AIR DISTRIBUTION AND FILTERING

PLENUM CHAMBER (G852137)

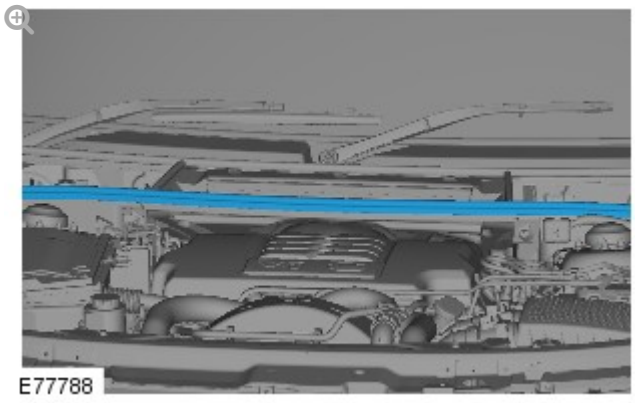
REMOVAL AND INSTALLATION

80.15.62	PLENUM - AIR INTAKE - RENEW	ALL DERIVATIVES	0.2	USED WITHINS	+

REMOVAL

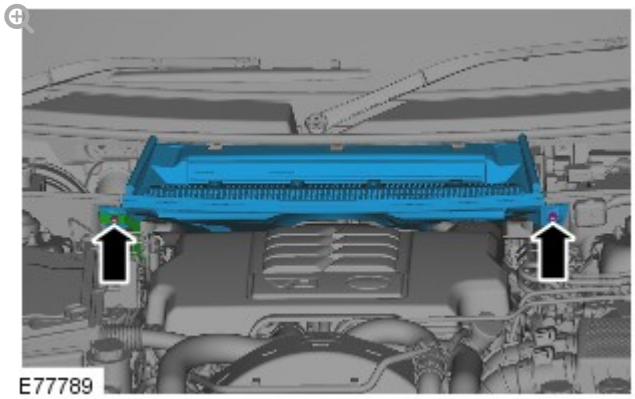
1. Secure the hood in the service position.
   - Release the support struts.

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

3. 

   Remove the hood seal from the plenum chamber.

4.



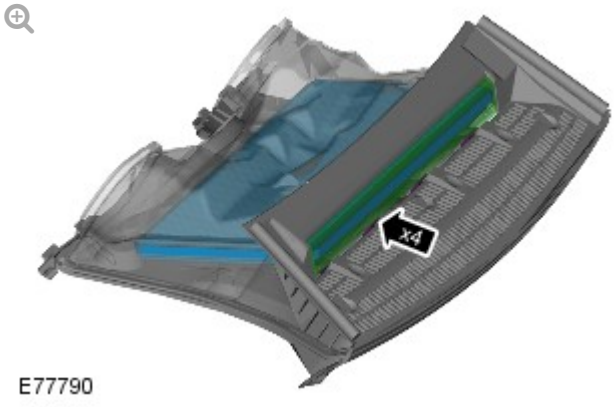
Remove the plenum chamber.

- Remove the 2 nuts.
- Vehicles with diesel engine only: Release the air conditioning (A/C) line bracket.

5.

NOTE:

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



Remove the pollen filter.

- Release the 4 clips.
- Release the pollen filter housing cover.

INSTALLATION

1. Install the pollen filter.
   - Secure the pollen filter housing cover.

2. **NOTE:**

   Make sure that the air inlet seals are fully seated before installation.

   Install the plenum chamber.
   - Vehicles with diesel engine only: Attach the A/C line bracket.
   - Tighten the nuts to 10 Nm (7 lb.ft).

3. Install the hood seal.

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

5. Connect the hood support struts.

2012.0 RANGE ROVER (LM), 412-01

AIR DISTRIBUTION AND FILTERING

UPPER CENTER REGISTERS

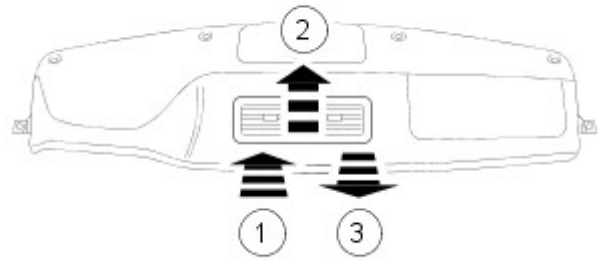
(G909487)

REMOVAL AND INSTALLATION

REMOVAL

1. **NOTE:**

   Take extra care when releasing the clips.



E81597

Remove the upper center registers.

1. Reposition the upper center registers towards the instrument panel.
2. Release the 3 front clips.
3. Release the 2 rear clips.

INSTALLATION

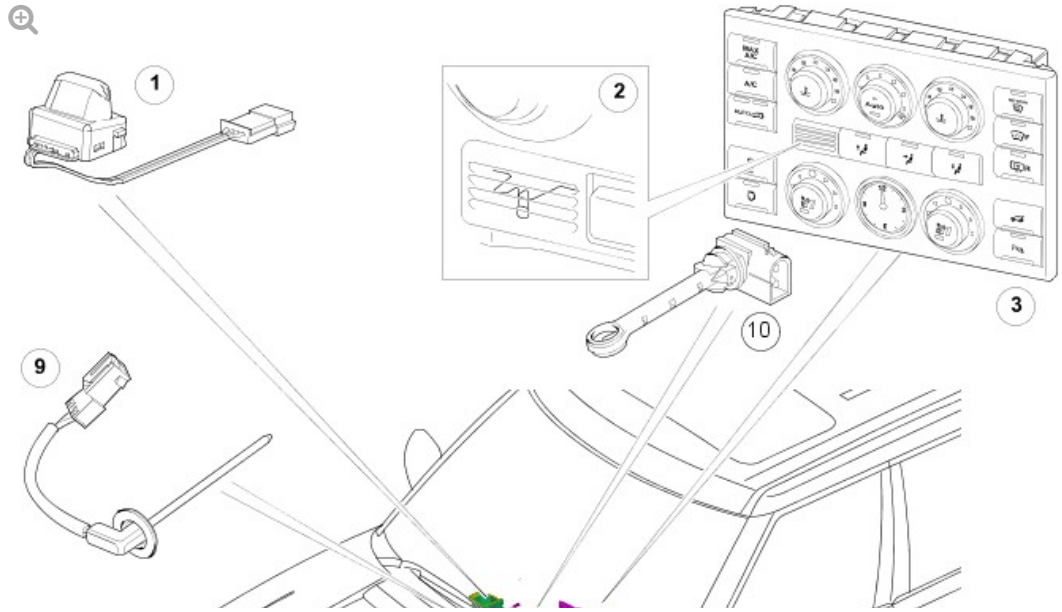
1. Install the upper center registers.
   - Secure the 5 clips.

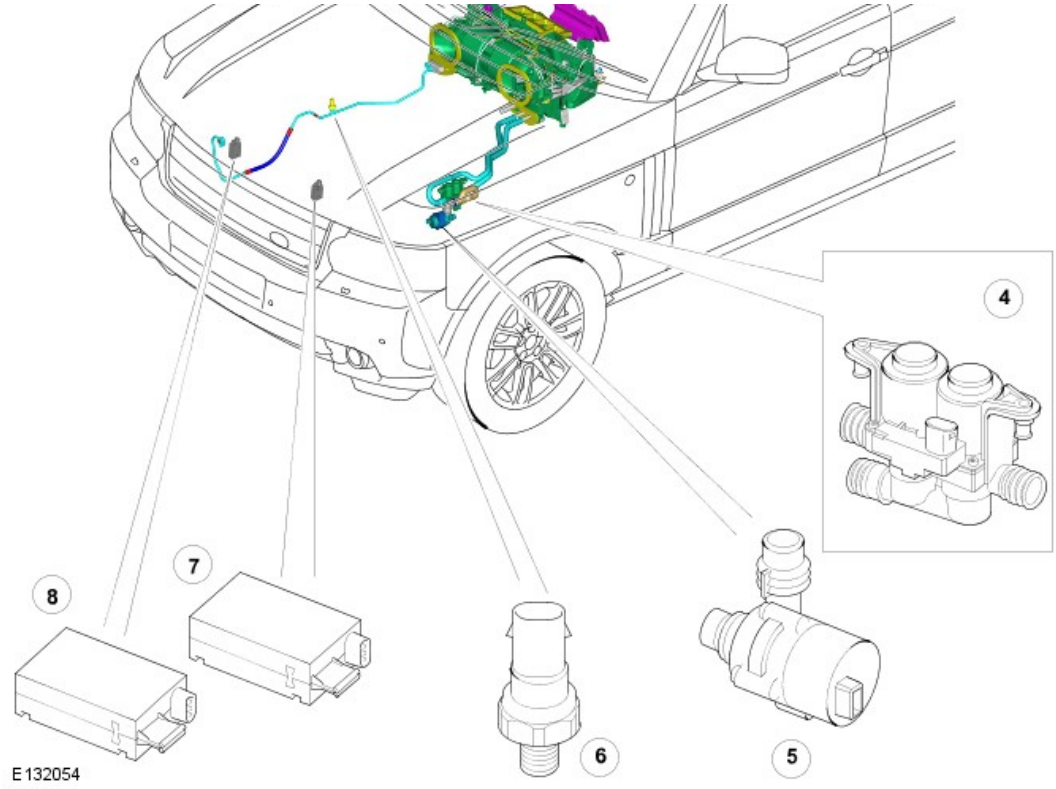
2012.0 RANGE ROVER (LM), 412-01

CLIMATE CONTROL

DESCRIPTION AND OPERATION

COMPONENT LOCATION





ITEM	DESCRIPTION
1	Sunlight sensor
2	In-vehicle temperature sensor
3	automatic temperature control (ATC) module
4	Coolant valve
5	Auxiliary coolant pump
6	Refrigerant pressure sensor
7	Pollution sensor - TdV8
8	Pollution sensor - 5.0L petrol
9	Evaporator temperature sensor
10	Heater temperature sensor

OVERVIEW

The air conditioning (A/C) control system automatically adjusts the temperature, volume and distribution of the air from the heater to maintain the individual temperature levels selected for the left-hand (LH) and right-hand (RH) sides of the cabin. The system also has manual overrides for the

intake air source, blower speed and air distribution.

Some vehicles may be fitted with a 4 zone climate control system.

ATC MODULE

The ATC module is installed in the center of the instrument panel. An integral control panel contains push switches and rotary switches/knobs for system control inputs. Orange tell-tale light emitting diode (LED)s in the switches and switch surrounds illuminate to indicate the current settings of the system. The rotary temperature switch is graduated in degrees Celsius, except on USA vehicles, where it is graduated in degrees Fahrenheit.

An in-vehicle temperature sensor and associated electric fan are installed behind a grille in the control panel.

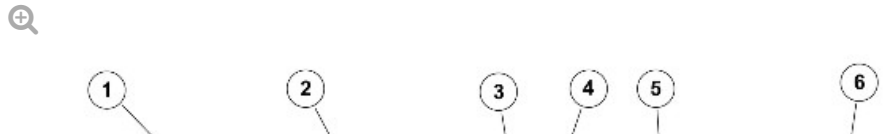
The ATC module processes inputs from the control panel switches and system sensors, then outputs the appropriate signals to control the A/C system. In addition to controlling the A/C system, the ATC module also controls the following:

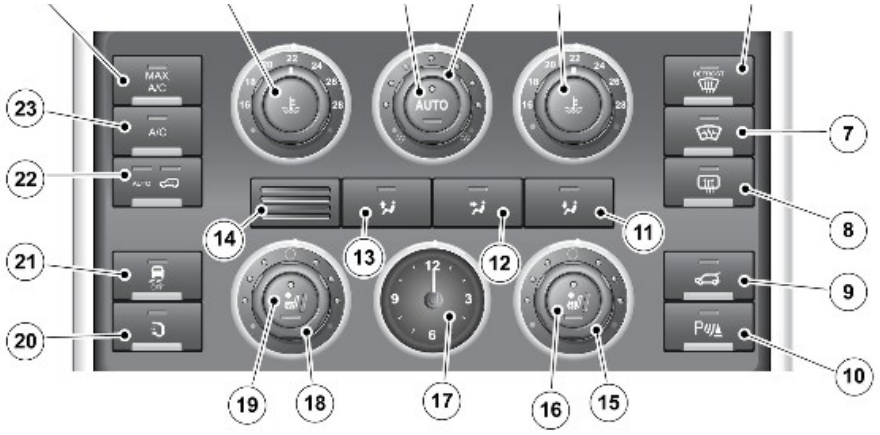
- The heated windshield and windshield wiper parking area heater (optional fit, not available on vehicles with infra red protection glass).
- The windshield washer jet heaters.
- The heated rear window.
- The front seat heaters.

NOTE:

Operation of the climatic seats is controlled by rotary knobs on the ATC module. For further information, refer to the 'Climatic Seats' information later in this section.

CONTROL PANEL





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ITEM	DESCRIPTION
1	Maximum A/C switch
2	LH temperature switch
3	Automatic mode switch
4	Blower switch
5	RH temperature switch
6	Defrost program switch
7	Heated front screen switch
8	Heated rear window switch
9	Tailgate release button
10	PDC (Park Distance Control) switch
11	Footwell distribution switch
12	Face distribution switch
13	Windshield distribution switch
14	In-vehicle temperature sensor
15	RH temperature switch
16	RH Climatic front seat switch
17	Clock
18	LH temperature switch
19	LH Climatic front seat switch

20	Rear system on/off switch
21	DSC (Dynamic Stability Control) switch
22	Air recirculation switch
23	A/C control switch

The switches on the control panel have the following functions:

Heated Windshield Switch

Energizes the heated windshield and the windshield wiper parking area heater for a set time period, until the switch is pressed again or until the engine stops, whichever occurs first. A LED above the switch is illuminated while the heaters are on.

LH and RH Seat Heater Switches

Activates the heater elements in the seat cushion and seat back at one of two heat levels. The first press of the switch energizes the heater elements at the higher heat setting and illuminates two LEDs in the switch. A second press of the switch sets the heater elements to the lower heat setting and extinguishes one of the LEDs. A further press of the switch de-energizes the heater elements and extinguishes the second LED. The seat heaters remain on until selected off or the ignition is switched off.

Enabled only with the engine running.

LH and RH Temperature Switches

Adjusts the nominal temperature settings of the LH and RH sides of the cabin between 16 and 28 °C (60 and 84 °F). The temperature range is engraved on the switch surrounds. A pointer on each switch indicates the selected temperature. In the minimum and maximum temperature positions, the system operates at maximum cooling or maximum heating respectively.

Automatic Mode Switch

Activates the automatic modes for air volume and distribution and also activates the A/C compressor. Separate LEDs in the automatic mode switch illuminate when the blower and the distribution control doors are in

automatic mode. Manually selecting the blower speed or a distribution switch extinguishes the related LED.

Blower Switch

For manual adjustment of blower speed. Up to seven LEDs in the switch surround illuminate to indicate the selected blower speed.

In automatic mode the LED (light emitting diode) does not illuminate.

A/C Switch

Controls activation of the A/C compressor. Allows the A/C compressor to be selected off for economy operation. A LED above the switch is illuminated when the A/C compressor is selected on.

Recirculation Switch

For manual or automatic selection of fresh or recirculated air. Two LEDs above the switch illuminate to indicate the mode and position of the recirculation doors. The first press of the switch sets the recirculation doors to automatic mode and illuminates the LHLED. A second press of the switch manually sets the recirculation doors to the recirculation position, extinguishes the LHLED and illuminates the RHLED. A further press of the switch manually sets the recirculation doors to the fresh air position and extinguishes the RHLED.

Maximum A/C Switch

For selection of maximum A/C when the ignition is on or rest heating when the ignition is off. A LED above the switch is illuminated when maximum cooling or rest heating is selected.

Distribution Switches (Windshield, Face and Footwell)

For manual selection of air distribution in any combination of windshield, face and footwell outlets. A LED above each switch illuminates when a selection is made.

Defrost Program Switch

Activates a program that automatically selects the heated windshield

Activates a program that automatically selects the heated windshield on, activates the A/C compressor and changes the system settings to direct dry heat to the windshield. A LED above the switch is illuminated while the defrost program is active.

Heated Rear Window Switch and Heated Front Screen

Enabled only with the engine running. Pressing the switch energizes the heated rear window for a set time period based on ambient temperature (i.e. stays on longer in cold ambient temperature), until the switch is pressed again or until the engine stops, whichever occurs first. A LED above the switch is illuminated while the heater is on.

INPUTS AND OUTPUTS

Five electrical connectors provide the interface between the ATC module and the vehicle/heater assembly wiring.

The ATC (automatic temperature control) receives all information from EMS via BCM. If the signal is CAN (controller area network) based and it has an associated QF (Quality Factor), then this is what will be stored in RAM (random access memory), so that it will be possible to log via CCP. If the signal is CAN based and lacking a QF, or if the signal is hardwired, then the HVAC s/w must determine the applicable QF value and report this via diagnostics or CCP when requested.

If a fault develops and QF = 0 at start up, then the evaporator sensor signal is used until QF >= 2.

If evaporator temperature sensor is faulty, then a default of 10°C will be used until either sensor QF >= 2.

If ambient temperature sensor QF >= 2 at start up, then during session QF drops to < 2, then the last known "good" value will be used until QF >= 2 again.

IN-VEHICLE TEMPERATURE SENSOR

The in-vehicle temperature sensor is an encapsulated negative temperature coefficient (NTC) thermistor that provides the ATC module with an input of cabin air temperature. The in-vehicle temperature sensor is installed behind

cabin air temperature. The in-vehicle temperature sensor is installed behind a grille in the ATC module control panel. An electric fan in the ATC module runs, to draw air through the grille and across the in-vehicle temperature sensor based on:

If MSCAN-Bus inactiv/active then

- Fan on for 300sec, then switch off.

If Power mode changes to 4, then

- Fan on for 300sec then fan off.

If Power mode changes to 6 and HVAC on, then

- Fan is on.

If Power mode changes to 6 and HVAC off, then

- Fan on for 15sec, then fan off.

If fan off, then fan requested to be on, then

- Wait x sec before fan on.

If Power mode 7, then:

- Fan on regardless of HVAC on/off status.

Fan is not disabled during crank (Power mode 9)

The ATC module uses the signal from the in-vehicle temperature sensor for control of the coolant temperature valve(s), blower speed and air distribution.

The signal voltage from the in-vehicle temperature sensor is between 0 and 5 V. The ATC module monitors the signal voltage and defaults to a temperature of 20 °C (68 °F) if it goes out of the range 0.4 - 4.8 V:

- If the signal voltage is less than 0.4 V, the ATC module assumes there is a short circuit to ground.
- If the signal voltage is more than 4.8 V, the ATC module assumes there is

an open circuit or a short circuit to battery.

REFRIGERANT PRESSURE SENSOR

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

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

The ATC module uses the signal from the refrigerant pressure sensor to protect the system from extremes of pressure and to calculate A/C compressor load on the engine for idle speed control.

For further information, refer to the 'Compressor Control' information later in this section.

EVAPORATOR TEMPERATURE SENSOR

The evaporator temperature sensor is a NTC thermistor that provides the ATC module with a temperature signal from the air outlet side of the evaporator. The evaporator temperature sensor is installed in the RH side of the heater assembly casing, and extends into the core of the evaporator.

The ATC module uses the input from the evaporator temperature sensor to control the engagement and disengagement of the A/C compressor clutch, to prevent the formation of ice on the evaporator.

The signal voltage from the evaporator temperature sensor is between 0 and 5 V. The ATC module monitors the signal voltage and defaults to a temperature of 0 °C (32 °F) if it goes out of the range 0.157 - 4.784 V:

- If the signal voltage is less than 0.157 V, the ATC module assumes there is a short circuit to ground.
- If the signal voltage is more than 4.784 V, the ATC module assumes there is an open circuit or a short circuit to battery.

HEATER TEMPERATURE SENSOR

The heater temperature sensor is a NTC thermistor that provides the ATC module with a temperature signal from the air outlet side of the heater core. Two sensors are installed, one each side of the vehicle center-line.

The ATC module uses the input from the heater temperature sensors to control the operation of the coolant valves.

The signal voltage from each heater temperature sensor is between 0 and 5 V. The ATC module monitors the signal voltage and defaults to a temperature of 55 °C (131 °F) if it goes out of the range 0.173 - 4.890 V:

- If the signal voltage is less than 0.173 V, the ATC module assumes there is a short circuit to ground
- If the signal voltage is more than 4.890 V, the ATC module assumes there is an open circuit or a short circuit to battery.

AUXILIARY COOLANT PUMP

The auxiliary coolant pump is an electric pump that ensures there is a satisfactory flow rate through the heater core at low engine speeds. The auxiliary coolant pump is installed in the engine compartment, in a rubber mounting attached to the side of the LH suspension turret. Operation of the auxiliary coolant pump is controlled by a power supply from the ATC module.

COOLANT VALVES

The coolant valves control the coolant flow to each side of the heater core. The coolant valves are installed in the engine compartment on a bracket attached to the side of the LH suspension turret.

Each coolant valve is a normally open solenoid valve controlled by a pulse width modulation (PWM) signal from the ATC module. The ATC module changes the length of time the coolant valve is open each duty cycle between 0 second (valve closed) and 3.6 seconds (valve held open). On the

between 0 second (valve closed) and 5.0 seconds (valve held open). On the automatic system, the PWM signals to the two valves are phase offset by 1.8 seconds to reduce coolant flow fluctuations.

SUNLIGHT SENSOR

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

If one of the photoelectric cells is faulty, the output from the other photoelectric cell is used for both sides of the vehicle. If both photoelectric cells are faulty, the ATC module uses a default value of zero.

POLLUTION SENSOR

The pollution sensor allows the ATC module to monitor the ambient air for the level of carbon monoxide (CO) and oxides of nitrogen (NOx). The pollution sensor is installed at the rear of the radiator, on the upper left side of the fan cowl.

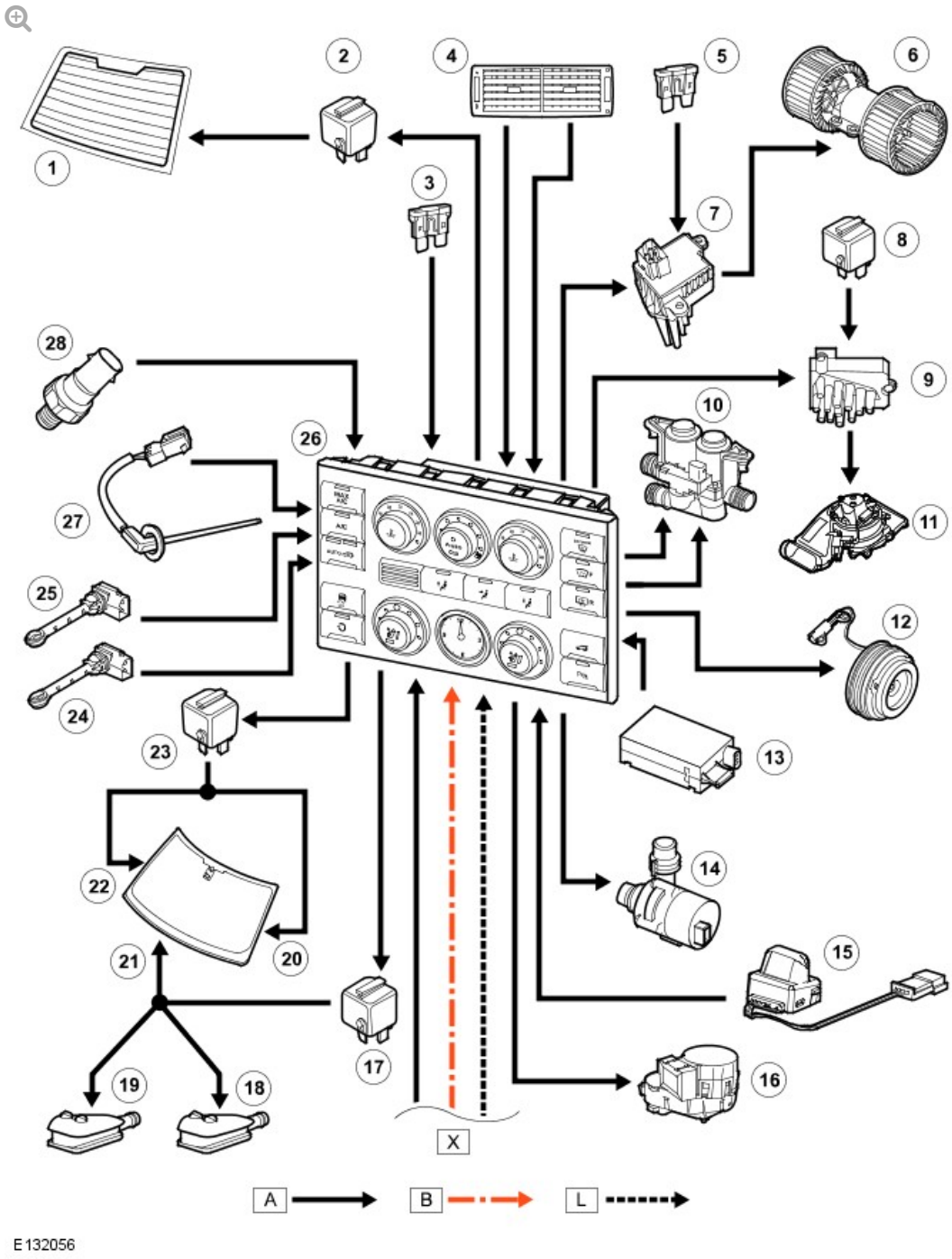
The ATC module outputs a battery power supply to heat the pollution sensor to operating temperature, and a 5 V reference voltage for the signal. The signal voltage from the pollution sensor is between 0 and 5 V.

If there is a fault with the pollution sensor, the ATC module disables automatic closing of the recirculation doors on detection of pollutants.

CONTROL DIAGRAM – SHEET 1 OF 2

NOTE:

A = Hardwired; **B** = MSCAN; **L** = LIN bus



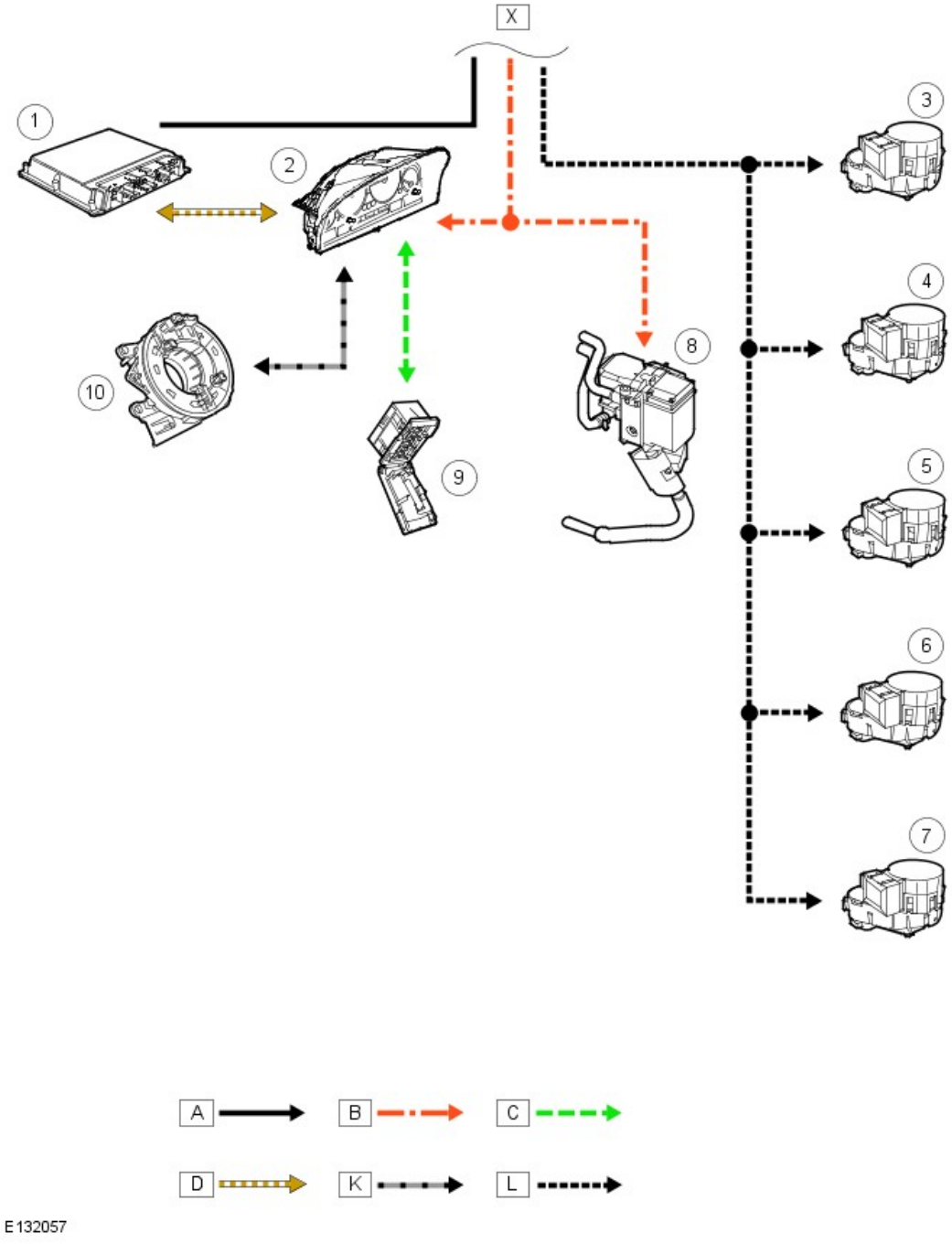
ITEM	DESCRIPTION
1	Heated rear window
2	Heated rear window relay
3	Fuse 12, central junction box (CJB)
4	Rear passenger face register
5	Fuse 64, CJB
6	Blower
7	Blower output stage

7	Blower output stage
8	Rear blower relay
9	Rear blower output stage
10	Dual coolant valve
11	Rear blower
12	Compressor clutch only on 3.6L TDV8
13	Pollution sensor
14	Auxiliary coolant pump
15	Sunlight sensor
16	Fresh/Recirculated air doors motor
17	Washer jet heater relay
18	LH washer jet
19	RH washer jet
20	Heated windshield, LH heater element
21	Heated windshield, wiper park heater element
22	Heated windshield, RH heater element
23	Heated windshield relay
24	RH heater temperature sensor
25	LH heater temperature sensor
26	ATC module
27	Evaporator temperature sensor
28	Refrigerant pressure sensor

CONTROL DIAGRAM – SHEET 2 OF 2

NOTE:

A = Hardwired; **B** = K bus; **C** = Diagnostic DS2 bus; **D** = High speed controller area network (CAN) bus; **K** = I bus; **L** = M bus;



ITEM	DESCRIPTION
1	engine control module (ECM)
2	Instrument cluster
3	Windshield distribution motor
4	Face level distribution motor
5	Footwell distribution motor
6	Rear face level temperature blend motor
7	Ram air motor
8	Fuel fired booster heater

9	Diagnostic socket
10	Clockspring

PRINCIPLES OF OPERATION

The system operates on the reheat principle. Air entering the heater assembly is cooled to a constant value by the evaporator and then reheated as necessary by the heater core to produce the temperature(s) selected on the control panel.

To determine the various system settings, the ATC module derives a reference value (called the Y factor) from:

- The temperature setting on the control panel.
- The ambient temperature.
- The in-vehicle temperature.

The reference value is measured in %, where -27.5% means maximum cooling is required and 100% means maximum heating is required. Separate reference values are produced for the LH and RH sides of the heater assembly.

The reference value is used for temperature control. The driver's side reference value is also used for door positioning and blower speed calculations.

When the ignition is turned off the ATC module memorizes the system settings and resumes the same settings the next time the ignition is switched on.

A/C COMPRESSOR CONTROL

There are 2 types of compressor:

- Internally controlled, clutched compressor (3.6L TDV8)
- Externally controlled, clutchless compressor (5.0L AJ133 NA/SC)

The A/C compressor is engaged by pressing either;

- the automatic mode switch
- the defrost switch
- the A/C switch
- or the maximum A/C switch.

INTERNALLY CONTROLLED CLUTCHED COMPRESSOR

This type of compressor uses a variable swash plate to vary to the displacement of the A/C (air conditioning) compressor which improves efficiency. This is achieved by reducing the displacement when the difference between the suction and discharge pressures in the A/C compressor as small.

The only external control of this device is a magnetic clutch which is controlled by the HVAC ECU. It is used to engage/disengage the compressor from the engine. The clutch is driven directly from the HVAC ECU via a high side power FET.

The software include an A/C off delay (10s) to prevent the rapid cycling of the clutch if a customer quickly presses the A/C button multiple time.

The following are the conditions will inhibit the A/C.

- Low ambient Temperature (Off at <-2DegC, On at > 2DegC)
- Low A/C Pressure (Off at <1.5Bar, On at > 2.5Bar)
- High A/C Pressure (Off at >20Bar, On at < 28Bar)
- Climate System Off/Blower zero
- Engine Off
- Engine Inhibit (due to high coolant, engine limp home, wide open throttle etc)
- Low evaporator temperature

The evaporator cut-off threshold is dependent on ambient, i.e. the lower the ambient, the higher the cut-off. The inhibit will be removed when the evaporator temp has recovered by 2Kelvin over the cut-out temp threshold.

EXTERNALLY CONTROLLED CLUTCHLESS COMPRESSOR

This type of compressor uses a variable swash plate to vary the displacement but this time it is indirectly controlled by the HVAC ECU. A small solenoid inside the compressor moves a spring which controls the displacement. The HVAC ECU controls this solenoid via a high side drive FET. The valve is a current controlled device which means the HVAC ECU include a current shunt in the drive circuit to measure the current being drawn by the device. The current is reduced by reducing the duty of the 400Hz PWM (pulse width modulation) control signal to the valve.

The HVAC ECU includes a complex algorithm to calculate the required duty by using a PID controller. It adjusts the PWM signal to try to get the measured evaporator sensor temperature to be the same as the target evaporator temperature.

The conditions for turning off the A/C are the same as the internally controlled except that the compressor duty is reduced rather than cut straight away which leads to a more refined control.

ENGINE IDLE SPEED CONTROL

There are 3 levels and the request from HVAC is set in both hot and cold ambients.

In hot ambients, the feature is to help with A/C performance by raising the A/C compressor speed and in cold ambients to help with cabin warm-up by increasing the engine speed.

The request is only sent when the climate system is on and engine is running. Otherwise the request is zero.

The 3 speeds are:

- Level 1 = 750rpm
- Level 2 = 900RPM
- Level 3 = 1200RPM

The speed thresholds are held in PCM and operate in both Neutral and Drive mode.

Also there is a piece of code to increase to level 2 if the A/C pressure jumps

to more than 20Bar as this means the A/C is struggling and needs an increased engine idle to help by increasing the A/C compressor speed and the viscous cooling fan speed.

ENGINE COOLING FAN CONTROL

The HVA C ECU calculates the requested cooling fan speed to PCM. The request is HVAC, and calculated based on ambient temperature, A/C pressure and then is compensated for vehicle speed. The request is only sent if the HVAC is switched on, A/C is on and engine is running.

The cooling fan demand (0..100%) has a rate limiter and includes a delay if the A/C is switched off.

A/C TORQUE CALCULATION

The torque used by the A/C system is calculated in the PCM. The PCM uses ambient temp, A/C pressure and A/C compressor displacement control valve current as inputs to determine the torque on the engine.

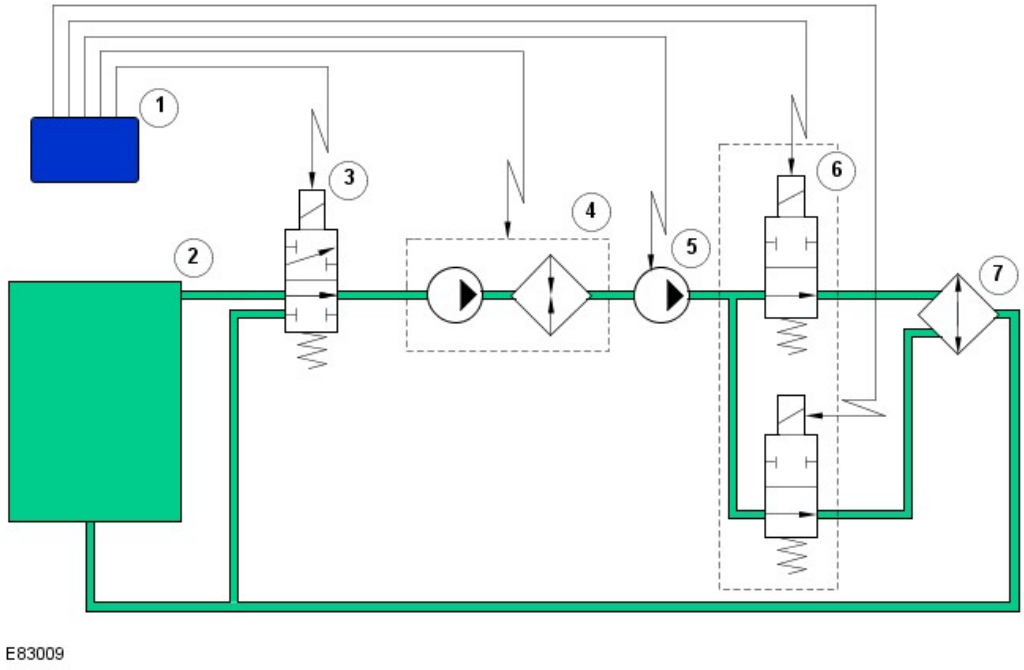
TEMPERATURE CONTROL

To determine the amount of heat required, in the form of coolant flow through the heater, the ATC module compares the reference value with the heater temperature and incorporates a correction factor to compensate for changes of coolant flow rate with engine speed. From the resultant value the ATC module determines the open duration of the coolant valve and outputs the appropriate control signal. On the automatic system, separate values and output signals are generated for each coolant valve to produce the individual temperature control for the LH and RH sides of the cabin.

When the temperature setting on the control panel is set to maximum, the ATC module signals the coolant valve to remain open. When the temperature setting on the control panel is set to minimum, the ATC module signals the coolant valve to remain closed.

On the automatic system, the minimum setting is over-ridden when the defrost program, maximum A/C, rest heating or fuel fired booster heater functions are selected.

Heater Coolant Circuit



ITEM	DESCRIPTION
1	Heater core
2	Coolant valves
3	Auxiliary coolant pump
4	Engine cooling system
5	ATC module
6	Changeover valve (where fitted)
7	Fuel fired booster heater (where fitted)

DOOR CONTROL

The position of the ram air doors is automatically controlled by the ATC module. The positions of the recirculation doors and the distribution doors are either automatically controlled by the ATC module or manually controlled by the related switches.

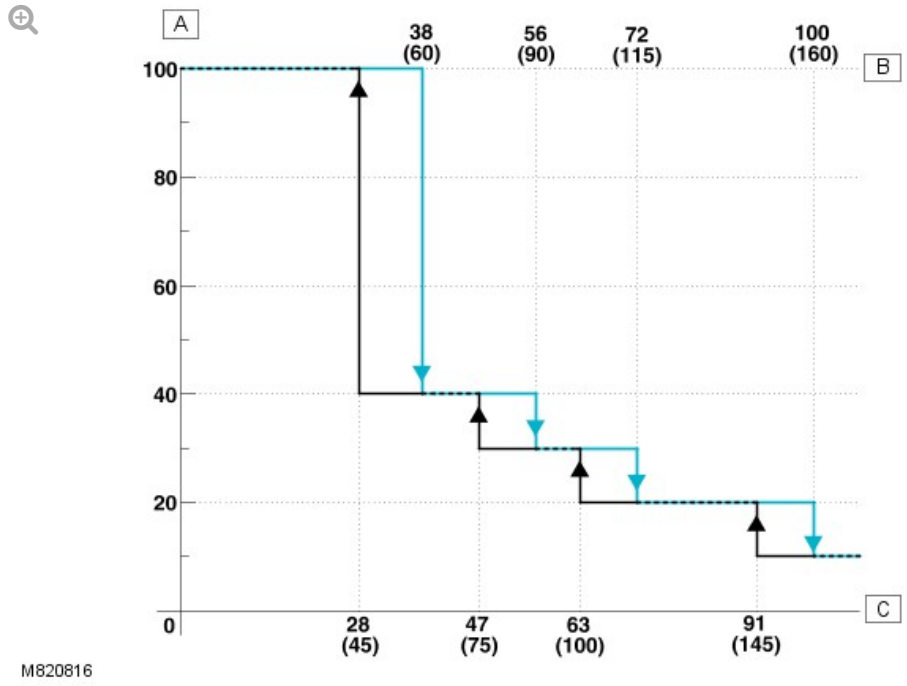
Ram Air Doors

The ATC module progressively closes the ram air doors, in four steps, as vehicle speed increases, and opens them again as vehicle speed decreases. At the maximum closed position, 90% of the fresh air inlet area is closed off. A hysteresis of 15 km/h (9 mph) prevents the ram air doors from hunting at a constant vehicle speed.

Ram Air Door Positions

NOTE:

A = Door position, % open; **B** = Opening speeds, mph (km/h); **C** = Closing speeds, mph (km/h)



Recirculation Doors

Unless the recirculation doors are manually selected closed, using the recirculation switch on the control panel or the steering wheel recirculation switch (where fitted), they are normally open, but automatically closed by the ATC module under certain conditions:

Rapid Cooling: For rapid cooling of the cabin, when the A/C system is selected on, if the driver's side reference value is less than -20% and the

ambient temperature is more than 6 °C (43 °F), the ATC module closes the recirculation doors. The ATC module opens the recirculation doors after 12 minutes (temperate climates) or 20 minutes (hot climates), if the driver's side reference value increases to more than -5% or if the ambient temperature decreases to 6 °C (43 °F).

Pollution: When the ATC module detects a high level of pollutants, it sets the recirculation doors to the recirculation position for:

- 3 minutes if the A/C system is in the heating mode.
- 10 minutes if the A/C system is in the cooling mode.

After the recirculation time period, the ATC module returns the recirculation doors to the fresh air position. After 1 minute, if the pollutants are still present, the ATC module repeats the recirculation cycle.

Ignition Off: If the recirculation doors are in the recirculation position when the ignition is switched off, the ATC module automatically sets them to the fresh air position, to ensure that fresh air is available if a fault occurs with the recirculation door drive circuit at the next ignition on. When the ignition is switched on, the ATC module sets the recirculation doors to the position they were in at ignition off.

Distribution Doors

When a manual distribution selection is made on the control panel, the ATC module moves the distribution doors to preset positions. When the system is in the automatic mode, the ATC module uses maps of the driver's side reference value to determine the position of the distribution doors. Each distribution door has a separate map, and there are separate maps for temperate, hot climates and Japan. The mapped positions of the face level distribution doors are given a correction factor from the sunlight sensor inputs.

BLOWER CONTROL

In the automatic mode, blower speed is determined from reference temperature maps. In general terms, the more heating or cooling required to achieve the temperature selected on the control panel with the driver's side temperature switch, the faster the blower speed.

When maximum cooling is first required in the automatic mode, the ATC module runs the blower at full speed for a fixed period regardless of any drop in cabin temperature. Different time periods are incorporated for the following markets:

- NAS and Gulf States
- Europe, ROW and Japan

NAS and Gulf States have the longest time period with the blower at full speed. The Land Rover approved diagnostic equipment can be used to change the market setting so, in some cases, if a customer complains of the duration the blower runs at full speed, changing the market setting could resolve the complaint.

When heating is required, blower speed is reduced if the engine is cold and then progressively increased to the nominal setting as the engine coolant temperature increases from 20 to 50 °C (68 to 122 °F).

Blower speed is also influenced by the sunlight sensor. At high light levels blower speed will increase to increase the cooling effect.

When the blower is selected off temperature regulation is no longer possible so the ATC module disengages the A/C compressor, de-energizes the auxiliary water pump and closes the coolant valves. Pressing any of the A/C system switches restores blower operation and activates the required function. If the blower is selected off when the ignition is switched off, the blower remains off if the ignition is switched on again within 15 minutes. If more than 15 minutes elapses between the ignition being switched off and back on again, the ATC module switches the blower on at speed 1.

If battery voltage is low the ATC module reduces blower speed to conserve power. If battery voltage decreases to less than 12 V, the ATC module decreases the blower signal voltage, and thus the voltage to the blower motor, in direct proportion to the reduction in battery voltage.

DEFROST PROGRAM

When the defrost program is selected the ATC module:

- Opens the windshield distribution doors and closes the face and footwell

doors.

- Sets the recirculation doors to the fresh air position.
- Runs the blower at speed 7.
- Activates the A/C compressor.
- Activates the heated rear window.
- Activates the heated windshield (where fitted).

When the ambient temperature is 10 °C (50 °F) and below, the ATC module signals the coolant valves to remain open. When the ambient temperature is more than 10 °C (50 °F), the ATC module checks the existing heater core temperature and, if necessary, increases the open time of the coolant valves to produce a minimum heater core temperature of 30 °C (86 °F).

The defrost program is cancelled by pressing the defrost switch again, or pressing the automatic, A/C or maximum A/C switches

MAXIMUM A/C

Pressing the maximum A/C switch while the engine is running and the ambient temperature is more than 7 °C (45 °F) provides the maximum cooling possible from the system to cool the cabin down as rapidly as possible. When maximum A/C is selected the coolant valves are held closed, the A/C compressor is engaged, the blower speed is set to maximum and the recirculation doors are set to the recirculation position. After 12 minutes the recirculation doors will be set to fresh air for 1 minute then returned to the recirculation position.

The maximum A/C function is cancelled when any of the other A/C system switches are pressed.

REST HEATING

When the engine is not running, pressing the maximum A/C switch activates the rest heating function to heat the cabin with residual heat from the engine. The rest heating function activates provided the following conditions exist:

- It is less than 2 minutes since the ignition was selected off.
- Ambient temperature is less than 15 °C (59 °F).

- Ambient temperature is less than 10 °C (50 °F).
- On the previous ignition cycle engine temperature exceeded 70 °C (158 °F).
- Battery voltage is 11.4 V minimum.

To provide the rest heating function, the ATC module activates the auxiliary coolant pump, coolant valves, control door and blower. The ATC module regulates the temperature (to the driver setting selected before the ignition was switched off), opens the face level distribution doors and runs the blower at speed 4.

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

- The maximum A/C switch is pressed again.
- The ignition is selected on.
- Battery voltage decreases to less than 11 V.

REAR PASSENGER FACE LEVEL AIR

The volume and temperature of the air from the rear passenger face register are adjusted with the rotary controls positioned at the rear of the floor console. Each rotary control operates a variable potentiometer connected to the ATC module. The rotary control initiates stepless changes of rear blower speed between off and full speed. The temperature rotary control controls the position of the rear passenger face level blend door in the heater assembly when the driver's side reference temperature is more than 0%.

Volume Control

The volume potentiometer outputs between 0 and 5 V to the ATC module. The ATC module translates the voltage from the potentiometer into a signal voltage for the output stage in the rear blower. Potentiometer voltages of less than 1.25 V are interpreted as a blower off selection and translate into a signal voltages less than 0.1 V. Potentiometer voltages between 1.25 and 5 V are translated into proportional signal voltages between 0.1 and 5 V.

The ATC module automatically switches off the rear blower when:

- The defrost program is active.
- The main blower is selected off.

- The main blower is selected off.
- The engine cranks.
- The ignition is selected off (the rear blower remains off during rest heating, parked heating and parked ventilation).

Temperature Control

The temperature potentiometer outputs between 0 and 5 V to the ATC module. The ATC module translates the voltage from the potentiometer into a blend door position between 0% (cold) and 100% (hot) and outputs the appropriate control signal on the M bus to the blend door motor. Potentiometer voltages of less than 1.5 V translate to a blend door position of 0%. Potentiometer voltages of more than 3.4 V translate to a blend door position of 100%. Potentiometer voltages between 1.5 and 3.4 V translate linearly to blend door positions between 0 and 100%.

HEATED WINDSHIELD (WHERE FITTED)

When the engine is running and the heated windshield is selected on, the ATC module illuminates the LED above the switch and energizes the heated windshield relay attached to the passenger end of the fascia cross tube. If not already active, the ATC module also activates the A/C compressor and the blower, and sets air distribution to windscreen. After 10 minutes (when ambient temperature is -15 °C (5 °F) or above) or 17 minutes (when ambient temperature is less than -15 °C (5 °F)), the ATC module extinguishes the LED and de-energizes the heated windshield relay. After the heater times out or is switched off, the timer in the ATC module is reset to zero.

HEATED REAR WINDOW

When the engine is running and the heated rear window is selected on, the ATC module illuminates the LED above the switch and energizes the heated rear window relay in the AJB (auxiliary junction box). After 10 minutes (when ambient temperature is -15 °C (5 °F) or above) or 17 minutes (when ambient temperature is less than -15 °C (5 °F)), the ATC module extinguishes the LED and operates the heated rear window at low power for 60 minutes. During the 60 minutes, the ATC module cycles the heated rear window relay off for 80 seconds and on for 40 seconds. If the heated rear window switch is pressed again during the low power phase, the ATC module illuminates the LED again and returns the heated rear window to full power by keeping the

heated rear window relay energized for 5 minutes. At the end of the 5 minutes the LED is extinguished and the 60 minutes low power phase is repeated.

The ATC module outputs a K bus message when the heated rear window is active. The message allows the navigation computer to compensate for the effect of the magnetic field generated when the heated rear window is active. In addition, the generic electronic module (GEM) transfers the message onto the P bus for the door modules, which activate the door mirror heaters together with the heated rear window.

WASHER JET HEATERS

The ATC module automatically energizes the washer jets relay, on the CJB, when the ignition is on and the ambient temperature is less than 3 °C (37 °F). If the ambient temperature increases to more than 6 °C (43 °F), the ATC module de-energizes the washer jets relay.

PARKED VENTILATION

Parked ventilation allows the vehicle interior to be ventilated with ambient air while parked with the engine stopped. Vehicles without a fuel fired booster heater have parked ventilation only. On vehicles with a fuel fired booster heater, parked ventilation operates in conjunction with parked heating.
For additional information, refer to: Auxiliary Heater (412-02B, Description and Operation).

Parked ventilation is controlled by direct selection on the TSD (touch screen display), or by using the TSD to program one or two on/off cycle times in the following 24 hour period. Both the direct selection and programmed time modes of operation are selected when the engine is stopped and the ignition switch is in position I; if required, the key can then be removed from the ignition switch and the vehicle locked. Parked ventilation only operates if the ambient temperature is 16 °C (61 °F) or more, and is automatically de-activated after 30 minutes, regardless of any programmed 'off' time, to prevent excessive drain on the battery. Parked ventilation is automatically de-activated when the ignition is switched on.

When programmed times for parked ventilation are entered on the TSD, the times are stored in the memory of the instrument cluster and the climate set

indicator in the top left corner of the TSD is permanently illuminated.

At a programmed parked ventilation start time, or when parked ventilation is selected on using the TSD, the instrument cluster outputs:

- A parked ventilation request to the TSD on a hardwired connection
- A parked ventilation request to the ATC module on the K bus
- The ambient temperature to the ATC module and GEM on the K bus.

On receipt of the messages:

- The climate set indicator flashes at 2 Hz, to indicate that parked ventilation is active.
- The ATC module operates the blower at speed 1, opens the face level distribution doors in the heater assembly and closes the windshield and footwell doors.

The ATC module disables parked ventilation if battery voltage is less than 11.4 V.

CLIMATIC SEATS

High specification vehicles are fitted with climatic seats, which are able to deliver heating and cooling to the front seat occupants. Vehicles fitted with climatic seats feature 2 additional rotary controllers mounted in the ATC module.

NOTE:

> If climatic seats are fitted, heated seat rotary controllers are featured on the ATC module control panel.

The controlling software for the climatic seats is contained within a control module mounted below the drivers seat. When a temperature selection is made through either of the rotary controllers, the instrument panel switch pack provides a PWM signal to the control module. The control module interprets the PWM signal as a temperature value and attempts to heat or cool the seat accordingly.

Both climatic front seats contain two Peltier cells; one in the cushion, one in the backrest. The Peltier cells are able to deliver heating and cooling based on a voltage provided by the control module. Each seat also contains a fan, which blows air over the Peltier cells to distribute heating or cooling throughout the seat.

The climatic seat control module monitors seat heating through a NTC temperature sensor. The temperature sensor is only used to monitor seat heating. Seat cooling is open loop, with no temperature signal provided back to the control module.

Although the switch LED's will illuminate if a selection is made when the ignition is switched on, the Peltier cells will not operate until the engine is running. After the ignition has been switched off, the control module will remember the current temperature settings for approximately 15 minutes. After this period, the seats will be set to 'off' when the ignition is switched back on.

REAR SEAT CENTRE CONSOLE CLIMATE CONTROLS – ULTIMATE (G1393706)

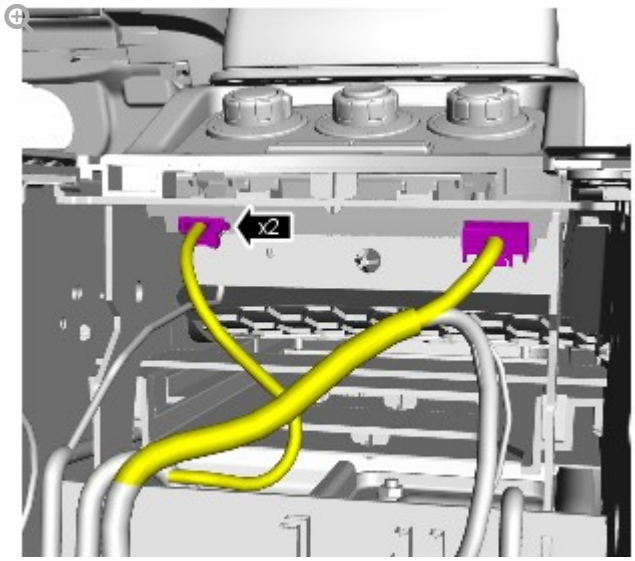
REMOVAL AND INSTALLATION

REMOVAL

NOTE:

Removal steps in this procedure may contain installation details.

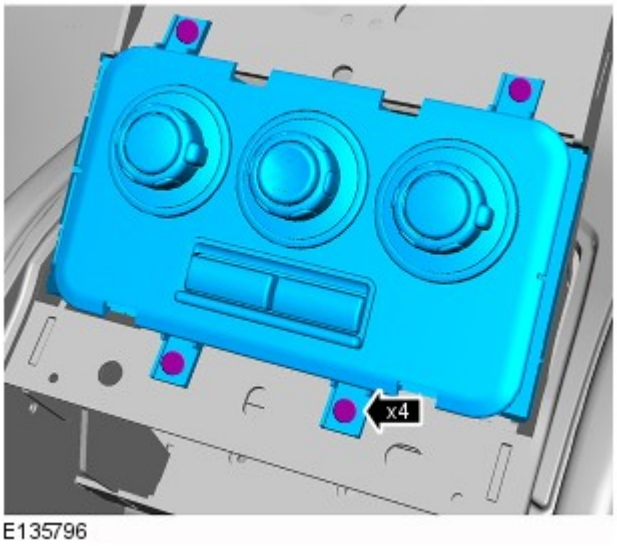
1. Refer to: Rotating Tray And Cupholder Assembly (501-12, Removal and Installation).

2. 

3.

- *Torque:* **3 Nm**

4.



- *Torque:* **3 Nm**

INSTALLATION

1. To install, reverse the removal procedure.

2012.0 RANGE ROVER (LM), 412-02

HEATING AND VENTILATION

SPECIFICATIONS

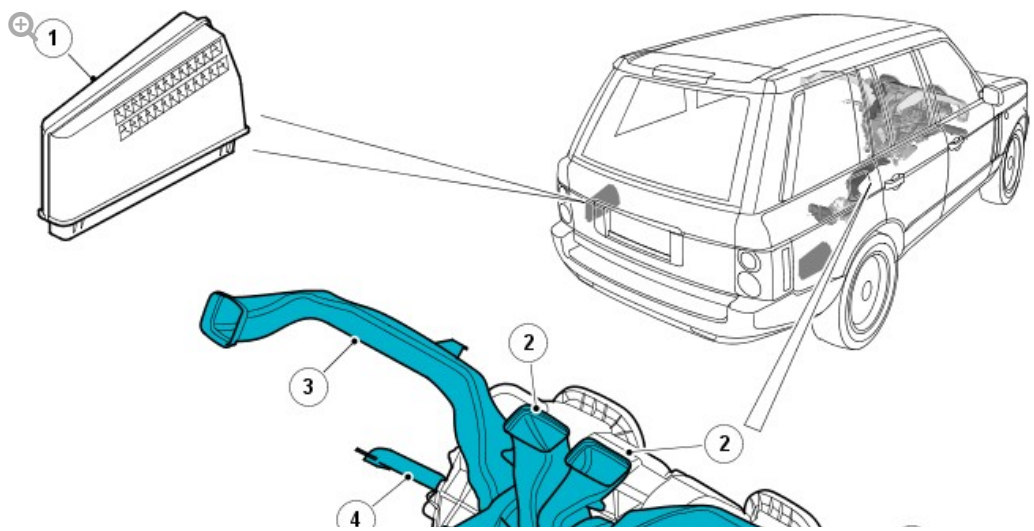
Authoring Template

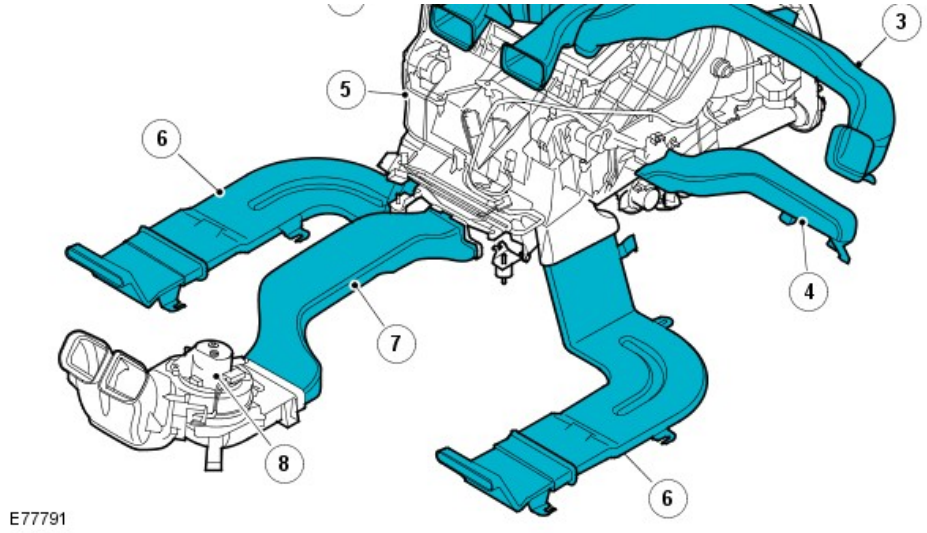
2012.0 RANGE ROVER (LM), 412-02

HEATING AND VENTILATION

DESCRIPTION AND OPERATION

COMPONENT LOCATION





ITEM	DESCRIPTION
1	Forced ventilation outlet
2	Windshield duct
3	Face level duct
4	Front footwell duct
5	Heater assembly
6	Rear footwell duct
7	Rear face duct
8	Rear blower

OVERVIEW

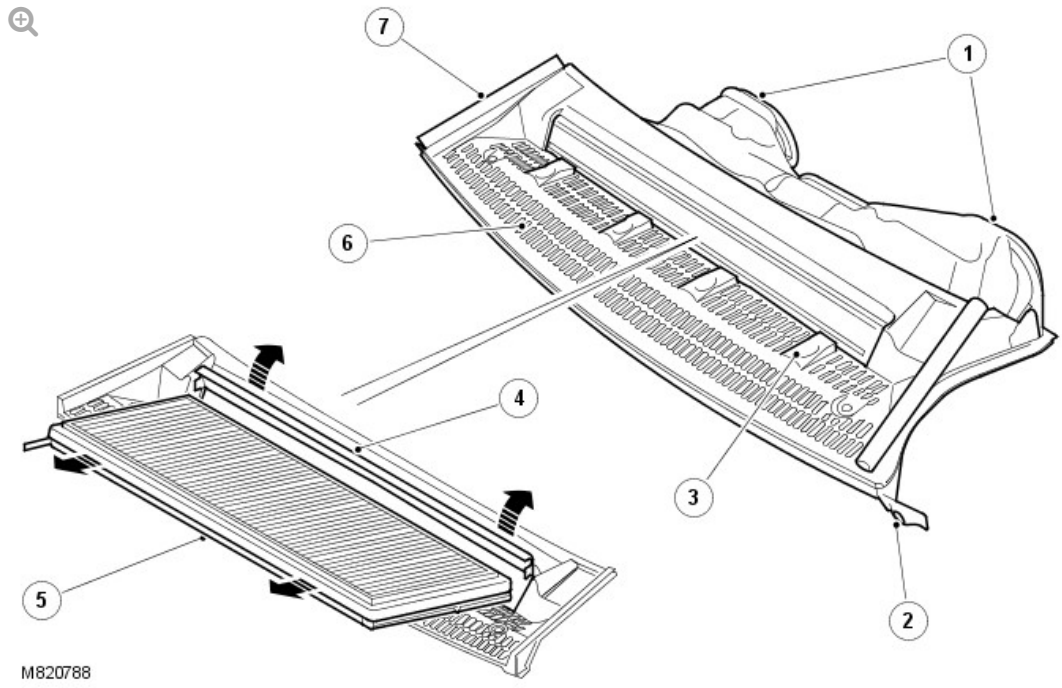
The heating and ventilation system controls the temperature and flow of air supplied to the vehicle interior. The system consists of:

- An air inlet duct.
- A heater.
- A rear blower.
- Two ventilation outlets.

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

Some vehicles may be fitted with a 4 zone climate control system.
For additional information, refer to: Auxiliary Climate Control (412-02C Auxiliary Climate Control, Description and Operation).

AIR INLET DUCT



ITEM	DESCRIPTION
1	Air outlet to heater assembly
2	Fixing lug
3	Door catch
4	Door
5	Particle or particle/odor filter
6	Inlet grille
7	Seal

The air inlet duct directs fresh air from above the hood into the heater. The air inlet duct is centrally mounted on the engine bulkhead, below a ventilation grill in the hood, and secured to the bulkhead closing panels.

The cabin air filter is installed in the air inlet duct behind a hinged door.

For additional information, refer to: Air Distribution and Filtering (412-01A Air Distribution and Filtering, Description and Operation).

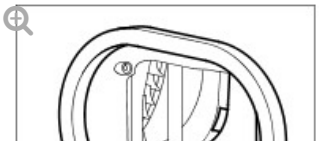
HEATER

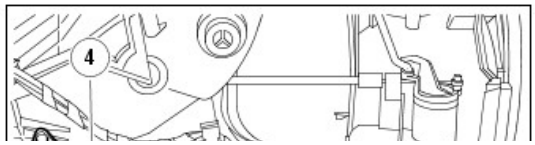
The heater controls the temperature, volume and distribution of air supplied to the distribution ducts as directed by selections made on the automatic temperature control (ATC) module control panel. The heater is installed on the vehicle center-line, between the instrument panel and the engine bulkhead. The heater consists of a casing formed from a series of plastic moldings. Internal passages integrated into the casing guide the air through the casing and separate it into two flows, one for the left-hand (LH) outlets and one for the right-hand (RH) outlets. Two drain outlets at the bottom of the casing are connected to overboard drain hoses in the sides of the transmission tunnel.

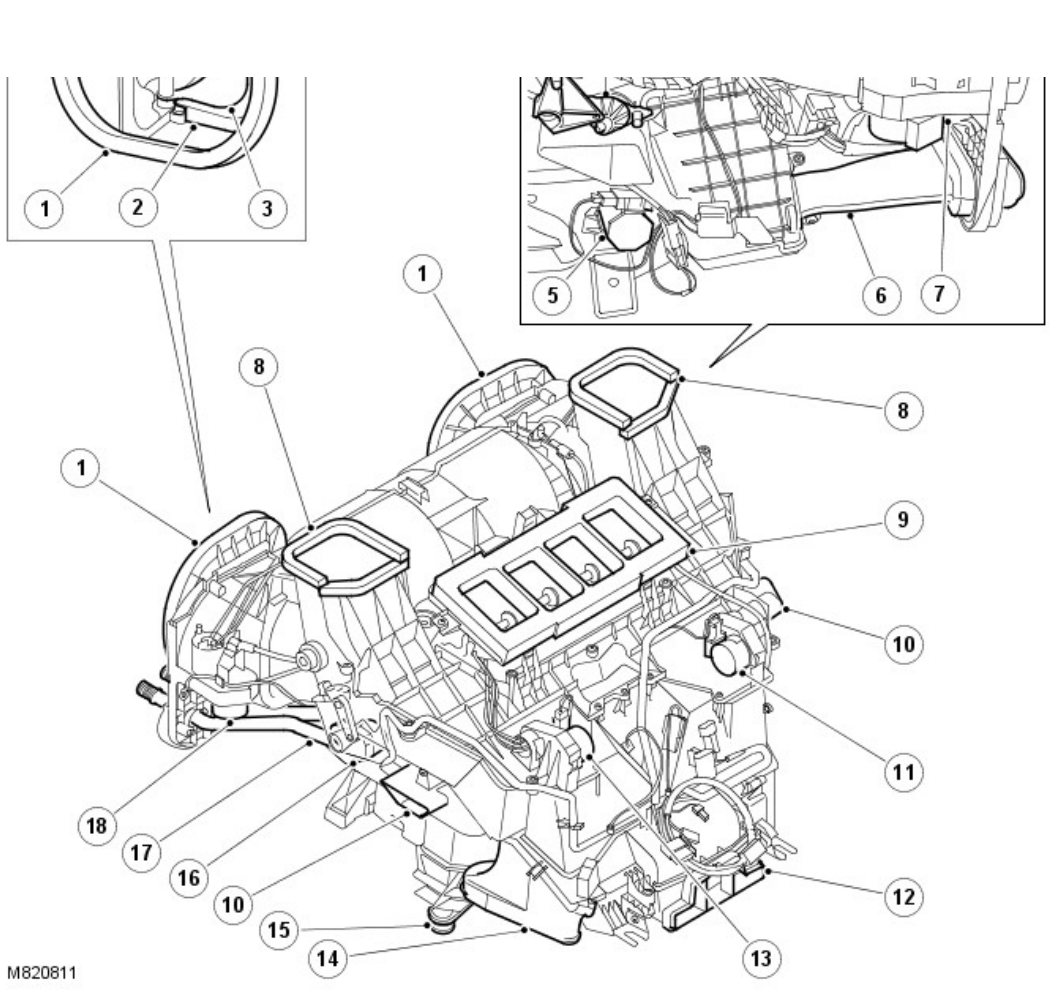
The heater incorporates:

- A blower.
- A blower motor control module.
- A heater core.
- Control doors.
- Control door motors.
- The thermostatic expansion valve and the evaporator of the air conditioning (A/C) system.
  For additional information, refer to: Air Conditioning (412-03A Air Conditioning, Description and Operation).
- The evaporator temperature sensor and 2 heater temperature sensors.
  For additional information, refer to: Control Components (412-01B Climate Control, Description and Operation).

Heater Assembly







ITEM	DESCRIPTION
1	Fresh air inlet
2	Fresh/Recirculated air door
3	Ram air door
4	Face level temperature blend door control
5	Rear face level temperature blend motor
6	Insulated refrigerant pipes
7	Ram air doors motor
8	Windshield air outlet
9	Face level air outlets
10	Front footwell air outlet
11	Footwell air doors motor
12	Rear face level air outlet
13	Face level air doors motor
14	Rear footwell air outlet

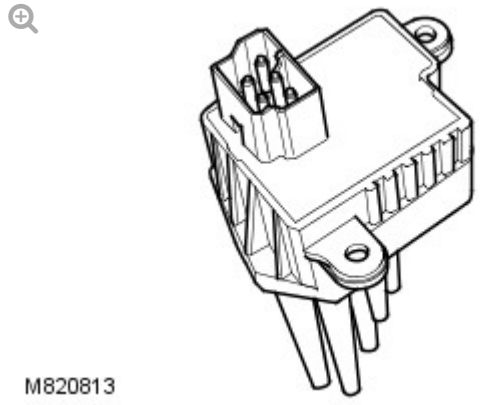
15	Water drain
16	Windshield distribution motor
17	Coolant pipes
18	Fresh/Recirculated air door motor

BLOWER

The blower is installed between the air inlets and the evaporator, and consists of 2 open hub, centrifugal fans powered by a single electric motor. Operation of the electric motor is controlled by the ATC module via the blower motor control module (voltage amplifier) installed in the outlet of the RH fan.

To produce the seven blower speeds the ATC module outputs a stepped control voltage between 0 and 8 V to the blower motor control module, which regulates a battery power feed from the central junction box (CJB) to the blower. The control voltage changes, in 1 V steps, between 2 V (blower speed 1) and 8 V (blower speed 7). If the control voltage is less than 2 V the blower is off.

Blower Motor Control Module



HEATER CORE

The heater core is internally divided into two separate halves, with separate coolant inlets for each half and a common coolant outlet. On the manual system, the two coolant inlets are connected to a common feed from the single coolant valve. Each coolant inlet pipe is connected to a feed from a separate coolant valve.

CONTROL DOORS

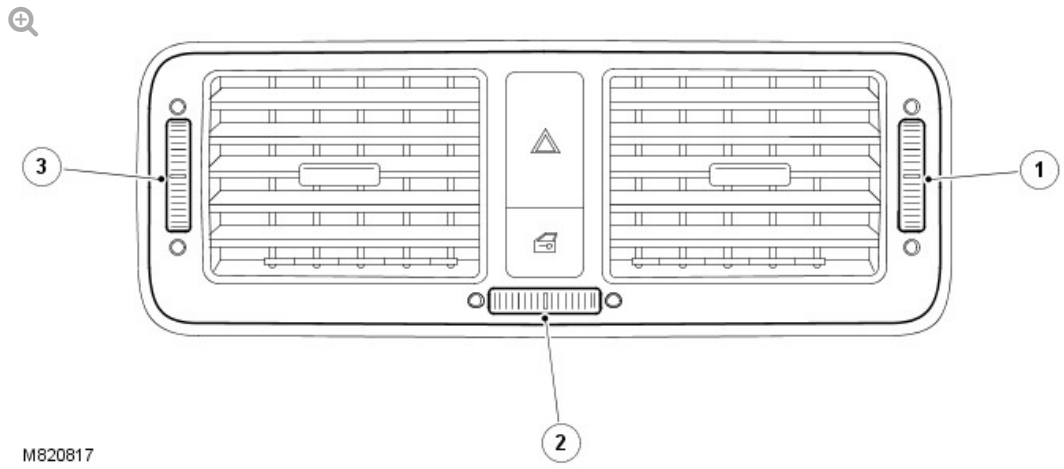
Control doors in the heater control the source of inlet air and the distribution and temperature of outlet air.

On both the manual and automatic heaters, a fresh/recirculated air door is installed in the air inlet on each side of the heater. A stepper motor drives the LH fresh/recirculated air door and a Bowden cable transmits the drive from the LH to the RH fresh/recirculated air door. On the automatic system, a ram air door is installed inside each fresh/recirculated air door. A stepper motor drives the RH ram air door and a Bowden cable transmits the drive from the RH to the LH ram air door.

Each side of the heater contains separate distribution doors for the footwell, face level and windshield. The related doors on each side of the heater are installed on common drive spindles. On the manual heater, the distribution doors are driven by Bowden cables connected to a cam mechanism, which, in turn, is driven by a stepper motor. On the automatic heater, each set of distribution doors is driven by a separate stepper motor.

On both the manual and automatic heaters, a blend door is installed below the face level registers. The blend door is driven by a Bowden cable connected to a thumbwheel on the center face level registers in the instrument panel, and allows the temperature of face level air to be modified with cold air direct from the evaporator.

Instrument Panel Center Face Level Register

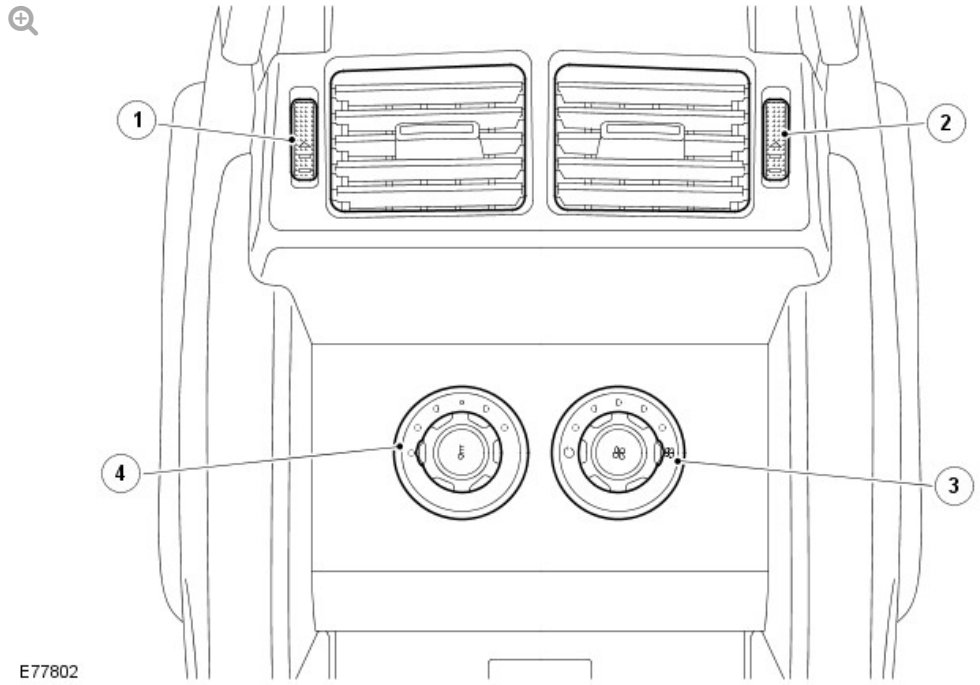


ITEM	DESCRIPTION

1	RH air control thumbwheel
2	Temperature control thumbwheel
3	LH air control thumbwheel

The heater incorporates an additional blend door for the air directed to the rear passenger face level register. This allows the temperature of rear face level air to be adjusted independently from the temperatures selected on the control panel of the ATC module. The blend door is driven by a stepper motor controlled by a thumbwheel on the rear passenger face level register. The blend door is also used to close off the rear passenger face level register when maximum air output is required for the front outlets, e.g. when defrost is selected.

Rear Passenger Face Level Register

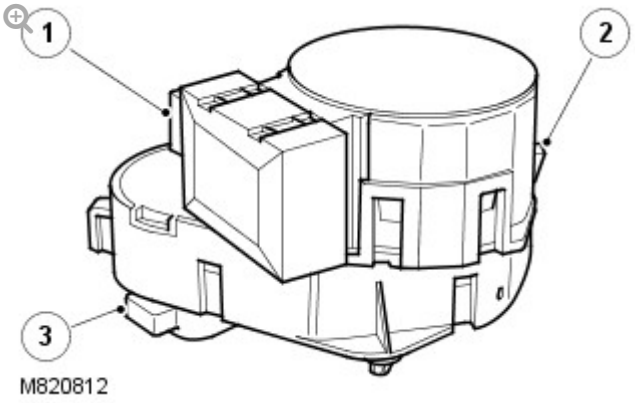


ITEM	DESCRIPTION
1	LH air control thumbwheel
2	RH air control thumbwheel
3	Blower control
4	Temperature control

CONTROL DOOR MOTORS

Two types of electrical stepper motor are used to operate the control doors in the heater. A conventional 500 Hz stepper motor operates the recirculation doors. Five bus controlled 200 Hz stepper motors operate the ram air, distribution (windshield, face level and footwell) and the rear face level temperature control doors. All of the stepper motors are controlled by the ATC module. None of the stepper motors are interchangeable.

Typical Control Door Motor



ITEM	DESCRIPTION
1	Electrical connector
2	Release clip
3	Output shaft

Each bus controlled stepper motor incorporates a microprocessor and is connected to an M bus from the ATC module, which consists of three wires making up power, ground and signal circuits. The microprocessor in each bus controlled stepper motor is programmed with a different address. Each M bus message from the ATC module contains the address of an individual bus controlled stepper motor, so only that motor responds to the message.

None of the stepper motors incorporate a feedback potentiometer. Instead, the ATC module determines the positions of the doors by using either their closed or open position as a datum and memorizing the steps that it drives the individual stepper motors. Each time the ignition is switched on, the ATC module checks the memorized position of the stepper motors against

fixed values for the current system configuration. If there is an error (e.g. after a power supply failure during operation or after replacement of the ATC module), the ATC module calibrates the applicable stepper motors, to re-establish the datums, by driving them fully closed or open before re-setting them to their nominal position. A calibration run can also be invoked using the Land Rover approved diagnostic system.

When any of the control doors are set to fully closed or open, the ATC module signals the related stepper motor to move the appropriate number of steps in the applicable direction. To accommodate build tolerances and wear, and to ensure the doors are held in the selected position, every 20 seconds the ATC module signals the stepper motor to move an additional 10 steps in the relevant direction.

REAR BLOWER

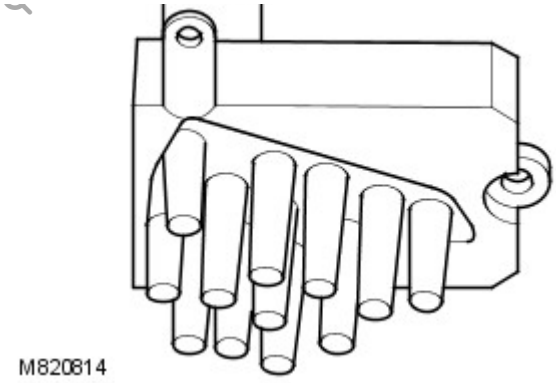
The blower is installed between the front seats, in the rear face air duct, and consists of an open hub, centrifugal fan powered by an electric motor. Operation of the electric motor is controlled by a rotary control on the rear passenger face vent via the ATC module and a blower motor control module (voltage amplifier) installed in the outlet of the fan.

The rotary control allows 7 differing blower speeds to be selected. The position of the rotary control is monitored by the ATC module, which then outputs a proportional control voltage between 0 and 5 V to the blower motor control module. The blower motor control module regulates a battery power feed from the rear blower relay to the blower to produce the related blower speed.

The rear blower relay is installed in the AJB (auxiliary junction box) and energized while the ignition is on.

Some vehicles may be fitted with a 4 zone climate control system.
For additional information, refer to: Auxiliary Climate Control (412-02C Auxiliary Climate Control, Description and Operation).

Rear Blower Motor Control Module



VENTILATION OUTLETS

The ventilation outlets promote the free flow of air through the passenger compartment. The outlets are installed in the LH and RH rear quarter body panels and vent passenger compartment air into the sheltered area between the rear quarter body panels and the rear bumper.

2012.0 RANGE ROVER (LM), 412-02

HEATING AND VENTILATION

DIAGNOSIS AND TESTING

For additional information.

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

2012.0 RANGE ROVER (LM), 412-02

HEATING AND VENTILATION

BLOWER MOTOR (G910468)

80.20.15	MOTOR – FAN – RENEW	ALL DERIVATIVES	7	USED WITHINS	+

REMOVAL

WARNINGS:

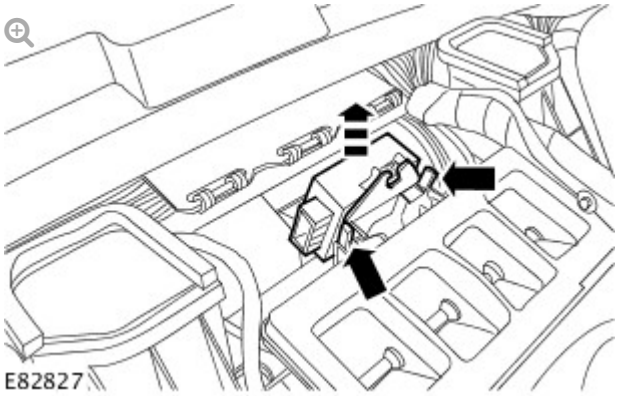
- Persons working on the supplemental restraint system (SRS) must be fully trained and have been issued with the safety guidelines.
- Allow a period of 10 minutes to elapse after disconnecting the battery before undertaking any work on the SRS.
- The SRS electrical connectors are unique. DO NOT force, or attempt to connect electrical connectors to the wrong sockets.
- The correct procedures must always be used when working on SRS components.
- It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.
- Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.
- Take extra care when handling SRS components.

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

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

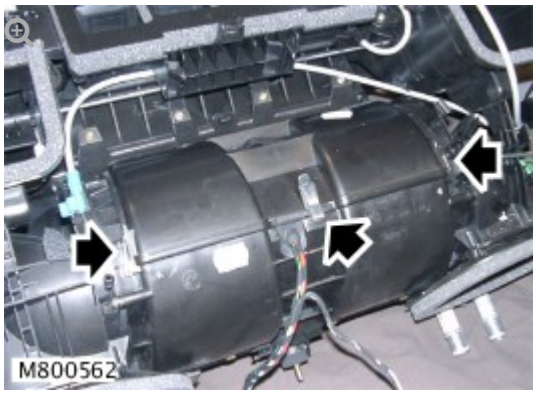
3. Remove the heater and evaporator core housing

3. Remove the heater and evaporator core housing.
   For additional information, refer to: Heater Core and Evaporator Core Housing (412-02, Removal and Installation).

4. 

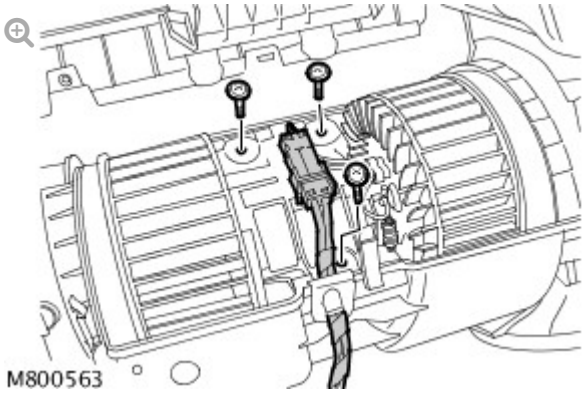
   Remove the passive anti-theft system (PATS) module.

   - Release the 2 clips.

5. 

   Remove the blower motor cover.

   - Release the 3 clips.

6. 

   Remove the blower motor.

   - Remove the 3 screws.

- Disconnect the electrical connector.
- Release the wiring harness grommet.
- Reposition the wiring harness.

INSTALLATION

1. Install the blower motor.
   - Secure the wiring harness grommet.
   - Connect the electrical connector.
   - Install the screws.
2. Install the blower motor cover.
   - Install the clips.
3. Install the PATS module.
   - Secure the clips.
4. Install the heater and evaporator core housing.
   For additional information, refer to: Heater Core and Evaporator Core Housing (412-02, Removal and Installation).
5. Connect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

2012.0 RANGE ROVER (LM), 412-02

HEATING AND VENTILATION

HEATER CONTROL VALVE

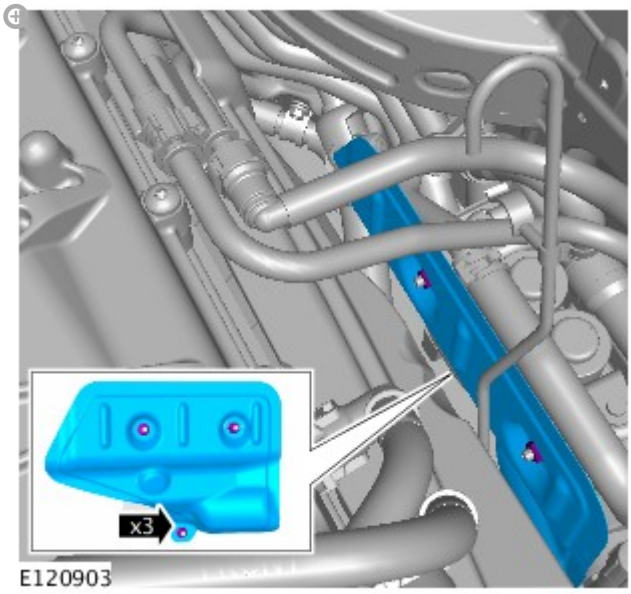
(G1240584)

REMOVAL AND INSTALLATION

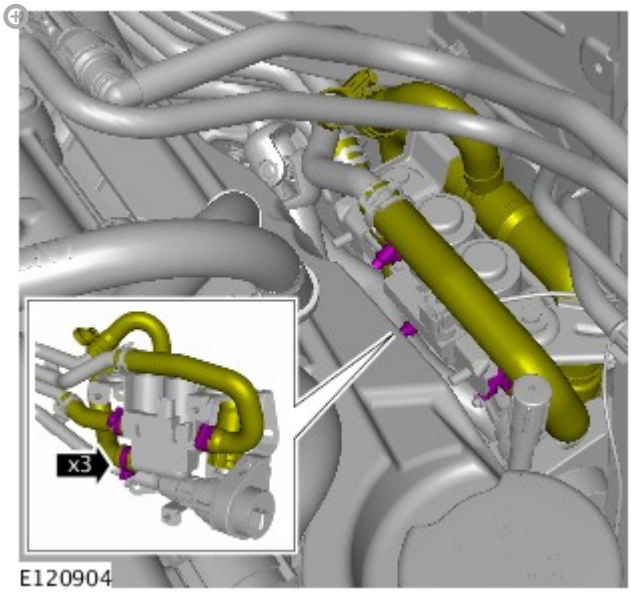
REMOVAL

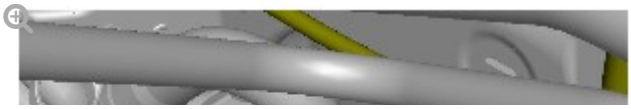
1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

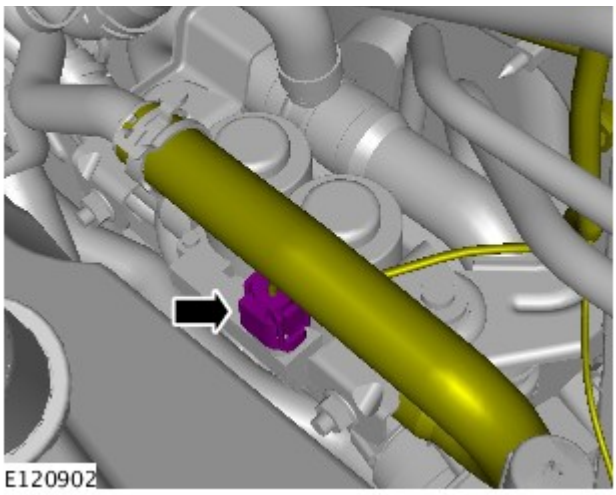
2. Drain the coolant.
   For additional information, refer to: Cooling System Draining, Filling and Bleeding - Vehicles Without: Supercharger (303-03B, General Procedures) /
   Cooling System Draining, Filling and Bleeding - Vehicles With: Supercharger (303-03B, General Procedures).

3. 

   TORQUE: 6 Nm

4. 

5. 



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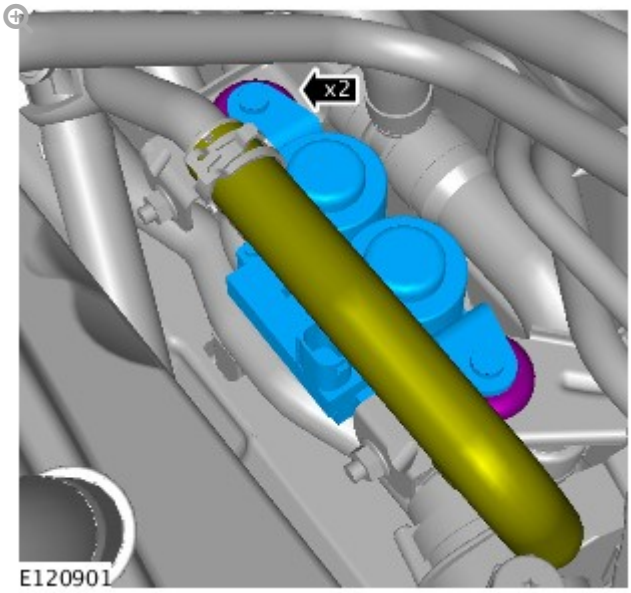


INSTALLATION

1. To install, reverse the removal procedure.

HEATER CORE – V8 S/C 5.0L PETROL (G1240582)

REMOVAL AND INSTALLATION

80.20.29	HEATER CORE – RENEW	5000 CC, AJ V8, SUPERCHARGED	6.6	USED WITHINS	+

REMOVAL

WARNINGS:

- Persons working on the supplemental restraint system (SRS) must be fully trained and have been issued with the safety guidelines.
- Allow a period of 10 minutes to elapse after disconnecting the battery before undertaking any work on the SRS.
- The SRS electrical connectors are unique. DO NOT force, or attempt to connect electrical connectors to the wrong sockets.
- The correct procedures must always be used when working on SRS components.
- It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.

- Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.
- Take extra care when handling SRS components.

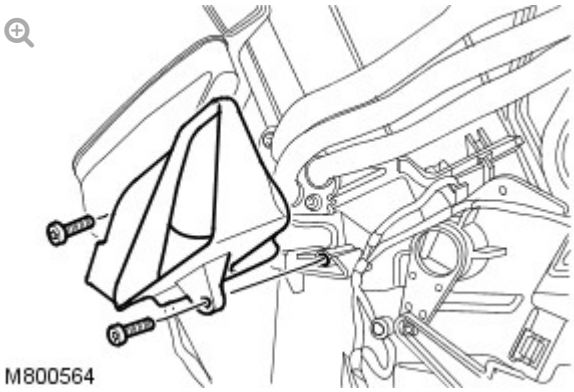
1. Set the footwell duct air outlet to closed.

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

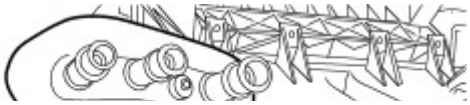
3. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).

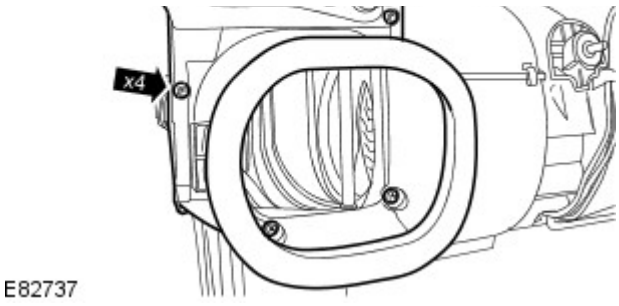
4. Remove the heater and evaporator core housing.
   For additional information, refer to: Heater Core and Evaporator Core Housing - 5.0L SC V8 - AJ133 (412-02A, Removal and Installation).

5. Reposition the heater and evaporator core housing for access.

6. 

   Remove the left-hand footwell duct.
   - Remove the 2 screws.

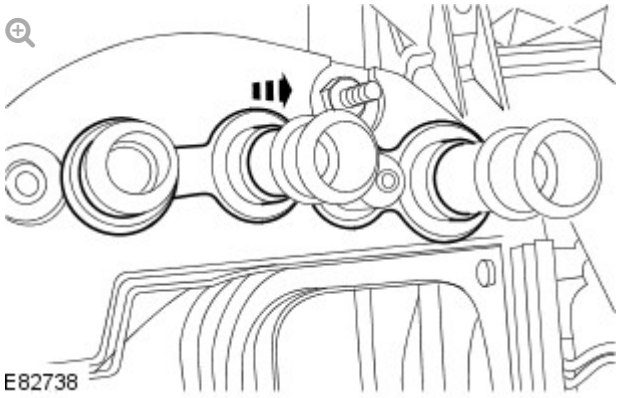
7. 



Remove the left-hand air intake duct.

- Remove the 4 screws.

8.

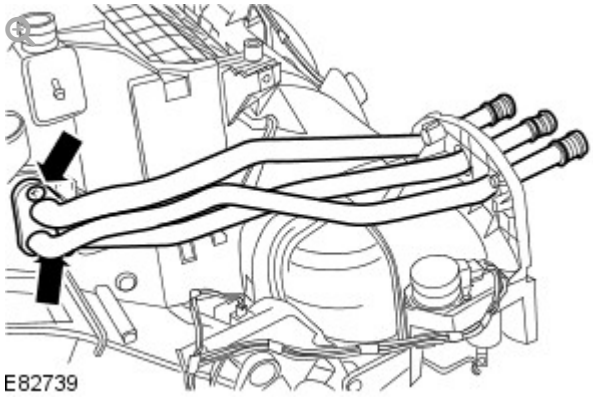


Remove the gasket from the heater core inlet and outlet pipes.

9.

CAUTION:

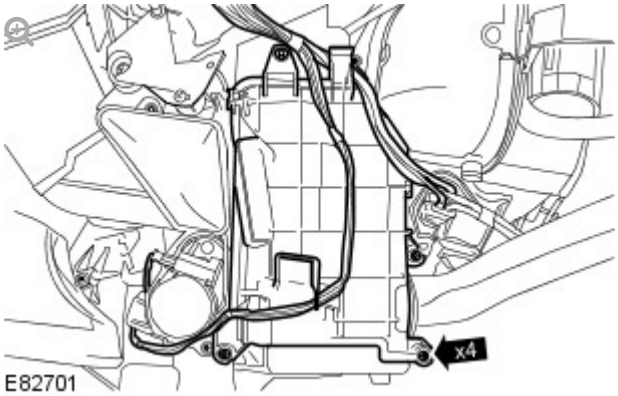
Always plug any open connections to prevent contamination.



Remove the heater core, inlet and outlet pipes.

- Remove the 2 screws.
- Remove and discard the 3 O-ring seals.

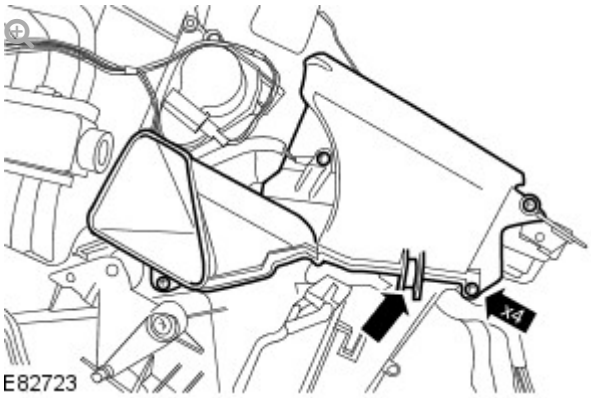
10.



Remove the thermostatic expansion valve cover.

- Release the wiring harness from the 2 tangs.
- Remove the 4 screws.

11.



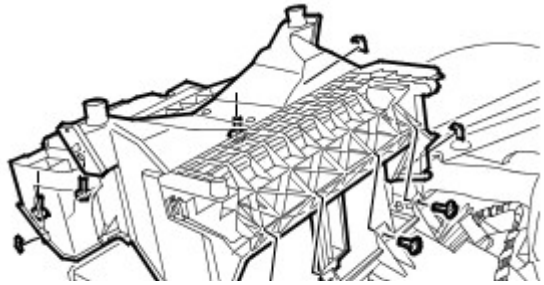
Remove the right-hand footwell duct.

- Remove the 4 screws.
- Remove the clip.

12. Disconnect the floor duct actuator motor electrical connector.

13. Release the evaporator temperature sensor from the heater and evaporator core housing.

14.



Remove the heater and evaporator core housing lower cover.

- Remove the 7 screws.
- Remove the 4 clips.

15. Remove the heater core.

INSTALLATION

1. Install the heater core.
2. Install the heater and evaporator core housing lower cover.
   - Install the screws.
   - Install the clips.
3. Install the evaporator temperature sensor to the heater and evaporator core housing.
4. Connect the floor duct actuator motor electrical connector.
5. Install the right-hand footwell duct.
   - Install the screws.
   - Install the clip.
6. Install the thermostatic expansion valve cover.
   - Install the screws.
   - Secure the wiring harness to the tangs.
7. Install the heater core, inlet and outlet pipes.
   - Clean the component mating faces.
   - Lubricate and install the new O-rings.

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

8. Install the gasket to the heater core inlet and outlet pipes.

9. Install the left-hand air intake duct.
   - Install the screws.

10. Install the left-hand footwell duct.
    - Install the screws.

11. Reposition the heater and evaporator core housing for access.

12. Install the heater and evaporator core housing.
    For additional information, refer to: Heater Core and Evaporator Core Housing - 5.0L SC V8 - AJ133 (412-02A, Removal and Installation).

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

2012.0 RANGE ROVER (LM), 412-02

HEATING AND VENTILATION

HEATER CORE AND

HEATER CORE AND EVAPORATOR CORE HOUSING – V8 S/C 5.0L PETROL (G1245182)

REMOVAL AND INSTALLATION

80.20.01.99	HEATER HOUSING – REMOVE FOR ACCESS AND REFIT	5000 CC, AJ V8, SUPERCHARGED	6	USED WITHINS	+

REMOVAL

WARNINGS:

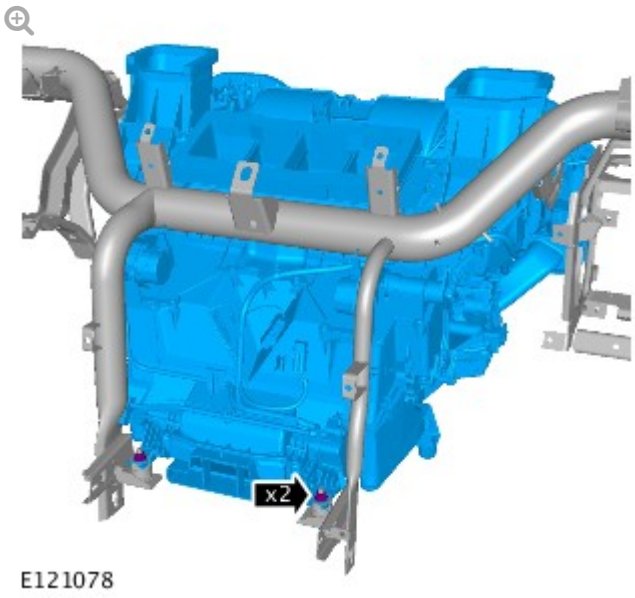
- Persons working on the supplemental restraint system (SRS) must be fully trained and have been issued with the safety guidelines.
- Allow a period of 10 minutes to elapse after disconnecting the battery before undertaking any work on the SRS.
- The SRS electrical connectors are unique. DO NOT force, or attempt to connect electrical connectors to the wrong sockets.
- The correct procedures must always be used when working on SRS components.
- It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.
- Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.
- Take extra care when handling SRS components.

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

2. Refer to: Cooling System Partial Draining and Vacuum Filling (303-03B Engine Cooling - TDV8 4.4L Diesel, General Procedures).

3. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging - V8 5.0L Petrol/V8 S/C 5.0L Petrol (412-00 Climate Control System - General Information, General Procedures).

4. Refer to: In-Vehicle Crossbeam - V8 S/C 5.0L Petrol (501-12 Instrument Panel and Console, Removal and Installation).

5. 

INSTALLATION

1. To install, reverse the removal procedure.

2012.0 RANGE ROVER (LM), 412-02

AUXILIARY HEATING

SPECIFICATIONS

Torque Specifications

DESCRIPTION	NM	LB-FT
Fuel fired booster heater exhaust pipe to body nuts	10	7
Fuel fired booster heater exhaust silencer to body bolt	10	7
Fuel fired booster heater to body bolts	10	7
Fuel fired booster heater to body nut	10	7
Fuel fired booster heater to bracket bolts	10	7

2012.0 RANGE ROVER (LM), 412-02

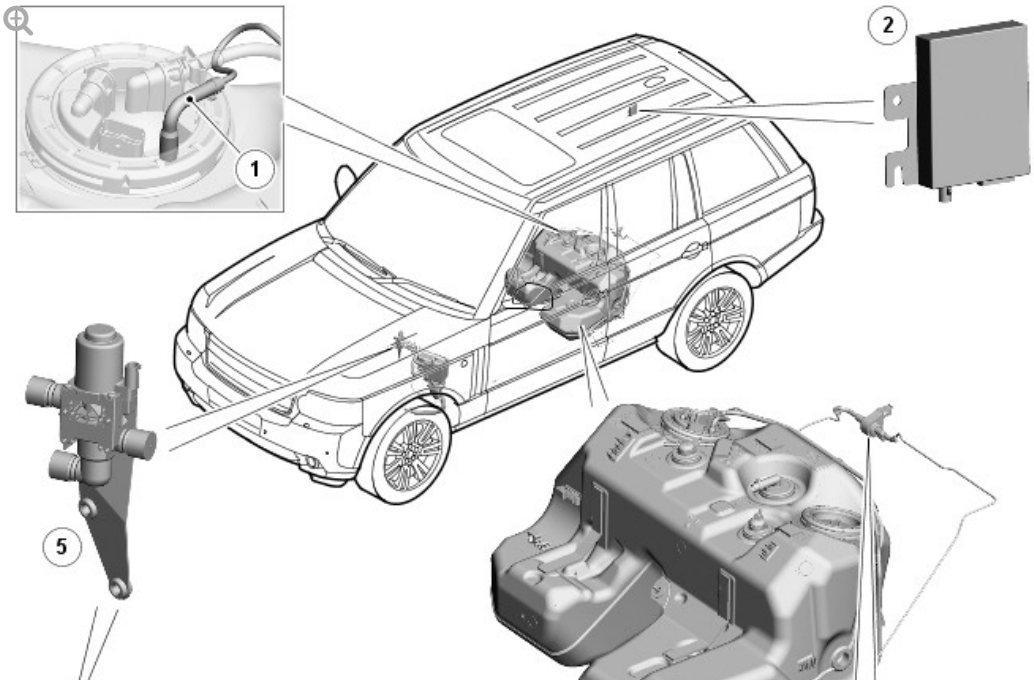
AUXILIARY HEATING

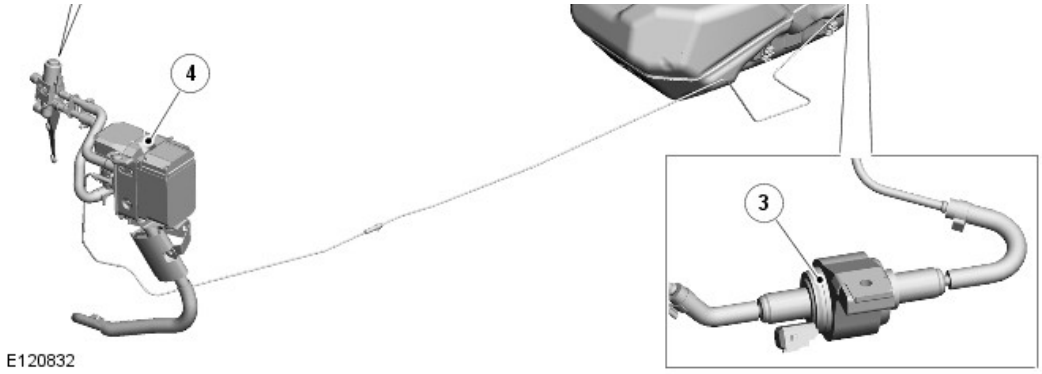
DESCRIPTION AND OPERATION

COMPONENT LOCATION

NOTE:

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





ITEM	DESCRIPTION
1	Fuel Fired Booster Heater (FFBH) fuel pipe tank connection
2	FFBH receiver
3	FFBH fuel pump
4	FFBH unit
5	Changeover valve

INTRODUCTION

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

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

A changeover valve allows the heater coolant circuit to be isolated from the engine coolant circuit during parked heating, to reduce the warmup time of the passenger compartment.

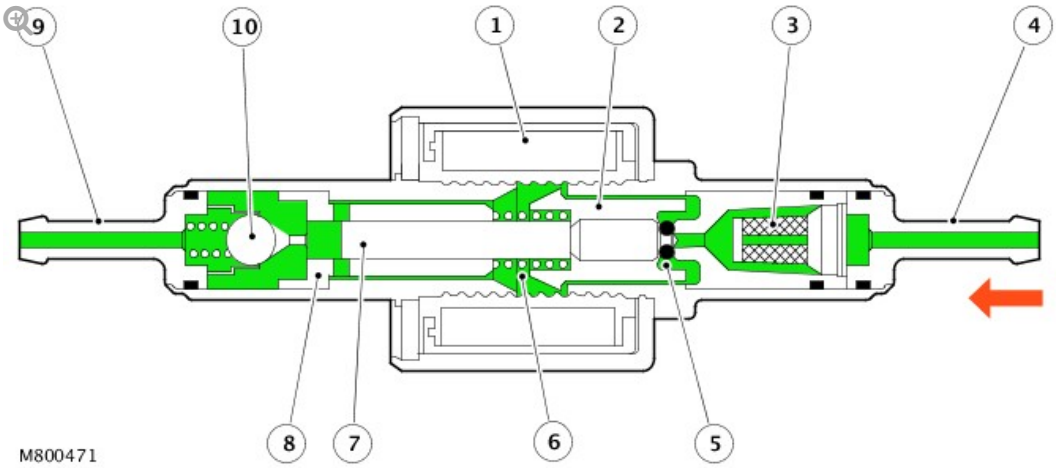
A control module integrated into the FFBH unit controls the operation of the FFBH unit and the FFBH fuel pump. The ATC (automatic temperature control) module controls the changeover valve. System operation is initiated by:

- The CJB (central junction box), via the ATC module, for parked heating selections made on the TSD (touch screen display).
  For additional information, refer to: Audio System (415-01, Description and Operation).
- The remote handset, via the TV (television)) system antenna and antenna amplifier, and the FFBH receiver, for remote activation of parked heating.
- The ATC module, for additional heating while the engine is running.

FFBH FUEL PUMP

The FFBH fuel pump regulates the fuel supply to the FFBH unit. The FFBH fuel pump is installed in a rubber mounting attached to a bracket on the underside of the rear floor, immediately in front of the spare wheel well. The pump is a self priming, solenoid operated plunger pump. The control module in the FFBH unit 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 unit.

Sectioned View of FFBH Fuel Pump



ITEM	DESCRIPTION
1	Solenoid coil
2	Plunger
3	Filter insert
4	Fuel line connector

5	O-ring seal
6	Spring
7	Piston
8	Bush
9	Fuel line connector
10	Non return valve

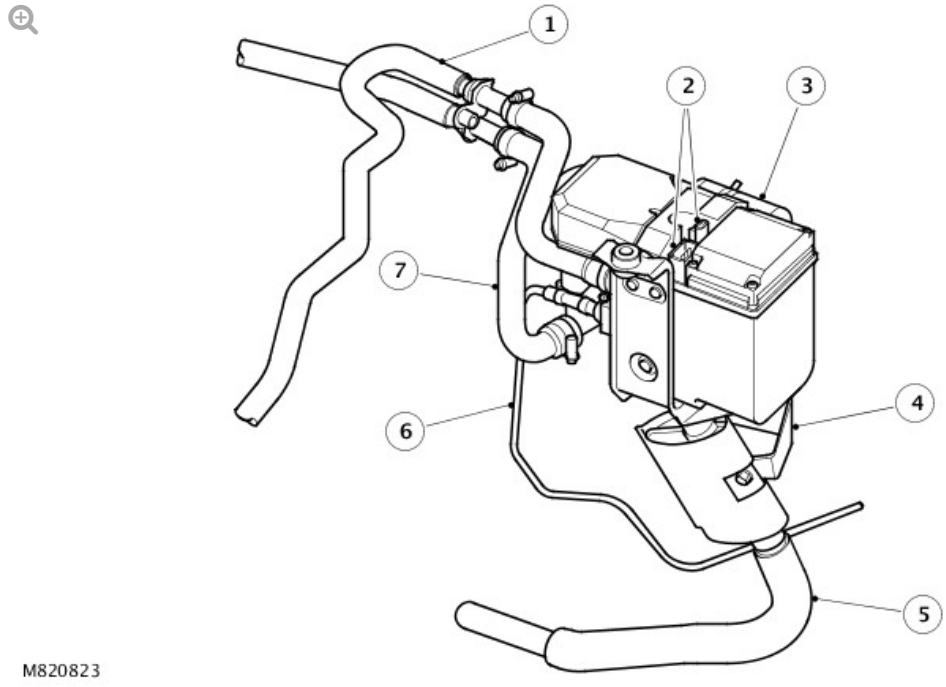
The solenoid coil of the FFBH fuel pump is installed around a housing, which contains a plunger and piston. The piston locates in a bush, and a spring is installed on the piston between the bush and the plunger. A filter insert and a fuel line connector are installed in the inlet end of the housing.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

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

FFBH UNIT

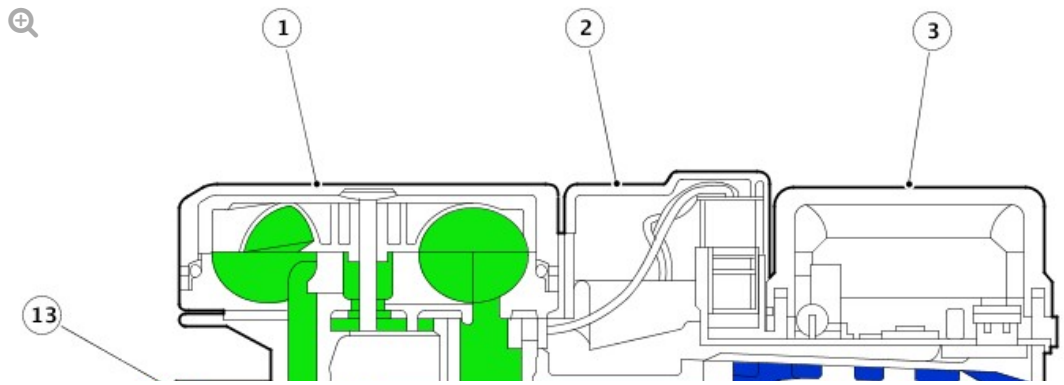
The FFBH unit is installed in the passenger side rear of the engine compartment, below the battery. It is connected in series with the coolant supply to the heater assembly. Two electrical connectors on the FFBH unit connect it to the vehicle wiring.

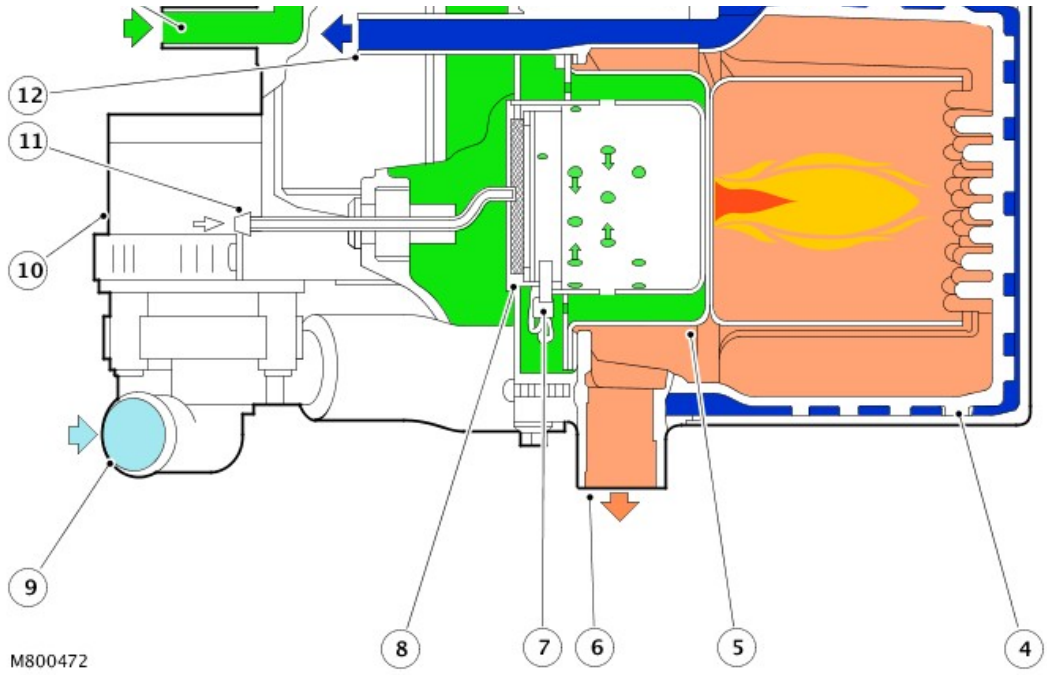
FFBH Unit Components



ITEM	DESCRIPTION
1	Coolant outlet hose
2	Electrical connectors
3	Air inlet filter
4	Mounting bracket
5	Exhaust pipe
6	Fuel supply line
7	Coolant inlet hose

Sectioned View of FFBH Unit





ITEM	DESCRIPTION
1	Combustion air fan
2	Burner housing
3	Control module
4	Heat exchanger
5	Burner insert
6	Exhaust
7	Glow plug/flame sensor
8	Evaporator
9	Coolant inlet
10	Circulation pump
11	Fuel inlet
12	Coolant outlet
13	Air inlet

CIRCULATION PUMP

The circulation pump is installed at the coolant inlet to the FFBH unit to assist the coolant flow through the FFBH unit and the heater assembly. The pump runs continuously while the FFBH unit is in standby or active operating modes. While the FFBH unit is inactive, coolant flow is reliant on

the engine coolant pump and the auxiliary coolant pump.

COMBUSTION AIR FAN

The combustion air fan regulates the flow of air into the unit to support combustion of the fuel supplied by the FFBH pump and to purge and cool the FFBH unit. A canister type filter is included in the air inlet supply line to prevent particulates entering and contaminating the FFBH unit.

BURNER HOUSING

The burner housing contains the burner insert and also incorporates connections for the exhaust pipe, the coolant inlet from the circulation pump and the coolant outlet to the heater assembly. The exhaust pipe directs exhaust combustion gases to atmosphere through a pipe below the FFBH unit.

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

CONTROL MODULE/HEAT EXCHANGER

The control module controls and monitors operation of the FFBH system. Ventilation of the control module is provided by an internal flow of air from the combustion air fan. The heat exchanger transfers heat generated by combustion to the coolant. A sensor in the heat exchanger provides the control module with an input of heat exchanger casing temperature, which the control module relates to coolant temperature and uses to control system operation. The temperature settings in the control module are calibrated to compensate for the difference between coolant temperature and the heat exchanger casing temperature detected by the sensor. Typically, as the coolant temperature increases, the coolant will be approximately 7 °C (12.6 °F) hotter than the temperature detected by the sensor; as the coolant temperature decreases, the coolant will be approximately 2 °C (3.6 °F) cooler than the temperature detected by the sensor.

CHANGEOVER VALVE

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

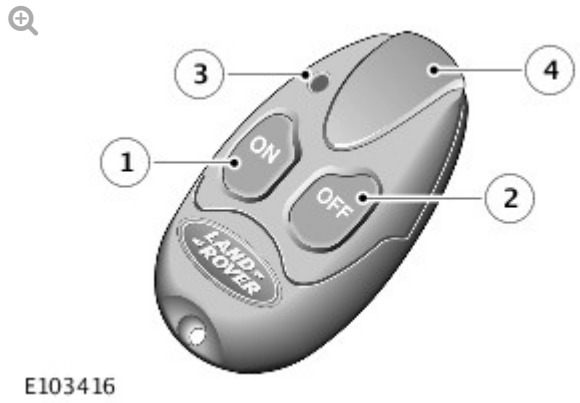
The changeover valve is controlled by a power feed from the ATC module.

FFBH RECEIVER

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

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

FFBH REMOTE HANDSET



ITEM	DESCRIPTION
1	On button
2	Off button

2	Off button
3	light emitting diode (LED)
4	Antenna

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

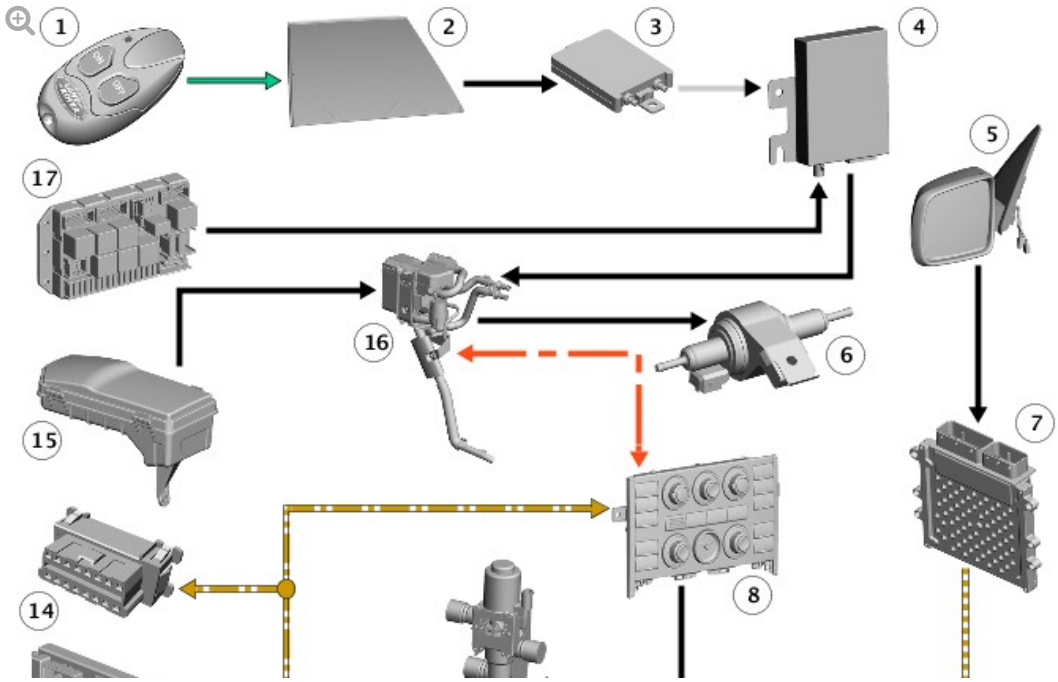
An LED (light emitting diode)flashes green when parked heating is active. If the LED flashes red after a start selection, then communication has not been established with the vehicle. If the LED flashes orange, the battery needs replacing.

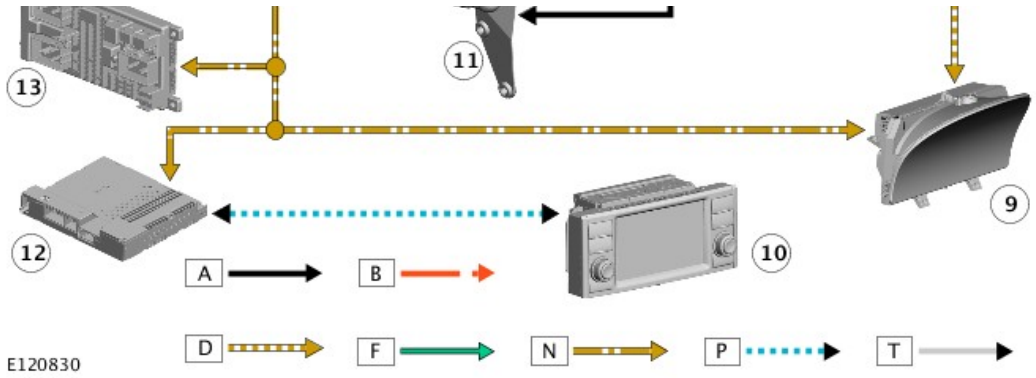
The FFBH remote handset is powered by a 3.3 V CR1/3N battery located under a cover on the rear of the handset.

CONTROL DIAGRAM

NOTE:

A = Hardwired; B = K bus; D = High speed CAN (controller area network); F = RF transmission; N = Medium speed CAN bus; P = MOST ring; T = Coaxial cable.





ITEM	DESCRIPTION
1	FFBH remote handset
2	RH side window antenna
3	TV antenna amplifier
4	FFBH receiver
5	LH door mirror (ambient air temperature sensor)
6	FFBH fuel pump
7	ECM
8	ATC module
9	Instrument cluster
10	TSD
11	Changeover valve
12	IHU
13	CJB (central junction box)
14	Diagnostic socket
15	EJB (engine junction box)
16	FFBH
17	AJB (auxiliary junction box)

OPERATION

The FFBH system operates in two modes:

- Parked heating, to heat the passenger compartment while the vehicle is

parked with the engine off.

- Additional heating, to boost heater performance while the engine is running.

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

During FFBH operation, with or without the engine running, the coolant valves of the climate control system remain de-energized and heater core temperature is directly related to the temperature of the coolant coming from the FFBH unit.

PARKED HEATING/VENTILATION

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

Parked heating/ventilation is controlled by direct selection on the TSD, by using the TSD to program one or two on/off cycle start times in the following 24 hour period, or by using the FFBH remote handset. 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. In all operating modes, parked heating/ventilation is automatically de-activated after 30 minutes (20 minutes for UK diesel vehicles) to prevent excessive drain on the battery. Parked ventilation is automatically de-activated when the ignition is switched on.

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

If the engine is started while parked heating is on:

- If the engine coolant temperature is equal to or more than the heater

coolant temperature, parked heating is switched off.

- If the engine coolant temperature is less than the heater coolant temperature, parked heating remains on until the engine coolant temperature reaches the heater coolant temperature. The changeover valve also remains closed until the engine coolant temperature reaches the heater coolant temperature, except on 5.0L vehicles, where the changeover valve is always open when the engine running (due to the positioning of the ECT (engine coolant temperature) sensor).

PROGRAMMED PARKED HEATING/VENTILATION

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

On receipt of the message:

- If the ambient temperature is less than 16 °C (61 °F) and, on diesel models, more than -20 °C (-4 °F), the ATC module initiates parked heating and:
  - Energizes the changeover valve.
  - Sends a K bus message to activate the FFBH.
  - Operates the blower at 47% of the maximum speed.
  - Operates the distribution doors in the heater assembly to direct the air to the footwells for approximately 30 seconds, then to either only the windscreen, or to both the footwells and the windscreen, depending on the ambient air temperature.
  - Flashes the auto blower LED at 2 Hz.
  - On diesel models, if the ambient temperature is -20 °C (-4 °F) or below, the ATC module sends a K 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.
- If the ambient temperature is 16 °C (61 °F) or more, the ATC module initiates parked ventilation and:
  - Operates the blower at 47% of maximum speed.

- Operates the distribution doors in the heater assembly to direct the air to the face level outlets.
- Flashes the auto distribution LED at 2 Hz.

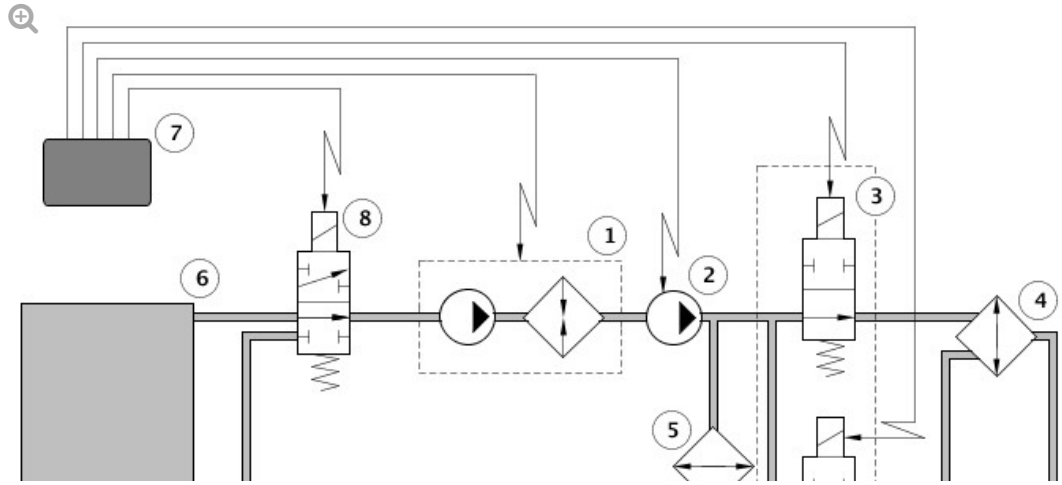
After 30 minutes (20 minutes for UK diesel vehicles), the ATC module stops the parked heating/ventilation:

- If parked heating is active, the ATC module:
  - Sends a K bus message to de-activate the FFBH.
  - Switches off the blower.
  - Returns the distribution doors to the previous settings.
  - After 3 minutes, de-energizes the changeover valve.
- If parked ventilation is active, the ATC module:
  - Switches off the blower.
  - Returns the distribution doors to the previous settings.

REMOTELY SELECTED PARKED HEATING/VENTILATION

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

Heater Coolant Circuit



E120831

ITEM	DESCRIPTION
1	FFBH unit
2	Auxiliary coolant pump
3	Coolant valves
4	Heater core
5	Rear heater core (four zone climate control only)
6	Engine cooling system
7	ATC module
8	Changeover valve

ADDITIONAL HEATING

Additional heating reduces the heater warm-up time and is also used to maintain heater performance throughout the drive cycle.

The ATC module activates the additional heating mode when the engine is running and the following conditions coexist:

- The ambient temperature is less than 1 °C (34 °F) on petrol vehicles or 8 °C (41 °F) on diesel vehicles.
- The engine coolant temperature is less than 75 °C (167 °F).
- The heater coolant temperature is less than 70 °C (158 °F).
- The heat demand is more then 75%.
- The blower is on.

To activate the additional heating mode, the ATC module energizes the auxiliary coolant pump and sends a K bus message to the FFBH unit to start/continue operation (the changeover valve remains de-energized).

The ATC module stops the FFBH and de-energizes the auxiliary coolant

pump when any of the following occur:

- The engine stops.
- The ambient temperature increases to more than 3 °C (37 °F) on petrol vehicles or 15 °C (59 °F) on diesel vehicles.
- The engine coolant temperature increases to more than 75 °C (167 °F).
- The heater coolant temperature increases to more than 70 °C (158 °F).
- The heat demand decreases to less than 70%.
- The blower is selected off.

FFBH UNIT

Once initiated by a message from the ATC module, FFBH operation is controlled by the control module in the FFBH unit. The control module controls the FFBH unit at one of two heat output levels, 2.5 kW at part load combustion and 5 kW at full load combustion.

Start Sequence

At the beginning of the start sequence the control module energizes the glow plug function of the glow plug/flame sensor, to preheat the combustion chamber, starts the combustion air fan at slow speed and energizes the coolant circulation pump. After approximately 30 seconds, the control module energizes the FFBH fuel pump at the starting sequence speed. The fuel delivered by the FFBH fuel pump evaporates in the combustion chamber, mixes with air from the combustion air fan and is ignited by the glow plug/flame sensor. The control module then progressively increases the speed of the FFBH fuel pump and the combustion air fan. Once combustion is established the control module switches the glow plug/flame sensor from the glow plug function to the flame sensing function to monitor combustion. From the beginning of the start sequence to stable combustion takes approximately 90 seconds for a start to part load combustion and 150 seconds for a start to full load combustion.

Coolant Temperature Control

When the control module first enters the active mode, it initiates a start to

full load combustion. Full load combustion continues until the heat exchanger casing temperature reaches 72 °C (162 °F), at this point the control module decreases the speed of the FFBH fuel pump and the combustion air fan to half speed, to produce part load combustion. The control module maintains part load combustion while the heat exchanger casing temperature remains between 68 and 76 °C (154 and 169 °F). If the heat exchanger casing temperature decreases to 68 °C (154 °F), the control module switches the system to full load combustion again. If the heat exchanger casing temperature increases to 76 °C (169 °F), 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 2 minute cool down period, the control module switches the combustion air fan off and then remains in the control idle phase while the heat exchanger casing temperature remains above 71 °C (160 °F). If the heat exchanger casing temperature decreases to 71 °C (160 °F), within 15 minutes of the control module entering the control idle phase, the control module initiates a start to part load combustion. If more than 15 minutes elapse before the heat exchanger casing temperature decreases to 71 °C (160 °F), the control module initiates a start to full load combustion.

In order to limit the build up of carbon deposits on the glow plug/flame sensor, the control module also enters the control idle phase if the continuous part and/or full load combustion time exceeds 72 minutes. After the cool down period, if the heat exchanger casing is still in the temperature range that requires additional heat, the control module initiates an immediate restart to part or full load combustion as appropriate.

Shutdown

When the ATC module sends a K bus message to de-activate the FFBH operation, the control module de-energizes the FFBH fuel pump to stop combustion, but continues operation of the combustion air fan and the circulation pump to cool down the FFBH unit. The cool down time depends on the combustion load at the time the message is received.

COMBUSTION LOAD	COOL DOWN TIME, SECONDS

Part	100
Full	175

Diagnostics

The control module monitors the FFBH system for faults. Up to six FFBH faults can be stored in a volatile memory in the control module, and up to 10 FFBH faults together with freeze frame data can be stored in the ATC module. If a further fault is detected, the oldest fault is overwritten by the new fault. The fault data can be retrieved using the Land Rover approved diagnostic equipment.

The control module also incorporates an error lockout mode of operation that inhibits system 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 circulation pump after a cool down time of approximately 2 minutes. Error lockout occurs for start sequence failures and/or combustion flameouts, heat exchanger casing overheat and out of limit input voltage. The error lockout mode can be cleared using the Land Rover approved diagnostic system, or by disconnecting the battery power supply for a minimum of 10 seconds.

Start Failure/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 casing temperature exceeds 105 °C (221 °F).

Out of Limit Voltage: The control module enters the error lockout mode if the battery or alternator power input is less than 10.5 ± 0.3 V for more than

20 seconds, or more than 15.5 ± 0.5 V for more than 6 seconds.

2012.0 RANGE ROVER (LM), 412-02

AUXILIARY HEATING

AUXILIARY HEATING

DIAGNOSIS AND TESTING

For additional information.

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

AUXILIARY HEATER REMOTE TRANSMITTER PROGRAMMING (G1390223)

GENERAL PROCEDURES

ACTIVATION

NOTE:

A second or third hand held transmitter can be programmed using this method.

1. **NOTES:**

   - Use a coin or similar implement to remove and install the battery cover.
   - Make sure that correct battery polarity is maintained.

   Remove and install the transmitter battery.

2. 

3. 

   Remove fuse 16 (5 Amp) from the rear loadspace fuse box.

4. **NOTE:**

   This completes the programming procedure.

   Install fuse 16 (5 Amp), and within 5 seconds press the OFF button on the transmitter for at least 1 second.

5. To confirm whether the programming procedure has completed correctly, push the off button. If a continuous red light is displayed

on the transmitter, the programming procedure was successful. If a flashing red light is displayed, the procedure was unsuccessful, or the transmitter is not in range. In this case, make sure the transmitter is within the recommended range and repeat the above procedure from step 4.

2012.0 RANGE ROVER (LM), 412-02

AUXILIARY HEATING

FUEL FIRED BOOSTER HEATER – V8 5.0L PETROL/V8 S/C 5.0L PETROL (G1393689)

REMOVAL AND INSTALLATION

80.40.01	FUEL FIRED BOOSTER HEATER (FFBH) - RENEW	5000 CC, AJ V8	2	USED WITHINS	+
80.40.01	FUEL FIRED BOOSTER HEATER (FFBH) - RENEW	AJ V8, SUPERCHARGED	1.3	USED WITHINS	+

REMOVAL

CAUTIONS:

- RHD illustration shown, LHD is similar.
- Make sure that all openings are sealed. Use new blanking caps.

NOTE:

Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.
   Refer to: Specifications (414-00, Specifications).

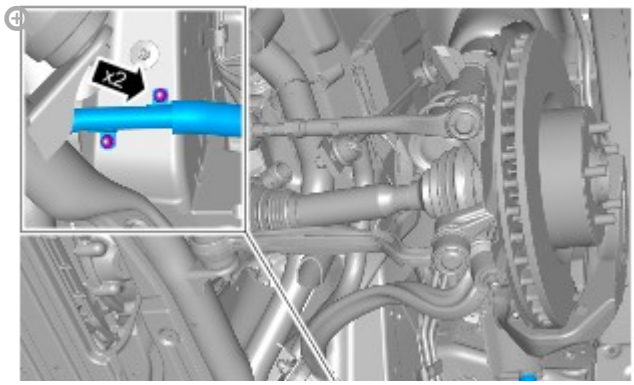
2. **WARNING:**

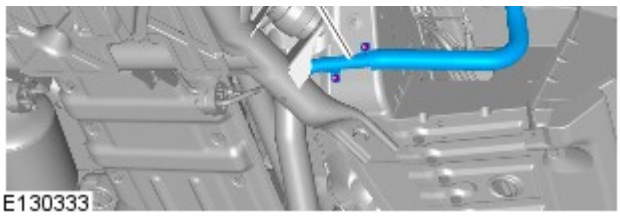
   Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

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

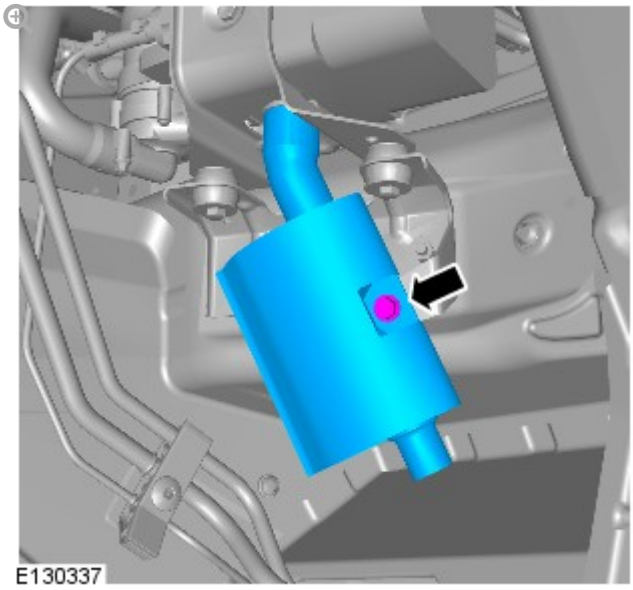
4. Refer to: Cooling System Draining, Filling and Bleeding - V8 5.0L Petrol (303-03 Engine Cooling - V8 5.0L Petrol/V8 S/C 5.0L Petrol, General Procedures).
   Refer to: Cooling System Draining, Filling and Bleeding - V8 S/C 5.0L Petrol (303-03 Engine Cooling - V8 5.0L Petrol/V8 S/C 5.0L Petrol, General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

5. 



Torque: **10 Nm**

6.

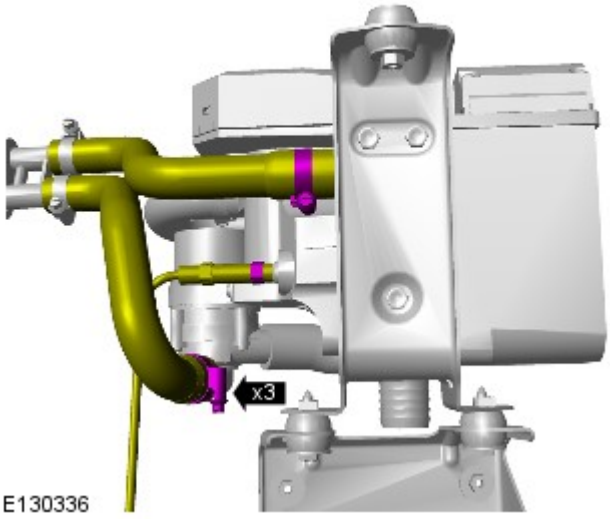


Torque: **10 Nm**

7.

CAUTION:

Be prepared to collect escaping fluids.



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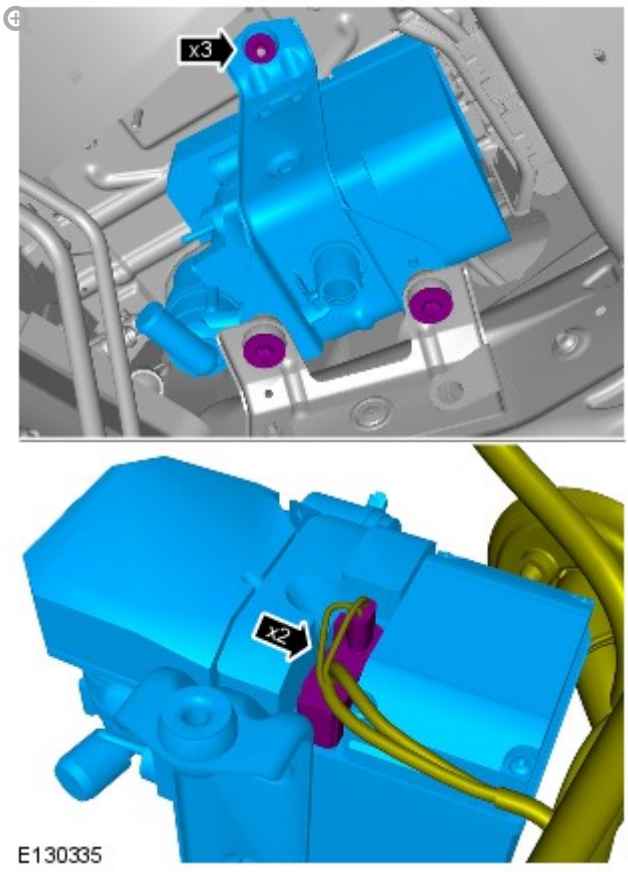
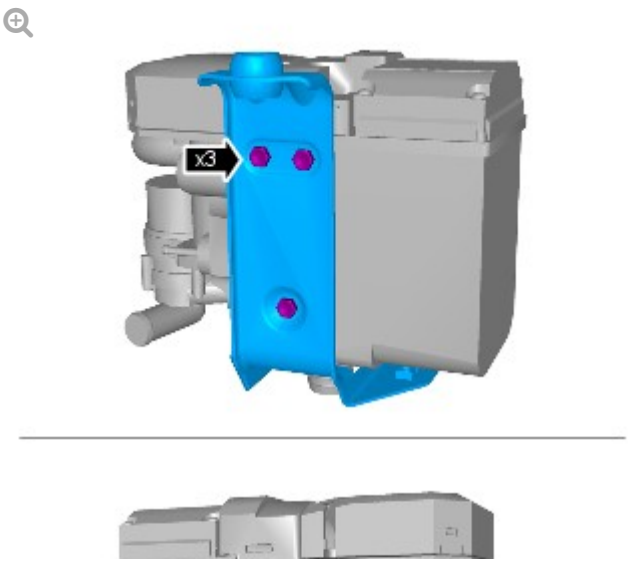


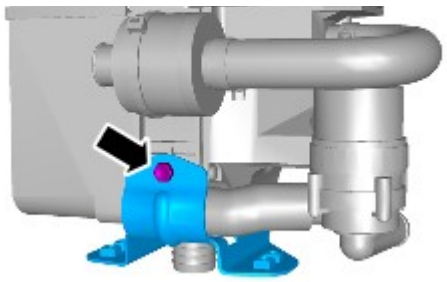
Torque: **10 Nm**

9.

NOTE:

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





E130334

Torque: **10 Nm**

INSTALLATION

1. To install, reverse the removal procedure.

2. **NOTE:**

   > Only carry out this step if a new fuel fired booster heater (FFBH) has been installed.

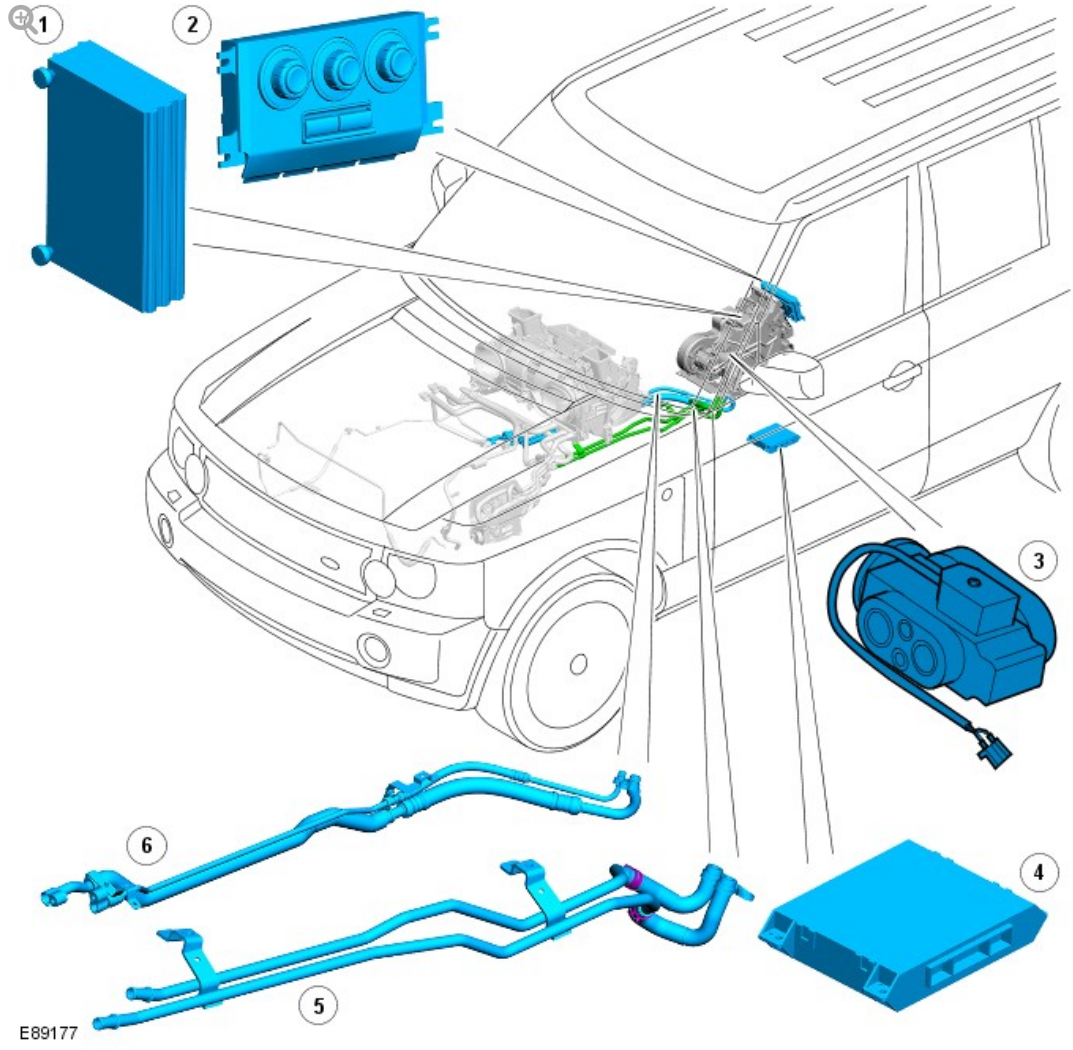
   Using the Land Rover approved diagnostic system, follow the on-screen instructions and configure the auxiliary heater control module (AHCM).

3. Connect the Land Rover approved diagnostic equipment to the vehicle and carry out the Fuel fired burner heater activation test.

AUXILIARY CLIMATE CONTROL

DESCRIPTION AND OPERATION

COMPONENT LOCATION



ITEM	DESCRIPTION
1	Evaporator
2	Rear climate control panel
3	Magnetic valve
4	Rear climate control module

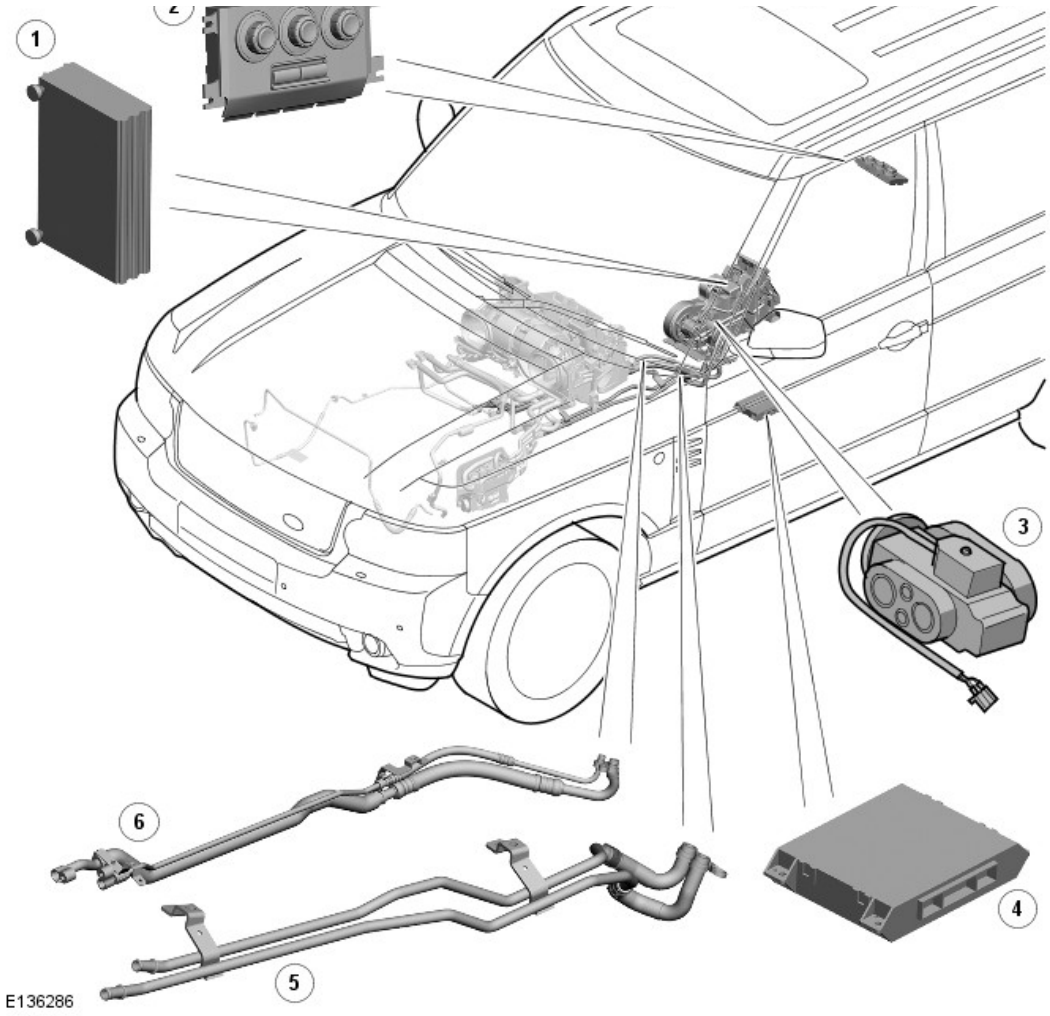
5	Heater pipes
6	Refrigerant lines

2012.0 RANGE ROVER (LM), 412-02

AUXILIARY CLIMATE CONTROL

DESCRIPTION AND OPERATION

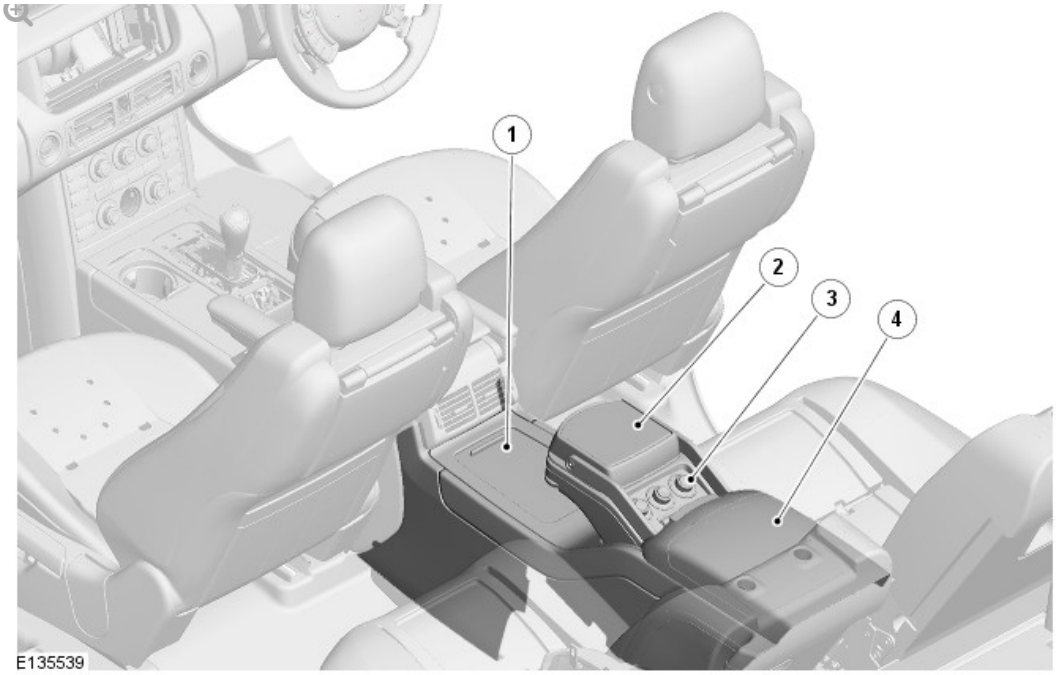
COMPONENT LOCATION – RANGE ROVER ULTIMATE



ITEM	DESCRIPTION
1	Evaporator
2	Rear climate control panel
3	Magnetic valve
4	Rear climate control module
5	Heater pipes
6	Refrigerant lines

GENERAL

The auxiliary climate control on Range Rover Ultimate is the standard rear climate control, with the exception that the rear climate control panel is relocated into the rear floor console.



ITEM	DESCRIPTION
1	Chiller unit (ref only)
2	Table (ref only)
3	Rear climate control panel
4	Rear stowage box (ref only)

The rear floor console harness has a short link harness which connects from the existing harness connector in the rear of the front floor console to the rear climate control panel. The panel and its operation are unchanged.

AIR CONDITIONING

SPECIFICATIONS

Lubricant

NOTE:

All compressors are supplied with 110ml oil. Any system that requires more than 110ml, including dual evaporator systems, will have had the additional amount added during vehicle build.

ITEM	ENGINE 3.6D	ENGINE 4.4D	ENGINE 5.0L
Air conditioning (A/C) compressor oil type	Sanden SP-10 PAG oil	Sanden SP-10 PAG oil	Sanden SP-10 PAG oil
A/C compressor oil - vehicles fitted with 2 zone	120 cm^3	110 cm^3	110 cm^3
A/C compressor oil - vehicles fitted with 4 zone	170 cm^3	200 cm^3	200 cm^3

Refrigerant

ITEM	SPECIFICATION
Refrigerant type	R134A

Capacity

ITEM	ENGINE 3.6D	ENGINE 4.4D	ENGINE 5.0L
Refrigerant - vehicles fitted with 2 zone	700 grammes	700 grammes	750 grammes
Refrigerant - vehicles fitted with 4 zone	880 grammes	880 grammes	930 grammes

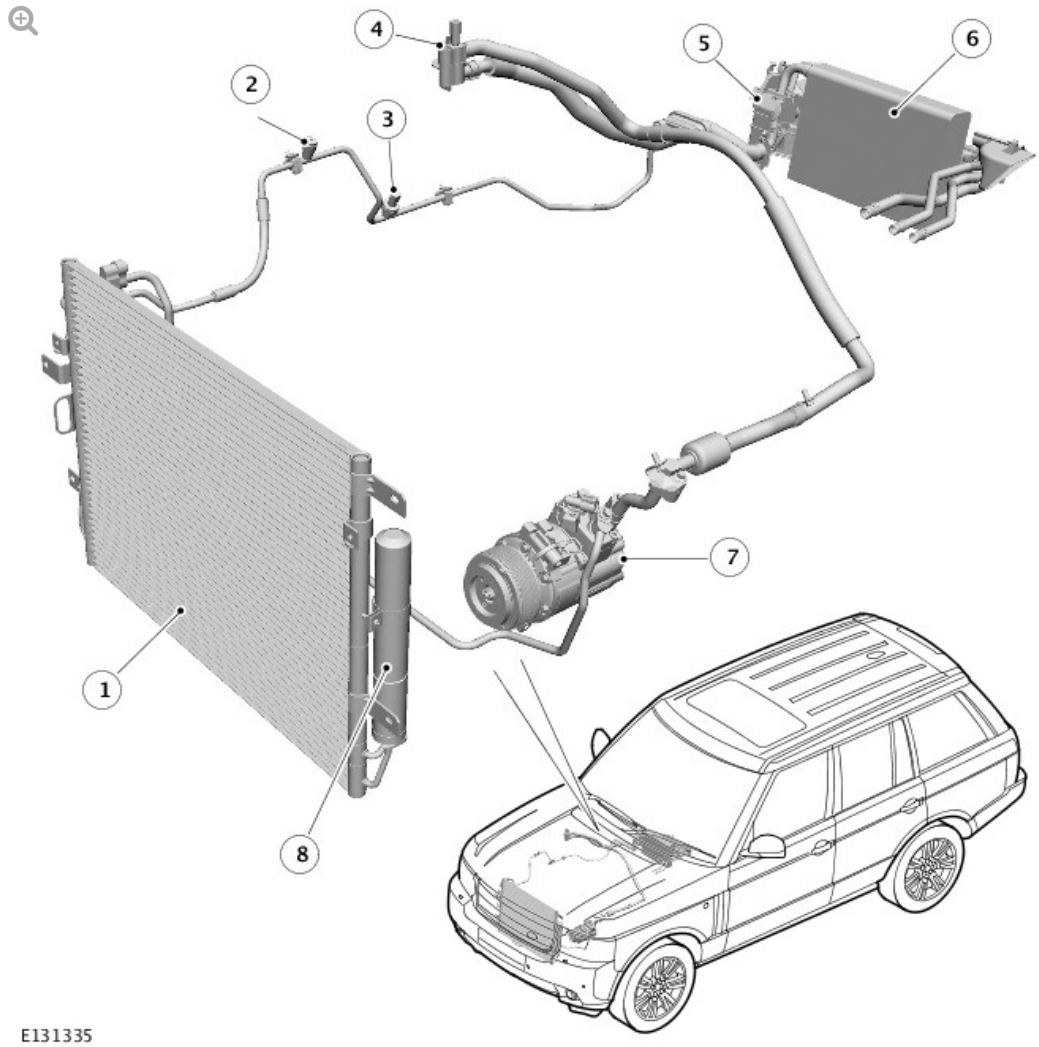
Torque Specifications

DESCRIPTION	NM	LB-FT	LB-IN
A/C compressor mounting bolts	25	18	-
A/C compressor manifold and tube retaining bolt	9	-	80
A/C line to bulkhead bolts	18	13	-
Thermostatic expansion valve (TXV) to refrigerant line clamp bolts	6	-	53
A/C line to compressor nuts	18	13	-
A/C line to condenser bolts	18	13	-
A/C refrigerant line to front evaporator nut - vehicles fitted with 4 zone	9	-	80
A/C refrigerant line to front evaporator bolt - vehicles fitted with 4 zone	18	13	-
A/C lines to rear evaporator bolts - vehicles fitted with 4 zone	9	-	80

AIR CONDITIONING

DESCRIPTION AND OPERATION

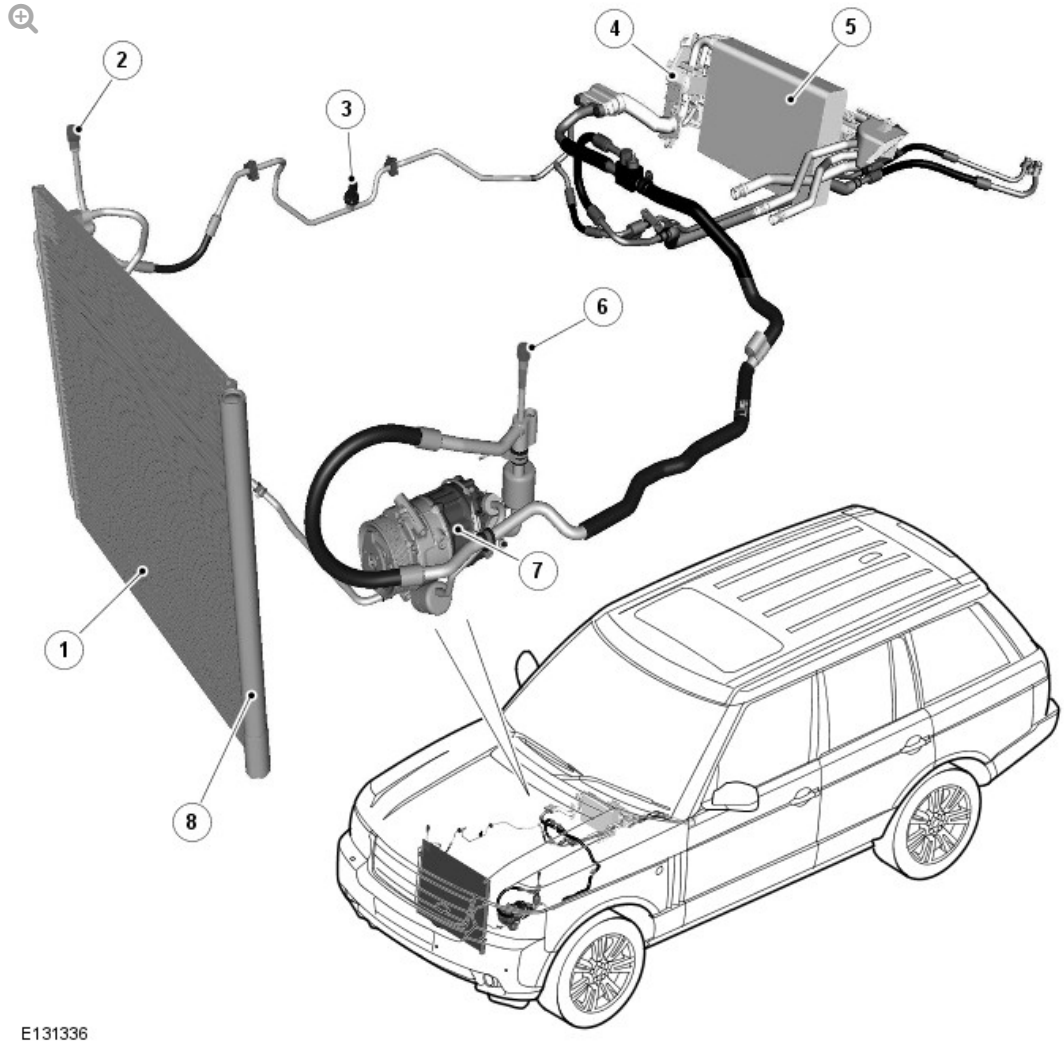
COMPONENT LOCATION - 3.6L TdV8



ITEM	DESCRIPTION
1	Condenser
2	High pressure servicing connection
3	Refrigerant pressure sensor
4	Low pressure servicing connection

5	Thermostatic expansion valve
6	Evaporator
7	air conditioning (A/C) compressor
8	Receiver drier module

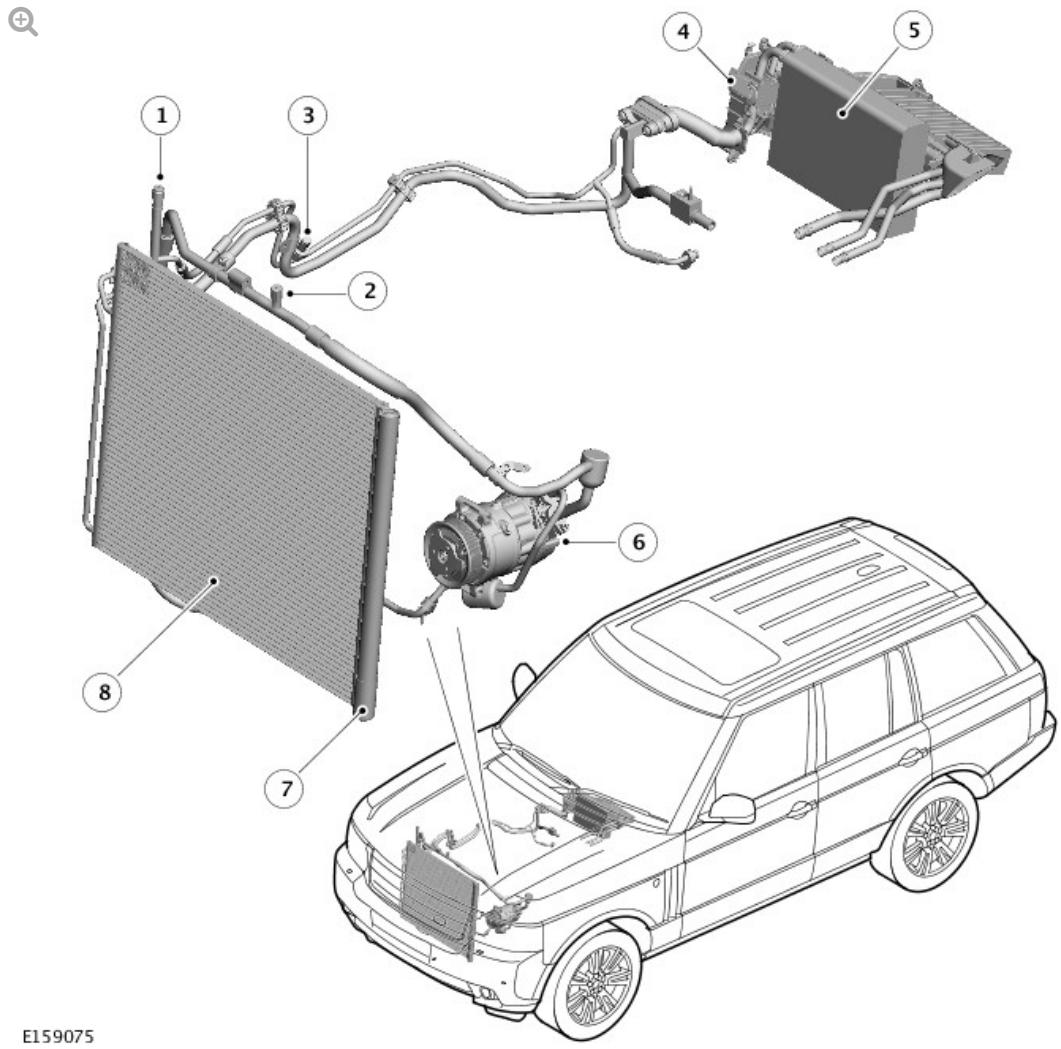
COMPONENT LOCATION - 5.0L V8



ITEM	DESCRIPTION
1	Condenser
2	Low pressure servicing connection
3	Refrigerant pressure sensor (reference)
4	Thermostatic expansion valve
5	Evaporator
6	High pressure servicing connection

7	air conditioning (A/C) compressor
8	Receiver drier module

COMPONENT LOCATION - 4.4L TdV8



ITEM	DESCRIPTION
1	Low pressure servicing connection
2	High pressure servicing connection
3	Refrigerant pressure sensor (reference)
4	Thermostatic expansion valve
5	Evaporator
6	air conditioning (A/C) compressor
7	Receiver drier module
8	Condenser

6	Condenser

OVERVIEW

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

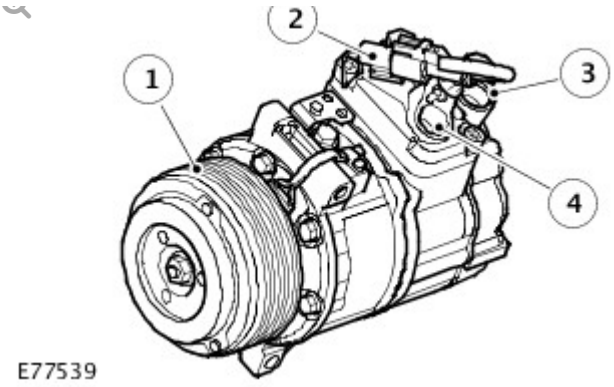
To accomplish the transfer of heat, the refrigerant is circulated around the system, where it passes through 2 pressure/temperature regimes. In each of the pressure/temperature regimes, the refrigerant changes state, during which process maximum heat absorption or release occurs. The low pressure/temperature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

Some vehicles may be fitted with a 4 zone climate control system.
For additional information, refer to: Auxiliary Heater (412-02B Auxiliary Heating, Description and Operation).

A/C COMPRESSOR

The A/C compressor circulates refrigerant around the system by compressing low pressure, low temperature vapor from the evaporator and discharging the resultant high pressure, high temperature vapor to the condenser. Although similar in appearance, the A/C compressor installed on 3.6L TdV8 vehicles differs slightly to the one installed on 5.0L V8 and 4.4L TdV8 vehicles.

3.6L TdV8 A/C Compressor



ITEM	DESCRIPTION
1	Pulley
2	Electrical connector
3	Inlet port
4	Outlet port

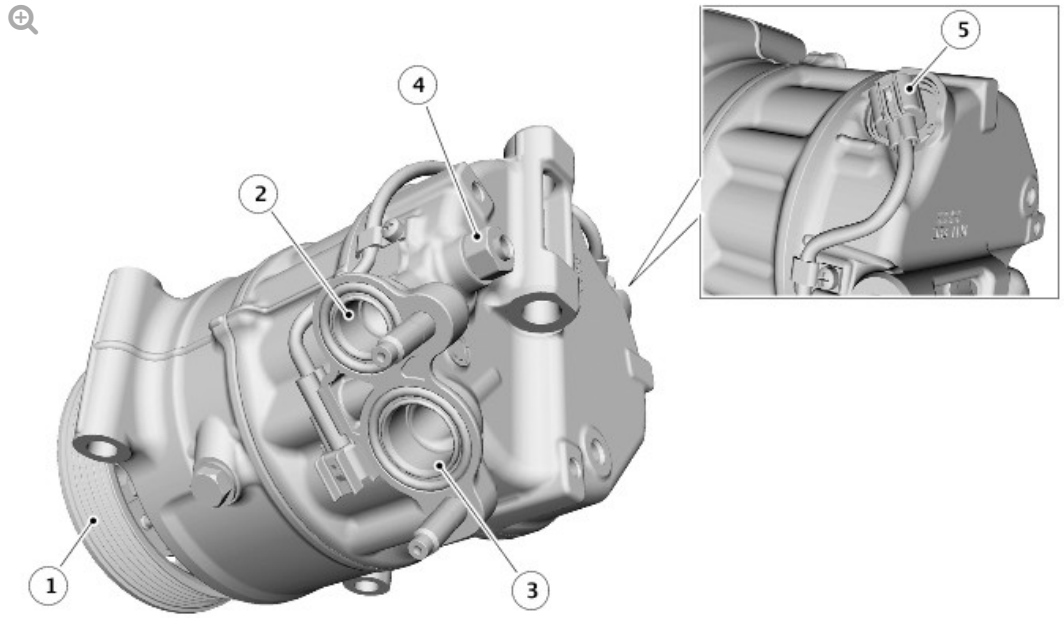
The A/C compressor fitted to 3.6L TdV8 diesel vehicles is a variable displacement unit. The secondary accessory drive belt, driven by the engine crankshaft, drives the A/C compressor via a pulley.

The A/C compressor is a 7 cylinder swash plate unit with a minimum displacement of 5.5 cm^3/rev (0.34 in^3/rev) and maximum displacement of 171 cm^3/rev (10.4 in^3/rev). A control valve in the A/C compressor automatically adjusts the displacement (i.e. flow of refrigerant), between the minimum and maximum values, to match the thermal load of the evaporator. By matching the refrigerant flow to the thermal load of the evaporator, the variable A/C compressor maintains a relatively constant evaporator temperature of approximately 3 to 4°C (37 to 39°F).

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

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

5.0L V8 and 4.4L TdV8 A/C Compressor



E131337

ITEM	DESCRIPTION
1	Pulley
2	Outlet port
3	Inlet port
4	Pressure relief valve
5	Electronic control valve connector

The A/C compressor fitted to 5.0 V8 petrol and 4.4L TdV8 vehicles is a variable displacement unit. The secondary accessory drive belt, driven by the engine crankshaft, drives the A/C compressor via a pulley. Operation of the compressor is controlled by an electronic control valve working in conjunction with the ATC (automatic temperature control) module.

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

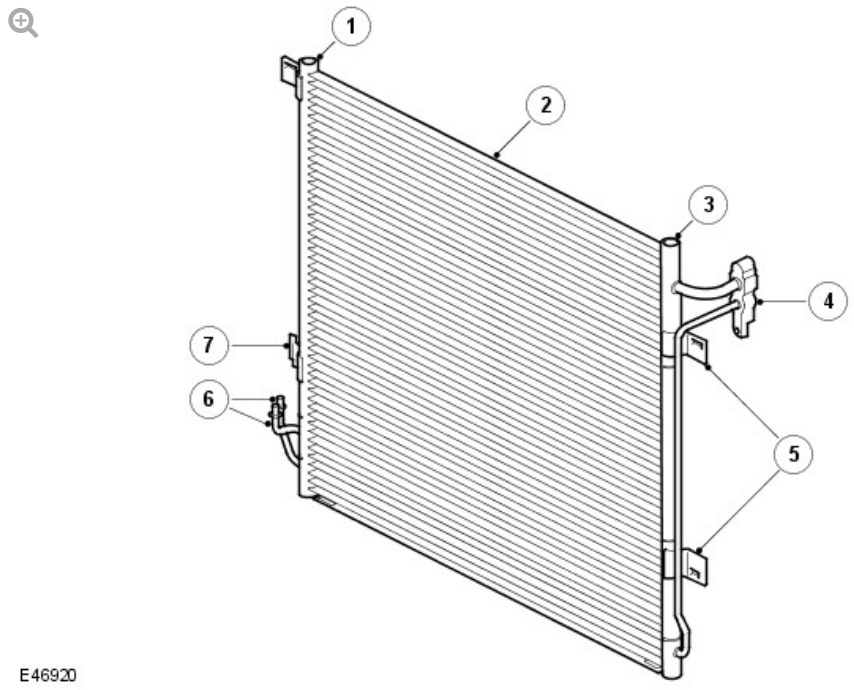
also considering fuel economy.

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

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

CONDENSER AND RECEIVER DRIER

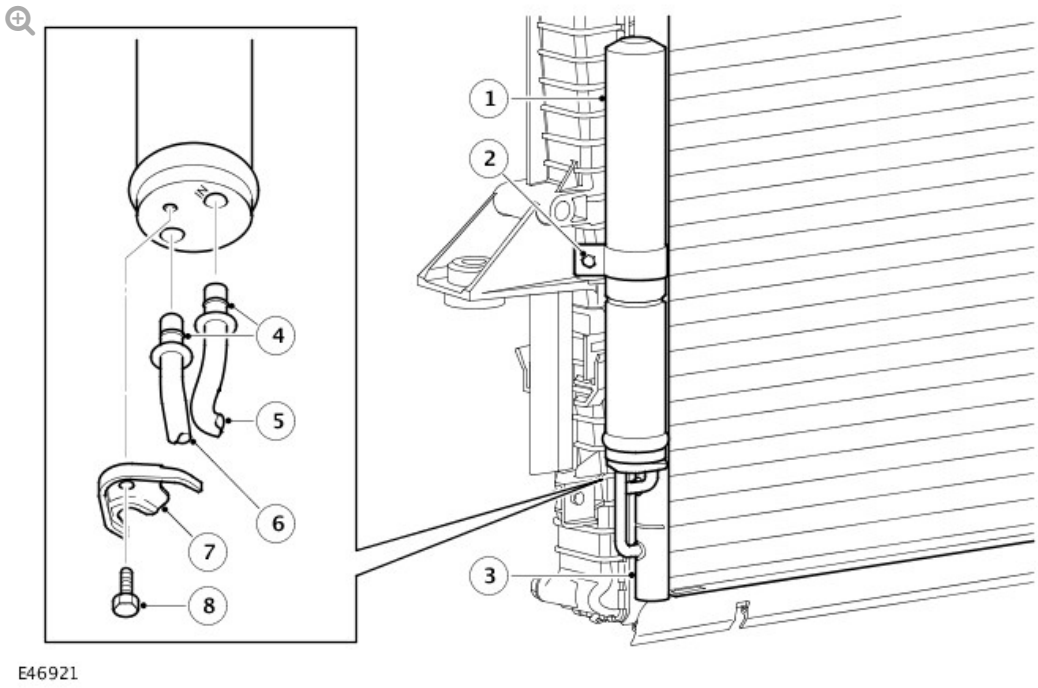
Condenser - 3.6L TdV8



ITEM	DESCRIPTION
1	right-hand (RH) end tank
2	Condenser core
3	left-hand (LH) end tank
4	High pressure line connector block
5	Condenser attachment brackets
6	Receiver drier pipes

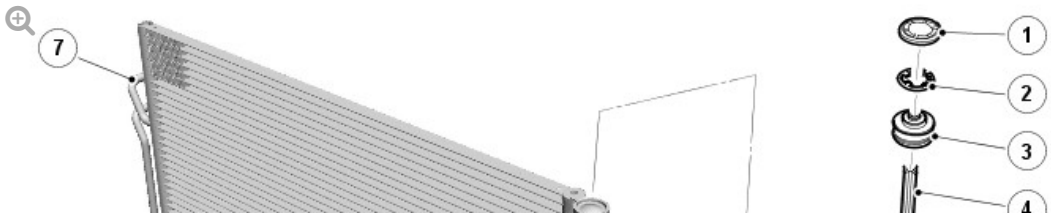
7	Receiver drier attachment bracket

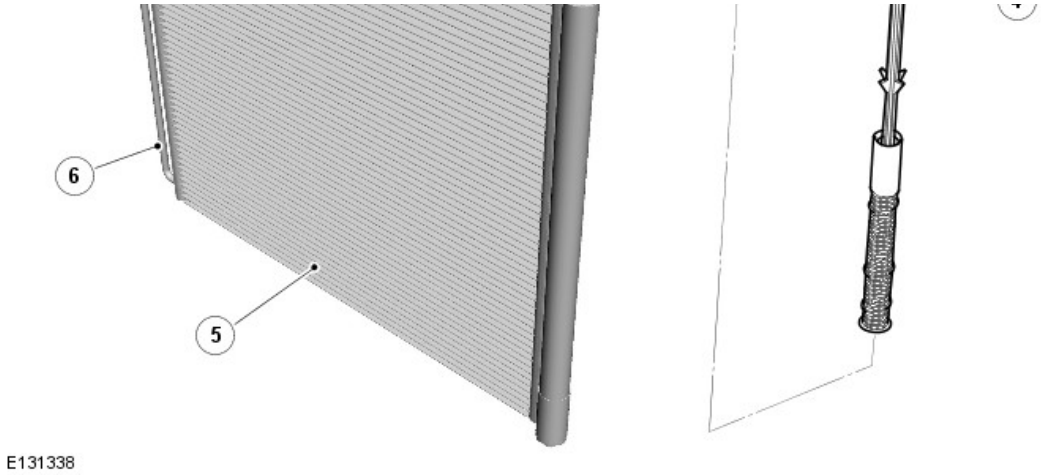
Receiver Drier - 3.6L TdV8



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

Condenser and Receiver Drier - 5.0L V8 and 4.4L TdV8





ITEM	DESCRIPTION
1	Cap
2	Spring clip
3	Sealing plug
4	Desiccant module
5	Condenser
6	Outlet pipe
7	Inlet pipe

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

The condenser is installed immediately in front of the radiator.

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

3.6L TDV8

Divisions in the end tanks separate the heat exchanger into a four pass upper (condenser) section and a two pass lower (sub-cooler) section. A connector block on the left end tank of the condenser provides connections for the high pressure lines from the A/C (air conditioning) compressor and

the evaporator. Two pipes at the bottom of the right end tank of the condenser provide connections for the receiver drier.

5.0L V8 AND 4.4L TDV8

Divisions in the end tanks separate the heat exchanger into a three pass upper (condenser) section and a single pass lower (sub-cooler) section, which are interconnected by the receiver drier module. The desiccant cluster and the filter in the receiver drier module are serviceable items retained in position by a threaded plug.

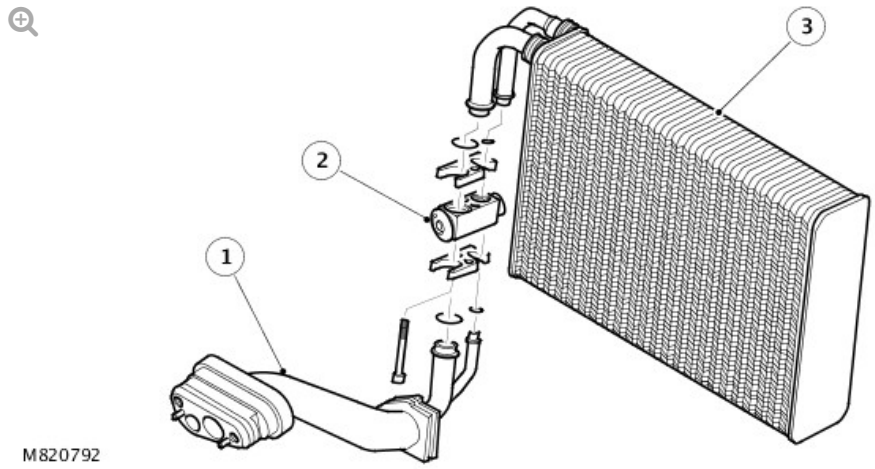
THERMOSTATIC EXPANSION VALVE

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

The temperature and pressure of the refrigerant leaving the evaporator act on the thermostatic expansion valve to control the volume of refrigerant flowing through the evaporator. The warmer the air flowing through the evaporator matrix, the more heat available to evaporate refrigerant and thus the greater the volume of refrigerant allowed through the metering valve.

EVAPORATOR

Evaporator and Thermostatic Expansion Valve



ITEM	DESCRIPTION
1	Insulated connection pipes
2	Thermostatic expansion valve

3	Evaporator

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

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

REFRIGERANT LINES

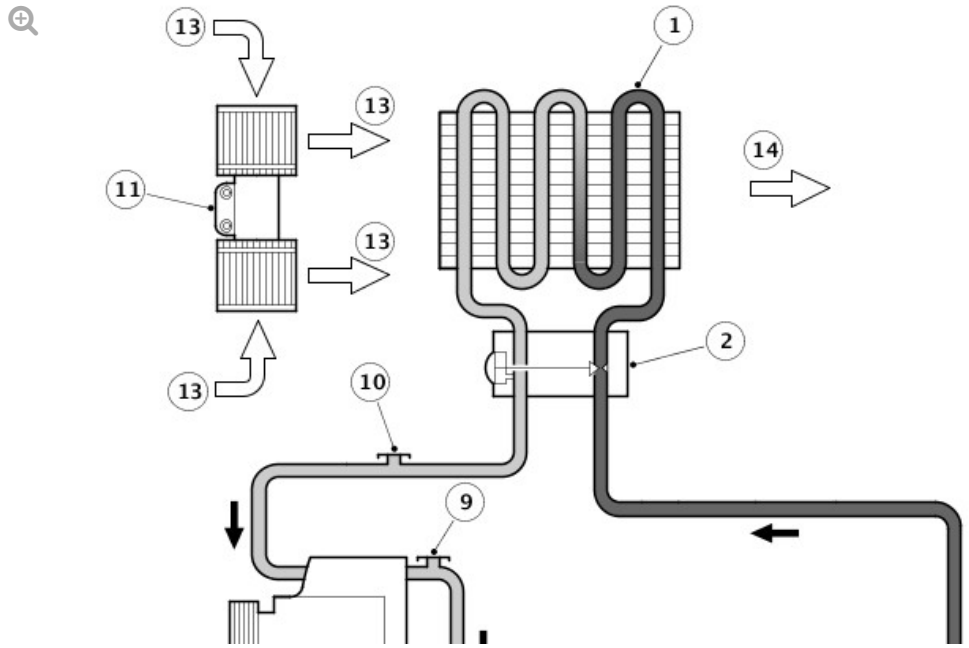
To maintain similar flow velocities around the system, the diameter of the refrigerant lines varies to suit the two pressure/temperature regimes. The larger diameters are installed in the low pressure/temperature regime and the smaller diameters are installed in the high pressure/temperature regime.

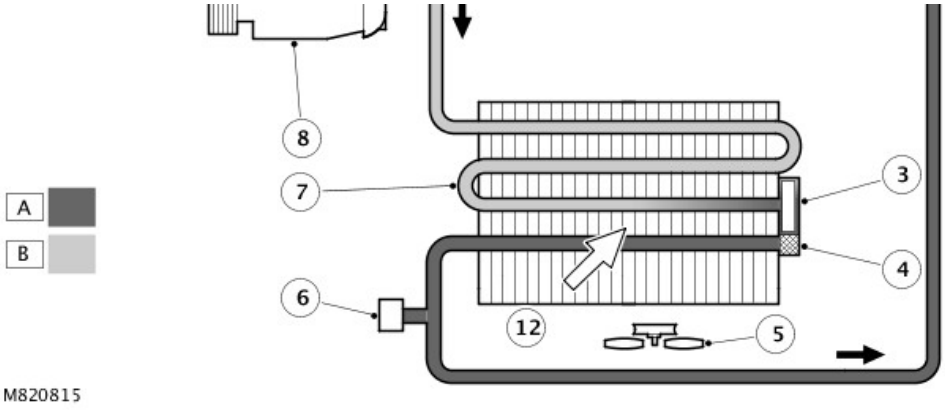
Low and high pressure charging connections are incorporated into the refrigerant lines near the front RH corner of the engine compartment.

CONTROL DIAGRAM

NOTE:

NOTE: A = Refrigerant liquid; B = Refrigerant vapor





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

2012.0 RANGE ROVER (LM), 412-03

AIR CONDITIONING

DIAGNOSIS AND TESTING

For additional information.

REFER to: Climate Control System (412-00 Climate Control System - General Information, Diagnosis and Testing).

AIR CONDITIONING (A/C) COMPRESSOR – V8 S/C 5.0L PETROL (G1230282)

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 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).

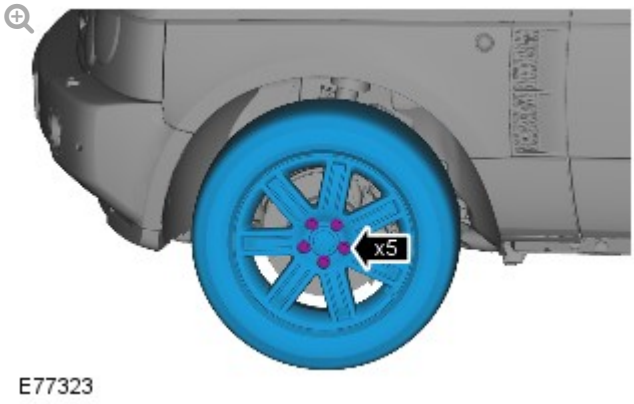
3. **WARNING:**

> Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

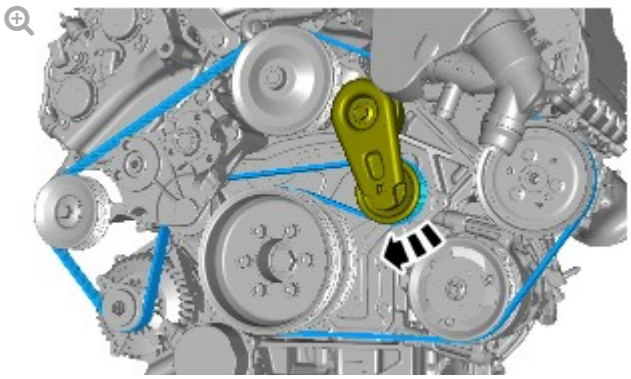
4. **CAUTION:**

> LH illustration shown, RH is similar.



Torque: **140 Nm**

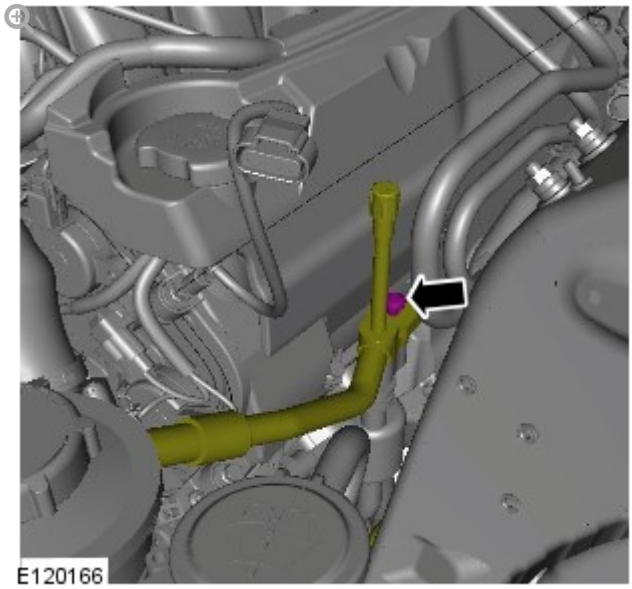
5. Refer to: Steering Gear - 5.0L SC V8 - AJ133, LHD AWD (211-02 Power Steering, Removal and Installation).

6. 

7.

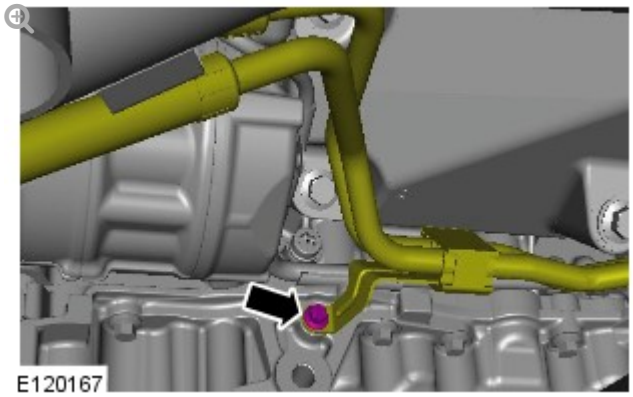
CAUTIONS:

- Make sure that all openings are sealed. Use new blanking caps.
- A new O-ring seal is to be installed.



Torque: **18 Nm**

8.

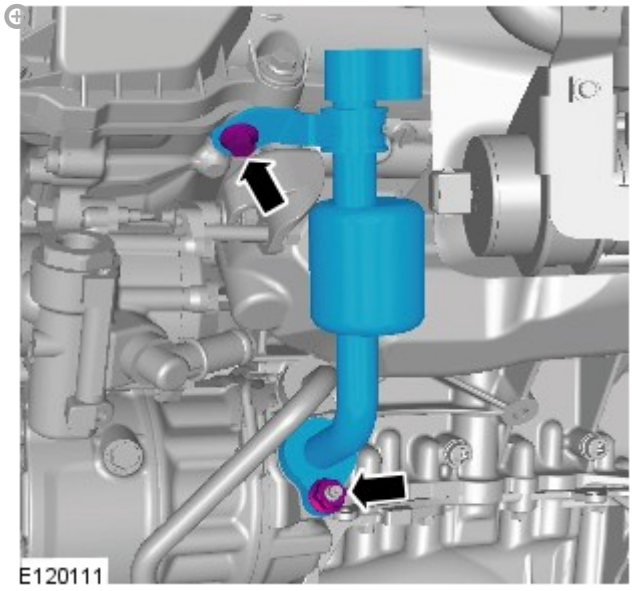


Torque: **25 Nm**

9.

CAUTIONS:

- Make sure that all openings are sealed. Use new blanking caps.
- A new O-ring seal is to be installed.



Torque:

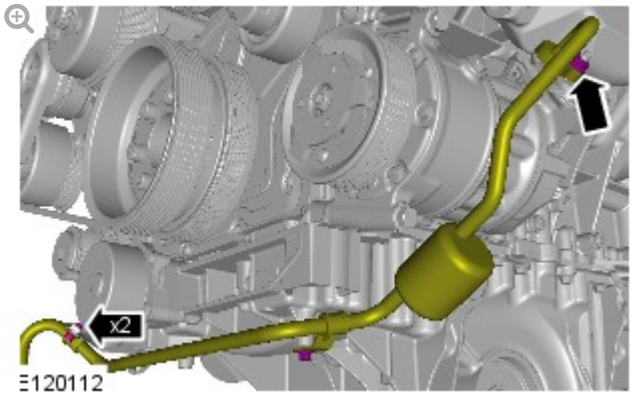
M8 nut **9 Nm**

M8 **25 Nm**

10.

CAUTIONS:

- Make sure that all openings are sealed. Use new blanking caps.
- A new O-ring seal is to be installed.

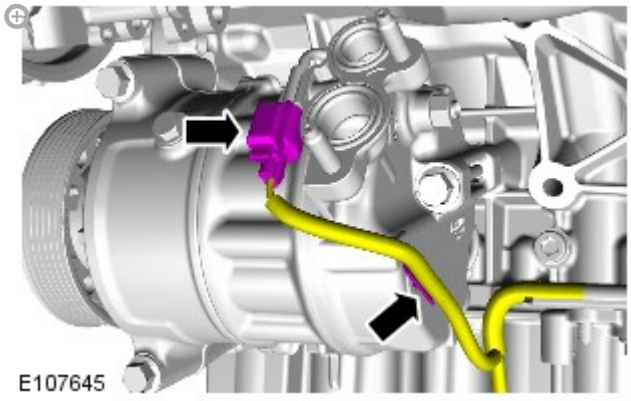


Torque:

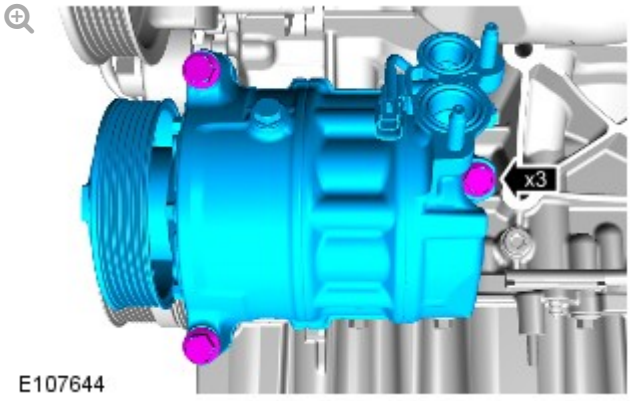
M8 nut **9 Nm**

M8 **9 Nm**

11.



12.



Torque: **25 Nm**

INSTALLATION

1. To install, reverse the removal procedure.

AIR CONDITIONING

CONDENSER CORE – V8 S/C 5.0L PETROL (G1225330)

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:**

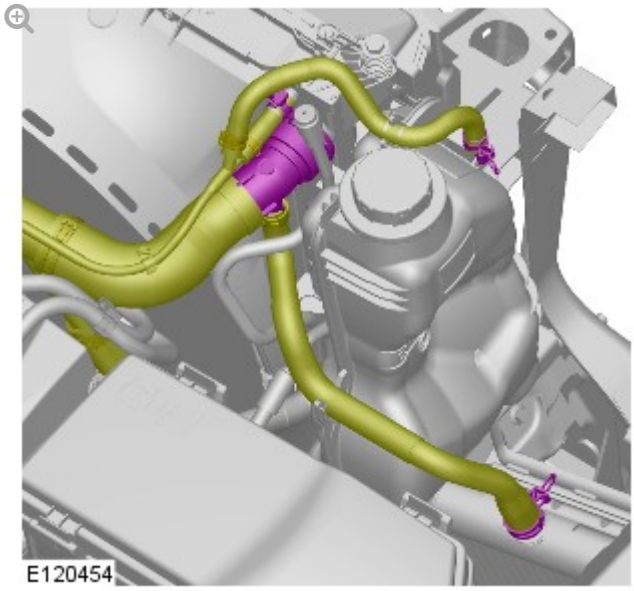
   Make sure to support the vehicle with axle stands.

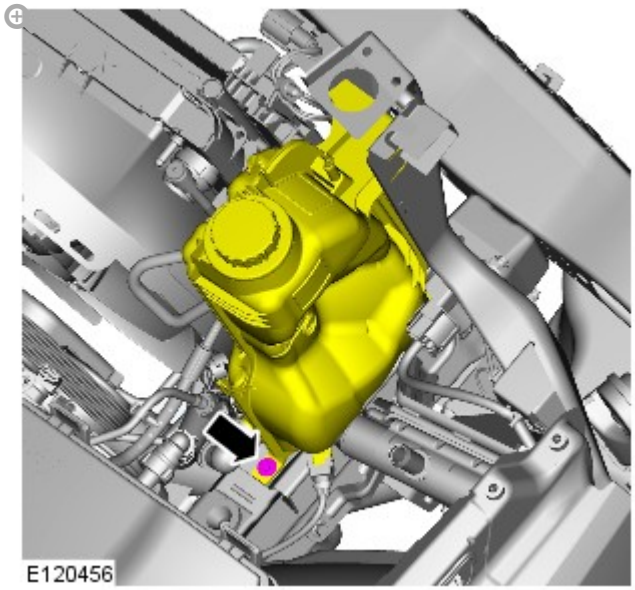
   Raise and support the vehicle.
3. Refer to: Cooling System Partial Draining and Vacuum Filling (303-03B Engine Cooling - TDV8 4.4L Diesel, General Procedures).
4. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging - V8 5.0L Petrol/V8 S/C 5.0L Petrol (412-00 Climate Control System - General Information, General Procedures).

5. Refer to: Hood Latch Panel (501-02 Front End Body Panels, Removal and Installation).

6. Refer to: Air Cleaner RH (303-12C Intake Air Distribution and Filtering - V8 5.0L Petrol, Removal and Installation).

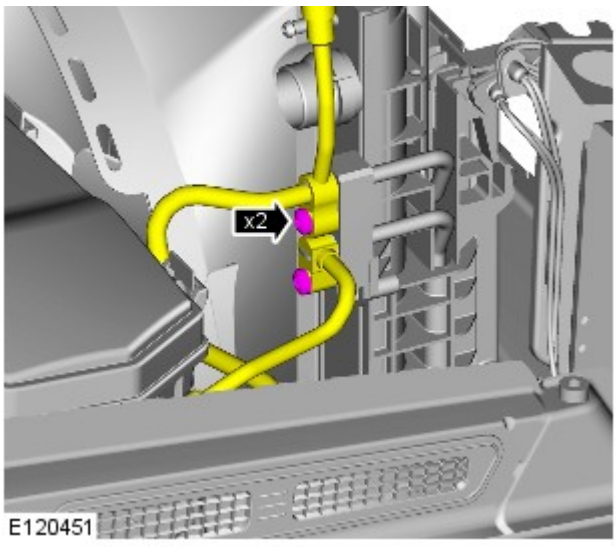
7. Refer to: Air Cleaner Outlet Pipe RH (303-12C Intake Air Distribution and Filtering - V8 5.0L Petrol, Removal and Installation).

8. 

9. 

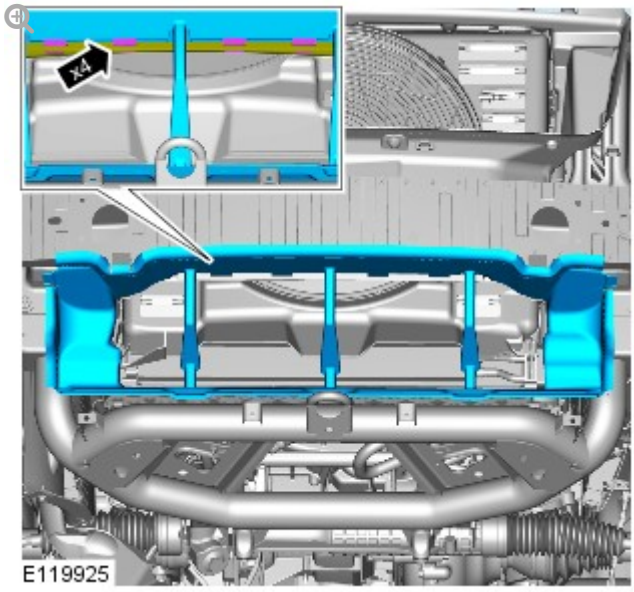
Torque: **9 Nm**

10. 



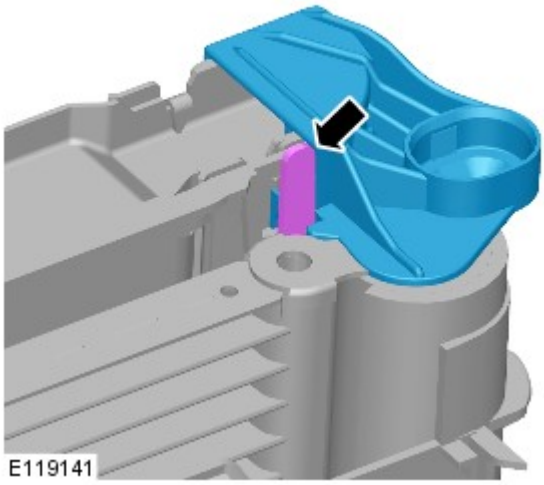
Torque: **8 Nm**

11.

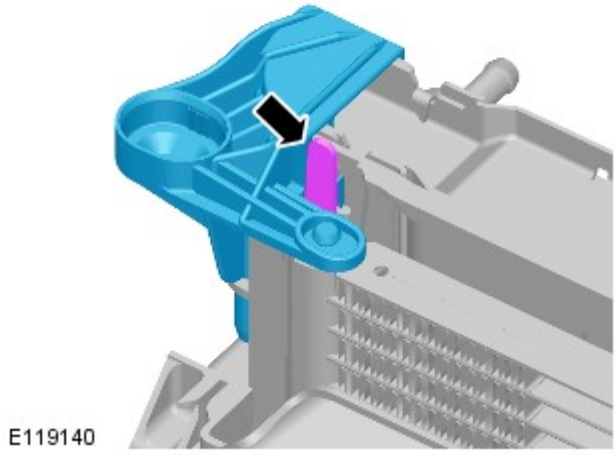


12.

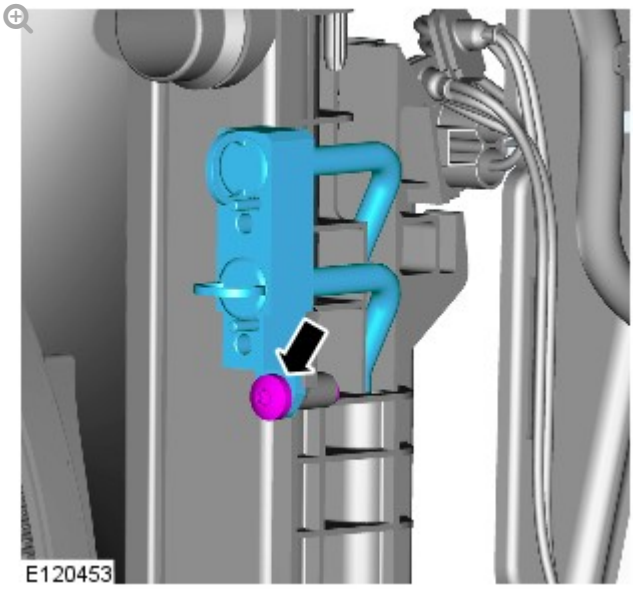
13.



14.



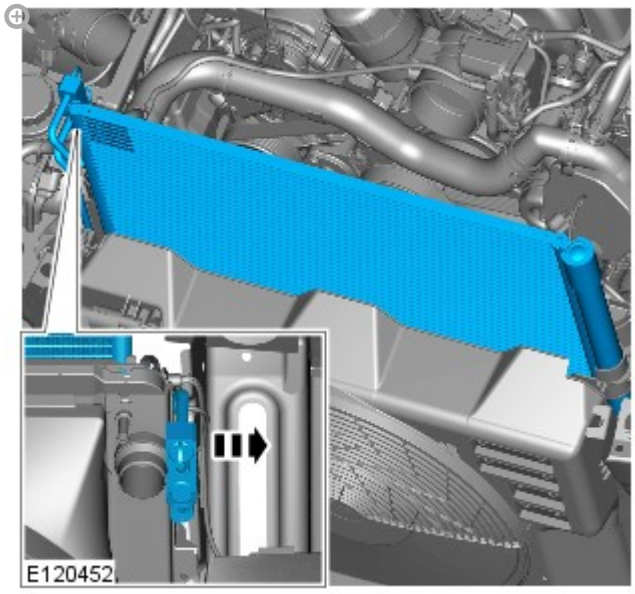
15.



Torque: **8 Nm**

16. **CAUTION:**

> Always protect the cooling pack elements to prevent accidental damage.



INSTALLATION

1. To install reverse the removal procedure.

2012.0 RANGE ROVER (LM), 412-03

AIR CONDITIONING

CONDENSER FAN – V8 5.0L PETROL/V8 S/C 5.0L PETROL (G1224145)

REMOVAL

NOTE:

Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.
   Refer to: Specifications (414-00, Specifications).

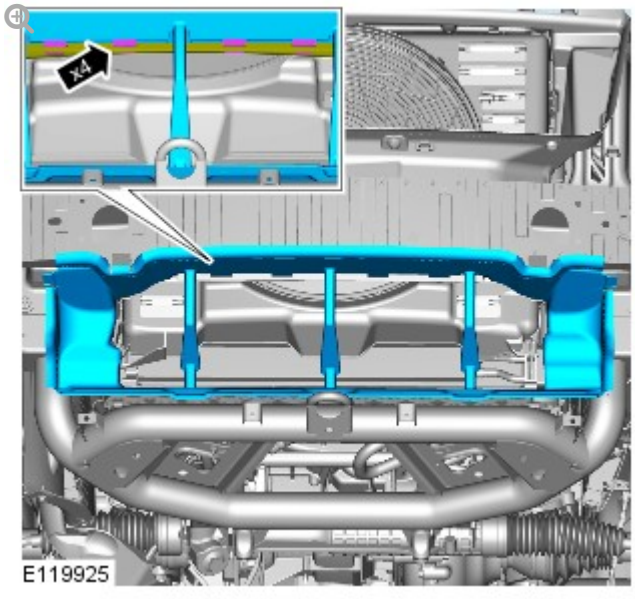
2. **WARNING:**

   Make sure to support the vehicle with axle stands.

   Raise and support the vehicle.

3. Refer to: Hood Latch Panel (501-02, Removal and Installation).

4.

5. 

6.

7.

INSTALLATION

1. To install reverse the removal procedure.

AIR CONDITIONING

EVAPORATOR CORE – V8 S/C 5.0L PETROL (G1345056)

REMOVAL AND INSTALLATION

REMOVAL

WARNINGS:

- Persons working on the supplemental restraint system (SRS) must be fully trained and have been issued with the safety guidelines.
- Allow a period of 10 minutes to elapse after disconnecting the battery before undertaking any work on the SRS.
- The SRS electrical connectors are unique. DO NOT force, or attempt to connect electrical connectors to the wrong sockets.

- The correct procedures must always be used when working on SRS components.
- It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.
- Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.
- Take extra care when handling SRS components.

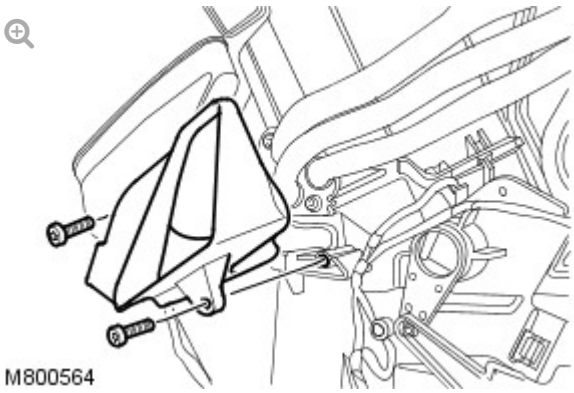
1. Set the footwell duct air outlet to closed.

2. Make the air bag supplemental restraint system (SRS) safe.
   Refer to: Standard Workshop Practices (100-00, Description and Operation).

3. Disconnect the battery ground cable.
   Refer to: Specifications (414-00, Specifications).

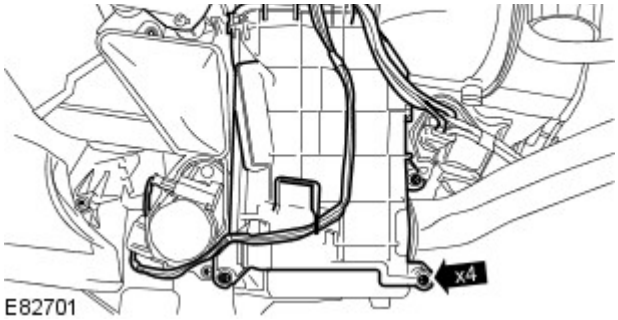
4. Remove the heater and evaporator core housing.
   Refer to: Heater Core and Evaporator Core Housing - 5.0L SC V8 - AJ133 (412-02, Removal and Installation).

5. Reposition the heater and evaporator core housing for access.

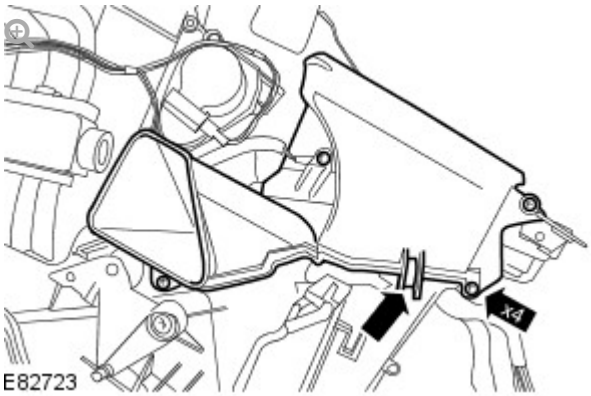
6. 

   Remove the left-hand footwell duct.

7. 



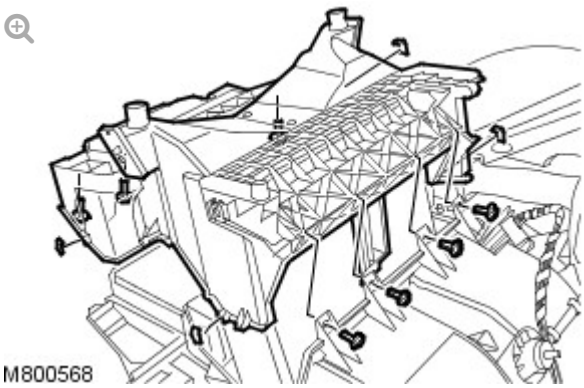
Remove the thermostatic expansion valve cover.

8. 

Remove the right-hand footwell duct.

9. Disconnect the footwell duct actuator electrical connector.

10. Release the evaporator temperature sensor from the heater and evaporator core housing.

11. 

Remove the heater and evaporator core housing lower cover.

12. **CAUTION:**

Make sure that all openings are sealed. Use new blanking

caps.

Remove the thermostatic expansion valve.

13. Remove the evaporator core.

INSTALLATION

1. Install the evaporator core.

2. **NOTE:**

   Remove and discard the blanking caps.

   Install the thermostatic expansion valve.

3. Install the heater and evaporator core housing lower cover.

4. Install the evaporator temperature sensor to the heater and evaporator core housing.

5. Connect the footwell duct actuator electrical connector.

6. Install the right-hand footwell duct.

7. Install the thermostatic expansion valve cover.

8. Install the left-hand footwell duct.

9. Reposition the heater and evaporator core housing for access.

10. Install the heater and evaporator core housing.
    Refer to: Heater Core and Evaporator Core Housing - 5.0L SC V8 - AJ133 (412-02, Removal and Installation).

11. Connect the battery ground cable.
    Refer to: Specifications (414-00, Specifications).

AIR CONDITIONING

RECEIVER DRIER – V8 S/C 5.0L PETROL (G1345058)

REMOVAL AND INSTALLATION

82.17.03	SUCTION ACCUMULATOR – RENEW	5000 CC, AJ V8, SUPERCHARGED	3.5	USED WITHINS	+

REMOVAL

NOTE:

Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.
   Refer to: Specifications (414-00, Specifications).

2. Refer to: Condenser Core - 5.0L SC V8 - AJ133 (412-03, Removal and Installation).

3. **NOTE:**

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

4. 

INSTALLATION

1. To install, reverse the removal procedure.

2012.0 RANGE ROVER (LM), 412-03

AIR CONDITIONING

THERMOSTATIC EXPANSION VALVE – V8 5.0L PETROL/V8 S/C 5.0L PETROL (G910473)

80.15.05	VENTILATOR – FACE LEVEL – LH – RENEW	ALL DERIVATIVES	0.1	USED WITHINS	+
82.25.01	VALVE – THERMOSTATIC EXPANSION – RENEW	RIGHT HAND DRIVE	1.2	USED WITHINS	+

REMOVAL

All vehicles

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

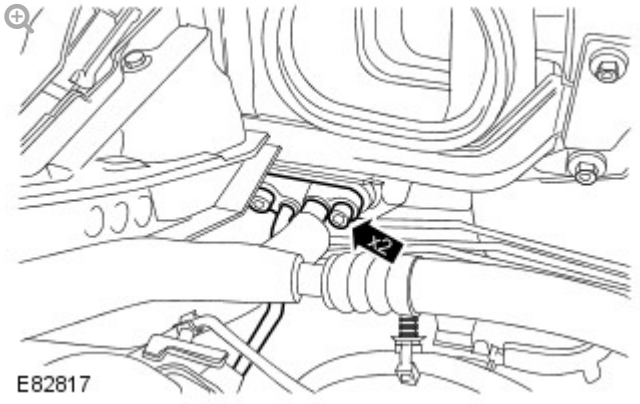
2. Remove the plenum chamber.
   For additional information, refer to: Plenum Chamber (412-01, Removal and Installation).

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

All vehicles

1. **CAUTION:**

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



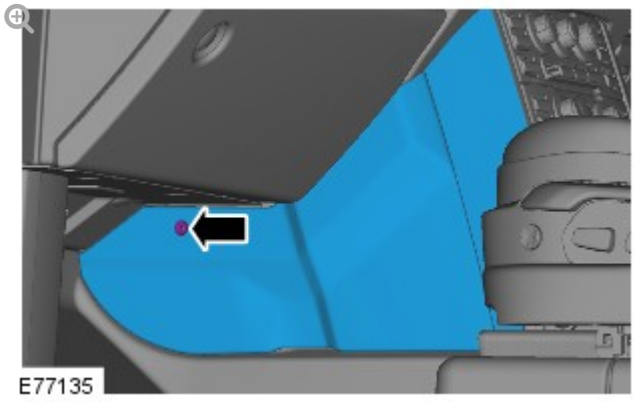
Disconnect the A/C pipes.

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

2.

NOTE:

LH illustration shown, RH is similar.



Remove the floor console extension trim panel.

- Remove the screw.
- Release the 2 clips.

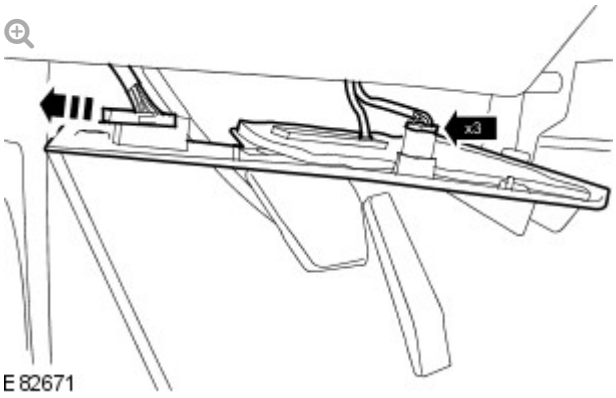
Right-hand drive vehicles

1.

Release the driver side closing trim panel.

- Remove the 4 screws.
- Remove the clip.

2.



Remove the driver side closing trim panel.

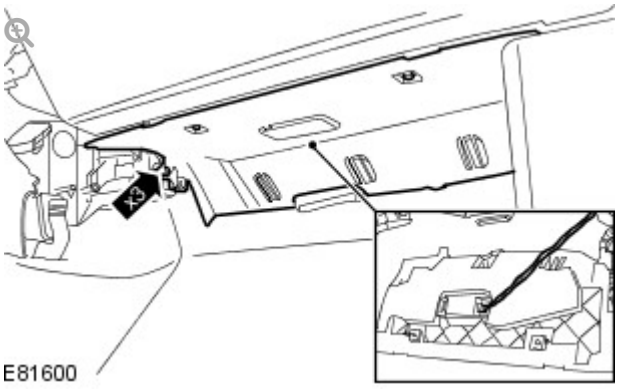
- Disconnect the 2 electrical connectors.
- Release the vehicle diagnostic socket.

3. Remove the right-hand front footwell duct .

- Remove the 2 screws.

	Left-hand drive vehicles

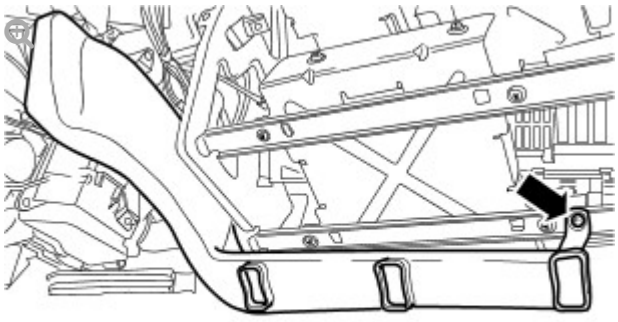
1.



Remove the passenger side closing trim panel.

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

2.



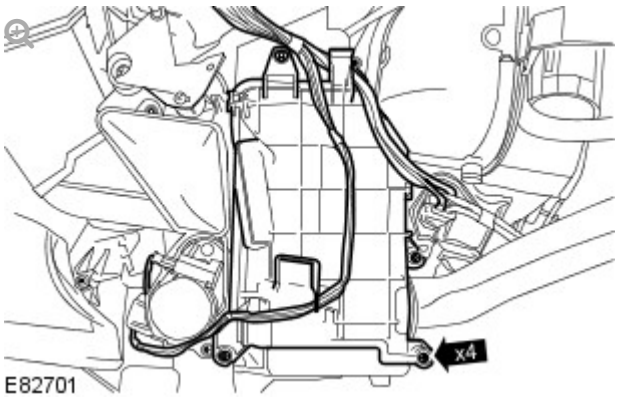
E82189

Remove the passenger side footwell duct.

- Remove the screw.

All vehicles

1.



E82701

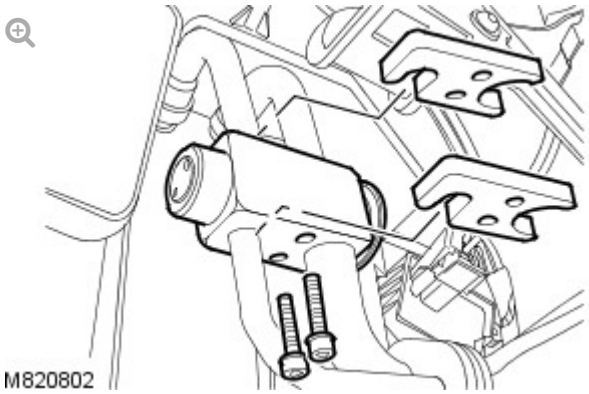
Remove the thermostatic expansion valve cover.

- Release the wiring harness from the 2 tangs.
- Remove the 4 screws.

2.

CAUTION:

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



Remove the thermostatic expansion valve.

- Remove the 2 bolts.
- Remove the 2 A/C pipe clamps.
- Remove the A/C pipes.
- Remove and discard the O-rings.

INSTALLATION

ℹ	All vehicles

1. Install the thermostatic expansion valve.
   - Remove the blanking caps from the ports.
   - Clean the component mating faces.
   - Lubricate and install the new O-rings.
   - Install the A/C pipes.
   - Install the 2 A/C pipe clamps.
   - Tighten the bolts to 6 Nm (4 lb.ft).
2. Install the thermostatic expansion valve cover.
   - Install the 4 screws.
   - Secure the wiring harness to the tangs.

ℹ	Right-hand drive vehicles

1. Install the right-hand front footwell duct.
   - Install the screws.

2. Install the driver side closing trim panel.
   - Connect the electrical connectors.
   - Attach the vehicle diagnostic socket.

3. Secure the driver side closing trim panel.
   - Install the screws.
   - Install the clip.

ℹ	Left-hand drive vehicles

1. Install the passenger side closing trim panel.
   - Connect the electrical connector.
   - Install the screws.

2. Install the passenger side footwell duct.
   - Install the screw.

3. **NOTE:**

   LH illustration shown, RH is similar.

   Install the floor console extension trim panel.
   - Secure the clips.
   - Install the screw.

4. Connect the A/C pipes.
   - Remove the blanking caps from the ports.
   - Clean the component mating faces.

- Lubricate and install the new O-rings.
- Install the A/C pipes.
- Tighten the bolts to 6 Nm (4 lb.ft).

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

6. Install the plenum chamber.
   For additional information, refer to: Plenum Chamber (412-01, Removal and Installation).

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

2012.0 RANGE ROVER (LM), 412-03

AUXILIARY CLIMATE CONTROL

SPECIFICATIONS

DESCRIPTION	NM	LB-FT
Auxiliary climate control assembly bolts	4	3
Auxiliary climate control sealing plate bolts	4	3
Air conditioning (A/C) pipe bolts	9	7

2012.0 RANGE ROVER (LM), 412-03

AUXILIARY CLIMATE CONTROL

DIAGNOSIS AND TESTING

For additional information.

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

2012.0 RANGE ROVER (LM), 412-03

AUXILIARY CLIMATE CONTROL

AUXILIARY CLIMATE CONTROL ASSEMBLY (G1345213)

REMOVAL

NOTE:

Removal steps in this procedure may contain installation details.

1. Refer to: Rear Passenger Entertainment Control Panel (415-07, Removal and Installation).
2. 

INSTALLATION

1. To install, reverse the removal procedure.

2012.0 RANGE ROVER (LM), 412-03

AUXILIARY CLIMATE CONTROL

AUXILIARY BLOWER MOTOR

(G1345219)

REMOVAL AND INSTALLATION

82.26.33	BLOWER MOTOR - ASSEMBLY - RENEW	ALL DERIVATIVES	0.7	USED WITHINS	+

REMOVAL

NOTE:

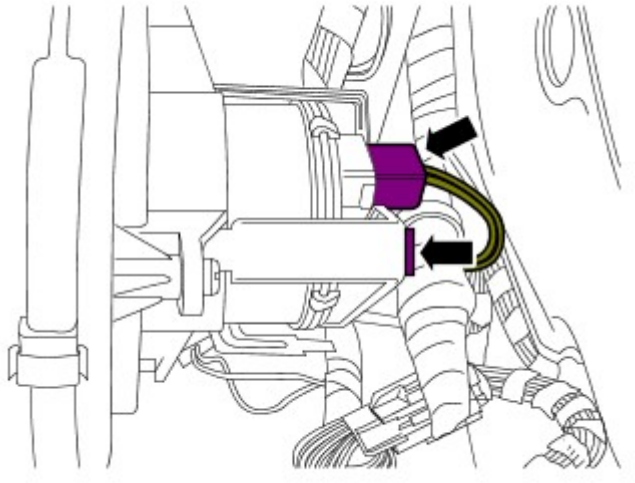
Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.
   Refer to: Specifications (414-00, Specifications).

2. Refer to: Floor Console (501-12, Removal and Installation).

3.

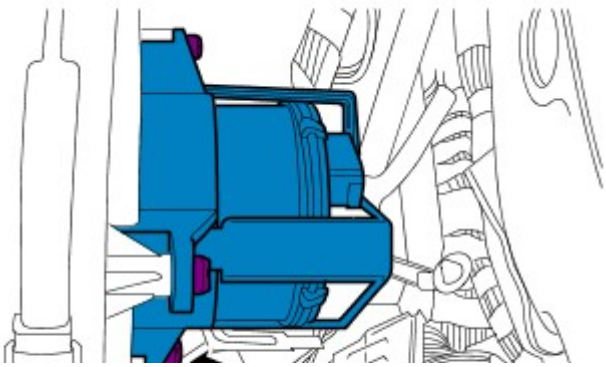
4.



E131175

5. **NOTE:**

   Note the fitted position.



E131178

INSTALLATION

1. To install, reverse the removal procedure.

AUXILIARY BLOWER MOTOR RESISTOR (G1345220)

REMOVAL AND INSTALLATION

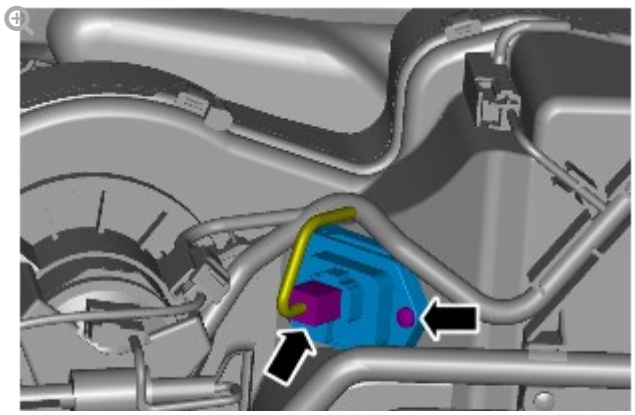
REMOVAL

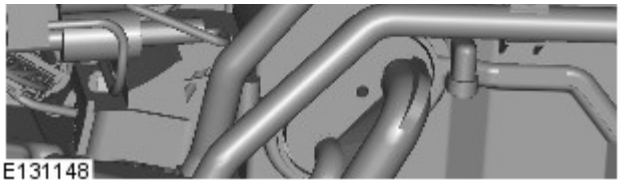
NOTE:

Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.
   Refer to: Specifications (414-00, Specifications).

2. Refer to: Floor Console (501-12, Removal and Installation).

3. 



INSTALLATION

1. To install, reverse the removal procedure.

2012.0 RANGE ROVER (LM), 412-03

AUXILIARY CLIMATE CONTROL

AUXILIARY FOOTWELL VENT/PUSH BLEND DOOR

VENT/DUCT BLEND DOOR ACTUATOR (G1345532)

REMOVAL AND INSTALLATION

REMOVAL

NOTE:

Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.
   Refer to: Specifications (414-00, Specifications).
2. Refer to: Rear Passenger Entertainment Control Panel (415-07, Removal and Installation).
3. **CAUTION:**

   Make sure damage does not occur to the auxiliary temperature blend door actuator link rod.

4. 

INSTALLATION

1. To install, reverse the removal procedure.

2012.0 RANGE ROVER (LM), 412-03

AUXILIARY CLIMATE CONTROL

AUXILIARY HEATER CORE AND EVAPORATOR CORE HOUSING – V8 5.0L PETROL/V8 S/C 5.0L PETROL (G1345480)

REMOVAL AND INSTALLATION

REMOVAL

WARNING:

Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

CAUTION:

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

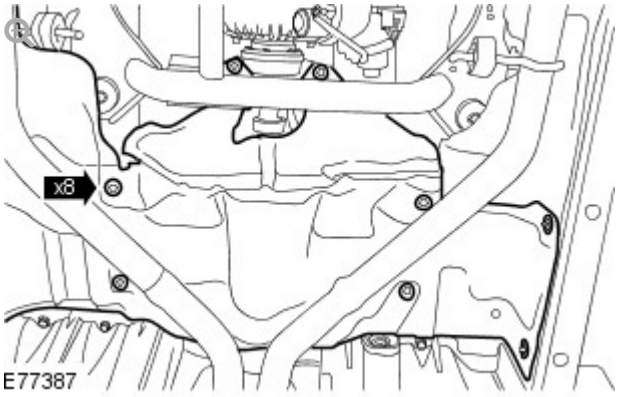
1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

2. Evacuate the air conditioning (A/C) system.
   For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging - 5.0L NA V8 - AJ133/5.0L SC V8 - AJ133 (412-00, General Procedures).

3. **WARNING:**

   Make sure to support the vehicle with axle stands.

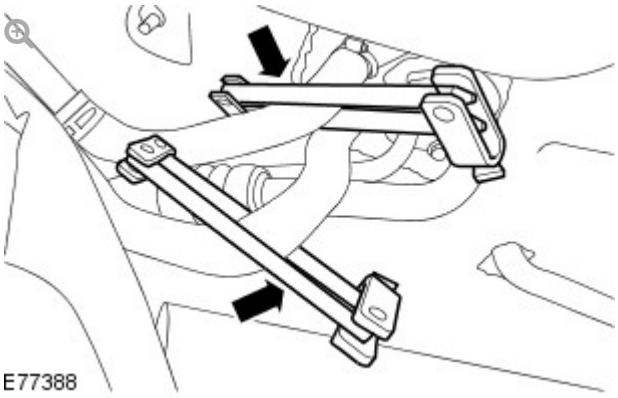
   Raise and support the vehicle.

4. 

Reposition the exhaust center heat shield.

- Remove the 8 nuts.

5.



Clamp the auxiliary heater core coolant hoses.

- Clamp the hoses to minimize coolant loss.

6.

WARNING:

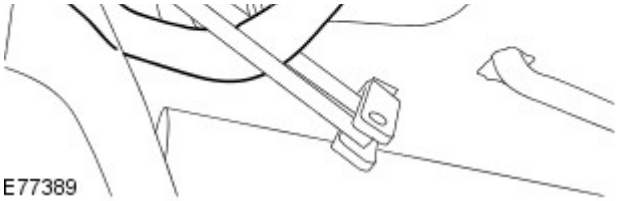
Since injury such as scalding could be caused by escaping steam or coolant, allow the vehicle cooling system to cool prior to carrying out this procedure.

CAUTION:

Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.

NOTE:

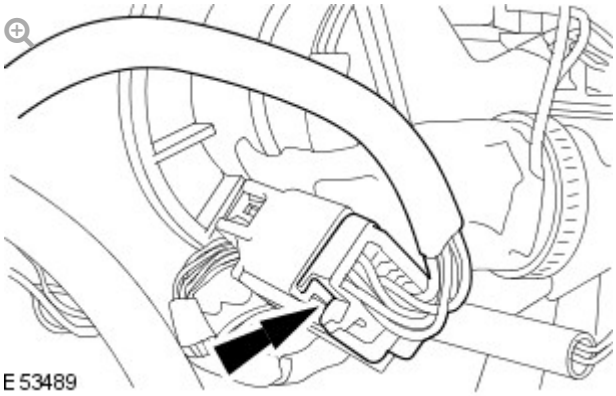
Some fluid spillage is inevitable during this operation.



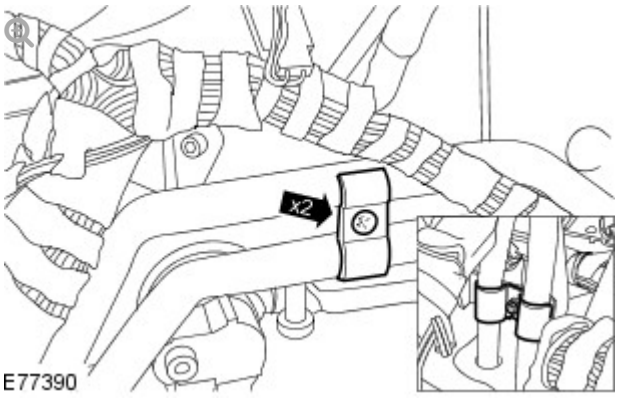
Disconnect the auxiliary heater core coolant hoses.

- Carefully release the 2 clips.
- Position a container to collect the fluid.

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

8. 

Disconnect the auxiliary heater core and evaporator core housing electrical connector.

9. 

Remove the auxiliary heater core inlet and outlet pipe brackets.

- Remove the 2 screws.

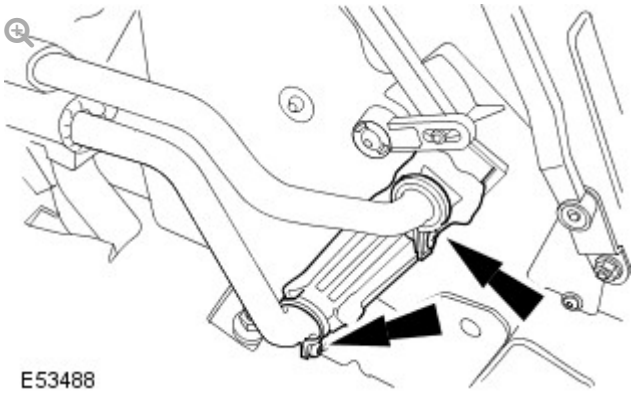
10. **WARNING:**

WARNING:

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

NOTE:

Some fluid spillage is inevitable during this operation.



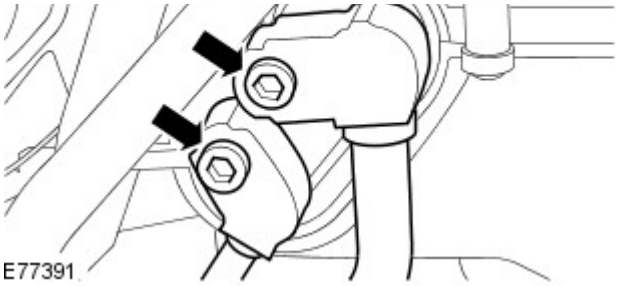
Undo and remove the heater core inlet and outlet pipe clamps.

- Position a container to collect the fluid.
- Position an absorbent cloth to collect fluid spillage.
- Disconnect the heater core inlet and outlet pipes.
- Remove and discard the two O-ring seals.
- Install blanking caps to the exposed ports.

11.

CAUTION:

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



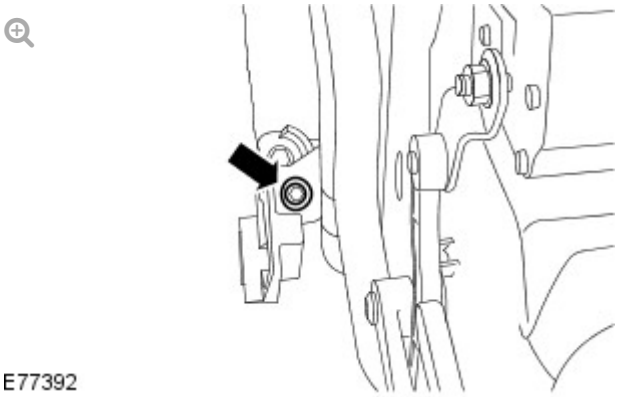
Disconnect the A/C pipes.

- Remove the 2 bolts.
- Discard the O-ring seals.

12.

NOTE:

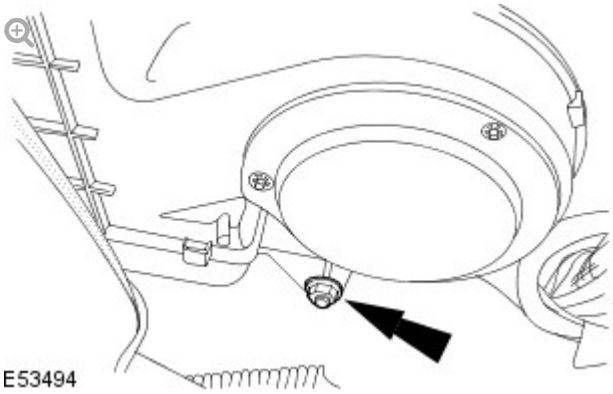
Left-hand shown, right-hand similar.



Remove the auxiliary heater core and evaporator core housing rear bolts.

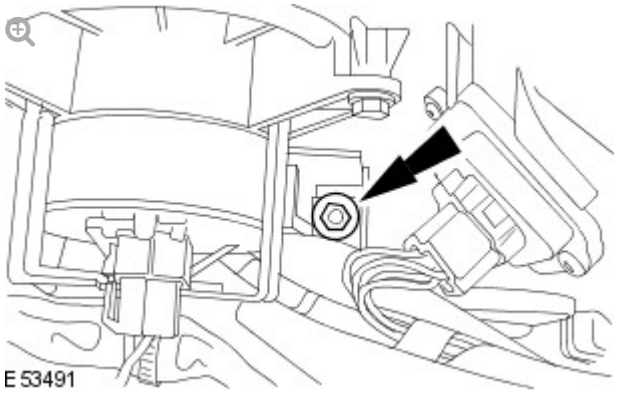
- Remove the 2 bolts.

13.



Remove the auxiliary heater core and evaporator core housing front

Remove the auxiliary heater core and evaporator core housing front RH bolt.

14. 

Remove the auxiliary heater core and evaporator core housing.

- Remove the auxiliary heater core and evaporator core housing front bolt.

INSTALLATION

1. Install the auxiliary heater core and evaporator core housing.
   - Install the 4 auxiliary heater core and evaporator core housing bolts.
   - Tighten to 4 Nm (3 lb.ft).
2. Connect the A/C pipes.
   - Remove the blanking caps from the ports.
   - Lubricate and install the new O-rings.
   - Install the 2 bolts and tighten to 2 Nm (1.5 lb.ft).
3. Install the auxiliary heater core inlet and outlet pipe clamps.
   - Remove the blanking caps from the ports.
   - Lubricate and install the new O-ring seals.
   - Connect the heater core inlet and outlet pipes.
   - Remove the container.
   - Remove the absorbent cloth.

4. Install the auxiliary heater core inlet and outlet pipe brackets.
   - Install the 2 screws.

5. Connect the auxiliary heater core and evaporator core housing electrical connector.

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

7. Connect the auxiliary heater core coolant hoses.
   - Install the 2 clips.
   - Remove the container.

8. Remove the coolant hose clamps.

9. Install the exhaust center heat shield.
   - Reposition the exhaust center heat shield.
   - Install the 8 nuts.

10. Recharge the A/C system.
    For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging - 5.0L NA V8 - AJ133/5.0L SC V8 - AJ133 (412-00, General Procedures).

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

12. Check and top-up the coolant.

13. Start and run the engine.
    - Hold the engine speed at 2,500 RPM for 30 seconds.
    - Return the engine to idle for 30 seconds.

- Repeat the above procedure a further 4 times.

14. Switch on the auxiliary heater.
    - Set the heater controls to HOT.
    - Make sure the auxiliary heater is emitting hot air.
15. Switch the engine off and allow to cool.
16. Check and top-up the coolant.

AUXILIARY TEMPERATURE BLEND DOOR ACTUATOR (G1345231)

REMOVAL AND INSTALLATION

REMOVAL

NOTE:

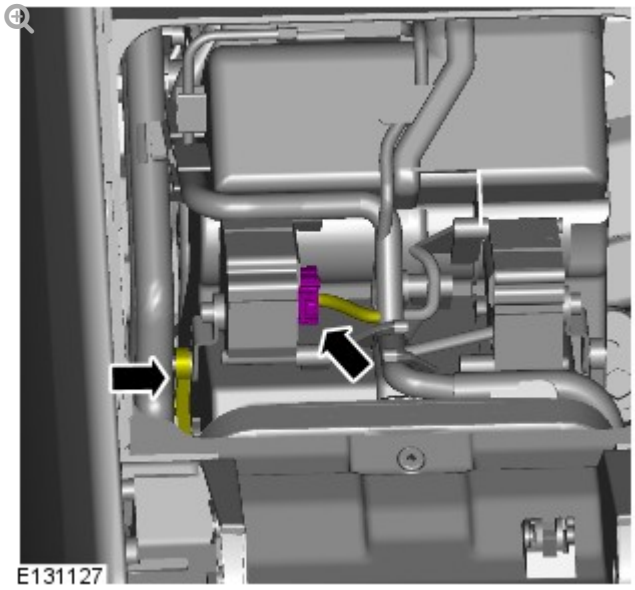
Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.
   Refer to: Specifications (414-00, Specifications).

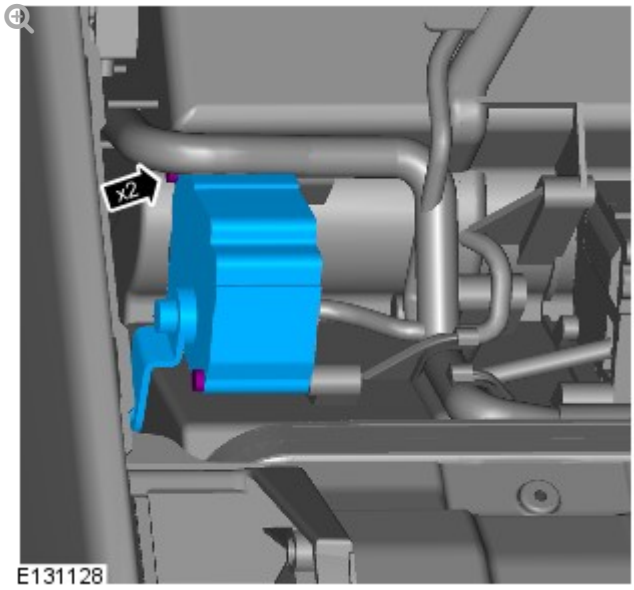
2. Refer to: Floor Console Stowage Compartment (501-12, Removal and Installation).

3. **CAUTION:**

   Make sure damage does not occur to the auxiliary temperature blend door actuator link rod.



4.



INSTALLATION

1. To install, reverse the removal procedure.

2012.0 RANGE ROVER (LM), 412-03

AUXILIARY CLIMATE CONTROL

EVAPORATOR CORE - V8

EVAPORATOR CORE – V8 5.0L PETROL/V8 S/C 5.0L PETROL (G1345223)

REMOVAL AND INSTALLATION

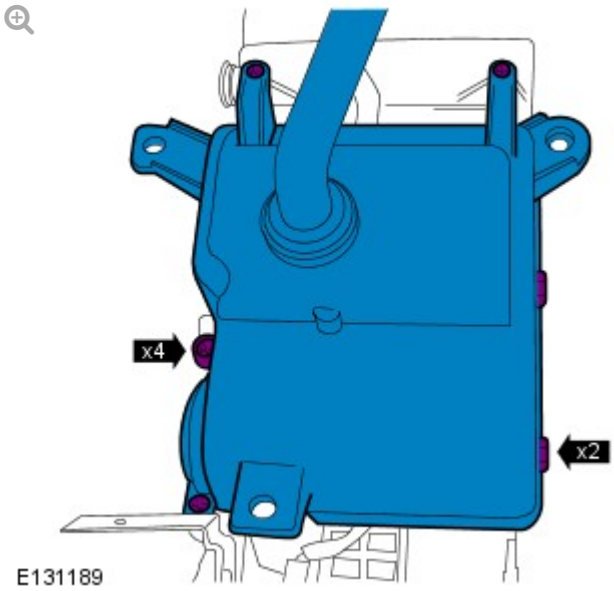
REMOVAL

NOTE:

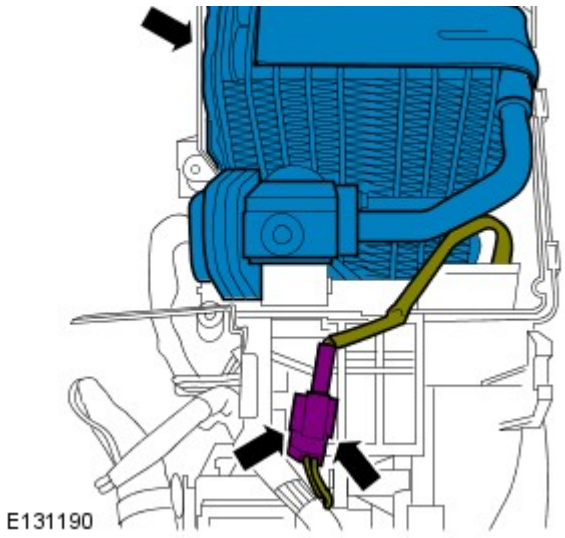
Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.
   Refer to: Specifications (414-00, Specifications).

2. Refer to: Auxiliary Heater Core and Evaporator Core Housing - 5.0L NA V8 - AJ133/5.0L SC V8 - AJ133 (412-03, Removal and Installation).

3. 

4. 



INSTALLATION

1. To install, reverse the removal procedure.

2012.0 RANGE ROVER (LM), 412-03

AUXILIARY CLIMATE CONTROL

HEATER CORE – V8 5.0L PETROL/V8 S/C 5.0L PETROL (G1345227)

REMOVAL AND INSTALLATION

82.25.20	EVAPORATOR – RENEW	5000 CC, AJ V8, SUPERCHARGED	6.5	USED WITHINS	+
82.25.20	EVAPORATOR	ALL	7.4	USED	+

REMOVAL

NOTE:

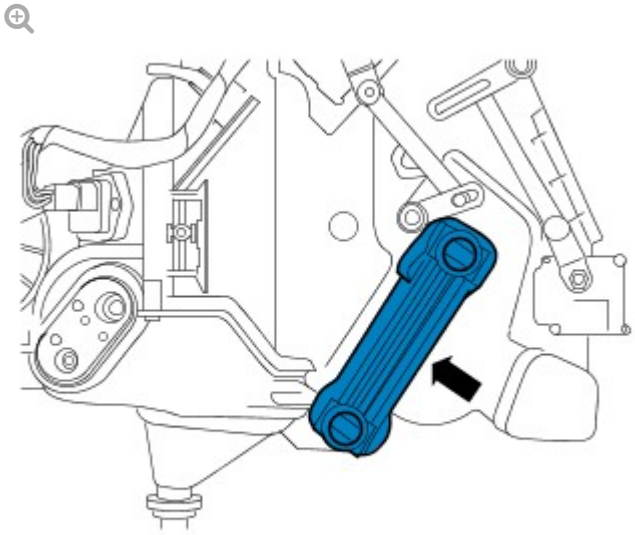
Removal steps in this procedure may contain installation details.

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

2. Refer to: Auxiliary Heater Core and Evaporator Core Housing - 5.0L NA V8 - AJ133/5.0L SC V8 - AJ133 (412-03, Removal and Installation).

3. **CAUTION:**

   Take extra care not to damage the component.



E131195

INSTALLATION

1. To install, reverse the removal procedure.

1. To install, reverse the removal procedure.

2012.0 RANGE ROVER (LM), 412-03

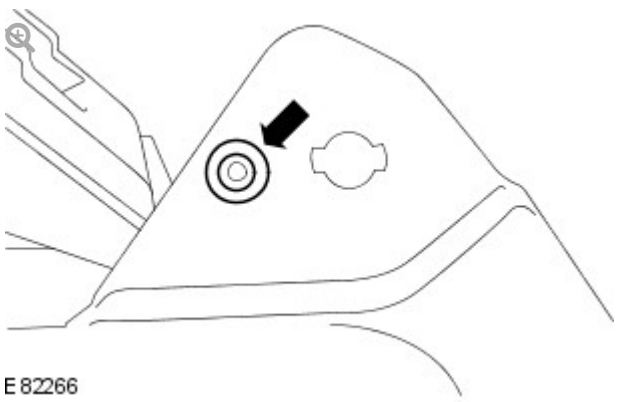
AUXILIARY CLIMATE CONTROL

REGISTER (G860270)

REMOVAL AND INSTALLATION

REMOVAL

1. Remove the floor console stowage compartment lid.
   For additional information, refer to: Floor Console Stowage Compartment Lid (501-12, Removal and Installation).

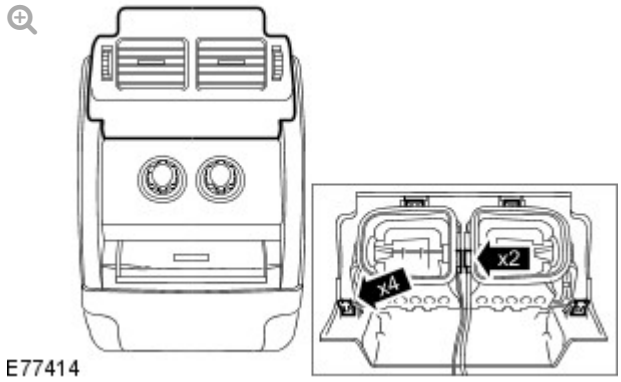
2. 

   Remove the floor console stowage compartment lid damper sleeve.

3.

NOTE:

Floor console shown removed for clarity.



Remove the register.

- Carefully release the 4 clips.
- Disconnect the 2 electrical connectors.

INSTALLATION

1. Install the register.
   - Connect the 2 electrical connectors.
   - Secure the 4 clips.
2. Install the floor console stowage compartment lid damper sleeve.
3. Install the floor console stowage compartment lid.
   For additional information, refer to: Floor Console Stowage Compartment Lid (501-12, Removal and Installation).

2012.0 RANGE ROVER (LM), 412-04

CONTROL COMPONENTS

CONTROL COMPONENTS

DIAGNOSIS AND TESTING

For additional information.

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

2012.0 RANGE ROVER (LM), 412-04

CONTROL COMPONENTS

AMBIENT AIR TEMPERATURE SENSOR (G1240557)

REMOVAL AND INSTALLATION

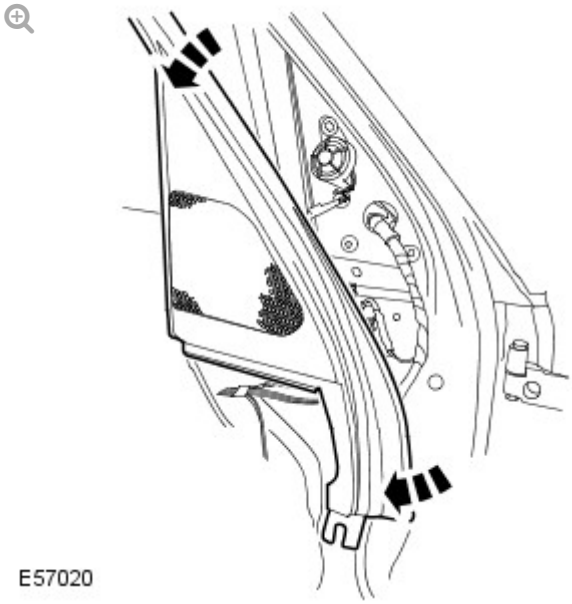
80.40.31	SENSOR – OUTSIDE TEMPERATURE – RENEW	ALL DERIVATIVES	0.1	USED WITHINS	+

80.40.31	SENSOR – OUTSIDE TEMPERATURE – RENEW	ALL DERIVATIVES	0.7	USED WITHINS	+

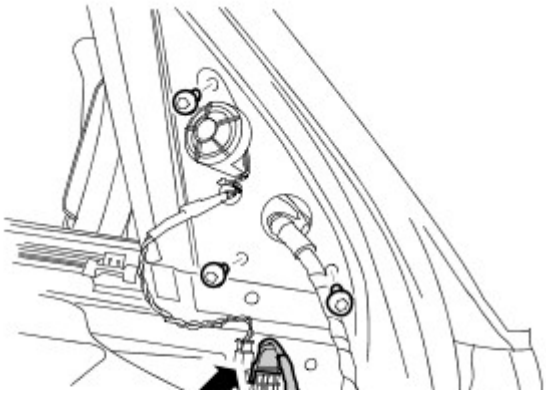
REMOVAL

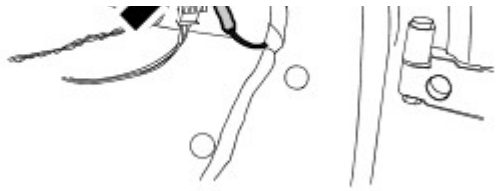
1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00, Specifications).

2. Remove the front door trim panel.
   For additional information, refer to: Front Door Trim Panel (501-05, Removal and Installation).

3. 
   E57020

   Release the window surround trim panel.

4. 



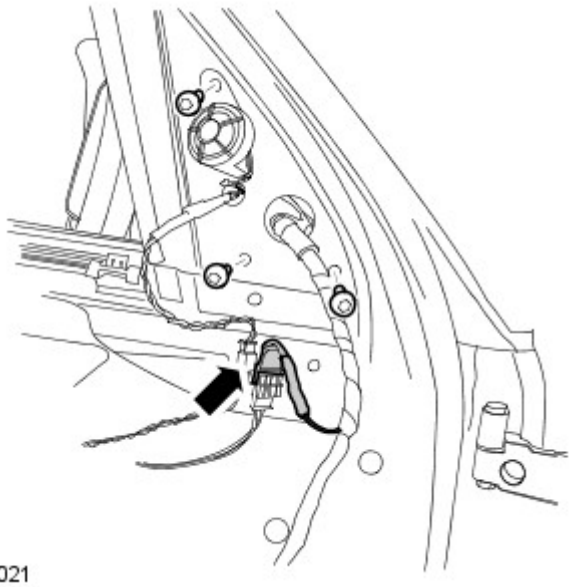
E57021

Remove the exterior mirror.

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

INSTALLATION

1.



E57021

Install the exterior mirror.

- Tighten the Torx screws to 8 Nm (6 lb.ft).
- Connect the electrical connector.

2.

Secure the window surround trim panel.

3. Install the front door trim panel.
   For additional information, refer to: Front Door Trim Panel (501-05, Removal and Installation).

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

CONTROL COMPONENTS

BLOWER MOTOR RESISTOR – RHD AWD (G910455)

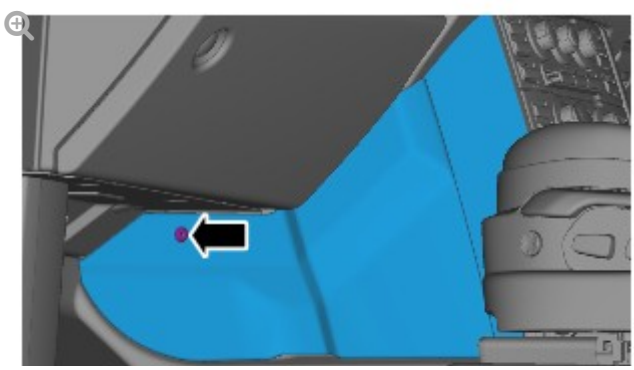
REMOVAL AND INSTALLATION

REMOVAL

1.

NOTE:

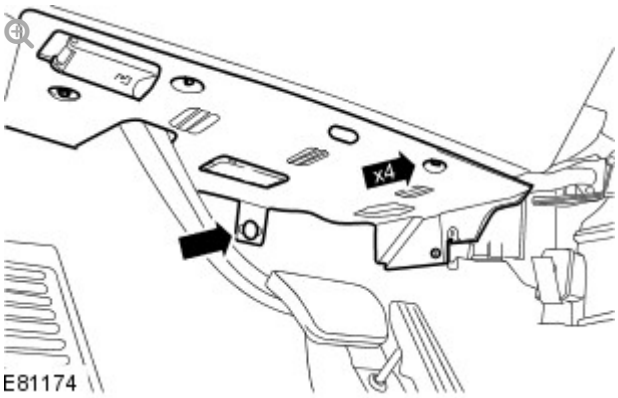
Left-hand shown, right-hand similar.



Remove the driver side floor console extension.

- Remove the screw.
- Release the 2 clips.

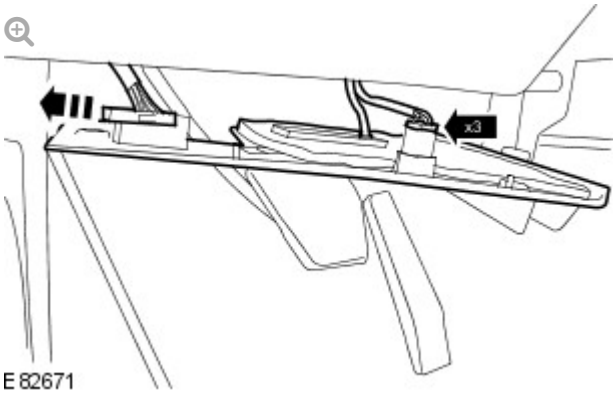
2.



Release the driver side closing trim panel.

- Remove the 4 screws.
- Remove the clip.

3.



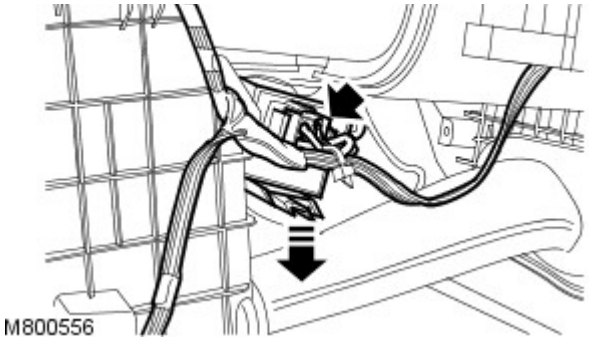
Remove the driver side closing trim panel.

- Disconnect the 2 electrical connectors.
- Release the vehicle diagnostic socket.

4. Remove the right-hand footwell duct.

- Remove the 2 screws.

5.



Disconnect the blower motor resistor electrical connector.

6. Remove the blower motor resistor.
   - Release the retaining clip.

INSTALLATION

1. Install the blower motor resistor.
2. Connect the blower motor resistor electrical connector.
3. Install the right-hand footwell duct.
   - Install the screws.
4. Install the driver side closing trim panel.
   - Attach the vehicle diagnostic socket.
   - Connect the electrical connectors.
5. Secure the driver side closing trim panel.
   - Install the screws.
   - Install the clip.
6. Install the driver side floor console extension.
   - Secure the clips.
   - Install the screw.

CONTROL COMPONENTS

DEFROST VENT/REGISTER BLEND DOOR ACTUATOR (G1653243)

REMOVAL AND INSTALLATION

80.10.36	MOTOR - DEFROSTER - WINDSHIELD - RENEW	RIGHT HAND DRIVE	0.1	USED WITHINS	+

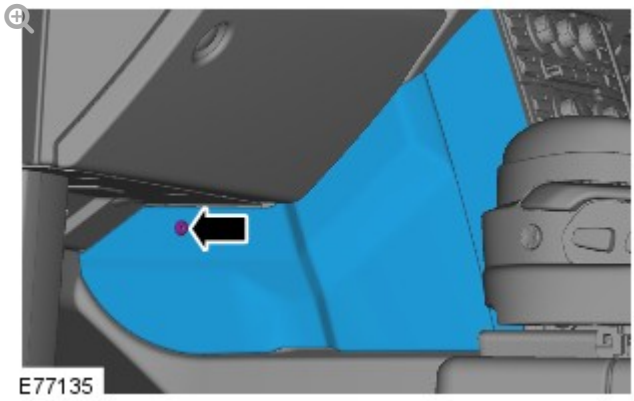
REMOVAL

Left-hand drive vehicles

1.

NOTE:

LHD illustration shown, RHD is similar.



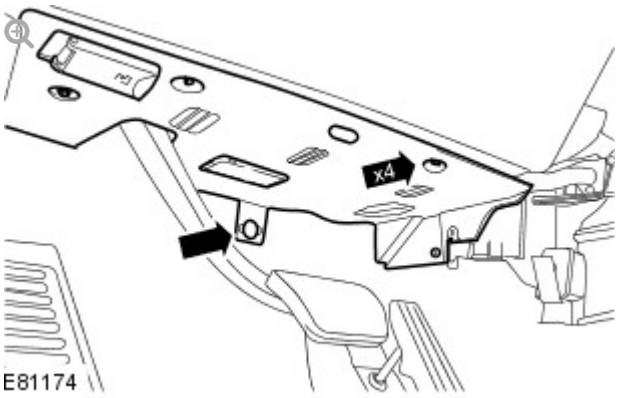
Remove the driver side floor console extension.

- Remove the screw.
- Release the 2 clips.

2.

NOTE:

LHD illustration shown, RHD is similar.



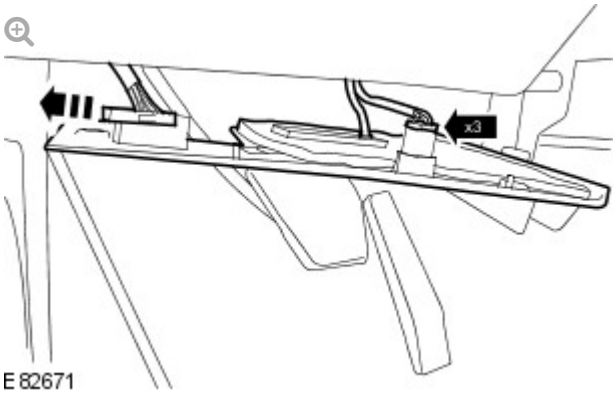
Release the driver side closing trim panel.

- Remove the 4 screws.
- Remove the clip.

3.

NOTE:

LHD illustration shown, RHD is similar.



Remove the driver side closing trim panel.

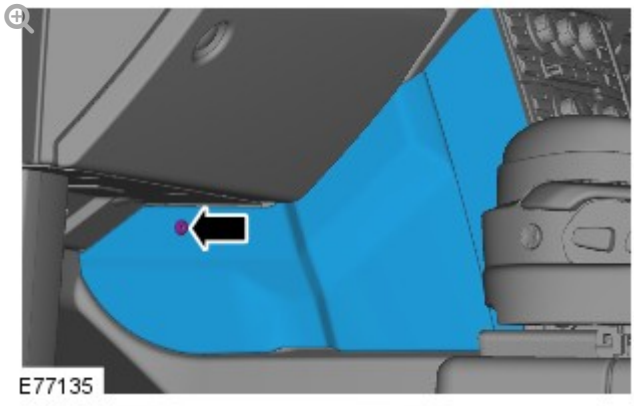
- Disconnect the 2 electrical connectors.
- Release the vehicle diagnostic socket.

	Right-hand drive vehicles

1.

NOTE:

LHD illustration shown, RHD is similar.



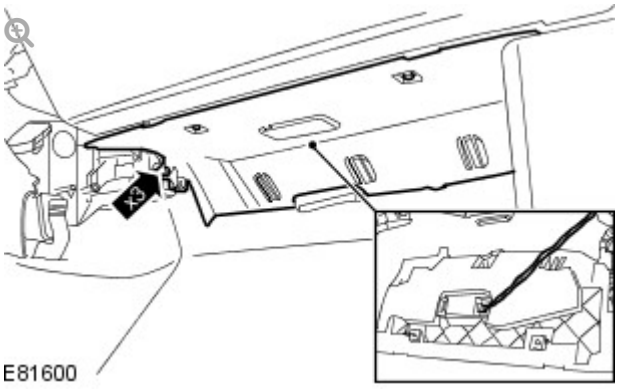
Remove the passenger side floor console extension.

- Remove the screw.
- Release the 2 clips.

2.

NOTE:

LHD illustration shown, RHD is similar.



Remove the passenger side closing trim panel.

- Remove the 3 screws.

Disconnect the footwell lamp electrical connector

- Disconnect the footwell lamp electrical connector.

All vehicles

1.

Remove the defrost vent blend door actuator.

- Disconnect the electrical connector.
- Release the clip.

INSTALLATION

All vehicles

1. Install the defrost vent blend door actuator.
   - Connect the electrical connector.

Left-hand drive vehicles

1. Install the driver side closing trim panel.
   - Connect the electrical connectors.
   - Attach the vehicle diagnostic socket.

2. Secure the driver side closing trim panel.
   - Install the screws.
   - Install the clip.

3. Install the driver side floor console extension.
   - Secure the clips.
   - Install the screw.

Right-hand drive vehicles

1. Install the passenger side closing trim panel.
    - Connect the footwell lamp electrical connector.
    - Install the screws.
2. Install the passenger side floor console extension.
    - Install the screw.
    - Secure the clips.

2012.0 RANGE ROVER (LM), 412-04

CONTROL COMPONENTS

DRIVER SIDE RECIRCULATION BLEND DOOR ACTUATOR (G1653244)

REMOVAL AND INSTALLATION

REMOVAL

WARNINGS:

- Persons working on the supplemental restraint system (SRS) must be fully trained and have been issued with the safety guidelines.
- Allow a period of 10 minutes to elapse after disconnecting the battery before undertaking any work on the SRS.
- The SRS electrical connectors are unique. DO NOT force, or attempt to connect electrical connectors to the wrong sockets.
- The correct procedures must always be used when working on SRS components.
- It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.
- Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.
- Take extra care when handling SRS components.

	Left-hand drive vehicles

1. Make the air bag supplemental restraint system (SRS) safe.
   For additional information, refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

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

3. Remove the lower glove compartment.
   For additional information, refer to: Lower Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

4.

Disconnect the central junction box (CJB) 8 electrical connectors.

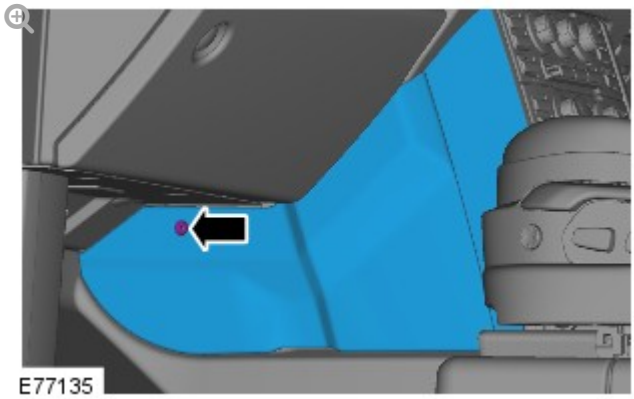
5. Release the CJB from the in-vehicle crossbeam.
   - Remove the 4 screws.

	Right-hand drive vehicles

1.

NOTE:

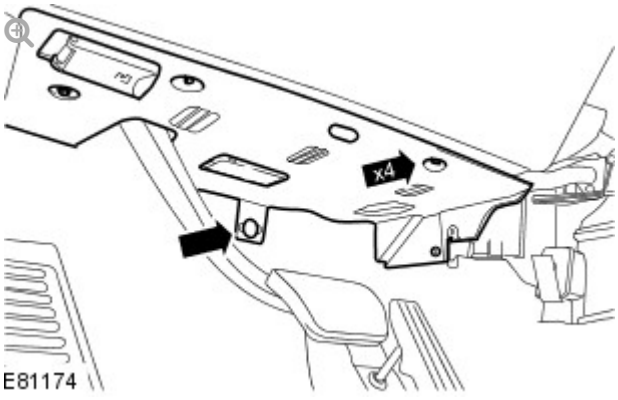
Left-hand shown, right-hand similar.



Remove the driver side floor console extension.

- Remove the screw.
- Release the 2 clips.

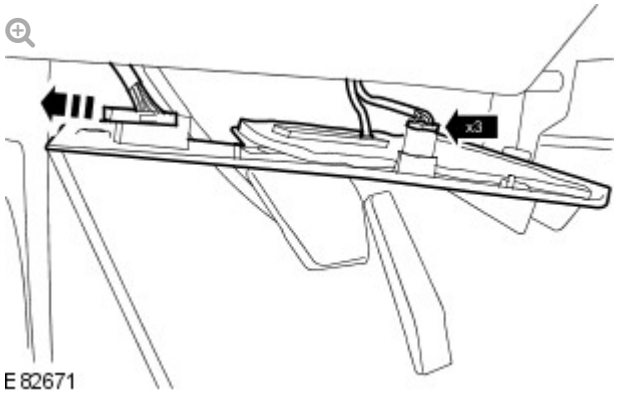
2.



Release the driver side closing trim panel.

- Remove the 4 screws.
- Remove the clip.

3.



Remove the driver side closing trim panel.

- Disconnect the 2 electrical connectors.
- Release the vehicle diagnostic socket.

All vehicles

1.

Remove the recirculation blend door actuator.

- Disconnect the electrical connector.

INSTALLATION

All vehicles

1. Install the recirculation blend door actuator.
   - Connect the electrical connector.

Left-hand drive vehicles

1. Install the CJB.
   - Install the screws.

2. Connect the CJB electrical connectors.

	Right-hand drive vehicles

1. Install the driver side closing trim panel.
   - Connect the electrical connectors.
   - Attach the vehicle diagnostic socket.

2. Secure the driver side closing trim panel.
   - Install the screws.
   - Install the clip.

3. Install the driver side floor console extension.
   - Secure the clips.
   - Install the screw.

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

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

CONTROL COMPONENTS

FOOTWELL VENT/DUCT BLEND DOOR ACTUATOR (G1653245)

REMOVAL AND INSTALLATION

REMOVAL

WARNINGS:

- Persons working on the supplemental restraint system (SRS) must be fully trained and have been issued with the safety guidelines.
- Allow a period of 10 minutes to elapse after disconnecting the battery before undertaking any work on the SRS.
- The SRS electrical connectors are unique. DO NOT force, or attempt to connect electrical connectors to the wrong sockets.
- The correct procedures must always be used when working on SRS components.

- It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.
- Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.
- Take extra care when handling SRS components.

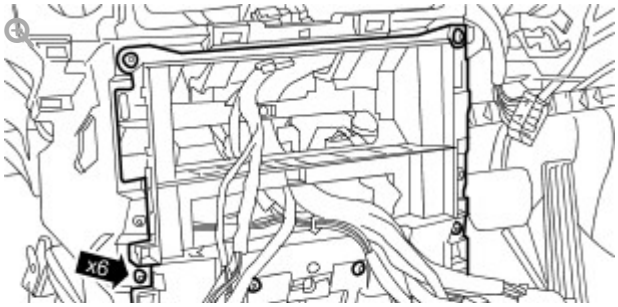
1. Make the air bag supplemental restraint system (SRS) safe.
   For additional information, refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

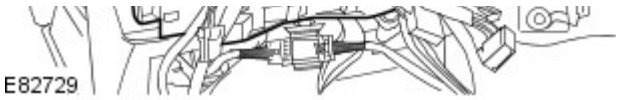
2. Disconnect the battery ground cable.
   For additional information, refer to: Specifications - Armoured (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the climate controlled seat switch.
   For additional information, refer to: Climate Controlled Seat Switch (501-10 Seating, Removal and Installation).

4. Remove the floor console.
   For additional information, refer to: Floor Console - TDV8 3.6L Diesel/V8 5.0L Petrol/V8 S/C 5.0L Petrol (501-12 Instrument Panel and Console, Removal and Installation).

5. Remove the lower center registers panel assembly.
   For additional information, refer to: Lower Center Registers Panel Assembly (501-12 Instrument Panel and Console, Removal and Installation).

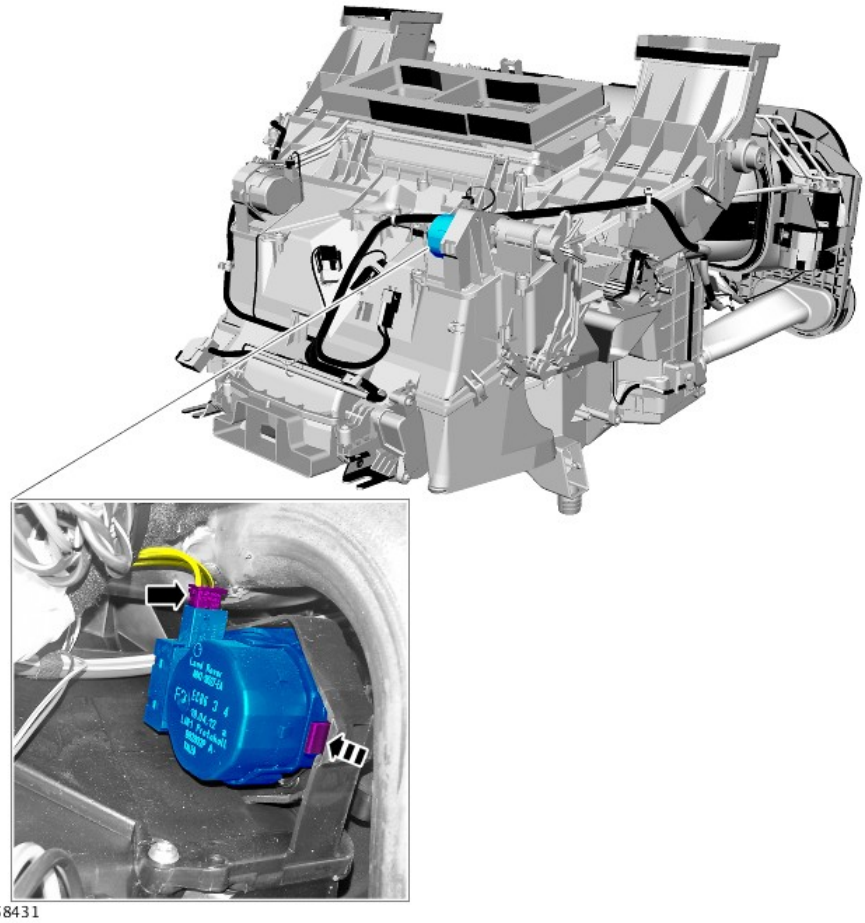
6. 



Remove the instrument panel center reinforcement.

- Remove the 6 screws.

7.



Remove the footwell duct blend door actuator.

- Disconnect the electrical connector.
- Release the clip.

INSTALLATION

1. Install the footwell duct blend door actuator.
   - Connect the electrical connector.
   - Secure the clips.
2. Install the instrument panel center reinforcement.

- Install the screws.

3. Install the lower center registers panel assembly.
   For additional information, refer to: Lower Center Registers Panel Assembly (501-12 Instrument Panel and Console, Removal and Installation).

4. Install the floor console.
   For additional information, refer to: Floor Console - TDV8 3.6L Diesel/V8 5.0L Petrol/V8 S/C 5.0L Petrol (501-12 Instrument Panel and Console, Removal and Installation).

5. Install the climate controlled seat switch.
   For additional information, refer to: Climate Controlled Seat Switch (501-10 Seating, Removal and Installation).

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

CONTROL COMPONENTS

PASSENGER SIDE RECIRCULATION BLEND DOOR ACTUATOR (G1653246)

REMOVAL AND INSTALLATION

REMOVAL

WARNINGS:

- Persons working on the supplemental restraint system (SRS) must be fully trained and have been issued with the safety guidelines.
- Allow a period of 10 minutes to elapse after disconnecting the battery before undertaking any work on the SRS.
- The SRS electrical connectors are unique. DO NOT force, or attempt to connect electrical connectors to the wrong sockets.
- The correct procedures must always be used when working on SRS components.
- It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.
- Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.
- Take extra care when handling SRS components.

Right-hand drive vehicles

1. Make the air bag supplemental restraint system (SRS) safe.
   For additional information, refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

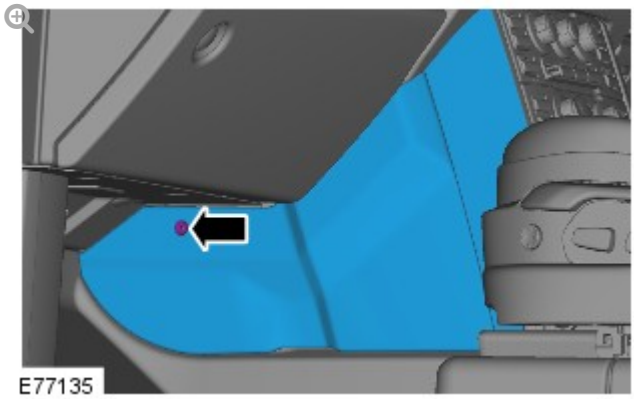
2. Disconnect the battery ground cable.
   For additional information, refer to: Specifications - Armoured (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the lower glove compartment.
   For additional information, refer to: Lower Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

Left-hand drive vehicles

1. **NOTE:**

   Left-hand shown, right-hand similar.



Remove the driver side floor console extension.

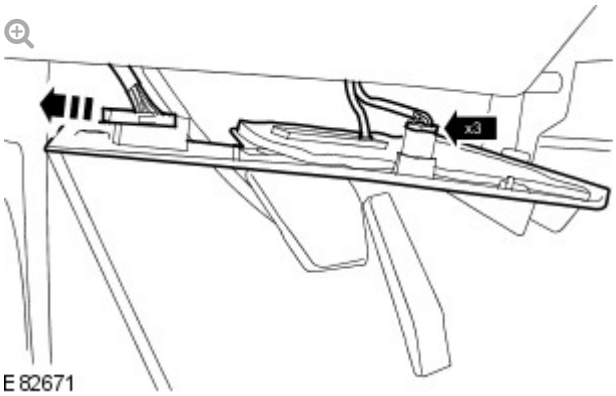
- Remove the screw.
- Release the 2 clips.

2. 

Release the driver side closing trim panel.

- Remove the 4 screws.
- Remove the clip.

3.

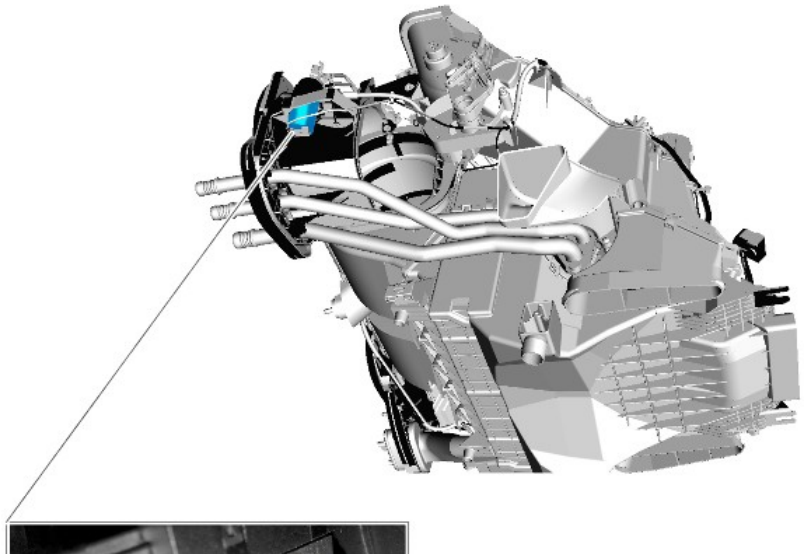


Remove the driver side closing trim panel.

- Disconnect the 2 electrical connectors.
- Release the vehicle diagnostic socket.

All vehicles

1.



E158433

Remove the recirculation blend door actuator.

- Disconnect the electrical connector.

INSTALLATION

ℹ	All vehicles

1. Install the recirculation blend door actuator.
   - Connect the electrical connector.

ℹ	Left-hand drive vehicles

1. Install the driver side closing trim panel.
   - Attach the vehicle diagnostic socket.
   - Connect the electrical connectors.
2. Secure the driver side closing trim panel.
   - Install the screws.
   - Install the clip.
3. Install the driver side floor console extension.
   - Secure the clips.
   - Install the screw.

ℹ	Right-hand drive vehicles

1. Install the lower glove compartment.
   For additional information, refer to: Lower Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

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

2012.0 RANGE ROVER (LM), 412-04

CONTROL COMPONENTS

SUNLOAD SENSOR (G1240222)

REMOVAL AND INSTALLATION

REMOVAL

NOTE:

Removal steps in this procedure may contain installation details.

1. Refer to: Standard Workshop Practices (100-00, Description and Operation).
2. Disconnect the battery ground cable.
   Refer to: Specifications (414-00, Specifications).
3. Refer to: Instrument Panel Reinforcement (501-12, Removal and Installation).
4. 

INSTALLATION

1. To install, reverse the removal procedure.

CONTROL COMPONENTS

IN-VEHICLE TEMPERATURE SENSOR (G1648678)

REMOVAL AND INSTALLATION

82.20.93	SENSOR - AIR TEMPERATURE (ASPIRATOR TYPE) - AUTOMATIC TEMPERATURE CONTROL - RENEW	ALL DERIVATIVES	0.2	USED WITHINS	+

REMOVAL

1. The in-vehicle temperature sensor is an integral part of the climate control assembly.

For additional information, refer to: Climate Control Assembly (412-04, Removal and Installation).

INSTALLATION

1. To install, reverse the removal procedure.

CONTROL COMPONENTS

CLIMATE CONTROL ASSEMBLY (G1652215)

REMOVAL AND INSTALLATION

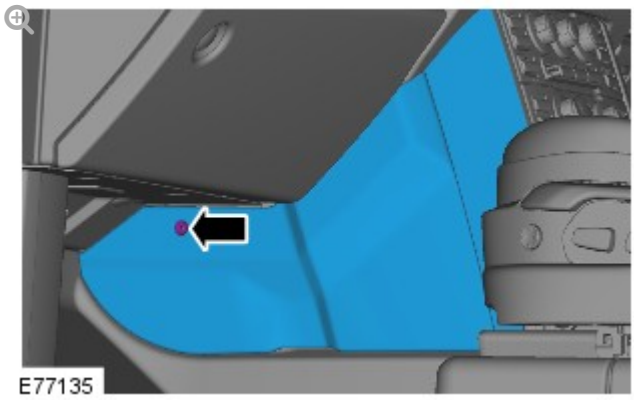
80.10.02	CONTROLS - CLIMATE - RENEW	ALL DERIVATIVES	0.3	USED WITHINS +

REMOVAL

NOTES:

- On high line models the climate control module is an integral part of the climate control assembly.
- Removal steps in this procedure may contain installation details.

1.

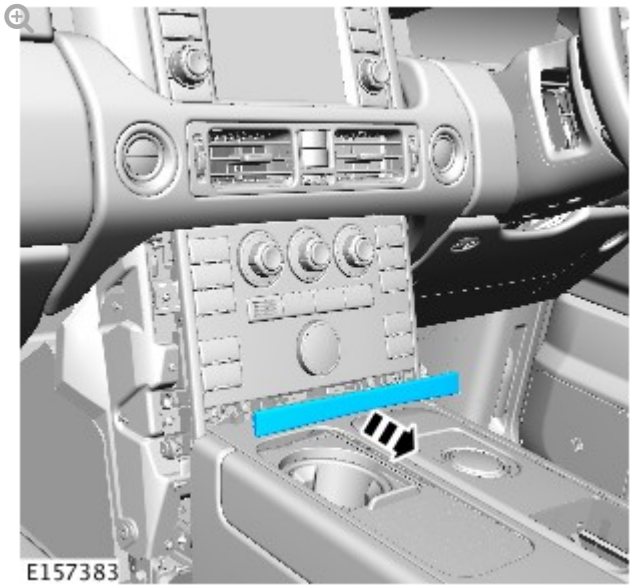


Remove the LH floor console extension. Repeat for the other side.

- Remove the screw.

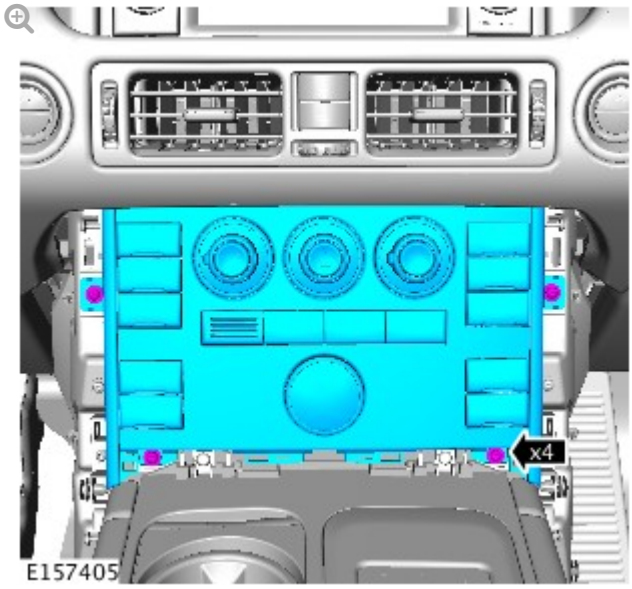
- Release the 2 clips.

2.



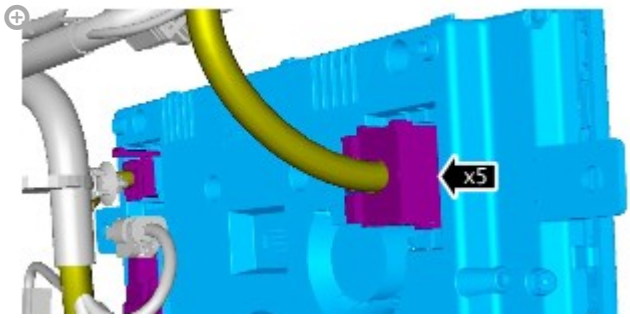
Remove the lower fascia trim.

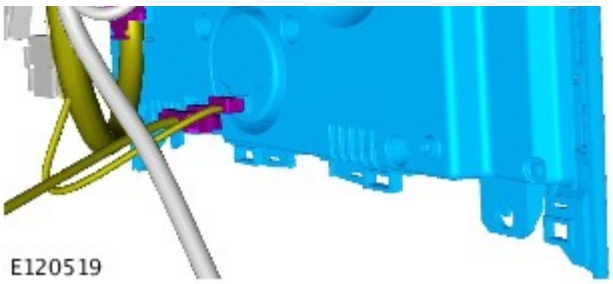
3.



Remove the retaining screws.

4.





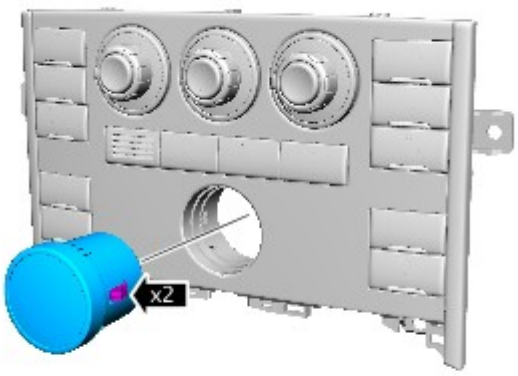
Remove the climate control assembly.

- Disconnect the electrical connectors.

5.

NOTE:

Do not disassemble further if removed for access only.



E157382

INSTALLATION

1. To install reverse the removal sequence.
   - Tighten retaining screws to 2 Nm

2. Using the Land Rover approved diagnostic system, calibrate a new climate control assembly.

2012.0 RANGE ROVER (LM), 412-04

CONTROL COMPONENTS

TEMPERATURE BLEND DOOR ACTUATOR (G1653248)

REMOVAL AND INSTALLATION

REMOVAL

WARNINGS:

- Persons working on the supplemental restraint system (SRS) must be fully trained and have been issued with the safety guidelines.
- Allow a period of 10 minutes to elapse after disconnecting the battery before undertaking any work on the SRS.
- The SRS electrical connectors are unique. DO NOT force, or attempt to connect electrical connectors to the wrong sockets.
- The correct procedures must always be used when working on SRS components.
- It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.
- Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.
- Take extra care when handling SRS components.

1. Make the air bag supplemental restraint system (SRS) safe.
   For additional information, refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

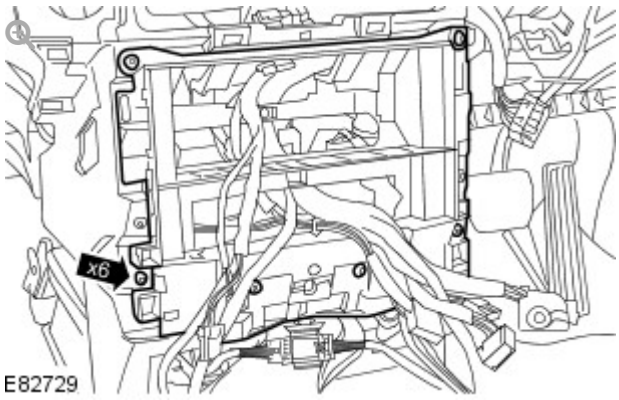
2. Disconnect the battery ground cable.
   For additional information, refer to: Specifications - Armoured (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the climate controlled seat switch.
   For additional information, refer to: Climate Controlled Seat Switch (501-10 Seating, Removal and Installation).

4. Remove the floor console

4. Remove the floor console.
   For additional information, refer to: Floor Console - TDV8 3.6L Diesel/V8 5.0L Petrol/V8 S/C 5.0L Petrol (501-12 Instrument Panel and Console, Removal and Installation).

5. Remove the lower center registers panel assembly.
   For additional information, refer to: Lower Center Registers Panel Assembly (501-12 Instrument Panel and Console, Removal and Installation).

6. 

   Remove the instrument panel center reinforcement.
   - Remove the 6 screws.

7. Remove the footwell duct blend door actuator.
   - Disconnect the electrical connector.
   - Release the clip.

INSTALLATION

1. Install the footwell duct blend door actuator.
   - Connect the electrical connector.
   - Secure the clips.

2. Install the instrument panel center reinforcement.

- Install the screws.

3. Install the lower center registers panel assembly.
   For additional information, refer to: Lower Center Registers Panel Assembly (501-12 Instrument Panel and Console, Removal and Installation).

4. Install the floor console.
   For additional information, refer to: Floor Console - TDV8 3.6L Diesel/V8 5.0L Petrol/V8 S/C 5.0L Petrol (501-12 Instrument Panel and Console, Removal and Installation).

5. Install the climate controlled seat switch.
   For additional information, refer to: Climate Controlled Seat Switch (501-10 Seating, Removal and Installation).

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

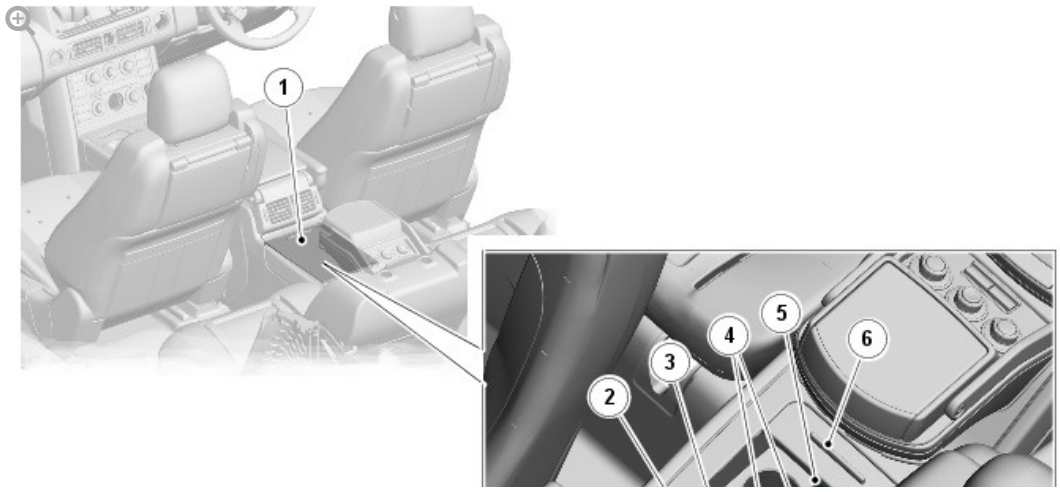
2012.0 RANGE ROVER (LM), 412-05

REFRIGERATION

DESCRIPTION AND OPERATION

REAR FLOOR CONSOLE CHILLER UNIT – RANGE ROVER ULTIMATE

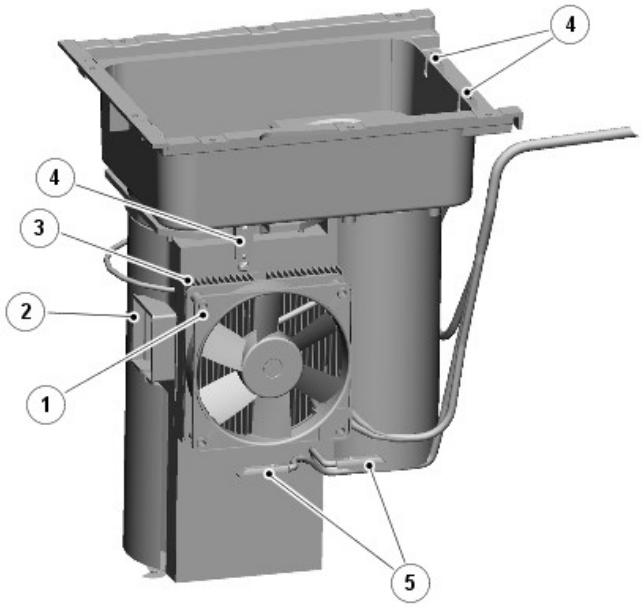
COMPONENT LOCATION



E135542

ITEM	DESCRIPTION
1	Chiller unit location
2	Bottle holder illumination ring
3	Bottle holder tube
4	Champagne flute tubes
5	Thermo-electric cooler on/off switch
6	Sliding cover

DESCRIPTION



E136401

ITEM	DESCRIPTION
1	Fan assembly
2	Printed Circuit Board (PCB)
3	Heatsink and Peltier cell assembly

4	Bottle tube illumination ring and champagne flute tube illumination LEDs (4 off)
5	Mood lighting LEDs

A drink chiller unit is incorporated in the front section of the rear floor console assembly. The chiller compartment has two small tubes for the location of two champagne flutes and a larger tube for a bottle. The compartment is leather lined with a veneer sliding lid.

A switch at the rear of the compartment switches a thermo-electric chiller on and off. An LED (light emitting diode) in the switch shows when the chiller is active. The chiller will operate when either the battery saver relay or infotainment relay in the CJB (central junction box) is energized. This allows the chiller to begin cooling as soon as the vehicle is unlocked or alternatively, to continue cooling when the ignition is turned off but the infotainment system remains active. The chiller can reduce the temperature in the compartment by approximately 8°C (12.4°F) below the ambient temperature inside the vehicle.

Power to the chiller unit is provided by a relay in the rear entertainment junction box located in the RH (right-hand) side of the luggage compartment, behind the trim panel. The ground for the relay is controlled by the Rear Entertainment Control Module (RECM) and the junction box relay receives a fused power supply from the vehicle battery via the RJB (rear junction box). The rear entertainment junction box contains two fuses; a 5A fuse for power supply to the Rear Entertainment Control Module (RECM) and a 10A fuse for power supply to the following components:

- rear floor console mood lighting LED's
- stowage box illumination LED's
- chiller unit
- rear seat audio control relay
- rear seat audio control switches.

The chiller unit illumination LED's are powered by the RECM at an illumination level determined by the instrument panel dimmer control. Two LED's are located at the rear of the box and illuminate the area of the

champagne flute tubes. Two further LED's illuminate a plastic ring around the top of the bottle holder tube.

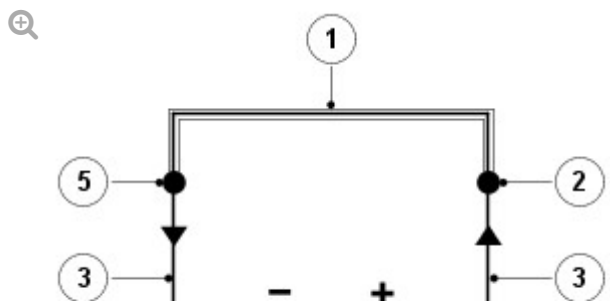
OPERATION

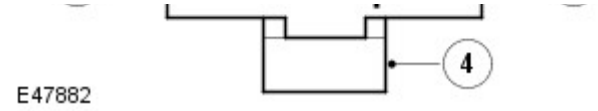
Operation of the thermo-electric chiller unit is controlled by an on/off switch on the top front edge of the container. An LED in the on/off switch is illuminated while the chiller unit is selected on. The chiller unit contains a thermo-electric cooler which uses a Peltier cell. The Peltier cell is able to deliver cooling based on a voltage provided by via the chiller switch. The chiller unit contains a fan, which draws warm air away from the heatsink attached to the Peltier cell.

Peltier Cell

The thermo-electric chiller unit is a solid state heat pump that uses the Peltier cell to cool the inside of the chiller box. The Peltier effect occurs when a direct current is passed through a circuit of two dissimilar conductors, which are connected together at two junctions; this causes one junction to become cold and one junction to become hot. The potential difference between the two conductors creates an electric field at each junction; when a current is then applied to the circuit the charge flows against the direction of the electric field at one junction, causing it to absorb heat, and with the direction of the electric field at the other junction, causing it to release heat. In thermo-electric coolers, a number of these circuits (known as couples) are connected together, in series, and sandwiched between ceramic plates, then connected to a heatsink and fan. On the chiller unit, the cold side of the thermo-electric cooler is attached to the aluminum liner of the bottle holder and the heatsink and fan are installed on the insulating outer layer.

Peltier Effect Circuit



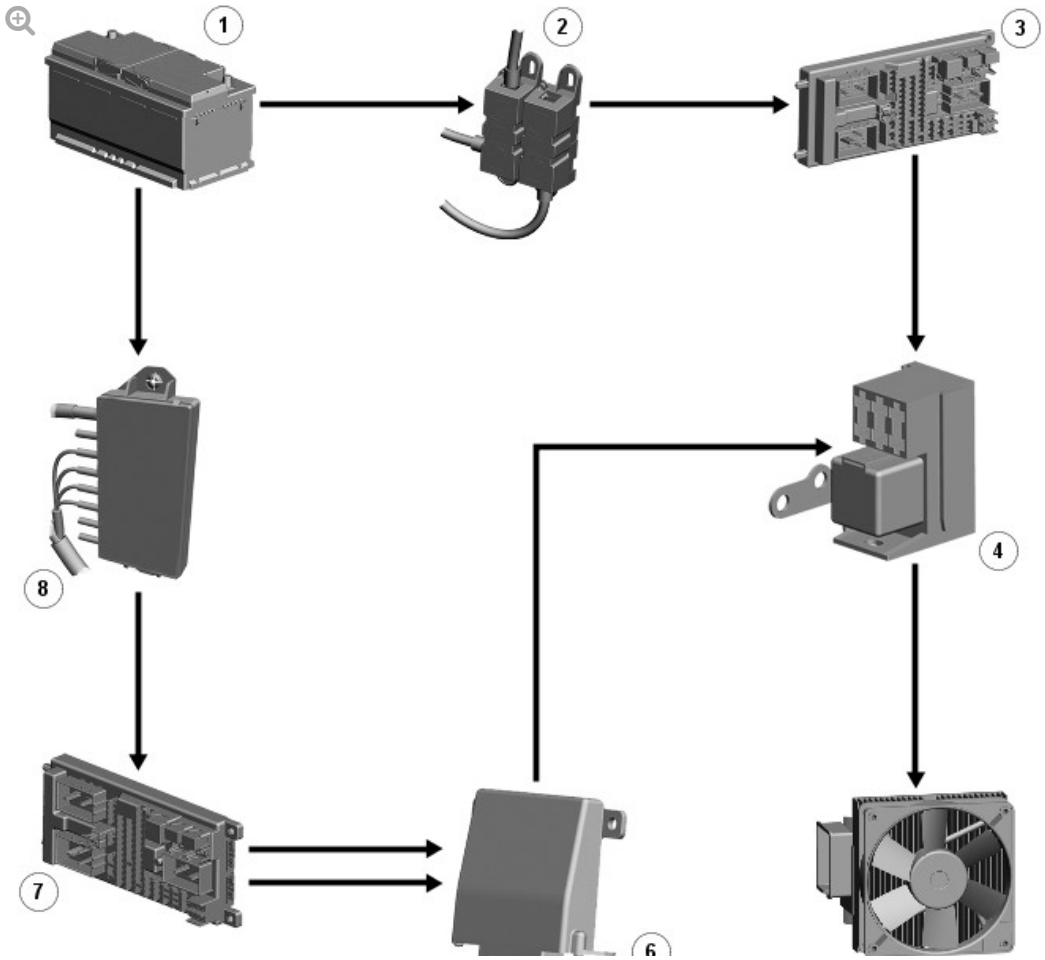


ITEM	DESCRIPTION
1	Conductor material
2	Hot junction
3	Conductor material
4	Power supply
5	Cold junction

CONTROL DIAGRAM

NOTE:

A = Hardwired



ITEM	DESCRIPTION
1	Battery
2	Battery Junction Box 2 (BJB2)
3	Rear Junction Box (RJB)
4	Rear entertainment junction box
5	Peltier cell and fan assembly
6	Rear Entertainment Control Module (RECM)
7	Central Junction Box (CJB)
8	Battery Junction Box (BJB)