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JULY 2007
COOL BREEZE
A SNOW PERFORMANCE BOOST COOLER

HAVING LIVED THROUGH A SUMMER IN LAS VEGAS, WE CAN TELL YOU THAT IT GETS HOT. IT'S NOT THE KIND OF HOT YOU ARE LIKELY TO SEE IN THE MIDDLE EAST, BUT WE'RE TALKING TRIPLE-DIGIT TEMPERATURES, NONETHELESS. EVEN IF YOU ENJOY HOT WEATHER, YOU HAVE TO BE SERIOUS ABOUT PERFORMANCE MODIFICATIONS TO PERFORM THEM IN 110-DEGREE HEAT. AND WHILE IT'S TOUGH ENOUGH ON A MECHANIC, IT'S WORSE FOR A HIGH-PERFORMANCE ENGINE AS HOT WEATHER ELEVATES ENGINE, OIL, COOLANT AND INTAKE TEMPS.

Steps should be taken to combat elevated oil and water temps, which is usually accomplished with a larger radiator, and lowering the coolant temp will have a positive effect on the oil temp. But for better control, a dedicated oil cooler is recommended. The combination should keep your motor coolant happy, even in the hot climates.

While a radiator upgrade and oil cooler will drop the respective system temperatures, it will not lower inlet temperature. And as heat is the enemy of performance, the colder the inlet air, the more power the engine can produce because colder air is more dense, meaning that it is tightly packed with power-producing oxygen molecules. The more oxygen molecules present in a given volume of air, the more power it will support, which is why race teams go to great lengths to build true cold-air systems. Not surprisingly, the engine generates a lot of heat while producing a given power output, and this radiant heat makes running an open-element (to the engine compartment) air filter a serious detriment to power. But by channeling cold air from an outside source, you bypass this hotter engine compartment air. While open-element air filters might look great, figure that such a configuration will add 35-40 degrees to the inlet temperature, and you'll see that it's not good. In addition to limiting power output, hot air also increases the chances of detonation, which is the sworn enemy of any high-performance motor.

Considering the fact that cold air equals more power and less chance of harmful detonation, there are applications where direct cold air to the motor is still not enough, like with a forced induction application. While turbo and blower motors will dramatically increase power output (especially on a VTEC Honda), there is a downside to boost. The laws of physics increase inlet charge temp as boost pressure increases because heat is a natural byproduct of compression. The higher the boost, the higher the inlet charge temperature. And as mentioned, heated inlet temps increase the chance of detonation. Things can only get worse from here as not only is the likelihood of detonation increased, but elevated cylinder pressure compounds the problem, further increasing the likelihood of detonation. Given the risk of detonation, how can it be that Honda Civics are running around with forced induction?

The answer is simple; a number of methods of controlling the inlet charge temps on a forced induction application are available, the most common of which is an intercooler. Intercooling works by running the heated inlet air through a cooling medium. This...
The boost supplied by the Jackson Racing supercharger was a good match. The already-powerful B16A VTEC motor is a good match. The supercharger provides just what the B16A is missing most, low- and mid-range torque. Adding boost on top of an already-impressive top-end charge (once the VTEC cams engage) allows the motor to provide an exceptionally broad power band. Even a stock B16A equipped with a Jackson Racing supercharger feels like one big VTEC motor with plenty of power everywhere.

As impressive as the Jackson Racing supercharger kit is at its standard 7 psi, it’s even better at 10 psi. As with any form of forced induction, the trouble with increasing boost on the JR-supercharged B16A is that the kit does not include any form of intercooling to help lower the inlet charge temps. When increasing boost, it is possible to tune a higher boost combination by decreasing ignition timing and running a richer mixture, but while this will reduce the chance of detonation, both have negative effects on power, to say nothing of increased fuel consumption. Running such a conservative tune takes away a significant amount of power added by increasing the boost from 7 to 10 psi, and this situation is compounded when running the factory ECU, ignition.
and FMU supplied with the JR supercharger kit. But if your motor was equipped with, say, a Honda, you could dial in timing and fuel curves to improve fuel mileage and power while running 10 psi, but ultimately, the limiting factor would still be a function of available octane and inlet charge temperature.

The JR Supercharged B16A needed some form of intercooling, so we chose the Snow Performance Boost Cooler. By injecting a combination of water and methanol into the inlet air stream, the Snow Boost Cooler dramatically lowers charge temps after compression. Basically, the ent in the mixture acts as a high-octane fuel to slightly enrich the mixture. This can be beneficial for applications in which the fuel system (injector size or fuel pump) is nearing its flow limit. And unlike nitrous oxide, the water/methanol injection will not increase the power output of the motor on its own unless injected into a diesel motor, where huge power gains are realized thanks to the additional fuel present. It will substantially lower the inlet charge temperature, which will in turn allow you to increase boost pressure and/or ignition timing. It will also allow you to run a slightly leaner air/fuel mixture, though the major gains will come from the additional boost and timing.

To put the Snow Boost Cooler to the test, we installed one on an ’00 Civic Si equipped with a JR supercharger. The JR kit was equipped with a blower pulley that provided 7 psi of boost. The Civic was also equipped with an FMU supplied with the JR supercharger kit to provide additional fuel while running stock injectors, a 255-liter/hour fuel pump and an MSD ignition amplifier. As equipped, the supercharged B16A produced 192 hp at 8,200 rpm and 129 lb-ft of torque at 6,500 rpm. The torque curve was broad, exceeding 120 lb-ft from 4,500 rpm to 8,200 rpm.

OUR TEST MOTOR CONSISTED OF A MILD B16A EQUIPPED WITH A JACKSON RACING SUPERCHARGER KIT. THE KIT WAS CONFIGURED FOR STREET USE ON PUMP GAS TO PRODUCE 6-7 PSI.
Running 7 psi, the JR-supercharged B16A produced 192 hp and 128 lb-ft of torque. With the Boost Cooler and the boost safely upped to 10 psi, the result was an increase in power to 215 hp and 146 lb-ft of torque.

**BASE VERSUS SNOW PERFORMANCE**
**WATER/METHANOL INJECTION: HORSEPOWER**

With safety being a concern, we decided to test the Snow Performance water/methanol injection system. Unlike nitrous oxide, the water/methanol system will not add power by itself unless installed on a diesel. It will, however, safely increase the ignition timing and/or boost pressure while maintaining a given detonation threshold. Like a conventional intercooler, you can produce more power on a given octane rating because of lower inlet temperatures. Since the Jackson Racing-supercharged B16A was not intercooler-equipped with the Snow Injection, we were able to safely increase the boost pressure by 2.5-3.0 psi. The result was a jump in power from 192 hp to 215 hp throughout the rev range without detonation.

**BASE VERSUS SNOW PERFORMANCE**
**WATER/METHANOL INJECTION: TORQUE**

With the proper air/fuel and timing, you can safely run 6-7 psi of non-intercooled boost on a B16A-powered Civic SI, but run more and you are flirting with detonation. This is especially true in hotter weather. It was with this in mind that we installed the Snow Performance methanol injection, and while we likely left a great deal of power on the table as we did not touch the ignition timing, upping the boost by 2.5-3.0 psi resulted in a consistent torque gain, with peak torque jumping from 129 lb-ft to 146 lb-ft. Torque production exceeded 140 lb-ft from 5,400 rpm to 7,600 rpm. Better yet, we know that this newfound power and boost level will be plenty safe, regardless of the ambient air temperature (we tested on an 87-degree day).