MotoMan

"The Moto ~ Maniac"

Power News Magazine

Presents:

Intake Porting Secrets !

Part 3:

The 2007 Superbike

Welcome To Power News !!

You're about to learn how to build a "2007 Superbike" ... using inexpensive porting technology, even before the manufacturers release it to the market !! Be sure to read the 17 past issues at the bottom of this article. They contain insights into how engines actually work, and intriguing new ways to power up your bike without spending a lot of money.

Take a pit stop from the "information super highway" and spend some time reading these pages. Get ready to explore fascinating new engine technologies and the ideas behind the power. I hope you find that you've gained some valuable knowledge for your time spent here on the pages of Mototune USA.

Power News is 100% free !! I only ask that you to help us promote the sport of motorcycling !!
If you like Power News, please forward this page to all of your riding / racing friends in your e-mail address list !!

Thanks !!
~ MotoMan

The 2007 Superbike

In 1899, this statement was released by the US patent office:

.

"Everything That Can Be Invented Already Has Been"

.

Looking back over history, we laugh at many of the ridiculous ideas that were held as 'fact' by the 'scientific establishment' of the time.

At the same time, we are amazed to learn that the true innovators, the free-thinkers & those who were ahead of their time were ridiculed or even punished for their daring to challenge the status-quo ... only to be found correct many years later.

Hindsight is 20/20 ... but the same "stuck in the box" thinking of old is still

here,
even in the 21st century. The 2002 version of this is: "there are so many people who have thought about this before me, all the good ideas are taken. "

Throughout civilization, people have always thought that their time was at the peak of innovation and invention, only to have the next generation develop newer, more innovative ideas.

The truth is that, even with all of our advances, we "know" a lot of facts, yet actually understand only a little.

Six Ways To Think Out of the Box:

1) **Don't** Automatically Believe Everything You Read
2) **Always** "Explore The Opposite"
3) **Never** Fear Failure
4) When in Doubt, **Go** For It !!
5) **Never** Put Limits On Your Imagination
6) **Read Power News**

Thinking Out of The Box To Discover High Velocity Porting:

Don't Automatically Believe Everything You Read

Many motorcycle tech articles say that big bore piston kits give more midrange and less of ar increase in top end power. The reason they give is that the port's ability to breathe at high rpn won't be matched to an increased displacement's ability to suck in more air/fuel mixture.

That seems to make perfect sense, except that it relies on the assumption that the ports are the correct size to begin with !!

When I first "over bored" an engine in 1990, I was surprised to learn that overbore pistons actually make lots more power at high rpm !!
This is a clue that the stock ports may not be small enough to provide the port velocity needed for maximum power.

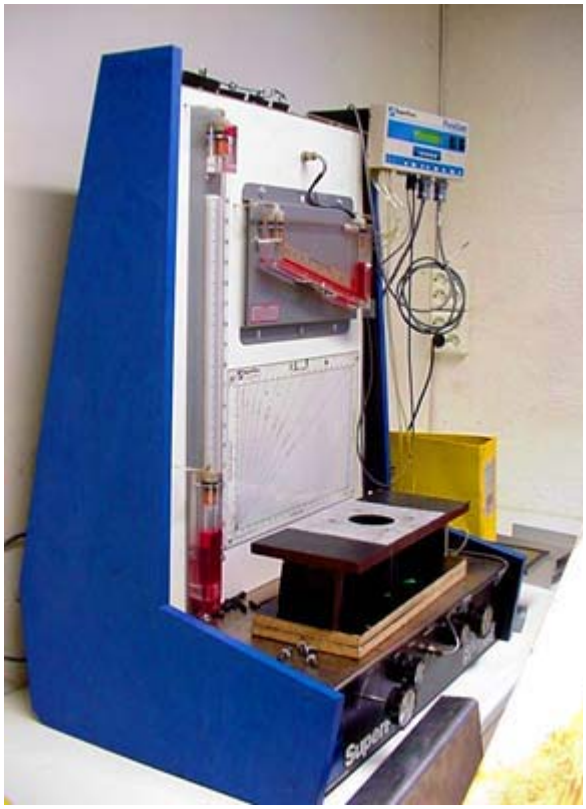
New Way To Use A Flowbench !!

A flowbench can be used to develop smaller, more aerodynamic ports.

The experiment I recommend is to apply modeling clay to the stock ports to test the effects of smaller port volume on airflow.

**By "exploring the opposite",
you can learn more about how to gain something:**

By first learning how to lose it !!



A Superflow Flowbench

Using Clay For Flowbench Testing

One of the problems with porting, is that by the time you find out you went the wrong way, the cylinder head may be ruined (**$$$**).

By adding clay to the stock ports, you can "ruin" the flow without actually ruining the ports. That's the best way to learn where the least "flow sensitive" areas of the port are.

Here I've added clay to 1/2 the port, so it's easier to compare the size difference of high velocity porting.

If an area is unaffected by the clay, you should try adding more. Using this method, an accurate "picture" of the flow characteristics of a port can be visualized.
Doing something "wrong" is sometimes the best way to figure out what's "right" !

Always "Explore The Opposite"

In this case, there was a huge

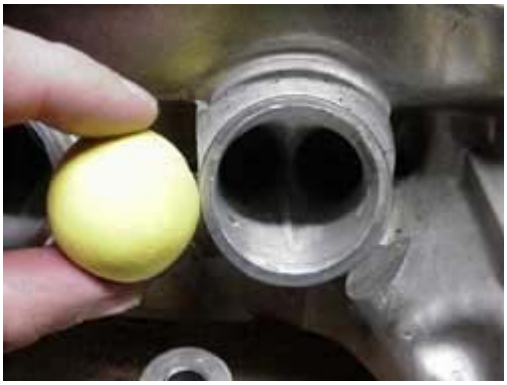
surprise !!

The photo on the right shows how much clay can be added to both sides of the port floor. The airflow, as measured on a flowbench **remains the same** !!

How is this extra space in the port helping flow or horsepower ??? It isn't, the area in the port that is unaffected by the clay is just dead space.

The port's airflow is mostly determined by the valve size. Extra space in the port only lowers the velocity.

There's lots of unnecessary dead space in the ports of most (1985-2002) multi intake valve Japanese motorcycle engines !!



There's this much dead space in a Honda CBR 600 F3 intake port

If you own a flowbench:

It's tempting to want to increase the port flow, but it much more important to increase the velocity !!

Most modern engines already have more than enoug flow in the stock ports. What they need is more velocity. I've intentionally made the ports so small tha they flowed 8% less than the stock ports. These high velocity ports always make the best midrange and top end power !!

Do the "clay test" first !!

Never Fear Failure

If a port can be made smaller without losing flow, then it seems logical that there should be a midrange gain, and you can consider that knowledge a win. On the other hand, if the bike turn out to be slow, it could be embarrassing !! But it wouldn't be failure, because it you'd learn a new way that didn't work, and that knowledge is a win as well !! Either way... you win !!

Never Fear Failure	**Never think of "failure" as failure, only as a valuable guide that re-directs you in the right direction.** **It's not easy to do, but when you decide to truly apply this concept, you'll never lose !!** **The only way people fail is when they're too afraid and don't do anything.**

When in Doubt, Go For It !!

As it turned out, I got "lucky", because when I first tested this porting idea in 1993 on a Honda Hawk at Daytona, there was both midrange & top end power gain !! Every multi intake valve engine I've tried it on since then has had a similar power increase.

" Luck " really is just a matter of "Going For It " enough times.

The Good News Is:

You Don't Need A Flowbench !!!

(I haven't used one in many years, and have won hundreds of races using this simple formula.)

The 65% Port Reduction Formula :

**For best power, the choke point height should be 65%
of the diameter of the intake valve !!**

An inside caliper is used to measure the height of the tightest point in the port. This is called the choke point, and it's located between the floor downturn, and the roof of the port just before the valve guide.

The only area that gets enlarged:

In order to make room for the porting tool, the intake valve guides should be ground down. This the only area of the port that should be enlarged.

Never grind down the exhaust valve guides

Measure the intake valve diameter.
This Honda F3 valve is 1.006 inches.

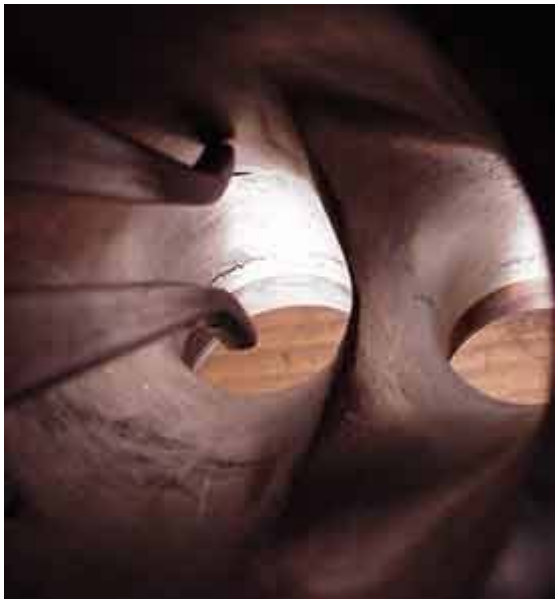
Use an inside caliper to measure the choke point...

The outside caliper is set to the valve size

1.006 inches X .65 = .654 inches.

In this photo, the inside caliper is set to 65% of the valve, or .654 inches.

The white line compares the 35% difference.



Here the caliper is at the choke point.

After the epoxy is in place it will be sanded down flat, until the calipers can fit into the .654 inches choke point. Only the height decreased, while the width of the port is unaffected.

Which engines does it work on ??

These are the cylinder heads I've high velocity ported to 65 percent of the diameter of the intake valve:

In each case ...

... the engine made an all rpm power increase of 6-8 percent !!

Yamaha
FZR 750 & 1000
FZR 400
FZR 600
R6, R1 & R7
YZF 600
(Thundercat)

Suzuki
GSXR 600 - 750
GSXR 1100
TL 1000 R&S
SV 650

Honda
Hawk NT 650
CBR 600 F2, F3, F4,F4I
CBR 900 - 929 etc...

Kawasaki
EX 500
ZX6,7,9,10,11
KLR 250-600
Vulcan 800

" Too Much Velocity ?? "

Honda F3

In 1996 I built a Honda F3 for the new 102 hp class. The rules allowed any engine modifications, as long as the bike didn't exceed 102 peak hp. on the official race dyno.

The engine had Wiseco 2 mm overbore pistons (636 cc's) and stock cams. Most F3's with this set up made around 99 - 100 hp with stock ports.

My customer wanted to be careful not to go over the limit, and he set a goal of 98 hp. I made the ports much smaller than I normally did, and when I flow tested them, they flowed 8 % less than stock !!

It seemed logical that if the ports had "too much velocity" the bike would gain midrange and lose 3-4 hp at high rpm. Using calculations derived from flow testing, I predicted that the engine should make 96 - 98 hp.

When we got down to the first 102 race at Daytona, I broke the engine in with about 6 dyno runs. The piston rings were definitely not 100% sealed, but the engine was ready for it's first full power dyno run.

The midrange was awesome, and it made 103.8 peak HP ... nearly 6 horsepower more than my prediction !!

Does reduction porting increase the port's turn radius, to make the ports more "downdraft" ???

No

On the newer, more "downdraft" cylinder head designs, this technique actually causes the port to become less downdraft.

The idea isn't to increase the port's turn radius or make it more downdraft, or even to make the air "flow" more easily. It's all about making the port a lot smaller for higher flow speed.

The ports that make the most power actually lose some
"flow" as measured on a flowbench !!

Remember: Velocity has a Greater Effect on Power than Flow does !!

Pushing The Limits 1 Step Further ....

Getting Down & Dirty !!

The KLX 250 ~ 365
"SuperDirtBike"

This motor had a 5mm larger bore, and a 9mm

longer stroked crank, which increased the single cylinder's capacity to 365 cc's !!

That would be like enlarging a 1000 to a 1460 !!

With a huge 46 percent increase in capacity, you wouldn't think the ports would benefit from being reduced.

One year before the motocross world was waking up to the reality that the 4 stroke Yamaha YZF 400 could rival 2 strokes in all out power...

This **KLX** project was already blowing away 2 stroke 250's !!

The Secret !!

Every possible area in the port was reduced, including the bowl area !!

By applying clay to the bowl area during flow testing, I was able to find another area of "dead flow space" in the KLX head. The epoxy really speeds up the intake charge past the valve and into the huge 46 % bigger cylinder.

The extremely rough surface finish helps to keep the fuel and air mixed as it enters the cylinder.

Finishing Your High Velocity Ports:

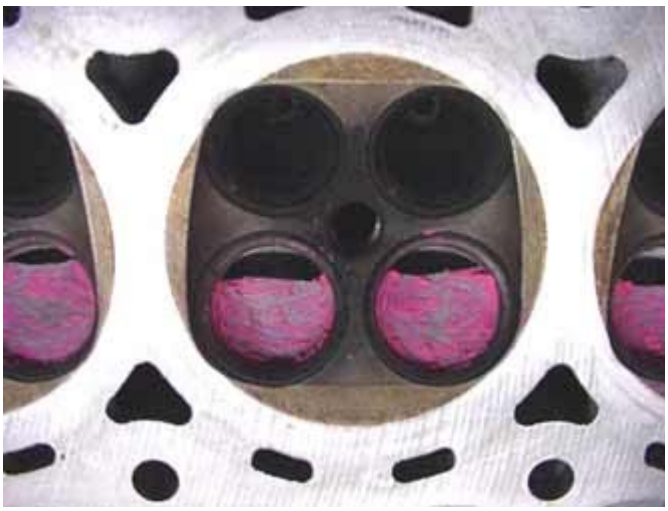
In the last issue we finished the port surface, and roughed it up in preparation for the epoxy. Next, modeling clay was used to keep the epoxy from running out past the valve seats. Then the ports were filled about 40 % with liquid epoxy. Let the epoxy set for at least 24 hours.

Now the clay's been removed and the epoxy is ready for finish porting:

First, sand down any irregularities in the floo and set the 65% choke height.

Don't sand on the sealing rim of the port !!

Instead, use a razor to cut off any excess epoxy.

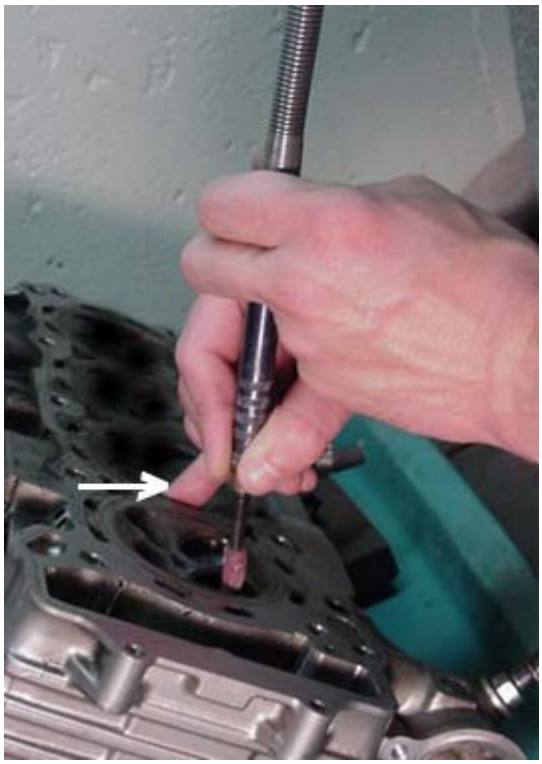


Be SUPER careful when you're removing epoxy near the valve seat area !!

Use a thin grinding stone to get out most of the extra epoxy from around the valve seat area....

60 Grit
(Coarse) Sanding Roll

...then use the 60 grit sanding roll to match the epoxy to the narrowest point in the valve seat insert, and to create a rough port surface.



Avoid the sealing area of the valve seat at all costs !! One nick with the porting tool will ruin the valve seal.

Also, be extra careful not to touch the lower valve seat angle. This port's flow has been ruined by another tuner who eliminated most of the lower angle !

Get a Grip

I grip the porting tool with both hands, also notice how I anchor my little finger to get maximum control of the tool.

Rotate the sanding roll in a circle to match the epoxy to the port throat. Keep the porting tool moving at all times to avoid digging into the epoxy.

As the aluminum and epoxy start to get matche up, put less pressure on the (softer) epoxy so i doesn't "sand" faster than the aluminum.

Ideally, you want the epoxy and the aluminum t blend perfectly, there should be no steps or depressions in the epoxy.

Caution:

When you're rounding the sharp angle from the floor to the valve seat, watch out that the sanding roll doesn't hit the valve seat on the other side !!

(It's easy to ruin a valve seat)

Next, use a strip of coarse emery cloth to get the radius almost perfect ...

For the last step, use a drop of super glue on a piece of emery cloth...

... to keep the sandpaper from falling off your finger !!

This will make the floor radius smooth, which is the most important area in terms of flow.

The intake ports are done !!

Where To Get Porting Bits:

Assorted Dremel Grinding Stones Available At Most Hardware Stores

60 Grit (Coarse) Sanding Roll & Pilot

60 Grit (Coarse) Sanding Roll
Box of 100
Part Number: 09898701

Pilot
Part Number: 09900663

...and now to answer the question you may be wondering:

Why don't the manufacturers know about smaller ports ???

MotoMan

"They Do."

!
!
!
!
!
!
!
!
!

Think about your answer to that one !!

... and I'll explain my answer in the next issue of Power News, which will be all about:

Exhaust Porting !!

Have a Cool Day !!

~MotoMan
