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08-29-2008, 12:32 PM

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Porting School #9 - 5 Rules to Goof-Proof Porting!

GFN Porting School

Here is where you can learn the intricacies of cylinder head design, porting techniques, building of flow benches and anything else that pertains to the flow of air through an engine.

Principle Contributor - David Vizard



5 Golden Rules to Goof-Proof Porting

#9 Follow the five rules discussed here and you will be sure not to fall foul to a power breaking move.

By
David Vizard

5 Golden Porting Rules

Follow these rules and you will avoid most porting pitfalls.

The title of this, part #9 of our Porting School series, is self explanatory – but why now? Why was this one not part #1? I gave this much thought when I started this series and came to the conclusion that it would be best to get, to an extent, immersed into our subject so to speak first. By introducing examples early on I felt that any 'general rules' that may be made from there on out would have more significance. For instance I won't need to explain the importance of getting the port size right – you will have already seen how that effects things as shown in PS#7. Really what I am going to do here is take a breather and sum up the implications of what has been covered so far – so here goes.

Rule #1

Locate the point of greatest restriction - and work on that first.

As obvious as Rule #1 seems the big problem for the novice is almost always a question of recognizing exactly where the greatest restriction in the induction/exhaust tract is. Primary restriction points are dealt with in PS #5 and 6 so if you have not read these two features yet now would be a good time. One aspect that the novice porter will be pleased about is that tackling the most restrictive part of the system and freeing up some flow potential delivers the best power return for the time invested. For the record pocket porting heads is all about focusing on Rule #1 too the exclusion of almost all else. At the end of the day pocket porting may not produce the fastest looking set of heads or the most photogenic but the results can be very satisfying.

Any time you constrain the air to flow along a path that you are dictating the total flow will almost certainly drop. If where the air in a port is flowing is investigated it will be found that there are two distinct situations which determine it's path. In the first situation we find that a substantial amount of air is flowing in a certain part of the port because the route along which it is flowing has minimal flow resistance. In the second situation we find that a lot of air is flowing at a certain point/area because of the shapes involved upstream, downstream or both of that high flow or 'busy' area. It is important to be able to recognize the difference between these two types of busy area's. With the first situation there is a strong indication that the area involved needs to be enlarged to make room for more air to flow along what can be seen to be a flow efficient path. The roof of a typical port is a good example here. In the second situation we find that the fix for more airflow is to add material at and around the point of fastest flow. A prime example here is the very high speed flow that can occur on, or just in front of, the short side turn of a relatively low angle intake port (SB Chevy and Ford are prime examples). The trick here is to recognize one source of high speed flow from the other as they require totally opposite responses. So before I get a ton of questions here let me tell you this is a subject we will get into later.

Rule #3

Air is heavier than you think. Keep up port velocities and avoid redundant cross sectional area's.

Once a head porter or head designer appreciates just how heavy air is

they tend to have a whole different prospective on the importance of port velocities and cross sectional area's. The dyno tests covered in PS #7 are a good demonstration of the need to have the ports appropriately sized for the job. When we get to the stage of flow testing ports we find that not only is there a need to know how much air is flowing but there is equally a need to know where it is flowing and how fast it is going. All this comes under the heading of velocity probing and the cost of the equipment necessary to do that falls into the peanut category. We have looked at how to build a flow bench and down the road we will look at what it takes to make and calibrate a velocity probe for just a few bucks. And one last point before moving on – I had better give at least some explanation as to what redundant port area is. As the term 'redundant' suggests it is an area of the port where little flow is taking place. If this is the case it is redundant to requirements. The best action to take here is to fill it in. Redundancy in a port makes for a lazy port and that results in a less than optimal torque output every where in the rpm range.

Rule #4

Mixture motion (swirl or tumble or a combination of both) is important - do not ignore it.

A charge that has little motion not only burns slower but also less effectively. This is most noticeable at low engine speeds. Lack of adequate mixture motion can cut torque output at say 1000 to 2000 rpm by as much as 25%. When engine speeds are high (5-6000 rpm) the need for port/chamber induced mixture motion is far less. Mixture motion from quench action between the piston crown and the cylinder head face can be instrumental toward increased torque at all engine speeds. At part throttle lack of mixture motion can also have a direct negative impact on mileage. Another desirable engine characteristic to suffer when low mixture motion is involved is throttle response.

Rule #5

Shape is all important - a shiny finish is not!

This is a big one here. The flow capability of a head absolutely cannot be judged by it's reflectivity! Heads with a rough finish the right shape will always out-power heads with a shiny finish the wrong shape! This being so don't be in too much of a hurry to start work with those 180 grit or finer emery rolls.

David Vizard

Other parts in this series are at:-

- #1 [Porting School #1 - Why engines need airflow](#)
- #2 [Porting School #2 - Super Cheap Flow Bench](#)
- #3 [Porting School #3 Budget Bench Calibration](#)
- #4 [Porting School #4 - Budget Bench Electronics](#)
- #5 [Porting School #5 Identifying Primary Restrictions](#)
- #6 [Porting School #6 - Secrets to reduce valve shrouding](#)
- #7 [Porting School #7 - Power & Port Volumes](#)
- #8 [Porting School #8 Optimal Port area's](#)
- #9 [Porting School #9 - 5 Rules to Goof-Proof Porting!](#)

#10 [Porting School #10 - Pushrod Pinch Point Power Issues](#)

In addition to the Porting School articles there are directly related cylinder head development subjects at the following sites:

Wet Flow :-

[Six Wet Flow Mistakes](#)

Combustion Dynamics:-

#1:- [Turbulence and Combustion Dynamics](#)

#2:- [In cylinder Turbulance and Combustion Dynamics](#)

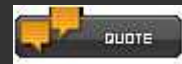
#3:- [Turbulence and Combustion Dynamics - Part 3](#)

#4:- Coming soon

#5:- [Turbulence and Combustion Dynamics - Crevice Volumes - Stealth Power Thief](#)

If you want to learn how to port heads professionally check out the site below.

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