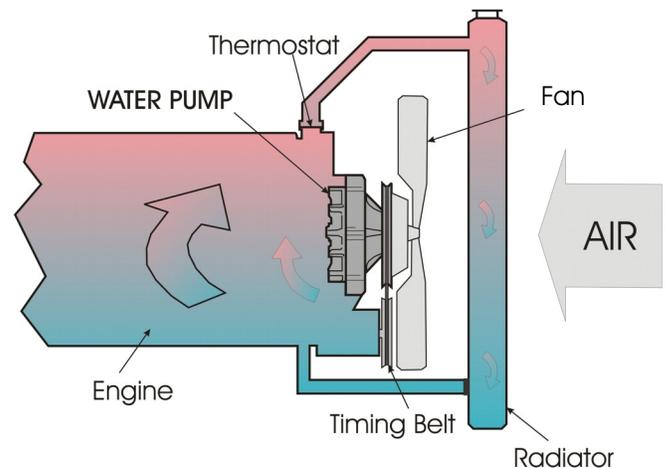


# How a Cooling System Works



The cooling system is a system of parts and fluid that work together to control an engine's operating temperature for optimal performance. The system is made up of passages inside the engine block and heads, a water pump and drive belt to circulate the coolant, a thermostat to control the temperature of the coolant, a radiator to cool the coolant, a radiator cap to control the pressure in the system, and hoses to transfer the coolant from the engine to the radiator.

The liquid that flows through a cooling system, antifreeze, or commonly referred to as **coolant**, withstands extreme hot and cold temperatures and contains rust inhibitors and lubricants to keep the system running smoothly.



Coolant follows a circulation path that begins with the **water pump**. The water pump's impeller uses centrifugal force to draw coolant from the radiator and push it into the engine block. Pumps are usually fan, serpentine timing belt, or timing chain driven. Nowadays, they may even be driven electrically. If the water pump experiences a leak from the seal, a cracked housing, broken impeller or a bearing malfunction, it can compromise the entire cooling system, causing the vehicle to overheat.

As coolant flows through the system, it picks up heat from the engine before arriving at the **thermostat**. The thermostat is a valve that measures the temperature of the coolant and opens to allow hot fluid to travel to the radiator. If the thermostat becomes 'stuck' and quits working, it will affect the entire cooling system.

Once released by the thermostat, hot coolant travels through a hose to be cooled by the **radiator**. The antifreeze passes through thin tubes in the radiator. It is cooled as air flow is passed over the outside of the tubes. Depending upon the speed of the vehicle, airflow is provided by the vehicle's movement down the road (ram air effect) and/or cooling fans. Radiator restrictions can compromise its ability to transfer heat. These can be either external air flow or internal coolant flow restrictions. A malfunctioning electric cooling **fan** or **fan clutch** can limit air flow across the radiator. Check/replace the fan clutch...the life expectancy of water pumps and fan clutches are about the same and share a common shaft. A failed fan clutch can cause severe damage to the water pump.

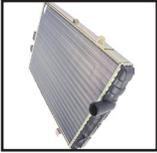
As coolant temperature increases, so does the pressure in the cooling system. This pressure is regulated by the **radiator cap**. Correct system pressure is required for proper water pump seal lubrication. Increasing the cooling system pressure raises the boiling point of the coolant. Each one pound of increased pressure raises the boiling point by 3°F. If the pressure builds up higher than the set pressure point, a spring-loaded valve in the cap will release the pressure. If an engine has overheated, the radiator cap and thermostat should be replaced.

It is important to regularly inspect the condition of your cooling system's **belts** and **hoses**. Soft hoses, oil soaked belts or cracked belts and hoses can have dire effects on the entire cooling system. Proper belt tension is also important.

Always refer to your manufacturer's manual to determine the recommended coolant type for your vehicle. This and the proper mixture of coolant and distilled water are the lifeblood towards keeping your system running cool. Most parts retailers now offer a solution of premixed coolant and distilled water. While it may seem like an unnecessary added expense, the cleanliness of the premixed solution will pay off over time.

Mineral deposits and sediments from corroded or malfunctioning parts accumulate in the cooling system. Before performing a cooling system repair, it is recommended to flush the cooling system prior to installing any new parts. This is a task made even easier by using a flush-fill kit. Failure to flush the system will contaminate the new parts being installed and could lead to premature component failure.

## Key Cooling System Components



### **Radiator:**

Heated coolant flows into the radiator inlet, is passed through a series of tubes and fins that effectively dissipate heat from the coolant.



### **Radiator Cap:**

The radiator cap is responsible for maintaining the proper amount of cooling system pressure. If the amount increases above the set pressure point, a spring-loaded valve in the cap releases extra pressure.



### **Coolant:**

As coolant, or antifreeze, flows through a hot engine, it absorbs engine heat to be dissipated in the radiator. Most coolant contains anti-rust and corrosion additives that prevent sediment build-up and premature cooling system component failure. Coolant comes in a variety of colors and formulas. Always use the formula and mixture recommended by the vehicle manufacturer.



### **Fan:**

The fan draws air through the radiator to assist in heat transfer.



### **Fan Clutch:**

The fan clutch engages as needed to draw air through the radiator. It allows the fan to free-wheel when air is not needed thus reducing horsepower loss and improving fuel efficiency. Note: not all vehicles are equipped with a fan clutch.



### **Belts:**

Whether it is a timing belt or an accessory drive belt, belts are often the driving link which turns the water pump. Timing chains sometimes perform the job of driving the water pump instead of the belt. They must always be in good condition and have the proper amount of tension to turn the pump at the correct speed and to avoid engine damage due to misaligned internal engine components.



### **Hoses:**

Hoses carry coolant to and from the radiator and heater core assembly. Hoses that are spongy to the touch or that have cracks present should always be replaced.



### **Thermostat:**

The thermostat regulates the flow of coolant into the engine keeping it at its optimum operating temperature. The thermostat is closed when the engine is cold. As the engine heats up, the thermostat opens and allows coolant from the radiator to circulate.



### **Water Pump:**

The water pump is considered the 'heart' of the cooling system and is usually located on the front of the cylinder block. A hose carries cooled coolant from the radiator to the water pump. A belt or chain turns the water pump shaft and coolant enters the center of the pump. The water pump has fan-like blades on an impeller that spins, creating centrifugal force, moving the liquid outward. Coolant is routed through the engine, cylinder heads and intake manifold by way of water jackets. The coolant then absorbs heat from the engine components and, once hot, leaves the engine and enters the radiator once again to begin the next cooling cycle.