CENTRAL VIRGINIA MACHINE SERVICE
HOME OF THE INJUN ENGINE!

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It will be best if you have an air compressor and at least a 1/2" impact gun. There are a couple of bolts that are MONSTERS without one. You will need 2 good pairs of jackstands and a solid piece of ground to raise the car at least 24". Concrete is recommended.

Intake & cam change:

Drain all fluids (oil, coolant) from engine.
Remove the air cleaner, upper radiator hose (at radiator), disconnect fuel line and vacuum to power brakes and transmission. If necessary, mark each with a piece of tape, labeled.
Disconnect throttle cable at carb and remove bracket from intake.
Remove any wires or other cables that may be attached to the intake or carb.
Place engine at TDC, firing on cylinder #1.
Remove distributor cap and remove distributor. Clamp is on block with a 9/16" head on the bolt. The clamp must be fully removed (unlike other types of engines). If distributor turns, but won't come out easily, spray carb cleaner at base and rotate back and forth. This will loosen the varnish buildup inside the bore. After repeating this a few times, the distributor will come right out. No prying or pounding will be necessary.
Remove the alternator and bracket. It may also be necessary to remove the power steering pump from the front of the engine. It will not be necessary to remove it entirely from the car. Once loose from the front, use a piece of wire to tie is up out of your way. The same is true of the A/C unit on the other side. DO NOT remove any A/C lines.
Remove the bolts holding the fan shroud in. There will be four on the top and two on the bottom. Some models use a slot on the bottom, with no bolts.
Remove the lower radiator hose from the water pump.
Disconnect the transmission cooling lines from the radiator. NOTE: Use a line wrench to break them free, then an open end to unscrew.
Lift the radiator out the top, being careful to clear the lower hose and not hit the fan blades.
Remove the shroud.
Holding the top pulley, remove the nuts that hold the fan clutch to the water pump. There are studs in the pump, so if they come out, don't worry. Remove the fan and top pulley.
On the upper right side of the water pump is a small-headed, long bolt, going into the front of the intake manifold. It is necessary only to loosen this bolt. Complete removal is not necessary at this point. It may be rusted in, and break. This is not uncommon.
Remove the intake bolts (6 per side).
With a medium sized screwdriver or small prybar, pry up on a corner of the intake. It should break free easily.
Lift the intake straight up and out.
Remove the two bolts holding the valley cover.
Carefully pry the valley cover up and avoid bending the edges.
Raise the car. Make sure the stands are under solid points. At this time, only the front needs to be up, and only enough to get under it comfortably. Before crawling under, SHAKE the car, to be sure it's stable. Safety cannot be over-emphasized.
Using a short 15/16" socket and the impact gun, remove the big bolt holding the harmonic balancer on.
If the impact is not available, or will not break it loose, you will need a large breaker bar, and lock the engine from turning. This can be done by inserting something into the bellhousing to jam the flywheel.
Remove the balancer. Unless there's a bunch of rust, it should slide off. Pontiacs are not an interference fit. If it's stubborn, a little tapping with a soft hammer will usually do the trick.
Remove the 4 oil pan bolts in the timing cover.
Lower the car.
Remove the 6 3/8" (9/16" heads) bolts holding the timing cover to the block. Two of them may be studs with nuts.
Remove the fuel pump from the timing cover.
Remove the timing cover.
Check the timing marks. They should both be at the top. This will insure you're at TDC on #1, firing.
Remove the 3/4" headed bolt in the front of the cam. The impact will blow it right out without damage.
Using two flat screwdrivers, evenly pry the top gear and bottom gear, alternating to assure an even pull, until the top gear releases.
Slide the bottom gear off the rest of the way.
Discard timing chain and old gears.
Remove the valve covers.
Remove the rocker arm nuts and rockers.

Remove the pushrods.
Scrape all the remnants of gasket from the valley cover and intake mainfold at this time. I put a rag under the area being scraped, but any debris can easily be removed with a shop vac.
Remove the lifters. They may need the carb spray treatment to get them up. It should be noted here, if you ever intend to use the cam and lifters again, maintain the order of the lifters as they are removed. They must go back on the SAME LOBE they came off, or the cam and lifters are worthless.
Remove the 2 bolts holding the cam retainer plate (1/2" head).
Remove the cam by sliding it out, and rotating slowly. The lobes will want to hang up in the bearings, so be gentle and patient. A few little scratches in the cam bearings won't hurt anything. Big gouges will.

Now, it's time to clean everything. Every part, without exception, must be cleaned, at least in solvent, but best in a caustic cleaner. A little solvent down the valley to wash the debris into the pan is also a good idea. I usually leave the drain plug out and the drain pan under the car for this. The oil pan must be scraped where the timing cover gasket is/was. It too, must be cleaned.
I recommend, if you have any doubt of the condition of the pieces, to replace them now (water pump, fuel pump, hoses, etc.).
Scrape all gasket surfaces clean. The front of the block, timing cover, fuel pump and flange, intake surfaces etc, are then washed with a lint-free rag soaked with brake cleaner.
Buff the threads of all the bolts with a wire wheel. These parts cannot be clean enough. Apply a drop of oil to the threads before installation. No sealant is necessary on any bolts at any time in this engine.

To reassemble, the process is basically reversed. There are some differences.
The new cam should be washed in clean solvent and dried. Apply a liberal coat of graphite assembly lube to each lobe. Hold the cam by the journals as you insert it, rotating slowly, much the same as when you removed the old one.
Carefully inspect the cam thrust plate. If it shows wear (not just a shiny spot, but a ridge deep enough to hang your fingernail on), it must be replaced. New ones are only available through restoration houses. I've tried a national search through GM, with no results. A good used one is acceptable, if it passes the fingernail test.
The retainer bolts are torqued to 15 lb. ft. I use a little Loctite Blue on the threads. DO NOT use Loctite Red.
The new cam will not have a woodruff key in it. The part is the same as a small block Chevy crank key. For a buck or so, just buy a new one. Pioneer PK-9 is sufficient. Tap it in with a soft hammer.
Install the top gear without the chain. Rotate until the timing mark is aligned with the spot where the previous cam was.
Remove the gear, taking care not to rotate the cam.
Imerse the new chain in engine oil.
Assemble the new chain and gears, ensuring the timing marks are properly aligned with the desired position.
Slide the crank gear on first, and assure the keyway in the cam gear is aligned with the woodruff key in the cam.
Slide the cam gear on fully, moving the crank gear in at the same time.
Install the fuel pump eccentric and cam bolt. Torque the bolt to 75 lb. ft.
Install the lifters, spreading a liberal amount of graphite assembly lube on the flat side. A little in the lifter bore can't hurt.
Install the pushrods.
If using the stock rocker arms, torque the nuts to 20 lb. ft.
Install the valve covers. No sealant is necessary. Torque the bolts to 18 lb. ft.
"Paint" the areas around the water inlets inn the block with Permatex Aviation.
A little Aviation on the oil pan can also help. DO NOT coat with RTV.
Use a small bead of RTV (about 1/4" in diameter) along the joining edges of the pan/block/timing cover.
The gasket set comes with small plastic retainers for installing the pan gasket. Use them.
Torque the timing cover bolts to 25 lb. ft.
Install the 4 bolts from under the car. Torque them to 15 lb. ft.
Reinstall the fuel pump. No sealant is necessary on the gasket. Torque the bolts to 20 lb. ft.
I use RTV to "make" the new valley cover gasket. It's much easier and more secure than the old cork thing that you must purchase separately. Black RTV is recommended. It can be purchased in a handy pressurized can with a nozzle. I like it. Lay the bead all the way around. Allow it to dry for about 10 minutes before lowering the valley cover in place. Care must be taken to not shift the position once it's down. Tighten the bolts to about 18 lb. ft.
Install the new flat "O" ring in the intake where it joins the water pump. A little Aviaition on this is not a bad thing.
No sealant is necessary on the intake gaskets. Use the little orange reatainers supplied in the set.
Torque the intake bolts to 25 lb. ft., starting in the center and working your way to outside edges.
Install all the rest of the stuff, assuring the balancer is torqued to AT LEAST 120 lb. ft. The book says 160, but this is very difficult to achieve. NOTE: If installing headers at this time, there is no need to install the distributor and the fan, as they must come out again anyway, to raise the engine for header installation.
Refill the coolant and assure there are no leaks.
If you're going to install headers at this time, go on to that. If not, add new oil and filter and start her up!

Allow the engine to run at about 2,000-2,500 RPM for about 15 minutes. This will allow the cam and lifters to establish a wear pattern, crucial to cam life. While doing this, monitor the temperature and oil pressure at all times.
Watch for leaks and listen for unwanted noises. If any problems occur, shut it off and correct the problem. At no time in the first 15 minutes of running time, should the engine be allowed to idle.