How to Hot Rod your Porsche 356

By Charles L Navarro

When seeking more power out of their engine, most 356 owners don't end up building a full race engine but rather what I call a "weekend warrior." These rebuilt "warm" to "hot" street engines, if done right, will last years or even a lifetime, since most 356s are not daily drivers.

It is well known that putting in a big bore kit is an easy way to increase HP and torque by increasing displacement. There is no replacement for displacement! 1720cc 86mm big bore kits have been the norm for decades now, superseded recently by the 90+ mm Nickies big bore kits introduced by LN Engineering. This new size is used by builders such as Air Power Racing and Willhoit Auto Restoration in their 1.9 liter high-output street engines. These engines make serious top end horsepower, but have the required low-end torque to offer the smooth operation and drivability of a stock engine. And they do this all while looking original, as Porsche would have intended. A word from the wise – whether you build it yourself or have a professional build your engine, do it once, and do it right. Many spend years accumulating parts for their dream engines and a big bore 356 can be done right, even on a budget. If you decide you can't build an 1883 on your own, you can buy one of the available "turnkey" solutions or have your preferred engine builder put one together for you, using this primer as your guide.

If you decide to embark on this undertaking, I strongly recommend reading as much as you can and researching your decisions thoroughly. And most importantly, don't rush things – haste makes waste. Buy the Maestro's 5-set Engine Assembly and tune up DVD from HCP Research. Aircooled Technology's engine rebuild video for the VW type 4 may also be helpful, as goes over many of the techniques and practices of good engine rebuilding etiquette.

Finally, please take the time to ensure that your suspension and brakes are in tip-top shape, since before you can go fast you must be able to stop fast! If your car doesn't have disc brakes, consider a front drum to disc conversion like the one offered by Zim's. Now that you are ready, let's talk about the 1883!

The reason why an 1883 Porsche 356 engine is such a popular choice for the street enthusiast is that the added displacement over that of a 1720 allows a greater flexibility in cam selection, providing a smooth idle, lots of low end torque, and more HP than what a 1720 delivers, and can be reliably built on late B through 912 engines, using C, SC, or 912 parts for reduced cost. Although there are many details that go into building a performance engine, let's start with the camshaft. Depending on whose numbers you use, a stock SC/912 engine makes 80% of peak torque at 2000 rpm and peak HP just below 6000 rpm.

Here is a table of popular cams to choose from when paired with an 1883:

Camshaft Grind	80% of peak torque available at RPM	Peak HP RPM
Stock SC/912	1500-2000	5500
Elgin 66509	2000	5500
Norris 331S	2000	5500-6000
Web 86	2000-2500	5500
Elgin 7010-17	2500	5500-6000
Neutek SX-1	2500	5500-6000
Elgin 7208-19	2500-3000	5500-6500
Elgin 7008-17	3000	5500-6000
681019	2500-3000	6000
Wide Lobe 912	3000-3500	6000
Neutek SX-3	3000-3500	6000-6500

Let me share with you a personal 1883 experience. The cam recommended to me for peak power at 6500 rpm was a Webcam 86a, but due to time constraints I went with a Neutek SX-3. This is a popular cam for vintage racing, and when paired with an 83.5 bore, will create an engine capable of making power right to 8000+ rpm. Based on the estimates and recommendations of various builders, with the added displacement I figured this was the most cam I could run for a street engine to maximize the potential of the added displacement and head work I had done (more on the heads later). With the cam's inherently peaky disposition, Carrillo rods and a Scat crankshaft were also recommended. Assembly was difficult as the connecting rods had to be clearanced because of an interference issue with the cam lobes when the engine was mocked up. Aside from this problem, the engine went together smoothly and performed better than expected.

The engine had a smooth idle, albeit a bit rich, made prodigious torque and pulled from 4500 to redline of 6500 like a freight train. So what was the catch? The engine got poor fuel economy and was a bear to drive in traffic since it didn't like to be loaded up below 2500 rpm. Just to give you a reference point, the SX-3 cam had lackluster fuel economy, giving me no better than 24 mpg at any point (all highway miles) and a more typical average of 16-20 mpg in mixed driving city and highway driving.

Since hindsight is 20/20, here's what I would do different the second time around. First, I would have chosen a milder cam, better suited to my driving habits.

There are some well known favorites such as the "Maestro grind", also known as an Elgin 66509. It's what I call a "stump puller", and when paired with an 1883 big bore kit produces more HP and torque than a stock engine but with similar powerbands, just shifted up a BIG notch. More than one shop mentioned this cam, for its prodigious low end torque, making the 356 a very friendly car to drive in most every situation. Although proper jetting will dictate fuel economy as much as your cam selection, I'm willing to bet this grind will give you the best fuel

economy all around, and if you're going to see a lot of stop and go driving this is the cam I would choose.

Now that I touched on a mild upgrade from a stock cam, the hottest cam I would run, down from a Neutek SX-3, would be Timothy Berardelli's 681019, which delivers the same fun to drive peakiness of the SX-3, but sacrifices a few HP and rpms on the top end to provide more torque about 500 rpm lower than the SX-3.

Another favorite of William Noblitt, based on his experience campaigning the first 1800cc Nickies engine both in vintage racing and hill climbs (and who now races an 1883cc power plant) is the Elgin 7010-17. This is the cam he currently runs in his Convertible D, in a 1720 with reconditioned nikasil-plated cylinders. This normally is considered the hottest cam you can use in a street 1720, but in an 1883, he thinks it would be a great cam, and would be about one step below the 681019 cam sold by Berardelli.

Regardless, there are lots of good cams to choose from. I recommend choosing a cam that makes peak HP at or right below 6000 rpm; I will elaborate on this reason later. Every builder has their own favorite cams. Many are more than happy to share with you their experiences with most of the cams I've listed above.

Whatever you do, make sure you use quality original ATE lifters, either NOS, or have your old ones reconditioned. There are lots of crappy lifters out there, and if you have a cam or lifter failure, it is a very expensive repair. You can help address break-in issues by using GM's EOS assembly lubricant to boost anti-wear additives at start up, especially paired with an oil specifically designed for breaking in engines, like Brad Penn's break in oil.

The above figures for power bands and peak horsepower are figured with a good exhaust and big carburetors, but most importantly, with work done to the heads, on the intake side. The exhaust ports flow well even bone stock, so you don't need to do any work there. On the heads I did for my 1883, the intakes were ported such that it corrected the exhaust to intake ratio, from the stock 1:1, to about a 0.7-0.8:1, which is the ideal ratio. This gives you about 25% more flow out of the intake port, equating to about 13-16% more HP and 7-10% more torque than with a stock head.

Porting the heads is a good way to make power, but there is more to it than just hogging out the intake port. The shape is where the power is, and flow is as important as port velocity. I recommend having a professional do your heads, which can vary from as low as $1200 for a bone stock rebuild to $2600+ for clones of the heads used on my engine, which I would say are one step less than full on race heads, to help the engine breath better. Heads that are ported incorrectly or ported too much will reduce performance and hurt driveability. If your budget is limited, you can leave your heads un-ported to save on cost,

knowing that you'll just be loosing a few horsepower and foot pounds of torque. You will still have significantly more torque and horsepower than any 1720 could ever provide reliably.

Using custom 8mm valves can save a lot of weight; just the intake valve alone weighs 24 grams lighter than stock and the exhaust valve is 14 grams lighter too. When paired to an aluminum, light chromoly, or titanium retainer, the weight savings are enormous. You might again ask why do this since this isn't a race car? Well, lower valve train mass allows you to reduce how much valve spring tension you have to run. In my case, with an engine that was revving only to 6500 rpm, we put in less tension than stock 912 valve springs. You don't need dual springs if you aren't going to be running rpms higher than 6000-6500, as this needlessly increases valve train cam wear and "motoring" horsepower (hp loss due to friction, etc). We do slightly better than stock rebuilds with these upgraded lightweight components for right around $1500, which includes smoothing or "fluffing" of the ports.

While on the topic of valve train weight, ideally you want to get a set of chromoly pushrods – the thin-wall sets sold by Classic and Speed Parts are more than adequate and are a significant weight reduction over that of the stock pushrods and other available aftermarket pushrods. Alternatively, Aircooled.net offers cut-to-length aluminum and chromoly pushrods of exceptional quality, allowing you to set your pushrod length just right to ensure proper valve train geometry.

Twin plugging is great, as it can let you run a half to a full point more compression in your engine versus a single plug configuration, but dual plug setups with the extra head work start at $2500 and can exceed $5000. The nice thing about an 1883 with a 90mm bore is that the pistons have very shallow dome heights, even with 22 degree heads and pistons, allowing for a very nice flame front without twin plugging, for greater resistance to detonation or pinging. Additionally, we did some testing and found that un-shrouding the chambers, except for just a hair around the valves, didn't help with flow much, if at all. In our case, we un-shrouded so little that you could still run a stock 82.5mm bore, even with our larger 40mm intake valve, allowing us to maintain the near stock 58.5cc chambers which again help us to keep the dome small on the piston as we limit the compression to 9.25-9.5:1, reducing piston weight and providing good flame front propagation. Keep in mind there are many variables to consider when choosing your compression ratio, including available octane and camshaft selection (search in Google for dynamic compression ratio).

Choosing the right carburetors is obviously critical. Too much carburetion, or not enough backpressure on the exhaust, can really hurt the low end of these engines, say below 3500 rpm. For a street 1883, a set of Weber 44 IDFs with 34 or 36mm venturies is plenty of breathing; similarly, a set of Weber 40 IDFs or 40 Solexes with bored out venturies will be sufficient and won't really hurt HP until

6000+ rpm. Alternatively you could have Harry Biecker bore out and replate your Solexes with larger butterflies and this is just as good if not better than 44 IDFs. Although somewhat limiting at higher rpms and with cams that produce their power at those higher rpms, Ron LaDow's 36mm Zenith NDIX carburetors if paired with the Maestro cam should provide a torquey engine that peaks out at 5500 rpm. Regardless of carburetor selection, I recommend using an electric rotary fuel pump, since the stock one cannot pump sufficient fuel to feed an 1883.

A set of short velocity stacks, like those typically included in the Weber kits or sold by Mainely Custom by Design are ideal for a street engine. Mainely Custom by Design also sells fuel pump block offs and billet sump plates, both of which are top notch and highly recommended. Regardless, you must run air filtration, and that consists of a quality K&N filter that has been oiled, preferably with a pre-filter, also available from K&N, that although not pretty, do help filter more than the K&N alone.

For the exhaust, I used one of Vic Skirmants stepped racing headers, with a muffler more or less retrofitted onto the system. For a race engine, maybe this header is ideal, but for a street 1883, a Bursch quiet power 1.5" header is more than sufficient with the caveat that you replace the muffler provided with the Bursch system with one that is less restrictive. The plus of this system over the racing header is that if you do use a full flow spin-on filter pump cover from Precision Matters, it will fit properly – we had to modify the racing header to clear the spin on filter. You will want a muffler that provides some backpressure but is basically free flowing. The best low restriction muffler I have ever run is the Phase 9 muffler. Another excellent choice is the Flowmaster 40, available from Racer Parts Wholesale. Running without a muffler might get you a few more ponies up top, but it really hurts the bottom end and overall drivability of the engine (as well as not being street legal!).

Now why do I recommend limiting peak HP to 6000 rpm? My reasoning for building an engine that doesn't make peak HP past 6000 or say 6500 rpm is to reduce load caused by the reciprocating mass on the connecting rods and crankshaft. Furthermore, when compression is kept between 9.25 and 9.5:1, the engine is significantly kinder to connecting rod bearings, improving their longevity. With all of this in mind, we have custom wrist pins made up and mill our JE Pistons to remove dead weight from the reciprocating components. As far as the crank and rods are concerned, we've lightened up the rotating mass at the end of the rod so much, that in some cases it's significantly lighter than an 86mm piston or close to the weight of a stock piston. Now how can you safely remove material you might ask? Well, there are different forging alloys available. The high silicon forging material, popular for use in cast iron cylinders because they don't expand, are weaker. We use a forging that has no silicon and matches the expansion rates of an aluminum cylinder much closer, allowing us to make the piston lighter without reducing its strength. As a safeguard, we apply a thermal

barrier coating to the crown of the piston, which can reduce piston temperatures, making for a stronger piston at operating temperatures.

Even though the pistons may cost a few hundred dollars more than off the shelf JE Pistons, the way we set up the pistons you can in most cases save the cost of Carrillo rods or a Scat crankshaft by significantly reducing the rotational mass, where it counts. Additionally, doing custom pistons every time we order a set allow us to dial in your compression ratio, allowing for you to choose your final compression ratio while maintaining an optimal .040-.060" deck height with minimal shimming.

For the rods and crankshaft, I recommend using SC or 912 rods and for the crankshaft, an un-counterweighted C crankshaft, SC, or 912 crankshaft. We also highly recommend that on top of having these components properly reconditioned, that if the crank needs more than just a polishing of the journals, that it be nitrided, and that all components are cryogenically treated. Although the price for reconditioning these parts varies, you have lots of excellent Porsche machine shops like Competition Engineering who are ready and willing to assist you with these tasks. When it comes to cryogenic treatment, it pays to do some research. You want to make sure they use thermal cycling with a cryogenic processor, not just dunking parts in liquid nitrogen. 300 Below in the Midwest does good work. Performance Cryogenics in the southern part of the country is also another company I have used in the past.

As far as your drive-train is concerned, you want to make sure your transmission is in tip top shape. I recommend having a shop proficient in working with Porsche transmissions go through your transmission and replace any worn parts. As with my transmission, it got new seals and gaskets and the shift rod was replaced, as it was bent. Nothing else needed changing. I also replaced my shift coupler with a new one and made sure my shifter wasn't in need of rebuilding. Vic Skirmants at 356 Enterprises is an excellent resource for making sure your transmission is up to the task.

Although not part of your transmission, your choice of flywheel and pressure plate is also important. You must use a Scat chromoly gland nut too! I kept my stock flywheel (without lightening) and a new stock pressure plate, and used a type 1 ceramic un-sprung clutch disc, to make sure there wouldn't be any slipping both at low rpms with lots of torque and with the hp at the top end. Although the un-sprung "racing" clutch disc in hind sight was overkill, with a stock pressure plate, clutch pedal travel and engagement was still light and relatively smooth. You can also use a new stock sprung 180mm clutch disc along with a stage 1 pressure plate from Kennedy Engineered Products and resurfaced new flywheel to ensure there is no slippage up to 150 ft/Lb of torque.

Alternatively, a modified 200mm flywheel and VW clutch disc can be used. Using both a heavy duty pressure late and racing clutch disc may prove too rough for

daily driving, so choose only one of the two. If you prefer the feel of a lightened flywheel, there is no reason not to lighten, keeping in mind that a stock weight flywheel will make the engine smoother at lower rpms and at idle. Kennedy Engineered Products also offers their pressure plates out of aluminum if you prefer lighter components. Your driving habits will dictate transmission and clutch life, so if you don't drag racing or do burnouts, I don't see there being any problem with the added power of an 1883 big bore engine and your drive train.

We use custom ARP head studs that are perfect for replacing your old thermally cycled head studs. ARP head studs are specifically designed to handle the increased expansion of an aluminum cylinder. You just torque them down to 24-28 ft/lbs, using the factory prescribed torquing procedure, just make sure to oil the head nut o-rings with assembly lubricant.

A note about valve covers: make sure each head is vented to the air cleaner or preferably, to a catch tank, and you use the steel reinforced valve cover gaskets, installed just with oil, sold by Vic Skirmants at 356 Enterprises. This will save you the hours of grief we encountered with my 1883 on the dyno, sucking in valve cover gaskets. Some builders recommend re-torquing the heads after the engine has been broken in, and we did so while the engine was on the dyno, after we were thoroughly convinced the engine was broken in.

A significant advantage of the Nickies 1883 90mm big bore over the standard 1720cc kits is that we open up the head and case registers, giving us wall thicknesses greater than a 86mm cylinder, for better rigidity and strength. The required machining should cost little more than what it normally costs to have your case and head sealing surfaces decked, which is a must for any rebuild. Any loss of height on the case can be made up with a custom base shim, which we can do in any thickness. Although pricey compared to inexpensive cast iron cylinders, with the thoughtful improvements we've applied to the pistons and careful selection of a camshaft, you can build a big bore 356 engine on a budget, saving over $3000 on the cost of Carrillo rods and a Scat crank, which can then be towards the pistons, cylinders, and machining for the case and heads. Furthermore, the use of aluminum cylinders, as Porsche discovered years ago, increases the thermal capacity of your engine, reducing the heat soak on cylinder heads and other vital engine components. This keeps your big bore 356 engine as reliable as a stock engine!

There is no need for fancy cooling modifications, as the Nickies aluminum cylinders provide added cooling (Carrera 4-cams made similar horsepower, and they used aluminum cylinders). Use a 28-blade fan for a street engine, and keep clear of power pulleys. If you're revving less than 6500 rpm, there is no need to run a16 blade fan or a power pulley to reduce fan speed. The stock oil cooler is more than adequate, the more expensive aluminum cooler isn't needed. Two reasons for the reduced oil temperatures of an 1883 are the reduced friction from the nikasil plated bores and the low tension piston rings we use that are

specifically designed for nikasil bores. These special low tension rings offer lower friction and longer ring life over traditional rings used on cast iron cylinders. We also fit the pistons with accumulator grooves to reduce blowby and increase compression. Additionally, the pistons are fit with split oil returns to help with improving oil control and reducing oil consumption. Some oil consumption is normal because of these low tension rings, over that typically seen with cast iron cylinders and higher tension rings. The selective use of piston coatings can further reduce transfer of heat into the pistons from consumption and reduce piston friction. Additionally, our lighter valve train and lighter valve springs with less tension also contribute to reduced oil temperatures.

Although not absolutely required for every 1883, using a full flow adapter with an external spin on oil filter can help reduce oil temperatures by 10 degrees F. A more compact and elegant solution is the Precision Matters full flow spin-on filter pump cover, as it eliminates the hassle and expense of running external oil lines and mounting the oil filter (though it requires running an electric tachometer). 356 Enterprises offers a full flow pump cover especially modified for users with mechanical tachometer drives.

There isn't much to be done to the ignition system. Assuming the car is still six volt, you want to have a new coil, and new spark plug wires, cap, rotor, and a Pertronix. For improved spark, MSD makes a 6 to 12 volt adapter for their 6AL ignition boxes, which although more expensive, provides superior multiple spark discharge. If your car is 12 volt, you can opt for a Mallory Unilite or MSD distributor, which has user adjustable ignition curves, and use a CDI ignition like the aforementioned Crane, MSD, or Mallory systems without an adapter. These systems can go a long way to improve idle on engines with big cams or that run rich at idle, as I discovered on my 1883, and extends service intervals on spark plug replacement, further reducing maintenance. Also, have your distributor checked to make sure the advance is working correctly, then set your max advance at 32-35 degrees at 3500 RPM. A twin plug engine would need roughly 20 to 24 degrees max advance at 3500 RPM. These are rough timing recommendations and may vary slightly, so don't be afraid to play with your timing and jetting. Just make sure only to make one change at a time!

Do not use a 009 or 050 distributor; the advance curves of these distributors are far from ideal for a street 356. Don't worry about setting your static timing or idle timing, since your full advance is what matters most – the idle timing will fall right into place if the max timing is step up right. I found that my engine worked best with about 5 degrees idle advance at 850-950 rpm and 35 degrees max advance at 3500 rpm, but you will have to find what works best for your engine. With a MSD or Mallory ignition and a quality copper core Bosch or NGK plug with about a .030" gap, you can expect at least 6,000 miles out of the plugs, but as long as it's idling smoothly they will go much longer, some claiming 15,000-18,000+ miles. I don't recommend using a precious metal plug on an engine with an MSD or Mallory, as they seem to get "fried" very quickly. If you are using just the stock

ignition, a Bosch Platinum WR7BP, NGK BP6HS or BPR6HIX will work just fine, with a .022-.024” gap.

Once you have broken your engine in properly, you must attend to tuning. I highly recommend using an Innovative Motorsports LM-1 wide band oxygen sensor monitor to carefully watch air-fuel ratios. Although not always the easiest to do on a carbureted engine, you will have to find a happy medium between air/fuel mixes at idle, while on the progressive circuit, and wide open throttle. I tried to shoot for 12.8:1 air/fuel mix from idle to wide open throttle, but I did end up with some spots where I was obviously running very rich, closer to 10.5-11:1 at WOT with my Weber 44s. What you want to guard against is running too rich during break in, as this will wash the cylinder walls and reduce the lubrication of the rings and bores, causing needless wear. Although an LM-1 with all the required accessories runs well over $500, you can rent a complete system to help with your tuning from Aircooled.net.

I recommend running the aforementioned break-in oil up to the first 1000 miles, but make sure to change it and the filter at least one time during this period. Adjust your valves after the first 30 minutes, then again after the first 100, 500, and 1000 miles. More than likely you won’t find that things have moved during break-in, but better to be safe than sorry.

When it comes to maintaining your 1883, regular oil changes and periodic valve adjustments are just about it. For most owners, changing their oil every 3,000 miles will be more than adequate if an approved oil is used. Some users of synthetic oils might even get away with less frequent changes, up to 5000 mi, especially with full flow filtration. On my 1883, valve adjustments settled in after the first 1000 mi, and after that point I just did monthly inspections to verify that I had some valve lash, between .004” and .006”. I never did have to adjust the valves even after 5000 mi. I also recommend using the highest grade and quality of premium unleaded, along with periodic application of fuel system cleaners, like Redline SI-1 (which is also available with lead-substitute), to help keep carburetors, intakes, valves, and combustion chambers clean.

Once you drive a 356 with an 1883, you’ll know why everyone wants one. Learning to live with an 1883 is pretty easy, as these are powerful, cool running engines, that once you have them tuned right, should last a lifetime with little maintenance other than valve adjustments, oil, and filter changes.

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Vendors and References

356 Enterprises
3359 Kings Mill Road
North Branch, MI 48461
http://www.356enterprises.com
810-688-2059
Transmission, Engine Rebuilding and Prep, Suspension and Brakes, re-enforced valve cover gaskets, Bursch racing header, Scat Crankshafts, Scat Chromoly gland nut

356 Registry
http://www.356registry.org
356 talk list, technical references, and vendor links

Aircooled.Net, Inc.
362 W. 6100 South, Unit A
Murray, UT 84107
http://www.aircooled.net
Ignition, Fuel System, LM-1 rentals

Aircooled Technology
47 Raby Drive
Cleveland, GA 30528
http://www.aircooledtechnology.com/store
706-865-1963
Sealants, Ignition, Fuel System, Engine rebuild videos

Air Power Racing
5860 Harrison Blvd.
S Ogden, UT 84403
http:///www.airpowerracing.com
801-475-9380
Turnkey 1883cc+ Big Bore Engines

Bieker Engineering
5215 Rogue River Hwy
Grants Pass, OR 97527
http://www.biekerengineering.com/
541-955-9777
Carburetor service and repair

Classic and Speed Parts
140 E. Santa Clara St. #15
Arcadia, CA 91006
http://www.classicandspeedparts.com

626-445-0108
Lightweight pushrods

Competition Engineering
2841 Fulop St.
Lake Isabella, CA 93240
http://www.competitioneng.com/
760-379-3879
Full Service Machine Shop

Elgin Cams
1808-D Empire Industrial Crt.
Santa Rosa, CA 95403
http://www.elgincams.com
707-545-6115
Camshaft grinding and lifter resurfacing

HCP Research
Cupertino, CA 95015
http://www.hcpresearch.com
408-727-1864
Engine assembly and tune-up DVDs

Kennedy Engineered Products
38830 17th St. East
Palmdale, CA 93550
http://www.kennedyeng.com
661-272-1147

LN Engineering
626 N. Locust St.
Momence, IL 60954
http://www.LNengineering.com
ph: 815-472-2939
Nickies, JE Pistons, R&R Pro & Carrillo Connecting Rods, ARP Hardware, Cylinder Head rebuilding, Lubricants

Mainely Custom by Design
Berwick, ME
http://www.mainelycustombydesign.com/
207-698-7646
Fuel pump block off, sump plates, billet filter velocity stack assemblies

Neutek Cams
NLA Limited
http://www.nlaparts.com

775-626-7800
Camshafts and reconditioned lifters, aluminum oil coolers

Norris Performance Products
14762 Calvert St.
Van Nuys, CA 91411-2705
818-780-1102
Camshafts and reconditioned lifters, performance valve springs and retainers

Precision Matters
http://www.precisionmatters.biz
415-252-1428
Full flow filtration, twin plugging

Rimco- Riddle Machine Co.
520 East Dyer Rd.
Santa Ana, CA 92707
http://www.rimcovw.com
714-549-0357
Machine shop, inexpensive basic parts reconditioning to factory specifications

Timothy Berardelli Racing
4950 Eisenhower Ave.
Alexandria, VA 22310
tbr356@hotmail.com
703-461-3436
Camshafts and reconditioned lifters, repair and maintenance

Webcam Camshafts
1815 Massachusetts Ave.
Riverside, CA 92507
951-369-5144
http://www.webcamshafts.com
Camshafts and lifters

Willhoit Auto Restoration
1360 Gladys Ave.
Long Beach, CA 90804
http://www.willhoitautorestoration.com
562-439-3333
Restorations, Turnkey 1883cc+ Big Bore Engines

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Zims Autotechnik
1804 Reliance Parkway
Bedford, TX 76021
http://www.allzim.com
Service and Parts, Bursch street header and mufflers, spark plugs, drum to disc brake conversion, electric 6/12v fuel pumps, oil coolers