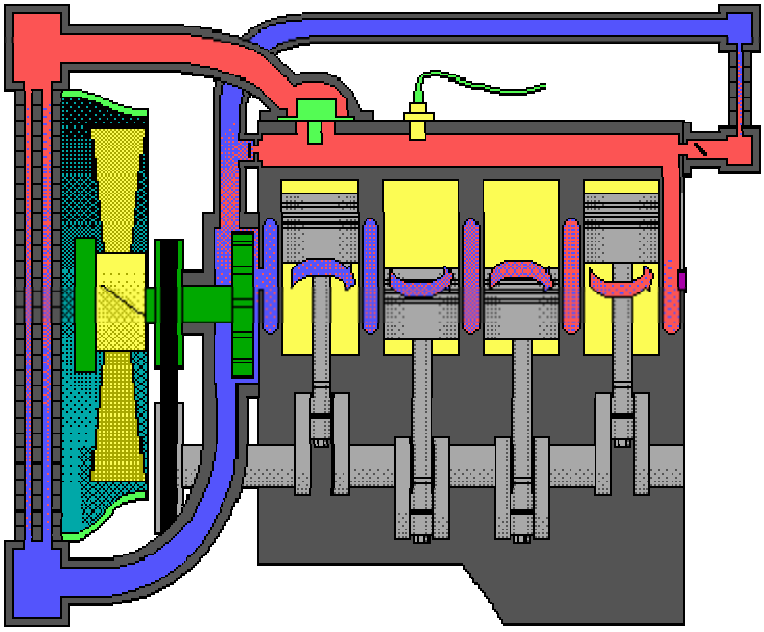
Coolant Flow Radiator And Engine Block



Below is an explanation of this system's operation

The Thermostat

Just like your body needs to warm up when you begin to exercise, your car's engine needs to warm up when it starts its exercise.

The thermostat provides control for your engine's warm-up period.

The thermostat is located between the engine and the radiator. This little temperature-sensitive spring valve stays closed during engine warm-up. When the thermostat is closed, it prevents coolant from leaving the engine and circulating through the radiator until the correct running temperature is reached. The correct running temperature for most engines is between 180 degrees F and 200 degrees F. When the right temperature is reached, the spring valve opens, allowing coolant to circulate through the radiator to be cooled-- almost like our bodies begin to perspire after we've warmed-up.

The temperature at which the thermostat is designed to open is called its rating, and may be stamped on the body. The 180 Degrees F thermostat begins to open at (you guessed it!) 180 Degrees F and is fully opened at 200 degrees F. Different engines use different temperature thermostats.

Some high range thermostats maintain engine operating temperatures above 200 degrees F. This causes the engine to burn up more pollutants and aids in emissions

control. However the range for your thermostat depends on the type of your engine, load requirements, weather, and other variables.

Most thermostats are the "pellet" type; the name comes from the wax pellet that expands as the engine coolant warms. The pellet's expansion forces the valve open. Thermostats occasionally get "stuck shut" which cuts off the cooling capacity of the radiator, at least partially. This often occurs after an engine has overheated for some other reason, such as when the water pump fails, or if a large coolant leak develops. For this reason, car makers usually place the thermostat in an accessible position.

Depending on the air temperature, the engine should take from five to fifteen minutes to warm up. If your engine takes a long time to warm up, or if it always runs hot, you might need to test the thermostat. A malfunctioning thermostat can cause excessive engine wear and waste fuel. A good time to have your thermostat checked is just before summer or winter.

Radiator Hoses

Hoses are used to connect the engine and the water pump to the radiator. Radiator hoses are made of flexible rubber; size varies depending upon the type of engine. Smaller hoses run to the heater core, these are known as (you guessed it) heater hoses.

Three types of hoses are; the common hose, the molded or shaped hose, and the accordion type hose. All of these hoses may have spiral wire in their construction. Spiral wire can be molded or inserted into the hoses, in the required shape, when the hose is constructed.

The common hose is straight and cannot take much bending before collapsing. It is made of rubber with fabric reinforcement.

Molded or shaped hoses are the same as the common hose with one exception. They will not collapse when bent, because all of the bends that they need are already molded into them.

Accordion type hoses not only put up with all kinds of severe bending, but they also absorb some of the vibration between the engine and the radiator.

Water (Coolant) Jackets

When our bodies feel cold, we put on a jacket. Our car engines wear permanent jackets for the opposite reason-- to keep cool!

The water jacket is a collection of passages within the block and head. These passages let the coolant circulate around the "hot spots" (valve seats and guides, cylinder walls, combustion chamber, etc.) in order to cool them off.

The engine block is actually manufactured in one piece with the water jackets cast into the block and cylinder head. At normal operating temperature, the water pump forces the coolant through the head gasket openings and on into the water jackets in the cylinder head. It flows around in there, cooling everything off by absorbing the

heat. After doing its thing, the coolant flows through the upper hose to the radiator where it releases the heat. Then, the water pump sends it back down into the engine's water jackets to continue the cooling process.

On the sides of the engine are "freeze" or "expansion" plugs, which are sheet metal plugs pressed into a series of holes in the block. These are designed to hold the pressure of the cooling system, but to pop out if the coolant in the block ever freezes.

The Heater Core

The heater core is a smaller version of the radiator that is used to keep your toes warm when it's cold outside.

The heater core is mounted under the dash board. Some of the hot coolant is routed through this little radiator, by more hoses. A small electric fan is also mounted there especially for the purpose of directing the heat inside the car. To turn this fan on, you use a switch called "fan" or "blower," located on your control panel. The principle is exactly the same as the one used in the radiator for your engine, except that the heat is released inside the car instead of outside. Most engines use the heater core to warm the air coming from the air conditioner if the dash setting is not on "cold". More efficient designs don't do this because it makes the engine work harder than it has to. They cycle the compressor on and off to lessen the cooling output.

If your car is running hot, turning the heater on will help to reduce the heat in the engine. Unfortunately, most cars don't overheat in the winter.

The Fan Clutch

The fan clutch is a small fluid coupling with a thermostatic device that controls a variable-speed fan. The fan clutch ensures that the fan will rotate at just the right speed to keep the engine from overheating, and reduces drive to the fan when it is no longer needed.

The fan clutch has a fluid coupling partly filled with silicone oil designed for just that purpose. If the temperature of the air passing through the radiator rises, the heat alerts a bimetal coil spring to "uncoil" or expand. When it expands, it allows just a little more oil to enter the fluid coupling, so the fluid coupling starts to rotate the fan. If the air coming through the radiator is cool, the opposite happens; the coil spring contracts, the oil leaves the fluid coupling and the fan slows. Slowing the fan when it is not needed reduces fuel consumption, makes less noise and saves engine power.

Sometimes a flat bimetal strip spring is used instead of a coil spring; it bows out and in when the temperature rises and drops, letting oil in and out of the fluid coupling.

Freeze Plugs (Expansion Plugs)

Freeze plugs (also called "blind" or "expansion core" plugs) are small steel plugs used to seal the holes in the engine block and head made in casting. They expand and flatten as they are driven into place, and make a tight seal. These are designed

to hold the pressure of the cooling system, but to pop out if the coolant in the block ever freezes.

If you have a leak in your cooling system, freeze plugs are one of the areas to have checked.

Temperature Sending Units

Since it is critical for you to keep an eye on the temperature of the coolant in your cooling system at all times, your car will have either a gauge or a warning light located on the instrument panel or dashboard (see temperature gauge). The question is, how does the information about your coolant get to the gauge? It gets there, or is sent by the temperature sending unit.

The temperature sending unit is a device that is placed so that it can determine the temperature of the engine coolant. Simply put, its resistance to electricity changes with increases and decreases in the temperature of the coolant. The electric resistance changes control the movement of the indicator needle on the temperature gauge. If you have an indicator light, or lights, these changes will cause the bulb to be connected to the battery if the temperature of your coolant gets too high. If this happens, the light goes on.

There are two types of sending units. One type uses a Bourdon tube instrument, a capillary tube filled with a special gas, and a capsule, or bulb. The other type uses an electric sender receiver.

The Bourdon tube type works by having one end of the tube attached to the gauge fitting, and the free end fastened to the needle indicator. A Bourdon tube is a round, hollow metal tube. Putting pressure on the hollow end causes it to try to straighten, so that the other end moves the needle on the gauge. Because it is placed in an engine water jacket, the pressure from the coolant temperature causes it to move, which, in turn forces the other end to move the gauge needle. When the coolant cools, the lack of pressure allows the needle to swing back to cold on the gauge.

The electric sender receiver type has a bimetal thermostat in the dashboard. This thermostat is linked to the gauge needle, so that when the engine gets warmer and passes more current, the thermostat, getting hotter itself, bends. When the thermostat bends, it moves the gauge needle, which indicates that the coolant temperature is rising. As it cools off, the thermostat "unbends" again, and the needle drops back to the cold indicator.