EIGHT WAYS TO BEAT THE HEAT

COURTESY OF CIRCLE TRACK & RACING TECHNOLOGY

GOOD ADVICE FOR KEEPING YOURSELF AND YOUR CAR COOL UNDER PRESSURE

Heat kills power. Heat damages parts. Oh, and heat robs the driver of his stamina, reflexes and concentration. Bad stuff all around, and that's why we've compiled this list of ways to beat the heat when it comes to racing — everything from making sure your radiator is working efficiently, to keeping the air / fuel charge cool, to keeping your driver comfortable. To do this, we've contacted many of the industry leaders in their respective categories for hints and tips on keeping excess heat at bay, and they responded with some pretty interesting stuff. Of course, this is still racing, so there is no way we can turn the inside of your Super Late Model on an Alabama track in August into a cool dip in a mountain stream, but many of these tips can help you keep heat losses to a manageable level.

1 FLUIDS

We're talking about the car's fluids, not yours — lubricants and coolants, specifically.
It's a well-known fact that when it comes to lubricants and oils, synthetics are less susceptible to thermal breakdown than mineral-based lubricants. But that isn't the only way you can use your race car's lubricants to lower heat. The primary purpose of oil is to reduce friction. Reducing friction increases horsepower and torque, as you already know, but it also reduces the heat that is a by-product of the friction. This is also true in the transmission and rear end, where more efficient oils can reduce the heat produced from driving the gears.

Royal Purple's engineers also tell us that the motor oil you use can also aid the combustion chamber seal at the rings. By providing a better seal between the cylinder wall and the piston rings, Royal Purple says its oils can lead to a 12 percent reduction in coolant temperature. As proof, the company says that it performed thermal imagery testing on a V-twin motorcycle engine to find that the oil temperature can be reduced 25 to 44 degrees F with just an oil change.

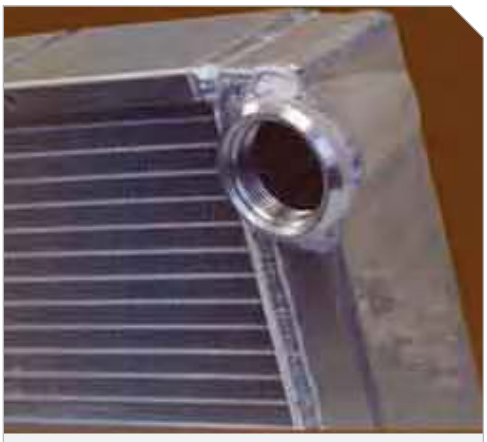
When it comes to the coolant in your engine and radiator, additives are also a popular way to knock the temperatures down. A good example is Royal Purple's Purple Ice coolant additive. These "coolant boosters" work by reducing the surface tension of the coolant (plain old water seems to work best), which allows better heat transfer from the metal in the engine into the coolant, and then from the coolant to the radiator. A secondary benefit from coolant additives like Purple Ice is that they also inhibit corrosion and scaling inside the engine, which is important because excessive scale buildup inhibits the flow of coolant through the engine and can lead to hot spots.

2 RADIATOR

The used Nextel Cup parts market is a great thing for Saturday-night racers trying to find more performance on a budget. But many racers have made a big mistake purchasing a used radiator out of a Nextel Cup car and installing it into their short-track machine. When racing a slower car on a more confined racetrack, the airflow to the radiator is going to be significantly less. Because of this, most radiators built for short-track racing use fewer fins to promote better flow through the radiator. "For a 1/4- to 3/8-mile track, I would recommend a radiator with a fin count in the range of 14 to 15 per inch with a two-row core," says C & R Radiators' Chris Paulsen. "As you get faster, you can increase the fin count, but on the lower speed tracks you will get better cooling by making sure you get plenty of flow through the radiator. More fins gives you a chance at better heat dissipation, but if you aren't getting the air moving through the radiator it doesn't do you any good."

Paulsen also recommends a regular cleaning regimen to ensure your radiator remains at peak working efficiency. If you race asphalt, rubber buildup can be a problem. Soaking your radiator in a solvent bath can help loosen up the tiny pieces of rubber that gets wedged between the fins. Just make sure, Paulsen cautions, to always cap off the ends of the radiator so that the solvent doesn't get inside the coolant tubes. "Most double-pass radiators use a baffle that uses a high-temp silicone seal," he explains. "If you allow solvent to get inside the radiator it can attack that seal."
If you are racing dirt, rubber buildup isn't as large a problem, and solvent doesn't have much effect on dirt. Instead, soaking your radiator in a soapy water solution will help. After soaking your radiator (either asphalt or dirt), rinse it with low-pressure water from a garden hose from the back to push any debris out of the radiator in the direction from which it came. Never use a high-pressure water hose (the kind you will find at a car wash) on your radiator because it can easily bend the cooling fins and do more harm than good.

Engine coolant "boosters" such as Royal Purple's Purple Ice, work by lowering the water's surface tension. This allows more efficient heat transfer from the metal in the engine to the coolant. When the hot coolant reaches the radiator, it also means it can more easily transfer its head to the radiator.



Chris Paulsen of C & R Radiator says that choosing the proper fin count is important for determining the right performance for your car. Slower, tighter tracks mean less airflow and require more spacing between the fins.

THE HARD FACTS ON COOLANT BOOSTERS
As part of its testing, Royal Purple performed dyno runs checking engine temperatures to see how different mixtures of coolant performed.

Here are the numbers they provided us:

50/50 mix of water and antifreeze 228°F

50/50 mix of water and antifreeze with Purple Ice added 222°F

Water only 220°F

Water with Purple Ice added 200°F

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Finally, Paulsen says that radiator stop leak products are a racer's worst enemy. "That stuff uses a ceramic that coagulates when it makes contact with air to plug any leaks. But racers are always draining their radiators to either pull it or the engine. As soon as that happens and you get air in the system, all the stop leak inside the radiator hardens and creates a ceramic insulator inside all the cooling tubes."

3 COATINGS

In just a few years, coatings have gone from something many racers considered to be little better than snake oil into a tool that's used just about everywhere on a race car. Coatings are widely thought of as a way to reduce friction, but other blends are great at controlling heat. The trick, according to Tech Line Coatings' Leonard Warren, is to understand what you want to do with the heat your race car produces. Coatings, known as thermal dispersants, can be used to help hot parts on the car radiate heat more efficiently. Tech Line sells coatings designed to be applied to radiators, oil pans, brake calipers and just about anything else you can think of to help them stay cooler. "We have seen thermal dispersants improve the thermal transfer efficiency of a radiator by 20 percent," he says. "I've applied it to an alternator and watched it drop 30 degrees of operating temperature the next time it was installed on the same engine."

Thermal barriers are an insulator and do the opposite. They can be applied to headers to keep the heat inside the tube and keep the engine compartment cooler. You can also mix and match the two. On an intake manifold, for example, Warren recommends applying a thermal barrier to the base and cylinder head flange to keep heat from radiating from the engine into the manifold. Then, apply a thermal dispersant to the top and under the runners if you are racing an air-gap manifold to help radiate any heat that the manifold does absorb. This can help keep the incoming air / fuel charge significantly cooler.

Coatings have also become incredibly durable. Warren says one of the areas to apply an engine coating can be inside the combustion chamber. A thermal barrier on the chamber roof and piston floor traps heat inside the negative space of the combustion chamber. "Many people think a coating inside the combustion chamber will make the metal hotter, but it does the opposite," he explains. "It keeps the metal from absorbing the heat from combustion and instead makes the cylinder firing more efficient. Instead of being absorbed into the cylinder head or engine block, the heat is used to produce more force pushing the piston down and then goes out the exhaust port."

4 THERMAL BARRIERS

Like coatings, thermal barriers are used just about anywhere and everywhere on a car. Thermal barriers come in many forms, but all are for the same purpose: keeping heat from traveling through that area. Sometimes it is to contain heat within a small area (header tubes). Sometimes it is to protect a cooler area from being warmed by a radiant heat source (the driver's compartment).

Design Engineering produces several products designed to keep the heat produced by your race car where you want it and away from the places you don't. One of the most interesting products is what Design Engineering calls its Protect-A-Boot. These are insulated sleeves designed to protect the spark plugs' connectors. These are extremely close to the exhaust headers and if the rubber boots melt or burn in spots, it can cause engine misfires.

The company also produces insulating mats that work well at keeping radiant engine heat from invading the driver's compartment. Design Engineering's Floor and Tunnel Shield is lightweight and just 3/16-inch thick but can withstand 1,170 degrees of direct, continuous heat while reflecting almost 90 percent of that heat. When applied to the firewall and floorboard where necessary, this can make a big difference in terms of driver comfort — and safety. After all, air blowing on your driver from a NACA duct can only do so much good when the bottom of his aluminum seat is cooking his backside like a frying pan.

STAINLESS STEEL = COOL?

Leonard Warren gave us a neat tip when it comes to heat control and the air / fuel charge. It doesn't have anything to do with coatings, but it was simply too good not to pass along.

"One thing many racers don't think about is to use stainless steel fasteners and insulated washers to connect everything between the carburetor and cylinder head," he says. "Stainless steel doesn't transfer heat very well, but carbon steel does. You can insulate everything, but if you use regular carbon steel bolts, the heat will just travel down those like a wick. I know one company that did a test with all different types of carburetor spacers. They found that nothing provided much insulation until they switched out the bolts holding down the carburetor and spacer with stainless steel bolts. If you are using a phenolic spacer but not getting the improvement you expected, it's probably because the heat from the engine is just traveling right up the bolts, past that phenolic spacer and heating up the fuel right in the carburetor. Switching to stainless fasteners will make your phenolic spacer a lot more effective."

In many cases, when it comes to stock car racing, coating a set of exhaust headers is preferable to wrapping them. But there are times when you require more insulation in specific areas — such as when the header runs right beside the starter. For those occasions, header sleeves work well.

Design Engineering produces these sleeves designed specifically to protect the spark plug boots from heat damage, which can cause misfires.

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5 RADIATOR FANS

Flex-a-lite is one of the leading manufacturers of automotive cooling fans of all types. When it comes to radiator fans to assist cooling, the company produces electric fans, clutch fans and fans designed to be mounted solidly to the water pump so we asked Lisa Chissus what works best for racing.

The answer, as you might expect, is to go with the electric fan whenever possible. Electric fans are powered by their own motor so they don't rob power from the engine, and dyno testing has proven that an electric fan can save you 25 hp versus an OE clutch fan. Fan clutches should never be used in racing because they only eat horsepower. If you find that you need the extra pulling power of a mechanical fan mounted to the water pump. Flex-a-lite produces flexible fans that essentially "flatten" out at high rpm and pull less power. They also pull less air, but if you have correctly built your radiator box the incoming air should be strong enough to provide adequate cooling by itself.

Whether you decide to use an electric or mechanical fan, Chissus strongly recommends using a fan shroud of some type. Air always follows the path of least resistance, she says, so if you do not use a shroud, the fan will simply pull air from inside the engine compartment and largely bypass the radiator. A shroud seals off the area between the fan and the radiator forcing the air pulled by the fan to come through the radiator. Shrouds should be designed to cover at least 70 percent of the radiator's surface area.

6 OIL COOLERS

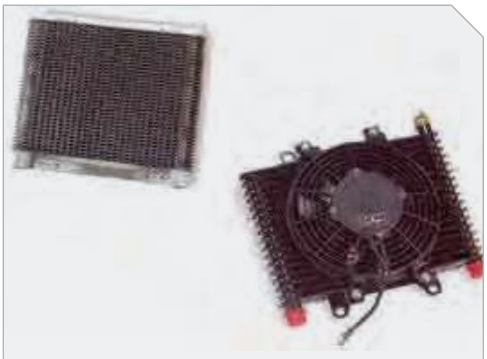
Since most Saturday-night racers are less than 100 laps on tracks that are 5/8-mile or less, many racers believe they don't need transmission and rear-end oil coolers. Granted, it is critical to run a rear-end oil cooler if you are running a Nextel Cup race at Atlanta, but your Late Model may be helped by one too.

The friction created by gears meshing in the rear-end produces extreme localized heating. This heat is right between the gear teeth, so shooting an infrared temperature gun on the housing can be misleading. A simple, belt-driven oil pump and a small oil cooler can make a world of difference. Keeping the temperature under control keeps the friction created between the ring and pinion gears from robbing as much power and also improves the reliability of the locker springs. By pumping the oil, you can also direct the cooled oil directly onto the ring gear as it re-enters the rear-end housing. This provides much better cooling and lubrication than relying on the ring gear to splash into a pool of oil at the bottom of the housing.

Manufacturers such as B & M Racing Performance produce high performance oil coolers that not only provide good heat transfer from the oil to air with minimum size and weight, they are also very resilient in order to stand up to the abuses of racing. B & M produces a stacked-plate cooler, which you can literally stand on without damaging, and a cooler with an integral fan for providing extra cooling power when needed.

Electric fans are normally more efficient than mechanical radiator fans because they use their own motor and don't pull power from the engine.

Whether you are using a mechanical fan or electric, a shroud will greatly increase its efficiency in terms of how much air it actually pulls through the radiator core. This Flex-a-lite electric fan comes with a built-in shroud — just make sure it covers at least 70 percent of the radiator's surface area.



B B & M Racing Performance produces stacked plate oil coolers (left) that are designed to be both lightweight and virtually indestructible — perfect for racing. In applications where getting enough airflow is a problem, it also produces cooler air with integrated fans.

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7 COOL SUITS

In longer, endurance-type racing events, it becomes critically important to keep the driver cool and comfortable. For those situations where insulating the driver from engine heat and providing a continuous flow of outside air simply isn't enough, driver "cool suits" are available.

Cool suits designed for racing typically employ a shirt with several feet of surgical tubing sewn in place. A small electric pump continually moves chilled water from a cooler through the tubing to keep the driver cool. By keeping the driver's trunk cool, the blood flow cools the rest of the body. Other systems provide chilled air, which is blown inside the driver's helmet. The cool air cools the lungs and, in turn, cools the rest of the body. The benefit of this system is that it can keep the driver's face shield from fogging up, but if the driver is wearing contacts the air can also dry out his eyes.

Cool Shirt produces both types of driver cooling systems and even sells a combination system that provides the driver with both chilled water to a cool shirt and cooled air inside his helmet. When shopping for a system, Tom Engebretson, Cool Shirt's general manager, recommends making sure it has a temperature or speed regulator that the driver can control. If not, the driver can become chilled, which can be just as much a detriment to concentration. Also, many cool air systems offer options to filter the air before it reaches the driver, which is an excellent idea.

Most cool suit designes feature several feet of surgical tubing sewn into a shirt that is worn next to the driver's skin. A small electric pump pushes chilled water through the tubes, cooling the driver.

8 PERSONAL PROTECTION EQUIPMENT

Personal protection equipment is just a fancy way to say the driver's firesuit, gloves, shoes, helmet and anything else on his body. The biggest complaint about personal protection equipment in general, is that in order to protect you from a fire the stuff makes you awfully hot and sweaty.

Fortunately, many companies are working on ways to make the stuff more protective with less bulk. One of the latest developments is a material called CarbonX® that Simpson and other manufacturers of protective equipment are including in their products. When used in clothing, CarbonX® is capable of withstanding 2,000 degrees F without damage and won't shrink or char when exposed to direct flame. It's also comfortable. CarbonX® can be worn next to the skin and possesses good wicking properties. That means it keeps you more comfortable when you sweat.

The old adage still holds true that more layers in your firesuit will mean better protection, but with the new advancements in technology the protection is better than ever before.

This high-end cool suit from Cool Shirt cools the driver with both chilled water against his skin and cool air to the helmet. It features regulators that the driver can control to adjust the level of cooling and a filter that cleans the air the driver breathes.

SOURCES

B & M Racing Performance
818-882-6422
www.bmracing.com

C & R Racing
317-293-4100
www.crracing.com

Cool Shirt
800-345-3176
www.coolshirt.net

Design Engineering
800-264-9472
www.designengineering.com

Flex-a-lite
800-851-1510
www.flex-a-lite.com

Royal Purple
888-382-6300
www.royalpurple.com

Simpson
800-654-7223
www.simpsonraceproducts.com

Tech Line Coatings
972-775-1429
www.techlinecoatings.com

Simpson is producing apparel that uses a material called CarbonX® to provide better protection and to wick sweat from the driver's skin to improve comfort over the course of a race.