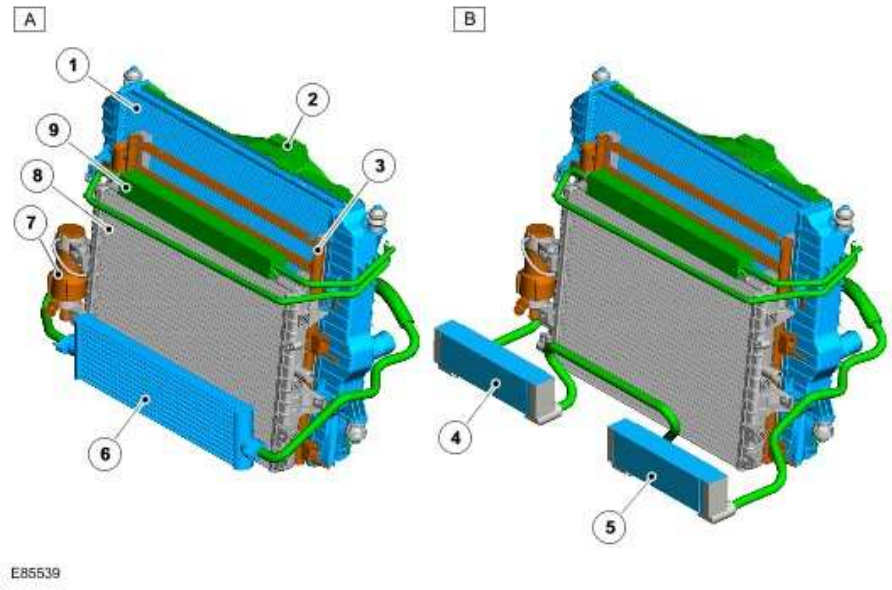
Engine Cooling - 4.2L SC V8 - AJV8

Authoring Template

COMPONENT LOCATION



Item	Part Number	Description
A		Single engine oil cooler variant
B		Twin engine oil cooler variant
1		Radiator assembly
2		Cooling fan shroud
3		Condenser
4		Right Hand (RH) engine oil cooler
5		Left Hand (LH) engine oil cooler
6		Engine oil cooler
7		Intercooler pump
8		Intercooler

9		Power steering oil cooler

OVERVIEW

The cooling system employed for the supercharged engine is very similar to the normally aspirated engine. The system is of the pressure relief by-pass type, which allows coolant to circulate around the engine and the heater circuit while the thermostat main valve is closed. The primary function of the cooling system is to maintain the engine within an optimum temperature range under changing ambient and engine operating conditions. Secondary functions are to provide heating for the passenger compartment and cooling for the transmission fluid and engine oil.

The cooling system comprises:

- A cooling module including common radiator, condenser, transmission oil cooler with additional water cooled, intake charge air radiator
- A passenger compartment heater matrix
- An engine driven coolant pump
- An electric coolant pump
- A thermostat
- An degas tank
- An electro-viscous cooling fan
- Transmission oil pipes
- Single or twin engine oil coolers
- Two charge air cooler assemblies (heat exchangers)
- Connecting hoses and pipes

ENGINE COOLING SYSTEM

A centrifugal pump mounted on the front of the engine and driven by an ancillary drive 'polyvee' belt circulates the coolant. The engine driven coolant pump circulates coolant through the cylinder block and cylinder heads via a chamber located in the 'vee' of the engine. Having passed through the engine the coolant returns to the thermostat housing. The coolant then progresses down the 'top hose' to the heater pipe. The heater pipes lead to the bulkhead and return to the engine side of the thermostat.

The engine contains a conventional thermostat, which is positioned such that the wax's temperature is controlled by both the coolant from the radiator and the bypass. This results in the thermostat being able to vary its opening temperature dependant on ambient conditions. The thermostat housing also contains a sprung loaded valve, which limits the amount flow using the bypass. This means that the engine can run without coolant flowing through the bypass temporarily, to improve heater performance.

The engine radiator is a cross-flow type with an aluminium matrix and has a drain tap on the lower RH rear face. There is an additional charge air radiator, located in front of the engine radiator, to support the water charge air coolers (heat exchangers) on the engine.

The coolant for the charge air cooling is driven by an electric pump at constant speed and is mounted

on the engine radiator end tank. This circuit shares the engine coolant via a vortex connection, in the engine to radiator hose. The lower engine radiator mountings are located part way up the end tanks. The mountings are fitted with rubber bushes, which sit on the upper chassis rails. The radiator upper is mounted by pins, which are pushed through rubber bushes mounted in the front end carrier above the radiator. The radiator also incorporates 2 connections for the transmission oil pipes.

The top and bottom hoses are mounted to the inlet and outlet sides of the thermostat housing.

The degas tank is fitted forward of the LH suspension turret in the engine compartment. The degas tank allows for the expansion of the coolant as the engine gets hot and also supplies the engine with coolant as the coolant in the engine contracts. The tank also allows any air trapped in the coolant to be removed.

The liquid cooled transmission fluid cooler is located behind the engine cooling radiator and is connected to the transmission via flexible hoses and metal pipes

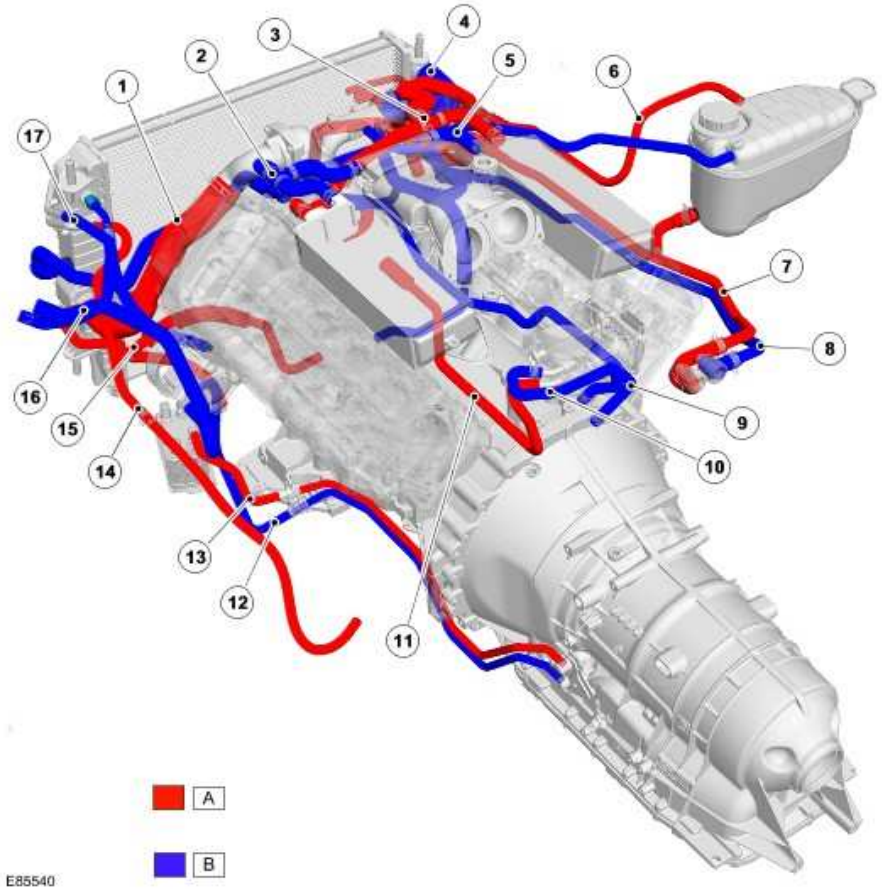
There are 2 variations of engine oil coolers available. One variant uses a single cooler located in front of the intercooler, whereas the second variant utilizes 2 coolers, 1 for each cylinder bank, also located in front of the intercooler.

The viscous fan unit is electronically controlled by the ECM to optimise fan speed for all operating conditions.

NOTE:

> If the electrical connections to the viscous fan are disconnected the fan will 'idle' and overheating may result. The ECM stores the appropriate fault codes in this case.

ENGINE COOLING SYSTEM OPERATION



Item	Part Number	Description
A		Hot coolant
B		Cold coolant
1		Radiator bottom hose
2		Hose assembly - Feed from intercooler radiator to LH and RH intercoolers
3		Hose assembly - Return from LH and RH intercoolers to intercooler radiator, via electric pump
4		Radiator top hose

5		Hose - Feed from RH intercooler to supercharger
6		Hose - Return from degas tank to intercooler radiator
7		Heater return pipe
8		Heater feed pipe
9		Hose - EGR coolant inlet
10		Hose - Feed to throttle heating assembly
11		Hose - Return from throttle heating assembly
12		Transmission oil cooler feed pipe
13		Transmission oil cooler return pipe
14		Hose - Power steering cooler return
15		Transmission oil cooler return pipe
16		Hose - Power steering cooler to reservoir feed
17		Hose - Power steering pump feed

When the engine is running the coolant pump is driven by the ancillary drive belt. This forces coolant to circulate around the engine and heater, while the thermostat and bypass valve are shut. As the temperature and pressure increases the bypass valve is forced open allowing coolant to circulate through the bypass valve. When the temperature reaches 82°C (180°F) the main thermostat begins to open allowing coolant to circulate through the main radiator. As the thermostat progressively opens (fully open at 95°C (203°F)), the bypass valve progressively closes forcing any coolant through the heater or radiator. Once coolant is allowed to circulate through the radiator, the transmission fluid and the engine oil coolers begin to receive coolant flow.

The increased coolant volume, created by heat expansion, is directed to the expansion tank through a bleed hose from the top of the radiator. The expansion tank has an outlet hose, which is connected into the coolant circuit. This outlet hose returns the coolant to the system when the engine cools.

Coolant flows through the radiator from the top right hand tank to the bottom left hand tank and is cooled by air passing through the matrix. The temperature of the cooling system is monitored by the ECM via the Engine Coolant temperature (ECT) sensor located in the cylinder head. The ECM uses signals from this sensor to control the cooling fan operation and adjust fuelling according to engine temperature.

To control the cooling fan, the ECM sends a Pulse Width Modulated (PWM) signal to the cooling fan module (integral to the ECM). The frequency of the PWM signal is used by the cooling fan module to determine the output voltage supplied to the fan motor.

The ECM varies the duty cycle of the PWM signal between 0 and 100% to vary the fan speed. If the PWM signal is outside the 0 to 100% range, the cooling fan module interprets the signal as an open or short circuit and runs the fans at maximum speed to ensure the engine and gearbox do not overheat.

The ECM operates the fan in response to inputs from the ECT sensor, the transmission oil temperature sensor, the A/C switch and the A/C pressure sensor.

The speed of the cooling fan is also influenced by vehicle road speed. The ECM adjusts the speed of the cooling fans, to compensate for the ram effect of vehicle speed, using the Controller Area Network (CAN) road speed signal received from the Anti-lock Braking System (ABS) module.