

## Engine Cooling - 4.2L SC V8 - AJV8 -

### Fluids

Item	Specification
* Anti-freeze	Havoline Extended Life Coolant (XLC) or any ethylene glycol based anti-freeze containing no methanol with only Organic Acid Technology (OAT) corrosion inhibitors
Anti-freeze concentration - Will provide frost protection to -40°C (-40°F)	50%
Specific gravity of coolant at 20°C (68°F) to protect against frost down to -40°C (-40°F)	1.068
Amount of anti-freeze to use for 50% concentration	6.25 litres (11 pints) (6.6 US quarts)



**CAUTION:** No other anti-freeze should be used with Havoline Extended Life Coolant.

### Capacity

Item	Capacity
Cooling system - from dry	15.0 litres (26.4 pints) (15.8 US quarts)
Cooling system - re-fill	12.5 litres (22 pints) (13.2 US quarts)

### General Specifications

Item	Specification
Cooling system type	Pressurised, thermostatically controlled with remote header tank
Radiator	Cross flow with integral transmission fluid cooler
Charge air cooler radiator	Cross flow
Expansion tank	Remote - fitted with a bleed screw and low coolant level sensor
Pressure cap rating	110 kPa (1.1 bar) (16 lbf/in <sup>2</sup> )
<b>Thermostat:</b>	
Starts to open	88° C (190° F)
Fully open	95° C (203° F)
Cooling fan	Engine driven, viscous coupled with electronic control
Cooling fan diameter	500 mm (19.7 in)
Direction of rotation	Anti-Clockwise when viewed from front of engine
Coolant pump	Centrifugal flow impellor, belt driven from crankshaft
Charge air cooler coolant pump	Electrical coolant pump

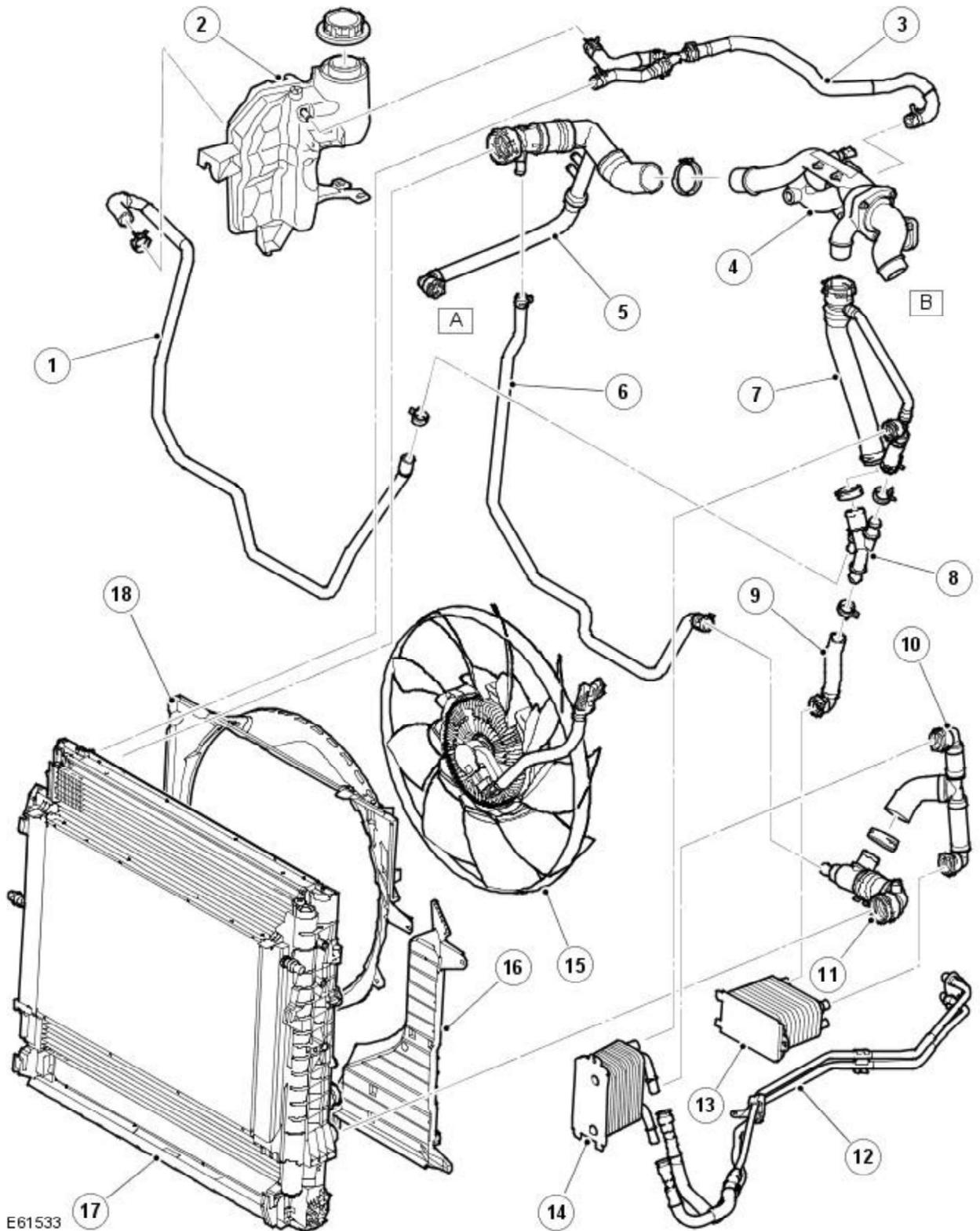
### Torque Specifications

Description	Nm	lb-ft
Coolant pump bolts	10	7
Coolant pump pulley bolts	25	18
Coolant expansion tank bolts	10	7
A/C refrigerant line to condenser bolt	10	7
Cooling fan to viscous coupling bolts	10	7
Cooling fan assembly	65	48
Thermostat housing bolts	10	7
Coolant manifold Torx screws	10	7
Power steering fluid reservoir bolts	10	7

# Engine Cooling - 4.2L SC V8 - AJV8 - Engine Cooling

Description and Operation

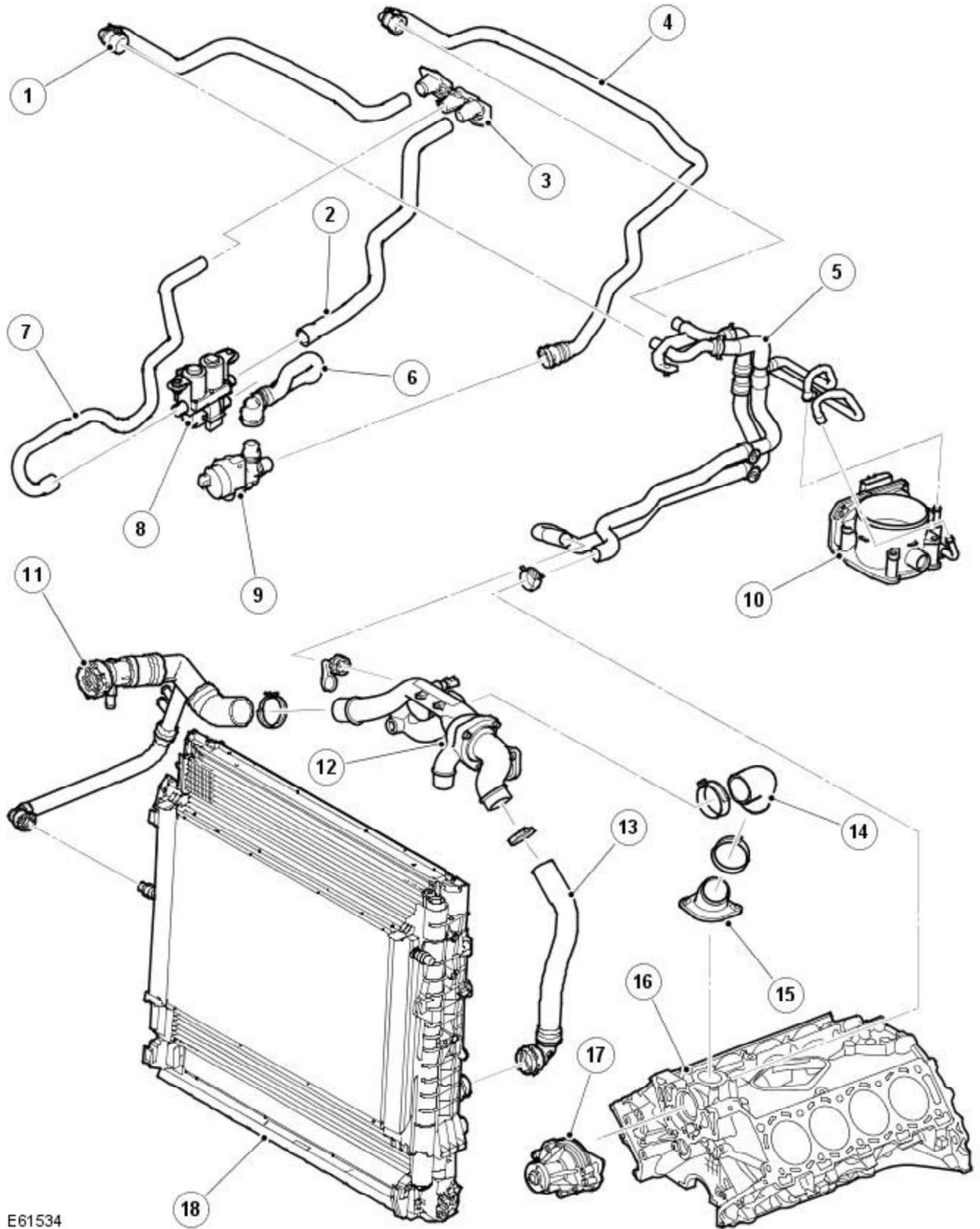
Cooling System Component Layout - Sheet 1 of 3



E61533

<b>Item</b>	<b>Part Number</b>	<b>Description</b>
A	-	Connection to charge air cooler
B	-	Connection to bottom hose
1	-	Hose assembly, expansion tank
2	-	Expansion tank
3	-	Hose, radiator to expansion tank
4	-	Thermostat housing
5	-	Hose, engine radiator
6	-	Hose, top hose to Oil Cooler Mixer Valve (OCMV)
7	-	Hose, thermostat housing to four-way connector
8	-	Four-way connector
9	-	Hose, four-way connector to Engine Oil Cooler (EOC)
10	-	Hose, OCMV to EOC and Transmission Oil Cooler (TOC)
11	-	OCMV
12	-	Transmission cooling pipes
13	-	EOC
14	-	TOC
15	-	Engine cooling fan
16	-	Mounting plate
17	-	Radiator assembly (power assisted steering cooler, engine and charge air)
18	-	Shroud - viscous fan

Cooling System Component Layout - Sheet 2 of 3

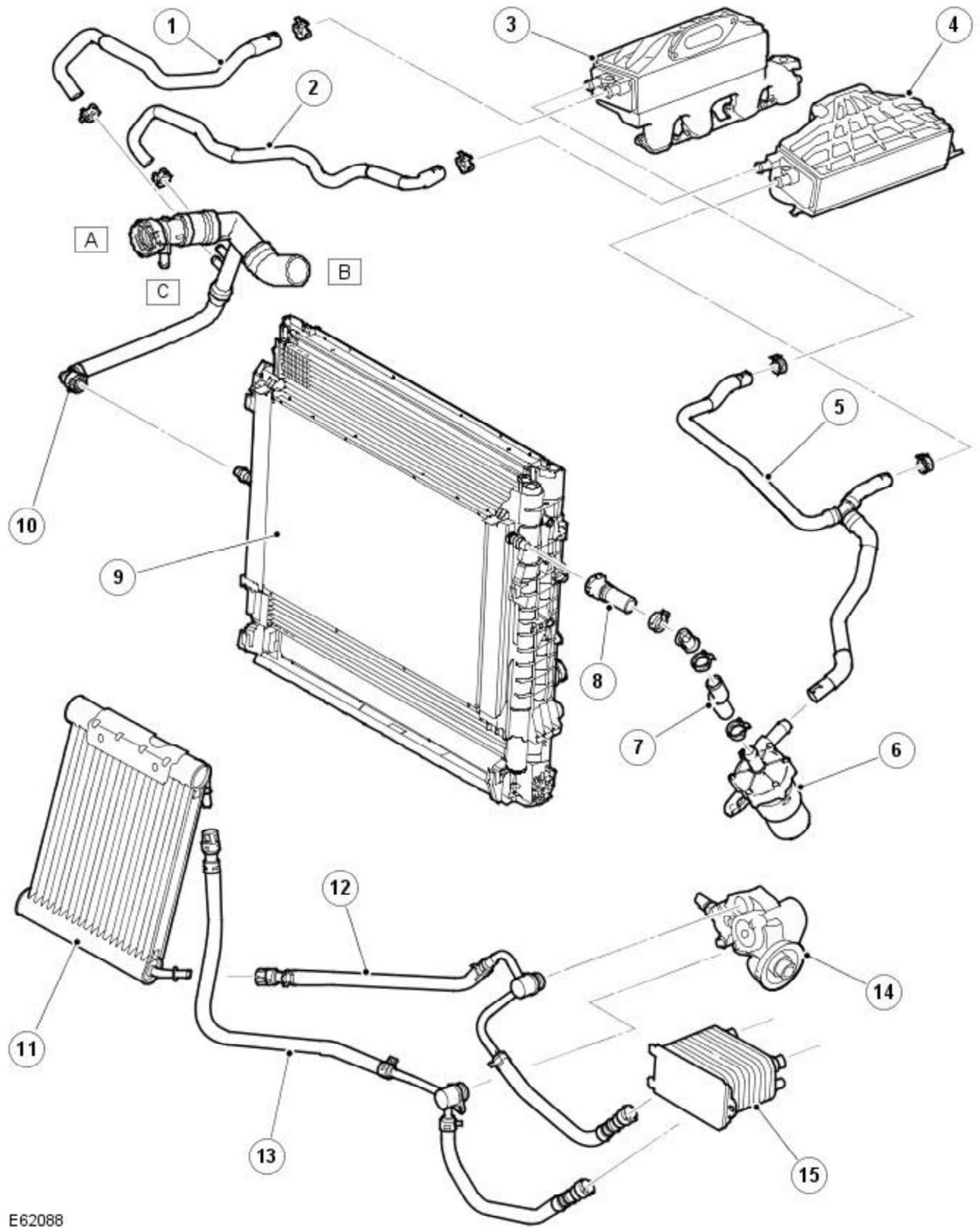


E61534

Item	Part Number	Description
1	-	Hose, heater return (vehicles without Fuel Fired Booster Heater (FFBH))
2	-	Hose, heater inlet

3	-	Bulkhead connections
4	-	Hose, coolant feed
5	-	Hose, heater feed and return
6	-	Hose, auxiliary coolant pump to temperature control valve
7	-	Hose, heater inlet
8	-	Temperature control valve
9	-	Auxiliary coolant pump
10	-	Electric throttle
11	-	Hose, top
12	-	Thermostate housing/engine outlet
13	-	Hose, bottom
14	-	Hose, coolant outlet elbow
15	-	Coolant outlet elbow
16	-	Cylinder block
17	-	Coolant pump
18	-	Radiator assembly, engine and charge air cooler

Cooling System Component Layout - Sheet 3 of 3



E62088

Item	Part Number	Description
A	-	Top hose connection
B	-	Connection to thermostat housing

C	-	Connection to OCMV
1	-	Hose, RH intercooler return
2	-	Hose, LH intercooler return
3	-	RH intercooler
4	-	LH intercooler
5	-	Hose, LH and RH intercooler feed
6	-	Electric coolant pump
7	-	Hose, electric coolant pump to radiator connector
8	-	Radiator connector
9	-	Radiator assembly, engine and charge air cooler
10	-	Hose, charge air cooler to top hose
11	-	Air blast EOC
12	-	Hose, air blast EOC feed to engine and TOC
13	-	Hose, air blast EOC return from engine and TOC
14	-	EOC
15	-	TOC

## GENERAL

The cooling system employed 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 radiator

A charge air cooler

A passenger compartment heater matrix

An engine driven coolant pump

An electric coolant pump

A thermostat

An expansion tank

An electro-viscous cooling fan

An Oil Cooler Mixer Valve (OCMV)

Connecting hoses and pipes

Oil to coolant Transmission Oil Cooler (TOC) and Engine Oil Coolers (EOC)

Air blast EOC

Electric condenser fan (hot markets only).

## ENGINE COOLING SYSTEM

The coolant is circulated by a centrifugal pump mounted on the front of the engine and driven by an ancillary drive 'polyvee' belt. The 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 wax thermostat, which is positioned such that the wax's temperature is controlled by both the coolant from the radiator and the bypass. The thermostat housing also contains a sprung loaded valve, which limits the amount of coolant using the bypass. At low engine speeds most coolant is diverted through the heater. At higher engine speeds the bypass opens to protect the heater matrix from higher pressures and flow rates. This means the engine can run without coolant flowing through the bypass temporarily, to improve heater performance.

The radiator is a cross-flow type with an aluminium matrix and has a drain tap on the lower right-hand rear face. The lower radiator mountings are located part way up the end tanks. The mountings are fitted with rubber bushes, which sit on plastic mounts clipped into the chassis rails. The radiator upper is mounted by pins, which are pushed through the bonnet locking platform above the radiator assembly.

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

The coolant expansion tank is fitted behind the RH side headlight in the engine compartment. The tank allows any air trapped in the coolant to be removed.

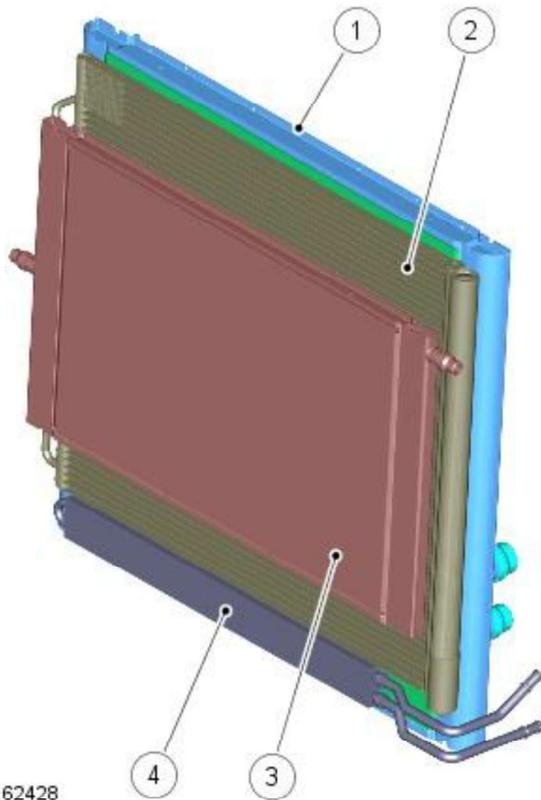
The liquid cooled Transmission Oil Cooler (TOC) is mounted to the fan cowl. It is fed coolant from the sub-cooled section of the radiator, which is controlled by the Oil Cooler Mixer Valve (OCMV).

The liquid cooled Engine Oil Cooler (EOC) is fed coolant from the sub-cooled section of the radiator, which is controlled by the OCMV. It is also mounted to the fan cowl below the TOC. Both the TOC and the EOC are connected in parallel.

An additional air blast engine oil cooler is mounted in the RH front wheel arch for enhanced oil cooling performance at high speeds (supercharged derivatives only).

The OCMV is a 2-stage valve which controls the heating and cooling of the engine and transmission oils. The operation of the first stage is to warm up both oils from cold to improve emissions and driveability. The second stage is fully operational once the coolant temperature reaches 91° C (196°F) and allows cooling of both oils (starts to open at 84°C (183°F)).

The charged air out of the supercharger is cooled using water to air intercoolers integral with the inlet manifold, one for each bank. 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. The coolant for these intercoolers is cooled using a radiator positioned in front of the air conditioning condenser. The intercooler circuit shares the engine coolant via a vortex connection situated in the radiator top hose.



Item	Part Number	Description
1	-	Engine radiator
2	-	Condenser
3	-	Charge air radiator
4	-	Power assisted steering cooler

- NOTE: The engine radiator and the intercooler circuits are filled using the same expansion tank.

For additional airflow through the radiator matrix, particularly when the vehicle is stationary or slow moving, there is an engine driven electro-viscous unit. This unit functions as a normal viscous fan, but with electronic control over the level of engagement of the viscous clutch. The Engine Control Module (ECM), which determines the required fan speed, controls the level of clutch engagement. The ECM determines engagement based on the coolant, ambient and transmission oil temperatures and Air Conditioning (A/C) system pressure. The fan is mounted using a RH thread (LH thread for naturally aspirated derivatives).

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. A 'check engine light' will also be displayed on the instrument cluster.