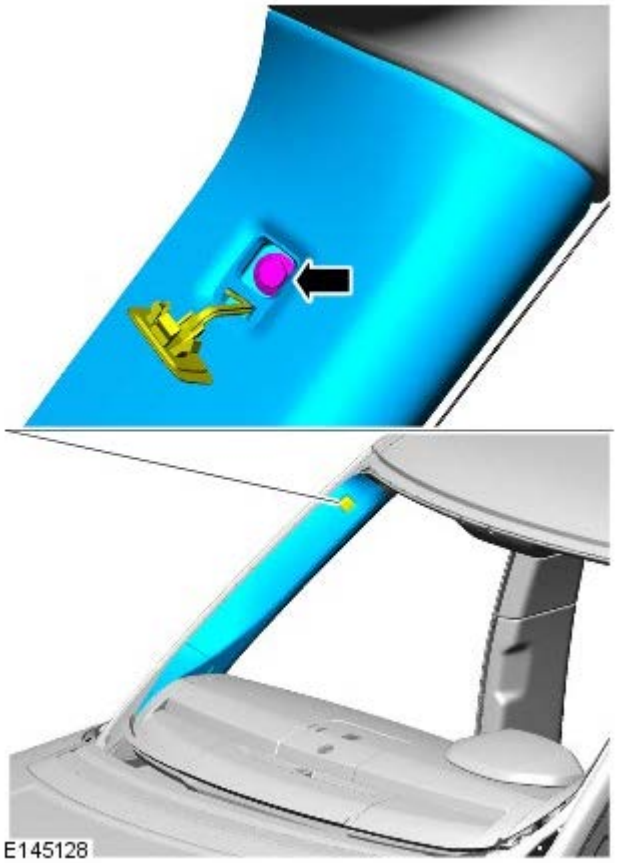
1. CAUTION: Apply heatshrink or protective tape to the end of a suitable tool to protect the interior components.



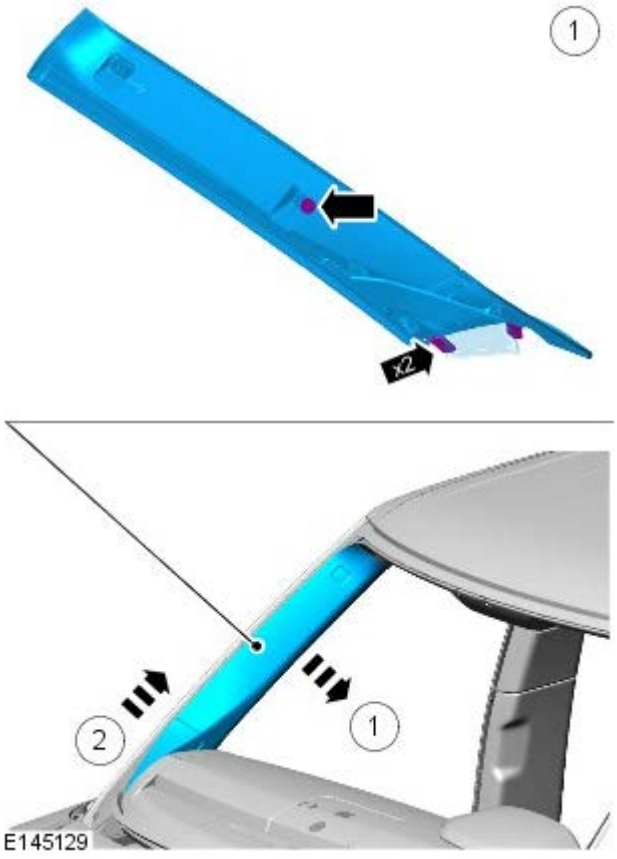
2. NOTE: Right-hand shown, left-hand similar.

3. NOTE: Right-hand shown, left-hand similar.

   Torque: 6 Nm



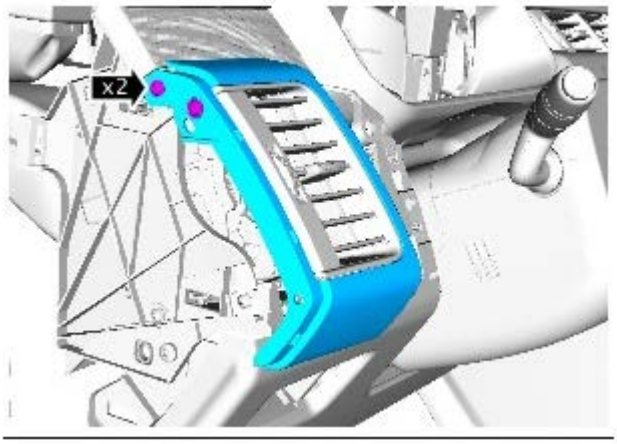
4. NOTE: Right-hand shown, left-hand similar.



5.

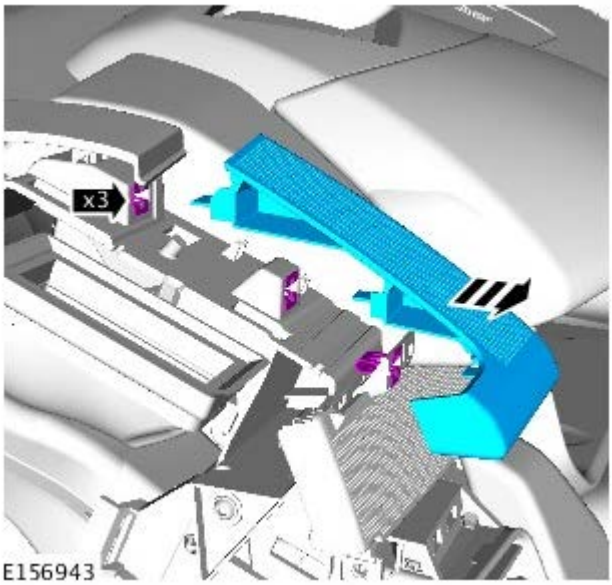


6.

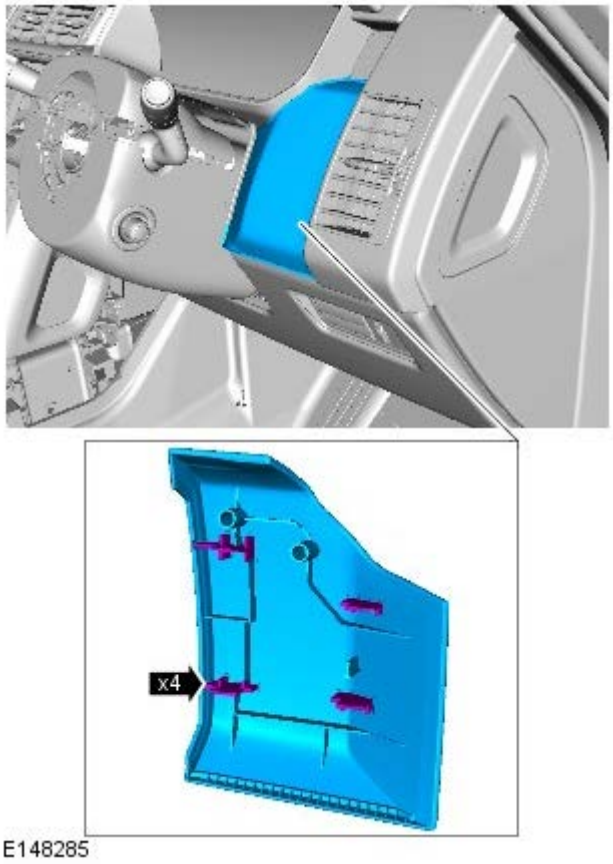




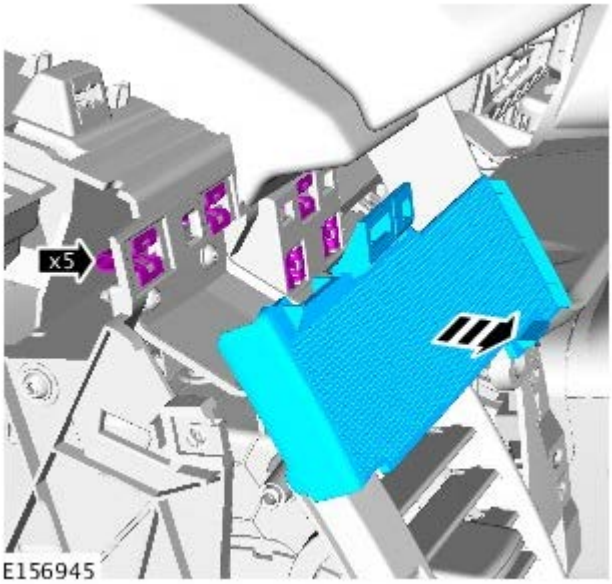
7.



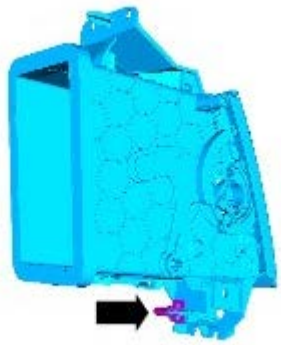
8.

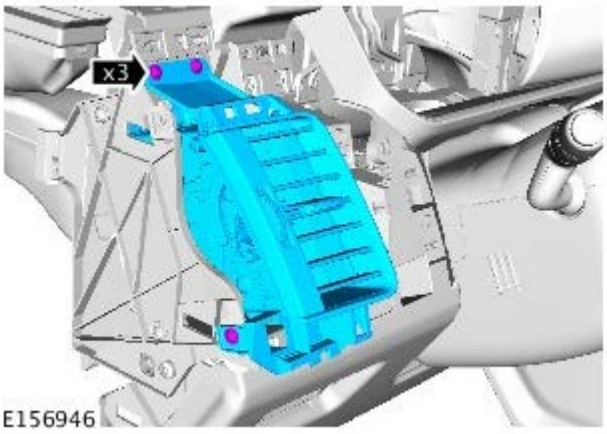


9.



10.





Installation

1. NOTE: Install the trim retaining clips in the moulding prior to installing the components.



E149095

2. To install, reverse the removal procedure.

Published: 13-Jun-2013

Climate Control - Distribution Motor – Demist

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.

All vehicles

1. Disconnect the battery ground cable.

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

Right-hand drive vehicles

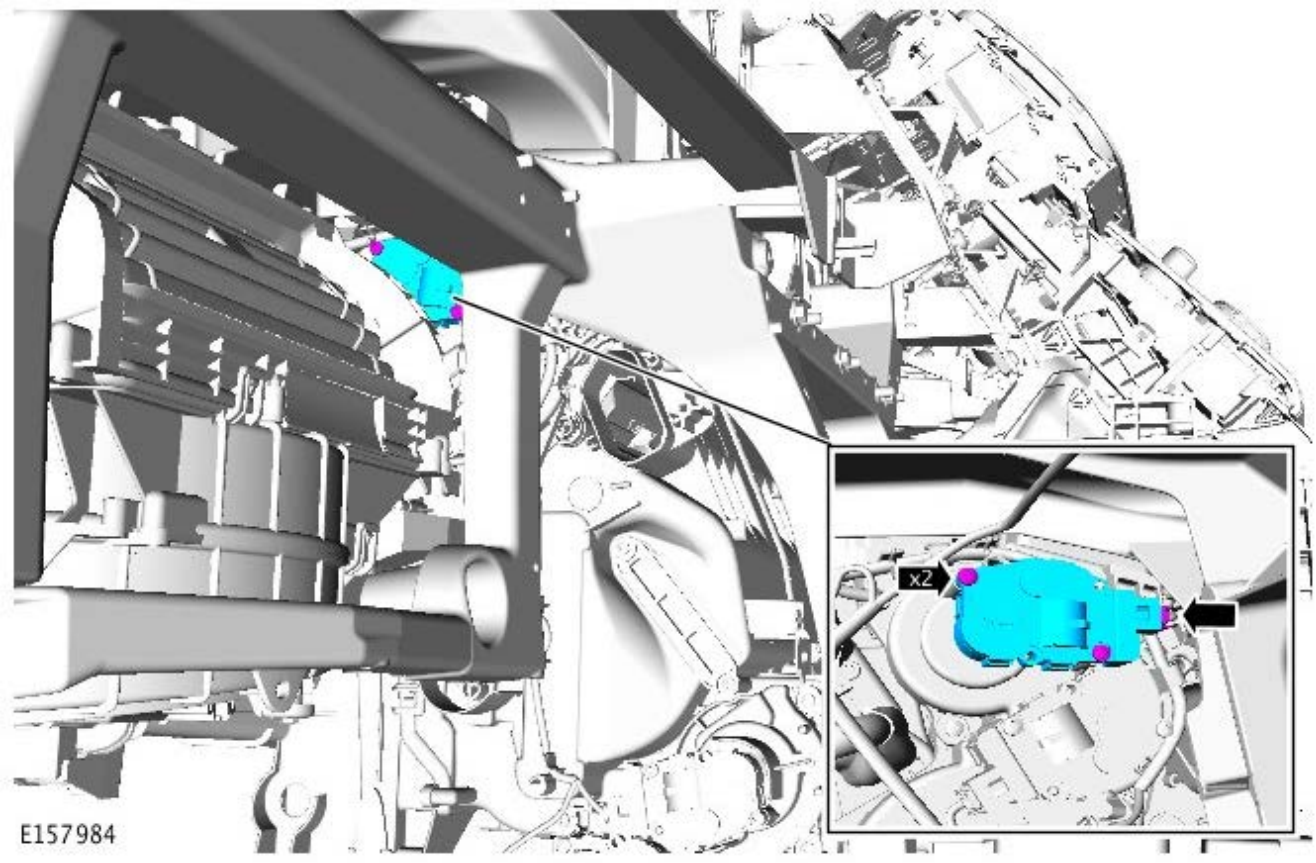
2. Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

Left-hand drive vehicles

3. Refer to: Instrument Panel Lower Section (501-12 Instrument Panel and Console, Removal and Installation).

All vehicles

4. NOTE: Right hand drive illustration shown, Left hand drive similar.



Installation

1. To install, reverse the removal procedure.

Published: 10-Jun-2013

Climate Control - Recirculation Motor

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

Some components shown removed for clarity.

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

Right hand drive illustration(s) shown, Left hand drive is similar.

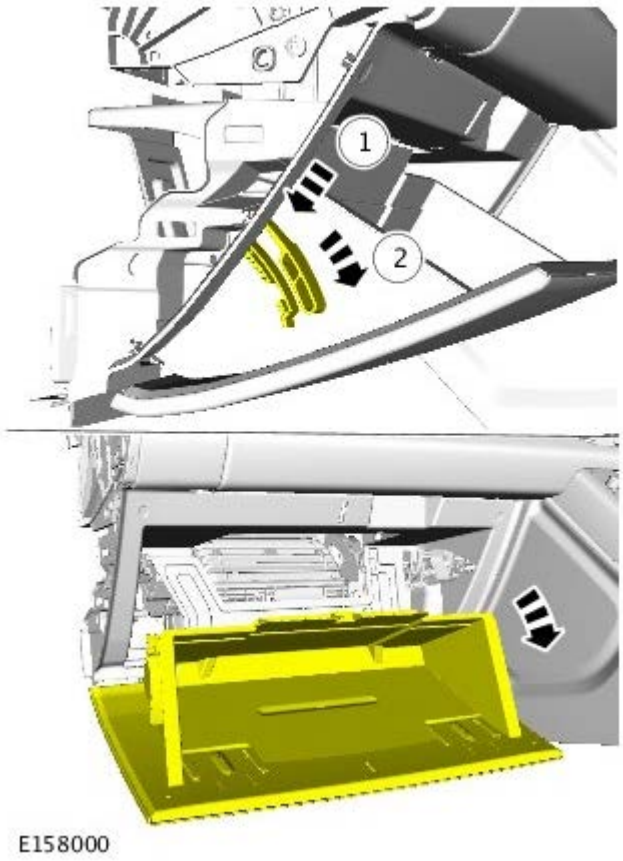
1.



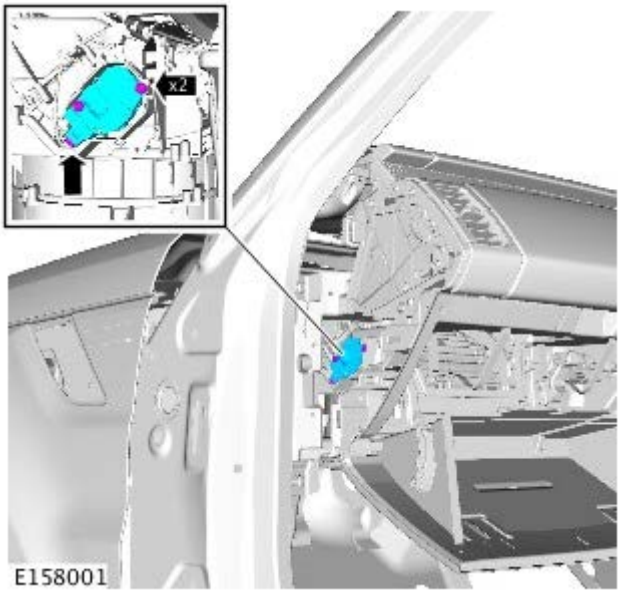
2.



3. NOTE: The procedure must be carried out on both sides.



4.



Installation

1. To install, reverse the removal procedure.

Published: 13-Jun-2013

Climate Control - Distribution Motor - Left Front Face/Feet

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.

All vehicles

1. Disconnect the battery ground cable.

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

Right-hand drive vehicles

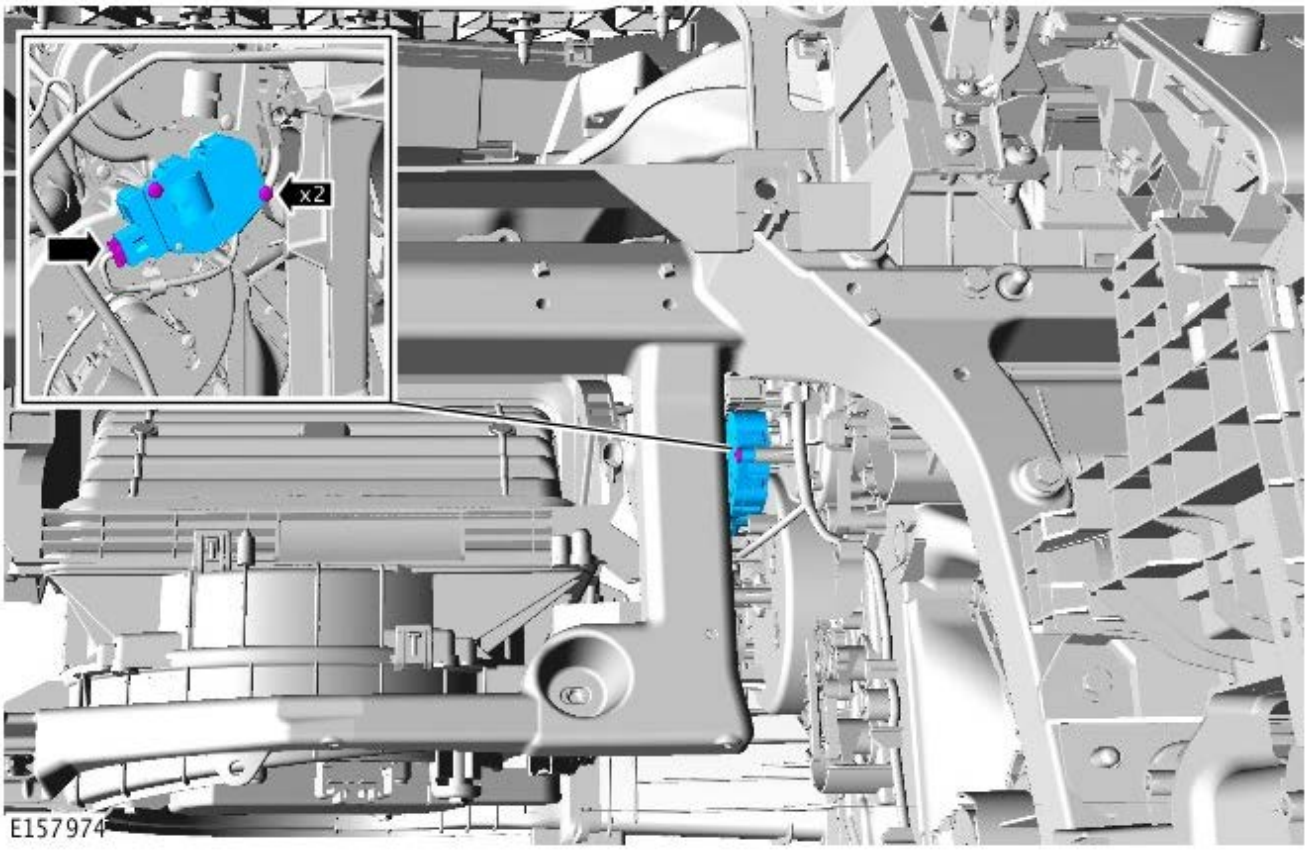
2. Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

Left-hand drive vehicles

3. Refer to: Instrument Panel Lower Section (501-12 Instrument Panel and Console, Removal and Installation).

All vehicles

4. NOTE: Right hand drive illustration shown, Left hand drive similar.



Installation

1. To install, reverse the removal procedure.

Published: 13-Jun-2013

Climate Control - Distribution Motor - Right Front Face/Feet

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.

All vehicles

1. Disconnect the battery ground cable.

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

Right-hand drive vehicles

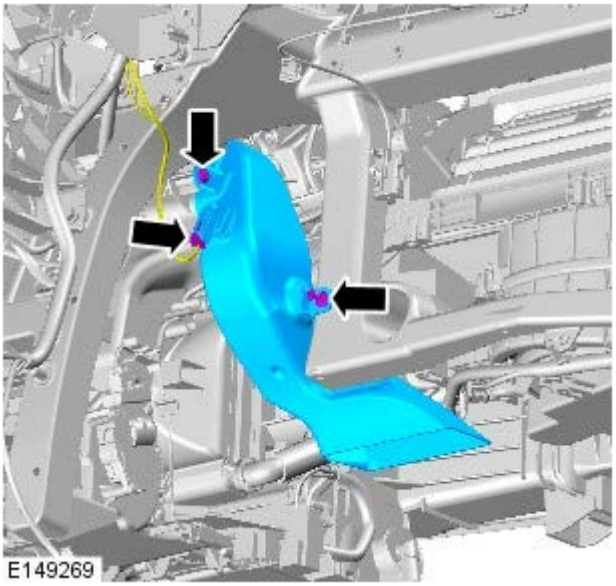
2. Refer to: Instrument Panel Lower Section (501-12 Instrument Panel and Console, Removal and Installation).

Left-hand drive vehicles

3. Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

Left-hand drive vehicles

4.



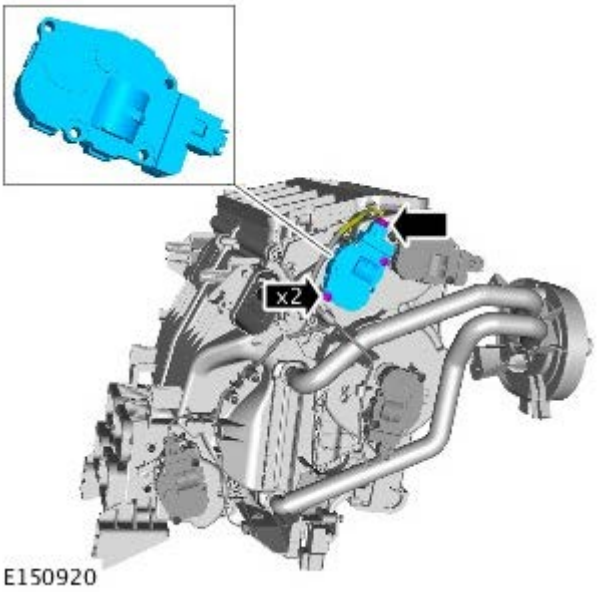
Left-hand drive vehicles

5.



All vehicles

6. NOTE: Left hand drive illustration shown, Right hand drive is similar.



Installation

1. To install, reverse the removal procedure.

Published: 07-Feb-2014

Climate Control - Pollen Filter

Removal and Installation

Removal

WARNING: Make sure that the blower motor is in the OFF position. Failure to follow this instruction may result in personal injury.

CAUTION: **During this procedure, the ignition must remain ON, the air conditioning (A/C) system must be in manual mode and the blower motor is in the OFF position. Failure to follow these instructions may result in damage to the recirculation flap.**

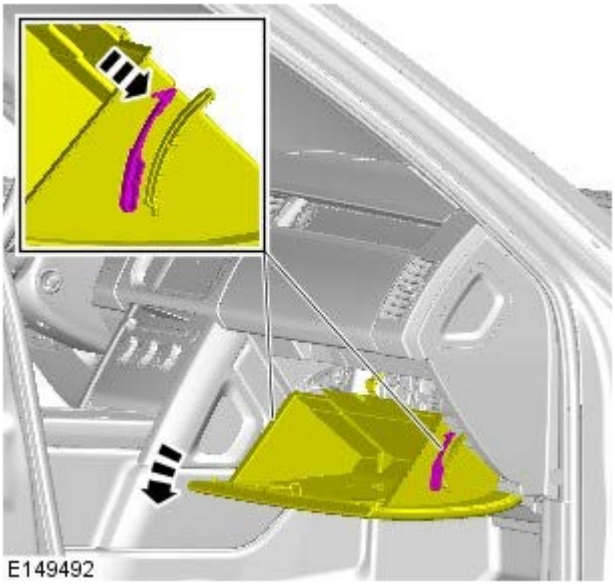
NOTE: Removal steps in this procedure may contain installation details.

1.



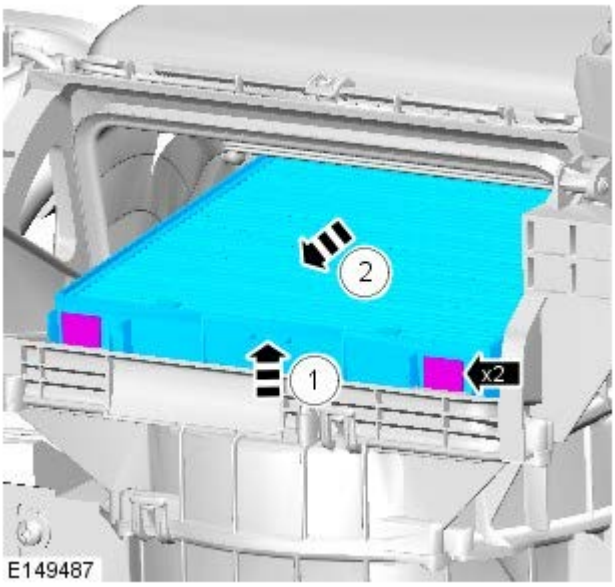
E156270

2.

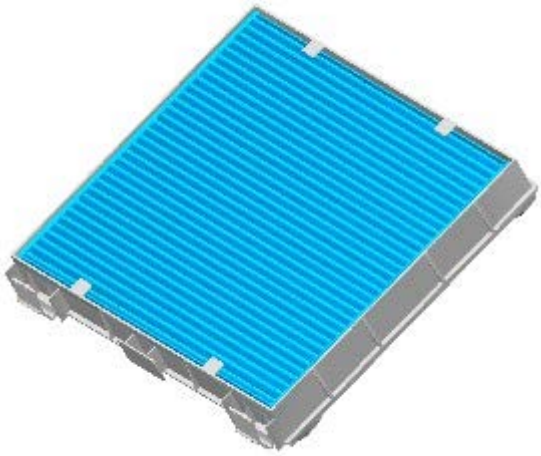


E149492

3.



4.



Installation

1. To install, reverse the removal procedure.

Published: 30-Oct-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle -

Torque Specifications

Description	Nm	lb-ft	lb-in
Air conditioning (A/C) compressor refrigerant line clamp to radiator bolt	7	-	62
A/C compressor refrigerant line clamp to engine nut - vehicles with 3.0L diesel	6	-	53
A/C compressor refrigerant lines retaining nuts - vehicles with 3.0L diesel	18	14	-
A/C compressor refrigerant line clamp to engine nuts - vehicles with 4.4L diesel	9		80
A/C compressor refrigerant lines retaining nuts- vehicles with 4.4L diesel	9		80
A/C refrigerant lines clamp to evaporator connector block bolt	10	7	-
A/C compressor refrigerant line retaining nuts - vehicles with 3.0L and 5.0L petrol	18	14	-
A/C compressor retaining bolts	25	18	-
A/C condenser core refrigerant line nuts	8	-	71
A/C condenser fan cowl bolts - vehicles with 3.0L and 5.0L petrol	7	-	62
A/C condenser core to radiator bolts	4.5	-	40
A/C condenser core bracket bolt	4.5	-	40
Receiver drier bolts	4	-	35
Heater core and evaporator core housing bolts	9	-	80
In-vehicle crossbeam to bulkhead bolt	20	15	-
Thermostatic expansion valve bolts	4	-	35

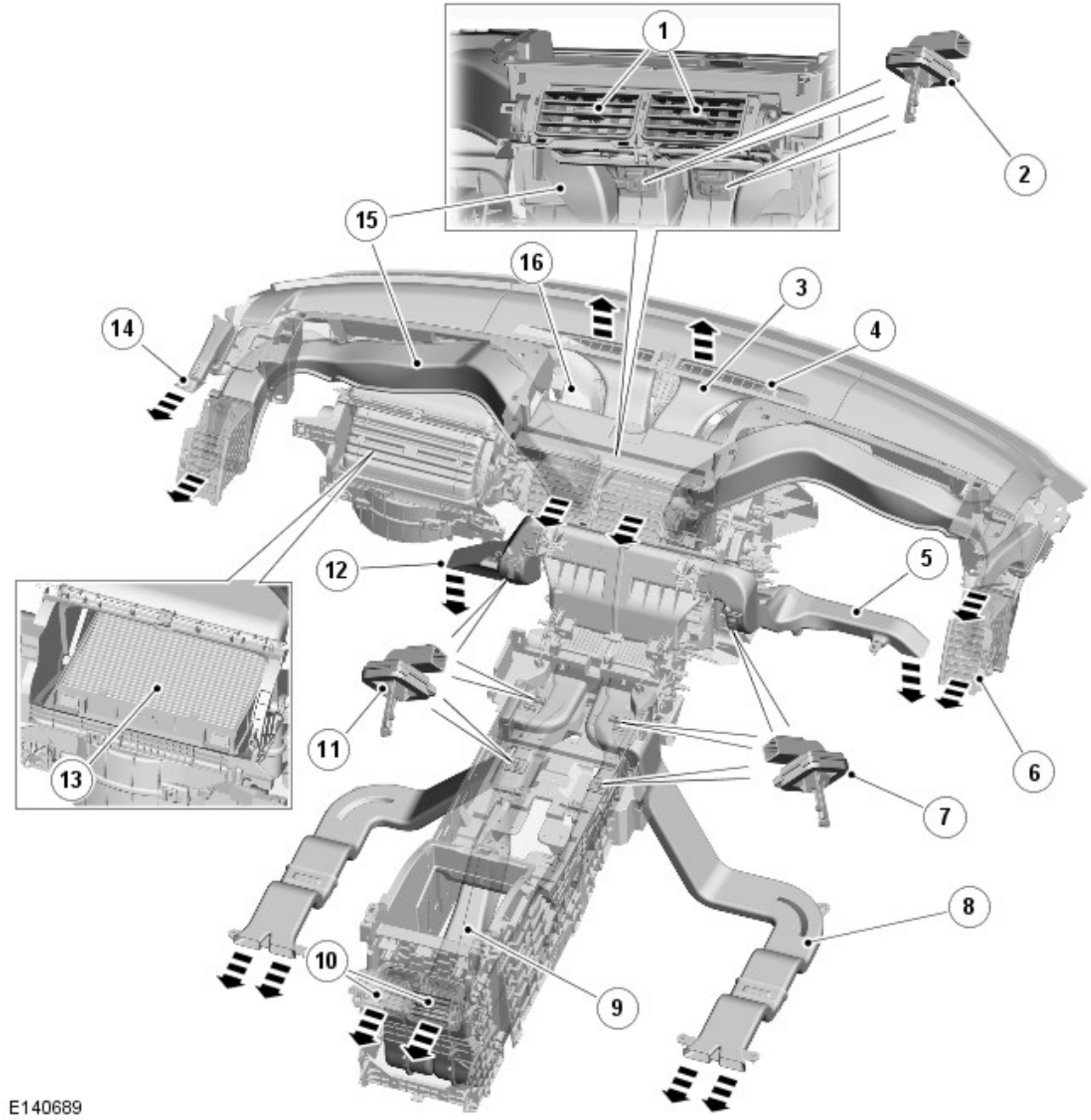
Published: 14-May-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Air Distribution and Filtering

Description and Operation

COMPONENT LOCATION

NOTE: RHD (right-hand drive) installation shown, LHD (left-hand drive) installation is mirror image.



Item	Part Number	Description
1	-	Center front face vents
2	-	Duct air temperature sensor - center front face
3	-	Demist duct (2 off)
4	-	Demist vent (2 off)
5	-	Driver foot duct
6	-	Outer front face vent (2 off)
7	-	Duct air temperature sensor - right front foot, rear foot and rear face
8	-	Rear foot duct (2 off)
9	-	Rear face duct (2 off)
10	-	Rear face vents
11	-	Duct air temperature sensor - left front foot, rear foot and rear face

12	-	Front passenger foot duct
13	-	Air filter
14	-	Side window vent (2 off)
15	-	Outer front face duct (2 off)
16	-	Side window duct (2 off)

OVERVIEW

The air distribution and filtering system consists of:

- Air ducts
- Air vents
- Air filter.

DESCRIPTION

Air Ducts

The air ducts consist of tubes connected between the climate control assembly and the various air vents around the vehicle interior. The center sections of the air ducts for the side window vents are integrated into the structure of the instrument panel. The rear foot ducts connect to the climate control assembly via ducts integrated into the structure of the floor console.

Eight duct air temperature sensors are installed to provide more accurate temperature control. The sensors are installed in the front foot ducts, the center front face ducts and in the rear foot and face ducts. The sensors are NTC (negative temperature coefficient) thermistors, which are connected to the ATCM (automatic temperature control module).
For additional information, refer to: Control Components (412-01B, Description and Operation).

Air Vents

Adjustable air vents are installed in the face outlets of the instrument panel and the floor console. The remainder of the outlets have fixed vents integrated into the end of the air duct or installed in the trim panel connected to the air duct.

Air Filter

The air filter is a combination pollen and odor filter installed in the air inlet duct, over the blower inlet.

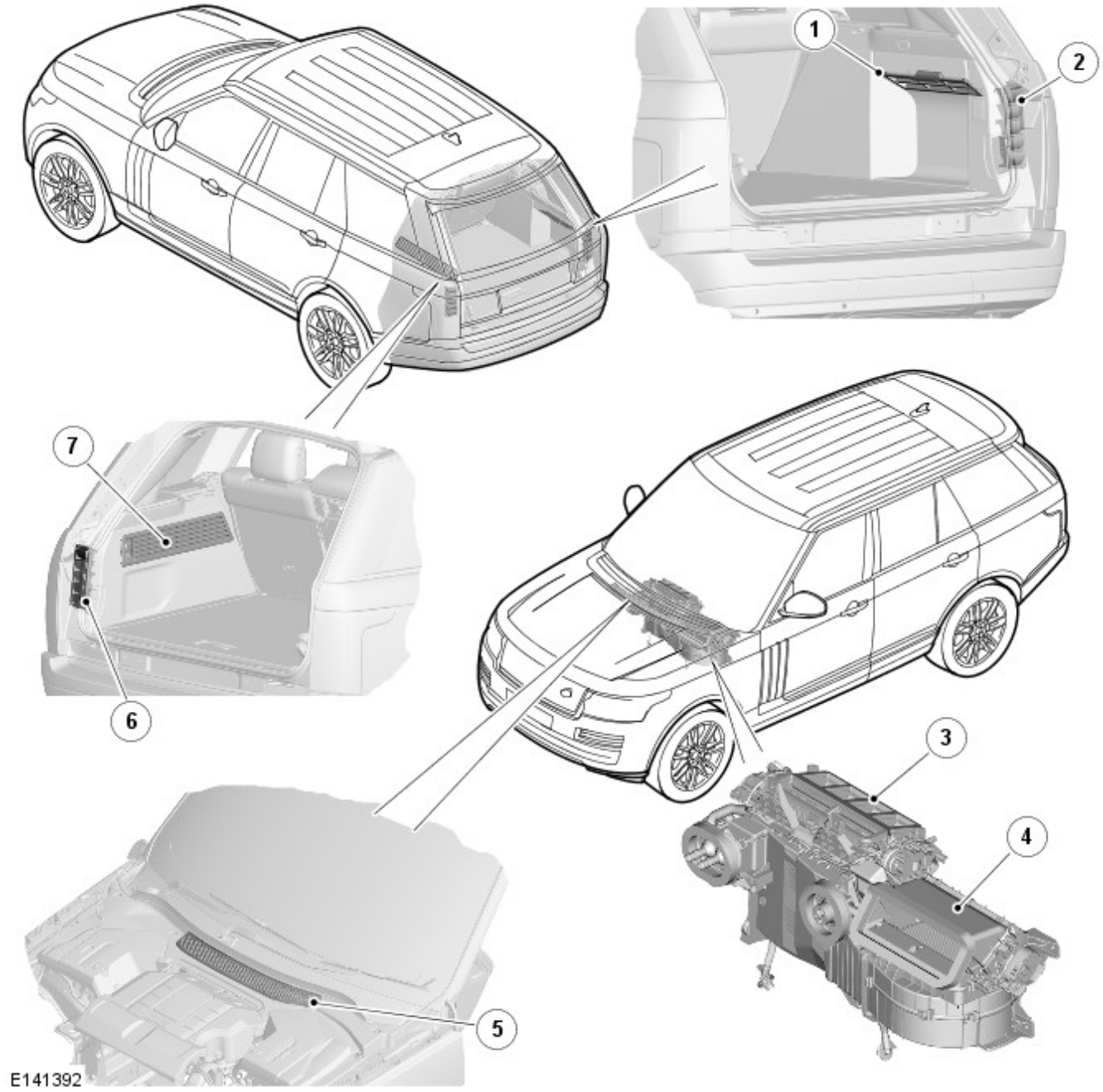
Published: 14-May-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Heating and Ventilation

Description and Operation

COMPONENT LOCATION

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



Item	Part Number	Description
1	-	Air extraction grille
2	-	Ventilation outlet
3	-	Climate control assembly
4	-	Air intake duct
5	-	Air intake grille
6	-	Ventilation outlet
7	-	Air extraction grille

OVERVIEW

The heating and ventilation system consists of:

- An air intake duct

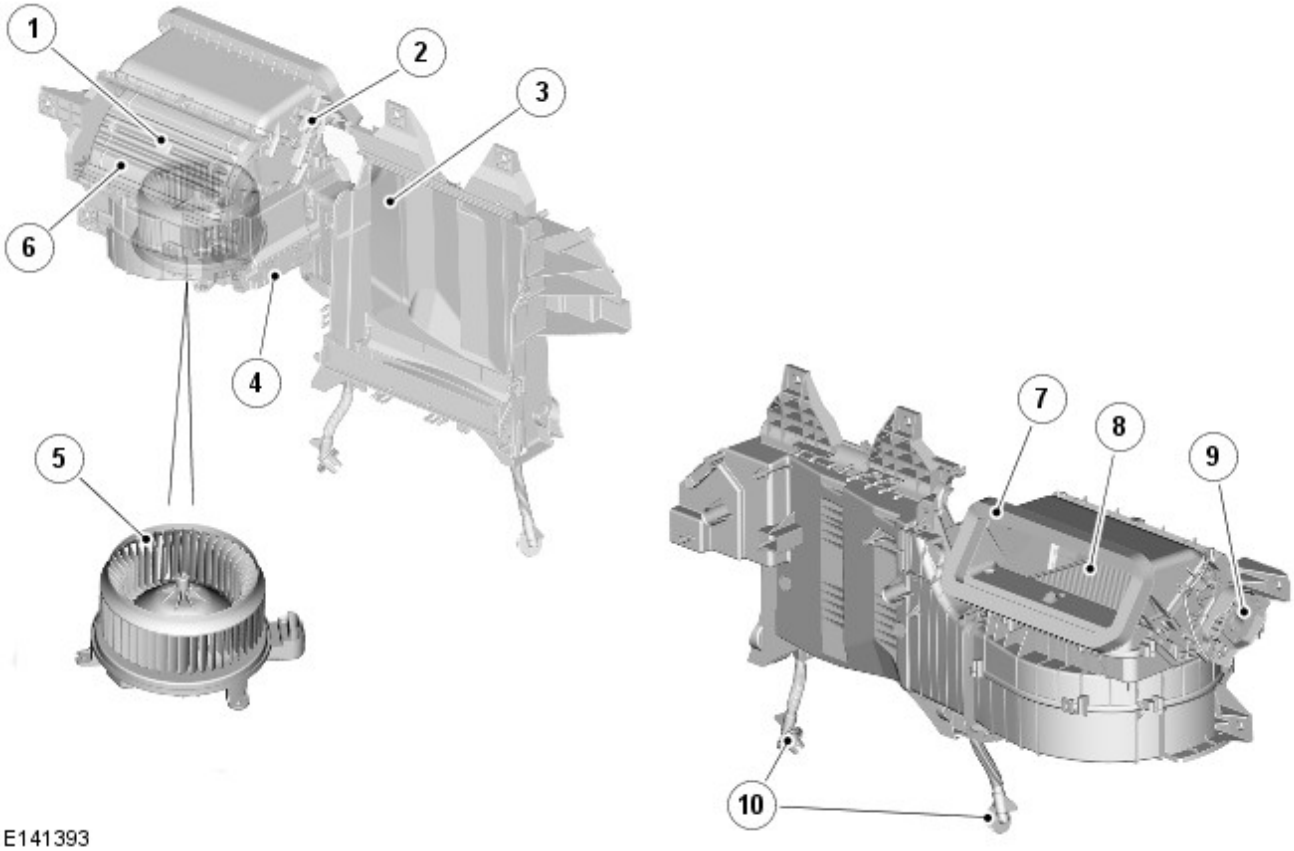
- A climate control assembly
- Two ventilation outlets.

Fresh or recirculated air flows into the climate control assembly from the intake duct, then through the distribution ducts to the vehicle interior. Fresh air is taken from an intake grille in the leaf screen. Air from the vehicle interior exhausts through the ventilation outlets via air extraction grilles in the luggage compartment side trim.

DESCRIPTION

Air Intake Duct

NOTE: RHD air intake duct shown, LHD air intake duct is mirror image.



Item	Part Number	Description
1	-	Recirculation air intake
2	-	Pollution sensor
3	-	Air outlet to climate control assembly
4	-	Automatic temperature control module
5	-	Blower
6	-	Recirculation door
7	-	Fresh air intake
8	-	Air filter
9	-	Recirculation motor
10	-	Condensate drain tubes

The air intake duct is installed behind the instrument panel, on the front passenger side, and connects the fresh air intake in the bulkhead panel to the climate control assembly. The air intake duct also contains:

- An intake for recirculation air
- The blower
- The air filter.
  For additional information, refer to: Air Distribution and Filtering (412-01B, Description and Operation).

A recirculation door is installed between the fresh and recirculation air intakes, to control the source of incoming air. The door is driven by a recirculation motor, which is controlled by the ATCM (automatic temperature control module) using a LIN (local interconnect network) bus signal. Power for the motor is also supplied by the ATCM.

The recirculation door has automatic and manual modes of operation. In the automatic mode the ATCM uses comfort algorithms to set the door position. In the manual mode, the ATCM sets the door to the position selected on the ICP (integrated control panel).
For additional information, refer to: Control Components (412-01B, Description and Operation).

BLOWER

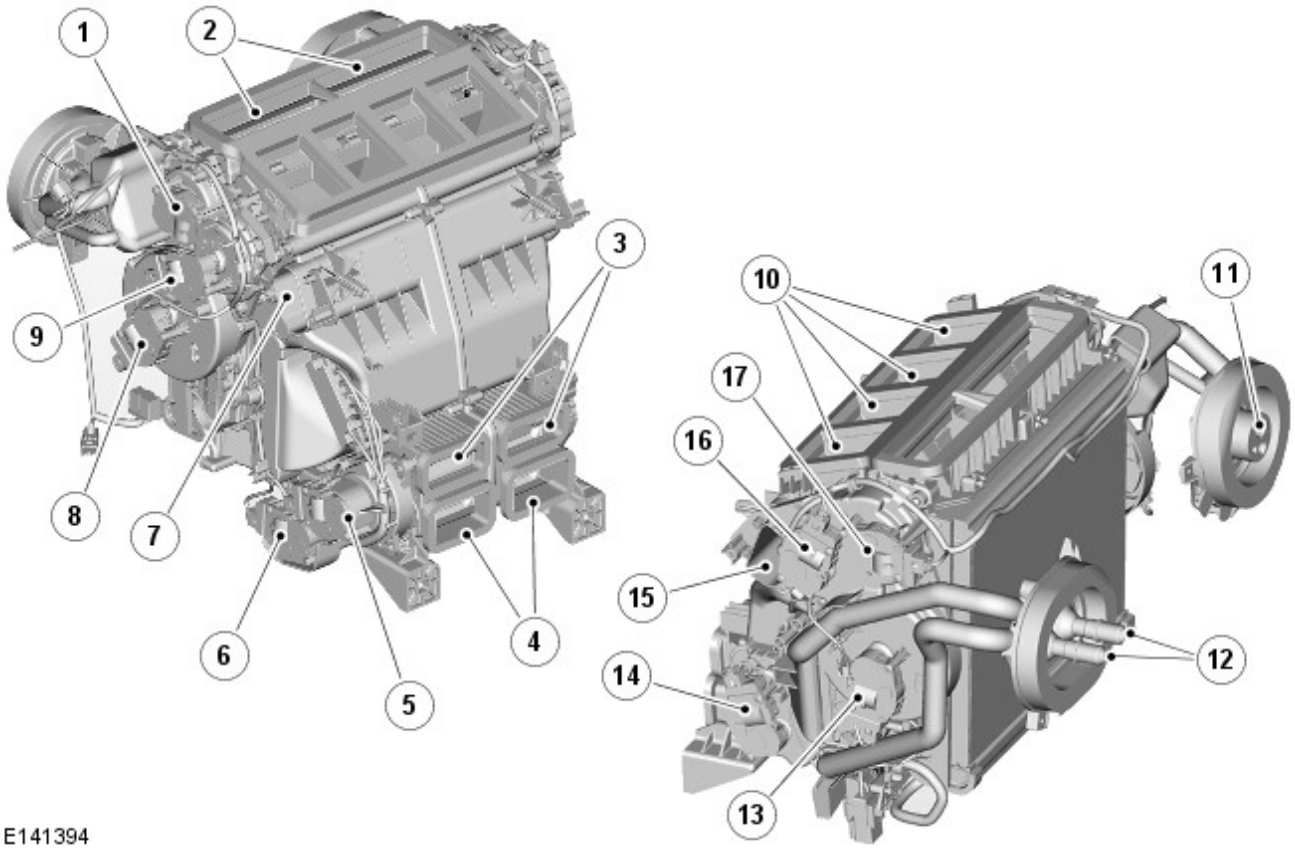
The blower is installed below the air filter, and consists of an open hub, centrifugal fan powered by a brushless electric motor. Operation of the blower is controlled by the ATCM, using the blower relay in the EJB (engine junction box) and a control module integrated into the blower motor.

When the blower is required, the ATCM energizes the blower relay, which then supplies battery power to the blower motor. The speed of the blower is controlled by the integral control module, which regulates the blower motor voltage in response to a PWM (pulse width modulation) signal from the ATCM.

When the blower is in the automatic mode the ATCM determines the blower speed required from comfort algorithms. When the blower is in the manual mode, the ATCM operates the blower at the speed selected on the ICP.
For additional information, refer to: Control Components (412-01B, Description and Operation).

Climate Control Assembly

NOTE: RHD climate control assembly shown, LHD climate control assembly similar.



E141394

Item	Part Number	Description
1	-	Demist distribution motor
2	-	Demist air outlets
3	-	Rear foot air outlets
4	-	Rear face air outlets
5	-	Rear face/foot distribution motor
6	-	Left rear temperature blend motor
7	-	Left front foot air outlet
8	-	Left front temperature blend motor
9	-	Left front face/foot distribution motor
10	-	Front face air outlets
11	-	Air conditioning pipe connector block
12	-	Coolant pipe connections
13	-	Right front temperature blend motor
14	-	Right rear temperature blend motor
15	-	Right front foot air outlet
16	-	Right front face/foot distribution motor
17	-	Cool air bypass motor

The climate control assembly is installed on the vehicle center-line, between the instrument panel and the bulkhead panel. The climate control assembly consists of a casing, which contains an evaporator, heater core, distribution doors and temperature blend doors. Internal passages integrated into the casing guide the air through the casing and separate it into two flows, one for the left outlets and one for the right outlets.

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

assembly.
For additional information, refer to: Air Conditioning (412-01B, Description and Operation).

The heater core is an aluminum two pass, fin and tube heat exchanger, installed across the width of the climate control assembly housing. Two aluminum tubes attached to the heater core extend through the bulkhead panel to connect with the engine cooling system. When the engine is running, coolant is constantly circulated through the heater core by the engine coolant pump. On vehicles with a FFBH (fuel fired booster heater), when the FFBH is active the coolant flow is assisted by an electric FFBH coolant pump.
For additional information, refer to: Fuel Fired Booster Heater (412-02B, Description and Operation).

The distribution doors direct the air flow to the face, foot and demist vents as required. A cool air bypass distribution door directs additional air bypassing the heater core for the face vents.

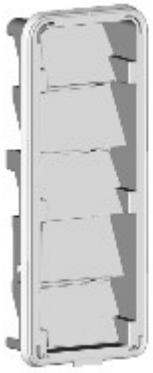
The temperature blend doors regulate the flow of air through the heater core to control the temperature of the air leaving the climate control assembly. The left front and right front temperature blend doors operate independently to allow different temperatures to be set for the front zones. The left rear and right rear temperature blend doors operate together on 3 zone vehicles and independently on 4 zone vehicles.

DISTRIBUTION AND TEMPERATURE BLEND MOTORS

Separate motors operate each of the five distribution doors and four temperature blend doors. If a motor is to be replaced, ensure it is replaced with the correct replacement part. Although similar in appearance, each of the motors is different and faults will occur if an incorrect motor is fitted.

Operation of the distribution and temperature blend door motors is controlled by the ATCM, which is connected to the motors by LIN bus, power and ground connections. A Hall effect sensor in each motor provides a position signal for the ATCM.
For additional information, refer to: Control Components (412-01B, Description and Operation).

Ventilation Outlets



E141395

The ventilation outlets are installed in the left and right rear quarters, behind the tail lamp assemblies.

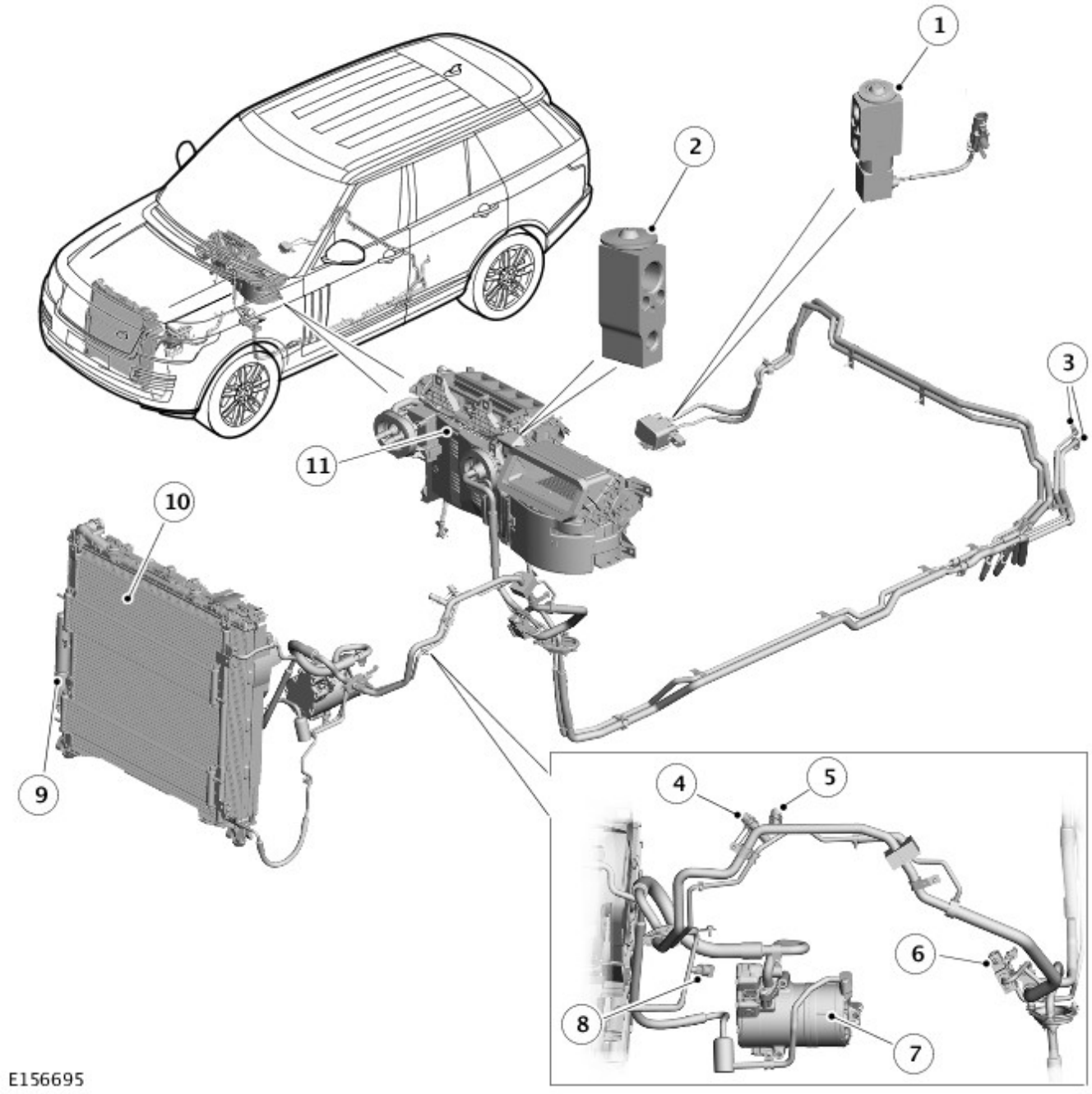
Each ventilation outlet consists of a grille covered by soft rubber flaps, and is effectively a non-return valve, preventing any odors from entering the vehicle. The flaps open and close automatically depending on the differential between passenger compartment and outside air pressures.

Published: 30-Jul-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Air Conditioning

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Hybrid electric vehicle battery isolation valve
2	-	Thermostatic expansion valve
3	-	To auxiliary climate control (where fitted)
4	-	High pressure servicing connection
5	-	Low pressure servicing connection
6	-	Climate control isolation valve
7	-	Electric air conditioning compressor
8	-	Refrigerant pressure sensor
9	-	Receiver drier
10	-	Condenser
11	-	Evaporator

OVERVIEW

The A/C (air conditioning) system provides the cooling for the climate control assembly, the HEV (hybrid electric

vehicle) battery cooling system and, where fitted, the auxiliary climate control assembly. The A/C system is a sealed, closed loop system filled with a charge weight of refrigerant as the heat transfer medium. Oil is added to the refrigerant to lubricate the internal components of the electric A/C compressor. The system consists of:

- An electric A/C compressor
- A condenser
- A receiver drier
- A climate control isolation valve
- A thermostatic expansion valve
- An evaporator
- A HEV battery isolation valve
- Low and high pressure refrigerant lines.

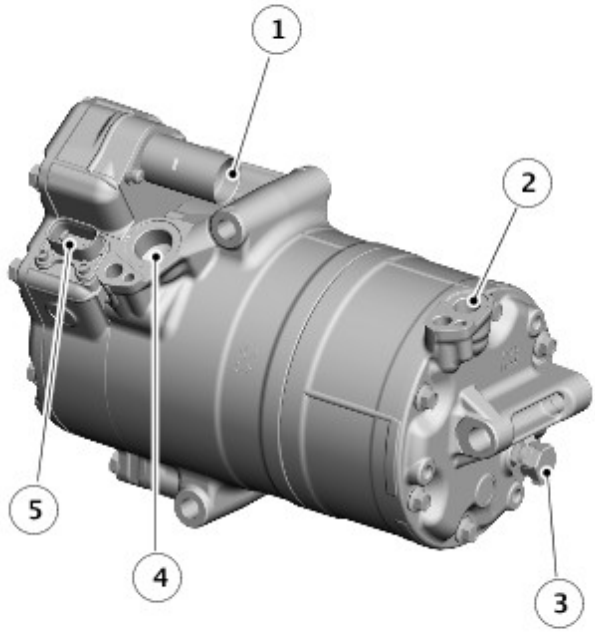
A pressure sensor in the high pressure refrigerant line allows the ATCM (automatic temperature control module) to monitor the status of the A/C system. The refrigerant flow necessary to provide the required cooling is calculated by the ATCM and controlled by varying the speed of the electric A/C compressor.
For additional information, refer to: Control Components (412-01B, Description and Operation).

The isolation valves allow the ATCM to prevent the flow of refrigerant through the climate control assembly or the HEV battery cooler when they do not require cooling.

Where fitted, the auxiliary climate control assembly also incorporates an isolation valve, which allows the ATCM to control the flow of refrigerant for auxiliary climate control cooling.
For additional information, refer to: Auxiliary Climate Control (412-02B, Description and Operation).

DESCRIPTION

Electric Air Conditioning Compressor



E156696

Item	Part Number	Description
1	-	High voltage electrical connector
2	-	Refrigerant outlet port
3	-	Pressure relief valve
4	-	Refrigerant inlet port
5	-	Low voltage electrical connector

The electric A/C compressor is a fixed displacement unit attached to the front left side of the engine. Inlet and outlet ports in the housing connect the compressor to the refrigerant lines from the evaporator/HEV battery cooler and the condenser respectively. To protect the refrigerant system from excessive pressure, a pressure relief valve is installed in the outlet side of the housing. Two electrical connectors are installed on the compressor housing:

- A low voltage electrical connector, connected to the front end wiring harness, provides:
  - A power supply from the ignition relay in the EJB (engine junction box), for the control circuitry in the compressor.
  - A ground.
  - A LIN (local interconnect network) bus connection, for communication with the ATCM.

- In and out connections for the high voltage interlock circuit of the BECM (battery energy control module).
  For additional information, refer to: Battery and Cables - TDV6 3.0L Diesel - Hybrid Electric Vehicle (414-01, Description and Operation).

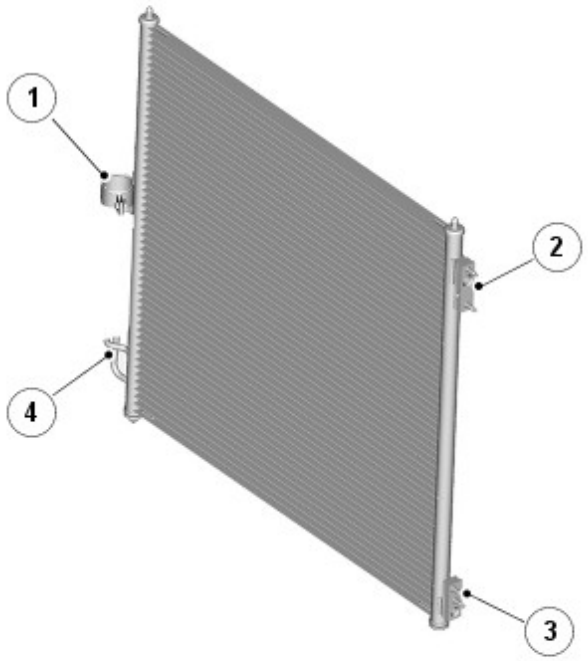
- A high voltage electrical connector, connected to an orange high voltage cable from the EPIC (electric power inverter converter).
  For additional information, refer to: Battery and Cables - TDV6 3.0L Diesel - Hybrid Electric Vehicle (414-01, Description and Operation).

The electric A/C compressor contains a scroll compressor, a three-phase 280 V AC (alternating current) asynchronous motor and an integrated inverter. The integrated inverter converts the high voltage DC (direct current) power from the EPIC into three-phase AC power, at the correct frequency to drive the motor at the desired speed (between 800 and 8500 rev/min). The ATCM automatically adjusts the speed of the compressor to match the refrigerant flow to the thermal load of the A/C system.

The inverter circuitry contains capacitors to filter electrical noise and voltage ripples, and a resistor bank that passively discharges the capacitors when the power supply is removed. During normal or emergency power down the resistor bank reduces the voltage stored in the capacitors to less than 50 volts in less than 1.5 seconds.

Refrigerant vapor from the inlet port of the electric A/C compressor flows through the inverter and the motor before it enters the scroll compressor. This maintains the operating temperature of the electric A/C compressor within acceptable limits by removing heat generated by the inverter and the motor.

Condenser



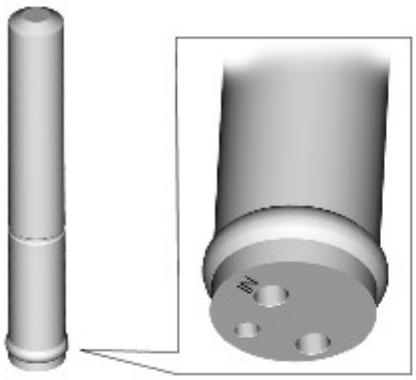
E141369

Item	Part Number	Description
1	-	Receiver drier attachment bracket
2	-	Refrigerant inlet port
3	-	Refrigerant outlet port
4	-	Receiver drier pipes

The condenser is installed immediately in front of the radiator. Pins on the bottom of the end tanks locate in bushes installed in brackets integrated into the bottom of the radiator. Two brackets attach pins on the top of the end tank to pins on the top of the radiator.

The condenser is classified as a sub-cooling condenser and consists of a fin and tube heat exchanger core installed between two end tanks. Divisions in the end tanks separate the heat exchanger into a four pass upper (condenser) section and a two pass lower (sub-cooler) section. Two connector blocks on the left end tank of the condenser provide connections for the high pressure lines from the electric A/C compressor and the evaporator. Two pipes at the bottom of the right end tank of the condenser provide connections for the receiver drier.

Receiver Drier



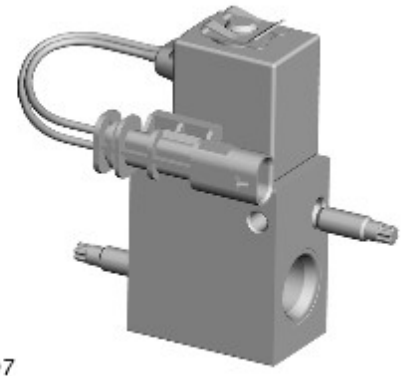
E141370

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. The body of the receiver drier is installed in 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.

Climate Control Isolation Valve



E156697

The climate control isolation valve is located in the rear left corner of the engine compartment, on a bracket attached to the IHX (internal heat exchanger) of the A/C pipes. The valve is a normally-open solenoid-operated shut-off valve installed in the high pressure A/C pipe from the IHX to the thermostatic expansion valve on the evaporator of the climate control assembly. Operation of the shut-off valve is controlled by a power feed from the ATCM.

If a fault occurs with the isolation valve control circuits, the shut-off valve defaults to open. This ensures that, while the electric A/C compressor is running, the refrigerant flow is always maintained and the compressor is adequately lubricated.

Thermostatic Expansion Valve

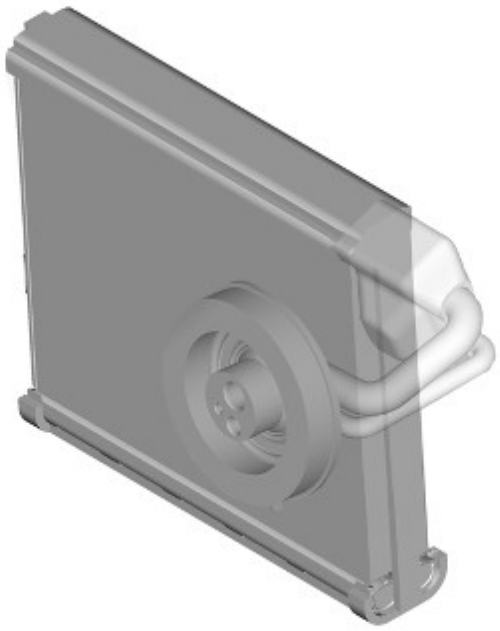


E127740

The thermostatic expansion valve is a block type valve attached to the inlet and outlet ports of the evaporator, under a thermal insulation cover.

Two bolts secure the refrigerant pipes and the thermostatic expansion valve to the inlet and outlet ports of the evaporator.

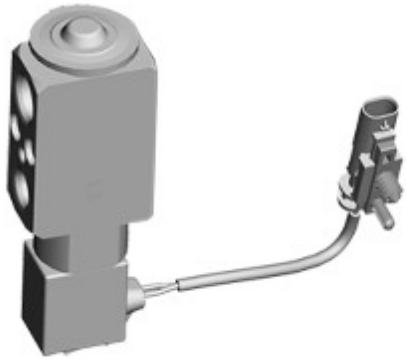
Evaporator



E141371

The evaporator is a fin and tube heat exchanger installed in the heater assembly, between the blower and the heater core.

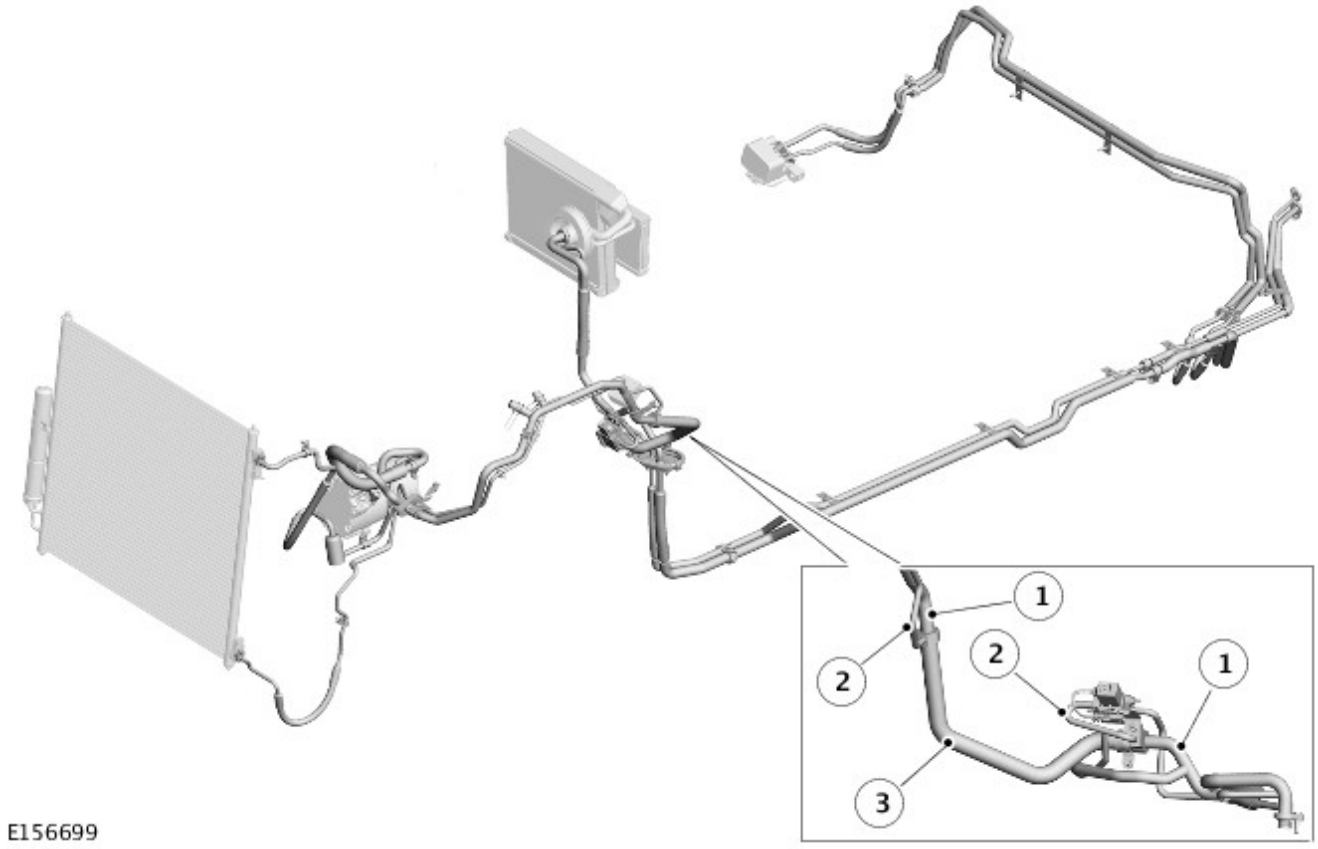
Hybrid Electric Vehicle Battery Isolation Valve



E156698

The HEV battery isolation valve is located on the right side of the HEV battery, attached to a bracket on the battery carrier. The valve combines a normally-closed solenoid-operated shut-off valve and a block-type thermostatic expansion valve. The valve is connected to the HEV battery cooler and to the low and high pressure A/C pipes from the engine compartment. Operation of the valve is controlled by a power feed from the ATCM.

Refrigerant Lines



Item	Part Number	Description
1	-	Low pressure pipe
2	-	High pressure pipe
3	-	Internal heat exchanger

The refrigerant lines consist of a combination of rigid pipes and flexible hoses. An internal heat exchanger increases the efficiency of the evaporator and ensures any residual liquid in the low pressure line is evaporated before it reaches the compressor.

Low and high pressure servicing connections are incorporated into the refrigerant lines for system servicing. The high pressure line also incorporates a refrigerant pressure sensor for the climate control system.
For additional information, refer to: Control Components (412-01B, Description and Operation).

On vehicles with auxiliary climate control, connections for the auxiliary A/C system are incorporated into the refrigerant lines under the passenger compartment floor, immediately in front of the rear left wheelarch.
For additional information, refer to: Auxiliary Climate Control (412-02B, Description and Operation).

OPERATION

The electric A/C compressor circulates the refrigerant around the system by compressing low pressure, low temperature vapor (from the climate control assembly evaporator and the HEV battery cooler) and discharging the resultant high pressure, high temperature vapor to the condenser. In the condenser the vapor converts to a liquid, which then passes through the receiver drier and out of the condenser. Provided their related isolation valves are open, the refrigerant then passes through the climate control assembly evaporator, the HEV battery cooler and, where fitted, the auxiliary climate control assembly evaporator. In the climate control evaporator(s) and the HEV battery cooler the refrigerant changes back to a low pressure, low temperature vapor, as it absorbs heat, then returns to the electric A/C compressor to begin the cycle again.

The ATCM adjusts the speed of the electric A/C compressor and operates the isolation valves to match the refrigerant flow to the cooling requests from:

- The TS (touch screen) or ICP (integrated control panel), for the climate control assembly and auxiliary climate control assembly, on the medium speed CAN (controller area network) comfort and convenience systems. For additional information, refer to:
  Control Components (412-01B, Description and Operation),
  Auxiliary Climate Control (412-02B, Description and Operation).
- The BECM, for the HEV battery cooling system, on the medium speed CAN comfort and convenience systems via the GWM (gateway module) and high speed CAN HEV systems.
  For additional information, refer to: Battery and Cables - TDV6 3.0L Diesel - Hybrid Electric Vehicle (414-01, Description and Operation).

Matching the refrigerant flow to the amount of cooling required maximizes fuel economy.

The ATCM transmits a drive and speed request to the electric A/C compressor on the LIN bus connection. The electric A/C compressor returns a message stating the actual speed that has been achieved. Internal faults detected by the electric A/C compressor are also transmitted on the LIN bus to the ATCM. The faults can be retrieved from the ATCM using Land Rover approved diagnostic equipment.

The isolation valves allow the ATCM to operate the refrigerant circuit in different configurations, depending on the cooling required. On vehicles without auxiliary climate control, there are three possible configurations, where refrigerant can be supplied to:

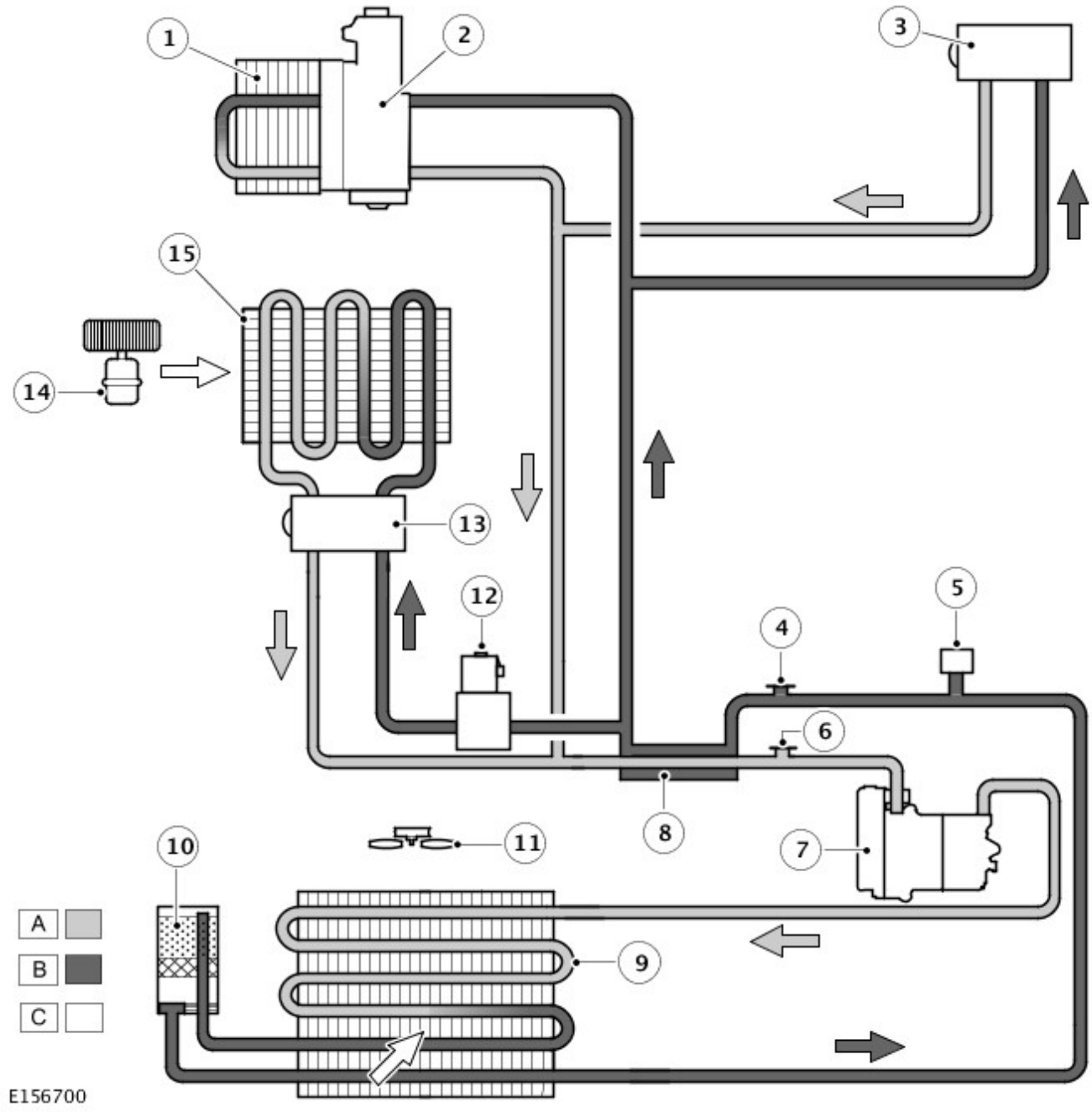
- Only the climate control assembly
- Only the HEV battery cooler
- The climate control assembly and the HEV battery cooler.

On vehicles with auxiliary climate control, the refrigerant circuit has two additional configurations, where refrigerant can be supplied to:

- The climate control assembly and the auxiliary climate control assembly
- The climate control assembly, the auxiliary climate control assembly and the HEV battery cooler.

When climate control assembly cooling is required, the climate control isolation valve remains de-energized. When auxiliary climate control assembly or HEV battery cooling is required, the ATCM energizes the related isolation valve.

Air Conditioning System Schematic

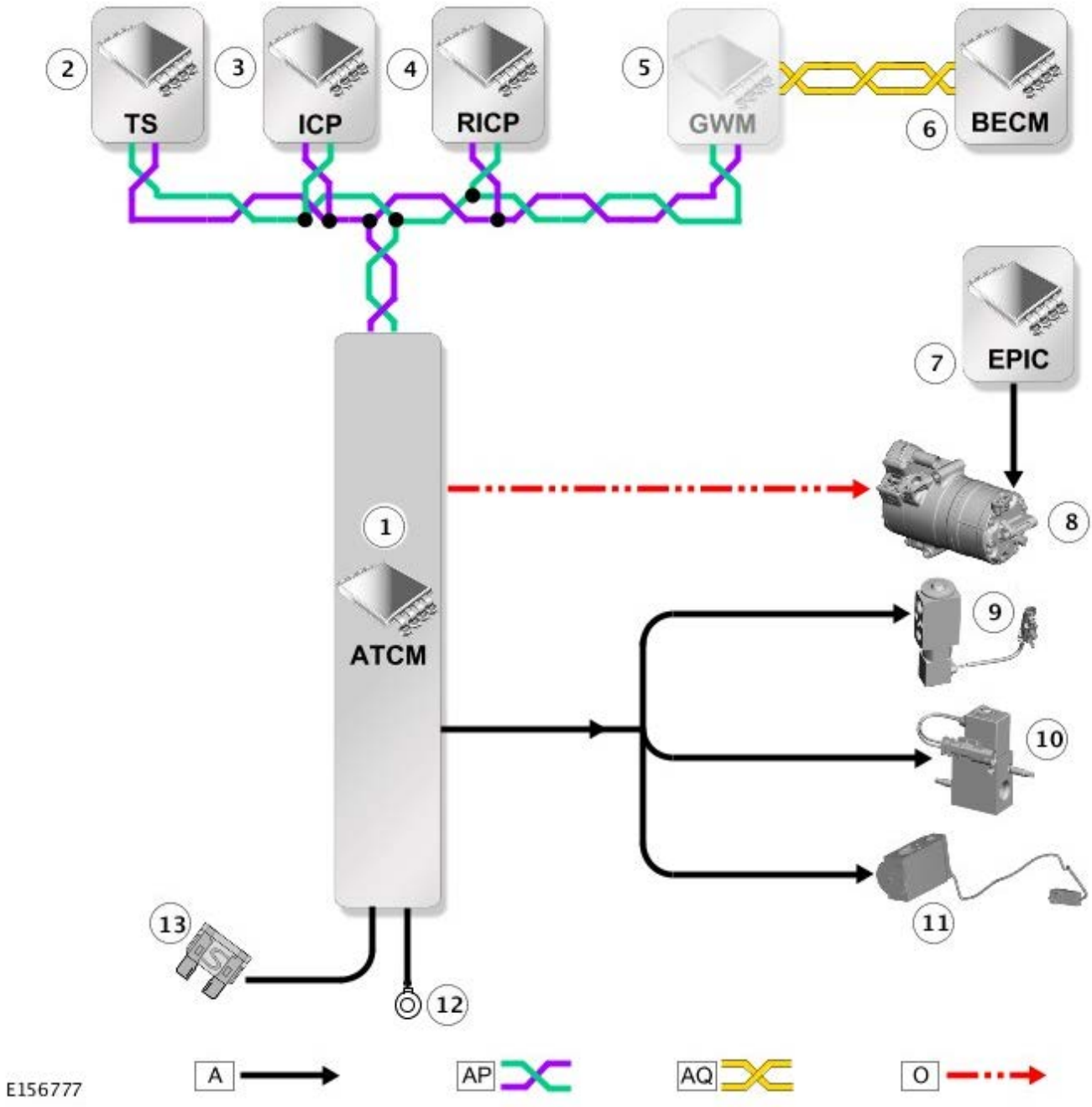


A = Refrigerant vapor; B = Refrigerant liquid; C = Air flow.

Item	Part Number	Description
1	-	HEV battery cooler
2	-	HEV battery isolation valve
3	-	Auxiliary climate control isolation valve (where fitted)
4	-	High pressure servicing connection
5	-	Refrigerant pressure sensor

6	-	Low pressure servicing connection
7	-	Electric air conditioning compressor
8	-	Internal heat exchanger
9	-	Condenser
10	-	Receiver drier
11	-	Electric cooling fans
12	-	Climate control isolation valve
13	-	Thermostatic expansion valve
14	-	Blower
15	-	Evaporator

Control Diagram



A = Hardwired connection; AP = Medium speed CAN comfort and convenience systems; AQ = High speed CAN hybrid systems; O = LIN bus.

Item	Part Number	Description
1	-	Automatic temperature control module
2	-	Touch screen
3	-	Integrated control panel
4	-	Rear integrated control panel
5	-	Gateway module
6	-	Battery energy control module
7	-	Electric power inverter converter

8	-	Electric air conditioning compressor
9	-	HEV battery isolation valve
10	-	Climate control isolation valve
11	-	Auxiliary climate control isolation valve
12	-	Ground
13	-	Power feed

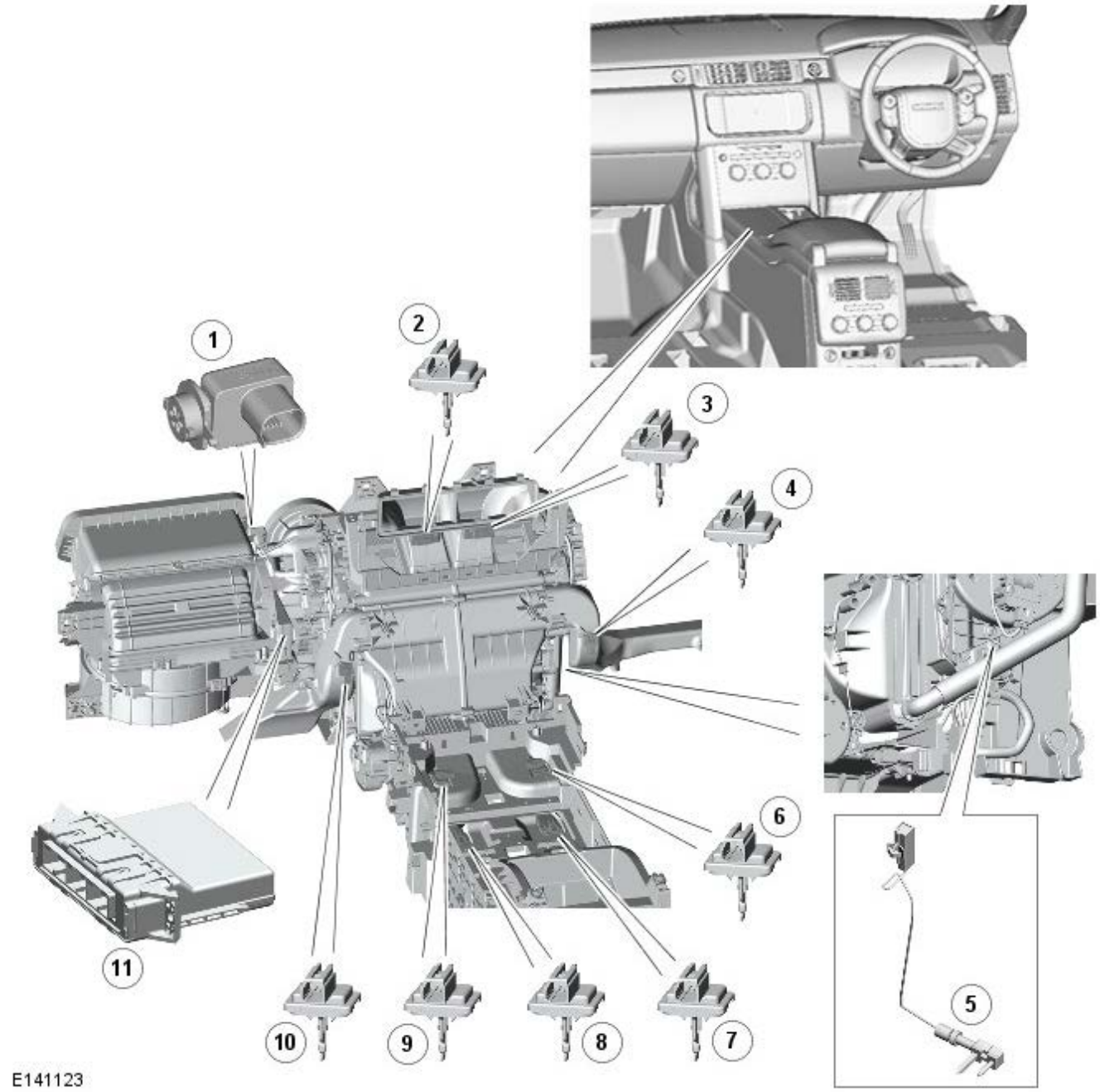
Published: 30-Jul-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Control Components

Description and Operation

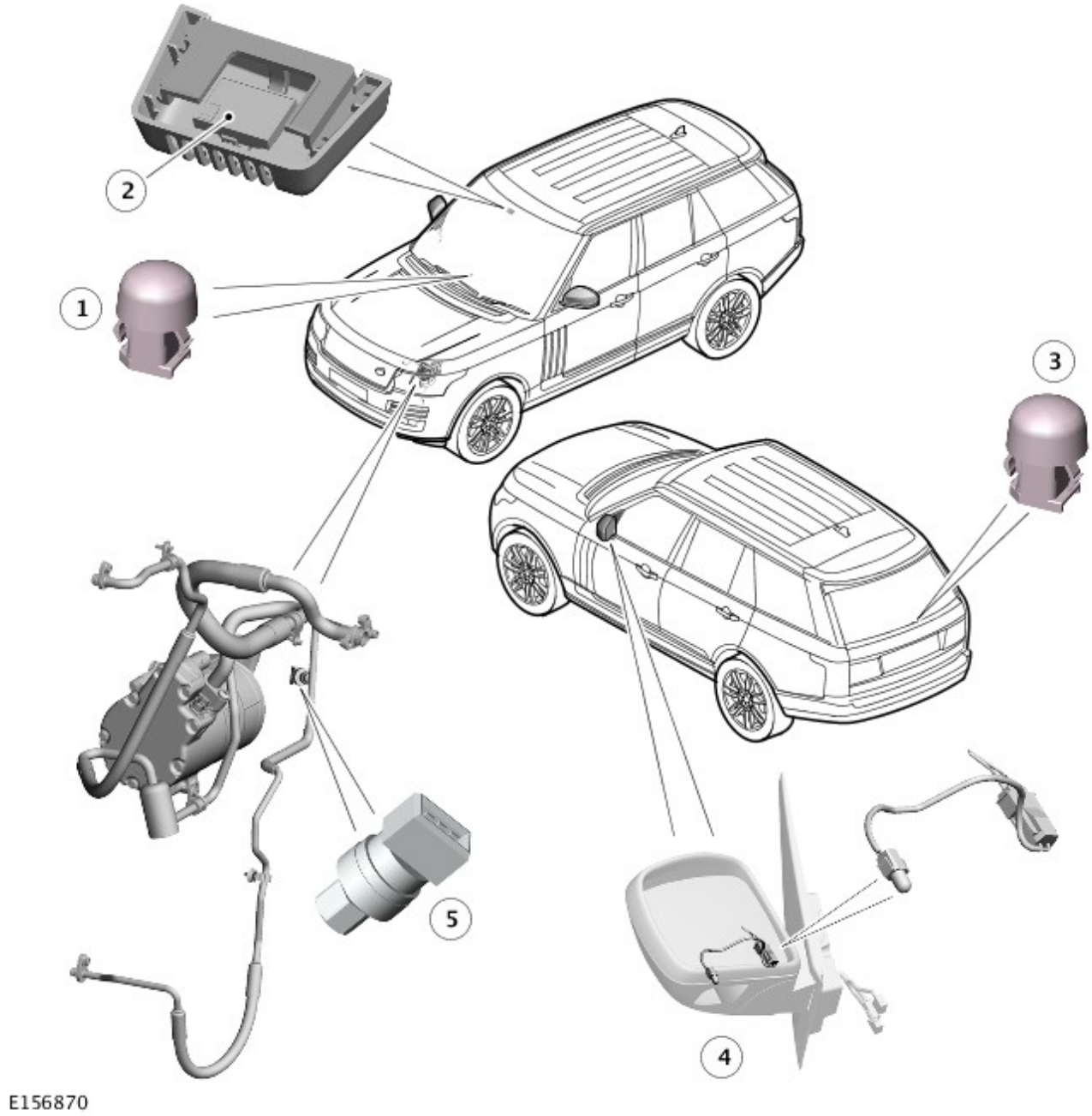
COMPONENT LOCATION - SHEET 1 OF 3

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



Item	Part Number	Description
1	-	Pollution sensor
2	-	Duct air temperature sensor - front left face
3	-	Duct air temperature sensor - front right face
4	-	Duct air temperature sensor - front right foot
5	-	Evaporator temperature sensor
6	-	Duct air temperature sensor - rear right foot
7	-	Duct air temperature sensor - rear right face
8	-	Duct air temperature sensor - rear left face
9	-	Duct air temperature sensor - rear left foot
10	-	Duct air temperature sensor - front left foot
11	-	Automatic temperature control module

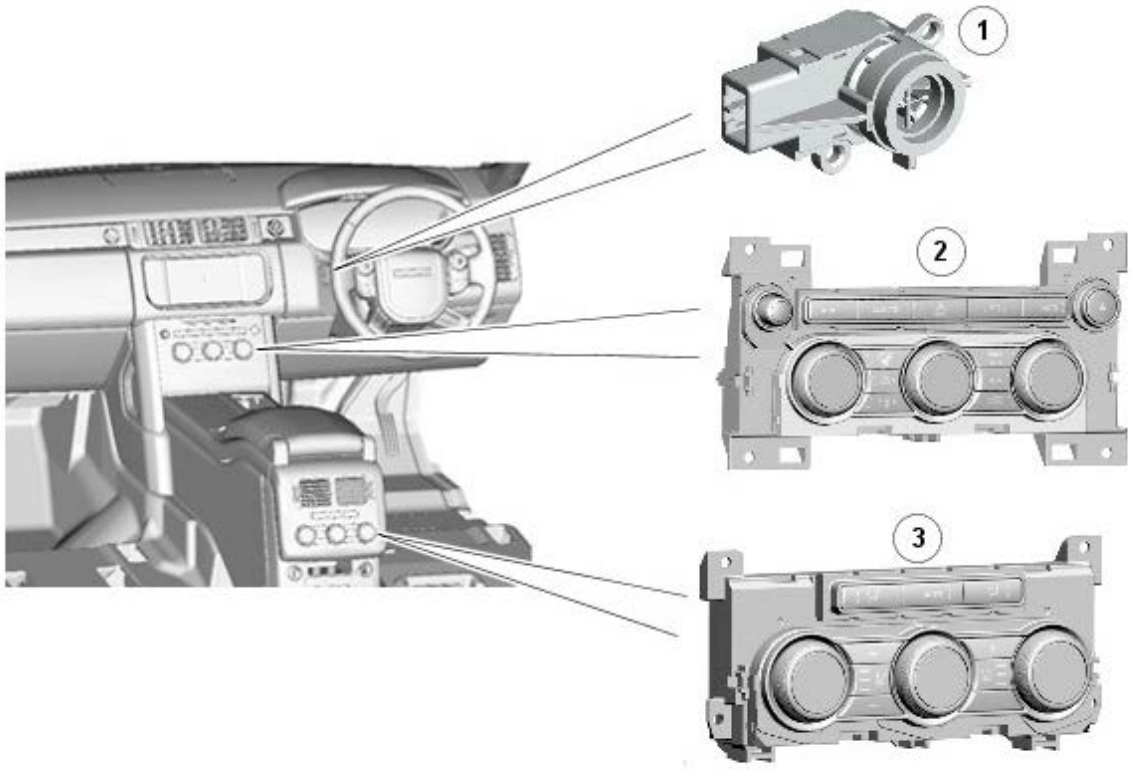
COMPONENT LOCATION - SHEET 2 OF 3



Item	Part Number	Description
1	-	Front sunload sensor
2	-	Humidity sensor
3	-	Rear sunload sensor
4	-	Ambient air temperature sensor
5	-	Refrigerant pressure sensor

COMPONENT LOCATION - SHEET 3 OF 3

NOTE: RHD installation shown, LHD installation similar.



E149320

Item	Part Number	Description
1	-	In-vehicle temperature sensor
2	-	Integrated control panel
3	-	Rear integrated control panel

OVERVIEW

The standard climate control system operates the A/C (air conditioning) system and the heating and ventilation system to control the temperature, volume and distribution of air from the climate control assembly. Operation can be fully automatic, but manual overrides are provided for the intake air source, blower speed and air distribution. The standard climate control system is a three zone system that maintains the individual temperature levels selected for the driver, front passenger and rear seat passenger areas of the vehicle.

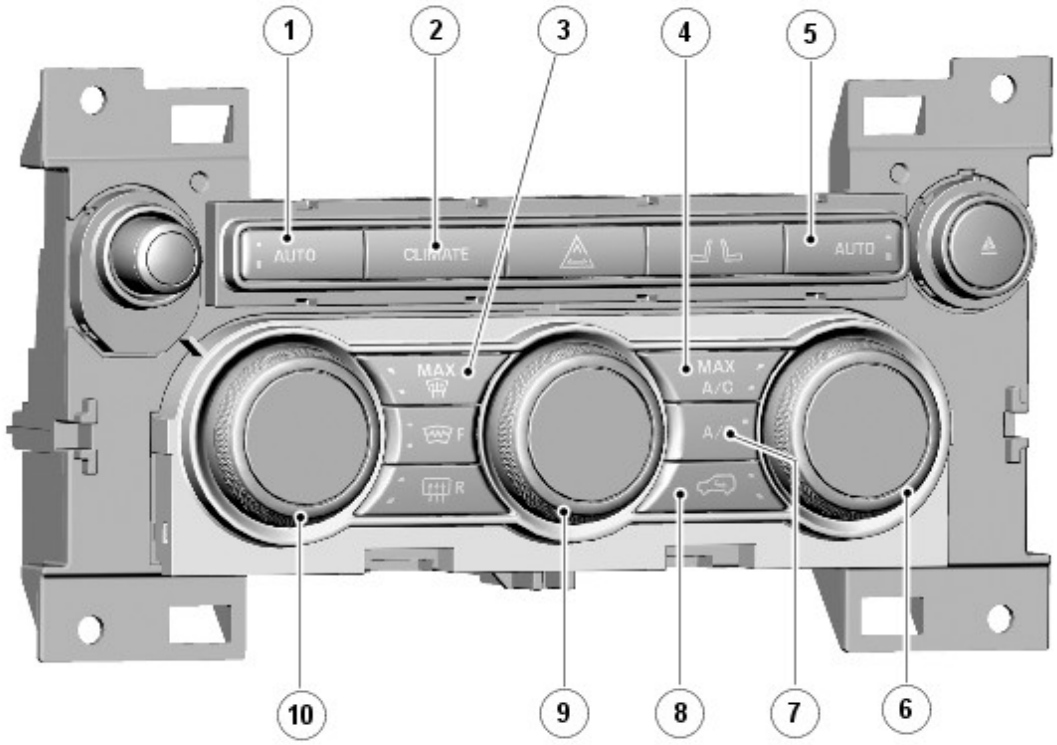
Auxiliary climate control (where fitted) provides individual control for the left and right rear seat passenger areas to give a four zone climate control system.
For additional information, refer to: Auxiliary Climate Control (412-02B, Description and Operation).

The standard climate control system consists of the following components:

- ICP (integrated control panel)
- Rear integrated control panel
- ATCM (automatic temperature control module)
- Ambient air temperature sensor
- Refrigerant pressure sensor
- Evaporator temperature sensor
- In-vehicle temperature sensor
- Humidity sensor
- Front and rear sunload sensors
- Pollution sensor
- Duct air temperature sensors.

DESCRIPTION

Integrated Control Panel



E141125

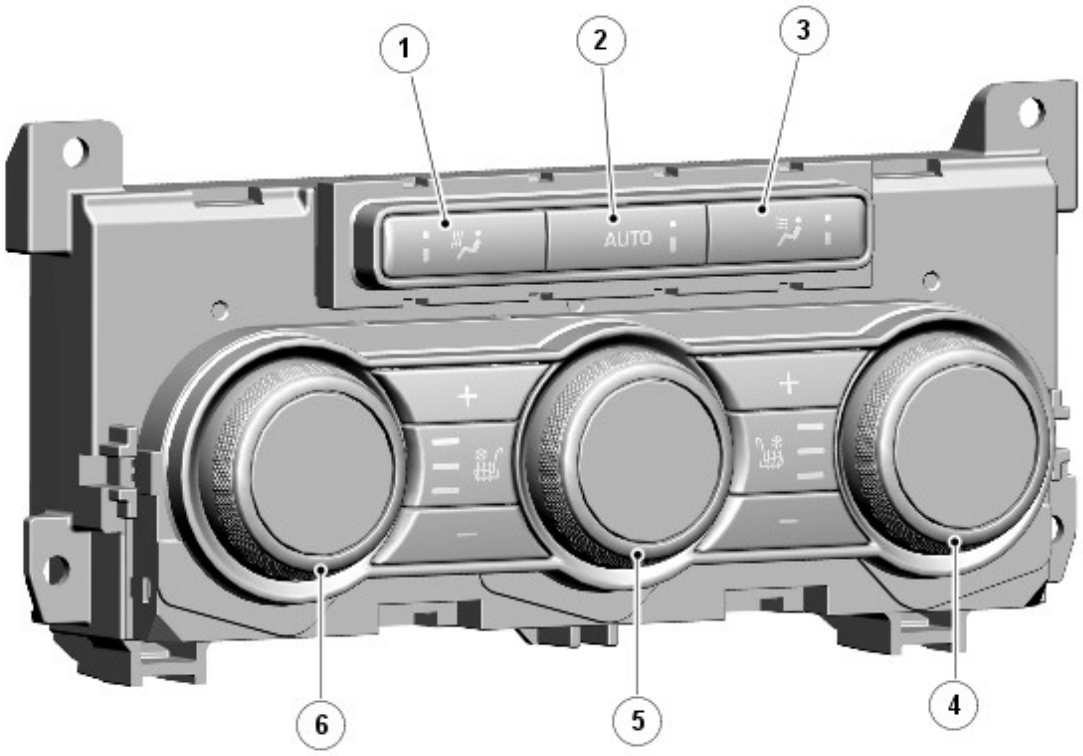
Item	Part Number	Description
1	-	Left automatic mode switch
2	-	Climate control menu switch
3	-	Maximum demist switch
4	-	Maximum air conditioning switch
5	-	Right automatic mode switch
6	-	Right temperature switch
7	-	Air conditioning system on/off switch
8	-	Recirculation switch
9	-	Blower switch
10	-	Left temperature switch

The ICP is installed in the center of the instrument panel and contains push switches and rotary switches for operation of the climate control system. Each push switch contains an amber status LED (light emitting diode). Display screens are integrated into the center of the rotary switches to display the selected temperature and blower speed as applicable. In addition to the switches for the climate control system, the ICP also contains switches for operation of:

- The audio system.
  For additional information, refer to: Audio System - TDV6 3.0L Diesel - Hybrid Electric Vehicle (415-01 Information and Entertainment System, Description and Operation).
- The hazard warning indicators.
  For additional information, refer to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).
- The front seat heaters/climate system.
  For additional information, refer to: Seats (501-10 Seating, Description and Operation).
- The windshield and rear window heaters.
  For additional information, refer to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Description and Operation).

The ICP converts selections on the climate control switches into medium speed CAN (controller area network) comfort and convenience systems messages, and transmits them to the ATCM.

Rear Integrated Control Panel



E141159

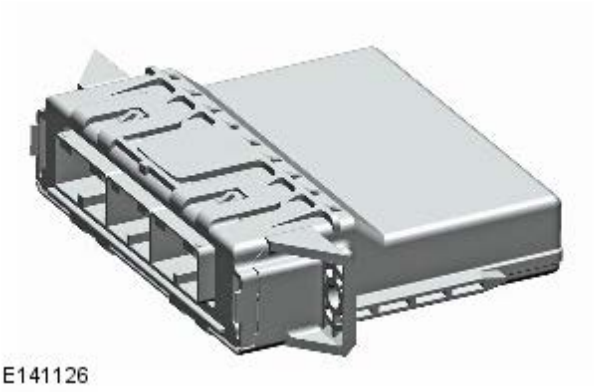
Item	Part Number	Description
1	-	Foot distribution switch
2	-	Automatic mode switch
3	-	Face distribution switch
4	-	Right temperature switch
5	-	Blower switch
6	-	Left temperature switch

On standard climate control systems the rear ICP is installed in the rear of the floor console. The control panel contains rotary and push button switches for controlling the temperature, volume and distribution of air ro the rear seats. Each push switch contains an amber status LED. Display screens are integrated into the center of the rotary switches to display the selected temperature and blower speed as applicable.

Additional push switches on the rear ICP are provided for control of seat heating/climate control seats.
For additional information, refer to: Seats (501-10 Seating, Description and Operation).

The rear ICP has a permanent battery power feed from the CJB (central junction box), and is connected to the medium speed CAN comfort and convenience systems. The rear ICP converts selections on the climate control switches into medium speed CAN messages, and transmits them to the ATCM.

Automatic Temperature Control Module



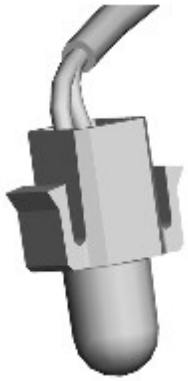
E141126

The ATCM is mounted on the inboard side of the air inlet duct, behind the front passenger side of the instrument panel.

The ATCM processes inputs from the climate control system sensors, the ICP, the rear ICP, the touch screen and other systems, then outputs the appropriate control signals to the A/C system and the heating and ventilation system. In addition to the A/C system and the heating and ventilation system, the ATCM also controls the following:

- Isolation valves for the climate control system and the HEV (hybrid electric vehicle) battery cooling system.
  For additional information, refer to: Air Conditioning (412-01B, Description and Operation).
- The windshield washer jet heaters and the wiper blade heater.
  For additional information, refer to: Wipers and Washers (501-16 Wipers and Washers, Description and Operation).
- The front and rear seat heaters (where fitted).
  For additional information, refer to: Seats (501-10 Seating, Description and Operation).
- Auxiliary climate control system (where fitted).
  For additional information, refer to: Auxiliary Climate Control (412-02B, Description and Operation).
- Fuel fired booster heater.
  For additional information, refer to: Fuel Fired Booster Heater (412-02B, Description and Operation).

Ambient Air Temperature Sensor



E116093

The ambient air temperature sensor is a NTC (negative temperature coefficient) thermistor installed in the left exterior rear view mirror, with the bulb of the sensor positioned over a hole in the bottom of the mirror casing.

The ECM (engine control module) supplies the ambient air temperature sensor with a 5 V reference voltage and translates the return signal voltage into a temperature. The ECM transmits the temperature on the high speed CAN powertrain systems for use by other systems. The ATCM receives the temperature, on the medium speed CAN comfort and convenience systems, from the gateway module.

Refrigerant Pressure Sensor



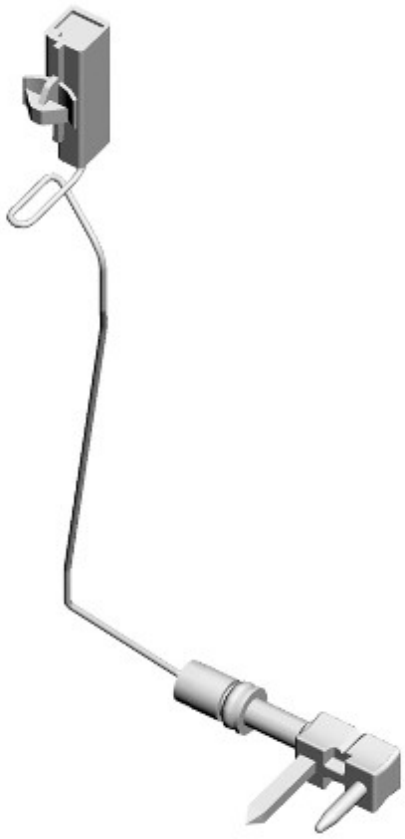
E141128

The refrigerant pressure sensor is located in the high pressure refrigerant line between the condenser and the thermostatic expansion valve.

The ATCM supplies a 5 V reference voltage to the refrigerant pressure sensor and receives a return signal voltage related to system pressure.

The ATCM uses the signal from the refrigerant pressure sensor to protect the refrigerant system from extremes of pressure, calculate the A/C compressor load and control the speed of the engine cooling fans.

Evaporator Temperature Sensor



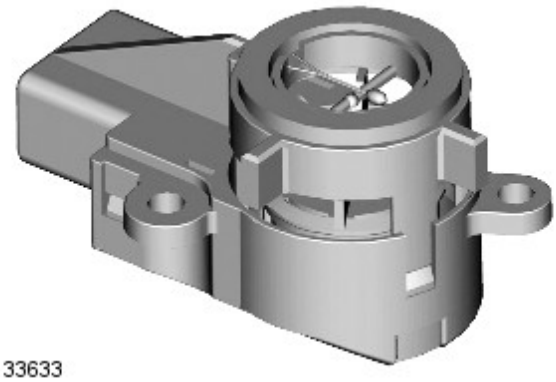
E97626

The evaporator temperature sensor is a NTC thermistor that provides the ATCM with a temperature signal from the air outlet side of the evaporator. The sensor extends into the air flow on the downstream side of the evaporator.

The ATCM uses the input from the evaporator temperature sensor to control the speed of the electric A/C compressor, and thus the operating temperature of the evaporator.

The ATCM supplies the evaporator temperature sensor with a 5 V reference voltage and translates the return signal voltage into a temperature. If the sensor develops a fault, the ATCM adopts a default temperature of 0 °C (32 °F).

In-vehicle Temperature Sensor



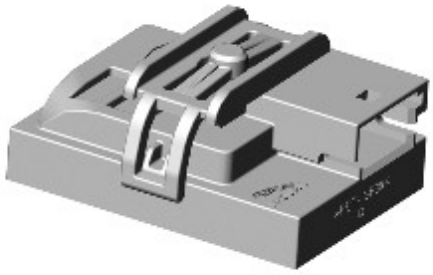
E133633

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. A motor driven fan in the sensor draws air through the grill and over the thermistor.

The ATCM uses the signal from the in-vehicle temperature sensor for control of the climate control assembly output temperatures, blower speed and air distribution.

The ATCM supplies the in-vehicle temperature sensor with a 5 V reference voltage and translates the return signal voltage into a temperature. If the in-vehicle temperature sensor develops a fault, the ATCM adopts a default temperature of 20 °C (68 °F).

Humidity Sensor



E141130

The humidity sensor is installed in a bracket attached to the inside of the windshield, to the right of the interior mirror. The sensor is concealed under a cover, which clips onto the bracket. The sensor comprises three individual elements:

- A capacitive humidity sensor
- A NTC thermistor air temperature sensor
- An infrared windshield glass temperature sensor.

The humidity sensor is powered by a feed from the battery saver relay in the CJB. The data from the three individual elements of the humidity sensor are transmitted in LIN (local interconnect network) bus messages to the ATCM. From the data, the ATCM:

- Adjusts the humidity of the air in the vehicle as necessary, to provide the optimum comfort level for occupants
- Calculates the dew point temperature of the air at the inside of the windshield.

Humidity within the vehicle is controlled by raising or lowering the temperature of the evaporator. An increase in evaporator temperature increases the moisture content of the air at the windshield. Lowering the evaporator temperature reduces the moisture content of the air in the interior.

If the temperature of the windshield glass is equal to or less than the dew point temperature, misting is likely to occur. To prevent this, the ATCM will:

- Increase the temperature of the air leaving the climate control assembly
- Adjust the position of the demist motor to direct more air to the windshield
- Adjust the position of the recirculation motor to admit more fresh air
- Energize the windshield heater.

Sunload Sensors



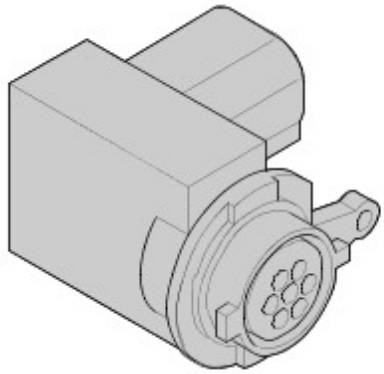
E141131

Front and rear sunload sensors are installed. The front sunload sensor is installed in the top of the instrument panel, in the center demist grille. The rear sunload sensor is installed in the interior trim panel of the upper tailgate.

The ATCM supplies the sunload sensors with a 5 V reference voltage. Each sensor contains photoelectric cells that provide the ATCM with two inputs of light intensity, which equates to the solar heating effect on the left and right sides of the vehicle.

The ATCM compensates for the solar heating effect by adjusting blower speed, climate control assembly output temperature and air distribution to maintain the required zone temperatures.

Pollution Sensor



E133637

The sensor is mounted on the inboard side of the air inlet duct, in the fresh air inlet.

The pollution sensor has battery power, ground and signal connections with the ATCM. Semiconductor material in the sensor undergoes a change of conductance if exposed to specific gases. The sensor uses this property to monitor for gases such as CO and NOx and so determine the quality of the fresh air entering the vehicle. The sensor transmits the air quality to the ATCM, in a PWM (pulse width modulation) signal, as one of the following four conditions:

- Static or reduced pollution levels
- Small increase in pollution levels
- Medium increase in pollution levels
- Rapid or large increase in pollution levels.

Based on the signal from the pollution sensor, the ATCM controls the intake air source to reduce the amount of contaminants entering the interior. This function is fully automatic, but can be overridden by manual selection of the air intake source using the recirculation switch on the ICP.

Duct Air Temperature Sensors



E141132

The duct air temperature sensors are NTC thermistors installed in the following distribution ducts:

- Front left and right center face ducts
- Front left and right foot ducts
- Second row left and right foot ducts
- Second row left and right face ducts

The duct air temperature sensors are provided with 5V reference signal and ground connections with the ATCM. The ATCM uses the sensor inputs in the calculations used to set the temperatures of the air leaving the climate control assembly.

OPERATION

In any drive mode, the climate control system can be activated using the AUTO switches on the ICP, or the AUTO soft keys on the **Front climate** or **Rear climate** menus of the touch screen. Provided the rear climate control panel is unlocked (on the touch screen **Rear climate** menu), pressing the AUTO switch on the rear ICP will also activate the system.

Intake Air Control

The source of inlet air is automatically controlled by the ATCM, unless overridden by pressing the recirculation switch on the ICP to give timed or latched recirculation. A brief press of the switch illuminates the switch indicator and activates timed recirculation. Pressing and holding the switch causes the switch indicator to flash and then illuminate constantly, indicating that the air inlet is in latched recirculation and the switch can be released. A second press of the switch cancels recirculation and the ATCM returns the recirculation door to the fresh air position. Timed recirculation is automatically cancelled after a set time, which varies with ambient air temperature.

During automatic control, the ATCM determines the required position of the recirculation door from comfort algorithms and the pollution sensor. If it detects pollution, the ATCM sets the air source to recirculation for 10 minutes, then to fresh air for 20 seconds to renew the air in the vehicle. The ATCM repeats this cycle until the pollution is no longer present.

The sensitivity of the pollution sensor can be adjusted on the touch screen, using the **Settings** soft key of the **Front climate** menu. The pollution sensing function can also be switched off by adjusting sensitivity to the minimum setting. If there is a fault with the pollution sensor, the ATCM disables automatic operation of the recirculation door.

Air Temperature Control

The ATCM calculates the temperature blend motor positions required to achieve the selected temperature and compares it against the current position. If there is any difference, the ATCM signals the motors to adopt the new position.

Air temperature is controlled automatically unless maximum heating (HI) or maximum cooling (LO) is selected. When maximum heating or cooling is selected, a comfort algorithm in the ATCM adopts an appropriate strategy for air distribution, blower speed, and air source.

Temperature control in one zone can be compromised by another zone being set to a high level of heating or cooling. True maximum heating or cooling (displayed as **HI** or **LO** on the touch screen and switches) can only be selected for the driver zone. If HI or LO is selected for the driver zone, the temperature for the other zones is automatically set to match the driver zone.

If A/C is selected off in the automatic mode, no cooling of the inlet air will take place. The minimum output air temperature from the system will be ambient air temperature plus any heat pick up in the air inlet path.

If the **Sync** soft key on the touch screen **Front climate** menu is pressed, the ATCM synchronizes the temperature of the other zones with the driver zone temperature.

Blower Control

When the system is in the automatic mode, the ATCM determines the blower speed required from a comfort algorithm. When the system is in the manual mode, the ATCM operates the blower at the speed selected on the ICP or the touch screen. The ATCM also adjusts blower speed to compensate for the ram effect on inlet air produced by forward movement of the vehicle. As vehicle speed and ram effect increases, blower motor speed is reduced, and vice versa.

The blower switch on the rear ICP has no control over the blower in the climate control assembly. Instead, the ATCM adjusts the rear distribution doors to increase the air flow through the rear distribution ducts from the climate control assembly.

Air Distribution Control

When the A/C system is in automatic mode, the ATCM automatically controls air distribution into the passenger compartment in line with its comfort algorithm. Automatic control is overridden by distribution selections on the touch screen, the ICP or the rear ICP. Air distribution remains as selected until one of the AUTO switches is selected or a different manual selection is made.

Electric Air Conditioning Compressor Control

The ATCM determines the amount of cooling required from the A/C system by evaluating the cooling requests from:

- The ICP and the rear ICP, for passenger compartment cooling
- The BECM (battery energy control module), for HEV battery cooling.
  For additional information, refer to: Battery and Cables - TDV6 3.0L Diesel - Hybrid Electric Vehicle (414-01, Description and Operation).

From the cooling requests the ATCM:

- Activates the climate control and HEV battery isolation valves as necessary to supply refrigerant to the required systems.
  For additional information, refer to: Air Conditioning (412-01B, Description and Operation).
- Calculates the optimum speed required for the electric A/C compressor, to produce the amount of cooling required, and the energy required to drive the compressor.

 NOTE: The ATCM adopts a different cooling strategy in high ambient temperature conditions. For the first 15 minutes of the vehicle being operated, the HEV battery isolation valve is closed. This allows the passenger compartment temperature to be achieved as quickly as possible. When the passenger compartment has reached the target temperature, or 15 minutes has elapsed, the HEV battery isolation valve is opened to reconnect the HEV battery cooler to the refrigerant circuit.

The ATCM transmits the energy required to drive the compressor in a CAN signal to the ECM. The ECM responds with a CAN signal of the HEV battery power available to drive the compressor. Provided there is sufficient power available, the final calculated compressor speed remains the optimum speed. If the power available is less than required to drive the compressor at the optimum speed, the ATCM reduces the final calculated compressor speed to match the power available. The ATCM then transmits a drive request with the final calculated speed on the LIN bus connection to the compressor. A return signal on the LIN bus of actual speed allows the ATCM to exercise closed loop control of compressor.

When climate control cooling is requested the ATCM maintains the evaporator at an operating temperature that varies with the passenger compartment cooling requirements. If the requirement for cooled air decreases, the ATCM raises the evaporator operating temperature by reducing the speed of the electric A/C compressor, which reduces the flow of refrigerant. The ATCM closely controls the rate of temperature increase to avoid introducing moisture into the passenger compartment.

If the requirement for cooled air increases, the ATCM lowers the evaporator operating temperature by increasing the

speed of the electric A/C compressor to increase the flow of refrigerant.

When climate control cooling is not required the ATCM stops the electric A/C compressor, unless it is required for HEV battery cooling.

The ATCM incorporates limits for the operating pressure of the refrigerant system. If the system approaches the high pressure limit, the electric A/C compressor speed is progressively reduced until the system pressure decreases. If the system falls below the low pressure limit, the electric A/C compressor is stopped, to avoid depletion of the lubricant in the compressor.

Cooling Fan Control

The ATCM determines the amount of condenser cooling required from the refrigerant pressure sensor, since there is a direct relationship between the temperature and pressure of the refrigerant. The cooling requirement is broadcast to the ECM on the medium speed CAN comfort and convenience systems. The ECM then controls the temperature of the condenser using the active grille air shutter and the electric cooling fans.

Maximum Demist

When the MAX demist switch on the ICP is pressed, the ATCM configures the climate control system as follows:

- Automatic mode off.
- A/C on.
- Selected temperature unchanged.
- Air inlet set to fresh air.
- Air distribution set to windshield.
- Blower speed set to high speed.

The ATCM also sends a medium speed CAN comfort and convenience systems message to the CJB to activate the windshield and rear window heaters.

The programmed demist function can be cancelled by one of the following:

- A second press of the MAX demist switch.
- Selecting any air distribution soft key on the touch screen.
- Pressing the driver side AUTO switch on the ICP.
- Switching the ignition OFF.

The blower speed can be adjusted without terminating the programmed demist function. If the blower speed has been adjusted and then the MAX demist switch is pressed again, the system will go back to the MAX demist default settings. If the MAX demist program is cancelled with the MAX demist switch or the driver side AUTO switch, the windshield and rear window heaters remain on until they time out.

Rest Heat

When the ignition is off, pressing the **Rest heat** soft key on the touch screen **Front climate** menu activates the rest heat function to heat the passenger compartment with residual heat from the engine. The rest heat function activates provided that:

- It is less than 2 minutes since the ignition was selected off.
- Ambient air temperature is less than 15 °C (59 °F).
- On the previous ignition cycle engine temperature exceeded 70 °C (158 °F).
- Battery voltage is 11.4 V minimum.

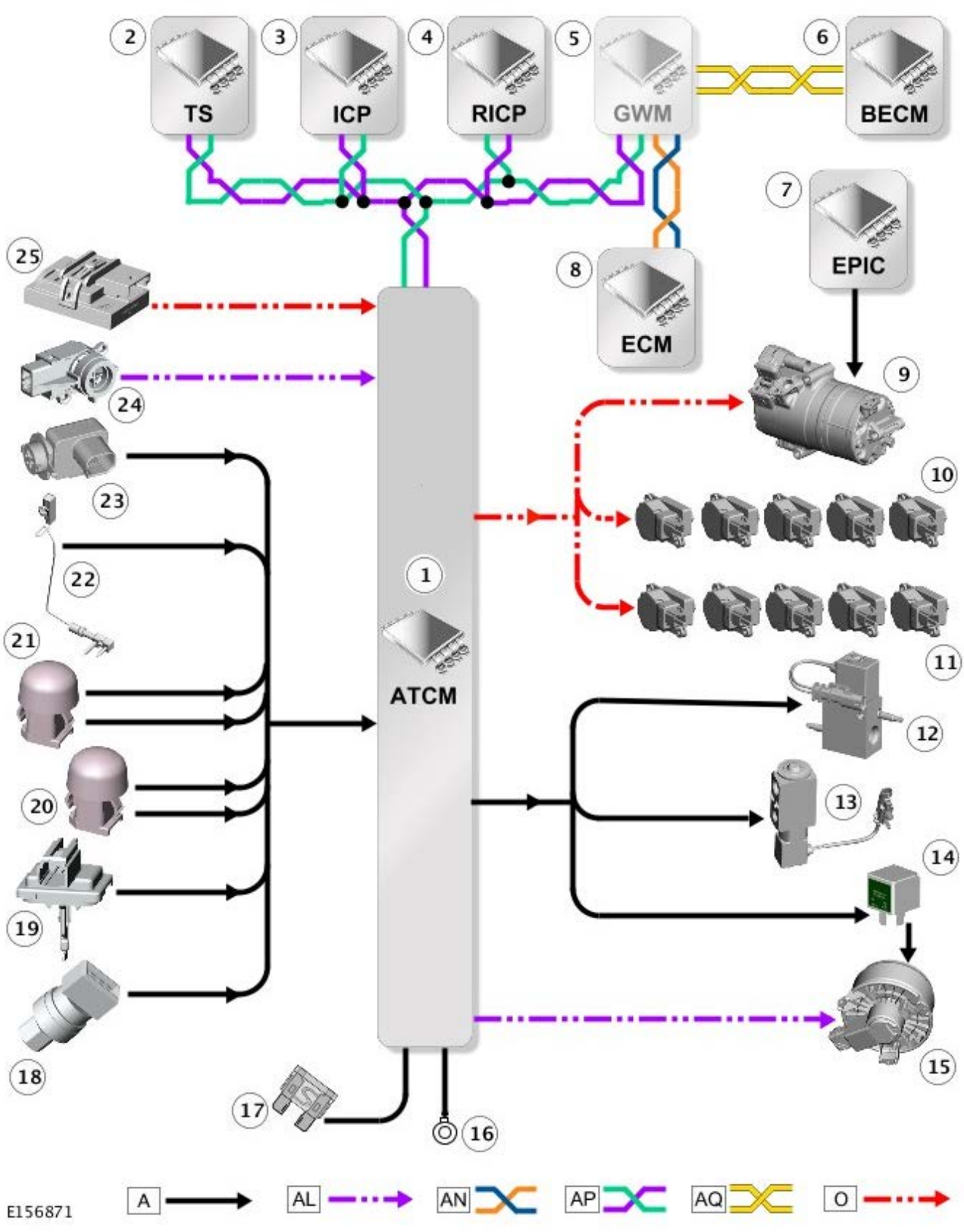
To provide the rest heat function, the ATCM:

- Sends a LIN bus message to the FFBH (fuel fired booster heater) control module to run the FFBH coolant pump.
- Operates the blower at medium speed.
- Sets the distribution doors to direct air to the face outlets.
- Sets the temperature blend doors to produce the temperature selected on the driver side before the ignition was switched off.

The rest heat function is cancelled after 15 minutes or when:

- The **Rest heat** soft key is pressed again.
- The ignition is selected on.
- Battery voltage decreases to less than 11 V.

Control Diagram



A = Hardwired connection; AL = PWM signal; AN = High speed CAN powertrain systems; AP = Medium speed CAN comfort and convenience systems; AQ = High speed CAN HEV systems; O = LIN bus.

Item	Part Number	Description
1	-	Automatic temperature control module
2	-	Touch screen
3	-	Integrated control panel
4	-	Rear integrated control panel
5	-	Gateway module
6	-	Battery energy control module
7	-	Electric power inverter converter

8	-	Engine control module
9	-	Electric air conditioning compressor
10	-	Distribution and temperature blend motors
11	-	Recirculation, cool air bypass, distribution and temperature blend motors
12	-	Climate control isolation valve
13	-	HEV battery isolation valve
14	-	Blower relay
15	-	Blower
16	-	Ground
17	-	Power supply
18	-	Refrigerant pressure sensor
19	-	Duct air temperature sensor (8 off)
20	-	Rear sunload sensor
21	-	Front sunload sensor
22	-	Evaporator temperature sensor
23	-	Pollution sensor
24	-	In-vehicle temperature sensor
25	-	Humidity sensor

Published: 16-May-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Blower Motor

Removal and Installation

Removal

NOTES:

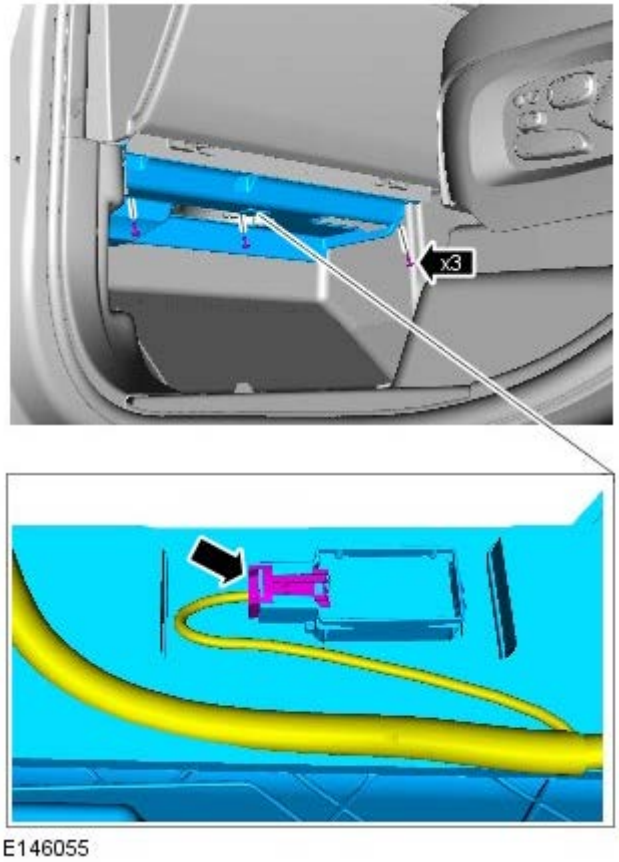
Removal steps in this procedure may contain installation details.

Right Hand illustration shown, Left Hand is similar.

1. Disconnect the battery ground cable.

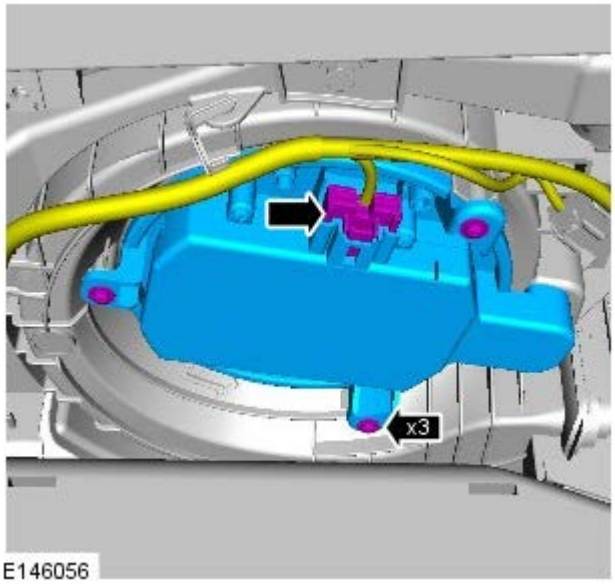
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2.



E146055

3.



Installation

1. To install, reverse the removal procedure.

Published: 16-May-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Center Registers

Removal and Installation

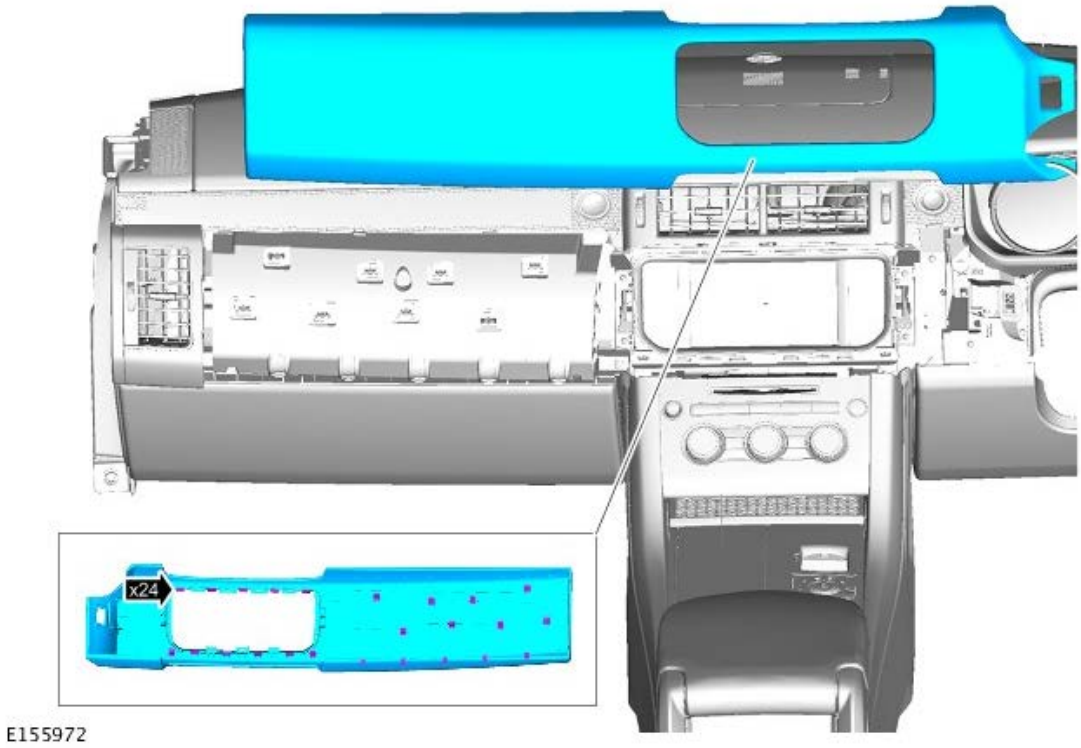
Removal

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.

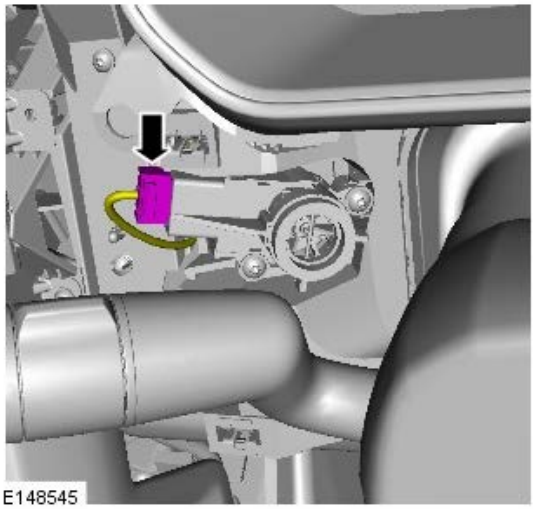


2.

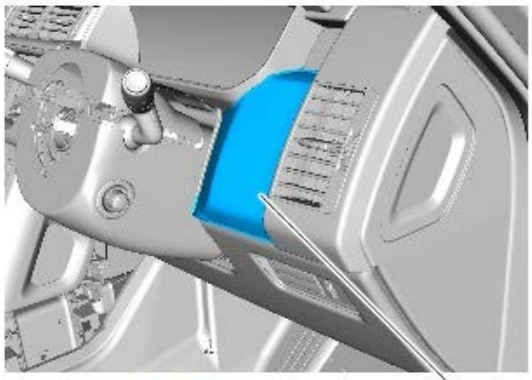


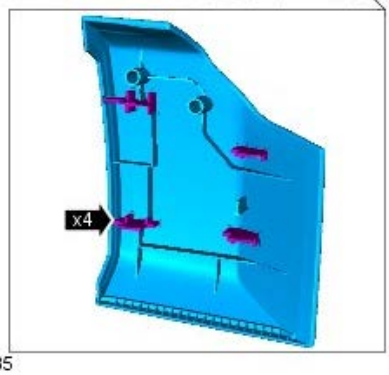


3.



E148545



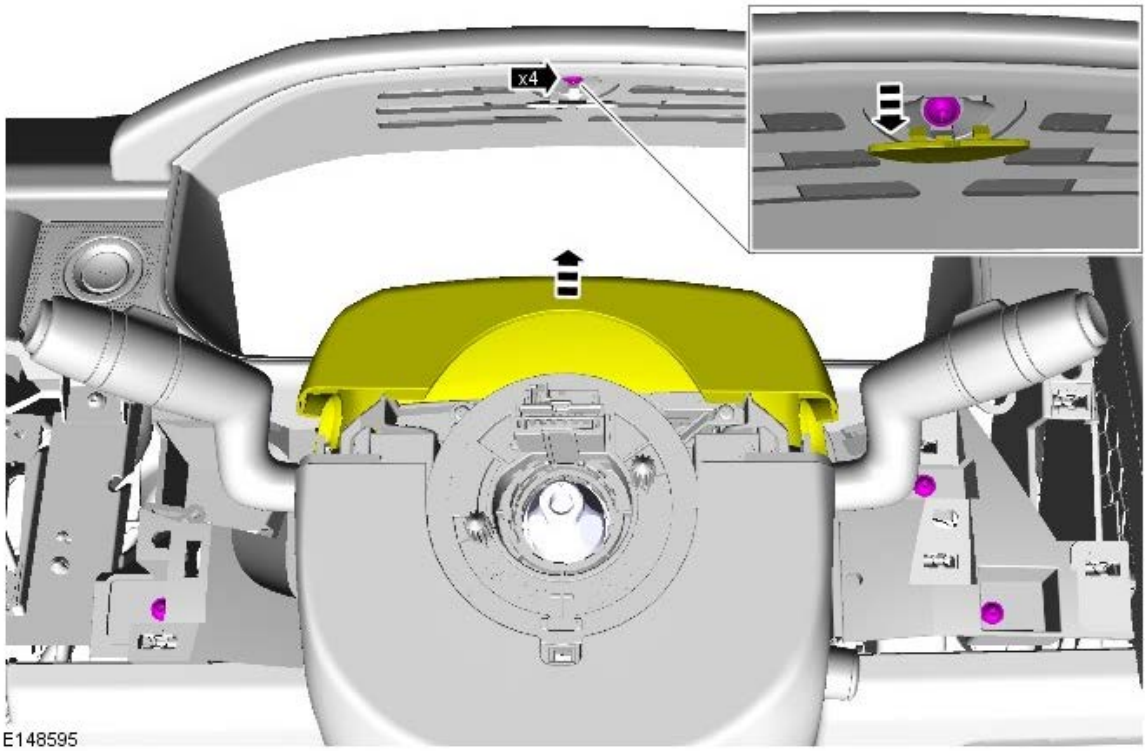


E148285

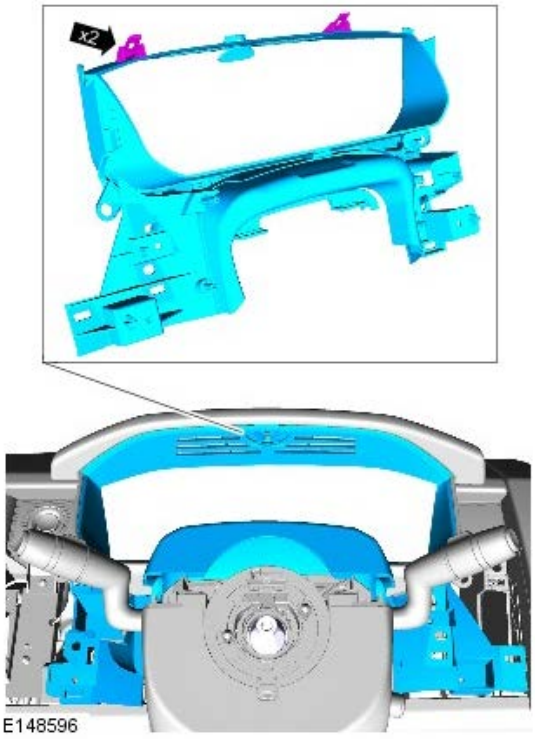
4. NOTE: The steering wheel is shown removed for clarity.

5. NOTE: The steering wheel is shown removed for clarity.

Torque:
1.7 Nm

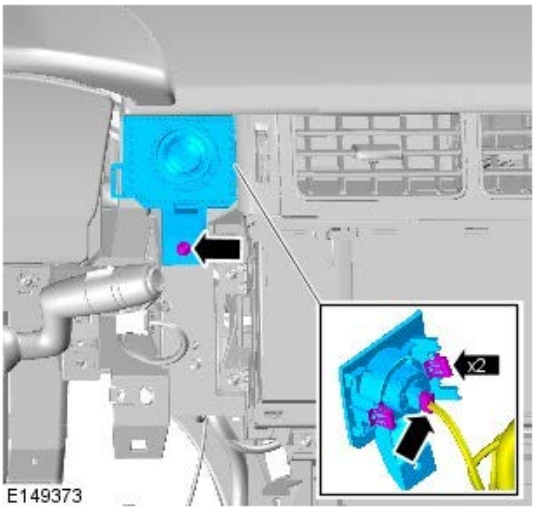


6. NOTE: The steering wheel is shown removed for clarity.

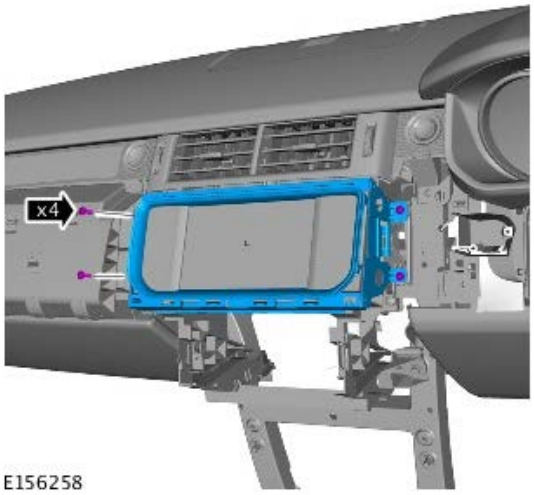


7. NOTE: Left Hand illustration shown, Right Hand is similar.

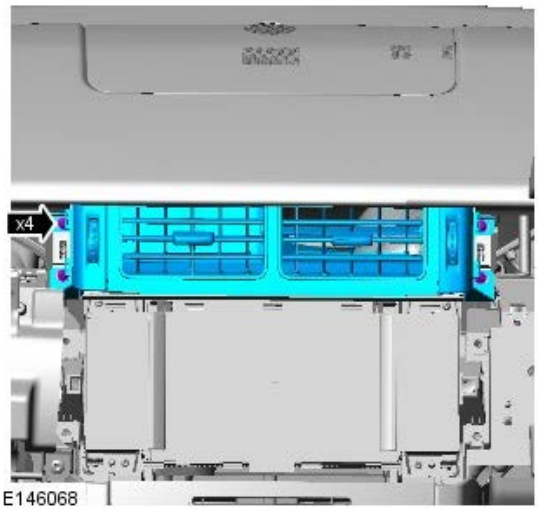
Torque: 1.7 Nm



8.



9.



Installation

1. NOTE: Install the trim retaining clips in the moulding prior to installing the components.



E149095

2. To install, reverse the removal procedure.

Published: 02-May-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Climate Control Assembly

Removal and Installation

Removal

NOTES:

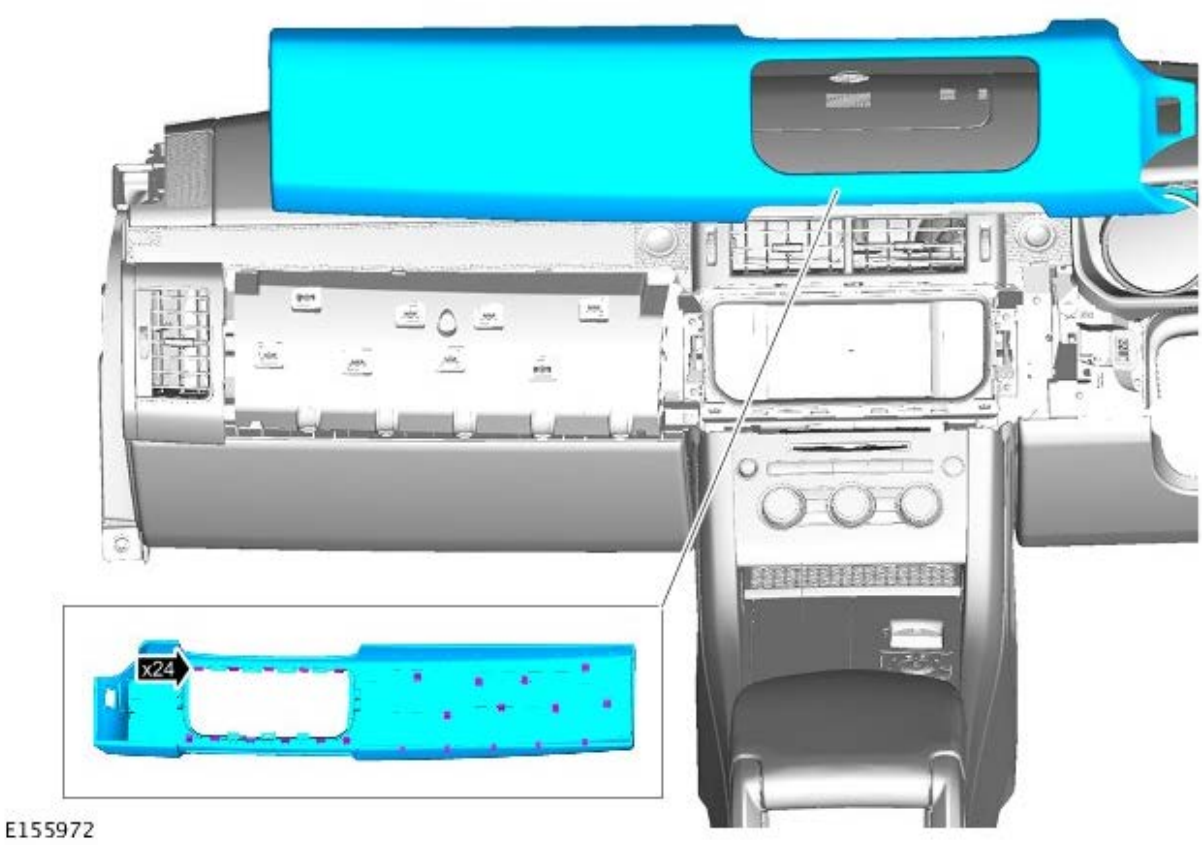
Removal steps in this procedure may contain installation details.

Some components shown removed for clarity.

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

1. Refer to: Specifications (414-01 Battery, Mounting and Cables, Specifications).

2.



3.



E155713

4. *Torque:* 9 Nm



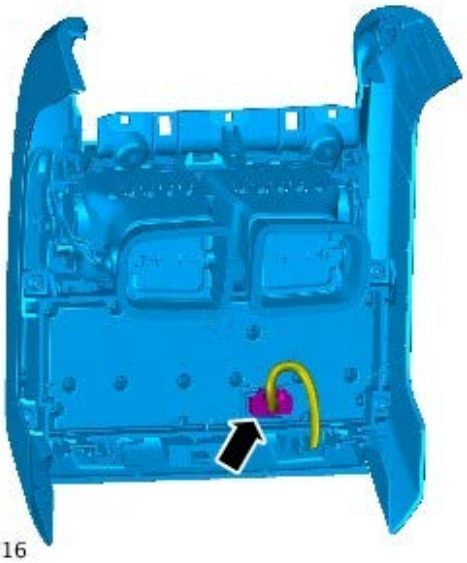
E155714

5.



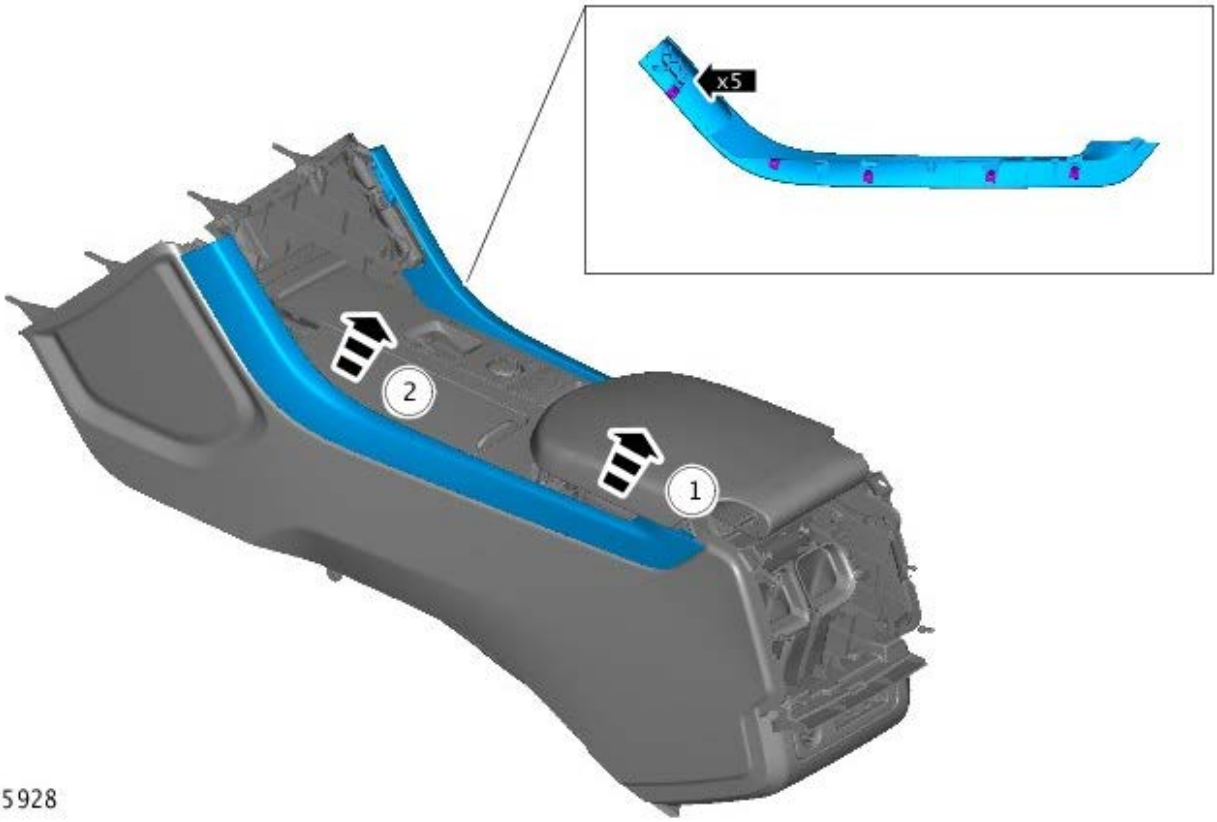
E155715

6.



E155716

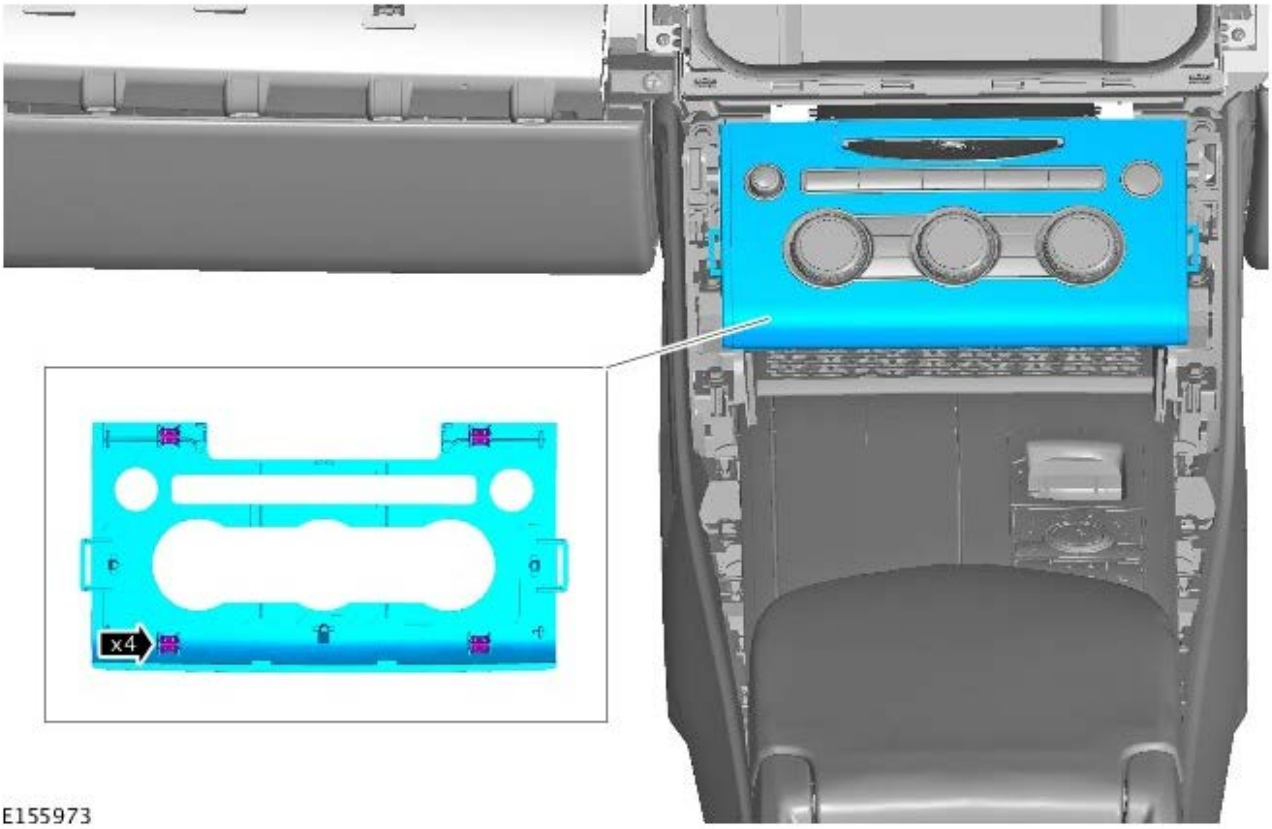
7.



E155928

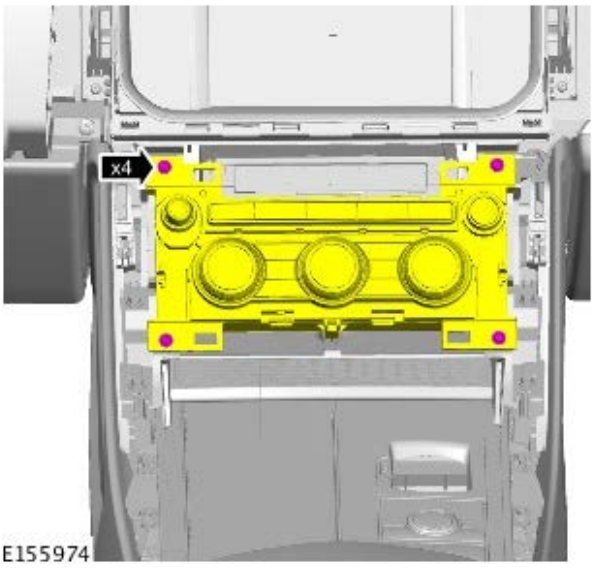
8.

9.



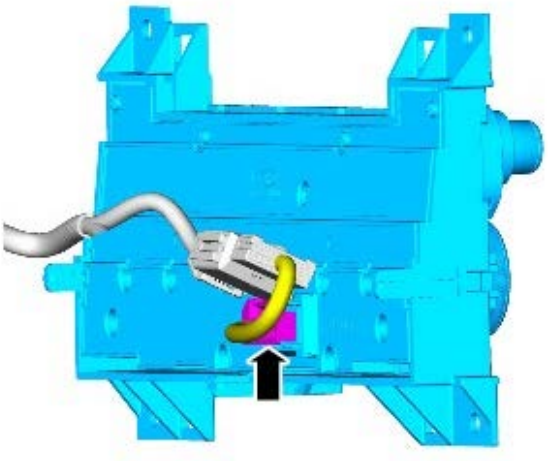
E155973

10.



E155974

11.



E155975

Installation

1. To install, reverse the removal procedure.

Published: 10-Jun-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Thermostatic Expansion Valve

Removal and Installation

Removal

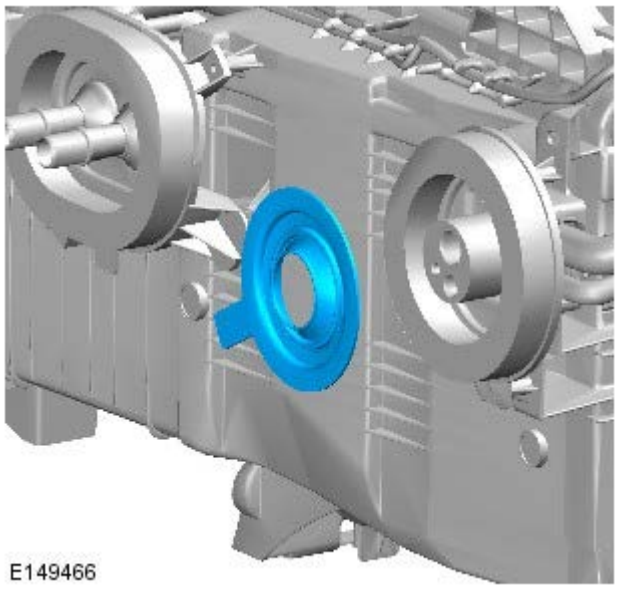
NOTES:

Removal steps in this procedure may contain installation details.

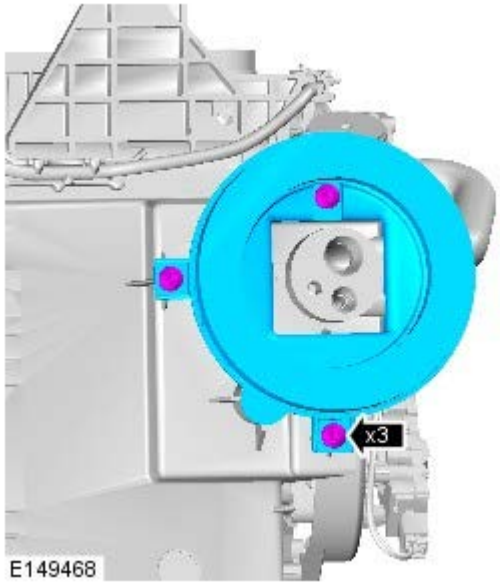
Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: Heater Core and Evaporator Core Housing (412-01A Climate Control, Removal and Installation).

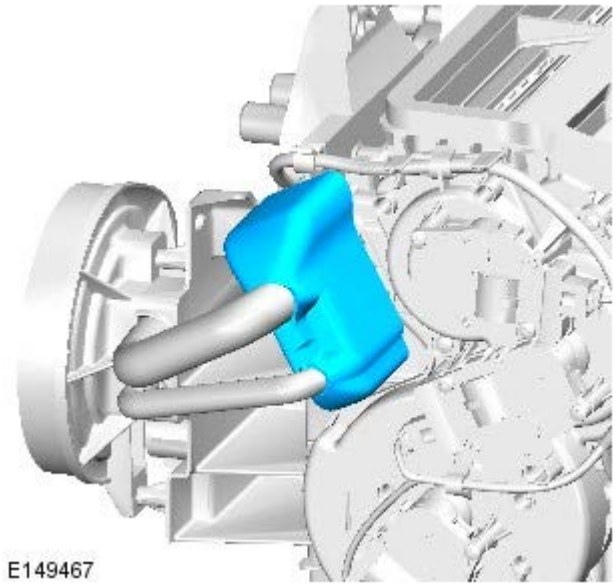
2.



3.



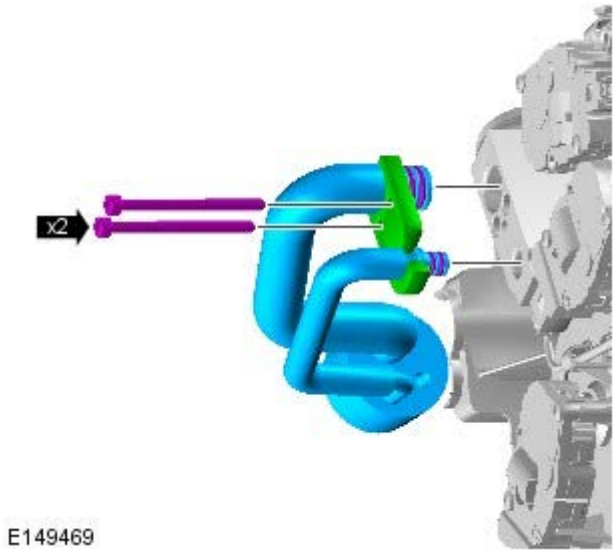
4.



5. CAUTION: Remove and discard the O-ring seals.

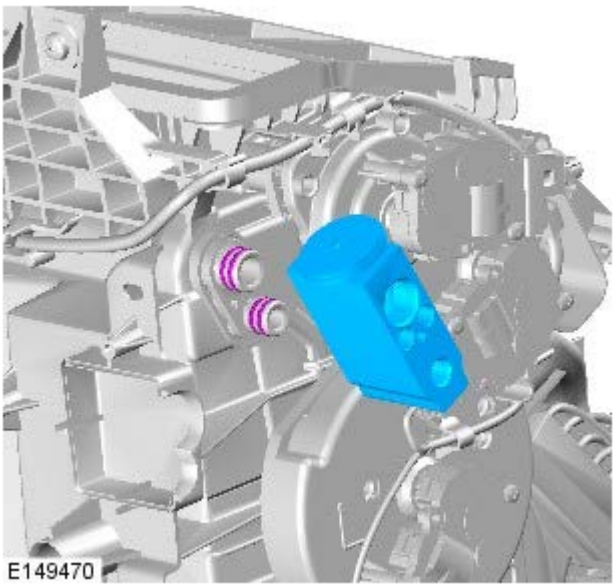
   NOTE: Install new O-ring seals.

   Torque: 4 Nm



6. CAUTION: Remove and discard the O-ring seals.

   NOTE: Install new O-ring seals.



Installation

1. To install, reverse the removal procedure.

Published: 10-Jun-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Evaporator

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

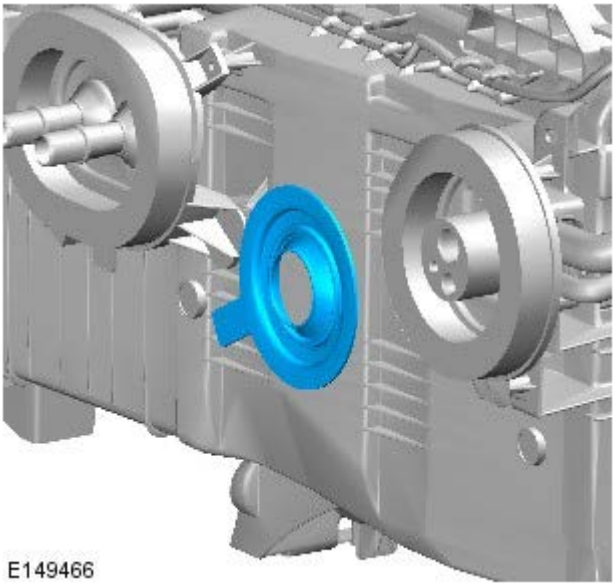
   Raise and support the vehicle.

2. Disconnect the battery ground cable.

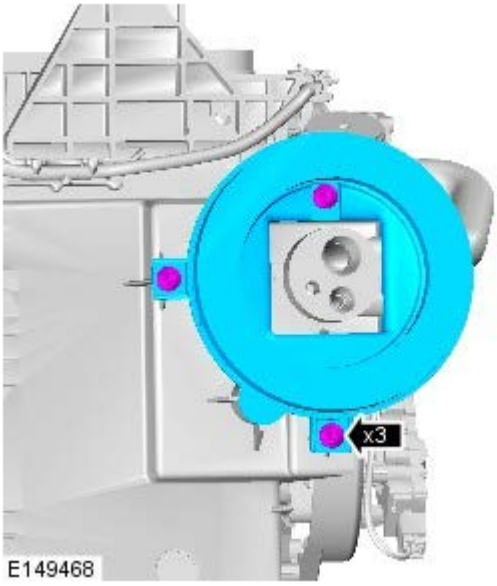
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Refer to: Heater Core (412-01A Climate Control, Removal and Installation).

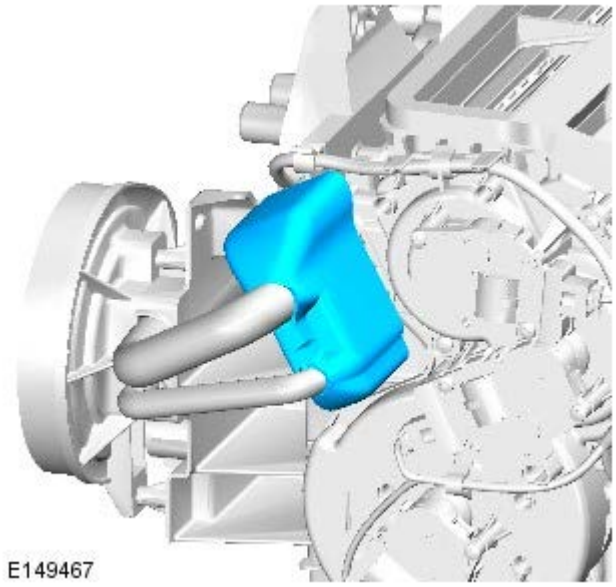
4.



5.



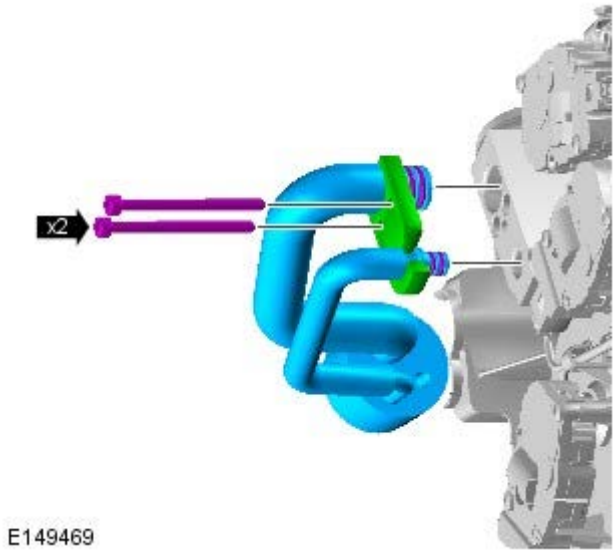
6.



7. CAUTION: Remove and discard the O-ring seals.

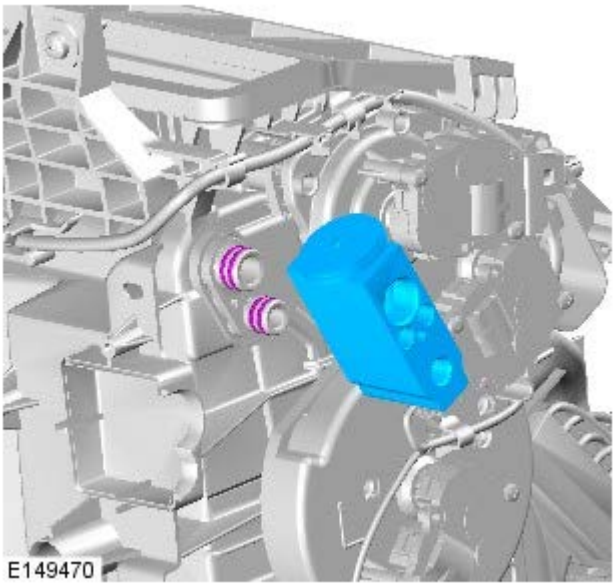
NOTE: Install new O-ring seals.

Torque: 4 Nm

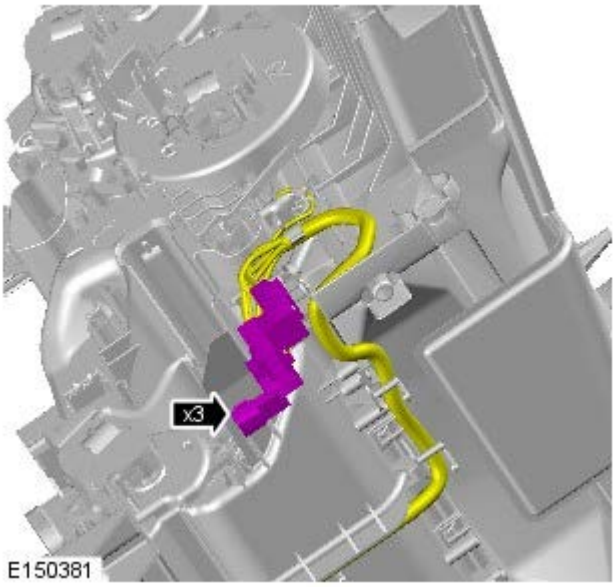


8. CAUTION: Remove and discard the O-ring seals.

NOTE: Install new O-ring seals.

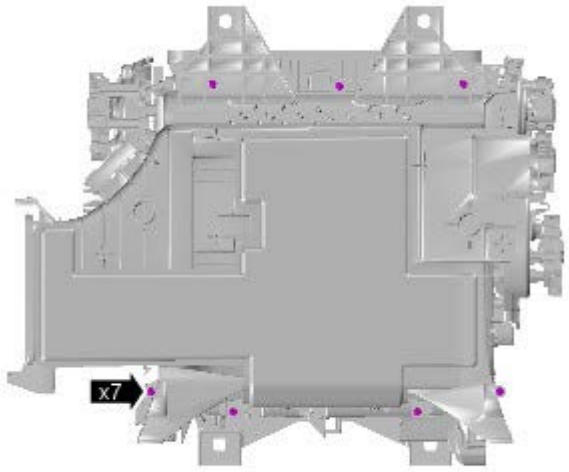


9.



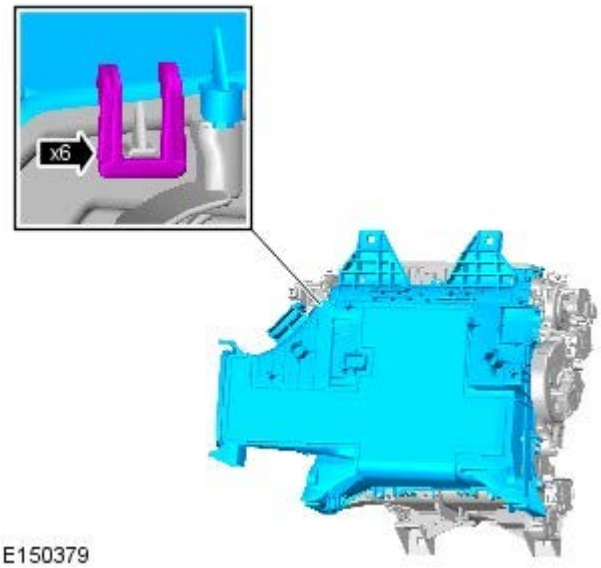
E150381

10.



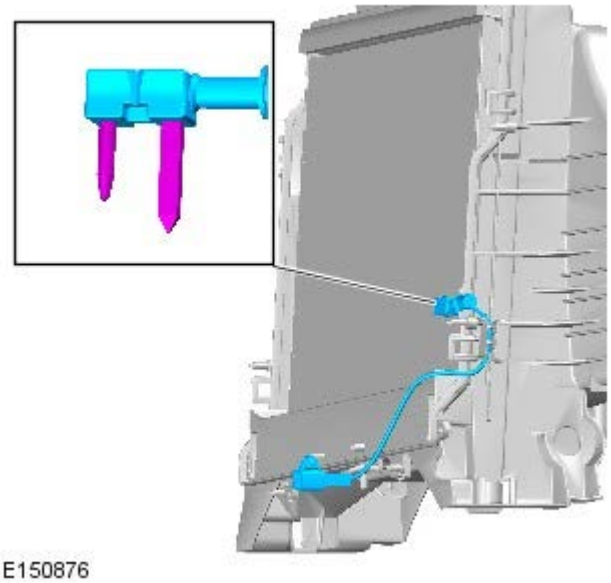
E150380

11.



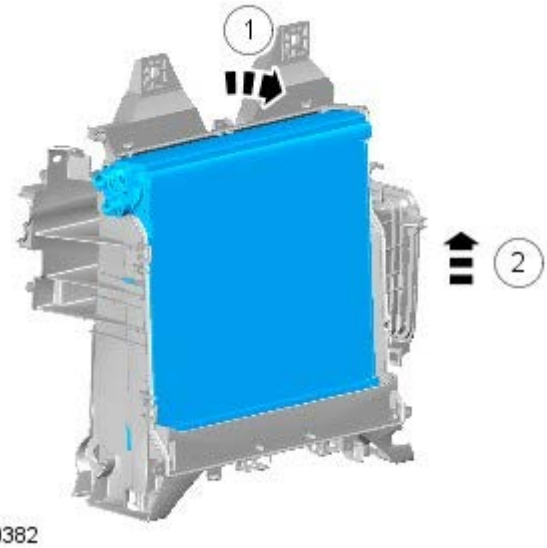
E150379

12.



E150876

13.



E150382

Installation

1. To install, reverse the removal procedure.

Published: 10-Jun-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Heater Core

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

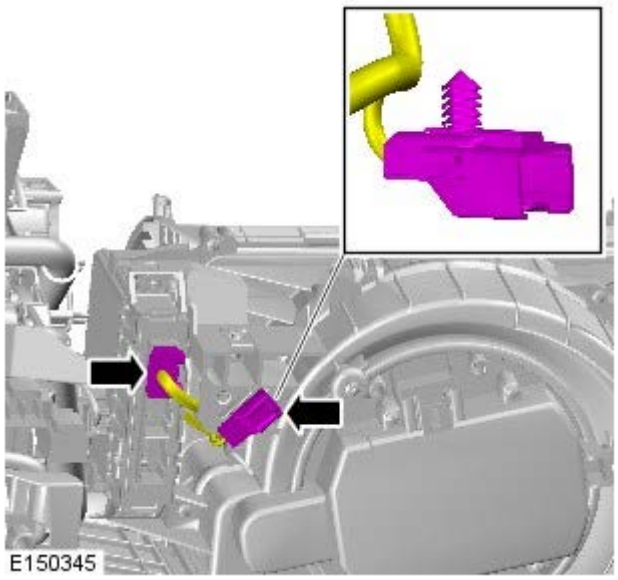
   Raise and support the vehicle.

2. Disconnect the battery ground cable.

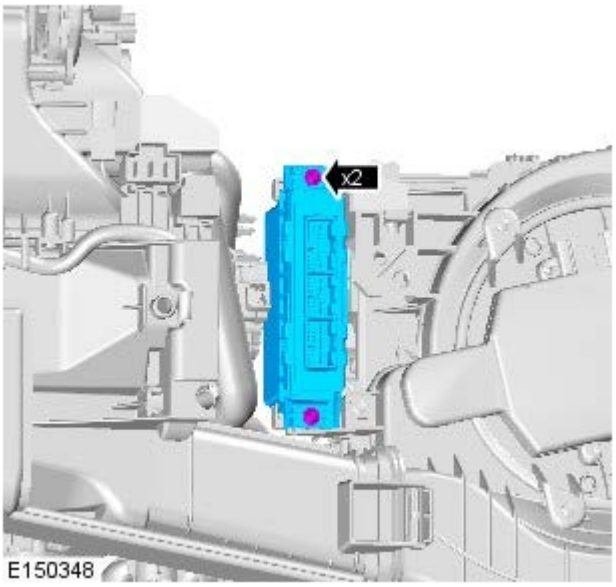
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

3. Refer to: Heater Core and Evaporator Core Housing (412-01A Climate Control, Removal and Installation).

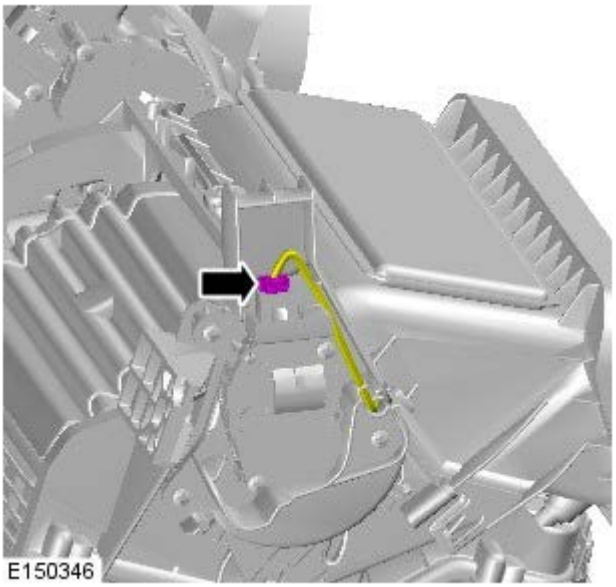
4.



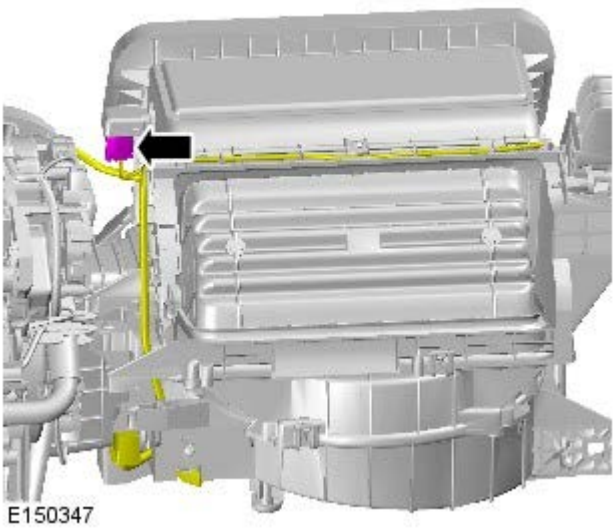
5.



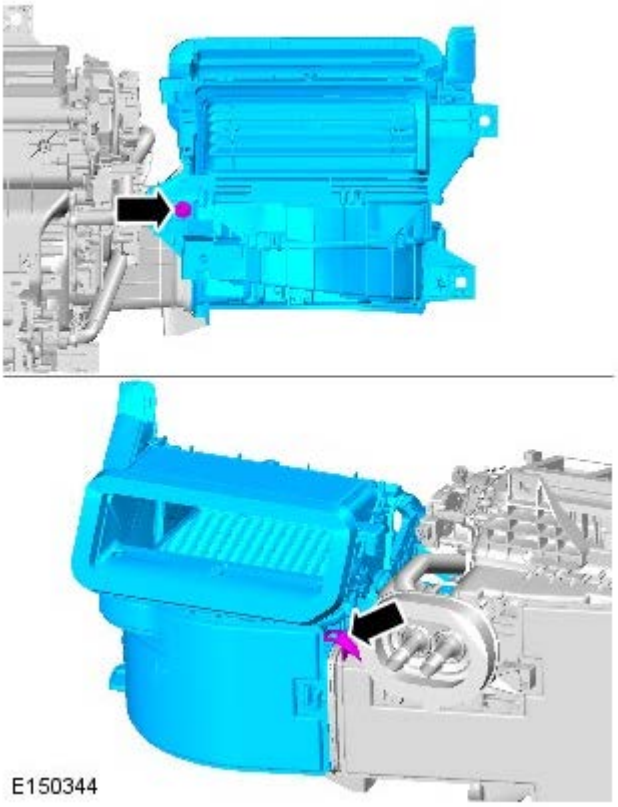
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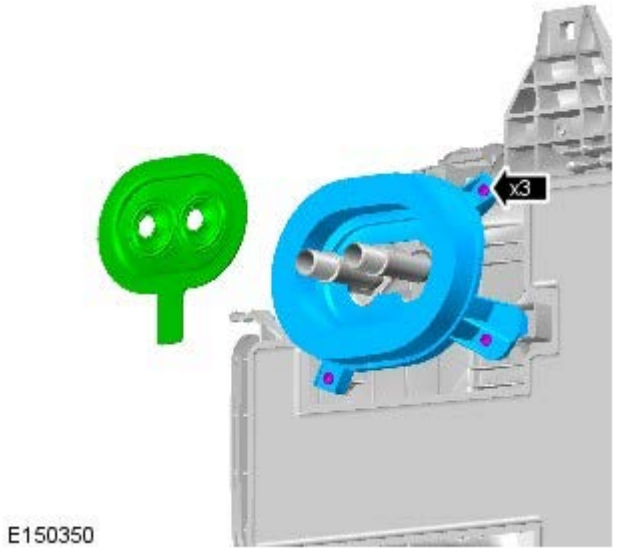
7.



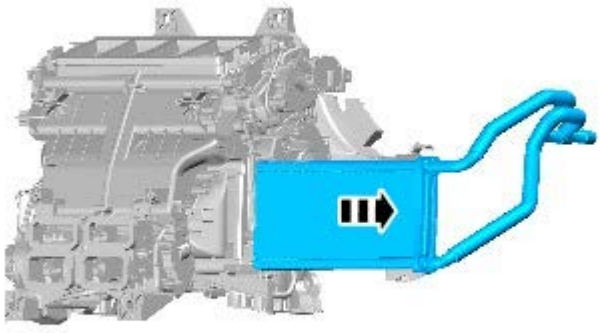
8.



9.



10.



E150349

Installation

1. To install, reverse the removal procedure.

Published: 07-Aug-2012

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Condenser

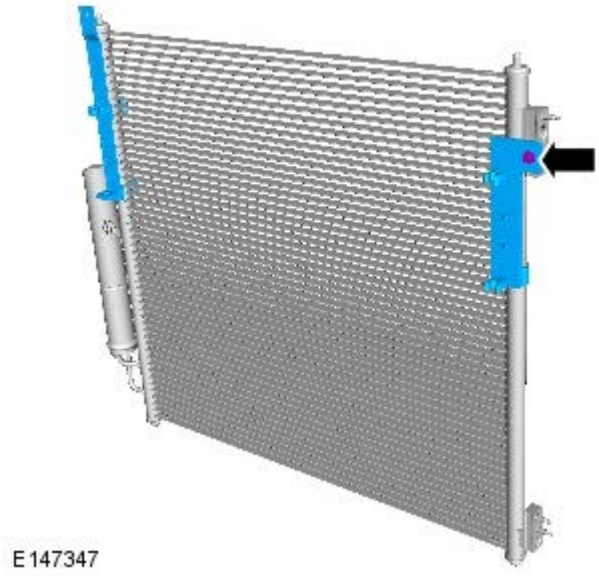
Removal and Installation

Removal

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

1. Refer to: Radiator (303-03A Engine Cooling - TDV6 3.0L Diesel, Removal and Installation).

2. *Torque:* 4.5 Nm



Installation

1. To install reverse the removal procedure.

Published: 27-Jun-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Ambient Air Temperature 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 Battery and Charging System - General Information, Specifications).

2. The ambient air temperature sensor is an integral part of the door mirror and cannot be removed. A new door mirror must be installed.

   Refer to: Exterior Mirror (501-09 Rear View Mirrors, Removal and Installation).

Installation

1. To install, reverse the removal procedure.

Published: 30-Oct-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Heater Core and Evaporator Core Housing

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

Some illustrations may show Right hand drive. Left hand drive is similar, but the essential information shown is always correct.

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

   Raise and support the vehicle.

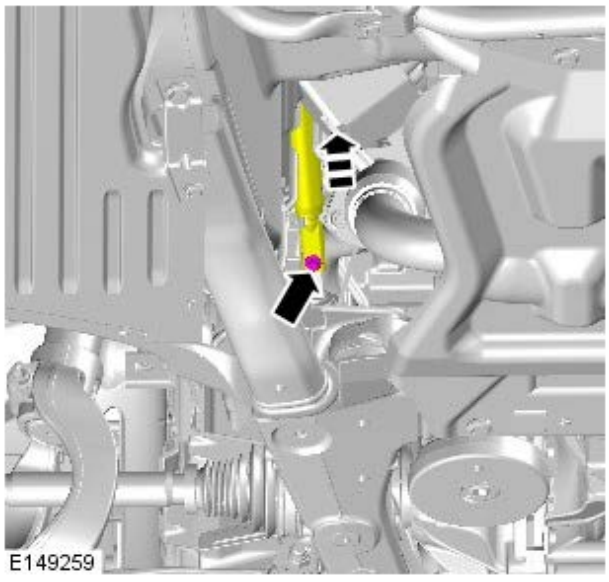
2. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

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

4. Refer to: Wiper Linkage Assembly (501-16 Wipers and Washers, Removal and Installation).

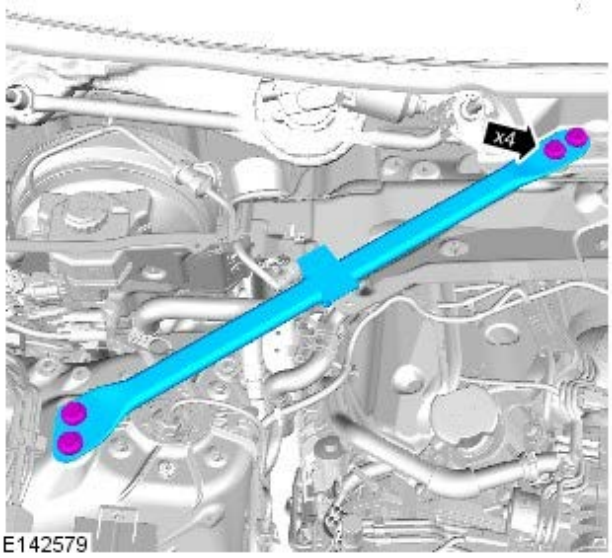
5. Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03A Engine Cooling - TDV6 3.0L Diesel, General Procedures).
   Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03B Engine Cooling - V6 S/C 3.0L Petrol, General Procedures).
   Refer to: Cooling System Partial Draining, Filling and Bleeding - V8 S/C 5.0L Petrol (303-03C Engine Cooling - V8 S/C 5.0L Petrol, General Procedures).
   Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03F Engine Cooling - TDV8 4.4L Diesel, General Procedures).
   Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03G Engine Cooling - SDV6 3.0L Diesel - Hybrid Electric Vehicle, General Procedures).



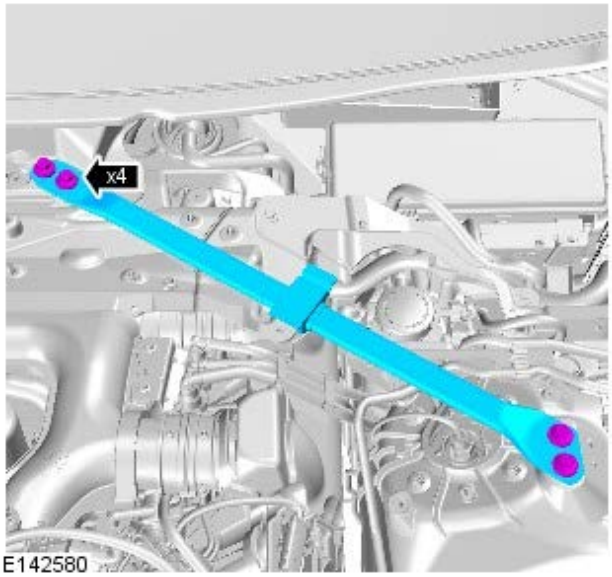
6. CAUTION: Discard the bolt.

   Torque: 44 Nm

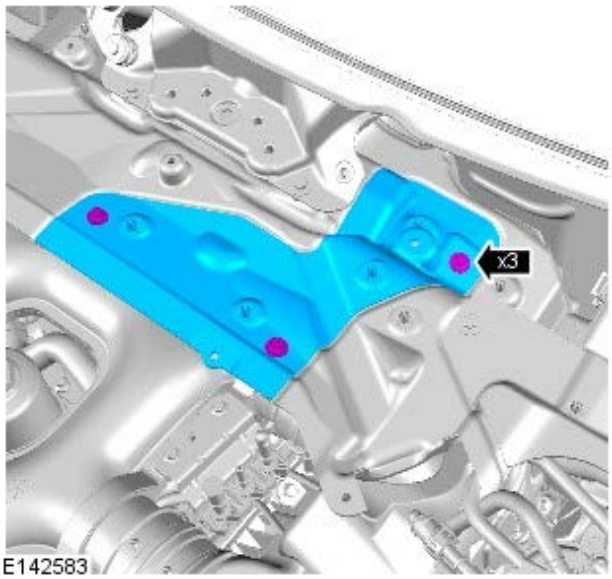
7. *Torque:* 55 Nm



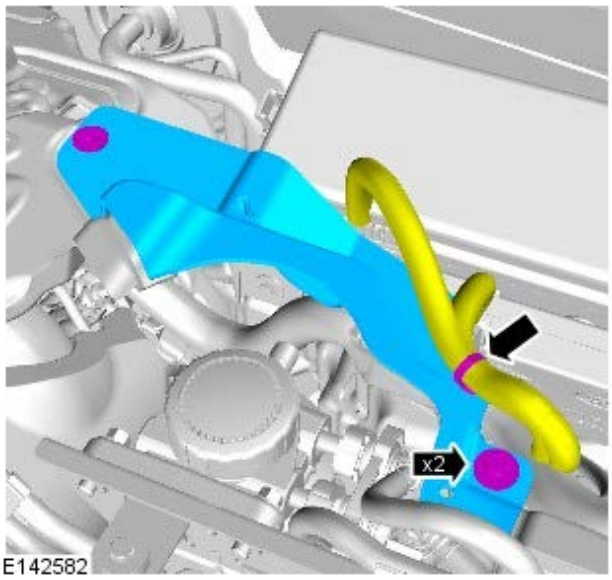
8. *Torque:* 55 Nm



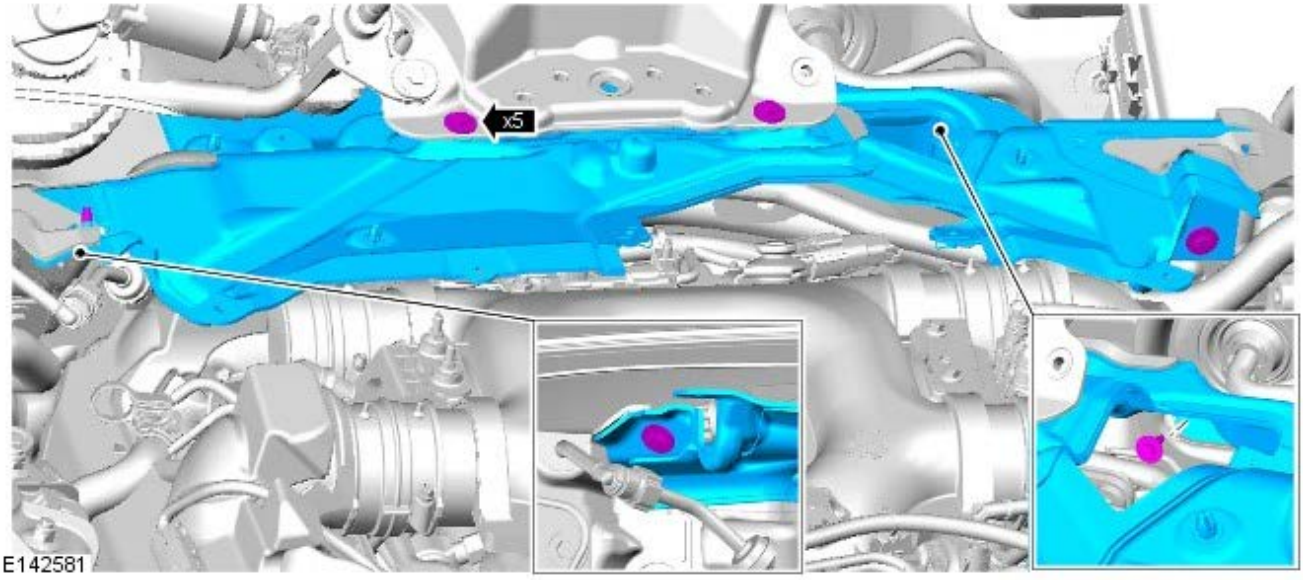
9. *Torque:* 6 Nm

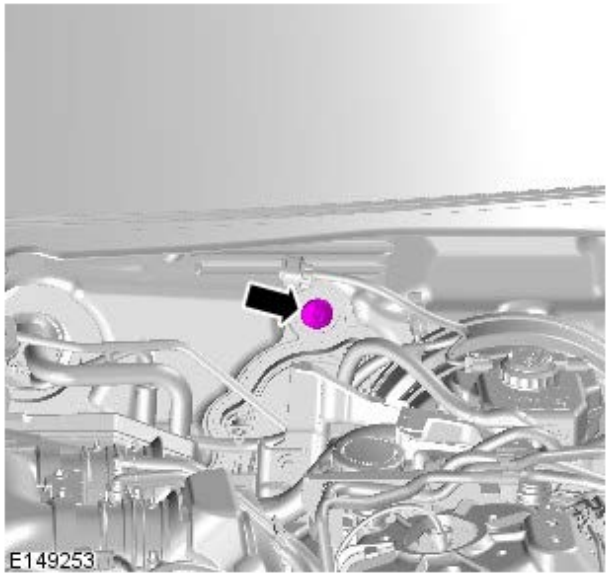


10. *Torque:* 6 Nm



11. *Torque:* 6 Nm



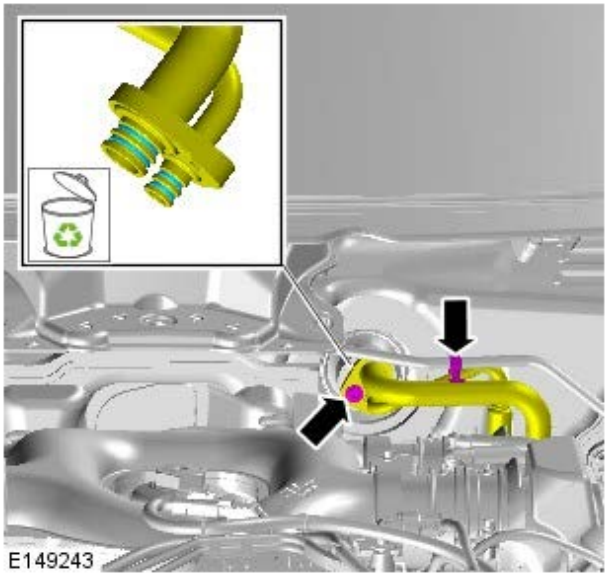


12. CAUTION: Install all the bolts finger tight before final tightening.

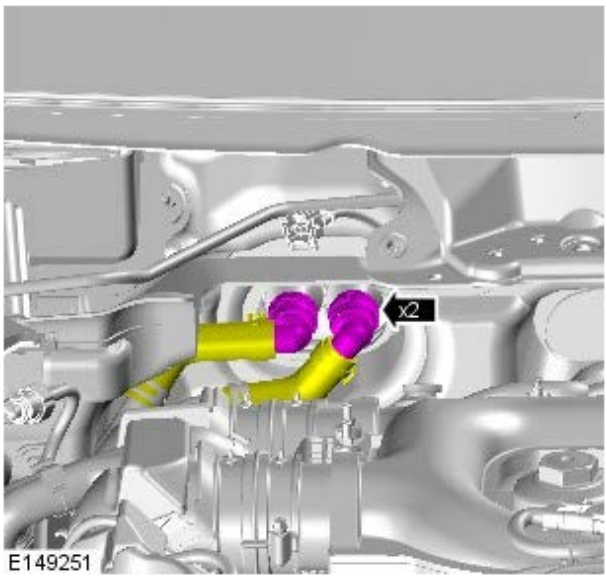
Torque: 20 Nm

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

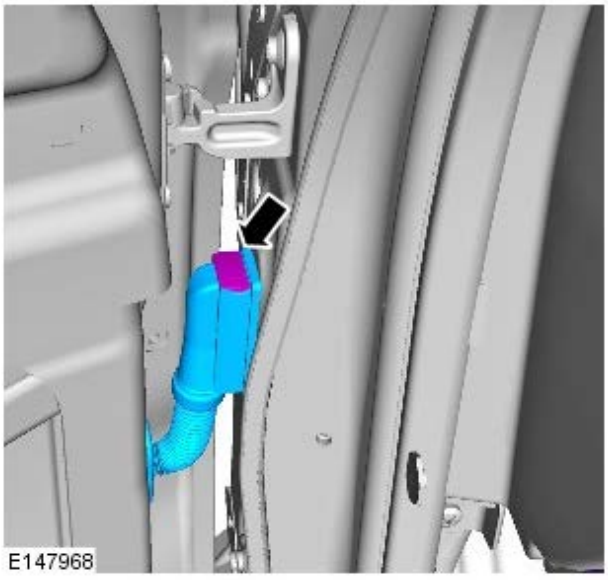
Torque: 10 Nm



14. CAUTION: Be prepared to collect escaping coolant.

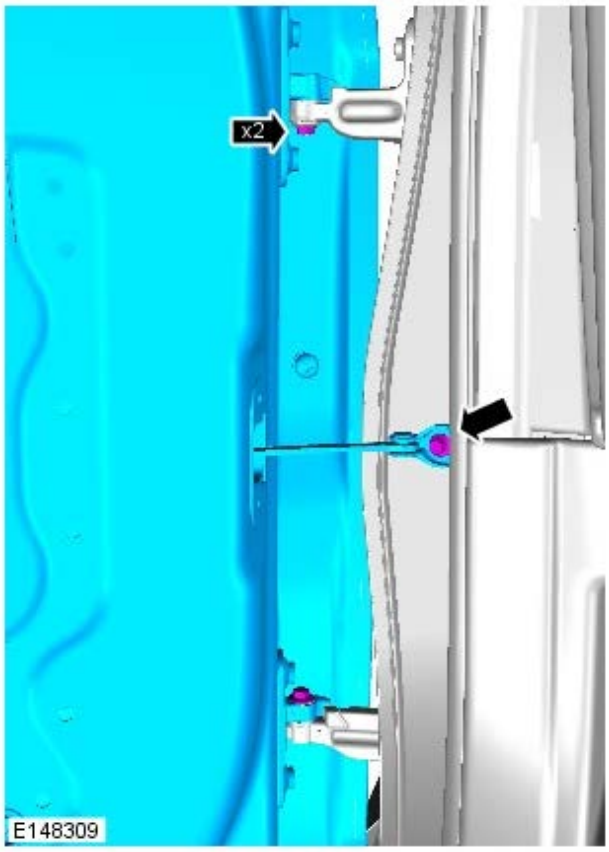


15. NOTE: Left hand illustration shown, right hand is similar.



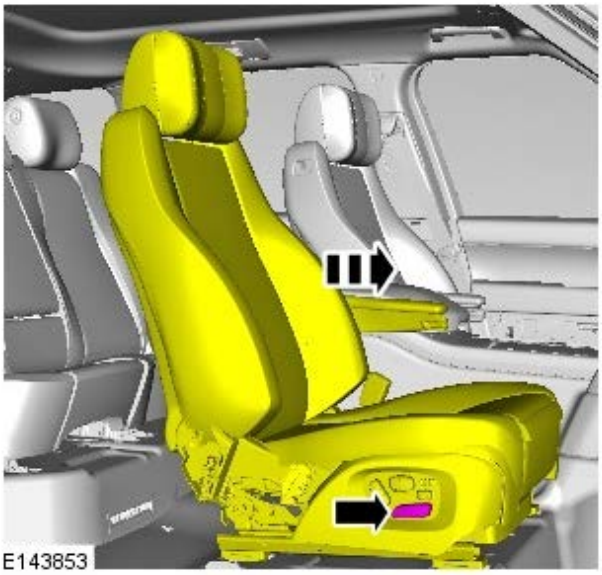
16. NOTES:

Left hand illustration shown, right hand is similar.



This step requires the aid of another technician.

Torque:
Torx bolt 24 Nm
M8 bolt 30 Nm



17. NOTES:

Repeat the procedure for the other side.

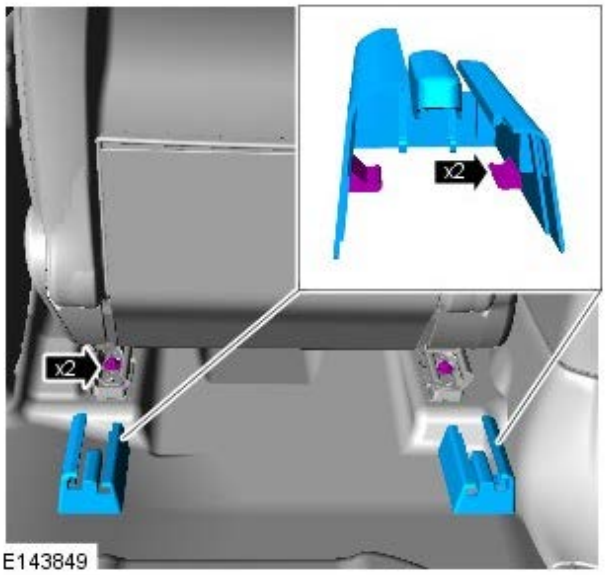
Right hand illustration shown, left hand is similar.

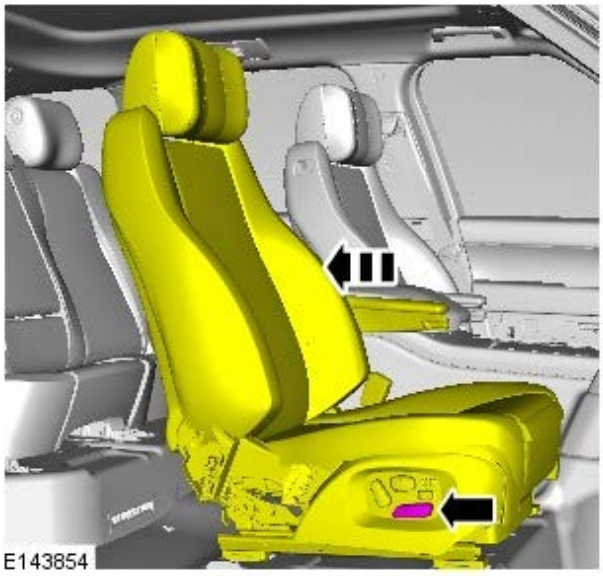
18. NOTES:

Repeat the procedure for the other side.

Right hand illustration shown, left hand is similar.

Torque: 47 Nm

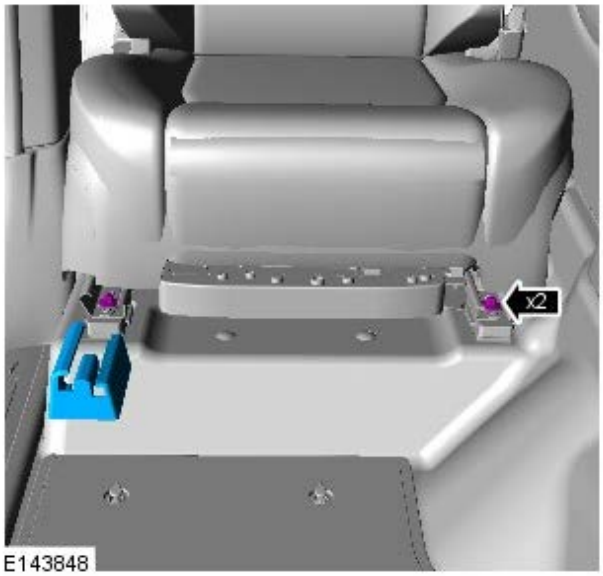




19. NOTES:

Repeat the procedure for the other side.

Right hand illustration shown, left hand is similar.



20. NOTES:

Repeat the procedure for the other side.

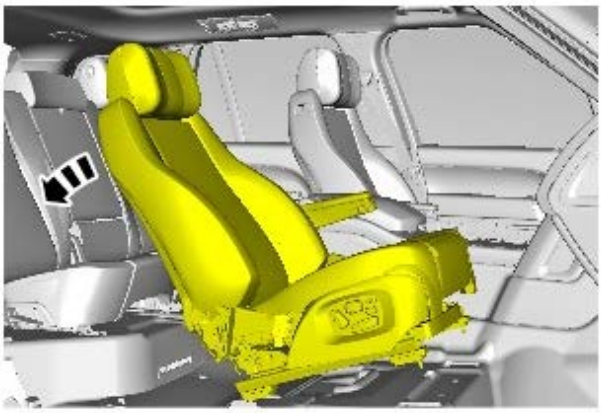
Right hand illustration shown, left hand is similar.

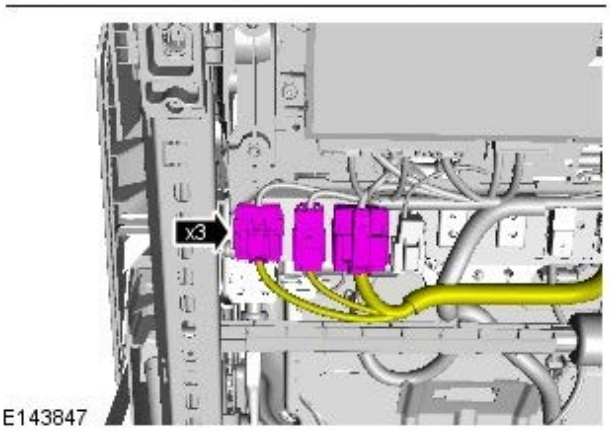
Torque: 47 Nm

21. Disconnect the battery ground cable.

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

22. NOTES:



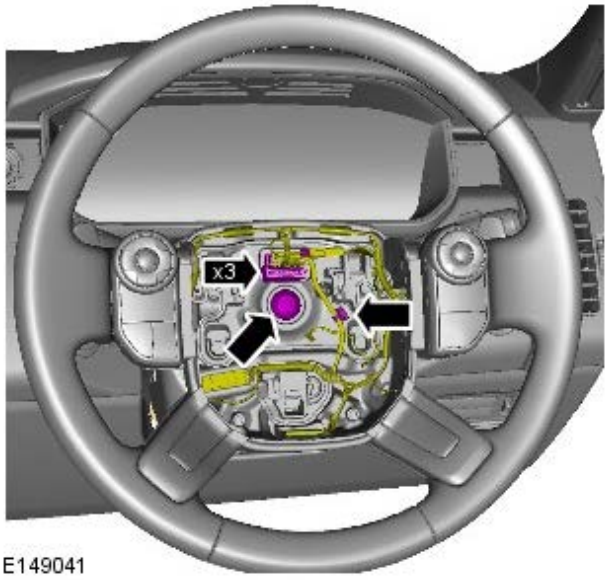


E143847

Repeat the procedure for the other side.

Right hand illustration shown, left hand is similar.

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

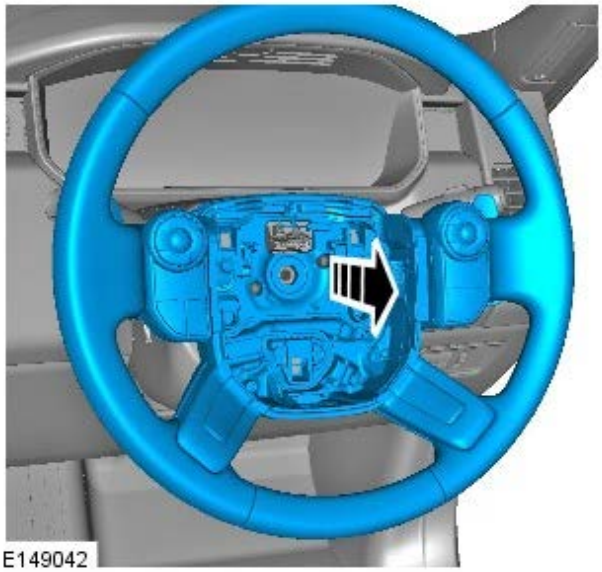


E149041

24. CAUTION: If a new steering column is installed, a new longer retaining bolt must be used to secure the steering wheel.

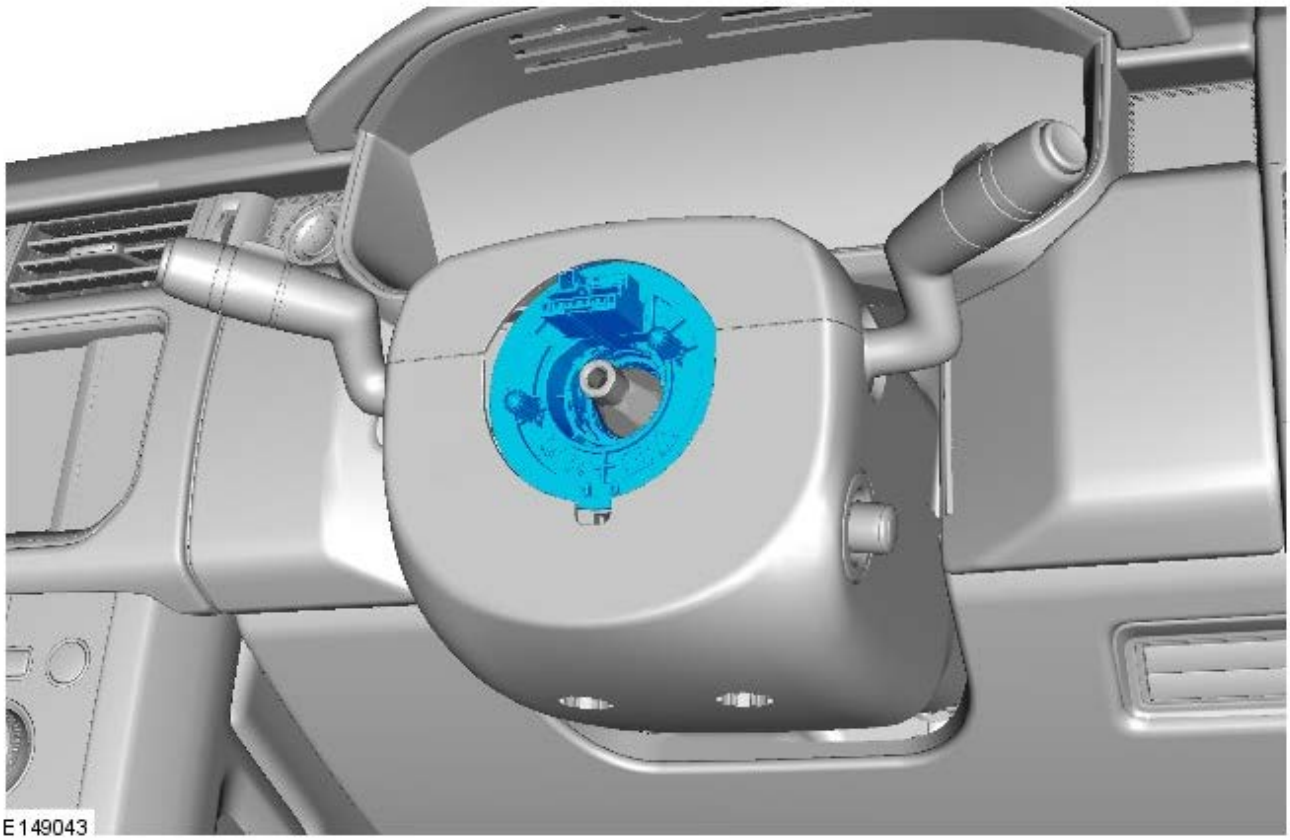
Torque: 47 Nm

25.

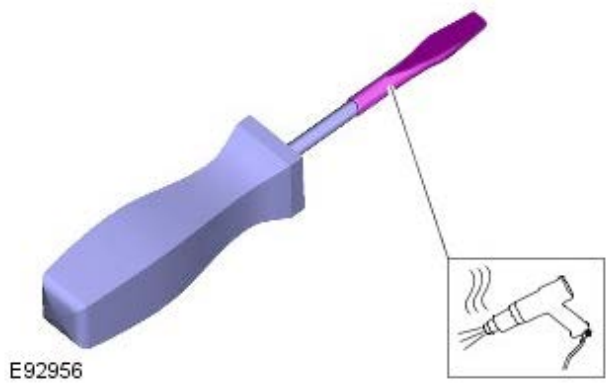

E149042

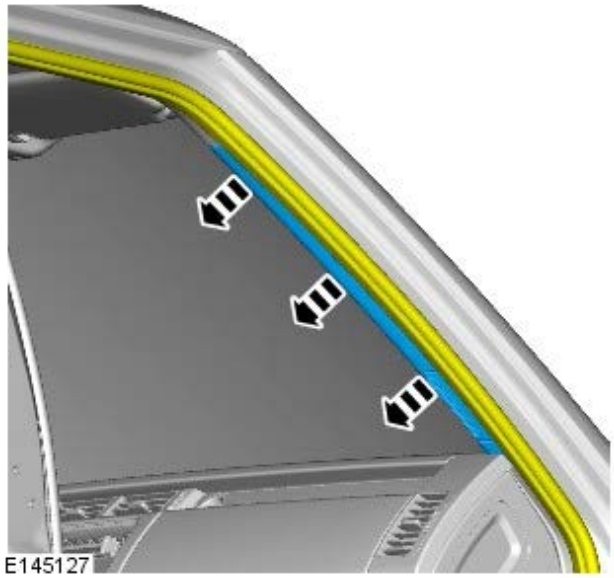
26. CAUTION: Make sure that the clockspring rotor does not rotate.

    Secure with adhesive tape.


E149043

27. CAUTION: Apply heatshrink or protective tape to the end of a suitable tool to protect the interior components.

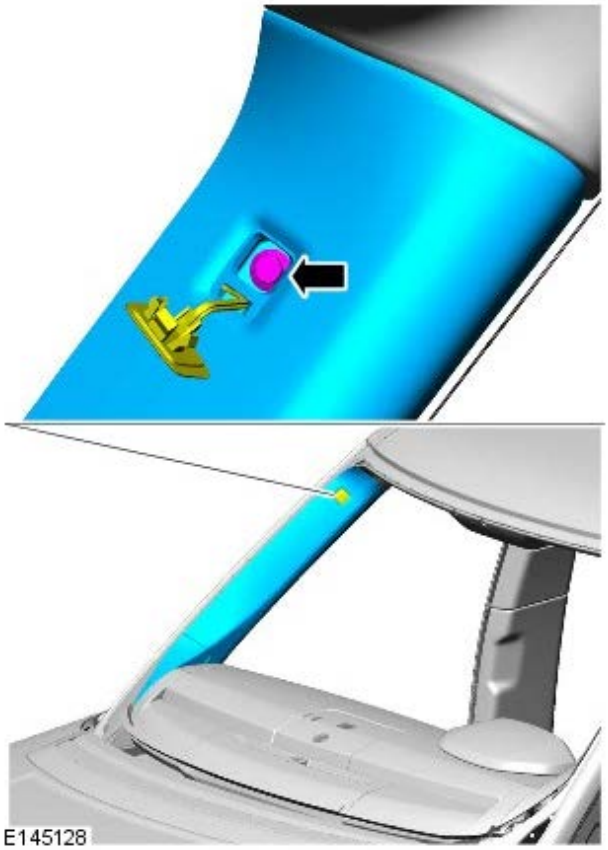

E92956


E145127

28. NOTES:

Repeat the procedure for the other side.

Right hand illustration shown, left hand is similar.


E145128

29. NOTES:

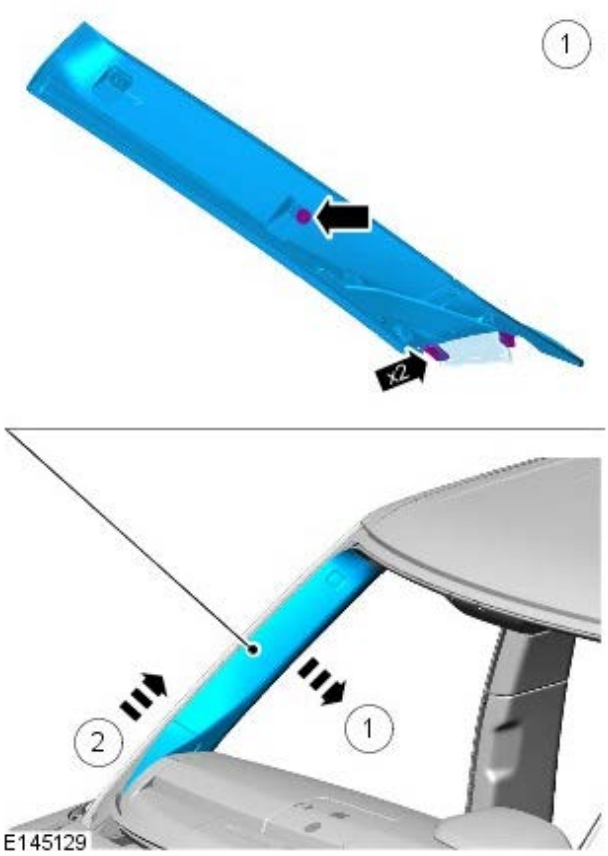
Repeat the procedure for the other side.

Right hand illustration shown, left hand is similar.

Torque: 6 Nm

30. NOTES:

Repeat the procedure for the other side.



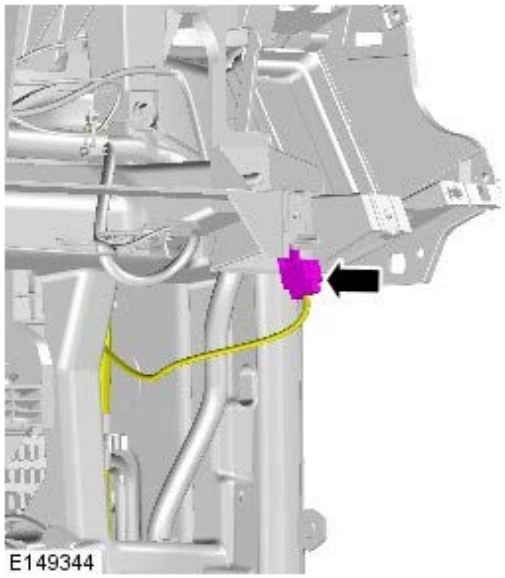
Right hand illustration shown, left hand is similar.

31. Refer to: Floor Console (501-12 Instrument Panel and Console, Removal and Installation).

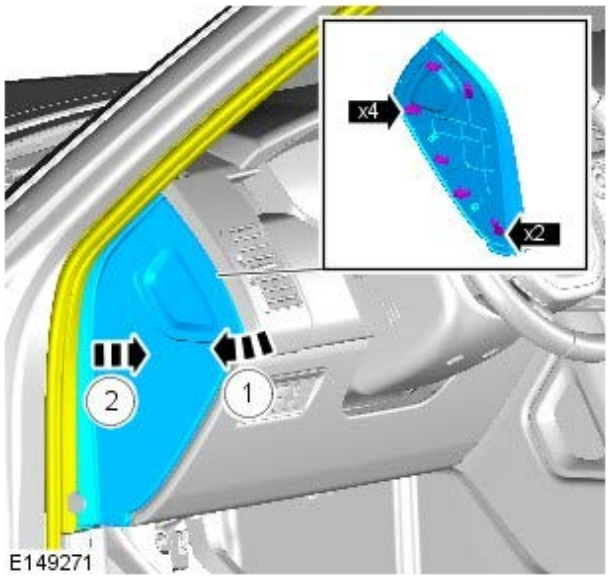
32. Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

33. Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

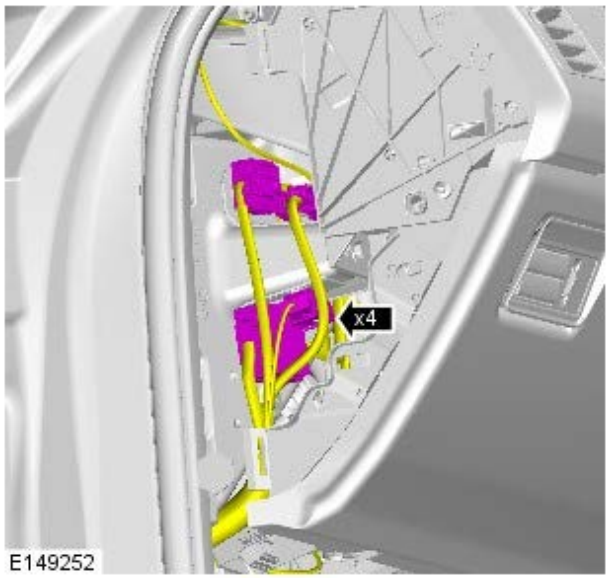
34.



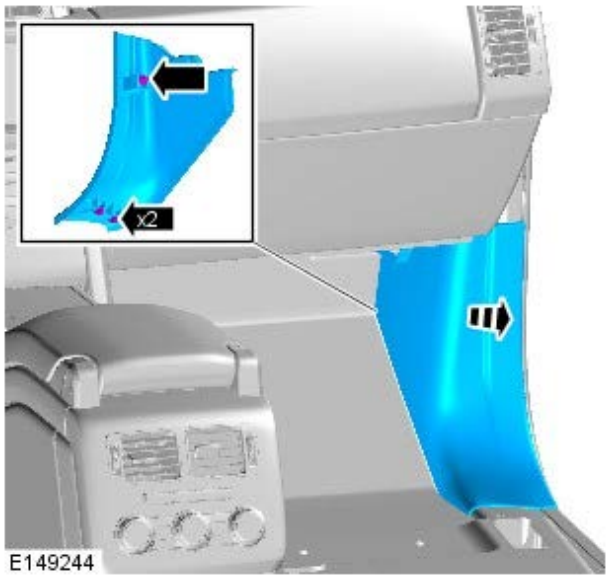
35.



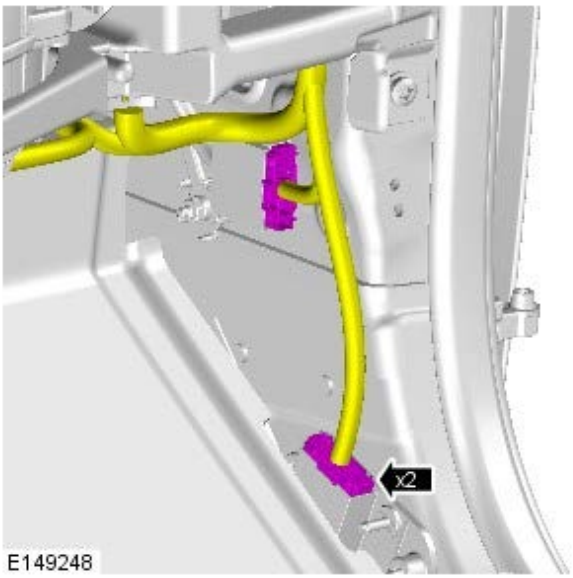
36.



37.



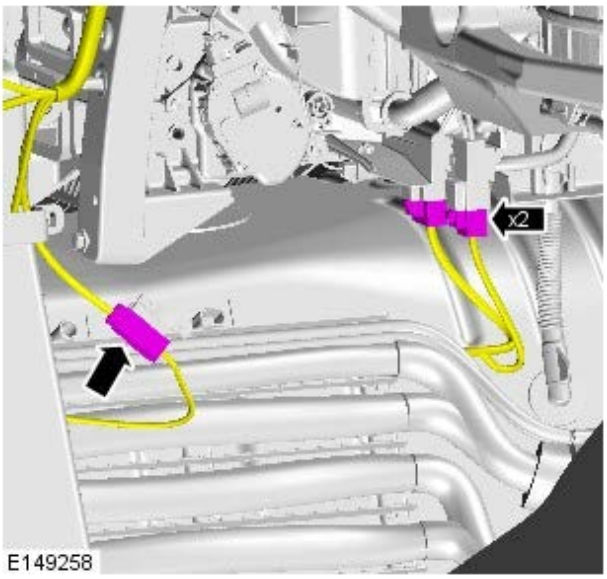
38.



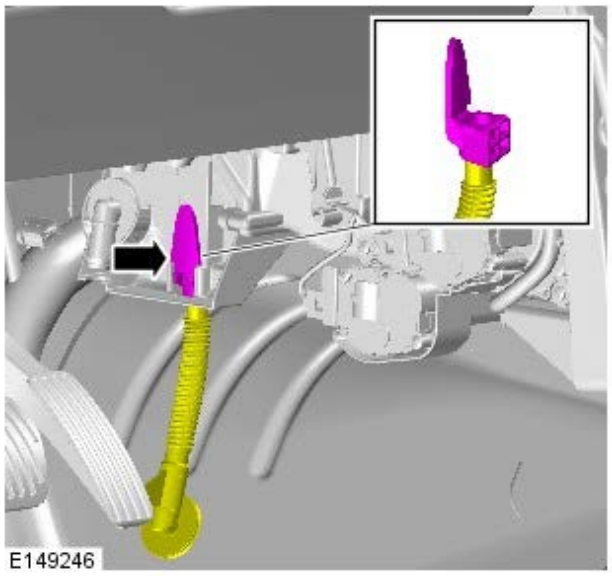
39.



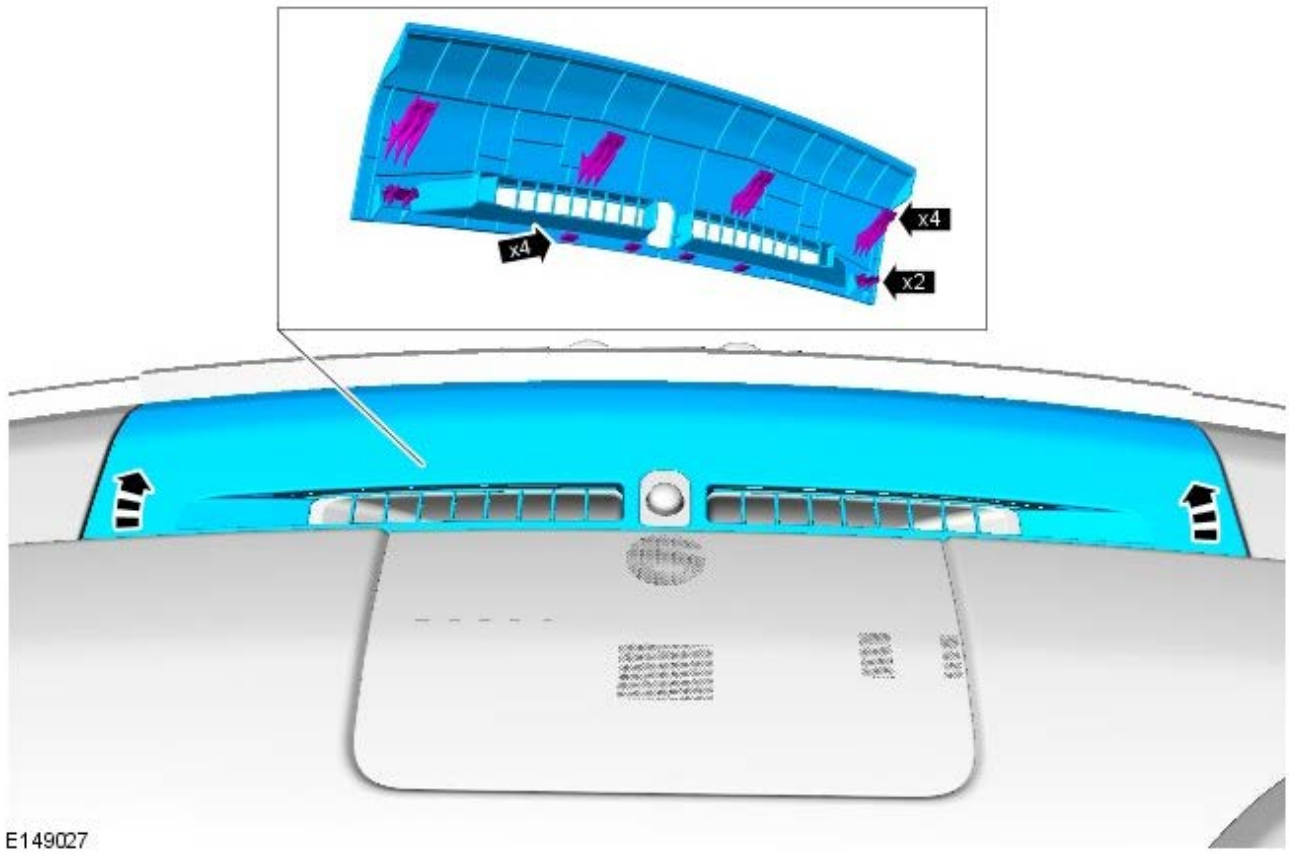
40.



41. NOTE: Repeat the procedure for the other side.

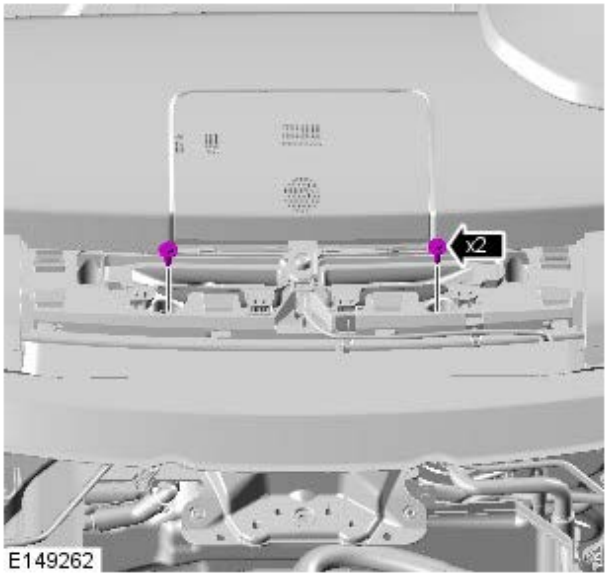


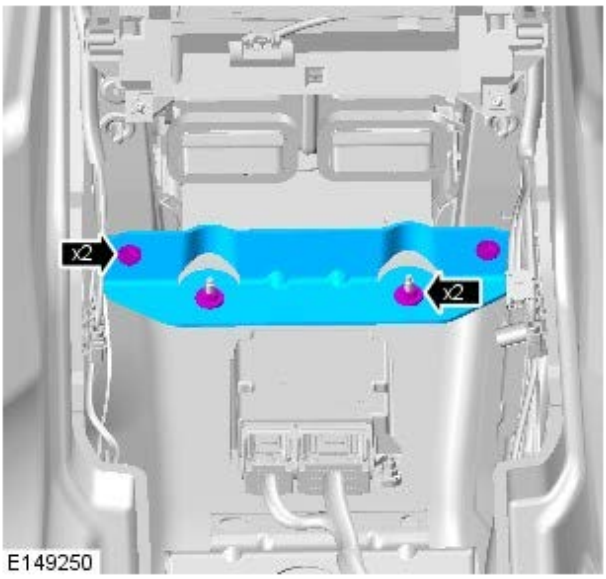
42.



43. CAUTION: Install all the bolts finger tight before final tightening.

Torque: 20 Nm



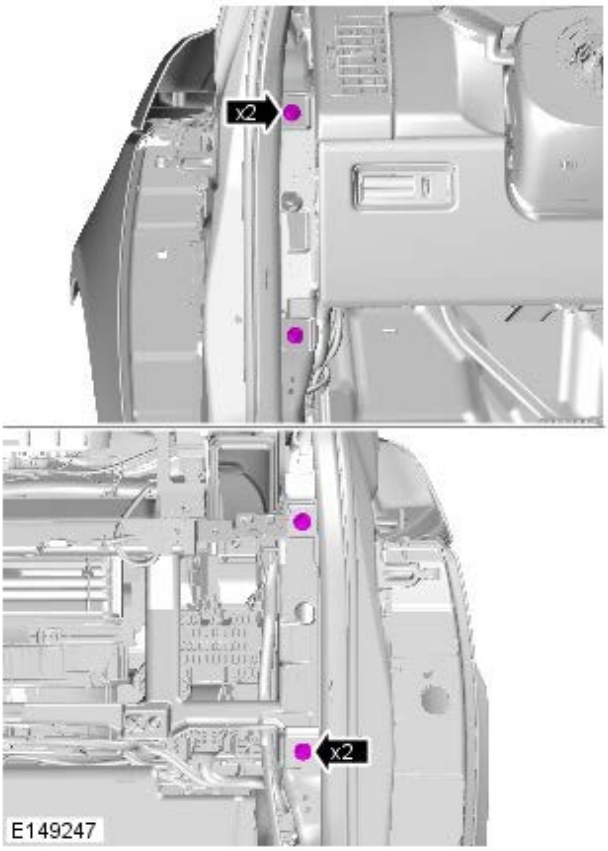


44. CAUTION: Install all the bolts finger tight before final tightening.

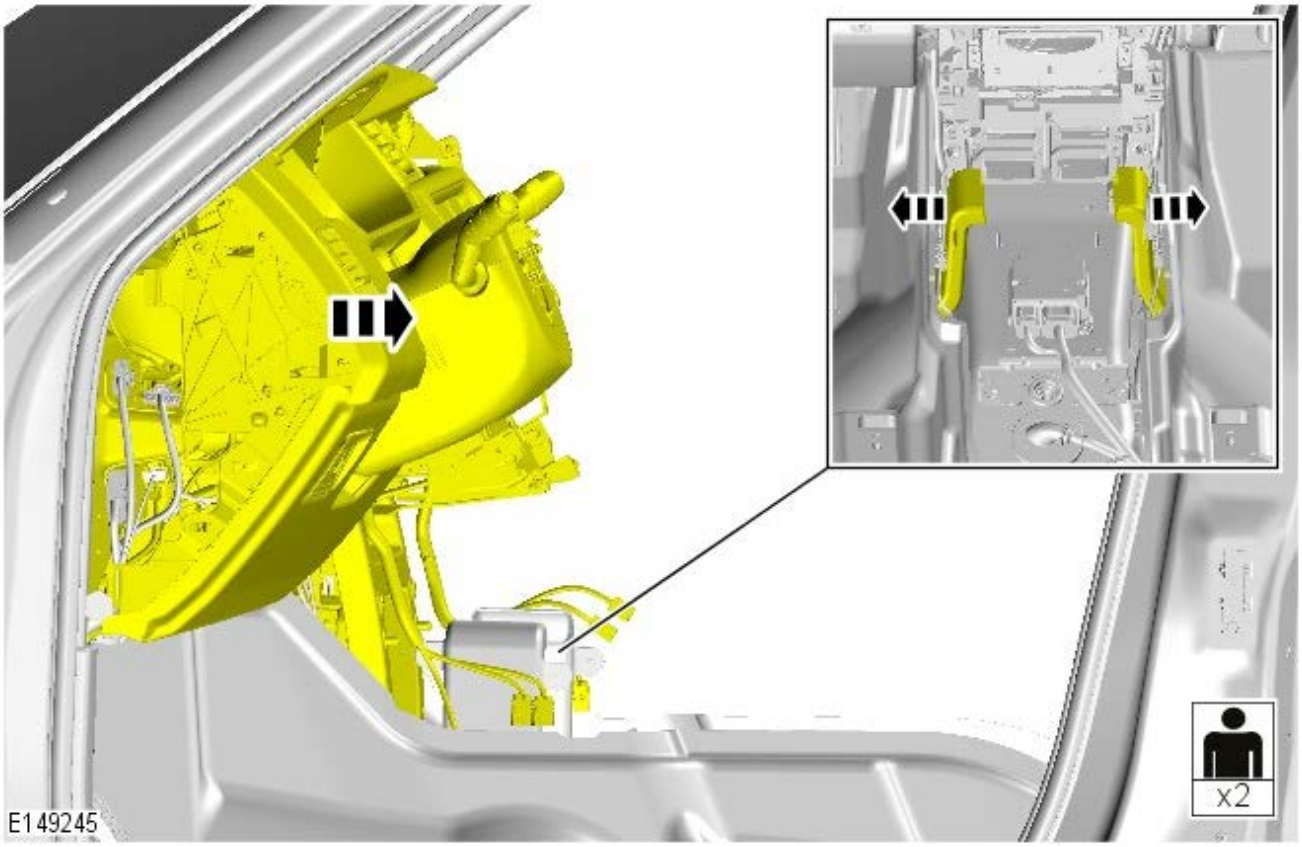
    Torque: 9 Nm

45. CAUTION: Install all the bolts finger tight before final tightening.

    Torque: 20 Nm



46.

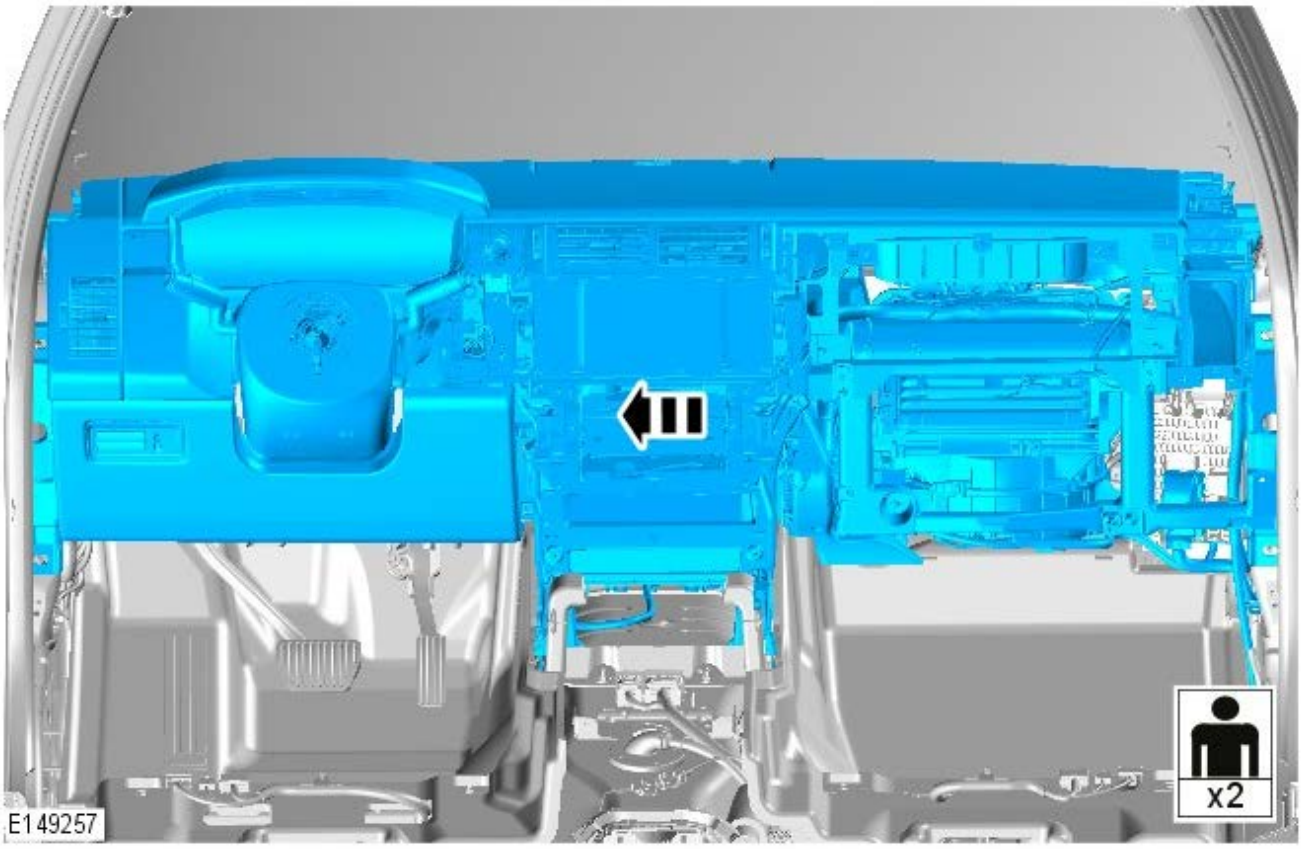


47. NOTE: Secure with cable ties.

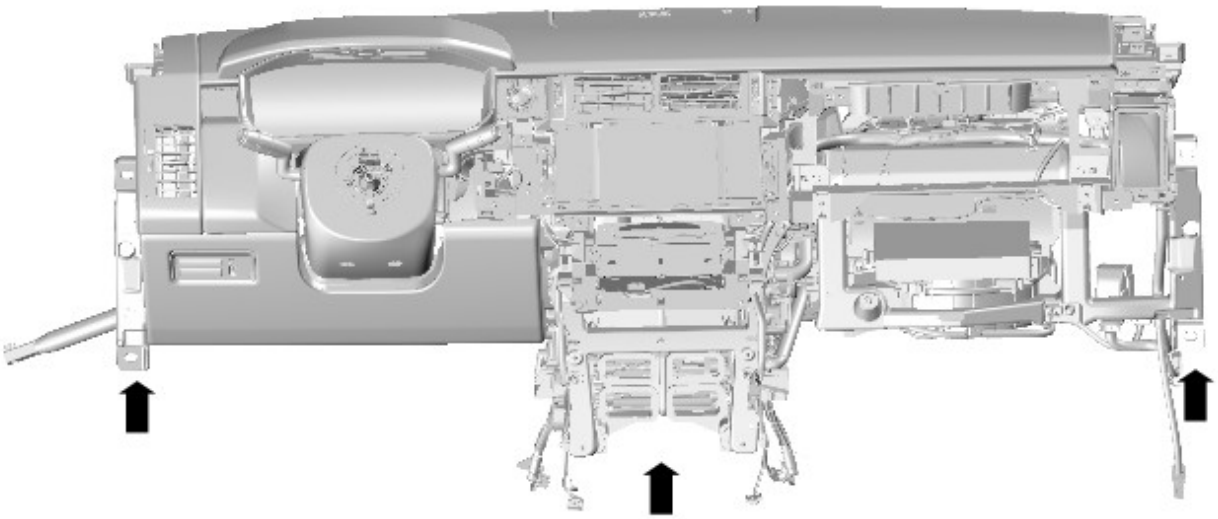


E149260

48.

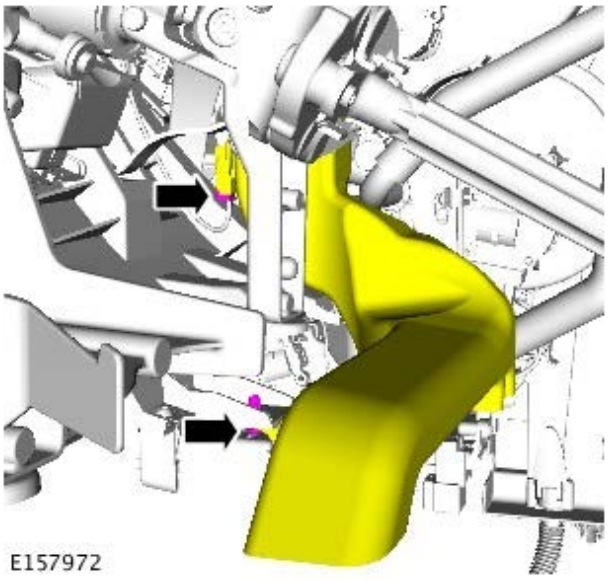


49. CAUTION: Make sure that the weight of the instrument panel is evenly supported. Failure to follow this instruction may result in damage to the components.



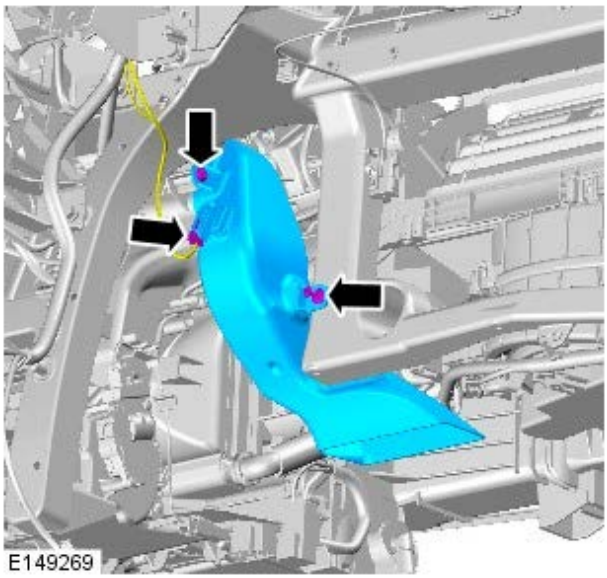
E149261

50.

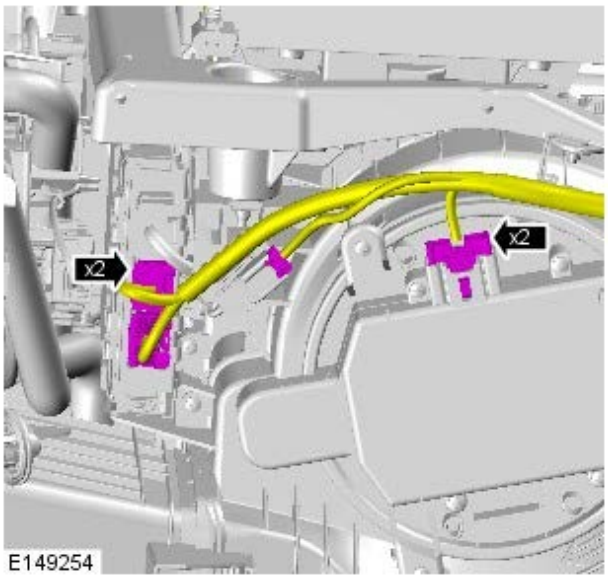


E157972

51.

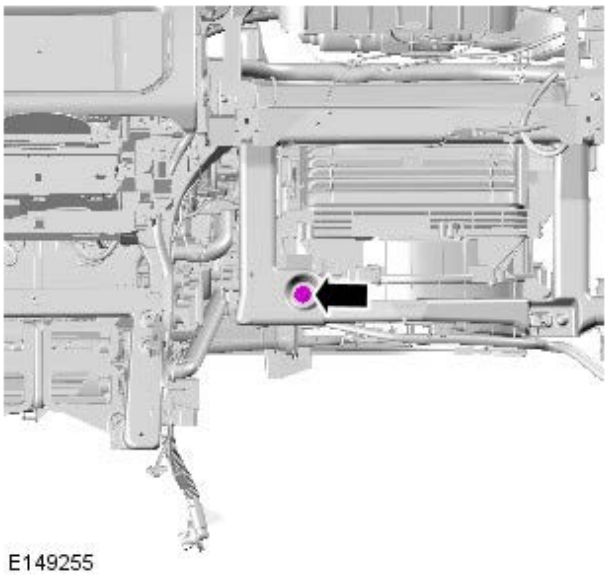


52.



53. CAUTION: Install all the bolts finger tight before final tightening.

Torque: 9 Nm

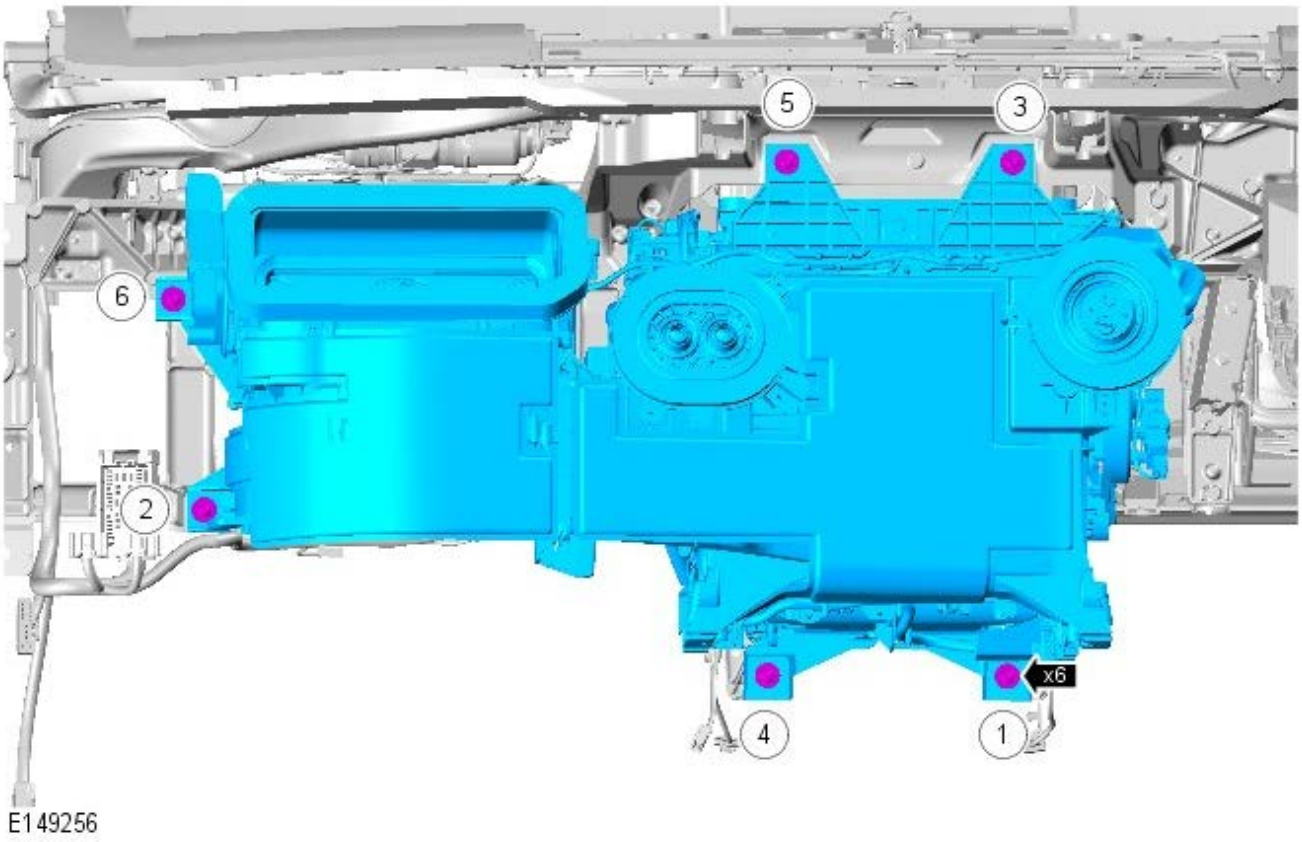


54. CAUTIONS:

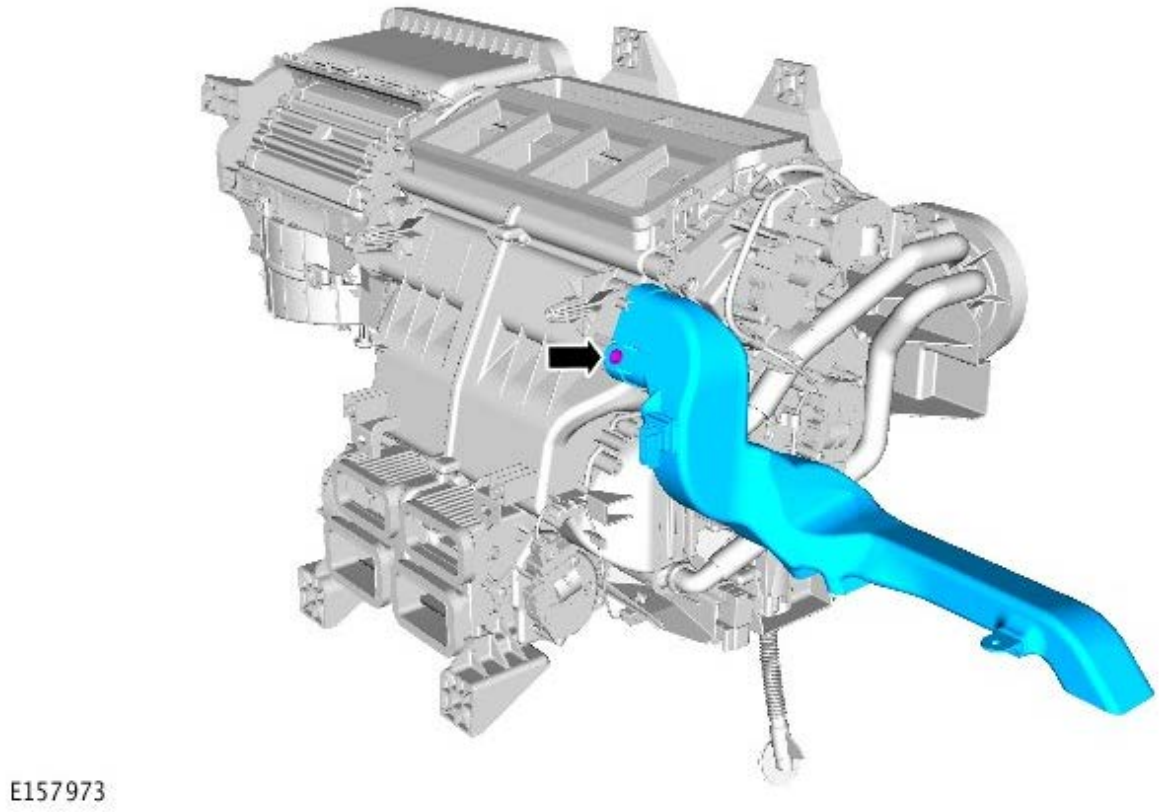
Install all the bolts finger tight before final tightening.

Tighten the bolts in the sequence shown.

Torque: 9 Nm

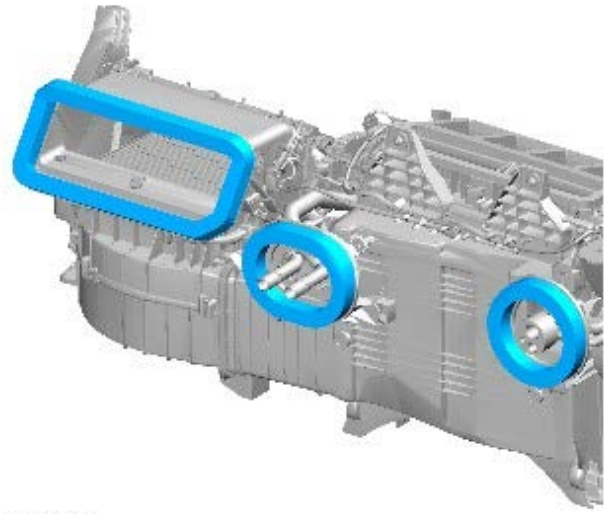


55.



Installation

1. CAUTION: Remove and discard the seals.



E149476

NOTE: Install new seals.



E149477

2. NOTE: Make sure that the grommets are correctly seated.

3. NOTE: Install the trim retaining clips in the moulding prior to installing the components.



E149095

4. To install, reverse the removal procedure.

Published: 12-Jun-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Receiver Drier

Removal and Installation

Removal

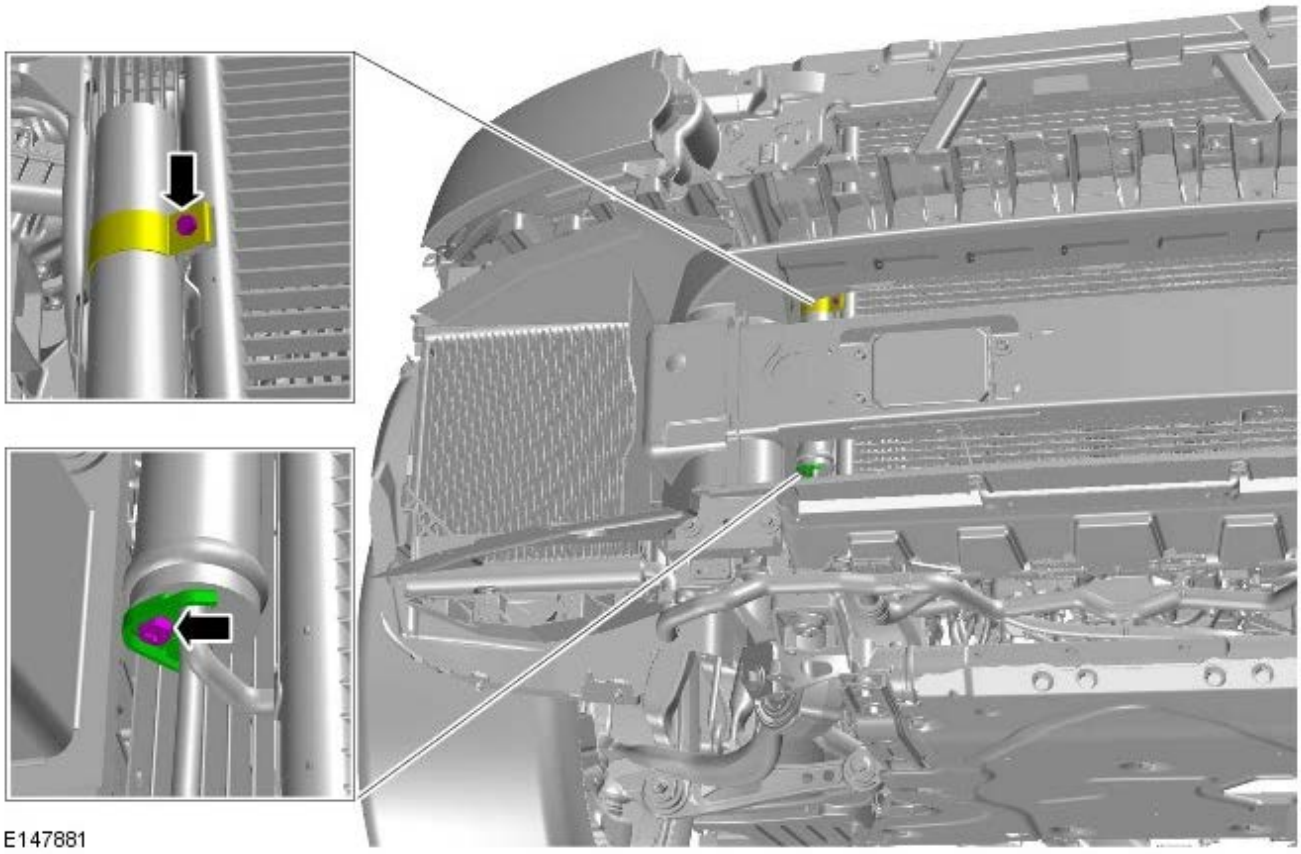
NOTES:

Removal steps in this procedure may contain installation details.

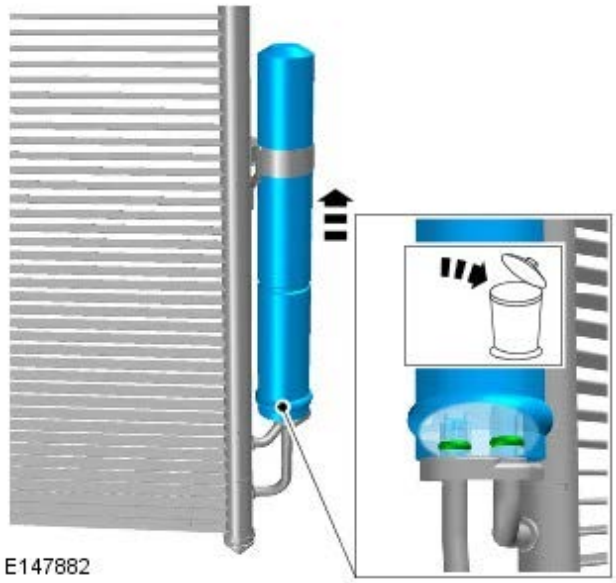
Make sure that all openings are sealed. Use new blanking caps.

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

1. Raise and support the vehicle.
2. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
3. Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).
4.



5.



Installation

1. To install, reverse the removal procedure.

Published: 16-May-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Ambient Air Quality Sensor

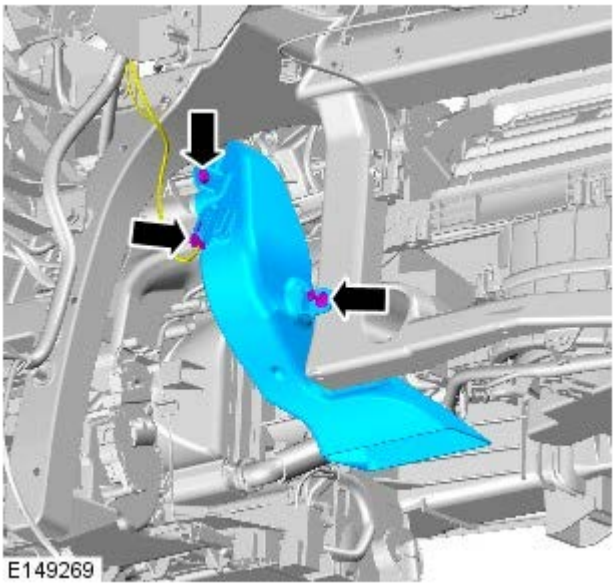
Removal and Installation

Removal

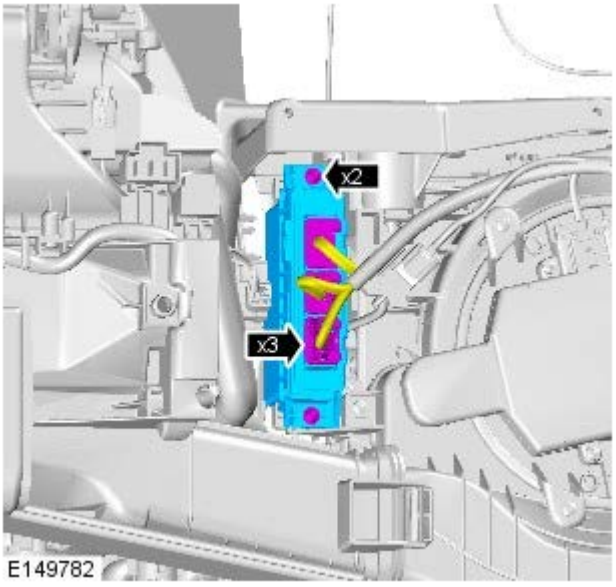
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

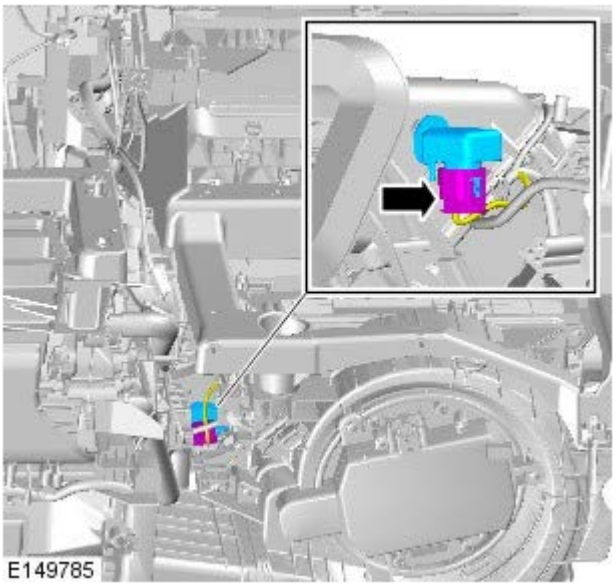
2.



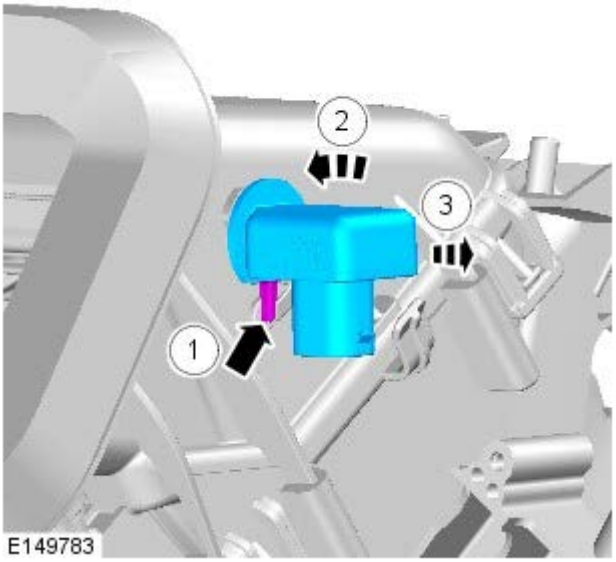
3.



4.



5.



Installation

1. To install, reverse the removal procedure.

Published: 10-Jun-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Integrated Control Panel

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

Some components shown removed for clarity.

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

1.



E155713

2.



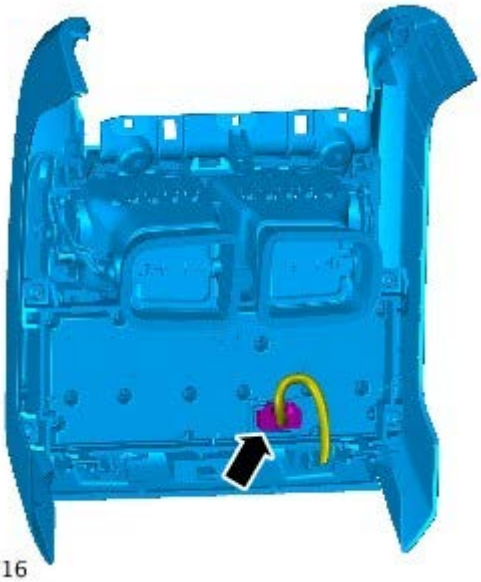
E155714

3.

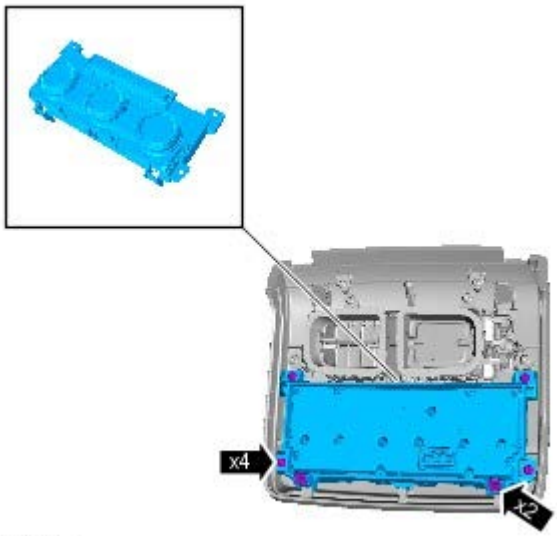


E155715

4.


E155716

5.



E148982

Installation

1. To install, reverse the removal procedure.

Published: 16-May-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - In-Vehicle Temperature Sensor

Removal and Installation

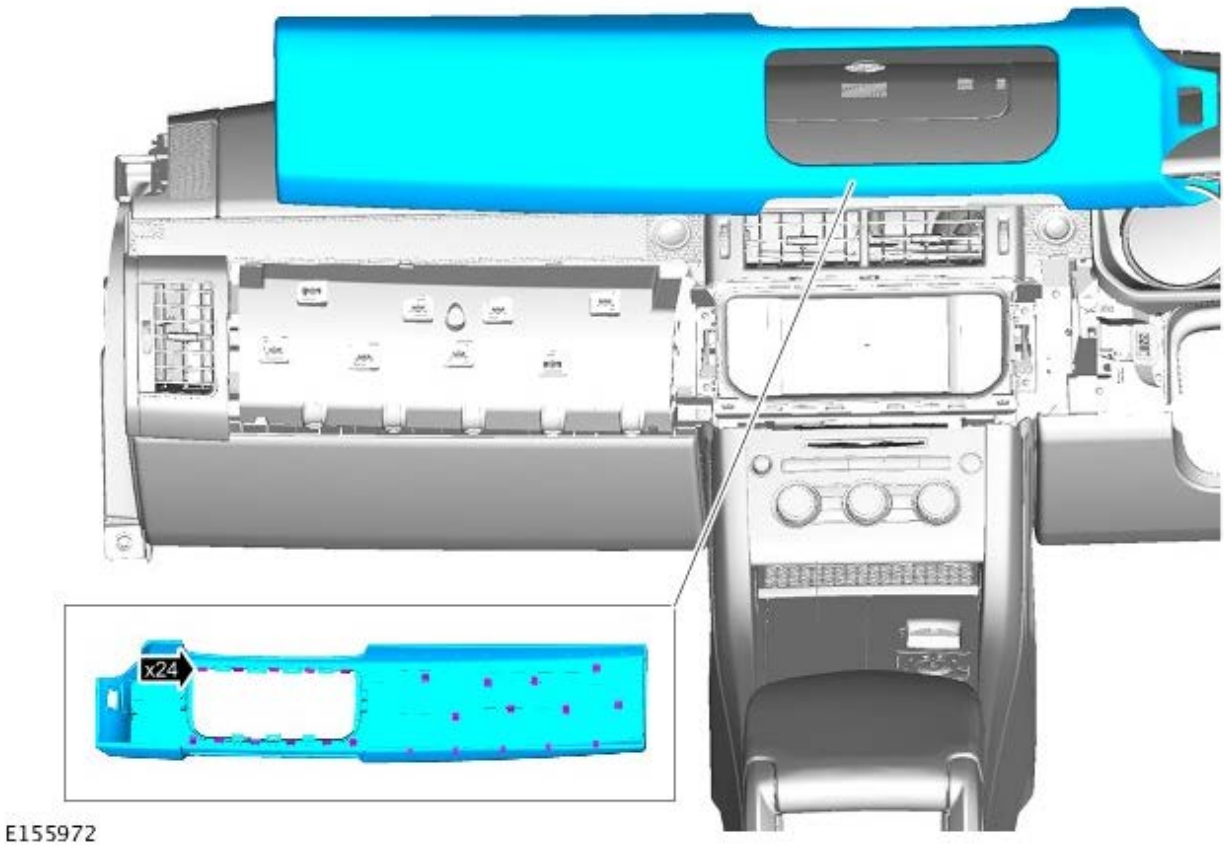
Removal

NOTES:

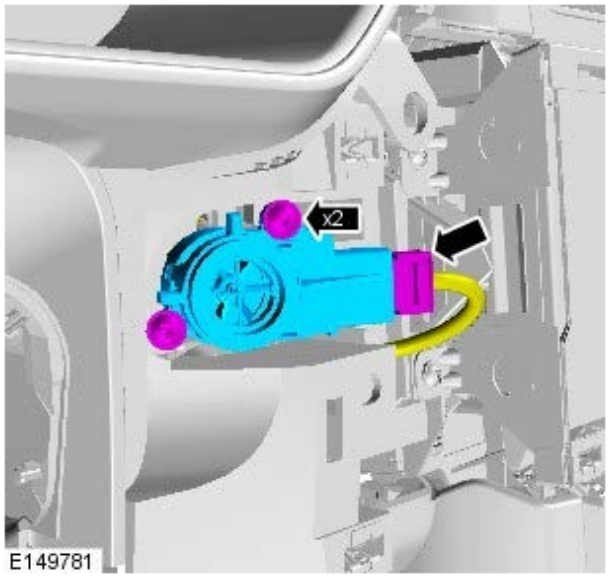
Removal steps in this procedure may contain installation details.

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

1.



2. NOTE: Left Hand illustration shown, Right Hand is similar.



Installation

1. NOTE: Install the trim retaining clips in the moulding prior to installing the components.



E149095

2. To install, reverse the removal procedure.

Published: 16-May-2013

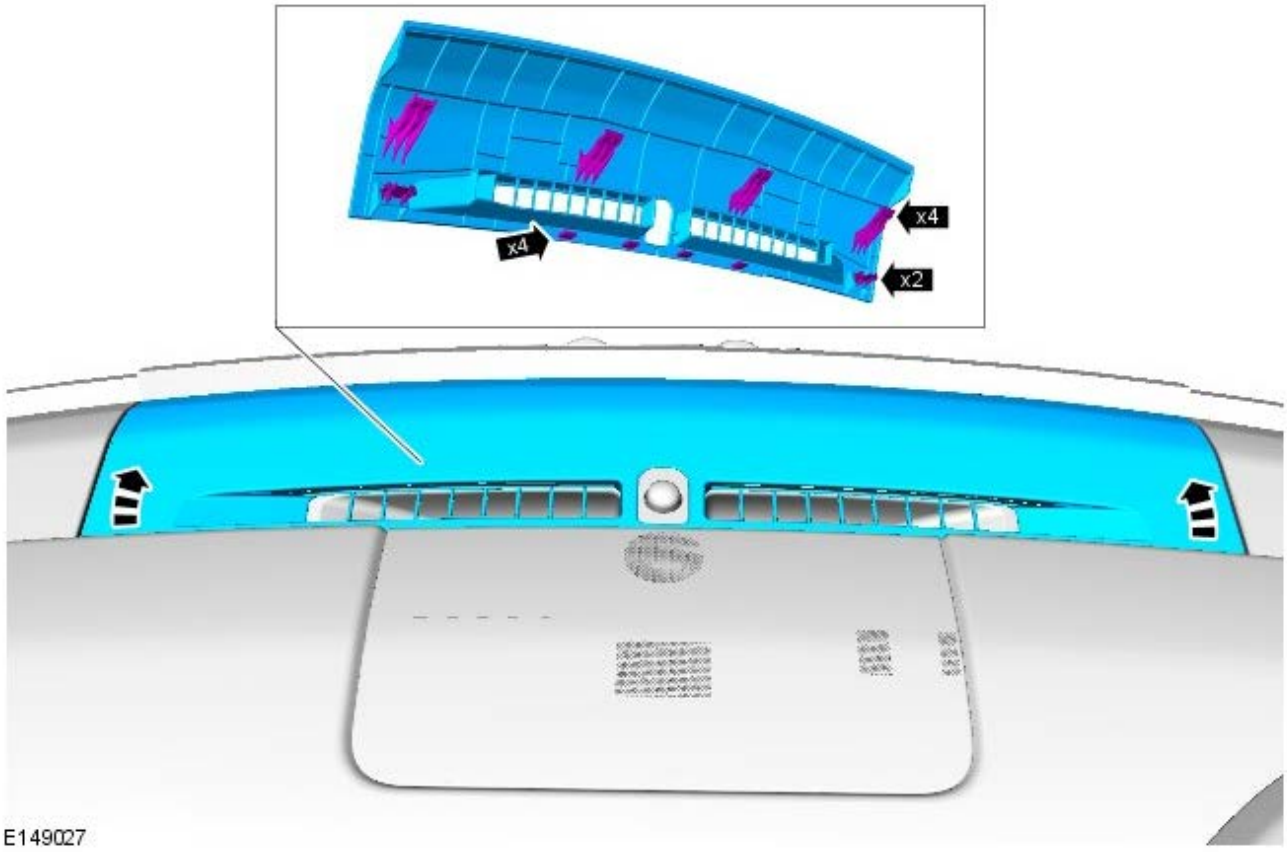
Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Front Sunload Sensor

Removal and Installation

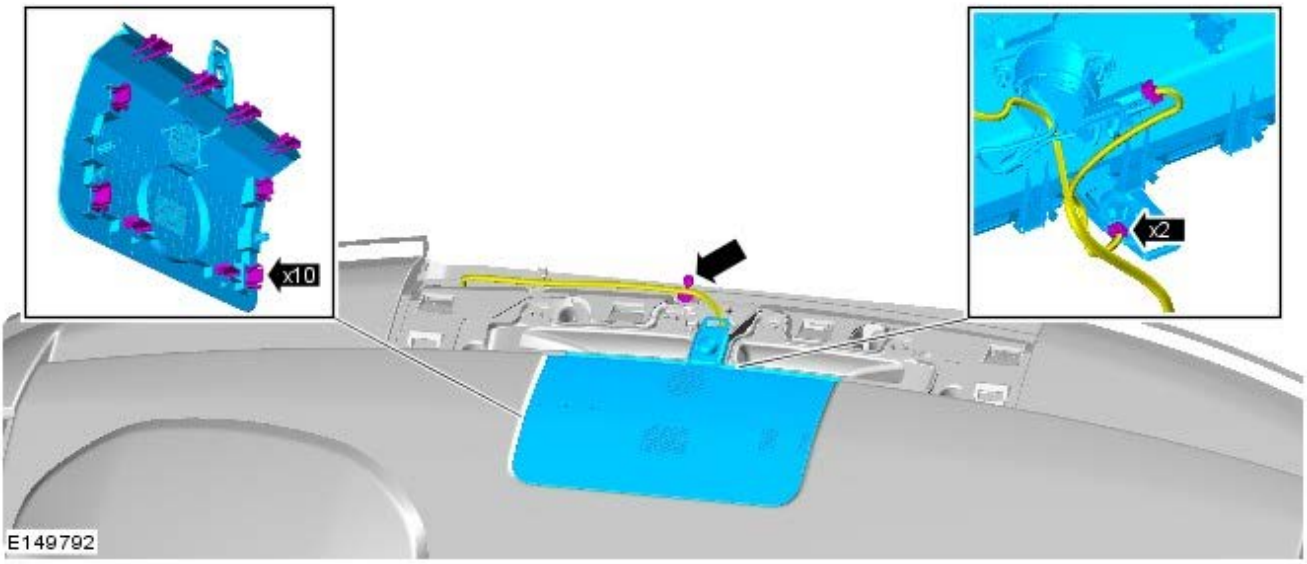
Removal

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

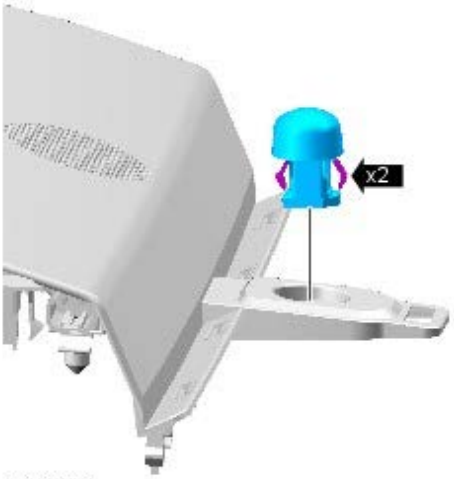
1.



2.



3.



E149793

Installation

1. To install, reverse the removal procedure.

This section contains no data

Published: 16-May-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Passenger Side Register

Removal and Installation

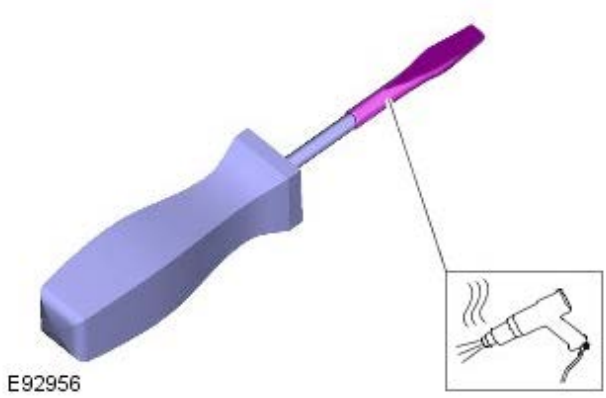
Removal

NOTES:

Removal steps in this procedure may contain installation details.

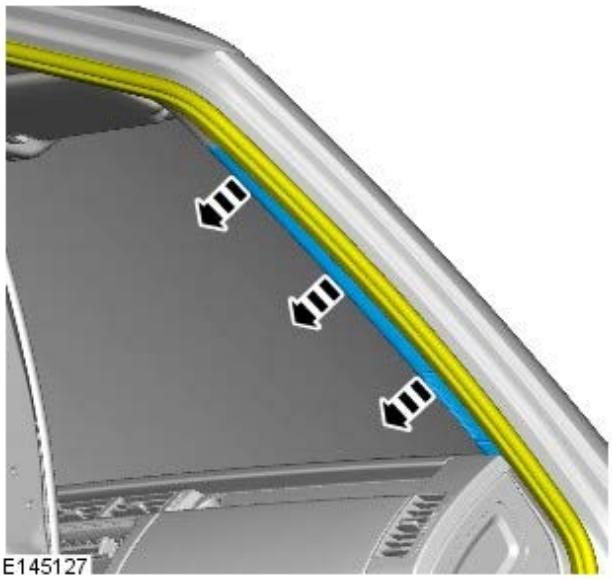
Some illustrations may show left hand drive. Right hand drive is similar, but the essential information shown is always correct.

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

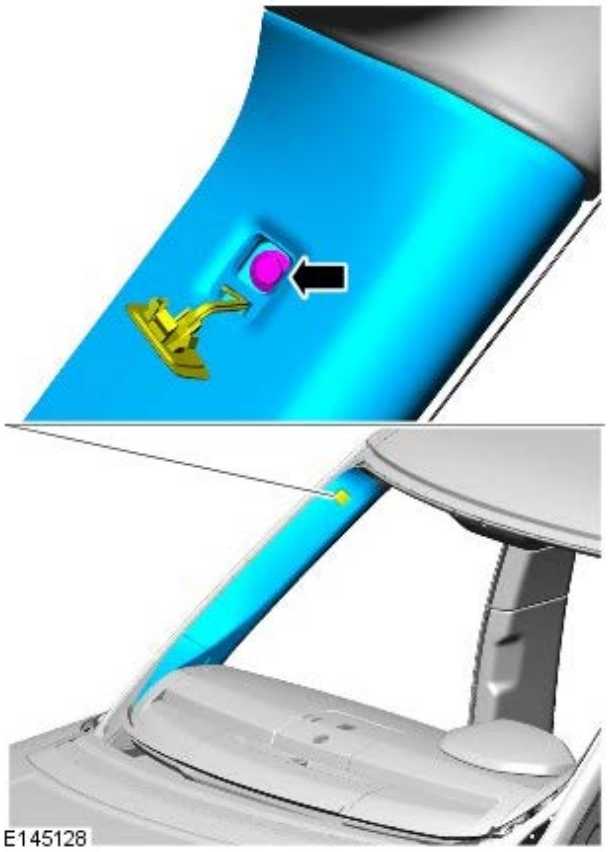


1. CAUTION: Apply heatshrink or protective tape to the end of a suitable tool to protect the interior components.

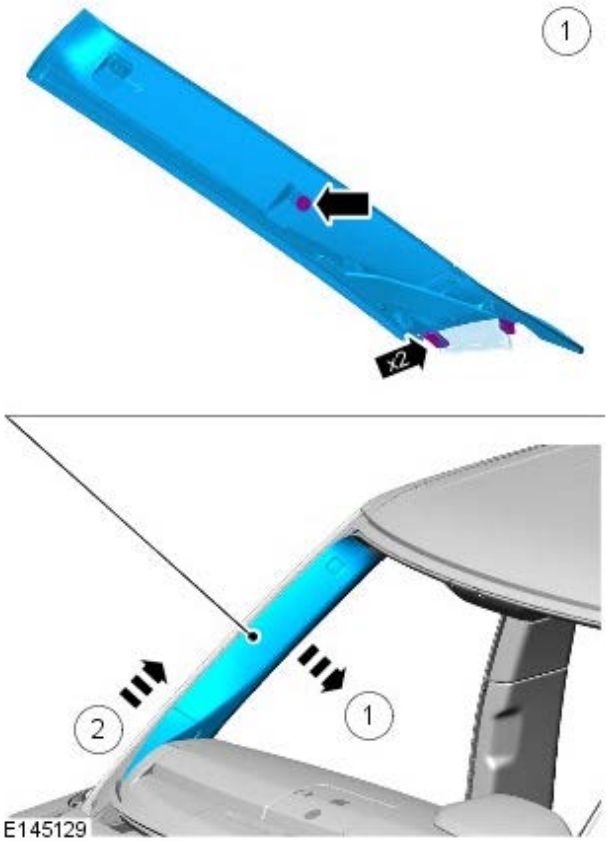
2.



3. *Torque:* 6 Nm



4.

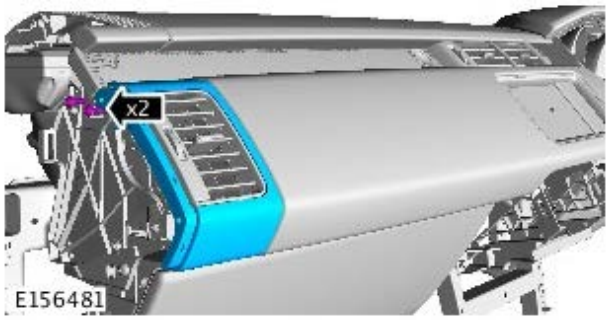


5.

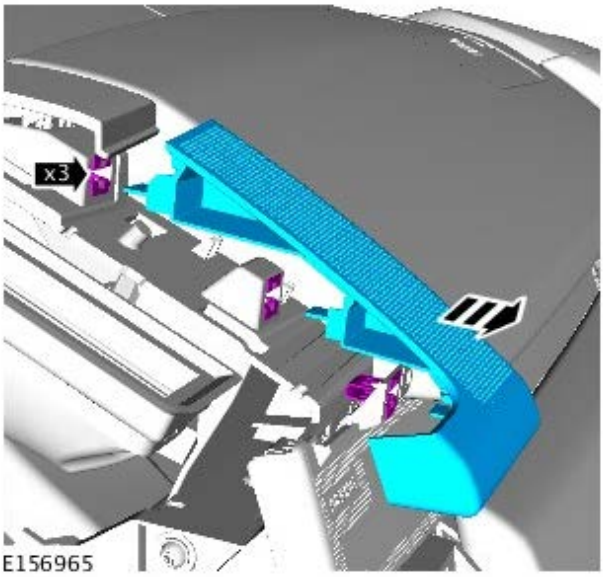


6.

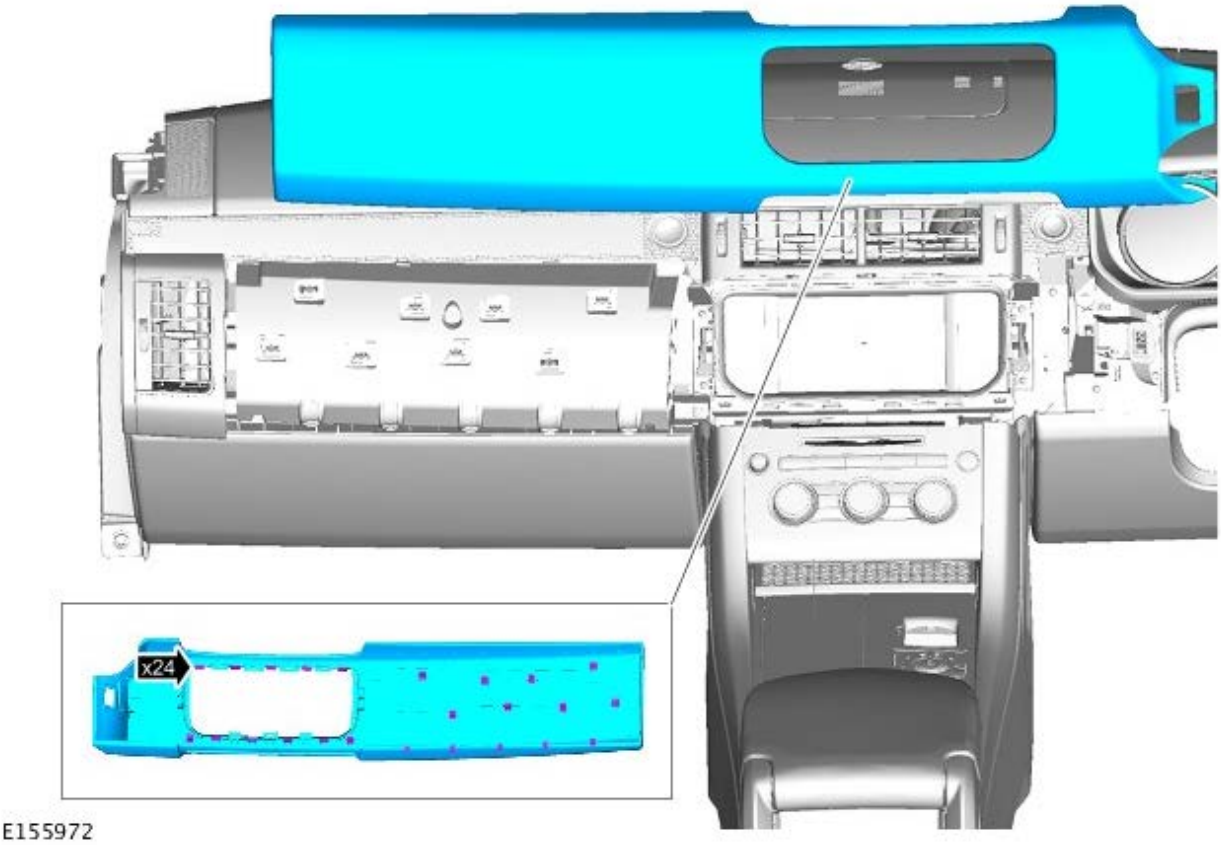




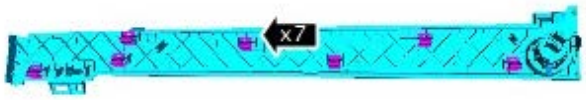
7.

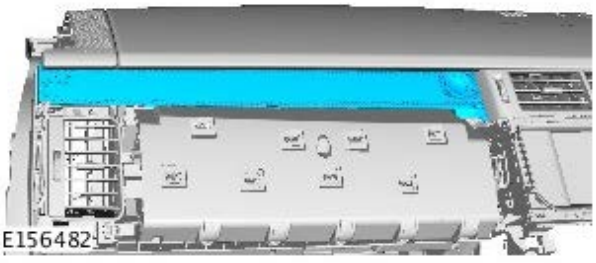


8.

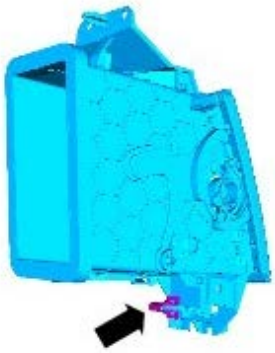


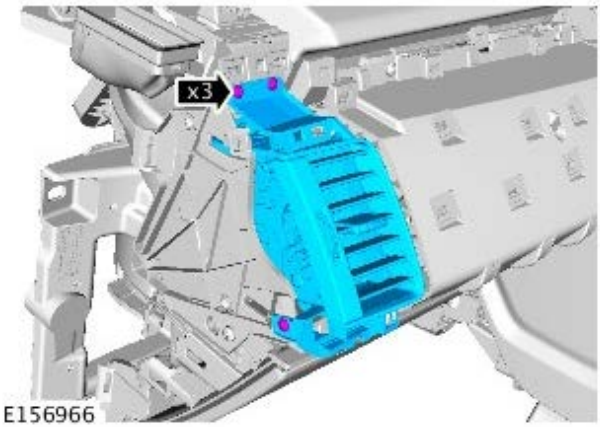
9.





10.





Installation

1. NOTE: Install the trim retaining clips in the moulding prior to installing the components.



E149095

2. To install, reverse the removal procedure.

Published: 13-Jun-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Cool Air Bypass Motor

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.

All vehicles

1. Disconnect the battery ground cable.

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

Right-hand drive vehicles

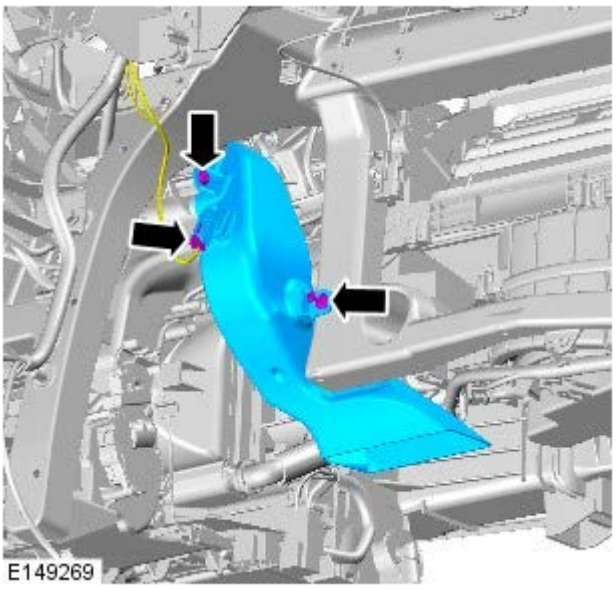
2. Refer to: Instrument Panel Lower Section (501-12 Instrument Panel and Console, Removal and Installation).

Left-hand drive vehicles

3. Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

Left-hand drive vehicles

4.



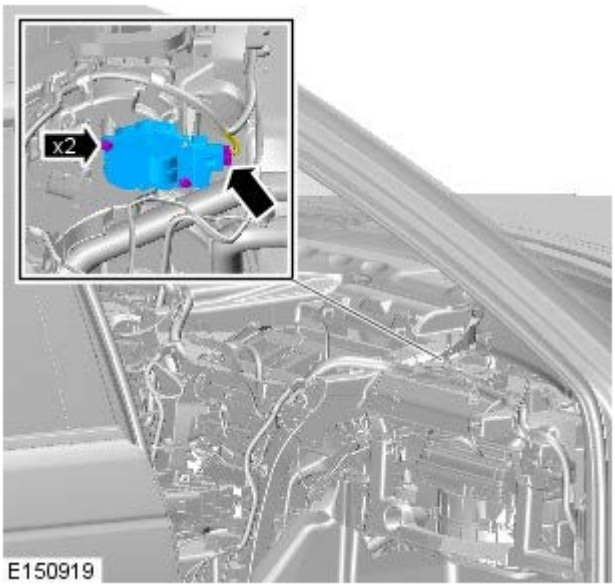
Left-hand drive vehicles

5.



All vehicles

6. NOTE: Left hand drive illustration shown, Right hand drive is similar.



Installation

1. To install, reverse the removal procedure.

Published: 16-May-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Driver Side Register

Removal and Installation

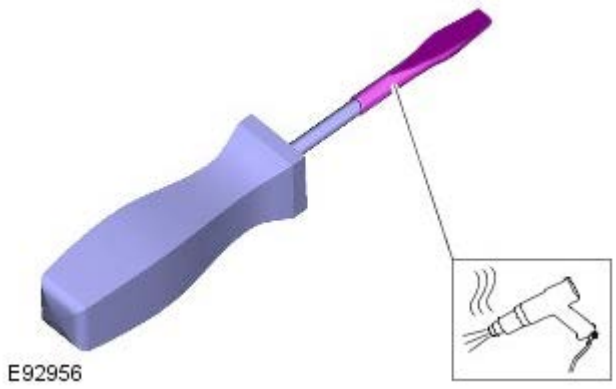
Removal

NOTES:

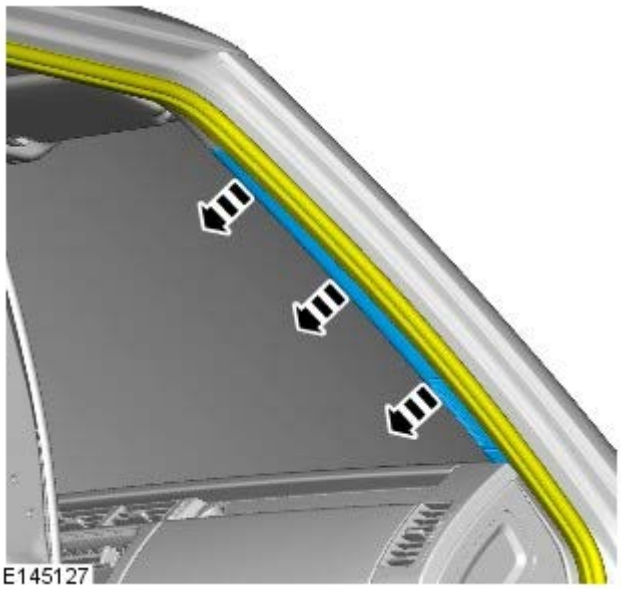
Removal steps in this procedure may contain installation details.

Some illustrations may show Right hand drive. Left hand drive is similar, but the essential information shown is always correct.

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



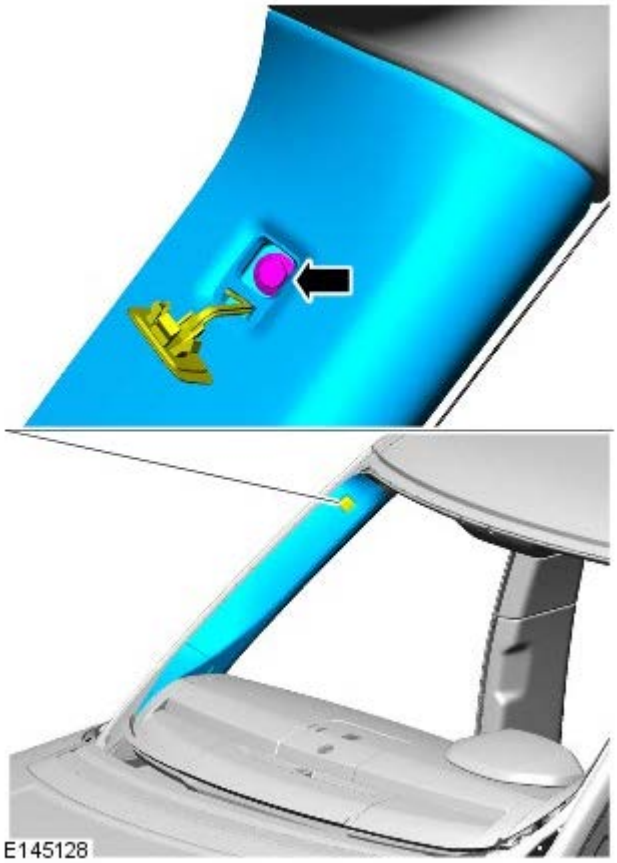
1. CAUTION: Apply heatshrink or protective tape to the end of a suitable tool to protect the interior components.



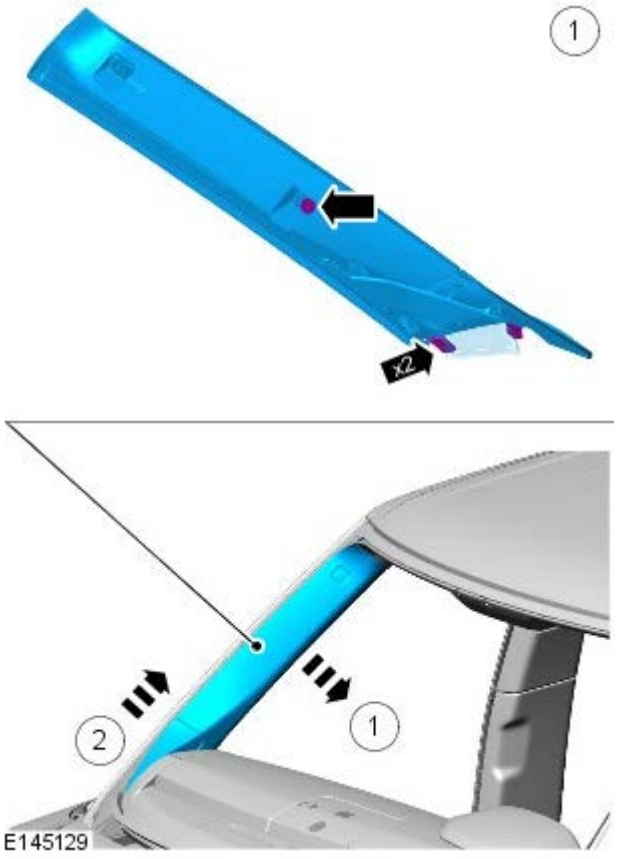
2. NOTE: Right-hand shown, left-hand similar.

3. NOTE: Right-hand shown, left-hand similar.

   Torque: 6 Nm



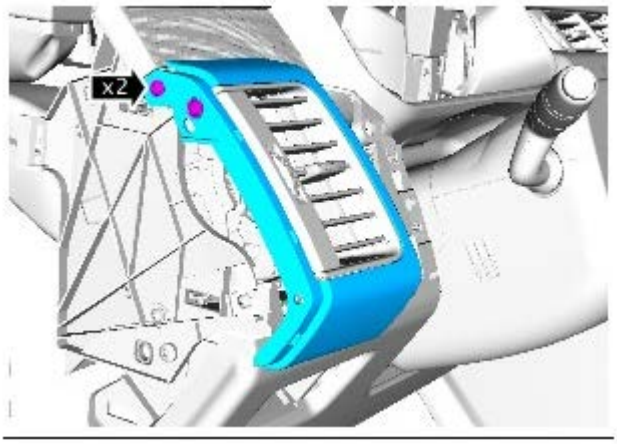
4. NOTE: Right-hand shown, left-hand similar.



5.

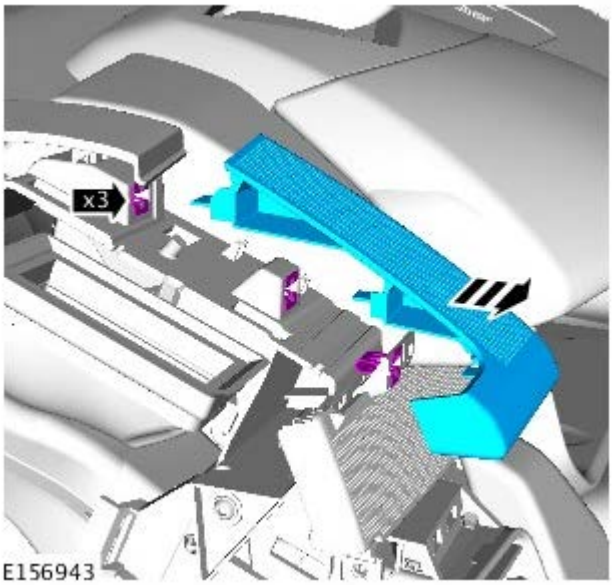


6.

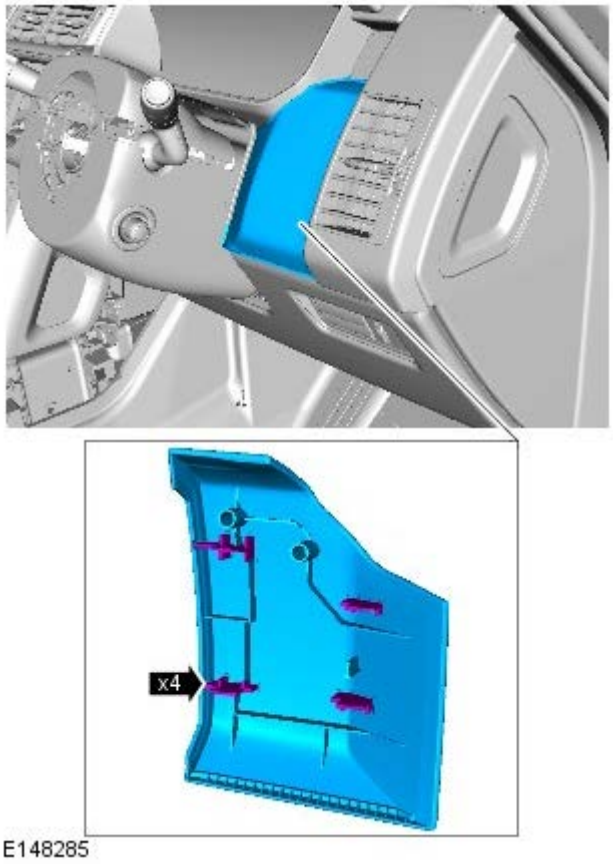




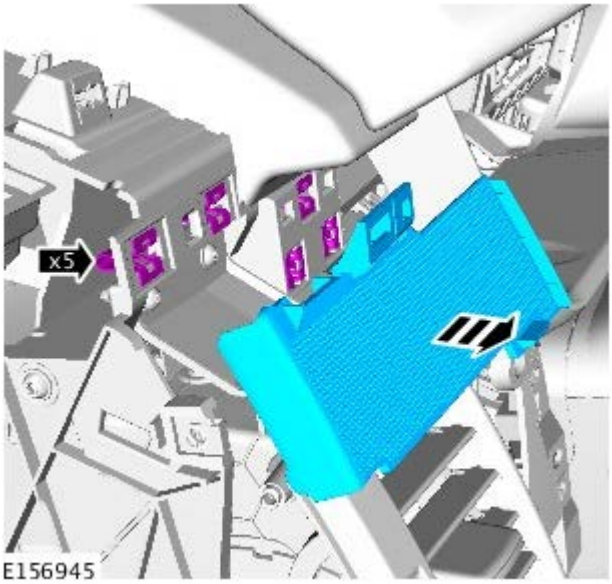
7.



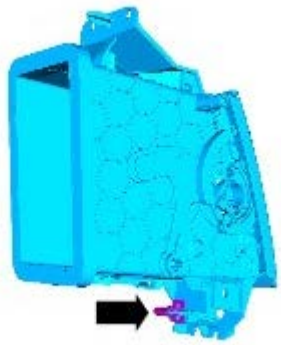
8.

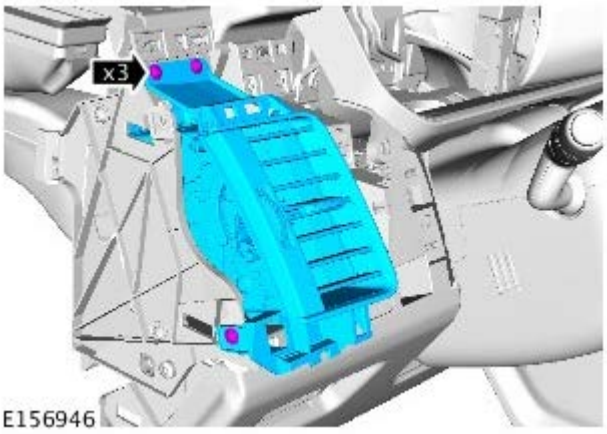


9.



10.





Installation

1. NOTE: Install the trim retaining clips in the moulding prior to installing the components.



E149095

2. To install, reverse the removal procedure.

Published: 13-Jun-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Distribution Motor – Demist

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.

All vehicles

1. Disconnect the battery ground cable.

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

Right-hand drive vehicles

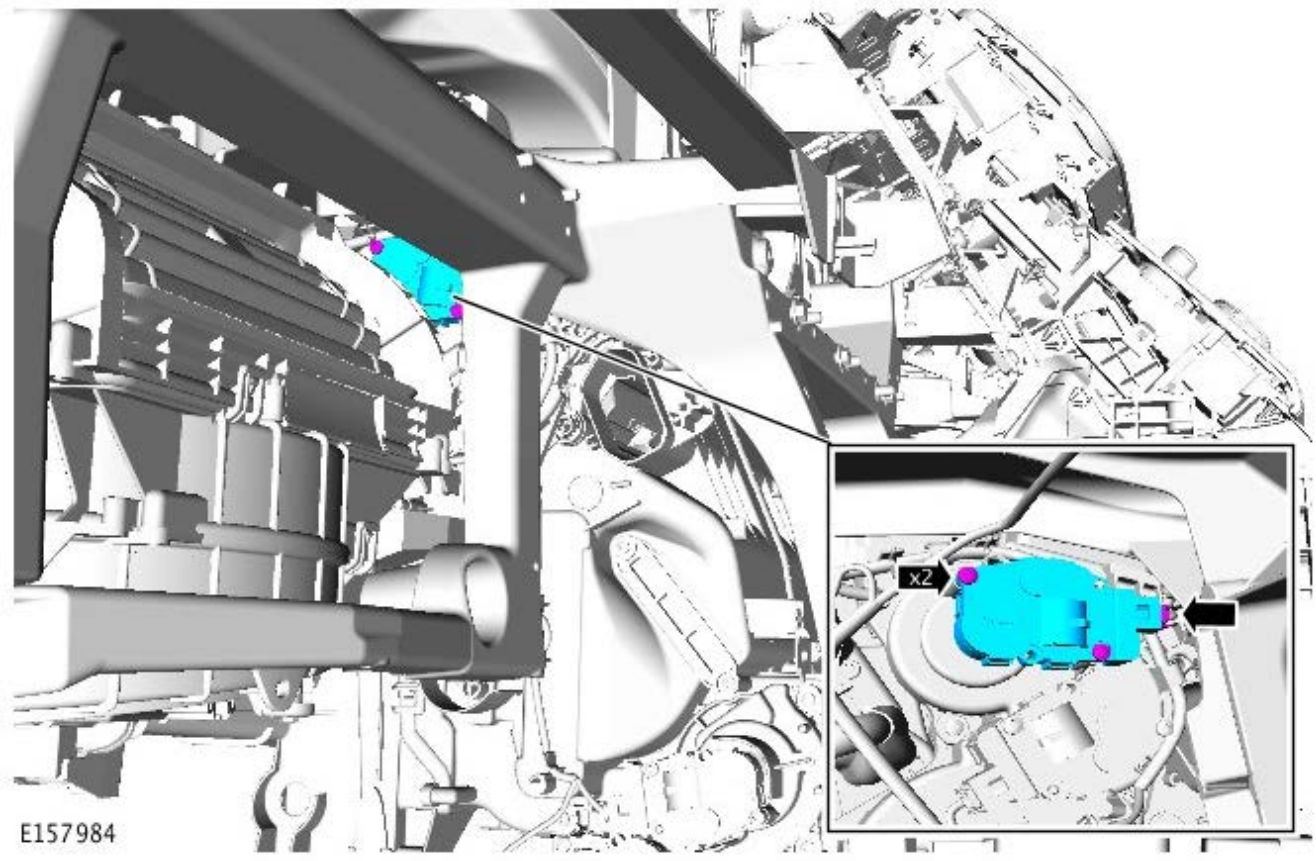
2. Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

Left-hand drive vehicles

3. Refer to: Instrument Panel Lower Section (501-12 Instrument Panel and Console, Removal and Installation).

All vehicles

4. NOTE: Right hand drive illustration shown, Left hand drive similar.



Installation

1. To install, reverse the removal procedure.

Published: 10-Jun-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Recirculation Motor

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

Some components shown removed for clarity.

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

Right hand drive illustration(s) shown, Left hand drive is similar.

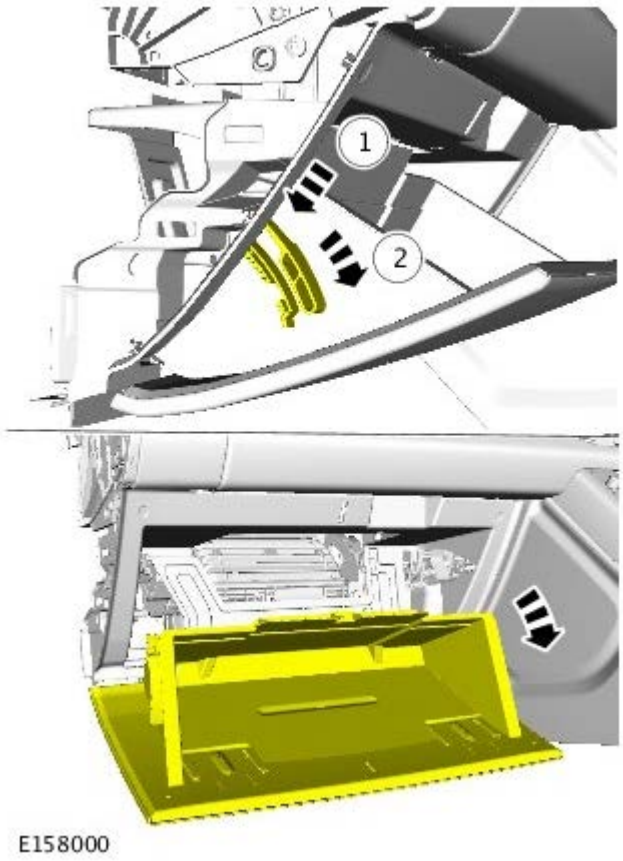
1.



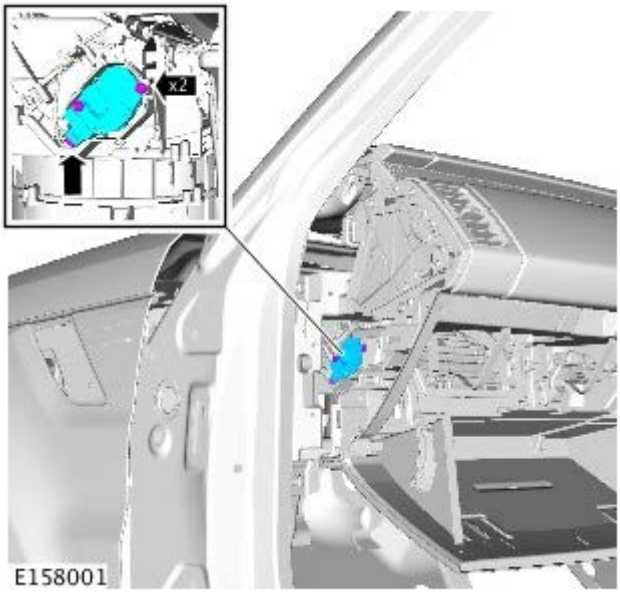
2.



3. NOTE: The procedure must be carried out on both sides.



4.



Installation

1. To install, reverse the removal procedure.

Published: 13-Jun-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Distribution Motor - Left Front Face / Feet

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.

All vehicles

1. Disconnect the battery ground cable.

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

Right-hand drive vehicles

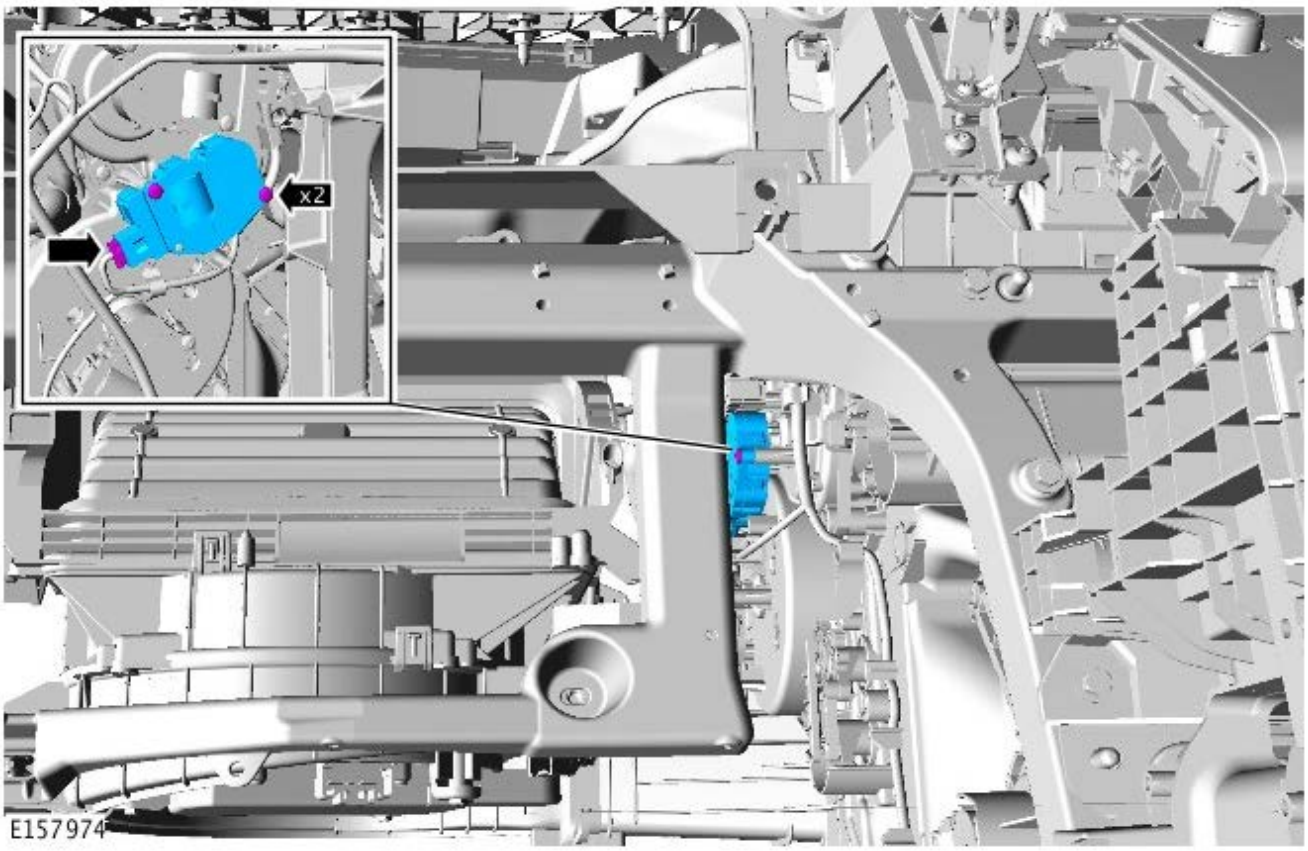
2. Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

Left-hand drive vehicles

3. Refer to: Instrument Panel Lower Section (501-12 Instrument Panel and Console, Removal and Installation).

All vehicles

4. NOTE: Right hand drive illustration shown, Left hand drive similar.



Installation

1. To install, reverse the removal procedure.

Published: 13-Jun-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Distribution Motor - Right Front Face/Feet

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.

All vehicles

1. Disconnect the battery ground cable.

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

Right-hand drive vehicles

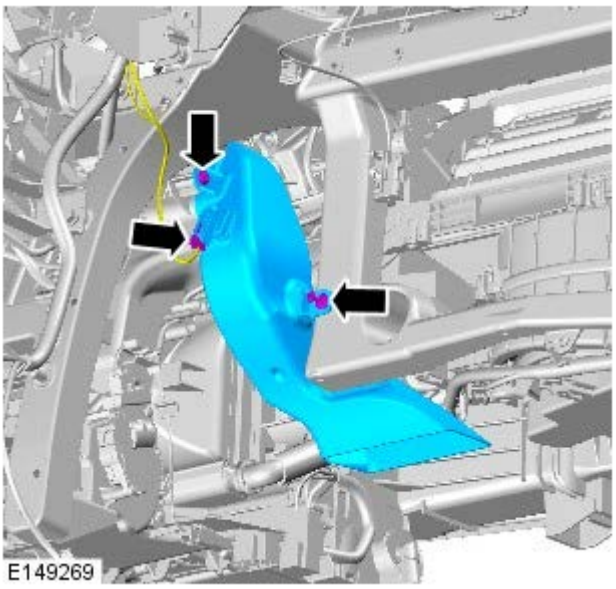
2. Refer to: Instrument Panel Lower Section (501-12 Instrument Panel and Console, Removal and Installation).

Left-hand drive vehicles

3. Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

Left-hand drive vehicles

4.



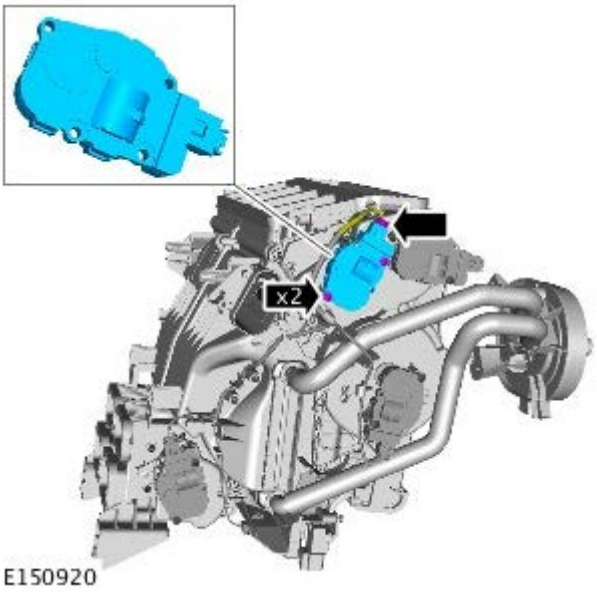
Left-hand drive vehicles

5.



All vehicles

6. NOTE: Left hand drive illustration shown, Right hand drive is similar.



Installation

1. To install, reverse the removal procedure.

Published: 07-Feb-2014

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Pollen Filter

Removal and Installation

Removal

WARNING: Make sure that the blower motor is in the OFF position. Failure to follow this instruction may result in personal injury.

CAUTION: **During this procedure, the ignition must remain ON, the air conditioning (A/C) system must be in manual mode and the blower motor is in the OFF position. Failure to follow these instructions may result in damage to the recirculation flap.**

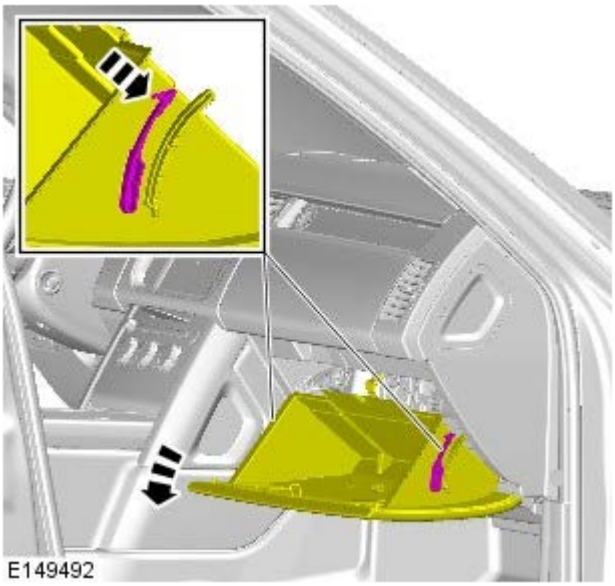
NOTE: Removal steps in this procedure may contain installation details.

1.



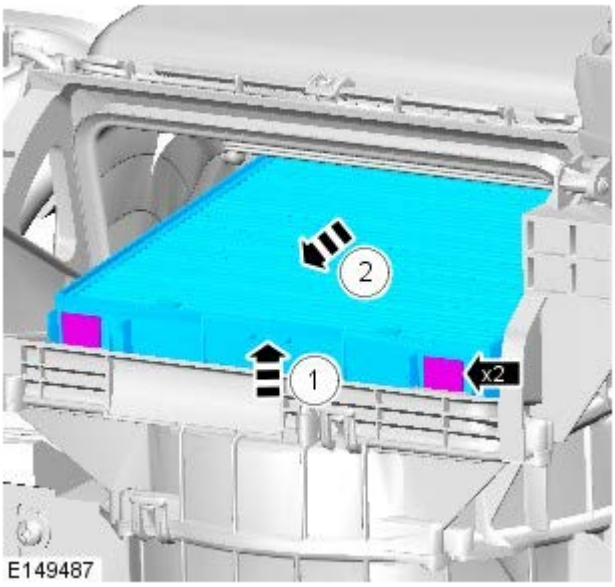
E156270

2.

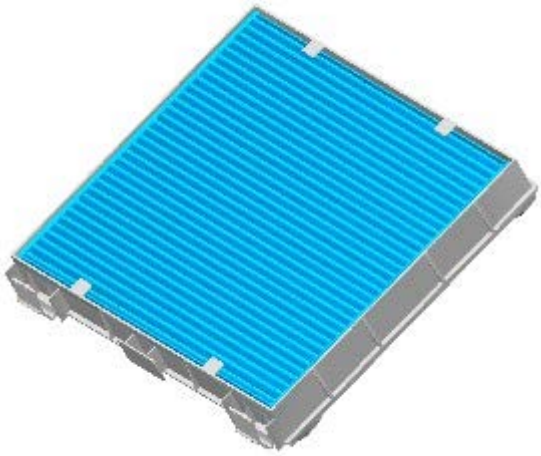


E149492

3.



4.



Installation

1. To install, reverse the removal procedure.

Published: 06-Sep-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Electric Air Conditioning (A/C) Compressor

Removal and Installation

Removal

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

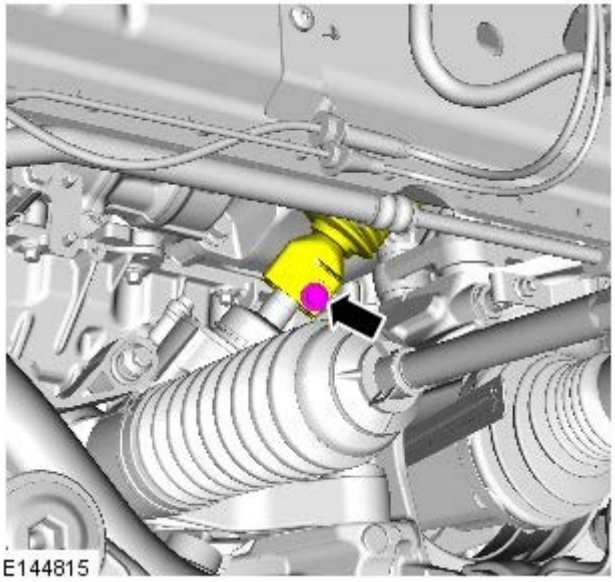
NOTES:

Component shown removed for clarity.

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: Hybrid Electric Vehicle (HEV) Decommission (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
3. Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03G Engine Cooling - SDV6 3.0L Diesel - Hybrid Electric Vehicle, General Procedures).
4. Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).



5. CAUTIONS:

   Discard the bolt.

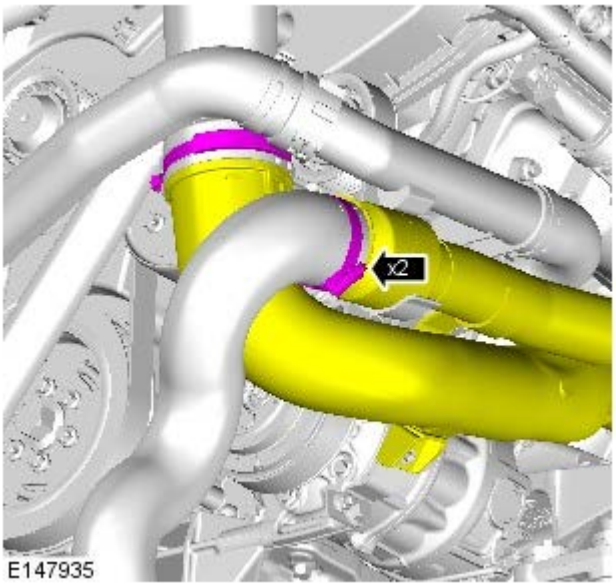
   Make sure that a new bolt is installed.

   NOTE: Left hand drive only.

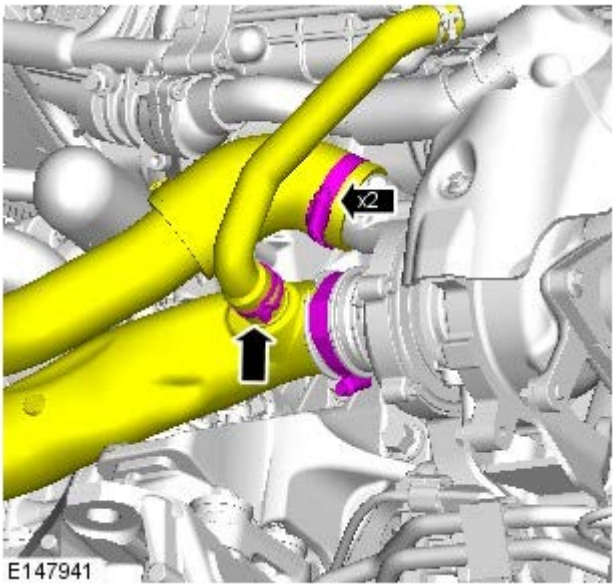
   Align the steering wheel to straight ahead.

   Torque: 30 Nm

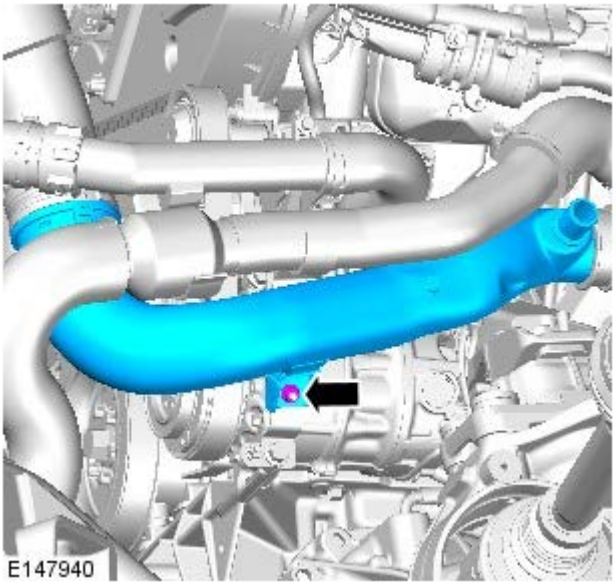
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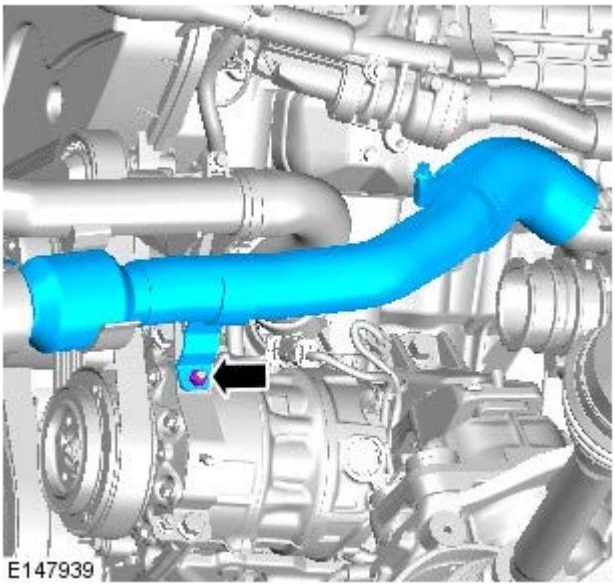
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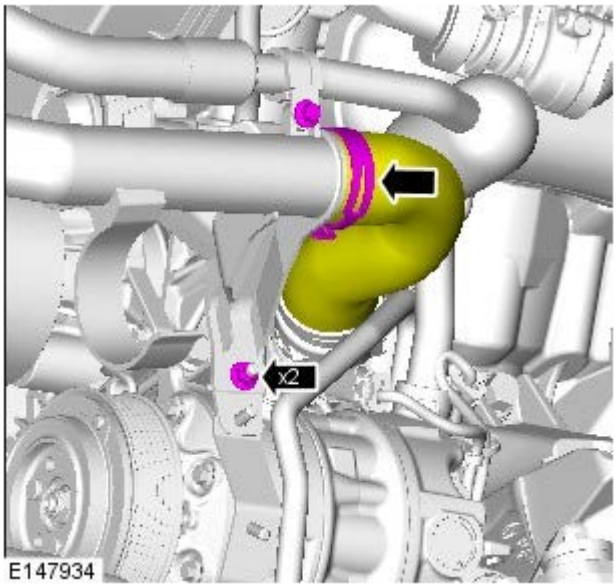


8. *Torque:* 6 Nm



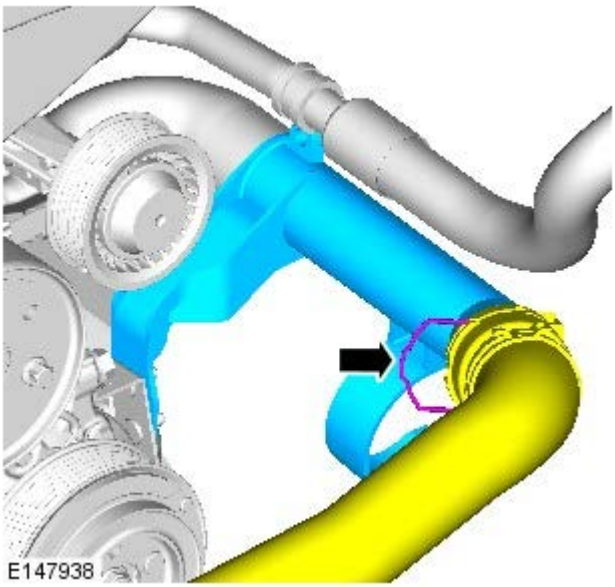
9. *Torque:* 6 Nm





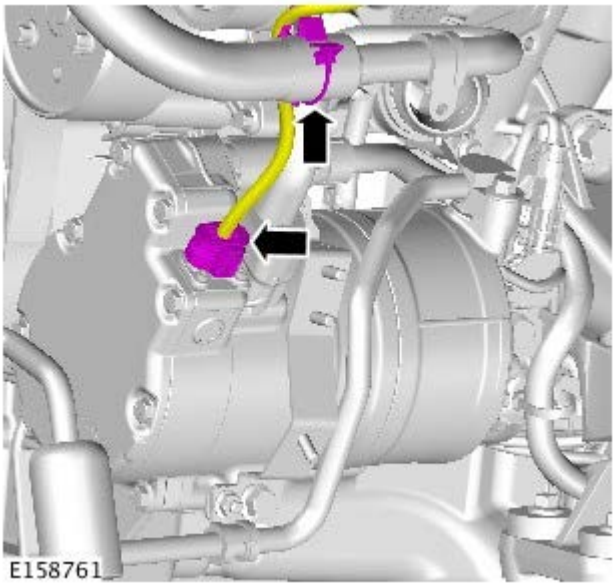
10. CAUTION: Be prepared to collect escaping coolant.

    Torque: 6 Nm

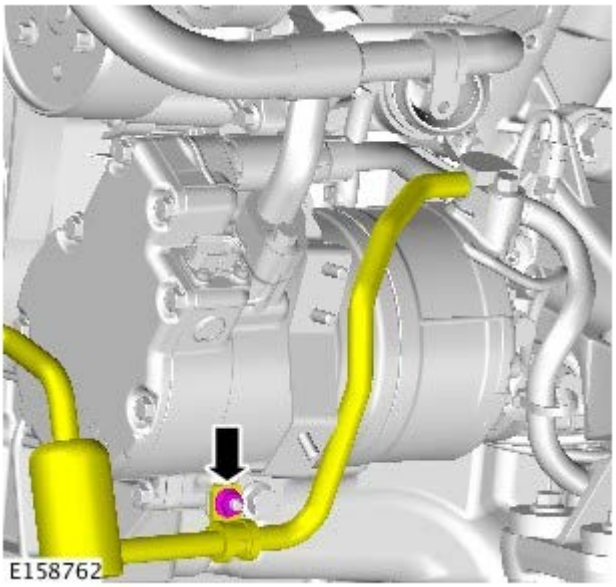


11. CAUTION: Be prepared to collect escaping coolant.

12.

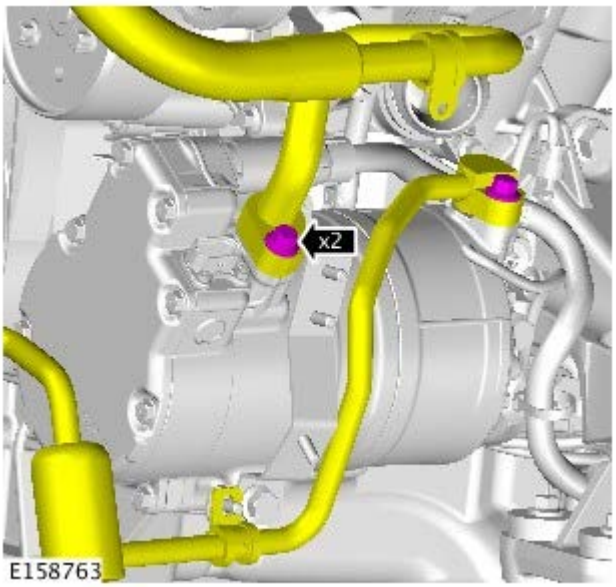


13. *Torque:* 6 Nm

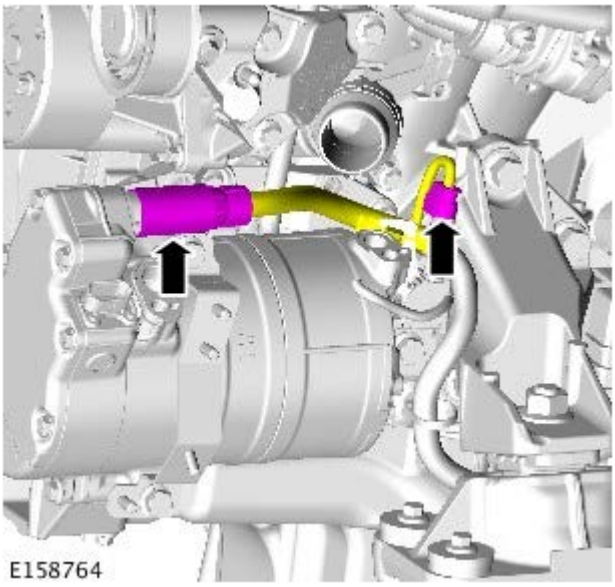


14. CAUTION: A new O-ring seal is to be installed.

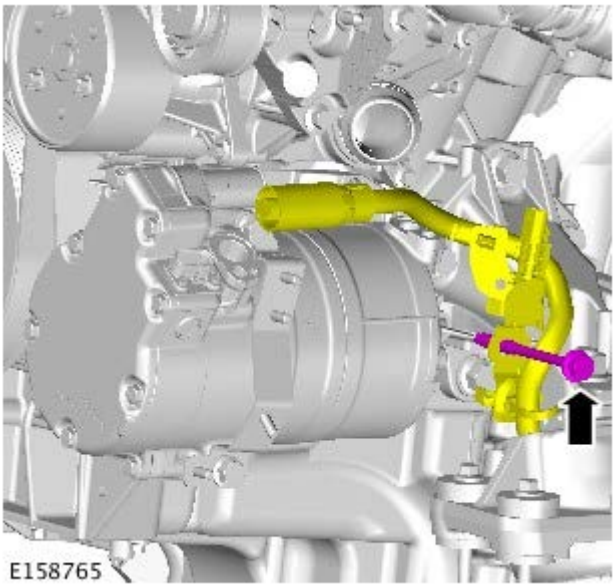
Torque: 18 Nm



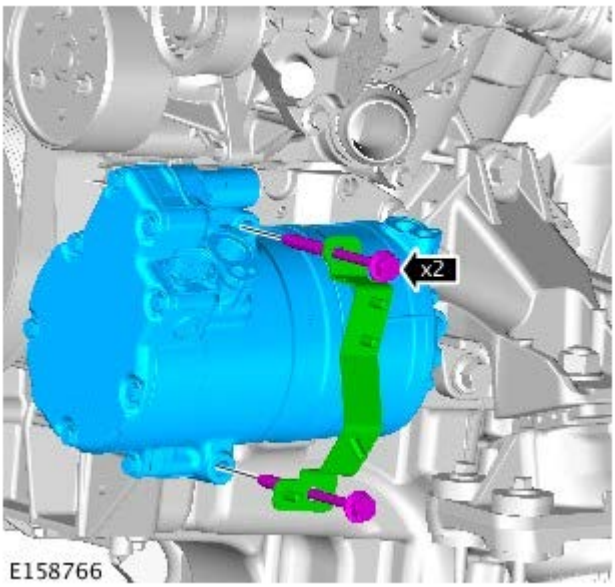
15.



16. *Torque:* 25 Nm



17. *Torque:* 25 Nm



Installation

1. To install, reverse the removal procedure.
2. Refer to: Hybrid Electric Vehicle (HEV) System Bonding Test (414-01 Battery, Mounting and Cables, General Procedures).

Published: 30-Sep-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Electric Air Conditioning (A/C) Compressor High Pressure Pipe

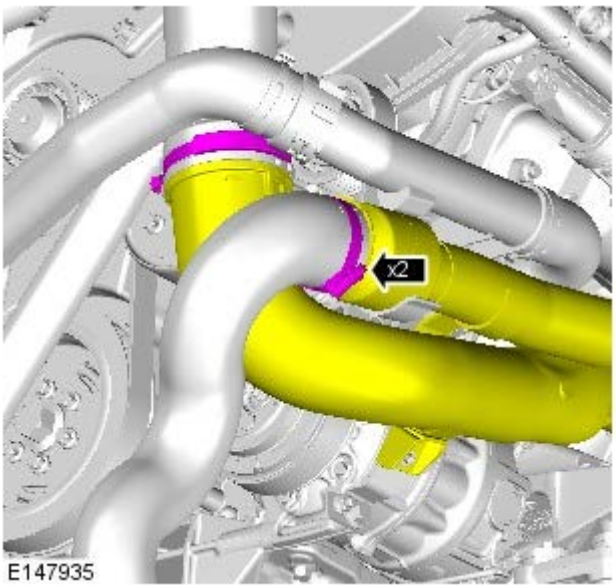
Removal and Installation

Removal

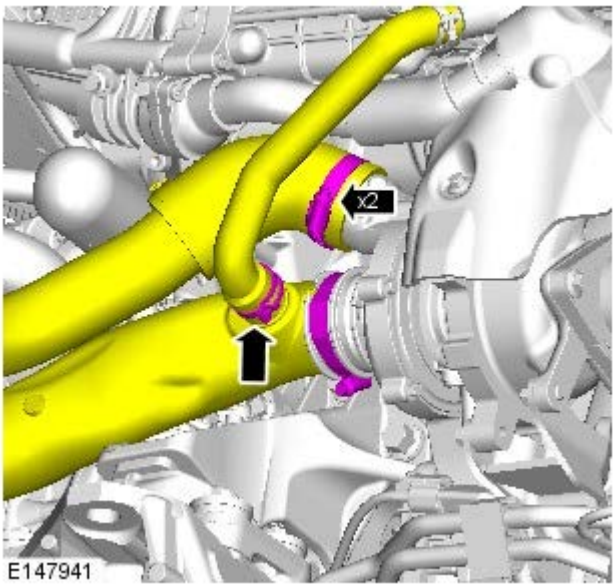
WARNING: This procedure can only be carried out after the vehicle has been decommissioned, by an approved person.

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

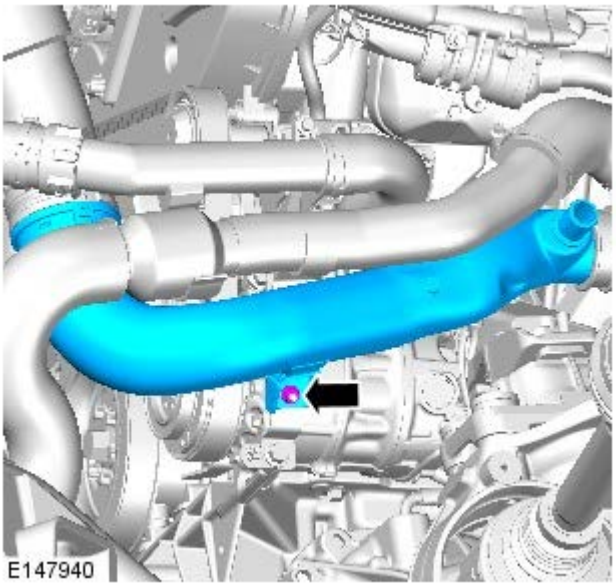
1. Refer to: Hybrid Electric Vehicle (HEV) Decommission (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Engine Cover - TDV6 3.0L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
4. Refer to: Coolant Expansion Tank (303-03A Engine Cooling - TDV6 3.0L Diesel, Removal and Installation).
5.



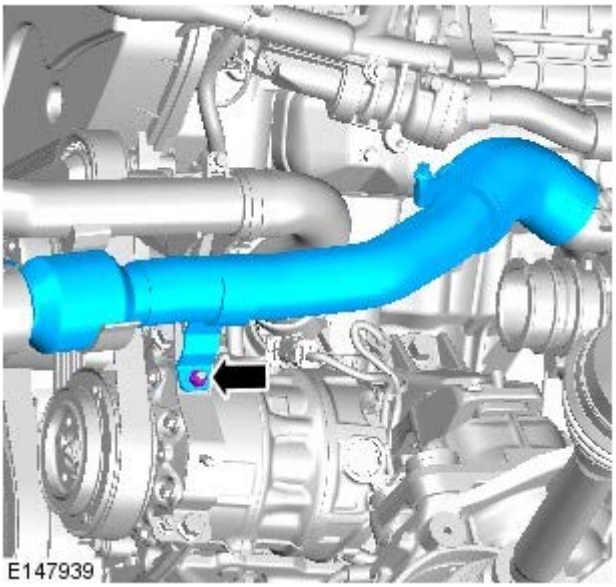
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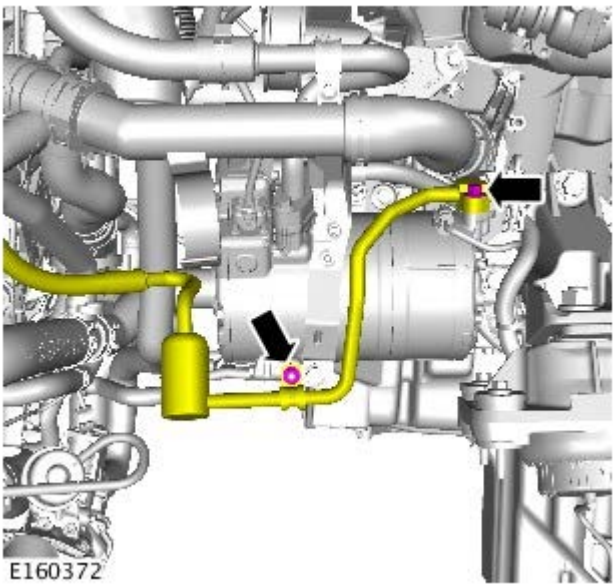
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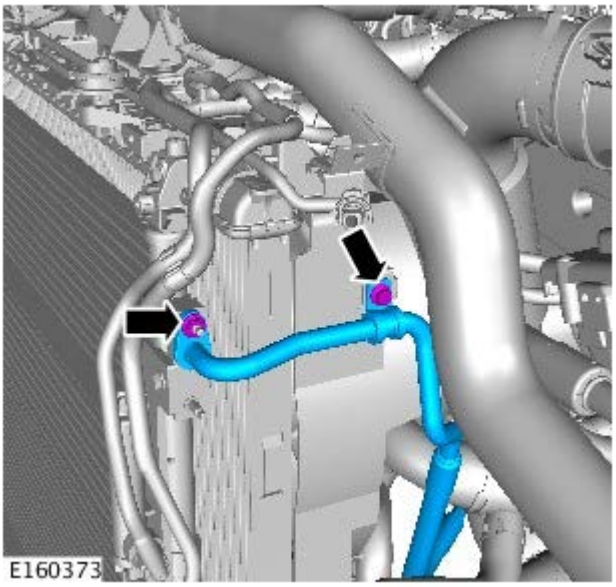
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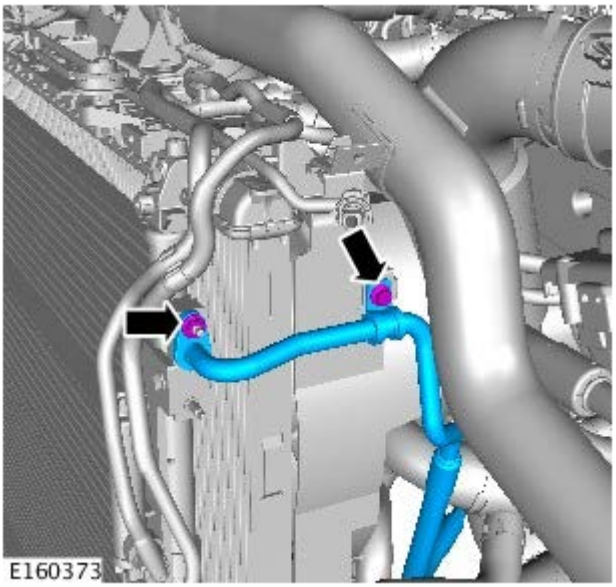
9. CAUTION: Remove and discard the O-ring seals.



10. CAUTION: Remove and discard the O-ring seals.



Installation

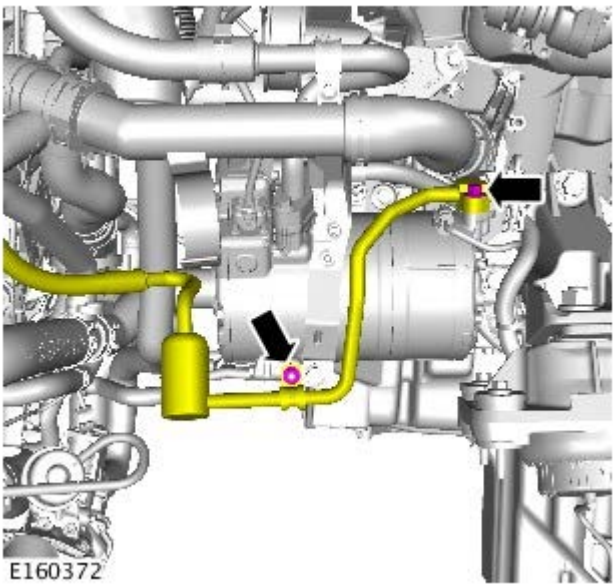


1. NOTES:

   Install new O-ring seals.

   Lubricate the O-ring seals with clean refrigerant oil.

   Torque: 6 Nm



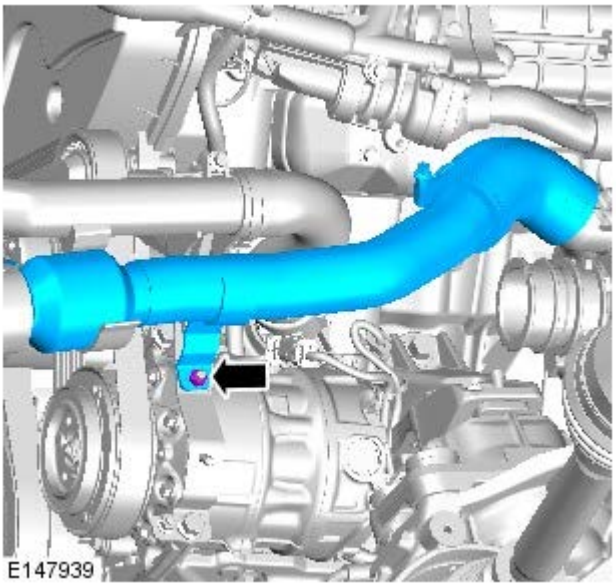
2. NOTES:

   Install new O-ring seals.

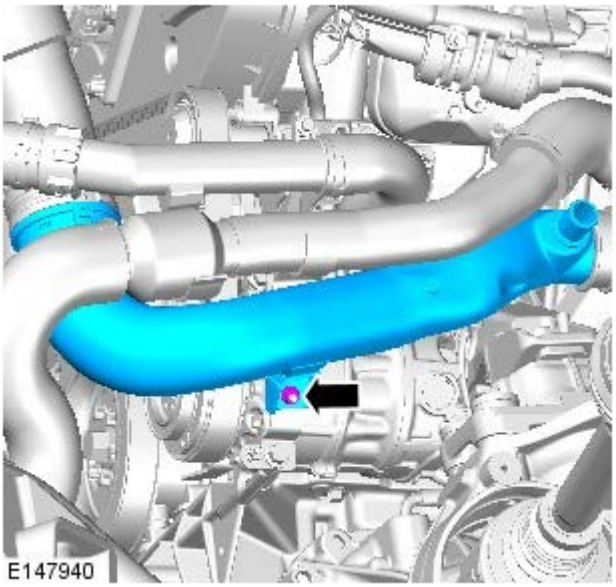
   Lubricate the O-ring seals with clean refrigerant oil.

   Torque:
   M6 6 Nm
   M8 18 Nm

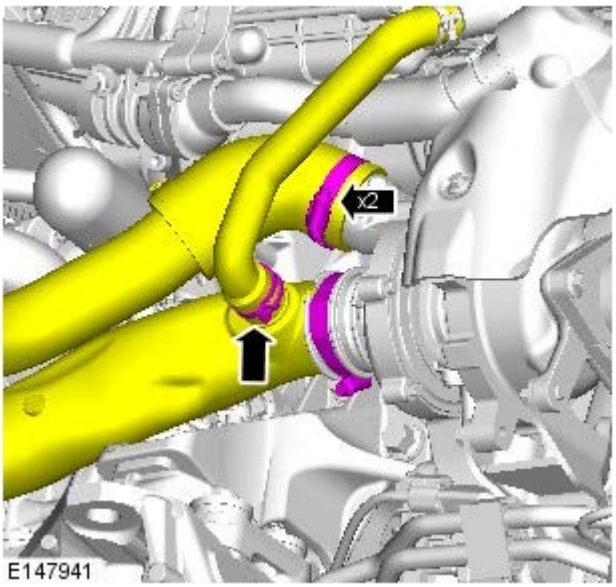
3.



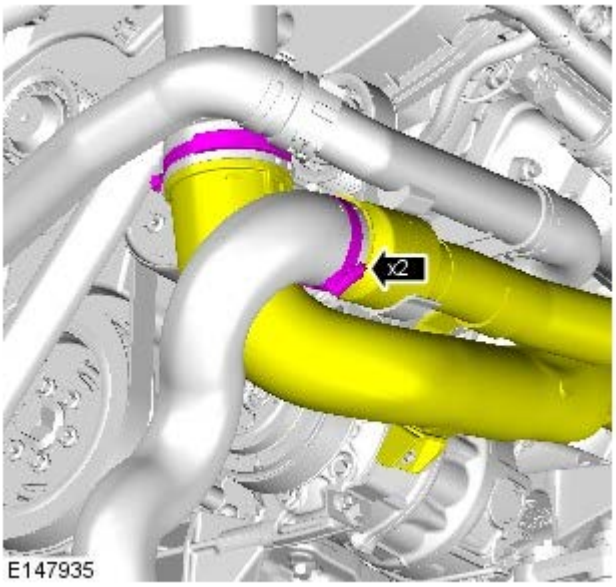
4.



5.



6.



7. Refer to: Coolant Expansion Tank (303-03A Engine Cooling - TDV6 3.0L Diesel, Removal and Installation).

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

9. Refer to: Engine Cover - TDV6 3.0L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

10. Refer to: Hybrid Electric Vehicle (HEV) Decommission (414-01 Battery, Mounting and Cables, General Procedures).

Published: 30-Sep-2013

Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Electric Air Conditioning (A/C) Compressor Low Pressure Pipe

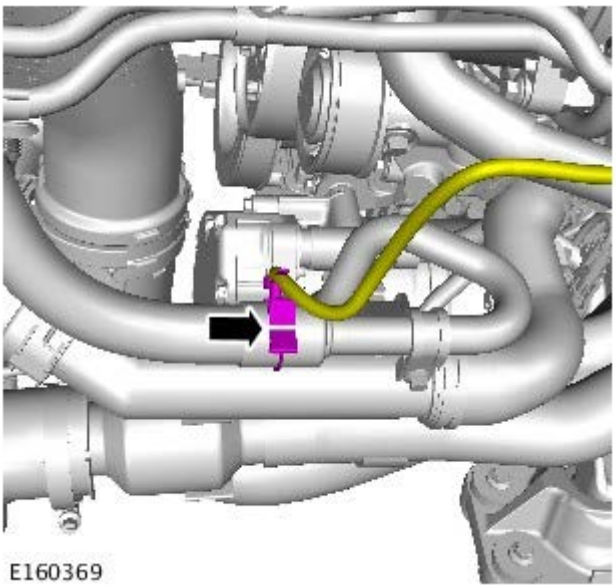
Removal and Installation

Removal

WARNING: This procedure can only be carried out after the vehicle has been decommissioned, by an approved person.

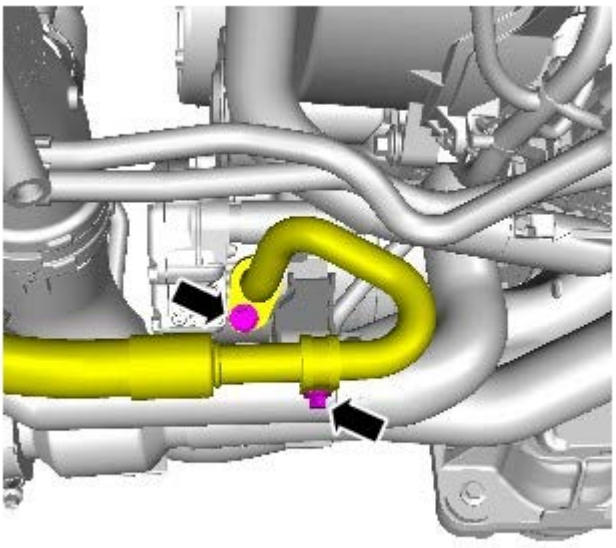
NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: Hybrid Electric Vehicle (HEV) Decommission (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Engine Cover - TDV6 3.0L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
4. Refer to: Air Cleaner LH (303-12A Intake Air Distribution and Filtering - TDV6 3.0L Diesel, Removal and Installation).
5.

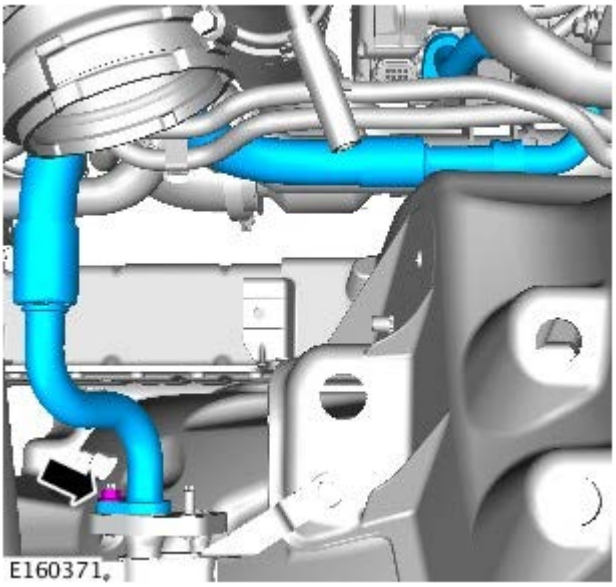


E160369

6. CAUTION: Remove and discard the O-ring seals.

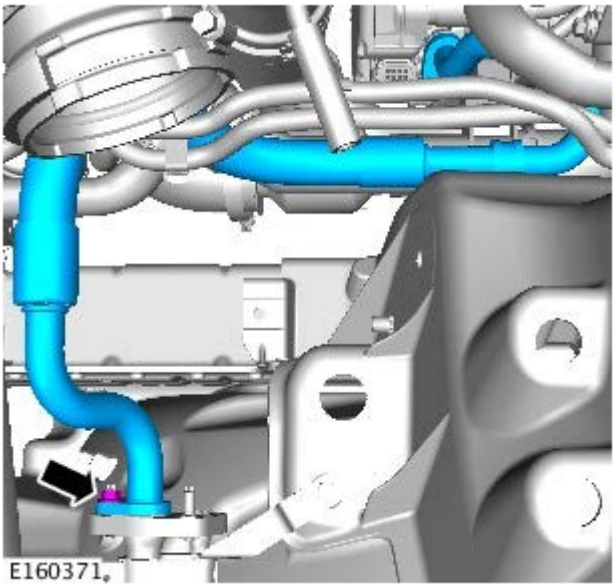


E160370



7. CAUTION: Remove and discard the O-ring seals.

Installation

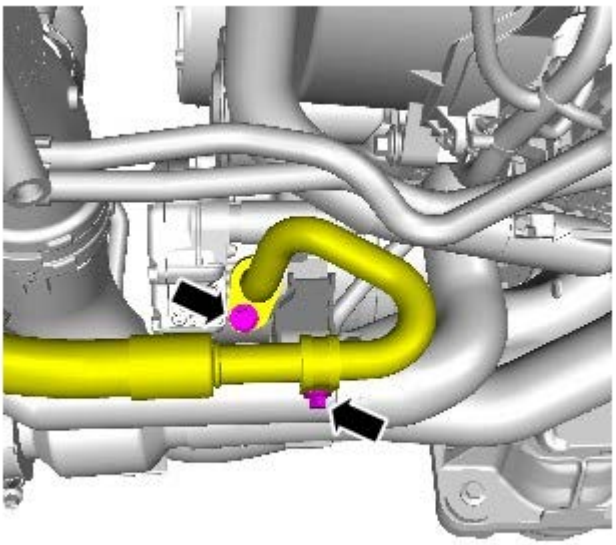


1. NOTES:

   Install new O-ring seals.

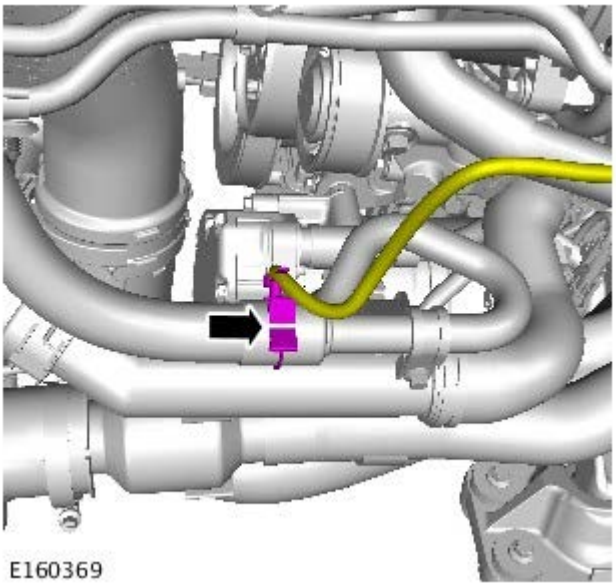
   Lubricate the O-ring seals with clean refrigerant oil.

   Torque: 6 Nm



2. *Torque:*
   M6 6 Nm
   M8 18 Nm

3.



4. Refer to: Air Cleaner LH (303-12A Intake Air Distribution and Filtering - TDV6 3.0L Diesel, Removal and Installation).

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

6. Refer to: Engine Cover - TDV6 3.0L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

7. Refer to: Hybrid Electric Vehicle (HEV) Decommission (414-01 Battery, Mounting and Cables, General Procedures).

Published: 19-Jul-2013

Auxiliary Climate Control -

Torque Specifications

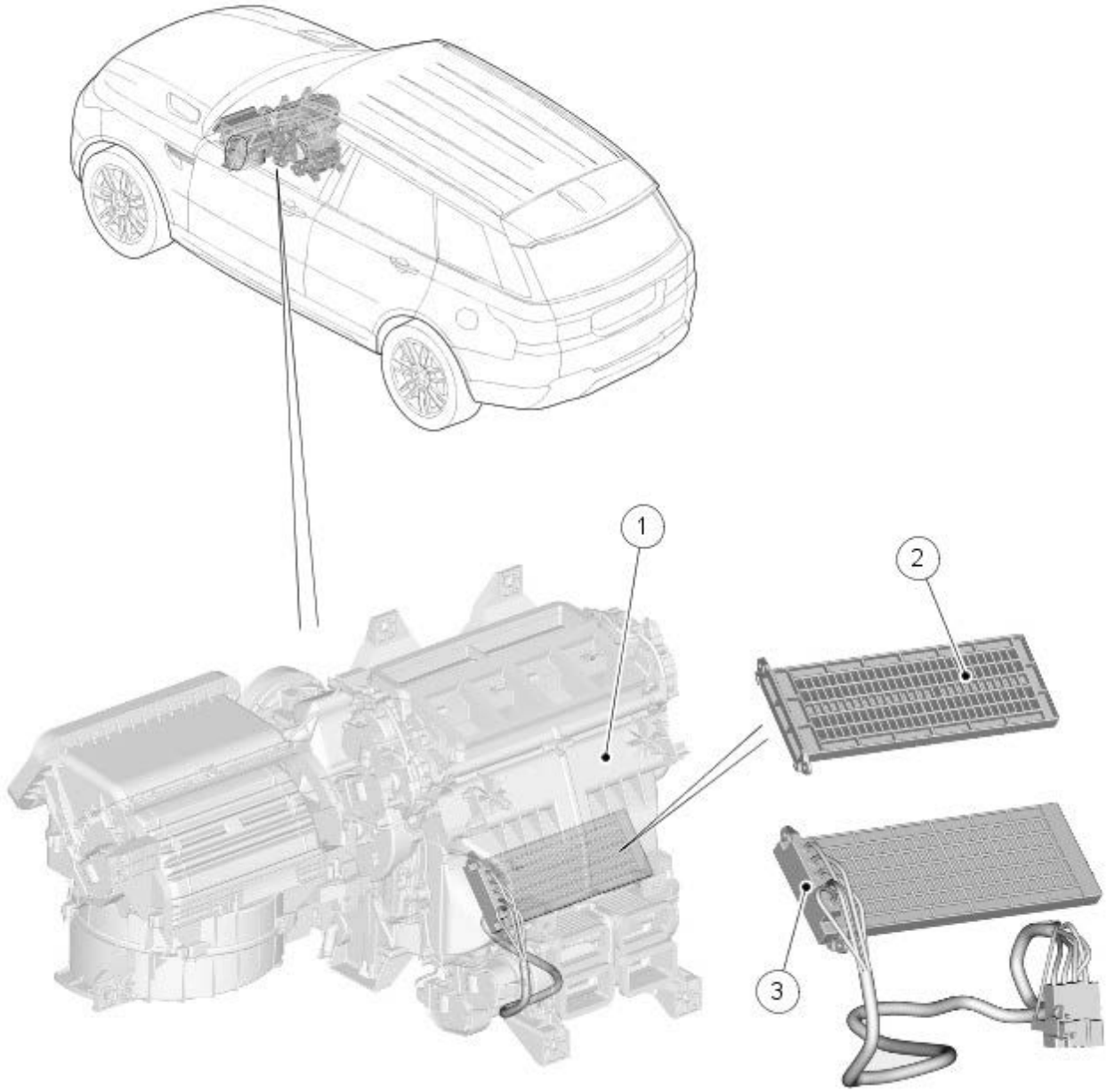
Description	Nm	lb-ft	lb-in
Fuel fired booster heater exhaust bolt	10	7	-
Fuel fired booster heater exhaust nut	10	7	-
Fuel fired booster heater bolts	10	7	-
Fuel fired booster heater fuel pump bolt	9	-	80
Fuel fired booster heater coolant pump bolts	1.5	-	13
Auxiliary refrigerant line bolts	10	7	-
Auxiliary heater core and evaporator core housing sealing plate nuts	10	7	-
Auxiliary heater core and evaporator core housing nuts	5	-	44
Auxiliary thermostatic expansion valve retaining bolts	4	-	35

Published: 02-May-2013

Auxiliary Climate Control - Electric Booster Heater

Description and Operation

COMPONENT LOCATION



E154223

Item	Part Number	Description
1	-	Climate control assembly
2	-	Baffle plate
3	-	Electric booster heater

OVERVIEW

Depending on model specification and market, diesel models may incorporate auxiliary heating in the form of an electric booster heater. Where fitted, the electric booster heater boosts the temperature of the air in the climate control assembly, downstream of the heater core.

Electric booster heater operation is entirely automatic. Maximum heat output is approximately 10% of that available from the heater core when the engine is at normal operating temperature. If necessary, the output from the electric booster heater can be varied, to keep the load within what the battery and charging system can support.

DESCRIPTION

Electric Booster Heater

The electric booster heater consists of a matrix, containing four 150 W ceramic coated PTC (Positive Temperature

Coefficient) elements, which is installed in the left side of the climate control assembly. On vehicles without an electric booster heater, a baffle plate is installed in place of the booster heater.

The elements of the electric booster heater are wired together in pairs, with separate power feeds to each pair from two relays in the EJB (Engine Junction Box). Operation of the relays is controlled by the ATCM (Automatic Temperature Control Module) module.

OPERATION

The ATCM uses the following inputs from the medium speed CAN (Controller Area Network) Comfort bus to control operation of the electric booster heater:

- Climate control system selections from the front and rear integrated control panels and the TS (Touch Screen).
- Ambient air temperature and engine coolant temperature from the ECM (Engine Control Module), which is transmitted on the high speed CAN Powertrain bus, via the GWM (Gateway Module).
- Battery and generator status from the gateway module
- Ignition mode and transit mode status from the CJB (Central Junction Box). The ignition mode signal starts-up from the CJB on medium speed CAN Body bus. The GWM converts this signal to medium speed CAN Comfort message, which is received by the ATCM.

The ATCM operates the electric booster heater, provided the vehicle is not in transit mode and there are no generator faults recorded, when the following conditions occur:

- The engine is running
- The blower is on (any speed)
- Heating is requested on the front or rear integrated control panel, or on the front or rear climate menu of the TS, and the desired vent temperature (calculated by the ATCM), is not being achieved
- The ambient air temperature is less than 10 °C (50 °F)
- The engine coolant temperature is less than 90 °C (194 °F)
- Battery charge state is more than 10 A.

Depending on the battery charge state, the ATCM energizes one or both pairs of elements of the electric booster heater. If the battery charge state changes while the electric booster heating is in operation, the ATCM adjusts the number of elements being used accordingly, as detailed below:

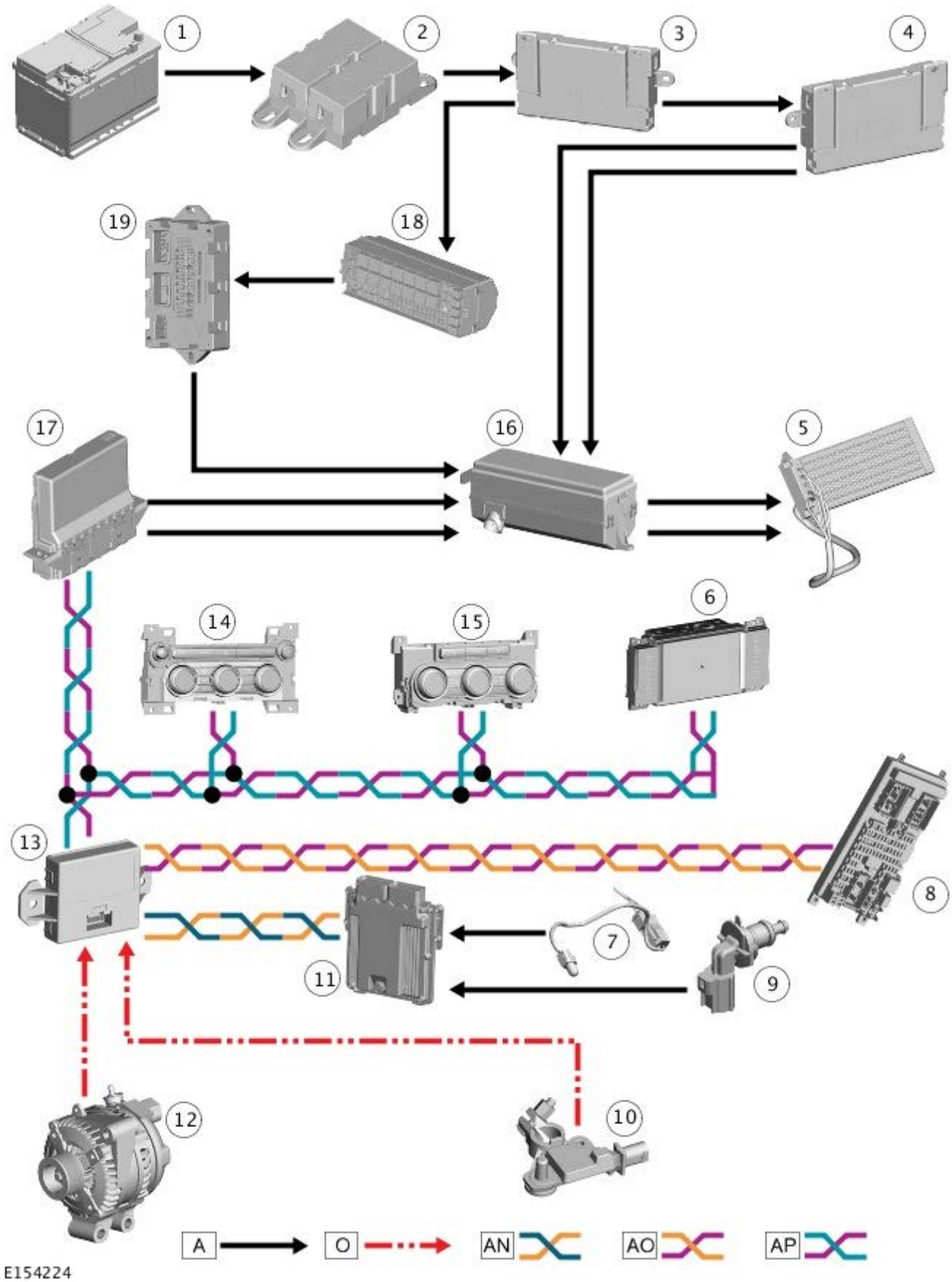
Battery Charge State (A)	Relay 1	Relay 2
10 or less	OFF	OFF
More than 10 and up to 60	ON	OFF
More than 60	ON	ON

The ATCM discontinues operation of the electric booster heater if the ambient temperature increases to 15 °C (59 °F), or any of the other required conditions ceases to exist.

The ATCM monitors the control circuits of the electric booster heater relays and records a DTC (Diagnostic Trouble Code) if it detects a short or open circuit. The load sides of the relays are not monitored, so any fault with these circuits or the electric booster heater will only be apparent by poor heating performance.

Control Diagram

NOTE: A = Hardwired, O = LIN (Local Interconnect Network) bus, AN = High speed CAN (Controller Area Network) bus, AO = Medium speed CAN Body bus, AP = Medium speed CAN Comfort bus.



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)
3	-	Battery Junction Box (BJB)
4	-	Auxiliary Junction Box (AJB)
5	-	Electric booster heater
6	-	Touch Screen (TS)
7	-	Ambient Air Temperature (AAT) sensor
8	-	Central Junction Box (CJB)

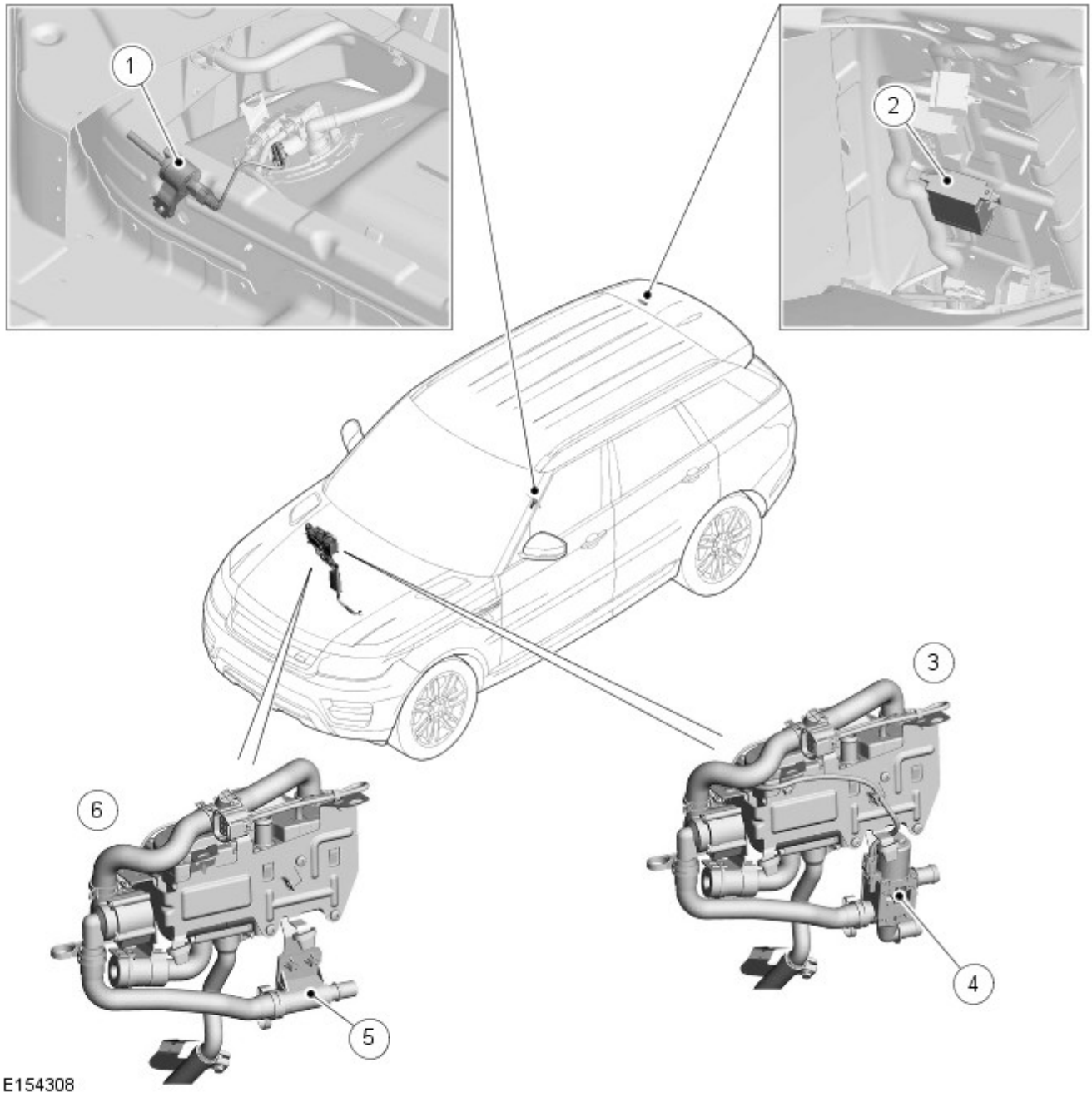
9	-	Engine Coolant Temperature (ECT) sensor
10	-	Battery Monitoring System (BMS) control module
11	-	Engine Control Module (ECM)
12	-	Generator
13	-	Gateway module (GWM)
14	-	Integrated Control Panel (ICP)
15	-	Rear Integrated Control Panel (RICP)
16	-	Engine Junction Box (EJB)
17	-	Automatic Temperature Control Module (ATCM)
18	-	Rear Junction Box (RJB)
19	-	Quiescent Current Control Module (QCCM)

Published: 26-Feb-2014

Auxiliary Climate Control - Fuel Fired Booster Heater

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Fuel Fired Booster Heater (FFBH) fuel pump (diesel installation shown, petrol installations similar)
2	-	Fuel Fired Booster Heater (FFBH) receiver (vehicles with timed climate control only)
3	-	Fuel Fired Booster Heater (FFBH) (vehicles with timed climate control)
4	-	Changeover valve (vehicles with timed climate control)
5	-	Coolant tube connector (vehicles without timed climate control)
6	-	Fuel Fired Booster Heater (FFBH) (vehicles without timed climate control)

OVERVIEW

Depending on model specification and market, the vehicle may incorporate auxiliary heating in the form of a FFBH (Fuel Fired Booster Heater). The FFBH boosts the temperature of the engine coolant supplied to the climate control assembly and, where fitted, the auxiliary climate control assembly.

Fuel for the FFBH is taken from the vehicle fuel tank, through a fuel line attached to the fuel pump module. A FFBH 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, which is circulated through the climate control assembly and, where fitted, the auxiliary climate control assembly, by a FFBH coolant pump.

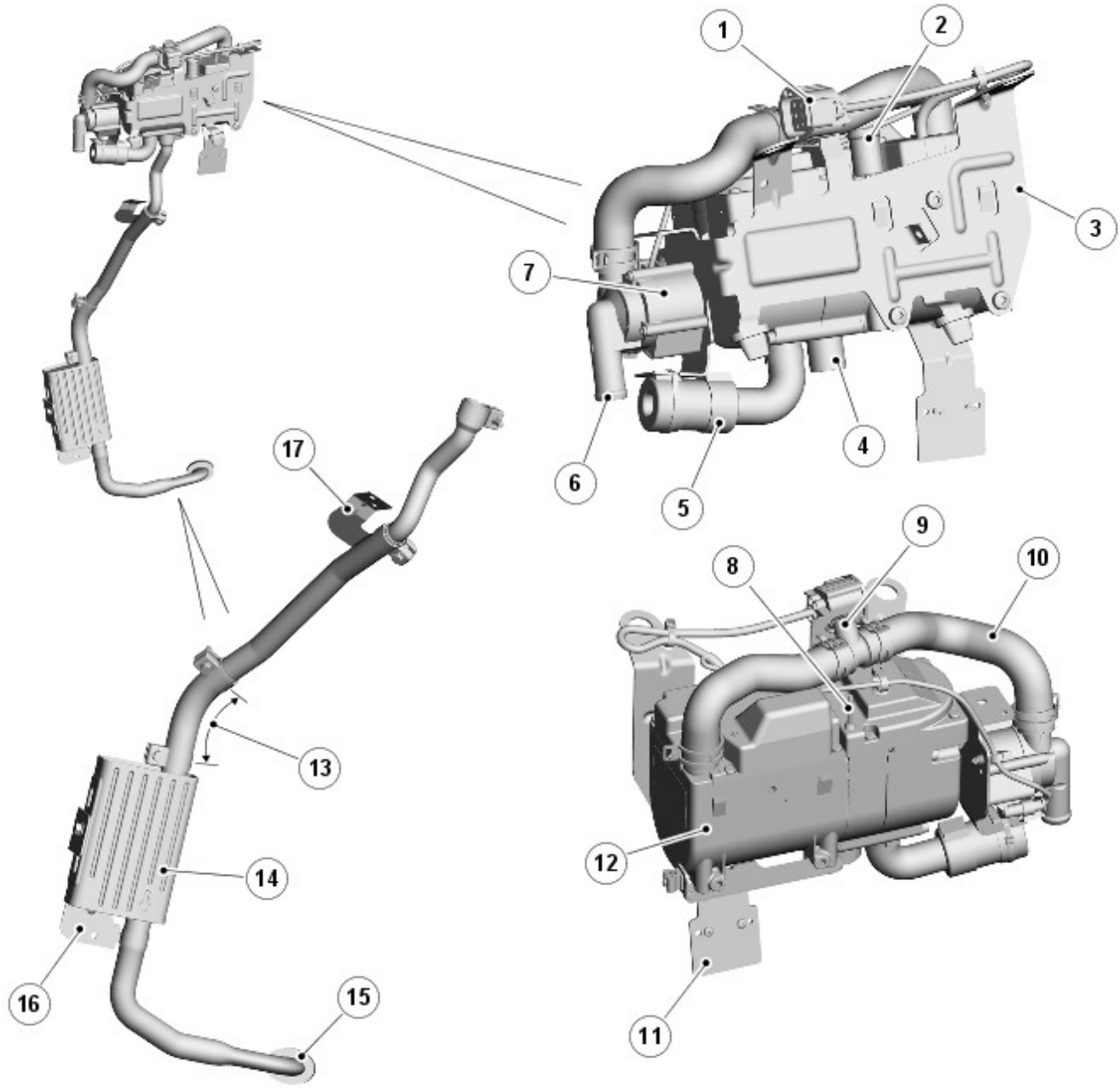
FFBH operation is automatic while the engine is running. Where timed climate control is incorporated, the FFBH can be selected to operate (depending on the ambient air temperature) while the vehicle is parked using the touch screen or a remote control.

Vehicles with timed climate control also incorporate:

- A FFBH receiver for communication with the remote control
- A changeover valve that allows the climate control coolant circuit to be isolated from the engine coolant circuit to reduce the warmup time of the passenger compartment.

DESCRIPTION

Fuel Fired Booster Heater



E148869

Item	Part Number	Description
1	-	Electrical connector
2	-	Coolant outlet
3	-	Support bracket
4	-	Exhaust outlet
5	-	Air intake hose
6	-	Coolant pump inlet
7	-	Coolant pump
8	-	Fuel inlet
9	-	Bleed screw
10	-	Coolant inlet hose

11	-	Coolant tube connector / changeover valve bracket
12	-	Fuel fired booster heater base unit
13	-	Exhaust flexible section
14	-	Muffler
15	-	Exhaust tailpipe bush
16	-	Muffler bracket
17	-	Exhaust bracket

The FFBH is installed in the engine compartment, on a support bracket attached to the rear of the right suspension housing. It is connected in series with the coolant supply to the climate control assembly. A flying lead on the FFBH connects it to the vehicle wiring. The FFBH consists of the following:

- A control module
- A combustion air fan
- A combustion chamber
- A heat exchanger
- A coolant pump
- An air intake hose and muffler
- An exhaust pipe and muffler.

CONTROL MODULE

The control module controls and monitors operation of the FFBH system. Power for the control module is provided by a permanent feed from the QCCM (Quiescent Current Control Module). A LIN (Local Interconnect Network) bus connection provides the communication link between the control module and the ATCM (Automatic Temperature Control Module). The control module also has:

- A ground connection
- Power feed and ground connections with the FFBH coolant pump
- A power feed connection with the FFBH fuel pump
- A signal line connection with the FFBH receiver (vehicles with timed climate control only).

COMBUSTION AIR FAN

The combustion air fan regulates the flow of air to the heater so as to ensure correct combustion. If the heater is operational while the engine is stopped or the heater enters the control idle phase, the air fan will continue to run in order to cool the combustion chamber in readiness for the next required start. The operation of the fan may be noticed during this process. This is perfectly normal.

COMBUSTION CHAMBER

The combustion chamber is located in the heat exchanger casing and the combustion air fan casing. The fuel feed pipe of the combustion chamber extends up through the cover of the combustion air fan. A glow plug is installed in the combustion chamber to provide the ignition source for the fuel:air mixture.

HEAT EXCHANGER

The heat exchanger transfers heat generated by the combustion chamber to the engine coolant. An overheating temperature sensor and a surface temperature sensor are installed in the heat exchanger and connected to the control module. The control module uses the temperature inputs to control system operation.

FFBH COOLANT PUMP

The FFBH coolant pump is an electric pump attached to outboard end of the FFBH support bracket. The pump intake is connected to either the heater coolant feed from the engine (vehicles without timed climate control) or to the changeover valve (vehicles with timed climate control). A hose, which incorporates a bleed screw, connects the outlet of the coolant pump to the coolant inlet of the FFBH.

The coolant pump runs continuously while the FFBH is in control idle or active operating modes. While the FFBH is inactive, coolant flow is reliant on the engine coolant pump.

AIR INTAKE HOSE AND MUFFLER

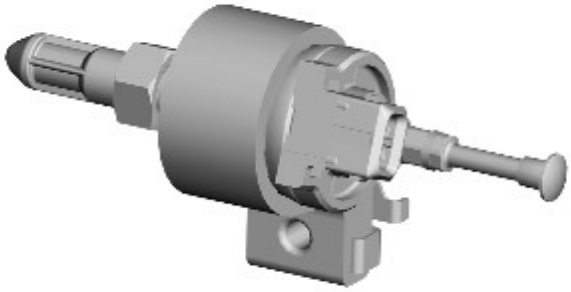
A canister type muffler and filter is incorporated into the air intake hose.

EXHAUST PIPE AND MUFFLER

The exhaust pipe and muffler directs exhaust combustion gases to atmosphere below the vehicle, to the rear of the right front wheel arch and towards the center of the vehicle. Exhaust vapor may be visible when the FFBH is running, depending on atmospheric conditions. Under normal operating conditions, the exhaust vapor will subside once the FFBH has achieved “Power status” and the exhaust pipe has reached normal operating temperature.

Under certain circumstances, for example after heater replacement or the disconnection of the fuel or coolant circuits, smoke may be visible from the general vicinity of the heater rather than the outlet of the exhaust. This may be as a result of residual fuel or coolant on the exhaust or heater body as a result of the service procedure. Under these circumstances, the heater must be run continually for 15-20 minutes until there are no signs of excessive smoke.

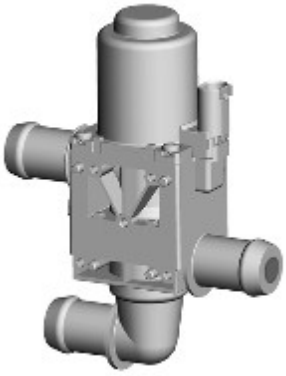
FFBH Fuel Pump



E148870

The FFBH fuel pump is installed in a rubber mounting attached to a crossmember under the rear floor, above the fuel tank. The pump is a self priming, solenoid operated plunger pump. The control module in the FFBH outputs a PWM (Pulse Width Modulation) signal to control the operation of the pump. When the pump is de-energized, it provides a positive shut-off of the fuel supply to the FFBH.

Changeover Valve (Vehicles With Timed Climate Control Only)

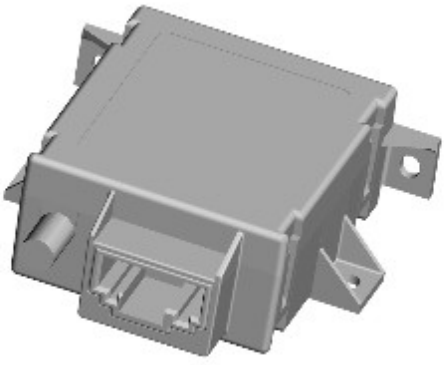


E148871

Where fitted, the changeover valve is attached to a bracket on the underside of the FFBH. 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.

Operation of the changeover valve is controlled by a power feed from the ATCM.

FFBH Receiver (Vehicles With Timed Climate Control Only)

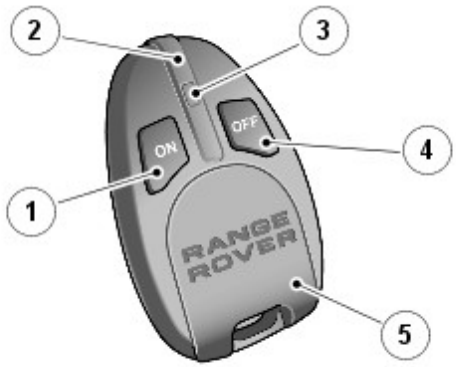


E148872

The FFBH receiver translates the FFBH remote control radio signals, relayed from the TV antenna amplifier, into a voltage output to the FFBH. When a request for timed climate control is received, the FFBH receiver outputs a battery power feed to the FFBH unit. When a request to switch off timed climate control is received, the FFBH receiver disconnects the power feed.

The FFBH receiver has a permanent power feed from the CJB (Central Junction Box) and is connected to the television antenna amplifier by a coaxial cable.
For additional information, refer to: Antenna (415-01 Information and Entertainment System, Description and Operation).

FFBH Remote Control (Vehicles With Timed Climate Control Only)



E148873

Item	Part Number	Description
1	-	ON switch
2	-	Antenna
3	-	Light Emitting Diode (LED) operating indicator
4	-	OFF switch
5	-	Battery cover

NOTE: Avoid touching the antenna when operating the ON or OFF switch. Covering the antenna will have an adverse affect on the transmitting range.

The FFBH remote control enables the timed climate control program to be activated and deactivated from outside the vehicle. The remote control has an approximate range of 100 m (328 ft). There is no need to point the remote control at the vehicle. Press and hold the ON button for approximately 2 seconds. The LED illuminates green to confirm that a timed climate program has been initiated. The LED continues to flash for a few seconds to indicate that the timed climate is active.

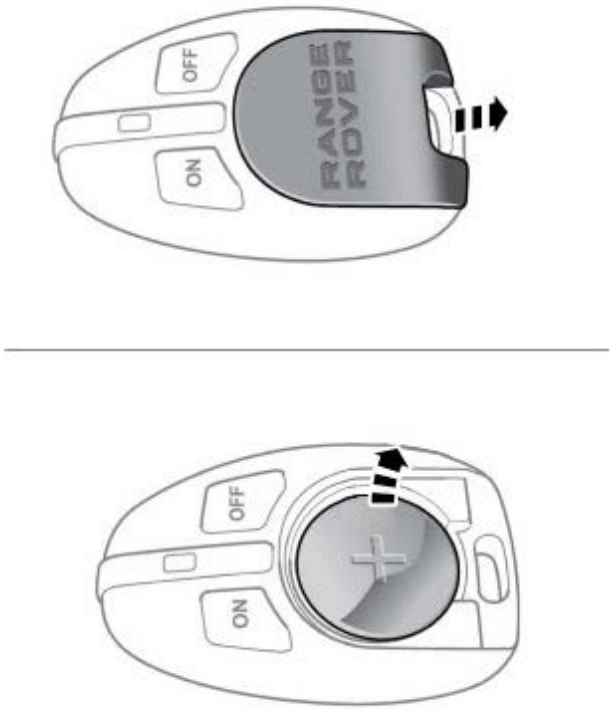
The timed climate program continues for 20-30 minutes, after which it switches off automatically to prevent the vehicle's battery from discharging. It also turns off automatically if the engine is started.

The LED indicator signals various states and conditions for the timed climate as follows:

- Illuminates green when the ON button is pressed and then quickly flashes green, to indicate that heater operation has been requested.
- Illuminates green followed by red when the OFF button is pressed, to indicate that the heater has been requested to shut down.
- Illuminates green and then quickly flashes red when either the ON or OFF button is pressed, to indicate that there is no communication with the receiver. This normally occurs if the vehicle is too far away.
- Illuminates green and then slowly flashes red when either the ON or OFF button is pressed, to indicate that there is an error.
- Flashes red when either the ON or OFF button is pressed, to indicate that the Timed climate remote battery needs replacing.

NOTE: The timed climate control program will only operate once per engine start to maintain battery condition.

REPLACING THE FFBH REMOTE CONTROL BATTERIES



E157943

With the front of the remote control facing upwards, press down on the rear of the battery cover and push completely off to reveal the battery compartment. Note that the battery should be inserted with the positive side facing upwards. Remove the old battery and ensuring that the correct polarity is maintained, insert a new, unused 3 volt CR2032 battery. Align and push the cover back to the original position.

FFBH REMOTE CONTROL PAIRING

Each FFBH remote control must be 'paired' to the FFBH receiver to enable communications. Each remote control has a unique identification number which is stored by the receiver. The receiver can store up 4 remote control identification numbers. If a fifth remote control is paired to the receiver, the receiver will overwrite the first paired remote control number.

Pair a remote control to the vehicle, as follows:

1. Remove fuse F1 (5A) from the CJB (Central Junction Box).
2. Wait for a minimum of 5 seconds.
3. Replace fuse F1 (5A) in the CJB then, within 5 seconds, press and hold the remote control OFF switch.
4. A successful pairing is indicated by the remote control LED illuminating red for 2 seconds.

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 FFBH receiver.

OPERATION

Fuel Fired Booster Heater

Operation of the FFBH is controlled by a status message from the ATCM (Automatic Temperature Control Module) to the control module. A similar status message, from the control module to the ATCM, advises the ATCM of the current operating status of the FFBH.

While the engine is running, if the ambient air temperature is less than 12°C (54°F) (Diesel) or 1°C (34°F) (Petrol) and the engine coolant temperature is less than 75°C (167°F) the ATCM changes the status message from 'heater off' to 'supplemental heat'. The control module then changes the status message it sends the ATCM to 'supplemental heat' and starts the FFBH.

If the engine is started and the FFBH is requested, the ATCM closes the recirculation door for the first 4 minutes or until the vehicle road speed exceeds 16 km/h (10 mph), after which time the ATCM opens the door to enable the ingress of fresh air. This feature is over ridden if the MAX demist switch on the ICP (Integrated Control Panel) is selected or if the ATCM detects a risk of misting of the windshield.

The FFBH will not start, or will discontinue operation, if any of the following occur:

- The control module is in the error lockout mode (see DIAGNOSTICS below).
- The engine stops running for approximately 4 seconds. The time delay is included for stall detection.
- The ATCM receives a 'fuel cut-off' message from the CJB on the medium speed CAN comfort and convenience systems, via the medium speed CAN (Controller Area Network) body systems and the GWM (Gateway

Module). The CJB sends the message if it receives a crash signal from the RCM (Restraint Control Module). For additional information, refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Description and Operation).

- The ATCM receives a low fuel level message from the CJB on the medium speed CAN comfort and convenience systems, via the medium speed CAN (Controller Area Network) body systems and the GWM (Gateway Module).
- The QCCM (Quiescent Current Control Module) disconnects the power supply to the FFBH. For additional information, refer to: Battery and Cables (414-01 Battery, Mounting and Cables, Description and Operation).

If the control module does not start the FFBH, or discontinues operation, the status message to the ATCM remains at, or changes to, 'heater off'.

If the ambient air temperature increases to 15°C (59°F) (Diesel) or 4°C (40°F) (Petrol) or the engine coolant temperature increases to 85°C (185°F), the ATCM cancels supplemental 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 ATCM to 'heater off'.

START SEQUENCE

At the beginning of a start sequence, the control module energizes the FFBH coolant pump then operates the following in a preset sequence to start the FFBH:

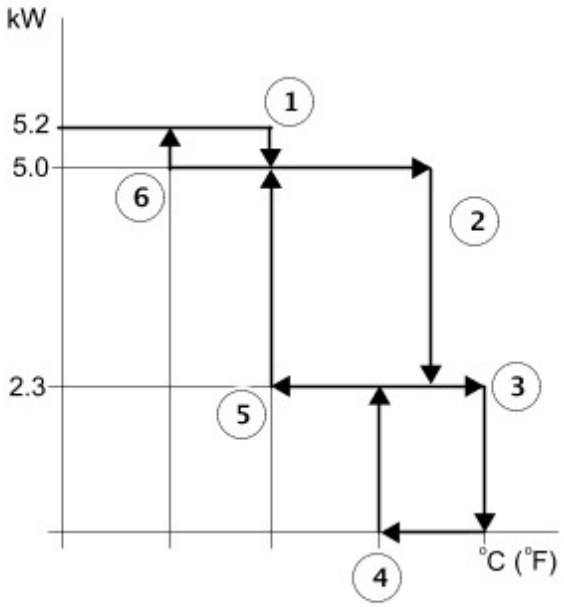
- The combustion air fan
- The glow plug
- The FFBH fuel pump.

Once combustion has stabilized, the control module switches off the glow plug. If the FFBH fails to ignite the control module repeats the start sequence.

COMBUSTION LOADS

While the FFBH is running, the control module cycles between power, high or low load combustion and a control idle phase of operation, depending on the temperature of the coolant in the heat exchanger. The heat output level at low load combustion is 2.3 kW. This rises to 5 kW at high load combustion and 5.2 kW at power load combustion. The control module transmits the amount of fuel used by the FFBH to the CJB, and the FFBH coolant temperature to the ATCM.

Switching Point Temperatures



E157985

Switching Point		Temperature, °C (°F)
Item Number	Description	
1	Power load to high load	65 °C (149°F)
2	High load to low load	80 °C (176°F)
3	Low load to control idle	85 °C (185°F)
4	Control idle to low load	75 °C (167°F)

5	Low load to high load	65 ºC (149ºF)
6	High load to power load	55 ºC (131ºF)

The switching point temperatures are for reference only and may vary depending on the fuel type and engine size.

After the start sequence, the control module maintains power load combustion until the coolant temperature reaches switching point temperature 1. At this temperature, the control module decreases the speed of the FFBH fuel pump and the combustion air fan to enable high load combustion. The control module maintains high load combustion while the coolant temperature remains between switching point temperatures 2 and 6. At high 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 6, the control module increases the speed of the FFBH fuel pump and the combustion air fan to full speed, to return to power load combustion. If the coolant temperature increases to switching point temperature 2, the control module decreases the speed of the FFBH fuel pump and the combustion air fan to enable low load combustion. At low load combustion the temperature of the coolant will again increase or decrease depending on the amount of heat required to heat the vehicle interior. If the coolant temperature decreases to switching point temperature 5 the control module increases the speed of the FFBH fuel pump and the combustion air fan to enable high load combustion. If the coolant temperature increases to switching point temperature 3, the control module enters a control idle phase of operation.

On entering the control idle phase, the control module immediately switches the FFBH fuel pump off, to stop combustion, and starts a timer for the combustion air fan. After a 90 seconds (diesel vehicles) or 120 seconds (petrol vehicles) 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 4. If the coolant temperature decreases to switching point temperature 4, the control module initiates a start to low load combustion.

SHUTDOWN

To stop the FFBH, the control module de-energizes the FFBH fuel pump to stop combustion, but continues operation of the combustion air fan and the coolant pump for a time, to cool down the FFBH. The cool down time is approximately 90 (diesel vehicles) or 120 (petrol vehicles) seconds.

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 Land Rover approved diagnostic equipment via the medium speed CAN Comfort 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 FFBH fuel pump, and stops the combustion air fan and coolant pump after the cool down time. Error lockout occurs for start sequence failures, combustion flameouts, heat exchanger casing overheat and if battery voltage is out of limits.

- 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 out of limits: Error lockout will occur if battery voltage is outside the limits of 10.5 to 16.0 volts.

The error lockout mode can be cleared using Land Rover approved diagnostic equipment, or by disconnecting the battery power supply to the FFBH for a minimum of 10 seconds.

Timed Climate Control

Where fitted, timed climate control provides a comfortable temperature in the passenger compartment of a vehicle parked with the engine off. When timed climate control operates, the passenger compartment is either heated by the FFBH and climate control blower (parked heating) or cooled by the climate control blower (parked ventilation), depending on the ambient air temperature. Parked heating occurs if the ambient air temperature is less than 16°C (61°F); parked ventilation occurs if the ambient air temperature is 16°C (61°F) or more. To prevent excessive drain on the battery, both parked heating and parked ventilation are automatically de-activated after 30 minutes.

In very cold conditions timed climate control also warms the engine to aid starting. Engine warming occurs if the ambient air temperature is -20 °C (-4 °F) or below.

When timed climate control is operating, the LED in the AUTO or A/C switch on the ICP will flash. If the AUTO switch LED flashes the engine or passenger compartment are being heated. If the A/C switch LED flashes the passenger compartment is being ventilated.

Timed climate control is controlled using either the touch screen or the FFBH remote control.

In order to minimize the potential for odor ingress from the FFBH, the ATCM will automatically close the recirculation door in the climate control assembly for the first 7 minutes of FFBH operation when activated by the timed climate control feature.

TOUCH SCREEN

The touch screen is used for direct selection of timed climate control or to program one or two 'on/off' cycle start-times per day, and one 'on/off' cycle start-time further in the future. The programmed start times are stored in the CJB. 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.

At a programmed start time or a direct selection on the touch screen, the CJB sends a start signal to the ATCM via the medium speed CAN body systems, GWM and medium speed CAN comfort and convenience systems. The ATCM module then initiates the appropriate mode of timed climate control operation.

To set a timed climate program:

- 1. Press the HOME MENU switch.
- 2. Touch the **Timed climate** soft key. This soft key may be set on a personal shortcut or accessed via the **Extra Features** soft key. Select 7 day timer, or single event, then select the timer soft key. If 7 day timer selected, then select the day for which you want to set a program. Alternatively, select **All week** to select the same start time for every day.
- 3. Touch the Timer 1 or Timer 2 soft key. The timers can be toggled between on and off using the power soft key.
- 4. Touch the up or down arrows to set the start time. Hours and minutes are adjusted separately.
- 5. Touch **OK**. The screen will display the activation time. If required, set the time for the other timer using the same process.
- 6. Once set, the timer events can be turned on or off as required in the Timed climate screen by selecting the 7 day timer or the single event soft key.

NOTES:

 Set times should to be programmed to start 30 minutes before the planned journey.

 Timed climate control will only operate once between engine starts. For example, a timed climate control request from the FFBH remote control will not be performed if a programmed timed climate control event has already occurred.

Any programmed timed climate control cycle may be cancelled by touching the relevant power soft key on the timer set up menu or the **Power** soft key on the **Timed climate** information home menu.

REMOTE CONTROL

When timed climate control is selected on or off with the FFBH remote control, the request is received by the FFBH receiver via the right TV antenna and the 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 ATCM on the LIN bus. The ATCM then initiates the appropriate mode of timed climate control operation.

A 'handshake' signal is sent back from the FFBH receiver to the remote control to confirm a valid on or off request and activate the remote control LED accordingly.

 NOTE: The ‘handshake’ signal only confirms remote control-FFBH receiver communications were successful, and not that the request has been performed.

TIMED CLIMATE CONTROL OPERATION

When the ATCM receives a timed climate control start request, its response depends on the ambient air temperature:

- If the ambient temperature is 16 °C (61 °F) or more, the ATCM 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.
- If the ambient temperature is less than 16 °C (61 °F) and more than -20 °C (-4 °F), the ATCM initiates parked heating and:
  - Energizes the changeover valve.
  - Sends a LIN 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.
- If the ambient temperature is -20 °C (-4 °F) or below, the ATCM sends a LIN 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 blower is switched on and passenger compartment heating commenced.

The FFBH will only activate in timed climate control if the following threshold conditions are met:

- Pre-burn battery voltage check: ≥11.5V (voltage at FFBH terminals).
- Pre-burn coolant temperature check: ≤15°C (internal FFBH measurement).
- Pre-burn fuel level check: ≥7.5 liters (value stored in FFBH at ignition off).

The fuel level value stored within the FFBH is only updated when the engine is running. When starting the FFBH in timed climate control with the engine off, the fuel level value used in the FFBH calculations will be that stored at the ignition off event. It is therefore possible for the FFBH to fail to operate in timed climate control if the engine was stopped with a low fuel level; if the fuel tank is subsequently refueled, the FFBH stored fuel level will still read low if the engine has not been started since refueling.

After 30 minutes, or if timed climate control is selected off with the touch screen or remote control, the ATCM discontinues timed climate control operation:

- If parked ventilation is active, the ATCM:
  - Switches off the blower.
  - Returns the distribution doors to the previous settings.
- If parked heating is active, the ATCM:
  - Sends a LIN 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.

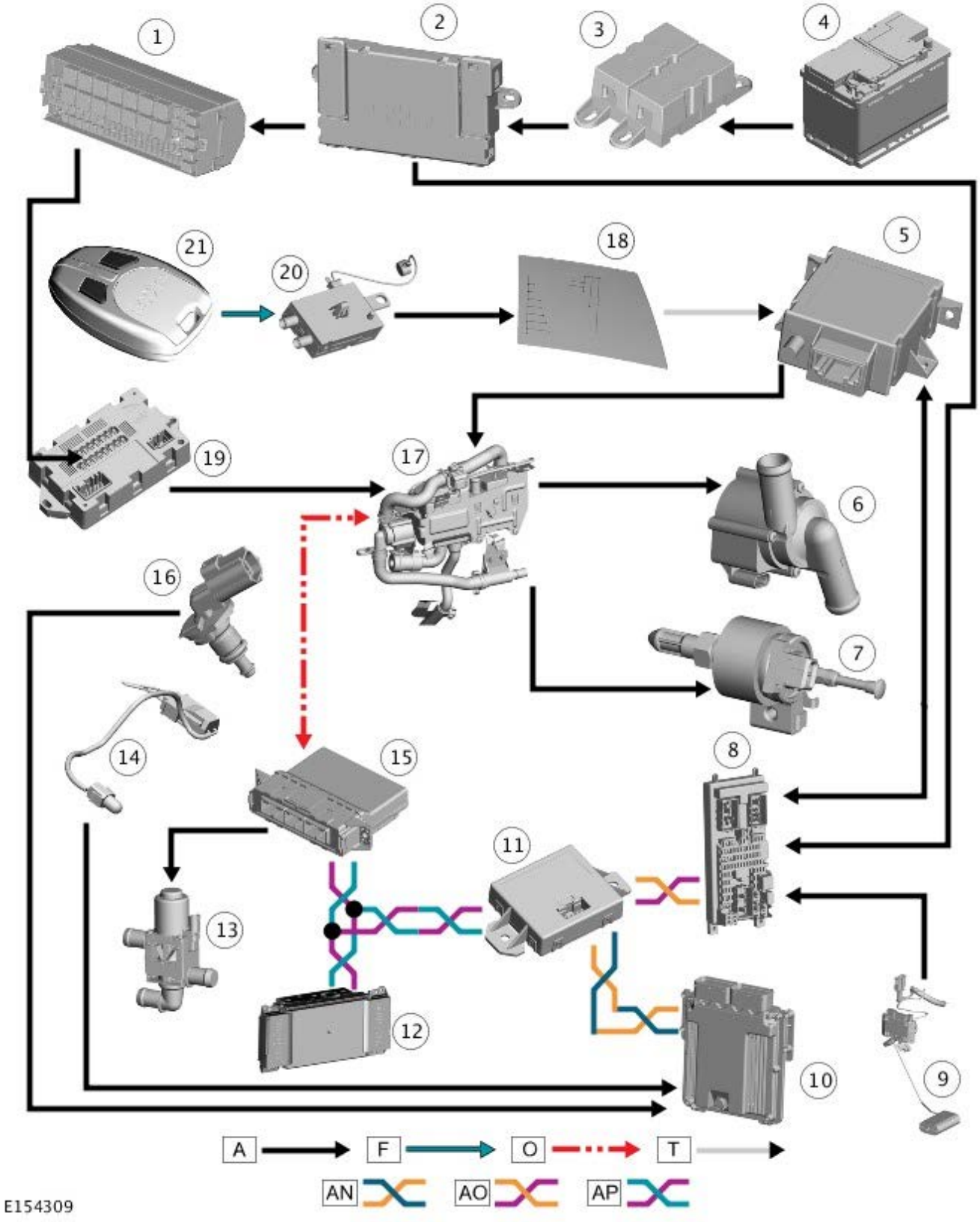
TRANSITION FROM TIMED CLIMATE CONTROL TO ENGINE RUNNING

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

Parked heating:

- Is de-activated when the engine starts if the engine coolant temperature is equal to or more than the heater coolant temperature.
- If the engine coolant temperature is less than the heater coolant temperature, parked heating remains active 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.

Control Diagram



A = Hardwired; F = RF transmission; O = LIN (Local Interconnect Network) bus; T = Co-axial cable; AN = High speed CAN powertrain systems; AO = Medium speed CAN body systems; AP = Medium speed CAN comfort and convenience systems.

Item	Part Number	Description
1	-	Rear Junction Box (RJB)
2	-	Battery Junction Box (BJB)
3	-	BJB 2
4	-	Battery
5	-	Fuel Fired Booster Heater (FFBH) receiver (vehicles with timed climate control only)
6	-	FFBH coolant pump
7	-	FFBH fuel pump

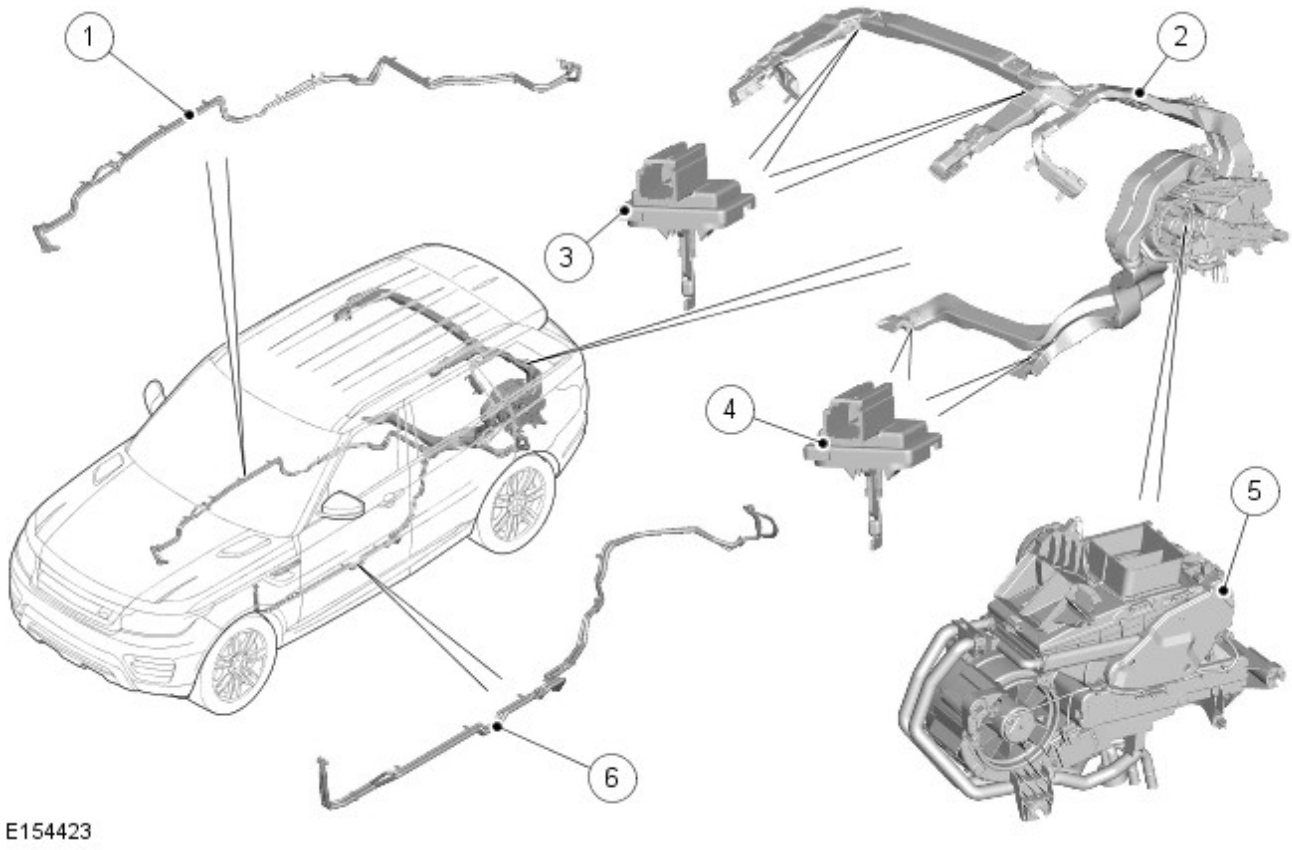
8	-	Central Junction Box (CJB)
9	-	Fuel level sensor
10	-	Engine Control Module (ECM)
11	-	Gateway Module (GWM)
12	-	Touch Screen (TS)
13	-	Changeover valve (vehicles with timed climate control only)
14	-	Ambient Air Temperature (AAT) sensor
15	-	Automatic Temperature Control Module (ATCM)
16	-	Engine Coolant Temperature (ECT) sensor
17	-	FFBH
18	-	Television antenna amplifier
19	-	Quiescent Current Control Module (QCCM)
20	-	Right television antenna
21	-	FFBH remote control (vehicles with timed climate control only)

Published: 02-May-2013

Auxiliary Climate Control - Auxiliary Climate Control

Description and Operation

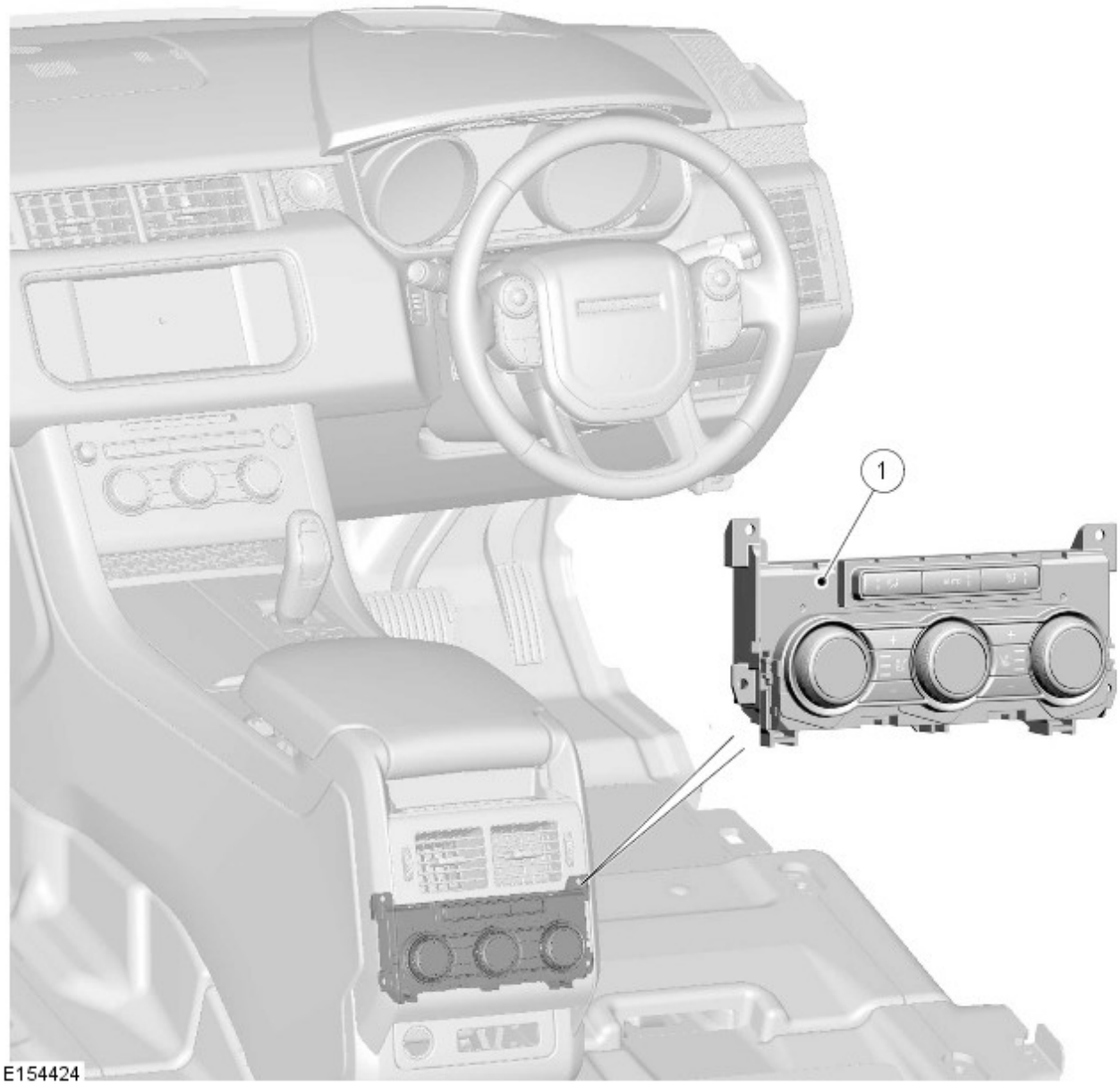
COMPONENT LOCATION - SHEET 1 OF 2



E154423

Item	Part Number	Description
1	-	Coolant pipes
2	-	Air distribution system
3	-	Duct air temperature sensor - face ducts (2 off)
4	-	Duct air temperature sensor - foot ducts (2 off)
5	-	Auxiliary climate control assembly
6	-	Air conditioning pipes

COMPONENT LOCATION - SHEET 2 OF 2



Item	Part Number	Description
1	-	Rear Integrated Control Panel (RICP)

OVERVIEW

The auxiliary climate control system provides additional air distribution vents and separate temperature zones for the left and right areas of the rear seats. The auxiliary climate control system consists of:

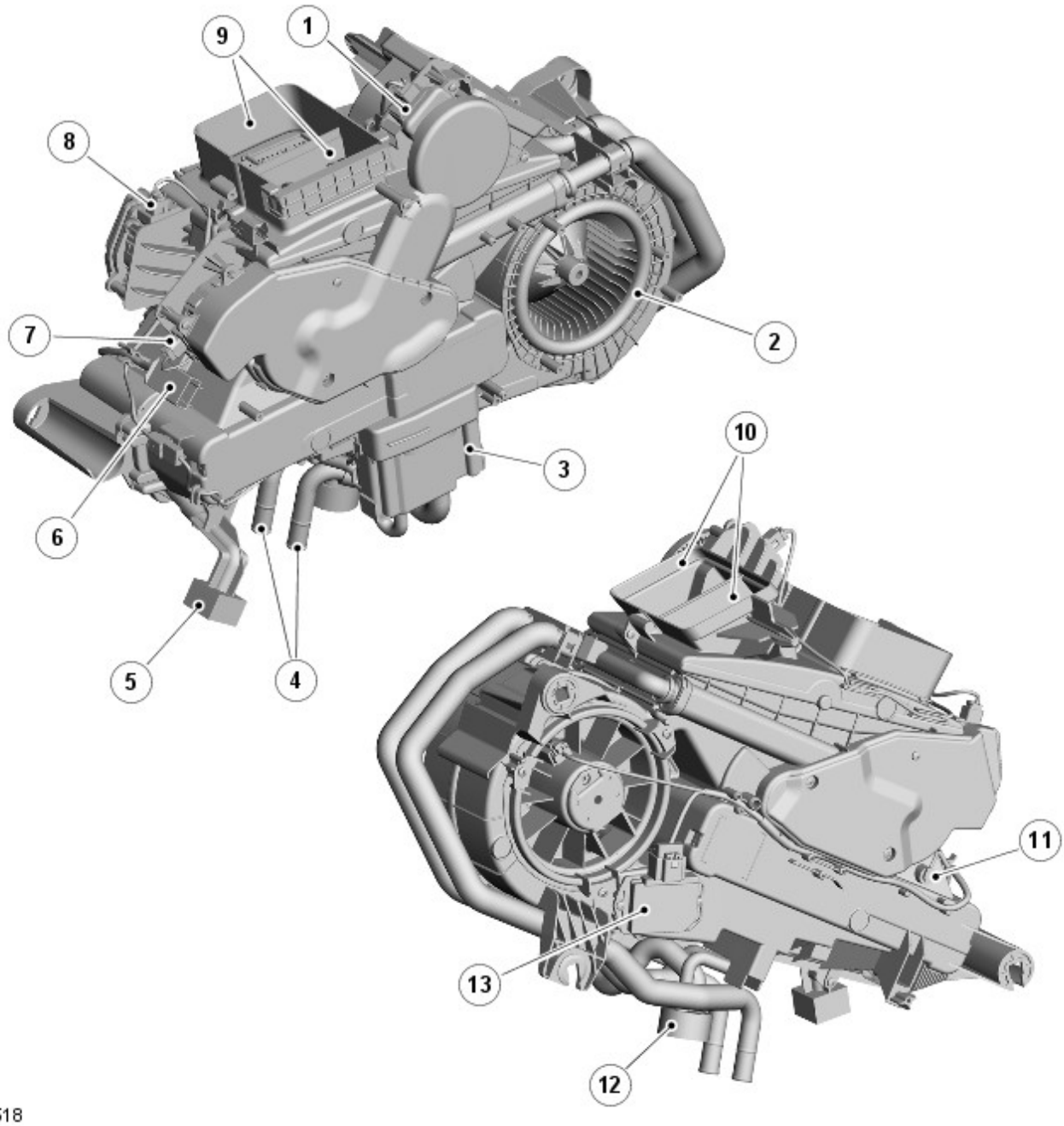
- An auxiliary climate control assembly.
- A refrigerant circuit.
- A heating circuit.
- A distribution system.
- The RICP (Rear Integrated Control Panel).

Operation of the auxiliary climate control system is controlled by the ATCM (Automatic Temperature Control Module), the RICP (Rear Integrated Control Panel) and the TS (Touch Screen).
For additional information, refer to: Control Components (412-01A Climate Control, Description and Operation).

Air from the passenger compartment is recirculated through the auxiliary climate control assembly, where the air is temperature regulated and then directed through the distribution system to vents in the headliner, the C pillar trim panels, and the carpet in front of the rear seats.

DESCRIPTION

Auxiliary Climate Control Assembly



E149518

Item	Part Number	Description
1	-	Distribution motor
2	-	Blower
3	-	Isolation valve
4	-	Coolant pipes
5	-	Evaporator drain tube
6	-	Electrical connector for vehicle harness
7	-	Right temperature blend motor
8	-	Left temperature blend motor
9	-	Face distribution outlets (to headliner and C pillar vents)
10	-	Foot level distribution outlets (carpet vents under the seats)
11	-	Evaporator temperature sensor
12	-	Air conditioning pipe connector block
13	-	Blower control module

The auxiliary climate control assembly is installed on the left side of the luggage compartment, behind the rear quarter trim panel. A grille in the trim panel allows air to flow from the luggage compartment into the auxiliary climate control assembly.

The auxiliary climate control assembly consists of a casing, formed from a pair of plastic moldings, which contains:

- An evaporator
- A heater core
- Temperature blend doors
- A distribution door

- A blower
- A blower control module
- An evaporator temperature sensor.

Refrigerant and coolant pipes from the engine compartment are connected to pipes from the evaporator and the heater core immediately below a seal plate in the rear left wheel arch. An evaporator drain tube, sealed with a foam rubber gasket, locates in the top of the left side member of the rear floor.

In the casing of the auxiliary climate control assembly, two parallel air steams flow from the blower through the evaporator and heater core to two pairs of distribution outlets. The left and right air streams supply the related rear zones of the passenger compartment. The front pair of distribution outlets supply the vents under the rear seats. The rear pair of distribution outlets supply the vents in the headliner and in the C pillar trim panels.

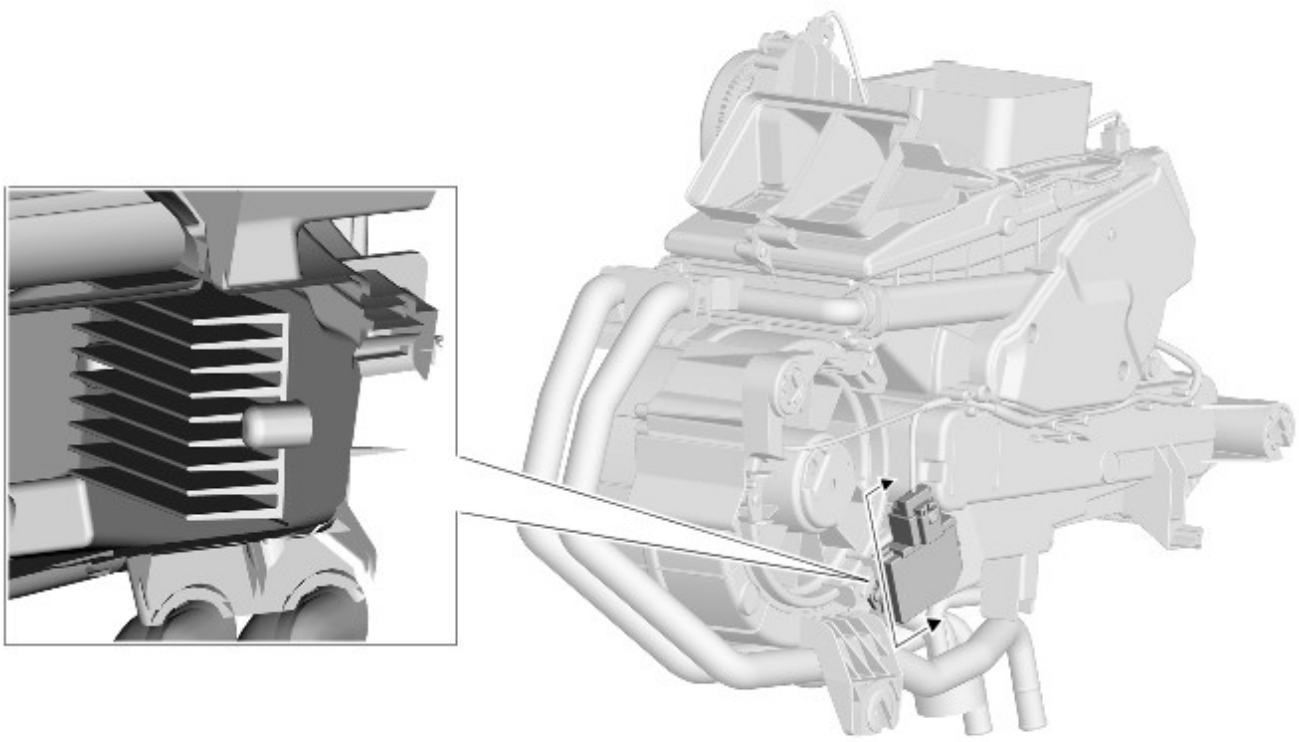
The left and right air streams each contain two temperature blend doors connected together with a link mechanism. Separate electric motors, installed on the rear of the casing, operate the temperature blend doors in each air stream to give independent temperature control for each rear climate zone.

The left and right air streams share a common distribution door installed below the distribution outlets. An electric motor, installed on the top of the casing, operates the distribution door.

A LIN (Local Interconnect Network) bus connects the distribution motor and the temperature blend motors in series with the ATCM. The motors are powered by feeds from the ATCM, and share a ground connection with the rear blower and rear blower control module.

The ATCM determines the positions of the distribution and temperature blend doors by using either their closed or open position as a datum and memorizing the steps that it drives the individual motors. Each time the ATCM is activated, it checks the memorized position of the motors against fixed values for the current distribution and temperature settings on the control panel. If there is an error, the ATCM calibrates the applicable motor, to re-establish the datums, by driving it fully closed or open before re-setting it to the nominal selected position. A calibration run can also be invoked using Land Rover approved diagnostic equipment.

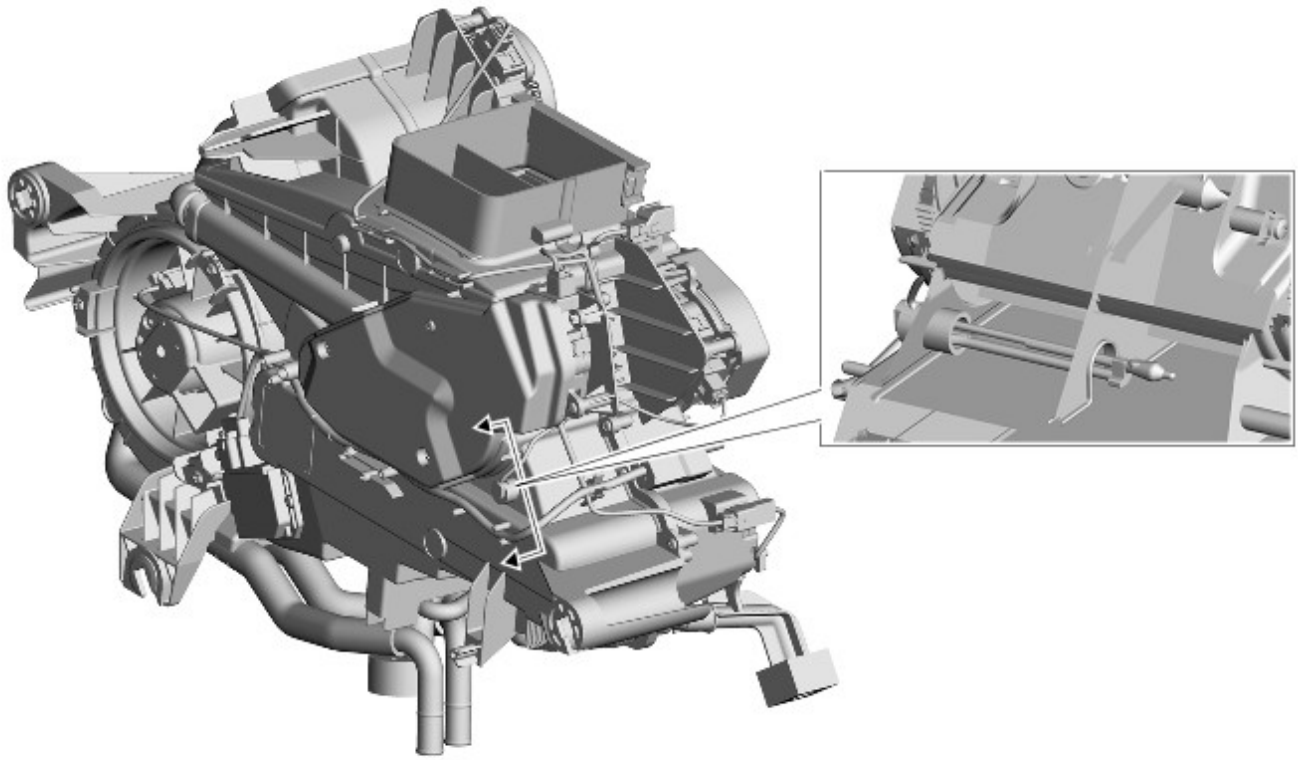
BLOWER CONTROL MODULE



E149519

The blower consists of an open hub, centrifugal fan powered by an electric motor. Power for the blower is supplied from the rear blower relay in the RJB (Rear Junction Box) via the blower control module, which is installed in the left side of the auxiliary climate control assembly, immediately downstream of the blower. To control blower speed, the ATCM outputs a PWM (Pulse Width Modulation) signal to the blower control module to regulate the voltage of the blower power supply.

EVAPORATOR TEMPERATURE SENSOR



E149520

The evaporator temperature sensor is installed in the auxiliary climate control assembly on the downstream side of the evaporator. The evaporator temperature sensor is a NTC thermistor connected to the rear integrated control panel.

Refrigerant Circuit

Low and high pressure pipes connect the front A/C (Air Conditioning) system to the auxiliary climate control assembly at a connector block in the left rear wheel arch, behind the wheel arch liner. On the auxiliary climate control assembly, pipes from the connector block are attached to an isolation valve on the evaporator.

AIR CONDITIONING PIPES

The A/C pipes consist of three sections of insulated pipe. The front and rear sections incorporate hoses at the ends that connect to the front A/C system and the auxiliary climate control assembly respectively. From the auxiliary climate control assembly, the A/C pipes are routed forward around the inboard side of the left rear wheel arch, then under the left edge of the floorpan to the rear of the left front wheel arch. The A/C pipes connect to the front climate control A/C system at a grommet in the wheel arch.

ISOLATION VALVE



E149521

The isolation valve is a combined solenoid operated shut-off valve and block-type thermostatic expansion valve attached to the inlet and outlet pipes of the evaporator. The ATCM controls the operation of the shut-off valve to isolate the auxiliary climate control assembly from the front A/C system.

Heater Circuit

Supply and return coolant pipes connect the engine cooling system to the heater core pipes of the auxiliary climate control assembly in the left rear wheel arch, behind the wheel arch liner.

The coolant pipes consist of sections of insulated rigid pipes connected together with flexible hose joints. Quick

release fittings connect the coolant pipes to the engine cooling system.

From the auxiliary climate control assembly, the coolant pipes are routed along the rear cross member and then forward under the right edge of the floorpan to the chassis longitudinal at the rear of the right front wheel arch liner.

Distribution System

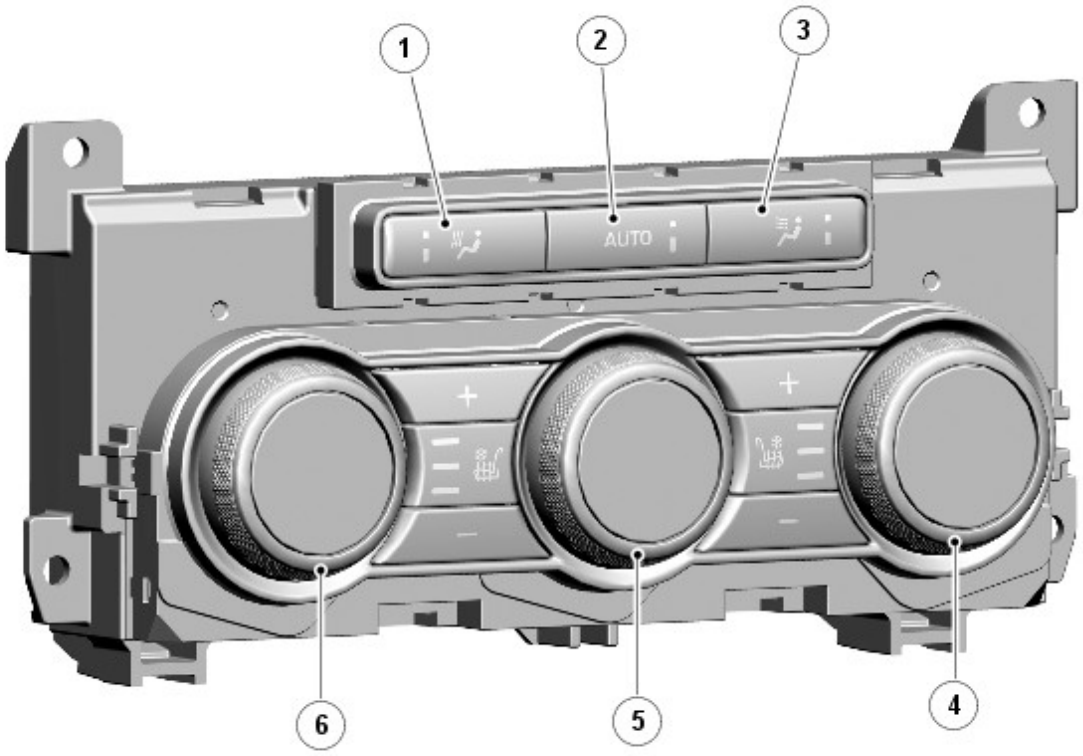
The distribution system consists of a network of air ducts that supply air from the distribution outlets of the auxiliary climate control assembly to the vents installed in:

- The headliner, above each rear door
- The left and right C pillar trim panel
- The carpet, below the left and right rear seats.

The vents in the headliner, and in the C pillar trim panel are adjustable, those in the carpet are fixed.

Four duct air temperature sensors are installed in the air ducts. Two sensors are installed in the left and right upper air ducts, to measure the air temperature of the headliner, and C pillar trim panel outlets. Two sensors are fitted in the lower air ducts, to measure the air temperature of the outlets below the seats. The sensors are NTC thermistors, which are connected to the RICP. The ATCM uses the data from the sensors in output temperature calculations for the related ducts.

Rear Integrated Control Panel



E141159

Item	Part Number	Description
1	-	Foot distribution switch
2	-	Automatic mode switch
3	-	Face distribution switch
4	-	Right temperature switch
5	-	Blower and on/off switch
6	-	Left temperature switch

The RICP is installed in the rear of the floor console. The control panel contains rotary and push button switches for controlling the temperature, volume and distribution of air ro the rear seats. Each push switch contains an amber status LED (Light Emitting Diode). Display screens are integrated into the center of the rotary switches to display the selected temperature and blower speed as appropriate.

Additional push switches on the RICP are provided for control of seat heating/climate control seats.
For additional information, refer to: Seats (501-10, Description and Operation).

The RICP has a permanent battery power feed from the CJB (Central Junction Box), and is connected to the medium speed CAN (Controller Area Network) Comfort bus. The RICP converts selections on the climate control switches into medium speed CAN Comfort messages, and transmits them to the ATCM. The RICP also receives inputs from the auxiliary climate system evaporator temperature sensor and four duct air temperature sensors. These inputs are also converted into medium speed CAN Comfort messages and transmitted to the ATCM module.

OPERATION

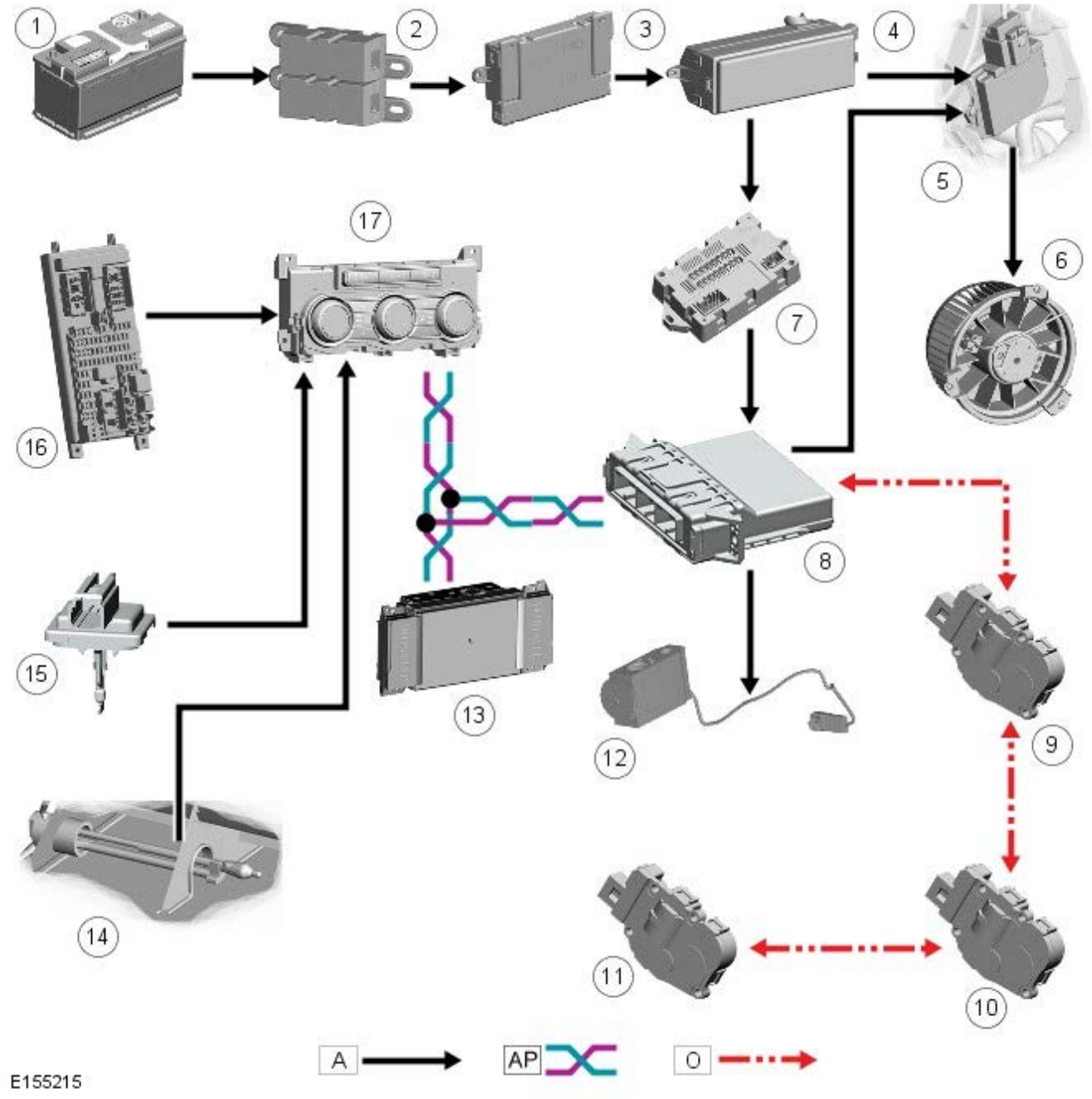
For the auxiliary climate control system to operate, the engine must be running and automatic mode selected on the RICP or the **Rear climate** menu of the TS. The ATCM then illuminates the LED in the RICP AUTO switch, energizes the isolation valve and the rear blower, and operates the temperature blend and distribution motors to maintain the temperatures selected on the RICP. If the main climate control system is not already operating, the ATCM also activates the A/C compressor and operates the main climate control system in automatic mode.

Once the auxiliary climate control system is operating, the blower, distribution and temperature can be adjusted as required on the RICP or the **Rear climate** menu of the touch screen. More than one distribution setting at a time may be selected to achieve the required air distribution.

The auxiliary climate control system can be selected off on the RICP, using the AUTO switch, or on the **Rear climate** menu of the TS. The **Rear climate** menu can also be used to lock the RICP to prevent operation of the auxiliary climate control system from the rear seats.

Control Diagram

NOTE: A = Hardwired, AP = Medium speed CAN (Controller Area Network) Comfort bus, O = LIN (Local Interconnect Network) bus.



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)
3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)

5	-	Blower control module
6	-	Blower
7	-	Quiescent Current Control Module (QCCM)
8	-	Automatic Temperature Control Module (ATCM)
9	-	Left temperature blend motor
10	-	Right temperature blend motor
11	-	Distribution motor
12	-	Isolation valve
13	-	Touch Screen (TS)
14	-	Evaporator temperature sensor
15	-	Duct air temperature sensor (4 off)
16	-	Central Junction Box (CJB)
17	-	Rear Integrated Control Panel (RICP)

Published: 10-Jun-2013

Auxiliary Climate Control - Electric Booster Heater

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

Some components shown removed for clarity.

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

All vehicles

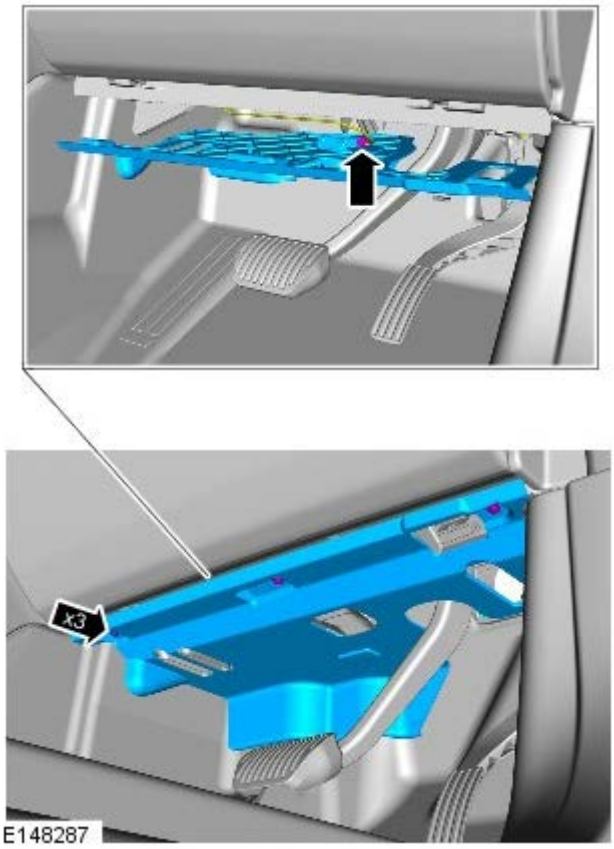
1. Disconnect the battery ground cable.

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

Right-hand drive vehicles

2. Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

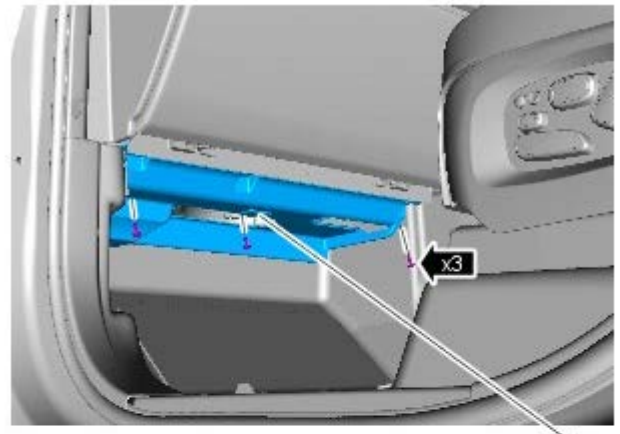
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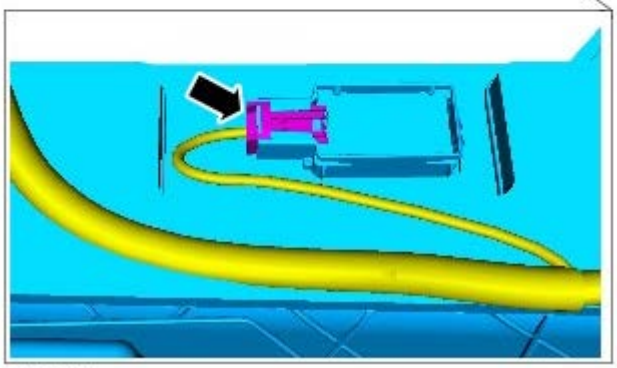


Left-hand drive vehicles

4. Refer to: Instrument Panel Lower Section (501-12 Instrument Panel and Console, Removal and Installation).

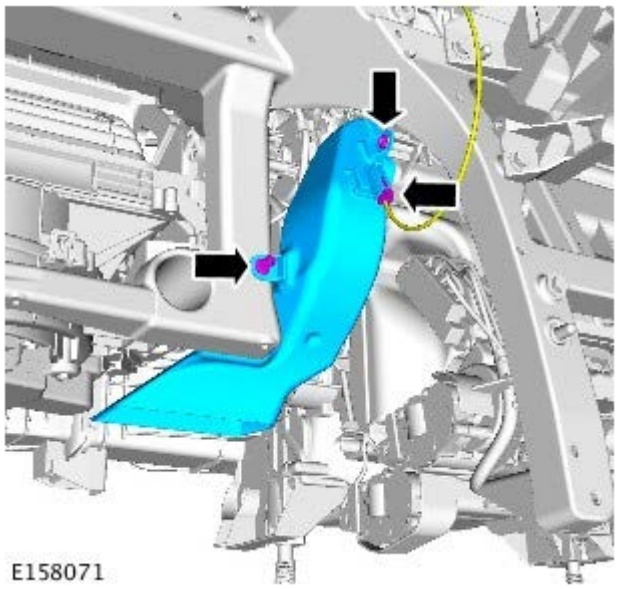
5. NOTE: Right hand drive illustration shown, Left hand drive is similar.





E146055

All vehicles

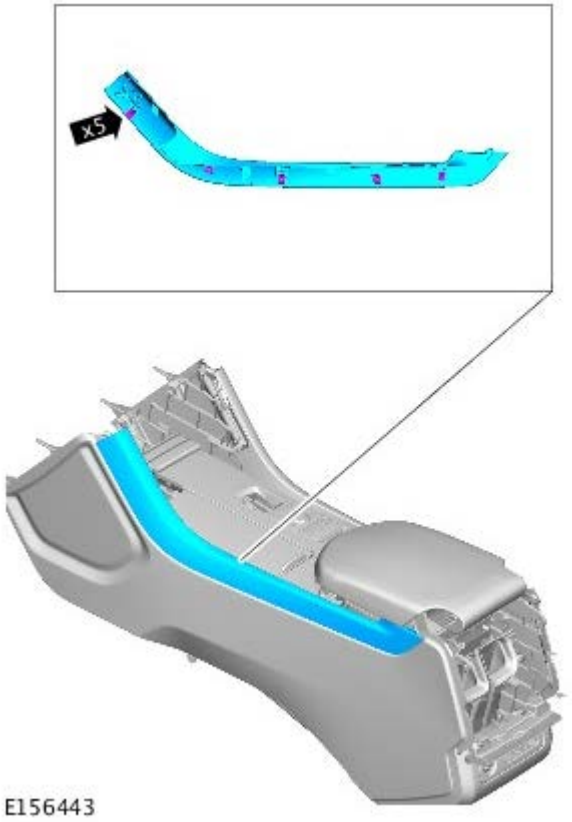


E158071

6. NOTE: Right hand drive illustration shown, Left hand drive is similar.

7. NOTE: Left hand illustration shown, Right hand is similar.

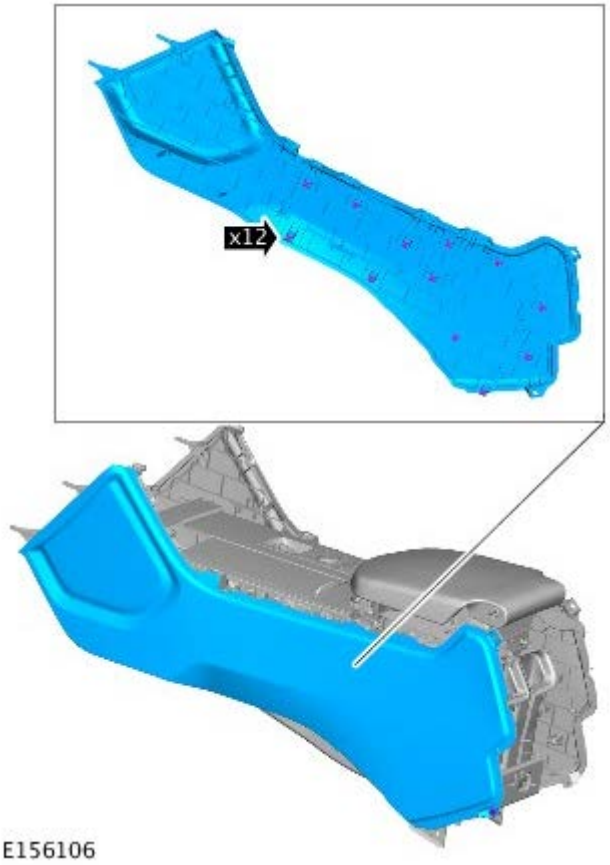
Remove Right hand trim



E156443

8. NOTE: Left hand illustration shown, Right hand is similar.

   Remove Right hand trim

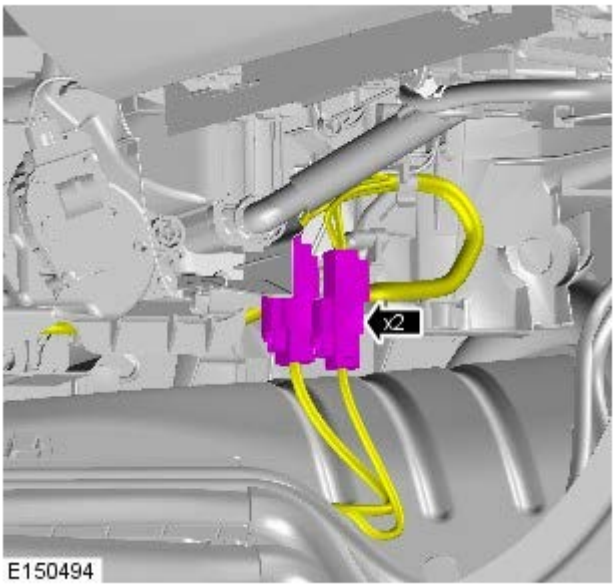


E156106

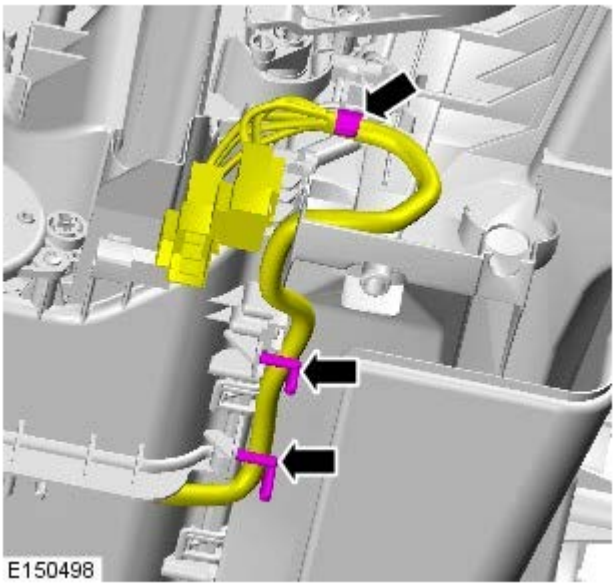
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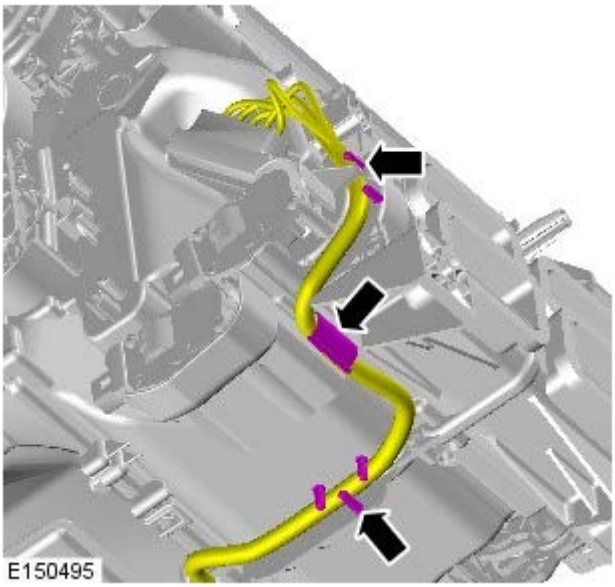
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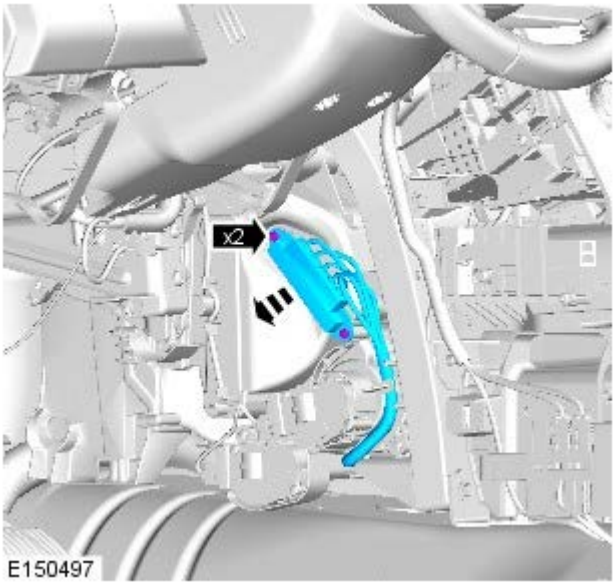
11.



12.



13.



Installation

1. To install, reverse the removal procedure.

Published: 23-Oct-2013

Auxiliary Climate Control - Fuel Fired Booster Heater

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. 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.

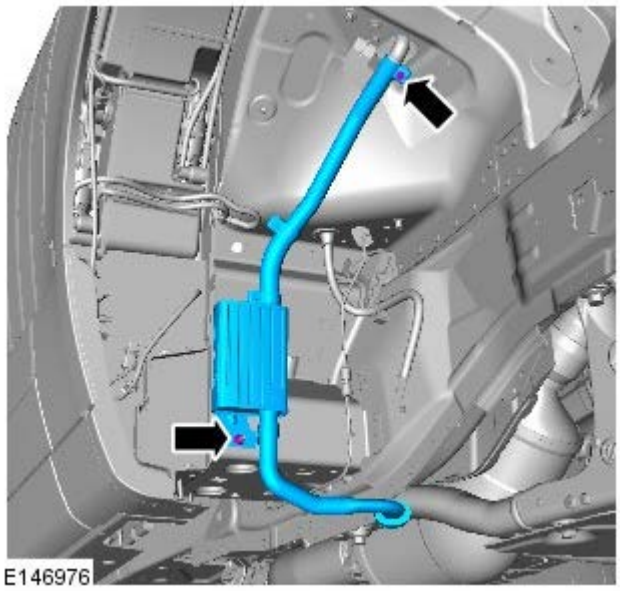
3. Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03F Engine Cooling - TDV8 4.4L Diesel, General Procedures).
   Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03A Engine Cooling - TDV6 3.0L Diesel, General Procedures).
   Refer to: Cooling System Partial Draining, Filling and Bleeding - V8 S/C 5.0L Petrol (303-03C Engine Cooling - V8 S/C 5.0L Petrol, General Procedures).

4. Refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).

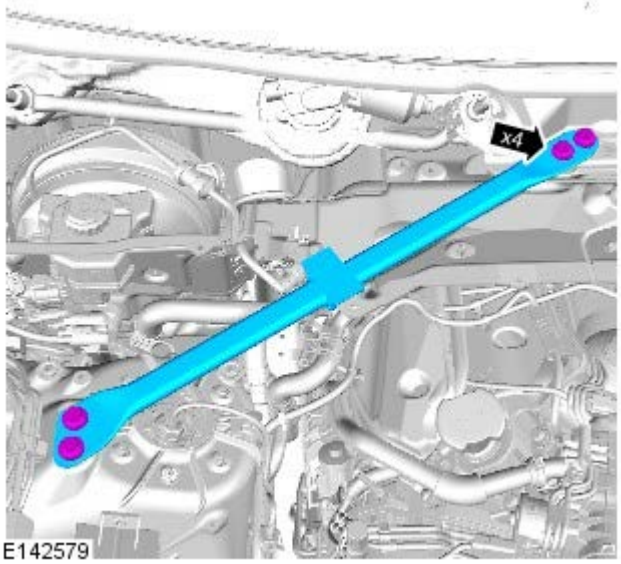
5. Remove the RH fender splash shield.

   Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

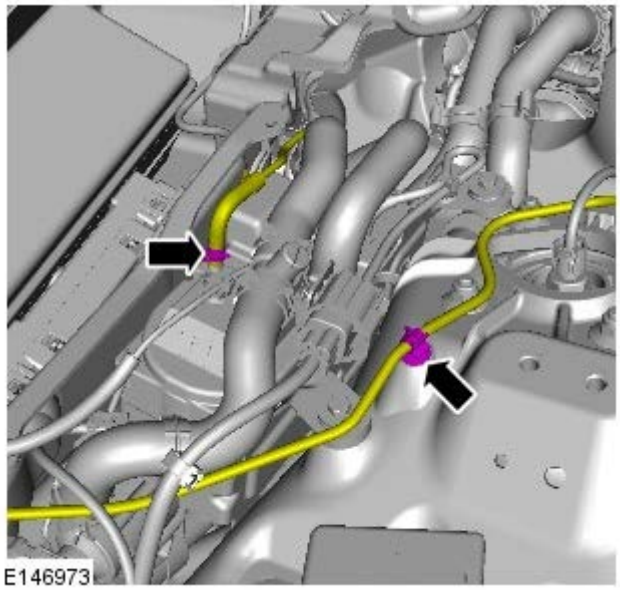
6. *Torque:* 10 Nm



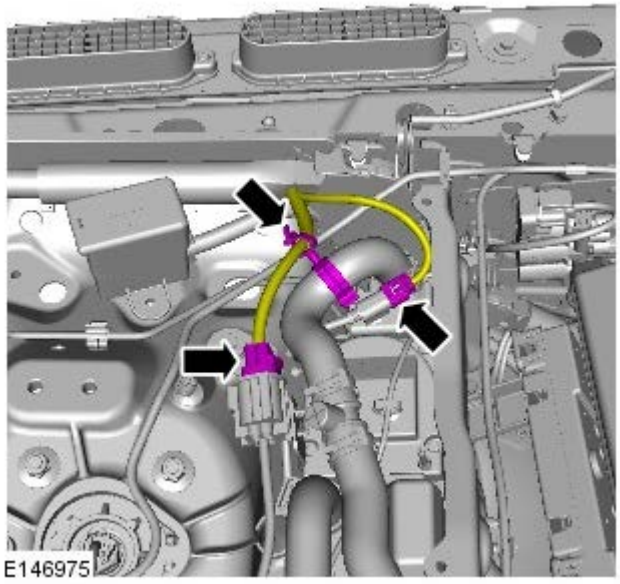
7. *Torque:* 55 Nm



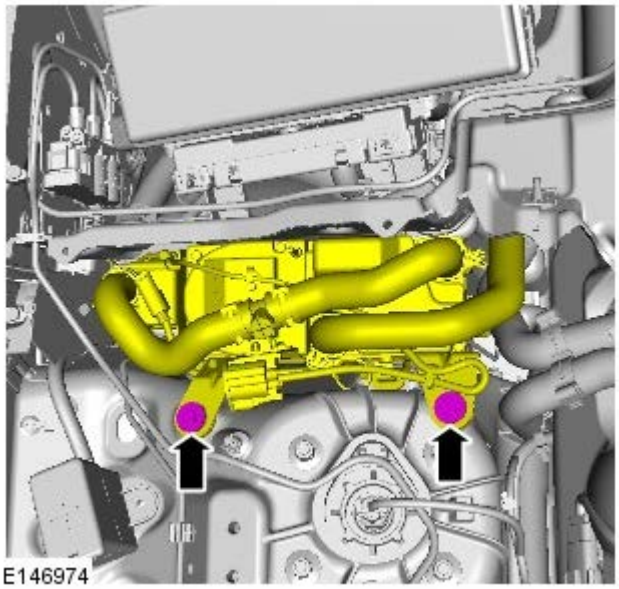
8. CAUTION: Be prepared to collect escaping fuel.



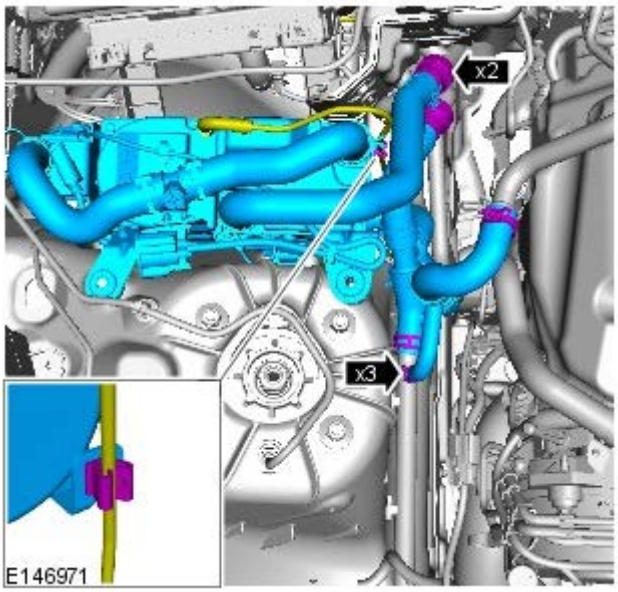
9.



10. *Torque:* 10 Nm

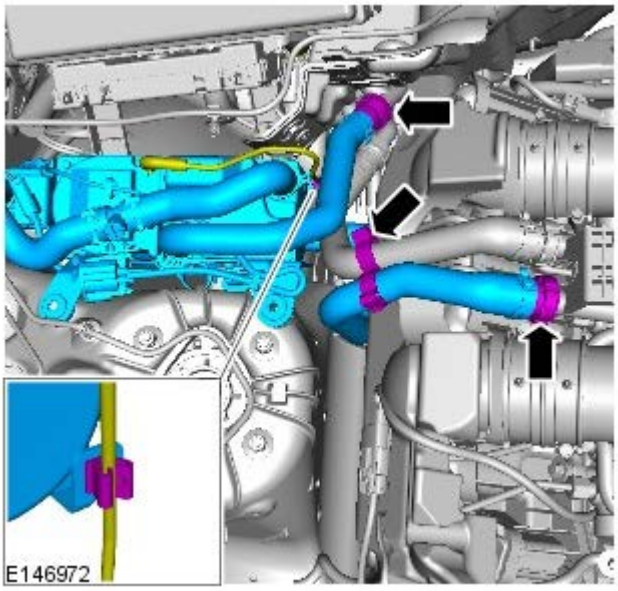


NOTE: Vehicles with 3.0L diesel engine.



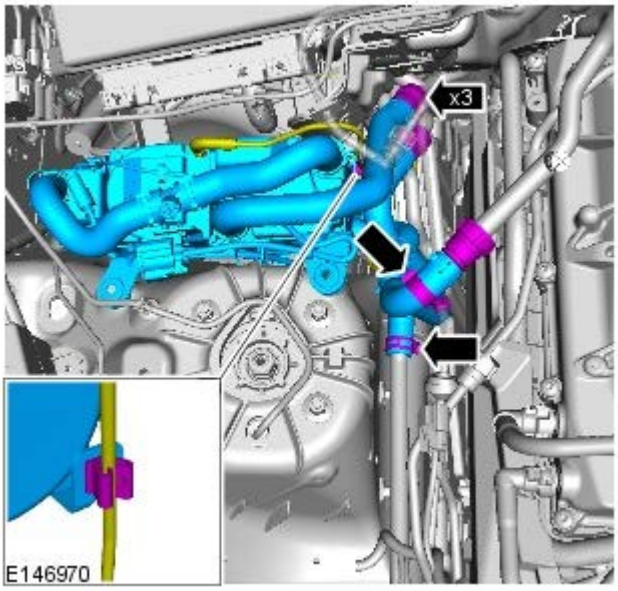
11. CAUTION: Be prepared to collect escaping coolant.

NOTE: Vehicles with 4.4L diesel engine.



12. CAUTION: Be prepared to collect escaping coolant.

NOTE: Vehicles with 5.0L engine.



13. CAUTION: Be prepared to collect escaping coolant.

Installation

1. To install, reverse the removal procedure.

Published: 24-Feb-2013

Auxiliary Climate Control - Fuel Fired Booster Heater Coolant Pump

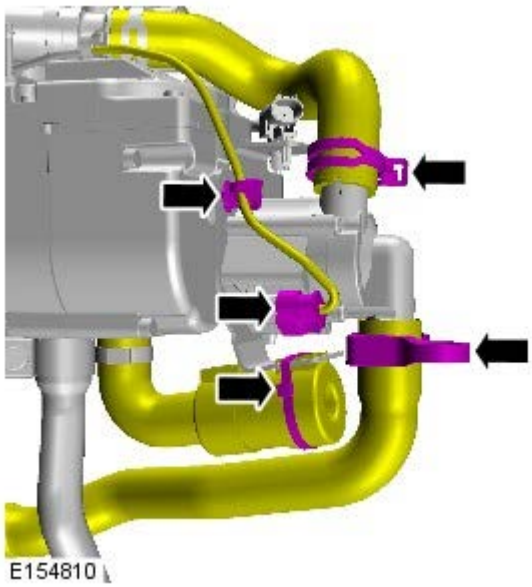
Removal and Installation

Removal

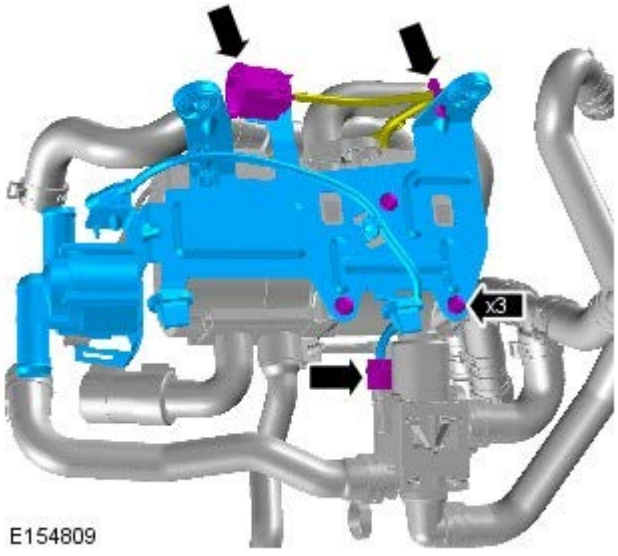
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Fuel Fired Booster Heater (412-02A Auxiliary Climate Control, Removal and Installation).

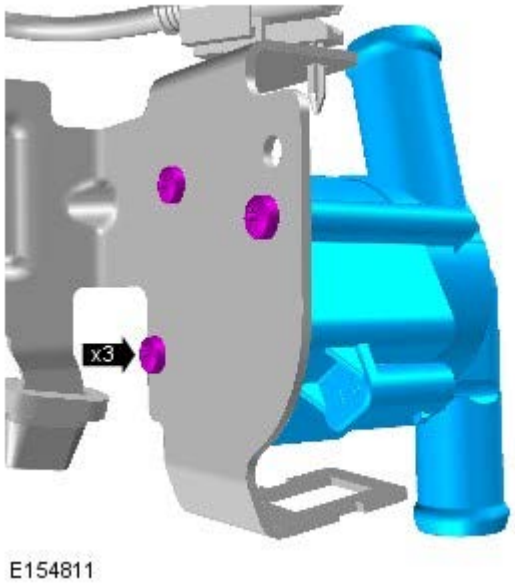
2.



3.



4. *Torque:* 1.5 Nm



E154811

Installation

1. To install, reverse the removal procedure.

Published: 18-Mar-2013

Auxiliary Climate Control - Fuel Fired Booster Heater Flame Sensor

Removal and Installation

Removal

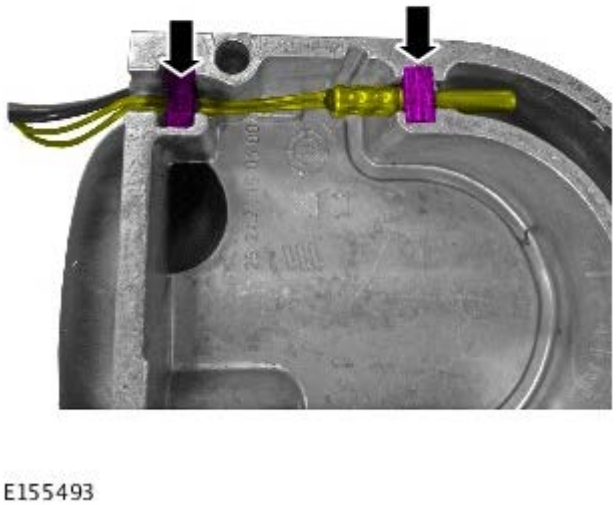
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Fuel Fired Booster Heater Combustion Chamber (412-02A Auxiliary Climate Control, Removal and Installation).

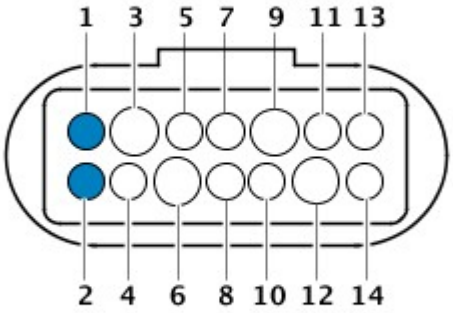
2.



3.



4. NOTE: Remove the terminals from the connector as indicated in order to replace the component.



E155492

Installation

1. CAUTION: Remove and discard the seals.

   NOTE: Install new seals.

   To install, reverse the removal procedure.

Published: 02-May-2013

Auxiliary Climate Control - Fuel Fired Booster Heater Fuel Pump

Removal and Installation

Removal

CAUTIONS:

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

If a new fuel pump is to be installed, make sure that the blanking caps are not removed prior to installation.

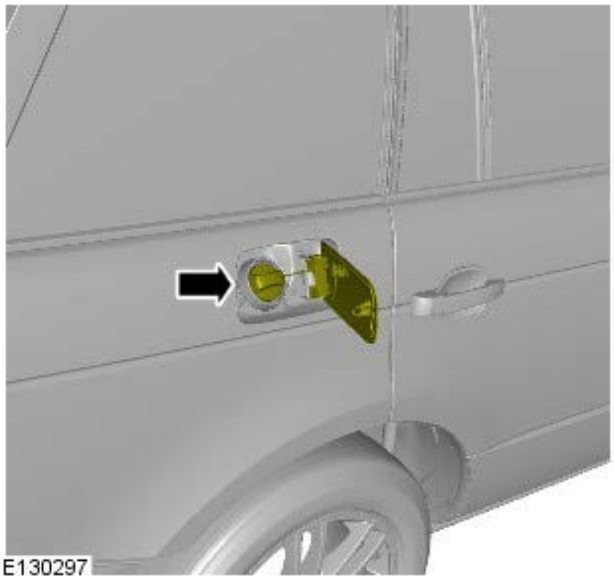
NOTE: Removal steps in this procedure may contain installation details.

All vehicles

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Disconnect the battery ground cable.

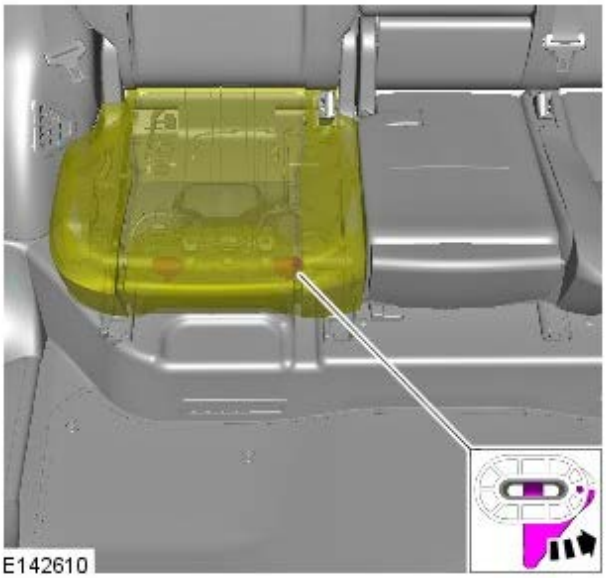
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).


E130297

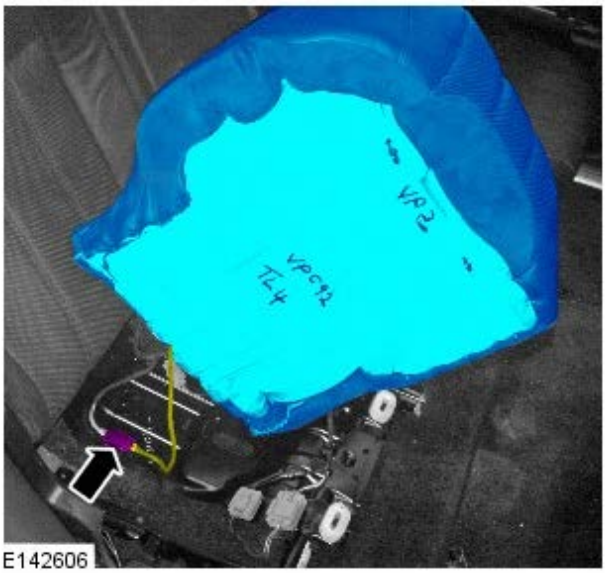
3. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Vehicles without occasional rear seats

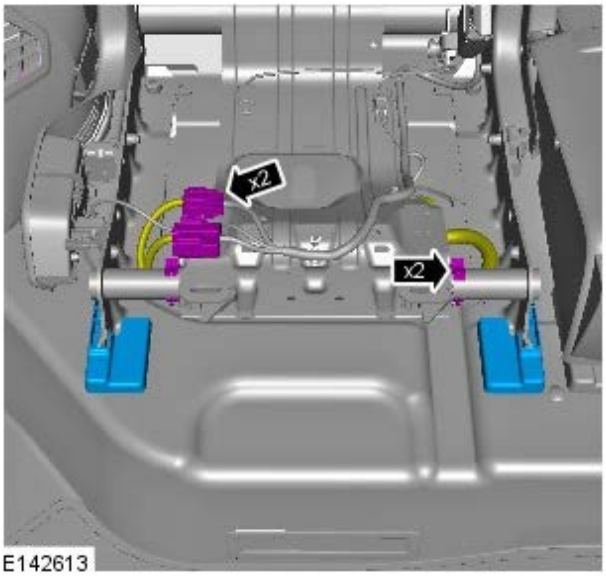
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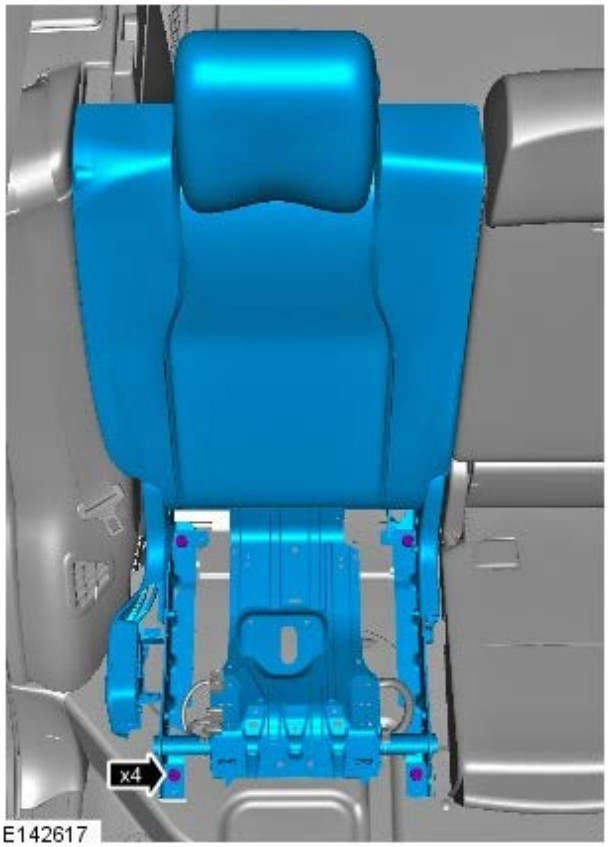
5.



6.



7. *Torque:* 50 Nm

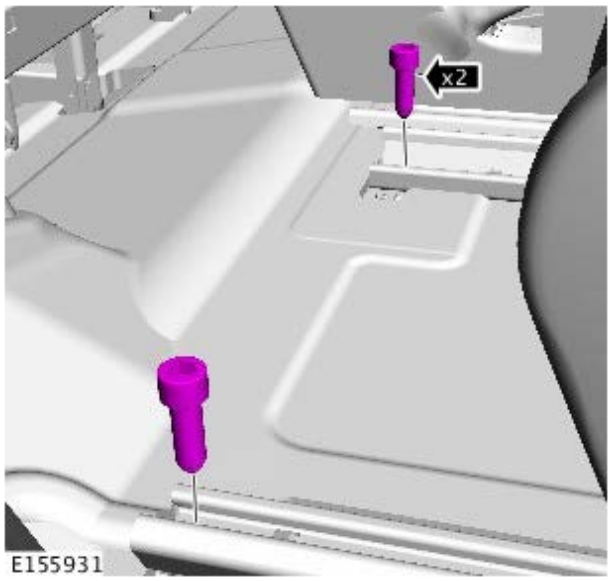


Vehicles with occasional rear seats

8.



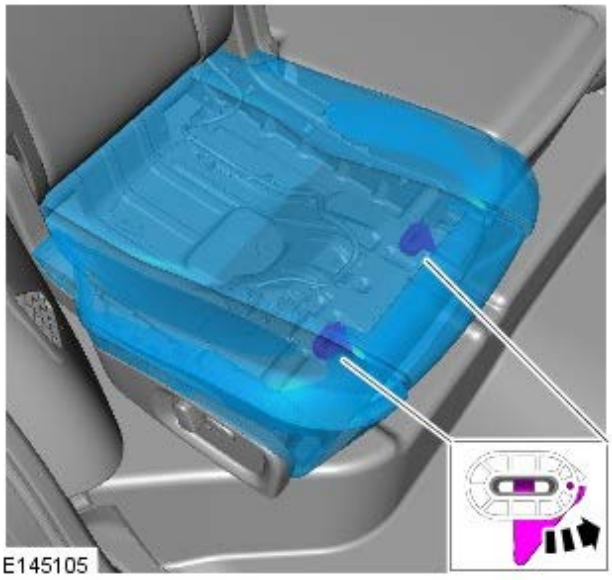
9. *Torque:* 50 Nm



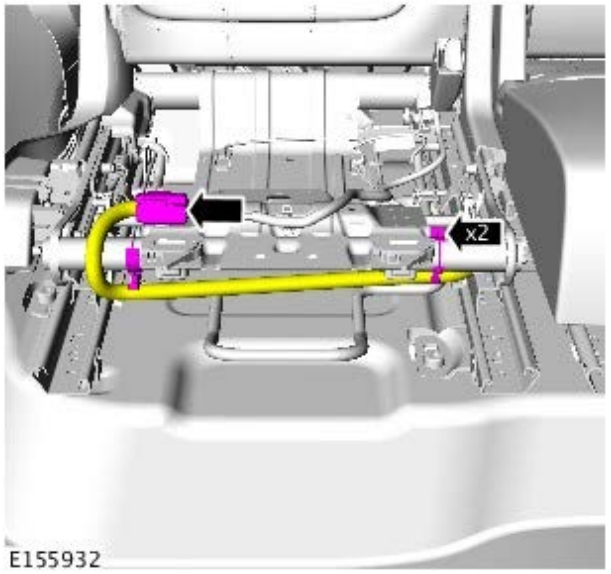
10.



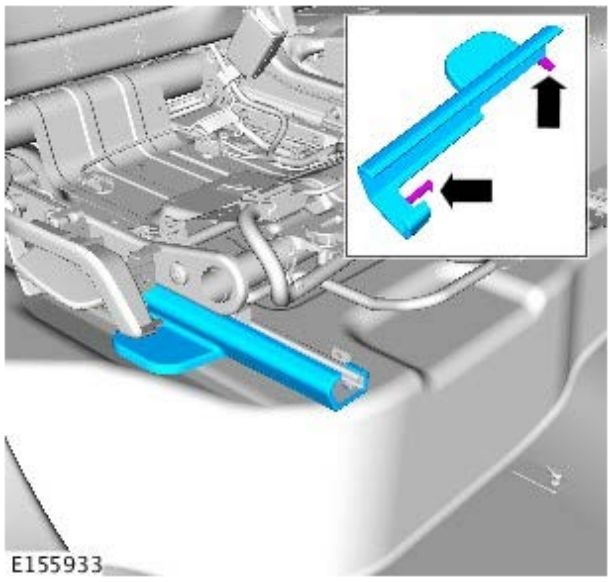
11.



12.



13.

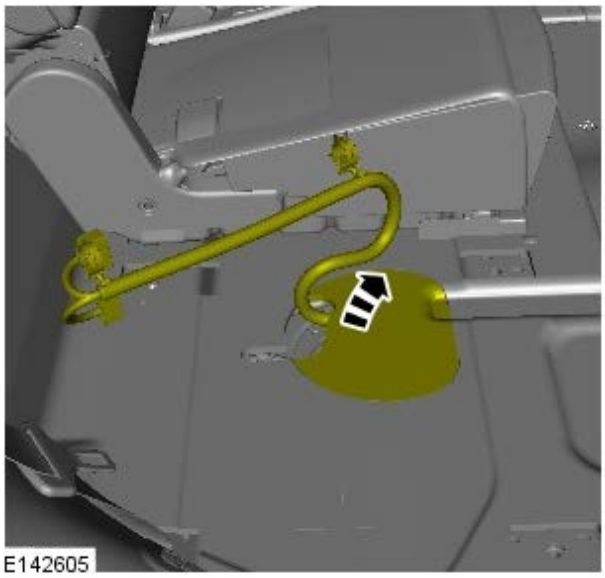


14. *Torque:* 50 Nm

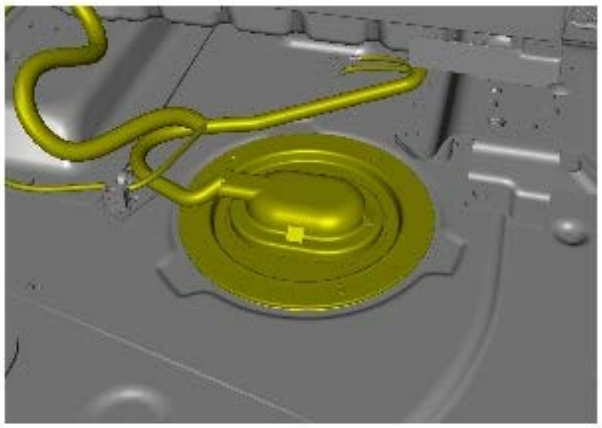


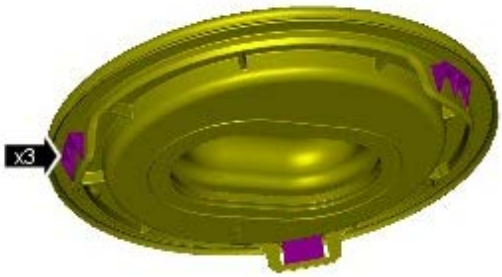
All vehicles

15.



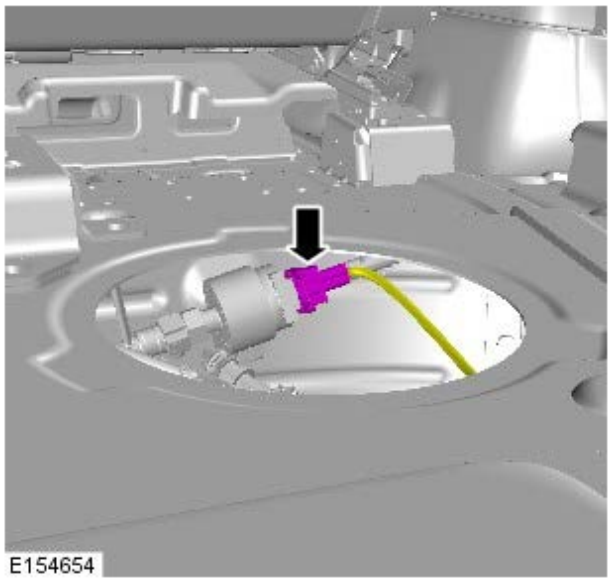
16.



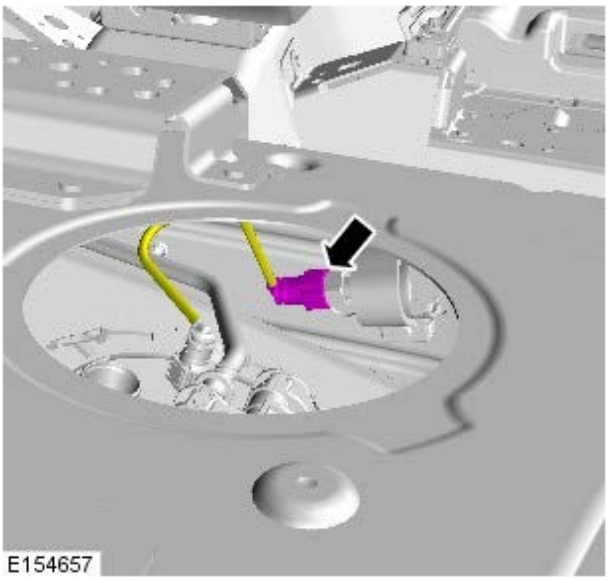


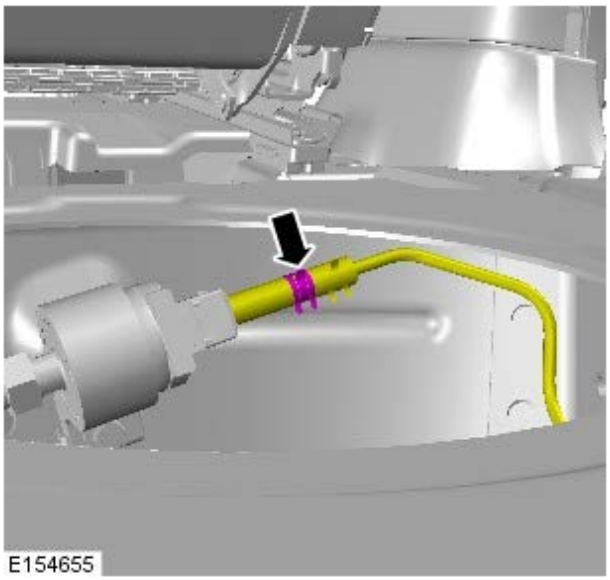
E142604

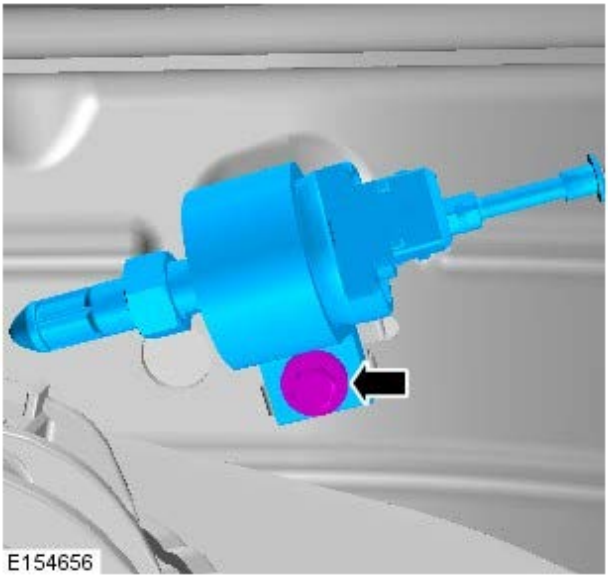
17.



18. CAUTION: Be prepared to collect escaping fuel.







19. CAUTION: Be prepared to collect escaping fuel.

20. *Torque:* 9 Nm

Installation

1. NOTE: Make sure that the fuel pipes do not contact the vehicle body.

   To install, reverse the removal procedure.

Published: 18-Mar-2013

Auxiliary Climate Control - Fuel Fired Booster Heater Glow Plug

Removal and Installation

Removal

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

1. Refer to: Fuel Fired Booster Heater Heat Exchanger (412-02A Auxiliary Climate Control, Removal and Installation).

2.



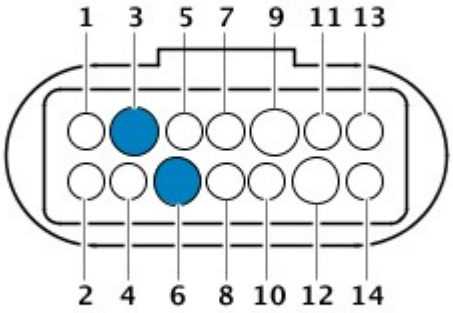
E155489

3.



E155482

4. NOTE: Remove the terminals from the connector as indicated in order to replace the component.



E155488

Installation

1. CAUTION: Remove and discard the seals.

   NOTE: Install new seals.

   To install, reverse the removal procedure.

Published: 16-May-2013

Auxiliary Climate Control - Auxiliary Blower Motor

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

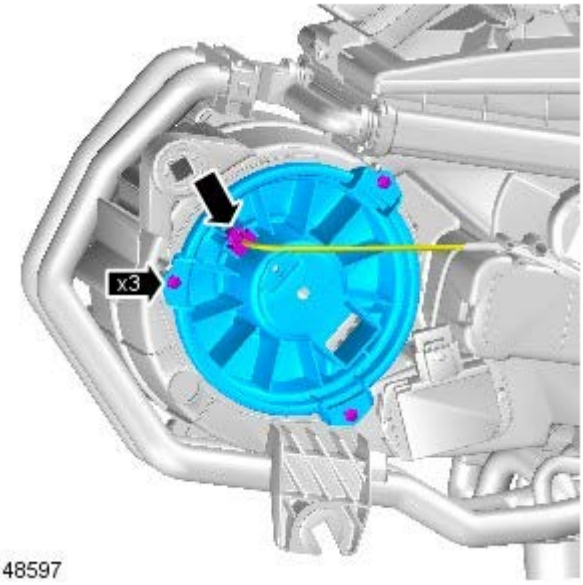
Some variation in the illustrations may occur, but the essential information is always correct.

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

   Raise and support the vehicle.

2. Refer to: Auxiliary Heater Core and Evaporator Core Housing (412-02A Auxiliary Climate Control, Removal and Installation).

3.



Installation

1. To install, reverse the removal procedure.

Published: 16-May-2013

Auxiliary Climate Control - Auxiliary Blower Motor Resistor

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

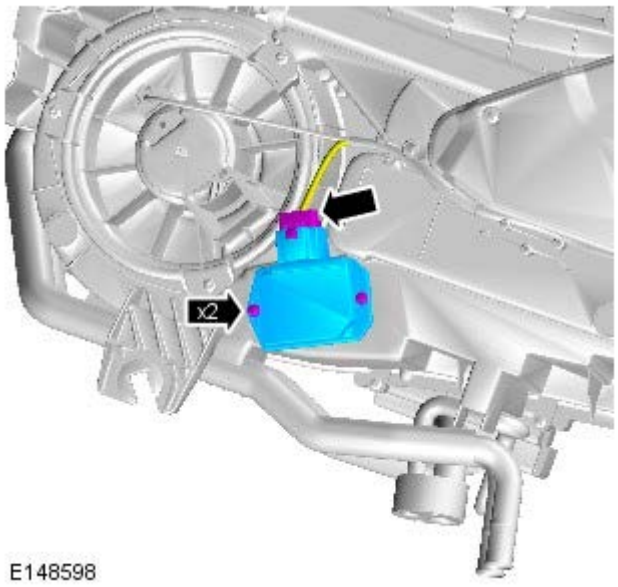
Some variation in the illustrations may occur, but the essential information is always correct.

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

   Raise and support the vehicle.

2. Refer to: Auxiliary Heater Core and Evaporator Core Housing (412-02A Auxiliary Climate Control, Removal and Installation).

3.



Installation

1. To install, reverse the removal procedure.

Published: 17-May-2013

Auxiliary Climate Control - Auxiliary Climate Control Face / Feet Motor

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

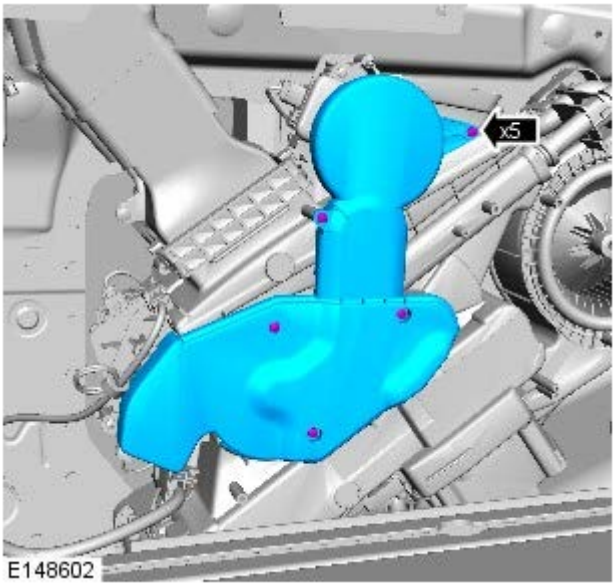
Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

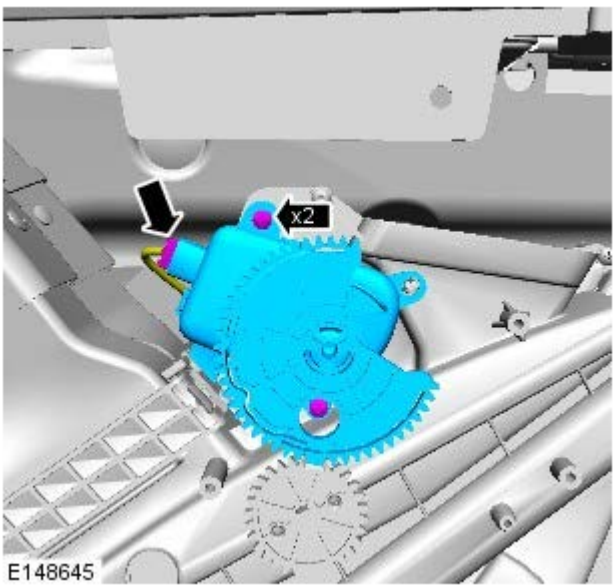
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Refer to: Loadspace Trim Panel LH (501-05 Interior Trim and Ornamentation, Removal and Installation).

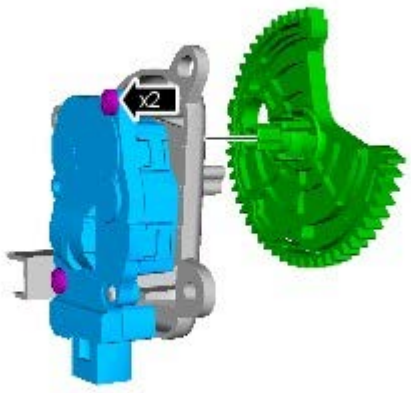
3.



4.



5.



E148646

Installation

1. To install, reverse the removal procedure.

Published: 16-May-2013

Auxiliary Climate Control - Auxiliary Heater Core

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

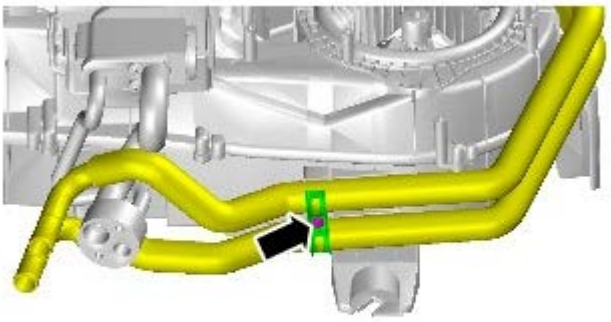
Some variation in the illustrations may occur, but the essential information is always correct.

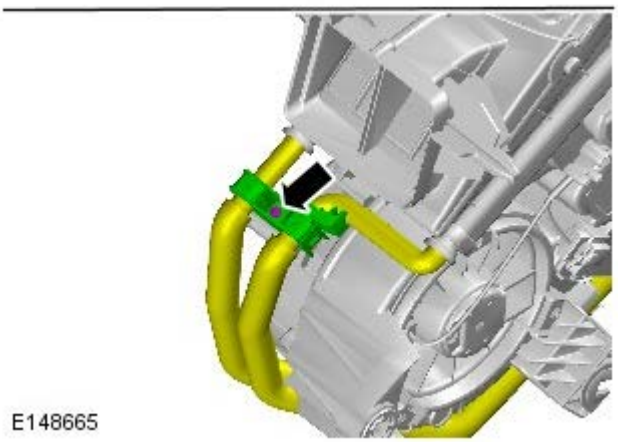
1. WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

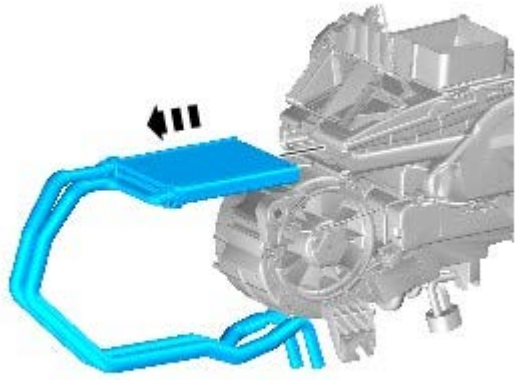
2. Refer to: Auxiliary Heater Core and Evaporator Core Housing (412-02A Auxiliary Climate Control, Removal and Installation).

3.





4.



E148668

Installation

1. To install, reverse the removal procedure.

Published: 17-May-2013

Auxiliary Climate Control - Auxiliary Heater Core and Evaporator Core Housing

Removal and Installation

Removal

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

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

   Raise and support the vehicle.

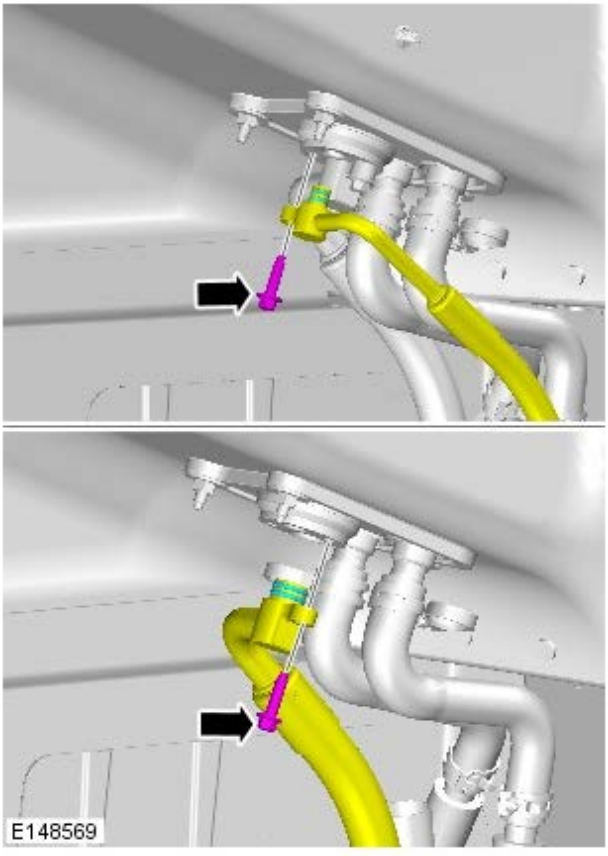
2. Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03A Engine Cooling - TDV6 3.0L Diesel, General Procedures).

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

4. Disconnect the battery ground cable.

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

5. Refer to: Rear Fender Splash Shield (501-08 Exterior Trim and Ornamentation, Removal and Installation).



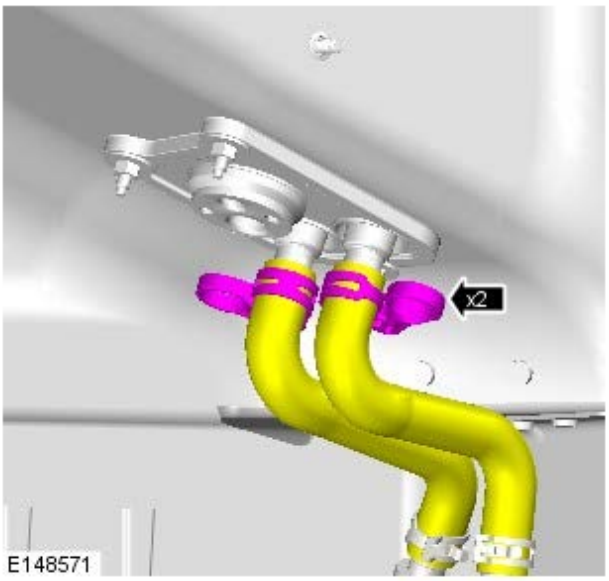
6. CAUTION: Install new o-ring seals

   NOTE: Remove and discard the O-ring seals.

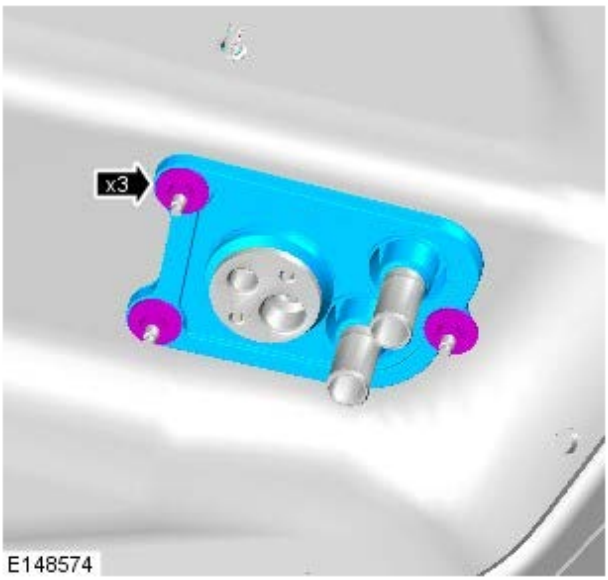
   Torque: 10 Nm

7. CAUTION: Be prepared to collect escaping

coolant.

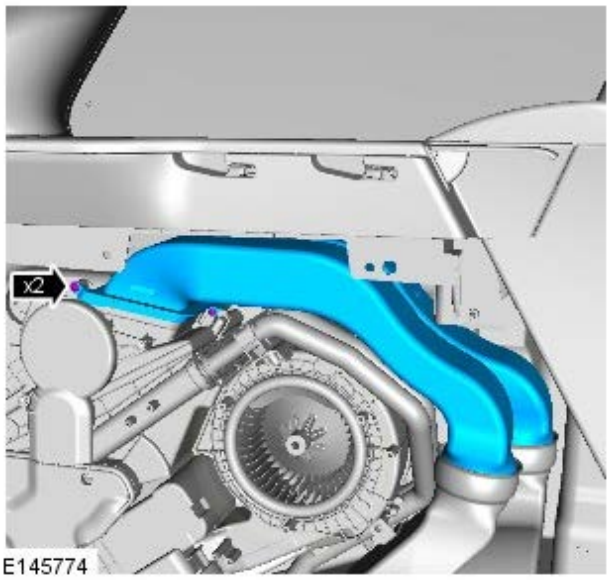


8. *Torque:* 10 Nm

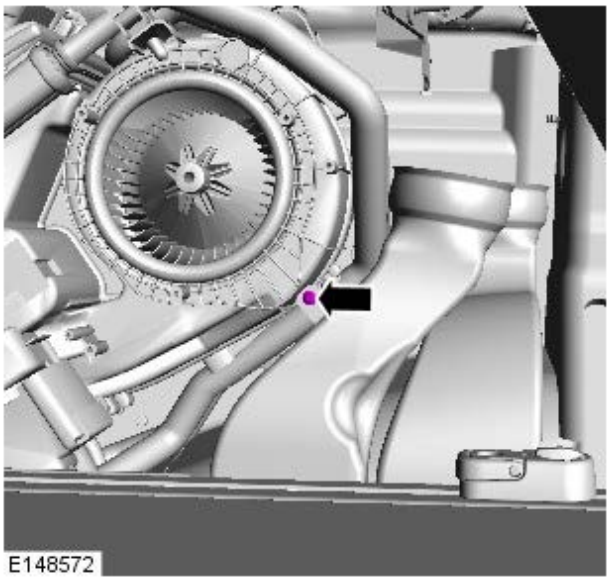


9. Refer to: Loadspace Trim Panel LH (501-05 Interior Trim and Ornamentation, Removal and Installation).

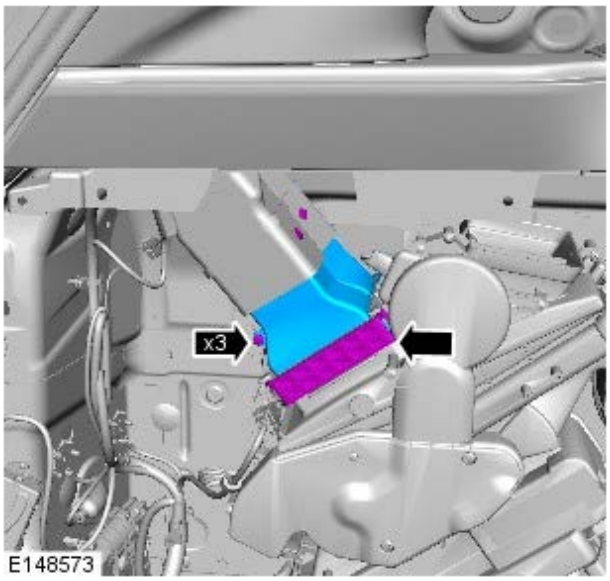
10. NOTE: LH shown.



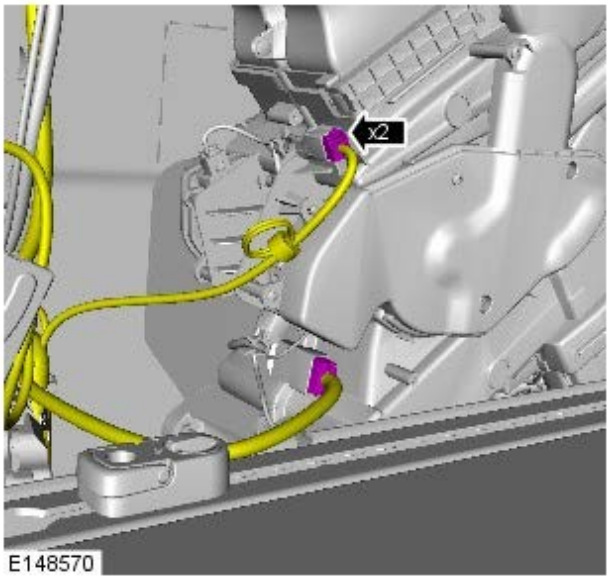
11.



12.

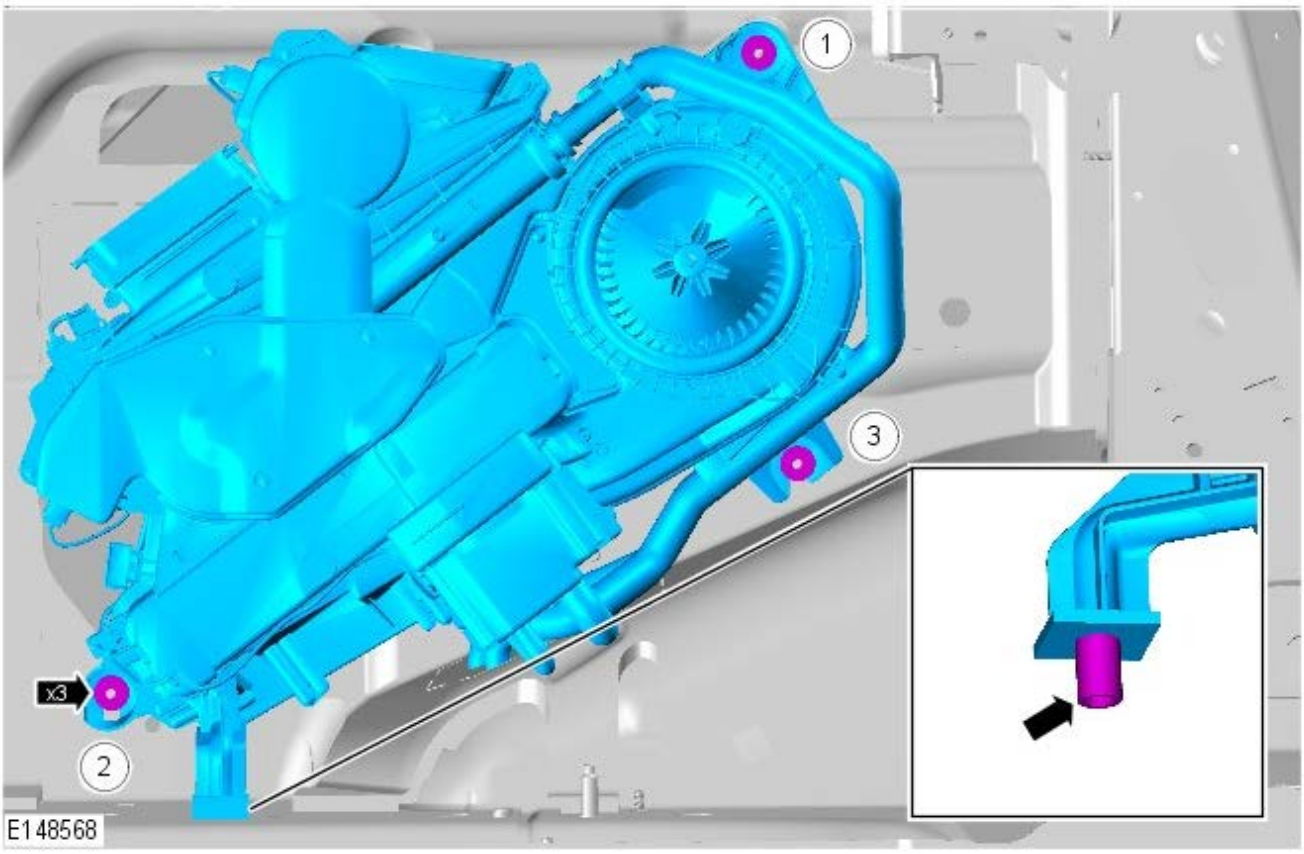


13.



14. CAUTION: Tighten the bolts in the sequence shown.

Torque: 5 Nm



Installation

1. NOTE: Remove and discard all blanking caps.

   To install, reverse the removal procedure.

Published: 16-Mar-2013

Auxiliary Climate Control - Fuel Fired Booster Heater Overheat Sensor

Removal and Installation

Removal

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

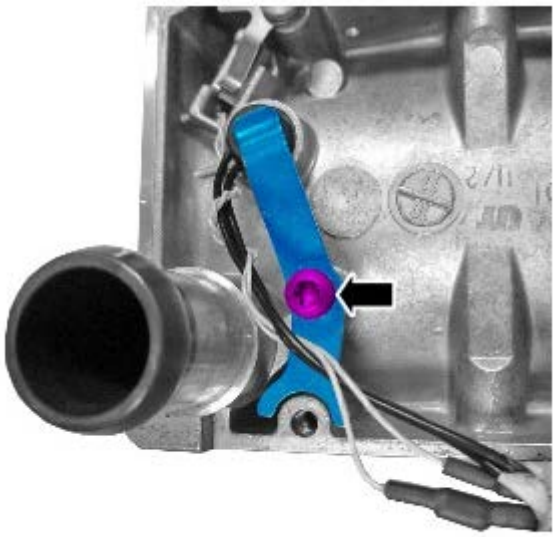
1. Refer to: Fuel Fired Booster Heater Control Module (412-02A Auxiliary Climate Control, Removal and Installation).

2.



E155487

3.



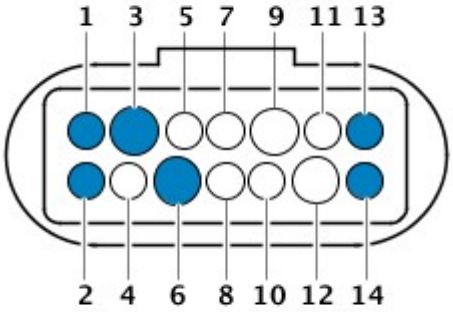
E155485

4.



E155486

5. NOTE: Remove the terminals from the connector as indicated in order to replace the component.



E155484

Installation

1. To install, reverse the removal procedure.

Published: 18-Mar-2013

Auxiliary Climate Control - Fuel Fired Booster Heater Heat Exchanger

Removal and Installation

Removal

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

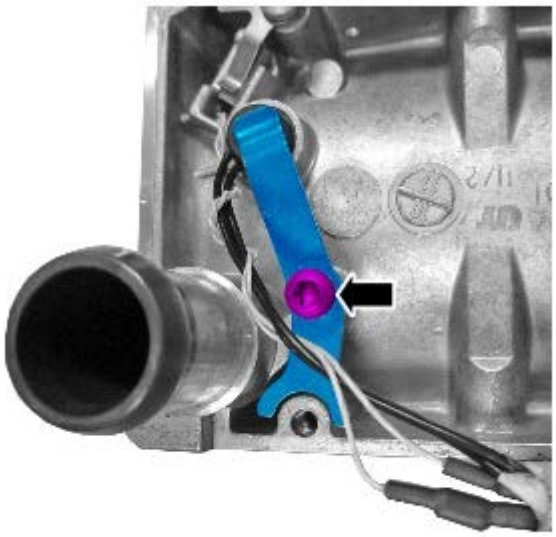
1. Refer to: Fuel Fired Booster Heater Control Module (412-02A Auxiliary Climate Control, Removal and Installation).

2.



E155487

3.



E155485

4.



E155486

5.





E155479

6.



E155483

Installation

1. CAUTION: Remove and discard the seals.

   NOTE: Install new seals.

   To install, reverse the removal procedure.

Published: 18-Mar-2013

Auxiliary Climate Control - Fuel Fired Booster Heater Combustion Chamber

Removal and Installation

Removal

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

1. Refer to: Fuel Fired Booster Heater Heat Exchanger (412-02A Auxiliary Climate Control, Removal and Installation).

2.



E155489

3.



E155481

Installation

1. CAUTION: Remove and discard the seals.

   NOTE: Install new seals.

   To install, reverse the removal procedure.

Published: 18-Mar-2013

Auxiliary Climate Control - Fuel Fired Booster Heater Blower

Removal and Installation

Removal

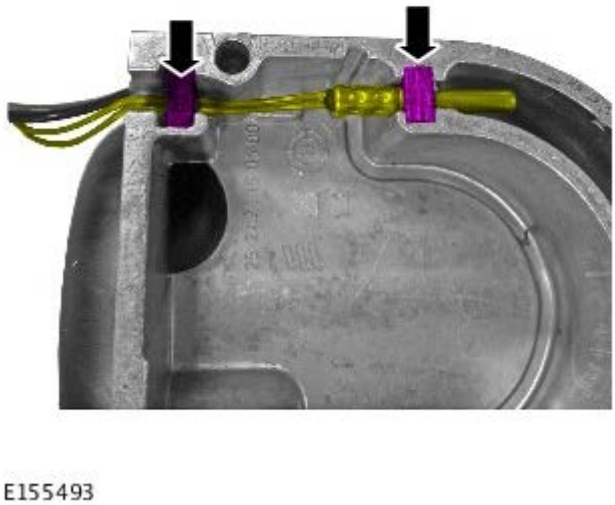
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Fuel Fired Booster Heater Combustion Chamber (412-02A Auxiliary Climate Control, Removal and Installation).

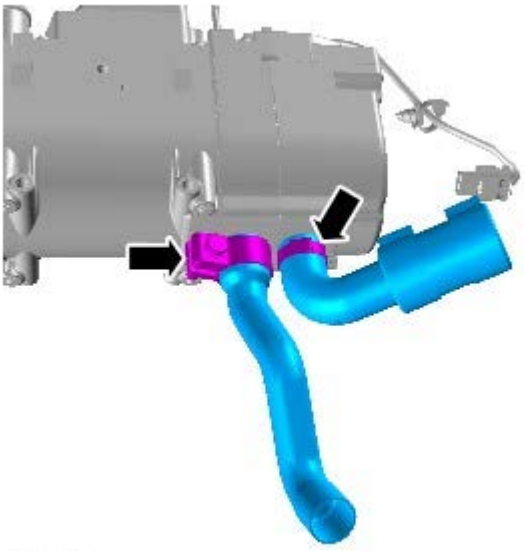
2.



3.



4.



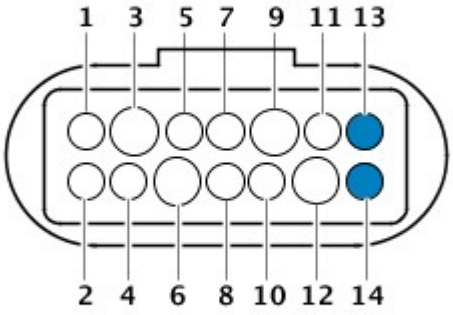
E155444

5.



E155491

6. NOTE: Remove the terminals from the connector as indicated in order to replace the component.



E155490

Installation

1. CAUTION: Remove and discard the seals.

 NOTE: Install new seals.

To install, reverse the removal procedure.

Published: 16-Mar-2013

Auxiliary Climate Control - Fuel Fired Booster Heater Control Module

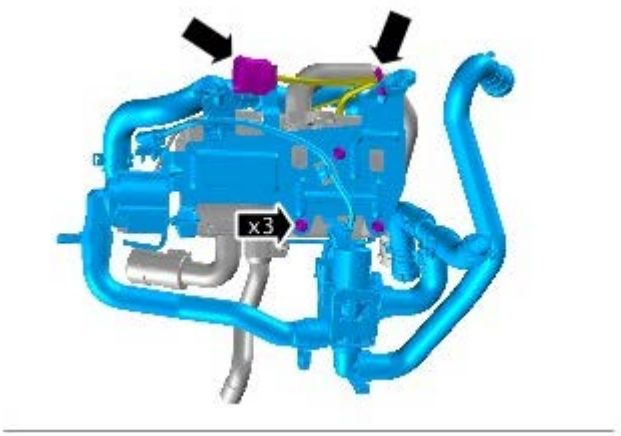
Removal and Installation

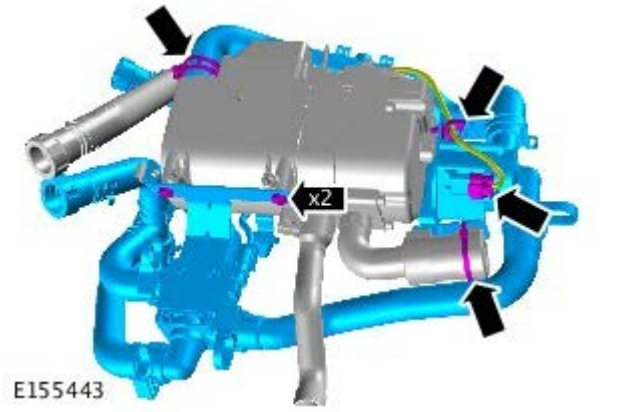
Removal

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

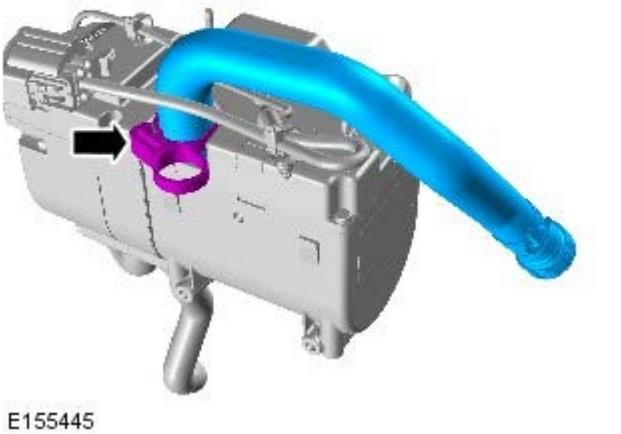
1. Refer to: Fuel Fired Booster Heater (412-02A Auxiliary Climate Control, Removal and Installation).

2.

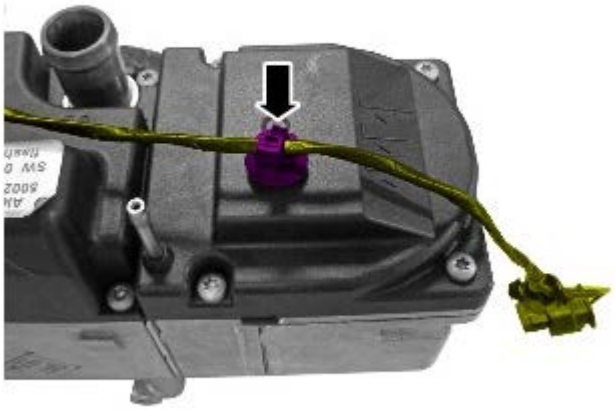




3.



4.



E155478

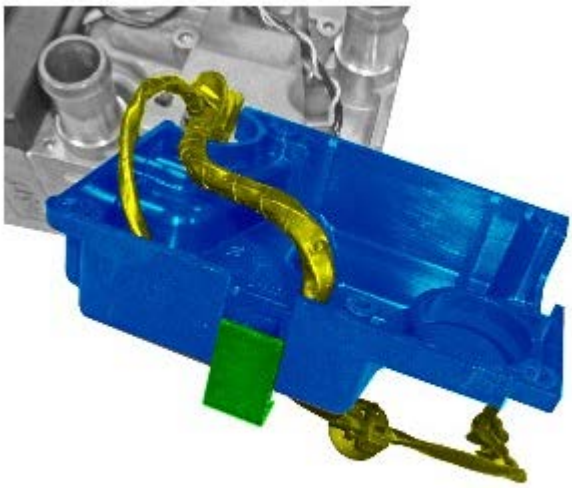
5.





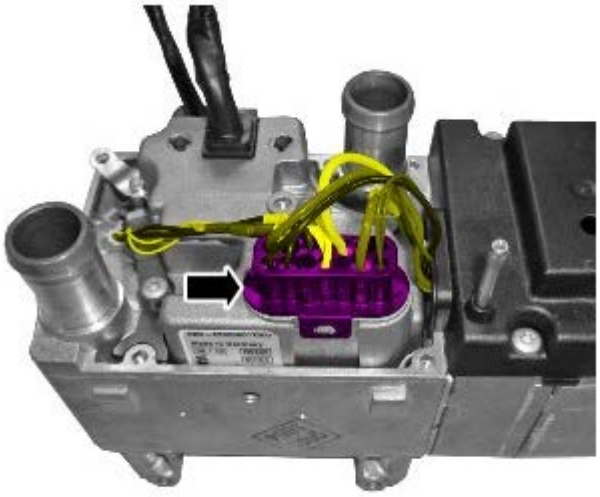
E155474

6.



E155477

7.



E155475

8.



E155476

Installation

1. To install, reverse the removal procedure.

Published: 16-May-2013

Auxiliary Climate Control - Auxiliary Temperature Blend Motor Left

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

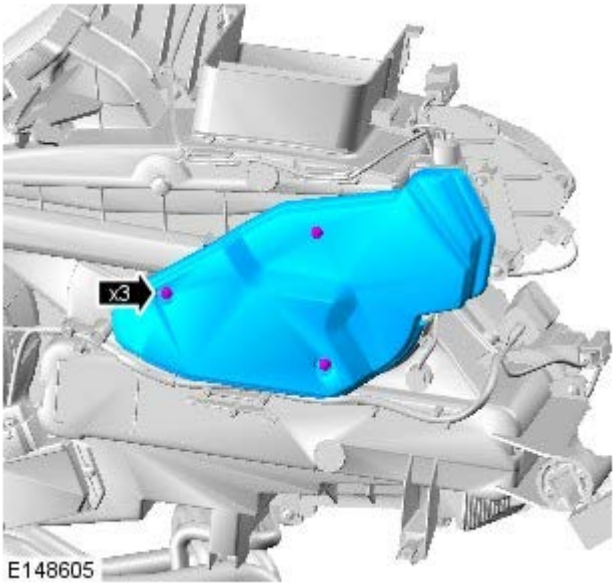
Some variation in the illustrations may occur, but the essential information is always correct.

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

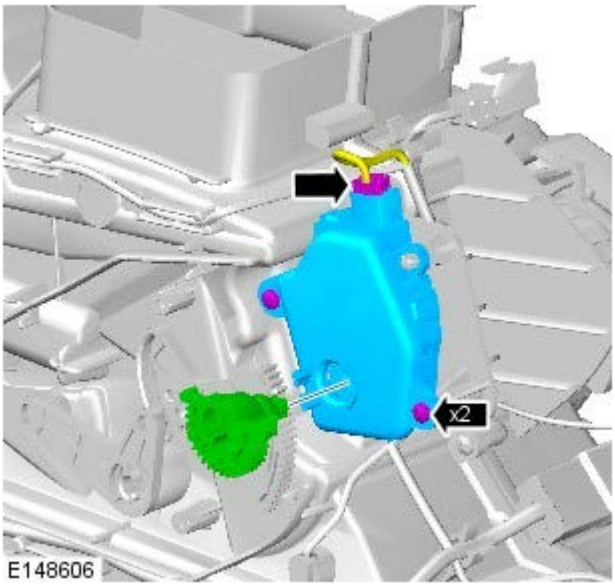
   Raise and support the vehicle.

2. Refer to: Auxiliary Heater Core and Evaporator Core Housing (412-02A Auxiliary Climate Control, Removal and Installation).

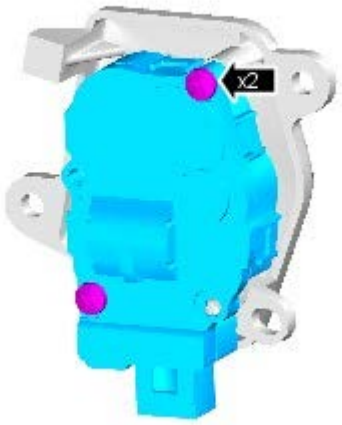
3.



4.



5.



E148607

Installation

1. To install, reverse the removal procedure.

Published: 16-May-2013

Auxiliary Climate Control - Auxiliary Temperature Blend Motor Right

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

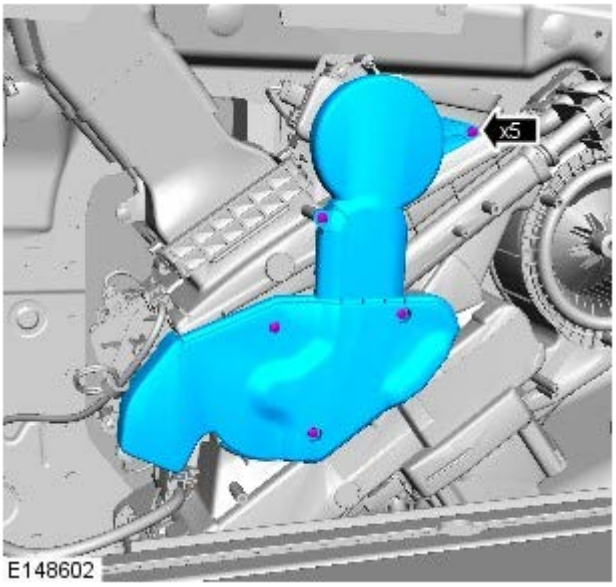
Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

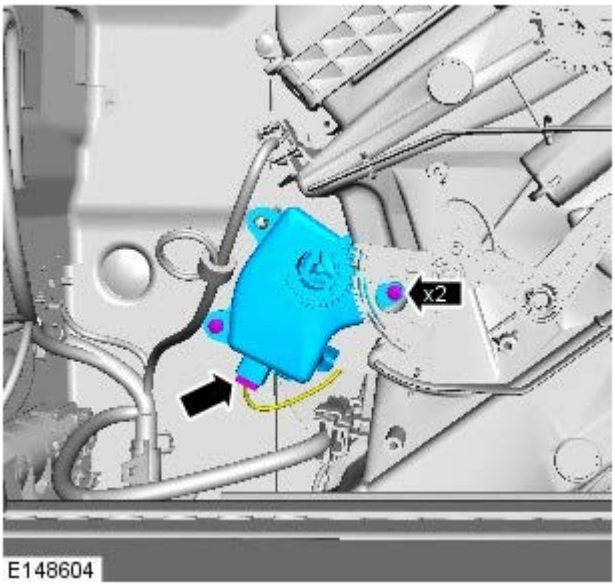
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Refer to: Loadspace Trim Panel LH (501-05 Interior Trim and Ornamentation, Removal and Installation).

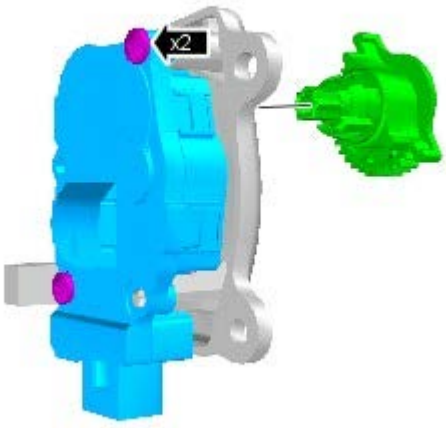
3.



4.



5.



E148603

Installation

1. To install, reverse the removal procedure.

Published: 17-May-2013

Auxiliary Climate Control - Auxiliary Thermostatic Expansion Valve

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

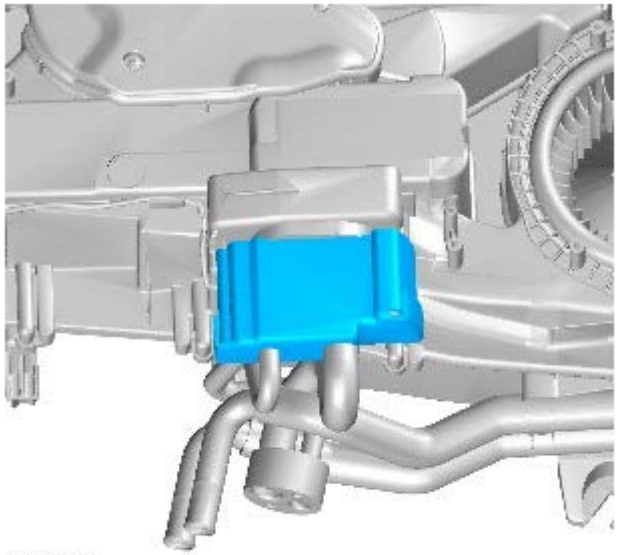
Some variation in the illustrations may occur, but the essential information is always correct.

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

   Raise and support the vehicle.

2. Refer to: Auxiliary Heater Core and Evaporator Core Housing (412-02A Auxiliary Climate Control, Removal and Installation).

3.



E148658

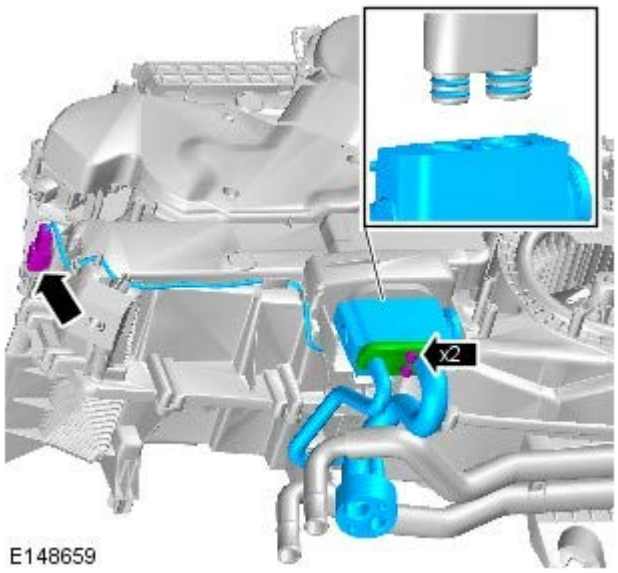
4. CAUTIONS:

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

   Remove and discard the O-ring seals.

   NOTE: Install new O-ring seals.

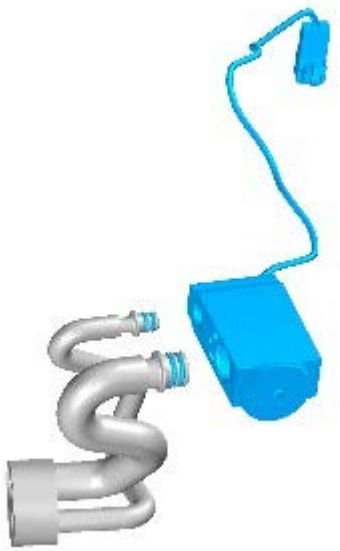
   Torque: 4 Nm



E148659

5. CAUTIONS:

   Before disconnecting or removing the components, make sure the area around the joint



E148660

faces and connections are clean and dry. Plug open connections to prevent contamination.

Remove and discard the O-ring seals.

NOTE: Install new O-ring seals.

Installation

1. NOTE: Remove and discard all blanking caps.

   To install, reverse the removal procedure.

Published: 19-Jul-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle -

Torque Specifications

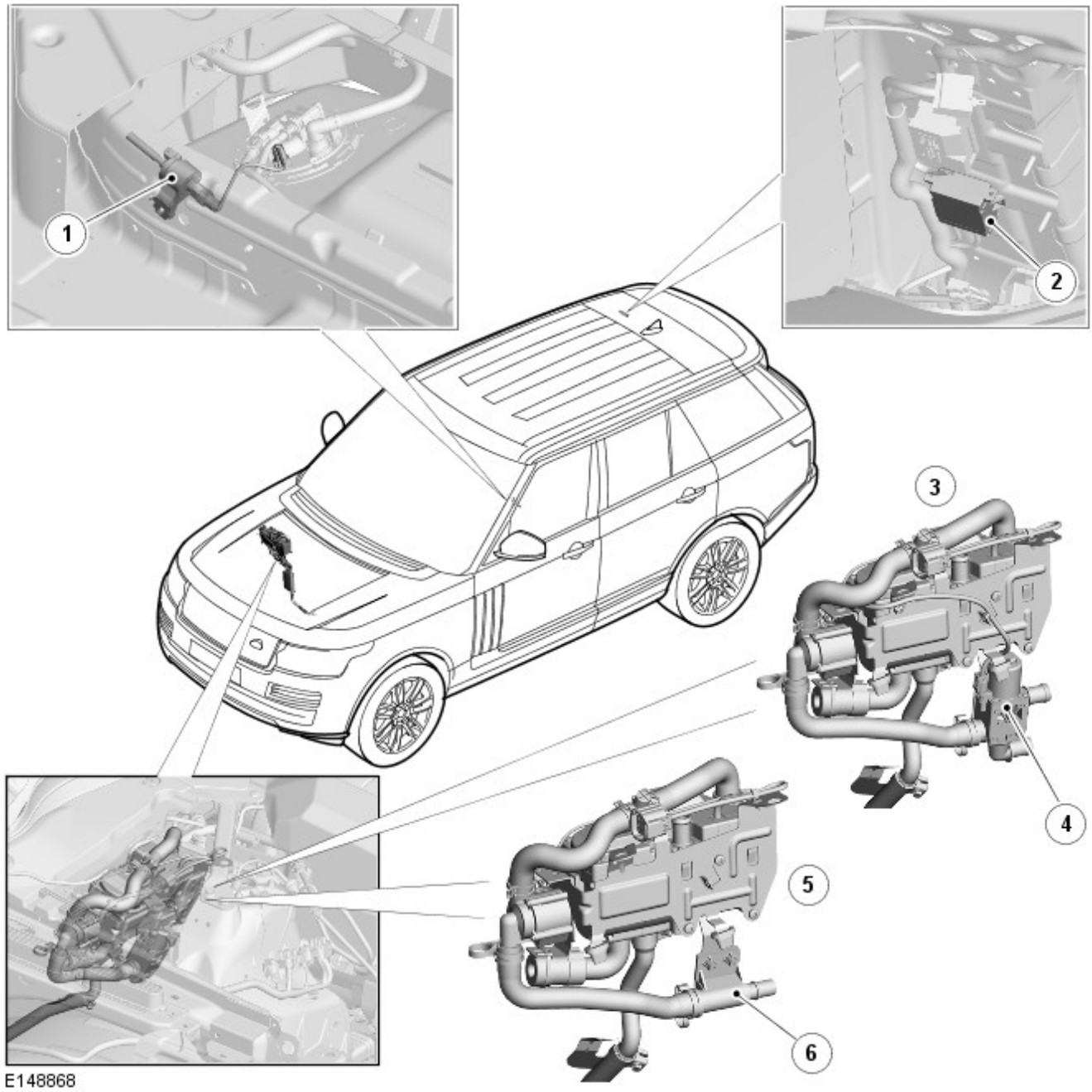
Description	Nm	lb-ft	lb-in
Fuel fired booster heater exhaust bolt	10	7	-
Fuel fired booster heater exhaust nut	10	7	-
Fuel fired booster heater bolts	10	7	-
Fuel fired booster heater fuel pump bolt	9	-	80
Fuel fired booster heater coolant pump bolts	1.5	-	13
Auxiliary refrigerant line bolts	10	7	-
Auxiliary heater core and evaporator core housing sealing plate nuts	10	7	-
Auxiliary heater core and evaporator core housing nuts	5	-	44
Auxiliary thermostatic expansion valve retaining bolts	4	-	35

Published: 30-Jul-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Fuel Fired Booster Heater

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Fuel Fired Booster Heater (FFBH) fuel pump
2	-	Fuel Fired Booster Heater (FFBH) receiver (vehicles with timed climate control only)
3	-	Fuel Fired Booster Heater (FFBH) (vehicles with timed climate control)
4	-	Changeover valve (vehicles with timed climate control)
5	-	Fuel Fired Booster Heater (FFBH) (vehicles without timed climate control)
6	-	Coolant tube connector (vehicles without timed climate control)

OVERVIEW

The vehicle incorporates auxiliary heating in the form of a FFBH (Fuel Fired Booster Heater). The FFBH boosts the temperature of the engine coolant supplied to the climate control assembly and, where fitted, the auxiliary climate control assembly.

Fuel for the FFBH is taken from the vehicle fuel tank, through a fuel line attached to the fuel pump module. A FFBH 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, which is circulated through the climate control assembly and, where fitted, the auxiliary climate control assembly, by a FFBH coolant pump.

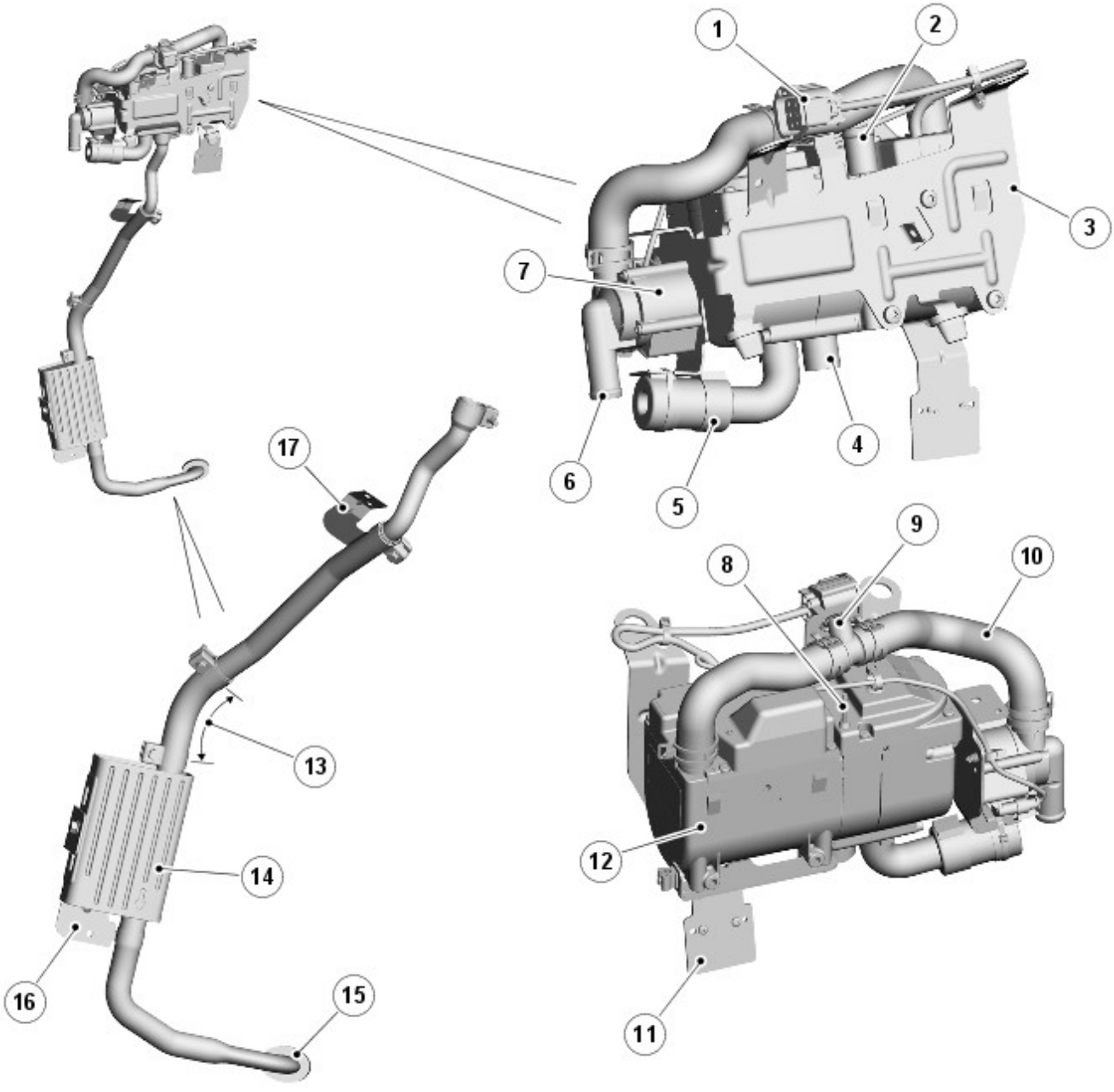
FFBH operation is automatic while the vehicle is in a drive cycle. Where timed climate control is incorporated, the FFBH can be selected to operate (depending on the ambient air temperature) while the vehicle is parked using the touch screen or a remote control.

Vehicles with timed climate control also incorporate:

- A FFBH receiver for communication with the remote control
- A changeover valve that allows the climate control coolant circuit to be isolated from the engine coolant circuit to reduce the warmup time of the passenger compartment.

DESCRIPTION

Fuel Fired Booster Heater



E148869

Item	Part Number	Description
1	-	Electrical connector
2	-	Coolant outlet
3	-	Support bracket
4	-	Exhaust outlet
5	-	Air intake hose
6	-	Coolant pump inlet
7	-	Coolant pump
8	-	Fuel inlet
9	-	Bleed screw

10	-	Coolant inlet hose
11	-	Coolant tube connector / changeover valve bracket
12	-	Fuel fired booster heater base unit
13	-	Exhaust flexible section
14	-	Muffler
15	-	Exhaust tailpipe bush
16	-	Muffler bracket
17	-	Exhaust bracket

The FFBH is installed in the engine compartment, on a support bracket attached to the rear of the right suspension housing. It is connected in series with the coolant supply to the climate control assembly. A flying lead on the FFBH connects it to the vehicle wiring. The FFBH consists of the following:

- A control module
- A combustion air fan
- A combustion chamber
- A heat exchanger
- A coolant pump
- An air intake hose and muffler
- An exhaust pipe and muffler.

CONTROL MODULE

The control module controls and monitors operation of the FFBH system. Power for the control module is provided by a permanent feed from the QCCM (Quiescent Current Control Module). A LIN (Local Interconnect Network) bus connection provides the communication link between the control module and the ATCM (Automatic Temperature Control Module). The control module also has:

- A ground connection
- Power feed and ground connections with the FFBH coolant pump
- A power feed connection with the FFBH fuel pump
- A signal line connection with the FFBH receiver (vehicles with timed climate control only).

COMBUSTION AIR FAN

The combustion air fan regulates the flow of air to the heater so as to ensure correct combustion. If the heater is operational while the engine is stopped or the heater enters the control idle phase, the air fan will continue to run in order to cool the combustion chamber in readiness for the next required start. The operation of the fan may be noticed during this process. This is perfectly normal.

COMBUSTION CHAMBER

The combustion chamber is located in the heat exchanger casing and the combustion air fan casing. The fuel feed pipe of the combustion chamber extends up through the cover of the combustion air fan. A glow plug is installed in the combustion chamber to provide the ignition source for the fuel:air mixture.

HEAT EXCHANGER

The heat exchanger transfers heat generated by the combustion chamber to the engine coolant. An overheating temperature sensor and a surface temperature sensor are installed in the heat exchanger and connected to the control module. The control module uses the temperature inputs to control system operation.

FFBH COOLANT PUMP

The FFBH coolant pump is an electric pump attached to outboard end of the FFBH support bracket. The pump intake is connected to either the heater coolant feed from the engine (vehicles without timed climate control) or to the changeover valve (vehicles with timed climate control). A hose, which incorporates a bleed screw, connects the outlet of the coolant pump to the coolant inlet of the FFBH.

The coolant pump runs continuously while the FFBH is in control idle or active operating modes. While the FFBH is inactive, coolant flow is reliant on the engine coolant pump.

AIR INTAKE HOSE AND MUFFLER

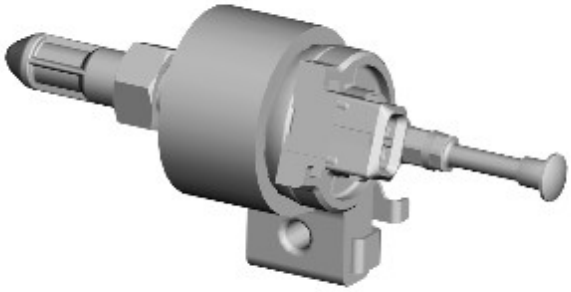
A canister type muffler and filter is incorporated into the air intake hose.

EXHAUST PIPE AND MUFFLER

The exhaust pipe and muffler directs exhaust combustion gases to atmosphere below the vehicle, to the rear of the right front wheel arch and towards the center of the vehicle. Exhaust vapor may be visible when the FFBH is running, depending on atmospheric conditions. Under normal operating conditions, the exhaust vapor will subside once the FFBH has achieved “Power status” and the exhaust pipe has reached normal operating temperature.

Under certain circumstances, for example after heater replacement or the disconnection of the fuel or coolant circuits, smoke may be visible from the general vicinity of the heater rather than the outlet of the exhaust. This may be as a result of residual fuel or coolant on the exhaust or heater body as a result of the service procedure. Under these circumstances, the heater must be run continually for 15-20 minutes until there are no signs of excessive smoke.

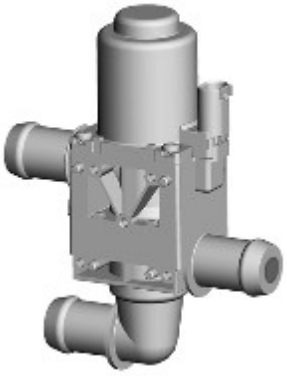
FFBH Fuel Pump



E148870

The FFBH fuel pump is installed in a rubber mounting attached to a crossmember under the rear floor, above the fuel tank. The pump is a self priming, solenoid operated plunger pump. The control module in the FFBH outputs a PWM (Pulse Width Modulation) signal to control the operation of the pump. When the pump is de-energized, it provides a positive shut-off of the fuel supply to the FFBH.

Changeover Valve (Vehicles With Timed Climate Control Only)

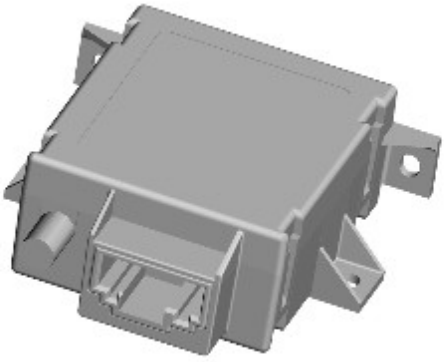


E148871

Where fitted, the changeover valve is attached to a bracket on the underside of the FFBH. The changeover valve is a normally open solenoid valve installed between the supply and return sides of the climate control assembly coolant circuit. When de-energized, the changeover valve connects the climate control assembly coolant circuit to the engine coolant circuit. When energized, the changeover valve isolates the climate control assembly coolant circuit from the engine coolant circuit.

Operation of the changeover valve is controlled by a power feed from the ATCM.

FFBH Receiver (Vehicles With Timed Climate Control Only)

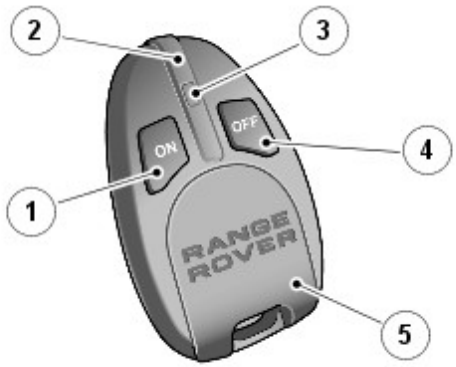


E148872

The FFBH receiver translates the FFBH remote control radio signals, relayed from the TV antenna amplifier, into a voltage output to the FFBH. When a request for timed climate control is received, the FFBH receiver outputs a battery power feed to the FFBH unit. When a request to switch off timed climate control is received, the FFBH receiver disconnects the power feed.

The FFBH receiver has a permanent power feed from the CJB (Central Junction Box) and is connected to the television antenna amplifier by a coaxial cable.
For additional information, refer to: Antenna (415-01, Description and Operation).

FFBH Remote Control (Vehicles With Timed Climate Control Only)



E148873

Item	Part Number	Description
1	-	ON switch
2	-	Antenna
3	-	Light Emitting Diode (LED) operating indicator
4	-	OFF switch
5	-	Battery cover

NOTE: Avoid touching the antenna when operating the ON or OFF switch. Covering the antenna will have an adverse affect on the transmitting range.

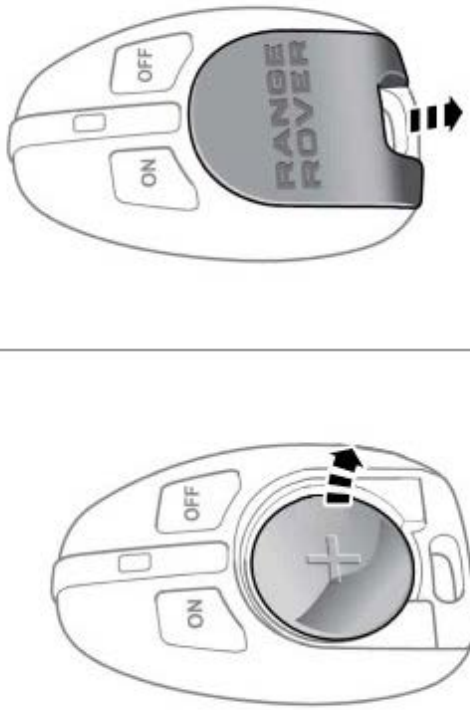
The FFBH remote control enables the timed climate control program to be activated and deactivated from outside the vehicle. The remote control has an approximate range of 100 m (328 ft). There is no need to point the remote control at the vehicle. Press and hold the ON switch for approximately 2 seconds. The LED operating indicator will illuminate green to confirm that a timed climate control program has been initiated. The LED flashes green once every 2 seconds to indicate that timed climate control is active.

The LED operating indicator signals various states and conditions for the timed climate control as follows:

- Illuminates green when the ON switch is pressed, then quickly flashes green to indicate that timed climate control operation has been requested.
- Illuminates green followed by red when the OFF switch is pressed to indicate that timed climate control has been requested to shut down.
- Illuminates green, then quickly flashes red when either the ON or OFF switch is pressed to indicate that there is no communication with the receiver. This normally occurs if the vehicle is too far away.
- Illuminates green, then slowly flashes red when either the ON or OFF switch is pressed to indicate that there is an error.
- Flashes red when either the ON or OFF switch is pressed to indicate the FFBH remote control battery needs replacing.

NOTE: The timed climate control program will only operate once per engine start to maintain battery condition.

REPLACING THE FFBH REMOTE CONTROL BATTERIES



E157943

With the front of the remote control facing upwards, press down on the rear of the battery cover and push completely off to reveal the battery compartment. Note that the battery should be inserted with the positive side facing upwards. Remove the old battery and ensuring that the correct polarity is maintained, insert a new, unused 3 volt CR2032 battery. Align and push the cover back to the original position.

FFBH REMOTE CONTROL PAIRING

Each FFBH remote control must be 'paired' to the FFBH receiver to enable communications. Each remote control has a unique identification number which is stored by the receiver. The receiver can store up 4 remote control identification numbers. If a fifth remote control is paired to the receiver, the receiver will overwrite the first paired remote control number.

Pair a remote control to the vehicle, as follows:

1. Remove fuse F1 (5A) from the CJB (Central Junction Box).
2. Wait for a minimum of 5 seconds.
3. Replace fuse F1 (5A) in the CJB then, within 5 seconds, press and hold the remote control OFF switch.
4. A successful pairing is indicated by the remote control LED illuminating red for 2 seconds.

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 FFBH receiver.

OPERATION

Fuel Fired Booster Heater

Operation of the FFBH is controlled by a status message from the ATCM (Automatic Temperature Control Module) to the control module. A similar status message, from the control module to the ATCM, advises the ATCM of the current operating status of the FFBH.

During a drive cycle, if the ambient air temperature is less than 12°C (54°F) and the engine coolant temperature is less than 75°C (167°F) the ATCM changes the status message from 'heater off' to 'supplemental heat'. The control module then changes the status message it sends the ATCM to 'supplemental heat' and starts the FFBH.

If the vehicle is stationary when the FFBH is requested, the ATCM closes the recirculation door in the climate control assembly for the first 4 minutes or until the vehicle road speed exceeds 16 km/h (10 mph), after which time the ATCM opens the door to enable the ingress of fresh air. This feature is over ridden if the MAX demist switch on the ICP (Integrated Control Panel) is selected or if the ATCM detects a risk of misting of the windshield.

The FFBH will not start, or will discontinue operation, if any of the following occur:

- The control module is in the error lockout mode (see DIAGNOSTICS below).
- The engine stops running for approximately 4 seconds. The time delay is included for stall detection.
- The ATCM receives a 'fuel cut-off' message from the CJB on the medium speed CAN (Controller Area Network) comfort and convenience systems, via the medium speed CAN body systems and the GWM (Gateway Module). The CJB sends the message if it receives a crash signal from the RCM (Restraint Control Module).

For additional information, refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B, Description and Operation).

- The ATCM receives a low fuel level message from the CJB on the medium speed CAN comfort and convenience systems, via the medium speed CAN body systems and the GWM (Gateway Module).
- The QCCM (Quiescent Current Control Module) disconnects the power supply to the FFBH.
  For additional information, refer to: Battery and Cables - TDV6 3.0L Diesel - Hybrid Electric Vehicle (414-01, Description and Operation).

If the control module does not start the FFBH, or discontinues operation, the status message to the ATCM remains at, or changes to, 'heater off'.

If the ambient air temperature increases to 15°C (59°F) or the engine coolant temperature increases to 85°C (185°F), the ATCM cancels supplemental 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 ATCM to 'heater off'.

START SEQUENCE

At the beginning of a start sequence, the control module energizes the FFBH coolant pump then operates the following in a preset sequence to start the FFBH:

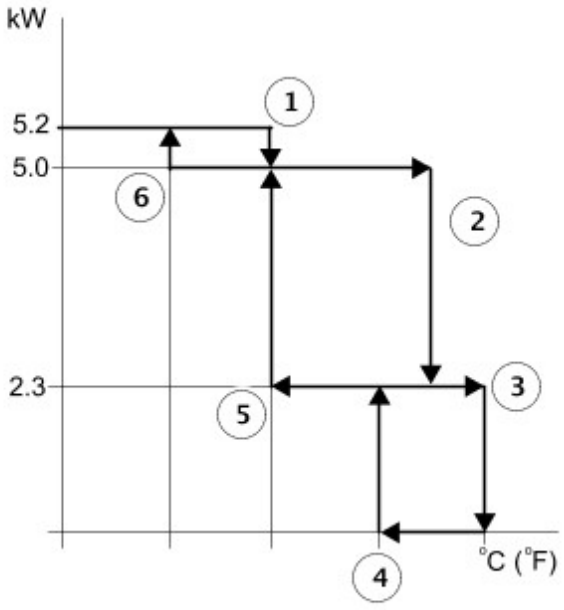
- The combustion air fan
- The glow plug
- The FFBH fuel pump.

Once combustion has stabilized, the control module switches off the glow plug. If the FFBH fails to ignite the control module repeats the start sequence.

COMBUSTION LOADS

While the FFBH is running, the control module cycles between power, high or low load combustion and a control idle phase of operation, depending on the temperature of the coolant in the heat exchanger. The heat output level at low load combustion is 2.3 kW. This rises to 5 kW at high load combustion and 5.2 kW at power load combustion. The control module transmits the amount of fuel used by the FFBH to the CJB, and the FFBH coolant temperature to the ATCM.

Switching Point Temperatures



E157985

Switching Point		Temperature, °C (°F)
Item Number	Description	
1	Power load to high load	65 °C (149°F)
2	High load to low load	80 °C (176°F)
3	Low load to control idle	85 °C (185°F)
4	Control idle to low load	75 °C (167°F)
5	Low load to high load	65 °C (149°F)
6	High load to power load	55 °C (131°F)

The switching point temperatures are for reference only and may vary depending on the fuel type and engine size.

After the start sequence, the control module maintains power load combustion until the coolant temperature reaches switching point temperature 1. At this temperature, the control module decreases the speed of the FFBH fuel pump and the combustion air fan to enable high load combustion. The control module maintains high load combustion while the coolant temperature remains between switching point temperatures 2 and 6. At high 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 6, the control module increases the speed of the FFBH fuel pump and the combustion air fan to full speed, to return to power load combustion. If the coolant temperature increases to switching point temperature 2, the control module decreases the speed of the FFBH fuel pump and the combustion air fan to enable low load combustion. At low load combustion the temperature of the coolant will again increase or decrease depending on the amount of heat required to heat the vehicle interior. If the coolant temperature decreases to switching point temperature 5 the control module increases the speed of the FFBH fuel pump and the combustion air fan to enable high load combustion. If the coolant temperature increases to switching point temperature 3, the control module enters a control idle phase of operation.

On entering the control idle phase, the control module immediately switches the FFBH fuel pump off, to stop combustion, and starts a timer for the combustion air fan. After a 90 seconds 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 4. If the coolant temperature decreases to switching point temperature 4, the control module initiates a start to low load combustion.

SHUTDOWN

To stop the FFBH, the control module de-energizes the FFBH fuel pump to stop combustion, but continues operation of the combustion air fan and the coolant pump for a time, to cool down the FFBH. The cool down time is approximately 90 seconds.

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 Land Rover approved diagnostic equipment via the medium speed CAN comfort and convenience systems. 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 FFBH fuel pump, and stops the combustion air fan and coolant pump after the cool down time. Error lockout occurs for start sequence failures, combustion flameouts, heat exchanger casing overheat and if battery voltage is out of limits.

- 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 out of limits: Error lockout will occur if battery voltage is outside the limits of 10.5 to 16.0 volts.

The error lockout mode can be cleared using Land Rover approved diagnostic equipment, or by disconnecting the battery power supply to the FFBH for a minimum of 10 seconds.

Timed Climate Control

Where fitted, timed climate control provides a comfortable temperature in the passenger compartment of a vehicle parked with the engine off. When timed climate control operates, the passenger compartment is either heated by the FFBH and climate control blower (parked heating) or cooled by the climate control blower (parked ventilation), depending on the ambient air temperature. Parked heating occurs if the ambient air temperature is less than 16°C (61°F); parked ventilation occurs if the ambient air temperature is 16°C (61°F) or more. To prevent excessive drain on the battery, both parked heating and parked ventilation are automatically de-activated after 30 minutes.

In very cold conditions timed climate control also warms the engine to aid starting. Engine warming occurs if the ambient air temperature is -20 °C (-4 °F) or below.

When timed climate control is operating, the LED in the AUTO or A/C switch on the ICP will flash. If the AUTO switch LED flashes the engine or passenger compartment are being heated. If the A/C switch LED flashes the passenger compartment is being ventilated.

Timed climate control is controlled using either the touch screen or the FFBH remote control.

In order to minimize the potential for odor ingress from the FFBH, the ATCM will automatically close the recirculation door in the climate control assembly for the first 7 minutes of FFBH operation when activated by the timed climate control feature.

TOUCH SCREEN

The touch screen is used for direct selection of timed climate control or to program one or two 'on/off' cycle start-times per day, and one 'on/off' cycle start-time further in the future. The programmed start times are stored in the CJB. 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.

At a programmed start time or a direct selection on the touch screen, the CJB sends a start signal to the ATCM via

the medium speed CAN body systems, GWM and medium speed CAN comfort and convenience systems. The ATCM module then initiates the appropriate mode of timed climate control operation.

To set a timed climate program:

- 1. Press the HOME MENU switch.
- 2. Touch the **Timed climate** soft key. This soft key may be set on a personal shortcut or accessed via the **Extra Features** soft key. Select 7 day timer, or single event, then select the timer soft key. If 7 day timer selected, then select the day for which you want to set a program. Alternatively, select **All week** to select the same start time for every day.
- 3. Touch the Timer 1 or Timer 2 soft key. The timers can be toggled between on and off using the power soft key.
- 4. Touch the up or down arrows to set the start time. Hours and minutes are adjusted separately.
- 5. Touch **OK**. The screen will display the activation time. If required, set the time for the other timer using the same process.
- 6. Once set, the timer events can be turned on or off as required in the Timed climate screen by selecting the 7 day timer or the single event soft key.

NOTES:

 Set times should to be programmed to start 30 minutes before the planned journey.

 Timed climate control will only operate once between engine starts. For example, a timed climate control request from the FFBH remote control will not be performed if a programmed timed climate control event has already occurred.

Any programmed timed climate control cycle may be cancelled by touching the relevant power soft key on the timer set up menu or the **Power** soft key on the **Timed climate** information home menu.

REMOTE CONTROL

When timed climate control is selected on or off with the FFBH remote control, the request is received by the FFBH receiver via the right TV antenna and the 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 ATCM on the LIN bus. The ATCM then initiates the appropriate mode of timed climate control operation.

A 'handshake' signal is sent back from the FFBH receiver to the remote control to confirm a valid on or off request and activate the remote control LED accordingly.

 NOTE: The ‘handshake’ signal only confirms remote control-FFBH receiver communications were successful, and not that the request has been performed.

TIMED CLIMATE CONTROL OPERATION

When the ATCM receives a timed climate control start request, its response depends on the ambient air temperature:

- If the ambient temperature is 16 °C (61 °F) or more, the ATCM 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.
- If the ambient temperature is less than 16 °C (61 °F) and more than -20 °C (-4 °F), the ATCM initiates parked heating and:
  - Energizes the changeover valve.
  - Sends a LIN 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.
- If the ambient temperature is -20 °C (-4 °F) or below, the ATCM sends a LIN 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 blower is switched on and passenger compartment heating commenced.

The FFBH will only activate in timed climate control if the following threshold conditions are met:

- Pre-burn battery voltage check: ≥11.5V (voltage at FFBH terminals).
- Pre-burn coolant temperature check: ≤15°C (internal FFBH measurement).
- Pre-burn fuel level check: ≥7.5 liters (value stored in FFBH at ignition off).

The fuel level value stored within the FFBH is only updated when the engine is running. When starting the FFBH in timed climate control with the engine off, the fuel level value used in the FFBH calculations will be that stored at the ignition off event. It is therefore possible for the FFBH to fail to operate in timed climate control if the engine was stopped with a low fuel level; if the fuel tank is subsequently refueled, the FFBH stored fuel level will still read low if the engine has not been started since refueling.

After 30 minutes, or if timed climate control is selected off with the touch screen or remote control, the ATCM discontinues timed climate control operation:

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

- If parked heating is active, the ATCM:
    - Sends a LIN 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.

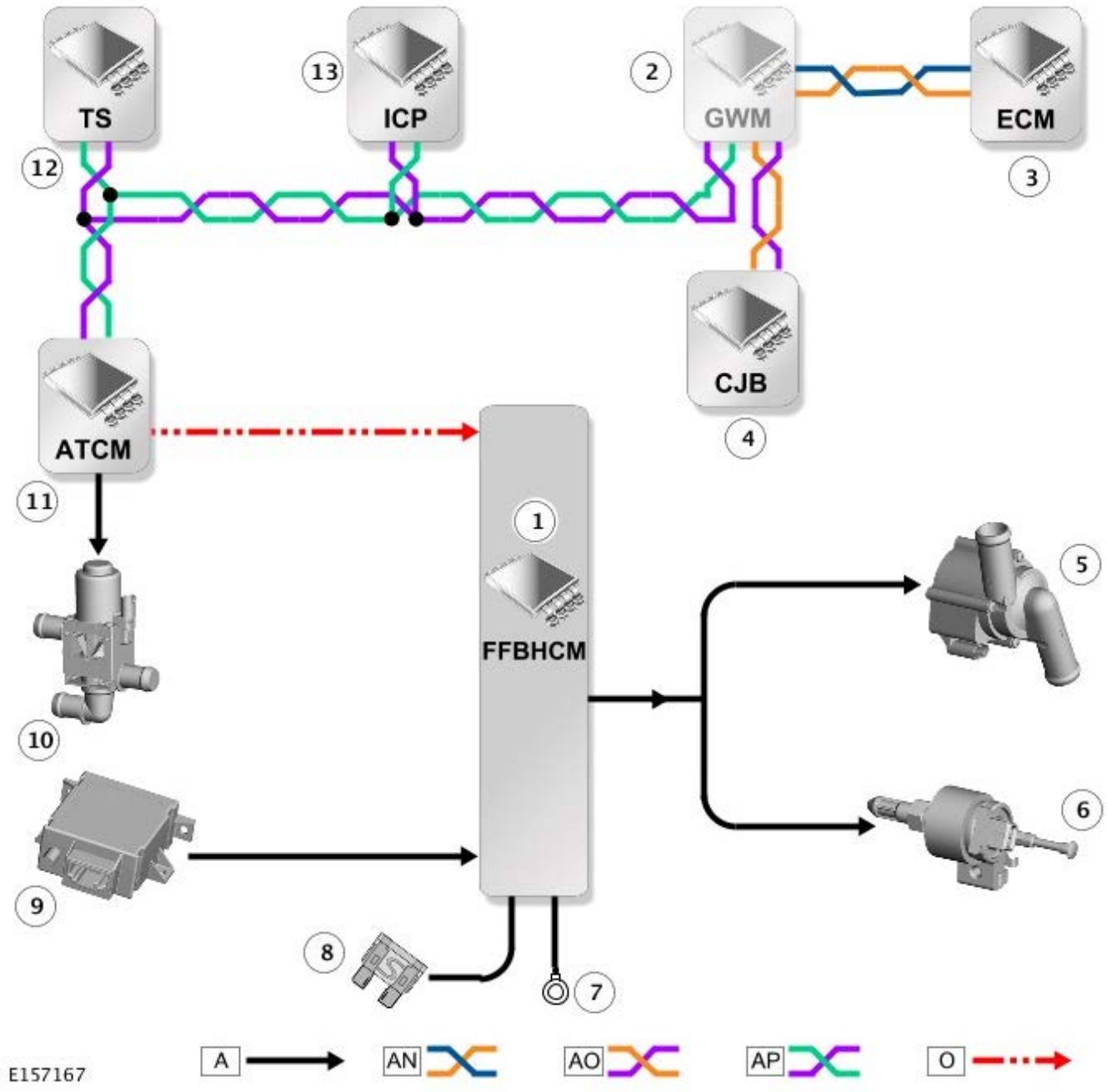
TRANSITION FROM TIMED CLIMATE CONTROL TO ENGINE RUNNING

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

Parked heating:

- Is de-activated at the start of a drive cycle if the engine coolant temperature is equal to or more than the climate control assembly coolant temperature.
- If the engine coolant temperature is less than the heater coolant temperature, parked heating remains active 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.

Control Diagram



A = Hardwired; AN = High speed CAN powertrain systems; AO = Medium speed CAN body systems; AP = Medium speed CAN comfort and convenience systems; O = LIN bus.

Item	Part Number	Description
1	-	Fuel fired booster heater control module
2	-	Gateway module
3	-	Engine control module
4	-	Central junction box

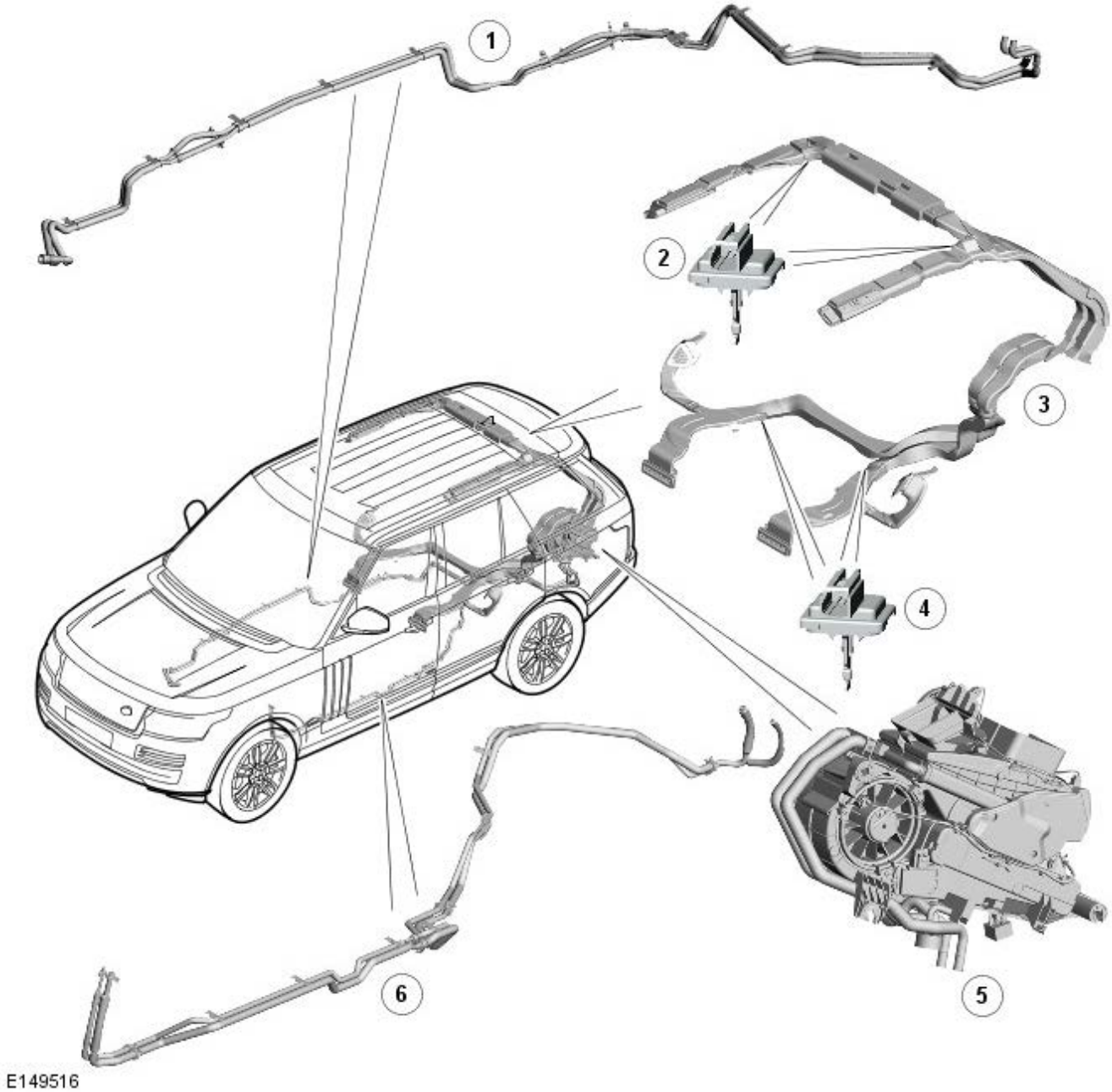
5	-	Fuel fired booster heater coolant pump
6	-	Fuel fired booster heater fuel pump
7	-	Ground
8	-	Power supply
9	-	Fuel fired booster heater receiver (vehicles with timed climate control only)
10	-	Changeover valve (vehicles with timed climate control only)
11	-	Automatic temperature control module
12	-	Touch screen
13	-	Integrated control panel

Published: 30-Jul-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Auxiliary Climate Control

Description and Operation

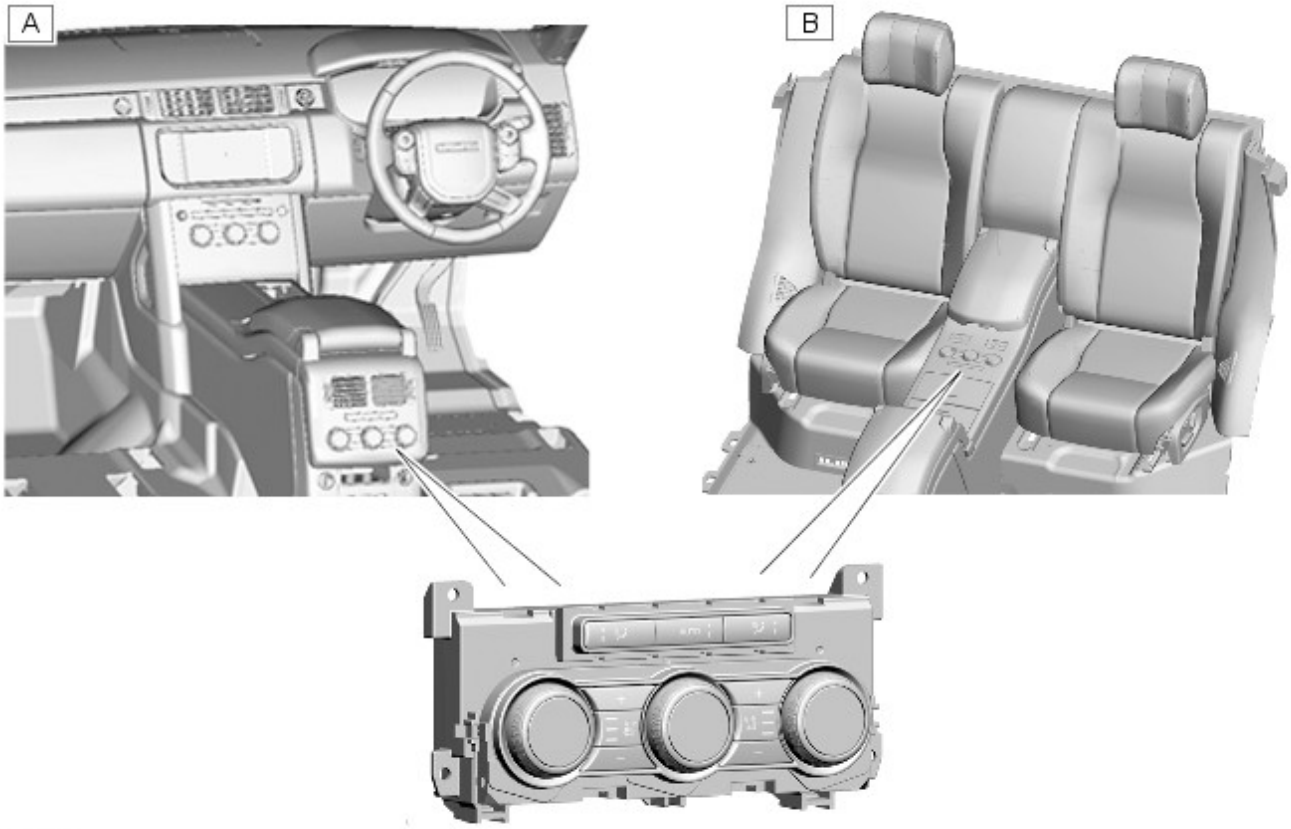
COMPONENT LOCATION - SHEET 1 OF 2



E149516

Item	Part Number	Description
1	-	Coolant pipes
2	-	Duct air temperature sensor - face ducts
3	-	Air distribution system
4	-	Duct air temperature sensor - lap and foot ducts
5	-	Auxiliary climate control assembly
6	-	Air conditioning pipes

COMPONENT LOCATION - SHEET 2 OF 2



E149517

Item	Part Number	Description
A	-	Rear integrated control panel - all except business seats
B	-	Rear integrated control panel – business seats

OVERVIEW

The auxiliary climate control system provides additional air distribution vents and separate temperature zones for the left and right areas of the rear seats. The auxiliary climate control system consists of:

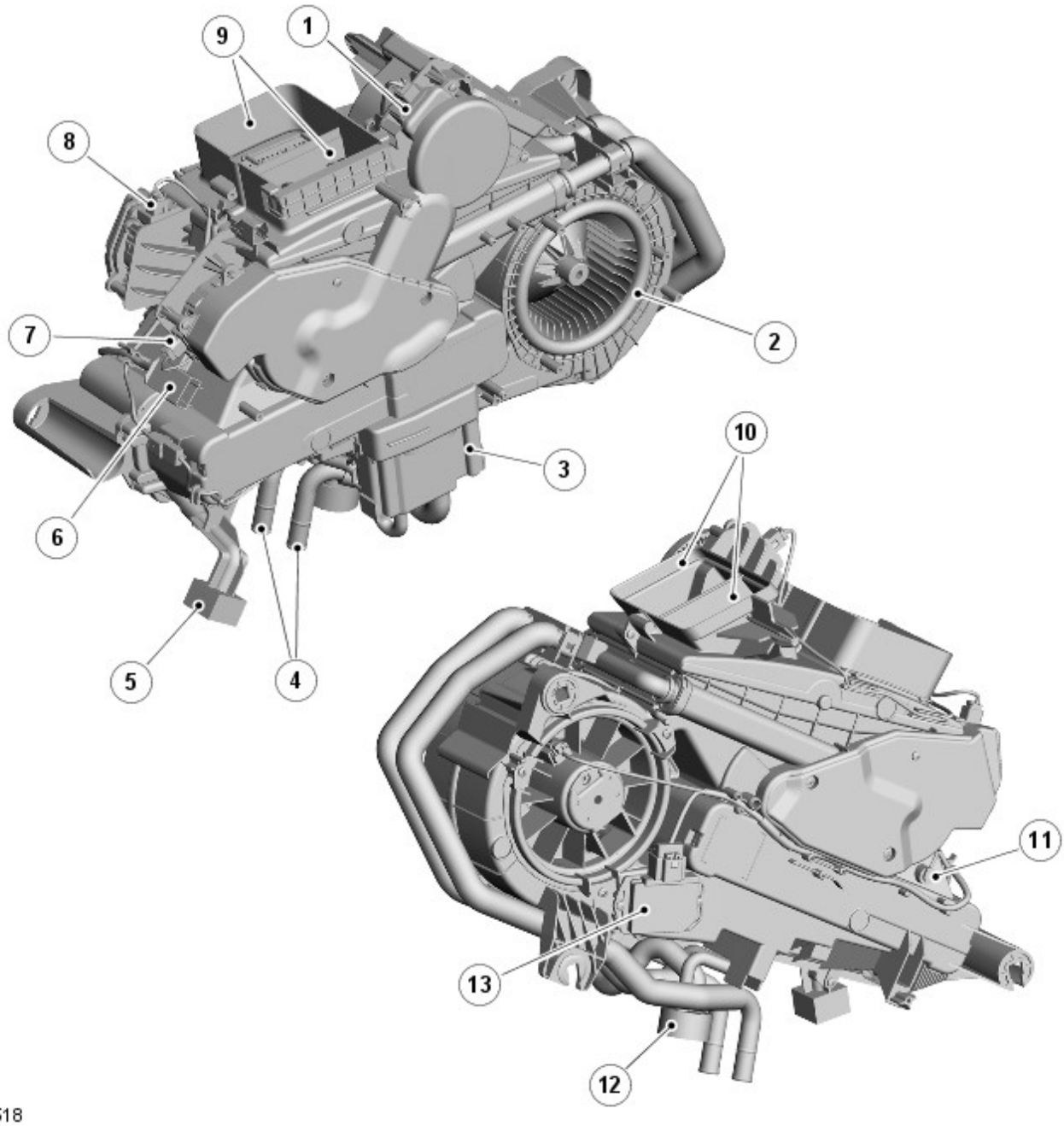
- An auxiliary climate control assembly.
- A refrigerant circuit.
- A heating circuit.
- A distribution system.
- The rear ICP (integrated control panel).

Operation of the auxiliary climate control system is controlled by the ATCM (automatic temperature control module), the rear ICP and the touch screen.
For additional information, refer to: Control Components (412-01B, Description and Operation).

Air from the passenger compartment is recirculated through the auxiliary climate control assembly, where the air is temperature regulated and then directed through the distribution system to vents in the headliner, the rear seat side bolsters and the carpet in front of the rear seats.

DESCRIPTION

Auxiliary Climate Control Assembly



E149518

Item	Part Number	Description
1	-	Distribution motor
2	-	Auxiliary blower
3	-	Auxiliary climate control isolation valve
4	-	Coolant pipes
5	-	Evaporator drain tube
6	-	Electrical connector for vehicle harness
7	-	Right temperature blend motor
8	-	Left temperature blend motor
9	-	Face distribution outlets (to headliner vents)
10	-	Lap and foot level distribution outlets (to seat side bolster and carpet vents)
11	-	Evaporator temperature sensor
12	-	Air conditioning pipe connector block
13	-	Auxiliary blower control module

The auxiliary climate control assembly is installed on the left side of the luggage compartment, behind the rear quarter trim panel. A grille in the trim panel allows air to flow from the luggage compartment into the auxiliary climate control assembly.

The auxiliary climate control assembly consists of a casing, formed from a pair of plastic moldings, which contains:

- An evaporator
- A heater core
- Temperature blend doors
- A distribution door

- A blower
- A blower control module
- An evaporator temperature sensor.

Refrigerant and coolant pipes from the engine compartment are connected to pipes from the evaporator and the heater core immediately below a seal plate in the rear left wheel arch. An evaporator drain tube, sealed with a foam rubber gasket, locates in the top of the left side member of the rear floor.

In the casing of the auxiliary climate control assembly, two parallel air steams flow from the blower through the evaporator and heater core to two pairs of distribution outlets. The left and right air streams supply the related rear zones of the passenger compartment. The front pair of distribution outlets supply the vents in the seat side bolsters and the carpet. The rear pair of distribution outlets supply the vents in the headliner.

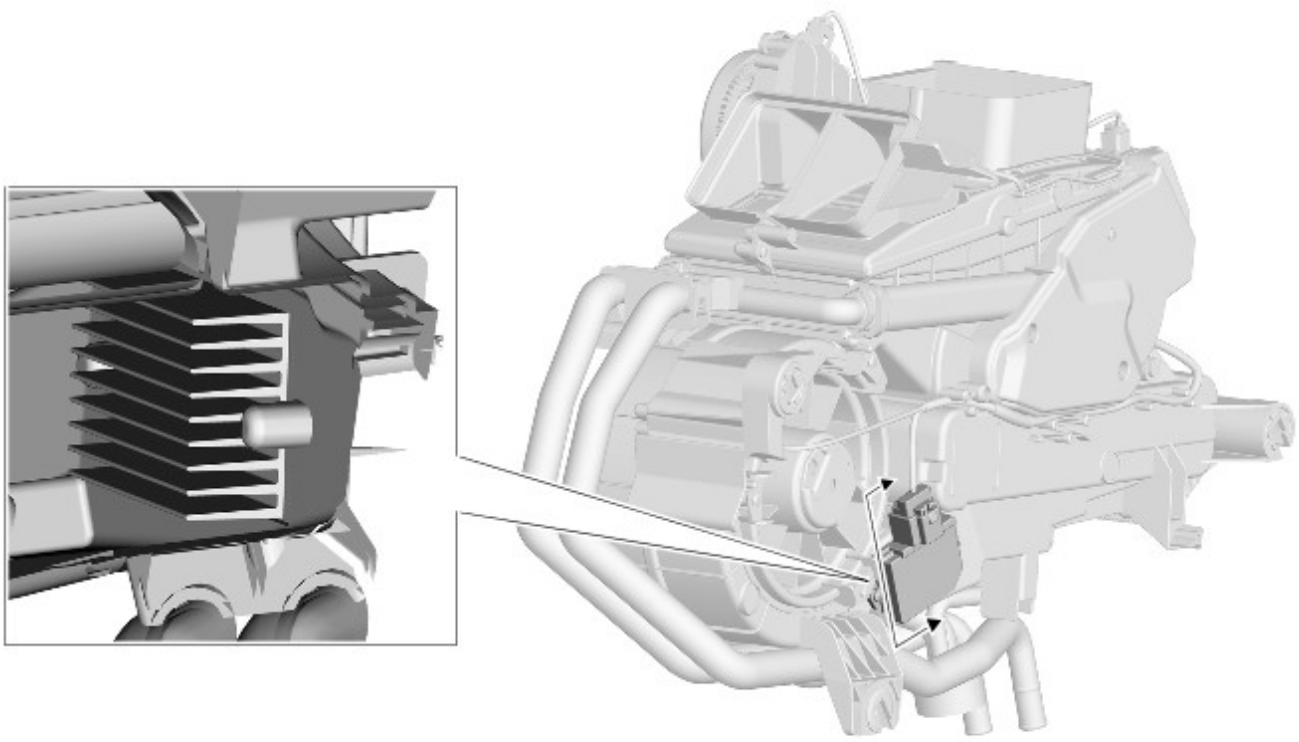
The left and right air streams each contain two temperature blend doors connected together with a link mechanism. Separate electric motors, installed on the rear of the casing, operate the temperature blend doors in each air stream to give independent temperature control for each rear climate zone.

The left and right air streams share a common distribution door installed below the distribution outlets. An electric motor, installed on the top of the casing, operates the distribution door.

A LIN (local interconnect network) bus connects the distribution motor and the temperature blend motors in series with the ATCM. The motors are powered by feeds from the ATCM, and share a ground connection with the auxiliary blower and auxiliary blower control module.

The ATCM determines the positions of the distribution and temperature blend doors by using either their closed or open position as a datum and memorizing the steps that it drives the individual motors. Each time the ATCM is activated, it checks the memorized position of the motors against fixed values for the current distribution and temperature settings on the control panel. If there is an error, the ATCM calibrates the applicable motor, to re-establish the datums, by driving it fully closed or open before re-setting it to the nominal selected position. A calibration run can also be invoked using Land Rover approved diagnostic equipment.

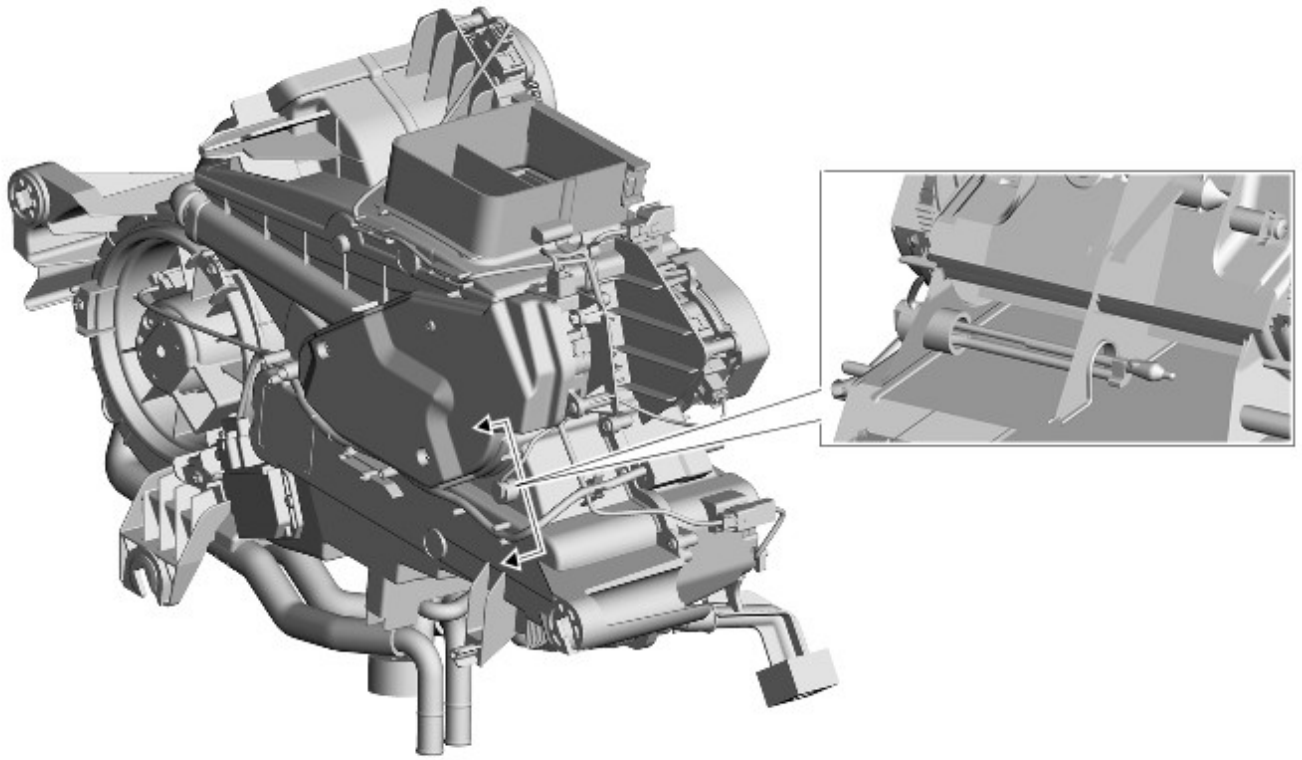
AUXILIARY BLOWER CONTROL MODULE



E149519

The auxiliary blower consists of an open hub, centrifugal fan powered by an electric motor. Power for the blower is supplied from the auxiliary blower relay in the EJB (engine junction box) via the auxiliary blower control module, which is installed in the left side of the auxiliary climate control assembly, immediately downstream of the blower. To control blower speed, the ATCM outputs a PWM (pulse width modulation) signal to the auxiliary blower control module to regulate the voltage of the auxiliary blower power supply.

AUXILIARY EVAPORATOR TEMPERATURE SENSOR



E149520

The auxiliary evaporator temperature sensor is installed in the auxiliary climate control assembly on the downstream side of the evaporator. The sensor is a NTC (negative temperature coefficient) thermistor connected to the rear integrated control panel.

Refrigerant Circuit

Low and high pressure pipes connect the front A/C (air conditioning) system to the auxiliary climate control assembly at a connector block in the left rear wheel arch, behind the wheel arch liner. On the auxiliary climate control assembly, pipes from the connector block are attached to an isolation valve on the evaporator.

AIR CONDITIONING PIPES

The A/C pipes consist of three sections of insulated pipe. The front and rear sections incorporate hoses at the ends that connect to the front A/C system and the auxiliary climate control assembly respectively. From the auxiliary climate control assembly, the A/C pipes are routed forward around the inboard side of the rear left wheel arch, then under the left edge of the floorpan to the rear of the front left wheel arch. The A/C pipes connect to the front climate control A/C system at a grommet in the front left wheel arch.

Connections for the A/C pipes of the battery pack isolation valve are incorporated into the auxiliary climate control A/C pipes to the rear of the left B pillar.
For additional information, refer to: Air Conditioning (412-01B, Description and Operation).

AUXILIARY ISOLATION VALVE



E149521

The auxiliary isolation valve is a combined solenoid operated shut-off valve and block-type thermostatic expansion valve attached to the inlet and outlet pipes of the evaporator. The ATCM controls the operation of the shut-off valve to isolate the auxiliary climate control assembly from the remainder of the A/C system.

Heater Circuit

Supply and return coolant pipes connect the engine cooling system to the heater core pipes of the auxiliary climate control assembly in the rear left wheel arch, behind the wheel arch liner.

The coolant pipes consist of sections of insulated rigid pipes connected together with flexible hose joints. Quick release fittings connect the coolant pipes to the engine cooling system.

From the auxiliary climate control assembly, the coolant pipes are routed along the rear cross member and then forward under the right edge of the floorpan to the chassis longitudinal at the rear of the front right wheel arch liner.

Distribution System

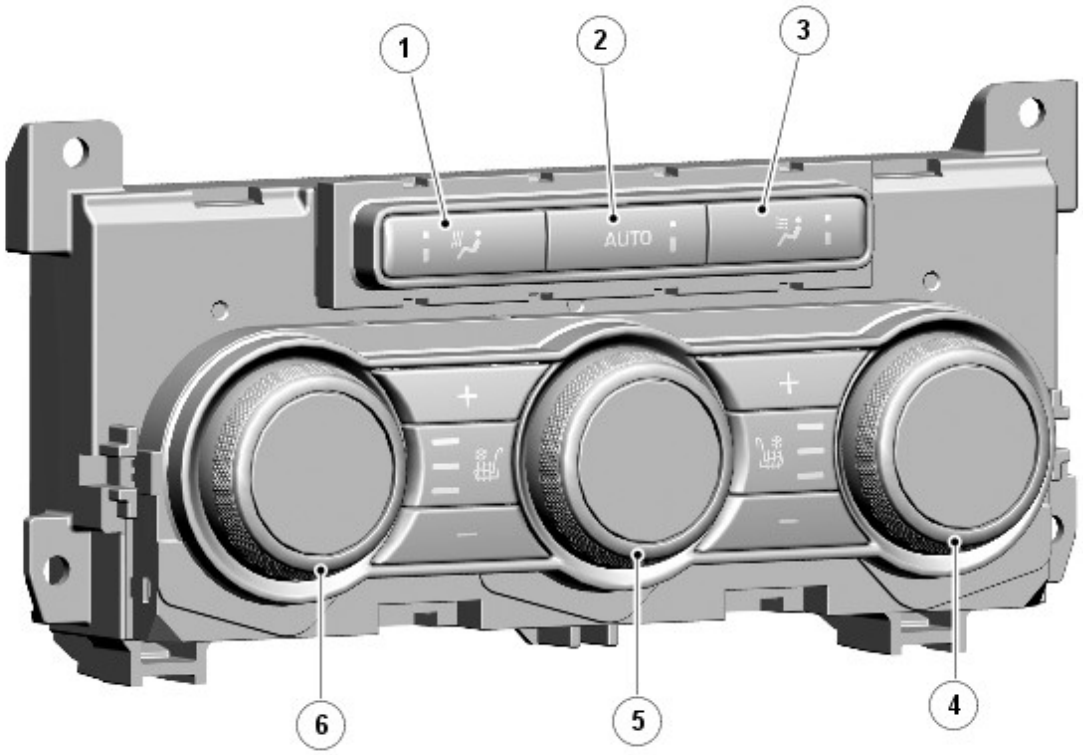
The distribution system consists of a network of air ducts that supply air from the distribution outlets of the auxiliary climate control assembly to the vents installed in:

- The headliner, above each rear door
- The left and right rear seat side bolsters
- The carpet, below the left and right rear seats.

The vents in the headliner are adjustable, those in the side bolsters and the carpet are fixed.

Four duct air temperature sensors are installed in the air ducts. One in each duct to the left and right vents in the headliner, one in the duct to the left vents in the seat side bolsters and carpet, and one in the duct to the right vents in the seat side bolsters and carpet. The sensors are NTC thermistors, which are connected to the rear integrated control panel. The ATCM uses the data from the sensors in output temperature calculations for the related ducts.

Rear Integrated Control Panel



E141159

Item	Part Number	Description
1	-	Foot distribution switch
2	-	Automatic mode switch
3	-	Face distribution switch
4	-	Right temperature switch
5	-	Blower switch
6	-	Left temperature switch

The rear ICP is installed either in the rear of the floor console or, on vehicles with business seats, in the rear seat console. The control panel contains rotary and push button switches for controlling the temperature, volume and distribution of air ro the rear seats. Each push switch contains an amber status LED (light emitting diode). Display screens are integrated into the center of the rotary switches to display the selected temperature and blower speed as appropriate.

Additional push switches on the rear ICP are provided for control of seat heating/climate control seats.
For additional information, refer to: Seats (501-10, Description and Operation).

The rear ICP has a permanent battery power feed from the CJB (central junction box), and is connected to the medium speed CAN (controller area network) comfort and convenience systems. The rear ICP converts selections on the climate control switches into medium speed CAN messages and transmits them to the ATCM. The rear ICP also

receives inputs from the auxiliary evaporator temperature sensor and the four duct air temperature sensors. These inputs are also converted into medium speed CAN messages and transmitted to the ATCM.

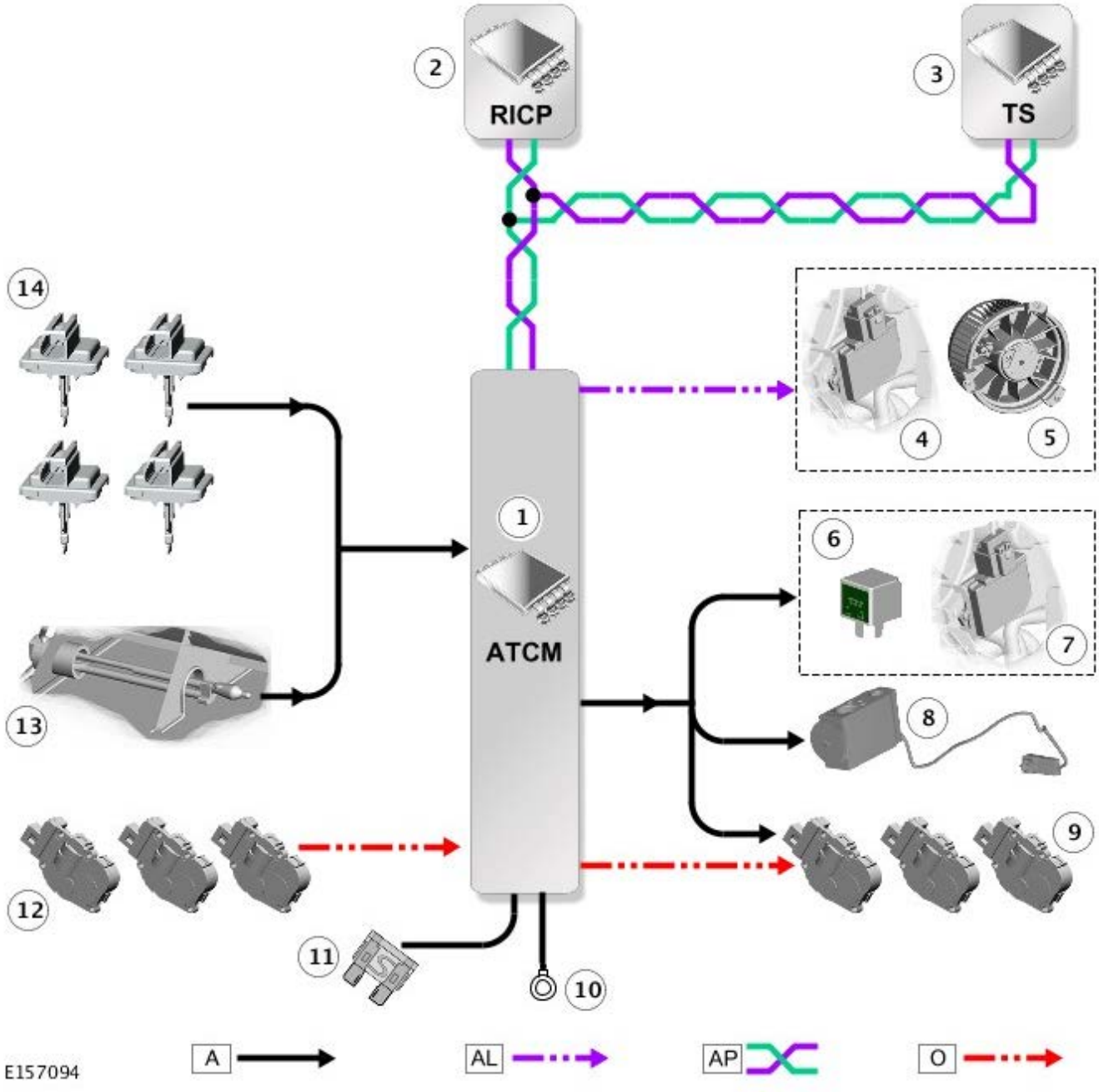
OPERATION

For the auxiliary climate control system to operate, the vehicle must be in one of the drive modes with the main climate control system active and automatic mode selected on the rear ICP or the **Rear climate** menu of the touch screen. The ATCM then illuminates the LED in the rear ICP AUTO switch, energizes the auxiliary climate control isolation valve and the auxiliary blower, and operates the auxiliary temperature blend and distribution motors to maintain the temperatures selected on the rear ICP.

Once the auxiliary climate control system is operating, the auxiliary blower, distribution and temperature can be adjusted as required on the rear ICP or the **Rear climate** menu of the touch screen. More than one distribution setting at a time may be selected to achieve the required air distribution.

The auxiliary climate control system can be selected off on the rear ICP, using the AUTO switch, or on the **Rear climate** menu of the touch screen. The **Rear climate** menu can also be used to lock the rear ICP to prevent operation of the auxiliary climate control system from the rear seats.

Control Diagram



A = Hardwired connection; AL = PWM connection; AP = Medium speed CAN comfort and convenience systems; O = LIN bus.

Item	Part Number	Description
1	-	Automatic temperature control module
2	-	Rear integrated control panel
3	-	Touch screen

4	-	Auxiliary blower control module
5	-	Auxiliary blower
6	-	Auxiliary blower relay
7	-	Auxiliary blower control module
8	-	Auxiliary climate control isolation valve
9	-	Auxiliary temperature blend and distribution motors
10	-	Ground
11	-	Power supply
12	-	Auxiliary temperature blend and distribution motors
13	-	Auxiliary evaporator temperature sensor
14	-	Duct air temperature sensors

Published: 10-Jun-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Electric Booster Heater

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

Some components shown removed for clarity.

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

All vehicles

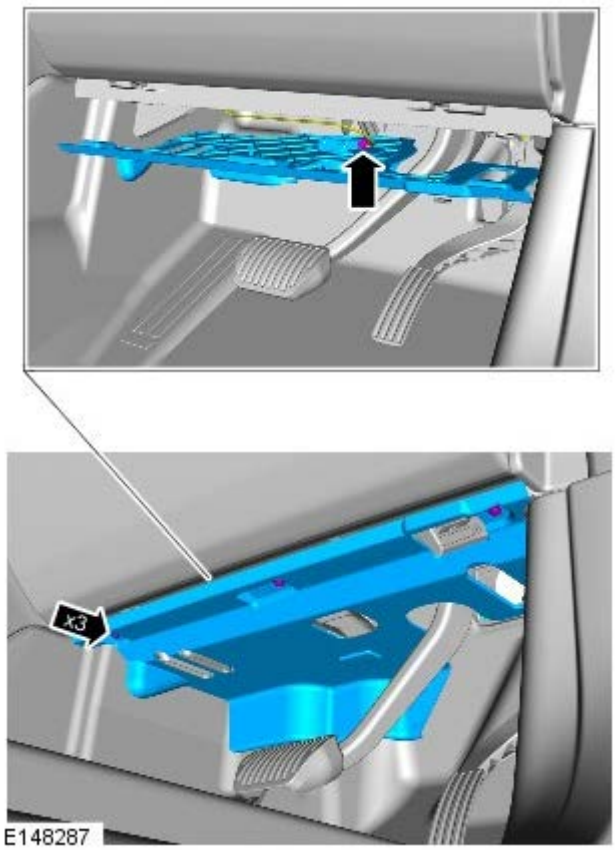
1. Disconnect the battery ground cable.

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

Right-hand drive vehicles

2. Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

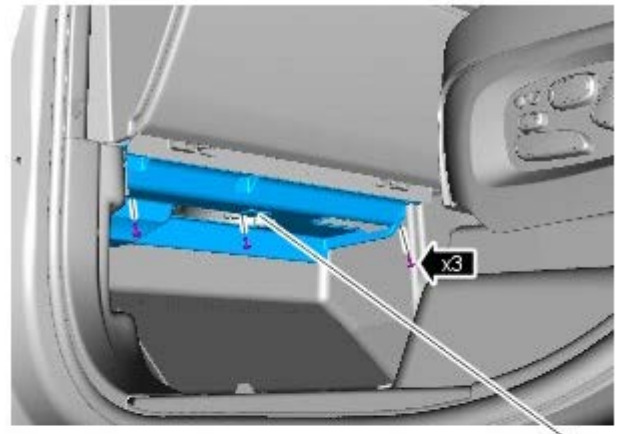
3.

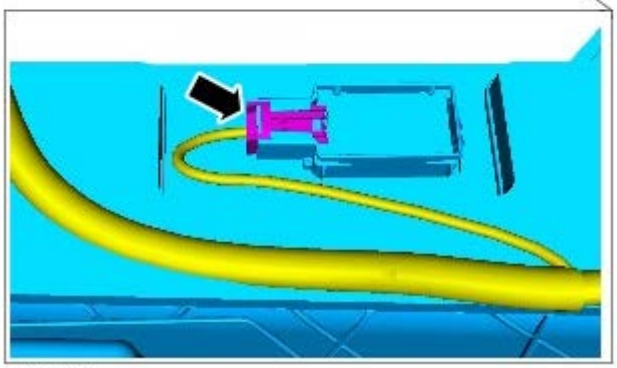


Left-hand drive vehicles

4. Refer to: Instrument Panel Lower Section (501-12 Instrument Panel and Console, Removal and Installation).

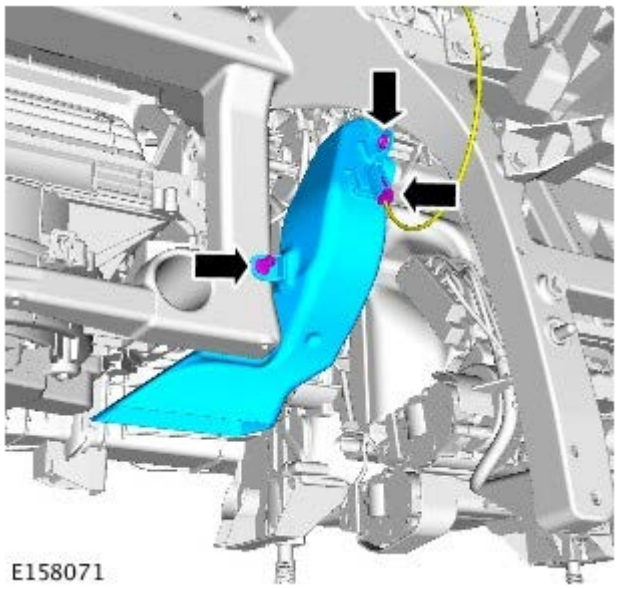
5. NOTE: Right hand drive illustration shown, Left hand drive is similar.





E146055

All vehicles

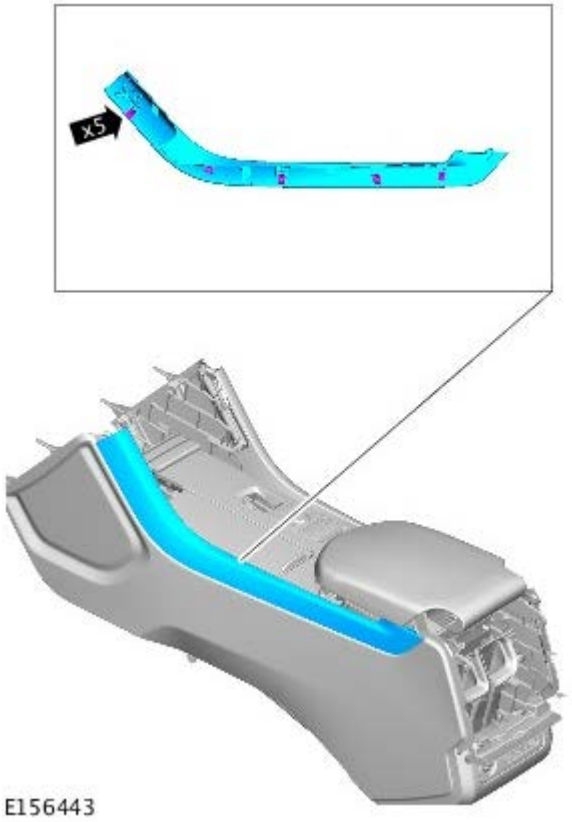


E158071

6. NOTE: Right hand drive illustration shown, Left hand drive is similar.

7. NOTE: Left hand illustration shown, Right hand is similar.

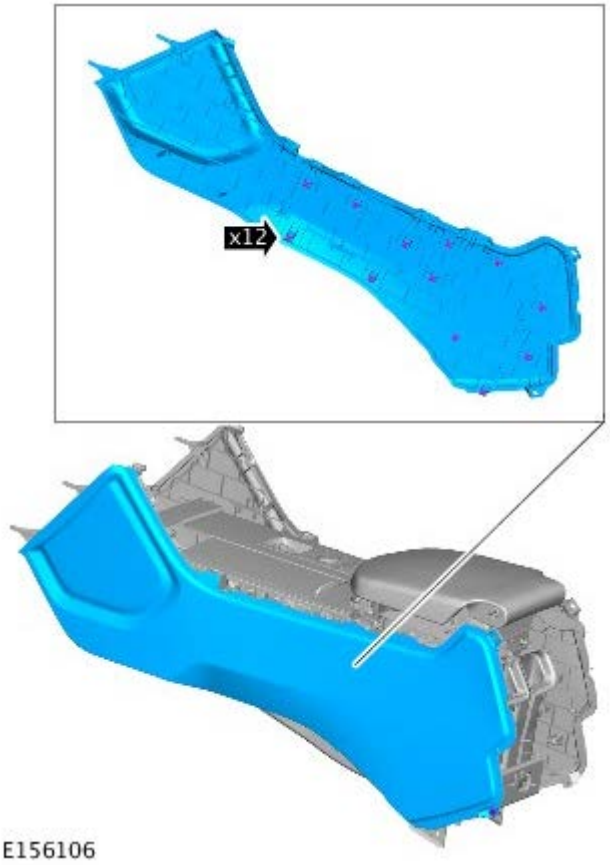
Remove Right hand trim



E156443

8. NOTE: Left hand illustration shown, Right hand is similar.

   Remove Right hand trim

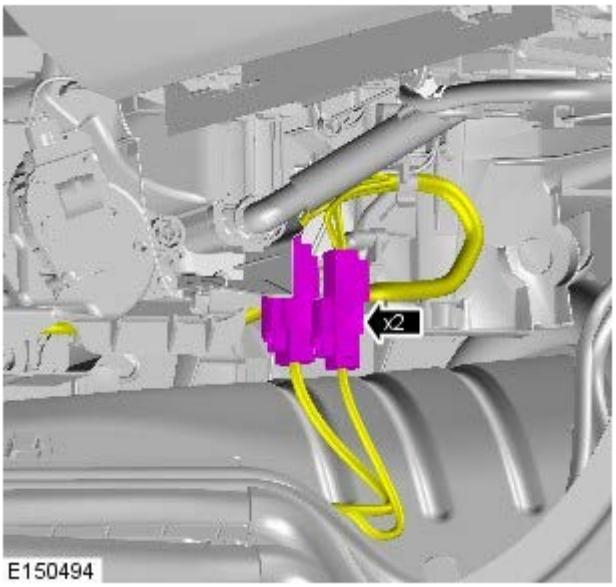


E156106

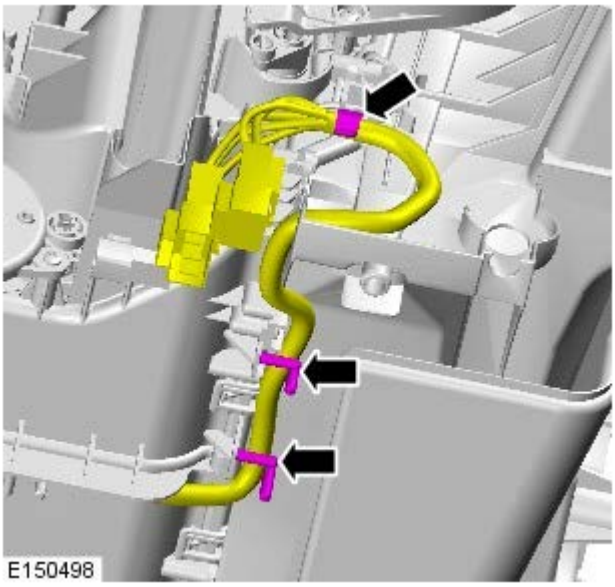
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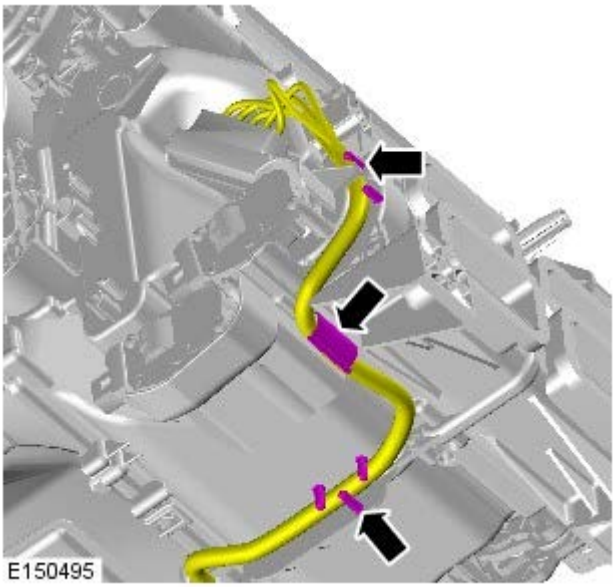
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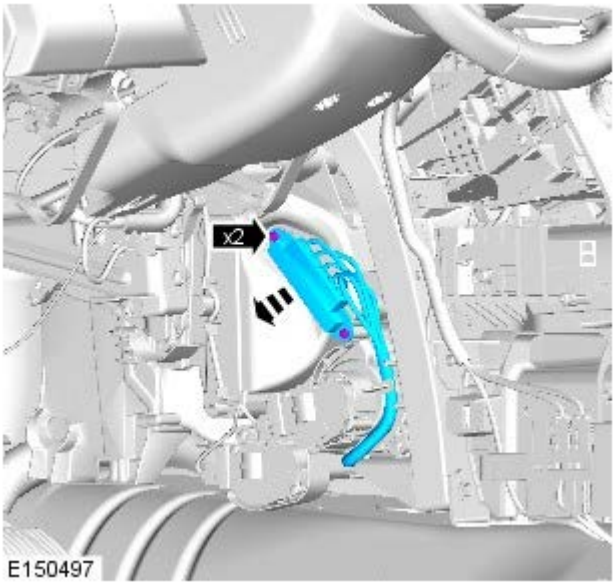
11.



12.



13.



Installation

1. To install, reverse the removal procedure.

Published: 23-Oct-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Fuel Fired Booster Heater

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. 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.

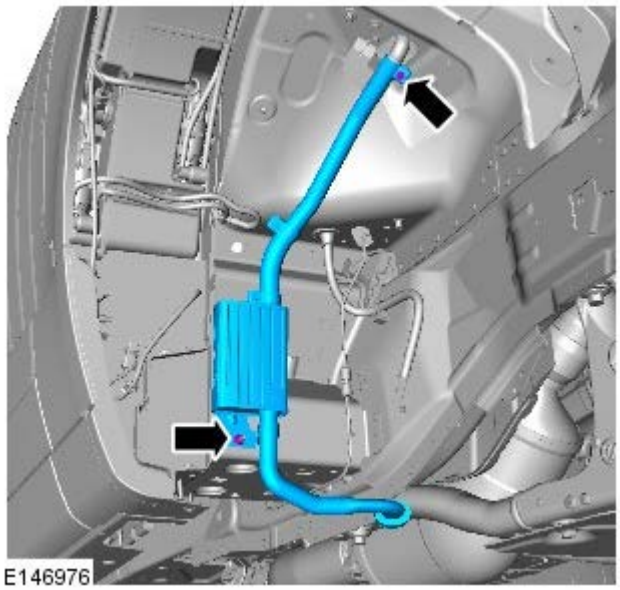
3. Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03F Engine Cooling - TDV8 4.4L Diesel, General Procedures).
   Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03A Engine Cooling - TDV6 3.0L Diesel, General Procedures).
   Refer to: Cooling System Partial Draining, Filling and Bleeding - V8 S/C 5.0L Petrol (303-03C Engine Cooling - V8 S/C 5.0L Petrol, General Procedures).

4. Refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).

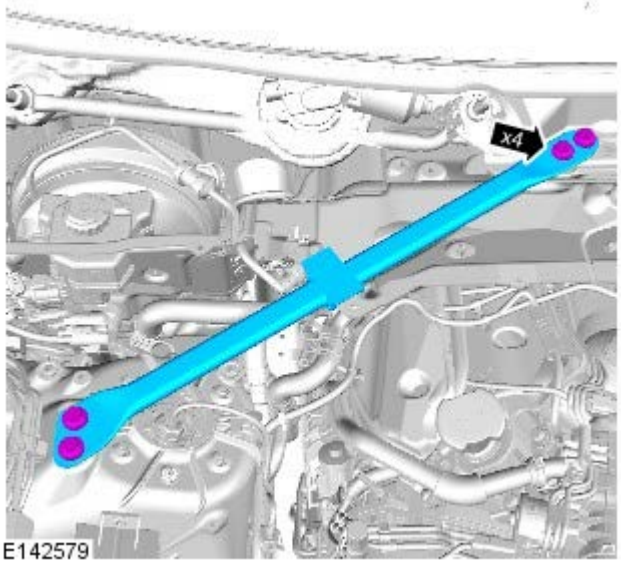
5. Remove the RH fender splash shield.

   Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

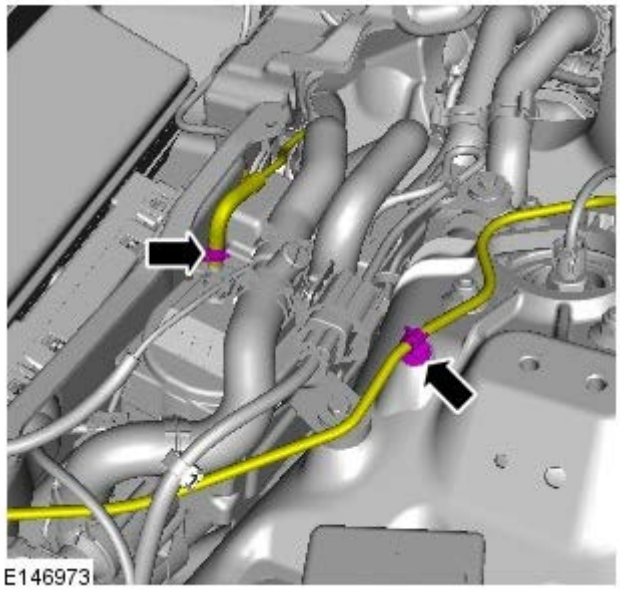
6. *Torque:* 10 Nm



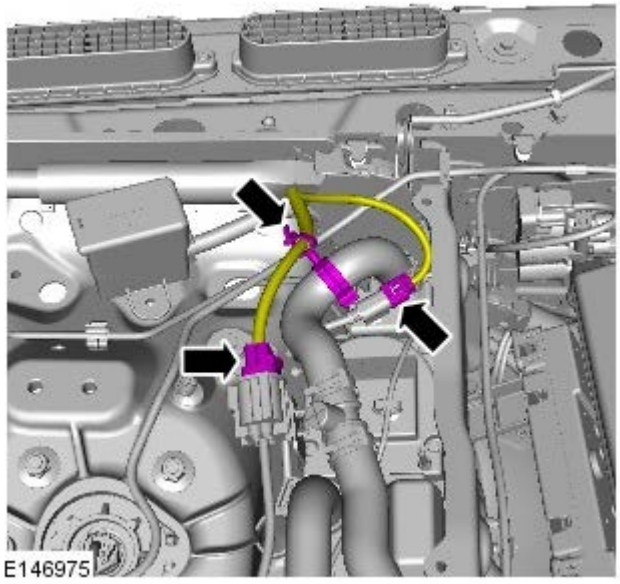
7. *Torque:* 55 Nm



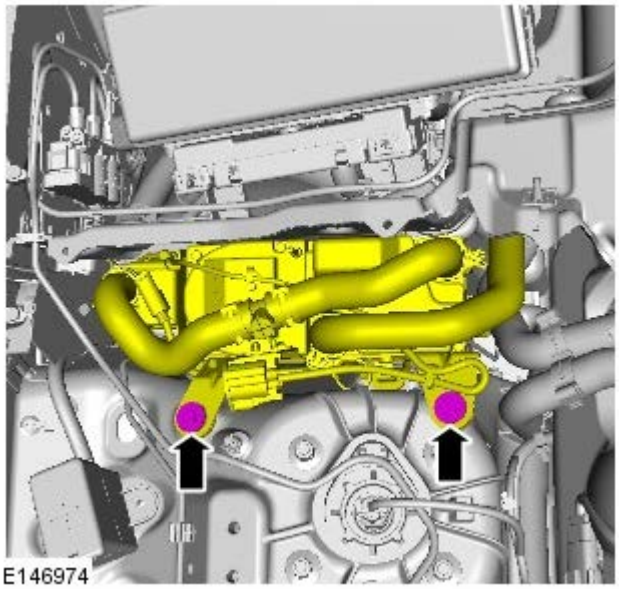
8. CAUTION: Be prepared to collect escaping fuel.



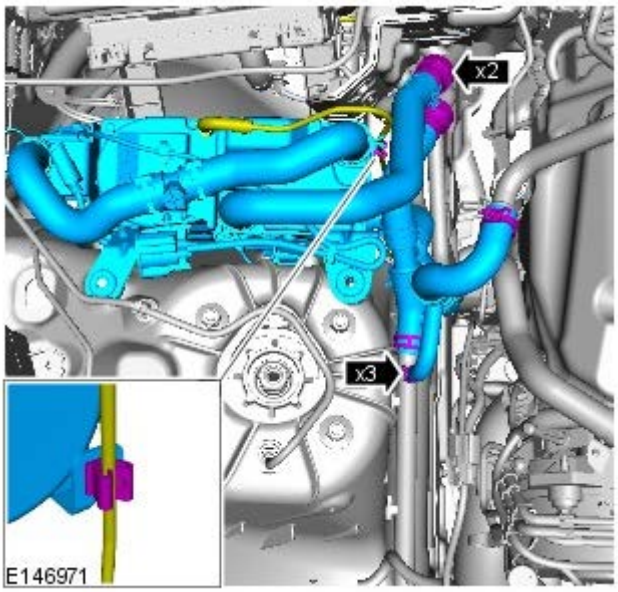
9.



10. *Torque:* 10 Nm

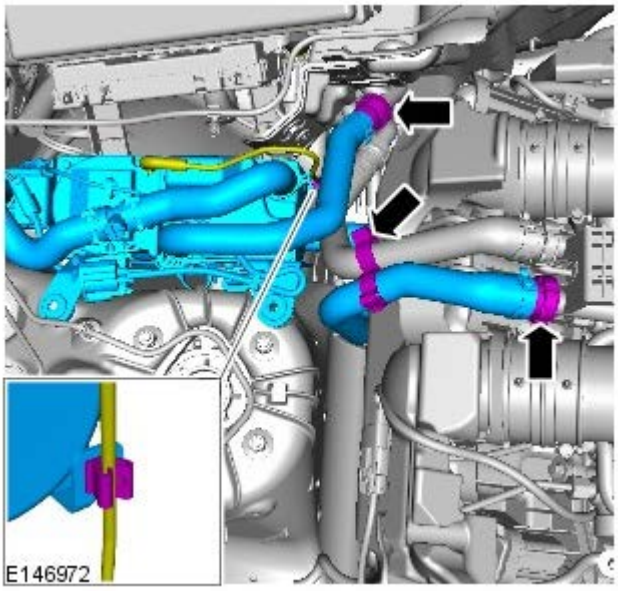


NOTE: Vehicles with 3.0L diesel engine.



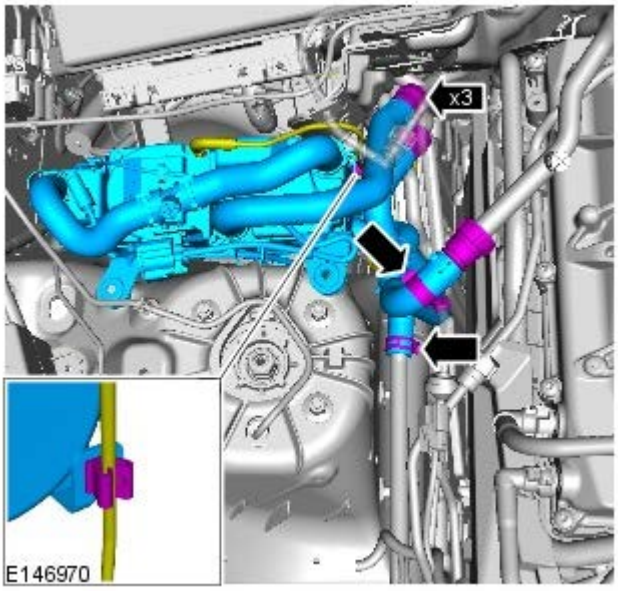
11. CAUTION: Be prepared to collect escaping coolant.

NOTE: Vehicles with 4.4L diesel engine.



12. CAUTION: Be prepared to collect escaping coolant.

NOTE: Vehicles with 5.0L engine.



13. CAUTION: Be prepared to collect escaping coolant.

Installation

1. To install, reverse the removal procedure.

Published: 24-Feb-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Fuel Fired Booster Heater Coolant Pump

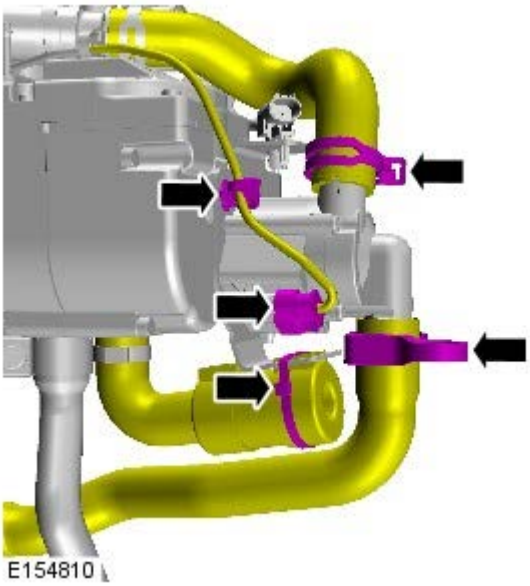
Removal and Installation

Removal

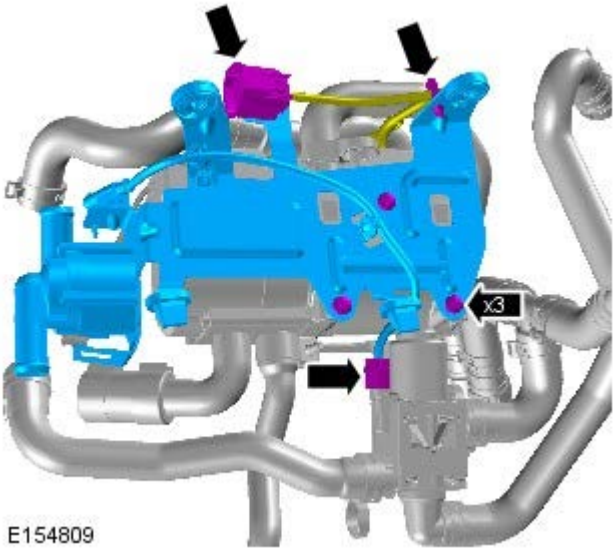
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Fuel Fired Booster Heater (412-02A Auxiliary Climate Control, Removal and Installation).

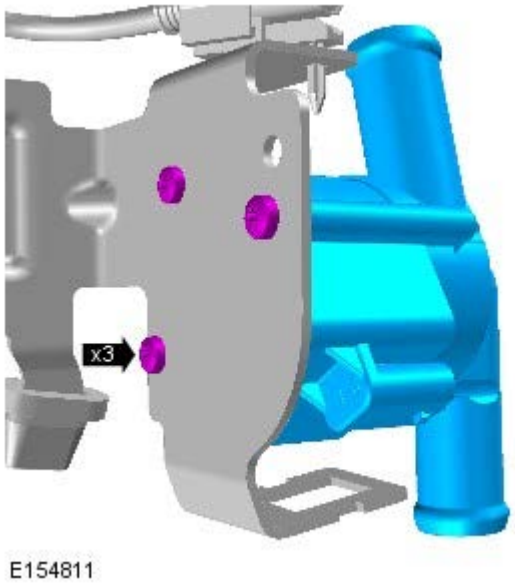
2.



3.



4. *Torque:* 1.5 Nm



E154811

Installation

1. To install, reverse the removal procedure.

Published: 18-Mar-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Fuel Fired Booster Heater Flame Sensor

Removal and Installation

Removal

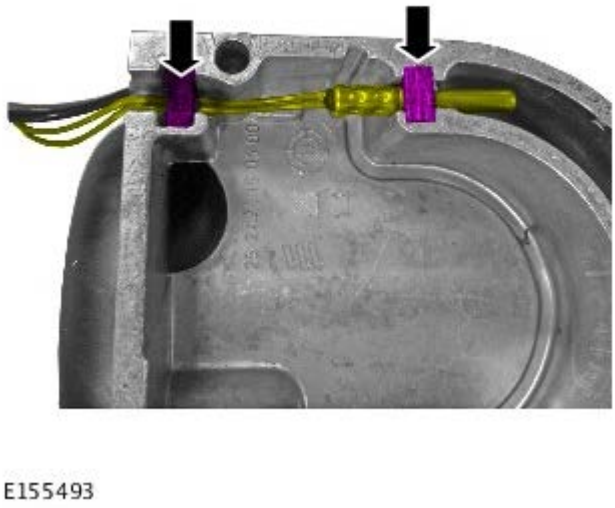
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Fuel Fired Booster Heater Combustion Chamber (412-02A Auxiliary Climate Control, Removal and Installation).

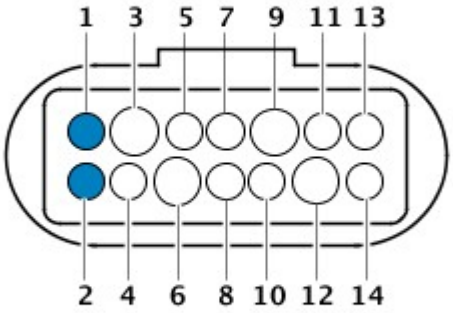
2.



3.



4. NOTE: Remove the terminals from the connector as indicated in order to replace the component.



E155492

Installation

1. CAUTION: Remove and discard the seals.

   NOTE: Install new seals.

   To install, reverse the removal procedure.

Published: 02-May-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Fuel Fired Booster Heater Fuel Pump

Removal and Installation

Removal

CAUTIONS:

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

If a new fuel pump is to be installed, make sure that the blanking caps are not removed prior to installation.

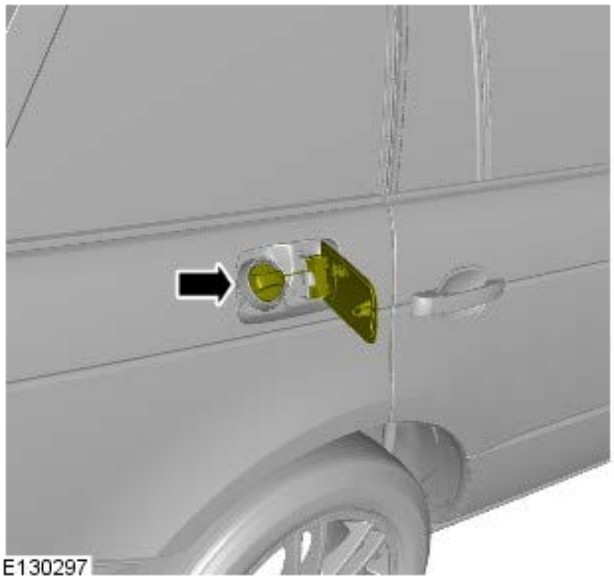
NOTE: Removal steps in this procedure may contain installation details.

All vehicles

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Disconnect the battery ground cable.

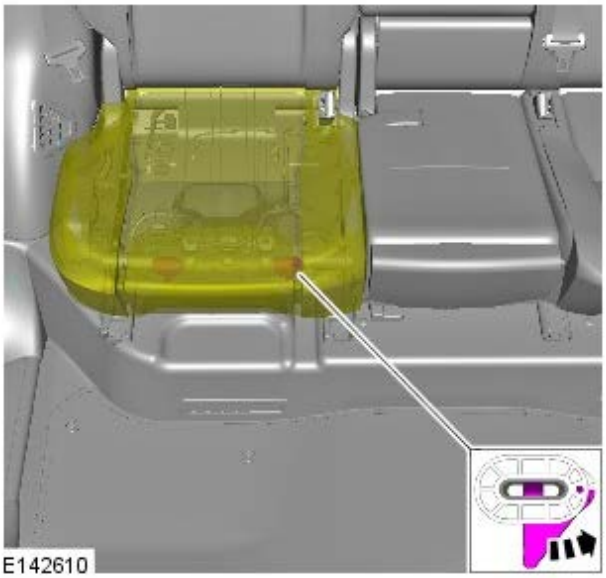
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).



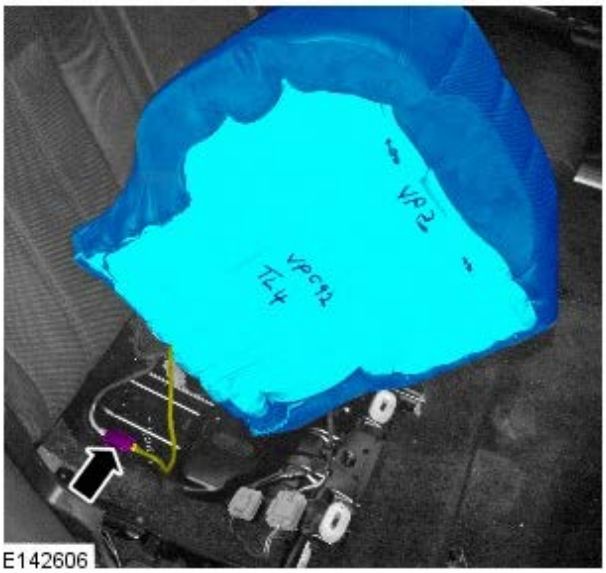
3. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Vehicles without occasional rear seats

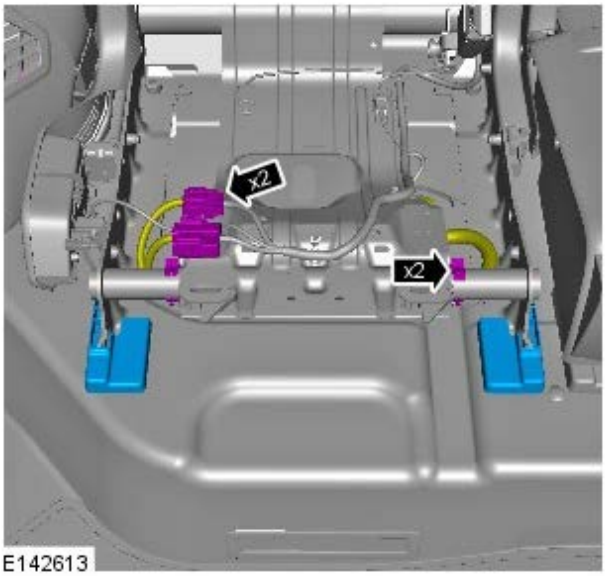
4.



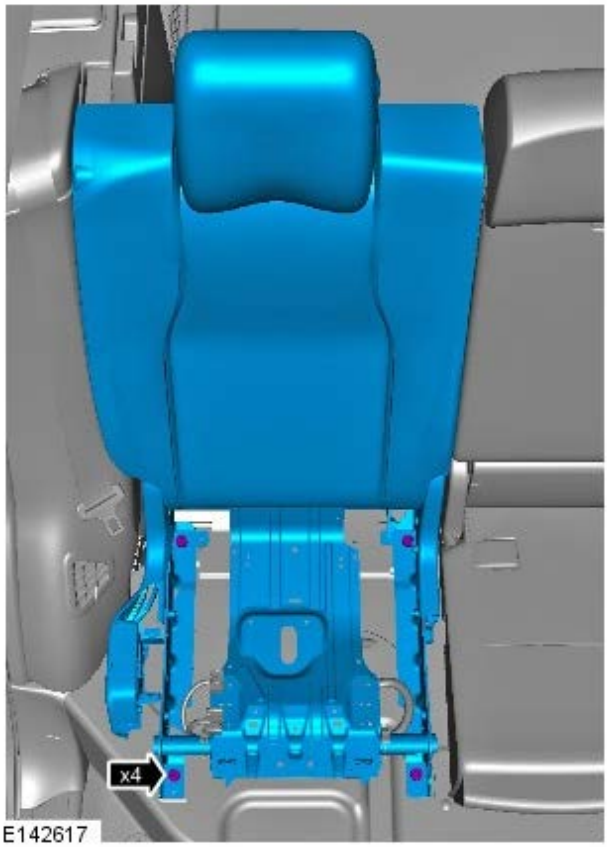
5.



6.



7. *Torque:* 50 Nm

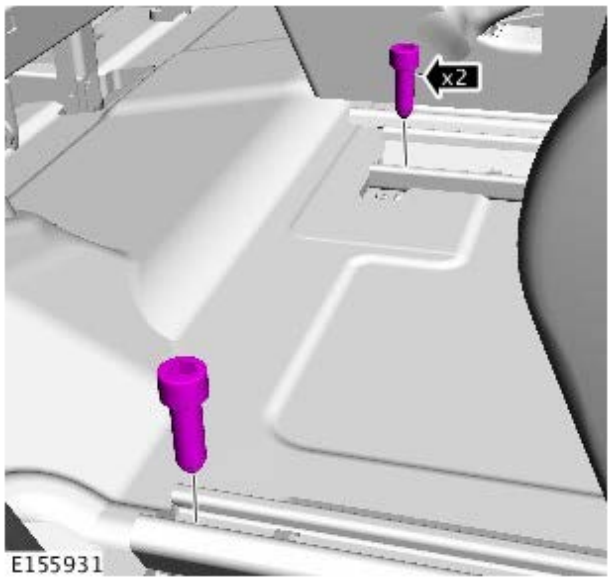


Vehicles with occasional rear seats

8.



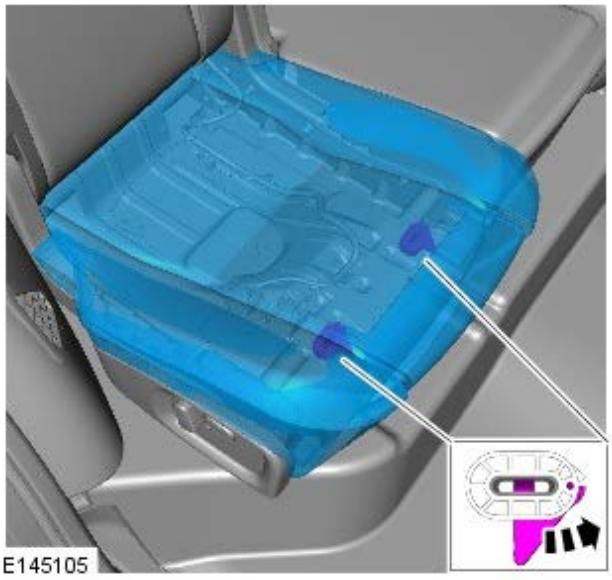
9. *Torque:* 50 Nm



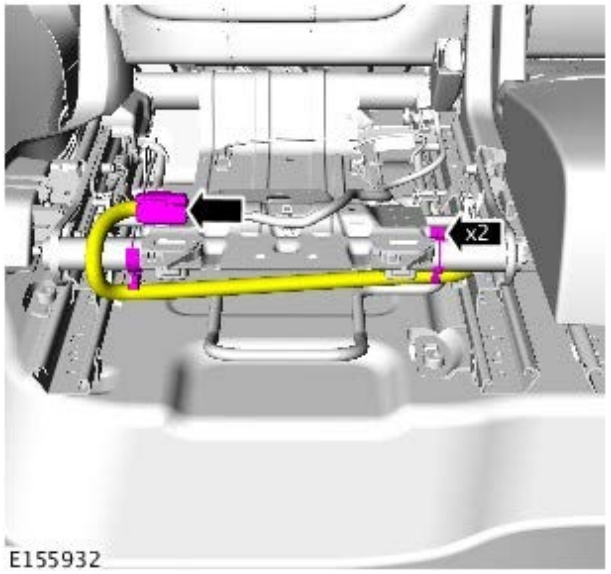
10.



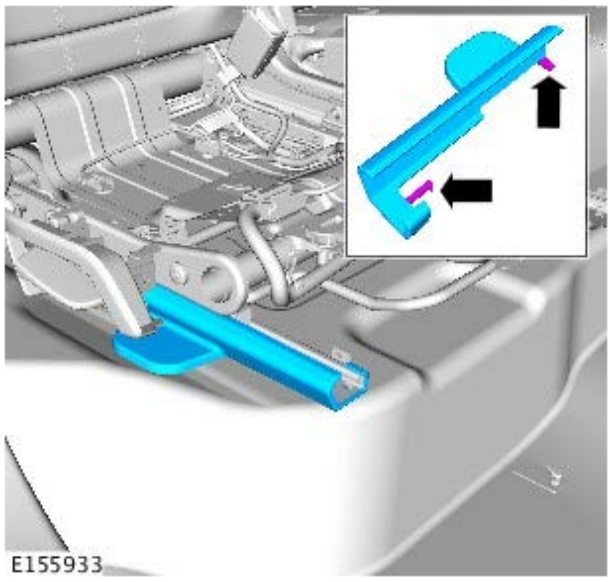
11.



12.



13.

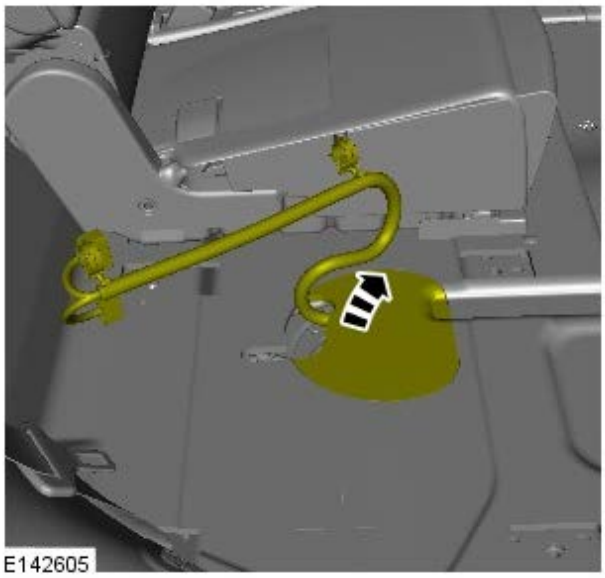


14. *Torque:* 50 Nm

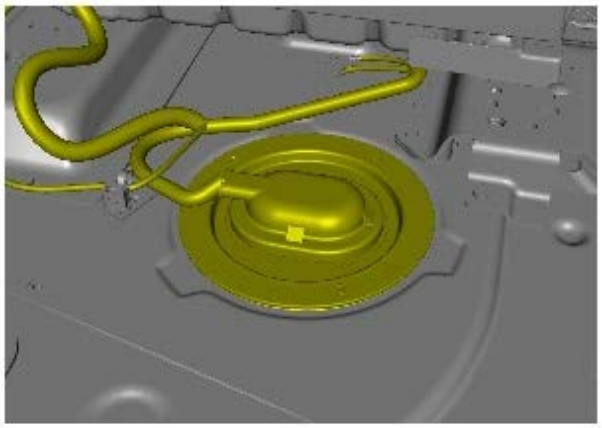


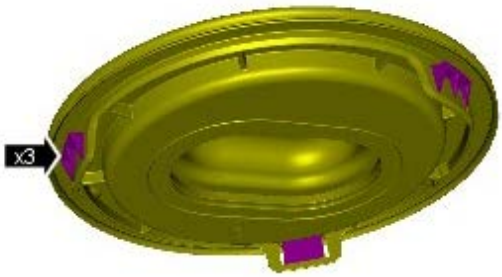
All vehicles

15.



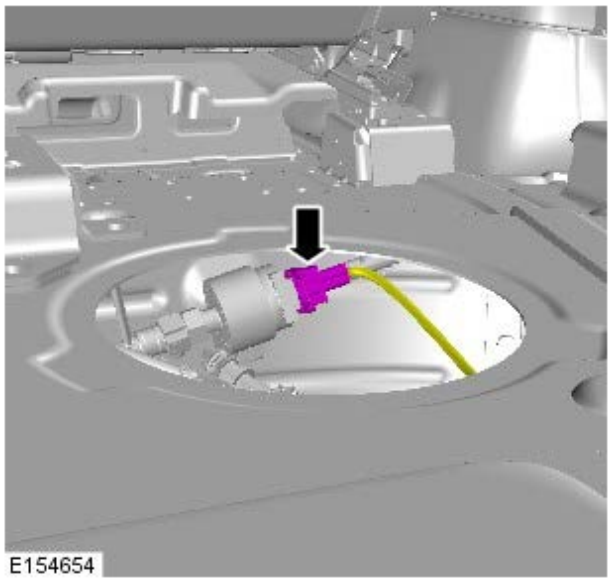
16.



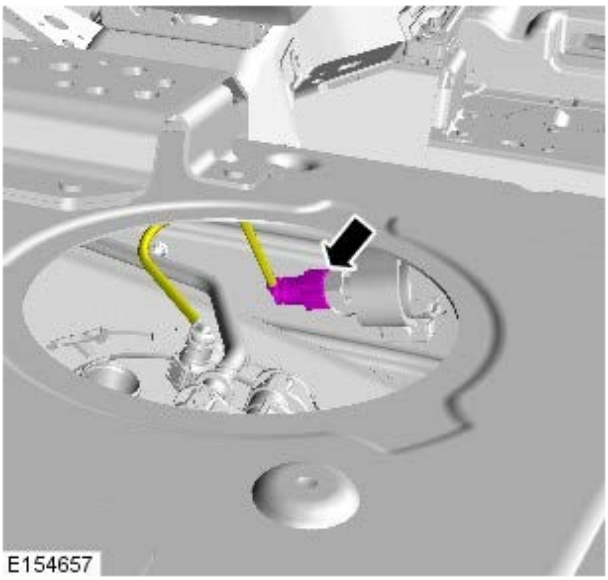


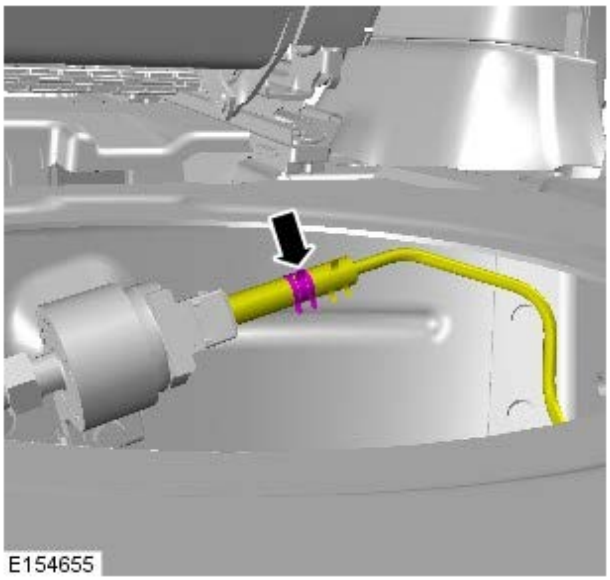
E142604

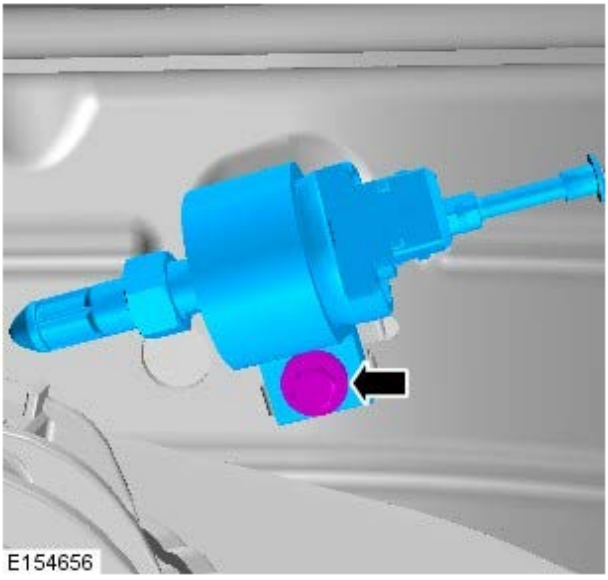
17.



18. CAUTION: Be prepared to collect escaping fuel.







19. CAUTION: Be prepared to collect escaping fuel.

20. *Torque:* 9 Nm

Installation

1. NOTE: Make sure that the fuel pipes do not contact the vehicle body.

   To install, reverse the removal procedure.

Published: 18-Mar-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Fuel Fired Booster Heater Glow Plug

Removal and Installation

Removal

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

1. Refer to: Fuel Fired Booster Heater Heat Exchanger (412-02A Auxiliary Climate Control, Removal and Installation).

2.



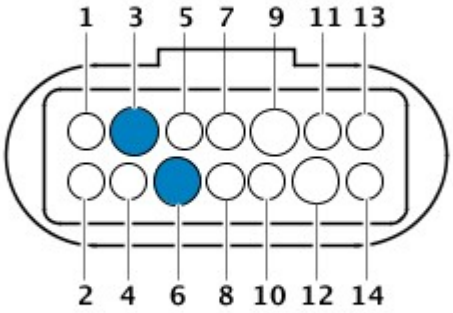
E155489

3.



E155482

4. NOTE: Remove the terminals from the connector as indicated in order to replace the component.



E155488

Installation

1. CAUTION: Remove and discard the seals.

   NOTE: Install new seals.

   To install, reverse the removal procedure.

Published: 16-May-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Auxiliary Blower Motor

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

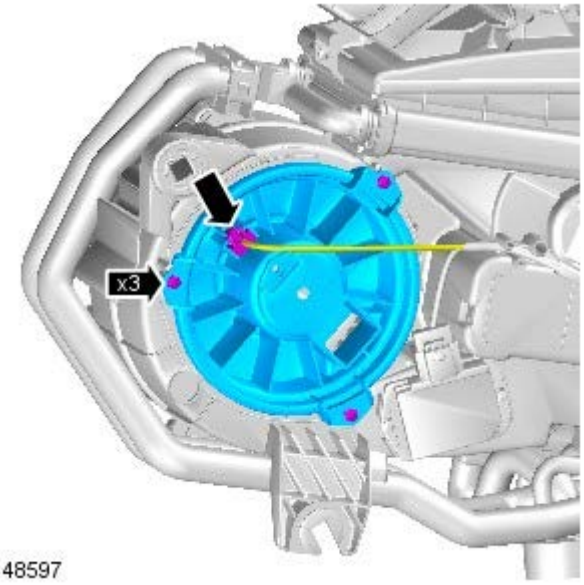
Some variation in the illustrations may occur, but the essential information is always correct.

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

   Raise and support the vehicle.

2. Refer to: Auxiliary Heater Core and Evaporator Core Housing (412-02A Auxiliary Climate Control, Removal and Installation).

3.



Installation

1. To install, reverse the removal procedure.

Published: 16-May-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Auxiliary Blower Motor Resistor

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

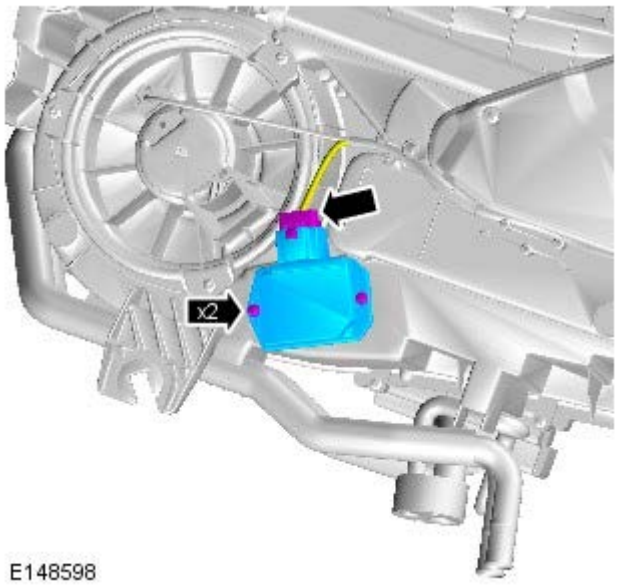
Some variation in the illustrations may occur, but the essential information is always correct.

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

   Raise and support the vehicle.

2. Refer to: Auxiliary Heater Core and Evaporator Core Housing (412-02A Auxiliary Climate Control, Removal and Installation).

3.



Installation

1. To install, reverse the removal procedure.

Published: 17-May-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Auxiliary Climate Control Face/Feet Motor

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

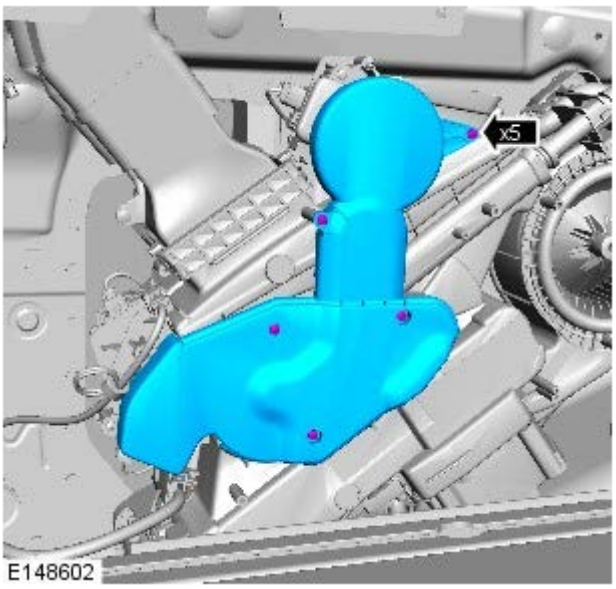
Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

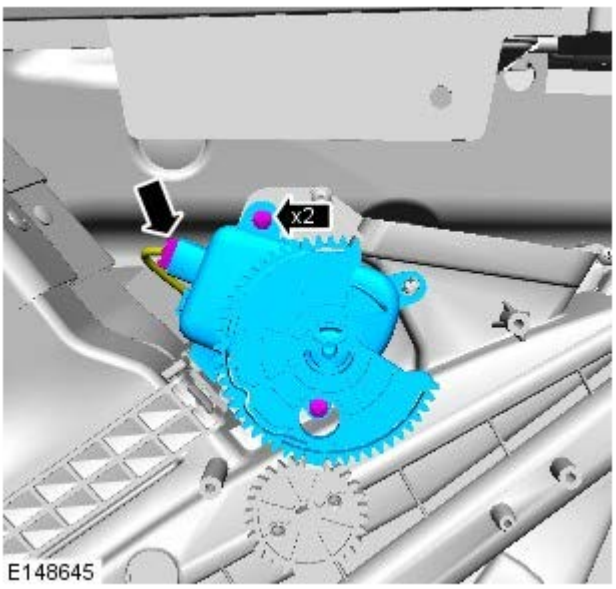
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Refer to: Loadspace Trim Panel LH (501-05 Interior Trim and Ornamentation, Removal and Installation).

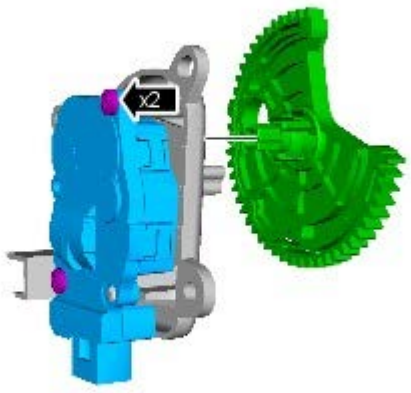
3.



4.



5.



E148646

Installation

1. To install, reverse the removal procedure.

Published: 16-May-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Auxiliary Heater Core

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

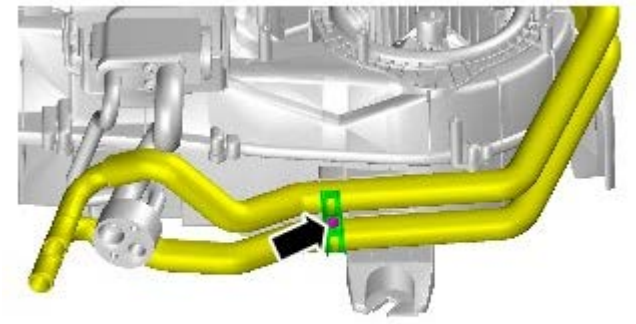
Some variation in the illustrations may occur, but the essential information is always correct.

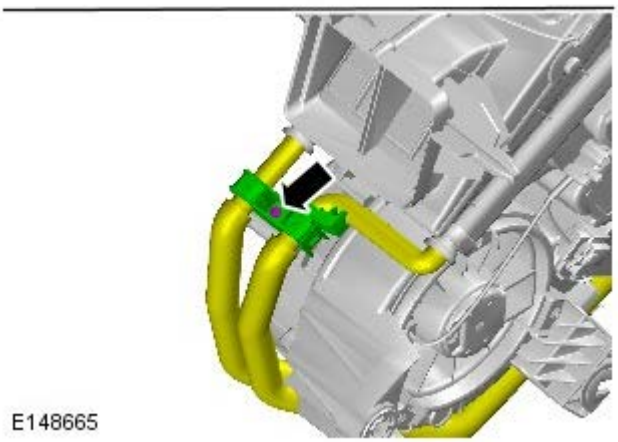
1. WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

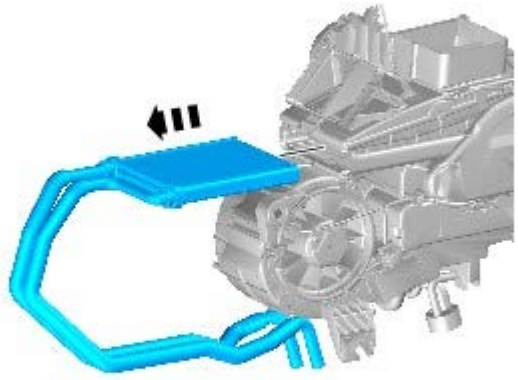
2. Refer to: Auxiliary Heater Core and Evaporator Core Housing (412-02A Auxiliary Climate Control, Removal and Installation).

3.





4.



E148668

Installation

1. To install, reverse the removal procedure.

Published: 17-May-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Auxiliary Heater Core and Evaporator Core Housing

Removal and Installation

Removal

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

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

   Raise and support the vehicle.

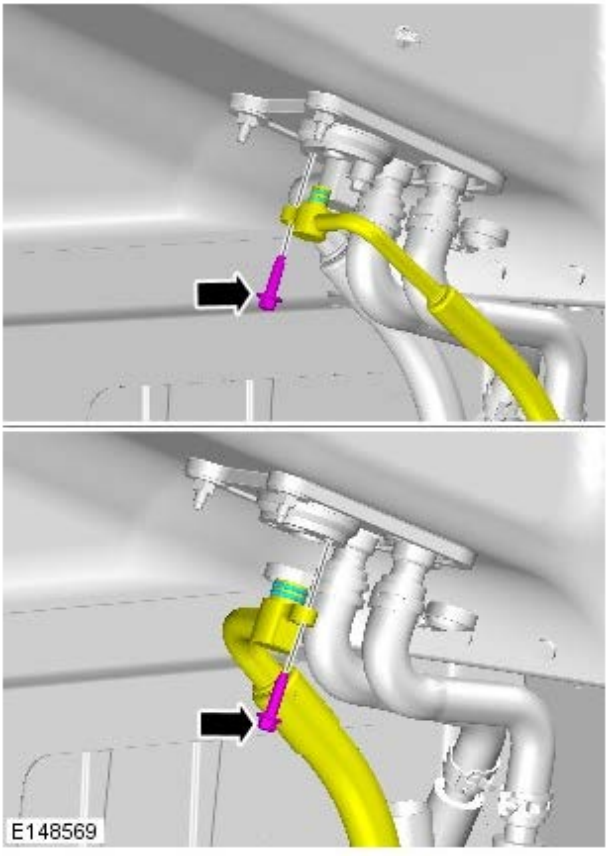
2. Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03A Engine Cooling - TDV6 3.0L Diesel, General Procedures).

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

4. Disconnect the battery ground cable.

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

5. Refer to: Rear Fender Splash Shield (501-08 Exterior Trim and Ornamentation, Removal and Installation).



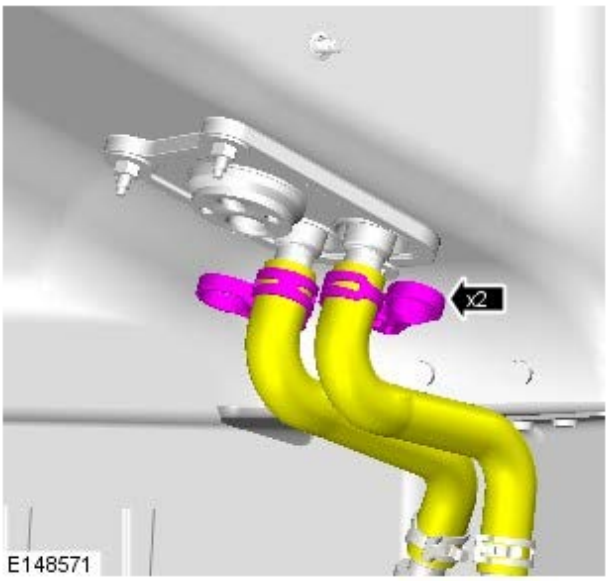
6. CAUTION: Install new o-ring seals

   NOTE: Remove and discard the O-ring seals.

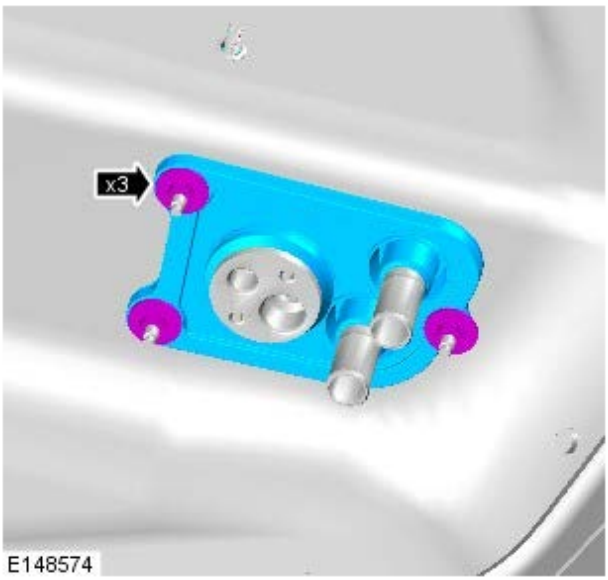
   Torque: 10 Nm

7. CAUTION: Be prepared to collect escaping

coolant.

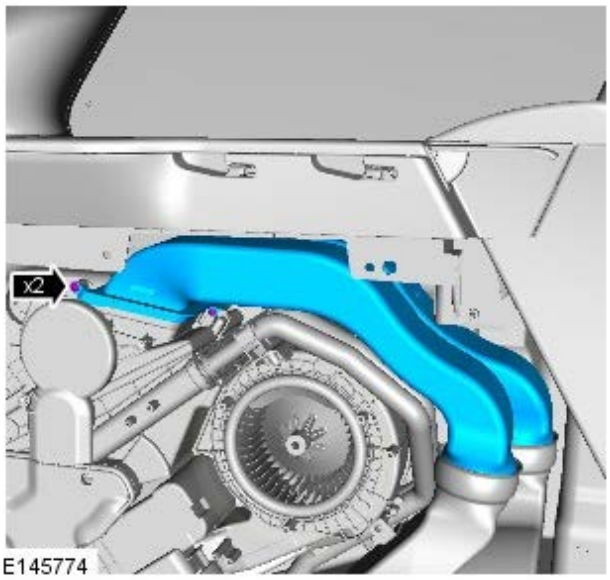


8. *Torque:* 10 Nm

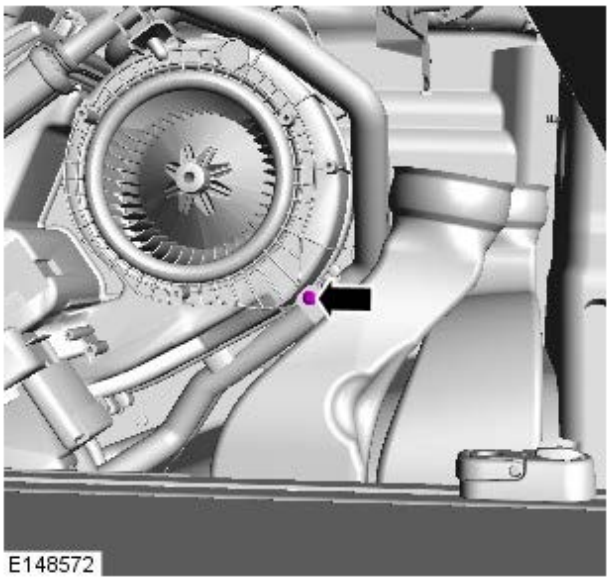


9. Refer to: Loadspace Trim Panel LH (501-05 Interior Trim and Ornamentation, Removal and Installation).

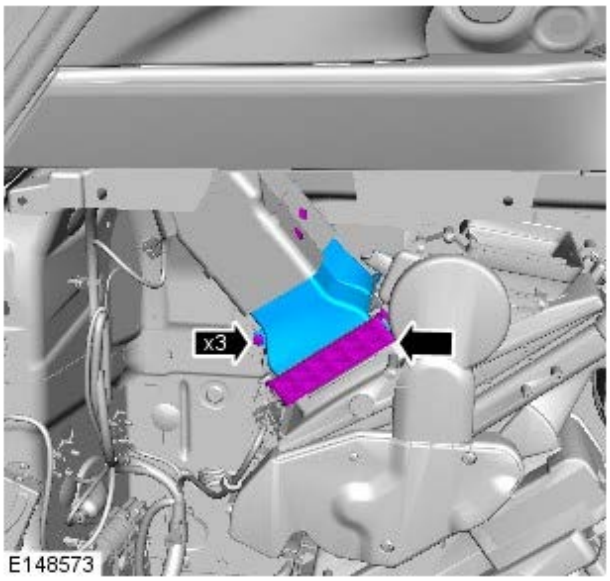
10. NOTE: LH shown.



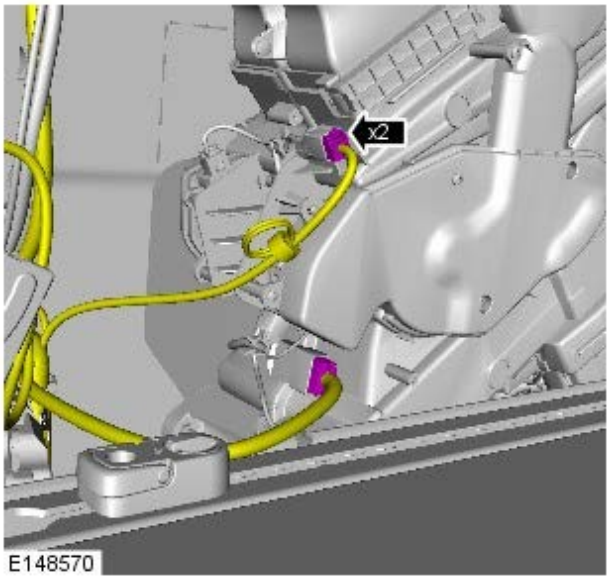
11.



12.

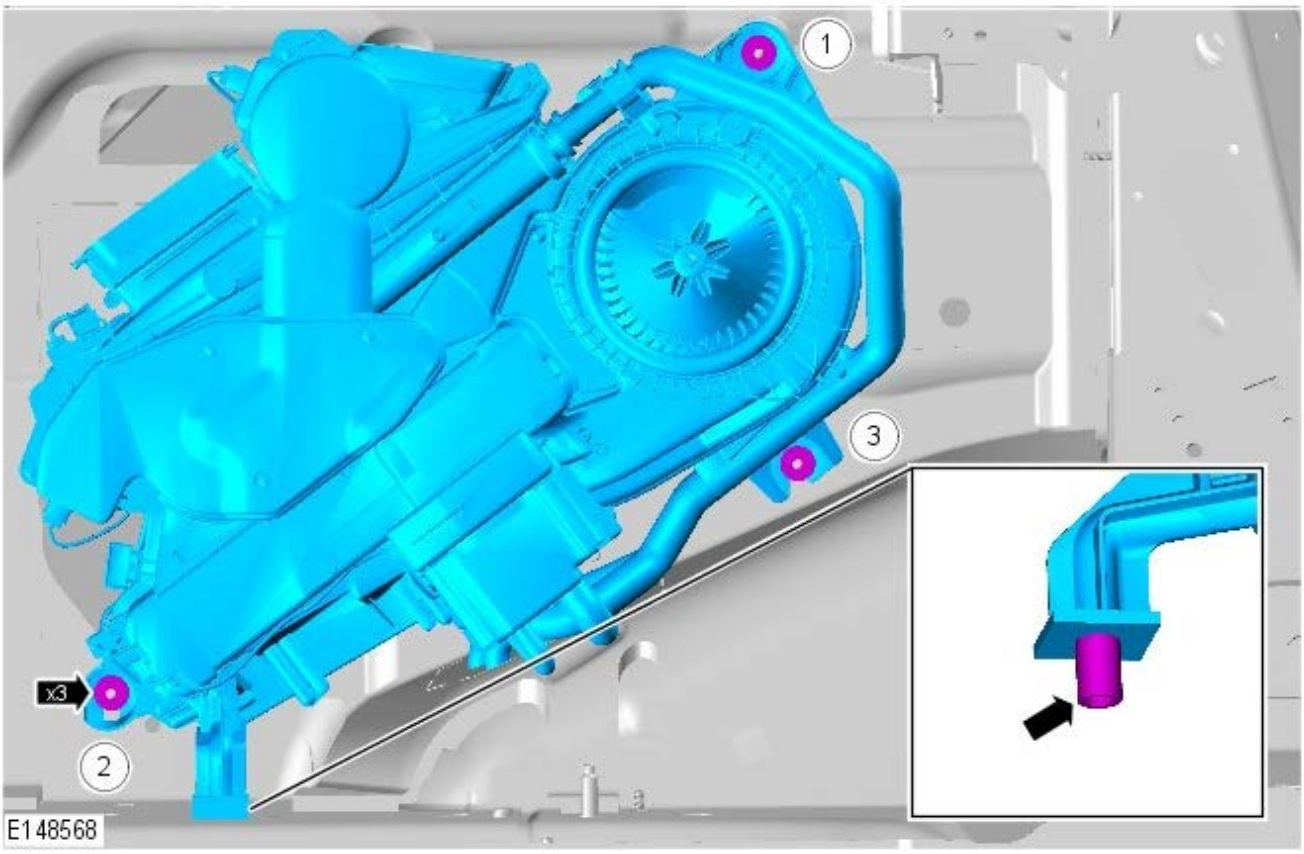


13.



14. CAUTION: Tighten the bolts in the sequence shown.

Torque: 5 Nm



Installation

1. NOTE: Remove and discard all blanking caps.

   To install, reverse the removal procedure.

Published: 16-Mar-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Fuel Fired Booster Heater Overheat Sensor

Removal and Installation

Removal

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

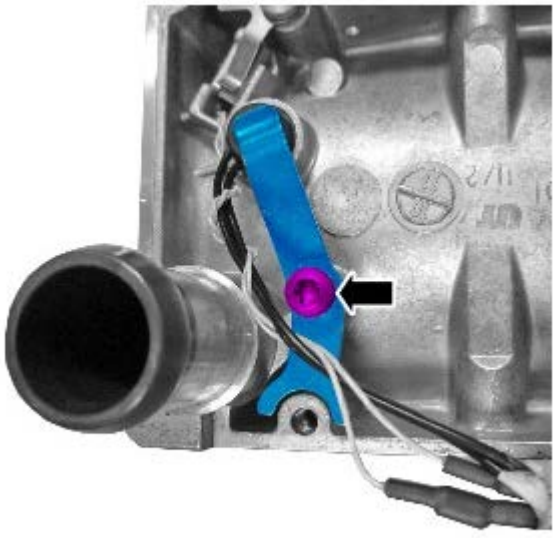
1. Refer to: Fuel Fired Booster Heater Control Module (412-02A Auxiliary Climate Control, Removal and Installation).

2.



E155487

3.



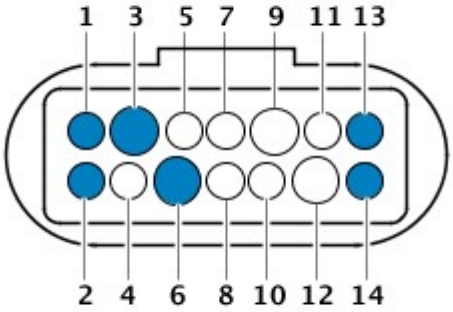
E155485

4.



E155486

5. NOTE: Remove the terminals from the connector as indicated in order to replace the component.



E155484

Installation

1. To install, reverse the removal procedure.

Published: 18-Mar-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Fuel Fired Booster Heater Heat Exchanger

Removal and Installation

Removal

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

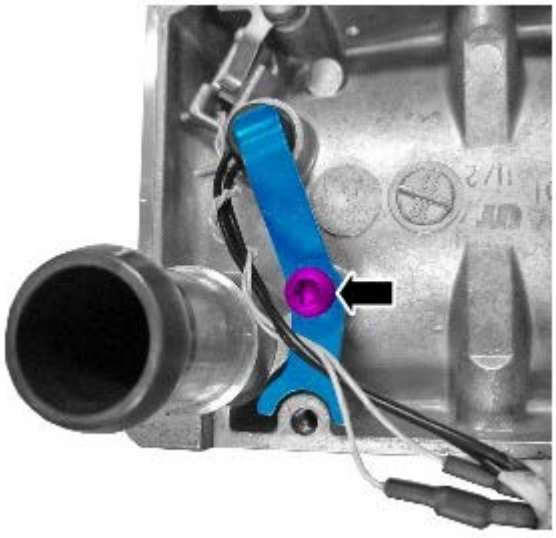
1. Refer to: Fuel Fired Booster Heater Control Module (412-02A Auxiliary Climate Control, Removal and Installation).

2.



E155487

3.



E155485

4.



E155486

5.





E155479

6.



E155483

Installation

1. CAUTION: Remove and discard the seals.

   NOTE: Install new seals.

   To install, reverse the removal procedure.

Published: 18-Mar-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Fuel Fired Booster Heater Combustion Chamber

Removal and Installation

Removal

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

1. Refer to: Fuel Fired Booster Heater Heat Exchanger (412-02A Auxiliary Climate Control, Removal and Installation).

2.



E155489

3.



E155481

Installation

1. CAUTION: Remove and discard the seals.

   NOTE: Install new seals.

   To install, reverse the removal procedure.

Published: 18-Mar-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Fuel Fired Booster Heater Blower

Removal and Installation

Removal

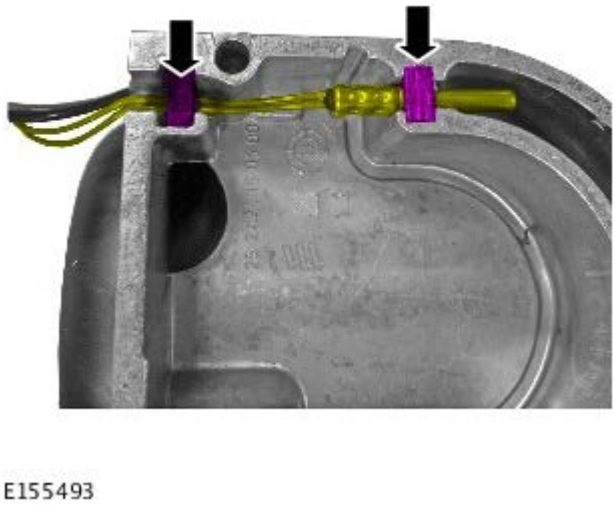
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Fuel Fired Booster Heater Combustion Chamber (412-02A Auxiliary Climate Control, Removal and Installation).

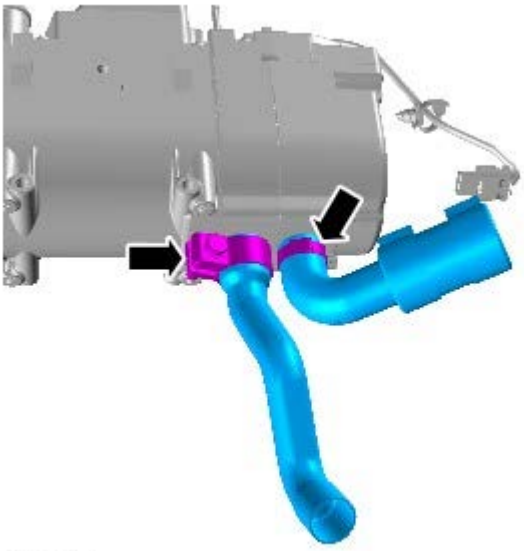
2.



3.



4.



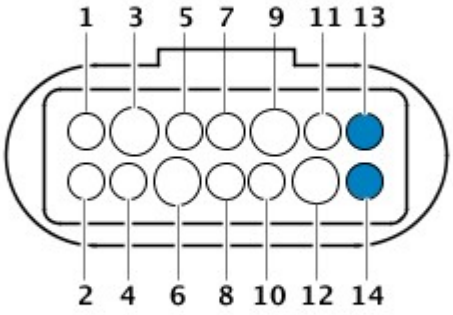
E155444

5.



E155491

6. NOTE: Remove the terminals from the connector as indicated in order to replace the component.



E155490

Installation

1. CAUTION: Remove and discard the seals.

 NOTE: Install new seals.

To install, reverse the removal procedure.

Published: 16-Mar-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Fuel Fired Booster Heater Control Module

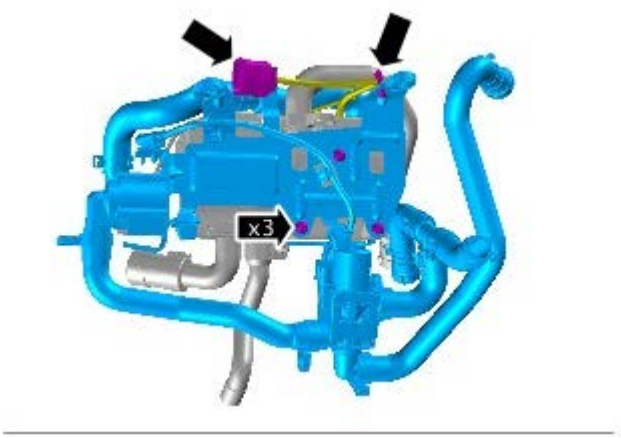
Removal and Installation

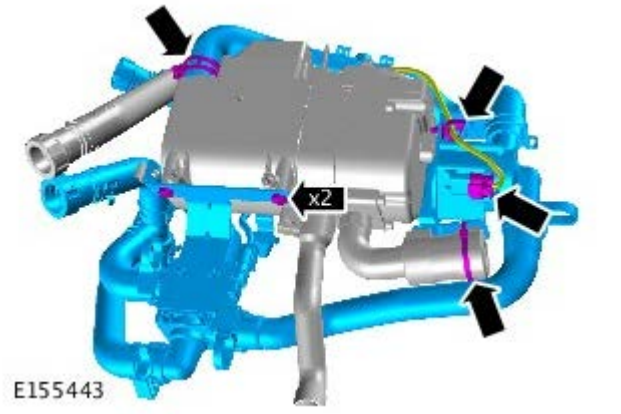
Removal

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

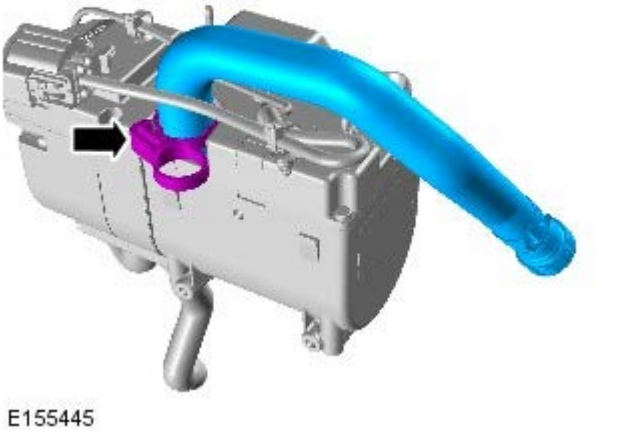
1. Refer to: Fuel Fired Booster Heater (412-02A Auxiliary Climate Control, Removal and Installation).

2.

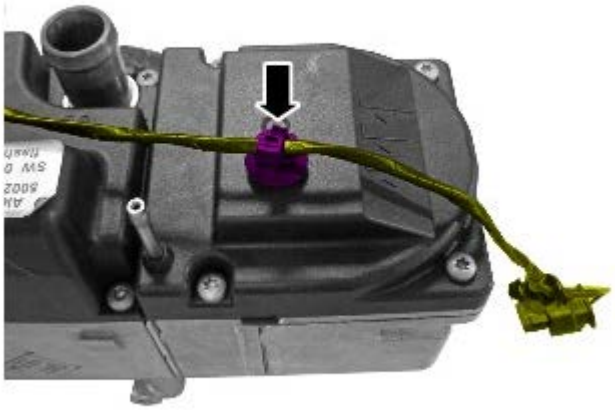




3.



4.



E155478

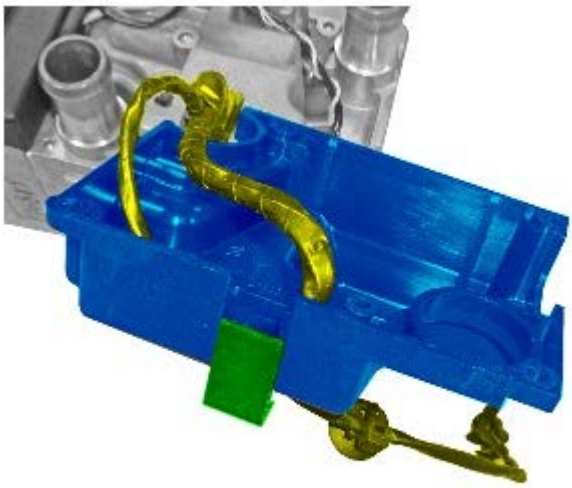
5.





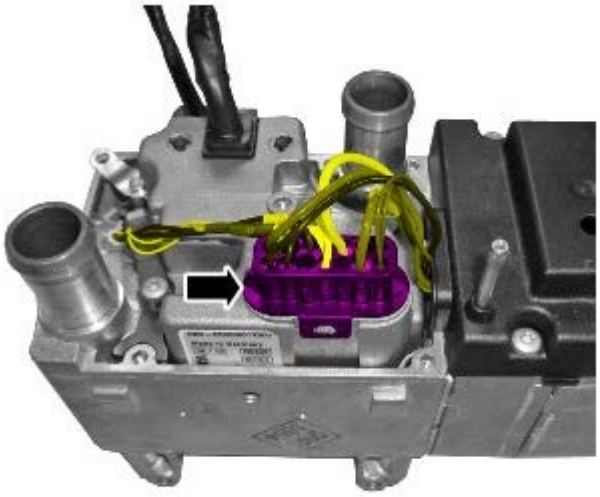
E155474

6.



E155477

7.



E155475

8.



E155476

Installation

1. To install, reverse the removal procedure.

Published: 16-May-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Auxiliary Temperature Blend Motor Left

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

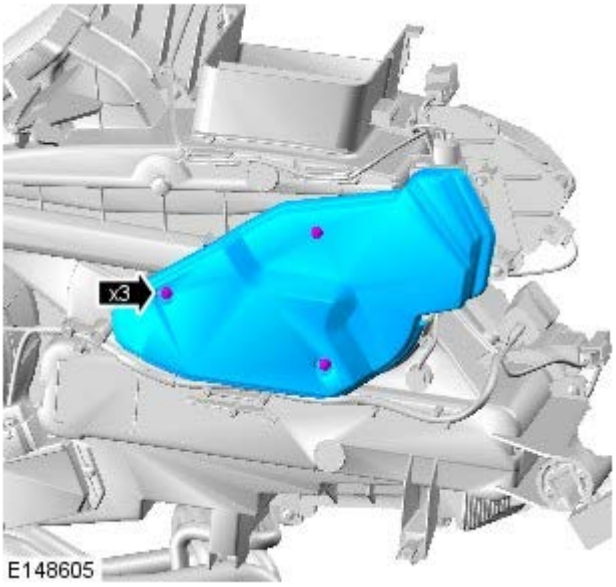
Some variation in the illustrations may occur, but the essential information is always correct.

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

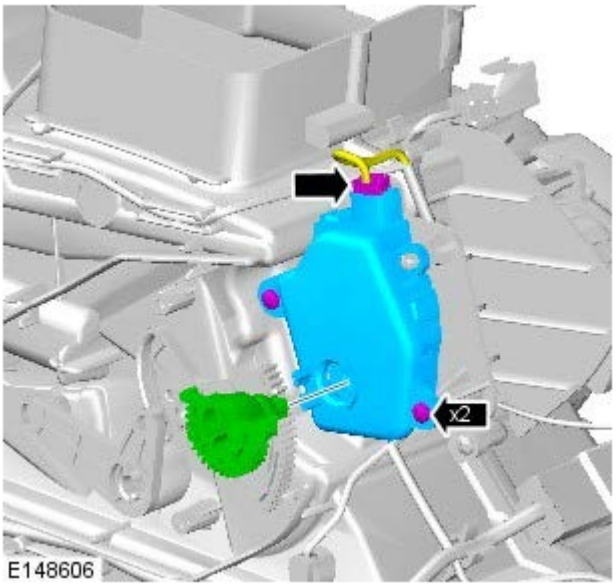
   Raise and support the vehicle.

2. Refer to: Auxiliary Heater Core and Evaporator Core Housing (412-02A Auxiliary Climate Control, Removal and Installation).

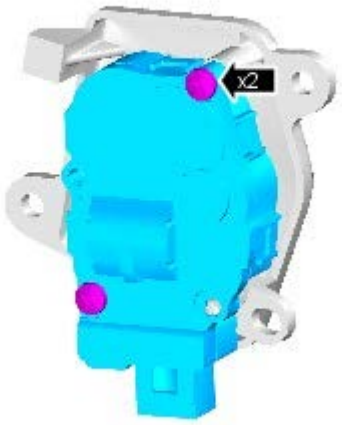
3.



4.



5.



E148607

Installation

1. To install, reverse the removal procedure.

Published: 16-May-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Auxiliary Temperature Blend Motor Right

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

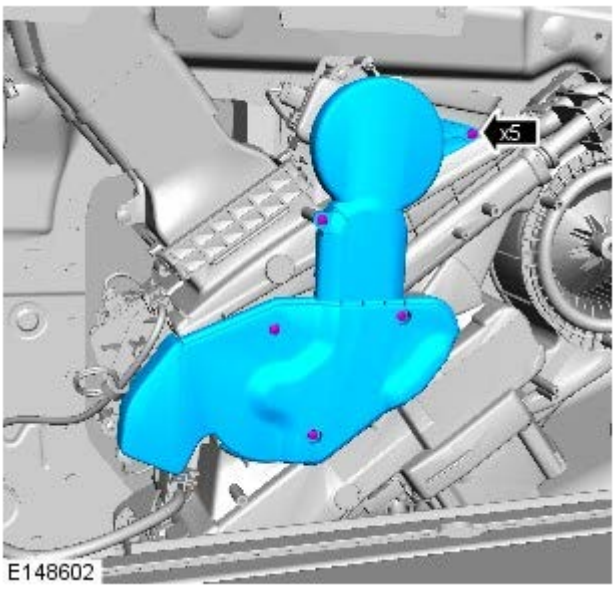
Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

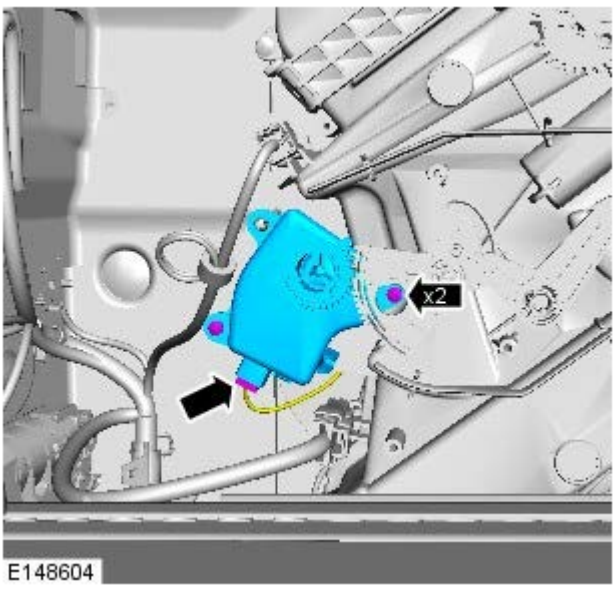
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Refer to: Loadspace Trim Panel LH (501-05 Interior Trim and Ornamentation, Removal and Installation).

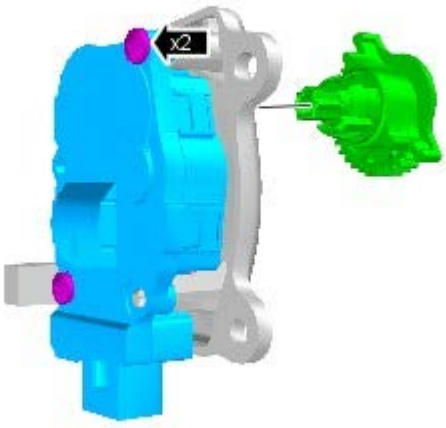
3.



4.



5.



E148603

Installation

1. To install, reverse the removal procedure.

Published: 17-May-2013

Auxiliary Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle - Auxiliary Thermostatic Expansion Valve

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

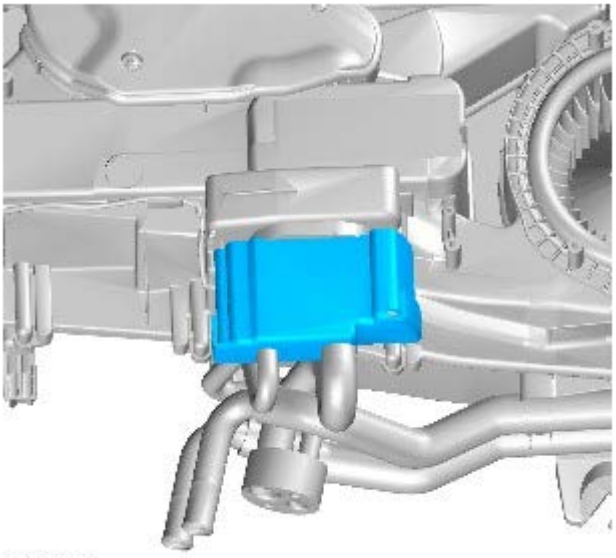
Some variation in the illustrations may occur, but the essential information is always correct.

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

   Raise and support the vehicle.

2. Refer to: Auxiliary Heater Core and Evaporator Core Housing (412-02A Auxiliary Climate Control, Removal and Installation).

3.



E148658

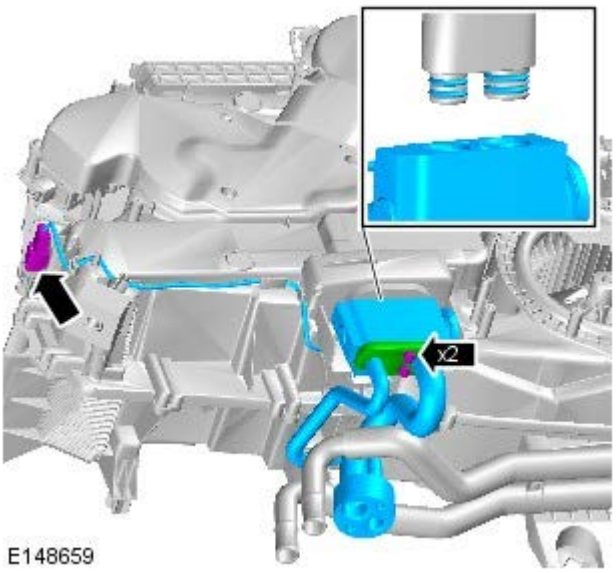
4. CAUTIONS:

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

   Remove and discard the O-ring seals.

   NOTE: Install new O-ring seals.

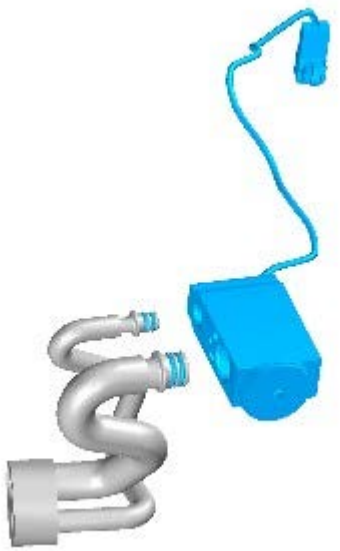
   Torque: 4 Nm



E148659

5. CAUTIONS:

   Before disconnecting or removing the



E148660

components, make sure the area around the joint faces and connections are clean and dry. Plug open connections to prevent contamination.

Remove and discard the O-ring seals.

NOTE: Install new O-ring seals.

Installation

1. NOTE: Remove and discard all blanking caps.

   To install, reverse the removal procedure.

Published: 02-May-2013

Instrument Cluster -

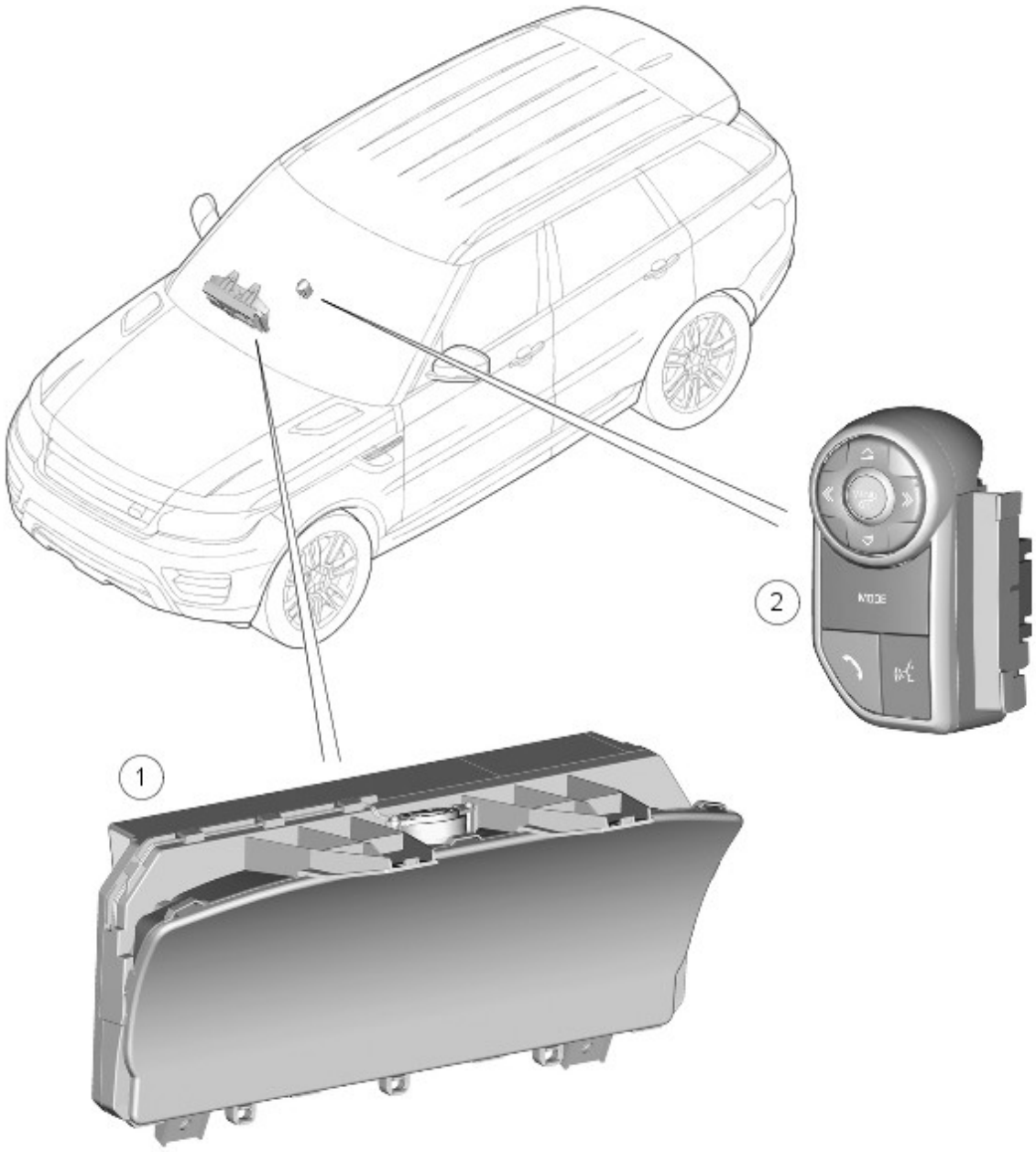
Description	Nm	lb-in
Instrument cluster surrounding trim screws	1.7	15
Instrument cluster upper screws	1.1	9.7
Instrument cluster lower screws	1.7	15

Published: 21-Oct-2013

Instrument Cluster - Instrument Cluster

Description and Operation

INSTRUMENT CLUSTER - COMPONENT LOCATION



E152252

Item	Part Number	Description
1	-	Instrument Cluster (IC)
2	-	Left steering wheel switchpack (menu control)

OVERVIEW

The IC (Instrument Cluster) is a high definition Thin Film Transistor (TFT) display.

The display is continually reconfigured to prioritize and refine the information presented to the driver. All displays are 'virtual' with the speedometer and the tachometer being the dominant features of the display. Two hardwired warning indicators are in the cluster; the security warning indicator and a primary airbag/Supplementary Restraint System (SRS) warning indicator. These warning indicators are LED (Light Emitting Diode)'s. All other warning indicators are generated within the IC TFT screen.

Two ambient light sensors; one on either side of the IC, (to ensure the brightest lighting conditions are detected) are used to adjust cluster illumination in response to prevailing lighting conditions.

The IC features a number of warning indicators. The warning indicators illuminate in one of four colors which indicate the level of importance of the warning as follows:

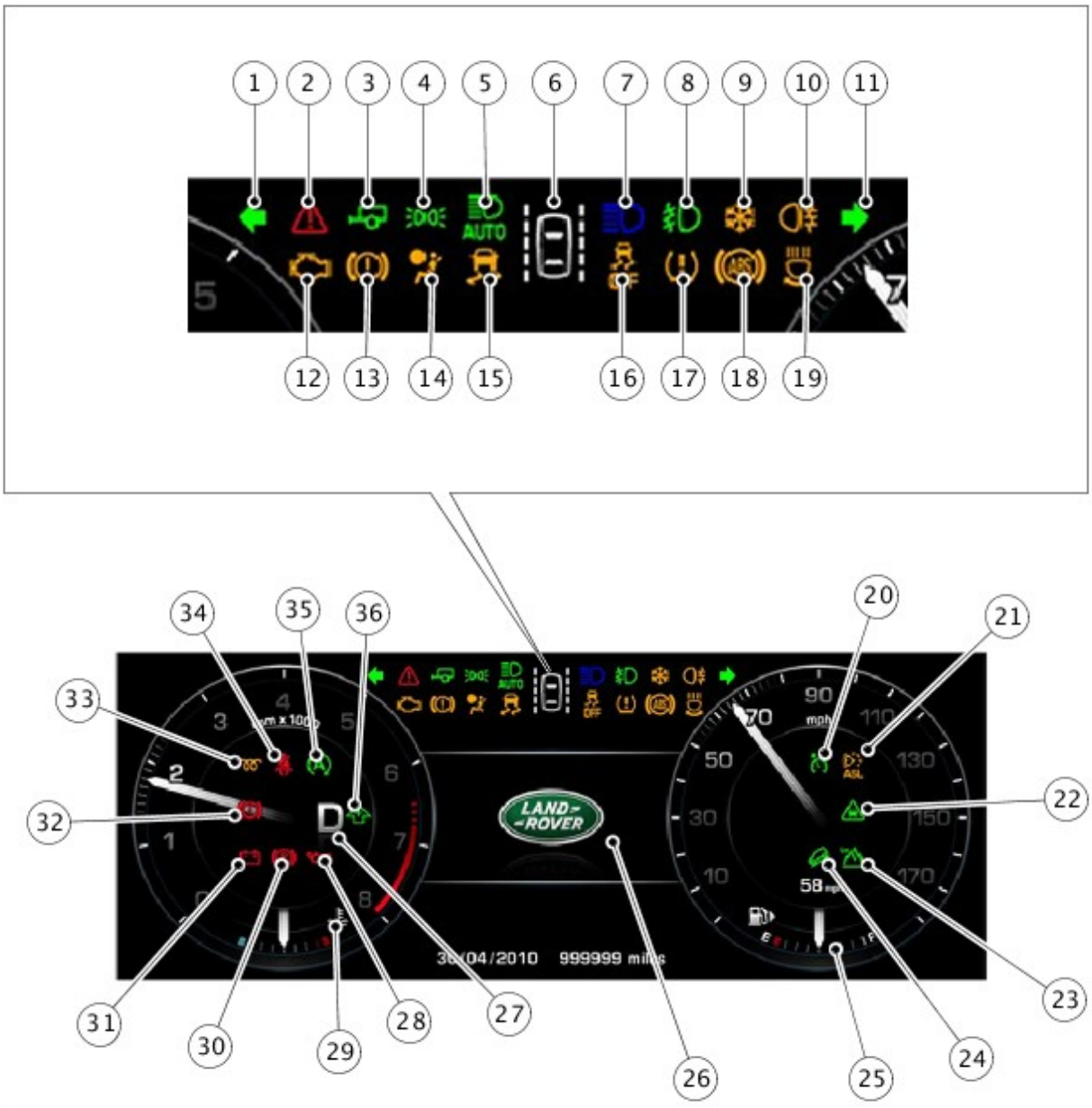
- Red = Warning

- Amber = Caution
- Green = System operative
- Blue = Headlamp high beam operative.

A feature and driver preference menu is available to allow the driver to select certain features and functions of the IC and change them to their personal preference. A menu control 'joy pad' is located on the left steering wheel switchpack and allows selection of the displayed functions and navigation of the menus. When selected, the menu is displayed in the TFT screen which allows access to a number of vehicle functions.

DESCRIPTION

Warning Indicators



E156930

Item	Part Number	Description
1	-	Left turn signal indicator active (green)
2	-	Critical warning indicator (red)
3	-	Trailer warning (green)
4	-	Side lamps on (green)
5	-	Auto High Beam (AHB) active (green)
6	-	Lane Departure Warning (LDW) (system)
7	-	High beam active warning (blue)
8	-	Front fog lamps active (green)
9	-	Frost warning (amber)
10	-	Rear fog lamps active (amber)
11	-	Right turn signal indicator active (green)

12	-	Check engine (MIL) warning (amber)
13	-	Tire Pressure Monitoring System (TPMS) warning indicator (amber)
14	-	Airbag warning (amber)
15	-	Dynamic Stability Control (DSC) active warning (amber)
16	-	DSC OFF warning (amber)
17	-	Tire Pressure Monitoring System (TPMS) warning (amber)
18	-	Anti-lock Brake System (ABS) warning amber
19	-	Adaptive Front lighting System (AFS) warning (amber)
20	-	Speed control active warning (green)
21	-	Automatic Speed Limiter (ASL) active warning
22	-	Forward alert active (green)
23	-	Low range selected (green)
24	-	Hill Descent Control (HDC) active (green)
25	-	Fuel level indicator
26	-	Message center
27	-	Gear indicator
28	-	Oil pressure warning (red)
29	-	Engine temperature indicator
30	-	Electric Park Brake (EPB) system warning (red)
31	-	Charge indicator warning (red)
32	-	Brake system warning (red)
33	-	Glow plug warning (amber) - Diesel only
34	-	Seatbelt warning (red)
35	-	Auto Stop/Start Active warning
36	-	Gear shift

The warning indicators are mainly located in 3 groups; one in the speedometer display, one in the tachometer display and one group in a central position at the top of the TFT screen.

There are 2 airbag/SRS warning indicators used. The primary airbag/SRS warning indicator is located on the left side of the cluster and is a hardwired LED. A secondary airbag/SRS warning indicator is located at the top center of the TFT screen and is only used in case of failure of the primary airbag/SRS warning indicator for legislation requirements.

A hardwired LED is located on the right side of the cluster and is used for the security LED.

Start-Up Screen



When the vehicle is locked most of the display goes off. Some vehicle status items remain until the vehicle systems shut down. When the vehicle is unlocked the display slowly illuminates to show the background image and display vehicle starting information to the driver.

Pressing the stop/start switch will initiate a full build of the screen display to display the speedometer and tachometer and also the warning indicators. When the engine is running a range of applicable instruments, messages and warning indicators are displayed.

Event Screens



A large number of differing permutations of screens are available to cover all possible combinations of the available functions. The above illustration shows the Terrain Response screen, but other screens are available to cover a range of vehicle functions.

Certain vehicle functions will overwrite the existing information displayed. Displays may move or be replaced to allow room for other displays as shown in the Terrain Response display above. For example, the speedometer may move to the right a little to allow room for important vehicle functional to be displayed.

A number of features are also used to convey information to the driver. For example, if speed control is selected, the set speed is displayed as a marker in the speedometer outer ring.

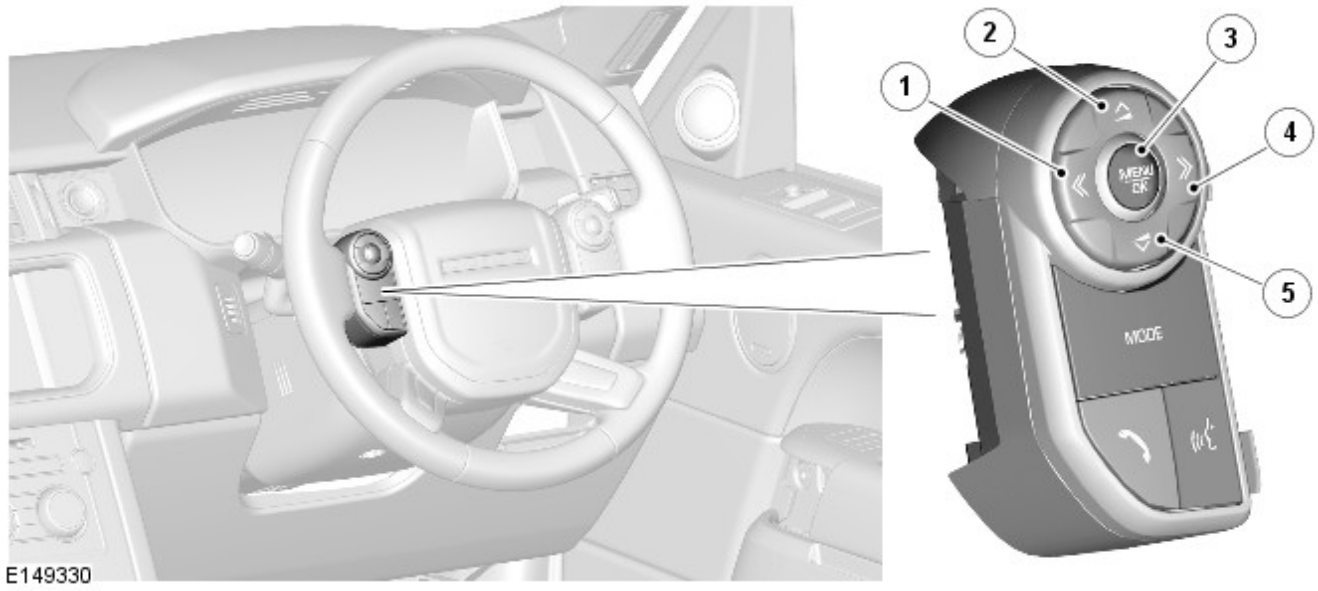
Instrument Cluster Menu



E149329

The IC menu is only visible when all current messages have been cleared and the MENU/OK switch is pressed. Menu selections are made using the MENU/OK switch to select the required menu option.

MENU/OK Switch



Item	Part Number	Description
1	-	Left selection switch
2	-	Up selection switch
3	-	MENU/OK switch
4	-	Right selection switch
5	-	Down selection switch

The left steering wheel switchpack contains the controls for the IC menu selection. The menu switch comprises a central MENU/OK switch and a four-way switch to allow menu selection UP/DOWN/LEFT/RIGHT. The switchpack is also used to control the audio system.
For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).

Once all current displayed messages are cleared by pressing the MENU/OK switch for each message, the IC menu is displayed with a single press of the MENU/OK switch.

The driver can navigate to the required menu using the UP/DOWN and LEFT/RIGHT switches. When the required menu is highlighted it can be selected using the MENU/OK switch.

When the 'MENU/OK' switch is pressed to select the required menu, the screen will display a sub-menu for that option or activate the selected item. Scroll arrows to the left of the menus show that additional menu items are available that are not visible in the current view. When the arrow is displayed brightly it indicates that additional menu items are available in that direction.

The current displayed menu can be closed by pressing the left switch on the menu switch. If sub-menus are open, pressing and holding the left switch on the menu control will close the sub-menus. The menu will close automatically if:

- no selection is made in the main menu within 10 seconds of opening
- a selection is made in the main menu and no further selection is made within 30 seconds. If a selection is made within the 30 second period, the timer will reset and a further 30 seconds will elapse before the menu automatically closes if no further selections are made.

The current menu can be exited or to move from a sub-menu without making a selection, press the left arrow on the menu control.

The following table shows the available menus and sub-menus and the options available within each menu.

Menu Options	Sub-Menu	Function
Main Menu	-	Displays the available main menus.
Driving Features	Show Warnings	Displays all active warning messages which can be scrolled through using the LEFT/RIGHT switches.
	Forward Alert	Enable/Disable forward alert.
	Collision Mitigation	
	Blindspot Monitoring	Enable/Disable blind spot monitoring system.
	Reverse-Traffic Detection	
	Cruise Eco-Data	Enable/Disable speed control ECO data view in IC.
	Traffic Sign Recognition	

	Lane Departure Warning	
	High Beam Assist	Enable/Disable the High Beam Assist feature. Configure the system for driving on the left or right side of the road.
	Active Seat Belt	
	Gear Shift Paddles	
	TPM Load Setting	Change the monitored tire pressures between 'Heavy Load' and 'Light Load' for the vehicle loading conditions.
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 (imperial/metric) to be displayed in the message center.
	Trip Content	Trip distance
		Average speed
		Average consumption
		Engine off
		Hybrid distance
		Instantaneous consumption
		Distance to empty
		Driving style
Instrument Display	Display Settings	Off-road View - enable/disable additional suspension information in the touch screen when using the Terrain Response system.
		Torchlight Effect - allows the cluster view to be changed to display all figures on speedometer and tachometer or limited figures in the area of the analogue pointer.
	Language	Čeština, Dansk, Deutsch, English, English (US,) Español, Español Americano, Français, Français Québécois, Italiano, Magyar, Nederlands, Norsk, Polski, Português, Português Brasileiro, Русский, Suomi, Svenska, Türkçe, Vlaams,Ελληνικά ニホンゴ, 繁體中文
	Digital Speedometer	Display digital speedometer and select between km/h and mph display units.
	Speedometer Dial	Display analogue speedometer and select between km/h or mph display units.
	Temperature Units	Allows the temperature to be displayed in Fahrenheit or Celsius.
Head-Up Display (HUD)	Head-Up Display (HUD) options	Cruise control,Navigation, Traffic signs, Gear state
	HUD brightness	Use steering wheel control to adjust. Press OK when finished. Press OK when finished. Graphic of steering wheel control/\ and \/ increase and decrease HUD brightness.
	HUD position	Use steering-wheel control to adjust. Press OK when finished. Graphic of steering wheel control/\ and \/ increase and decrease HUD position.
Vehicle Set-Up		
	Passenger Airbag	Enable/Disable the passenger airbag.
	Alarm Sensors	Temporarily disable the interior space protection and the tilt sensor for the next time the vehicle is locked. The setting is automatically re-enabled when the vehicle is unlocked using the Smartkey.
	Reverse-dip Mirror	Enable/Disable automatic dipping of the exterior mirrors when reverse gear is selected.
	2-Stage Unlocking	Enable/Disable the single-point entry door unlocking feature.
	Audible Lock Warning	Enable/Disable audible warning when vehicle is locked.
	Windows Global Open	Enable/Disable the window global open feature operated with the Smartkey.
	Windows Global Close	Enable/Disable the windows global close feature operated with the Smartkey.
	Winter Wipe Mode	Enable/Disable the winter park position for the front windshield wipers.
	Drive-Away Locking	Disable/Adjust automatic locking of the doors depending on the vehicle speed. The following selections are available; OFF, 8 km/h (5 mph), 16 km/h (10 mph), 32 km/h (20 mph).
	Headlamp Delay	Enable/Disable the headlamp delay feature and configure the amount of time the headlamps will remain on. The following selections are available; OFF, 30 seconds, 60 seconds, 120 seconds, 240 seconds.
Vehicle info	Tire Pressure Check	Tire pressure display in selected units. Show reference pressures only when vehicle is stationary.

	TPM Load Setting	**TPM Load Setting**
		Normal Load
		Heavy Load
		TPM Load Setting (US)
		Comfort
		Normal
	Recommended Pressures	Displays the recommended Front and Rear tire pressures.
	Pressure display units	**Pressure display units**
		psi
		kPa
		bar
	Oil level	Oil Level Indicator
	Diesel Exhaust Fluid	Oil Level Indicator
	Last Alarm	Information on Last Alarm Trigger
	Vehicle VIN	Vehicle Identification Number
	AHB Sensitivity	Normal Mode
		Test Mode

CAR CONFIGURATION FILE (CCF)

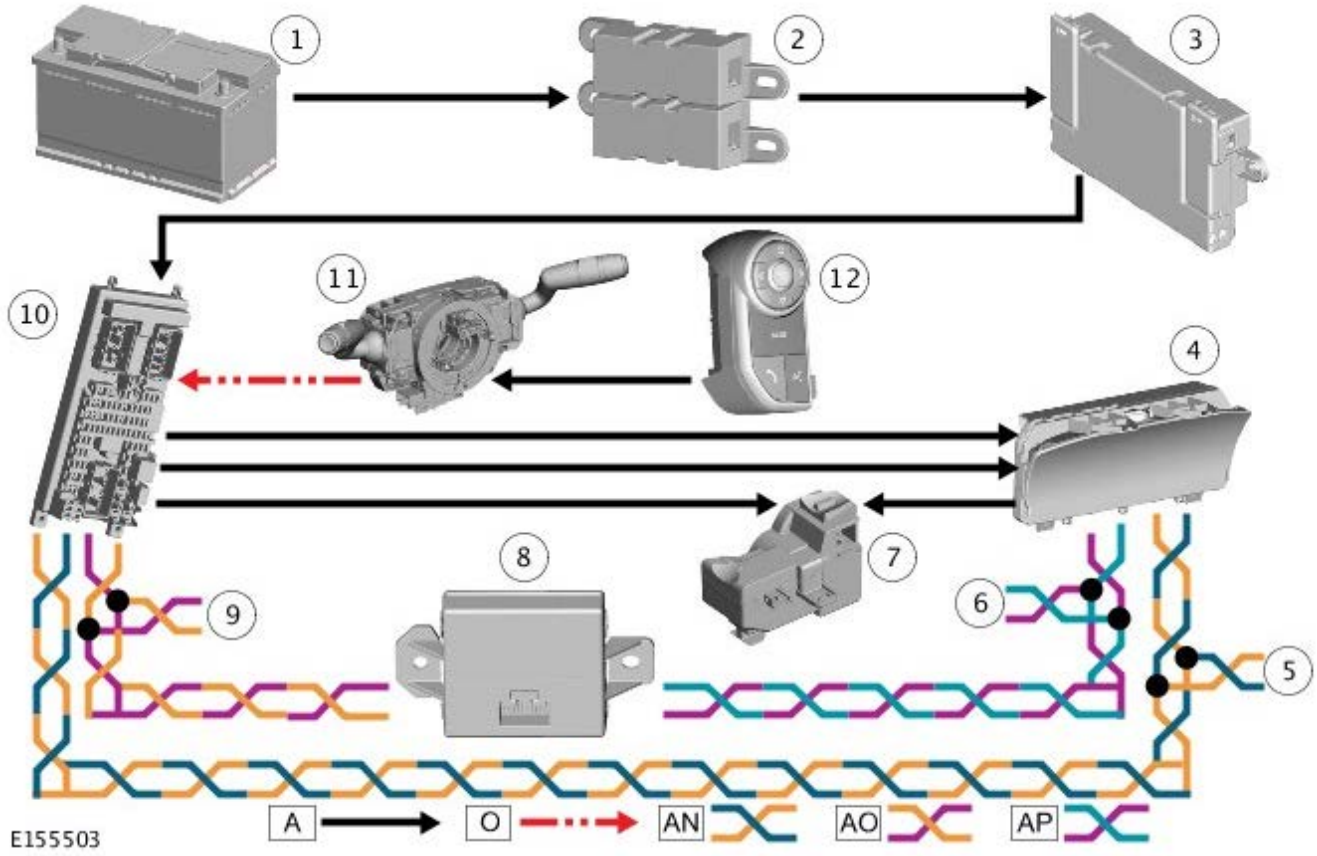
The Car Configuration File (CCF) contains all relevant data about the specification and market condition of the applicable vehicle, immobilisation codes and driver personal settings. This information is retained in the CJB and is read by the IC, enabling the cluster to detect which systems and components are fitted to the vehicle. This information is continuously sent to the IC on the medium speed CAN (Controller Area Network) Body and CAN Comfort bus, involvement of the GWM (Gateway Module). The IC also backs up the CCF in it's internal memory.

The CCF will also need to be updated using an approved Land Rover diagnostic system if the vehicle is modified in service from its original factory specification. This can include fitting non-standard wheels and/or tyres, optional accessory dealer fit components with an electrical interface, for example park distance control.

OPERATION

CONTROL DIAGRAM

NOTE: A = Hardwired, O = LIN (Local Interconnect Network) bus, AN = High speed CAN (Controller Area Network) Powertrain bus, AO = Medium speed CAN Body bus, AP = Medium speed CAN Comfort bus.



Item Part Number Description

1	-	Battery
2	-	Battery Junction Box 2 (BJB2)
3	-	Battery Junction Box (BJB)
4	-	Instrument Cluster (IC)
5	-	High speed CAN Powertrain bus connection to other vehicle systems
6	-	Medium speed CAN Comfort bus connection to other vehicle systems
7	-	Electric Steering Column Lock (ESCL) control module
8	-	Gateway Module (GWM)
9	-	Medium speed CAN Body bus connection to other vehicle systems
10	-	Central Junction Box (CJB)
11	-	Clockspring
12	-	Left steering wheel switchpack

Three processors within the IC manage communications between the vehicle and the IC display and incorporate the operating software required to drive screen re-configurations.

The IC receives a permanent fused supply from the CJB (Central Junction Box).

The IC is connected to other vehicle systems and control modules via the medium speed CAN Comfort bus, and high speed CAN Powertrain bus, LIN (Local Interconnect Network) bus, and MOST (Media Oriented System Transport) connections. The IC is also connected to the Touch Screen (TS) via a LVDS (Low-Voltage Differential Signalling) connection for video data transmission. Refer to Audio System and Navigation System for details of MOST and LVDS connections. For additional information, refer to: (415-01 Information and Entertainment System)

Audio System (Description and Operation),
Navigation System (Description and Operation).

The majority of information is passed to the IC from other system control modules on the high speed CAN Powertrain and medium speed CAN Comfort buses directly. The GWM allows to communicate the IC with other modules, which are connected to the high speed CAN Chassis, or medium speed CAN Body bus. However, some vehicle sensors are hardwired directly to the IC.

The security LED is controlled by a hardwired connection from the CJB. A FET (Field Effect Transistor) within the CJB controls the output to the LED.

The ESCL (Electric Steering Column Lock) control module is connected to a hardwired connection to the IC. Security information from other control modules is passed via the network buses and when the conditions are correct the IC instructs the ESCL control module to unlock the steering column.

The left steering wheel switchpack is hardwired to the clockspring, which is connected to the TS. The TS then passes the driver selections made on the left steering wheel switchpack to the IC and other control modules on the medium speed CAN Body bus directly, or via the GWM.

The CJB is connected on the medium speed CAN Body and high speed CAN Powertrain bus. The IC acts as a gateway for ambient lighting signals from the CJB and converters them to LIN bus signals which are passed from the IC to the interior ambient lighting LED's.
For additional information, refer to: Interior Lighting (417-02 Interior Lighting, Description and Operation).

Published: 30-Jan-2014

Instrument Cluster - Instrument Cluster

Diagnosis and Testing

Principles of Operation

For a detailed description of the instrument cluster operation, refer to the relevant description and operation section in the workshop manual. REFER to: Instrument Cluster (413-01, Description and Operation).

Car Configuration File (CCF)

CAUTION: If a new instrument cluster is to be installed, the instrument cluster renewal procedure must be carried out using the approved diagnostic system. This will ensure that the CCF data is correctly transferred from the central junction box to the replacement cluster. The CCF will also need to be updated using the approved diagnostic system if the vehicle is modified in service from its original factory specification. This can include the fitting of non-standard wheels and/or tires and optional accessory dealer install components with an electrical interface, such as park distance control

The CCF contains all relevant data about the specification and market condition of the applicable vehicle, immobilization codes and driver personal settings. This information is retained in the central junction box, the engine control module and the instrument cluster enabling each system module to detect which systems and components are installed to the vehicle. The information is continuously transferred between these three system modules to ensure that the data is constantly backed-up between the modules

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. Confirm which, if any, warning indicators and/or messages were displayed on the instrument cluster. For a list of messages:
   REFER to: Information and Message Center (413-08, Description and Operation).
3. Visually inspect for obvious electrical faults

Visual inspection

Electrical
• Battery • Fuses - Central and battery junction boxes - Megafuses • Wiring harness • Damaged, loose or corroded connectors • CAN circuits • Instrument cluster • Central junction box • Engine control module

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. Use the approved diagnostic system or a scan tool to retrieve any DTCs before moving onto the DTC index
   - Make sure that all DTCs are cleared following rectification

DTC index

For a complete list of all diagnostic trouble codes that could be logged on this vehicle, please refer to section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Instrument Cluster (IC) - Virtual Display (100-00 General Information, Description and Operation).

Published: 02-May-2013

Instrument Cluster - Instrument Cluster

Removal and Installation

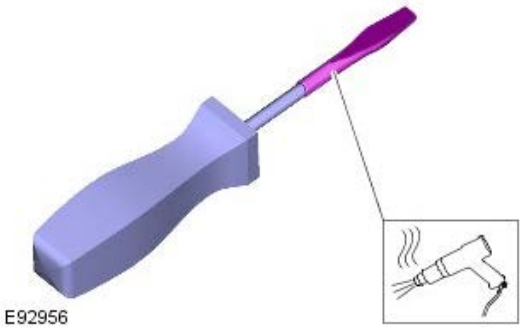
Removal

NOTES:

When a new instrument cluster is to be installed, the Land Rover approved diagnostic system must be connected to the vehicle and the instrument cluster renewal procedure followed. This will allow vehicle coding data and current service interval data to be correctly installed to the new instrument cluster.

Removal steps in this procedure may contain installation details.

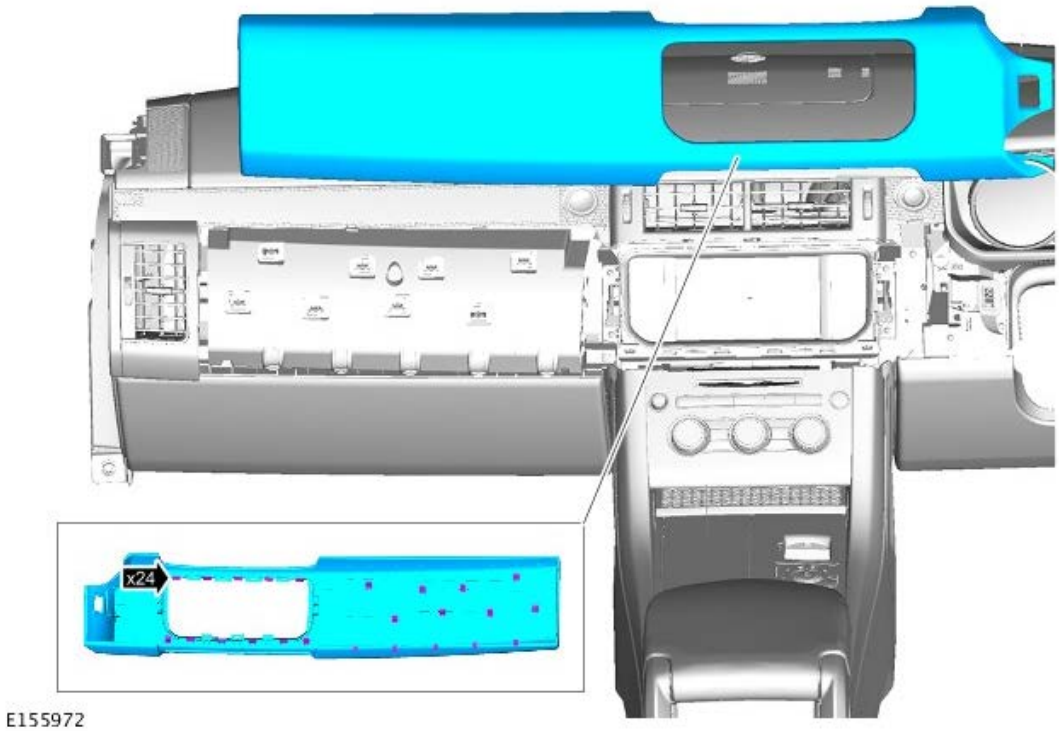
Some variation in the illustrations may occur, but the essential information is always correct.



1. CAUTION: Apply heatshrink or protective tape to the end of a suitable tool to protect the interior components.

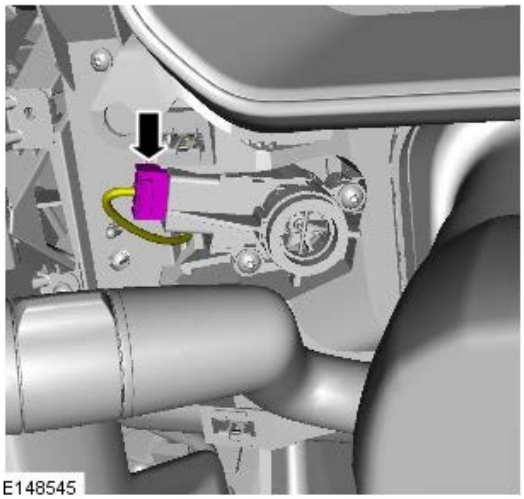
2. Disconnect the battery ground cable.

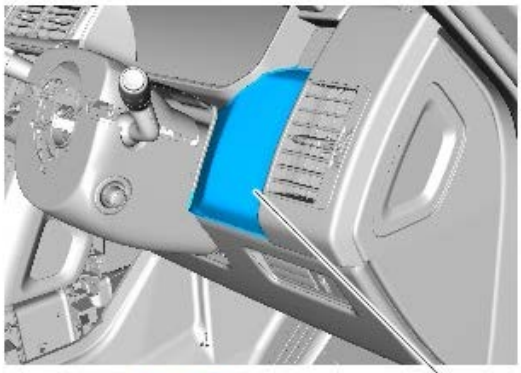
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).



3. NOTE: Release the trim clips from the middle to the sides, failure to follow this instruction may result in damage to the retaining frame.

4.

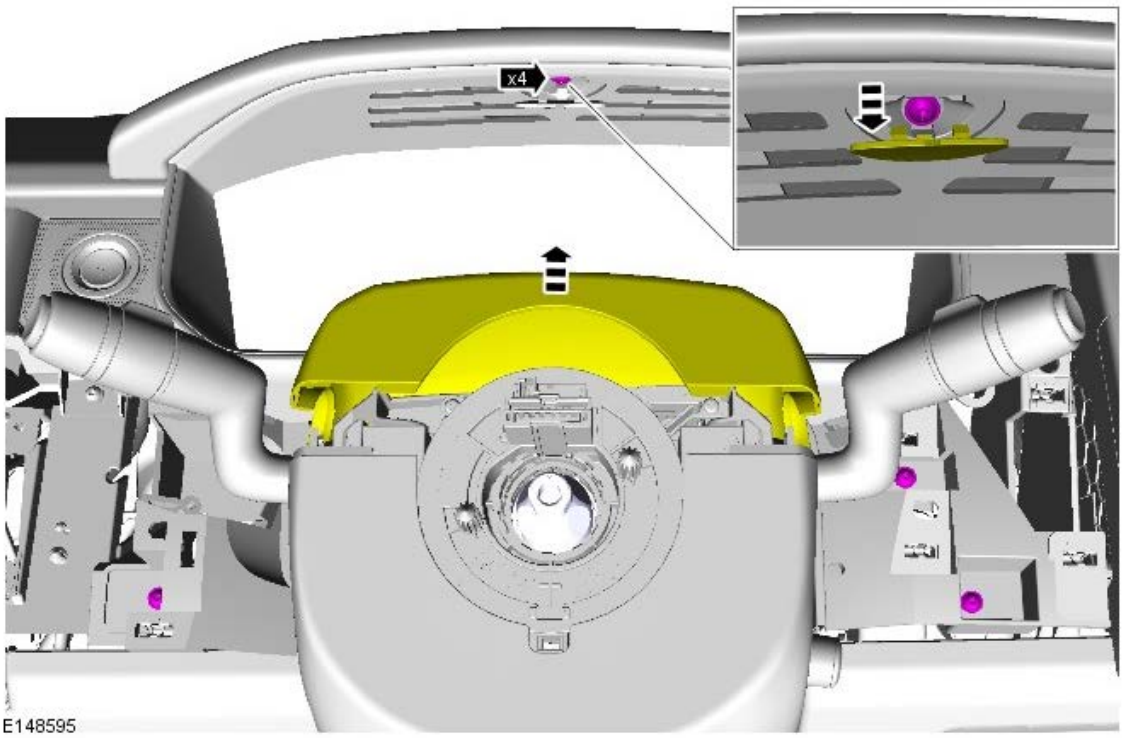

E148545



E148285

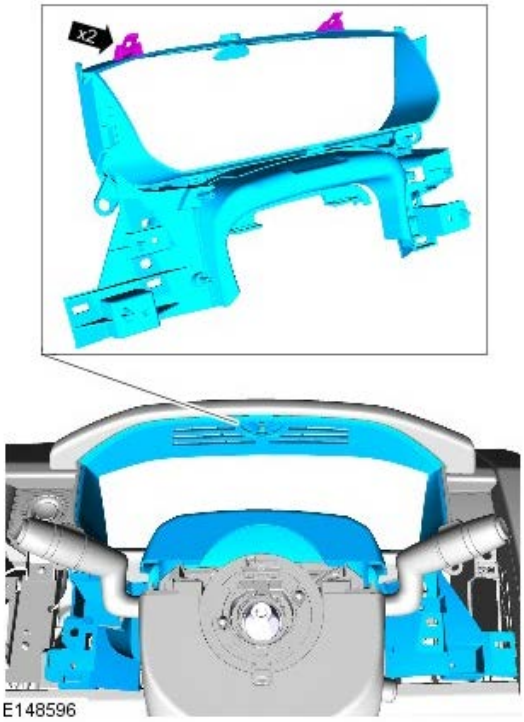
5. NOTE: The steering wheel is shown removed for clarity.

6. *Torque:* 1.7 Nm



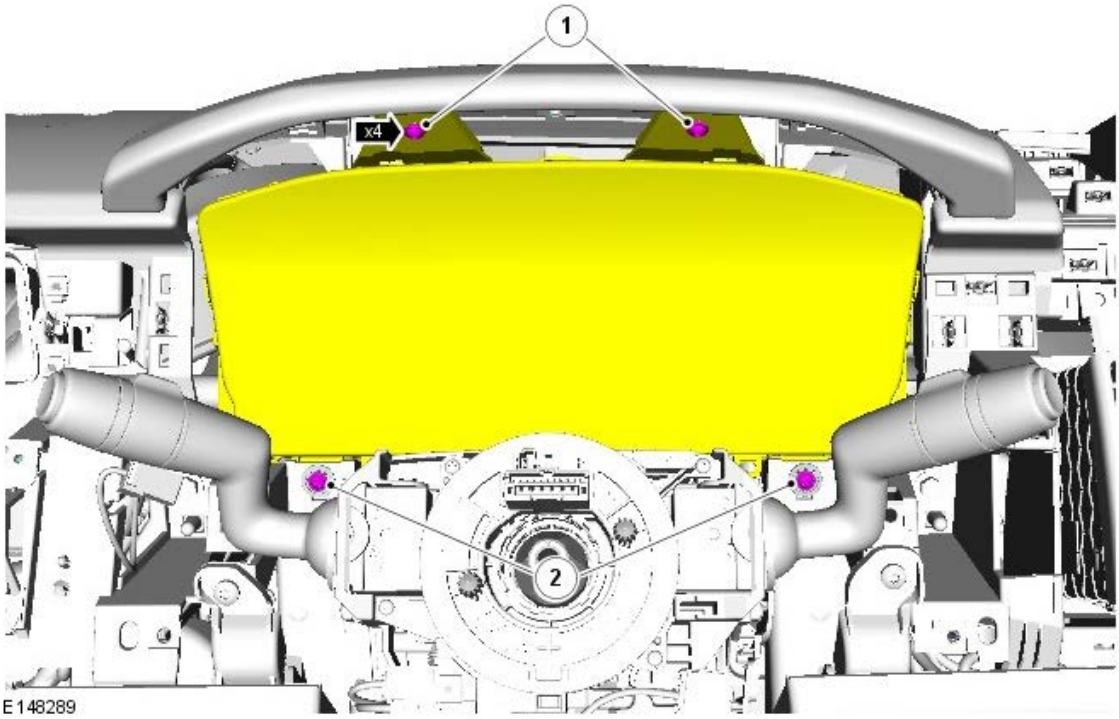
E148595

7.

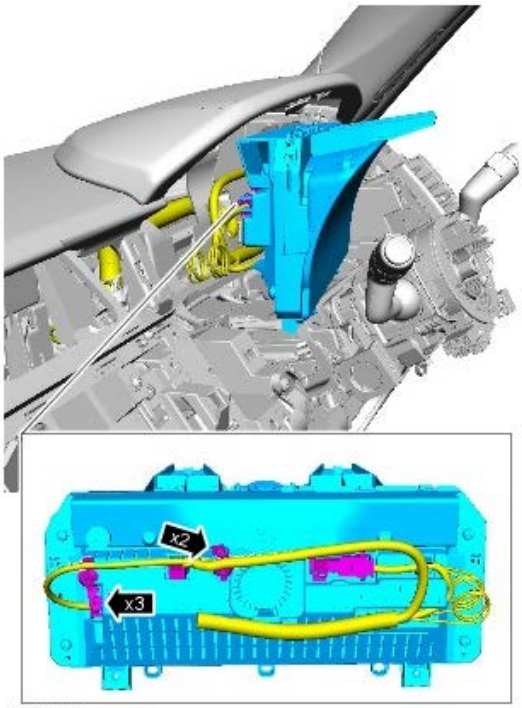


8. NOTE: The steering wheel is shown removed for clarity.

Torque:
Upper screws (1) 1.1 Nm
Lower screws (2) 1.7 Nm

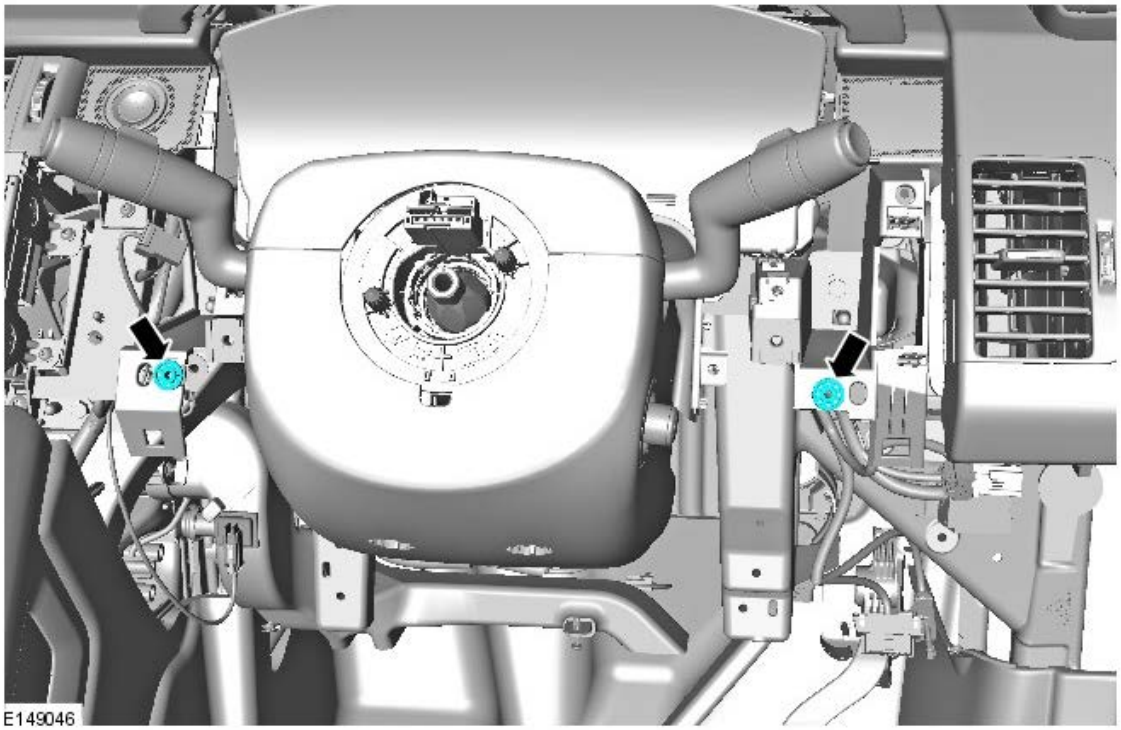


9.



E148290

Installation


E149046

1. NOTE: Install new retaining clips.

2. NOTE: Install the trim retaining clips in the moulding prior to installing the components.



E149095

3. To install, reverse the removal procedure.
4. Using the diagnostic tool, configure the instrument cluster.

Published: 08-Aug-2012

Horn - Horn

Removal and Installation

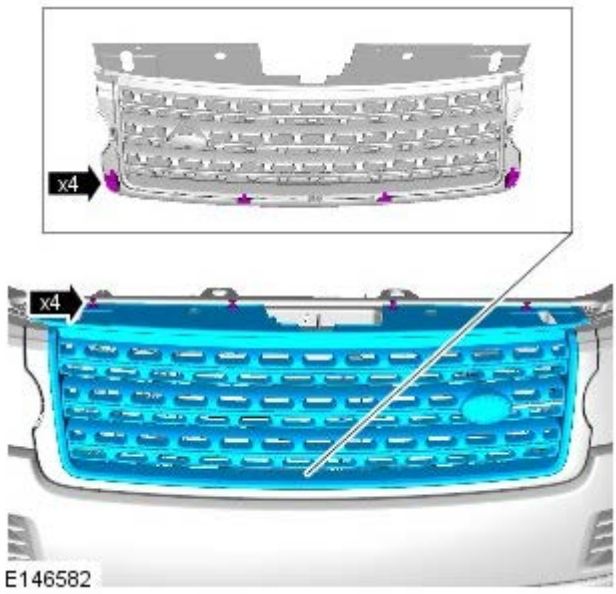
Removal

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

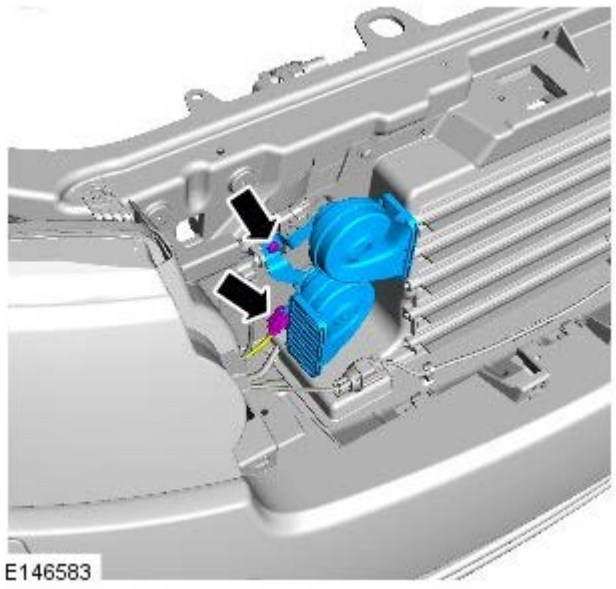
1. Disconnect the battery ground cable.

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

2.



3.



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



Installation

1. To install, reverse the removal procedure.

Published: 20-May-2013

Information and Message Center - Information and Message Center

Description and Operation

OVERVIEW

The Instrument Cluster (IC) is a high definition Thin Film Transistor (TFT) display. The display is continually reconfigured to prioritise and refine the information presented to the driver.

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

Published: 29-Oct-2013

Warning Devices -

Torque Specifications

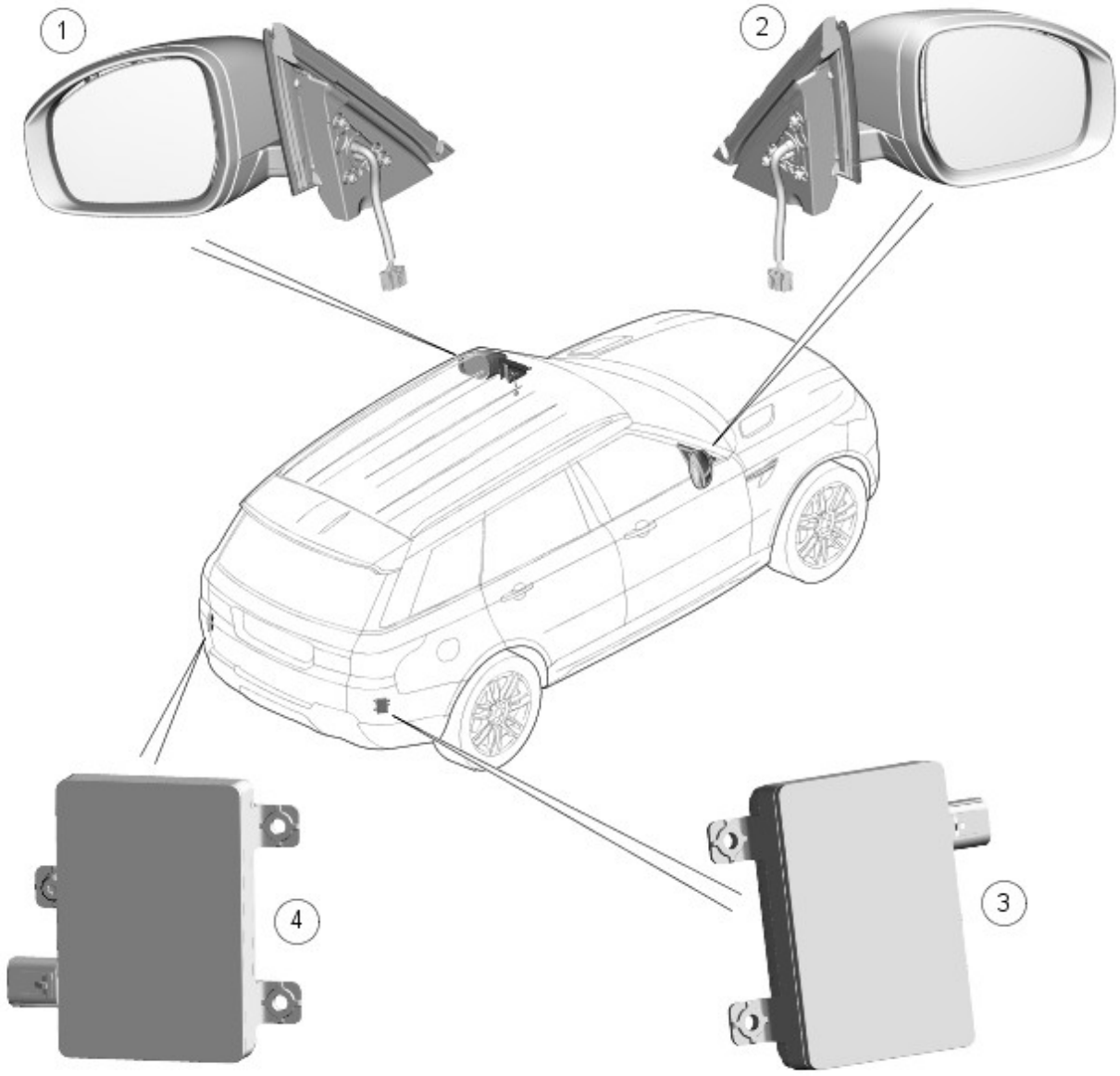
Description	Nm	lb-ft	lb-in
Low tire pressure module retaining bolts	10	7	-
General proximity sensor module (GPMS) retaining bolts	10	7	-
Blind spot monitoring sensor bracket retaining bolts	1.9	-	17
Blind spot monitoring sensor retaining bolts	1.9	-	17

Published: 31-May-2013

Warning Devices - Blindspot Monitoring System

Description and Operation

COMPONENT LOCATION



E152293

Item	Part Number	Description
1	-	Left Door Mirror Warning Lamp
2	-	Right Door Mirror Warning Lamp
3	-	Right Blindspot Monitoring Control Module (BMCM)
4	-	Left Blindspot Monitoring Control Module (BMCM)

OVERVIEW

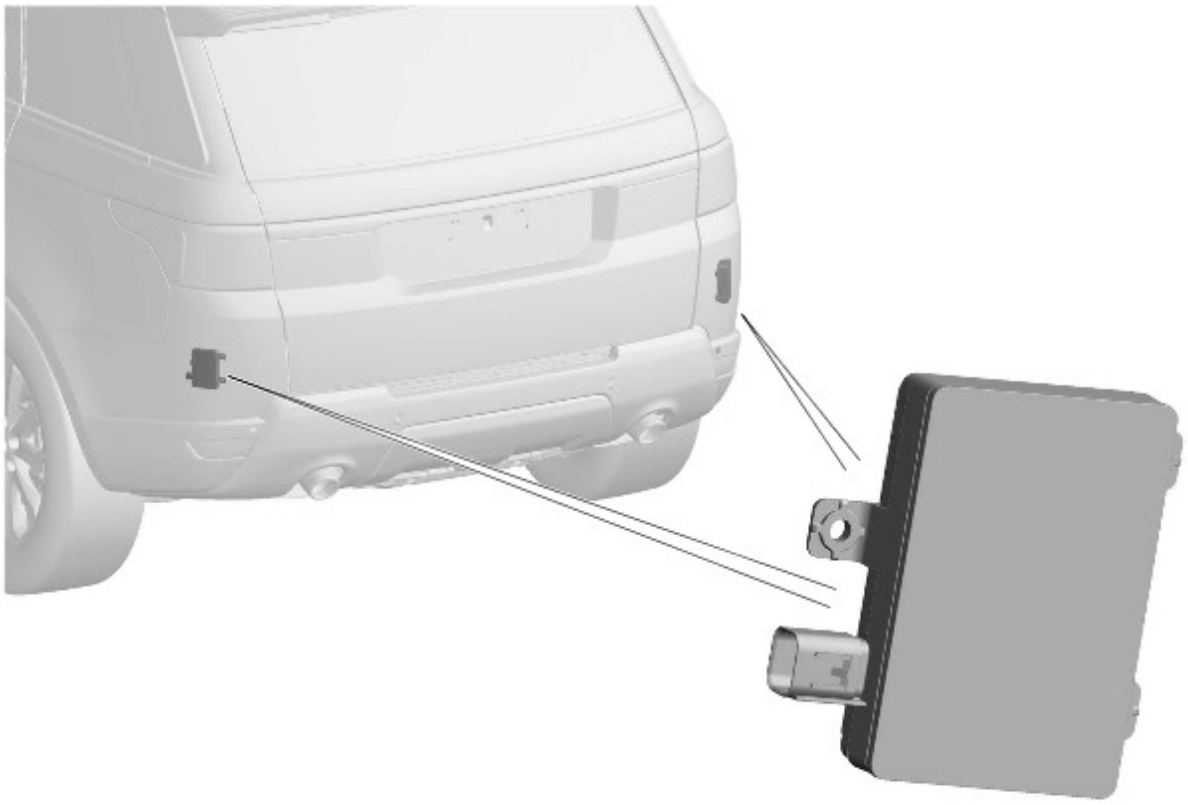
Eliminating blind spots is a major element in vehicle body design, but because of the structural requirements of B, C and D pillars, blind spots cannot be entirely eliminated, so the Blindspot Monitoring System is there to help assist the driver safely crossover in moving traffic.

The Blindspot Monitoring System Comprises:

- Left BMCM
- Right BMCM
- Left Side Door Mirror Assembly
- Right Side Door Mirror Assembly

The system uses two radar sensors operating at a frequency of 24GHz, they are incorporated in each of a Blindspot

Monitoring Control Module (BMCM), that are located at the rear of the vehicle (one module each side) behind each of the rear wheels and are connected via a private HS CAN (Controller Area Network) bus to exchange information.



E152294

The BMCMs warn the driver of:

- The presence of a vehicle in the blind spot zone
- The presence of a vehicle in the closing vehicle warning zone that meets the threat criteria.

Each BMCM has an 8 way connector that has power, ground, medium speed CAN Comfort bus wires, two private high speed CAN wires and two hard wire connections one to the status light and one for the alert icon in the mirror.

The BMCM carries out an auto-alignment self-check every time when in use, this procedure can take up to an hour in some environments, however the operation of the blindspot monitoring system will continue to operate as normal.

Each module will detect a vehicle in the driver's Blindspot. Once the vehicle is detected the module illuminates an amber warning 'alert icon' Light Emitting Diode (LED) in the relevant exterior door mirror.

The driver will be notified of the threat in the closing vehicle warning zone by flashing the existing blind spot icon in the relevant door mirror.

If the system displays 'blind spot not available' and there is a misalignment trouble code in the system, the physical sensors must be checked for mounting and body work should be checked for damage or repair.

When the system initiates, it performs a self-check, during which the warning icons in the mirrors illuminate alternately for a short period of time. Each module does a left/right determination check when the ignition is switched on. Each mirror has a different circuit configuration so that the modules can determine which mirror they are connected to. If a module detects the wrong mirror it will go into a fault condition.

The BMCMs receive vehicle speed on the medium speed CAN Comfort bus from the CJB (Central Junction Box), via the GWM (Gateway Module) and becomes active from 8mph (13kph). The system returns to standby state once the speed drops below 3mph (5kph).

CAUTION: The blind spot monitoring system is designed as a driver aid not a safety device. The driver should always exercise due care and attention whilst driving.

SYSTEM OPERATION

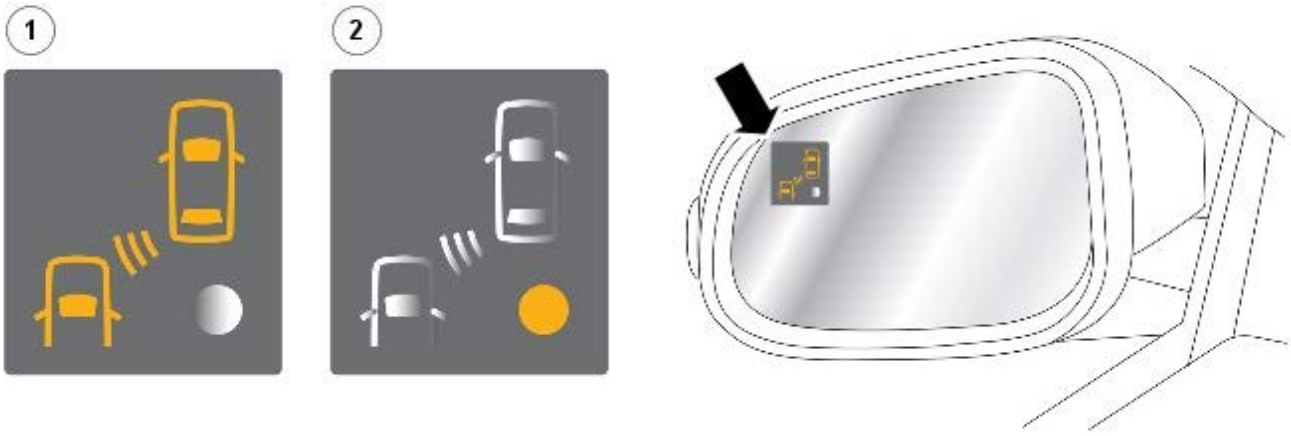
The Blindspot Monitoring System uses a cross over radar pattern to the rear and side of the vehicle and is used to determine actual moving vehicles eliminating any stationary roadside objects which are false warnings.

The two radar sensors mounted at the rear of the vehicle will continuously scan for and track traffic on the areas to the left-rear and right-rear of the vehicle and will alert on vehicles to a range of 50 meters.

They will warn the driver of the presence of vehicles in a defined closing vehicle warning zone, which poses a threat to the driver if a lane change manoeuver is made.

NOTE: If an overtaking vehicle is detected on both sides of the vehicle simultaneously, the warning alert icons in both mirrors will illuminate.

The BSMS lenses are shaped so as to minimize the visibility to other drivers. The LED's are located towards the outside extremity of the mirror face, within the peripheral view of the driver but not in any area of the mirror where they could obscure or distract from the image.



E97753

Item	Part Number	Description
1	-	Warning alert icon
2	-	System status warning indicator

The LED lighting sequence is as follows;

- Amber alert LED icon permanently lit - system operational, vehicle detected in blind spot area.
- No LED's lit – system active no vehicle detected in blind spot area.
- Amber status LED permanently lit - system not active or faulty.

The system has operating limitations and is automatically turned off under certain operating conditions. During these operating conditions the amber status LED is permanently lit.

The system operating limitations are as follows;

- The system is inactive until vehicle speed is greater than 8mph – 13kph (amber status LED permanently lit).
- The system is inactive if an approved trailer is connected to the vehicle (amber status LED permanently lit).
- If Reverse Traffic Detection (RTD) is fitted and reverse gear is selected the status LED will be out as the system is active. When RTD is not fitted the system is inactive when reverse gear or park is selected (amber status LED permanently lit).

If either of the radar signals are blocked or distorted, for example by water, the radar face of the module is covered in mud, sleet or snow the system may detect this and be disabled with the amber status LED permanently lit together with a 'blind spot monitoring blocked' message displayed in the Instrument Cluster (IC) message centre. The system is disabled until the blockage is cleared.

If there is a fault in the system the amber status LED is permanently lit and a 'blind spot monitoring not available' message displayed in the IC message centre. The system is disabled until the fault is rectified.

System fault and blockage warnings are as follows;

- The system is disabled when the radar module signal is blocked (amber status LED permanently lit and IC message).
- The system is disabled by a fault (amber status LED permanently lit and IC message).

If there is a failure in the communication network and the warning LED cannot be displayed in the mirror, a failure message will be displayed in the IC message centre.

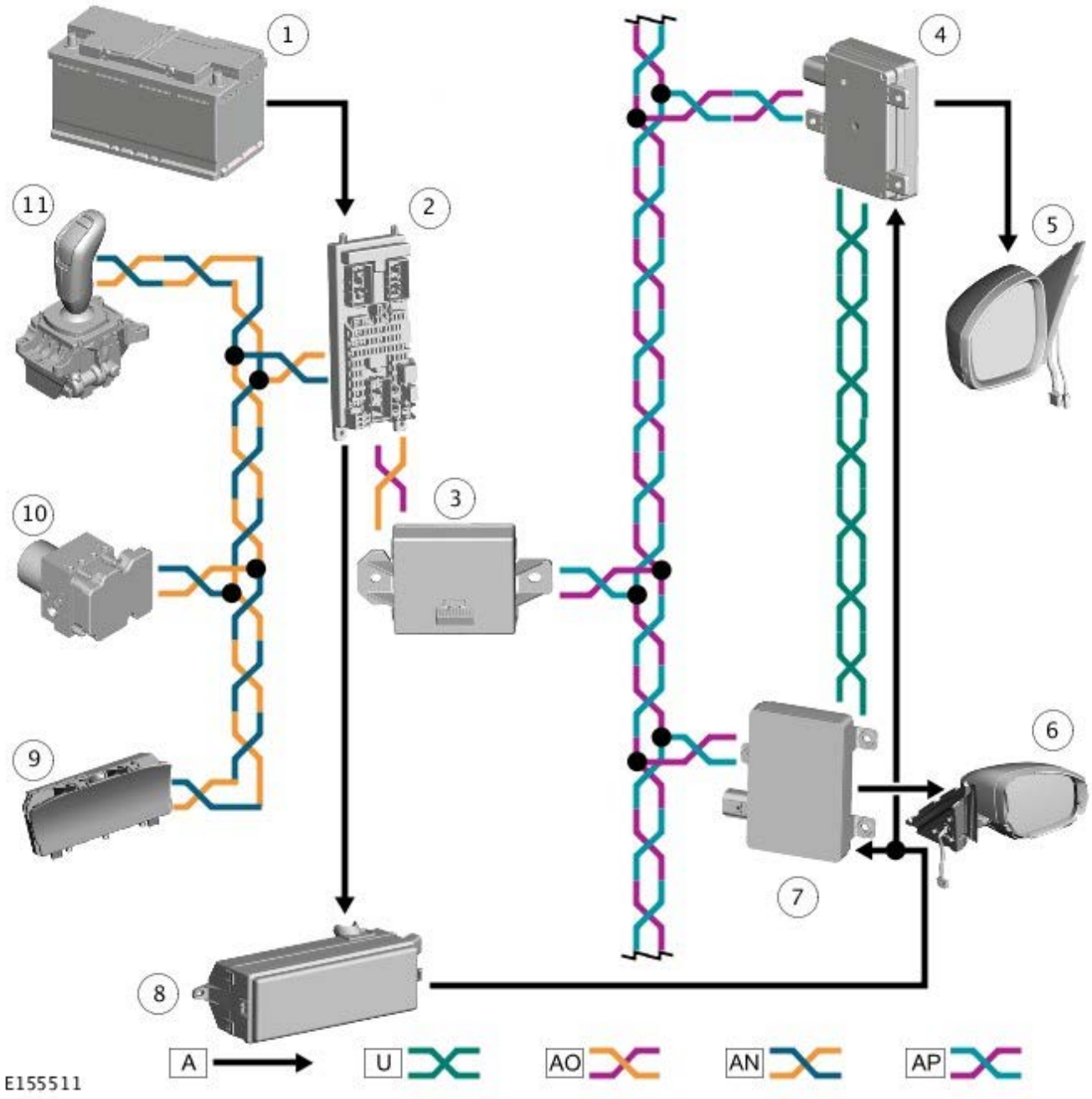
When any faults are present in the system, DTC's (diagnostic trouble codes) are stored in both BMCM's appropriate to each module. Replacement of modules requires the right module to be configured using the Jaguar approved diagnostic equipment. All Left modules are supplied as L405 LHS modules. The calibration and the signal calibration will need to be configured.

Calibration of the modules using the Jaguar approved diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

Control Diagram

NOTE: A = Hardwired, U = Private High speed CAN (Controller Area Network) bus, AO = Medium speed CAN

Body bus, AP = Medium speed CAN Comfort bus.



Item	Part Number	Description
1	-	Battery
2	-	Central Junction Box (CJB)
3	-	Gateway Module (GWM)
4	-	Left Blindspot Monitoring Control Module (BMCM)
5	-	Left Door Mirror
6	-	Right Door Mirror
7	-	Right Blindspot Monitoring Control Module (BMCM)
8	-	Rear Junction Box (RJB)
9	-	Instrument Cluster (IC)
10	-	Anti-lock Brake System-module (ABS)
11	-	Transmission Control Switch (TCS)

Published: 31-Jul-2012

Warning Devices - Warning Devices

Diagnosis and Testing

Principles of Operation

For a detailed description of the blindspot monitoring system, refer to the relevant description and operation sections in the workshop manual.
REFER to: Blindspot Monitoring System (413-09 Warning Devices, 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

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

NOTE: Particular attention should be paid to the following items where DTCs may not be logged:

- Check for contamination (e.g. dirt, grime, frosting, ice) around the blindspot monitoring sensors and clear

Visual Inspection

Mechanical	Electrical
• Exterior rear view mirror glass • Mud or sleet contamination around rear bumper area • Blindspot monitoring control modules (left/right)	• Fuse(s) • Relay(s) • Wiring harness • Electrical connector(s) • Blindspot monitoring control modules (left/right)

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
• The instrument cluster displays 'BSM System Fault' • DTC B11C9-15 is logged within the left side blindspot monitoring control module • The left alert icon is constantly illuminated	• Left warning alert LED circuit - short circuit to power	• Refer to the electrical circuit diagrams and check left warning alert LED circuit for short circuit to power
• The instrument cluster displays 'BSM System Fault' • DTC B11C9-15 is logged within the left side blindspot monitoring control module • No short to power or open circuit fault on the system status LED circuit	• Left mirror ground circuit - open circuit, high resistance	• Refer to the electrical circuit diagrams and check the left mirror ground circuit for open circuit, high resistance
• The instrument cluster displays 'BSM System Fault' • DTC B11C9-15 is logged within the right side blindspot monitoring control module • No short to power or open circuit fault on the system status LED circuit	• Right mirror ground circuit - open circuit, high resistance	• Refer to the electrical circuit diagrams and check the right mirror ground circuit for open circuit, high resistance
• The instrument cluster displays 'BSM System Fault'	• Left system status LED circuit - short circuit to ground	• Refer to the electrical circuit diagrams and check left driver display status LED circuit for short circuit to ground. Repair circuit as

DTC U0232-00 is logged within the right side blindspot monitoring control module • The left driver display status LED does not illuminate when the vehicle is stationary, in Park and the ignition is on	Suspect left side blindspot monitoring control module failure	required, clear DTC and retest • If DTC remains, check and install a new left side blindspot monitoring control module
• The instrument cluster displays 'BSM System Fault' • DTC U0232-00 is logged within the right side blindspot monitoring control module • When the system is powered up the left side warning alert LED does not illuminate during the bulb self-checks	• Left side warning alert LED circuit - short circuit to ground, open circuit, high resistance • Suspect left side blindspot monitoring control module failure	• Refer to the electrical circuit diagrams and check left side warning alert LED circuit for short circuit to ground, open circuit, high resistance. Repair circuit as required, clear DTC and retest • If DTC remains, check and install a new left side blindspot monitoring control module
• The instrument cluster displays 'BSM System Fault' • DTC U0233-00 is logged within the left side blindspot monitoring control module • The right side system status LED is constantly illuminated	• Right side system status LED circuit - short circuit to power • Suspect right side blindspot monitoring control module failure	• Refer to the electrical circuit diagrams and check right side system status LED circuit for short circuit to power. Repair circuit as required, clear DTC and retest • If DTC remains, check and install a new right side blindspot monitoring control module
• The instrument cluster displays 'BSM System Fault' • DTC U0233-00 is logged within the left side blindspot monitoring control module • When the system is powered up the right side system status LED does not illuminate during the bulb self-checks	• Right side system status LED circuit - open circuit, high resistance • Suspect right side blindspot monitoring control module failure	• Refer to the electrical circuit diagrams and check right side system status LED circuit for open circuit, high resistance. Repair circuit as required, clear DTC and retest • If DTC remains, check and install a new right side blindspot monitoring control module
• The instrument cluster displays 'BSM System Fault' • DTC U0233-00 is logged within the left side blindspot monitoring control module • When the system is powered up both the right side display LEDs do not illuminate during the bulb self-checks	• Right mirror ground circuit - open circuit, high resistance • Suspect right side blindspot monitoring control module failure	• Refer to the electrical circuit diagrams and check the right mirror ground circuit for open circuit, high resistance. Repair circuit as required, clear DTC and retest • If DTC remains, check and install a new right side blindspot monitoring control module

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: Module Name: Blind Spot Monitoring Control Module Left/Right (100-00, Description and Operation).

Published: 10-Feb-2014

Warning Devices - Service Indicator Reset

General Procedures

Synchronization

1. Connect the Land Rover approved diagnostic equipment.
2. Run the service indicator reset application and follow the on-screen instructions.
3. Remove the Land Rover approved diagnostic equipment.

Published: 04-Aug-2012

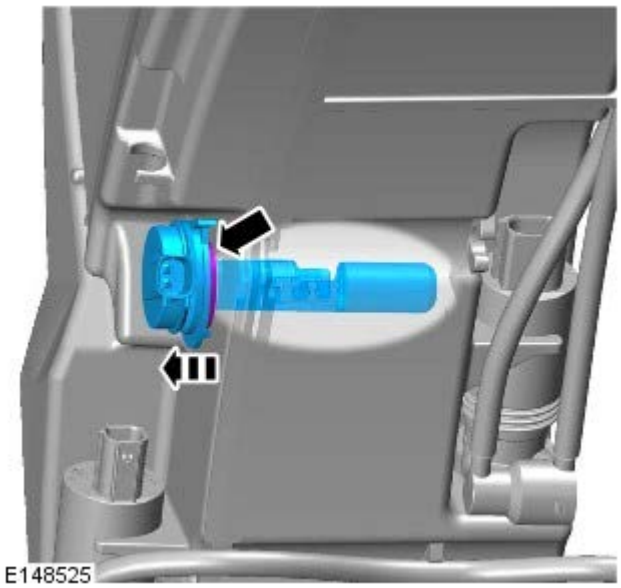
Warning Devices - Low Washer Fluid Warning Indicator Switch

Removal and Installation

Removal

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

1. Refer to: Windshield Washer Reservoir (501-16 Wipers and Washers, Removal and Installation).



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

Installation

1. To install, reverse the removal procedure.

Published: 02-May-2013

Warning Devices - Blindspot Monitoring Sensor LH

Removal and Installation

Removal

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

1. Disconnect the battery ground cable.

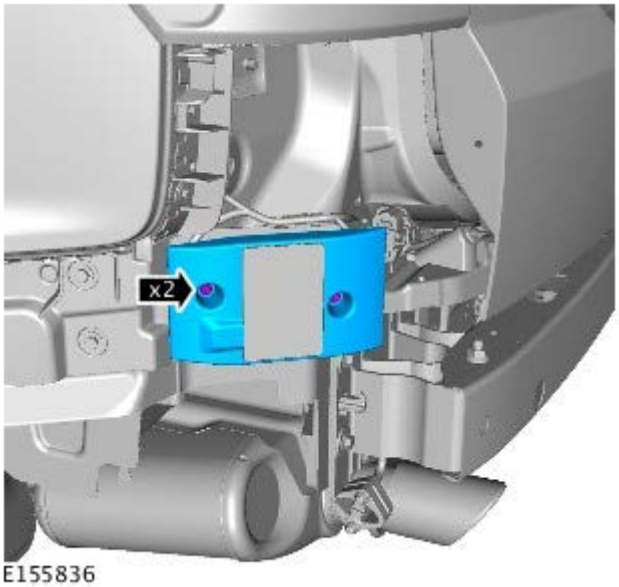
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

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

   Raise and support the vehicle.

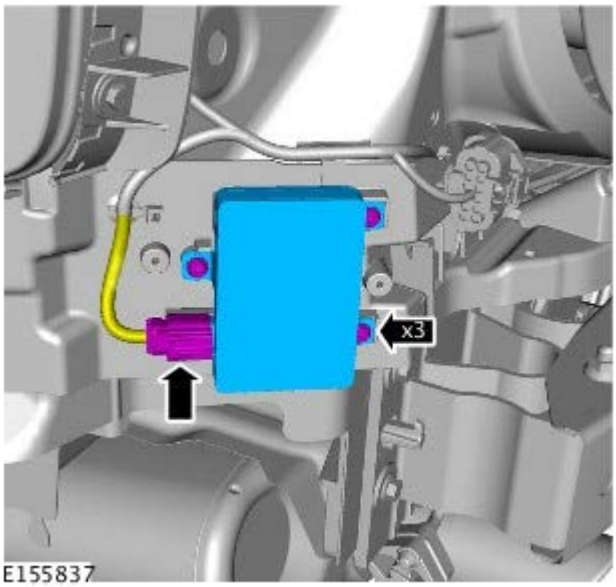
3. Refer to: Rear Bumper Cover (501-19 Bumpers, Removal and Installation).

4. *Torque:* 1.9 Nm



E155836

5. *Torque:* 1.9 Nm



E155837

Installation

1. To install, reverse the removal procedure.

Published: 07-Nov-2013

Warning Devices - General Proximity Sensor Module

Removal and Installation

Removal

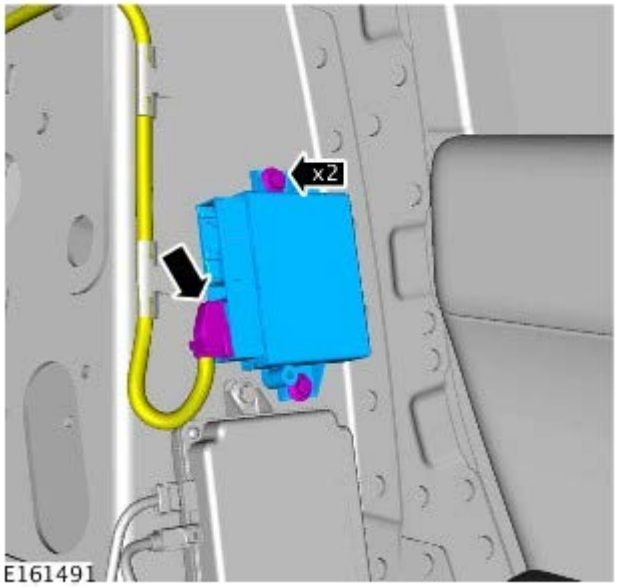
NOTES:

Removal steps in this procedure may contain installation details.

The ignition must be switched off.

1. Refer to: C-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. *Torque:* 10 Nm



Installation

1. To install, reverse the removal procedure.

2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 22-Oct-2013

Warning Devices - Door Mirror Wade Sensor

Removal and Installation

Removal

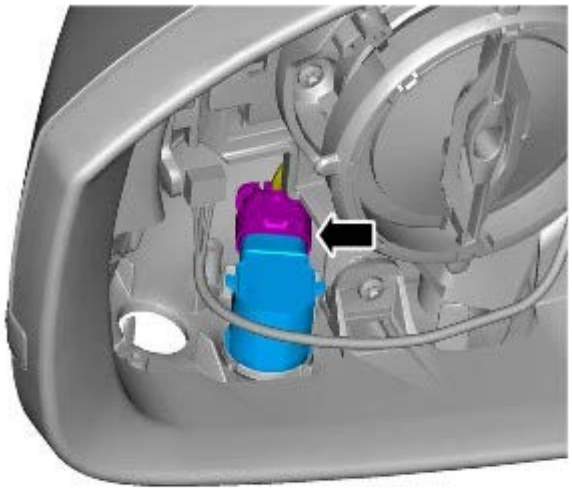
NOTES:

Removal steps in this procedure may contain installation details.

The ignition must be switched off.

LH illustration shown, RH is similar.

1. Refer to: Side Parking Aid Camera (413-13 Parking Aid, Removal and Installation).



E160928

2. CAUTION: Take extra care not to damage the wiring harnesses.

Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 29-Oct-2013

Parking Aid -

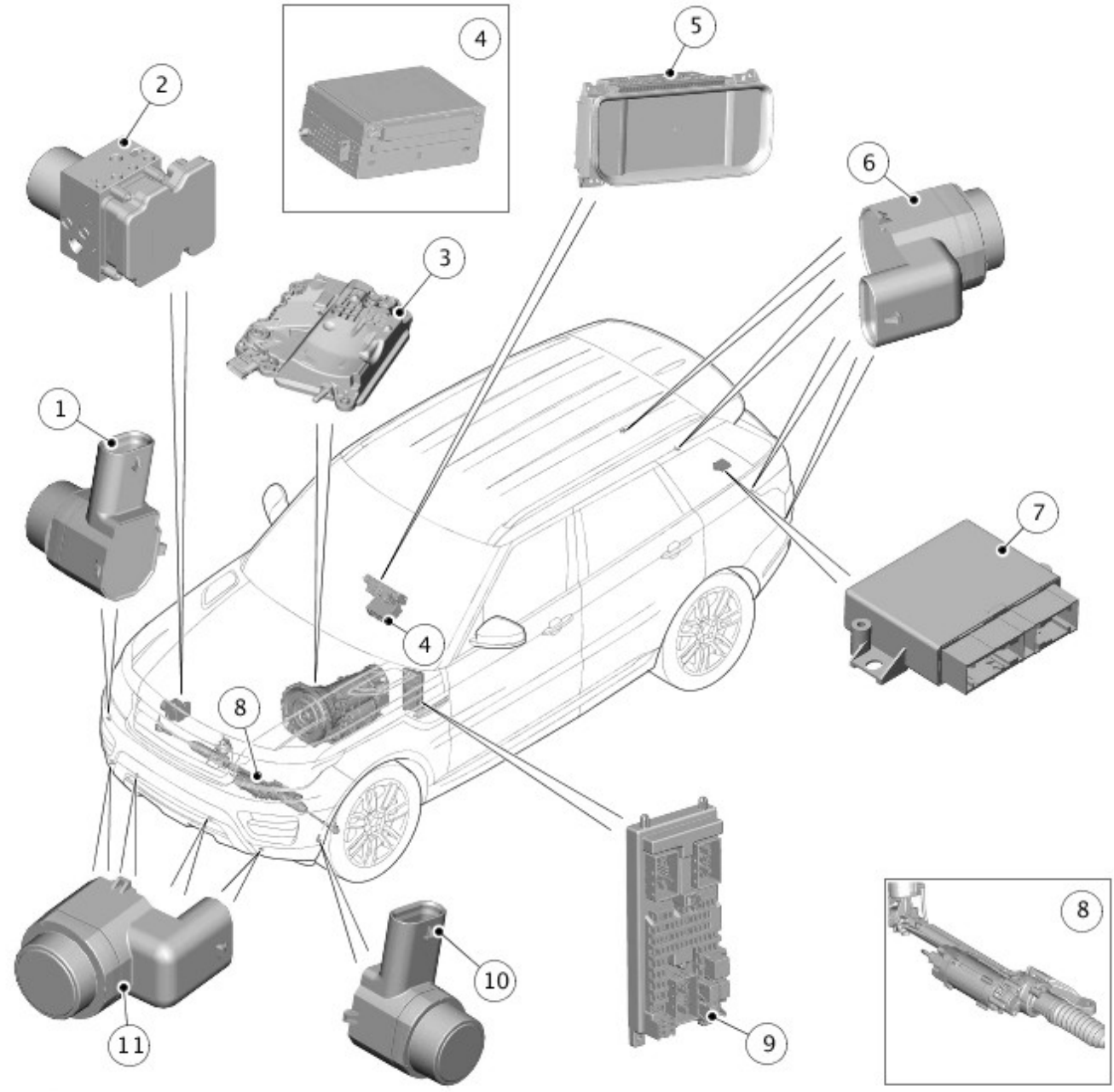
Description	Nm	lb-ft	lb-in
Parking aid module retaining bolts	10	7	-
Parking aid camera module retaining bolts	10	7	-

Published: 24-Jun-2013

Parking Aid - Parking Aid

Description and Operation

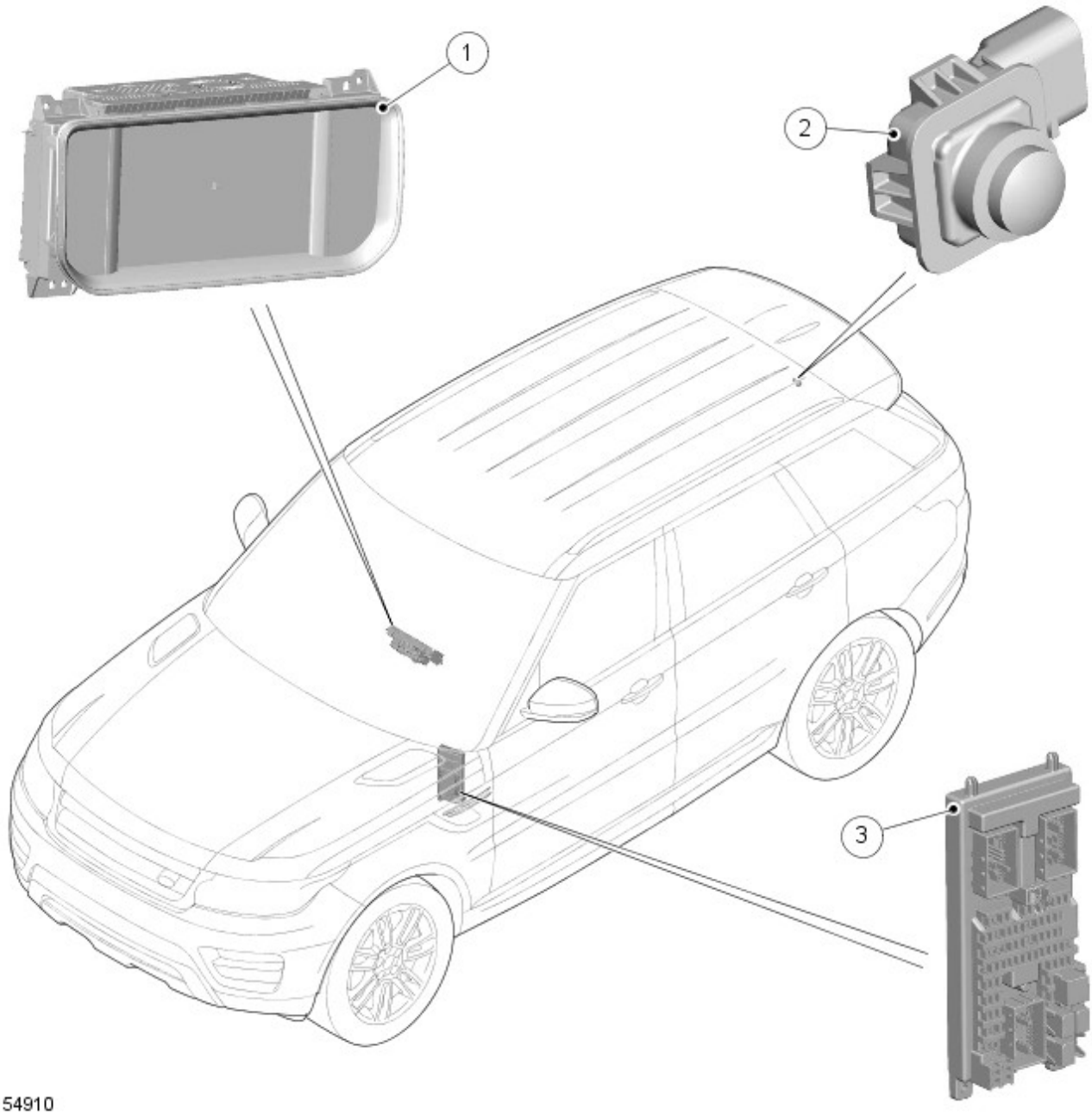
COMPONENT LOCATION - SHEET 1 OF 4 - PARKING AID AND PARK ASSIST



E154911

Item	Part Number	Description
1	-	Front right slot detect parking aid sensor
2	-	Anti-lock brake system (ABS) control module
3	-	Transmission Control Module (TCM)
4	-	Integrated Audio Module (IAM)
5	-	Touch Screen (TS)
6	-	Rear parking aid sensors (4 off, 2 outer 2 inner)
7	-	Parking Aid Control Module (PACM)
8	-	Power steering gear
9	-	Central Junction Box (CJB)
10	-	Front left slot detect parking aid sensor
11	-	Front parking aid sensors (4 off, 2 outer 2 inner)

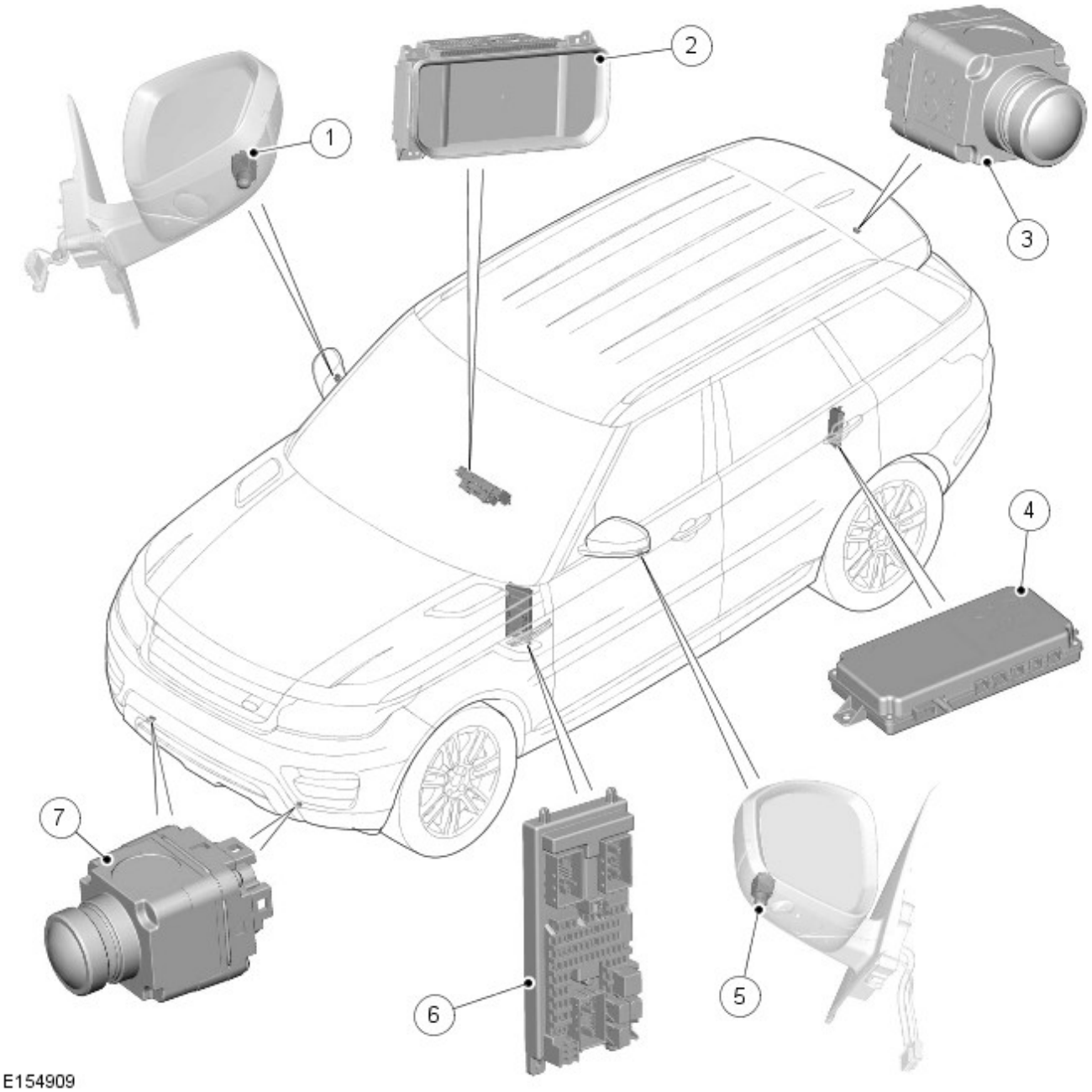
COMPONENT LOCATION - SHEET 2 OF 4 - REAR VIEW CAMERA SYSTEM (LOW-LINE)



E154910

Item	Part Number	Description
1	-	Touch Screen (TS)
2	-	Rear view camera (Lo-line)
3	-	Central Junction Box (CJB)

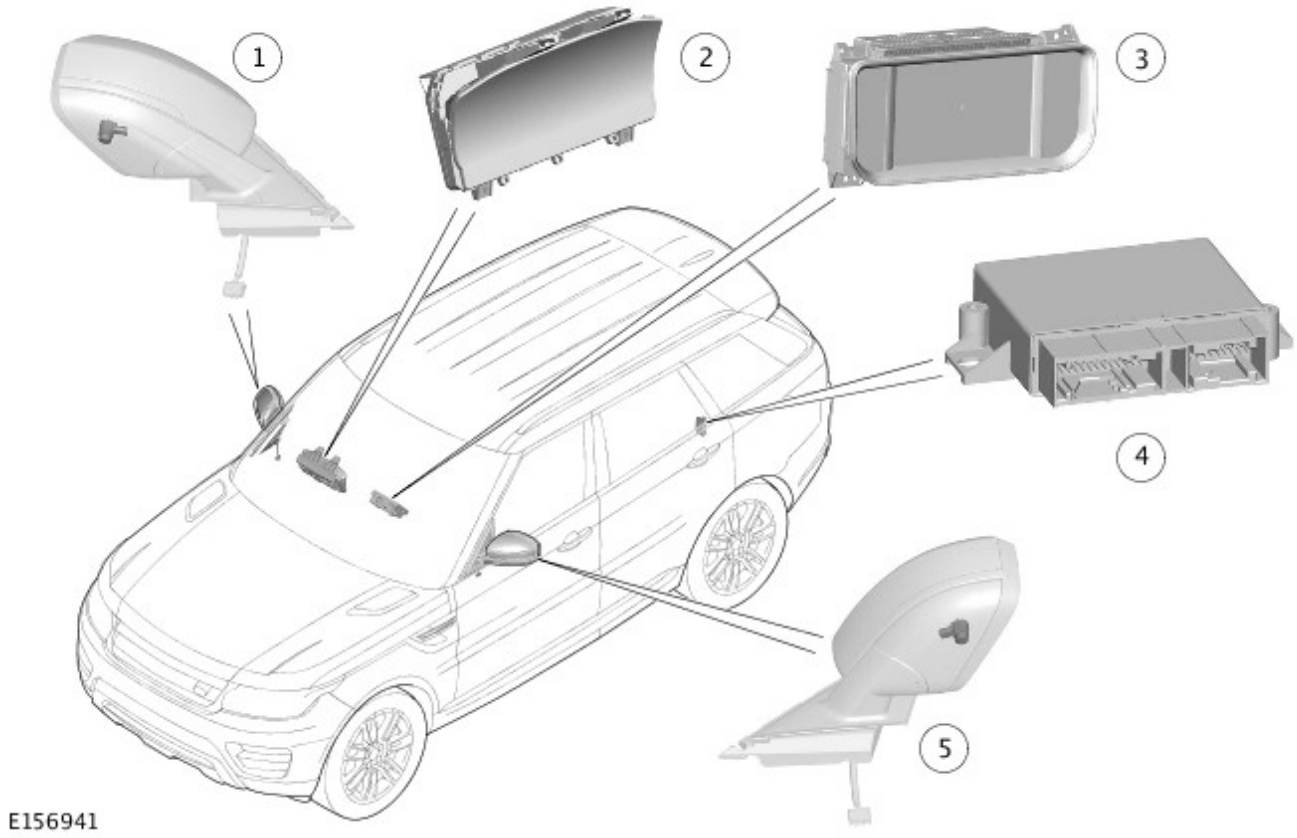
COMPONENT LOCATION SHEET 3 OF 4 - PROXIMITY CAMERA SYSTEM (HIGH-LINE)



E154909

Item	Part Number	Description
1	-	Right door mirror camera
2	-	Touch screen (TS)
3	-	Rear view camera
4	-	Camera Control Module (CCM)
5	-	Left door mirror camera
6	-	Central Junction Box (CJB)
7	-	Front bumper camera (2 off)

COMPONENT LOCATION - SHEET 4 OF 4 - WADE SENSING SYSTEM



Item	Part Number	Description
1	-	Right door mirror - wade sensing sensor
2	-	Instrument Cluster (IC)
3	-	Touch Screen (TS)
4	-	General Proximity Sensor Module (GPSM)
5	-	Left door mirror - wade sensing sensor

PARKING AID - OVERVIEW

The parking aid system provides an audible and visual warning to the driver when any obstacles are in the path of the vehicle during forward or reverse low-speed manoeuvres. The system consists of six ultrasonic sensors in the front bumper, included the front side slot sensors, and four ultrasonic sensors in the rear bumper, a parking aid control module and a parking aid switch.

At low speeds, the parking aid module uses the ultrasonic sensors to monitor the area around the front and rear bumpers. If an object is detected within a monitored area, the module then outputs a warning using the audio system speakers. The sensors can detect solid objects such as posts, walls and other vehicles. Additionally, the system is able to sense more difficult forms, for example a wire mesh fence. Objects very close to the ground may not be detected because of their low height.

CAUTION: When washing the vehicle do not aim high pressure water jets directly at the sensors. Do not use abrasive materials or hard/sharp objects to clean the sensors. Only use approved vehicle shampoo.

The parking aid/park assist system incorporates the following main components:

- Parking Aid Control Module (PACM)
- Parking aid switch
- Park assist switch (if fitted)
- Eight parking aid sensors on the front and rear bumper
- Two additional side sensor on the outer side of front bumper (front slot sensors for park assist system, if fitted)

The PACM (Parking Aid Control Module) is connected to the high speed Chassis CAN (Controller Area Network) bus. The PACM communicates with the audio system via the GWM (Gateway Module), and the TS (Touch Screen). The GWM allows the communication between the PACM and the TS, since TS is connected to the medium speed Comfort CAN bus. The TS is connected to the audio/infotainment system also, via the MOST (Media Oriented System Transport) ring. The TS can transmit the warning signal request to the AAM (Audio Amplifier Module), through the MOST ring. The AAM then outputs the applicable warning tones to the front or rear speakers, when an object is detected. The high speed CAN bus is used to collect vehicle data from other vehicle systems.

The parking aid system is automatically activated when:

- Drive (D) is selected from Park (P) or Reverse (R).
- The vehicle's speed decreases to less than 10 km/h (6 mph).
- Reverse gear is selected.

The Parking aid system operates at speeds up to 16 km/h (10 mph).

PARK ASSIST - OVERVIEW

 CAUTION: Park assist is a supplement to, and not a replacement for, good observation and a safe driving style. It is the driver's responsibility, at all times, to make sure the manoeuvres are carried out safely.

 NOTE: Park assist is available to all markets.

Park assist is an aid to manoeuvring the vehicle in of parking spaces and parking bays. Park assist is able to help the driver to search the suitable parking space, and it can assist the parallel parking manoeuvre into the parking space.

The optional park assist system operates using two additional sensors mounted in the front wheel arch moldings, together with parking aid sensors, front and rear.

To parallel park the driver switches on the park assist function to identifying a potential parking space and slowly drives past the space. The sensors in the front arch moldings scan the size of the parking space as the vehicle is driven past it. The driver will be informed by the park assist system, when the slot is big enough to park the vehicle.

The driver is alerted to a suitable parking space on the passenger side via an audible warning and a graphical representation in the IC (Instrument Cluster) message center. If the driver decides to park on the driver's side of the vehicle the turn signal indicator must be operated. This action will prioritize driver's side parking space information which will be presented to the driver in the message center. (For further information refer to the 'Principle of Operation - Park Assist' section.)

If there is sufficient space, the driver is prompted by the park assist control:

- to stop the vehicle
- to select reverse gear
- and lets go of the steering wheel.

Park assist then actively supports the driver by taking over the steering control and parks the vehicle in the available space.

Where a curb is present its position is also taken into account for the calculation of the parking trajectory. If there is no curb, the system calculates a trajectory to align the vehicle with the vehicle parked in front.

The driver continues to brake, accelerate, and select the correct gear. Park assist will instantly de-activate if the vehicle speed is too high or if the driver takes over the steering manoeuvre.

The park assist function can be switched on, or off at any time by the driver using a switch located next to the 'park aid' switch. The switch is illuminated by a LED (Light Emitting Diode) when the system is on.

When the park assist function is switched on and prior to each separate stage of the parking maneuver the system carries out a self-check procedure.

During the park assist manoeuvre all front and rear parking aid sensors are active. To activate the park assist 'search for a space' function the vehicle must be in a forward gear and travelling below 18 mph (30 km/h). Above this speed the system de-activates, only re-activating when the speed drops back below the set speed threshold. The search system is not active if the reverse (R) gear or park (P) mode is selected. During the park assist reverse and forward manoeuvres the system is only active up to a vehicle speed of 5 mph (8 km/h) with a warning of increased speed at 4 mph (7 km/h). The system de-activates above 5 mph (8 km/h). The system will cancel if any force is placed upon steering wheel during any part of the parking manoeuvre.

CAMERA SYSTEMS - OVERVIEW

 CAUTION: It remains the driver's responsibility to detect obstacles and estimate the vehicle's distance from them when reversing.

Lo-Line camera system (Rear view camera) - Overview

The rear view camera provides additional information to the driver when reversing the vehicle. When reverse gear is selected, the system automatically displays a wide-angle color image of the view from the rear of the vehicle onto the TS. The Lo-line camera system uses one rear view camera, which is fitted in the tailgate, next to the exterior handle.

Hi-Line camera system - Overview

The hi-line system provides the driver with a visual-aid when maneuvering the vehicle at low speeds. The system uses a CCM (Camera Control Module) to capture the camera data and display the resulting images on the TS, providing the driver with a 360° view around the vehicle. The hi-line camera system is also supported by various driving-aid features where graphical information and warnings are superimposed onto the images displayed on the TS.

The hi-line 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 tailgate.

REVERSE TRAFFIC DETECTION - OVERVIEW

The (RTD) Reverse Traffic Detection system provides a warning to the driver of any moving vehicle, at either side that may cause an accident during a reversing manoeuvre. To avoid this situation, the system is able to use the following warning modes to inform the driver, when the vehicle is in a reversing manoeuvre:

- An amber warning icon, which flashes in the relevant exterior mirror, and warning tones via the audio system.
- The rear camera screen, or
- the parking aid screen is shown on the TS, with the warning icon on the relevant side.

WADE SENSING SYSTEM - OVERVIEW

The Wade Sensing feature provides the driver with information about the water depth, during wading through water. The purpose is to assist the average driver whilst driving through water to avoid the dangerous situations.

A GPSM (General Proximity Sensor Module) is fitted to the vehicle, on the left C pillar, behind the seat bolster. The GPSM hosts software to deliver the wade sensing functionality. Two downward facing, door mirror mounted ultrasonic sensors are connected to the GPSM, and provide input signals to the GPSM which measures the reflection from the water surface to calculate the depth of water through which the vehicle is travelling.

The water depth is calculated from:

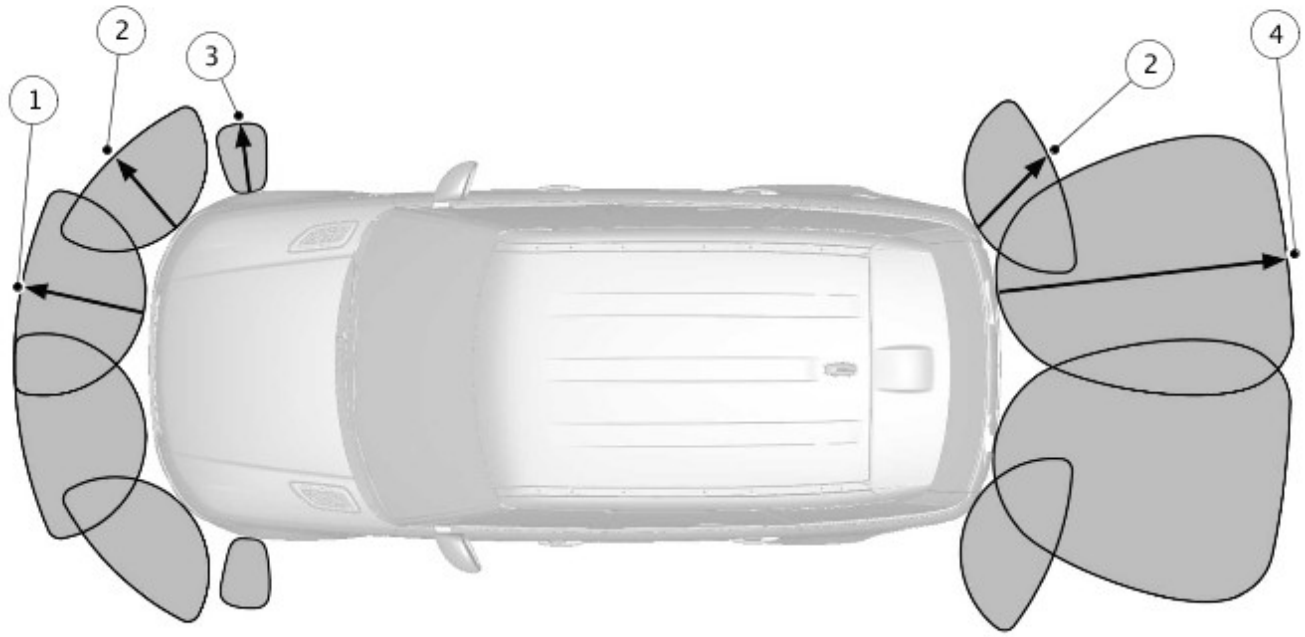
- Sensor mounting height - measured distance to water surface
- +/- offset from the suspension height adjustment

SYSTEM OPERATION

PRINCIPLES OF OPERATION - PARKING AID

If reverse (R) is the first gear selected after the ignition is switched on, all the front (included the front side sensors) and rear parking aid sensors will become operational. If a forward drive gear is subsequently selected, the front parking aid sensors only will remain operational until vehicle speed increases above 16 km/h (10 mph), park (P) is selected or the parking aid system control switch is pressed.

DISTANCE CALCULATION FOR AUDIBLE WARNINGS



E156740

Item Number	Sensor Location	Maximum Detection Range Audio Tone	Continous Audio Tone
1	Front Inner	Approximately 1200 mm (47 inches)	Approximately 300 mm (12 inches)
2	Rear/Front Outer	Approximately 1200 mm (47 inches)	Approximately 300 mm (12 inches)
3	Front Side (If fitted)	Approximately 400 mm (16 inches)	Approximately 300 mm (12 inches)
4	Rear Inner	Approximately 1800 mm (71 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 PACM 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.

When the reverse (R) gear or neutral (N) selected, all the front and rear sensors are active, included the front side sensors, when the drive (D) gear is selected, only the front sensors are active.

In receiver mode, the sensor receives impulses that were emitted by adjacent sensors. The PACM 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 PACM calculates the distance from the vehicle to the nearest object.

The PACM 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 heard from the rear or front speakers, accordig to the transmission gear selection.

Except the NAS vehicles, the volume output of the parking aid audible tones can be adjusted using the audio volume control when the parking aid system is activated. The volume can also be adjusted from the home menu screen by selecting 'Setup', 'System' followed by 'Volume Presets' on the TS. The volume can be adjusted using the + or - selections on the TS.

The PACM receives a signal on the high speed Chassis CAN bus from the CJB (Central Junction Box) with contribution of the GWM, when a trailer is fitted. When this signal is detected, the PACM suspends operation of the rear parking aid system. The ignition needs to be cycled once the trailer has been disconnected to activate the rear parking aid system.

Audible warnings

The PACM 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.

Diagnostics

The PACM has a diagnostic connection via the high speed Chassis CAN bus to enable faults to be retrieved using the Land Rover approved diagnostic equipment. Additionally an on-board diagnostic routine within the PACM 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. The control switch LED will also flash 6 times when reverse gear is selected or the Parking aid system switch is pressed.

PRINCIPLES OF OPERATION - PARK ASSIST

The system assists the driver to park the vehicle into a parallel parking slot. The system conducts search for vehicle speeds below 30 km/h. Any suitable slot found during search will be retained for a distance of up to 8m once the vehicle has passed the slot. The driver may select a slot that has been passed by simply activating the turn signal indicator on the desired side of the vehicle. When first activated 'Park Assist' searches for a space on the passenger side of the vehicle. To search for a space on the driver’s side, signal a turn in that direction. The driver can manually activate the search mode by pressing the Park Assist function switch.

Once a suitable slot has been found, the system shall inform the driver and the driver may stop the vehicle to proceed with parking into the available slot. The system controls the steering wheel whilst the driver is responsible to retain adequate vehicle speed (max. 7 km/h), using the accelerator and brake pedals. The driver is further assisted during the parking manoeuvre with front and rear Parking Aid system, to warn the driver of objects in close proximity to the vehicle.

REVERSE TRAFFIC DETECTION

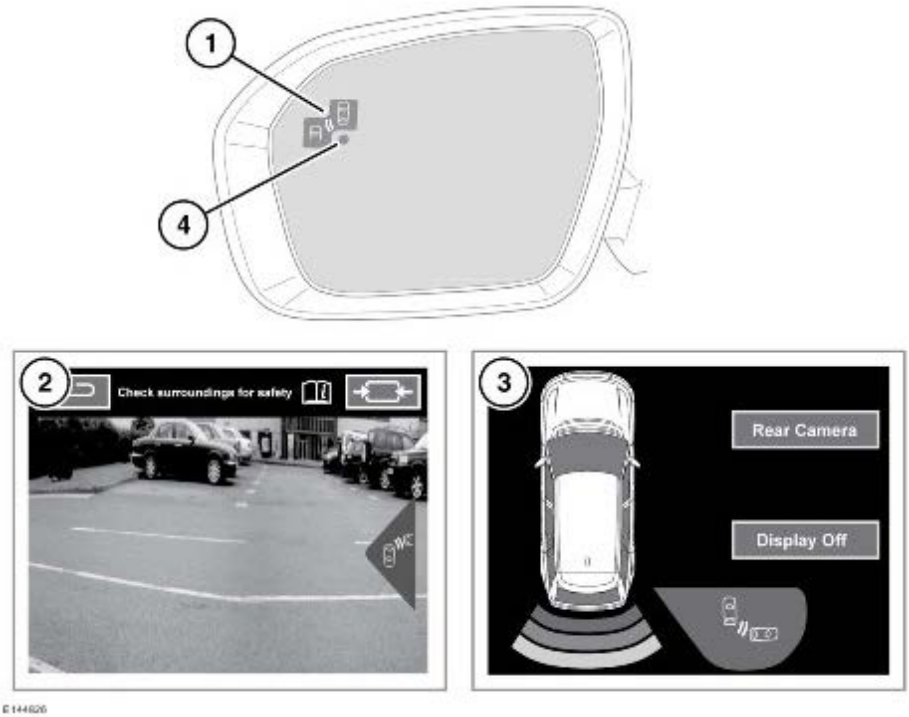
 CAUTION: The Reverse Traffic Detection (RTD) system is a supplement to, not a replacement for, safe driving, good observation and use of the exterior and rear-view mirrors.

 NOTE: RTD is automatically disabled when a trailer is connected and when Park assist is active.

The RTD system provides a warning to the driver of any moving vehicle, at either side that may cause an accident during a reversing manoeuvre. To avoid this situation, the system is able to use the following warning modes to inform the driver, when the vehicle is in a reversing manoeuvre:

- An amber warning icon, which flashes in the relevant door mirror, and warning tones via the audio system.
- The rear camera screen, or
- the parking aid screen is shown on the TS, with the warning icon on the relevant side.

Reverse Traffic Detection warnings



Item	Part Number	Description
1	-	Amber warning icon on exterior mirror
2	-	Rear camera screen with icon on TS
3	-	Parking aid screen with icon on TS
4	-	Reverse Traffic Detection dot icon (system is unavailable)

The system can be enabled or disabled via the IC (Instrument Cluster) menu. When RTD is disabled, an amber dot (4) will be displayed in both door mirrors.

The RTD function is a part of the Blind Spot Monitoring system, and it is available up to 16 km/h (10mph).

The reverse traffic detection system will automatically disable if any of the sensors become partially or completely obscured. Additionally, the amber warning indicator dot will illuminate on the exterior mirrors, and the 'Reverse Traffic Sensor Blocked' message will appear on the IC message center.

If a fault with a radar sensor is detected, an amber warning indicator dot will illuminate in the exterior mirrors and the message 'Reverse Traffic Detection System Not Available' is displayed in the IC message center.

Even if the detected fault only affects the radar sensor on 1 side of the vehicle, the whole system is disabled. If the fault is temporary, the system will operate correctly once the engine has been switched off and then on again.

PRINCIPLE OF OPERATION - PARK ASSIST

Park assist is an aid to manoeuvring the vehicle in and out of parking spaces and parking bays. Once the system has identified a parking space using its ultrasonic sensors, it will steer the vehicle into place automatically, if the driver chooses the park in the slot. The driver continues to brake, accelerate and select the correct gear. Informative graphics and messages are displayed in the IC (Instrument Cluster) message center, to guide the driver through each stage of the maneuver.

The system assists the driver to park the vehicle into a parallel parking slot. The system conducts search for vehicle speeds below 30 km/h. Any suitable slot found during search will be retained for a distance of up to 8m once the vehicle has passed the slot. The driver may select a slot that has been passed by simply activating the turn signal indicator on the desired side of the vehicle. When first activated 'Park Assist' searches for a space on the passenger side of the vehicle. To search for a space on the driver’s side, signal a turn in that direction. The driver can manually activate the search mode by pressing the Park Assist function switch.

Once a suitable slot has been found, the system shall inform the driver and the driver may stop the vehicle to proceed with parking into the available slot. The system controls the steering wheel whilst the driver is responsible to retain adequate vehicle speed (max. 7 km/h), using the accelerator and brake pedals. The driver is further assisted during the parking manoeuvre with front and rear Parking Aid system, to warn the driver of objects in close proximity to the vehicle.

Vehicles with park assist have a separate switch to activate the system.

The park assist sensors are connected with hardwire to the PACM. Scanned information is constantly transmitted to the module.

The park assist system is active when the park assist switch is activated. The switch is illuminated by a amber LED, powered by the PACM. The switch is hardwired to the PACM.

To activate the park assist system, press the 'Park Assist' button while driving forwards at less than 11 mph (18 km/h). The 'Park Assist' button indicator will illuminate. Auto searching is active while the vehicle's speed is below 18mph (30km/h) (Active mode). If the vehicle's speed exceeds the 18mph (30km/h), the park assist system will be deactivated automatically, and the park assist button indicator will extinguish (passive mode). If the park assist is selected when the vehicle is moving between 11mph (18km/h) and 18mph (30km/h), the 'Parallel Park Maximum Speed 30 kph' will be displayed in the IC message center.

 CAUTION: Park assist is a driving aid only. It remains the driver's responsibility to drive with due care and attention during parking manoeuvres.

NOTES:

 Park assist sensors may not detect some obstructions, e.g. narrow posts, small objects close to the ground, mesh fences and, in some circumstances, bicycles or motor cycles parked alongside the kerb.

 All sensors must be kept clean and free from debris or obstructions, e.g., leaves, mud, snow, ice, frost or insects. Failure to keep the sensors clean may result in sensor miscalculation or false indications.

Park assist must not be used if:

- A temporary spare wheel is in use.
- A sensor is damaged or the bumper is damaged sufficiently to affect a sensor mounting point.
- A sensor is obstructed by items attached to the vehicle, e.g., bumper covers, a bicycle rack, a trailer, stickers, etc.
- The vehicle is being used to transport a load that extends beyond the vehicle perimeter, for example a trailer.

Once a parking space has been identified, the PACM module calculates the parking trajectory, communicating output information to the following vehicle systems:

- The PSCM via high speed CAN Chassis bus. The trajectory calculations are processed by the PSCM ready for the first stage of the parking maneuver. Once a vehicle speed signal is received (vehicle reversing) the PSCM independently controls the steering trajectory.
- The IC message center by high speed CAN Chassis and Powertrain bus, via the GWM. The message center displays the relevant park assist information/instructions to the driver
- The front and rear parking aid sensor information are transmitted from the PACM to the TS, via the GWM (Gateway Module). The TS has a gateway function too, to provide the AAM (Audio Amplifier Module) with sensor information via the MOST ring. The audible warning tones are emitted through the audio system speakers.

During any Park assist manoeuvre, the Parking aid system will remain active and will sound when objects are detected near the vehicle. A parking manoeuvre can be cancelled at any point by holding/turning the steering wheel or by pressing the Park assist button.

Service Information

If the on-board diagnostic system identify a fail, the following warnings will be apply:

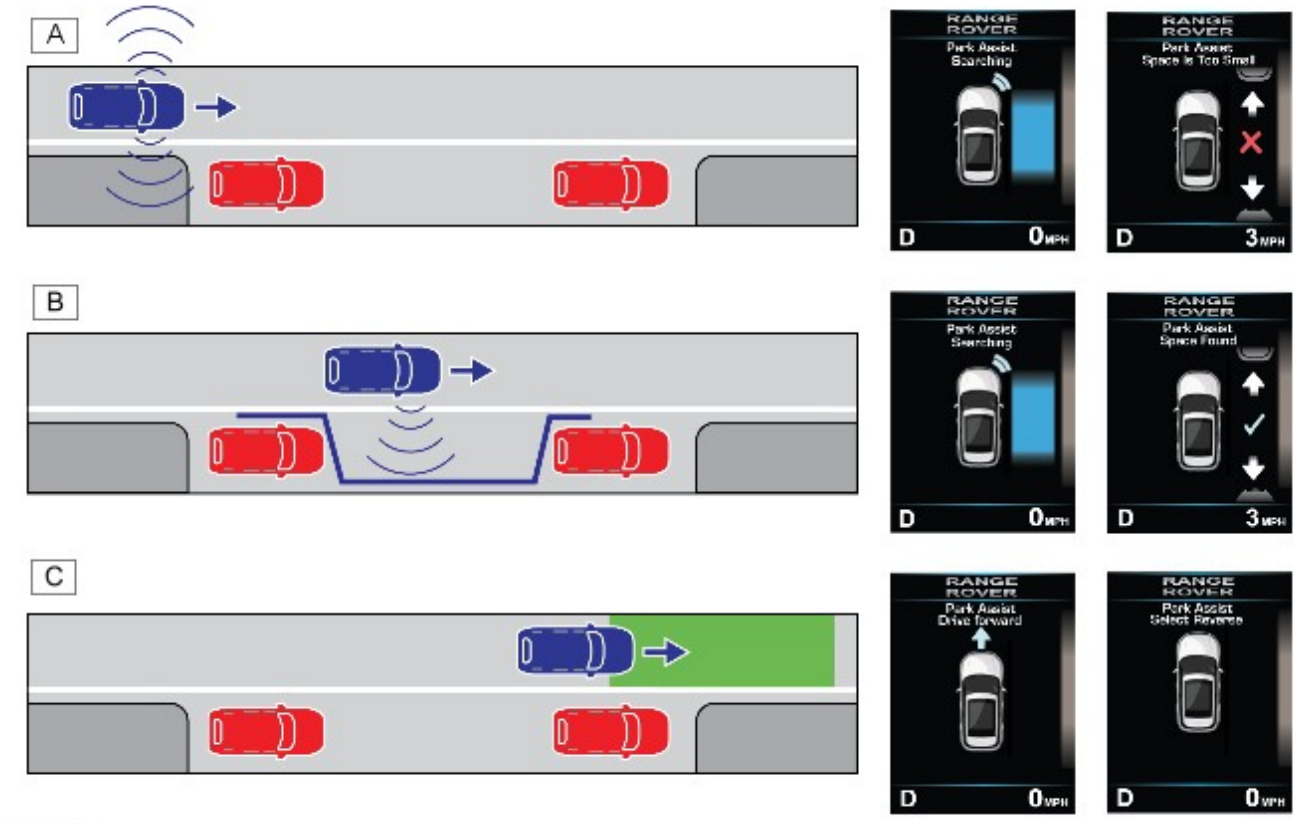
- The IC displays an error message.
- The front audio system speakers will emit a 3 second continuous tone
- A DTC (Diagnostic Trouble Code) is logged in the PACM module.

Searching for a Parking Space

Once the driver has identified a possible parking space the park assist system carries out the following checks and procedures:

- The system constantly searches for a space on the both sides of the vehicle. If the system has been manually activated from the driver, it is possible to select the desired side to park with the turn signal indicators. The system continuously scans on both sides. The park assist display appears in the message center and shows the 'Searching' message and graphic. For park assist to search effectively, maintain a distance of 0.5 to 1.5 metres (1.6 to 4.9 ft) between the vehicle and the line of parked vehicles/obstacles in which you want to park.
- As the vehicle moves forward, parallel to a row of parked vehicles, it detects the parked vehicles.
- The system can detect a space up to four meters away from the side of vehicle. The system will only offer a space which is 1.2 times the length of the vehicle (or greater) and deep enough to park the vehicle.
- When the vehicle detects a sufficient size parking space, the driver is instructed to stop the vehicle and select reverse gear.
- The system calculates the appropriate trajectory to park the vehicle into the detected space.

 CAUTION: Make a visual check before starting the reversing manoeuvre to make sure the space has not changed in any way.



E132749

Item	Part Number	Description
A	-	Park assist system activated searching for space.
B	-	Park assist detects and measures space.
C	-	Vehicle comes to end of space and stops ready for next state.

Reversing into Space

When reverse gear is selected the IC message center displays the appropriate parking instructions. Park assist will then take control of the vehicle's steering system and the steering wheel must be released. Release the foot brake carefully to move the vehicle slowly into the parking space (vehicles with automatic transmission).

NOTES:

The driver must maintain full control of the accelerator and brakes throughout the manoeuvre.

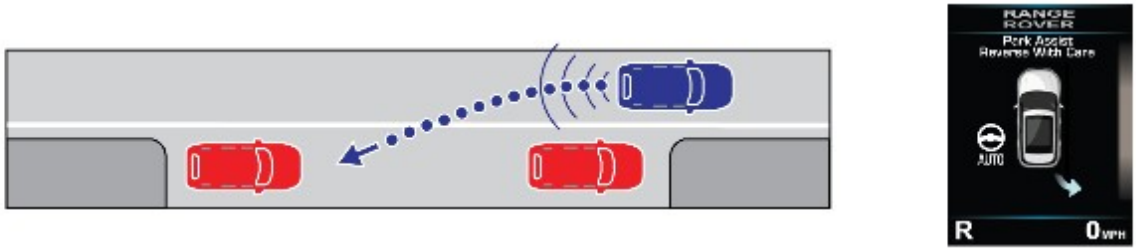
Do not move the vehicle until the 'Parallel Parking. Reverse with care' message is displayed.

If the steering wheel is manually turned while Park assist has control of the steering, Park assist will deactivate and the Park assist button indicator will extinguish.

If the vehicle's speed exceeds 5 km/h (3 mph) during the parking manoeuvre, Park assist will display a message until the vehicle's speed decreases to less than 5 km/h (3 mph). If the vehicle's speed exceeds 7 km/h (4 mph), Park assist will deactivate and the indicator lamp in the park assist button will extinguish.

The following checks and procedures are applied:

- The driver follows message center instructions, moving the vehicle backwards along the trajectory calculated by the park assist system
- Detected obstacles at 0.9m generate an intermittent sound tone over the vehicle rear speakers.
- Detected obstacles at 0.3m generate a constant sound tone over the vehicle rear speakers.
- On reaching the end of the reversing maneuver the driver is instructed to stop the vehicle.
- The driver selects a forward gear to prepare for the next stage of the parking manoeuvre.
- If the vehicle has been parked in a large space in correct position, the manoeuvre is complete and the system operation ends.



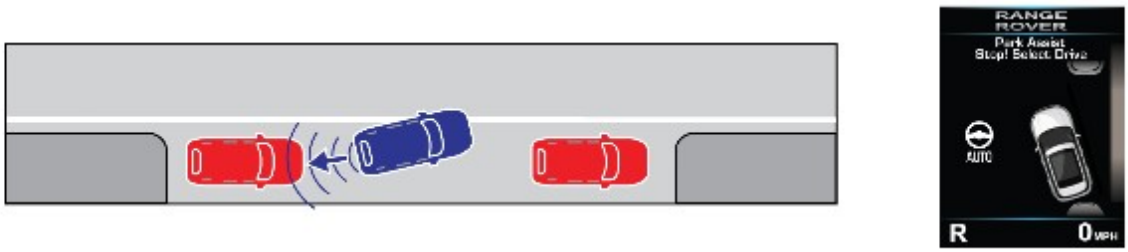
E135456

Correction within the parking space

If the vehicle is not in the correct position after the initial reversing manoeuvre, the driver is instructed to select a forward gear with the 'Stop! Select D and await next instruction' message. When the forward gear is selected, the IC message center displays the appropriate parking instructions.

The following checks and procedures are applied:

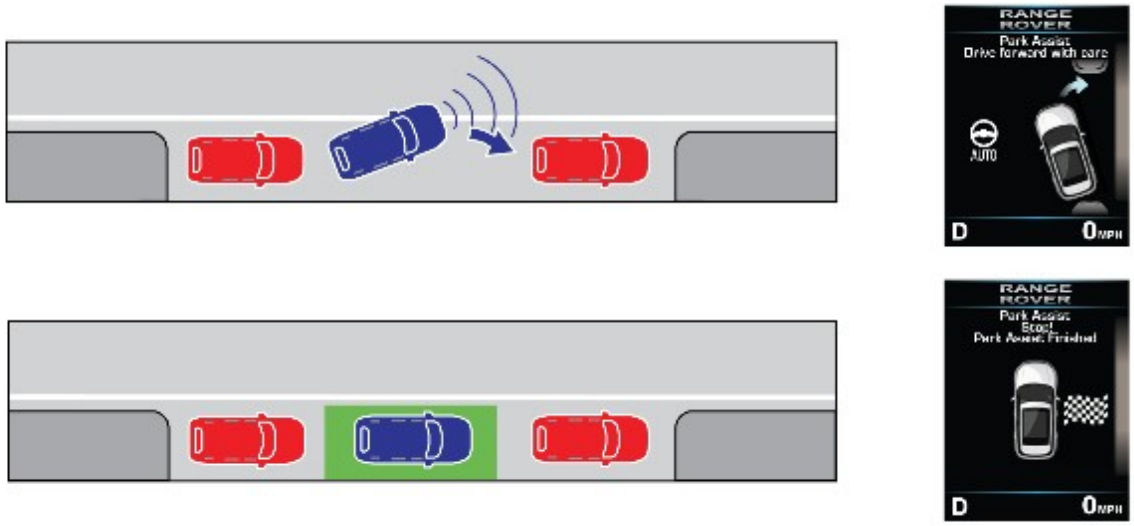
- The driver follows the message center instructions, moving the vehicle forwards along the trajectory calculated by the park assist system.
- Detected obstacles at 0.6m generate an intermittent sound tone over the vehicle front speakers.
- Detected obstacles at 0.3m generate a constant sound tone over the vehicle front speakers.
- On reaching the end of the forward maneuver the driver is instructed to apply the footbrake to stop the vehicle.
- The driver selects reverse gear to prepare for the next stage of the parking maneuver.
- If the vehicle is in the final position the maneuver is complete and the system operation ends.



E135457

If the vehicle is parking in a smaller space more shuffling may be required to complete the parking maneuver.

Driver selects forward gear - further shuffling is completed.



E135458

When the parking manoeuvre is complete, the 'Stop! Park Assist finished' message will be displayed on the message center.

PRINCIPLES OF OPERATION - WADE SENSING

The GPSM (General Proximity Sensor Module) hosts a software to deliver the wade sensing functionality. Two ultrasonic sensors are located on the underside of the door mirrors. The ultrasonic sensors are hardwired to the GPSM directly. The GPSM supplies the sensors with an ignition power and an earth lead connection. The sensors give a signal voltage, which is proportional to the measured reflection from the water. The water depth calculation is based on the reflection from the water surface, which is measured by the sensors, and:

- +/- offset from suspension height adjustment from the ISCM (Integrated Suspension Control Module) via the high speed Chassis CAN (Controller Area Network) bus.

CAUTIONS:

The sensors and the area below the sensors must be kept clean and free from snow, ice, mud and other debris. Failure to keep the sensors clean may result in sensor miscalculation.

If the door mirrors are in the folded position, Wade sensing will operate but will give false readings.

The door mirrors must be in the normal (unfolded) position when using the Wade sensing system.

These inputs are used to provide the driver audible and visual information about the depth of water and the gradient of the vehicle around the lateral axis, as compared to the water level, when the vehicle is moving through the water. The wade sensing system can display the water depth information on the TS (Touch Screen) through the CAN bus. Additionally, the IC (Instrument Cluster) can show several warning messages, about the 'Near', 'Reached', and 'Exceeded' water level. If any fault is detected in connection with the wade sensing system, the IC will display fault warning on the message center. Since the GPSM is connected to the high speed Chassis CAN bus, the water depth information is transmitted via the GWM (Gateway Module). The GWM converts the high speed Chassis CAN signal to medium speed Comfort CAN bus message, which is received by the TS and IC. The audible tones are transmitted by the audio system.

CAUTIONS:

When using the wade sensing feature, the driver is advised not to wade through flowing or rough water.

The wade sensing system cannot detect the true level of water if a layer of ice or snow exists on the water surface.

The wade sensing system should not be used during off-road driving, as rapid increases in water depth cannot be detected in time to deliver a warning message to the driver.

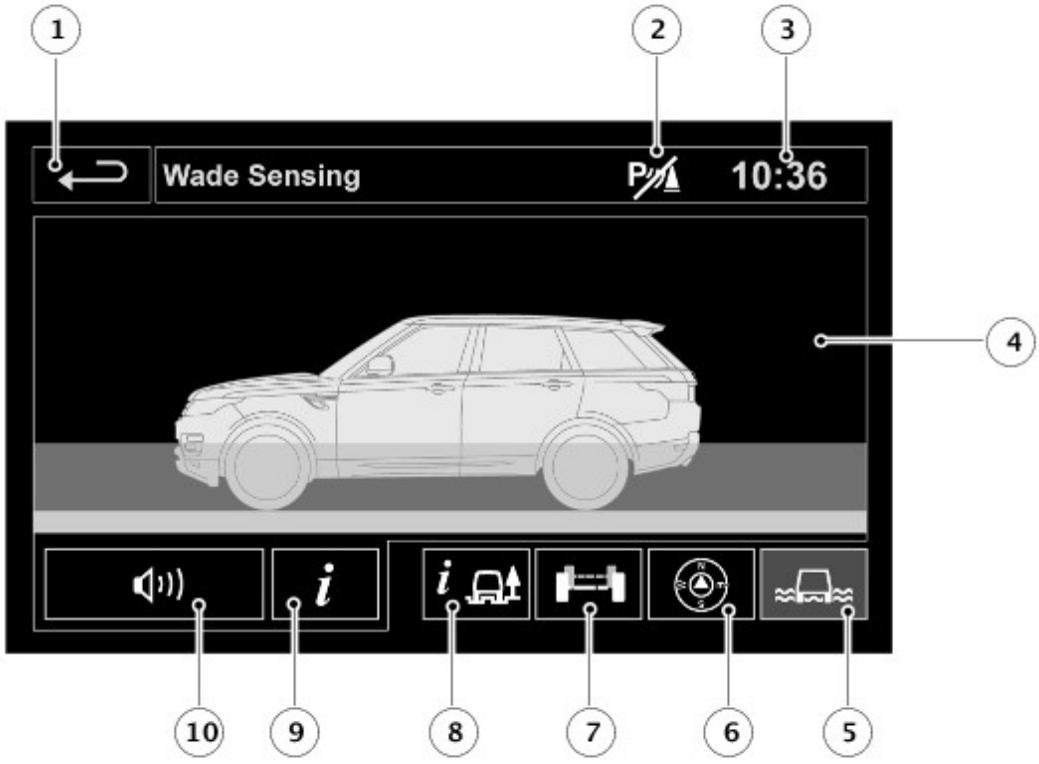
The wade sensing screen can be selected from the TS '4X4' or 'Extra Features' menus.



E154941

Item	Part Number	Description
1	-	Extra features menu to reach the wade sensing display

The TS is able to display the current and maximum water depths. The system will warn the driver as the maximum depth for wading approaches.



E152244

Item	Part Number	Description
1	-	'Back' soft key
2	-	Parking aid system disabled
3	-	Clock

4	-	Wade sensing screen
5	-	Wade sensing selected
6	-	Compass display
7	-	4X4i display
8	-	Terrain Response display
9	-	Information Display
10	-	Audio On/Off soft key

The TS provides the driver with the following information:

- Initial wading advice.
- Maximum vehicle wade depth.
- Advised to select 'Off Road' suspension height to support maximum wade ability.
- Ice wade warning, preventing potential damage to the vehicle.
- Near max wade depth.
- Max wade depth reached.
- Max wade depth exceeded.
- Road Gradient - level, nose down, nose up

The system warns the driver via the TS and IC and audible tones, when the maximum depth approaches. If the road gradient exceeds the 10% value, or the vehicle speed is grater than 10 km/h (6mph), the TS view will grey out. If the vehicle's speed exceeds 30 km/h (19 mph) for 30 seconds, wade sensing will automatically switch off.

 CAUTION: Wading performance is improved if the vehicle suspension is set to 'Off Road' height. Wade sensing will not operate if the vehicle is fitted with fixed side steps, or side tubes. Parking aid, park assist and intelligent stop/start systems are all disabled when wade sensing is operating.

The PACM (Parking Aid Control Module) becomes aware of the working of wade sensing system, through the high speed Chassis CAN bus.

PRINCIPLES OF OPERATION - CAMERA SYSTEMS

LO-LINE CAMERA SYSTEM

A shielded co-axial cable connection between the camera and the TS is used for the video image transmission.

The camera receives power at all times when the ignition is in power mode 6 or 7 from the RJB (Rear Junction Box). When reverse gear is selected, the CJB (Central Junction Box) sends a reverse gear selected signal on the medium speed CAN Body bus. This signal is transmitted by the GWM to the rear view camera, which connects to the medium speed CAN Comfort bus. The camera then sends a message to entertainment system requesting for the image to be displayed and the TS. The displaying of the TS is a wide-angle color image of the view from the rear of the vehicle.

When reverse gear is deselected, the camera image remains on the TS for 5 seconds after the transmission has been put into drive 'D', 'P', 'N', or 'S'. This is to prevent the TS 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 5 second period, the camera image is removed from the TS.

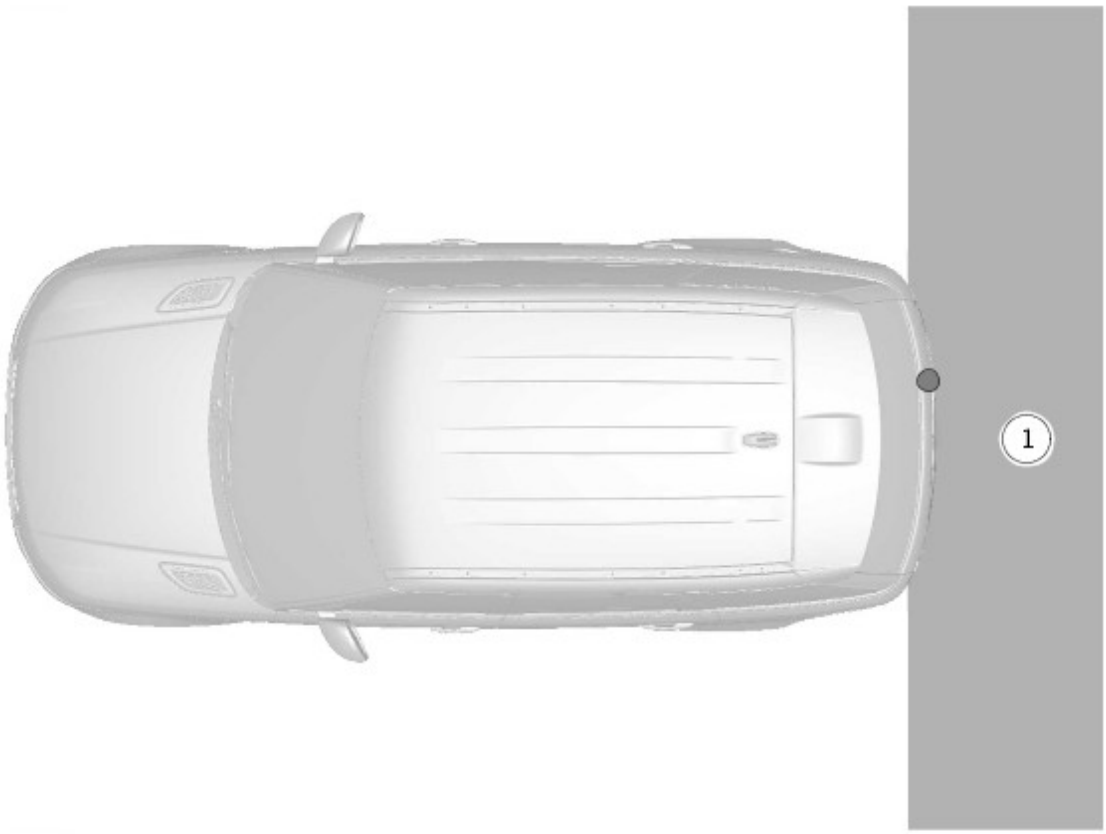
If the TS display is switched off, the camera image will be automatically displayed when reverse gear is selected. When reverse gear is deselected and the 5 second period has expired, the TS will revert back to its switched off state.

Lo-Line Rear View Camera



Item	Part Number	Description
1	-	Rear view camera (Lo-line)

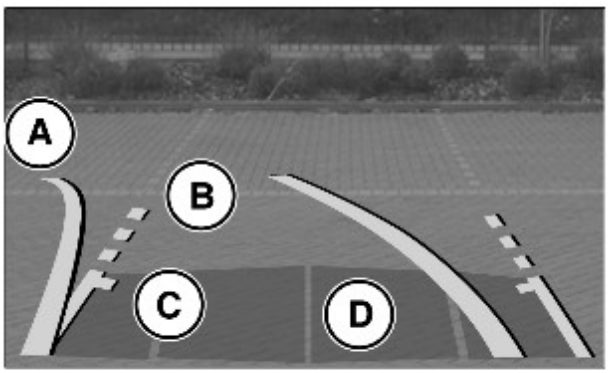
Camera Coverage Zone - Lo-line

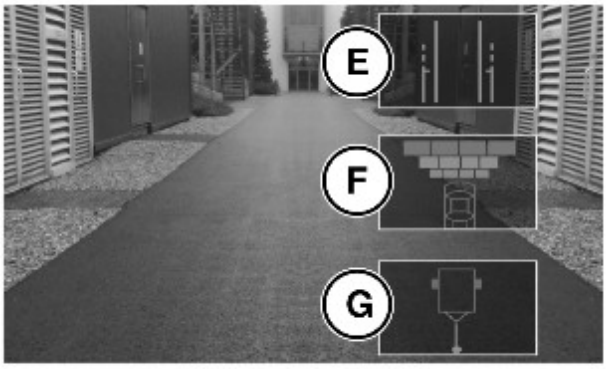


E156742

Item	Part Number	Description
1	-	Rear view camera coverage zone

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, automatically displays a wide-angle color image of the view from the rear of the vehicle onto the TS. Overlay graphics are displayed by a combination of signals received on the medium speed CAN Comfort bus to the TS.





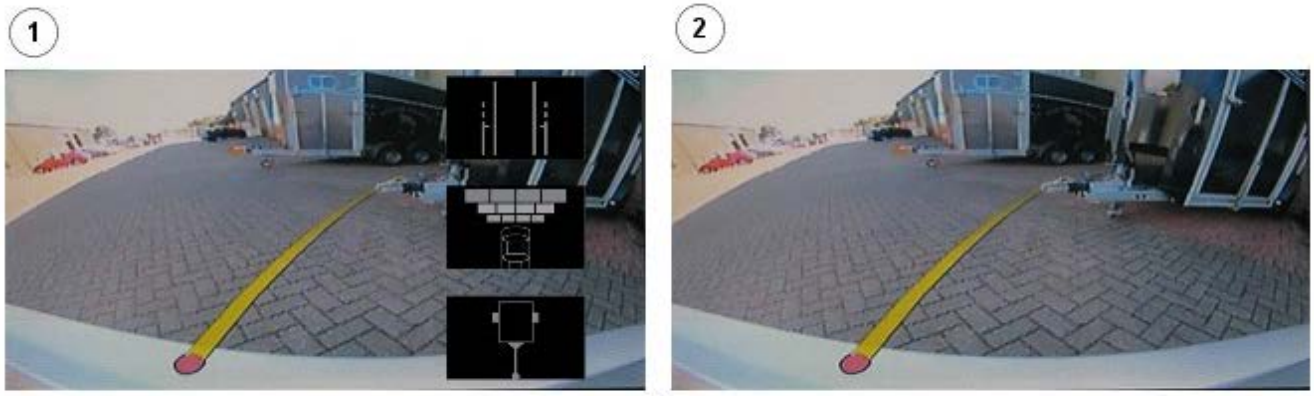
E141731

Item	Part Number	Description
A	-	Solid line: The projected path based on current steering wheel position.
B	-	Dotted line: The safe working width of the vehicle (including exterior mirrors).

C	-	Tailgate access guideline: Do not reverse beyond this point if tailgate access is required.
D	-	Parking sensor activation: A colored area appears, to indicate which rear sensor(s) has been activated.
E	-	User option. Touch to enable/disable A, B & C.
F	-	User option. Touch to enable/disable D.
G	-	User option. Touch to enable/disable Hitch Assist guidance lines.

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 TS. Within the settings menu the driver can activate the Hitch Guidance feature. Hitch guidance provides a trajectory line indicating the path of the towball in relation to the steering angle applied to the vehicle.



E152127

Item	Part Number	Description
1	-	Touch Screen (TS) - Rear view menu screen
2	-	Tow ball trajectory line

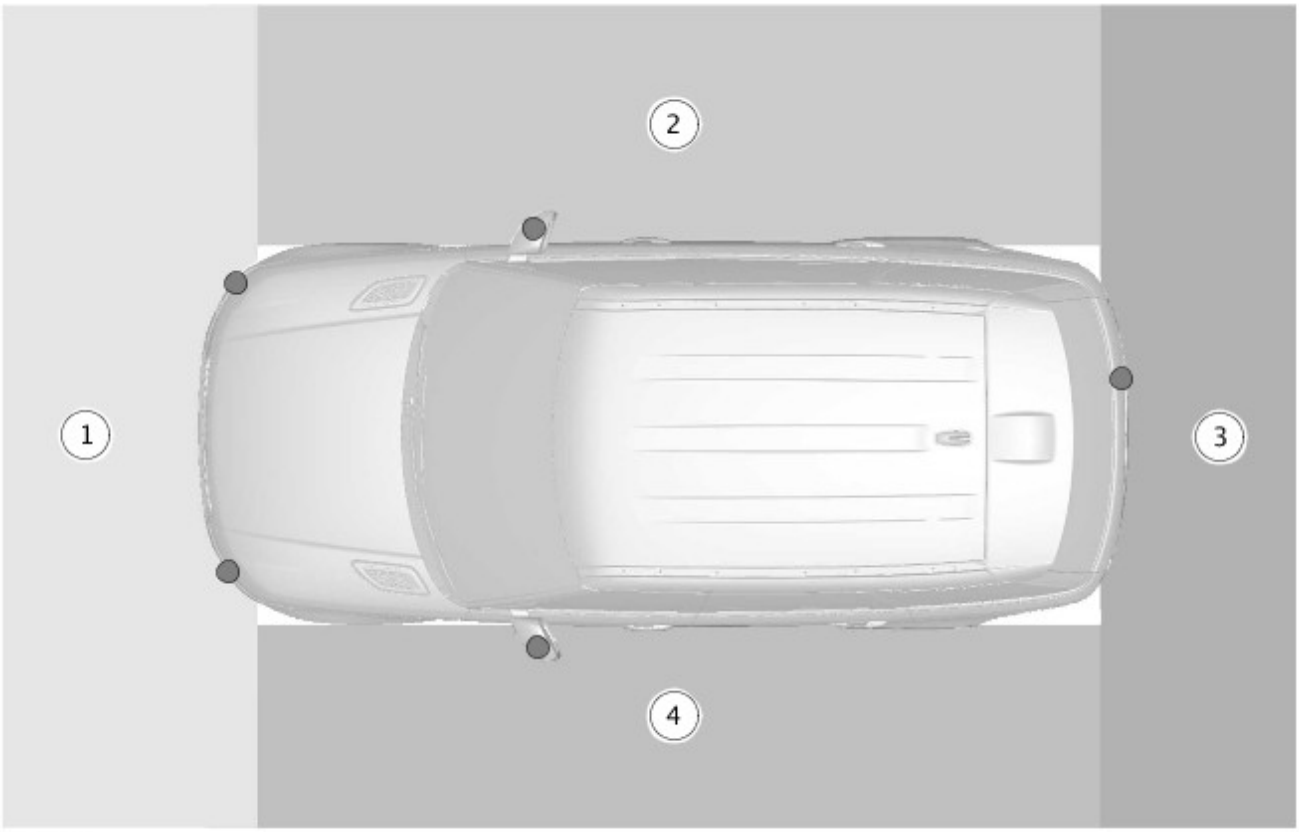
Hi-LINE CAMERA SYSTEM

The Hi-Line camera system provides the driver with a visual-aid when maneuvering the vehicle at low speeds. The system uses the CCM (Camera Control Module) to capture the camera data and display the resulting images on the TS, 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 TS.

The Hi-line 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 - Hi-line



E156741

Item	Part Number	Description
1	-	Front Camera coverage zone
2	-	Right door mirror camera coverage zone
3	-	Rear camera coverage zone
4	-	Left door mirror camera coverage zone

Automatic operation

- Once the vehicle speed exceeds 18 km/h (11 mile/h) the images will automatically switch off
- Once automatically switched off, the camera view will be disabled until:
  - another ignition cycle occurs and the system is automatically functioned, or
  - the camera system is manually selected on the TS
  - the vehicle speed reduces under 18km/h
  - With the ignition ‘on’ and ‘Reverse’ selected, the camera system will display the view from the rear of the vehicle.

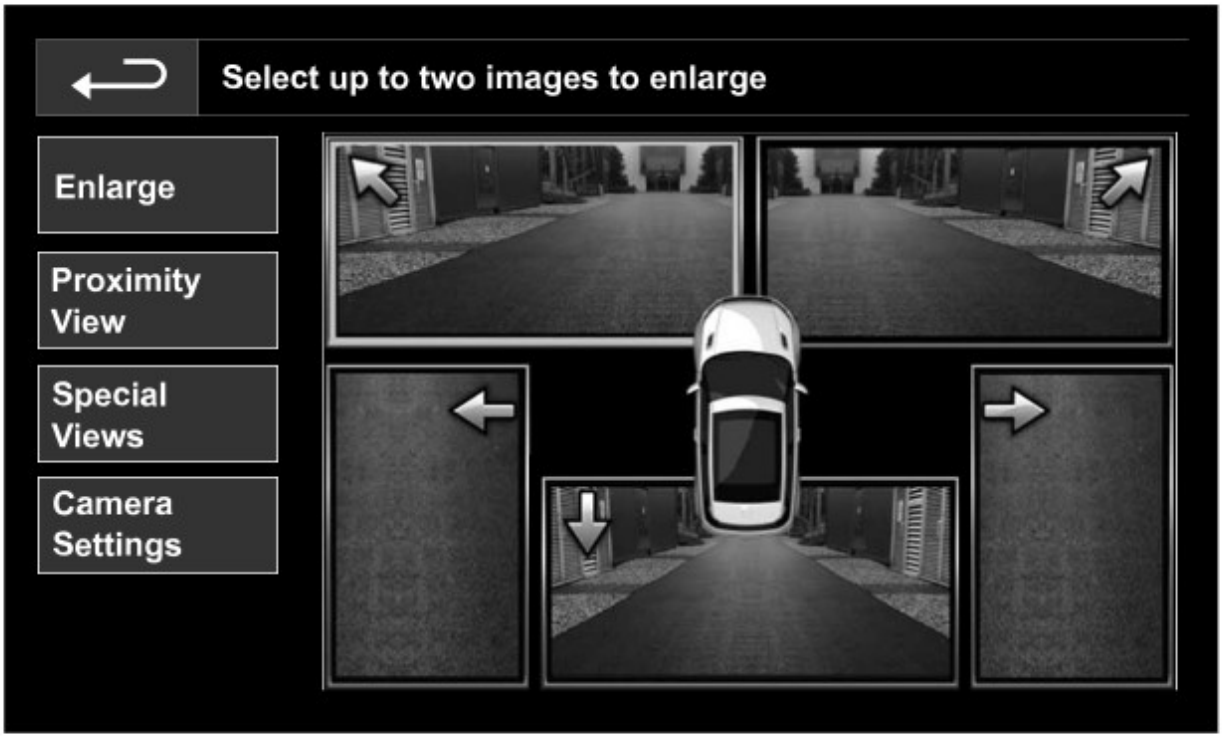
Manual operation

- The camera home page is accessed using the ‘Cameras’ icon on the ‘Navigation’ home screen on the TS or via the ‘Extra Features’ menu.
- Camera views can be accessed at all times.

Selecting views

Camera settings soft key is only visible on Japanese specification vehicles.

Camera home screen frame rate is reduced to 15 frames per second, all other camera views are shown at 30 frames per second.



E141729

- 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 the front passenger side cameras. These images provide the driver with an enhanced view of the area forward and opposite the driver.

Automatic Operation

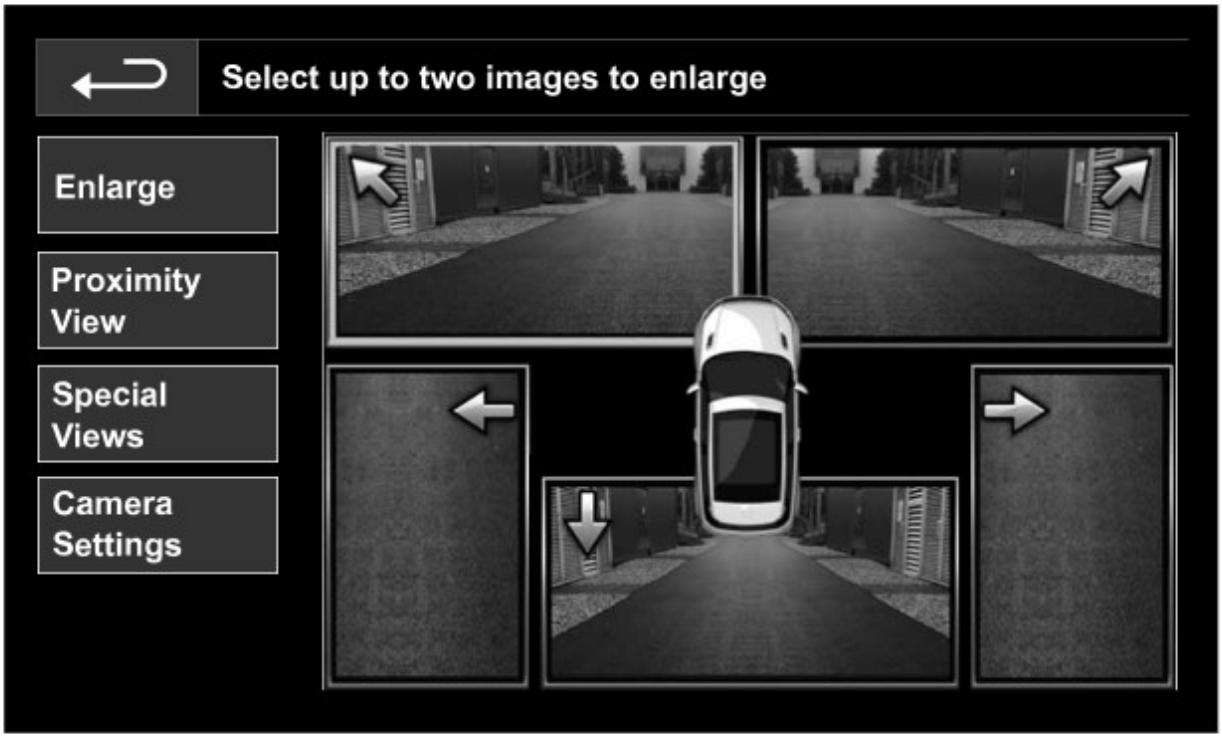
- Once the vehicle speed exceeds 18 km/h (11 mile/h) the images will automatically switch off.
- Once automatically switched off, the camera view will be disabled until:
  - another ignition cycle occurs and the system is automatically functioned, or
  - the camera system is manually selected on the TS
  - the vehicle speed reduces under 18km/h.
  - With the ignition ‘on’ and ‘Reverse’ selected, the camera system will display the view from the rear of the vehicle.

Manual Operation

The camera home page is accessed using the ‘Cameras’ icon on the ‘Navigation’ home screen on the TSD or via the ‘Extra Features’ menu.

Camera views can be accessed at all times.

Selecting Views



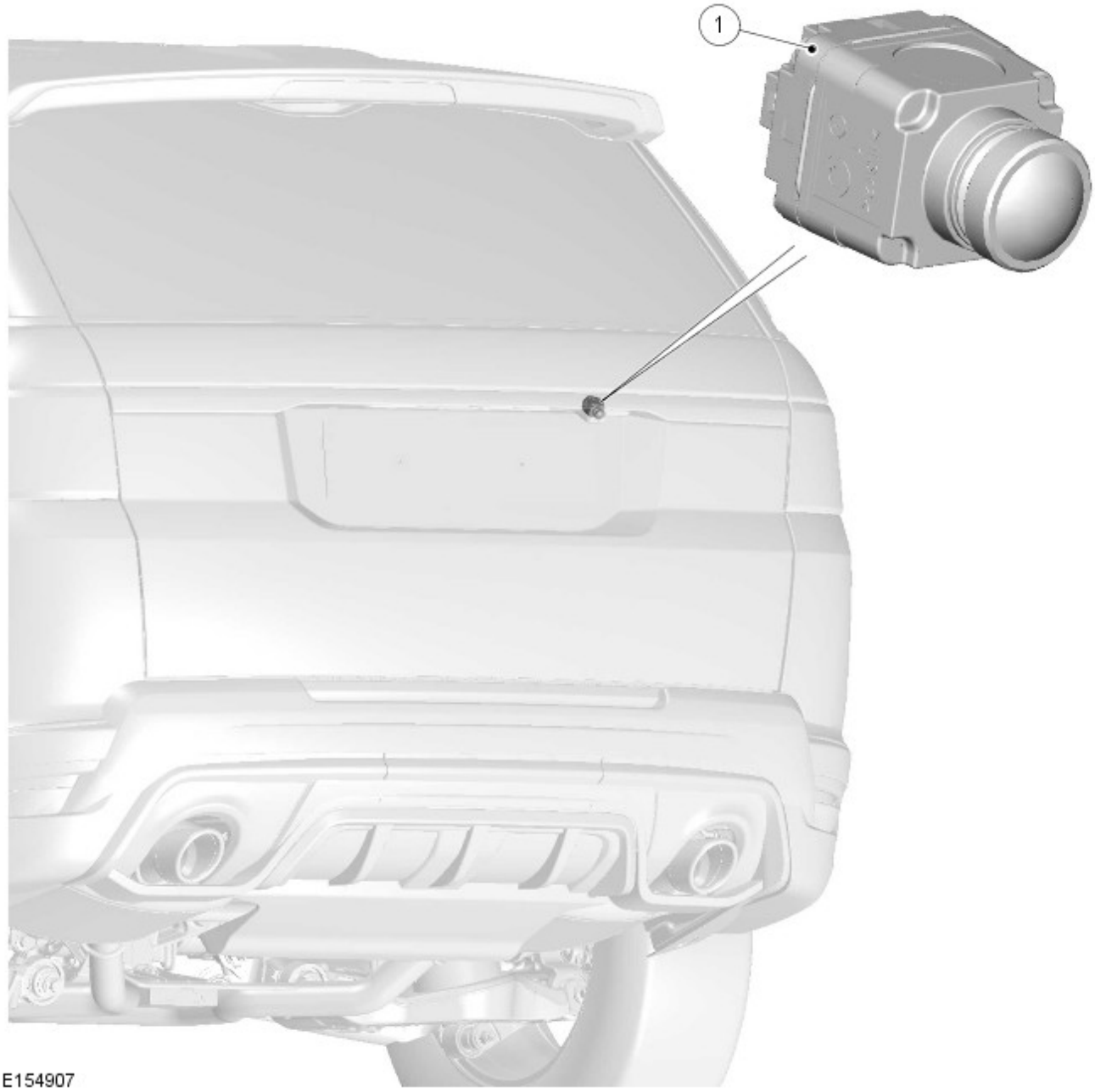
E141729

- 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 the front passenger side cameras. These images provide the driver with an enhanced view of the area forward and opposite the driver.

Hi-Line Rear View Camera



Item	Part Number	Description
1	-	Rear view camera (Hi-line)

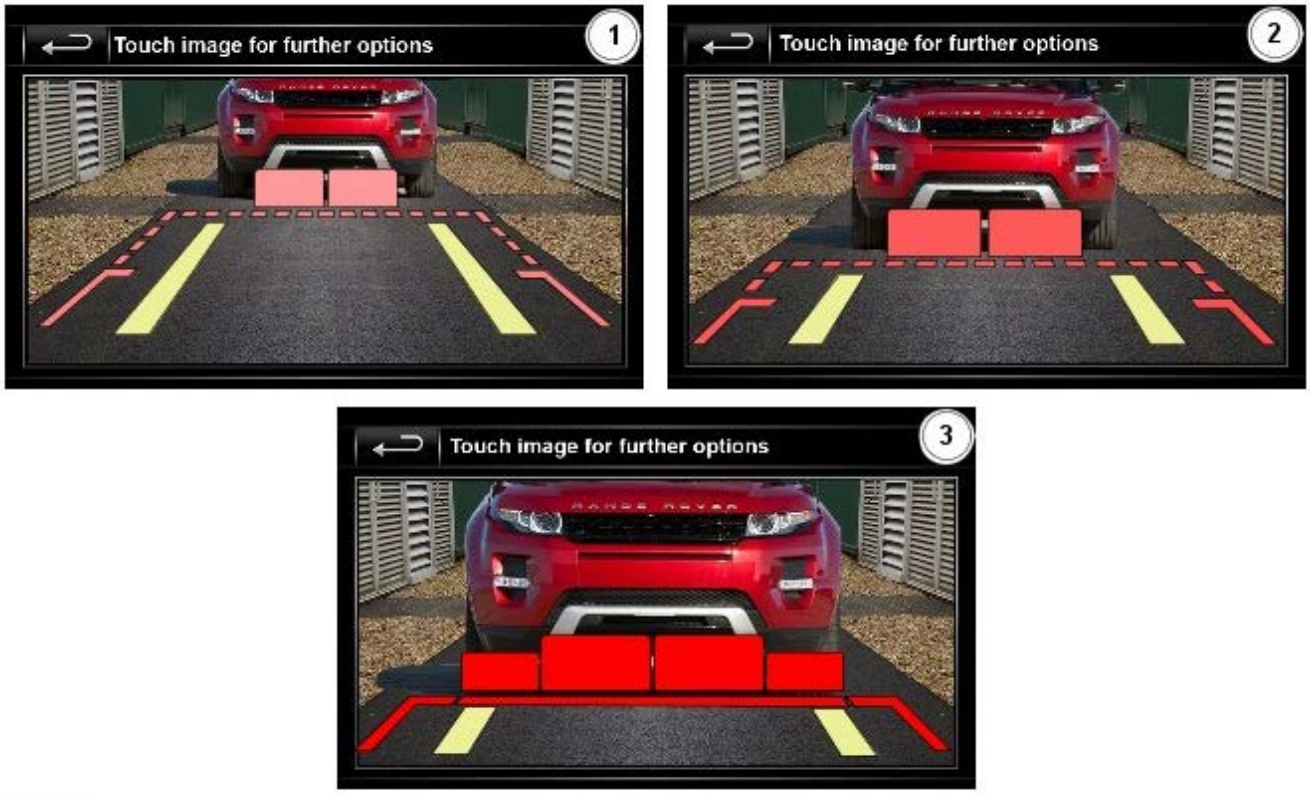
The rear view camera provides additional information to the driver when reversing the vehicle. When reverse gear is selected the camera integrated into the tailgate handle assembly, automatically displays a wide-angle color image of the view from the rear of the vehicle onto the TS.

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 CCM through the medium speed CAN Comfort bus via the GWM.

The reversing-aid graphics can be disabled in the settings menu or by touching the TS whilst reverse gear is selected and the camera view is displayed.

Reversing Visual Warnings



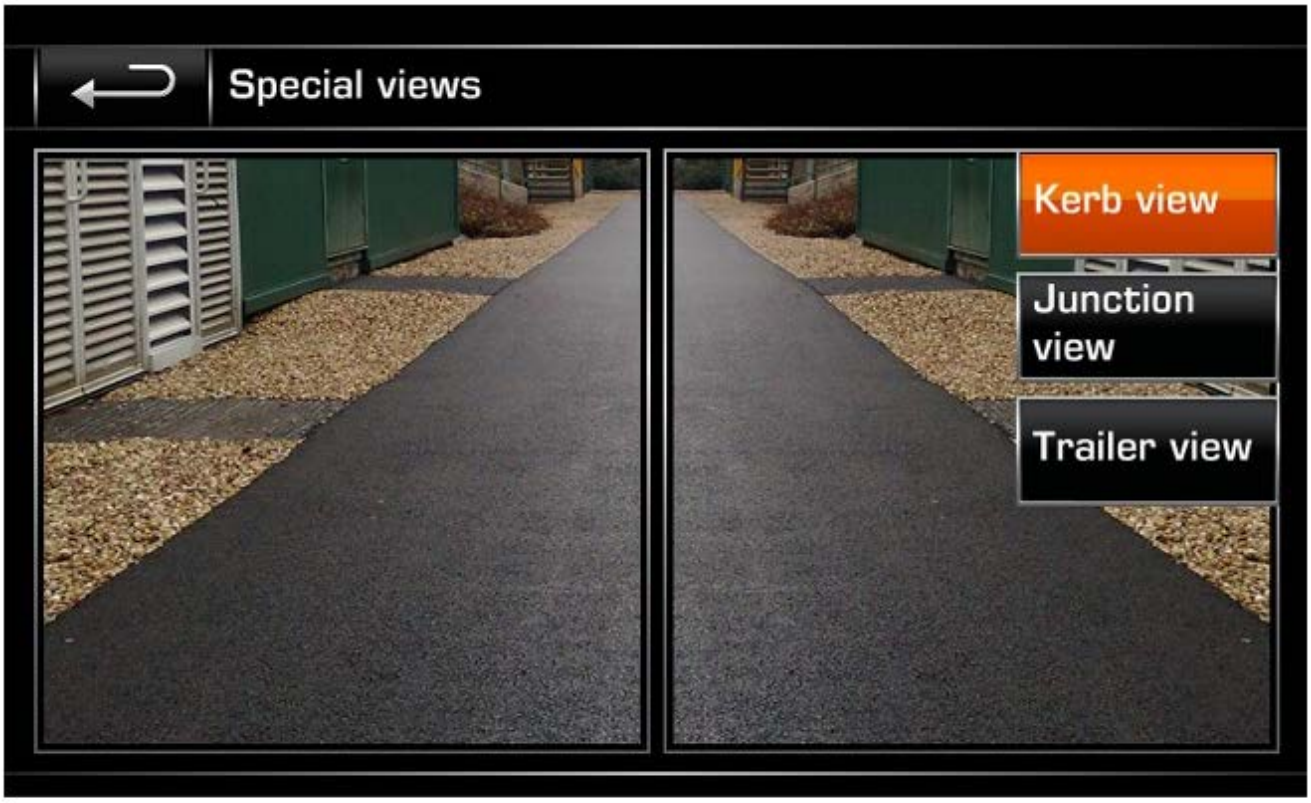
E148937

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	-	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:

- Kerb 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 CCM, through the recognition of a new serial number during the ‘camera count’ procedure that takes place during the ‘ignition on’ phase via the LIN (Local Interconnect Network) bus.

If a new camera is installed calibration must be performed using the diagnostic equipment and the vehicle’s TS. During the calibration procedure, setup software in the control module overlays fine colored lines on the TS 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 TS.

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.

If body repairs are performed that affect the camera system, a calibration procedure must be executed after the repairs are completed.

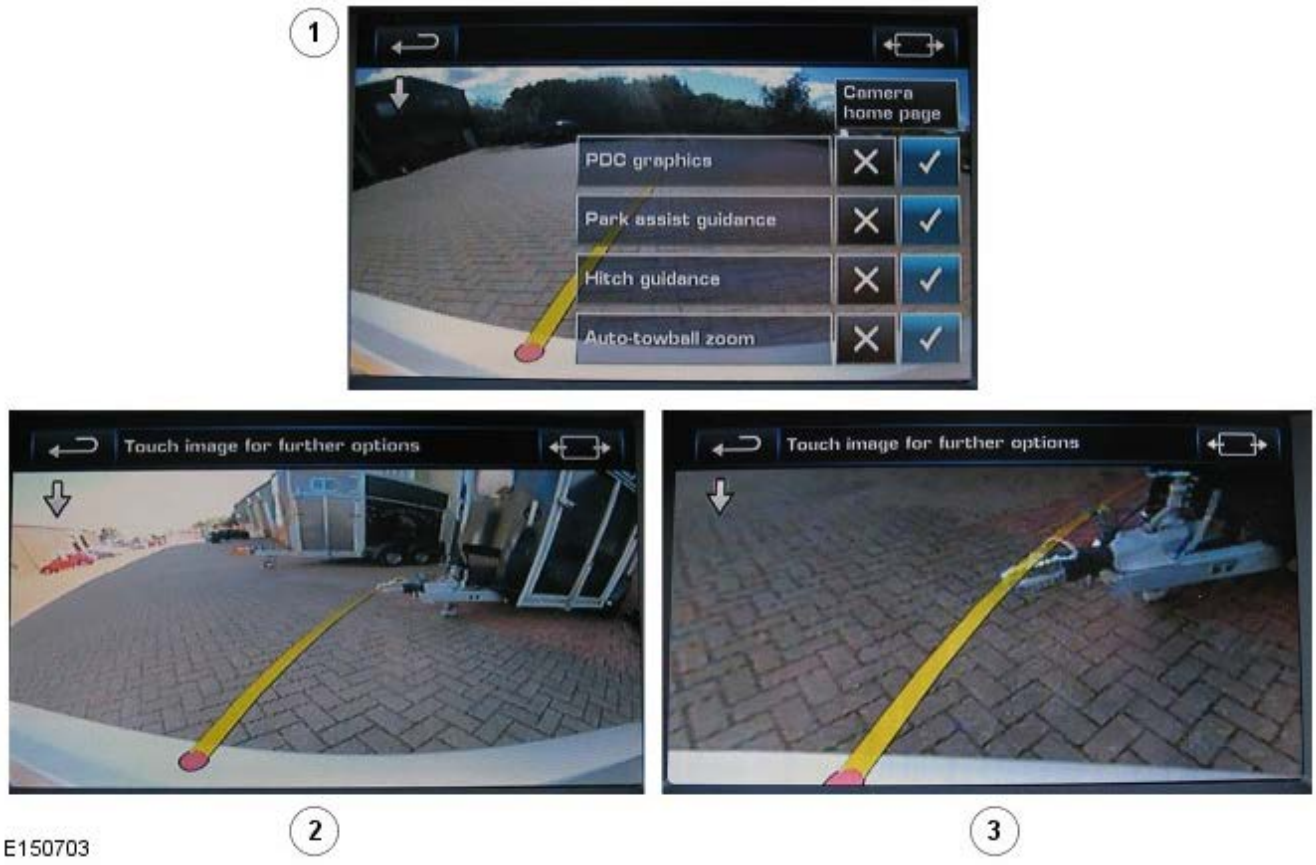
System Fault

In the event of camera fault, a DTC is logged in the CCM, and an icon is presented to the driver on the TS 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 TS.

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 (TS) image – Auto towball Zoom feature
2	-	Tow ball trajectory line
3	-	Automatic zoom

TOW ASSIST - NEW TRAILER

When the CJB detects the trailer electrical plug has been connected, the trailer setup screen is displayed automatically on the TS 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'.

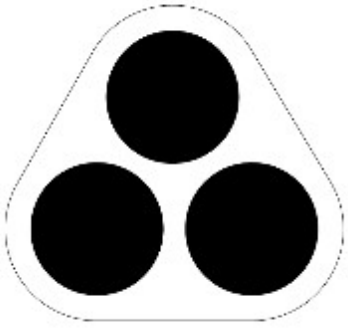
Trailer Setup – Step 1 of 6

- 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



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’.

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’.

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’.

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’.

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 TS with the question: ‘Has a trailer been connected?’

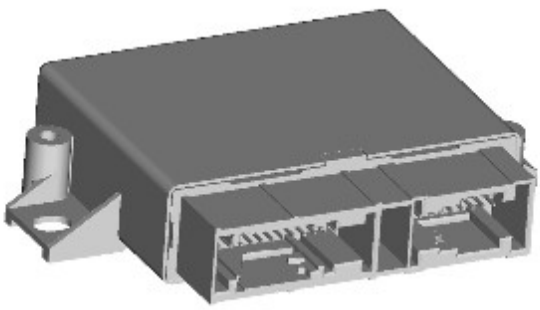
Selecting ‘Yes’ from the previous screen brings a list of pre-set, or previously saved, trailers. Highlight the required trailer, and select ‘OK’.

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.

COMPONENT DESCRIPTION

PARKING AID CONTROL MODULE (PACM)



E156975

The parking aid control module is located in the luggage compartment, behind the left quarter trim panel of luggage compartment (above the Auxiliary climate control assembly if it is fitted).

The parking aid control module has two connectors which provide for power, ground and high speed Chassis CAN bus

connections, front parking aid sensors and rear parking aid sensors.

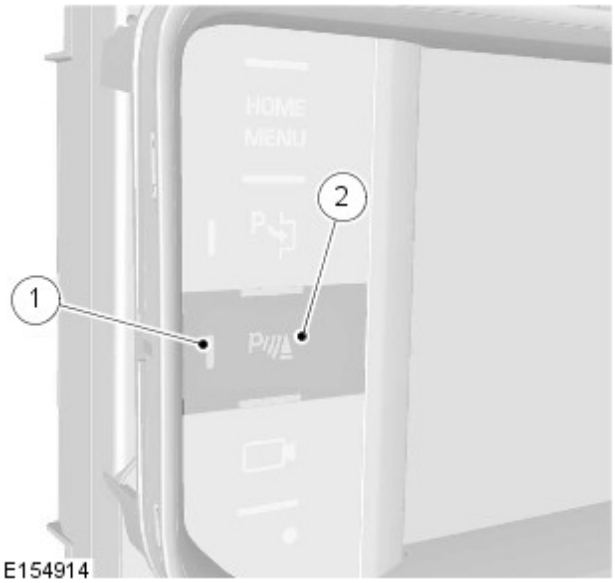
The PACM receives the following information from other systems, via the high speed Chassis CAN bus:

- ABS module - Road speed signal
- TCM (Transmission Control Module) - Reverse gear engaged signal

The module also outputs messages on the high speed Chassis CAN bus. The GWM processes these messages and converts them into medium speed Comfort CAN messages, which are passed to the TS. The TS converts them into MOST (Media Orientated System Transport) signals system. These signals are then used by the power amplifier to emit the applicable warning tones from the front or rear audio speakers when an object is detected by the front or rear parking aid sensors. A warning tone can also be emitted to alert the driver to a fault in the parking aid system.

The control module has a diagnostic connection via the high speed Chassis 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. The control switch LED will also flash 6 times when reverse gear is selected or the parking aid switch is pressed.

Parking Aid Switch



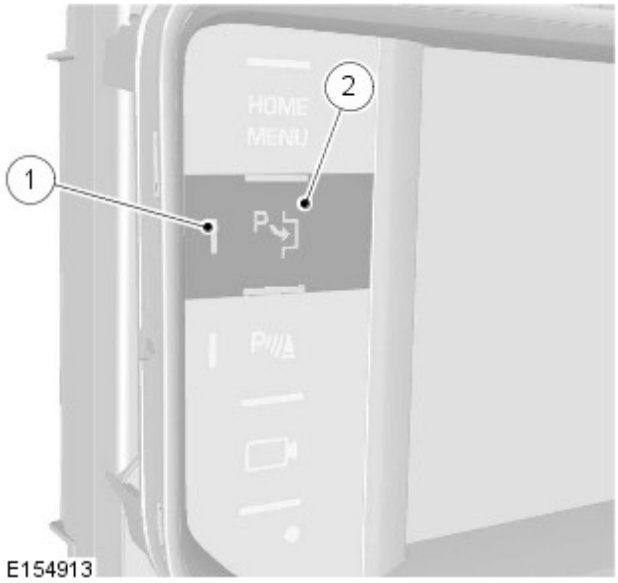
Item	Part Number	Description
1	-	Parking aid switch indicator
2	-	Parking aid switch

The parking aid switch is located in the left TS switch pack.

The switch is a non-latching push switch which allows the driver to select the parking aid system on or off. When pressed, the switch momentarily connects a ground to the PACM. The LED indicates when the parking aid system is active. The LED is controlled by the PACM. To switch the Parking aid system off, press the button.

The Parking aid system will remain off until the next ignition cycle, reverse gear is selected, or the system is manually switched back on again.

Park Assist Switch



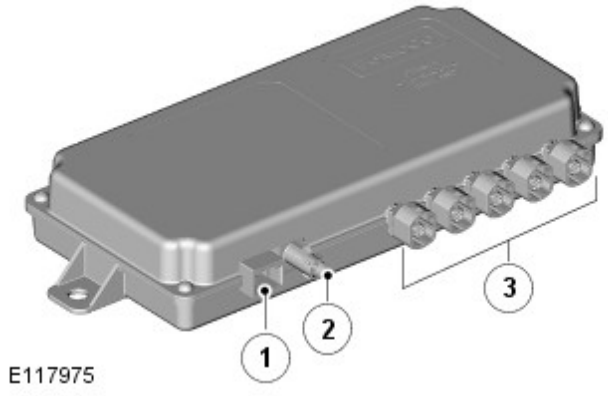
Item	Part Number	Description
1	-	Park assist switch indicator
2	-	Park assist switch

The park assist switch is located in the left TS switch pack.

The switch is a non-latching push switch which allows the driver to select the park assist system on or off. When pressed, the switch momentarily connects a ground to the PACM. The LED indicates when the park assist system is active. The LED is controlled by the PACM.

The control switch allows the driver to activate/deactivate the park assist system if operation is required or not required.

CAMERA CONTROL MODULE (CCM)



Item	Part Number	Description
1	-	Power supply, ground and BUS connector
2	-	Connection to the Touch Screen (TS)
3	-	Five camera connections

The CCM is located in the passenger compartment, behind the rear left seat bolster trim panel, under the GPSM module.

- medium speed CAN Comfort network
- five camera inputs
- video signal output to the TS
- 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 via the NTSC (National Television System Committee) analogue video line.

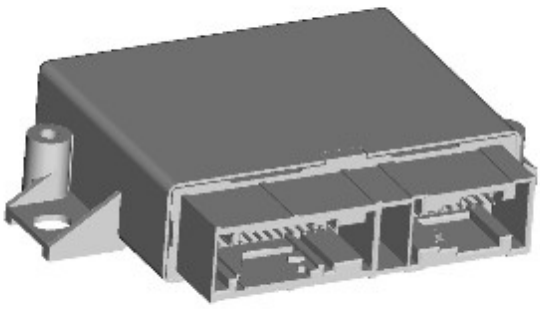
The control module also adds guidance and warning overlays to the camera images to create the various driving-aid features supported by the camera proximity system; for example, visual direction is made available when reversing the vehicle.

The module communicates with each individual camera via the LIN 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.

In addition to the data lines the camera receives a power supply and a ground from the control module.

Care must be taken when routing, disconnecting and reconnecting the camera harnesses.

GENERAL PROXIMITY SENSOR MODULE (GPSM) - WADE SENSING



E156975

The GPSM is located in the passenger compartment, behind the rear left seat bolster trim panel, above the CCM module.

The GPSM has a connector, which provide for power, ground and high speed Chassis CAN bus connections, and the sensors in the door mirrors. The control module is able to transmit and receive the following important information on the high speed Chassis CAN bus:

- +/- offset from the ISCM (Integrated Suspension Control Module)
- water depth to the TS (Touch Screen), via the GWM (Gateway Module).

When the vehicle is started, the GPSM receives the Car Configuration File (CCF) from the CJB (Central Junction Box), then the CJB energizes the extended ignition relay in the RJB (Rear Junction Box). The ignition relay supply the GPSM with power, and it is ready to operate.

The control module has a diagnostic connection via the high speed Chassis 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.

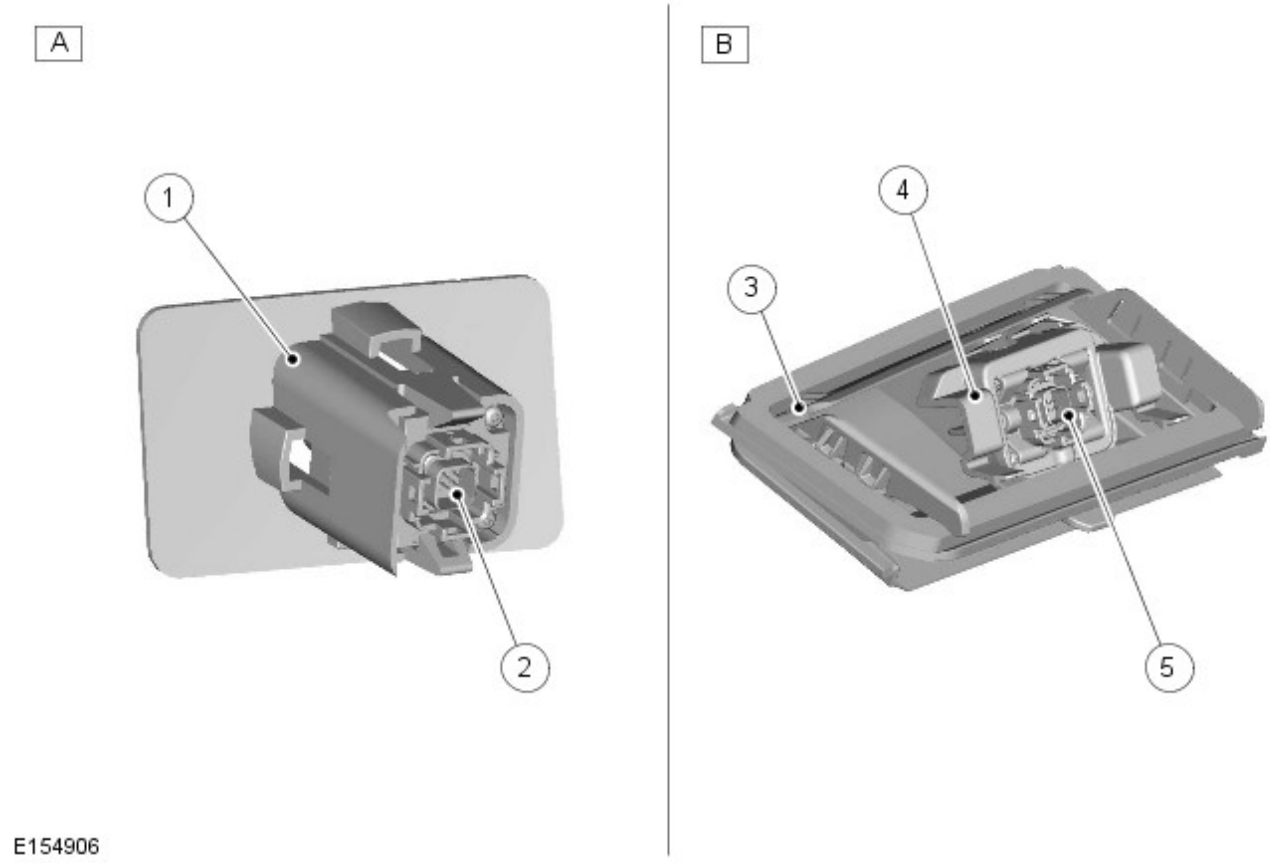
Cameras



E141725

The Hi-line 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. Reversing lights are crucial to successful night operation of the rear view camera.

Camera Mounting



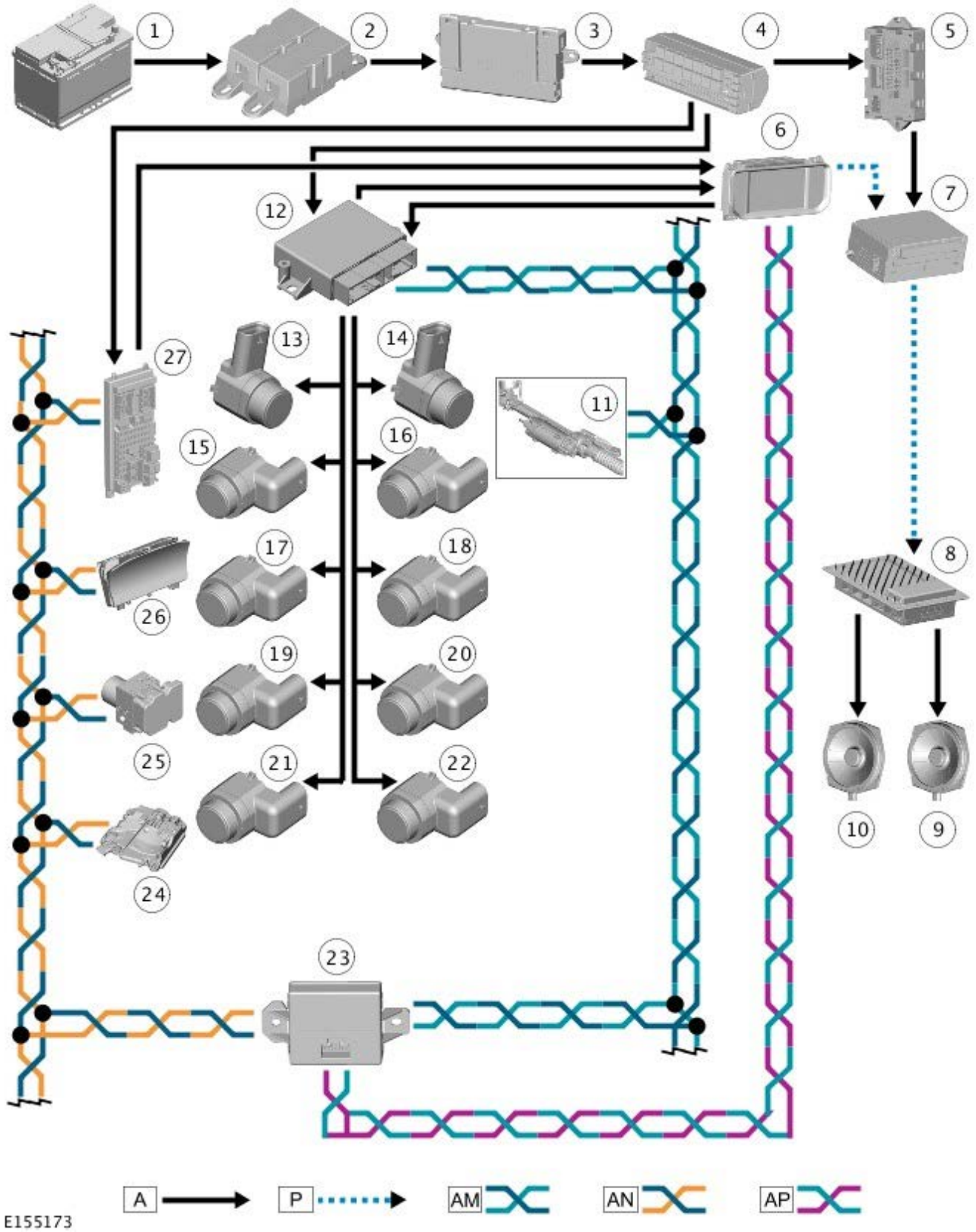
Item	Part Number	Description
A	-	Front view camera mounting
B	-	Rear view camera mounting (Hi-line shown)
1	-	Front view camera bracket in bumper
2	-	Front view camera
3	-	Exterior tailgate handle bezel
4	-	Rear view camera bracket
5	-	Rear view camera

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 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 2 mm. In the event of camera replacement, a calibration routine must be performed.

CONTROL DIAGRAM - SHEET 1 OF 4 - PARKING AID AND PARK ASSIST

NOTE: A = Hardwired, P = MOST (Media Oriented System Transport) bus, AM = High speed CAN (Controller Area Network) Chassis bus, AN = High speed CAN Powertrain bus, AP = Medium speed CAN Comfort bus.

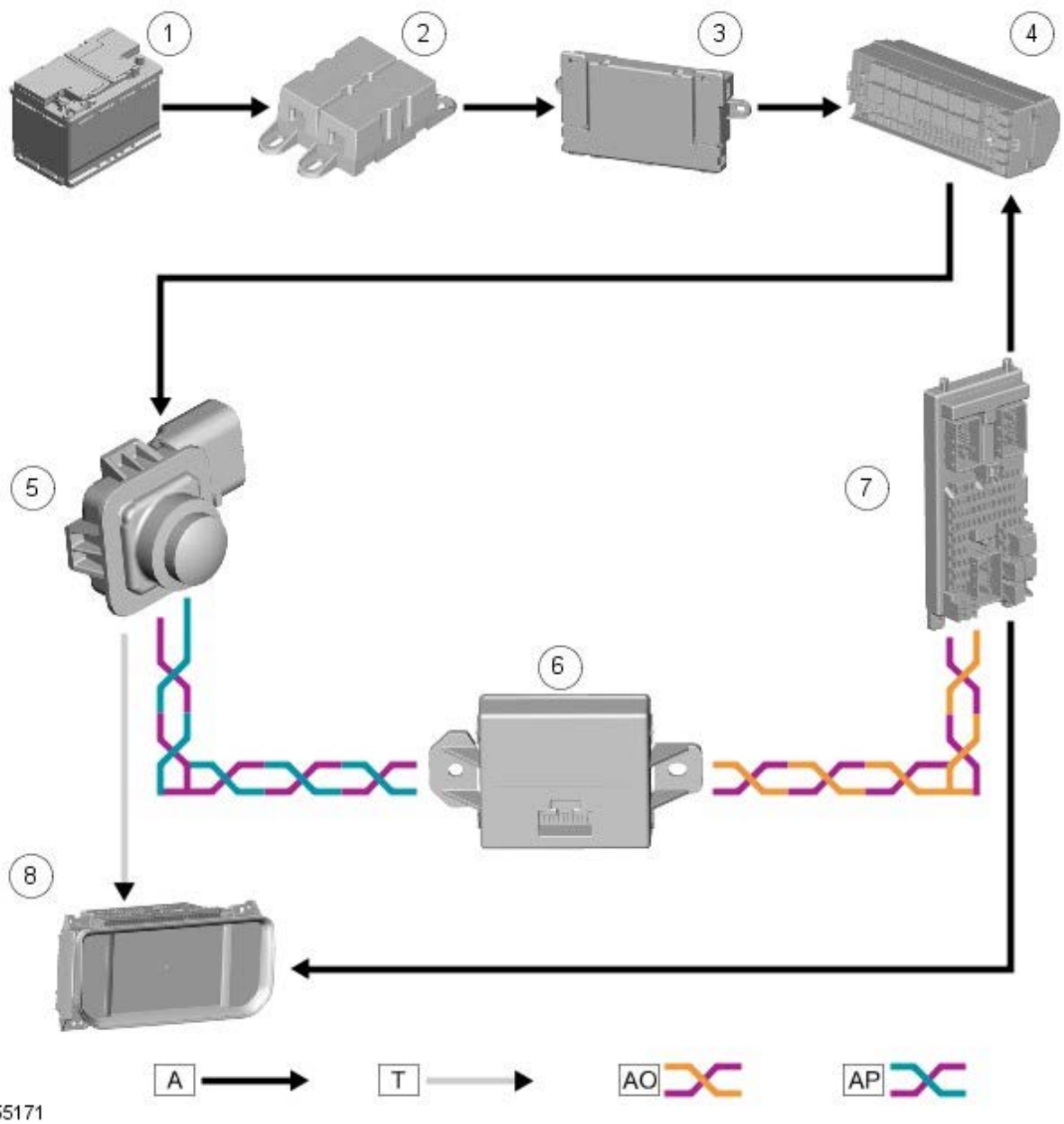


Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)
3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)
5	-	Quiescent Current Control Module (QCCM)
6	-	Touch Screen (TS)
7	-	Integrated Audio Module (IAM)
8	-	Audio Amplifier Module (AAM)
9	-	Front speakers
10	-	Rear speakers

11	-	Power steering gear
12	-	Parking Aid Control Module (PACM)
13	-	Front left slot detect parking aid sensor
14	-	Front right slot detect parking aid sensor
15	-	Front left outer parking aid sensor
16	-	Front right outer parking aid sensor
17	-	Front left inner parking aid sensor
18	-	Front right inner parking aid sensor
19	-	Rear left outer parking aid sensor
20	-	Rear right outer parking aid sensor
21	-	Rear left inner parking aid sensor
22	-	Rear right inner parking aid sensor
23	-	Gateway Module (GWM)
24	-	Transmission Control Module (TCM)
25	-	Anti-lock Brake System (ABS) control module
26	-	Instrument Cluster (IC)
27	-	Central Junction Box (CJB)

CONTROL DIAGRAM - SHEET 2 OF 4- REAR VIEW CAMERA SYSTEM (LOW-LINE)

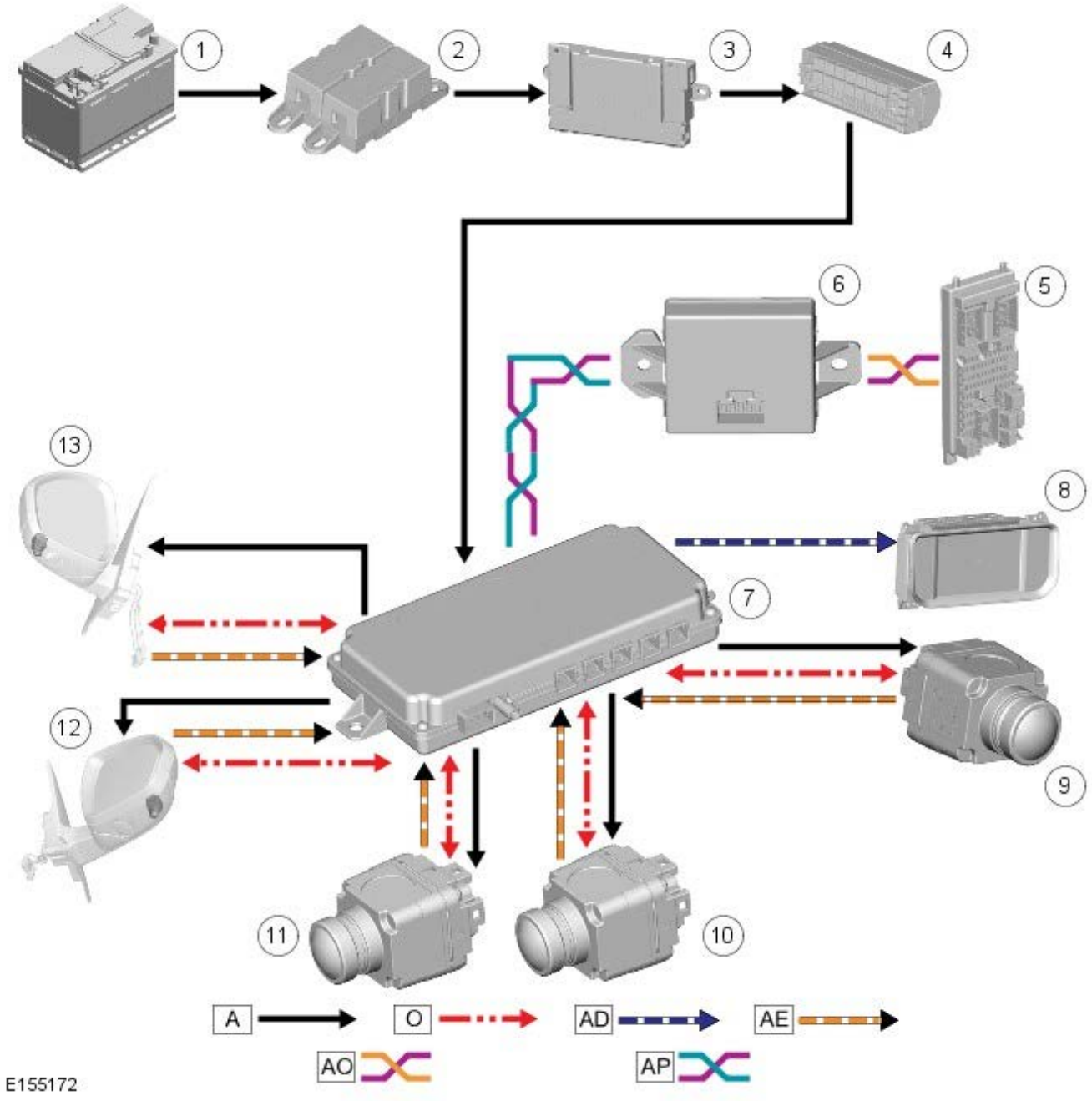
NOTE: A = Hardwired, T = CoAxial wire, AO = Medium speed CAN (Controller Area Network) Body bus, AP = Medium speed CAN Comfort bus.



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)
3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)
5	-	Rear view camera
6	-	Gateway module (GWM)
7	-	Central Junction Box (CJB)
8	-	Touch Screen (TS)

CONTROL DIAGRAM - SHEET 3 OF 4 - PROXIMITY CAMERA SYSTEM (HI-LINE)

NOTE: A = Hardwired, O = LIN (Local Interconnect Network) bus, AD = NSTC (National Television System Committee), AE = LVDS (Low-Voltage Differential Signalling), AO = Medium speed CAN (Controller Area Network) Body bus, AP = Medium speed CAN Comfort bus.

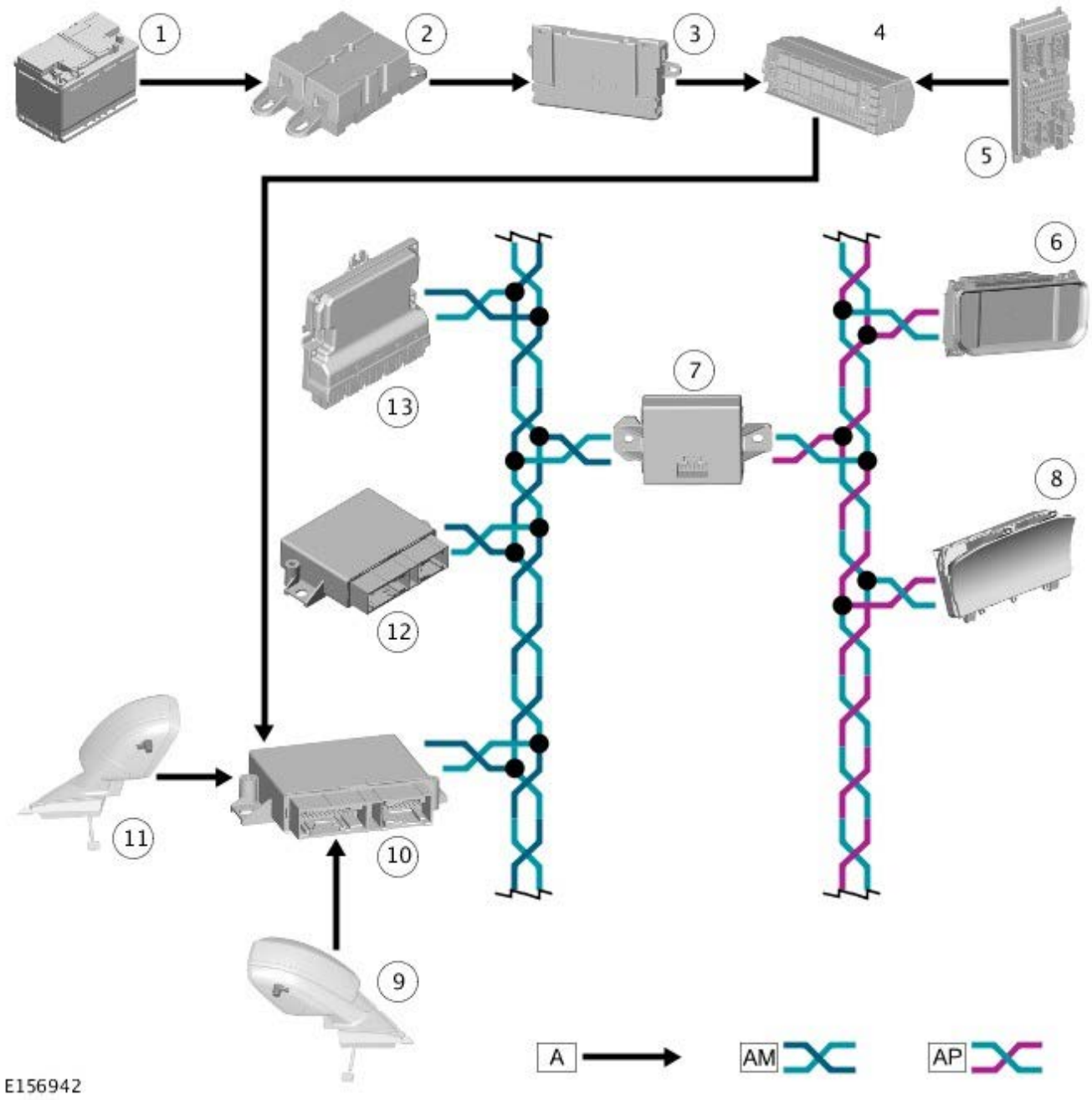


Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)
3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)
5	-	Central Junction Box (CJB)

6	-	Gateway Module (GWM)
7	-	Camera Control Module (CCM)
8	-	Touch Screen (TS)
9	-	Rear view camera
10	-	Front right camera
11	-	Front left camera
12	-	Right mirror camera
13	-	Left mirror camera

CONTROL DIAGRAM - SHEET 4 OF 4 - WADE SENSING SYSTEM

NOTE: A = Hardwired, AM = High speed CAN (Controller Area Network) Chassis bus, AP = Medium speed CAN Comfort bus.



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)
3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)
5	-	Central Junction Box (CJB)
6	-	Touch Screen (TS)
7	-	Gateway Module (GWM)

8	-	Instrument Cluster (IC)
9	-	Right door mirror with sensor
10	-	General Proximity Sensor Module (GPSM)
11	-	Left door mirror with sensor
12	-	Parking Aid Control Module (PACM)
13	-	Integrated Suspension Control Module (ISCM)

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: 20-Jan-2013

Parking Aid - Front Inner Parking Aid Sensor

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

LH illustration shown, RH is similar.

The ignition must be switched off.

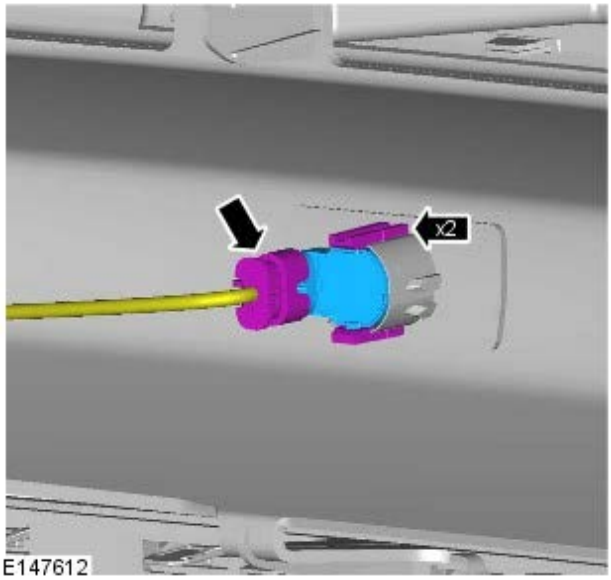
Check the sensor before removing to note if the sensor(s) are painted or unpainted.

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

   Raise and support the vehicle.

2. Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).

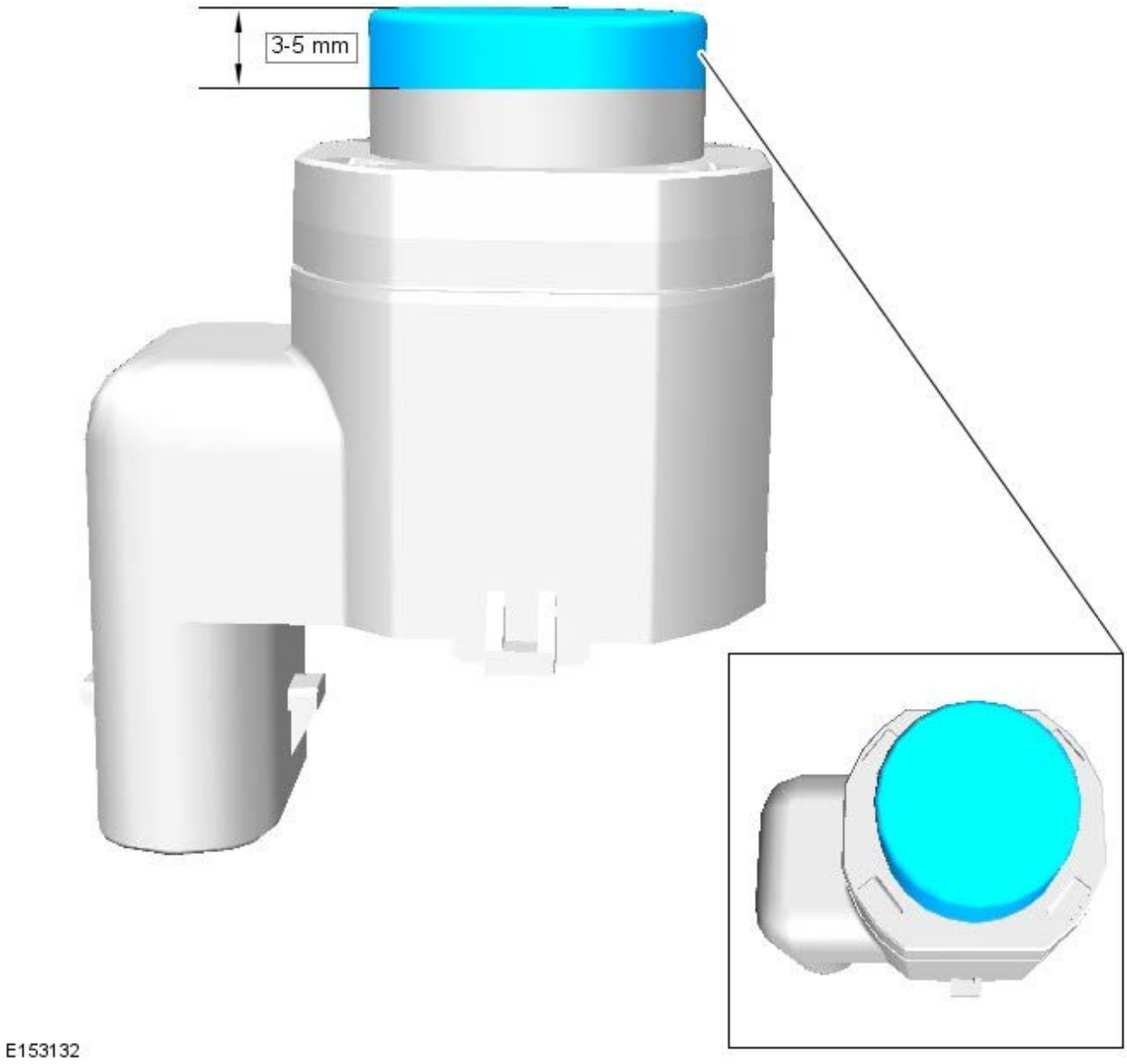
3.



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: 20-Jan-2013

Parking Aid - Front Outer Parking Aid Sensor

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

LH illustration shown, RH is similar.

The ignition must be switched off.

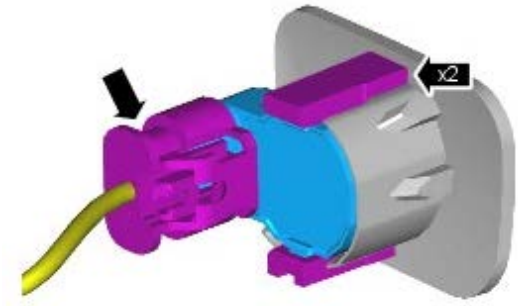
Check the sensor before removing to note if the sensor(s) are painted or unpainted.

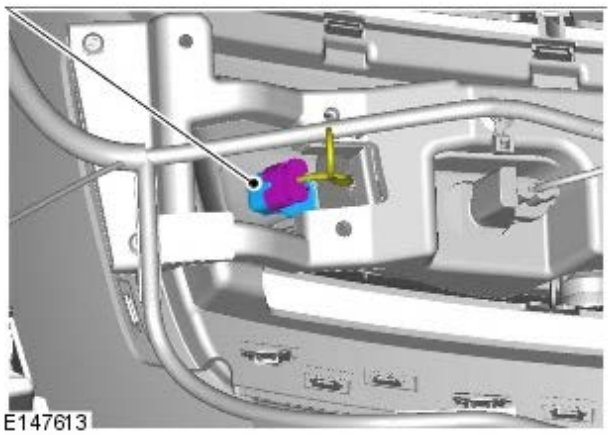
1. WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).

3.

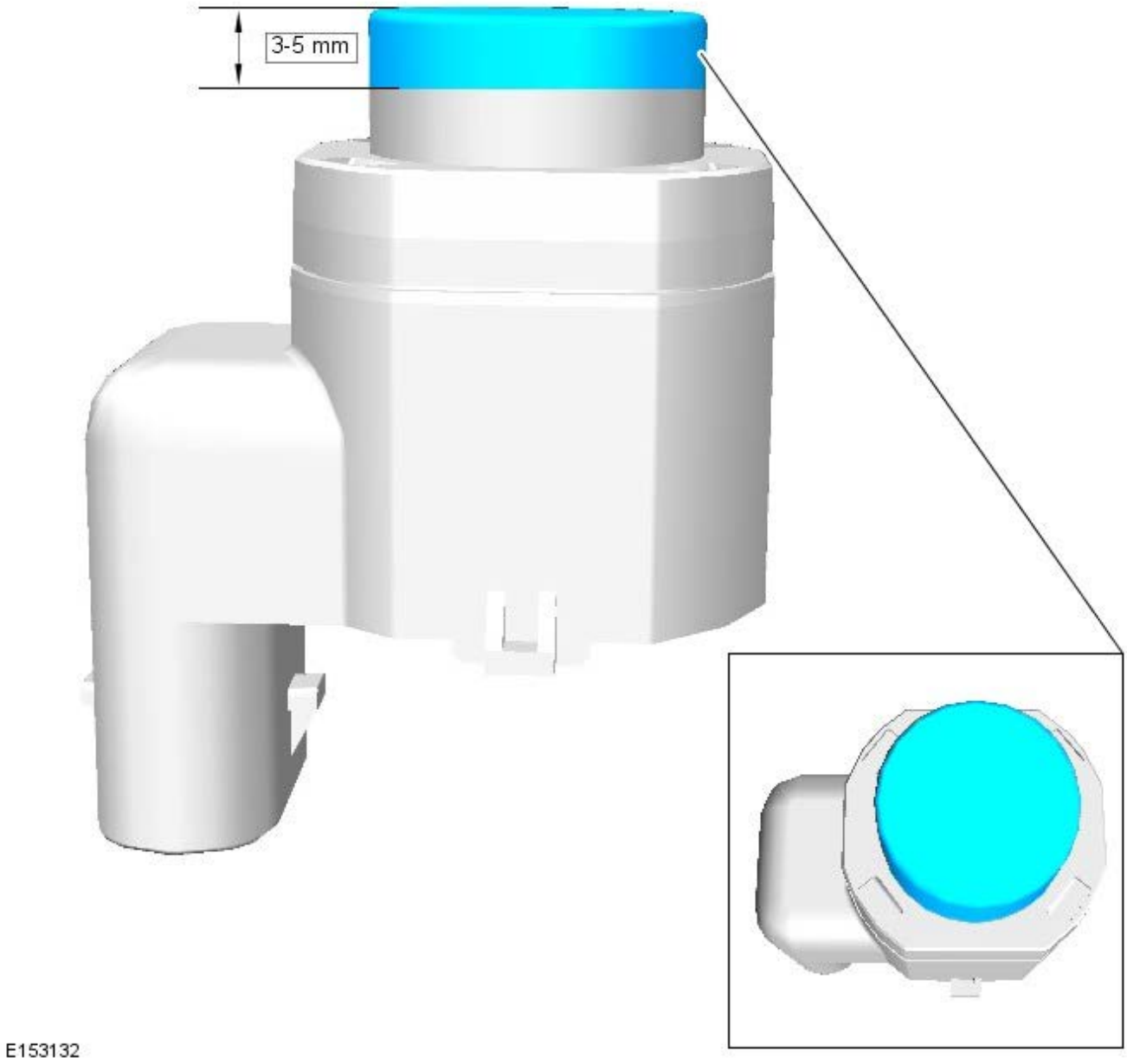




Installation

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: 16-Oct-2012

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.

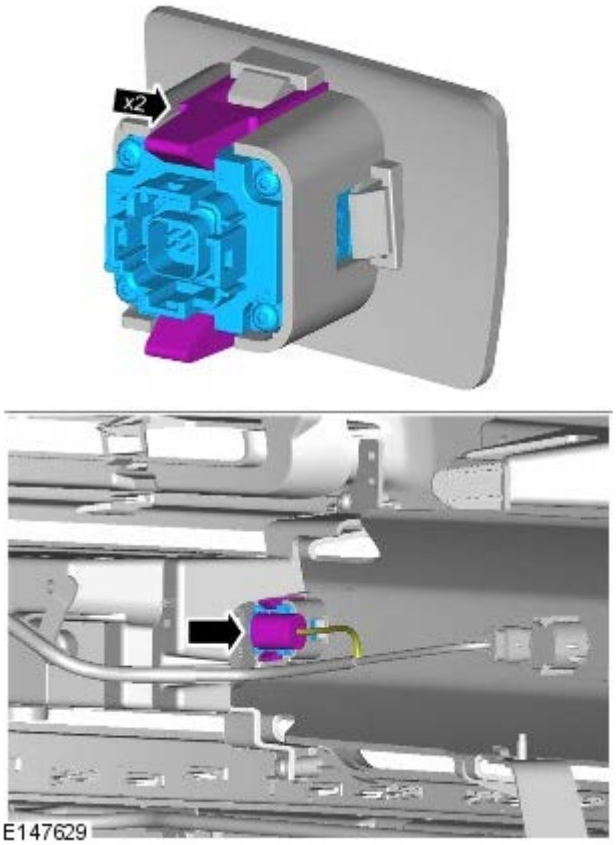
1. WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

2. Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).

3. CAUTION: If a new camera is installed, only the front face must be painted. Failure to follow this instruction may result in the component malfunctioning.

   NOTE: LH illustration shown, RH is similar.



Installation

1. To install, reverse the removal procedure.

2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 26-Sep-2012

Parking Aid - Parking Aid Module

Removal and Installation

Removal

NOTES:

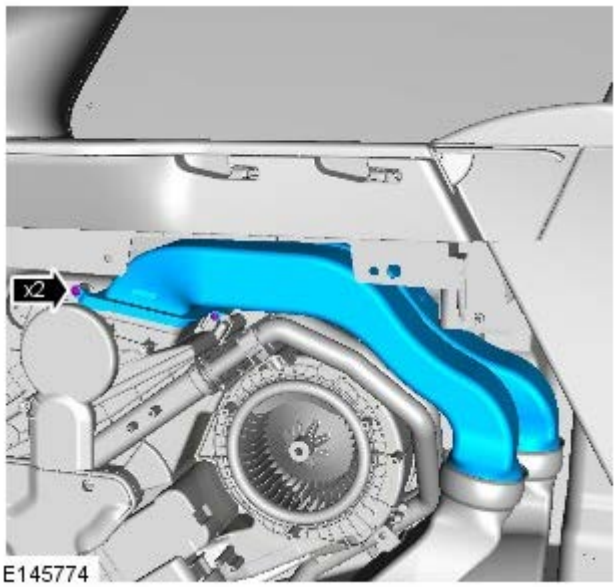
If a new parking aid module is to be installed, configure the parking aid module using the Land Rover approved diagnostic system.

Removal steps in this procedure may contain installation details.

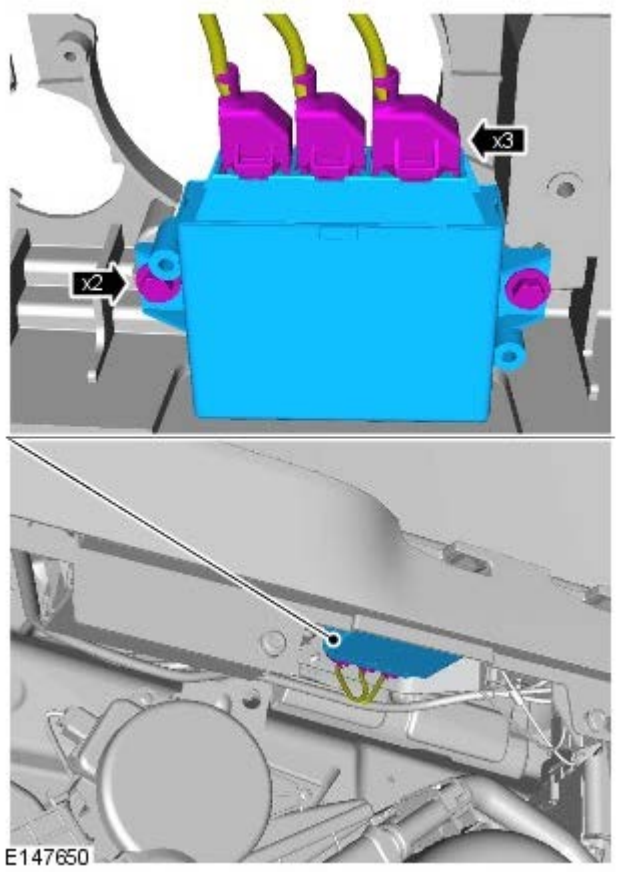
The ignition must be switched off.

1. Refer to: Loadspace Trim Panel LH (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



3. *Torque:* 10 Nm



Installation

1. To install, reverse the removal procedure.
2. Using the diagnostic tool, configure the parking aid module.

Published: 29-Oct-2013

Parking Aid - Parking Aid Camera Module

Removal and Installation

Removal

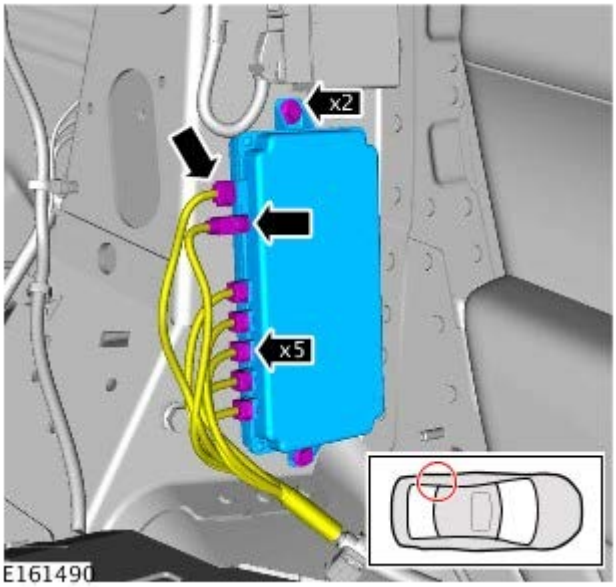
NOTES:

Removal steps in this procedure may contain installation details.

The ignition must be switched off.

1. Refer to: C-Pillar Lower Trim Panel (501-05, Removal and Installation).

2. *Torque:* 10 Nm



Installation

1. To install, reverse the removal procedure.

2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 04-May-2013

Parking Aid - Rear Parking Aid Camera

Removal and Installation

Removal

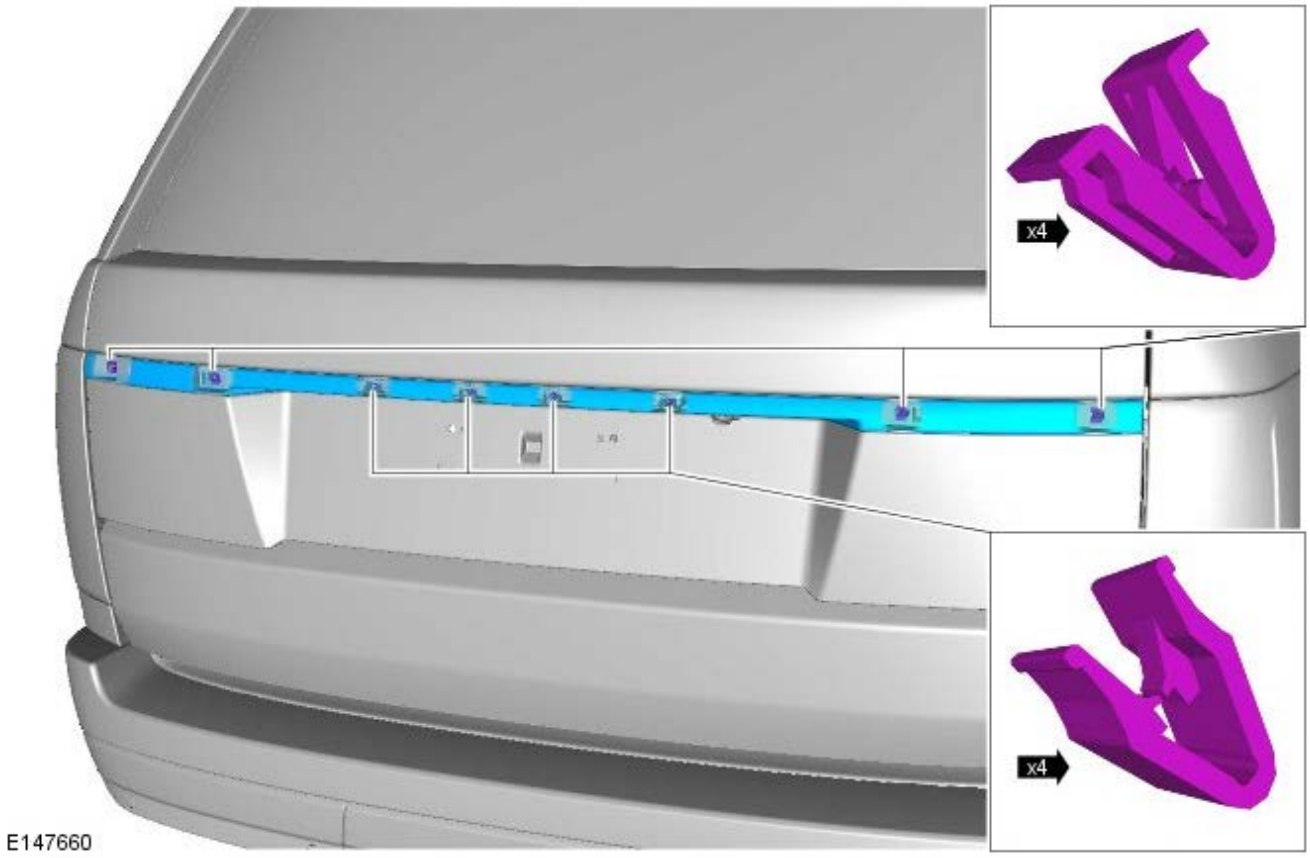
NOTES:

Removal steps in this procedure may contain installation details.

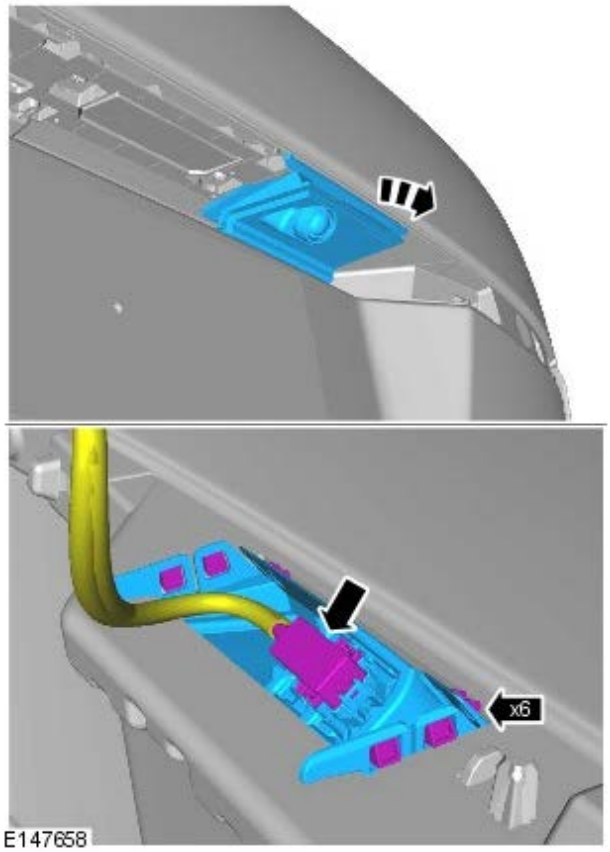
The ignition must be switched off.

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

1. CAUTION: Make sure to protect the paintwork.



2.



3. 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: 20-Jan-2013

Parking Aid - Rear Parking Aid Sensor

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

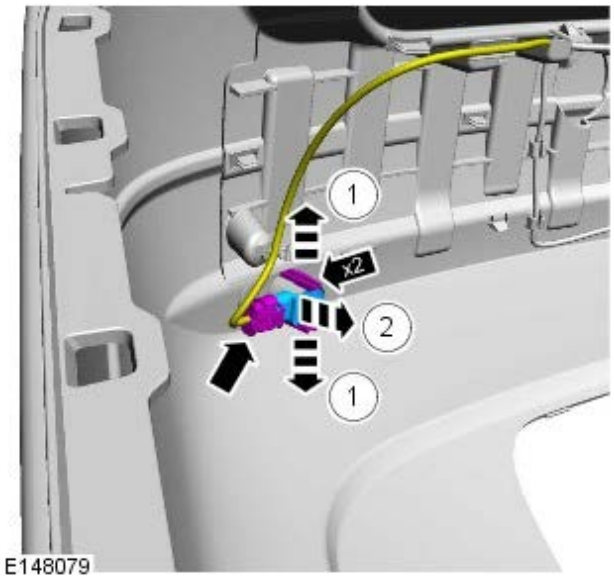
Check the sensor before removing to note if the sensor(s) are painted or unpainted.

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

   Raise and support the vehicle.

2. Refer to: Rear Bumper Cover (501-19 Bumpers, Removal and Installation).

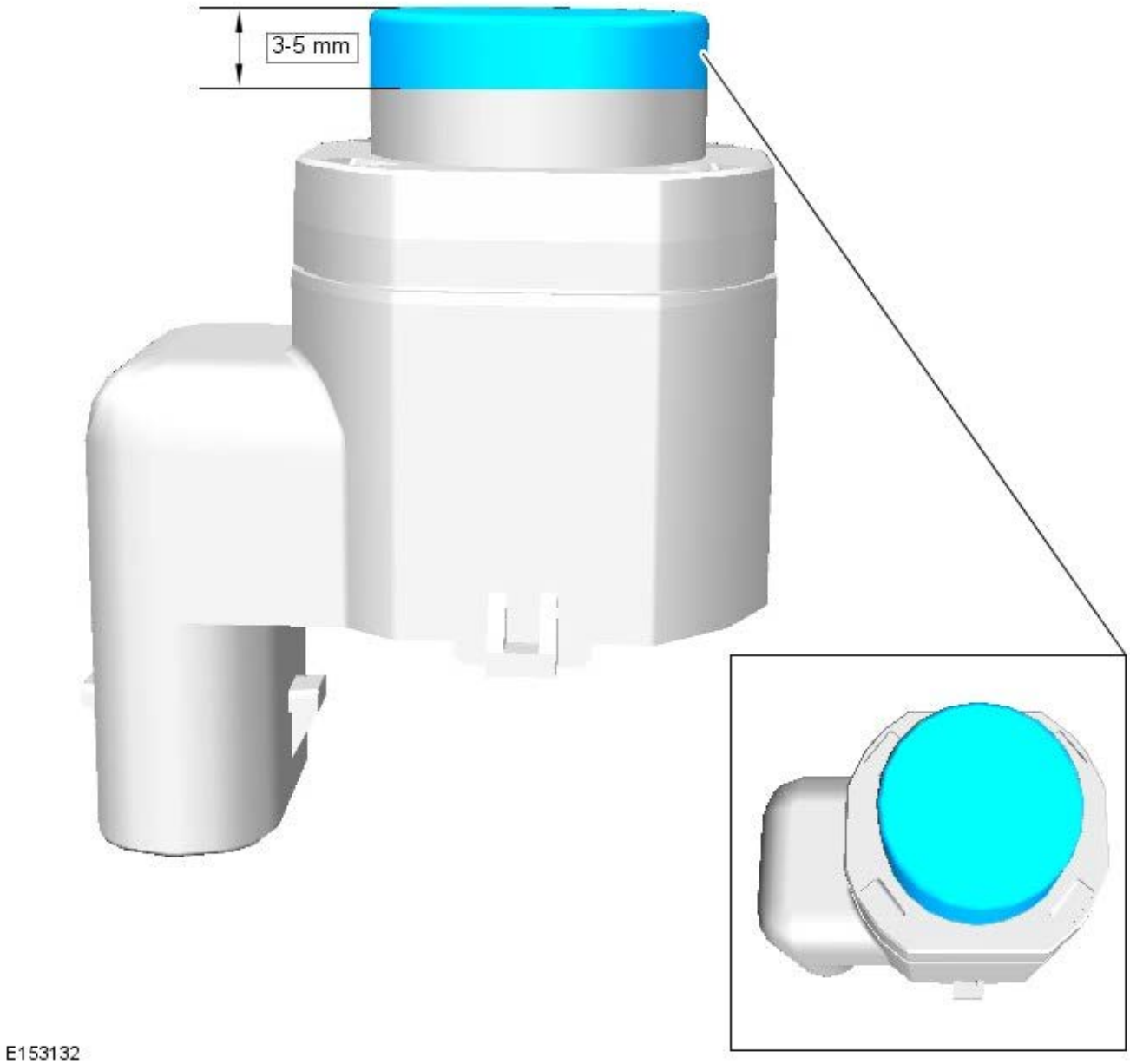
3.



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: 22-Oct-2013

Parking Aid - Side Parking Aid Camera

Removal and Installation

Removal

NOTES:

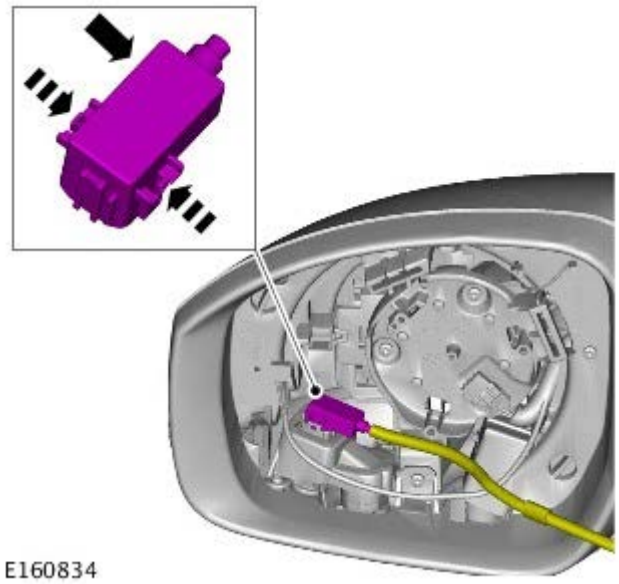
Removal steps in this procedure may contain installation details.

The ignition must be switched off.

LH illustration shown, RH is similar.

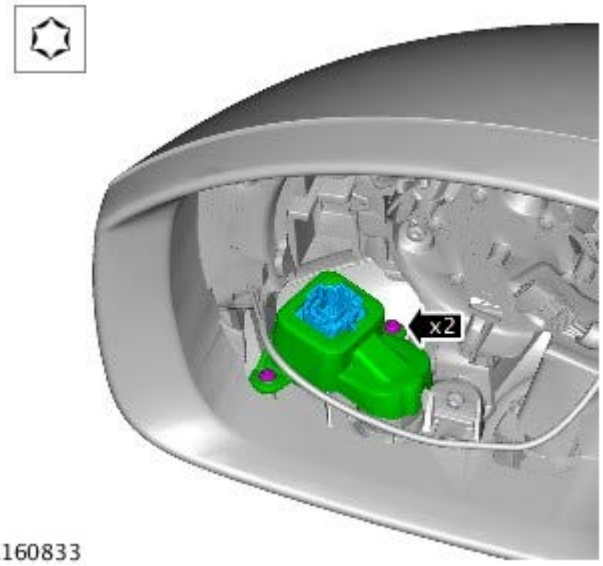
1. Refer to: Exterior Mirror Motor (501-09, Removal and Installation).

2. CAUTION: Take extra care not to damage the wiring harnesses.



E160834

3. *Torque:* 0.5 Nm



E160833

Installation

1. To install, reverse the removal procedure.

2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 28-Feb-2014

Battery and Charging System - General Information -

Battery

Engine variants	Item	Specifications
Primary battery	Type	Absorbed glass mat (AGM)
	Capacity	90 **Ah**
	Cold cranking amps	850 **CCA**
	Reserve capacity	150 minutes
Secondary battey - vehicles with 3.0 TdV6 (cold markets only) and vehicles with 4.4L TdV8	Type	Absorbed glass mat (AGM)
	Capacity	70 **Ah**
	Cold cranking amps	760 **CCA**
	Reserve capacity	120 minutes
Secondary battey - vehicles with Stop/Start system	Type	Absorbed glass mat (AGM)
	Capacity	14 **Ah**
	Cold cranking amps	200 **CCA**

Primary battery disconnect/connect

CAUTIONS:

The vehicle status and battery condition must be established before attempting battery disconnect/connect. Reference must then be made to the following table to establish the relevant procedure to be followed.

After connecting the battery, the steering wheel must be turned to full left-hand and full right-hand lock with the engine running. This allows the dynamic stability control system to calibrate the steering wheel position. Failure to follow this instruction will result in a variety of instrument cluster warning lights being illuminated.

NOTE: If there is insufficient capacity in the battery to disarm the alarm, the alarm may sound on connection of the battery - turning the ignition key to position II will disarm the alarm.

Vehicle status	**Battery charged**	**Battery discharged**
-	**Procedure**	**Procedure**
Vehicles without Telematics	-	-
Engine running	1	-
Vehicle powered down, locked and alarmed	2	3
Vehicle unlocked	4	5
Vehicles with Telematics	-	-
Engine running	6	-
Vehicle powered down, locked and alarmed	7	8
Vehicle unlocked	9	10

Procedure 1

Disconnect the battery	**Connect the battery**
1. If possible, apply the parking brake or chock the wheels	**1.** Make sure that all the electrical systems and ignition are switched **OFF**
2. Set the ignition to the **OFF** position.	**2.** Connect the battery **GROUND** cable
3. Wait 2 minutes for the engine management system to **POWER DOWN**	**3.** 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
4. Remove the spare wheel	**4.** Using suitable Land Rover diagnostic equipment calibrate the electric park brake, both tailgates. Check the clock and navigation settings.
5. Disconnect the battery **GROUND** cable	-

Procedure 2

Disconnect the battery	**Connect the battery**
1. Unlock the vehicle and disarm the alarm using the **UNLOCK** button on the key fob	**1.** Make sure that all the electrical systems and ignition are switched **OFF**
2. Enter the vehicle, set the ignition to the **ON** position, apply the parking brake or chock the wheels and then set the ignition to the **OFF** position.	**2.** Connect the battery **GROUND** cable
3. Wait 2 minutes for the engine management system to **POWER DOWN**	**3.** 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

4.Remove the spare wheel	**4.** Using suitable Land Rover diagnostic equipment calibrate the electric park brake, both tailgates. Check the clock and navigation settings.
5. Disconnect the battery **GROUND** cable	-

Procedure 3

Disconnect the battery	Connect the battery
1. Unlock the vehicle from the driver's door using the key	**1.** Make sure that all the electrical systems and ignition are switched **OFF**
2. Enter the vehicle, apply the parking brake or chock the wheels	**2.** Connect the battery **GROUND** cable
3. Remove the spare wheel	**3.** Set the ignition to the **ON** position.
4. Disconnect the battery **GROUND** cable	**4.** 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
-	**5.** Using suitable Land Rover diagnostic equipment calibrate the electric park brake, both tailgates. Check the clock and navigation settings.

Procedure 4

Disconnect the battery	Connect the battery
1. Enter the vehicle, set the ignition to the **ON** position, apply the parking brake or chock the wheels and then set the ignition to the **OFF** position.	**1.** Make sure that all the electrical systems and ignition are switched **OFF**
2. Wait 2 minutes for the engine management system to **POWER DOWN**	**2.** Connect the battery **GROUND** cable
3. Remove the spare wheel	**3.** 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
4. Disconnect the battery **GROUND** cable	**4.** Using suitable Land Rover diagnostic equipment calibrate the electric park brake, both tailgates. Check the clock and navigation settings.

Procedure 5

Disconnect the battery	Connect the battery
1. Enter the vehicle, apply the parking brake or chock the wheels	**1.** Make sure that all the electrical systems and ignition are switched **OFF**
2. Remove the spare wheel	**2.** Connect the battery **GROUND** cable
3. Disconnect the battery **GROUND** cable	**3.** Set the ignition to the **ON** position.
-	**4.** 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
-	**5.** Using suitable Land Rover diagnostic equipment calibrate the electric park brake, both tailgates. Check the clock and navigation settings.

Procedure 6

Disconnect the battery	Connect the battery
1. Make sure the customer has placed stolen vehicle tracking into **Service Mode** (if equipped).	**1.** Make sure that all the electrical systems and ignition are switched **OFF**
2. If possible, apply the parking brake or chock the wheels	**2.** Connect the battery **GROUND** cable
3. Set the ignition to the **OFF** position.	**3.** 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
4. Wait 2 minutes for the engine management system to **POWER DOWN**	**4.** Using suitable Land Rover diagnostic equipment calibrate the electric park brake, both tailgates. Check the clock and navigation settings.
5. Remove the spare wheel	**5.** Request stolen vehicle tracking removed from **Service Mode** (if equipped).
6. Disconnect the battery **GROUND** cable	-

Procedure 7

Disconnect the battery	Connect the battery
1. Make sure the customer has placed stolen vehicle tracking into **Service Mode** (if equipped).	**1.** Make sure that all the electrical systems and ignition are switched **OFF**
2. Unlock the vehicle and disarm the alarm using the **UNLOCK** button on the key fob	**2.** Connect the battery **GROUND** cable
3. Enter the vehicle, set the ignition to the **ON** position, apply the parking brake or chock the wheels and then set the ignition to the **OFF** position.	**3.** 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
4. Wait 2 minutes for the engine management system to **POWER DOWN**	**4.** Using suitable Land Rover diagnostic equipment calibrate the electric park brake, both tailgates. Check the clock and navigation settings.
5. Remove the spare wheel	**5.** Request stolen vehicle tracking removed from **Service Mode** (if equipped).

6. Disconnect the battery **GROUND** cable	-

Procedure 8

 CAUTION: Battery discharge may have activated the stolen vehicle tracking, check with customer if equipped.

Disconnect the battery	Connect the battery
1. Make sure the customer has placed stolen vehicle tracking into **Service Mode** (if equipped).	**1.** Make sure that all the electrical systems and ignition are switched **OFF**
2. Unlock the vehicle from the driver's door using the key	**2.** Connect the battery **GROUND** cable
3. Enter the vehicle, apply the parking brake or chock the wheels	**3.** Set the ignition to the **ON** position.
4. Remove the spare wheel	**4.** 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
5. Disconnect the battery **GROUND** cable	**5.** Using suitable Land Rover diagnostic equipment calibrate the electric park brake, both tailgates. Check the clock and navigation settings.
-	**5.** Request stolen vehicle tracking removed from **Service Mode** (if equipped).

Procedure 9

Disconnect the battery	Connect the battery
1. Make sure the customer has placed stolen vehicle tracking into **Service Mode** (if equipped).	**1.** Make sure that all the electrical systems and ignition are switched **OFF**
2. Enter the vehicle, set the ignition to the **ON** position, apply the parking brake or chock the wheels and then set the ignition to the **OFF** position.	**2.** Connect the battery **GROUND** cable
3. Wait 2 minutes for the engine management system to **POWER DOWN**	**3.** 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
4. Remove the spare wheel	**4.** Using suitable Land Rover diagnostic equipment calibrate the electric park brake, both tailgates. Check the clock and navigation settings.
5. Disconnect the battery **GROUND** cable	**5.** Request stolen vehicle tracking removed from **Service Mode** (if equipped).

Procedure 10

 CAUTION: Battery discharge may have activated the stolen vehicle tracking, check with customer if equipped.

Disconnect the battery	Connect the battery
1. Make sure the customer has placed stolen vehicle tracking into **Service Mode** (if equipped).	**1.** Make sure that all the electrical systems and ignition are switched **OFF**
2. Enter the vehicle, apply the parking brake or chock the wheels	**2.** Connect the battery **GROUND** cable
3. Remove the spare wheel	**3.** Set the ignition to the **ON** position.
4. Disconnect the battery **GROUND** cable	**4.** 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
-	**5.** Using suitable Land Rover diagnostic equipment calibrate the electric park brake, both tailgates. Check the clock and navigation settings.
-	**6.** Request stolen vehicle tracking removed from **Service Mode** (if equipped).

Secondary battery disconnect/connect

Vehicle status	Procedure
Vehicles without Telematics	1
Vehicles with Telematics	2

Procedure 1

Disconnect the battery	Connect the battery
1. Enter the vehicle, apply the parking brake or chock the wheels	**1.** Make sure that all the electrical systems and ignition are switched **OFF**
2. Remove the luggage compartment side trim	**2.** Connect the battery **GROUND** cable
3. Wait 2 minutes for the engine management system to **POWER DOWN**	**3.** Set the ignition to the **ON** position.
4. Disconnect the battery **GROUND** cable	**4.** 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
-	**5.** Using suitable Land Rover diagnostic equipment calibrate the electric park brake, both tailgates. Check the clock and navigation settings.

Procedure 2

Disconnect the battery	Connect the battery
1. Make sure the customer has placed stolen vehicle tracking into **Service Mode** (if equipped).	**1.** Make sure that all the electrical systems and ignition are switched **OFF**
2. Enter the vehicle, apply the parking brake or chock the wheels	**2.** Connect the battery **GROUND** cable
3. Remove the luggage compartment side trim	**3.** Set the ignition to the **ON** position.
4.Wait 2 minutes for the engine management system to **POWER DOWN**	**4.** 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
5. Disconnect the battery **GROUND** cable	**5.** Using suitable Land Rover diagnostic equipment calibrate the electric park brake, both tailgates. Check the clock and navigation settings.
-	**6.** Request stolen vehicle tracking removed from **Service Mode** (if equipped).

Vehicle Jump (Emergency) Starting - Using Another Vehicle

WARNINGS:

 Take care when working near rotating parts of the engine.

 Prior to attempting to start the disabled vehicle, make sure that the parking brake is applied or suitably chock the wheels. Make sure that 'P' - PARK - Automatic Gearbox or NEUTRAL - Manual Gearbox is selected.

 Suitable eye protection must be worn when working in the vicinity of the battery.

 DO NOT attempt to start the disabled vehicle if it is suspected that the electrolyte in the battery is frozen.

 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.

CAUTIONS:

 Make sure that there is no physical contact between the donor and disabled vehicles other than the booster cables.

 Make sure that the slave battery/starting aid is of the 12 volt type.

 Make sure that all electrical systems and ignition are switched OFF prior to connecting the booster cables.

 Disconnect the booster cables prior to operating any electrical systems.

Vehicle status	Procedure
Vehicles without Telematics	1
Vehicles with Telematics	2

Procedure 1

Carry out the following operations in the sequence given
1. Connect one end of the RED (+) booster cable to the POSITIVE (+) battery terminal of the **DONOR** vehicle
2. Connect the other end of the RED (+) booster cable to the POSITIVE (+) battery terminal of the **DISABLED** vehicle
3. Connect one end of the BLACK (-) booster cable to the GROUND (-) battery terminal of the **DONOR** vehicle
4. 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 from the battery or fuel lines on 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 the engines of both vehicles to idle for a few minutes, then switch off the engine of the **DONOR** vehicle
8. Disconnect the BLACK (-) booster cable from the earth point of the **PREVIOUSLY DISABLED** vehicle
9. Disconnect the BLACK (-) booster cable from the battery of the **DONOR** vehicle
10. Disconnect the RED (+) booster cable from the **PREVIOUSLY DISABLED** vehicle
11. Disconnect the RED (+) booster cable from the battery of the **DONOR** vehicle

Procedure 2

Carry out the following operations in the sequence given
1. Make sure the customer has placed stolen vehicle tracking into **Service Mode** (if equipped).
1. Connect one end of the RED (+) booster cable to the POSITIVE (+) battery terminal of the **DONOR** vehicle
2. Connect the other end of the RED (+) booster cable to the POSITIVE (+) battery terminal of the **DISABLED** vehicle
3. Connect one end of the BLACK (-) booster cable to the GROUND (-) battery terminal of the **DONOR** vehicle

4. 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 from the battery or fuel lines on 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 the engines of both vehicles to idle for a few minutes, then switch off the engine of the **DONOR** vehicle
8. Disconnect the BLACK (-) booster cable from the earth point of the **PREVIOUSLY DISABLED** vehicle
9. Disconnect the BLACK (-) booster cable from the battery of the **DONOR** vehicle
10. Disconnect the RED (+) booster cable from the **PREVIOUSLY DISABLED** vehicle
11. Disconnect the RED (+) booster cable from the battery of the **DONOR** vehicle
12. Request stolen vehicle tracking removed from **Service Mode** (if equipped).

Vehicle Jump (Emergency) Starting - Using a Slave Battery/Starting Aid

Vehicle status	**Procedure**
Vehicles without Telematics	1
Vehicles with Telematics	2

Procedure 1

Carry out the following operations in the sequence given
1. Connect the end of the RED (+) booster cable to the POSITIVE (+) battery terminal of the vehicle
2. Connect the end of the BLACK (-) booster cable to a good earth point (e.g. unpainted metal surface or engine mounting) at least 0.5 m from the battery or fuel lines on the vehicle
3. Start the engine of the vehicle and allow it to idle
4. Disconnect the BLACK (-) booster cable from the earth point of the vehicle
5. Disconnect the RED (+) booster cable from the battery terminal of the vehicle.

Procedure 2

Carry out the following operations in the sequence given
1. Make sure the customer has placed stolen vehicle tracking into **Service Mode** (if equipped).
2. Connect the end of the RED (+) booster cable to the POSITIVE (+) battery terminal of the vehicle
3. Connect the end of the BLACK (-) booster cable to a good earth point (e.g. unpainted metal surface or engine mounting) at least 0.5 m from the battery or fuel lines on the vehicle
4. Start the engine of the vehicle and allow it to idle
5. Disconnect the BLACK (-) booster cable from the earth point of the vehicle
6. Disconnect the RED (+) booster cable from the battery terminal of the vehicle.
7. Request stolen vehicle tracking removed from **Service Mode** (if equipped).

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.

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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.							
*							
*							
*							
*							
*							

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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:

Battery and Cables (414-01 Battery, Mounting and Cables, Description and Operation),
Battery Care Requirements (414-00 Battery and Charging System - General Information, Description and Operation),
Quiescent Drain (414-00 Battery and Charging System - General Information, Description and Operation).

Principle of Operation

For a detailed description of the generator and regulator system and operation, refer to the relevant description and operation section of the workshop manual. **Generator and Regulator**

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 • Drive belt • Drive belt tensioner • Generator pulley • Check the security of the generator fittings	• Generator • Battery/battery connections • Starter motor • Harnesses and connectors • Fuses • Starter motor megafuse • Charge warning light function • CAN circuits • Engine 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, 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 lamp does not come on	• Bulb/circuit fault • Generator fault • CAN circuit fault • Engine control module fault	Check the warning lamp function with the ignition on and the engine off. Replace bulbs or repair the circuit(s) as necessary. Check for DTCs indicating a generator, CAN or engine control module fault
Charge warning lamp stays on/battery discharges	• Accessory drive belt broken • Generator pulley slipping on shaft • Generator fault • Battery cable fault • CAN circuit fault	Check the battery and generator cables. Refer to the electrical guides. Check for DTCs indicating a generator fault. Check the accessory drive belt condition and tension. Check that the pulley does not rotate independently of the generator. Check for DTCs indicating a CAN or engine control module fault

	Engine control module fault	
Charge warning lamp intermittent	• Accessory drive belt slipping • Battery cable fault • Generator wiring fault • Generator fault • CAN circuit fault	Check the accessory drive belt condition and tension. Check the battery and generator cables. Refer to the electrical guides. Check for DTCs indicating a generator or CAN circuit fault. Note that the use of a power pack or boost charger may bring the warning lamp on until disconnected
Battery discharges without the charge warning lamp staying on	• Battery fault • Battery quiescent drain • Intermittent generator fault	Check the battery condition, check for battery quiescent drain. REFER to: Quiescent Drain (414-00 Battery and Charging System - General Information, Description and Operation). Check for DTCs indicating a generator fault. It is possible for the altcom circuit to short circuit to ground without setting a DTC. If no other reason for discharge can be found, check this circuit. Refer to the electrical guides
Noise (mechanical)	• Accessory drive belt slipping • Generator fault	Check the accessory drive belt condition and tension. Disconnect the accessory 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: (100-00 General Information)

Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (Description and Operation),
Diagnostic Trouble Code Index: Gateway Module (Description and Operation),
Diagnostic Trouble Code (DTC) Index - TDV6 3.0L Diesel , DTC: Engine Control Module (ECM) (Description and Operation),
Diagnostic Trouble Code (DTC) Index - TDV8 4.4L Diesel, DTC: Engine Control Module (ECM) (Description and Operation),
Diagnostic Trouble Code (DTC) Index - V8 S/C 5.0L Petrol, DTC: Engine Control Module (ECM) (Description and Operation).

Published: 11-May-2011

Battery, Mounting and Cables -

Torque Specifications

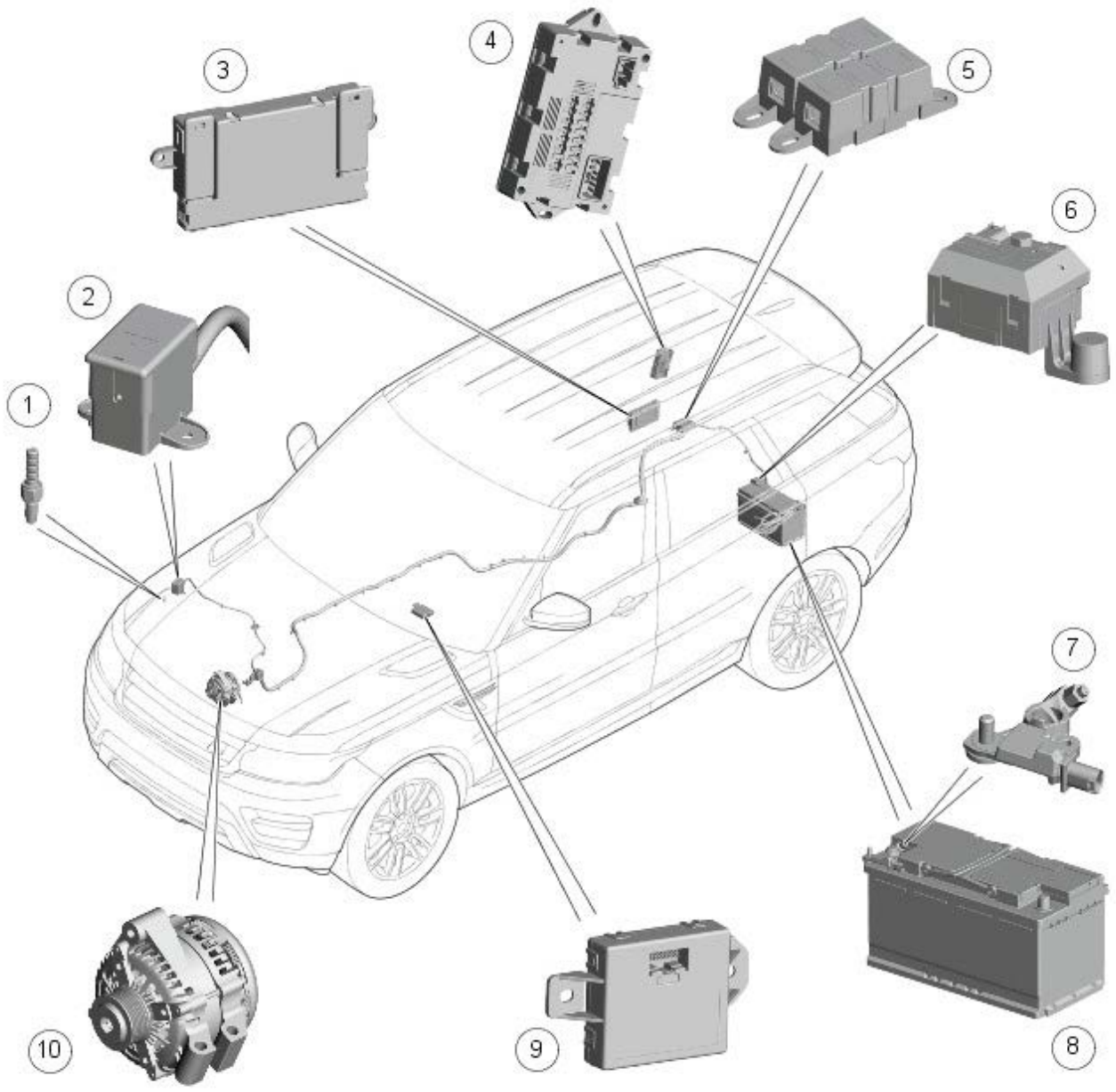
Item	Nm	lb-ft	lb-in
Battery clamp bolt	9	-	80
Battery terminal nut	6	-	53
Battery tray to body bolt	5	-	44
Fuel fired booster heater to battery tray nut	10	7	-

Published: 28-Feb-2014

Battery, Mounting and Cables - Battery and Cables

Description and Operation

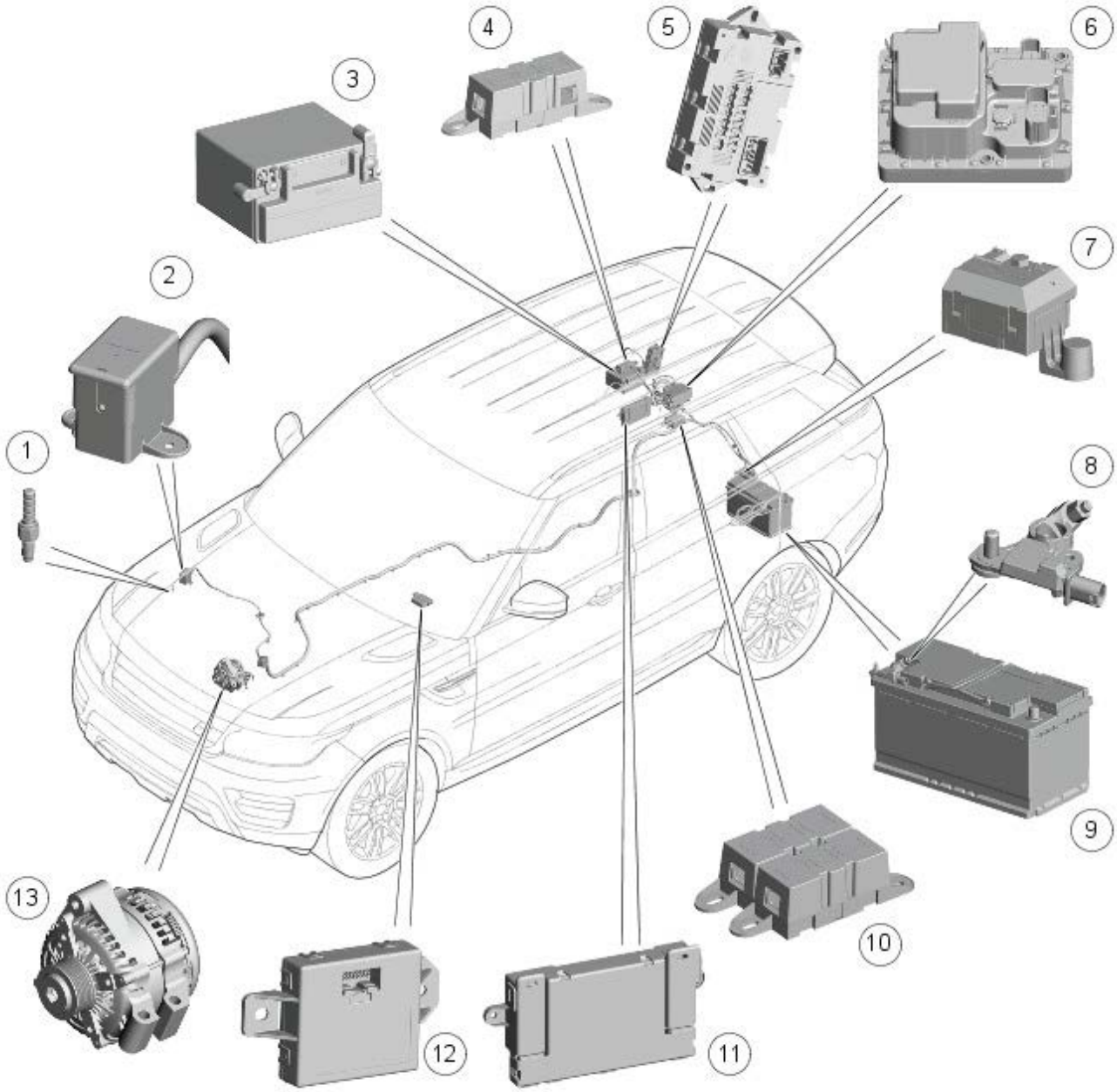
COMPONENT LOCATION - SINGLE BATTERY VEHICLES



E154410

Item	Part Number	Description
1	-	Jump start terminal negative (-)
2	-	Jump start terminal positive (+)
3	-	Battery Junction Box (BJB)
4	-	Quiescent Current Control Module (QCCM)
5	-	Battery Junction Box 2 (BJB2)
6	-	Transit relay
7	-	Battery Monitoring System (BMS) control module
8	-	Battery
9	-	Gateway Module (GWM)
10	-	Generator

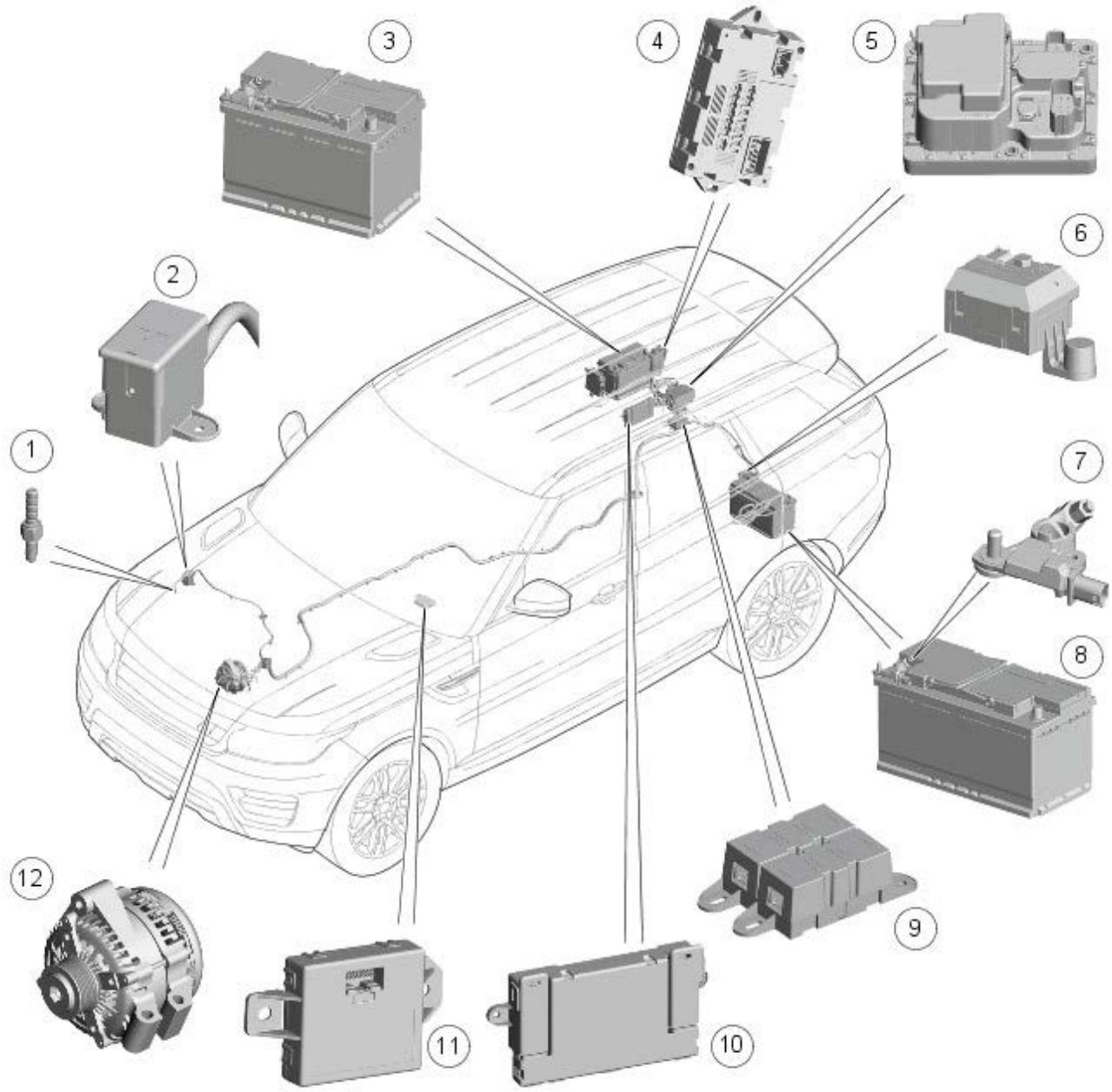
COMPONENT LOCATION - DUAL BATTERY SYSTEM WITH STOP/START SYSTEM - ALL, EXCEPT COLD CLIMATE TDV6 3.0L.



E154412

Item	Part Number	Description
1	-	Jump start terminal negative (-)
2	-	Jump start terminal positive (+)
3	-	Secondary battery
4	-	Megafuse
5	-	Quiescent Current Control Module (QCCM)
6	-	Power Supply Distribution Box
7	-	Transit relay
8	-	Battery Monitoring System (BMS) control module
9	-	Primary battery
10	-	Battery Junction Box (BJB) 2
11	-	Battery Junction Box (BJB)
12	-	Gateway Module (GWM)
13	-	Generator

COMPONENT LOCATION - DUAL BATTERY SYSTEM - TDV8 4.4L ALL MARKETS, AND TDV6 3.0L COLD CLIMATE WITH, OR WITHOUT STOP/START SYSTEM.



E154411

Item	Part Number	Description
1	-	Jump start terminal negative (-)
2	-	Jump start terminal positive (+)
3	-	Auxiliary battery
4	-	Quiescent Current Control Module (QCCM)
5	-	Power Supply Distribution Box
6	-	Transit relay
7	-	Battery Monitoring System (BMS) control module
8	-	Primary battery
9	-	Battery Junction Box 2 (BJB2)
10	-	Battery Junction Box (BJB)
11	-	Gateway Module (GWM)
12	-	Generator

OVERVIEW - SINGLE BATTERY VEHICLES

A single primary battery is located in the luggage compartment floor in a plastic molded tray. The battery is secured in position by a foam pad and clamped in position by the air suspension air supply unit.

The battery on petrol and diesel vehicles is a 90Ahr, 850A CCA Absorbed Glass Mat (AGM) Valve Regulated Lead-Acid (VRLA) battery.

A BMS (Battery Monitoring System) control module is mounted on the battery negative terminal. The BMS control module is integral with the battery negative cable and is controlled by the GWM (Gateway Module).

CAUTION: To avoid damaging the BMS control module, always use the ground (negative (-)) terminal stud point and the positive (+) terminals on the right side top mount in the engine compartment. Never connect directly to the primary battery negative or positive terminals when connecting a slave power supply to the vehicle, the BMS control module can be damaged.

If a new battery is fitted to the vehicle, the BMS control module will require re-calibrating using a Land Rover approved diagnostic system.

When the vehicle leaves the factory, a transit relay is fitted to the primary battery positive terminal. The transit relay is connected to the CJB (Central Junction Box) which limits the electrical functions to essential items only, to reduce loads on the battery. The transit relay provides battery power to the BJB2 (Battery Junction Box 2) which supplies the starter motor, generator and the positive jump start terminal. The transit relay must be removed from the vehicle during the Pre-Delivery Inspection (PDI). For additional information, refer to the PDI Manual.

The battery provides power to the BJB (Battery Junction Box) via BJB2. The BJB contains megafuses, delivering power to the CJB, the RJB (Rear Junction Box), the AJB (Auxiliary Junction Box), the EJB (Engine Junction Box) and the starter motor and generator. In addition to all junction boxes containing fuses and relays, the RJB and CJB contain software to control a number of vehicle systems. These functions are covered in the appropriate sections of this manual.

Two jump start terminals are located adjacent to the right side top mount in the engine compartment. A cover protects the positive (+) terminal when not in use. If jump starting is required, the cover must be removed and the positive (+) jump lead attached securely. The cover must be fitted to the positive terminal when not in use. The negative (-) jump lead is attached to a stud located on the right side top mount. When connecting jump start cables to the vehicle ensure they cannot touch each other or touch parts of the vehicle. Doing so could damage the jump start equipment of blow a mega fuse within the vehicle.

The GWM hosts most of the software required to control the primary battery charging system and components. The GWM monitors the components and can store fault related DTC (Diagnostic Trouble Code)'s. The GWM contains the intelligent power management system and the BMS software. Monitoring of the primary battery condition is controlled by the GWM and the BMS control module.

OVERVIEW - DUAL BATTERY SYSTEM VEHICLES - TDV8 4.4L ALL MARKETS, AND TDV6 3.0L COLD CLIMATE WITH OR WITHOUT STOP/START SYSTEM.

Two batteries are fitted to accommodate the dual battery system used for starting systems.

A primary battery is located in the luggage compartment floor in a plastic molded tray and clamped in position by the air suspension air supply unit.

On TDV8 4.4L diesel in all markets and TDV6 3.0L diesel cold climate (with or without stop/start system) vehicles, the auxiliary battery is located on the right side of the luggage compartment on a battery support tray and secured with a strap, threaded rods and a clamp bolted to the tray.

- The primary battery is a 90Ahr, 850CCA Absorbed Glass Mat (AGM) Valve Regulated Lead-Acid (VRLA) battery on all vehicles.
- The auxiliary battery fitted to TDV8 4.4L diesel in all markets and TDV6 3.0L diesel in cold climate markets is a 70Ahr, 760CCA AGM battery.

A Battery Monitoring System (BMS) control module is mounted on the primary battery negative terminal. The BMS control module is integral with the battery negative cable and is controlled by the Gateway Module (GWM).

CAUTION: To avoid damaging the BMS control module, always use the ground (negative (-)) terminal stud point and the positive (+) terminals on the right side top mount in the engine compartment. Never connect directly to the primary battery negative or positive terminals when connecting a slave power supply to the vehicle, the BMS control module can be damaged.

If a new primary battery is fitted to the vehicle, the BMS control module will require re-calibrating using a Land Rover approved diagnostic system. This will also apply if a new auxiliary battery is fitted to TDV8 4.4L diesel in all markets and TDV6 3.0L diesel cold climate vehicles.

When the vehicle leaves the factory, a transit relay is fitted to the primary battery positive terminal. The transit relay is connected to the CJB which limits the electrical functions to essential items only, to reduce loads on the primary battery. The transit relay provides battery power to the BJB2 which supplies the starter motor, generator, power supply distribution box and the positive jump start terminal. The transit relay must be removed from the vehicle during the PDI. For additional information, refer to the PDI Manual.

The primary battery provides power to the BJB. The BJB contains three megafuses, delivering power to the RJB, the EJB and the starter motor and generator. In addition to containing fuses and relays, the RJB and CJB contain software to control a number of vehicle systems. These functions are covered in the appropriate sections of this manual.

Two jump start terminals are located adjacent to the right side top mount in the engine compartment. A cover protects the positive (+) terminal when not in use. If jump starting is required, the cover must be removed and the positive (+) jump lead attached securely. The cover must be fitted to the positive terminal when not in use. The negative (-) jump lead is attached to a stud located on the right side top mount. When connecting jump start cables to the vehicle ensure they cannot touch each other or touch parts of the vehicle. Doing so could damage the jump start equipment of blow a mega fuse within the vehicle.

Dual Battery System

The dual battery system used on TDV8 4.4L Diesel in all markets and TDV6 3.0L diesel in cold climate markets with or without stop/start system, differs from the dual battery system used on vehicles with the all markets stop/start system. The dual battery system uses the auxiliary battery which is switched in parallel with the primary battery if the ambient temperature falls below a certain threshold, or the state of charge of the primary battery falls below a certain level. The function of the auxiliary battery is to assist the primary battery in cranking the car at a suitable speed to provide a start.

In addition the dual battery system in TDV8 4.4L Diesel isolates all electrical components and systems sensitive to low supply voltage from the primary battery while an engine start is in progress and supplies them from the auxiliary battery.

The dual battery system in TDV6 3.0L diesel cold climate stop/start system additionally isolates all electrical components and systems sensitive to low supply voltage from the primary battery while an engine start is in progress by the stop/start system, and supplies them from the auxiliary battery.

The dual battery system comprises the following components:

- Power Supply Distribution Box
- Gateway Module (GWM)
- Primary battery
- Auxiliary battery.

The GWM hosts most of the software required to control the dual battery system and components. The GWM monitors the components and can store fault related DTC's.

The GWM controls the charging system software in conjunction with the ECM, RJB, CJB and ABS (Anti-lock Brake System) control module via the high speed CAN (Controller Area Network) Powertrain, and medium speed CAN Body bus.

The GWM contains the intelligent power management system and the BMS software. Monitoring of the primary and auxiliary battery condition is controlled by the ECM, GWM and the BMS control modules.

OVERVIEW - DUAL BATTERY SYSTEM VEHICLES WITH STOP/START SYSTEM.

Two batteries are fitted to accommodate the dual battery system used for the all markets vehicles with stop/start system.
For additional information, refer to: Starting System (303-06A Starting System - TDV6 3.0L Diesel, Description and Operation) /
Starting System (303-06B Starting System - V6 S/C 3.0L Petrol, Description and Operation) /
Starting System (303-06C Starting System - V8 S/C 5.0L Petrol, Description and Operation).

A primary battery is located in the luggage compartment floor in a plastic molded tray and clamped in position by the air suspension air supply unit.

On stop/start system vehicles, the secondary battery is located in the right side of the luggage compartment on a battery support tray and secured with a strap bolted to the tray.

- The primary battery is a 90Ahr, 850CCA Absorbed Glass Mat (AGM) Valve Regulated Lead-Acid (VRLA) battery on all vehicles.
- The secondary battery is a 14Ahr, 200CCA AGM battery on all vehicles with stop/start (except TDV6 3.0L cold climate vehicles).
- The auxiliary battery is a 70Ah, 760CCA, AGM battery, in TDV6 3.0L cold climate vehicles with stop/start system ONLY.

A BMS control module is mounted on the primary battery negative terminal. The BMS control module is integral with the battery negative cable and is controlled by the GWM.

The secondary battery is not fitted with a BMS control module.

CAUTION: To avoid damaging the BMS control module, always use the ground (negative (-)) terminal stud point on the right side top mount in the engine compartment. Never connect directly to the primary battery negative terminal when connecting a slave power supply to the vehicle, the BMS control module can be damaged.

If a new primary battery is fitted to the vehicle, the BMS control module will require re-calibrating using a Land Rover approved diagnostic system.

When the vehicle leaves the factory, a transit relay is fitted to the primary battery positive terminal. The transit relay is connected to the CJB which limits the electrical functions to essential items only, to reduce loads on the primary battery. The transit relay provides battery power to the BJB2 which supplies the starter motor, generator, power supply distribution box and the positive jump start terminal. The transit relay must be removed from the vehicle during the PDI. For additional information, refer to the PDI Manual.

The primary battery provides power to the BJB. The BJB contains three megafuses, delivering power to the RJB, the EJB and the starter motor and generator. In addition to containing fuses and relays, the RJB and CJB contain software to control a number of vehicle systems. These functions are covered in the appropriate sections of this manual.

Two jump start terminals are located adjacent to the right side top mount in the engine compartment. A cover protects the positive (+) terminal when not in use. If jump starting is required, the cover must be removed and the positive (+) jump lead attached securely. The cover must be fitted to the positive terminal when not in use. The negative (-) jump lead is attached to a stud located on the right side top mount. When connecting jump start cables to the vehicle ensure they cannot touch each other or touch parts of the vehicle. Doing so could damage the jump start equipment of blow a mega fuse within the vehicle.

Dual Battery System

The dual battery system is used on all vehicles with the stop/start system. The dual battery system prevents the vehicle electrical systems being subjected to undesirably low voltages during repeated engine restarts. If the electrical systems are subject to low voltages the customer may notice degraded performance of components and systems and incorrect fault DTC's may be stored.

The dual battery system isolates all electrical components and systems sensitive to low supply voltage from the primary battery while an engine start is in progress, and supplies them from the secondary battery. Without the dual battery system, the electrical power required by the starter motor to crank the engine for each start would cause a voltage drop across the entire vehicle electrical network, and cause control modules to function incorrectly and in some cases reset and/or record DTC's.

If the dual battery system is unable to prevent electrical supplies to the vehicle systems being subjected to low voltage levels during engine stop/start operations, due to the condition of the primary and/or secondary batteries or a system fault, the stop/start feature (where fitted) is disabled.

The dual battery system comprises the following components:

- Power Supply Distribution Box
- Gateway Module (GWM)
- Primary battery
- Secondary battery in all markets vehicles, or an Auxiliary battery in cold climate vehicles with TDV6 3.0L diesel engine start/stop system.

The GWM hosts most of the software required to control the dual battery system and components. The GWM monitors the components and can store fault related DTC's.

The GWM controls the charging system software in conjunction with the ECM, RJB, CJB and ABS control module via the high speed CAN Powertrain and medium speed CAN Body bus.

On vehicles with stop/start, the GWM software will monitor the status of the stop/start system and determine, along with the ECM, if battery condition is sufficient to support a stop/start event. It can also request to maintain vehicle systems by keeping the engine running or initiating a restart due to, for example, climate control system requirements or request for restart from the ECM. A brake pressure signal is received from the ABS control module which will indicate to the GWM that an engine restart is required from driver operation of the foot brake.

The GWM contains the intelligent power management system and the BMS software. Monitoring of the primary battery condition for stop/start is controlled by the ECM, GWM and the BMS control module.

DESCRIPTION

PRIMARY BATTERY - ALL VEHICLES

The primary battery is located in a plastic tray under the luggage compartment floor in a central position in the luggage compartment, below the suspension air supply unit. A foam pad and the air suspension air supply unit bracket secures the primary battery in position. The battery is vented via a tube which passes through a grommet in the floorpan.

On new vehicles the primary battery positive terminal is fitted with a transit relay. The transit relay must be removed using the correct process detailed in the Pre Delivery Inspection (PDI) manual.

The battery negative terminal is fitted with a BMS control module. The BMS control module is integral with the battery negative cable and communicates with the GWM via a LIN (Local Interconnect Network) bus connection. The battery condition information is passed to the GWM which controls the generator output accordingly.

CAUTIONS:

 To avoid damaging the BMS control module, always use the ground (negative (-)) terminal stud point on the right side top mount in the engine compartment. Never connect directly to the primary battery negative terminal when connecting a slave power supply to the vehicle, the BMS control module can be damaged.

 Failure to use the recommended ground point will lead to the setting of a DTC (diagnostic trouble code). Incorrect information of battery condition will be retained by the BMS control module due to the unmonitored current flow into the battery. The system will however, recognize and compensate for the change in battery status after a period of time.

If a new battery is fitted, the BMS control module will require re-calibration using a Land Rover approved diagnostic system. Replacement of the BMS control module requires no action as the control module will re-calibrate automatically.

SECONDARY BATTERY - STOP/START SYSTEM VEHICLES

The smaller secondary battery is located in the right side of the luggage compartment on a battery support tray and secured with a strap bolted to the tray. The battery negative (-) terminal is connected via a cable to the vehicle body. The positive (+) terminal is connected by a cable to the Power Supply Distribution Box. The battery is vented via a tube which passes through a grommet in the floorpan.

The state of charge of the secondary battery is monitored by the Gateway Module (GWM).

AUXILIARY BATTERY - TDV8 4.4L DIESEL ALL MARKETS AND TDV6 3.0L DIESEL COLD

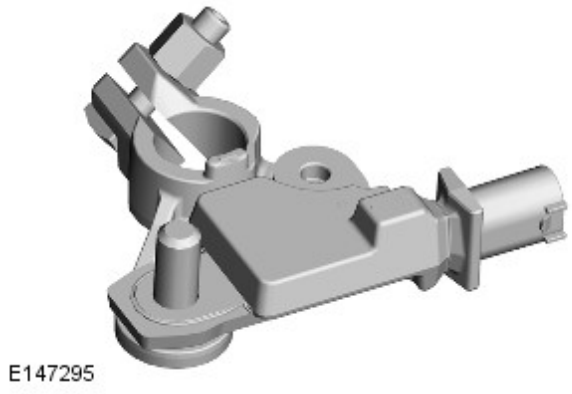
CLIMATE VEHICLES

The auxiliary battery is located on the right side of the luggage compartment on a battery support tray and secured with a strap, threaded rods and a clamp bolted to the tray. The battery negative (-) terminal is connected via a cable to the vehicle body. The positive (+) terminal is connected by a cable to the power supply distribution box. The battery is vented via a tube which passes through a grommet in the floorpan.

The state of charge of the auxiliary battery is monitored by the GWM.

BATTERY MONITORING SYSTEM

Battery Monitoring System Control Module



Single Battery and Dual Battery System Vehicles

NOTE: The secondary battery on stop/start system vehicles is not fitted with a BMS control module.

On all vehicles a BMS control module is located on the primary battery negative (-) terminal. The module is located on the battery post and is clamped to the post with a bolt and nut.

The primary battery negative ground cable is connected to the BMS control module and is attached to a ground stud on the vehicle body.

The BMS control module is connected into the vehicle wiring harness via a multiplug. The BMS control module receives a 12V power supply direct from the primary battery positive terminal. A LIN bus connection provides communication between the BMS control module, the GWM and the QCCM (Quiescent Current Control Module) for control and monitoring of the battery current drain and state of charge.

The BMS control module measures battery current and voltage, which it communicates to the GWM over a LIN bus connection. The GWM transmits the battery information over the CAN bus to other vehicle systems. Based on the information received from the BMS control module, the GWM and the ECM will control the output from the generator and request the switching off of electrical loads if necessary.

CAUTION: Due to the self-calibration routine, it is recommended that all power supply diagnostic testing is carried out using the Land Rover approved diagnostic system rather than a digital multimeter.

The BMS control module is able to generate DTC's to help diagnose primary and auxiliary battery or generator power supply issues. These DTC's can be read using the Land Rover approved diagnostic system. The Land Rover approved diagnostic system can also be used to implement a primary and auxiliary battery and generator self test routine. For additional information, refer to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

If a fault is detected, the GWM and the ECM will override the BMS control module.

The BMS control module DTC's can be used to help diagnose battery or generator power supply faults. The DTC's are stored in GWM. The Land Rover approved diagnostic system has a process for an automated power supply diagnostic procedure. The procedure provides a menu driven process to locate a fault in a logical sequence. The procedure uses the capability of the BMS control module and generator LIN bus controlled functions to provide current flow information and will detect if the BMS control module or generator are functioning correctly.

BMS Low Battery Warning and Energy Management Messages

The BMS continuously monitors the condition of the primary vehicle battery. If excessive battery discharge occurs, the system will begin to shut down non-essential electrical systems in order to protect the battery.

If the BMS calculates that battery condition is not within set parameters, there are 3 messages that can be displayed, 2 on the touch screen and 1 on the message center. These inform the user that the battery is either at a low level of charge or the engine-off power consumption limit has been exceeded.

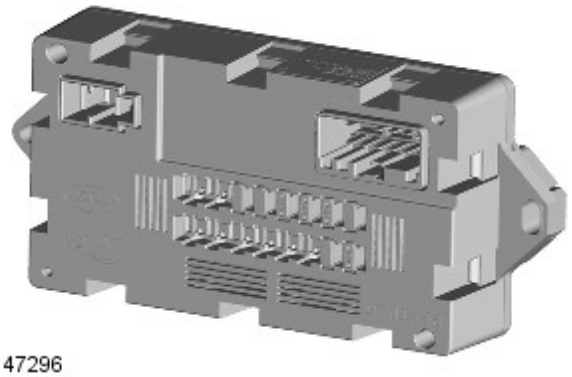
- **Low Battery - Please switch engine on or system will shutdown in 3 minutes**: is displayed as a **Warning** on the touch screen if the engine is not running. This indicates that the battery has fallen below a predefined threshold. As soon as the battery is charged back above this threshold then the message will be removed.
- **Low Battery - Please start your engine** is displayed on the message center if the engine is not running. This indicates that the battery has fallen below a predefined threshold. As soon as the battery is charged back

above this threshold then the message will be removed or it can be manually removed by pressing 'OK'.
- **System will shut down in 3 minutes**: is displayed as an **Energy management** on the touch screen if the engine is not running, and system features are causing excessive battery discharge. After 3 minutes the BMS will begin shutting down vehicle systems. Normal system operation will resume when the engine is started.

This is based on a percentage of battery capacity available for the customer to use with the engine off. The percentage can change based upon several factors.

Once triggered, the resetting of this message will not occur until the vehicle is driven for 10 minutes with the engine running (to allow the battery to recoup any lost charge). However, if the engine is run for less than 10 minutes, the message will only be displayed after an additional 5 minutes with the ignition on but engine off.

QUIESCENT CURRENT CONTROL MODULE - ALL VEHICLES



E147296

The QCCM is located right rear corner of the luggage compartment.

An addition to the Battery Monitoring System, and using signals already transmitted by the BMS control module(s), the QCCM cuts power supply to other non-essential control modules to avoid excessive discharge of the primary battery. The systems supplied via the QCCM are the audio/entertainment systems and the climate control systems.

Some control modules can cause unnecessary battery drain due to the module staying awake after the vehicle electrical system has been shut down. The QCCM in conjunction with the GWM, monitor and control the systems to prevent battery drain.

The system consists of three components:

- The BMS control module
- The GWM
- The QCCM.

The battery monitoring system checks primary battery health by analyzing battery quiescent current, battery current drain or state of charge, and determines if any action is required to protect the primary battery. If action is required this is communicated to the GWM.

The GWM control logic uses this information to determine if action is required to assist primary battery protection. The QCCM receives open and close commands from the GWM and reacts accordingly.

The software that controls the QCCM is contained within the GWM.

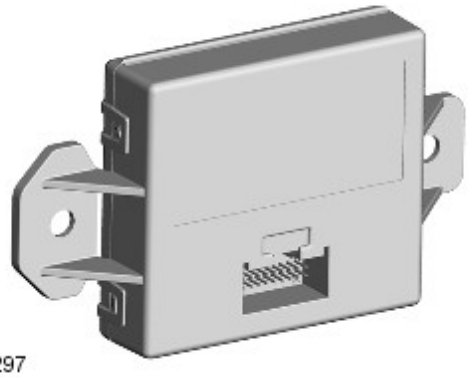
The system will be set in transit mode on delivery. Transit mode has no QCCM operation and the relays remain closed. Therefore battery drain could occur and the system will not react to it.

A PDI process requires the system to be put into Normal mode, which enables the quiescent current control module, before handing over to the customer.

The QCCM has a routine to clean the relay contacts if required. This routine is performed using the Land Rover approved diagnostic system and, if unsuccessful, the unit will require replacement.

The module contains a number of fuses which supply and protect the audio/entertainment systems, the climate systems, the GWM.

GATEWAY MODULE (GWM)



E147297

The GWM is attached to a bracket, which is bolted to the passenger side of the cross-car beam, behind the instrument panel.

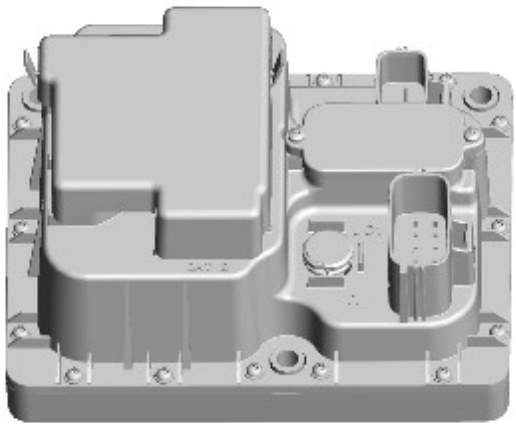
The GWM contains software to control the following functions:

- Determine condition of primary, auxiliary and secondary batteries
- Control the output from the generator using load management software
- Controls stop/start system using power management to inhibit unnecessary electrical loads
- Control the Power Supply Distribution Box to enable the switching of the battery inputs.

The GWM communicates with other system modules on the high speed CAN Powertrain and Chassis, and medium speed CAN Body and Comfort buses.

The GWM communicates with the BMS control module and the power supply distribution box via a LIN bus.

POWER SUPPLY DISTRIBUTION BOX



E154413

The Power Supply Distribution Box is located in the right side of the luggage compartment, rearward of the BJB. The power supply distribution box incorporates two banks of MOSFETs, which are activated by the GWM to switch the vehicle loads between the batteries during stop/start on vehicles with stop/start system, and also for charging the secondary or auxiliary battery.

The power supply distribution box receives a battery supply direct from the primary battery to BAT1 terminal and a battery supply from the secondary or auxiliary battery to BAT2 terminal. The power supply distribution box also incorporates a microcontroller, which receives commands from the GWM via a LIN bus connection. The power supply distribution box connects or disconnects either the primary or secondary battery to the vehicle loads according to the GWM commands. In addition, there is a diagnostic connection between the GWM and power supply distribution box, to detect faults with the power supply distribution box.

The MOSFETs in the power supply distribution box have a fail-safe Body Diode mode which will ensure there is always a connection from the primary battery to the vehicle loads in the event of a failure in the power supply distribution box. At least 60A can be supplied to the loads in this mode. The GWM will detect such a failure and will shut down non-essential loads so as not to overload the power supply distribution box.

OPERATION

BATTERY MONITORING SYSTEM AND QUIESCENT CURRENT CONTROL - SINGLE AND DUAL BATTERY SYSTEM VEHICLES

When the ignition is off (power mode 0), the BMS control module records the primary battery state of charge and

begins to monitor the battery condition from this point.

If the battery state of charge falls by 7%, the BMS control module will monitor the primary battery for 5 minutes. The BMS control module sends a ‘warning’ message on the LIN bus to the GWM. If after the 5 minute monitoring period, the battery charge has continued to fall or below 50% due to the quiescent drain current being too high, the BMS control module will determine that some control modules are still 'awake'. The BMS control module sends a shutdown message on the LIN bus to the GWM. The GWM sends a CAN bus message on the medium speed CAN Body and Comfort, and high speed CAN Powertrain and Chassis networks to all control modules, requesting them to shutdown.

The BMS control module will monitor the primary battery state of charge for a further 15 minutes and determine if the battery state of charge is still dropping.

The BMS control module sends a 'Power Disconnect' signal to the GWM on the LIN bus. The GWM then sends a signal to the QCCM on the LIN bus to open its internal relays. When the QCCM relays are open, the power supply from the primary battery to non-critical control modules is removed. The non-critical control modules are any modules associated with the infotainment system and also the climate control system.

The use of a LIN bus communication ensures that no other control modules are 'woken' during this process. If CAN bus communication was used, all modules on the CAN bus would be woken by the message.

BMS Control Module Self Calibration

Periodically the BMS control module will initiate a self-calibration routine. To self calibrate, the battery monitoring system first charges the battery to its full condition.

 NOTE: If the vehicle is only driven for short periods the charging process could take a number of days to complete.

Once the battery is fully charged, the BMS control module will discharge the battery to approximately 75% of its full state of charge, but never lower than 12.2 V. The time taken to complete this part of the routine is dependent on the electrical load on the vehicle.

When the second part of the routine has been successfully completed, the BMS control module will return the battery to its optimum level of charge. The optimum level of charge will be between 12.6 V and 15 V, depending on battery condition, temperature and loading.

The BMS control module also monitors the primary battery condition with the engine switched off. If a low voltage condition is detected the BMS control module can request the infotainment system is switched off to protect battery voltage.

DUAL BATTERY SYSTEM - STOP/START SYSTEM VEHICLES ONLY

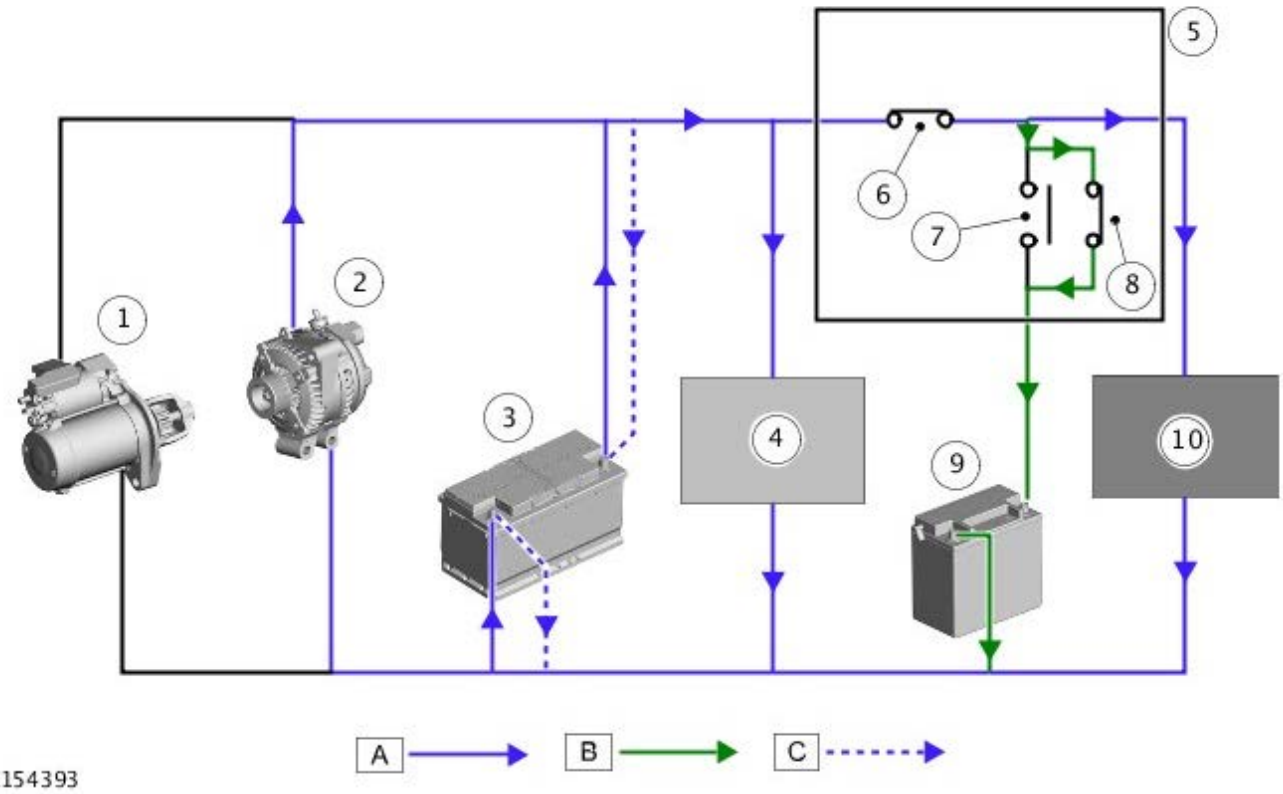
The dual battery system prevents electrical loads on the vehicle being subjected to low voltage levels during an ECO (stop/start system) engine start. Low voltage can occur due to the power demand of the TSS (Tandem Solenoid Starter) motor and could result in degraded performance of components and/or system control modules. The GWM contains the software to control the dual battery system and electrical load management system to ensure that ECO engine starts do not affect other vehicle systems.

The dual battery system isolates all power supply sensitive electrical components which may be affected by low voltage from the primary battery due TSS motor operation, and supplies them with power from the secondary battery when an engine start is in progress.

The power supply distribution box contains two banks of MOSFETs, which operate to change the power supply into two separate circuits when an ECO engine start is required. Sensitive electrical components are supplied from the secondary battery. The primary battery power is used exclusively to supply the starter motor and maintain essential power loads to the engine management system required for engine starting. The power supply distribution box operates according to commands from the GWM over the LIN bus.

Dual Battery system vehicles with stop/start system - Normal State (Engine Running)

 NOTE: A = Primary battery/generator supply, B = Secondary battery charging, C = Primary battery charging.



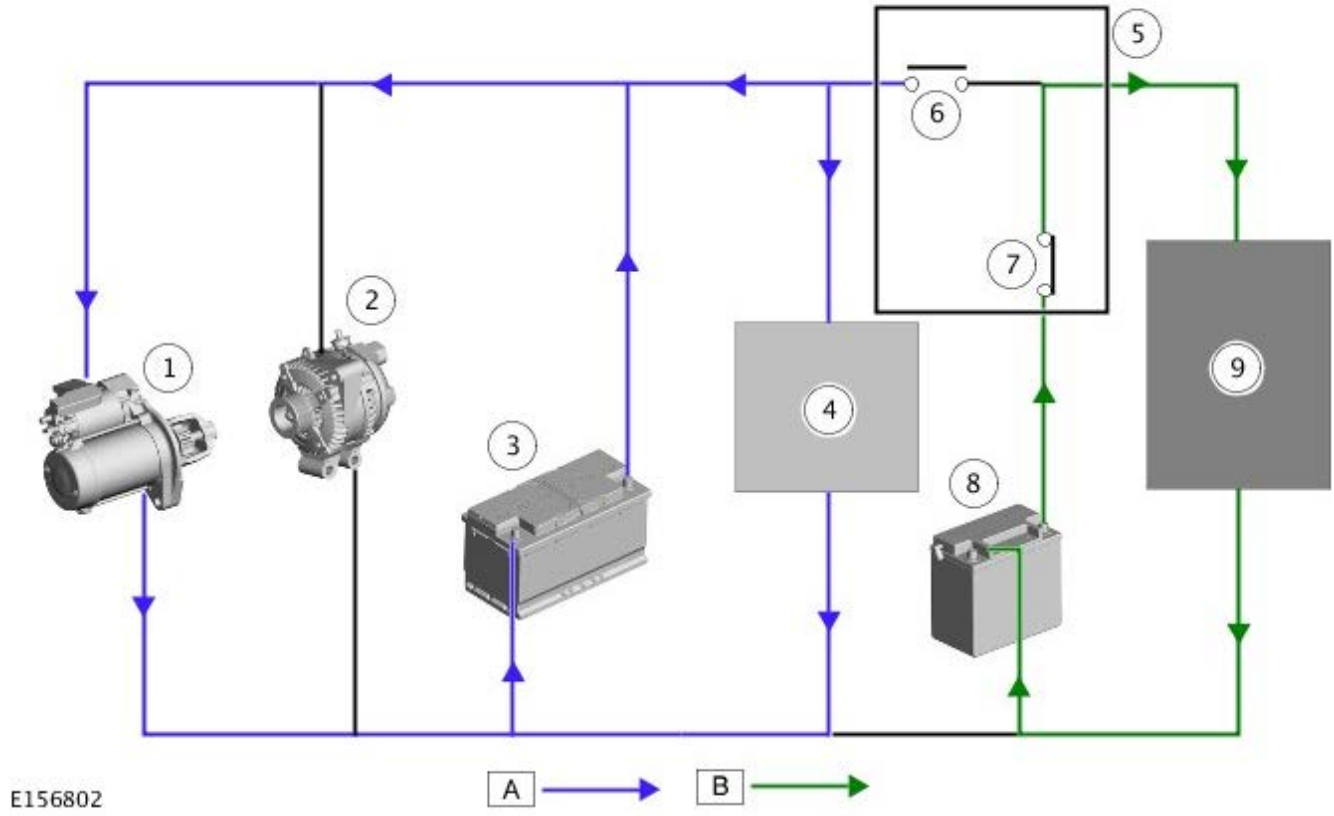
Item	Part Number	Description
1	-	Tandem Solenoid Starter (TSS) motor
2	-	Generator
3	-	Primary battery
4	-	Power and engine management system loads
5	-	Power Supply Distribution Box
6	-	BAT 1 connection on Power Supply Distribution Box (connected)
7	-	BAT 2 connection on Power Supply Distribution Box (disconnected)
8	-	BAT 2 connection on Power Supply Distribution Box (connected)
9	-	Secondary battery
10	-	Sensitive loads

When the engine is running, all electrical systems are powered from the primary battery and the generator (the sensitive loads are supplied by the BAT1 connection of the power supply distribution box (6)). The GWM and the power supply distribution box communicate via the LIN bus, and the power supply distribution box isolates the secondary battery from the system (7).

The GWM monitors the state of charge of both the primary and secondary batteries to ensure that sufficient voltage is available for the next ECO engine start. The GWM can apply charging to the secondary battery via the power supply distribution box, if it is required. If the charging of secondary battery is necessary, the power supply distribution box connects the secondary battery, and the generator starts to charge it.

Dual Battery System - ECO Engine Stop/Start state.

NOTE: A = Primary battery supply, B = Secondary battery supply.



Item	Part Number	Description
1	-	Tandem Solenoid Starter (TSS) motor
2	-	Generator
3	-	Primary battery
4	-	Power and engine management system loads
5	-	Power Supply Distribution Box
6	-	BAT 1 connection on Power Supply Distribution Box - disconnected
7	-	BAT 2 connection on Power Supply Distribution Box - connected
8	-	Secondary or auxiliary battery
9	-	Sensitive loads

When the ECO start is required, the GWM sends a signal to the power supply distribution box via the LIN bus. The power supply distribution box opens isolates the primary battery from sensitive loads, and the primary battery supplies the starter motor and power loads only, to ensure the quick engine start. In same time the power supply distribution box connects the secondary battery, to supply the sensitive loads while the ECO start in progress.

DUAL BATTERY SYSTEM - AUXILIARY BATTERY TDV8 4.4L DIESEL ALL MARKETS AND TDV6 3.0L DIESEL COLD CLIMATE VEHICLES

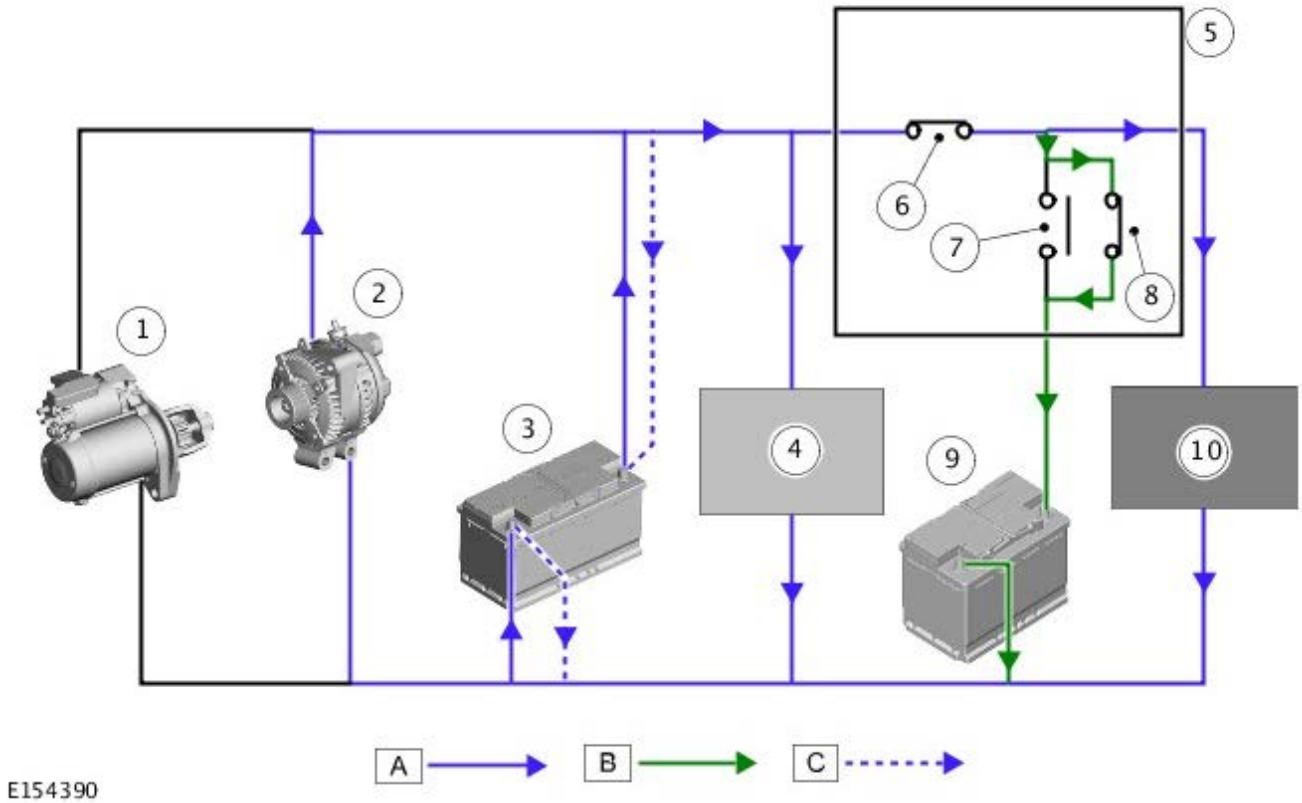
The dual battery system on vehicles with an auxiliary battery, allows both batteries to be connected in parallel, to provide increased amperage to the starter motor for efficient starting in cold climates. The auxiliary battery assists the primary battery in operating the starter motor to crank the engine at a sufficient speed for efficient starting. The auxiliary battery is switched in parallel with the primary battery once the ambient temperature falls below a certain threshold, or the state of charge of the primary battery falls below a predetermined charge level.

In addition, in the cold climate vehicles with TDV6 3.0L diesel engine with stop/start system, the auxiliary battery supplies the sensitive loads when the ECO start is active. This is similar to the all markets vehicles with stop/start system, where a secondary battery is fitted.

The power supply distribution box contains two banks of MOSFETs, which operate to introduce the auxiliary battery in parallel with the primary battery, or to switch the auxiliary battery to supply the sensitive loads when an ECO start is required. The power supply distribution box connects or isolates the batteries on receipt of LIN bus information from the GWM.

Dual Battery System - Primary and Auxiliary batteries - Normal state (Engine Running)

NOTE: A = Primary battery/generator supply, B = Auxiliary battery charging, C = Primary battery charging.



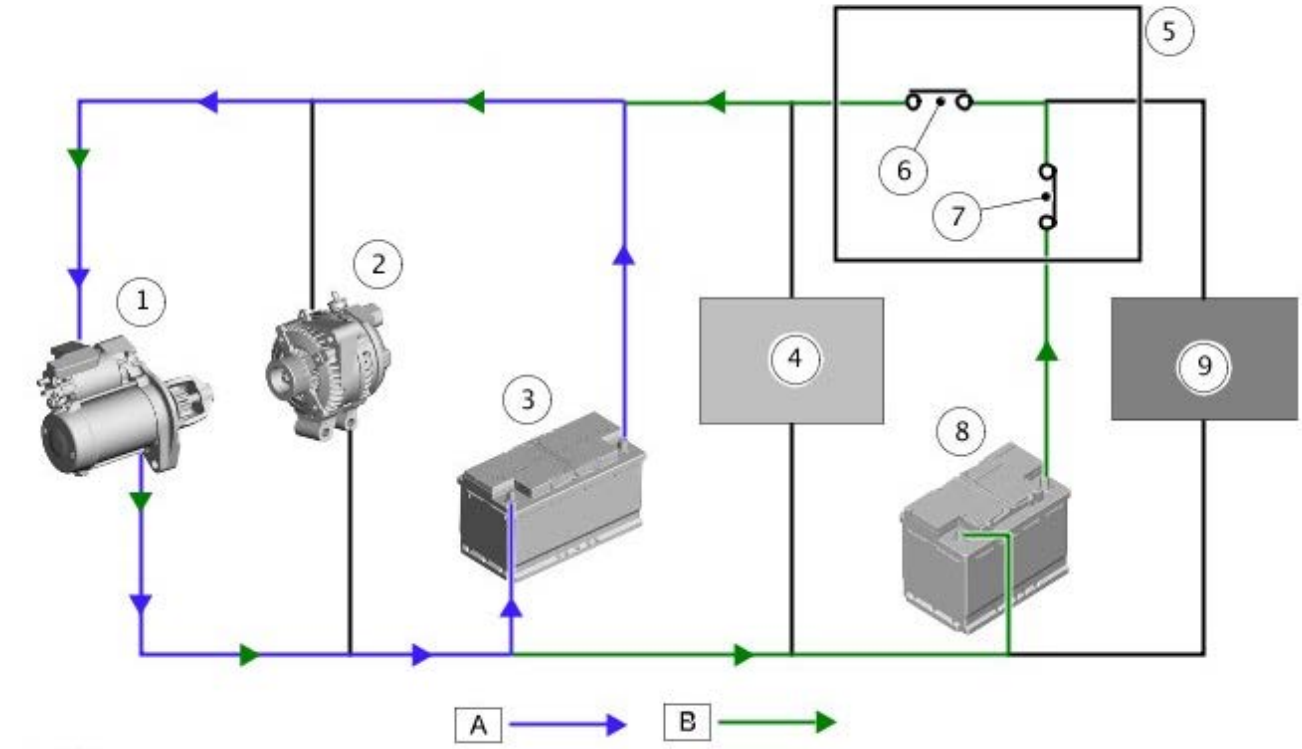
Item	Part Number	Description
1	-	Starter motor / TSS motor
2	-	Generator
3	-	Primary battery
4	-	Power and engine management system loads
5	-	Power Supply Distribution Box
6	-	BAT 1 connection on Power Supply Distribution Box - connected
7	-	BAT 2 connection on Power Supply Distribution Box - disconnected
8	-	BAT 2 connection on Power Supply Distribution Box - connected
9	-	Auxiliary battery
10	-	Sensitive loads

When the engine is running, all electrical systems are powered from the primary battery and the generator. The GWM and the power supply distribution box communicate via the LIN bus, and the power supply distribution box isolates the auxiliary battery from the system.

The GWM monitors the state of charge of both the primary and auxiliary batteries to ensure that sufficient voltage is available for the next ECO engine start. The GWM can apply charging to the auxiliary battery via the power supply distribution box, if it is required. If the charging of auxiliary battery is necessary, the power supply distribution box connects the auxiliary battery, and the generator starts to charge it.

Dual Battery System - Primary and Auxiliary Batteries in Parallel for Starting

NOTE: A = Primary battery supply, B = Auxiliary battery supply.



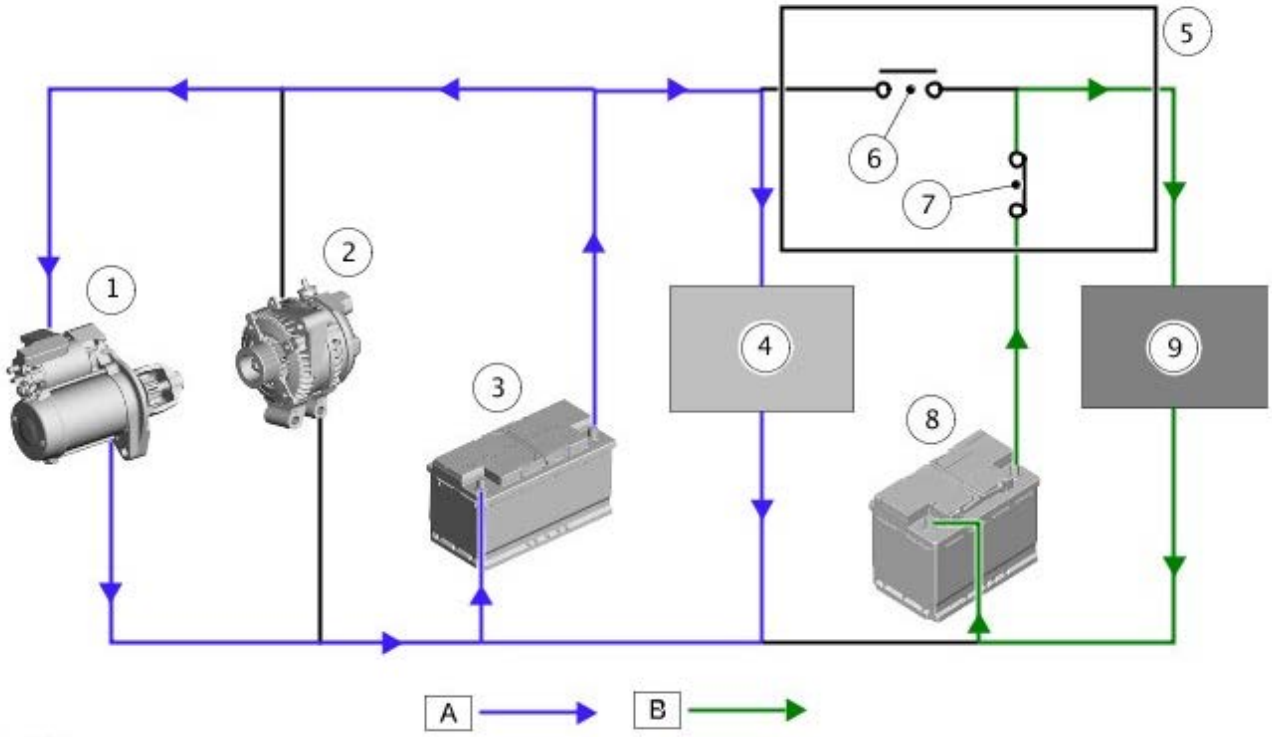
E154392

Item	Part Number	Description
1	-	Starter motor / TSS motor
2	-	Generator
3	-	Primary battery
4	-	Power and engine management system loads
5	-	Power Supply Distribution Box
6	-	BAT 1 connection on Power Supply Distribution Box - connected
7	-	BAT 2 connection on Power Supply Distribution Box - connected
8	-	Auxiliary battery
9	-	Sensitive loads

When the ambient temperature is below a predetermined level and the GWM receives a start signal via the high speed CAN Powertrain bus from the CJB, the GWM communicates with the power supply distribution box via the LIN bus to keep the primary battery connected, and also connect the auxiliary battery. The power for the starter motor is supplied from both batteries. When the ECM receives the start signal, it energizes the starter relay in the EJB which operates the starter motor solenoid to operate the starter motor.

Dual Battery system - ECO Engine Stop/Start State with auxiliary battery and TDV8 4.4L normal engine starting.

NOTE: A = Primary battery supply, B = Auxiliary battery supply.



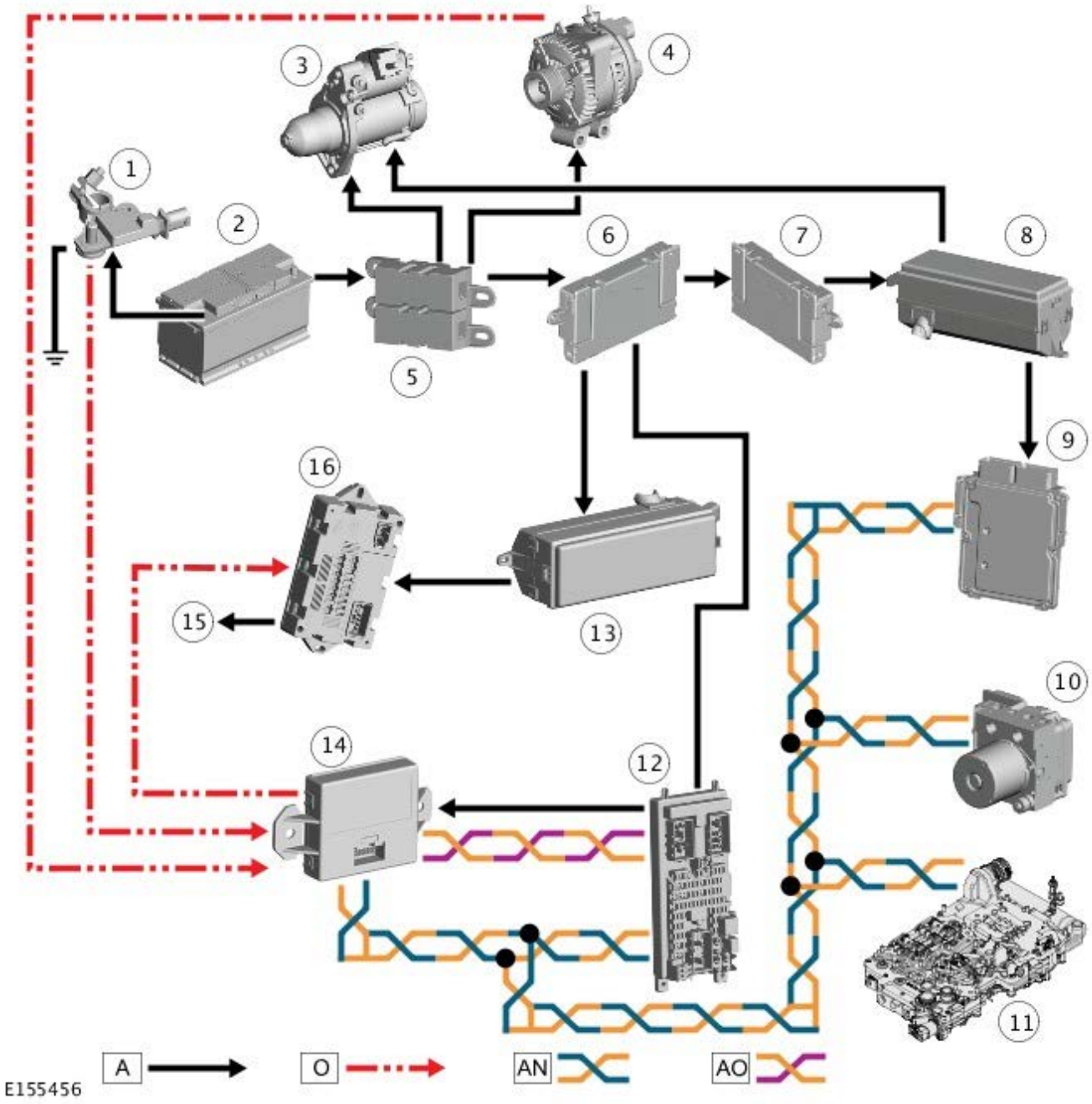
E154391

Item	Part Number	Description
1	-	TSS motor
2	-	Generator
3	-	Primary battery
4	-	Power and engine management system loads
5	-	Power Supply Distribution Box
6	-	BAT 1 connection on Power Supply Distribution Box - disconnected
7	-	BAT 2 connection on Power Supply Distribution Box - connected
8	-	Auxiliary battery
9	-	Sensitive loads

When the ECO start is required (cold climate vehicles with TDV6 3.0L diesel engines with stop/start system), the GWM sends a signal to the power supply distribution box via the LIN bus. The power supply distribution box isolates the primary battery from sensitive loads, and the primary battery supplies the starter motor and power loads only, to ensure the quick engine start. In same time the power supply distribution box connects, the auxiliary battery to supply the sensitive loads, while the ECO start in progress.

CONTROL DIAGRAM - SINGLE BATTERY VEHICLES

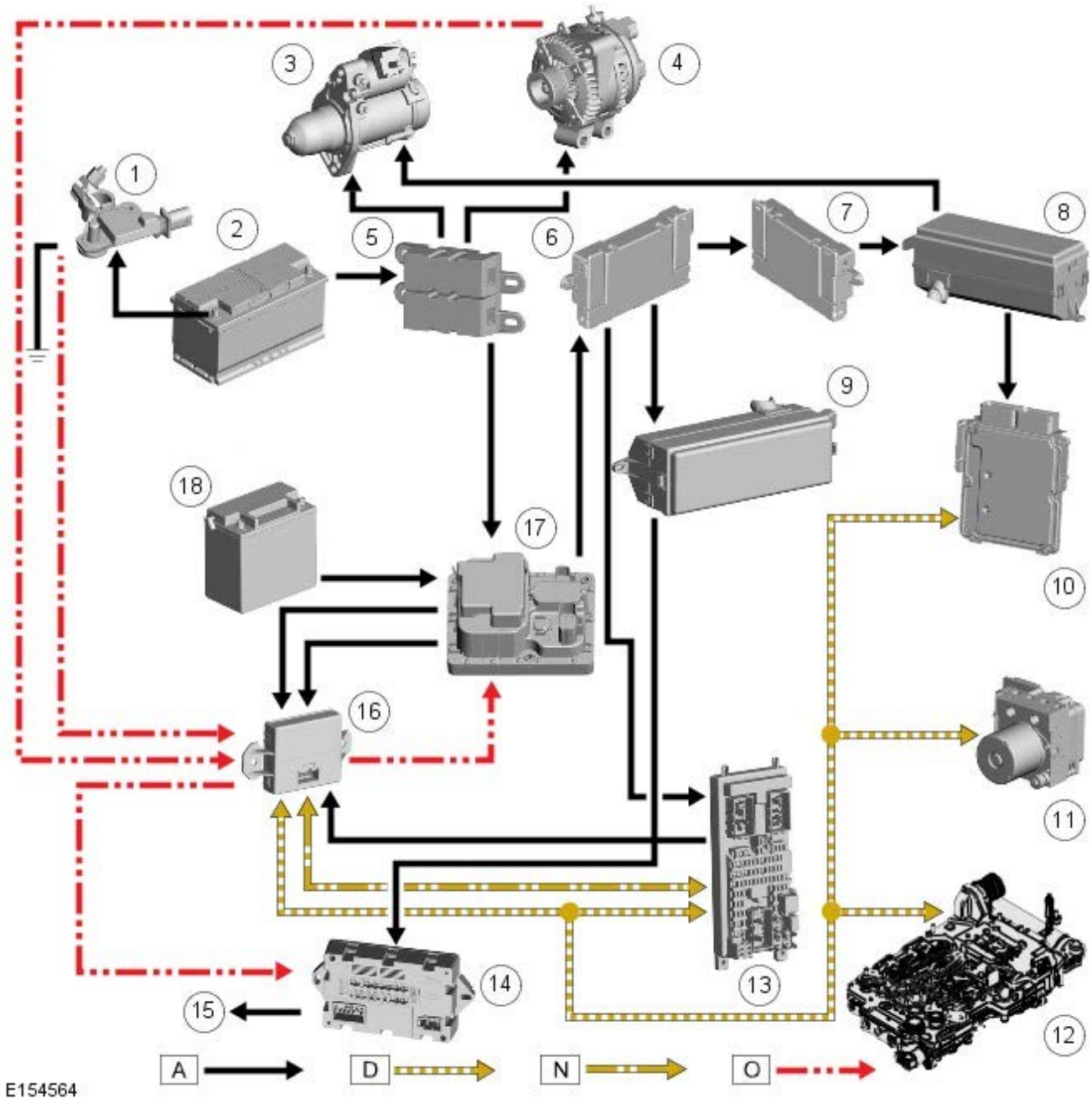
NOTE: A = Hardwired, O = LIN (Local Interconnect Network) bus, AN = High speed CAN (Controller Area Network) Powertrain bus, AO = Medium speed CAN Body bus.



Item	Part Number	Description
1	-	Battery Monitoring System (BMS) control module
2	-	Primary battery
3	-	Starter motor
4	-	Generator
5	-	Battery Junction Box 2 (BJB2)
6	-	Battery Junction Box (BJB)
7	-	Auxiliary Junction Box (AJB)
8	-	Rear Junction Box (RJB)
9	-	Engine Control Module (ECM)
10	-	Anti-lock Brake System (ABS) control module
11	-	Transmission Control Module (TCM)
12	-	Central Junction Box (CJB)
13	-	Engine Junction Box (EJB)
14	-	Gateway Module (GWM)
15	-	Power supply to infotainment and climate control modules
16	-	Quiescent Current Control Module (QCCM)

CONTROL DIAGRAM - DUAL BATTERY VEHICLES

NOTE: A = Hardwired, O = LIN (Local Interconnect Network) bus, AN = High speed CAN (Controller Area Network) Powertrain bus, AO = Medium speed CAN Body bus.



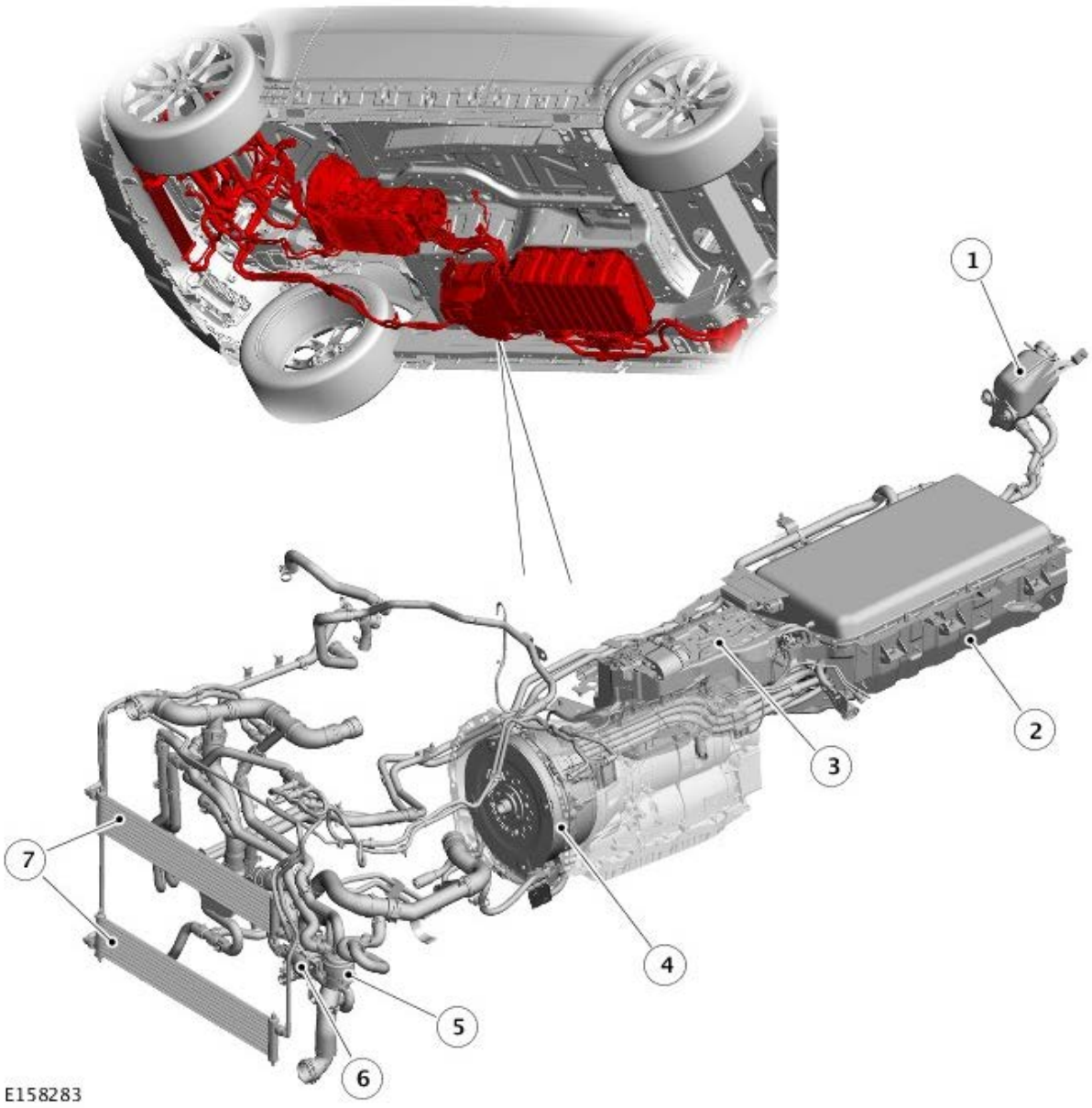
Item	Part Number	Description
1	-	Battery Monitoring System (BMS) control module
2	-	Primary battery
3	-	Starter motor / TSS motor
4	-	Generator
5	-	Battery Junction Box 2 (BJB2)
6	-	Battery Junction Box (BJB)
7	-	Auxiliary Junction Box (AJB)
8	-	Engine Junction Box (EJB)
9	-	Rear Junction Box (RJB)
10	-	Engine Control Module (ECM)
11	-	Anti-lock Brake System (ABS) control module
12	-	Transmission Control Module (TCM)
13	-	Central Junction Box (CJB)
14	-	Quiescent Current Control Module (QCCM)
15	-	Power supply to infotainment and climate control modules
16	-	Gateway Module (GWM)
17	-	Power Supply Distribution Box
18	-	Secondary / Auxiliary battery

Published: 28-Feb-2014

Battery, Mounting and Cables - Battery and Cables SDV6 3.0L Diesel - Hybrid Electric Vehicle

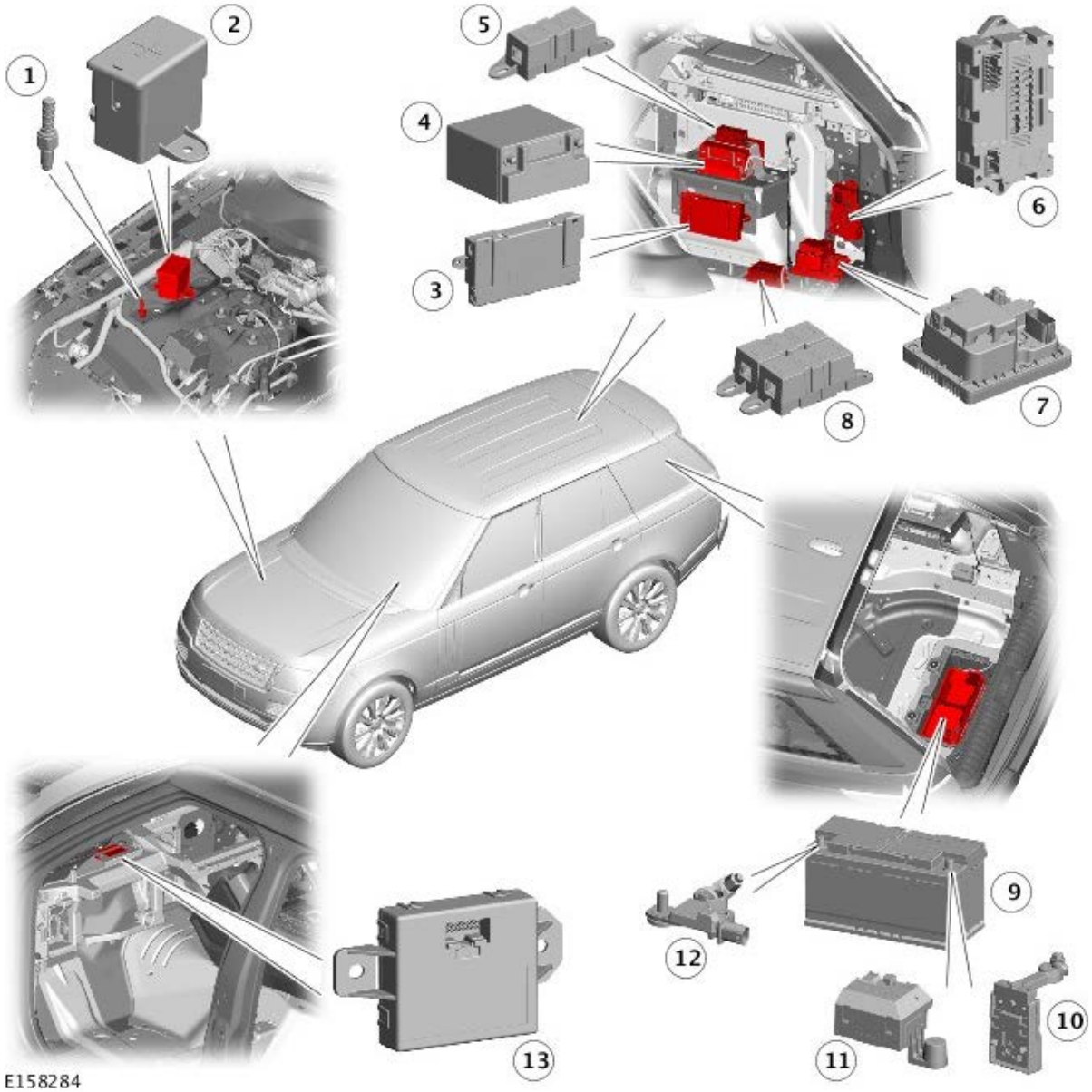
Description and Operation

COMPONENT LOCATION - HYBRID ELECTRIC VEHICLE (HEV) BATTERY PACK AND MOTOR GENERATOR



Item	Part Number	Description
1	-	Hybrid electric Vehicle (HEV) battery pack coolant expansion tank
2	-	HEV Battery
3	-	Electric Power Inverter Converter (EPIC)
4	-	Motor Generator (MG)
5	-	EPIC coolant pump
6	-	MG coolant pump
7	-	EPIC coolers - upper and lower

COMPONENT LOCATION - DUAL BATTERY SYSTEM WITH STOP/START SYSTEM



Item	Part Number	Description
1	-	Jump start terminal negative (-)
2	-	Jump start terminal positive (+)
3	-	Battery Junction Box (BJB)
4	-	Secondary battery (or auxiliary battery - cold climate markets)
5	-	Megafuse
6	-	Quiescent Current Control Module (QCCM)
7	-	Power Supply Distribution Box (PSDB)
8	-	Battery Junction Box (BJB) 2
9	-	Primary battery
10	-	Megafuse
11	-	Transit relay
12	-	Battery Monitoring System (BMS) control module
13	-	Gateway Module (GWM)

OVERVIEW - HYBRID ELECTRIC VEHICLE (HEV) BATTERY PACK AND MOTOR GENERATOR

The Hybrid Electric Vehicle (HEV) systems are controlled by software contained within the ECM (engine control module). This software is sometimes referred to as the Vehicle Supervisory Controller (VSC).

The following components comprise the HEV system:

- Engine Control Module (ECM)
- HEV battery
- Electric Power Inverter Converter (EPIC)
- Motor Generator (MG)
- EPIC coolers
- EPIC coolant pump
- MG coolant pump
- High voltage cables
- Air Conditioning (A/C) for battery cooling.
  For additional information, refer to: Air Conditioning (412-01B Climate Control - SDV6 3.0L Diesel - Hybrid Electric

Vehicle, Description and Operation).

The HEV battery pack comprises the HEV battery and the EPIC which are contained in an HEV battery pack cradle. The cradle is attached to the underside of the floorpan.

The HEV battery comprises 72 6.9 Ah Li-ion battery cells which are connected series with a total nominal battery voltage of 260 volts, and a capacity of 1.7 kWh. The HEV battery supplies power to operate the Motor Generator (MG) to propel the vehicle under electric power. The battery also supplies power to additional electrical components, for example electric Air Conditioning (A/C) compressor. The battery is cooled by its own dedicated cooling system and the vehicle A/C system.

The EPIC is located in the HEV battery pack cradle, forward of the HEV battery. The EPIC converts high voltage Direct Current (DC) to 12V DC to support the vehicle electrical loads.

The EPIC has two modes of operation:

- Motor mode - which applies 3 phase current from the HEV battery to the MG to propel the vehicle
- Generator mode - applies 3 phase current from the MG to charge the HEV battery and supply 12V DC to the vehicle electrical system.

The EPIC is cooled by coolant from the engine coolant circuit, but is a unique circuit from the engine cooling system. Coolant is circulated by a dedicated EPIC coolant pump and cooled by two EPIC coolers located forward of the radiator.

The MG is connected to the engine and the automatic transmission and is located on the transmission input shaft. When the vehicle engine is running the dual mass flywheel, attached to the MG, functions as conventional dual mass flywheel. The engine disconnect clutch within the MG is used to connect and disconnect the drive from the engine to the transmission. For further information on the dual mass flywheel and disconnect clutch, refer to the Transmission
For additional information, refer to: Transmission Description (307-01B Automatic Transmission/Transaxle - Vehicles With: 8HP70 8-Speed - Hybrid Electric Vehicle - Automatic Transmission – AWD, Description and Operation).

On vehicle deceleration the MG applies regenerative braking to apply a charging current to the HEV battery pack and assist the vehicle braking system. For details on regenerative braking refer to Braking Control System
For additional information, refer to: Braking Control System - SDV6 3.0L Diesel - Hybrid Electric Vehicle (206-11 Brake Controls, Description and Operation).
When the vehicle is operating under electrical power, the MG operates as an electric motor to provide drive through the automatic transmission using power from the HEV battery.

The MG is cooled by coolant from the engine coolant circuit. Coolant is circulated by a dedicated MG coolant pump.

The ECM HEV software can operate both the vehicle engine and HEV system simultaneously to provide the optimum and most efficient delivery of torque to the transmission.

OVERVIEW - DUAL BATTERY SYSTEM WITH STOP/START SYSTEM

Two batteries are fitted to support the stop/start system.
For additional information, refer to: Starting System (303-06 Starting System - TDV6 3.0L Diesel, Description and Operation).

A primary battery is located in the luggage compartment floor in a plastic molded tray and clamped in position by the air suspension air supply unit.

On stop/start system vehicles, a secondary battery is located in the right side of the luggage compartment on a battery support tray and secured with a strap bolted to the tray.

- The primary battery is a 90Ahr, 850CCA Absorbed Glass Mat (AGM) Valve Regulated Lead-Acid (VRLA) battery on all vehicles.
- The secondary battery is a 14Ahr, 200CCA AGM battery on all vehicles with stop/start.

A Battery Monitoring System (BMS) control module is mounted on the primary battery negative terminal. The BMS control module is integral with the battery negative cable and is controlled by the Gateway Module (GWM).

The secondary battery is not fitted with a BMS control module.

CAUTION: To avoid damaging the BMS control module, always use the ground (negative (-)) terminal stud point on the right side top mount. Never connect directly to the primary battery negative terminal when connecting a slave power supply to the vehicle, the BMS control module can be damaged.

If a new primary battery is fitted to the vehicle, the BMS control module will require re-calibrating using a Land Rover approved diagnostic system.

When the vehicle leaves the factory, a transit relay is fitted to the primary battery positive terminal. The transit relay is connected to the Central Junction Box (CJB) which limits the electrical functions to essential items only, to reduce loads on the primary battery. The transit relay provides battery power to the Battery Junction Box 2 (BJB2) which supplies the starter motor, Power Supply Distribution Box (PSDB) and the positive jump start terminal. The transit relay must be removed from the vehicle during the Pre-Delivery Inspection (PDI). For additional information, refer to the PDI Manual.

The primary battery provides power to the BJB (battery junction box). The BJB contains three megafuses, delivering power to the RJB (rear junction box), the EJB (engine junction box) and the Tandem Solenoid Starter (TSS) motor. In addition to containing fuses and relays, the RJB and CJB (central junction box) contain software to control a number of vehicle systems. These functions are covered in the appropriate sections of this manual.

Two jump start terminals are located adjacent to the right side top mount in the engine compartment. A cover protects the positive (+) terminal when not in use. If jump starting is required, the cover must be removed and the positive (+) jump lead attached securely. The cover must be fitted to the positive terminal when not in use. The negative (-) jump lead is attached to a stud located on the right side top mount.

Dual Battery System

The dual battery system is used on all vehicles with the stop/start system. The dual battery system prevents the vehicle electrical systems being subjected to undesirably low voltages during repeated engine restarts. If the electrical systems are subject to low voltages the customer may notice degraded performance of components and systems and incorrect fault DTC (diagnostic trouble code) may be stored.

The dual battery system isolates all electrical components and systems sensitive to low supply voltage from the primary battery

while an engine start is in progress, and supplies them from the secondary battery. Without the dual battery system, the electrical power required by the TSS motor to crank the engine for each start would cause a voltage drop across the entire vehicle electrical network, and cause control modules to function incorrectly and in some cases reset and/or record DTC's.

If the dual battery system is unable to prevent electrical supplies to the vehicle systems being subjected to low voltage levels during engine stop/start operations, due to the condition of the primary and/or secondary batteries or a system fault, the stop/start feature (where fitted) is disabled.

The dual battery system comprises the following components:

- Power Supply Distribution Box (PSDB)
- Gateway Module (GWM)
- Primary battery
- Secondary battery.

The Gateway Module (GWM) hosts most of the software required to control the dual battery system and components. The GWM monitors the components and can store fault related DTC's.

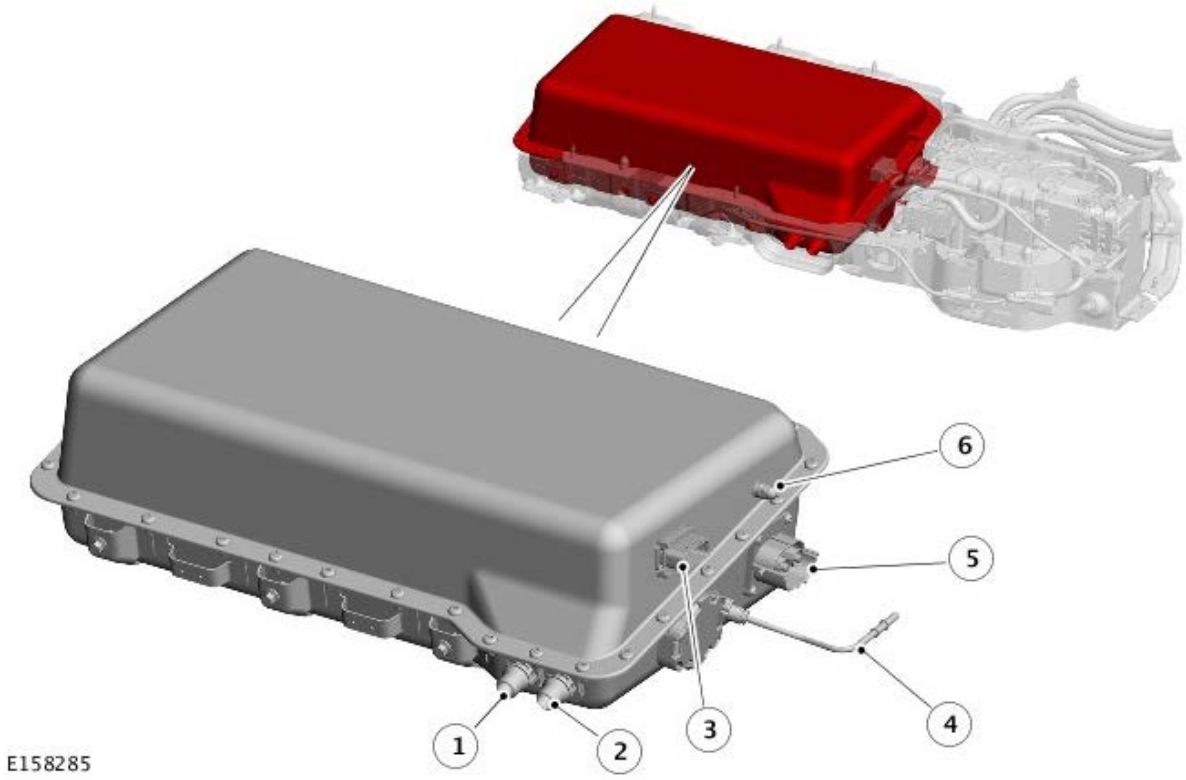
The GWM controls the charging system software in conjunction with the ECM, RJB, CJB and ABS (anti-lock brake system) control module via the high speed and medium speed CAN (controller area network) bus.

On vehicles with stop/start, the GWM software will monitor the status of the stop/start system and determine, along with the ECM, if battery condition is sufficient to support a stop/start event. It can also request to maintain vehicle systems by keeping the engine running or initiating a restart due to, for example, climate control system requirements or request for restart from the ECM. A brake pressure signal is received from the ABS control module which will indicate to the GWM that an engine restart is required from driver operation of the foot brake.

The GWM contains the intelligent power management system and the BMS software. Monitoring of the primary battery condition for stop/start is controlled by the ECM, GWM and the BMS control module.

DESCRIPTION - HYBRID ELECTRIC VEHICLE (HEV) BATTERY PACK AND MOTOR GENERATOR

Hybrid Electric Vehicle (HEV) Battery



Item	Part Number	Description
1	-	Coolant inlet
2	-	Coolant outlet
3	-	Low voltage (12V) connector
4	-	Exhaust vent and breather tube
5	-	High voltage (260V) connector
6	-	Battery to vehicle ground point

WARNING: The HEV battery can contain up to 300 V which can cause serious injury or death.

DO NOT short circuit the battery terminals.

DO NOT reverse the polarity of any connector to the HEV battery system.

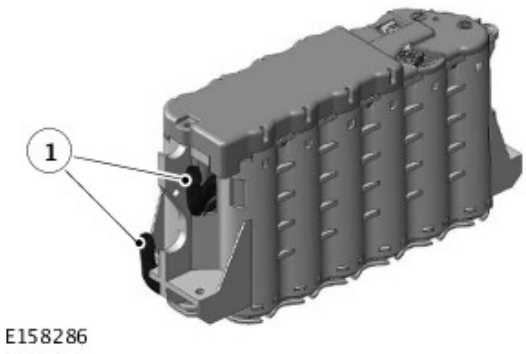
DO NOT disassemble the HEV battery.

The HEV battery is located in a fabricated battery pack carrier and secured with screws to the carrier. The battery pack carrier is secured to the right side of the vehicle floorpan with screws.

The HEV battery comprises a fabricated housing which contains 72 battery cells. The housing also contains cooling circuit

pipework for the battery cell thermal management, a Battery Energy Control Module (BECM) for control of the battery output, charging and management and an exhaust vent.

Battery Module



Item	Part Number	Description
1	-	Cooling system connections

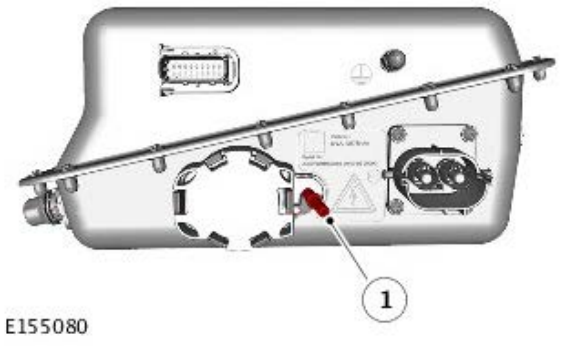
The 72 Lithium Ion Nickel Cobalt Aluminium cells are grouped in six modules of twelve cells. The cells in each module are wired in series and sealed in a plastic casing. Each battery cell can provide between 3.5 - 3.9 Volts (V) and each module provides 42.0 - 46.9 V, giving a combined HEV battery operating range of 252 to 280 V.

Battery Cell



Each battery module has connections to the HEV battery cooling circuit and also has a cell supervisory circuit which the Battery Energy Control Module (BECM) uses to monitor the temperature and condition of the individual cells.

The battery cooling circuit is a dedicated system for cooling of the HEV battery cells. The system is controlled by the Battery Energy Control Module (BECM) which operates the HEV battery cooling system as required via an electric HEV battery coolant pump and instructs the Automatic Temperature Control Module (ATCM) to operate the HEV battery isolation valve to allow the battery coolant to be cooled by the vehicle air conditioning system.



Item	Part Number	Description
1	-	HEV battery vent

The HEV battery casing has an exhaust vent and a breather tube which allows pressure equalisation of the battery casing under normal operating conditions. A secondary function of the breather is to allow the HEV battery casing to be vented in the unlikely event that a cell generates gases. Conditions that can cause a cell to generate gases are; cell has exceeded maximum temperature, over charging, damaged battery cells or an internal short circuit.

Battery Energy Control Module (BECM)

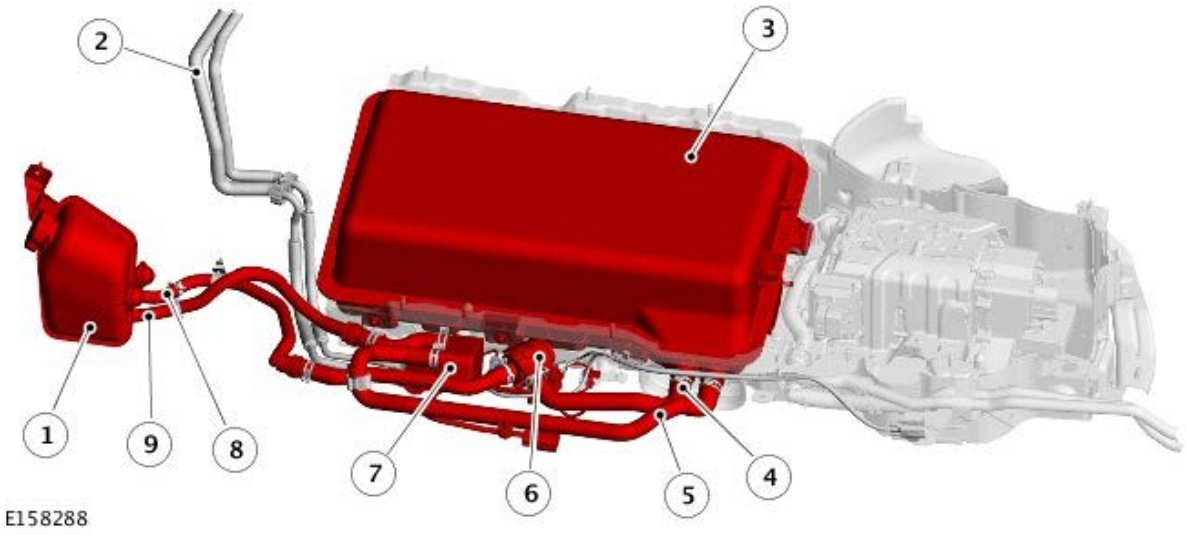
The Battery Energy Control Module (BECM) is located within the battery housing. The BECM manages and protects the HEV battery system and is connected to the 12 V vehicle system via a dedicated CAN HEV systems bus.

The HEV battery management functions of the BECM are as follows:

- Monitor the voltage and temperature of each individual battery cell
- Protect each battery cell from overcharging or discharging
- Perform cell balancing to adjust cell voltages

- Calculate and transmit the battery state of charge on the CAN HEV systems bus
- Calculate and transmit the available battery power on the CAN HEV systems bus
- Monitor the high voltage interlock loop for integrity of the high voltage connectors.

Hybrid Electric Vehicle (HEV) Battery Cooling System



Item	Part Number	Description
1	-	HEV battery coolant expansion tank
2	-	Air Conditioning (A/C) refrigerant pipes
3	-	HEV battery
4	-	Coolant inlet pipes - to HEV battery
5	-	Coolant outlet pipes - from HEV battery
6	-	HEV battery coolant pump
7	-	HEV battery cooler and isolation valve
8	-	Coolant outlet
9	-	Coolant inlet

The battery cooling circuit comprises a remote coolant system, with a HEV battery pack coolant expansion tank, HEV battery coolant pump, coolant hoses and a HEV battery cooler and isolation valve.

The Battery Energy Control Module (BECM) controls the operation of the HEV battery coolant pump using a PWM (pulse width modulation) output to control the speed of the pump.

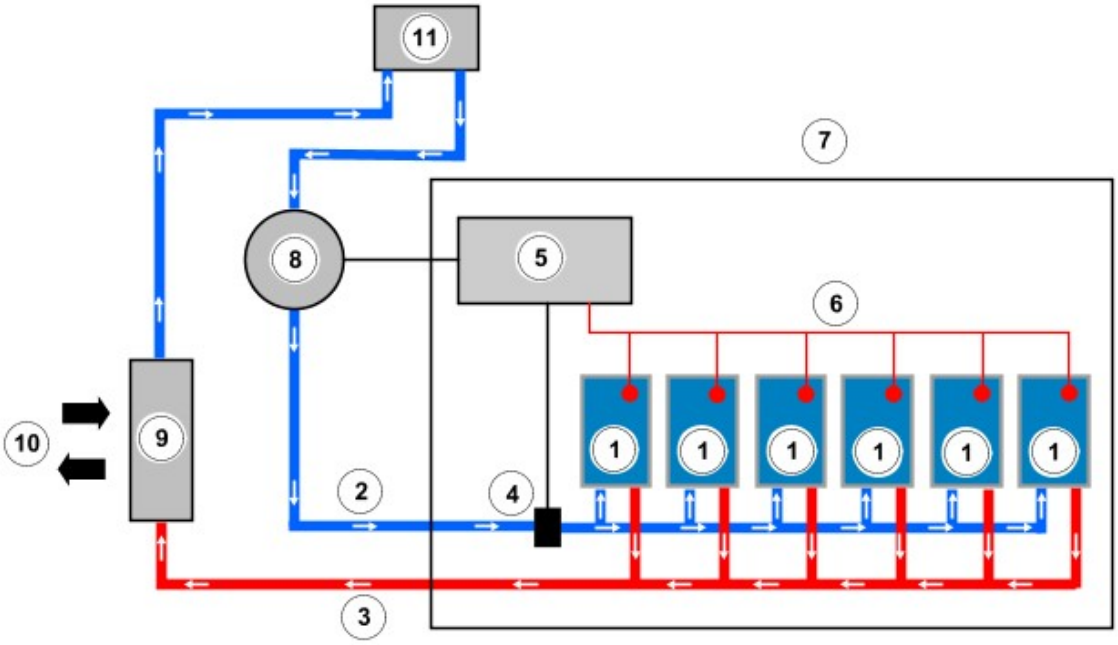
The Automatic Temperature Control Module (ATCM) operates the isolation valve in response to signals on the high speed CAN HEV systems bus from the BECM for HEV battery cooling. When the isolation valve is open, the Air Conditioning (A/C) system passes refrigerant through the HEV cooler, cooling the HEV battery coolant.

The BECM controls the coolant flow through the HEV battery cells and, using the ATCM, maintains the HEV battery coolant temperature at an optimum temperature of between 15 to 25°C (59 to 77°F).

The HEV battery cooling system uses a 50:50 water to coolant (anti-freeze) ratio.

The HEV coolant is independent of the engine cooling system. An HEV battery coolant expansion tank is located behind the right rear wheel arch liner.

HEV Battery Cooling System Schematic Diagram



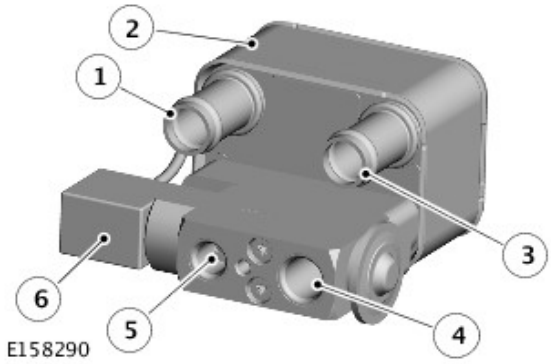
E158289

Item	Part Number	Description
1	-	Battery modules (6 off)
2	-	Coolant inlet
3	-	Coolant outlet
4	-	Coolant temperature sensor
5	-	Battery Energy Control Module (BECM)
6	-	Battery module temperature sensors (6 off)
7	-	HEV battery
8	-	HEV battery coolant pump
9	-	HEV battery cooler and isolation valve
10	-	Air Conditioning (A/C) system inlet/outlet to HEV battery cooler via isolation valve
11	-	HEV battery coolant expansion tank

The HEV battery contains a HEV battery coolant temperature sensor which measures the temperature of the coolant entering the battery modules. The coolant passes through each module cooling the cells within each module. Each battery module has a cell temperature sensor. Each temperature sensor passes cell temperature information to the Battery Energy Control Module (BECM).

The BECM can protect the HEV battery from over or under cooling and if necessary control the contactors for individual battery modules to protect them from damage. Maintaining the 72 battery cells at the optimum temperature is critical for maintaining their power capacity and life expectancy.

HEV Battery Cooler and Isolation Valve



E158290

Item	Part Number	Description
1	-	Coolant outlet to HEV battery expansion tank
2	-	HEV battery cooler
3	-	Coolant inlet from HEV battery
4	-	Air conditioning system Low Pressure (LP) connection
5	-	Air conditioning system High Pressure (HP) connection
6	-	Isolation valve solenoid operated valve

The HEV battery cooler is located on the right side of the HEV battery. The cooler and the isolation valve are joined together to

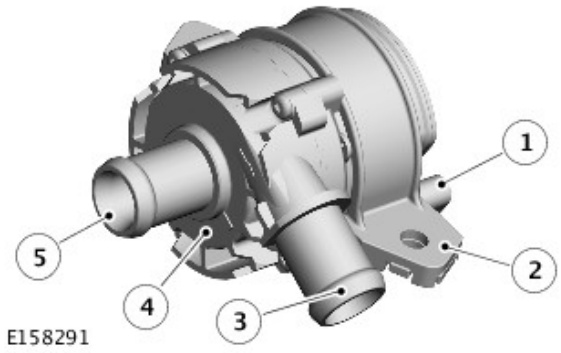
form an assembly. The isolation valve is secured to the cooler with two screws and sealed with O ring seals.

The isolation valve is secured to a molded tray with two screws and washers. The tray is attached to the HEV battery cradle.

The Air Conditioning (A/C) refrigerant passes from the isolation valve inlet, through passageways in the HEV battery cooler and back through the isolation valve to return to the vehicle A/C system. The isolation valve is a solenoid operated valve which is controlled by the Automatic Temperature Control Module (ATCM) on receipt of a cooling request from the BECM. When the valve is closed, the refrigerant is prevented from circulating through the cooler and no cooling of the HEV battery coolant will occur.

The HEV battery cooler is a metal fabrication with two ports for coolant inlet and outlet. Coolant returning from the HEV battery is passed through passageways in the cooler where it cooled by the temperature differential with the A/C refrigerant. The coolant passes from the cooler to the HEV battery expansion tank. An electric HEV battery coolant pump circulates the coolant around the HEV battery cooling circuit.

HEV Battery Coolant Pump



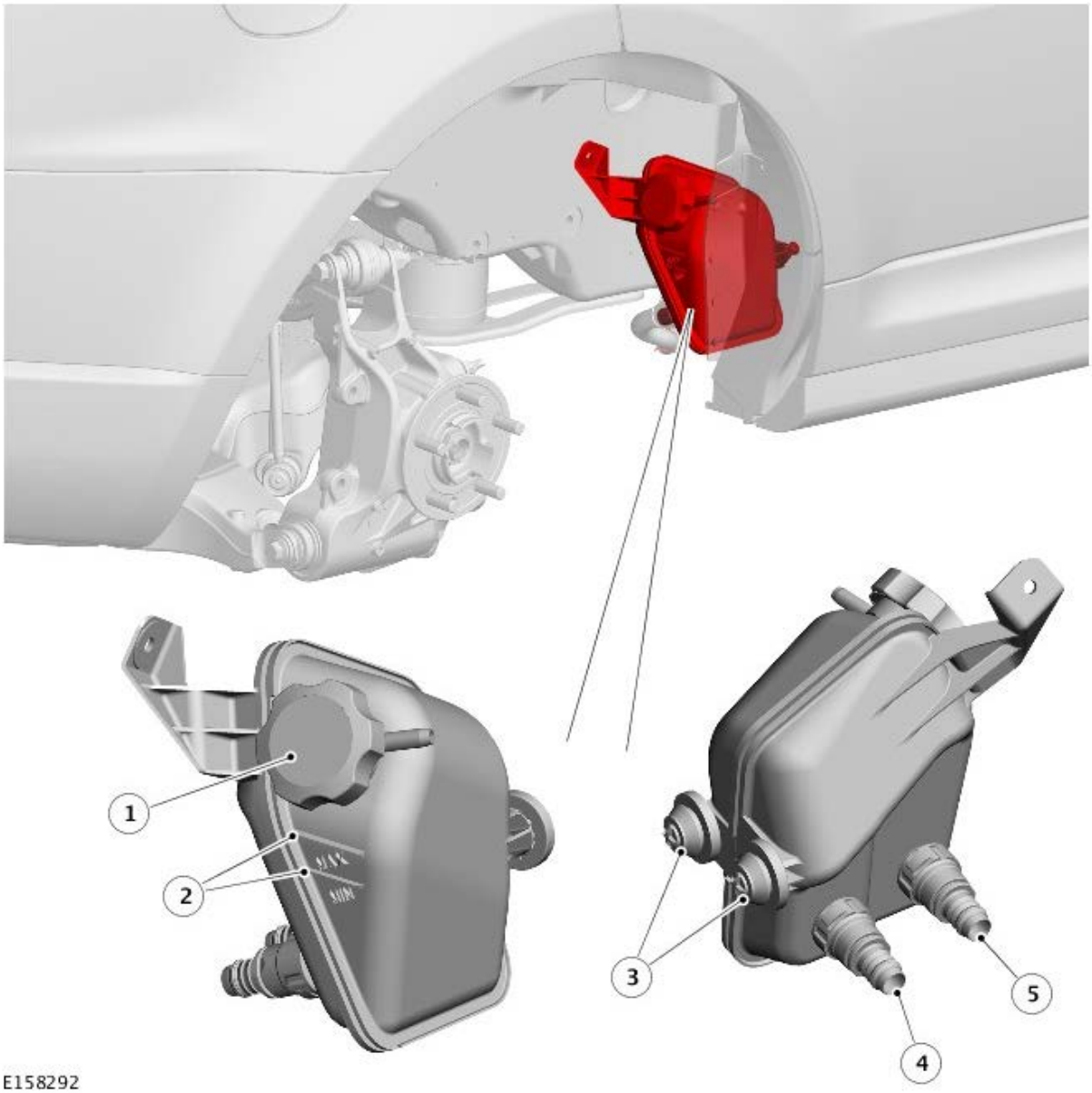
Item	Part Number	Description
1	-	Electrical connector
2	-	Mounting bracket
3	-	Coolant outlet
4	-	Electric pump
5	-	Coolant inlet

The HEV battery coolant pump is located on the right side of the HEV battery. The HEV battery coolant pump is secured to a molded tray with a bracket, two rubber isolation mountings and two screws and washers. The tray is attached to the HEV battery cradle.

The HEV battery coolant pump is controlled by the BECM to regulate the coolant flow around the HEV battery coolant circuit. the pump receives an ignition feed from the Engine junction box (EJB) and a PWM control output from the BECM. Using the PWM output, the BECM is able to control the pump speed and therefore the coolant flow around the HEV battery cooling circuit.

The HEV battery coolant pump provides a diagnostic feedback to the BECM.

HEV Battery Coolant Expansion Tank



E158292

Item	Part Number	Description
1	-	High and low level indicators
2	-	Filler cap
3	-	Rubber mountings
4	-	Coolant inlet
5	-	Coolant outlet

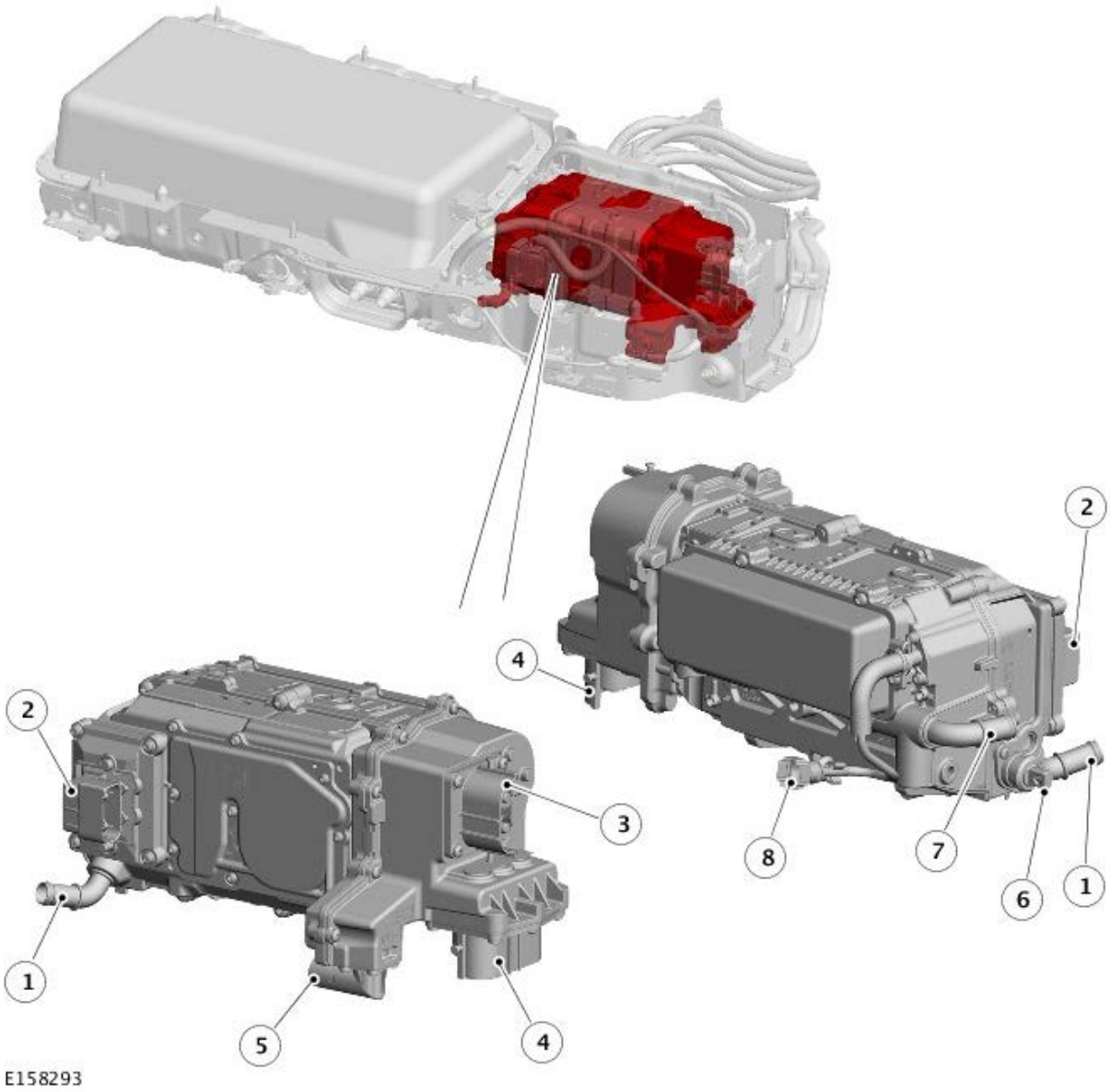
The plastic molded HEV battery coolant expansion tank is located in the rear right wheel arch, behind the wheel arch liner. The tank is attached by two rubber isolation mounts and positively retained with a bolt and washer to the vehicle body.

Two connections on the expansion tank allow for the fitment of the coolant hose from the HEV battery cooler and to the HEV battery coolant pump.

A sealed cap allows for the filling of the HEV battery cooling system. The cap is fitted with a spring loaded pressure relief valve. Excess coolant pressure is relieved via the valve and vented to atmosphere via a connection on the filler neck of the expansion tank.

Two level marks molded onto the expansion tank show the upper and lower fill levels.

Electric Power Inverter Converter (EPIC)



Item	Part Number	Description
1	-	Coolant inlet connection
2	-	Low voltage connector - vehicle 12 V interface
3	-	HEV battery connector
4	-	Motor Generator (MG) connector
5	-	High voltage connector for electric Air Conditioning (A/C) compressor
6	-	12 V charging output to vehicle primary and secondary battery system
7	-	Coolant outlet connection
8	-	Breather

WARNING: The EPIC can output a voltage of up to 300 V which can cause serious injury or death.

DO NOT short circuit any terminals.

DO NOT disassemble the EPIC.

The EPIC is located in the front of the fabricated battery pack carrier and secured with additional brackets and screws to the carrier. The battery pack carrier is secured to the right side of the vehicle floorpan with screws.

The EPIC has three primary functions:

- Convert 260 V Direct Current (DC) to Alternating Current (AC) to provide power for the Motor Generator (MG) from the HEV battery.
- Convert 260 V AC to DC to charge the HEV battery from the MG
- Convert DC to DC to power the vehicle 12 V systems.

The EPIC has five electrical connectors which connect to the following systems/components:

- A 2 pin connector for power supply to the electric A/C compressor
- A single stud connector for 12 V output to the vehicle battery system for primary and secondary battery charging
- A 28 pin low voltage connector for interface between the high voltage system and the vehicle low voltage system
- A 2 pin connector for power supply from the HEV battery
- A 3 pin connector to the Motor Generator (MG).

The EPIC is the central component between the HEV battery and the MG and is also linked to vehicle low voltage 12 V system. The EPIC has an integral control module which manages the power conversion, monitors the operating status of the EPIC and controls the 3-phase output to drive the MG as a motor.

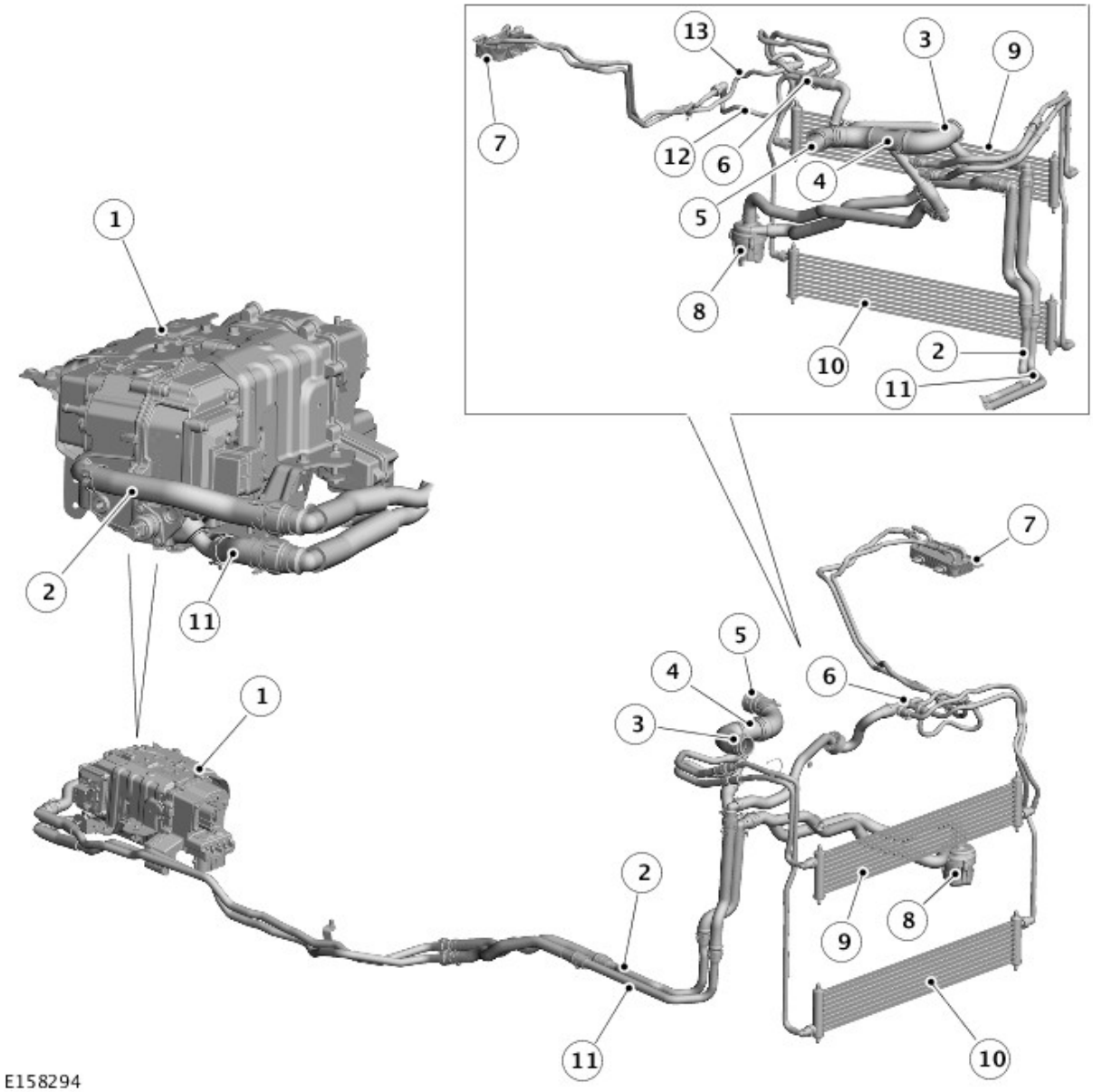
The EPIC has two functions; an inverter and a converter.

The AC/DC inverter performs two functions; to regulate and convert 260 V DC current from the HEV battery into three-phase AC current to operate the MG as a motor and to regulate and convert three-phase AC from the MG to 260 V charging input into the HEV battery. The inverter monitors current, voltage and thermal temperatures of the unit to protect against over current, over voltage and over temperature of the inverter via communication with the integral control module. The inverter also generates and controls its own internal power supply.

The DC/DC converter regulates and transforms the 260 V DC current from the HEV battery or MG to 12 V DC to charge the vehicle 12 V primary and secondary batteries. It also provides a protective insulation between the high voltage (260 V) and low voltage (12 V) systems. Current, voltage and thermal temperatures are monitored to protect the unit against over current, over voltage and over temperature of the converter via communication with the integral control module. The MG also generates its own internal power supply.

The EPIC integral control module is connected on the CAN HEV systems bus and can communicate with the BECM and other vehicle systems to control the HEV systems.

EPIC Cooling System



E158294

Item	Part Number	Description
1	-	EPIC
2	-	Coolant return to EPIC coolant pump
3	-	Radiator upper hose to radiator
4	-	Vortex manifold
5	-	Engine water outlet hose connection
6	-	Five way manifold
7	-	Engine fuel cooler
8	-	EPIC coolant pump
9	-	Upper EPIC cooler
10	-	Lower EPIC cooler

11	-	Coolant supply to EPIC
12	-	Fuel cooler supply hose
13	-	Fuel cooler return hose

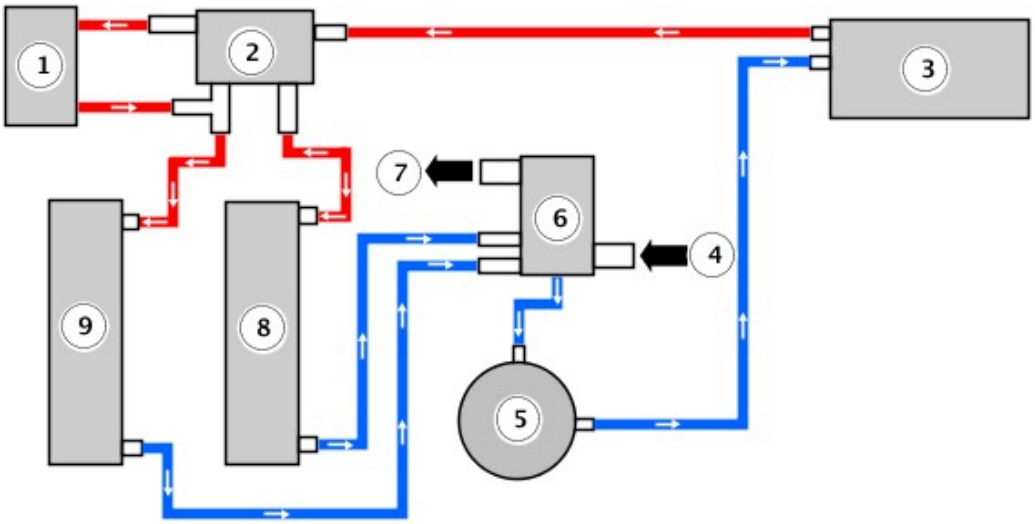
The EPIC cooling system is integrated into the engine cooling system. The EPIC cooling system uses the engine cooling circuit and engine coolant, but is separated from the engine cooling system by a vortex manifold. The EPIC cooling system has an electric EPIC cooling pump to circulate coolant around the EPIC cooling circuit.

Two dedicated coolers are located in front of the engine cooling radiator. These receive coolant returning from the EPIC via a five way manifold. Coolant from the five way manifold is also directed through the engine fuel cooler to cool the fuel before it enters the engine fuel system.

The vortex manifold is located in the engine upper hose. The vortex manifold has baffles which direct the flow individually around the engine cooling and EPIC cooling circuits, keeping the two circuits separated but allowing the circuits to share the same coolant supply.

The EPIC coolant pump receives a 12V power supply from the EJB and is controlled by the EPIC integral control module using a PWM output. A temperature sensor internal in the EPIC measures the coolant temperature and controls the flow around the EPIC cooling system using the PWM output to control the speed and flow from the EPIC coolant pump.

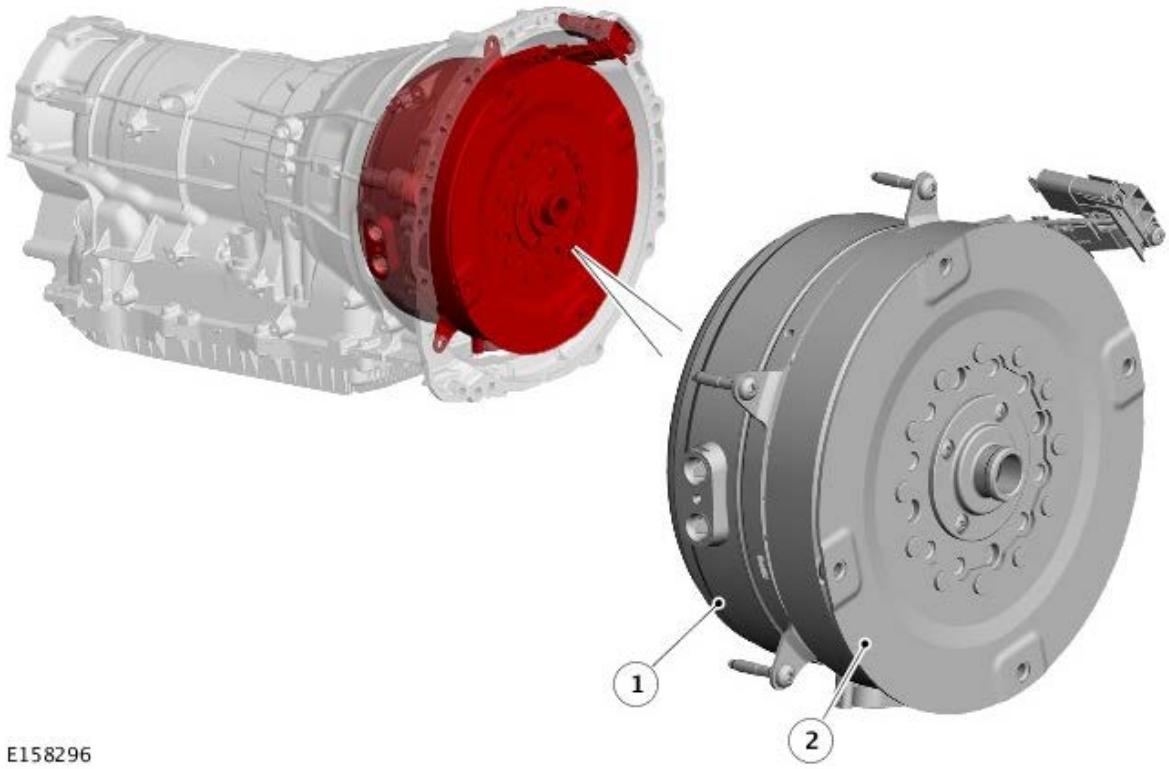
EPIC Cooling System Schematic Diagram



E158295

Item	Part Number	Description
1	-	Fuel cooler
2	-	Five-way manifold
3	-	EPIC
4	-	Engine coolant from engine water outlet
5	-	EPIC coolant pump
6	-	Vortex manifold
7	-	Engine coolant to radiator upper hose
8	-	Lower EPIC cooler
9	-	Upper EPIC cooler

Motor Generator (MG)



E158296

Item	Part Number	Description
1	-	Motor Generator (MG)
2	-	Dual mass flywheel

WARNING: The MG uses and generates voltages of up to 300 V which can cause serious injury or death.

Do not short circuit any terminals.

Do not disassemble the MG.

The Motor Generator (MG) is located within the automatic transmission housing together with a dual mass flywheel, and is connected to the transmission input shaft via a disconnect clutch. The dual mass flywheel acts in the same way as on a non-hybrid vehicle to smooth the transient firing pulses from the engine. As well as the disconnect clutch between the input shaft and the MG, there is a larger launch clutch located within the transmission. There is no torque converter in this system, but the two clutches act to provide similar functionality to a torque converter in a traditional automatic transmission. On vehicle deceleration the MG applies regenerative braking to apply a charging current to the HEV battery pack and assist the vehicle braking system. For details on regenerative braking refer to Braking Control System
For additional information, refer to: Braking Control System - SDV6 3.0L Diesel - Hybrid Electric Vehicle (206-11 Brake Controls, Description and Operation).

The dual mass flywheel transfers the torque from the engine to the transmission, replacing the conventional torque converter. For additional information, refer to: Transmission Description (307-01B Automatic Transmission/Transaxle - Vehicles With: 8HP70 8-Speed - Hybrid Electric Vehicle - Automatic Transmission – AWD, Description and Operation).

When the vehicle is decelerating, the MG performs 'regenerative braking' which uses the motor to slow the vehicle in conjunction with the ABS and to simultaneously use the regenerative braking to provide a charging input to the HEV battery.

The MG is controlled by the HEV software located in the ECM in conjunction with the EPIC integral control module.

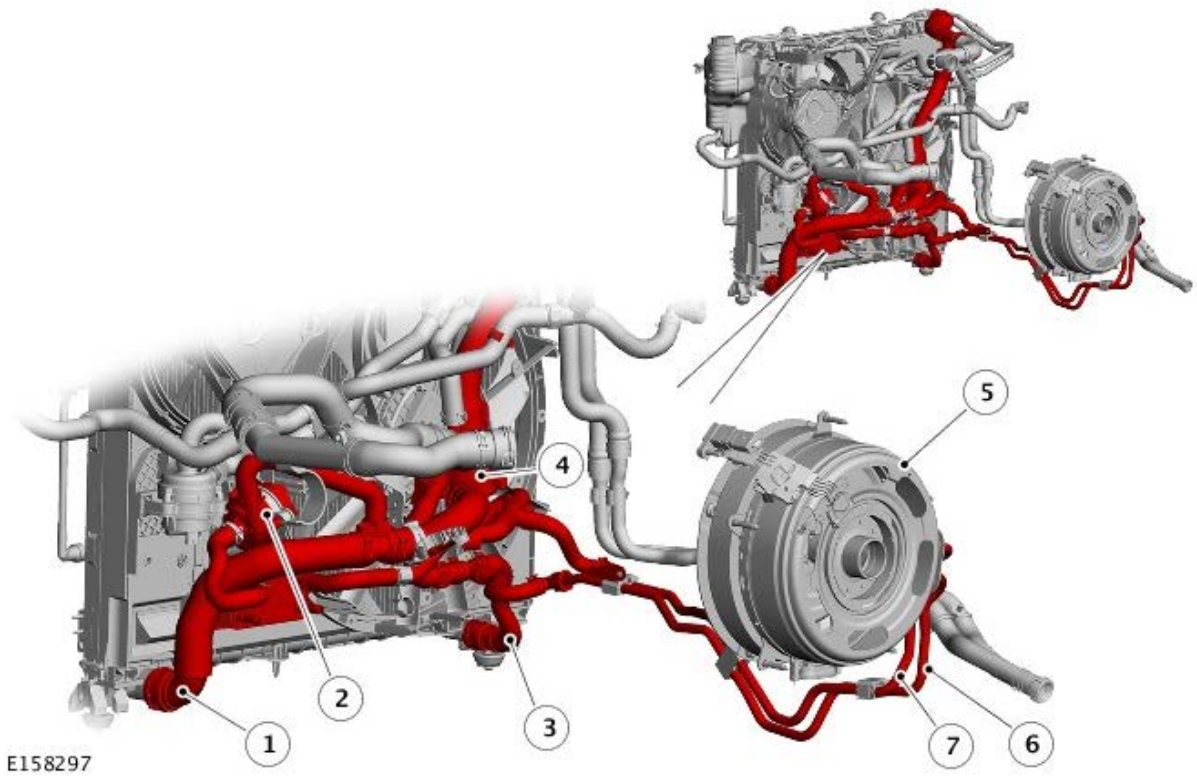
When the MG is being used as an electric motor to provide torque into the transmission, the EPIC controls the MG operation to provide the requested torque. The MG uses a 3-phase AC output from the EPIC. The torque required is regulated by the EPIC which supplies an AC frequency which is proportional to the required rotation speed of the MG.

The MG comprises a multi-pole rotor and a stator containing 24 coils.

The rotor is a multi-pole permanent magnet which provides constant magnetic field output. The rotor has splines which mesh with splines on the automatic transmission input shaft. Torque from the vehicle engine or the MG is achieved through the rotor.

The stator coils are divided into three sets of eight coils which are connected in series. Each set of coils corresponds to a single phase of the three phase AC output.

Motor Generator (MG) Cooling System



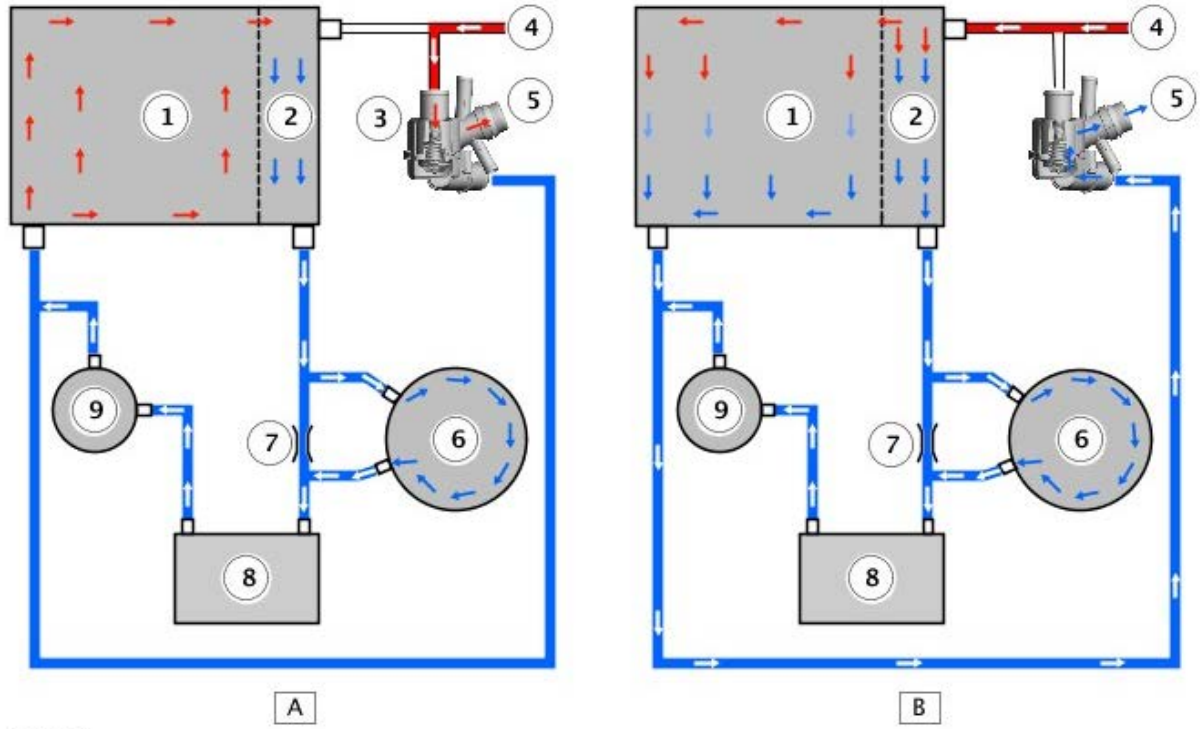
Item	Part Number	Description
1	-	Radiator lower hose
2	-	Motor Generator (MG) coolant pump
3	-	Radiator sub-cooler lower hose
4	-	Thermostat
5	-	Motor Generator (MG)
6	-	Coolant inlet to MG
7	-	Coolant outlet from MG

The MG cooling system is integrated into the engine cooling system. The MG cooling system uses the engine cooling circuit and engine coolant. Engine coolant is circulated through the MG using an electric MG coolant pump to circulate engine coolant through the MG and also through the Automatic Transmission Fluid (ATF) cooler.

A three-way connector on the MG coolant outlet pipe has a restrictor which ensures coolant flow passes through the MG, while allowing a limited flow direct through the ATF cooler. The coolant from the MG cooling system passes through the ATF cooler after it has passed through the MG..

The MG coolant pump is controlled by the HEV software located in the ECM using a PWM output. A temperature sensor in the MG and a temperature sensor in the automatic transmission, measure the coolant temperature and controls the flow around the MG and ATF cooling system using the PWM output to control the speed and flow from the MG coolant pump. The pump is permanently operating when the vehicle ignition is on (power mode 6). The ECM controls the operation of the active grille air shutter and the engine cooling fans. When additional cooling is required, the ECM will open the active grille air shutters to provide cooling. If the temperature cannot be lowered by opening of the active grille air shutters, the ECM will then operate the electric cooling fans.

Motor Generator (MG) Cooling Schematic Diagram



E158298

Item	Part Number	Description
A	-	Thermostat closed
B	-	Thermostat open
1	-	Main radiator
2	-	Radiator sub-cooler
3	-	Thermostat
4	-	Hot engine coolant return
5	-	Engine coolant inlet
6	-	Motor Generator (MG)
7	-	Restrictor
8	-	Automatic Transmission Fluid (ATF) cooler
9	-	Motor Generator (MG) coolant pump

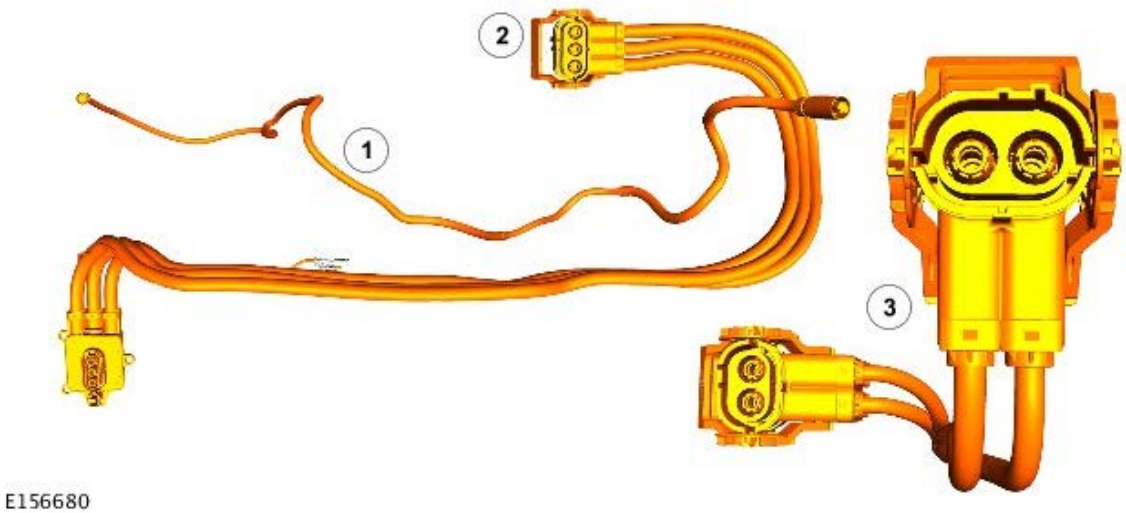
High Voltage (HV) Cables and Grounds

WARNING: Ensure the Hybrid Electric Vehicle high voltage electrical systems are isolated and safe before performing any maintenance procedures. Serious injury or death could occur.

The high Voltage (HV) cables are coloured orange for easy identification. Each HV cable connector has a mechanical locking device which ensures the HV cable is securely fitted and prevents the HV cables being connected to the incorrect sockets in the components. The HV cable that connects between the EPIC and the MG is a 3-phase HV cable carrying AC current.

The HV cables and connectors are heavily insulated to protect against ingress of dirt or moisture and to provide resistance to impact damage.

High Voltage Cables



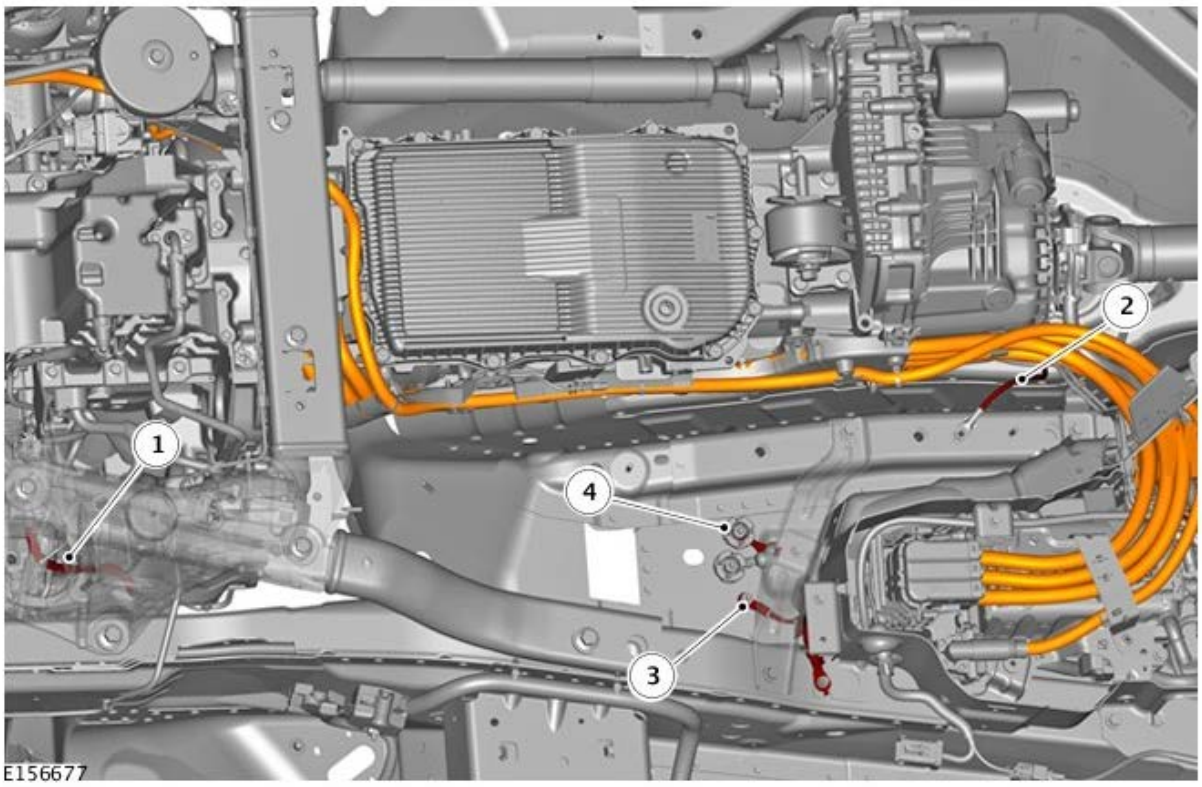
E156680

Item	Part Number	Description
1	-	Electric A/C compressor high voltage cable
2	-	EPIC to MG 3-phase high voltage cable
3	-	EPIC to HEV battery high voltage cable

All HEV components are electrically bonded to the vehicle body to provide against electrical shock.

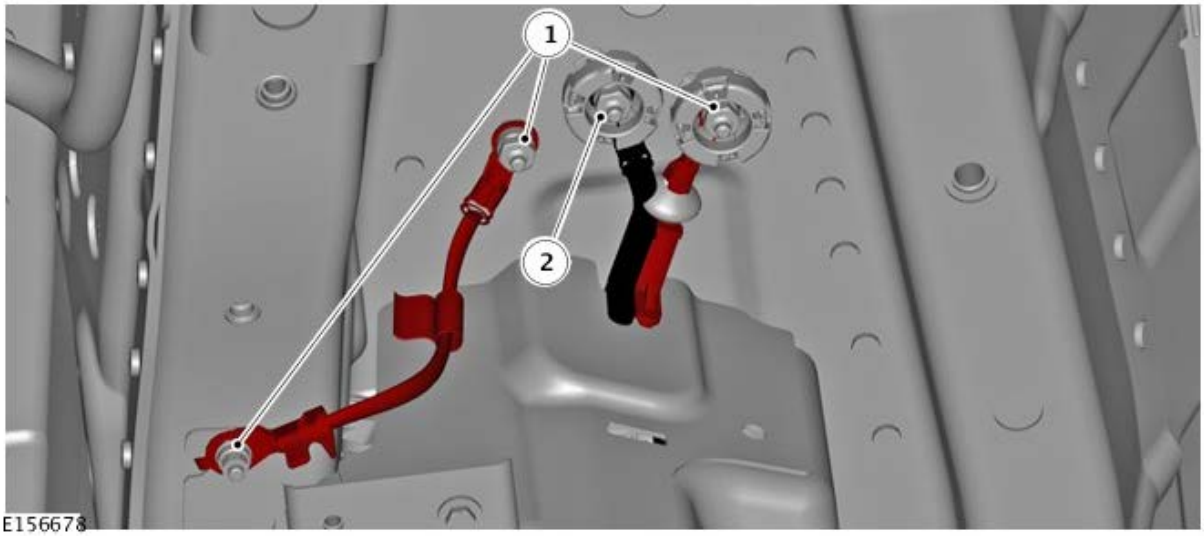
All components have a bonding strap to the vehicle body which links all the components together via the vehicle body. If a ground fault for example should occur, the bonding system ensures all components remain at the same potential or voltage, protecting from electric shock. This also protects against any high voltages passing through the vehicle body, therefore protecting the vehicle occupants from high voltages should a component failure occur.

Grounds

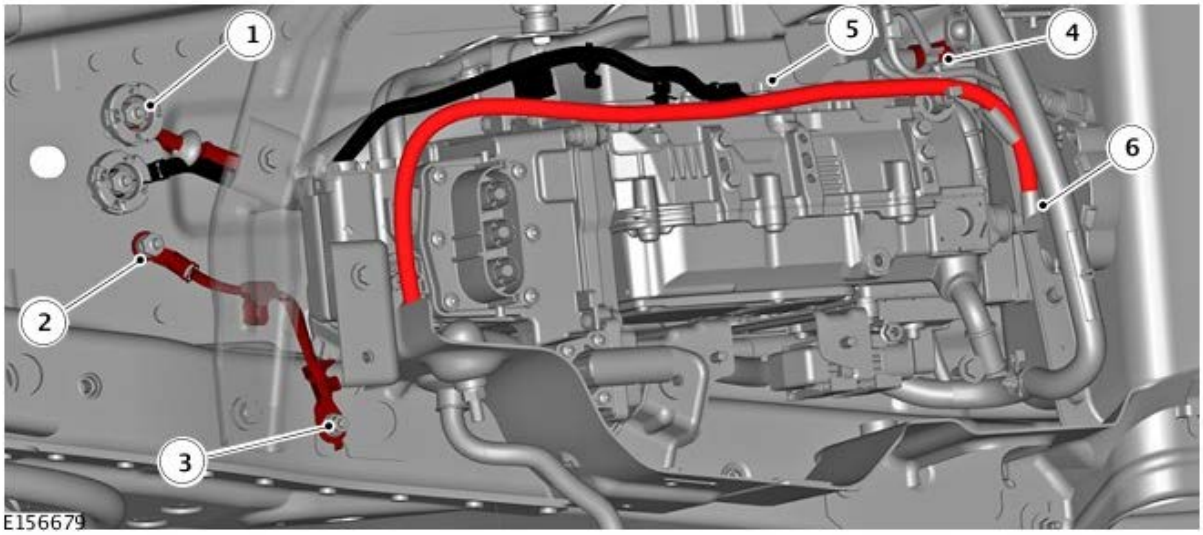


E156677

Item	Part Number	Description
1	-	Engine to vehicle body ground bonding strap
2	-	Transfer case to vehicle body ground bonding strap
3	-	HEV battery pack cradle to vehicle body ground bonding strap
4	-	HEV battery to vehicle body ground bonding strap



Item	Part Number	Description
1	-	Ground bonding strap attachment points
2	-	Low voltage supply (12 V) ground bonding strap



Item	Part Number	Description
1	-	HEV battery ground bonding strap
2	-	HEV battery pack cradle ground bonding strap vehicle body attachment point
3	-	Vehicle body attachment point
4	-	HEV battery ground bonding strap
5	-	EPIC Low voltage (12 V) ground bonding strap
6	-	Low voltage (12 V) power supply cable

It is important that all high voltage and ground point connections are clean and secure.

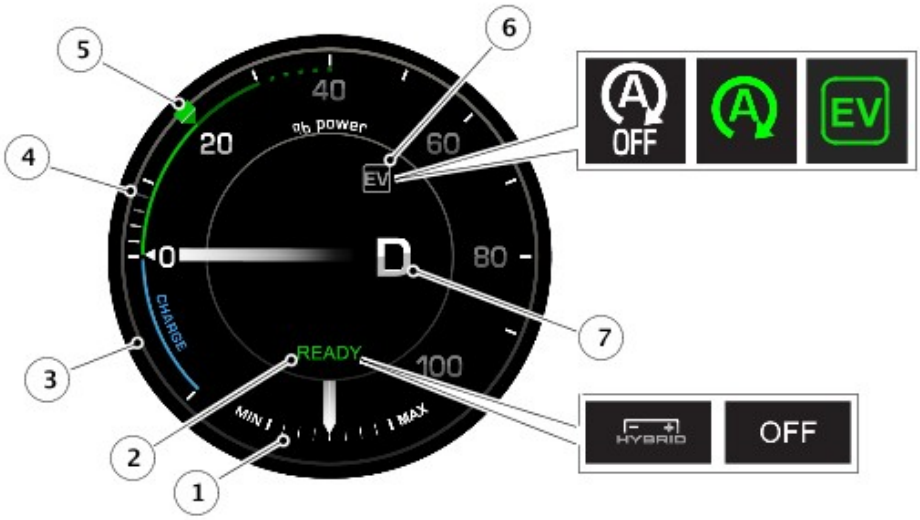
Ground bonding strap connections must be clean of dirt, paint and grease. Care must be taken to make sure the connections are tightened to the correct torque. Over-tightening will damage the bonding strap, reducing its capacity to function correctly.

Instrument Cluster

The instrument cluster has a Hybrid Power display which provides the driver with information about the hybrid system.

The Hybrid Power display replaces the tachometer and is displayed when required. Certain vehicle operating conditions can substitute between the Hybrid Power and tachometer displays giving each priority depending on the vehicle operating condition.

A reduced Hybrid Power display option is also available. When the reduced display is active, the tachometer and engine temperature is displayed and information messages relating to the hybrid system are turned off. When HEV mode is active the hybrid power gauge and the HEV battery charge gauge is displayed. The reduced hybrid power display option can be changed using the instrument cluster 'Hybrid Content' menu.



E158299

Item	Part Number	Description
1	-	HEV battery state of charge gauge
2	-	Hybrid system status indicator
3	-	HEV battery charging gauge
4	-	Power gauge
5	-	Engine start marker
6	-	EV mode
7	-	Transmission gear selection indicator

"HEV Battery State of Charge Gauge - displays the current state of charge of the HEV battery. In Normal Car Mode the scale represents the range 39% to 52% battery charge, with the top blue increment range representing 52% to 65% battery charge. Note that prior to PDI (pre-delivery inspection) the vehicle is in Transit Mode and the scaling is 39% to 52% and of the blue increment range represents 60 to 65% battery charge providing a clear indication of the minimum charge (60%) at which the vehicle should be released from the factory."

HEV Battery State of Charge Gauge - displays the current state of charge of the HEV battery. The scales represents the range 35 - 65 % power.

Hybrid system Status Indicator - displays 'READY' when the Hybrid system is available to deliver power when required but is idle at this time, the vehicle is ready to be driven. The icon changes to the Hybrid +/- icon when the system is actively working. The state of charge gauge will display the word 'OFF' when the system is not active; the vehicle is not ready to be driven.

HEV Battery Charging Gauge - displays the amount of charge being supplied to the HEV battery when the vehicle is recuperating energy from regenerative braking or coasting. During these conditions the needle will remain at 0 and the gauge is progressively filled with blue increments to display the charging amount.

Power Gauge - displayed scale indicates the amount of power requested and is displayed as a percentage. The green area indicates the most fuel efficient range or best for economy zone, the scale beyond the green band is greyed out until the needle passes the green band.

"Engine Start Marker - If EV Mode has been selected the Engine Start Marker is illuminated in green, and indicates the approximate power at which the engine will start. The marker moves because the power depends on MG speed."

EV Mode Indicator - EV mode indicator is illuminated in a green colour to indicate to the driver that EV mode has been selected. The EV mode indicator changes to a grey colour when the vehicle is no longer driving exclusively with electric power.

DESCRIPTION - DUAL BATTERY SYSTEM WITH STOP/START SYSTEM

Primary Battery

The primary battery is located in a plastic tray under the luggage compartment floor in a central position in the luggage compartment, below the suspension air supply unit. A foam pad and the air suspension air supply unit bracket secures the primary battery in position. The battery is vented via a tube which passes through a grommet in the floorpan.

On new vehicles the primary battery positive terminal is fitted with a transit relay. The transit relay must be removed using the correct process detailed in the Pre Delivery Inspection (PDI) manual.

The battery negative terminal is fitted with a BMS control module. The BMS control module is integral with the battery negative cable and communicates with the GWM via a LIN (local interconnect network) bus connection. The battery condition information is passed to the GWM which controls the charging output accordingly via the ECM.

CAUTION: To avoid damaging the BMS control module, always use the ground (negative (-)) terminal stud point on the right side top mount. Never connect directly to the primary battery negative terminal when connecting a slave power supply to the vehicle, the BMS control module can be damaged.

Failure to use the recommended ground point will lead to the setting of a DTC. Incorrect information of battery condition will be retained by the BMS control module due to the unmonitored current flow into the battery. The system will however, recognize and compensate for the change in battery status after a period of time.

If a new battery is fitted, the BMS control module will require re-calibration using a Land Rover approved diagnostic system. Replacement of the BMS control module requires no action as the control module will re-calibrate automatically.

Secondary Battery

The smaller secondary battery is located in the right side of the luggage compartment on a battery support tray and secured with a strap bolted to the tray. The battery negative (-) terminal is connected via a cable to the vehicle body. The positive (+) terminal is connected by a cable to the PSDB. The battery is vented via a tube which passes through a grommet in the floorpan.

The state of charge of the secondary battery is monitored by the Gateway Module (GWM).

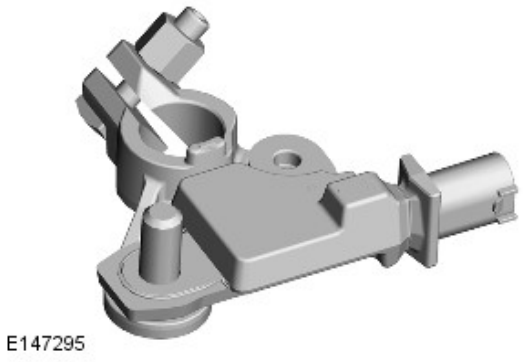
Auxiliary Battery - TDV6 3.0L Diesel Cold Climate Vehicles Only

The auxiliary battery is located on the right side of the luggage compartment on a battery support tray and secured with a strap, threaded rods and a clamp bolted to the tray. The battery negative (-) terminal is connected via a cable to the vehicle body. The positive (+) terminal is connected by a cable to the PSDB. The battery is vented via a tube which passes through a grommet in the floorpan.

The state of charge of the auxiliary battery is monitored by the Gateway Module (GWM) using the BMS control module.

Battery Monitoring System (BMS)

Battery Monitoring System Control Module



NOTE: The secondary battery on stop/start system vehicles is not fitted with a BMS control module.

A BMS control module is located on the primary battery negative (-) terminal. The module is located on the battery post and is clamped to the post with a bolt and nut.

On dual battery vehicles with an auxiliary (cold climate) battery, a BMS control module is located on both the primary and auxiliary battery negative (-) terminals. The BMS control modules are located on the battery post and are clamped to the post with a bolt and nut.

The primary and auxiliary battery negative ground cables are connected to the BMS control module and are attached to a ground stud on the vehicle body.

The BMS control module is connected into the vehicle wiring harness via a multiplug. The BMS control module receives a 12V power supply direct from the primary or auxiliary battery positive terminal. A LIN bus connection provides communication between the BMS control module, the Gateway Module (GWM) and the Quiescent Current Control module (QCCM) for control and monitoring of the battery current drain and state of charge.

The BMS control module measures battery current and voltage, which it communicates to the GWM over a LIN bus connection. The GWM transmits the battery information over the medium and high speed CANbus to other vehicle systems. Based on the information received from the BMS control module, the GWM and the ECM will control the output from the Electrical Power Inverter Converter (EPIC) and request the switching off of electrical loads if necessary.

CAUTION: Due to the self-calibration routine, it is recommended that all power supply diagnostic testing is carried out using the Land Rover approved diagnostic system rather than a digital multimeter.

The BMS control module is able to generate DTC's to help diagnose primary and auxiliary battery power supply issues. These DTC's can be read using the Land Rover approved diagnostic system. The Land Rover approved diagnostic system can also be used to implement a primary and auxiliary battery self test routine. For additional information, refer to the Diagnosis and Testing section of the workshop manual.

If a fault is detected, the GWM and the ECM will override the BMS control module.

The BMS control module DTC's can be used to help diagnose battery power supply faults. The DTC's are stored in GWM. The Land Rover approved diagnostic system has a process for an automated power supply diagnostic procedure. The procedure provides a menu driven process to locate a fault in a logical sequence. The procedure uses the capability of the BMS control module LIN bus controlled functions to provide current flow information and will detect if the BMS control module is functioning correctly.

BMS Low Battery Warning and Energy Management Messages

The BMS continuously monitors the condition of the primary vehicle battery. If excessive battery discharge occurs, the system will begin to shut down non-essential electrical systems in order to protect the battery.

If the BMS calculates that battery condition is not within set parameters, there are 3 messages that can be displayed, 2 on the touch screen and 1 on the message center. These inform the user that the battery is either at a low level of charge or the engine-off power consumption limit has been exceeded.

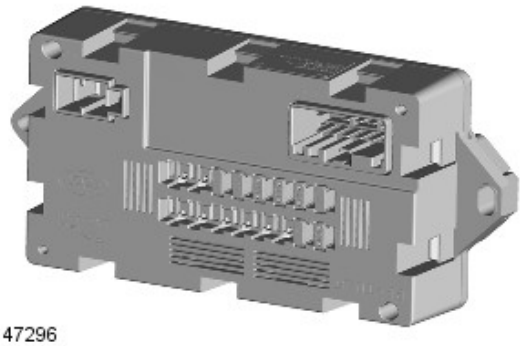
- **Low Battery - Please switch engine on or system will shutdown in 3 minutes**: is displayed as a **Warning** on the touch screen if the engine is not running. This indicates that the battery has fallen below a predefined threshold. As soon as the battery is charged back above this threshold then the message will be removed.
- **Low Battery - Please start your engine** is displayed on the message center if the engine is not running. This indicates that the battery has fallen below a predefined threshold. As soon as the battery is charged back above this threshold then the message will be removed or it can be manually removed by pressing 'OK'.
- **System will shut down in 3 minutes**: is displayed as an **Energy management** on the touch screen if the engine is

not running, and system features are causing excessive battery discharge. After 3 minutes the BMS will begin shutting down vehicle systems. Normal system operation will resume when the engine is started.

This is based on a percentage of battery capacity available for the customer to use with the engine off. The percentage can change based upon several factors.

Once triggered, the resetting of this message will not occur until the vehicle is driven for 10 minutes with the engine running (to allow the battery to recoup any lost charge). However, if the engine is run for less than 10 minutes, the message will only be displayed after an additional 5 minutes with the ignition on but engine off.

Quiescent Current Control Module (QCCM)



E147296

The quiescent current control module is located right rear corner of the luggage compartment.

An addition to the Battery Monitoring System, and using signals already transmitted by the BMS control module(s), the quiescent current control module cuts power supply to other non-essential control modules to avoid excessive discharge of the primary battery. The systems supplied via the quiescent current control module are the audio/entertainment systems and the climate control systems.

Some control modules can cause unnecessary battery drain due to the module staying awake after the vehicle electrical system has been shut down. The quiescent current control module in conjunction with the GWM, monitor and control the systems to prevent battery drain.

The system consists of three components:

- The BMS control module
- The GWM
- The quiescent current control module.

The battery monitoring system checks primary battery health by analyzing battery quiescent current, battery current drain or state of charge, and determines if any action is required to protect the primary battery. If action is required this is communicated to the GWM.

The GWM control logic uses this information to determine if action is required to assist primary battery protection. The quiescent current control module receives open and close commands from the GWM and reacts accordingly.

The software that controls the quiescent current control module is contained within the GWM.

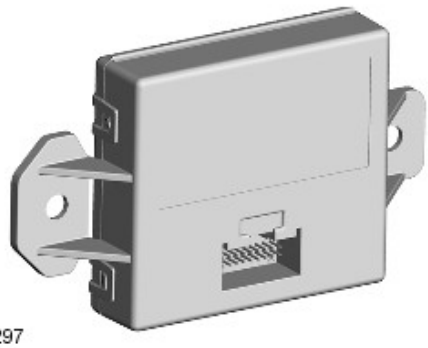
The system will be set in transit mode on delivery. Transit mode has no quiescent current control module operation and the relays remain closed. Therefore battery drain could occur and the system will not react to it.

A PDI process requires the system to be put into Normal mode, which enables the quiescent current control module, before handing over to the customer.

The quiescent current control module has a routine to clean the relay contacts if required. This routine is performed using the Land Rover approved diagnostic system and, if unsuccessful, the unit will require replacement.

The module contains a number of fuses which supply and protect the audio/entertainment systems, the climate systems, PSDB and the GWM.

Gateway Module (GWM)



E147297

The GWM is attached to a bracket, which is bolted to the passenger side of the cross-car beam, behind the instrument panel.

The GWM contains software to control the following functions:

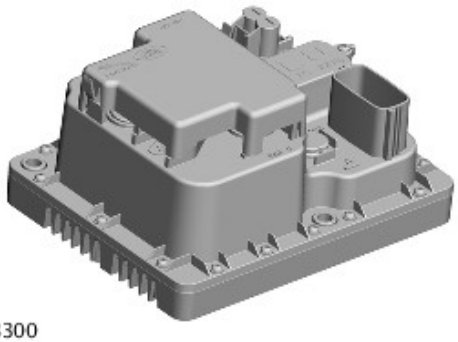
- Determine condition of primary, auxiliary and secondary batteries
- Control the output from the EPIC using load management software in conjunction with the ECM

- Controls stop/start system using power management to inhibit unnecessary electrical loads
- Control the PSDB to enable the switching of the contactors.

The GWM communicates with other system modules on the high speed and medium speed CAN buses.

The GWM communicates with the BMS control module and the PSDB via a LIN bus.

Power Supply Distribution Box (PSDB)



E158300

The PSDB is located in the right side of the luggage compartment, rearward of the BJB. The PSDB houses two contactors which are controlled by the GWM for switching power supplies during stop/start cycles and also for charging the secondary or auxiliary battery.

The PSDB receives a battery supply direct from the primary battery to contactor 1 and a battery supply from the secondary or auxiliary battery to contactor 2 vi a 100A megafuse.

The PSDB receives a battery supply from the primary battery to contactor 1 via the battery 500A megafuse and the Battery Junction Box 2 (BJB2) and a battery supply from the secondary or auxiliary battery to contactor 2.

Field Effect Transistor's (FET) are located in the PSDB. The FET's are connected in parallel with contactor 1 and allow the primary battery power to flow to the sensitive loads during the contactor switching process to ensure there is no interruption in power supply to the sensitive loads. The FET's also act as a secondary path to allow power to be supplied to the sensitive loads should a fault occur and the contactor 1 becomes stuck open. The FET's will allow a current of up to 200A to flow through them.

A LIN bus connection from the GWM passes contactor operation signals to the PSDB which operates the contactors as applicable.

The GWM will also instruct the PSDB to apply charging to the secondary or auxiliary battery via a LIN bus message. The GWM instructs the PSDB of the charging current required for the secondary or auxiliary battery and the PSDB applies the requested stabilized current to the secondary or auxiliary battery via a dedicated connection direct to the secondary or auxiliary battery.

The PSDB diagnoses the coils of the contactors and will report a fault via the LIN bus to the GWM.

OPERATION

OPERATION - HYBRID ELECTRIC VEHICLE (HEV) BATTERY PACK AND MOTOR GENERATOR

HEV Battery

The Battery Energy Control Module (BECM) monitors and manages the HEV battery system. The BECM is continuously updating its status to the HEV software contained within the ECM.

The BECM HEV battery management system performs the following functions:

- Monitor the voltage and temperature of each cell
- Protect each cell from over-charge and over-discharge
- Calculate and transmit via the CAN HEV systems bus the battery state of charge
- Calculate and transmit via the CAN HEV systems bus the available battery power
- Supply and monitor the High Voltage Interlock Loop.

Each battery cell houses a temperature sensor allowing the BECM to monitor their individual and the overall battery temperature values. The BECM monitors the battery temperature, and using a dedicated cooling circuit, the battery temperature is kept within the range of 28 – 32 °C (82.4 – 89.6°F) when the HEV system is active.

The BECM closely monitors the voltage of the HEV battery and each of the cells. It will employ protection measures if the HEV battery is at risk from under or over voltage.

If the HEV battery system is not within the system operating range of 180 – 296 volts, the BECM issues a CAT 1 fault. The system will still operate but may need attention.

If a cell voltage exceeds the operating limits the BECM issues a fault based on the operating status as shown in the following table:

	> 4.1 Volts	> 4.2 Volts	< 2.0 Volts	< 1.9 Volts
Charging	CAT 6	CAT 6	CAT 6	CAT 6
Driving	CAT 1	CAT 6	CAT 1	CAT 6

The HEV battery is isolated from the high voltage system by three low voltage operated contactors. The BECM controls the software to close or open the contactors, connecting or disconnecting the HEV battery from the high voltage system.

The contactors are critical for the safe operation of the system, the operation is closely scrutinised by the BECM. The BECM software adheres to a strict safety process before any contactor activation occurs.

If the BECM detects any issues with the battery management system the appropriate fault code is logged and transmitted onto the CAN HEV systems bus.

The following fault codes can be stored:

Code Category	Description of fault code
CAT 1	Assigned to errors which occur during a drive cycle, they are collected for warranty or data collection purposes, they are not transmitted onto the CAN HEV systems bus.
CAT 3	Assigned to non-critical errors, system may still function safely but requires attention
CAT 6	Assigned to critical faults which allow the vehicle 5 seconds to go into limp home mode before the system is disabled
CAT 7	Assigned to critical faults which require the immediate shut down of the system

Warning indicators with a related text message are displayed in the instrument cluster for critical and non-critical faults.

An amber warning triangle is displayed with an appropriate message to advise the driver that the HEV system is unavailable to due to operating conditions. For example, if the HEV battery state of charge is too low, the amber warning indicator will be illuminated until the HEV battery reaches the threshold for state of charge. Once the operating conditions are correct, the amber warning indicator will be extinguished and the message will be removed. If the warning indicator remains illuminated the driver must take the vehicle to the dealer to diagnose the fault.

A red warning triangle is displayed with an appropriate message to advise the driver that the HEV system is unavailable due to a permanent fault. The operating range to vehicle may be reduced and the driver must stop the vehicle when safe to do so. The HEV system will require the dealer to diagnose and rectify the fault.

Contactor Operation

Before the BECM connects the HEV battery to the high voltage system, a series of checks and tests must be performed to ensure the system has met all the safety criteria. The BECM has several states of operation, each with a set process:

 NOTE: The system relies on the successful transition from one mode to another to operate correctly; an understanding of each mode may help with diagnosing any system faults.

- **0. Unpowered State**
  - The BECM has never been powered up (new, uninstalled component)
- **1. Initialization**
  - The first time the BECM is connected and receives a 12 volt power supply it will enter this state. The BECM processor wakes up and prepares the BECM for use. Once completed the BECM transitions into the next state.
- **2. Sleep State**
  - In this state all the control functions of the BECM shut down or go into a low power mode to conserve the low voltage battery power. The BECM periodically wakes up to perform a HEV battery cell balancing function. Cell balancing is a method used to gain the maximum power and capacity from a battery cell by ensuring the battery can be charged close to 100% state of charge without the risk of overcharging and therefore damaging the cells. When a valid ignition signal (12 volts) is received by the BECM it will change to the 'Unavailable State'. (12V signal is hardwired to the ignition relay within the Central Junction box (CJB))
- **3. Start-Up State**
  - This state is a transition between the Sleep and the Standby State. During this process the BECM initialises the processor and applies any adaptions which it may have stored in its memory.
  - Vehicle Command verification: The BECM verifies that a current CAN signal requesting the vehicle HEV system remains valid after which the BECM will change to the Standby state.
  - When the system is powering down and changing from the disconnected to the sleep state, operating data is stored in the BECM non-volatile memory during the unavailable state.
- **4. Stand-By State (HEV battery is disconnected)**
  - The BECM closes the negative contactor and the pre-charge contactor. As the current has to flow through a resistor, this allows the high voltage circuit to be charged in a controlled manner. The reduction of current flow prevents any damage occurring to the contacts of the contactors, therefore reducing contactor wear.
  - The BECM compares the battery voltage to the high voltage circuit and monitors the time it takes to reach a fully charged condition. If the high voltage circuit charges to within 5% of the HEV battery voltage, the BECM will change to the running state.
- **5. Pre-Charge State**
  - If the high voltage circuit fails to charge to within 5% of the battery voltage within 640 ms the command to open the contactors is sent. The BECM returns to the standby state. If the BECM enters the Pre-charge state 3 times within 10 seconds there will be a delay for 2 minutes before another attempt to pre-charge is made.
- **6. Running state**
  - When the BECM closes the positive contactor the HEV battery is now fully connected and provides full power to the high voltage circuit.
  - The BECM continuously monitors and manages the HEV battery system to maintain a safe and efficient operation until it receives a request from the vehicle to power down the system or a critical fault occurs.
  - Using this method of connecting the HEV battery to the high voltage system gives the BECM the facility to isolate the HEV battery from the HEV system, providing protection for the HEV battery in conditions which may potentially damage the HEV battery.
  - If a request to power down is sent by the vehicle or a critical fault is detected, the BECM returns to the standby state via the shutdown state.
- **7. Shut-Down State**
  - When the system is powering down and changing from the Running State to the Standby State, operating and diagnostic data is stored in the non-volatile memory.
  - A positive contactor weld check is conducted. The BECM compares the HEV battery voltage to the voltage measured across the positive contactors. Two voltage measurements are taken, one at the negative bus and the other at the positive bus. If the difference between the voltages differs by more than 10 volts, a positive contactor is deemed to be welded closed
  - A negative contactor Weld check is conducted. The BECM compares the HEV battery voltage to the voltage measured across the Negative Contactor. Two voltage measurements are taken, one from the fuse and one from the negative bus. If the voltage differs by more than 10 volts, the negative contactor is deemed to be welded closed.

Contactor Weld Detected



E155741

If the BECM verifies that a contactor has not opened, a red critical warning triangle is displayed in the instrument cluster, accompanied by a red warning indicator.

The vehicle may still be driven, however the system may be unable to completely isolate the HEV battery. The 3-phase high voltage cables may remain live and extreme care must be taken when working on the vehicle.

Under no circumstances should an attempt be made to decommission the vehicle.

A contactor actuators driver check is conducted. A continuity test is conducted on the three actuator driver circuits to verify they are functioning correctly.

A failure of any of the above tests will result in the appropriate fault code being logged. These will be of a CAT7 status and the HEV system will be disabled.

Battery Voltage Verification: The BECM checks the HEV battery open circuit voltage to determine the state of charge.

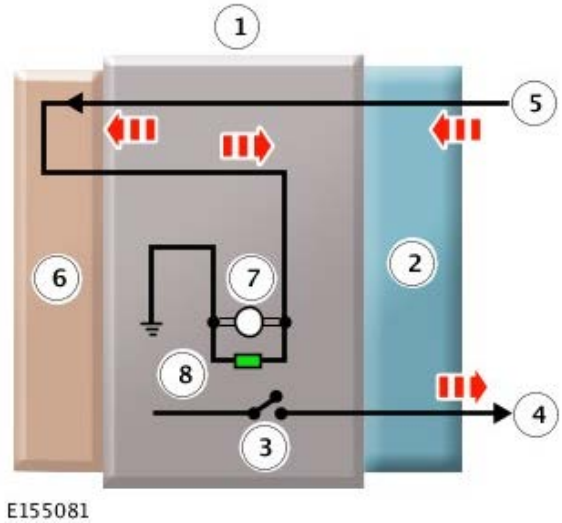
From Start-up to Shut-down the following diagnostic checks are performed continuously:

- Category Fault Check: The entire High Voltage system is checked for the presence of any CAT6 or 7 faults.
- A valid and correct emergency notification signal has been received by the BECM.
- The internal isolation test produced a valid result.
- The High Voltage Inter-lock Loop is complete.

High Voltage Interlock Loop

The BECM uses a low voltage integrity circuit or loop to monitor and ensure all of the components of the high voltage circuit, including the high and low voltage harness connections, are securely connected.

If the high voltage interlock loop becomes open-circuit or the current drops below a pre-determined threshold, the BECM transmits a CAT7 fault via the CAN HEV systems bus. If this occurs during the disconnected state the contactors remain open, if in the Pre-Charge or Running state the contactors are immediately opened and the HEV system is disabled.

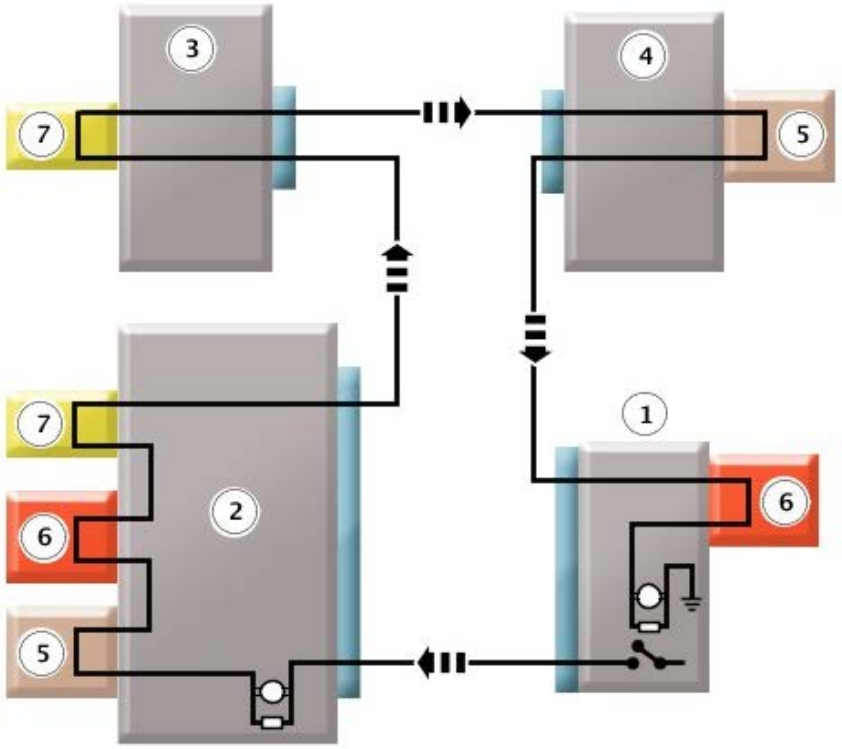


E155081

Item	Part Number	Description
1	-	Battery Energy Control Module (BECM)
2	-	Low voltage connector
3	-	Transistor
4	-	High voltage interlock loop - output
5	-	High voltage interlock loop - input
6	-	3-phase high voltage cable connector - HEV battery to Electric Power Inverter Converter (EPIC)
7	-	Current sensor
8	-	150 Ohm resistor

The high voltage interlock loop check is only conducted once a valid Emergency Notification Signal has been received by the BECM. When active, the BECM applies a 12 volt supply via the transistor to the high voltage interlock loop output line. The high voltage interlock loop output line passes through the high voltage connector to the EPIC. From the EPIC, the circuit passes through all of the other components before returning to the BECM via the high voltage interlock loop input line.

The high voltage interlock loop circuit flows through the high voltage connector to complete the circuit. This ensures the connectors are fitted and secured correctly. This principle is applied to all of the high and low voltage connectors.



E155082

Item	Part Number	Description
1	-	Battery Energy Control Module (BECM)
2	-	Electric Power Inverter Converter (EPIC)
3	-	Electric Air Conditioning (A/C) compressor
4	-	Motor Generator (MG)
5	-	MG 3-phase high voltage cable
6	-	HEV battery 3-phase high voltage cable
7	-	Electric A/C compressor 3-phase high voltage cable

The EPIC contains a current sensor and a 150 Ohm resistor, similar to the one shown in the BECM. The EPIC validates and checks the current flow and, depending on the result, it will then issue a high voltage interlock loop 'Okay' or high voltage interlock loop 'Not Okay' message to the BECM via the CAN HEV systems bus.

The BECM allows a time of 350ms to validate the current flow, the response from the EPIC will be as follows:

- EPIC high voltage interlock loop status to verify 2 or high voltage interlock loop not checked
- Followed by:
- EPIC high voltage interlock loop status 1 or high voltage interlock loop 'OK.' Upon receipt of a valid high voltage interlock loop 'OK' message, the BECM will perform a high voltage interlock loop circuit test via the current sensor and the 150 Ohm resistor.

The high voltage interlock loop and resistance values are verified in the following table:

Voltage	Loop Resistance	Loop Current	High Voltage Interlock Loop Status
12V	<1700 Ohm	>5A	Okay
12V	>1700 Ohm	<5A	Not Okay

Battery Care

The HEV battery is a non-serviceable assembly. In the event of an internal fault the module must be returned to Land Rover. The battery case must not be opened in any circumstances.

Any HEV battery which is to be stored before it is fitted to a vehicle should be kept in a dry, ventilated area away from moisture

and at a temperature of between -10 and 30°C (14 - 86°F). Lower temperatures reduce the self-discharge rate of the battery cells.

The BECM is designed to reduce the risk of an electric shock; the contactors are open by default. However, care should be taken when handling the HEV battery to avoid any damage which may increase the risk of an electric shock.

If the HEV battery appears to be damaged or if damage is suspected but not visible (For example it has been dropped or the vehicle has been involved in an accident), it should be returned to Land Rover and a replacement HEV fitted.

The battery must not be left in an inverted position for a time exceeding 6 hours. Store the HEV battery in its installed orientation.

Care must be taken when handling the HEV battery due to its weight and avoid any damage to the connecting interfaces. Protective covers must be used if the HEV battery 3-phase high voltage cable has been removed. All protective covers must be removed or fitted with care. Damage to the connecting interfaces of either the HEV battery or the 3-phase high voltage cable connections may result in the HEV system not functioning correctly.

The HEV battery will gradually discharge over time even when there is no load connected. This is called self-discharge and is normal behaviour for a Lithium Ion battery. The rate of discharge is expressed as a percentage of the state of charge of the HEV battery. The HEV battery will self-discharge at a rate of 0.3% a day once the BECM has achieved the “Unavailable state”.

The HEV battery must not be allowed to fall below 20% state of charge. If the state of charge falls to below 20%, the BECM will inhibit the closure of the contactors as a protective measure to prevent the battery becoming damaged by over discharging. A HEV battery in this condition must be removed from the vehicle and returned to Land Rover for rectification.

HEV Battery Cooling

Each battery cell in each battery module has a cell temperature sensor. The temperature sensors pass cell temperature information to the Battery Energy Control Module (BECM). The BECM compares the HEV battery coolant inlet temperature to the output from the six battery modules and can regulate the cooling of the battery cells by varying the flow from the HEV battery coolant pump and instructing the Automatic Temperature Control Module (ATCM) to apply air conditioning system cooling through the HEV battery cooler and isolation valve.

The ATCM receives data to evaluate from the BECM with regards to the HEV battery cooling circuit. The BECM monitors the temperature of the coolant within its cooling circuit via a thermistor. The target temperature of the coolant is 10°C (50°F) and the target temperature of the battery cells is 30°C (86°F). The BECM monitors the cell temperature and when it reaches 32°C a request for cooling is transmitted onto the CAN HEV systems bus. When the cell temperature reaches 28°C the request to suspend the cooling is transmitted.

The HEV software in the ECM receives the cooling request along with other data such as the available power from the HEV battery or EPIC relating to the electrical energy level of the HEV system. The VSC will then evaluate the data and pass on the cooling power request to the ATCM.

The ATCM evaluates the climate control request and combines it with the request from the HEV system. The ATCM issues the required speed request to the electric Air Conditioning (A/C) compressor and applies the correct cooling configuration (isolation operation) to suit the current vehicle conditions, while still maintaining the vehicle is operated in the most energy efficient manner.
For additional information, refer to: Air Conditioning (412-01B Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle, Description and Operation).

The ATCM adopts a different cooling strategy in high ambient temperature (50°C (122°F)) conditions. For the first 15 minutes of the vehicle being operated, the HEV battery cooling circuit is isolated from the air conditioning circuit. This is to allow the vehicle interior target temperature to be achieved as quickly as possible. When the vehicle interior has reached the target temperature, or 15 minutes has elapsed, the HEV battery cooling circuit is integrated into the air conditioning cooling strategy by opening the HEV battery isolation valve.

Electric Power Inverter Converter (EPIC)

The EPIC is the central link between all of the components of the high voltage HEV system and is also linked to the vehicle electrical low voltage system.

The EPIC has an integral control module which manages the high and low voltage systems, monitors the operating status of the EPIC and also regulates the 3-phase output to operate the MG as an electric motor or generator.

The engine of the HEV is not fitted with a conventional generator. The vehicle 12V electrical system and the 12 Volt primary and secondary batteries are supplied charging power from the HEV battery via the EPIC when the MG is operating as a generator.

The 12 Volt vehicle electrical system is connected to the EPIC via a cable. This cable on a conventional vehicle would normally be attached to the generator to provide the charging output for the vehicle batteries. In this instance the charging output for the vehicle 12V batteries is provided by the EPIC. The process of 12V electrical supply from the EPIC is performed by an internal step-down transformer.

The EPIC integral control module receives a charging load request via the CAN HEV systems bus from the Gateway Module (GWM) in the same manner as a conventional vehicle 12 volt generator would. It regulates the voltage and current to produce the correct output voltage and current to match the vehicle 12V load request.

This technology allows the high voltage system to remain completely isolated from the 12V low voltage system.

Because 12 Volt vehicle batteries are charged from the high voltage system, if the HEV system is not functioning the 12 volt vehicle batteries will not be charged. The 12 volt vehicle batteries can be charged from an external charger by connection at the charging posts in the same manner as a conventional vehicle. Note that the HEV battery cannot be charged via an external charging device.

Electric Power Inverter Converter (EPIC) Cooling

A large amount of heat is produced within the EPIC as a result of the high electrical loading and, like the HEV battery it has a dedicated cooling circuit. The circuit has an electric EPIC coolant pump for coolant flow and is controlled by the EPIC integral control module using a PWM signal.

The EPIC coolant pump is always active and the PWM is varied by the EPIC integral control module to vary the flow through the system and the two (upper and lower) EPIC coolers. Via the CAN HEV systems bus, the EPIC integral control module issues its cooling status to the HEV software in the ECM. The ECM has a cooling strategy for the vehicle engine cooling system and the HEV EPIC and MG cooling systems and will firstly open the active grille air shutters to improve air flow through the radiator and

EPIC coolers and, if necessary, will operate also the engine cooling fan to control the cooling requirements of the EPIC and MG and the engine cooling requirements.

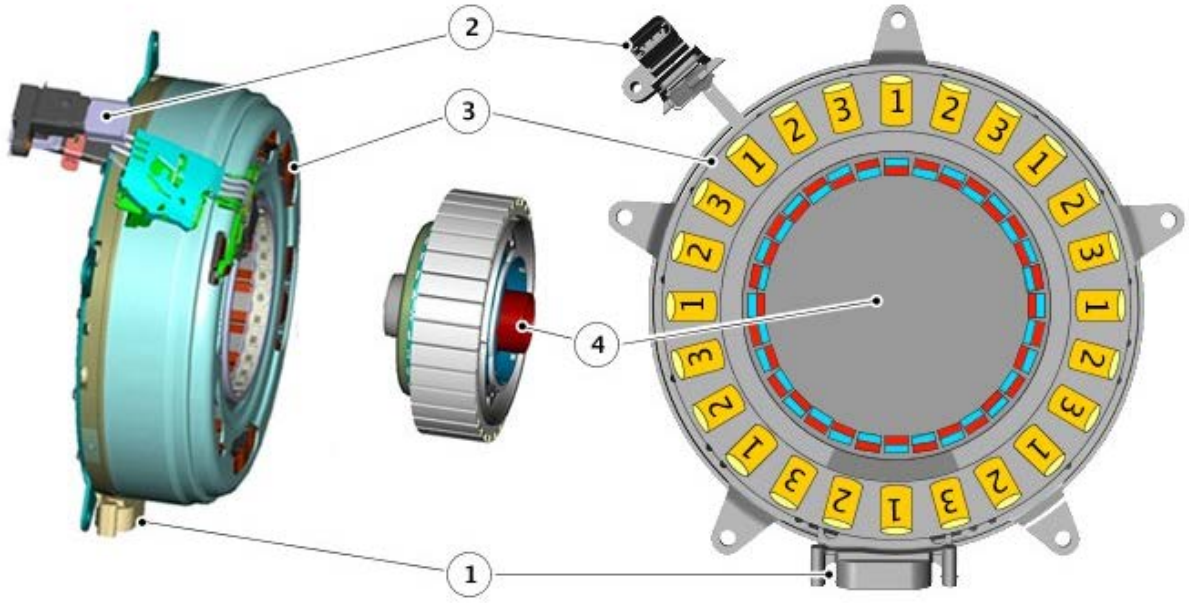
The EPIC cooling circuit connects to the engine cooling circuit by the Vortex Valve (3). The vortex valve allows coolant from the engine cooling circuit to fill the EPIC cooling circuit. When the cooling systems are active the vortex valve separates the coolant flow for each circuit, creating two different temperature cooling circuits that share a common coolant source.

The EPIC regulates the coolant flow from the EPIC through the EPIC upper and lower coolers located in front of the main radiator in respect to the temperature measured by an temperature sensor located within the EPIC. The EPIC cooling system strategy is to achieve a maximum operating temperature of 65°C (149°F). If the EPIC coolant temperature reaches 85°C (185°F) the EPIC may reduce the power output to control the coolant operating temperature.

Motor Generator (MG)

The MG is an AC synchronous motor with a maximum output of 35kW of power or 170Nm of torque. The term 'synchronous' defines that the rotor speed is directly proportional to the frequency of the AC input. (The speed of the rotor will synchronise to the AC frequency applied to the stator coils).

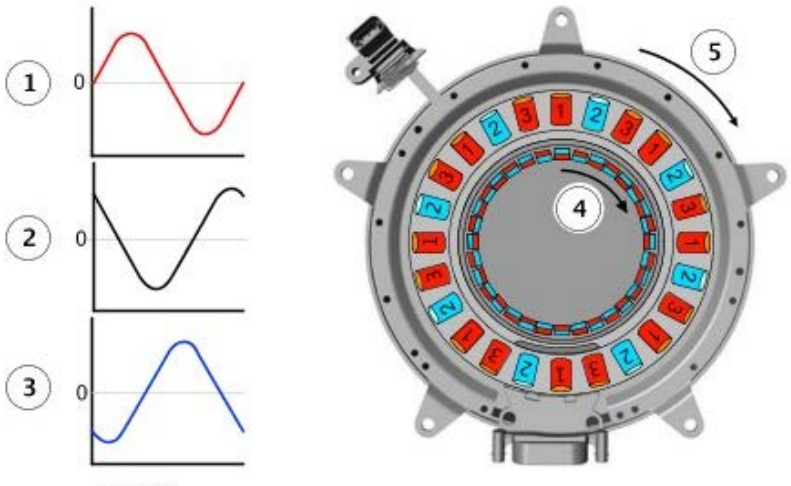
The Stator is formed by the arrangement of 24 coils.



E156683

Item	Part Number	Description
1	-	3-Phase high voltage cable connection
2	-	Speed sensor connector - low voltage
3	-	Stator
4	-	Rotor

The coils are divided into three sets, each containing 8 coils which are wired in parallel. Each set of coils corresponds to a single phase of the 3-phase input. The coils are arranged around the stator in a uniform pattern.



E156684

Item	Part Number	Description
1	-	Phase 1
2	-	Phase 2
3	-	Phase 3
4	-	Magnetic field direction of rotation
5	-	Rotor direction of rotation

As the three separate phases are energized the coil arrangement creates a rotating magnetic field. The speed of the rotating field is directly proportional to the frequency of the AC input. The rotating field ensures the motor is driven in the correct direction of rotation.

The rotor is a 32-pole permanent magnet design which provides a constant magnetic field output. The rotor is splined to the input shaft of the transmission, drive into the transmission by either the vehicle engine or the MG is achieved by rotating the rotor.

The rotating magnetic field of the stator interacts with the magnetic field of the rotor causing the rotor to rotate. As the speed of the rotor becomes synchronised with the rotating magnetic field of the stator, the motor becomes “locked”, in this state the motor achieves its maximum torque output.

The EPIC integral control module must know the position of the rotor at all times. This is achieved by measuring the current in a number of coil windings. The EPIC integral control module needs this information to control the motor speed accurately.

Motor Operation

The EPIC receives a torque request from the HEV software in the ECM. The EPIC integral control module calculates the AC frequency required to rotate the rotor at the correct speed and power output to provide the level of torque requested. The faster the rotor turns the greater the back Electromotive Force (EMF) becomes, so as the AC frequency is increased, the phase voltage is also increased to balance out the back EMF of the rotor and maintain the correct level of power and torque output.

A AC frequency of 0Hz is applied so that the EPIC integral control module can learn the rotor position. When completed, the AC frequency is increased to the calculated target AC frequency to create the required rotating magnetic field within the stator windings.

Rotor speeds are controlled to a minimum speed of 300 rpm, to assist the drive ability of the vehicle.

The 3-phase output to the MG is generated by the EPIC integral control module (EPICM). The HEV battery supplies DC voltage to the EPIC six switch bridge inverter. The vector control strategy of the EPIC integral control module (EPICM) dictates the switching pattern in the six switch bridge inverter to maintain optimum performance.

Regenerative braking is detailed in the Brake Controls section.
For additional information, refer to: Braking Control System - SDV6 3.0L Diesel - Hybrid Electric Vehicle (206-11 Brake Controls, Description and Operation).

Motor Generator Cooling

High temperatures are generated within the MG as a result of the high mechanical and electrical loads that are applied. To regulate the temperature, the MG has a dedicated cooling circuit which is integrated into the vehicle engine cooling circuit.

The MG has a temperature sensor which is hardwired to the EPIC integral control module. The EPIC can regulate the coolant flow through the stator housing by modulating the speed of the electric MG coolant pump using a PWM output. Coolant is drawn from the main radiator sub-cooler, through the MG stator housing, through the Automatic Transmission Fluid (ATF) cooler and then back to the main radiator via the thermostat housing.

When the engine is cold and the thermostat is closed, the coolant returns from the ATF cooler directly into the main radiator lower hose. This ensures that the MG cooling circuit operate independently of the main engine cooling system, while sharing a common coolant source.

The ECM has a cooling strategy for the vehicle engine cooling system and the HEV EPIC and MG cooling systems and will firstly open the active grille air shutters to improve air flow through the radiator and EPIC coolers and, if necessary, will operate also the engine cooling fans to control the cooling requirements of the EPIC and MG and the engine cooling requirements.

Dual Mass Flywheel (DMF)

For additional information, refer to: Transmission Description (307-01B Automatic Transmission/Transaxle - Vehicles With: 8HP70 8-Speed - Hybrid Electric Vehicle - Automatic Transmission – AWD, Description and Operation).

Engine Control Module - HEV Software

Dedicated software for controlling the HEV systems is located in the ECM. The ECM controls the following functions:

- Power up and down of the HEV components
- HEV battery state of charge management
- Calculation of the total powertrain torque and power demand
- Calculation of the optimum proportion of the required torque distribution between the MG and the vehicle engine
- Calculation of the HEV system operating modes
- Management of the driving mode transitions
- Control of the engine disconnect clutch in conjunction with the TCM (transmission control module) to ensure smooth transition of torque
- Energy management control for the electric A/C compressor
- Management of HEV system faults.

Power Up and Down

When the vehicle ignition is on (power mode 6) the ECM sends a command to the BECM via the CAN HEV systems bus to close the HEV battery contactors and to the EPIC to open the discharge contactor thus enabling the HEV system. (The BECM changes from the Sleep state to the Running state).

The BECM transmits to the ECM, via the CAN HEV systems bus, the current HEV battery state of charge and the electrical power limits.

When a normal power down is required, the ECM sends the command to the BECM to open the HEV battery contactors and the EPIC to close the discharge contactor and shut down the HEV system.

HEV Battery State of Charge Management

Based on information from the BECM, the ECM determines if and when the MG should be used as a generator. To maximise efficiency it takes into account the current load of the vehicle engine and then calculates a suitable generator load which has the least impact on fuel economy or the drivers performance request.

The calculated value is then sent to the EPIC via the CAN HEV systems bus.

Calculation of the Total Powertrain Torque and Power Demand

The ECM constantly monitors inputs with reference to the driver's demands and the current vehicle condition. Based on these inputs the ECM calculates the total overall power output required to achieve the driver request.

The accelerator pedal position and speed of application will determine the driver's torque demand.

Once the demand has been calculated, the ECM must consider the operating condition of the vehicle. For example:

- The Terrain Response switchpack input will determine if the stop/start system inhibit mode has been selected.
- The TCM may request a reduction in torque to enable a smooth gear-change to take place.
- The ABS control module may request a torque reduction to implement a traction control situation.
- The driver requests and the correct torque output is calculated, the ECM then selects the optimum method of delivery.

Calculation of the Optimum Proportion of the Required Torque Distribution Between the MG and the vehicle Engine

The ECM has calculated the overall torque output and the current power available from the HEV battery. The ECM conducts "Torque Arbitration", it calculates which power source should deliver what percentage of the required torque. A command is sent to from the ECM to the EPIC as to the torque output required from each power source.

Calculation of the HEV System Operating Modes

Based on driver inputs, the ECM calculates the optimum operating mode that corresponds to the current vehicle operating condition. The ECM manages the driving mode and ensures a smooth transition from one operating mode to another as the vehicle operating conditions vary.

Stop/Start System: The ECM identifies an Stop/Start System 'stop' condition and implements the engine stop providing no inhibitors are present. For a Stop/Start System 'start', the ECM determines the amount of torque required from the vehicle engine to suit the current vehicle operating condition. The ECM starts the engine and applies the correct operating parameters to achieve the target torque output before the drive is connected. This ensures the transition between drives remains smooth.

Management of the Driving Mode Transitions

As the vehicle driving mode changes from one mode to another, the ECM manages the application of the engine disconnect clutch to determine which power source applies the drive into the transmission. The ECM sends the command to the TCM to open or close the disconnect clutch.

Before the clutch is operated the ECM synchronises the speed of the two power inputs so the torque delivery remains uniform and to reduce any slip of the disconnect clutch.

The TCM manages the operation of the launch clutch to ensure the drive into the transmission is delivered to the gear set smoothly. This launch clutch pack has a higher degree of thermal management to allow for sustained periods of slipping.

The torque delivered through the launch clutch is controlled by slipping the launch clutch to eliminate:

- Drivetrain vibrations which can be caused when high levels of torque are applied too quickly
- Drivetrain shudder which can be caused when the drivetrain backlash is greater than the torque applied.

Regenerative Braking

During braking conditions the ECM transmits to the ABS control module the braking torque of the MG when used as a generator. The ABS control module applies a braking strategy to make full use of the MG braking torque whenever possible. The objective of the system is to reclaim as much kinetic energy as possible without impeding the performance of the baking system.
For additional information, refer to: Braking Control System - SDV6 3.0L Diesel - Hybrid Electric Vehicle (206-11 Brake Controls, Description and Operation).

Electric Air Conditioning (A/C) Compressor

The Automatic Temperature Control Module (ATCM) communicates with the ECM with regards to the energy required from the HEV Battery to drive the electric A/C compressor. The ECM determines the level of energy available for use and the ATCM calculates a speed for the electric A/C compressor based upon the result.
For additional information, refer to: Air Conditioning (412-01B Climate Control - SDV6 3.0L Diesel - Hybrid Electric Vehicle, Description and Operation).

HEV System Faults

The ECM is in constant communication with the components of the HEV system. If a fault is reported by any of the components the ECM sends a command to the Instrument Cluster (IC) to display the relevant fault warning icon and text message to the driver. The ECM also supplies the IC with the data for the HEV display in the IC.

Safety Tests

Emergency Notification Signal

The BECM is in constant communication with the Restraints Control Module (RCM) via a hardwired signal wire. The signal has three potential states:

- No event/normal operation: Indicated by a constant 10Hz signal, the battery contacts may be closed when required
- Fuel Cut-off event: An emergency event has occurred, indicated by a varying 250 – 500Hz signal, the battery contacts are opened immediately
- Not healthy: The BECM has not received a valid Emergency Notification Signal from the hard-wired connection to the Restraints Control Module (RCM). A fault is recorded, but the battery contactors may close if the BECM receives a valid Emergency Notification Signal from the RCM as a CAN bus message.

Insulation Tests

The BECM performs two insulation tests on the high voltage circuit to ensure no ground faults exist; an internal test and an external test. A resistance measurement is made between the high voltage circuit and the vehicle body.

- Internal test: Whilst the contactors are open, this test checks the isolation between the high voltage circuit inside the battery and the battery case. If a valid result is not obtained within 5 seconds, the BECM logs an internal isolation fault and the contactors are prevented from closing.
- External test: After the contactors are closed, this test checks the isolation of the complete high voltage circuit, both internally to the battery casing and externally to include the EPIC and the MG. The timing of the test varies to allow the external circuit capacitance to settle. If a fault is found, the BECM logs an external isolation fault, but the system will continue to operate as normal.

The BECM will log a fault if the measured external isolation drops below 40kOhms. Short circuits are protected by a non-serviceable inbuilt 200Amp fusible link.

OPERATION - BATTERY MONITORING SYSTEM AND QUIESCENT CURRENT CONTROL - DUAL BATTERY SYSTEM VEHICLES

When the ignition is off (power mode 0), the BMS control module records the primary battery state of charge (and auxiliary battery where fitted) and begins to monitor the battery condition from this point.

If the battery state of charge falls by 7%, the BMS control module will monitor the primary battery (and auxiliary battery where fitted) for 5 minutes. If after the 5 minute monitoring period, the battery charge has continued to fall due to the quiescent drain current being too high, the BMS control module will determine that some control modules are still 'awake'. The BMS control module sends a shutdown message on the LIN bus to the Gateway Module (GWM). The GWM sends a CAN bus message on both the medium and high speed networks to all control modules, requesting them to shutdown.

The BMS control module will monitor the primary battery (and auxiliary battery where fitted) state of charge for a further 5 minutes and determine if the battery state of charge is still dropping. If a quiescent drain current continues, the primary battery (and auxiliary battery where fitted) state of charge will continue to drop. If the state of charge falls to 12% of the initial monitoring value, the BMS control module determines that one or more control modules are still awake and a failure to respond to the shutdown request may indicate an error state within the control module(s).

The BMS control module sends a 'Power Disconnect' signal to the GWM on the LIN bus. The GWM then sends a signal to the quiescent current control module on the LIN bus to open its internal relays. When the quiescent current control module relays are open, the power supply from the primary battery (and auxiliary battery where fitted) to non-critical control modules is removed. The non-critical control modules are any modules associated with the infotainment system and also the climate control system. Once the infotainment system modules have been switched off, the vehicle must be run for at least 5 minutes to charge the battery before the system modules can be operated with the engine switched off.

The use of a LIN bus communication ensures that no other control modules are 'woken' during this process. IfCAN bus communication was used, all modules on the CAN bus would be woken by the message.

BMS Control Module Self Calibration

Periodically the BMS control module will initiate a self-calibration routine. To self calibrate, the battery monitoring system first charges the battery to its full condition.

NOTE: If the vehicle is only driven for short periods the charging process could take a number of days to complete.

Once the battery is fully charged, the BMS control module will discharge the battery to approximately 75% of its full state of charge, but never lower than 12.2 V. The time taken to complete this part of the routine is dependent on the electrical load on the vehicle.

When the second part of the routine has been successfully completed, the BMS control module will return the battery to its optimum level of charge. The optimum level of charge will be between 12.6 V and 15 V, depending on battery condition, temperature and loading.

The BMS control module also monitors the primary battery (and auxiliary battery where fitted) condition with the engine switched off. If a low voltage condition is detected the BMS control module can request the infotainment system is switched off to protect battery voltage.

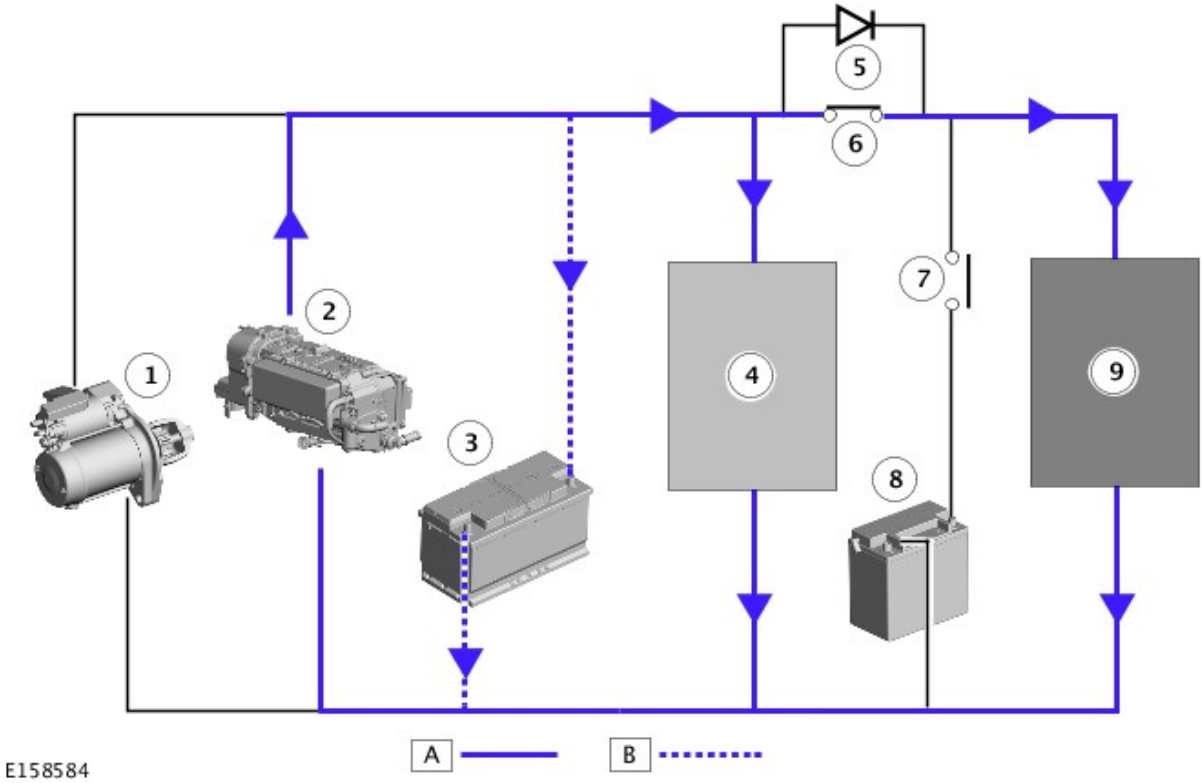
DUAL BATTERY SYSTEM - SECONDARY BATTERY STOP/START SYSTEM

The dual battery system prevents electrical loads on the vehicle being subjected to low voltage levels during an ECO (stop/start system) engine start. Low voltage can occur due to the power demand of the Tandem Solenoid Starter (TSS) motor and could result in degraded performance of components and/or system control modules. The Gateway Module (GWM) contains the software to control the dual battery system and electrical load management system to ensure that ECO engine starts do not affect other vehicle systems.

The dual battery system isolates all power supply sensitive electrical components which may be affected by low voltage from the primary battery due TSS motor operation, and supplies them with power from the secondary battery when an engine start is in progress.

The Power supply Distribution Box (PSDB) contains two contactors, which operate to change the power supply into two separate circuits when an ECO engine start is required. Sensitive electrical components are supplied from the secondary battery. The primary battery power is used exclusively to supply the TSS motor and maintain essential power loads to the engine management system required for engine starting. The contactors are operated by software contained in the PSDB on receipt of LIN bus information from the GWM.

Dual Battery System - Normal State (Engine Running)

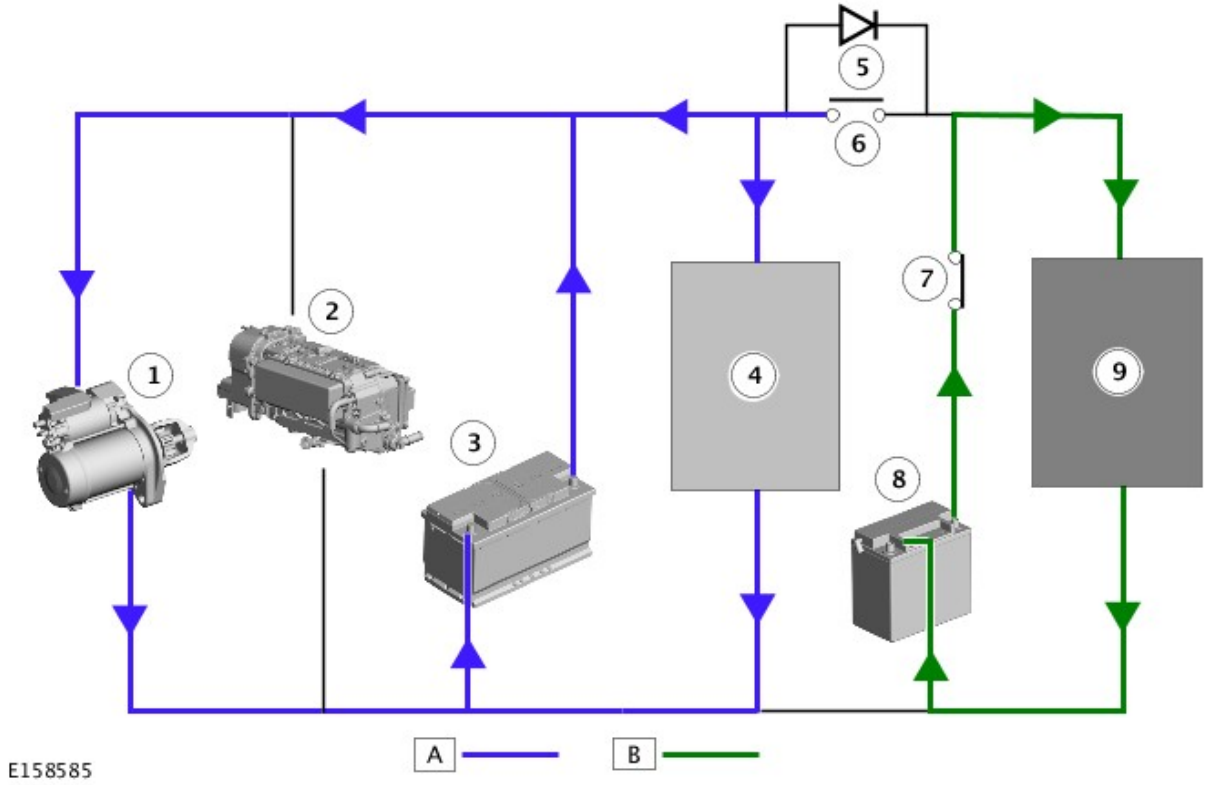


Item	Part Number	Description
NOTE:	-	A = Primary battery supply; B = Battery charging/discharging
1	-	Tandem Solenoid Starter (TSS) motor
2	-	Electrical Power Inverter Converter (EPIC)
3	-	Primary battery
4	-	Power and engine management system loads
5	-	Field Effect Transistor (FET)
6	-	Contactor 1 closed
7	-	Contactor 2 open
8	-	Secondary or auxiliary battery
9	-	Sensitive loads

When the engine is running, the electrical systems are powered from the primary battery via the PSDB and the Electrical Power Inverter Converter (EPIC). The GWM and the PSDB communicate via the LIN bus and the PSDB controls the contactors to isolate the secondary battery from the system by opening its contactor.

The GWM monitors the state of charge of both the primary and secondary batteries to ensure that sufficient voltage is available for the next ECO engine start. The GWM can apply` charging to the secondary battery via the PSDB if required.

Dual Battery system - ECO Engine Stop/Start State



Item	Part Number	Description
NOTE:	-	A = Primary battery supply; B = Secondary/auxiliary battery supply
1	-	Tandem Solenoid Starter (TSS) motor
2	-	Electrical Power Inverter Converter (EPIC)
3	-	Primary battery
4	-	Power and engine management system loads
5	-	Field Effect Transistor (FET)
6	-	Contactor 1 open
7	-	Contactor 2 closed
8	-	Secondary or auxiliary battery
9	-	Sensitive loads

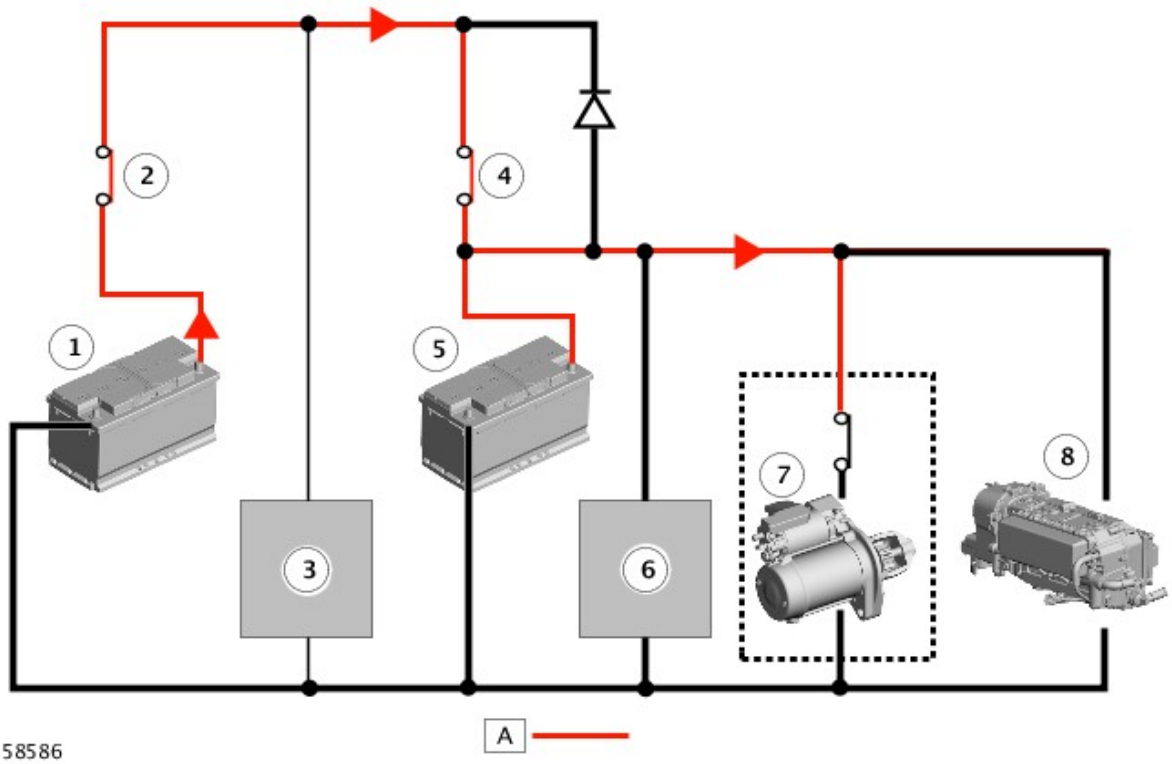
DUAL BATTERY SYSTEM - AUXILIARY BATTERY COLD CLIMATE VEHICLES

The dual battery system on vehicles with an auxiliary battery, allows both batteries to be connected in parallel, to provide increased amperage to the starter motor for efficient starting in cold climates. The auxiliary battery assists the primary battery in operating the starter motor to crank the engine at a sufficient speed for efficient starting.

The auxiliary battery is switched in parallel with the primary battery once the ambient temperature falls below a certain threshold, or the state of charge of the primary battery falls below a predetermined charge level.

The Power Supply Distribution Box (PSDB) contains two contactors, which operate to introduce the auxiliary battery in parallel with the primary battery. The contactors are operated by software within the PSDB on receipt of LIN bus information from the Gateway Module (GWM).

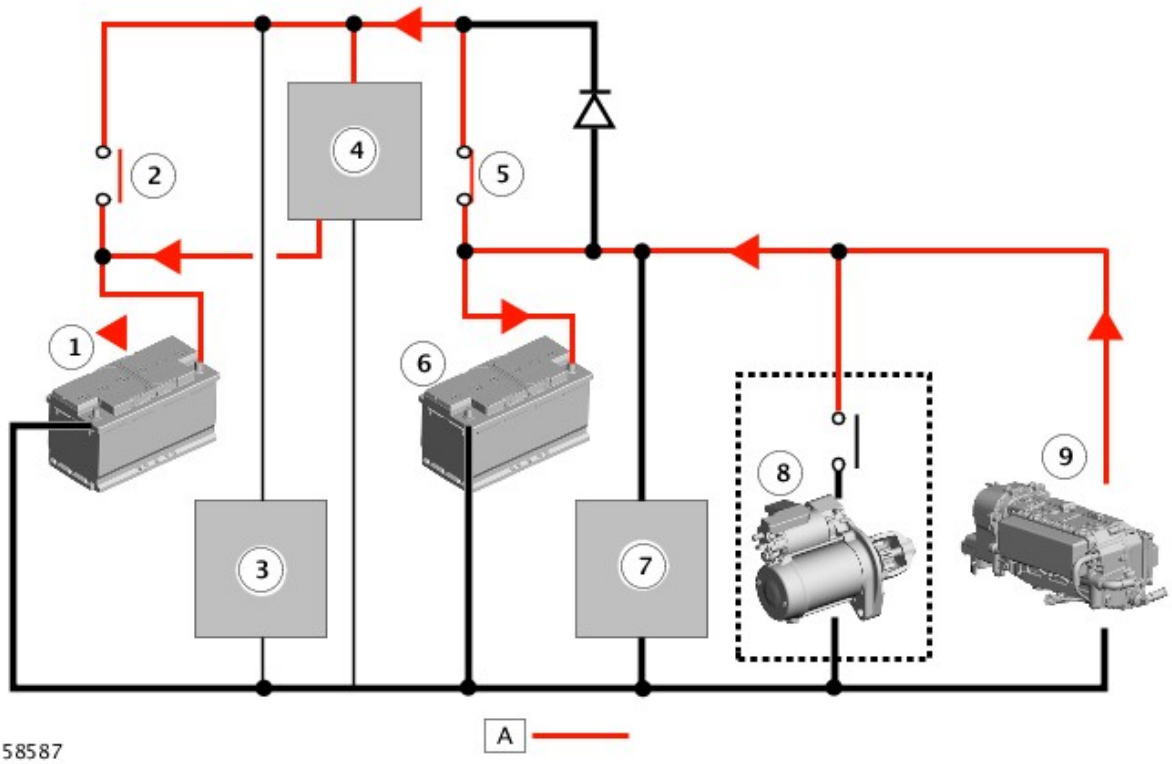
Dual Battery System - Primary and Auxiliary Batteries in Parallel for Starting



Item	Part Number	Description
A =	-	Power flow
1	-	Auxiliary battery
2	-	Contactor 2 closed
3	-	Sensitive loads
4	-	Contactor 1 closed
5	-	Primary battery
6	-	Power and engine management system loads
7	-	Starter motor
8	-	Electrical Power Inverter Converter (EPIC)

When the ambient temperature is below a predetermined level and the GWM receives a start signal via the high speed CAN bus from the CJB, the GWM communicates with the PSDB via the LIN bus to keep contactor 1 closed and close contactor 2 in the PSDB. The power for the starter motor is supplied from both batteries. When the ECM receives the start signal, it energizes the stater relay in the CJB which operates the starter motor solenoid to operate the starter motor.

Dual Battery System - Primary and Auxiliary Batteries - Engine Running



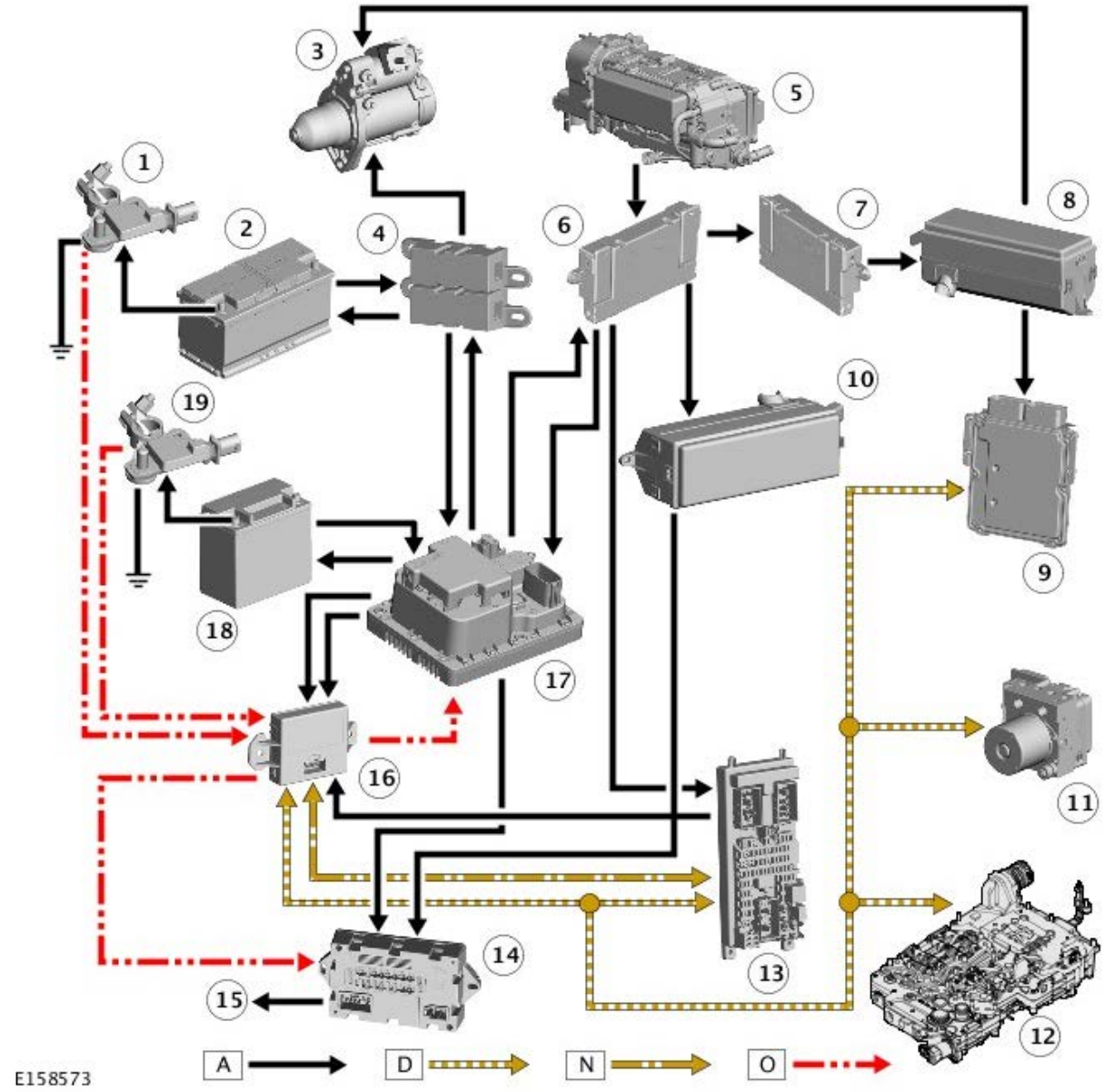
Item	Part Number	Description
A =	-	Power flow
1	-	Auxiliary battery
2	-	Contactor 2 open
3	-	Sensitive loads
4	-	Power supply distribution Box (PSDB)
5	-	Contactor 1 closed
6	-	Primary battery
7	-	Power and engine management system loads
8	-	Starter motor
9	-	Electrical Power Inverter Converter (EPIC)

The ECM issues an engine running signal on the high speed CAN powertrain systems bus. This is received by the GWM which instructs the PSDB via the LIN bus to open contactor 2 in the PSDB, which isolates the auxiliary battery. The vehicle electrical systems are then powered by the primary battery and the Electrical Power Inverter Converter (EPIC) 12V output.

CONTROL DIAGRAM

CONTROL DIAGRAM - HEV DUAL BATTERY SYSTEM

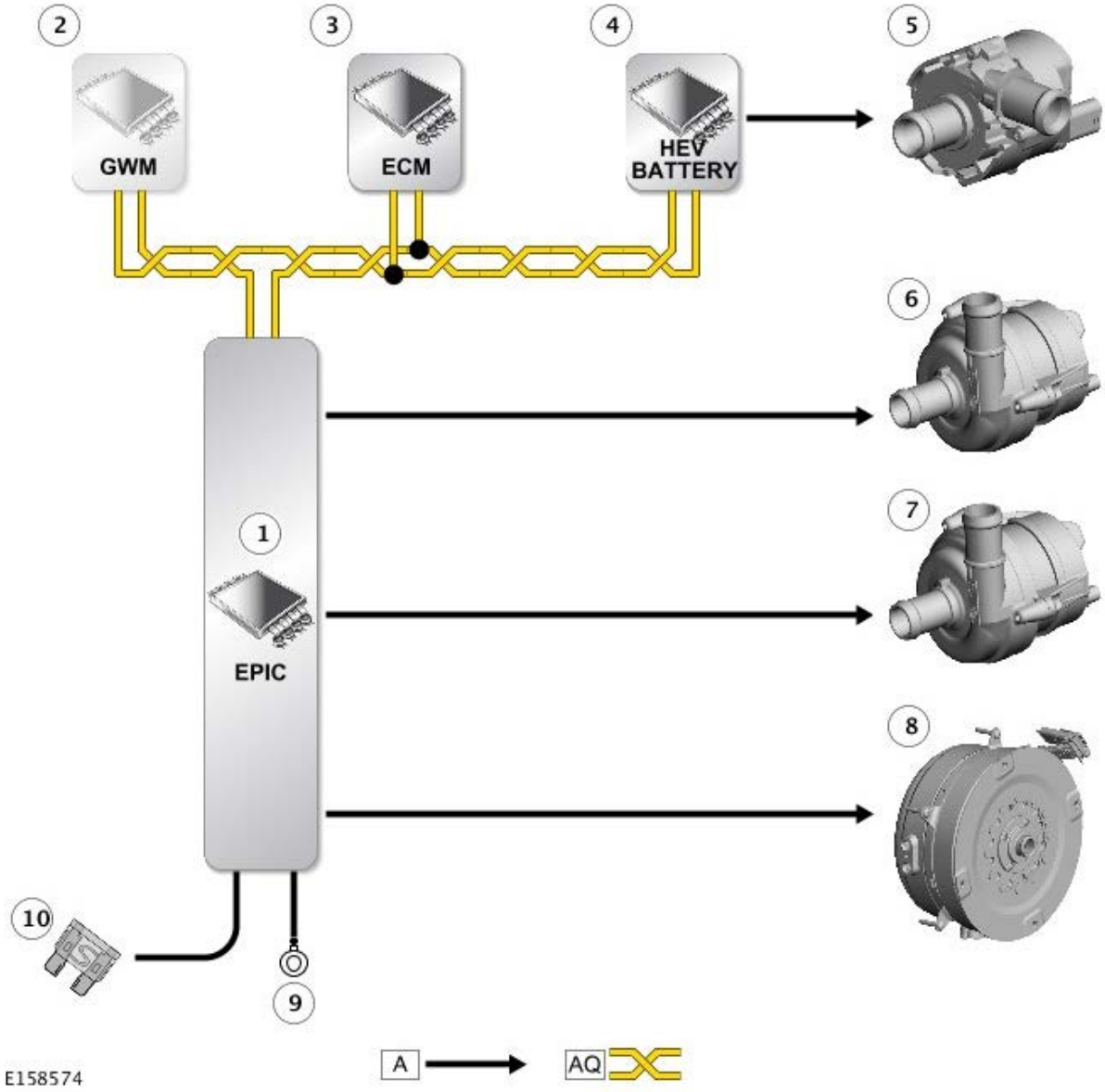
NOTE: **A** = Hardwired; **D** = High speed CAN bus; **N** = Medium speed CAN bus; **O** = LIN bus



Item	Part Number	Description
1	-	Battery Monitoring System (BMS) control module
2	-	Primary battery
3	-	TSS motor (stop/start vehicles only) or Starter motor
4	-	Battery Junction Box 2 (BJB2)
5	-	Electric Power Inverter Converter (EPIC)
6	-	Battery Junction Box (BJB)
7	-	Auxiliary Junction Box (AJB)
8	-	Rear Junction Box (RJB)
9	-	Engine Control Module (ECM)
10	-	Engine Junction Box (EJB)
11	-	Anti-lock Brake System (ABS) control module
12	-	Transmission Control Module (TCM)
13	-	Central Junction Box (CJB)
14	-	Quiescent Current Control Module (QCCM)
15	-	Power supply to infotainment and climate control modules
16	-	Gateway Module (GWM)
17	-	Power Supply Distribution Box (PSDB)
18	-	Secondary or auxiliary battery
19	-	Battery Monitoring System (BMS) control module (only fitted to auxiliary battery when fitted)

CONTROL DIAGRAM - HEV LOW VOLTAGE CIRCUIT

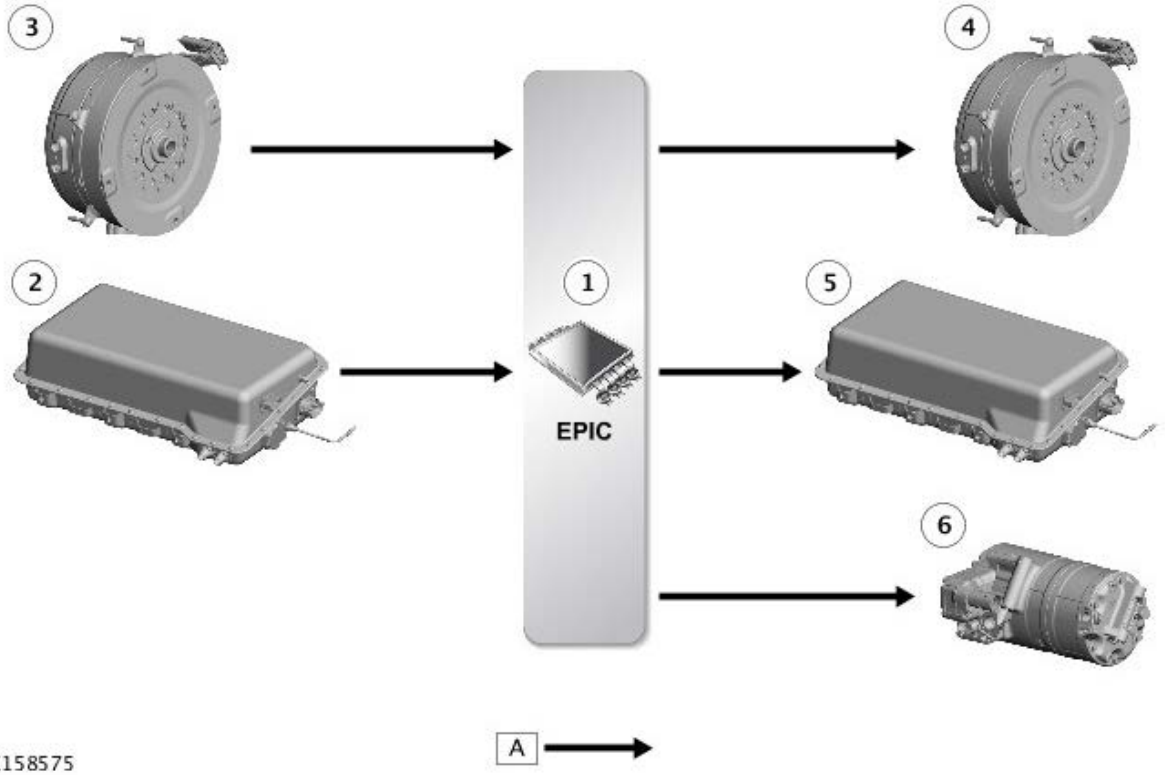
NOTE: **A** = Hardwired; **AQ** = High Speed HEV CAN bus



Item	Part Number	Description
1	-	Electric Power Inverter Converter (EPIC)
2	-	Gateway Module (GWM)
3	-	Engine Control Module (ECM)
4	-	HEV battery
5	-	HEV battery coolant pump
6	-	Motor Generator (MG) coolant pump
7	-	EPIC coolant pump
8	-	Motor Generator (MG)
9	-	Ground
10	-	Fused power supply from Battery Junction Box (BJB)

CONTROL DIAGRAM - HEV HIGH VOLTAGE CIRCUIT

NOTE: **A** = Hardwired



E158575

Item	Part Number	Description
1	-	Electrical Power Inverter Converter (EPIC)
2	-	HEV battery (power input for MG operation)
3	-	Motor Generator (charging function input)
4	-	MG (motor function)
5	-	HEV battery (charging input)
6	-	Electric Air Conditioning (A/C) compressor

Published: 31-Jul-2012

Battery, Mounting and Cables - Battery

Diagnosis and Testing

For further diagnostic information.
REFER to: Charging System (414-00 Battery and Charging System - General Information, Diagnosis and Testing).

For a detailed description of the charging system and operation, refer to the relevant description and operation section of the workshop manual. REFER to:

Battery and Cables (414-01 Battery, Mounting and Cables, Description and Operation),
Battery Care Requirements (414-00 Battery and Charging System - General Information, Description and Operation),
Quiescent Drain (414-00 Battery and Charging System - General Information, Description and Operation).

Published: 26-Sep-2013

Battery, Mounting and Cables - Battery SDV6 3.0L Diesel - Hybrid Electric Vehicle

Diagnosis and Testing

Principles of Operation

For a detailed description of the Battery, Mounting and Cables, refer to the relevant Description and Operation section in the workshop manual.
REFER to: Battery and Cables - TDV6 3.0L Diesel - Hybrid Electric Vehicle (414-01, Description and Operation).

Inspection and Verification

WARNINGS:

A risk assessment must be performed before any work is undertaken.

All hybrid electric vehicle work must be performed by a suitably qualified person.

Appropriate Personal Protection Equipment (PPE) must be worn when working on or near a hybrid electric vehicle high voltage system.

The hybrid electric vehicle battery pack casing must not be opened due to the risk of exposure to hazardous voltage, which may cause serious injury or death.

The electric power inverter converter casing must not be disassembled due to the risk of exposure to hazardous voltage, which may cause serious injury or death.

If the hybrid electric vehicle battery pack is damaged or overcharged, there is a risk of exposure to hazardous voltage and/or highly corrosive electrolyte mist. If liquid or vapour is observed leaking from the hybrid electric vehicle battery pack, take the following action:

- **Evacuate the area**
- **Notify manager**
- **Do not breathe smoke/vapour**
- **Contain spillage using spill kit**
- **Wash any spillage off body and clothing (remove contaminated clothing)**

If the hybrid electric vehicle warning indicator is illuminated, the Battery Energy Control Module (BECM) cannot isolate the high voltage cables. Live working will be necessary to rectify the fault.

The motor generator can generate a voltage if the wheels are rotated, even if the hybrid electric vehicle system has been made safe.

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.

When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

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.

Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

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.

 Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

 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.

 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 damage and system integrity

Visual Inspection

Mechanical	Electrical
• Hybrid electric vehicle battery pack cooling system • Electric power inverter converter cooling system • Air conditioning system • Automatic transmission	• Fuses • Wiring harnesses and connectors • High voltage cables • Hybrid electric vehicle battery pack • Battery Energy Control Module (BECM) • Electric Power Inverter Converter Module (EPICM) • Motor generator • Battery energy control module electric coolant pump • Electric power inverter converter electric coolant pump • Motor generator coolant pump

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	Possible Causes	Action
Liquid or vapour electrolyte emission from hybrid electric vehicle battery pack vent	• Hybrid electric vehicle battery pack internal failure - Cell(s) damaged/overheating • Hybrid electric vehicle battery pack overcharging	• Refer to the workshop manual WARNINGS
Hybrid electric vehicle warning indicator illuminated	• Hybrid electric vehicle battery pack fault - Contactor stuck closed	• Using the manufacturer approved diagnostic system, check the battery energy control module for related DTCs and refer to the relevant DTC index
Hybrid electric vehicle battery pack cooling system leak	• Hoses • Battery pack cooler and isolation valve • Hybrid electric vehicle battery pack coolant pump • Hybrid electric vehicle battery pack internal leak	 NOTE: The hybrid electric vehicle battery pack has a stand alone cooling system • Pressure test the hybrid electric vehicle battery pack cooling system. Repair the leak as necessary
Electric power inverter converter cooling system leak	• Hoses • Coolers • Electric power inverter converter coolant pump • Electric power inverter converter internal coolant leak	 NOTE: The electric power inverter converter cooling system is incorporated into the engine cooling system • Refer to the relevant section of the workshop manual and pressure test the cooling system. Repair the leak as necessary
Motor generator cooling system leak	• Hoses • Coolers • Motor generator coolant	 NOTE: The motor generator cooling system is incorporated into the engine cooling system

	pump • Motor generator internal coolant leak	• Refer to the relevant section of the workshop manual and pressure test the cooling system. Repair the leak as necessary

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: Battery Energy Control Module (BECM) - Hybrid Electric Vehicle (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Electric Power Inverter Converter Module (EPICM) - Hybrid Electric Vehicle (Description and Operation).

Published: 21-Oct-2013

Battery, Mounting and Cables - Hybrid Electric Vehicle (HEV) Decommission

General Procedures

Special Tool(s)

 E160316	JLR-415-009 Hybrid Electric Vehicle (HEV) Battery Isolator

Deactivation



WARNINGS:

This procedure must be carried out in the exact sequence shown. Failure to do so could result in serious personal injury.

This procedure must only be carried out by authorised personnel.

Make sure that you also comply with any local legislation regarding working with high voltages, whilst carrying out this procedure.

Approved personal protection equipment, to include; safety glasses or visor, black rubber gloves meeting the required standards and non-flammable, non-melting clothing, must be worn when instructed to do so.

All padlock keys must be kept in the **designated** secured storage container away from the vehicle.

NOTE: Some components shown removed for clarity.

1. WARNING: If the symbol illustrated is displayed in the instrument cluster, the decommissioning procedure **must not** be carried out.

   If the symbol illustrated is displayed in the instrument cluster, proceed to step 26.



E155741

2. WARNING: If either P0AA1-04 or P0AA4-04 diagnostic trouble codes (DTCs) are stored, the decommissioning procedure **must not** be carried out.

   - Connect the Land Rover approved diagnostic equipment and carry out a diagnostic check on the high voltage

system.
- If either P0AA1-04 or P0AA4-04 diagnostic trouble codes (DTCs) are stored, proceed to step 26

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

   Raise and support the vehicle

4. Make sure that the transmission is in PARK with the engine and ignition switched off.

5. Using the Land Rover approved diagnostic equipment start the decommissioning procedure.

6. Remove **all** smart keys and store at a location at least 5 metres away from the vehicle.

7. WARNING: All external 12 volt sources must be disconnected from the vehicle before proceeding.

   Make sure that all external 12 volt sources are disconnected from the vehicle. For example; towbar sockets, 12 volt accessory sockets and charging points.

8. WARNING: Make sure that the battery ground cable is placed securely away from the battery ground post.

   Disconnect the primary battery ground cable.

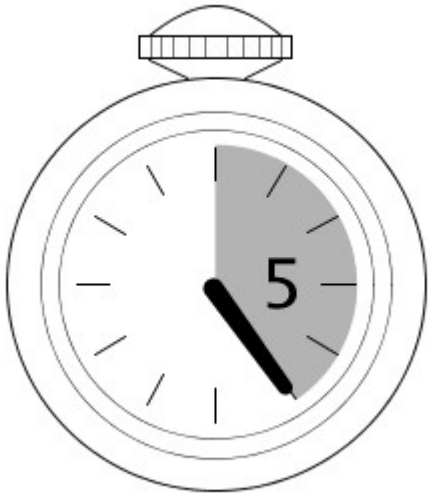
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

9. WARNING: Make sure that the battery ground cable is placed securely away from the battery ground post.

   Disconnect the auxiliary battery ground cable.

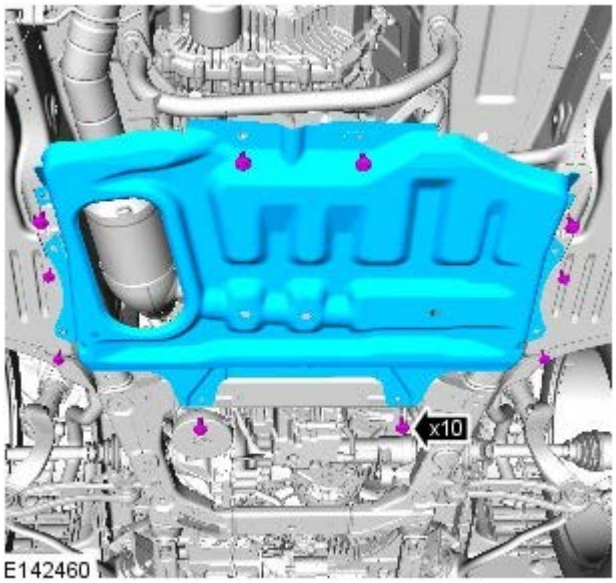
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

10. WARNING: Allow a minimum of 5 minutes for the high voltage system to completely discharge.

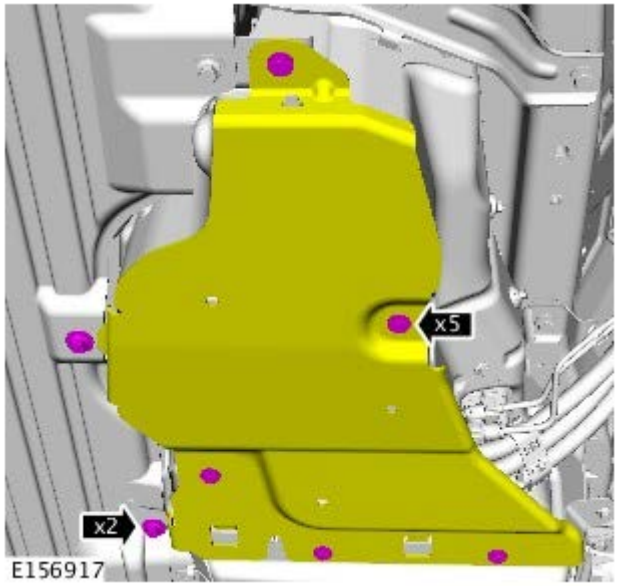


E151969

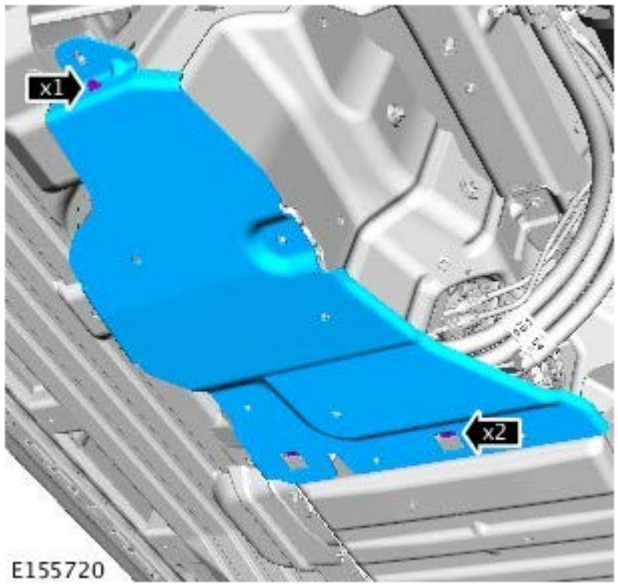
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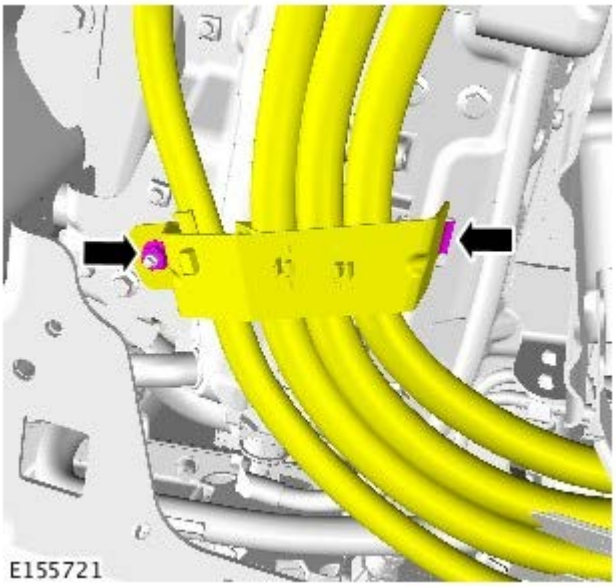
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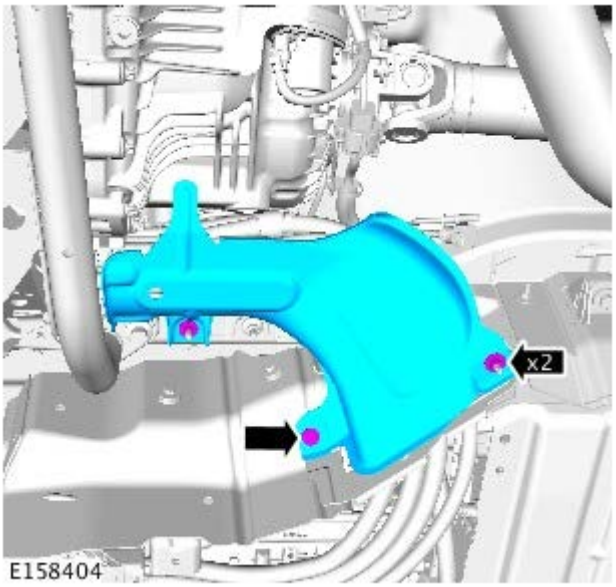
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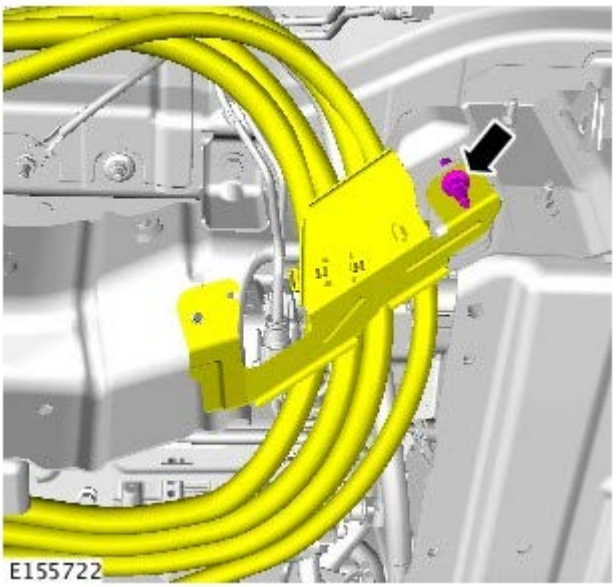
14.



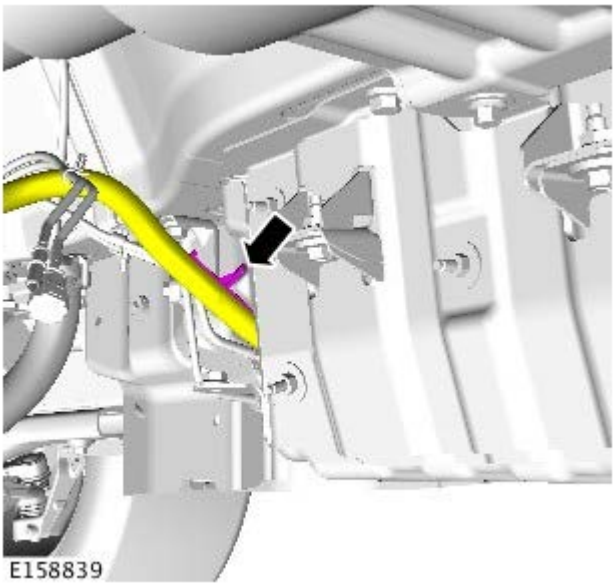
15.



16.



17.





18. WARNINGS:

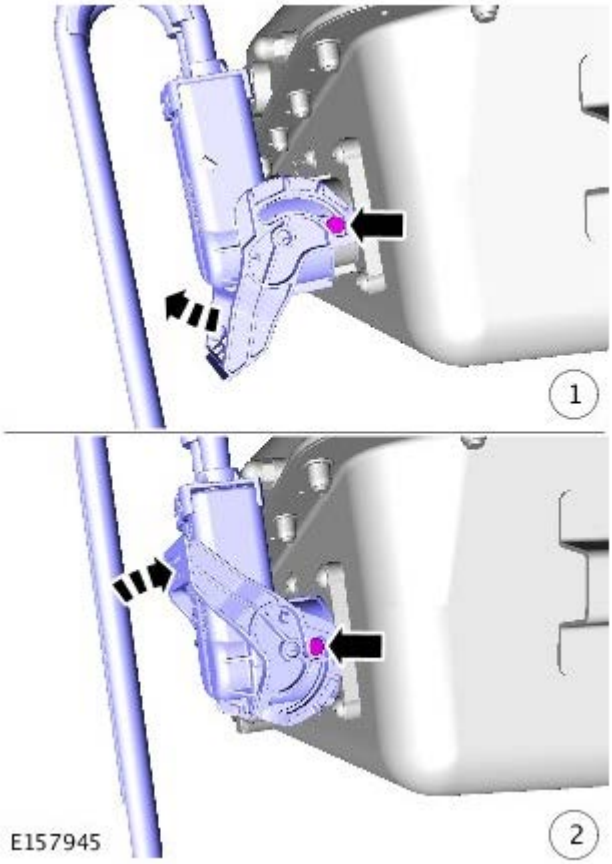
Make sure that the recommended personal protection equipment is worn during this step. Failure to do so could result in serious injury.

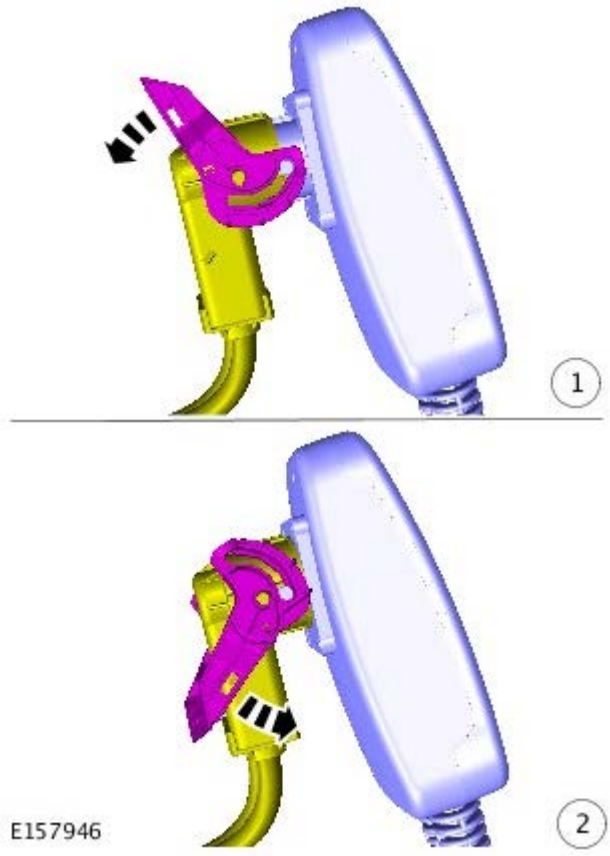
Do not carry out this step until the high voltage system has been allowed to completely discharge.

19. WARNING: **Make sure that the recommended personal protection equipment is worn during this step. Failure to do so could result in serious injury.**

CAUTION: Make sure that the special tool is correctly located.

Connect the special tool **VM8105** to the high voltage battery electrical connector.





20. WARNING: **Make sure that the recommended personal protection equipment is worn during this step. Failure to do so could result in serious injury.**

CAUTION: Make sure that the special tool is correctly located.

Connect the special tool **VM8105** to the high voltage battery wiring harness.

21. WARNINGS:

Make sure that the recommended personal protection equipment is worn during this step. Failure to do so could result in serious injury.

This step must be carried out in the exact sequence shown.

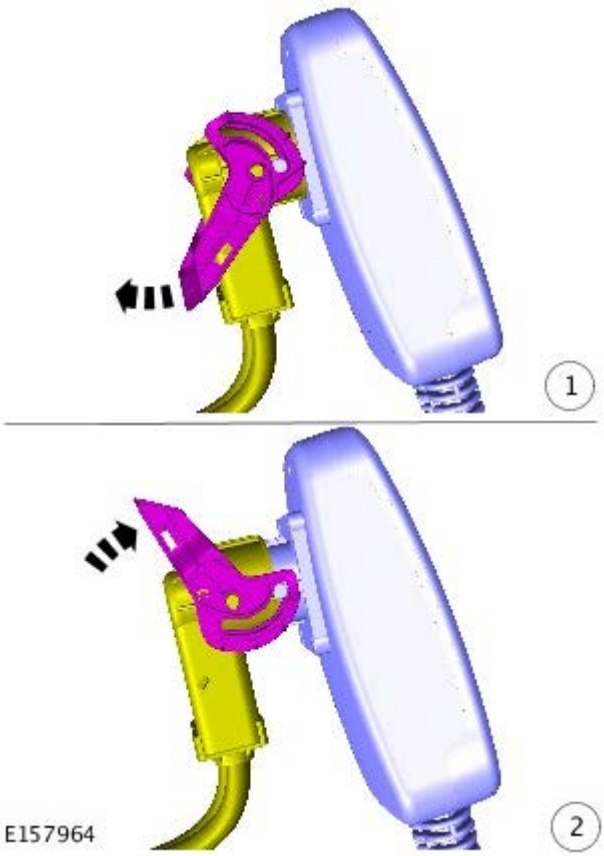
1. Connect the special tool **VM8105** to the Land Rover approved diagnostic equipment.
2. Resume the decommissioning procedure as instructed by the Land Rover approved diagnostic equipment.
3. If the decommissioning procedure resulted in a pass, proceed to step 27. If the procedure did not result in a pass, proceed to the next step.

22. WARNINGS:

Make sure that the recommended personal protection equipment is worn during this step. Failure to do so could result in serious injury.

This step must be carried out in the exact sequence shown.

1. Wait 5 minutes then repeat the decommissioning procedure in the previous step.
2. If the decommissioning procedure resulted in a pass, proceed to step 27. If the procedure did not result in a pass, proceed to the next step.

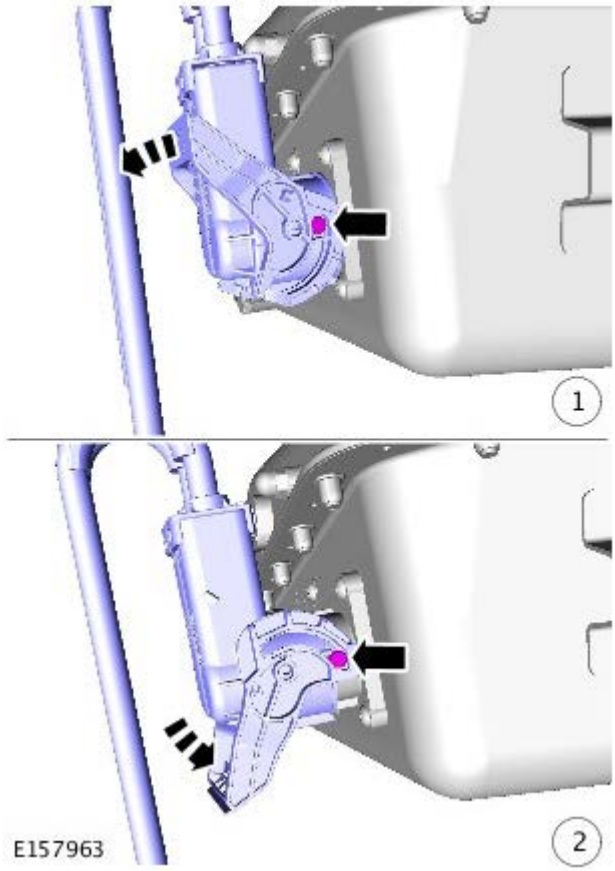


23. WARNING: **Make sure that the recommended personal protection equipment is worn during this step. Failure to do so could result in serious injury.**

    Remove the special tool **VM8105**.

24. WARNING: **Make sure that the recommended personal protection equipment is worn during this step. Failure to do so could result in serious injury.**

    Remove the special tool **VM8105**.

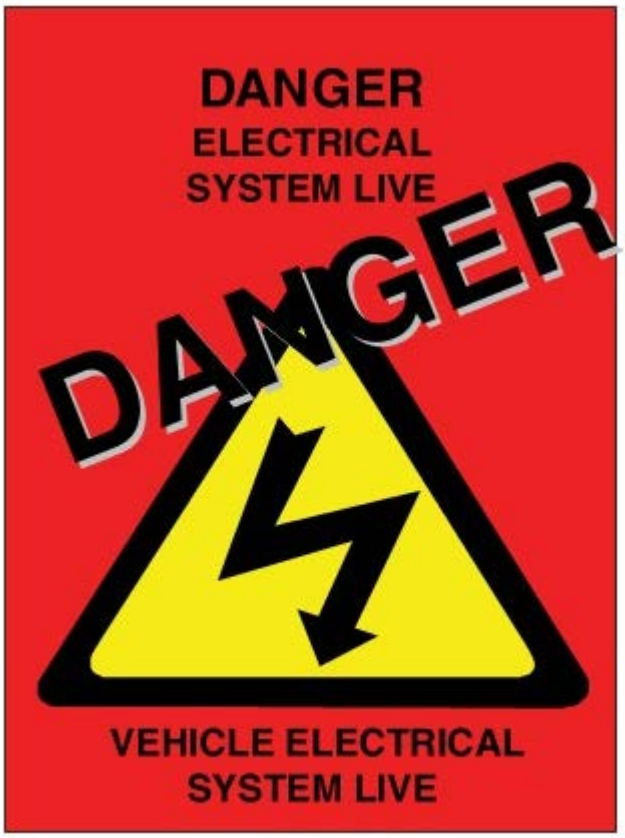




25. WARNING: **Make sure that the recommended personal protection equipment is worn during this step. Failure to do so could result in serious injury.**

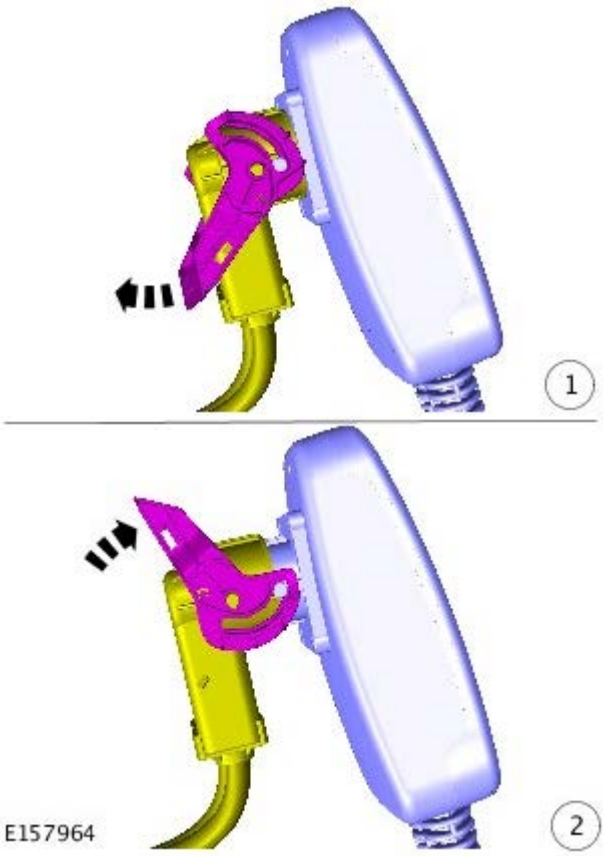
26.

- Quarantine the vehicle and contact customer support.
- Make sure that the appropriate sign is displayed on the vehicle, where it is clearly visible. The sign should state that:
- **Danger electrical system live.**
- **Vehicle electrical system live.**

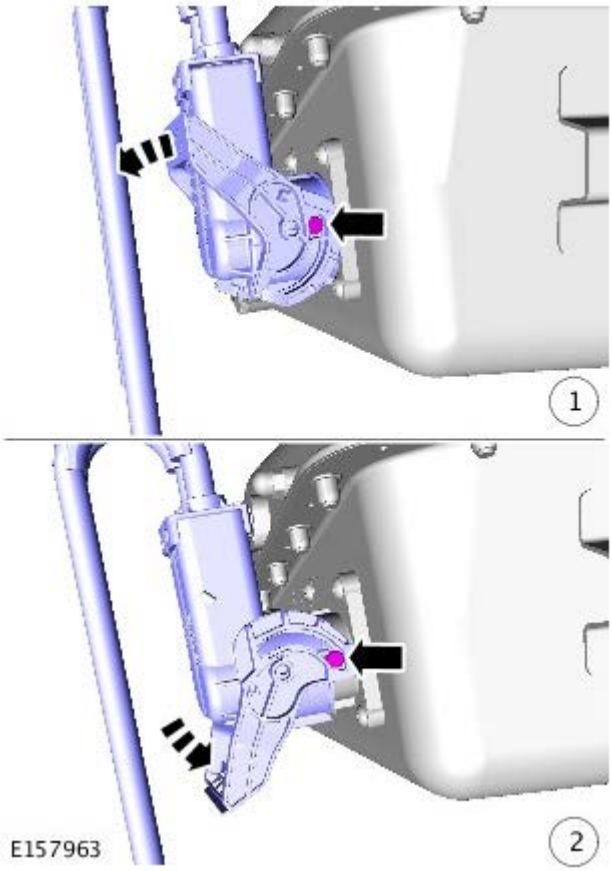


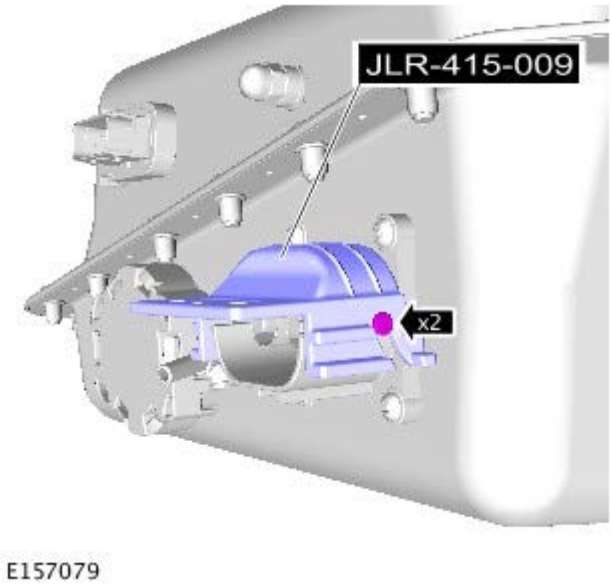
E160529

27. Remove the special tool **VM8105**.



28. Remove the special tool **VM8105**.



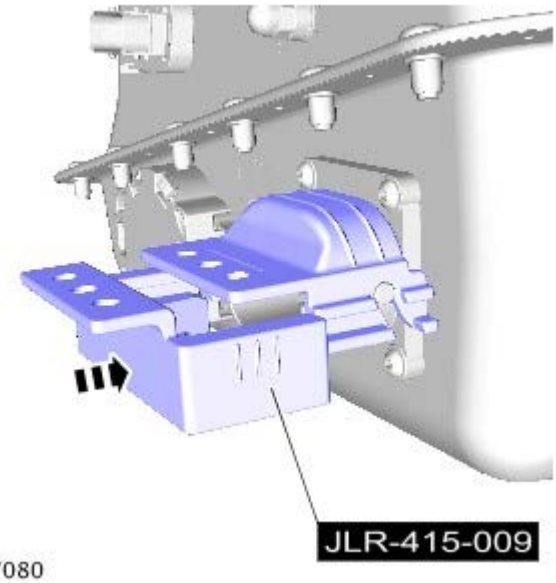


29. WARNING: Make sure that the special tool is located correctly.

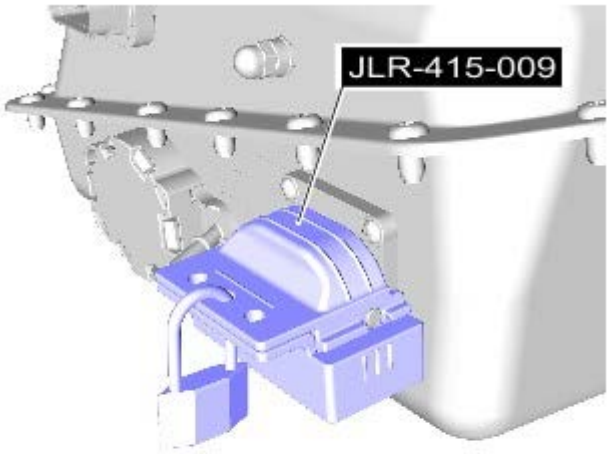
Special Tool(s): JLR-415-009

30. WARNING: Make sure that the special tool is located correctly.

Special Tool(s): JLR-415-009



E157080



E157081

31. WARNING: All padlock keys must be kept in the **designated** secured storage container away from the vehicle.

Using a suitable padlock, secure the special tool to the high voltage battery.

Special Tool(s): JLR-415-009

32.

- Make sure that the appropriate sign is displayed on the vehicle, where it is clearly visible. The sign should state that:
- **Re-work is in progress.**
- **The vehicle high voltage electrical system is disabled and safe to work on.**
- **The vehicle high voltage electrical system is isolated.**



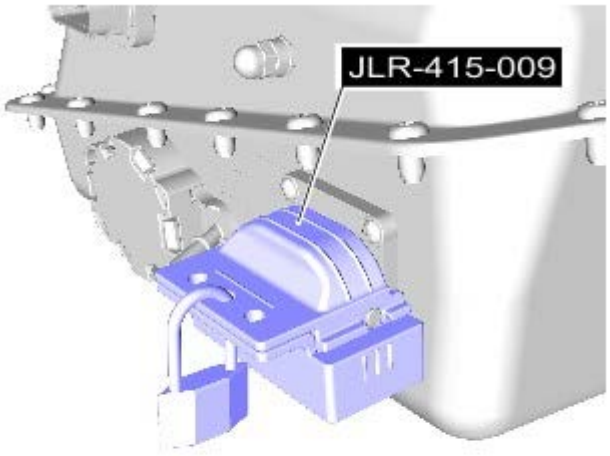
E160114

33. Make sure that all the relevant documentation is completed.

Activation

1. Remove the special tools.

   Special Tool(s): JLR-415-009

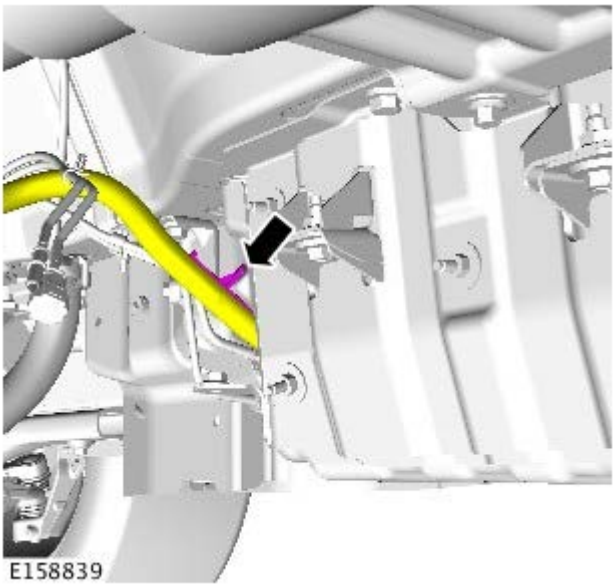


E157081

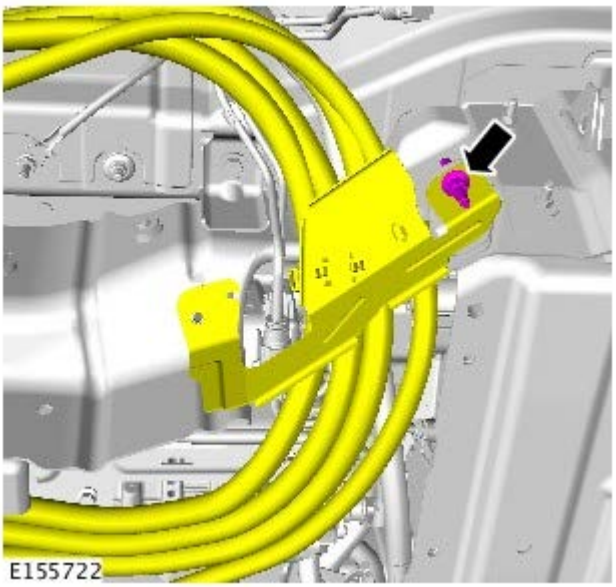
2.



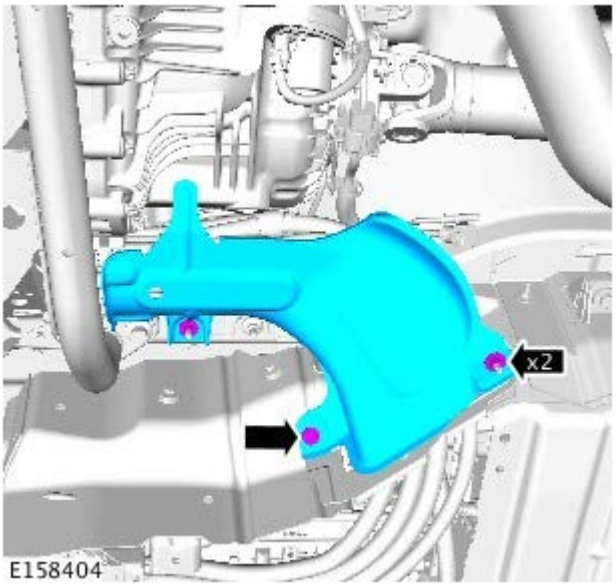
3.



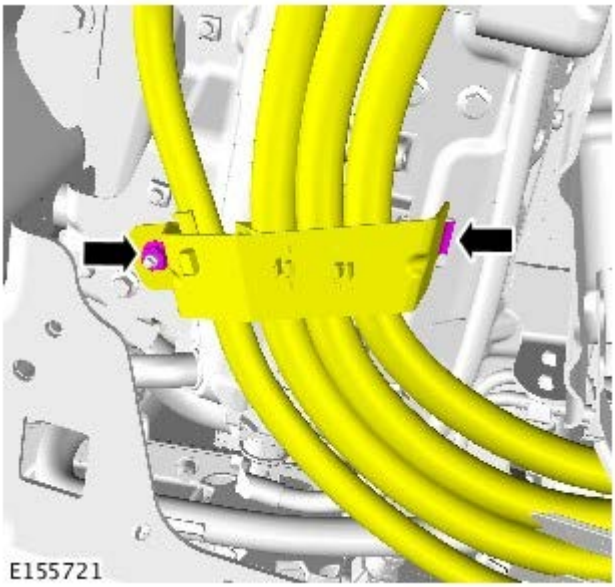
4. *Torque:* 10 Nm



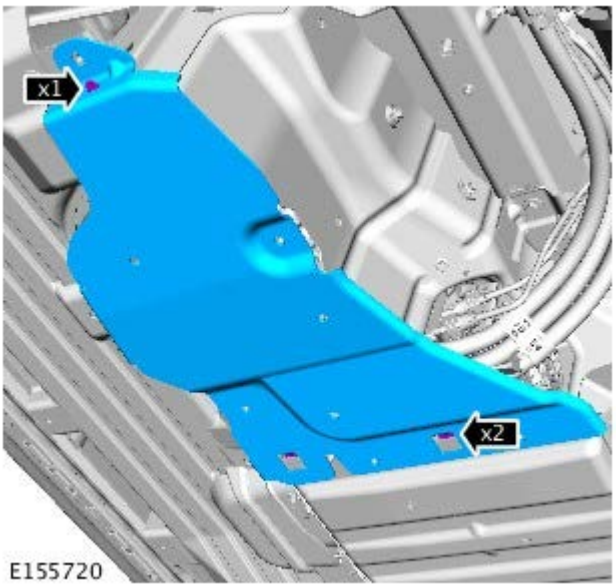
5. *Torque:* 10 Nm



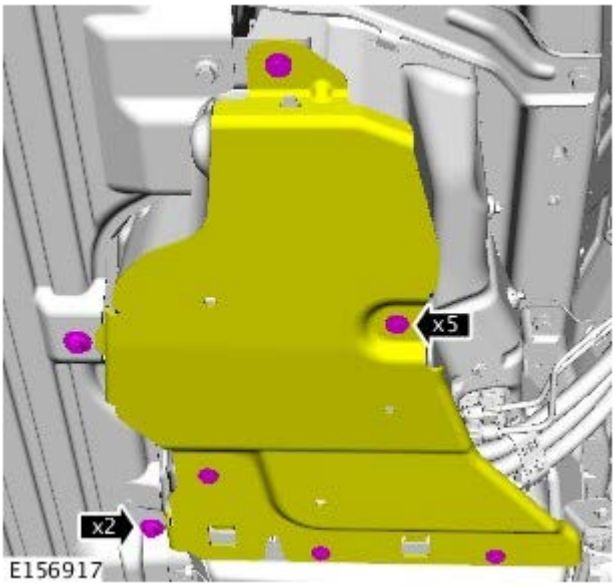
6. *Torque:* 10 Nm

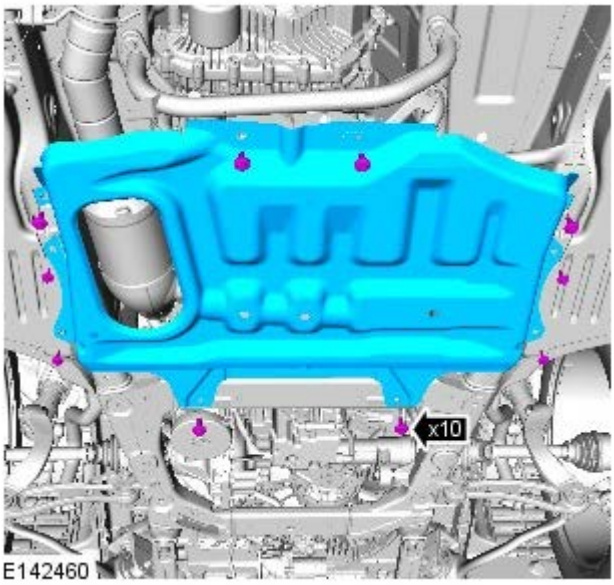


7.



8. *Torque:* 10 Nm





9. *Torque:*
   M6 10 Nm
   M10 60 Nm

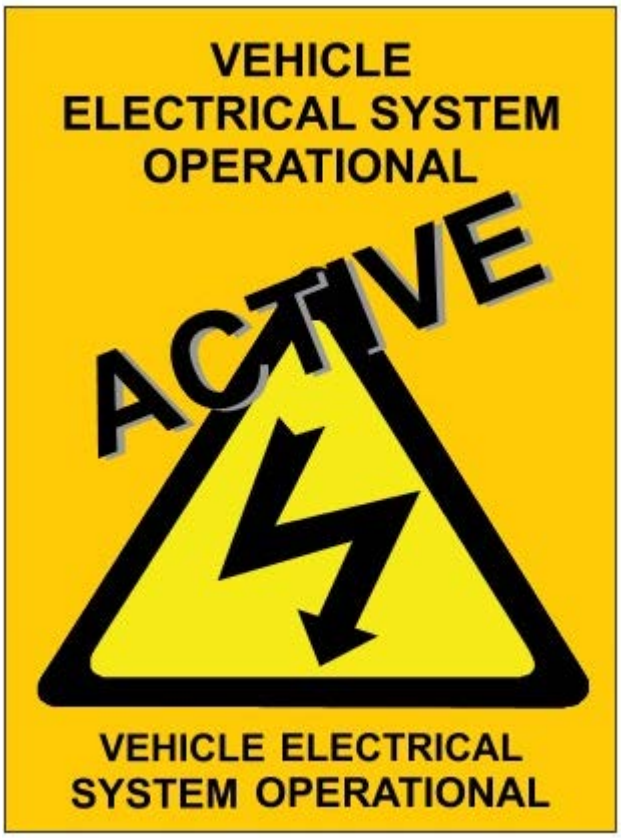
10. Connect the auxiliary battery ground cable.

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

11. Connect the primary battery ground cable.

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

12.
    - Make sure that the appropriate sign is displayed on the vehicle, where it is clearly visible. The sign should state that:
    - **The vehicle high voltage electrical system is operational.**
    - **The vehicle high voltage electrical system is active.**



E160115

13. Make sure that all the relevant documentation is completed.

Published: 11-Sep-2013

Battery, Mounting and Cables - Hybrid Electric Vehicle (HEV) System Bonding Test

General Procedures

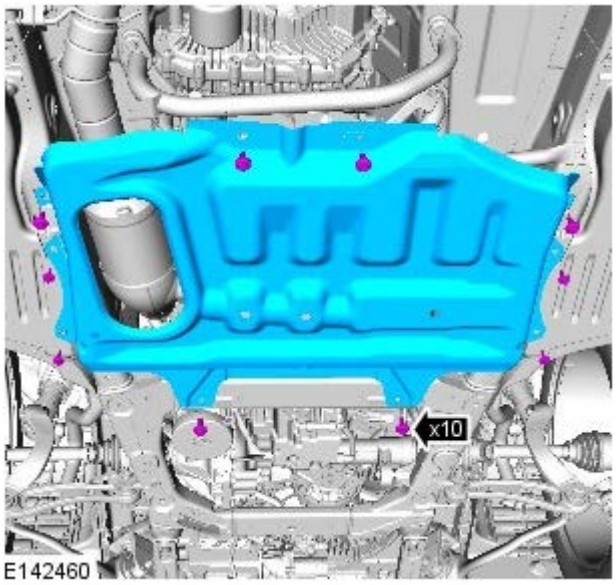
Check

WARNINGS:

If the vehicle has been decommissioned, do not re-commission the vehicle until all the bonding checks have been carried out and have passed (any concerns must be rectified).

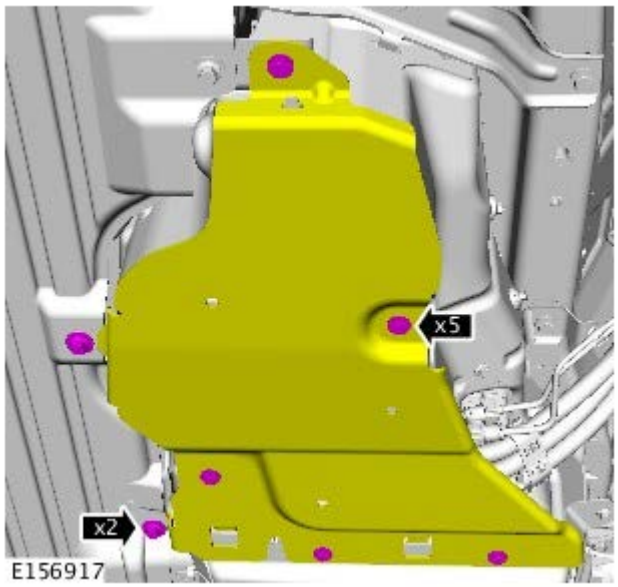
If the vehicle is NOT decommissioned whilst carrying out this procedure, make sure that the hybrid electric vehicle (HEV) decommissioning procedure is followed before rectifying any concerns.

CAUTION: Make sure that the components are clean, dry and free from corrosion and foreign material.



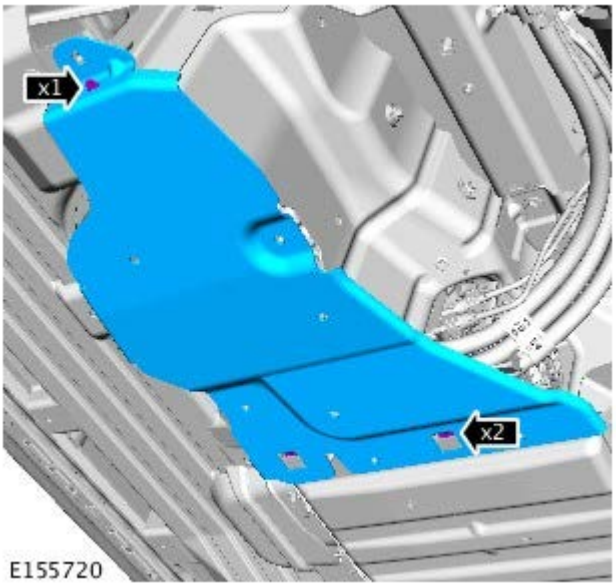
1. NOTE: If the vehicle has been decommissioned proceed to step 4.

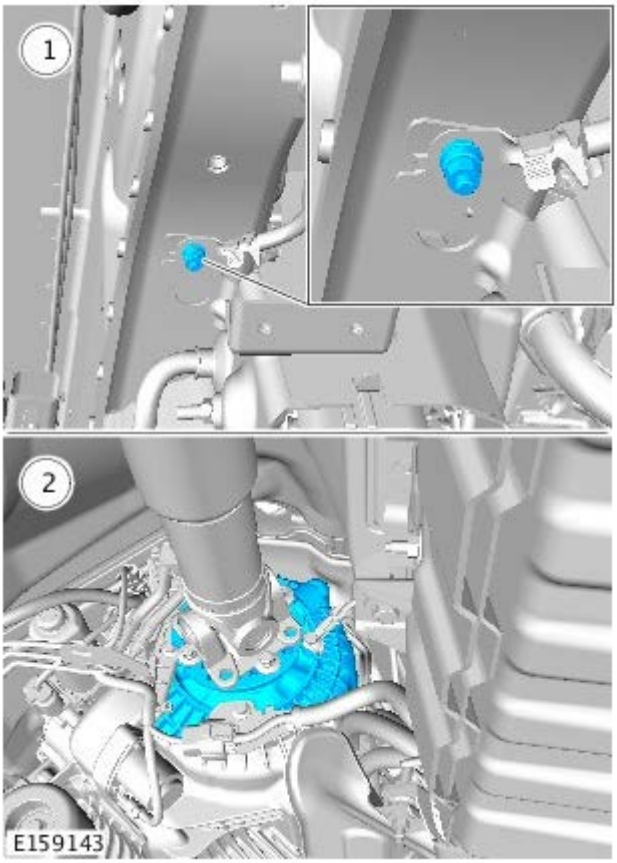
   Torque:
   M10 60 Nm
   M6 10 Nm



2. *Torque:* 10 Nm

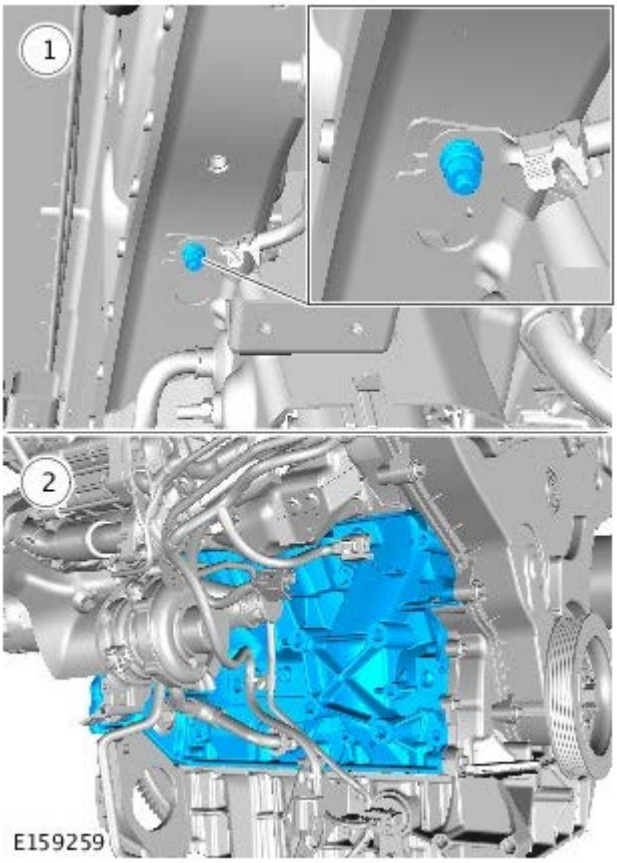
3.

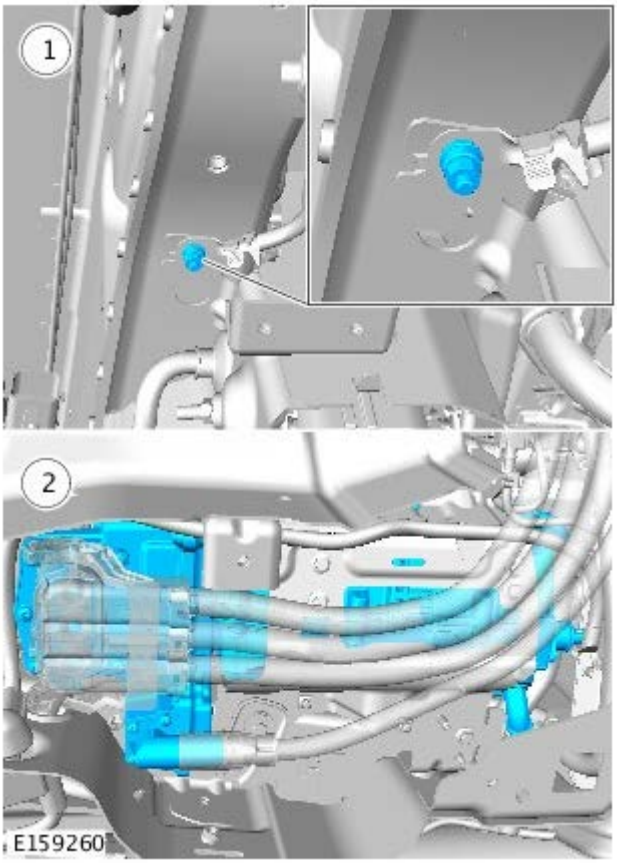




4. CAUTION: The probe at point 2 must be in direct contact with the casing, not the bonding strap or bonding strap fixing.
    - Using Land Rover approved diagnostic equipment, carry out the HEV system bonding test application between the two points shown.
    - Point 1: The HEV battery pack cradle bonding strap fixing.
    - Point 2: The transfer case casing.

5. CAUTION: The probe at point 2 must be in direct contact with the cylinder block.
    - Using Land Rover approved diagnostic equipment, carry out the HEV system bonding test application between the two points shown.
    - Point 1: The HEV battery pack cradle bonding strap fixing.
    - Point 2: The cylinder block.



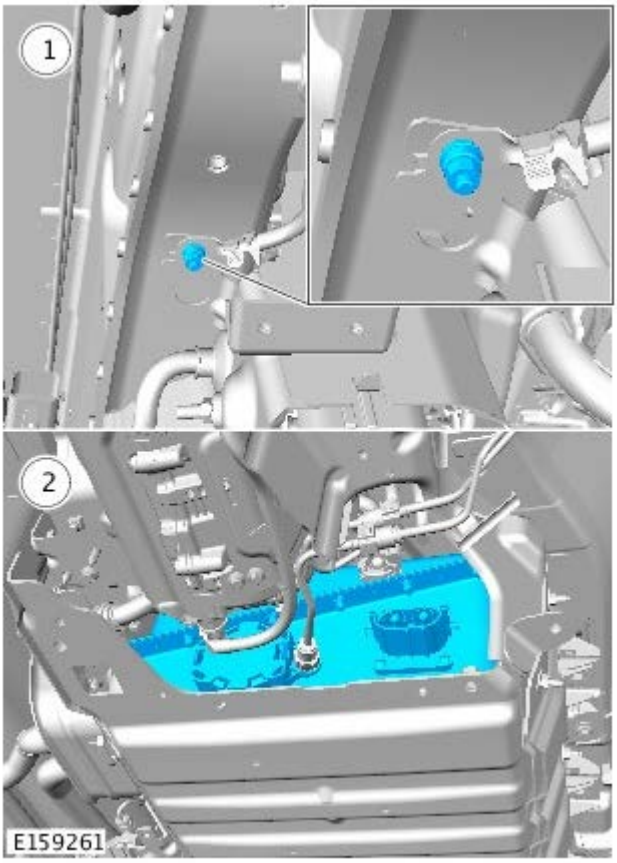


6. CAUTION: The probe at point 2 must be in direct contact with the casing, not the bonding strap or bonding strap fixing.

    - Using Land Rover approved diagnostic equipment, carry out the HEV system bonding test application between the two points shown.
    - Point 1: The HEV battery pack cradle bonding strap fixing.
    - Point 2: The electric power inverter converter (EPIC) casing.

7. CAUTION: The probe at point 2 must be in direct contact with the casing, not the bonding strap or bonding strap fixing.

    - Using Land Rover approved diagnostic equipment, carry out the HEV system bonding test application between the two points shown.
    - Point 1: The HEV battery pack cradle



bonding strap fixing.

- Point 2: The HEV battery pack casing.

Published: 22-Nov-2013

Battery, Mounting and Cables - Hybrid Electric Vehicle (HEV) Battery Cooling System Draining, Filling and Bleeding

General Procedures

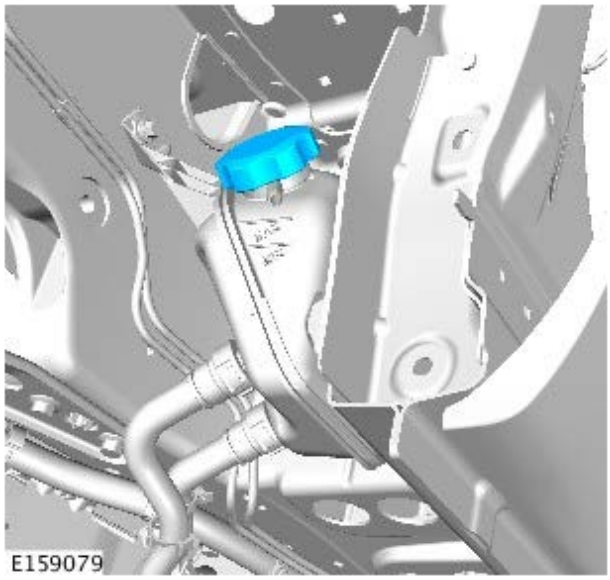
Draining

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

   Raise and support the vehicle.

2. Remove the rear right fender splash shield.

   Refer to: Rear Fender Splash Shield (501-08 Exterior Trim and Ornamentation, Removal and Installation).

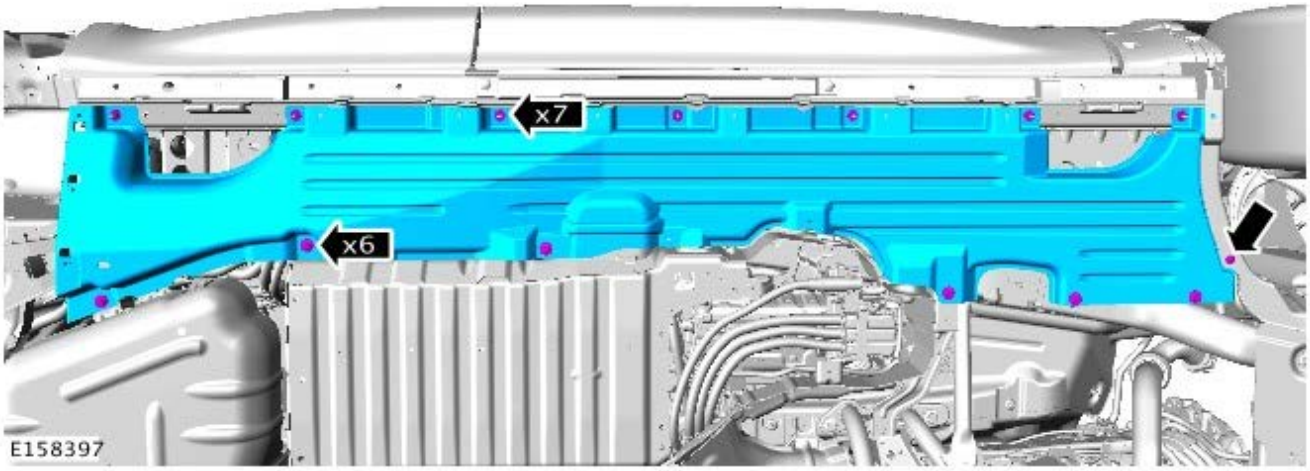


3. CAUTION: Make sure that the area around the component is clean and free of foreign material.

4. NOTE: RH side only.

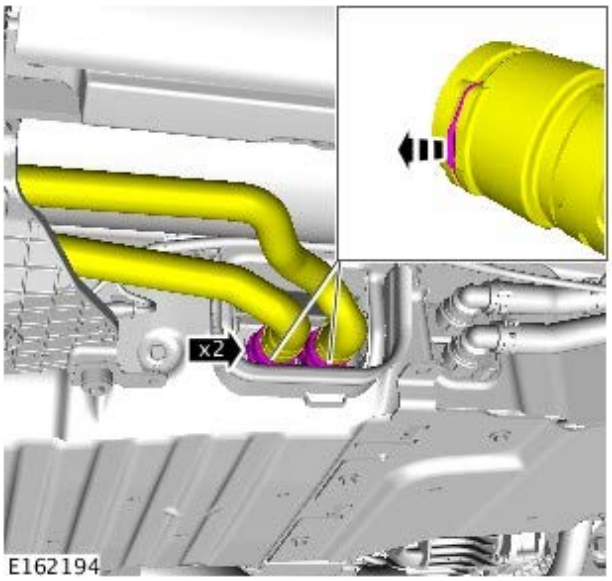
   Refer to: Rear Rocker Panel Moulding (501-08 Exterior Trim and Ornamentation, Removal and Installation).

5. NOTE: RH side only.

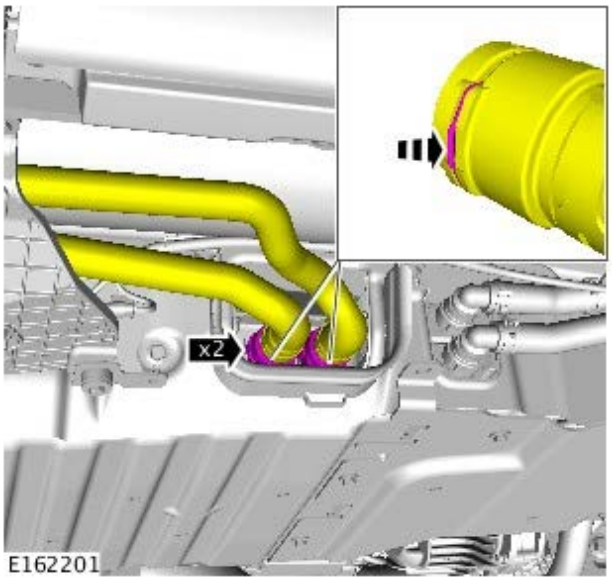


6. CAUTION: Be prepared to collect escaping

coolant.

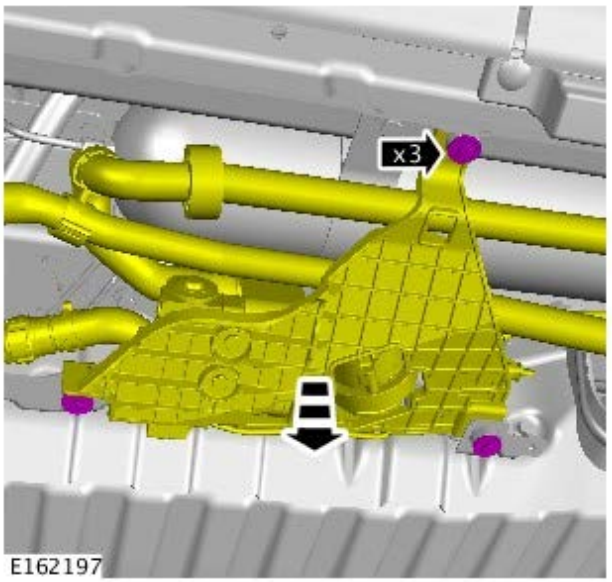


7.



Filling

1.



2. CAUTION: The coolant pump assembly requires lowering and supported by the coolant hoses during this procedure.

   Add coolant to the battery coolant expansion tank as required, until the upper level mark is achieved.

3. CAUTIONS:

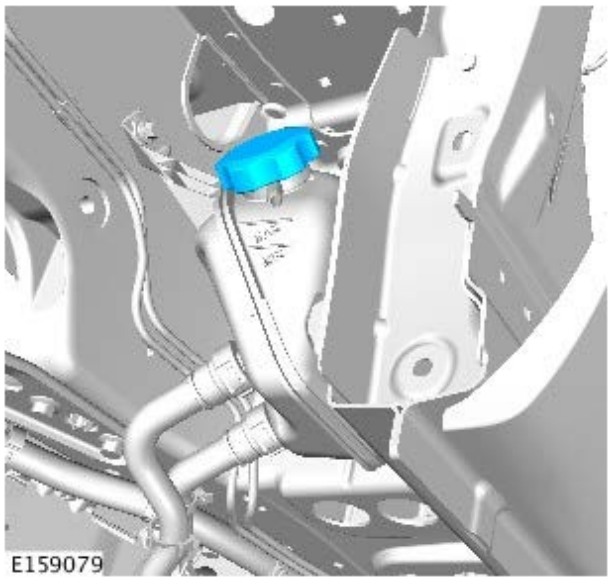
   The coolant pump assembly requires lowering and supported by the coolant hoses during this procedure.

   If the coolant pump fails to run, the coolant pump has entered its run-dry mode. In this case the coolant pump assembly will require lowering further. This will make sure that the coolant pump is primed correctly and any air in the system is dispersed.

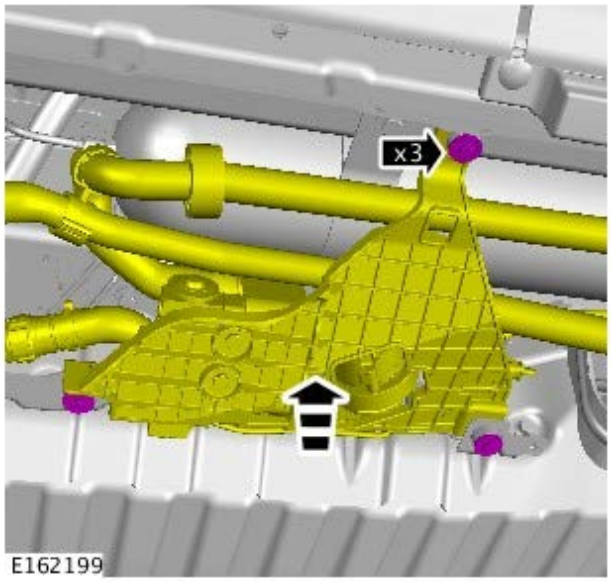
   Using Land Rover approved diagnostic equipment, run the battery coolant pump until the coolant level drops and coolant can be seen circulating around the system through the expansion tank.

4. Fill the coolant level in the battery coolant expansion tank, to the maximum cold fill line.

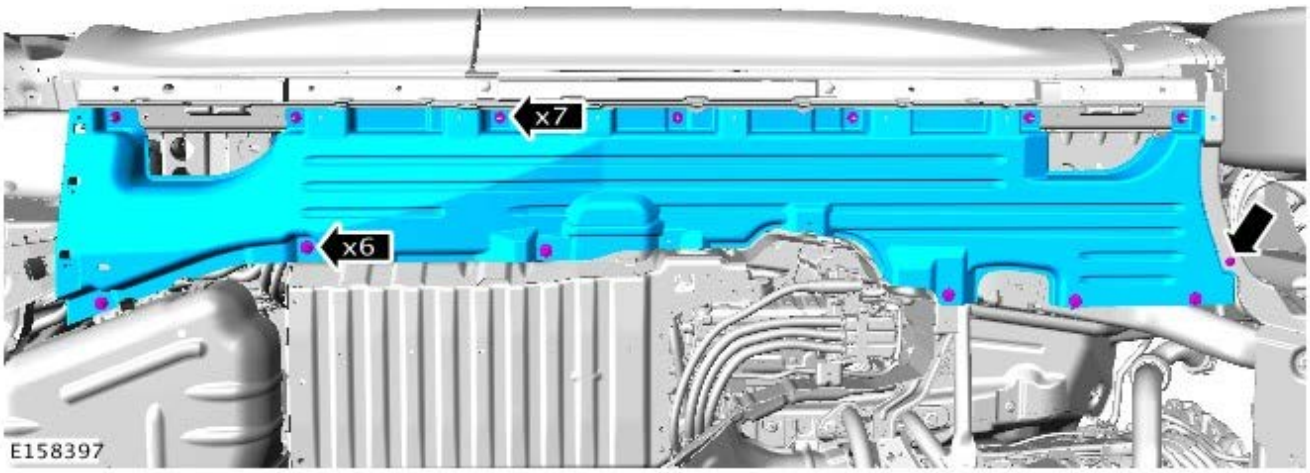
5.



6. *Torque:* 10 Nm



7. NOTE: RH side only.



8. NOTE: RH side only.

   Refer to: Rear Rocker Panel Moulding (501-08 Exterior Trim and Ornamentation, Removal and Installation).

9. Install the rear right fender splash shield.

   Refer to: Rear Fender Splash Shield (501-08 Exterior Trim and Ornamentation, Removal and Installation).

Published: 06-Aug-2012

Battery, Mounting and Cables - Auxiliary Battery

Removal and Installation

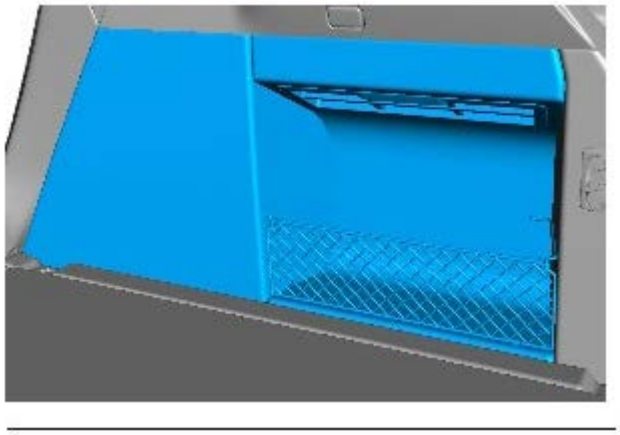
Removal

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

1. Disconnect the battery earth lead.

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

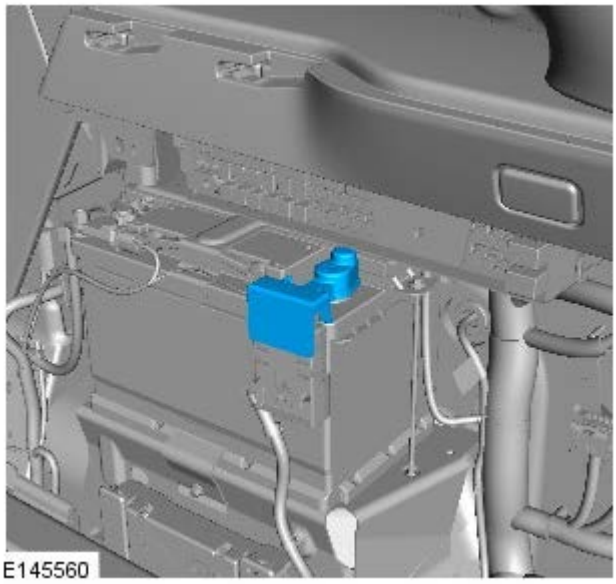
2.





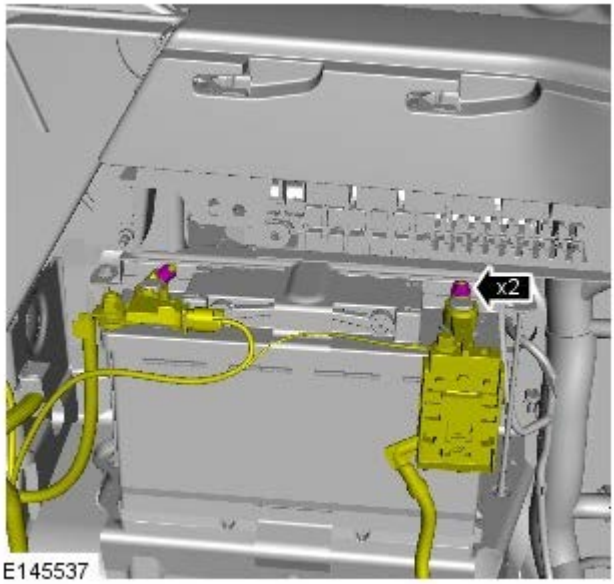
E145529

3.

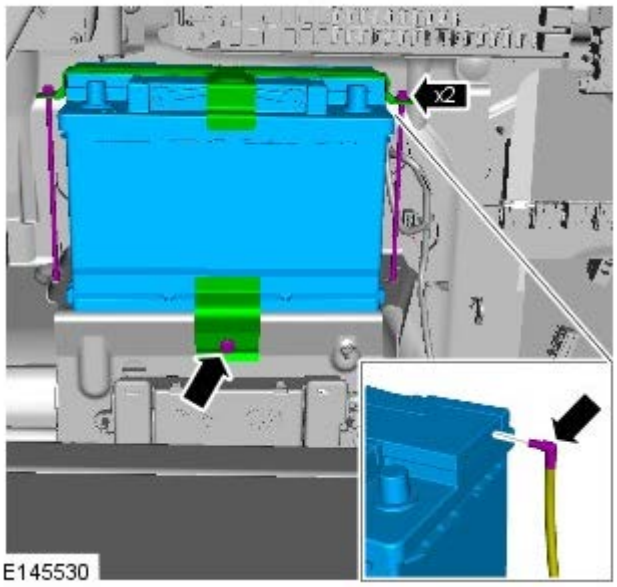


E145560

4. *Torque:* 10 Nm



5. *Torque:* 9 Nm



Installation

1. To install reverse the removal procedure.

Published: 25-Sep-2013

Battery, Mounting and Cables - Battery Vehicles Without: 7 Seats

Removal and Installation

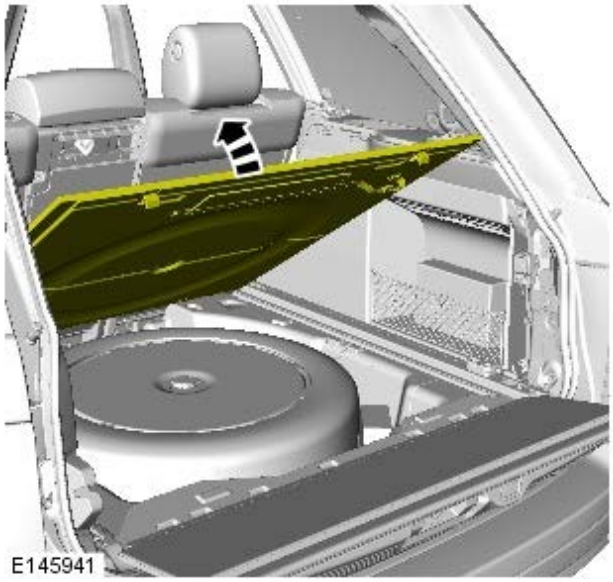
Removal

NOTES:

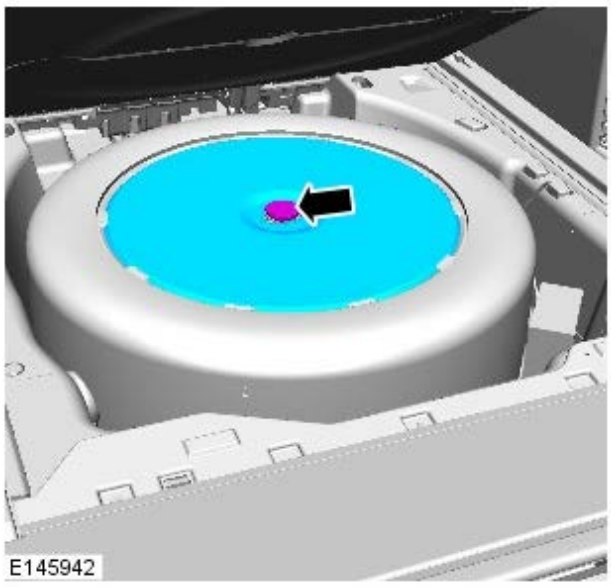
Some variation in the illustrations may occur, but the essential information is always correct.

Removal steps in this procedure may contain installation details.

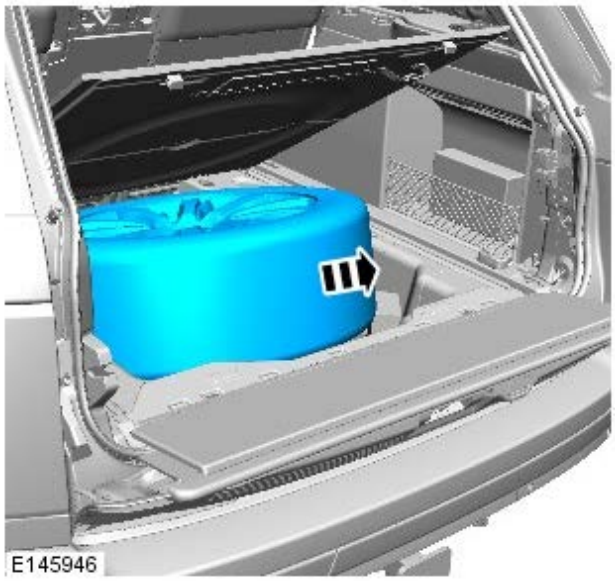
1.



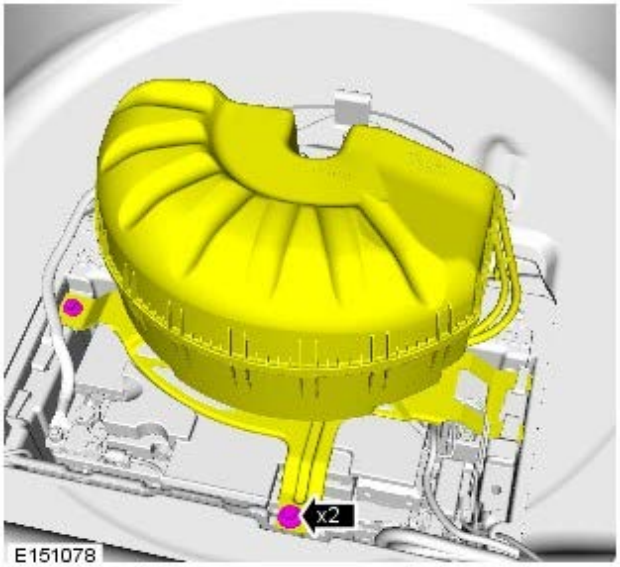
2.



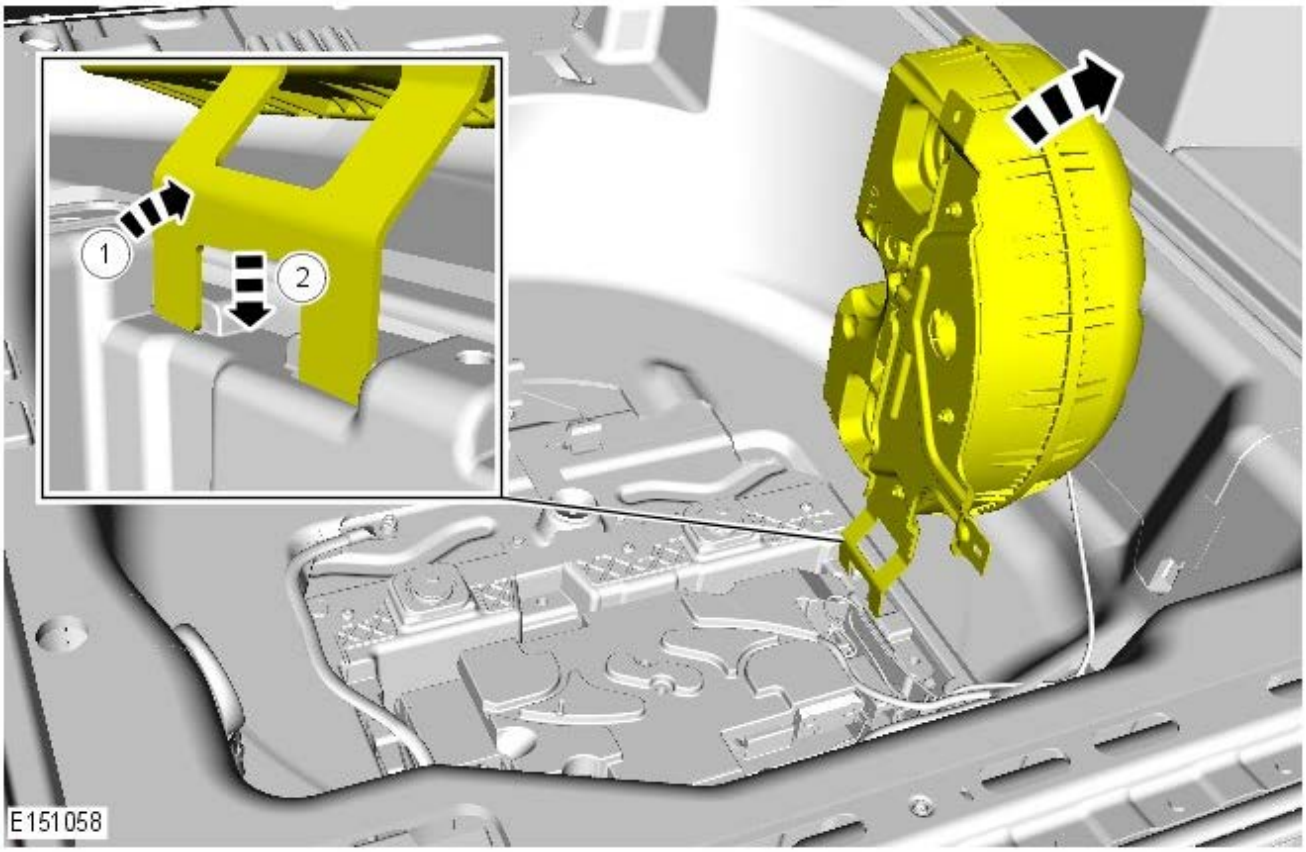
3.



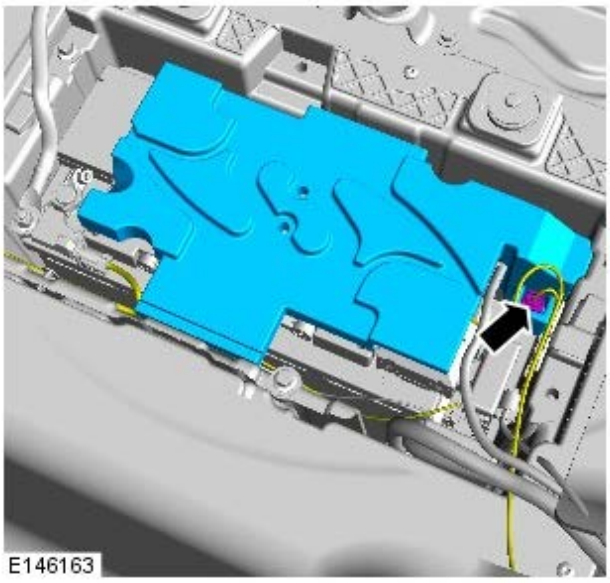
4.



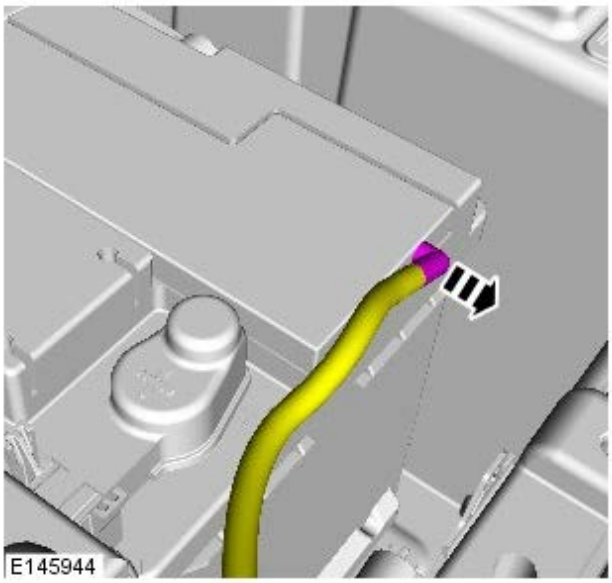
5. CAUTION: Secure the air suspension compressor in the upright position as illustrated.

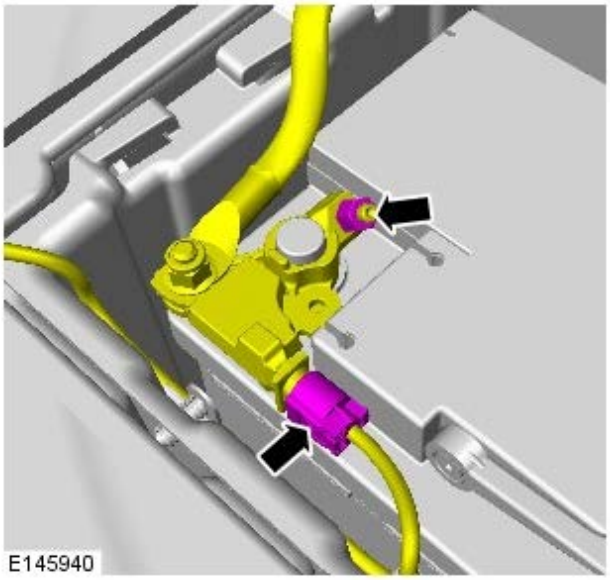


6.



7.

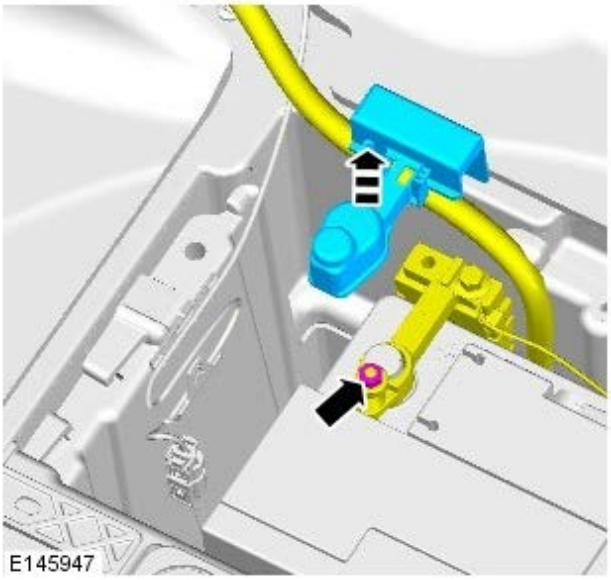




8. CAUTION: Make sure the component is aligned as shown.

NOTE: Disconnect the ground cable first.

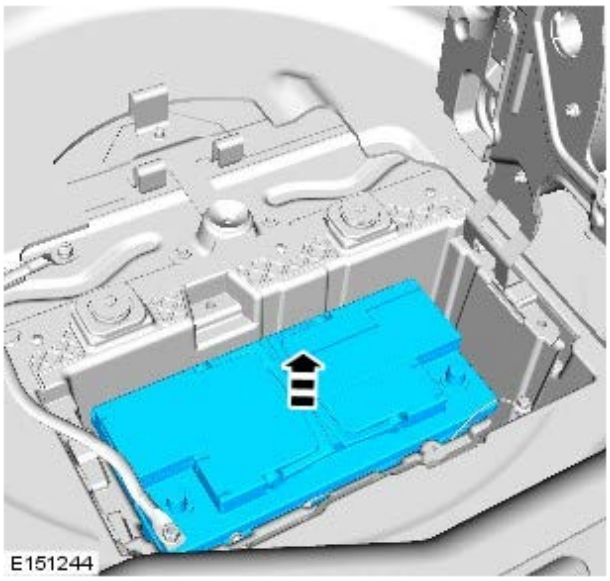
Torque: 6 Nm



9. CAUTION: Make sure the component is aligned as shown.

Torque: 6 Nm

10.



Installation

1. CAUTIONS:

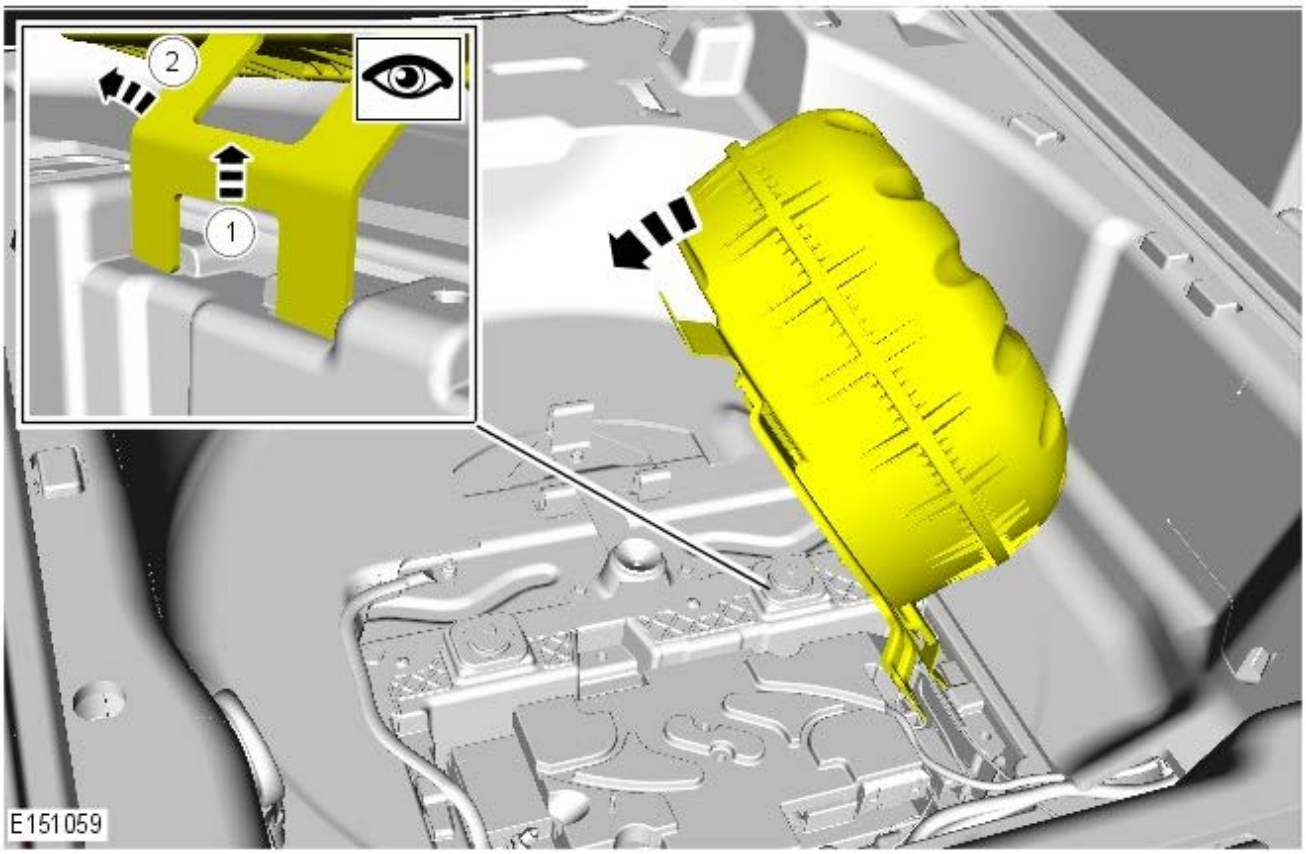
   Make sure the air suspension compressor is located correctly in its mounting bracket.

   Make sure that the battery monitoring system (BMS) module wiring harness does not get caught beneath the battery securing clamp.

   Make sure that the battery is positioned fully outboard on the battery tray and that no harnesses or hoses are trapped before securing the battery with the bolts.

   Make sure the component is correctly located on its mounting bracket. Lift the component by 10 mm before lowering into position.

   To install, reverse the removal procedure.


2
1
E151059

Published: 09-Jan-2014

Battery, Mounting and Cables - Battery Vehicles With: 7 Seats

Removal and Installation

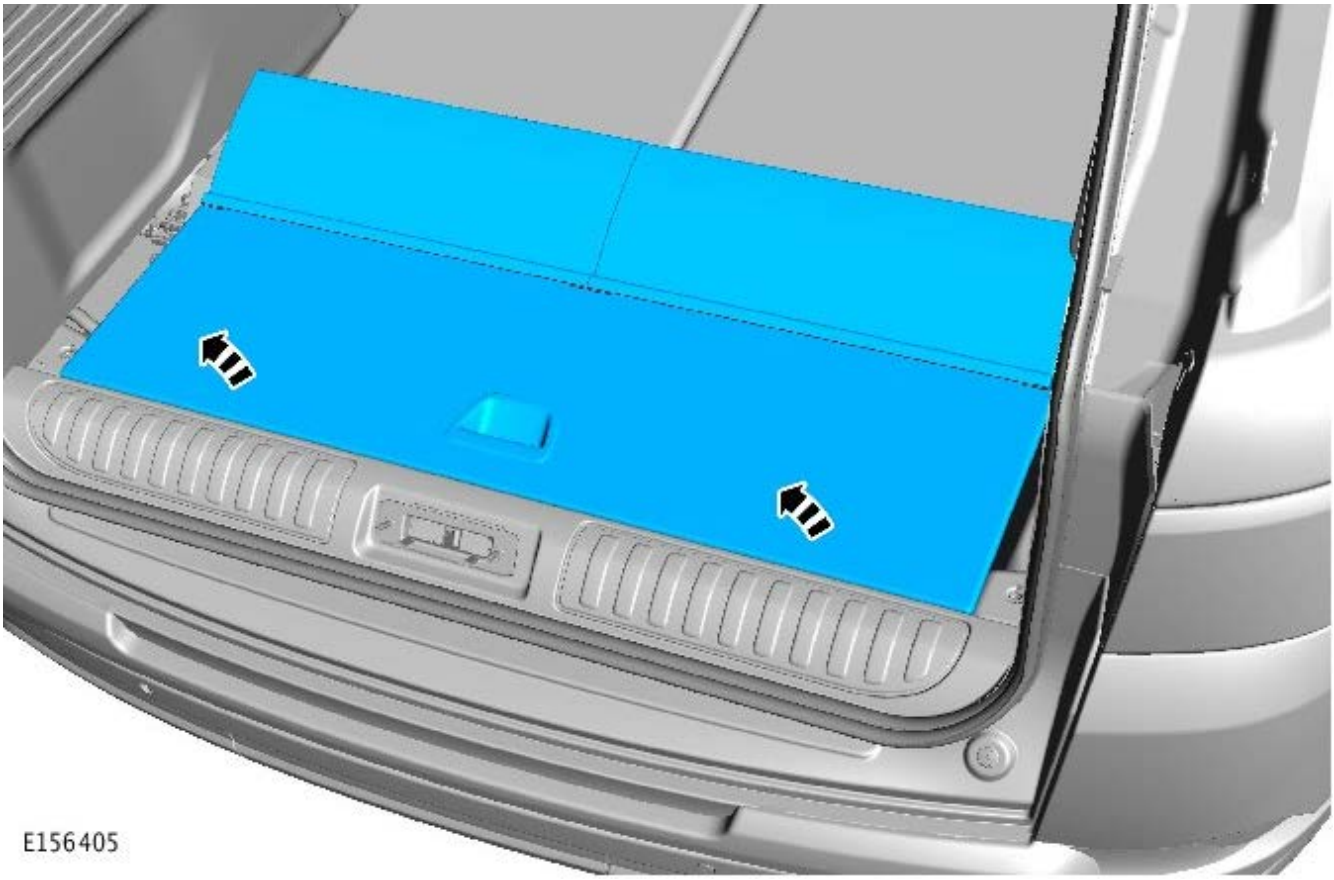
Removal

NOTES:

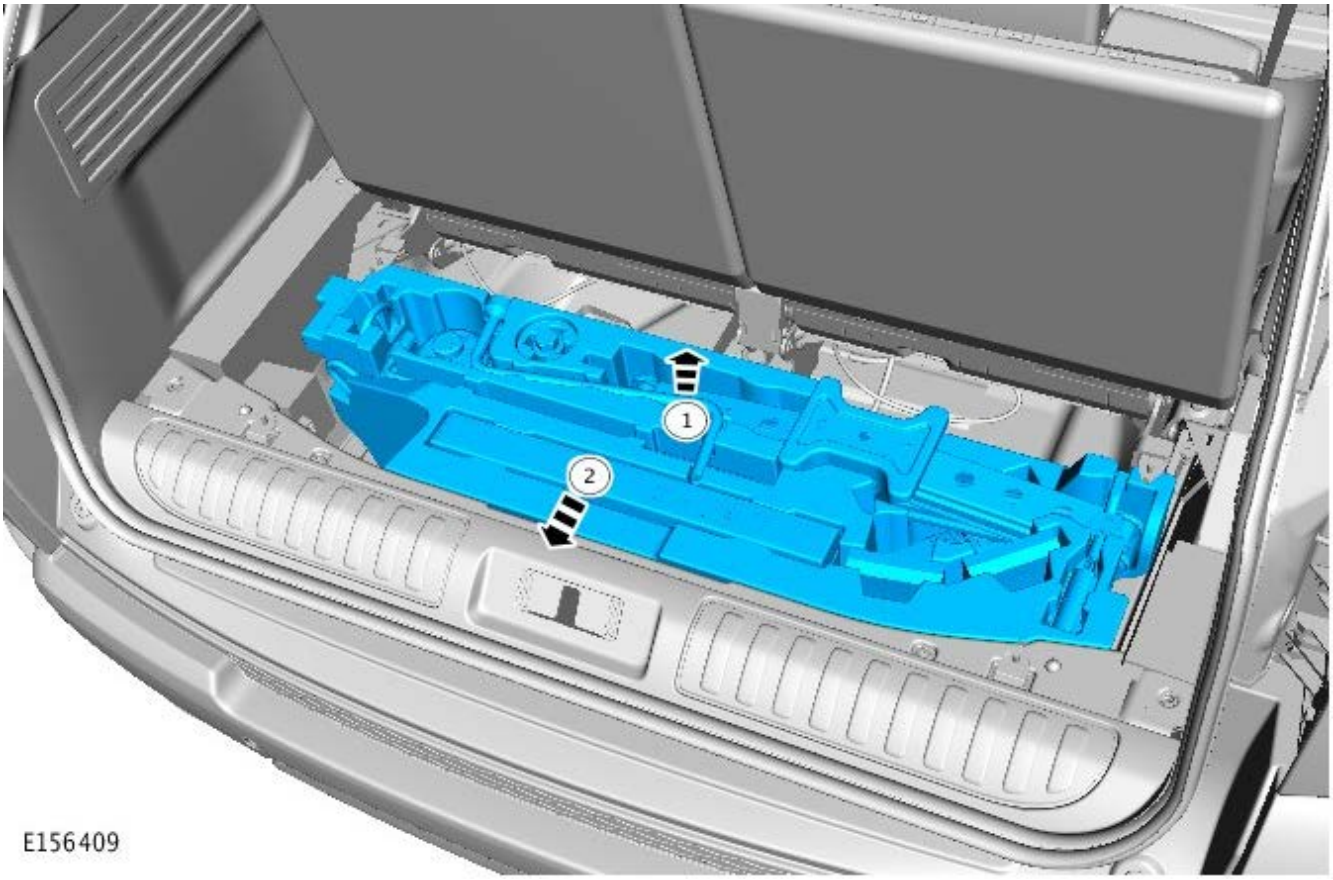
Some variation in the illustrations may occur, but the essential information is always correct.

Removal steps in this procedure may contain installation details.

1.

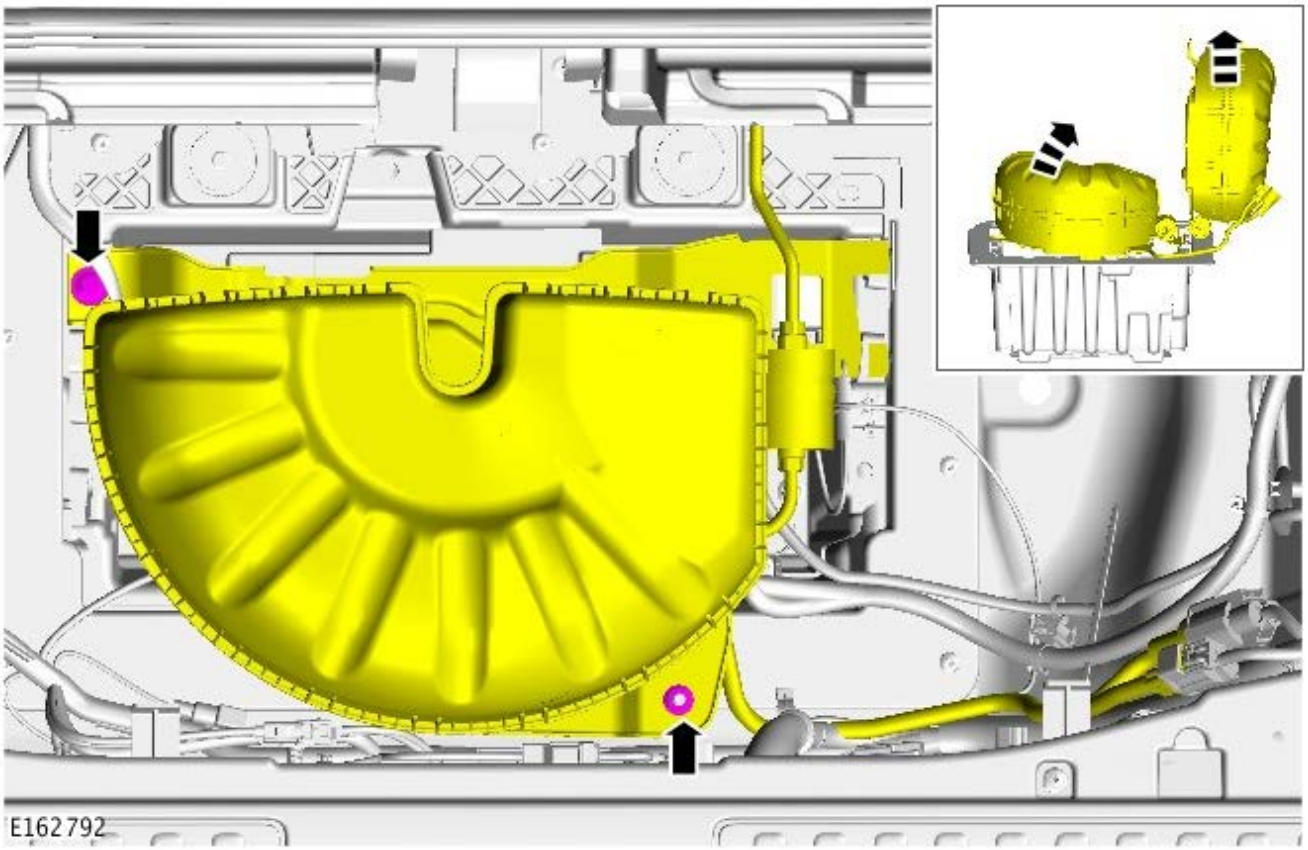


2.

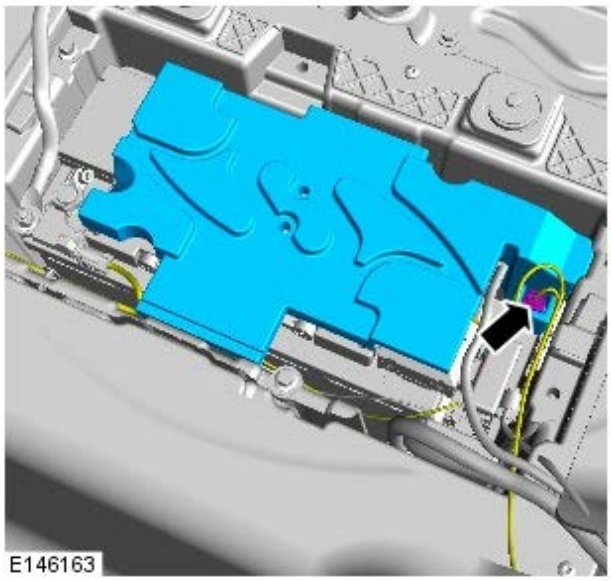


3. CAUTION: Secure the air suspension compressor in the upright position as illustrated.

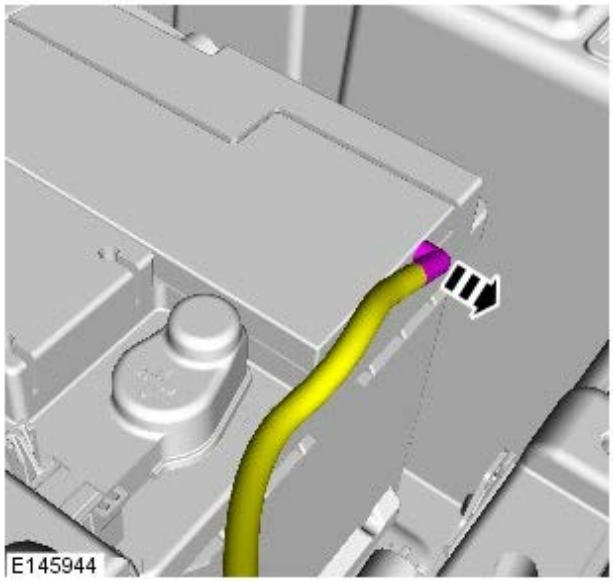
Torque:
Nut 25 Nm
Bolt 10 Nm



4.



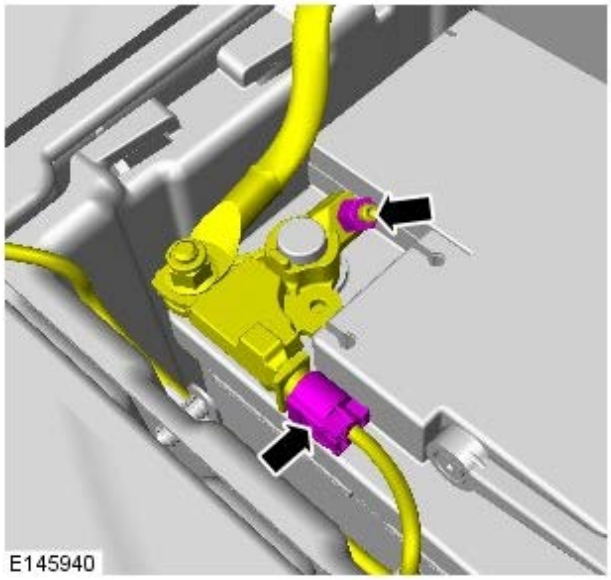
5.



6. CAUTION: Make sure that the component is aligned as shown.

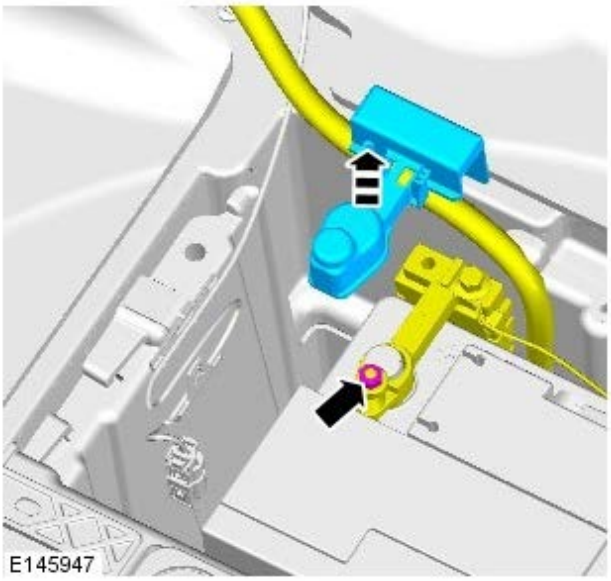
NOTE: Disconnect the ground cable first.

Torque: 6 Nm

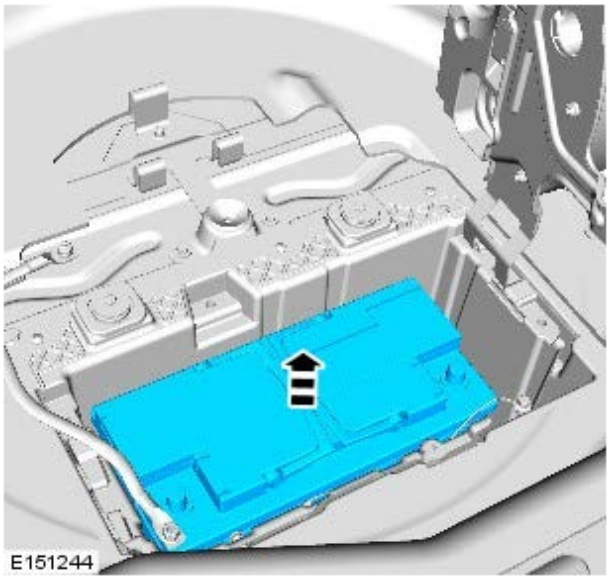


7. CAUTION: Make sure that the component is aligned as shown.

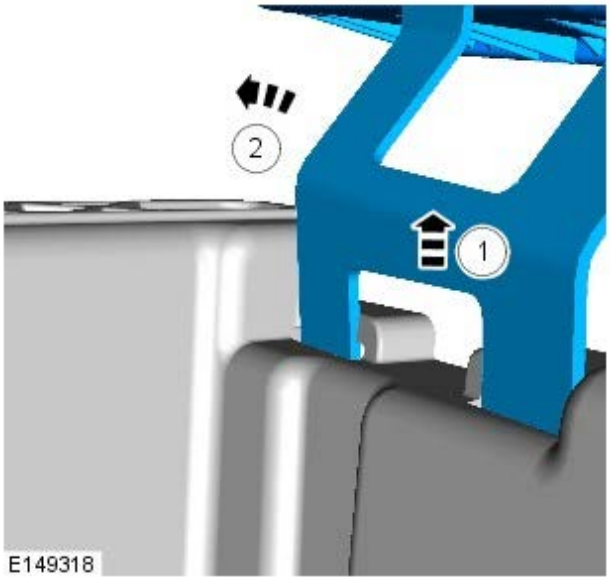
Torque: 6 Nm



8.



Installation



1. CAUTIONS:

   Make sure that the air suspension compressor is located correctly in its mounting bracket.

   Make sure that the battery monitoring system (BMS) module wiring harness does not get caught beneath the battery securing clamp.

   Make sure that the battery is positioned fully outboard on the battery tray and that no harnesses or hoses are trapped.

   Make sure that the component is correctly located on its mounting bracket. Lift the component by 10mm before lowering into position.

   To install, reverse the removal procedure.

Published: 16-Dec-2013

Battery, Mounting and Cables - Battery Tray

Removal and Installation

Removal

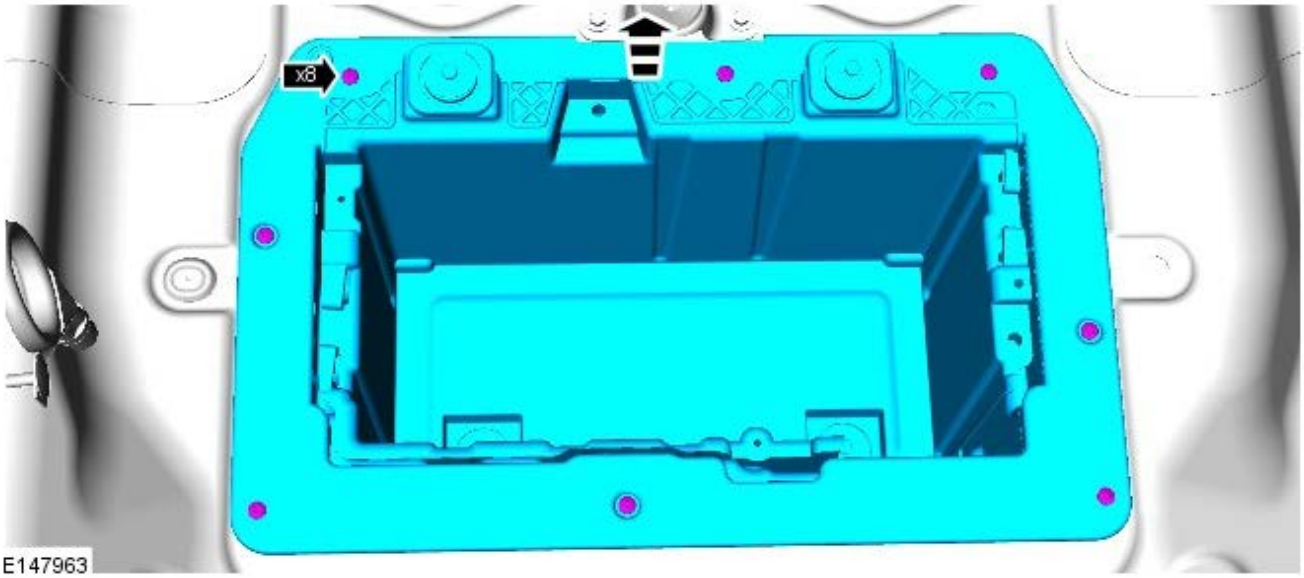
NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

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

2. Refer to: Battery - Vehicles Without: 7 Seats (414-01 Battery, Mounting and Cables, Removal and Installation).
   Refer to: Battery - Vehicles With: 7 Seats (414-01 Battery, Mounting and Cables, Removal and Installation).

3. CAUTION: Make sure that the surface is clean and free of foreign material.



Installation

1. To install, reverse the removal procedure.

Published: 06-Sep-2013

Battery, Mounting and Cables - Hybrid Electric Vehicle (HEV) Battery

Removal and Installation

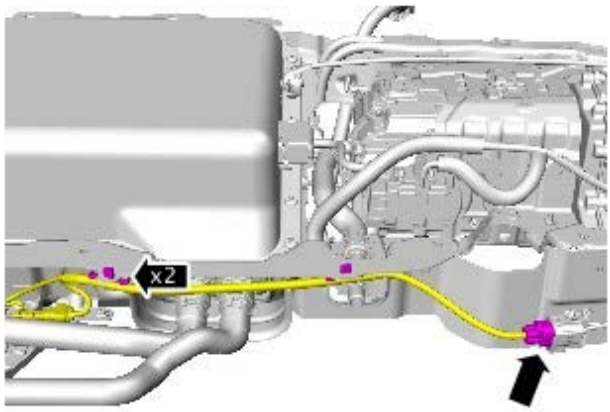
Removal

WARNING: This procedure can only be carried out after the vehicle has been decommissioned, by an approved person.

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

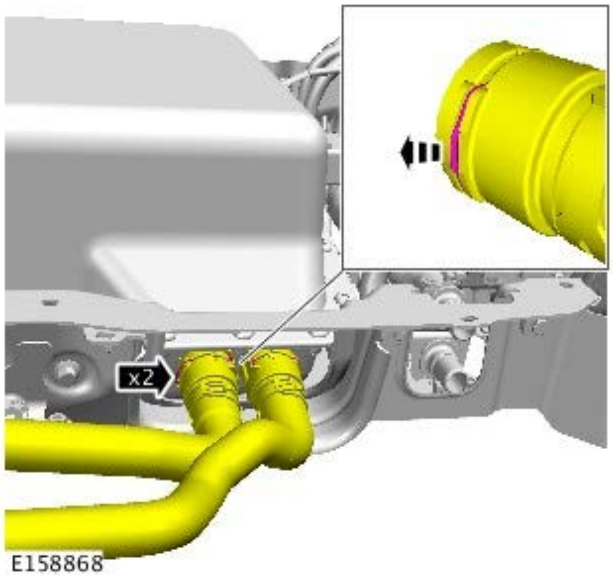
1. Refer to: Hybrid Electric Vehicle (HEV) Battery Pack Cradle (414-01 Battery, Mounting and Cables, Removal and Installation).

2.



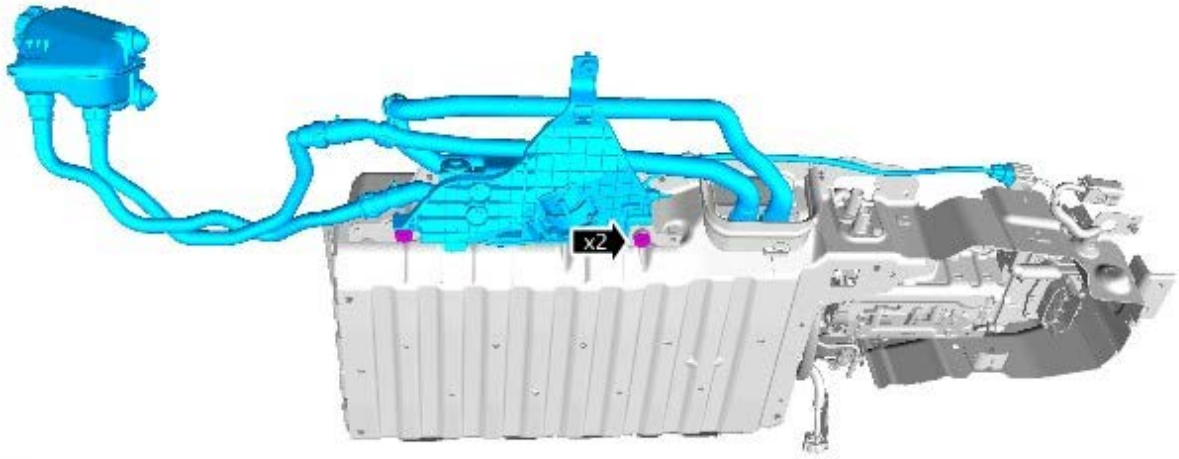
E158867

3. CAUTION: Be prepared to collect escaping coolant.



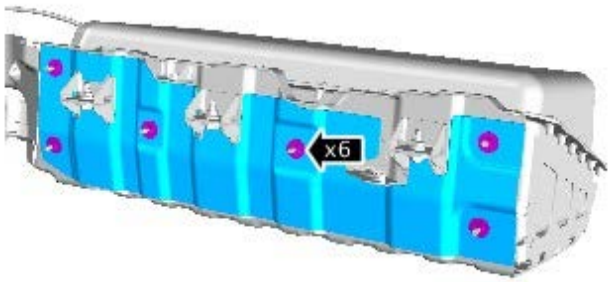
E158868

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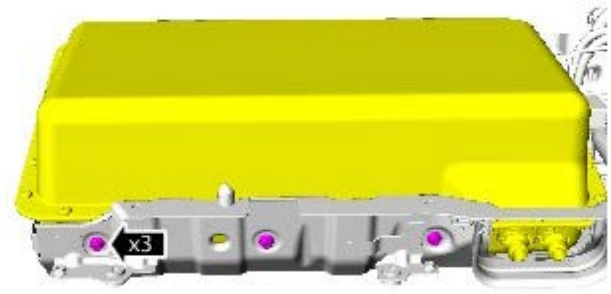
E158869

5.



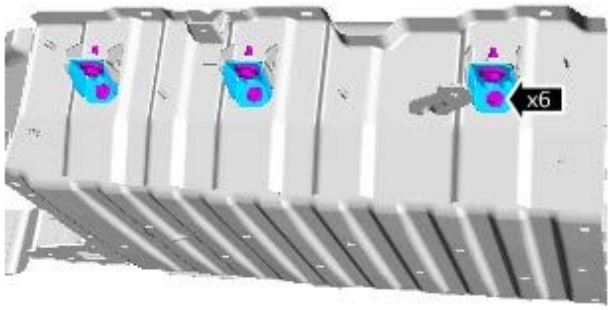
E158821

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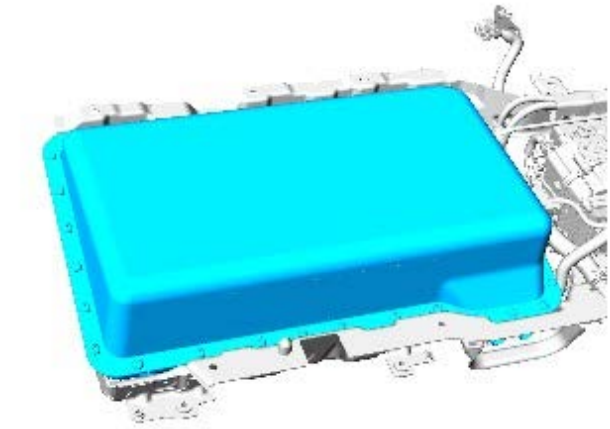
E158870

7.



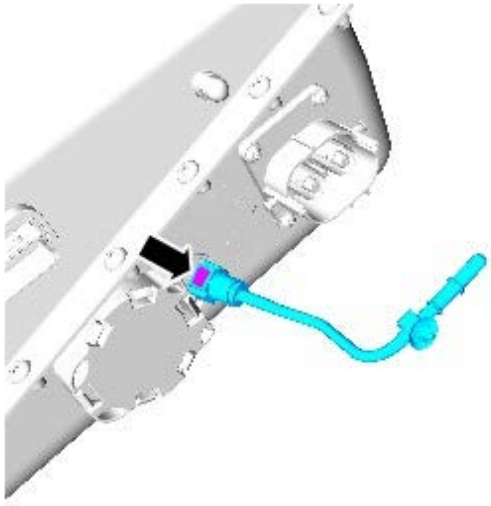
E158823

8. NOTE: This step requires the aid of another technician.



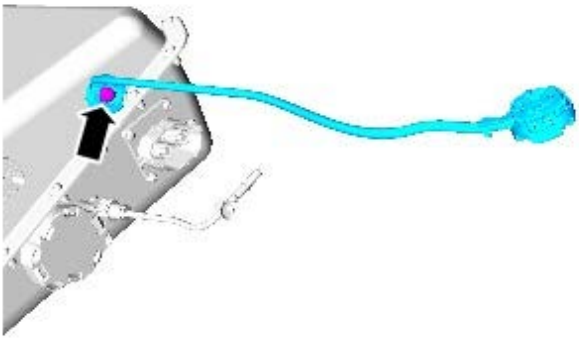
E158873

9.



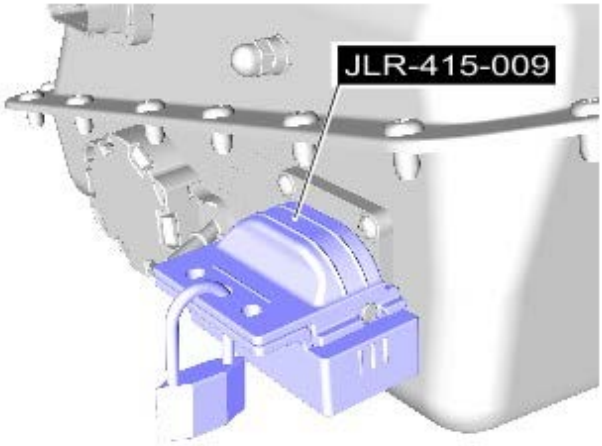
E158875

10.



E158876

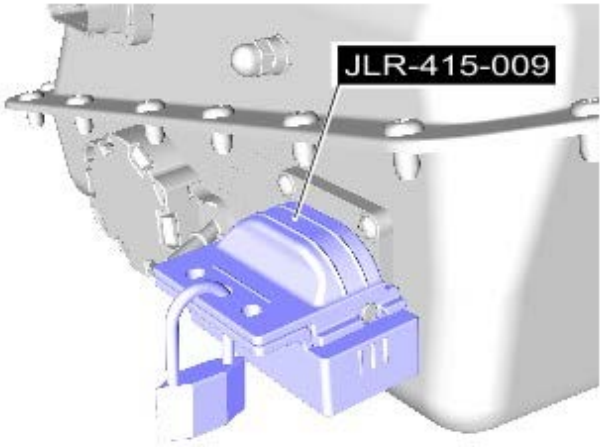
11. Remove the special tools.



E157081

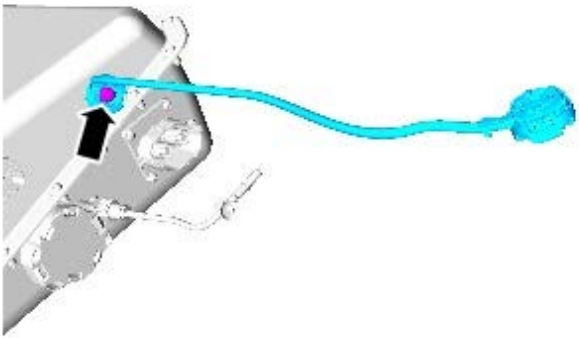
Installation

1.



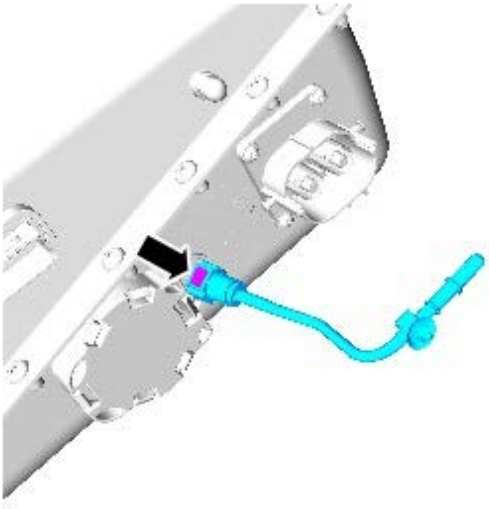
E157081

2. *Torque:* 10 Nm



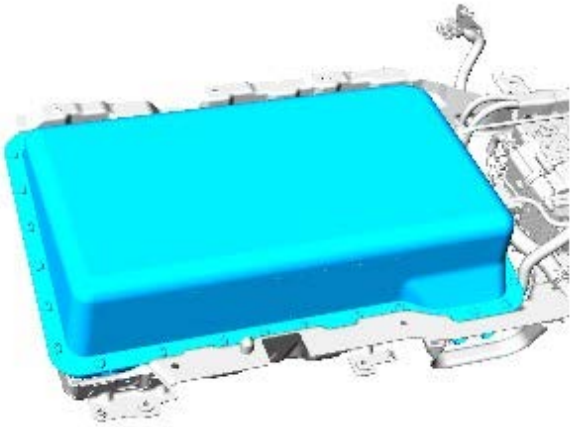
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3.



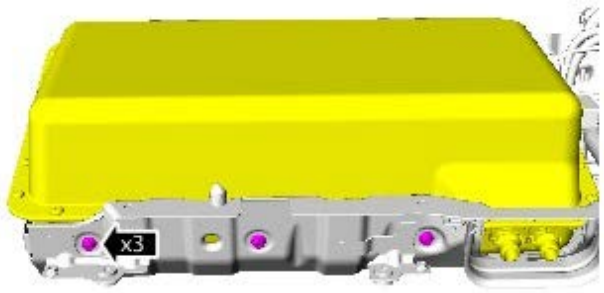
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4. NOTE: This step requires the aid of another technician.



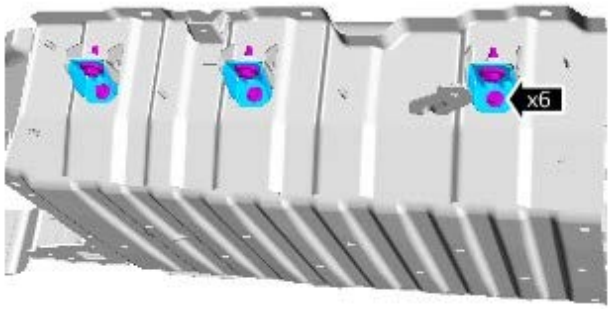
E158873

5. CAUTION: Only tighten the bolts finger-tight at this stage.



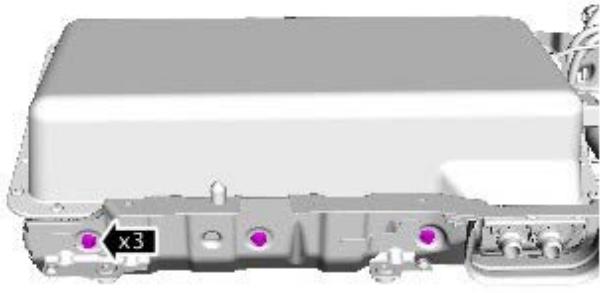
E158870

6. CAUTION: Only tighten the bolts finger-tight at this stage.



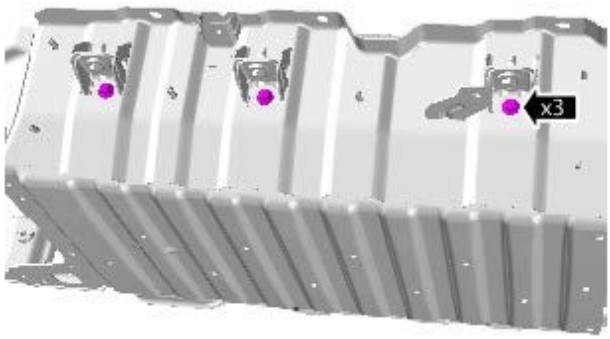
E158823

7. *Torque:* 22 Nm



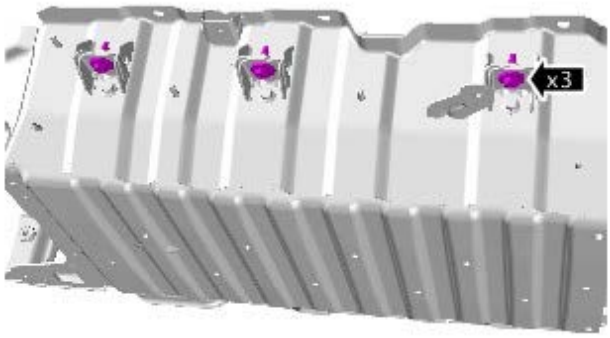
E159784

8. *Torque:* 22 Nm



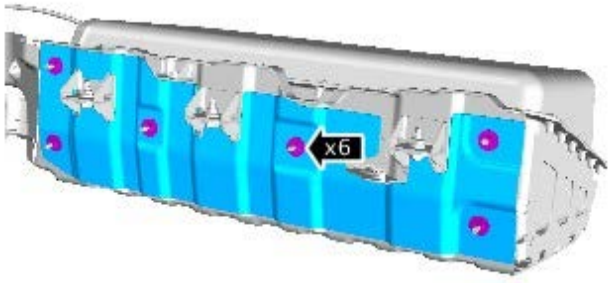
E159778

9. *Torque:* 22 Nm



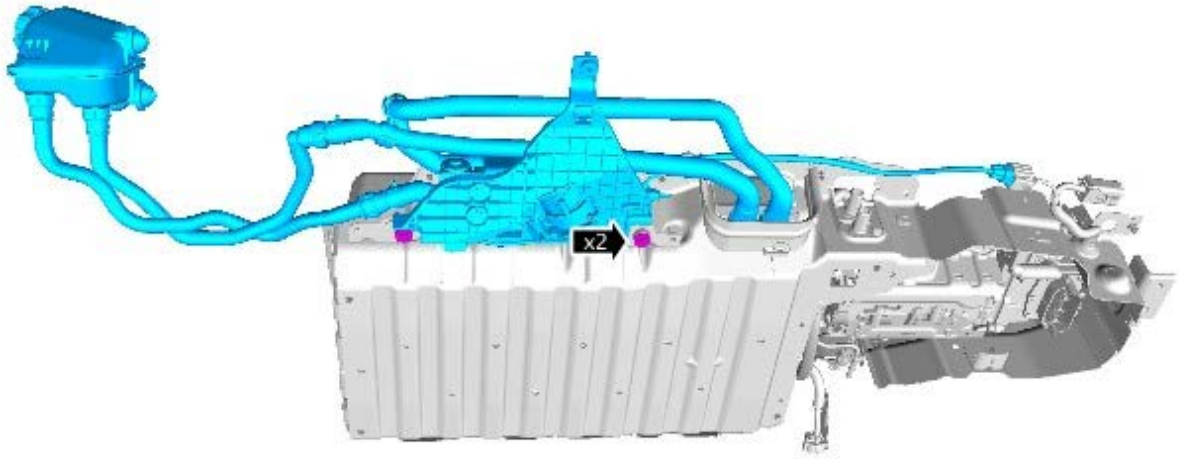
E159779

10. *Torque:* 10 Nm



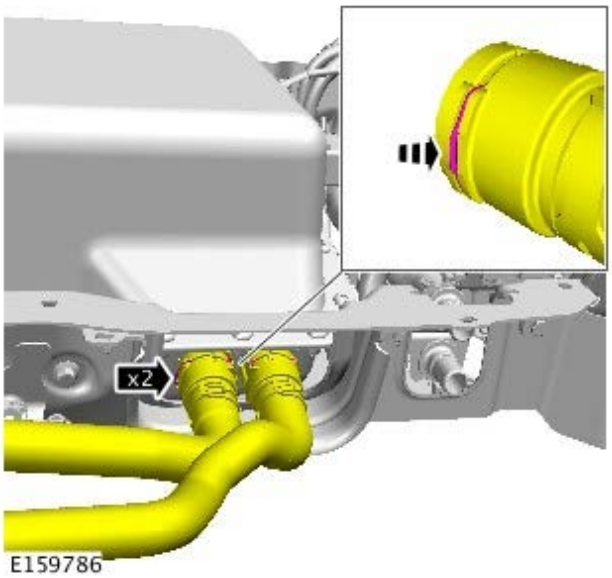
E158821

11. *Torque:* 10 Nm



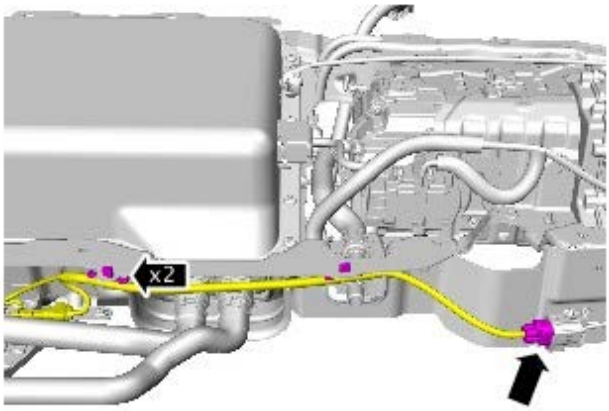
E158869

12.



E159786

13.



E158867

14. Refer to: Hybrid Electric Vehicle (HEV) Battery Pack Cradle (414-01 Battery, Mounting and Cables, Removal and Installation).

Published: 22-Nov-2013

Battery, Mounting and Cables - Hybrid Electric Vehicle (HEV) Battery Pack Cradle

Removal and Installation

General Equipment

Transmission jack

Removal

WARNING: This procedure can only be carried out after the vehicle has been decommissioned, by an approved person.

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

1. Decommission the vehicle.

   Refer to: Hybrid Electric Vehicle (HEV) Decommission (414-01 Battery, Mounting and Cables, General Procedures).

2. Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03A Engine Cooling - TDV6 3.0L Diesel, General Procedures).

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

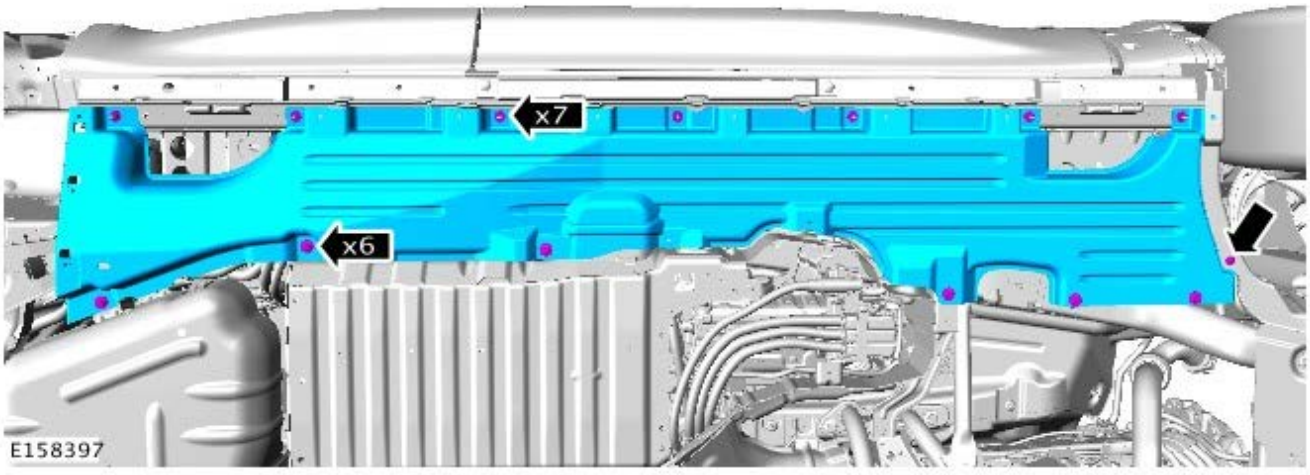
4. Remove the rear right fender splash shield.

   Refer to: Rear Fender Splash Shield (501-08 Exterior Trim and Ornamentation, Removal and Installation).

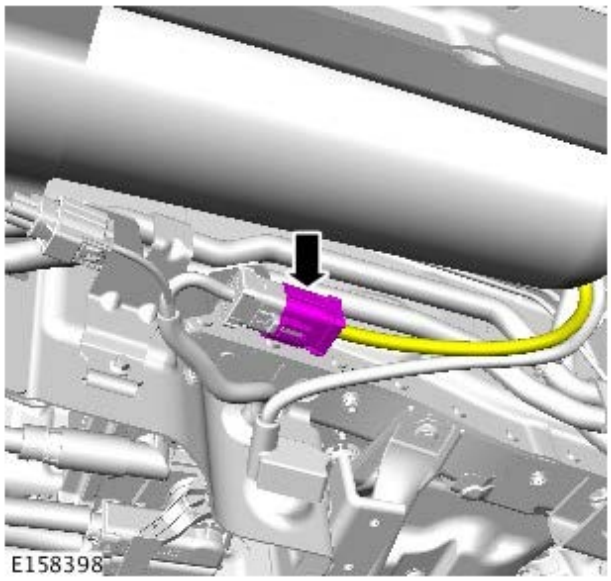
5. NOTE: RH side only.

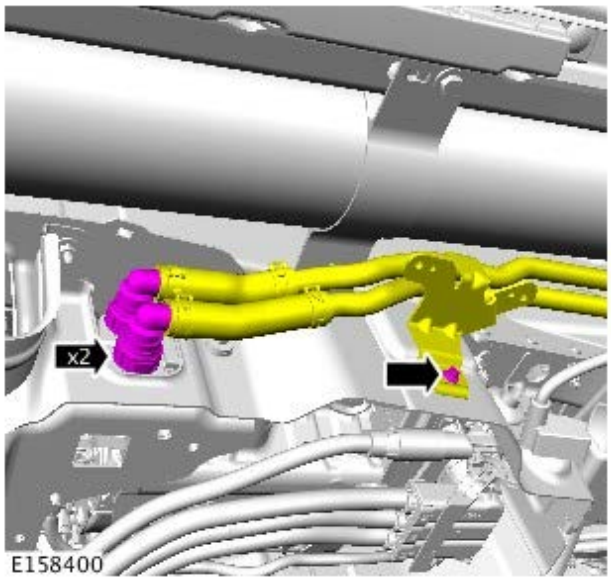
   Refer to: Rear Rocker Panel Moulding (501-08 Exterior Trim and Ornamentation, Removal and Installation).

6. NOTE: RH side only.



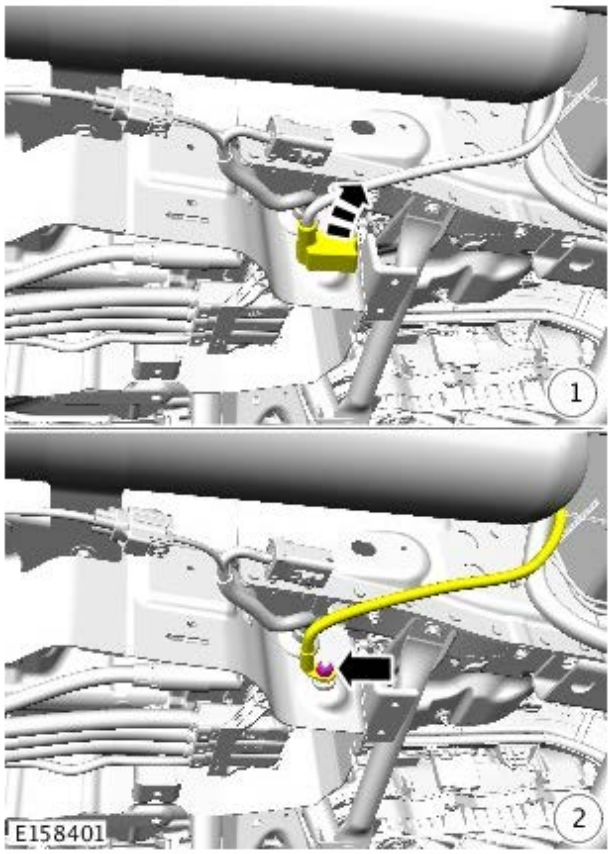
7.



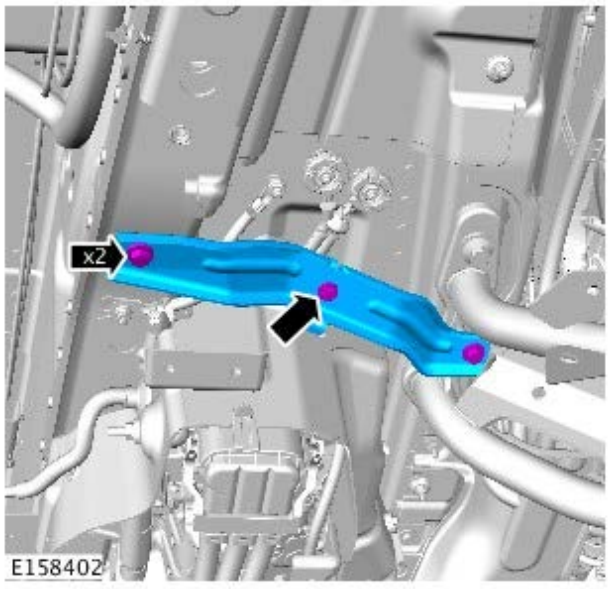


8. CAUTION: Be prepared to collect escaping coolant.

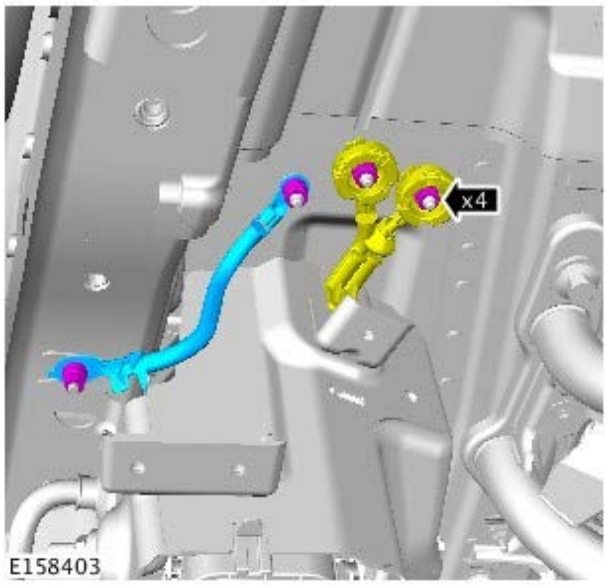
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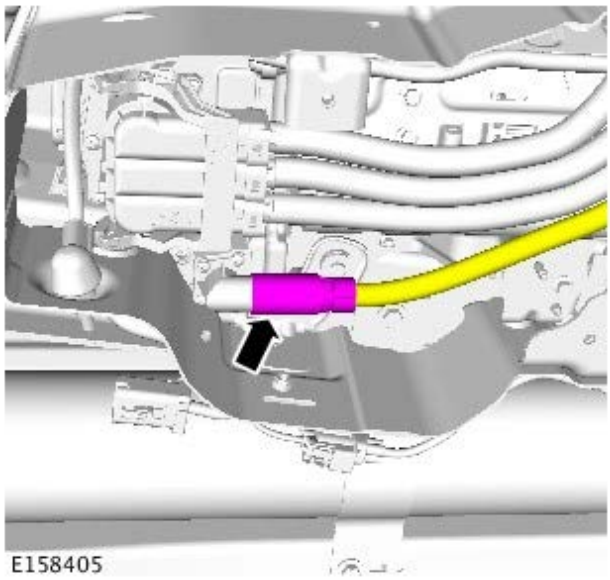


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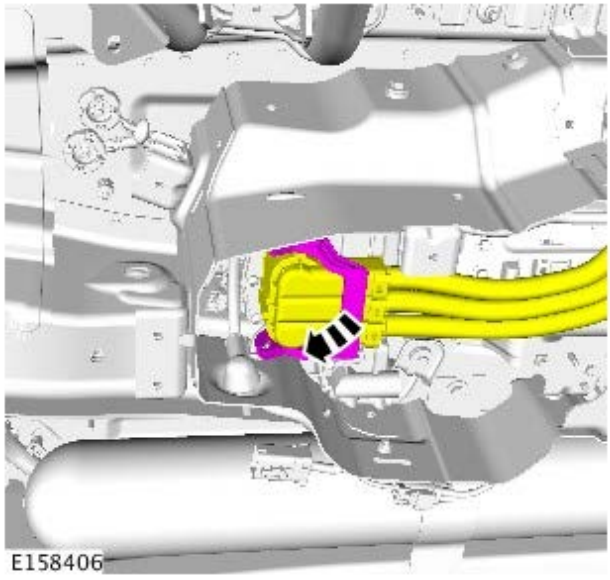


11. CAUTION: Make sure that the area around the component is clean and free of foreign material.



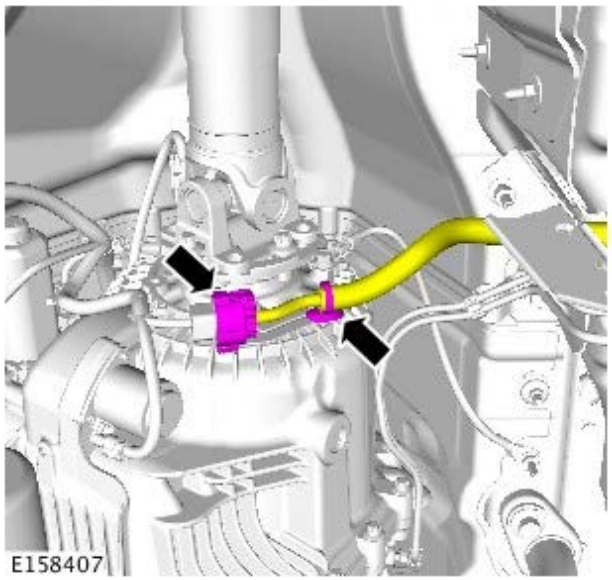


12. CAUTION: Make sure that the area around the component is clean and free of foreign material.

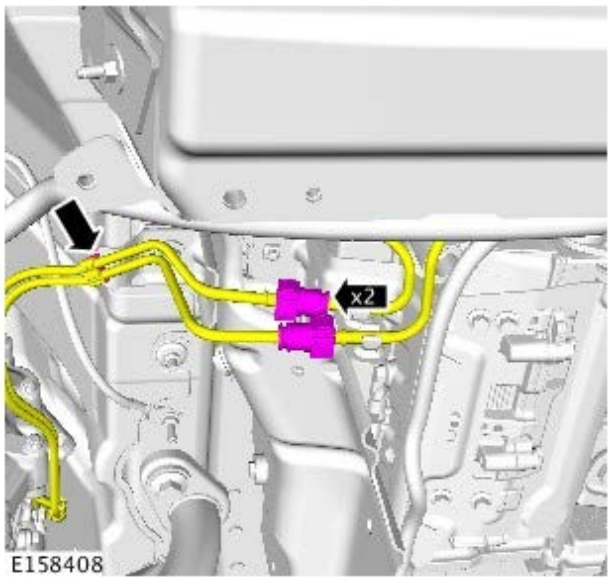


13. CAUTION: Make sure that the area around the component is clean and free of foreign material.

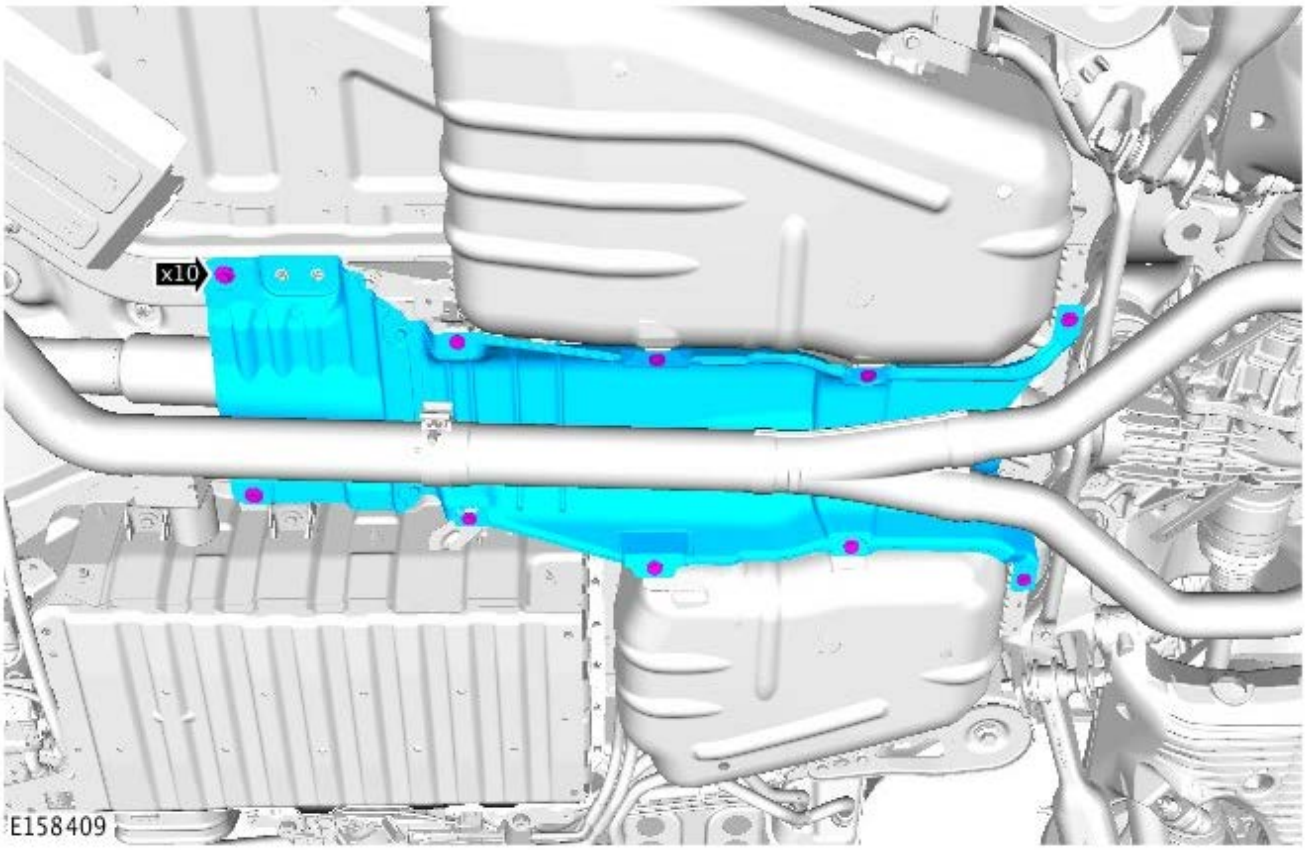
14.

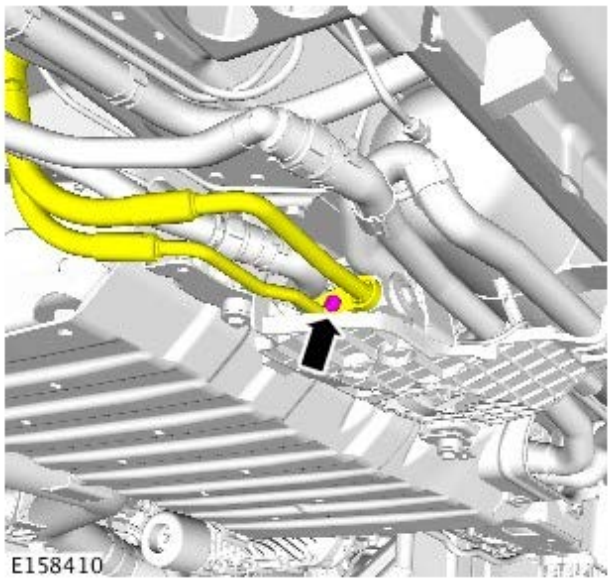


15.



16.

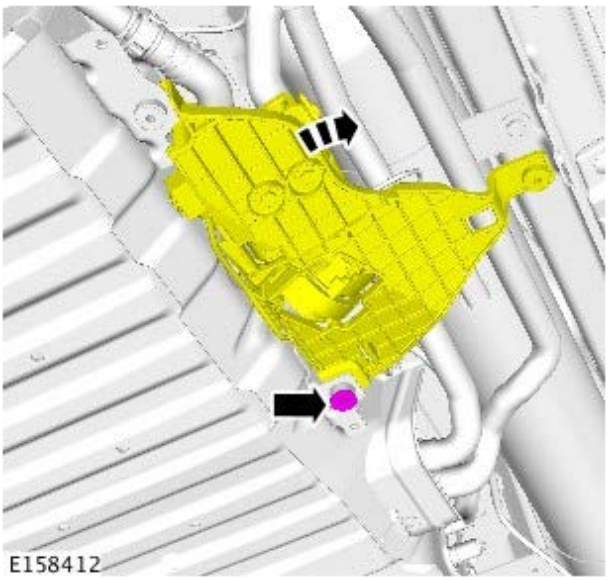




17. CAUTION: Remove and discard the O-ring seals.

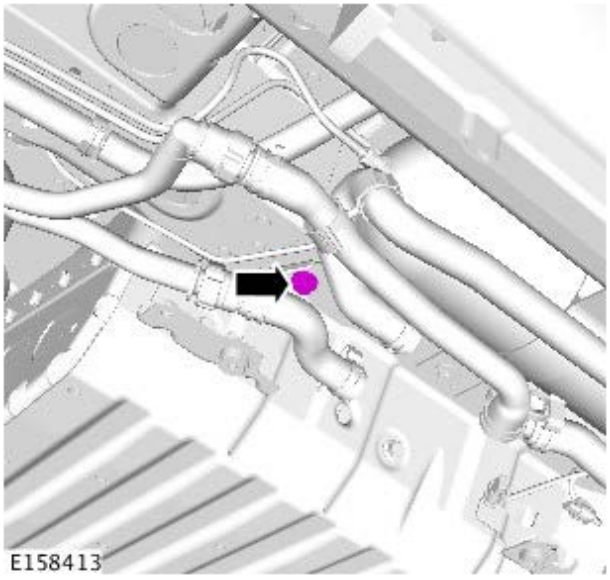
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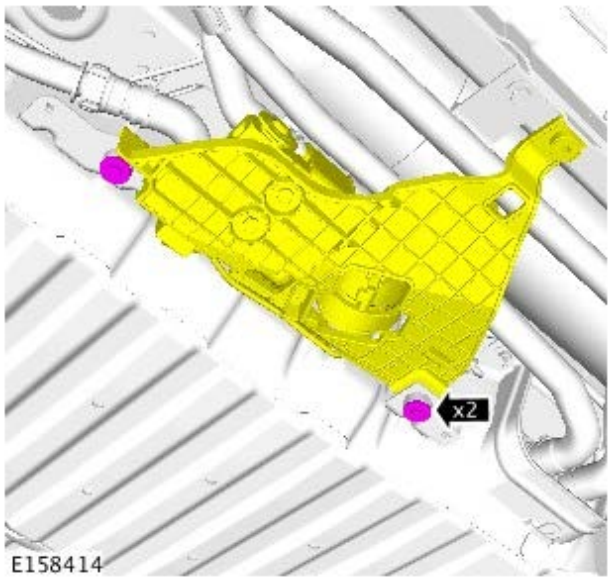


19. NOTE: Loosen the bolt, but do not fully remove.

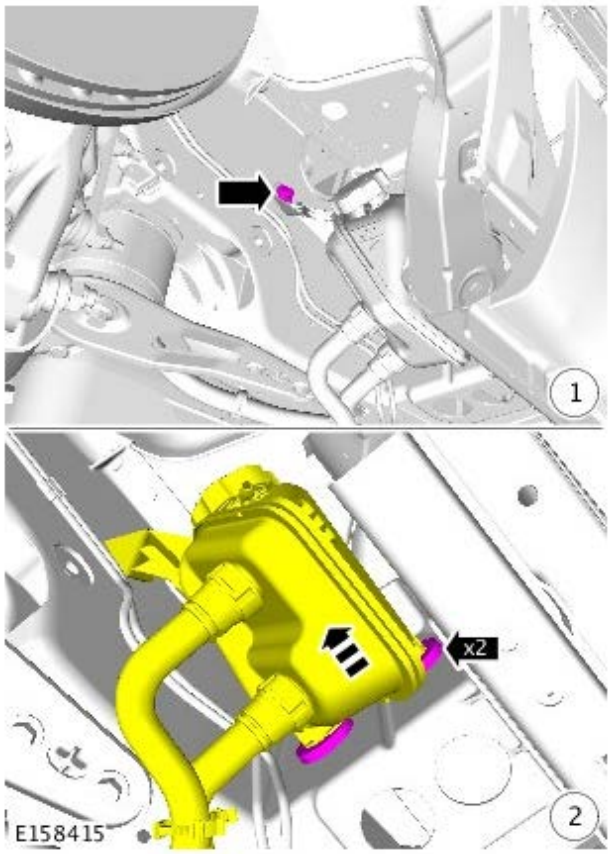
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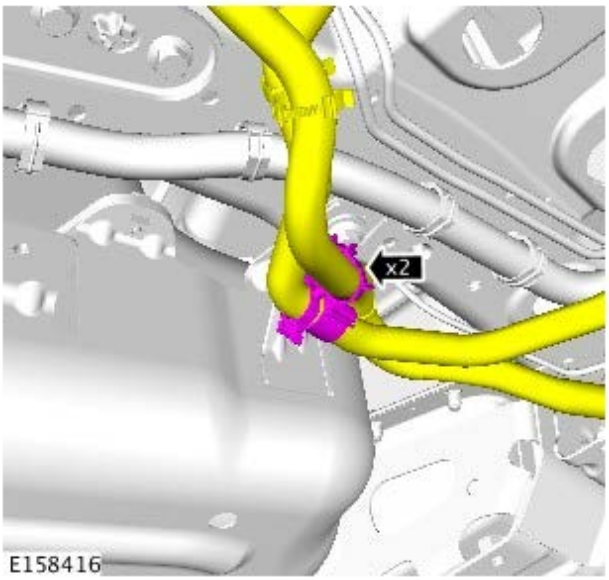
21. Install the retaining bolts finger tight.



22.

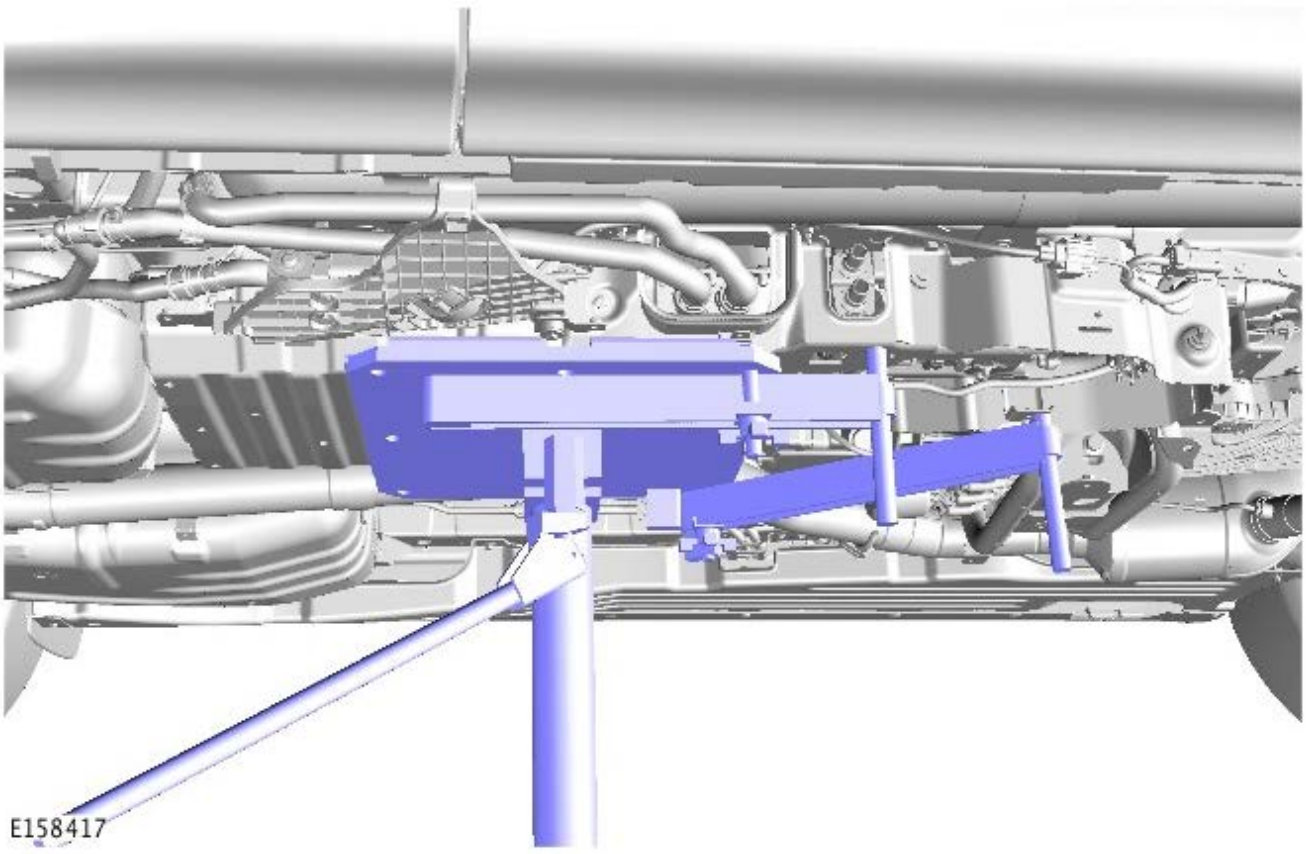


23.

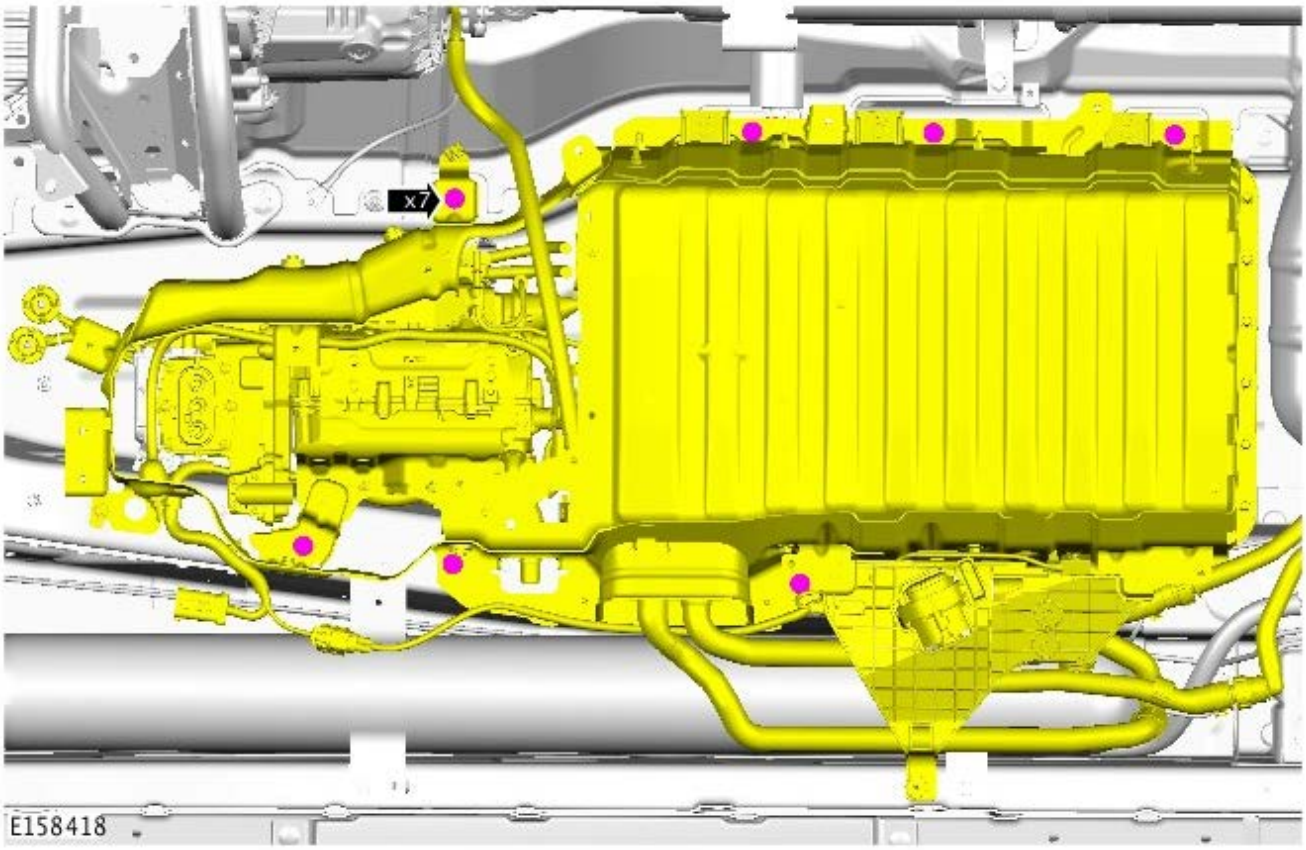


24. WARNING: Secure the battery cradle to the transmission jack.

General Equipment: Transmission jack

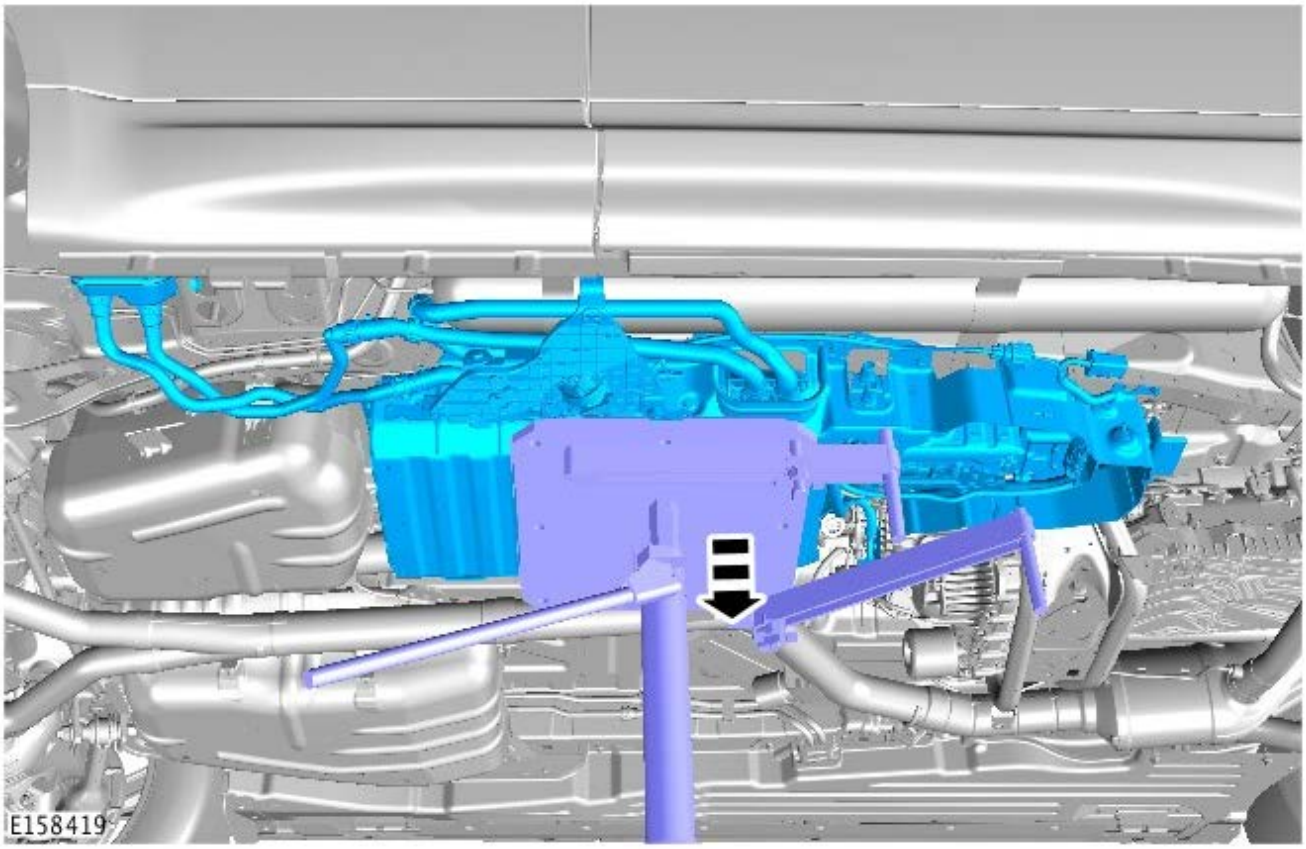


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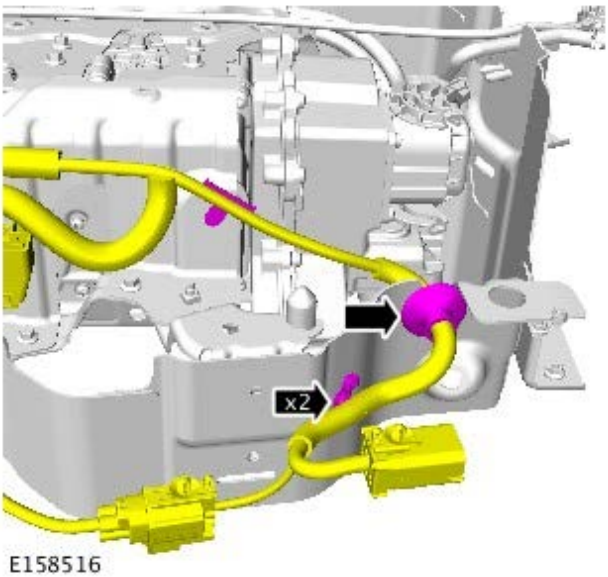


26. NOTE: Do not disassemble further if the component is removed for access only.

Using the transmission jack, lower and remove the battery cradle assembly.

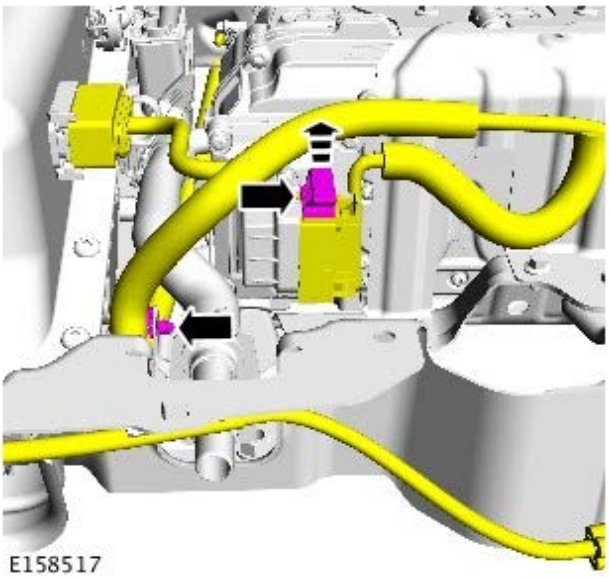


27.

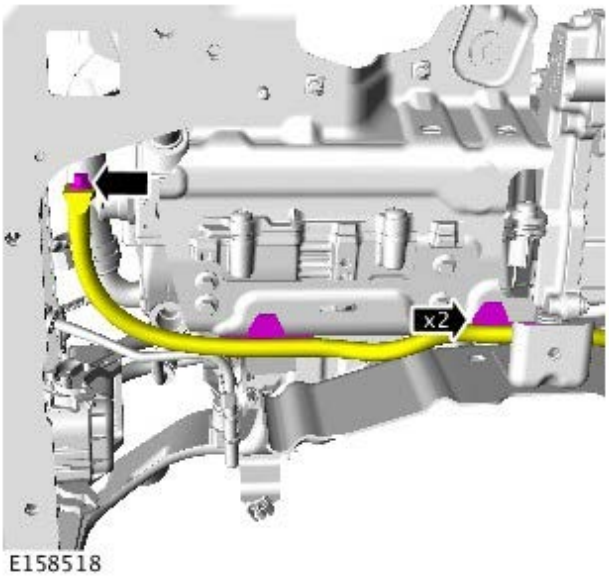


E158516

28.

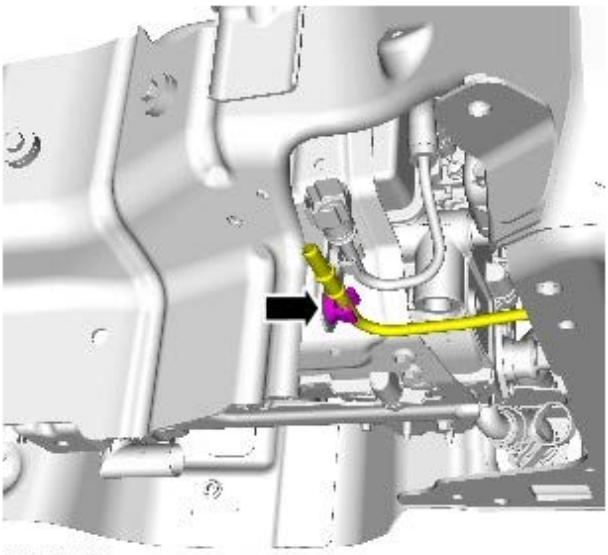

E158517

29.



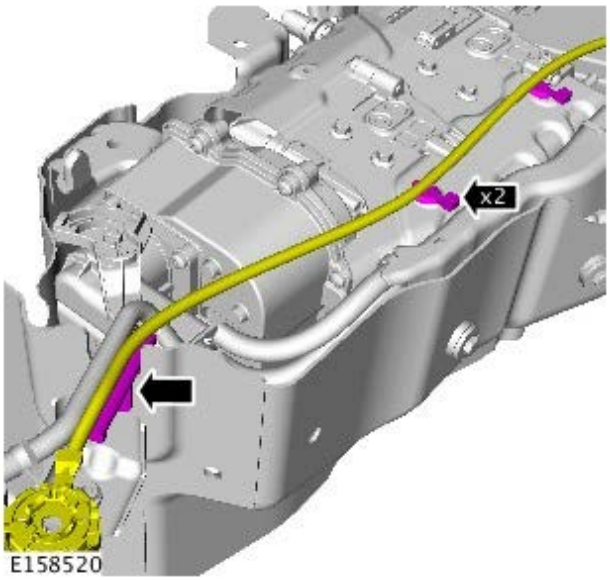
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30.



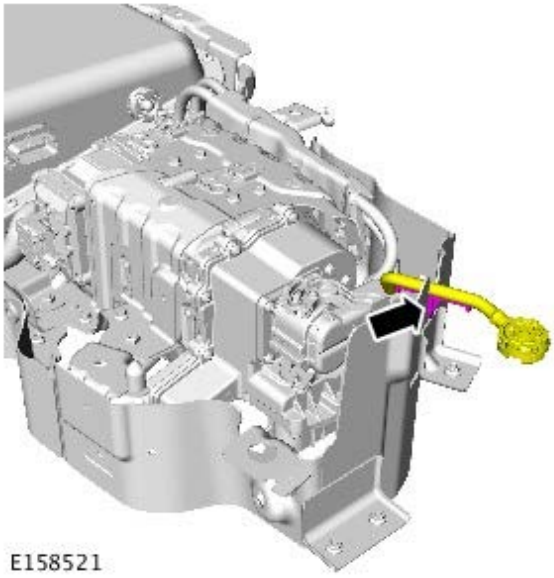
E158519

31.



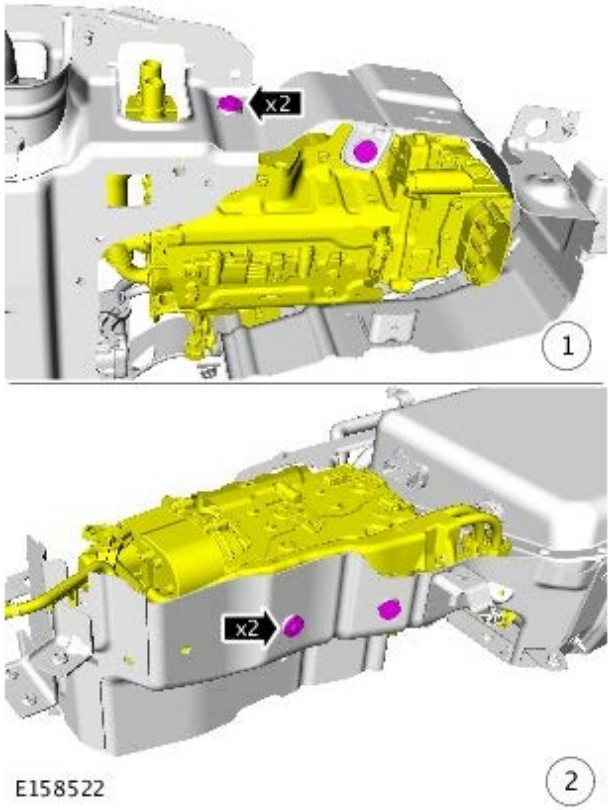
E158520

32.



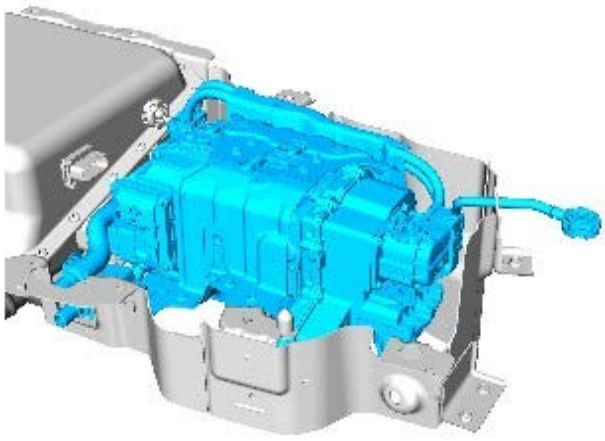
E158521

33.



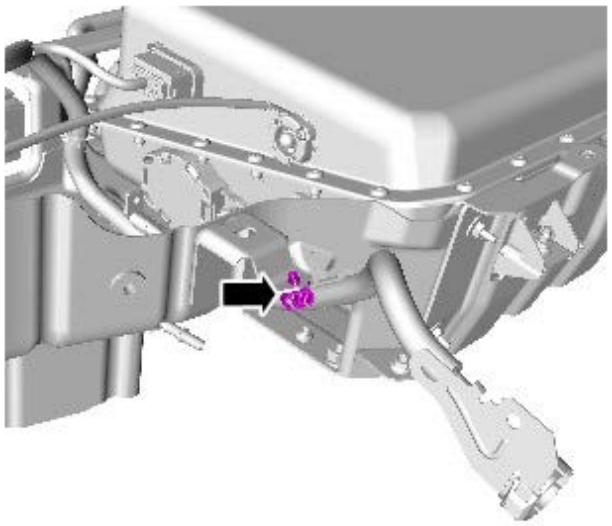
E158522

34.



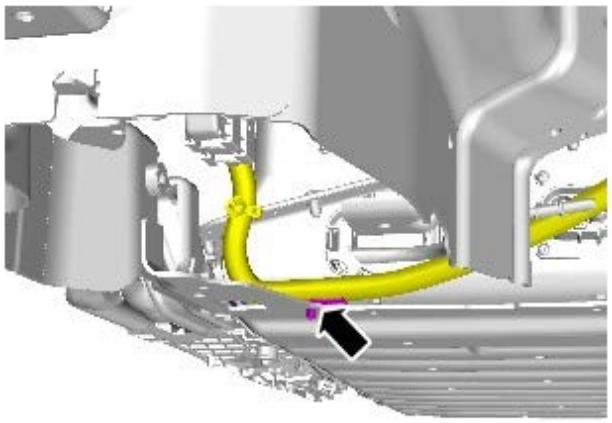
E158523

35.



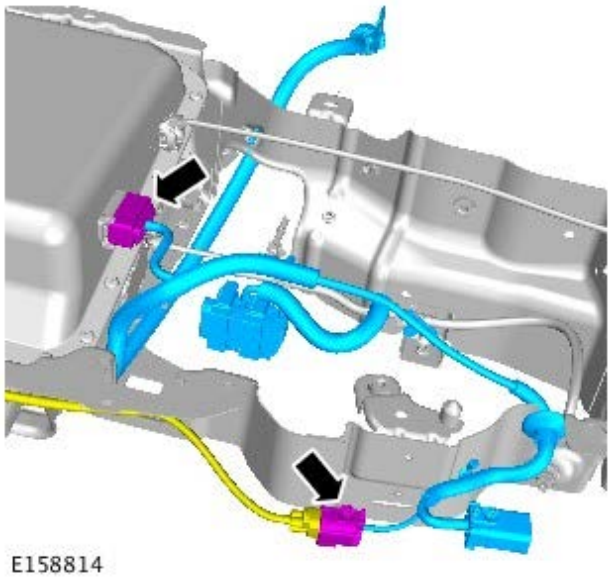
E158812

36.



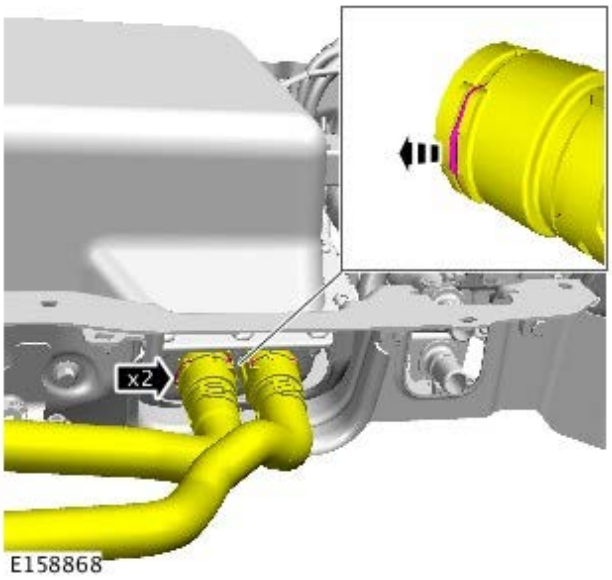
E158813

37.

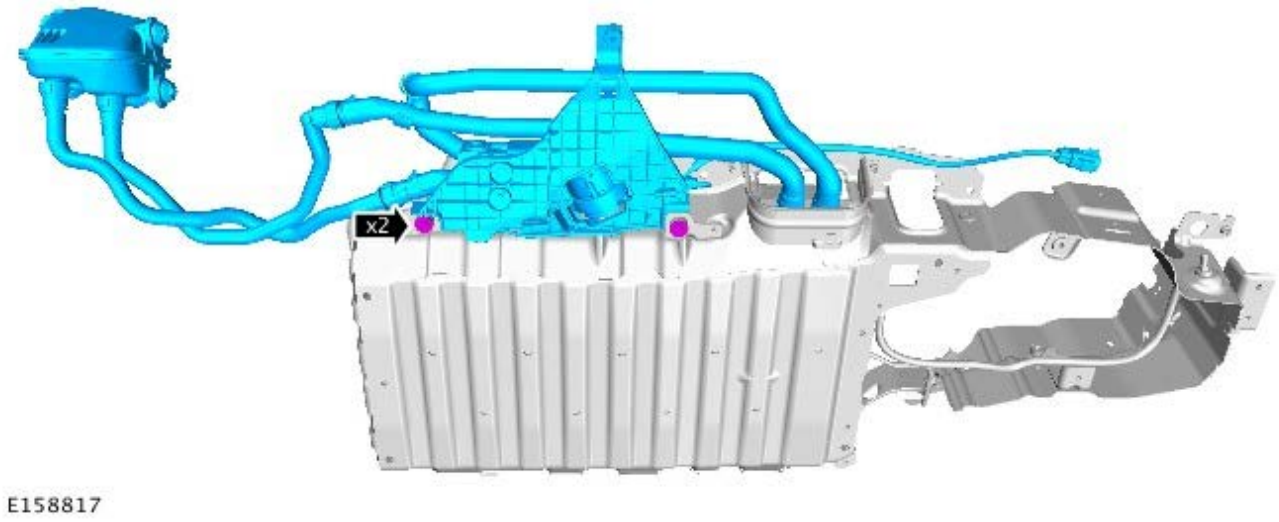


E158814

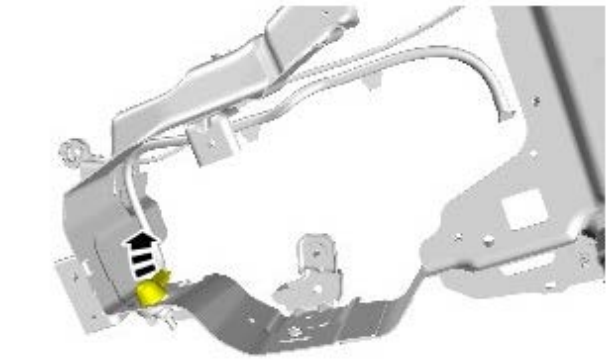
38. CAUTION: Be prepared to collect escaping coolant.

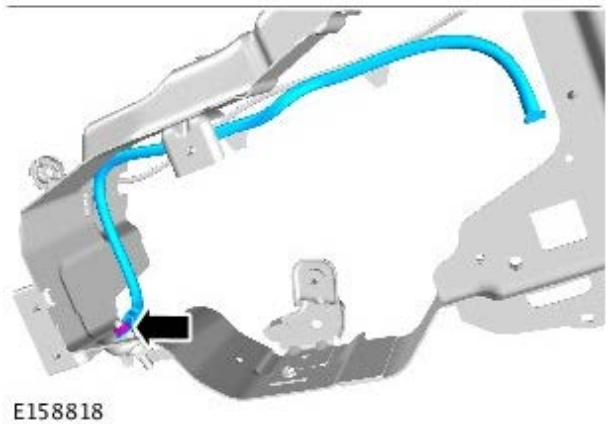


39.



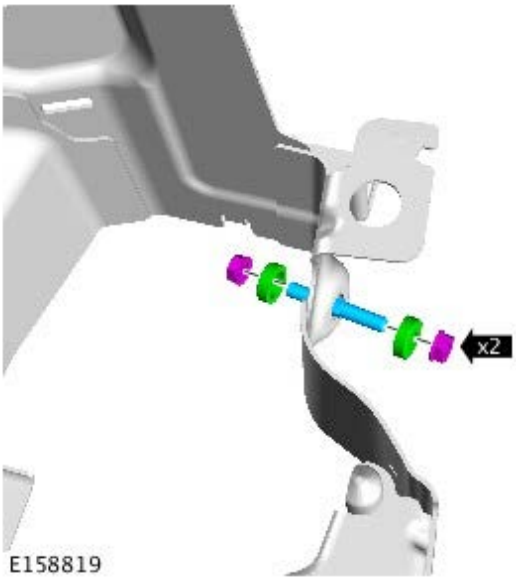
40.





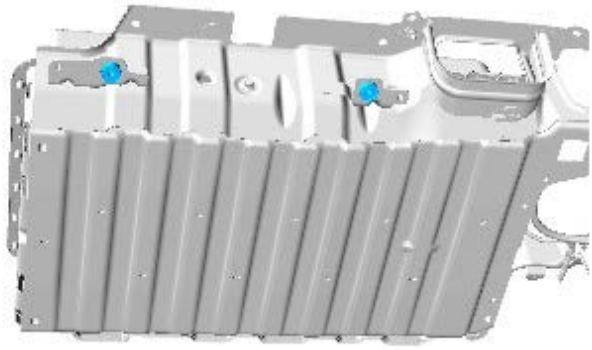
E158818

41.



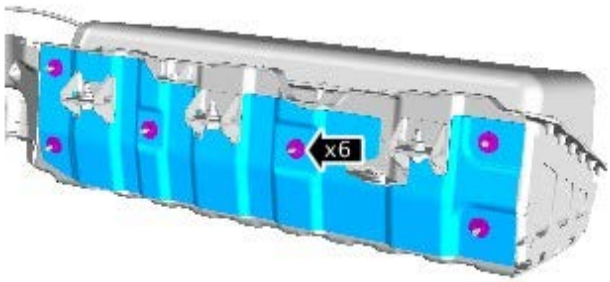
E158819

42.



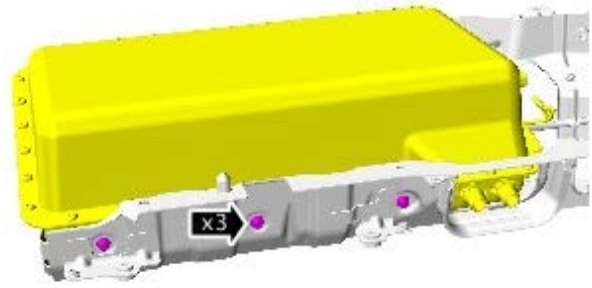
E158820

43.



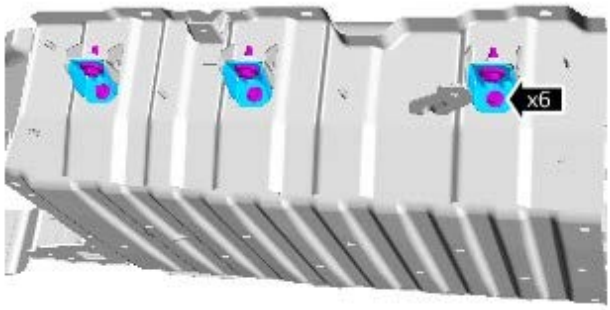
E158821

44.



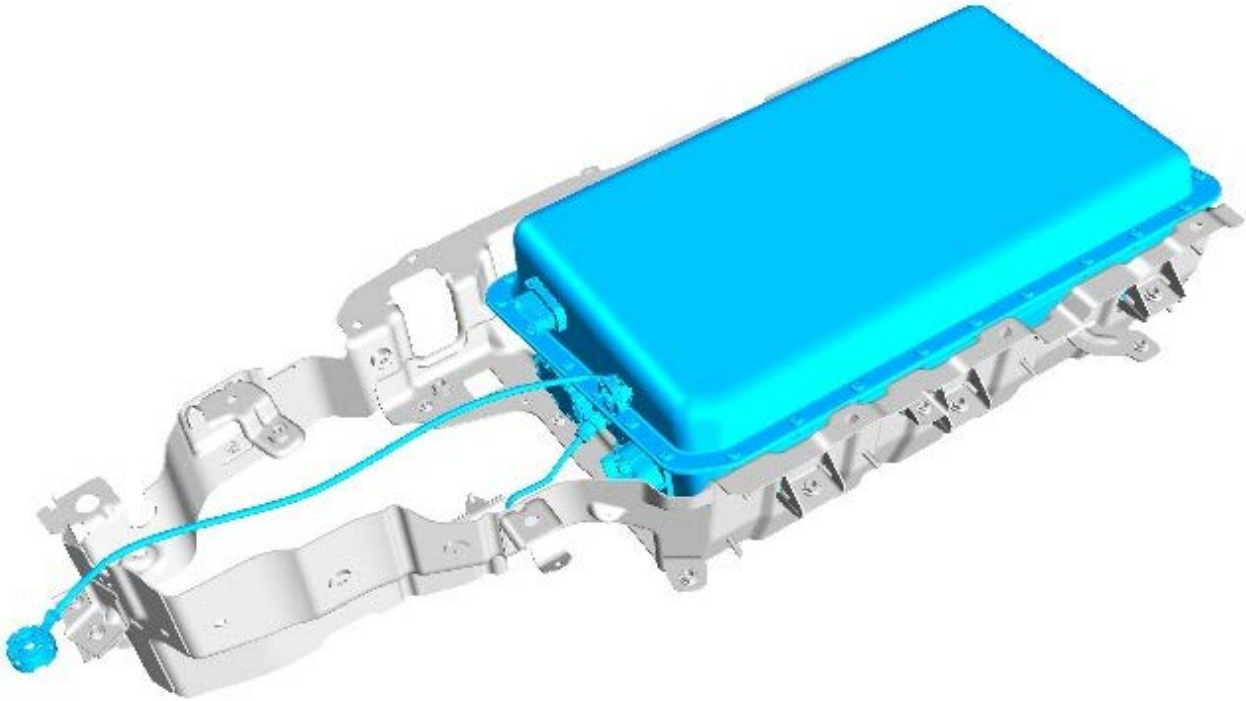
E158822

45.



E158823

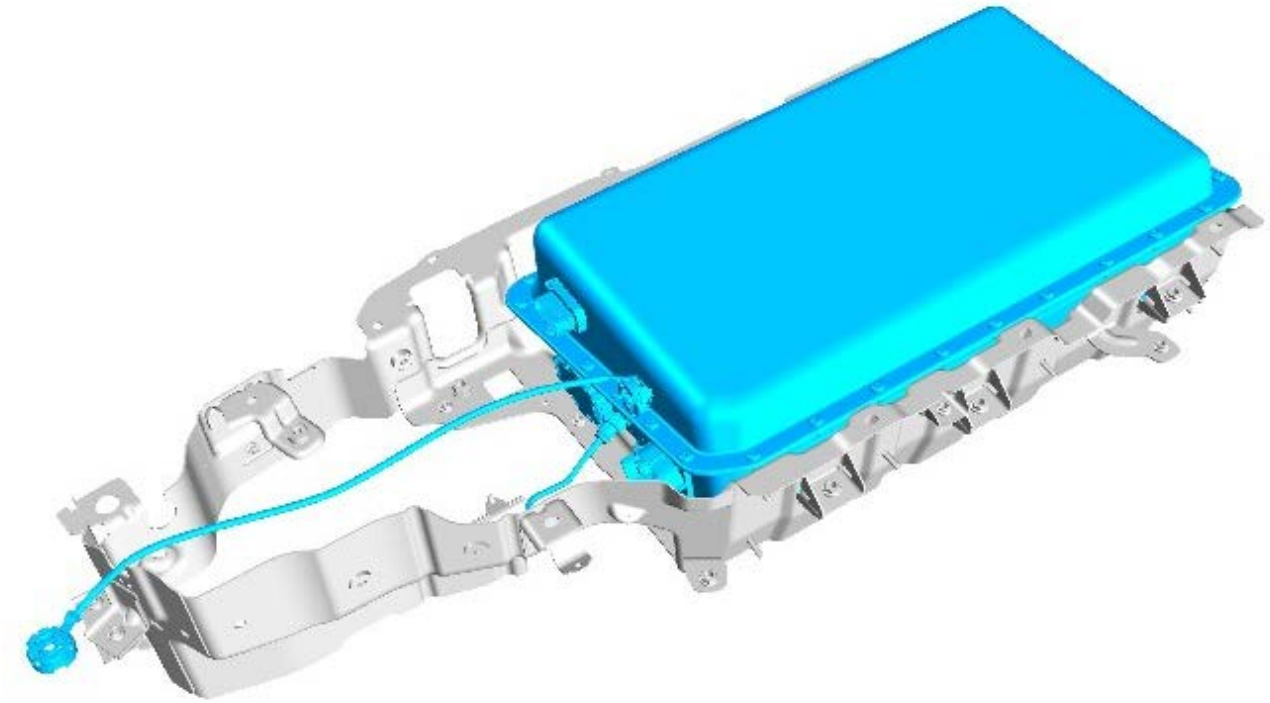
46. NOTE: This step requires the aid of another technician.



E158824

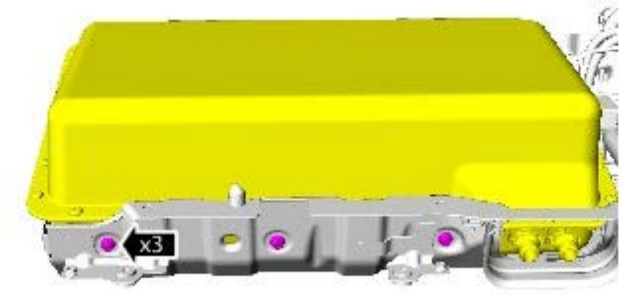
Installation

1. NOTE: This step requires the aid of another technician.



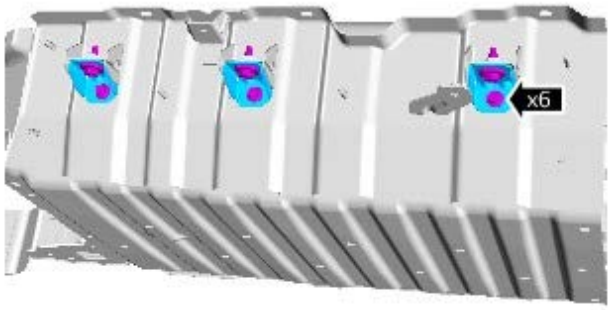
E158824

2. CAUTION: Only tighten the bolts finger tight at this stage.



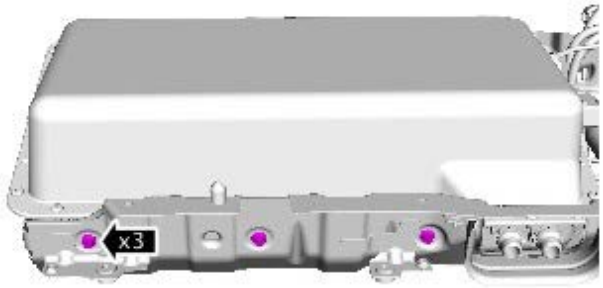
E158870

3. CAUTION: Only tighten the bolts finger tight at this stage.



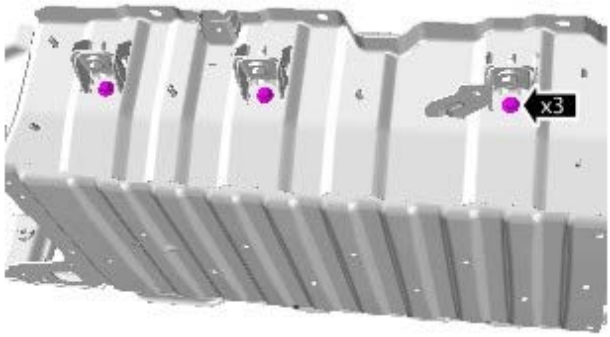
E158823

4. *Torque:* 22 Nm



E159784

5. *Torque:* 22 Nm



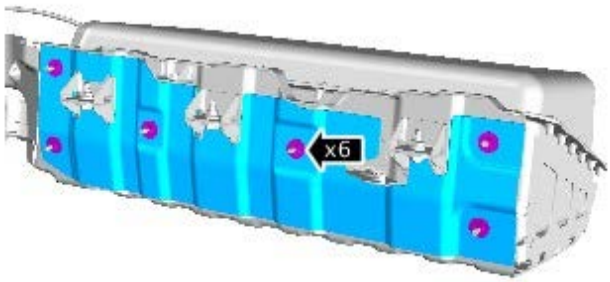
E159778

6. *Torque:* 22 Nm



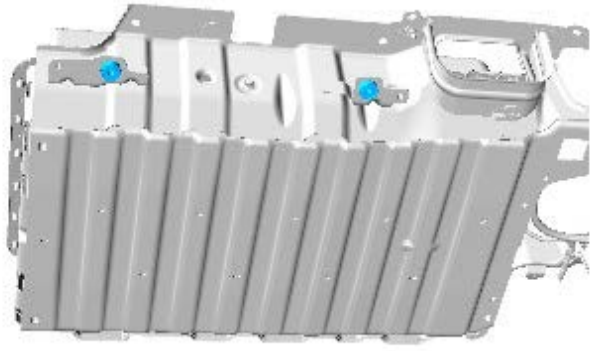
E159779

7. *Torque:* 10 Nm



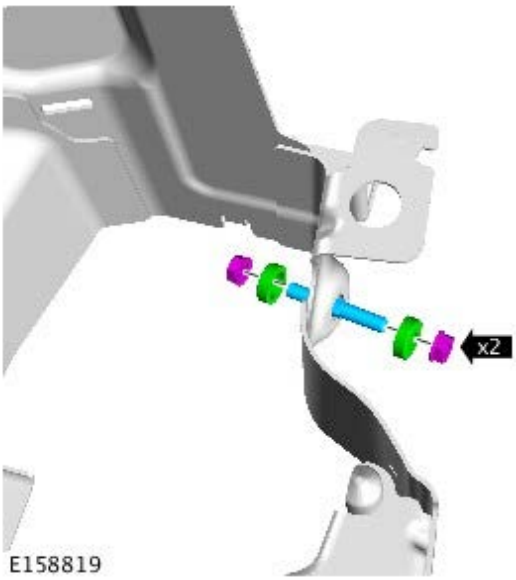
E158821

8.



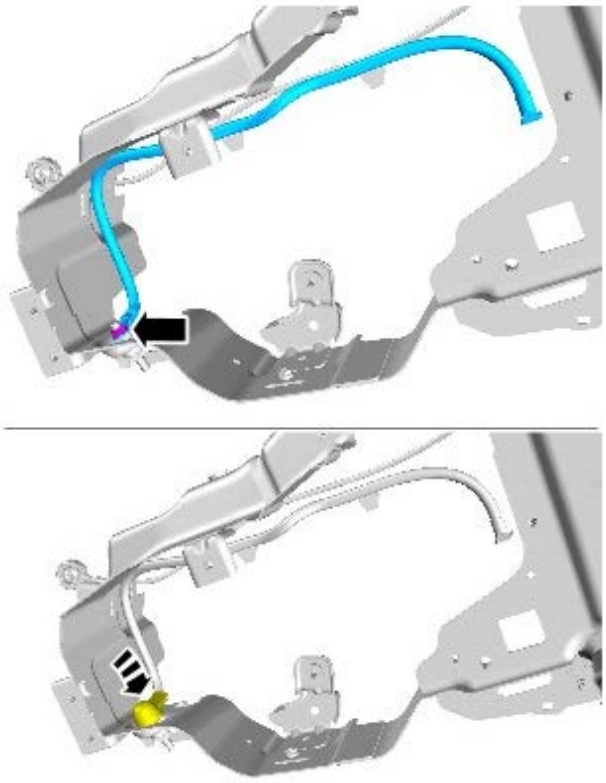
E158820

9. *Torque:* 10 Nm

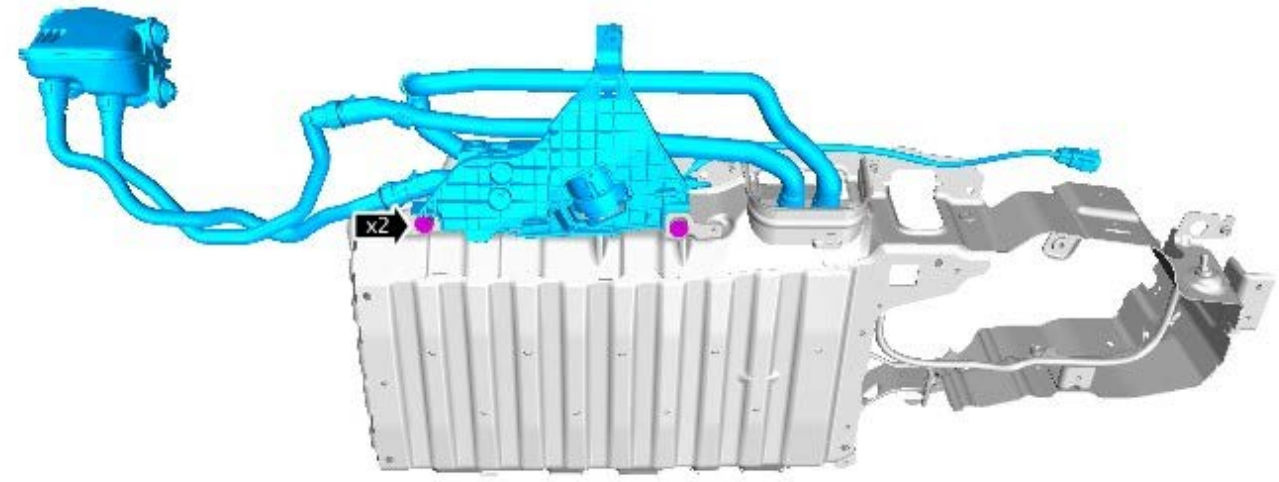


E158819

10. *Torque:* 10 Nm

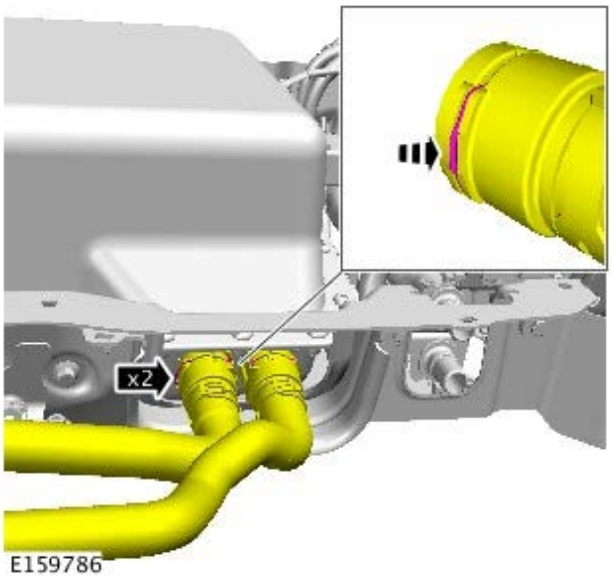

E158904

11. CAUTION: Only tighten the bolts finger-tight at this stage.



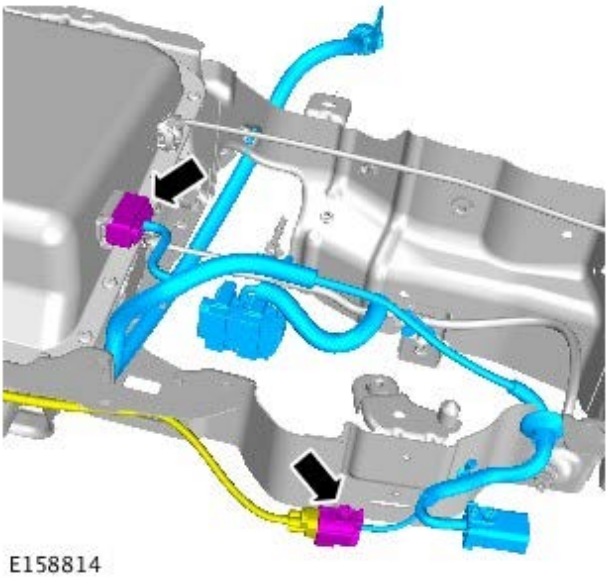
E158817

12.



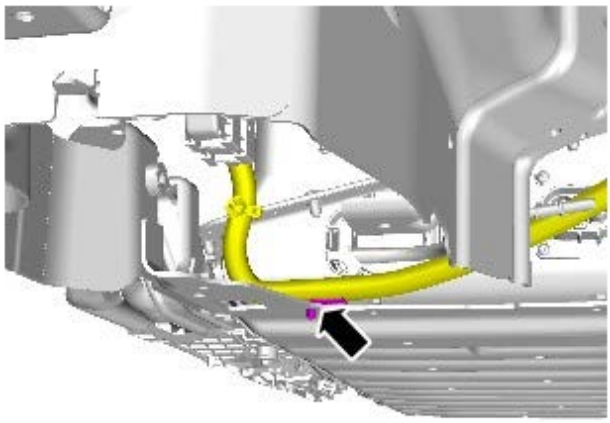
E159786

13.



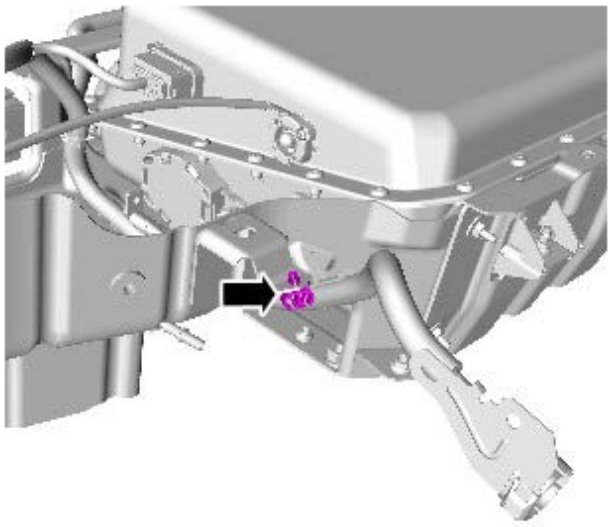
E158814

14.



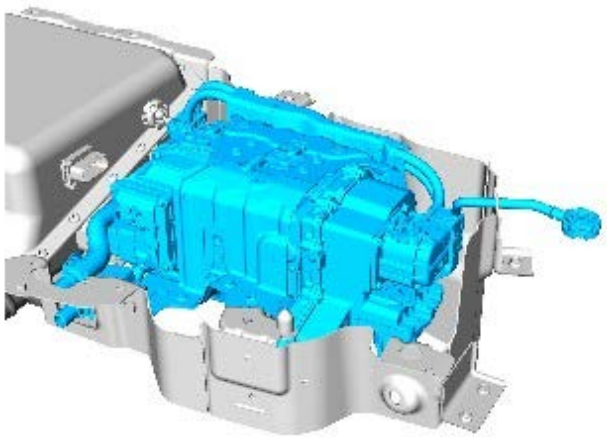
E158813

15.



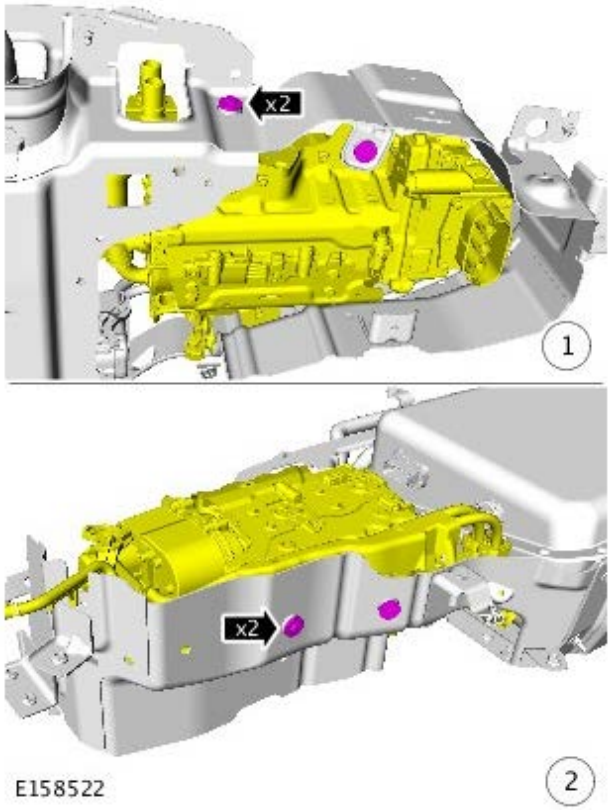
E158812

16.

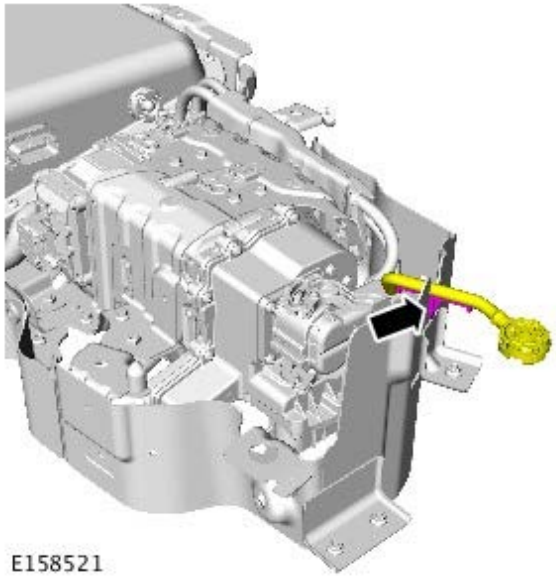


E158523

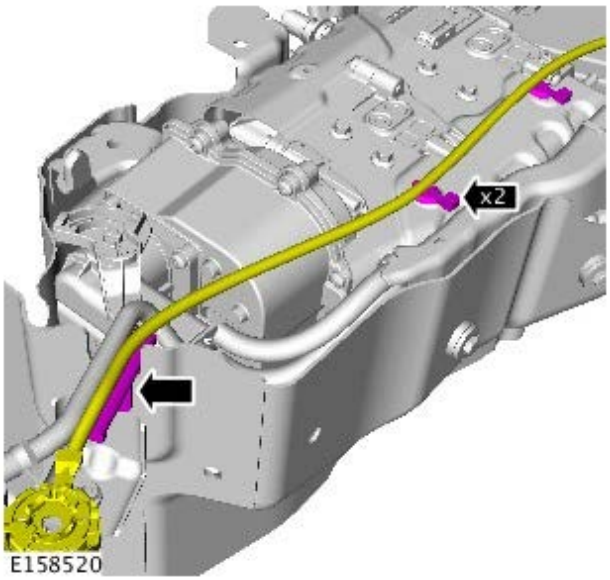
17. *Torque:* 9 Nm



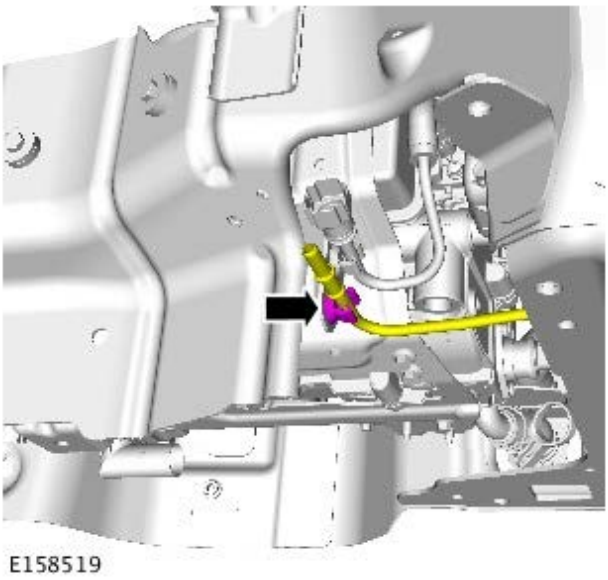
18.



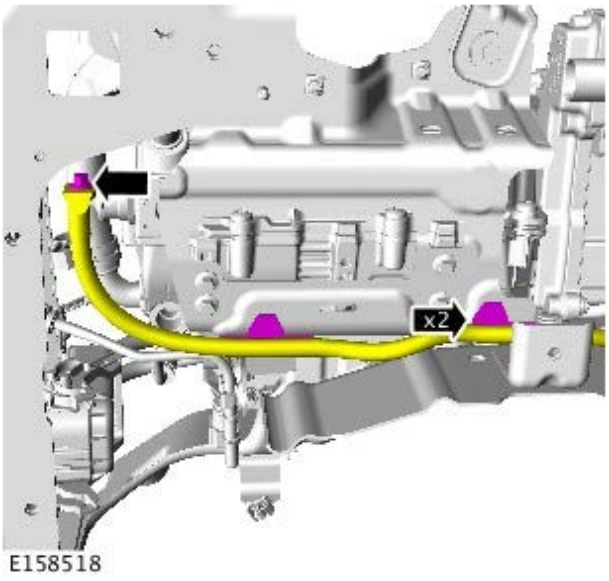
19.



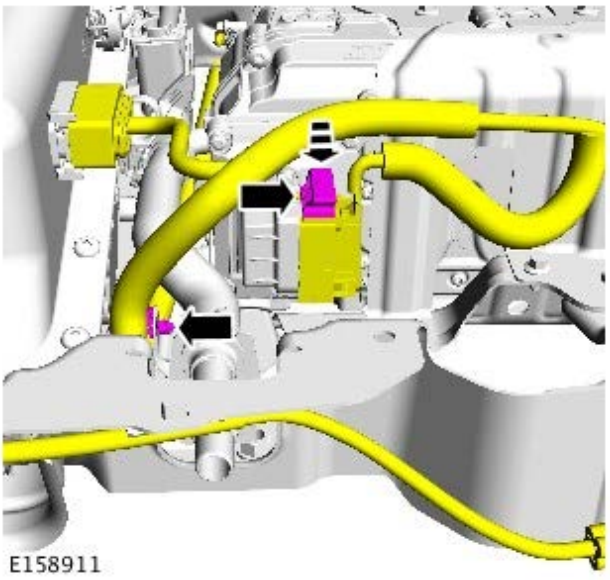
20.



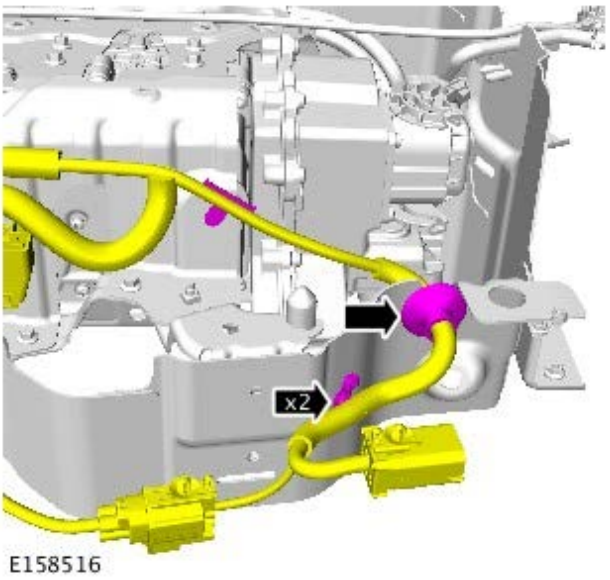
21. *Torque:* 10 Nm



22.

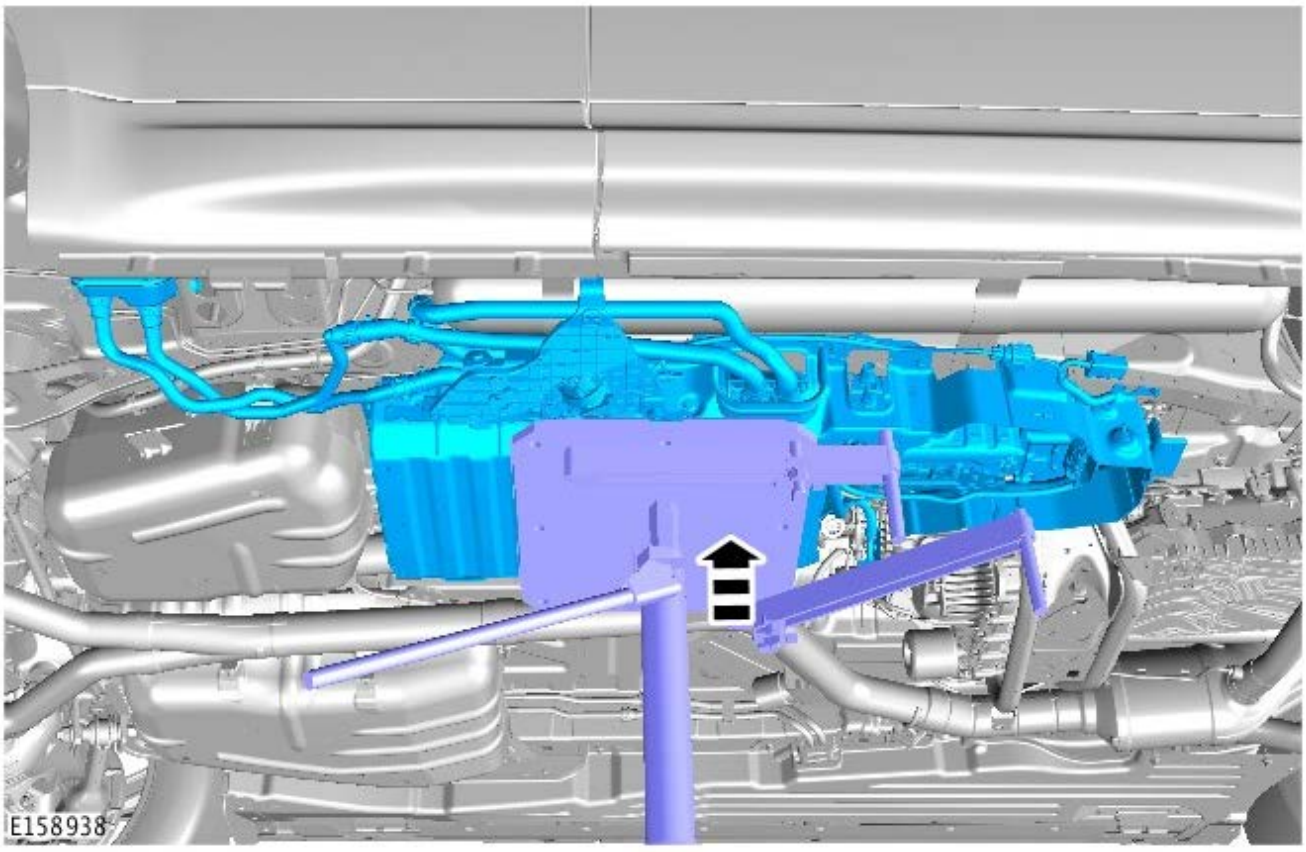

E158911

23.

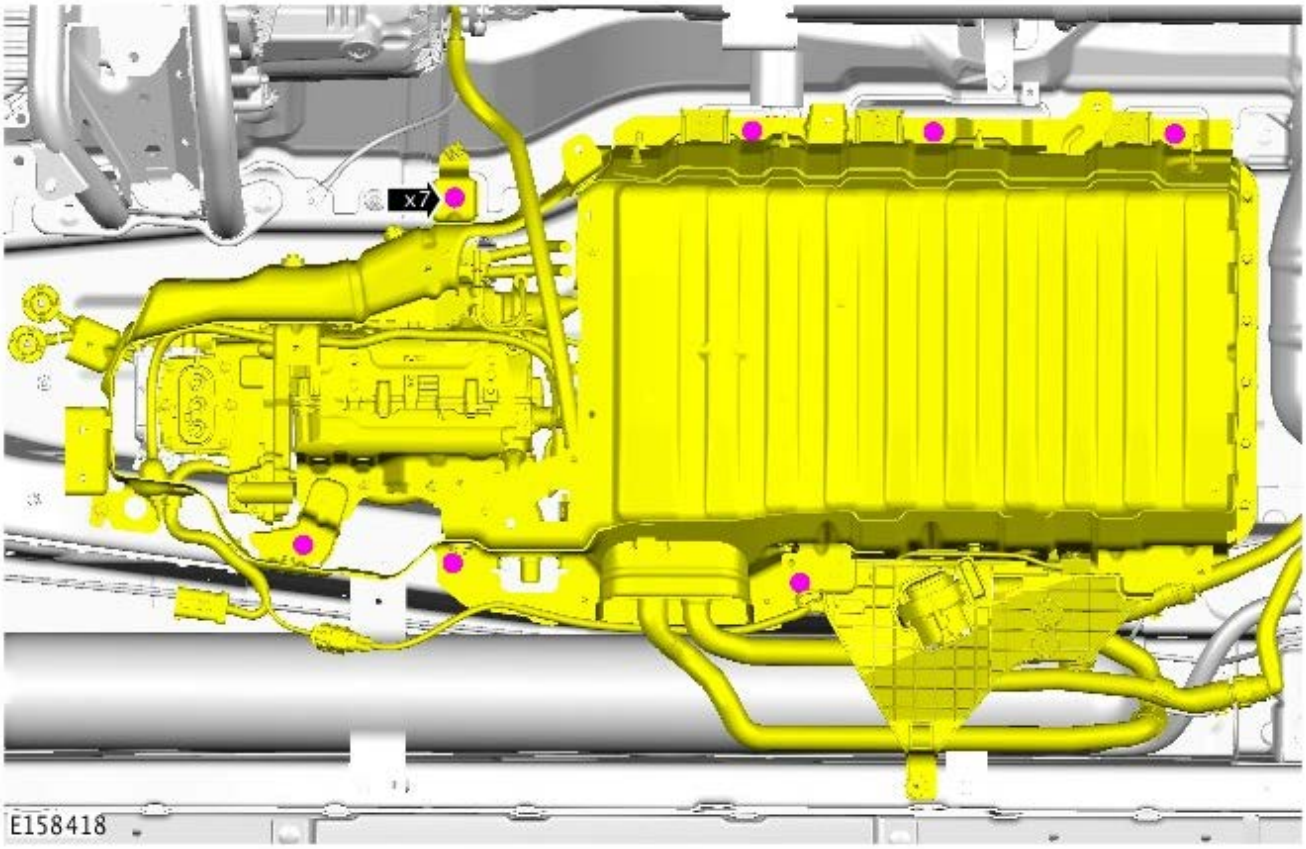


E158516

24. Raise the transmission jack and the battery cradle assembly.

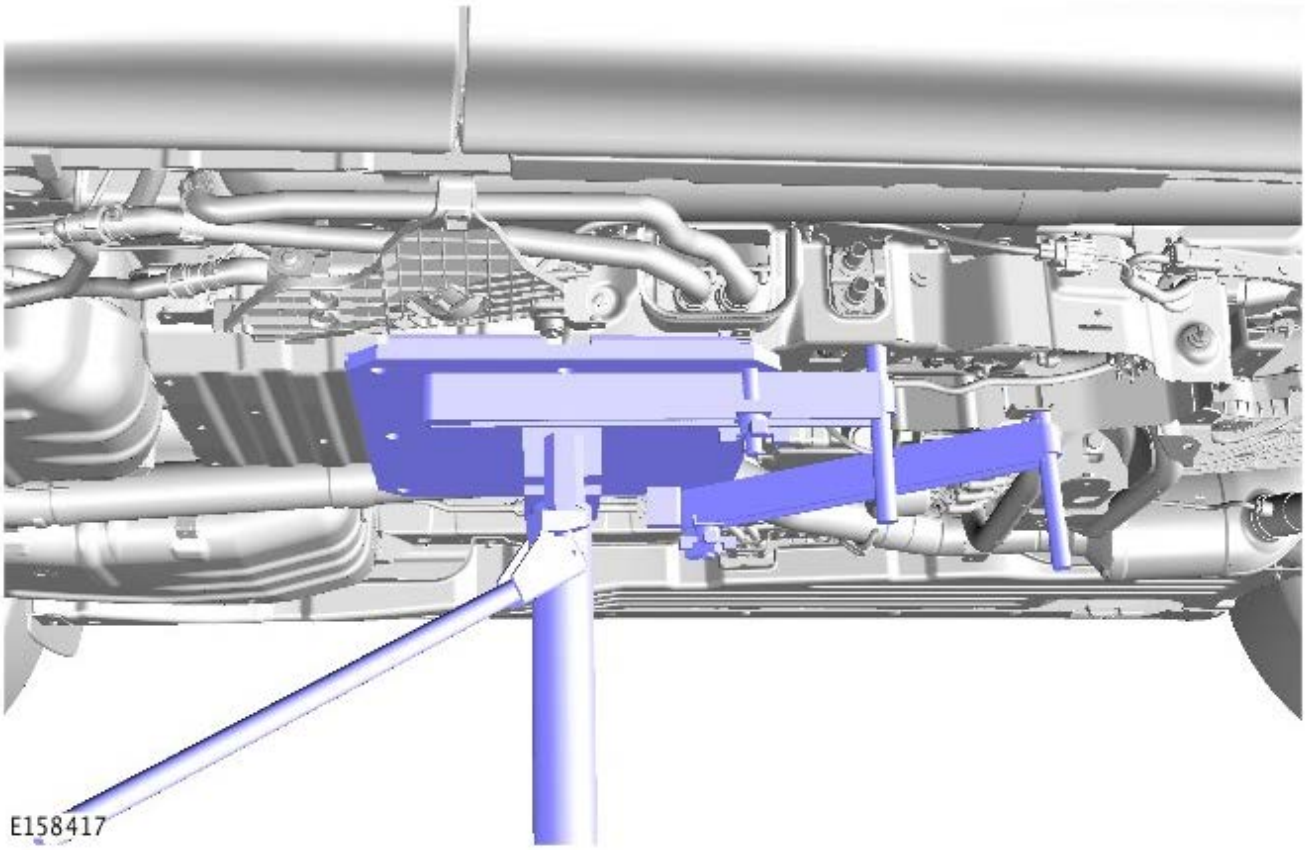


25. *Torque:* 25 Nm

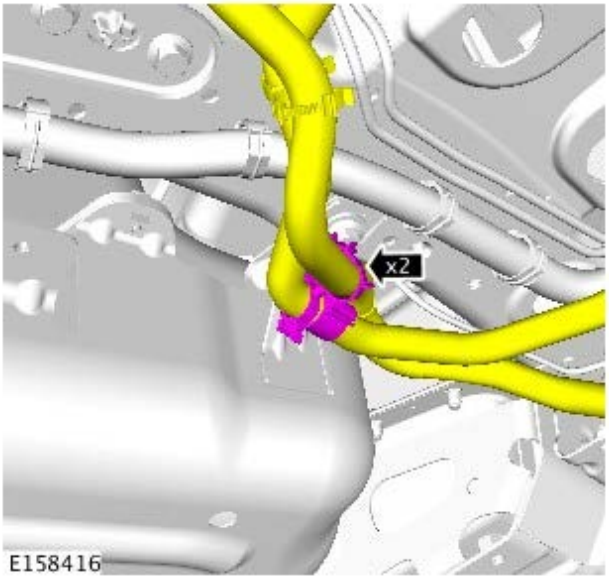


26. Remove the equipment illustrated.

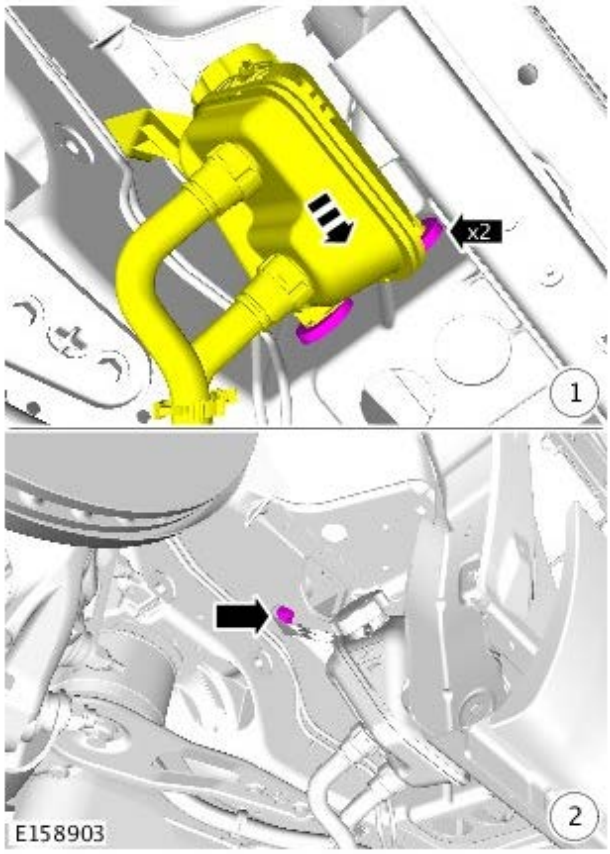
General Equipment: Transmission jack



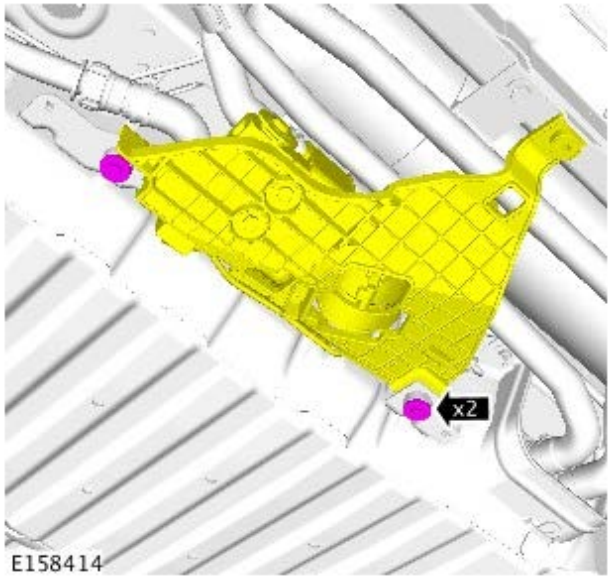
27.



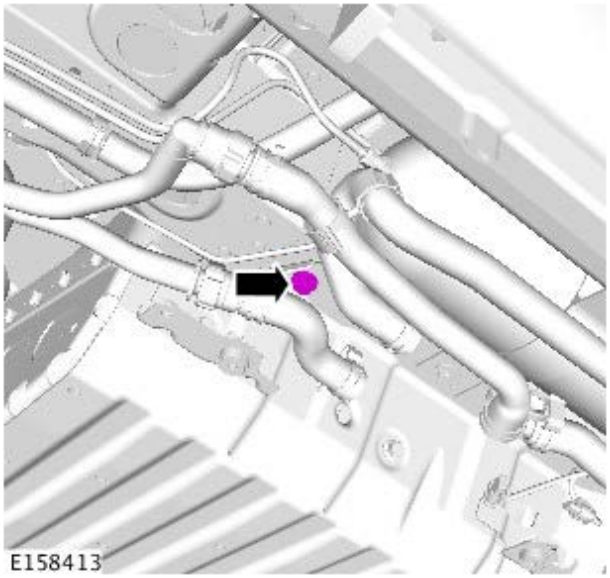
28. *Torque:* 7 Nm

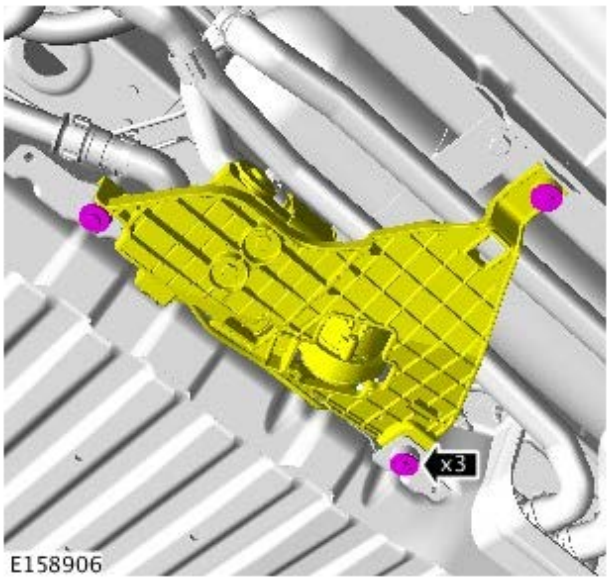


29.



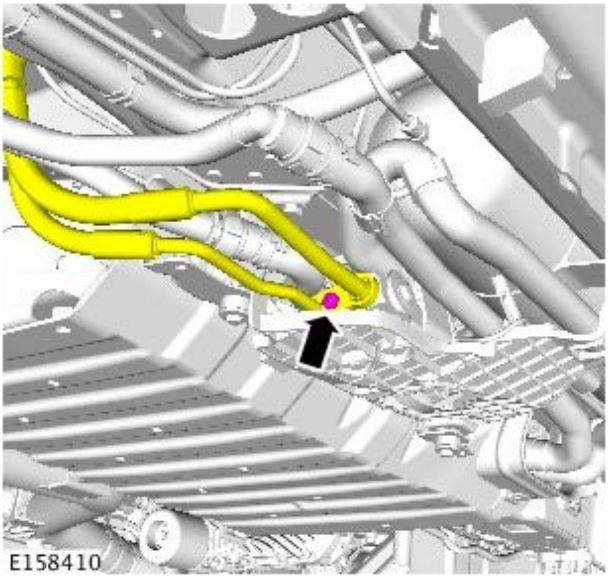
30. *Torque:* 25 Nm





31. NOTE: Do not carry out this step if the battery coolant system requires filling and bleeding.

    Torque: 10 Nm



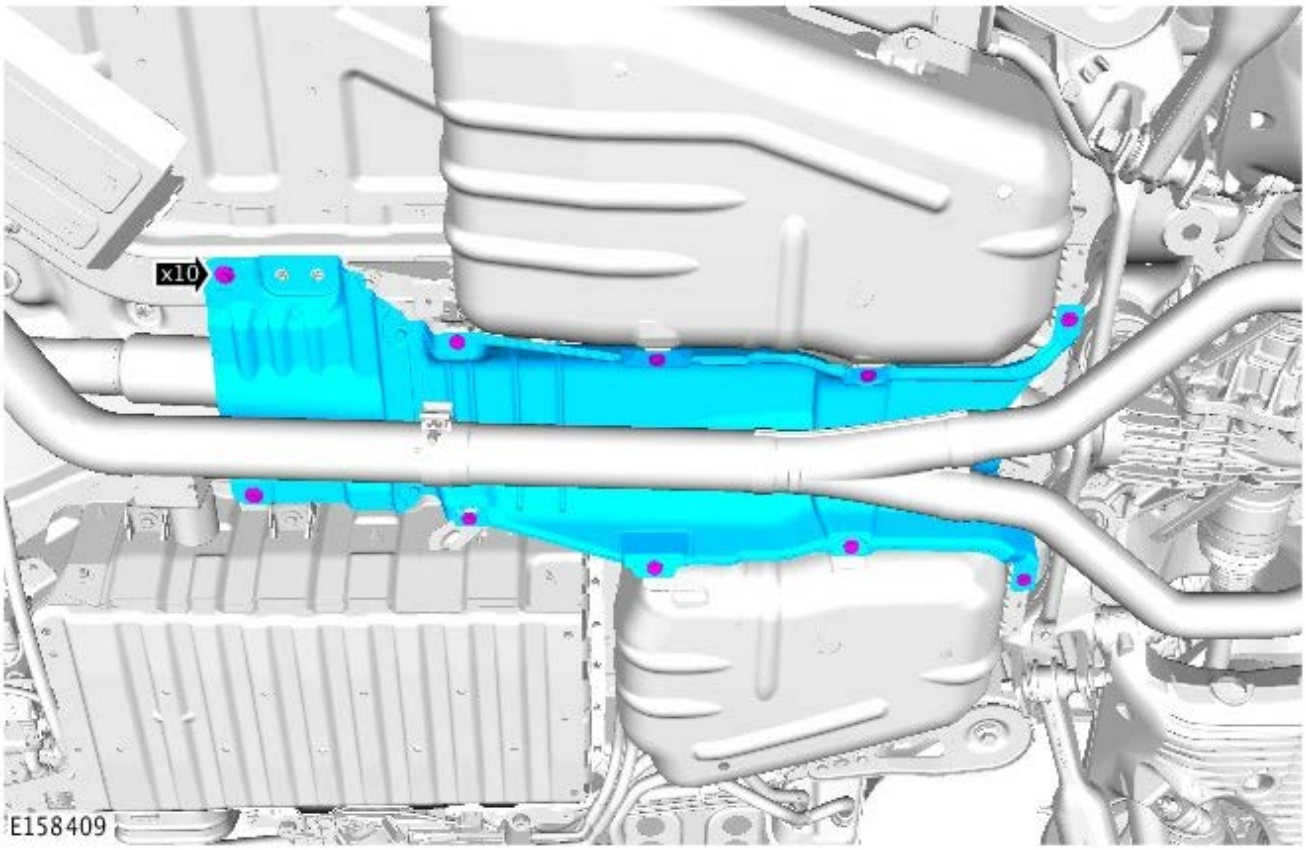
32. NOTES:

    Do not carry out this step if the battery coolant system requires filling and bleeding.

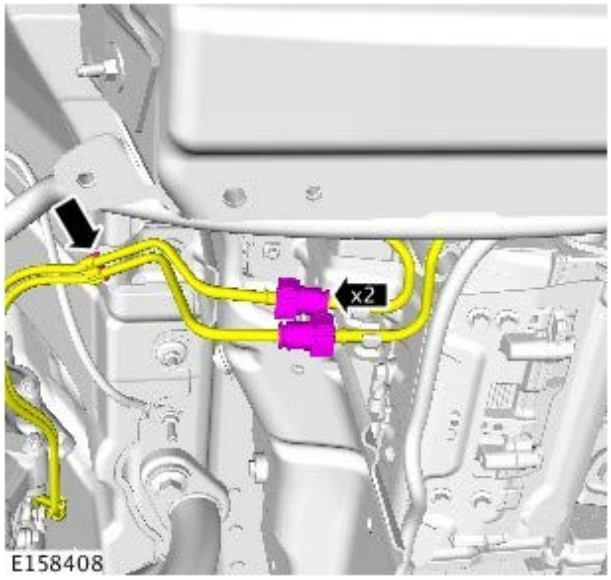
    Install new O-ring seals.

    Torque: 9 Nm

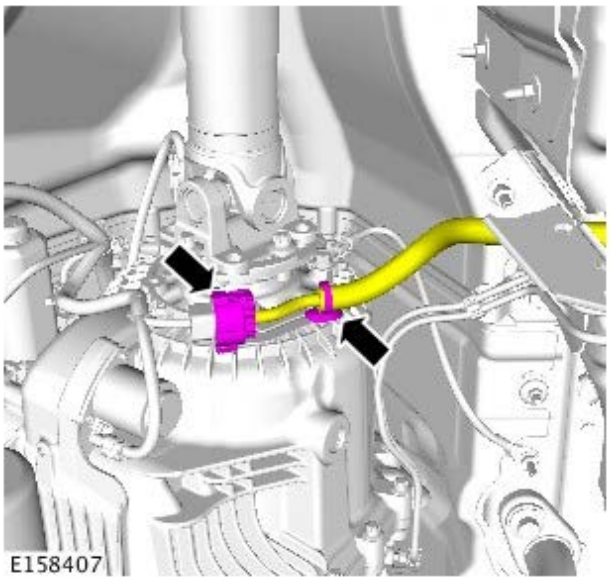
33. *Torque:* 5 Nm

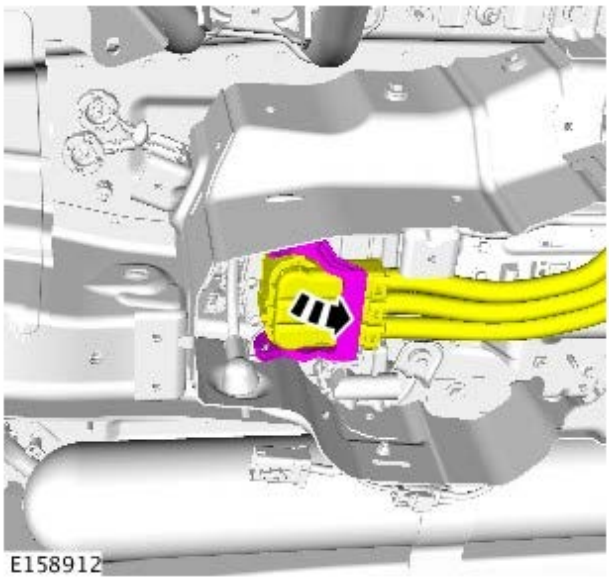


34.

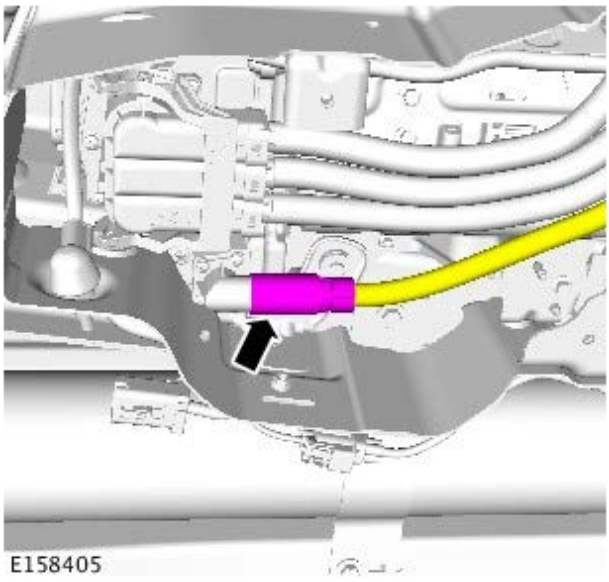


35.





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

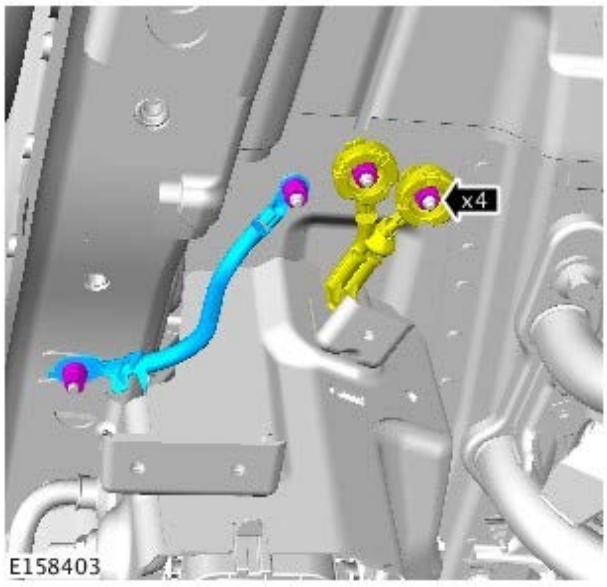


37. CAUTION: Make sure that the area around the component is clean and free of foreign material.

38. CAUTIONS:

Do not exceed the specified torque value.

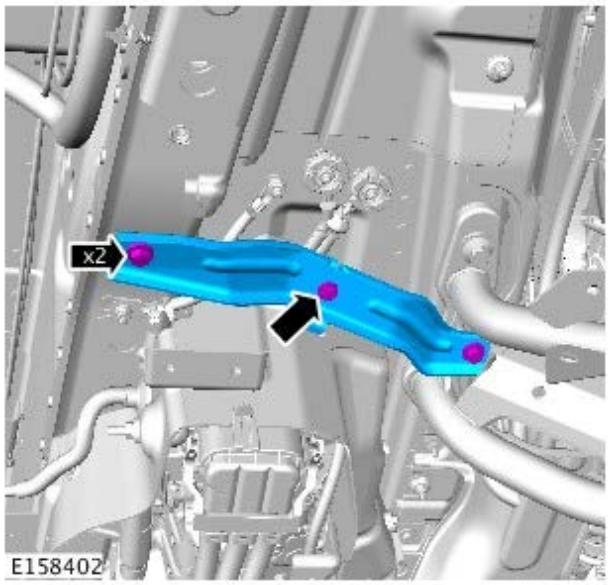
Make sure that the area around the component



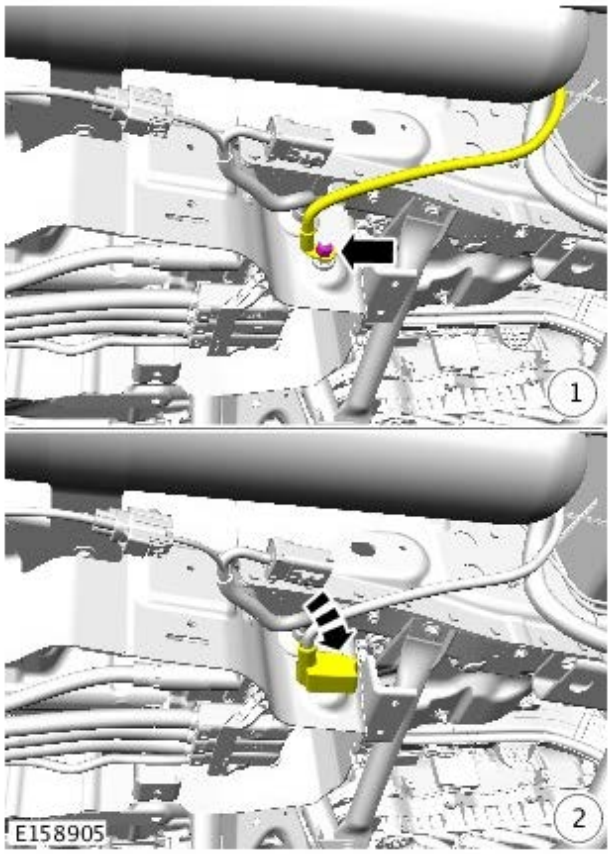
is clean and free of foreign material.

Torque: 25 Nm

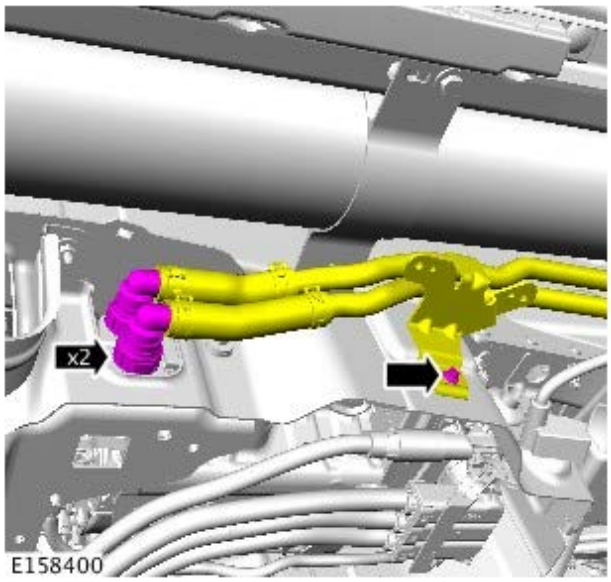
39. *Torque:*
    M6 10 Nm
    M8 25 Nm



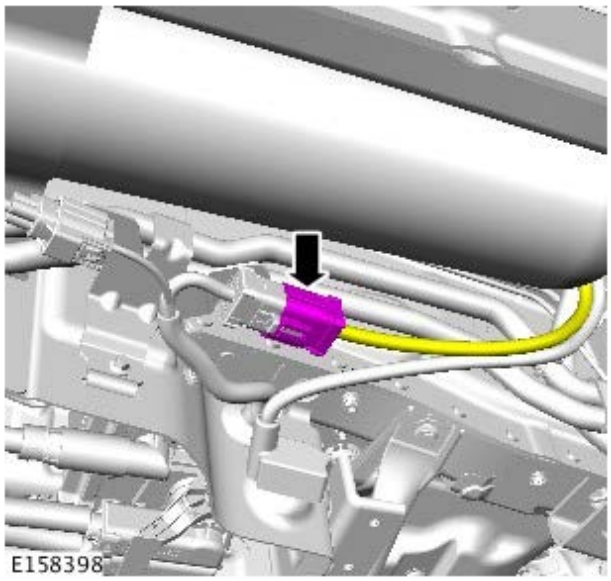
40. *Torque:* 25 Nm



41. *Torque:* 9 Nm

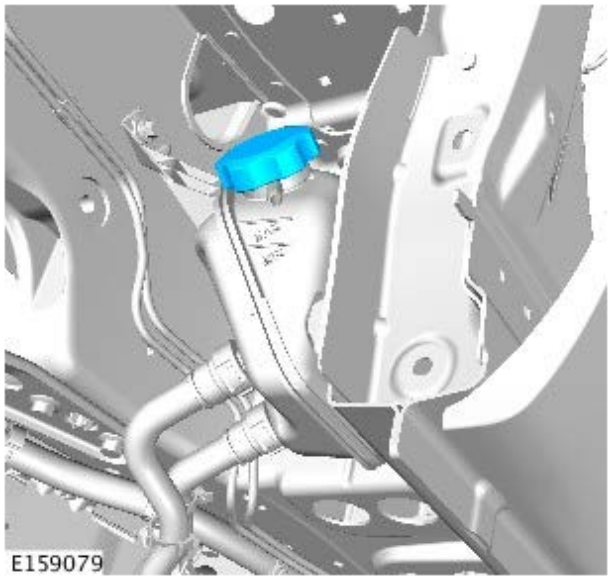


42.



43. Refer to: Hybrid Electric Vehicle (HEV) System Bonding Test (414-01 Battery, Mounting and Cables, General Procedures).

44. Refer to: Hybrid Electric Vehicle (HEV) Decommission (414-01 Battery, Mounting and Cables, General Procedures).



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

NOTE: Do not carry out steps 42 to 48 if the battery coolant system does not require filling and bleeding.

46. CAUTION: The coolant pump assembly requires lowering and supported by the coolant hoses during this procedure.

Add coolant to the battery coolant expansion tank as required, until the upper level mark is achieved.

47. CAUTIONS:

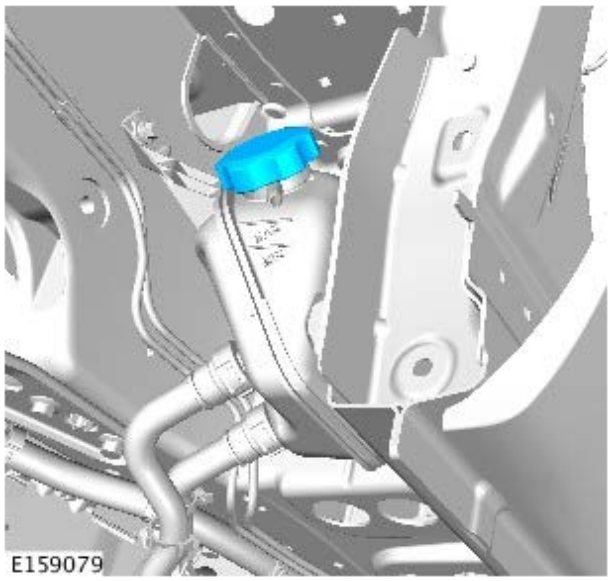
The coolant pump assembly requires lowering and supported by the coolant hoses during this procedure.

If the coolant pump fails to run, the coolant pump has entered its run-dry mode. In this case the coolant pump assembly will require lowering further. This will make sure that the coolant pump is primed correctly and any air in the system is dispersed.

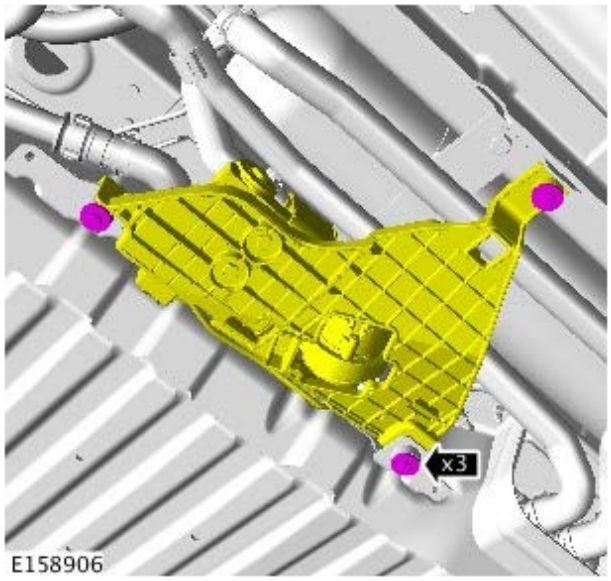
Using Land Rover approved diagnostic equipment, run the battery coolant pump until the coolant level drops and coolant can be seen circulating around the system through the expansion tank.

48. Fill the coolant level in the battery coolant expansion tank, to the maximum cold fill line.

49.

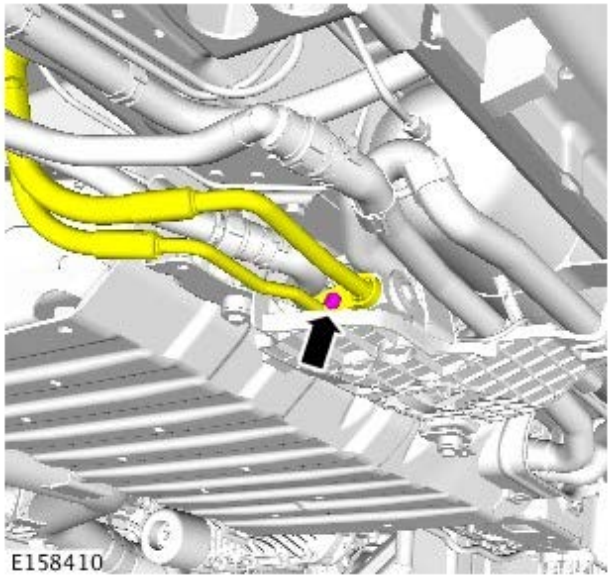


50. *Torque:* 10 Nm

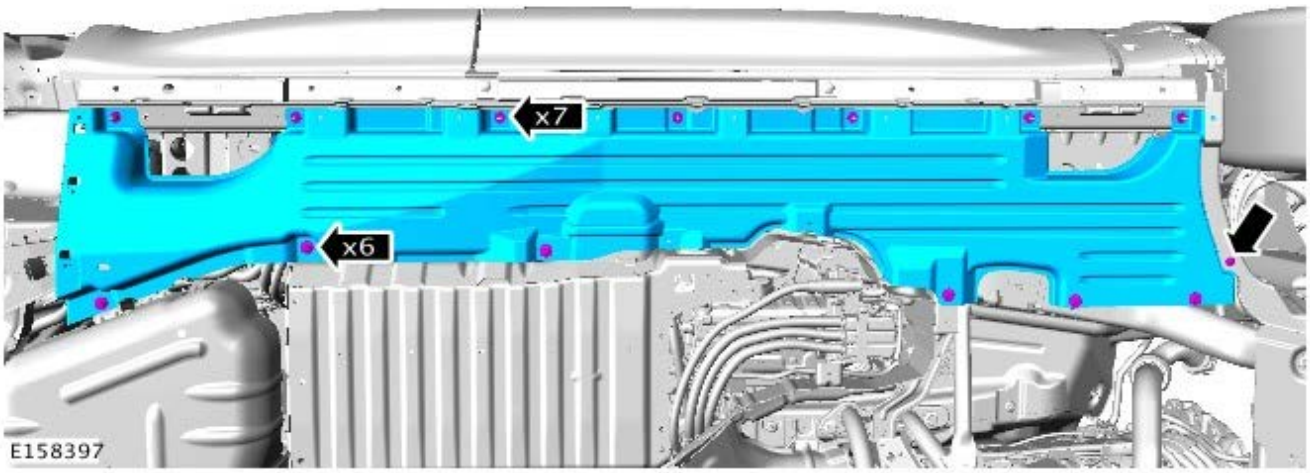


51. NOTE: Install new O-ring seals.

Torque: 9 Nm



52.



53. NOTE: RH side only.

    Refer to: Rear Rocker Panel Moulding (501-08 Exterior Trim and Ornamentation, Removal and Installation).

54. Install the rear right fender splash shield.

    Refer to: Rear Fender Splash Shield (501-08 Exterior Trim and Ornamentation, Removal and Installation).

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

56. Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03A Engine Cooling - TDV6 3.0L Diesel, General Procedures).

Published: 08-Jul-2013

Battery, Mounting and Cables - Electric Power Inverter Converter (EPIC)

Removal and Installation

Removal

WARNING: This procedure can only be carried out after the vehicle has been decommissioned, by an approved person.

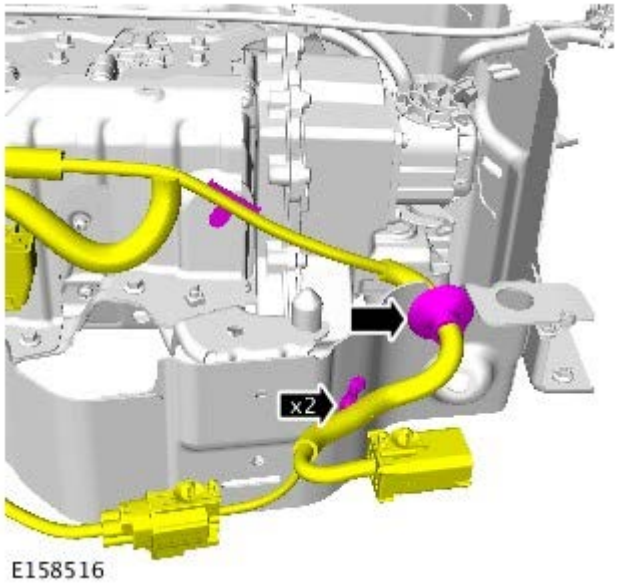
NOTES:

Removal steps in this procedure may contain installation details.

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

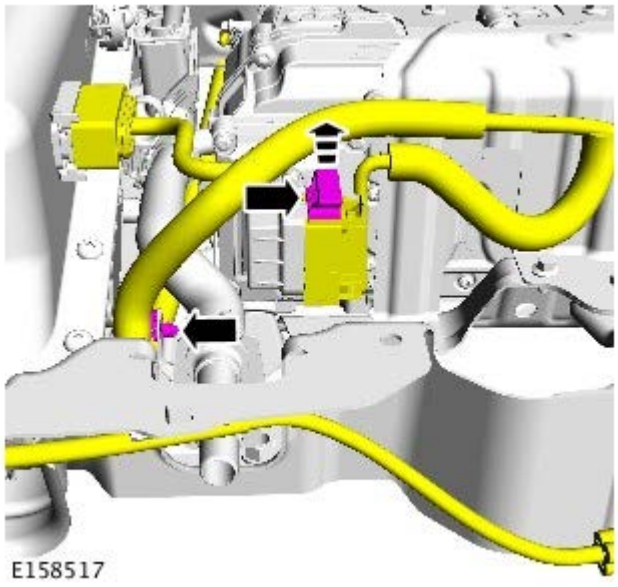
1. Refer to: Hybrid Electric Vehicle (HEV) Battery Pack Cradle (414-01, Removal and Installation).

2.



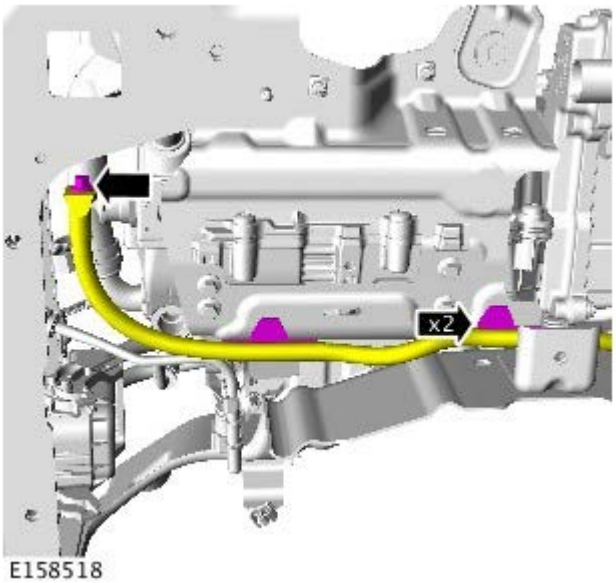
E158516

3.



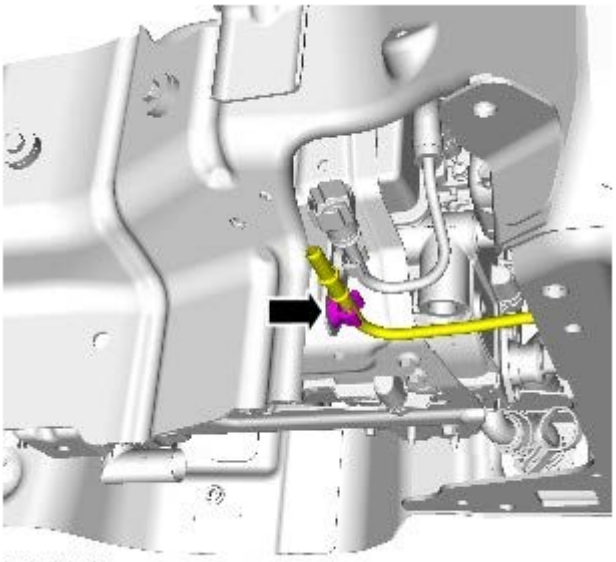
E158517

4. *Torque:* 10 Nm

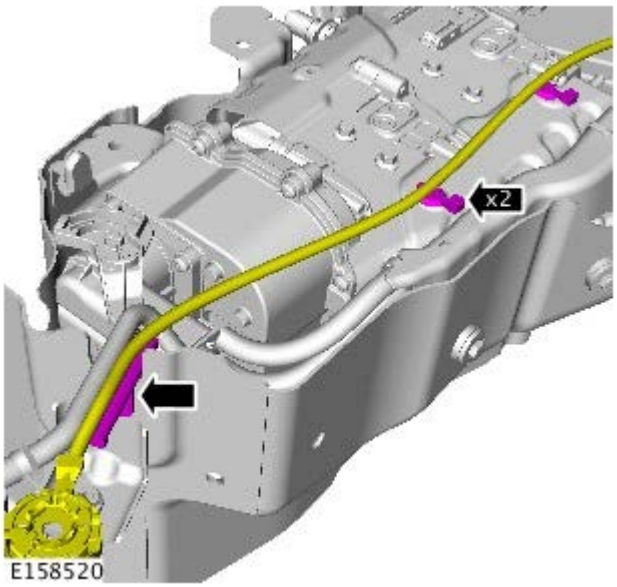


E158518

5.

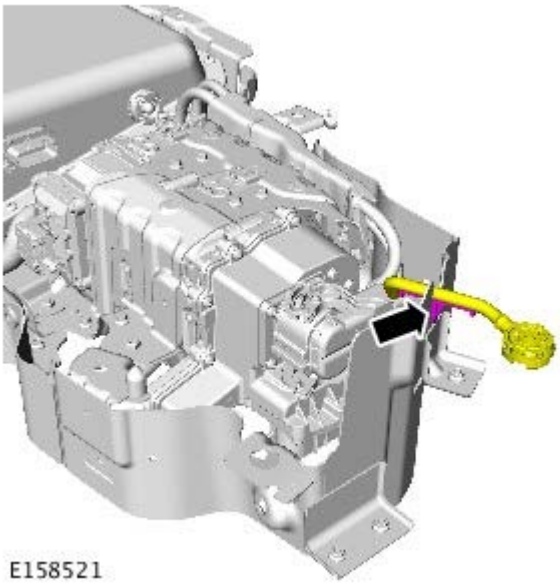

E158519

6.



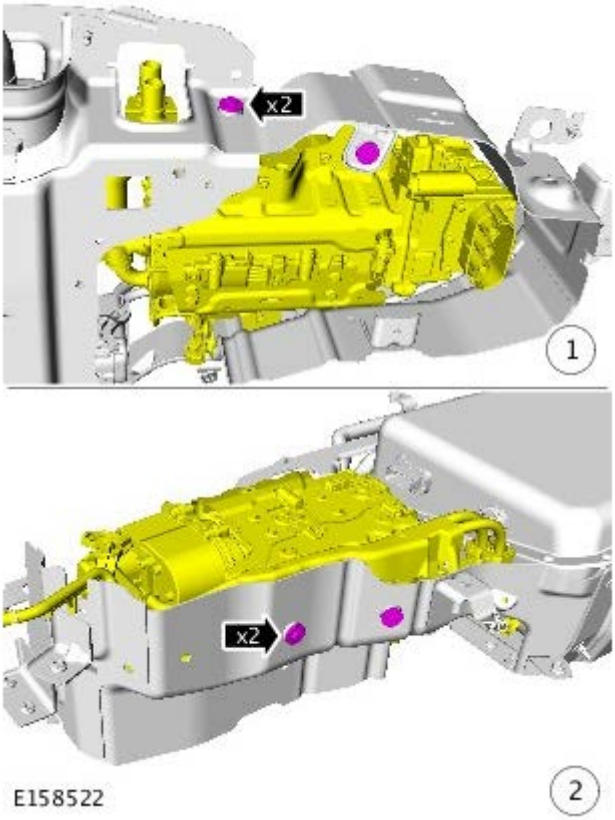
E158520

7.



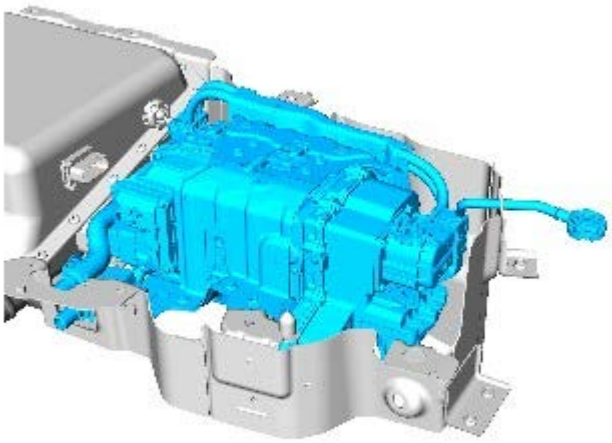
E158521

8. *Torque:* 9 Nm



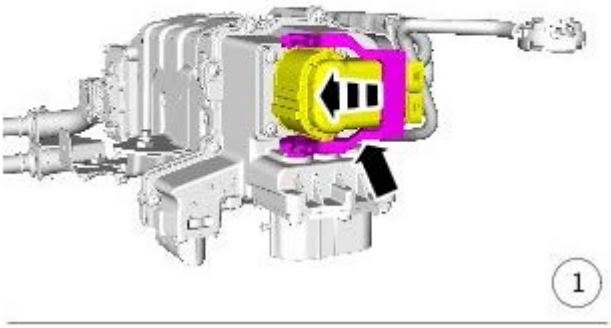
E158522

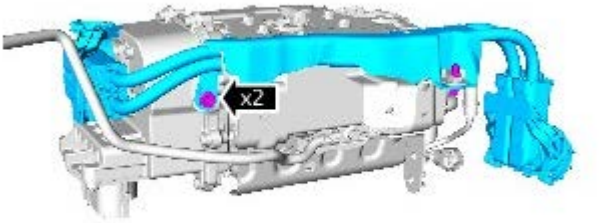
9. NOTE: Do not disassemble further if the component is removed for access only.



E158523

10. *Torque:* 9 Nm

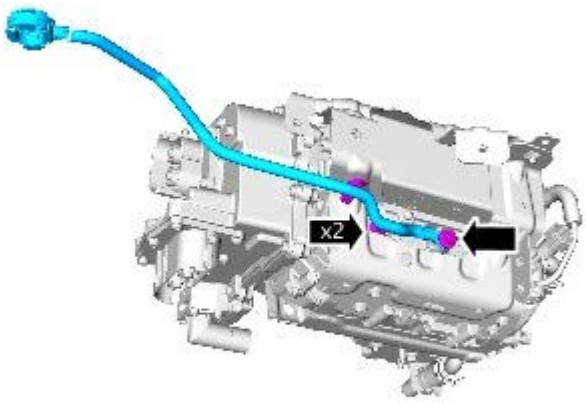




E158524

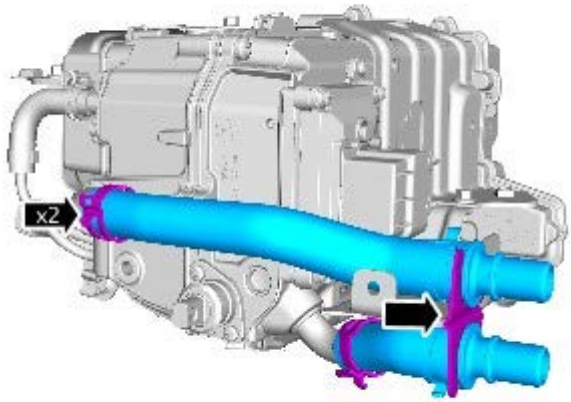
2

11. *Torque:* 25 Nm



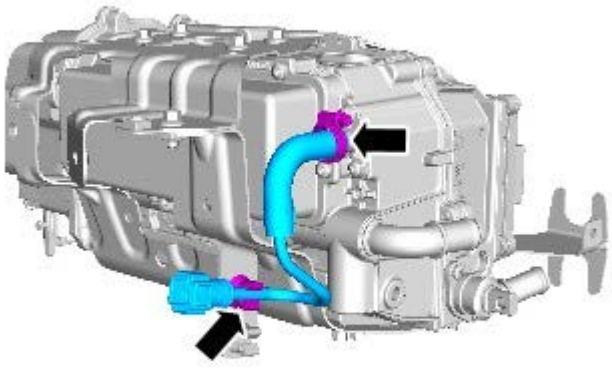
E158525

12.



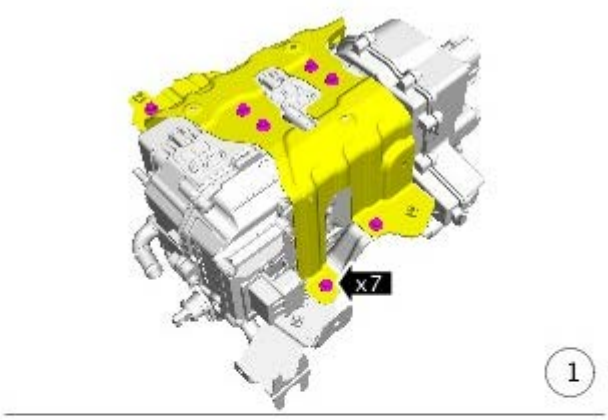
E158526

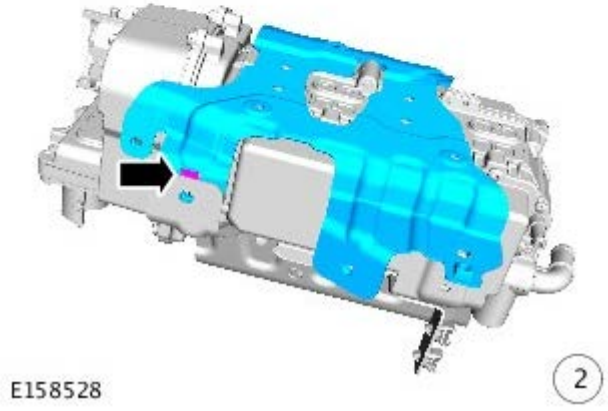
13.



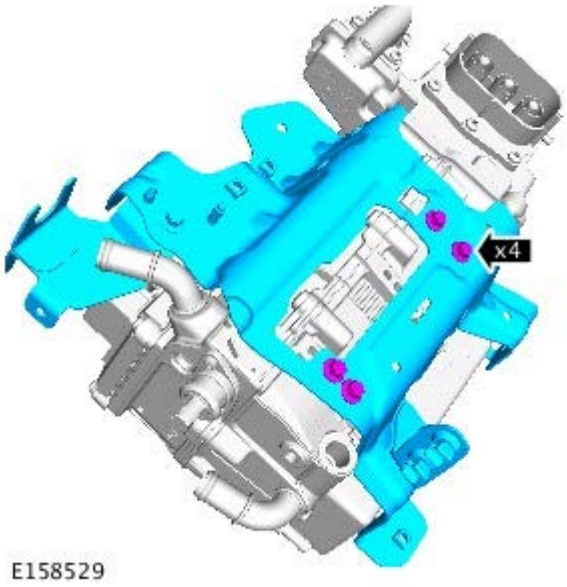
E158527

14. *Torque:* 10 Nm





15. *Torque:* 10 Nm



Installation

1. To install, reverse the removal procedure.

Published: 20-Nov-2013

Battery, Mounting and Cables - Hybrid Electric Vehicle (HEV) Battery Expansion Tank

Removal and Installation

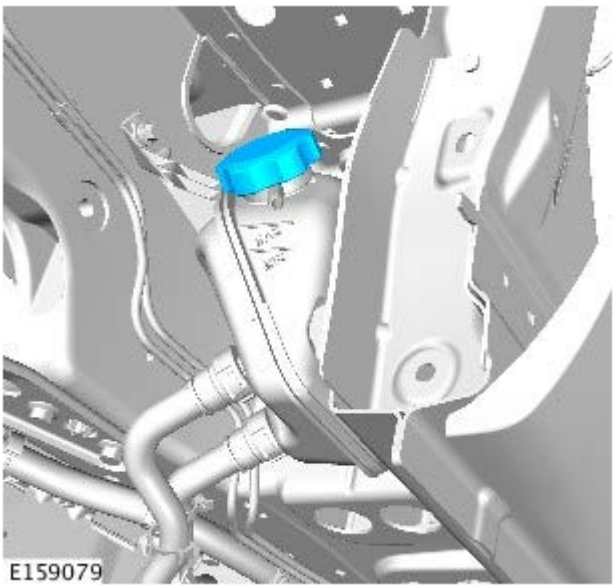
Removal

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

   Raise and support the vehicle.

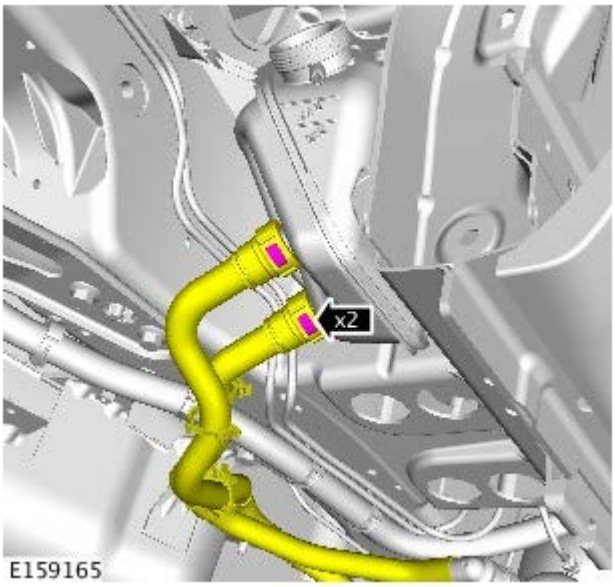
2. Remove the rear right fender splash shield.

   Refer to: Rear Fender Splash Shield (501-08 Exterior Trim and Ornamentation, Removal and Installation).



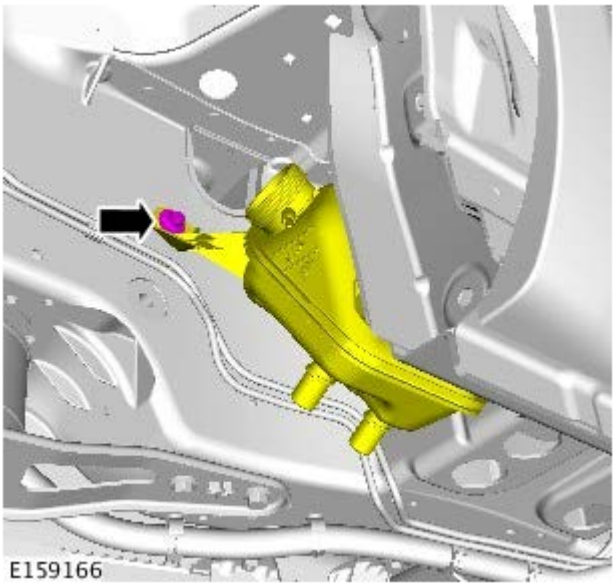
3. CAUTION: Make sure that the area around the component is clean and free of foreign material.

4. Using a suitable syringe, remove the coolant from the expansion tank.

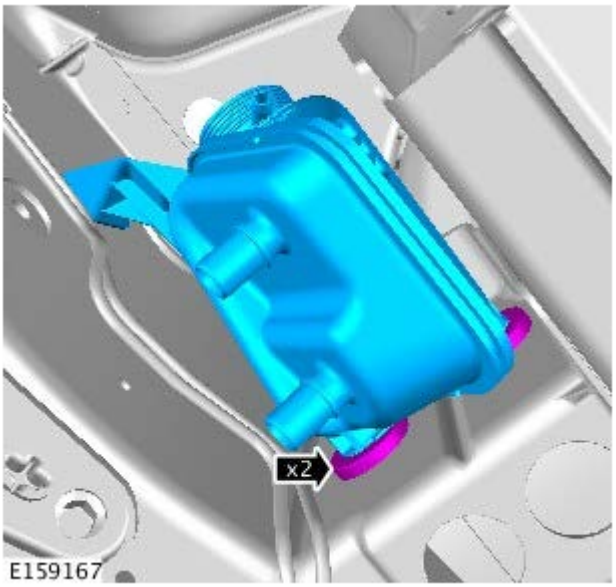


5. CAUTION: Be prepared to collect escaping coolant.

6.

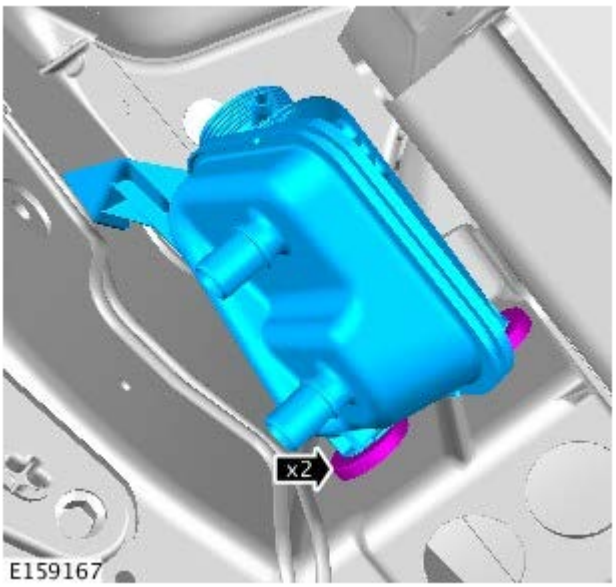


7.

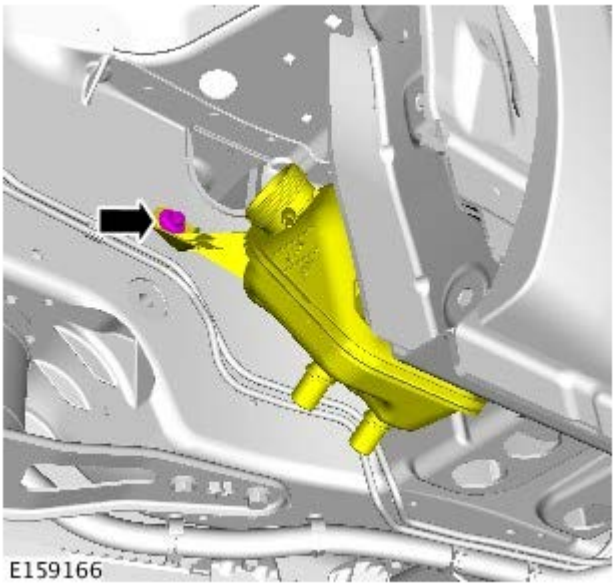


Installation

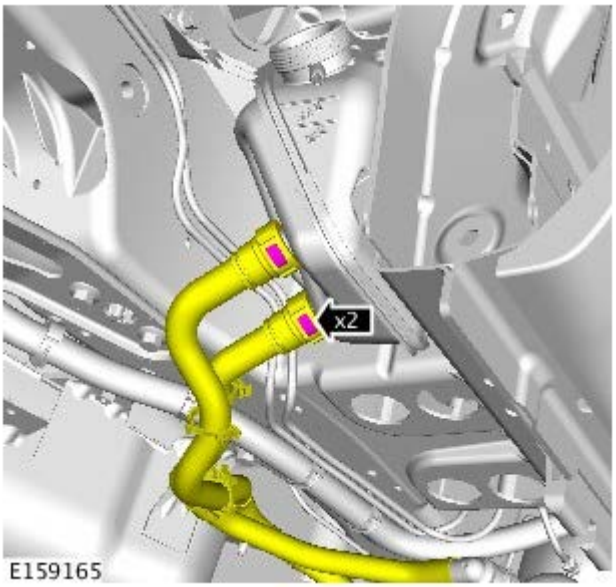
1.



2. *Torque:* 7 Nm

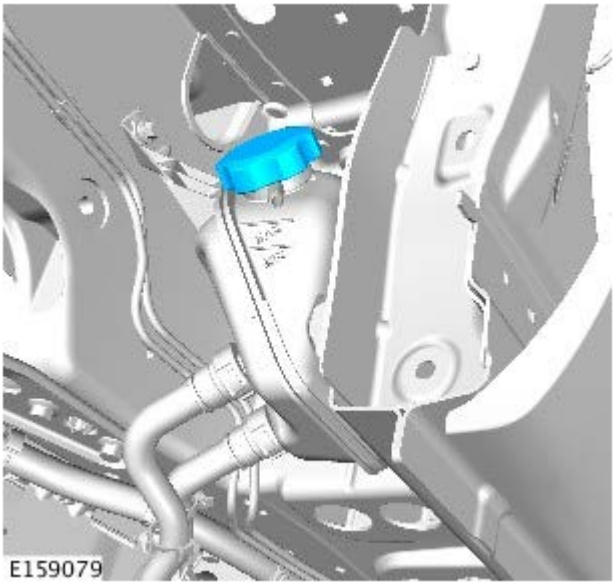


3.



4. Fill the coolant level in the battery coolant expansion tank, to the maximum cold fill line.

5.



6. Install the rear right fender splash shield.

Refer to: Rear Fender Splash Shield (501-08 Exterior Trim and

Ornamentation, Removal and Installation).

Published: 22-Nov-2013

Battery, Mounting and Cables - Hybrid Electric Vehicle (HEV) Battery Coolant Pump

Removal and Installation

Removal

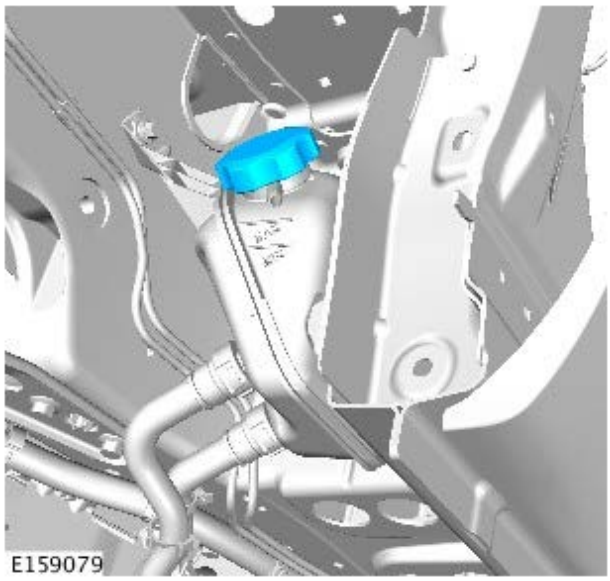
NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

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

   Raise and support the vehicle.

2. Remove the rear right fender splash shield.

   Refer to: Rear Fender Splash Shield (501-08 Exterior Trim and Ornamentation, Removal and Installation).

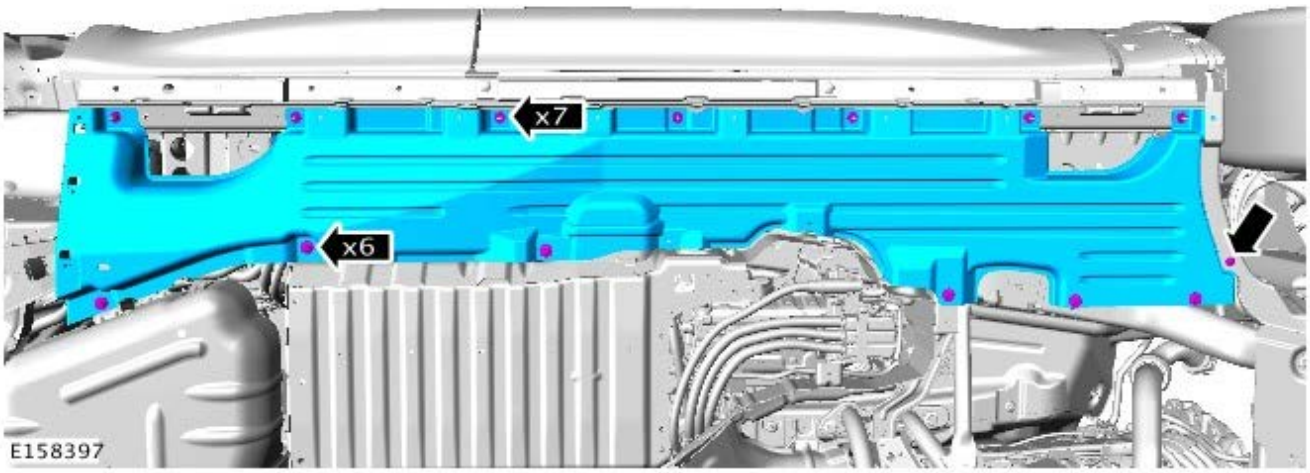


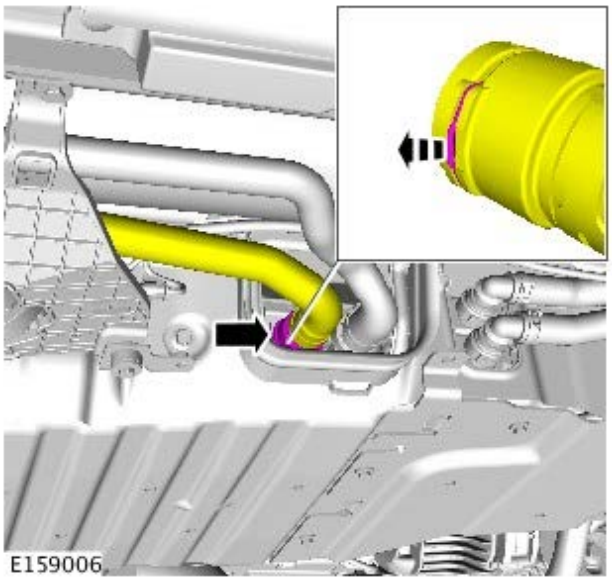
3. CAUTION: Make sure that area around the component is clean and free of foreign material.

4. NOTE: RH side only.

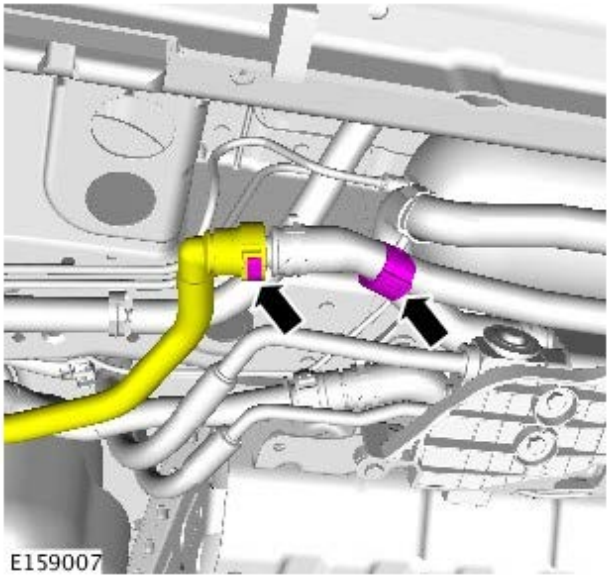
   Refer to: Rear Rocker Panel Moulding (501-08 Exterior Trim and Ornamentation, Removal and Installation).

5. NOTE: RH side only.



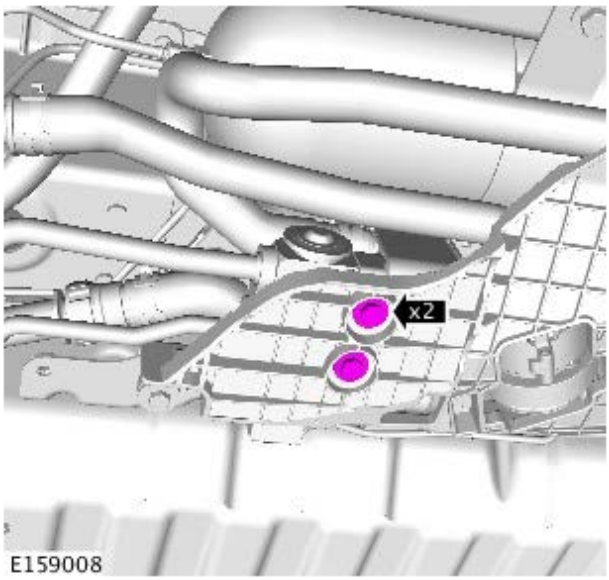


6. CAUTION: Be prepared to collect escaping coolant.

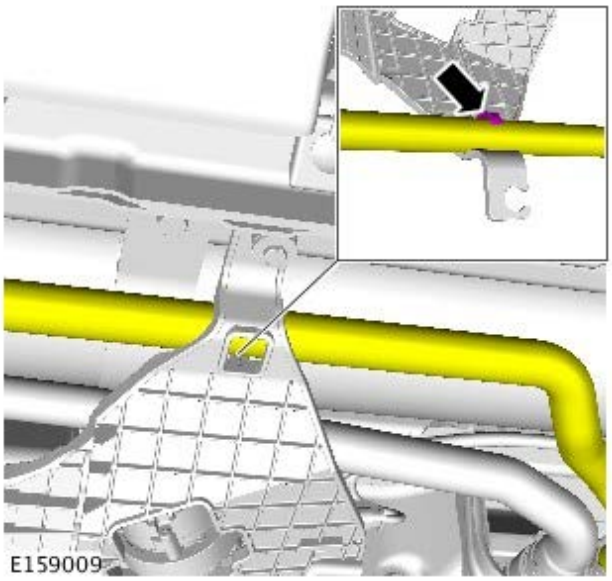


7. CAUTION: Be prepared to collect escaping coolant.

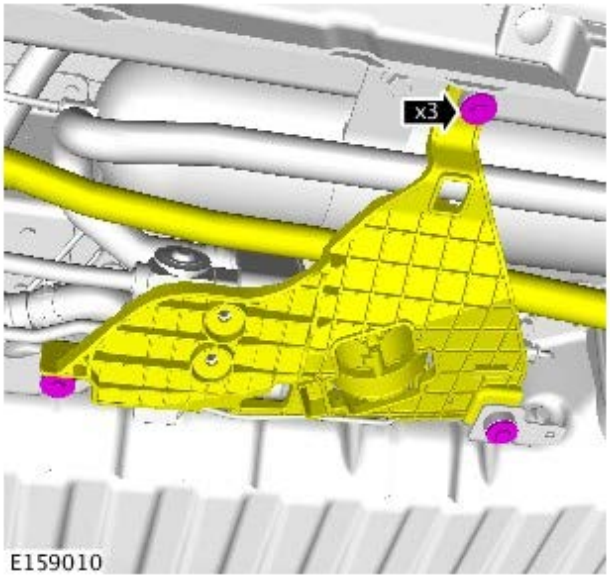
8.



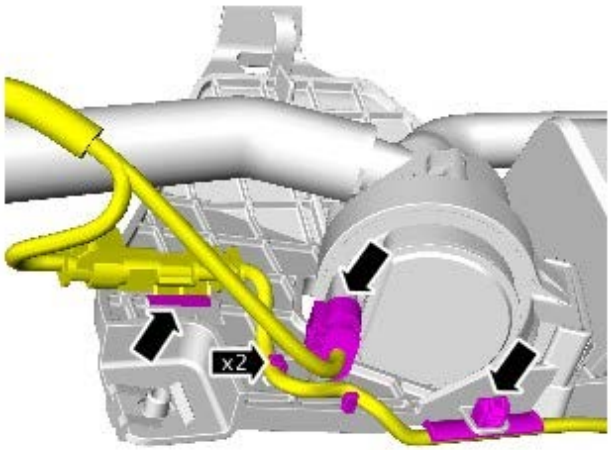
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10.

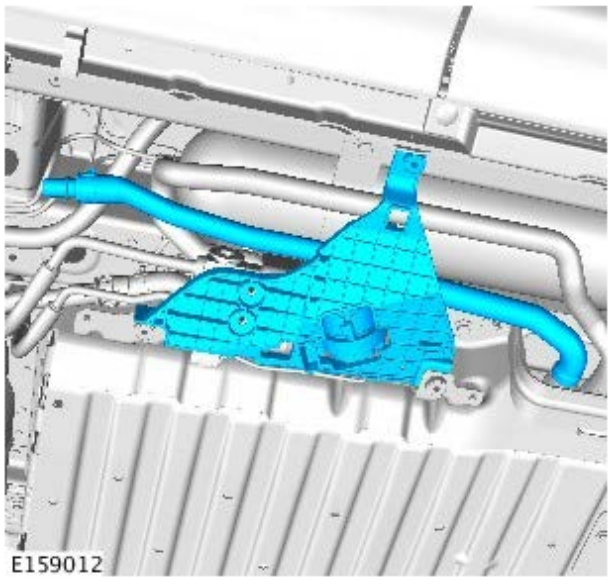


11.



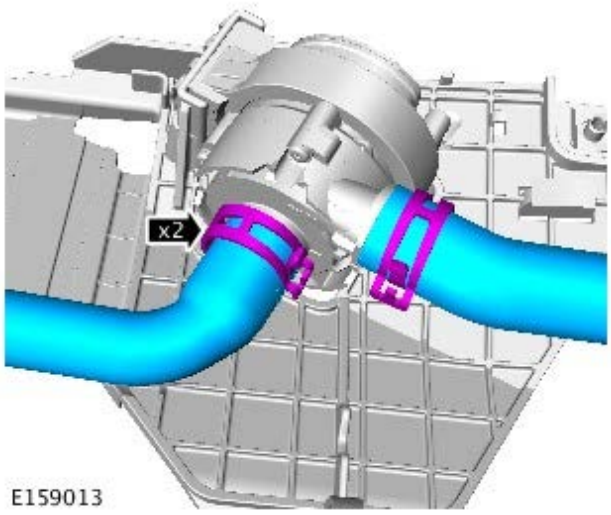
E159011

12. Remove the components.



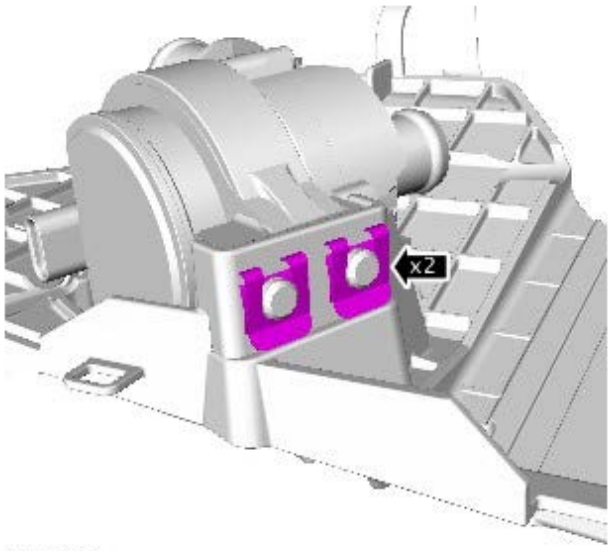
E159012

13. CAUTION: Be prepared to collect escaping coolant.



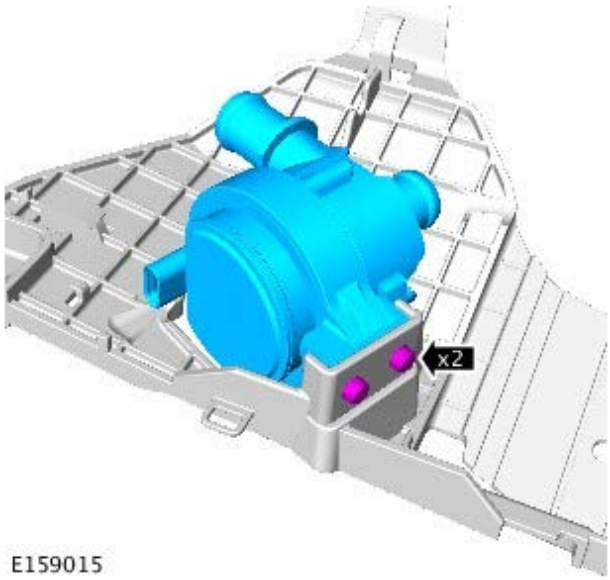
E159013

14.



E159014

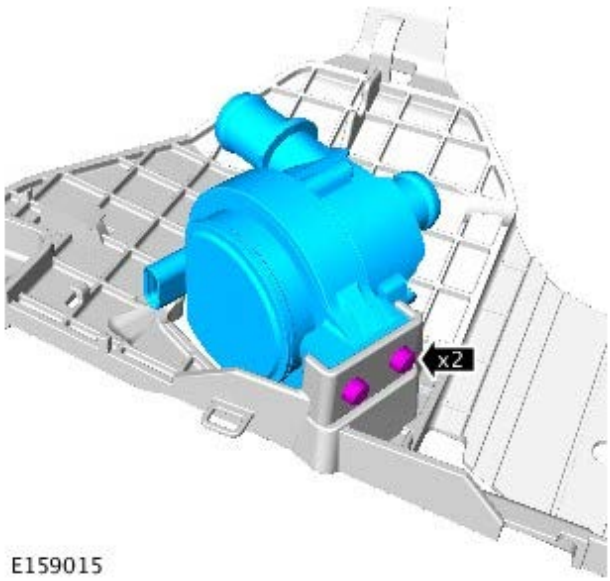
15.



E159015

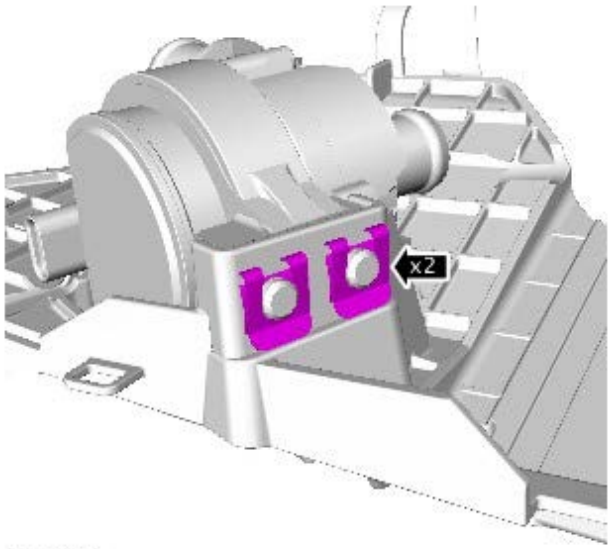
Installation

1.



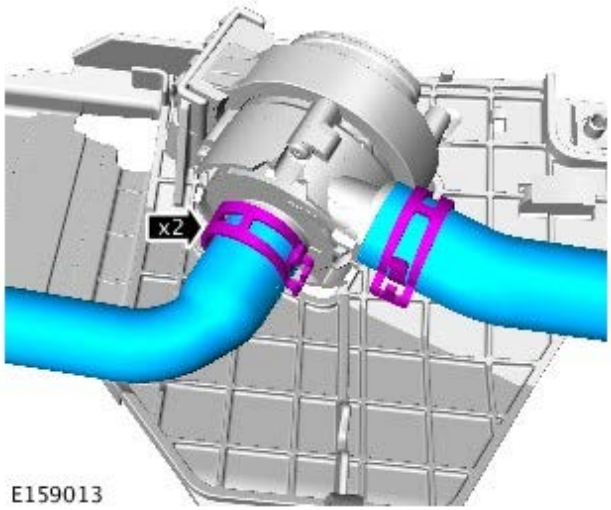
E159015

2.



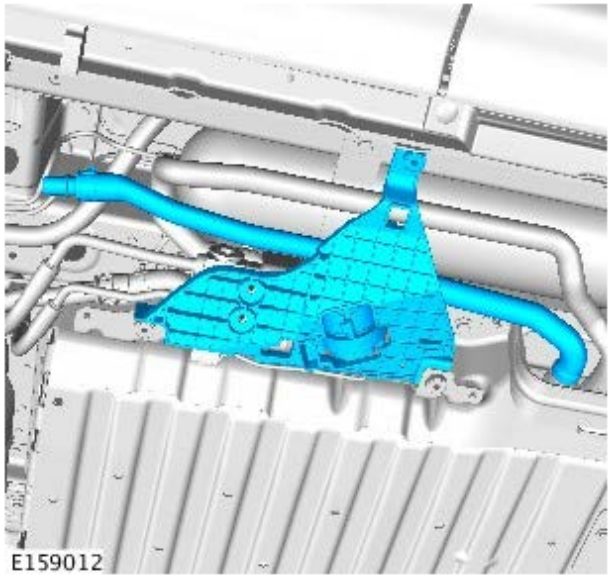
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3.



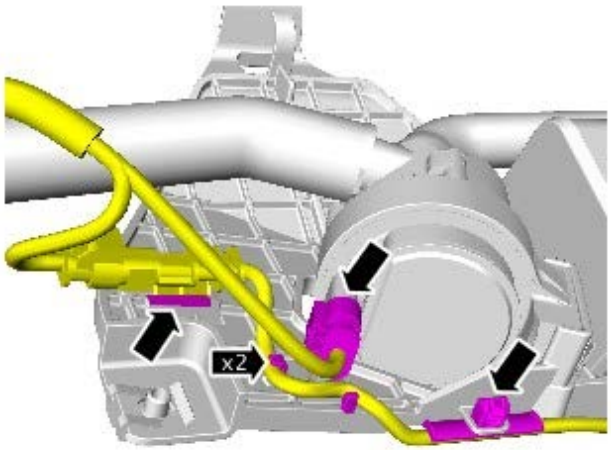
E159013

4. NOTE: Do not install the bolts at this stage.



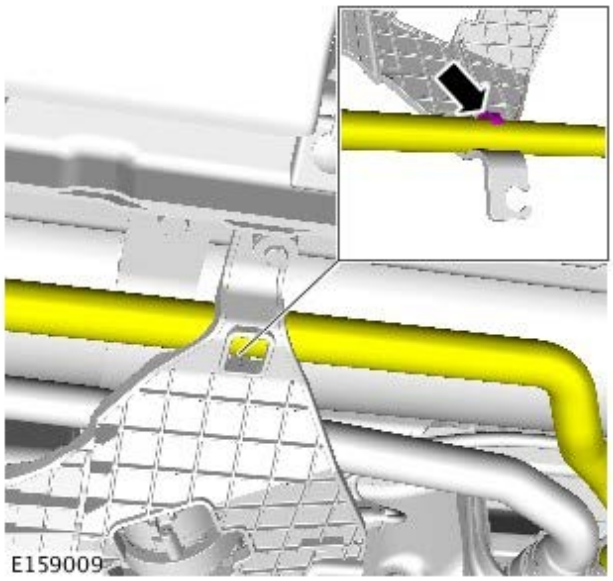
E159012

5.



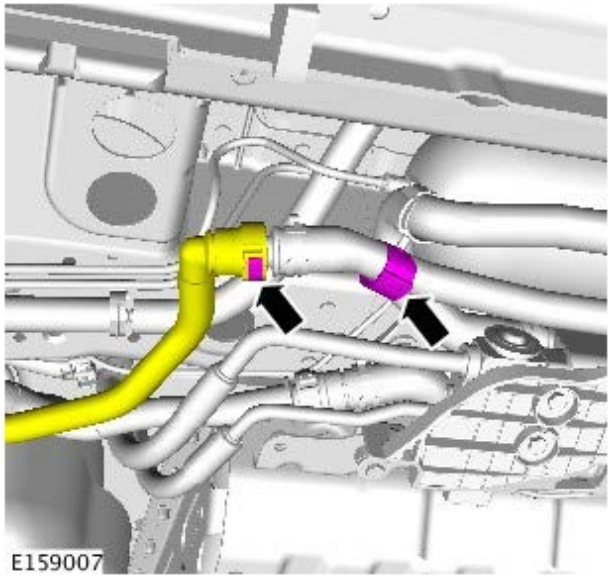
E159011

6.



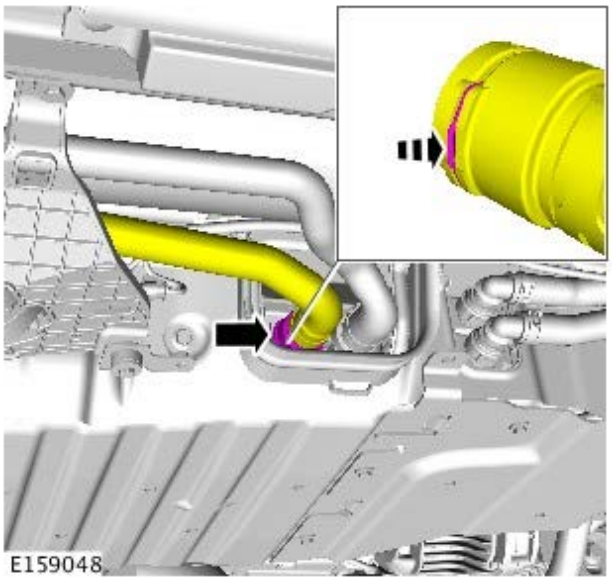
E159009

7.



E159007

8.



9. CAUTION: The coolant pump assembly needs to be lowered and suspended by the coolant hoses during this procedure.

   Add coolant to the battery coolant expansion tank as required, until the upper level mark is achieved.

10. CAUTIONS:

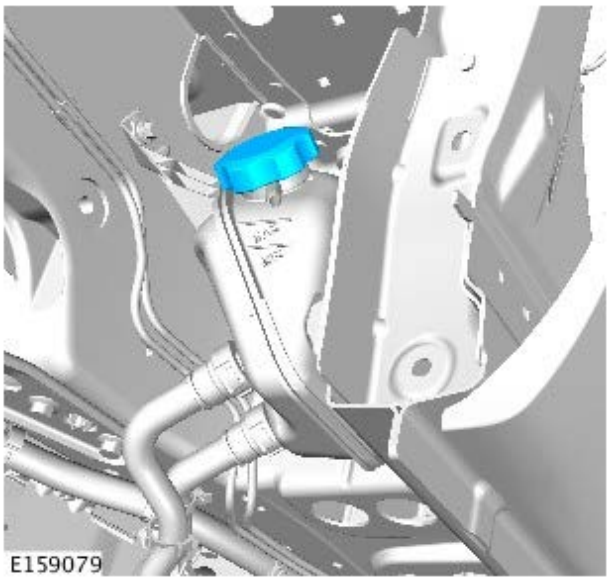
    The coolant pump assembly needs to be lowered and suspended by the coolant hoses during this procedure.

    If the coolant pump fails to run, the coolant pump has entered its run-dry mode. In this case the coolant pump assembly will require lowering further. This will make sure that the coolant pump is primed correctly and any air in the system is dispersed.

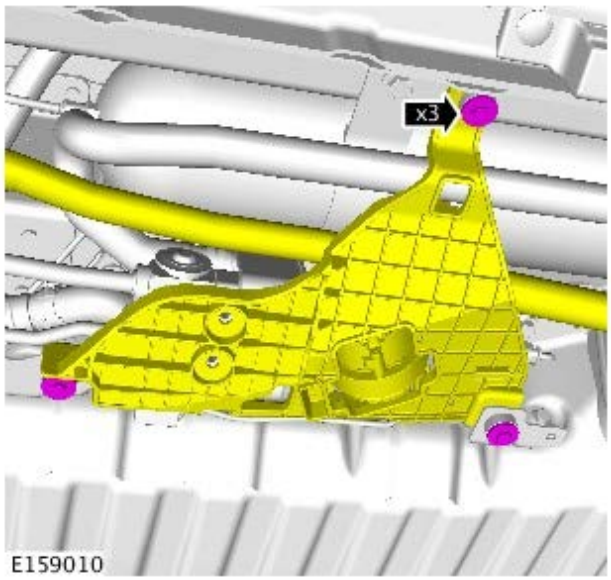
    Using Land Rover approved diagnostic equipment, run the battery coolant pump until the coolant level drops and coolant can be seen circulating around the system through the expansion tank.

11. Fill the coolant level in the battery coolant expansion tank, to the maximum cold fill line.

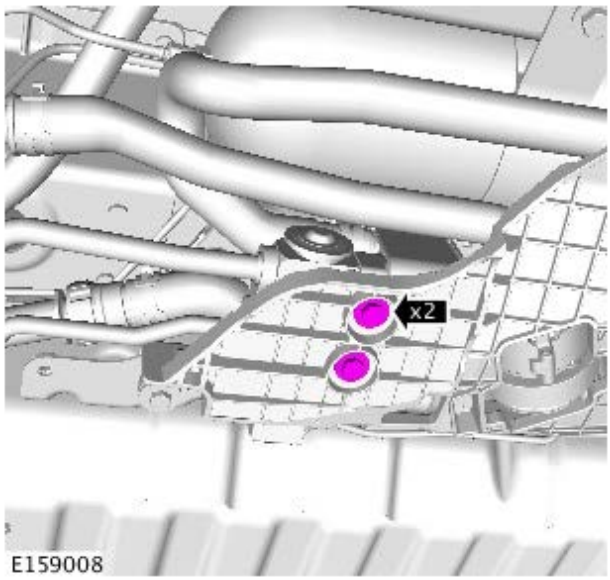
12.



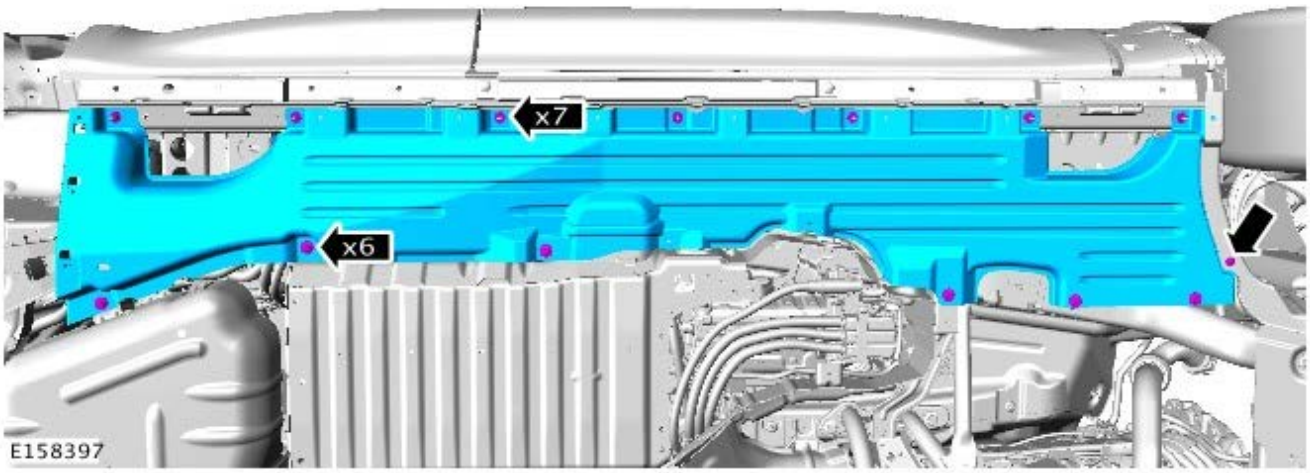
13. *Torque:* 10 Nm



14. *Torque:* 9 Nm



15.



16. Refer to: Rear Rocker Panel Moulding (501-08 Exterior Trim and Ornamentation, Removal and Installation).

17. Install the rear right fender splash shield.

Refer to: Rear Fender Splash Shield (501-08 Exterior Trim and Ornamentation, Removal and Installation).

Published: 06-Sep-2013

Battery, Mounting and Cables - 3-Phase High Voltage Cables

Removal and Installation

Removal

WARNING: This procedure can only be carried out after the vehicle has been decommissioned, by an approved person.

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

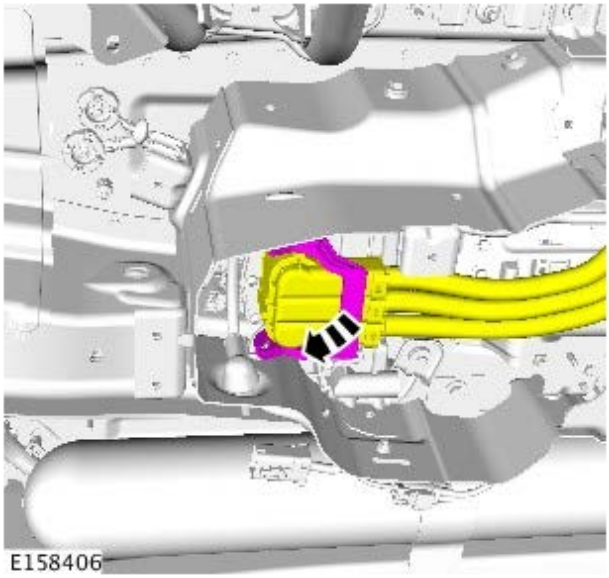
1. Decommission the vehicle.

   Refer to: Hybrid Electric Vehicle (HEV) Decommission (414-01 Battery, Mounting and Cables, General Procedures).

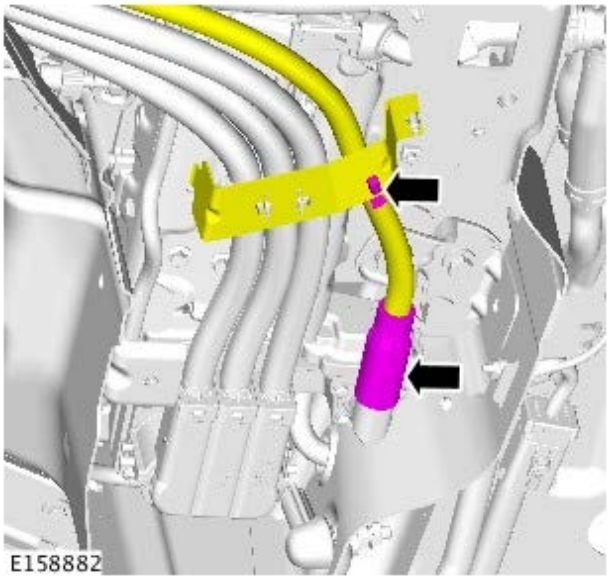
2. WARNING: Make sure to support the vehicle with axle stands.
   - Raise and support the vehicle.

3. Refer to: Transmission Support Crossmember - TDV6 3.0L Diesel (502-02 Full Frame and Body Mounting, Removal and Installation).

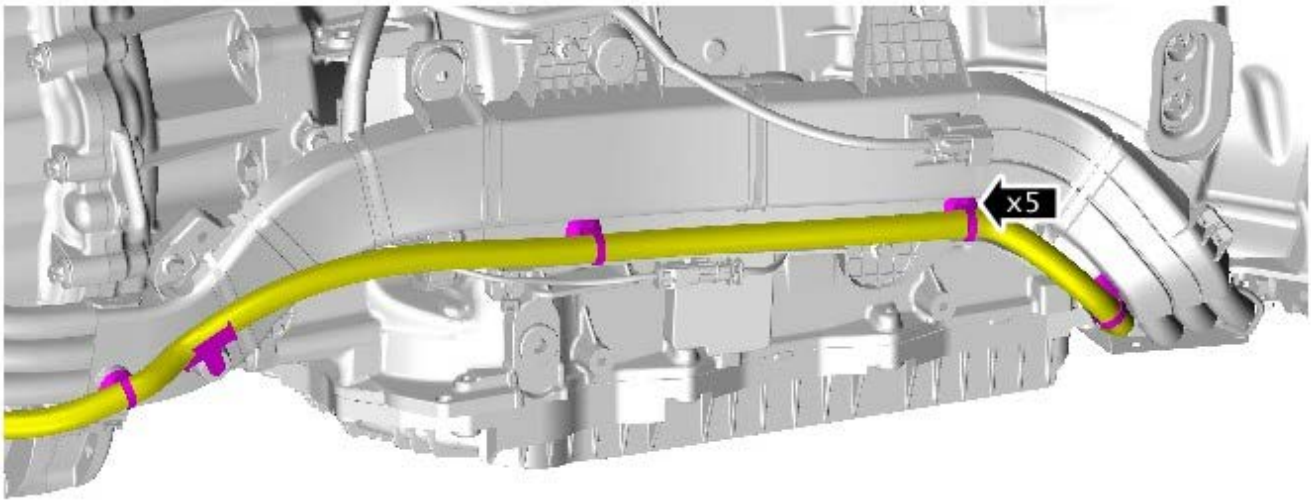
4.



5.

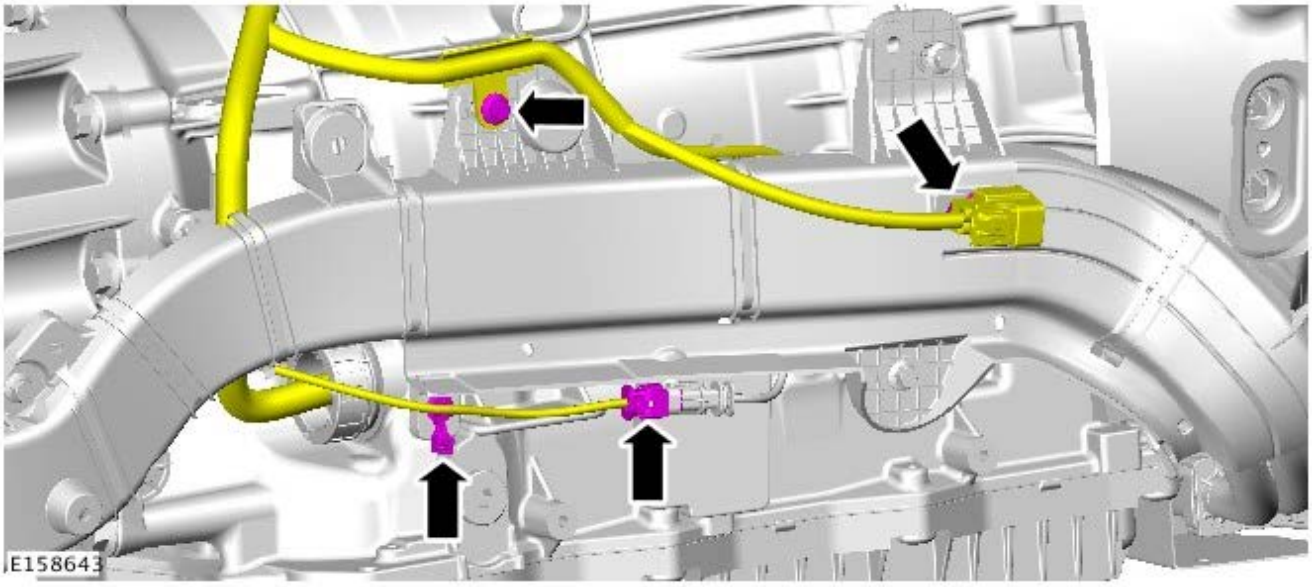


6.



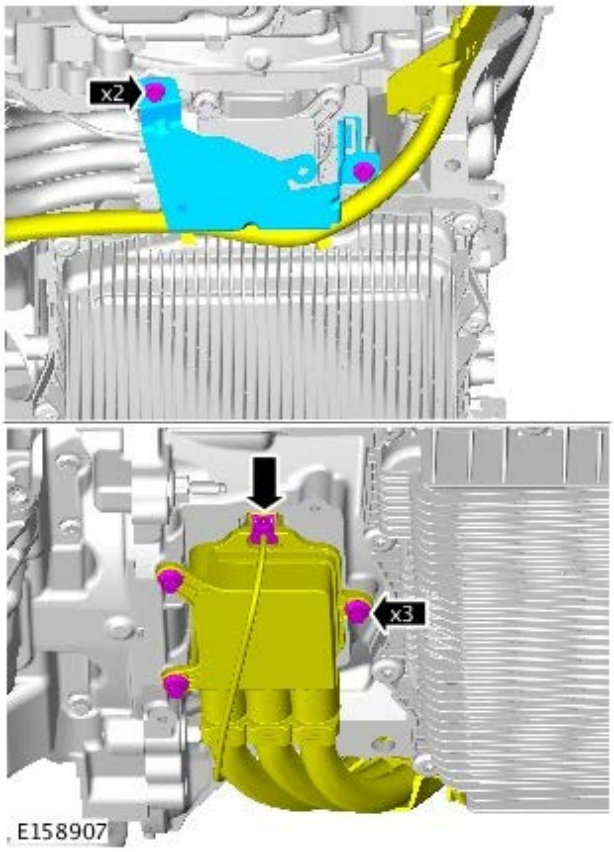
E158641

7. *Torque:* 10 Nm

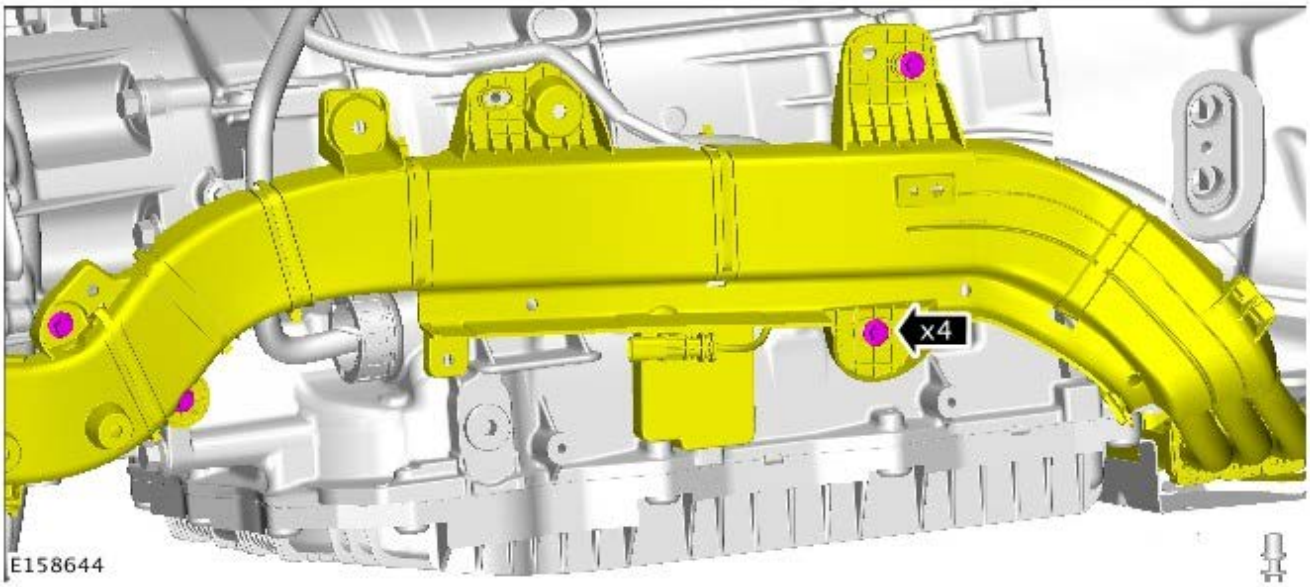


E158643

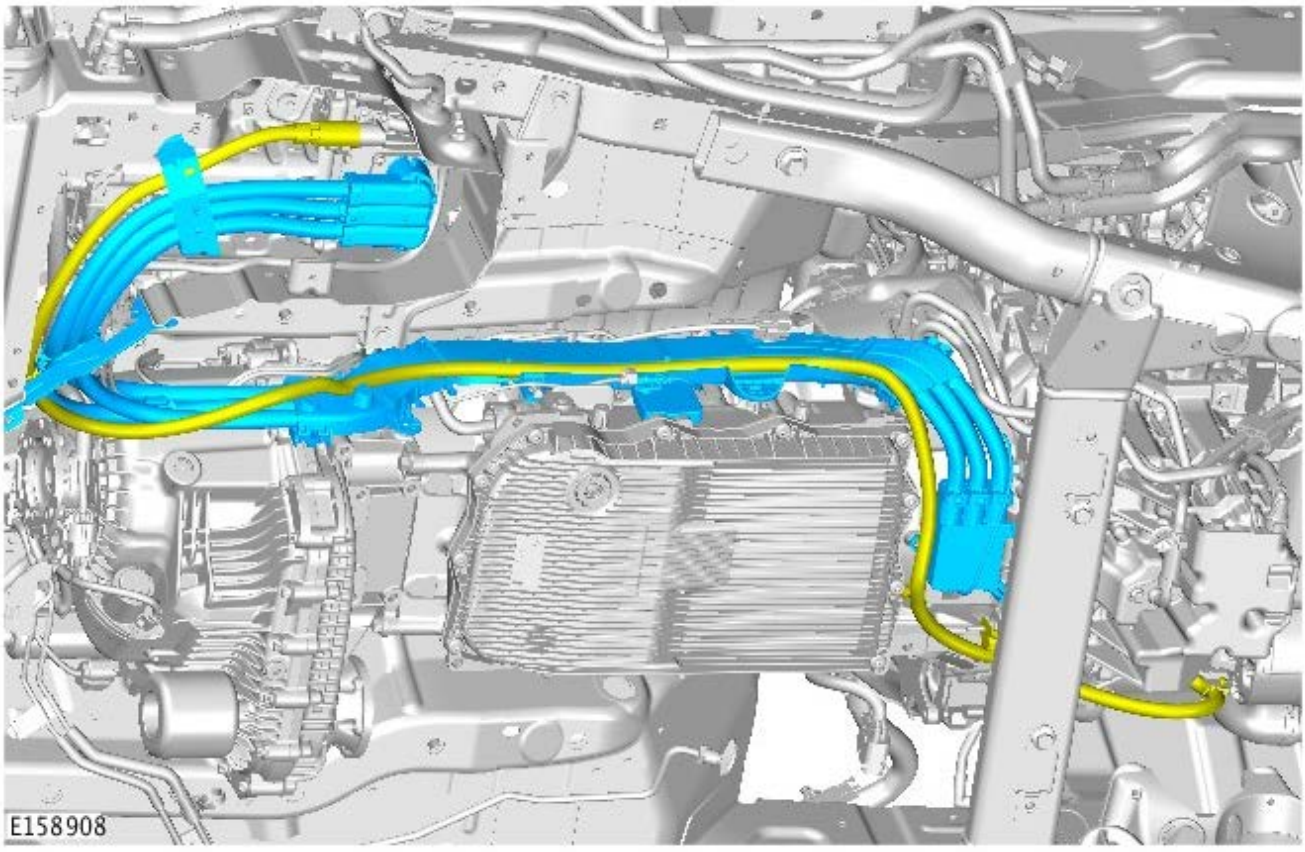
8. *Torque:* 10 Nm



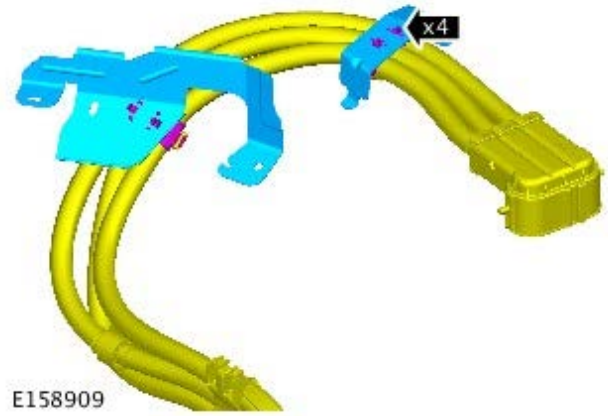
9. *Torque:* 10 Nm



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



11.



Installation

1. To install, reverse the removal procedure.

Published: 06-Sep-2013

Battery, Mounting and Cables - High Voltage Cables

Removal and Installation

Removal

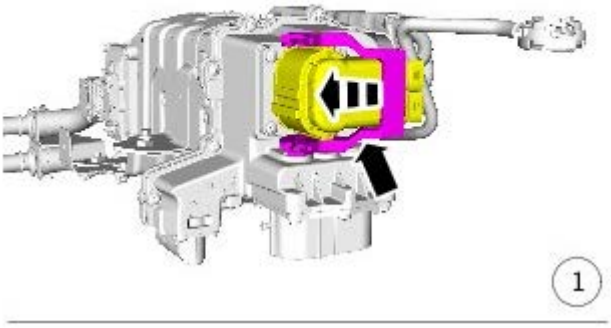
WARNING: This procedure can only be carried out after the vehicle has been decommissioned, by an approved person.

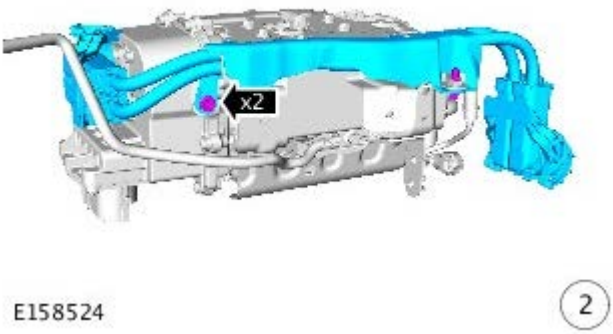
NOTE: Removal steps in this procedure may contain installation details.

1. Decommission the vehicle.

   Refer to: Hybrid Electric Vehicle (HEV) Decommission (414-01 Battery, Mounting and Cables, General Procedures).

2. WARNING: Make sure to support the vehicle with axle stands.
   - Raise and support the vehicle.
3. Refer to: Electric Power Inverter Converter (EPIC) (414-01 Battery, Mounting and Cables, Removal and Installation).
4. *Torque:* 9 Nm





Installation

1. To install, reverse the removal procedure.

Published: 20-Aug-2013

Battery, Mounting and Cables - High Voltage Cable

Removal and Installation

Removal

WARNING: This procedure can only be carried out after the vehicle has been decommissioned, by an approved person.

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

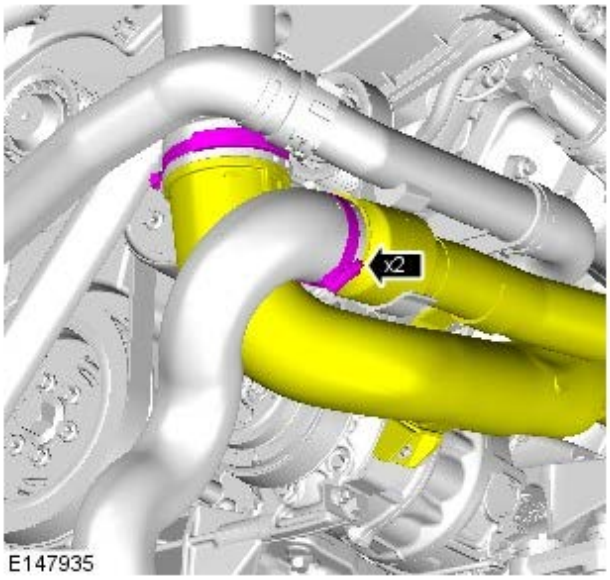
1. Decommission the vehicle.

   Refer to: Hybrid Electric Vehicle (HEV) Decommission (414-01 Battery, Mounting and Cables, General Procedures).

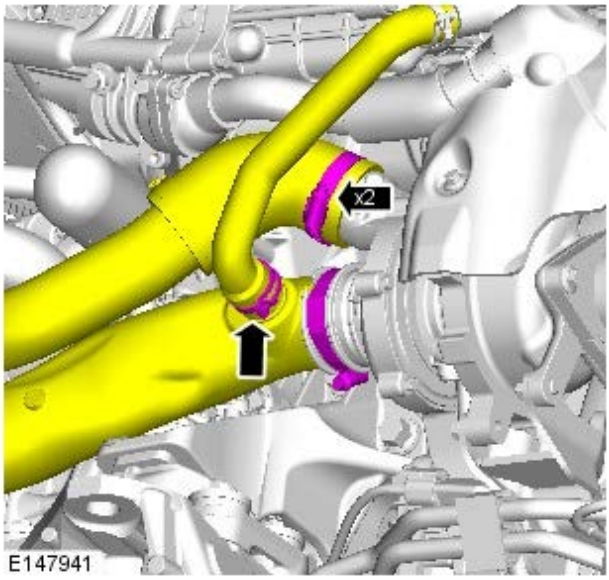
2. WARNING: Make sure to support the vehicle with axle stands.
   - Raise and support the vehicle.

3. Refer to: Transmission Support Crossmember - TDV6 3.0L Diesel (502-02 Full Frame and Body Mounting, Removal and Installation).

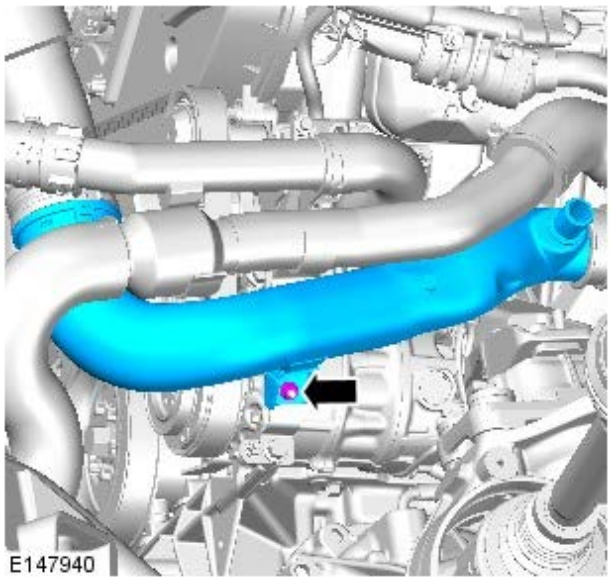
4.



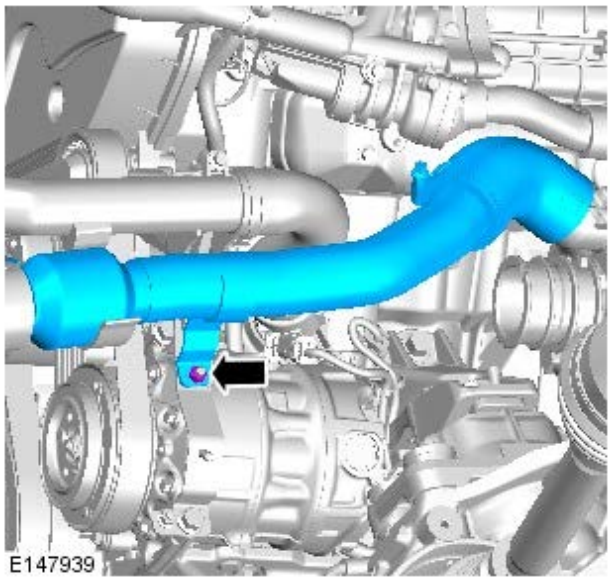
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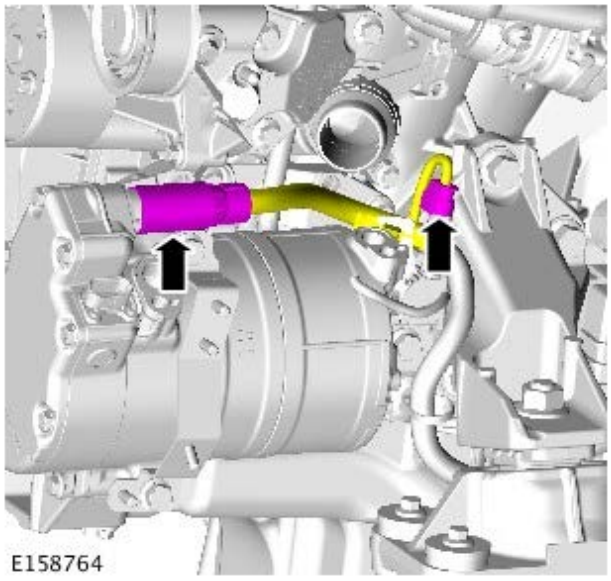
6. *Torque:* 6 Nm



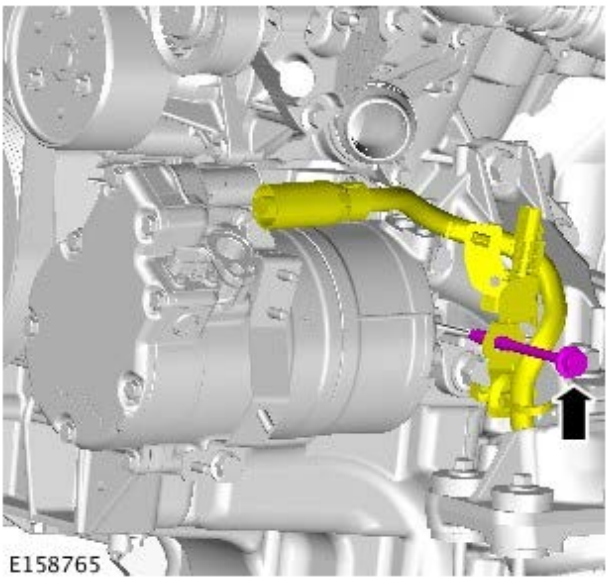
7. *Torque:* 6 Nm



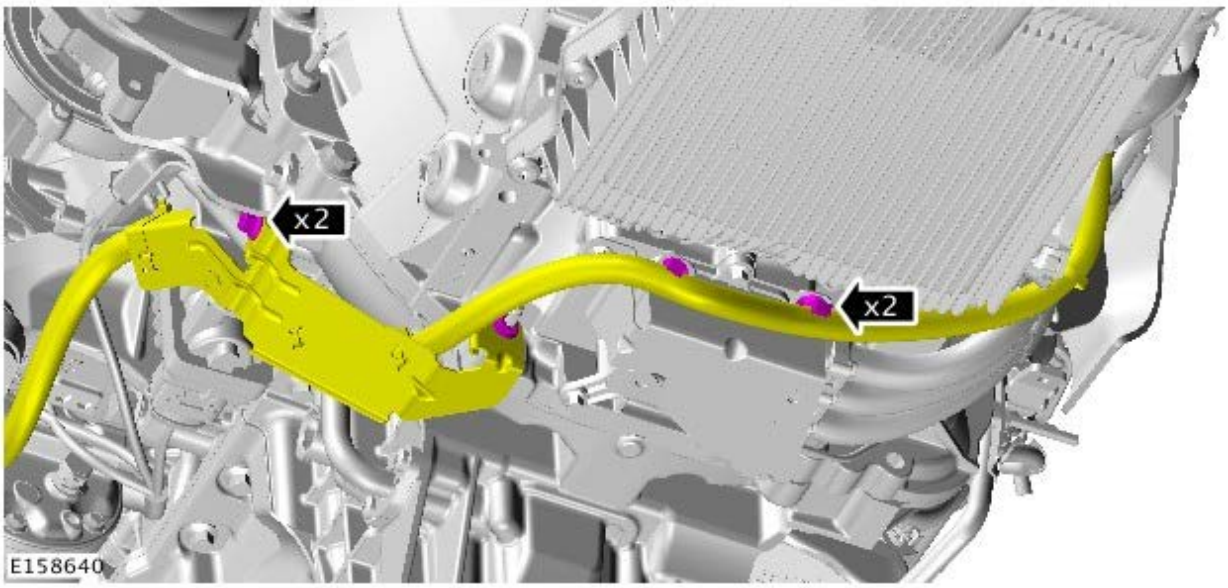
8.



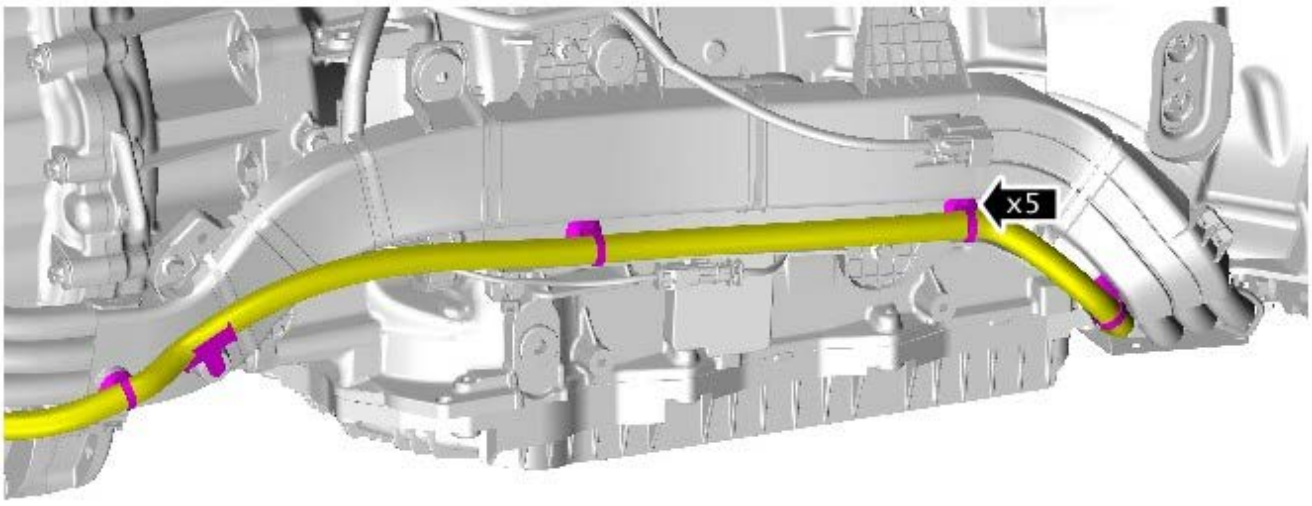
9. *Torque:* 25 Nm



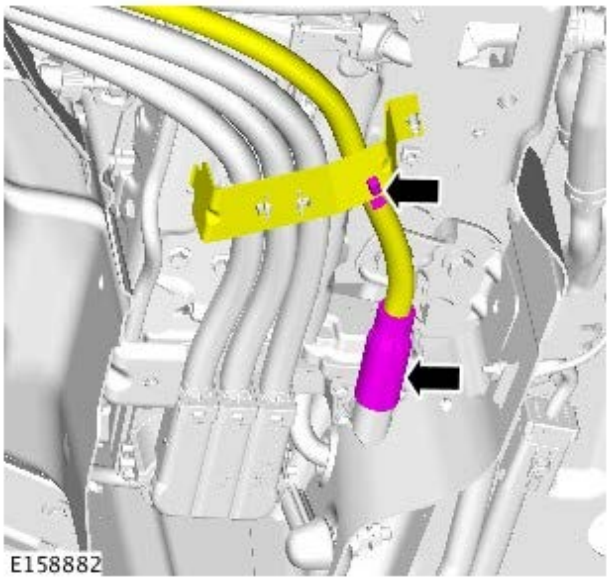
10. *Torque:* 10 Nm



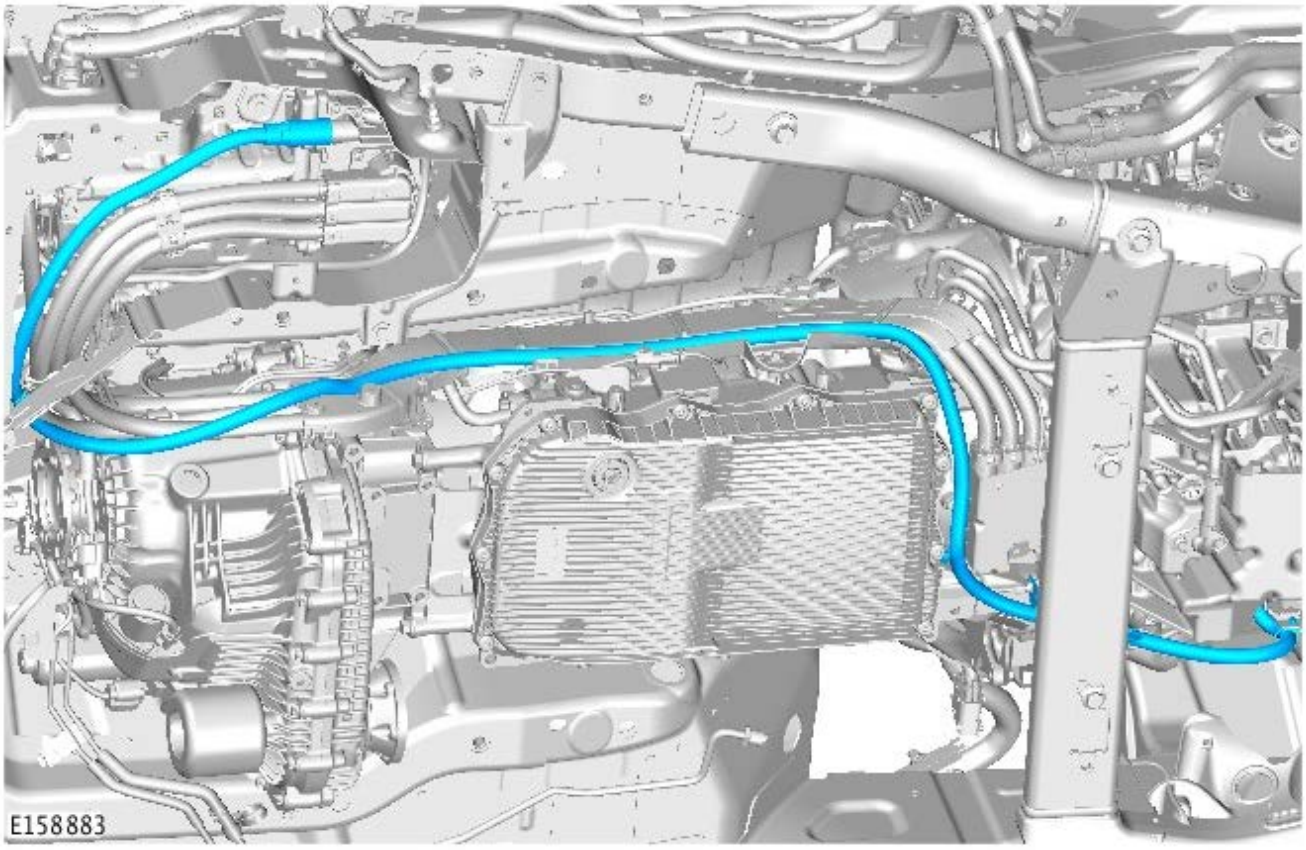
11.



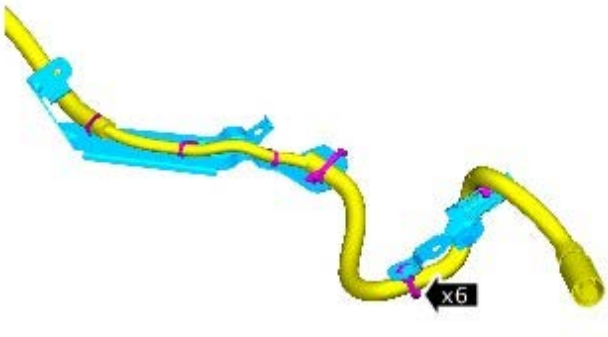
12.



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



14.



E158884

Installation

1. To install, reverse the removal procedure.

Published: 22-Nov-2013

Battery, Mounting and Cables - Hybrid Electric Vehicle (HEV) Battery Cooler and Isolation Valve

Removal and Installation

Removal

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

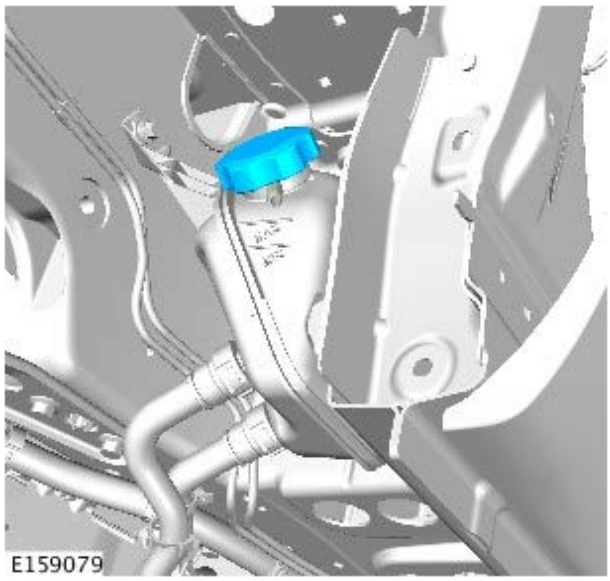
1. WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

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

3. Remove the rear right fender splash shield.

   Refer to: Rear Fender Splash Shield (501-08 Exterior Trim and Ornamentation, Removal and Installation).

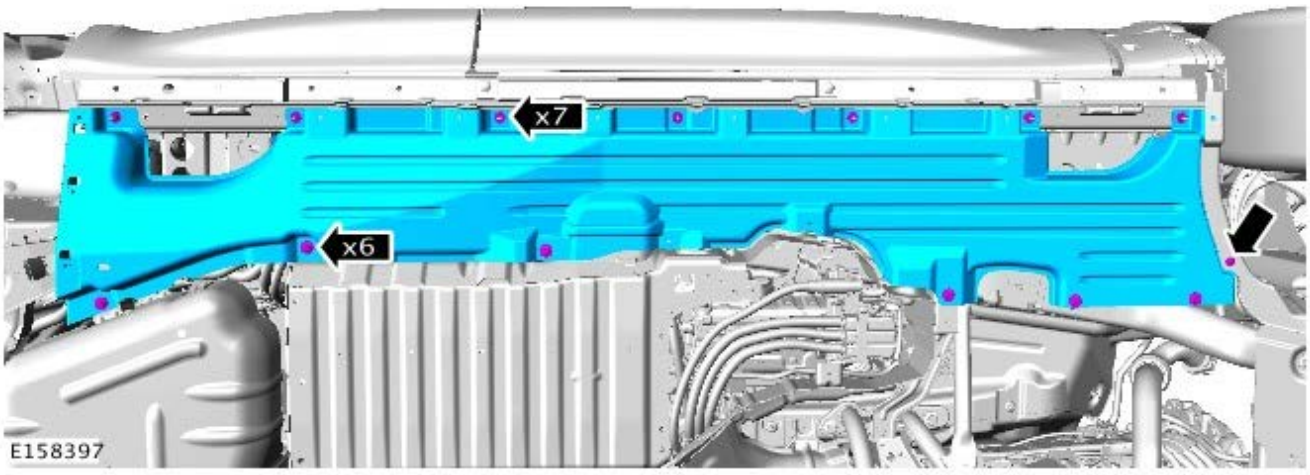


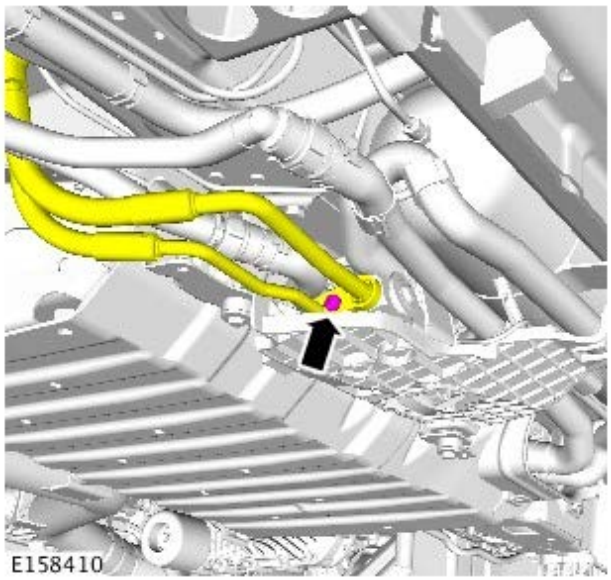
4. CAUTION: Make sure that the area around the component is clean and free of foreign material.

5. NOTE: RH side only.

   Refer to: Rear Rocker Panel Moulding (501-08 Exterior Trim and Ornamentation, Removal and Installation).

6. NOTE: RH side only.



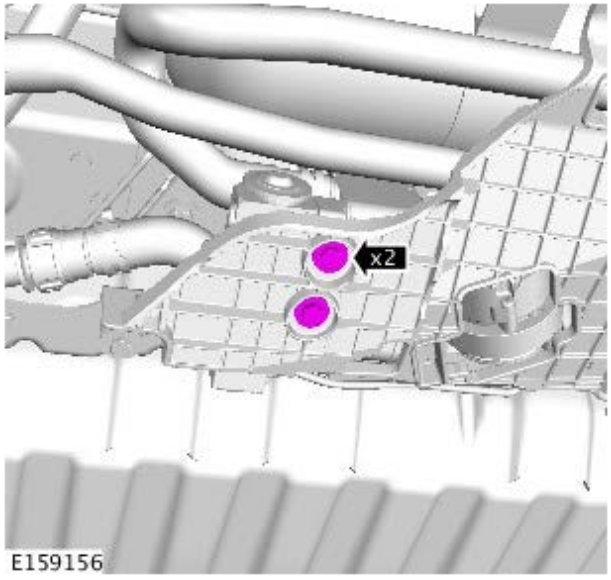


7. CAUTIONS:

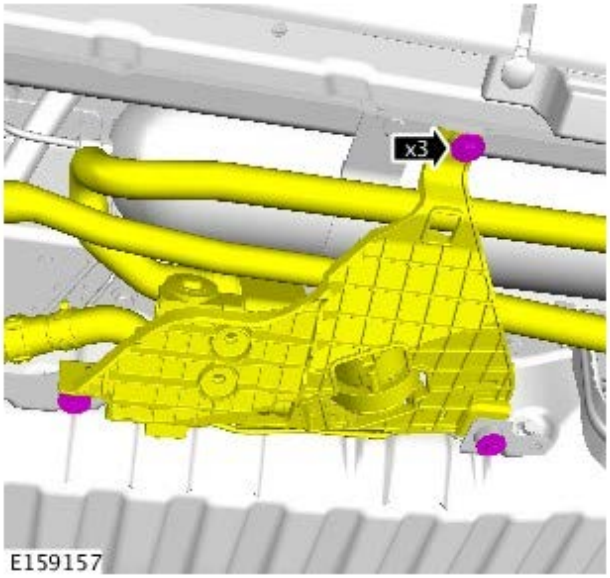
   Remove and discard the O-ring seals.

   Be prepared to collect escaping oil.

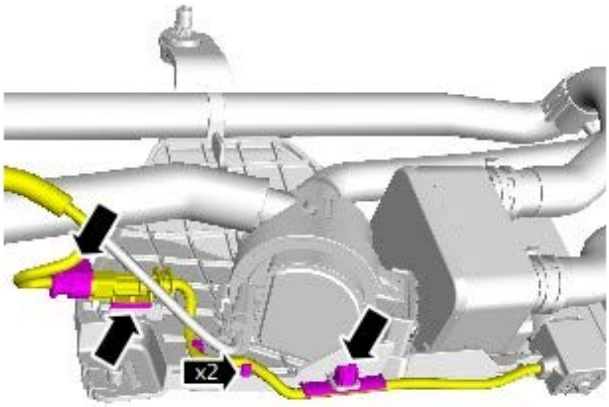
8.



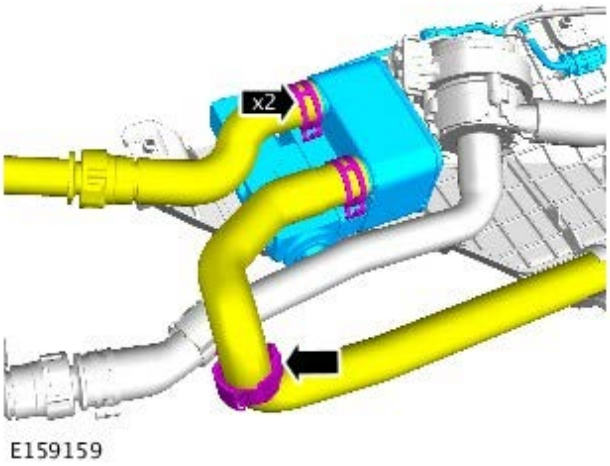
9.



10.

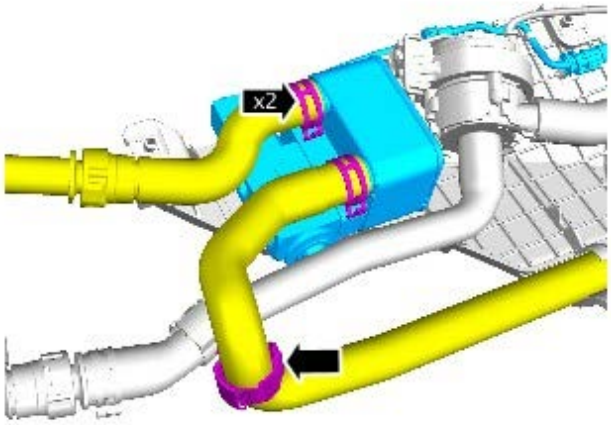


11. CAUTION: Be prepared to collect escaping coolant.



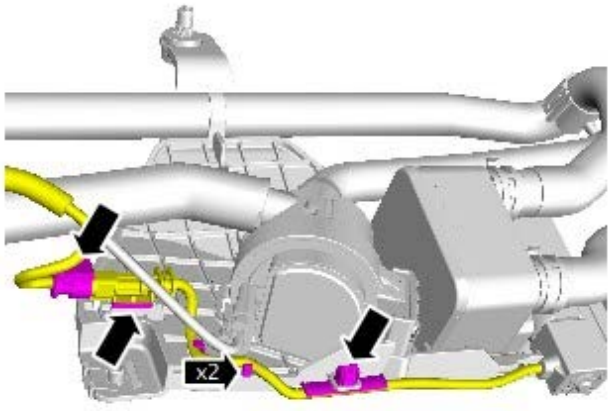
Installation

1.



E159159

2.



E159158

3. CAUTION: The coolant pump assembly requires lowering and supported by the coolant hoses during this procedure.

   Add coolant to the battery coolant expansion tank as required, until the upper level mark is achieved.

4. CAUTIONS:

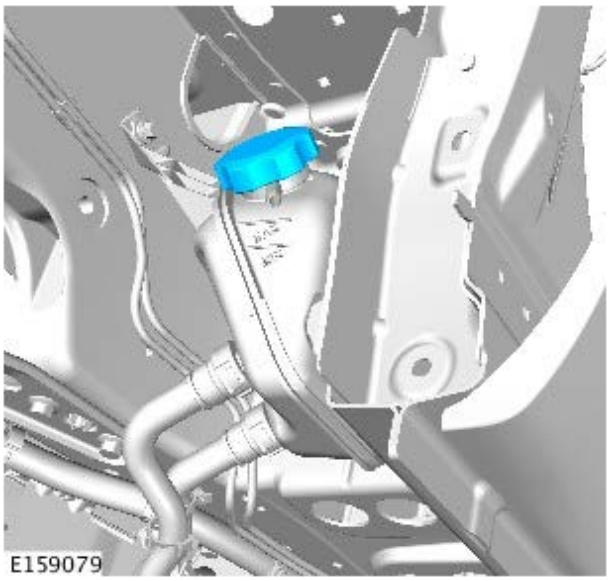
   The coolant pump assembly requires lowering and supported by the coolant hoses during this procedure.

   If the coolant pump fails to run, the coolant pump has entered its run-dry mode. In this case the coolant pump assembly will require lowering further. This will make sure that the coolant pump is primed correctly and any air in the system is dispersed.

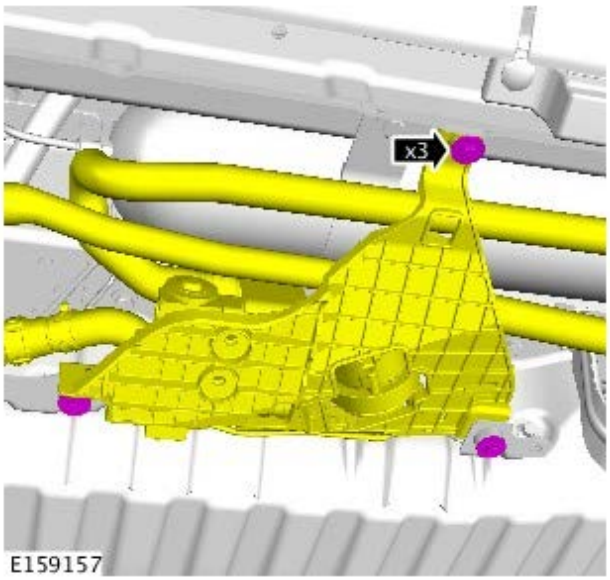
   Using Land Rover approved diagnostic equipment, run the battery coolant pump until the coolant level drops and coolant can be seen circulating around the system through the expansion tank.

5. Fill the coolant level in the battery coolant expansion tank, to the maximum cold fill line.

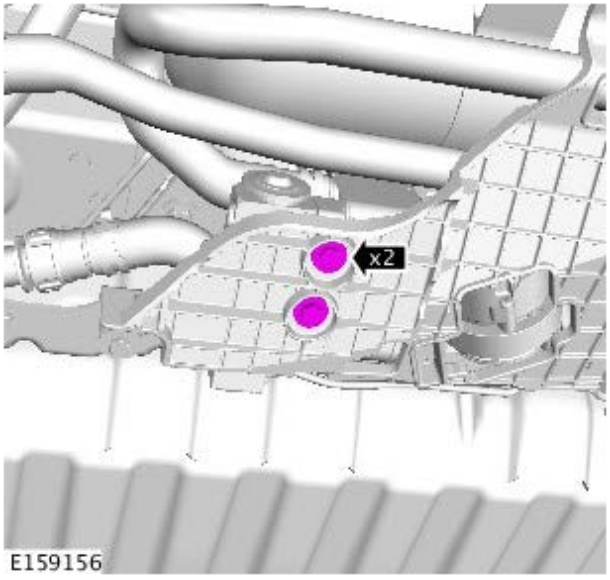
6.



7. *Torque:* 10 Nm

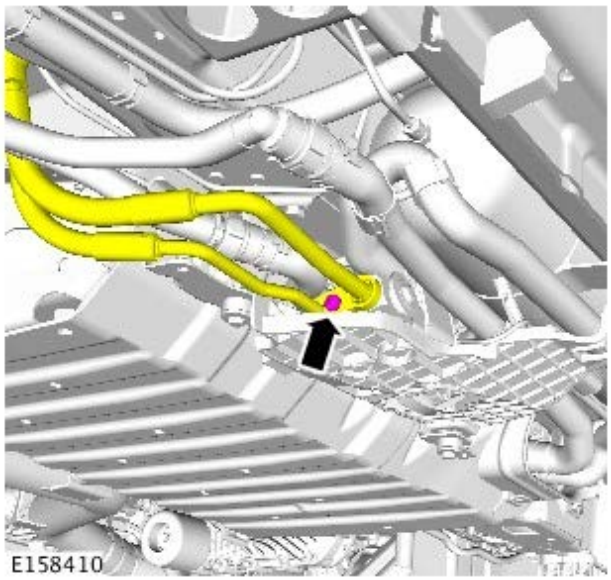


8. *Torque:* 9 Nm

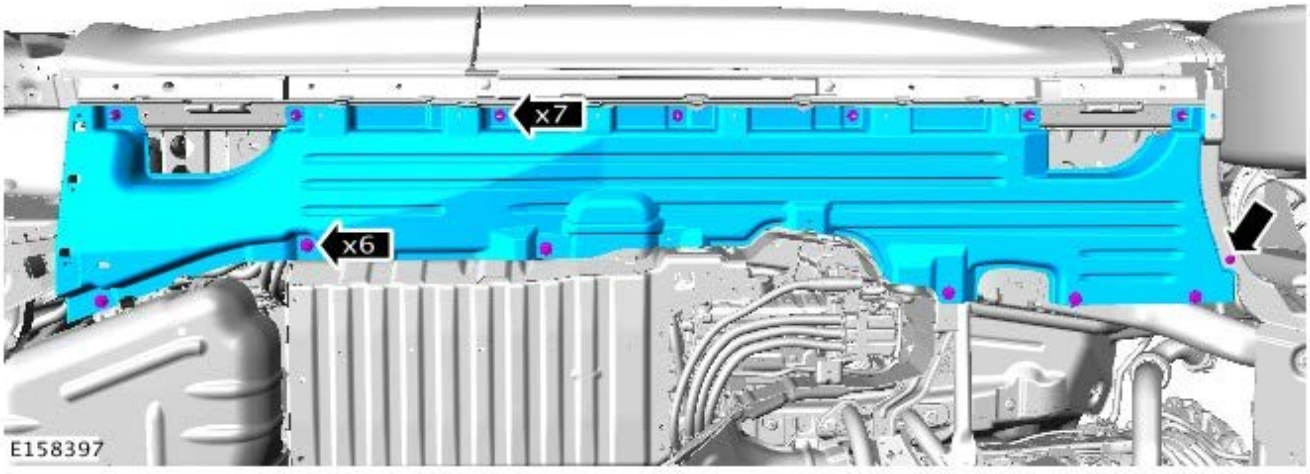


9. NOTE: Install new O-ring seals.

   Torque: 9 Nm



10. NOTE: RH side only.



11. Refer to: Rear Rocker Panel Moulding (501-08 Exterior Trim and Ornamentation, Removal and Installation).

12. Install the rear right fender splash shield.

    Refer to: Rear Fender Splash Shield (501-08 Exterior Trim and Ornamentation, Removal and Installation).

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

Published: 06-Sep-2013

Battery, Mounting and Cables - Electric Vehicle (EV) Mode Switch

Removal and Installation

Removal

1. Refer to: Ride and Handling Optimization Switch (204-06, Removal and Installation).

Installation

1. Refer to: Ride and Handling Optimization Switch (204-06, Removal and Installation).

Published: 06-Sep-2013

Battery, Mounting and Cables - Electric Power Inverter Converter (EPIC) Coolant Pump

Removal and Installation

Removal

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

1. Disconnect the battery ground cable.

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

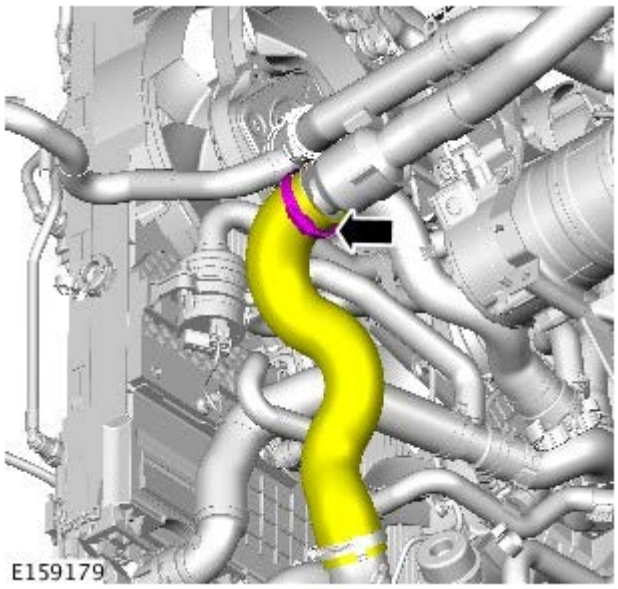
2. WARNING: Make sure to support the vehicle with axle stands.

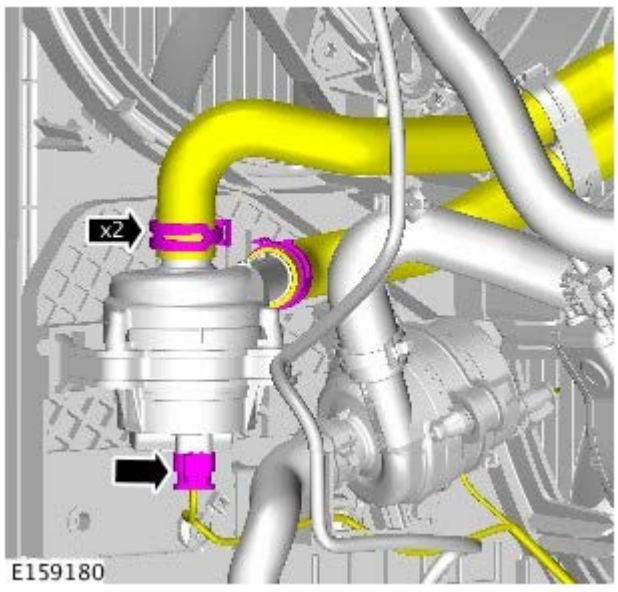
   Raise and support the vehicle.

3. Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

4. Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03A Engine Cooling - TDV6 3.0L Diesel, General Procedures).

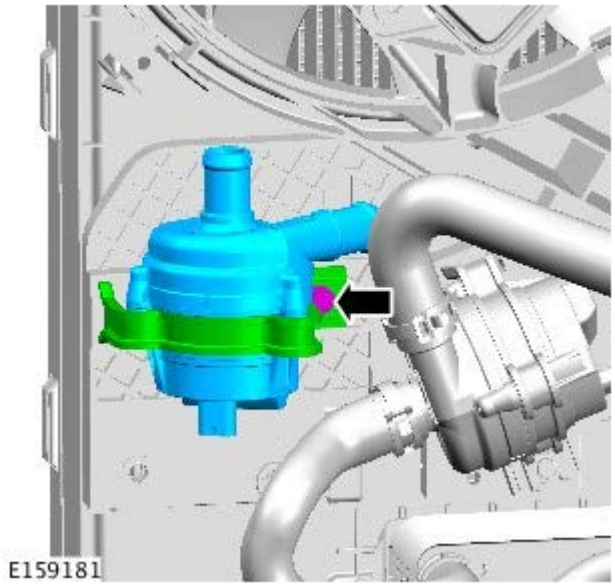
5.





6. CAUTION: Be prepared to collect escaping coolant.

7. *Torque:* 6 Nm



Installation

1. To install, reverse the removal procedure.

Published: 06-Sep-2013

Battery, Mounting and Cables - Electric Power Inverter Converter (EPIC) Lower Cooler

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

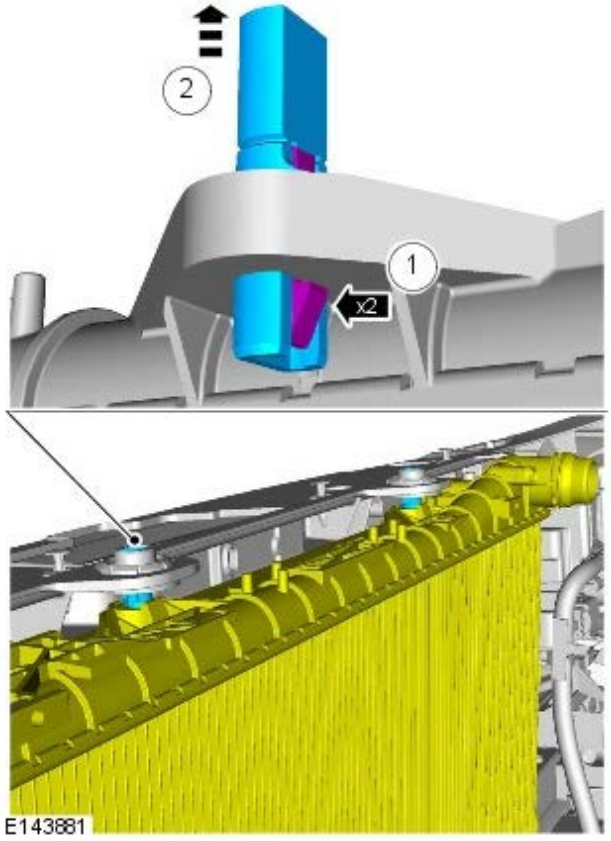
Some variation in the illustrations may occur, but the essential information is always correct.

Some components shown removed for clarity.

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

2. Refer to: Cooling Fan (303-03A Engine Cooling - TDV6 3.0L Diesel, Removal and Installation).

3.



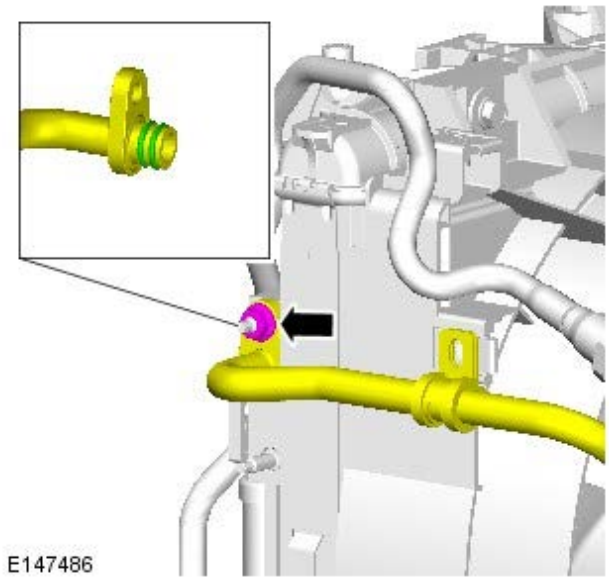
4. CAUTIONS:

   Make sure that all openings are sealed.

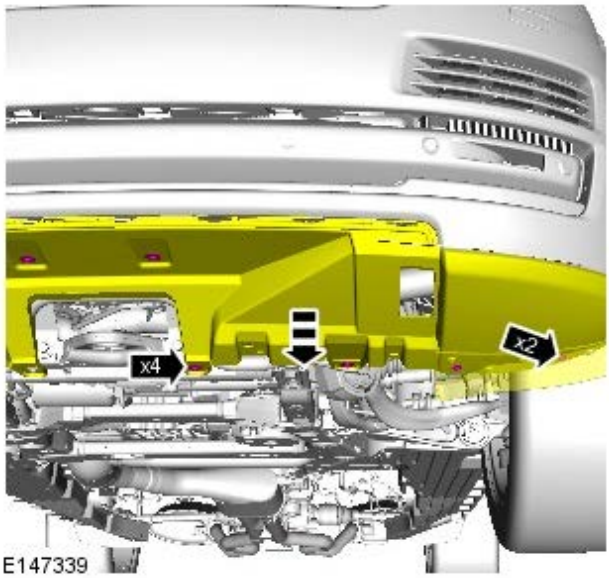
   Remove and discard the O-ring seals.

   NOTE: Install new O-ring seals.

   Torque: 8 Nm



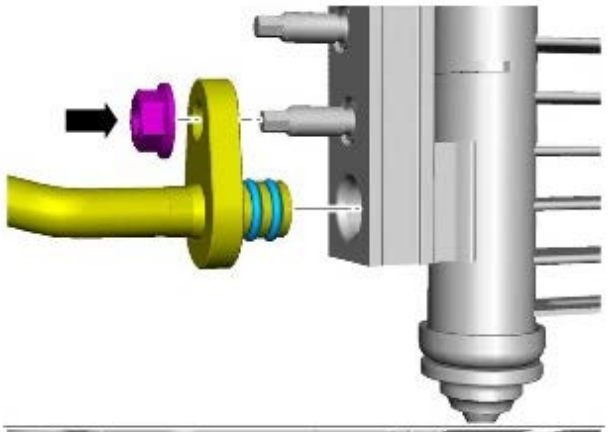
5.

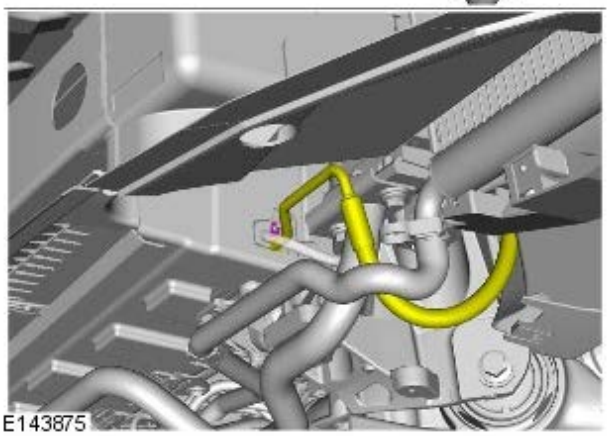


6. CAUTION: Remove and discard the O-ring seals.

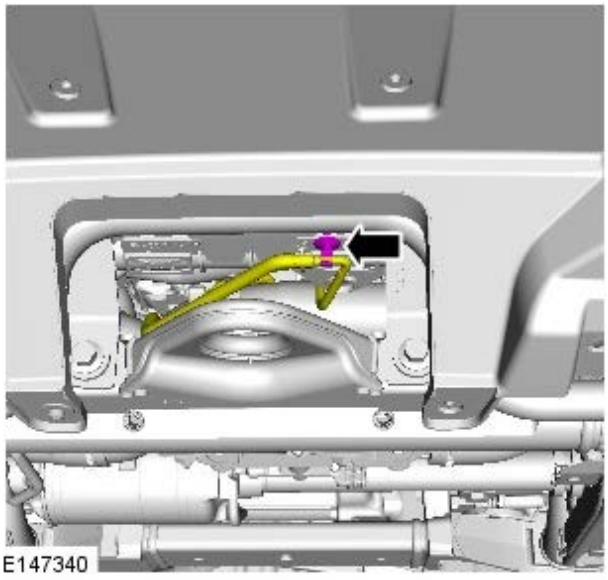
NOTE: Install new O-ring seals.

Torque: 8 Nm

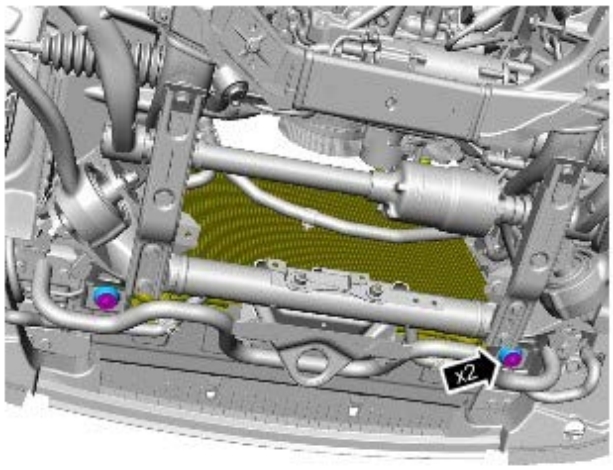




7.



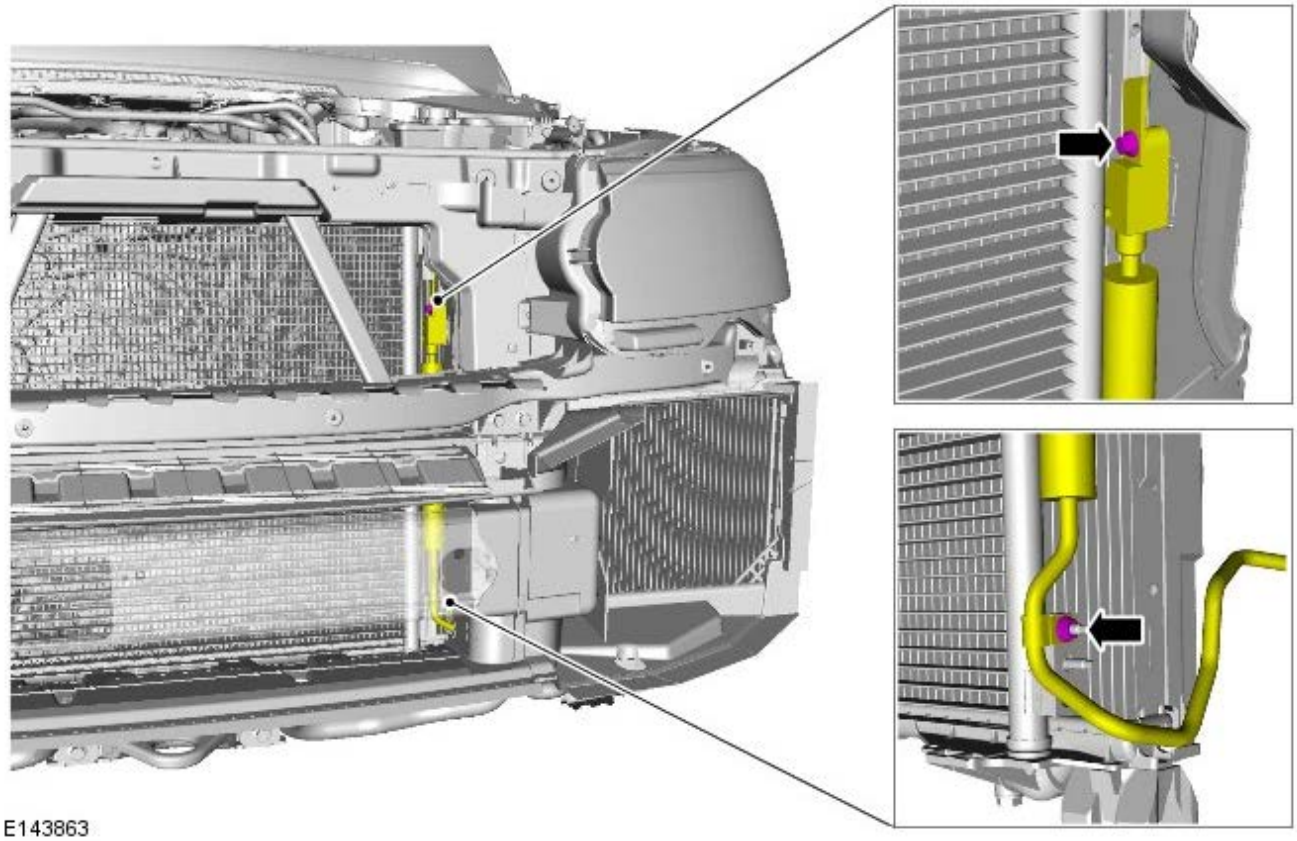
8. *Torque:* 15 Nm



E143877

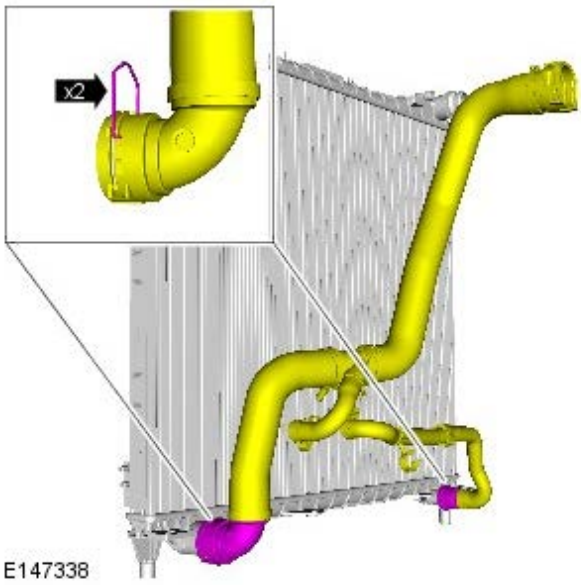
9. NOTE: If equipped.

Torque: 7 Nm

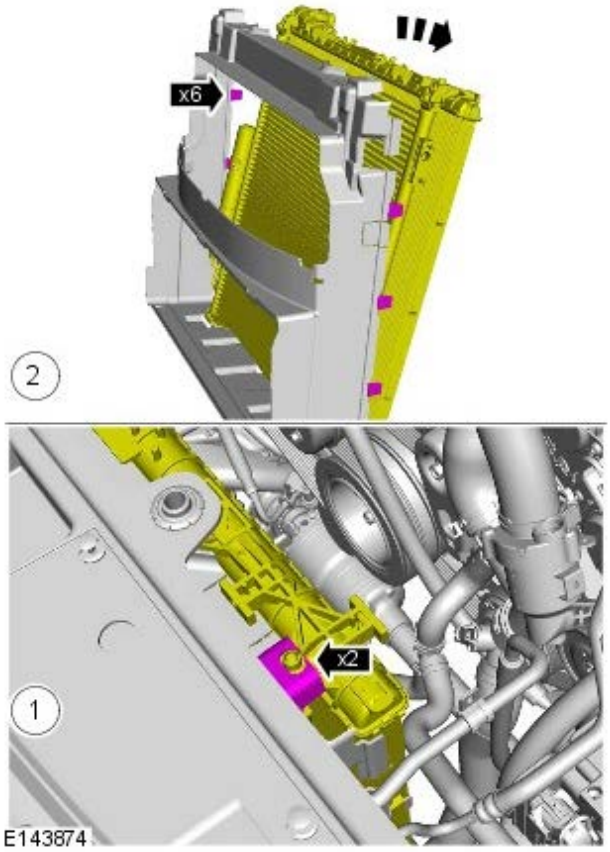


E143863

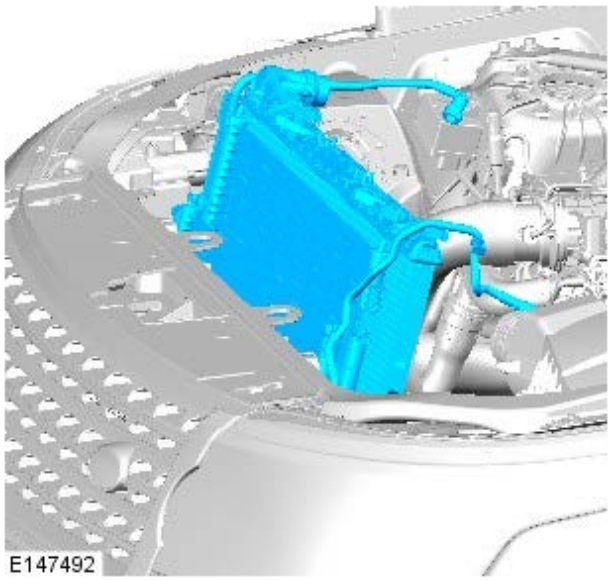
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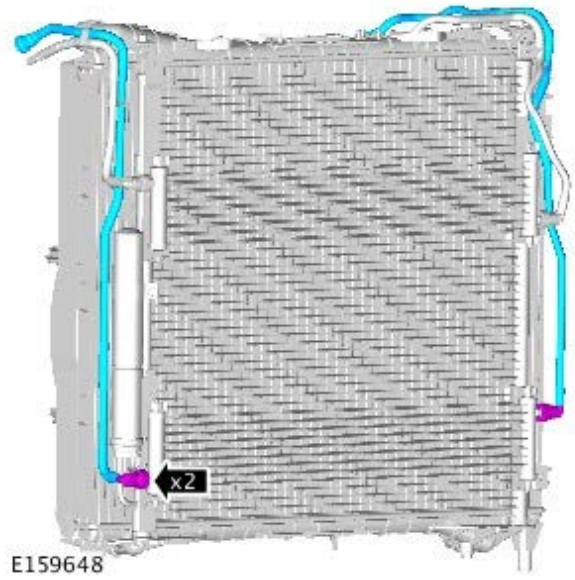
11. CAUTION: Always protect the cooling pack elements to prevent accidental damage.



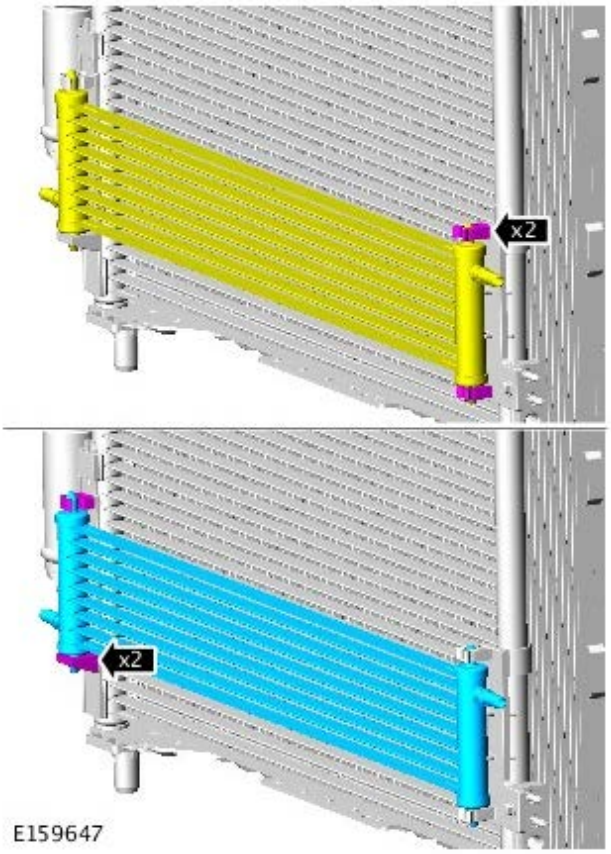
12. CAUTION: Always protect the cooling pack elements to prevent accidental damage.



13.



14.



Installation

1. To install, reverse the removal procedure.

Published: 06-Sep-2013

Battery, Mounting and Cables - Electric Power Inverter Converter (EPIC) Upper Cooler

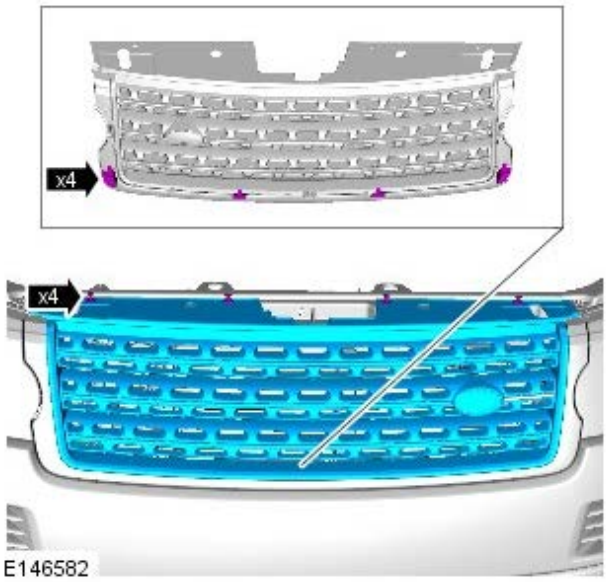
Removal and Installation

Removal

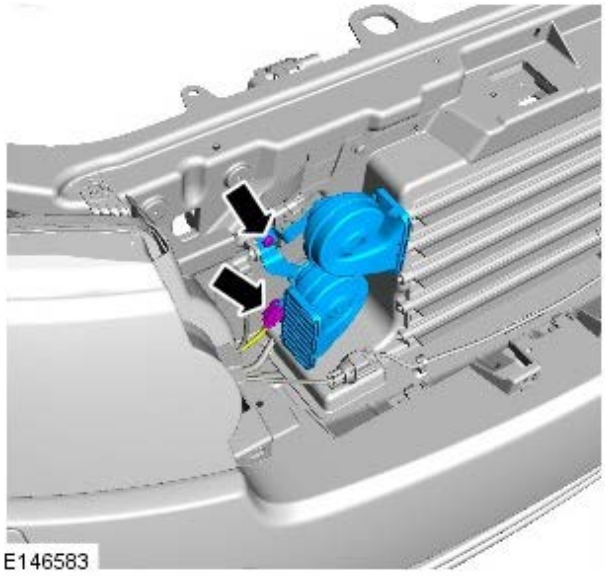
NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03A Engine Cooling - TDV6 3.0L Diesel, General Procedures).

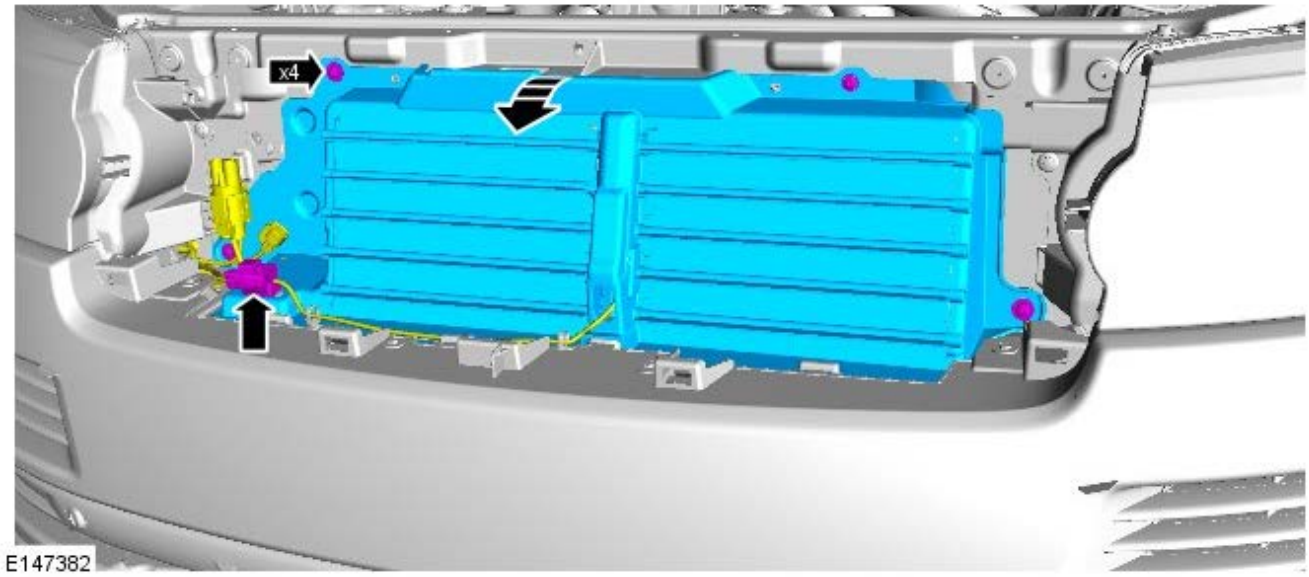
2.



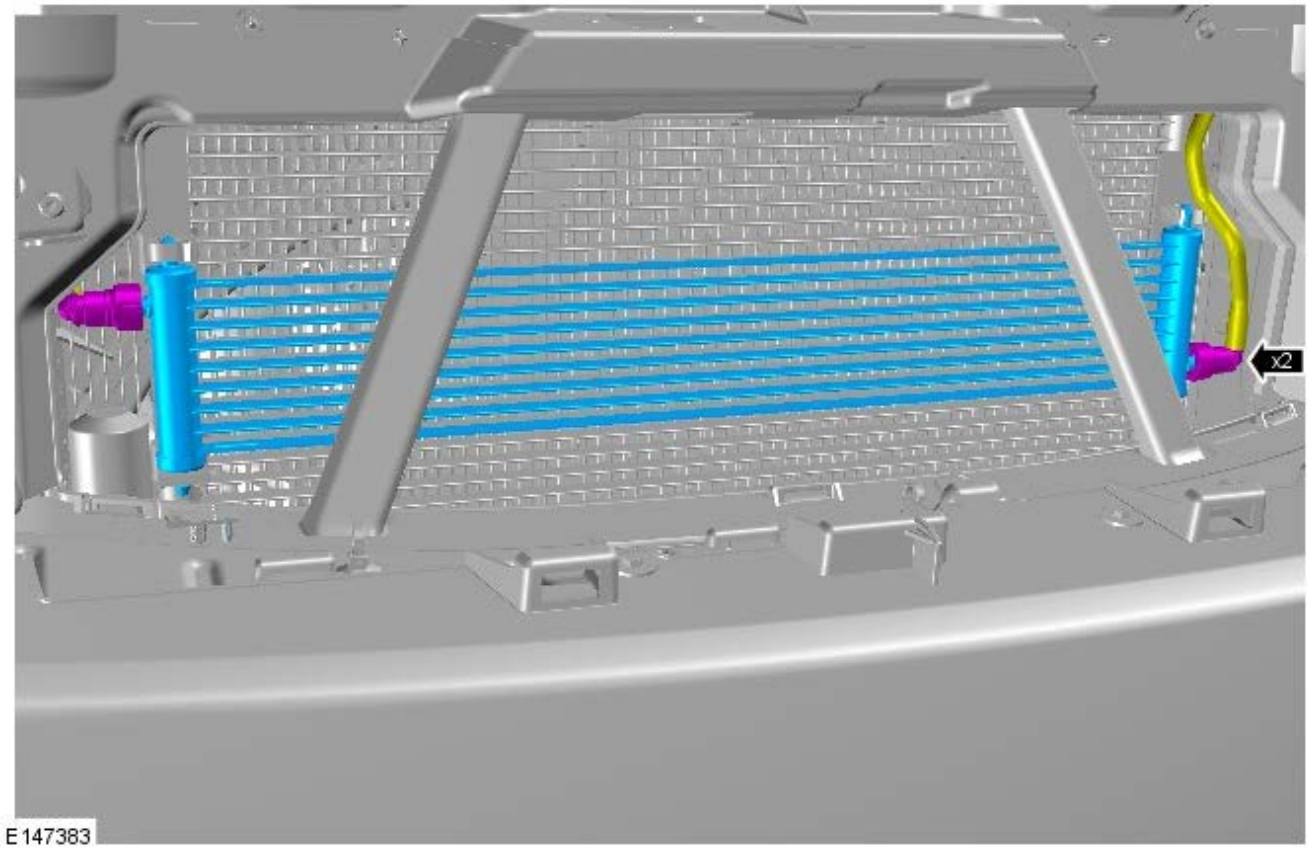
3.



4.



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



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Generator and Regulator - TDV6 3.0L Diesel -

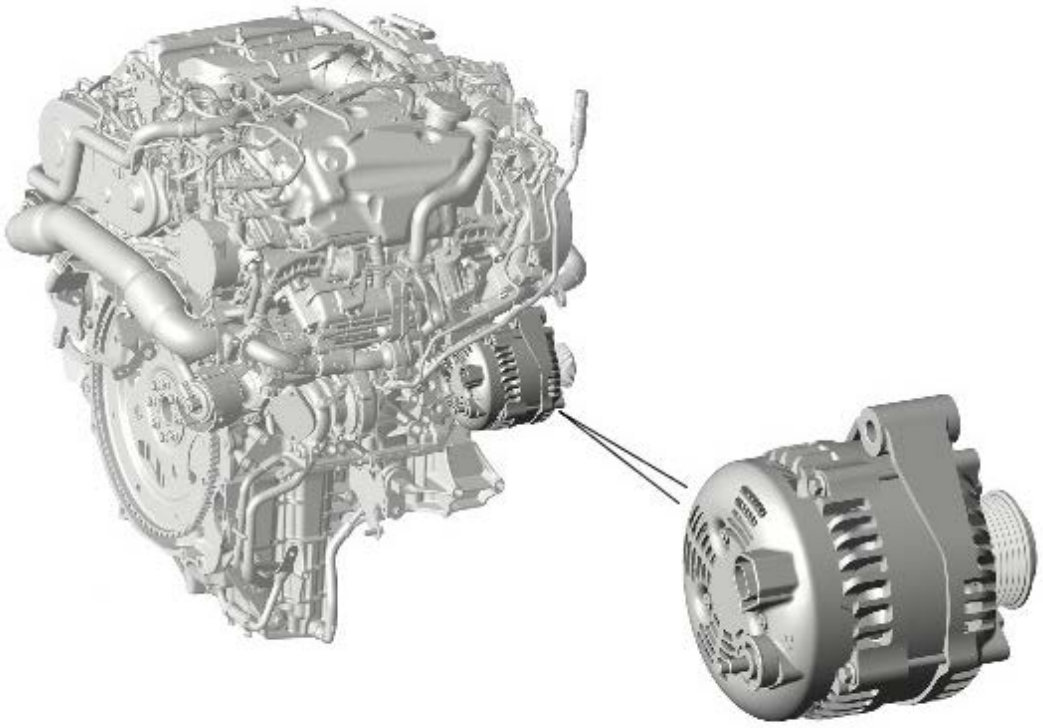
Description	Nm	lb-ft	lb-in
Generator retaining bolts	47	35	-
Battery positive cable retaining nut	12	9	-

Published: 28-May-2013

Generator and Regulator - TDV6 3.0L Diesel - Generator

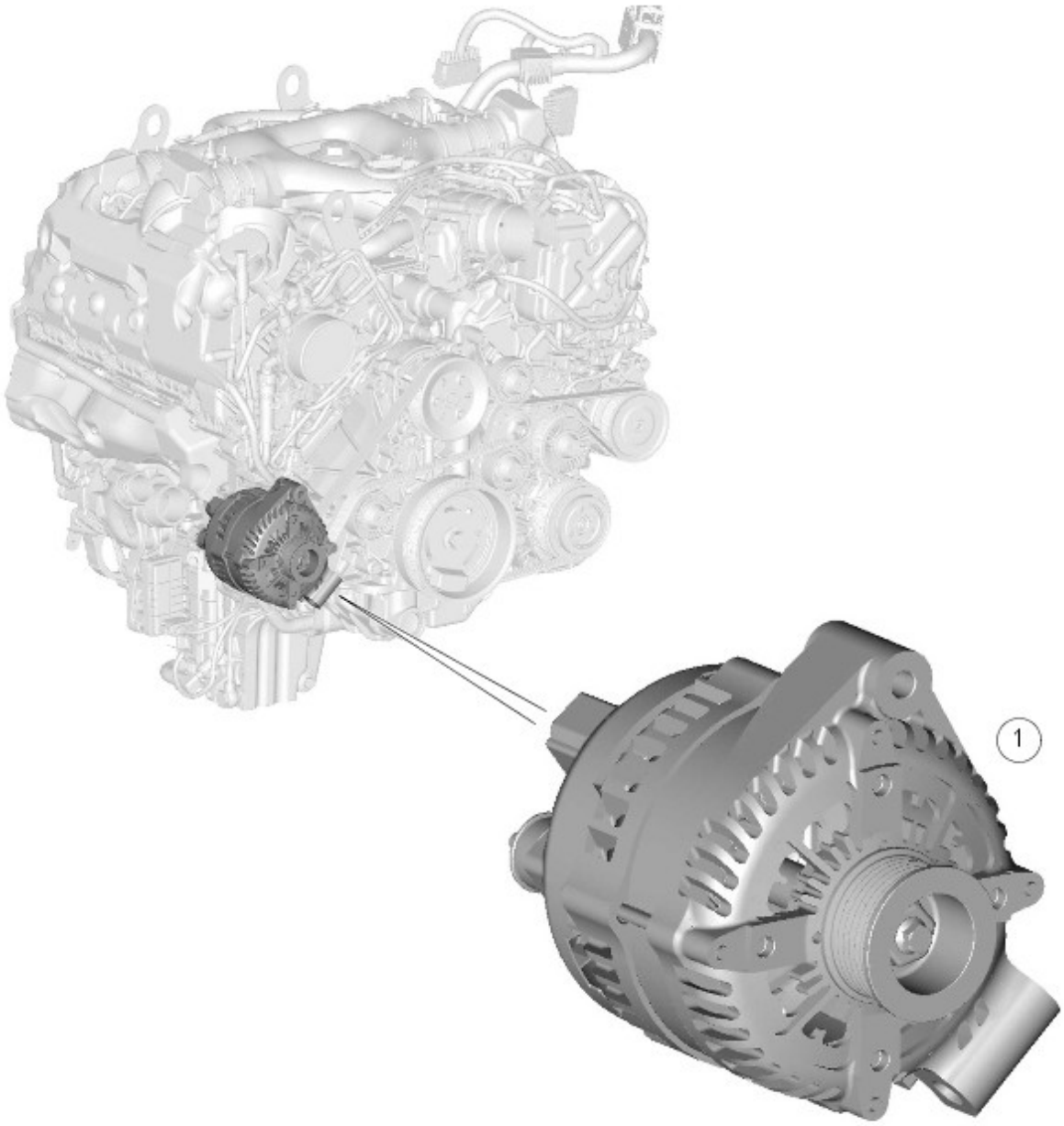
Description and Operation

COMPONENT LOCATION - SHEET 1 OF 3 - VEHICLES WITH TDV6 3.0L DIESEL ENGINE.



E149164

COMPONENT LOCATION - SHEET 2 OF 3 - VEHICLES WITH TDV8 4.4L DIESEL ENGINE.

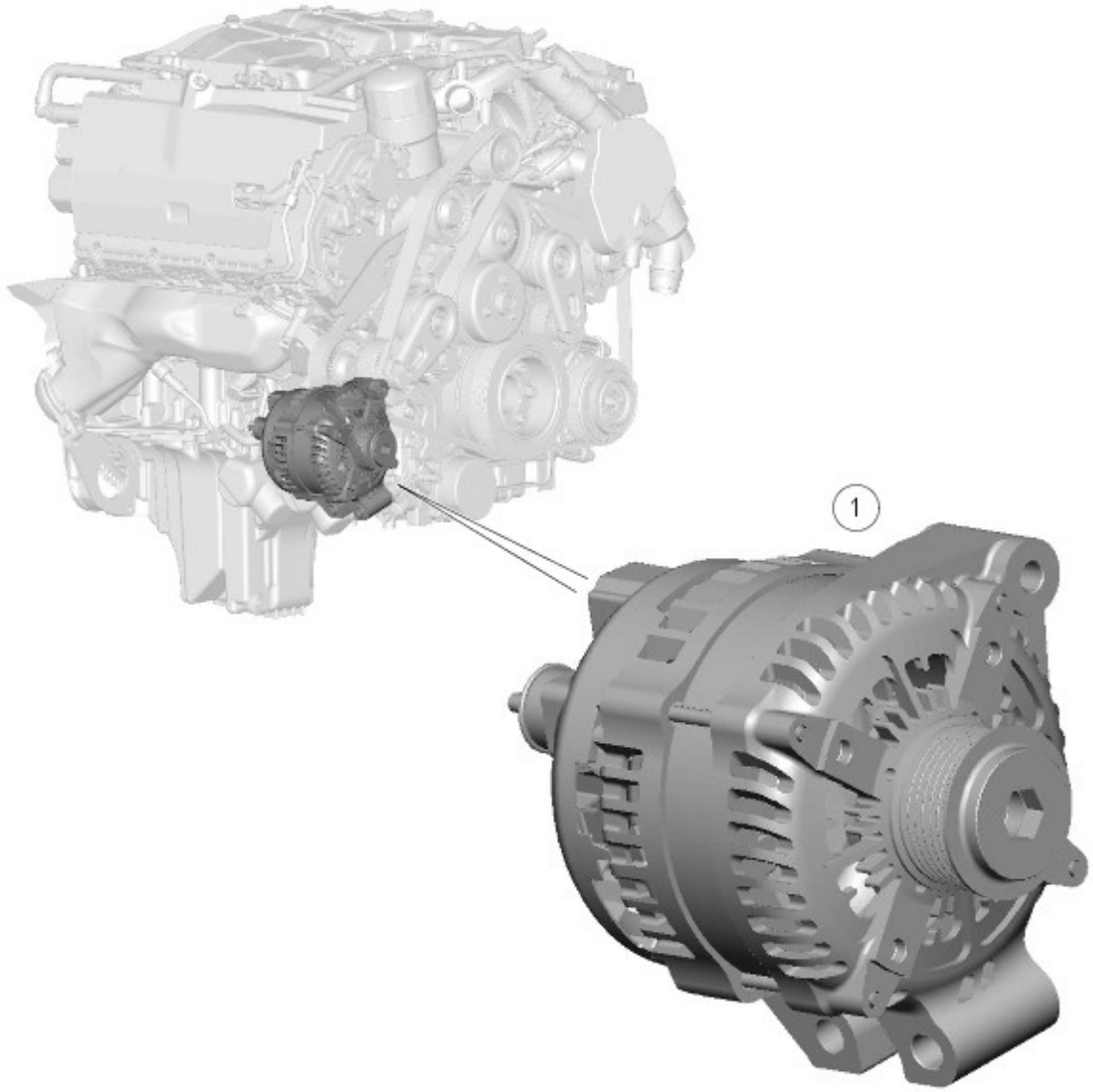


E154715

Item	Part Number	Description
1	-	Generator

COMPONENT LOCATION - SHEET 3 OF 3 - VEHICLES WITH V6 S/C 3.0L AND V8 S/C 5.0L PETROL ENGINE.

NOTE: V6 S/C 3.0L Petrol installation shown, V8 S/C 5.0L Petrol similar.



E154716

Item	Part Number	Description
1	-	Generator

OVERVIEW

The generator is mounted on the front right side of the engine and is driven at approximately three times engine speed by the accessory drive belt.

The charging system consists of a generator and regulator assembly and a GWM (Gateway Module). The generator and regulator assembly generates electrical power for the vehicle electrical system and maintains the primary battery and the secondary or auxiliary battery (where fitted) in a charged state. The rate of charge for the primary battery and the secondary or auxiliary battery (where fitted) is controlled by the GWM.
For additional information, refer to: Battery and Cables (414-01 Battery, Mounting and Cables, Description and Operation).

When the engine is running the generator produces an AC (Alternating Current), which is converted to a DC (Direct Current) internally. The output from the generator is controlled by the voltage regulator (located inside the generator) and then supplied to the primary battery through the BJB2 (Battery Junction Box 2) to the primary battery positive cable.

Charging of the secondary or auxiliary battery on dual battery vehicles is controlled by the GWM, and the power supply distribution box. Generator output is directed to the secondary or auxiliary battery via a contactor in the power supply distribution box which is controlled by the GWM.

DESCRIPTION

The regulator provides a controlled variable Direct Current (DC) voltage output from the generator. Two electrical terminals are provided on the outer casing of the generator. One terminal supplies the DC voltage output from the

generator to the battery positive terminal. The second terminal provides the LIN (Local Interconnect Network) bus connection between the regulator and the GWM.

The output from the generator is AC. A bridge rectifier within the generator converts the AC to DC.

The generator comprises a rotor winding, which is rotated by the generator pulley via the primary drive belt, a stator which is retained stationary within the generator housing, a voltage output regulator and a bridge rectifier.

The rotor winding assembly rotates inside the stator winding. The rotor generates a magnetic field and the stator winding develops AC voltage and current flows from the induced magnetic field of the rotor.

The regulator monitors the stator output voltages. Depending on the measured voltages, and signals from the GWM on the LIN bus, the regulator will adjust the amount of rotor field current to control generator output. The regulator is located within the generator housing.

The regulator will vary the charging system voltage output level depending on signals from the GWM. If the charging system voltage falls below a predetermined level, the GWM, via the LIN bus, will control the regulator to increase the field current produced by the stator and the rotor, increasing the magnetic field, which results in an increased generator output. If the charging system voltage raises above the predetermined level, the GWM, via the LIN bus, will control the regulator to decrease field current, reducing the magnetic field and decreasing the generator output. The regulator controls the field current by adjusting the power supplied to the rotor windings.

The following variants of generator are fitted to the specific engine types:

- V8 S/C 5.0L Petrol - 180A SC3 Denso
- V6 S/C 3.0L Petrol - 180A SC3 Denso
- TDV8 4.4L Diesel - 220A SC4 Denso
- TDV6 3.0L Diesel - 220A SC4 Denso

OPERATION

The output voltage required from the generator and regulator is calculated by the GWM.
For additional information, refer to: Battery and Cables (414-01 Battery, Mounting and Cables, Description and Operation).

The BMS (Battery Monitoring System) control module on the primary battery, is connected to the GWM via a LIN bus connection. The BMS control module measures battery current and voltage, which it communicates to the GWM over a LIN bus connection. Based on the information received from the BMS control module, the GWM will control the output from the generator, and if necessary, will also request the switching off of electrical loads if necessary. The GWM controls the generator voltage regulator via the LIN bus connection and can adjust the generator output applicable to demand.

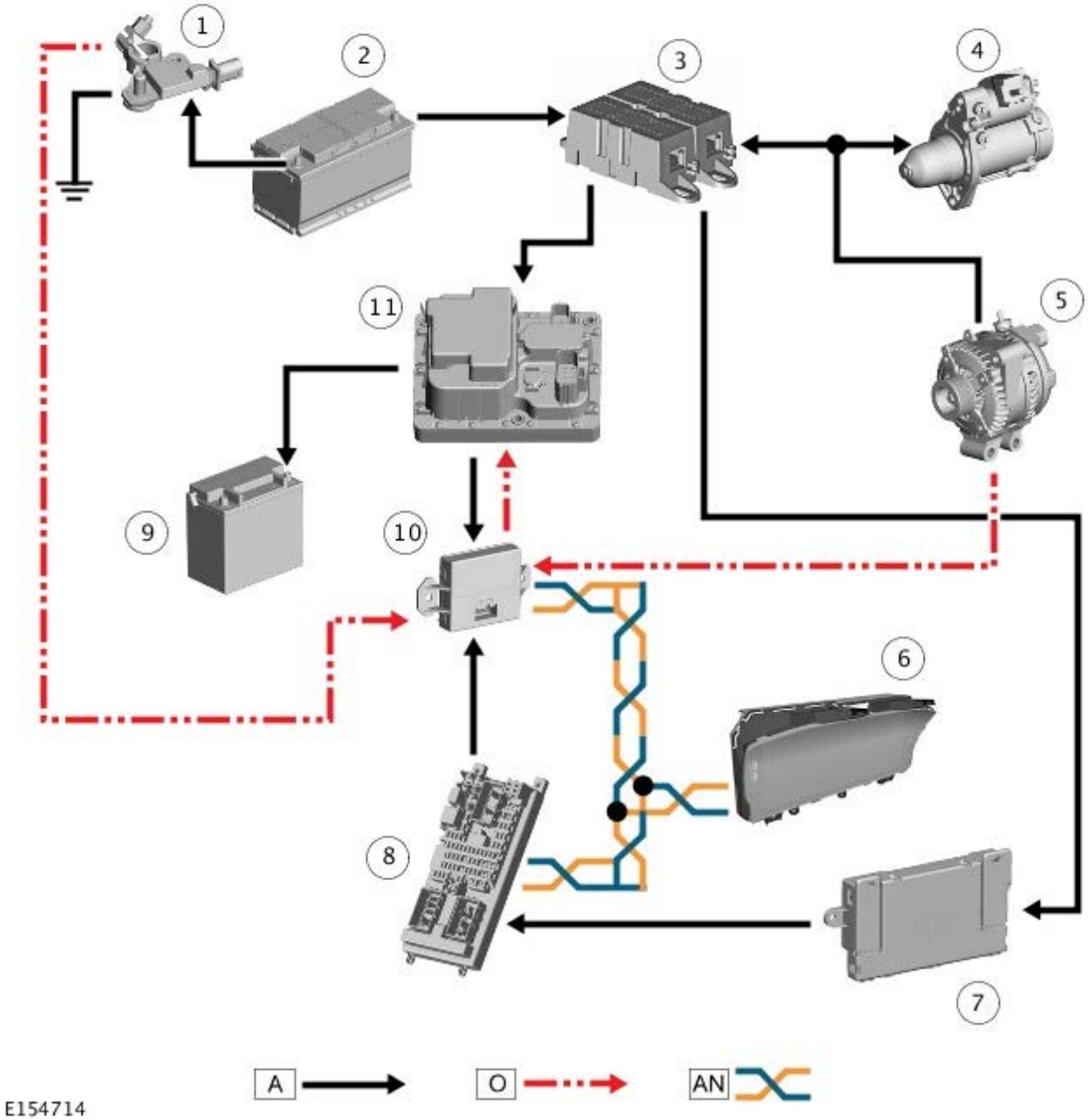
The GWM will over-ride the voltage value if it detects a fault in the power supply system.

The GWM also signals the IC (Instrument Cluster) to display a warning message if it detects a fault with the generator and regulator.
For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

The GWM controls the charge warning indicator in the IC. Failure of the generator or regulator to provide sufficient charge for the primary battery to support vehicle demand, the GWM will instruct the IC via the high speed CAN (Controller Area Network) Powertrain bus to illuminate the charge warning indicator.

CONTROL DIAGRAM

 NOTE: A = Hardwired, O = LIN (Local Interconnect Network) bus, AN = High speed CAN (Controller Area Network) Powertrain bus.



E154714

Item	Part Number	Description
1	-	- Battery Monitoring System (BMS) control module
2	-	Primary battery
3	-	Battery Junction Box 2 (BJB2)
4	-	Starter motor/TSS motor
5	-	Generator
6	-	Instrument Cluster (IC)
7	-	Auxiliary Junction Box (AJB)
8	-	Central Junction Box (CJB)
9	-	Secondary/Auxiliary battery
10	-	Gateway module (GWM)
11	-	Power Supply Distribution Box

Published: 31-Jul-2012

Generator and Regulator - TDV6 3.0L Diesel - Generator

Diagnosis and Testing

For further diagnostic information.
REFER to: Charging System (414-00 Battery and Charging System - General Information, Diagnosis and Testing).

For a detailed description of the generator and regulator 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).

Published: 15-May-2013

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.

1. Disconnect the battery ground cable.

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

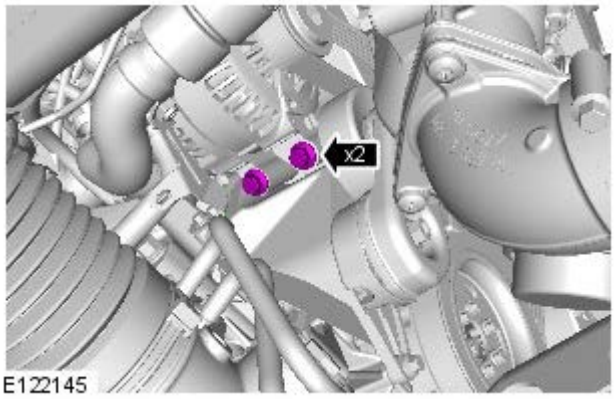
2. Refer to: Accessory Drive Belt Tensioner (303-05A Accessory Drive - TDV6 3.0L Diesel, Removal and Installation).

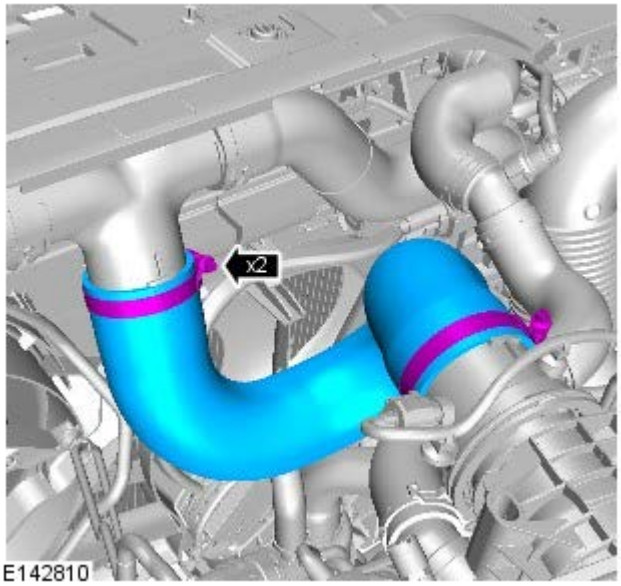
3. WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

4. Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

5. *Torque:* 47 Nm



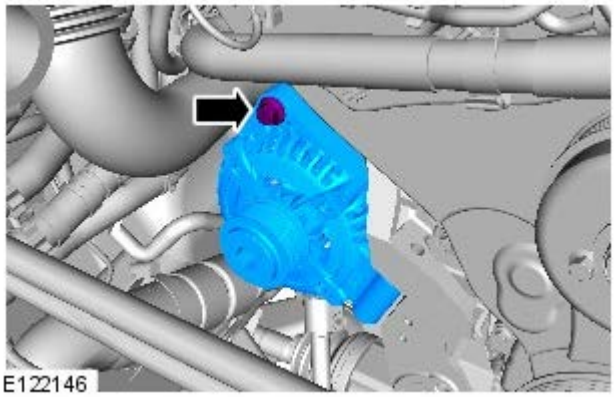


6. NOTE: Make sure the retaining clips are correctly installed and tightened.

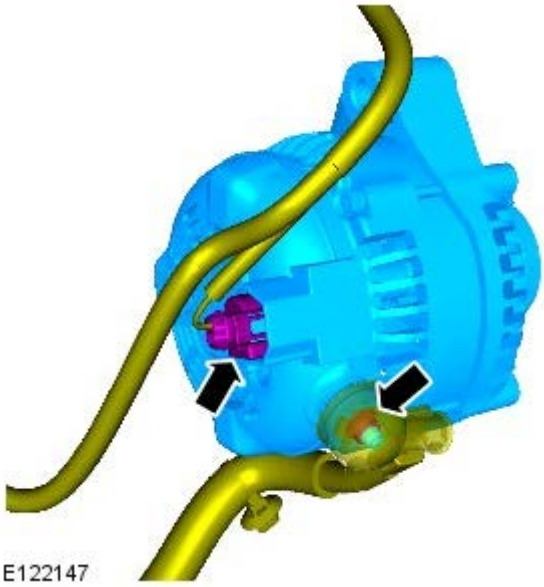
   Torque: 3 Nm

7. CAUTION: Take extra care not to damage the wiring harnesses.

   Torque: 47 Nm



8. *Torque:* 12 Nm



Installation

1. To install, reverse the removal procedure.

Published: 11-May-2011

Generator and Regulator - V6 S/C 3.0L Petrol -

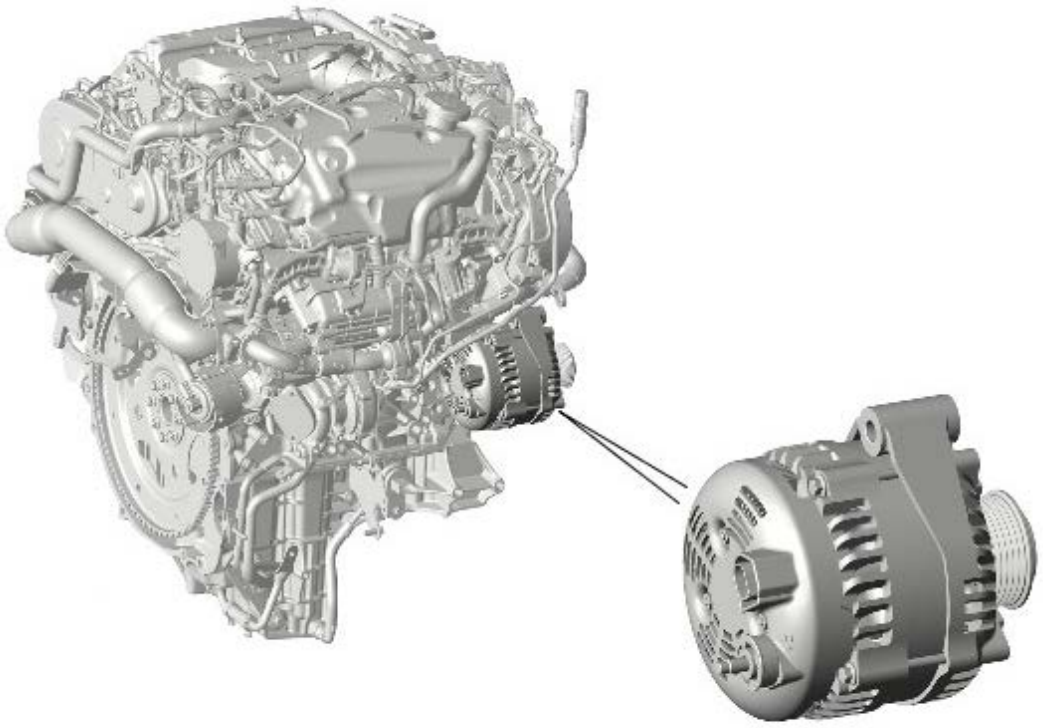
Description	Nm	lb-ft	lb-in
Generator retaining bolts	47	35	-
Battery positive cable retaining nut	12	9	-

Published: 28-May-2013

Generator and Regulator - V6 S/C 3.0L Petrol - Generator

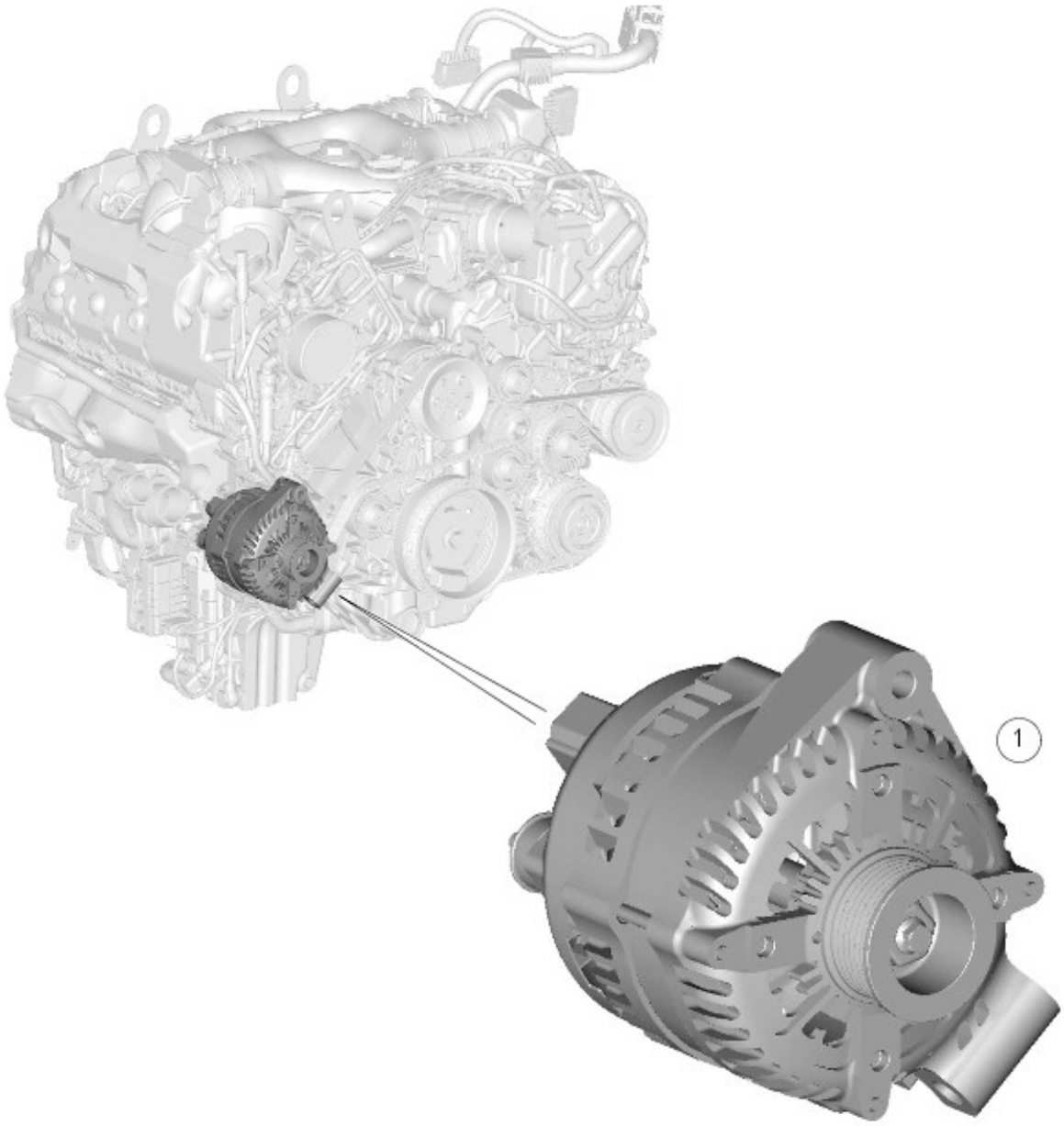
Description and Operation

COMPONENT LOCATION - SHEET 1 OF 3 - VEHICLES WITH TDV6 3.0L DIESEL ENGINE.



E149164

COMPONENT LOCATION - SHEET 2 OF 3 - VEHICLES WITH TDV8 4.4L DIESEL ENGINE.

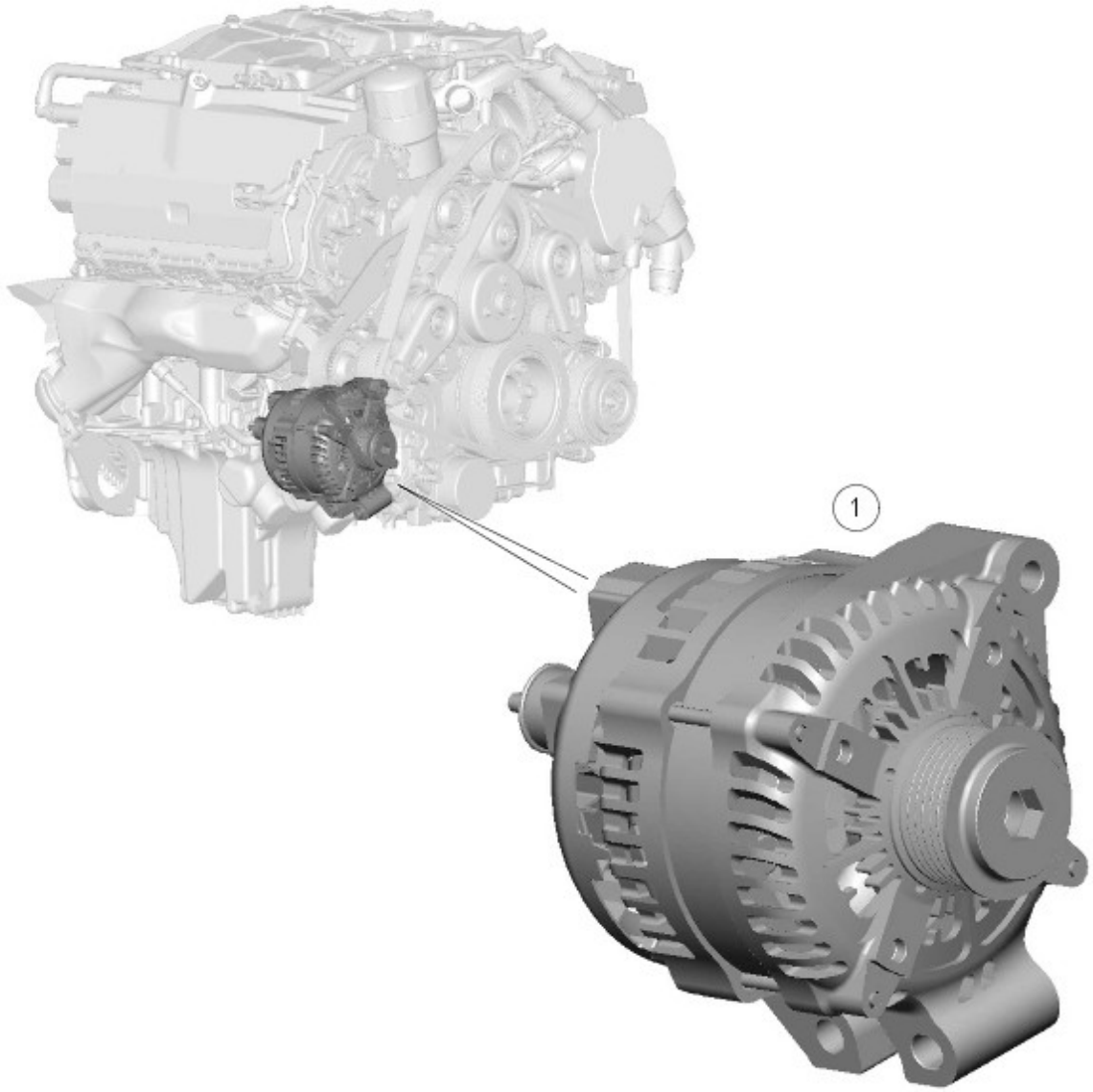


E154715

Item	Part Number	Description
1	-	Generator

COMPONENT LOCATION - SHEET 3 OF 3 - VEHICLES WITH V6 S/C 3.0L AND V8 S/C 5.0L PETROL ENGINE.

NOTE: V6 S/C 3.0L Petrol installation shown, V8 S/C 5.0L Petrol similar.



E154716

Item	Part Number	Description
1	-	Generator

OVERVIEW

The generator is mounted on the front right side of the engine and is driven at approximately three times engine speed by the accessory drive belt.

The charging system consists of a generator and regulator assembly and a GWM (Gateway Module). The generator and regulator assembly generates electrical power for the vehicle electrical system and maintains the primary battery and the secondary or auxiliary battery (where fitted) in a charged state. The rate of charge for the primary battery and the secondary or auxiliary battery (where fitted) is controlled by the GWM.
For additional information, refer to: Battery and Cables (414-01 Battery, Mounting and Cables, Description and Operation).

When the engine is running the generator produces an AC (Alternating Current), which is converted to a DC (Direct Current) internally. The output from the generator is controlled by the voltage regulator (located inside the generator) and then supplied to the primary battery through the BJB2 (Battery Junction Box 2) to the primary battery positive cable.

Charging of the secondary or auxiliary battery on dual battery vehicles is controlled by the GWM, and the power supply distribution box. Generator output is directed to the secondary or auxiliary battery via a contactor in the power supply distribution box which is controlled by the GWM.

DESCRIPTION

The regulator provides a controlled variable Direct Current (DC) voltage output from the generator. Two electrical terminals are provided on the outer casing of the generator. One terminal supplies the DC voltage output from the

generator to the battery positive terminal. The second terminal provides the LIN (Local Interconnect Network) bus connection between the regulator and the GWM.

The output from the generator is AC. A bridge rectifier within the generator converts the AC to DC.

The generator comprises a rotor winding, which is rotated by the generator pulley via the primary drive belt, a stator which is retained stationary within the generator housing, a voltage output regulator and a bridge rectifier.

The rotor winding assembly rotates inside the stator winding. The rotor generates a magnetic field and the stator winding develops AC voltage and current flows from the induced magnetic field of the rotor.

The regulator monitors the stator output voltages. Depending on the measured voltages, and signals from the GWM on the LIN bus, the regulator will adjust the amount of rotor field current to control generator output. The regulator is located within the generator housing.

The regulator will vary the charging system voltage output level depending on signals from the GWM. If the charging system voltage falls below a predetermined level, the GWM, via the LIN bus, will control the regulator to increase the field current produced by the stator and the rotor, increasing the magnetic field, which results in an increased generator output. If the charging system voltage raises above the predetermined level, the GWM, via the LIN bus, will control the regulator to decrease field current, reducing the magnetic field and decreasing the generator output. The regulator controls the field current by adjusting the power supplied to the rotor windings.

The following variants of generator are fitted to the specific engine types:

- V8 S/C 5.0L Petrol - 180A SC3 Denso
- V6 S/C 3.0L Petrol - 180A SC3 Denso
- TDV8 4.4L Diesel - 220A SC4 Denso
- TDV6 3.0L Diesel - 220A SC4 Denso

OPERATION

The output voltage required from the generator and regulator is calculated by the GWM.
For additional information, refer to: Battery and Cables (414-01 Battery, Mounting and Cables, Description and Operation).

The BMS (Battery Monitoring System) control module on the primary battery, is connected to the GWM via a LIN bus connection. The BMS control module measures battery current and voltage, which it communicates to the GWM over a LIN bus connection. Based on the information received from the BMS control module, the GWM will control the output from the generator, and if necessary, will also request the switching off of electrical loads if necessary. The GWM controls the generator voltage regulator via the LIN bus connection and can adjust the generator output applicable to demand.

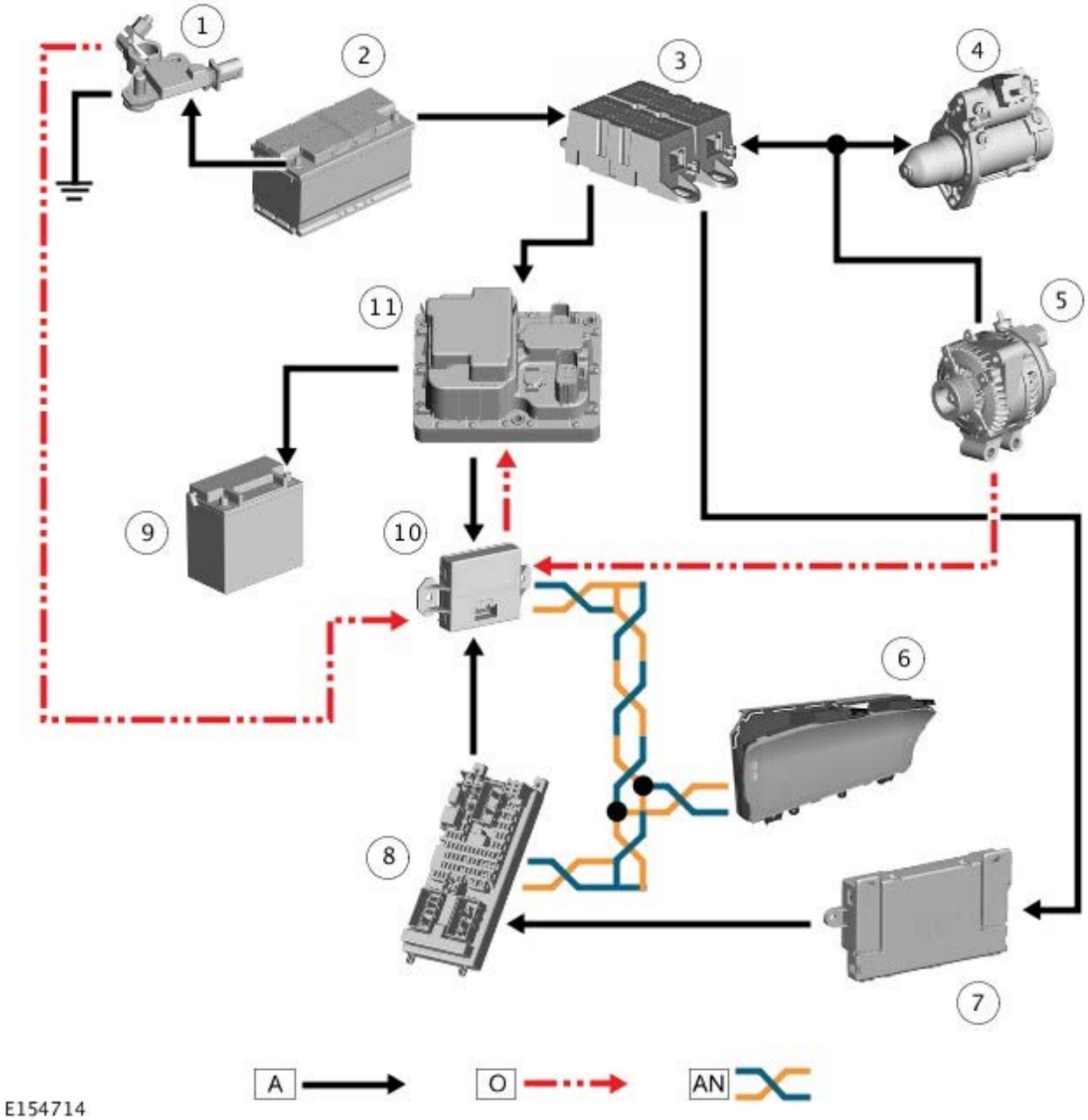
The GWM will over-ride the voltage value if it detects a fault in the power supply system.

The GWM also signals the IC (Instrument Cluster) to display a warning message if it detects a fault with the generator and regulator.
For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

The GWM controls the charge warning indicator in the IC. Failure of the generator or regulator to provide sufficient charge for the primary battery to support vehicle demand, the GWM will instruct the IC via the high speed CAN (Controller Area Network) Powertrain bus to illuminate the charge warning indicator.

CONTROL DIAGRAM

 NOTE: A = Hardwired, O = LIN (Local Interconnect Network) bus, AN = High speed CAN (Controller Area Network) Powertrain bus.



E154714

Item	Part Number	Description
1	-	- Battery Monitoring System (BMS) control module
2	-	Primary battery
3	-	Battery Junction Box 2 (BJB2)
4	-	Starter motor/TSS motor
5	-	Generator
6	-	Instrument Cluster (IC)
7	-	Auxiliary Junction Box (AJB)
8	-	Central Junction Box (CJB)
9	-	Secondary/Auxiliary battery
10	-	Gateway module (GWM)
11	-	Power Supply Distribution Box

Published: 02-May-2013

Generator and Regulator - V6 S/C 3.0L Petrol - Generator

Diagnosis and Testing

For additional information.
REFER to: Charging System (414-00 Battery and Charging System - General Information, Diagnosis and Testing).

Published: 02-May-2013

Generator and Regulator - V6 S/C 3.0L Petrol - Generator

Removal and Installation

Removal

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

1. Disconnect the battery ground cable.

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

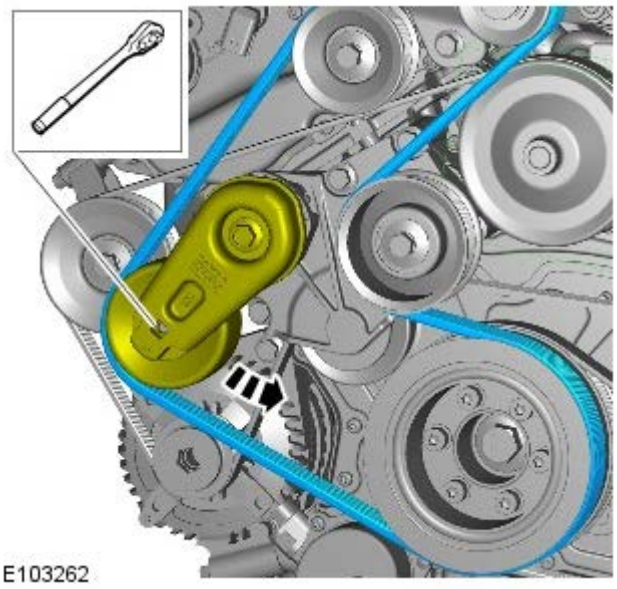
2. Refer to: Air Cleaner Outlet Pipe LH (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

3. Refer to: Air Cleaner Outlet Pipe RH (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

4. Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

5. Refer to: Cooling Fan (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Removal and Installation).

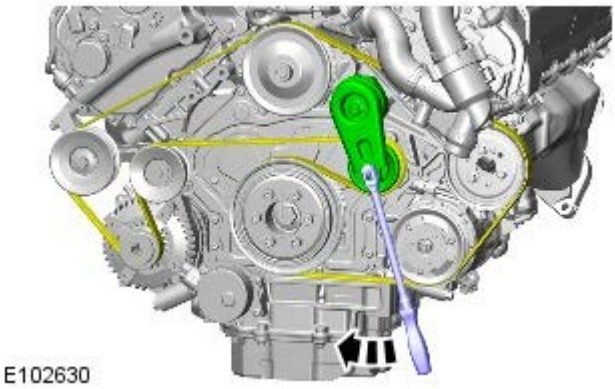
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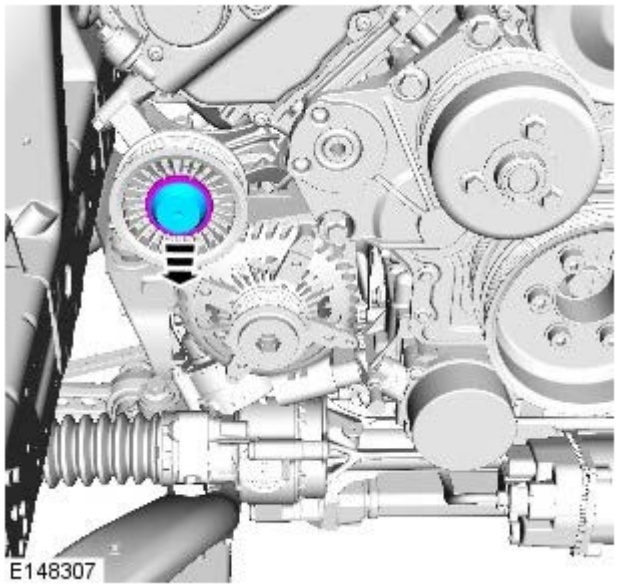
7. *Torque:* 40 Nm



8.



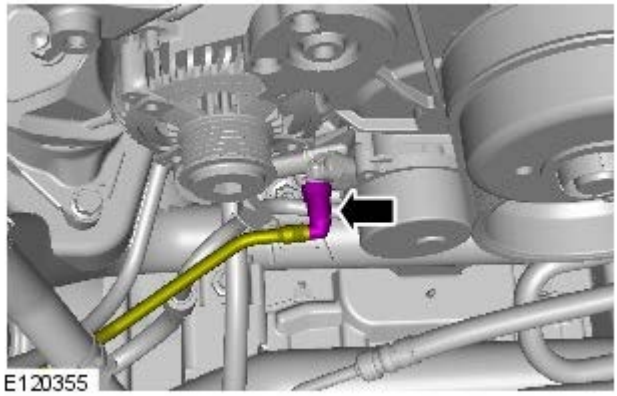
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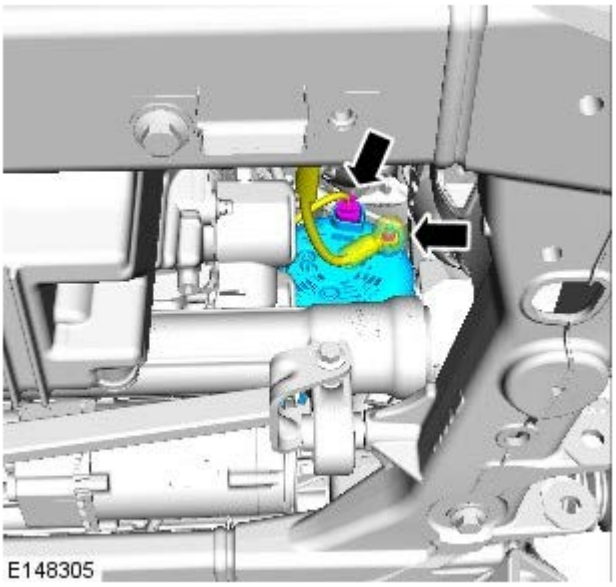
10. *Torque:* 40 Nm



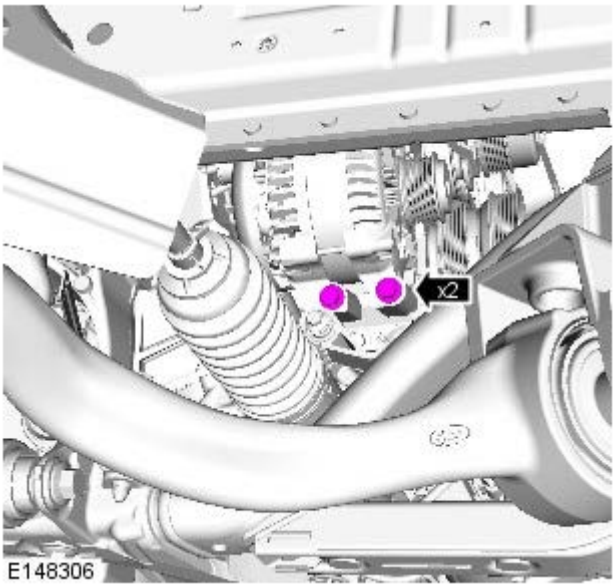
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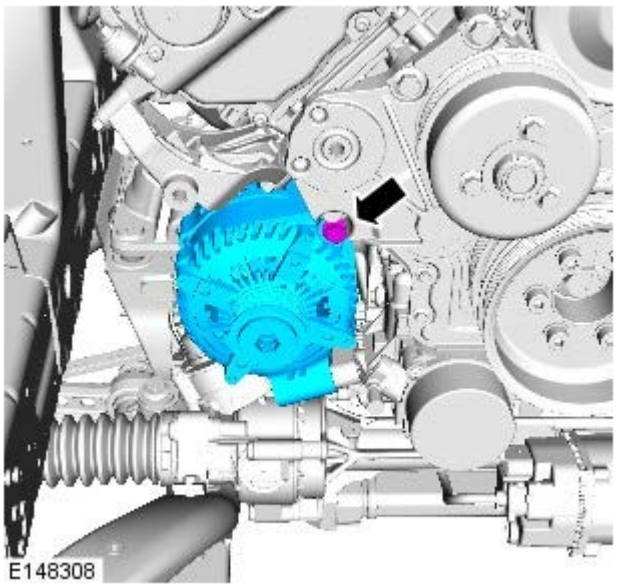
12. *Torque:* 12 Nm



13. *Torque:* 48 Nm



14. *Torque:* 48 Nm



Installation

1. CAUTIONS:

Make sure that the accessory drive belt is correctly located

on each pulley.

 Clean and inspect the accessory drive belt pulleys for damage.

To install, reverse the removal procedure.

Published: 11-May-2011

Generator and Regulator - V8 S/C 5.0L Petrol -

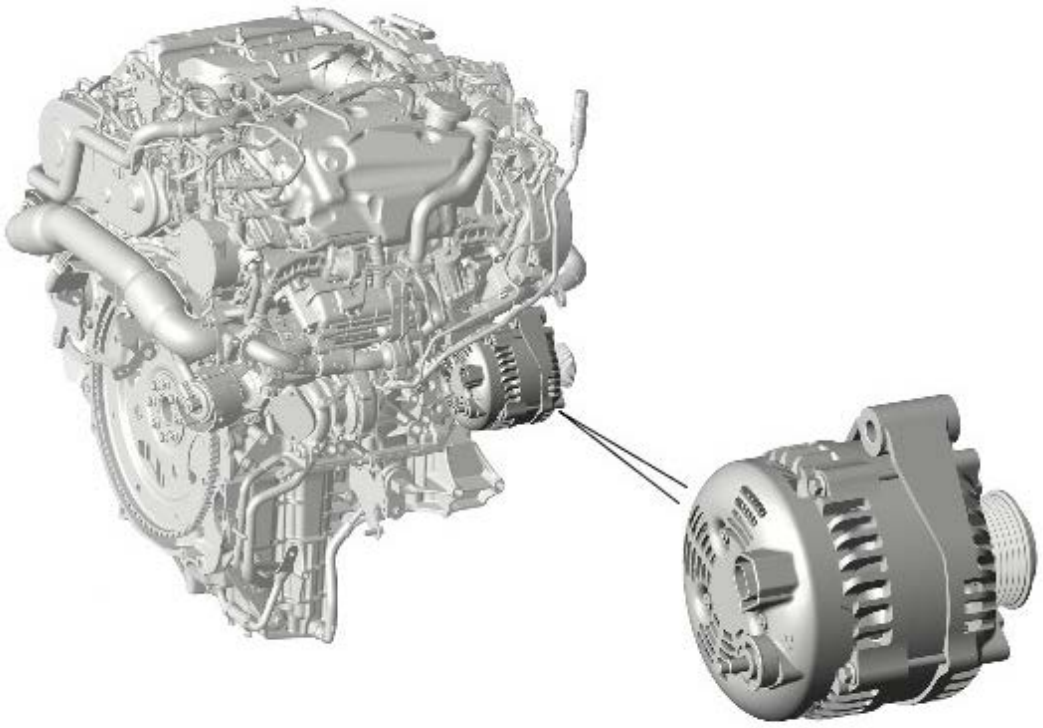
Description	Nm	lb-ft	lb-in
Generator retaining bolts	47	35	-
Battery positive cable retaining nut	12	9	-

Published: 28-May-2013

Generator and Regulator - V8 S/C 5.0L Petrol - Generator

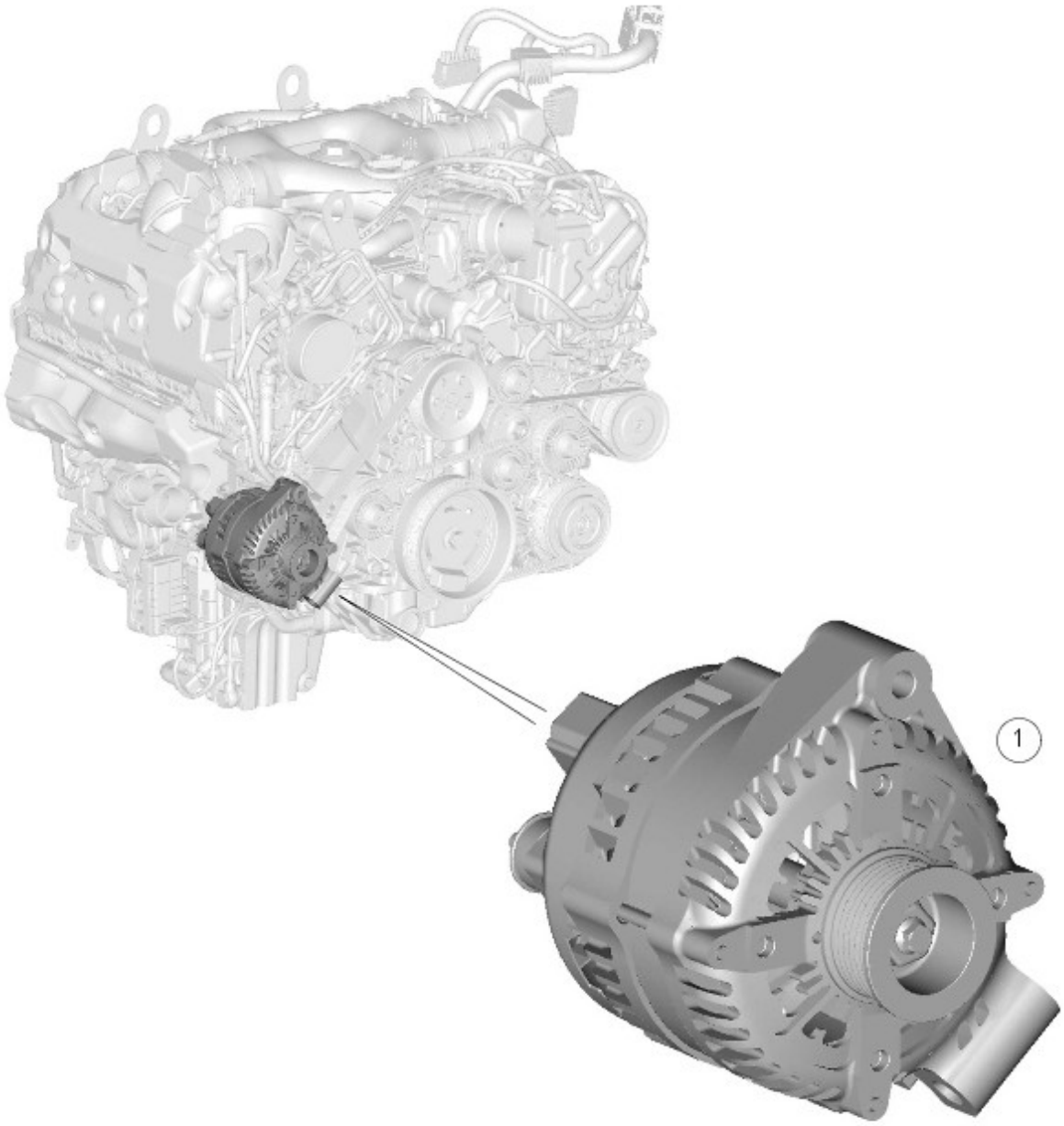
Description and Operation

COMPONENT LOCATION - SHEET 1 OF 3 - VEHICLES WITH TDV6 3.0L DIESEL ENGINE.



E149164

COMPONENT LOCATION - SHEET 2 OF 3 - VEHICLES WITH TDV8 4.4L DIESEL ENGINE.

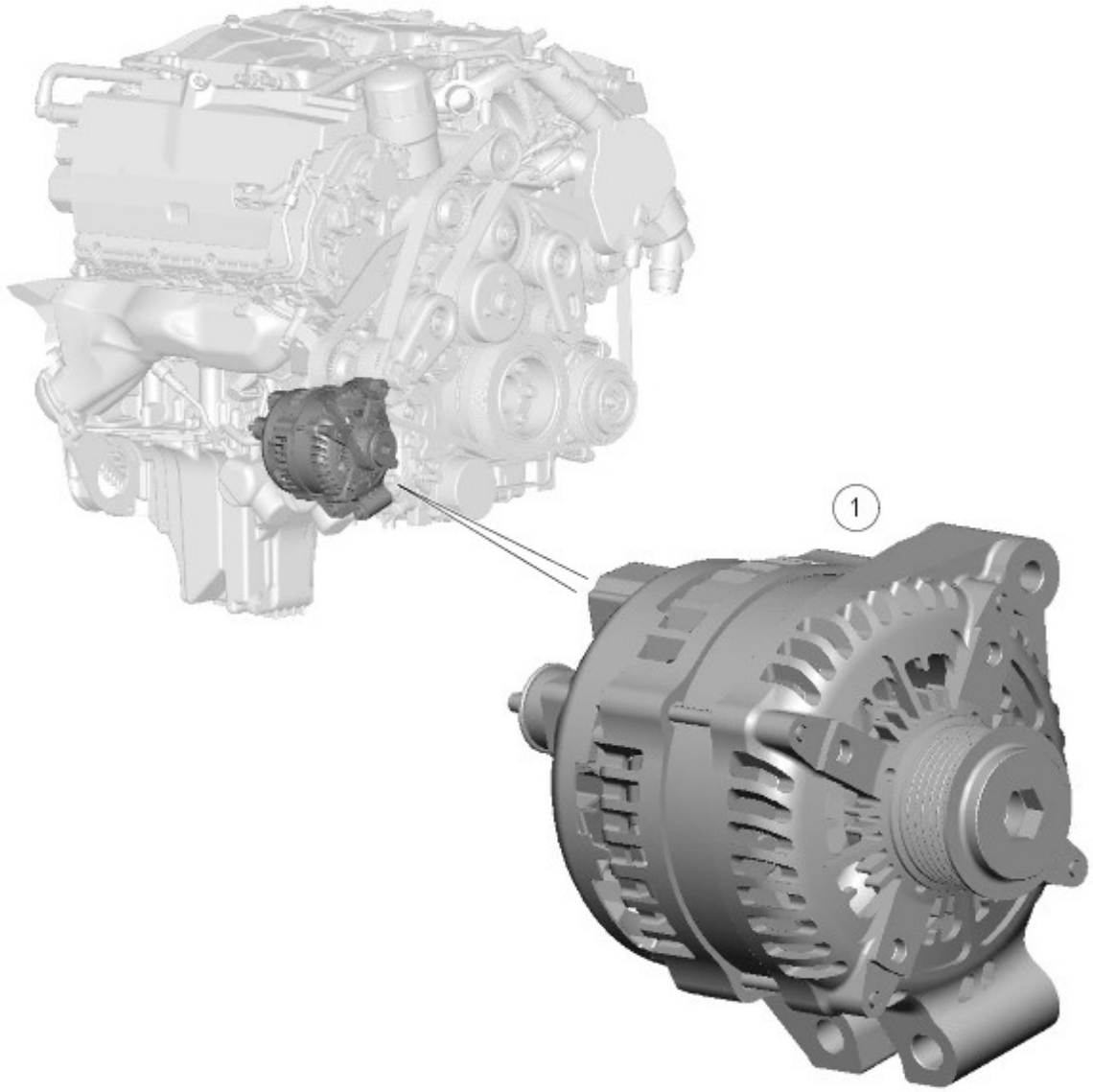


E154715

Item	Part Number	Description
1	-	Generator

COMPONENT LOCATION - SHEET 3 OF 3 - VEHICLES WITH V6 S/C 3.0L AND V8 S/C 5.0L PETROL ENGINE.

NOTE: V6 S/C 3.0L Petrol installation shown, V8 S/C 5.0L Petrol similar.



E154716

Item	Part Number	Description
1	-	Generator

OVERVIEW

The generator is mounted on the front right side of the engine and is driven at approximately three times engine speed by the accessory drive belt.

The charging system consists of a generator and regulator assembly and a GWM (Gateway Module). The generator and regulator assembly generates electrical power for the vehicle electrical system and maintains the primary battery and the secondary or auxiliary battery (where fitted) in a charged state. The rate of charge for the primary battery and the secondary or auxiliary battery (where fitted) is controlled by the GWM.
For additional information, refer to: Battery and Cables (414-01 Battery, Mounting and Cables, Description and Operation).

When the engine is running the generator produces an AC (Alternating Current), which is converted to a DC (Direct Current) internally. The output from the generator is controlled by the voltage regulator (located inside the generator) and then supplied to the primary battery through the BJB2 (Battery Junction Box 2) to the primary battery positive cable.

Charging of the secondary or auxiliary battery on dual battery vehicles is controlled by the GWM, and the power supply distribution box. Generator output is directed to the secondary or auxiliary battery via a contactor in the power supply distribution box which is controlled by the GWM.

DESCRIPTION

The regulator provides a controlled variable Direct Current (DC) voltage output from the generator. Two electrical terminals are provided on the outer casing of the generator. One terminal supplies the DC voltage output from the

generator to the battery positive terminal. The second terminal provides the LIN (Local Interconnect Network) bus connection between the regulator and the GWM.

The output from the generator is AC. A bridge rectifier within the generator converts the AC to DC.

The generator comprises a rotor winding, which is rotated by the generator pulley via the primary drive belt, a stator which is retained stationary within the generator housing, a voltage output regulator and a bridge rectifier.

The rotor winding assembly rotates inside the stator winding. The rotor generates a magnetic field and the stator winding develops AC voltage and current flows from the induced magnetic field of the rotor.

The regulator monitors the stator output voltages. Depending on the measured voltages, and signals from the GWM on the LIN bus, the regulator will adjust the amount of rotor field current to control generator output. The regulator is located within the generator housing.

The regulator will vary the charging system voltage output level depending on signals from the GWM. If the charging system voltage falls below a predetermined level, the GWM, via the LIN bus, will control the regulator to increase the field current produced by the stator and the rotor, increasing the magnetic field, which results in an increased generator output. If the charging system voltage raises above the predetermined level, the GWM, via the LIN bus, will control the regulator to decrease field current, reducing the magnetic field and decreasing the generator output. The regulator controls the field current by adjusting the power supplied to the rotor windings.

The following variants of generator are fitted to the specific engine types:

- V8 S/C 5.0L Petrol - 180A SC3 Denso
- V6 S/C 3.0L Petrol - 180A SC3 Denso
- TDV8 4.4L Diesel - 220A SC4 Denso
- TDV6 3.0L Diesel - 220A SC4 Denso

OPERATION

The output voltage required from the generator and regulator is calculated by the GWM.
For additional information, refer to: Battery and Cables (414-01 Battery, Mounting and Cables, Description and Operation).

The BMS (Battery Monitoring System) control module on the primary battery, is connected to the GWM via a LIN bus connection. The BMS control module measures battery current and voltage, which it communicates to the GWM over a LIN bus connection. Based on the information received from the BMS control module, the GWM will control the output from the generator, and if necessary, will also request the switching off of electrical loads if necessary. The GWM controls the generator voltage regulator via the LIN bus connection and can adjust the generator output applicable to demand.

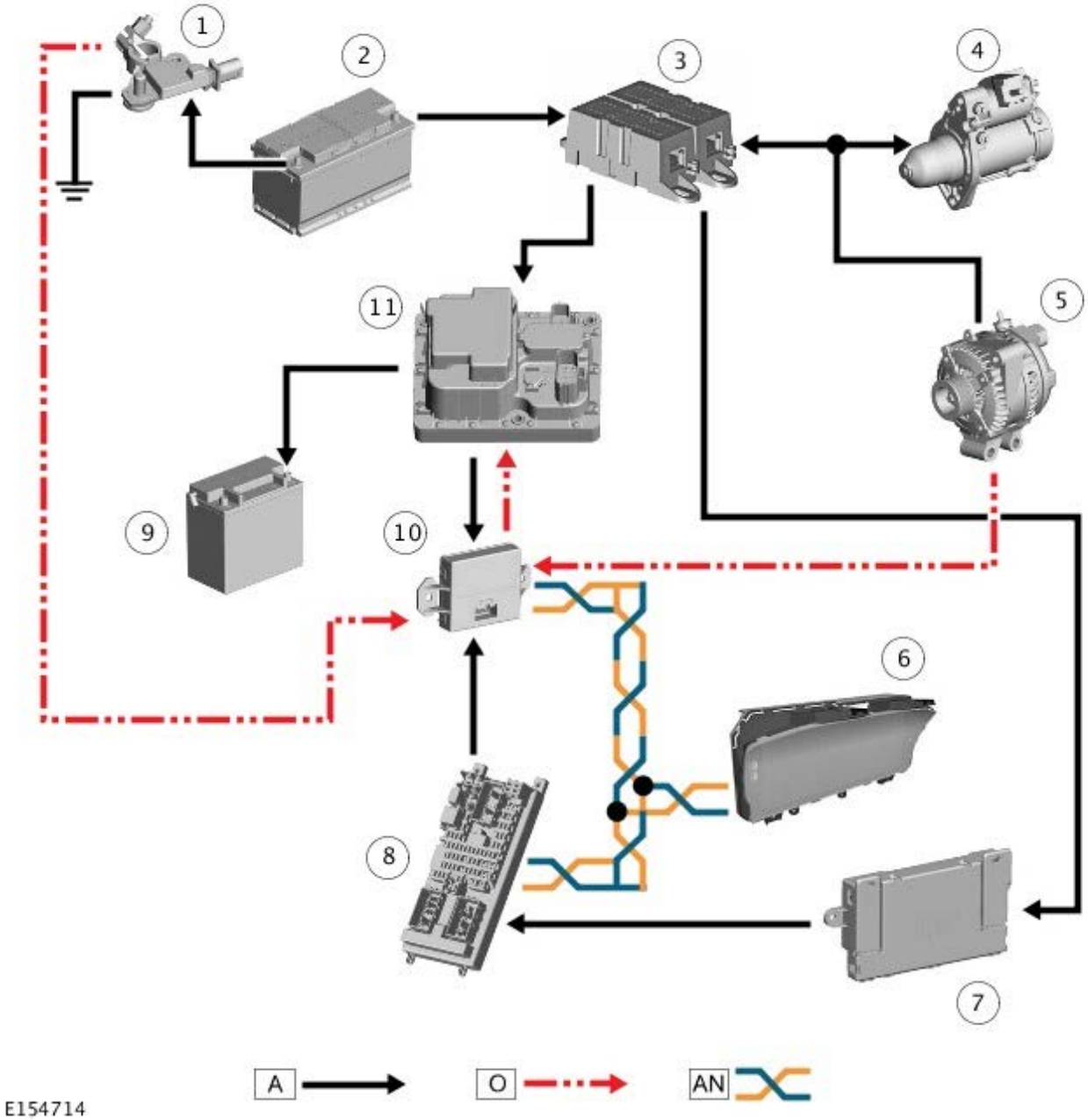
The GWM will over-ride the voltage value if it detects a fault in the power supply system.

The GWM also signals the IC (Instrument Cluster) to display a warning message if it detects a fault with the generator and regulator.
For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

The GWM controls the charge warning indicator in the IC. Failure of the generator or regulator to provide sufficient charge for the primary battery to support vehicle demand, the GWM will instruct the IC via the high speed CAN (Controller Area Network) Powertrain bus to illuminate the charge warning indicator.

CONTROL DIAGRAM

 NOTE: A = Hardwired, O = LIN (Local Interconnect Network) bus, AN = High speed CAN (Controller Area Network) Powertrain bus.



E154714

Item	Part Number	Description
1	-	- Battery Monitoring System (BMS) control module
2	-	Primary battery
3	-	Battery Junction Box 2 (BJB2)
4	-	Starter motor/TSS motor
5	-	Generator
6	-	Instrument Cluster (IC)
7	-	Auxiliary Junction Box (AJB)
8	-	Central Junction Box (CJB)
9	-	Secondary/Auxiliary battery
10	-	Gateway module (GWM)
11	-	Power Supply Distribution Box

Published: 31-Jul-2012

Generator and Regulator - V8 S/C 5.0L Petrol - Generator

Diagnosis and Testing

For further diagnostic information.
REFER to: Charging System (414-00 Battery and Charging System - General Information, Diagnosis and Testing).

For a detailed description of the generator and regulator system and operation, refer to the relevant description and operation section of the workshop manual. REFER to: Generator (414-02C, Description and Operation).

Published: 28-Feb-2013

Generator and Regulator - V8 S/C 5.0L Petrol - Generator

Removal and Installation

Removal

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

1. Disconnect the battery ground cable.

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

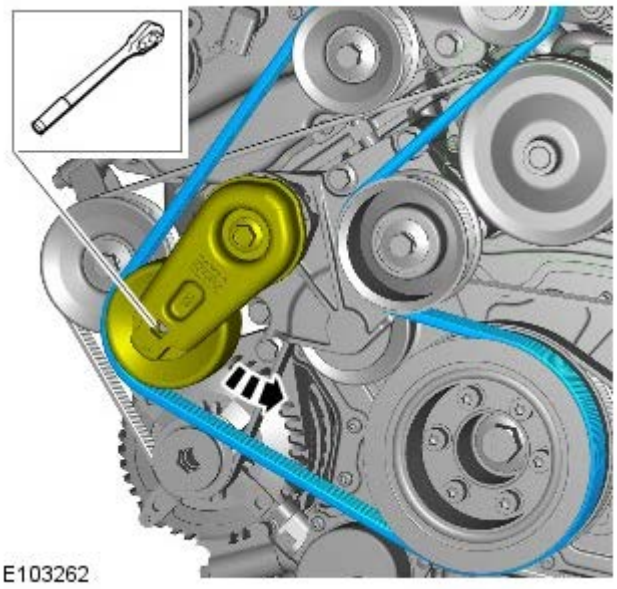
2. Refer to: Air Cleaner Outlet Pipe LH (303-12C Intake Air Distribution and Filtering - V8 S/C 5.0L Petrol, Removal and Installation).

3. Refer to: Air Cleaner Outlet Pipe RH (303-12C Intake Air Distribution and Filtering - V8 S/C 5.0L Petrol, Removal and Installation).

4. Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

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

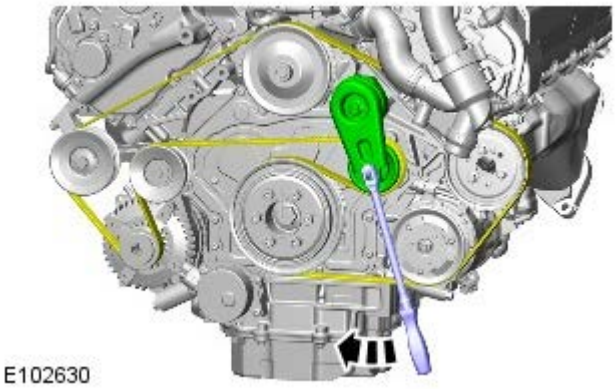
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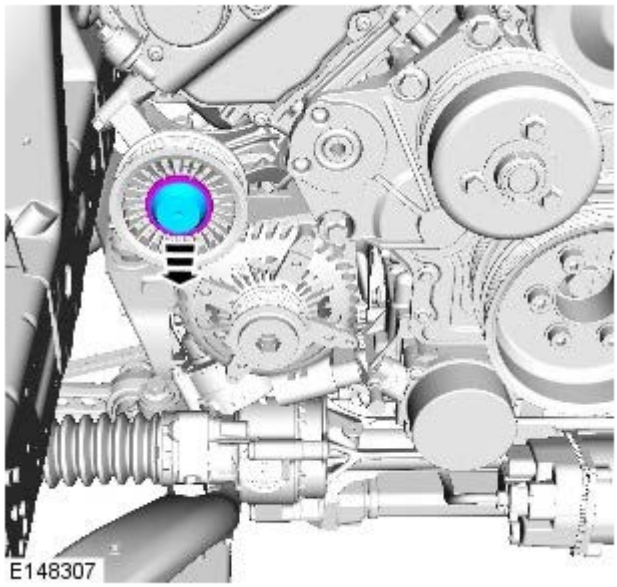
7. *Torque:* 40 Nm



8.



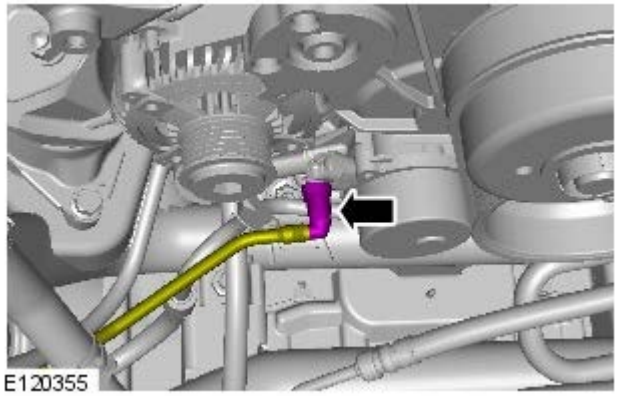
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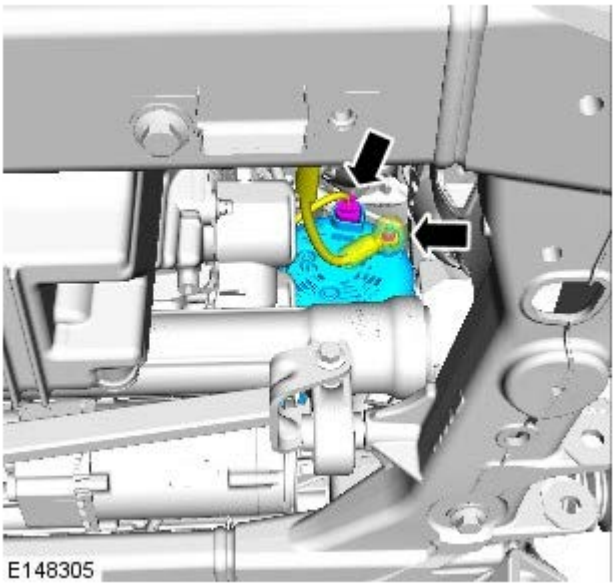
10. *Torque:* 40 Nm



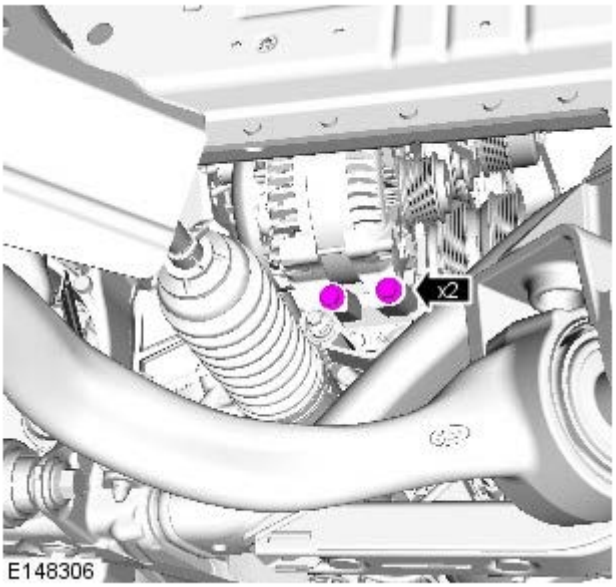
11.



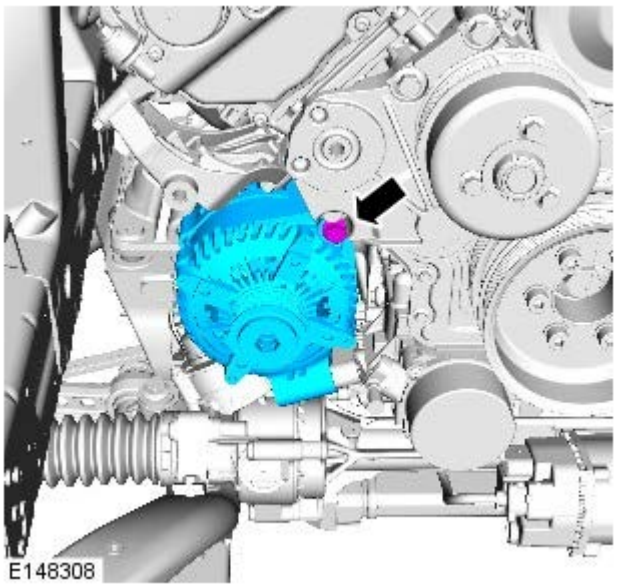
12. *Torque:* 12 Nm



13. *Torque:* 48 Nm



14. *Torque:* 48 Nm



Installation

1. CAUTIONS:

Make sure that the accessory drive belt is correctly located

on each pulley.

 Clean and inspect the accessory drive belt pulleys for damage.

To install, reverse the removal procedure.

Published: 28-Oct-2013

Generator and Regulator - TDV8 4.4L Diesel -

General Specification

Item	Specification
Generator:	
Make/Type	Denso SC6
Output	130 / 220 amps @ 25º C
Pulley	Overrunning alternator decoupler
Voltage control	Local interface network (LIN)
Voltage setpoint regulation	Controlled by engine management system (EMS)

Torque Specifications

Description	Nm	lb-ft
* Generator harness nut	12	9
Generator bolts	47	35

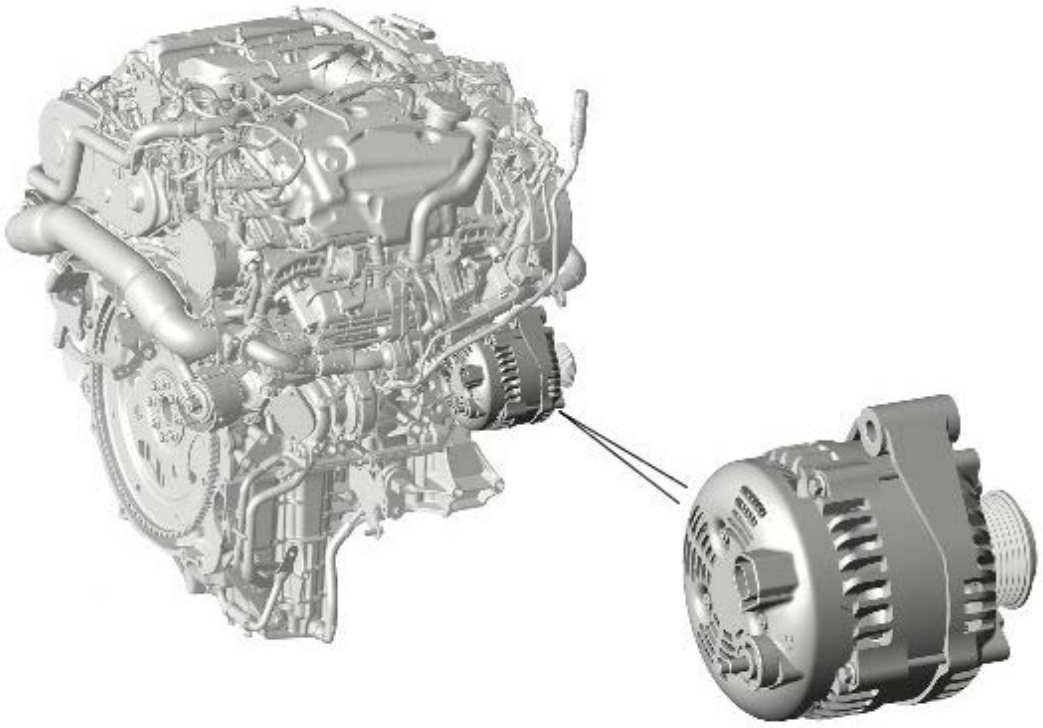
CAUTION: *Damage to the internal connections will result if this torque is exceeded.

Published: 28-May-2013

Generator and Regulator - TDV8 4.4L Diesel - Generator

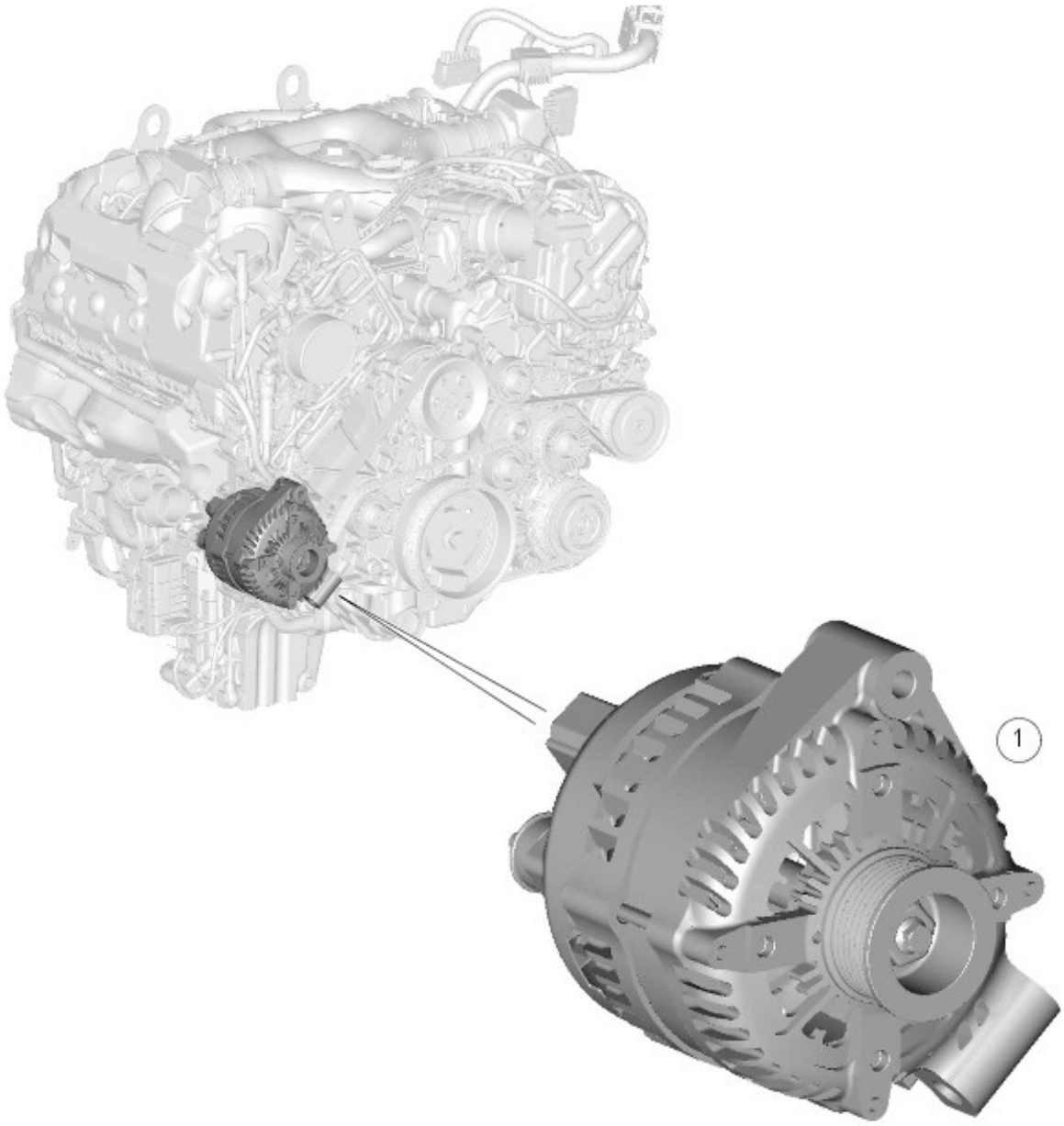
Description and Operation

COMPONENT LOCATION - SHEET 1 OF 3 - VEHICLES WITH TDV6 3.0L DIESEL ENGINE.



E149164

COMPONENT LOCATION - SHEET 2 OF 3 - VEHICLES WITH TDV8 4.4L DIESEL ENGINE.

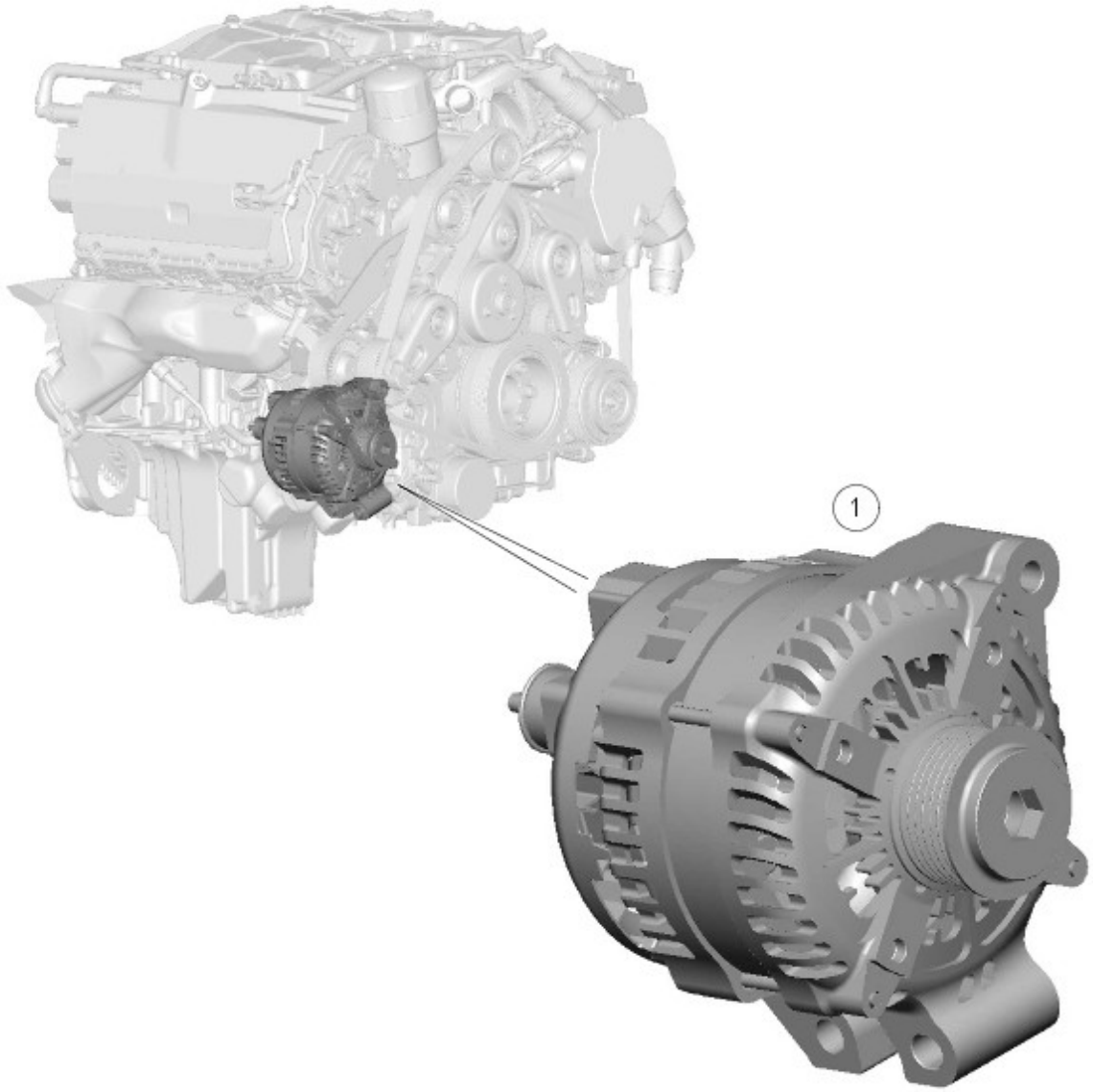


E154715

Item	Part Number	Description
1	-	Generator

COMPONENT LOCATION - SHEET 3 OF 3 - VEHICLES WITH V6 S/C 3.0L AND V8 S/C 5.0L PETROL ENGINE.

NOTE: V6 S/C 3.0L Petrol installation shown, V8 S/C 5.0L Petrol similar.



E154716

Item	Part Number	Description
1	-	Generator

OVERVIEW

The generator is mounted on the front right side of the engine and is driven at approximately three times engine speed by the accessory drive belt.

The charging system consists of a generator and regulator assembly and a GWM (Gateway Module). The generator and regulator assembly generates electrical power for the vehicle electrical system and maintains the primary battery and the secondary or auxiliary battery (where fitted) in a charged state. The rate of charge for the primary battery and the secondary or auxiliary battery (where fitted) is controlled by the GWM.
For additional information, refer to: Battery and Cables (414-01 Battery, Mounting and Cables, Description and Operation).

When the engine is running the generator produces an AC (Alternating Current), which is converted to a DC (Direct Current) internally. The output from the generator is controlled by the voltage regulator (located inside the generator) and then supplied to the primary battery through the BJB2 (Battery Junction Box 2) to the primary battery positive cable.

Charging of the secondary or auxiliary battery on dual battery vehicles is controlled by the GWM, and the power supply distribution box. Generator output is directed to the secondary or auxiliary battery via a contactor in the power supply distribution box which is controlled by the GWM.

DESCRIPTION

The regulator provides a controlled variable Direct Current (DC) voltage output from the generator. Two electrical terminals are provided on the outer casing of the generator. One terminal supplies the DC voltage output from the

generator to the battery positive terminal. The second terminal provides the LIN (Local Interconnect Network) bus connection between the regulator and the GWM.

The output from the generator is AC. A bridge rectifier within the generator converts the AC to DC.

The generator comprises a rotor winding, which is rotated by the generator pulley via the primary drive belt, a stator which is retained stationary within the generator housing, a voltage output regulator and a bridge rectifier.

The rotor winding assembly rotates inside the stator winding. The rotor generates a magnetic field and the stator winding develops AC voltage and current flows from the induced magnetic field of the rotor.

The regulator monitors the stator output voltages. Depending on the measured voltages, and signals from the GWM on the LIN bus, the regulator will adjust the amount of rotor field current to control generator output. The regulator is located within the generator housing.

The regulator will vary the charging system voltage output level depending on signals from the GWM. If the charging system voltage falls below a predetermined level, the GWM, via the LIN bus, will control the regulator to increase the field current produced by the stator and the rotor, increasing the magnetic field, which results in an increased generator output. If the charging system voltage raises above the predetermined level, the GWM, via the LIN bus, will control the regulator to decrease field current, reducing the magnetic field and decreasing the generator output. The regulator controls the field current by adjusting the power supplied to the rotor windings.

The following variants of generator are fitted to the specific engine types:

- V8 S/C 5.0L Petrol - 180A SC3 Denso
- V6 S/C 3.0L Petrol - 180A SC3 Denso
- TDV8 4.4L Diesel - 220A SC4 Denso
- TDV6 3.0L Diesel - 220A SC4 Denso

OPERATION

The output voltage required from the generator and regulator is calculated by the GWM.
For additional information, refer to: Battery and Cables (414-01 Battery, Mounting and Cables, Description and Operation).

The BMS (Battery Monitoring System) control module on the primary battery, is connected to the GWM via a LIN bus connection. The BMS control module measures battery current and voltage, which it communicates to the GWM over a LIN bus connection. Based on the information received from the BMS control module, the GWM will control the output from the generator, and if necessary, will also request the switching off of electrical loads if necessary. The GWM controls the generator voltage regulator via the LIN bus connection and can adjust the generator output applicable to demand.

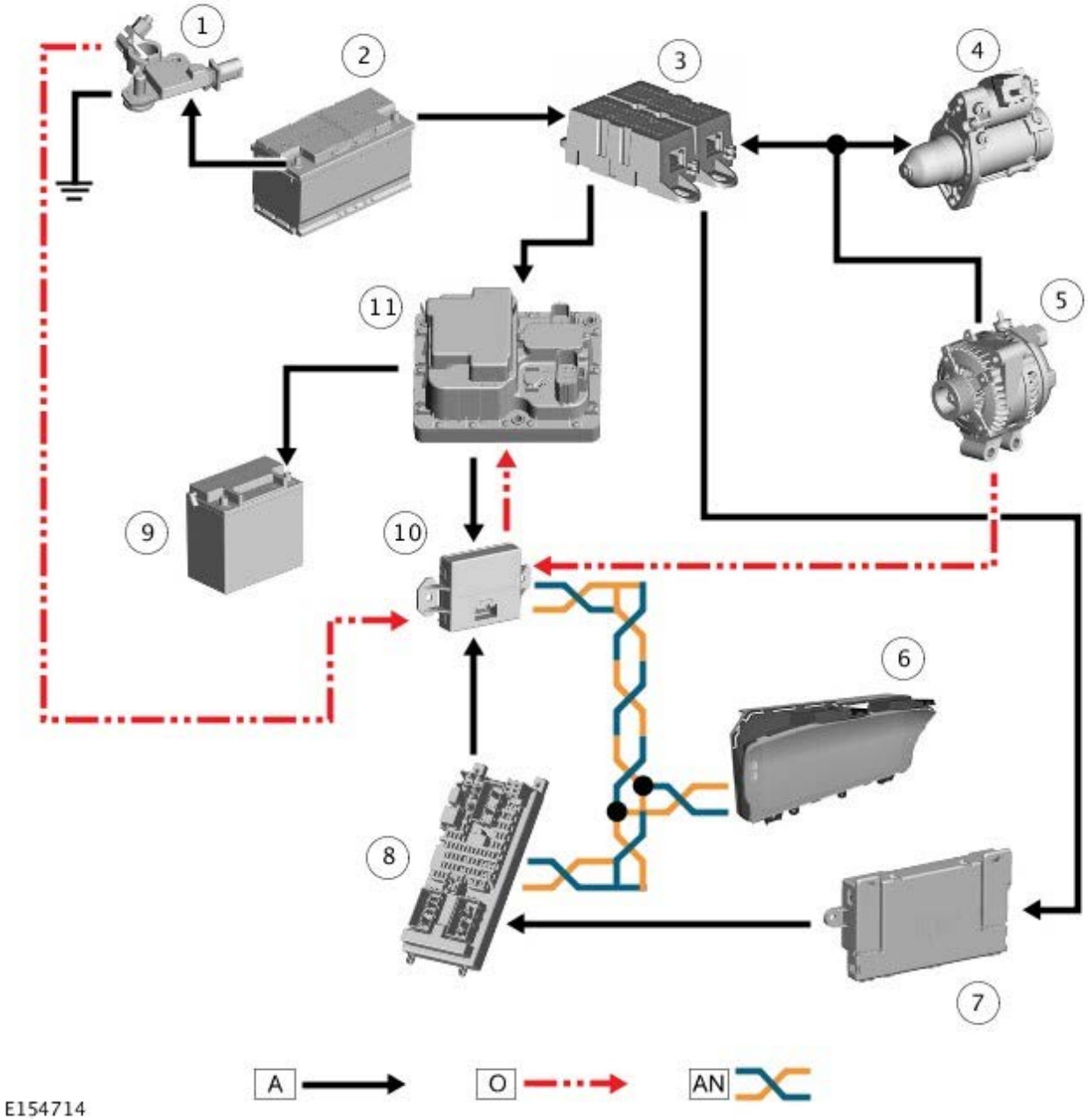
The GWM will over-ride the voltage value if it detects a fault in the power supply system.

The GWM also signals the IC (Instrument Cluster) to display a warning message if it detects a fault with the generator and regulator.
For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

The GWM controls the charge warning indicator in the IC. Failure of the generator or regulator to provide sufficient charge for the primary battery to support vehicle demand, the GWM will instruct the IC via the high speed CAN (Controller Area Network) Powertrain bus to illuminate the charge warning indicator.

CONTROL DIAGRAM

 NOTE: A = Hardwired, O = LIN (Local Interconnect Network) bus, AN = High speed CAN (Controller Area Network) Powertrain bus.



E154714

Item	Part Number	Description
1	-	- Battery Monitoring System (BMS) control module
2	-	Primary battery
3	-	Battery Junction Box 2 (BJB2)
4	-	Starter motor/TSS motor
5	-	Generator
6	-	Instrument Cluster (IC)
7	-	Auxiliary Junction Box (AJB)
8	-	Central Junction Box (CJB)
9	-	Secondary/Auxiliary battery
10	-	Gateway module (GWM)
11	-	Power Supply Distribution Box

Published: 31-Jul-2012

Generator and Regulator - TDV8 4.4L Diesel - Generator

Diagnosis and Testing

For further diagnostic information.
REFER to: Charging System (414-00 Battery and Charging System - General Information, Diagnosis and Testing).

For a detailed description of the generator and regulator system and operation, refer to the relevant description and operation section of the workshop manual. REFER to: Generator (414-02B, Description and Operation).

Published: 22-Oct-2013

Generator and Regulator - TDV8 4.4L Diesel - Generator

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.

Engine shown removed for clarity.

1. Disconnect the battery ground cable.

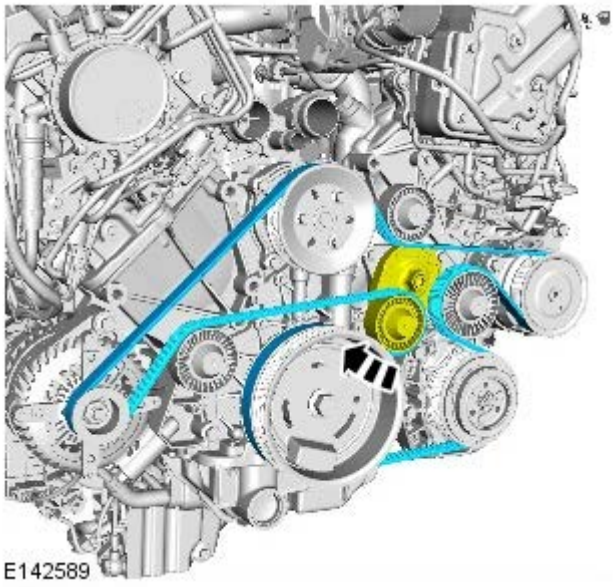
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

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

   Raise and support the vehicle.

3. Refer to: Cooling Fan (303-03F Engine Cooling - TDV8 4.4L Diesel, Removal and Installation).

4.



5. Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

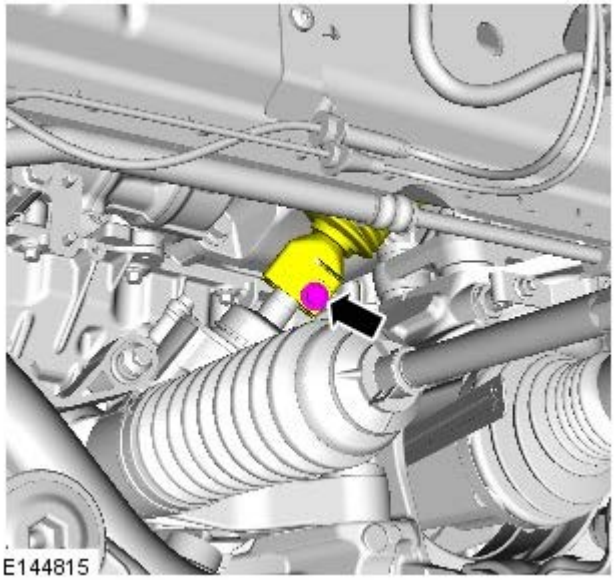
6. CAUTION: Discard the bolt.

   NOTES:

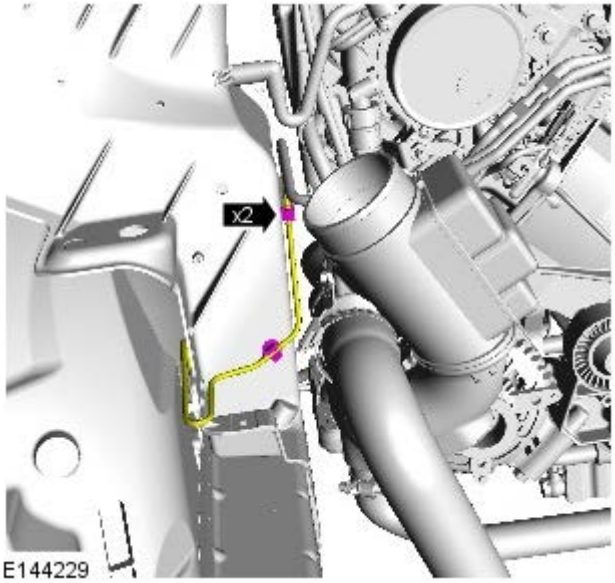
   Right hand drive only.

   LHD illustration shown, RHD is similar.

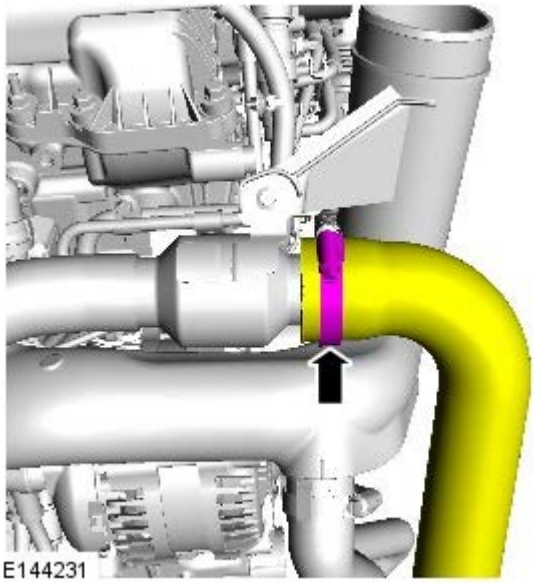
   - Align the steering wheel to straight ahead.
   - Using a suitable tool, clean out the threads.
   - *Torque:* 30 Nm



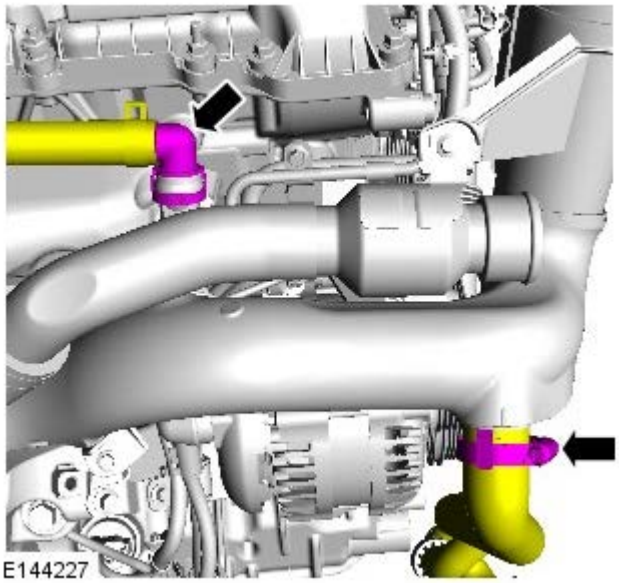
7.



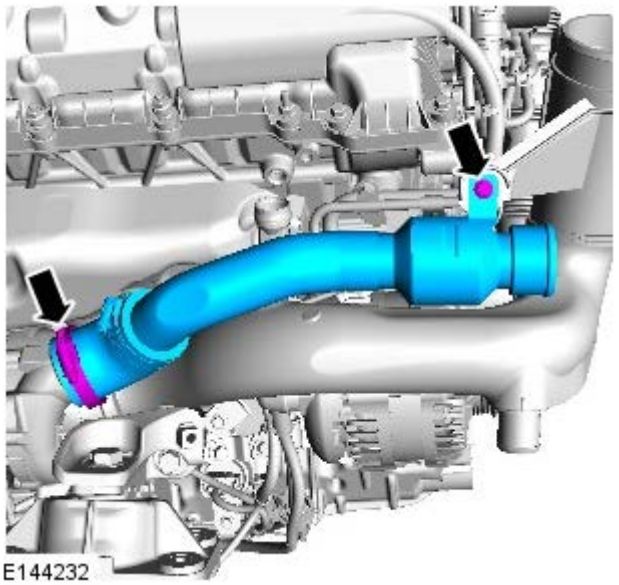
8. *Torque:* 3.5 Nm



9. *Torque:* 3.5 Nm

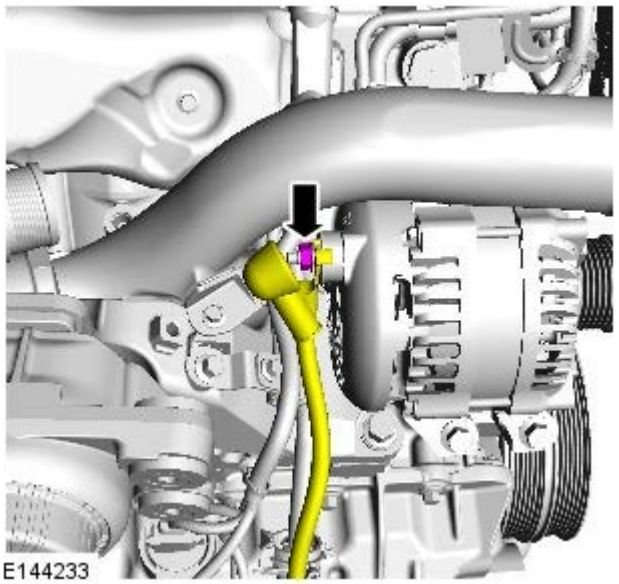

E144227

10. *Torque:*
    Clamp 3.5 Nm
    Bolt 8 Nm


E144232

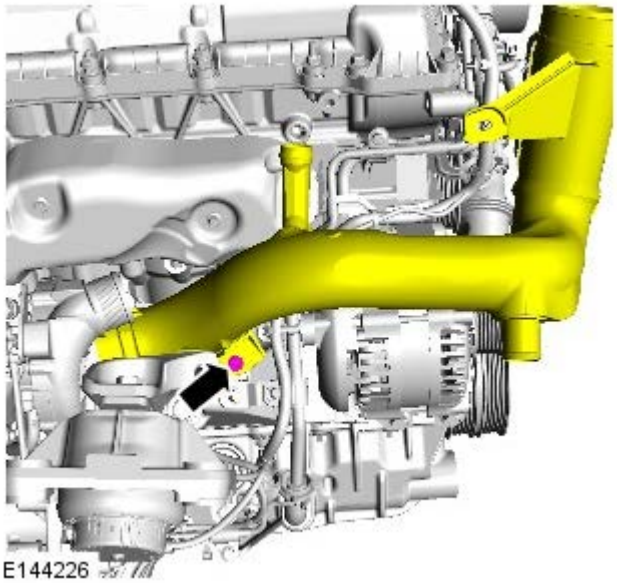
11. CAUTION: Take extra care when removing the battery cable from the generator.

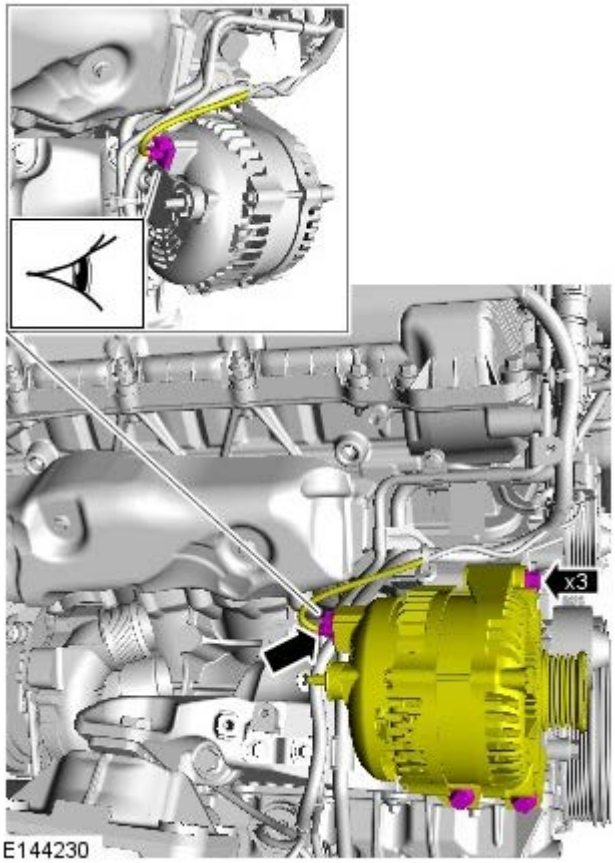
    Torque: 12 Nm


E144233

12. NOTE: The component cannot be removed at this stage.

    Torque: 8 Nm


E144226



E144230

13. CAUTIONS:

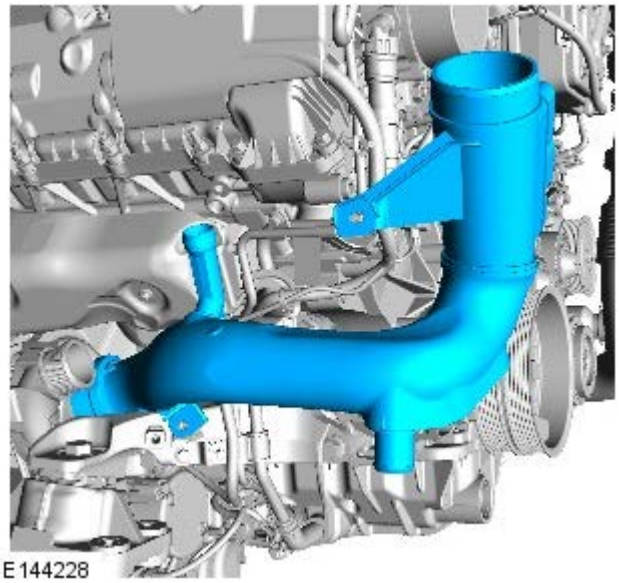
Take extra care not to damage the battery cable terminal when removing the wiring harness or generator. Make sure that the terminal is not bent or split.

Support the generator prior to disconencting the electrical connectors.

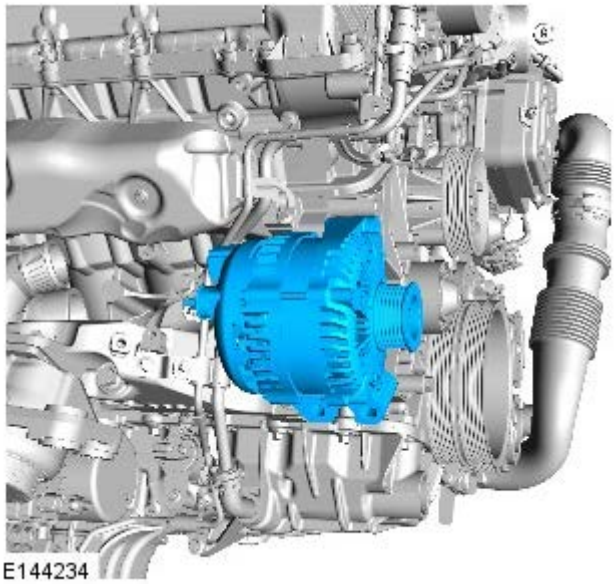
NOTE: The component cannot be removed at this stage.

Torque: 47 Nm

14.


E144228

15.


E144234

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

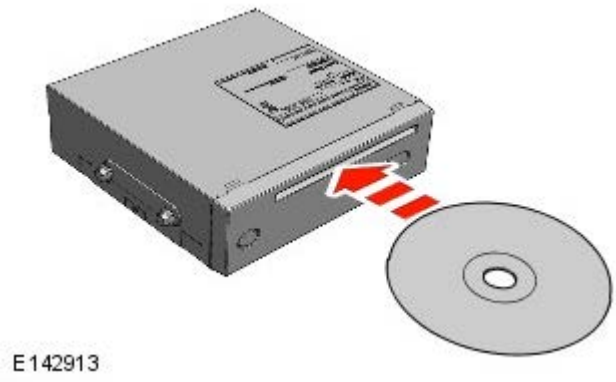
Map Update Applicability

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)

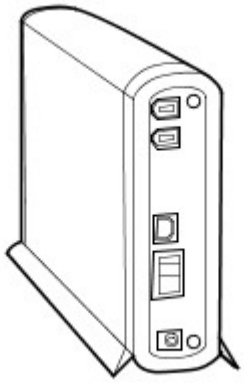
DVD Map Updates



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.





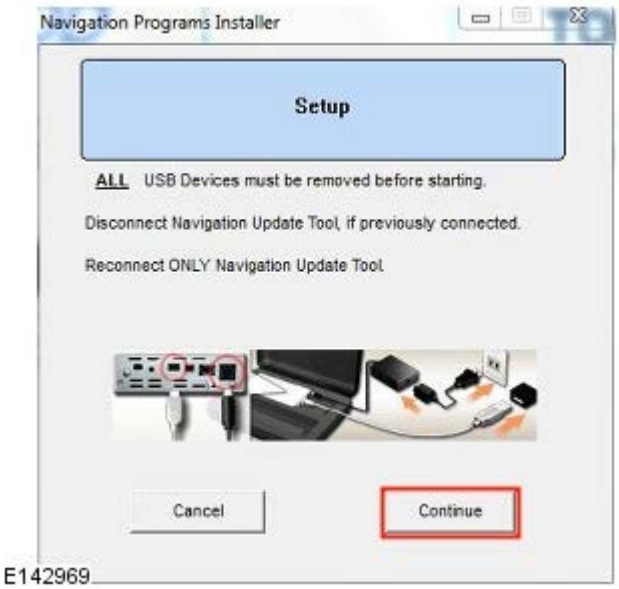
E142966

- Select **Setup** on th navigation update tool.



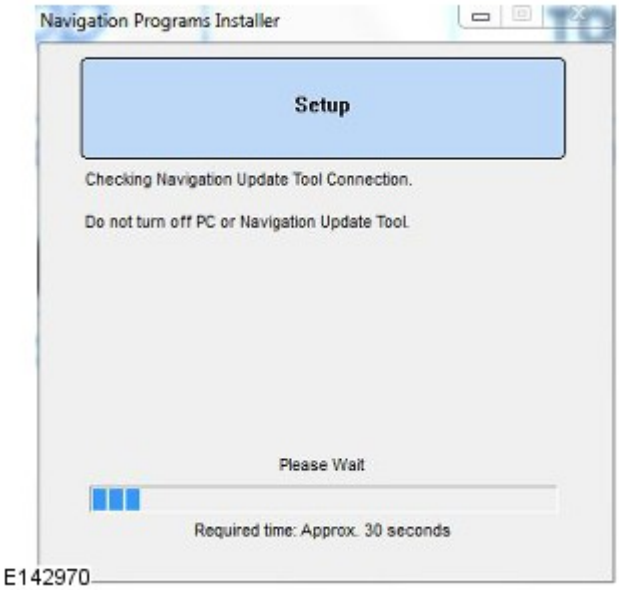
E142967

- 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.



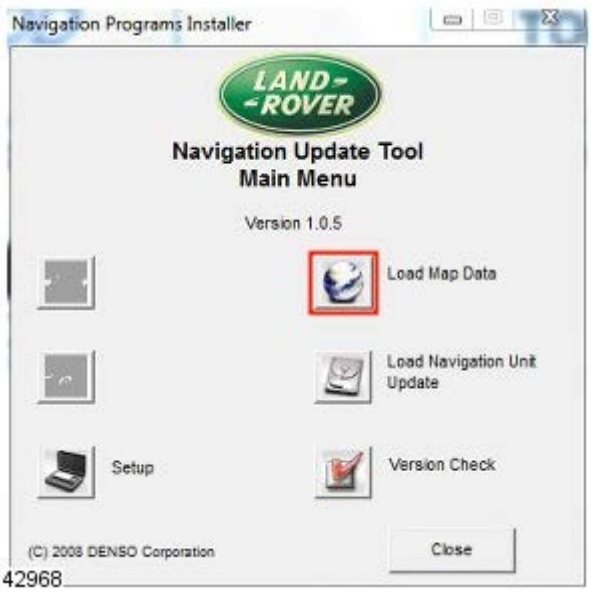
E142971

- 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.



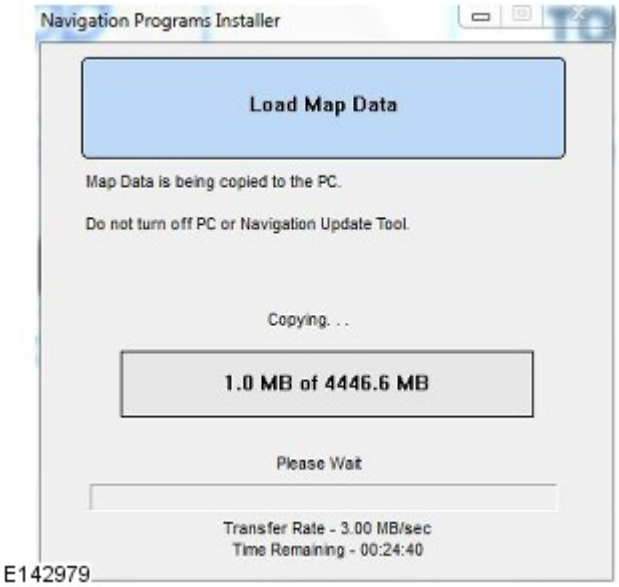
E142977

- 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.



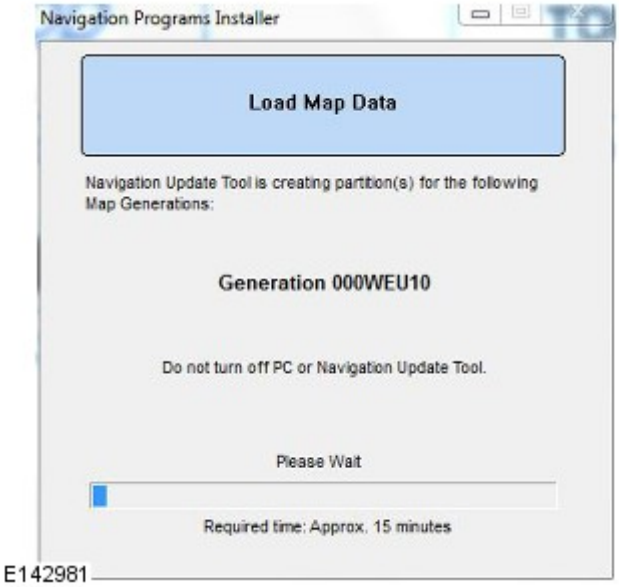
E142979

- 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.

Published: 03-Feb-2014

Information and Entertainment System - General Information - Information and Entertainment System

Diagnosis and Testing

Principle 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: (415-01 Information and Entertainment System)

Audio System (Description and Operation),
Navigation System (Description and Operation),
Video System (Description and Operation),
Cellular Phone (Description and Operation),
Speakers (Description and Operation),
Voice Control (Description and Operation),
Antenna (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	Display normal	• MOST harness	• Check MOST harness connectors for

sources)		connections loose • MOST harness connections contaminated • MOST harness misrouted - Too many bends or bend radius less than 25mm • Audio amplifier system fault	security • Check MOST harness connectors for contamination • 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	-	• No station stored to	• Store a station to the relevant **Preset**

select preset station when **Preset #** soft key operated		relevant **Preset #** soft key	# 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 • Auxiliary device link cable fault • Integrated audio module internal failure	• Connect a known good auxiliary device to the auxiliary socket and retest • 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	-	• FM/TMC antenna fault	

inoperative		• 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	5-8 kbps (mono); 12 kbps (stereo) playback supported. 31 kbps (mono) playback cannot be guaranteed but an attempt will be	'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 only at specified bit rates	made to play	supported
	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.

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 Module (AAM) (Description and Operation),
Diagnostic Trouble Code Index: Integrated Audio Module (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Digital Radio Control Module (DRCM) (Description and Operation),
Diagnostic Trouble Code Index: Integrated Control Panel (Description and Operation),
Diagnostic Trouble Code Index: Touch Screen (Description and Operation),
Diagnostic Trouble Code Index: Touch Screen Switchpack (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Rear Seat Entertainment Control Module (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Satellite Radio Control Module (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: TV Control Module (TVCM) - Digital (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 information and entertainment system, refer to the relevant description and operation sections in the workshop manual. REFER to: Cellular Phone (415-01 Information and Entertainment 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

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
• 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 relevant 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 complete list of diagnostic trouble codes (DTCs) that could be logged on this vehicle refer to Section 100-00 of the workshop manual.

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 diagnosisGO 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 diagnosisGO 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 unsuccessful, 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 the integrated audio 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
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
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

Inspection and Verification

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

Principles of Operation

The information in this section is intended to help with basic diagnosis of the navigation system

For a detailed description of the navigation system, refer to the relevant description and operation section in the workshop manual.
REFER to: Navigation System (415-01, Description and Operation).

Touch Screen Display 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 color on the screen will change when a hard switch is pressed. (Power switch operation cannot be checked on this screen)

Soft key Test

The soft key test calibrates the soft key coordinates and checks soft key 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)

Soft key 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 soft key using the "Start Calibration" function

DTC Information

Search for the meaning of the displayed DTC

Vehicle Configurations

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. 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 / parking brake position (electric park brake on or off)
- Speed inhibit
- MOST fibre optic transceiver temperature
- Output audio allocation

Video Inputs Test

This screen will allow the testing of video inputs that are connected to the touch screen. These include:

- Companion camera
- 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

Color bar

This function allows the technician to test the colors generated by the touch screen. A second screen displays six solid colors, selecting the color will fill the screen with the chosen color and pressing the touch screen again will revert back to the color 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

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
  - 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. 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

Inspection and Verification

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

Visual Inspection

Electrical
• Battery • Fuses - Central and battery junction boxes - Megafuses • Wiring harness • Damaged, loose or corroded connectors • Touch screen • GPS antenna • TV antenna • Satellite antenna • FM antenna • Companion camera • Rear view camera • Microphone • Accessory USB unit • Steering wheel controls • Clockspring • Integrated audio module • Audio amplifier module • ABS control module • Wheel speed sensors • Vehicle information and communication system (VICS Japan only) receiver • VICS beacon antenna (Japan only) • CAN circuits • MOST system • Mobile phone

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, disconnected • 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, disconnected • 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)	• MOST system • Electrical harness open/short circuit, disconnected	GO to Pinpoint Test D.
The screen does not dim	• Electrical harness	GO to Pinpoint Test E.

	• open/short circuit, disconnected • Component failure	
Noise on the screen, screen color is abnormal	• Electrical harness open/short circuit, disconnected • Component failure	GO to Pinpoint Test F.
The soft keys 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 mobile phone • 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 Tool" operation manual	Refer to the "Navigation Update 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 • 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 touch screen in the centre at the top of the screen for approximately 5 seconds and then press and hold the touch screen 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 stepGO 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, retest 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, retest 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 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 proximity camera 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 retest the vehicle **No** Check and install a new touch screen 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 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 retest 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 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 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 "Soft Keys 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 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
	Are there any foreign objects adhered to the display light sensor?

	Yes Remove foreign objects and retest 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 as required. Refer to the new module/component installation note at top of DTC index

PINPOINT TEST F : NOISE ON THE SCREEN; SCREEN COLOR 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 color is normal when the screen setting (contrast) is reset to the default values
	Is the screen color 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 retest **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 as required. Refer to the new module/component installation note at top of DTC index **No** GO to F5.
F5: COLOR BAR CHECK	
	1 Carry out the display diagnostics color bar check test
	Are the results of the display diagnostics color bar check normal? **Yes** Operation is normal **No** Check and install a new touch screen as required. Refer to the new module/component installation note at top of DTC index

PINPOINT TEST G : THE SOFT KEYS DO NOT RESPOND	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: SOFT KEY TEST	
	1 The soft keys not responding on the navigation screen only
	Are the soft keys not responding on the navigation screen only? **Yes** Proceed to the next step **No** Check and install a new touch screen as required. Refer to the new module/component

	installation note at top of DTC index
G2: SOFT KEY CHECK	
	1 Carry out the soft key check in the display diagnostics
	Are the results of the display diagnostics soft key check normal? **Yes** Check the symptoms againOperation is normal **No** GO to G3.
G3: START CALIBRATION ROUTINE	
	1 Carry out the start calibration routine from the display diagnostics soft key test
	Is normal operation resumed after correction? **Yes** Operation is normal **No** Check and install a new touch screen 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
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 retest 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 antennaProceed 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 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 retest 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 devicesGO 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 retest 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 retest 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 retest vehicle **No** Check MOST connection at the touch screen, check the MOST devicesProceed 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 MOBILE PHONE.	
	1 Check to see if sound is only absent when using the audio system or mobile phone
	Does only the audio system or mobile phone sound not output? **Yes** Check MOST connection at the touch screen, 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 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 retest 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 depresse
	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, 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 harness and connections
	Has a fault been identified with the touch screen harness or connections? **Yes** Rectify the fault and retest the vehicle **No** Check and install a new touch screen 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 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 checksCheck the ABS control module for related DTCs and refer to the relevant DTC indexCarry 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 requiredRectify the fault and retest 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 as required. Refer to the new module/component installation note at top of DTC index **No** Carry out MOST ring circuit checksCheck the ABS control module for related DTCs and refer to the relevant DTC indexCarry 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 requiredRectify the fault and retest 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 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 mobile phone 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 mobile phone is Bluetooth compatible
	Is the mobile phone Bluetooth compatible? **Yes** GO to Q3. **No** Use a Bluetooth compatible mobile phone
Q3: HANDSET POWER CHECK	
	1 Check to see if the handset is switched 'ON'
	Is the mobile phone switched 'ON'? **Yes** GO to Q4. **No** Switch handset 'ON' and retest
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 mobile phone recognizes the in-vehicle system
	Does the mobile phone recognize the in-vehicle system? **Yes** GO to Q6. **No** Retest using a different Bluetooth compatible mobile phone. If the fault is still evident, suspect the integrated audio module. Refer to the new module/component installation note at the top of this procedure
Q6: HANDSET COMMUNICATION CHECK	
	1 Switch the Bluetooth mobile phone 'OFF' then back 'ON' again
	Does the mobile phone recognize the in-vehicle system? **Yes** Operation is normal **No** Suspect the integrated audio 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 mobile phone is within communications range
	Is the mobile phone within a 10 metre range of the integrated audio module? **Yes** GO to Q8. **No** Move the mobile phone to within a 10 metre range of the integrated audio module
Q8: HANDSET COMMUNICATION CHECK	
	1 Check to see if when transmitting, the mobile phone is also receiving
	When transmitting, is the mobile phone also receiving? **Yes** Check MOST connection at the touch screen, check the MOST devices **No** Replace the mobile phone

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 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 NavteqIf the activation code is valid but map cannot be activated, check and install a new touch screen as required. Refer to the new module/component installation note at top of DTC indexInitiate 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 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 as required. Refer to the new module/component installation note at top of DTC index **No** Contact dealer technical support to assist in reconfiguring the car configuration file 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, 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: (100-00 General Information)

Diagnostic Trouble Code (DTC) Index - DTC: Navigation Control Module - Extended Markets (Description and Operation),
Diagnostic Trouble Code Index: Touch Screen (Description and Operation).

Published: 24-Oct-2012

Information and Entertainment System -

Torque Specifications

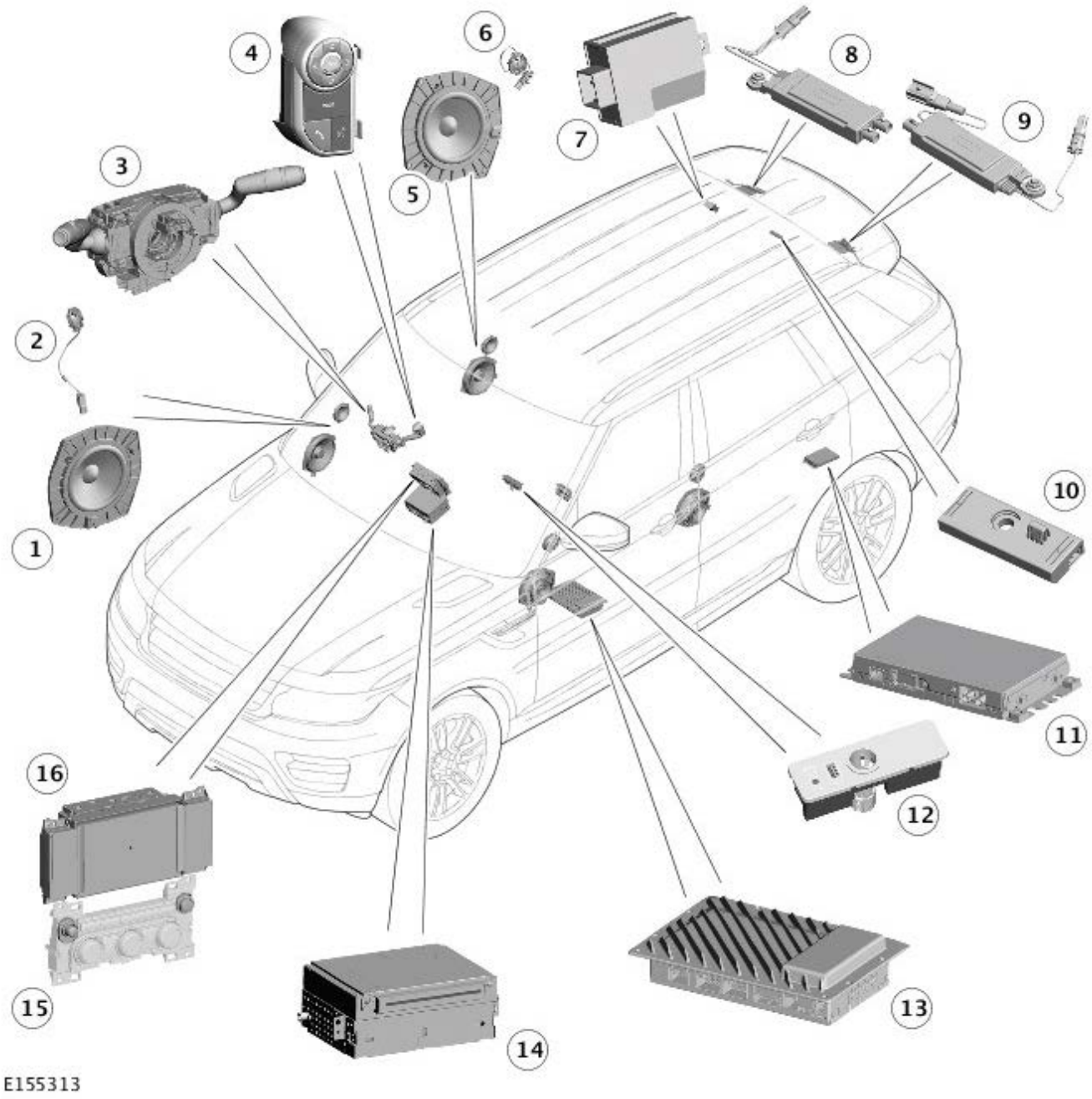
Description	Nm	lb-ft	lb-in
Audio unit	2.2	-	19
Audio unit antenna nut	25	18	-
Audio unit antenna bolts	9	-	80
Subwoofer speaker bolts	3.6	-	3
Navigation control module bolts	9	-	80
Television (TV) module nuts	9	-	80
Television (TV) module bolts	9	-	80
Audio amplifier module nuts	9	-	80
Digital radio control module nuts	9	-	80

Published: 19-Aug-2013

Information and Entertainment System - Audio System

Description and Operation

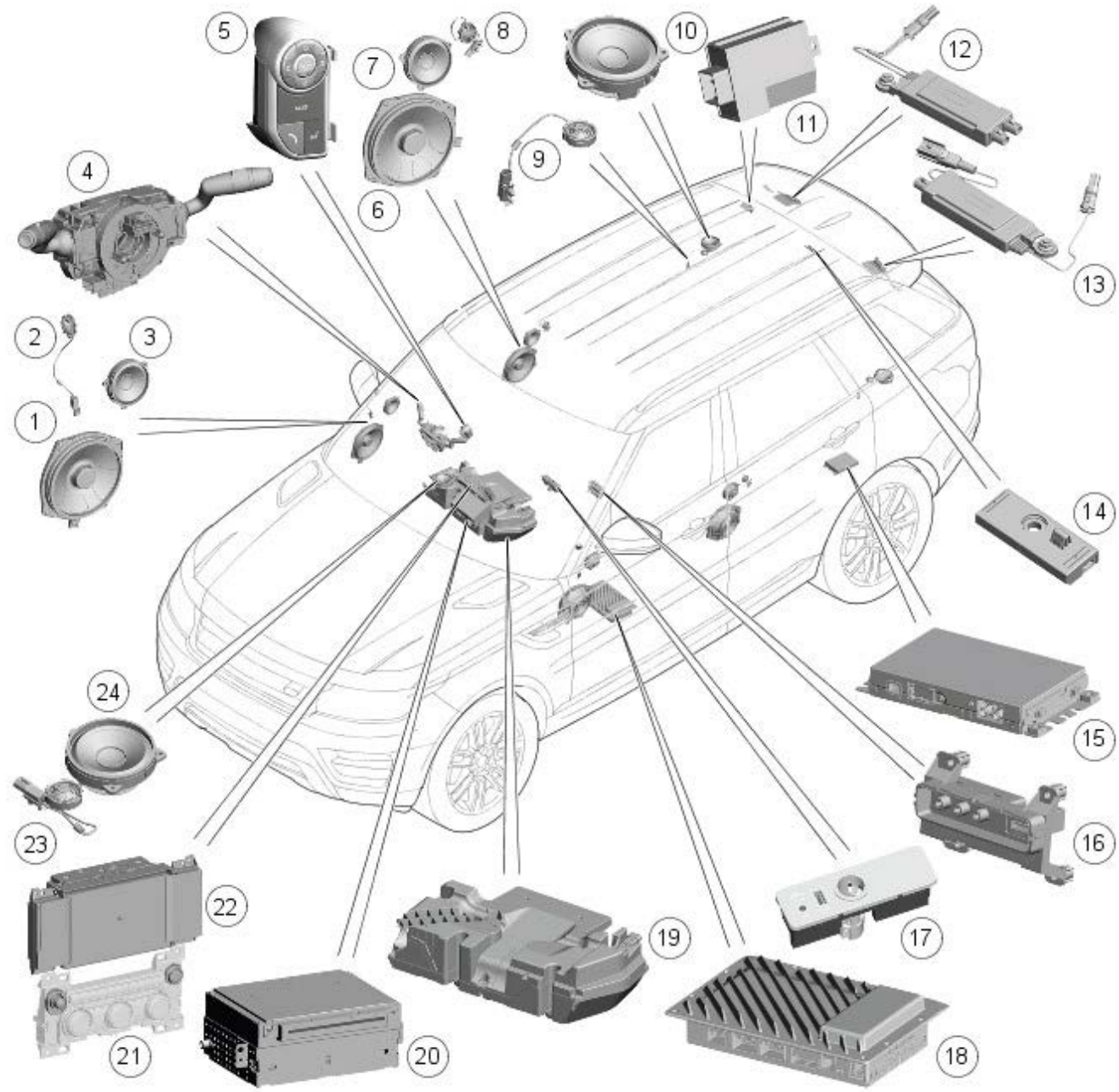
COMPONENT LOCATION - 8 SPEAKER AUDIO SYSTEM



Item	Part Number	Description
1	-	Front bass speaker (2 off)
2	-	Front mid-range speaker (2 off)
3	-	Clockspring
4	-	Left steering wheel switchpack
5	-	Rear bass speaker (2 off)
6	-	Rear mid-range speaker (2 off)
7	-	RF filter - Tailgate wiper motor
8	-	Antenna amplifier - FM2/Digital Radio/TMC/(VICS Japan only)
9	-	Antenna amplifier - AM/FM
10	-	RF filter - High mounted stop lamp
11	-	Digital Radio Control Module (DRCM) or satellite radio control module (NAS only)
12	-	Portable audio interface panel
13	-	Audio Amplifier Module (AAM)
14	-	Integrated Audio Module (IAM)
15	-	Integrated Control Panel (ICP)

16	-	Touch Screen (TS)

COMPONENT LOCATION - MERIDIAN SURROUND SYSTEM

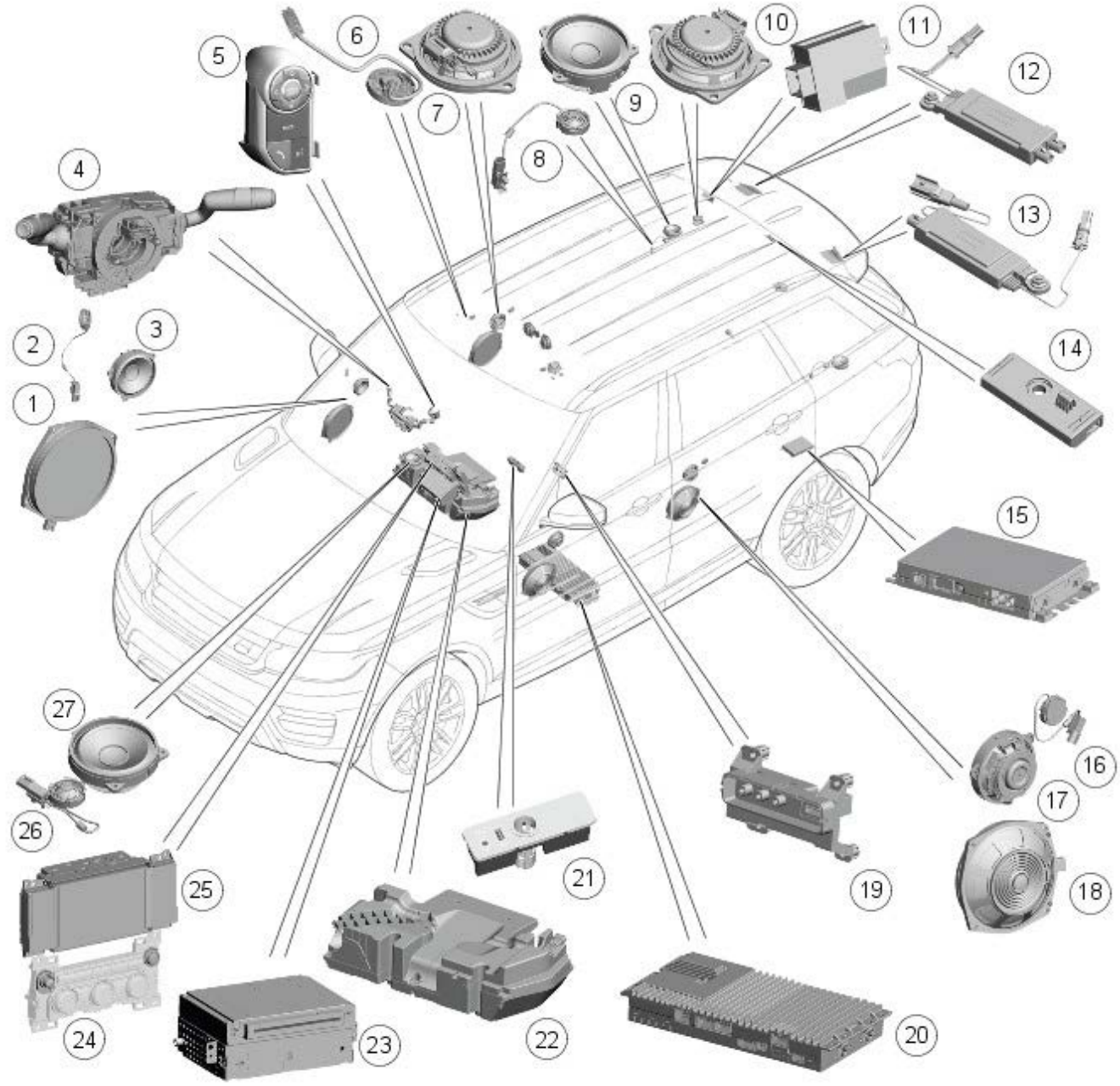


E155314

Item	Part Number	Description
1	-	Front bass speaker (2 off)
2	-	Front tweeter speaker (2 off)
3	-	Front mid-range speaker (2 off)
4	-	Clockspring
5	-	Left steering wheel switchpack
6	-	Rear bass speaker (2 off)
7	-	Rear mid range speaker (2 off)
8	-	Rear tweeter speaker (2 off)
9	-	Rear surround tweeter speaker (2 off)
10	-	Rear surround mid-range speaker (2 off)
11	-	RF filter - Tailgate wiper motor
12	-	Antenna amplifier - FM2/Digital Radio/TMC/(VICS Japan only)
13	-	Antenna amplifier - AM/FM
14	-	RF filter - High mounted stop lamp
15	-	Digital Radio Control Module (DRCM) or satellite radio control module (NAS only)
16	-	Audio Video Input/Output (AVIO) panel
17	-	Portable audio interface panel
18	-	Audio Amplifier Module (AAM)

19	-	Sub-woofer
20	-	Integrated Audio Module (IAM)
21	-	Integrated Control Panel (ICP)
22	-	Touch Screen (TS)
23	-	Instrument panel surround tweeter speaker
24	-	Instrument panel surround mid-range speaker

COMPONENT LOCATION - MERIDIAN SIGNATURE REFERENCE SYSTEM



E155315

Item	Part Number	Description
1	-	Front bass speaker (2 off)
2	-	Front tweeter speaker (2 off)
3	-	Front mid-range speaker (2 off)
4	-	Clockspring
5	-	Left steering wheel switchpack
6	-	Microphone - Dynamic Equalization (4 off)
7	-	Front headliner surround low profile mid-range speaker (2 off)
8	-	Rear surround sound tweeter speaker (2 off)
9	-	Rear surround mid-range speaker (2 off)
10	-	Rear headliner surround mid-range speaker (2 off)
11	-	RF filter - Tailgate wiper motor
12	-	Antenna amplifier - FM2/Digital Radio/TMC/(VICS Japan only)

13	-	Antenna amplifier - AM/FM
14	-	RF filter - High mounted stop lamp
15	-	Digital Radio Control Module (DRCM) or satellite radio control module (NAS only)
16	-	Rear tweeter speaker (2 off)
17	-	Rear mid-range speaker (2 off)
18	-	Rear bass speaker (2 off)
19	-	Audio Video Input/Output (AVIO) panel
20	-	Audio Amplifier Module (AAM)
21	-	Portable audio interface panel
22	-	Sub-woofer
23	-	Integrated Audio Module (IAM)
24	-	Integrated Control Panel (ICP)
25	-	Touch Screen (TS)
26	-	Instrument panel surround tweeter speaker
27	-	Instrument panel surround mid-range speaker

OVERVIEW

The audio system is available in three versions:

- 8 Speaker Audio System 256W - 8 speakers and single slot CD (Compact Disc) player
- Meridian Surround System 880W - Meridian Trifield, Dolby Pro Logic IIx and DTS Neo:6 Surround Sound System, 19 speakers including dual voice coil subwoofer and single slot CD player
- Meridian Signature Reference System 1700W Meridian Trifield, Meridian Trifield 3D, Dolby Pro Logic IIx, Dolby Pro Logic IIz, and DTS Neo:X Surround Sound System - 23 Speakers including dual voice coil subwoofer and single slot CD player.

The following applications and facilities are available to the audio system:

- Auxiliary input
- MP3-compatible, single slot CD
- AM / FM radio
- HD Radio™ (NAS only)
- Digital Radio Control Module (Europe and Asia only) or Satellite Radio control module (NAS only).
- EON, RDS, PTY, TA
- Bluetooth® and audio streaming
- 40GB Hard Disc Drive (HDD) for navigation and virtual CD player (where fitted)
- Hard Drive Navigation system (except Japan and Asian markets) with virtual CD player and single slot DVD. (where fitted)
- Interactive 'Say What You See' (SWYS) Advanced Voice system. (where fitted)
- Front media interface

A range of audio systems are available combining radio and CD / DVD functions, satellite radio or Digital Radio, MP3 disc compatibility, RDS, PTY and TA functions. The IAM (Integrated Audio Module) is a combined radio tuner, CD / DVD player and incorporates a 40GB hard drive for use by the audio for storing music and also stores the operating system and files for the navigation system (not applicable to Asian market vehicles).

A portable audio interface panel allows for the connection of a range of portable audio devices to the car's audio system. The panel is controlled through the Integrated Audio Module (IAM), with play back through the vehicle's speaker system. This system allows the user to import data from their personal portable media player to interface with the vehicle, including iPod® and other MP3 players, or USB (Universal Serial Bus) mass storage devices such as memory sticks. MP3 players can also be controlled through the Touch Screen (TS) if they are configured as mass storage devices. The portable audio interface panel includes a 3.5mm auxiliary jack-plug socket, plus a USB2 connector which allows connectivity for a wide variety of USB devices, including iPods via the USB. The USB port also includes a charging function, although it does not support a USB hub. The maximum charging current supplied is 500mA. The user can connect either an iPod or a USB device to the USB connector, and select the appropriate function from the TS.

Digital Radio (DAB, DAB+ and DMB) is available in Europe, Canada, Australia and Asian markets and gives access to digital radio channels for better sound quality and enhanced functionality depending on local service availability. A Digital Radio control module processes the received digital signals. The system receives reception signals from the following sources to ensure optimum signal strength:

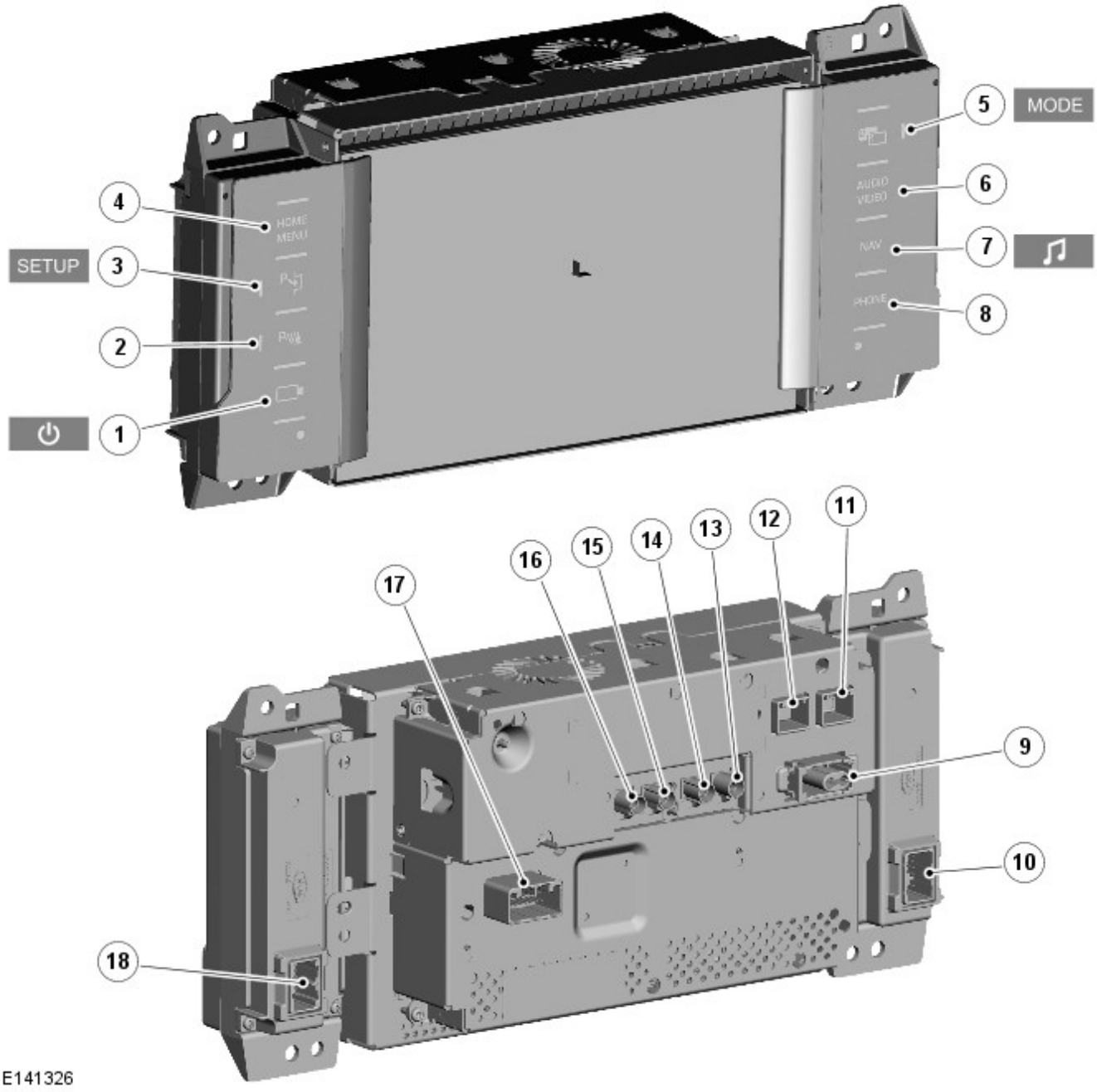
- Digital Radio band L antenna located in the roof pod antenna module
- Digital Radio band III antenna located in the rear spoiler.

For NAS vehicles, the digital format adopted is Satellite Digital Audio Radio Service (SDARS) which specifically links to the Sirius® network. The subscription 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 satellite radio control module processes digital signals from the satellite radio antenna located in the roof pod.

Primary user control of the audio system is via the TS and the Integrated Control Panel (ICP), 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) Comfort bus to the IAM. The IAM relays the control signals to the rest of the audio system on a Media Oriented System Transport (MOST) ring. The TS is the timing master for the MOST ring and also hosts a gateway function between the medium speed CAN Comfort bus and the MOST ring.

DESCRIPTION

Touch Screen (TS)



Item	Part Number	Description
1	-	Camera view on/off or screen on/off soft key
2	-	Park distance control on/off soft key
3	-	Park assist on/off or Settings menu soft key
4	-	Home menu button
5	-	Dual view on/off or audio/video Mode soft key
6	-	Audio/Video menu soft key
7	-	Navigation menu or audio settings soft key
8	-	Telephone menu soft key
9	-	Connector - MOST
10	-	Left TS switchpack connector
11	-	Connector - LVDS output to instrument cluster
12	-	Connector - LVDS input from Integrated Audio Module (IAM) or Navigation control module (Japan or Asia)
13	-	Connector - CVBS video input from parking aid camera control module or rear view camera
14	-	Connector - CVBS video input from TV control module or RSE control module
15	-	Connector - CVBS video input from IAM
16	-	Connector - CVBS video output to RSE control module

17	-	Connector - Power, ground, Medium Speed CAN bus, steering wheel switch input
18	-	Right TS switchpack connector

The Touch Screen (TS) is located in the center of the instrument panel. The TS comprises an 8 inch color, touch sensitive display, with two separate touch sensitive TS switchpacks located on either side.

Two versions of the TS are available; single view and dual view. Additionally TS switchpacks differ depending on system specification; for example, if Park Assist, navigation, dual view or rear view camera is specified on the vehicle, these soft keys will replace Setup, Audio Settings, Mode and display on/off respectively. The functions can still be accessed via the home menu using the screen on the TS.

The TS is the Bus Master for the Media Oriented System Transport (MOST) system and contains the timing master for the MOST system.

When the vehicle systems become active the TS is woken up by CAN bus activity and subsequently wakes up the other audio modules via the MOST.

The TS is the primary user interface of the audio system. It communicates with the other components of the audio/infotainment system on the MOST ring and allows control of the audio system and other infotainment systems from a single point. No configuration procedure is required if the TS or TS switchpacks are replaced.

Calibration of the TS using approved Land Rover diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

The rear of the TS has electrical connectors for power, ground, medium speed CAN Comfort bus, Low Voltage Differential Signalling (LVDS) and Composite Video Baseband Signal (CVBS) video and MOST. The usage of the LVDS and CVBS connectors differs depending on the equipment level of the vehicle.

The TS switchpacks comprise a number of touch sensitive soft keys. The soft keys are not visible when the system is powered down. When the system is active the soft keys are illuminated. When a soft key is pressed, a line above and below the soft key is illuminated to indicate the press has been accepted.

Each TS switchpack has a single connector which provides electrical connections to the control modules for the soft key functions and tell-tale LED illumination. Additionally, each switchpack is connected to other vehicle systems via the medium speed CAN Comfort bus.

DUAL-VIEW TOUCH SCREEN (where fitted)



E141327

Item	Part Number	Description
1	-	Dual-view softkey

The dual-view TS 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 view DVD and TV independent of the driver.

Vehicles fitted with a dual view TS are supplied with a headphone transmitter located in the headliner and one pair of Whitefire™ infra-red wireless headphones. This allows the front seat passenger to view and listen to music, DVD and TV without disturbing the driver.

NOTE: Due to legislation the NAS markets do not receive this option. A single view display is available in these markets.

The dual-view TS 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 soft key on the TS switchpack should be pressed by either the driver or the passenger. This will then switch the TS to dual-view mode allowing the passenger to view TV or video, but not the driver. The Dual View Control Menu is available by the second press of soft key, where the user can exit from the dual view mode, or change the dual view source.



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

Once dual-view has been selected, the driver can change the current screen without affecting the passengers view by the source on the TS.

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. The passenger's can choose to use headphones 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.

CLOCK

The CJB (Central Junction Box) contains the master clock functionality. Other vehicle infotainment system modules that require clock functionality use the time supplied from the CJB.

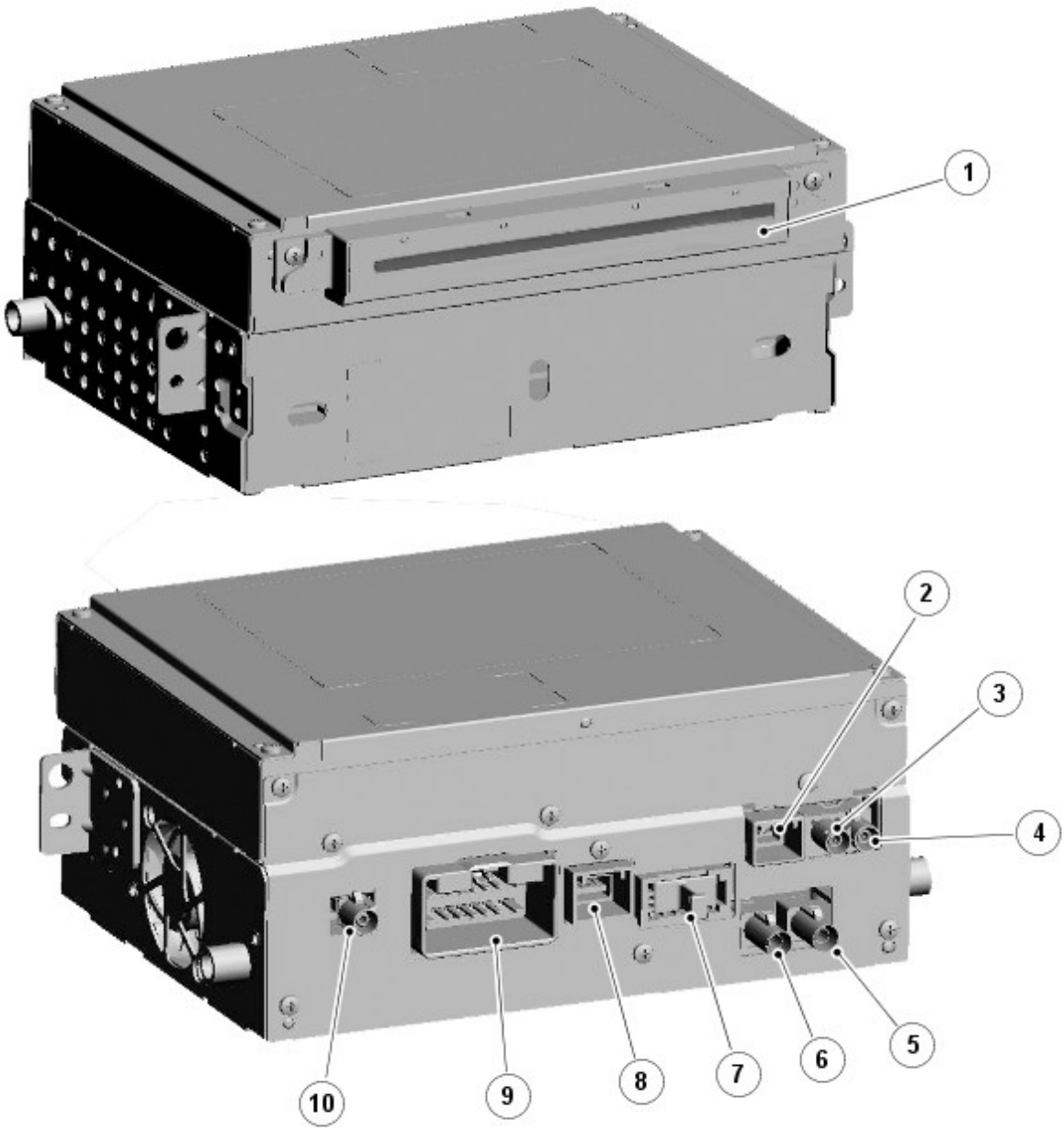
The clock is available to any control module that is connected to an interconnecting bus, for example, either of the CAN buses or the MOST ring.

The clock display is 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 TS. Under conditions when any bus system could be asleep or shut down, the TS does not allow clock adjustments.

Integrated Audio Module (IAM)

NOTE: IAM3 version shown, not all connectors are present on IAM versions 1 and 2



E141328

Item	Part Number	Description
1	-	CD/DVD loading slot
2	-	Connector - LVDS output to TS (IAM2 and 3 versions only)
3	-	Connector - AM/FM antenna amplifier input (All IAM versions)
4	-	Connector - FM2/TMC/(VICS Japan only) antenna amplifier input (All IAM versions)
5	-	Connector - Global Positioning System (GPS) antenna input (IAM3 version only)
6	-	Connector - VICS beacon antenna input (Japan only) (IAM3 versions only)
7	-	Connector - MOST input/output (All IAM versions)
8	-	Connector - Universal Serial Bus (USB) input from portable audio interface panel (All IAM versions)
9	-	Connector - Power, ground, AM/FM antenna amplifier power output, microphone inputs, auxiliary inputs from portable audio interface panel (All IAM versions)
10	-	Connector - CVBS video output to TS

The Integrated Audio Module (IAM) is located in the instrument panel, behind the Integrated Control Panel (ICP).

Three levels of IAM are available; IAM 1, IAM 2 and IAM3. The following table shows the features supported by each IAM version.

Feature	IAM1	IAM2	IAM3
CD/DVD	Single CD	Single CD/DVD	Single CD/DVD
Bluetooth®	Yes	Yes	Yes

USB	Yes	Yes	Yes
Virtual CD (Hard Disc Drive (HDD))	No	No	Yes
Compact Disc DataBase (CDDB)	No	No	Yes
Navigation (40GB HDD)	No	No	Yes
Voice control	No	No	Voice (hi-line and memo)
Microphone	Yes	Yes	Yes
Audio Auxiliary input	Yes	Yes	Yes
Amplifier	External	External	External
Radio Tuners	2	2	2
	USA: dual tuner with HD Radio™	USA: dual tuner with HD Radio™	USA: dual tuner with HD Radio™ and RDS TMC
	Europe: dual tuner	Europe: dual tuner	Europe: dual tuner with RDS TMC
			Japan: dual tuner with FM VICS
HD Radio™ (USA Only)	Yes	Yes	Yes
RDS (Europe) / RBDS (NAS)	Yes/Yes	Yes/Yes	Yes/Yes
MOST for Navigation	No	No	Yes
Video output	No	Yes (one source)	Yes (one source)
DVD output to RSE (Rear Seat Entertainment) control module	No	Yes	Yes

The IAM3 has the following features, in addition to those supported by IAM1 and IAM2:

- Navigation 40GB Hard Disc Drive (HDD) (30GB used for Navigation)
- TMC/(VICS Japan only)
- Off Road Navigation
- 40GB HDD (10GB used for music storage) - virtual CD/DVD - allows the storage of up to 10 CDs to create a 'virtual' multichanger.
- Voice recognition
- Wireless headphones.

All 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 TS is woken up by CAN bus activity and subsequently wakes up the IAM via the MOST.

The IAM incorporates an AM (Amplitude Modulation)/FM (Frequency Modulation) 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 TS 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) / (Radio Broadcast Data System (RBDS) in NAS markets) functions:
    - Station name
    - Radio text
    - PTY
    - Traffic Announcements (TA) (Europe only)
    - AF switching (Europe only)
    - REG to lock to regional/local broadcast (Europe only)
- Seek station
- Tune up/down.

When the optional Digital Radio Control Module (DRCM) is specified, the audio system is fitted with a separate digital radio tuner. This allows the reception of digital broadcast stations which can be received via the FM2/digital radio band III antenna located in the rear spoiler or via the digital radio band 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 Satellite Radio Control Module (SRCM). This allows for the reception of the satellite digital broadcast stations which are received via a satellite radio antenna located in the roof pod.

The IAM supplies a power output to the AM/FM antenna amplifier. Except the DRCM and SRCM (NAS Market), all radio antennas are routed into the IAM. The DRCM or SRCM (NAS market) antenna is connected to the DRCM or SRCM directly.

The IAM incorporates a power management function. Should the vehicle battery level drop below a predetermined level, the unit will limit its functionality. The IAM receives MOST signals from the TS. The TS receives medium speed CAN Comfort bus signals from other vehicle systems which it uses to determine the wake up/shut down process for the modules on the MOST ring.

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 (ALL IAM's)/DVD PLAYER (IAM2 AND 3 ONLY)

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 virtual CD.

The random and repeat features follow the normal CD random and repeat feature functions.

When a CD error occurs, the IAM will alert the user by showing a message related to the error in the TS. 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 IAM 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 IAM3 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.

Integrated Control Panel (ICP)

The ICP is located in the center of the instrument panel, below the TS. The panel is secured with four screws to the instrument panel structure.

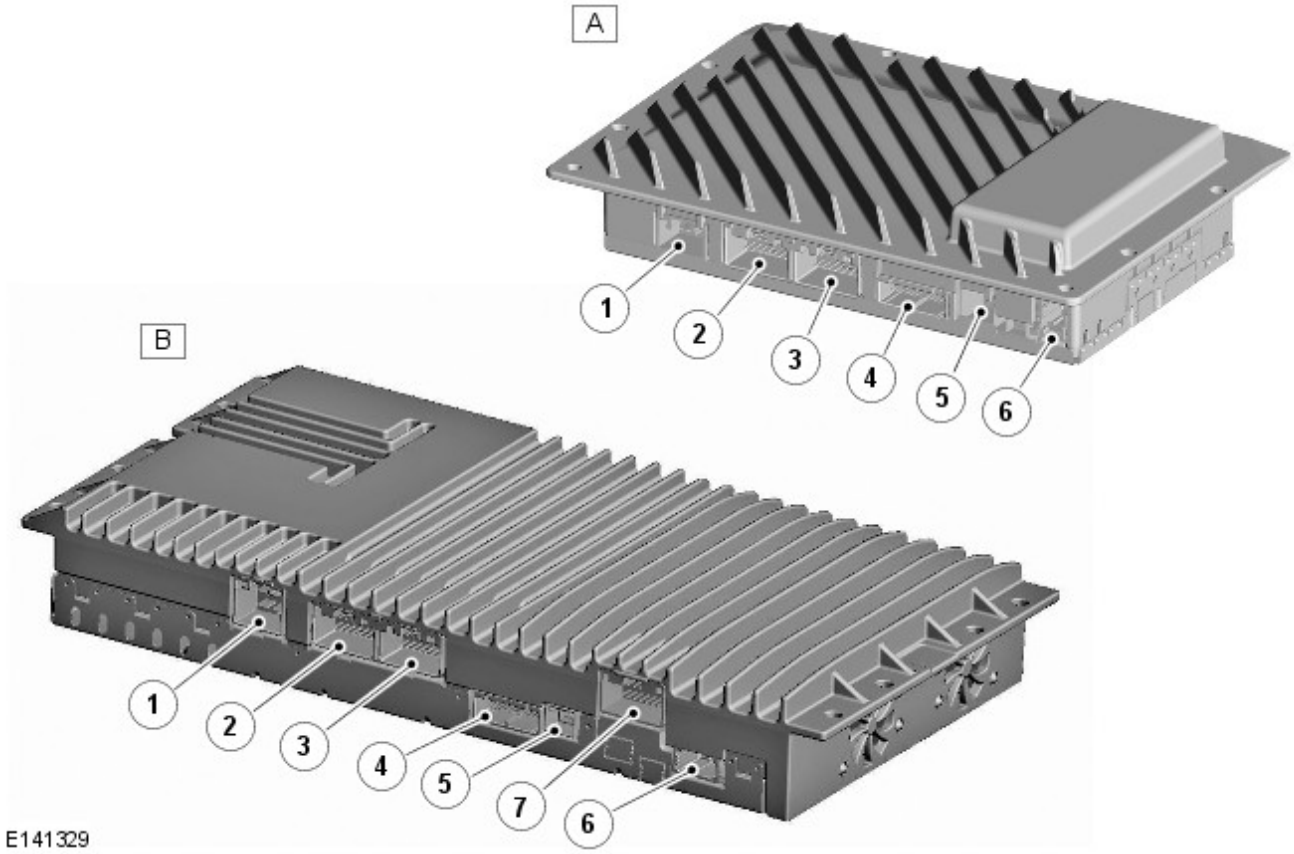
The ICP is a plastic molding which is shared with the climate control system. The ICP contains 2 audio controls. A rotary control switch on the left side controls the audio volume by rotation of the control. The audio system can be turned on and off by pressing the control. A switch on the right side ejects a CD/DVD from the IAM.

The ICP has a single connector which provides power and ground, panel illumination and medium speed CAN Comfort bus connections for both the ICP and the ATCM (Automatic Temperature Control Module) controls.

The ICP also contains switches and controls for hazard warning indicators, heated seats and climate control systems. For additional information, refer to:

Exterior Lighting (417-01 Exterior Lighting, Description and Operation),
Seats (501-10 Seating, Description and Operation),
Control Components (412-01A Climate Control, Description and Operation).

Audio Amplifier Module



Item	Part Number	Description
A	-	8 Speaker Audio System and Meridian Surround System audio amplifier module
B	-	Meridian Signature Reference System audio amplifier module
1	-	Connector - Power and ground
2	-	Connector - Speakers
3	-	Connector - Speakers (not used in Meridian Surround System)
4	-	Connector - Power from RJB, microphones input (not used in 8 Speaker Audio System or Meridian Surround System)
5	-	Connector - headphone transmitter
6	-	Connector - MOST
7	-	Connector - Speaker (Meridian Signature Reference system only)

The audio amplifier module is located below the left front seat. The audio amplifier module is attached to 2 brackets which are secured to 4 studs the vehicle floor pan and secured with flanged nuts.

The system has 3 audio amplifier module options depending on the audio system fitted:

- 256W - 8 Speaker Audio
- 880W - Meridian Surround system
- 1700W - Meridian Signature Reference system.

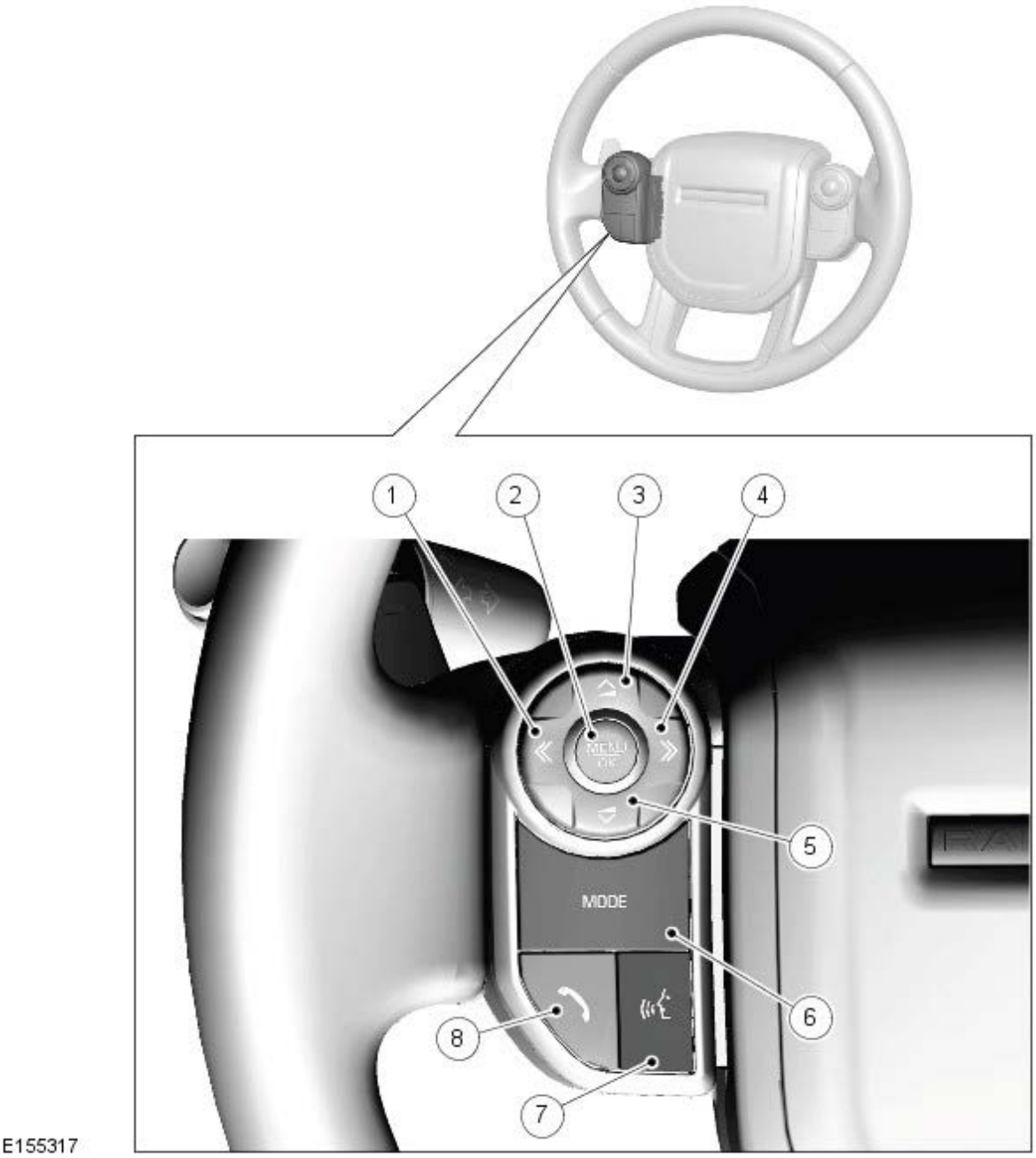
The audio amplifier module is connected to the other audio system components on the MOST ring. The amplifier module processes incoming audio signals from other system modules on the MOST ring. Hardwired connectors provide outputs for the vehicle speakers, output to the headphone transmitter and power and ground. Power supplies are received from the RJB (Rear Junction Box).

In conjunction with the 23 speakers, the AUD3-24 channel Meridian Signature Reference system audio amplifier module produces 1700W output and features Meridian Trifield, Meridian Trifield 3D, Dolby Pro Logic IIx, Dolby Pro Logic IIz, and DTS Neo:X surround sound.

Dynamic Equalization (EQ) - Meridian Signature Reference System Only

Four dynamic EQ microphones, located in the headliner, are used for Dynamic EQ. The system uses the four microphones to measure noise within the vehicle (for example, wind or road noise). This information is processed by the audio amplifier module, which calculates which frequencies being played need to be compensated due to the noise. The audio amplifier module then adjusts the volume, bass and treble outputs to counter the noise inside the vehicle.

Left Steering Wheel Switchpack (Audio)



Item	Part Number	Description
1	-	Seek, previous radio preset, previous track, scroll down telephone list
2	-	Menu/OK button (instrument cluster menu control)
3	-	Volume increase
4	-	Seek, next radio preset, next track, scroll up telephone list
5	-	Volume decrease
6	-	Mode button
7	-	Voice button
8	-	Telephone answer/end call button

The left steering wheel switchpack is located on the left side of the steering wheel.

The switches are a resistive ladder type which apply a different voltage to the TS in response to different switches being pressed.

The left steering wheel switchpack 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.

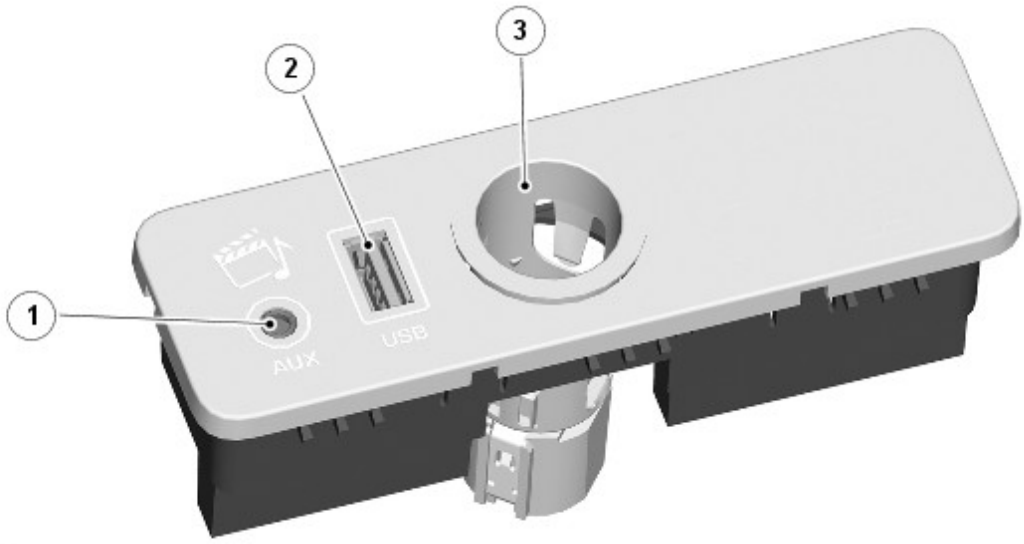
A further long press will scan forwards through the current waveband until the button is released
- » Long press up:
  - to auto seek up the frequency to the next radio station.
- « Long press down:
  - to auto seek down the frequency to the next radio station.
-
- Volume increase for any audio source
- Volume decrease for any audio source.

The MENU/OK button is for use with the instrument cluster menu.
For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

For further details on the telephone button refer to Cellular Phone.
For additional information, refer to: Cellular Phone (415-01 Information and Entertainment System, Description and Operation).

For further details on the voice button refer to Voice Control.
For additional information, refer to: Voice Control (415-01 Information and Entertainment System, Description and Operation).

Portable Audio Interface Panel



E142557

Item	Part Number	Description
1	-	3.5mm jack plug - MP3 connection
2	-	Universal Serial Bus (USB) connector
3	-	12V accessory connector

The portable audio interface panel is located in the floor console below the stowage compartment lid and is fitted to all audio systems. The interface is a media hub between a portable input device and the IAM. The interface contains two USB ports and a 3.5mm jack plug connector.

Devices that can be connected to the portable audio interface panel 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 TS to select that device input. Depending on the device connected, many of the audio controls on the TS and steering wheel switches can be used.

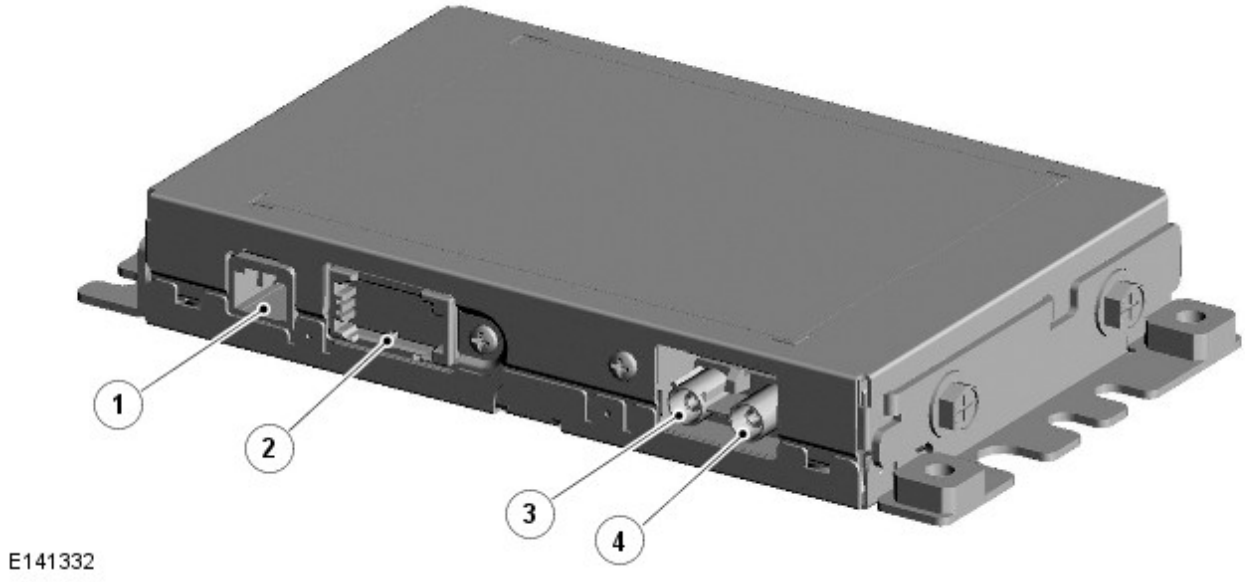
NOTE: It is recommended to disconnect an iPod when leaving the vehicle. Failure to do so may result in the iPod battery discharging.

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.

Digital Radio Control Module



Item	Part Number	Description
1	-	Connector - power and ground
2	-	Connector - MOST
3	-	Connector - L Band antenna input
4	-	Connector - Band III antenna input

The digital radio control module is located on the floor of the luggage compartment, on the left side. The module has mounting brackets that are located on studs and secured with flanged nuts.

Digital Radio is designed to provide reliable, multi-service broadcasting for reception by mobile, portable and fixed tuners.

Digital radio 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). The digital radio control module selects the strongest radio transmitter, minimizing signal loss.

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 digital 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.

Digital radio is broadcast in 3 formats on a compatible network structure. The digital radio control module is capable of processing all digital formats and is therefore not market specific. The 3 formats are:

- Digital Audio Broadcasting (DAB) - MP3 coding
- Digital Audio Broadcasting + (DAB+) - MP3 and MP4 coding
- Digital Multimedia Broadcasting (DMB) - MP3 and MP 4 coding with video/multimedia.

Digital radio is currently broadcast across Europe, Canada, Australia and parts of Asia. System transmission is via a terrestrial network, on two separate broadcasting bands:

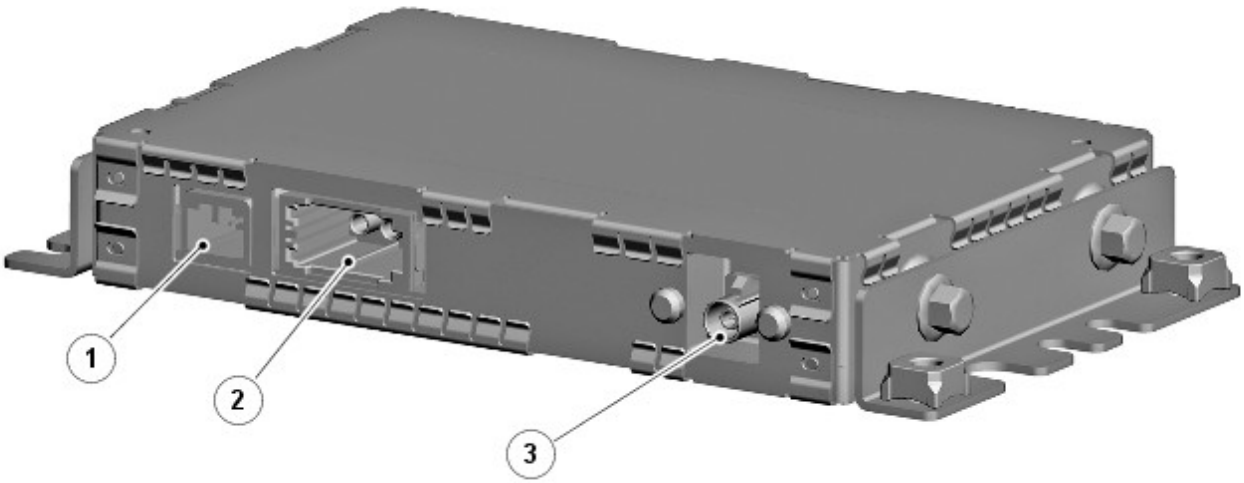
- Band-L - Received from roof pod antenna
- Band III - Received from spoiler mounted antenna.

Operation of the digital radio system is the same as the radio operation with selections made through the TS to access and navigate the system functions.

The digital radio control module is a dedicated tuner which is controlled by the TS on the MOST ring. The tuner processes the signals from the digital radio antennas. Information is transmitted on the MOST ring and processed by the IAM. The processed information is sent out to the audio amplifier module and broadcast through the speaker system.

No configuration procedure is required if the digital radio control module is replaced. Calibration of the module using Land Rover approved diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

Satellite Radio Control Module (NAS only)



E141333

Item	Part Number	Description
1	-	Connector - power and ground
2	-	Connector - MOST
3	-	Connector - satellite radio antenna input

The satellite radio control module is located on the floor of the luggage compartment, on the left side. The module has mounting brackets that are located on studs and secured with flanged nuts.

The Satellite radio control module is a dedicated tuner which is controlled by the IAM on the MOST ring. The tuner filters the signals from the satellite radio antenna located in the roof pod or sigma pod. Information is transmitted on the MOST ring and processed by the IAM. The processed information is sent out to the audio amplifier module and broadcast through the speaker system.

The digital radio format adopted for NAS vehicles is satellite radio operating in the S-Band frequency range (2.3 GHz). Satellite Digital Audio Radio Service (SDARS) service provider 'Sirius® XM' 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 satellite radio system in the vehicle. The satellite radio control module switches between the satellite signal and the repeater network signal depending on the strength of the signal at any given time.

The Sirius® satellite system comprises:

- Satellites
- Ground repeaters
- Up-link ground stations
- Radio receiver systems

The Sirius® satellite radio system uses three satellites on an inclined elliptical orbit. This ensures that each satellite spends approximately 16 hours a day over the continent of North America, 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. The satellite service comprises over 100 channels of digital entertainment which is provided by subscription requiring a monthly payment. In order to obtain a subscription, the satellite radio control module ID number will need to be retrieved from the module. This is achieved as follows:

- When the vehicle first receives live signal within the US or Canada, the TS will display ch184 as the tuned channel (labelled as Preview). The radio text will display Call 1888-539-Sirius. Alternatively, when the radio is subscribed, unsubscribe channels shall also display this information in the radio text
- The ESN/SID can always be found the following way, regardless of the subscription status of the radio. Press **Settings** on the TS, then select **Sirius ID** icon in the settings view. This will display the ESN/SID and the phone number. If a telephone 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 TS 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 satellite radio function is accessed by pressing the **SAT 1/2/3 +** soft key. This allows the user access to another bank of possible favourites, with the option to store 6 favourites on each of SAT 1, SAT 2 and SAT 3.

Operation of the satellite radio system is the same as the radio operations with selections made through the TS to access and navigate the system functions.

No configuration procedure is required if the satellite radio control module is replaced. Calibration of the satellite radio control module using approved Land Rover diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

HD Radio™ (NAS only)

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.

Antennas

AM, FM. digital radio, satellite radio, TV and other system antennas are located in the rear spoiler, roof pod and side windows. Refer to the Antennas section.
For additional information, refer to: Antenna (415-01 Information and Entertainment System, Description and Operation).

Speakers

The number, location and specification of the speakers in the vehicle differs depending on the level of audio system fitted.

For further details of the speaker systems, refer to the Speakers section.
For additional information, refer to: Speakers (415-01 Information and Entertainment System, Description and Operation).

Advanced Voice Control System

The advanced voice system provides the driver with the option of voice control for a range of supported functions. The following systems include Voice functionality:

- Radio, satellite radio and Digital Radio (if fitted)
- CD player
- Hard disk drive/virtual CD player
- USB and auxiliary connections
- Navigation system
- Bluetooth® Telephone system
- Vehicle notepad.

For further details of the advanced voice control system refer to the Voice Control section.
For additional information, refer to: Voice Control (415-01 Information and Entertainment System, Description and Operation).

OPERATION

Media Oriented Systems Transport (MOST)

The components of the audio/infotainment systems are all connected on the Media Oriented Systems Transport (MOST) ring. The MOST ring is a fiber 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 (TS) 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 fiber 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 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
- TS
- Digital Radio Control Module (DRCM) (if fitted)
- Satellite Radio Control Module (SRCM) (NAS only)
- Audio Amplifier Module (AAM)
- Navigation computer (Japan only)
- Rear Seat Entertainment (RSE) control module
- TV tuner (if fitted)
- Instrument Cluster (IC).

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 TS. This TS 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 TS which can be retrieved using approved Land Rover diagnostic equipment.

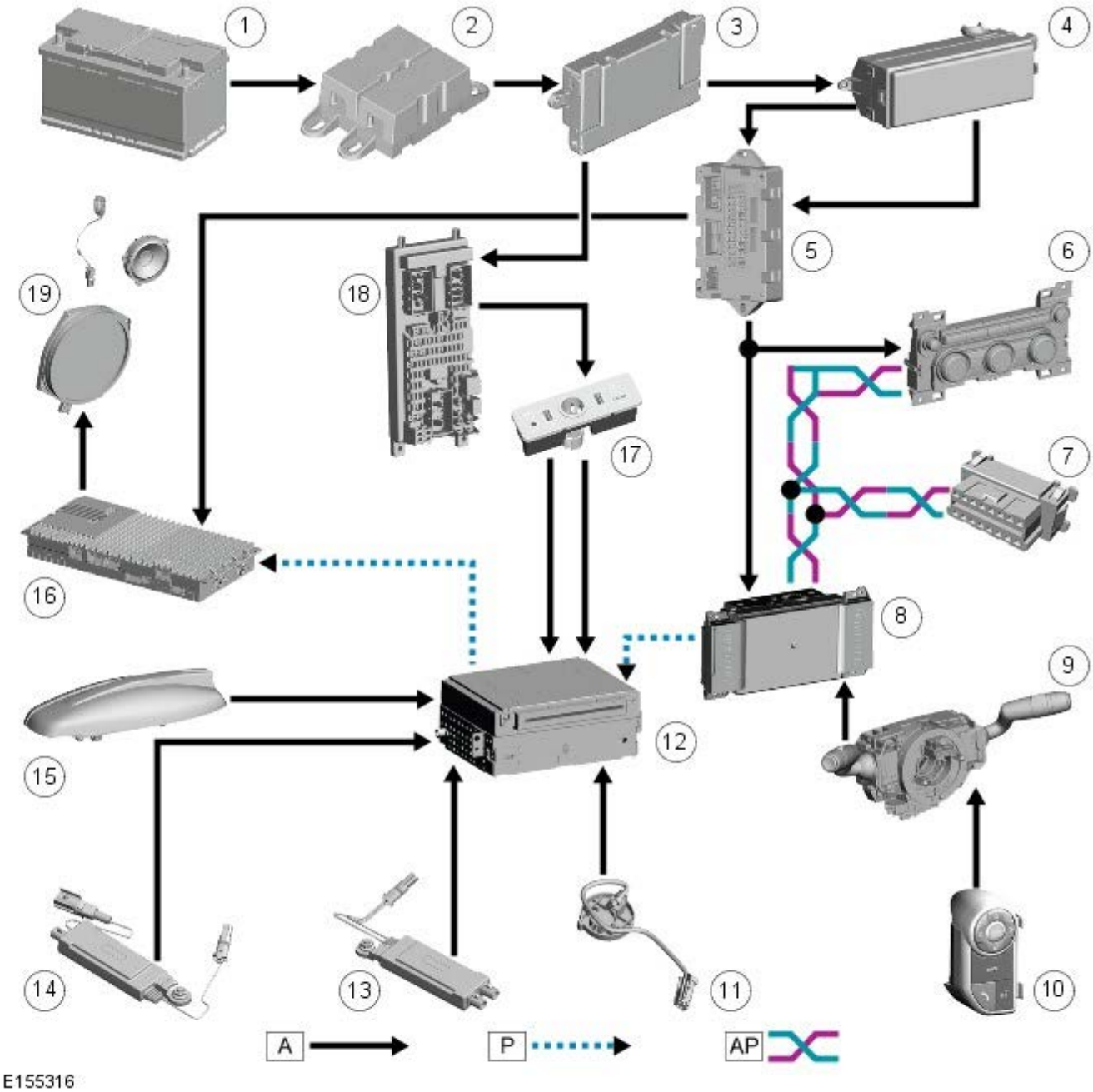
The MOST connection to the instrument cluster allows audio, navigation, telephone and voice control information to be displayed in the instrument cluster TFT display.
For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

Audio System Gateway Functions

The TS is the gateway between medium speed CAN Comfort bus and the MOST systems. A typical example of information transfer is vehicle speed information from the ABS (Anti-lock Brake System) control module used to control the dynamic equalization function (where fitted). The vehicle speed information from the ABS control module is sent on the high speed CAN Chassis bus and collected by the Gateway Module (GWM). The signal is passed to the medium speed CAN Comfort bus to the TS. The TS passes the information on the MOST to audio amplifier module which also uses the inputs from the microphones to calculate the volume adjustment required. The calculations are performed by the audio amplifier module which adjusts the output to the speaker system.

Control Diagram - Audio System

NOTE: A = Hardwired, P = MOST connection, AP = Medium speed CAN (Controller Area Network) Comfort bus.

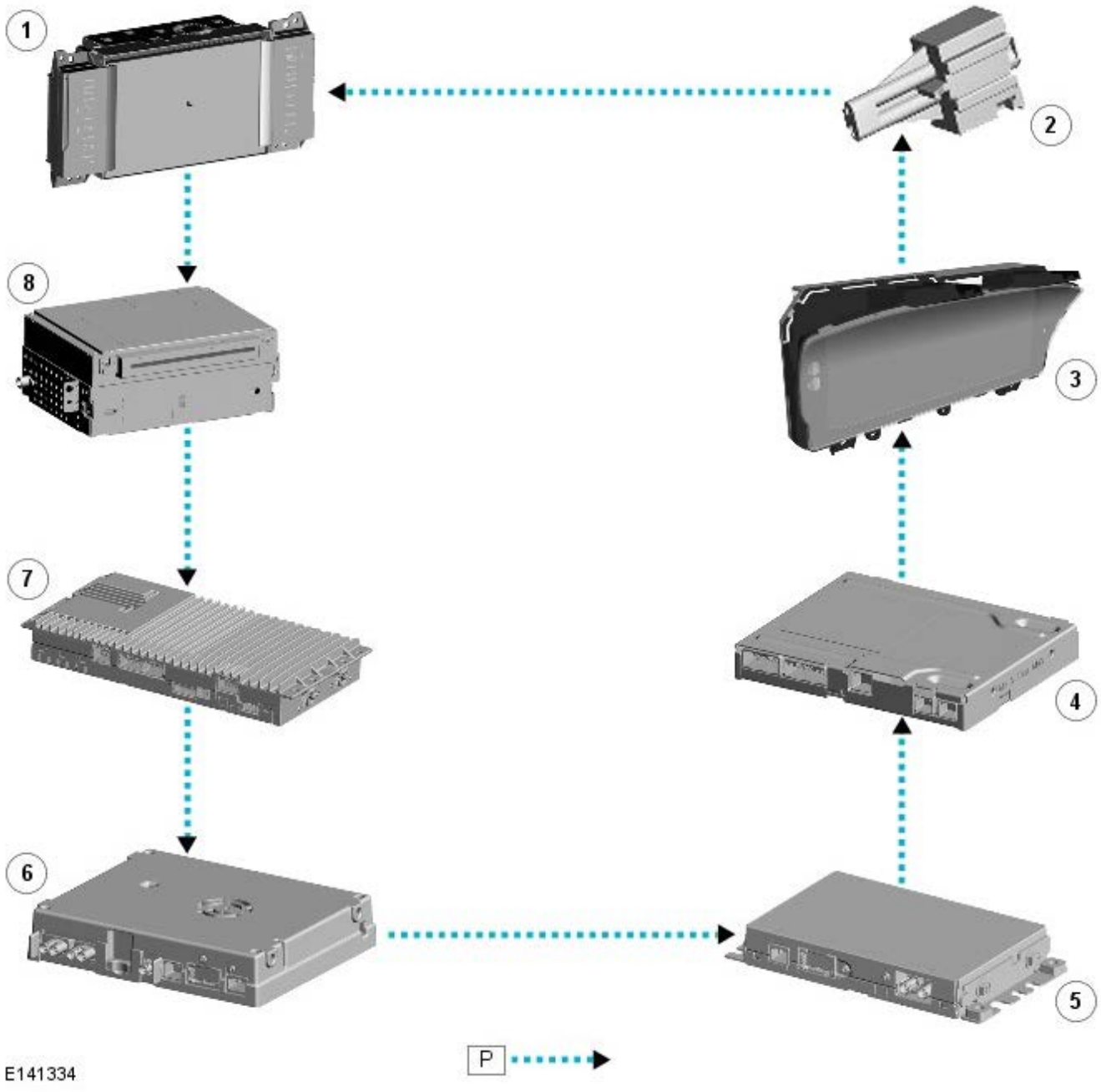


E155316

Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)

3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)
5	-	Quiescent Current Control Module (QCCM)
6	-	Integrated Control Panel (ICP)
7	-	Diagnostic connector
8	-	Touch Screen (TS)
9	-	Clockspring
10	-	Left steering wheel audio switches
11	-	Microphone (Voice system)
12	-	Integrated Audio Module (IAM)
13	-	FM2 / Digital Radio / TMC / VICS (Japan only) antenna amplifier
14	-	AM / FM antenna amplifier
15	-	Roof pod / (GPS antenna Ref only)
16	-	Audio Amplifier Module (AAM)
17	-	Portable audio interface panel
18	-	Central Junction Box (CJB)
19	-	Vehicle speaker system

Control Diagram - MOST



P = MOST;

Item	Part Number	Description
1	-	Touch Screen (TS)

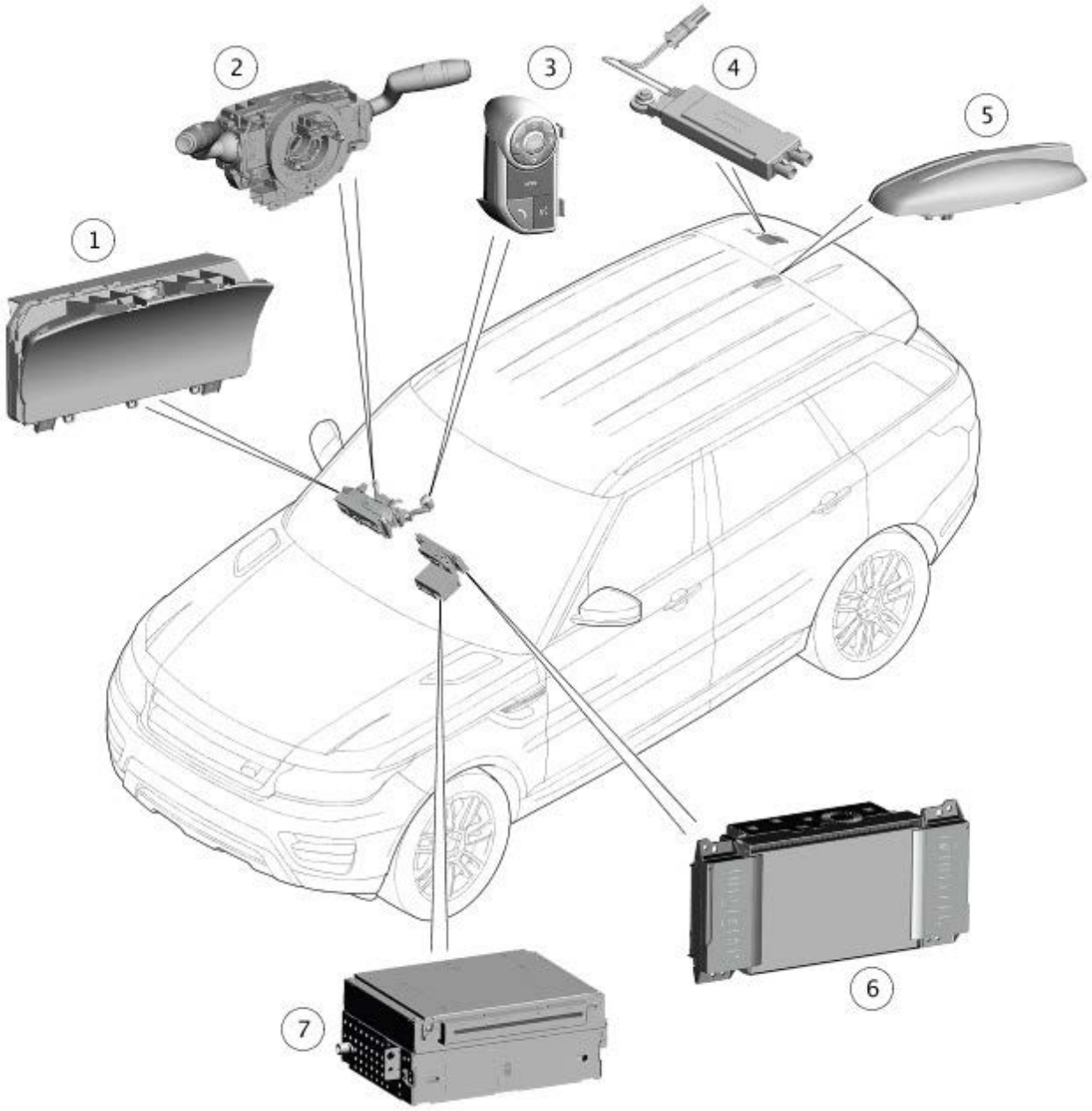
2	-	MOST diagnostic connector
3	-	Instrument cluster
4	-	Rear Seat Entertainment (RSE) control module
5	-	Digital radio control module (ROW) / Satellite radio control module (NAS)
6	-	TV control module
7	-	Audio amplifier module
8	-	Integrated Audio Module (IAM)

Published: 22-May-2013

Information and Entertainment System - Navigation System

Description and Operation

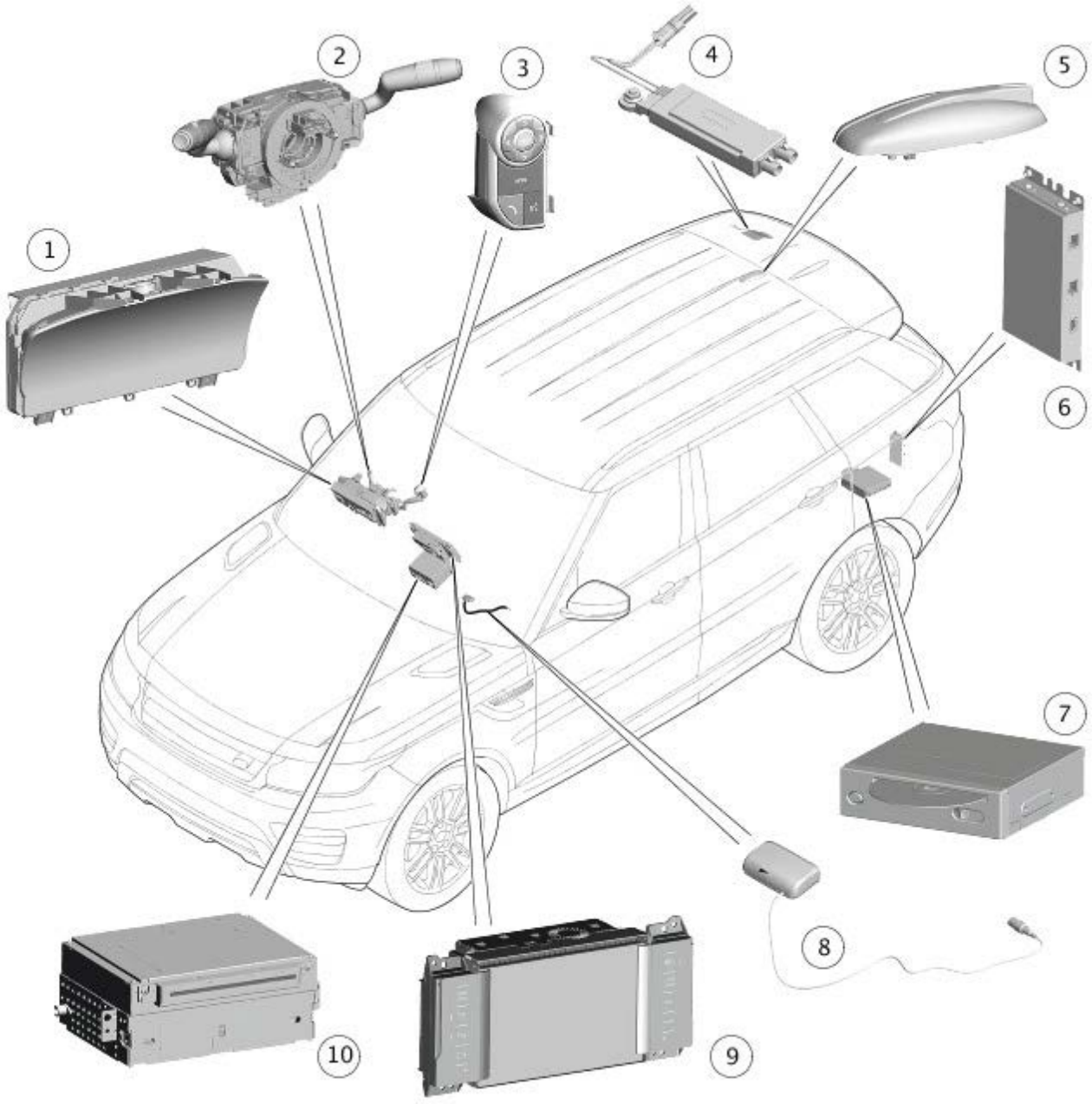
COMPONENT LOCATION - ROW



E155572

Item	Part Number	Description
1	-	Instrument Cluster (IC)
2	-	Clockspring
3	-	Left steering wheel switchpack
4	-	Antenna amplifier FM2/digital radio/TMC
5	-	Roof pod
6	-	Touch Screen (TS)
7	-	Integrated Audio Module (IAM)

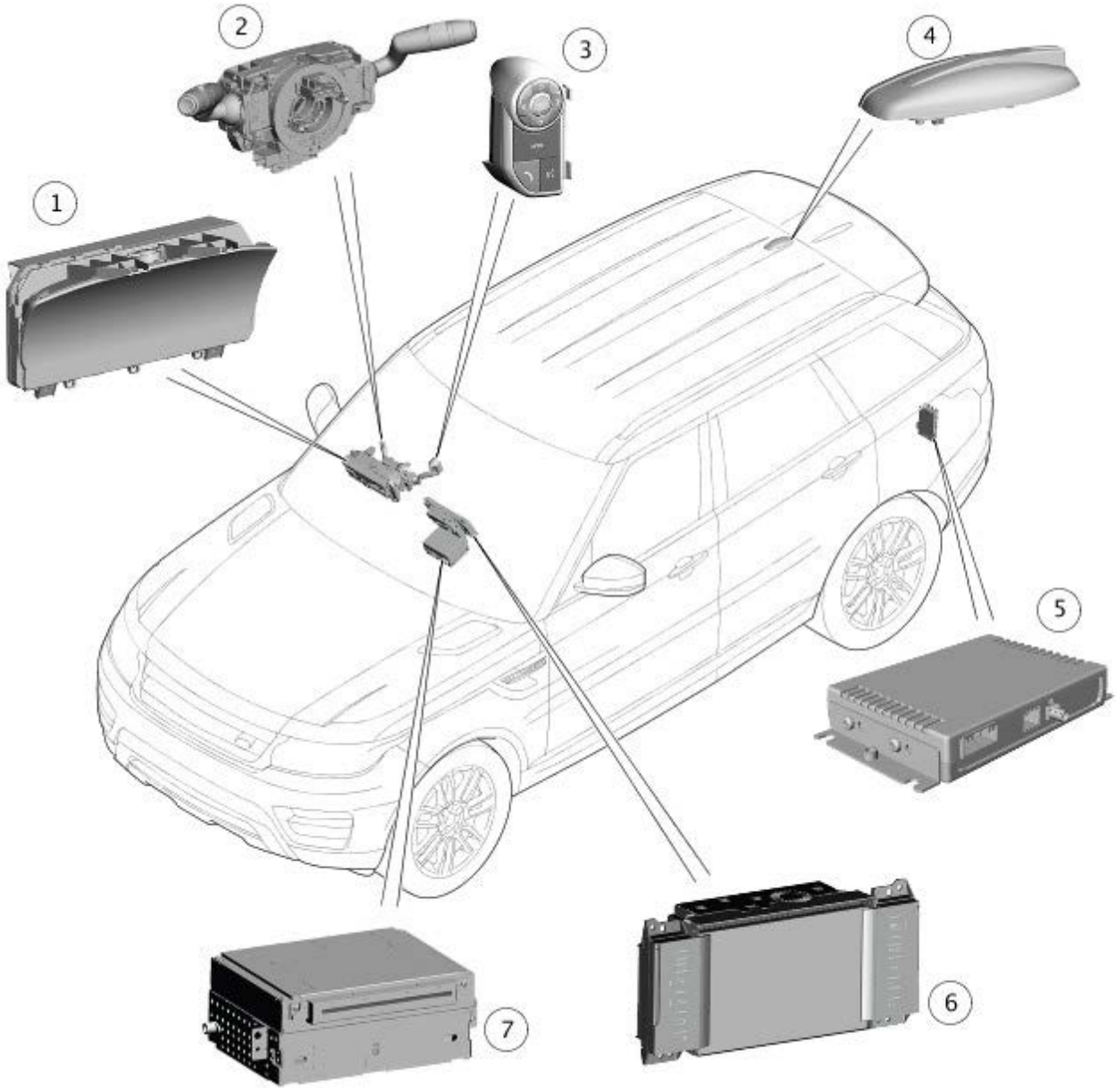
COMPONENT LOCATION - JAPAN



E155571

Item	Part Number	Description
1	-	Instrument Cluster (IC)
2	-	Clockspring
3	-	Left steering wheel switchpack
4	-	Antenna amplifier - FM2/Digital Radio/VICS
5	-	Roof pod
6	-	Navigation Interface Module (NIM)
7	-	Navigation Control Module (NCM)
8	-	VICS beacon antenna
9	-	Touch Screen (TS)
10	-	Integrated Audio Module (IAM)

COMPONENT LOCATION - ASIA



E155570

Item	Part Number	Description
1	-	Instrument cluster
2	-	Clockspring
3	-	Left steering wheel switchpack
4	-	Roof pod
5	-	Navigation Control Module (NCM)
6	-	Touch Screen (TS)
7	-	Integrated Audio Module (IAM)

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. The system provides the driver with the option of on-road and off-road navigation.

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 HDD (Hard Disc 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 TS (Touch Screen) and the Land Rover Voice system. System volume adjustment can be made using the ICP (Integrated Control Panel), TS and left steering wheel switchpack.

There are a number of navigation system variants specific to various markets. On all systems the GPS (Global Positioning System) signal is received by the GPS antenna located 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 integrated into the rear spoiler. 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 TS which is located in the center of the instrument panel. Control signals from the TS are sent on the MOST (Media Oriented System Transport) ring to the navigation software within the IAM. The IAM uses a dedicated GVIF (Gigabit Video InterFace) bus to transmit video signals to the TS.

The navigation system uses the following components:

- Integrated Audio Module (IAM)
- Single or Dual-view Touch Screen (TS)
- Roof pod GPS (Global Positioning System) antenna
- Instrument Cluster (IC).

The dual-view TS allows the front seat passenger to view television and video images when the car is being driven. The dual-view screen allows the driver to see the navigation or other system screens but not the TV or video when the vehicle is moving. The screen can be switched between single and dual view using a button on the TS.

NOTE: Due to legislation, the NAS markets do not receive this dual-view option.

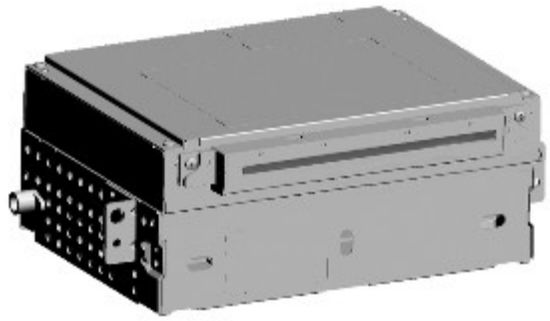
Japanese market vehicles have a modified system from other markets. These vehicles have an additional NCM (Navigation Control Module) and a NIM (Navigation Interface Module) located in the luggage compartment.

The Japanese navigation system includes the VICS (Vehicle Information and Communication System) function. The VICS supplies information to enable the NCM to re-route the navigation guidance or to inform the vehicle driver of traffic conditions in the vehicles vicinity. VICS information is provided to the system through an FM antenna integrated into the rear spoiler and a VICS beacon located on the left side of the instrument panel.

Asia markets have a unique system which is fitted to the vehicle by the dealer or port of entry. These vehicles have a separate navigation computer module located in the luggage compartment.

DESCRIPTION - ROW

Integrated Audio Module (IAM)



E141841

NOTE: The Japan/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 'Description - Japan' or 'Description - Asia' for details of the Japan/Asia navigation system.

The IAM is located in a central position in the instrument panel, behind the ICP (Integrated Control Panel).

Three levels of IAM are available; IAM 1, IAM 2 and IAM3. Only the IAM 3 module supports navigation.

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 TS (Touch Screen), left steering wheel switchpack or by voice commands.

A 40 GB hard drive is used for storing the information for satellite navigation and music files. A 10GB partition is provided for storing music files, the remaining 30GB is used for map data storage.

The integral hard drive for the navigation system removes the requirement of a separate navigation computer module usually found in the rear luggage compartment. 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 now have to be loaded directly into the IAM from a DVD or USB memory device.

The map images are transmitted from the IAM to the TS via a LVDS (Low Voltage Differential Signal) link cable. Turn by turn instructions are also available, these are displayed in the IC (Instrument Cluster) via a medium speed CAN (Controller Area Network) Comfort bus link between the IC and TS.

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 Land Rover diagnostic system.

Calibration of the IAM using an approved Land Rover diagnostic system enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

For further details on IAM functionality refer to the Audio system.
For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).

Touch Screen (TS)



E141842

The TS is located in the center of the instrument panel. The TS comprises an 8 inch color, touch sensitive display, with two separate touch sensitive TS switchpacks located on either side.

Two versions of the TS are available; single view and dual view. Additionally TS switchpacks differ depending on system specification; for example, if Park Assist, navigation, dual view or rear view camera is specified on the vehicle, these soft keys will replace Setup, Audio Settings, Mode and display on/off respectively. The functions can still be accessed via the home menu using the touch screen on the TS.

The TS is the Bus Master for the MOST system and contains the timing master for the MOST system.

The TS is the primary user interface 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. No configuration procedure is required if the TS or TS switchpacks are replaced.

The TS switchpacks comprise a number of touch sensitive soft keys. The soft keys are not visible when the system is powered down. When the system is active the soft keys are illuminated. When a soft key is pressed, a line above and below the soft key is illuminated to indicate the press has been accepted.

The driver's view is event driven, for example. if reverse gear is selected the rear view camera is displayed automatically, overriding the displayed navigation or other information.

For further details on TS functionality refer to the Audio system.
For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).

Roof Pod



E141520

The navigation GPS antenna is located in the roof pod. Depending on vehicle specification the roof pod can contain a GPS, digital radio or satellite radio antennas.

The roof pod is fitted externally on the roof panel and is attached to the roof panel with two flanged nuts which screw onto captive studs in the roof pod. Two co-axial connectors provide for the connection for the GPS antenna and the satellite or digital radio antenna.

Traffic Message Channel (TMC) Antenna

Data messages for TMC are received through the FM antenna and antenna amplifier located in the rear spoiler. The antenna is also used by the IAM for reception of FM2 and Digital Radio transmissions.

For further details on the antenna systems refer to the Antenna system.

For additional information, refer to: Antenna (415-01 Information and Entertainment System, Description and Operation).

Advanced Voice Control System

NOTE: Voice control of the navigation system is not available in Japan or Asia markets.

The advanced voice system provides the driver with the option of voice control for a range of supported functions. The following systems include Voice functionality:

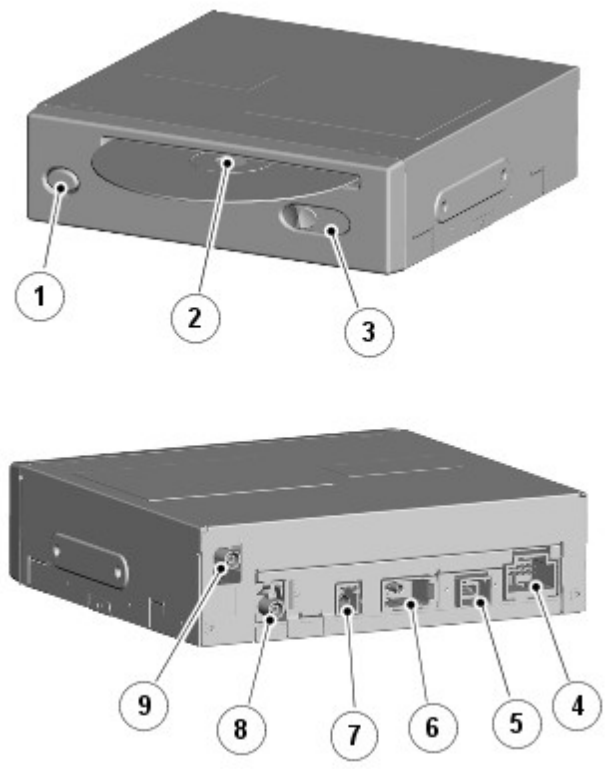
- Radio, satellite radio and Digital Radio (if fitted)
- CD player
- Hard disk drive/virtual CD player
- USB and auxiliary connections
- Navigation system
- Bluetooth® Telephone system
- Vehicle notepad.

For further details of the advanced voice control system refer to the Voice Control section.
For additional information, refer to: Voice Control (415-01 Information and Entertainment System, Description and Operation).

DESCRIPTION - JAPAN

The Japan satellite navigation system uses a separate navigation control module with map data supported by an DVD disk. Additional components are: a NCM (Navigation Control Module) and a NIM (Navigation Interface Module).

Navigation Control Module (NCM)



E142023

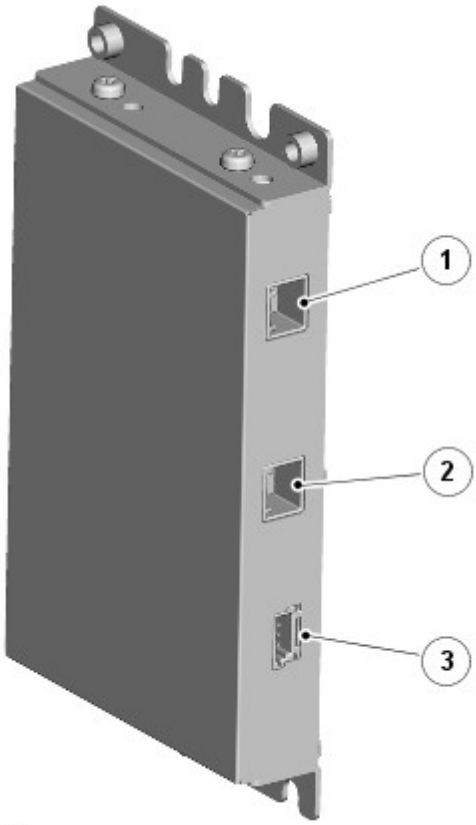
Item	Part Number	Description
1	-	DVD eject button
2	-	DVD loading slot
3	-	DVD eject lock
4	-	Power and ground connections
5	-	GVIF video output connector to Navigation Interface Module (NIM)
6	-	MOST connector
7	-	VICS beacon antenna connector
8	-	GPS (global positioning system) antenna connector
9	-	VICS FM antenna connector

A NCM (Navigation Control Module) is located in the left rear of the luggage compartment, The module is located on a bracket secured to the luggage compartment floor and is accessible via an opening in the spare wheel well carpet.

The NCM is a DVD drive which reads map data direct from a DVD. The NCM is connected on the MOST ring and communicates with the TS to initiate navigation video and audio output. The GPS antenna is connected directly to the NCM.

The NCM outputs the video signals in a GVIF (Gigabyte Video InterFace) format to a NIM (Navigation Interface Module) which converts the GVIF input to a LVDS (Low-Voltage Differential Signalling) video signal output which is then passed to the TS. Audio output is on the MOST ring to the AAM (Audio Amplifier Module). VICS (Vehicle Information and Communication System) transmission signals are received by the NCM via an FM antenna and a VICS antenna amplifier. Infrared and RF microwave VICS transmissions are also received by the VICS beacon antenna, located on the top of the instrument panel, and are passed to the NCM.

Navigation Interface Module (NIM)



E142024

Item	Part Number	Description
1	-	Power, ground and 5V signal voltage from TS connector
2	-	LVDS video output to TS connector
3	-	GVIF video input from Navigation Control Module (NCM) connector

A NIM (Navigation Interface Module) is located in the left rear of the luggage compartment, attached to a bracket shared with the TV control module.

The NIM is required to convert the GVIF video output to LVDS video signal which is compatible with the TS.

A 5V signal output from the TS is connected to the NIM. The signal voltage initiates a power up of the NIM when the TS is active.

Vehicle Information and Communication System (VICS)

The VICS is a similar system to the TMC used outside of Japan. VICS is a unique system to Japan and provides countrywide coverage and broadcasts of real-time traffic and weather information.

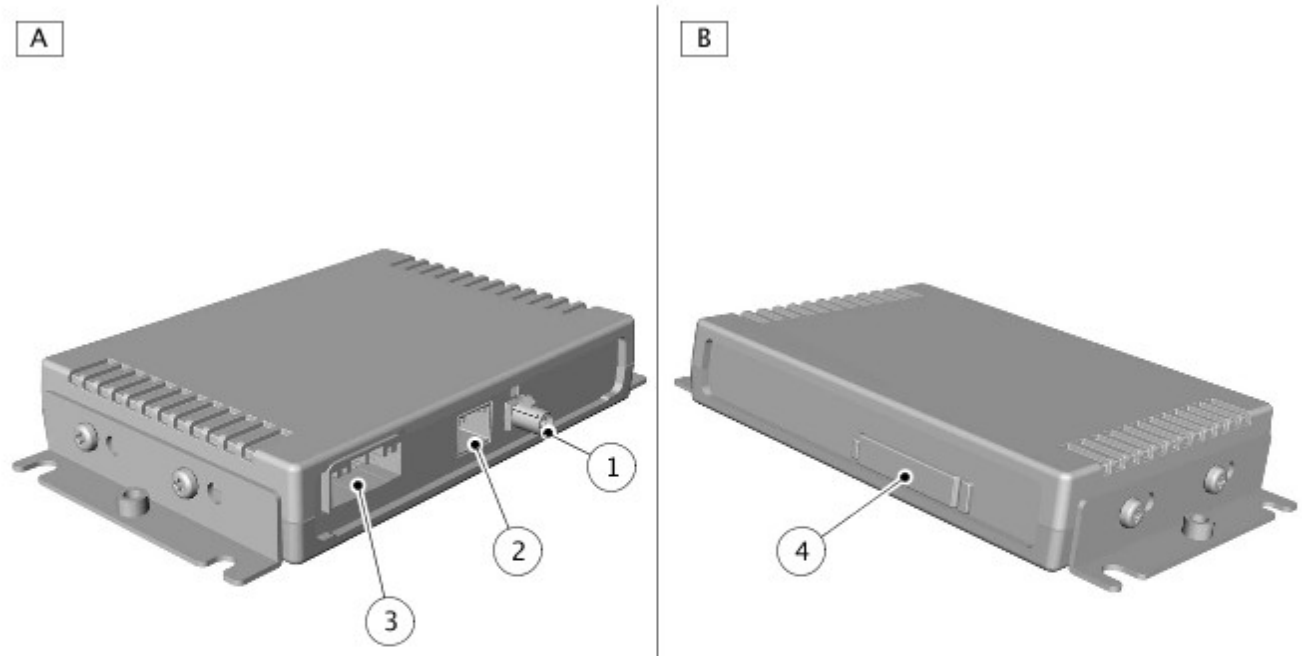
The VICS has three methods of transmitting the traffic data to the vehicle's navigation system: FM, microwave RF and infrared.

The microwave and infrared transmissions are both received by the VICS beacon antenna located on the instrument panel.

The same information is also transmitted on a FM wavelength and is received by the FM antenna located in the rear spoiler and uses the audio system antenna amplifiers to pass the signals to the NCM.

DESCRIPTION - ASIA

Navigation Control Module (NCM)



E155576

Item	Part Number	Description
A	-	Front view
B	-	Rear view
1	-	GPS antenna connector
2	-	LVDS video output to the Touch Screen (TS)
3	-	Power supply, CAN Comfort, and audio connector
4	-	Secure Digital (SD) storage card

In some Asia markets, a unique navigation computer module is fitted. In some cases this can be 'factory' fitted or fitted at PDI (Pre -Delivery Inspection) by the dealer or at Port of Entry (POE). The medium speed CAN Comfort based NCM (Navigation Control Module) is located in the left rear of the luggage compartment, attached to a bracket shared with the TV control module.

The NCM outputs the video signals in a LVDS format direct to the TS. Audio output is passed to the IAM which converts the signals and passes them to the AAM on the MOST ring. When Audio is required, such as a Voice guidance instruction, the Asia NCM communicates to the vehicle audio system using a hard wire connection between the TS and the Asia NCM. TS co-ordinates and vehicle power mode status is obtained through the medium speed CAN Comfort bus. Map data is stored via a multimedia SD (Secure Digital) card accessible through an access point on the module.

A 5V signal output from the TS is connected to the navigation control module. The signal voltage initiates a power up of the navigation control module when the TS is active.

OPERATION

The navigation system receives GPS information via the GPS antenna. 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 TS home menu.

Navigation is initiated by the driver inputting a destination. This can be achieved via the TS by:

- Entering an address
- 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 TS home menu and subsequent sub-menu selection sends a control request signal to the IAM for Rest Of World (ROW) markets, or NCM (Navigation Control Module) (Japan only) on MOST ring. In Asia markets the TS control request is passed to the NCM via the medium speed CAN Comfort bus. The requested control

information is processed by the IAM for ROW, or the NCM for Japan and Asia only.

On ROW vehicles, if voice guidance is operational, the voice signals are passed from the IAM to the AAM (Audio Amplifier Module) 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 NCM on the MOST to the AAM for output on the speaker system.

On Asia vehicles, if voice guidance is operational, the voice signal information is relayed from the NCM, via an analogue audio signal to the IAM. The IAM converts the analogue signals which are then passed to the AAM on the MOST ring for output on the speaker system.

The navigation audio output is through the front speakers whilst the background audio, for example radio or CD, is played at a reduced volume on the rear speakers. On Asia systems the radio or CD output is paused while navigation audio output is operating.

The GPS signal is available to the navigation system at all times when the vehicle ignition is switched on.

Navigation user voice commands are made using the Land Rover Advanced Voice system. The TS processes the analogue signal from the Voice switch on the left steering wheel switchpack. This is passed from the TS onto the MOST system to the Land Rover Advanced Voice control software which is integral with the IAM (ROW) or NCM (Japan). Voice control of the navigation system is not available on Asia specification vehicles.

The TS 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 TS 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 NCM (for processing). Navigation commands are handled internally within the NCM without the need for communicating with the TS for control.

Traffic data from the TMC or the VICS is processed by the IAM or NCM (Japan only), distributed to the TS with any supporting voice instruction relayed through the MOST ring to either the IAM or AAM, dependant on equipment level, for output on the speaker system.

Traffic Message Channel (TMC)

NOTE: TMC is not available in all markets.

The TMC is a specific application of the FM Radio Data System (RDS) or Radio Broadcast Data System (RBDS) (NAS only) used for broadcasting real-time traffic and weather information. Data messages are received and decoded by the IAM. The IAM processes the received information and alerts the driver and offers alternative route guidance to avoid the incident.

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. Those 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 located in the rear spoiler and the audio system antenna amplifiers to pass the signals to the IAM.

Vehicle Information and Communication System (VICS) - Japan Only

The VICS is a similar system to the TMC used outside of Japan. VICS is a unique system for Japan and provides countrywide coverage and broadcasts of real-time traffic and weather information. The VICS has three methods of transmitting the traffic data to the vehicle's navigation system: FM, microwave RF and infrared. The microwave and infrared transmissions are both received by the VICS beacon antenna. The same information is also transmitted on a FM wavelength and is received by the FM antenna located in the rear spoiler and uses the audio system antenna amplifiers to pass the signals to the NCM.

The VICS supplies information to enable the navigation computer module to re-route the navigation guidance or to inform the vehicle driver of traffic conditions in the vehicles vicinity.

The Radio Frequency (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.

Infrared 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
- Parking availability information.

The traffic data is split from the normal FM transmissions by the FM antenna amplifier module.

Off-Road Navigation

 NOTE: Off-Road Navigation is not available on Asia/Japan navigation systems.

Off-road navigation is selected pressing the 'NAV' hard key on the TS then select the Off-road nav icon.

Off-road navigation maps are similar to the on-road maps but have additional features and information, for example; a large compass display, heading, altitude, latitude and longitude.

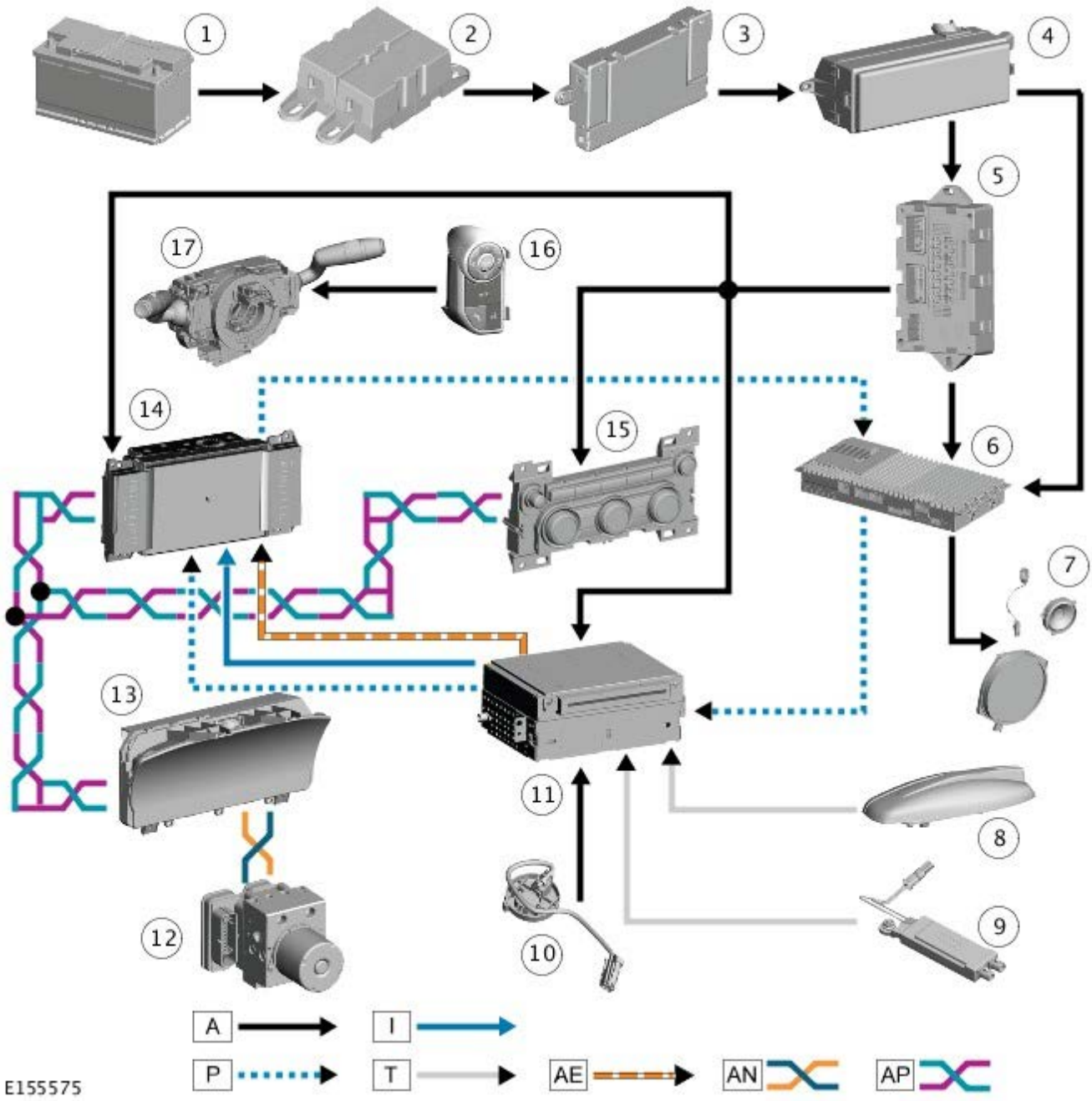
When switching to off-road navigation mode during on-road guidance, the current highlighted on-road route will be removed from the map and on-road guidance will be suspended. Way points and destination icons will remain displayed. The destination is marked with a double circle.

When exiting off-road guidance, the system recalculates the route and reverts to on-road guidance.

 NOTE: TMC/VICS is not available during off road navigation.

CONTROL DIAGRAM - ROW

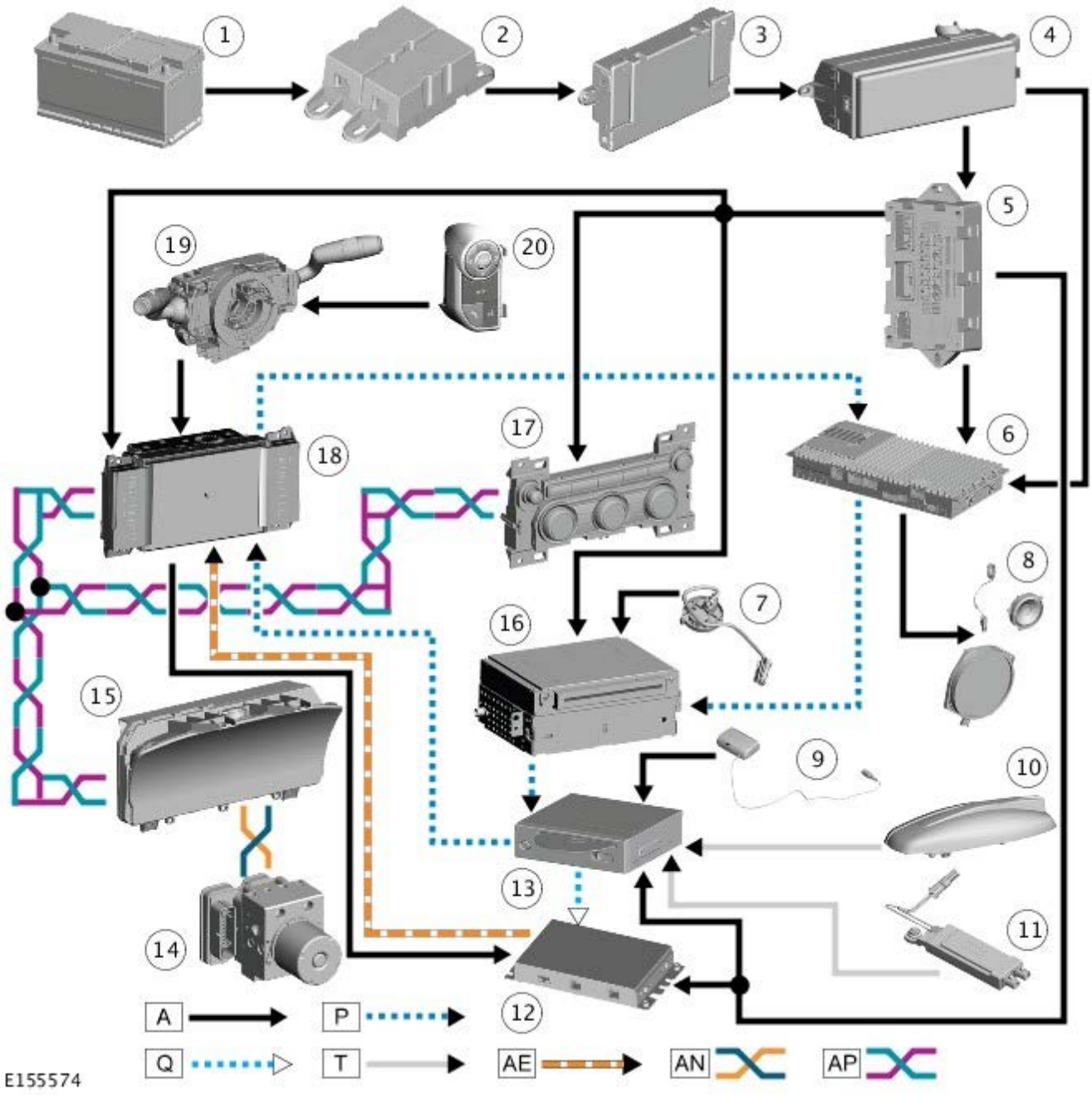
 NOTE: A= Hardwired, I = CVBS, P = MOST, T = Coaxial, AE = LVDS, AN = High speed CAN (Controller Area Network) Powertrain bus, AP = Medium speed CAN Comfort bus.



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)
3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)
5	-	Quiescent Current Control Module (QCCM)
6	-	Audio Amplifier Module (AAM)
7	-	Vehicle speakers
8	-	Roof pod
9	-	Antenna amplifier FM2/Digital Radio/TMC
10	-	Microphone
11	-	Integrated Audio Module (IAM)
12	-	Anti-lock Brake System (ABS) control module
13	-	Instrument Cluster (IC)
14	-	Touch Screen (TS)
15	-	Integrated Control Panel (ICP)
16	-	Left steering wheel switchpack
17	-	Clockspring

CONTROL DIAGRAM - JAPAN

NOTE: A = Hardwired, P = MOST, Q = GVIF, T = Coaxial, AE = LVDS, AN = High speed CAN (Controller Area Network) Powertrain bus, AP = Medium speed CAN Comfort bus.

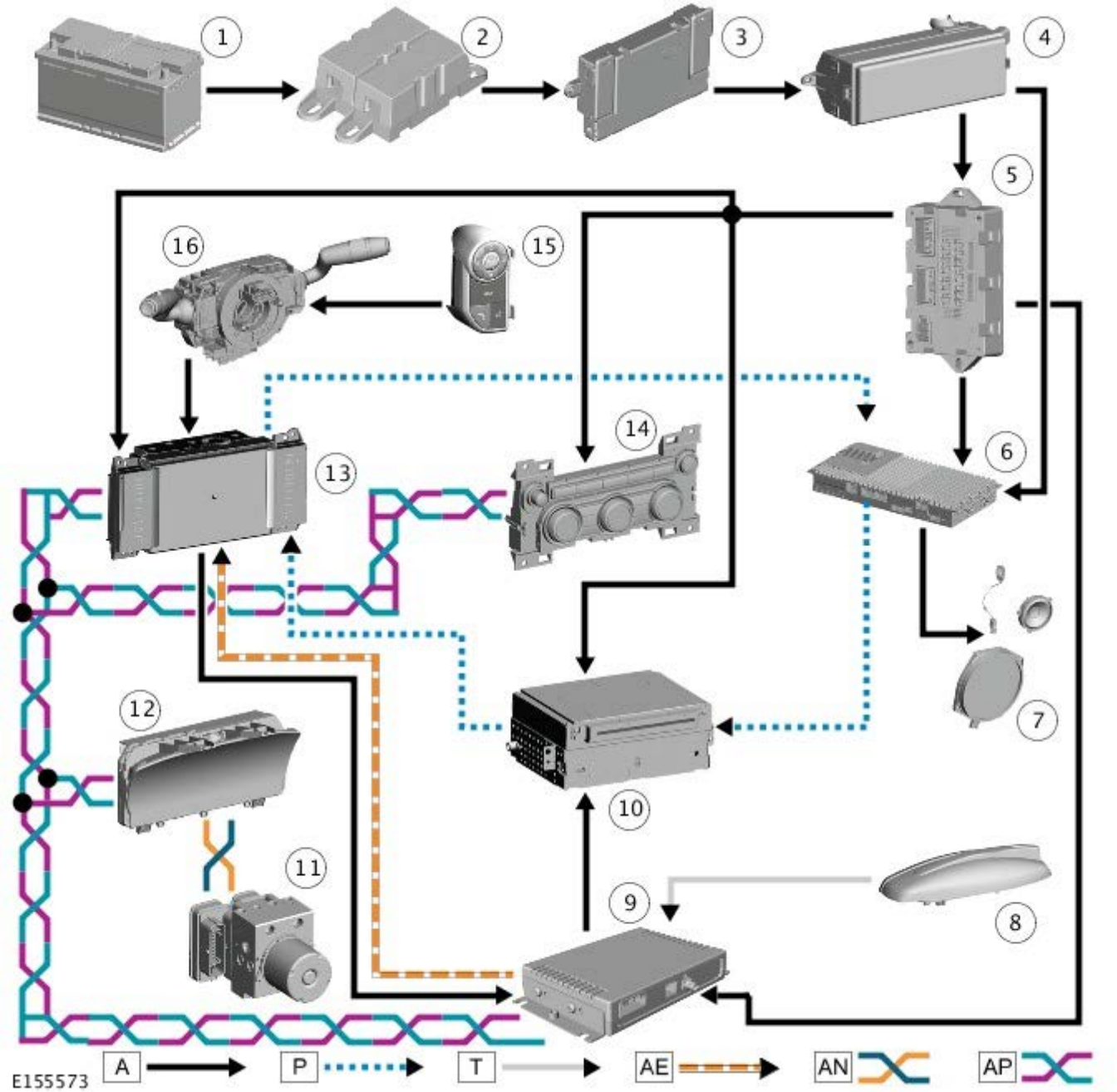


Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)
3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)
5	-	Quiescent Current Control Module (QCCM)
6	-	Audio Amplifier Module (AAM)
7	-	Microphone
8	-	Vehicle speakers
9	-	VICS beacon antenna
10	-	Roof pod
11	-	Antenna amplifier - FM2/Digital Radio/VICS
12	-	Navigation Interface Module (NIM)
13	-	Navigation Control Module (NCM)
14	-	Anti-lock Brake System (ABS) control module
15	-	Instrument Cluster (IC)
16	-	Integrated Audio Module (IAM)
17	-	Integrated Control Panel (ICP)

18	-	Touch Screen (TS)
19	-	Clockspring
20	-	Left steering wheel switchpack

CONTROL DIAGRAM - ASIA

NOTE: A = Hardwired, P = MOST, T = Coaxial, AE = LVDS, AN = High speed CAN (Controller Area Network) Powertrain bus, AP = Medium speed CAN Comfort bus.



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)
3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)
5	-	Quiescent Current Control Module (QCCM)
6	-	Audio Amplifier Module (AAM)
7	-	Vehicle speakers
8	-	Roof pod
9	-	Navigation Control Module (NCM)
10	-	Integrated Audio Module (IAM)
11	-	Anti-lock Brake System (ABS) control module
12	-	Instrument Cluster (IC)

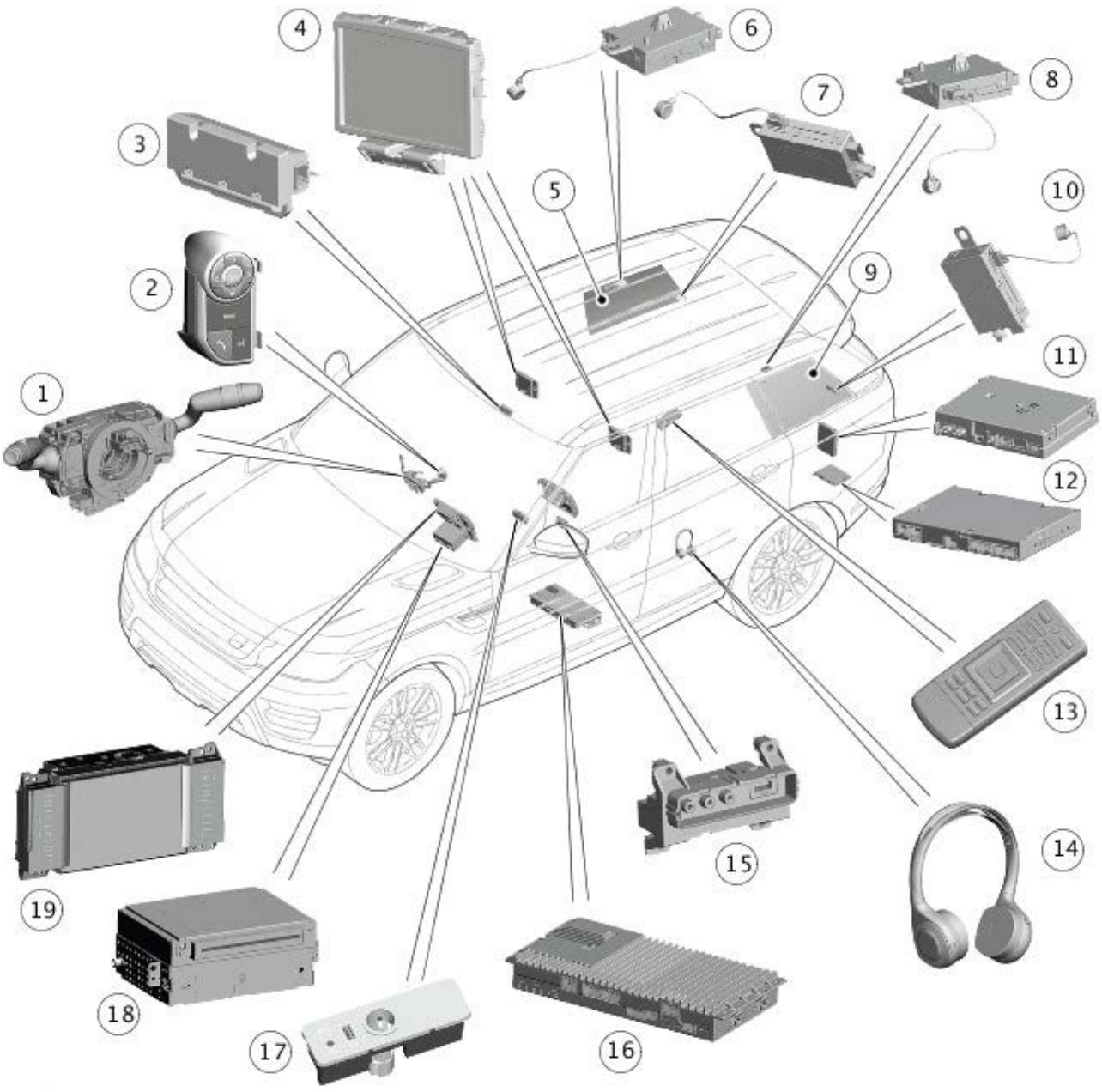
13	-	Touch Screen (TS)
14	-	Integrated Control Panel (ICP)
15	-	Left steering wheel switchpack
16	-	Clockspring

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Information and Entertainment System - Video System

Description and Operation

COMPONENT LOCATION - VIDEO SYSTEM



E155785

Item	Part Number	Description
1	-	Clockspring
2	-	Left steering wheel switchpack
3	-	Headphones transmitter
4	-	Rear Seat Entertainment (RSE) screen
5	-	Right rear quarter window TV antenna
6	-	Right upper Television (TV) antenna amplifier
7	-	Right lower TV antenna / Fuel Fired Booster Heater (FFBH) remote control antenna amplifier (when fitted)
8	-	Left upper TV antenna amplifier
9	-	Left rear quarter window TV antenna
10	-	Right lower TV antenna amplifier
11	-	TV Control Module (TVCM)
12	-	Rear Seat Entertainment Control Module (RSECM)
13	-	RSE remote control
14	-	Wireless headphones (up to 3 off)

15	-	Audio Visual Input/Output (AVIO) panel
16	-	Audio Amplifier Module (AAM)
17	-	Portable audio interface panel
18	-	Integrated Audio Module (IAM)
19	-	Touch Screen (TS)

OVERVIEW

The fiber optic, Media Orientated System Transport (MOST) based system provides video and audio entertainment for the front and rear seat occupants. The system allows rear seat occupants to view DVD (digital versatile disc) video and TV on two RSE screens, listen to audio output via the vehicle speakers or wireless headphones or display video images on the RSE screens from an external source, such as a video player or games console.

TV and DVD video images can also be displayed on the Touch Screen (TS) if the vehicle is below a predetermined speed threshold or has dual-view TS fitted (where market regulations allow).

The system comprises the following components:

- Rear Seat Entertainment Control Module (RSECM)
- TVCM
- Four TV Antennas
- Four TV Antenna amplifiers
- Two RSE screens
- RSE remote control
- Wireless headphones
- AVIO panel.

The RSE system also uses other components which form part of the audio system as follows:

- Touch Screen (TS)
  For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).
- Integrated Audio Module (IAM)
  For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).
- Audio Amplifier Module (AAM)
  For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).
- Headphones transmitter
- Vehicle speakers.
  For additional information, refer to: Speakers (415-01 Information and Entertainment System, Description and Operation).

DESCRIPTION

Touch Screen (TS)


E141842

The Touch Screen (TS) is located in the center of the instrument panel and is the driver control interface for the infotainment system. The TS comprises an 8 inch color, touch sensitive display, with two separate touch sensitive TS switchpacks located on either side. The TS is connected to the MOST ring and communicates with the other components in the audio/infotainment system.

The TS communicates with the RSECM and TVCM via MOST ring. Composite Video Baseband Signal (CVBS) is used to transmit video images from/to the RSECM and TVCM.

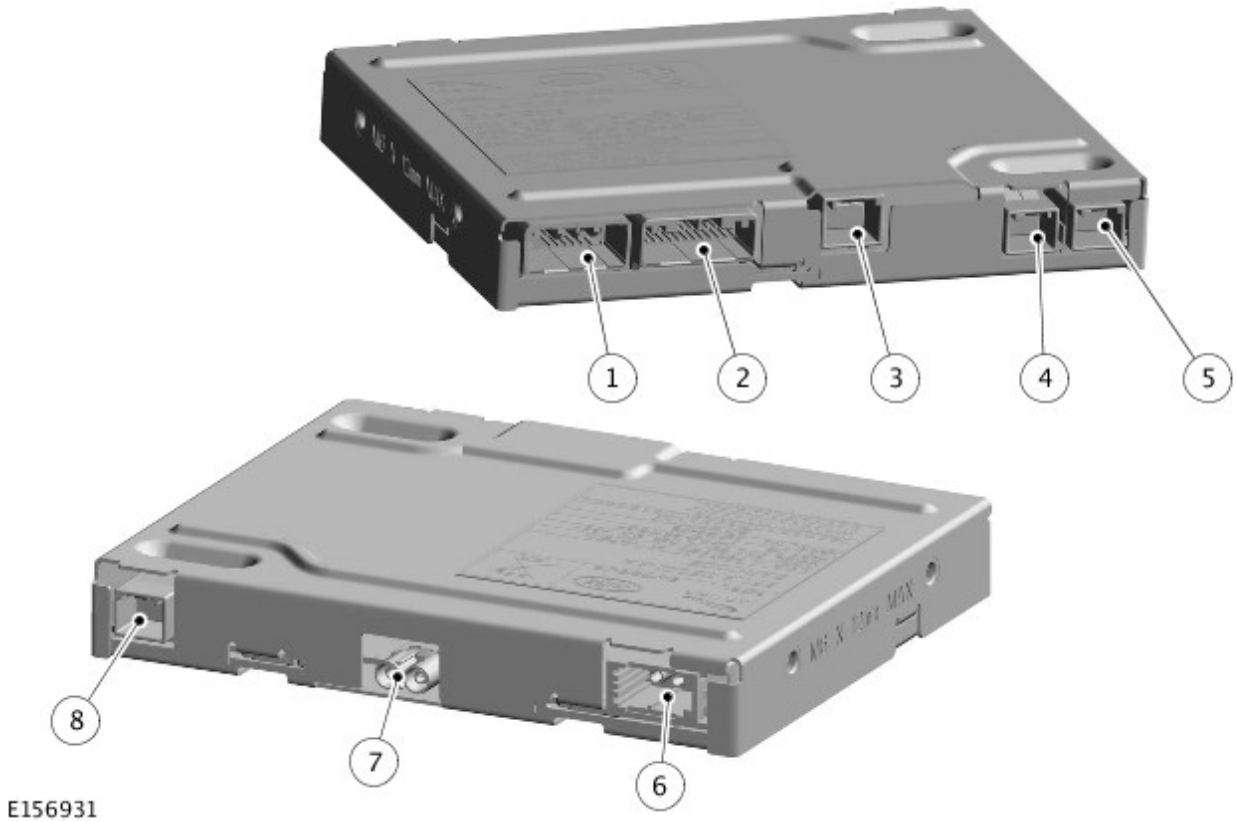
The TS also provides driver display and control of the audio system, telephone, the rear view camera, proximity cameras, and the navigation system.

Two versions of the TS are available; single view and dual view. Additionally, TS switchpacks differ depending on system specification; for example, if Park Assist, navigation, dual view or rear view camera is specified on the vehicle, these soft keys will replace Setup, Audio Settings, Mode and display on/off respectively. The functions can still be accessed via the home menu on the TS.

NOTE: Due to legislation, certain markets do not receive this dual-view option. A single view display is available in these markets.

For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).

Rear Seat Entertainment (RSE) Control Module



Item	Part Number	Description
1	-	Connector - 12V power supply to RSE screens, power supply from RJB and ground
2	-	Connector - AVIO panel audio/video input, private medium speed CAN to RSE screens
3	-	AVIO panel connector - USB input
4	-	LVDS connector - video output to right RSE screen
5	-	LVDS connector - video output to left RSE screen
6	-	Connector - MOST
7	-	CVBS connector - TV video output to Touch Screen (TS)/Video input from TS
8	-	LVDS connector - video input from TVCM

The Rear Seat Entertainment Control Module (RSECM) is located in the rear left side, on the floor of the luggage compartment, behind the trim panel. The RSECM is attached to 2 brackets which are secured to the floor pan with 2 bolts and the rear side quarter panel with a nut on a captive stud.

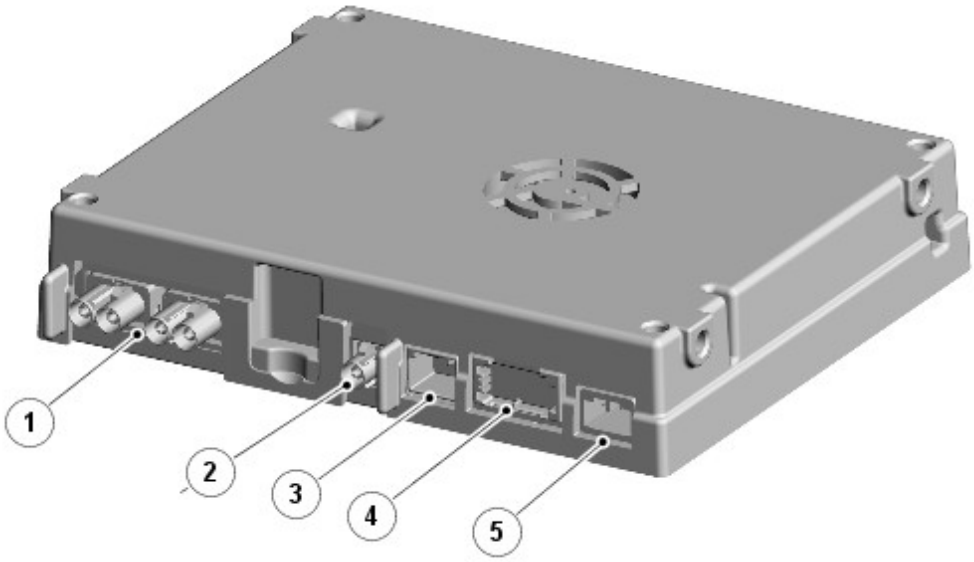
The RSECM receives video and audio inputs from the IAM, TVCM and AVIO panel and outputs TV video to the TS and RSE screens and audio to the Audio Amplifier Module (AAM).

The RSECM is connected directly to the following modules for the purpose of processing audio, video, input and output signals:

- TS - Connected via CVBS video - Processes DVD video from IAM to RSE screens
- AAM - Connected via MOST - Processes audio signals for output on vehicle speaker system or headphones
- TVCM - Connected via Low Voltage Differential Signaling (LVDS) - TV signals are processed and passed to TS and RSE screens
- Rear screens - Connected to RSE screens via LVDS and medium speed CAN (controller area network) - Processes wireless infra-red signals
- AVIO panel - Connected via audio/video/USB (universal serial bus) - Processes audio and video signals from remote source.

The RSECM receives a permanent power supply via a fused connected from the BJB (battery junction box) and the RJB (rear junction box).

Television (TV) Control Module



E141954

Item	Part Number	Description
1	-	Connectors - Antennas
2	-	CVBS connector - to Touch Screen (TS)
3	-	LVDS connector - to RSECM
4	-	Connector - MOST
5	-	Connector - power from Rear Junction Box (RJB) and ground

The TVCM is at the rear of the luggage compartment, in the spare wheel well. The TVCM is connected to the infotainment system using one harness connector, one LVDS connector (for RSE vehicles), one single FACRA connector for CVBS connection to the TS (non RSE vehicles), one MOST connector and two dual FACRA connectors for the antenna connections.

On vehicles with RSE, the video output is passed from the TVCM on LVDS to the RSECM and from the RSECM on CVBS to the TS. On a vehicle with RSE fitted the CVBS output from the TVCM is not used.

On vehicles without RSE, the video output is passed from the TVCM on CVBS to the TS. LVDS output is not used.

The front seat occupants can view the TV transmissions on the TS if the vehicle is stationary (market dependent). If the vehicle is fitted with a dual view TS then the front passenger can view the TV transmissions even when the vehicle is moving, but the driver will only be able to watch TV transmissions (or video) when stationary. This can vary depending on local market laws. When the RSE system is fitted, the TVCM allows the rear seat occupants to view television transmissions on the RSE screens.

Due to analogue transmissions Worldwide being switched off, Land Rover are introducing more TVCM's to support the numerous digital TV standards that are being implemented. To ensure that analogue and digital transmissions are received in all markets, three types of TVCM are available. The type of TVCM fitted is dependant on which digital standard is supported in different markets (if at all).

- Digital Hybrid TVCM - this TVCM supports digital DVB-T standard (MPEG2 only) and analogue TV transmissions. This TVCM is only fitted to markets that still have significant analogue broadcasts and minor digital coverage or to vehicles in markets that still have significant analogue broadcasts and where Land Rover do not currently have a TVCM that supports the digital TV standard in that market. This TVCM requires the use of a link lead that combines the power/ground and CVBS output into one connector that mates with the connectors on this type of module.
- DVB-T TVCM - this TVCM is digital only (no analogue tuner) and supports both MPEG2 and MPEG4 digital compression standards. This TVCM is fitted in any market that has significant DVB-T coverage (most of Europe and some of the rest of the World).
- ISDB-T TVCM - this TVCM is for the Japanese market only and receives ISDB-T digital broadcasts only (no analogue). This TVCM requires the use of a link lead that combines the power/ground and CVBS output into one connector that mates with the connectors on this type of module.

The TVCM is connected on the MOST ring which it uses to output its audio signals to the audio amplifier module. Video output from the TVCM is on an LVDS cable to the RSECM or a CVBS screened co-axial cable to the TS in vehicles without the RSE system. Four further connections provide for the signal input from four TV antenna amplifiers which are in turn attached to four antennas in the rear quarter windows.
For additional information, refer to: Antenna (415-01 Information and Entertainment System, Description and Operation).

The TVCM contains three or four internal tuners (depending on the TVCM fitted); all of the tuners are connected to the antennas. The tuners receive the audio and video signals. The tuner, or combination of tuners with the strongest signal, are automatically used to display the required TV channel.

One of the internal tuners is always 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.

In certain areas signal strengths will vary. When in an area of weak reception, a break-up in picture and sound quality, or a blank screen or frozen picture and audio muting may occur. Dependant on the type of TVCM fitted, it

may be of benefit to switch between analogue and digital TV stations.

The main advantage of digital TV reception is the improved picture quality. Four TV antennas are located in the rear quarter windows. In the event of a loss of digital reception, a 'loss of reception' message is displayed. The TV system also has a programme diversity function as well as antenna diversity that allows the current tuned programme to be maintained as the vehicle passes through regions with different transmitters broadcasting on different frequencies. This function is only occurs where the reception data for the presently tuned channel matches the data of the new signal.

The system offers a choice of aspect ratios, between 4:3, 16:9 and zoom. The zoom ratio will always try to fill the screen and avoid the black bars/squashed image. For digital signals the broadcaster will usually send the correct format for the transmitted programme and this will remove one of the incorrect formats from the screen (4:3 or 16:9). The "Zoom" option is always available and will always be selected as the default format. If the format is unknown (typical for analogue) then all three format options will be displayed. The TS offers picture quality using a resolution of 800x480 pixels for single view and 400x480 pixels for dual view.

TV CONTROL MODULE - JAPAN

Japanese market vehicles are fitted with a TVCM unique to that market. The control module 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 will be 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.

Television (TV) Antennas

TV antennas are located in the rear side windows. Refer to the Antennas section.

For additional information, refer to: Antenna (415-01 Information and Entertainment System, Description and Operation).

Wireless Headphones



Item	Part Number	Description
1	-	Headphones transmitter
2	-	Wireless headphones

The headphones transmitter is located in the roof headliner near the front overhead console assembly.

The headphones transmitter transmits audio output for reception by the wifeless headphones for the front and rear seat passengers. The headphone transmitter is connected to the audio amplifier module via a Low Voltage Differential Signal (LVDS) plug connector. Audio data is relayed to the headphone transmitter from the audio amplifier module

via the LVDS line. The audio amplifier module also supplies the power and ground for the headphones transmitter. The audio signal, is then passed on to the wireless headphones via a Whitefire® digital infra-red signal to any seating position within the interior of the vehicle. The digital signal means that each headphone user is able to listen to a different audio source.

NOTE: Providing an audio source is directed to the headphones transmitter, faint red lights can be seen behind the smoked glass cover of the transmitter. This can be useful for diagnosis to prove audio infra-red transmission is active.

The headphone system includes Dolby® headphone surround sound when listening to the DVD source.

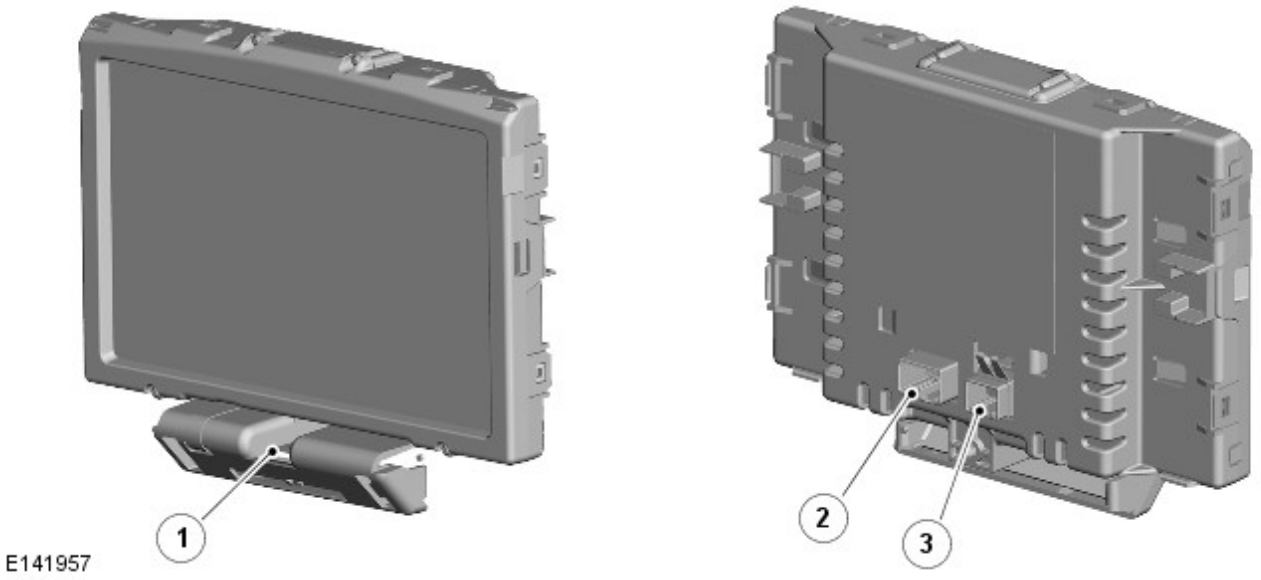
NOTE: There is no docking station to store the wireless headphones, therefore charging of the batteries is not supported via the vehicle electrical system.

The system can support up to three pairs of wireless headphones. When a dual-view screen is fitted, the front passenger can listen to TV/DVD (digital versatile disc) and when Rear Seat Entertainment (RSE) screens are fitted, rear passengers can listen to selected source on RSE screen. The headphones have an adjustable headband which operates on a ratchet mechanism.

The left side and the right side of the wireless headphone houses the infra-red receiver sensors which receive the transmitted signals from the headphones transmitter. Two AAA batteries are located below a sliding cover. When inserting the batteries it is important that the battery polarity is observed as marked in the battery compartment.

The right side of the wireless 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 right side of the wireless headphone is operated. The LED will remain on and the wireless headphones powered until the switch is operated for a second time. If the wireless headphones have not received an infra-red signal from the headphones transmitter for several minutes, they will automatically switch off to prevent battery drain.

Rear Seat Entertainment (RSE) Screens



Item	Part Number	Description
1	-	Infrared sensor
2	-	Connector - 12V supply, ground, private CAN
3	-	Connector LVDS - from RSECM

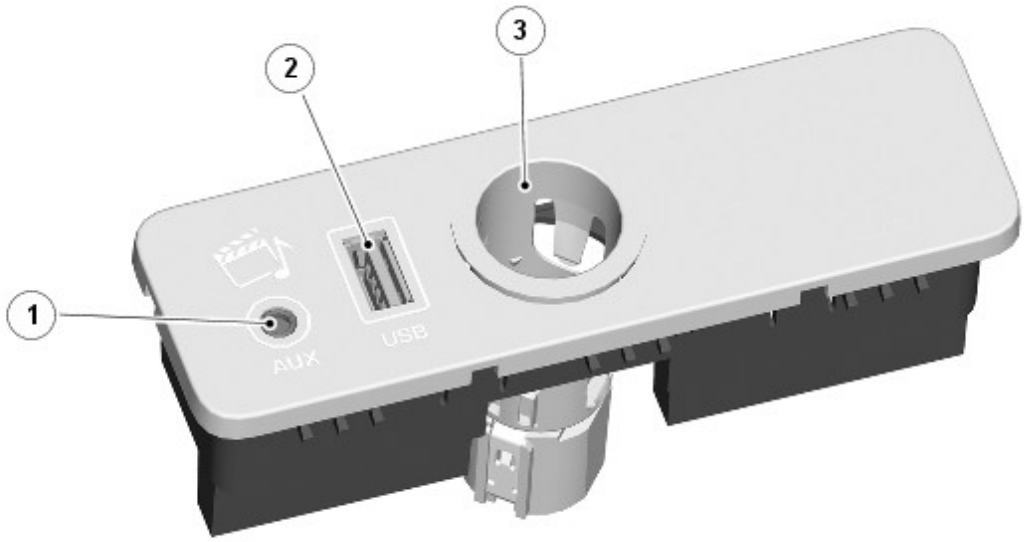
The RSE screens are located in the rear of the front seat head restraints. The screen is secured in the head restraint with one screw and 2 metal clips which are covered by a removable surround. The screen is an 8 inch, auto dimming, 800X480 resolution Thin Film Transistor (TFT) monitor.

An infrared receiver sensor is located centrally in the bottom portion of the screen surround. The sensor receives infrared transmissions from the RSE remote control and passes them to the RSECM on a private CAN bus system which is only connected between the RSECM and the RSE screens. The RSECM 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.

Each RSE screen is connected to the RSECM using a 12 pin harness connector and 2 pin LVDS video connector.

Portable Audio Interface Panel



E142557

Item	Part Number	Description
1	-	3.5mm jack plug - MP3 connection
2	-	Universal Serial Bus (USB) connector
3	-	12V accessory socket

The portable audio interface panel is located in the floor console below the stowage box lid and is fitted to all audio systems. The interface is a media hub between a portable input device and the IAM. The interface contains two USB ports, an iPod® port and a 3.5mm jack plug connector.

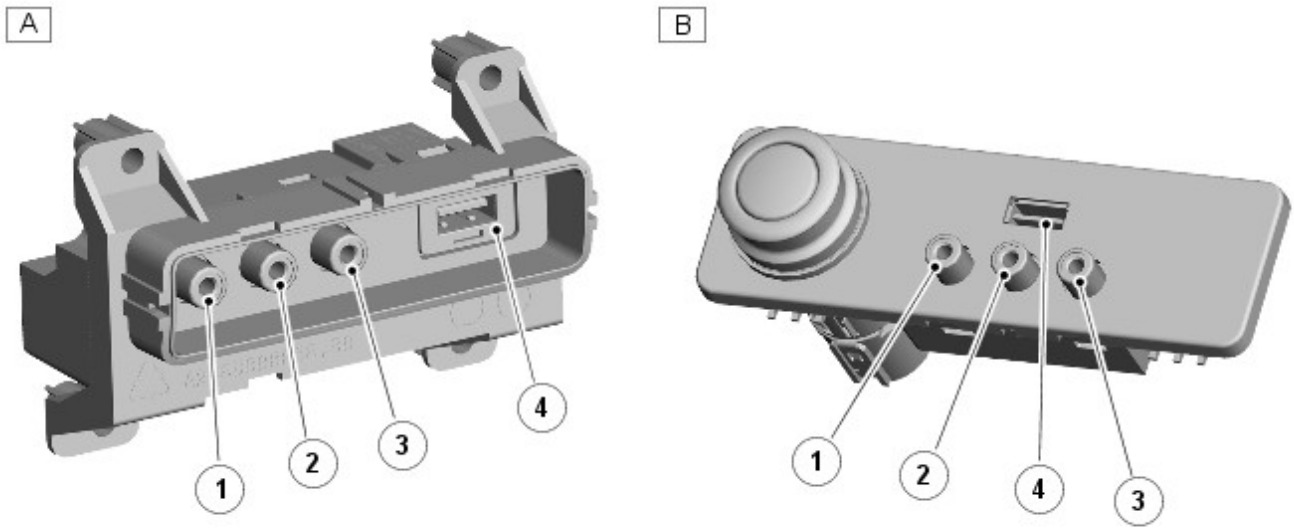
The portable audio interface panel is connected to the vehicle with two harness connectors. The harness connector from the USB ports has gold plated pins.

Devices that can be connected to the portable audio interface panel 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).

For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).

Audio Visual Input/Output (AVIO) Panel



E141955

Item	Part Number	Description
A	-	Standard AVIO panel - located in rear of floor console
B	-	Business class AVIO panel - located in rear seat console
1	-	Yellow socket - Composite video input
2	-	White socket - Left audio input
3	-	Red socket - Right audio input

4 - USB

The AVIO panel is located in the rear of the floor console below the rear Integrated Control Panel (ICP) on standard vehicles and in the rear seat console, below the armrest on business class vehicles.

The panel provides for the connection of auxiliary audio and video inputs from an external source, such as a games console, via three AV sockets on the panel.

The sockets are connected to the RSECM and allow the auxiliary input video to be played on the RSE screens and the audio to be played on the vehicle speakers or on the wireless headphones. The auxiliary input video cannot be displayed on the TS.

The single USB plug allows for the attachment of an auxiliary audio input, such as iPod®/iPhone®, an MP3 player or a USB memory stick. This plug is connected directly to the RSECM and allows audio to be selectable on the RSE screens and played on the wireless headphones or through the vehicle speakers. It will also allow standard definition Div X video files to be played from a USB memory stick.

The AVIO panel is connected to the RSECM using a single 20 pin harness connector.

OPERATION

Television

The television system has various levels of user control through the Touch Screen (TS), the Integrated Control Panel (ICP) and the left steering wheel switchpack. The system includes 6 analogue and 12 digital channel pre-sets. As with the audio system, the user can tune up or down through the channels and store a channel by a long press of the selected preset button. The system offers a choice of screen aspect ratios.

For the digital bands, the options available on the TS are the correct aspect ratio for the broadcast and "zoom" which will fit the picture to the screen (no black bands). For analogue TV all aspect ratio options will be available including 16:9, 4:3 and zoom. Two antennas are used because the system is dynamic and each one is connected to an individual tuner. The TVCM evaluates which antenna has the strongest signal and will use a combination of antennas to generate the TV image and sound. At any point in time the TVCM is using either one or two of the antennas and it's tuners to scan the TV frequencies and generate an up to date channel list.

The television system is primarily controlled from the TS and the ICP which are located in the center of the instrument panel and also the left steering wheel switchpack. Control signals from the TS are sent on the Media Oriented System Transport (MOST) ring to the TVCM. The TVCM uses a dedicated Composite Video Baseband Signal (CVBS) bus to transmit video signals to the TS. Where RSE is fitted, the TV can also be controlled using the RSE remote control and the video output will be delivered to the RSECM via an Low Voltage Differential Signalling (LVDS) video link. The TV video feed is then forwarded on to the TS from the RSECM via a CVBS output.

Control signals from the ICP and the left steering wheel switchpack are relayed on the medium speed CAN bus to the TS. The TS relays the control signals to the TVCM on the MOST ring. The TS is the bus master for the MOST ring and also hosts a gateway function between the medium speed CAN bus and the MOST ring.

The TVCM audio output signals are sent on the MOST ring to the audio amplifier module for speaker output.

Rear Seat Entertainment (RSE)

The RSECM is connected directly to both rear RSE screens via a medium speed CAN link and a Low-Voltage Differential Signaling (LVDS) connection. Infra-red signals from the RSE remote control are received by the RSE screens and user requests are communicated via a private medium speed CAN link to the RSECM. Video signals are communicated via the LVDS to one or both screens as requested.

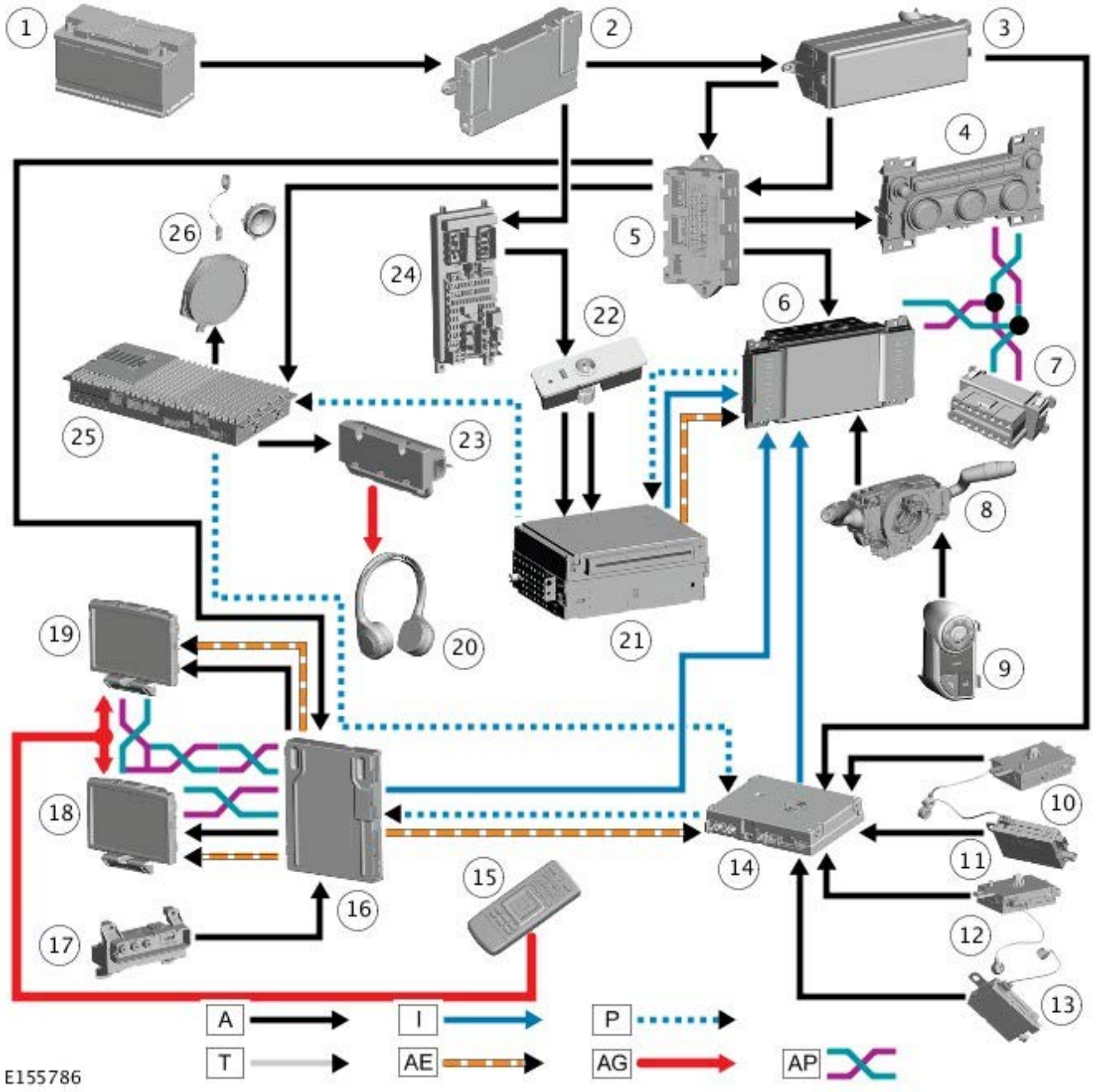
The RSECM communicates with the audio system via the MOST connection. Audio input from the Audio Video Input/Output (AVIO) panel is processed by the RSECM and passed on the MOST ring to the audio amplifier module to allow audio output to be played on the vehicle speakers or on the wireless headphones.

Video input from the TVCM and the AVIO panel is also processed by the RSECM and passed to the two RSE screens. The TV Video is also passed to the TS on separate video connection. The RSECM also controls the power supplies to the RSE screens and relays the infra-red RSE remote control signals received by the RSE screen infra-red sensors. The infra-red signals are passed from the RSE screens to the RSECM on a local CAN bus system.

A time limit operation is active when the ignition is off and the vehicle is unlocked (Power mode 4) and the system is manually switched on using the TS. 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.

CONTROL DIAGRAM

 NOTE: **A** = Hardwired; **F** = RF transmission; **I** = CVBS; **AP** = Medium Speed Comfort CAN (controller area network) bus; **P** = MOST;**T** = Coaxial; **AE** = LVDS; **AG** = Infrared



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)
3	-	Battery Junction Box (BJB)
4	-	Integrated Control Panel (ICP)
5	-	Quiescent Current Control Module (QCCM)
6	-	Touch Screen (TS)
7	-	Diagnostic socket
8	-	Clockspring
9	-	Left steering wheel switchpack
10	-	Right upper TV antenna amplifier
11	-	Right lower TV antenna amplifier/Fuel Fired Booster Heater (FFBH) remote control antenna amplifier (when fitted)
12	-	Left upper TV antenna amplifier
13	-	Left lower TV antenna amplifier
14	-	TV Control Module (TVCM)
15	-	RSE remote control
16	-	RSE module
17	-	AVIO panel
18	-	Right RSE screen
19	-	Left RSE screen
20	-	Wireless headphone (3 off)

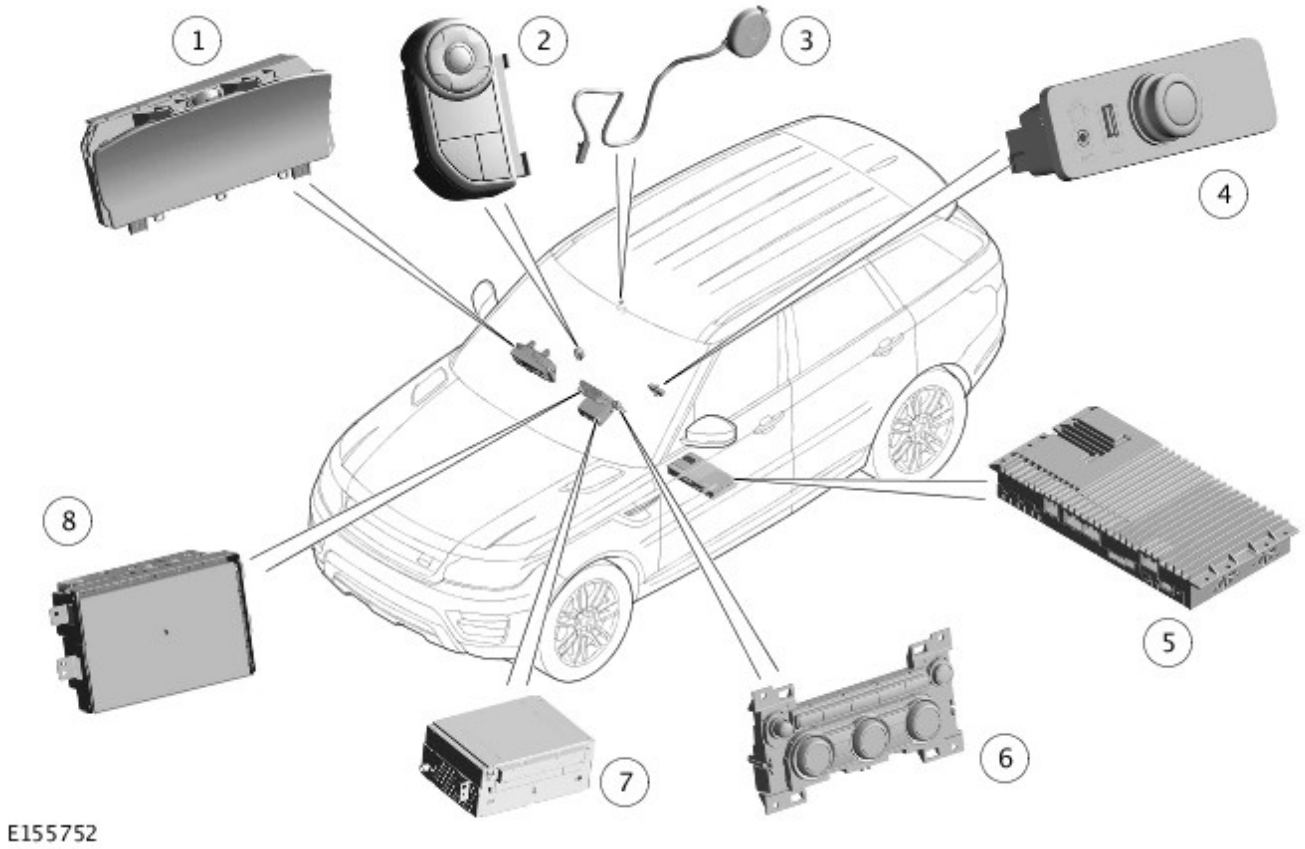
21	-	Integrated Audio Module (IAM)
22	-	Portable audio interface panel
23	-	Headphones transmitter
24	-	Central Junction Box (CJB)
25	-	AAM
26	-	Vehicle speakers

Published: 22-May-2013

Information and Entertainment System - Cellular Phone

Description and Operation

BLUETOOTH® PHONE SYSTEM - COMPONENT LOCATION



Item	Part Number	Description
1	-	Instrument Cluster (IC)
2	-	Left steering wheel switchpack
3	-	Microphone
4	-	User interface panel
5	-	Audio Amplifier Module (AAM)
6	-	Integrated Control Panel (ICP)
7	-	Integrated Audio Module (IAM)
8	-	Touch Screen (TS)

OVERVIEW

The Bluetooth® mobile phone system uses the customers own Bluetooth® capable mobile phone in conjunction with the vehicle information and entertainment system. The system is controlled by the Integrated Audio Module (IAM). The IAM has a Bluetooth® antenna incorporated into the unit.

Mobile phone handsets must be paired with the IAM, requiring the input of a 4 digit PIN (personal identification number) before they can be used with the vehicle system.

Once paired, any mobile phone can be 'docked' to the vehicle without re-entering the PIN. In addition, the last connected device will dock automatically next time it is 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® phone system to provide hands free operation of the users Bluetooth® phone.

The Bluetooth® mobile phone 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 (IC) (for phone information in message center)
- Touch Screen (TS)
- Microphone
- Left steering wheel switchpack

Audio Amplifier Module (AAM).

Pairing of new mobile phones 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 mobile phone and the IAM. Communication between the mobile phone and the vehicle system is only via Bluetooth®. This can limit the available functions dependant on the mobile phone used.

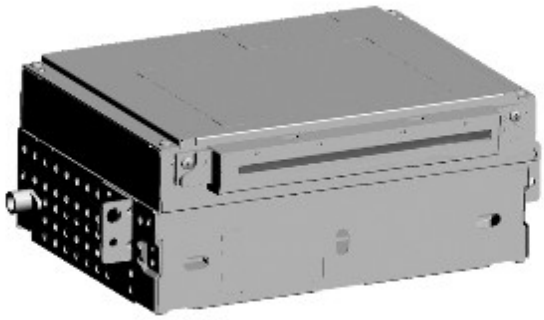
The system allows the driver to make, receive and end phone calls using the TS or the left steering wheel switchpack or voice control (where specified).

The Land Rover Advanced Voice system can be specified.
For additional information, refer to: Voice Control (415-01 Information and Entertainment System, Description and Operation).

Compatible Bluetooth® mobile phones can communicate with the vehicle's in-built phone system. Pairing and connection must be made with the ignition on or the engine running.

DESCRIPTION

Integrated Audio Module (IAM)



E141841

The IAM is located in the instrument panel, behind the Integrated Control Panel (ICP) and the ATC (automatic temperature control) module. The IAM communicates with the Bluetooth® mobile phone using internal hardware and a Bluetooth® antenna and software for phone functionality.

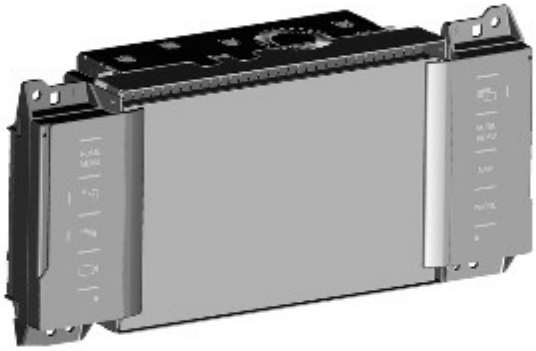
The IAM is connected to the Media Oriented system Transport (MOST) ring and communicates with the Touch Screen (TS) and AAM in order to provide the phone feature in the vehicle.

When the Bluetooth® mobile phone is specified, the IAM supports the Bluetooth™ mobile phone functionality and audio streaming. Bluetooth® mobile phone software and a Bluetooth® antenna are located within the IAM. The software within the IAM processes the Bluetooth® wireless signals from the users Bluetooth® mobile phone and allows audio output, voice input and data display on the TS.

The hands free microphone is hardwired to the IAM. The microphone is also used by the Land Rover Advanced Voice system for phone and other infotainment system operation.

Refer to the Audio section for further detail of the IAM.
For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).

Touch Screen (TS)



E141842

The Touch Screen (TS) provides the user interface of the Bluetooth® phone system.

The TS communicates with the rest of the audio/infotainment system on the MOST ring and allows control of the

phone system and other infotainment systems from a single point.

The TS communicates with the IAM on the MOST ring and provides the driver interface and driver display of the phone system. The TS also provides driver display and control of the audio, the rear view camera, the navigation system, voice system, rear seat entertainment and other vehicle functions.
For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).

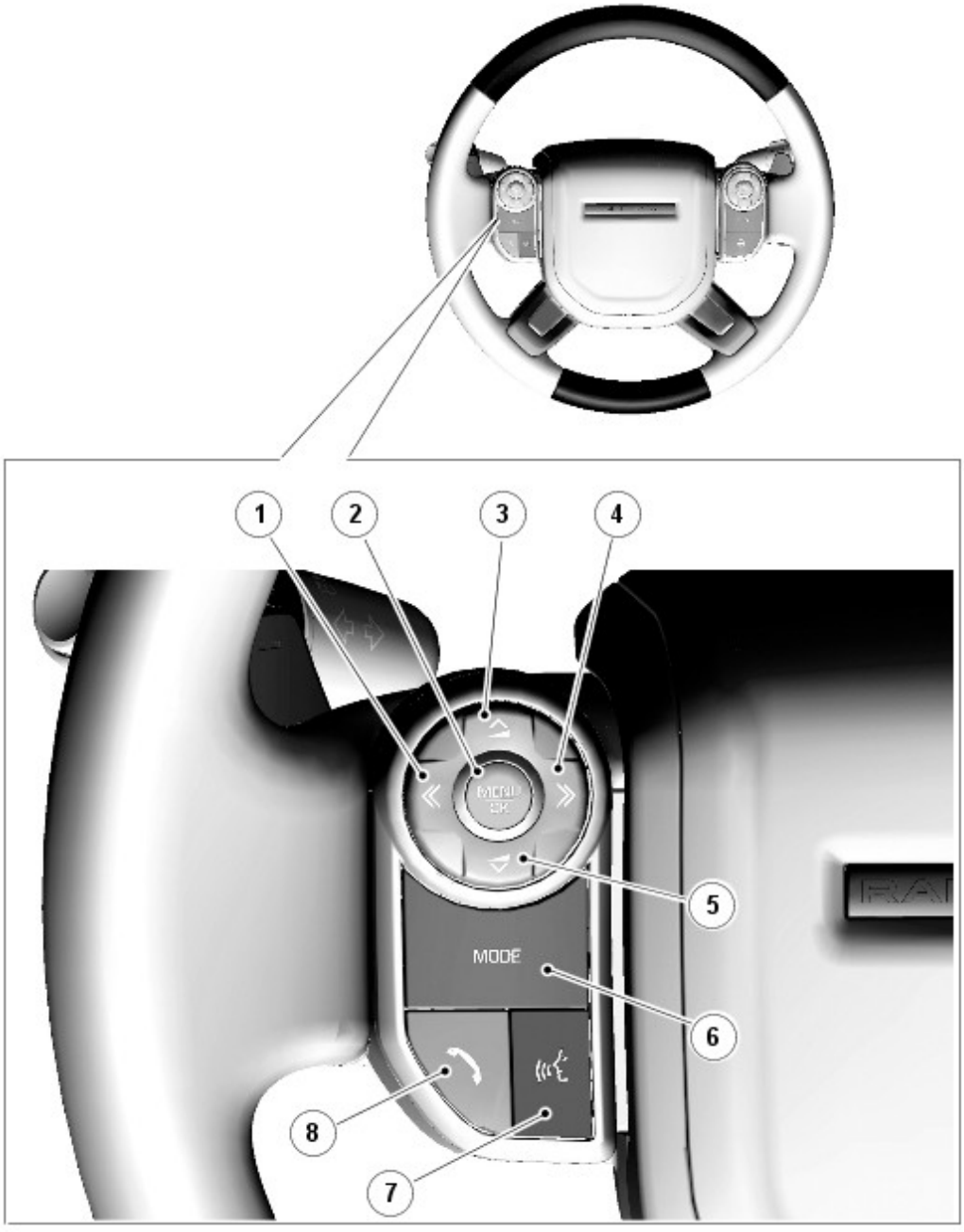
The phone system and other systems are operated by a combination of the soft key switches located in the TS switchpacks on each side of the TS and the 'virtual' soft keys displayed on the TS, in addition to the left steering wheel switchpack.

Microphone


E141843

A directional type microphone is fitted to the driver side of the overhead console so that it is directed towards the driver. It is connected to the 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 phone use.

Left Steering Wheel Switchpack



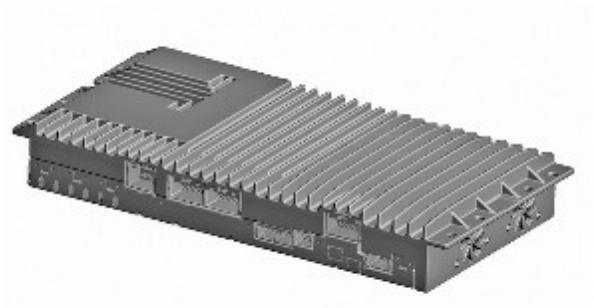
Item	Part Number	Description
1	-	Seek, previous radio preset, previous track, scroll down phone list, when 'Last 10' calls shown in TS will scroll forward through lists 'Last 10 Dialled', 'Last 10 Missed' and 'Last 10 Received'
2	-	Menu/OK switch (IC menu control), answer an incoming telephone call or end an active telephone call
3	-	Volume increase, scroll up when in 'Phonebook' and 'Last 10' screens
4	-	Seek, next radio preset, next track, scroll up phone list, when 'Last 10' shown in TS will scroll back through lists 'Last 10 Received', 'Last 10 Missed' and 'Last 10 Dialled'
5	-	Volume decrease, scroll down when in 'Phonebook' and 'Last 10' screens
6	-	Mode switch
7	-	Voice switch
8	-	Phone answer/end call switch

The switches for the phone system are located on the left steering wheel switchpack. The driver can use these switches for several phone related functions including:

- Accept incoming calls
- Reject incoming calls
- Make phone calls from the mobile telephones own phone book (phone book/call lists).

Audio Amplifier Module

NOTE: Meridian Signature Reference System audio amplifier module shown



E141845

The AAM is located below the left front seat. It is connected to the audio system via the MOST. Speaker connections from the amplifier are hardwired.

Bluetooth®

The Bluetooth® phone system allows the user to pair and connect their own mobile phone (Bluetooth® enabled only) to the vehicle phone 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 TS (if supported by the phone handset software)
- Phonebook download (if supported by the phone handset)
- Dialed calls (if supported by the phone handset)
- Missed calls (if supported by the phone handset)
- Received calls (if supported by the phone handset).

BLUETOOTH® PAIRING

Before a Bluetooth® mobile phone 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 a mobile 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 (accessory power mode 4, ignition power mode 6 or engine running power mode 7) and ensure that the TS is active.
- From the home menu, select Phone.
- A menu will appear. Select Search new.

NOTES:

The mobile phone must set to 'discoverable' for the pairing to work (vehicle to device only).

The vehicle’s Bluetooth® system is discoverable for only 3 minutes (device to vehicle only).

Device to Vehicle

- Select **Device** to vehicle option. On some mobile phones, this is referred to as new paired device. See the mobile phone operating instructions for further information.
- Using the mobile phone, search for the vehicle.
- When the vehicle's Bluetooth® system is discovered (named Range Rover), follow the on-screen instructions. Select **Yes** when prompted, to confirm the pairing. Either the mobile phone or the vehicle system will ask for a PIN (personal identification number). When prompted, enter a four digit PIN of your choice and select **OK** to confirm.
- Enter the same PIN into the other device.
- Once the mobile 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 the mobile phone from the displayed list and select the corresponding Pair and Connect option.

A PIN will be displayed in the TS, enter this PIN into the mobile phone.
- Once the mobile 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. Refer to the mobile phone’s operating instructions for further information.

CHANGING THE CONNECTED PHONE

Up to 10 Bluetooth® devices (mobile phones 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 phone 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 mobile phone from the displayed list
- Once the mobile phone is connected to the system, a confirmation message will be displayed before switching to the Digit Dial screen.

Advanced Voice Control System

The advanced voice system provides the driver with the option of voice control for a range of supported functions. The following systems include Voice functionality:

- Radio, satellite radio and Digital Radio (if fitted)
- CD player
- Hard disk drive/virtual CD player
- USB and auxiliary connections
- Navigation system
- Bluetooth® phone system
- Vehicle notepad.

For further details of the Advanced Voice Control system refer to the Voice Control section.
For additional information, refer to: Voice Control (415-01 Information and Entertainment System, Description and Operation).

OPERATION

Bluetooth® Phone System

The Bluetooth® mobile phone system is controlled from the TS, via voice control and the left steering wheel switchpack. Signals from the steering wheel switchpack are sent via the clockspring to the TS. The TS 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 AAM and is output on the vehicle speaker system.

The hands free profile of the system allows the display of the network signal strength, network operator and phone battery level indication on the vehicle display, where the mobile phone supports this function. Also, if applicable, the mobile phone will show a "car" or "headset" symbol to indicate it is in hands free profile.

Mobile phone 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 mobile phones are fully compatible with Land Rover, but through testing individual phone handset models, Land Rover has produced a list of compatible phone 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 mobile phones. The list also describes how to check the software version of each individual phone manufacturer. This list must be consulted by users, sales and service teams to confirm whether customer's mobile phone is compatible or not. Performance will vary, based on the phone’s software version, battery condition, coverage and the network provider. Mobile phones are warranted by their manufacturer, not Land Rover.

Land Rover is continually validating compatible mobile phone and software combinations. The most up-to-date compatibility list will always be available on-line from Land Rover.

NOTE: To achieve full Bluetooth® mobile phone functionality, it is crucial that the mobile phone software level matches the version detailed in the list of compatible phone 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.

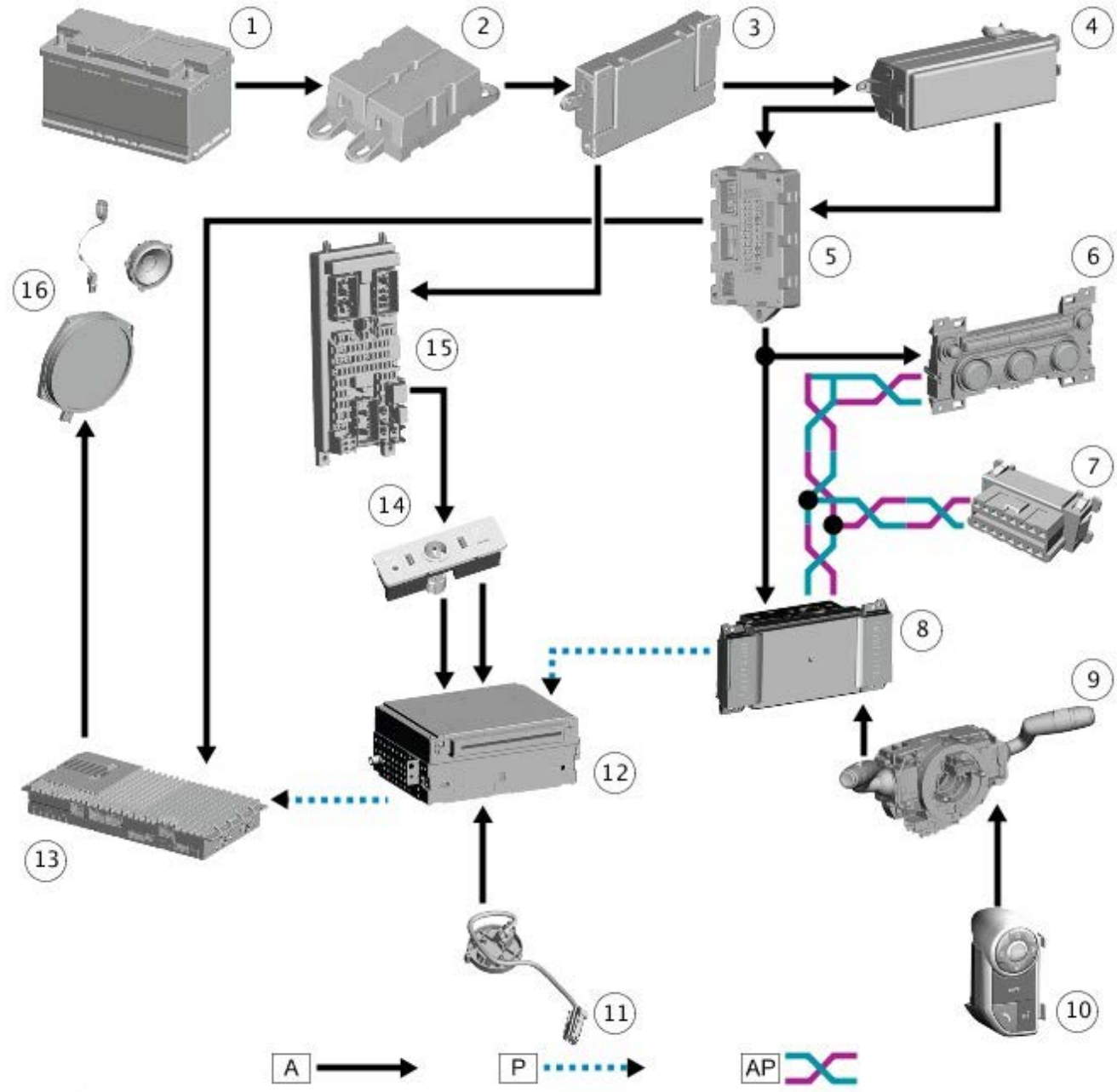
Bluetooth® is a wireless RF connection which operates with the user's own mobile phone. It does not have to be fixed into the vehicle and is designed to function without an external aerial. The mobile phone can be located

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 mobile phone can be charged from the 12 volt power socket or USB (universal serial bus) (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).

CONTROL DIAGRAM

NOTE: A = Hardwired, P = MOST connection, AP = Medium speed CAN (Controller Area Network) Comfort bus.



E155753

Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)
3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)
5	-	Quiescent Current Control Module (QCCM)
6	-	Integrated Control Panel (ICP)
7	-	Diagnostic connector
8	-	Touch Screen (TS)
9	-	Clockspring
10	-	Left steering wheel audio switches
11	-	Microphone (Voice system)

12	-	Integrated Audio Module (IAM)
13	-	Audio Amplifier Module (AAM)
14	-	User interface panel
15	-	Central Junction Box (CJB)
16	-	Vehicle speakers

Refer to the Audio section for full MOST control diagram
For additional information, refer to: Audio System (415-01 Information and Entertainment System, Description and Operation).

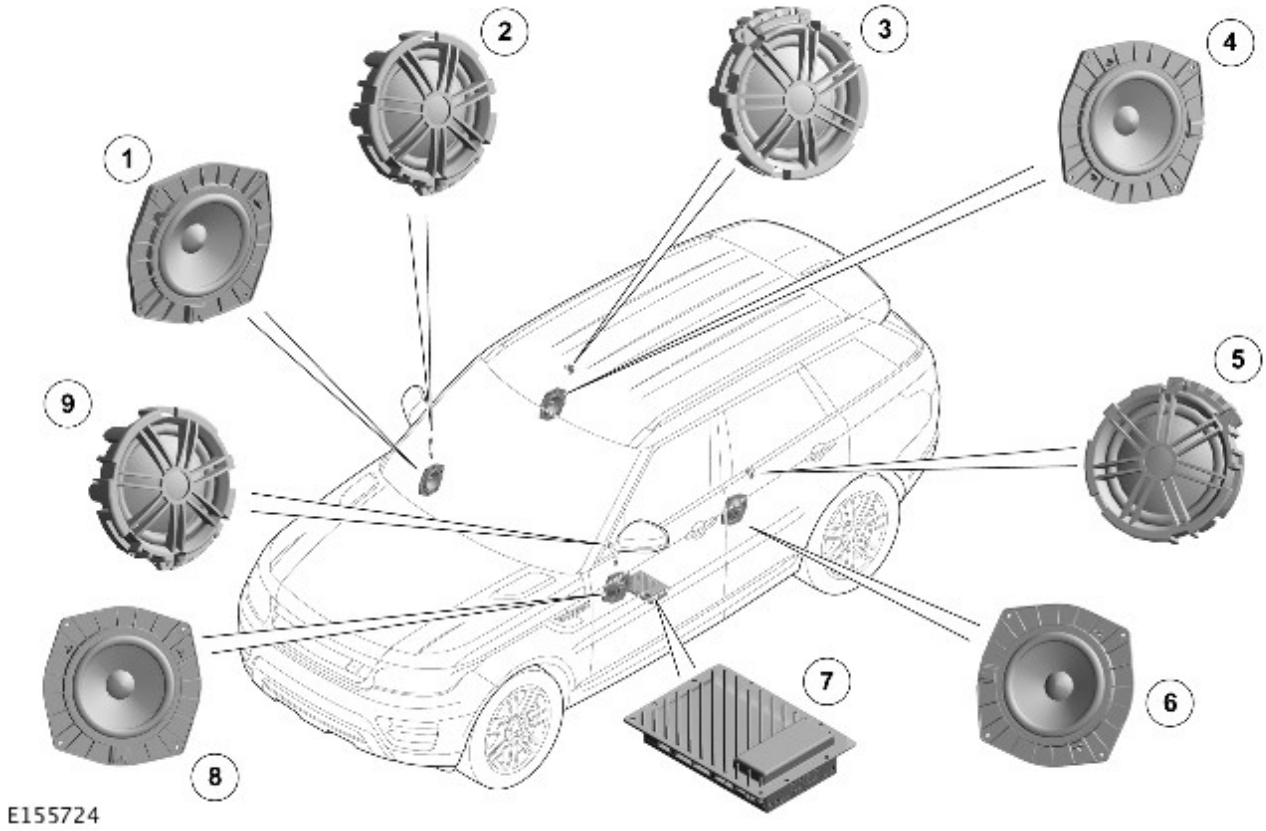
Published: 19-Aug-2013

Information and Entertainment System - Speakers

Description and Operation

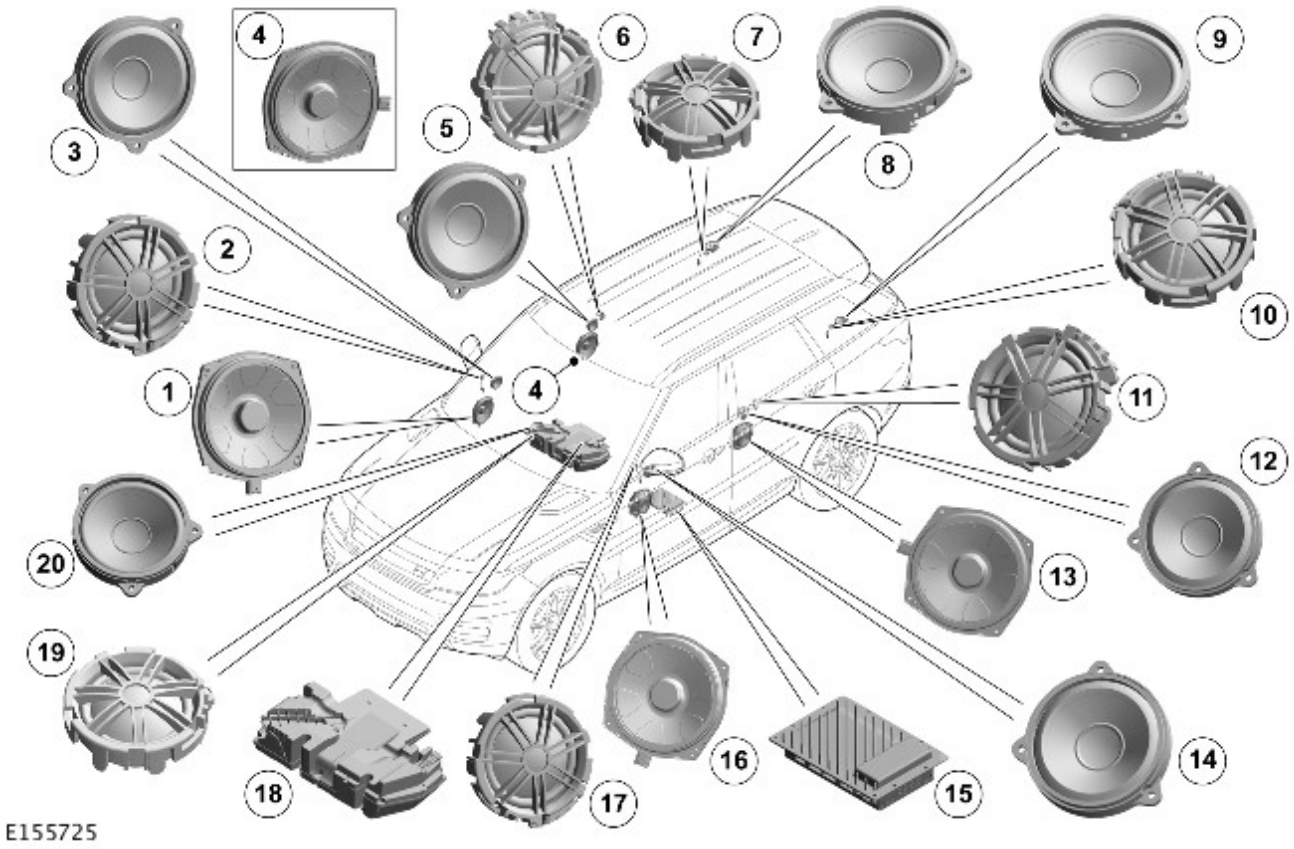
COMPONENT LOCATION

COMPONENT LOCATION - 8 Speaker Audio System



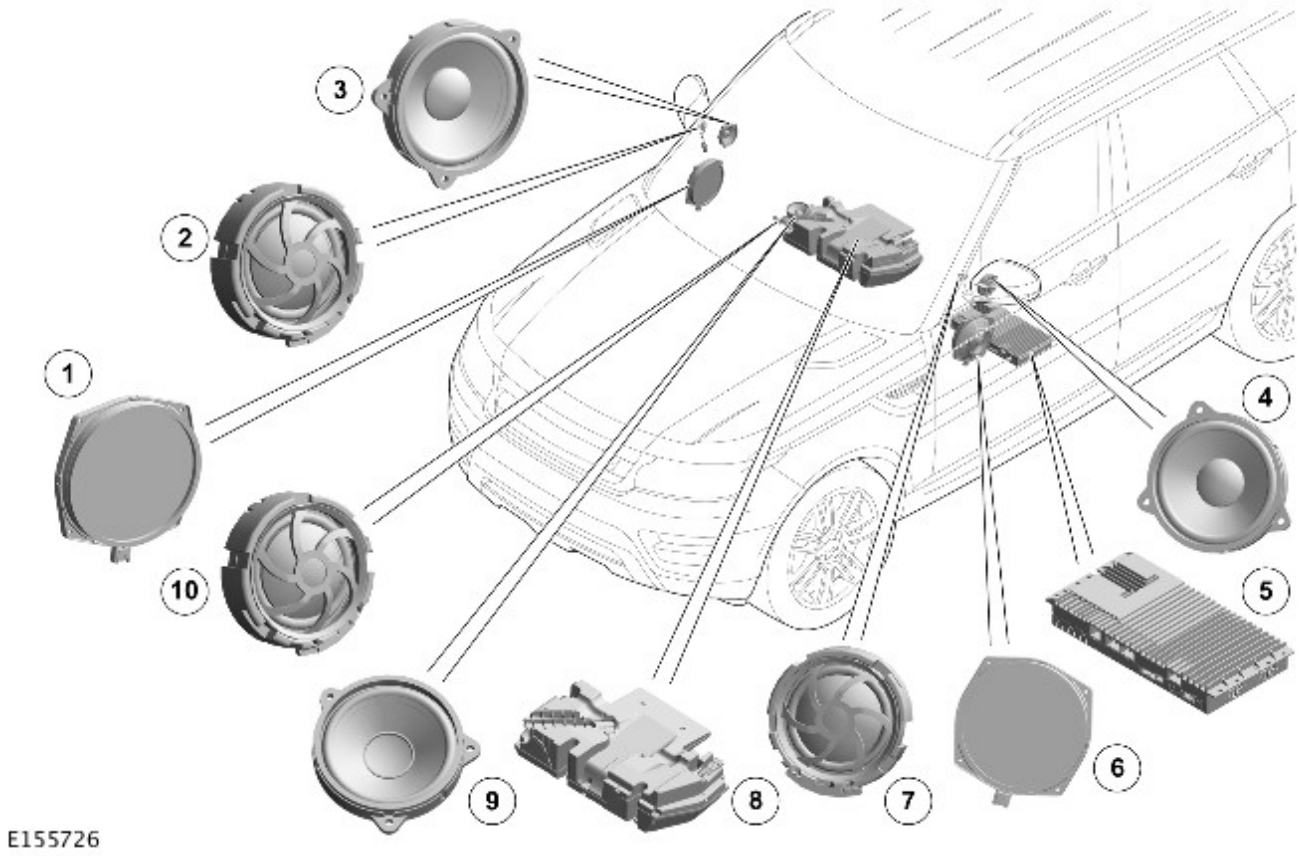
Item	Part Number	Description
1	-	Front right door bass speaker
2	-	Front right door tweeter speaker
3	-	Rear right door tweeter speaker
4	-	Rear right door bass speaker
5	-	Rear left door tweeter speaker
6	-	Rear left door bass speaker
7	-	Audio Amplifier Module (AAM)
8	-	Front left door bass speaker
9	-	Front left door tweeter speaker

COMPONENT LOCATION - Meridian Surround System - 880W



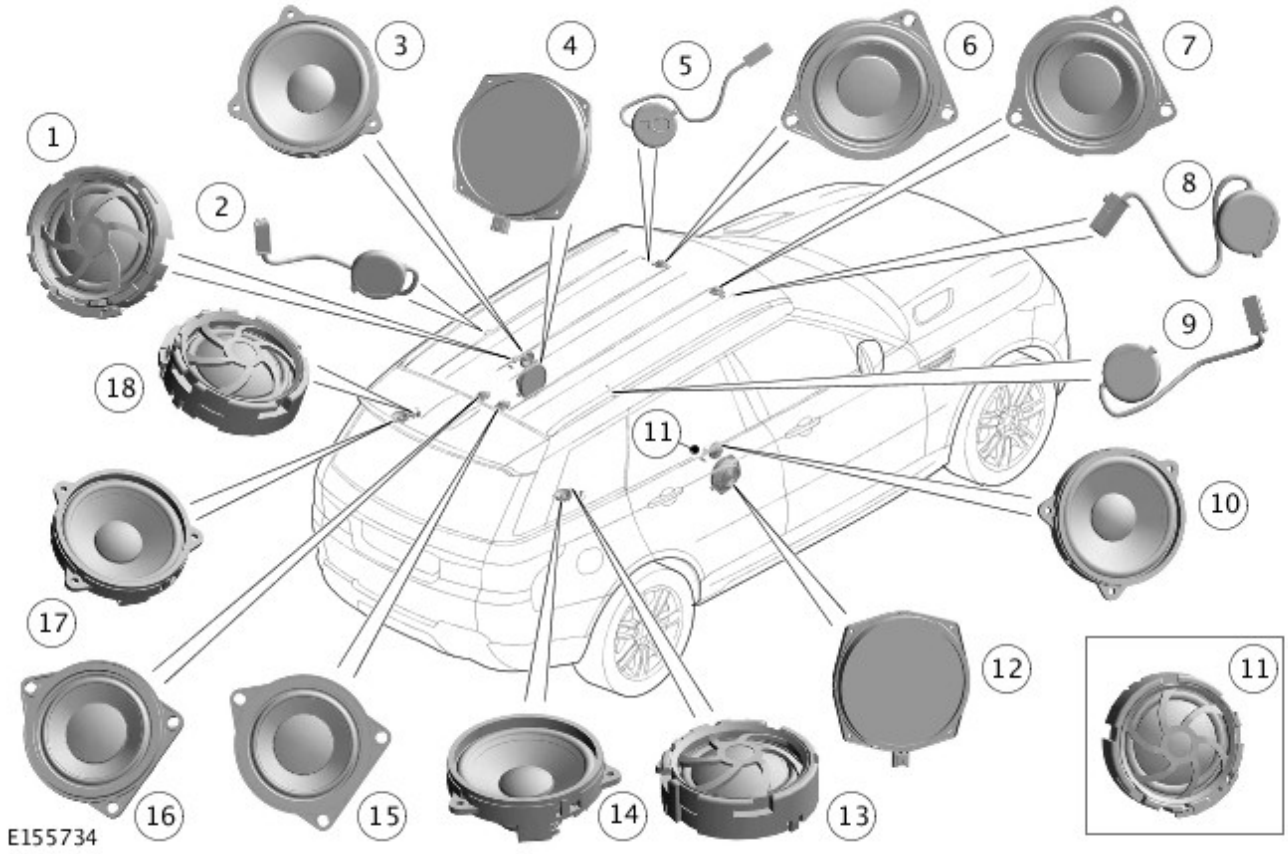
Item	Part Number	Description
1	-	Front right door bass speaker
2	-	Front right door tweeter
3	-	Front right door mid-range speaker
4	-	Rear right door bass speaker
5	-	Rear right door mid-range speaker
6	-	Rear right door tweeter speaker
7	-	Luggage compartment right tweeter speaker
8	-	Luggage compartment right mid-range speaker
9	-	Luggage compartment left mid-range speaker
10	-	Luggage compartment left tweeter speaker
11	-	Rear left door tweeter speaker
12	-	Rear left door mid-range speaker
13	-	Rear left door bass speaker
14	-	Front left door mid-range speaker
15	-	Audio Amplifier Module (AAM)
16	-	Front left door bass speaker
17	-	Front left door tweeter speaker
18	-	Sub-woofer
19	-	Instrument panel tweeter speaker
20	-	Instrument panel mid-range speaker

COMPONENT LOCATION - Meridian Signature Reference System - 1700W - SHEET 1 of 2



Item	Part Number	Description
1	-	Front right door bass speaker
2	-	Front right door tweeter speaker
3	-	Front right door mid-range speaker
4	-	Front left door mid-range speaker
5	-	Audio Amplifier Module (AAM)
6	-	Front left door bass speaker
7	-	Front left door speaker
8	-	Sub-woofer
9	-	Instrument panel mid-range speaker
10	-	Instrument panel tweeter speaker

COMPONENT LOCATION -Meridian Signature Reference System - 1700W - SHEET 2 of 2



Item	Part Number	Description
1	-	Rear left door tweeter speaker
2	-	Rear left Dynamic Volume Control (DVC) microphone
3	-	Rear left door mid-range speaker
4	-	Rear left door bass speaker
5	-	Front left Dynamic Volume Control (DVC) microphone
6	-	Front left headliner low profile mid-range speaker
7	-	Front right headliner low profile mid-range speaker
8	-	Front right Dynamic Volume Control (DVC) microphone
9	-	Rear right Dynamic Volume Control (DVC) microphone
10	-	Rear right door mid-range speaker
11	-	Rear right door tweeter speaker
12	-	Rear right door bass speaker
13	-	Rear right luggage compartment tweeter speaker
14	-	Rear right luggage compartment low profile mid-range speaker
15	-	Rear right headliner low profile mid-range speaker
16	-	Rear left headliner low profile mid-range speaker
17	-	Rear left luggage compartment low profile mid-range speaker
18	-	Rear left luggage compartment low profile tweeter speaker

OVERVIEW

The vehicle has three levels of audio system available:

8 Speaker Audio System

- 256W - separate AAM
- 8 speakers

Meridian Surround System - 880W

- 880W Meridian sound system - separate AAM, Dolby® Pro Logic® II Surround Sound System
- - Meridian Trifield, Dolby Pro Logic IIx and DTS Neo:6 Surround Sound System, 19 speakers including dual voice coil sub-woofer and single slot CD player

Meridian Signature Reference System - 1700W

- 1700W Meridian Surround Sound system - separate audio amplifier module, Dolby® Pro Logic® II Surround Sound System
- Meridian Trifield, Meridian Trifield 3D, Dolby Pro Logic IIx, Dolby Pro Logic IIz, DTS Neo:6, and DTS Neo:X Surround Sound System - 23 Speakers including dual voice coil sub-woofer and single slot CD player.

The audio systems are powered by an AAM located below the front left seat. The AAM is controlled by the Integrated Audio Module (IAM) on the Media Oriented System Transport (MOST) ring. The speakers are hard wired to the AAM.

The AAM on the Meridian Signature Reference System is larger than those used on the Meridian System and Meridian Surround System. The amplifier contains cooling fans to assist with cooling due to the high power output.

DESCRIPTION

8 Speaker Audio System

The system comprises 8 speakers:

- 4 tweeters, aluminium dome, 25mm
- 4 bass, paper cone, rubber edge, 165mm

Meridian Surround System

The system comprises 19 speakers:

- 7 tweeters, aluminium dome, 25mm
- 7 mid-range, polypropylene cone, rubber edge
- 4 bass, paper cone, rubber edge, 200mm
- Sub-woofer, paper cone, rubber edge, 200mm

Meridian Signature Reference System

The system comprises 23 speakers:

- 7 tweeters, titanium dome, 25mm
- 4 low profile mid-range, Glass Fibre, Dyneema with Poly Resin cone, rubber edge
- 7 mid-range, Glass Fibre, Dyneema with Poly Resin cone, rubber edge
- 4 bass, Glass fibre, Dyneema with Poly Resin cone, rubber edge, 200mm
- Sub-woofer, paper cone, rubber edge, 250mm

Bass Sub-Woofer (not fitted to 8 speaker audio system)

The bass sub-woofer is located below the front seats. The sub-woofer is located in 4 studs in the floor pan and secured with 4 nuts. A single 4 pin connector, connects the sub-woofer to the vehicle wiring harness.

The dual voice coil 200mm diameter sub-woofer speaker is located in the underside of the sub-woofer molding. The low-frequency bass sound from the sub-woofer complements the high frequency sounds from the other system speakers.

The passive sub-woofer is powered by the AAM.

The sub-woofer on all systems are visually the same, however, the sub-woofer used on the Meridian Signature Reference System differs acoustically to the sub-woofer used on the Meridian and Meridian Surround systems.

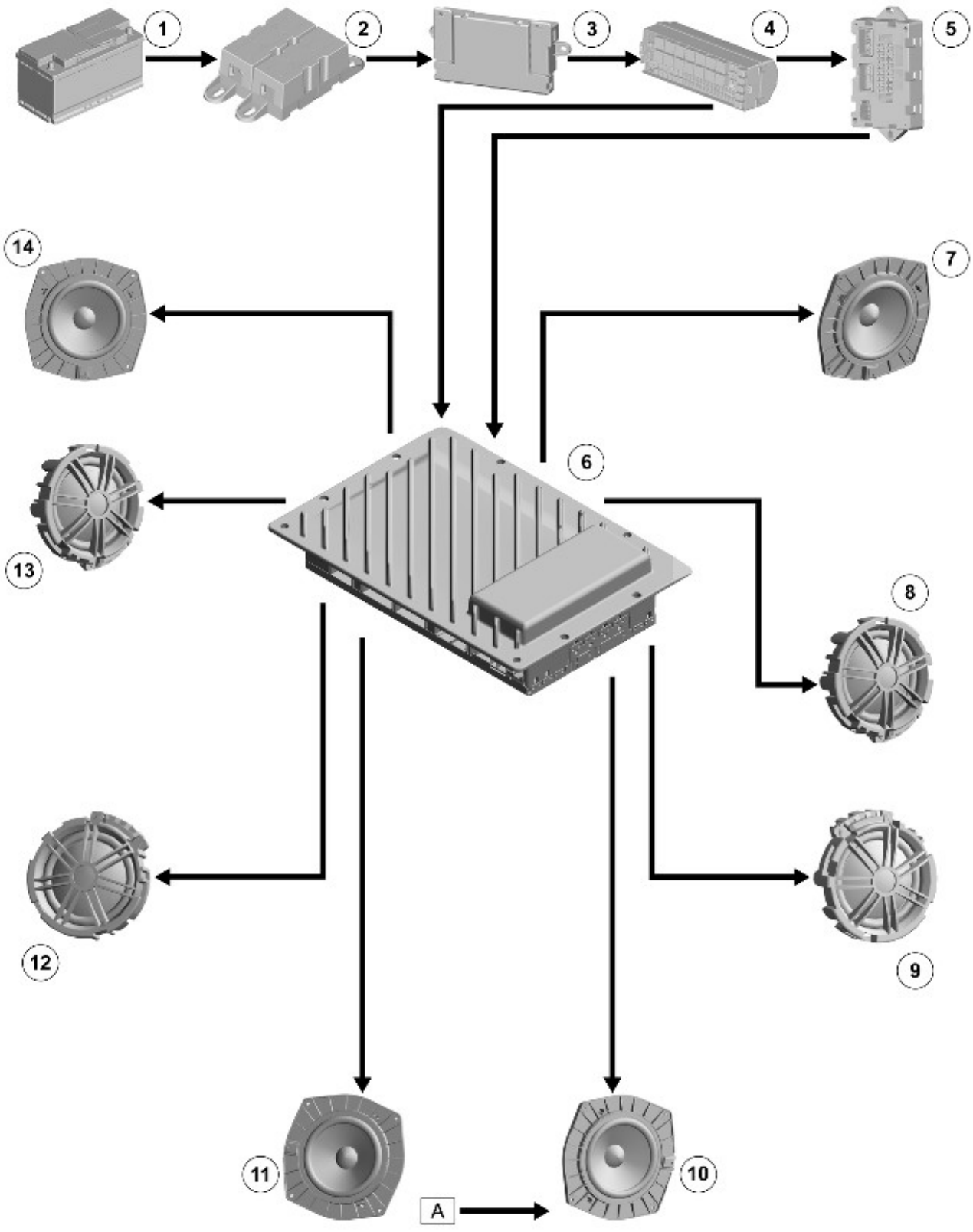
OPERATION

All vehicle speakers are powered by the AAM, located below the front left seat. The speakers are hardwired to the amplifier.

Audio signals for the audio output originate from various audio sources and are passed to the AAM on the Media Oriented System Transport (MOST) ring. The AAM is available in three outputs depending on vehicle specification; 256W, 880W and 1700W.

CONTROL DIAGRAM - 8 Speaker Audio System

 NOTE: **A** = Hardwired



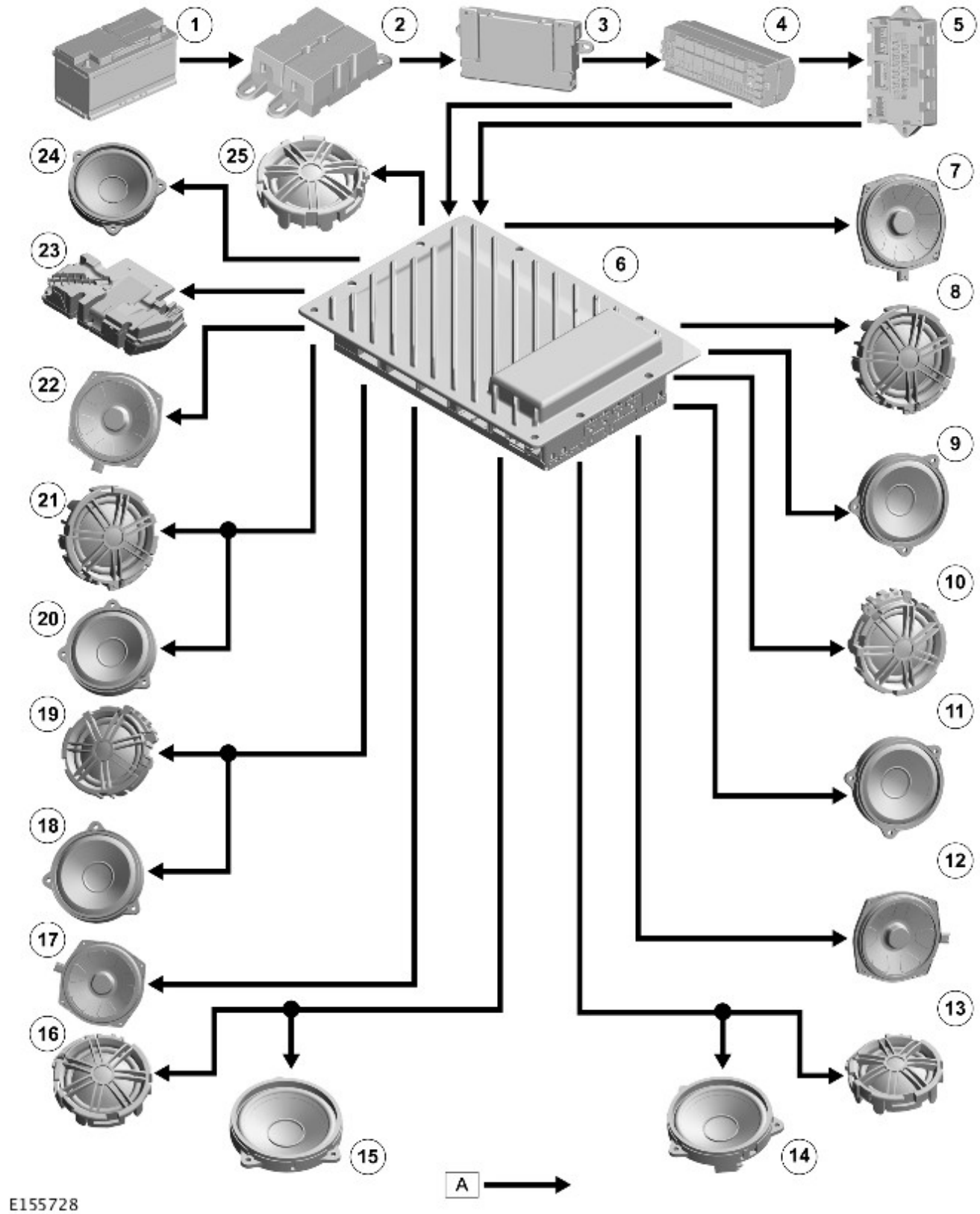
E155727

Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)
3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)
5	-	Quiescent Current Control Module (QCCM)
6	-	Audio Amplifier Module (AAM)
7	-	Front right door bass speaker
8	-	Front right door tweeter speaker
9	-	Rear right door tweeter speaker
10	-	Rear right door bass speaker

11	-	Rear left door bass speaker
12	-	Rear left door tweeter speaker
13	-	Front left door tweeter speaker
14	-	Front left door bass speaker

CONTROL DIAGRAM - Meridian Surround System - 880W

NOTE: **A** = Hardwired

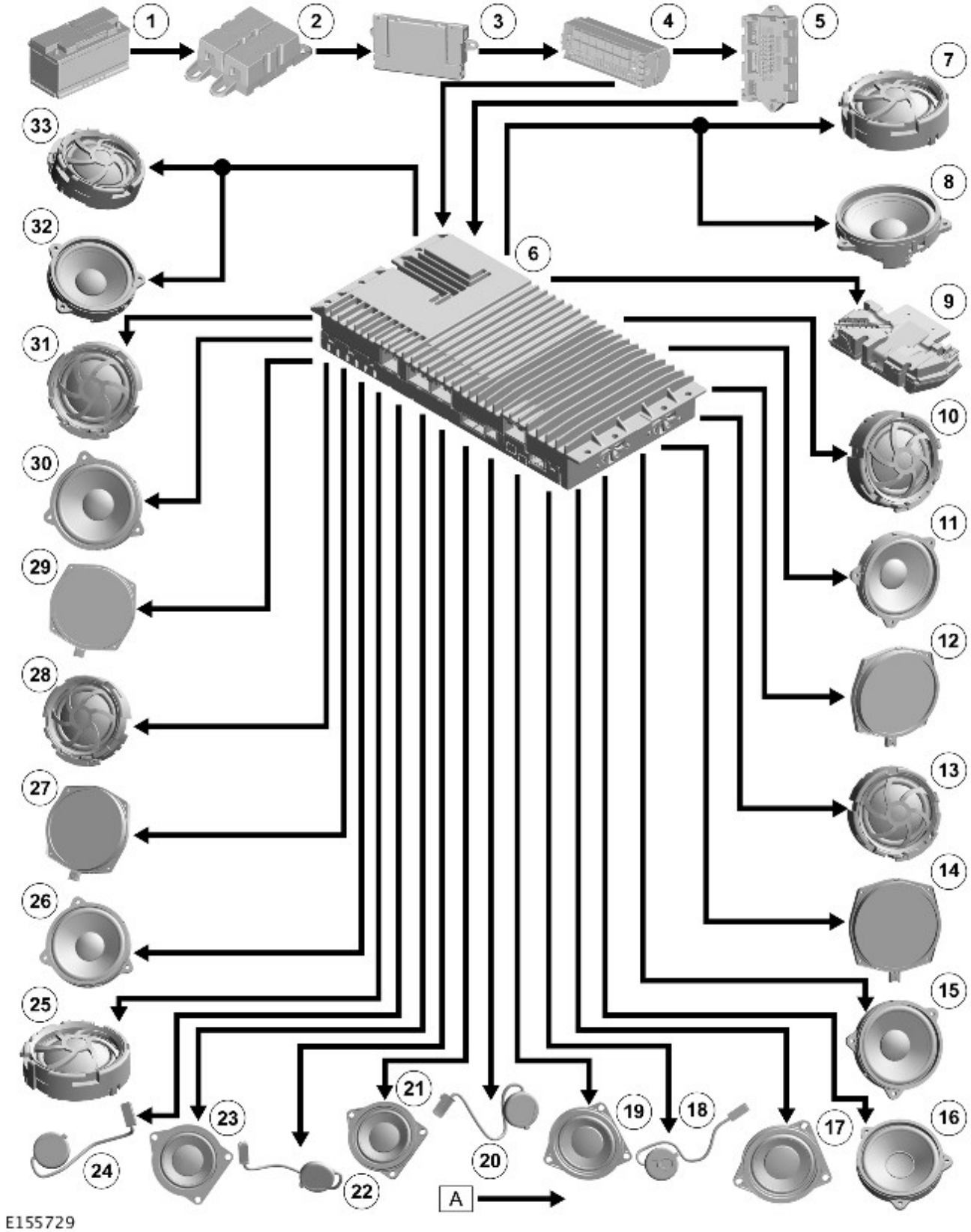


Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)

3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)
5	-	Quiescent Current Control Module (QCCM)
6	-	Audio Amplifier Module (AAM)
7	-	Front right door bass speaker
8	-	Front right door mid-range speaker
9	-	Front right door tweeter speaker
10	-	Rear right tweeter speaker
11	-	Rear right door bass speaker
12	-	Rear right door mid-range speaker
13	-	Luggage compartment right tweeter speaker
14	-	Luggage compartment right mid-range speaker
15	-	Luggage compartment left mid-range speaker
16	-	Luggage compartment left tweeter speaker
17	-	Rear left door bass speaker
18	-	Rear left door mid-range speaker
19	-	Rear left door tweeter speaker
20	-	Front left door mid-range speaker
21	-	Front left door tweeter speaker
22	-	Front left door bass speaker
23	-	Sub-woofer
24	-	Instrument panel low profile mid-range speaker
25	-	Instrument panel low profile tweeter speaker

CONTROL DIAGRAM - Meridian Signature Reference System - 1700W

 NOTE: **A** = Hardwired



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)
3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)
5	-	Quiescent Current Control Module (QCCM)
6	-	Audio Amplifier Module (AAM)
7	-	Right luggage compartment tweeter speaker
8	-	Right luggage compartment mid-range speaker
9	-	Sub-woofer
10	-	Front right door tweeter speaker

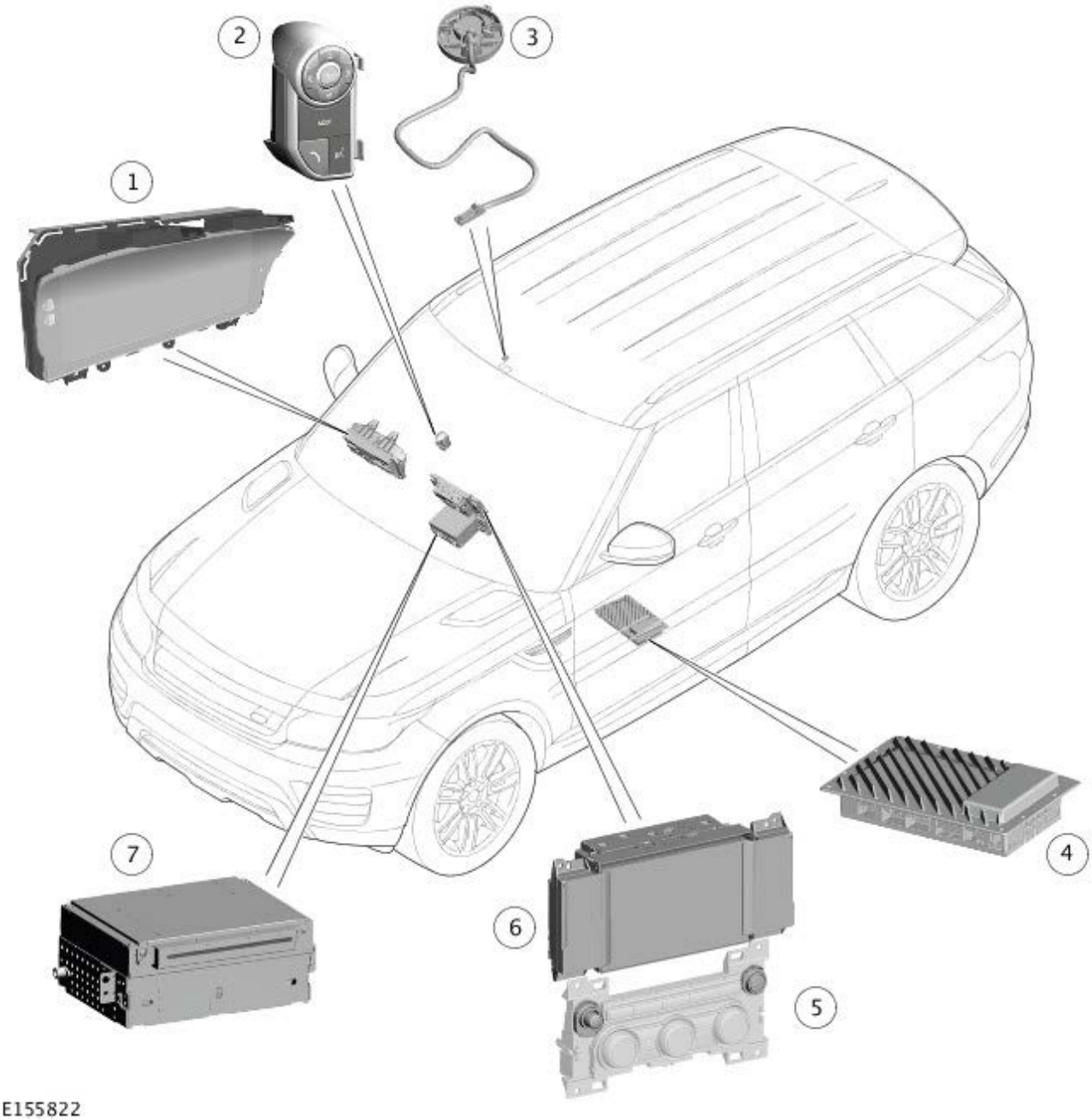
11 - Front right door mid-range speaker
12 - Front right door bass speaker
13 - Rear right door tweeter speaker
14 - Rear right door bass speaker
15 - Rear right door mid-range speaker
16 - Instrument panel low profile mid-range speaker
17 - Front left headliner low profile mid-range speaker
18 - Front left Dynamic Volume Control (DVC) microphone
19 - Front right headliner low profile mid-range speaker
20 - Front right Dynamic Volume Control (DVC) microphone
21 - Rear left headliner low profile mid-range speaker
22 - Rear left Dynamic Volume Control (DVC) microphone
23 - Rear right headliner low profile mid-range speaker
24 - Rear right Dynamic Volume Control (DVC) microphone
25 - Instrument panel low profile tweeter speaker
26 - Rear left door mid-range speaker
27 - Rear left door bass speaker
28 - Rear left door tweeter speaker
29 - Front left door bass speaker
30 - Front left door mid-range speaker
31 - Front left door tweeter speaker
32 - Left luggage compartment mid-range speaker
33 - Left luggage compartment tweeter speaker

Published: 22-May-2013

Information and Entertainment System - Voice Control

Description and Operation

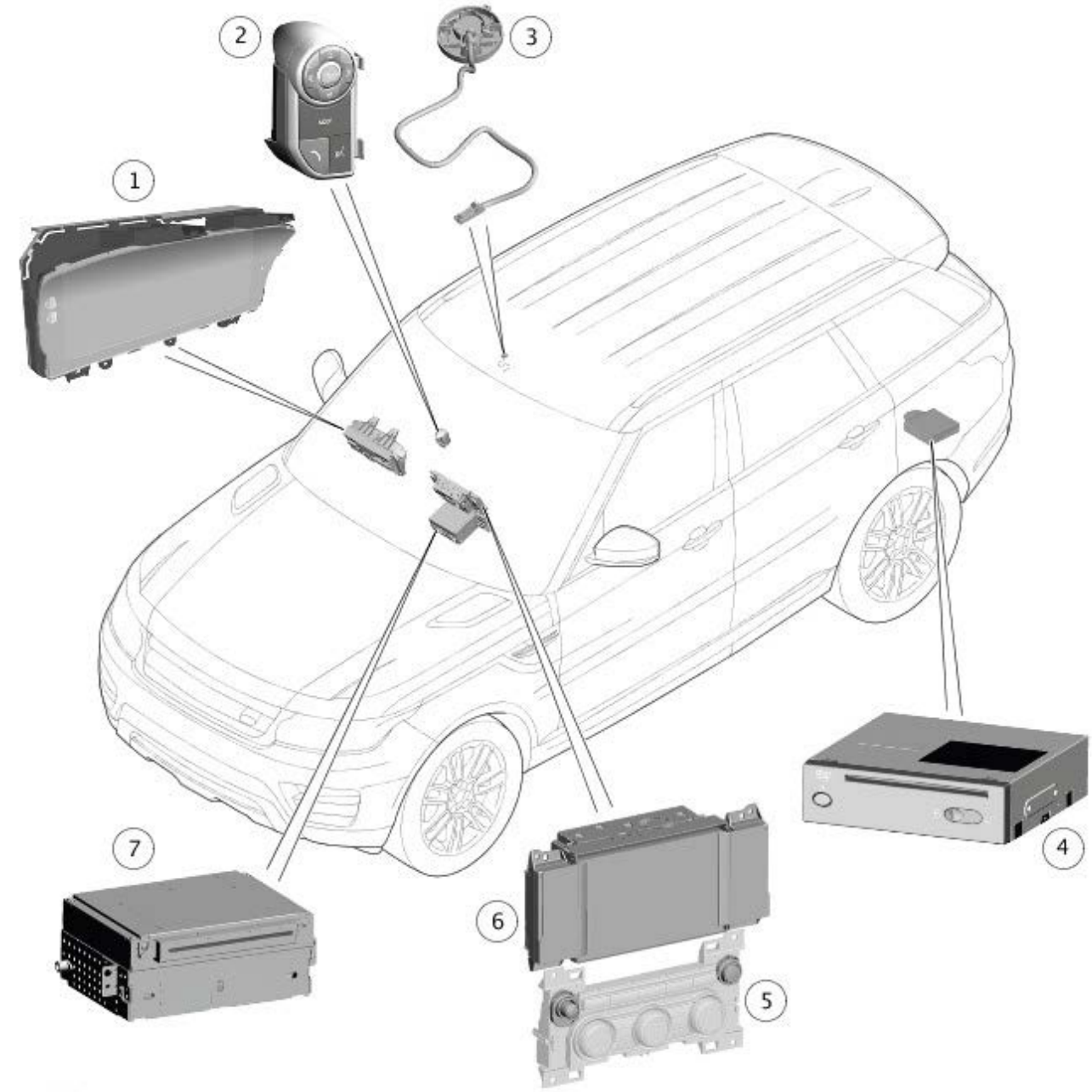
COMPONENT LOCATION - ROW



E155822

Item	Part Number	Description
1	-	Instrument Cluster (IC)
2	-	Left steering wheel switchpack
3	-	Microphone
4	-	Audio Amplifier Module (AAM)
5	-	Integrated Control Panel (ICP)
6	-	Touch Screen (TS)
7	-	Integrated Audio Module (IAM)

COMPONENT LOCATION - JAPAN/ASIA



E155823

Item	Part Number	Description
1	-	Instrument Cluster (IC)
2	-	Left steering wheel switchpack
3	-	Microphone
4	-	Navigation Control Module
5	-	Integrated Control Panel (ICP)
6	-	Touch Screen (TS)
7	-	Integrated Audio Module (IAM)

OVERVIEW

NOTE: Only basic voice controls are available for Japan specification vehicles. Voice control is not available in other Asian markets.

The Rest Of World (ROW) Advanced Range Rover Voice system provides the driver with the option of voice control for a range of supported functions. In addition to the navigation system, phone system and the notepad functions, the system also supports radio, satellite radio, digital radio, single CD (compact disc), virtual CD changer, USB (universal serial bus) and auxiliary connection functions (where fitted).

The ROW Advanced Range Rover Voice system adopts a concept known as 'Say What You See' (not applicable to Japan specification vehicles). Each of the Advanced Range 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.

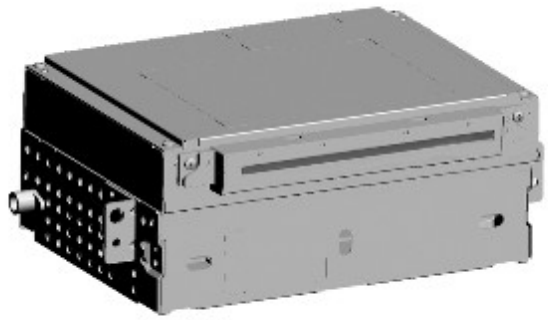
The system allows the vehicle user to concentrate fully on driving the vehicle, without any need to divert their eyes

from the road ahead in order to check information read outs on the vehicle instrument panel or Touch Screen (TS). The voice control system also feeds back audible information to the vehicle user.

Voice control is mainly a software based system. The software for controlling the voice system is resident in the Integrated Audio Module (IAM), TS. The IAM and TS each contain more than one voice control software component and communication between all three modules is via the Media Oriented System Transport (MOST) ring. A voice control microphone is located in the front overhead console and is hardwired to the IAM.

DESCRIPTION

Integrated Audio Module (IAM)



E141841

NOTE: The Japanese specification voice system does not store map and voice data on the IAM. All other functions of the IAM are applicable to Japan specification vehicles. Refer to 'Japanese Voice System' section below for details of the Japanese voice system.

The IAM is located in central position in the instrument panel, behind the Integrated Control Panel (ICP).

The IAM is connected on the MOST ring to the other infotainment system components. The hands free microphone is also hardwired to the IAM. The microphone is used for voice control, hands free telephony and Dynamic Volume Control (DVC). The IAM contains the recognizer, dialogue and Text-to-Speech (TTS) parts of the voice engine used to determine what the user wants to control by voice.

A 40 GB hard drive is used primarily for storing the information for satellite navigation. A 10GB partition is provided for storing music files, the remaining 30GB is used for map and voice control data storage e.g. Voice feedbacks.

The integral hard drive for the navigation system removes the requirement of a separate navigation computer usually found in the rear luggage compartment. The IAM stores the navigation map and voice control data locally within the 30GB hard drive partition. Map upgrades and software now have to be loaded directly into the IAM from a CD (compact disc).

The IAM communicates on the MOST ring with the rest of the Infotainment system. If the IAM is replaced it must be configured as a new module using an approved Land Rover diagnostic system. Calibration of the IAM using an approved Land Rover diagnostic system enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

Touch Screen (TS)



E141842

The Touch Screen (TS) is mounted centrally in the instrument panel. It provides the user interface to the rest of the Infotainment system. As well as being connected to other vehicle systems via the medium speed CAN (controller area network) bus and the rest of the infotainment system via the MOST ring, the left steering wheel switchpack for infotainment control are also connected to the TS via a hardwired resistive ladder.

The controlling software for the voice system is contained in the TS. This is responsible for starting and ending the voice engine in the IAM as well initiating any requested actions. It also provides information to a 'Say What You See' visual prompter in the TS which determines what to show during a dialogue with the voice system.

The driver can control voice functions by briefly pressing the voice button on the left steering wheel switchpack. The

TS will then initiate a voice session in the IAM, allowing the user to say voice commands to activate some of the infotainment system features.

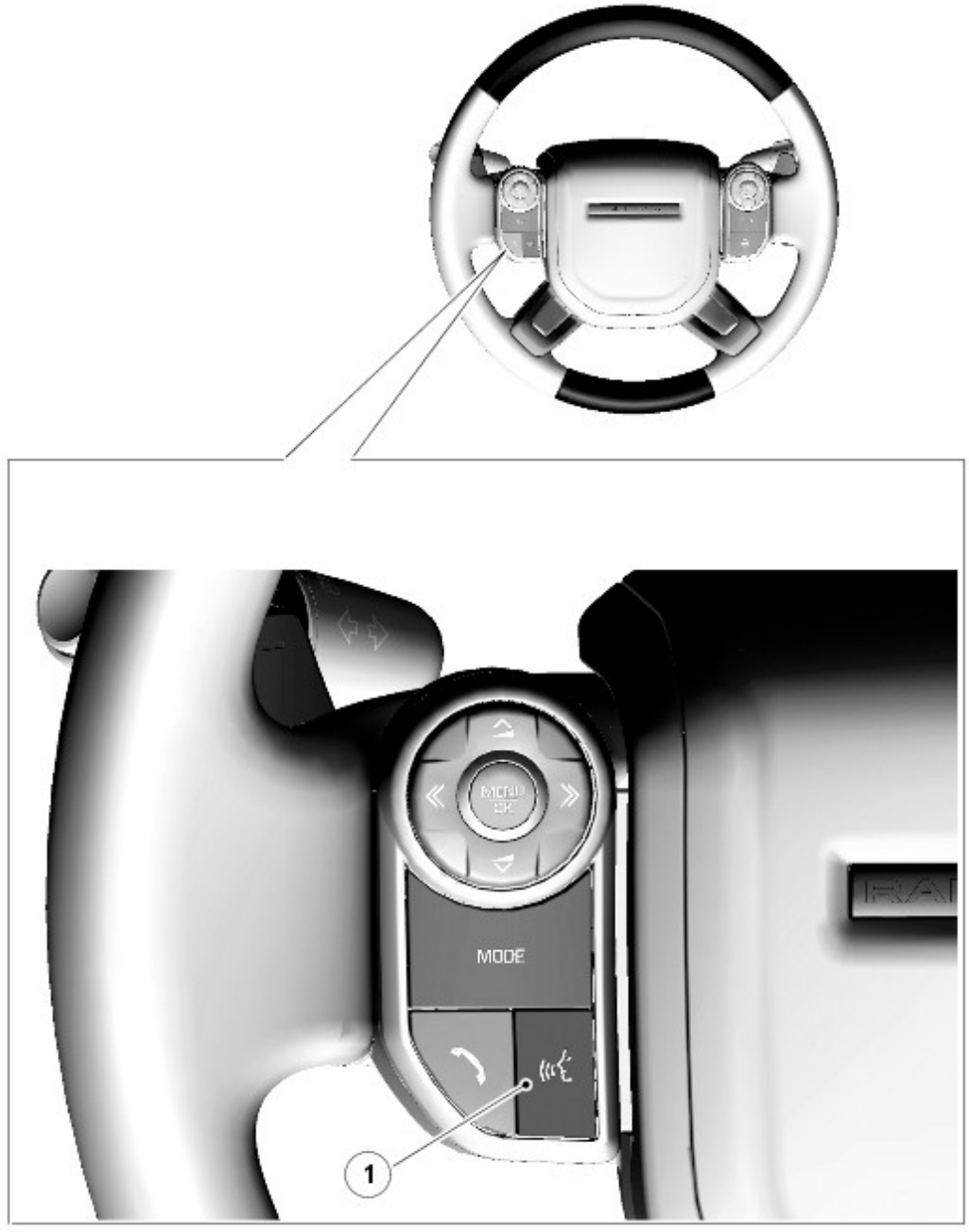
Microphone



E141843

The directional type microphone is fitted to the driver side of the overhead console so that it is directed towards the driver. It is connected to the 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.

Left Steering Wheel Switchpack



E141844

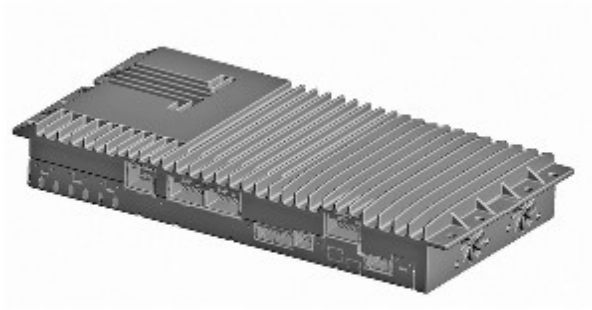
Item	Part Number	Description
1	-	Voice switch

The push-to-talk switch for the voice system is located on the left steering wheel switchpack. The driver is able to use this switch for:

- Starting a voice session
- Cancelling/Ending a voice session
- "Barging in (Interrupting) during a voice session (stops playing the current feedback and moves directly to the next listening tone, allowing the user to immediately enter the next command rather than having to wait).

Audio Amplifier Module

NOTE: Meridian Signature Reference System audio amplifier module shown



E141845

The AAM is located below the front left seat. It is connected to the audio system via the MOST bus. Speaker connections from the amplifier are hardwired.

Japanese Voice System

The Japanese voice system is part of the Japanese navigation system and uses the standard system components, with the exception that the map and voice data is not stored on the IAM hard disc drive. Additional components are:

- a navigation control module
- a navigation video interface module.

The two additional modules are used to read the map and voice data and output audio and video signals to the TS, IAM and audio amplifier module.

NAVIGATION CONTROL MODULE

A separate NCM is located on the floor of the luggage compartment.



E141846

The NCM is a DVD drive which reads voice and map data direct from a DVD. The NCM is connected on the MOST ring and communicates with the TS to initiate a voice session.

The NCM outputs the video signals in a Gigabyte Video InterFace (GVIF) format to a video interface module which converts the GVIF input to a Low-Voltage Differential Signalling (LVDS) video signal output which is then passed to the TS. Audio output is on the MOST ring to the AAM.

VICS FM transmission signals are received by the NCM via an FM antenna and a VICS antenna amplifier. Infra-red VICS transmissions are also received by the VICS beacon antenna, located on the top of the instrument panel, and are passed to the NCM.

OPERATION

NOTE: Only basic voice controls are available for Japan specification vehicles.

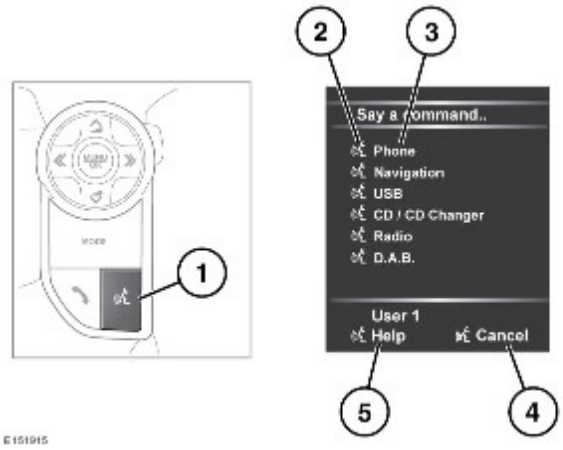
The ROW advanced voice system provides the driver with the option of voice control for a range of supported functions. The following systems can be controlled by Voice:

- Bluetooth® Telephone system
- Navigation system
- Vehicle notepad
- Radio, satellite radio and digital radio (if fitted)
- CD player
- Virtual CD player
- USB and auxiliary connections.

The 'notepad' facility allows voice notes to be recorded. Voicetags for phone dialling, radio stations and navigation locations allow the system to be personalized and there are help and tutorial functions to provide advice on using the system.

The Advanced Voice system uses a 'visual prompter' system known as 'Say What You See' (SWYS). Each of the Advanced Voice functions are supported by 'Help' commands; saying "Help" at any point in the conversation will give a context sensitive explanation of what the user can do at that point. The SWYS visual prompter shown in the TS 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.

Steering Wheel Controls and Voice Control Menu



Item	Part Number	Description
1	-	Voice switch
2	-	Voice symbol
3	-	SWYS visual prompter
4	-	When displayed, say Cancel to cancel the current voice session
5	-	When displayed, say Help to get assistance during a voice session

NOTE: Telephony voice commands are only accessible when a Bluetooth® device is docked to the vehicle.

The system is operated by the voice switch on the left steering wheel switchpack. Voice commands are detected by the dedicated 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 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 switch, 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.

Command List

A full list of all shortcut voice commands can be found on the Touch Screen (TS) by pressing the 'command list' softkey 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**' softkey next to any command shows alternative ways of saying the same command.

Starting a Voice Session

To start a voice session the driver operates the voice switch on the left steering wheel switchpack briefly. An audible

tone can be heard, followed by the presentation of the 'Say What You See' (SWYS) visual prompter in the TS indicating some commonly used available commands. A voice symbol alongside each item in the list indicates that the system is listening. Always wait for the listening tone to finish playing before using the command. To end a session the same switch is pressed and held until a double beep is heard.

When the voice switch is operated on the left steering wheel switchpack, a voltage is received at the TS via the clockspring assembly. This voltage is sent on a single wire from the switchpack, through a resistive ladder. The whole process is then initiated via the MOST network; for example the TS starts the voice session and carries out the resulting action requested by the user, but the IAM maintains the dialogue with the user. The SWYS visual prompter is calculated and shown in the TS, when requested to do so by the IAM. The accompanying voice feedback is sent to the AAM for broadcast over the speakers from the IAM. If a recognized user instruction is received via the microphone, this is then processed and sent to the TS to perform the required action.

 NOTE: Should a higher priority display be required on the TS, this will prevent or cancel the current voice session.

Voice Tutorial

There is a voice tutorial that can be accessed either by giving the 'voice tutorial' command or by pressing the 'voice tutorial' softkey located in the 'Operating Guide' option in the 'Voice Settings' menu on the TS. 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 (interrupt) and saying shortcut commands.

Voicetags

Voicetags allow the user to store voice entries as shortcuts to control various functions; for example routing to navigation locations, dialling numbers and tuning to radio stations. The voicetags sub-menu, in the voice settings menu in the TS, accesses controls for navigation, phone, radio and depending on specification digital radio or satellite radio.

Voice Training

Voice training is used to adjust the system to recognize the user's voice more accurately. The voice system allows two different users to create separate profiles, providing training for User 1 and User 2. 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. Once activated, another 'pop-up' indicates that training is in progress.

Voice training phrases will be shown on the 'SWYS visual prompter' in the TS 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.

Voicetags 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 voicetags 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 was to be replaced then all voicetags and training would be lost.

 If either the IAM, Instrument Cluster or the TS 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.

Dialling 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 voicetag 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.

NOTES:

The contact name must be spoken as displayed in the phonebook in the TS. For example, if "Smith Steven" is shown in the Phonebook in the TS, it is unlikely that the voice system will recognise "Steven Smith" (order reversed), "Steve Smith" or just "Steven" (partial name) correctly.

The system will attempt to recognise names based on the currently selected voice language. Foreign contacts may not be recognised correctly and depending on the characters used, may not be recognised at all.

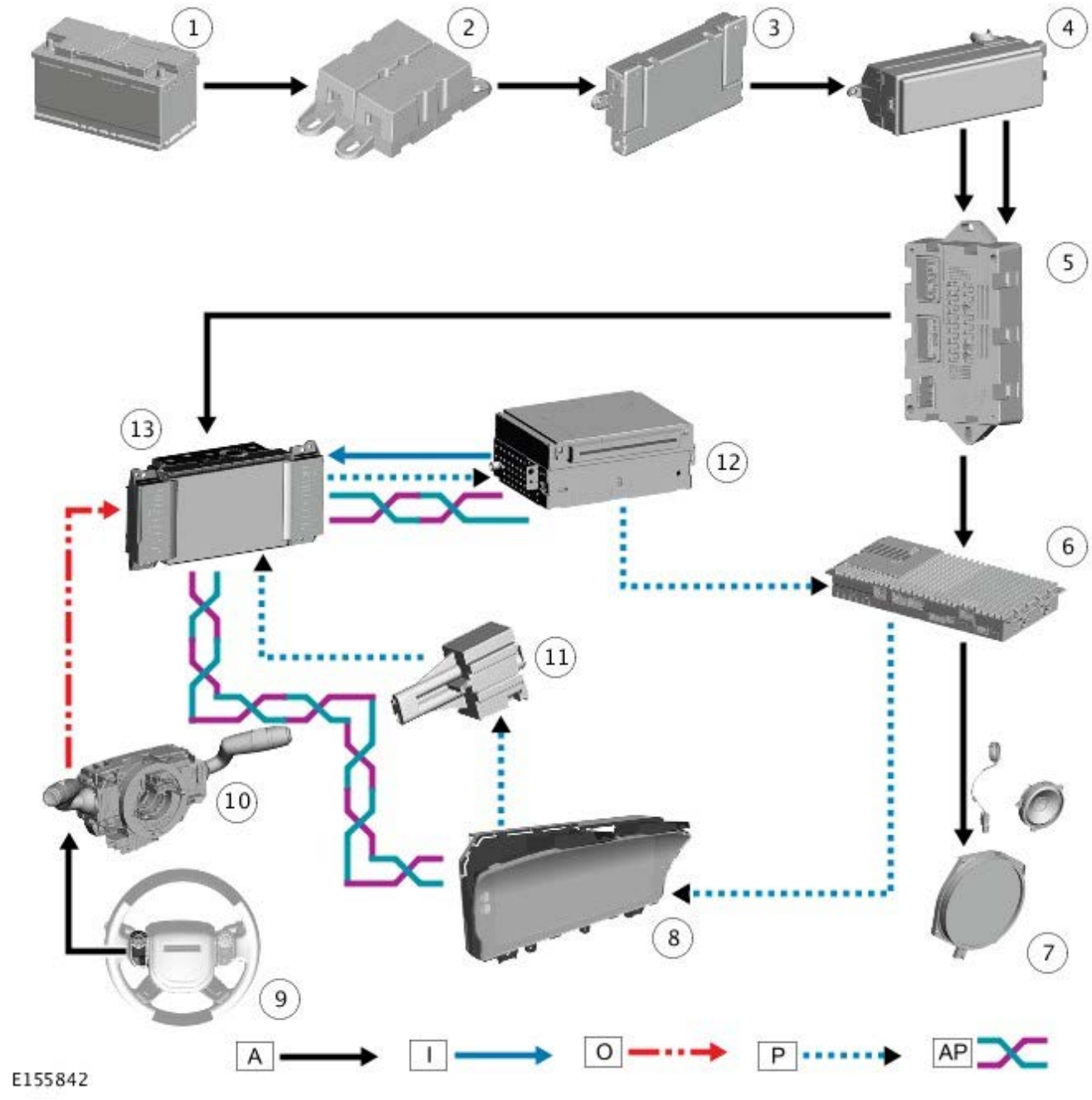
For regularly used contacts with more than one number or a foreign name, the user can store a voicetag as a shortcut.

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.

CONTROL DIAGRAM - ROW

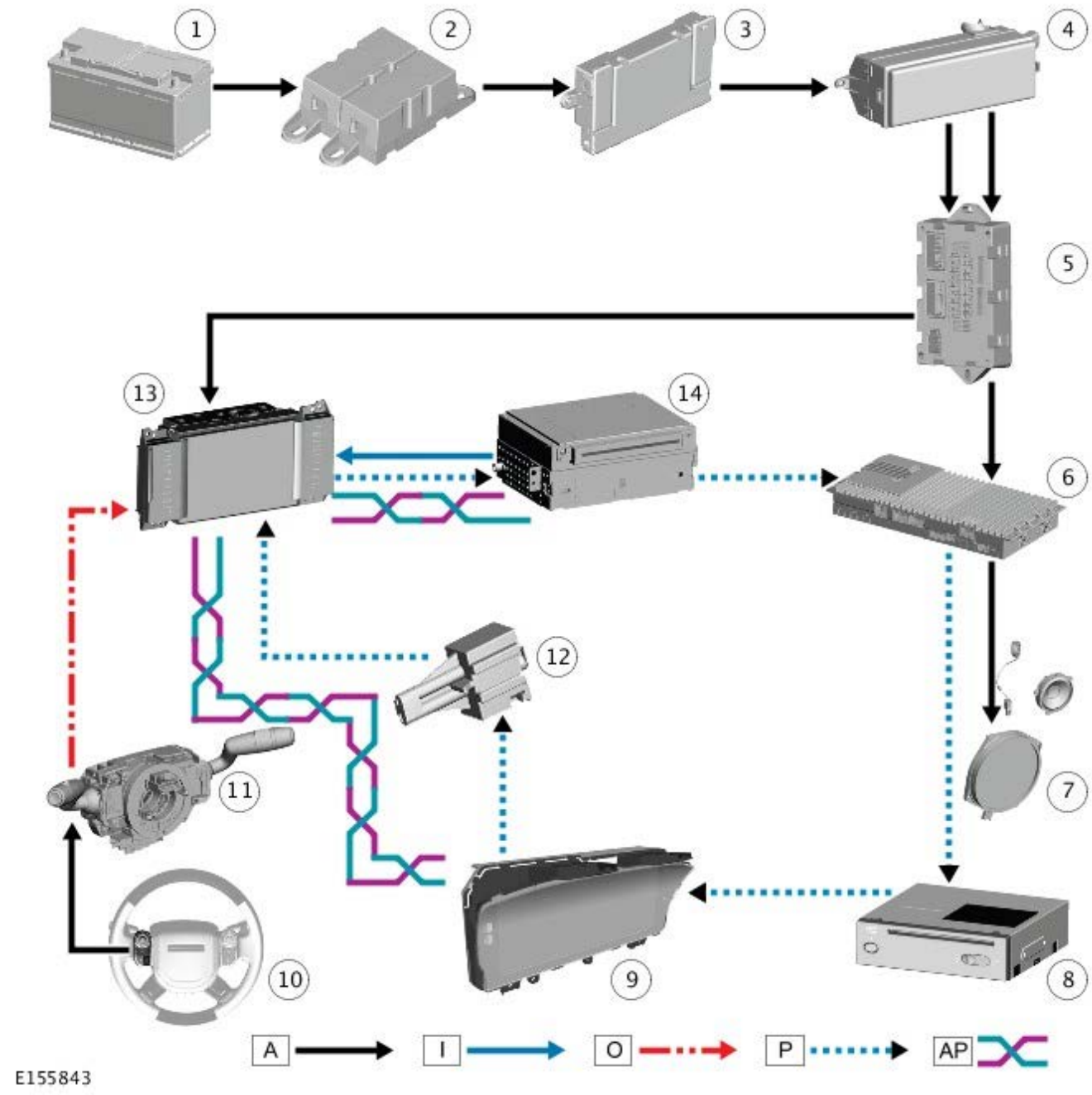
NOTE: **A** = Hardwired; **I** = CVBS; **O** = LIN;**P** = MOST; **AP**= MS CAN Comfort



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)
3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)
5	-	Quiescent Current Control Module (QCCM)
6	-	Audio Amplifier Module (AAM)
7	-	Vehicle speakers
8	-	Instrument Cluster (IC)
9	-	Left steering wheel switchpack
10	-	Clockspring
11	-	MOST diagnostic connector
12	-	Integrated Audio Module (IAM)
13	-	Touch Screen (TS)

CONTROL DIAGRAM - JAPAN

NOTE: **A** = Hardwired; **I** = CVBS; **O** = LIN;**P** = MOST; **AP**= MS CAN Comfort



Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box 2 (BJB2)

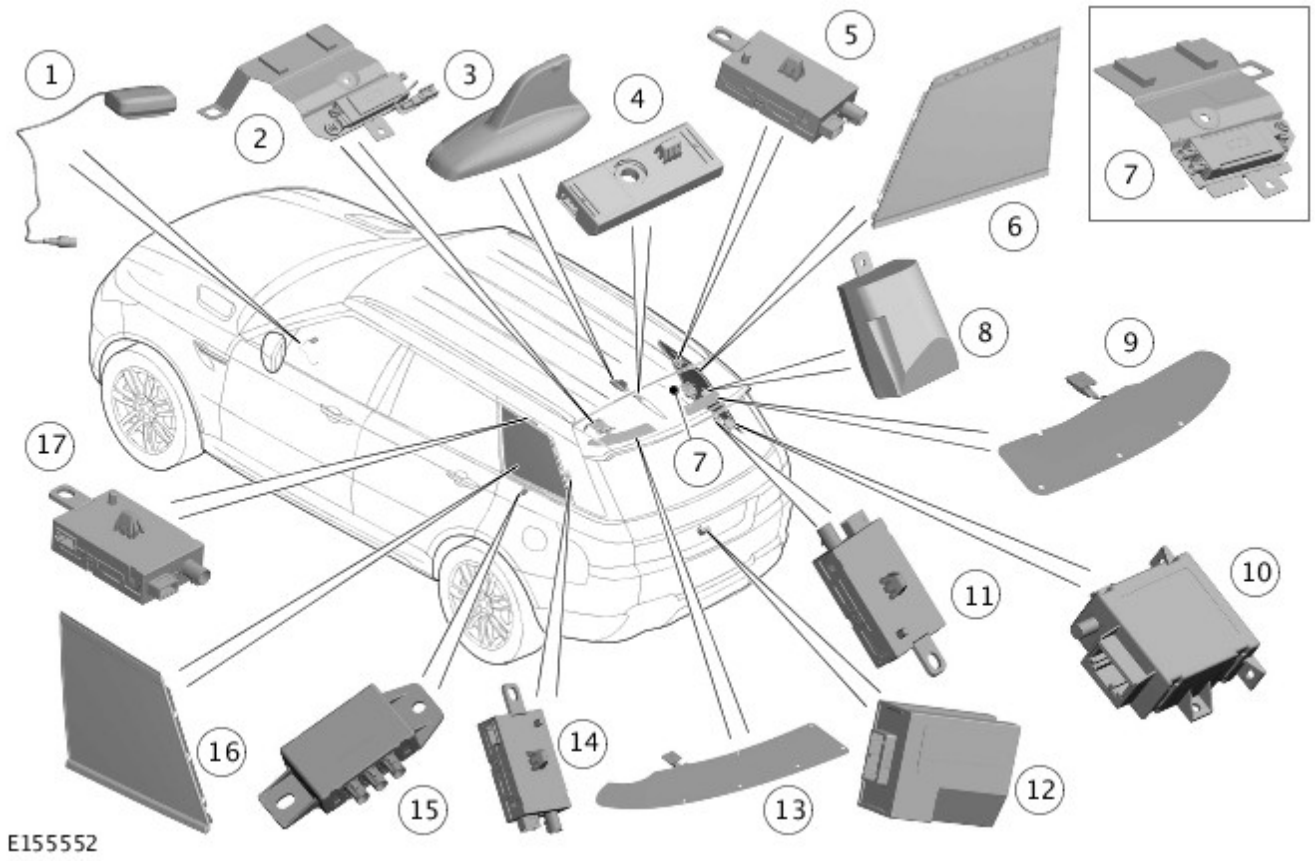
3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)
5	-	Quiescent Current Control Module (QCCM)
6	-	Audio Amplifier Module (AAM)
7	-	Vehicle speakers
8	-	Navigation Control Module (NCM)
9	-	Instrument Cluster (IC)
10	-	Left steering wheel switchpack
11	-	Clockspring
12	-	MOST diagnostic connector
13	-	Touch Screen (TS)
14	-	Integrated Audio Module (IAM)

Published: 31-May-2013

Information and Entertainment System - Antenna

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Vehicle Information and Communication System (VICS) beacon antenna
2	-	Amplitude Modulation (AM) / Frequency Modulation (FM) antenna amplifier
3	-	Roof pod (Global Positioning System (GPS)/digital radio/satellite radio (NAS)
4	-	High Mounted Stop Lamp (HMSL) and Heated Rear Window (HRW) Radio Frequency (RF) filter
5	-	Right upper - TV antenna amplifier
6	-	Right TV antenna / Fuel Fired Booster Heater (FFBH) remote control antenna print on glass (when fitted)
7	-	FM2 / digital radio / VICS (Japan only) antenna amplifier
8	-	Rear wiper motor RF filter FFBH remote control receiver (when fitted)
9	-	FM2 / digital radio / TMC / VICS (Japan only) foil antenna
10	-	FFBH remote control receiver (when fitted)
11	-	Right lower TV antenna amplifier /FFBH remote control antenna amplifier (when fitted)
12	-	Rear View Camera (RVC) RF filter
13	-	AM/FM antenna foil
14	-	Left lower - TV antenna amplifier
15	-	GPS antenna splitter
16	-	Left TV antenna print on glass
17	-	Left upper - TV antenna amplifier

OVERVIEW

The AM/FM, digital radio band III and VICS (Japan only) antennas foils are located in the rear spoiler. The antennas are part of the spoiler assembly which is a bonded component and therefore the antennas are not serviceable as separate items.

Two foil antennas are located in the rear spoiler which are common to all models.

The AM/FM and FM2/DAB/VICS antenna amplifier assemblies are fitted onto the tailgate upper moulding, below the rear spoiler.

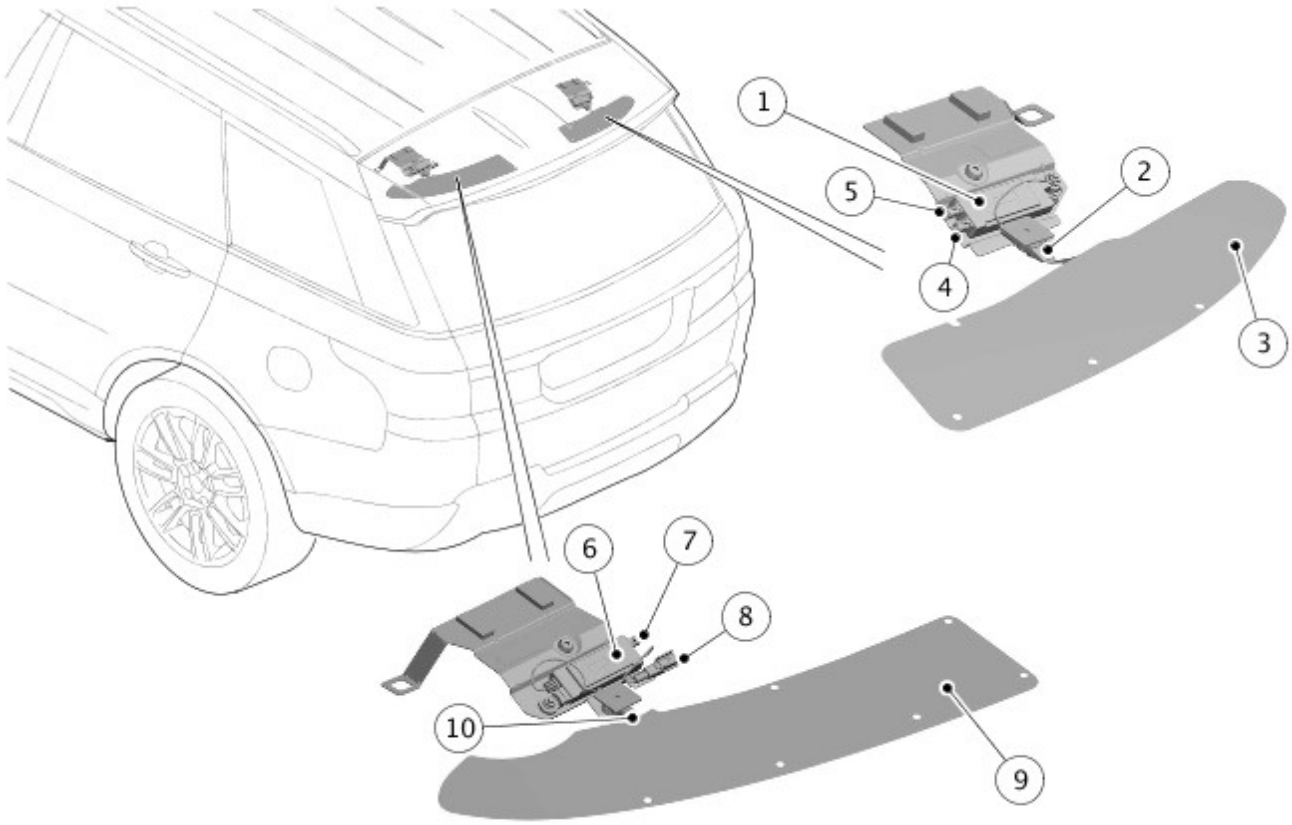
Satellite radio (Satellite Digital Audio Radio Service (SDARS)) (NAS only), digital radio Band L and the GPS (global positioning system) antennas are located in the roof pod.

Two TV antennas are located in each rear quarter window glass and their amplifiers are located above and below the window glass. The TV antenna in the right rear quarter glass is also used for the Fuel Fired Booster Heater (FFBH) remote control RF reception, when fitted.

Japanese specification vehicles can also be fitted with a additional Vehicle Information and Communication System (VICS) beacon antenna.

DESCRIPTION

Tailgate Mounted Antenna Assemblies



E155553

Item	Part Number	Description
1	-	FM2/FM2+DAB-3/FM2+VICS antenna amplifier
2	-	Connector – antenna to amplifier
3	-	Foil antenna: FM2/DAB/VICS
4	-	Connector - FM co-axial cable to IAM
5	-	Connector - DAB or VICS co-axial cable to Navigation control module (Japan only)
6	-	AM/FM antenna amplifier
7	-	Co-axial cable to Integrated Audio Module (IAM)
8	-	Connector - Power supply from IAM
9	-	Foil antenna-AM/FM
10	-	Connector – antenna to amplifier

AM/FM ANTENNA

The AM/FM antenna is located in the left side of the spoiler. The antenna is a foil type with a single connection to the AM/FM antenna amplifier.

The amplifier is located on a bracket which is attached to the upper tailgate structure.

The amplifier is connected via a co-axial cable to the Integrated Audio Module (IAM). The IAM supplies a power output to the amplifier.

FM2/DIGITAL RADIO BAND III ANTENNA

The FM2 antenna is located in the right side of the spoiler. The antenna is a foil type with 2 connections to the FM2 amplifier. Depending on market, the amplifier is also utilized for reception of digital radio band III and VICS (Japanese) transmissions.

The amplifier is located on a bracket which is attached to the upper tailgate structure.

The amplifier is connected via 2 co-axial cables to the IAM; one supplying the FM transmissions and the other supplying the digital radio band III.

VICS /FM2 ANTENNA (JAPAN ONLY)

Data messages for VICS are received through the VICS/FM2 antenna and antenna amplifier located in right side of the rear spoiler. The antenna is a foil type with 2 connections to the amplifier.

The amplifier is located on a bracket which is attached to the upper tailgate structure.

The amplifier has two output connections; one is connected via a co-axial cable to the IAM for FM2 transmissions, the second connection is for the VICS antenna and is connected to the Navigation module via a co-axial cable.

Global Positioning System (GPS) Antenna



E141520

The navigation system GPS antenna is located in the roof pod. Depending on vehicle specification the roof pod can contain nothing,GPS, digital radio L-Band or satellite radio (SDARS) antennas.

The roof pod is fitted externally on the roof panel and is attached to the roof panel with two flanged nuts which screw onto captive studs in the roof pod. Two co-axial connectors provide for the connection for the GPS antenna and the satellite or digital radio antenna.

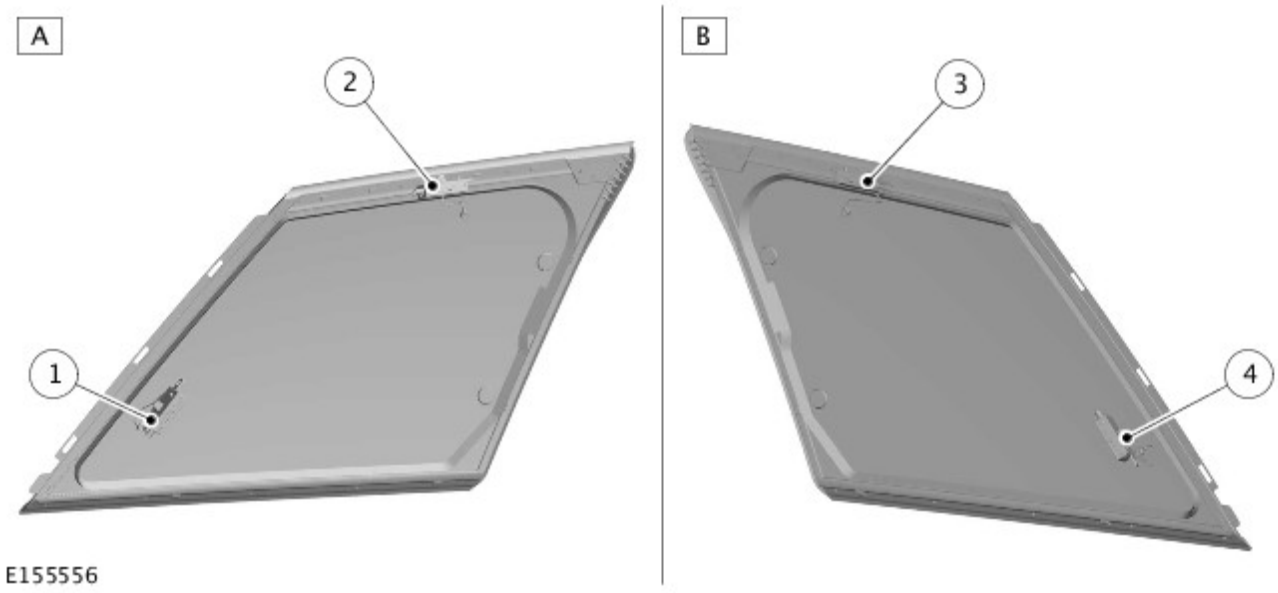
VICS Beacon Antenna (Japan only)

The VICS beacon antenna is located on the top of the instrument panel. The antenna is attached to the surface of the instrument panel with an adhesive pad.

The VICS beacon antenna is connected to the Navigation control module.

The antenna receives infrared and RF signals from roadside transmitters. The RF reception from the beacon is in addition to the RF reception from the rear spoiler mounted antenna.

Television (TV) Antennas



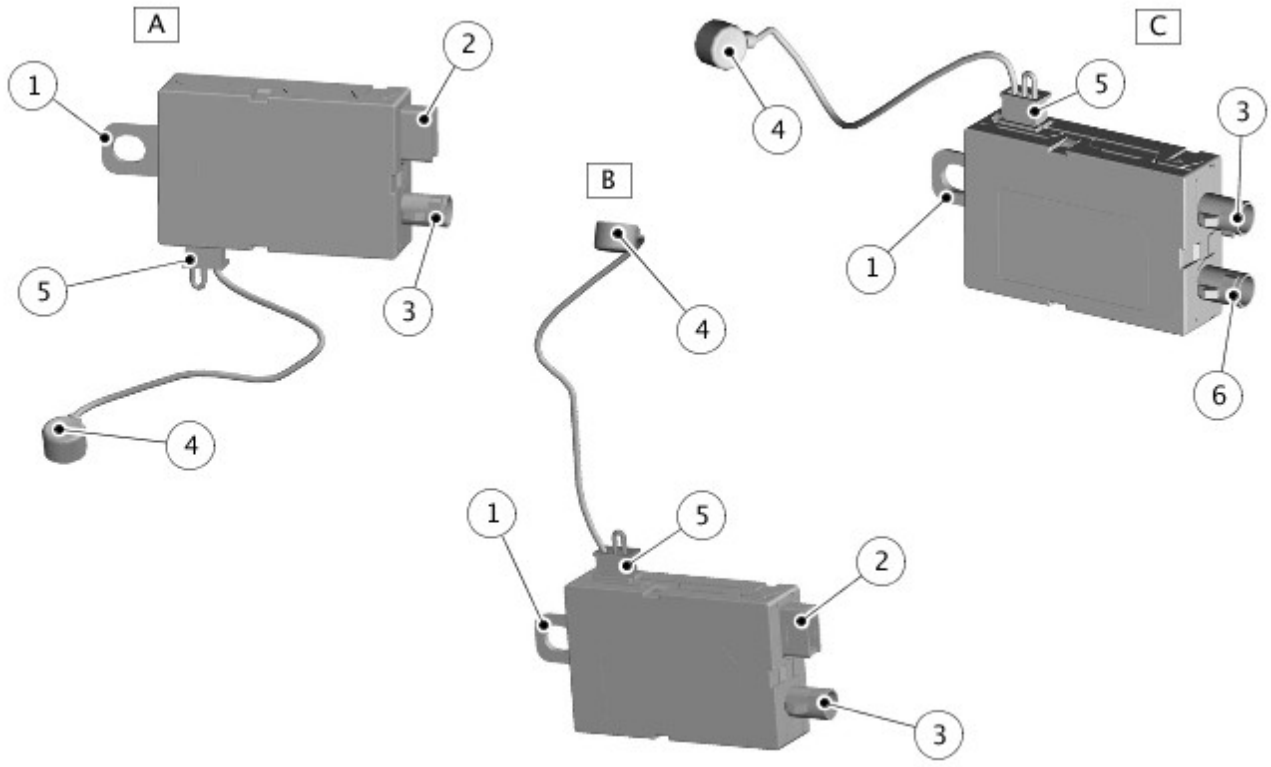
E155556

Item	Part Number	Description
A	-	Right rear quarter window
B	-	Left rear quarter window
1	-	TV antenna amplifier/FFBH amplifier (where fitted)
2	-	TV antenna amplifier
3	-	TV antenna amplifier
4	-	TV antenna amplifier

Four TV (television) antennas are used; 2 in each rear quarter window.

The TV/Telestart antenna pattern is printed onto the rear quarter window glass inside surface. Each antenna has a press stud type connector for the connection to the amplifier and each antenna has one amplifier. The lower amplifier on the right side quarter window also controls the RF reception for the Fuel Fired Booster Heater (FFBH) remote control.

TV ANTENNA AMPLIFIERS



E157802

Item	Part Number	Description
A	-	TV only amplifier
B	-	TV and FFBH remote control RF amplifier
1	-	Attachment lug/ground
2	-	Connector to TV Control Module (TVCM)
3	-	Connector to TV control receiver
4	-	Antenna connection
5	-	MQS connector
6	-	Co-axial connector to TVCM

There are 3 TV amplifiers and 1 TV/FFBH remote control RF amplifier fitted. The antenna on the rear left quarter window glass are for TV only. The upper antenna in the rear right quarter window glass is for TV only, the lower antenna is for TV and FFBH RF reception.

The 3 TV antenna amplifiers are functionally identical assemblies, but, have handed RF input connections to the press stud on the rear quarter window glass and steering pins. The combined TV/FFBH RF amplifier is a unique unit with 2 co-axial plugs.

A co-axial cable from each amplifier is connected to the TV control module. The FFBH RF signal is passed from the combined amplifier to the FFBH via a co-axial cable.
For additional information, refer to: Fuel Fired Booster Heater (412-02A Auxiliary Climate Control, Description and Operation).

Radio Frequency (RF) Filters

Two RF filters are used on the antenna system to remove any electrical noise interference being detected by the antenna systems.

A rear wiper motor relay RF filter is located on the right E pillar. The filter is located in the power supply from the Engine Junction Box (EJB) to the rear wiper motor.

A high mounted stop lamp and Heated Rear Window (HRW) RF filter is mounted in a central position on the rear roof cross-member. The filter is located in the power supply from the Central Junction Box (CJB) to the high mounted stop lamp. One of the terminals is also connected to the HRW power feed and filters any RF noise on the power supply wire.

OPERATION

Diagnostics

The Integrated Audio Module (IAM) can detect the connections between the tuners in the IAM and the antenna amplifiers. Faults in these connections will store a DTC (diagnostic trouble code) in the IAM.

The TV control module can detect the connections between the tuners in the TC Control Module (TVCM) and the antenna amplifiers.

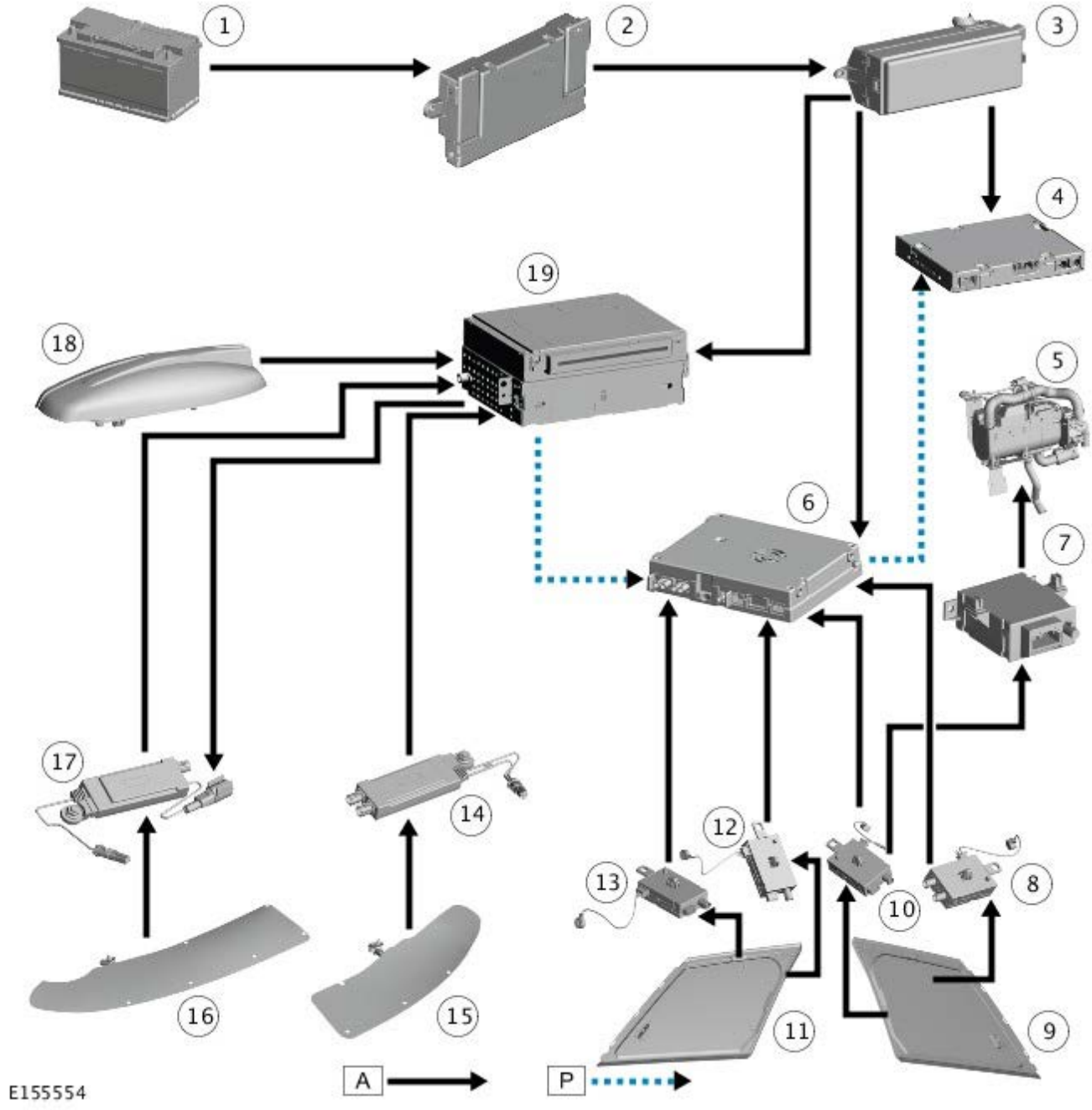
The connections from the rear quarter window TV antenna elements and the radio spoiler mounted foils and the antenna amplifiers are not monitored by the IAM or the TVCM and therefore a DTC will not be recorded for a fault in these connections. These connections require a manual check of the security of the connectors and a continuity check to ensure there are no broken connections or wires.

NOTE: The foil antennas in the rear spoiler are not serviceable items and replacement requires a new spoiler to be fitted.

The satellite radio (NAS only), the digital radio L-band and the GPS antennas are monitored by their respective control modules and faults in these antennas will record DTCs in the control modules.

CONTROL DIAGRAMS

Control Diagram - Rest of World (ROW)

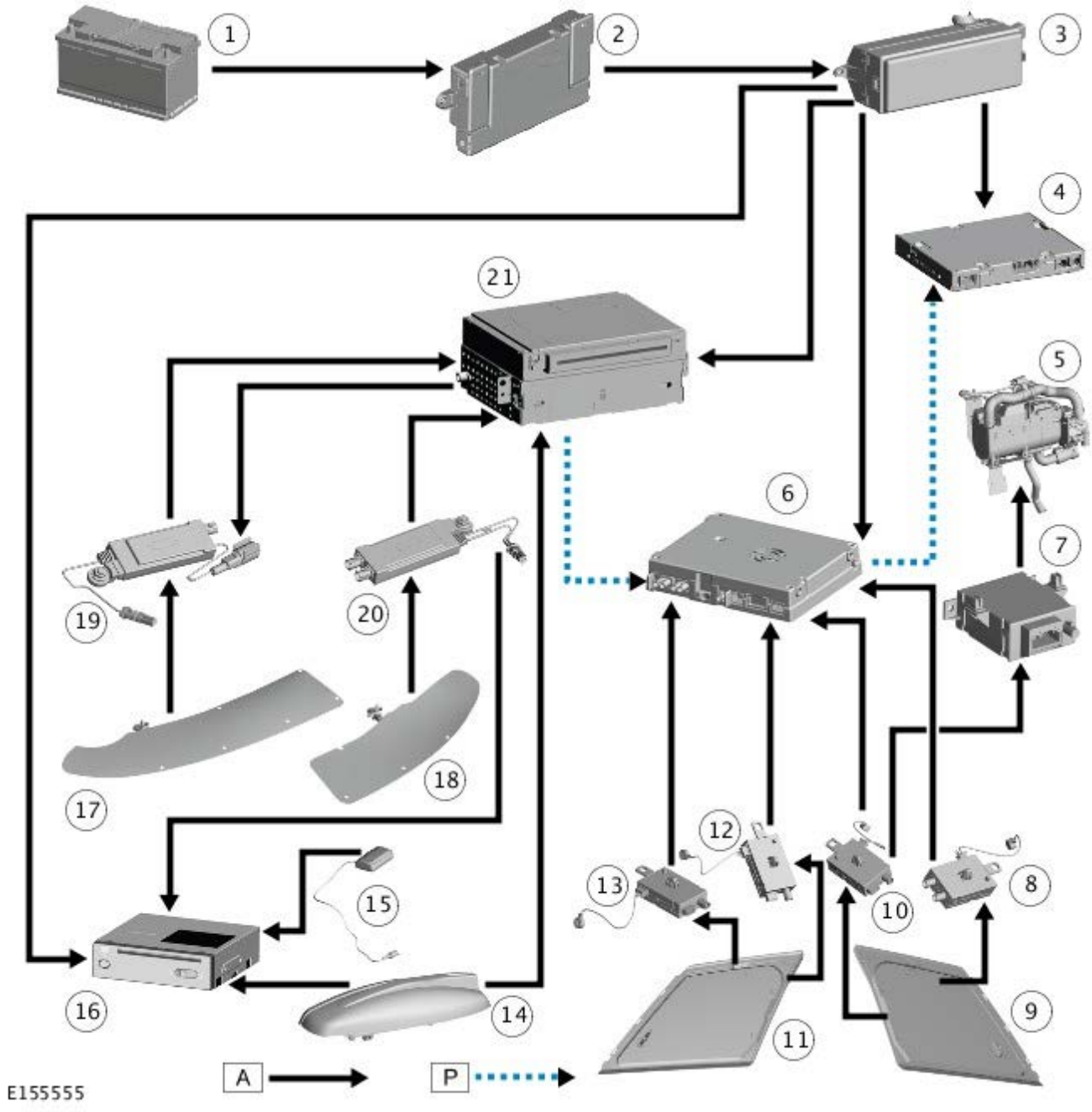


A = Hardwired; P = MOST

Item	Part Number	Description
1	-	Battery

2	-	Battery Junction Box (BJB)
3	-	Rear Junction Box (RJB)
4	-	Rear Seat Entertainment Control Module (RSECM) (where fitted - reference only)
5	-	Fuel Fired Booster Heater (FFBH) (when fitted - reference only)
6	-	Television Control Module (TVCM)
7	-	FFBH receiver
8	-	TV antenna amplifier
9	-	TV antenna amplifier /FFBH remote control antenna amplifier (when fitted)
10	-	Right TV antenna / Fuel Fired Booster Heater (FFBH) remote control antenna (when fitted)
11	-	Left TV antenna
12	-	TV antenna amplifier
13	-	TV antenna amplifier
14	-	FM2 / digital radio / TMC foil antenna
15	-	FM2 / digital radio / TMC antenna amplifier
16	-	AM / FM foil antenna
17	-	AM / FM antenna amplifier
18	-	Roof pod (GPS/digital radio/satellite radio (NAS))
19	-	Integrated Audio Module (IAM)

Control Diagram - Japan, Asia



A = Hardwired; P = MOST

Item	Part Number	Description

1	-	Battery
2	-	Battery Junction Box (BJB)
3	-	Rear Junction Box (RJB)
4	-	Rear Seat Entertainment (RSE) control module (when fitted - reference only)
5	-	Fuel Fired Booster Heater (FFBH) (when fitted - reference only)
6	-	Television (TV) Control Module
7	-	FFBH receiver
8	-	TV antenna amplifier
9	-	TV antenna amplifier /FFBH remote control antenna amplifier (when fitted)
10	-	Right TV antenna / Fuel Fired Booster Heater (FFBH) remote control antenna (when fitted)
11	-	Left TV antenna
12	-	TV antenna amplifier
13	-	TV antenna amplifier
14	-	Roof pod (GPS/digital radio)
15	-	VICS beacon antenna (Japan only)
16	-	Navigation Control Module (NCM)
17	-	AM / FM foil antenna
18	-	FM2 / digital radio / TMC / VICS (Japan only) foil antenna
19	-	AM / FM antenna amplifier
20	-	FM2 / digital radio / TMC / VICS (Japan only) antenna amplifier
21	-	Integrated Audio Module (IAM)

Published: 21-Nov-2013

Information and Entertainment System - Information and Entertainment System

Diagnosis and Testing

Principle 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: (415-01 Information and Entertainment System)

Audio System (Description and Operation),
Navigation System (Description and Operation),
Video System (Description and Operation),
Audio System (Description and Operation),
Navigation System (Description and Operation),
Video System (Description and Operation),
Cellular Phone (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

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

Visual Inspection

Mechanical	Electrical
• Audio amplifier module • Integrated audio module • Digital radio control module • Integrated control panel • Touch screen • Touch screen switchpacks • Navigation control module • Rear seat entertainment control module • Satellite radio control module • TV control module • Compact disc player jammed, not loading • Scratched/dirty compact discs • Loudspeakers	• Fuses • Loose or corroded connector(s) • Audio amplifier module • Integrated audio module • Digital radio control module • Integrated control panel • Touch screen • Touch screen switchpacks • Navigation control module • Rear seat entertainment control module • Satellite radio control module • TV control module • 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, check for diagnostic trouble codes (DTCs) and refer to the relevant DTC index

DTC Index

For a list of diagnostic trouble codes 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 Module (AAM) (Description and Operation),
Diagnostic Trouble Code Index: Integrated Audio Module (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Digital Radio Control Module (DRCM) (Description and Operation),
Diagnostic Trouble Code Index: Integrated Control Panel (Description and Operation),
Diagnostic Trouble Code Index: Touch Screen (Description and Operation),
Diagnostic Trouble Code Index: Touch Screen Switchpack (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Navigation Control Module - Extended Markets (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Rear Seat Entertainment Control Module (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Satellite Radio Control Module (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: TV Control Module (TVCM) - Digital (Description and Operation).

Published: 02-May-2013

Information and Entertainment System - Audio Unit

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

Remove the media from the unit and make sure that the customer preset details are noted for installation, as the data will be lost during removal.

Some components shown removed for clarity.

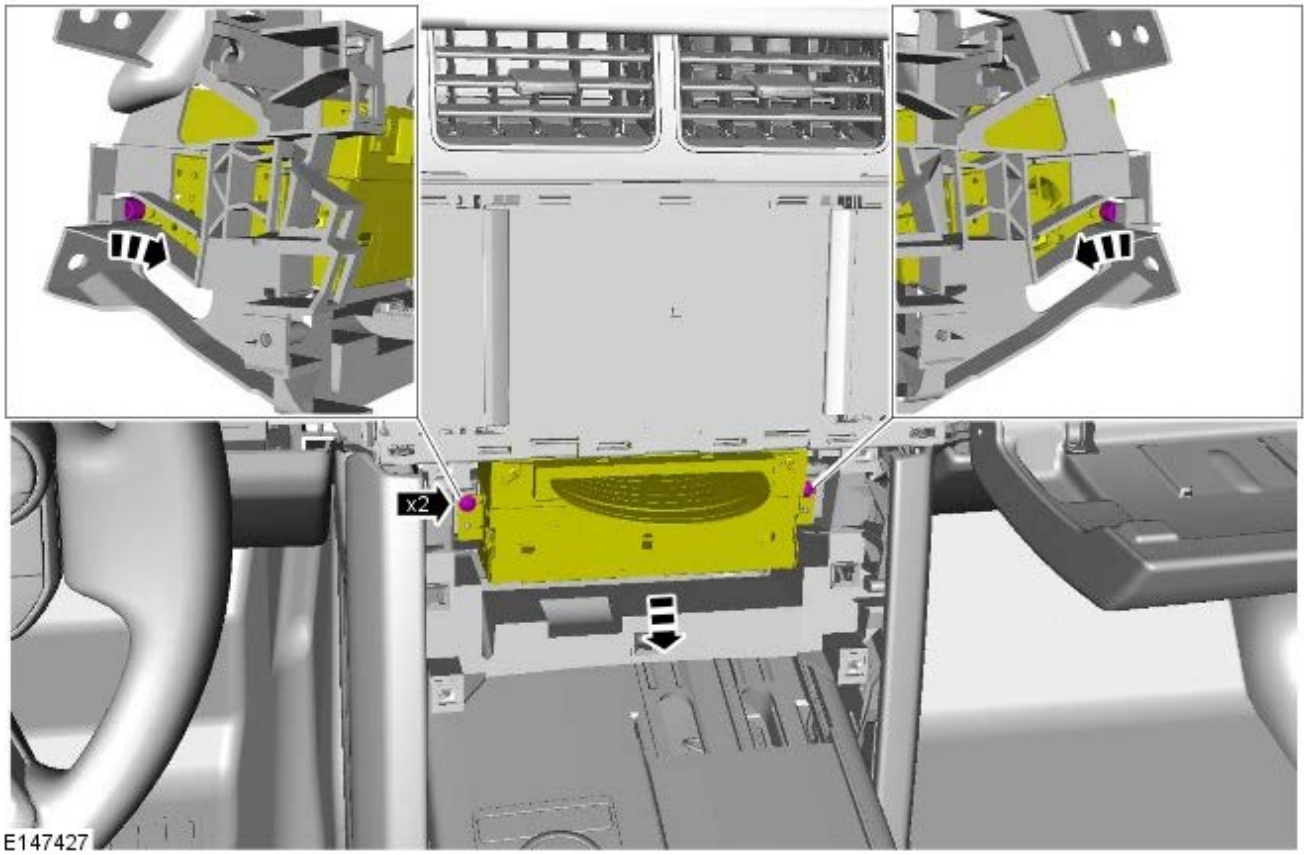
Some variation in the illustrations may occur, but the essential information is always correct.

1. .

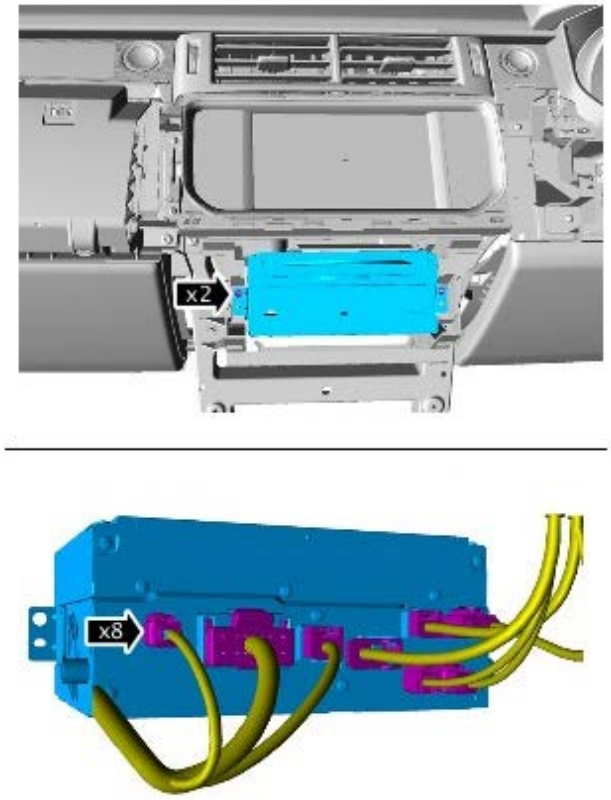
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Refer to: Climate Control Assembly (412-01A Climate Control, Removal and Installation).

3. *Torque:* 2.2 Nm



4.



E156257

Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 02-May-2013

Information and Entertainment System - Front Door Speaker

Removal and Installation

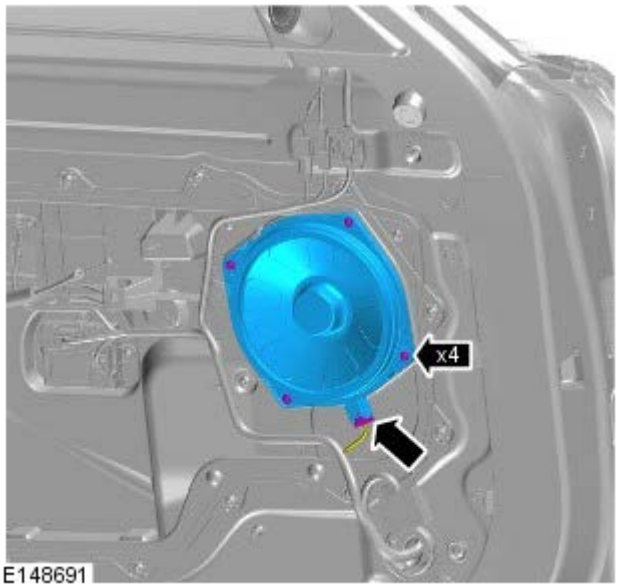
Removal

CAUTION: LH illustration shown, RH is similar.

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

1. Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



Installation

1. To install, reverse the removal procedure.

Published: 02-May-2013

Information and Entertainment System - Rear Door Speaker

Removal and Installation

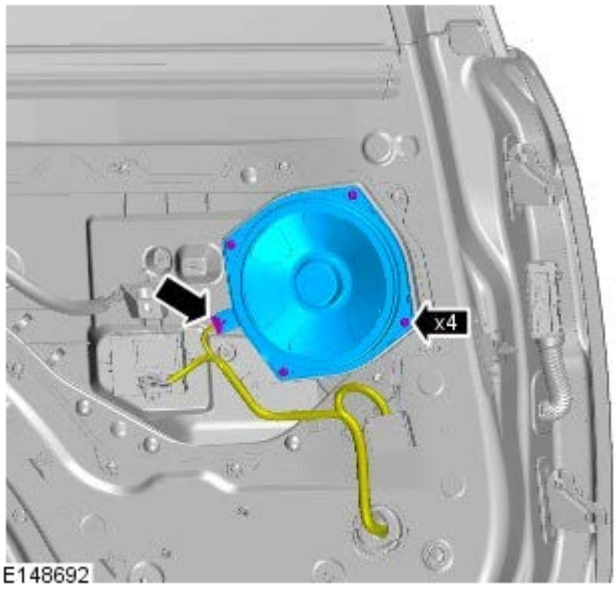
Removal

CAUTION: LH illustration shown, RH is similar.

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

1. Refer to: Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



Installation

1. To install, reverse the removal procedure.

Published: 02-May-2013

Information and Entertainment System - Rear Quarter Panel Speaker

Removal and Installation

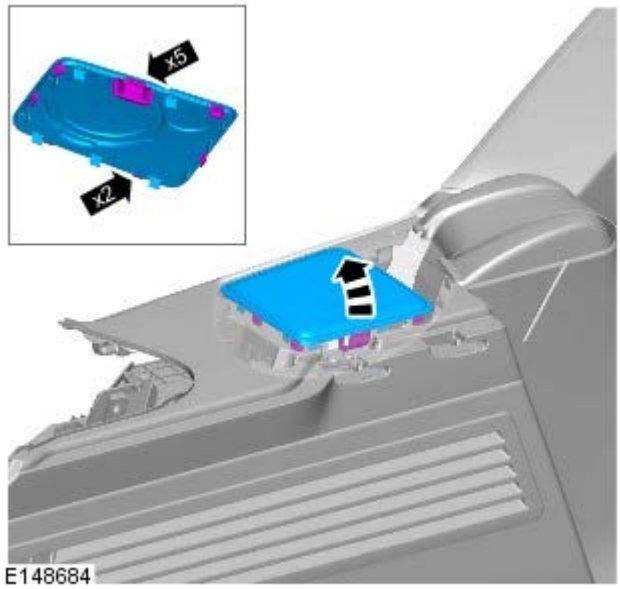
Removal

NOTES:

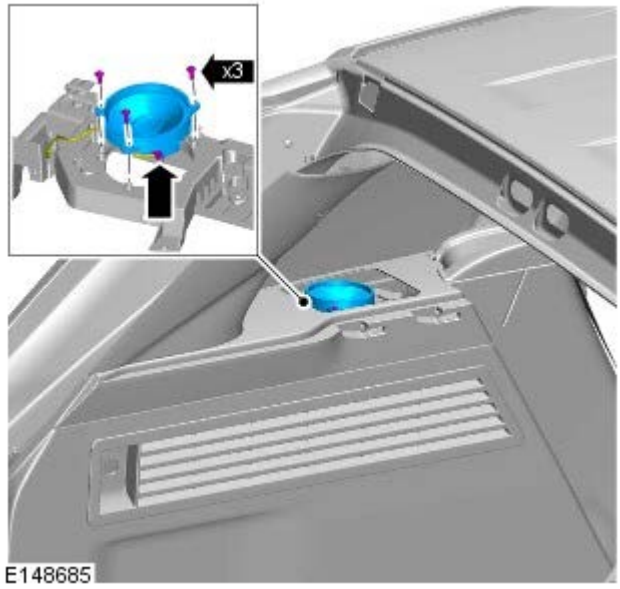
Removal steps in this procedure may contain installation details.

LH illustration shown, RH is similar.

1.



2.



Installation

1. To install, reverse the removal procedure.

Published: 02-May-2013

Information and Entertainment System - Information and Entertainment Display

Removal and Installation

Removal

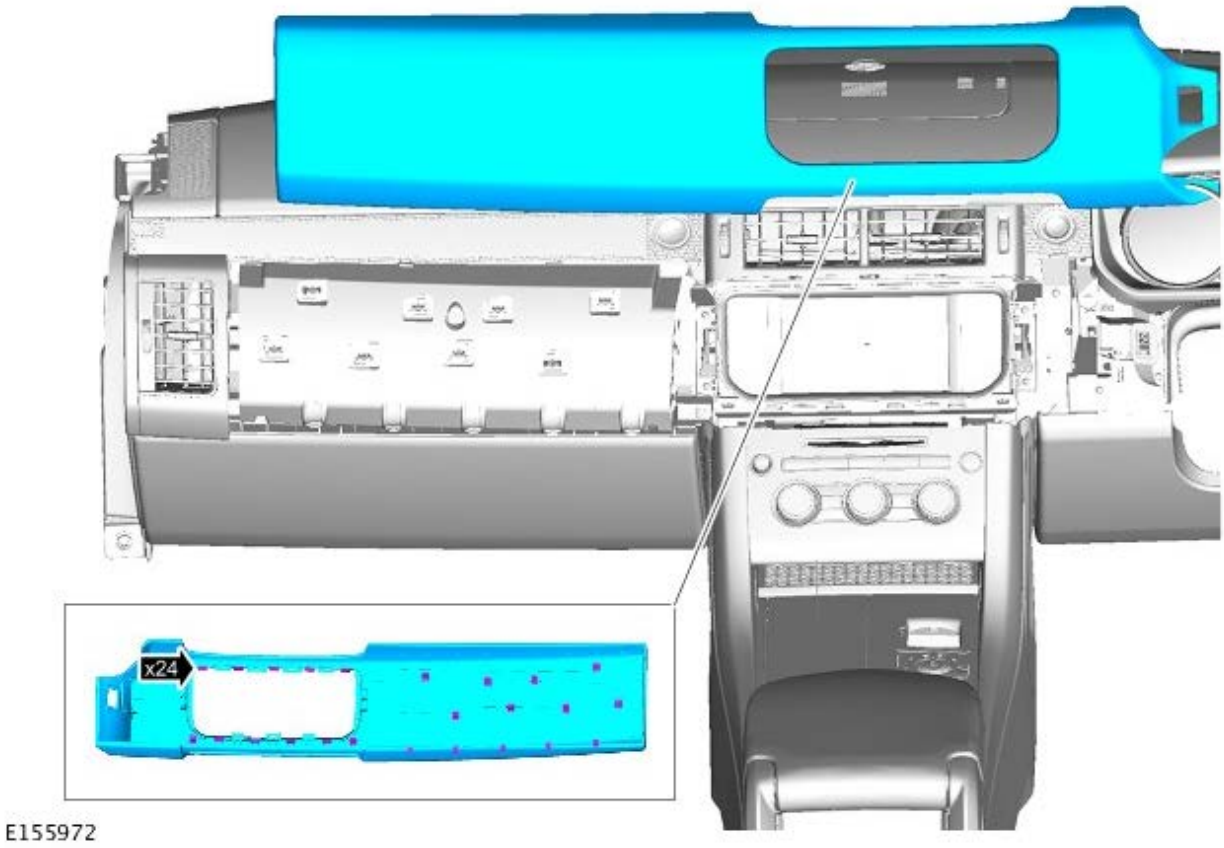
NOTES:

Removal steps in this procedure may contain installation details.

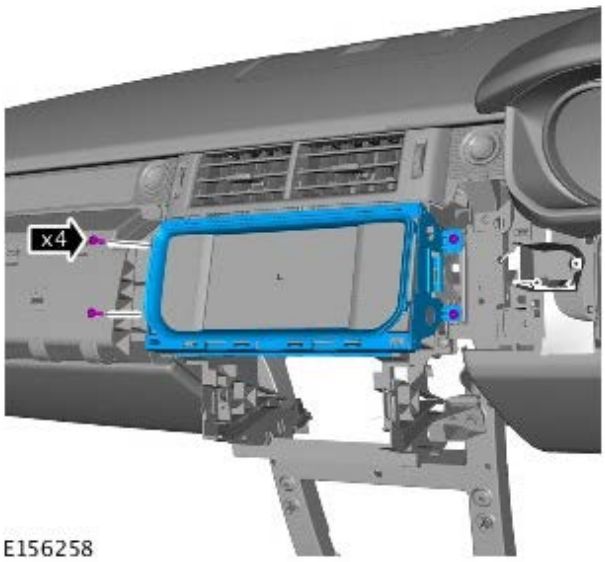
Some components shown removed for clarity.

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

1. Disconnect the battery ground cable.
2.

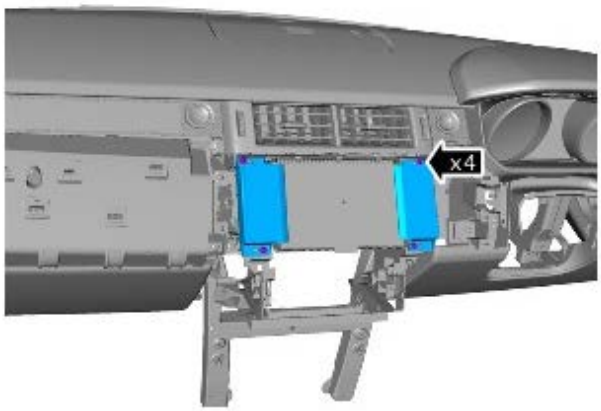


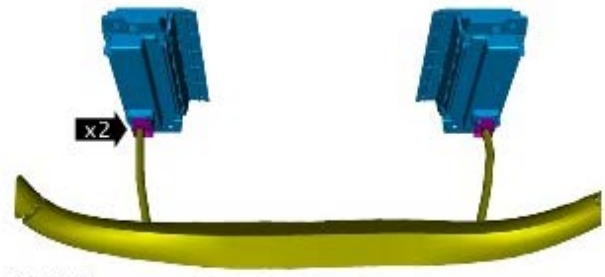
3.



E156258

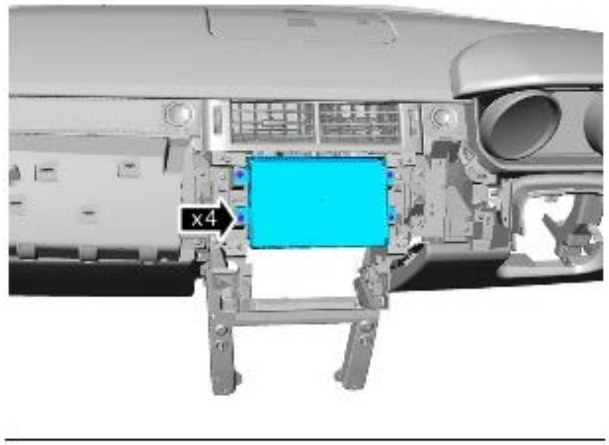
4.

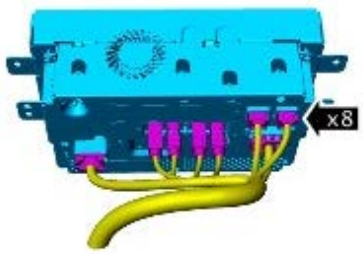




E156259

5.





E156260

Installation

1. To install, reverse the removal procedure.

Published: 16-Oct-2012

Information and Entertainment System - Audio Amplifier Module

Removal and Installation

Removal

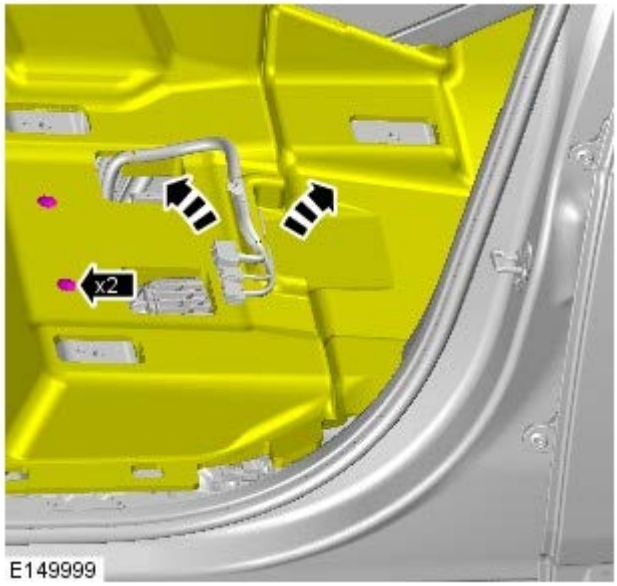
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the left front seat.

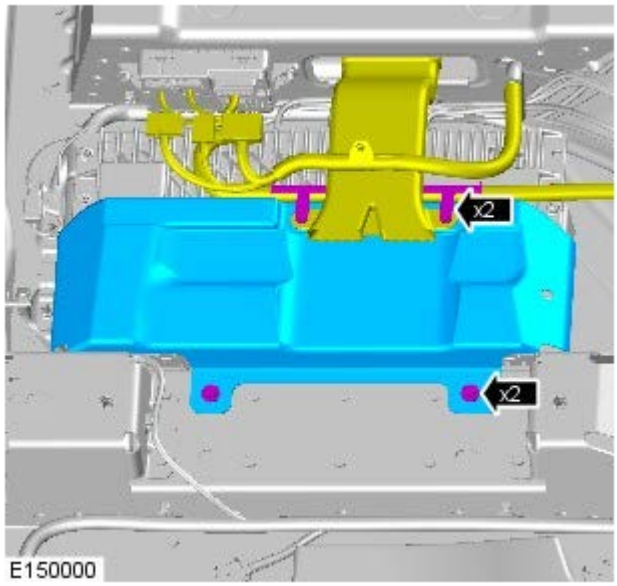
   Refer to: Front Seat (501-10, Removal and Installation).

2. Refer to: Front Scuff Plate Trim Panel (501-05, Removal and Installation).

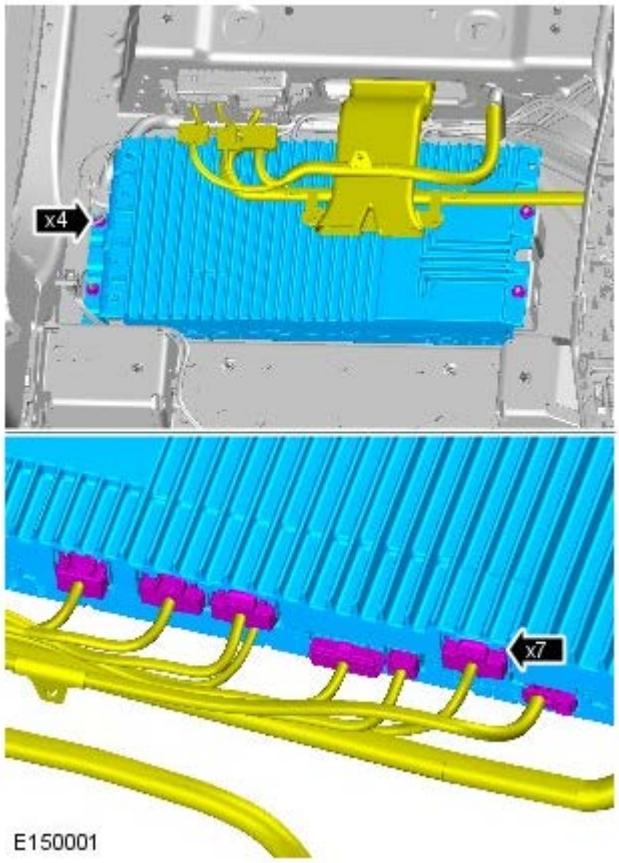
3.



4. *Torque:* 9 Nm



5. *Torque:* 9 Nm



Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 16-Oct-2012

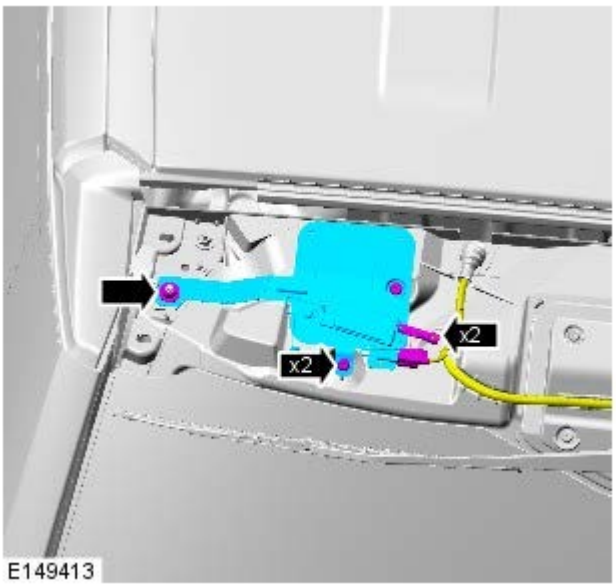
Information and Entertainment System - Audio Unit Antenna

Removal and Installation

Removal

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

1. Refer to: Rear Spoiler (501-08 Exterior Trim and Ornamentation, Removal and Installation).



2. *Torque:*
   M6 9 Nm
   M8 25 Nm

Installation

1. To install, reverse the removal procedure.

Published: 04-Aug-2012

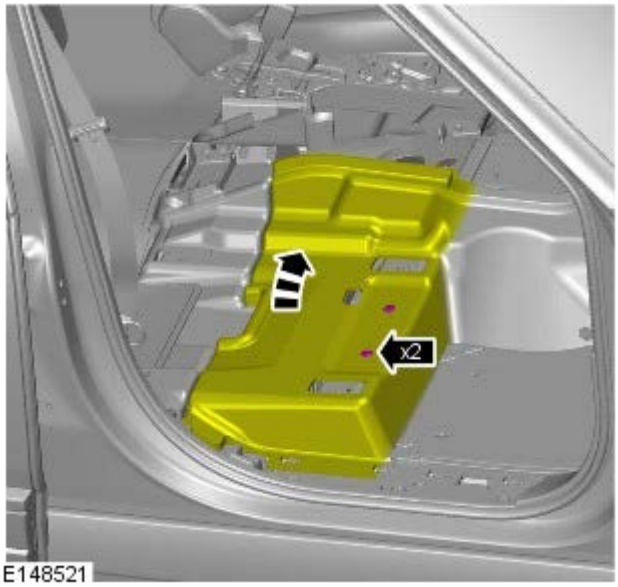
Information and Entertainment System - Subwoofer Speaker

Removal and Installation

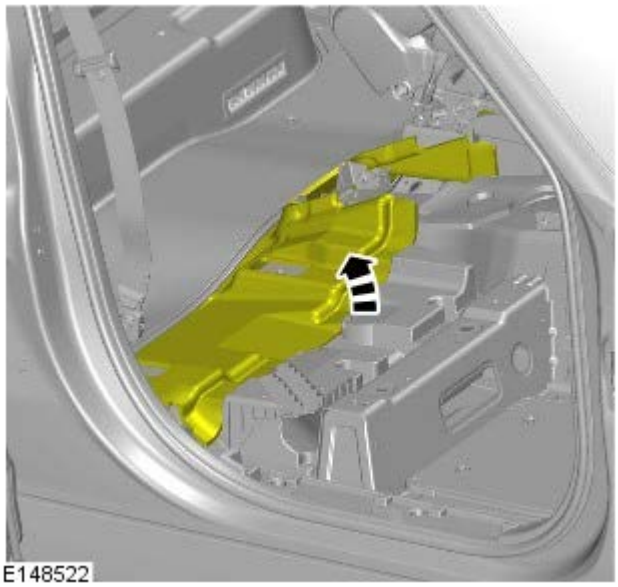
Removal

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

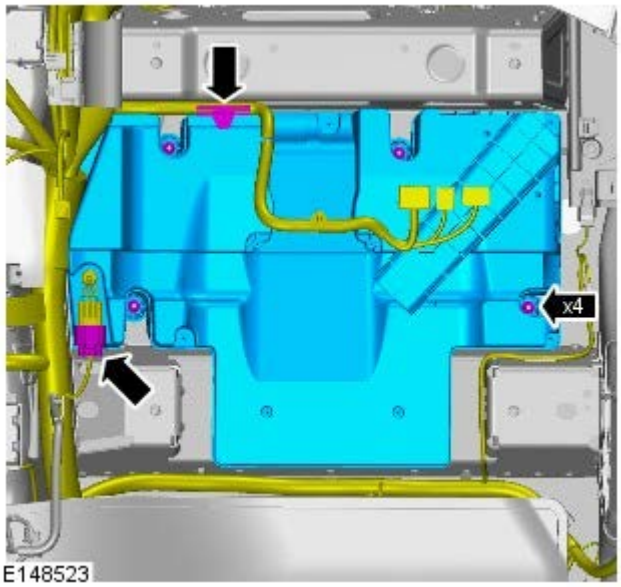
1. Refer to: Front Seat - Vehicles With: Power Seats (501-10 Seating, Removal and Installation).
2. Refer to: Front Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
3.



4.



5. *Torque:* 3.6 Nm



Installation

1. To install, reverse the removal procedure.

Published: 02-May-2013

Information and Entertainment System - Navigation Control Module Vehicles Without: 7 Seats

Removal and Installation

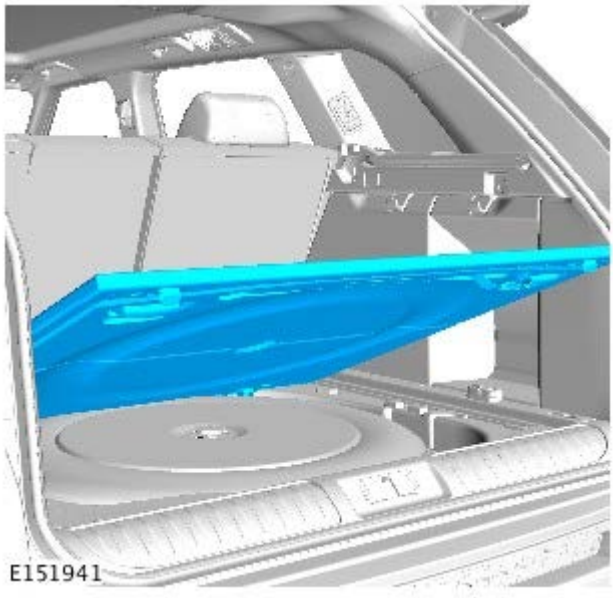
Removal

NOTES:

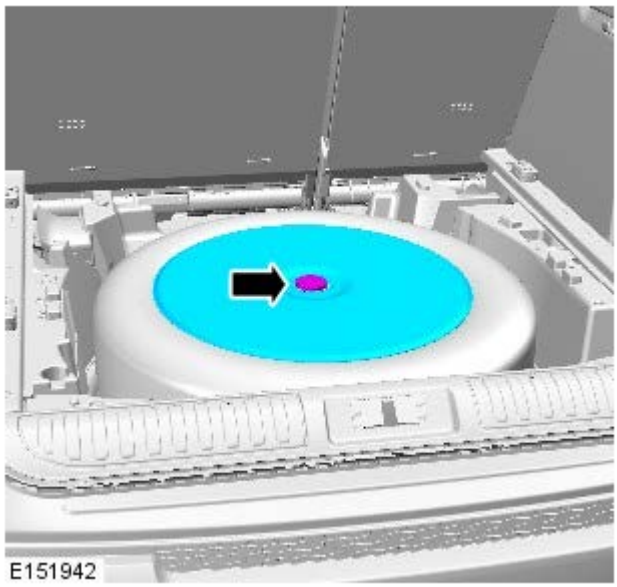
Removal steps in this procedure may contain installation details.

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

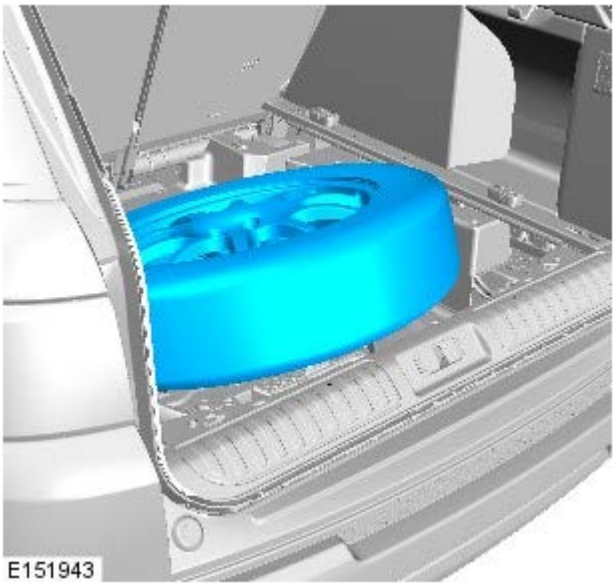
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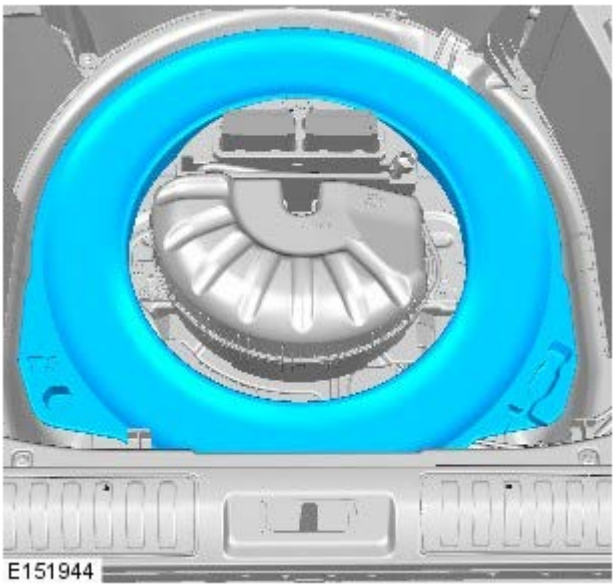
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3.



4.

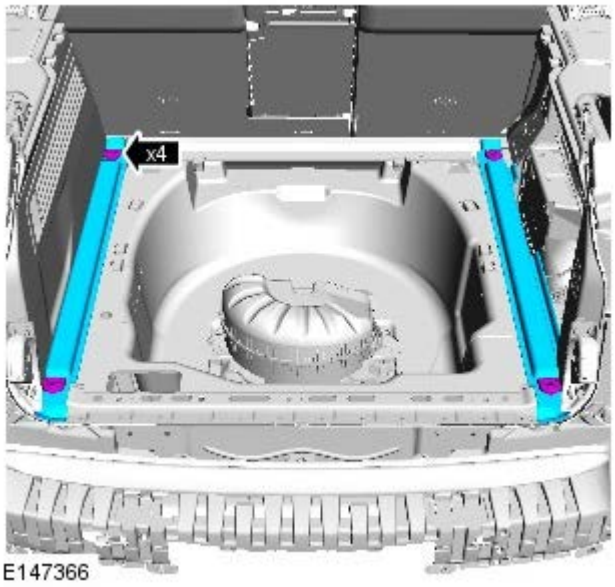


5. Disconnect the battery ground cable.

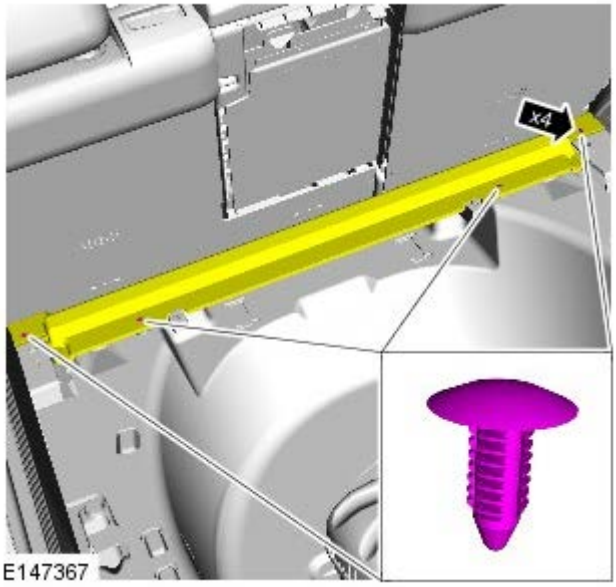
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

6. Refer to: Loadspace Trim Panel LH (501-05 Interior Trim and Ornamentation, Removal and Installation).

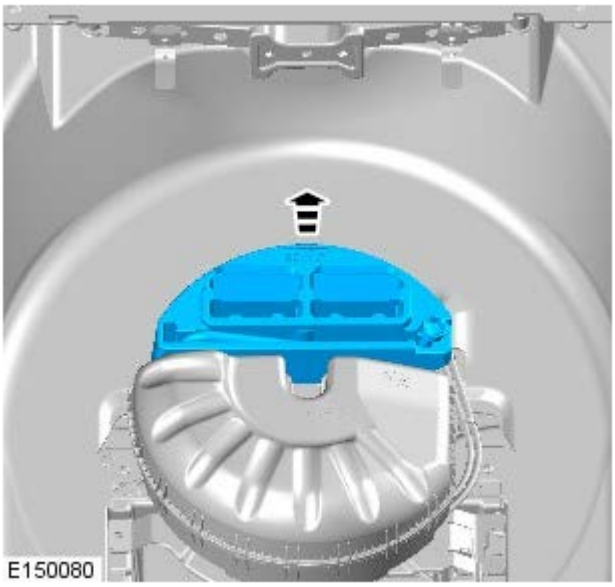
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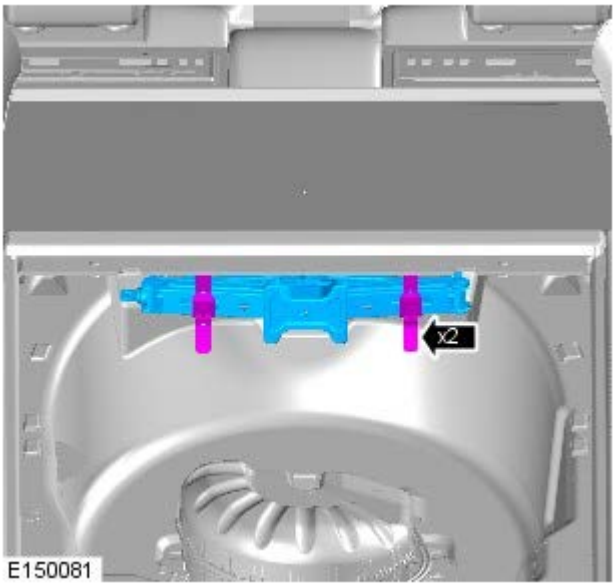
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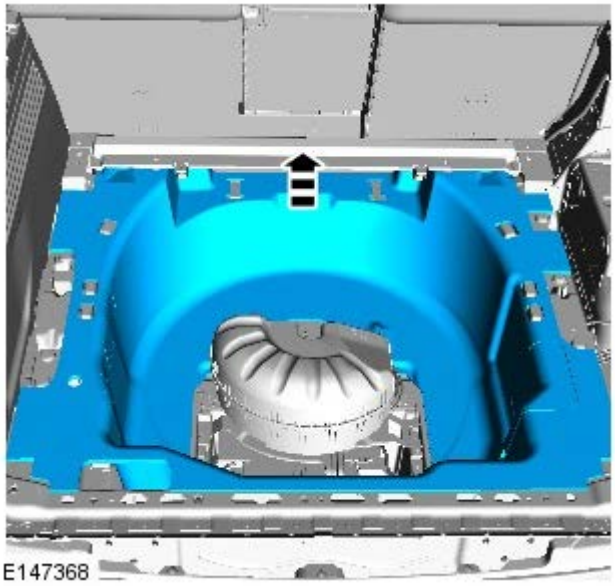
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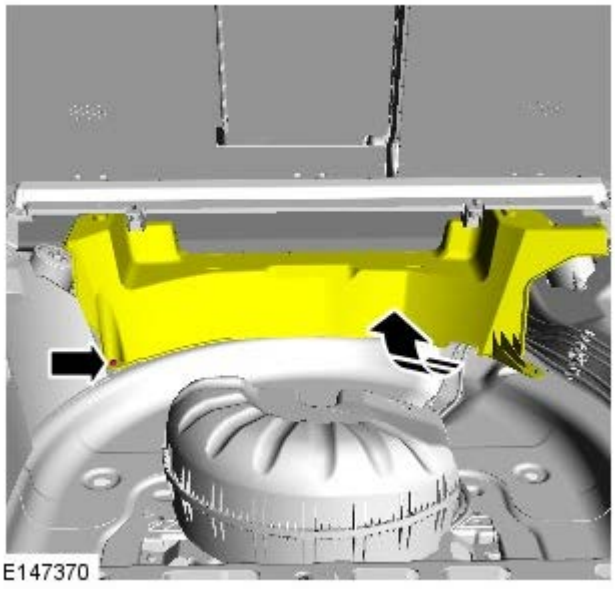
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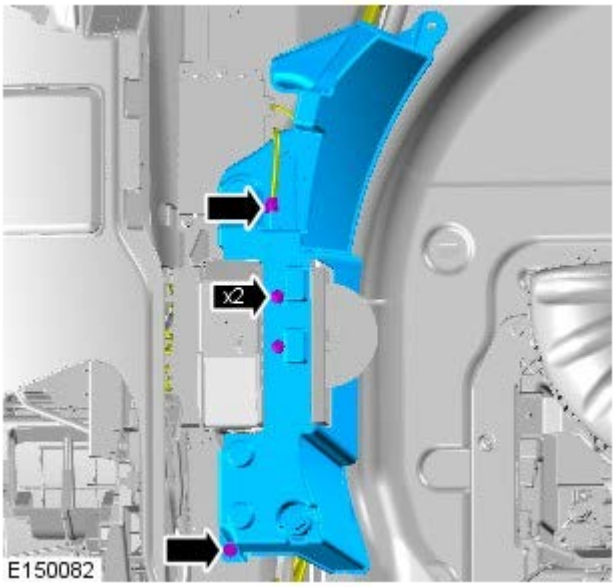
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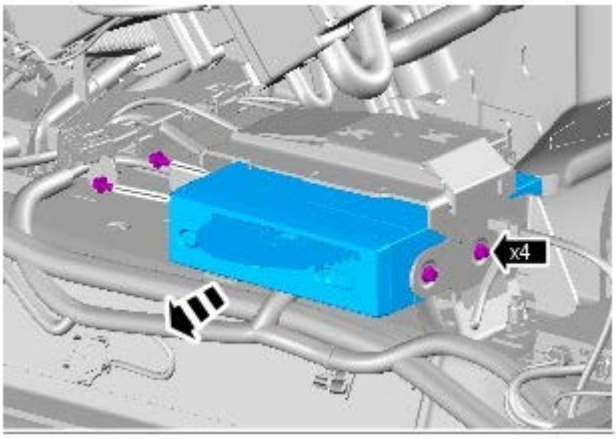
12. *Torque:* 9 Nm

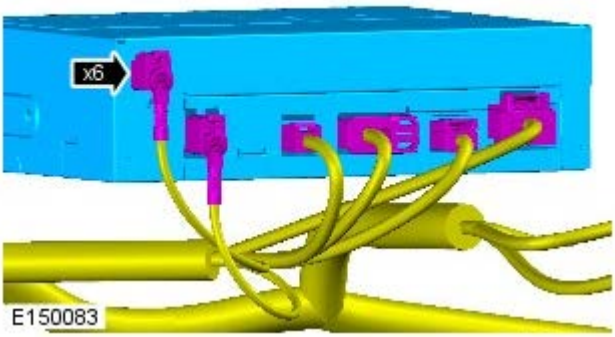


13. *Torque:* 9 Nm



14. *Torque:* 9 Nm





Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

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Information and Entertainment System - Navigation Control Module
Vehicles With: 7 Seats

Removal and Installation

Removal

NOTES:

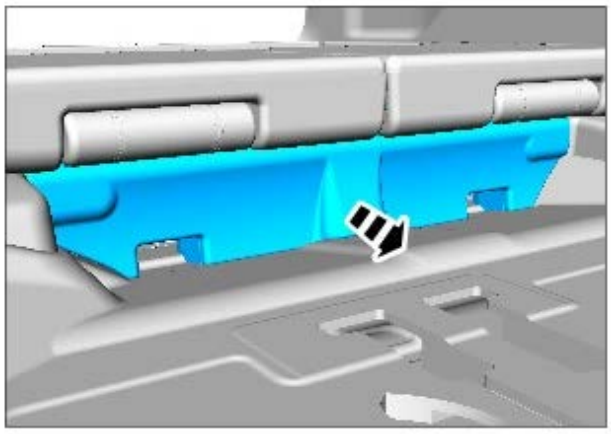
Removal steps in this procedure may contain installation details.

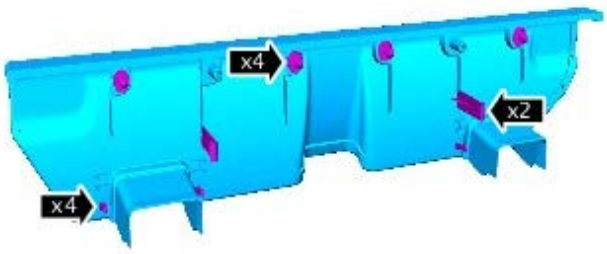
Some variation in the illustrations may occur, but the essential information is always correct.

1.

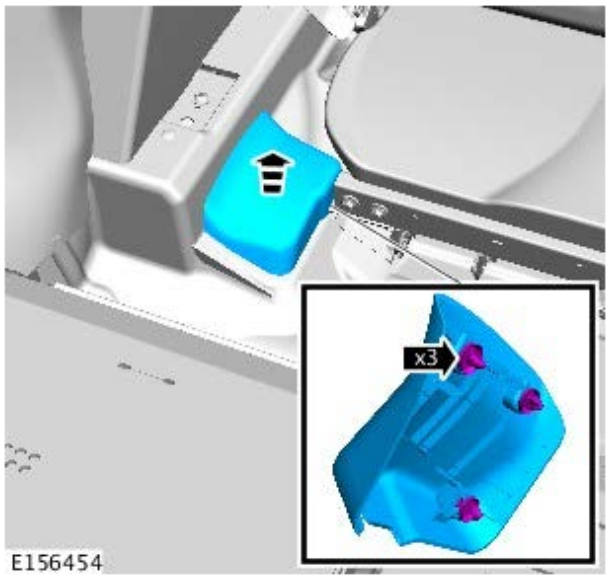


2. CAUTION: Care must be taken not to damage the component.



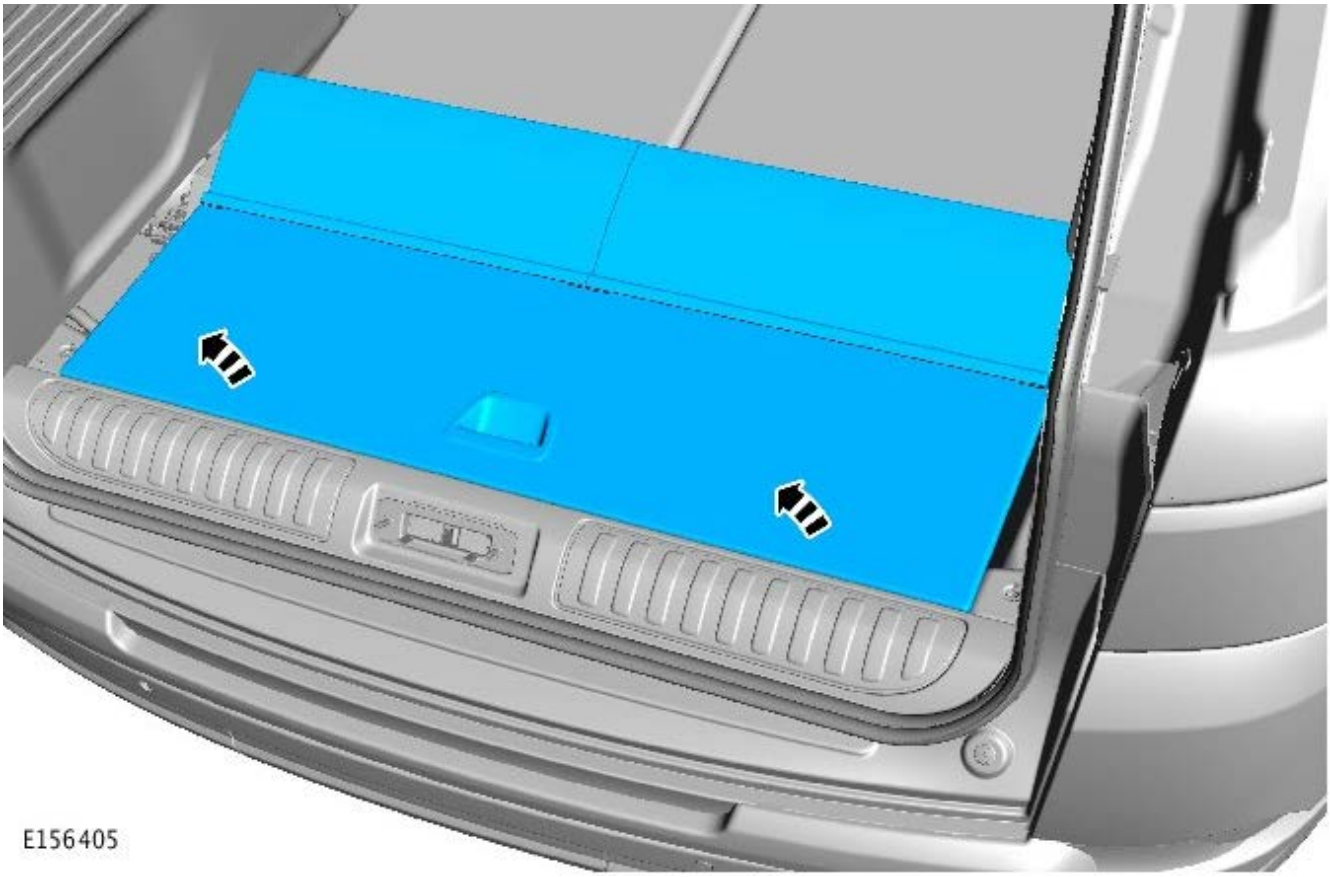


E155790

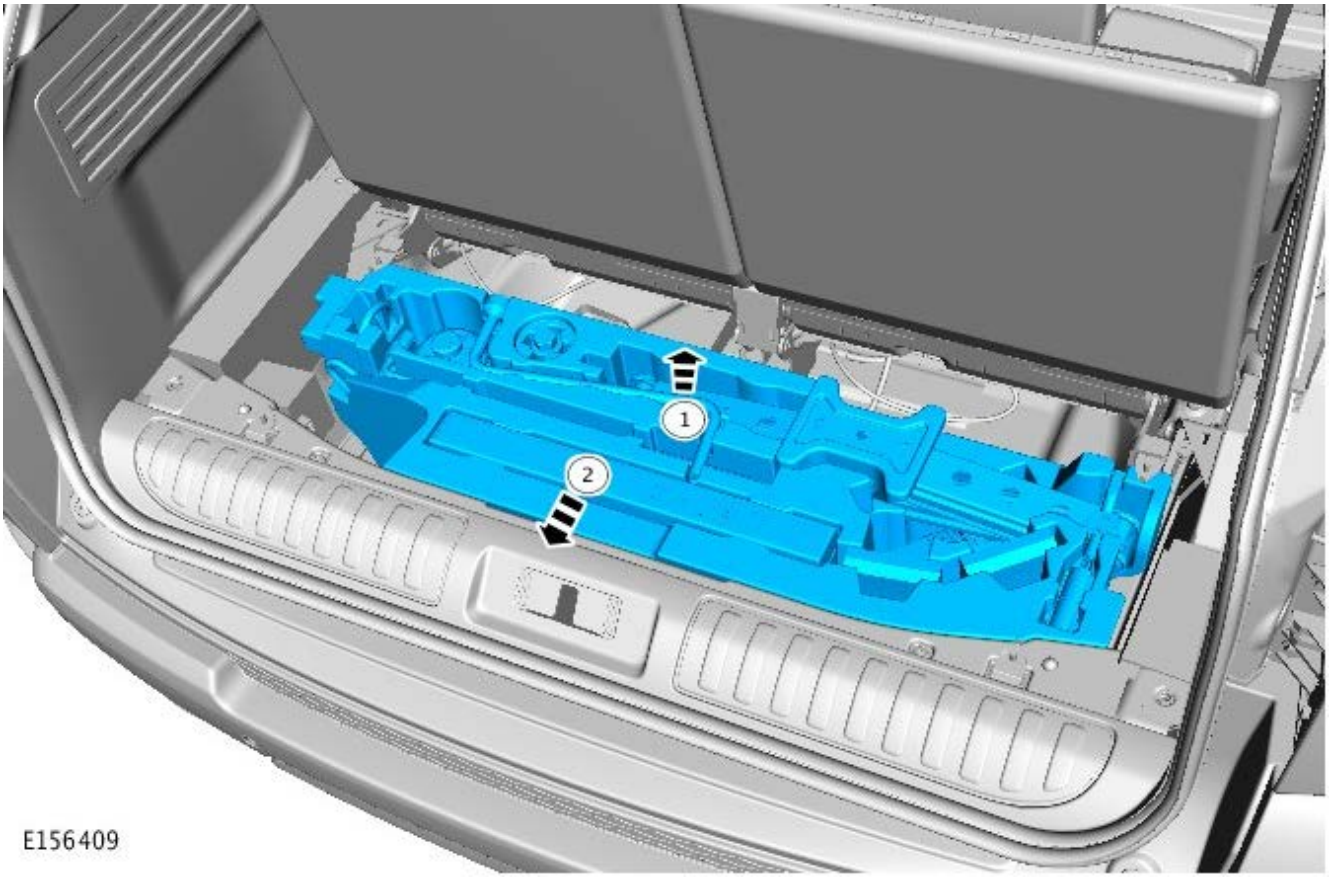


3. NOTE: Repeat the procedure for the other side.

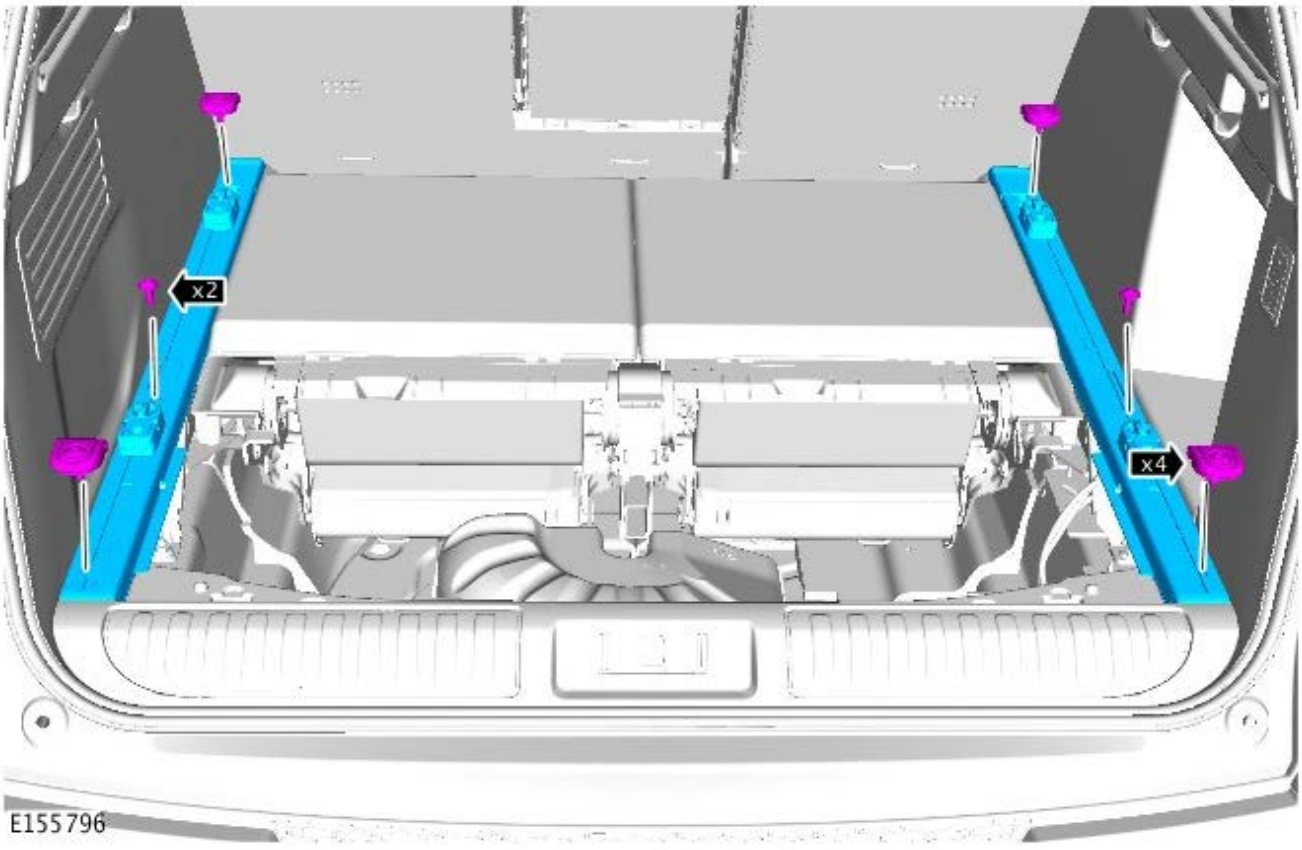
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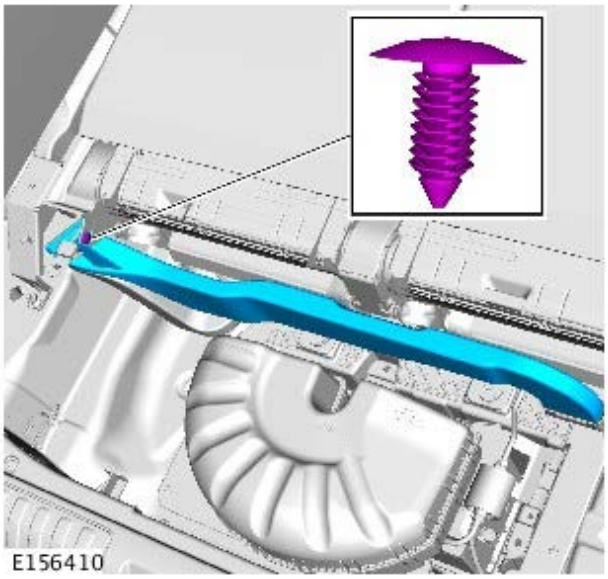
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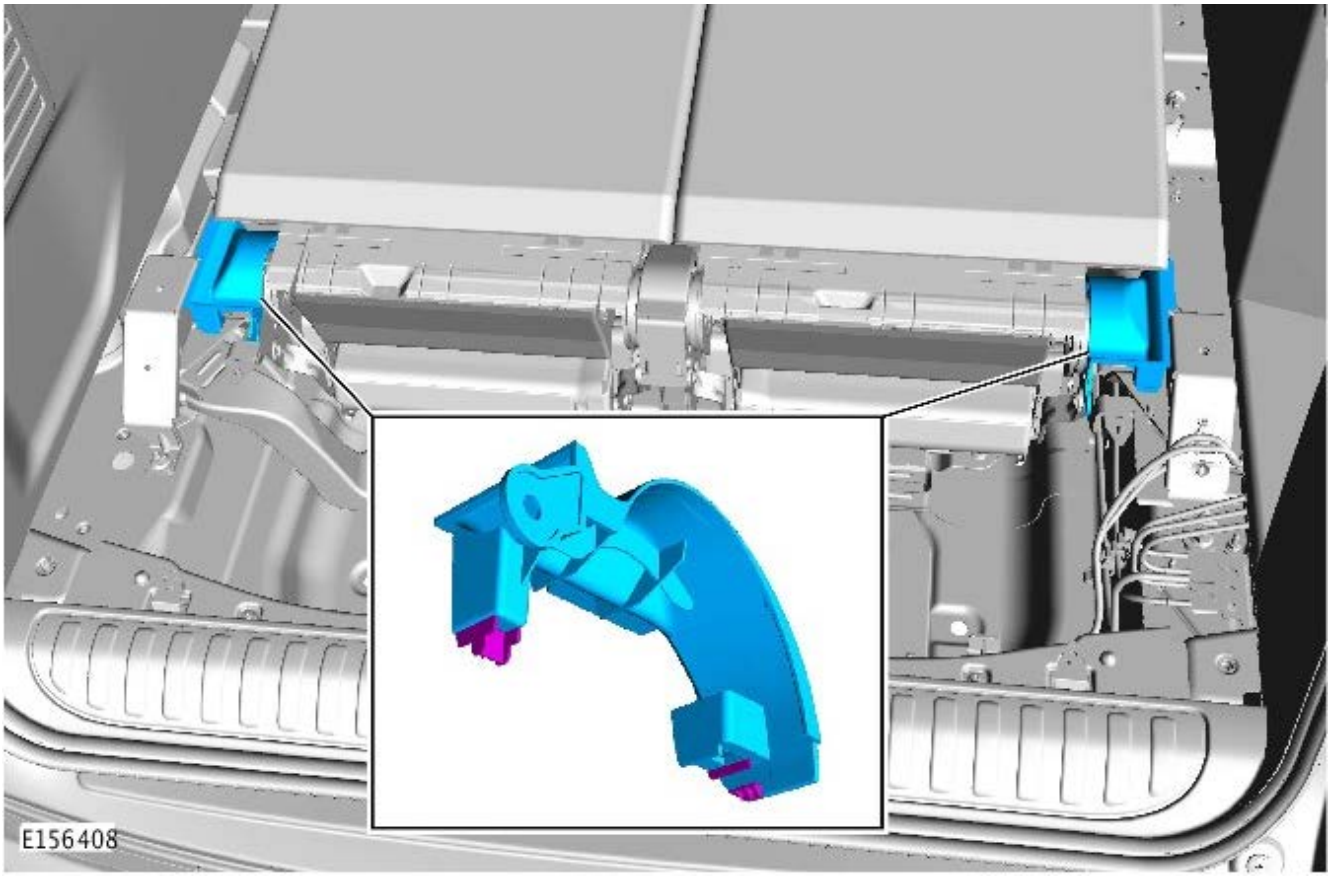
6. *Torque:* 25 Nm



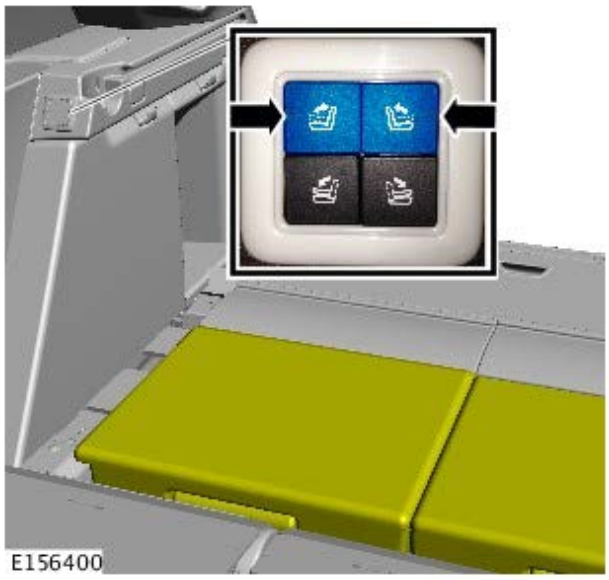
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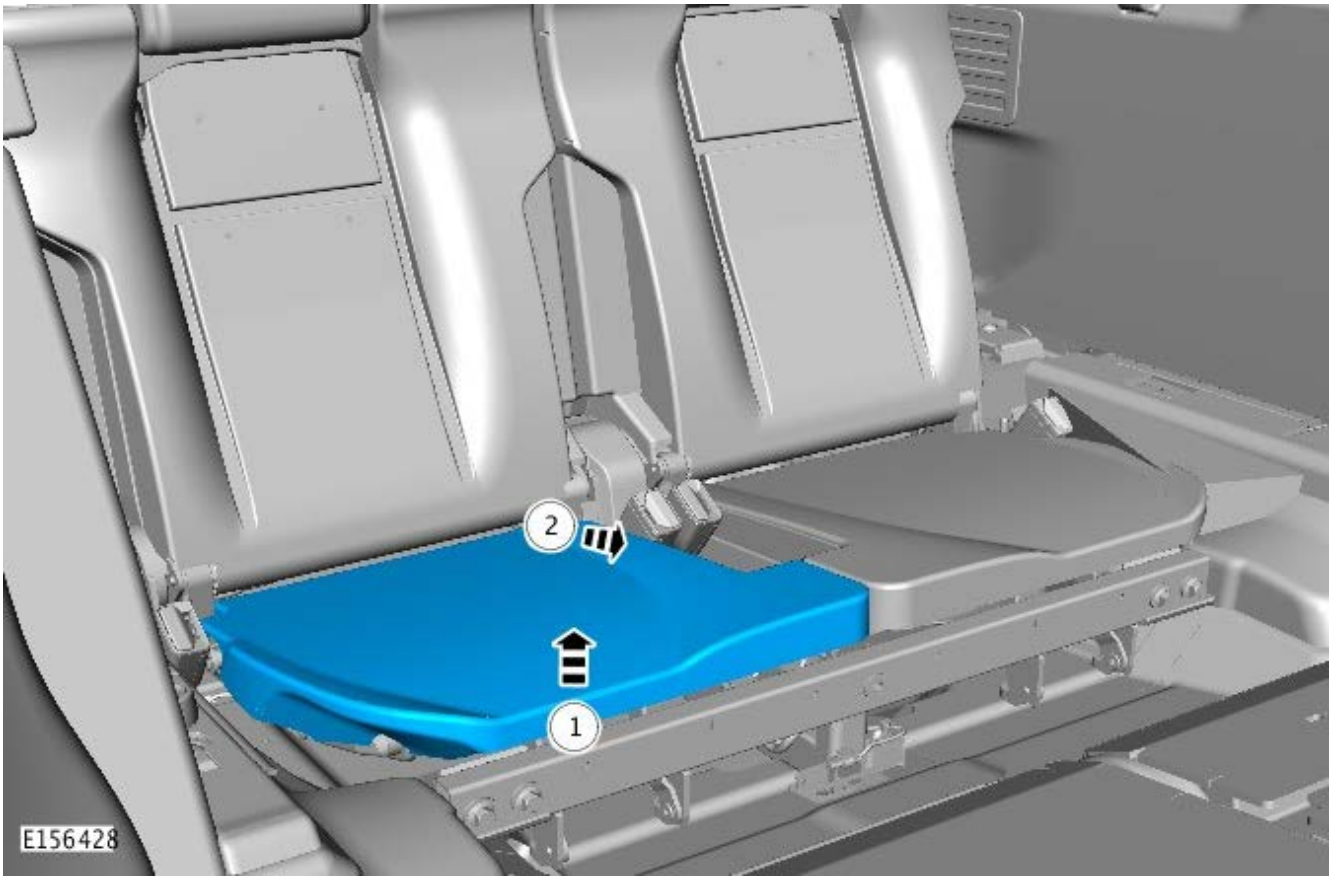
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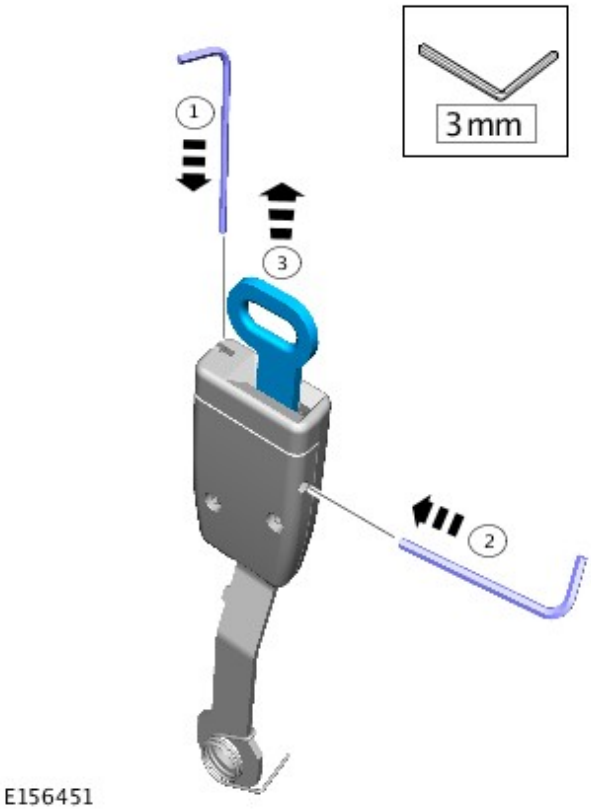
9.



10. NOTE: Repeat the procedure for the other side.



11.

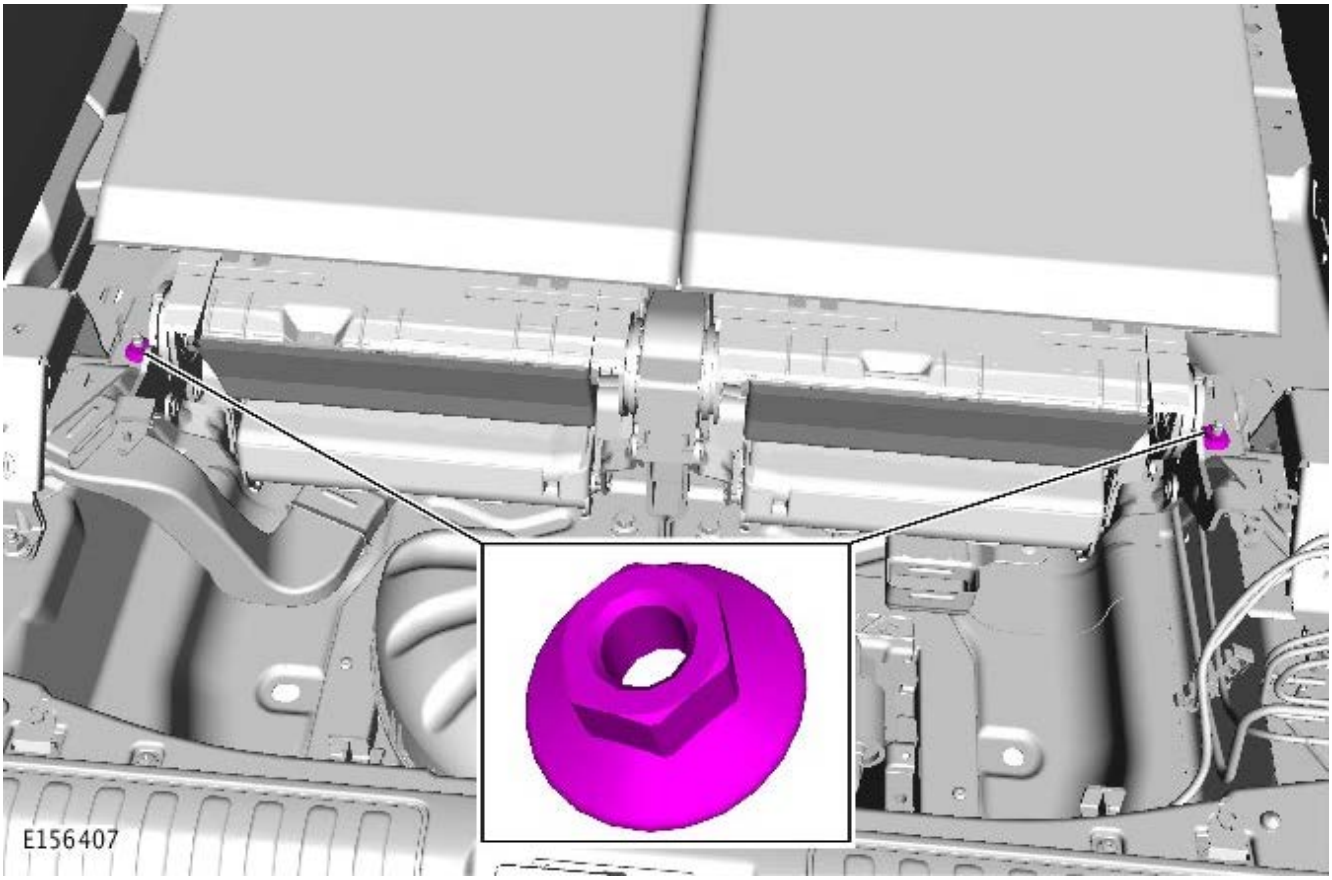


12. Disconnect the battery ground cable.

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

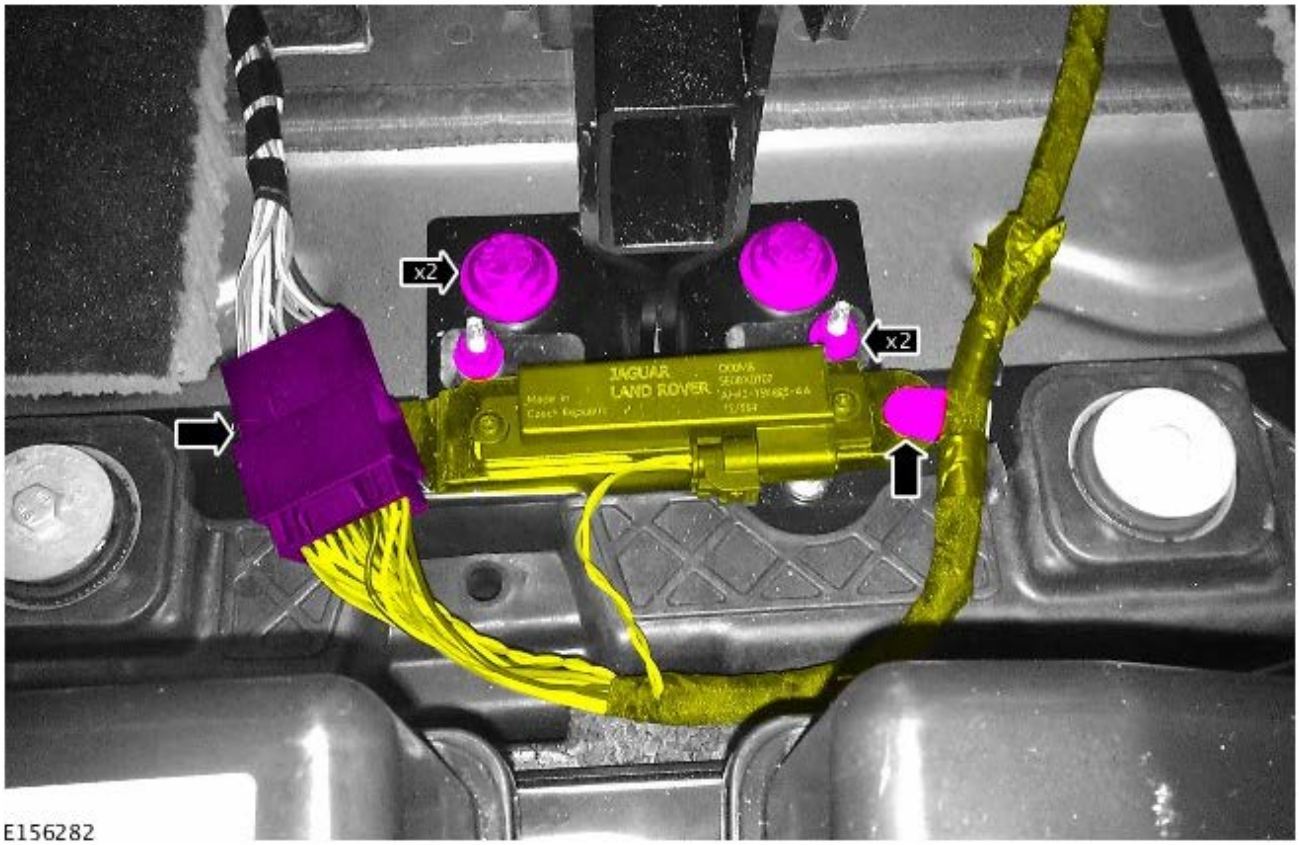
13. NOTE: Discard the retaining nuts.

    Torque: 45 Nm

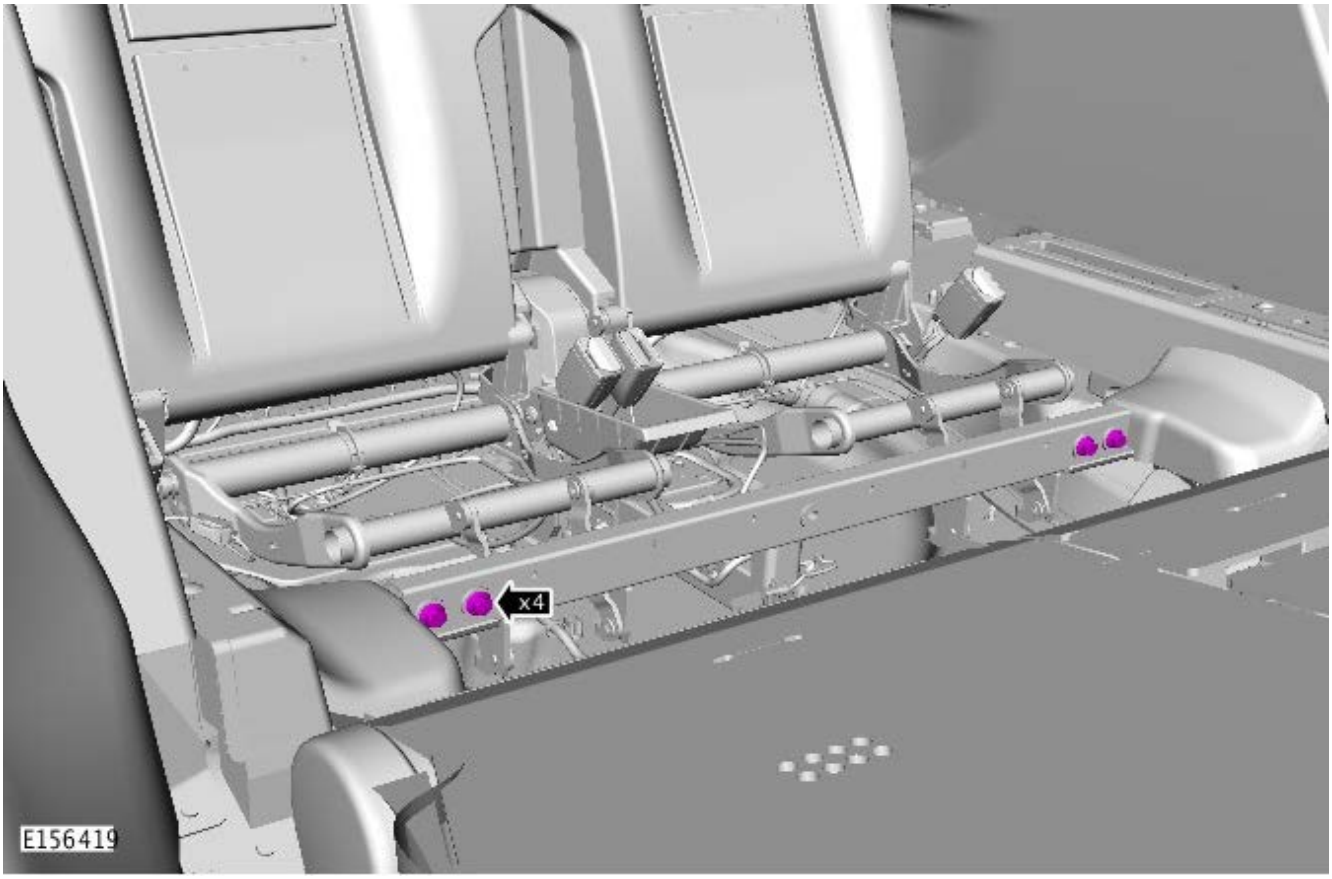


14.

- *Torque:* 47 Nm
- *Torque:* 3 Nm



15. *Torque:* 47 Nm

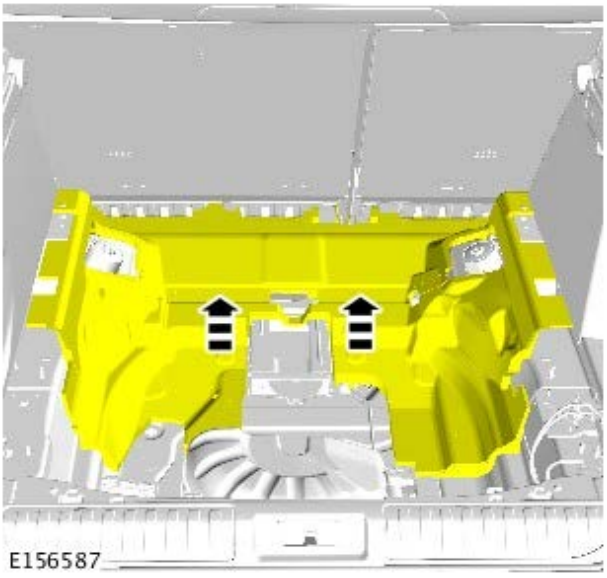


16. WARNING: This step requires the aid of another technician.

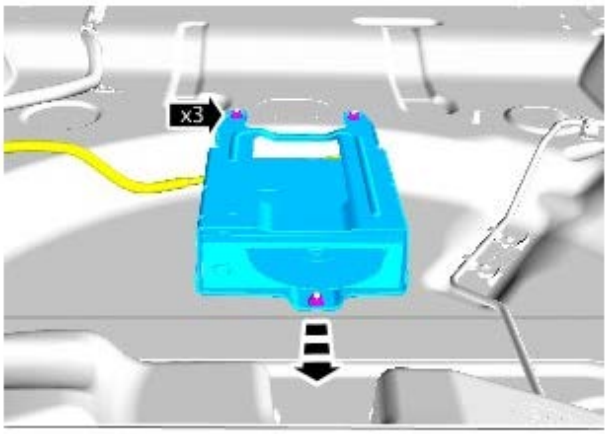
CAUTION: Care must be taken to avoid damaging the surrounding components.



17.



18. *Torque:* 9 Nm

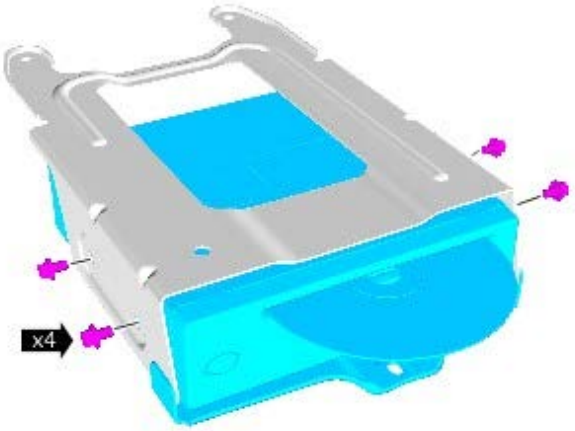




E156588

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

Torque: 9 Nm



E156589

Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

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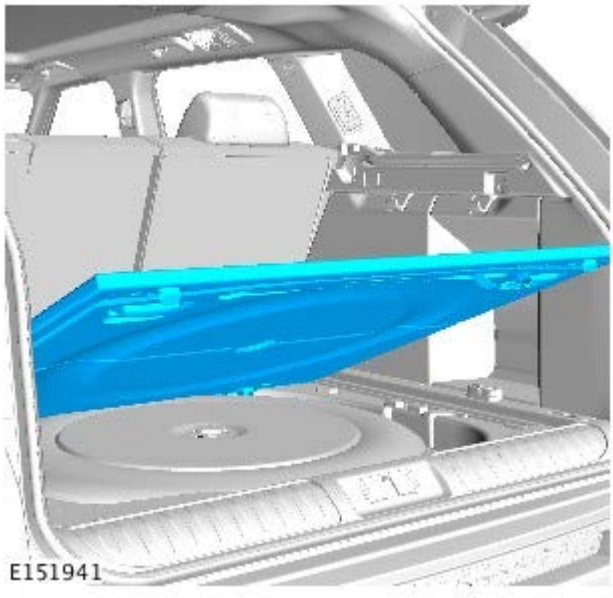
Information and Entertainment System - Digital Audio Module Vehicles Without: 7 Seats

Removal and Installation

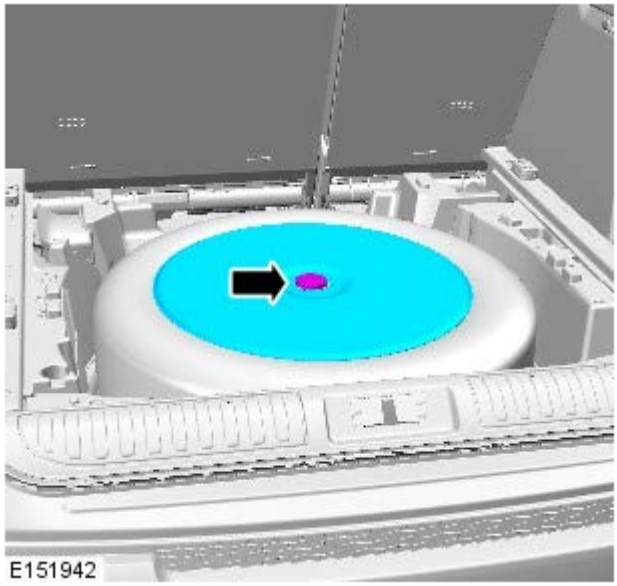
Removal

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

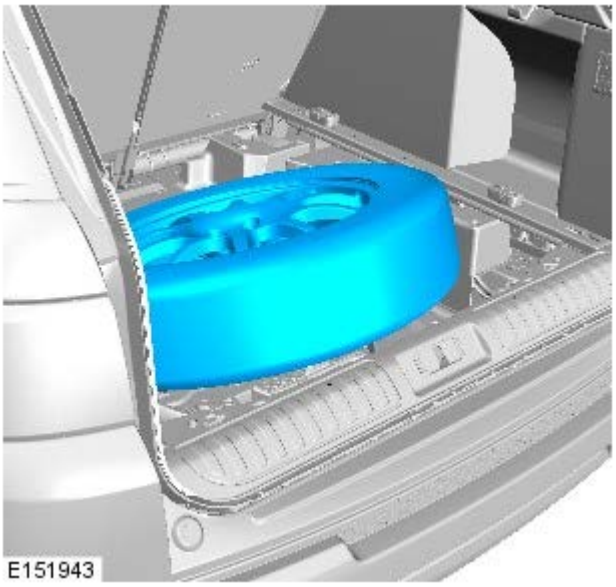
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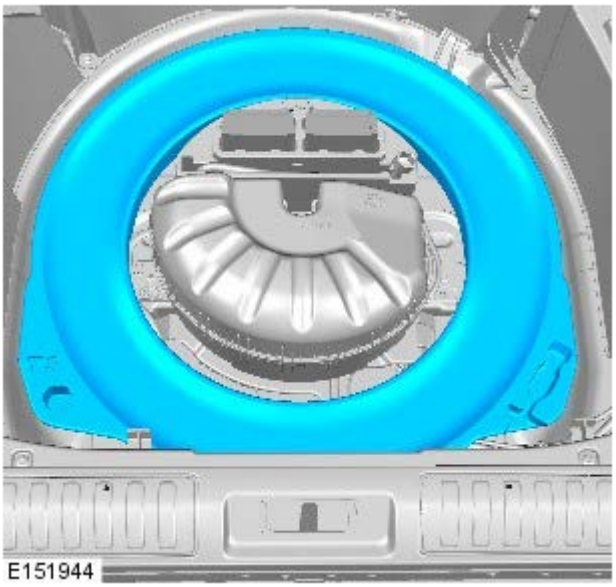
2.



3.



4.

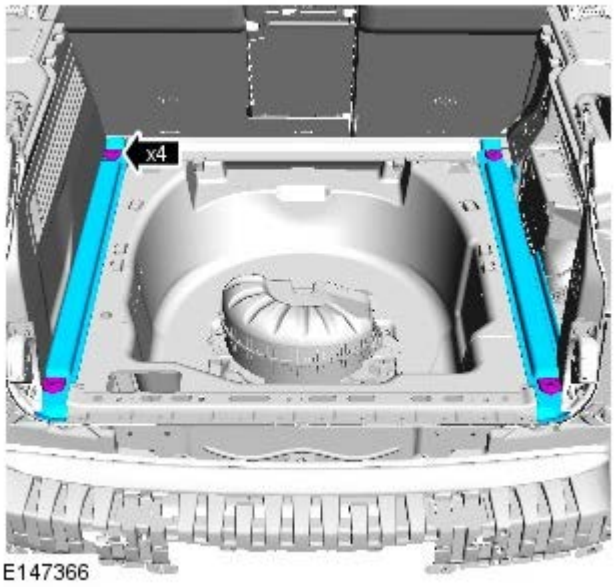


5. Disconnect the battery ground cable.

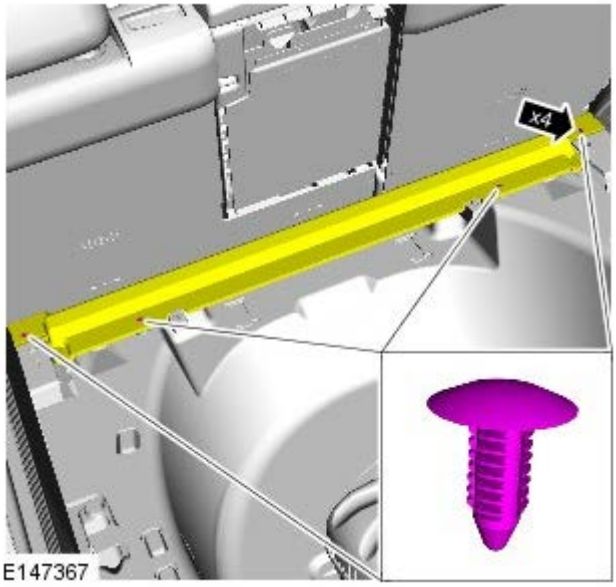
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

6. Refer to: Loadspace Trim Panel LH (501-05 Interior Trim and Ornamentation, Removal and Installation).

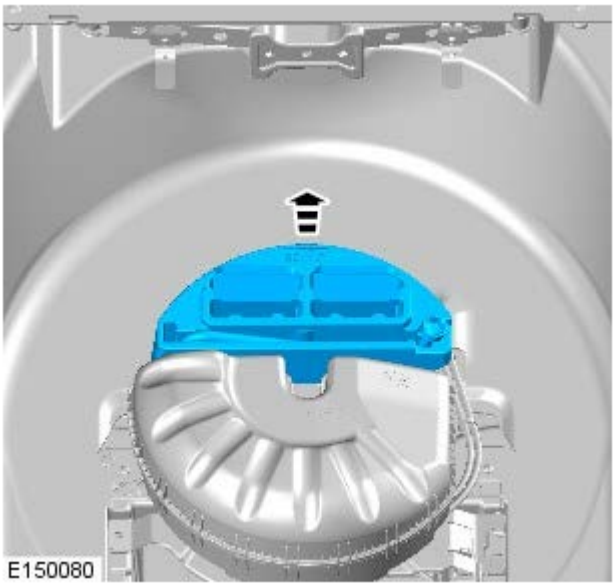
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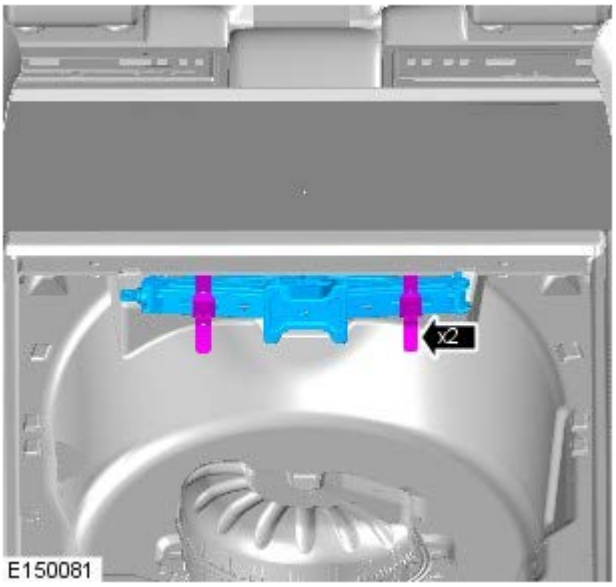
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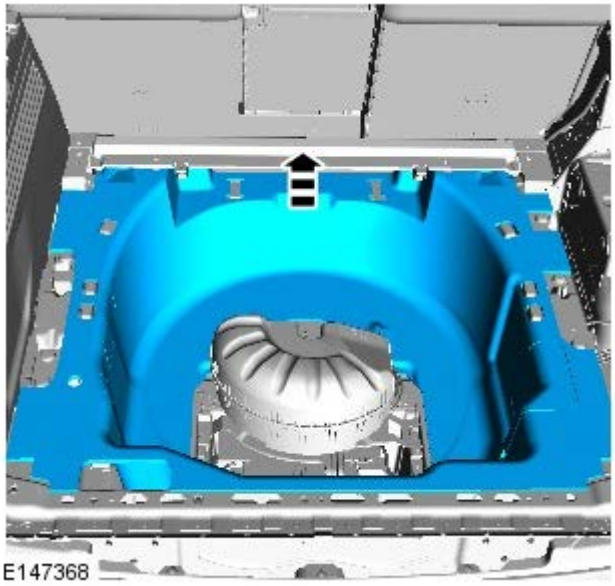
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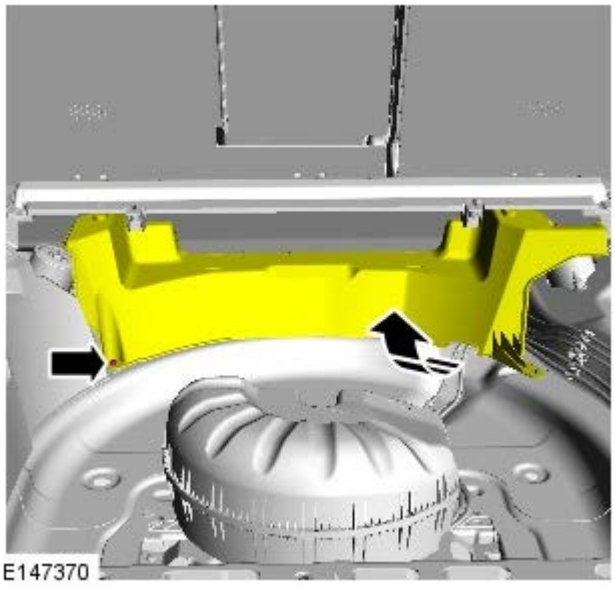
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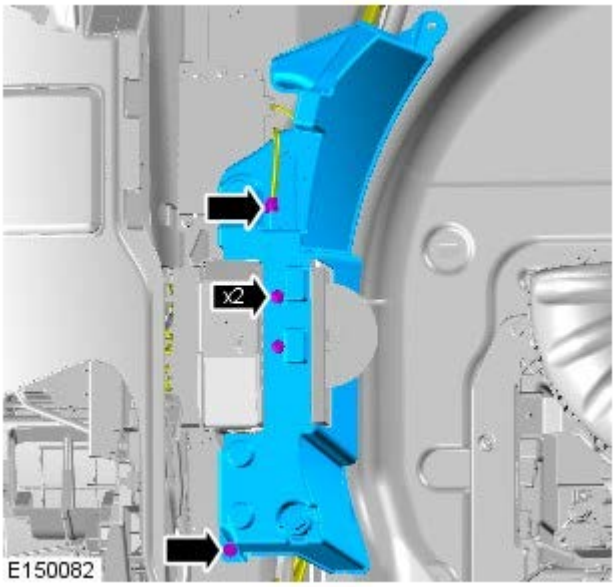
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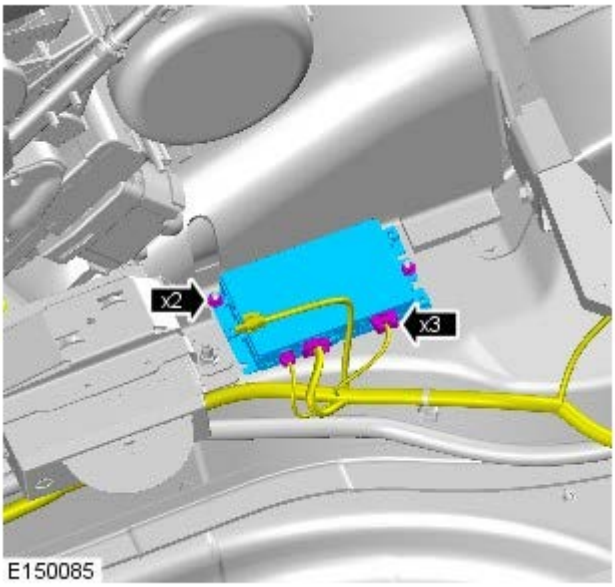
12. *Torque:* 9 Nm



13. *Torque:* 9 Nm



14. *Torque:* 9 Nm



Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

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Information and Entertainment System - Digital Audio Module Vehicles With: 7 Seats

Removal and Installation

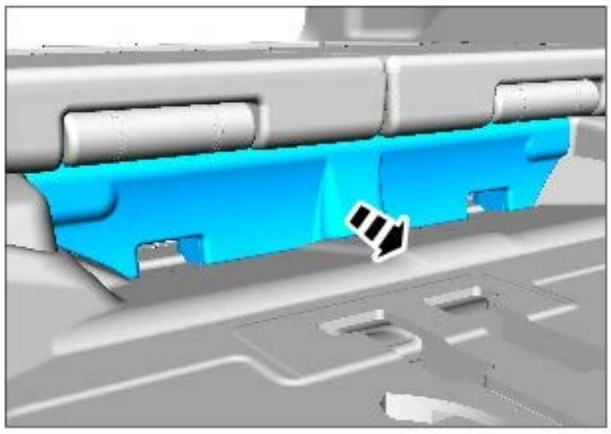
Removal

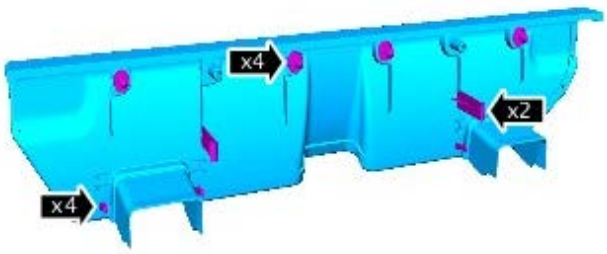
NOTE: Removal steps in this procedure may contain installation details.

1.

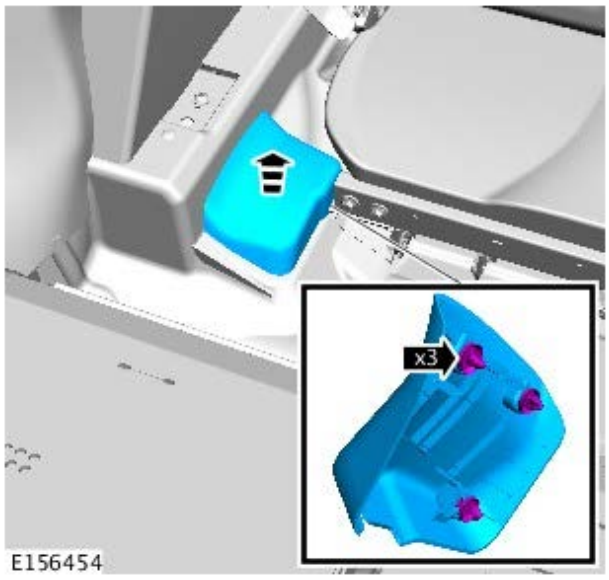


2. CAUTION: Care must be taken not to damage the component.



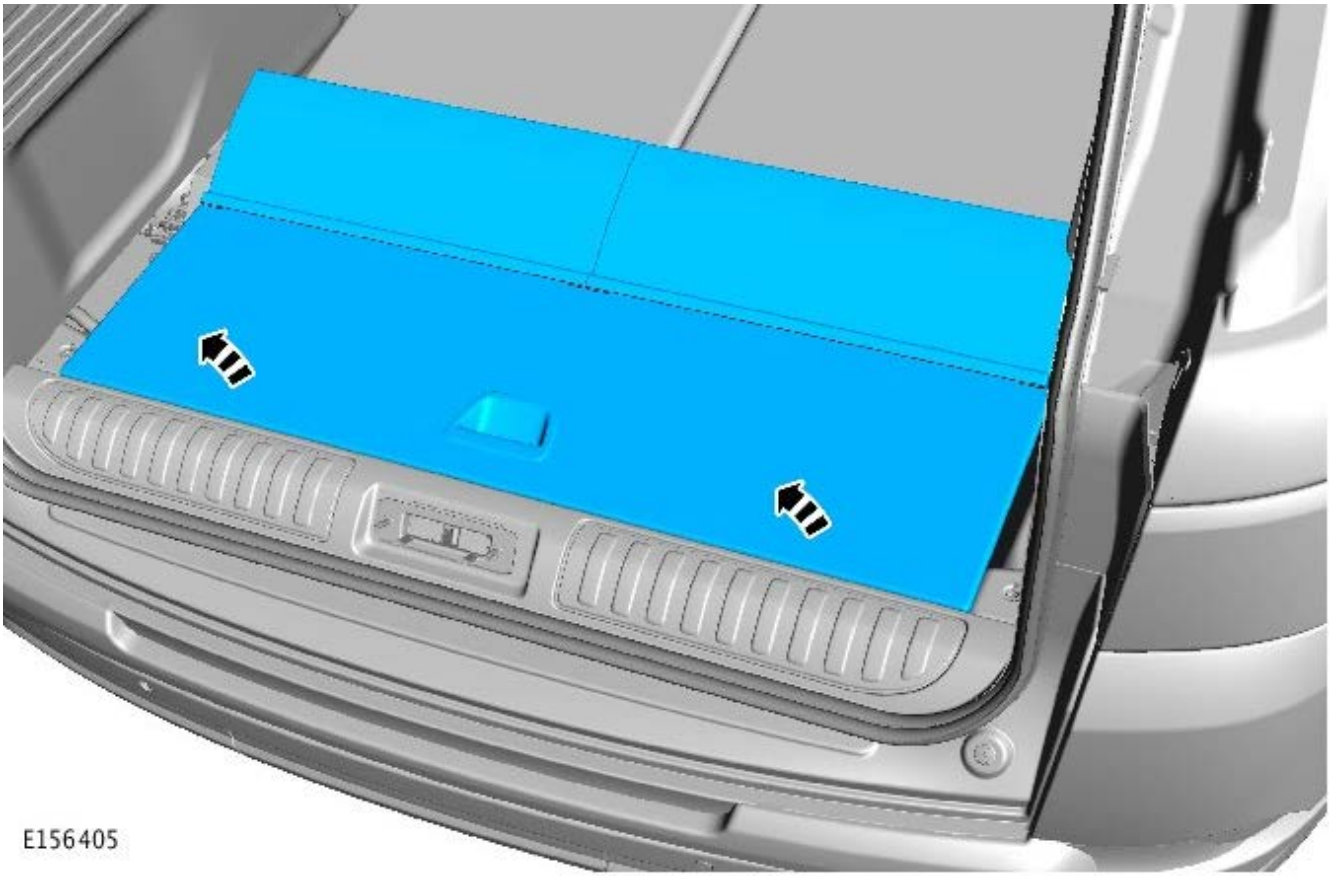


E155790

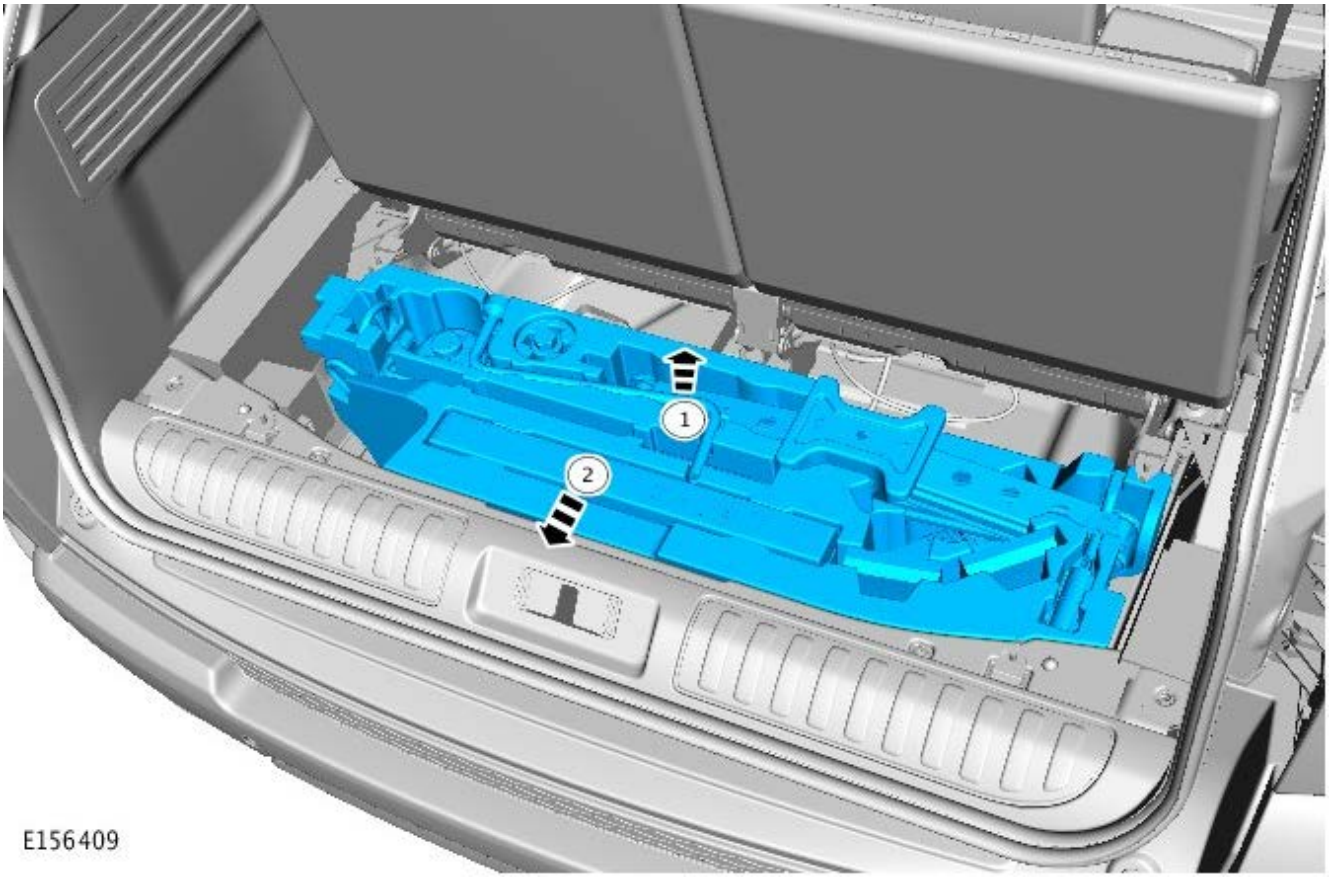


3. NOTE: Repeat the procedure for the other side.

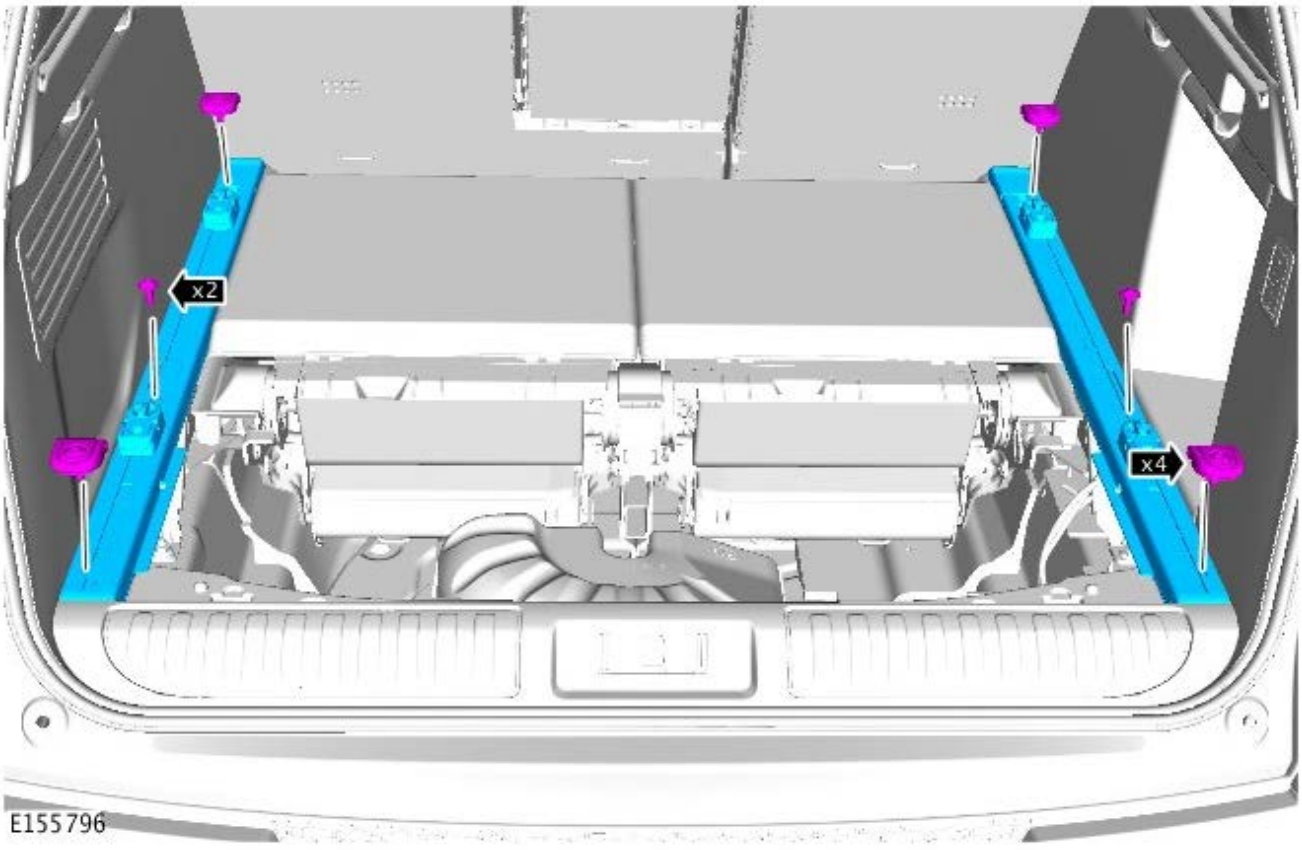
4.



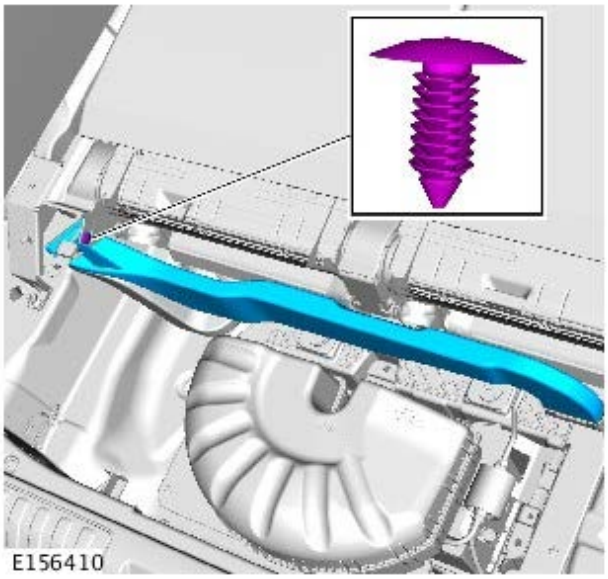
5.



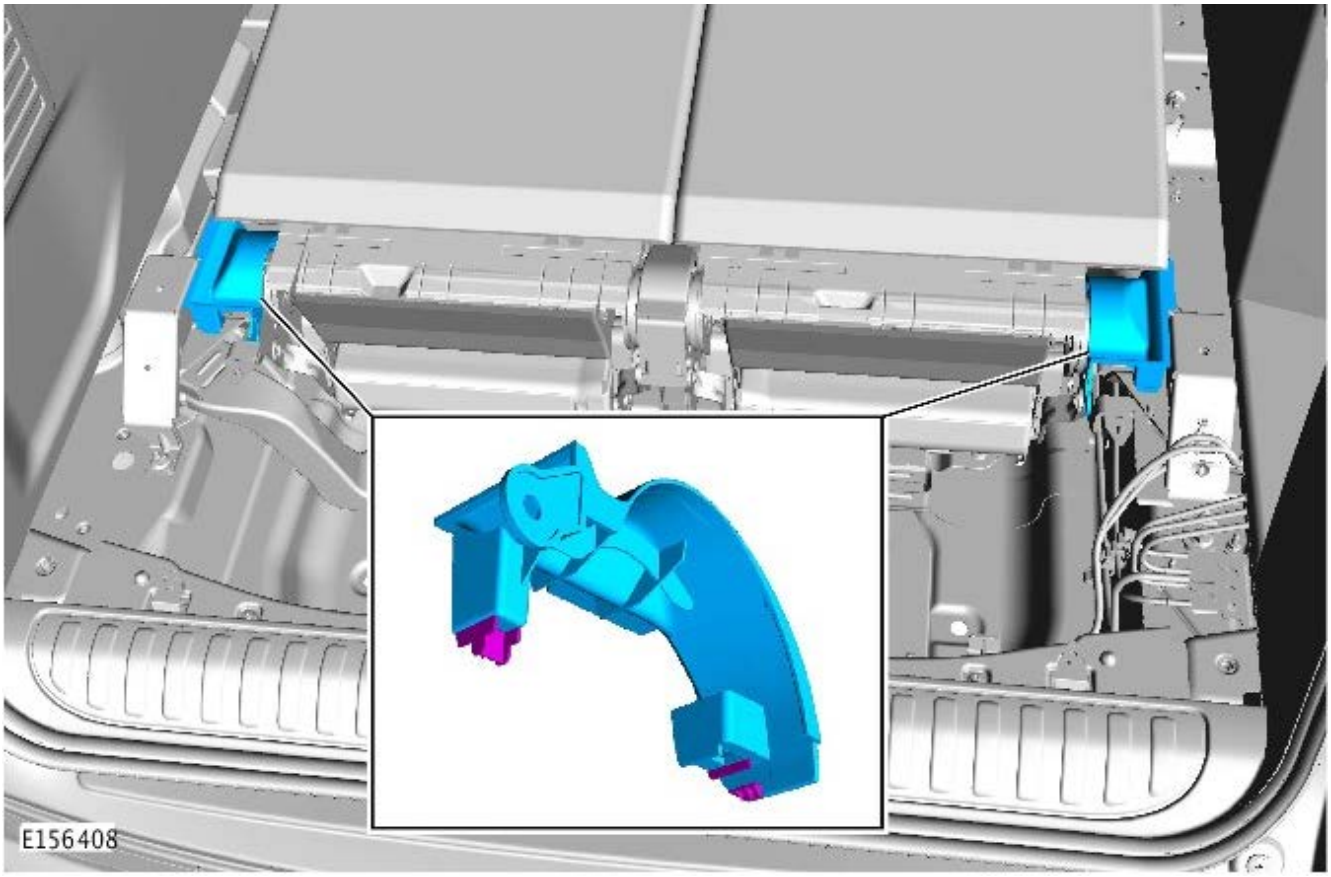
6. *Torque:* 25 Nm



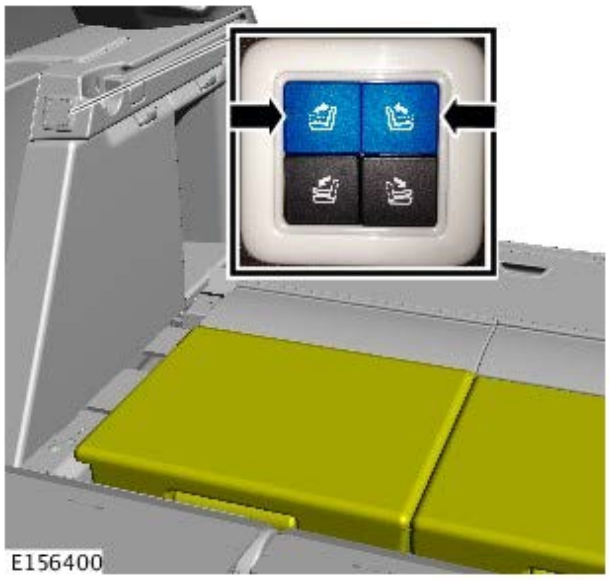
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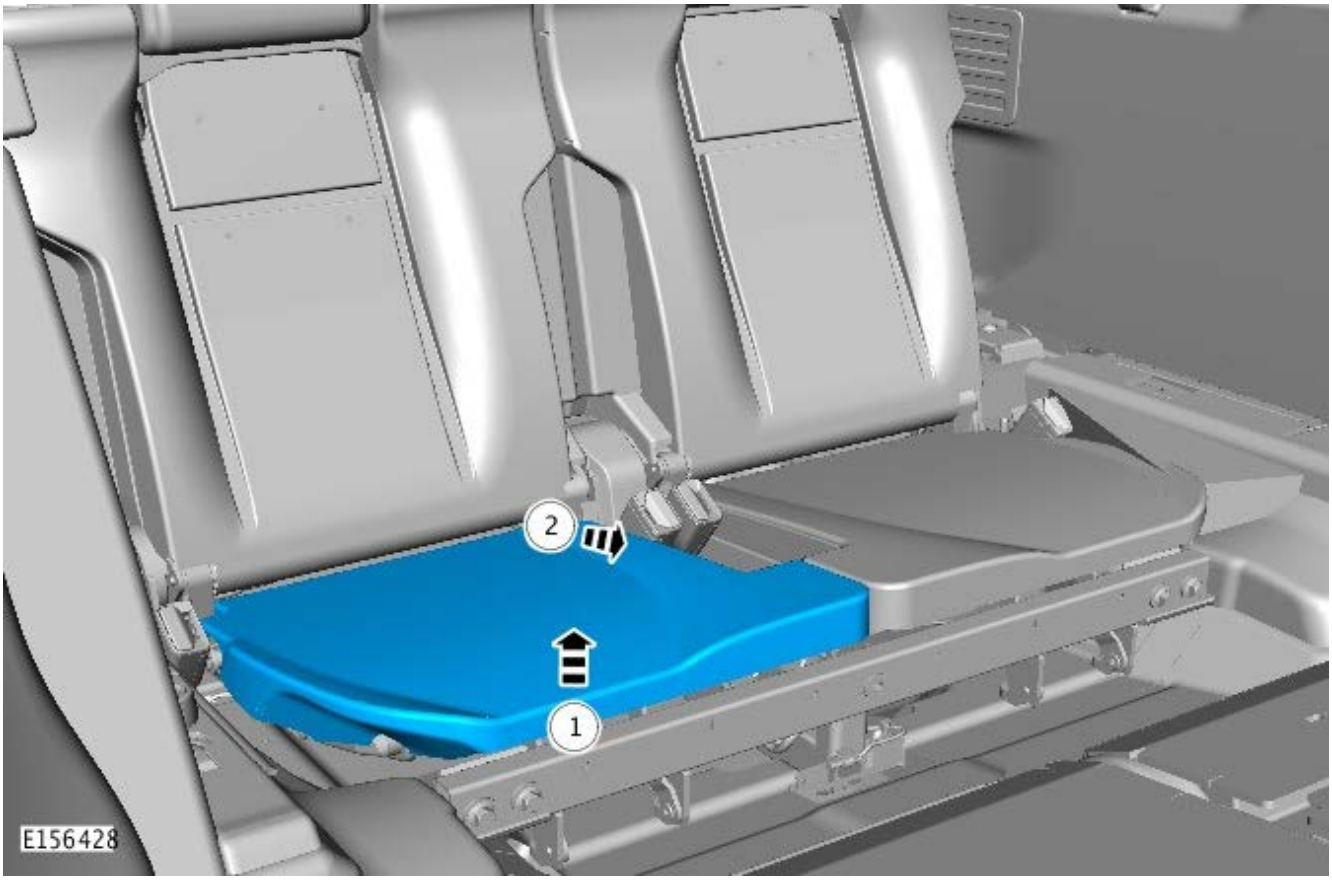
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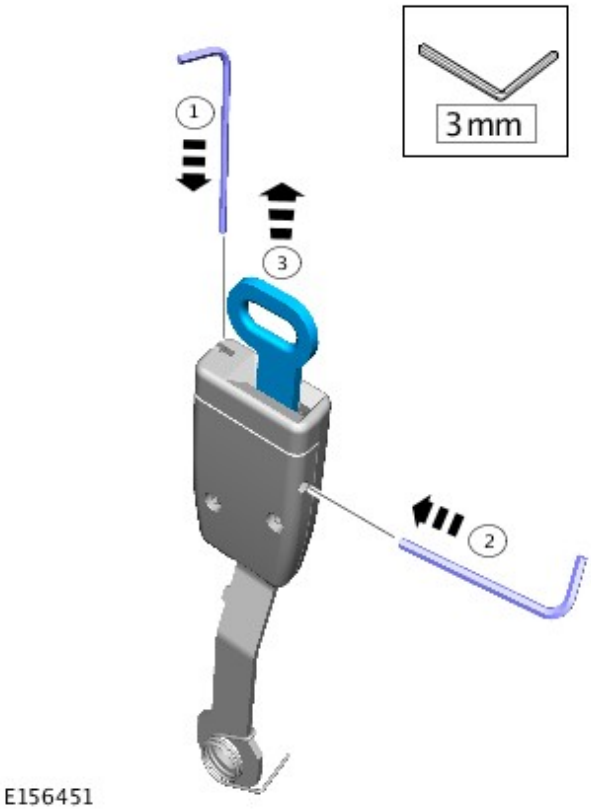
9.



10. NOTE: Repeat the procedure for the other side.



11.

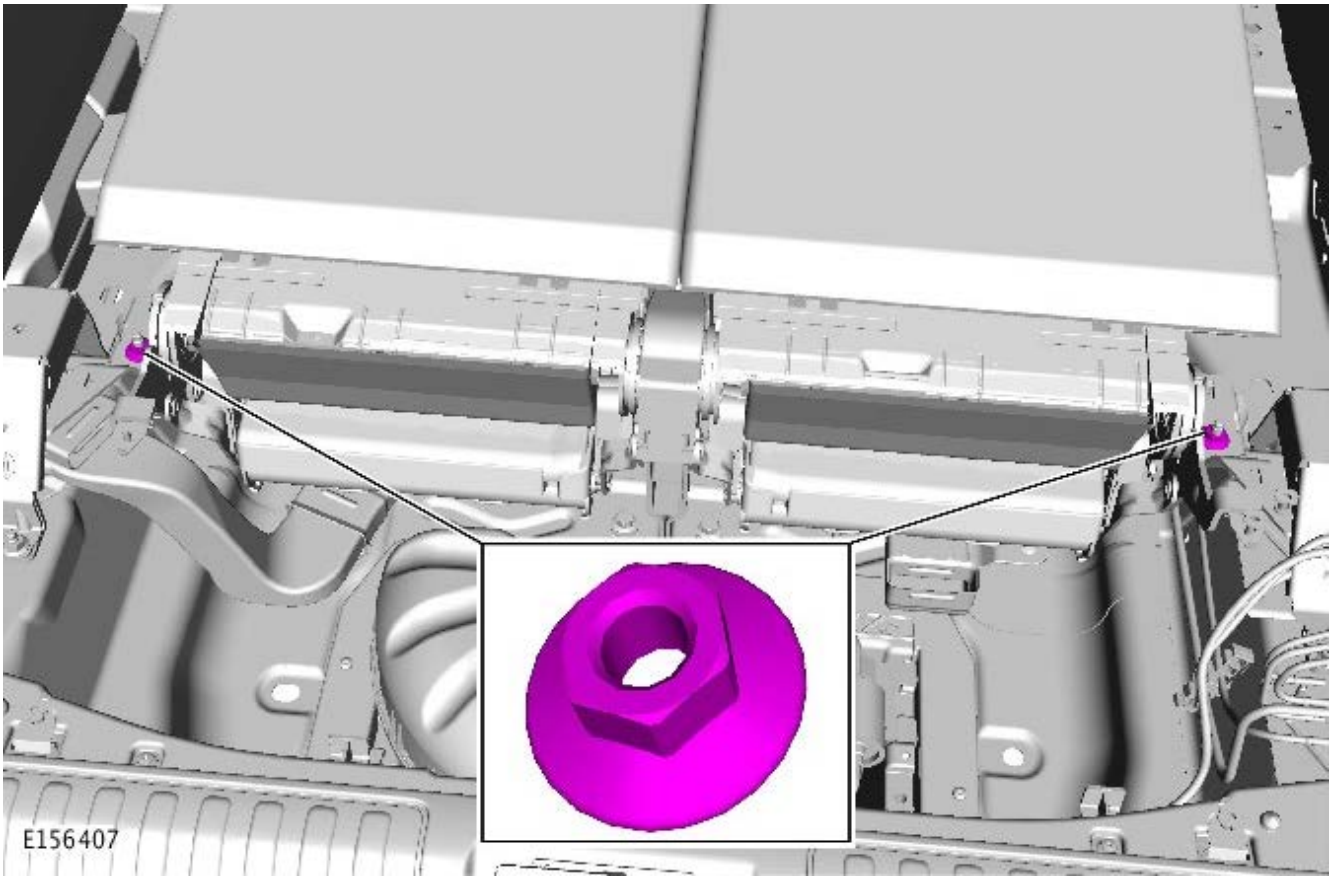


12. Disconnect the battery ground cable.

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

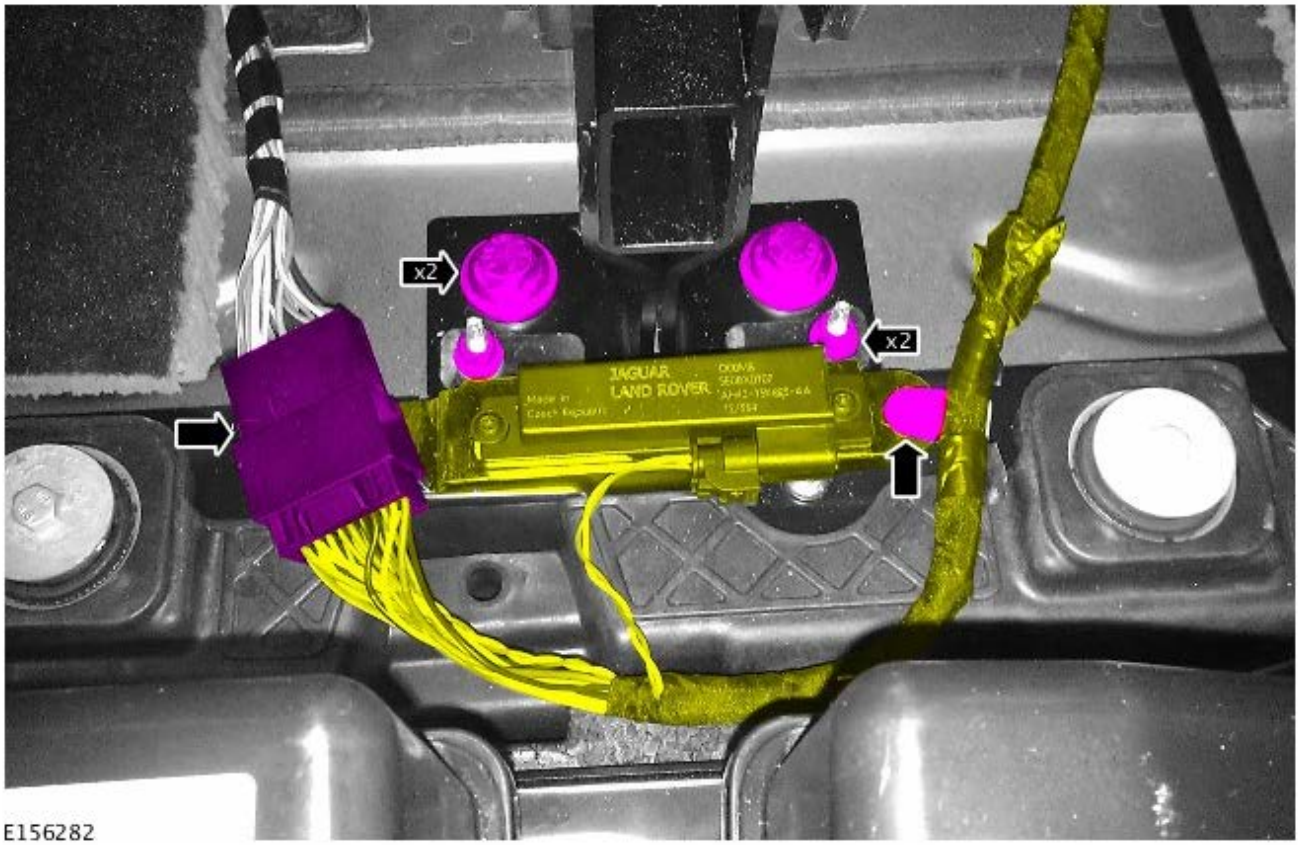
13. NOTE: Discard the retaining nuts.

    Torque: 45 Nm

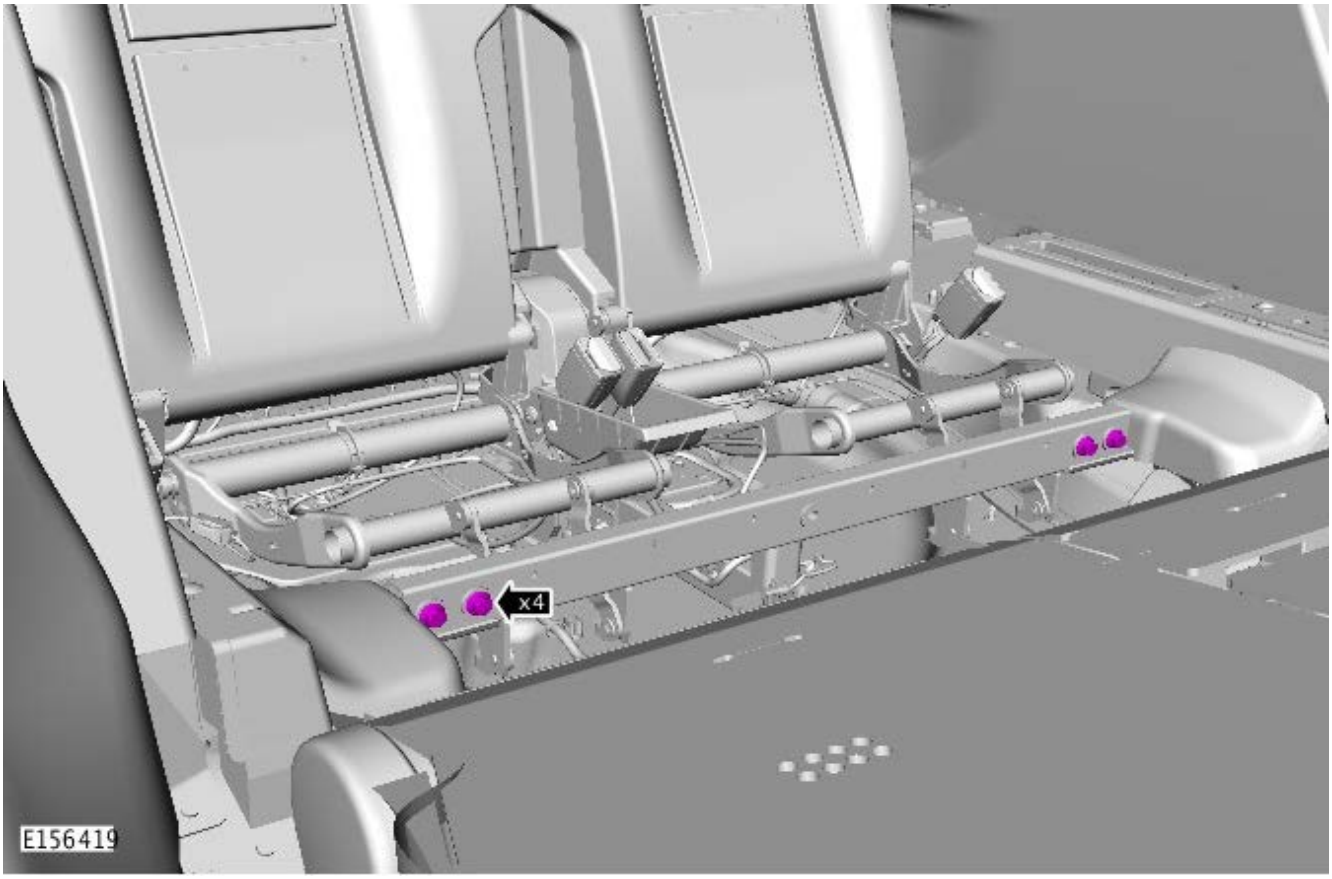


14.

- *Torque:* 47 Nm
- *Torque:* 3 Nm



15. *Torque:* 47 Nm

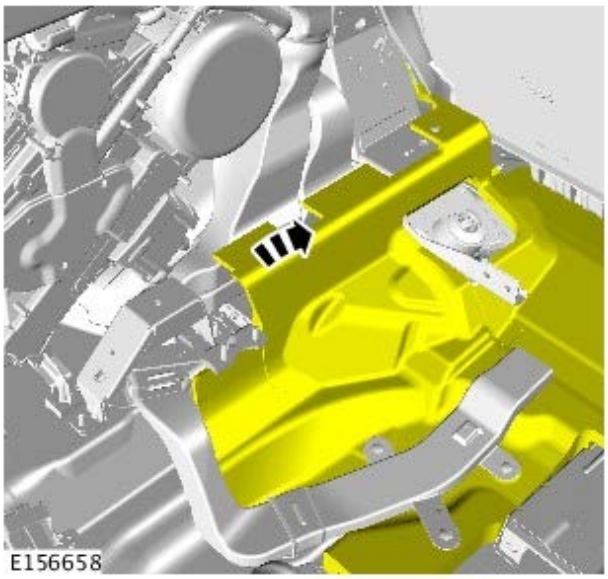


16. WARNING: This step requires the aid of another technician.

CAUTION: Care must be taken to avoid damaging the surrounding components.



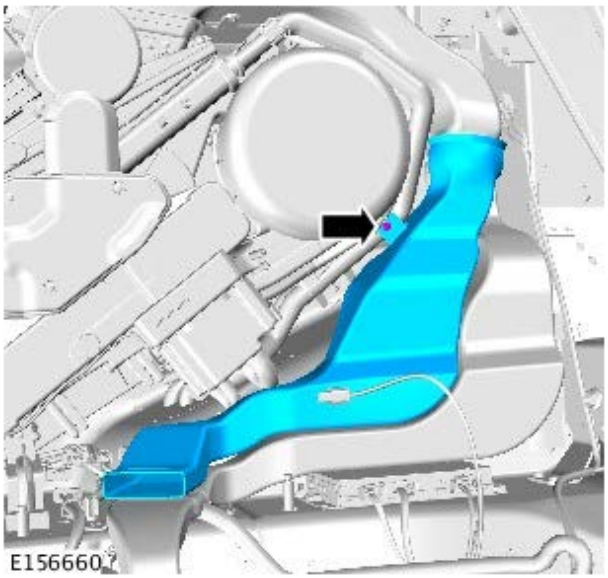
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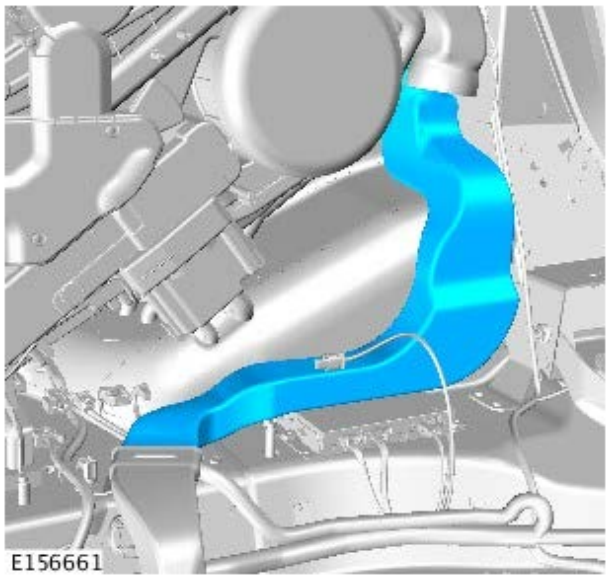
18. *Torque:* 50 Nm



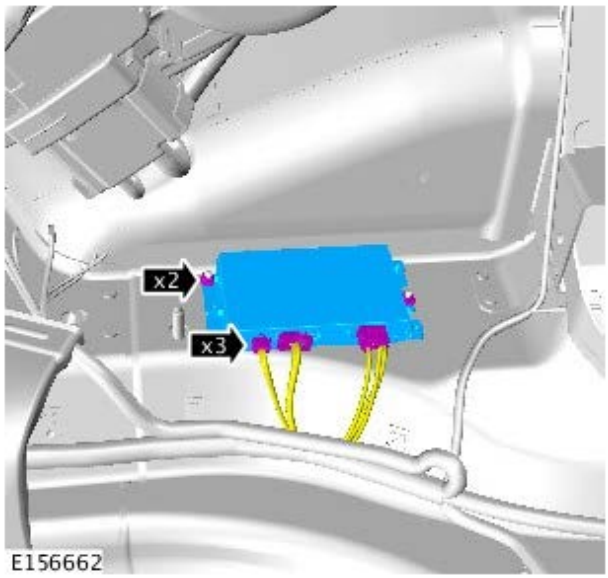
19.



20.



21. *Torque:* 9 Nm



Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 02-May-2013

Information and Entertainment System - Television (TV) Module

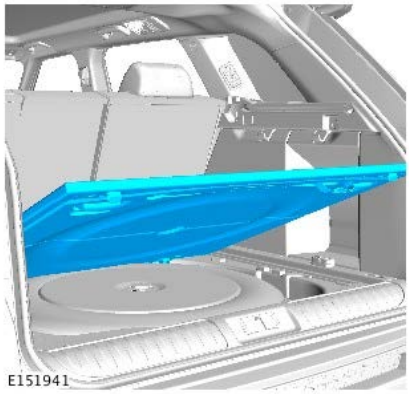
Removal and Installation

Removal

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

Vehicles without occasional rear seats

1.



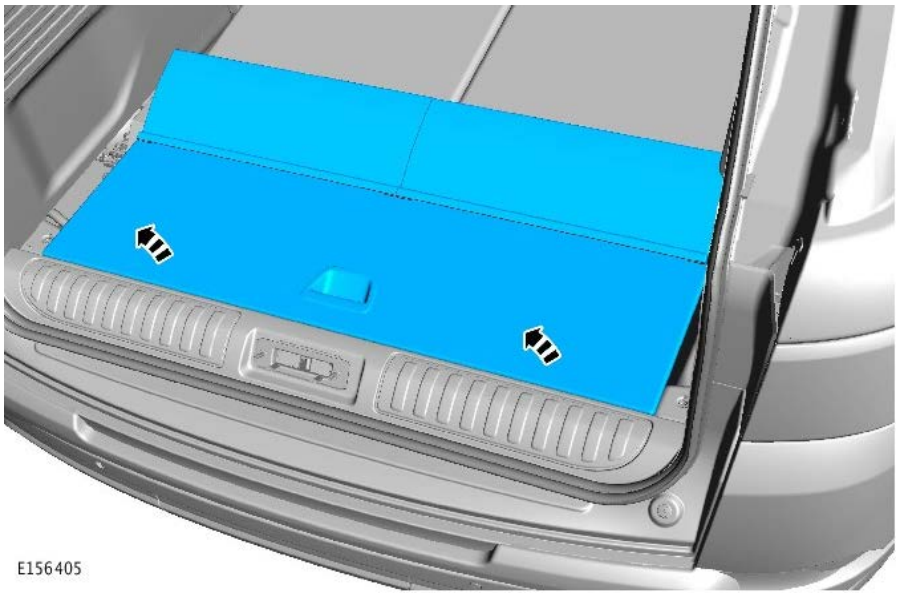
Vehicles without occasional rear seats

2.



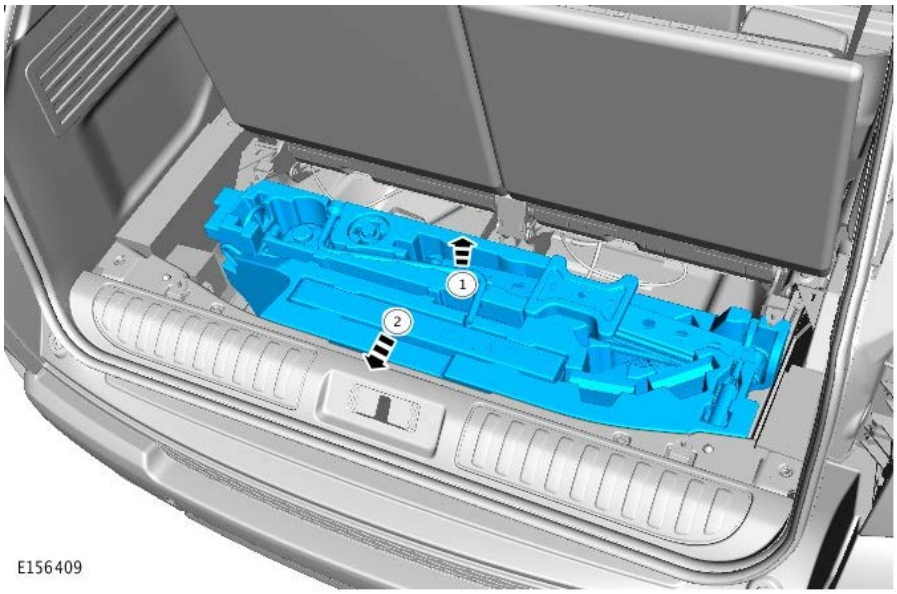
Vehicles with occasional rear seats

3.

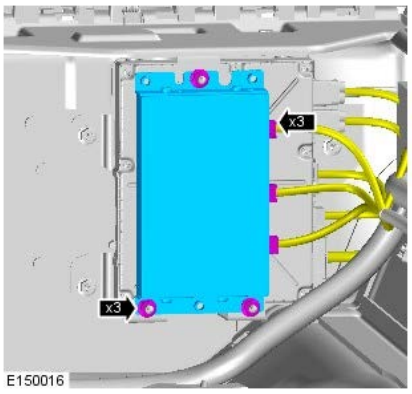


Vehicles with occasional rear seats

4.



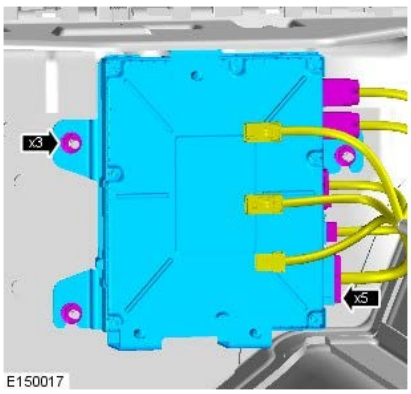
All vehicles



5. NOTE: If equipped.

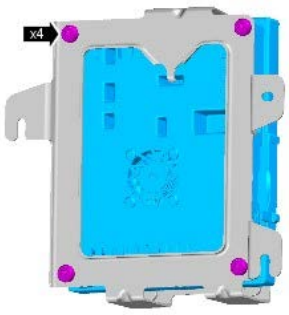
   Torque: 9 Nm

6. *Torque:* 9 Nm



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

   Torque: 9 Nm



Installation

1. If a new component has been installed, configure using Land Rover approved diagnostic equipment.
2. To install, reverse the removal procedure.

Published: 10-Sep-2012

Information and Entertainment System - Video Display

Removal and Installation

Removal

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

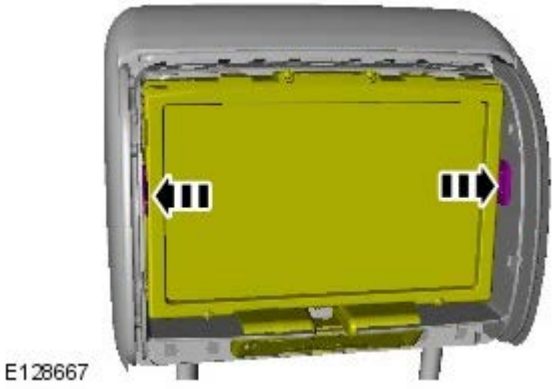
1.



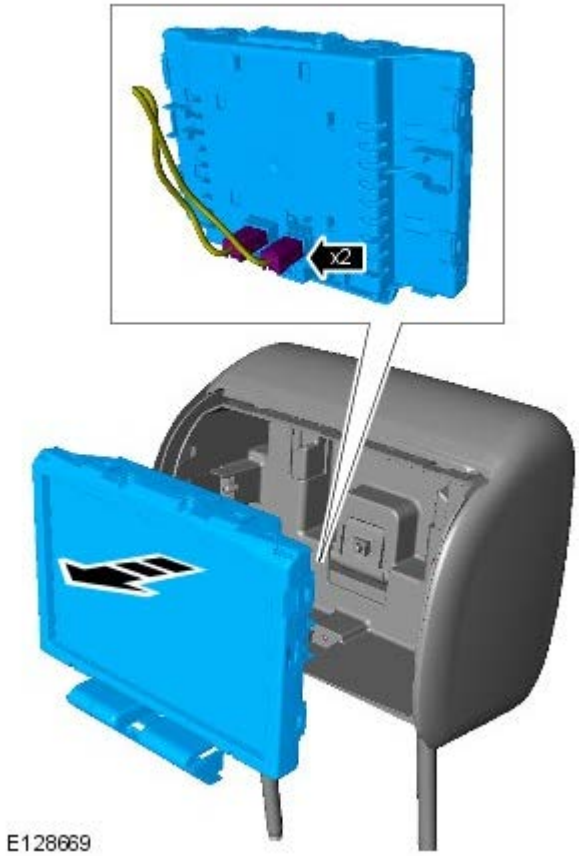
2.



3.



4.



Installation

1. To install, reverse the removal procedure.

Published: 04-May-2013

Exterior Lighting -

General specifications

Item	Specification	Rating
Low beam headlamp bulb - vehicles with conventional headlamps	Halogen H7 Long Life (LL)	55W
High beam headlamp bulb - vehicles with conventional headlamps	Halogen H7 LL	55W
High intensity discharge headlamp bulb - low and high beam	D3S	35W
Cornering lamp	LED's - high output	-
Static bending lamp	LED's - high output	-
Front fog lamp bulb	Halogen H11	55W
Rear fog lamp	Bulb	19w
Front turn signal lamp	Bulb	8W
Rear turn signal lamp	LED	-
Side repeater lamp bulb	Capless	5W
Front side lamp	LED	-
Stop lamp	LED	-
High mounted stop lamp (HMSL)	LED	-
Tail lamp	LED	-
License plate lamp bulb	Festoon	5W
Reversing lamp bulb	Bayonet H6W	6W
Side marker lamp bulb - front and rear- Federal	LED	-

WARNING: Refer to the general information - electrical precautions section of this manual prior to carrying out any procedures on the high intensity discharge headlamp system installed to certain vehicles.

Torque specifications

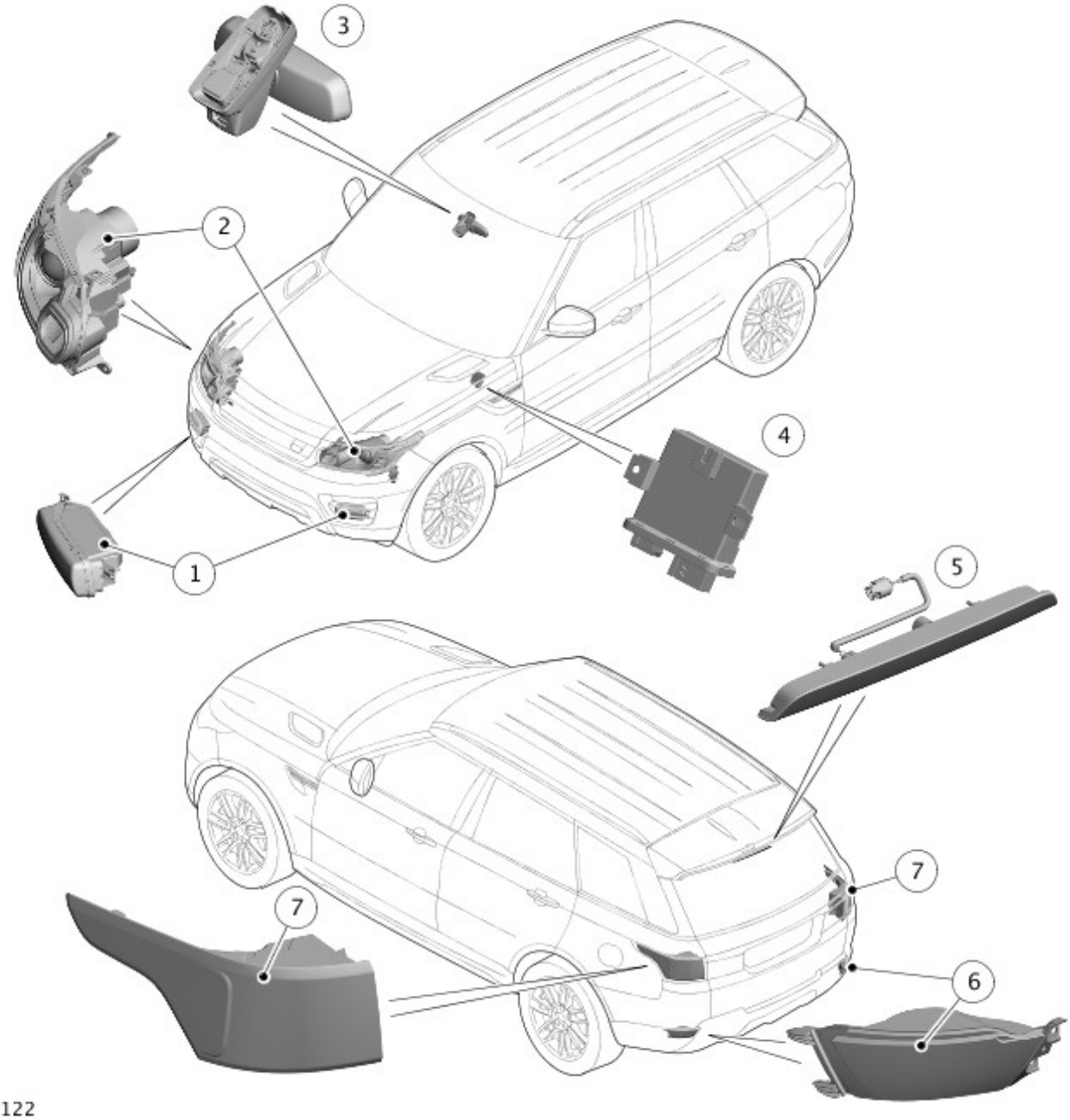
Item	Nm	lb-ft	lb-in
Adaptive front lighting module bolts	5	7	44
Front fog lamp bolts	2.5	-	22
Headlamp bolts	5	-	44
Rear lamp bolts	2.5	-	22
High level brake light nuts	1.75		15
Rear fog lamp bolts	2.3		20

Published: 14-May-2013

Exterior Lighting - Exterior Lighting

Description and Operation

Exterior Lighting Component Location



E156122

Item	Part Number	Description
1	-	Front fog lamps
2	-	Headlamp assembly
3	-	Interior mirror (daylight sensor and AHB camera)
4	-	Headlamp Leveling Control Module (HLCM)
5	-	High Mounted Stop Lamp (HMSL)
6	-	License plate lamp
7	-	Tail lamp assembly

OVERVIEW

The exterior lighting is controlled by the CJB (central junction box). The CJB controls the following vehicle functions:

- Control and monitoring of exterior lamps including turn signal indicators and hazard warning functionality
- Communication and control and monitoring of trailer lighting via the trailer module
- Monitoring and evaluation of check control inputs from other system control modules and output of applicable messages in the instrument cluster message center.

The CJB is connected to the medium and high speed CAN (controller area network) bus. The CJB contains a

microprocessor which performs the control, monitoring and evaluation functions.

A combined rain/light sensor is fitted which controls the automatic wiper operation and the automatic lighting function.

An Auto High Beam system can also be fitted which automatically controls the high beam headlamps.

All exterior lamps are LED (light emitting diode) apart from the Xenon headlamps and the reverse lamps.

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 indicators side repeater lamps
- Stop lamps and High Mounted Stop Lamp (HMSL)
- Reversing lamps
- Rear fog lamps
- Front fog lamps
- Static bending lamps (if fitted - AFS headlamp except NAS)
- Low and high beam headlamps
- Adaptive Front lighting System (AFS) (if fitted).
- Daytime Running Lamps

CENTRAL JUNCTION BOX

The CJB is located behind the glove compartment and is connected to the vehicle wiring harness.

The CJB receives four permanent battery power supplies via the BJB (battery junction box).

The lighting circuits are not all protected by conventional fuses as some are protected by Metal Oxide Semiconductor Field Effect Transistors (MOSFETs). The control circuitry within the CJB and the CJB for each individual circuit can detect and isolate a problem circuit.

Failure of the turn signal will be notified to the driver but flashing the turn indicator icon at double speed. The external lamp will flash at normal rate. No other lamp failure will be notified to the driver.

Input Signals for Lamp Control

The CJB receives inputs from the following switches:

- Left steering column multifunction switch for turn signal indicators, main beam, front and rear foglamps, side lamps, headlamps, auto headlamps, high beam/headlamp flash and Auto High Beam system
- Brake pedal switch
- Momentary push switch for hazard warning.

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 CAN bus from the TCM (transmission control module) to enable the CJB to activate the reverse lamps.

The CJB can receive a hazard warning indicator activation message from the RCM (restraints control module), 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 Auto High Beam, the auto high beam control module outputs signals on the medium speed CAN bus to the CJB to control the high beam headlamps.

Circuit Protection

Operation of the lamps is performed using 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 front fog lamps are controlled by relays and the circuit is protected by conventional fuses.

Xenon Bulb Control Module (XBCM)

If a xenon draws high current the CJB will detect a short circuit and remove the supply to the XBCM. If the XBCM unit is disconnected then the CJB will continue to power the XBCM as there is no open load detection enabled for the Xenon output.

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.

Crash Signal Activation

In the event of an accident of a severity to activate and deploy the airbags, the Restraints Control Module (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

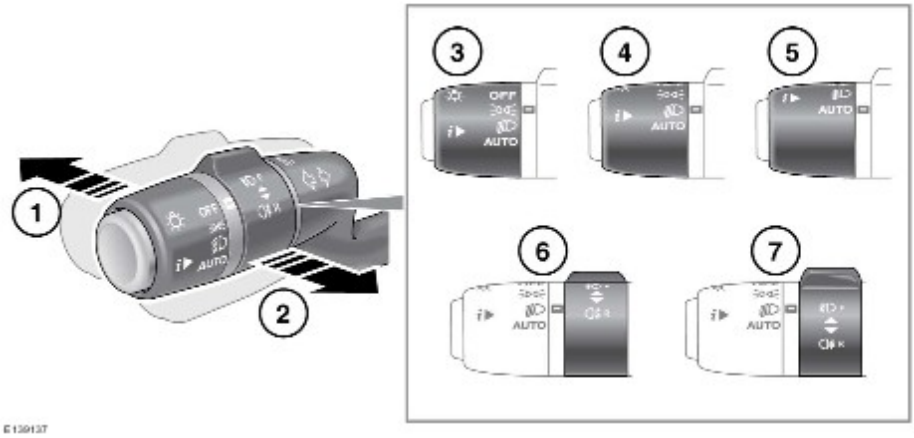
In the event of the security system being triggered, the CJB requests activation of the hazard warning lamps.

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 at a voltage 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. The switch illumination can also be controlled via the dimmer when the door is opened and the vehicle is unlocked.

LIGHTING CONTROL SWITCH



Item	Part Number	Description
1	-	High Beam select
2	-	High beam cancel/flash
3	-	Side lamp on
4	-	Headlamp on
5	-	Auto headlamp position
6	-	Rear fog lamp on/off
7	-	Front fog lamp on/off

All lighting (apart from the hazzard warning lamps) control is via the left steering column multifunction switch. The switch comprises two rotary switches for controlling side lamps and headlamps and fog lamps and a push/pull function for high/low beam selection.

The lighting control switch is hardwired to the steering wheel module which in turn is connected to the CJB via a Lin bus.

The left steering column multifunction switch is located on the left side of the steering column and controls the following functions:

- Headlamp low/high beam
- Headlamp high beam flash
- Left/right turn signal indicators
- Trip computer functions. For additional information refer to 413-08 Information and Message Center.

The high beam on and flash functions are connected on a single wire to the CJB. The switch assembly contains resistors and the ground for each selection is passed through a different resistor for each selection. The same also applies to the turn signal indicators. The CJB senses the resistance on the ground wire and determines which function has been selected.

The turn signal indicators incorporate a lane change function. To activate the lane change function, hold the lever partially up or down against spring pressure to indicate a lane change. The directional indicator will flash three times. The lane change function can be enabled or disabled using an approved Land Rover diagnostic system.

HEADLAMP ASSEMBLY

General

Two types of headlamp are available; Bi-xenon™ or Adaptive Front lighting System (AFS).

Headlamp removal is not required for replacement of the xenon bulbs. The rear of the headlamp unit has a removable access cover which allow access to the bulb.

A large cover, which is rotated counter-clockwise to remove, allows access to the low/high beam xenon bulb.

The turn signal indicators, side lamps, static bending lamp (where fitted), daylight running lamps and the side marker lamp (where fitted) are LED's. None of the LED's are serviceable items.

In all markets except NAS, the headlamps have two adjustment screws which allow for the manual setting of the vertical and horizontal beam alignment. A 6mm Allen key is used to rotate the adjusters to achieve the required setting. The inboard adjuster controls the vertical aiming and the outboard adjuster controls the horizontal aiming.

On NAS vehicles the headlamp is regarded as 'Visual Optically Left' (VOL) aiming. There is no horizontal adjustment. Refer to the Service Repair Procedures manual for headlamp alignment data and procedures.

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 Library and circuit diagrams for pin details.

Two breathers are located on the rear of the headlamp housing. The Goretex breathers allow air flow in and out of the headlamp but prevent the ingress of moisture from rain, road spray or washing. If condensation occurs within the headlamp, check that the breathers are not blocked with mud etc before further action is taken.

Headlamp Operation

The lamps contained within the headlamp assembly have differing functionality depending on the function selected.

The low beam headlamps are switched on when the ignition is in power mode 6 (ignition on) or above and:

- the lighting control switch is the headlamp position or
- 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 power mode 6 (ignition on) or above and:

- the lighting control switch is in the headlamp position or the headlamps are activated by the AUTO feature and the left steering column multifunction switch is pushed forward, away from the driver or
- the headlamp flash function is operated by pulling the left steering column multifunction switch towards the driver or
- the auto high beam system is active.

Common Headlamp Features

Turn Signal Indicators

The turn signal indicator LED's are in the outer part of the headlamp assembly. The LED's are not serviceable components. The LED's are controlled by an LED control module located at the rear of the headlamp assembly.

Side Lamps

On the low line headlamp design the side lamps and daytime lamps are located in the inner lamp of the headlamp, on High line they are located in a pattern around the outer edge of the inner lamp and along the lower edge of the lamp unit. The LED's are not serviceable components. The LED's are controlled an LED control module located at the rear of the headlamp assembly.

Side Marker Lamps (NAS only)

The side marker lamp LED is located in a molded receptacle in the outer edge of the headlamp. The side marker lamp illuminates a small rectangular section between the orange side reflectors on the outside of the headlamp. The LED is not a serviceable component.

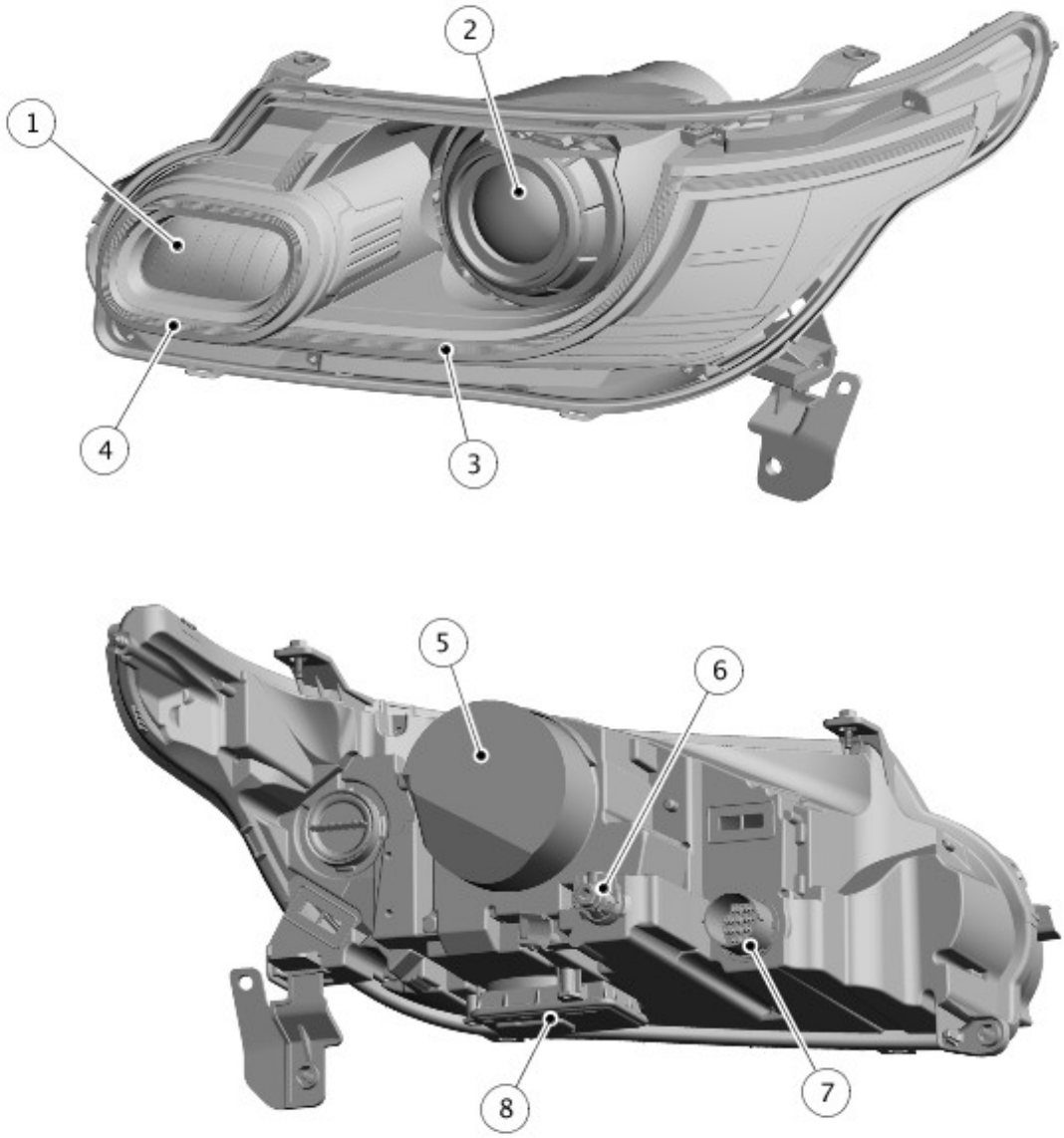
Headlamp Hand of drive

Previous models required the use of a tourist lever to set the headlamps for driving on a particular side of the road. The Range Rover Sport has a headlamp beam pattern that negates the need for a mechanical lever.

Auto High Beam (AHB)

Instead the headlamps can be configured for the side of road on which the vehicle is to be driven on via the Vehicle set-up in the message center. When in vehicle set-up select AHB, then select the side of road that the vehicle is to be driven on.

Xenon Headlamps



E156123

Item	Part Number	Description
1	-	Daylight running lamp and side lamp (Low line) cornering lamp (High line)
2	-	Bi-xenon™ projector module (dipped beam and high beam)
3	-	Turn signal indicator LED's
4	-	Daylight running and side lamps (High Line Headlamps)
5	-	Cover - bi-xenon™ headlamp bulb
6	-	Horizontal beam adjuster
7	-	Electrical connector
8	-	Light Emitting Diode (LED) control module

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
- Xenon bulbs must be disposed of as hazardous waste
- Only operate the lamp in a mounted condition in the reflector.

The headlamps use a complex surface reflector for the halogen high beam 'fill-in' lamp. This type of lamp has the reflector divided into separate parabolic segments, with each segment having a different focal length. A halogen H7LL 55W bulb is retained in an extended holder. The holder is secured in the rear of the high beam 'fill-in' lamp lens by

rotating clockwise.

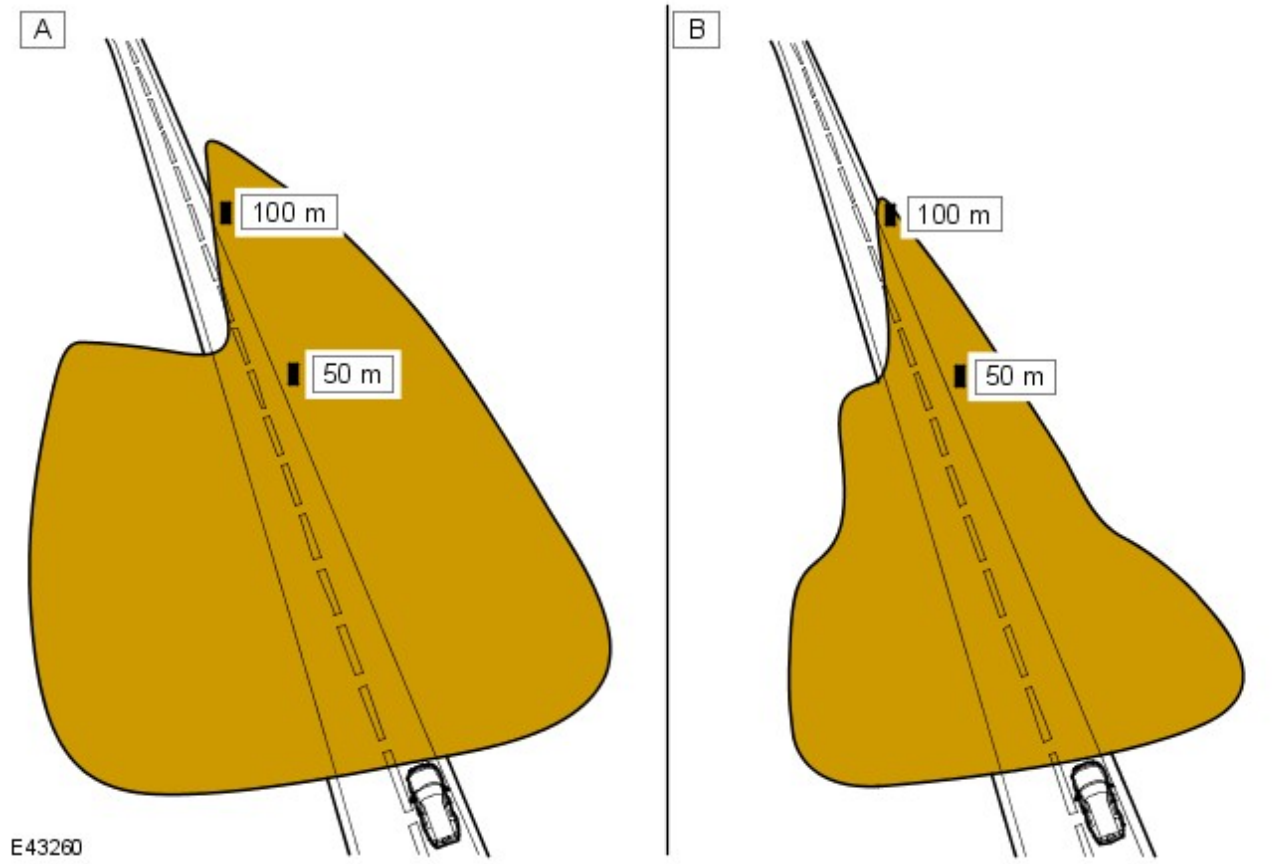
The xenon headlamp is known as 'Bi-Xenon™' (the Bi-Xenon™ trademark is the property of Hella KGaA Hueck & Co., Germany) because it operates as both a low and high beam unit. The xenon bulb is located in a projector module which comprises an ellipsoidal lens with a solenoid controlled shutter to change the beam output from low to high.

NOTE: If the lighting control switch is in the 0 (off) position, the xenon lamps will operate when the high beam 'flash' function is operated, the lamp will be lit but the shutter will only operate in high beam. If the lighting switch is in the headlamp position or the 'AUTO' position with the low beam headlamp 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 xenon control module and an igniter for each headlamp. The xenon control modules and the igniters provide the regulated power supply required to illuminate the xenon bulbs through their start-up phases of operation.

The xenon bulb is located in the rear of the projector module. The D3S xenon bulb incorporates an integral igniter unit and both components must be replaced if the bulb fails.

Xenon/Halogen Headlamp Beam Comparison



Item	Part Number	Description
A	-	Bi-Xenon™
B	-	Halogen

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 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. The bulb is an integral part of the igniter and is electrically connected by a connector located in the igniter unit.

The shutter controller is a solenoid which operates the shutter mechanism via a lever. The shutter is used to change the beam projection from low beam to high beam and visa versa.

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 to produce the characteristic 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 up to 30000 volts to establish the arc. This is produced by the igniter. The warm-up phase begins once the arc is established. The xenon control module regulates the supply to the bulb 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 module changes to continuous phase. The

supply voltage to the bulb is reduced and the operating power required for continual operation is reduced to 35W. The process from start-up to continuous phase is completed in a very short time.

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) Headlamps

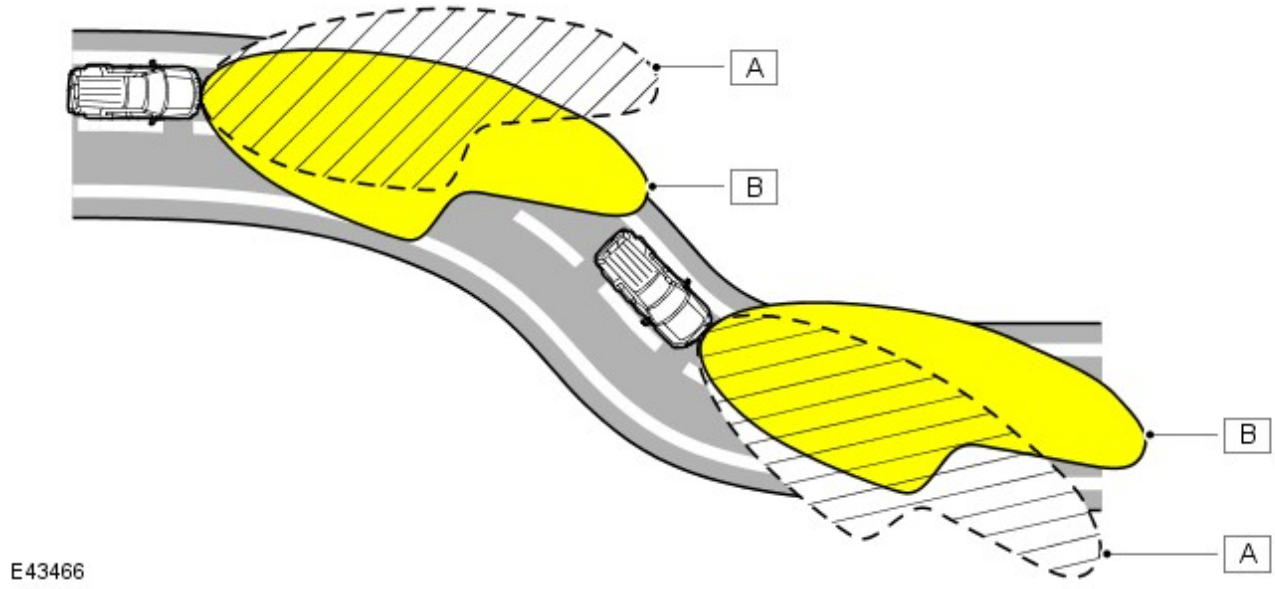
The AFS headlamp is similar in its construction to the xenon headlamp described previously. The projector module is constructed and operates as described for the xenon headlamp with the addition of the AFS system which allows the projector module to be moved vertically and horizontally by stepper motors. The following description covers the additional differences to the xenon headlamp with 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.

The bi-xenon™ module within the headlamp is controlled by actuator motors which rotate the projector module on its vertical and horizontal axes to adjust the beam output to suit the cornering conditions and vehicle inclination.

The AFS is controlled by an HLCM which is located on the instrument panel frame, behind the glove compartment. The module is connected to and controls an AFS power module located inside the headlamp housing. Signals from the HLCM are processed by the AFS module which controls the stepper motors to adjust the vertical and horizontal alignment of the projector module. The AFS power module also controls and regulates the operation of the static bending lamp (if fitted) which is requested by the HLCM but controlled by the CJB.

AFS Concept



Item	Part Number	Description
A	-	Conventional headlamp beam distribution
B	-	AFS headlamp beam distribution

The AFS xenon headlamp construction is similar to the non-AFS xenon headlamp assembly. The AFS headlamp has a xenon control module located on the underside of the lamp assembly. An additional AFS power module is located inside the headlamp housing. The AFS power modules supply the correct voltage to the stepper motors which control the positioning and movement of the AFS projector module.

The AFS assembly contains an additional carrier frame which provides the location for the AFS actuators. The remaining lamps are as described previously for the xenon headlamp. The AFS headlamp also incorporates a static bending/cornering lamp (except on NAS market vehicles).

The carrier frame is attached to the AFS vertical actuator. The projector module has a central pivot point which allows the module to move horizontally in response to operation of the AFS horizontal actuator.

The AFS actuators are bi-polar (2 phase) dc stepper motors which are driven by a power output from the AFS power module. Each stepper motor receives its position information from the HLCM via the applicable AFS power module. When the actuators are powered to their requested positions, a holding current is applied to maintain the actuator position.

Headlamp Leveling Control Module (HLCM)

The HLCM is located on the instrument panel frame, behind the glove compartment.

The HLCM is connected to the high speed CAN bus and receives inputs from other vehicle systems on the status of the following parameters:

- Steering angle
- Vehicle speed
- Headlamp status
- Engine running
- Reverse gear selected
- Automatic lighting on.

The AFS will only operate when the HLCM receives an engine running signal on the CAN bus and when the vehicle is in drive with the headlamps ON. When the engine running signal is received the HLCM performs an initialization routine.

The AFS will also function when the lighting control switch is in the AUTO position and the HLCM receives a lights on signal from the rain/light sensor and an engine running signal.

The HLCM then monitors the inputs from the other vehicle systems to control the AFS functionality according to cornering (steering) angles and vehicle speed.

The HLCM is connected to each AFS module on a private Local Interconnect Network (LIN) bus. The power modules read operating values supplied from the HLCM and control the output drivers for the stepper motor actuators inside the headlamp assembly.

AFS Operation

The AFS 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, e.g. when turning left, the left projector module will have a greater swiveling angle than the right projector module.

Initialization Procedure

When the HLCM receives an ignition on signal, the control module performs the initialization procedure which ensures that the headlamps are correctly aligned on both their vertical and horizontal axes.

The AFS swivel initialization starts less than 1 second after the headlamp leveling initialization is activated to ensure that the headlamps are at or below the 0 degree position in the vertical axis, thus preventing glare to oncoming vehicles. The left and right AFS actuator motors are powered from the 0 degree position to a small movement to the inboard position, then another small movement to the outboard position and then back to the 0 degree position.

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 power mode 6 (ignition on) 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 HLCM performs a diagnostic routine every time AFS is requested. If any fault is found, the HLCM will suspend the operation of the AFS function.

If the swivel system has failed, the HLCM will lower the projector module using the leveling actuator motors to a position much lower than standard to prevent excess glare to oncoming vehicles.

The HLCM 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 HLCM using the Land Rover recommended diagnostic tool to check for fault codes.

Static Bending/Cornering Lamps

NOTE: The static bending/cornering lamps are not fitted to NAS vehicles with AFS headlamps

The static bending/cornering lamps, which are a standard feature on AFS headlamps, are designed to illuminate the direction of travel when cornering at low speeds. The static bending/cornering lamp functionality, which is controlled by the CJB, is unique to vehicles with AFS headlamps and operates using inputs from the steering angle sensor.

The static bending/cornering lamp LED's are incorporated into the headlamp assembly. The design of the lens projects a spread of light from the vehicle at approximately 45 degrees to the vehicle axis.

The static bending/cornering lamp uses 2 high power LED's located in the headlamp housing. The LED's are not serviceable components.

Cornering Lamp Functionality

The cornering lamps are 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 lamps are controlled by the left steering column multifunction switch with the lighting control switch in the headlamp position and the ignition switch in power mode 6 (ignition on). The cornering lamps are not supplied power when the vehicle is in power mode 6 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) at which point the static bending lamp functionality is activated. Cornering lamps only illuminate when:

- In Drive
- Vehicle speed is slower than 40kph
- One of the direction indicators is on
- Headlamps are dipped

Only one cornering lamp will illuminate at any one time. If the left turn signal indicators are selected on, the left cornering lamp will be illuminated and visa versa, providing the vehicle speed and lighting control switch positions are correct.

Static Bending Lamp Functionality

The static bending lamps operate with a steering angle sensor CAN signal and vehicle speed signal which is received by the HLCM and the CJB. The HLCM sends a static bending lamp on request to the CJB which activates the static bending lamp LED's.

When the operation parameters of the lamp are reached, the CJB illuminates the static bending lamp LEDs on using a full power Pulse Width Modulation (PWM) voltage. When the lamp is switched off, the CJB fades the LED's off by decreasing the PWM voltage in a linear manner.

AUTOMATIC HEADLAMPS

The automatic headlamp function is a driver assistance system. The driver can override the system operation by selection of side lamps or headlamps on if the ambient light conditions require front and rear lighting to be active.

The automatic headlamp system uses a rain/light sensor which is connected via the Local Interconnect Network (LIN) bus to the CJB to control the headlamp functionality. The 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. Refer to the Wipers and Washers section for details of the rain/light sensor and automatic wiper operation. For additional information refer to Wipers and Washers 501-16.

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 rain/light sensor can detect if the vehicle has entered a tunnel or similar environment and will activate the headlamps on entry to the tunnel when the ambient and forward light levels have fallen quickly. When the tunnel is exited, the rain/light sensor detects the sudden increase in light levels and requests the lights to be switched off.

Certain light and weather conditions are not detected accurately by the rain/light sensor. The driver should override the automatic headlamps function if in any doubt about weather conditions and the requirement for exterior lights to be active.

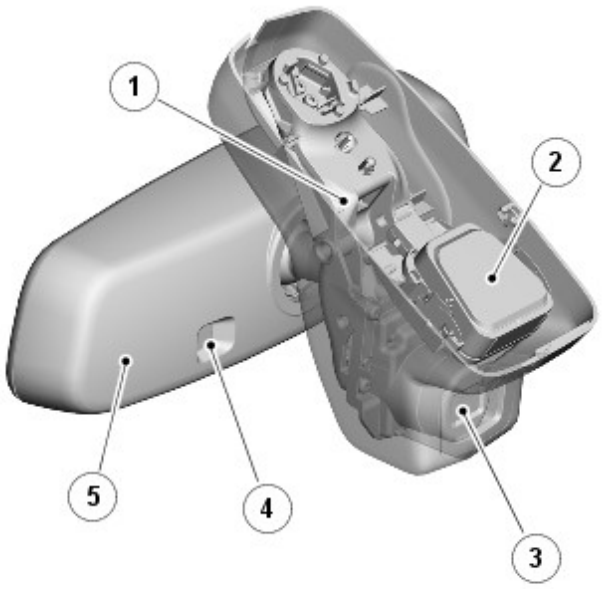
The automatic headlamp operation uses ambient light levels which are monitored by a photodiode incorporated in the rain/light sensor. The rain/light sensor sends a lights on/off request to the CJB via the LIN bus, which responds by switching on the low beam headlamps, front side lamps and rear tail lamps. The automatic headlamps are activated under the following conditions:

- Twilight
- Darkness
- Rain
- Snow
- Tunnels
- Underground or multi-level car parks.

Operation of the automatic headlamps requires the ignition to be 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 automatic headlamp function has been selected and the ambient light falls below a pre-defined level then the front and rear fog lamps can be manually activated. If the ambient light rises above that level then the fog lamps will be deactivated along with the rest of the lamps. If the ambient light then falls below this level again the lamps will be activated, but the fog lamps which were previously selected will not.

AHB



E148927

Item	Part Number	Description
1	-	Rear view mirror calibration bracket
2	-	Rain/light sensor (Auto headlamps)
3	-	Image sensor
4	-	Front light sensor
5	-	Auto High Beam Control Module (AHBCM)

AHB 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.

AHB Warning Indicator



E117699

Item	Part Number	Description
1	-	Warning indicator (green)

The Auto High Beam (AHB) system is controlled by a Auto High Beam Control Module (AHBCM) 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 AHBCM 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 AHB 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.

Auto High Beam Operation

The AHB operates as part of the automatic headlight system. When driving at night with the lighting control switch in the automatic position and the left steering column multifunction switch in the central position, with sufficient darkness (approximately 1 lux or less) and a suitable road speed, the AHB will automatically operate the high beam lighting when necessary. A warning symbol in the instrument cluster confirms to the driver when the AHB 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)

AHB 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:

- AHB has been first 'enabled' via the instrument cluster menu
- Lighting control switch is in the 'Auto' position
- Left 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, AHB 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, AHB 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 AHB 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 AHB system at any time. When the AHB system is activated, pulling the left 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 AHB 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 AHB warning indicator will illuminate again.

Correct Performance

In addition, AHB 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
- AHB system has been set for correct 'hand of traffic' via the driver menu settings – 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 AHB feature must first be enabled using the configuration menu available in the instrument cluster. However if required, the AHB 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 AHB 'Enable'

To set the AHB 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 > AHB
- 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.

 NOTE: Enabling or disabling high beam assist will not affect the ‘Hand of Traffic’ settings once set.

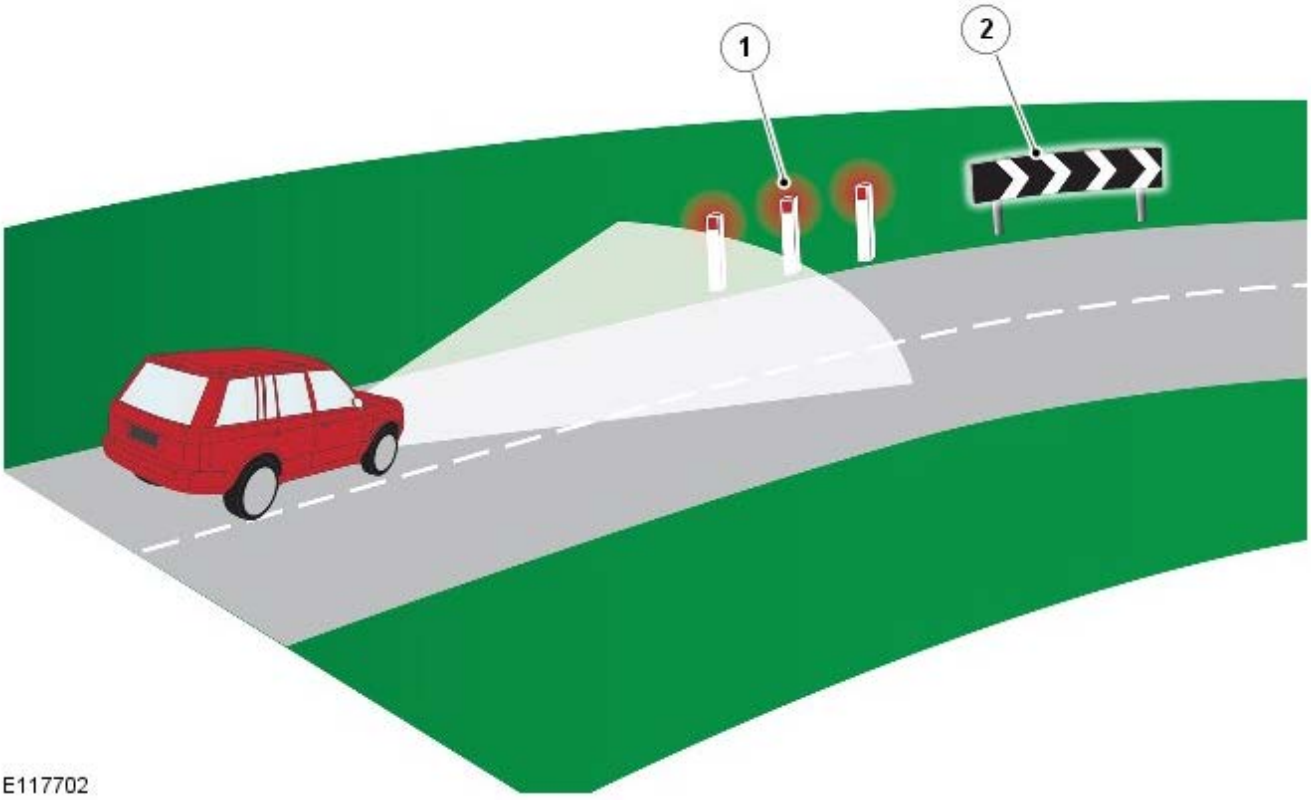
System Limitations

The AHB 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 AHB system to undesirably operate the high beam headlamps or take no action at all. Examples of these situations are as follows:

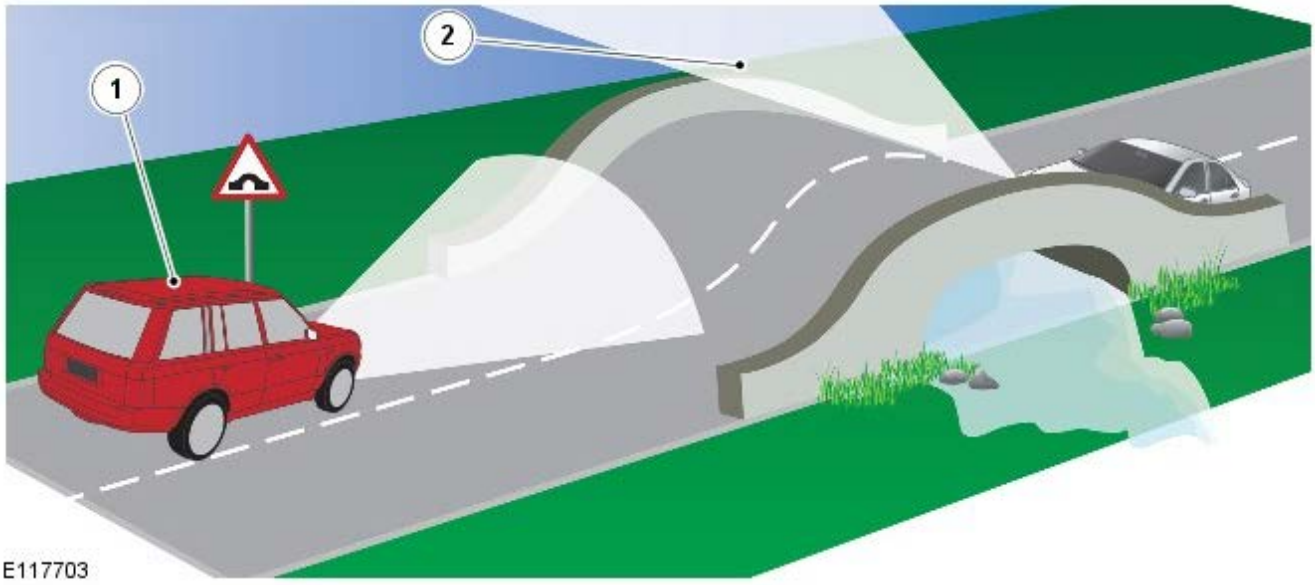
- Dips, hollows or crests in the road
- Highly reflective static Road signs
- Tight bends
- Poorly illuminated vehicles e.g. cyclists or small mopeds
- Motorway central barriers
- Extreme weather conditions e.g. Fog, heavy snow
- Exterior domestic or industrial lighting

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 AHB
2	-	Oncoming vehicle headlamps can be seen by the driver before the AHB 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 AHB 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.

AHB 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 "AHB Sensor Blocked" message within the message centre

System Calibration

To achieve effective operation of the AHB 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 AHB 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.

HEADLAMP DELAY

The CJB controls a headlamp delay function which illuminates the driveway after leaving the vehicle. The headlamp delay will operate on low beam headlamps only regardless of the position of the left steering column multifunction switch.

The headlamp delay is activated when the lighting control switch is in the 'Auto' position and the engine is switched off. The message center displays a 'HEADLIGHT DELAY' message and the low beam headlamps will be activated for a period of approximately 30, 60, 120 or 240 seconds, which is selectable using the instrument cluster menu. After the delay period, the CJB automatically switches off the delay function, extinguishing the headlamps.

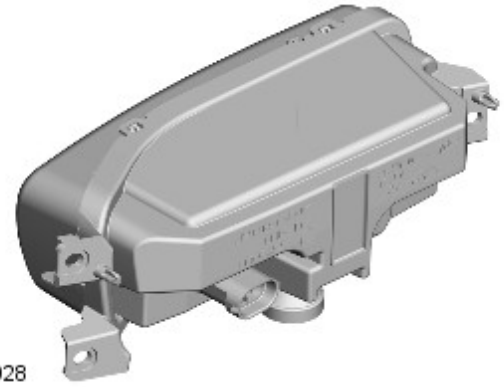
The headlamp delay feature can also be switched off by pressing the headlamp button on the smart key.

INSTRUMENT CLUSTER WARNING INDICATOR ILLUMINATION

The warning indicators in the instrument cluster for left and right turn signal indicator, front and rear fog lamps and headlamp low and high beam and side lamps are activated by the CJB via messages to the instrument cluster on the medium and high speed CAN buses. The synchronisation of the turn signal warning indicator with the external turn signal indicator lamp frequency is controlled by a cyclic transmission of the light status on the medium speed CAN bus.

The AFS warning indicator is controlled by a signal from the HLCM.

FRONT FOG LAMPS

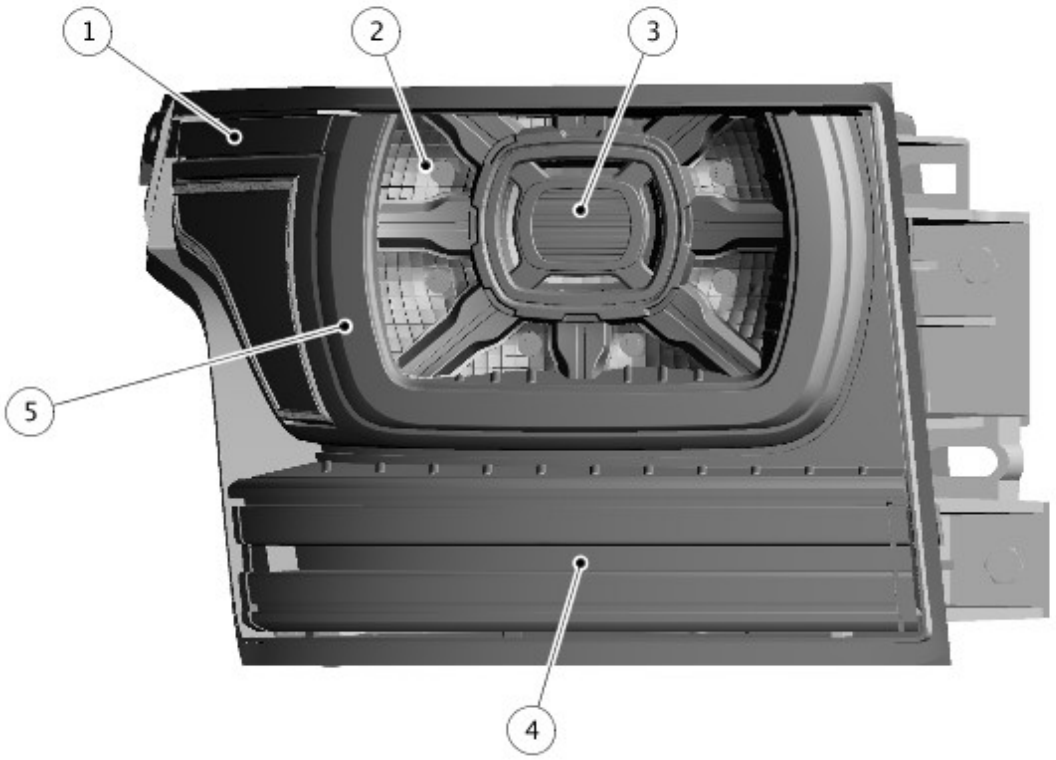


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The front fog lamps are located in the front bumper below the headlamps. Each lamp provides illumination from two LEDs located in the top of the unit.

Adjustment of the fog lamp units is via an adjuster located in the base of each unit.

TAIL LAMP ASSEMBLY



E156124

Item	Part Number	Description
1	-	Tail lamp LED's
2	-	Stop lamp LED's
3	-	Reversing lamps
4	-	Turn signal indicator LED's
5	-	Tail lamp LED's

All lamps in the tail lamp assembly use LED's.

On NAS vehicles, an additional LED is used to accommodate the side marker lamp.

None of the LED's are serviceable items.

SIDE REPEATER LAMPS



Item	Part Number	Description
1	-	LED direction indicator lamp

The side repeater lamps are located in the door mirror casing. The side repeater lamps use LEDs for illumination.

LICENSE PLATE LAMPS

Two license plate lamps are located in the trim above the license plate in the lower tail door. The lamps are press fitted in their apertures and secured by an integral plastic clip.

HAZARD WARNING LAMPS

The hazard warning lamps use the front and rear turn signal indicator lamps and the side repeater lamps as previously described. These are controlled by the CJB in response to a hazard warning lamp request from the instrument panel switch.

Crash Signal Activation

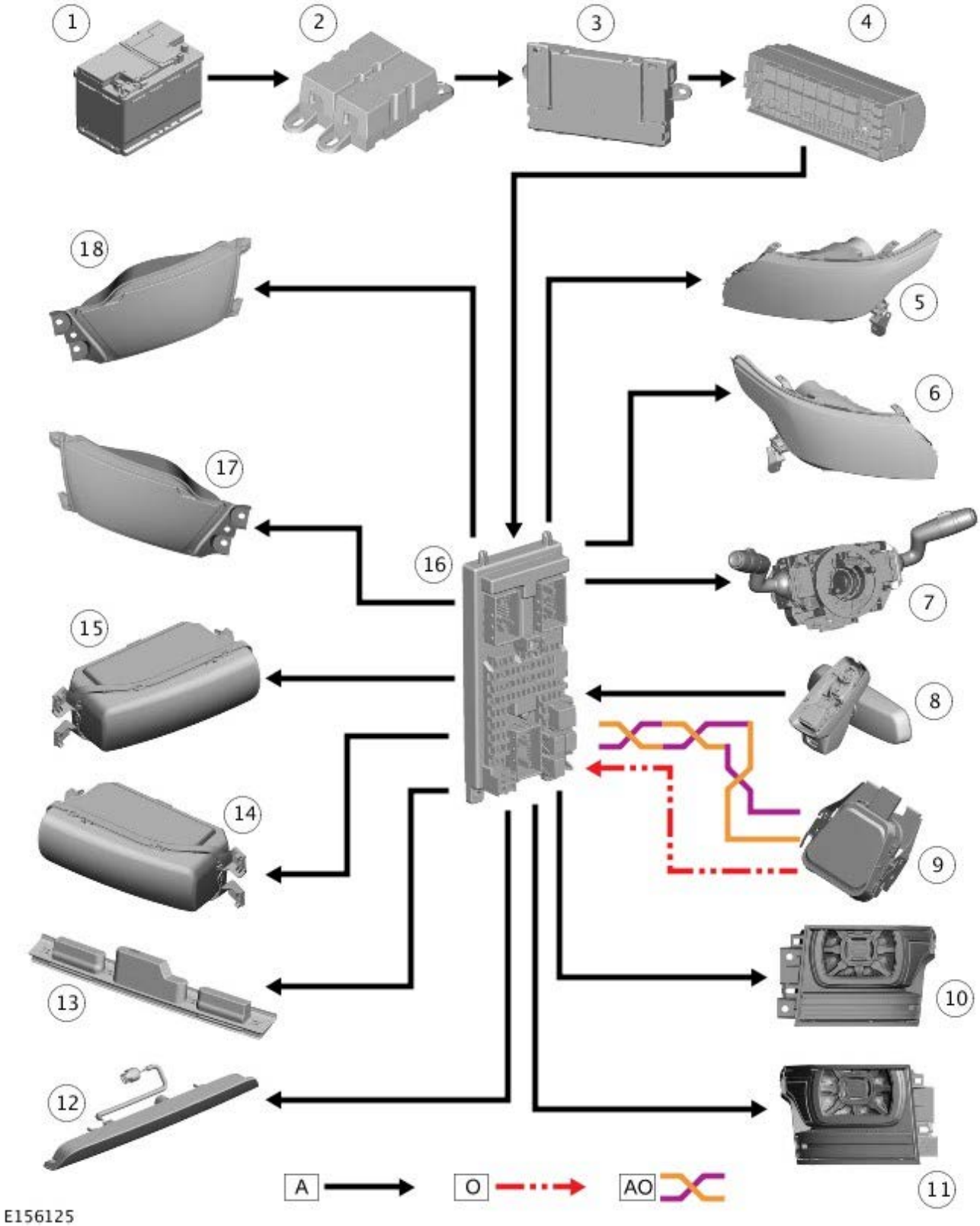
In the event of an accident of a severity to activate and deploy the airbags, the RCM requests various electrical operations to assist with the crash situation. The RCM requests via the bus systems to the CJB to activate the hazard warning lamps. These will continue to operate until deselected using the hazard warning lamp switch in the instrument panel. The lamps flash at a frequency which is the same as the frequency used to flash the headlamp high beam in the same situation.

DAYTIME RUNNING LAMPS (DRL)

DRL operation is detailed in a separate section. For additional information refer to 417-04 Daytime Running Lamps.

EXTERIOR LIGHTING CONTROL DIAGRAM

NOTE: **A** = Hardwired; **D** = Medium Speed CAN bus; **O** = LIN Bus.

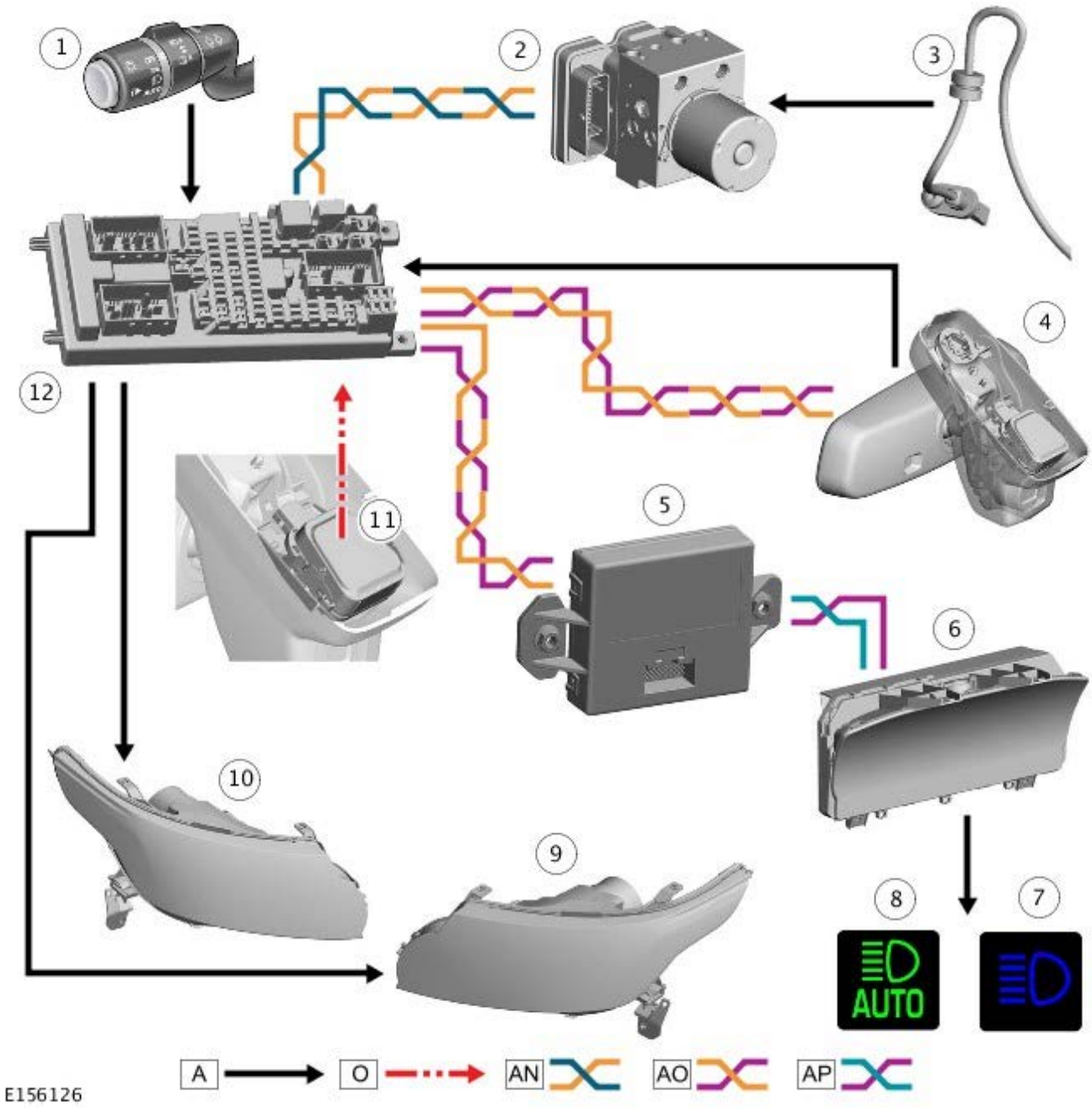


Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box (BJB) 2
3	-	Battery Junction Box (BJB)
4	-	Rear Junction Box (RJB)
5	-	Left headlamp
6	-	Right headlamp
7	-	Clockspring (CLKSPRNG)
8	-	Auto High Beam Control Module (AHBCM) and image sensor
9	-	Rain/light sensor
10	-	Right tail lamp

11	-	Left tail lamp
12	-	High Mounted Stop Lamp (HMSL)
13	-	Licence plate lamps
14	-	Front left fog lamp
15	-	Front right fog lamp
16	-	Central Junction Box (CJB)
17	-	Rear right fog lamp
18	-	Rear left fog lamp

AUTO HIGH BEAM 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	-	Anti-block Brake System (ABS) control module
3	-	Wheel speed sensor
4	-	Auto High Beam Control Module (AHBCM) and image sensor
5	-	Gateway Module (GWM)
6	-	Instrument Cluster (IC)
7	-	High beam warning indicator
8	-	AHB warning indicator

9	-	Left headlamp assembly
10	-	Right headlamp assembly
11	-	Rain/light sensor
12	-	Central Junction Box (CJB)

Published: 31-Jul-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

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 and installation • Left-side steering column multifunction switch and installation	• Fuses • Wiring harness • Loose or corroded connector(s) • Battery junction box • Central junction box • Headlamp leveling control module • Headlamp power modules • Engine control module • ABS control module • Integrated suspension control module • LIN circuits • 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 fault • Air suspension system fault	Check the fuse(s) condition. Check the headlamp leveling motor and linkage condition. Check the headlamp leveling circuit. Refer to the electrical guides. Check for DTCs indicating headlamp leveling circuit and air suspension system fault(s)

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: Module Name: Headlamp Leveling Control Module (100-00, Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00 General Information, Description and Operation),
Diagnostic Trouble Code Index: Integrated Suspension Control Module (100-00, Description and Operation).

Published: 13-Dec-2013

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	• Fuses • Relays • Wiring harness • Loose or corroded connector(s) • Battery junction box • Central junction box • Headlamp leveling control module • Headlamp power modules • Instrument cluster • Steering angle sensor module • Transmission control module • Engine control module • Anti-lock brake system control module • Integrated suspension control module • LIN circuits • 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 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	Check the bulb and fuse condition. Check the headlamp circuits. Check the lighting control switch function. Refer to the electrical guides. Check for DTCs indicating a headlamp or related circuit fault

	control switch fault	
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	Check the bulb condition and rating. Check the tourist lever is set correctly. Check the headlamp circuits. Check the lighting control switch function. Refer to the electrical guides
Low beam lamp(s) stuck on High beam lamp(s) stuck on	• Circuit fault • Lighting control switch fault • Headlamp timer function fault	Check the headlamp circuits. Check the lighting control switch function. Check the headlamp timer function. Refer to the electrical guides. Check for DTCs indicating a headlamp circuit fault
Headlamp low/high beam switching function inoperative	• Circuit fault • Lighting control switch fault • Xenon headlamp shutter mechanism fault	Check the headlamp circuits. Check the lighting control switch function. Check the xenon headlamp shutter mechanism operation. Refer to the electrical guides. Check for DTCs indicating a headlamp circuit fault
Warning indicator(s) inoperative	• Fuse(s) blown • Lighting control switch fault • Circuit fault • Instrument cluster fault	Check the fuse(s). Check the lighting control switch function. Check the warning indicator circuits. Refer to the electrical guides. Check for DTCs indicating an instrument cluster or CAN system fault

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: Headlamp Leveling Control Module (HLCM) (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Auto High Beam Control Module (AHCM) (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (Description and Operation).

Published: 13-Dec-2013

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

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 • Stop lamp switch condition and installation	• Fuses • Wiring harness • Loose or corroded connector(s) • Hill descent relay • Battery junction box • Central junction box • Anti-lock brake system control module • 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 • Circuit fault • Stop lamp switch fault	Check the bulb, LED lamp and fuse condition. Check the stop lamp circuits. Check the stop lamp switch function. Refer to the electrical guides. Check for DTCs indicating a stop lamp circuit fault
Stop lamp(s) dim	• Incorrect bulb rating • Circuit fault	Check the bulb condition and rating. Check the stop lamp circuits. Refer to the electrical guides
Stop lamp(s) stuck on	• Stop lamp switch fault • Circuit fault • Hill descent relay circuit fault	Check the stop lamp switch function. Check the stop lamp circuits. Refer to the electrical guides. Check for DTCs indicating a stop lamp circuit fault

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: 16-Dec-2013

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

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

Visual Inspection

Mechanical	Electrical
• Turn signal indicator(s) condition and installation • Cornering lamp(s) condition and installation • Bulbs and installation • Bulb holders and installation • Lighting control switch and installation • Hazard warning lamp switch condition and installation	• Fuses • Wiring harness • Loose or corroded connector(s) • Battery junction box • Central junction box • Steering angle sensor • Anti-lock brake system control module • Instrument cluster • Headlamp leveling control module • Restraints control module • 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(s)/hazard warning lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Circuit fault • Lighting control switch fault • Hazard warning lamp switch fault	Check the bulb and fuse condition. Check the turn signal indicator/hazard warning lamp circuits. Check the lighting control switch function. Check the hazard warning lamp switch function. Refer to the electrical guides. Check for DTCs indicating a turn signal indicator/hazard warning lamp circuit fault
Turn signal indicator(s)/hazard warning lamp(s) dim	• Incorrect bulb rating • Circuit fault • Lighting control switch fault • Hazard warning lamp switch fault	Check the bulb condition and rating. Check the turn signal indicator/hazard warning lamp circuits. Check the lighting control switch function. Check the hazard warning lamp switch function. Refer to the electrical guides
Turn signal indicator(s)/hazard warning lamp(s) stuck on	• Lighting control switch fault	Check the turn signal indicator/hazard warning lamp circuits. Check the lighting control switch function. Check the hazard warning lamp switch function. Refer to the electrical guides. Check for DTCs indicating a turn signal indicator/hazard warning lamp circuit fault

	• Hazard warning lamp switch fault • Circuit fault	
Hazard warning lamp(s) inoperative	• Fuse(s) blown • Lighting control switch inoperative • Hazard warning lamp switch inoperative • Circuit fault • Instrument cluster fault	Check the fuse(s). Check the lighting control switch function. Check the hazard warning lamp switch function. Check the hazard warning lamp circuits. Refer to the electrical guides. Check for DTCs indicating an instrument cluster or CAN system fault
Cornering lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Circuit fault • Lighting control switch fault	Check the bulb and fuse condition. Check cornering lamp circuits. Check the lighting control switch function. Refer to the electrical guides. Check for DTCs indicating a cornering lamp circuit fault
Cornering lamp(s) dim	• Incorrect bulb rating • Circuit fault • Lighting control switch fault	Check the bulb condition and rating. Check the cornering lamp circuits. Check the lighting control switch function. Refer to the electrical guides
Cornering lamp(s) stuck on	• Lighting control switch fault • Circuit fault	Check the cornering lamp circuits. Check the lighting control switch function. Refer to the electrical guides. Check for DTCs indicating a cornering lamp circuit fault

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: 16-Dec-2013

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

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 plate 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 • Central junction box • Rain/light sensor • LIN circuits • 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 • Circuit fault • Lighting control switch fault	Check the bulb and fuse condition. Check the tail/license plate lamp circuits. Check the lighting control switch function. Refer to the electrical guides. Check for DTCs indicating a tail/license plate lamp circuit fault
Tail/license plate lamp(s) dim	• Incorrect bulb rating • Circuit fault • Lighting control switch fault	Check the bulb condition and rating. Check the tail/license plate lamp circuits. Check the lighting control switch function. Refer to the electrical guides
Tail/license plate lamp(s) stuck on	• Circuit fault • Lighting control switch fault	Check the tail/license plate lamp circuits. Check the lighting control switch function. Refer to the electrical guides. Check for DTCs indicating a tail/license plate lamp circuit fault
Tail/license plate lamp(s) inoperative when the autolamp switch option is selected	• Fuse(s) blown • Lighting control switch fault • Circuit	Check the fuse(s). Check the lighting control switch function. Check the automatic headlamp circuit. Refer to the electrical guides. Check for DTCs indicating a rain/light sensor or LIN system fault

	fault • Rain/light sensor fault • LIN circuit fault	

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: 17-Dec-2013

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

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 • Lighting control switch condition and installation	• Fuses • Wiring harness • Loose or corroded connector(s) • Front fog lamp relay • Front fog lamp warning indicator • Lighting control switch • Battery junction box • Central junction box

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
Front fog lamp inoperative	• Bulb failure • Fuse(s) blown • Circuit fault • Lighting control switch inoperative	Check the bulb condition. Check the fuse(s). Check the front fog lamp circuits. Check the lighting control switch function. Refer to the electrical guides
Front fog lamp dim	• Incorrect bulb rating • Circuit fault • Lighting control switch fault	Check the bulb condition and rating. Check the front fog lamp circuits. Check the lighting control switch function. Refer to the electrical guides
Front fog lamp lighting coverage poor	• Front fog lamp alignment incorrect	Check and adjust front fog lamp alignment
Front fog lamp warning indicator inoperative	• Fuse(s) blown • Lighting control switch inoperative • Circuit fault • Instrument cluster fault	Check the fuse(s). Check the lighting control switch function. Check the warning lamp circuits. Refer to the electrical guides. Check for DTCs indicating an instrument cluster fault

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: 19-Dec-2013

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

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 • Lighting control switch condition and installation	• Fuses • Wiring harness • Loose or corroded connector(s) • Rear fog lamp warning indicator • Lighting control switch • Battery junction box • Central junction box

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 • Circuit fault • Lighting control switch inoperative	Check the bulb condition. Check the fuse(s). Check the fog lamp circuits. Check the lighting control switch function. Refer to the electrical guides
Rear fog lamp dim	• Incorrect bulb rating • Circuit fault • Lighting control switch fault	Check the bulb condition and rating. Check the fog lamp circuits. Check the lighting control switch function. Refer to the electrical guides
Rear fog lamp warning indicator inoperative	• Fuse(s) blown • Lighting control switch inoperative • Circuit fault • Instrument cluster fault	Check the fuse(s). Check the lighting control switch function. Check the warning lamp circuits. Refer to the electrical guides. Check for DTCs indicating an instrument cluster fault

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: 17-Dec-2013

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

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 • Bulb and installation • Bulb holder and installation	• Fuses • Wiring harness • Loose or corroded connector(s) • Reverse lamp relay • Battery junction box • Central junction box • Transmission control module • 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 • Circuit fault • Missing reverse lamp switch signal	Check the bulb and fuse condition. Check the reverse lamp circuits. Refer to the electrical guides. Check for DTCs indicating a reverse lamp circuit fault
Reverse lamp(s) dim	• Incorrect bulb rating • Circuit fault	Check the bulb condition and rating. Check the reverse lamp circuits. Refer to the electrical guides

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: 17-Dec-2013

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

NOTE: 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 • Central junction box • Trailer fuse box • Trailer relay box • Instrument cluster • 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 • Circuit fault • Stop lamp switch fault	Check the bulb and fuse condition. Check the trailer stop lamp circuit. Check the stop lamp switch function. Refer to the electrical guides
Trailer stop lamp(s) dim	• Incorrect bulb rating • Circuit fault • Stop lamp switch fault	Check the bulb condition and rating. Check the trailer stop lamp circuit. Check the stop lamp switch function. Refer to the electrical guides
Trailer stop lamp(s) stuck on	• Circuit fault • Stop lamp switch fault	Check the trailer stop lamp circuits. Check the stop lamp switch function. Refer to the electrical guides
Trailer fog lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Circuit fault	Check the bulb and fuse condition. Check the trailer fog lamp circuit. Refer to the electrical guides
Trailer fog lamp(s) dim	• Incorrect bulb rating • Circuit fault	Check the bulb condition and rating. Check the trailer fog lamp circuit. Refer to the electrical guides
Trailer fog lamp(s) stuck on	• Circuit fault	Check the trailer fog lamp circuit. Refer to the electrical guides
Trailer tail and license plate lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Circuit fault	Check the bulb and fuse condition. Check the trailer tail and license plate lamp circuit. Check the trailer tail and license plate lamp relay function. Refer to the electrical guides

	• Trailer side lamp relay fault	
Trailer tail and license plate lamp(s) dim	• Incorrect bulb rating • Circuit fault • Trailer side lamp relay fault	Check the bulb condition and rating. Check the trailer tail and license plate lamp circuit. Check the trailer side lamp relay function. Refer to the electrical guides
Trailer tail and license plate lamp(s) stuck on	• Circuit fault • Trailer tail and license plate lamp relay fault	Check the trailer tail and license plate lamp circuit. Check the trailer tail and license plate lamp relay function. Refer to the electrical guides
Trailer turn signal indicator(s) inoperative	• Bulb failure • Fuse(s) blown • Circuit fault	Check the bulb and fuse condition. Check the trailer turn signal indicator circuit. Refer to the electrical guides
Trailer turn signal indicator(s) dim	• Incorrect bulb rating • Circuit fault	Check the bulb condition and rating. Check the trailer turn signal indicator circuits. Refer to the electrical guides
Trailer turn signal indicator(s) stuck on	• Circuit fault	Check the bulb and fuse condition. Check the trailer turn signal indicator circuit. Refer to the electrical guides
Trailer reverse lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Circuit fault • Trailer reverse lamp relay fault	Check the bulb and fuse condition. Check the trailer reverse lamp circuit. Check the trailer reverse lamp relay function. Refer to the electrical guides
Trailer reverse lamp(s) dim	• Circuit fault • Trailer reverse lamp relay fault	Check the bulb condition and rating. Check the trailer reverse lamp circuit. Check the trailer reverse lamp relay function. Refer to the electrical guides
Trailer reverse lamp(s) stuck on	• Circuit fault • Trailer reverse lamp relay fault	Check the trailer reverse lamp circuit. Check the trailer reverse lamp relay function. Refer to the electrical guides
Warning lamp(s) inoperative	• Fuse(s) blown • Circuit fault • Instrument cluster fault	Check the fuse(s). Check the warning lamp circuit. Refer to the electrical guides. Check for DTCs indicating an instrument cluster or CAN system fault
Trailer socket battery feed missing	• Fuse(s) blown • Circuit fault	Check the fuse condition. Check the trailer battery feed circuit. Refer to the electrical guides
Trailer socket ignition feed missing	• Fuse(s) blown • Circuit fault • Trailer socket relay fault	Check the fuse condition. Check the trailer ignition feed circuit. Check the trailer ignition feed relay operation. Refer to the electrical guides

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: 31-Jul-2012

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: 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
• Lighting control switch and installation • Rain/Light sensor condition and installation • Wiper control switch and installation	• Fuses • Relays • Wiring harness • Loose or corroded connector(s) • Battery junction box • Central junction box • Rain/Light sensor control module • LIN circuits • 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 automatic headlamp switch option is selected	• Fuse(s) blown • Lighting control switch fault • Wiper control switch fault • Circuit fault • Rain/Light sensor fault • LIN circuit fault	Check the fuse(s). Check the lighting and wiper control switch functions. Check the automatic headlamp circuit. Refer to the electrical guides. Check for DTCs indicating a rain/light sensor or LIN system fault
Automatic headlamp switch illumination inoperative	• Fuse(s) blown • Lighting control switch fault • Circuit fault • Automatic headlamp relay fault	Check the fuse(s). Check the lighting control switch function. Check the automatic headlamp relay circuit. Refer to the electrical guides. Check for DTCs indicating an automatic headlamp fault

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-Apr-2013

Exterior Lighting - Headlamp Adjustment

General Procedures

Check

NOTES:

LH illustration shown, RH is similar.

The headlamp setting is 1.2 % below horizontal and parallel.

1. Refer to: Air Suspension Manual Tight Tolerance Setting Mode (204-05 Vehicle Dynamic Suspension, General Procedures).
2. Align the headlamp beam setting equipment to one headlamp.
3. Switch the headlamps on and to dipped beam.

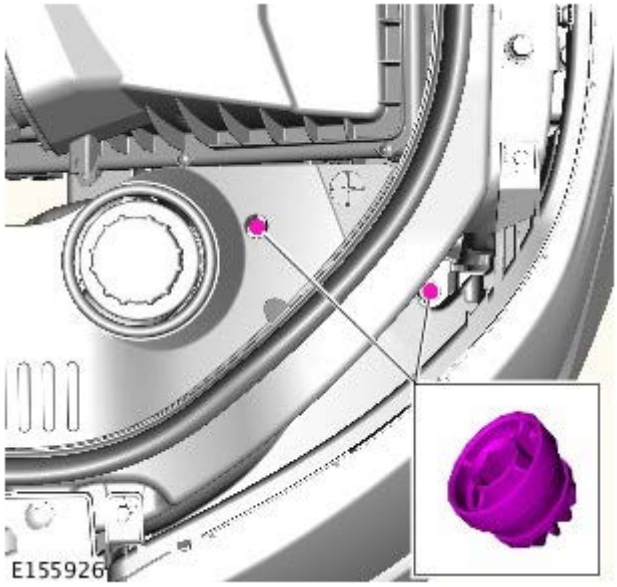
Adjustment

NOTES:

LH illustration shown, RH is similar.

The headlamp setting is 1.2 % below horizontal and parallel.

1. Adjust the headlamps.



2. To adjust the second headlamp, repeat the above procedure.

Published: 04-Aug-2012

Exterior Lighting - Approach Lamp

Removal and Installation

Removal

CAUTION: Take extra care not to damage the component.

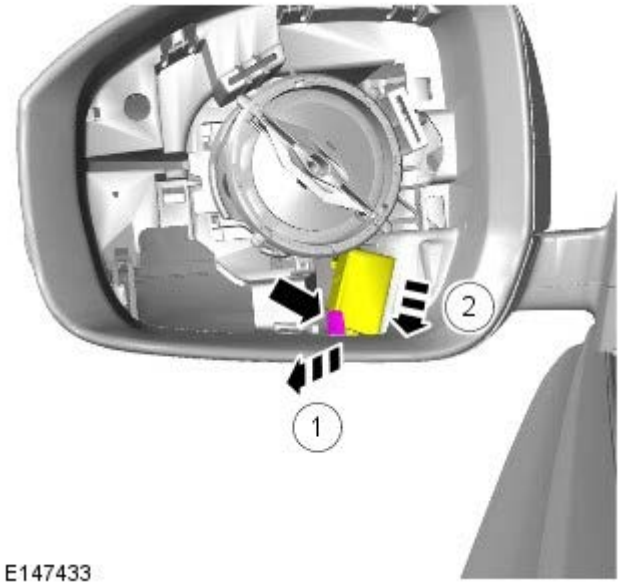
NOTES:

Removal steps in this procedure may contain installation details.

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

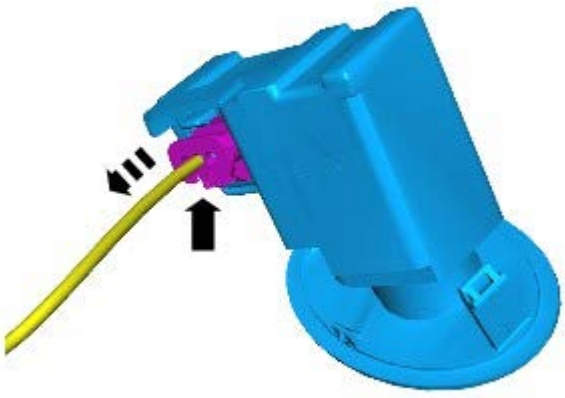
1. Refer to: Exterior Mirror Glass (501-09, Removal and Installation).

2.



E147433

3.



E147434

Installation

1. To install reverse the removal procedure.

Published: 06-Aug-2012

Exterior Lighting - Adaptive Front Lighting Module

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

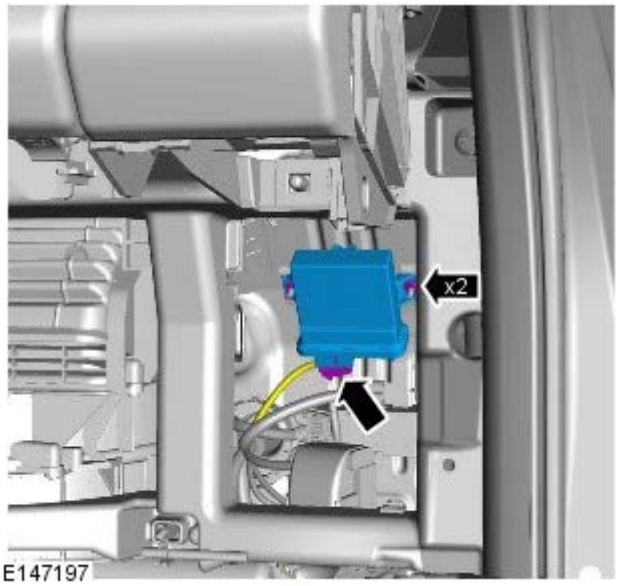
LHD illustration shown, RHD is similar.

1. Remove the battery ground cable.

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

2. Refer to: Central Junction Box (CJB) (418-00, Removal and Installation).

3. *Torque:* 5 Nm



Installation

1. To install reverse the removal procedure.

Published: 02-May-2013

Exterior Lighting - Front Fog Lamp

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

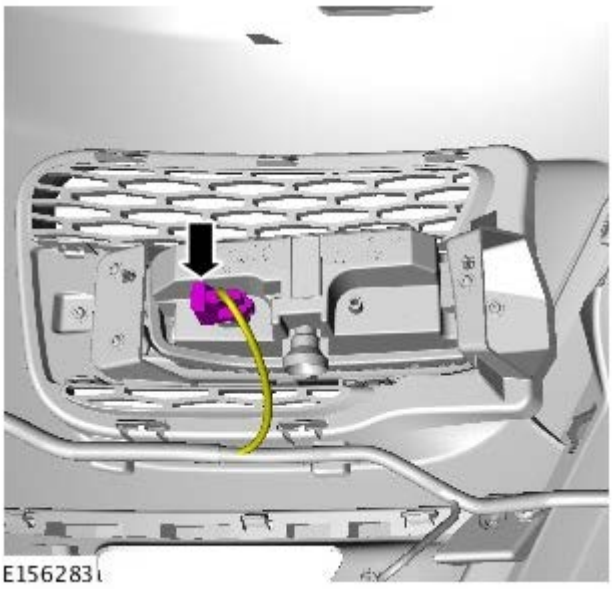
Some variation in the illustrations may occur, but the essential information is always correct.

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

   Raise and support the vehicle.

2. Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).

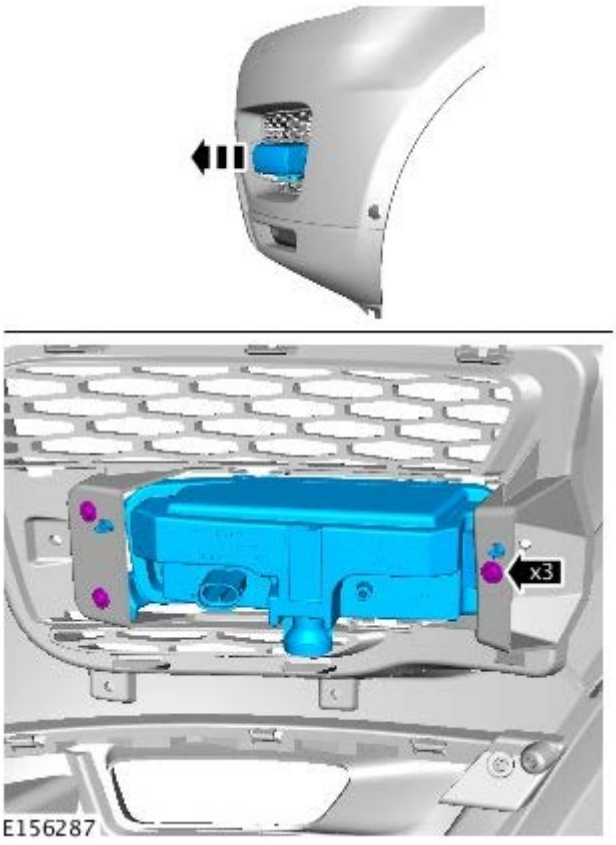
3.



4. *Torque:* 2.5 Nm



5. *Torque:* 2.5 Nm



Installation

1. To install reverse the removal procedure.

Published: 02-May-2013

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.

LH illustration shown, RH is similar.

The ignition must be switched off.

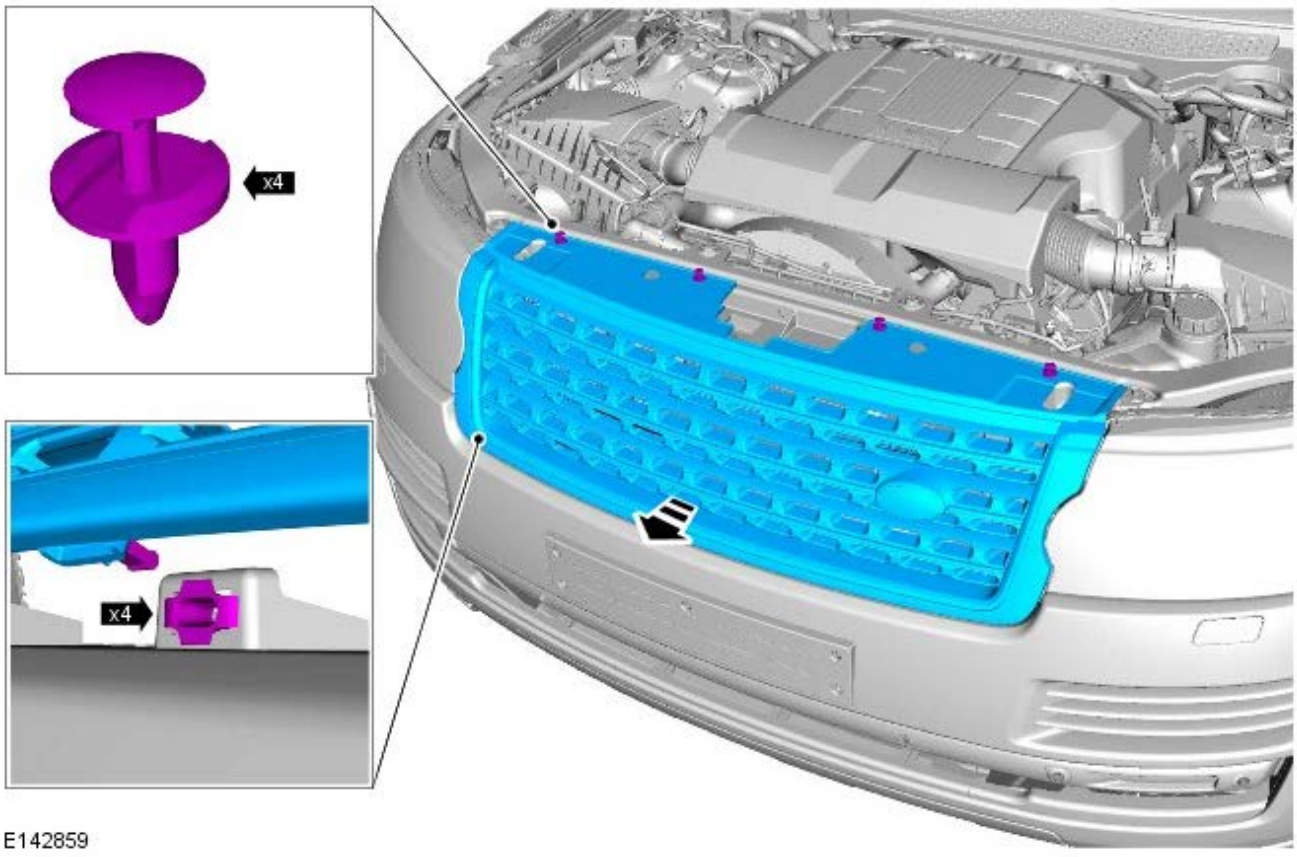
1. Disconnect the battery ground cable.

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

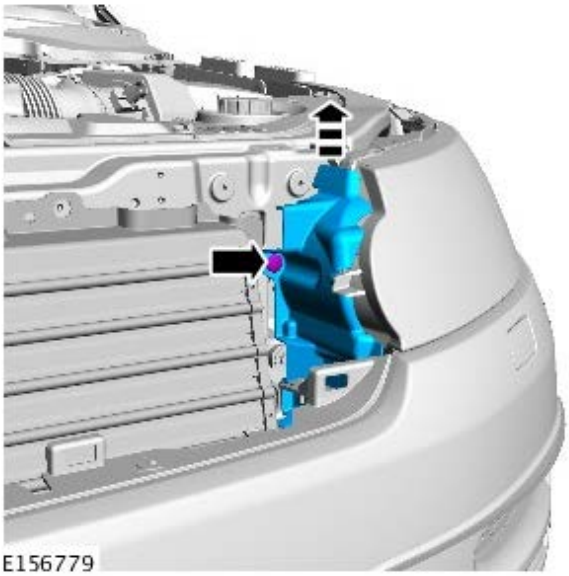
2. WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

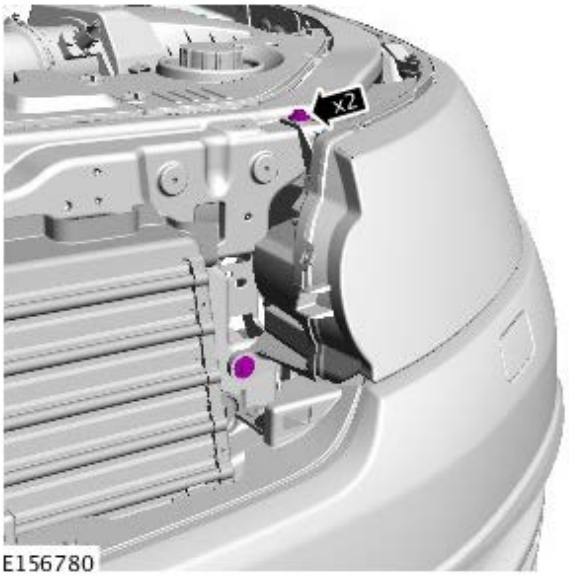
3.



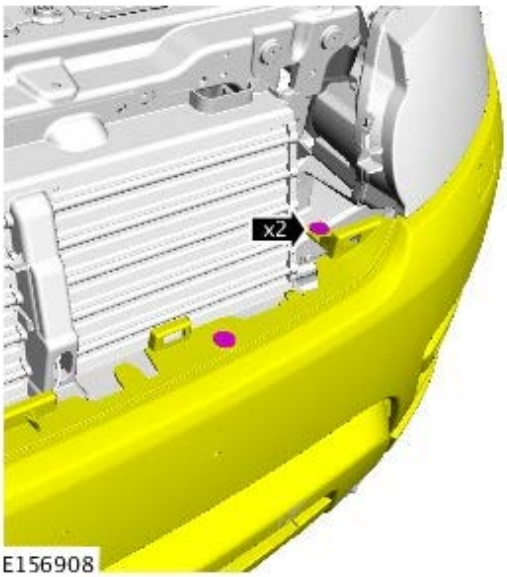
4. *Torque:* 5 Nm



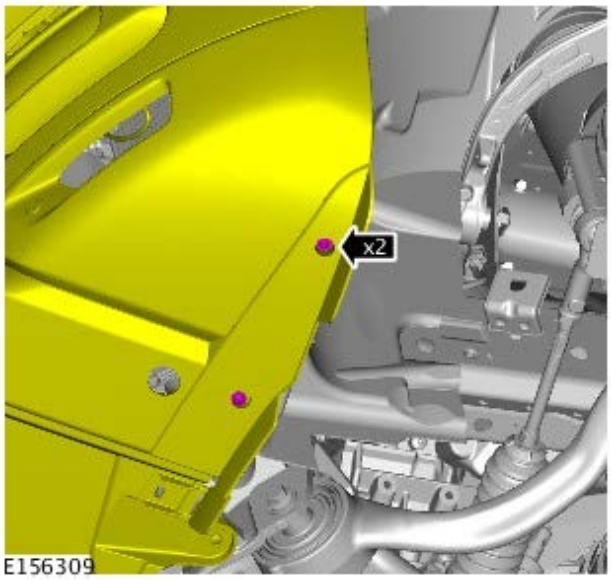
5. *Torque:* 5 Nm



6.

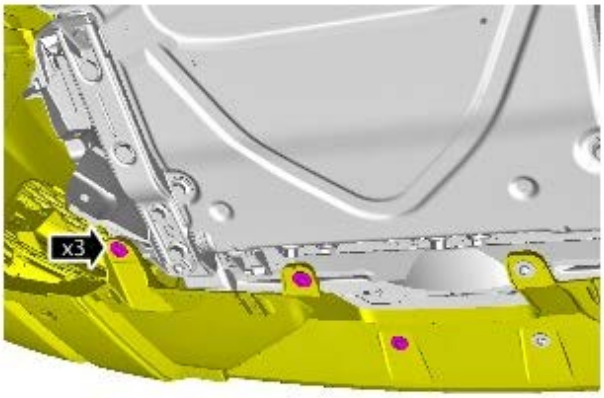


7.



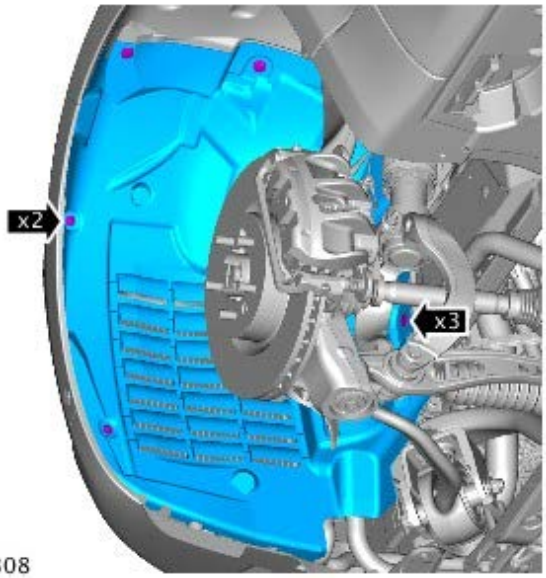
E156309

8.



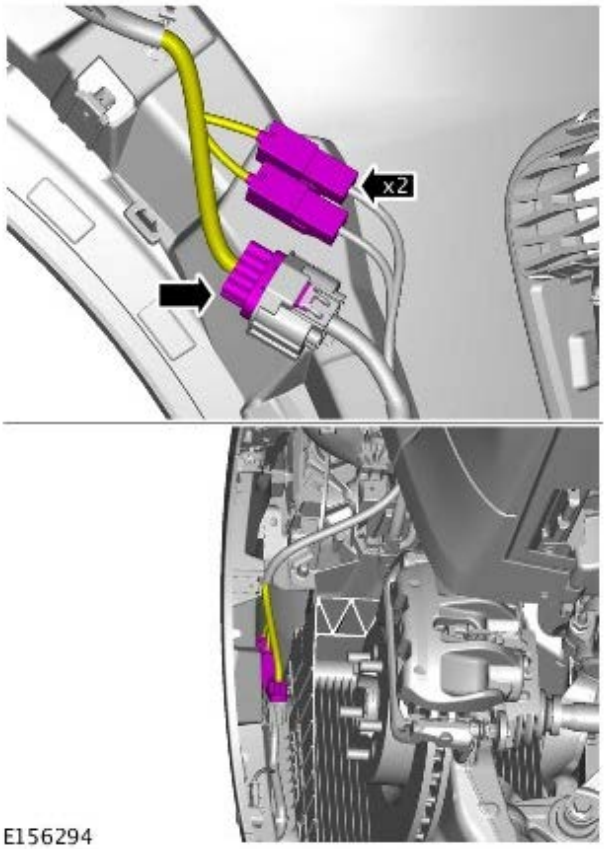
E156907

9.



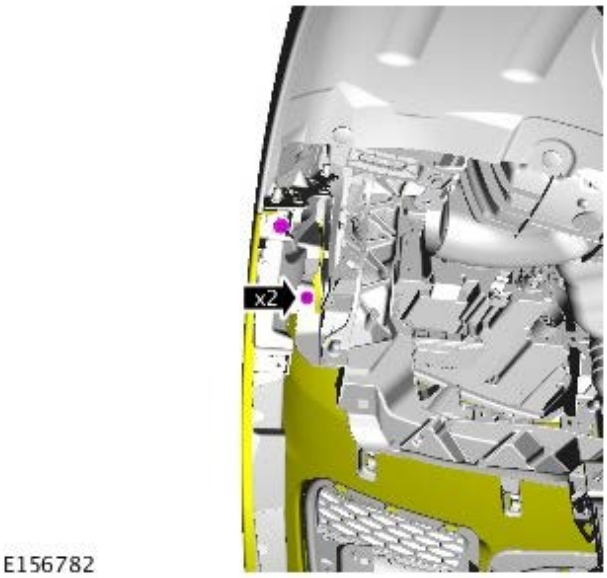
E156308

10. NOTE: LH shown.



E156294

11.

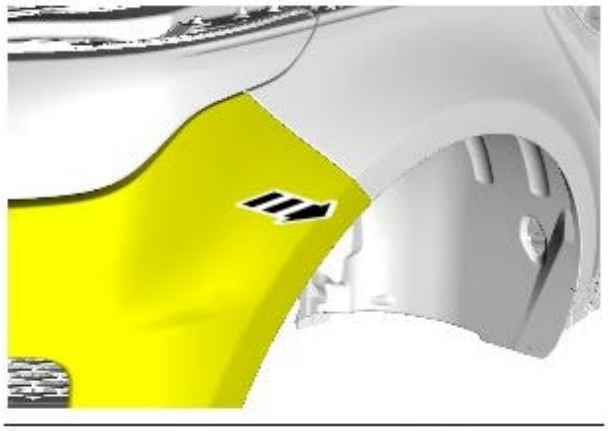


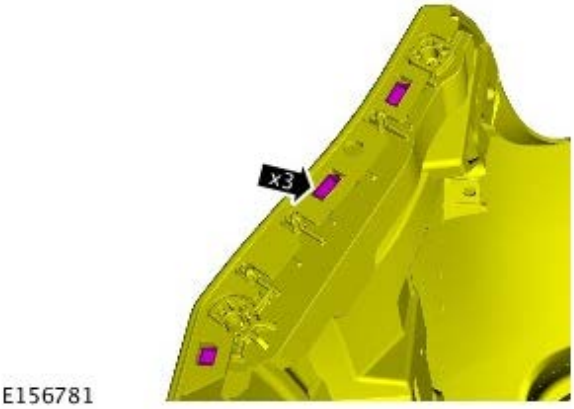
E156782

12. CAUTIONS:

Take extra care not to damage the component.

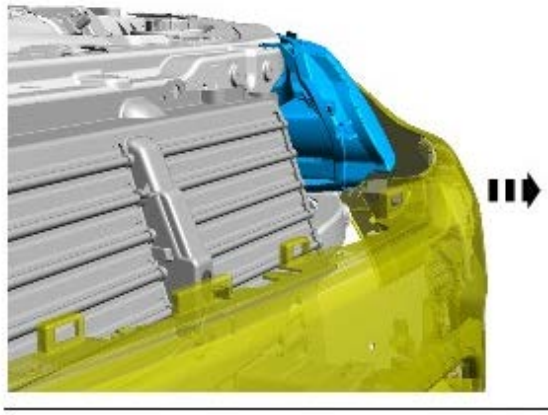
Take extra care not to damage the surrounding components.





E156781

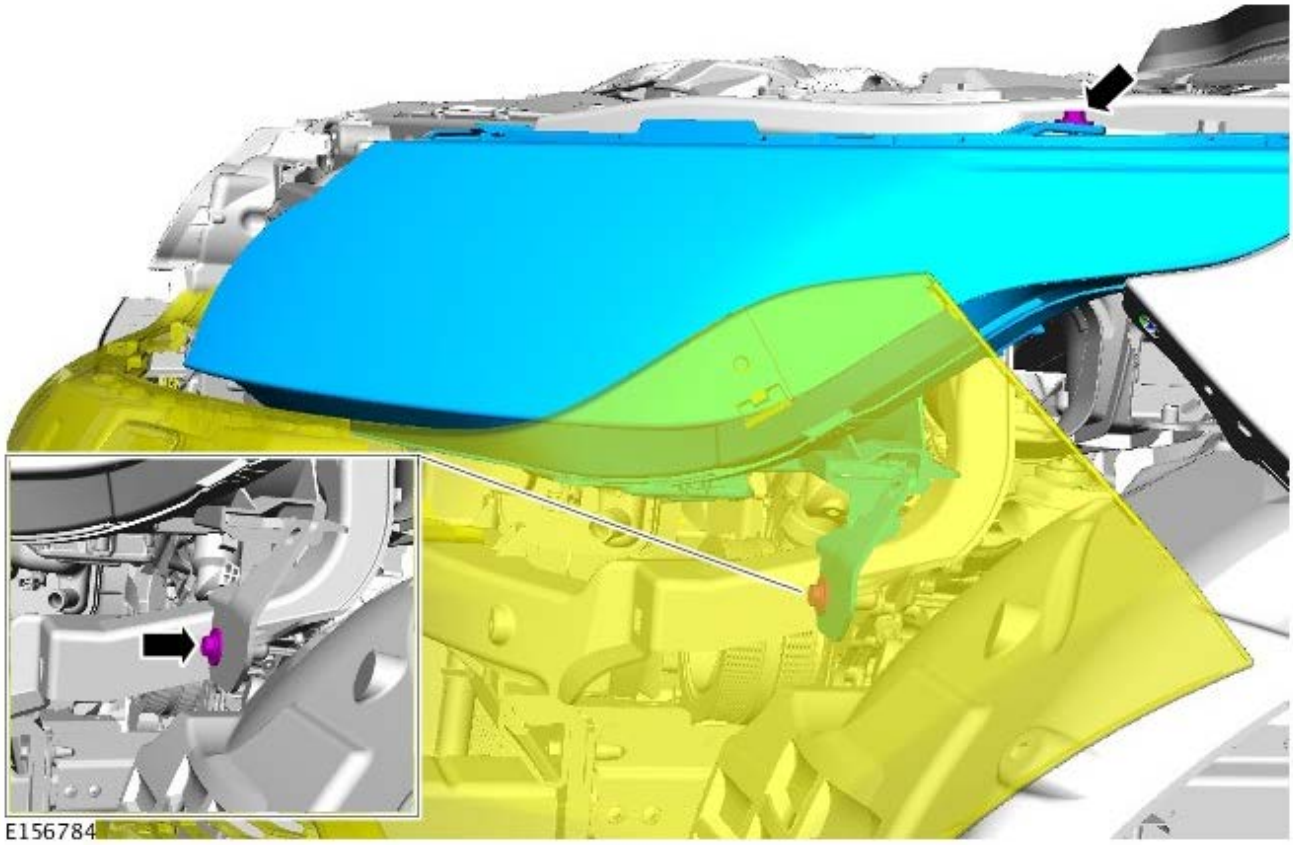
13. CAUTION: Take extra care not to damage the surrounding components.



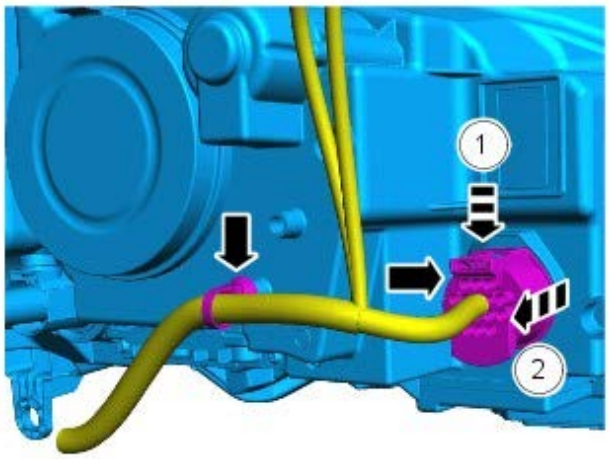


E156783

14. *Torque:* 5 Nm



15.



E146807

Installation

1. To install reverse the removal procedure.
2. Refer to: Headlamp Adjustment (417-01 Exterior Lighting, General Procedures).

Published: 25-Apr-2013

Exterior Lighting - Headlamp Bulb

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.

CAUTION: LH illustration shown, RH is similar.

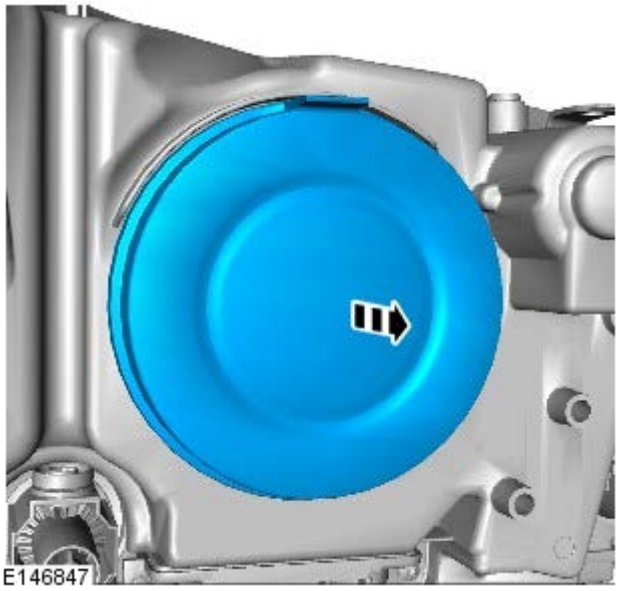
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the battery ground cable.

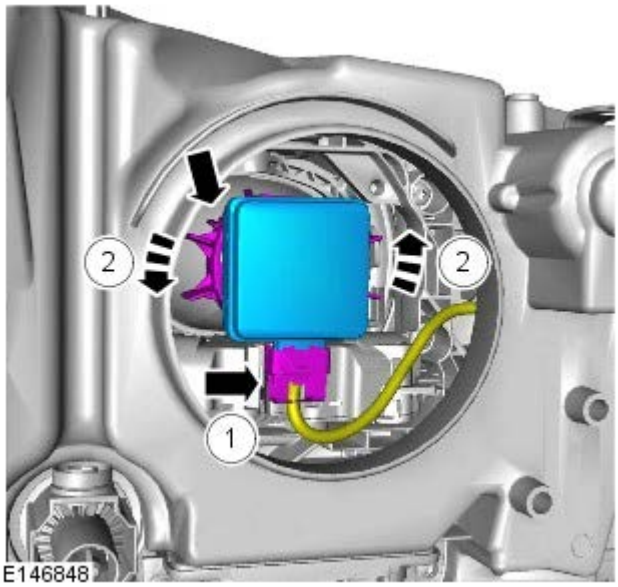
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Refer to: Air Cleaner LH (303-12A Intake Air Distribution and Filtering - TDV6 3.0L Diesel, Removal and Installation).
   Refer to: Air Cleaner LH (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).
   Refer to: Air Cleaner LH (303-12C Intake Air Distribution and Filtering - V8 S/C 5.0L Petrol, Removal and Installation).
   Refer to: Air Cleaner LH (303-12D Intake Air Distribution and Filtering - TDV8 4.4L Diesel, Removal and Installation).

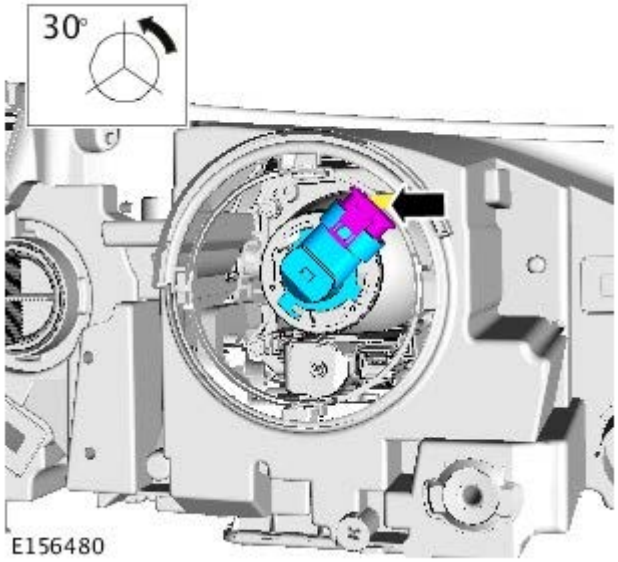
3.



4. NOTE: If equipped with Xenon lighting.



5. NOTE: If equipped with standard lighting.



Installation

1. To install, Reverse the removal procedure.

Published: 05-Apr-2013

Exterior Lighting - Headlamp Switch

Removal and Installation

Removal

1. Remove the left steering column multifunction switch. For additional information, refer to: Steering Column Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).

Installation

1. To install reverse the removal procedure.

Published: 29-Apr-2013

Exterior Lighting - High Mounted Stoplamp

Removal and Installation

Removal

CAUTION: Protect the surrounding components.

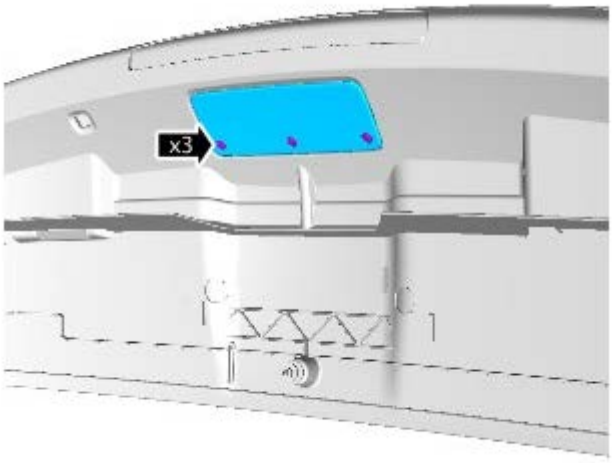
NOTES:

Removal steps in this procedure may contain installation details.

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

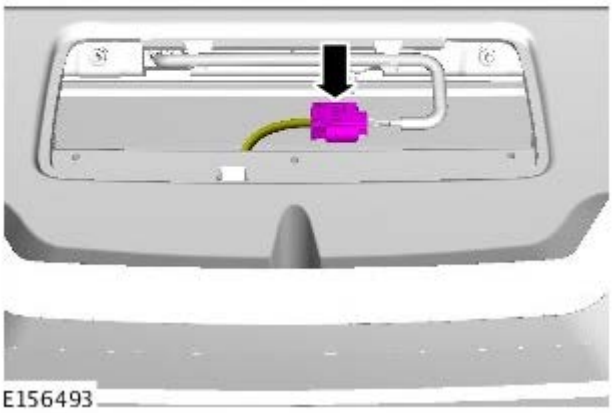
1. For additional information, refer to: Rear Spoiler (501-08 Exterior Trim and Ornamentation, Removal and Installation).

2. CAUTION: Take extra care not to damage the component.



E156492

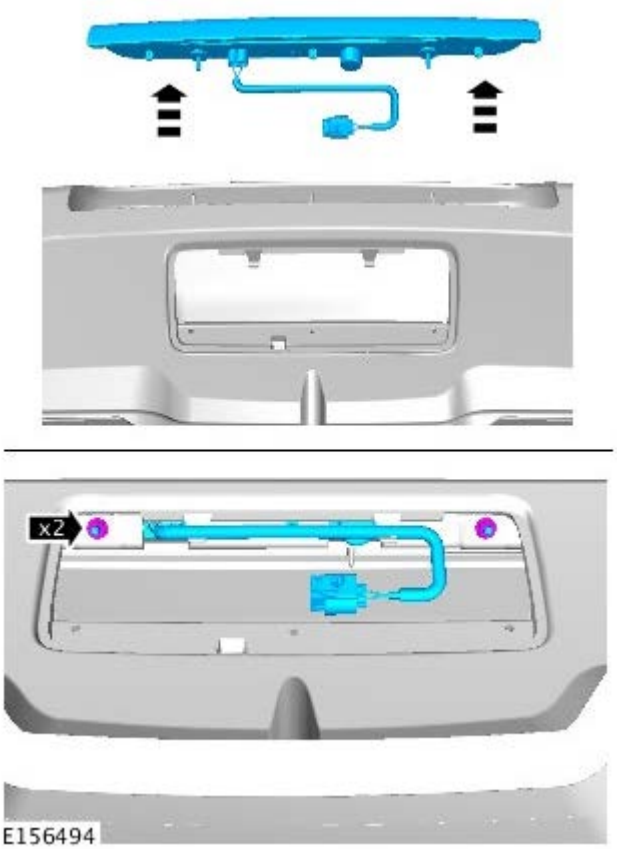
3.



E156493

4. CAUTION: Take extra care when handling the component.

   TORQUE: 1.75 Nm



Installation

1. To install reverse the removal procedure.

Published: 02-May-2013

Exterior Lighting - Rear Fog Lamp

Removal and Installation

Removal

CAUTION: RH illustration shown, LH is similar.

NOTES:

Removal steps in this procedure may contain installation details.

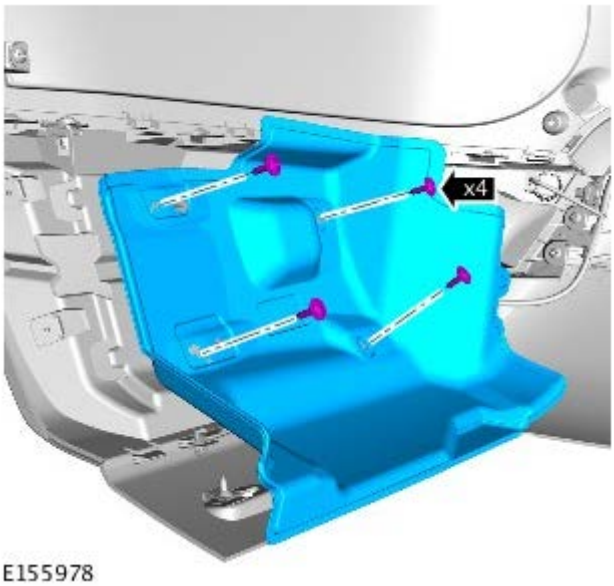
Some variation in the illustrations may occur, but the essential information is always correct.

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

   Raise and support the vehicle.

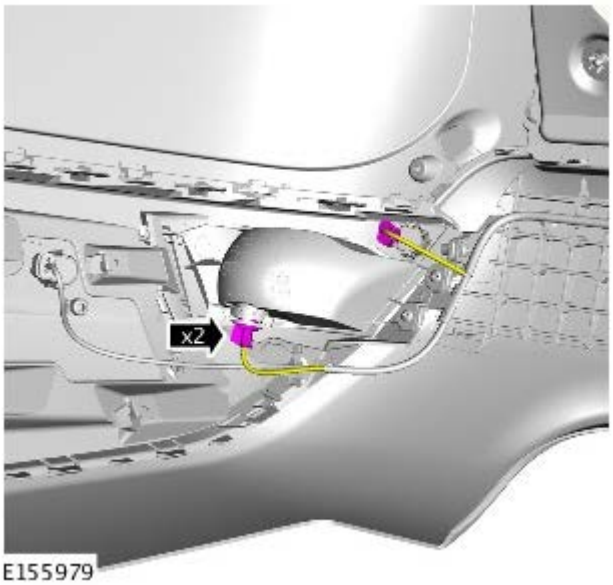
2. Refer to: Rear Bumper Cover (501-19 Bumpers, Removal and Installation).

3. *Torque:* 2.3 Nm



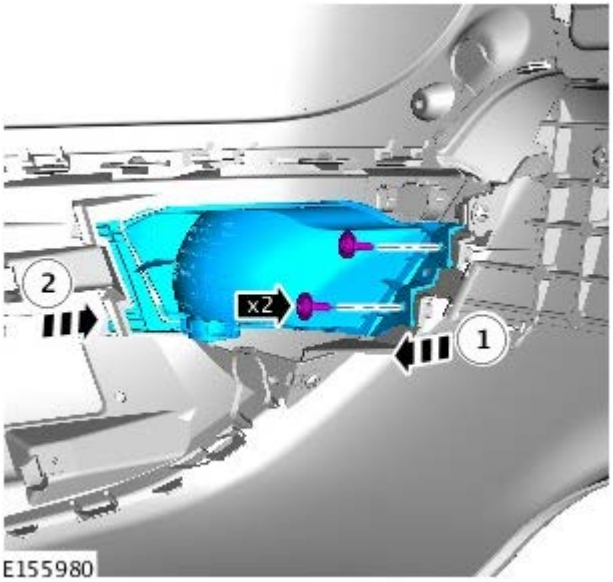
E155978

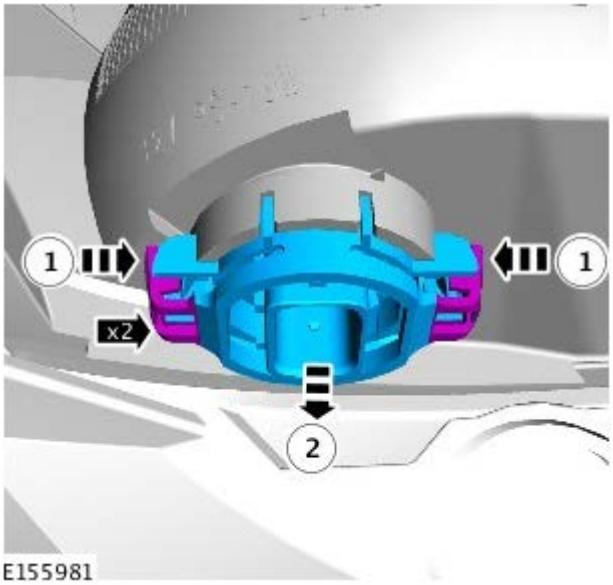
4.



E155979

5. *Torque:* 2.3 Nm





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

Installation

1. To install reverse the removal procedure.

Published: 02-May-2013

Exterior Lighting - Rear Fog Lamp Bulb

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.

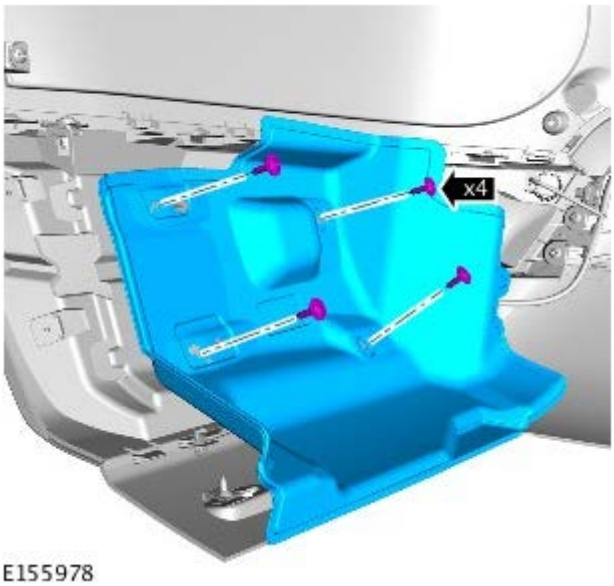
RH illustration shown, LH is similar.

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

   Raise and support the vehicle.

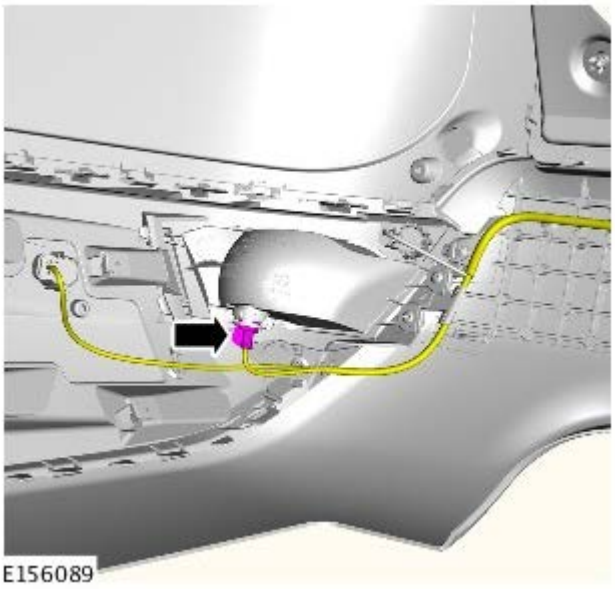
2. Refer to: Rear Bumper Cover (501-19 Bumpers, Removal and Installation).

3. *Torque:* 9 Nm



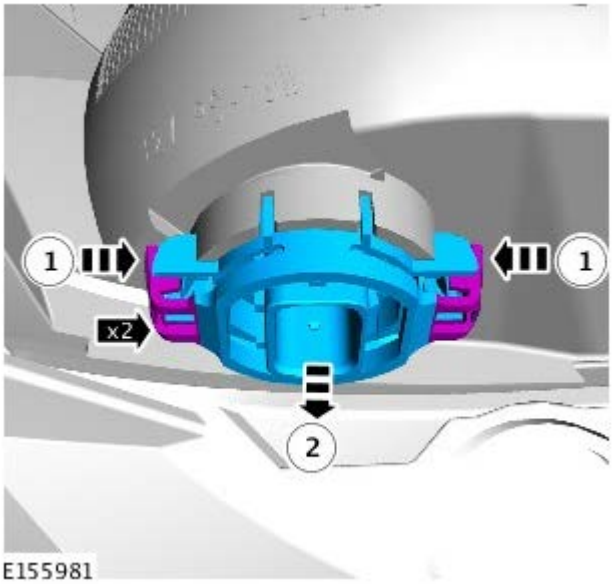
E155978

4.



E156089

5.



Installation

1. To install, reverse the removal procedure.

Published: 02-May-2013

Exterior Lighting - Rear Lamp Assembly

Removal and Installation

Removal

CAUTION: Protect the surrounding paintwork to avoid damage.

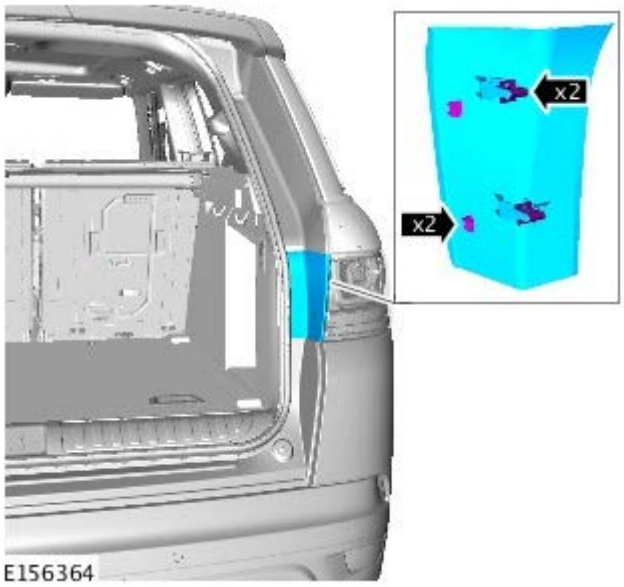
NOTES:

Removal steps in this procedure may contain installation details.

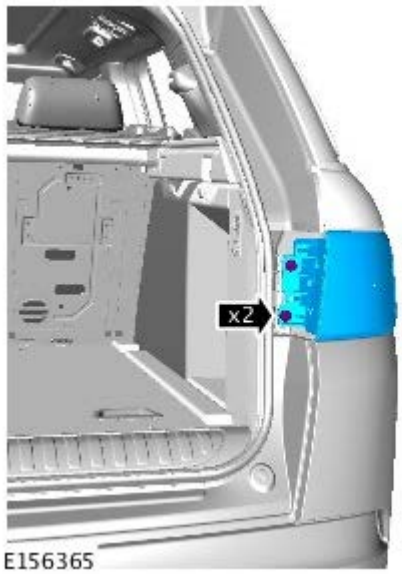
RH illustration shown, LH is similar.

The ignition must be switched off.

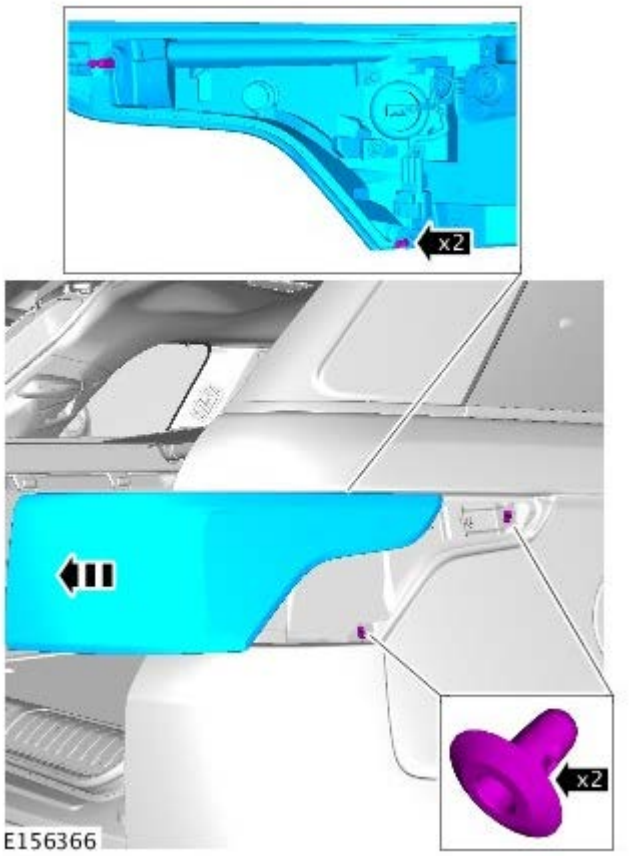
1.



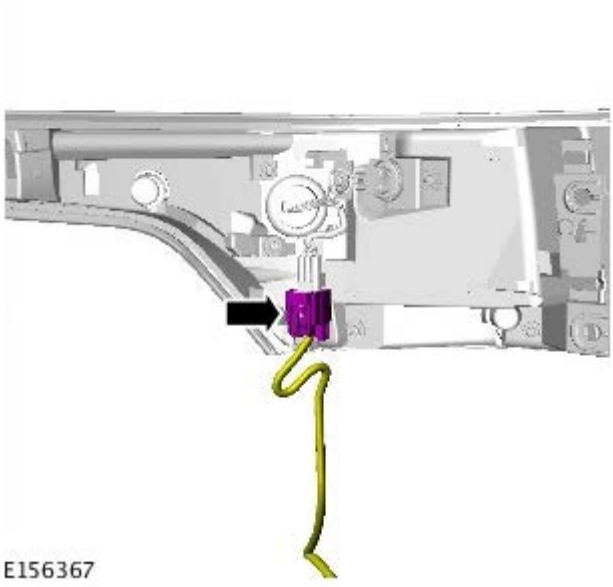
2. *Torque:* 2.5 Nm



3.



4.



Installation

1. To install reverse the removal procedure.

Published: 04-Aug-2012

Exterior Lighting - Side Turn Signal Lamp

Removal and Installation

Removal

NOTES:

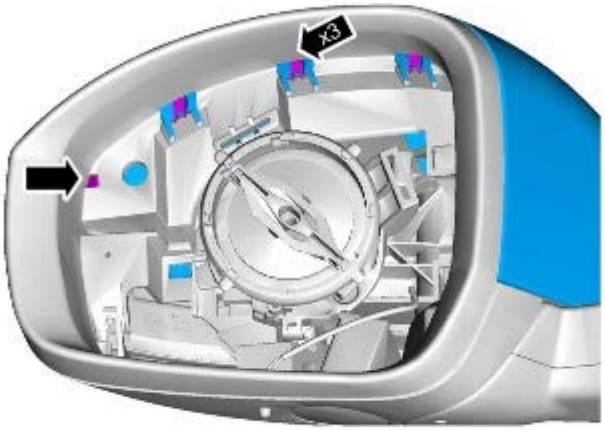
Removal steps in this procedure may contain installation details.

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

LH illustration shown, RH is similar.

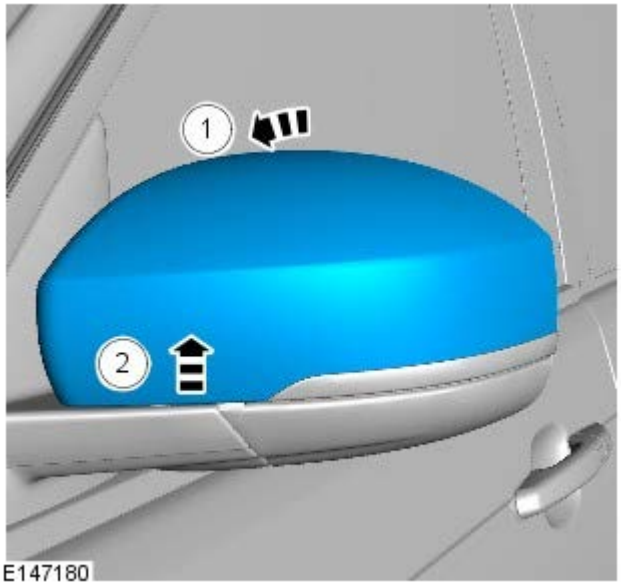
1. For additional information, refer to: Exterior Mirror Glass (501-09, Removal and Installation).

2.



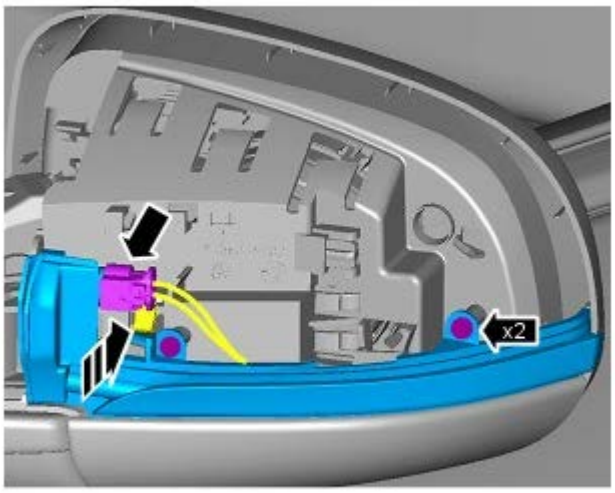
E147179

3.



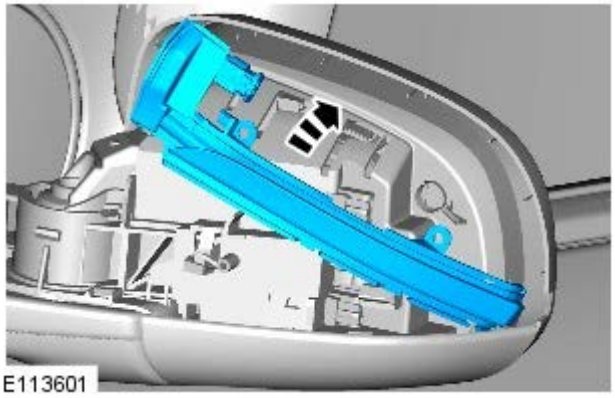
E147180

4.



E113600

5.



E113601

Installation

1. To install reverse the removal procedure.

Published: 11-Sep-2012

Exterior Lighting - Stoplamp Switch

Removal and Installation

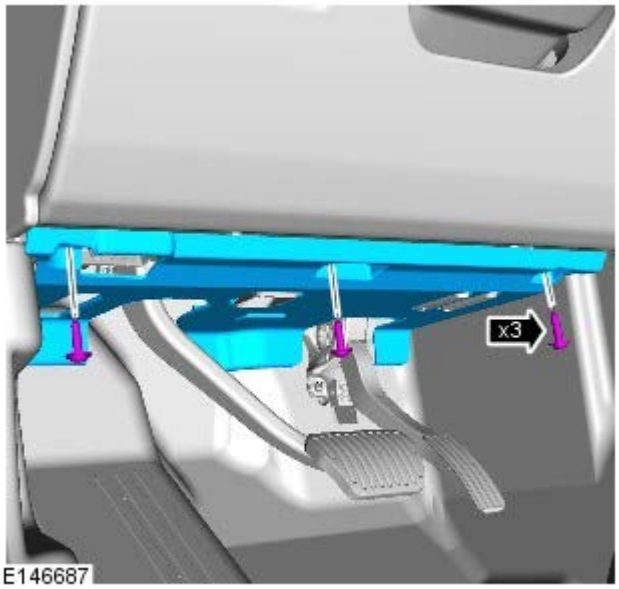
Removal

NOTES:

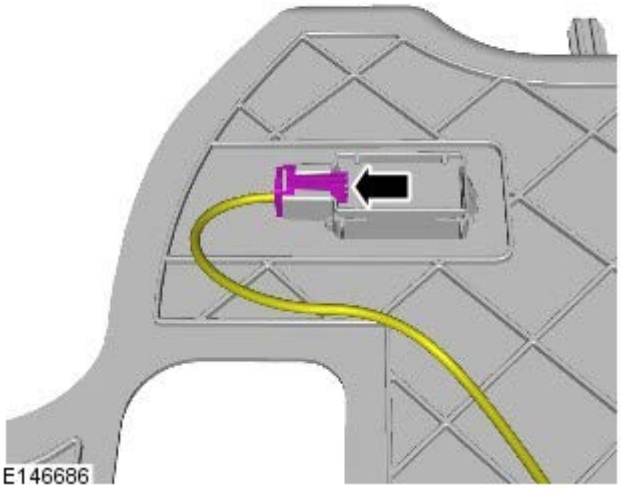
Removal steps in this procedure may contain installation details.

LHD illustration shown, RHD is similar.

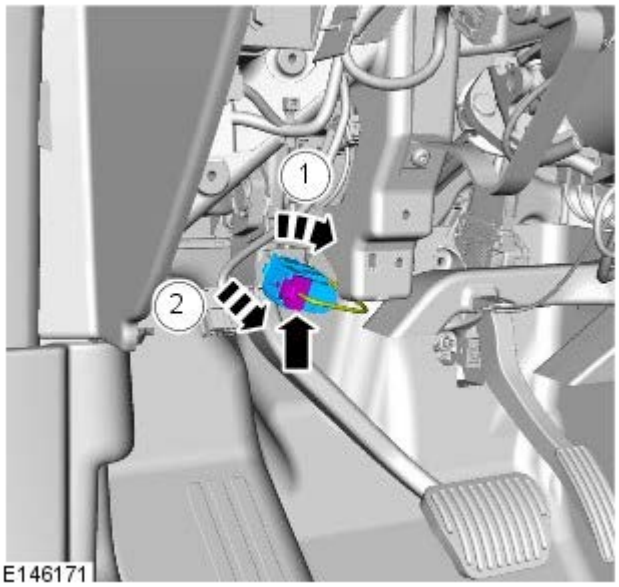
1.



2.



3.



Installation

1. To install, reverse the removal procedure.

Published: 04-May-2013

Exterior Lighting - Front Turn Signal Lamp Bulb

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

LH illustration shown, RH is similar.

The ignition must be switched off.

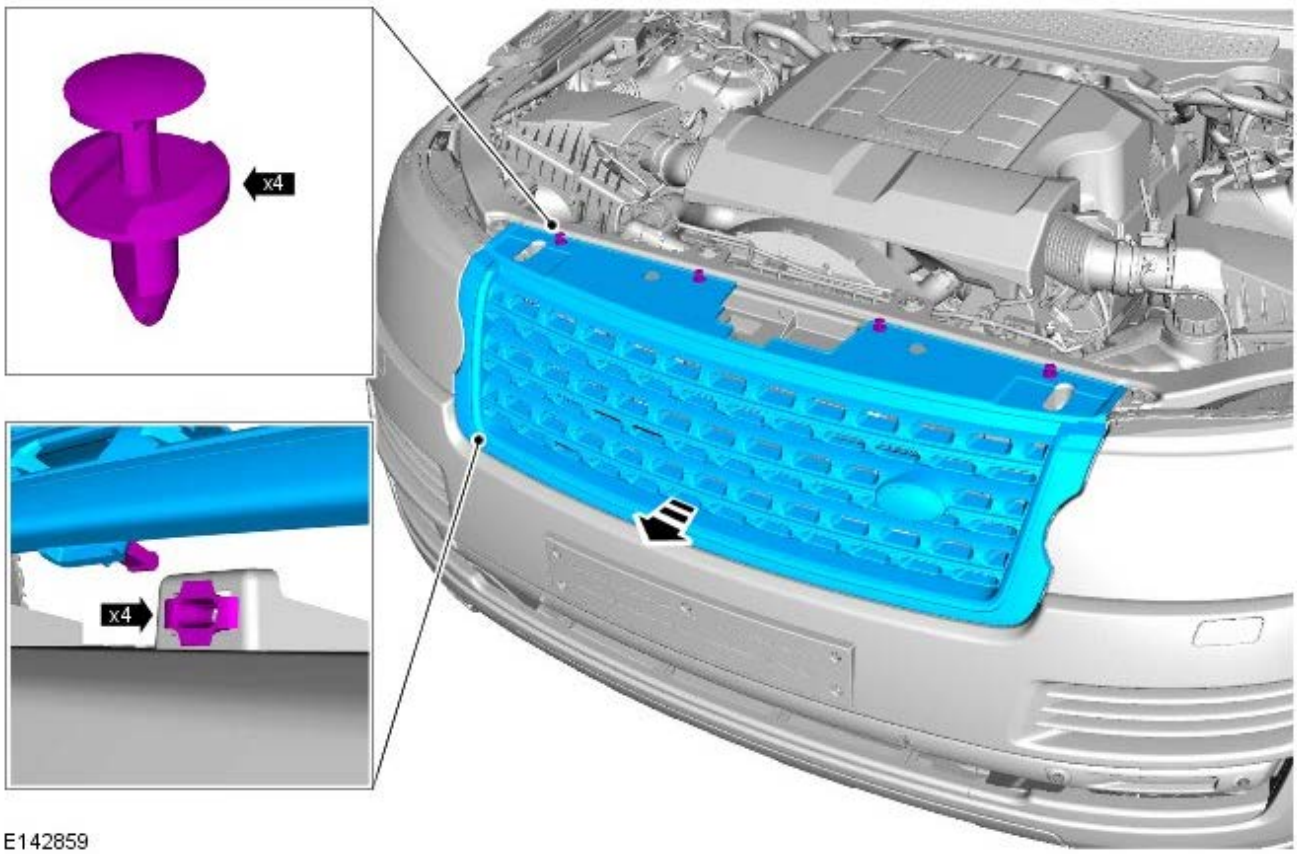
1. Disconnect the battery ground cable.

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

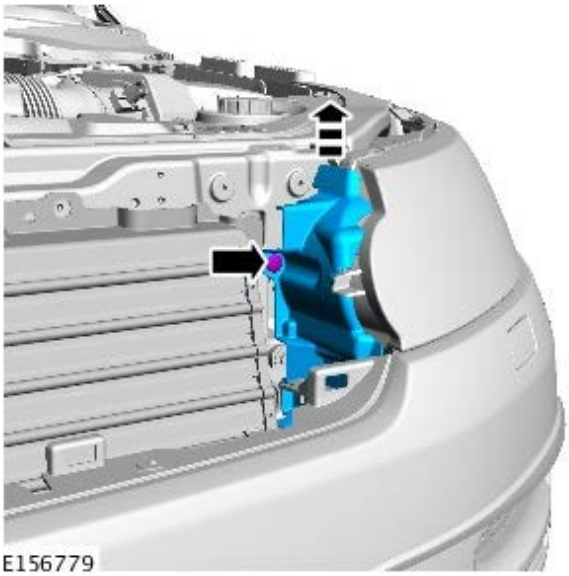
2. WARNING: Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

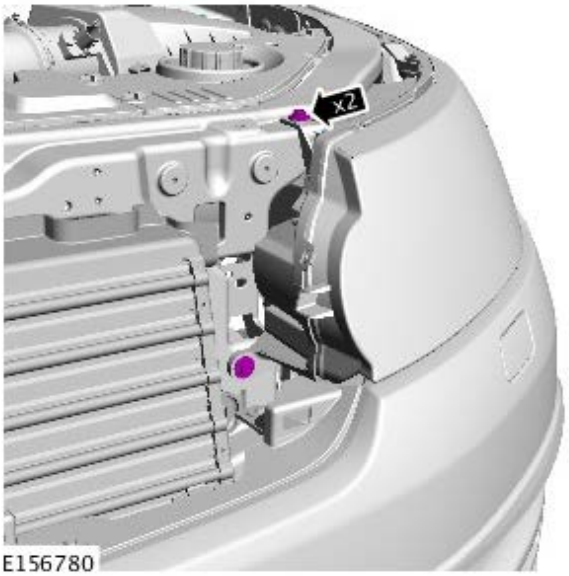
3.



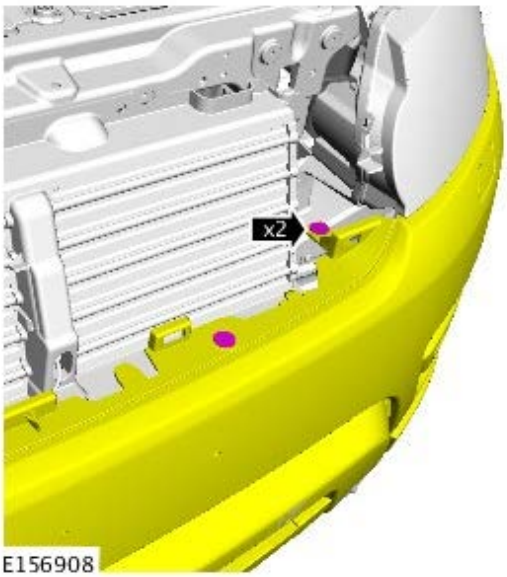
4. *Torque:* 5 Nm



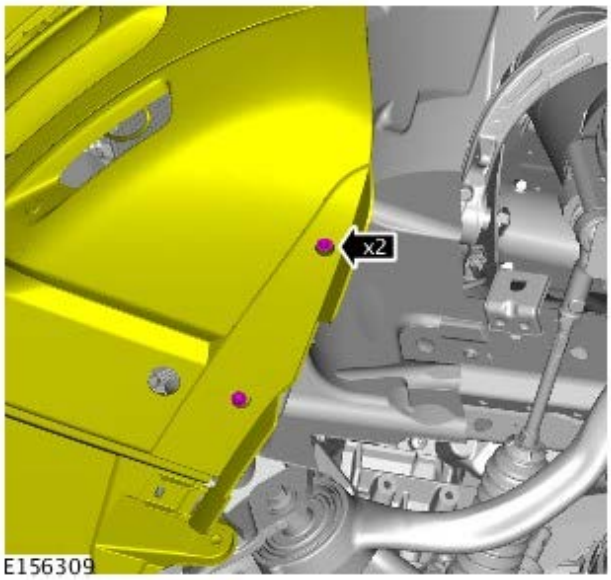
5. *Torque:* 5 Nm



6.

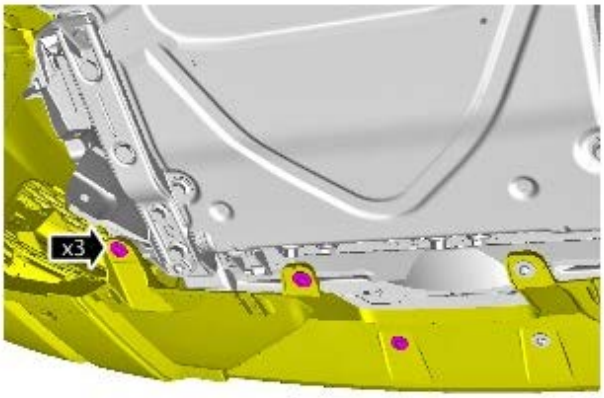


7.



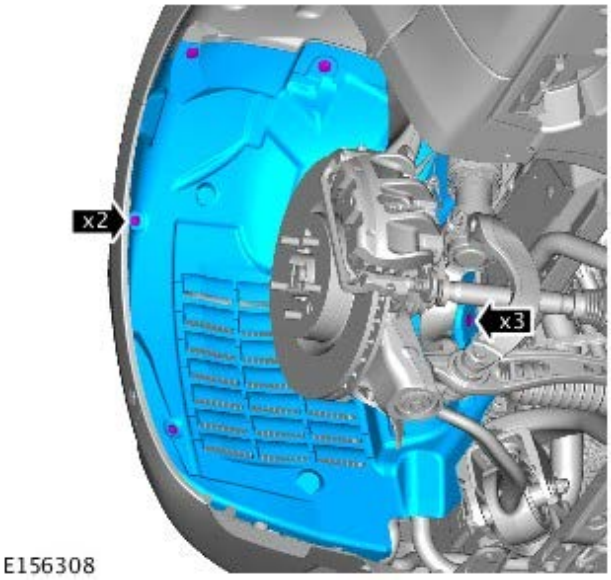
E156309

8.



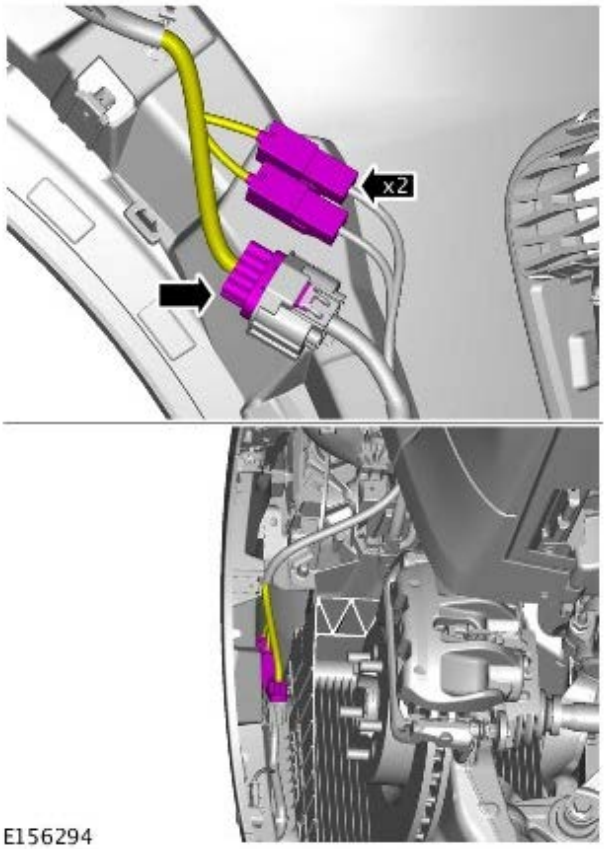
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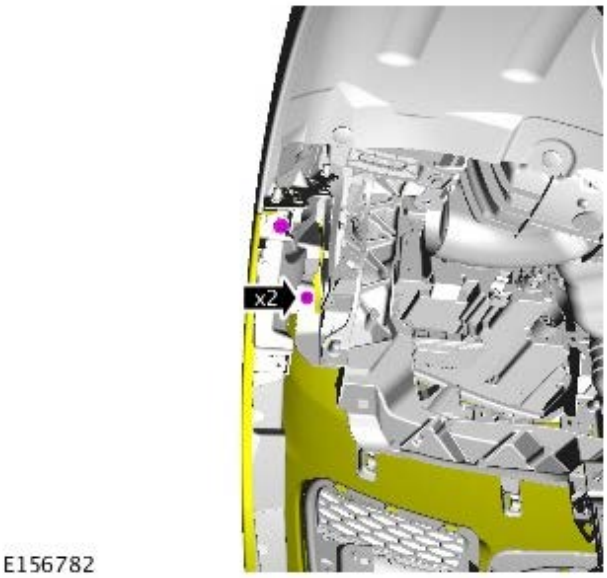
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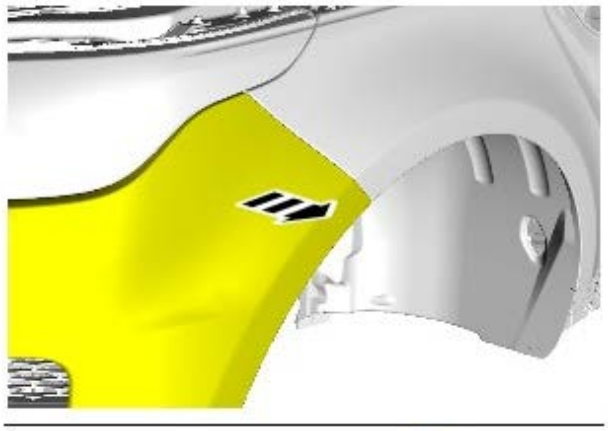


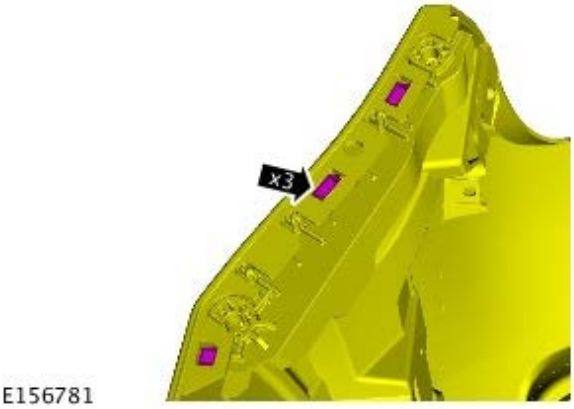
E156782

12. CAUTIONS:

Take extra care not to damage the component.

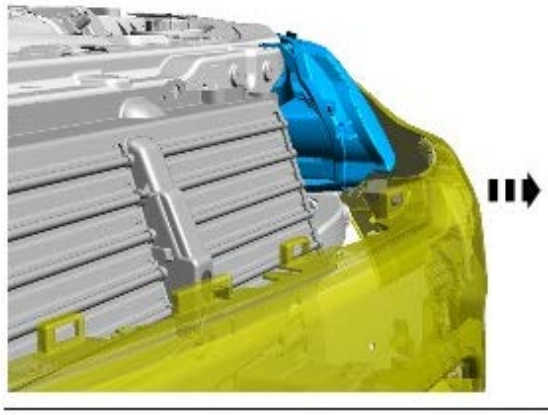
Take extra care not to damage the surrounding components.





E156781

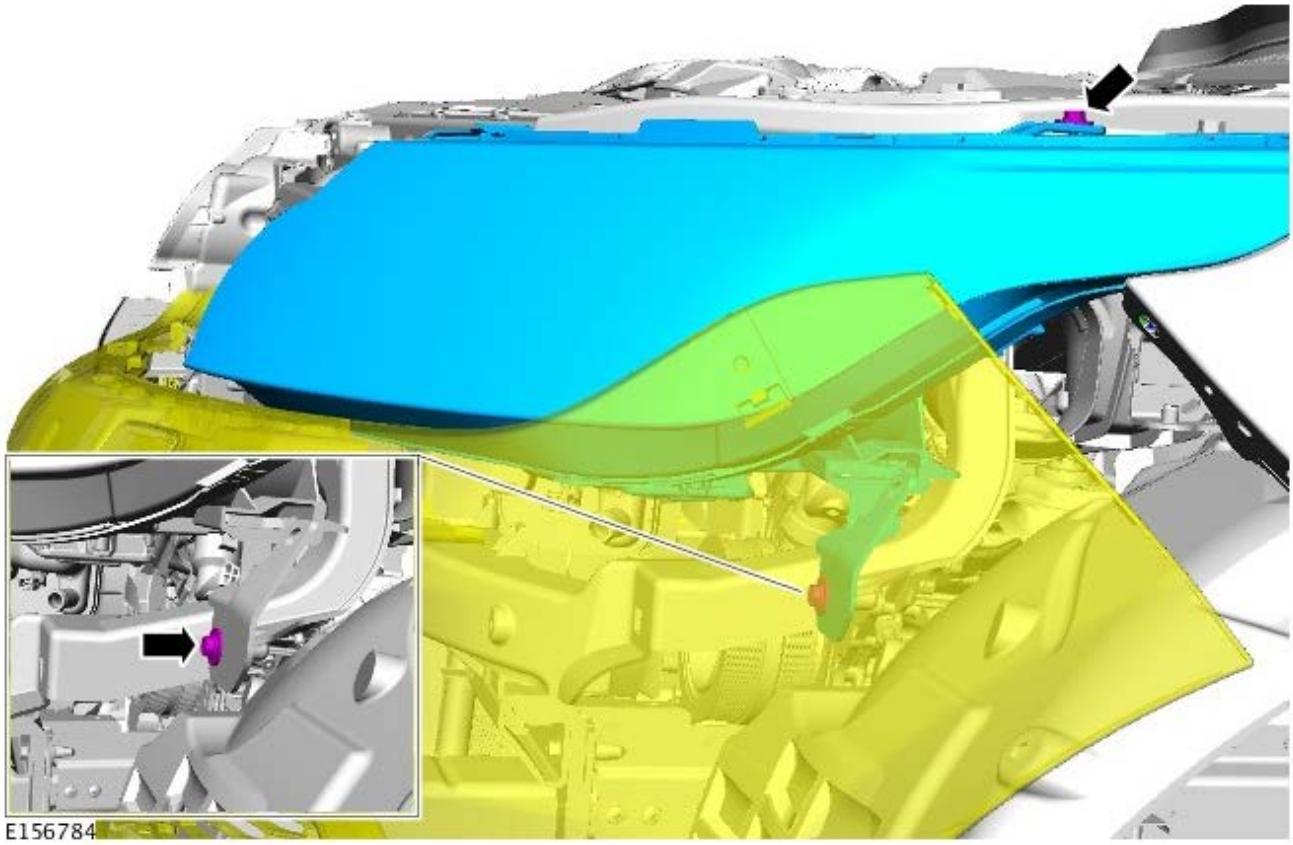
13. CAUTION: Take extra care not to damage the surrounding components.





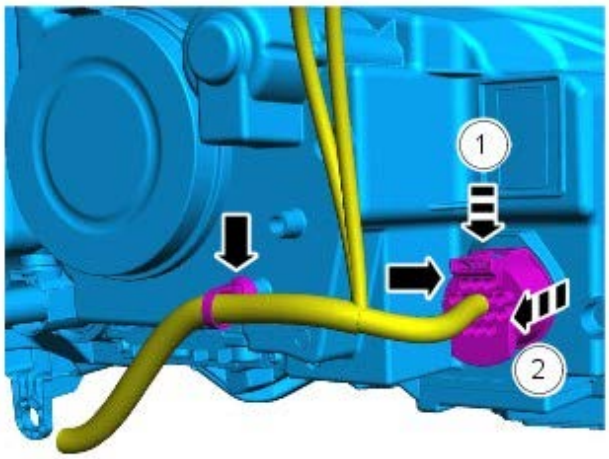
E156783

14. *Torque:* 5 Nm



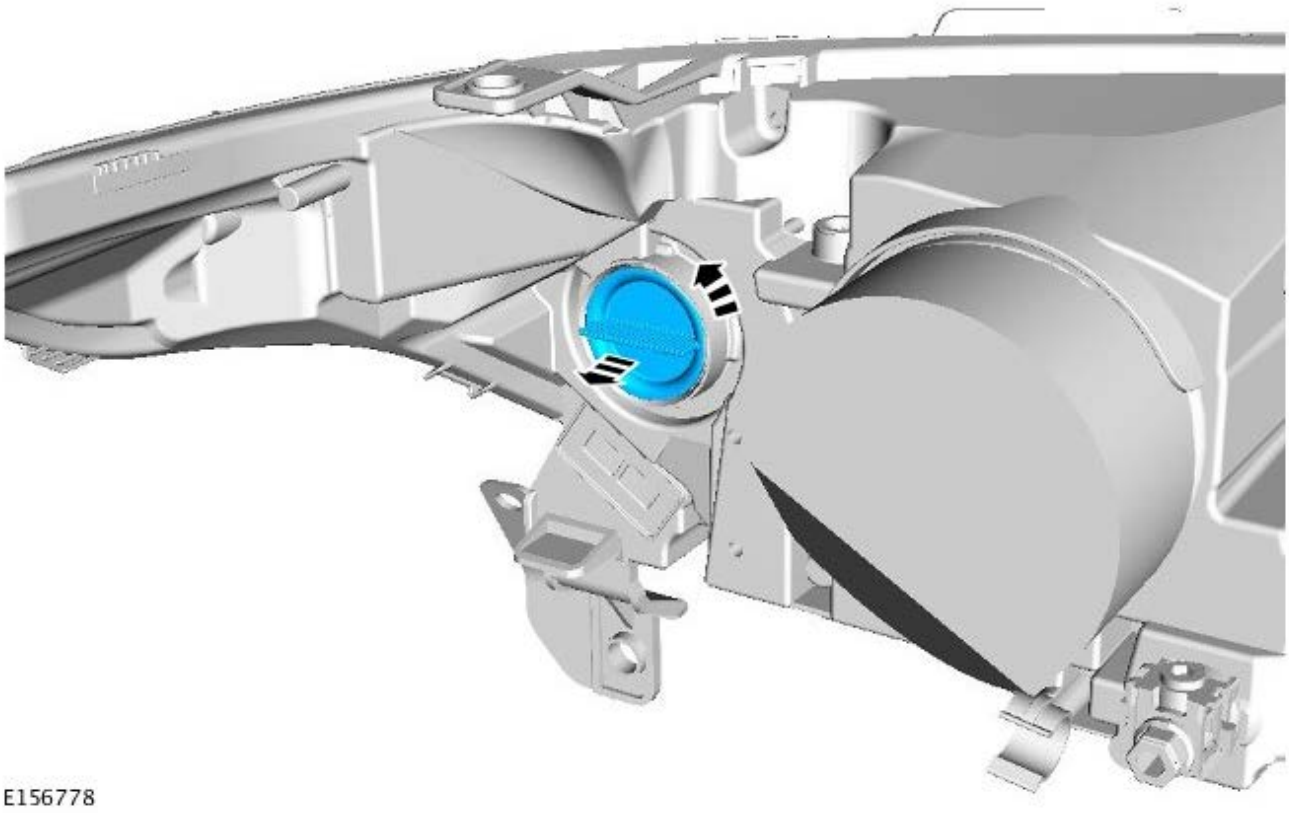
E156784

15.



E146807

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



E156778

Installation

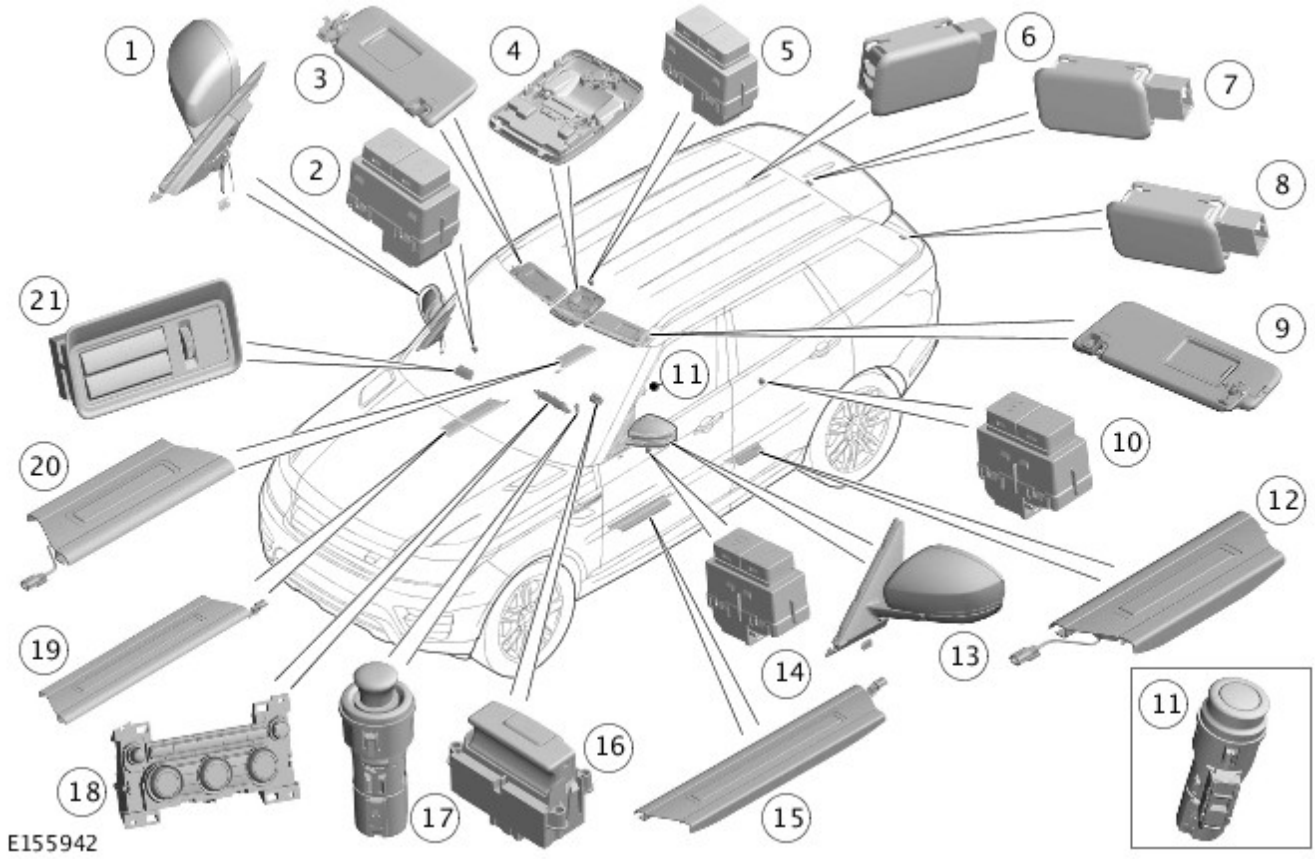
1. To install reverse the removal procedure.
2. Refer to: Headlamp Adjustment (417-01 Exterior Lighting, General Procedures).

Published: 16-Oct-2013

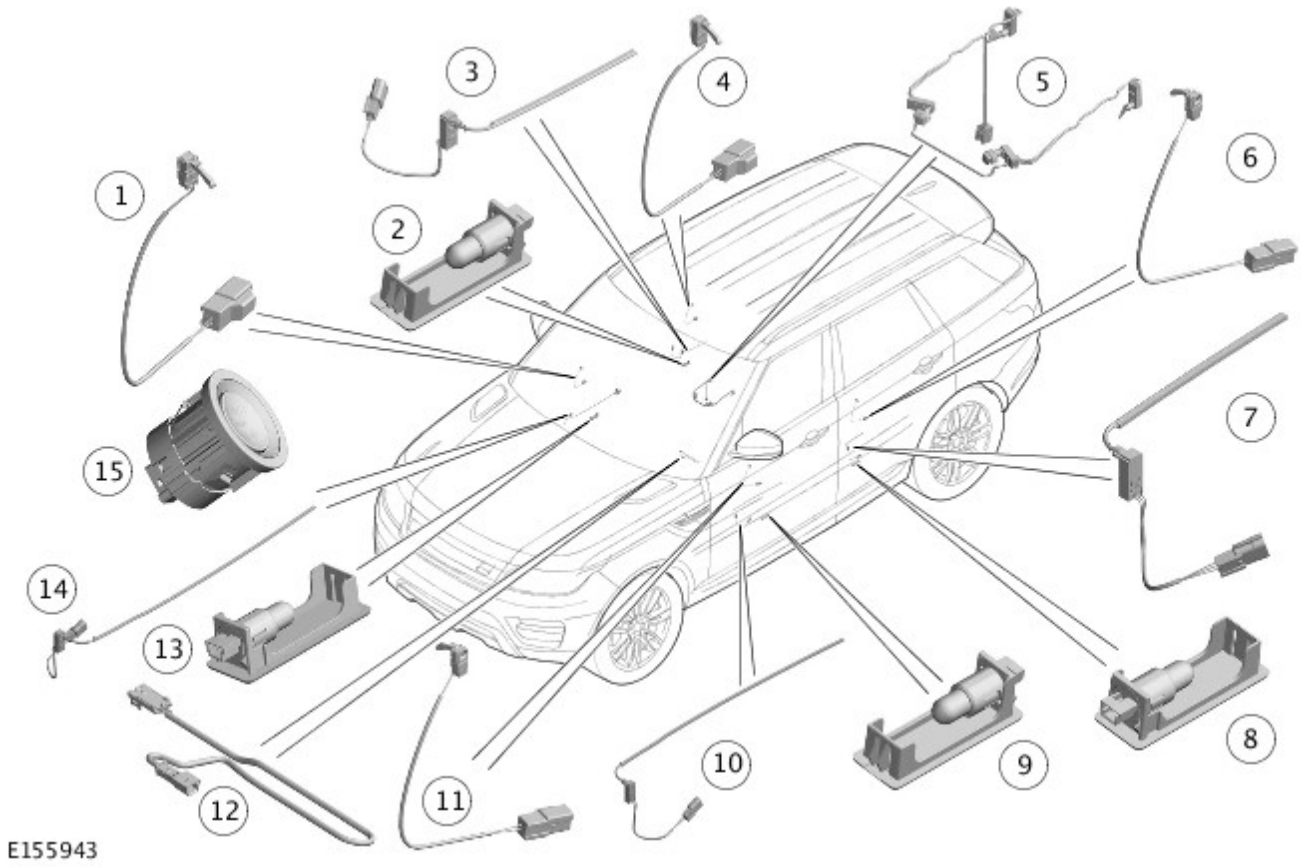
Interior Lighting - Interior Lighting

Description and Operation

INTERIOR LIGHTING COMPONENT LOCATION



Item	Part Number	Description
1	-	Right approach Lamp
2	-	Front central door locking unlock switch - Driver door
3	-	Sunvisor - vanity mirror lamp
4	-	Front overhead console
5	-	Rear central door locking unlock switch - rear right door
6	-	Luggage compartment lamp
7	-	Tailgate luggage compartment lamp
8	-	Tailgate luggage compartment lamp
9	-	Sunvisor - vanity mirror lamp
10	-	Rear central door locking unlock switch - rear left door
11	-	Rear 12v accessory socket
12	-	Rear left treadplate illumination Light Emitting Diode (LED)
13	-	Left approach Lamp
14	-	Front central door locking unlock switch - Passenger door
15	-	Front left treadplate illumination Light Emitting Diode (LED)
16	-	Electric Park Brake (EPB) switch
17	-	Front 12v accessory socket
18	-	Integrated Control Panel (ICP)
19	-	Front right treadplate illumination Light Emitting Diode (LED)
20	-	Rear right treadplate illumination Light Emitting Diode (LED)
21	-	Auxiliary lighting switch



Item	Part Number	Description
1	-	Driver door handle ambience lighting LED
2	-	Rear right door puddle lamp
3	-	Rear right door pocket configurable ambience lighting LED (if fitted)
4	-	Rear right door handle ambience lighting LED
5	-	Floor console configurable ambience lighting LED (if fitted)
6	-	Rear left door handle ambience lighting LED
7	-	Rear left door pocket configurable ambience lighting LED (if fitted)
8	-	Rear left door puddle lamp
9	-	Passenger door puddle lamp
10	-	Passenger door pocket configurable ambience lighting LED (if fitted)
11	-	Passenger door handle ambience lighting LED
12	-	Glovebox lamp
13	-	Driver door puddle lamp
14	-	Driver door pocket configurable ambience lighting LED (if fitted)
15	-	Start/Stop switch

GENERAL

NOTES:

Unless otherwise stated the interior lighting system uses LED (light emitting diode)s instead of bulbs.

The LED illumination of the front door pockets and the front and rear interior door handles is a function of the CJB (central junction box) and only operates when the light control switch is in the side lamp or headlamp positions.

The interior lighting is controlled by the CJB which is located behind the glovebox. The interior lighting comprises the following lamps:

- Approach lamps
- Central locking unlock switch - 4 off
- Vanity mirror lamp - 2 off
- Front overhead console
- Luggage compartment lamp
- Tailgate lamp - 2 off
- 12 v accessory socket - 2 off
- Treadplate illumination - 4 off
- Electric parking Brake (EPB) switch
- Integrated Control Panel (ICP)

- Auxiliary lighting switch
- Door handle ambience lighting - 4 off
- Puddle lamp - 4 off
- Door pocket lighting - 4 off
- Glovebox lamp
- Start/Stop switch

Overhead Console Lighting

The interior lamps have two modes of operation; automatic or manual. In the automatic mode the interior lamp functionality is controlled by the CJB on receipt of various input signals, or can be manually selected.

The following table shows the bulbs used for the interior lighting and their type and rating:

Bulb	Type	Rating
Door puddle lamps	Capless	5W

LUGGAGE COMPARTMENT LAMPS

The luggage compartment lamps comprise one lamp unit located on the right trim panel, adjacent to the auxiliary power socket, and two lamps located in the interior trim panel of the tailgate. All of these lamps are of the same design. The lamps are controlled by the tail door latch assembly and the CJB and operate on the automatic interior lamp functionality.

GLOVEBOX LAMP

The glove compartment lamp is located inside the glove compartment, at the top, adjacent to the latch. The lamp housing also incorporates a plunger type switch which is activated to switch the lamp on when the glove compartment lid is opened.

VANITY MIRROR ILLUMINATION LAMPS

The vanity mirror lamps are located in the front sun visors. The lamps are located behind a hinged cover, either side of the mirror glass. The lamps are activated by a simple switch which operates when the mirror cover is lifted.

DOOR PUDDLE LAMPS

Each of the doors is fitted with a puddle lamp to illuminate the ground below the door when the door is open. The front door puddle lamps are located in the lower face of the door, facing the ground. The rear door puddle lamps are located in the bottom of the door trim panel.

The puddle lamps are controlled by the CJB and operate on the automatic interior lamp functionality.

DOOR MIRROR APPROACH LAMPS

The exterior mirror housings are fitted with a lamp which illuminates the area below the front door. The housing contains a plastic lens which directs a beam of light in the required area.

The lamps are controlled by the CJB, via the front driver and passenger door modules. The CJB sends a CAN (controller area network) message to the door module to illuminate the approach lamps when an unlock signal, a front door open signal.

DIAGNOSTICS

Diagnostics for the interior lamps is limited to a check of the function of the front interior lamp switch. The CJB can be interrogated using a Land Rover approved diagnostic system to establish the correct operation of the front interior lamp switch, the door switches and the tail door switch.

OPERATION

The interior lamp operation is activated by any of the following input signals:

- Door switch contacts (front and rear)
- Tail door latch assembly
- Power Mode 4
- Central locking, lock request
- Central locking remote handset operation
- Crash sensor
- Front interior lamp switch.

The load space lamp and the upper tail door lamps are not switched on with the interior lamps. These lamps are only activated when the upper tail door is opened. When the upper tail door is opened, the interior lamps, in addition to the load space lamps, are switched on and are subject to the CJB timers. The tail door open signal to the CJB is provided by a microswitch in the tail door latch assembly.

AUTOMATIC OPERATION

The automatic control of the interior lamps has several switch on and off conditions as follows:

- The interior lamps are switched on when one or more doors are opened. When all the doors are closed, the interior lamps are switched off after a delay of 20 seconds. If the vehicle is locked after closing the doors, within the 20 second period, the lamps go off immediately.

- In power mode 4, the interior lamps are switched on for 20 seconds. This timer is overridden if a door is subsequently opened.
- When the vehicle is unlocked and the doors are closed, the interior lamps can be activated for a further 20 second period by pressing the 'unlock' button on the remote handset.
- When the vehicle is unlocked from a locked condition, the interior lamps are activated for a 20 second period. This timer is overridden if a door is subsequently opened.
- If a door is left open, the interior lamps will remain on for 16 minutes. After this period, the CJB timer switches the interior lamps off to prevent excessive battery drain.

The CJB uses a PWM (pulse width modulation) operation of the interior lamps for the on/off conditions. The lamps are switched on with a 'soft ramp' of 1.3 seconds. The lamps are switched off with a 'soft ramp' of 2.6 seconds. The soft on/off operation is controlled by a semiconductor within the CJB

MANUAL OPERATION

The interior lamps can be switched on or off using the manual switch for the front interior lamp. The front interior lamp switch will switch all interior lamps, front and rear, on or off. If the interior lamps are on when the switch is pressed, all interior lamps will go off.

In power mode 4 or 6 and the front interior lamp switch is used to switch the interior lamps on, the lamps will remain on continuously. If the ignition is put into power mode 0, the interior lamps will be subject to the 16 minute CJB timer. The interior lamp is immediately switched off when the vehicle is locked. After a locking procedure, the interior lamp automatic control is reinstated.

The rear interior lamp switch will switch the rear interior lamp only on or off.

CONTINUOUS OFF - HUNTING MODE

To prevent drain on the battery if the doors are to remain open for some time (or for customers to prevent the interior lighting illuminating when unlocking the vehicle – Hunting Mode), the interior lamps automatic operation can be turned off. This is stored in the CJB EEPROM and is also activated following a system power down or a reset of the CJB

To enter the continuous off (Hunting mode) condition, the front interior lamp switch must be pressed and held for more than 3 seconds. The courtesy lamp will flash to confirm this. The continuous off function can only be disabled by pressingand holding the front interior lamp for more than 3 seconds, full automatic control is resumed. When continuous off is active, the rear interior lamp switch can still be used to switch the rear interior lamp only on or off. When continuous off mode is active, the front interior lighting can still be manually activated.

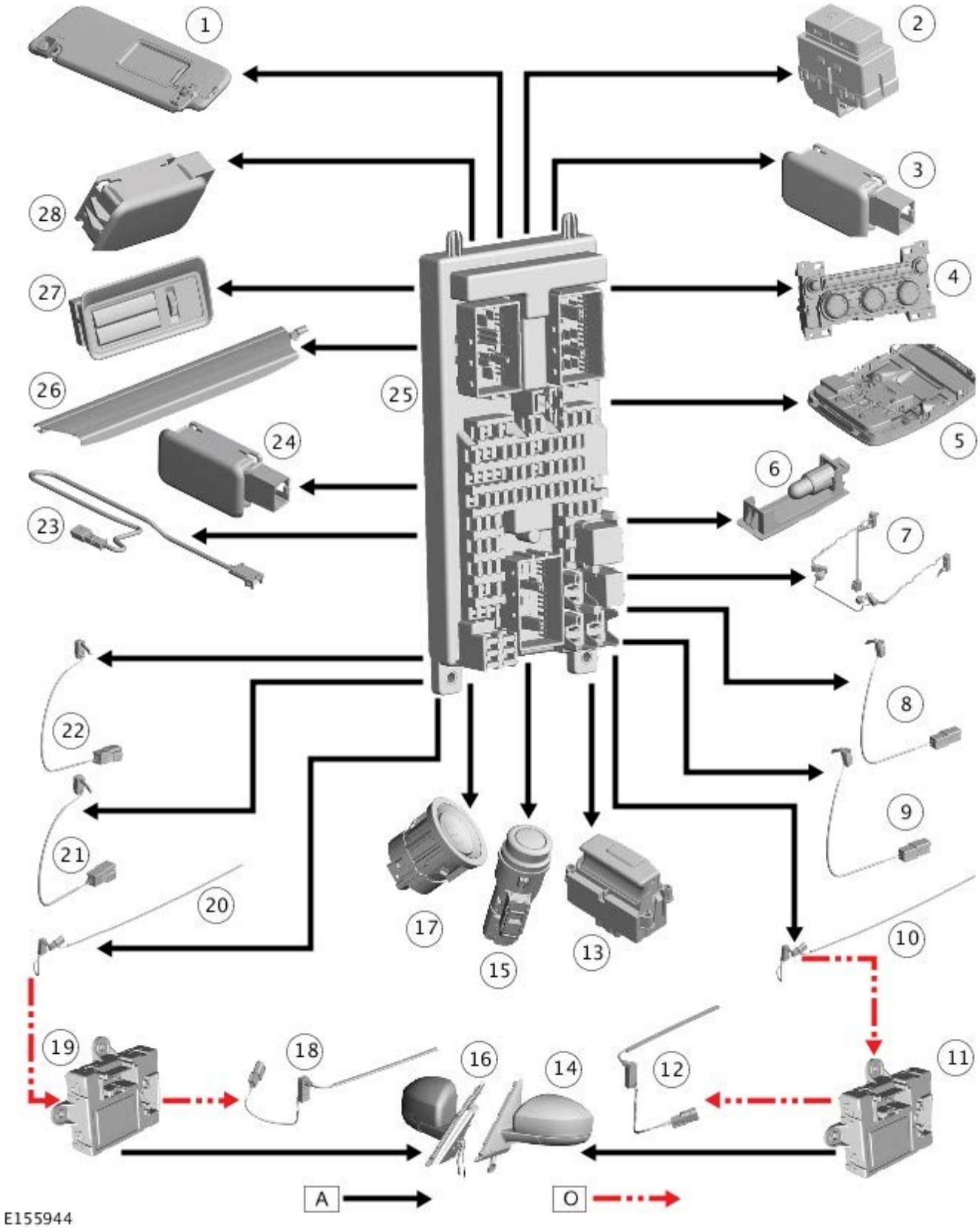
CRASH SIGNAL OPERATION

The CJB receives a crash signal on a hardwired connection from the RCM (restraints control module) in the event of a crash of a severity to activate the airbags. On receipt of this signal, the CJB activates the interior lamps which are on permanently and not subject to the CJB timer.

The crash operation of the interior lamps can only be cancelled by operating the manual switch on the front interior lamp or by locking and unlocking the vehicle.

INTERIOR LIGHTING CONTROL DIAGRAM

 NOTE: **A** = Hardwired; **O** = Lin Bus



Item	Part Number	Description
1	-	Vanity mirror LED - 2 off
2	-	Central locking unlock switch - 4 off
3	-	Tailgate luggage compartment lamp
4	-	Integrated Control Panel (ICP)
5	-	Front overhead console
6	-	Door Puddle Lamps x4
7	-	Floor console ambience lighting LED
8	-	Driver door handle ambience lighting LED
9	-	Rear right door handle ambience lighting LED
10	-	Passenger door pocket ambience lighting LED

11	-	Passenger Door Module (PDM)
12	-	Rear left door pocket ambience lighting LED
13	-	Electric Park Brake (EPB) switch
14	-	Passenger door approach lamp
15	-	12v accessory socket - 2 off
16	-	Driver door approach lamp
17	-	Start/Stop switch
18	-	Driver door pocket ambience lighting LED
19	-	Driver Door Module (DDM)
20	-	Rear right door pocket ambience lighting LED
21	-	Rear left door handle ambience lighting LED
22	-	Passenger door handle ambience lighting LED
23	-	Glovebox lamp
24	-	Tailgate luggage compartment lamp
25	-	Central Junction Box (CJB)
26	-	Treadplate illumination Light Emitting Diode (LED) - 4 off
27	-	Auxiliary lighting switch
28	-	Luggage compartment lamp

Ambience Lighting

The ambience lighting will illuminate when the position lamps or dipped beam is active.

If the position lamps or dipped beam is not active then when a customer selects an ambience lighting option it will illuminate the LEDs for 1second as a preview then go off.

The LED ambience lighting is located:

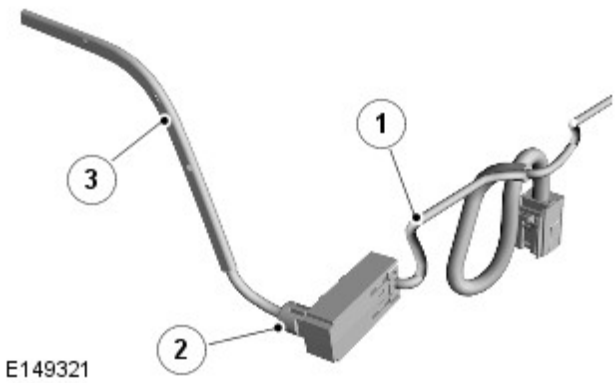
- In the door grab handles
- Front passenger footwells

Ambience lighting is provided by LED units around the vehicle. Each component is made up of three parts:

- LED light source
- A light guide
- A light guide carrier

LED Ambience Lighting Component

NOTE: Example shown, units vary with application.



Item	Part Number	Description
1	-	Electrical supply
2	-	LED light source
3	-	LED Light Guide

The ambience lighting systems are controlled by the CJB. Customer ambient lighting selections in the Touch Screen (TS) are processed and sent to the CJB via a MS CAN bus. The CJB then sends out MS CAN messages to the door modules and the IPC. The IPC and the door modules then transmits the information via LIN to the LED modules. The LED modules then interpret this information before illuminating the LEDs.

Configurable Ambience Lighting (If Fitted)

The configurable ambience lighting system has variable color options which can be adjusted by the customer using a menu option in the Touch-screen.

The configurable ambience lighting system uses LED's which are combined together to make a range of 10 different colors. In addition to the color of the ambient lighting, customers can also vary the brightness.

The LED configurable ambience lighting is located:

- On the front floor console
- In the door pockets

Published: 24-Jun-2013

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 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.

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 • Glove compartment 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 • Ambient lighting LEDs in rear door handles, door pockets, floor consoles (front and rear) condition and installation	• Bulbs • Fuses • Battery junction box • Central junction box • Wiring harness • Loose or corroded connector(s) • Main interior lamp switch • Map reading lamp switches • Vanity mirror lamp switches • Glove compartment lamp switch • Ambient lighting LEDs in rear door handles, door pockets, floor consoles (front and rear) • Tailgate 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
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	Possible Causes	Action
Front/rear interior lamp inoperative	• Automatic mode switched off • Fuse(s) blown • Circuit fault • Switch fault • Lamp internal failure	• GO to Pinpoint Test A.
Ambient lighting LED inoperative	• LED failure • Fuse(s) blown • Circuit fault	• Check the LED condition • Check the LED connector • Check the fuse(s) • Check the lamp circuits
Map reading lamp(s) inoperative	• Fuse(s) blown • Circuit fault • Switch fault • Lamp internal failure	• Check the fuse(s) • Check the lamp circuits • Check the switch function • Check the lamp
Vanity mirror lamp(s) inoperative	• Fuse(s) blown • Circuit fault	• Check the fuse(s) • Check the lamp circuits

	• Switch fault • Lamp internal failure	• Check the switch function • Check the lamp
Glove compartment lamp inoperative	• Fuse(s) blown • Circuit fault • Switch fault • Lamp internal failure	• Check the fuse(s) • Check the lamp circuits • Check the switch function • Check the lamp
Footwell lamp inoperative	• Fuse(s) blown • Circuit fault • Lamp internal failure	• Check the fuse(s) • Check the lamp circuits • Check the lamp
Door mirror approach lamp(s) inoperative	• Fuse(s) blown • Circuit fault • Lamp internal failure	• Check the fuse(s) • Check the lamp circuits • Check the lamp
Puddle lamp(s) inoperative	• Bulb failure • Fuse(s) blown • Circuit fault	• Check the bulb condition • Check the fuse(s) • Check the lamp circuits
Luggage compartment lamp inoperative	• Fuse(s) blown • Circuit fault • Switch fault • Lamp internal failure	• Check the fuse(s) • Check the lamp circuits • Check the switch function • Check the lamp

Pinpoint Tests

PINPOINT TEST A : INTERIOR LAMP FUNCTION TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: INTERIOR LAMP FUNCTION TEST 1	
	1 Lock the vehicle
	2 Unlock the vehicle using the smart key unlock switch
	3 Visually check the front and rear interior lamps
	Are any of the interior lamps illuminated? **Yes** Test passed. GO to A2. **No** Test failed. GO to Pinpoint Test B.
A2: INTERIOR LAMP FUNCTION TEST 2	
	1 Visually check the front and rear interior lamps
	Is the front interior lamp illuminated? **Yes** Test passed. GO to A3. **No** Test failed. GO to Pinpoint Test E.
A3: INTERIOR LAMP FUNCTION TEST 3	
	1 Visually check the front and rear interior lamps
	Is the rear left interior lamp illuminated? **Yes** Test passed. GO to A4. **No** Test failed. GO to Pinpoint Test F.
A4: INTERIOR LAMP FUNCTION TEST 4	
	1 Visually check the front and rear interior lamps
	Is the rear right interior lamp illuminated? **Yes** Test passed. GO to A5. **No** Test failed. GO to Pinpoint Test G.
A5: INTERIOR LAMP FUNCTION TEST 5	
NOTE: The interior lamps should extinguish 20 seconds after the vehicle was unlocked if a door was not opened.	
	1 Wait for the interior lamps to extinguish
	2 Visually check the front and rear interior lamps
	Have the front and rear interior lamps extinguished? **Yes** Test passed. GO to A6. **No** Test failed. Check the instrument cluster for a message indicating that a door is open when it is closed
A6: INTERIOR LAMP FUNCTION TEST 6	
NOTE: The vehicle will lock 30 seconds after it was unlocked if a door was not opened. If this has occurred, unlock the vehicle using the smart key unlock switch and wait until the interior lamps extinguish before continuing.	

	1 Open a door
	2 Visually check the front and rear interior lamps
	Are the front and rear interior lamps illuminated? **Yes** Test passed. GO to A7. **No** Test failed. Check the instrument cluster for an absence of door open message when a door is open
A7: INTERIOR LAMP FUNCTION TEST 7	
NOTE: Steps 2 to 4 should be completed within 20 seconds.	
	1 Enter the vehicle
	2 Close the door
	3 Start the engine
	4 Visually check the front and rear interior lamps
	Have the front and rear interior lamps extinguished? **Yes** Test passed. GO to A8. **No** Test failed. Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
A8: INTERIOR LAMP FUNCTION TEST 8	
	1 Briefly touch the front interior lamp lens
	2 Visually check the front and rear interior lamps
	Are the front and rear interior lamps illuminated? **Yes** Test passed. GO to A9. **No** Test failed. GO to Pinpoint Test D.
A9: INTERIOR LAMP FUNCTION TEST 9	
	1 Briefly touch the front interior lamp lens
	2 Visually check the front and rear interior lamps
	Have the front and rear interior lamps extinguished? **Yes** Test passed. GO to A10. **No** Test failed. GO to Pinpoint Test D.
A10: INTERIOR LAMP FUNCTION TEST 10	
	1 Stop the engine
	2 Visually check the front and rear interior lamps
	Are the front and rear interior lamps illuminated? **Yes** Test passed. GO to A11. **No** Test failed. Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
A11: INTERIOR LAMP FUNCTION TEST 11	
	1 Exit the vehicle
	2 Close the door
	3 Lock the vehicle
	4 Visually check the front and rear interior lamps
	Have the front and rear interior lamps extinguished? **Yes** Tests complete **No** Test failed. Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index

PINPOINT TEST B : AUTO MODE FUNCTION TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: AUTO MODE FUNCTION TEST 1	
NOTE: Interior lamps auto mode off is also known as Hunting mode.	
	1 Set the ignition to on
	2 Touch the front interior lamp lens for 5 seconds (or until the interior lamp flashes)
	3 Check the touch screen for a message
	Was "Auto function on" displayed on the touch screen? **Yes** Test passed. GO to B2. **No** Test failed. GO to B3.
B2: AUTO MODE FUNCTION TEST 2	
	1 Open a door
	2 Close the door

	3 Visually check the front and rear interior lamps
	Are the front and rear interior lamps illuminated? **Yes** Tests complete **No** Test failed. GO to Pinpoint Test C.
B3: AUTO MODE FUNCTION TEST 3	
	1 Touch the front interior lamp lens for 5 seconds (or until the interior lamp flashes)
	2 Check the touch screen for a message
	Was "Auto function on" displayed on the touch screen? **Yes** Auto mode now set to on. GO to Pinpoint Test C. **No** Test failed. GO to Pinpoint Test D.

PINPOINT TEST C : BATTERY AND CHARGING SYSTEM TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: BATTERY AND CHARGING SYSTEM TEST 1	
NOTE: Interior lamp operation is inhibited if the battery state of charge is below threshold	
	1 Refer to the relevant section of the workshop manual and test the battery and charging system
	Are the battery and charging system operating within specification? **Yes** Test passed. GO to Pinpoint Test E. **No** Refer to the relevant section of the workshop manual and repair the battery and charging system as necessary

PINPOINT TEST D : INTERIOR LAMP SIGNAL TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: INTERIOR LAMP SIGNAL TEST 1	
	1 Using the manufacturer approved diagnostic system, check datalogger signal - Master Interior Light Switch (0xD902)
	2 Briefly touch the front interior lamp lens and check for a change in the signal
	Did the signal change? **Yes** Tests inconclusive. GO to Pinpoint Test A. **No** Test failed. GO to D2.
D2: INTERIOR LAMP SIGNAL TEST 2	
NOTE: In step 1, do not disconnect the electrical connector(s). The lamp is removed for access only.	
	1 Refer to the relevant section of the workshop manual and remove the front interior lamp
	2 Set a multimeter to measure voltage
	3 Connect the multimeter to terminals 19 (YE-GY) and 10 (BK)
	Does the multimeter display battery voltage? **Yes** Test passed. GO to D3. **No** Test failed. GO to D4.
D3: INTERIOR LAMP SIGNAL TEST 3	
	1 Connect the multimeter to terminals 19 (YE-GY) and 10 (BK)
	2 Briefly touch the front interior lamp lens and check for a change in the voltage
	Did the multimeter measure 0V? **Yes** Tests inconclusive. GO to Pinpoint Test A. **No** Install a new front interior lamp
D4: INTERIOR LAMP SIGNAL TEST 4	
	1 Connect the multimeter to terminal 10 (BK) and earth
	Did the multimeter measure 0V? **Yes** Refer to the electrical circuit diagrams and check the front interior lamp switch signal circuit for open circuit, high resistance **No** Refer to the electrical circuit diagrams and check the front interior lamp earth circuit for open circuit, high resistance

PINPOINT TEST E : FRONT INTERIOR LAMP TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**

E1: FRONT INTERIOR LAMP TEST 1	
NOTE: In step 1, do not disconnect the electrical connector(s). The lamp is removed for access only.	
	1 Refer to the relevant section of the workshop manual and remove the front interior lamp
	2 Open a door
	3 Set a multimeter to measure voltage
	4 Connect the multimeter to front interior lamp terminals 18 (GY-VT) and 10 (BK)
	Does the multimeter display battery voltage? **Yes** Install a new front interior lamp. To continue with interior lamp function test GO to Pinpoint Test A. **No** Test failed. GO to E2.
E2: FRONT INTERIOR LAMP TEST 2	
	1 Open a door
	2 Connect the multimeter to front interior lamp terminal 10 (BK) and earth
	Did the multimeter measure 0V? **Yes** Refer to the electrical circuit diagrams and check the front interior lamp supply circuit for open circuit, high resistance **No** Refer to the electrical circuit diagrams and check the front interior lamp earth circuit for open circuit, high resistance

PINPOINT TEST F : REAR LEFT INTERIOR LAMP TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: REAR LEFT INTERIOR LAMP TEST 1	
NOTE: In step 1, do not disconnect the electrical connector(s). The lamp is removed for access only.	
	1 Refer to the relevant section of the workshop manual and remove the rear left interior lamp
	2 Open a door
	3 Set a multimeter to measure voltage
	4 Connect the multimeter to rear left interior lamp terminals 2 (GY-VT) and 3 (BK)
	Does the multimeter display battery voltage? **Yes** Install a new rear left interior lamp. To continue with interior lamp function test GO to Pinpoint Test A. **No** Test failed. GO to F2.
F2: REAR LEFT INTERIOR LAMP TEST 2	
	1 Open a door
	2 Connect the multimeter to rear left interior lamp terminal 3 (BK) and earth
	Did the multimeter measure 0V? **Yes** Refer to the electrical circuit diagrams and check the rear left interior lamp supply circuit for open circuit, high resistance **No** Refer to the electrical circuit diagrams and check the rear left interior lamp earth circuit for open circuit, high resistance

PINPOINT TEST G : REAR RIGHT INTERIOR LAMP TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: REAR RIGHT INTERIOR LAMP TEST 1	
NOTE: In step 1, do not disconnect the electrical connector(s). The lamp is removed for access only.	
	1 Refer to the relevant section of the workshop manual and remove the rear right interior lamp
	2 Open a door
	3 Set a multimeter to measure voltage
	4 Connect the multimeter to rear right interior lamp terminals 2 (GY-VT) and 3 (BK)
	Does the multimeter display battery voltage? **Yes** Install a new rear right interior lamp. To continue with interior lamp function test GO to Pinpoint Test A. **No** Test failed. GO to G2.
G2: REAR RIGHT INTERIOR LAMP TEST 2	
	1 Open a door
	2 Connect the multimeter to rear right interior lamp terminal 3 (BK) and earth
	Did the multimeter measure 0V? **Yes** Refer to the electrical circuit diagrams and check the rear right interior lamp supply circuit for open circuit, high resistance

	No Refer to the electrical circuit diagrams and check the rear right interior lamp earth circuit for 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: (100-00 General Information)

Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Driver/Passenger Door Module (DDM/PDM) (Description and Operation).

Published: 24-Sep-2013

Interior Lighting - Second Row Interior Lamp

Removal and Installation

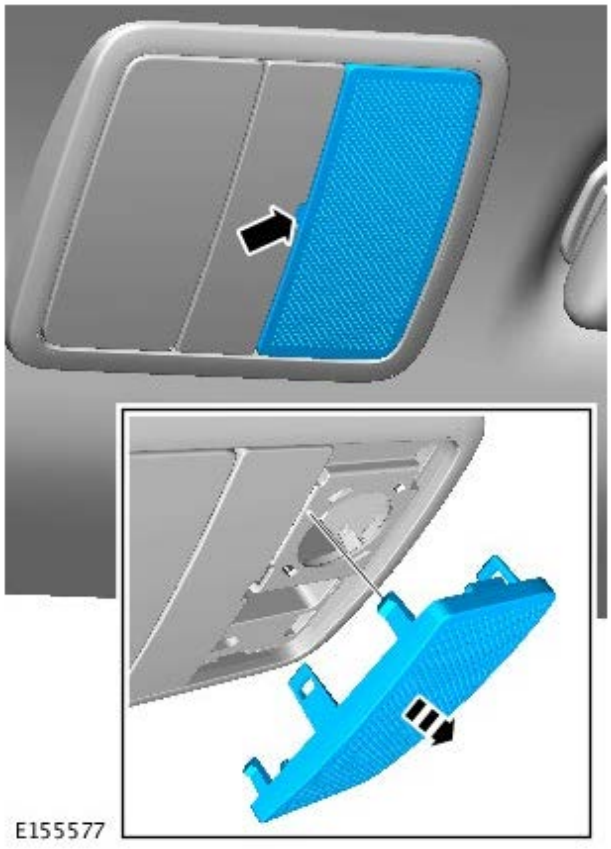
Removal

NOTES:

Removal steps in this procedure may contain installation details.

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

Low level light unit



1. NOTES:

   LH illustration shown, RH is similar.

   This step must be repeated on both sides.



2. NOTES:

   LH illustration shown, RH is similar.

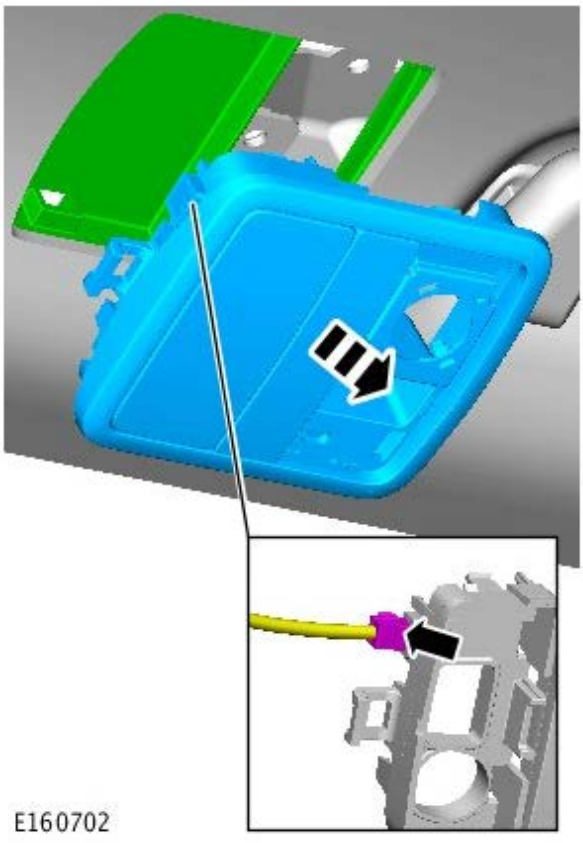
   This step must be repeated on both sides.

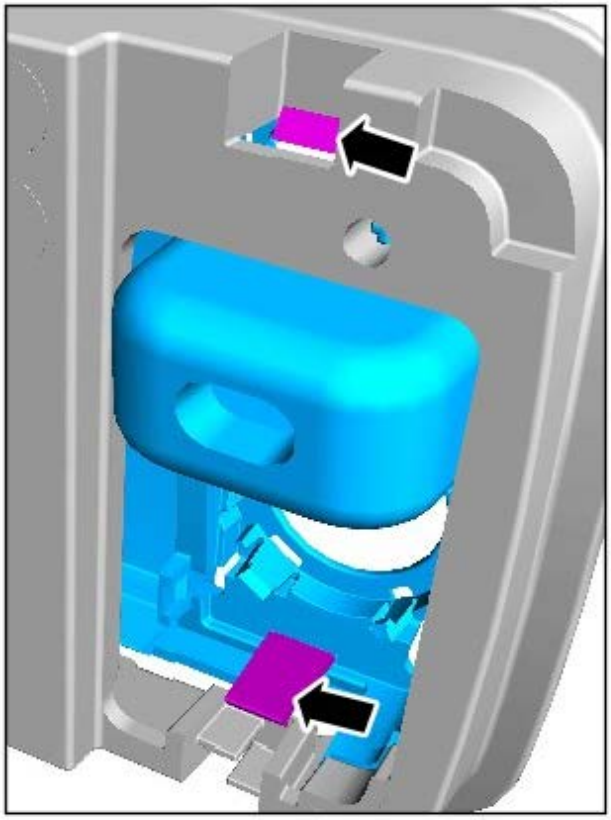
   Torque: 6 Nm

3. NOTES:

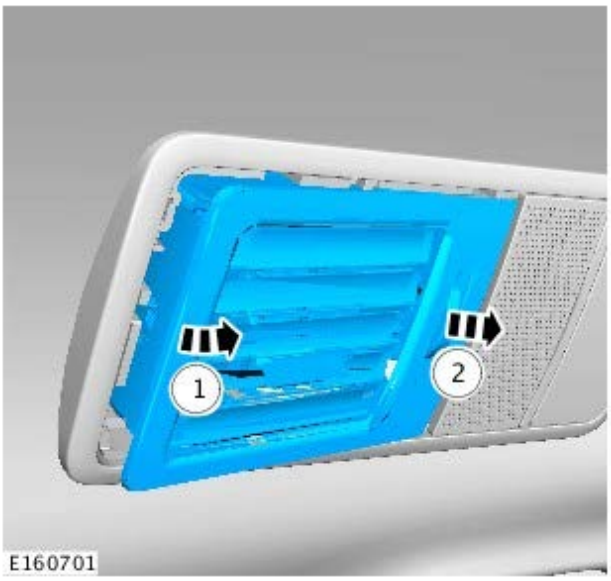
   This step must be repeated on both sides.

LH illustration shown, RH is similar.





Medium level light unit



4. NOTES:

This step must be repeated on both sides.

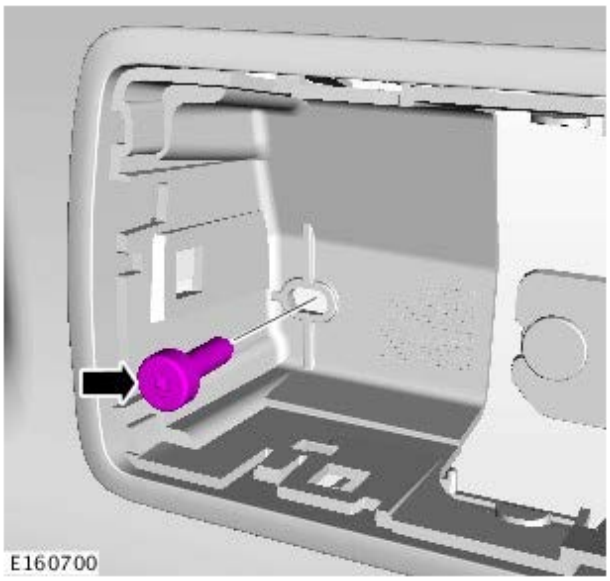
RH illustration shown, LH is similar.

5. NOTES:

This step must be repeated on both sides.

RH illustration shown, LH is similar.

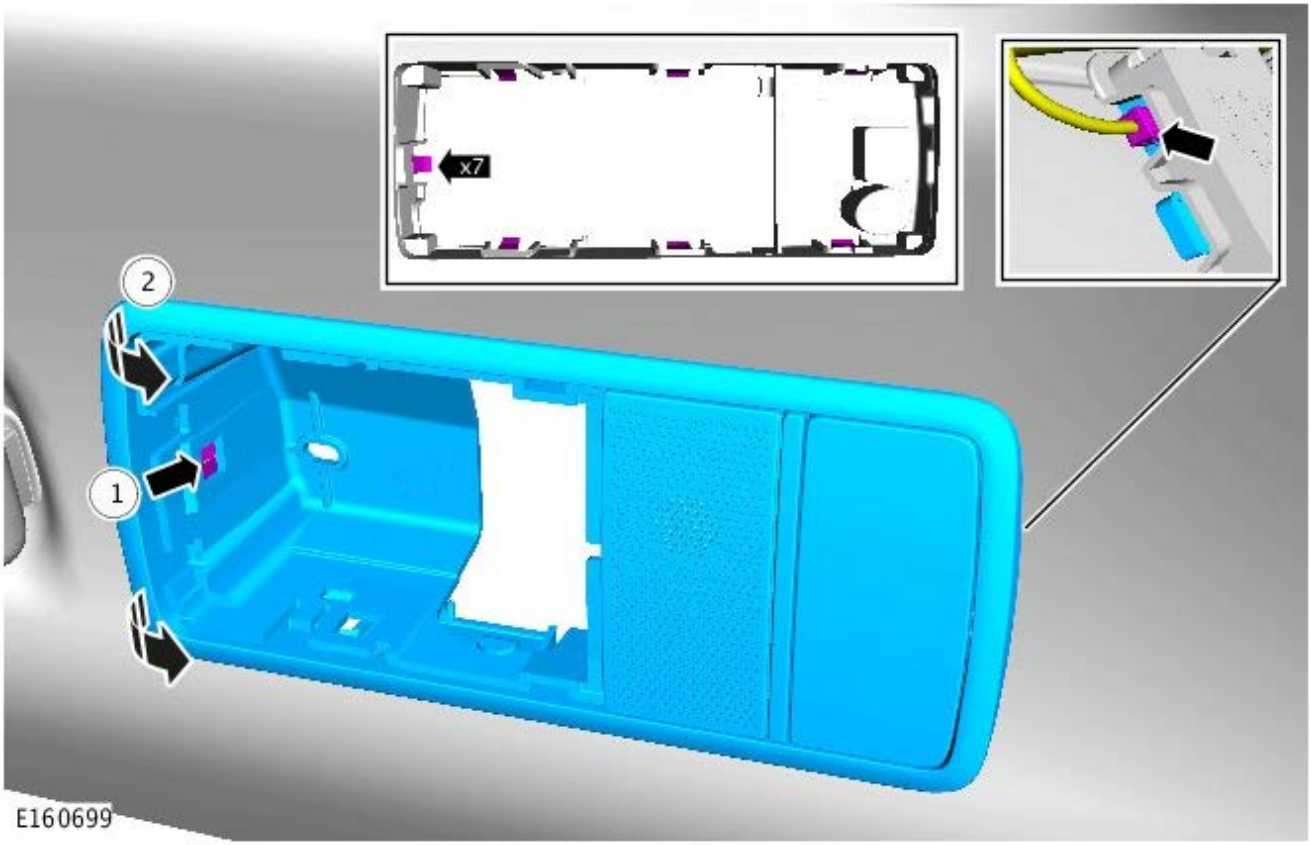
Torque: 6 Nm



6. NOTES:

This step must be repeated on both sides.

RH illustration shown, LH is similar.

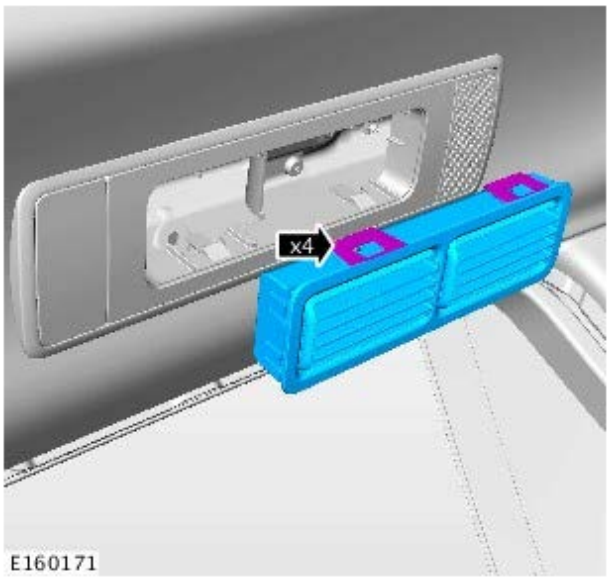


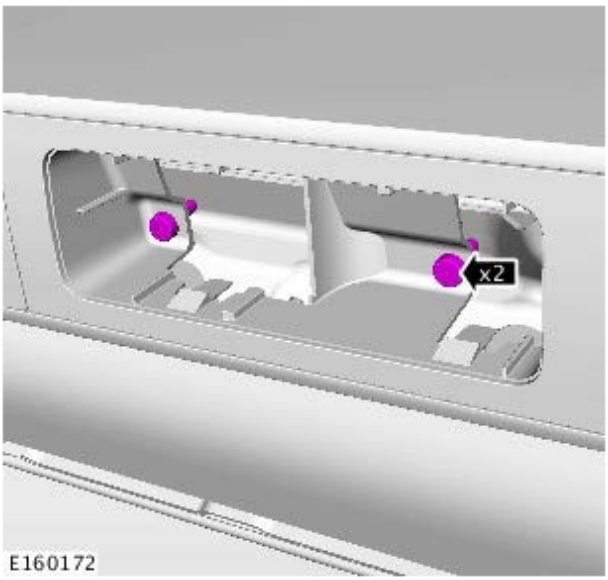
High level light unit

7. NOTES:

This step must be repeated on both sides.

RH illustration shown, LH is similar.





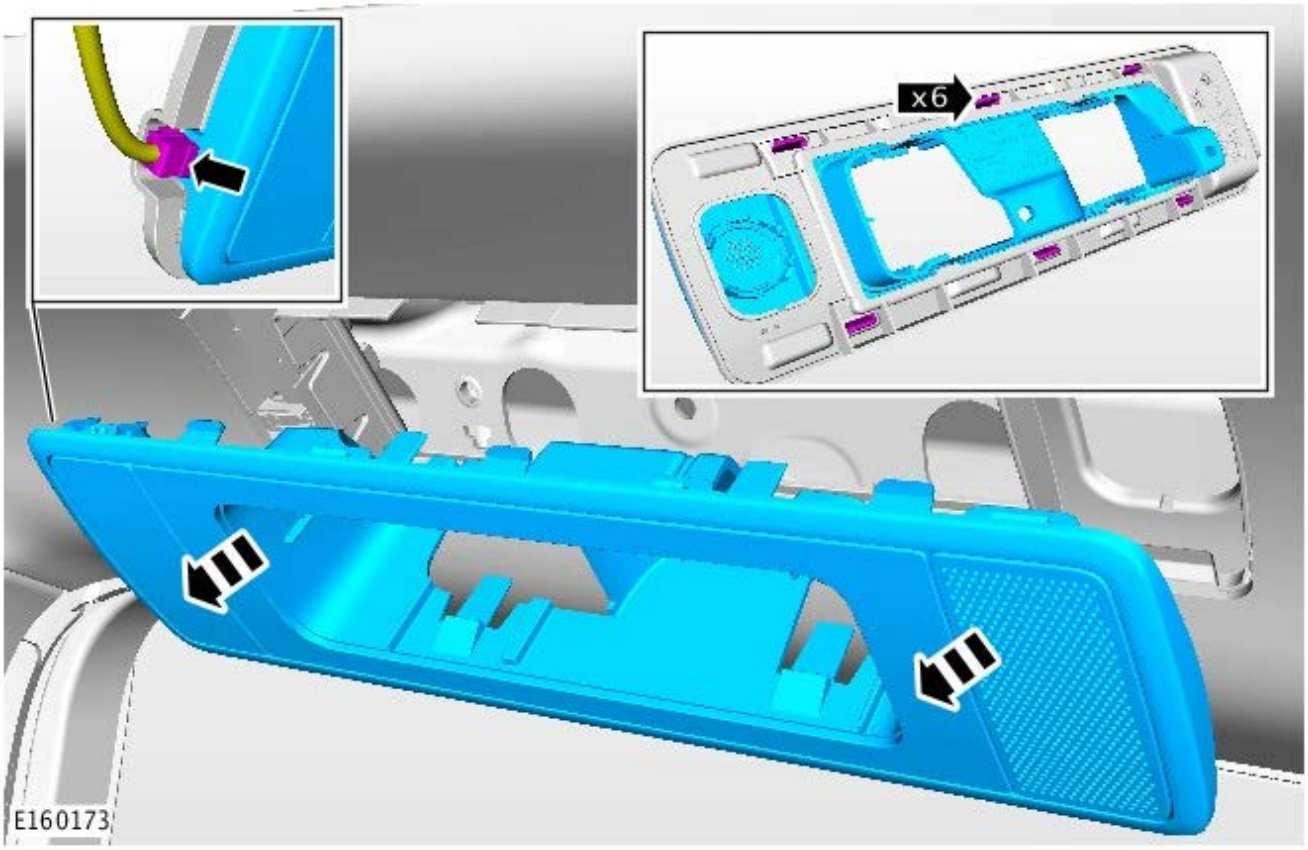
8. NOTES:

   This step must be repeated on both sides.

   RH illustration shown, LH is similar.

   Torque: 6 Nm

9. NOTE: RH illustration shown, LH is similar.



Installation

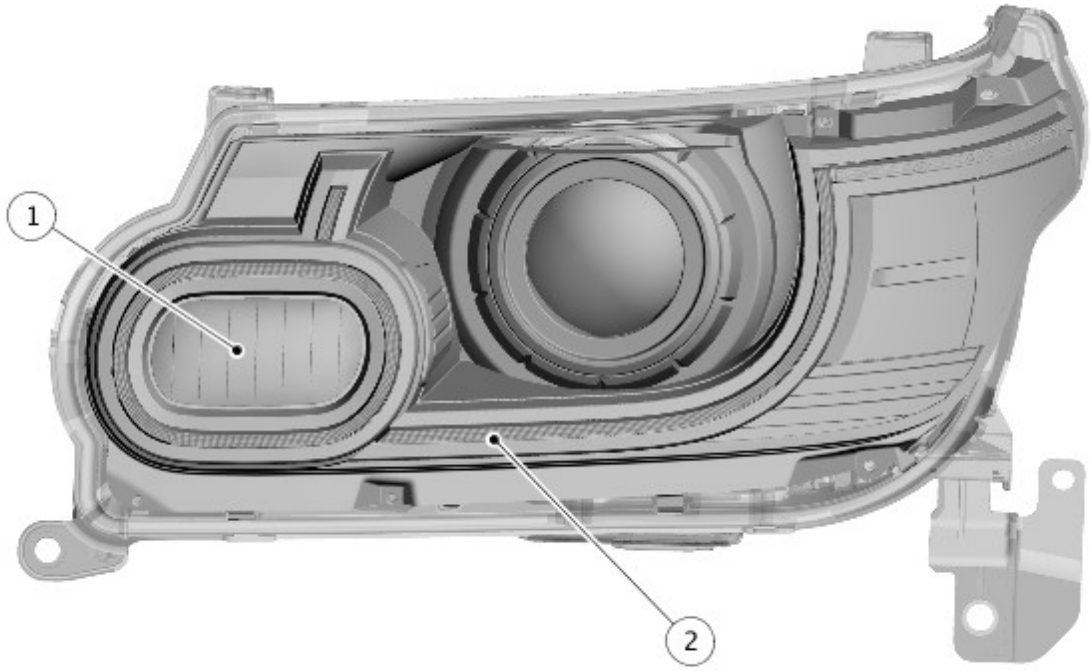
1. To install, reverse the removal procedure.

Published: 14-May-2013

Daytime Running Lamps (DRL) - Daytime Running Lamps (DRL)

Description and Operation

Depending upon the variant of headlamp used, the DRL use different parts of the headlamp, see illustration for usage.



E156184

Item	Part Number	Description
1	-	Daylight running lamp and side lamp (Low line headlamp) cornering lamp (High line headlamp)
2	-	Daylight running and side lamps (High Line Headlamps)

The DRL are permanently illuminated when the vehicle is being driven. DRL are used in a number of markets.

DRL

DRL are active when the following parameters are met:

- PARK is not selected
- Ignition is in mode 7
- The CJB (central junction box) receives an engine running signal
- The lighting control switch is in the off or 'Auto' lamps position.

NOTES:

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.

Adaptive Front lighting System (AFS) (where fitted) is deactivated 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 multifunction switch will be deactivated.

When the parking brake is applied or the selector lever is in the PARK position on automatic transmission vehicles, DRL will remain ON (except NAS market). 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.

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: 02-May-2013

Module Communications Network -

Torque Specifications

Description	Nm	lb-ft	lb-in
Central junction box (CJB) nuts	10	7	-
Battery junction box (BJB) nuts	9	-	80
BJB wiring harness M8 nuts	12	9	-
BJB wiring harness M5 nuts	5.5	-	49
Dual battery junction box (DBJB) nuts	9	-	80
DBJB wiring harness nuts	20	15	-
Dual battery module (DBM) bolts	4.1	-	36
Gateway module bolts	9	-	80
Quiescent current control module nuts	9	-	80

Published: 02-May-2013

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 G.

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.

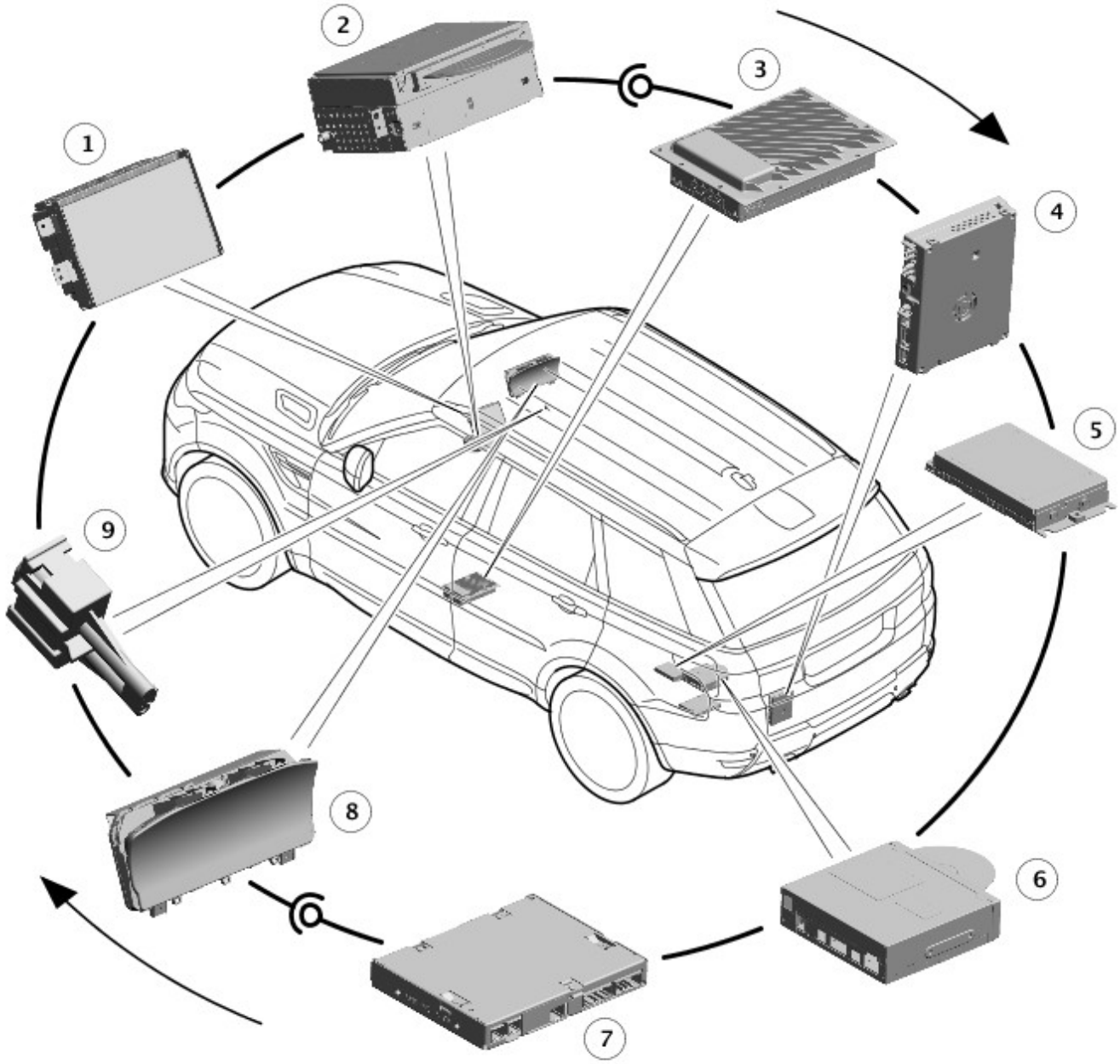
For example, if a global DTC read were to be carried out, only DTCs stored in the modules that the manufacturer approved diagnostic system could communicate with would be displayed. If there was an open circuit fault in a certain position on the CAN harness, the modules that could display DTCs would 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)



E151780

NOTE: Items 1, 2, 3, 8 and 9 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	TV Control Module (TVCM)
5	Digital Radio Control Module (DRCM)
6	Navigation Control Module (NCM) - Japan
7	Rear Seat Entertainment Control Module (RSECM)
8	Instrument Cluster (IC)
9	MOST diagnostic connector

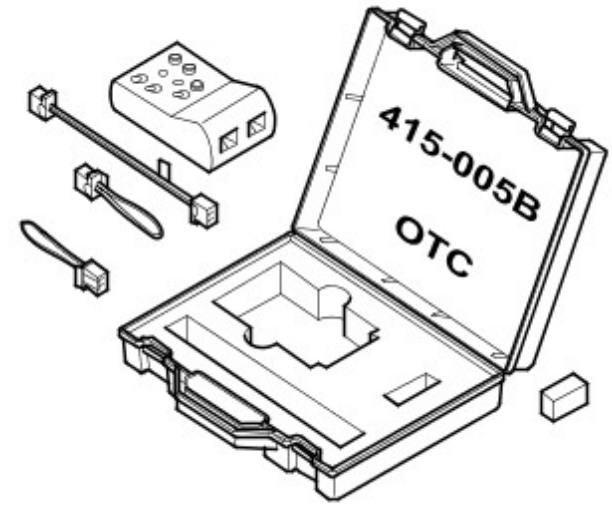
Overview

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

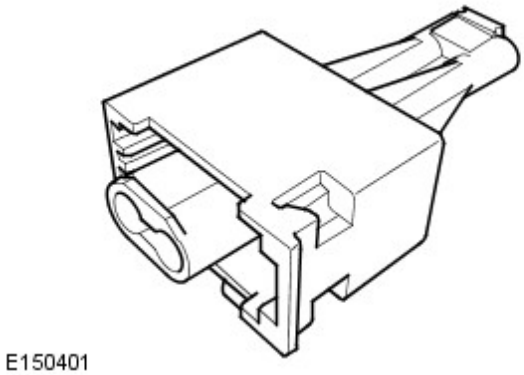
MOST Diagnostic Tools

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	Remove the cover from the MOST diagnostic connector
	3	Set the MOST tester power switch to 'on'
	4	Connect the MOST tester to the MOST diagnostic connector
	5	Check the Touch Screen (TS) for indication of a MOST network fault
	Has the MOST network been restored? **Yes** The MOST diagnostic connector cover is causing the MOST network fault. GO to B2. **No** The MOST diagnostic connector cover is not causing the MOST network fault. GO to B3.	
B2: MOST NETWORK INITIAL TEST 2		
	1	Disconnect the MOST tester
	2	Install the cover to the MOST diagnostic connector
	Has the MOST network been restored? **Yes** No further action required **No** Install a new MOST diagnostic connector cover	
B3: MOST NETWORK INITIAL TEST 3		
	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 E. **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 C.

PINPOINT TEST C : MOST NETWORK UPSTREAM TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: MOST NETWORK UPSTREAM TEST 1	
	1 Refer to the electrical circuit diagrams and identify the preceding 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 UPSTREAM TEST 2	
	1 Disconnect the MOST harness connector from the control module
	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 control module or the MOST harness to the succeeding control module. GO to C3. **No** The MOST network fault is located upstream of the disconnected control module. Reconnect the MOST harness connector to the control module. GO to C1.
C3: MOST NETWORK UPSTREAM 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 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 D. **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 D : CONTROL MODULE TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: 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 D2.
D2: 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 D3. **No** Repair the power and/or ground circuit
D3: 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 E : MOST NETWORK FINAL DOWNSTREAM TEST	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: 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 tester from the MOST diagnostic connector
	2 Install the cover to the MOST diagnostic connector
	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 E2. **No** The fault is in the harness between the MOST diagnostic connector and the Touch Screen (TS). Install a new MOST harness as necessary
E2: 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 G.

PINPOINT TEST F : MOST NETWORK FINAL UPSTREAM TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: 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 Integrated Audio Module (IAM). Install a new MOST harness as necessary **No** GO to Pinpoint Test G.

PINPOINT TEST G : TOUCH SCREEN (TS) TESTS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: 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 G2.
G2: 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 G3. **No** Repair the power and/or ground circuit
G3: 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.

Published: 02-May-2013

Module Communications Network - Battery Junction Box (BJB)

Removal and Installation

Removal

NOTES:

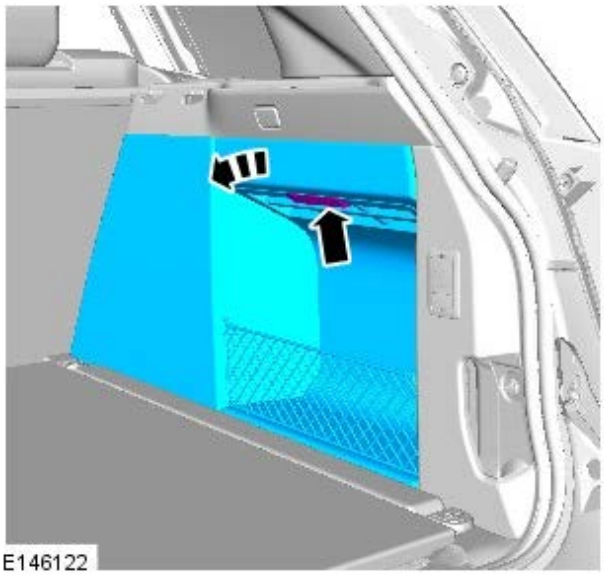
Some variation in the illustration may occur, but the essential information is always correct.

Removal steps in this procedure may contain installation details.

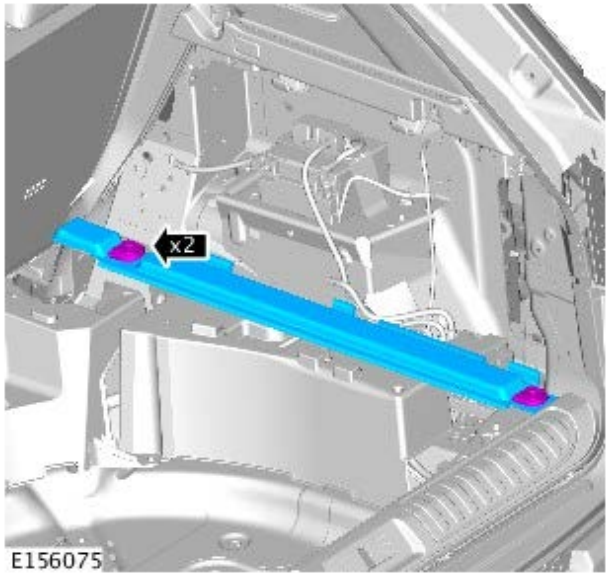
1. Disconnect the battery ground cable

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

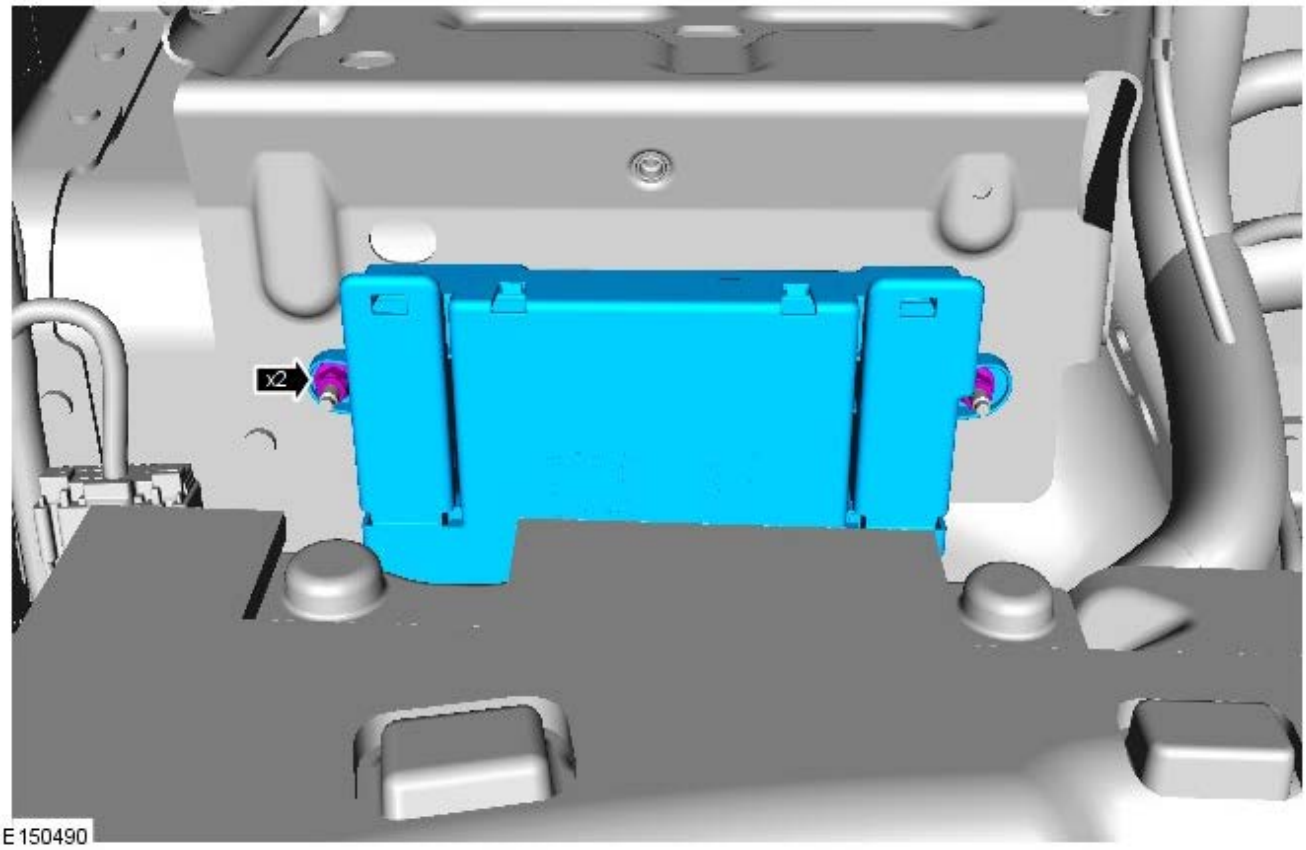
2.



3.

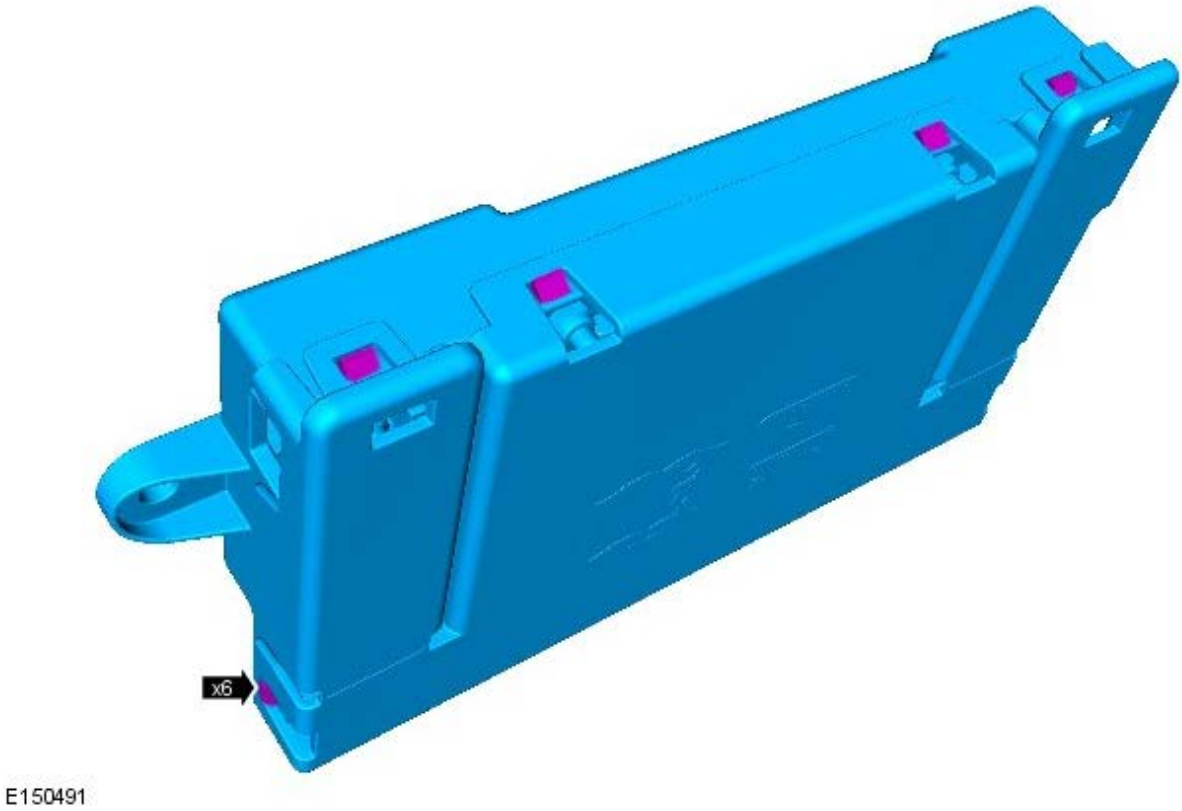


4. *Torque:* 9 Nm



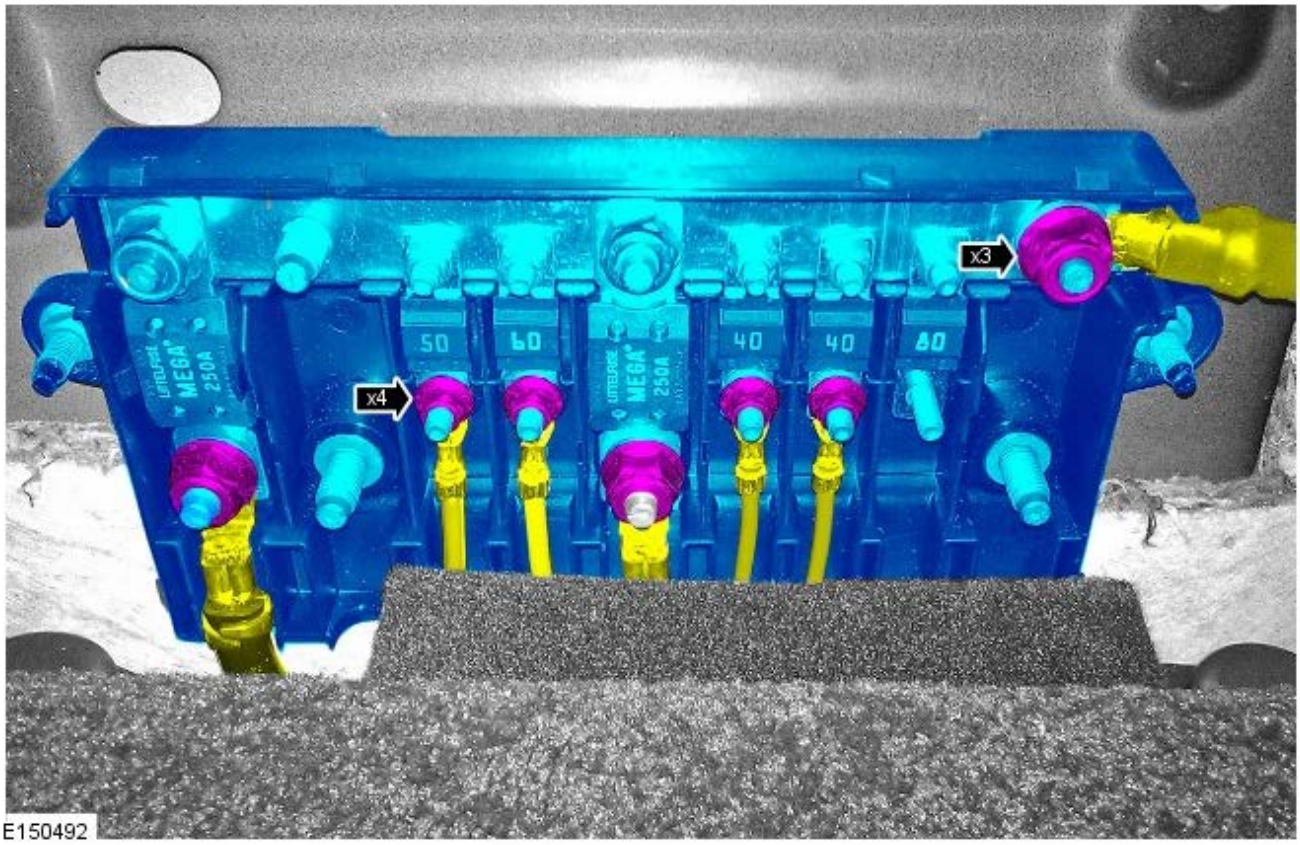
E150490

5. NOTE: Component shown removed for clarity.



E150491

6. *Torque:*
   M8 Nut 12 Nm
   M5 Nut 5.5 Nm



Installation

1. To install, reverse the removal procedure.

Published: 04-Apr-2013

Module Communications Network - Central Junction Box (CJB)

Removal and Installation

Removal

NOTES:

Component shown removed for clarity.

RHD shown, LHD is similar.

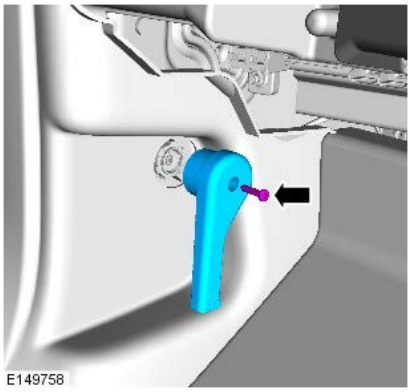
Removal steps in this procedure may contain installation details.

All vehicles

1. Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).
2. Refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

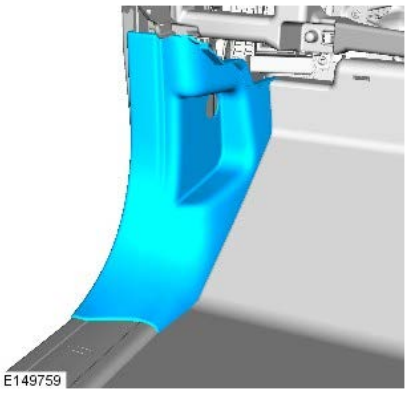
Right-hand drive vehicles

3.

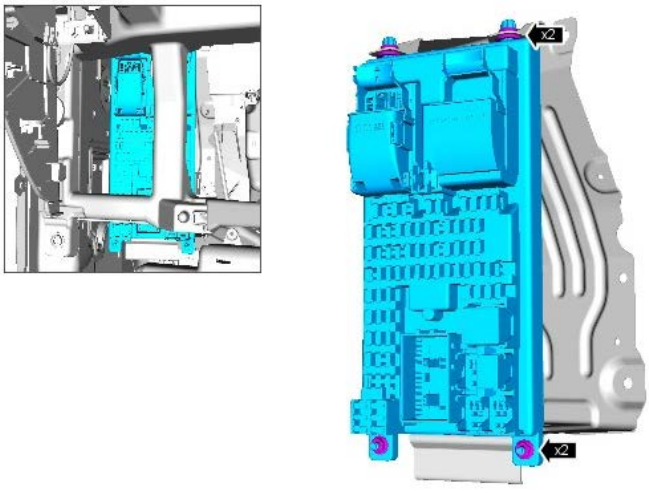


All vehicles

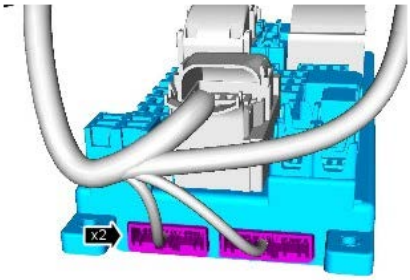
4.



5. *Torque:* 10 Nm

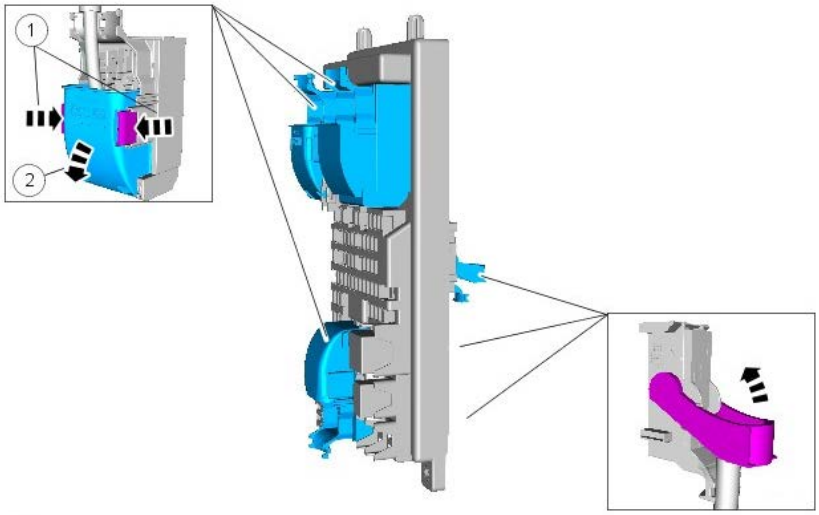


6.



E149761

7.



E149762

Installation

1. To install, reverse the removal procedure.

Published: 02-May-2013

Module Communications Network - Dual Battery Junction Box (DBJB)

Removal and Installation

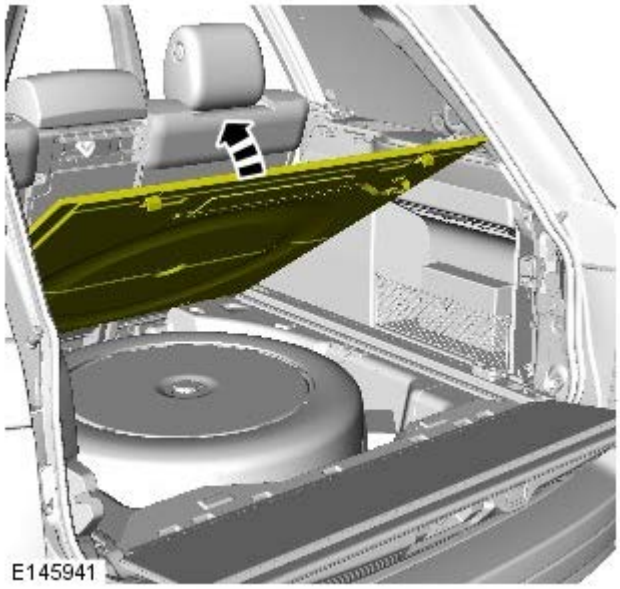
Removal

NOTES:

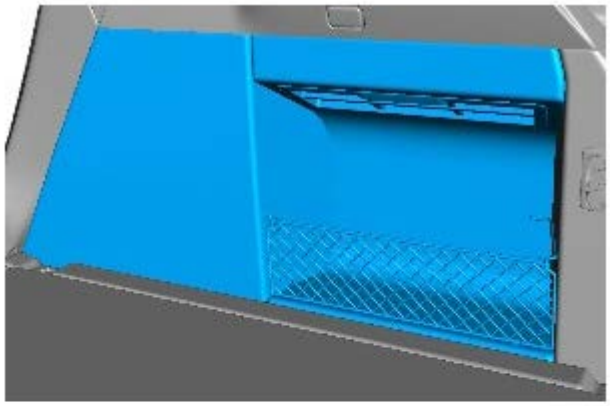
Some variation in the illustrations may occur, but the essential information is always correct.

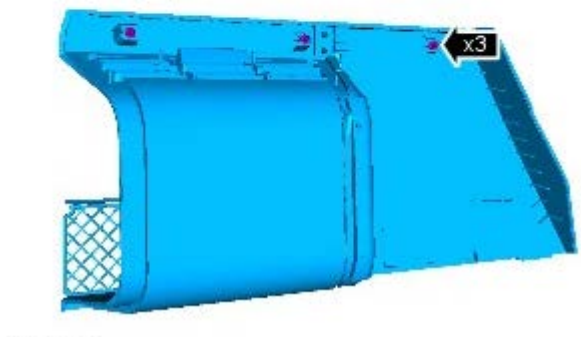
Removal steps in this procedure may contain installation details.

1.



2.

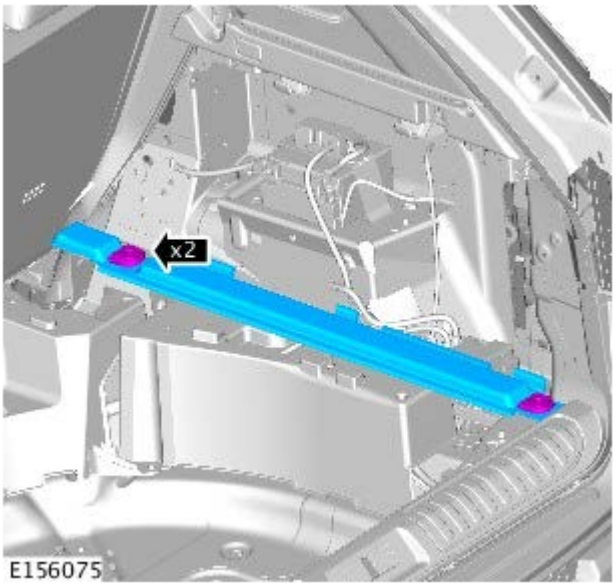




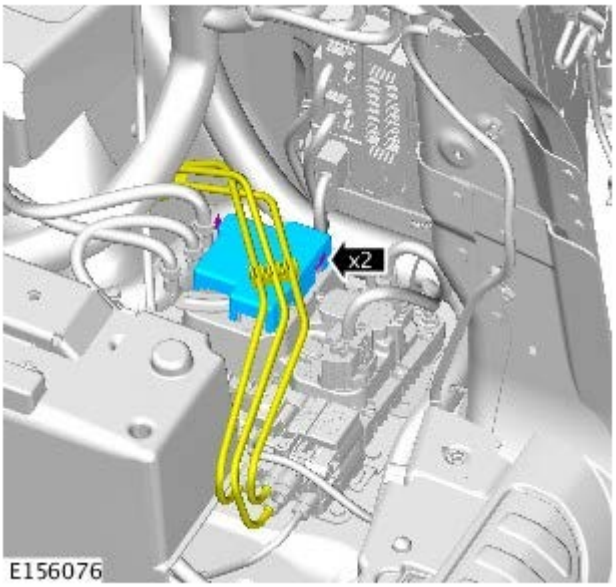
3. Disconnect the battery ground cable.

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

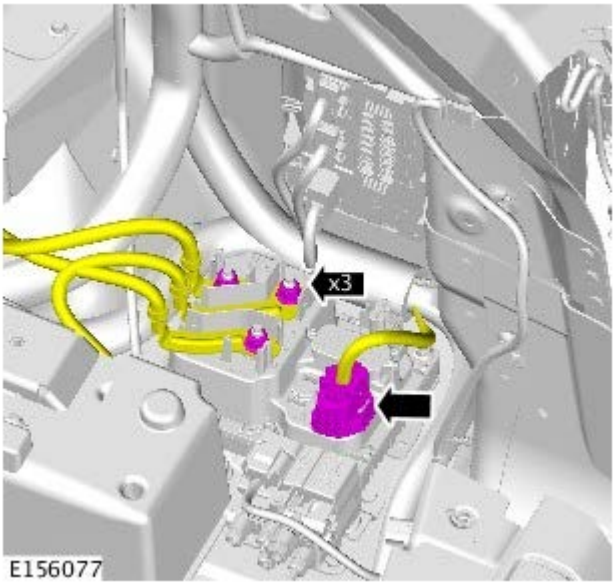
4.



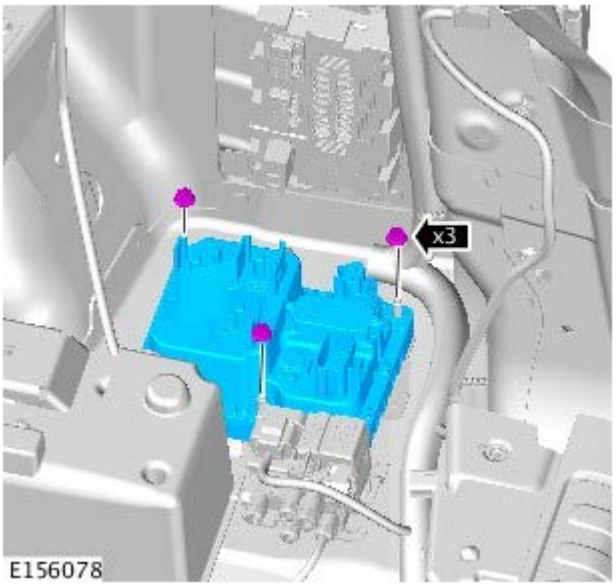
5.



6. *Torque:* 9 Nm



7. *Torque:* 9 Nm



Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 13-May-2013

Module Communications Network - Gateway Module

Removal and Installation

Removal

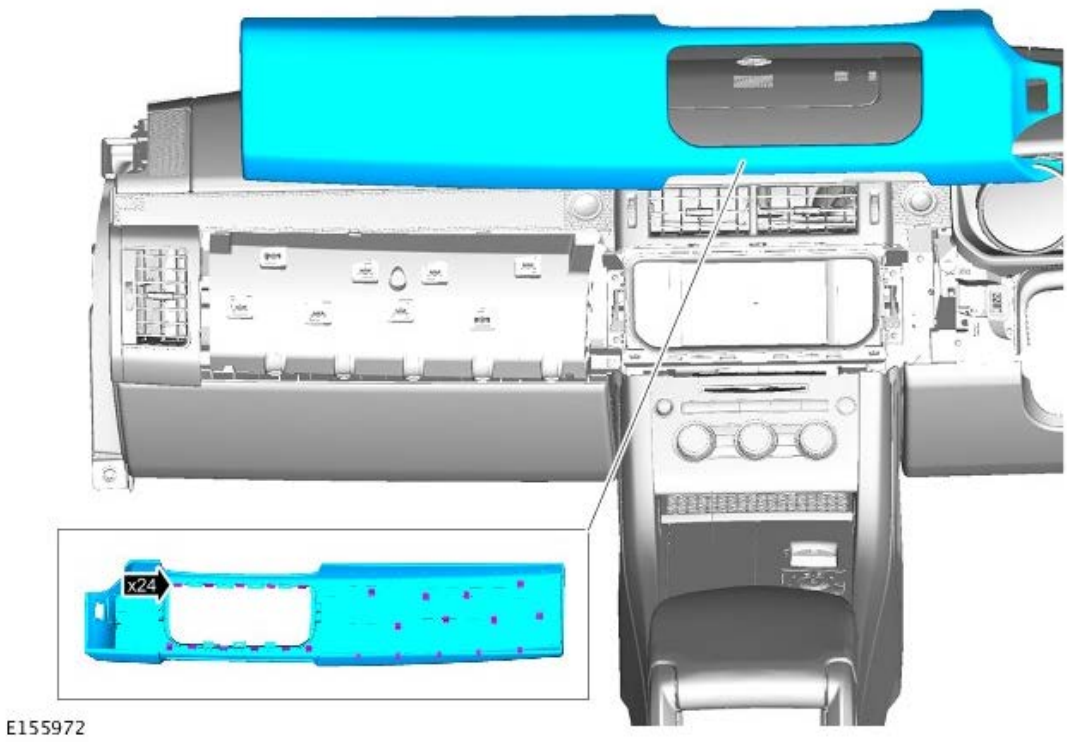
NOTES:

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

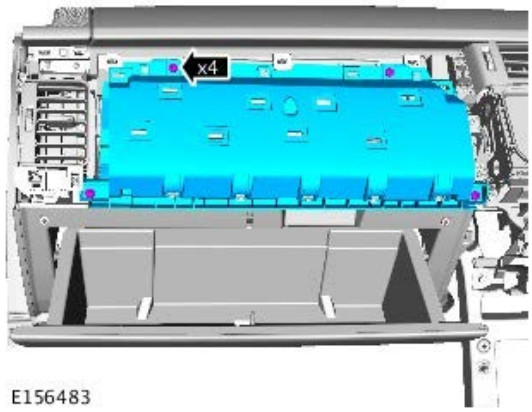
Engine shown removed for clarity.

Removal steps in this procedure may contain installation details.

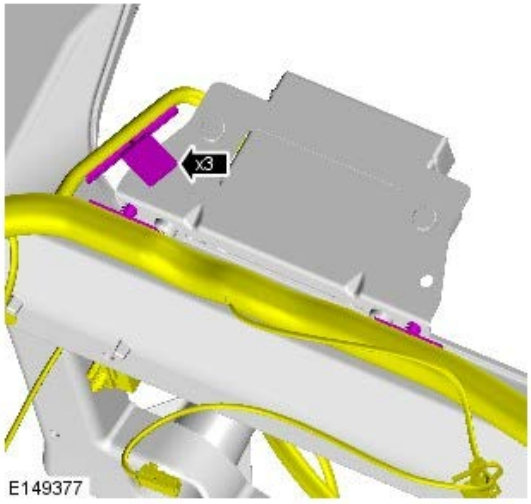
1. NOTE: Release the trim clips from the middle to the sides, failure to follow this instruction may result in damage to the retaining frame.



2.

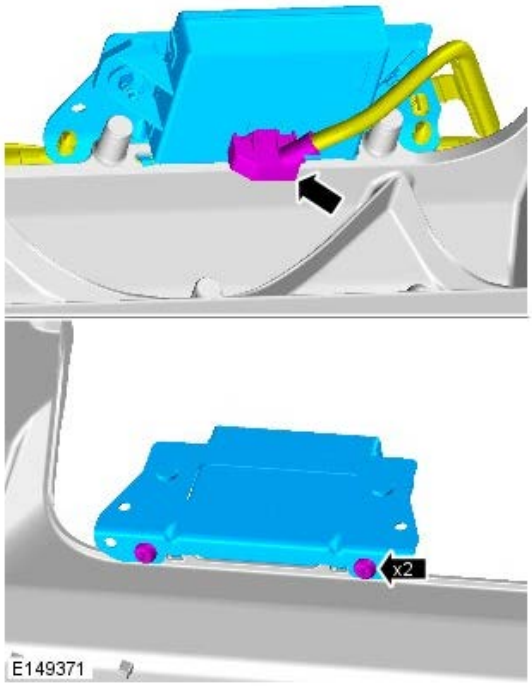


3.

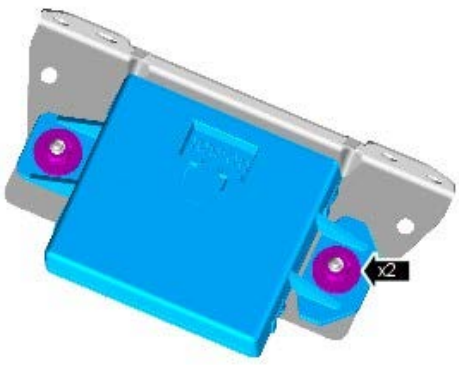


4. CAUTION: Install all the bolts finger tight before final tightening.

   Torque: 9 Nm



5. *Torque:* 5 Nm



E149452

Installation

1. To install, reverse the removal procedure.
2. If a new component is to be installed, configure using Land Rover approved diagnostic equipment.

Published: 04-Apr-2013

Module Communications Network - Quiescent Current Control Module

Removal and Installation

Removal

NOTES:

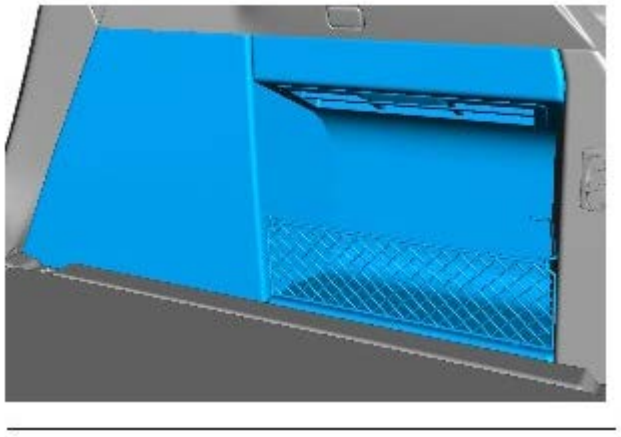
Removal steps in this procedure may contain installation details.

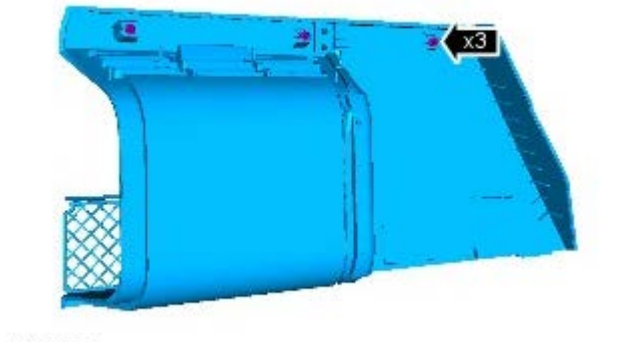
Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

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

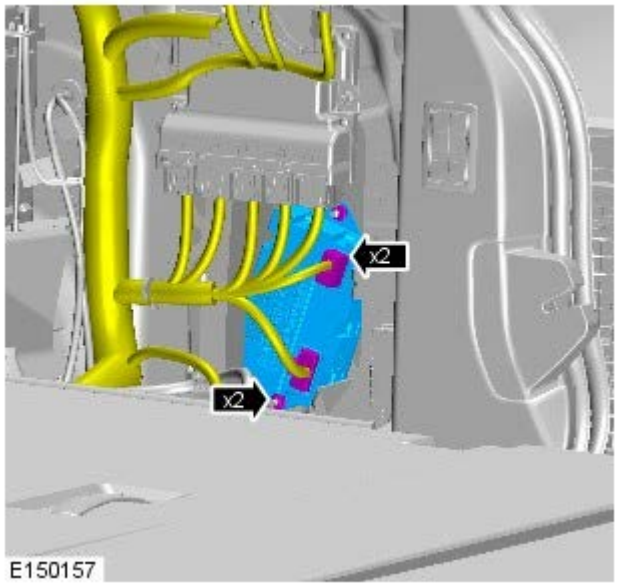
2.





E145529

3. *Torque:* 9 Nm



E150157

Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 07-Jan-2013

Wiring Harnesses -

Torque Specifications

Description	Nm	lb-ft
TDV6 3.0L		
FEAD idler pulley bracket bolts	9	6
Engine harness cover bolts	10	7
Engine harness clip bolt	10	7
TDV8 4.4L		
Boost pipe nuts	10	7
Upper injector heat shield nuts	6	4
Lower injector heat shield nuts	10	7
V8 5.0L		
Engine harness rear support bracket bolts	47	35
Wiring harness support housing bolts	6	4
Engine RH and LH bank front cover earth bolts.	10	7

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.

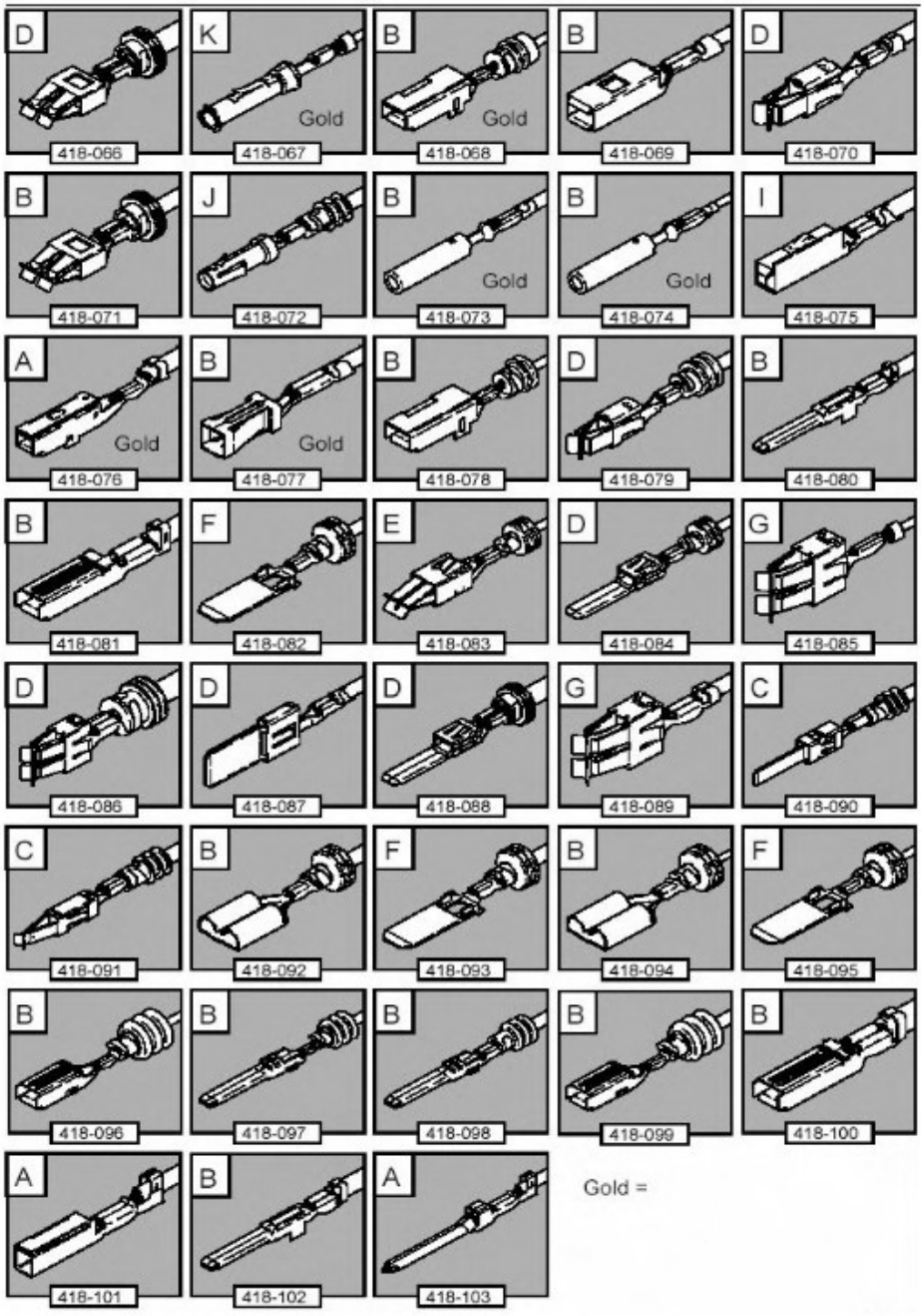
If an electrical connector terminal is not available approval for the repair is **NOT** given and in these circumstances a new wiring harness must be installed.

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

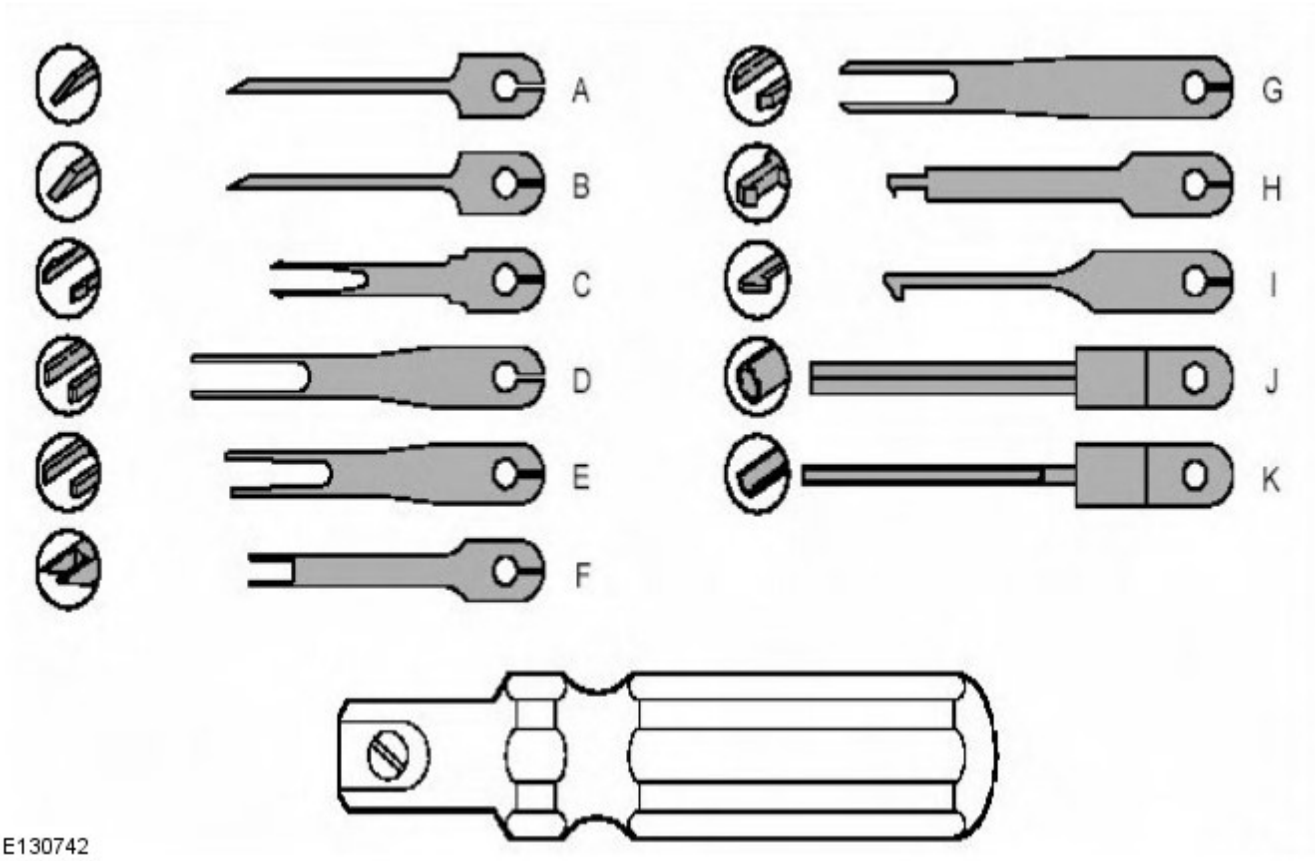
The wiring harness repair tools comprises:

- 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.

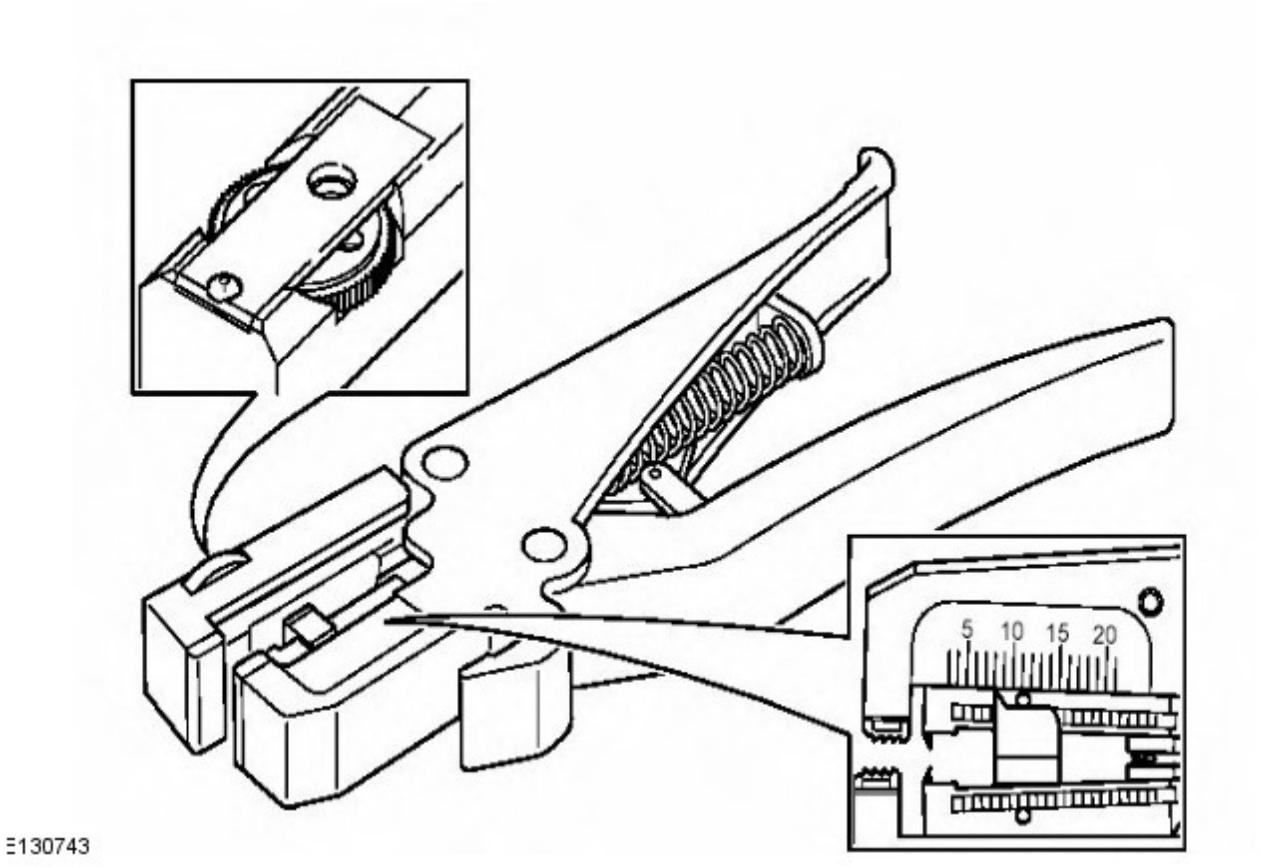
Extraction Handle and Tips



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

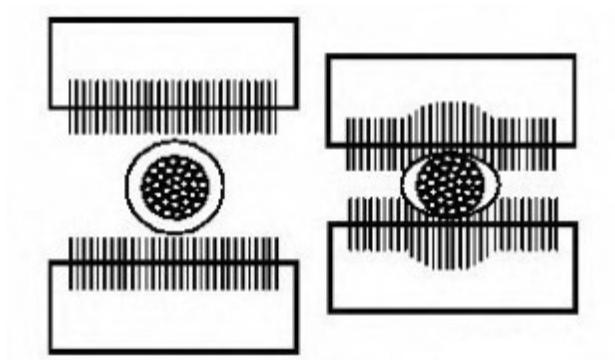


By pressing the outer edges of the wiring harness cable length stop together the adjuster can be slid up or down the jaw. This decreases or increases the length by which the wiring harness cable insulation will be stripped from the

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.

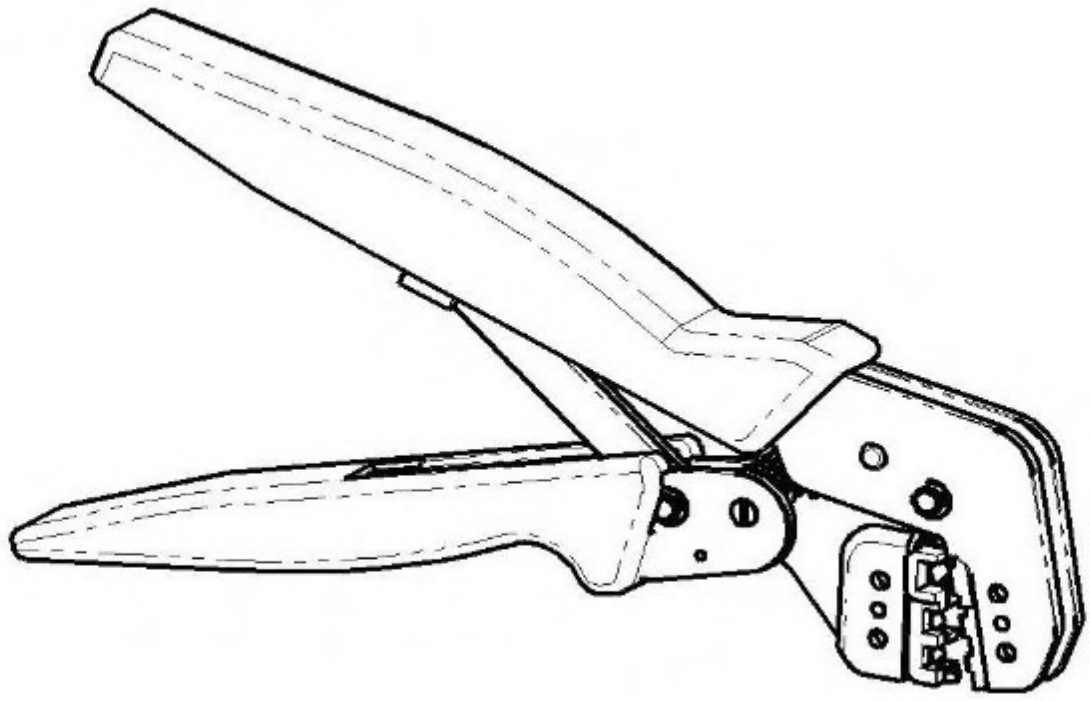
Cable Correctly Gripped in Stripper Blades



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

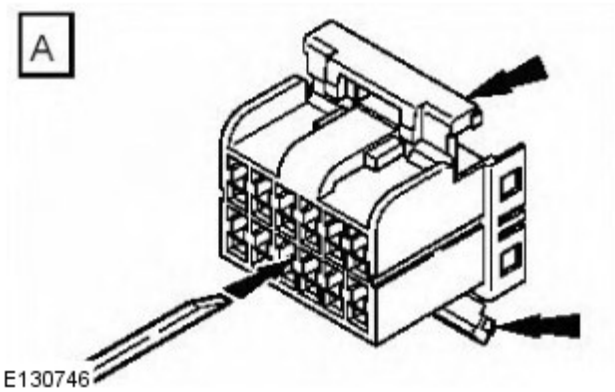
Electrical Connector Terminal Extraction

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.

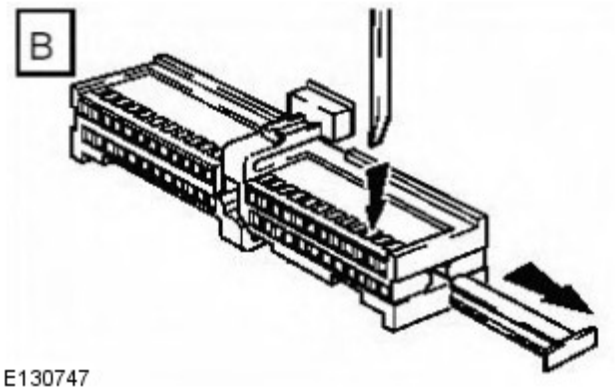
Various types of electrical connector have seals installed internally or externally to prevent moisture ingress. These normally do not have to be removed but make sure that they are installed when the electrical connectors are connected.

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.

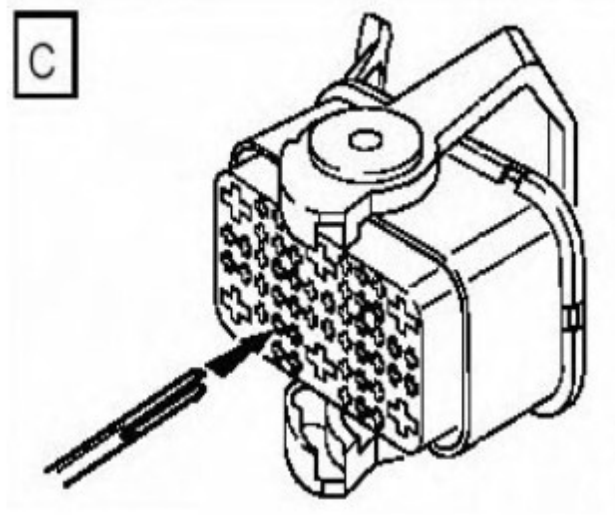
NOTE: **Examples of the extraction tips and anti-backout tips.**

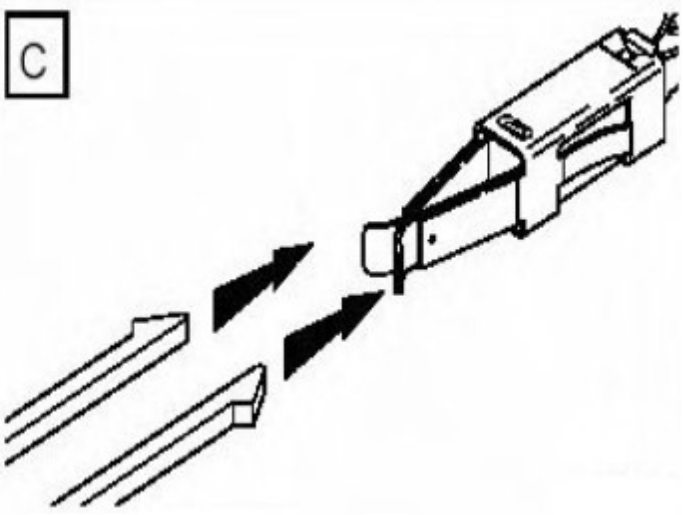


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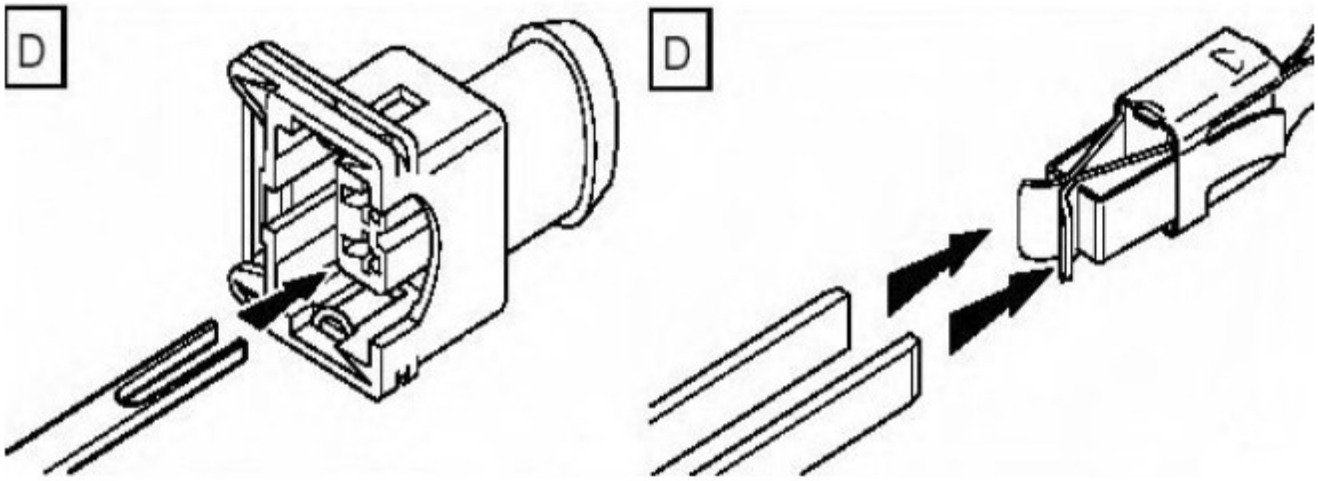


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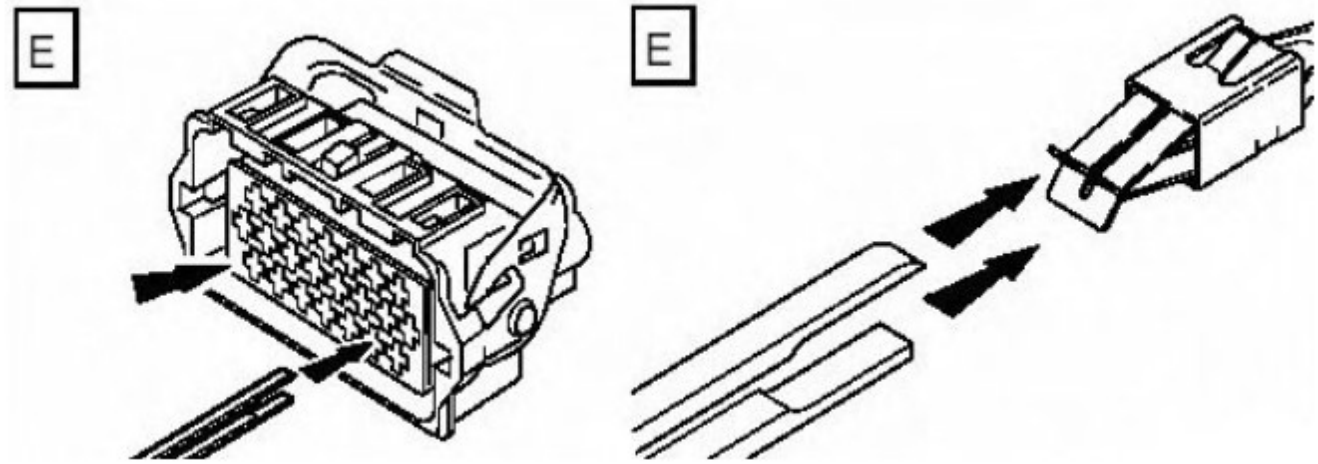




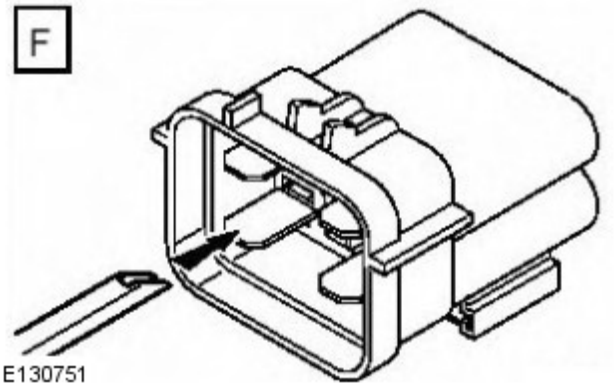
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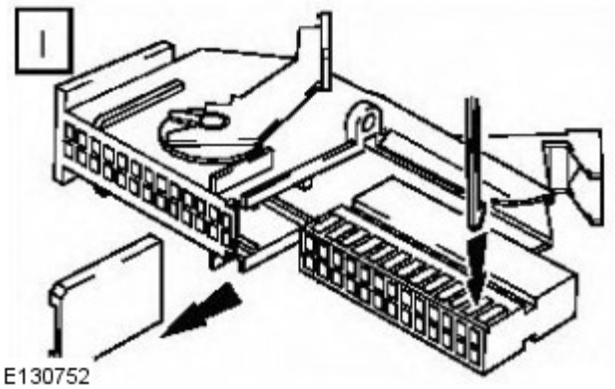
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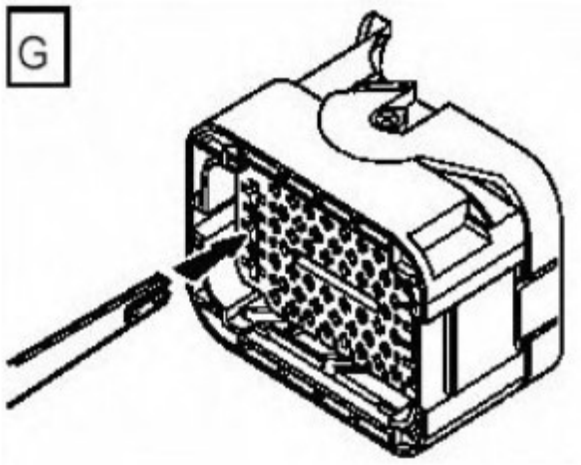
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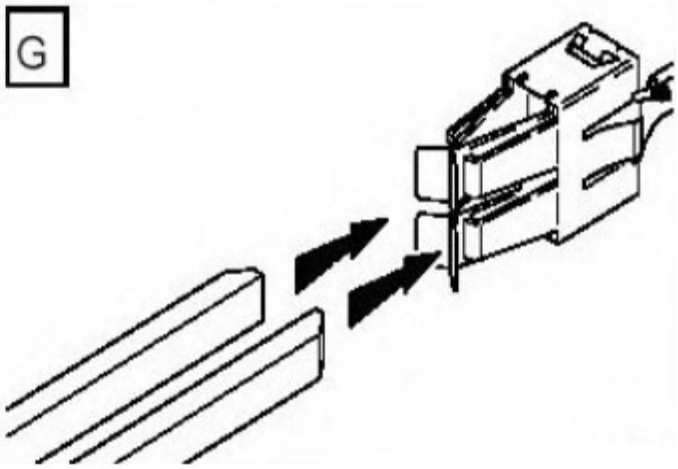


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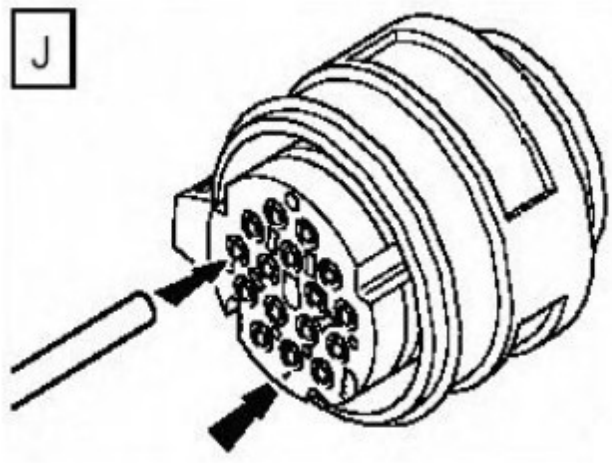


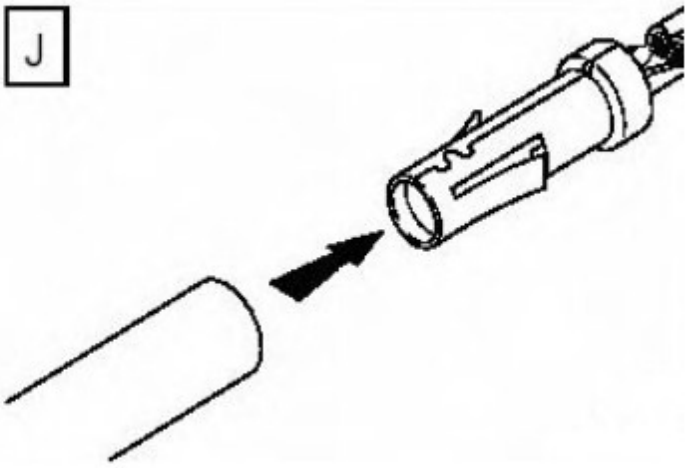
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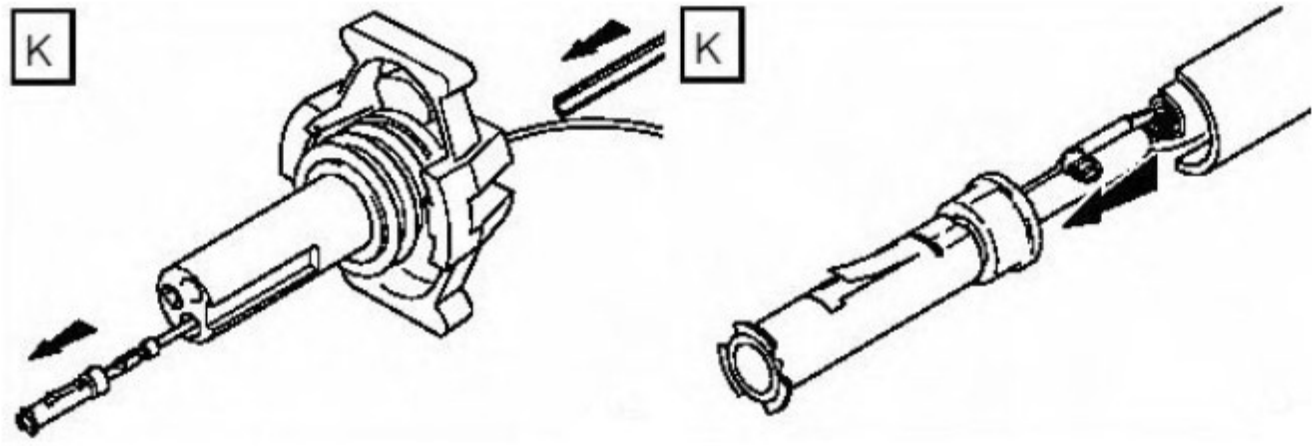


E130753





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:

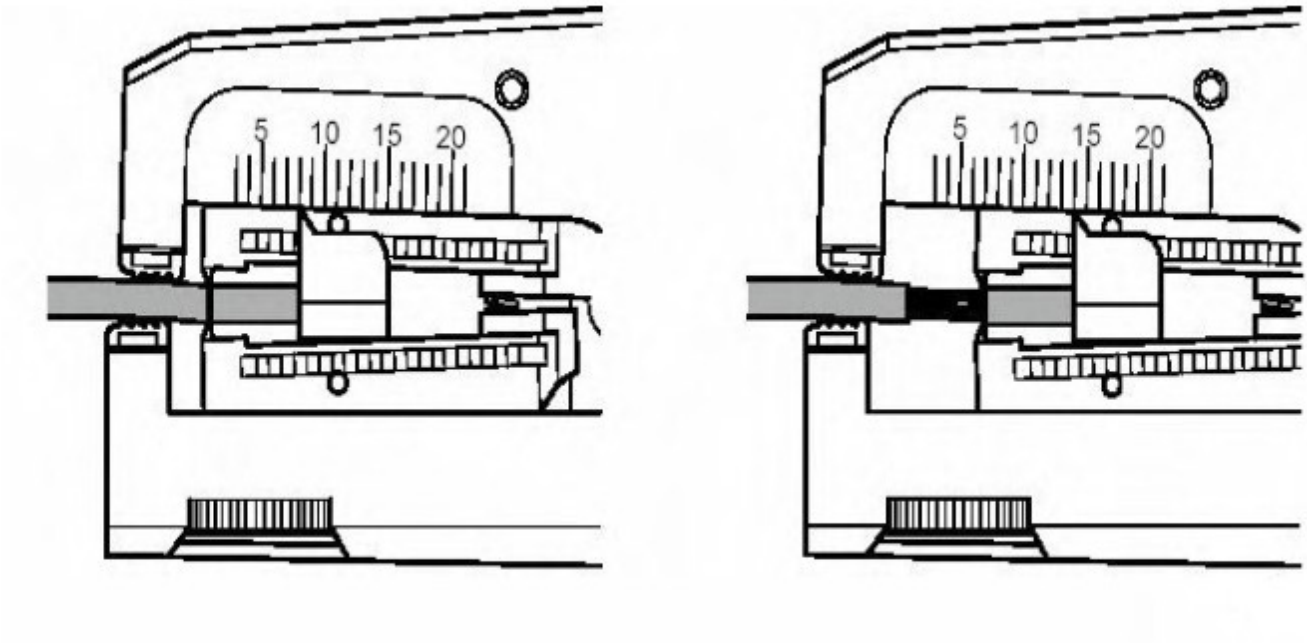
    When using a heat source make sure that it is localised and causes no damage to surrounding materials.

    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

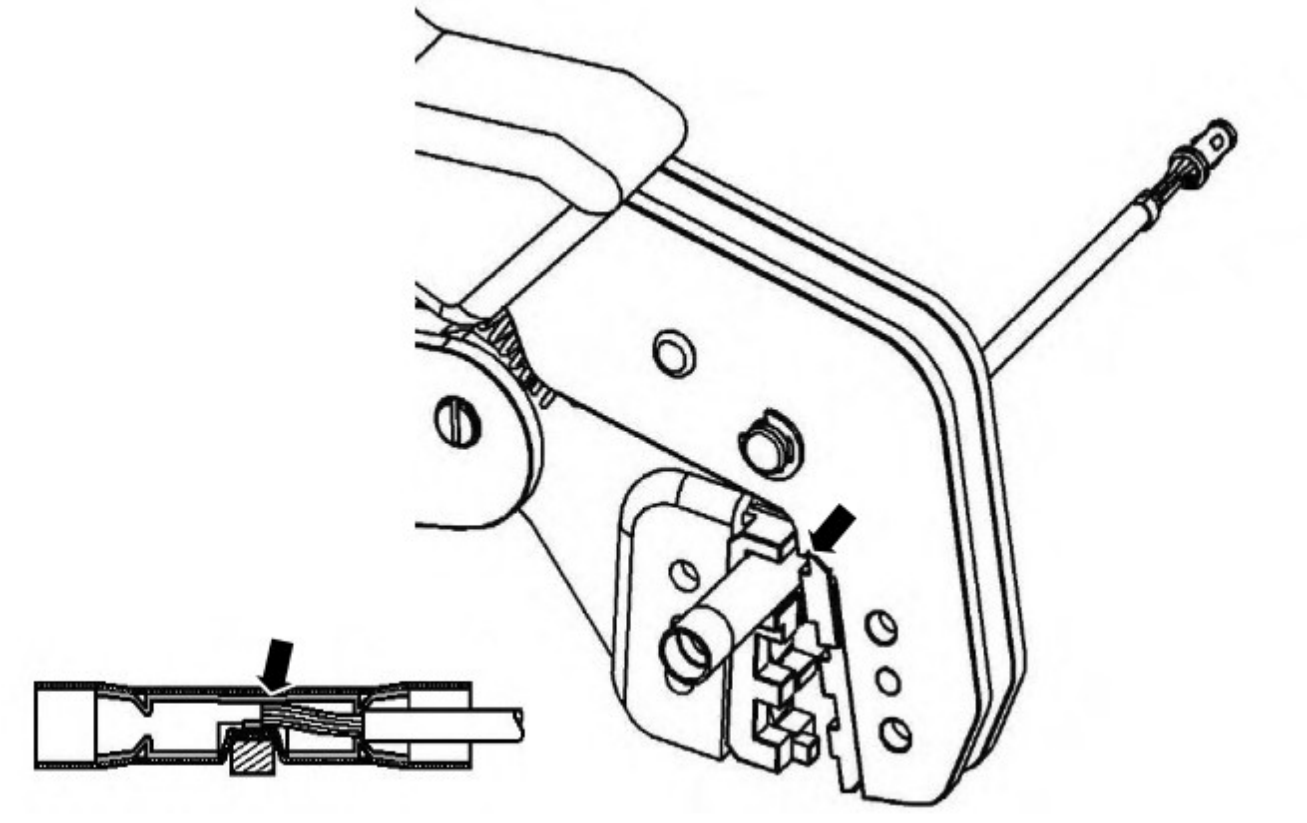
right to the electrical connector as the terminals must have a little movement and not be firmly bound to the electrical connector or wiring harness. Make sure that the cable identification sleeve(s) are showing at the wiring harness electrical connector.

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: 20-Aug-2013

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.

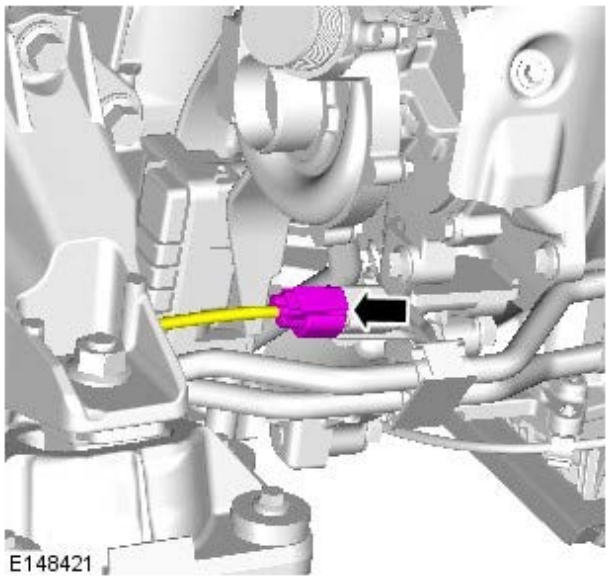
Removal steps in this procedure may contain installation details.

1. Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

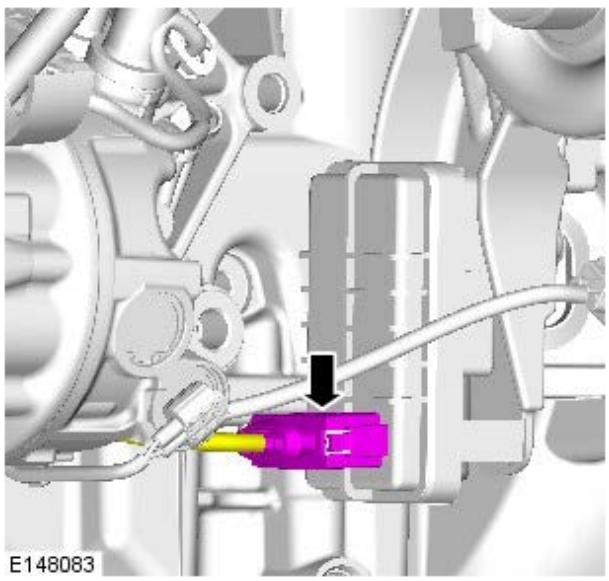
2. Refer to: Exhaust Gas Recirculation (EGR) Valve LH (303-08A Engine Emission Control - TDV6 3.0L Diesel, Removal and Installation).

3. Refer to: Air Conditioning (A/C) Compressor - TDV6 3.0L Diesel (412-01A, Removal and Installation).
   Refer to: Electric Air Conditioning (A/C) Compressor (412-01B, Removal and Installation).

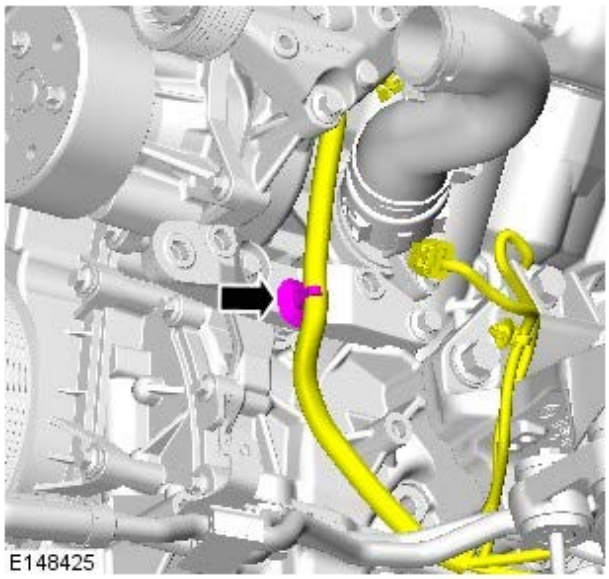
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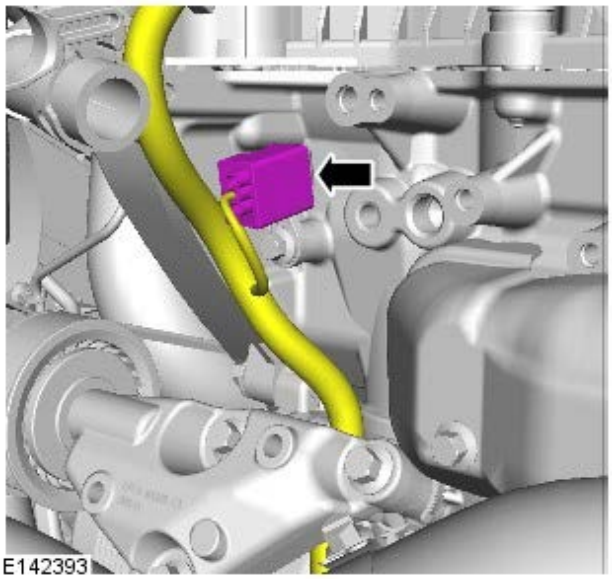
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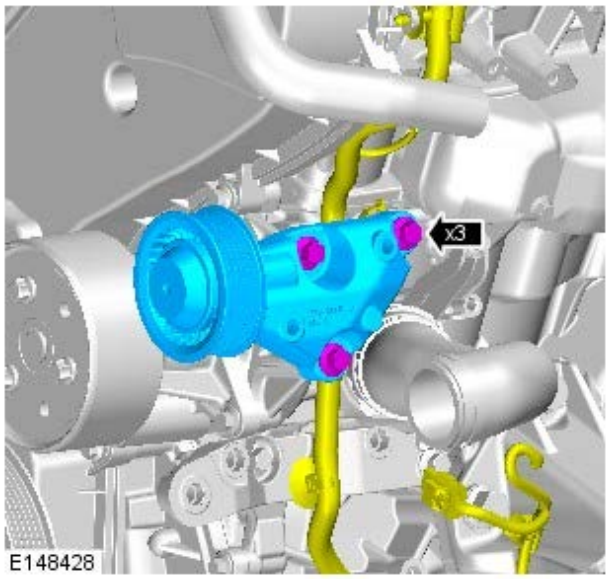
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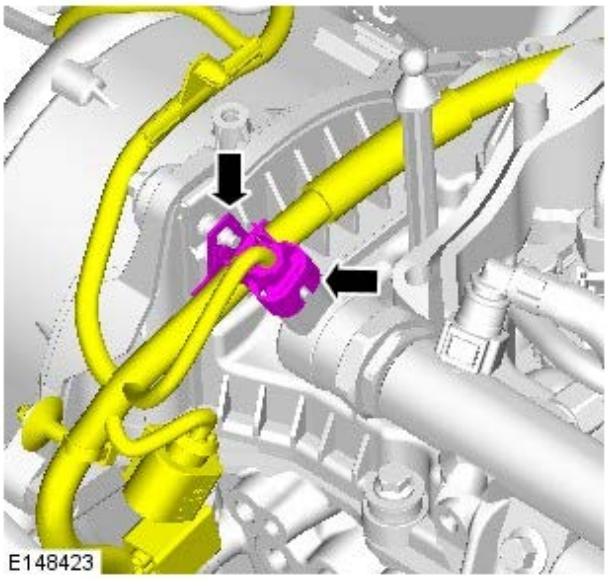
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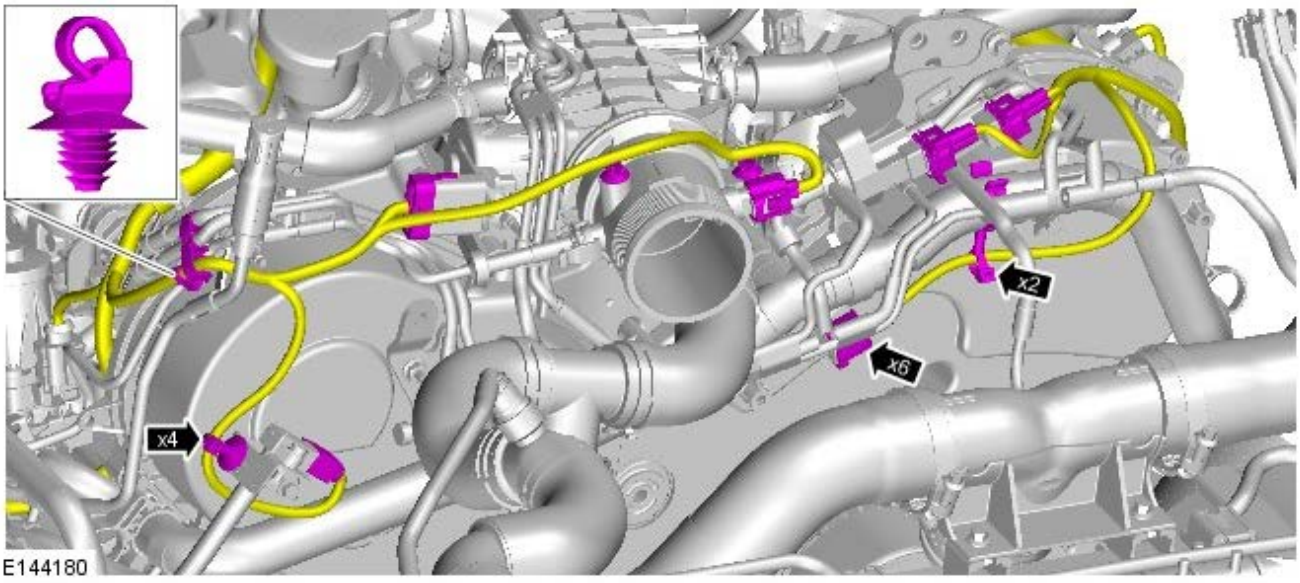
8. *Torque:* 9 Nm



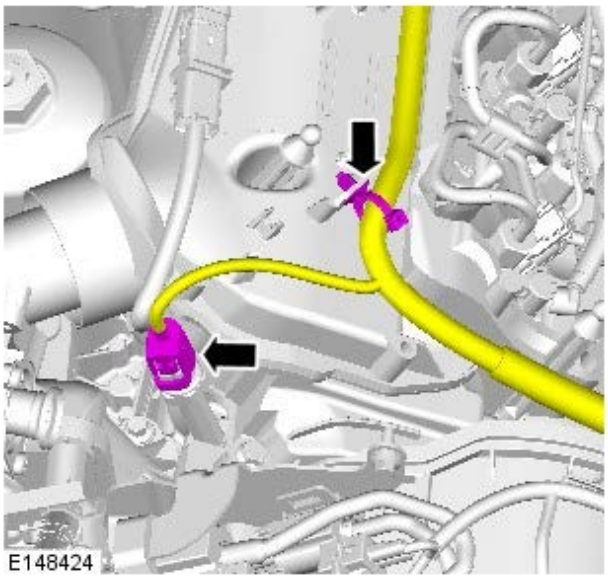
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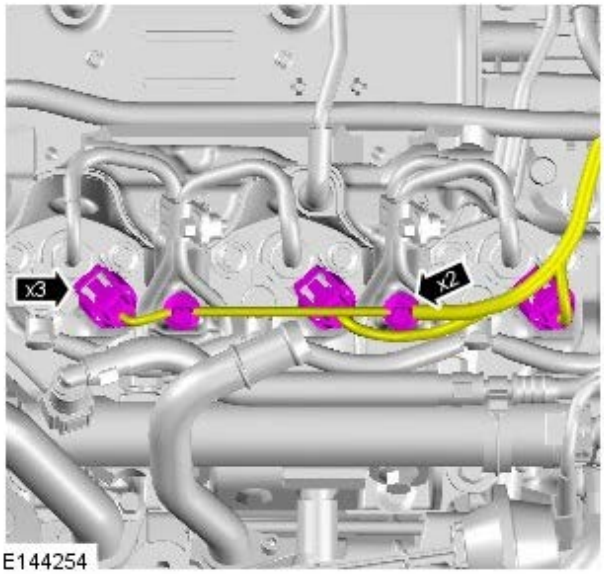
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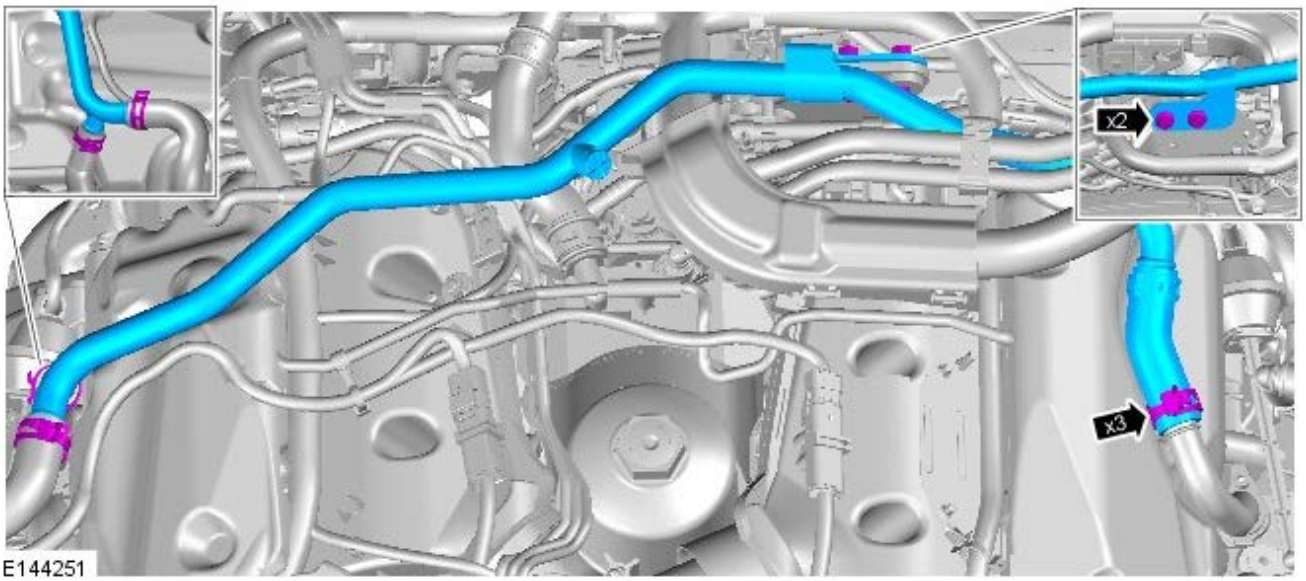
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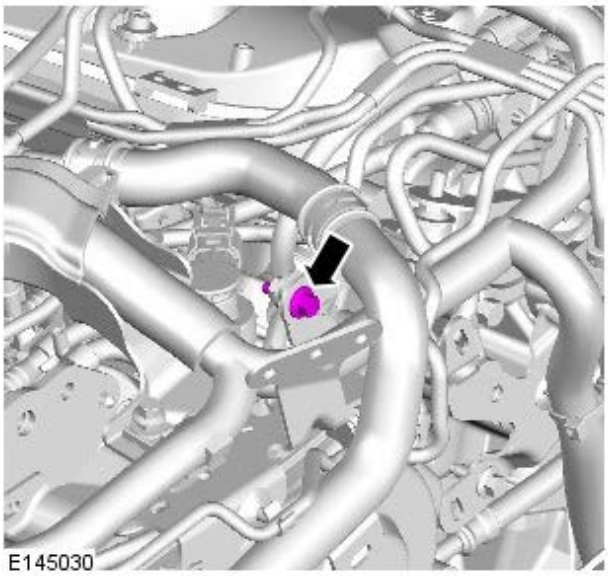
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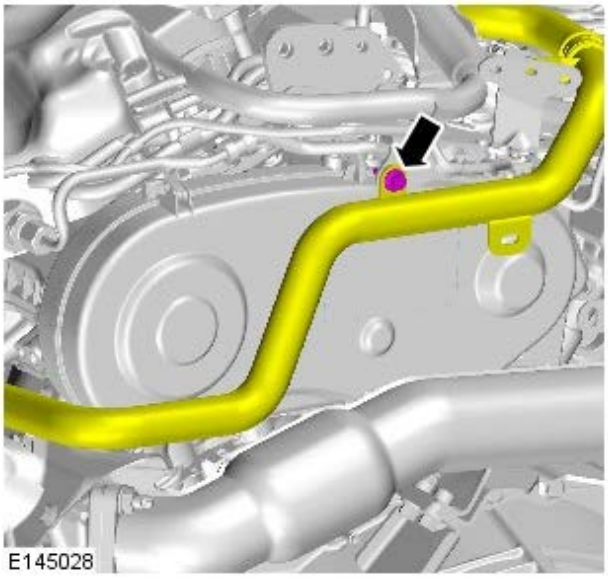
14. *Torque:* 10 Nm



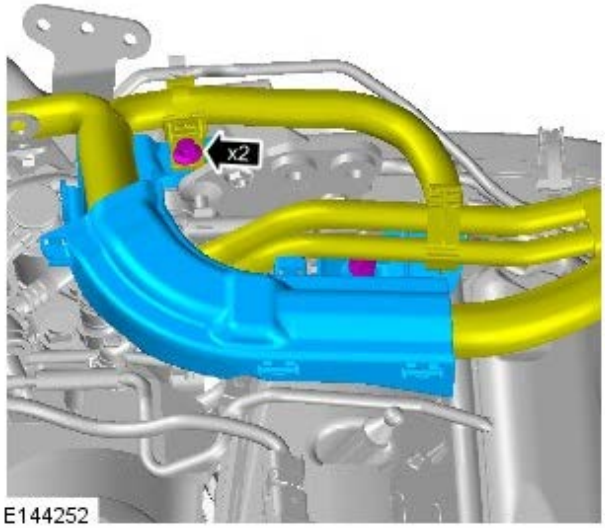
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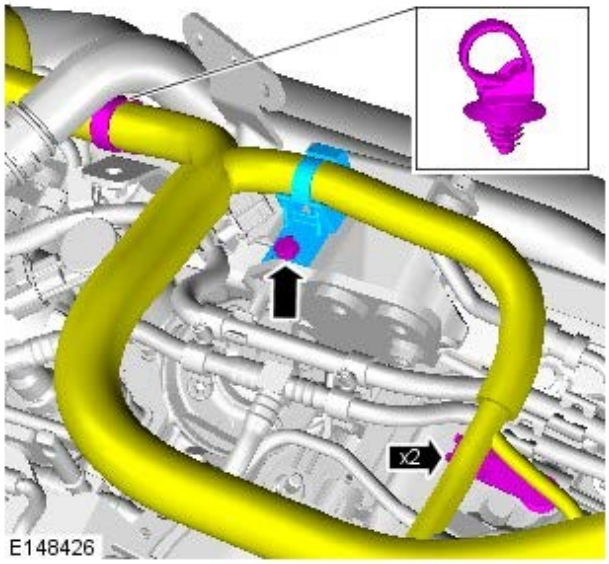
16. *Torque:* 10 Nm



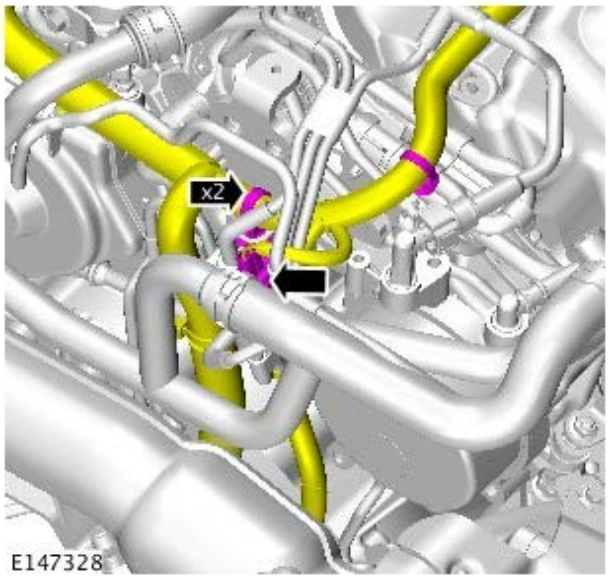
17. *Torque:* 10 Nm



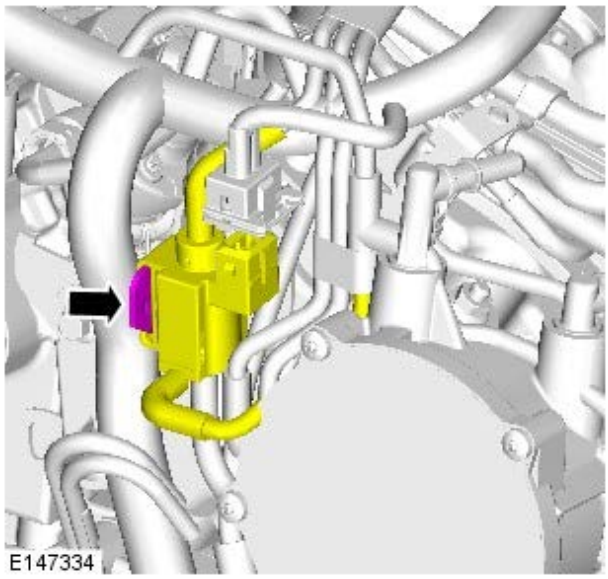
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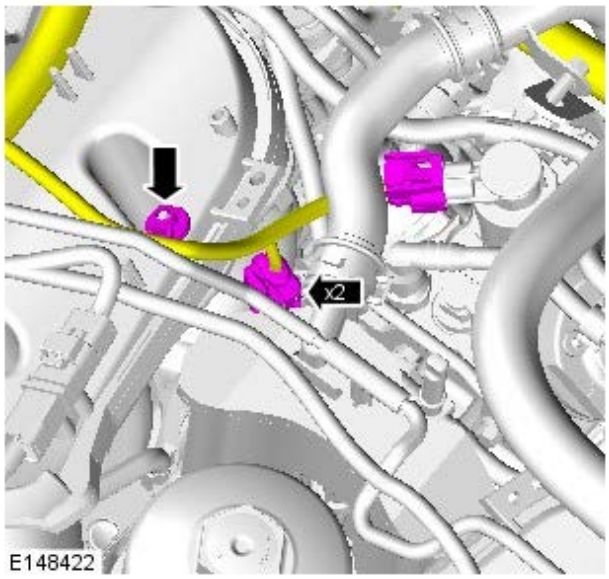
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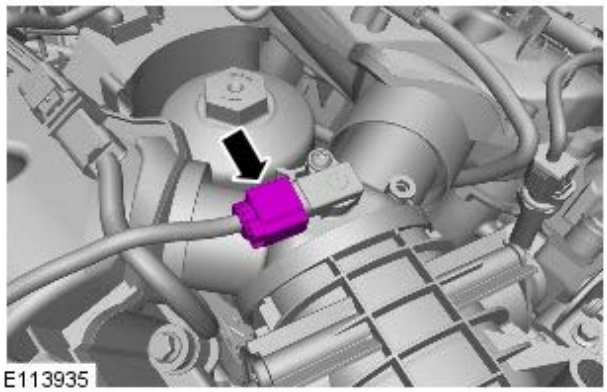
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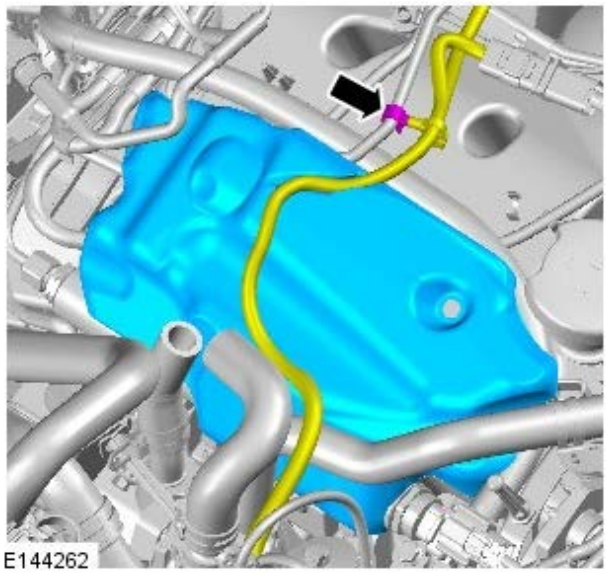
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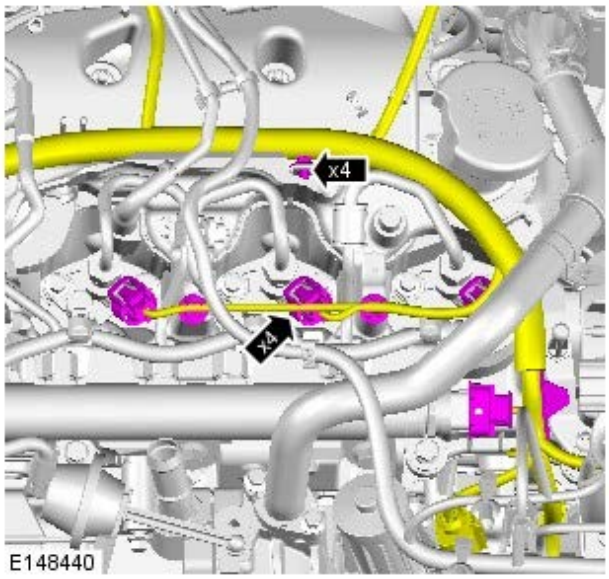
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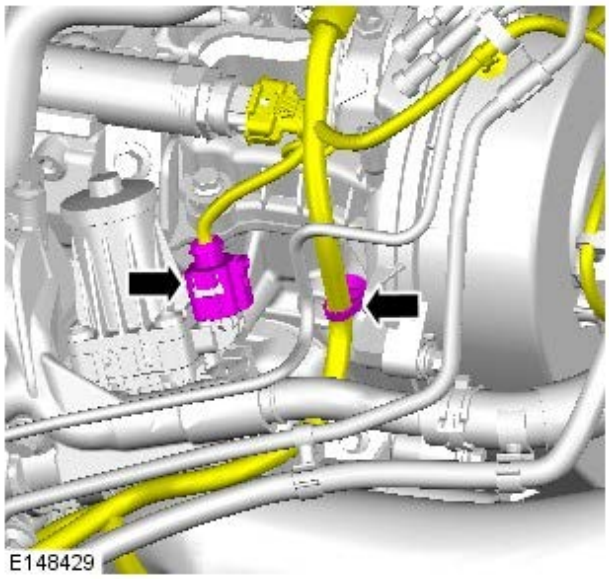
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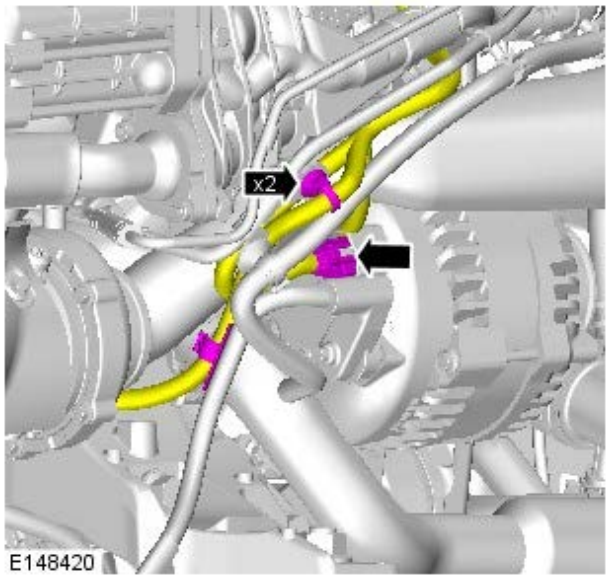
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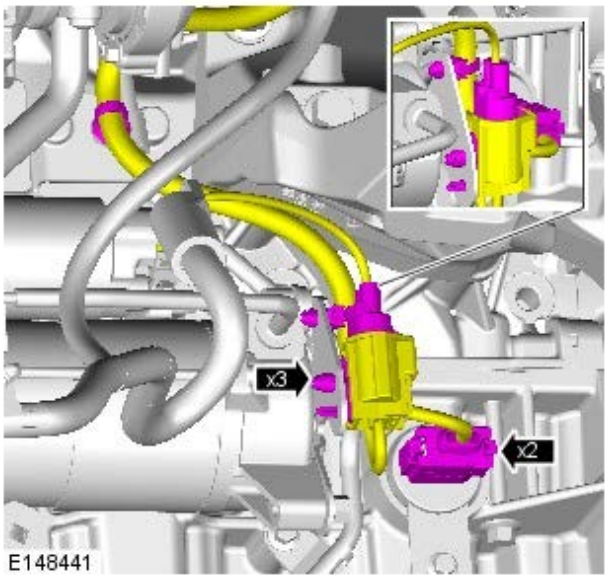
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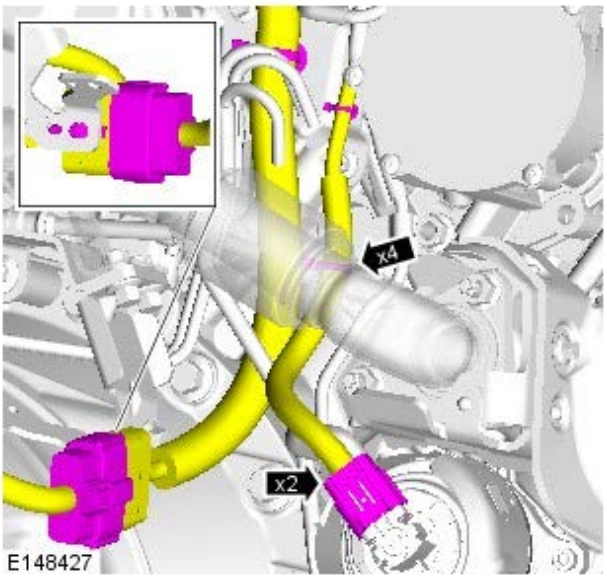
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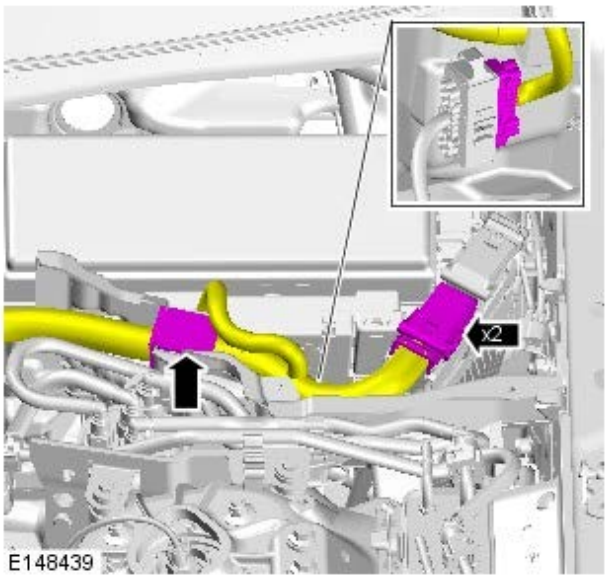
27.



28.



29. NOTE: Right-hand shown, left-hand similar.

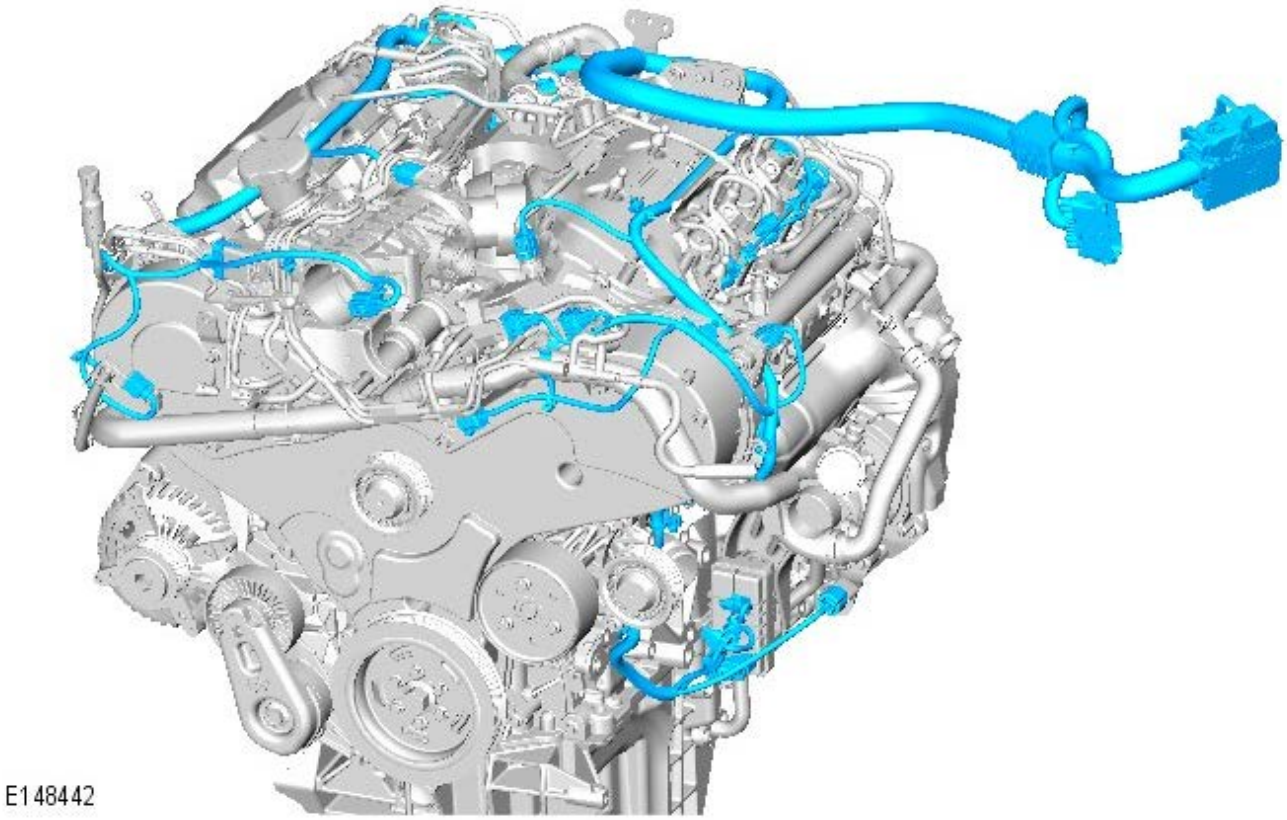


30. CAUTION: Take extra care not to damage the wiring harnesses.

NOTES:

Note the position of the wiring harnesses to aid installation.

Right-hand shown, left-hand similar.



Installation

1. To install, reverse the removal procedure.

Published: 02-May-2013

Wiring Harnesses - Engine Wiring Harness V6 S/C 3.0L Petrol

Removal and Installation

Removal

CAUTION: Note of the routing of the wiring harnesses.

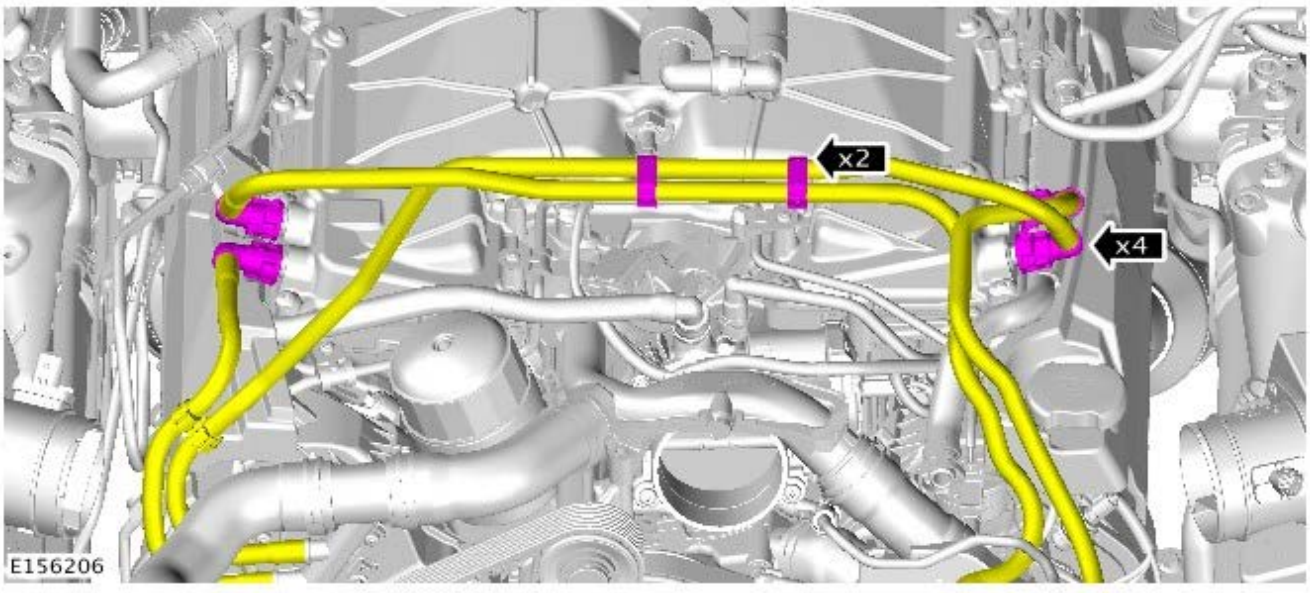
NOTES:

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

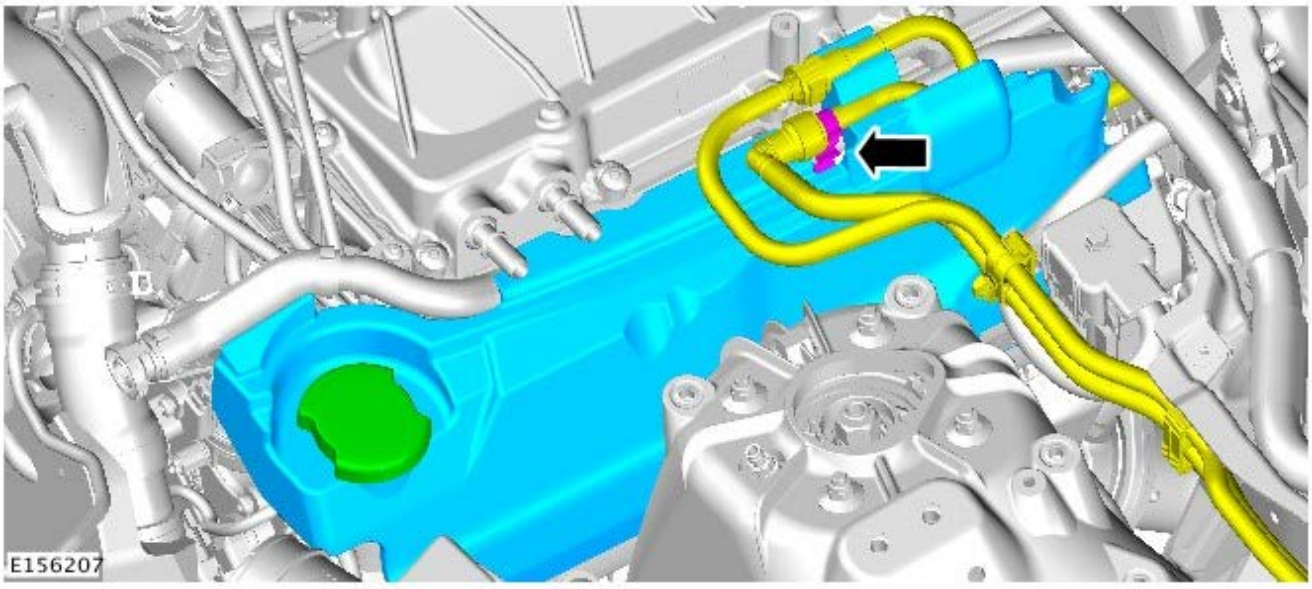
Removal steps in this procedure may contain installation details.

1. Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).
2. WARNING: Make sure to support the vehicle with axle stands.

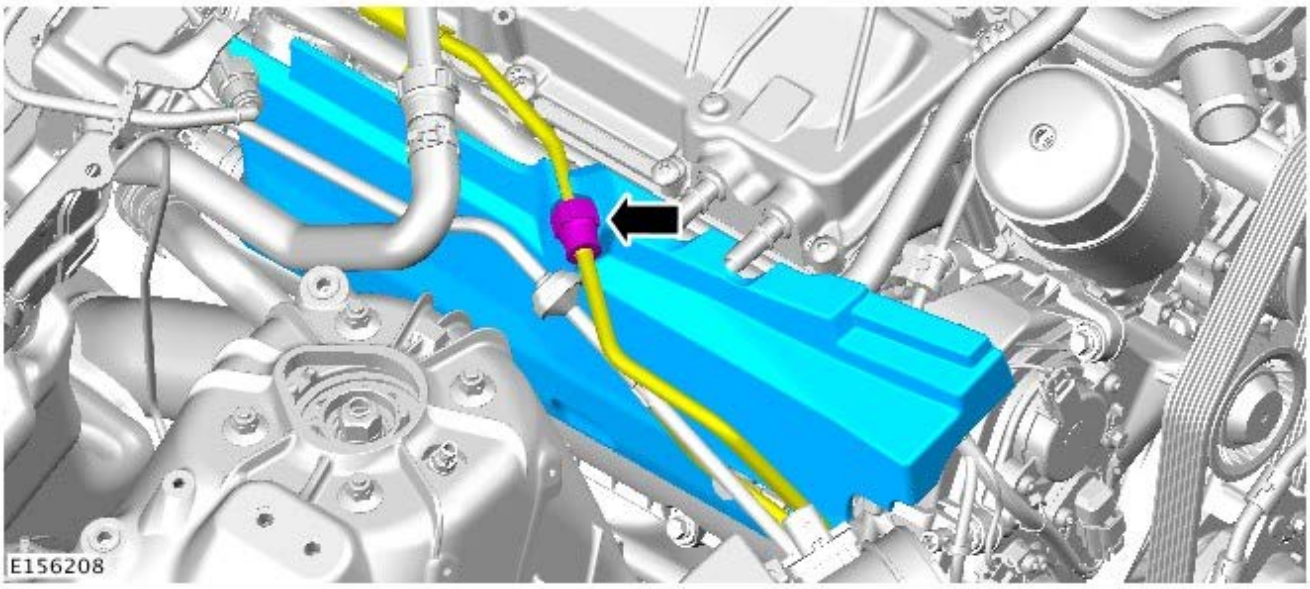
   Raise and support the vehicle.
3. Refer to: Air Cleaner Outlet Pipe LH (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).
4. Refer to: Air Cleaner Outlet Pipe RH (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).
5. Refer to: Secondary Bulkhead Center Panel - V6 S/C 3.0L Petrol (501-02 Front End Body Panels, Removal and Installation).
6. Refer to: Cooling System Partial Draining, Filling and Bleeding (303-03B Engine Cooling - V6 S/C 3.0L Petrol, General Procedures).
7. Refer to: Exhaust System (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation).
8. CAUTION: Be prepared to collect escaping coolant.



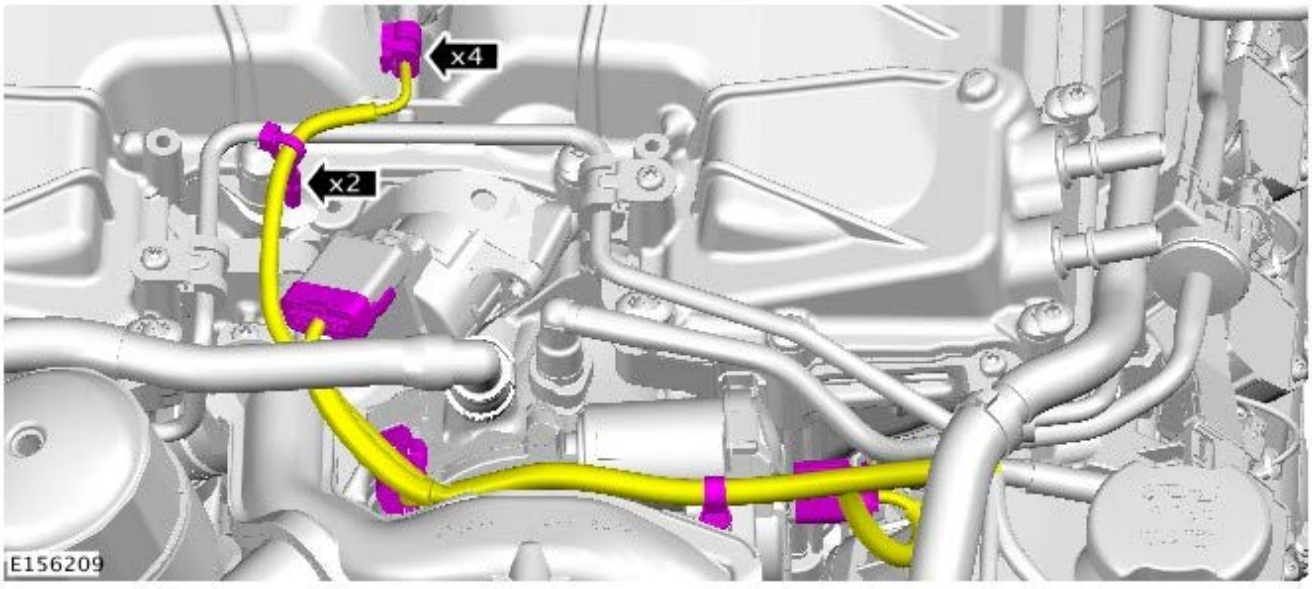
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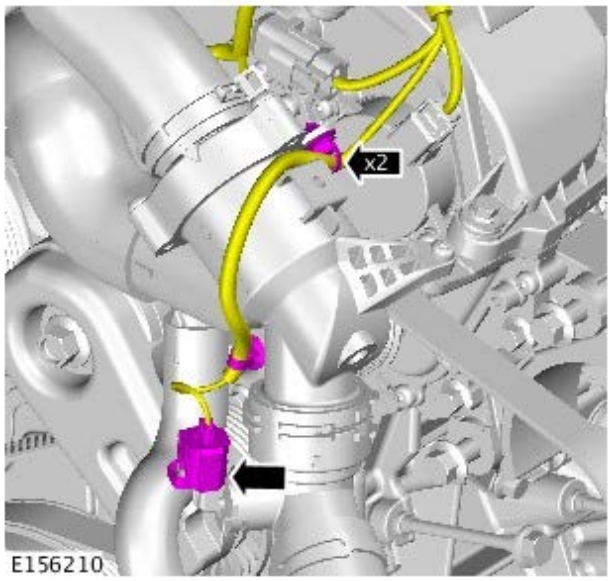
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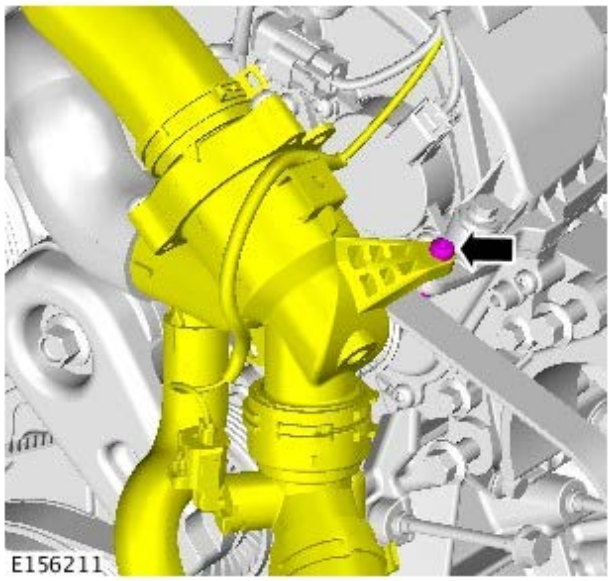
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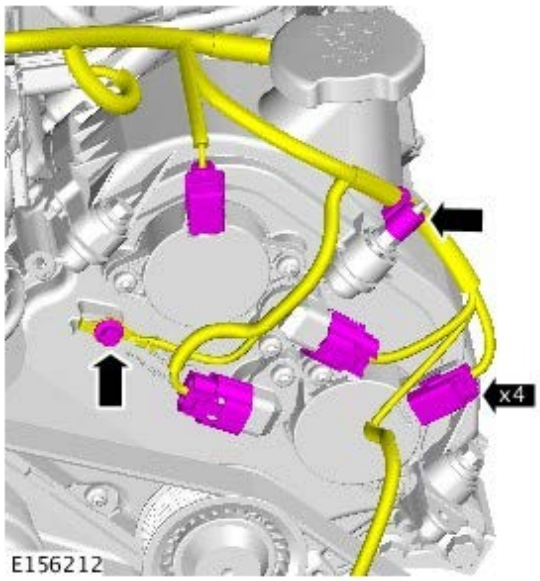
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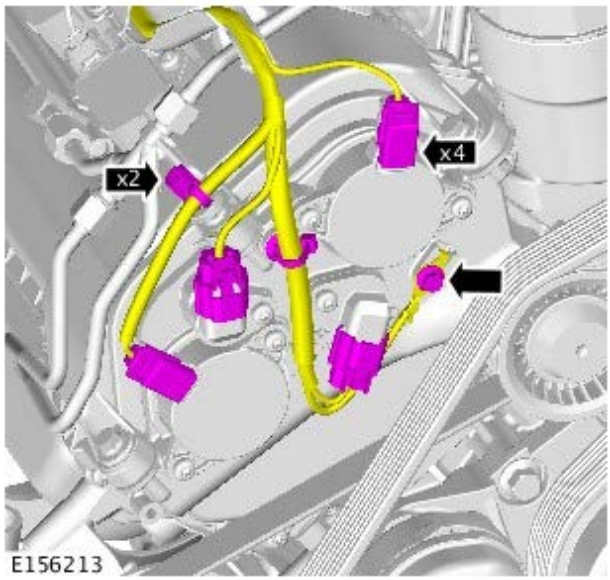
13. *Torque:* 10 Nm



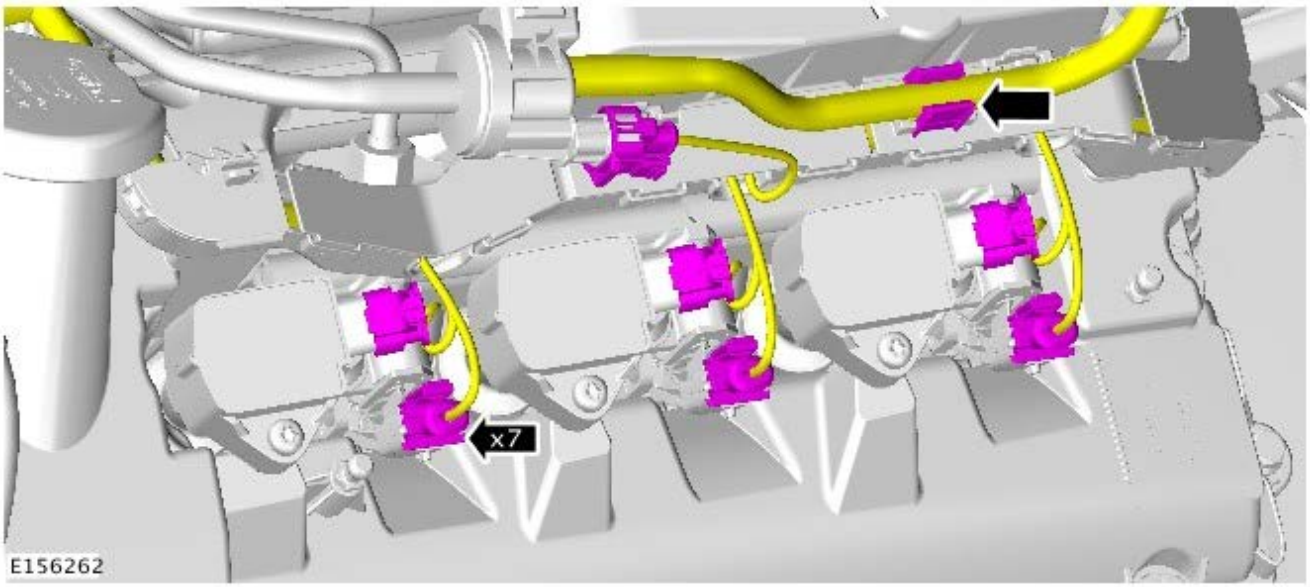
14. *Torque:* 10 Nm



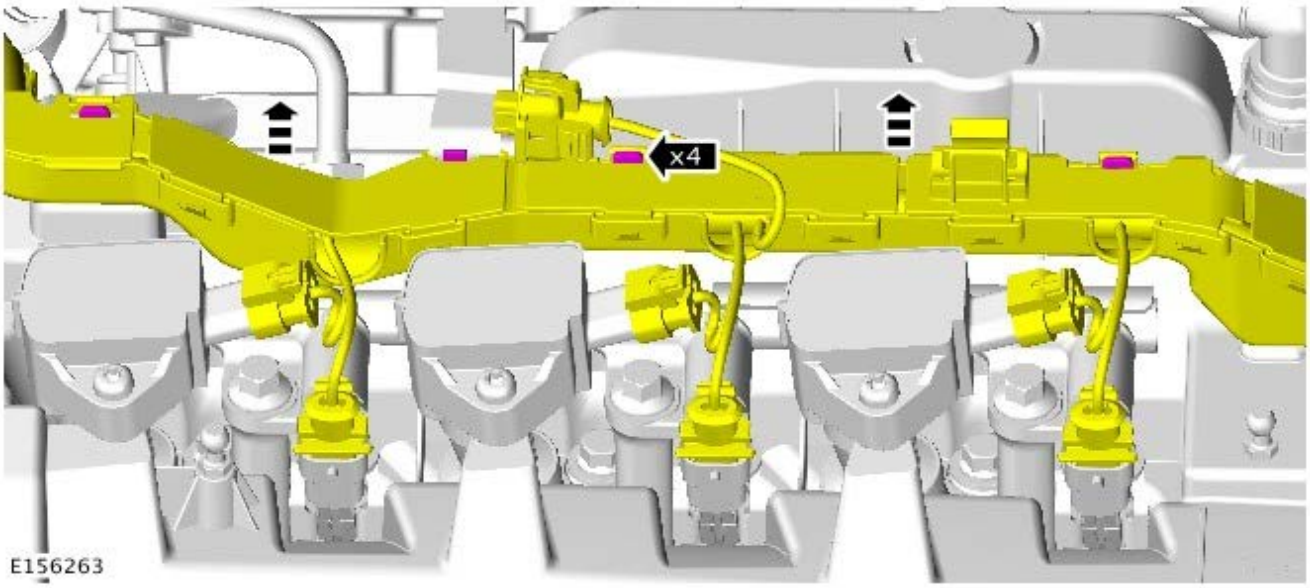
15. *Torque:* 10 Nm



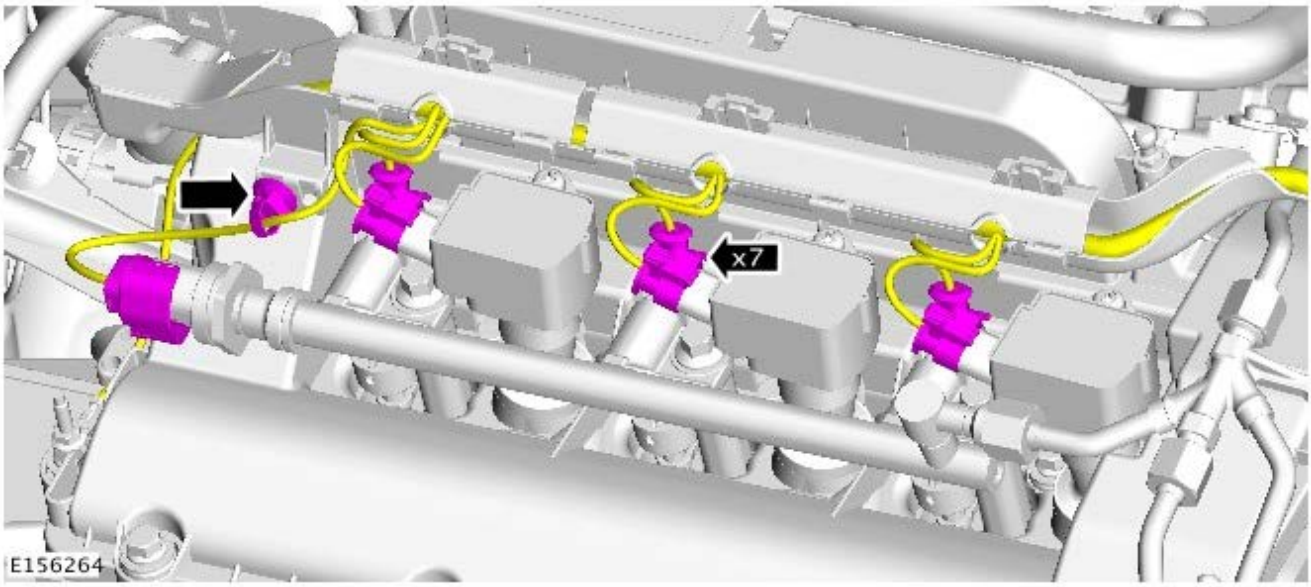
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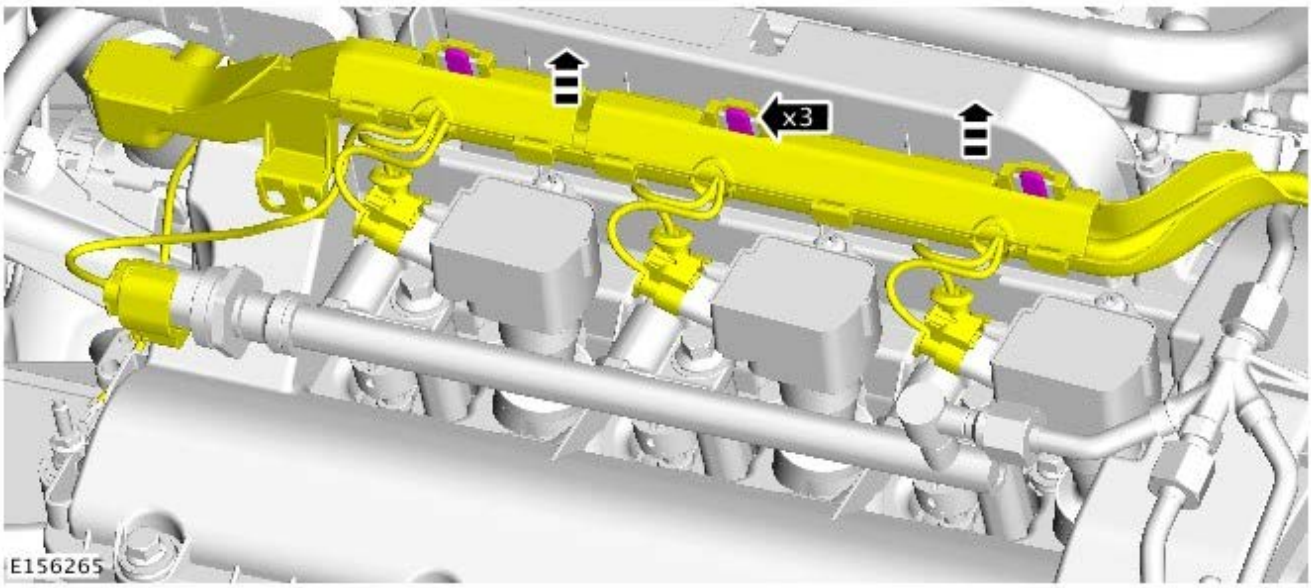
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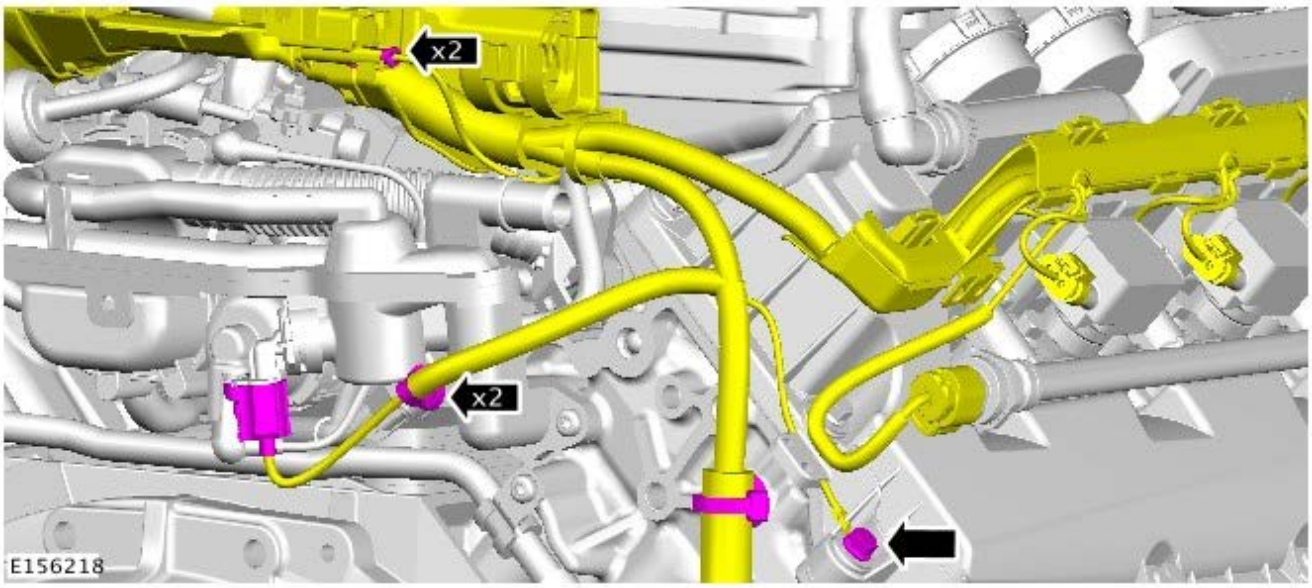
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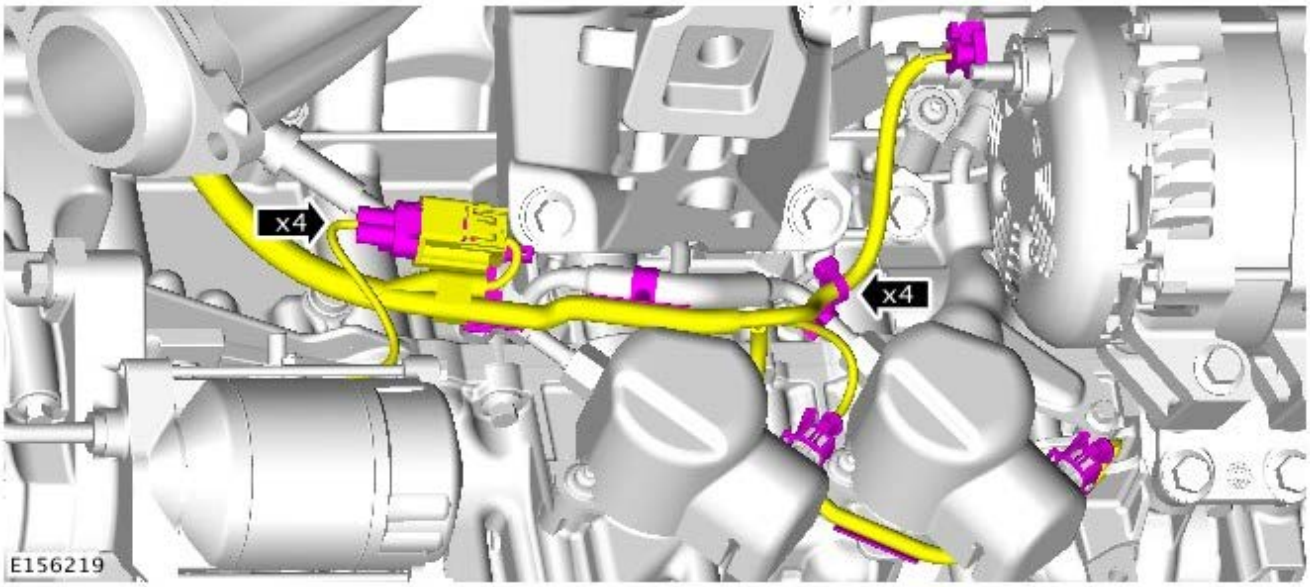
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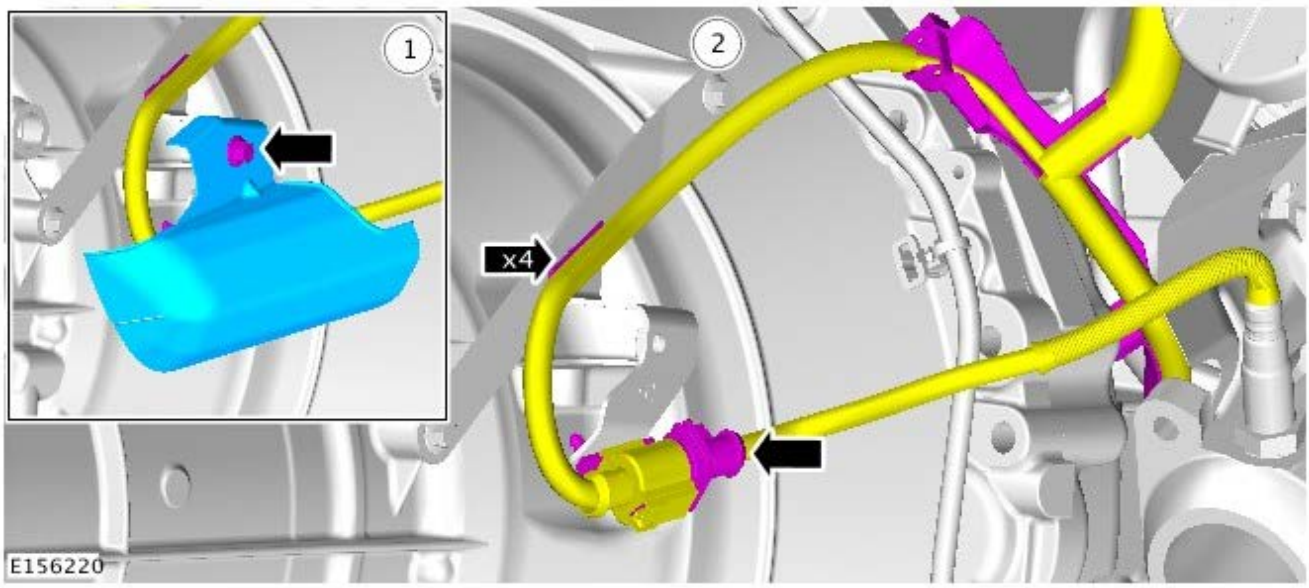
20. *Torque:* 13 Nm



21.



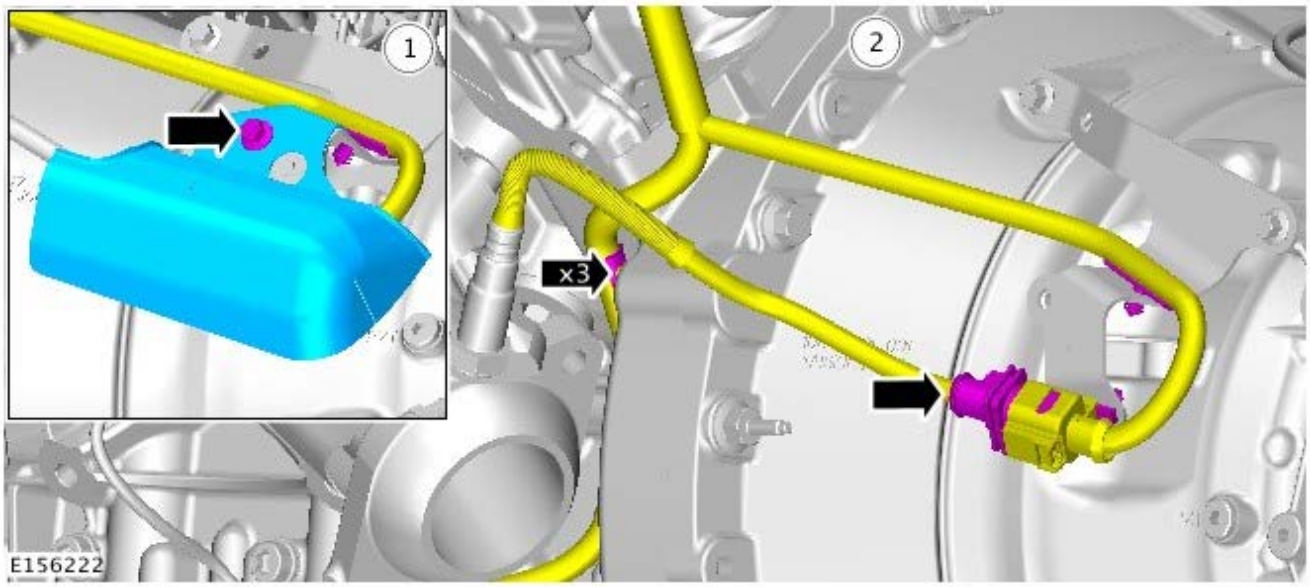
22. *Torque:* 11 Nm



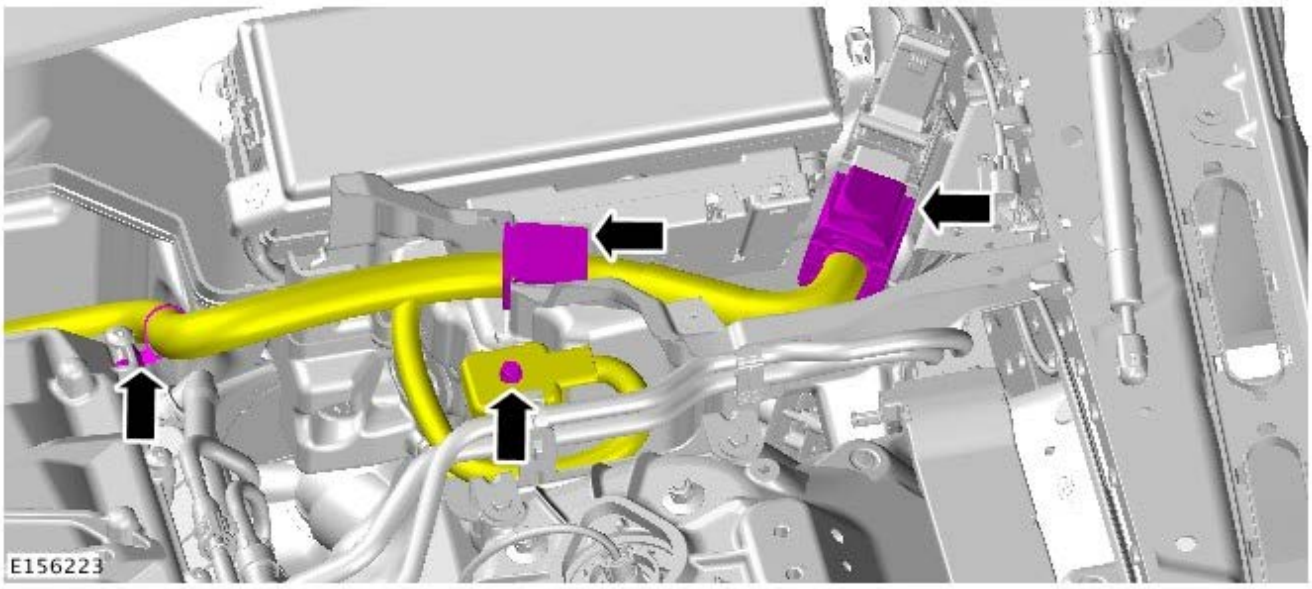
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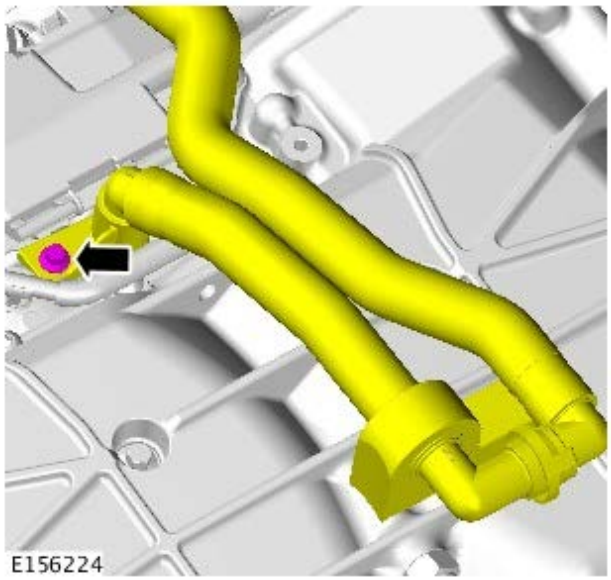
24. *Torque:* 11 Nm



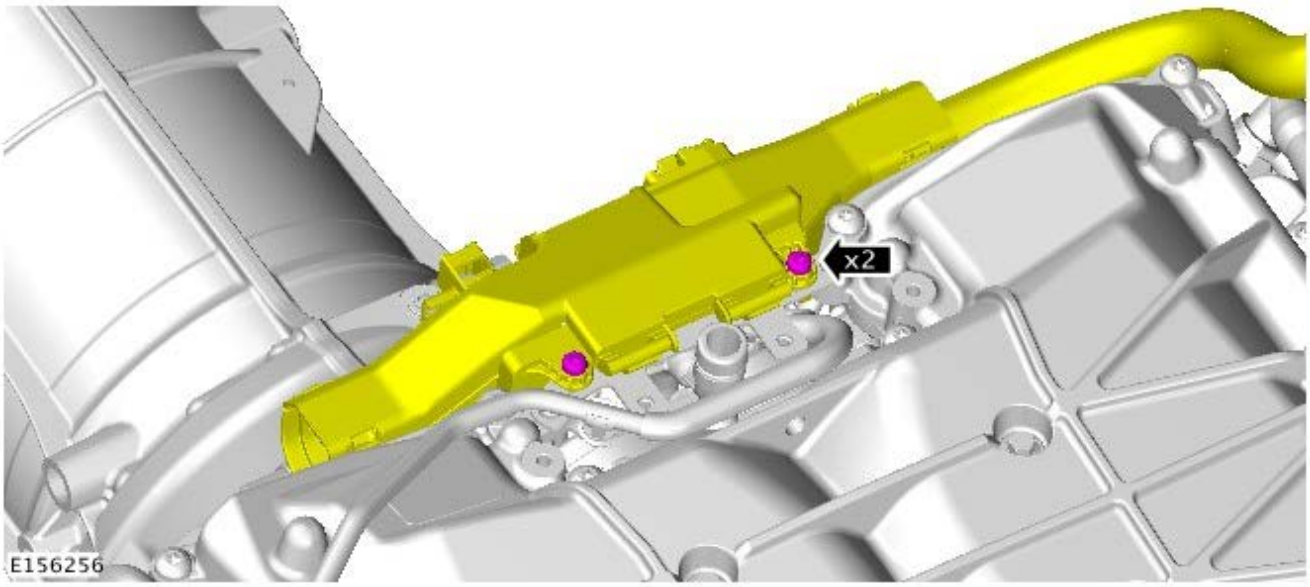
25. *Torque:* 7 Nm



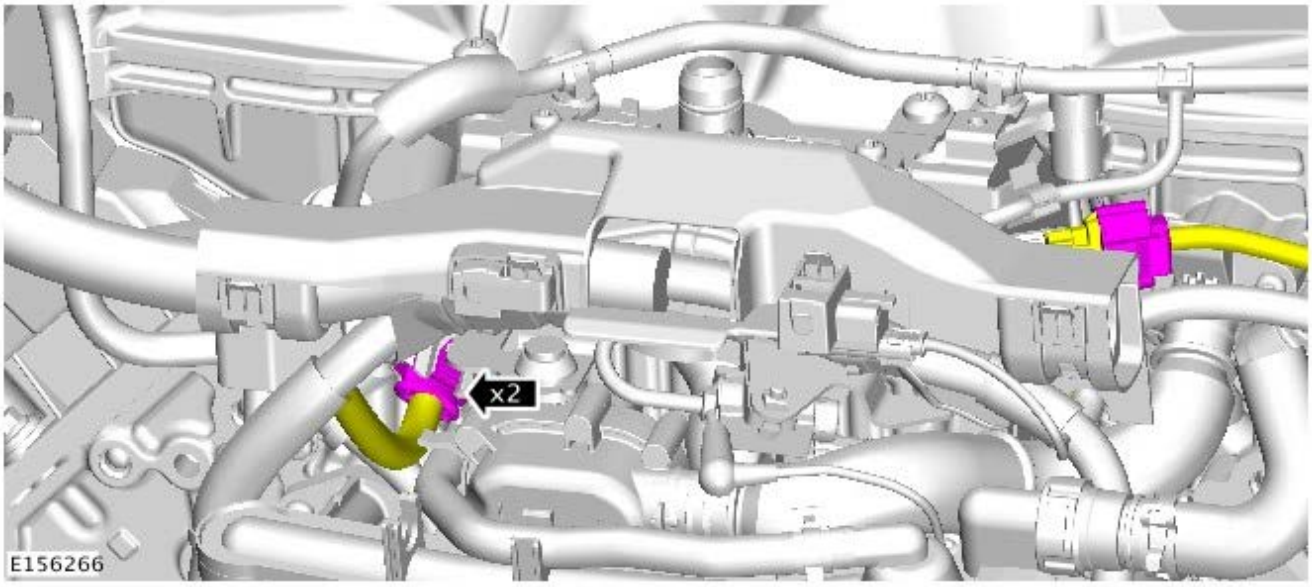
26. *Torque:* 10 Nm



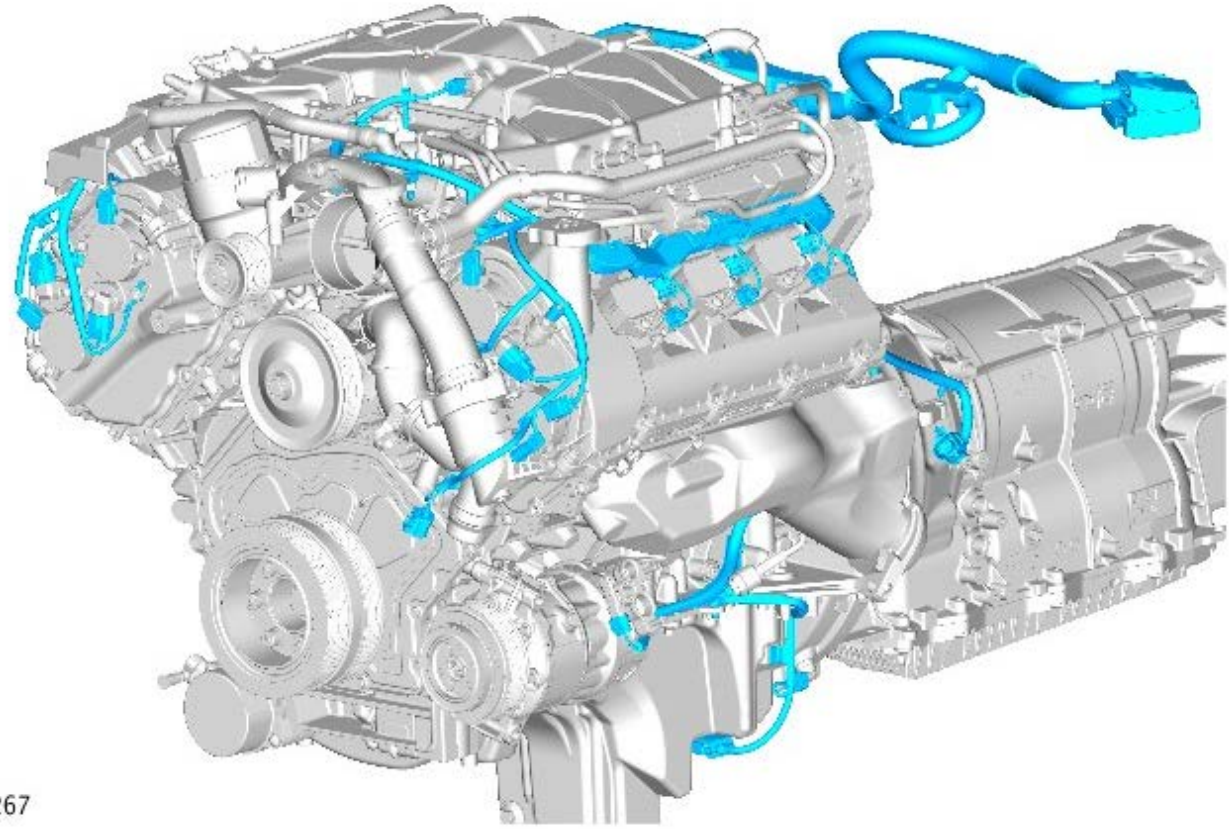
27. *Torque:* 10 Nm



28.



29.



Installation

1. CAUTION: Make sure the the electrical harness is not trapped during the installation.

   To install, reverse the removal procedure.

Published: 02-May-2013

Wiring Harnesses - Engine Wiring Harness V8 S/C 5.0L Petrol

Removal and Installation

Removal

CAUTION: Note of the routing of the wiring harnesses.

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. 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 Cleaner Outlet Pipe LH (303-12C Intake Air Distribution and Filtering - V8 S/C 5.0L Petrol, Removal and Installation).

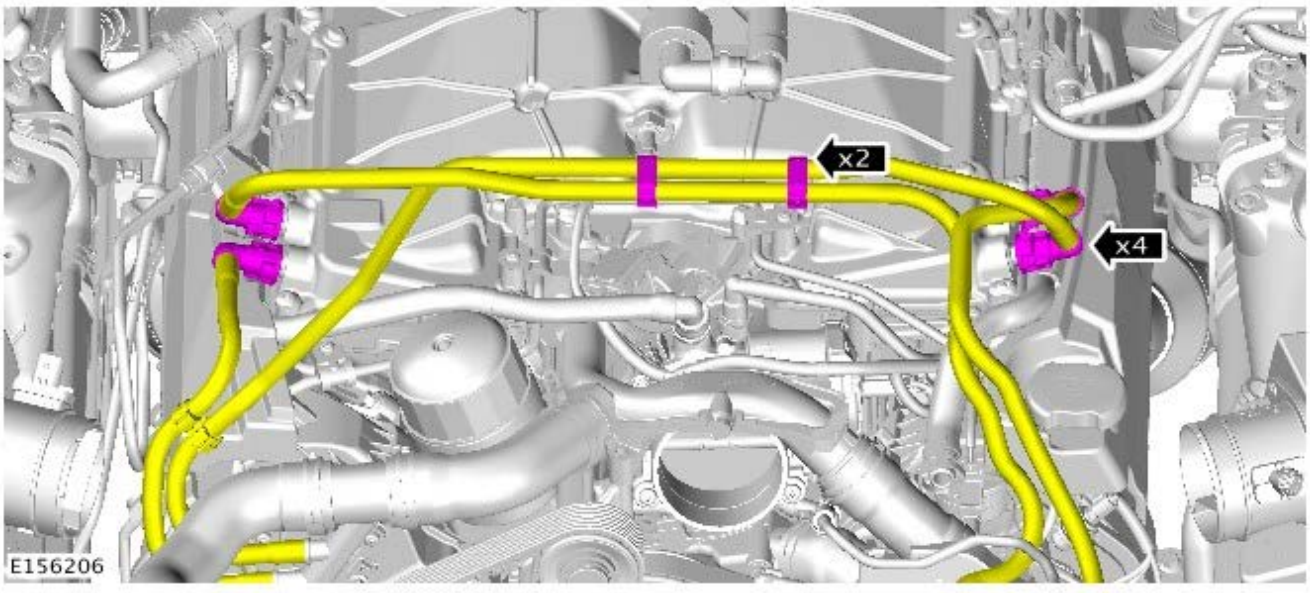
4. Refer to: Air Cleaner Outlet Pipe RH (303-12C Intake Air Distribution and Filtering - V8 S/C 5.0L Petrol, Removal and Installation).

5. Refer to: Secondary Bulkhead Center Panel - V8 S/C 5.0L Petrol (501-02 Front End Body Panels, Removal and Installation).

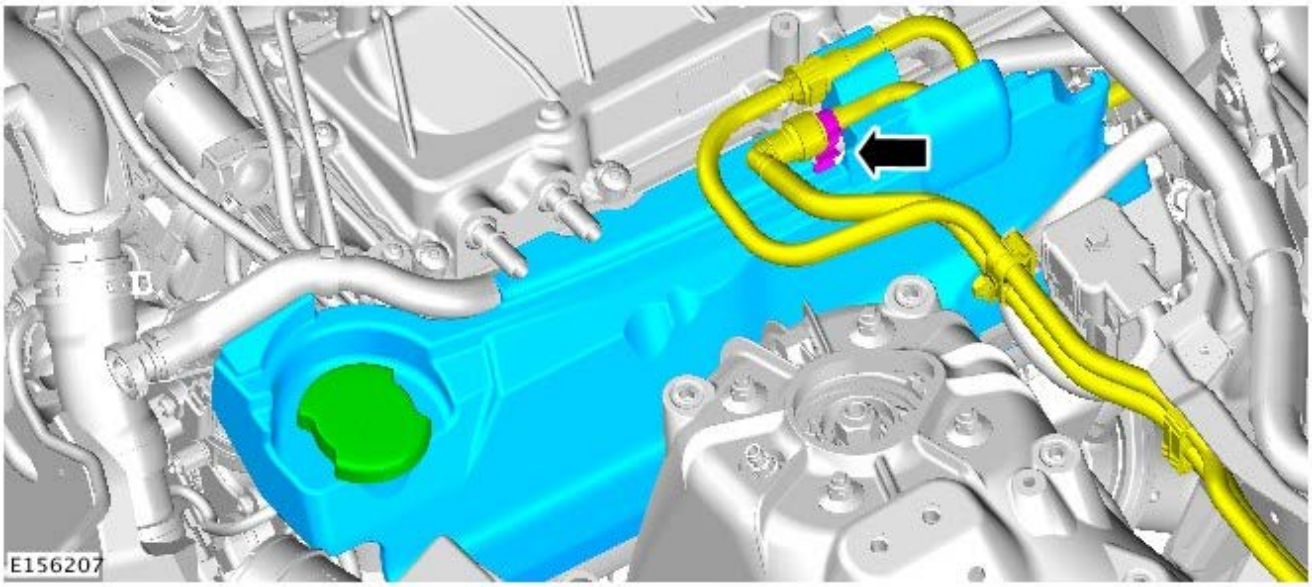
6. Refer to: Cooling System Partial Draining, Filling and Bleeding - V8 S/C 5.0L Petrol (303-03C Engine Cooling - V8 S/C 5.0L Petrol, General Procedures).

7. Refer to: Exhaust System (309-00C Exhaust System - V8 S/C 5.0L Petrol, Removal and Installation).

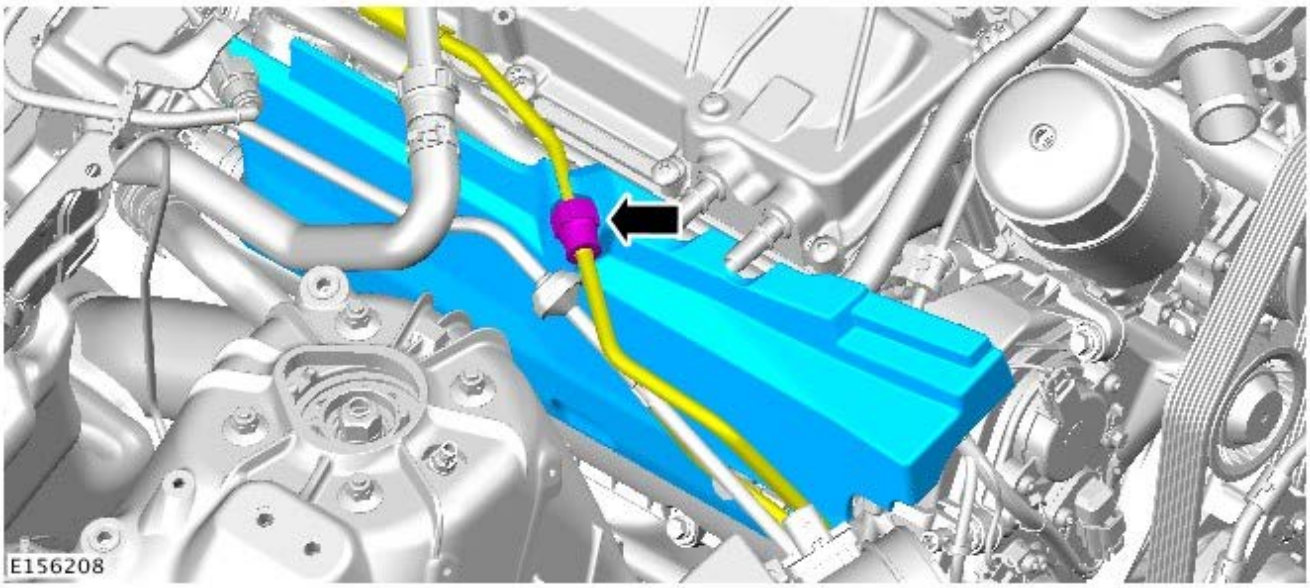
8. CAUTION: Be prepared to collect escaping coolant.



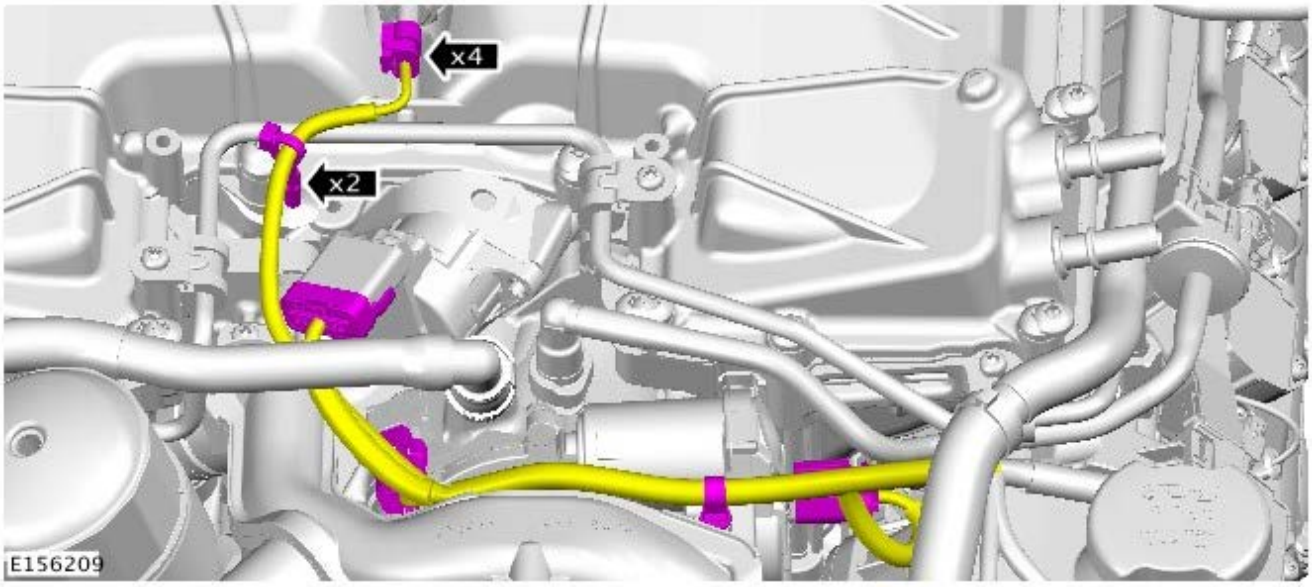
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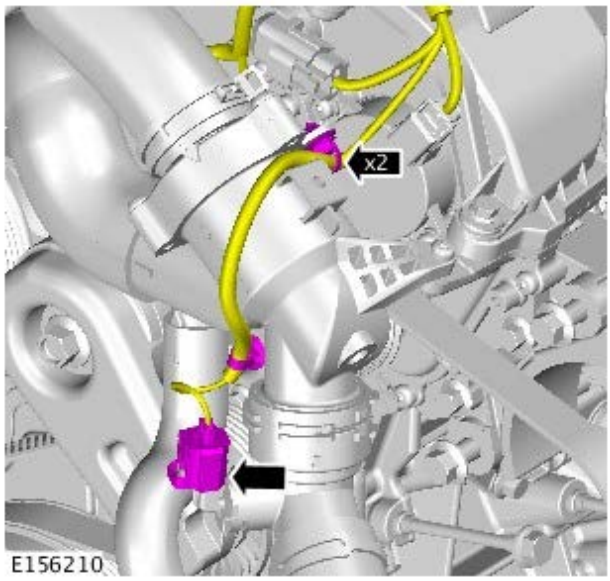
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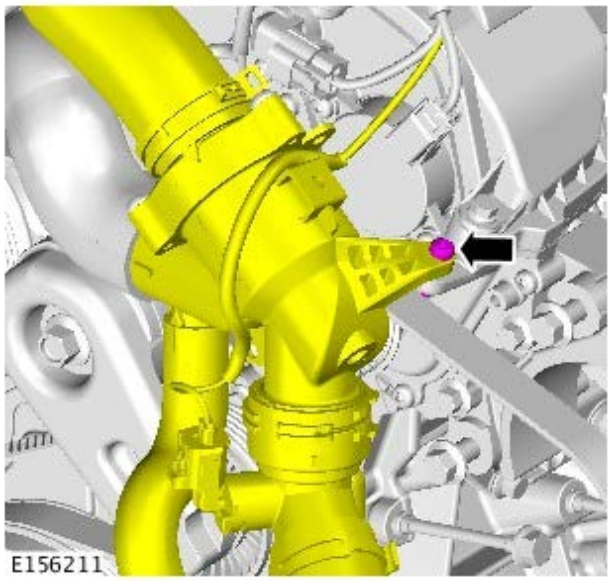
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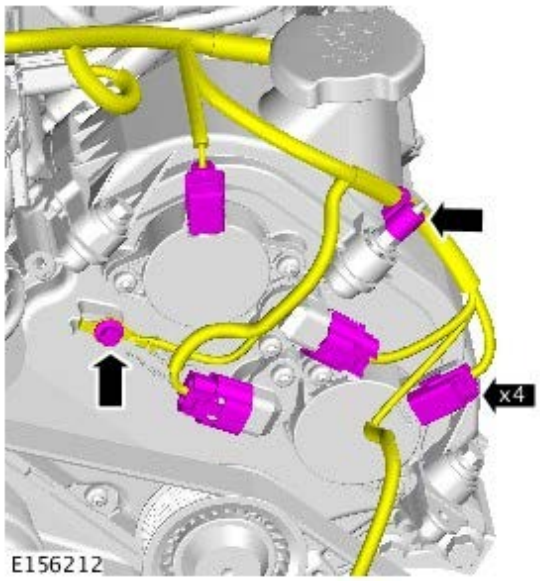
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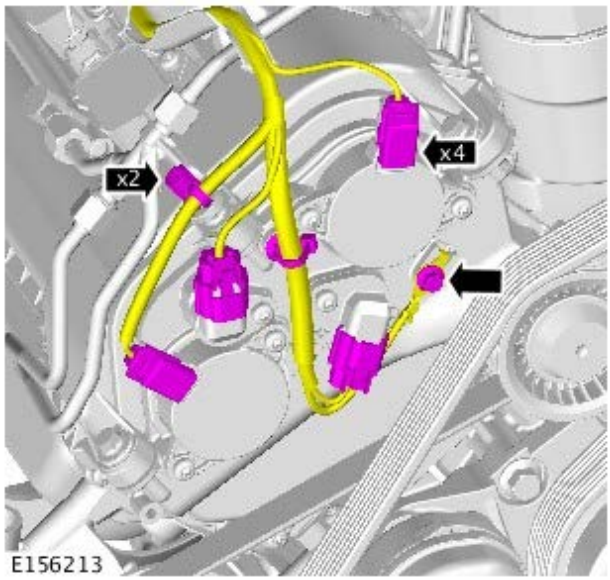
13. *Torque:* 10 Nm



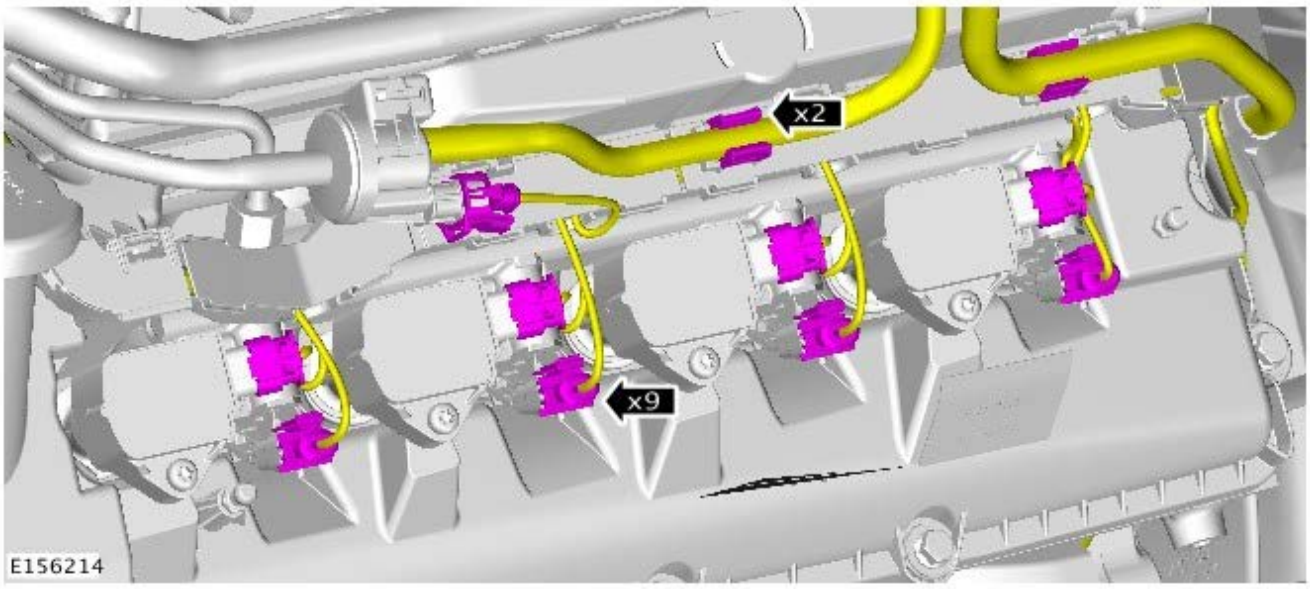
14. *Torque:* 10 Nm



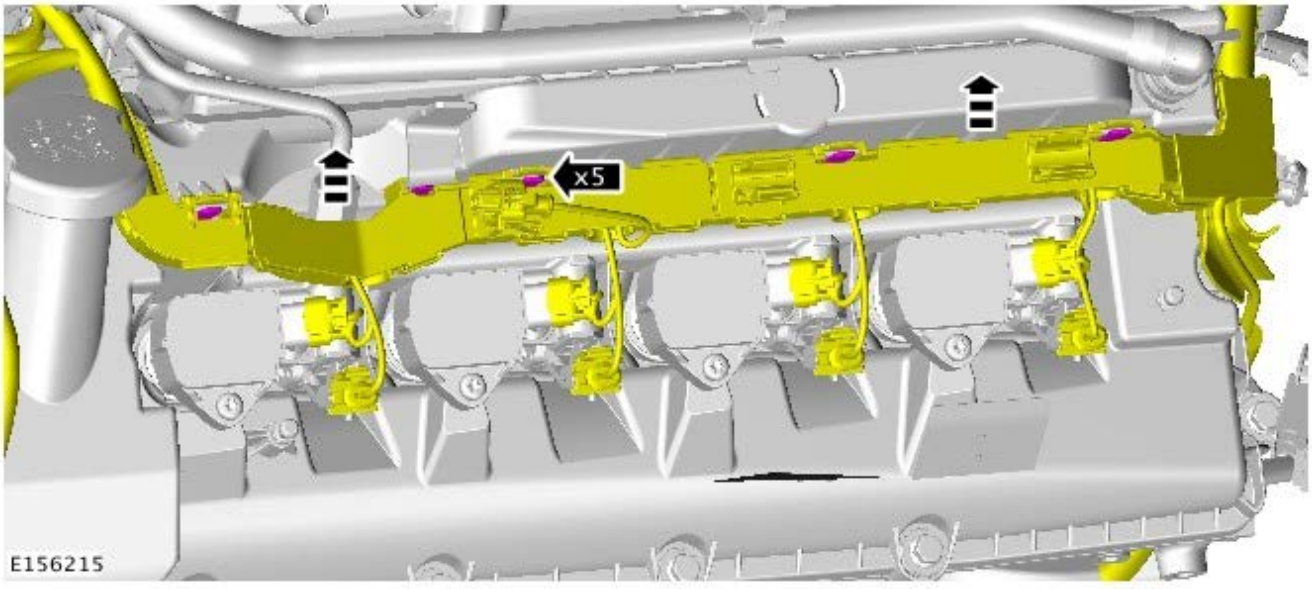
15. *Torque:* 10 Nm



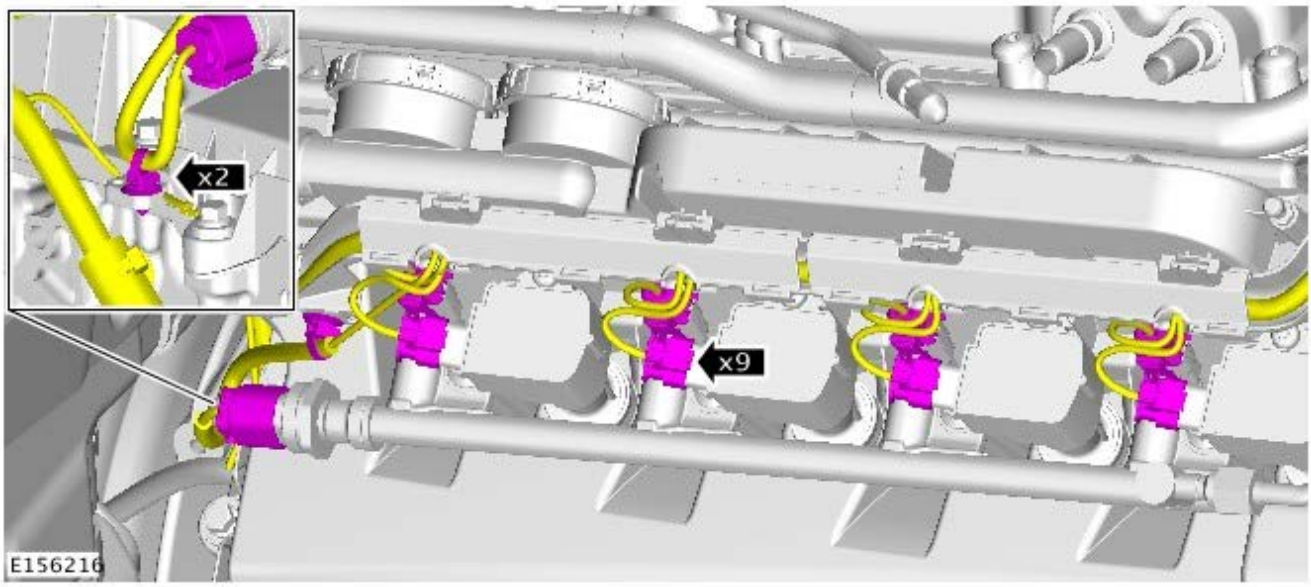
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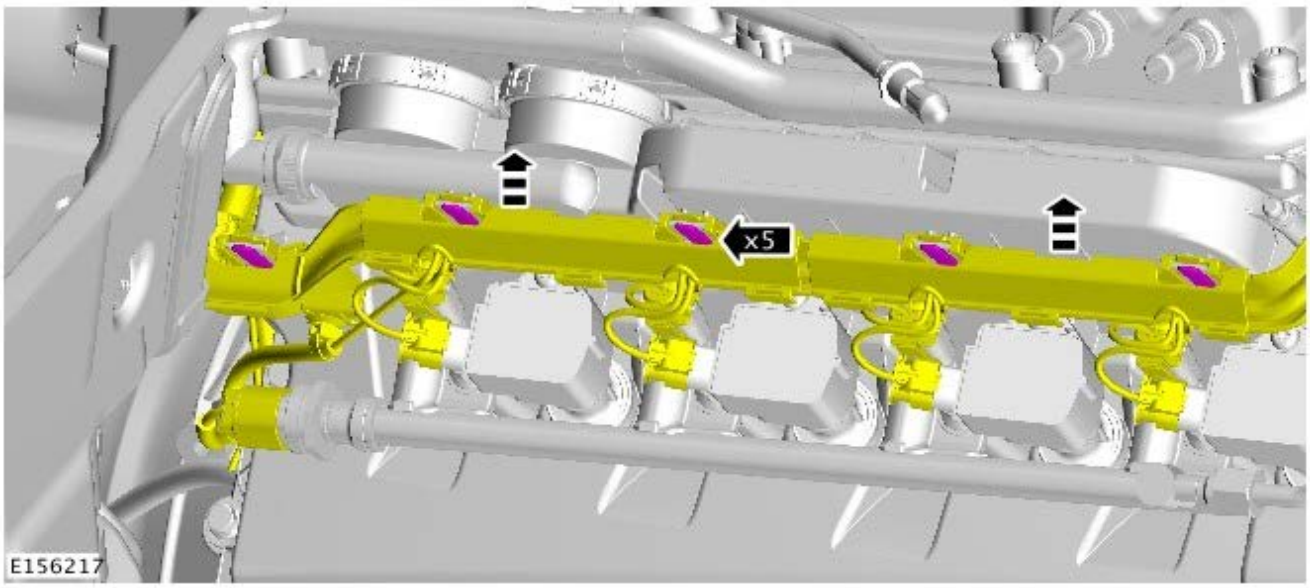
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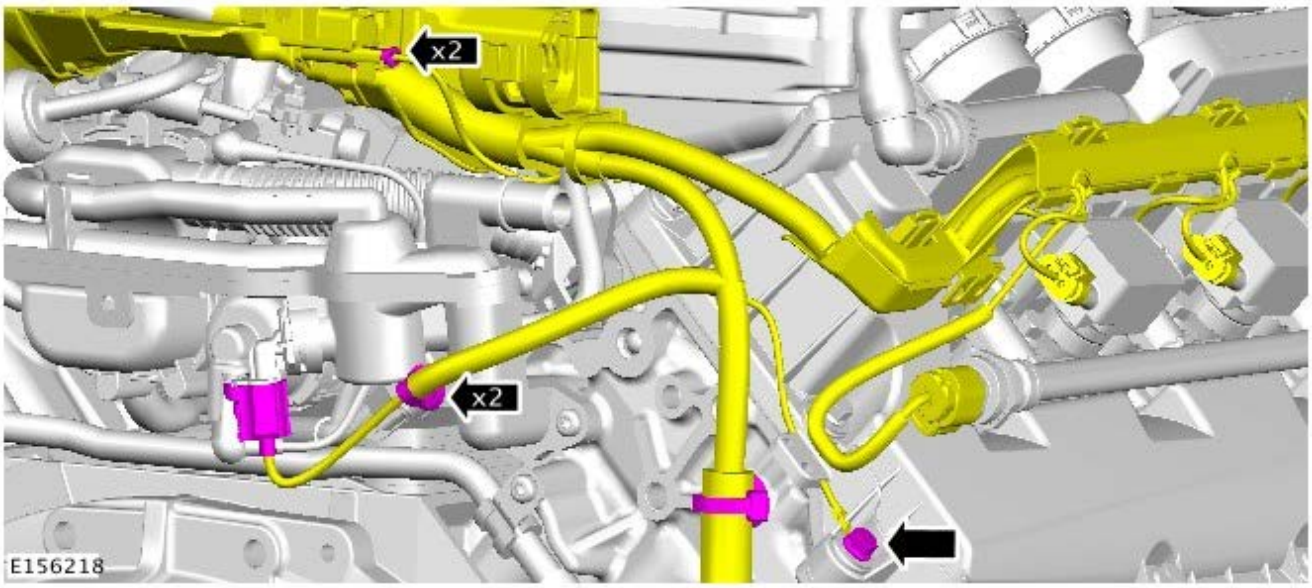
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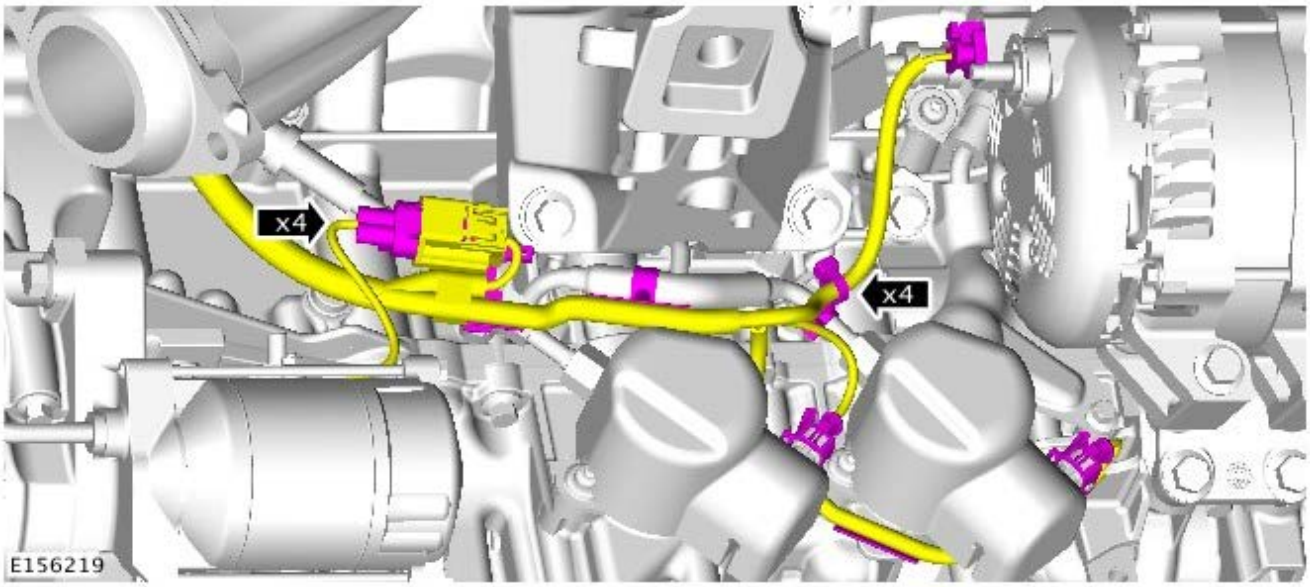
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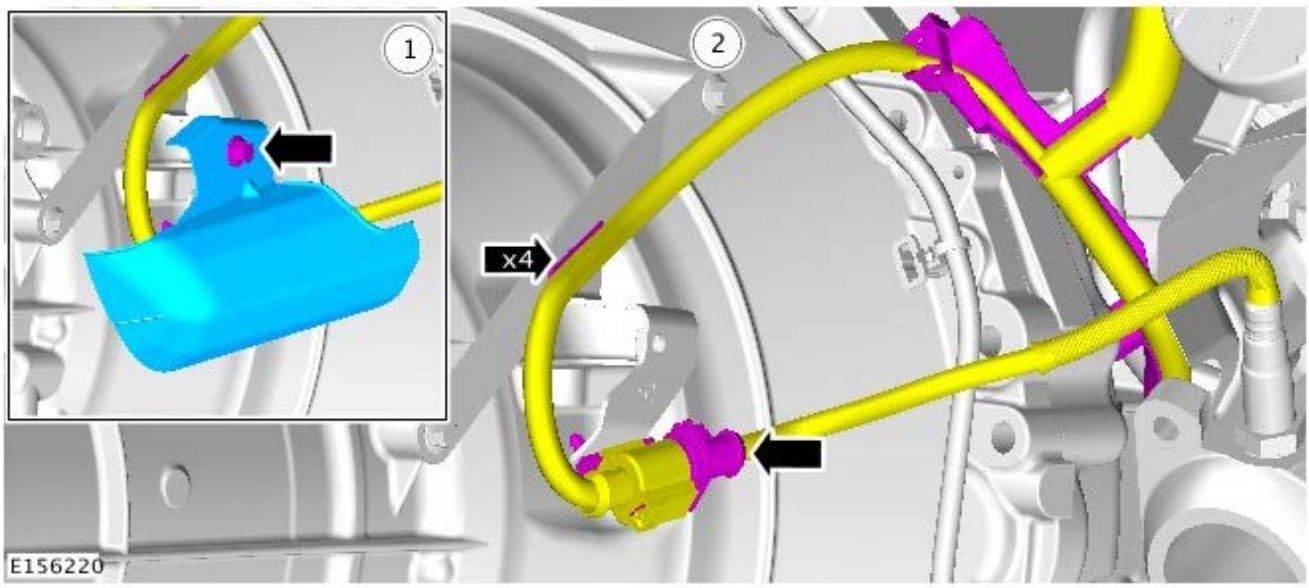
20. *Torque:* 13 Nm



21.



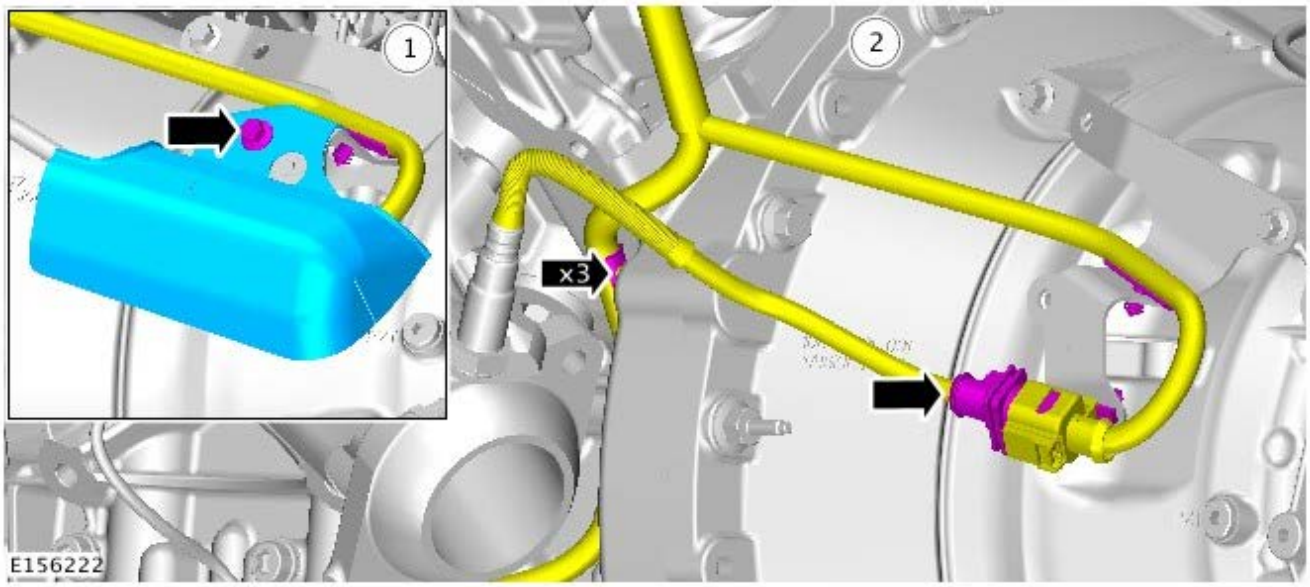
22. *Torque:* 11 Nm



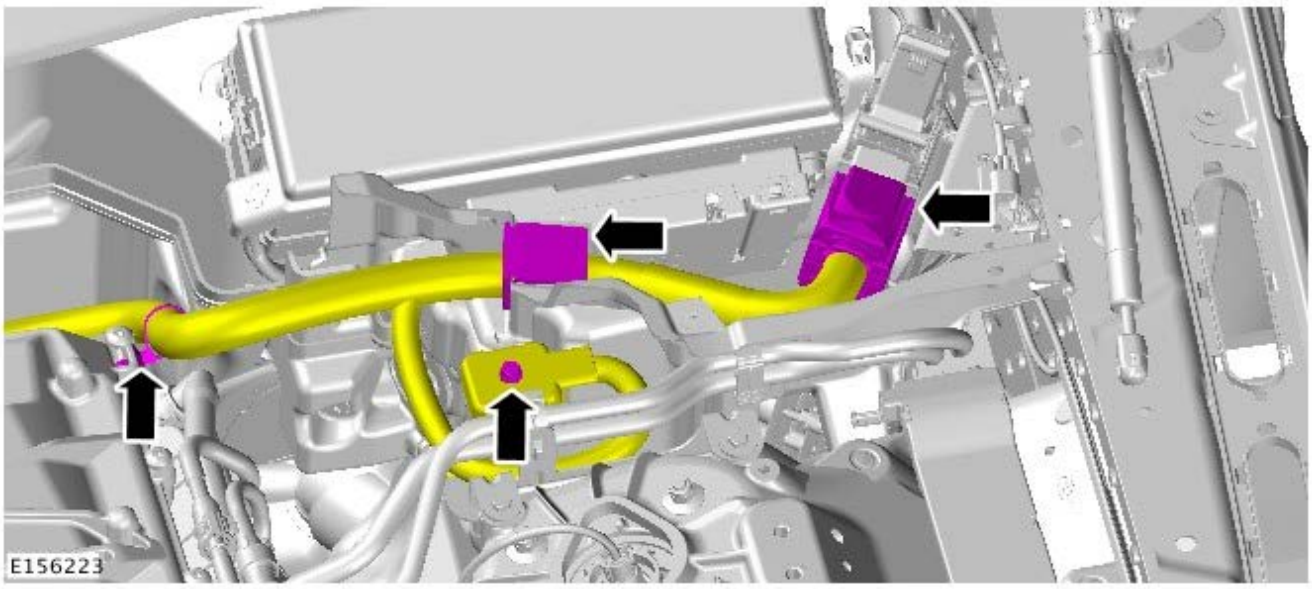
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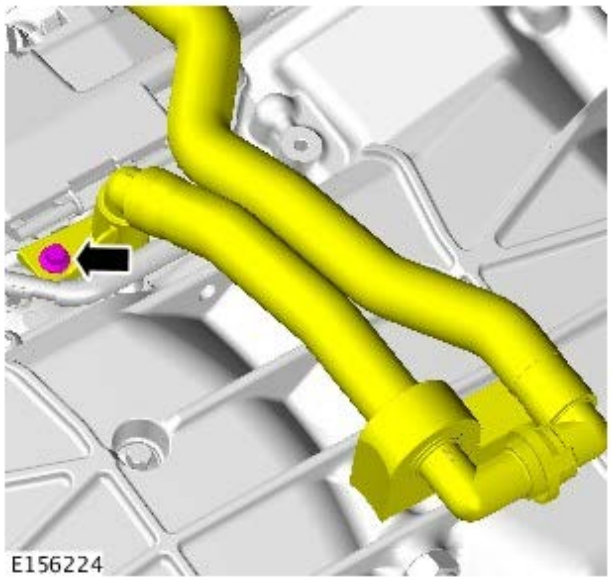
24. *Torque:* 11 Nm



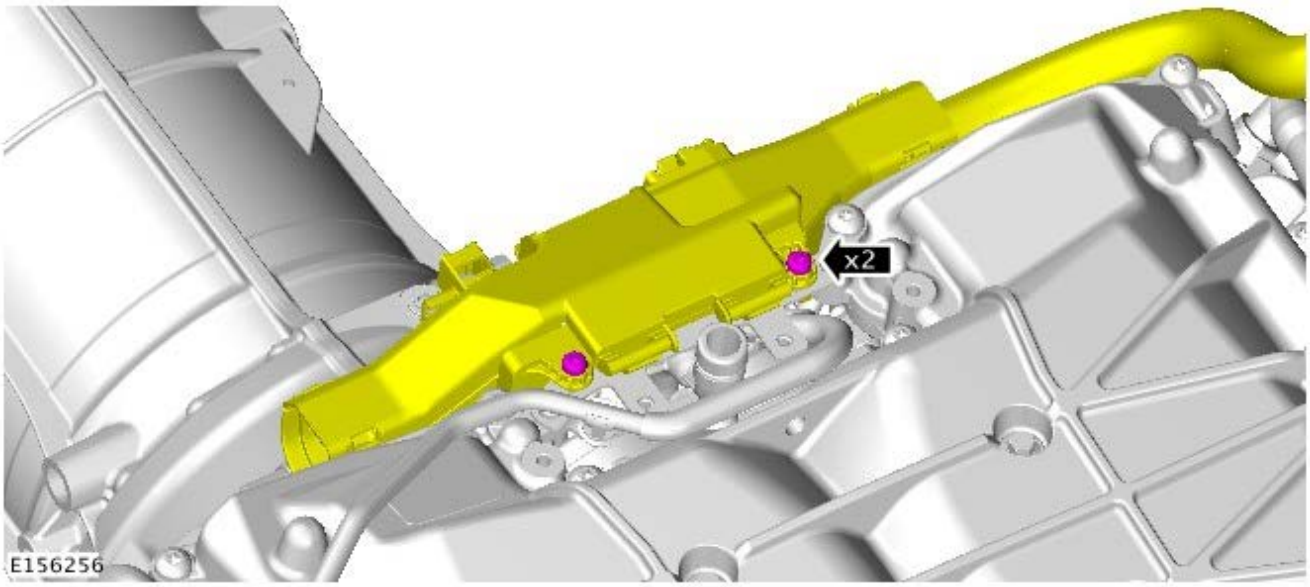
25. *Torque:* 7 Nm



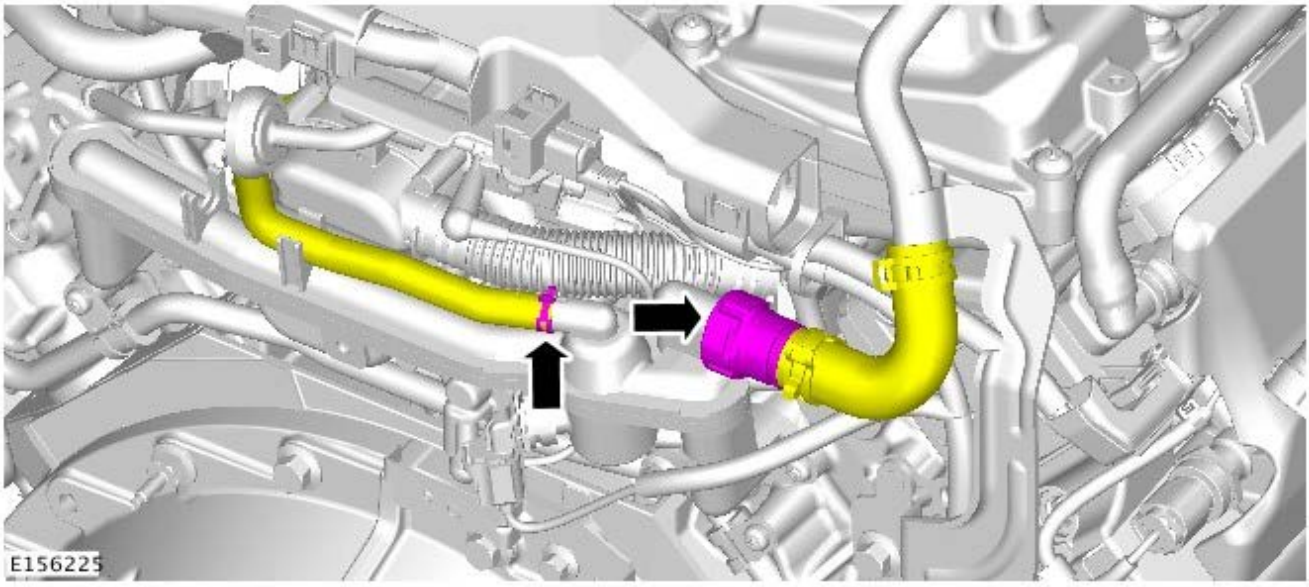
26. *Torque:* 10 Nm



27. *Torque:* 10 Nm



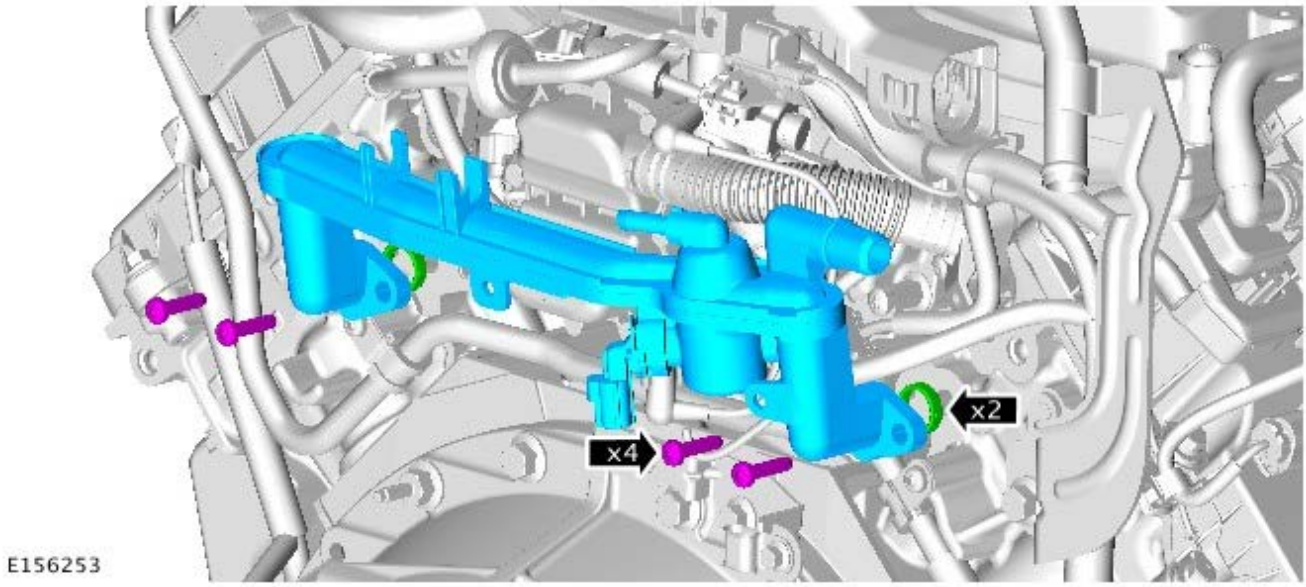
28. CAUTION: Be prepared to collect escaping coolant.



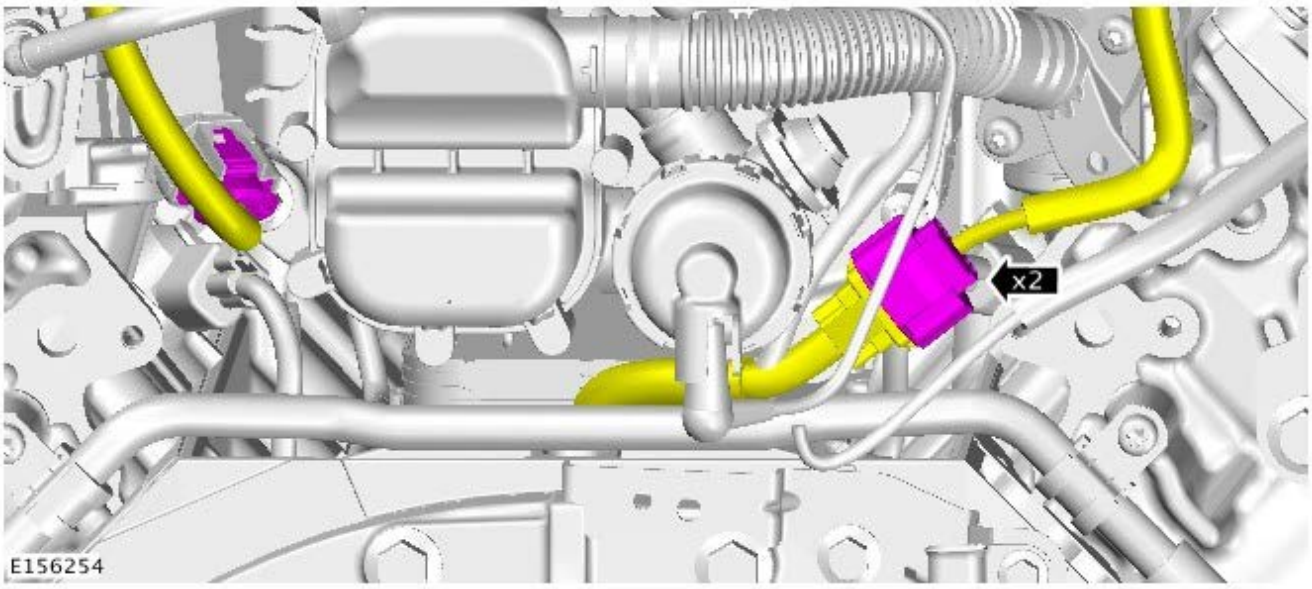
29. CAUTION: Be prepared to collect escaping coolant.

NOTE: Install new O-ring seals.

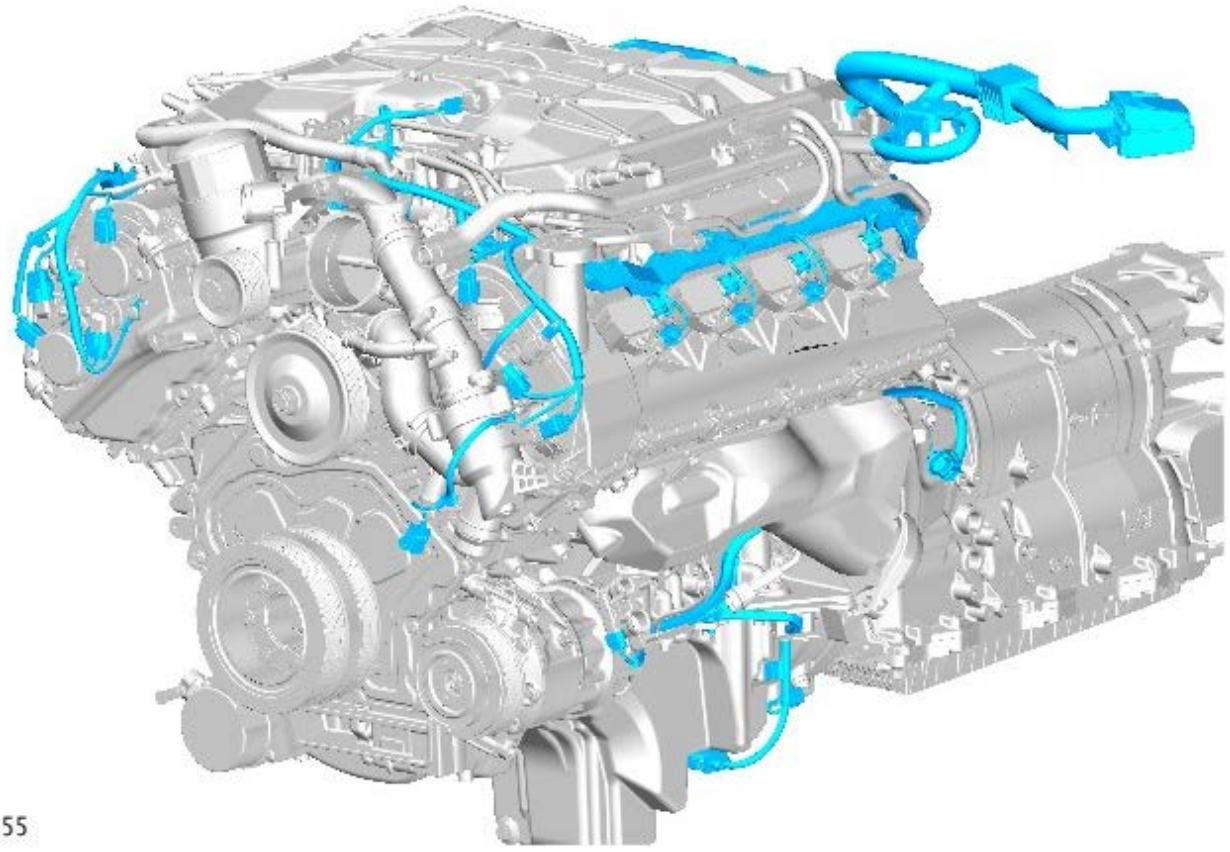
Torque: 10 Nm



30.



31.



Installation

1. CAUTION: Make sure the the electrical harness is not trapped during the installation.

   To install, reverse the removal procedure.

Published: 02-Dec-2013

Wiring Harnesses - Engine Wiring Harness TDV8 4.4L Diesel

Removal and Installation

Removal

NOTES:

LHD shown, RHD 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. 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: Secondary Bulkhead Center Panel - TDV8 4.4L Diesel (501-02, Removal and Installation).

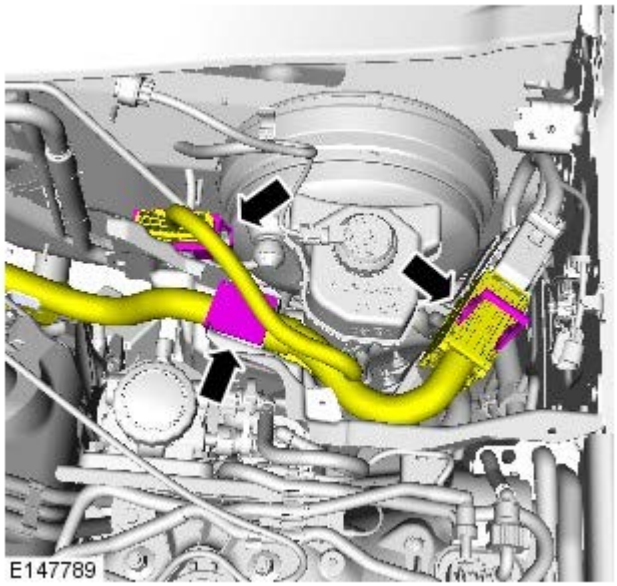
4. Refer to: Fuel Fired Booster Heater (412-02A Auxiliary Climate Control, Removal and Installation).

5. Refer to: Fuel Filter Element (310-01D Fuel Tank and Lines - TDV8 4.4L Diesel, Removal and Installation).

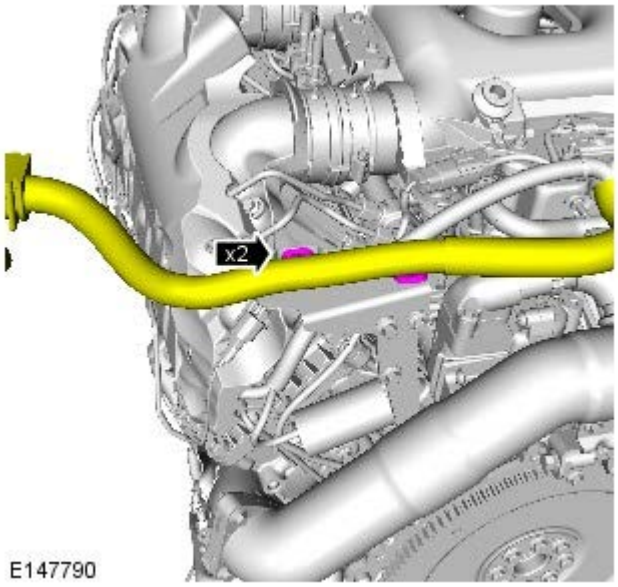
6. Refer to: Generator (414-02D Generator and Regulator - TDV8 4.4L Diesel, Removal and Installation).

7. Refer to: Starter Motor (303-06D Starting System - TDV8 4.4L Diesel, Removal and Installation).

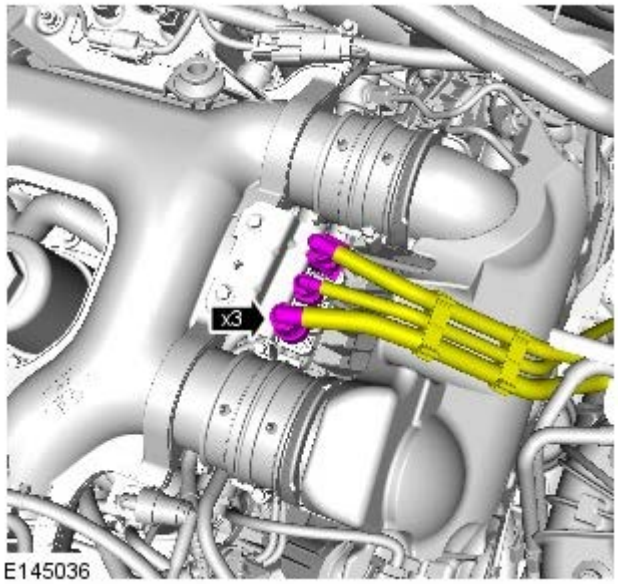
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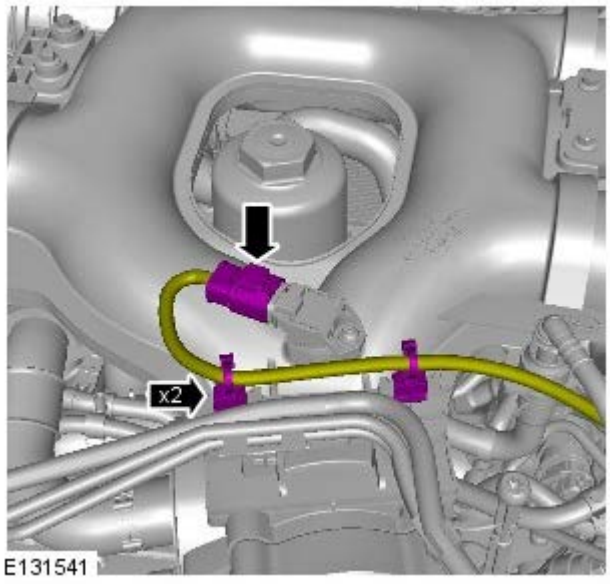
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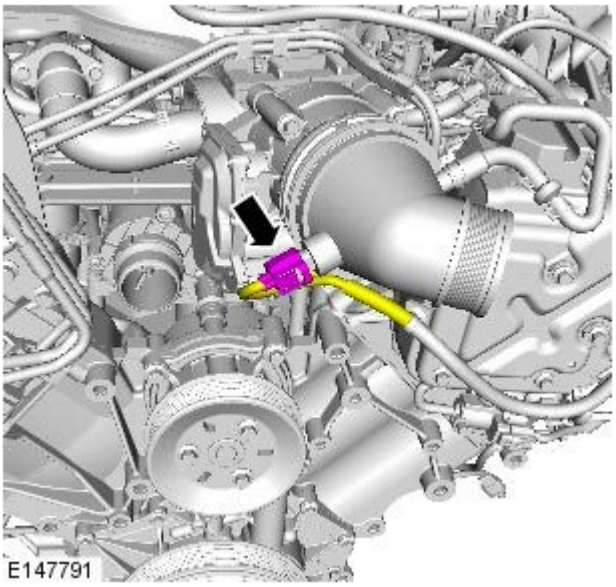
10. CAUTION: Make sure that all openings are sealed. Use new blanking caps.

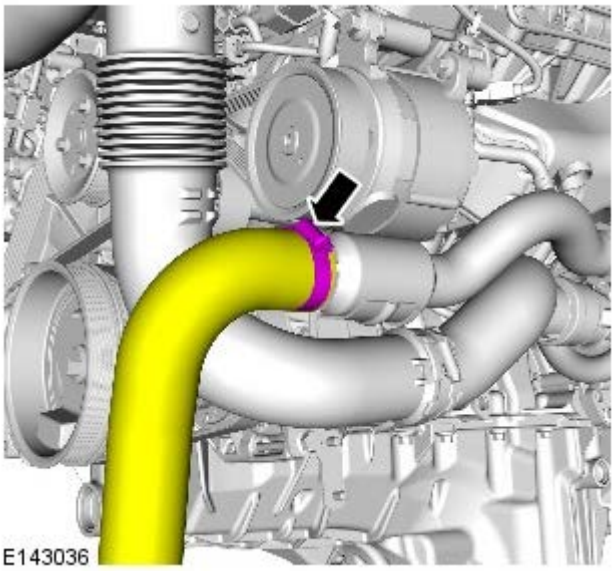


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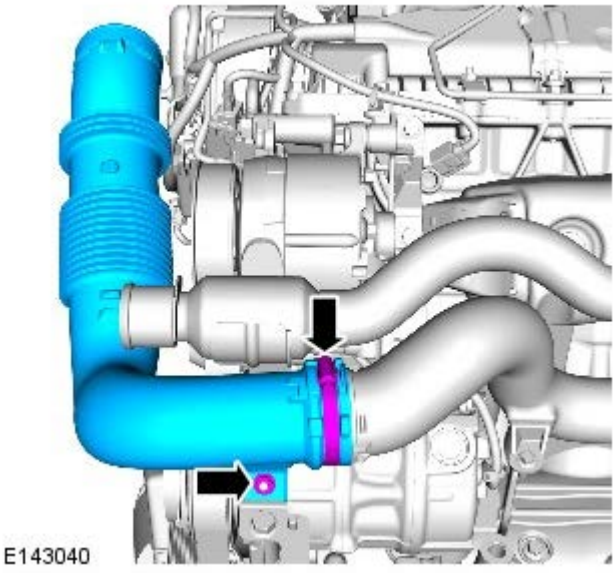
12.





13. NOTE: Make sure the retaining clips are correctly installed and tightened.

Torque: 3.5 Nm



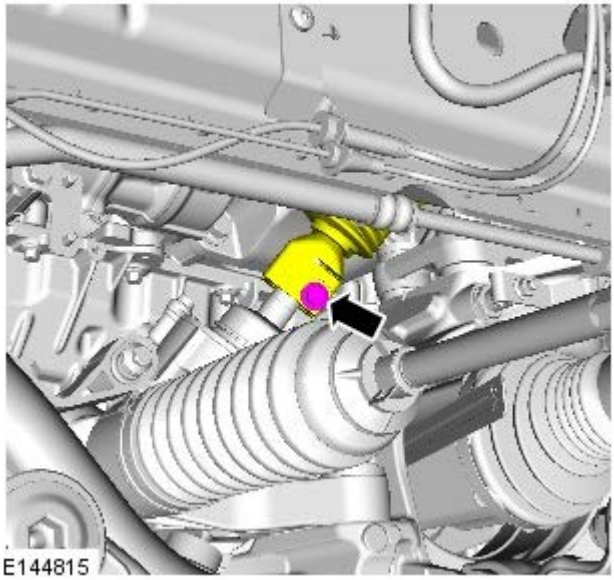
14. NOTE: Make sure the retaining clips are correctly installed and tightened.

Torque:
M6 10 Nm
Clamp 3.5 Nm

15. CAUTION: Discard the bolt.

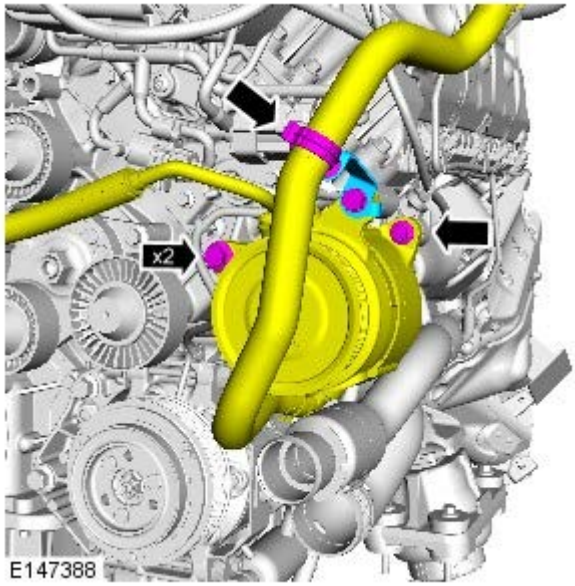
NOTE: Left hand drive only.

Align the steering wheel to straight ahead.

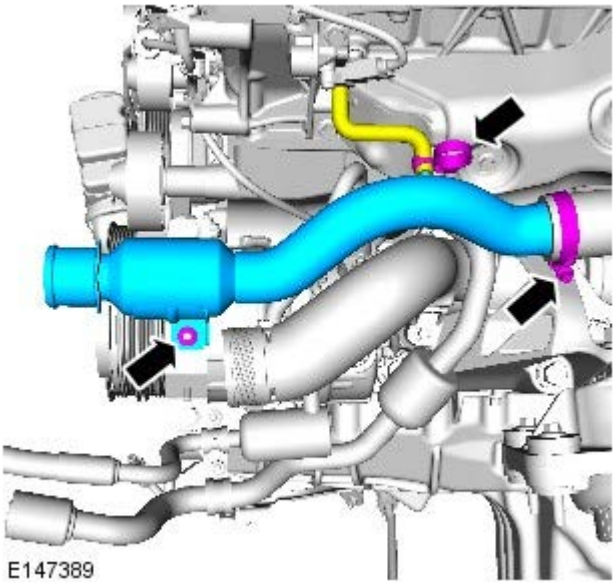


Torque: 30 Nm

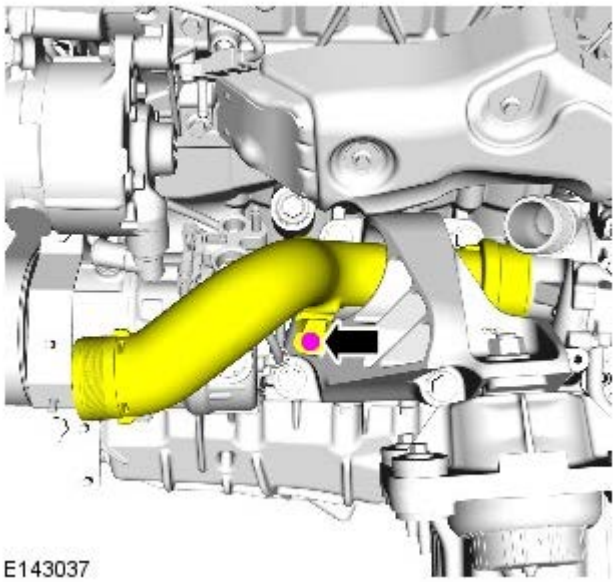
16. *Torque:*
    M8 25 Nm
    M10 45 Nm



17. *Torque:*
    M6 10 Nm
    Clamp 3.5 Nm

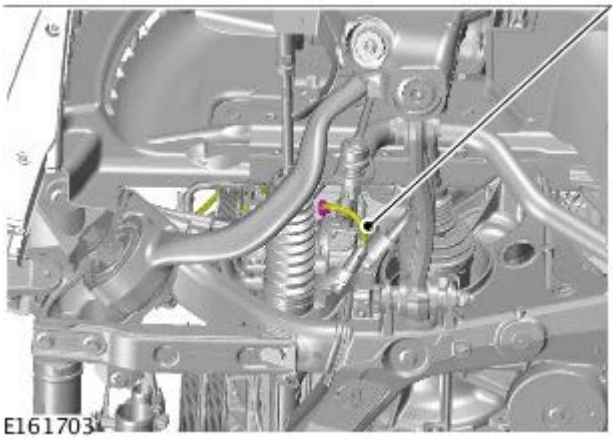


18. *Torque:* 12 Nm



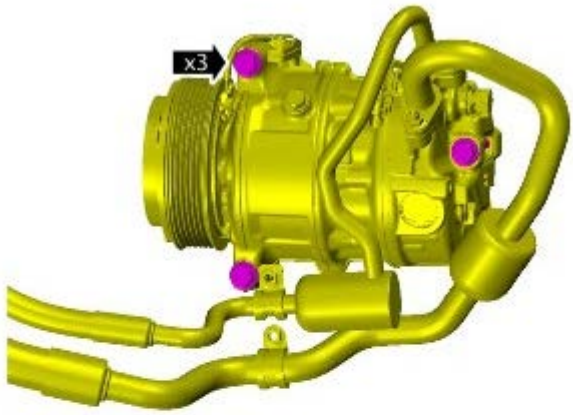
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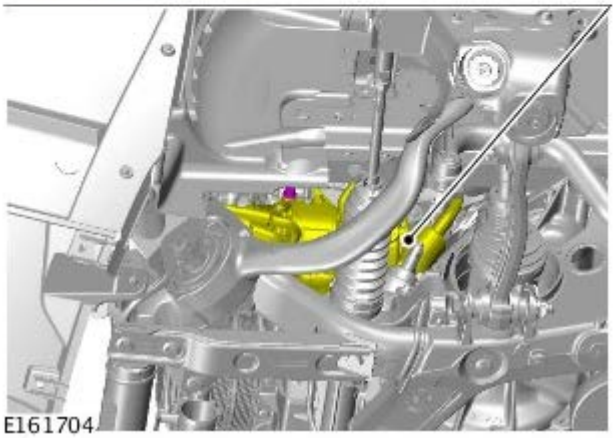




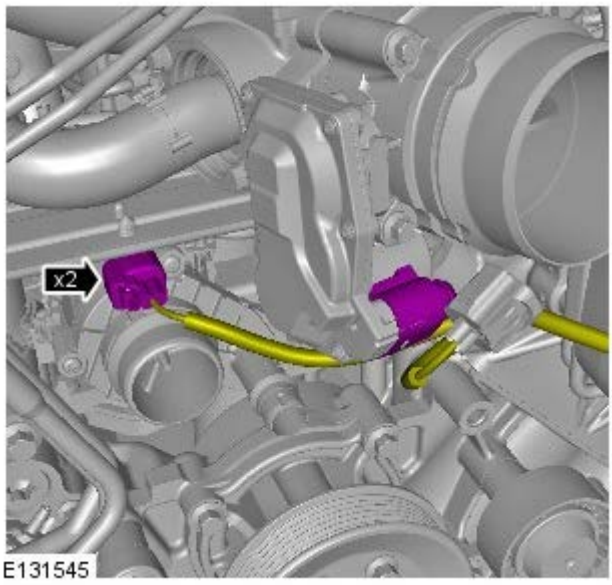
20. Tie aside.

Torque: 25 Nm

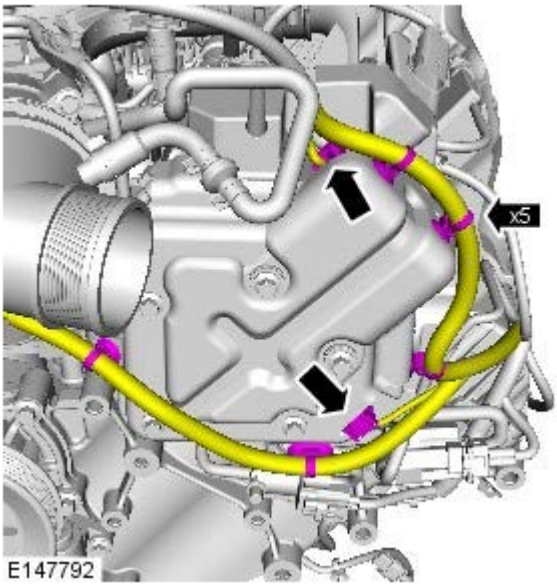




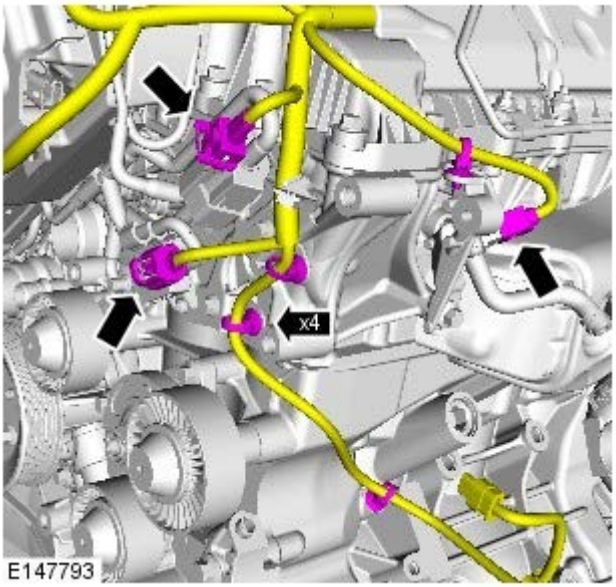
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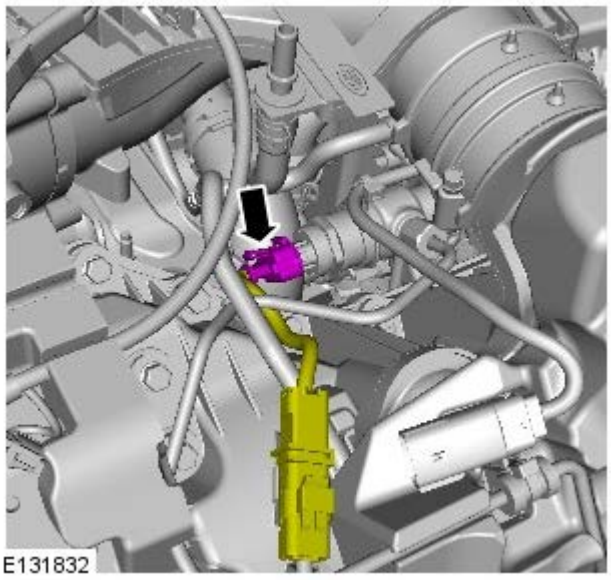
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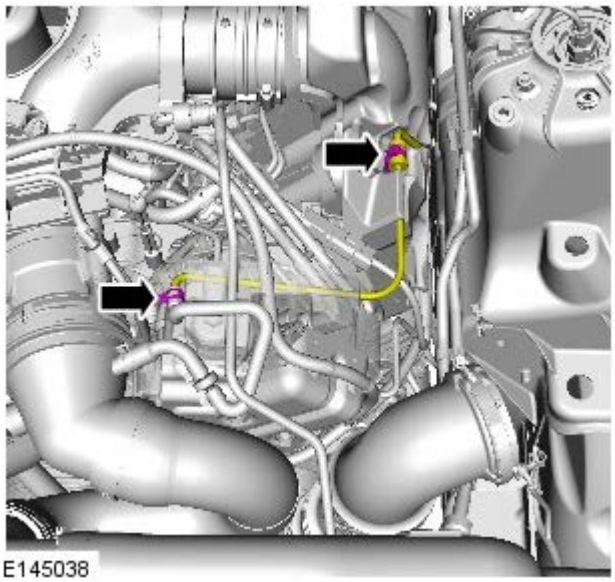
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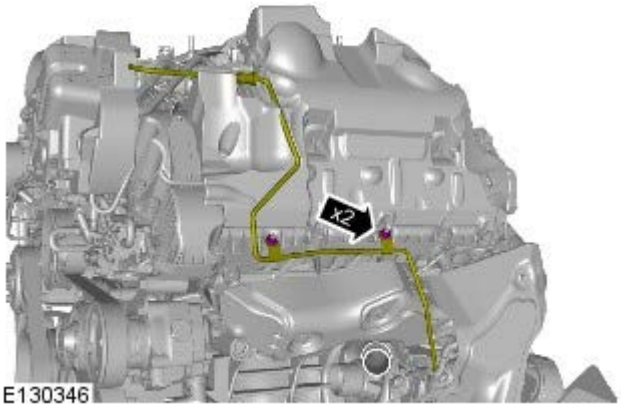
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25.

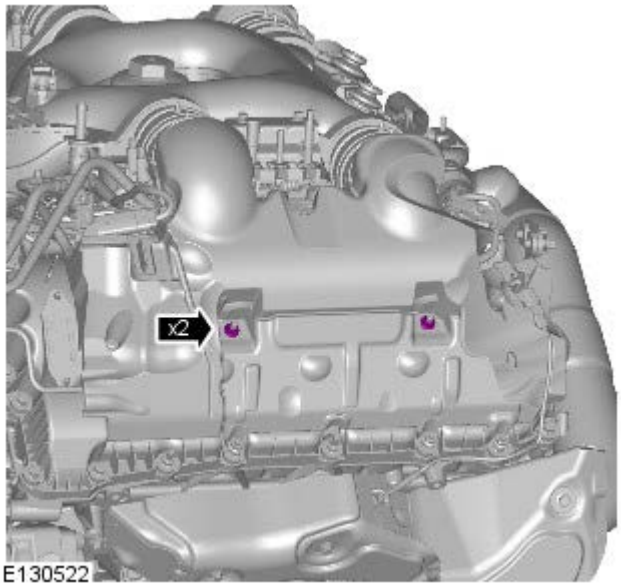

E145038

26. *Torque:* 10 Nm



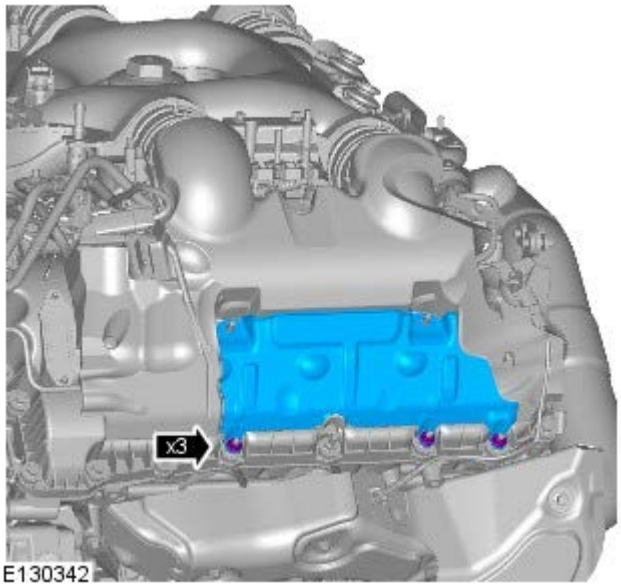
E130346

27. *Torque:* 6 Nm

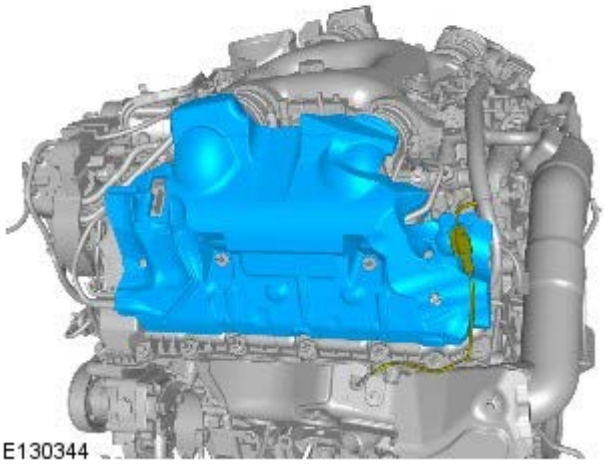


E130522

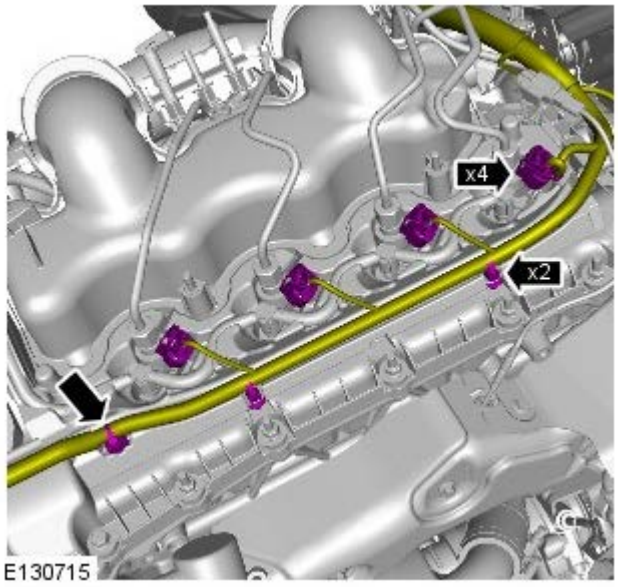
28. *Torque:* 10 Nm



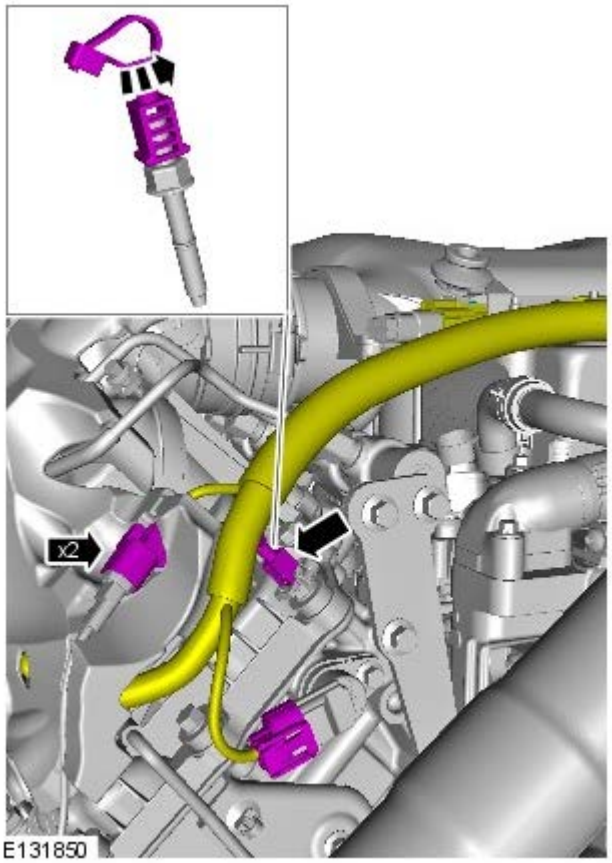
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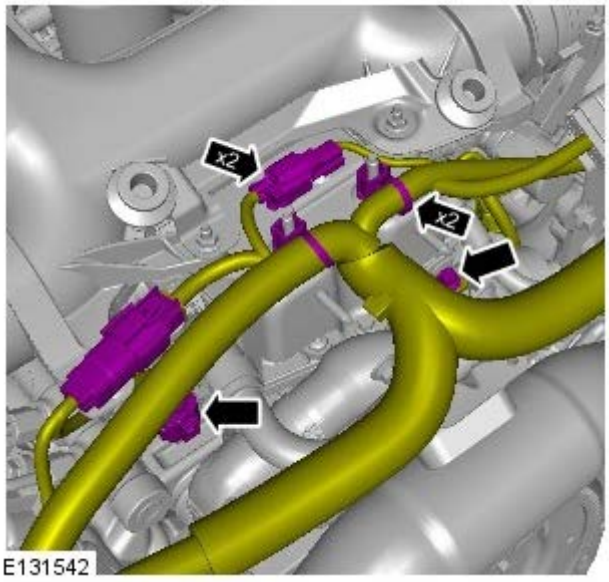
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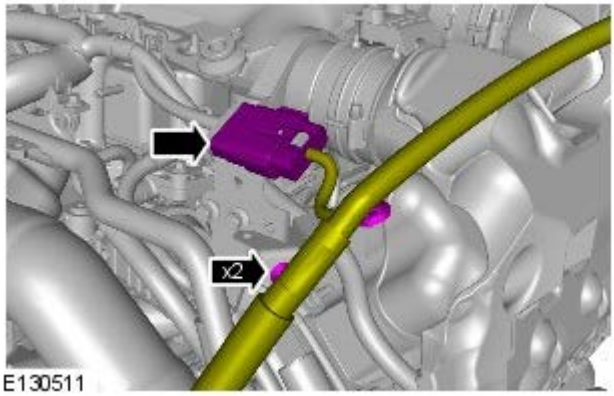
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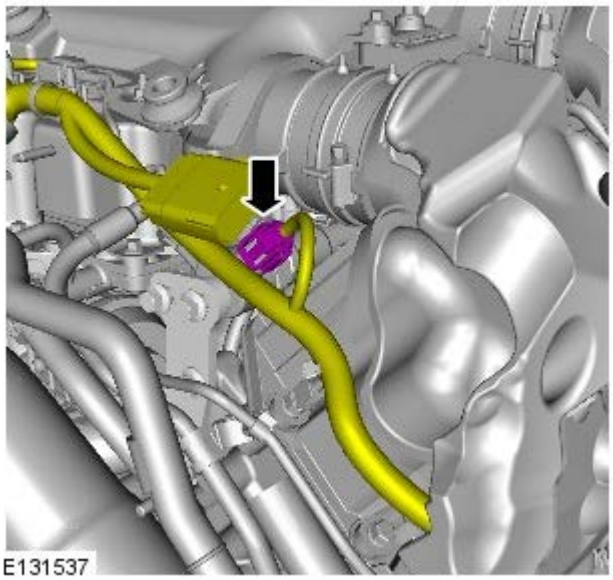
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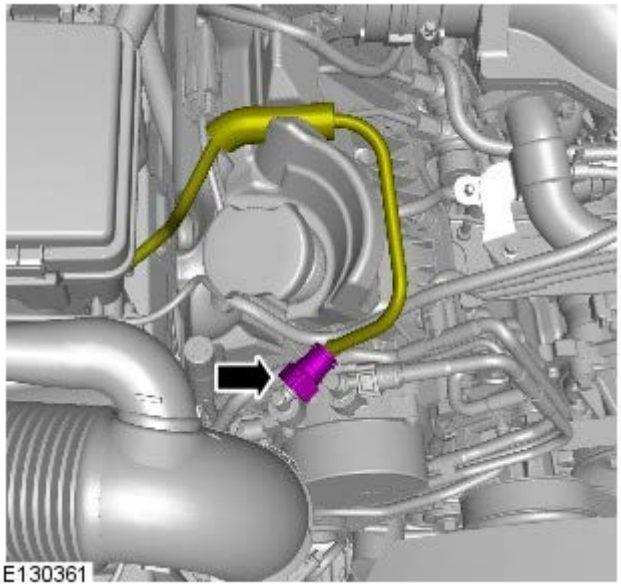
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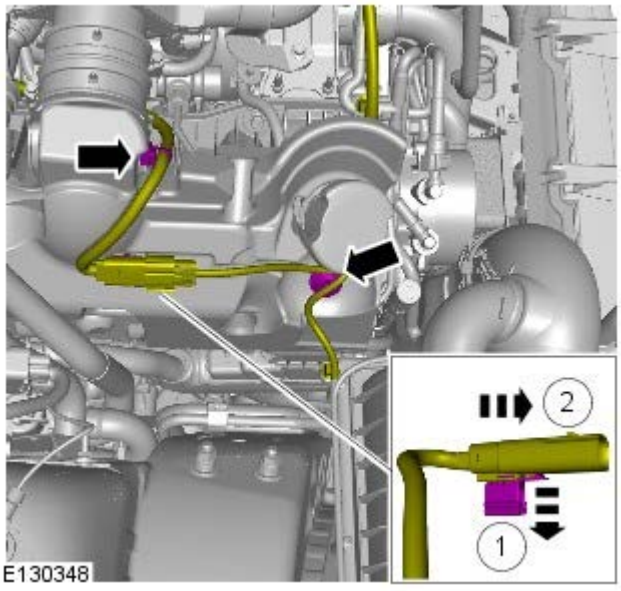
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35.

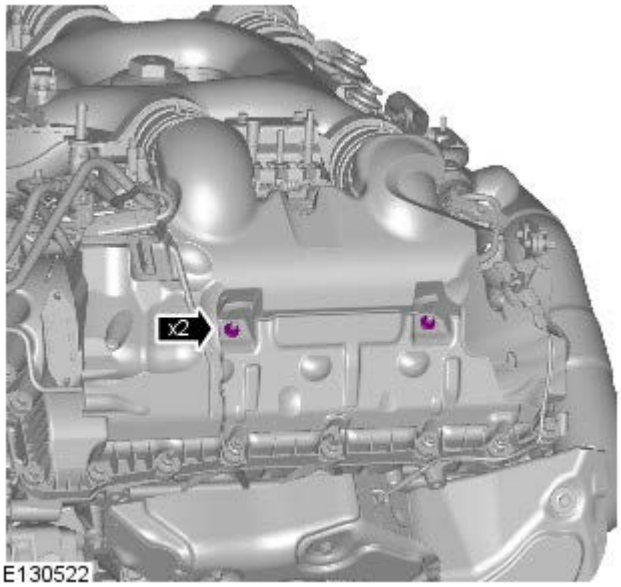


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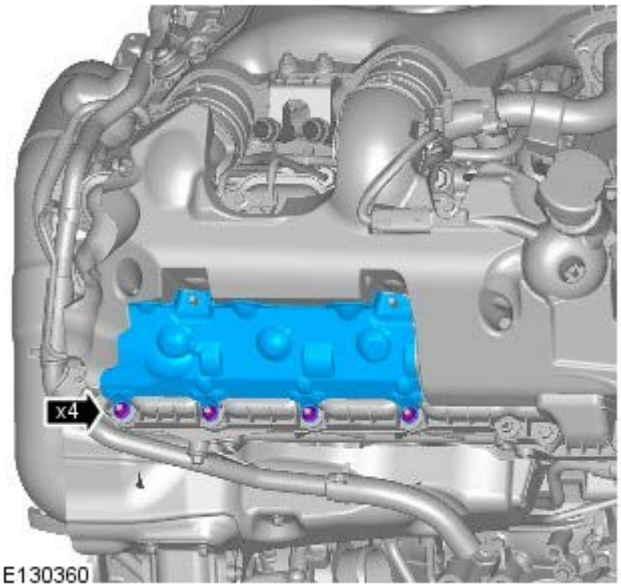


37. CAUTION: LH illustration shown, RH is similar.

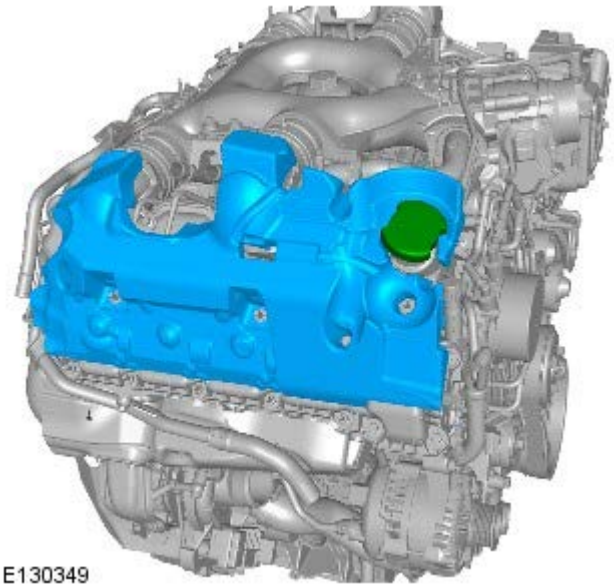
Torque: 6 Nm



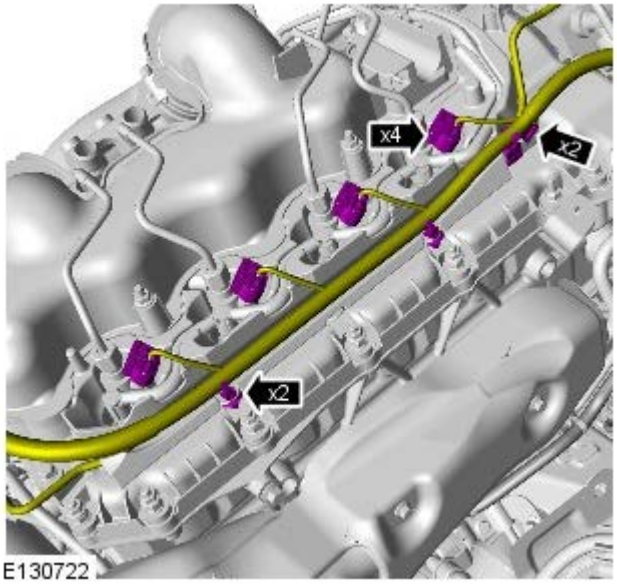
38. *Torque:* 10 Nm



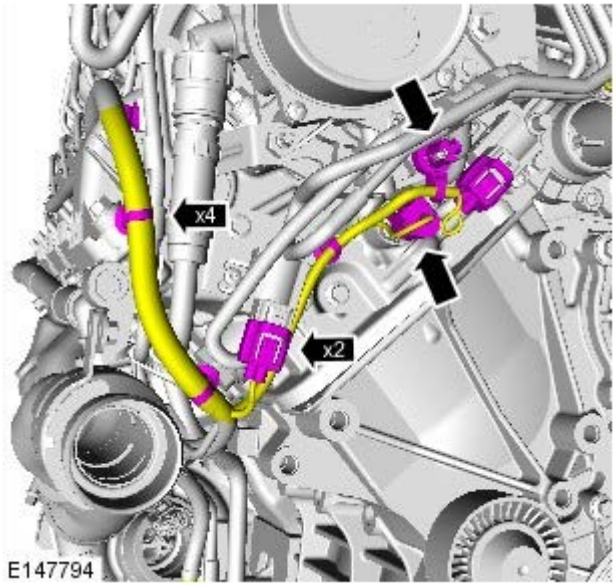
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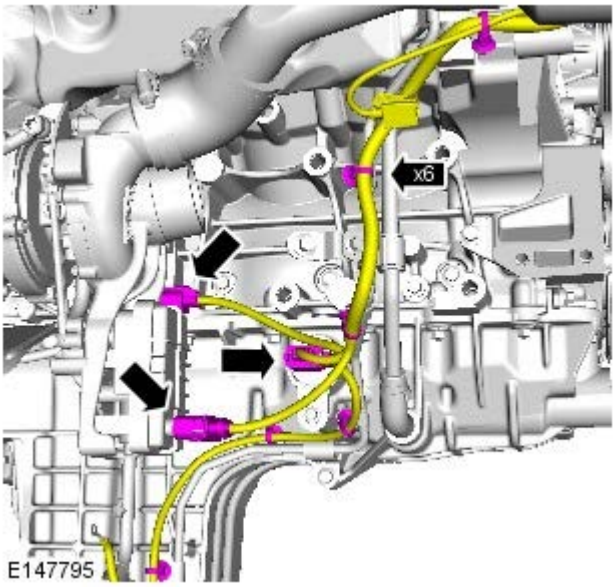
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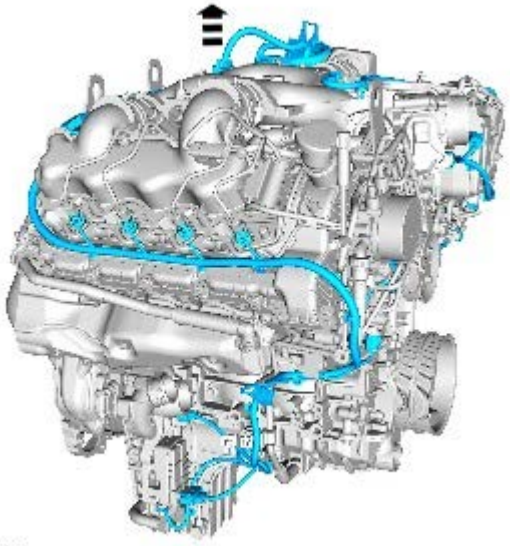
41.



42.



43.



E147796

Installation

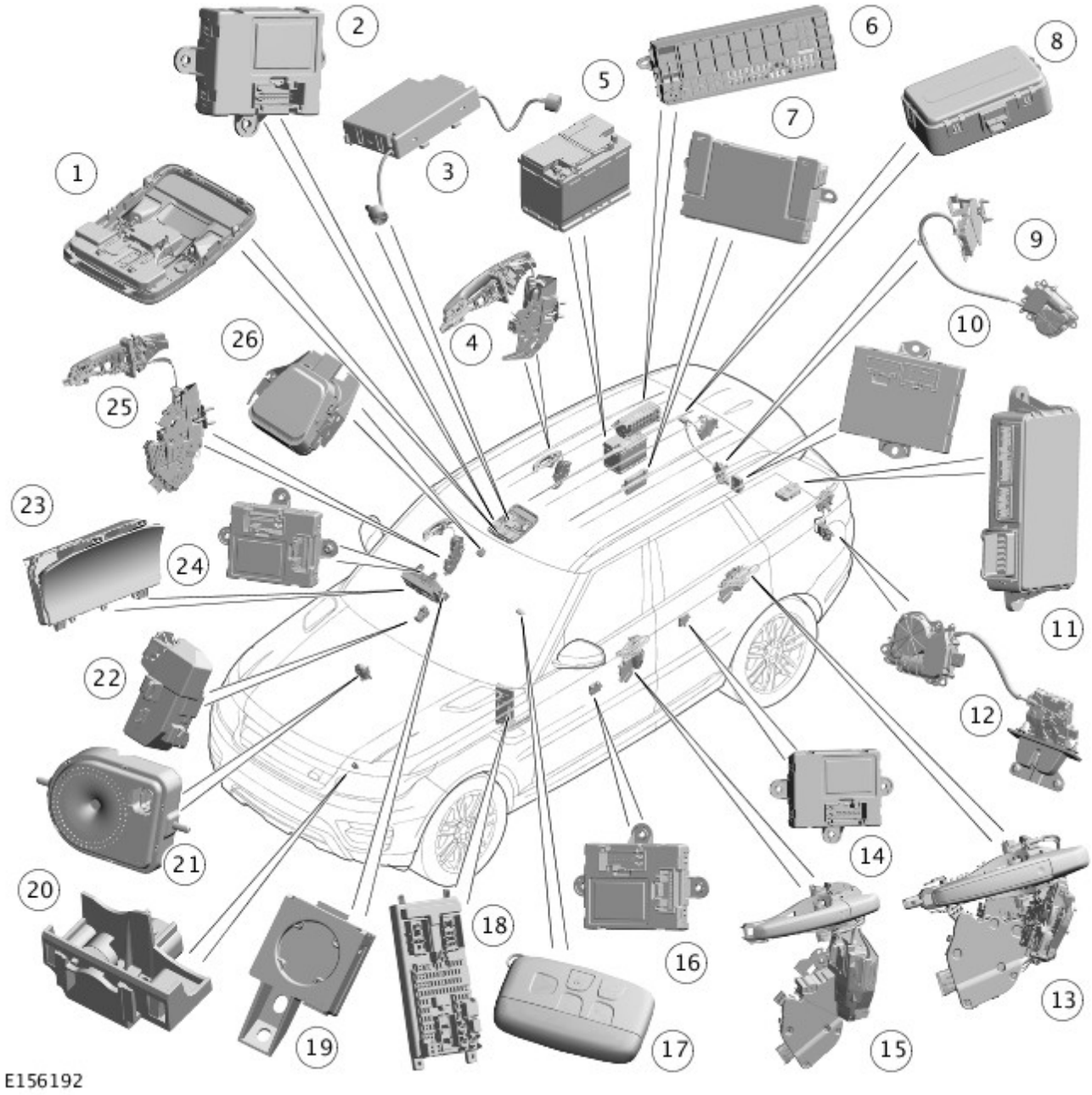
1. To install, reverse the removal procedure.

Published: 14-May-2013

Anti-Theft - Active - Anti-Theft - Active

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Front overhead console
2	-	Rear right door module
3	-	Volumetric sensor
4	-	Rear right door latch
5	-	Battery
6	-	Rear Junction Box (BJB)
7	-	Battery Junction Box (BJB)
8	-	RF (Radio Frequency) receiver
9	-	Right tailgate latch
10	-	Tailgate Control Module (TCM)
11	-	Keyless Vehicle Module (KVM)
12	-	Left tailgate latch
13	-	Rear left door latch
14	-	Rear left door module
15	-	Front left door latch

16	-	Passenger Door Module (PDM)
17	-	Smartkey
18	-	Central Junction Box (CJB)
19	-	Immobilizer Antenna Unit (IAU)
20	-	Hood switch
21	-	Battery Back-Up Sounder (BBUS)
22	-	Electric Steering Column Lock (ESCL)
23	-	Instrument Cluster (IC)
24	-	Driver Door Module (DDM)
25	-	Front right door latch
26	-	Rain/light sensor

OVERVIEW

The active anti-theft system monitors the hinged panels for unauthorized opening. In some markets the anti-theft system also incorporates monitoring of the vehicle interior and vehicle tilt sensing.

The active anti-theft alarm system is controlled by the following body system control modules:

- CJB
- Left and right front and rear door modules
- IC.

The CJB is the main controller in the system. The CJB controls the following security functions, in addition to other vehicle functions:

- Locking, double locking and unlocking
- Monitoring of hinged panel micro switches and panel ajar states
- Interior motion sensor
- BBUS or vehicle horns
- Passive arming and disarming
- Panic alarm function
- Smartkey transponder reading
- Interior lighting.

Two levels of vehicle anti-theft alarm are available; perimeter mode monitors all opening panels and volumetric mode (if fitted) monitors the vehicle interior for intrusion and it also incorporates a tilt sensor to monitor if the vehicle is being moved.

NOTE: Volumetric mode and tilt sensing are not available in certain markets

The Smartkey provides the following functionality:

- Unlock (central unlock or single point entry)
- Lock and double lock
- Tailgate release
- Approach lighting
- Panic alarm.

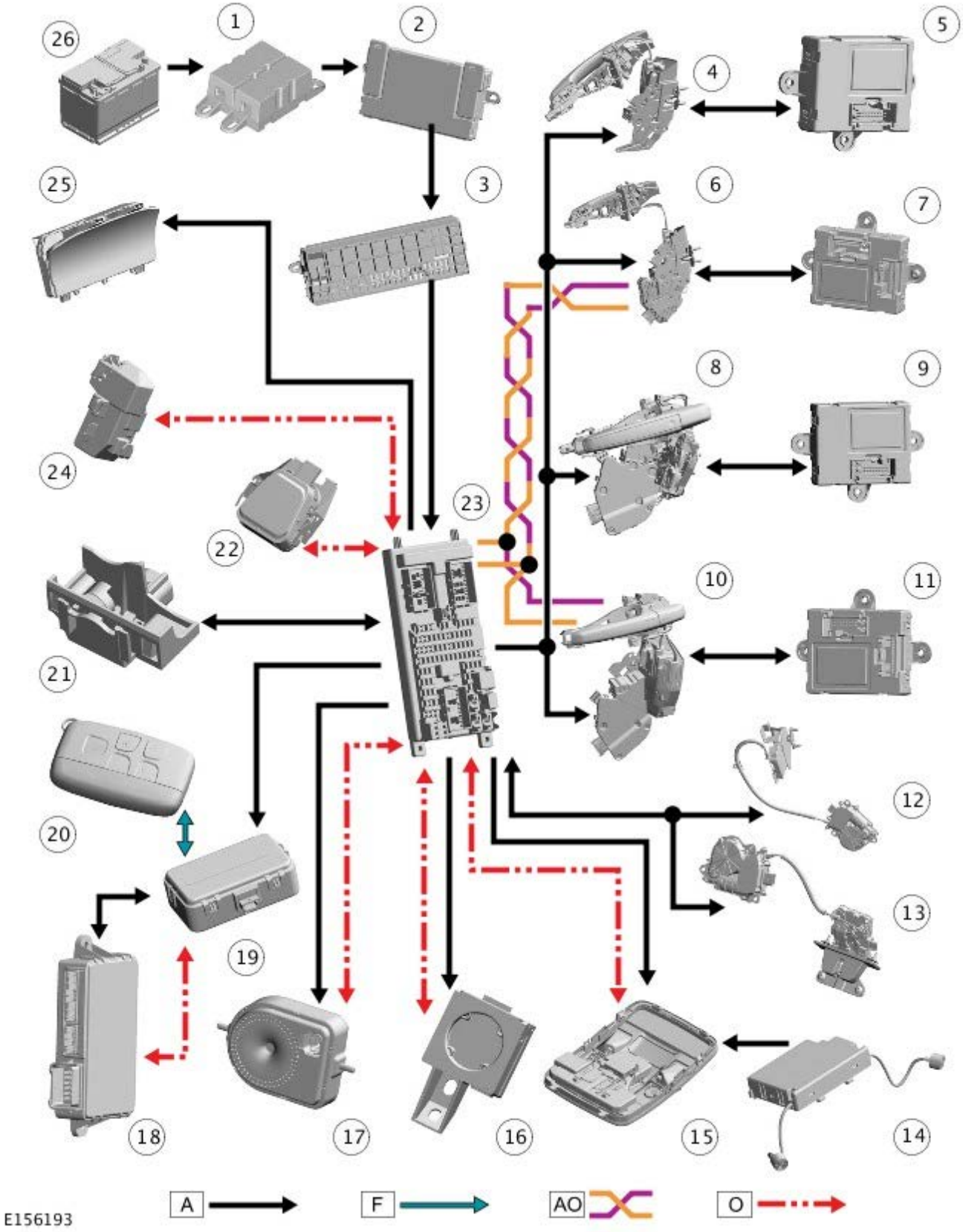
The lock and unlock switches also control a 'lazy' lock and unlock feature which will automatically close or open the windows with an extended press of the applicable switch. This feature is only available in certain markets and is controlled in conjunction with the door modules.

WARNING: Never double lock the vehicle with any person or animal inside.

NOTE: Double locking is only available in certain markets.

The Smartkey contains an emergency access key. This can be used in the event of failure of the Smartkey or the vehicle battery to unlock the vehicle. The left door handle contains a concealed mechanical key barrel which can be used with the emergency key to access the vehicle. This will not disable the perimeter or interior alarm systems which will be activated when the door is opened. To cancel the alarm, the Smartkey must be held next to the IAU and the stop/start switch must be pressed.
For additional information, refer to: Handles, Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

Control diagram



Item	Part Number	Description
1	-	Battery Junction Box 2 (BJB2)
2	-	Battery Junction Box (BJB))
3	-	Rear Junction Box (RJB)
4	-	Rear right door latch mechanism
5	-	Rear right door module
6	-	Front right door latch and mechanism
7	-	Driver Door Module (DDM)
8	-	Rear left door latch and mechanism
9	-	Rear left door module
10	-	Front left door latch and mechanism

11	-	Passenger Door Module (PDM)
12	-	Left tailgate latch
13	-	Right tailgate latch
14	-	Volumetric sensor
15	-	Front overhead console
16	-	Immobilizer Antenna Unit (IAU)
17	-	Battery Back-Up Sounder (BBUS)
18	-	Keyless Vehicle Module (KVM)
19	-	Radio Frequency (RF) receiver
20	-	Smartkey
21	-	Hood latch
22	-	Rain/light sensor
23	-	Central Junction Box (CJB)
24	-	Electric Steering Column Lock (ESCL)
25	-	Instrument Cluster (IC)
26	-	Battery

System operation

PRINCIPLES OF OPERATION

The CJB automatically arms and disarms the active anti-theft system when it operates the Central Locking System (CLS).

On vehicles without a Volumetric sensor, only the perimeter mode is available to monitor the hinged panels and the validity of the Smartkey.

When perimeter mode is active, the CJB monitors panel ajar switches located in the latch mechanisms of the front and rear doors and the tailgate. A separate hood ajar micro switch, located in hood latch mechanism in the engine compartment, monitors the hood status.

When volumetric mode is active, the CJB monitors the interior of the vehicle for movement using a Volumetric sensor located in the front overhead console.

Arming

On vehicles without a Volumetric sensor and a tilt sensor, the active anti-theft system is armed in the perimeter mode when the vehicle is either locked or double locked.

On vehicles fitted with a Volumetric sensor, the system has 2 modes of operation; perimeter mode and volumetric mode.

Perimeter mode

Perimeter mode only monitors the hinged panels and validity of the Smartkey in the start control module. Perimeter mode is activated by a single press of the lock switch on the Smartkey.

Volumetric Mode

Volumetric mode monitors the vehicle interior for intrusion. If the vehicle is fitted with a BBUS, which incorporates a tilt sensor, the vehicle attitude is also monitored when volumetric mode is active. Volumetric mode is activated by a second press of the lock switch on the Smartkey. The second press of the switch must occur within 3 seconds of the first press. The second press of the lock switch also activates the perimeter mode double locking feature.

The CJB arms the active anti-theft system when it locks or double locks the vehicle, providing all the following conditions are met:

- all doors, tailgate and hood are closed
- the CJB is not in transit mode.

When the vehicle has successfully completed its locking routine, confirmation will be given by a single flash of the turn signal indicators to indicate the locked condition. If double locking is activated, then the confirmation will be given by a double flash of the turn signal indicators; one flash for locked and one long flash for double locked.

Mislock

If any doors, tailgate or hood is open when a lock or double lock request is received, the active anti-theft alarm system remains disarmed and the CJB generates a short mislock sound from the vehicle horns or BBUS and the turn signal indicators will not flash. Each attempt to lock will be confirmed by an audible chime being emitted.

When the CJB arms the active anti-theft system, it first enables perimeter mode and monitors the status of the hinged panels. If the vehicle is fitted with a BBUS, an arming signal is sent from the CJB to enable the sounder. If the vehicle is double locked and fitted with a Volumetric sensor, the CJB then sends an arming signal to the module and tilts the sensor when double locked. The CJB ignores the signals from the Volumetric sensor for the first 30 seconds to allow time for the vehicle interior to settle and prevent false alarm activation.

If the tailgate is opened via the Smartkey, the Volumetric sensor and the tilt sensor are inhibited until the tailgate is closed.

Disarming

The CJB will disarm the active anti-theft system to prevent false alarm activation under certain conditions as follows:

- When the active anti-theft system is armed in volumetric mode, if the vehicle battery voltage decreases to less than 9 volts, the CJB will disable the volumetric mode and remain in perimeter mode only. This prevents false alarm activation because the Volumetric sensor cannot operate correctly below 9 volts.
- On vehicles fitted with a BBUS, if the vehicle battery voltage decreases from 9.5 to 9 volts in more than a 30 minute period, the CJB de-activates the BBUS and, if required, will use the vehicle horns to sound an audible alarm trigger warning. This prevents false alarm activation. At voltages below 9 volts, the CJB will not generate the 'heartbeat' signal to the BBUS. The BBUS interprets this as the CJB has been tampered with and activates its sounder. If the battery voltage subsequently rises to more than 9.5 volts, the CJB will re-arm the BBUS.
- If the vehicle is unlocked using the unlock switch on the Smartkey and, within 60 seconds a hinged panel is not opened, the CJB automatically re-locks the vehicle and re-arms the active anti-theft system (if the 'auto re-lock' feature is enabled). This prevents leaving the vehicle unlocked and disarmed by accidental operation of the Smartkey unlock switch.

Alarm

When the alarm is triggered, the CJB activates audible and visual warnings. The audible warnings are produced by the security horns or the BBUS. Visible indications are produced using the turn signal indicators.

The CJB activates the vehicle horns or BBUS and the visual indications for 30 seconds. The activation is stopped for 5 seconds and, if the alarm trigger is still present, the CJB will cycle again for 30 seconds (60 seconds in certain markets). This will be repeated for up to a maximum of 10 cycles (3 cycles in certain markets) of 30 seconds (60 seconds in certain markets) for any one arming period. The CJB will ignore the trigger cause if the 10 cycles (3 cycles in certain markets) have been completed and the alarm trigger is still present or until it receives a disarm signal.

 NOTE: If the BBUS is triggered due to tamper detection, the visual indication using the turn signal indicators is not activated.

The alarm can be triggered by any of the hinged panels being opened, the Volumetric sensor detects a movement inside the vehicle, the tilt sensor detects vehicle movement or an ignition tamper is detected (invalid Smartkey).

Battery Back-Up Sounder

When the CJB arms the active anti-theft system, in either the perimeter mode or the volumetric mode, the CJB sends an arming signal to the BBUS on the LIN bus. When the system is armed in the volumetric mode, the CJB also sends an arming signal to the tilt sensor (if fitted).

 NOTE: If a BBUS is fitted, it is also armed with the perimeter mode lock request. However, the tilt functionality is not enabled in perimeter mode.

On receipt of the arming signals, the sounder and the tilt sensor respond with a status message. If the CJB does not receive the status signals within 12 seconds, the CJB assumes there is a fault and responds with a disarm signal to either the sounder and/or the tilt sensor and stores a related fault code. If the sounder is disarmed when the active anti-theft system is armed and the system is subsequently triggered, the CJB energizes the horn relay and uses the vehicle horns to sound the audible warning in place of the sounder.

When the sounder is armed, the CJB sends a periodic (heartbeat) signal to the sounder which prompts the sounder to monitor the vehicle battery supply and the LIN bus link with the CJB. The sounder will operate if:

- it receives an alarm signal from the CJB or the tilt sensor
- the power supply or the LIN bus link to the CJB is disrupted.

The tilt sensor measures the longitudinal and lateral angle of the vehicle over a range of ±16 degrees from the horizontal. When the active anti-theft system is armed in volumetric mode, the tilt sensor stores the current vehicle angles in its memory and monitors the tilt sensor readings. If the vehicle angle changes in either direction by more than the alarm limit, the tilt sensor activates the sounder.

If the alarm system is active and the battery or the BBUS is disconnected, the sounder will operate without the visual indication of the turn signal indicators flashing.

Global Open/Close

The global open/close feature allows the user to fully raise/lower the windows with a single press of a Smartkey switch. The switch must be pressed and held for more than 2 seconds. Either or both global open/close functions can be disabled using a Land Rover approved diagnostic system.

 NOTE: Remote global close is not available in certain markets, North American Specification (NAS) for example.

Single Point Entry

The single point entry feature only unlocks the driver's door, all other doors remain locked. A single press of the unlock switch on the Smartkey will unlock only the driver's door, a second press is required to unlock the remaining doors and tailgate.

If the vehicle is double locked, the first press of the unlock switch on the Smartkey unlocks the driver's door. The remaining doors revert to the single locked state and can therefore be unlocked using the interior door handles, the Smartkey unlock switch or the unlock switch on the instrument panel switch pack.

Changing from central locking to single point entry can be carried out by pressing the lock and unlock switches on the Smartkey simultaneously. The turn signal indicators will flash to confirm that the function change has been performed.

Drive Away Locking

The drive away door locking feature locks the doors and the tailgate if they are unlocked when the vehicle reaches a certain speed.

On vehicles with automatic transmission, with all the doors, tailgate and hood closed and the gear selector not in 'P' Park or 'N' Neutral position, if the CJB detects, via a High speed CAN (controller area network) message from the ABS (Anti-lock Brake System) module, that the vehicle speed is more than 7 km/h (5 mph), the doors will automatically lock.

On vehicles with manual transmission, with all the doors, tailgate and bonnet closed, if the CJB detects, via a high speed CJB message from the ABS module, that the vehicle speed is more than 7 km/h (5 mph), the doors will automatically lock.

Remote Handset Additional Features

In addition to the lock and unlock switches, the Smartkey has convenience switches.

Panic Alarm

The panic alarm feature allows the user to activate the vehicle alarm system using the Smartkey. The 'panic switch', identified by a triangle symbol, can be pressed 3 times within 3 seconds or pressed and held for more than 3 seconds to activate the panic alarm.

The panic alarm feature can be cancelled after 5 seconds of operation by pressing the triangle symbol 3 times within 3 seconds or pressing and holding for more than 3 seconds.

Global Open/Close

A global open and close feature can be operated from the Smartkey. This feature allows the vehicle windows to be opened/closed by a single press of the lock or unlock switch. The switch must be pressed and held for more than 2 seconds to activate the global open/close feature. The global open/close feature is not available in all markets. The windows must be initialized for the global functionality to work.

Tailgate Release

A tailgate release switch can pressed to unlock and release the tailgate latch only. This will operate with the vehicle locked and alarmed or unlocked. If the vehicle is locked and alarmed, when the tailgate release switch is pressed, the tailgate can be opened without triggering the alarm system. When the tailgate is subsequently closed, the alarm will be re-activated.

Headlamp Convenience

A headlamp convenience switch can be pressed to operate the headlamps to assist departure or approach to the vehicle. A single press of the switch will operate the headlamps for approximately 25 seconds, after which time they will automatically turn off. A second press of the switch will turn off the headlamps if the 25 second period has not been reached. Pressing the stop/start switch within the 25 second period will also turn off the headlamp convenience feature.

Convenience mode

When the vehicle is unlocked using the unlock switch on the Smartkey, the vehicle's electrical system initiates convenience mode. The following systems become active:

- memory - seat adjustment and mirror position
- interior and exterior lighting
- audio system
- IC message center
- horn
- cigar lighter/power socket.

Component description

DOOR MODULES

The door modules provide the interface between the door latch motors, the door and latch switches and the CJB. The door modules provide door micro switch status information and enable the door motors on request from the CJB.

The rear door modules are controlled via the front door modules on the LIN bus. Additionally, the front door modules also control the exterior mirror functions.

CENTRAL JUNCTION BOX

The CJB controls the following functions:

- the horns (as an alarm function)
- the tailgate latch motor and micro switches (including the tailgate external release switch)
- the tailgate ajar switch
- the turn signal indicators
- the fuel filler flap operation.

The CJB also has a connection to the RCM (Restraints Control Module) for automatic operation of the interior lights and the turn signal indicators in the event of an accident.

NOTE: If the CJB is replaced, the new module will require configuring to the master car configuration using a Land Rover approved diagnostic system.

The CJB automatically arms and disarms the active anti-theft system when the vehicle is locked and unlocked after successful confirmation that a valid Smartkey has been used.

Component Description

INSTRUMENT CLUSTER

The IC controls the alarm indicator which is incorporated in the main display in the IC.

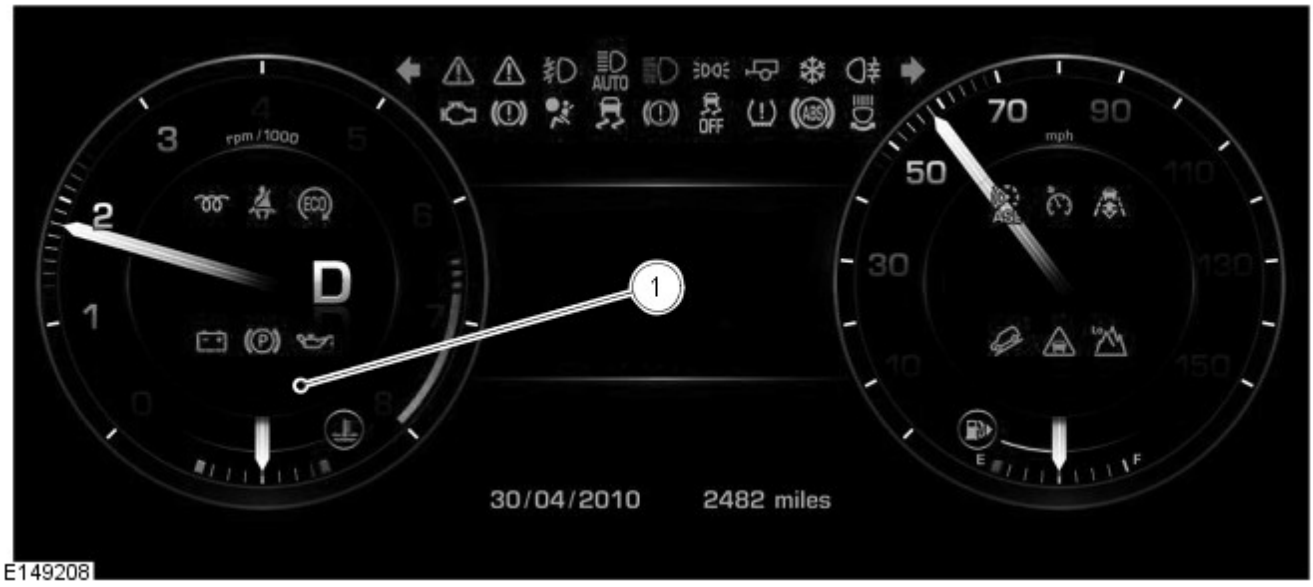
The IC also controls, in conjunction with the CJB, the ECM (Engine Control Module) and the ABS module, the engine immobilization. The ECM controls the engine crank and fuel functions and the ABS module controls the tilt function. The ECM and ABS module communicate to each other after the CJB processes the valid Smartkey information.

Alarm Indicator

The alarm indicator is a LED (Light Emitting Diode) located in the IC. When the ignition is off, the indicator gives a visual indication of the active anti-theft system to show if the alarm system is set or unset.

When the ignition is on, the indicator provides a visual indication of the status of the passive anti-theft (engine immobilization) system. If the immobilization system is operating correctly, the LED will be illuminated for 3 seconds at ignition on and then extinguish.

If a fault exists in the immobilization system, the LED will be either permanently illuminated or flashing for 60 seconds. This indicates that a fault exists and a fault code has been recorded. After the 60 second period, the LED will flash at different frequencies which indicate the nature of the fault.



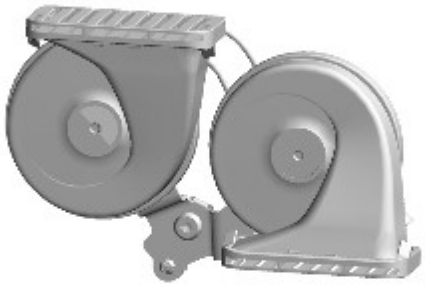
Item	Part Number	Description
1	-	Alarm indicator Light Emitting Diode (LED)

Operation of the alarm indicator is controlled by the IC which varies the flash rate of the LED to indicate the system status of the alarm and the immobilization systems.

Alarm / Immobilization Status	Alarm Indicator Status	Alarm Indicator Function
UNSET	No flash	LED will flash twice quickly with a long interval between and is repeated 10 times. Slow 'active' flash then follows.
SET - with perimeter alarm	Flashing	LED will flash twice quickly with a long interval between and is repeated 10 times. Slow 'active' flash then follows.
SET - with volumetric alarm	Flashing	LED will flash three times quickly with a long interval in between and is repeated 10 times. Slow 'active' flash then follows.

ACTIVE	Flashing	Slow flash once alarm is activated at a frequency of 100ms on and 200ms off.
UNSET - alarm activated during previous SET cycle	Flashing rapidly	LED will flash rapidly until the CJB receives an accessory power mode 4 signal.

VEHICLE HORNS



E149048

The vehicle horns are located above the front bumper armature. The horns are connected directly to the CJB which activates the horns when the alarm is triggered.

Battery Back-Up Sounder (if fitted)



E134262

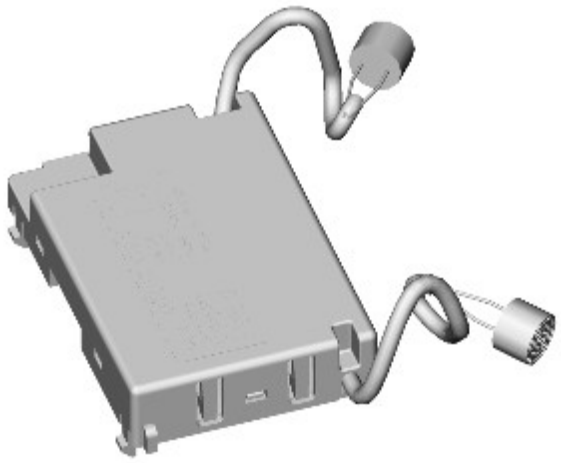
The BBUS is located in the right plenum, in the engine bay. The sounder is only fitted in certain markets.

On vehicles with a BBUS, a tilt sensor is incorporated which monitors the vehicle attitude. The CJB monitors the tilt sensor and can detect if the vehicle is being moved, towed or raised and activate the alarm.

The tilt sensor within the BBUS can be deactivated via the IC options menu to prevent false activations if the vehicle is to be parked on a ferry for example.

Operation of the sounder is controlled by the CJB on a LIN bus. The sounder is also connected with a permanent battery supply via the CJB. An integral, rechargeable battery powers the sounder if the vehicle battery supply from the CJB is interrupted.

Volumetric sensor



E134263

The Volumetric sensor is standard fitment in some markets and available as an option in other markets. It is not available in all markets. The Volumetric sensor comprises two sensors which allow the interior of the vehicle to be monitored. The module is located in a central position in the front overhead console.

The Volumetric sensor is activated with the volumetric mode which in turn is enabled when the vehicle is double locked. The vehicle can be locked and alarmed with the module deactivated if a pet is to be left in the vehicle for example, by single locking the active anti-theft system.

When volumetric mode is active, if the vehicle battery voltage falls to below 9 volts, the CJB will ignore any inputs from the module to prevent false alarm activation

Published: 31-Jul-2012

Anti-Theft - Active - Anti-Theft - Active

Diagnosis and Testing

Principles of Operation

Electric Steering Column Lock (ESCL)

For a detailed description of the anti-theft - active operation, refer to the relevant description and operation section of the workshop manual. REFER to: Anti-Theft - Active (419-01A Anti-Theft - Active, 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

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

Visual Inspection

Mechanical	Electrical
• Start/stop button • Electric steering column lock • Vehicle key	• Fuses • Electrical harnesses • Harness connectors • Vehicle key battery • Central junction box (controls +12 volt supply to electric steering column lock and software logic for electric steering column lock control) • Instrument pack (provides electrical ground circuit to electric steering column lock) • 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 check the system for any logged diagnostic trouble codes (DTCs) and proceed to the DTC index

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: Module Name: Electric Steering Column Lock Control Module (100-00, Description and Operation) /
Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00 General Information, Description and Operation) /
Diagnostic Trouble Code (DTC) Index - DTC: Instrument Cluster (IC) - Conventional display (100-00 General Information, Description and Operation).

Published: 04-Aug-2012

Anti-Theft - Active - Anti-Theft Alarm Horn with Integral Battery

Removal and Installation

Removal

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

Right-hand drive vehicles

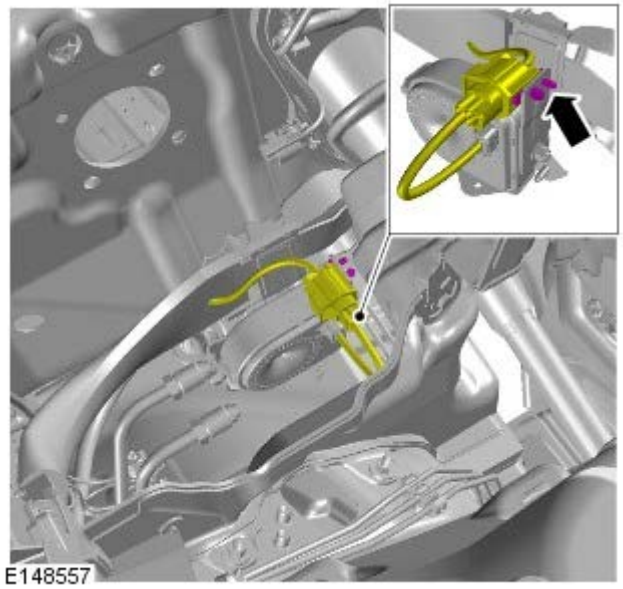
1. Refer to: Brake Booster - RHD (206-07 Power Brake Actuation, Removal and Installation).

Left-hand drive vehicles

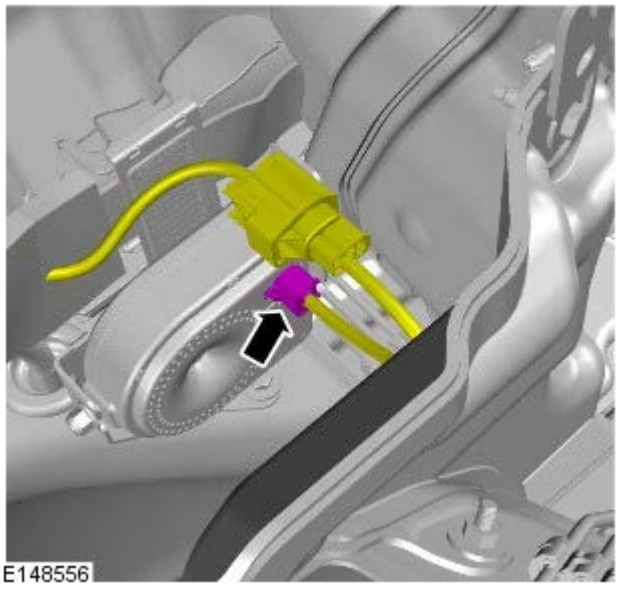
2. Refer to: Secondary Bulkhead Panel RH - TDV6 3.0L Diesel (501-02 Front End Body Panels, Removal and Installation).
   Refer to: Secondary Bulkhead Panel RH - TDV8 4.4L Diesel (501-02, Removal and Installation).
   Refer to: Secondary Bulkhead Panel RH - V6 S/C 3.0L Petrol /V8 S/C 5.0L Petrol (501-02 Front End Body Panels, Removal and Installation).

All vehicles

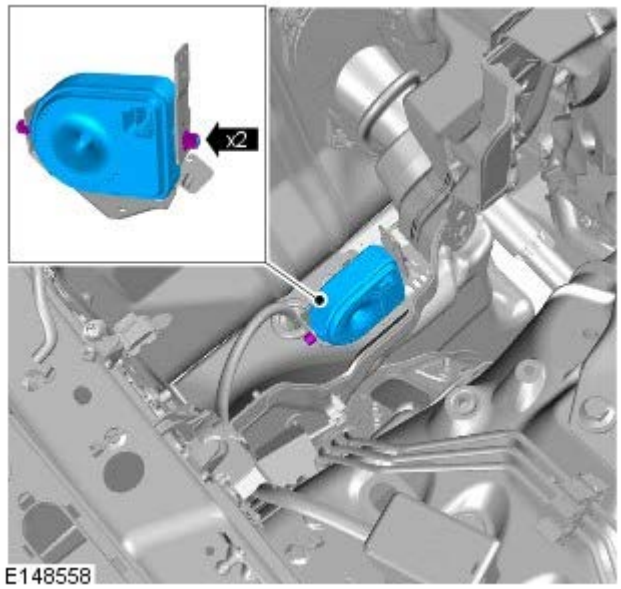
3.



4.



5. *Torque:* 7 Nm



Installation

1. To install, reverse the removal procedure.

Published: 01-Aug-2012

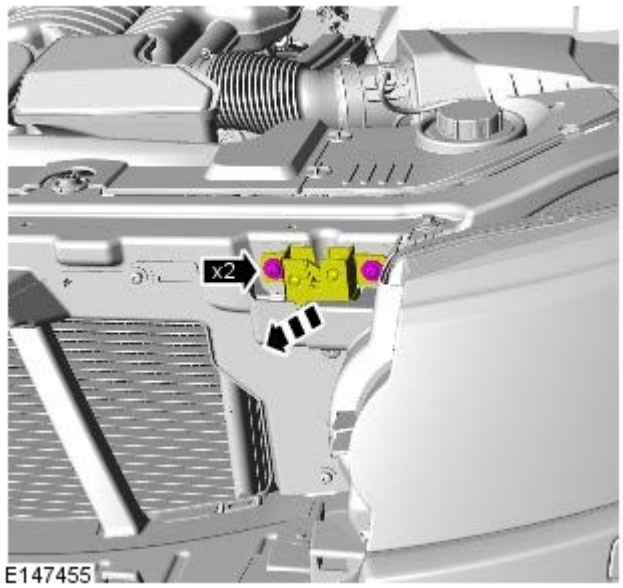
Anti-Theft - Active - Hood Switch

Removal and Installation

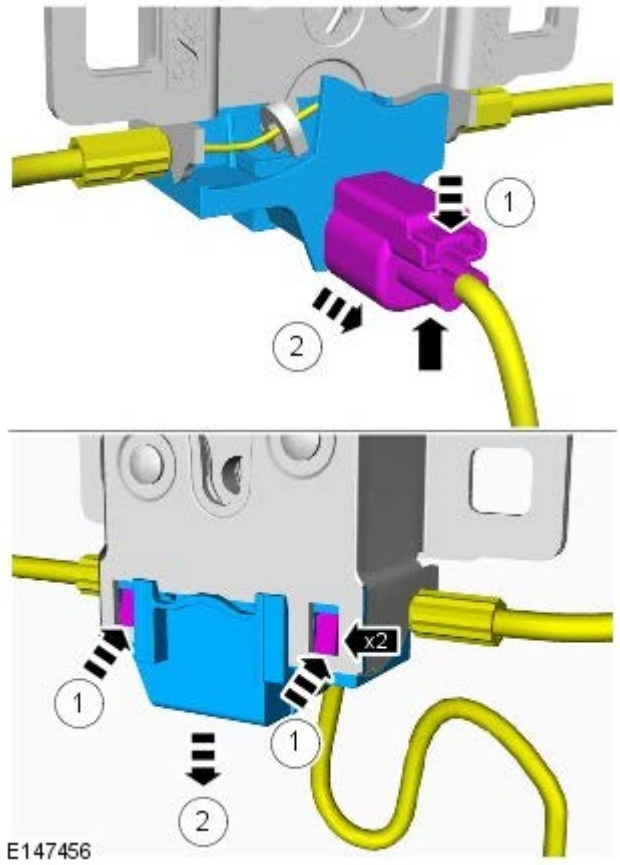
Removal

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

1. Refer to: Radiator Grille (501-08 Exterior Trim and Ornamentation, Removal and Installation).
2. *Torque:* 10 Nm



3.



Installation

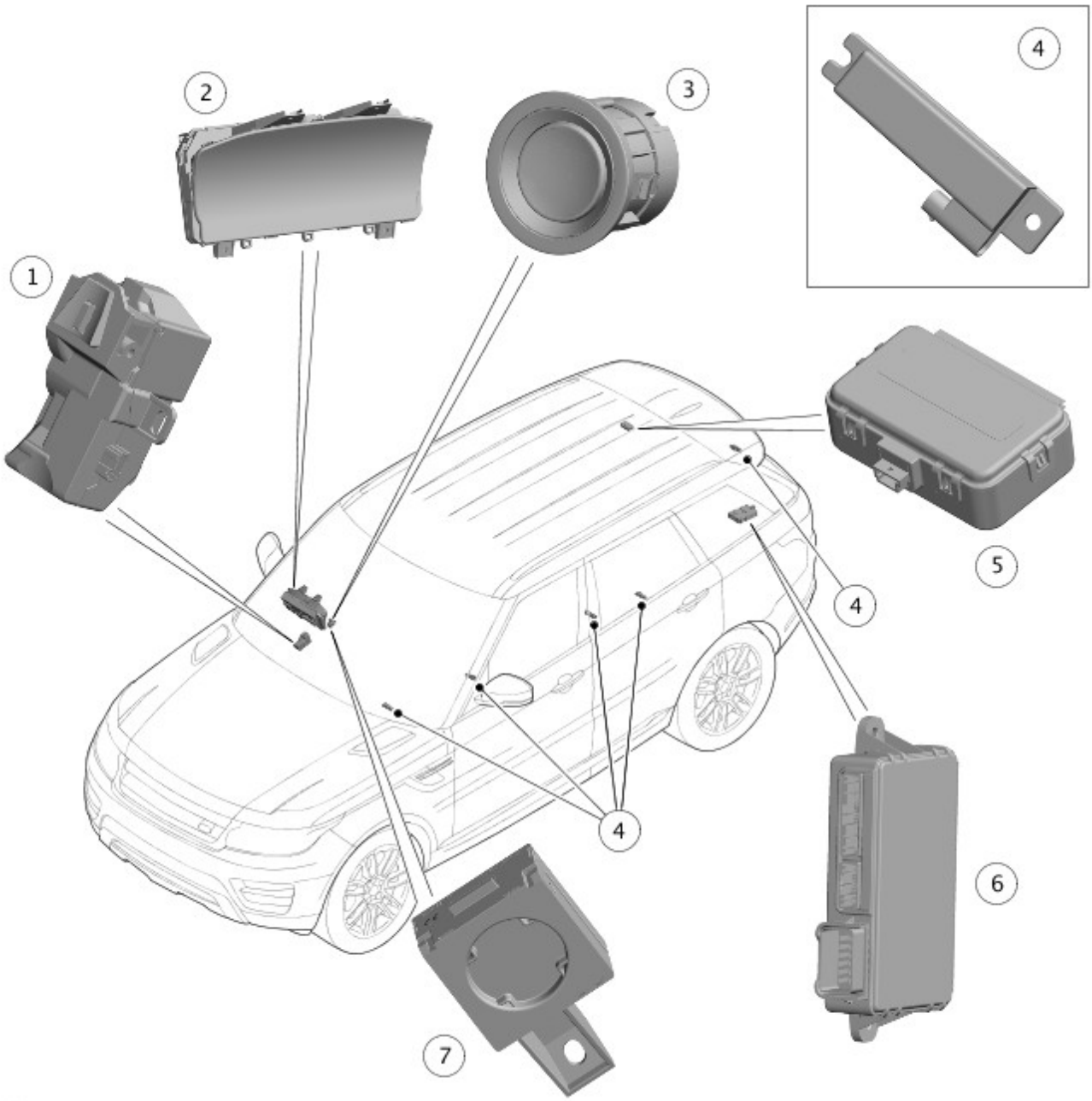
1. To install reverse the removal procedure.
2. Adjust the hood latch.

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Anti-Theft - Passive - Anti-Theft - Passive

Description and Operation

COMPONENT LOCATION



E156271

Item	Part Number	Description
1	-	Electric Steering Column Lock (ESCL)
2	-	Instrument Cluster (IC)
3	-	Stop/start switch
4	-	LF antenna (5 off)
5	-	Radio Frequency (RF) receiver
6	-	Keyless Vehicle Module (KVM)
7	-	Immobilizer Antenna Unit (IAU)

OVERVIEW

Passive Start

The passive start system relies on the detection of a uniquely coded Smartkey via low frequency antennas strategically situated within the vehicle. The antennas ensure the Smartkey is always within the active transmission zone of the antennas wherever the Smartkey 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 Smartkey 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).

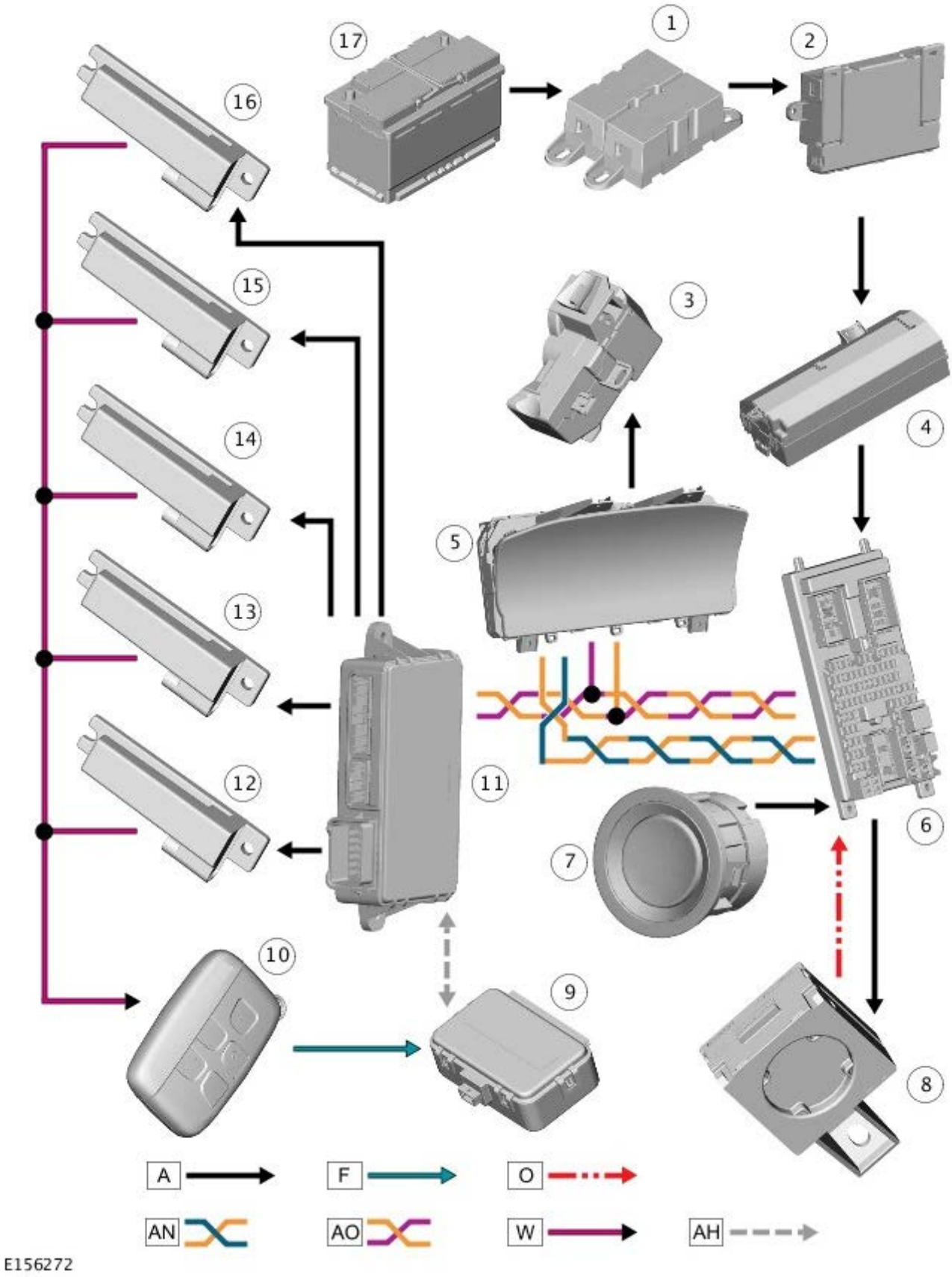
The system provides a secure interface between the CJB (central junction box) and the ECM (engine control module) to prevent unauthorized starting of the engine. This is achieved by immobilization of the engine crank system and the fuel system, using encoded data exchange between the Smartkey and multiple control modules.

Engine starting is initiated when the encoded data exchange between the Smartkey 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 stop/start switch when 'Park' position is selected and the brake pedal is pressed.

Control Diagram

 NOTE: **A** = Hardwired connection; **F** = RF Transmission; **O** = LIN (local interconnect network) bus; **D** = High speed CAN (controller area network) connection; **N** = Medium speed CAN bus; **W** = LF Transmission; **AH** = Serial Communications Link



Item	Part Number	Description
1	-	Battery Junction Box 2 (BJB2)
2	-	Battery Junction Box (BJB)
3	-	ESCL
4	-	Rear Junction Box (RJB)
5	-	IC
6	-	Central Junction Box (CJB)
7	-	Stop/start switch
8	-	IAU

9	-	RF receiver
10	-	Smartkey
11	-	KVM
12	-	LF antenna
13	-	LF antenna
14	-	LF antenna
15	-	LF antenna
16	-	LF antenna
17	-	Battery

Passive Start

At the request of the CJB the KVM prompts each of the internal low frequency antennas to output a signal. When the Smartkey 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 'Smartkey valid' signal to the CJB via the Medium-speed CAN (controller area network) bus.

Once the CJB receives the authorization and confirms the response with an internal calculation, it passes coded data to the IC on the High-speed CAN bus. Upon confirmation from the IC 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 IC only provides a ground for the steering lock motor.

NOTE: Electric Steering Column Lock is market dependent.

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 (FPDM) to operate the fuel pump in conjunction with the ECM.

If the KVM fails to locate the Smartkey, a message 'SMARTKEY NOT FOUND REFER TO HANDBOOK' will appear in the IC message center and the keyless start back-up process will have to be used to mobilize and start the vehicle.

Component Description

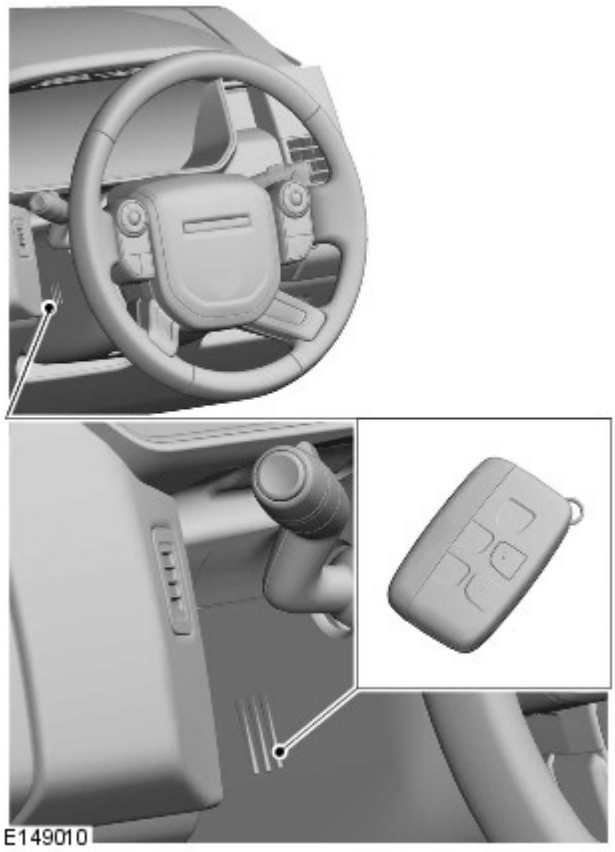
Keyless Start Backup

If the vehicle has been unlocked using the emergency key blade or the Smartkey 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:

- Press the stop/start switch, if the KVM fails to locate the Smartkey, the message 'SMARTKEY NOT FOUND REFER TO HANDBOOK' shall be displayed.
- Position the Smartkey against the lower left side of the steering column, with the buttons facing downwards. The ribs denote actual location of the IAU.
- Press the stop/start switch with the brake pedal depressed to start the engine.

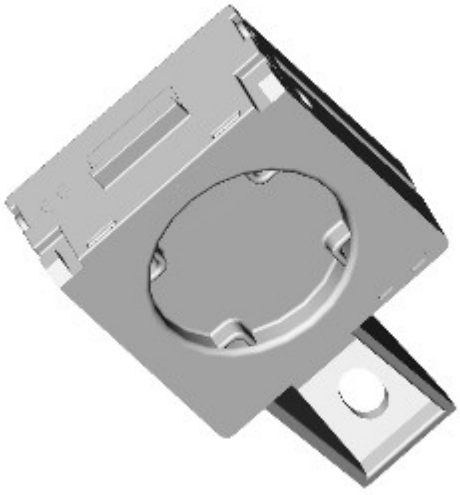
NOTE: If the 'SMARTKEY NOT FOUND WARNING' is no longer displayed (only displayed for 10s), then the sequence would have to be repeated.

Smartkey positioned next to immobilizer antenna unit



This process bypasses the data exchange between the KVM and the CJB. This is an inductive process and will operate even if the battery in the Smartkey is discharged. A transponder within the Smartkey is detected by the IAU. The IAU communicates this code with the CJB via a LIN (local interconnect network) bus connection. The CJB then initiates the vehicle start process in the normal manner.

Immobilizer Antenna Unit



E134665

The IAU is used if the KVM is unable to authorize the Smartkey. If the KVM is unable to identify the Smartkey, for example if the Smartkey battery voltage is low or there is local RF interference, the transponder within the Smartkey can be read in the conventional manner. The driver will be alerted to this by a chime and a message in the IC message center 'SMARTKEY NOT FOUND REFER TO HANDBOOK'.

Low Frequency (Interior) Antennas

Five LF (low frequency) antennas for the passive start system are positioned in specific locations within the vehicle.

The KVM transmits an LF signal via the antennas which is received by the Smartkey. The Smartkey then responds by transmitting a RF signal which is received by the RF receiver and passed to the KVM for authorization.

Keyless Vehicle Module

The KVM controls signal transmissions to and from the Smartkey and provides authorization to allow the vehicle to be started. The module has a Medium speed CAN connection to the CJB for authorizing vehicle starting.

Radio Frequency Receiver

The RF receiver transmission is received from the Smartkey to enable key identification.

Published: 31-Jul-2012

Anti-Theft - Passive - Anti-Theft - Passive

Diagnosis and Testing

Principles of Operation

For a detailed description of the anti-theft - passive system and operation, refer to the relevant description and operation section of the workshop manual. REFER to: Anti-Theft - Passive (419-01B Anti-Theft - Passive, Description and Operation).

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),
Diagnostic Trouble Code (DTC) Index - DTC: Module Name: Keyless Vehicle Module (100-00, Description and Operation).

Published: 02-May-2013

Multifunction Electronic Modules -

Torque Specifications

Description	Nm	lb-ft	lb-in
Driver seat module (DSM) bolts	3	-	27
Keyless vehicle module (KVM) bolts	9	-	80
Front seat retaining bolts	47	35	-

Published: 31-Jul-2012

Multifunction Electronic Modules - Driver Door Module (DDM)

Diagnosis and Testing

Description and Operation

For a detailed description of the driver/passenger door modules, refer to the relevant description and operation sections in the workshop manual.

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

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

Visual Inspection

Mechanical	Electrical
• Check for stuck/jammed switches and buttons • Visibly damaged or worn components • Loose or missing fasteners	• Fuse(s) • Electrical connector(s) • Wiring harness

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 diagnostic trouble codes index

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: Driver/Passenger Door Module (100-00, Description and Operation).

Published: 31-Jul-2012

Multifunction Electronic Modules - Remote Keyless Entry (RKE) Module DTC: Keyless Vehicle Module

Diagnosis and Testing

Principles of Operation - Keyless Vehicle Module (KVM)

For a detailed description of the keyless vehicle module operation, refer to the relevant description and operation sections in the workshop manual.

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

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

Visual Inspection

Mechanical	Electrical
• Misaligned door(s), hood or luggage compartment lid • Door latch(s) • Actuating rod(s) • Exterior door handle(s) • Interior door handle(s) • Door lock cylinder • Cable(s) • Luggage compartment lid exterior release switch	• Fuse(s) • Wiring harness • Electrical connector(s) • Door lock actuator(s) • Remote transmitter batteries • Vehicle battery • Remote transmitter • Door lock switch(s)

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: Module Name: Keyless Vehicle Module (100-00, Description and Operation).

Published: 02-May-2013

Multifunction Electronic Modules - Driver Seat Module (DSM)

Removal and Installation

Removal

WARNINGS:

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

Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.

To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.

To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.

Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

Painting over the driver air bag module trim cover or instrument panel could lead to deterioration of the trim cover and air bags. Do not for any reason attempt to paint discolored or damaged air bag module trim covers or instrument panel. Install a new component. Failure to follow this instruction may result in personal injury.

NOTES:

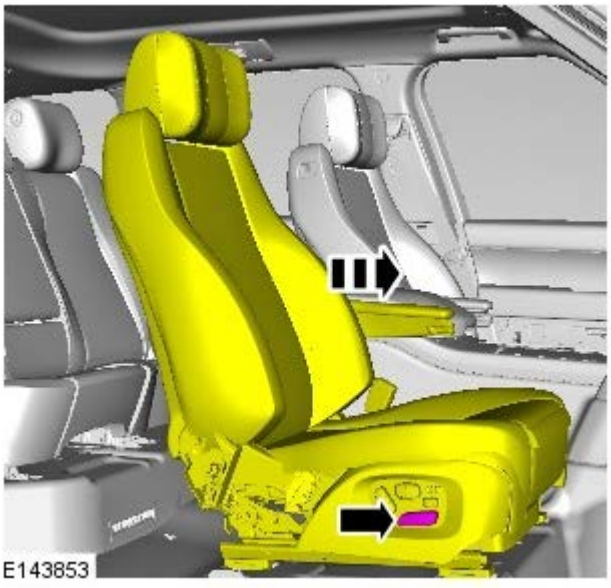
Removal steps in this procedure may contain installation details.

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

1. Make the SRS system safe.

   Refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

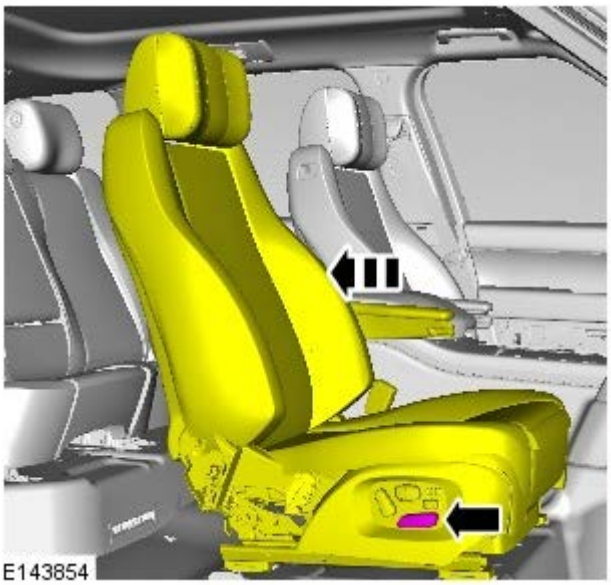
2.



3. *Torque:* 47 Nm



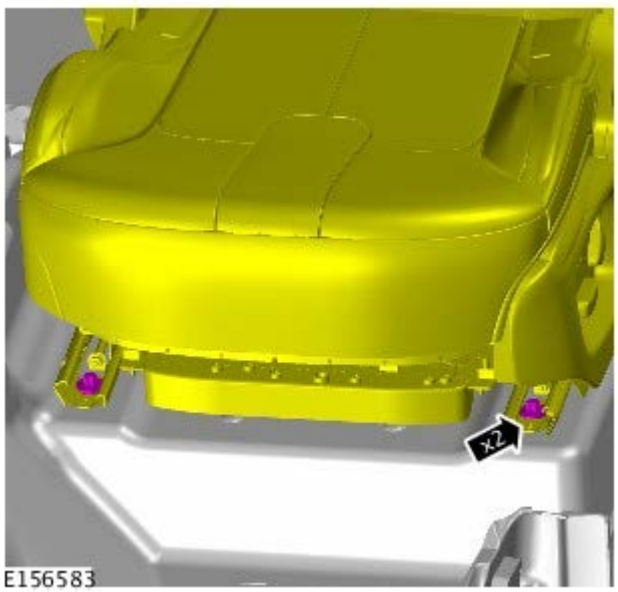
4.



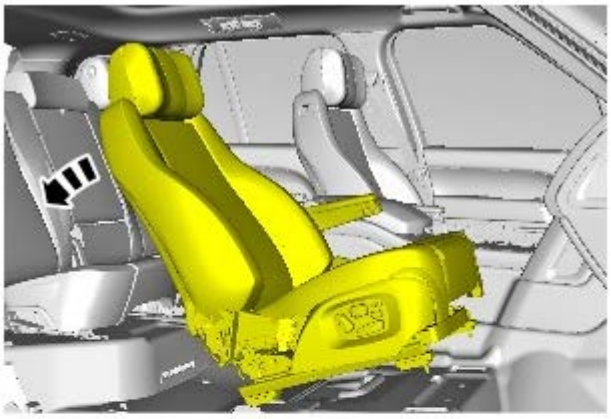
5. Disconnect the battery ground cable.

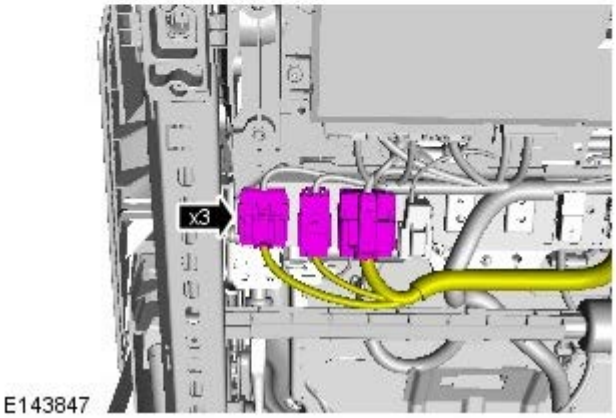
   Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

6. *Torque:* 47 Nm

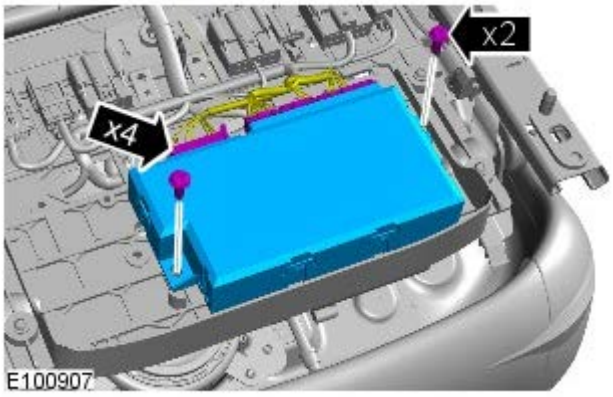


7.





8. *Torque:* 3 Nm



Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Published: 09-Apr-2013

Multifunction Electronic Modules - Front Door Module (FDM)

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

LH illustration shown, RH is similar.

1. Disconnect the battery ground cable.

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

2. Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3.



Installation

1. CAUTION: If a new component has been installed, configure using Land Rover approved diagnostic equipment.

   To install, reverse the removal procedure.

Published: 09-Apr-2013

Multifunction Electronic Modules - Rear Door Module (RDM)

Removal and Installation

Removal

NOTES:

Removal steps in this procedure may contain installation details.

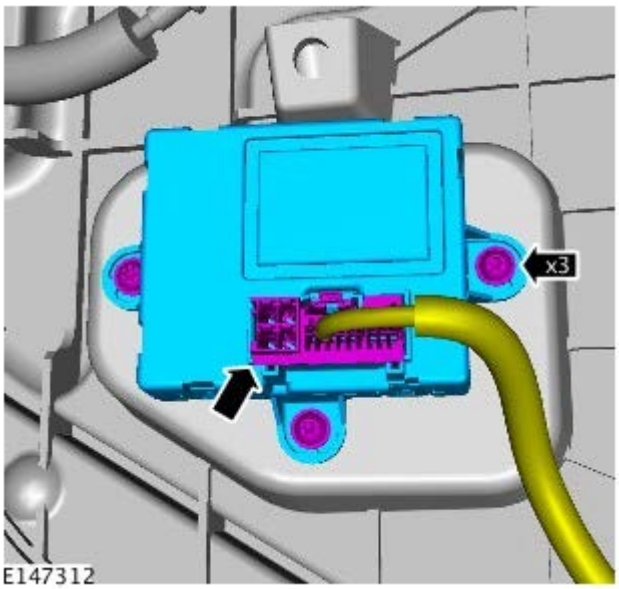
LH illustration shown, RH is similar.

1. Disconnect the battery ground cable.

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

2. Refer to: Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3.



Installation

1. CAUTION: If a new component has been installed, configure using Land Rover approved diagnostic equipment.

   To install, reverse the removal procedure.

Published: 19-Feb-2014

Multifunction Electronic Modules - Keyless Vehicle Module (KVM)

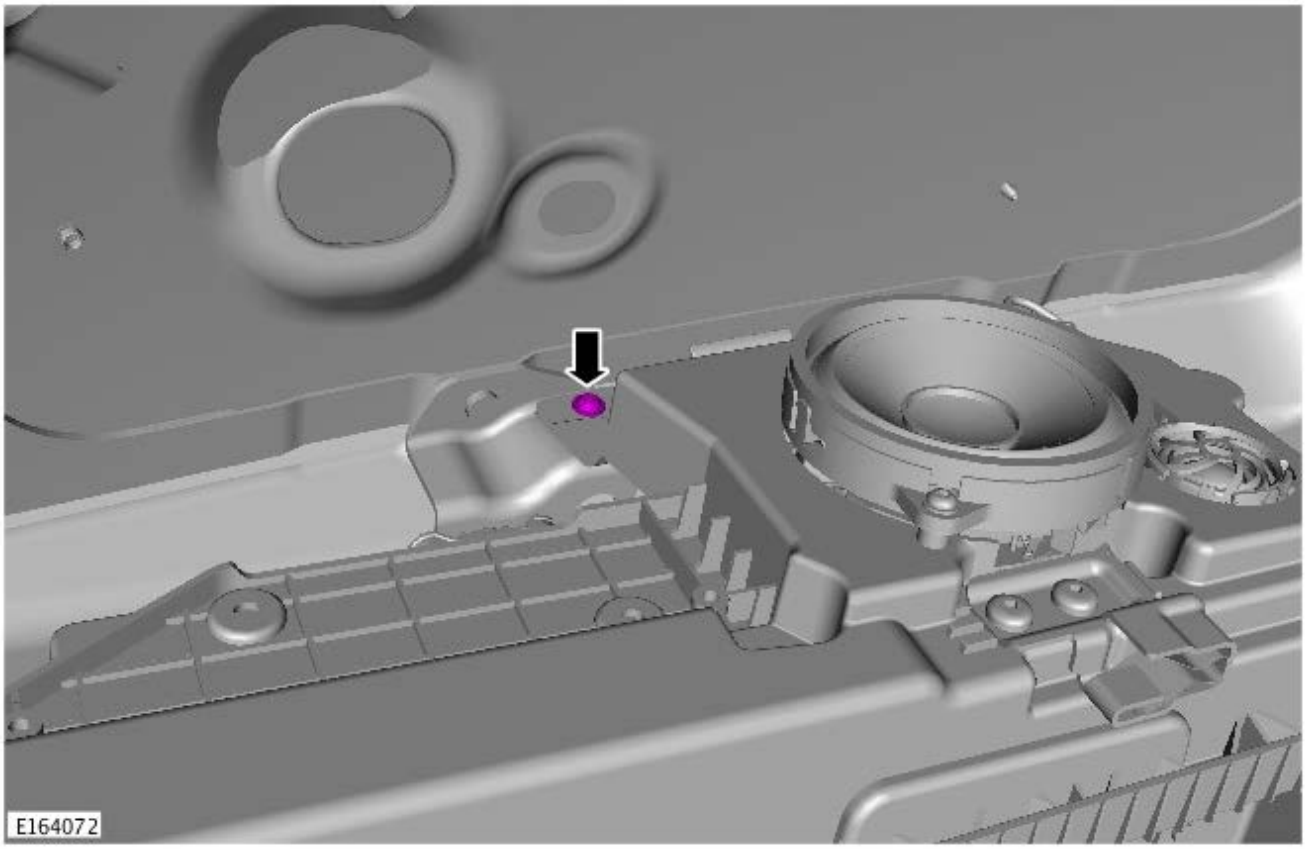
Removal and Installation

Removal

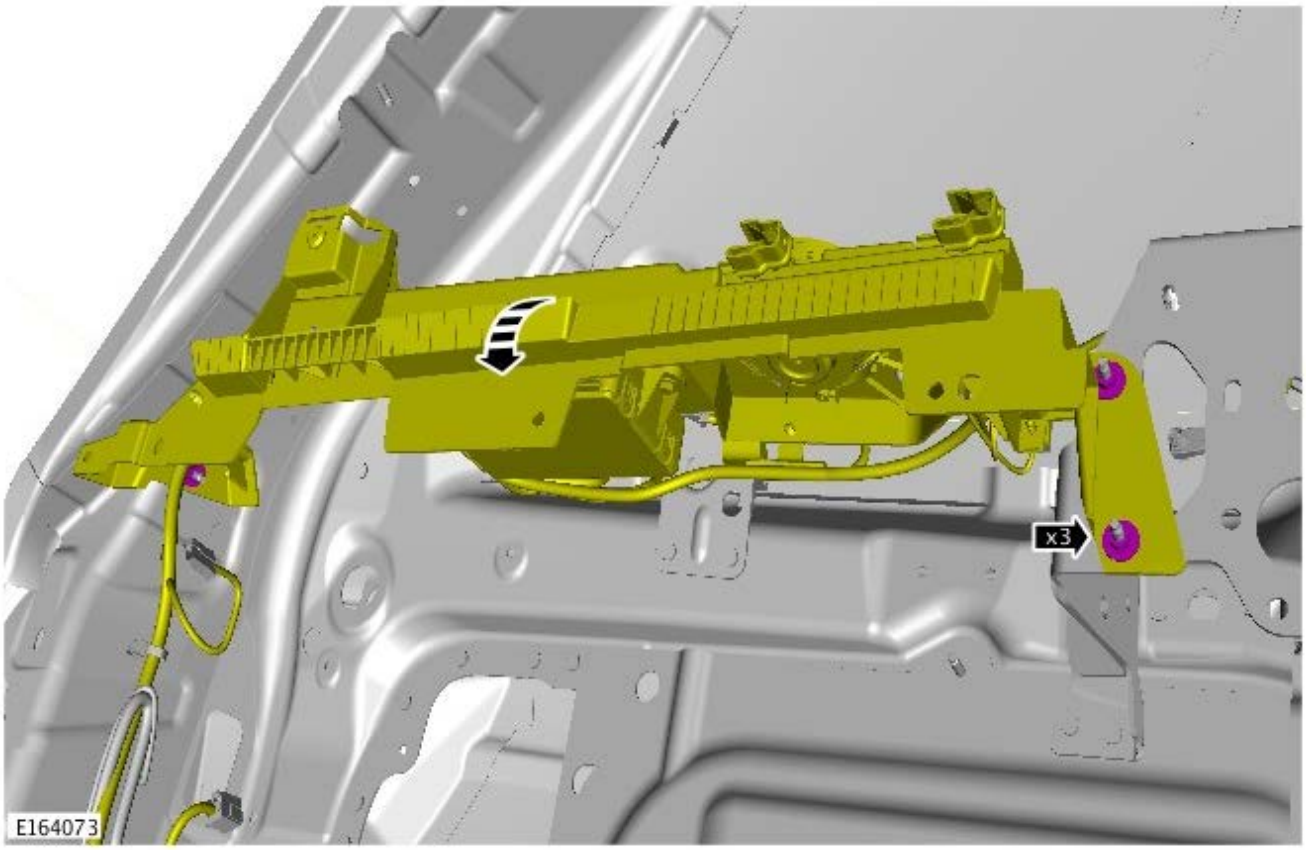
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Luggage Compartment Upper Trim Panel (501-05, Removal and Installation).

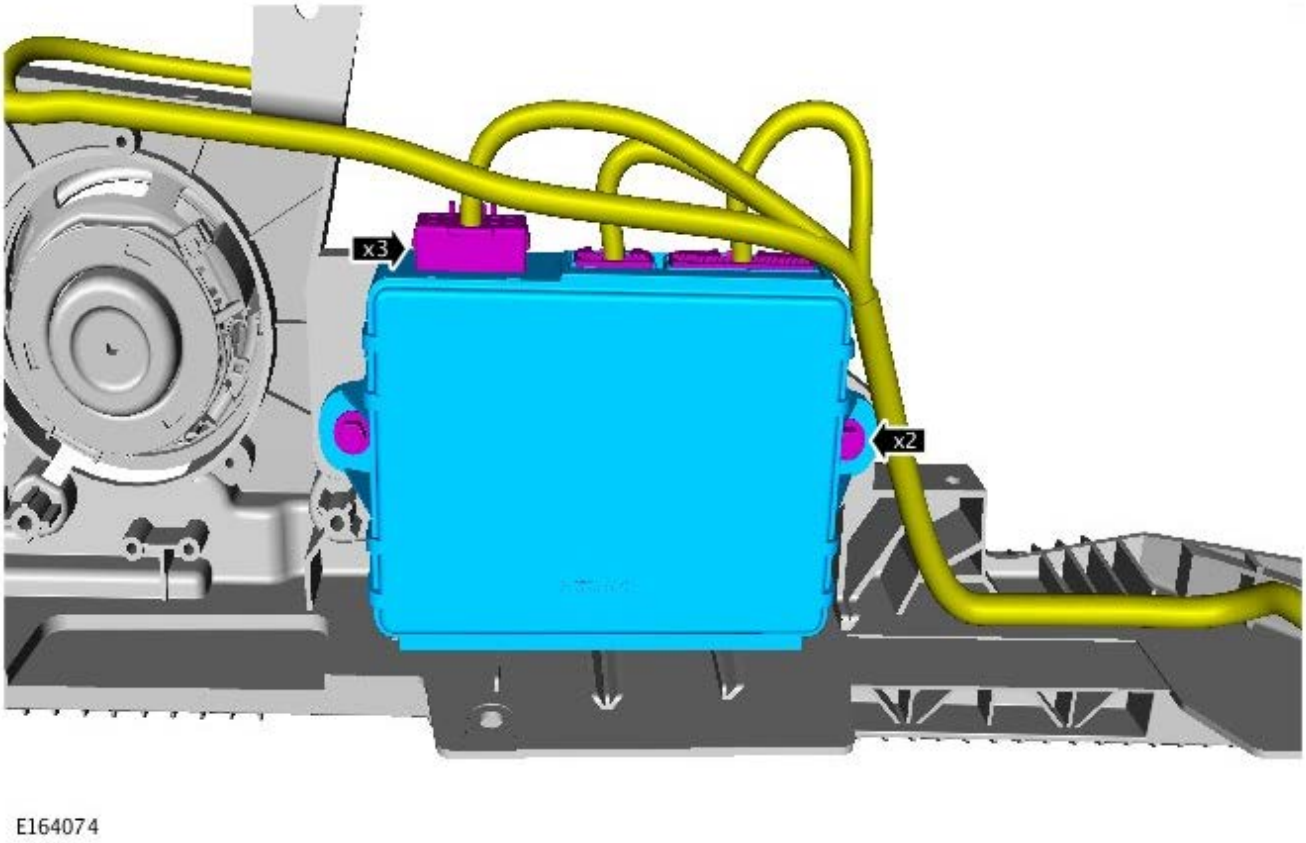
2.



3. *Torque:* 6 Nm



4. *Torque:* 9 Nm



Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.