

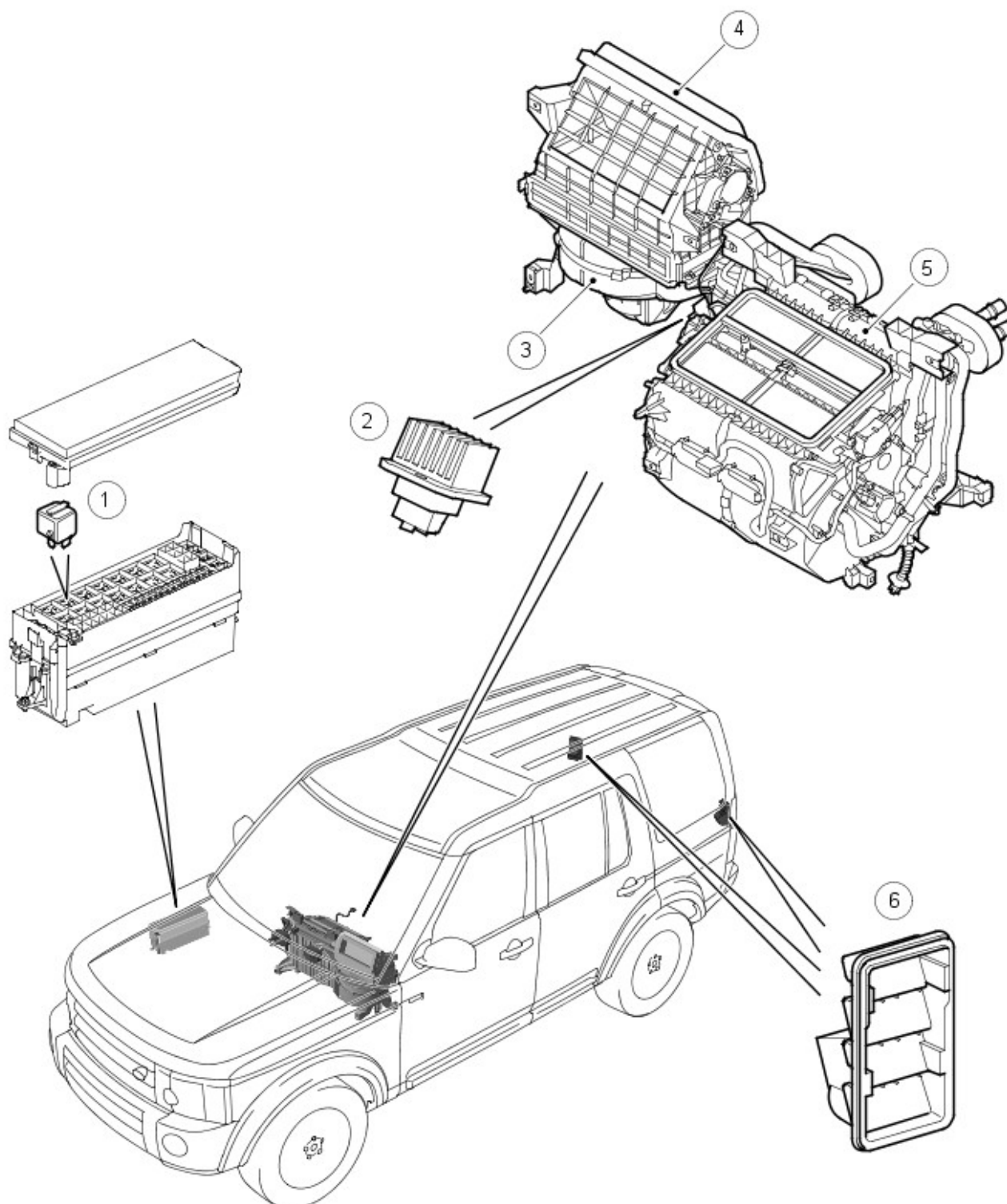
Heating and Ventilation - Heating and Ventilation

Description and Operation

COMPONENT LOCATIONS



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



E47348

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

- | | | |
|---|---|---------------------|
| 4 | - | Air inlet duct |
| 5 | - | Heater |
| 6 | - | Ventilation outlets |

GENERAL

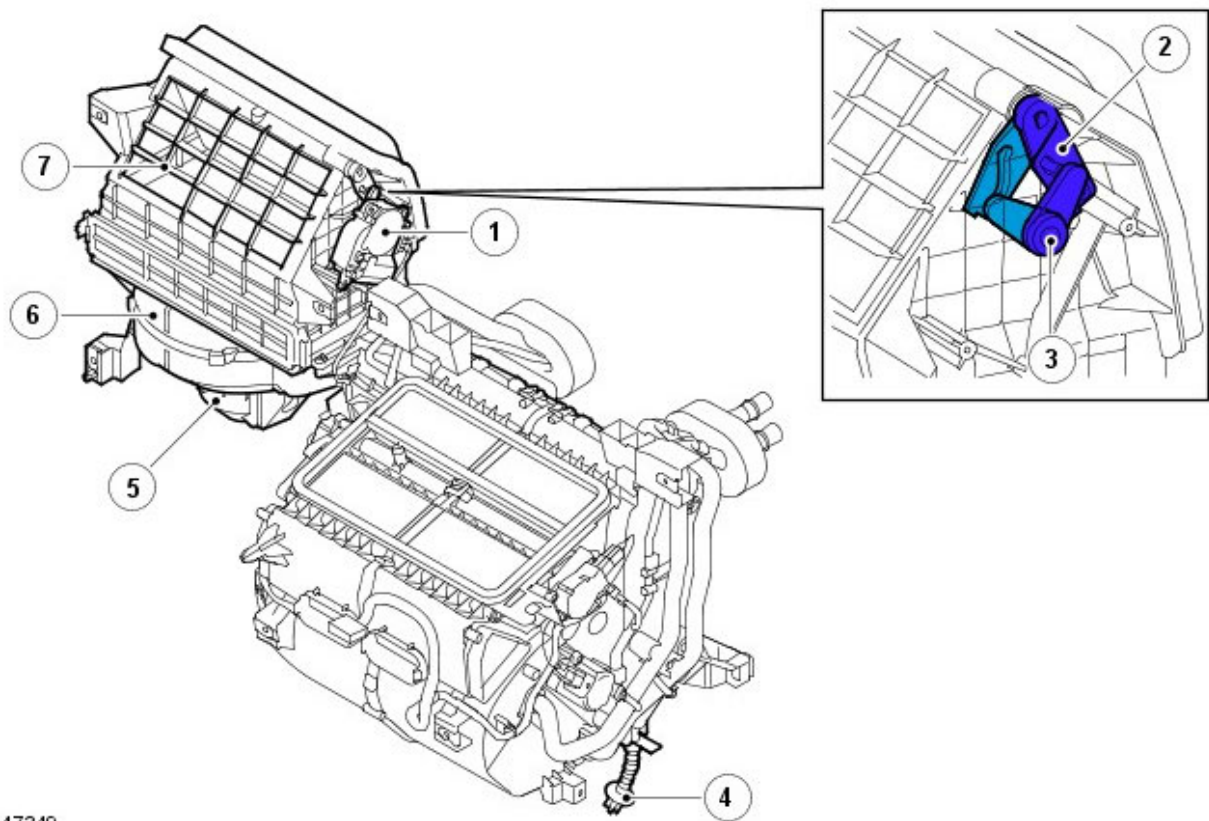
The heating and ventilation system controls the temperature and flow of air supplied to the vehicle interior. The system consists of:

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

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

AIR INLET DUCT

 NOTE: RHD version shown, LHD mirror image



E47349

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

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

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

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

- The cabin air filter.
- For additional information, refer to: Air Distribution and Filtering (412-01 Air Distribution and Filtering,

- Description and Operation).
- The blower.
- The blower control module.

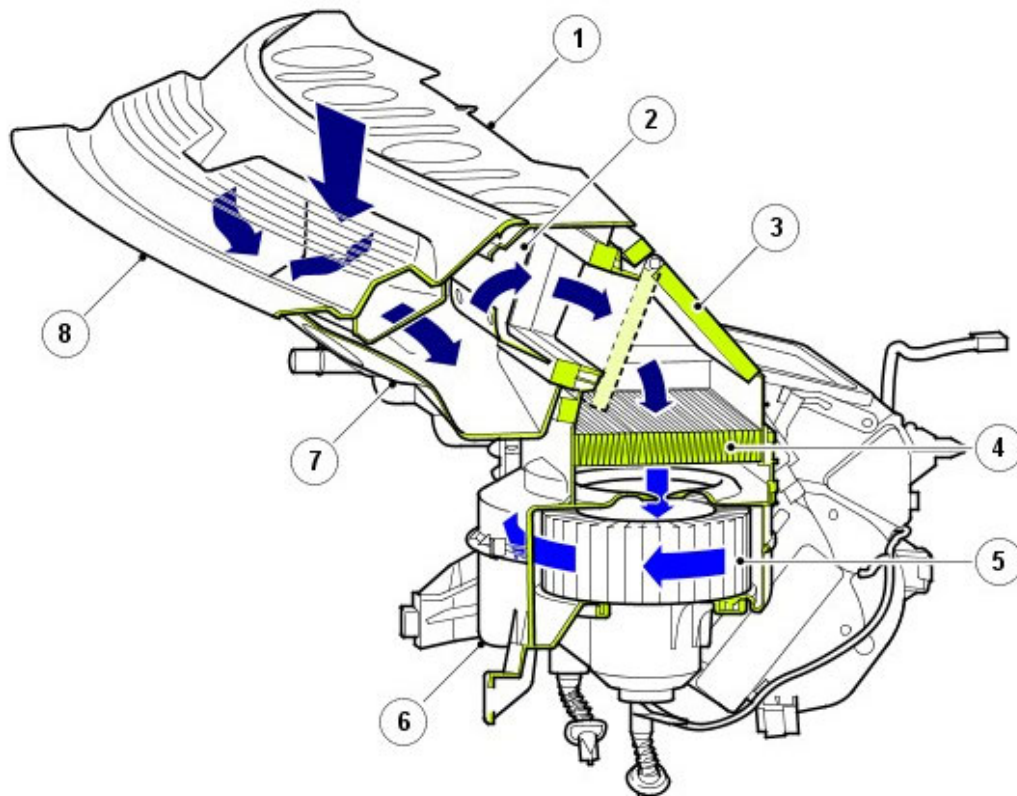
The outlet from the air inlet duct forms the rear wall of the heater, enclosing the evaporator and incorporating the two evaporator drain outlets. Drain tubes connect the evaporator drain outlets to the transmission tunnel, to direct the water that condenses on the evaporator overboard.

A recirculation door is installed between the fresh and recirculated air inlets, to control the source of incoming air. A lever on the recirculation door is driven by the recirculation door motor. Operation of the recirculation door motor is automatically controlled by the [ATC \(automatic temperature control\)](#) module and manually controlled by a switch on the [ATC](#) module control panel.

For additional information, refer to: Control Components (412-04 Control Components, Description and Operation).

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

Air Flow Through Air Inlet Duct



E47350

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

BLOWER

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

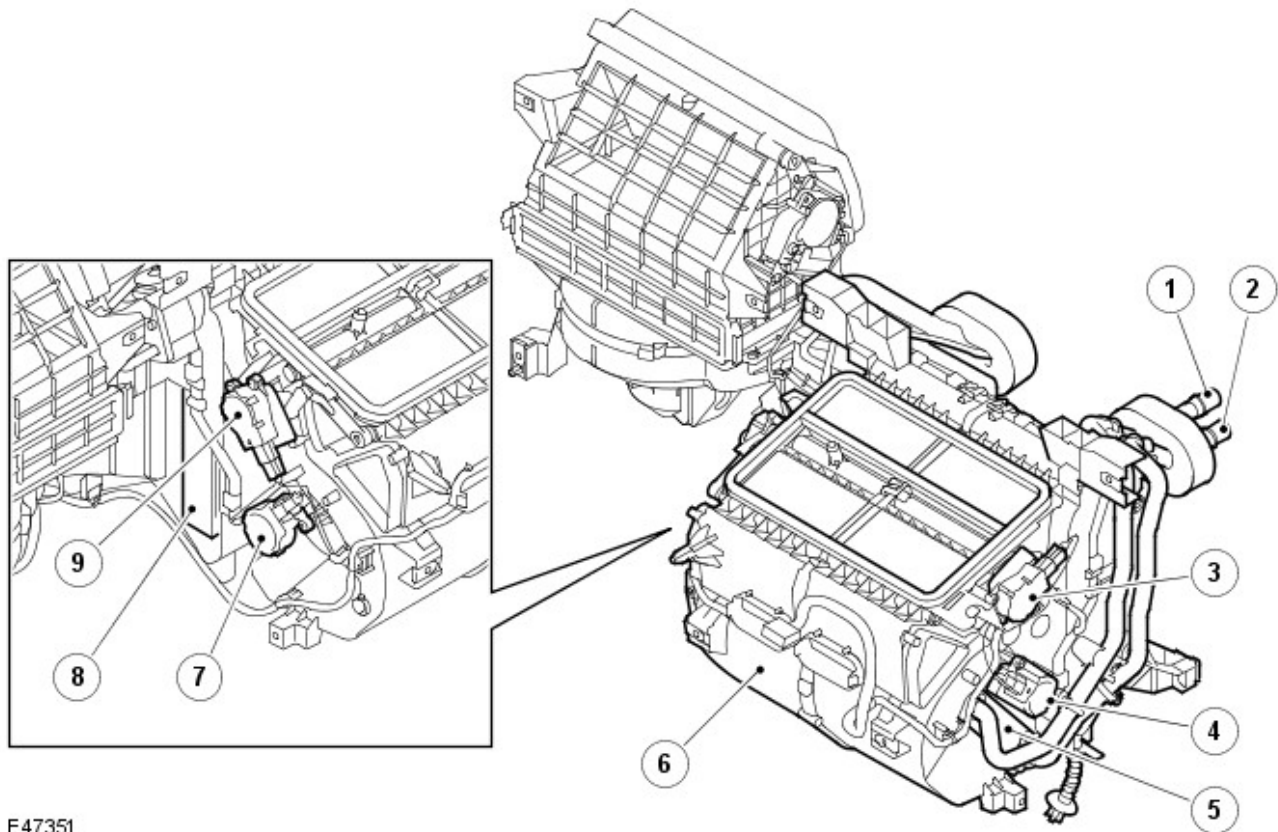
When the blower is required, the [ATC](#) module energizes the coil of the blower relay. The energized blower relay supplies battery power to the blower motor, which is connected to ground through the blower control module. The speed of the blower is controlled by the blower control module, the blower motor control module regulates the voltage in response to the voltage signal from the linear [ATC](#) module. To change the blower motor voltage, [ATC](#) module will change the working cycle linear voltage signal.

When the blower is in the automatic mode the [ATC](#) module determines the blower speed required from the comfort algorithms. When the blower is in the manual mode, the [ATC](#) module operates the blower at one of seven fixed

speeds as selected on the control panel.
For additional information, refer to: Control Components (412-04 Control Components, Description and Operation).

HEATER

 NOTE: RHD unit shown, LHD units similar



E47351

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

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

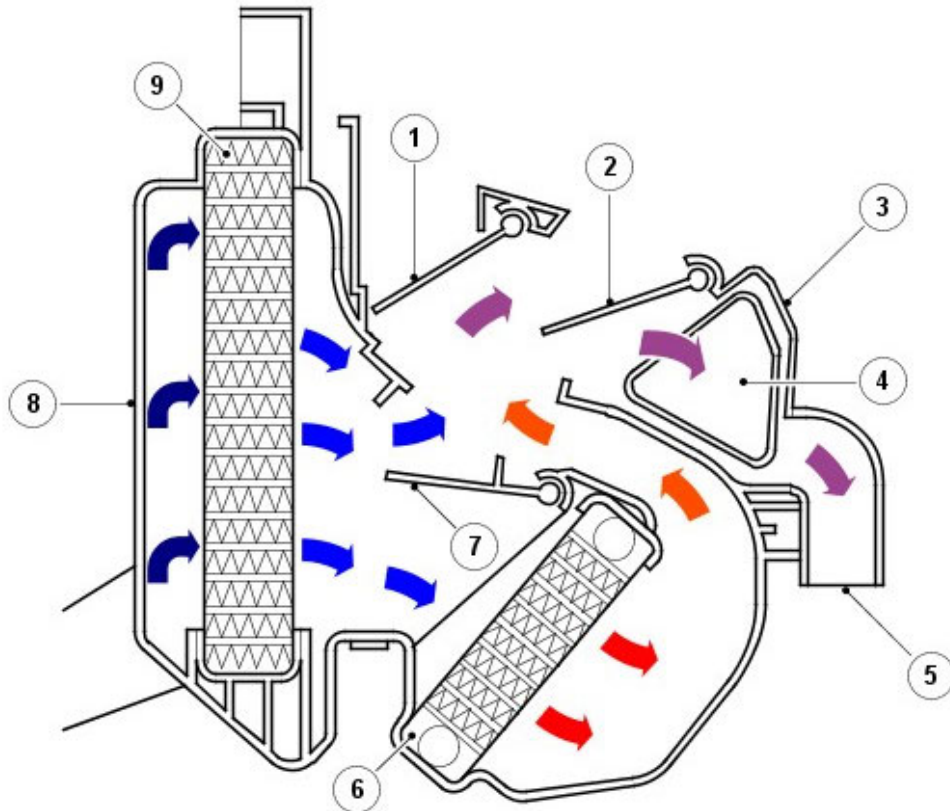
When the A/C (air conditioning) system is operating, the evaporator cools the air entering the heater.

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

For additional information, refer to: Auxiliary Heater (412-02B Auxiliary Heating, Description and Operation).

Two temperature blend doors, one LH and one RH, regulate the flow of air through the heater core to control the temperature of the air leaving the heater. On the automatic system, the two temperature blend doors operate independently to allow different temperatures to be set for the LH and RH outlets. On the manual system, the temperature blend doors are coupled together and produce a common temperature for the LH and RH outlets.

Air Flow Through Heater



E47352

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

Stepper Motors

On the automatic system, separate stepper motors operate the **RH** and the **LH** side temperature blend doors. On the manual system, a single stepper motor operates both the **RH** and the **LH** temperature blend doors.

The distribution doors in the heater are also operated by stepper motors. One for the windshield distribution door and one for the face and feet distribution door.

If a stepper motor is to be replaced, ensure it is replaced with the correct replacement part. Although similar in appearance, each of the stepper motors is different and faults will occur if an incorrect motor is fitted.

Operation of the distribution and temperature blend door stepper motors is controlled by the **ATC** module, which is connected to the stepper motors by a LIN (local interconnect network) bus.

All of the stepper motors contain microprocessors, which store positional information. To enable the **ATC** module to move the stepper motors correctly it requires the following information:

- The travel range, end to end, of each motor.
- Where each motor is on its range.

Approximately 2 minutes after the vehicle ignition is switched off, the climate control system powers down. At this point, the **ATC** module stores the position of each stepper motor in its memory. Each of the stepper motors also stores its own position in its memory. When the ignition is next switched on, all of the stepper motors send positional information to the **ATC** module via the LIN bus. This information is compared with the positional information stored within the **ATC** module memory.

In normal circumstances, the information sent by the stepper motors matches that held in the **ATC** module memory. In this instance, the **ATC** module recognizes there are no problems with the system and starts normally. If however, there are differences, the **ATC** module carries out a calibration routine.

The stepper motor calibration routine will normally take about 15 seconds to complete, but can take up to approximately 2 minutes in certain circumstances. During this period:

- The programmed de-frost **LED (light emitting diode)** on the **ATC** module panel will flash.
- All other climate control operations will be suspended.

The programmed de-frost LED will stop flashing after 2 minutes, regardless of whether the exercise was successful or not so it is important to check that calibration has been carried out successfully. To do this:

1. Switch the ignition off.
2. Switch the ignition back on.
3. Check for a flashing programmed de-frost LED.

If calibration has been successful, the programmed de-frost LED will not flash and the system will return to normal operation. If flashing does occur, more investigation will be required .

Automatic Calibration: The ATC module will automatically initiate a calibration routine every 175 hours of vehicle life. This occurs approximately 1 minute after the ignition has been switched off once 175 hours is reached. In this instance, the programmed de-frost LED will not blink.

Forced Calibration: The ATC module can be manually forced to carry out a calibration routine on the stepper motors. This can be carried out by holding down the ECON and recirculation buttons on the ATC module panel while simultaneously switching the ignition on. The ATC module will now carry out a calibration routine on the stepper motors, but will flash the ECON LED rather than the programmed de-frost LED.

Stepper Motor Diagnostics

Fault diagnosis on the heater stepper motors falls into two main groups:

- Electrical fault: A DTC (diagnostic trouble code) will be raised and logged in the ATC module memory.
- Mechanical fault: The programmed de-frost LED will blink to indicate the ATC module is attempting to carry out a calibration routine.

A calibration routine will be initiated by the ATC module if any of the following occur:

- One or more of the stepper motors is replaced.
- The ATC module is replaced.
- A foreign object enters the system and causes a stepper motor to stall.

Stepper motor related DTCs are stored in the ATC module memory and can be retrieved using T4. For additional information, refer to: Climate Control System (412-00, Diagnosis and Testing).

VENTILATION OUTLETS

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

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

Heating and Ventilation - Heating and Ventilation

Diagnosis and Testing

Principles of Operation

For a detailed description of the heating and ventilation system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Heating and Ventilation (412-02 Heating and Ventilation, Description and Operation).

Inspection and Verification



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



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

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

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Front End Accessory Drive (FEAD) belt • Refrigerant • Heater control flaps • Ducting • Cabin air filter • Coolant level • Compressor • Cooling fan 	<ul style="list-style-type: none"> • Fuses • Electrical harnesses • Harness connectors • Blower motor • Cooling fan • Actuators

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

DTC Index

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

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Climate Control Module (HVAC) (100-00, Description and Operation).

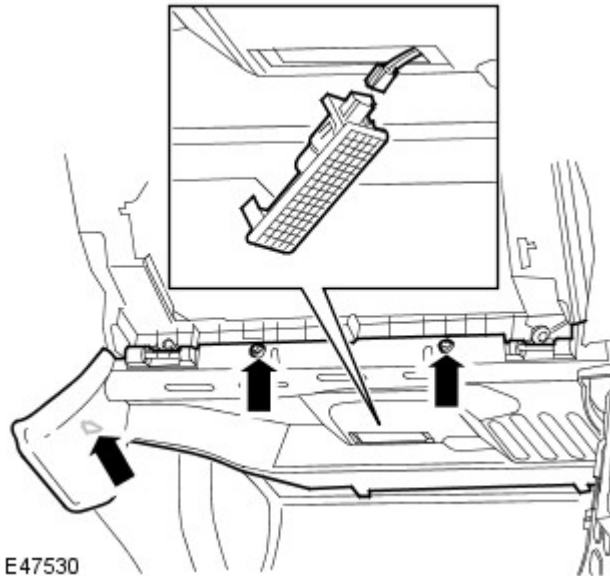
Heating and Ventilation - Blower Motor

Removal and Installation

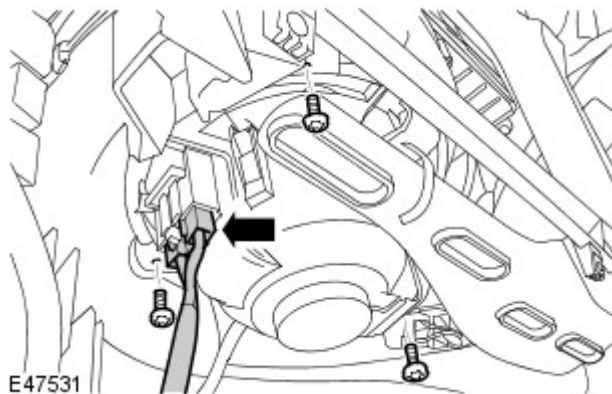
Removal

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

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




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



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

Installation

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

Install the blower motor.

- Tighten the screws.
- Connect the electrical connector.

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

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

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

Heating and Ventilation - Heater Core LHD AWD

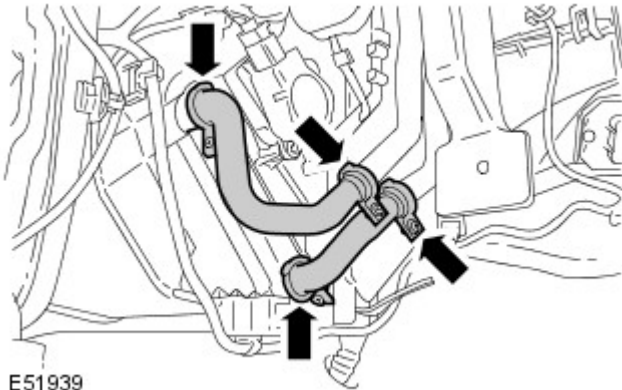
Removal and Installation

Removal

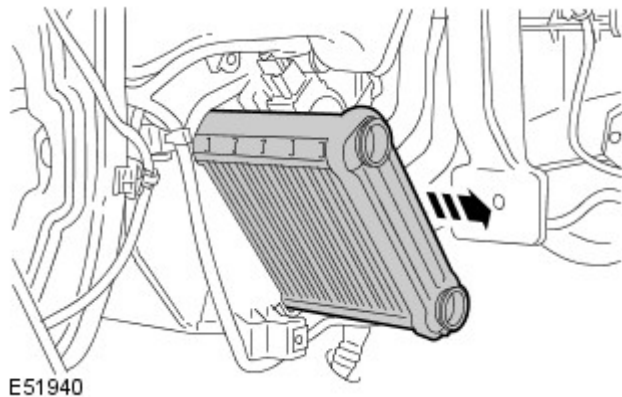
1. Drain the cooling system.
For additional information, refer to: Cooling System Partial Draining, Filling and Bleeding (303-03B, General Procedures).
2. Remove the instrument panel passenger side reinforcement.

For additional information, refer to: [Instrument Panel Passenger Side Reinforcement](#) (501-12 Instrument Panel and Console, Removal and Installation).

3. Remove the heater core upper and lower pipes.
 - Position a container to collect the fluid.
 - Loosen the 4 screws and remove the clips.
 - Remove and discard the 4 O-ring seals.



4. Remove the heater core.



Installation

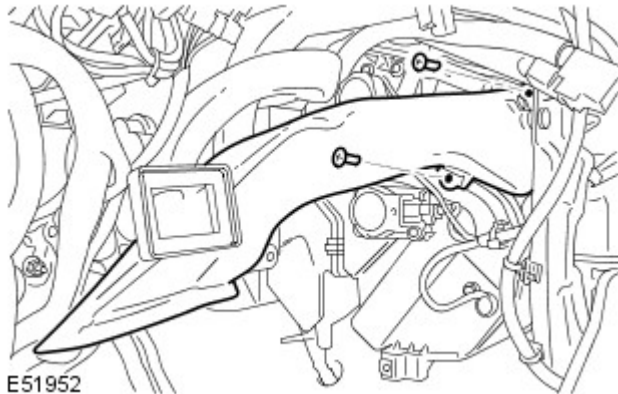
1. Install the heater core.
2. Install the heater core upper and lower pipes.
 - Clean the components.
 - Install the new O-ring seals.
 - Install the clips and tighten the screws.
 - Remove the container.
3. Install the instrument panel passenger side reinforcement.
For additional information, refer to: [Instrument Panel Passenger Side Reinforcement](#) (501-12 Instrument Panel and Console, Removal and Installation).
4. Refill the cooling system.
For additional information, refer to: Cooling System Partial Draining, Filling and Bleeding (303-03B, General Procedures).

Heating and Ventilation - Heater Core RHD AWD

Removal and Installation

Removal

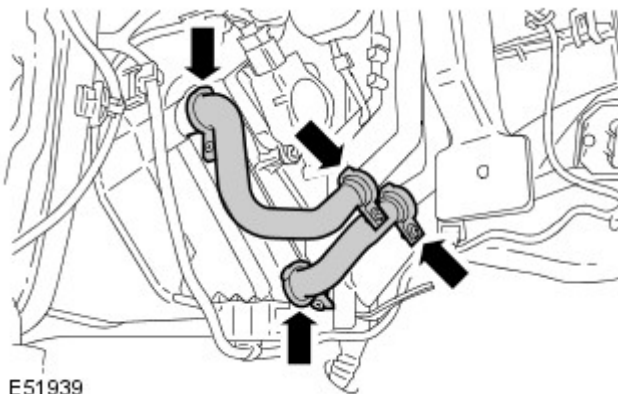
1. Drain the cooling system.
For additional information, refer to: Cooling System Partial Draining, Filling and Bleeding (303-03B, General Procedures).
2. Remove the instrument panel driver side reinforcement.
For additional information, refer to: [Instrument Panel Driver Side Reinforcement](#) (501-12 Instrument Panel and Console, Removal and Installation).



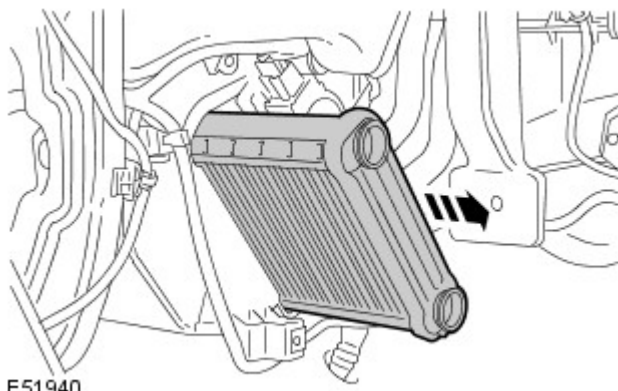
3.  **NOTE:** LHD illustration shown, RHD is similar.

Remove the driver side footwell duct.

- Remove the 2 Torx screws.



4. Remove the heater core upper and lower pipes.
 - Position a container to collect the fluid.
 - Loosen the 4 screws and remove the clips.
 - Remove and discard the 4 O-ring seals.



5. Remove the heater core.

Installation

1. Install the heater core.
2. Install the heater core upper and lower pipes.
 - Clean the components.
 - Install the new O-ring seals.
 - Install the clips and tighten the screws.
 - Remove the container.

3. Install the driver side footwell duct.
 - Tighten the screws.
4. Install the instrument panel driver side reinforcement.
For additional information, refer to: [Instrument Panel Driver Side Reinforcement](#) (501-12 Instrument Panel and Console, Removal and Installation).
5. Refill the cooling system.
For additional information, refer to: Cooling System Partial Draining, Filling and Bleeding (303-03B, General Procedures).