

Cylinder and pistons buying decisions

Budget: This part isn't going to be easy but needs to be discussed. In order to achieve your goals on performance you will need a plan and a budget. If money is not a problem fast forward to plan. ☺ The plan is the most important part because all the money in the world is negated if the plan is bad. Conversely a well designed plan will conserve \$ by eliminating waste or by simply showing you that you simply can't get there from here with the funds allotted. Over the years I have seen most people use a form of "under construction" which when done right might be the best way to go. By making changes step by step you can spread the cash flow out over a period of time but determining the best order is challenging. The PLAN organizes your thoughts. This article hopefully will aid you in forming your plan.

First off let's look at how you are going to use the bike for the MAJORITY of the time. We have formatted our catalogue using 3 basic levels of performance:

Street: (Horsepower to cubic inch ratios of .75- 1.0 to 1*) This is for people who want to enhance the performance of their bike but retain almost stock dependability and ridability. The skill levels required to build this combination are moderate and the rider skill are within reach of most people. Most of the ingredients at this level are "bolt on" And give you a "good bang for the buck" It is also where most people will waste money if they are planning to move up to pro-street later.

The most likely things to change are: exhaust, cams, ignition and carburetion. Choices can be very easy-improve the exhaust flow and the bike will respond. It is now lean due to your increased flow so add more fuel and the bike responds again—lot of fun!!! Overall gearing should be understood and looked at. Most people that don't have a complete plan or aren't willing to form one should STOP NOW.

Pro-Street: (hp to cubes ratios 1.0-1.5 to 1*) This level is where the rider wants more than "bolt on" power. This is the level when stuff really starts to happen and it can be either rewarding or frustrating. At this point you should pick a company and/or an engine builder and start to develop a relationship. Don't go price shopping and jumping all around between people, you will only dilute your buying power. At this level the pressures and stresses that the engine will need to produce will really rise. A good engine builder's experience will really pay off now. If you bought right at the "street level" most of your components can be retained. At this level the "theory of constraints" thought process will be invaluable in getting the right changes at the right time. I will lightly cover this thought process in an upcoming article. Now the power levels will usually dictate that the engine will need to be opened up. Engine size usually increases at this point and we feel that you need to make sure that the "foundation of your engine is strong" Money spent now for the future is the key. Many new H-D engines have fine lower ends and need no additional parts, though a call to us can save you some money. We recommend our cylinder and piston kits at this stage because you don't want weak parts in your "foundation" By replacing the pistons, you can improve your combustion chamber efficiencies. High quality parts such as the rings, pins and gaskets should be used also. Other changes at this level are increased engine size by big-bore, stroking or both.

A good set of ported heads really pay off now and the cam will need to be changed if you increase the engine size substantially. The tuning of the bike will be more critical now so your engine builder/tuner will pay off.

Pro level: Call ☺

I would like to go over our different types of cylinders and pistons and connect them to the level of performance in which they are recommended;

Ductile Iron Cylinders: The old and still new standard for high performance. This Material is used when the envelope is really pushed such as top fuel and pro-stock racing. The ability to torque the head independent of the base is desirable in many engine combinations. The CNC machining allows us to really manufacture a cylinder for the job. This cylinder is also needed for a bolt down type of engine such as the shovelhead where all the combustion stresses are held down by the bottom of the cylinder. This cylinder is still a very good seller for us---all the ultra-high output engines in racing use this type of cylinder.

Cast Iron Cylinders. These were designed by me around 1990 using the same basic criteria as the ductile: Bore straightness and integrity. There is still no other street cylinder that is as dimensionally stable as it. Used on countless record holders including our 9 second street sportster it is a known quantity. Its strength is also its biggest drawback- it has a minimal growth rate when heated. On an aluminum cylinder if you mis-tune an engine and it runs hot the cylinder growth will “take off” and the piston clearance will increase. On a Cast Iron Cylinder the growth rate is half that of aluminum and the actual running clearance will be much tighter on it when hot. This characteristic is what gives the exceptional ring seal and power output but must be understood. I have experienced mechanics that will purchase no other type because of its superior sealing abilities (both gaskets and rings). I also have experienced mechanics with no idea of how they work and I advise them not to buy. I use these and love them.

Aluminum with cast-in liner: Our customer base demanded us to design a conventional aluminum cylinder but with our attention to ring seal. A few years ago we were contracted to machine some aluminum barrels that used a pressed-in liner. It was quite an eye opener concerning bore distortion. The cylinder needs to be heated up to insert the sleeve and when it cools the sleeve is trapped. Unfortunately the bore is severely distorted when cool and that is the same temperature used for all the machining processes. So the bore will be ok when cold but compromised when the engine heats up and the press fit is released. This discovery told us to cast in the sleeve to eliminate the stresses caused by a press fit. We chose to fully machine our sleeve for uniform wall thicknesses and also to obtain the desired shape for retention. We made our sleeve thickness much thicker than other offering to give it increased rigidity. The body of the casting incorporates thicker cross sections to resist the stresses in a high performance engine. These basic changes give us unparalleled ring seal which translates to more

power and excellent oil control. These cylinders produced over 200 horsepower in an AHDRA street-pro engine and have traveled an amazing 208 MPH on a Bonneville effort.

Aluminum with nickel/silicon carbide bore coating: Once again our customer base insisted that we produce a product utilizing our methods and quality. These cylinders have an exceptional rate of heat dissipation which is an advantage on an engine type that tends to run hot. Examples of what we would classify as an egg-cooker are Evo full dressers and Buells. Now before I tick anybody off about the Buell comment let me explain. The lean fuel mixtures combined with a two into one exhaust system cause overheating on the rear cylinder and piston. This is based on years of data....Piston damage, rod bearing failure and rear rockerbox gasket baking....on stock bikes that are out of tune. If an engine hurts itself the customer has the opportunity to “make it bigger” while he has the engine apart. If the engine builder/tuner doesn’t understand what the cause of this is, the problem will get worse when you increase the engine size. The characteristics of this type of cylinder (expansion when hot & heat dissipation) help negate the engines problems. Don’t misunderstand though, if your engine is detonating you still are going to damage the pistons and rings----you just might not scuff the cylinders.

Evo full dressers are easy to explain.... A poor oiling system with minimal cooling abilities combined with a LARGE amount of work to perform lead to very high engine temperatures. Any cylinder that can improve cooling would be a benefit on these models.

A quick piston overview: We use forged pistons in 99% of our combinations for strength and weight. The top of the piston is also the floor of the combustion chamber and needs to be thought of that way. Piston tops can be broken down into two initial groups: Flattop and domed. Domed can be further broken down in groups consisting of placement of the dome i.e.: center, perimeter, offset and reverse.

Flattop pistons are very common due to their ease in installation. Benefits also include light weight, minimal surface area exposed to the heat and un-obstructive chamber view during the overlap cycle.

Domed pistons are used to increase the compression ratios but can cause problems if the burn or actual air flow is compromised. The octane rating necessary to control detonation is tied to the pressures and shape of the chamber. All of our piston shapes are dyno developed and tested. If a kit we manufacture fits your needs, call us and place your order. If you cannot find an engine kit that fits your requirements listed in our information, please call us and we will engineer one to fit your needs.

Now some Quick recommendations:

Evo Big Twins: Use our Baisley 2:1 oil pump gears on all applications. The Twin Cam turns the oil pump 1:1 (Crankshaft RPM /oil pump RPM). The stock evo is 4:1 so going to 2:1 is a good move. This will improve the engine cooling on any engine is a no-brainer. If you have a good tuner buy the cast iron cylinder. It will reward you with years

of service. If you are unsure of the tuning abilities or live in an extremely hot climate, buy the all aluminum cylinder.

Sportsters: Basically the same advice about the tuning and climate. The oiling system is slightly compromised on the 1991 to 2003 models and should be checked. The 2004 models got pistons squirter like the Twin cam and should be very reliable. Use the Cast iron with good tuning or the all aluminum for extreme heat applications. Customer favorite is the 88 c.i. Square combination.

Buells: Use the all aluminum unless you are an experienced tuner. Top choices are the 74 and 88 inch square combinations.

Twin Cams: What a great engine!!! Well engineered, it has a super oiling system that lubricates and cools making the engine almost foolproof. I have a personal favorite in the over-square 107 and highly recommend it. Have fun!!

Well this was kind of long and I know it didn't answer all the potential questions so send us an e-mail and we will be glad to help.

Thanks Ron Dickey

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