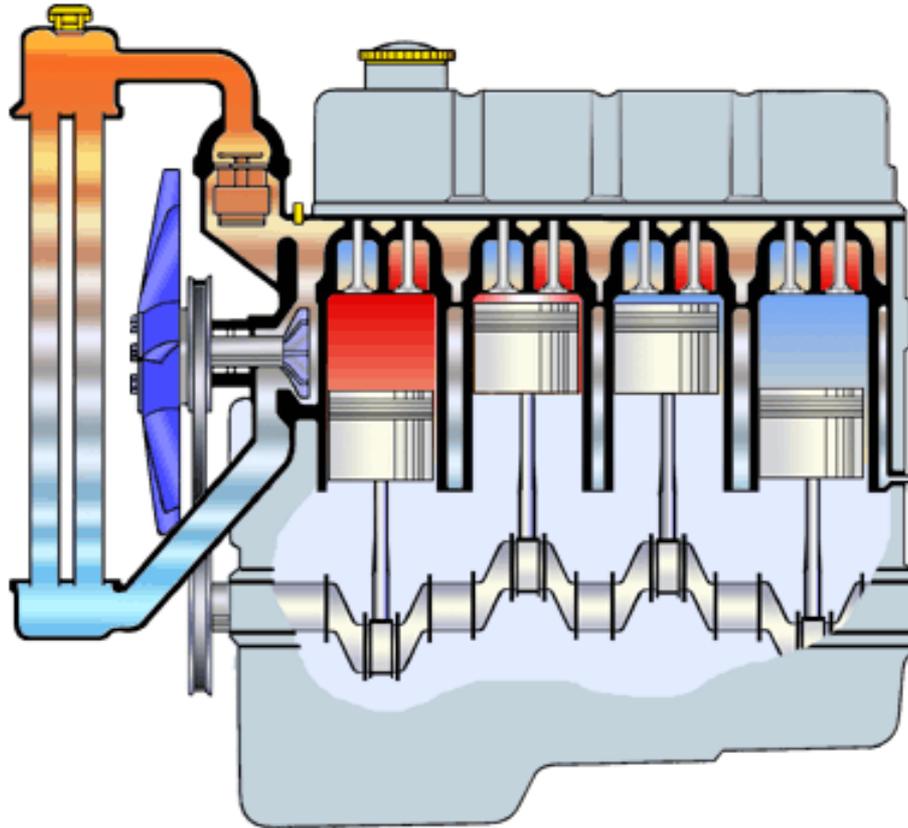


# Cooling System

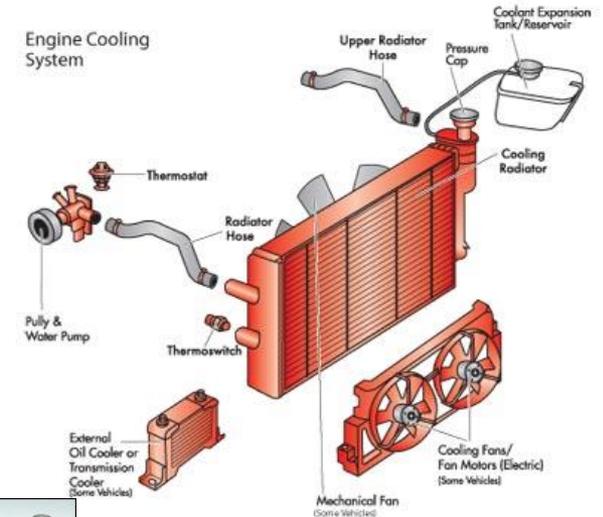
- Get the engine up to optimum operating Temperature as quickly as possible and maintains it at that temperature .
- Controls the heat produced in combustion chamber, so that the engine parts are not damaged & the oil does not break down.



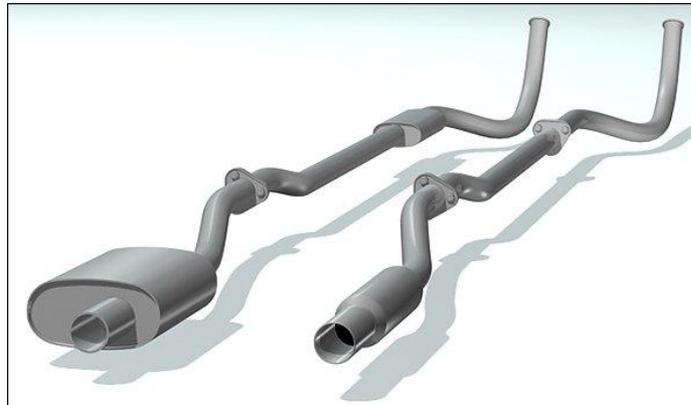
# Cooling System

## TOTAL FUEL BURNED

1/3 cooling system



1/3 Exhaust system



1/3 Propels the vehicle



# Cooling System

## AIR COOLED

- Have metal FINS on the outer perimeter of the engine.
- Heat is transferred from the engine, through these fins, into the atmosphere.



# Cooling System

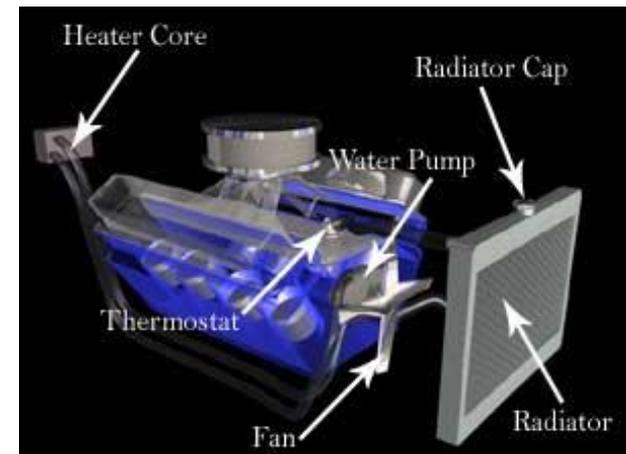
## LIQUID COOLED

- A liquid (**coolant**) is circulated around the cylinders and absorb heat from the cylinder walls and cylinder head.

**COOLANT** is a mixture of antifreeze (*Ethylene Glycol*) and Water (*some Aluminum radiators have special antifreeze*)



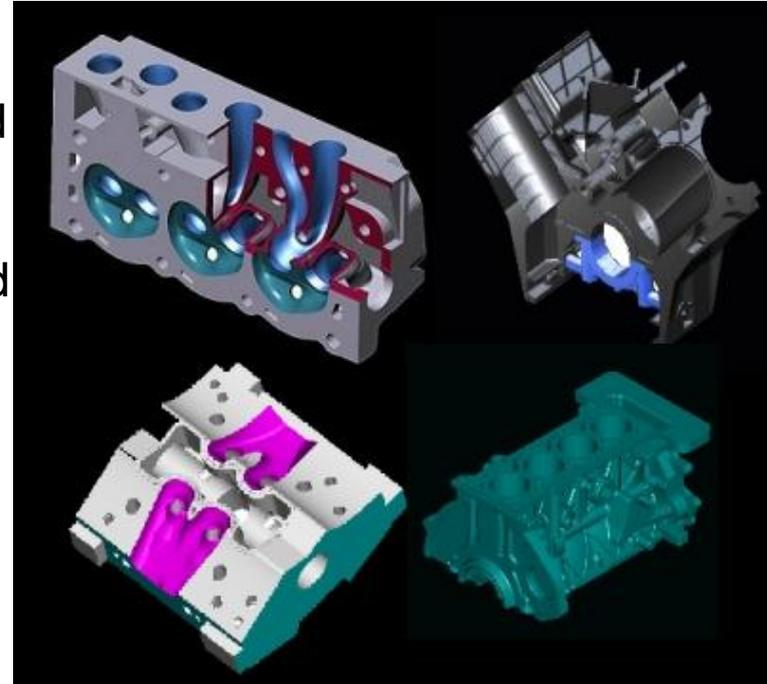
- Coolant absorbs heat as it passes through the engine and also lubricates the water pump.
- Hot coolant enters the radiator in which the heat is passed on to air that is flowing through the radiator.
- Prevents rust and corrosion from the water jackets.
- Cooling system flush is recommended every two years in order to remove any rust or contaminants.



# Cooling System

## Water Jackets

- Designed to keep engine block and cylinder head cool.
- Open spaces between the outside of cylinder and inside of cylinder block and head.
- When engine is running at normal operating temperature, the coolant is forced through the water jackets in the engine block, through the head gasket, into the head, and back to the radiator.



**Cylinder head gasket** sits between the short block and cylinder head.

- If damaged, the coolant enters the combustion chamber and the combustion into the cooling system. It will allow acids to form.  
(WHITE SMOKE)

# Cooling System

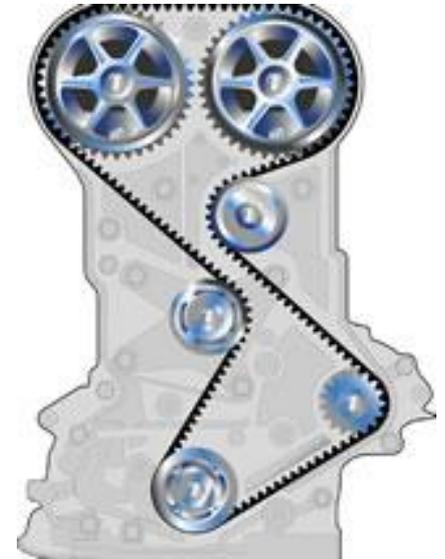
## Water Pump (Impeller Type)

- Draws the coolant from the radiator, through the lower radiator hose, and then forces it through the water jackets, back into the radiator.
- If the clutch fan can be wiggled up and down, most likely the water pump needs to be replaced.
- Water pumps gasket is placed between the water pump and the engine block to prevent leakage (if left loose it might leak and if tightened too much it might crack).



# Cooling System

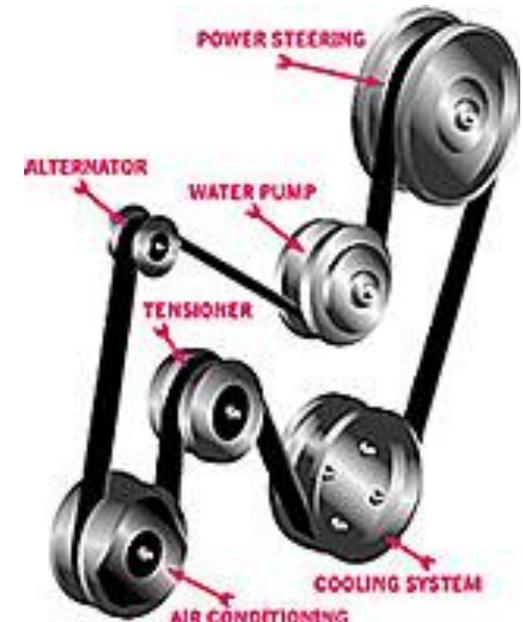
- **Water pump is driven by the crankshaft through**
- **Timing Belt** (*Keeps Cam and Crank shafts in time*)
- **Drive/accessory Belt** (Runs alternator, power-steering pump, AC, etc.)



V-Belt



Serpentine Belt



# Cooling System

**Engine Fan** draws air through the radiator at low speeds (i.e. Traffic)

**Clutch fan** is mounted on the water pump and is driven by the drive belt.

- It slips at higher speed, in turn slowing the fan speed down.
- It locks up at slow speeds, in turn speeding up the fan RPMs.
- Should be able to turn when the engine is turned off.



# Cooling System

**Electric fan** is mounted on the radiator and is operated by battery power.



- Is controlled by the thermostat switch.
- Is located on Thermostat housing, Block, or Radiator.

• Some modern cars have the range between 193° to 207° F (89 to 97° C)

• On AC equipped cars, a second fan is mounted, and it runs any time AC is turned on.

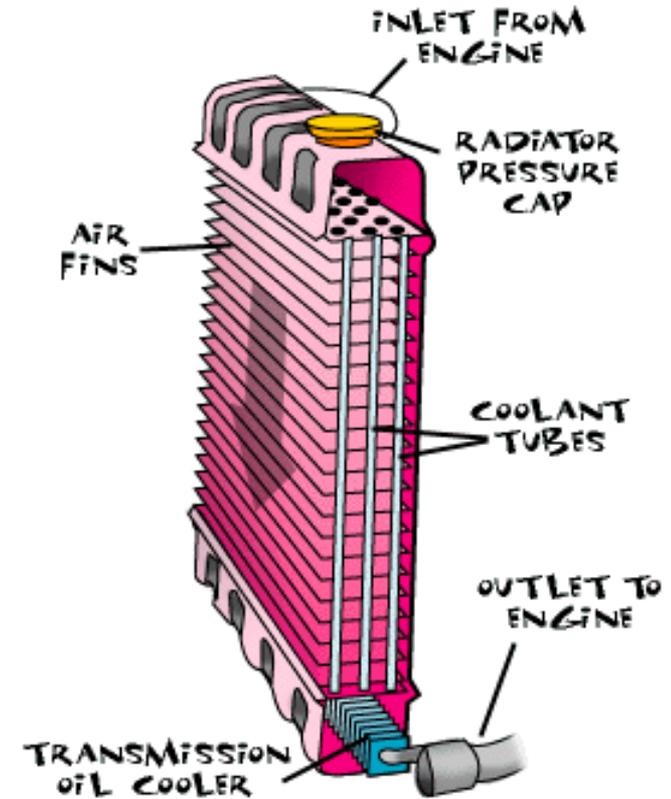


**CAUTION** Electric fan may run while the engine is turned off.

# Cooling System

**Radiator** is a heat exchanger that removes heat from the coolant passing through it.

- Vertical or Horizontal core
- Vehicles equipped with automatic transmission have transmission cooler build into the radiator.
- Some vehicles (towing purposes) have oil cooler mounted to “or” build into the radiator.

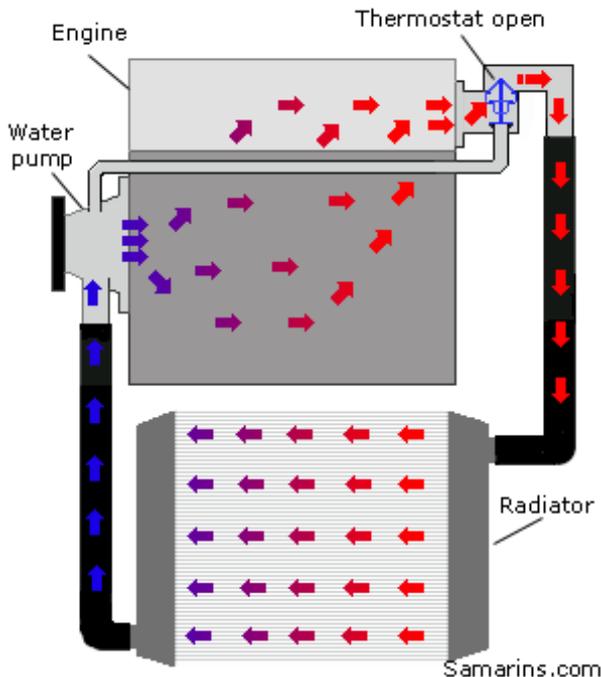


# Cooling System

**Thermostat** placed between the cylinder head and top radiator hose.

- Purpose is to close off this passage when engine is cold

- The temperature that the thermostat opens is called ***thermostat rating***.



- Higher temperature thermostats are used on the modern vehicles.

- If thermostat is stuck open the engine will run cool, and if the thermostat is stuck closed the engine will Overheat.

- Can be checked by placing in the boiling water.



# Cooling System

**Radiator Pressure cap** seals the cooling system and pressurize it.

- Most caps insert 12-16 lbs of pressure.
- Each pound of pressure inserted increases the boiling point of coolant by  $1.8^{\circ}\text{C}$  ( $3^{\circ}\text{F}$ ).  
Boiling point of water is  $100^{\circ}\text{C}$  ( $212^{\circ}\text{F}$ ).
- Has a built in pressure relief valve to prevent excessive pressure build-up.
- Has a vacuum vent valve (when engine is shut off and it cools, the coolant volume is reduced)

Excess coolant goes to the expansion tank.

**CAUTION** never open the radiator cap if you can't squeeze the top radiator hose.



# Cooling System

## Hoses

Top Radiator hose brings the coolant back to the radiator and are molded specifically for individual make and model.



Lower radiator hose draws the coolant into the engine, from the radiator and is attached to the water pump. (sometimes a spring is inserted in order to prevent collapsing)



# Cooling System

## BLOCK HEATER

- Fitted into the block to keep the engine warm during extremely cold weather. (Diesel Engines)



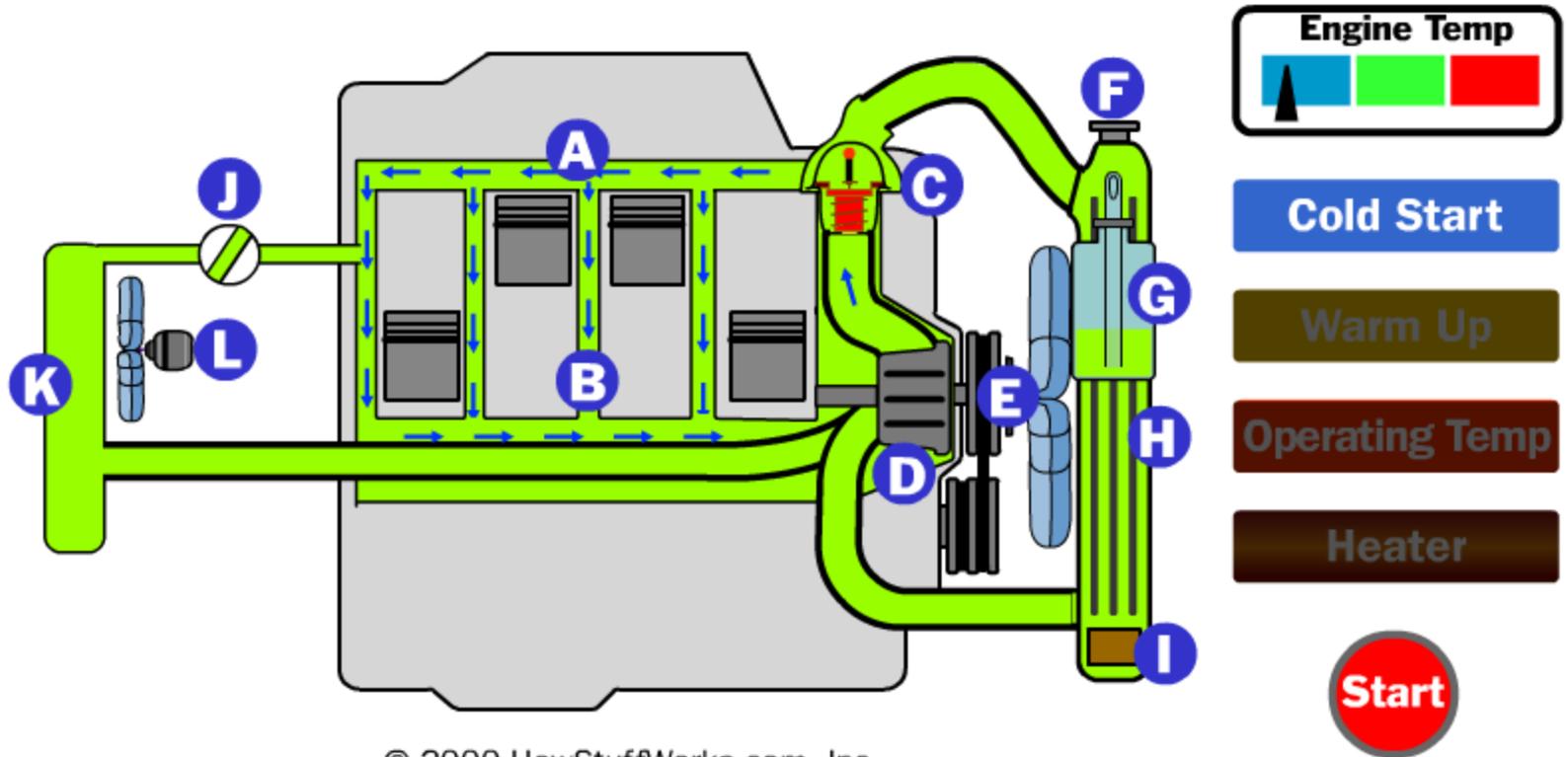
## FREEZE PLUG

- Prevents engine block cracking if water freezes inside.

- Common cause of freeze plug failure is rust.



# Cooling System



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# Cooling System

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