Keeping Your Cool For Improved Performance

One serious by-product of running any internal-combustion engine is heat. Heat is generated by the chemical reaction resulting from the combustion process and from the friction of the moving parts. Excessive heat is bad for performance, so you must control it to prevent catastrophic problems, such as detonation and seizure of the rotating/moving components.

To combat the intense heat build-up, most vehicles utilize some type of cooling system — either using liquid or air to maintain the engine's operating temperature. The oiling system also contributes to lowering temperatures, but its main job is, of course, lubrication.

Most cooling systems incorporate the following: a fluid coolant (water or antifreeze) that flows through the engine and absorbs heat; a pump to move the fluid; hoses and passageways in the block, heads, and sometimes intake manifold to transfer the fluid; and a radiator that transfers heat away from the engine.

On street cars and trucks, you'll find a thermostat, which, when closed, prevents coolant from flowing from the engine to the radiator until the engine has reached a certain temperature. This allows quicker warm-up and helps the engine maintain the desired operating temperature. The proper operating temp is designed into the vehicle by the manufacturer and dictated by factors such as durability, emissions, performance, and NVH (noise, vibration, and harshness).

In racing, the desired operating temperature is often far different than what the factory requires. Today, manufacturers require very quick warm-up times and hotter operating temperatures to reduce emissions. In drag racing, however, we opt for cooler temperatures because that allows more aggressive ignition timing for increased performance with less fear of detonation. But some heat is necessary, especially in the oil, to ensure proper ring seal and maximum performance.

Without a cooling system, most engines would overheat and fail. Despite the fact that drag racing engines run for a short period of time, a cooling system is still required — at least on most engines. (Note: There is a very small percentage of race vehicles that do not utilize a cooling system, the most popular being Top Fuelers, Funny Cars, Top Alcohol Dragsters and Funny Cars, and some Comp cars.)

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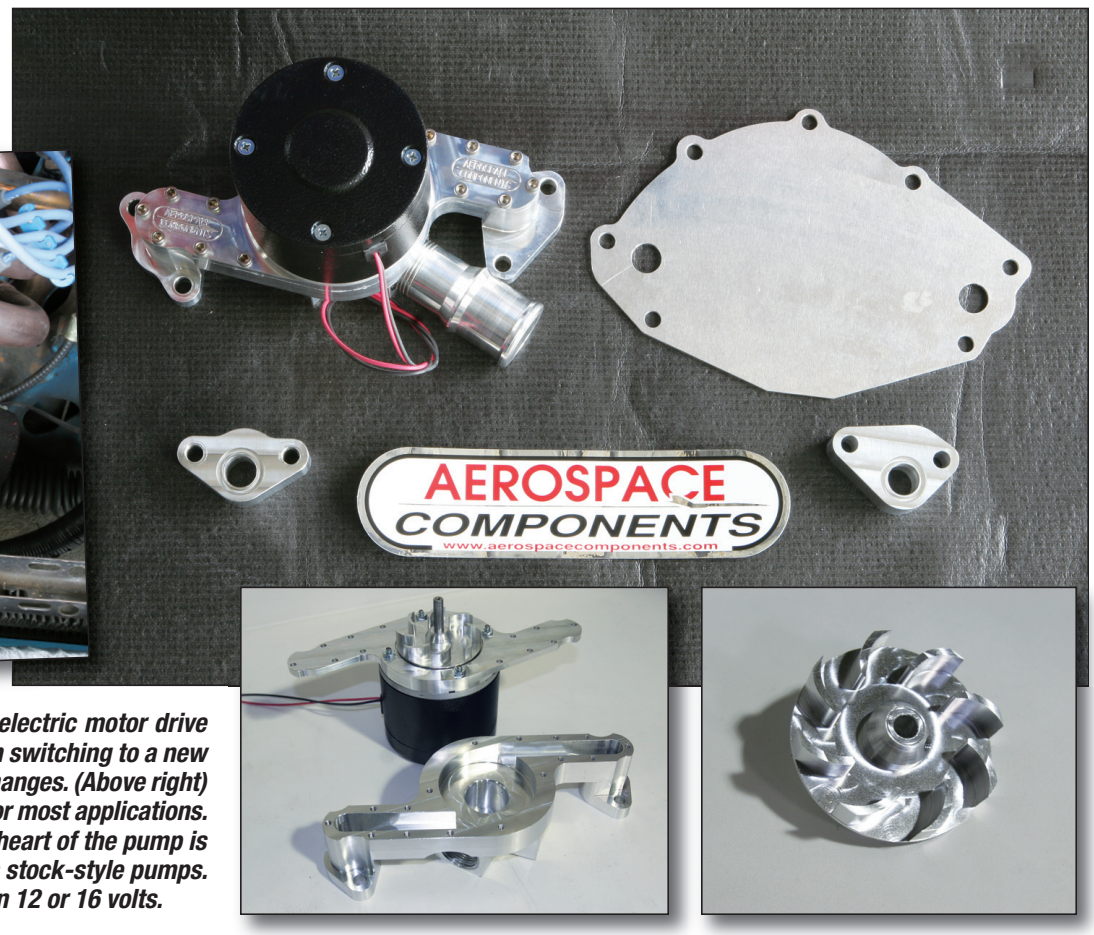

(Above left) I've run a stock-style water pump with an external electric motor drive and had great success, but in my search for improved cooling, I'm switching to a new pump from Aerospace Components, and I'm making some other changes. (Above right) Aerospace Components sells a complete electric water pump kit for most applications. It is billet in design and made 100 percent in the U.S. (Right) The heart of the pump is the computer-designed billet impeller, which greatly outperforms stock-style pumps. This unit is designed to flow 37 gallons per minute and can run on 12 or 16 volts.

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Because engine temperature has a big effect on performance, be it in the horsepower or consistency departments, most racers want the ability to control temperature. When looking for consistency, it's important to have consistent combustion temperatures. If each time you come to the line the engine is at a different temperature, the power level will fluctuate and so will your elapsed time.

Running an engine with the water temperature cold (50 to 70 degrees) helps racers tune to produce extra power; the cold condition of the coolant will keep the heads and intake cooler and will increase the density of the incoming air, thusly enriching the oxygen level. You can also get away with more ignition, which will enable you to create greater cylinder pressure and make more power.

In contrast, a hot engine can cause a decrease in power. Like the heads, the intake and cylinder become heat-soaked, and the air entering the engine will carry with it less oxygen and less potential for making horsepower.

To achieve maximum performance and consistency, most racers tend to modify their cooling systems. This can be done in a number of ways. First, we often swap the stock water pump for a high-performance unit, like the one pictured in this column made by Aerospace Components. This pump features a billet body with a computer-designed billet impeller that moves more water than stock-style pumps. It's designed to clear belt-drive systems, draws only 4 amps, outputs 37 gallons per minute, features stainless-steel hardware, and can be used with both 12- and 16-volt systems. It also has a one-year factory warranty and is made 100 percent in the U.S.

Another common modification, especially on older cars, is to remove the stock clutch fan and replace it with an electric unit. This can greatly reduce parasitic drag and free up some horsepower. In fact, when switching from a standard belt-driven water pump and fan to an electric system, I've seen gains of 10 to 20 horsepower at the wheels. In addition, having an electric water pump and fan gives you the ability to run the water pump and fan while the engine isn't running for quicker cooldown between runs. Of course, you will need to remove the thermostat to do this. ***ND***

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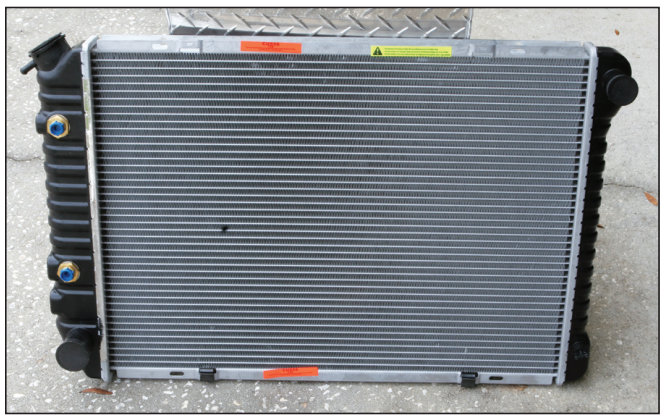
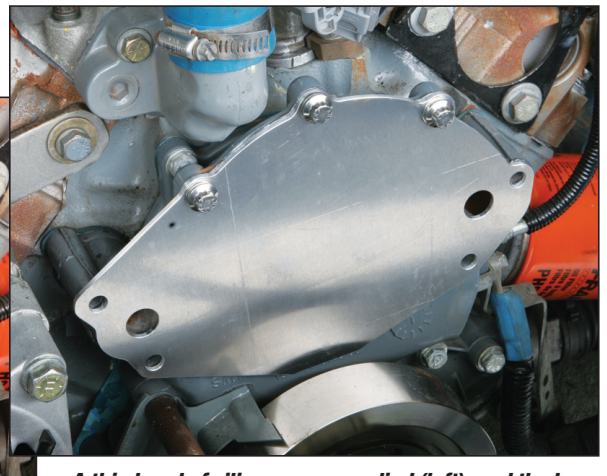
After draining the water from the system, we removed the hoses and the stock radiator. The original Ford piece was factory issued and had about 100,000 street miles and 15 years of on-track duty. It served its time well but was clogged and not working very efficiently.

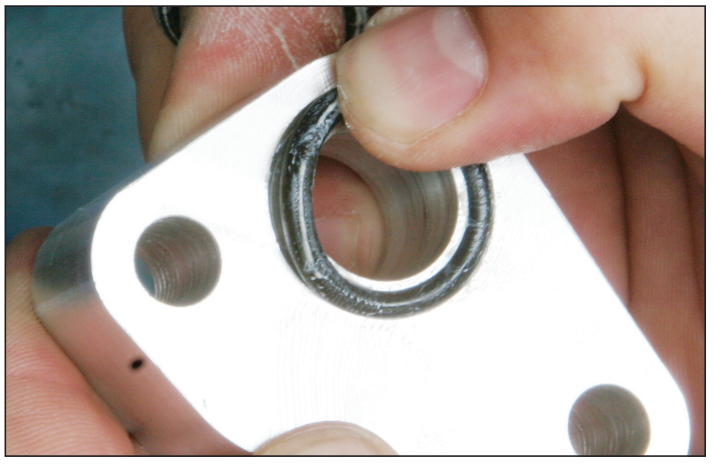


I replaced the stock radiator with a replacement from Auto Zone — a bargain at roughly $90.

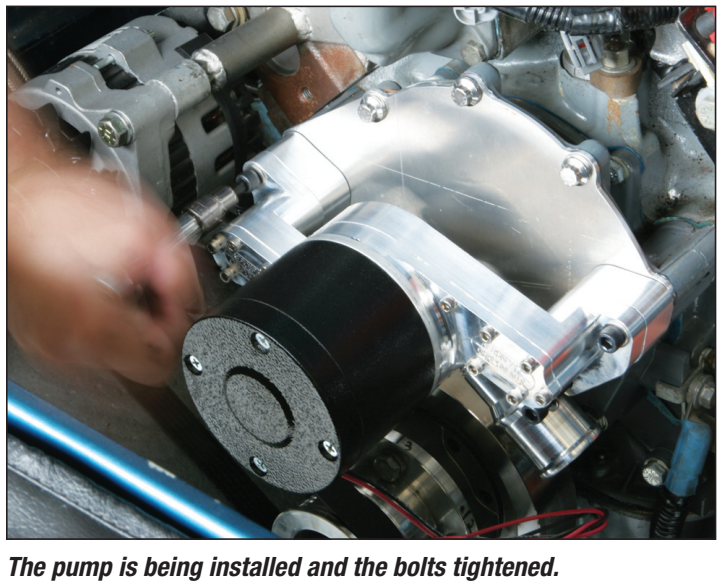
Next, we unbolted the old water pump and cleaned the gasket material from the flange.



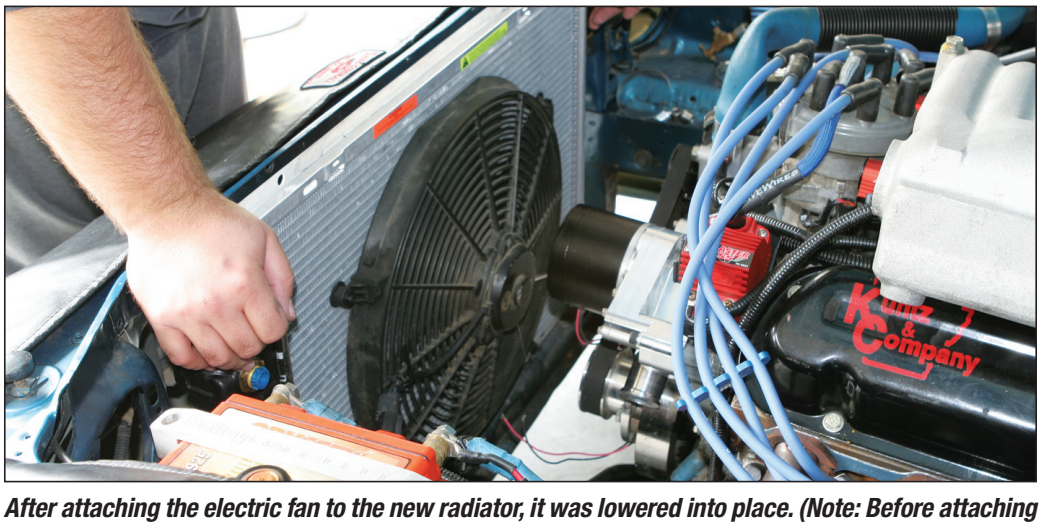
A thin bead of silicone was applied (left), and the base plate for the Aerospace pump was installed (above).



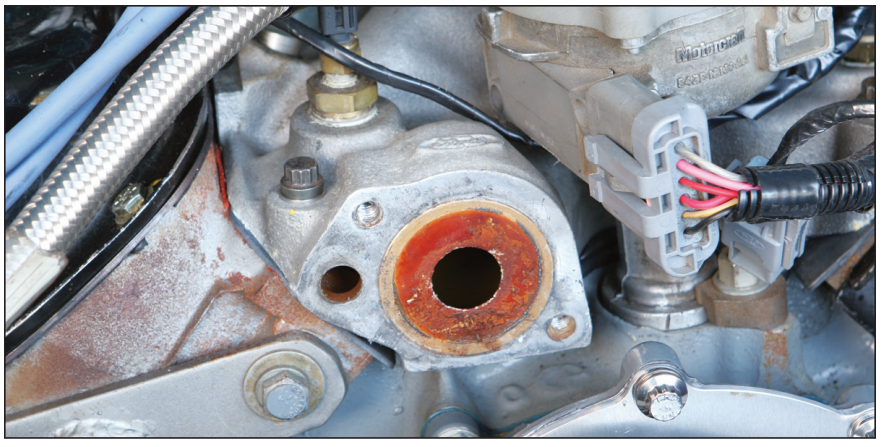
Aerospace supplies two standoffs in the kit to space the pump out. Rubber O-rings seal it from leaks.

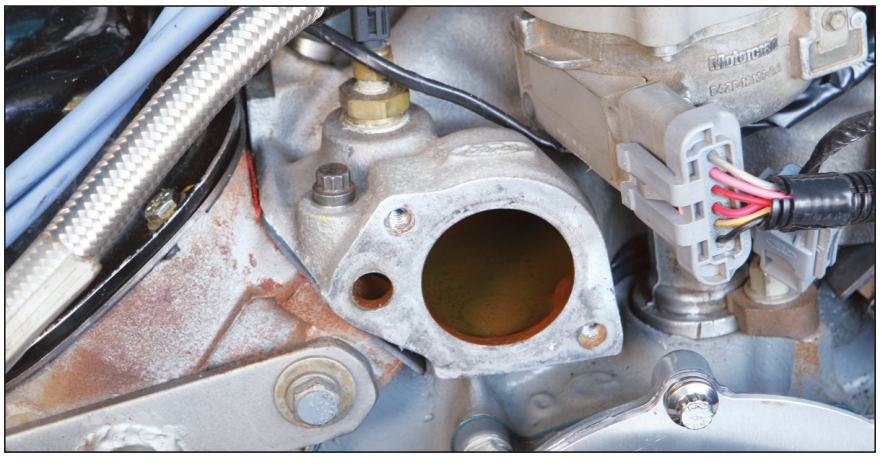


The pump is being installed and the bolts tightened.



After attaching the electric fan to the new radiator, it was lowered into place. (Note: Before attaching any new fan, test-fit the radiator. This is the second radiator; the first one I purchased from another auto chain did not fit well.)





(Above) Most experts agree that it is not necessary in drag racing to run a restrictor in place of the thermostat. The theory is that engine cooling will improve by keeping the coolant in the radiator/engine for a longer period of time, when in fact you want as much flow as possible because this is what removes the heat from the engine. I had a restrictor in place because it was the thing to do but have removed it.

(Left) The last item added is Water Wetter from Red Line. Water Wetter will enhance the performance of your cooling system by dropping temperatures and providing lubrication for seals and your pump when straight water is used. (Above) Fully installed, the pump looks awesome and should do a great job of keeping my engine cool.

Sources

Aerospace Components
727-347-9915
AerospaceComponents.com

Red Line Synthetic Oil
707-745-6100
RedLineOil.com