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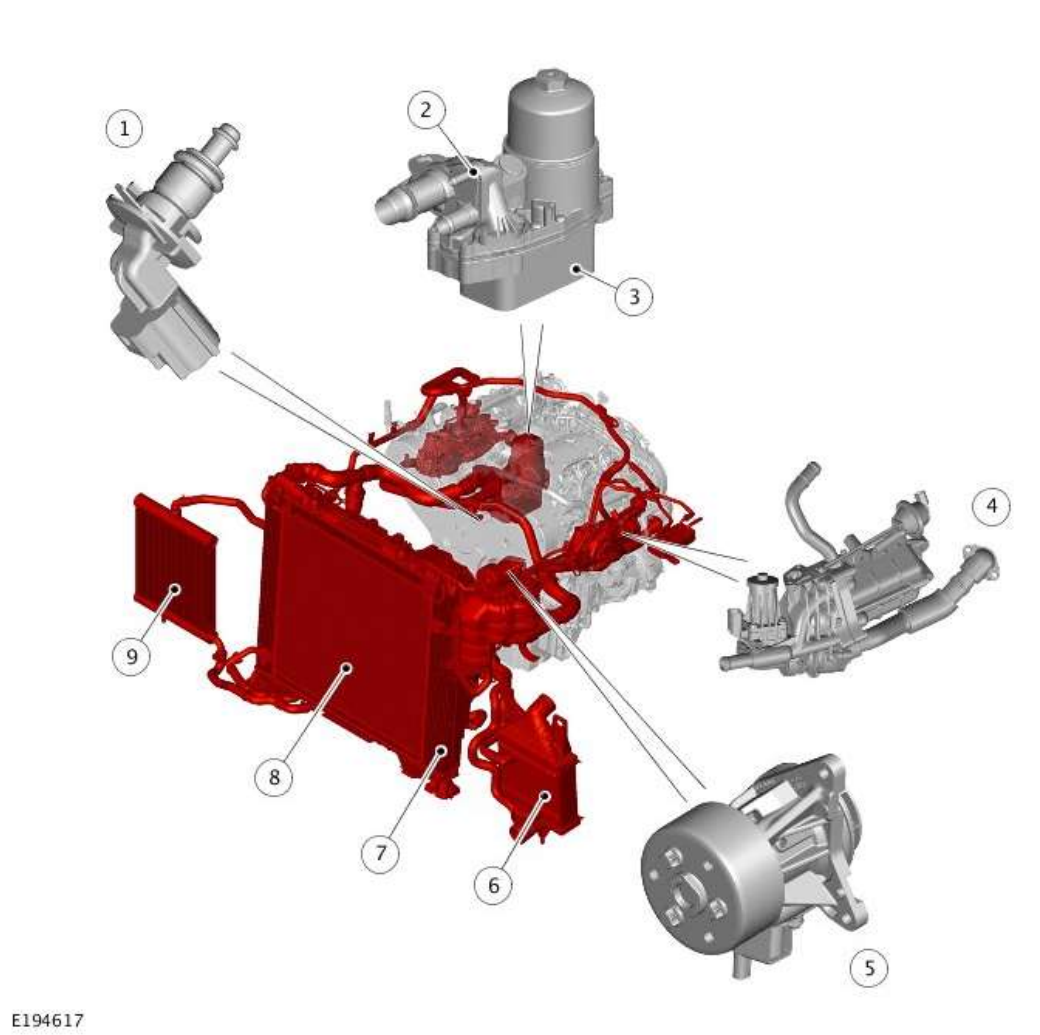
ENGINE COOLING - TDV6 3.0L DIESEL

DESCRIPTION AND OPERATION

COMPONENT LOCATION

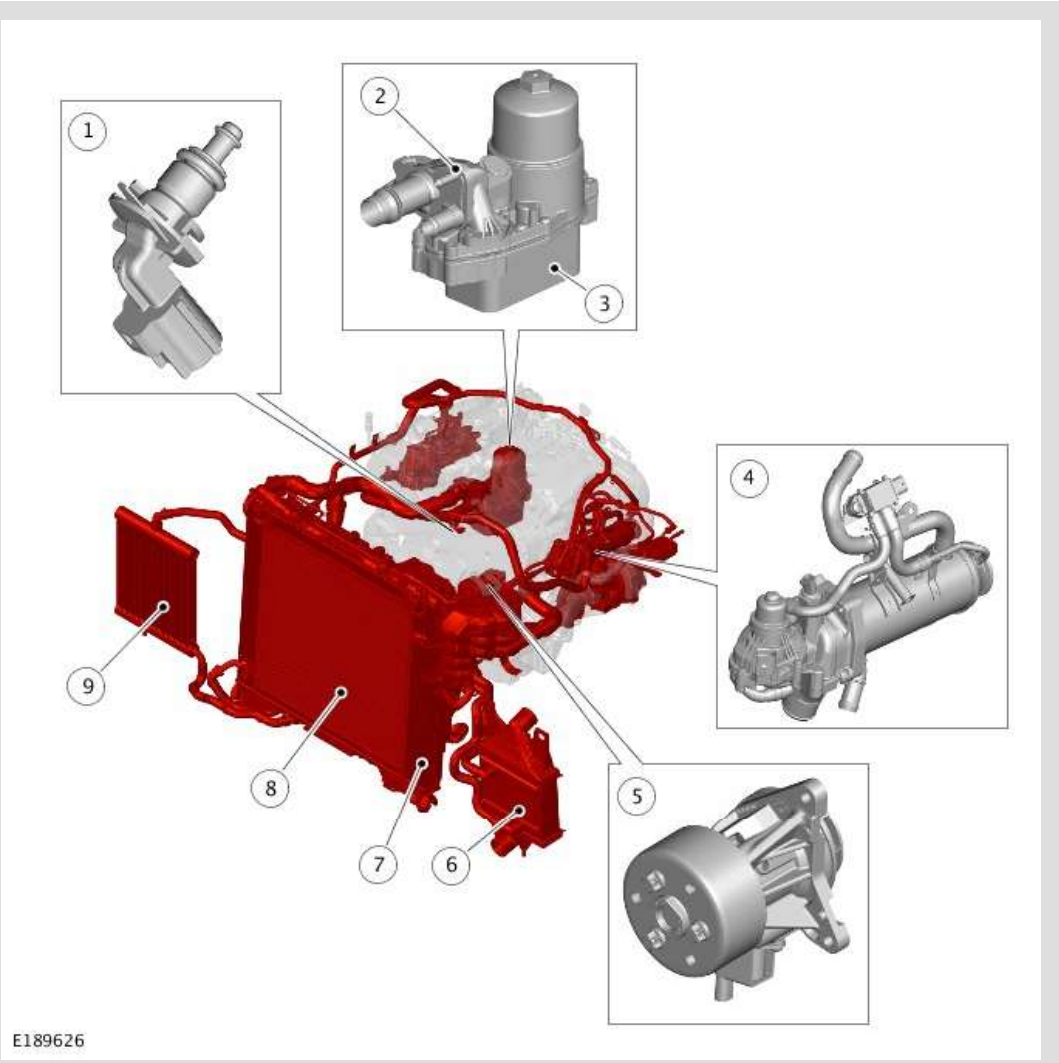
COMPONENT LOCATION - 1 OF 4 - FRONT VIEW - EU4 MARKET VEHICLES



ITEM	DESCRIPTION

1	Engine Coolant Temperature (ECT) sensor
2	Coolant outlet connector
3	Engine oil cooler
4	High Pressure (HP) Exhaust Gas Recirculation (EGR) cooler
5	Variable coolant pump
6	Charge air cooler
7	Radiator
8	Charge air radiator
9	Auxiliary radiator

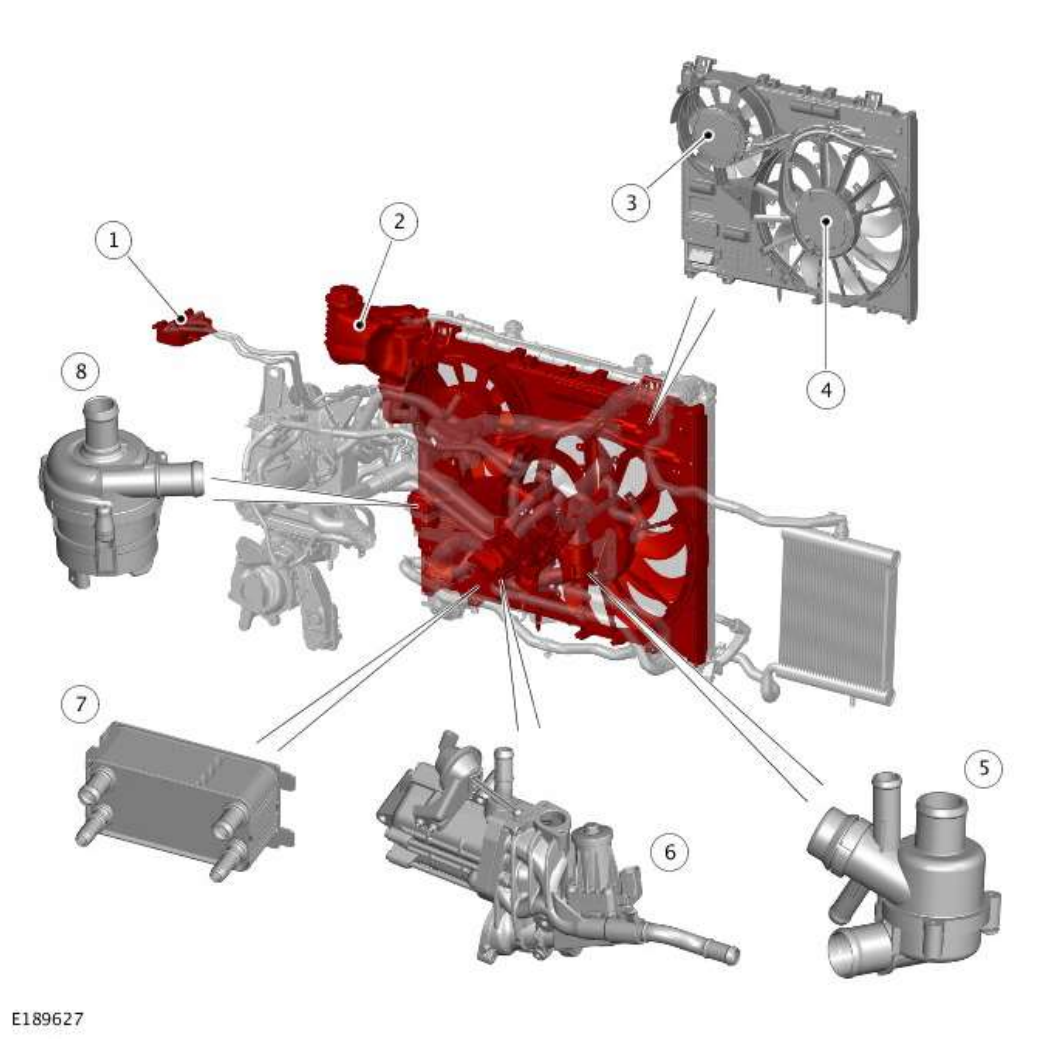
COMPONENT LOCATION - 2 OF 4 - FRONT VIEW - ALL MARKET VEHICLES EXCEPT EU4



ITEM	DESCRIPTION
1	Engine Coolant Temperature (ECT) sensor

2	Coolant outlet connector
3	Engine oil cooler
4	Low Pressure (LP) Exhaust Gas Recirculation (EGR) cooler
5	Variable coolant pump
6	Charge air cooler
7	Radiator
8	Charge air radiator
9	Auxiliary radiator

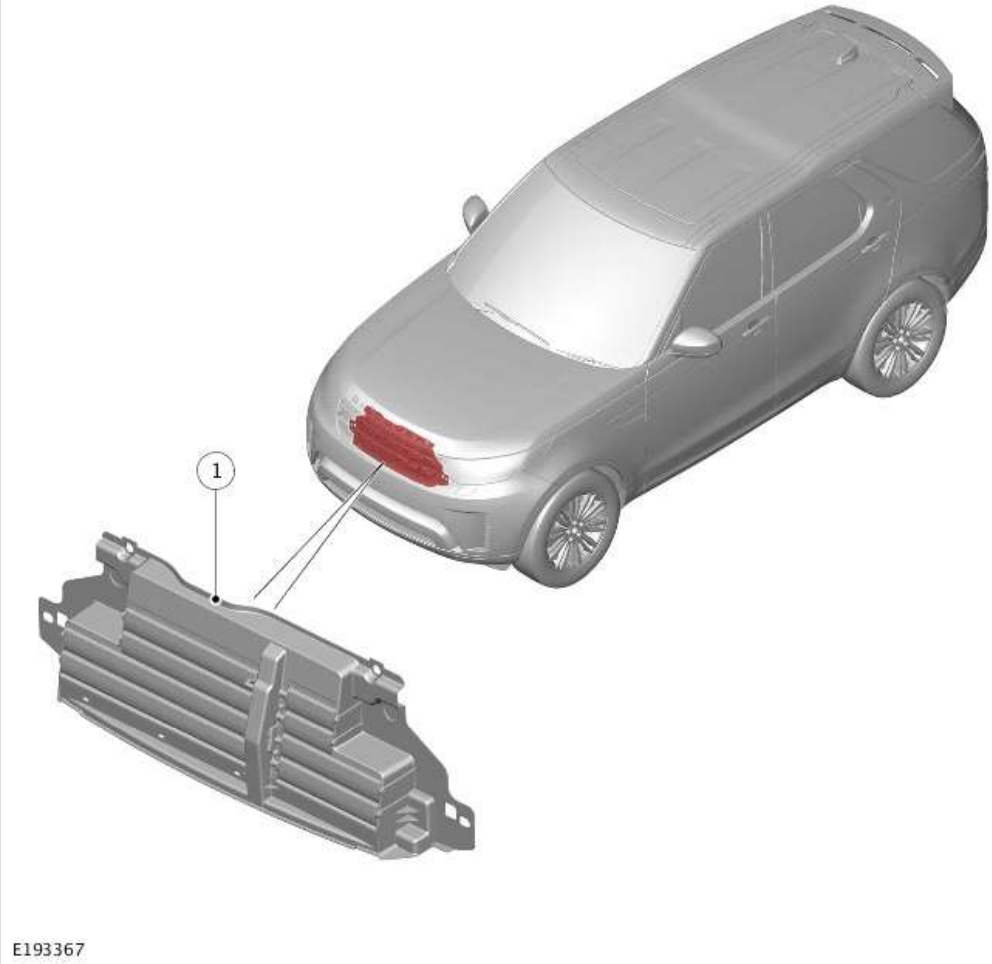
COMPONENT LOCATION - 3 OF 4 - REAR VIEW



ITEM	DESCRIPTION
1	Fuel cooler
2	Coolant expansion tank

3	Electric cooling fan - auxiliary
4	Electric cooling fan - main
5	Thermostat
6	High Pressure (HP) Exhaust Gas Recirculation (EGR) cooler
7	Automatic Transmission Fluid (ATF) cooler
8	Charge air coolant pump

COMPONENT LOCATION - 4 OF 4 - ACTIVE GRILLE AIR SHUTTER - NAS MARKET VEHICLES ONLY



ITEM	DESCRIPTION
1	Active grille air shutter

OVERVIEW

The engine cooling system maintains the engine within an optimum temperature range under changing ambient and engine operating conditions.

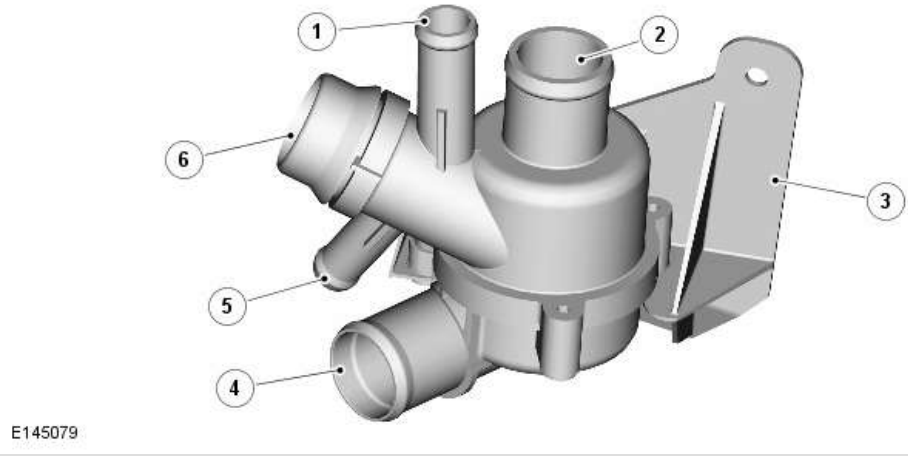
The cooling system also provides:

- Heating for the passenger compartment. For additional information, refer to: Heating and Ventilation (412-01, Description and Operation), Auxiliary Climate Control (412-02, Description and Operation).
- Cooling for the:
  - Engine oil
    For additional information, refer to: Engine (303-01A, Description and Operation).
  - Fuel system
    For additional information, refer to: Fuel Tank and Lines (310-01A, Description and Operation).
  - Exhaust Gas Recirculation (EGR) system
    For additional information, refer to: Engine Emission Control (303-08A, Description and Operation).
  - Variable Geometry Turbocharger (VGT)
    For additional information, refer to: Turbocharger (303-04B, Description and Operation).
  - Automatic Transmission Fluid (ATF)
    For additional information, refer to: Transmission Cooling (307-02A, Description and Operation).
  - Charge air cooler
    For additional information, refer to: Intake Air Distribution and Filtering (303-12A, Description and Operation).

In some markets, an active grille air shutter is installed to reduce aerodynamic drag and engine warm up time.

DESCRIPTION

THERMOSTAT



ITEM	DESCRIPTION
1	Heater return hose connection
2	Bypass hose connection
3	Thermostat bracket
4	Lower hose connection
5	Coolant expansion tank return hose connection
6	Coolant pump coolant inlet connection

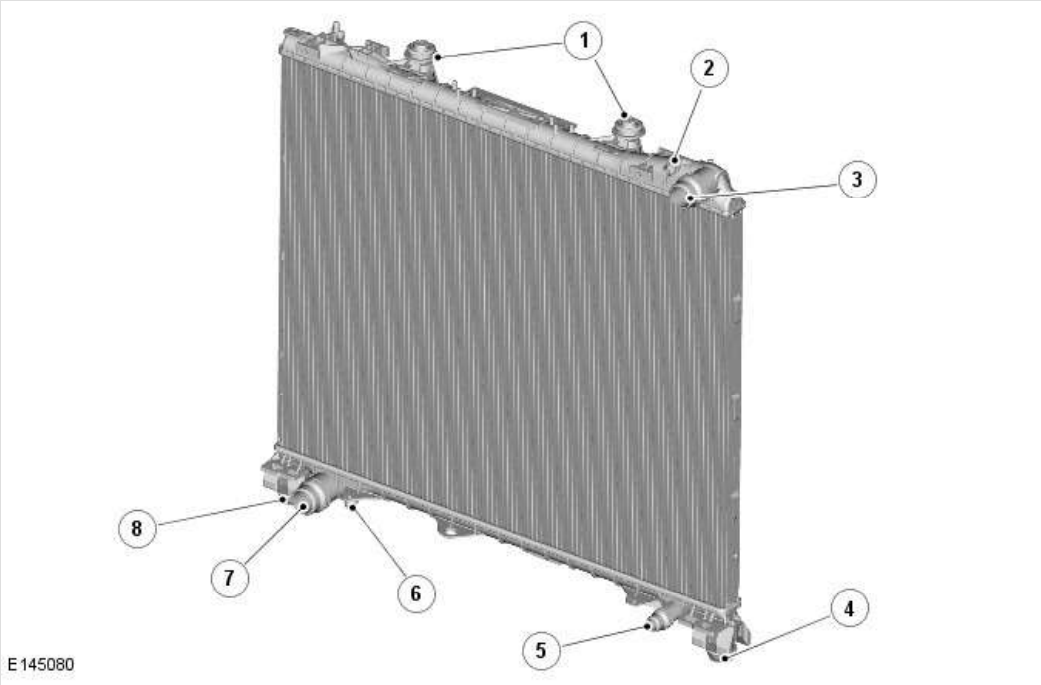
A pressure relief type thermostat is located behind the radiator, on a bracket attached to the cooling fan shroud. The thermostat body contains a wax element and a spring loaded bypass valve.

The thermostat housing is connected to the following:

- The radiator lower hose
- The engine bypass hose
- The feed hose to the engine coolant pump
- The heater return hose
- The coolant expansion tank return hose.

The thermostat allows rapid engine warm-up by preventing coolant flow through the radiator and by limiting coolant flow through the cylinder block when the engine is cold. The thermostat is not a serviceable item and it can be replaced as an assembly.

RADIATOR



ITEM	DESCRIPTION
1	Upper mounts
2	Vent hose connection
3	Upper hose connection
4	Lower mount
5	Automatic Transmission Fluid (ATF) cooler hose connection
6	Drain screw
7	Lower hose connection
8	Lower mount

The radiator is a vertical-flow type with an aluminum core and plastic end tanks. The radiator is located in the vehicle by bushes attached to the end tanks. The lower bushes are installed in the front subframe. The upper bushes are installed in the front end carrier.

Upper and lower hose connections are incorporated into the upper and lower end tanks respectively. The lower end tank also incorporates a drain screw, and a connection for

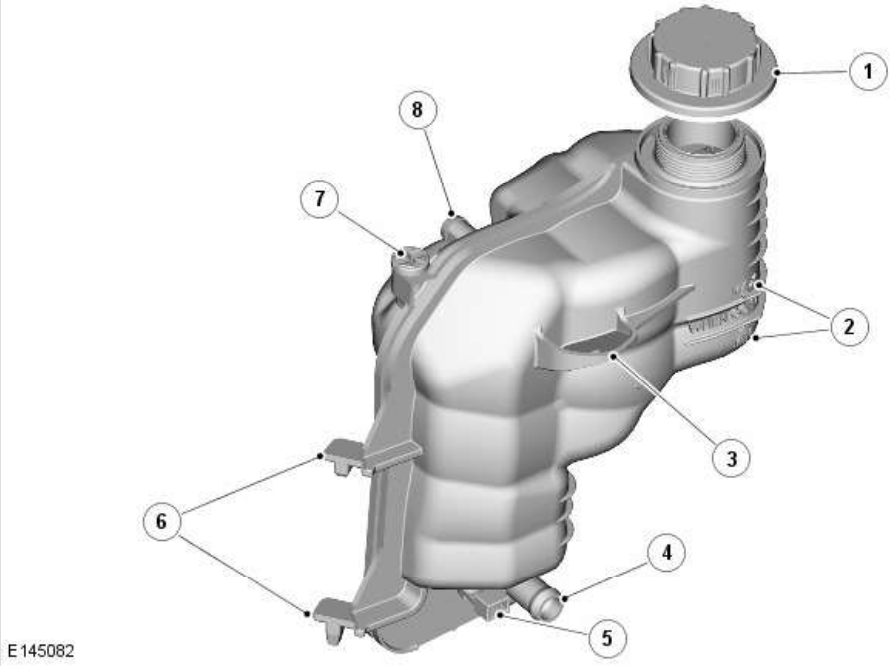
the coolant feed hose of the Automatic Transmission Fluid (ATF) cooler. The upper end tank incorporates a connection for a vent hose to the coolant expansion tank. The end tanks also incorporate mounting points for the cooling fan shroud and the Air Conditioning (A/C) condensor.

VARIABLE COOLANT PUMP

The variable coolant pump has a housing that supports a shaft with an impeller attached to one end and a drive hub at the other. The housing is attached to the front of the cylinder block with the impeller located in a pumping chamber. The variable coolant pump is driven by a pulley attached to the drive hub and driven by the accessory drive belt at engine speed.
For additional information, refer to: Accessory Drive (303-05A, Description and Operation).

The variable coolant pump has a shroud mechanism which can be used to create zero flow in the engine coolant circuit to enable accelerated engine warm-up. The operation of the shroud is controlled by the Powertrain Control Module (PCM) via a solenoid valve which is attached to the variable coolant pump housing with a screw. The solenoid valve is connected to the PCM via a hardwired connection. When the engine is cold and the engine speed is between 1900 RPM and 4800 RPM, the PCM activates the solenoid valve. Therefore the shroud moves to the 'no coolant flow' position. When the engine approaches the operating temperature the PCM deactivates the solenoid valve and the shroud retracts to its base position. This results full coolant flow from the coolant pump to the engine cooling system.

COOLANT EXPANSION TANK



ITEM	DESCRIPTION
1	Filler cap
2	MAX and MIN level markings
3	Mounting lug
4	Supply hose connection
5	Coolant level sensor
6	Mounting lugs
7	Bleed screw
8	Vent hose connection

The coolant expansion tank is located in the left side of the engine compartment. The tank is located by a grommet on its underside and positively secured with a bolt and washer to a bracket on the vehicle body. The tank has a second bracket that locates in a molded slot in the tank body.

The coolant expansion tank has three connections. A connection for radiator bleed, for engine bleed and for outlet to the thermostat housing.

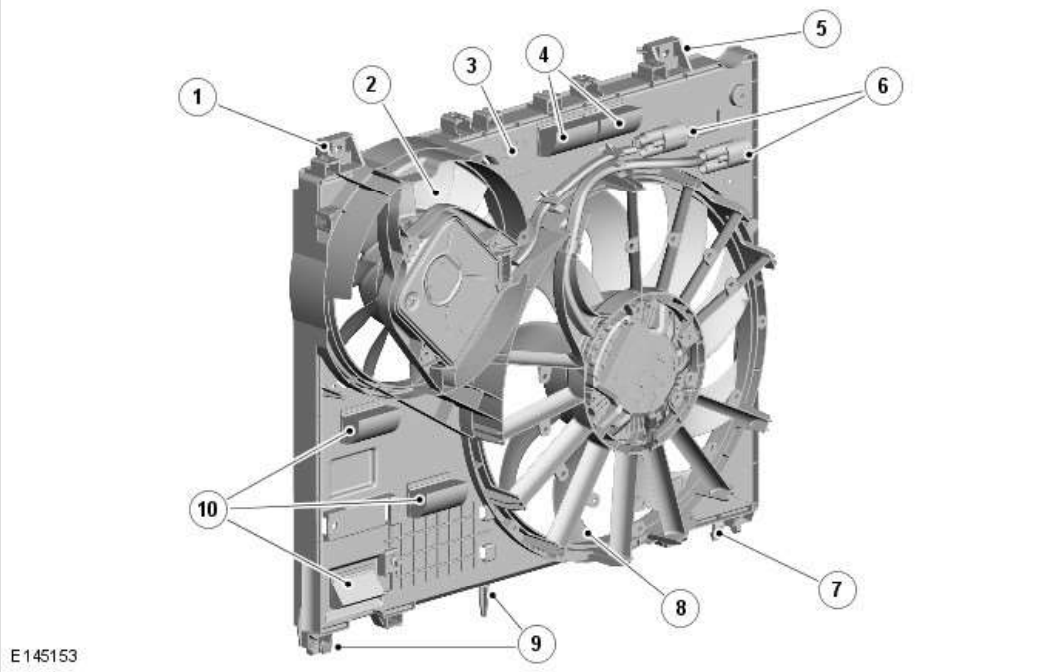
An engine coolant level sensor is located in the underside of the tank body. The sensor reacts to the influence of a magnetic field. A float with integral magnet is located inside the tank, over the sensor tube. The sensor has contacts inside the tube, which are normally open. When the fluid level reduces, the magnetic float moves down the tube. When the magnet reaches the sensor contacts, the magnetic field closes the contacts. The sensor connects hardwired to the Body Control Module/Gateway Module (BCM /GWM) Assembly which receives the signals from the sensor. Maximum and minimum marks are molded on the tank body.

The coolant expansion tank provides the following functions:

- Service fill.
- Coolant expansion during warm-up.
- Air separation during operation.
- System pressurization by the filler cap.

The coolant expansion tank has an air space of approximately 0.5 to 1 liter (1.06 to 2.11 US pints), above the MAX level, to allow for coolant expansion.

ELECTRIC COOLING FAN



ITEM	DESCRIPTION
1	Mounting lug
2	Electric cooling fan - auxiliary
3	Cooling fan shroud

4	Speed flaps
5	Mounting lug
6	Electrical connectors
7	Mounting lug
8	Electric cooling fan - main
9	Mounting lugs
10	Speed flaps

Vehicles have two variable speed electric cooling fans to help regulate the engine coolant temperature. The fan shroud is attached to the rear of the radiator. The shroud incorporates speed flaps, which pivot open to allow engine compartment cooling at speed.

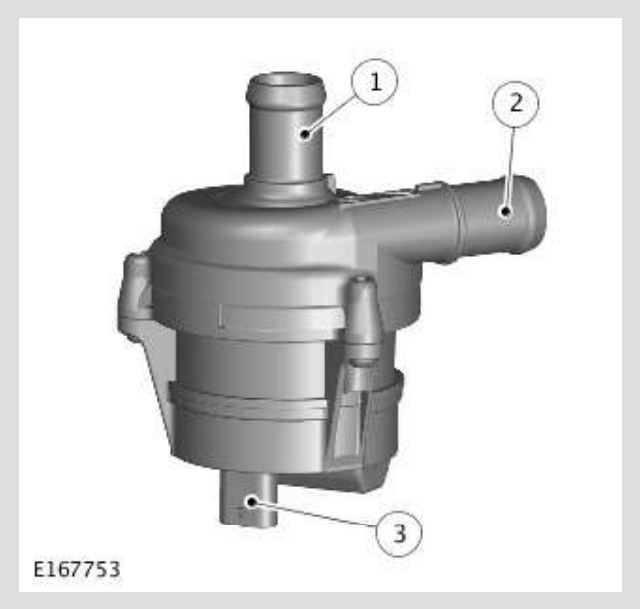
Each electric cooling fan is operated by a control module, integrated into their electric motor, which is controlled by the PCM. Electrical connectors at the right side of the fan shroud provide the interface between the cooling fan harnesses and the vehicle wiring.

The control module of each electric cooling fan is provided with:

- A battery power supply from the Auxiliary Junction Box (AJB).
- An ignition signal from the PCM relay in the Engine Junction Box (EJB).
- A Pulse Width Modulation (PWM) signal from the PCM.
- A ground.

To control each electric cooling fan, the PCM varies the duty cycle of the PWM signal. The cooling fan control module translates the duty cycle into a fan target speed and sets the output current to the fan motor accordingly.

CHARGE AIR COOLANT PUMP



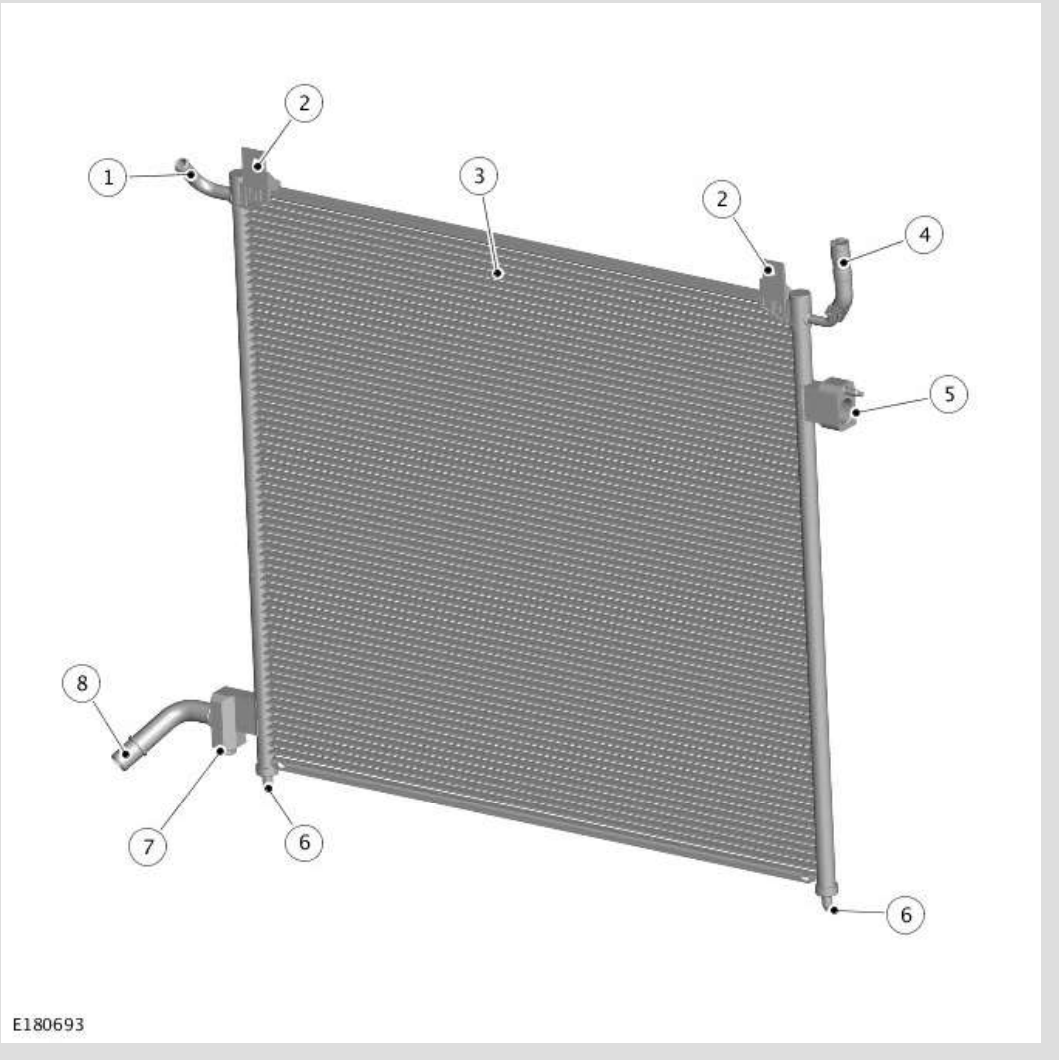
ITEM	DESCRIPTION
1	Coolant inlet connection
2	Coolant outlet connection
3	Electrical connector

The charge air coolant pump is an electric pump attached to the rear left side of the engine cooling fan shroud. Hoses connect the intake of the charge air coolant pump to the charge air radiator, and the outlet to the charge air cooler. An electrical connector provides the interface between the motor of the charge air coolant pump and the vehicle wiring. Operation of the charge air coolant pump is controlled by a PWM signal from the PCM.

CHARGE AIR COOLER

A charge air cooler is installed on the left side of the cooling pack, behind the left outer air intake in the front bumper.
For additional information, refer to: Intake Air Distribution and Filtering (303-12A, Description and Operation).

CHARGE AIR RADIATOR

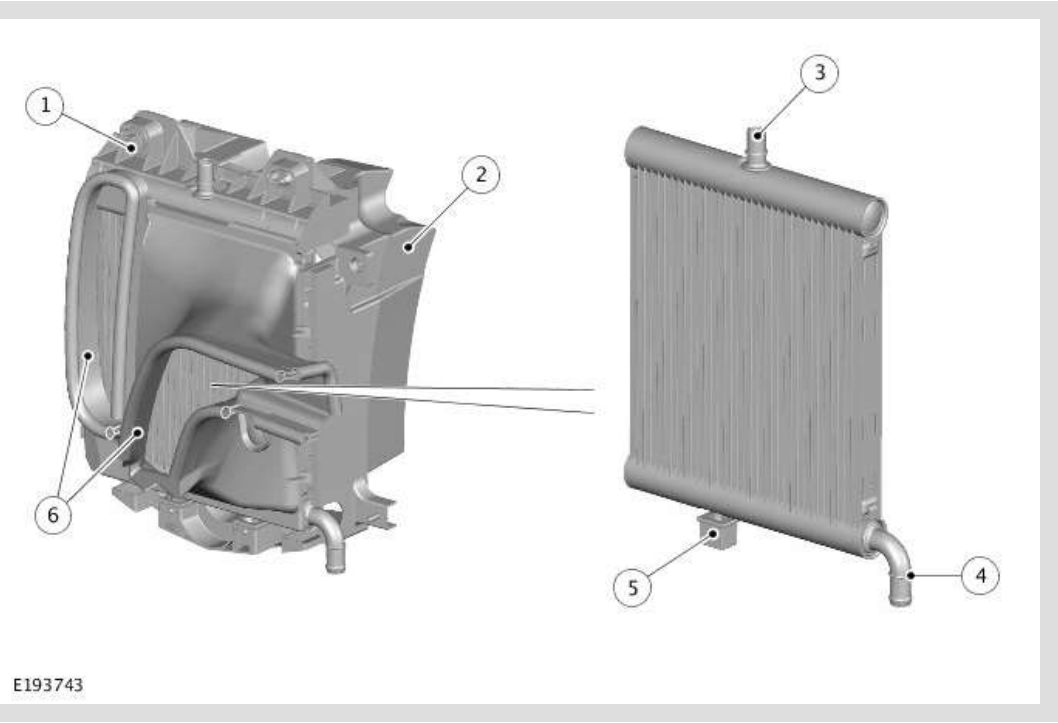


ITEM	DESCRIPTION
1	Coolant expansion hose connection
2	Mounting bracket
3	Charge air radiator
4	Bleed screw
5	Coolant outlet connection
6	Mounting pin
7	Drain screw
8	Coolant inlet connection

The charge air radiator is located between the radiator and the A/C condensor. The charge air radiator is attached to the A/C condensor with two pins at the bottom of the end tanks. Two brackets are attached to the top of the charge air radiator, which are providing the connection to the A/C condensor with two screws.

The right end tank comprises connections to the charge air coolant pump inlet and the engine cooling system. A drain plug is integrated into the bottom of the coolant inlet connection. The connection with the radiator on the top of the right end tank accommodates the thermal expansion and retraction. In addition it enables filling and draining of the coolant in the charge air cooling system. The left end tank comprises a coolant outlet connection to the charge air cooler and a bleed screw.

AUXILIARY RADIATOR



ITEM	DESCRIPTION
1	Radiator support bracket
2	Rear air duct
3	Coolant hose connection - Auxiliary radiator inlet
4	Coolant hose connection - Auxiliary radiator outlet
5	Isolator
6	Front air ducts

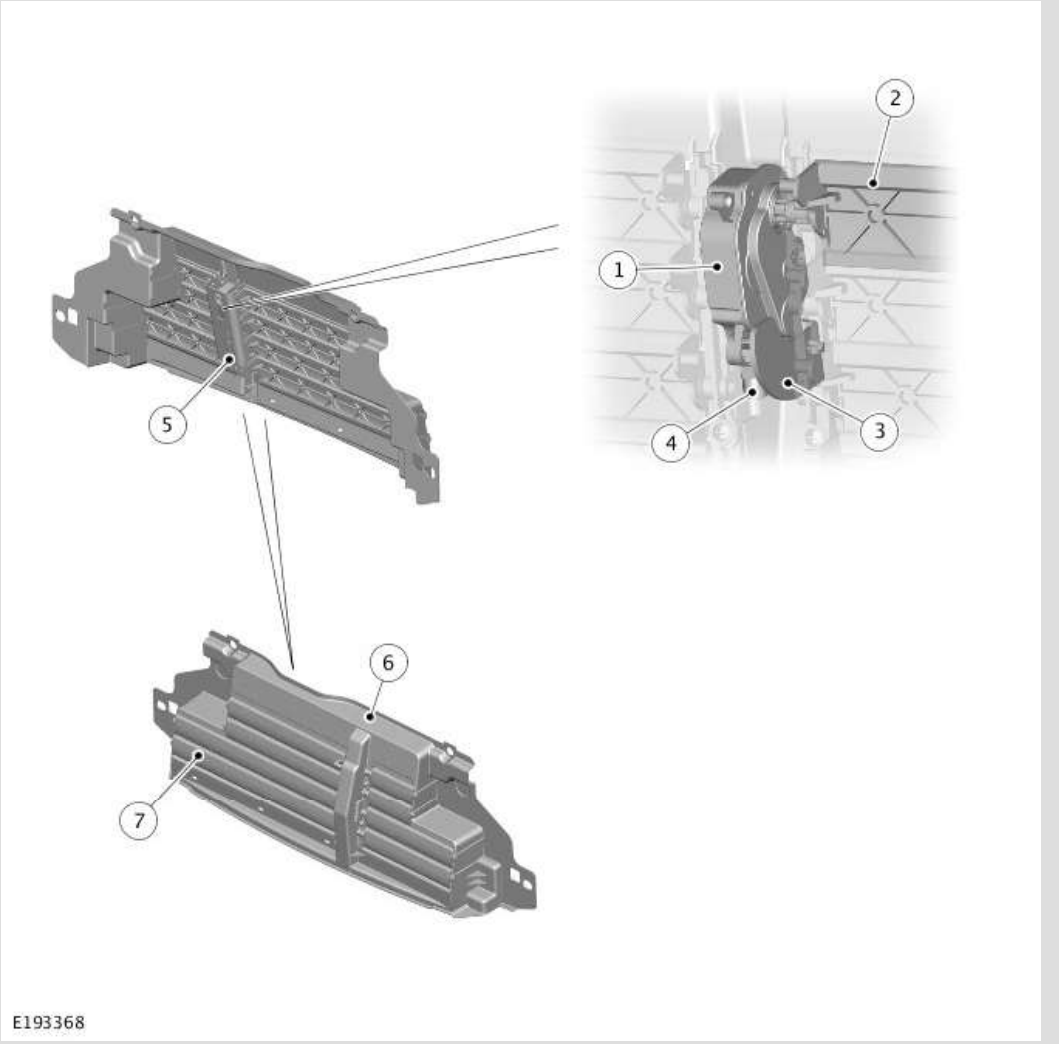
The auxiliary radiator is located on the right side of the cooling pack, behind the outer air intake in the front bumper. The auxiliary radiator is installed in air ducts attached to the front bumper armature and the front end carrier. The lower end tank of the auxiliary radiator is located in the air duct by a spigot fitted with an isolator bush. The upper end tank of the auxiliary radiator is held in a support bracket in the air duct.

The auxiliary radiator is connected in parallel with the (main) radiator to increase the engine cooling capacity.

ENGINE COOLANT

The coolant is silicate free and must not be mixed with conventional engine coolant.

ACTIVE GRILLE AIR SHUTTER - NAS MARKET VEHICLES ONLY



ITEM	DESCRIPTION
1	Motor
2	Master vane
3	Support bracket

4	Electrical connector
5	Vane link
6	Housing
7	Vane (8 off)

The active grille air shutter is installed behind the radiator grille and attached to the front end carrier. The active grille air shutter incorporates moveable vanes that control the air flow into the top half of the upstream main duct attached to the front of the cooling pack.

The vanes are installed in a housing in two groups of four and operated by an electric motor. The motor is held in a support bracket in the housing. The inboard hinge pin of one of the vanes (the master vane) is engaged in the output shaft of the motor. A lever on the inboard end of each vane is engaged in a motor link. When the motor turns the master vane, the motor link transfers the movement to the levers of the other seven vanes, which then turn in unison with the master vane.

The design of the vanes equalizes the wind loading on each side of the hinge pin, which reduces the resistance to turning when the vehicle is traveling at speed. A seal along the top edge of each vane provides sealing between adjacent vanes, and between the two upper vanes and the housing. The vanes can be set to one of 14 positions between fully closed and fully open, and have a range of movement of 80 degrees. During normal operation, for the vanes to move from fully closed to fully open takes approximately 30 seconds. To move the vanes from fully open to fully closed takes approximately 90 seconds.

Operation of the motor is controlled by the PCM, which communicates with the motor on a Local Interconnect Network (LIN) bus connection. Power for the motor is provided by a power supply from the PCM relay in the EJB.

OPERATION

COOLANT CIRCUIT FLOW

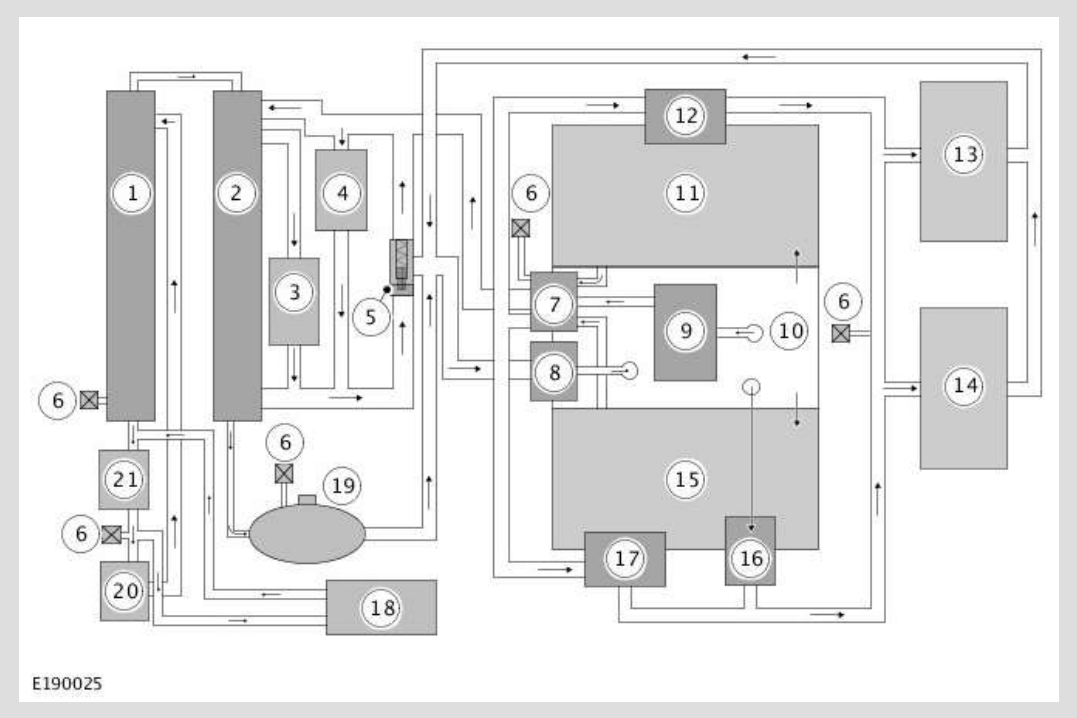
When the engine is running the coolant is circulated around the engine cooling system by the variable coolant pump. From the coolant pump, coolant flows through the cylinder block and the cylinder heads to the coolant outlet connector. Some of the coolant in the cylinder block is diverted through the engine oil cooler before returning to the coolant outlet connector. The Variable Geometry Turbocharger (VGT) coolant inlet hose is connected to the cylinder block. Some of the coolant from the cylinder block flows through the VGT to the Exhaust Gas Recirculation (EGR) cooler outlet hose assembly.

From the coolant outlet connector, the majority of the coolant flows to the thermostat, either directly or via the radiator, depending on the temperature of the coolant and engine speed. The remainder of the coolant flows through the EGR coolers and the heater circuit to the thermostat. From the outlet of the thermostat the coolant flows to the coolant inlet connector on the left side of the cylinder block and back to the coolant pump.

A separate hose from the radiator allows extra-cooled coolant from the radiator to flow through the Automatic Transmission Fluid (ATF) cooler. The coolant from the ATF cooler returns to the system through a connector in the radiator lower hose.

The charge air cooling system is operationally independent of the engine cooling system, but connected to it at the radiator upper end tank. When the charge air coolant pump is running, the coolant flows from the pump outlet through the charge air cooler, the charge air radiator and back to the pump inlet connection.

Schematic Diagram - Coolant Circuit Flow



ITEM	DESCRIPTION
1	Charge air radiator
2	Radiator
3	Automatic Transmission Fluid (ATF) cooler
4	Auxiliary radiator
5	Thermostat
6	Static bleed point - 5 off

7	Coolant outlet connection
8	Variable coolant pump
9	Engine oil cooler
10	Cylinder block
11	Cylinder head - Bank 1
12	Right Exhaust Gas Recirculation (EGR) cooler
13	Heater core - climate control assembly
14	Heater core - auxiliary climate control assembly - If equipped
15	Cylinder head - Bank 2
16	Variable Geometry Turbocharger (VGT)
17	Left Exhaust Gas Recirculation (EGR) cooler
18	Fuel cooler
19	Coolant expansion tank
20	Charge air cooler
21	Charge air coolant pump

THERMOSTAT

The thermostat is closed at temperatures below approximately 82°C (179°F). When the coolant temperature reaches approximately 82°C (179°F) the thermostat starts to open and is fully open at approximately 96°C (204°F). In this condition the full flow of coolant is directed through the radiator.

COOLANT LEVEL SENSOR

If the coolant level in the expansion tank decreases below a predetermined value, the coolant level sensor connects a ground to the Body Control Module/Gateway Module (BCM/GWM) assembly, which sends a message to the Instrument Cluster (IC) on the High Speed (HS) Controller Area Network (CAN) comfort systems bus to display a warning message
For additional information, refer to: Information and Message Center (413-08, Description and Operation).

ELECTRIC COOLING FAN

The Powertrain Control Module (PCM) determines when to operate the electric cooling fan from the Engine Coolant Temperature (ECT) sensor input and a cooling fan request from the Automatic Temperature Control Module (ATCM). The PCM also adjusts the fan speed to compensate the ram effect of vehicle speed.

The PCM varies the duty cycle of the Pulse Width Modulation (PWM) signal to the engine cooling fan control module between 0 and 100% to operate the fan motor in one of four modes:

- Off
- Minimum speed - 750 RPM
- Linear variable speed between minimum and maximum speeds
- Maximum speed - 2820 RPM.

Under hot operating conditions, the electric cooling fan may continue to operate for up to 5 minutes after the engine has been switched off.

The engine cooling fan control module monitors for over and under input voltage, a stalled motor and a partially stalled motor. If it detects any of these faults the fan control module temporarily pulls the PWM signal to ground to notify the fault to the PCM. The length of time the PWM signal is pulled to ground varies between 2 and 8 seconds, depending on the fault. The control module repeats the notification process at 5 second intervals until the fault is cleared. If there is more than one fault, only the highest priority fault is notified to the PCM.

The fault priorities in descending order are the following:

- Over voltage
- Under voltage
- Stalled motor
- Partially stalled motor.

The PCM records a related Diagnostic Trouble Code (DTC) for faults notified by the fan control module and signals the BCM/GWM assembly via the FlexRay bus. The BCM /GWM assembly transmits the signal on the HS CAN comfort systems bus to the IC to display a warning message.

The nominal operating voltage for the engine cooling fans is 9 to 16 Volts. If the input voltage is outside of these limits, the fan control module stops operation of the electric cooling fan and notifies the PCM of the fault. After an under or over voltage occurs, the cooling fan operation is resumed when the input voltage increases to 9.5 Volts, or decreases to 15.5 Volts, respectively.

To check for a stalled motor, each time it supplies power to start the electric cooling fan the control module checks the cooling fan motor speed after 2 seconds. If the speed is zero, the fan control module determines the fan motor is stalled and tries a restart. For a restart, the fan control motor disconnects the power from the fan motor then immediately reconnects it at an increased current level. The fan control module will try up to six restarts of a stalled motor, increasing the output current each time. If

the fan motor remains stalled after the sixth restart, the fan control module waits 40 seconds then notifies the PCM of the fault and begins the start process again.

To check for a partially stalled motor, while the fan is running the fan control module monitors the current draw against fan speed. If the current draw is over the limit for more than 10 seconds, the fan control module disconnects the power from the fan motor and notifies the PCM of the fault. After 40 seconds, the fan control module starts the motor again.

The fan control module incorporates a temperature sensor to prevent damage caused by excessive heat at high ambient temperatures. Operation of the fan control module is discontinued if the temperature reaches 135°C (275°F). Operation resumes when the temperature decreases to 120°C (248°F).

If a fault occurs with the ignition signal or the PWM signal, the fan control module adopts the following fan speeds:

SIGNAL	FAULT	FAN SPEED	
		IGNITION ON	IGNITION OFF
Pulse Width Modulation (PWM)	Duty cycle implausible	Maximum	Off
Pulse Width Modulation (PWM)	Frequency out of range	Maximum	Off
Pulse Width Modulation (PWM)	Open circuit	Maximum	Off
Pulse Width Modulation (PWM)	Short circuit to battery	Maximum (provided cooling fan is not damaged)	Off
Pulse Width Modulation (PWM)	Short circuit to ground	Maximum (provided cooling fan is not damaged)	Off
Ignition	Open circuit	Off	Off
Ignition	Short circuit to battery	According to Pulse Width Modulation (PWM) duty cycle	Maximum
Ignition	Short circuit to ground	Off (PCM relay fuse may blow)	Off

CHARGE AIR COOLER

Electrical power for the charge air coolant pump is supplied from the PCM relay, located in the Engine Junction Box (EJB). When the relay is energized, it connects power from the battery to the charge air coolant pump. Operation of the charge air coolant pump is controlled by the PCM with a PWM signal. When the charge air coolant pump is running, coolant flows from the pump outlet through the charge air cooler, the charge air radiator and back to the pump inlet connection.

ACTIVE GRILLE AIR SHUTTER - NAS MARKET VEHICLES ONLY

During normal driving operation, the PCM determines vane position from the thermal condition of the vehicle, which is an output of the fan control logic.

The vane position depends on the following:

- The engine coolant temperature
- The Air Conditioning (A/C) demand
- The ambient air temperature
- The fuel temperature
- The Terrain Response® mode selection.

If vehicle speed reaches 180 km/h (112 mph) the vanes move to the fully open position. The vanes resume a calculated opening position when vehicle speed decreases to 140 km/h (87 mph).

In the case of engine cooling fan after-run, the vanes remain open. Once the fan after-run ends, the vanes close and the motor will send a signal to the PCM indicating it is ready to power down.

Calibration Mode

When the PCM shuts down, the motor loses its memory. Therefore a calibration is required every time the ignition is switched on unless the PCM has remained active between ignition off and ignition on, for example engine cooling fan after-run.

Calibration only commences after the engine has started.

The calibration process opens and closes the vanes to find the end stops and range of motion between them. This range of movement is checked and if it is within the specified limits, the cycle is passed. This cycle can take up to 16 seconds.

The software allows for a total of six calibration attempts.

If the first attempt fails, as soon as a position demand exceeds 45%, it will carry out the remaining five attempts, one after the other, until they either pass a calibration or fail all six attempts.

If the vanes pass the third calibration, for example the vanes had been frozen for the first two attempts and have since thawed out, the remaining attempts are saved for the rest of the drive cycle.

A 'Calibration Failed Fault' DTC will only be stored if the calibration fails from the first attempt and all attempts are used up.

The vanes will then be commanded to open as much as possible.

If the first calibration passes, then a 'Calibration Failed Fault' DTC cannot be set until the next drive.

NOTE:

The motor is very sensitive to voltage drops from engine cranking and may trigger a further calibration.

Jet Wash Mode

Jet wash mode allows the motor to fully open the vanes and then power down so that the radiator can be cleaned.

To activate jet wash mode:

1. Start the engine.
2. Stop the engine and turn the ignition off.
3. Turn the ignition on (do not start the engine).
4. Select Terrain Response® sand mode.
5. Turn the ignition off.

This sequence prevents to enter jet wash mode accidentally when the ignition is turned off in sand mode.

The vanes will default to fully open whether the calibration has been completed or not. (See calibration mode section above)

Once the position feedback shows that the vanes are fully open, the motor will indicate to the PCM that it is ready to power down.

Fault Diagnosis

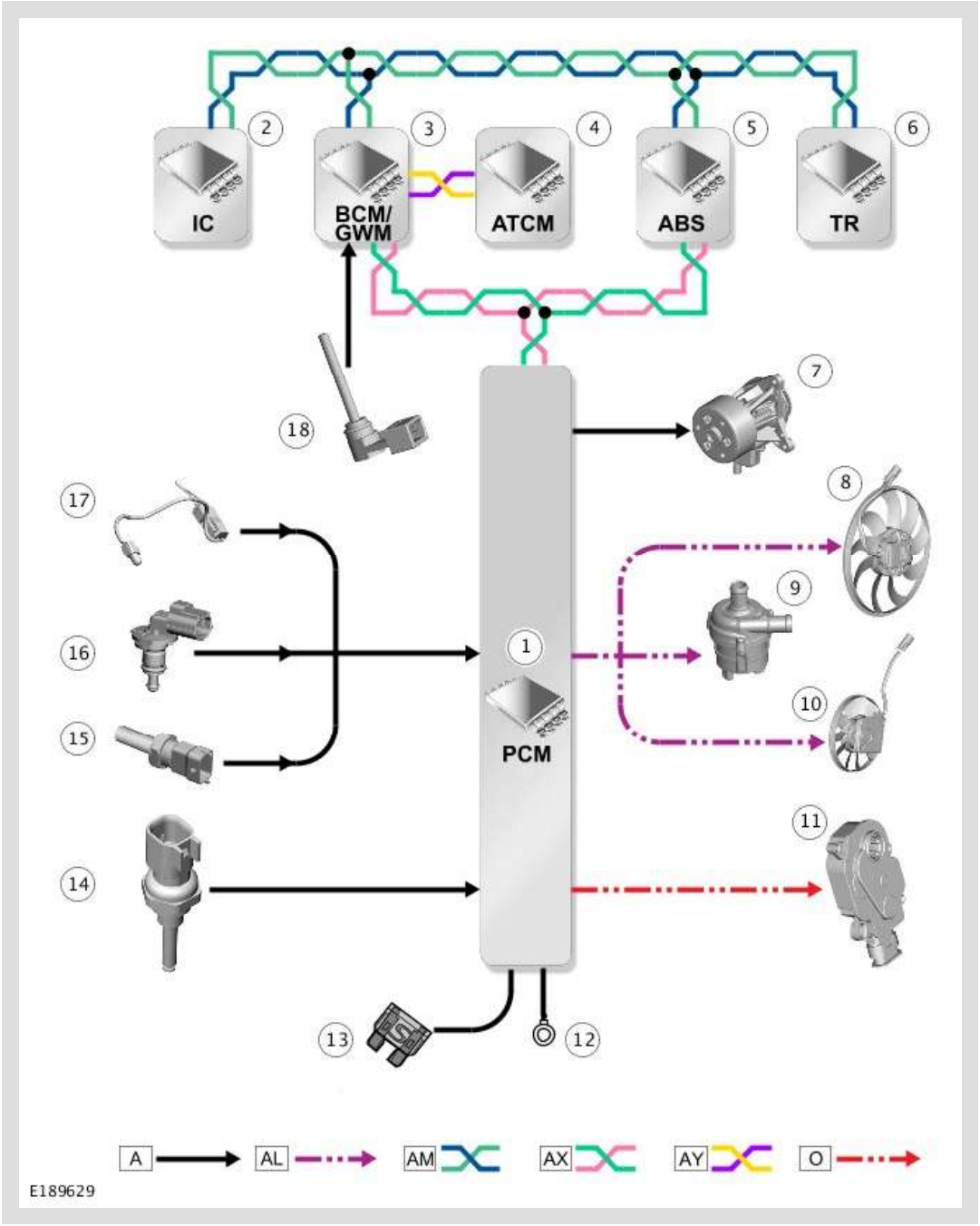
If there is a fault with the active grille air shutter, the 'Engine Over Temperature' warning is displayed in the Instrument Cluster (IC) message center. For each fault, a flag is set and after a calibrated de-bounce time, a DTC is stored in the PCM.

The following faults can be detected:

- Mechanical blockage fault – Motor encounters too much resistance and stalls. Max Torque = 0.7 - 0.8 Nm. Once blocked, the motor will try to re-calibrate up to maximum number of attempts as described in the calibration section.

- Calibration failed fault - Fault stored if all calibration attempts have failed in that drive cycle.
- Electrical fault - Motor reports an internal electrical fault.
- Supply voltage fault - Motor supply voltage falls outside the range 7.5 V - 17.5 V.
- Thermal shutdown fault - Motor circuits exceed their inbuilt temperature threshold.
- Disconnect fault - Linkage between the motor and the vanes becomes disconnected.
- Local Interconnect Network (LIN) Bus communication fault and Node detection fault - A fault with the motor, its signal wire or its supply that causes a breakdown in signals to the PCM. If the motor is still operational and only the signal wire has a short circuit/open circuit, then the motor will fail safe fully open after 10 seconds of not receiving a signal.

CONTROL DIAGRAM



A = HARDWIRED; AL = PULSE WIDTH MODULATION (PWM); AM = HIGH SPEED (HS) CONTROLLER AREA NETWORK (CAN) CHASSIS SYSTEMS BUS; AX = FLEXRAY BUS; AY = HIGH SPEED (HS) CONTROLLER AREA NETWORK (CAN) POWER MODE ZERO BUS; O = LOCAL INTERCONNECT NETWORK LIN) BUS.

ITEM	DESCRIPTION
1	Powertrain Control Module (PCM)
2	Instrument Cluster (IC)
3	Body Control Module/Gateway Module (BCM/GWM) Assembly

4	Automatic Temperature Control Module (ATCM)
5	Anti-lock Brake System (ABS) control module
6	Terrain Response (TR) switchpack
7	Variable coolant pump
8	Electric cooling fan - main
9	Charge air coolant pump
10	Electric cooling fan - auxiliary
11	Active grille air shutter motor - NAS market vehicles only
12	Ground
13	Power supply
14	Cylinder head temperature sensor
15	Fuel temperature sensor
16	Engine Coolant Temperature (ECT) sensor
17	Ambient Air Temperature (AAT) sensor
18	Coolant level sensor

PUBLISHED: 31-JUL-2012
2017.0 DISCOVERY (LR), 303-03

ENGINE COOLING - TDV6 3.0L DIESEL

DIAGNOSIS AND TESTING

PRINCIPLE OF OPERATION

For a detailed description of the engine cooling system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Engine Cooling (303-03A, 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.

1. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

MECHANICAL	ELECTRICAL
▪ Coolant leaks ▪ Coolant hoses	▪ Fuses ▪ Harnesses

▪ Coolant expansion tank ▪ Radiator ▪ Heater core ▪ Active grill air shutter ▪ Accessory drive belt ▪ Cooling fan	▪ Loose or corroded connector(s) ▪ Engine coolant temperature sensor

1. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

1. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

SYMPTOM CHART

SYMPTOM	POSSIBLE CAUSES	ACTION
Coolant loss	▪ Hoses ▪ Hose connections ▪ Radiator ▪ Water pump ▪ Heater core ▪ Gaskets ▪ Engine casting cracks ▪ Engine block core plugs	Carry out a visual inspection. If there are no obvious leaks, carry out a cooling system pressure test. Rectify any leaks as necessary. Refer to the relevant section of the workshop manual
Overheating	▪ Low /contaminated coolant ▪ Thermostat ▪ Cooling fan ▪ Engine coolant temperature sensor ▪ Restricted air flow over the radiator ▪ Active grill air shutter	Check the coolant level and condition. Carry out a cooling system pressure test. Rectify any leaks as necessary. Check the thermostat and rectify as necessary. Check the cooling fan operation, make sure the cooling fan rotates freely. Check for obstructions to the air flow over the radiator. Check the active grill air shutter operation using the manufacturer approved service tool

Engine not reaching normal temperature	▪ Thermostat ▪ Cooling fan	Check the thermostat operation. Check the cooling fan operation, make sure the cooling fan is not seized

DTC INDEX

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - TDV6 3.0L Diesel, DTC: Engine Control Module (100-00, Description and Operation).

PUBLISHED: 21-NOV-2016
2017.0 DISCOVERY (LR), 303-03

ENGINE COOLING - TDV6 3.0L DIESEL

SPECIFICATIONS

Fluid

NOTE:

Coolant must be collected into a clean container and can be reused if not contaminated.

DESCRIPTION	SPECIFICATION
Land Rover premium cooling system fluid	Havoline XLC
Coolant concentration	50%
Vehicles with block heater coolant concentration	60%

Capacity

ITEM	LITRES
Vehicles fitted with 2 zone air conditioning (A/C)	9.4
Vehicles fitted with 2 zone A/C and fuel fired booster heater (FFBH)	9.6
Vehicles fitted with 4 zone A/C	11.2
Vehicles fitted with 4 zone A/C and FFBH	11.4
HEV battery circuit	1.5

DESCRIPTION	NM	LB-FT	LB-IN
Coolant outlet assembly bolts	10	7	88
Coolant pump bolts	10	7	88
Coolant pump pulley bolts	25	18	221

Thermostat housing bracket to fan shroud bolt	5	4	44
Thermostat housing bolts	5	4	44
A/C pipes to condenser nuts	8	6	71
A/C pipe to fan shroud bolt	7	5	62
Charge air cooler pipe connector to fan shroud bolt	8	6	71
Charge air cooler hose clamp to fan shroud bolt	7	5	62
Engine cooling module bolts	15	11	133
Cooling fan shroud bolts	7	5	62
Transmission fluid cooler to fan shroud bolt	10	7	88
Coolant bleed screw(s)	3	2	27
Radiator retaining bush	15	11	133
Charge air radiator bolts	4	3	35

PUBLISHED: 08-MAY-2017
2017.0 DISCOVERY (LR), 303-03

ENGINE COOLING - TDV6 3.0L DIESEL

RADIATOR (G1947908)

REMOVAL AND INSTALLATION

26.40.01	RADIATOR ASSEMBLY - RENEW	3000 CC, TDV6	1.7	USED WITHINS

REMOVAL

CAUTION:

Before disconnecting any components, make sure the area is clean and free from foreign material. When disconnected all openings must be sealed.

NOTE:

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

1.

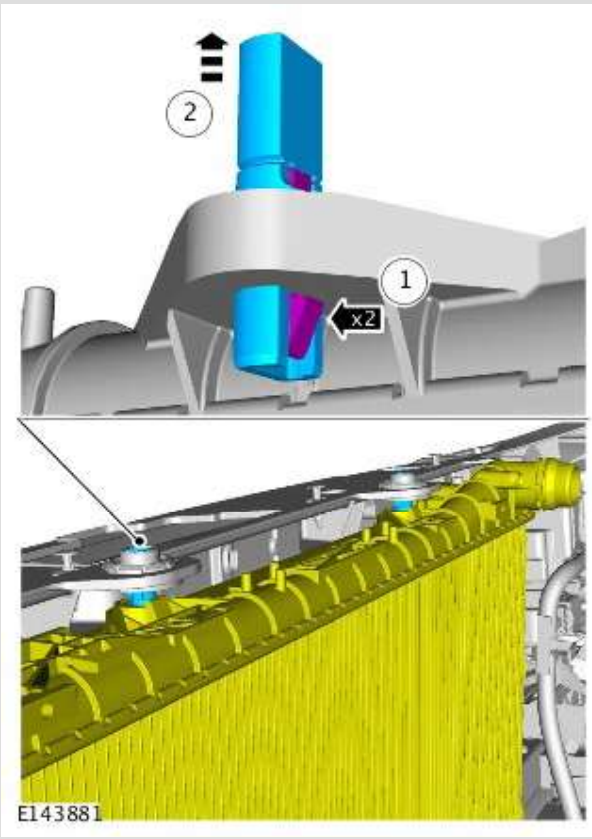
WARNING:

Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

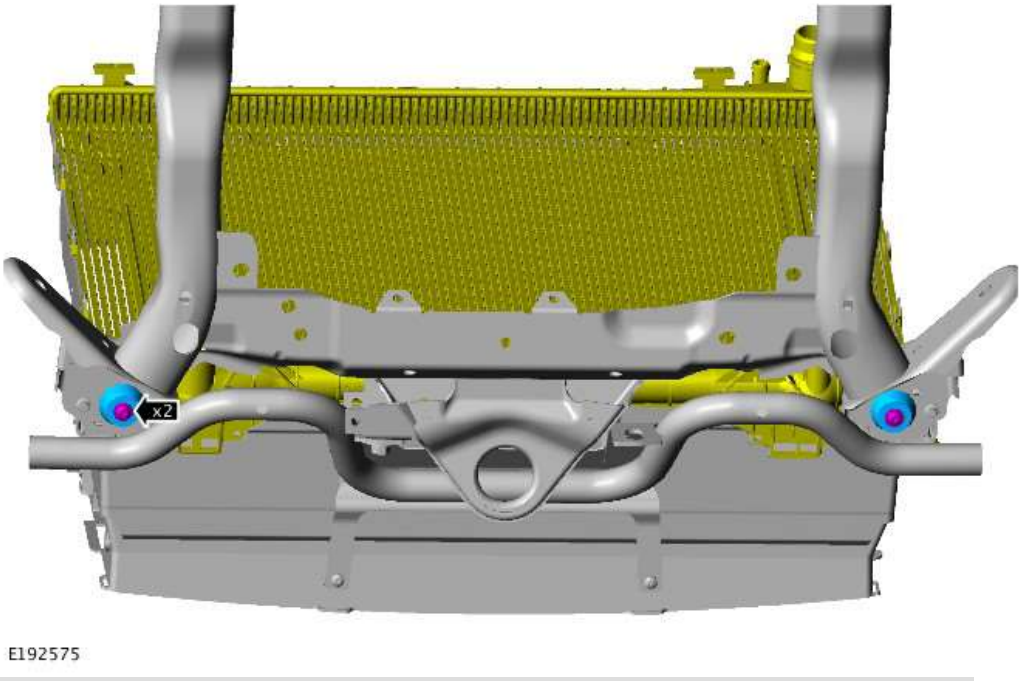
2. Drain the coolant system.
Refer to: Cooling System Partial Draining and Vacuum Filling (303-03 Engine Cooling - TDV6 3.0L Diesel, General Procedures).

3. Remove the cooling fan.
Refer to: Cooling Fan (303-03 Engine Cooling - TDV6 3.0L Diesel, Removal and Installation).

4. 

Remove the locking tabs.

5.

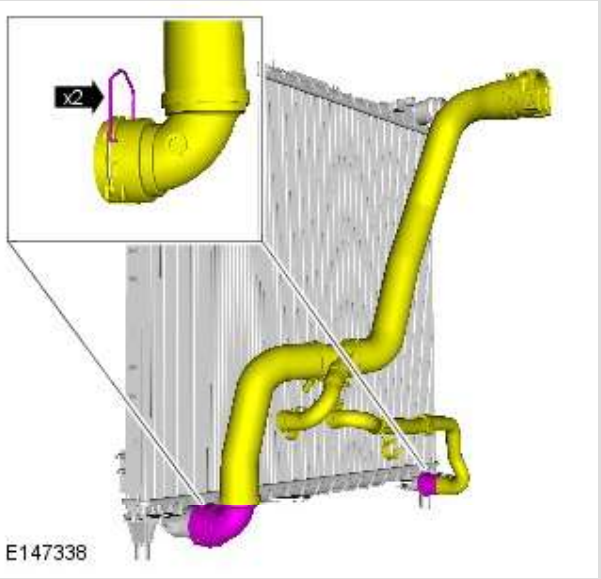


Remove the 2 bolts securing the cooling pack to the front subframe assembly.

6.

CAUTION:

Be prepared to collect escaping coolant.

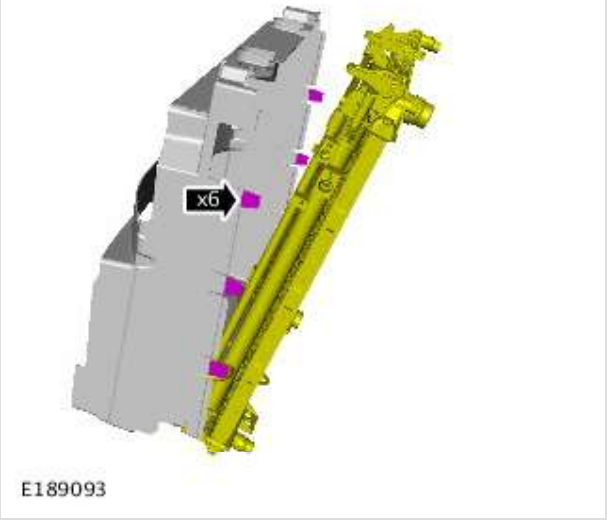


Release the coolant pipes.

7.

CAUTION:

Always protect the cooling pack elements to prevent accidental damage.

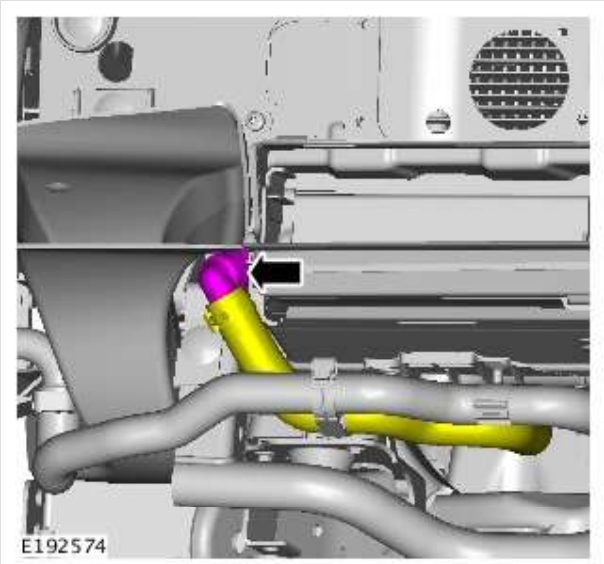


Release the six clips securing the radiator assembly into the shroud.

8.

CAUTION:

Be prepared to collect escaping coolant.

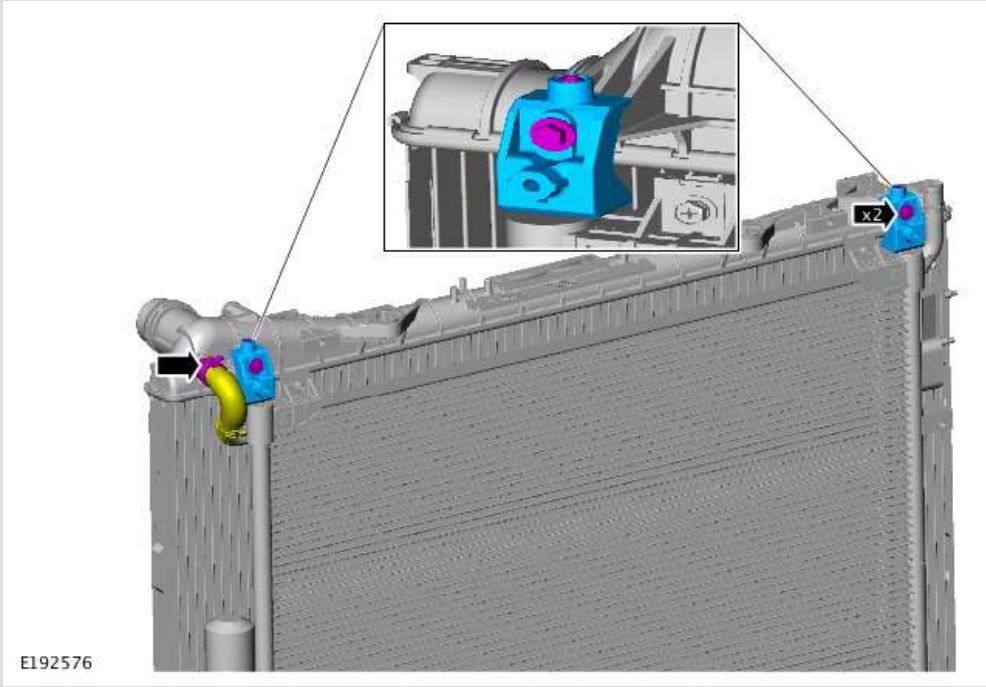


Tilt the cooling module to allow access and release the front lower coolant pipe.

9.

CAUTION:

Be prepared to collect escaping coolant.



- Release the coolant pipe.
- Release the brackets.

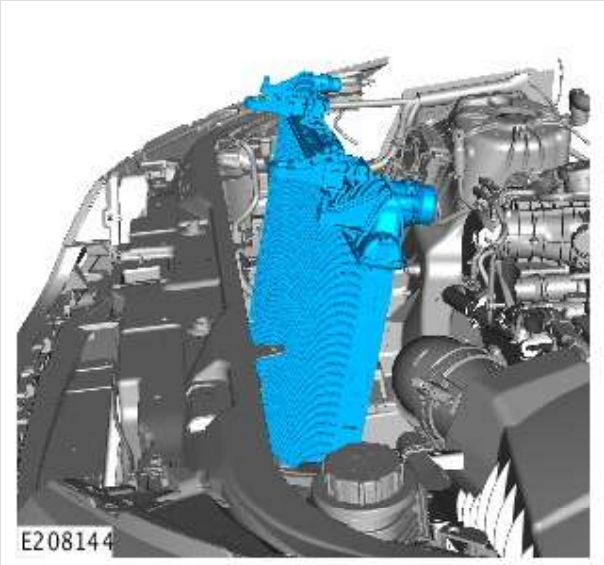
10.

CAUTION:

Always protect the cooling pack elements to prevent accidental damage.

NOTE:

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



Remove the radiator assembly from the vehicle.

11.

NOTE:

Repeat the procedure for the other side.

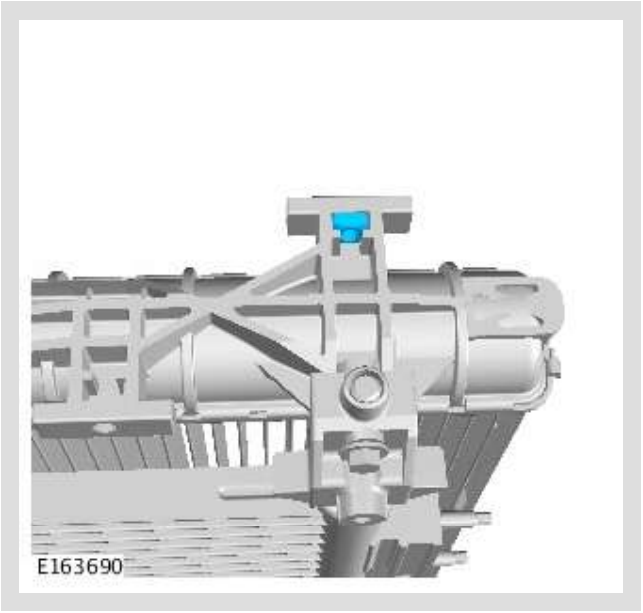
Remove the threaded inserts from the radiator assembly.

INSTALLATION

1.

NOTE:

Only carry out this step if previously removed.



Install the threaded inserts into the correct position on the radiator assembly.