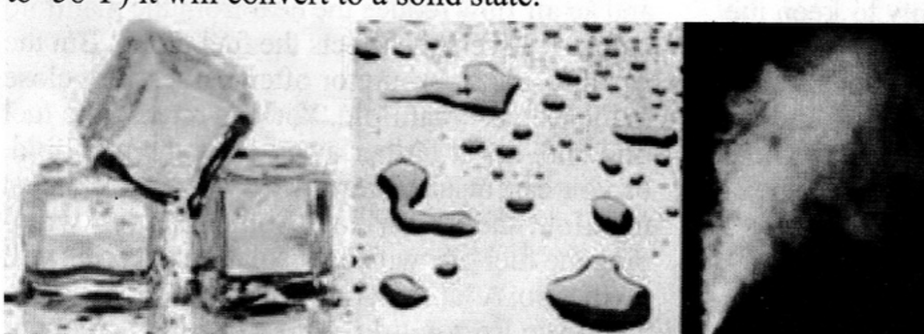
WHAT IS VAPOR LOCK?

How Can the Problem Be Solved?

by Ken McNeil

Vapor lock, very simply, means that gas (not gasoline, but vaporized liquid) has formed in the fuel line and is locking the liquid gasoline out. Having stated that seemingly self-evident fact, let's get some terminology straightened out. In this article we will call gasoline by its full name, 'gasoline,' rather than abbreviate it to the more common terminology. We might refer to it as fuel or petrol. But whether 'gasoline,' 'fuel' or 'petrol,' it is in the liquid state. You have learned that all matter takes on one of three physical states: solid, liquid or gaseous.

Water, for example, can be readily converted to a solid state (ice) by lowering its temperature to below the point of freezing, 0°C (32°F). It can just as readily be converted to a gaseous state (steam) by heating it to a temperature above 100°C (212°F). Normally when we refer to the 'freezing point' or the 'boiling point,' we are referencing water. But other solids, liquids and gases are subject to conversion of their state as well, by heating or cooling; not to the reference points of water – each material has its own 'freezing' or 'boiling' point. The boiling point of any liquid is reached when the vapor pressure exceeds the atmospheric pressure. As pressure increases, so does the 'boiling' point. Gasoline will freeze – it has to get mighty cold for a hard freeze, but when the temperature drops to somewhere around -40° to -50°C (that's -40° to -58°F) it will convert to a solid state.



All matter can normally be found in one of three states: solid (left), liquid (center) or gas (right). And matter can be converted from one state to another by heating or cooling.

It is more common for gasoline or petrol to reach a temperature where it is converted from a liquid state to a gaseous state. I know that you are waiting with baited breath for a firm temperature, but, sorry, you are not going to get it. The reason is that gasoline or petrol which comes out of the dispensing pump at your local Mobil, Shell or Chevron station, is NOT pure gasoline. It is a blend of all kinds of additives, designed to make your engine run cleaner, with fewer deposits, etc., etc. You've heard all of the advertisements. The gasoline companies spend millions of dollars convincing you that theirs is the best, the most efficient, having the most and finest additives. Well, each of those additives – in their liquid state – have their own 'boiling' point. Add to that the dreaded ethanol, and the boiling point is changed even further. Pure ethanol boils at 78.3°C (173°F) – quite a bit lower than even water. (It's freezing temperature, though, is much lower than that of water -114°C [-173.2°F], which is why it is added to what is euphemistically called 'winter gasoline,' lowering the freezing point considerably.)

Because of the various ingredients mixed into the Shell or Mobil or whatever it is that you are pumping into your tank, the boiling point of the liquid varies. And, as pointed out above, with a higher concentrate of ethanol in the winter, it can boil at an even lower temperature. Now, having dodged the question for about as long as I can, let me throw a temperature range at you: the boiling point of gasoline can range from about 38°C (100°F) to about 205°C (400°F). Doesn't help you much, does it? That's most of the physics lesson for today. Now let's discuss vapor lock.

Simply, vapor lock occurs when petrol (the liquid) is converted to a gas (vapor) in the fuel line, in the fuel pump or in the carburetor. Although it can occur, vapor lock is much less common with electric fuel pumps than with mechanical pumps. Vapor lock is not a common occurance; actually it is fairly rare. If you experience it regularly, odds are good that modifications have been made to your car's cooling, exhaust or fuel system. Most cars do not experience vapor lock. Vapor lock is more likely to occur at higher altitudes where the atmospheric pressure is lower and boiling temperatures are lower.

When ambient temperature at a particular point in the fuel delivery system reaches or exceeds the boiling point for the particular blend of fuel you are using, the liquid is converted to a vapor. Generally, the fuel delivery system is not designed or capable of moving a vapor; it is designed to move liquids.

Anytime a part of the fuel delivery system – and that includes the gas-tank-to-fuel-pump-line, the fuel pump itself, the fuel-pump-to-carburetor-line or the carburetor itself – is exposed to abnormally high temperatures, the liquid in the system can boil. Under normal circumstances, as the car or truck was designed, there is adequate air flow to keep the temperature of those components cool enough so that their contents do not boil. But on a super-hot day, sitting in heavy traffic where the air flow is minimized, or at elevated altitudes where atmospheric pressure is lower (and so is the boiling point), the liquid can convert.

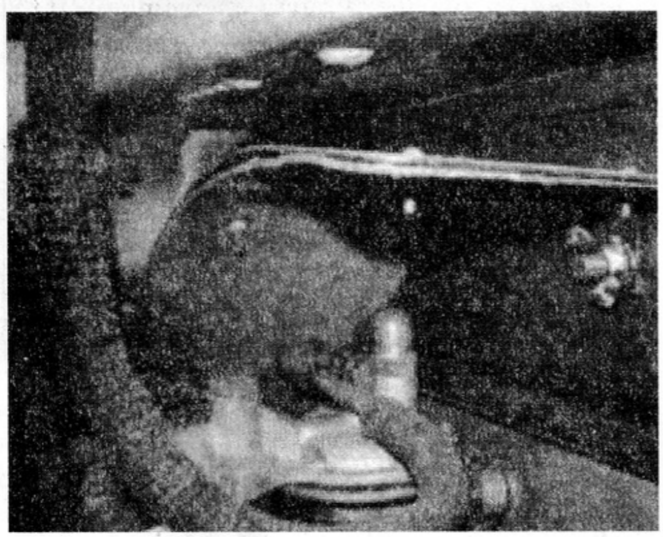
Modifications to the fuel delivery system can also disrupt the cooling of the system as it was designed by the engineers many years ago. Rerouting a fuel line closer to an exhaust or tail pipe, or rerouting the exhaust system closer to a fuel line, can cause elevated temperatures where the fuel line passes close to the exhaust. This could occur near the rear of the vehicle, near the gas tank, or at the engine, where the fuel line passes close to the exhaust manifold or the exhaust pipe. The liquid fuel in that portion of the line will have a tendency to boil, converting the liquid to a gas and locking down the fuel delivery. If liquid petrol does not get to the carburetor, and through the float bowl, the engine will starve for fuel and sputter or stall.

What is the answer, or is there an answer? Sure! Cool down the fuel line. Air is a lousy conductor of temperature. If you can increase the air barrier between the hot parts of the engine and the fuel line, chances are you will decrease the chance for vapor lock. Air can be heated, though, enough to heat a fuel line component to the point of boiling. An adequate fresh air flow will normally remove the hot air, replacing it with (relatively) cool air.

It is often difficult to determine exactly where the vapor lock is occurring. Sometimes, when it does occur, measuring the temperature of each component along the entire fuel delivery line with a non-contact thermometer might give you a hint. A visual examination, beginning at the carburetor and working down and back, might indicate areas where a fuel line or component is unusually or particularly close to a heat source. Generally the mechanical fuel pump is separated from the exhaust manifold far enough so that, under normal operating conditions, an air barrier and an air flow reduce the heat from the manifold before it adversely affects the fuel pump. But the gas line to the carburetor often passes very close to the exhaust manifold. You can reroute the fuel line, moving it farther away from the manifold, or you can insert a barrier between the exhaust manifold and the fuel line. Sometimes just wrapping the fuel line with an insulating covering will do the job. A fabric wrap – like wire loom, available from Restoration Supply Co. in a variety of diameters, a rubber hose or something similar will often be an adequate barrier. Be sure that whatever you are using does not come in contact with the exhaust manifold. It could be the source of a fire. A metal shield, placed between the exhaust manifold and the fuel line, will probably divert much of the heat. Insulate the metal shield (on the side away from the manifold) with an insulation such as fiberglass or asbestos. A very common solution way back when was to put wooden clothespins on the line. I am not sure whether the purpose was to divert the heat, dispel the heat or wick it away from the fuel line, but it seemed to work.

Follow the fuel line back along the frame of the vehicle. If the line was buried inside the frame, there may not be an adequate air flow to keep it cool, especially if any part of the exhaust system comes very close to the frame or passes through the frame near that point.

Finally, what can you do if the engine sputters and stalls due to vapor lock? As I blithely wrote earlier, "Cool down the fuel line." You can shut off the engine and let it cool down. Open the hood to allow some of the under-hood hot air escape. If you are near someplace with a garden hose, lightly spraying the fuel line with water will help. CAUTION: do not spray cold water onto the hot engine or exhaust manifold.



An insulated heat shield plus the asbestos-coated wire loom protects the fuel pump and fuel line from exhaust manifold heat.

Asbestos coated fabric, wire loom or even just a section of rubber hose, will help insulate the fuel line from ambient heat.

A section of rubber hose wrapped around a fuel line where it passes near a heat source might be all that is necessary. Split the hose lengthwise and snap it over the line.

It could cause the hot metal to contract too rapidly and crack. Be discreet with where you spray the cold water. If you are lucky, your breakdown will have happened near someplace where you can get yourself a cool drink while the engine cools off. You can wet a rag (or even a tee-shirt in an emergency) with drinking water (or water from the windshield washer reservoir) and wrap it around the offending section of line. Once the vapor cools enough to revert to a liquid state, you should be good to go.

If it happens while you are in heavy stop-and-go (or no-go) traffic, once you get the engine started again, run it at a high idle when you are not moving. It will help increase the air flow through the engine compartment. And if you are often spending time in heavy, slow-moving traffic, consider investing in a supplemental electric fan to keep the air circulating. Scotts Cooling Fans (a former advertiser in *SK*) has both the hard-to-find 6-volt fans and 12-volt fans: scottscoolingfans.com.

S.K.