MotoMan

" Today, I'm Going to Talk About The Super Sonic Nozzle "

POWER NEWS Magazine

Presents:

Super Sonic Nozzle

V i e w e r F e e d b a c k

Hi MotoMan,

The other day I started working on another cylinder head for my car that I occasionally drag race here in Antigua, and I had started the porting on the inlets. I'd match ported the manifold to the head and hesitated.

Looking at the last head I'd done, I realized that opening everything up to the max had plainly worked against me. With dual twin weber 45's on the previous build, I'd lost 2 seconds in the quarter mile from high 14's to mid 16's.

I just thought I'd thank you for the kick in the ass wake-up factor. The port size and velocity of mix had been haunting me since last September and I was really beginning to feel that I was wrong in my assumption, as everybody around me was feeding me masses of other solutions.

I look forward to campaigning the car later this year and, believe me, you'll be among the first to hear confirmation of your porting thoughts.

Wonderful site.

Alistair

Hi Alistair !

I originally got the idea of making smaller ports on motorcycle engines from reading car magazines from the mid 1980's. They didn't specifically say that smaller ports were better, just that "sometimes" bigger ports weren't so good...

So, I just "thought out of the box" and decided to try smaller ports. They work !! The reason more people haven't done it has more to do "the box" than logic or evidence.

~MotoMan

Hi MotoMan!

I came across your engine break- in procedure link on the bulletin board for my car (Toyota

MR2).. after I read that, I proceeded to do no work the rest of the morning and read all of the articles. Thanks for the good info!

It just so happens that my engine, the 4AGE, originally came in what is now called the "large port", and later went to higher compression and smaller ports in the "small port" version. Some folks do the swap for the increase in HP, but I'm thinking I would just like to use JB Weld and shave the head a bit for the compression.

I was wondering if you have an opinion on the idea of JB Weld and aluminum expanding at different rates.

Thanks!
-- Adrian

Hi Adrian !

You just brought up a great point that I'll be getting to in this issue -- (Do manufacturers know about small ports ??)

The reason I use JB Weld is that it matches the expansion of aluminum and cast iron perfectly. Actually the more expensive "aluminum" epoxies I first tested in 1991 cracked and came loose !!

Since I first started using JB Weld in 1992, I've never had any come loose. The main thing is to get the port completely clean & oil free, and that the thickest point of the epoxy is at least .080" / 2mm thick. This won't be a problem, since on most heads it will be around 7-8 mm thick.

~MotoMan

Science has progressed at an amazing rate in the past 100 years, yet there is still widespread resistance to accepting how much we still don't know.

Surprisingly, this resistance is common in the scientifically educated community - where you would hope the most enquiring and curious minds would be...

In 1994 I had a conversation with 3 guys from an engineering college that were in the Formula SAE competition. This is a contest in which the students build a race car using a motorcycle engine, and then compete against teams from other schools all over the USA.

Anyhow, as we were driving down the road in my van ... I told them about how my customers were winning everything in sight at the motorcycle races using my High Velocity Ports. The first thing they all said was:

"Yeah ... but what about **'Supersonic Nozzle'** ..." ?!?

" Super - Sonic - Nozzle ??? "

That was the funniest phrase I'd heard in a long time, and the more I thought about it, the funnier it got. Pretty soon I was laughing so hard, I almost

lost control of the vehicle....!!!

"No, seriously", they said, "supersonic nozzle is why small ports don't work ... we learned it in engineering school !! When a gas reaches the speed of sound (supersonic) the flow becomes really turbulent, creating a huge nozzle effect (**restriction**)." ...

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MotoMan Says:

I'm not saying that the supersonic nozzle effect doesn't exist. For example, if you wanted to get the maximum amount of air to pass through a pipe as fast as possible, you wouldn't want to restrict it with supersonic turbulence. Of course the solution would be to make the pipe bigger !!

But, the problem with applying that idea to engines is that it assumes that engine airflow works the way it does on a flow bench ... that port flow is a constant steady stream. It also assumes that the cylinder is only filled by the action of the piston, and ignores the charging phenomenon.

This is an example of "half science"....

Which is when a phenomenon is observed and found to be true, and then incorrectly applied to another situation.

What's Actually Happening:

It's true that at the peak of intake port velocity, high velocity porting does cause the airflow to reach and even exceed supersonic speed, and the "nozzle" causes the port to not gain any more flow at that point in the cycle. The flow is momentarily restricted, but it's important to note that that doesn't mean it stops flowing air !!

When the port velocity slows to below supersonic, and the piston is returning up again, the charging effect overcomes the loss created by the dreaded **SuperSonicNozzle** !!

The overall effect is a net gain in cylinder filling over the intake period.

Back To The Engineering Students

The big problem is that the students had automatically closed their minds to exploring & testing that area of engine technology ...

... because a textbook "expert" said it wouldn't work !!

The saddest thing of all is that now 8 years later those engineers could be on the cutting edge of the automotive industry ! They should be leading the way and in control of their own careers, instead of just "following the flock".

Check things out for yourself !!

Try This Experiment:

The next time you're at a really wide flat expanse of land or sea, take a look at the horizon. Next, take a look at a full moon on a clear night.

What Do You See ??

You'll notice that the earth really is curved and the moon actually looks spherical !!

"Experts" once said that the earth was flat & everyone just believed them.

The earth didn't suddenly become spherical because a scientist proved it was, it was always that way !

Truth is self-evident, when it's so obvious. Still, people have been known to deny even the exceedingly obvious.

Why ??
It's all about "the box".

Despite all the logic & overwhelming race victories, why is the idea of smaller ports still so hard to accept ??

Once again, it has absolutely nothing to do with reality, it's all about "the box" !!

Here are some thoughts about small ports:

1) It seems to good to be true.
(Cynicism is fear.)

2) Some people who have always thought "bigger is better" will find it hard to do opposite, because it implies that their way was wrong.
(We're told all our lives that wrong = failure, and that failure is to be feared at all costs.)

3) The idea of smaller ports begs the question: why wouldn't the manufacturers make the ports smaller in the first place ???
(It's scary to think that "experts" would suppress knowledge & technology.)

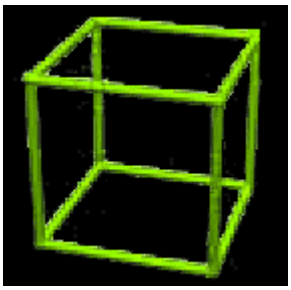
4) Smaller ports are all about the net gain in flow, rather than the instant satisfaction that comes from seeing a "flowbench" gain.
(The idea of giving up instant gratification now, for a much bigger gain later is a scary concept.)

5) It would have been published in the mainstream textbooks & magazines.
(It's scary to think that the media doesn't have knowledge of all things, or that they don't always tell the truth

6) For some people it's simply a matter of:

" That's not the way everyone else does it "
(Most people find it impossible to think differently than others, out of fear of being ridiculed.)

That's right ... Fear makes up the 6 sides of this type of "box"



Q: Who makes the "Box" ???
A: We build it ourselves, gradually over the course of a lifetime.

Once he becomes aware that the box exists, every man must make a conscious choice to stay in it.
Therefore, every man is also equally free to escape from it.

Hey ... I just thought of a funny new way to say "Think Out of The Box" :

MotoMan

Don't Get Sucked Into The Super Sonic Nozzle

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What's one of the best ways to escape the powerful 'thinking vacuum' created by the SuperSonicNozzle ???

Hi Velocity Port Your Own Cylinder Head

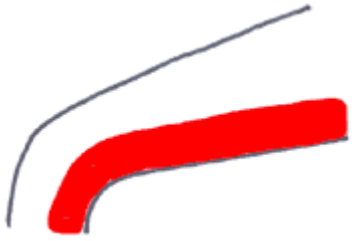
By doing it yourself, you'll not only get more power for your engine, you'll also refuse to accept "the box" !!

ARTWORK

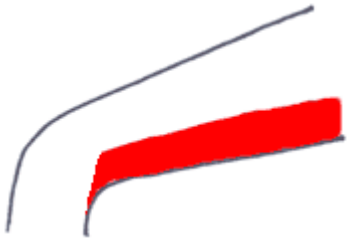
The way it works is 100% science, but since you're really creating a 3D sculpture, high velocity porting is more like art than any other aspect of engine tuning.
But you don't have to be Leonardo DaVinci or Pablo Picasso to do it !!

You say you're not an artist ??

By taking your time and following these guidelines, you'll be surprised at how much natural artistic ability you have.



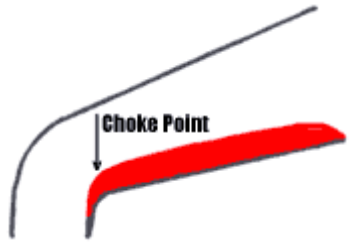
Gravity will naturally level the epoxy. Since the of the port slopes down at a constant angle, t epoxy floor "automatically" makes the correct funnel effect.



Next, match the epoxy near the valve bowl to existing circle created by the valve seat. Don' enlarge the opening, just match it, and you'll ge perfectly shaped valve pocket.
You're half way there !

From there you carefully sand the floor down to correct height as described in the past issues.

You can see if a flat surface is level, right ??
It's easy !!



Once the choke point height is set, then sand t radius smooth as described in the past issues.

Then sand the entry radius smooth.

You can feel if a radius has a nice smooth curve to it, right ??
Right on !!

Carefully blend the transition from the manifolds into the port. You'll have to remove them when you sand out the epoxy. Since they aren't numbered, I use a grinding stone to mark the rubber manifold.

You are now hereby officially qualifie High Velocity port your head !!

Go For It !!

The arrows point to the 2 marks, indicating that this one's for port #2 !!

The Bandwagon

I've seen lots of discussion forums & chat rooms discussing the latest Power News articles. M people are asking the others: what do you think of smaller ports ??

What if I told you that the best tuners, producing the fastest engines at the highest levels of v competition used this technique ???

or

What if I didn't say that ??

Does it change the logic of the last 3 issues of Power News ??

Who cares what everyone else thinks ... what do you think ???

It's a fact that most people want to be on the popular side. If it seems like "most people" support an idea, then the vast majority of people will find it safe to jump on the bandwagor in spite of the truth or falseness of the idea.

Plenty of "bandwagon" riders have fallen off the cliff and crashed.
The " human nature " of the bandwagon effect is a serious liability to logical thinking.

Power News isn't about the bandwagon.

It's about having the strength to think and act on ideas based on logic ...

... not because "everyone else thinks so ".

Getting off the bandwagon ride gives you a new kind of power ... don't you agree ??

Do the manufacturers know about high velocity ports ???

Of course they do.

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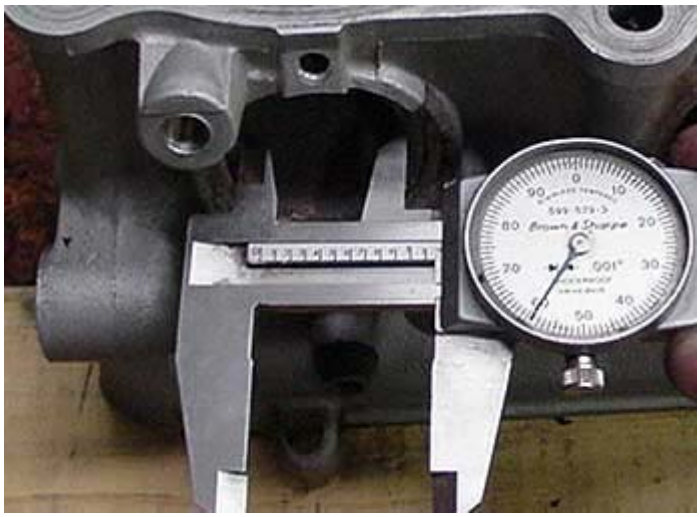
Many of the magazine new model shootouts and reviews are subjective and offer few deep insights into how engine performance is actually improved from year to year. But if you reading carefully you can sometimes "connect the dots" about smaller ports !!

Here are 2 examples that come to mind:

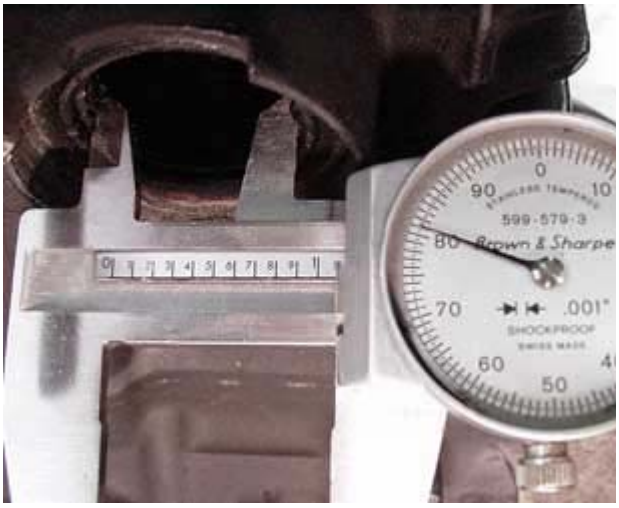
1995 CBR 600f3 "Intake porting changes" are one of the listed improvements from the previou 1998 R1 "the valves are 1mm smaller than the previous FZR1000 Thunder Ace."
Both models were clearly better than their predecessors, and both made use of higher velocity (smaller) intake ports !!

Introduction To Exhaust Porting:

Here's more evidence of the difference between what is commonly thought and what is actuall



2001 GSXR 1000 / 145 horsepower
Exhaust Port Diameter 1.160 inches / 29.5 mm



1988 FZR 400 / 45 Horsepower
Exhaust Port Diameter 1.080 inches / 27.5 r

Let's do some detective work !!

Why does the most cutting edge horsepower sportbike of 2001, the **GSXR 1000** have exha ports that are only about 8 % larger than a 1988 **FZR400** ... especially considering that the 1000 has 250 % more displacement ??

8 % = 250 % ... huh ??
Of course the 400 revs higher, but the difference is not enough to make up for this rather huge math "problem" !!

Do you think that somewhere, some tuners have unknowingly lost power because they deci that the "hot set up" on the **GSXR1000** should be to enlarge those "teeny-weeny" exhaust p to make them more "manly-size" ?? 😂😂😂😂

Do you think that somewhere, some tuners have unknowingly lost power because they deci that the "hot set up" on the **FZR400** should be to enlarge those "teeny-weeny" exhaust port

make them more "manly-size" ?? 

Another way of looking at it would be to say "don't enlarge the exhaust ports on your 400 un
you're sure you can get more than 140 hp from it !!

Did you ever see a 140 hp **FZR400** ??
...how about a 280 hp 800 ?? ... or a 350 hp 1000 ???

It starts to get clear when you think this way.

Don't Enlarge Your Exhaust Ports !!! Most Are Waaay Too Big Already !!

"MotoMan" Has A Brief Conversation With "Hearing-But-Not-Actually-Listening-Man".

H-B-N-A-L-M: If smaller ports really do make more power, then why wouldn't the manufactu
make the ports the correct size in the first place ??

MM: By gradually reducing the port size in small increments each year, they can easily add n
power and thus offer the "new and improved" version with a few
more horsepower than last year's model.

H-B-N-A-L-M: No way... the manufacturers would all have to agree to that, because if or
factory broke out and made the ports really small, business competition would force the othe
to make their ports smaller also.

MM: They cooperate with each other, the competition is mostly an illusion.

H-B-N-A-L-M: No way ... sorry, I just can't believe that.

MM: Okay, well then you've got to believe that back in 1991 one guy working out of his hous
3 months with a $2,000 flowbench out smarted 4 industrial giants that have employed thousa
of the world's finest engineers doing 50 years worth of R&D with billions of dollars at thei
disposal and they still haven't figured this all out yet.

H-B-N-A-L-M: Hey, that's a run on sentence, I learned that in school.

MM: Yup.

Stay Tuned !!
Exhaust Porting Part 2 ...
... in the next action packed issue of Power News !!!

2 Ways You Can Help Promote Power News: