ENGINE COOLING - OPERATION

Coolant flow

Engine warm up - up to 99MY

When the engine is started from cold, the thermostat, integral in the housing, prevents any coolant circulation through the radiator by closing off the supply from the radiator bottom hose.

During engine warm up, the water pump moves coolant around the cylinders to the rear of the engine block and along the galleries in both cylinder banks. At the rear of the cylinder block the coolant rises through a large port in both cylinder head/block joint faces to the inlet manifold.

From the manifold, the coolant flow is divided between the by-pass hose, the heater feed hose and the plenum chamber feed pipe. The heater feed hose supplies the heater matrix, located within the distribution unit of the heating and ventilation system. The coolant is then carried, via the heater return hose, back to the thermostat housing to complete the cycle.

The heater matrix acts as a heat exchanger reducing coolant temperature as it passes through the matrix. With the thermostat closed and coolant flowing around the by-pass circuit, the cooling system is operating at maximum heater performance.

The plenum chamber is heated by a flow of coolant through the feed pipe from the inlet manifold. A bleed pipe returns the coolant from the plenum chamber across the engine to the expansion tank.

Engine hot - up to 99MY

When normal engine running temperature is reached, the main valve of the thermostat opens and a secondary valve closes the bypass port. With the thermostat open, coolant is circulated through the top hose to the radiator.

The air flowing between the tubes cools the coolant as it passes through the radiator. A controlled flow of the lower temperature coolant is drawn from the base of the radiator, through the bottom hose, by the water pump and blended with hot coolant returning from the heater matrix. Coolant circulation through cylinder block and cylinder heads to the heater matrix and plenum chamber remains the same.

Coolant is drawn from the base of the radiator, through the bottom hose, by the water pump. Coolant circulation through the cylinder block and cylinder heads to the heater matrix and plenum chamber remains the same.

An integral bleed pipe connects the top of the radiator to the expansion tank and aids bleeding of air from the coolant system. The expansion tank cap contains a pressure valve which allows excessive pressure and coolant to vent to the overflow pipe if the system has been overfilled.

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During engine warm up, the water pump moves coolant around the cylinders to the rear of the engine block and along the galleries in both cylinder banks. At the rear of the cylinder block the coolant rises through a large port in both cylinder head/block joint faces to the inlet manifold.

From the manifold, the coolant flow is divided between the outlet pipe and the top hose by-pass connection to the thermostat housing, the heater inlet pipe and hose and the throttle housing inlet hose.

The heater inlet pipe and hose supply the heater matrix, located within the distribution unit of the heating and ventilation system. The coolant is then carried, via the heater return hose and pipe, back to the thermostat housing to complete the cycle.

The heater matrix acts as a heat exchanger reducing coolant temperature as it passes through the matrix. With the thermostat closed and coolant flowing around the by-pass circuit, the cooling system is operating at maximum heater performance.

The throttle housing inlet hose allows coolant to flow from the inlet manifold to the plate attached to the bottom of the throttle housing. A return pipe directs coolant flow from the throttle housing to the expansion tank.

Engine hot - from 99MY

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The air flowing between the tubes cools the coolant as it passes through the radiator. A controlled flow of the lower temperature coolant is drawn from the base of the radiator, through the bottom hose, by the water pump and blended with hot coolant returning from the heater matrix. Coolant circulation through the cylinder block and cylinder heads to the heater matrix and throttle housing remains the same.

A bleed pipe connects the top of the radiator to the expansion tank and aids bleeding of air from the coolant system. The expansion tank cap contains a pressure valve which allows excessive pressure and coolant to vent to the overflow pipe if the system has been overfilled.

Viscous fan

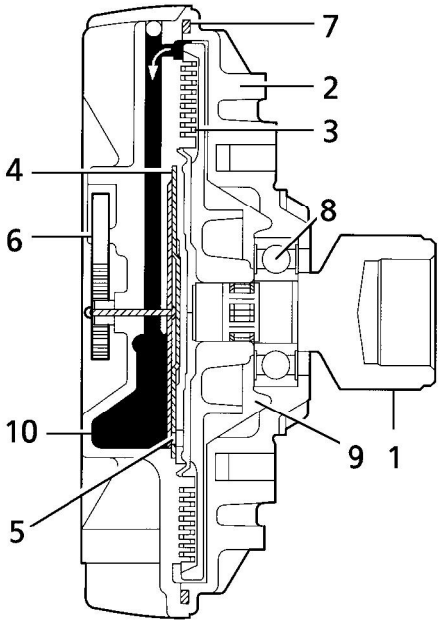
There are two main components of the viscous fan drive : An input (drive) member consisting of a threaded shaft passing through a bearing into the clutch plate and secured to the water pump. An output (driven) member comprises the main body to which the fan attaches, with the temperature sensing mechanism (bi-metal coil) and pump plates.

The fan drive only has to be engaged periodically, between 5% and 10% of the time during normal driving conditions, because usually the vehicle is cooled by ram air.

A bi-metal coil senses air temperature behind the radiator. When a pre-determined temperature is reached, the coil opens a valve which allows fluid to enter the drive area. Centrifugal force circulates the fluid to the annular drive area. There are two sets of annular grooves, one in the drive clutch and the other in the drive body, a specific clearance being provided between the two sets of grooves. When this clearance is filled with viscous fluid a shearing action, caused by the speed differential between the two drive components, transmits torque to the fan. The fluid is thrown to the outside of the unit by centrifugal force from where it is then re-circulated to the reservoir via the pump plate adjacent to the drive member.

If the engine speed is increased, the amount of slip will also increase to limit the maximum fan speed.

Viscous unit disengaged (engine at normal operating temperature)



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1. Input (drive) member
2. Output (driven) member
3. Running clearance
4. Pump plate
5. Valve (closed)
6. Sensing mechanism (bi-metal coil)
7. Fluid seal
8. Bearing,input member
9. Fluid chamber
10. Fluid reservoir