Where the Rubber Meets the Road ……. Part III The Cylinder Head

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"The Torque Output of an Engine is limited by just how effectively we can make it Breathe" David Vizard 1985

This month I will cover the XPAG cylinder head. We will examine stock and modified heads, to increase power, reliability and yes even economy. For most of us, rebuilding and modifying the cylinder head should be left up to experienced engine builders. You should make sure that the company you are dealing with has the proper equipment to perform the work. In this article we will cover:

- The inherent design chairestics of a stock XPAG cylinder head
- Modifications to increase efficiency
- After market cylinder heads
- How to choose a shop that can do the job right the first time

The inherent design characteristics of a stock XPAG cylinder head

There is no question that the cylinder head is where the power is made, it is in fact the "Heart and Soul" of the engine. The design of the XPAG head dates back to September of 1939 and was first used on the TB. There are two basic design types. The "early" "Banana Head" with short 1/2-inch spark plugs. Then starting with XPAG/TD2/22735 a round water hole head with used with longer-reach 3/4-inch plugs. The thickness of a stock TC head is 76.65mm (3.018-inches) TD and TF XPAG 75.16mm (2.959-inch) TF XPEG 76.75mm (3.021-inch) (Source: MG Racers News Letter Code 106 by Mike Lewis, Bayou Racing)

Understanding that in its simplest form, the XPAG engine is nothing more or less than an air pump. A useful step toward appreciating an engines ultimate power limitation is air flow. When an engines ability to draw in more air with increasing R.P.M. ceases, so does the rise in power. In other words, the engine has hit peak power. Of all the restrictions existing in an induction or exhaust system, the cylinder head proves the greatest impediment to flow, and ultimately the limitation of an engines power output. Within the cylinder head itself it is the valve size and location that is most important not necessarily the size of the ports.

The XPAG head utilizes siamesed intake ports, where two cylinders share a common carburetor. A stud boss separates the ports. The intake volume is approximately 90cc's. The intake valve head diameter is 1.299 inches. The seat angle is 30 degrees. It is very common today to find seats ground at 45 degrees however as pointed out in last months article seats cut at 30 degrees provide a 23% area

advantage at lifts up to 0.150. This is approximately one half of the total lift of a stock valve.

The exhaust port is square and measures 1.65 inches on each side. It is almost the same size as an early small block chevy. The valve head diameter is 1.221 inches. The seat angle is 30 degrees.

Modifications to increase efficiency

The first step toward understanding cylinder head porting is appreciating the importance of being able to isolate and deal with flow restriction. Airflow starts at the air cleaner and continues through the exhaust. A high restriction air cleaner will restrict flow and fuel economy will be degraded. Using an APT Tapered K&N offset filter for 1 1/4-inch or 1 1/2-Inch S&U carburetors, is the first step toward improving flow. You get the highest filtering capability with out impeding airflow. K&N filters designed specifically for the 1 1/4 and 1 1/2 S&U carburetors can be purchased from Advanced Performance Technology by calling; 800-278-3278.

The same is true for the muffler. There is a lot of backpressure in a stock muffler. Although it is a straight through design, the little round holes inside the muffler impede flow. According to David Vizard, a flow rating of 2.2-2.5 cubic feet per minute per horsepower will allow the engine to produce close to the same power as it does on an open exhaust. We can accomplish this or come very close by using a high flow large volume muffler like the new Flowmaster "50" Series with Delta-Flow technology.

Once we have the Goesintos and Gooutas fixed we can now focus on the cylinder head.

Selecting the right parts

Finding a completely stock XPAG cylinder head not an easy task. Most have been shaved to some degree to make the surface flat or to increase the compression ratio. Measure your head to determine how much material has been removed. Remember that when you increase the bore size, you will also increase the compression ratio. Increasing the compression ratio will also improve economy.

Cylinder Head Porting

In order to get a better understanding of the process and components, we need to know where to start. First we will examine the valve ratios and size and determine what effect they have on our XPAG. Second we will examine the combustion chamber and how we can improve performance by unshrouding the valves. Third we will break the port down into 3 sections and discuses various modifications that improve flow.

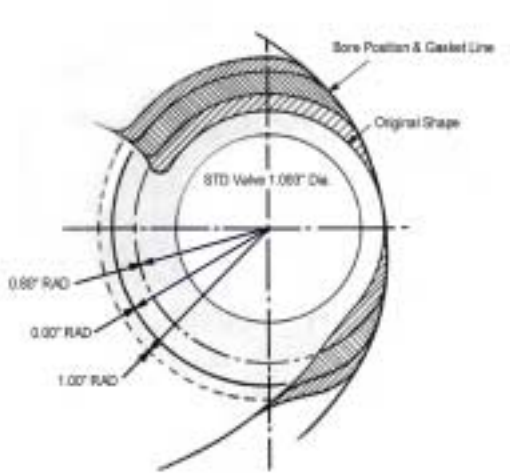
Valve Ratios and Size

According to David Vizard on an engine that uses siamesed intake ports the intake should flow approximately 43% to 54% more than the exhaust. Although I do not have the flow-bench data for a stock cylinder head we can see that the difference in diameter between the intake and exhaust valve is only 0.078-inches. This is a very small difference.

The XPAG engine Data Service Supertuning Manual by W.K.F. Wood edited by Jerry Austin 11/99, suggest using larger valves in the Stage IA configuration. On a stock engine, with a bore diameter of 2.6181-inch, the larger valves don't have much clearance. The centerline distance between the valves is approximately 1.6-inches the radius for the large intake is .7087-inche the exhaust valve radius is .6693-inch together the overall diameter is 2.978-inch. The bore diameter is 2.6181-inch. The difference is approximately .359-inch. Although the net valve lift is approximately .315 for a stock cam, it is important to check clearances especially valve to piston clearance, which should be no less than 0.100-inch.

The Combustion Chamber And Unshrouding the valves

First just installing a larger valve does not guarantee increased flow. In a test conducted by David Vizard, using a SuperFlow SF 300 Flow Bench, on an 850 Mini combustion chamber revealed the following. In an unmodified 850 combustion chamber, changing the stock 850 valve 1.093-inch, with a larger 1.5625-inch 1100 valve, the 1100 valve showed slight improvements between 0.075 and 0.200-inch lift, but at lifts higher than 0.200 the smaller valve flowed approximately 20 C.F.M. more air @ 25" pressure drop at 0.315-inch lift. By unshrouding the valve 0.800-inch radius as shown below, gave a substantial increase in flow. Therefore a smaller diameter valve that has been unshrouded may provide better flow that just installing a larger valve.



Effect on airflow when a closed chamber head is unshrouded to varying degrees.

"Sweeping the Chamber" is a method used to unshroud the valve. Cutting the chamber to the outside of the cylinder can increase the flow. It is done using the Serdi 100. Following any modifications to the combustion chamber, the volume of the chamber must be measured and the new compression ratio calculated.

Sweeping the Chamber

Intake & Exhaust Ports

I wouldn't ever discourage anyone from porting his or her own cylinder head. I have in the past, ported Small Block Chevy heads using "Porting Templates" to determine the various shape of the ports and valve pocket. However with the advent of modern equipment like the Serdi 100, a shop can save you a considerable amount of time, and at the same time provide consistency from port to port or chamber to chamber.

Since we are focusing on a street engine and not a racing engine, I don't think that we need to port the head using a flow bench. But it could be a nice project to port one cylinder, make a mold using Blue-Sil a special latex and silicone combination and make porting templates from the mold.

To establish where our priorities lie in reducing flow restrictions, we can divide the XPAG port into three (3) sections.

Section one is for all particle purposes, a straight run toward the bowl area. The intake port feeds two cylinders, and is divided by a stud boss. This boss does not isolate the two intake runners since it is open in the back.

Section two is where the two ports merge. The intake valve for the number one cylinder is open; the intake valve of the second cylinder is closed. Each cylinder "sees" the entire port area. This siamesed port has its shortcomings. Care should be taken not to sharpen the "beak" behind the stud boss, as this

will restrict flow. Instead, it should have a nice radius and blend into the bowl.

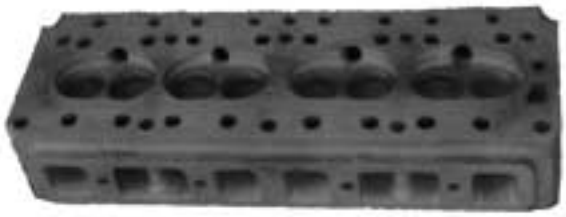
I wish I could tell you the optimum shape of the stud boss but I can't. This is an area where a flow bench could be used to determine the optimum shape. My cylinder head has about the same radius in the front as in the back. The problem with this design is that the air from the closed valve moves very slow as it collides with the faster mixture from the port with the open valve.

Section three is the bowl area under the valve. It is also referred to as the valve pocket. You may have herd term "pocket porting" this in conjunction with the valve seat is the most important part of the port.

After market Cylinder Heads

If you would like to run a high compression engine and not overheat the engine. Or, instead of making a large investment in a stock head, then the "Ultimate Cylinder head modification for your XPAG engine is an aluminum head". Offered by Brown and Gammonds LTD, in the U.K..

What you get is brand new "Laystall Lucas" aluminum head. The head is supplied with a 40cc combustion chamber as that provides an 8.0:1 compression ratio. On a 1250cc engine, or a 9.0:1 compression ratio on a 1466 engine. A close look at the head shows that the ports are approximately 0.5-inches longer than stock. The major down side is that this head is really expensive.



How to choose a shop that can do the job right the first time

As many of us know, rebuilding our 50+ year-old engines is getting expensive. For this reason it is my opinion that we should seek out the most qualified vendors who know what they are doing with our cylinder heads, and have the right equipment to do a proper job.

The Serdi Corporation manufactures one of the best cylinder head valve seat and valve guide machining systems. The Serdi 100 is a self-centering valve-boring machine. The cylinder head floats on a cushion of air until its cutting head is perfectly aligned with the valve guide, then it is locked into position for the actual cutting process. This results in correct alignment for the new valve seats with the guide.

If you are looking for the best equipment this is it

Hales Automotive Machine Shop (714-871-2054) located in Fullerton has a great reputation for rebuilding the XPAG cylinder head. A complete rebuild can be done for under $250.00. According to John Seim " I've only sent about 10 engine jobs (4 of my own) to him. You might say that Alan Hail is an honorary member of the VMG."

If you are looking for a shop that can provide complete rebuild, porting services and flow bench testing, then I recommend Advanced Performance Technology. Although they specialize in the MGA and beyond, they can do an outstanding job on an XPAG head. This is where I shop. They are located in Riverside next to the K&N factory. Contact David Anton at 800-278-3278.

Next month we will cover carburetors intake and exhaust manifolds. Till then Happy Motoring.