Lincoln Mark VII Cooling Systems

Written By Kit Sullivan March 15, 2003

"Wow! That car is hot!" If spoken in regards to your classic muscle-car's ability to elicit complimentary remarks, you are all set!
On the other hand, if by 'hot' they are making reference to the growing puddle of anti-freeze that seems to collect on the ground every time you drive your car, that is another story altogether.
Does your car seem to run hot at idle, but settles into its 'normal' zone once you start driving? If so, there may be a few pointers about the automotive cooling system that can help you alleviate that 'hot under the collar' feeling.

THE BASICS!

Even though the mechanics of a typical automotive cooling system are simple enough for even a moderately-knowledgeable person to understand, there are still a few things that can even 'trip-up' an expert. Let's start with the basics of an automotive cooling system.
First of all there is the engine block itself. Running throughout the engine block are passages designed to let engine coolant flow to as many areas as possible to cool the engine as it is running. These passageways are known as the 'water jacket'.
Some engine blocks have a very efficiently designed water jacket, which allows an engine to effectively 'shed' the heat it generates into the surrounding engine coolant on a consistent basis.
Unfortunately, there are also some engine blocks out there that do not have the most well-engineered design when it comes to water jackets. Theses type of engines will be prone to localized hot-spots in the engine, which can lead to premature head-gasket failure, oil leaks, and shortened engine life.
An engine's water jacket cannot be changed or modified in any way, so any improvements must come from one or more of the other components that make up the cooling system.

MOVE THAT COOLANT!

The coolant must be moved throughout the engine, and that duty falls to the water pump.

On our classic cruisers, the water pump is most often attached to the front of the engine, and is usually driven by a belt attached to the engine's pulley-system, although some high-performance aftermarket water pumps can be electrically driven, as are most of today's modern cars.

WHERE ARE WE MOVING IT TO?

As the water pump causes the coolant to travel through the engine's water jacket, it picks up at holds heat away from the engine itself.
The coolant continues on out of the engine through a hose attached to the upper section of the radiator.
The coolant travels through many tiny tubes from the top of the radiator to the bottom, and these tubes have tiny fins attached to the outside of them.
As air flows across the surface area of these fins, the heat that is held in the coolant is released to the outside air, lowering the temperature of the coolant.

BACK TO THE ENGINE!

The now lower-temperature coolant travels through a hose attached from the lower section of the radiator back into the engine to repeat the process all over again!

In its most basic form, that is essentially the design and function of a typical cooling system.
However, there is much more to consider than that.

A typical engine is engineered to run at around an average temperature of 250-260 degrees.
Water boils at 212 degrees (at sea level). Water, like any liquid, will absorb, and continue to hold more and more heat until it reaches its boiling, or vaporization point.
At the point of vaporization, this boiling liquid will spontaneously release all of its stored heat.
This is called the 'Latent Heat of Vaporization' law. It is this unbendable law of nature that allows a vehicle's cooling system to operate.

If we were to allow the coolant to boil, or vaporize at 212 degrees, it would do so inside your 250-degree engine, releasing all that heat back into your motor. That's no good.
No, we need to keep it in a liquid state, non-vaporized, so it will continue to hold heat.

PRESSURIZE IT!

At an ambient (surrounding) air-pressure equal to 'sea-level', water boils at 212 degrees.
Decreasing the air pressure on any liquid will allow it to boil at an even lower temperature. Likewise, increasing the air pressure on any liquid will raise its vaporization, or boiling point.
For every 1 pound of pressure applied to water above 'sea-level', the boiling point of that water is raised by approximately 4 degrees.
So, if you were to increase the pressure on your cooling system's coolant by 15 pounds (over ambient), you would be adding an additional 60 degrees of temperature holding ability, added to the initial 212 degrees, for a total of 272 degrees before the fluid would vaporize, and release all of its heat.
272 degrees is well above the 250 degree operating temperature of most engines, and this is what allows our cooling systems to operate as effectively as they do.

Most vehicles operate with a radiator cap that will apply an additional 15-16 lbs. of pressure over ambient, giving us the ability to keep our engines cool, yet still hear the occasional "Man, that's hot!"

STRAIGHT WATER? NO WAY!

Running straight water would give us the ability to cool the engine, but in a short amount of time, the natural corrosiveness of the water would wreak havoc on the insides of our cooling systems.
The bearings in the water pump need constant lubrication, and water is a poor lubricant. For that reason, we need to have some type of oil-based lubricant for our water pump.
Electrolysis is also a normal condition that develops in a typical cooling system.
By creating a negative electrical charge on the interior surfaces of the cooling system, and a positive electrical charge in the fluid itself, electrolysis causes the metal and mineral content of the water and coolant's additive package to drop out of suspension and create scale and corrosion on the inside of the whole system.
This scale and corrosion is called 'plating out'. If left unchecked, this scale and corrosion can cause cooling system failure in a relatively short amount of time.
To combat this corrosive activity, many different additives are used to keep the electrolysis under control, as well as to keep any contamination and corrosive particles in suspension and away from the interior of the system.

THOSE PESKY THERMOSTATS

Another extremely important component of your classic hot-rod's cooling system is the thermostat.
In just about all applications, the thermostat is a temperature controlled device that blocks the full flow of the coolant through the entire cooling system until a pre-determined temperature has been reached.
There are a lot of misconceptions out there as to how important a thermostat really is.
To help alleviate a hot-running engine, some think that removing the thermostat and allowing full-time, unrestricted flow of coolant that the engine will run cooler.
If your engine is running hot and overheating, assuming that the rest of the cooling system is in good working order and has the capacity to keep your high-dollar, big-horse motor cool, then removing the thermostat is NEVER the correct thing to do.
A car with no thermostat will usually take a much longer time to warm up than is normal.
Until an engine reaches operating temperature, it is running very inefficiently. A consistently too-cool engine uses more fuel, produces an extremely large amount of contaminants, leading to sludge formation in your engine, and promotes accelerated wear and tear.
In some circumstances, an engine being operated with the thermostat removed may NEVER reach full operating temperature, dramatically shortening the engine's life.

WHY IS IT OVERHEATING?

If your engine is consistently running hot, or overheating, then you need to look at the rest of the system and determine where the weak spot is.

First, is the radiator in good shape? Are there any obvious leaks or green corrosion evidence on the outside of the radiator's fins or external tanks? Is there a large amount of fins missing or bent over? The fins on the radiator's cross-tubes are very small and fragile and can be bent over blocking the air flow quite easily.
If you have a lot of bent fins, there are special radiator-fin 'combs' that are available to help you straighten them out. Just be careful, as they are very fragile.
In fact, they can also be broken off from stone collisions, or fall off from rust and corrosion.
If the outside of the radiator looks acceptable, make sure that you are getting full and consistent flow on the inside of the radiator.
With the engine fully warmed up and at operating temperature, carefully place the palm of your hand on the front side of the radiator and feel for hot and cold spots.
A consistent temperature across the entire surface of the radiator indicates that there is probably good flow inside.

However, if you fell an obvious cool spot while the rest is warm, there is a good possibility that your radiator may be partially plugged up, severely reducing its ability to function correctly.
A plugged radiator can be 'boiled-out' at some radiator shops, but a new radiator is usually your best bet.

DON'T FORGET THAT RADIATOR CAP!

A poorly functioning radiator cap is one of the most often overlooked items on a typical vehicle.
A radiator cap is designed to let your cooling system increase its operating pressure and hold it at its designed limit, yet bleed off any excess pressure so that the cooling system does become damaged by over-pressurization.
A weak cap can cause your system to loose pressure at a much lower than normal level, severely reducing the cooling ability, and also causing you to lose coolant through evaporation.
You should replace your radiator cap every 2 years, or whenever you are performing a radiator flush.

GET THAT AIR MOVING!

Next, check the airflow-management system on your vehicle. What's that, you say?
It's simply the fan, the fan shroud and any component that helps airflow travel across your radiator.
At cruising speeds, most vehicles receive enough airflow across their radiators to provide sufficient cooling for their engine.
If your car runs cool at cruise, but tends to overheat at idle, then there is probably insufficient airflow across the radiator at low speeds or idle.
The cooling-fan is designed to provide that airflow at low and idle speeds. To make sure that they are giving you the best performance, there are a few things to check.
First, are the fan blades all present and accounted for? A fan that is missing blades causes an imbalance, reduces cooling and most importantly…is extremely dangerous!
Make sure that your fan is in the right location to your fan shroud.
According to 'Griffin', makers of excellent high quality radiators and other cooling system components, a fan needs to be no further away from the inside surface of a radiator than 2 inches. Any further away than that and the fan cannot create the air velocity needed for proper cooling.
Second, the outside diameter of the fan itself needs to be within ½" of the opening diameter of the fan shroud.
A fan with a too-small diameter will 'bleed' pressure around the blades through the fan shroud opening, reducing airflow across your radiator.

And the ideal spacing for the fan inside the shroud is for the blades to be as close to half inside, and half outside the fan shroud opening as possible.
Sometimes, different combinations of fan shrouds, fan spacers and fans themselves can dramatically improve the performance of your cooling system.
Another area often overlooked on our older classic cruisers is how well the outside edges of the radiator are 'sealed up' to prevent air flow from 'bleeding off' the front of the radiator before it even has a chance to go through it.
The factory usually had many individual plastic 'dams', or block off plates that helped to direct the flow of air through the radiator.
Some cars even have a tiny plastic 'spoiler' underneath the cross member whose sole function is to direct air up, and across the radiator.
If any, or all of these are missing, which can be common on a 30+ year-old car, your cooling system may not work as well as it was originally designed to.
Sometimes, adding an aftermarket fan may be your best bet. Whereas the factory may have installed a five blade fan, a six or eight bladed fan may give you the extra airflow that your cruiser needs.
And most factory installed fans are solid, fixed-pitch fans. This means that the blades are stiff and do not flex under operation.
An aftermarket flex-fan is designed with flexible blades that have a severe pitch to the blades, allowing for the maximum amount of airflow at low speeds, while at high speeds the flexible blades will 'flatten-out' somewhat reducing the high drag that a high-pitch fan would induce.
This helps to prevent the fan from 'robbing' horsepower from your engine at high r.p.m., which can be very significant.

Now while most fans are bolted directly to the front of the water-pump pulley, many vehicles came from the factory with a 'fan-clutch'.
A fan clutch simply lets the fan 'connect' solidly to the pulley and provide maximum efficiency at low speeds, yet disconnects and allows the fan to 'free-wheel' at higher speeds when the fan is not needed.
These were provided to help quiet down the 'whoosh' that comes from a 'full-time' fan, while at the same time helping to increase fuel economy.
A fan clutch connects and disconnects based on temperature or r.p.m., depending on the specific application.
If your car is equipped with a fan clutch, make sure that it is in good working order. A fan clutch that fails to 'engage' when needed can cause a car to consistently overheat.
This one little device has caused many-a driver to scratch their heads, unable to figure out the problem with their cooling system.

Of course, electric fans are all the rage today, and almost every single new vehicle on the road uses one or a combination of them.

Many, many owners of older, classic cars have added electric fans to their cars to supplement the cooling on their vehicles.
Some have even removed the fixed-fans completely and replaced them with electric fans.
The idea is simple, and it works. At low speeds, when you need the maximum amount of fan speed to pull air across your radiator, an electric fan will operate at high r.p.m.
At cruising speed, when there is sufficient airflow across your radiator, the electric fan 'turns off', and produces no horsepower robbing drag on your engine.
Adding an electric fan to your pride and joy is a relatively simple and very effective way to help you, and your 'baby', keep your cool!

DON'T FORGET THE HOSES!

Make sure that your radiator hoses as well as your heater hoses are all in good shape.
Some vehicles have a water pump that can move the coolant through the system pretty forcefully, which can cause a radiator hose to collapse at high r.p.m. operation, blocking the flow of much-needed coolant.
This problem can be exaggerated, especially if the thermostat is removed!
This will most often affect the lower radiator hose, but both the lower and the upper can be susceptible to collapsing. This can be difficult to diagnose, as it will most often happen at cruising speeds, where it is not possible to watch the hoses.
Some high quality hose manufacturers put stiff spring-like coils in some of their hose to prevent this exact problem.
If you suspect you are a victim of the dreaded 'collapsed hose syndrome', a hose with an inside coil may be for you.

GOTTA' PUMP THAT WATER!

Your water pump is obviously an important piece in the whole 'symphony' of cooling that is going on under your hood.
Most factory-installed water pumps are adequate to provide enough flow under normal conditions.
On the bottom of the shaft portion of most water pumps is a 'weep hole'. If there is any sign of anti-freeze around this weep hole, that is a sure sign that your water pump is on its way out and you should replace it as soon as possible.
Now just because your water pump is working the way it was designed to doesn't mean that they are always going to be sufficient if your engine has been modified and produces significantly more power than normal.
An aftermarket, high performance water pump will usually be constructed of better grade materials, to much more exacting tolerances.

Most of them are specifically designed to be able to withstand the increased torque and power that a high performance engine produces.
They will usually have a significant increase in pumping ability over stock, also.

USE A HIGH QUALITY COOLANT!

A good, high quality anti-freeze/coolant has all the additives, lubricants and anti-corrosives that are needed for a typical vehicle.
In addition to the much-needed additives, most typical coolant is made with an ethylene-glycol base.
When mixed in proper proportions with water, this ethylene-glycol based coolant will increase the boiling point of the whole mixture by a few degrees.

WHAT IS THE CORRECT RATIO?

Most manufacturers recommend a mixture of 50/50 water to coolant. This will give most vehicles the best all-around performance of freeze-up protection and boil-over protection.
This does not mean that this is the best ratio for you…just the general vehicle driver.

One thing to keep in mind is that anti-freeze is heavier…much heavier than water. 10 times heavier in fact.
Think about this: A car that has a 50/50 mix of anti-freeze/ water has to work 5 times as hard as a car that has straight water, just to move the fluid around the inside of the engine!
An engine that is working harder in this way will produce less fuel economy and less power, while at the same time producing more heat and greater emissions!
As discussed before, you should never run your cooling system with just straight water under any circumstances, but you may not need to run 50% coolant either.
To maximize your cooling systems potential, consider a few facts: does your car sit outside in the cold, snowy regions of the northeast on a blustery sub-zero night? Or does it spend its nights in a comfortable 75 degree garage in Florida?
If your car does not see freezing cold temperatures, there is no need to use such a heavy concentration of coolant.
Most anti-freeze manufacturers recommend a minimum of 25 anti-freeze/ 75 % water, but that is just to ensure that you are getting an adequate supply of additives in the mix.
Depending on your climate, you may be able to make do with as little as 1 quart of anti-freeze, and the rest water. All the supplemental additives and water pump bearing lubricants that are needed are available in a separate pour-in product.

In addition to this, you may want to strongly consider the use of an additional 'surfactant' additive. This particular additive actually breaks down the surface tension of the water, allowing it to cool even better. These products are very effective, and two popular brands are 'Water Wetter' by 'RedLine', and 'Super Cooler' by 'Royal Purple'. These are both quite inexpensive and very effective. Use of one of these types of products alone can bring your average coolant temperature down by as much as 10 degrees! A great bargain no matter how you look at it.
By using as light as possible a mixture of coolant, water and additives, your engine will run cooler, create more power, use less fuel, produce fewer emissions, and best of all...it will last longer!

HOW OFTEN SHOULD I FLUSH THE SYSTEM?

No matter what brand of anti-freeze you use, or how little or how much you drive your car, the cooling system will eventually need to be completely flushed out and all-new water/coolant/additives put in.
This will help to keep the damaging corrosives out of the system, it will prevent premature component failure, and it will ensure that you will get the proper cooling that your engine needs.
To give your cooling system the best chance for long life, a complete flush every two years will return great dividends.

WHAT KIND OF COOLANT?

For many, many years, the typical 'green stuff' was the only type of antifreeze/coolant available. And it works fine.
In the last few years, there have been a few different types of 'extended life' coolants offered as factory-fill (General Motors 'Dex-Cool'), as well as aftermarket formulations.
These are all basically formulated with what is known as 'P.A.O.' technology (Poly Alpha Olephin), which is mostly a way to manufacture the coolant without all the heavy minerals and additives that cause the 'plating out' problems discussed earlier.
If you are so inclined, most of these coolants will work fine in your classic car, but just make sure that it is recommended for your particular type of cooling system components. The label on the back of the coolant container will tell you what you need to know.

DON'T DRINK IT!

Anti-freeze is extremely poisonous, so it is of utmost importance that you do not leave any new or old anti freeze laying around unattended where any neighborhood animals might inadvertently drink it.
Anti-freeze has a strong sweet taste that dogs and cats find very enticing, so be sure to store any antifreeze in a sealed container.

Several years ago, there were a couple of brands of anti-freeze that were advertised as a 'solution' to the problem of accidental poisonings. ('Peak' is an example).
The marketing for these type of products made it seem to be completely safe if an animal accidentally drank some.
This is completely untrue. These, as all anti-freeze/coolants, are still extremely poisonous. It just takes a little more to be fatal.

IS ALL WATER THE SAME?

While most people use ordinary tap water in their cooling systems, some areas of the country have a fairly high level of minerals and such in their municipal water supply, making what is known as 'hard' water.
This hard water can rapidly accelerate the 'plating out' process that occurs in your cooling system, so you might want to consider a popular alternative.
Distilled water, which has had most of the minerals and 'hard' particles removed from it is far better for your cooling system. It is readily available at most supermarkets, and is only a buck or so a gallon.
If in doubt about the quality of your tap water, be safe and use distilled water in your classic machine.

KEEP YOUR COOL!

Following these general guidelines will go a long way towards helping you and your classic 'hot-rod' to stay cool, but still be considered 'one hot ride!"

