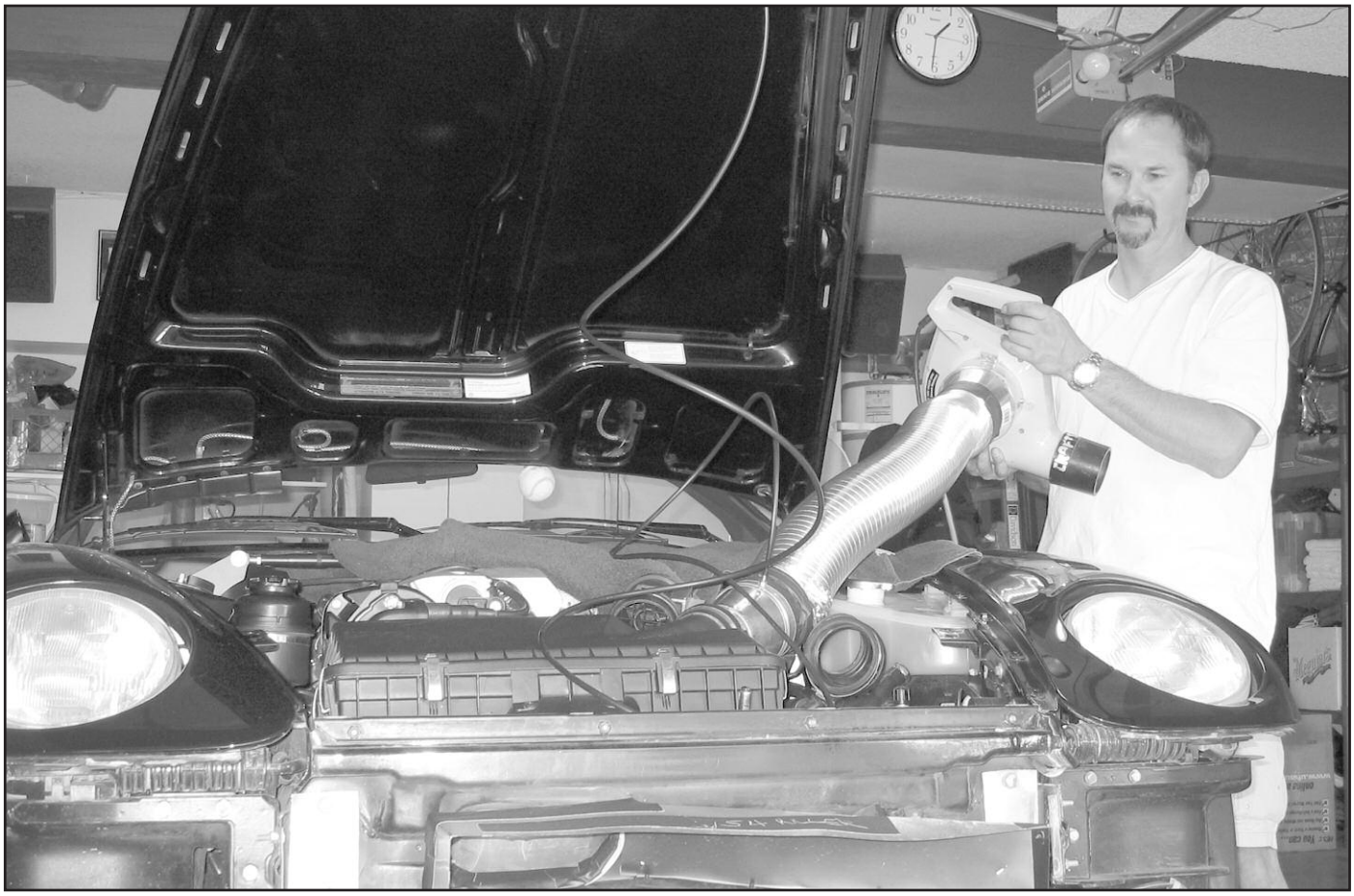
HOW MUCH DOES YOUR INTAKE



SUCK?

by Bob "Flash" Larson

Have you ever had one of those days where everything you know seems wrong? That's the kind of thing that was going on when we started working on the intake of the 968.

In the ongoing search for ways to squeak little bits of hidden power out of the already potent 968 engine, without spending a year of your child's college tuition, there are really only a few places to look. Porsche did a pretty good job of getting all there was to be had out of the 3.0 liter 4 cylinder power plant. They did have certain marketing and practicality limitations though, which left a couple of areas open to a little massaging. In a previous article, we found there was a fair amount to be had, for very little money, in the Racer X chip from www.Speed-6.com, which managed the fuel mixture and timing better than the other chips on the market, and added a nice little bump to the already wide power curve. We then decided to look into the other half of the fuel mixture equation, the intake.

The intake manifold itself is a thing of superb engineering. The innovative resonant induction technology resulted in an effective .3 bar (4psi) boost. This coupled with the Vario-Cam made for a 14% increase in horsepower and a 9% increase in torque over its derivative engine, and all without increasing fuel

consumption. Getting anything out of the intake system, after the MAF, was going to prove to be difficult, and definitely costly (not keeping in line with the idea of D.I.Y mods). Forward of the MAF however, we suspected some serious improvement could be made in the reduction of negative pressure.

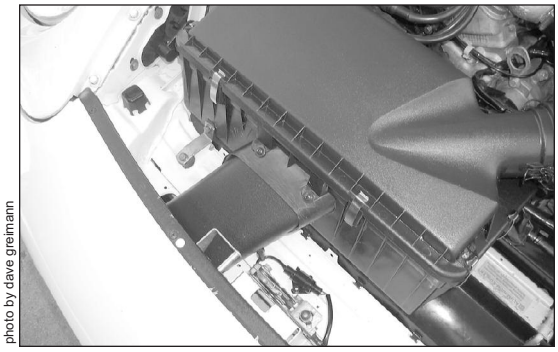


photo by dave greimann

Negative pressure is simply resistance in the intake system, (caused by things that slow the air down, or hinder the airflow's getting into the cylinders). The goal of any intake is to get the most amount of cold air into the engine. At the same time, governments place restrictions of acceptable sound levels those intakes can produce. Furthermore, design, marketing and manufacturing issues come into play, often resulting in performance compromises. This is the case with the 968 Airbox and filter. The factory Airbox, while doing an excellent job of attenuating sound, does a pretty poor job of getting air into the engine. That's right, Porsche messed up!

Taking a look at the Airbox itself, one immediately sees that it is an odd shape, and not likely to lend itself easily to smooth flow. The paper panel filter is not being effectively used, which is easily seen by a look at the dirt pattern, which only comprises a small area of the filter, exactly matching the path from the snorkel to the MAF. The snorkel is a very small opening, which is parked behind a bumper shock and makes a hard turn, which slows down the air. All of these things help quiet down the intake, but we were sure were robbing the engine of power. We were confident that we could get more air into the engine if we grabbed more air at the inlet and then let it funnel down to the 3" diameter MAF.


photo by dave greimann

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To test the theory, we did some experimenting. My good friend Dave Greimann fabricated a modified snorkel, which increased the intake area by 70% and eliminated the bend. It retained the "Bell Mouth" feature, found on the stock snorkel, which we knew would facilitate the reduction of turbulence. Driving results showed improvement in throttle response. Ok, we were on the right track. Bigger is better. But how far can we go? This led to my design of a ram-air intake, which consisted of a complete sheet metal plenum and intake snorkel that increased the intake area by 90%, and had the additional advantage of the ramming effect of the plenum, which was more than 4 times the surface area of the stock snorkel. Even better response, and improvement that was easily felt. The subjective results were good, but we felt that there was more to be had, and now it was getting down to real engineering work, and we needed to do some real testing. It was time to create a controlled environment and break out the Manometer.

We inserted tap points in multiple places in the Airbox, so we could attach our Manometer, and a fixed pressure source, to determine where the resistance points, or negative pressure zones were, and ultimately eliminate them.

We tested the stock Airbox with a stock paper filter, and with a K&N filter. We then tested the stock Airbox with both filters and with Dave's snorkel. Then we tested the Plenum system. We were sure that one of these would provide the best intake we could get. We never considered, at this point, that Porsche had designed in a problem. The results were in line with what we expected, and were very pleasing.

But was this all there was? Clearly the plenum was getting more air into the system, and the results were impressive, but we still wondered if there was more to be had. We knew about cone filter setups, and while costly, they resulted in gains on other cars. The application on this car was going to be difficult, because it required removing the front bumper cover every time you wanted to clean or change the filter, which made it unattractive, but if it meant real gains, we thought it might be worth it. There was one system out there that we already knew of, and it made claims of 15hp. We knew we couldn't leave that stone unturned.

We decided to duplicate that system, and test a cone filter intake that featured a 3" pipe connected directly to the MAF, and had the filter placed immediately behind the center grille of the car. Wow! A big improvement in negative pressure

photo by bob "flash" larson

reduction. The cone filter worked. This puzzled us though. The surface area of the pipe was only as big as the stock snorkel. We knew from our systems that bigger was better. How could something smaller work better? What were we missing?

After going home that day, both Dave and I refused to let go of that question, and after we had a phone conversation, Dave conducted a little experiment of his own. He punched some big holes in the Airbox and hooked up the manometer. Bingo! The box itself was creating the largest part of the resistance. After a few more phone calls, and a little quick experimentation, we found that one could actually open the box up to a point were the air filter became effectively transparent. A removal of the stock snorkel and its rubber trim gasket, and the addition of a few well chosen holes at just the right size, (along with some trim pieces from www.968Engineering.com, that maximized the flow and cleaned up the appearance), and we were there. We had bested even the cone filter! That meant that the MAF could pull as much air as it wanted, unencumbered by anything in front of it! ZERO restriction to the intake manifold (other than the MAF itself). Here is a chart that shows the restrictions, measured in inches of water, of the different intakes.

SETUP	AFTER FILTER	BEFORE FILTER
ALL STOCK	6.50	5.50
K&N ONLY	5.50	5.50
LG SNORKEL & K&N	3.50	3.50
FULL PLENUM + K&N	3.20	3.20
CONE FILTER AND TUBE		2.75
MODIFIED BOX + PAPER	1.00	0.00
MODIFIED BOX + K&N	0.00	0.00

Fitting the Airbox was also improved by the replacement of the little rubber inserts (that hold down the lower half of the Airbox, and are a real pain to reinstall in the radiator support), with some great little captive hardware pieces (also available at www.968engineering.com).

Ok great, but what about intake temperatures you ask? Some quick checking there showed that as long as the car was moving, the intake temperatures at the MAF were the same as ambient temperature in front of the car, and the time it took to drop the extra 15 degrees or so that would accumulate while the car was sitting still, was so short, that you've spent more time reading this sentence than it took to cool it back down. In fact, after a short bit of driving, the sheet metal in front of the Airbox actually gets cold to the touch, while the sheet metal elsewhere in the engine compartment is still quite warm.

This is as much air as you can get into this engine without forced induction. All this was with no removal of the front bumper cover, and no expensive parts to buy. We had hit the mother load!!! Some road testing had our Butt-O-Meters registering almost as much improvement as the chip gave us. This was incredible. Now it was time for Dyno testing.

We showed up again at our favorite Dyno shop, Brainstorm in Culver City, CA, who specializes in, and deals almost exclusively in, Dyno tuning and forced induction systems. We used another of our local group member's cars belonging to Ken Chaing. We were halfway through the testing when all of a sudden coolant was spraying everywhere. It shot all over the bay and all over the Dyno.

Important side note: when contemplating doing any such testing, make sure that everything is in tip-top shape. You will be subjecting the car to loads that may make things fail that you had not considered before.

After doing some emergency bypass surgery on the now leaking upper radiator hose, we were again ready to get back to the testing. We expected some smoking, as a result of the coolant going everywhere, and as we started the next run, we were not disappointed. Then, oddly, the smoking became more of a billowing, and from the other side of the engine. I looked down to find that there was a small very strong jet of oil coming from the base of the oil filter. Now there was not only the watery coolant all over the floor and Dyno, but there was the liquid brown from the oil. It looked like a very bad morning after a very good night of way too much Tequilla. After making the appropriate embarrassed apologies, and a bit of cleanup, and tightening back down the loose oil filter, we went again back to the testing. Unfortunately, during all the mishaps,

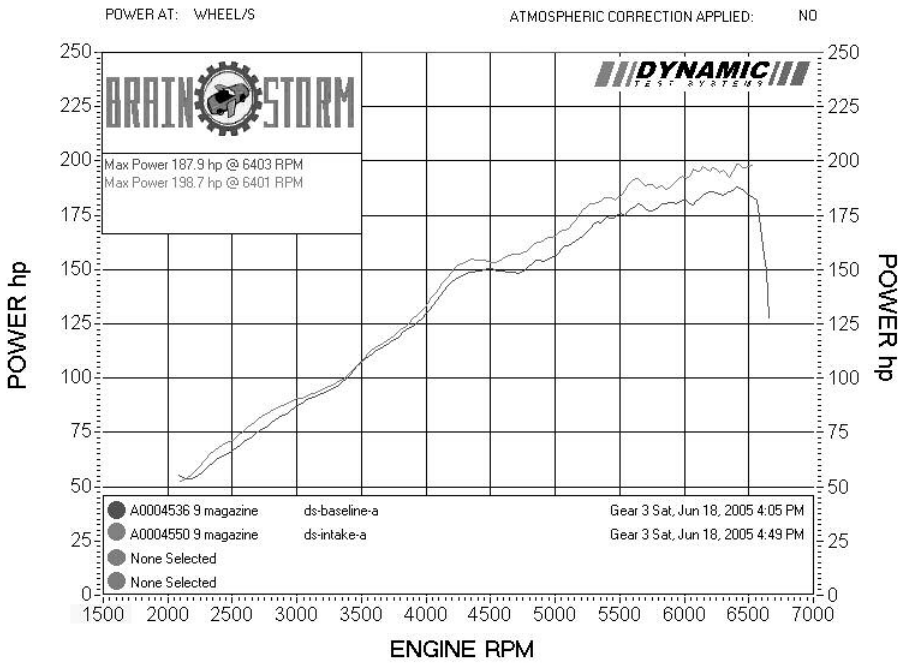
conditions were allowed to slip out of control, and the data was corrupted. This meant another day at the Dyno.

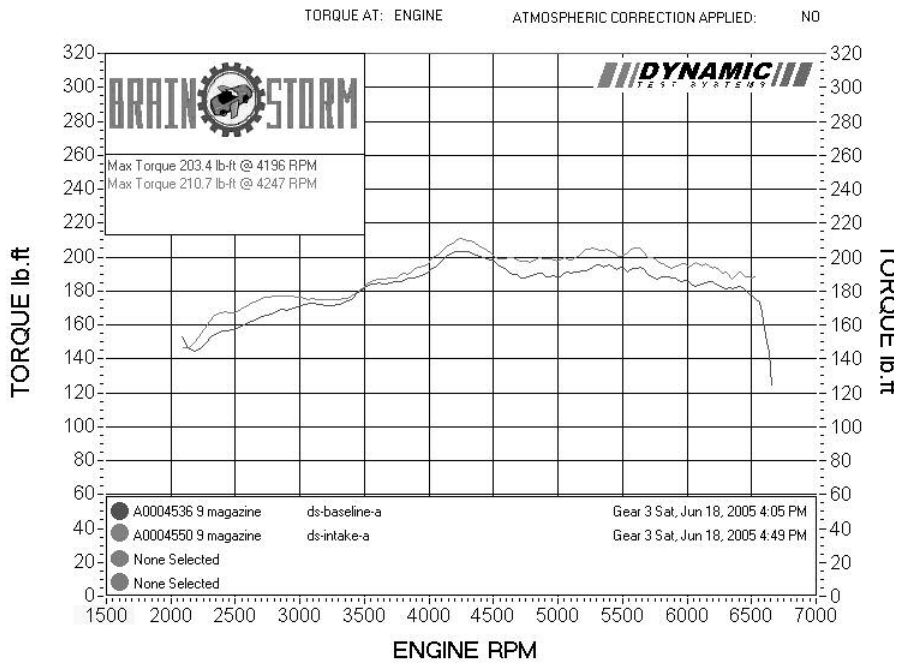
Ken's car was unavailable this time, so another local 968 owner, DJ Paul, loaned us his car. You just have to love a guy that says "Sure. Take my car and run it to redline numerous times. Have fun." This time we got through it all just fine.

The results were amazing. The Airbox mod and K&N air cleaner together gave us 10.8 peak horsepower and 7.3 lb/ft of peak torque for about $40!!!

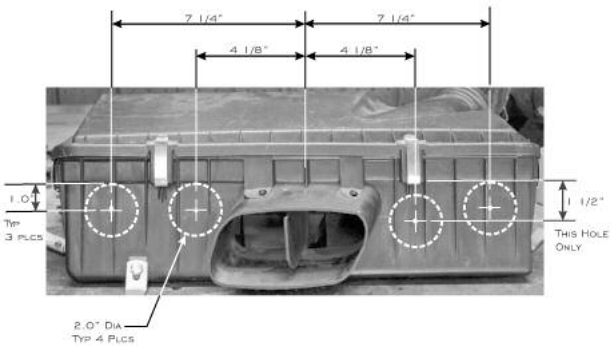
This was truly one of the easiest and best mods we have done to the car to date. The only down side we can see, is the addition of a small amount of intake noise, in the form of a nice deep throaty growl when you stand on it (frankly a big plus in our minds). There is also the potential for some additional cleaning in the engine bay, as the intake is no longer sealed from the outside world, and stuff from in front of the car finds its way in there a bit more easily. We think this is a great opportunity to get in there a bit more frequently and check other things out anyway, and well worth it.

For those of you who wish to duplicate our "free" horsepower, here is a diagram of where to put the holes. All you need is a hole saw, a variable speed drill, a glue gun, and the parts mentioned above.





AIR BOX FLOW MODIFICATIONS



1. USING A 2.0" DIAMETER HOLE SAW, CUT 4 HOLES IN THE AIR BOX FACE AS SHOWN.

2. HOT MELT GLUE IN THE TRIM RINGS FOR A FINISHED LOOK. OTHER BONDING METHODS ARE ACCEPTABLE TOO, BUT CAN YOU ACTUALLY WAIT 5 MINUTES FOR THE EPOXY TO CURE TO TRY THIS OUT??? :)