

Exhaust Heat Risers – Fact and Fiction

The Problem - Carburetor Icing

Older automobiles and trucks had no heat risers. Their need was not even understood. Model A Fords never had them, nor did other automobiles of that era. As technical advancements took place and auto manufacturing proliferated, a problem developed. Engines would start and run fine for several minutes, but then would stall out briefly in chilly weather. Often the vehicle would drive for a mile or two, and then stall. This problem would typically occur once or twice, and then the engine would warm up enough that it ran fine.

The problem only surfaced on chilly days when the temperature was between 32 and 40 degrees. If the ambient temperature was higher or lower than these two points, the problem never materialized. It then became apparent that the issue was more noticeable on damp or rainy days, when humidity was high. The problem was exhibited most often on vehicles that were started up and driven just as soon as possible, with little or no warm-up time. In colder areas, many people learned to avoid the issue by simply letting the engine warm up for a few minutes before beginning to drive.

The cold stalling issue never developed on stationary engines, tractors, larger trucks or construction equipment because typically these applications were given a few minutes of warm-up time. Also, industrial applications for many engines typically called for most of their use at fixed speeds. Parts books reveal that Dodge Pilothouse trucks up to and including one-ton size were equipped with heat riser valves in the forties and fifties. Larger trucks did not use them.

People who opened their hoods after their vehicles died during these unusual stalling circumstances were surprised to see white frost on their carburetor castings. If the vehicle sat for a minute or two, rising heat from the warming engine would thaw this frost and the engine would again start and run. In parts of the country where these temperatures were endemic, the problem became big enough to cause traffic tie-ups and unhappy drivers. The phenomenon became known as carburetor *icing*.

In another life, this writer lived and drove a school bus in southeast Appalachian Ohio. On spring and fall mornings, the old International bus I drove would stall out about half a mile from the house, on the first hill I climbed. It usually stalled at about the same spot each time. By the time the bus came to a stop, it could be started again and would run fine. Sometimes it stalled twice before beginning to warm up. I soon learned to start it and let it warm up before beginning to move. That completely solved the problem.

Finally, someone with a good understanding of carburetors figured out the problem. What actually happens at these just-above-freezing temperatures is that as cold, moist air is drawn into the air horn, the venturi cluster in the carburetor throat speeds up the air as it does what it is designed to do. In the process, this faster moving air became a few degrees colder – enough for the moisture in the damp air to collect and actually freeze on metal throttle plates and carburetor throat area. Enough frost can be produced in this fashion to

completely choke off the engine's incoming air. As soon as the engine stalls, what little heat is present in the engine rises, the frost thaws in just a few seconds, and the engine will start again and run fine. This problem can happen two or three times in succession, when the temperatures and humidity are just right for the frost to occur. Once the engine warms the carburetor just a little, the problem disappears completely.

The Fix

It is this writer's opinion that a fix for this problem began to appear on vehicles around the time of the introduction of the automatic choke. Various methods were introduced to remedy the issue. One of the simplest of these devices was the heat riser valve in exhaust manifolds. This valve is simply a metal flapper with a counter weight that pivots inside the manifold. It is controlled by a small spiral thermostatic spring. When temperatures are low, the spring closes the valve. Once closed, the engine's exhaust is directed up and through a passage inside the intake manifold, just below the carburetor. As soon as the thermostatic spring senses a little heat, it began to relax, allowing the valve flap to drop open so that exhaust exits the manifold in its normal fashion.

Problem was, these valves worked summer and winter, whether needed or not. Every time an engine cools down, the heat riser valve closes. Every time the engine warms up, the valve opens. Heat risers have no earthy value on very cold or very hot days, but only in damp, humid temperatures in the thirties range. When they are needed, it is only for two or three minutes, until the engine warms the carburetor sufficiently to overcome this icing issue.

Several auto makers came up with the idea of a *hot box* of sheet metal that surrounded the exhaust manifold, with a flex pipe up to the carburetor air cleaner intake, where warmer air could be drawn into the engine, solving the issue of carburetor icing. Typically an air flap or door was incorporated in the air cleaner intake opening that would close when temperatures were low and then open once the engine began to warm up. These methods worked fine, and continued in use until the advent of fuel injection in the mid-eighties, when on-board computers used temperature sensors to handle the problem of frosting throttle bodies. Today, the problem is so old as to be forgotten by most, since it no longer confronts motorists generally. Few drivers ever understood the issue even when they experienced it.

Is A Heat Risers Necessary Today?

What is left for us who restore vintage vehicles now is the primitive heat riser, likely the earliest of the devices used to combat carburetor icing. Since the entire issue is somewhat esoteric, few people ever knew what was happening, even when they experienced it with their own vehicle. Most owners and collectors have little or no understanding of the purpose or need for this device. Herein lies the problem around which this discussion centers.

As a result of this general lack of knowledge on the subject of heat risers, there is in our fraternal collectors' midst much local wisdom and old wives' tales about the need for this

little valve. Contrary to popular belief, heat risers do NOT increase gas mileage, make engines start easier, idle smoother or run faster or better. They have absolutely nothing whatsoever to do with the choke circuit. Their only function is to keep the carburetor from frosting in chilly, humid cold start-up conditions. They serve no other function and perform absolutely no other service for your engine.

Heat risers were never needed – and never will be – in parts of the country where temperatures stay above 40 degrees. When the air temperature is lower than 32 degrees, water freezes, moist air becomes dry air, and once again heat risers are not needed. In dry climates, carburetor icing is not a problem even when temperatures are in the range where frost can occur, because there is insufficient humidity in the air to produce frost on cold metal.

The DOWN Side of Heat Risers

If you restore a vehicle that was manufactured with a heat riser, it is authentically correct to repair this little flap and spring as it was originally. Having a working heat riser is not a sin, nor will it cause any problems later on – UNLESS it ever seizes in the cold - or closed - position. Should this happen, the engine will be forced to burn fuel that has been overheated by the exhaust manifold for a steady, full-time diet. Since a closed heat riser flap directs hot exhaust gasses toward the base of the carburetor, fuel bowl temperatures now rise and fuel will boil, especially on hot shut-down.

Most gasolines will boil at about 144 degrees. When a hot engine is shut down, engine heat rises up towards the carburetor. This overheated fuel in the float bowl now boils or evaporates away. This results in an empty fuel bowl on the next start-up, which in turn requires extra engine cranking to pump fuel from the tank. Because the carburetor temperature is elevated, fuel expands and affects the float level, and a strong fuel odor may become noticeable when the vehicle is parked in a garage. Now the engine may run rougher, the higher fuel temperatures lead to a likelihood of vapor lock issues developing, and fuel mileage and power will be sacrificed. Herein lies the first negative concern for the heat riser valve.

The other problem that most often happens to old heat risers is that the spiral thermostatic spring rusts and breaks. This metal spring simply cannot withstand the many heat cycles it must endure, sitting there at the hottest spot in the exhaust manifold – the throat where all cylinders meet to exit into the exhaust head pipe. Heat riser thermostat springs are quite fragile. They are very thin, and soon begin to rust. When they were new, they didn't last more than a few years. I'm old enough to remember hearing them rattle on then-late model cars in the fifties and sixties. Once the thermostatic spring breaks, it just rattles around until it either falls off or someone knocks it off to get rid of the noise.

When the spring no longer functions, the air flap valve inside the manifold also rattles around loosely on its counterweight, with nothing to control its position. This loose valve in the center of the exhaust stream can also cause noise that may be tough to diagnose. The valve can actually move around enough to elongate the holes in the manifold where the valve shaft pivots, and in severe cases can damage the manifold casting proper. In

conclusion, the down side of heat riser use today in restorations is that they can seize and cause operational problems, or they can rattle loose and make noise – in extreme situations causing damage to the manifold.

This problem really becomes evident with older vehicles that have been driven many miles, because the nature of heat riser valves is that they ALWAYS work when engines are started up cold. Even though they are seldom needed, they always close when cold and open when the engine begins to warm up. This constant use simply wears them out. The valve flap pivots on a shaft that rides in two holes drilled into the manifold. Because of the high heat, there are no bearings on this pivot point. Some manifolds use bronze bushings in the pivot holes, but even they are often short lived. Lubricating this wear point can only be done with special material that this writer has never seen offered on the market today. Use of motor oil or other lubricants simply causes the pivot point to coke up and leaves a deposit.

Conclusion

Since the heat riser feature is needed only a few times each year in most climates, and poses the potential for problems if it should seize, I chose to lock my own flap in the open position. I just held it clockwise and struck the counterweight a few times with a hammer, folding it against the manifold casting, which keeps it from moving. This fix could easily be undone if anyone wanted to do so.

In the unlikely event that I am ever driving my vehicle on one of those rare days when temperature and humidity combine to cause carburetor icing, I will just let the engine warm up three or four minutes before I leave the barn, and I'll never see the problem exhibited.

Here's to the ice in your carburetor

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