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PISTONS

In today's market, there are an enormous number of pistons available for a performance engine. I'll try to make sense of it for you. CVMS sells pistons chosen for a specific application, and we have no specific "deal" with any one vendor.

A "cast" piston is made of molten aluminum poured into a permanent mold. Once the casting has cooled, it is removed from the mold and machined to the desired dimensions. A cast piston can be easily identified by the "parting lines" visible on the underside, where the molds "split".

Silvolite, Sterling (Sealed-Power) are examples of high quality stock replacement castings. Badger is more a "rebuilder" piston, meant to satisfy minimum requirements, rather than a high quality replacement.

A "forged" piston is made by heating a lump of aluminum alloy to the point where it is pliable but not molten. The "slug" is dropped into a "die", and another die strikes a hard blow from the top, forcing the slug to conform to the shape of the dies. Once it cools, it is machined to the desired dimensions in a similar manner as the cast pistons. A forged piston can be easily identified by the lack of parting lines on the underside and the smooth "grain" of the underside surfaces.

A forged piston is physically stronger than a casting, and much less brittle. It maintains dimensional stability under more severe conditions, and will "flex" a bit, where a casting will not, making it more forgiving under extreme conditions.

NOTE: Neither a cast or forged piston is capable of withstanding the destructive elements of detonation.

Much of the following discussion revolves around the Pontiac, but much of the information applies to all engine families. Stock replacement pistons, in all cases except Ram Air IV and SDs (yes, that includes 455HO), are of the gravity-cast, permanent mold type. This is also what Pontiac installed in them. They are fairly light, and very rigid. They are the choice for a non-performance application.

Care must be taken to assure you get the right one for your application. Most aftermarket brands have a generic "fitsall" for the 400. You will find 8 valve reliefs instead of four. In this manner, the piston maker doesn't need to make two different pistons for the "early" (small valve) heads and the "later" (large valve) '67 head. The angle and placement of the valves is different.

These pistons don't present a problem in the average grocery getter, but I think they're butt-ugly. They also add about 6 cc's to the chamber, over the stock type piston. This can be used to your advantage by reducing static compression just enough to make the engine pump-gas "friendly". Flame propagation is not optimum.

The '73 and newer 400 piston usually doesn't have this feature. It's dimensionally the same as any other 400 except the large chamfer around the head of the piston.

The Ram Air and SDs used a "TRW" forging. Everyone has heard of TRW pistons! Well, folks, TRW no longer exists in the automotive aftermarket industry. A few years back, Federal Mogul bought TRW and Sealed-Power and merged them. The "Power Forged" TRW piston is now marketed as "Speed Pro Power-Forged". Fortunately, Federal Mogul has some business savvy, and did not discontinue the Power Forged piston line. Most part numbers are still readily available.

This piston is made of a high-silicon aluminum alloy, which has desirable expansion characteristics. Because of this, it may be installed with less clearance than other forged pistons. It runs quieter, and is longer lived. Speed Pros are VERY tough. They are suitable for nearly any street application, including NOx and supercharging.

The major drawback to the Speed Pro is the weight. They are very heavy (comparatively). Perhaps as much as 50% heavier than equivalent strength "racing" pistons. This, combined with a stock connecting rod, is the kiss of death. The rod simply can't carry the load.

All current part numbers have a graphite coated skirt for better resistance to scuffing. These are also good for stock engines wishing to reduce static compression, as the head of the piston is thick enough to turn or mill a "dish" as deep as .125" without compromising the integrity of the piston.

For more serious applications, where true racing pistons are desired, there are several good options. Virtually all piston makers will make a Pontiac. Today, JE (Jahns Engineering) in CA, is acknowledged as the best, pretty much throughout the industry. I like them. They are light and strong. Most Nextel Cup engines use these. You will pay anywhere from \$100 up, depending on "options". And that may not include the pin! JE has a "shelf" line (a variety of popular applications are "on the shelf") , SRP (Sportsman Racing Products).

These are made from the same forging as the more expensive piston, with a bit less attention to machining detail. They also, are very good. These are the pistons provided in the more popular "stroker" kits for most engine families, including all the Eagle kits for the Pontiac. They are suitable for all but the highest levels of racing, and a very good street piston, as well.

Ross Racing Pistons is another top-notch piston and a very easy company to do business with. They, like JE, are in SoCal. They are light, and very strong. I like the Ross better because they cost a bit less, look like more care was taken in manufacture, and the people at Ross are a pleasure to deal with, even if there's a problem.

We have seen one engine self-destruct (split a Crower billet rod right up the middle, bearing failure) and beat the head half to death with the piston, but the forging did not come apart. Ross also has "stocking pistons" on the shelf, but do not keep part numbers for the Pontiac.

Brooks Racing Components is now supplying high quality, light weight forgings for the Pontiac, in virtually any bore and pin placement, including the larger bores being used by the aftermarket blocks. They're available through a couple popular East Coast Pontiac shops for about \$200 less than the "high priced spread"...We use them in many applications with complete success.

Probe Industries also supplies a high quality, light weight forging, sold through a couple of the West Coast Pontiac dealers. Reports are favorable, but we have no hands-on experience with

them yet. Our experience with Probe's products in other engine families has been good, Fords in particular. They are advertised to be available in most popular bore sizes and pin placements for the Pontiac and are competitively priced to the BRC offerings.

There are many others, as stated before. Venolia, Arias, Wiseco, etc., are all very good. Each have their own little "quirks". The ones described above seem to be the more popular today.

"Hyper-eutectic" pistons have become popular for many mid-level and stock applications. In short, a hyper-eutectic piston is a permanent mold casting, using an alloy very high (percentage) in silicon. It is essentially "super-saturated", allowing for more dimensional stability and resistance to surface friction, and maintaining the more desirable expansion characteristics of a casting over a forging.

There has come available, the Keith Black hyper-eutectic cast piston. I have no data on the Pontiac replacement. I have used the small Chevy stuff in the past, with mixed results. If you MUST use them (in your heart, NOT your head), be sure to follow their instructions for clearance and ring gap VERY closely. The ring gap is where the failures came in the Chevys, before Silvolite (parent company) revealed the fix. I don't like them. They are billed as a viable replacement to a forging. In my opinion, that's not true.

Speed Pro offers hyper-eutectic pistons for Ford and Chevy builds, but not for the Pontiac. These pistons are far superior to the KBs. We use them routinely in lower level circle track engines. Requests to Federal Mogul to design and produce a hyper-eutectic version of the Pontiac castings has fallen on deaf ears, at least to this point in time.

I recommend using a forged piston in all applications. The savings in a stock engine, when using Silvolite or Sealed-Power vs. Speed Pro, is less than 40%, and the trade off is significant. By using the Speed Pro, you also leave the future open for more goodies...

If price is not the issue, even in a street engine, and the desire to use only the best is the issue, I recommend the BRC or SRP. They are drastic overkill where street pistons are concerned, but the variety of sizes makes them very attractive.

If you are in a class-race endeavor, and have a full budget, JE or Ross are the only good choices. Order next year's now!

On the subject of "class racing", most sanctioning bodies issue specifications for each application. They would usually include all dimensions and minimum weight. In an NHRA "Stock Class" engine, the acceptable piston will have all the same parameters (ring land sizes and location, skirt profile, compression distance, weight, etc.) as the piston described in the factory blueprint for a given engine.

Maximum oversize is also specified, usually .030". The advantage of buying an expensive aftermarket racing piston for these engines is the material the piston is made of, and what little advantage can be gained through "rules interpretation".

Ross has an extensive array of "Stock Class" pistons. So does JE. It appears the most popular in NHRA is CP Products in California. I spoke to them while building a classer 403 Olds ('77 Firebird Formula, "M/SA"). The man couldn't (or wouldn't) explain what made his product 20% better (the increase in cost) than both Ross and JE, when all the rules were the same, effectively making the piston the same. We went with Ross. Two seasons and still going strong.

The size of the piston, and the ring specs, are always an issue. In round numbers, Pontiacs use a 4 1/8" bore. The "other" more popular brand using the same bore size is the 400 small block Chevy. The 396/402 Big Block Chevy also uses this bore size, but valve placement is quite different. Most Pontiac "shelf" pistons are based on the same slug as the 400SB. 400 Pontiacs are 4.120" or 4.121", depending on which book you read. But what's a thousandth among friends...? A 389 is smaller at 4.060". This means you can bore a 389 .060" over and have a standard bore 400. I do it often for certain applications. 400 pistons are more readily available, even in standard bore. For the aficionado that MUST have the correct piston, 389 pieces are still out there but drying up fast. Speed Pro forgings are also still available, but usually special order.

The stock type 389/400 uses a 5/64, 5/64, 3/16" ring pack. The 421/428 also uses the same pack. The 455 uses a slightly different set (5/64, 1/16, 3/16), presumably to help protect against scorching the second ring due to the extremely high MPS (mean piston speed) of the longer stroke.

The 421 piston is no longer available in stock form. Apparently, there was just not enough demand to keep up production. The aforementioned piston makers will duplicate the original if necessary.

The 428 piston is but .030" larger in diameter than a standard 421, so the standard 428 is a suitable replacement in all applications except those with high-lift (over .500") cams. The valve reliefs must be recut at the proper angle for the 421 cylinder head. I've not found that necessary for engines with stock or low-lift cams. The 428 piston also has a small dish in the middle. This is merely for the purpose of increasing the combustion chamber capacity. It allowed Pontiac to use the same production cylinder heads on 428s as 400s, significantly reducing manufacturing costs.

Unfortunately, 428 pistons from Speed Pro are drying up. Federal Mogul has not committed to another production "run" of the Speed Pro forging.

Placement of the wrist pin is the main difference between the 400, 428 and 455 piston. A standard 455 bore is only .030" larger than that of the 400 or 428. The great increase in displacement comes from the stroke. The stroke is the determining factor in the placement of the pin (compression distance). The longer the stroke, the higher the pin placement. You have no doubt heard of using 455 pistons in a 400 with a longer rod. This is made possible by the placement of the pin. The 455 stroke is .460" longer than a 400. Ideally, a rod .230" longer would put the top of the 455 piston in the same place in relation to the deck with a 400 stroke. The stock rod is 6.625" center to center. The perfect length would be 6.855". Unfortunately, this is not a commonly used rod size for any production engine. It would require the use of custom made rods. Custom made pistons are much less money than custom rods. 6.800" rods are a commonly used size for big block Chevy "tall deck" blocks for performance applications.

The other solution is to "deck" the block .055". This is not an unheard of amount. A small amount of intake manifold surfacing makes the whole thing work together well. It does make future changes more complicated, as special "fitting" is required for intakes and cylinder heads.

If you opt for the BBC rod (6.635 or 6.800), order the piston with a .990" diameter pin. The BBC has a raft of pin types available. For a street/strip or circle track application, I use the 150" wall thickness steel pin. This is the "standard" pin shipped with the "big three" piston makers. It's tough, though a bit heavy.

The "thin wall" pin is made of tool steel and much lighter. For drag racing applications, or where the engine will be taken apart regularly (so they can be checked for wear), this is the pin of choice. There are, too, more exotic materials available. None of these more exotic pins are suitable for street use.

The ring pack for the racing pistons is different than the stock pistons. Most use a 1/16, 1/16, 3/16 setup. Speed Pro supplies the correct rings. For all but high RPM drag motors, I use the standard tension oil ring. Low tension rings are available. While significantly reducing parasitic drag, they allow more oil into the combustion chamber. Not a good thing for a street motor or a circle track application. 455s and strokers have a higher tendency to use oil than the shorter stroke engines.

For more serious drag racing applications, a .043" top ring is called for. Be sure these rings are available in the desired bore size before ordering your pistons.

Jim